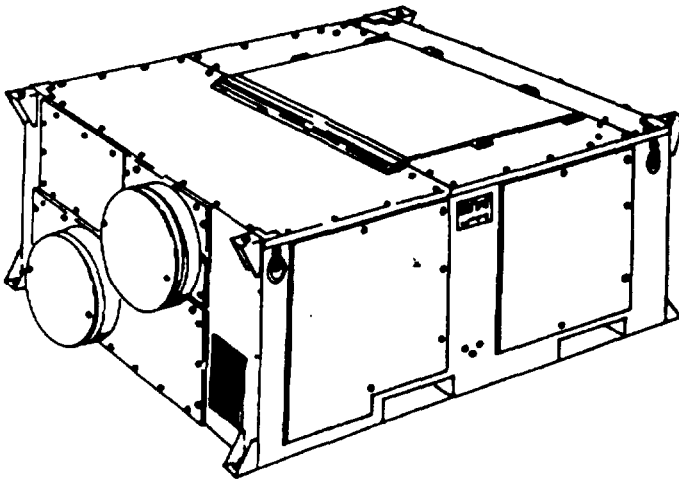


TECHNICAL MANUAL

OPERATOR, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL



AIR CONDITIONER
54,000 BTU/HR
208/230 VOLT, THREE PHASE,
50/60 HERTZ, MODEL AH-54

NSN 4120-01-283-4096

Approved for public release; distribution is unlimited.

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CHANGE

NO. 1

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

Operator, Unit, Direct Support and General Support
Maintenance Manual

**AIR CONDITIONER, 54,000 BTU/HR
208/230 VOLT, THREE PHASE,
50/60 HERTZ, MODEL AH-54
NSN 4120-01-283-4096**

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TM 9-4120-398-14, 18 December 1991 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

5-7 through 5-10
5-19 and 5-20
B-7 and B-8

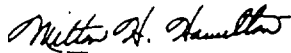
Insert pages

5-7 through 5-10
5-19 and 5-20
B-7 and B-8

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

By Order of the Secretary of the Army:

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*Administrative Assistant to the
Secretary of the Army*

01636

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

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25E, (qty rqr block no. 3819).

WARNINGS**HIGH VOLTAGE**

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electrical equipment unless there is another person nearby who is familiar with operation and hazards of equipment and who is competent in administering first aid. For artificial respiration, refer to FM 21-11. When technician is aided by operators, he must warn them about dangerous areas.

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

Be careful not to contact high-voltage connections of 208/230 volts ac input when installing or operating this equipment.

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

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

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

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Capacitors can retain a high electrical charge. Touching the terminals of a charged capacitor can result in severe electrical shock and skin burns. Always ground the terminals of a capacitor as soon as they are exposed.

Panels, covers, screens, and grilles installed on unit are there for a purpose.

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

WARNINGS

While handling coils, wear gloves to avoid cuts and reduce fin damage on coil.

Heating element is extremely hot. Severe burns can be caused by touching with bare skin.

DANGEROUS CHEMICAL
(R22)
is used in this equipment

DEATH

or severe injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye-contact is possible. Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous and corrosive gas.

Discharge refrigerant in a suitable container and in an open area and not around an open flame.

All refrigerant-22 must be discharged from system and entire system must be purged with dry nitrogen before beginning any debrazing operation.

If compressor burnout is suspected, use care when handling compressor to avoid touching compressor sludge. Acid in sludge can cause burns.

Avoid inhaling fumes and burns from acid formed by burnout of oil and refrigerant. Wear a gas mask if area is not thoroughly ventilated. Wear protective goggles or glasses to protect eyes. Wear rubber gloves to protect hands.

Polyurethane foam used as insulation in air conditioner will break down to form toxic gases if exposed to flame of a torch at brazing temperature.

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves, and other suitable protective clothing.

WARNINGS

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

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards and wear eye protection and other protective equipment.

Clean parts in a well ventilated area

Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly.

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

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

Wear eye protection when blowing solvent from parts. Air pressure should not exceed 30 psig (2.1 kg/cm²).

**OPERATOR'S, UNIT,
DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL
FOR
AIR CONDITIONER
54,000 BTU/HR
208/230 VOLT, THREE-PHASE, 50/60 HERTZ
MODEL AH-54**

NSN 4120-01-283-4096

Approved for public release; distribution is unlimited.

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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

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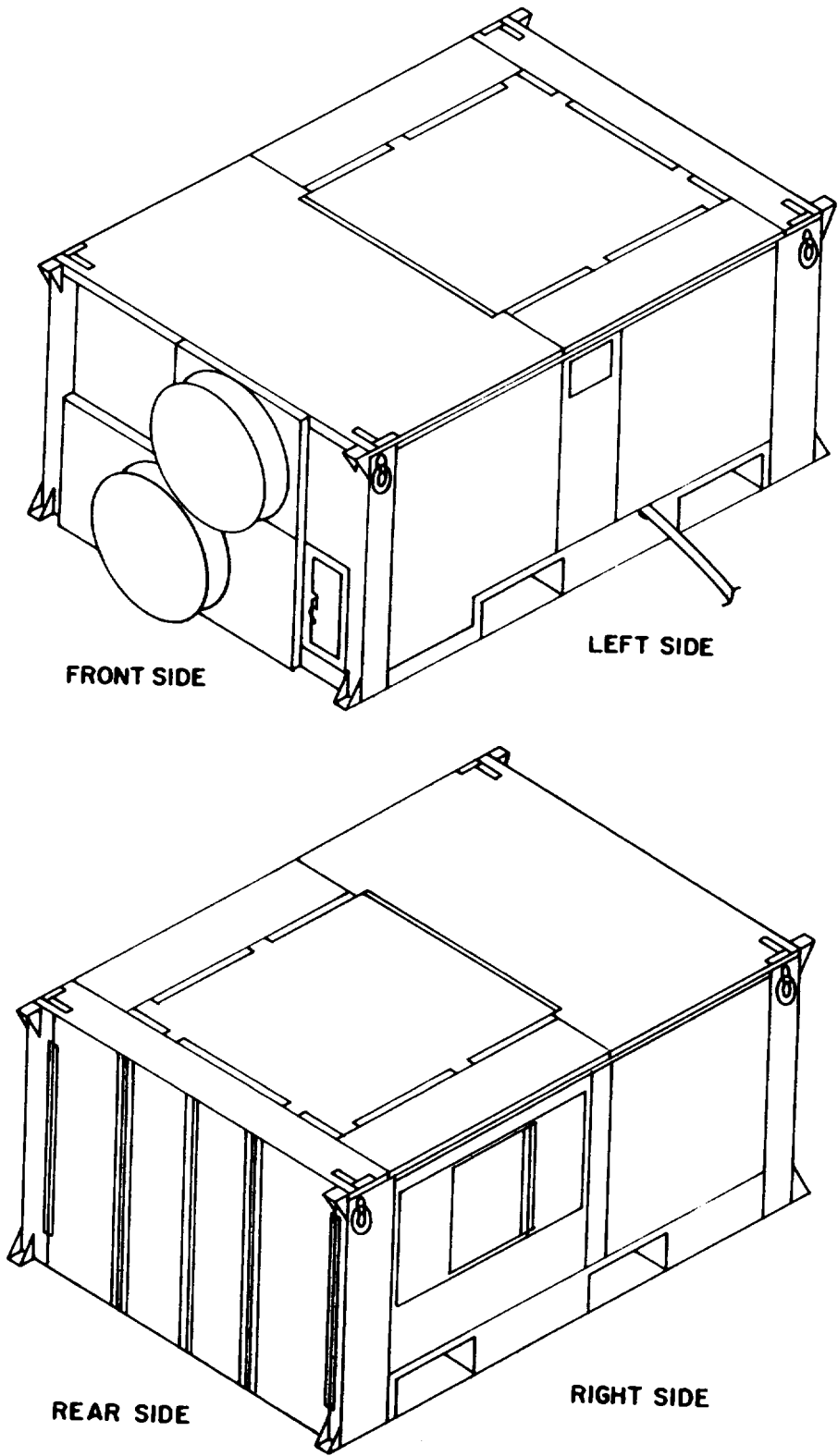


Figure 1-1. Air Conditioner

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

- a. Type of Manual. Operator's, Unit, Direct Support, and General Support Maintenance Manual.
- b. Model Number and Equipment Name. Airtacs Model AH-54, 54,000 BTU/HR, 208/230 Volt, Three-phase, 50/60 Hertz Air Conditioner.
- c. Purpose of Equipment. Cools, heats, and ventilates enclosed spaces. The unit covered by this manual is designed for cooling and heating air to a desired predetermined range and circulating the conditioned air to provide heating and cooling of equipment or personnel within the conditioned area.

1-2. MAINTENANCE FORMS AND RECORDS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. WARRANTY INFORMATION. Airtacs Corporation warrants products to be free from defects in material and workmanship under normal use and service, and will, within one year from date of original installation, or 18 months from shipping, whichever is first, repair or replace without cost to the original customer any part, assembly or portion thereof which shall be returned to our factory, with prepaid transportation charges and which our inspection shall show to be defective. Under the terms of this warranty, Airtacs Corporation assumes no responsibility for the labor cost involved in removing any defective part or installation of such part, or any service charges. Nor shall Airtacs be liable for any injury, loss or damage (direct, indirect or consequential) arising out of the use or inability to use the product. This warranty is in lieu of all other warranties, expressed or implied.

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's). If your Air Conditioner needs improvement let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a SF 368 (Quality Deficiency Report). Mail it to us at Commander, U.S. Army Troop Support Command, Attention: AMSTR-MOF, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120-1798. We will send you a reply.

1-5. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. Command decisions, according to tactical situation, will determine when destruction of the air conditioning unit will be accomplished. A destruction plan will be prepared by the using organization, unless one has been prepared by higher authority. For general destruction procedures for this equipment, refer to TM 750-244-3, procedures for Destruction of Equipment to Prevent Enemy Use.

1-6. PREPARATION FOR STORAGE OR SHIPMENT. Contact unit maintenance for air conditioning unit preparation for storage or shipment. (See para 4-39.)

Section II. EQUIPMENT DESCRIPTION

1-7. PURPOSE, CAPABILITIES, AND FEATURES

a. Purpose of AH-54 Air Conditioner. The Air Conditioner is designed to ventilate, cool or heat, and to filter air in rooms or enclosures.

b. Capabilities and features

- (1) Provides a maximum of 54,000 BTU/HR of cooling or 32,785 BTU/HR of heating.
- (2) Has two stages of heat.
- (3) Provides source of outside (fresh) ventilation air.
- (4) Is self contained in a single cabinet that is suited to air condition van, shelter, or room installations.
- (5) Operates in environmental conditions from tropic to arctic.
- (6) Is fully transportable.

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

a. CONDITIONED AIR (EVAPORATOR) FAN (1)- Draws air into the evaporator section and exhausts it through the evaporator (cooling) coil and heater elements into the room or enclosure.

b. HEATER ELEMENTS (HR 1 thru HR6) (2) – Consists of two banks of three elements each. Both banks are controlled in automatic mode heating with the mode selector in AUTO.

c. FRESH AIR DAMPER (3) – Provides outside air.

d. INDICATOR, SIGHT LIQUID (4) – Allows visual inspection and indicates condition of liquid refrigerant when the unit is operating in the cool mode.

e. INPUT POWER CABLE (5) - For connection of external power.

f. EXTERNAL CONTROL PANEL (6) – Contains a three-position mode selector switch, a temperature control thermostat and a pushbutton circuit breaker.

g. EVAPORATOR COIL (7) – Serves as a heat exchanger by transferring heat from the air passing over the tubing and fins to the refrigerant passing through the tubing.

h. COMPRESSOR (B3) (8) – Pumps refrigerant through the system during cooling operations.

i. CONDENSER COIL (9) – Serves as a heat exchanger by transferring heat from the refrigerant passing through the tubing to the air passing over the tubing and fins.

j. CONDENSER COIL GUARD (10) - Protects coil from damage.

k. EVAPORATOR BLOWER MOTOR (B1) (11) – Drives the conditioned air (evaporator) fan.

l. CONDENSER MOTOR (B2) (12) - Drives the outside air (condenser) fan.

m. CONDENSER IMPELLER (13) – Draws air through the condenser coil and discharges the heated air back to the outside during cooling operations.

n. CONDENSATE TRAPS AND DRAIN HOSE (14) – The drip pan is located directly below the evaporator coil line and is built into the casing. Its purpose is to collect condensate that drips off the evaporator coil during cooling operations. Condensate water then empties out of the air conditioner through the drain line.

o. HIGH PRESSURE CUTOUT SWITCH (S4) (15) - Protects compressor from possible damage due to excessively high refrigerant pressures.

p. AIR FILTER (16) – Provides filtered return air.

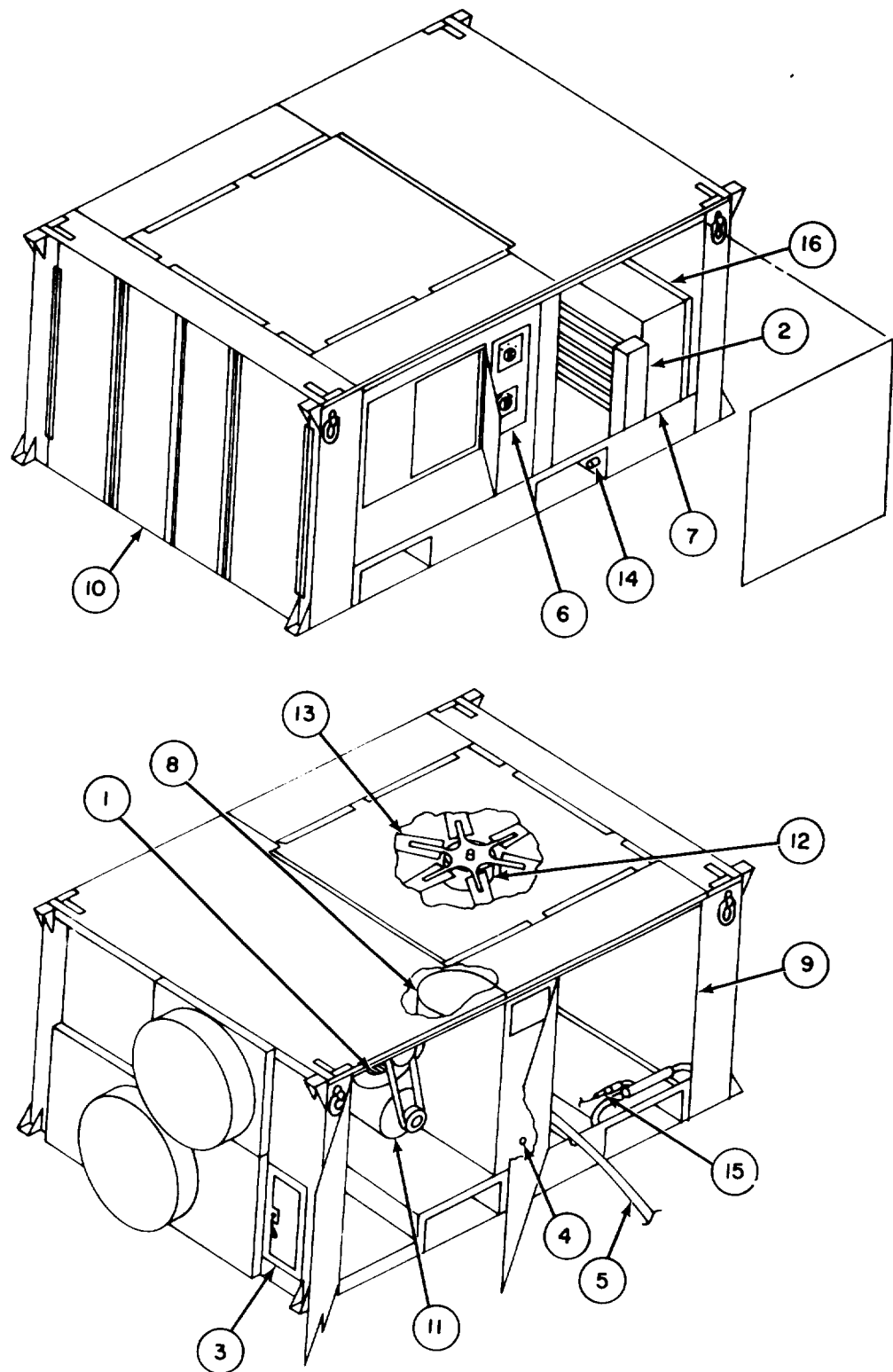


Figure 1-2. Location of Major Components

1-9. PERFORMANCE DATA

OPERATING TEMPERATURES

LOW	-50 °F (-45 °C)
HIGH	+125 °F (+46 °C)

PERFORMANCE

COOLING CAPACITY	54,000 Btu/hr
HEATING CAPACITY	32,785 Btu/hr

POWER REQUIRED

VOLTAGE	208/230
PHASE	3
HERTZ	50/60
AMPERAGE	130 (starting) 25 (running)
POWER	10 kW

DIMENSIONS

WIDTH	48 in. (1219 mm)
LENGTH	71 in. (1803 mm)
HEIGHT	32 in. (812 mm)
WEIGHT	920 lb (417.68 kg)

REFRIGERANT

TYPE	R-22
CHARGE	10 lb (4.54 kg)

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-10. THEORY OF OPERATION

a. **COOLING.** During air cooling operation, the compressor delivers refrigerant gas at high temperature and pressure to the condenser. A fan blowing across the condenser coil carries away refrigerant heat, causing the refrigerant to condense from a gas to a liquid, still under high pressure. From the condenser, the liquid refrigerant passes through an expansion (throttling) valve, emerging as a liquid at lower pressure into the evaporator. The air to be conditioned is blown across the evaporator coils, where heat is extracted causing the refrigerant to boil and become a heated gas. From the evaporator, refrigerant enters the compressor to repeat the continuing cycle. A thermostat cycles the compressor for conditioned air temperature control.

b. **AIRFLOW SYSTEM.** As indicated in figure 1-3, the air conditioner is divided into two separate airflow compartments. Cooled airflow takes place in the front compartment; heat rejection airflow takes place in the rear compartment. A metal wall seals the front compartment from the rear, preventing air from passing between the two compartments.

c. **CONDENSER AIRFLOW.** Heat-filled refrigerant is pumped into the condenser. A fan draws in outside air through the finned condenser coil and delivers the heated air to the outside. Fan and coil are sized for adequate forced air cooling with outside air entering at a temperature as high as 125°F.

d. **EVAPORATOR AIRFLOW.** From the conditioned space, the evaporator blower pulls air through a filter and across the evaporator coil, and delivers the filtered, cooled air into the conditioned space. A manually-operated damper (figure 2-1) can be adjusted to admit fresh air upstream from the blower.

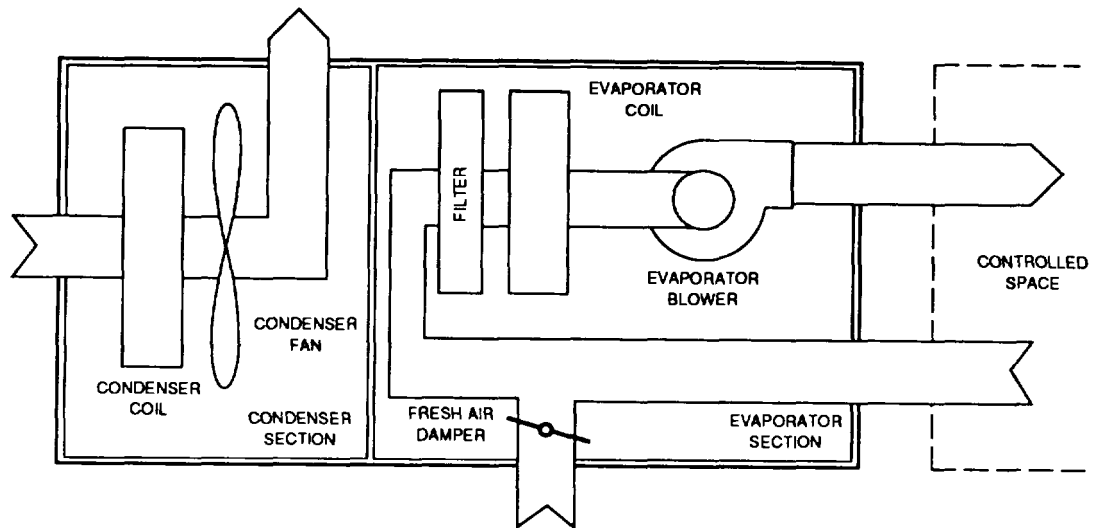


Figure 1-3. Air Conditioner Airflow System

e. **HUMIDITY.** Heat is extracted from the air flowing across the evaporator coil. Cooling the air extracts excess moisture, lowering the relative humidity of the air delivered to the conditioned space. The extracted moisture collects on the evaporator coil as drops of water, drips down into a drain pan and empties out of the air conditioner through the drain line (figure 1-2).

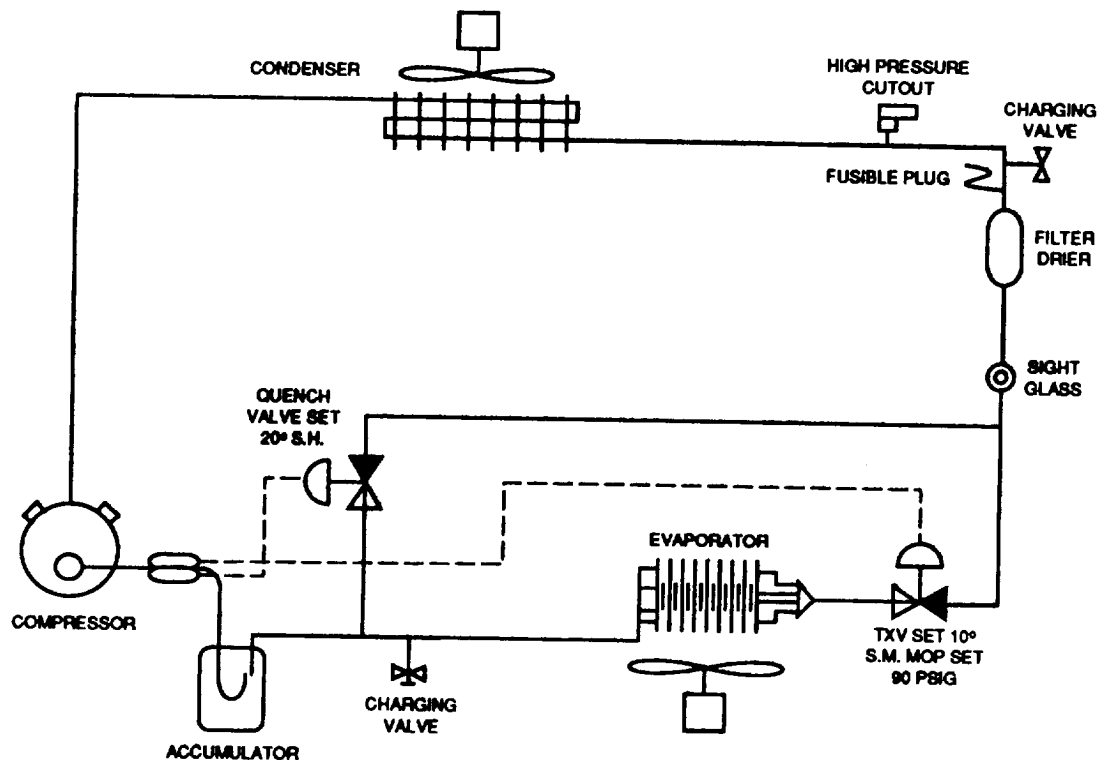


Figure 1-4. Refrigeration System Schematic Diagram

f. REFRIGERATION SYSTEM. Figure 1-4 is a schematic flow diagram of the refrigeration system in the air Conditioner. Operation is as follows

(1) COMPRESSOR. Low-pressure, low temperature refrigerant vapor is drawn into the hermetically-sealed motor-compressor unit through the low pressure line from the accumulator. Refrigerant enters the compressor unit into the shell near the top, is circulated around and through the motor, and enters the compressor. From the compressor, the refrigerant under high pressure is delivered to the condenser. During compressor motor rotation, grooves in the crankshaft carry oil from the crankcase to bearing surfaces.

(2) CONDENSER. From the compressor, refrigerant gas enters the condenser at a pressure sufficient to raise its condensation temperature above that of the ambient air. Thus, as the airflow across the condenser coil extracts heat from it the refrigerant condenses to a liquid and settles to the bottom level of the condenser coil.

(3) LIQUID LINE COMPONENTS. From the condenser, liquid refrigerant passes through a filter-drier and a sight glass. A drying chemical in the filter-drier absorbs moisture, acids, and other liquid contaminants, and a filter captures and retains solid contaminants. The sight glass provides visible indication of the fluid state of the refrigerant. Refrigerant passing through the sight glass should be in the form of a clear liquid. Bubbles in the sight glass are an indication of a shortage of refrigerant in the system. Also in the liquid line are: a charging valve for adding liquid refrigerant a cutout that switches off the electrical circuit when the refrigerant pressure becomes excessive and a plug containing a fusible metal that melts when the liquid refrigerant becomes overheated, allowing refrigerant to escape.

(4) **EXPANSION.** After flowing through the filter-drier and sight glass, the liquid refrigerant enters the thermostatic expansion valve. The pressure difference across the valve produces refrigerant flow through the valve orifice into the lower-pressure space in the evaporator. The rate of flow through the thermostatic expansion valve (TXV) determines the degree of refrigerating action that takes place. Extending from the valve is a sensing element that is affixed to the compressor suction line. The sensed temperature affects the throttling action in the valve, allowing more refrigerant to flow through at high loads to maintain 10°F superheat, and throttling the flow at low loads to prevent refrigerant from entering the compressor in the liquid state.

(5) **HEAT ABSORPTION.** Reduced pressure inside the evaporator causes the refrigerant to vaporize. In changing into a vapor, the refrigerant absorbs heat initially from the evaporator coils and fins, and subsequently from the air blown across the evaporator. A venturi-type distributor at the evaporator inlet breaks up the refrigerant flow into six circuits for equal passage through the various parallel coils in the evaporator.

(6) **ACCUMULATOR.** Suction produced by the compressor draws refrigerant into the compressor intake. Refrigerant is compressible as a vapor but not as a liquid. Liquid refrigerant entering the compressor results in “slugging” and can cause mechanical damage. An accumulator between the evaporator and compressor collects any liquid refrigerant in the system at that point and in an inverted U-shaped outlet tube in the accumulator ensures that only vapor is drawn into the compressor.

(7) **QUENCH VALVE.** Refrigerant pumped through the compressor carries away the heat produced by current flow through the sealed-in motor windings. The temperature of the refrigerant gas depends upon the superheat and rate of refrigerant flow. A quench valve, with sensor at the compressor suctions, opens when the gas superheat temperature reaches 20 degrees above the normal boiling (vaporizing) temperature of the refrigerant. Liquid refrigerant from the condenser vaporizes in flowing through the quench valve, mixing cool gas with the hot gas to maintain the temperature of the refrigerant entering the compressor below 90° F.

(8) **COMPRESSOR CRANKCASE HEATER.** A tubular strip heater clamped around the external shell of the compressor warms the oil and evaporates the refrigerant prior to air conditioner startup. Turning on the compressor motor starter automatically disconnects the crankcase heater.

g. **HEATING SYSTEM.** The heating element grid is located in the evaporator compartment (figure 1-2). When the heating system is operating, return air, after passing through the evaporator coil, is heated and delivered to the discharge duct by the evaporator blower. Two relays on the control board energize three heating rods each.

h. **THERMOSTATIC CONTROL.** The thermostat bulb fastened to the frame near the inner rim of the air return duct adapter senses the return air temperature and actuates the thermostat. A three-stage thermostat is used. A high temperature stage turns on the air conditioner two low temperature stages switch on the heating element relays. At the first low temperature stage, a set of three element rods is energized and thermostatically cycles on and off with return air temperature variations. At the second low temperature stage, the other set of three rods is energized and the first set remains energized while the second set thermostatically cycles on and off. The operating points for the three stages are adjustable by means of the temperature selector on the control panel

i. ELECTRICAL CONTROL SYSTEM. Figure 1-5 is reference for the following discussion of the air conditioner electrical control system.

(1) OPERATING MODES. Switch S1 allows selection of two operating modes: ventilate and automatic. In the ventilate mode, air is circulated without cooling or heating; in the automatic mode, the thermostat controls the temperature of the output air.

(2) VENTILATE MODE. With S 1 in the VENTILATE position, only the evaporator fan motor operates. The startup and operating sequence is as follows:

(a) Control relay K4 is energized through closed contacts K5-X1 (line 2).

(b) K4-X1 contacts close, locking in K4 and energizing evaporator fan starter K1 (line 3). The evaporator fan begins operation.

(c) K4-X2 contacts close, energizing control relay KS. K5 locks in through contacts K5-X2. K5-X1 contacts open.

(d) If the evaporator fan overheats, its thermal cutout (TCO) opens, breaking the circuit to K1 (line 3) and de-energizing the fan motor.

(e) K4 is also de-energized. K4-X1 holding contacts open. K4-X2 contacts open. However, KS remains energized through its holding contacts K5-X2 (line 1).

(f) With K5 energized, contacts K5-X1 remain open. Therefore, return to normal temperature (evaporator fan TCO closes) cannot restore operation of the fan (see 1 above). The fan is restarted by turning S1 to the OFF-RESET position, which de-energizes K5 and allows K5-X1 to reclose.

(3) AUTOMATIC MODE COOLING. With S1 in the AUTO mode, operation of the air conditioner is controlled by the thermostat S2; however, all evaporator fan controls bypass the thermostat, thereby allowing the evaporator fan to run continuously. Operation in the AUTO mode with S2 in the high temperature stage (cooling) is as follows:

(a) The evaporator fan starts up and operates as described in paragraph 1-10d.

(b) Closed contacts K4-X3 provide a circuit to thermostat S2 to turn on condenser fan starter K2 (line 6).

(c) Closed contacts K3-X5 provide a circuit to time delay relay K6 (line 7). K6 contacts close after a one-minute delay.

(d) Contacts K6-X1 close, providing a circuit to turn on compressor motor starter K3 (line 5).

(e) Contacts K3-X6 close, locking in the compressor starter. Contacts K3-X5 open, taking the time delay relay out of the circuit. Contacts K5-X1 open.

(f) In cycling to open, thermostat S2 breaks the circuit through K3-X6 to compressor motor starter K3 and condenser fan starter K2. In cycling to close, the thermostat initiates the action described in steps (b) through (e).

(g) The high temperature cutout HTCO and all high and low pressure, safety, and overload controls for the compressor and the condenser fan motor are in series with evaporator fan thermal cutout TCO to control relay K4. Activation of any of these safety controls de-energizes K4. Contacts K4-X1, K4-X2, and K4-X3 open. Relay K5 remains energized holding K5-X1 open. Thus all electrical components are kept de-energized until the tripped safety or overload resets, and control switch S1 has been rotated momentarily to the OFF-RESET position.

(h) With the exception of the compressor motor overloads, all safety controls, etc., as described in step (g) are in series with evaporator fan thermal cutout TCO to control relay K4. Internal wiring of the compressor has been designed to incorporate the thermal cutouts within the compressor.

(4) AUTOMATIC MODE HEATING. Operation in the heating mode with S2 in the second and third stages (heating) is as follows:

(a) When the thermostat low-temperature air setting is satisfied, S2 stage 1 (COOL) switches off.

(b) At a temperature nominally 15°F below stage 1 turnoff, stage 2 (HEAT 1) switches on.

(c) K7 is energized, supplying 3-phase ac to HR4, HR5, and HR6.

(d) S2 stage 2 cycles with a temperature differential of 3° between on and off.

(e) At a temperature nominally 2-1/2 °F lower the stage 2 turn on, stage 3 (HEAT 2) switches on.

(f) K8 is energized, supplying 3-phase ac to HR1, HR2, and HR3.

(g) S2 stage 3 cycles with a temperature differential of 3° between on and off.

(5) TEMPERATURE OVERLAP. With 2-1/2 °F separating stage 2 switch on and stage 3 switch on, each having a 3° differential, the low end of stage 2 overlaps the high end of stage 3 by 1/2°, avoiding a “dead space” in the controlled temperature range.

j. AIR CONDITIONER SAFETY CONTROLS. Table 1-1 lists the air conditioner safety controls, describes their location in the air conditioner and references applicable maintenance procedures. As illustrated in figure 1-5, all safety controls are series connected in the circuit of control relay K4. Actuation of any safety control opens the circuit and de-energizes the air conditioner.

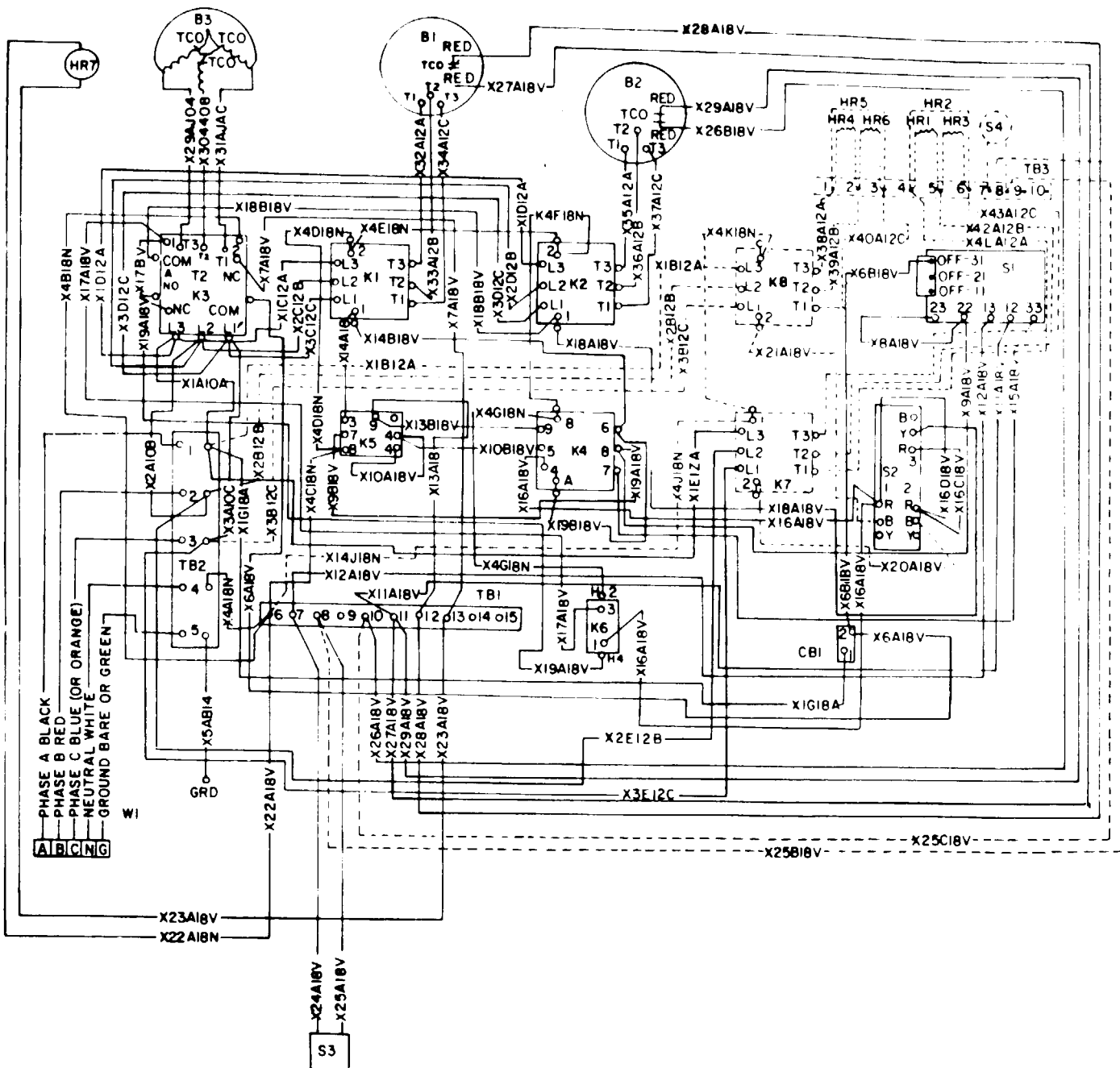
TABLE 1-1. AIR CONDITIONER SAFETY CONTROLS

NOMENCLATURE	FUNCTION	LOCATION
High Pressure Cutout	Protects from excessive refrigerant pressure.	In refrigerant high side line manifold (figure 5-9).
High Temperature Cutout	Protects from excessive temperatures from auxiliary heater.	Above heating element on evaporator coil top plate (figure 5-10).
Compressor Overload	Switch opens from excessive compressor temperature.	Integral within compressor.
compressor Thermal cutout	Switch opens from excessive compressor temperature.	Integral within compressor.
Condenser Fan Thermal cutout	Switch opens from excessive condenser fan motor temperature.	Imbedded in condenser fan motor.
Evaporator Fan Thermal cutout	Switch opens from excessive evaporator fan motor temperature.	Imbedded in evaporator fan motor.
Fusible Plug	Plug element melts at predetermined temperature relieving refrigerant pressure.	In refrigerant high side line manifold (figure 5-13).

* NOTE 1. Allow time for controls to cool and reset. The compressor overload may require as long as 1 hour to reset.

LEGEND	
SYM	DESCRIPTION
B1	MOTOR EVAP
B2	MOTOR COND
B3	COMPRESSOR
CB1	CIRCUIT BREAKER
HR1	HEATER
HR2	HEATER
HR3	HEATER
HR4	HEATER
HR5	HEATER
HR6	HEATER
HR7	HEATER CRANKCASE
K1	RELAY
K2	RELAY
K3	RELAY
K4	RELAY
K5	RELAY
K6	RELAY TIME DELAY
K7	RELAY
K8	RELAY
S1	SWITCH ROTARY
S2	THERMOSTAT
S3	SWITCH, HIGH PRESS
S4	HIGH TEMP CUT-OUT
TR1	TERMINAL BLOCK
TB2	TERMINAL BLOCK
TB3	TERMINAL BLOCK
W1	CABLE POWER

Figure 1-5. Air Conditioner Electrical Schematic Diagram



CHAPTER 2

OPERATING INSTRUCTIONS

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

2-1. GENERAL. The model AH-54 Air Conditioner is designed for a variety of installations and for operation under a wide range of climatic conditions. It is also designed for continuous or intermittent operation. Operators must be aware of any peculiarities or operational limitations for their specific installation. See the appropriate shelter or system manual for instructions peculiar to your specific installation.

2-2. OPERATOR'S CONTROLS. See figure 2-1 for a general description of the controls that an operator will normally be concerned with. For specific operating instructions, see Sections III and IV of this chapter.

2-3. INDICATORS. The refrigerant sight glass (fig. 1-2, item 4) is the only visual indicator used on the air conditioner. The sight glass is a port or window through which the refrigerant condition can be seen. Liquid refrigerant actually flows through the sight glass chamber only during cooling cycles. The unit must be operated approximately 15 minutes in maximum cooling prior to checking condition of refrigerant at sight glass. Excessive moisture in the refrigerant may damage or possibly destroy the compressor. If the liquid refrigerant observed in the sight glass has an opaque, milky appearance, or frequent bubbles appear, the volume of refrigerant is low and the system should be charged. Either moisture or low charge indications should be reported to your supervisor.

CAUTION

Do not operate the air conditioner in the cooling mode if numerous bubbles appear in the sight glass. Cooling operation may be continued with only an occasional bubble appearing in the window, but the sight glass should be rechecked after each four hours of operation to ensure that the condition has not become worse.

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-4 GENERAL. Preventive Maintenance Checks and Services (PMCS) are essential to the efficient operation of the air conditioner and to prevent possible damage that might occur through neglect or failure to observe warning symptoms in a timely manner. Checks and services performed by operators are limited to those functions which are described in table 2-1.

a. Before You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS. Perform your before (B) PMCS.

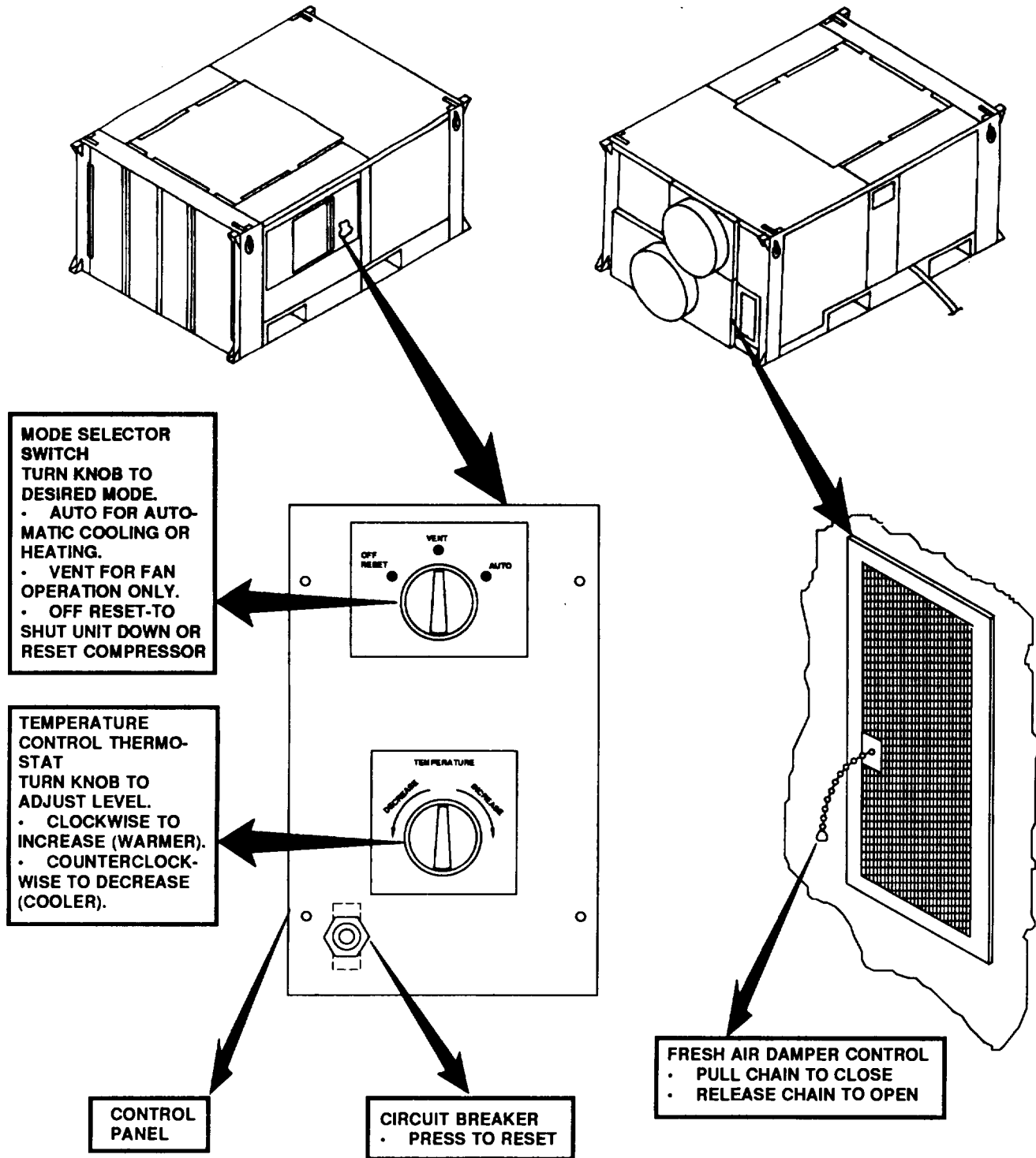


Figure 2-1. Operator's Controls

b. While You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS. Perform your during (D) PMCS.

c. After You Operate. Be sure to perform your after (A) PMCS.

d. If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using DA form 2404. See DA PAM 738-750, the Army Maintenance Management System (TAMMS), for instructions.

e. Perform Weekly as well as BEFORE operations PMCS if:

- (1) You are the assigned operator and have not operated the item since the last Weekly check.
- (2) You are operating the item for the first time.

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shutdown.

TABLE 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Item No.	Interval				Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/Available If:
	B	D	A	W			
1		•			Information and Data Plates	Check for legibility and loose or missing hardware.	
2	•				Flexible Ducts	Check for obstructions, damage, proper adjustment, loose or missing hardware.	
3	•				Covers, Doors, and Panels	Check that covers, doors, and panels are in place. Check covers, doors, and panels for cracks, dents, and missing hardware. Check for stiffness or binding of hinges.	Covers, doors, and panels missing or damage that would cause operating hazard.
4	•				Grilles	Check that grilles are in place.	Missing parts or damage that would cause operating hazards.
	•			•		Check grilles for obstructions, damage, and loose or missing hardware.	

TABLE 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued

Item No.	Interval				Item To Be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/Available If:
	B	D	A	W			
5	•	•			Fresh Air Damper	Check for proper adjustment. Check for freedom of operation.	control chain broken, missing or inoperable.
6	•				Drain Hose	Check for water collection.	Water collecting.
7	•				External Control Panel	Check for obvious damage and missing knobs. Check for proper operation.	Control panel damaged. Unit not operating properly.
8	•				Sight Liquid Indicator	After 15 minutes of operation in maximum cooling, check for bubbles or milky flow indicating low refrigerant charge. Check for yellow color which indicates presence of moisture.	Bubbles or milky flow is observed.

Section III. OPERATION UNDER USUAL CONDITIONS

2-5 ASSEMBLY AND PREPARATION FOR USE. Services of Unit Maintenance should be employed for original unpacking, assembly installation, preparation for use, and other setup procedures. See paragraphs 4-2 thru 4-9.

2-6. INITIAL ADJUSTMENTS AND CHECKS

a. Inspect all covers, panels, grilles, and screens for loose mounting, obstructions, or shipping damage. Report any deficiencies to unit maintenance.

b. Perform the before operation preventive maintenance checks and services listed in table 2-1.

2-7. GENERAL OPERATING PROCEDURES

a Before operation.

(1) Check to see that power cable has been connected to a source of 208/230 volt, three phase, 4 wire, 50/60 hertz power.

CAUTION

Wait 5 hours before starting air conditioner so that the crankcase heater may drive any liquid refrigerant out of the compressor.

NOTE

The 5-hour warm-up is for initial installation only. If the electrical power to the unit remains connected, the crankcase heater will stay hot and the compressor can be started at any time. Refrigerant gas will condense in cool compressor crankcase oil. The off must be warm to prevent startup damage to the compressor. Power interruptions of short duration will not require warm-up time if the compressor crankcase has not been allowed to cool.

(2) Check that all air inlet (2) and outlet (1) duct openings are clear (figure 2-2).

(3) Check that drains (3) are either open or piped to a satisfactory location with a proper drain system.

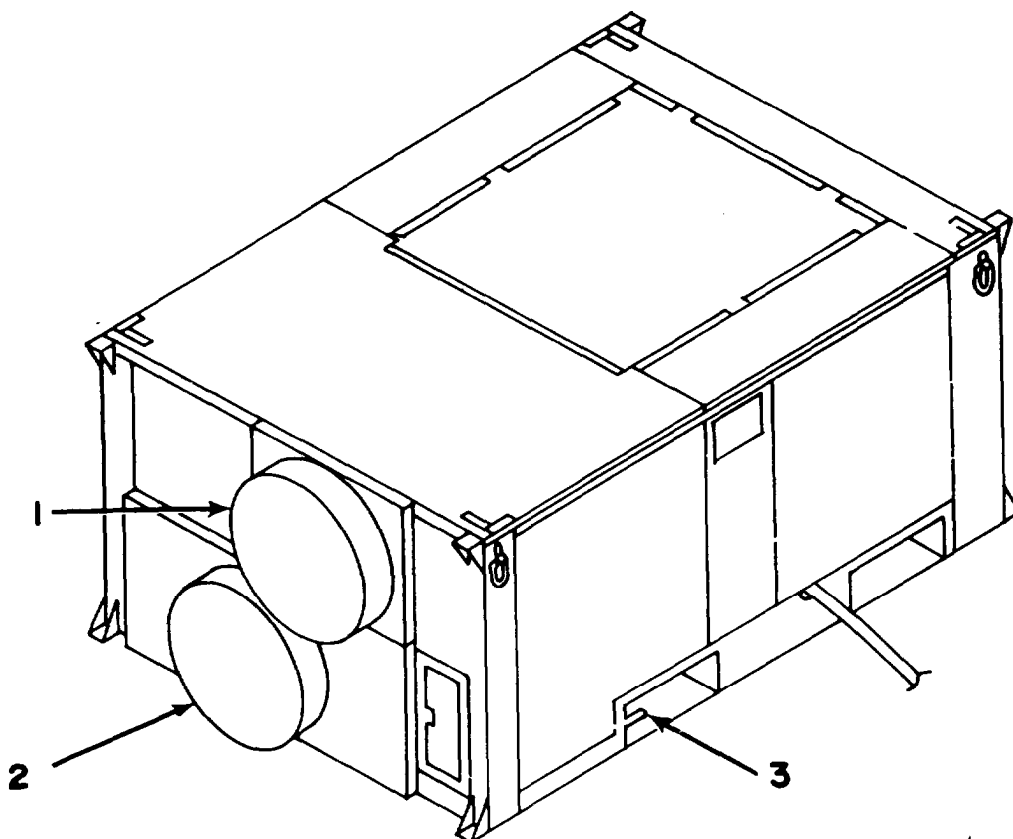


Figure 2-2. Openings and Drains

(4) Table 2-2 lists the recommended control settings for the desired mode of operation. Minor adjustments may be made to get the desired mixture of recirculated and fresh air.

- (5) Open and secure condenser inlet and outlet panels.
- b. General operation of controls (To increase comfort and save energy.)
 - (1) During warm or cold weather.
 - (a) Limit traffic through doors as much as possible.
 - (b) Keep doors and windows tightly closed.
 - (c) Limit use of fresh (outside) air.

NOTE

It is normally better to keep the fresh air damper slightly open. This will create a slight overpressure, provide replacement oxygen, and reduce room odors. Damper should be closed during extrem weather conditions and during periods when fast warmup or cooling is necessary.

(d). Do not adjust controls unnecessarily. Properly set the controls (See Paragraph 2-8 thru 2-11) and the unit will automatically control the temperature. The temperature control thermostat on the control panel operates like a conventional room thermostat except that the temperature scale is not marked on the control panel. The thermostat has a control range of 40 °F to 90°F (5° to 32 °C). The centered position of the control knob would be approximately 65°F (18° C). The full INCREASE would be 90°F (32 °C). The full DECREASE would be 40°F (5 °C):

- (2) During cold weather. Adjust shales, blinds, etc. (when applicable) to admit sunlight during day. Close them at night.
- (3) During hot weather. Adjust shades, blinds, etc. (when applicable) to block out sunlight during day.

Table 2-2. OPERATOR CONTROL SETTINGS

Mode	Mode Selector Switch	Temperature Control Thermostat	Fresh Air Damper
Ventilate with 100% recirculated air	VENT	Does not operate	Closed
Ventilate with make-up (fresh air)	VENT	Does not operate	Open
Heating with 100% recirculated air	AUTO	Desired temperature	Closed
Heating with make-up (fresh air)	AUTO	Desired temperature	Open
cooling with 100% recirculated air	AUTO	Desired temperature	Closed
Cooling with make-up (fresh air)	AUTO	Desired temperature	Open
off	OFF-RESET	Does not operate	Open or Closed

2-8 OPERATION IN VENTILATE MODE (NO HEATING OR COOLING NEEDED)

- Turn mode selector switch to VENT.

CAUTION

Do not operate the air conditioner in the AUTO mode for cooling when the outside temperature is below 50°F. For cooling, use the VENT mode and admit makeup air as required.

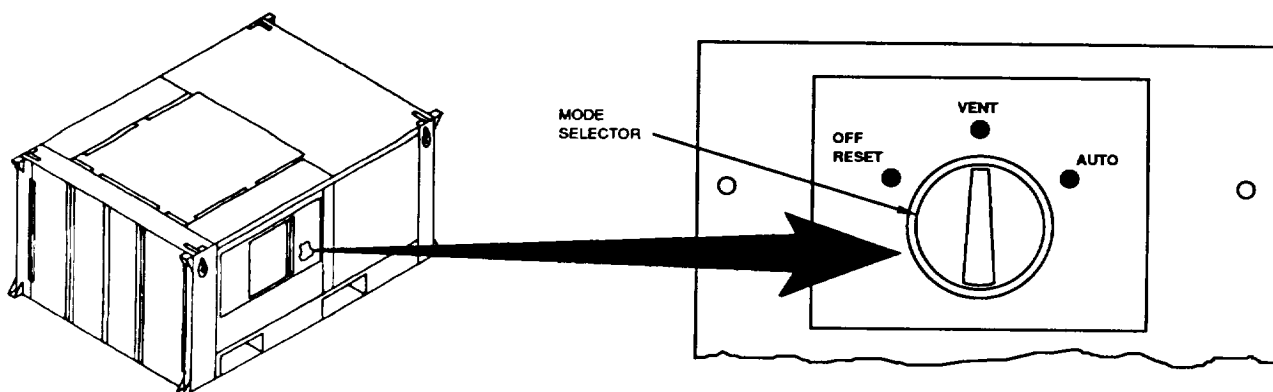


Figure 2-3. Ventilator Control Setting

b. Admit as needed. A manually-operated damper at the front of the air conditioner can be opened to introduce fresh air into the evaporator airflow. The damper admits outside air upstream of the evaporator filter.

c. Unhook the damper chain from its key slot. Allow the hinge spring to pull open the damper door. Lock door in described open position by hooking chain in key slot.

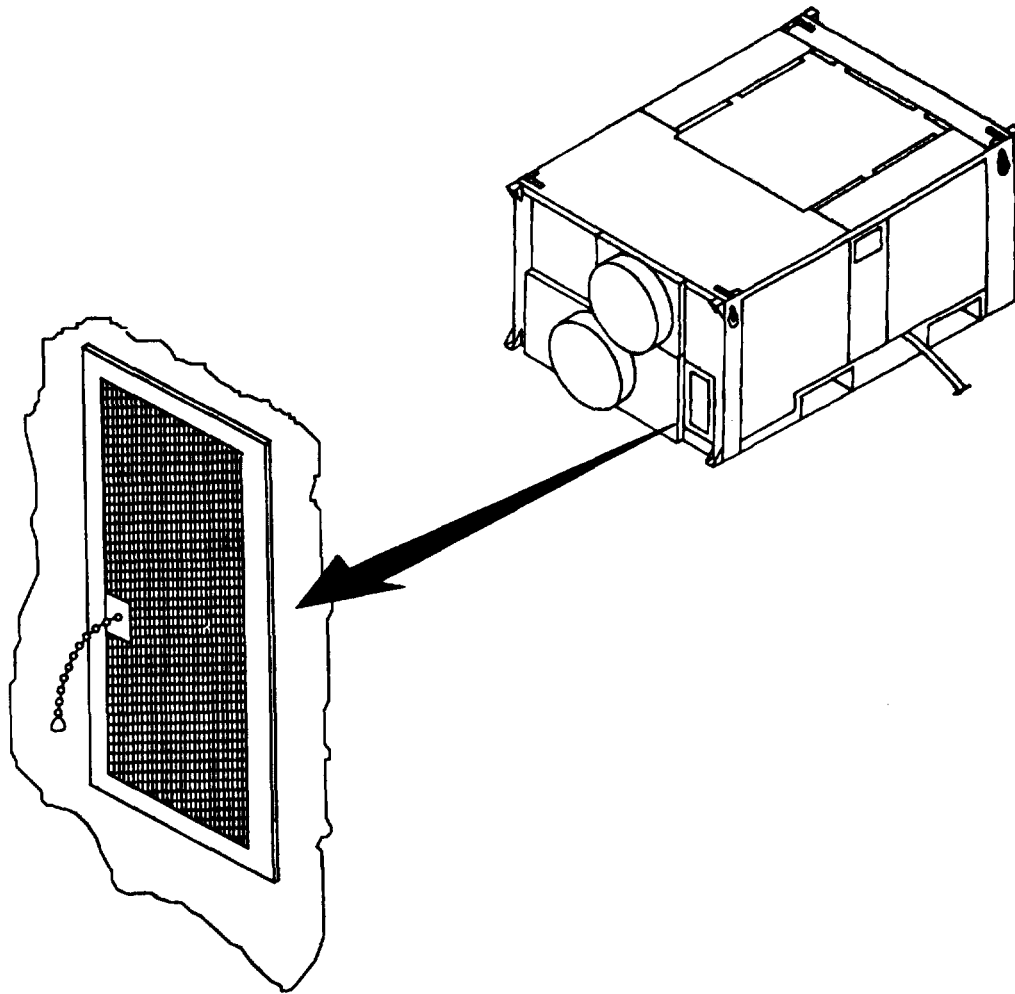


Figure 2-4. Fresh Air Damper (Door) Adjustment

NOTE

When using fresh air for ventilation, a window, door or vent should be opened. If the room or enclosure is tightly closed, and overpressure will buildup and decrease the volume of fresh air drawn in.

2-9. OPERATION IN AUTO MODE (COOLING OR HEATING)

- a. Turn mode selector switch to AUTO.

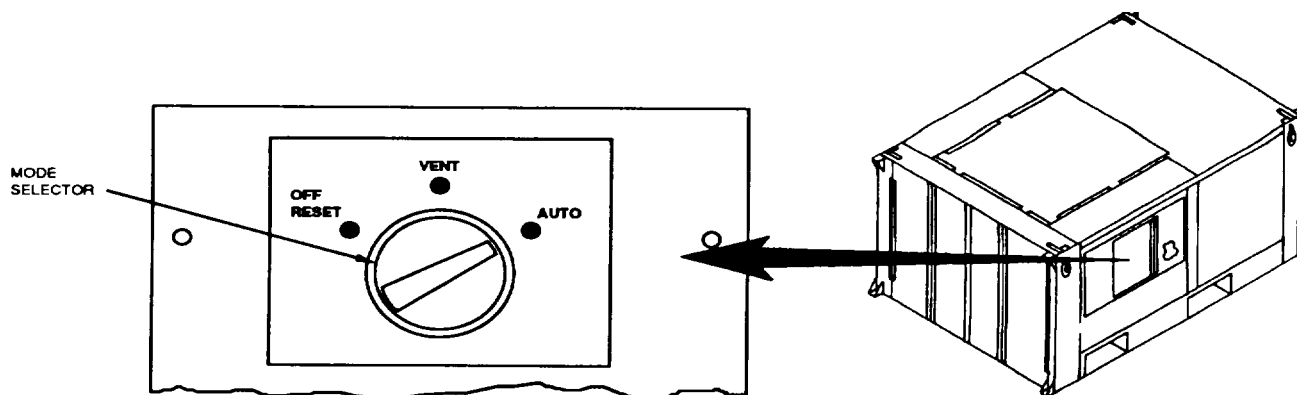


Figure 2-5. AUTO Mode Control Setting

- b. Turn temperature control knob as far as it will go in the INCREASE (warmer) position.

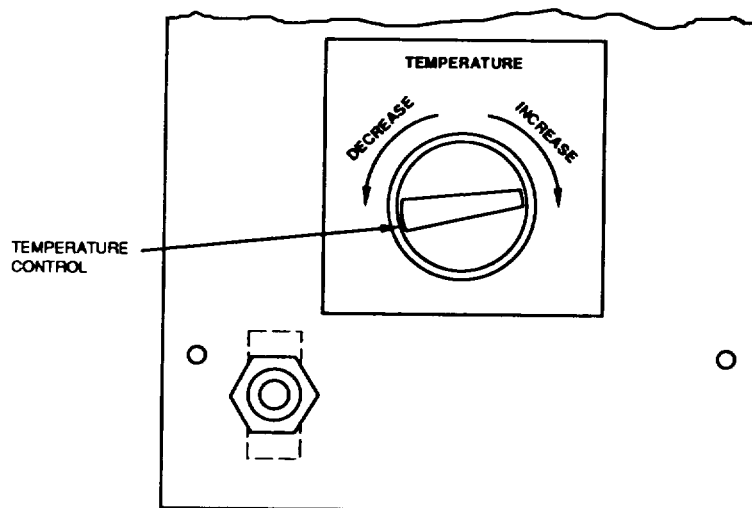


Figure 2-6. Temperature Control Setting

c. When room or enclosure temperature reaches the desired level , slowly turn the temperature control knob toward DECREASE (cooler). Heating will stop when you reach the approximate room temperature. Further adjustment can be made by turning the temperature control knob slightly toward INCREASE (warmer) or DECREASE (cooler) until desired temperature is controlled automatically.

d. Adjust fresh air damper (door) to desired setting. It is normally better to keep the fresh air damper slightly open. Damper should be closed during very cold weather and during fast warmup periods.

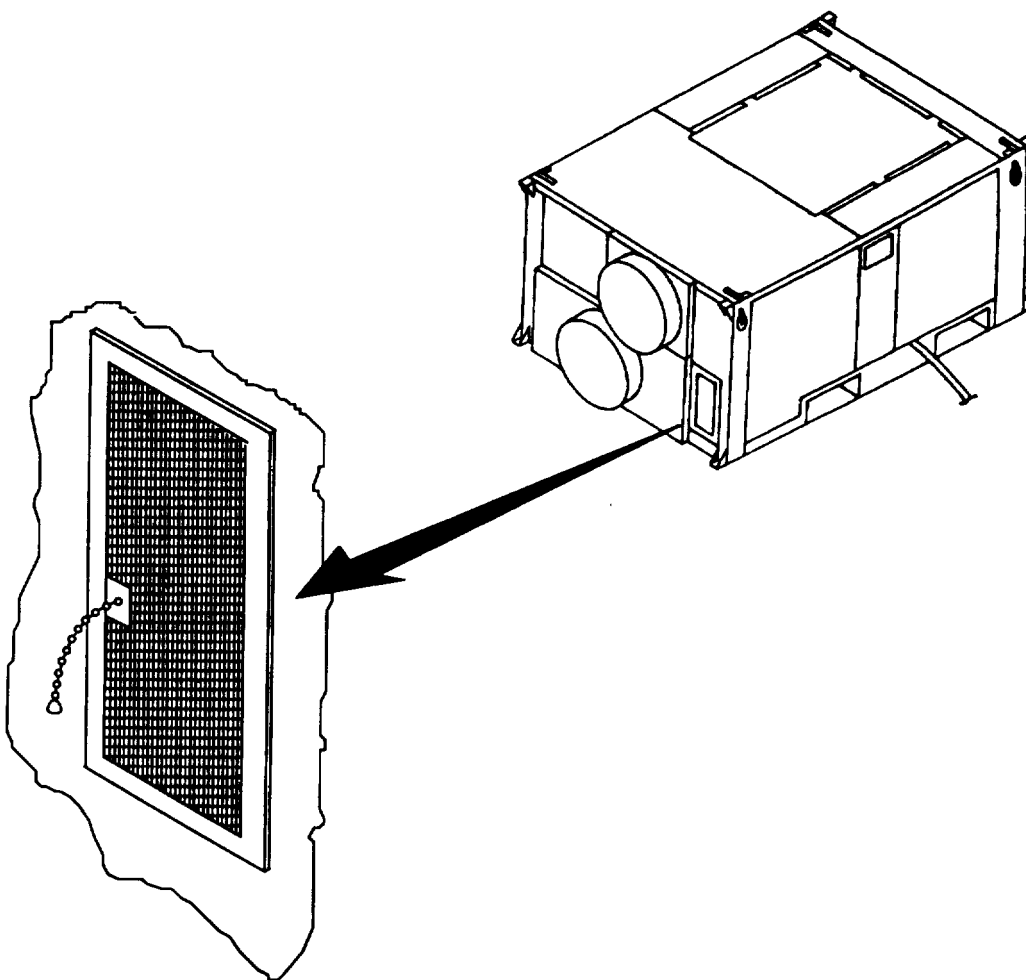


Figure 2-7. Fresh Air Damper (Door Adjustment

CAUTION

Immediately following a power source interruption, rotate selector switch to OFF/RESET. To prevent voltage fluctuation damage to the compressor motor. Do not turn on air conditioner until the generator has come up to full speed.

NOTE

A high temperature cutout (HTCO) located near the heating elements will turn them off if the temperature in the heater compartment reaches an excessive level.

2-10. RESET MODE

a. In the event of unexpected shutdown while the air conditioner is operating normally in the VENT or AUTO mode, rotate the mode selector momentarily to the OFF/RESET position, then back to VENT or AUTO.

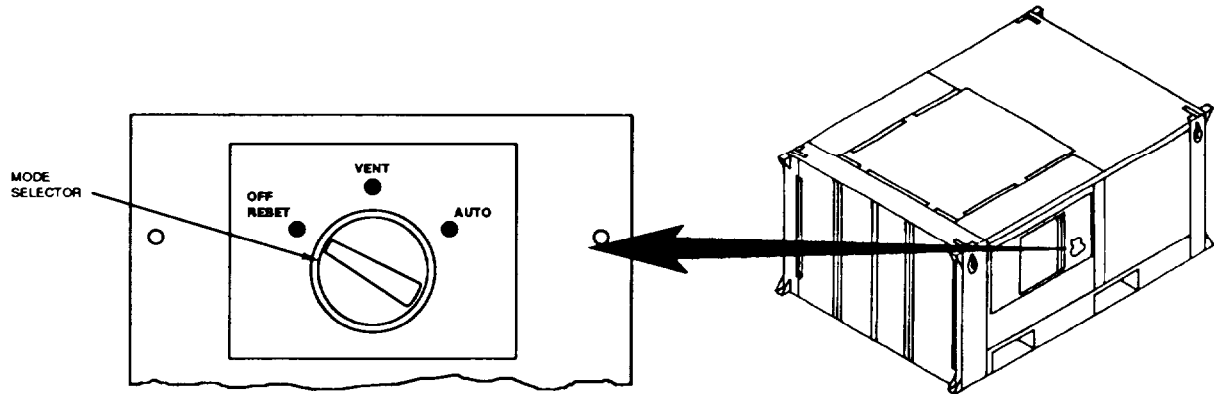


Figure 2-8. Reset Mode Setting

b. If the air conditioner does not then resume normal operation, contact your supervisor and unit maintenance.

2-11. OVERLOAD

a. To reset, push the reset button on the circuit breaker.

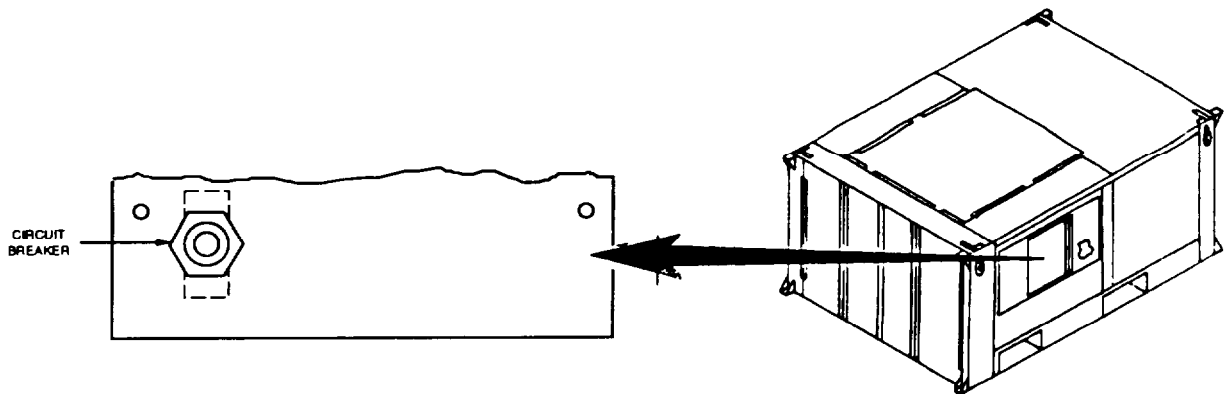


Figure 2-9. Circuit breaker reset

b. Rotate the mode selector momentarily to the OFF-RESET position, then move to VENT or AUTO.

NOTE

If the circuit breaker continues to trip, contact your supervisor and unit maintenance.

2-12. SHUTDOWN (OFF). Turn mode selector to OFF-RESET position.

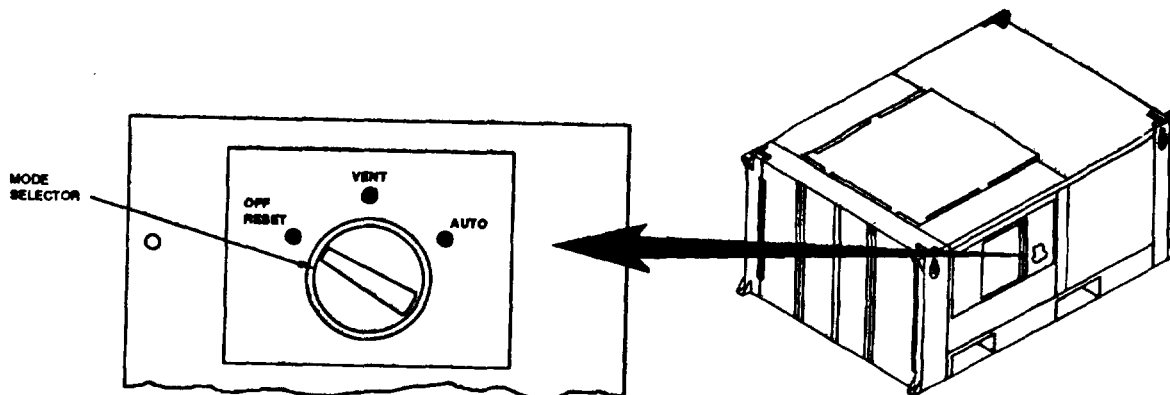


Figure 2-10. OFF-RESET Setting

CAUTION

To prevent possible damage to equipment DO NOT disconnect power to the air conditioner during periods of normal shutdown. Power should be disconnected only if unit is to be serviced, during emergency conditions, or during periods of extended shutdown due to warmup period of compressor heaters.

2-13. PREPARATION FOR MOVEMENT. When the unit is to be moved, the services of organizational maintenance shall be employed for the necessary preparations. See Chapter 4, Section IV.

2-14. INFORMATION PLATE.
shown.

Information and identification plates and markings furnished with the unit are as

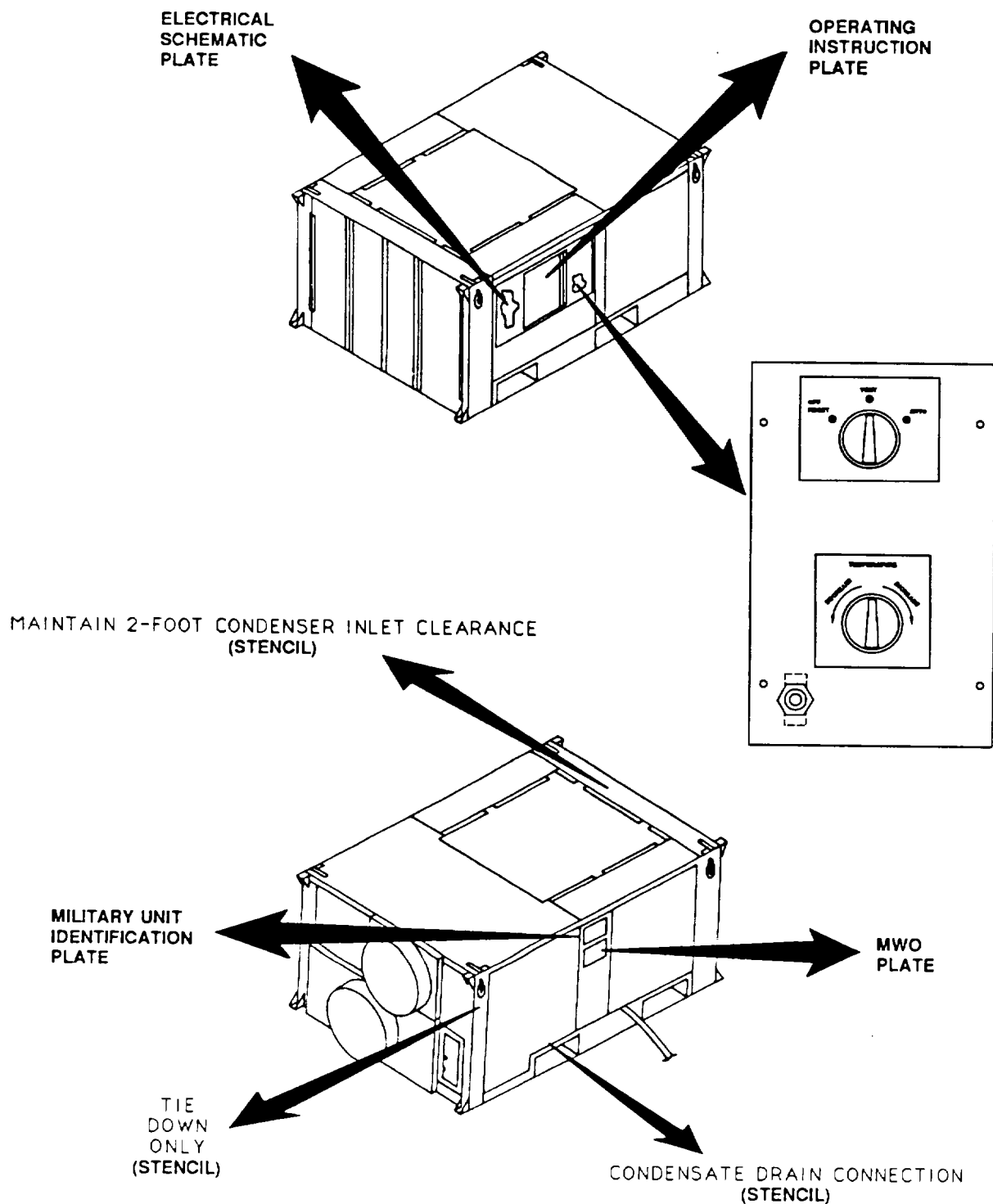


Figure 2-11. Information Plate

Section IV. OPERATING UNDER UNUSUAL CONDITIONS

2-15. GENERAL. The air conditioner is designed to operate normally within a wide range of climatic conditions. However, some extreme conditions require special operating and servicing procedures to prevent undue loading and excessive wear on the equipment.

2-16. OPERATION IN EXTREME HEAT. The air conditioner is designed to operate in temperatures up to 120 °F (48.9°C). Extra care should be taken to minimize the cooling load when operating in extremely high temperatures. Some of the steps that may be taken are:

- a. Check all openings in the shelter or enclosure, especially doors and windows, to be sure they are tightly closed. Limit in and out traffic, if possible.
- b. When possible, use shades or awnings to shutout direct rays of the sun.
- c. 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 needed for ventilation.

NOTE

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

2-17. OPERATION IN EXTREME COLD

CAUTION

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

The air conditioner is designed to operate in temperatures down to -50 °F (-45 °C). Extra care should be taken to minimize the heating load when operating in extremely low temperatures. Some of the steps that maybe taken are:

- a. Check all openings in the enclosure, especially doors and windows, to be sure they are tightly closed. Limit in and out traffic, if possible.
- b. Open shades and awnings to permit entry of direct rays of the sun, if appropriate.
- c, Limit the amount of cold, outside airintroduced through the fresh air damper to that needed for ventilation.

NOTE

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

2-18. OPERATION IN DUSTY OR SANDY CONDITIONS. Dusty and sandy conditions can seriously reduce the efficiency of the air conditioner by clogging the air filters and thereby causing a restriction of 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 mist eliminator, condensate trap, and water drain lines. Some of the steps that may be taken are:

- a. Frequent cleaning of filters and all other areas of dust and sand accumulation. In extreme conditions, daily cleaning of filters may be necessary.
- b. Limit the amount of dusty or sandy outside air introduced through the fresh air damper to that essential for ventilation.

2-19. OPERATION IN UNUSUALLY WET CONDITIONS. The air conditioner is designed for normal exposure to the elements, so it is reasonably waterproof. Some of the steps that should be taken in an extremely wet climate are:

- a. More frequent inspection and cleaning of the condensate trap and drain lines to insure proper drainage.
- b. Open evaporator section access door and dry out interior where condensate has collected.

2-20. OPERATION IN SALT AIR OR SEA SPRAY. Salt air or sea spray may cause many of the same clogging problems as encountered when operating in a dusty or sandy environment. In addition, the nature of salt presents serious corrosion problems. Frequent cleaning is necessary during which all exposed surfaces should be thoroughly spray rinsed or sponged with fresh water to remove salt.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. GENERAL. No operator lubrication is required.

Section II. OPERATOR TROUBLESHOOTING PROCEDURES

3-2. USE OF TABLE

a. Table 3-1 contains troubleshooting instructions designed to be useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner. The table lists the common malfunctions which you may find during the operation or maintenance of the air conditioner or its components. You should perform the tests/ inspections and corrective actions in the order listed.

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

c. Report any trouble or corrective action beyond the scope of operator maintenance to your supervisor and Unit Maintenance.

TABLE 3-1. OPERATOR TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<div>WARNING</div> <p>Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.</p>		
1. AIR CONDITIONER DOES NOT START IN ANY MODE.		
	Step 1. Check to see if power has been disconnected.	
		Connect input power.
	Step 2. Check to see if circuit breaker is tripped.	
		Reset button. If circuit breaker continues to trip, contact your supervisor.
2. REDUCED COOLING CAPACITY.		
	Step 1. Check that all doors, windows, and other openings in the room or enclosure are tightly closed.	
		Tightly close all openings.
	Step 2. Check operation of temperature control.	
		Set control at maximum DECREASE (cooler); then, if condition improves, adjust properly.
	Step 3. Check for restricted duct airflow.	
		Spread ducts properly.
	Step 4. Check to be sure that excessive hot, outside air is not being introduced through the fresh air damper.	
		Fully close damper, then, if condition improves, adjust properly.
	Step 5. Check for clogged drain hose.	
		Unclog drain hose.

TABLE 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 6. Check liquid sight indicator for bubbles in refrigerant.	Turn off. Contact your supervisor.
3. REDUCED HEATING CAPACITY.	Step 1. Check that all doors, windows, and other openings in the room or enclosure are tightly closed.	Tightly close all openings.
	Step 2. Check operation of temperature control.	Set control to fully INCREASE (warmer); then, if condition improves, adjust properly.
	Step 3. Check for restricted duct airflow.	Spread ducts properly.
	Step 4. Check to be sure that excessive cold outside air is not being introduced through the fresh air damper.	Fully close damper; then, if condition improves, adjust properly. Otherwise contact your supervisor.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT

4-1. GENERAL

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

b. Special Tools, TMDE, and Support Equipment. Test, Measurement, and Diagnostic Equipment (TMDE) and support equipment include standard equipment found in any organizational maintenance shop. No special tools are required for maintenance of this equipment.

c. Repair parts. Repair parts and special tools are listed and illustrated in the TM 9-4120-398-24P Repair Parts and Special Tools List (RPSTL), covering Unit, Direct Support, and General Support Maintenance for this equipment.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

4-2. UNLOADING. The air conditioner is shipped assembled and ready for subsequent operation. The system contains a full charge of refrigerant compressor oil. To unload and set for use, proceed as follows:

WARNING

Do not lift air conditioner by tiedown eyes. Injury to personnel or damage to equipment could occur from improper hoisting.

- a. Remove tiedowns. Unload unit using a hand truck or fork lift.
- b. Move air conditioned to installation site and position as described in paragraph 4-5.
- c. Inspect air conditioner as directed in Section III.

4-3. UNPACKING

a. General. Normally, the packaged air conditioner should be moved into the immediate area in which it is to be reinstalled before it is unpacked.

b. Remove shipping container. Cut metal bands that hold the top of container to pallet. Remove staples that secure fiber board container to pallet. Lift container vertically and remove it from the base and cabinet.

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

NOTE

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

4-4. CHECKING UNPACKED EQUIPMENT. Perform receiving inspection of the air conditioner in the following manner:

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report damage on form SF364, Report of Discrepancy.

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.

4-5. INSTALLATION SITE PREPARATION

a. General. The air conditioner is designed so that it is adaptable to a variety of installation arrangements. Most typical installations are made by preparing an opening in an exterior wall of the room or enclosure to be conditioned and positioning the air conditioner so that the ducts can be attached as shown in figure 4-2. The following are minimum requirements for all installations:

(1) A relatively flat unobstructed space of an area not less than 4 feet by 8 feet is required for emplacement of the air conditioner. If the air conditioner is to be located on an uneven terrain, the raised corner must not be higher than 5 inches above the lowered corner. Overhead clearance for condenser fan exhaust should be available. See figure 4-1 for installation dimensions.

NOTE

Provide a minimum distance of 2 feet at rear of unit for condenser air circulation.

(2) An unobstructed flow of air from outside the conditioned area to the inlet and outlet of the condenser.

(3) An unobstructed flow of air from inside the conditioned area to the conditioned air intake and discharge.

(4) An unobstructed flow of air from outside the conditioned area to the fresh air damper intake.

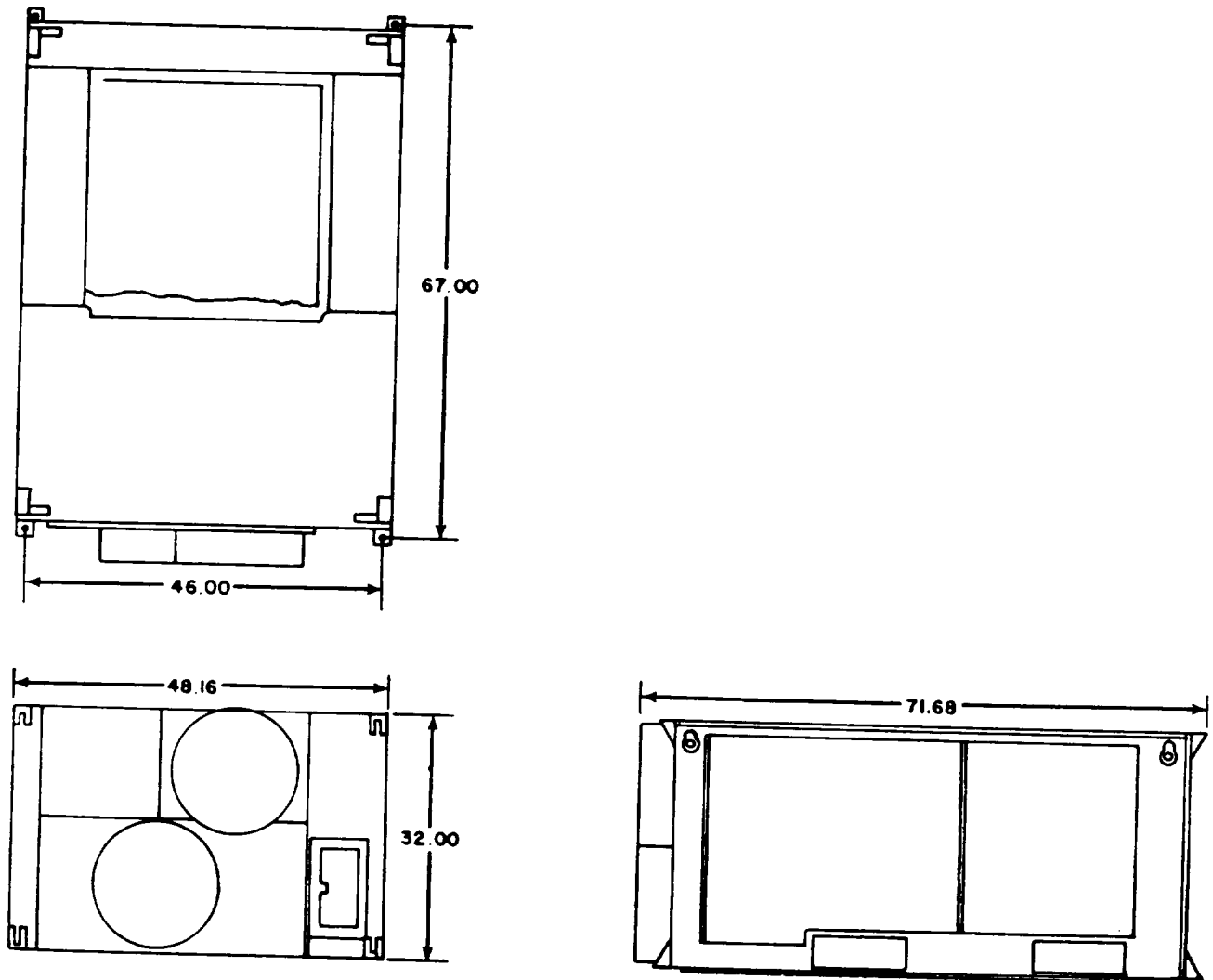


Figure 4-1. Installation Dimensions

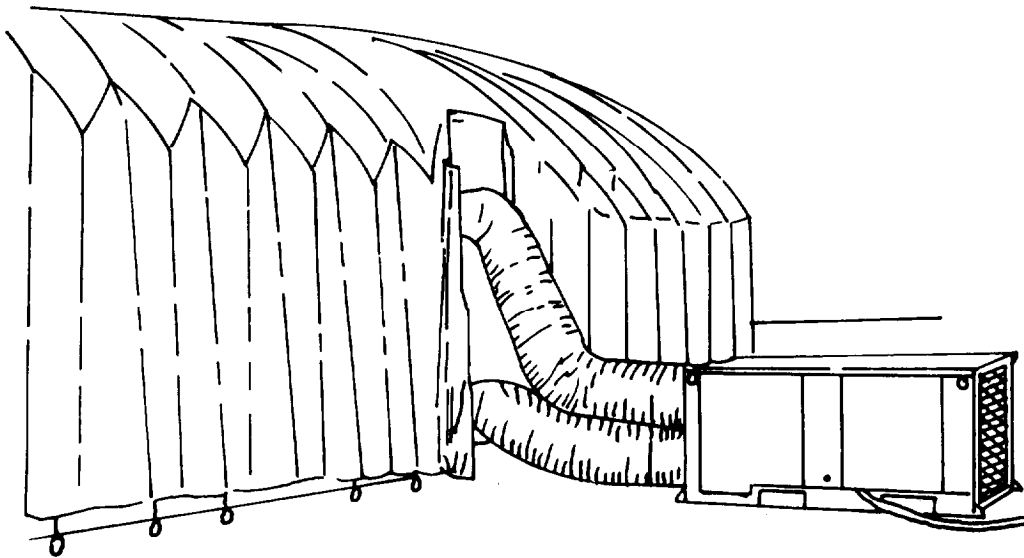


Figure 4-2. Air Conditioner Duct Attachment to Structure

(5) Access to all sides of the cabinet for routine operation and servicing and for necessary maintenance actions.

(6) Access to the top of the cabinet for removal of the top panel and sufficient headroom to allow maintenance actions and internal component removal and installation through the top panel opening.

(7) A source of 208/230 volt three phase, four wire, 50/60 hertz input power rated at 35 amps. The power source outlet should be located as near as possible to the installed location of the air conditioner and should not exceed 25 feet. The power source wiring must include a disconnect switch. However, provisions should be made to insure that power is not disconnected during normal operation and that the disconnect is not used to turn off the air conditioner for normal shutdown.

(8) An integral power cable is provided for operations of the unit. A connector is provided on the end of the power cord for attachment to the power source. A case ground is provided through the fifth wire of the power cable.

NOTE

An earth ground capable of handling 35 amps is required.

(9) Check that no source of dangerous or objectionable fumes are located near the fresh air intake.

(10) If possible make use of terrain features such as trees and buildings to provide a shaded location. This will minimize the cooling load on the air conditioner.

(11) If possible avoid locations where the condenser and fresh air intakes will be laden with dust, dirt, soot, smoke, or other debris.

b. Place the air conditioner approximately 6 to 7 feet from the structure to be cooled with front of unit (figure 4-2) pointing toward the building. Position the air conditioner for duct attachment free of kinks or sharp bends to allow unobstructed passage through air delivery and air return ducts.

4-6. INSTALLATION INSTRUCTIONS

a. Duct Connections. Two flexible ducts are contained in the storage space inside the air conditioner. To remove the ducts and attach to the air conditioner duct adapters, proceed as follows:

(1) On the left side of air conditioner observe two hinged panels. The panel toward the rear (figure 1-1) gives access to the interior storage space. Open the panel by rotating the lock fasteners 1/4-turn to the left (counter-clockwise). Loosen the two wing nuts on each duct rack and lift out the flexible ducts and racks. Store racks inside condenser compartment after removing ducts.

(2) Remove the duct adapter flange covers from the front of the air conditioner. Store covers inside condenser compartment.

NOTE

Observe airflow directional arrow on duct. The 7-foot duct attaches to the air return (1) and the 9-foot duct attaches to the supply (2) as shown in figure 4-3.

(3) Slide the end of the duct onto the duct adapter. When properly in place, the hem containing the strap is passed over the raised rim of the port flange (figure 4-3). Make sure the strap ends are positioned to allow adequate space for working with tools.

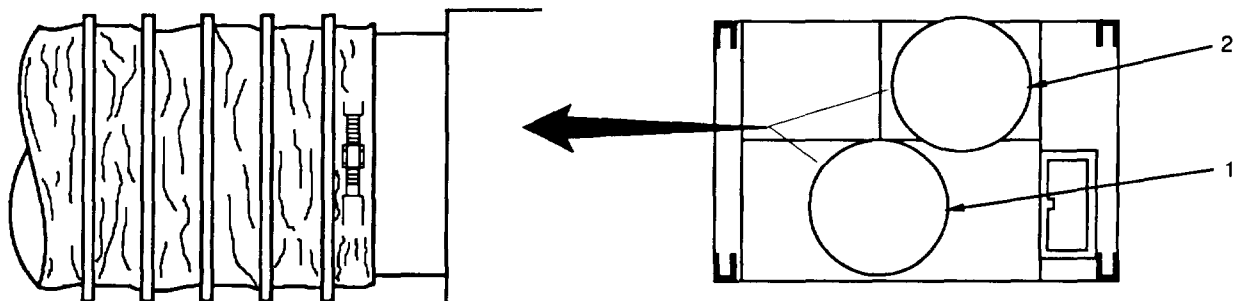


Figure 4-3. Flexible Duct Attachment to Duct Adapter Flange

(4) Insert the serrated end of the strap under the screw at the other end such as to engage the screw threads onto the serrations (figure 4-4).

(5) Tighten the screw sufficiently to clamp the 7-foot duct securely onto the return fitting adapter port flange. Do not overtighten; the duct will carry airflow at a relatively low pressure.

(6) Repeat steps (3) through (5) as necessary to attach the 9-foot flexible duct to the supply fitting.

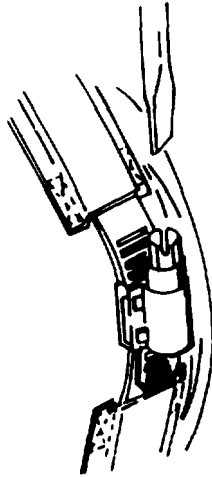


Figure 4-4. Method of Tightening Clamp

(7) Repeat steps (3) through (6) as necessary to attach the 9-foot flexible ducts (supply) to the structure that will receive the conditioned air. Figure 4-2 shows an air conditioner properly connected to a structure.

b. Drain Hose Connection. Condensate drain hoses are provided for connection to the drain outlets which are located in the fork lift opening on each side of the unit. The 1/2 inch barbed hose connection is connected to the 1/4-female pipe fitting and the hose is then attached to the barbed connector. During shipment the drain hose can be disconnected and placed in the duct storage compartment along with the power cable.

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

4-7. INTRODUCTION, INSPECTION, AND SERVICE

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

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

c. Table 4-1 lists the unit preventive maintenance checks and services that should be performed at quarterly intervals (or otherwise stated in table 4-1). The PMCS items in the table have been arranged and numbered in a logical sequence to provide for greater personnel efficiency and least amount of required maintenance downtime.

WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electrical equipment unless there is another person nearby who is familiar with operation and hazards of equipment and who is competent in administering first aid. For artificial respiration, refer to FM 21-11. When technician is aided by operators, he must warn them about dangerous areas.

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

Be careful not to contact high-voltage connections of 208/230 volts ac input when installing or operating this equipment.

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

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

TABLE 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Item No.	W – Weekly			Item to be inspected	M – Monthly	Procedures Check for and have repaired or adjusted as necessary	Q – Quarterly	Equipment is not ready/available if:
	Interval	W	M	Q				
1	•				Doors, Covers and Panels	a. Check for loose or missing hardware, defective 1/4-turn fasteners.		
2			•		Air Filter	b. Lubrication as required.		
				•		a. Open the evaporator access door (1).		
						b. Remove the filter (2).		
						c. Replace if defective.		
						d. Wash the filter with a water spray until clean. Allow filter to dry.		
						e. Spray filter with coating		
						f. Return air filter to air conditioner. Close and secure evaporator access door.		

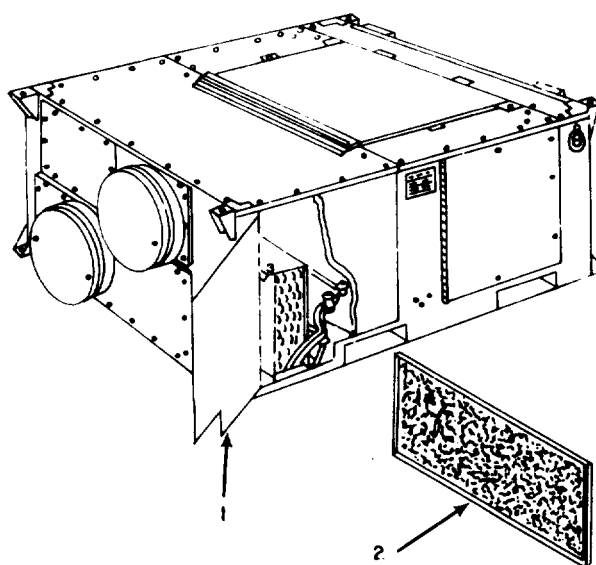


TABLE 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - Continued

Item No.	W – Weekly			Item to be inspected	M – Monthly	Q – Quarterly
	W	M	Q			
3	•			Flexible Ducts	a. Inspect for worn or torn spots. b. Check for security of attachment to flanges. c. Clean as required.	
4		•	•	External Control Panel	Inspect for missing, loose, or damaged knobs.	
5			•	Internal Control Board	Check Terminal lug attachment to relays, starters, and terminal boards.	
6		•		Electrical Leads	Inspect for damaged insulation, broken connections to lugs, and indications of deterioration.	
7		•		Power Cable	a. Inspect for frayed or damaged insulation, secure attachment to terminal block and condition of attachment plug. b. Inspect cord condition at point of entry to control board through strain relief cable fitting.	
8		•		Evaporator Blower	Inspect for loose or missing hardware.	
9	•			Evaporator Belts	Check for damaged, worn or missing fan belt.	
10	•			Evaporator Fan Motor	a. Inspect for secure motor mounting. Check for loose or missing hardware. b. Check electrical attachment.	
11		•	•	Heater Assembly	a. Inspect for secure mounting. b. Inspect cable condition at point of entry to terminal box.	

TABLE 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - Continued

Item No.	W – Weekly			Item to be inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is not ready/available if:
	W	M	Q			
12		•		Condenser Fan Impeller	a. Ensure secure fan attachment to motor shaft.	
		•			b. Inspect for loose or missing hardware.	
		•			c. Check electrical attachments.	
13			•	Evaporator Coil	a. Inspect for secure mounting.	
			•		b. Check for loose or missing hardware.	
			•		c. Check fins for dents, bent edges, or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.	
			•		d. Clean coil with a soft bristle brush, vacuum cleaner and brush attachment, or use compressed air at 30 psi or less from the inside of the unit to blow the dirt out. Take care to avoid fin damage.	
14			•	Thermostatic Expansion Valve	a. Inspect for secure mounting.	
		•			b. Check copper tubing attachment.	
		•			c. Inspect for damaged remote bulb tubing.	
			•		d. Check sensor bulb for secure attachment.	
15			•	Liquid Quench Valve	a. Inspect for secure mounting.	
		•			b. Check copper tubing attachment.	
		•			c. Inspect for damaged remote bulb tubing.	
			•		d. Check sensor bulb for secure attachment.	

TABLE 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - Continued

Item No.	W – Weekly			Item to be inspected	M – Monthly	Q – Quarterly	Equipment is not ready/available if:
	W	M	Q				
16			•	Accumulator	Inspect for secure mounting. Check copper tubing attachment.		
17			•	Condenser Coil	a. Inspect for secure mounting.		
			•		b. Check for loose or missing hardware.		
			•		c. Check fins for dents, bent edges, or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.		
			•		d. Clean coil with a soft bristle brush, vacuum cleaner and brush attachment, or use compressed air at 30 psi or less from the inside of the unit to blow the dirt out. Take care to avoid fin damage.		
18			•	Sight Liquid Indicator	a. Inspect for secure mounting.		
			•		b. Insure that glass is clean.		
			•		c. Check for broken glass.		
19		•		Compressor Unit	Inspect for secure mounting. Check electrical attachment.		

Section IV. UNIT TROUBLESHOOTING

4-8. GENERAL

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner unit. Each malfunction for an individual component unit or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

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

c. Table 4-2 lists the common malfunctions which you may find during the operation or maintenance of the air conditioner unit or its components. Before using this table, be sure you have performed all applicable checks and the tests/inspections and the corrective actions in the order listed.

WARNINGS

HIGH VOLTAGE

is used in operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.

Never work on electrical equipment unless there is another person nearby who is familiar with operation and hazards of equipment and who is competent in administering first aid. When technician is aided by operators, he must warn them about dangerous areas.

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

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

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

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

TABLE 4-2. UNIT TROUBLESHOOTING

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. AIR CONDITIONER FAILS TO OPERATE IN ANY MODE.		
Step 1. Check for tripped circuit breaker.		
Reset circuit breaker (See figure 2-1.)		
Step 2. Check for defective circuit breaker.		
Replace circuit breaker (See paragraph 4-27.)		
Step 3. Check for defective power cord.		
Replace power cord. (See paragraph 4-30.)		
Step 4. Check for defective mode selector switch (S1.)		
Replace switch. (See paragraph 4-25.)		
Step 5. Check for defective thermostat control (S2.)		
Replace thermostat. (See paragraph 4-26.)		
Step 6. Check for defective control relay (K4, K5.)		
Replace relay. (See paragraph 4-28.)		
If problem still exists, refer to supervisor.		
2. AIR CONDITIONER STOPS - VENT MODE.		
Step 1. Check for tripped circuit breaker.		
Reset circuit breaker. (See figure 2-1.)		
Step 2. Check for defective mode selector switch (S1.)		
Replace switch. (See paragraph 4-25.)		
Step 3. Check for defective control relay (K4, K5.)		
Replace relay. (See paragraph 4-28.)		
Step 4. Check for defective motor starter (K1.)		
Replace relay. (See paragraph 4-28.)		

TABLE 4-2. UNIT TROUBLESHOOTING-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Check for tripped thermal cutout (TCO) in fan motor.	Allow to cool and restart air conditioner. (See paragraph 2-10.) If problem still exists, refer to supervisor.
3. AIR CONDITIONER STOPS - AUTO MODE.		
	Step 1. Check for tripped circuit breaker.	Reset circuit breaker. (See figure 2-1.)
	Step 2. Check for defective mode selector switch (S1.)	Replace switch. (See paragraph 4-25.)
	Step 3. Check for defective thermostat control switch (S2)	Replace switch. (See paragraph 4-26.)
	Step 4. Check for defective control relay (K4, K5.)	Replace relay. (See paragraph 4-28.)
	Step 5. Check for continuity in high temperature cutout switch.	Replace defective cutout. (See paragraph 4-38.) If problem still exists, refer to supervisor.
4. NO (OR REDUCED) COOLING.		
	Step 1. Check sight glass for bubbles or discoloration.	Shut down air conditioner and contact supervisor.
	Step 2. Check for defective time delay relay (K6).	Replace time delay relay. (See paragraph 4-28.)

TABLE 4-2. UNIT TROUBLESHOOTING-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 3. Check for clogged air filter.	Clean falter. (See paragraph 4-21.)
	Step 4. Check for defective thermostatic control switch (S2).	Replace thermostatic control switch. (See paragraph 4-26.)
	Step 5. Check for defective condenser fan motor.	Replace motor. (See paraqraph 4-37.) If problem still exists, refer to supervisor.
5. EXCESSIVE COOLING.		
	Step 1. Check for defective thermostatic control switch (S2).	Replace thermostatic control switch. (See paragraph 4-26.)
	Step 2. Check for defective time delay relay (K6.)	Replace time delay relay. (See paragraph 4-28.)
	Step 3. Check for defective compressor motor starter (K3.)	Replace motor starter. (See paragraph 4-28.) If problem still exists, refer to supervisor.
6. MOTOR/COMPRESSOR UNIT EXCESSIVELY NOISY.		
	Check for unit loose on base.	Tighten hold-down bolts as necessary. If problem still exists, refer to supervisor.

TABLE 4-2. UNIT TROUBLESHOOTING-Continued

MALFUNCTION**TEST OR INSPECTION****CORRECTIVE ACTION**

7. MOTOR/COMPRESSOR UNIT INOPERATIVE (OTHER COMPONENTS FUNCTIONING).

Step 1. Check for defective time-delay relay (K6.)

Replace relay. (See paragraph 4-28.)

Step 2. Check for defective motor starter (K3.)

Repair or replace motor stinter. (See paragraph 4-28.)

If problem still exists, refer to supervisor.

8. EVAPORATOR BLOWER INOPERATIVE - VENT MODE OR AUTO MODE.

Step 1. Check for broken belt

Replace belt. (See paragraph 4-33.)

Step 2. Check for pulley loose on motor shaft or on blower shaft.

Tighten setscrew. (See paragraph 4--34.)

Step 3. Check for defective mode selector switch (S1).

Replace switch. (See paragraph 4-25.)

Step 4. Check for defective control relay (K4, K5.)

Replace relay. (See paragraph 4-28.)

Step 5. Check for defective motor starter (K1.)

Replace starter. (See paragraph 4-28.)

Step 6. Check for defective evaporator fan motor (B1.)

Replace motor. (See paragraph 4-31.)

If problem still exists, refer to supervisor.

9. EVAPORATOR BLOWER INOPERATIVE - AUTO MODE ONLY,

Check for defective high temperature cutout switch.

Replace switch. (See paragraph 4-38.)

If problem still exists, refer to supervisor.

TABLE 4-2. UNIT TROUBLESHOOTING-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10. CONDENSER FAN INOPERATIVE.		
Step 1. Check for loose impeller.		
Tighten setscrews. (See paragraph 4-36.)		
Step 2. Check for defective mode selector switch (51).		
Replace switch. (See paragraph 4-25.)		
Step 3. Check for defective control relay (K4-K5).		
Replace relay. (See paragraph 4-28.)		
Step 4. Check for defective motor starter (K2).		
Replace starter. (See paragraph 4-28.)		
Step 5. Check for defective condenser fan motor (B2).		
Repair or replace motor. (See paragraph 4-37.)		
If problem still exists, refer to supervisor.		
11. COMPRESSOR RUNS CONTINUOUSLY.		
Step 1. Check for defective thermostat (S2).		
Replace thermostat. (See paragraph 4-26.)		
Step 2. Check for defective motor starter (K3).		
Replace motor starter. (See paragraph 4-28.)		
Step 3. Check sight glass for bubbles or discoloration.		
Shut down air conditioner and contact supervisor.		

TABLE 4-2. UNIT TROUBLESHOOTING-Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
12. REDUCED HEATING CAPACITY.		
Step 1. Check for clogged air filter.		
Clean air filter. (See paragraph 4-21.)		
Step 2. Check for defective heater control relay (K7-K8).		
Replace relay. (See paragraph 4-28.)		
Step 3. Check for defective heating element.		
Replace heating element, (See paragraph 4-35.)		
Step 4. Check for defective thermostat (S2.)		
Replace thermostat. (See paragraph 4-26.)		
Step 5. Check for defective evaporator blower.		
Replace blower. (See paragraph 4-32.)		
Step 6. Check for defective high temperature cut out.		
Replace high temperature cut out. (See paragraph 4-38.)		
If problem still exists, refer to supervisor.		

Section V. UNIT MAINTENANCE PROCEDURES

4-9. GENERAL. The procedures in this section have been arranged in the order in which the items appear in the organizational (O) maintenance level column on the Maintenance Allocation Chart (MAC) which is provided in Appendix B. Step-by-step procedures have been provided for all actions authorized to be performed by Unit Maintenance in the order in which they appear on the MAC.

The procedures in this section have been arranged in the order in which the items appear in the organizational (O) maintenance level column on the Maintenance Allocation Chart (MAC) which is provided in Appendix B. Step-by-step procedures have been provided for all actions authorized to be performed by Unit Maintenance in the order in which they appear on the MAC.

4-10. INFORMATION PLATES

This task covers: Replacement

INITIAL SETUP

Equipment Conditions

Power OFF

Tools

Tool kit, refrigeration SVC
Riveter, blind, hand

General Safety Instructions

Materials/Parts

Solvent (Item 15 Appendix E)
Cleaning cloths (Item 12 Appendix E
Adhesive (Item 1 Appendix E)

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).

Replacement

- a. Adhesive mounted.

WARNINGS

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).

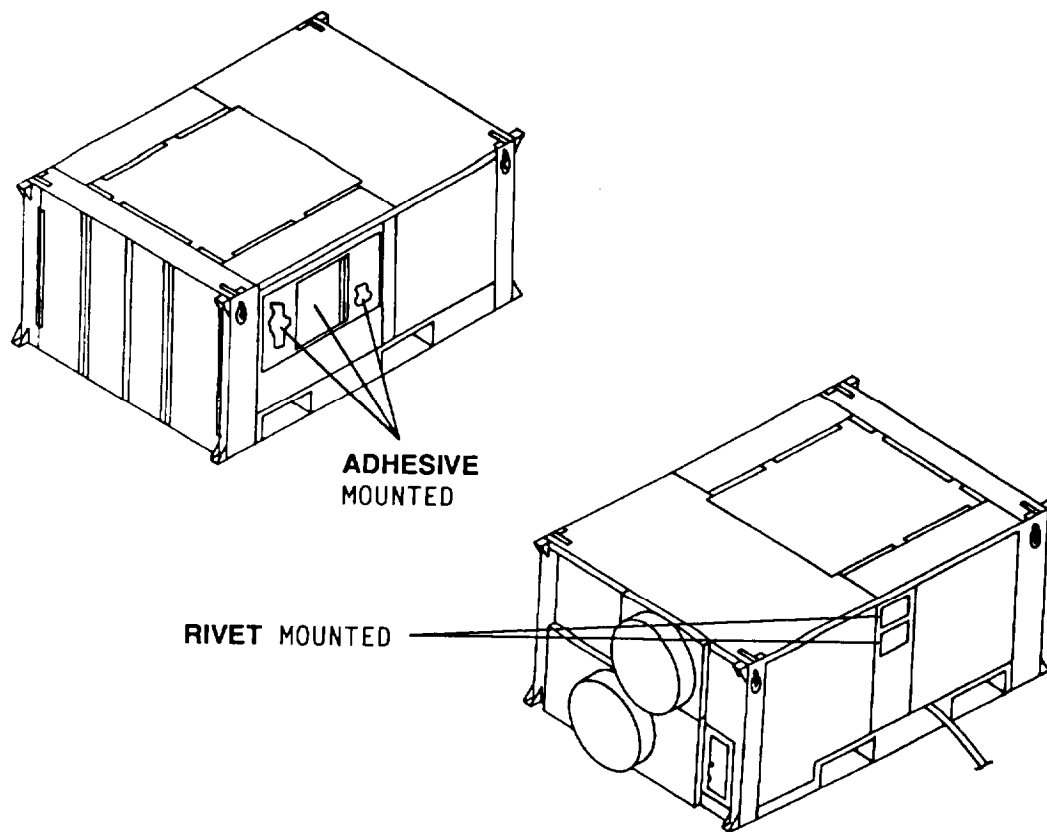
(1) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean information plate and mounting surface.

(2) Apply a thin coat of adhesive (item 1 Appendix E) to the information plate and mounting surface. Allow adhesive to dry until tacky. Apply the information plate to mounting surface and press firmly to assure an even bond.

(3) Using solvent (item 15 Appendix E) and cleaning cloth (item 12 Appendix E), remove excess adhesive from areas around the information plate, being careful not to allow solvent to flow underneath the information plate.

4-10. INFORMATION PLATES (cont)**b. Rivet mounted.**

- (1) Select drill bit one size smaller in diameter than the rivet to be removed.
- (2) Position the drill bit on the center of the rivet head and drill down slightly below the riveted surface.
- (3) Using a center punch, snap the rivet head off and punch the remaining rivet material through the hole.
- (4) Select the proper replacement rivet and insert in the rivet clinching tool.
- (5) Place the rivet in the hole and maintain the rivet shaft perpendicular to the material being riveted.
- (6) Apply a slow, even pressure on the clinching tool until the rivet is set.
- (7) Make sure rivet is snug and not free to rotate.

**Figure 4-5. Information Plates**

4-11. CONDENSER INLET GRILLE

This task covers a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power is disconnected

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Removal.

- (1) Open the condenser inlet panel (1).
- (2) Remove the 18 screws (2) and lockwashers (3) holding the condenser inlet grille (4) onto the back end of the air conditioned.
- (3) Remove the grille.

b. Inspection/Repair.

- (1) Inspect the door for general condition and proper operation.
- (2) Repair by straightening bends and dents. Replace if necessary.

c. Installation.

- (1) Aline the grille holes with the frame holes.
- (2) Install the 18 screws (2) and lockwashers (3) holding the condenser grille (4).
- (3) Close the condenser inlet panel(1).

4-11. CONDENSER INLET GRILLE (cont)

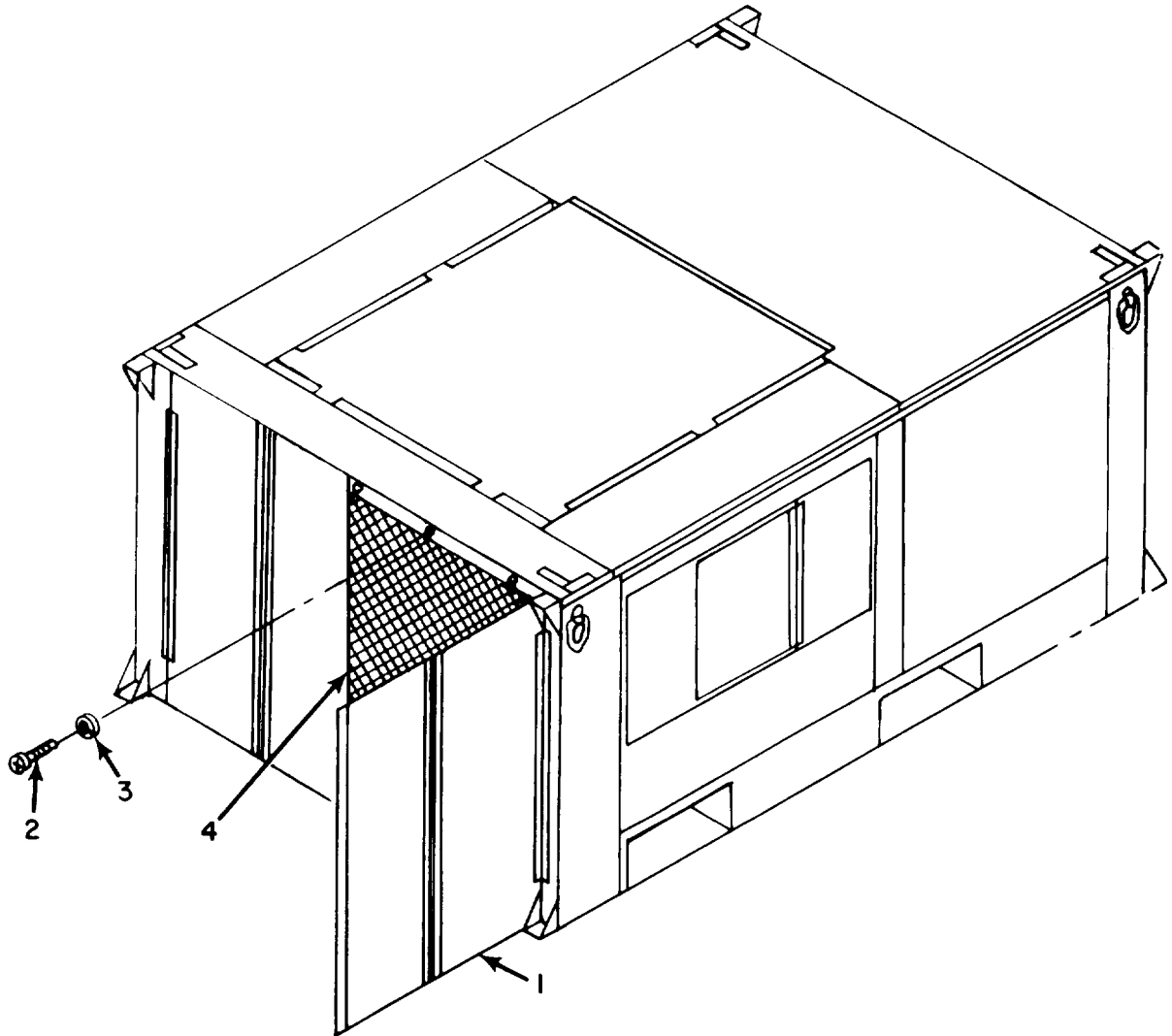


Figure 4-6. Condenser Inlet Grille

4-12 EVAPORATOR ACCESS DOOR

This task Covers: a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Tools

Tool kit refrigeration SVC
Riveter, blind hand

Materials/Parts

Insulation (TM 9-4120-398-24P)
Adhesive (item 1 Appendix E)
Gasket (TM 9-4120-398-24P)
Solvent (Item 15 Appendix E)
Cleaning cloths (Item 12 Appendix E)

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Loosen four turnlock fasteners (1), and open the door.
- (2) Remove five blind rivets (2) holding the door hinge to the frame.

b. Inspection/Repair.

- (1) Inspect the door for general condition and proper operation.
- (2) Repair by straightening bends and dents. Replace if necessary.
- (3) To replace gasket or insulation:

- (a) Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

4-12. EVAPORATOR ACCESS DOOR (cont)**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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

- (1) Aline the hinge holes with the frame holes.
- (2) Insert and set the five blind rivets (2).
- (3) Close the door and tighten the four turnlock fasteners (1).

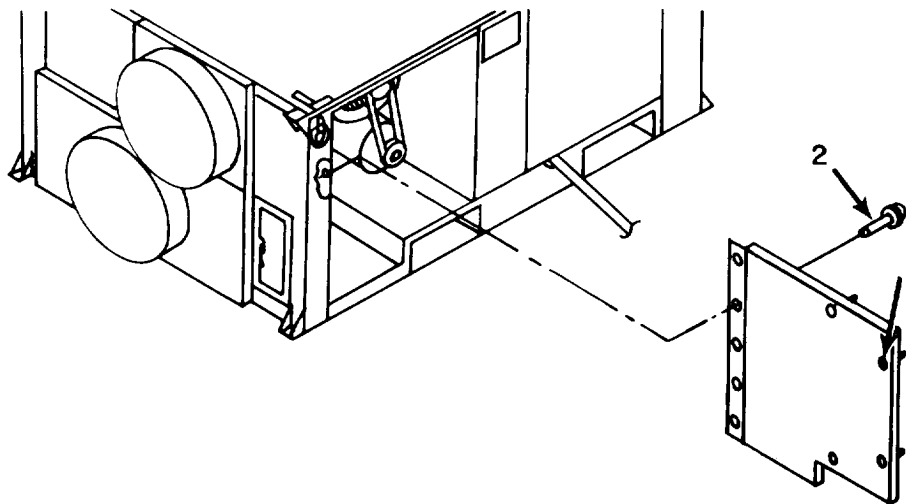


Figure 4-7. Evaporator Access Door

4-13. EVAPORATOR ACCESS PANEL

This task covers a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Rower OFF

Tool kit, refrigeration SVC

Material/Parts

Insulation (TM 9-4120-398-24P)
Adhesive (item 1 Appendix E)
Gasket (TM 9-4120-398-24P)
Solvent (Item 15 Appendix E)
Cleaning cloths (Item 12 Appendix E)

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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 ° to 59 °C).

a. Removal.

- (1) Remove 14 screws (1) holding the panel (2) to the frame.
- (2) Remove panel (2).

b. Inspection/Repair.

- (1) Inspect the panel for general condition.
- (2) Repair by straightening bends and dents. Replace if necessary.
- (3) To replace gasket or insulation:

- (a) Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

4-13. EVAPORATOR ACCESS PANEL (cont)**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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

(1) Position panel (2) in place.

(2) Secure with 14 screws (1).

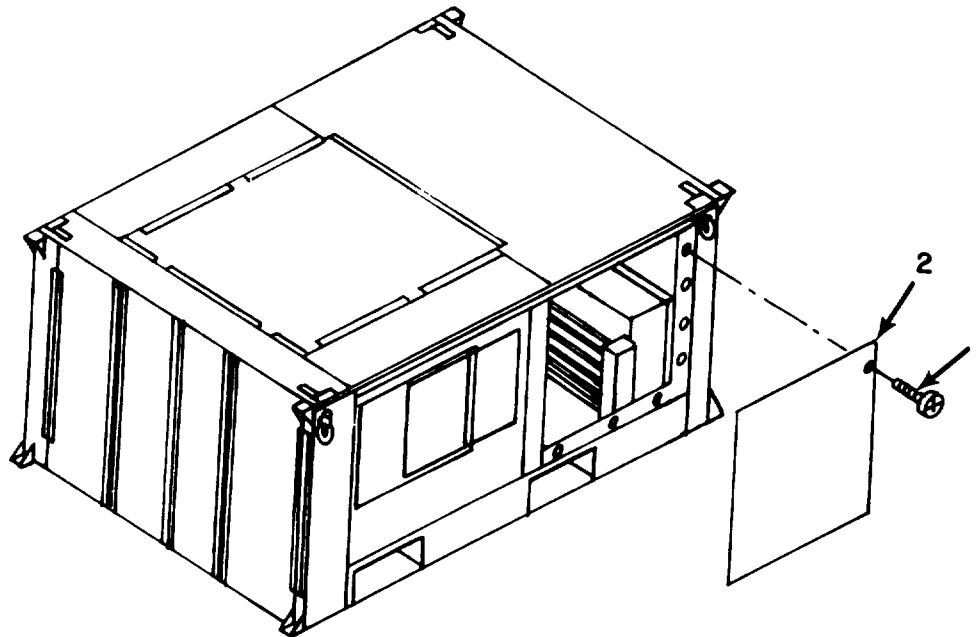


Figure 4-8. Evaporator Access Panel

4-14. CONDENSER ACCESS DOOR

This task covers: a. Repair
 b. Replacement

Initial Setup

Equipment Condition

Power OFF

Tools

Tool kit, refrigeration SVC
Riveter, blind, hand

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 AppedixE)
Gasket (TM 9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

General Safety Instructions

WARNINGS

Voltages used can kill Always
disconnect power cord to air conditioner
before performing any internal
maintenance. Shutting unit off at its
control panel does not disconnect
unit power.

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. Removal.

- (1) Loosen two turnlock fasteners (1), and open the door,
- (2) Remove five blind rivets (2) holding the door hinge to the frame.

b. Inspection/Repair.

- (1) Inspect the door for general condition and proper operation.
- (2) Repair by straightening bends and dents. Replace if necessary.
- (3) To replace gasket.
 - (a) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

4-14. CONDENSER ACCESS DOOR (cont)

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

- (1) Aline the hinge holes with the frame holes.
- (2) Insert and set the five blind rivets.
- (3) Close the door and tighten the two turnlock fasteners.

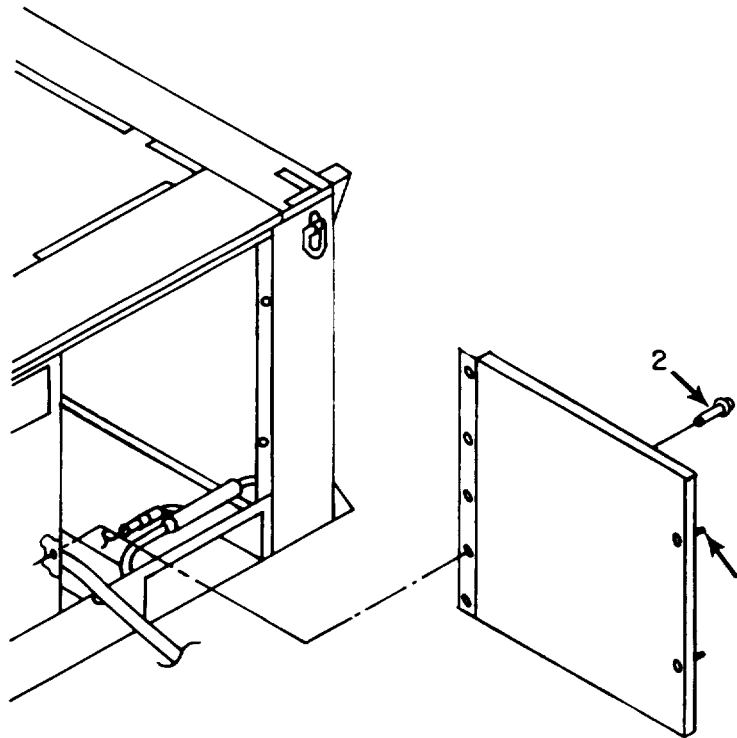


Figure 4-9. Condenser Access Door

4-15. CONDENSER OUTLET PANEL AND GRILLE

This task covers a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM 9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

Tools

Tool kit refrigeration SVC
Riveter, blind, hand

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Loosen six stud fasteners (1) from condenser outlet panel (2).
- (2) Remove the nine blind rivets (3) holding the top hinge (4).
- (3) Remove the condenser outlet panel (2).
- (4) Remove the grille (5) by removing the 10 tapping screws (6), then lift grille out.

b. Inspection/Repair.

- (1) Inspect the panel for general condition and proper operation.
- (2) Repair by straightening bends and dents. Replace if necessary.

4-15. CONDENSER OUTLET PANEL AND GRILLE (cont)

(3) To replace gasket:

(a) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

- (1) Aline the grille mounting holes with the frame holes.
- (2) Install 10 tapping screws (6) in the grille (5).
- (3) Place the condenser outlet panel (2) in position and insert the nine blind rivets (3) holding the top hinge (4).
- (4) Tighten six stud fasteners (1) to hold the condenser outlet panel (2).

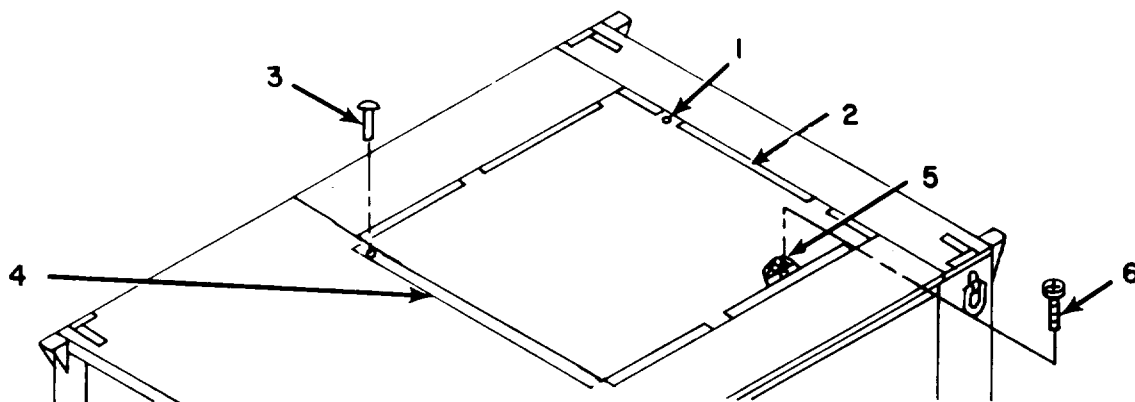


Figure 4-10. Condenser Outlet Panel and Grille

4-16. TOP FRONT PANEL

This task covers: a. Repair
 b. Replacement

INITIAL SETUP

<u>Equipment Condition</u>	<u>Tools</u>
Pbwer OFF Top panel removed (paragraph 4-15)	Tool kit, refrigeration SVC
<u>Materials/Parts</u>	<u>General Safety Instructions</u>
Solvent (Item 15 Appendix E) Adhesive (Item 1 Appendix E) Insulation (TM 9-4120-398-24P) Cleaning cloths Item 12 Appendix E)	<p>WARNINGS</p> <p>Voltages used can kill, Always disconnect power cord to air conditioner before Performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit pwer.</p> <p>Dry cleaning solvent (Federal Specification P-D-680) used to clean parts is potentially dangerous to personnel and property,</p> <p>Do not use near open flame or excessive heat. Flash point of solvent is 100 °F to 138 °F (38 °C to 59 °C).</p>

- a. Removal..
- (1) Remove two screws (1), lockwashers (2), washers (3), and stacking bolts (4) from top front panel (5).
 - (2) Remove 14 tapping screws (6) from front and top of panel (5).
 - (3) Remove top front panel (5).
- b. Inspection/Repair.
- (1) Inspect the panel for generall condition.
 - (2) Repair by straightening bends and dents. Replace if necessary.

4-16. TOP FRONT PANEL (cont)

(3) To replace insulation:

(a) Remove as much old insulation material as possible by pulling or scraping it away from the metal surface

W A R N I N G

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and insulation with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the insulation to the metal. Press into firm contact all over.

c. Installation.

(1) Position top front panel (5) and align mounting holes with frame fasteners.

(2) Install 14 tapping screws (6) in top front panel (5).

(3) Install two stacking bolts (4), screws (1), lockwashers (2), and washers (3).

(4) Install top panel. (See paragraph 4-15.)

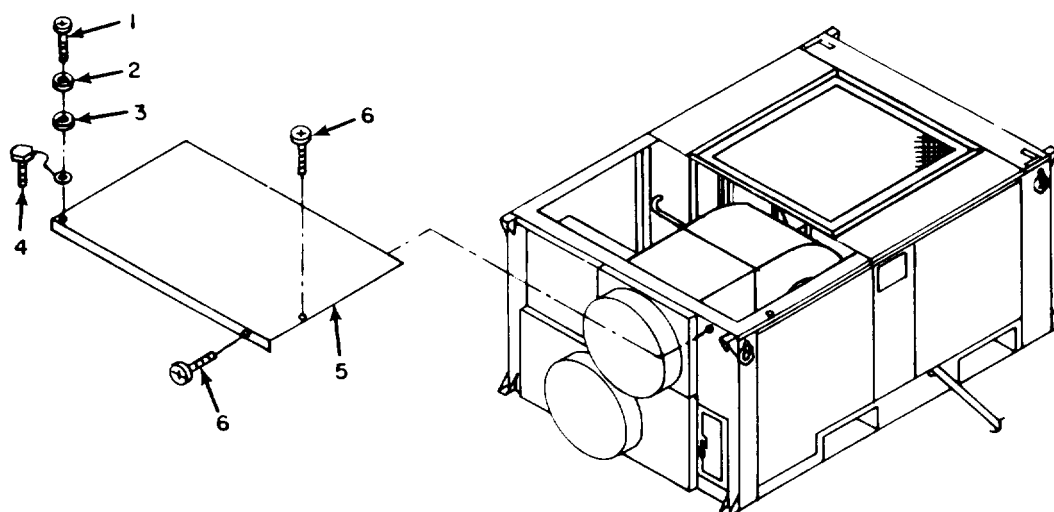


Figure 4-11. Top Front Panel

4-17. CONTROL BOARD PANEL

This task covers a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM 9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Loosen two fasteners (1).
- (2) Remove eight screws (2).
- (3) Remove control board panel (3).

b. Repair.

- (1) Straighten bends and dents. Replace as Required.
- (2) To replace gasket
 - (a) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

4-17. CONTROL BOARD PANEL (cent)**W A R N I N G**

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

- (1) Place the control board panel (3) back into position.
- (2) Secure panel to frame with eight screws (2).
- (3) Tighten two fasteners (1).
- (4) Install new instruction plates on panel as required. (See paragraph 4-10.)

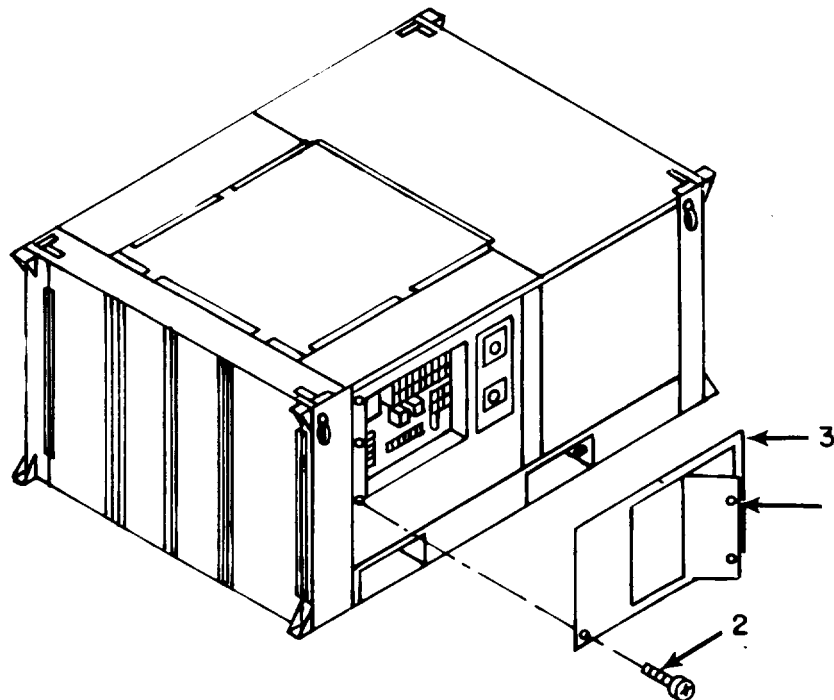


Figure 4-12. Control Board Panel

4-18. FRONT PANEL

This task covers: a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM 9-4120-398-24P)
Insulation (TM9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

Tools

Tool kit refrigeration SVC

General Safety Instructions

WARNINGS

voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Remove 12 screws (1).
- (2) Remove front panel (2).

b. Repair.

- (1) Repair by straightening bends and dents. Replace if necessary.
- (2) To replace gasket or insulation

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

4-18. FRONT PANEL (cont)**W A R N I N G**

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

(1) Aline mounting holes with easing fasteners.

(2) Secure top panel (2) to casing with 12 screws (1).

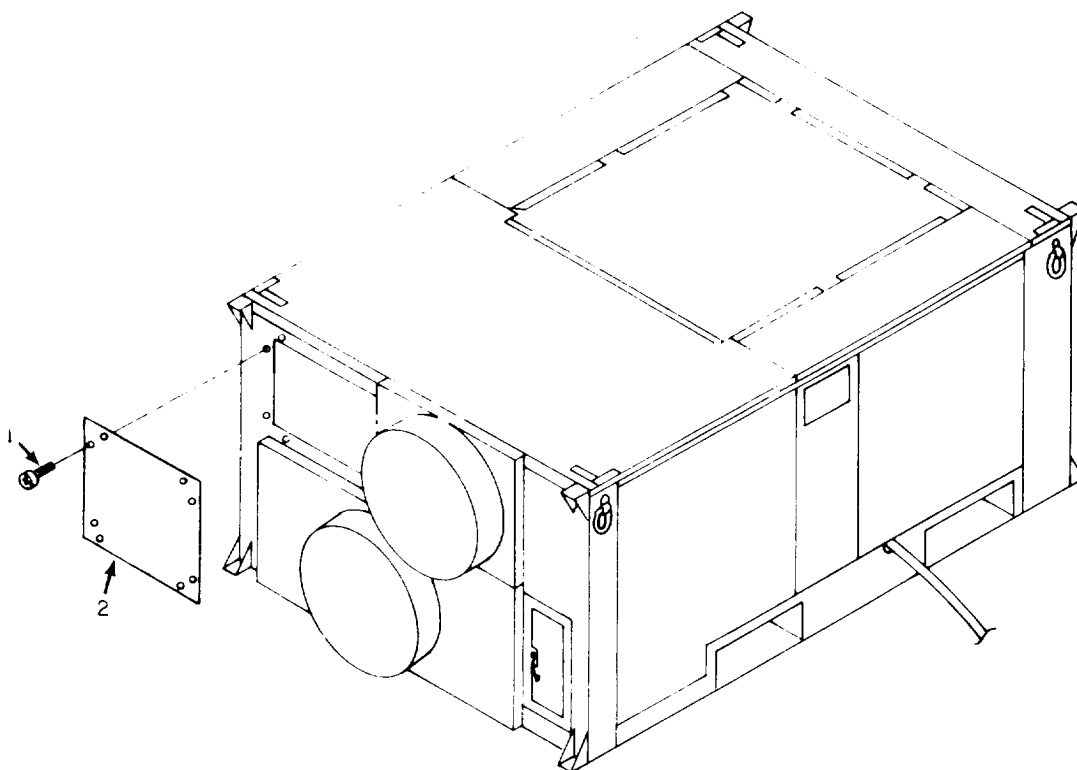


Figure 4-13. Front Panel

4-19. SUPPLY DUCT ADAPTER

This task covers: a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Supply flexible duct removed
(Paragraph 4-6)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM9-4120-398-24P)
Insulation (TM9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Remove 14 screws (1).
- (2) Remove adapter (2).

b. Repair.

- (1) Repair by straightening bends and dents. Replace if necessary.
- (2) To replace gasket or insulation:
 - (a) Remove as much old gasket or insulation material as possible by pulling or scraping it away from the metal surface.

4-19. SUPPLY DUCT ADAPTER (cont)**W A R N I N G**

Dry cleaning solvent (Federal Specification P-D680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 °F to 138°F (38°C to 59 °C).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c.Installation.

Aline mounting holes with easing fasteners.

Secure adapter (2) to casing with 14 screws (1).

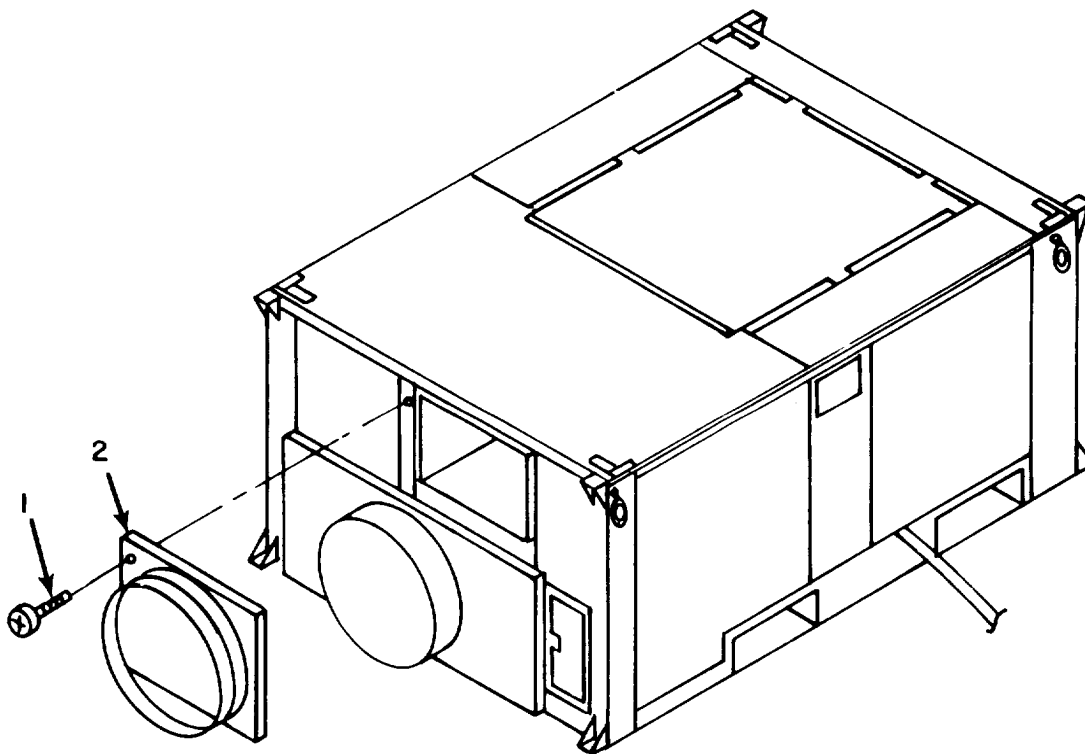


Figure 4-14. Supply Duct Adapter

4-20. RETURN DUCT ADAPTER

This task covers: a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Return flexible duct removed
(Paragraph 4-6)
Supply duct adapter removed
(Paragraph 4-19)

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM9-4120-398-24P)
Insulation (TM9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNINGS

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Remove 22 screws (1).
- (2) Remove adapter (2).

b. Repair.

- (1) Repair by straightening bends and dents. Replace if necessary.

4-20. RETURN DUCT ADAPTER (cont)

(2) To replace gasket or insulation:

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

WARNINGS

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

(1) Aline mounting holes with casing fasteners.

(2) Secure adapter (2) to casing with 22 screws (1).

(3) Install supply duct adapter. (See paragraph 4-19.)

(4) Install return flexible duct, (See paragraph 4-6.)

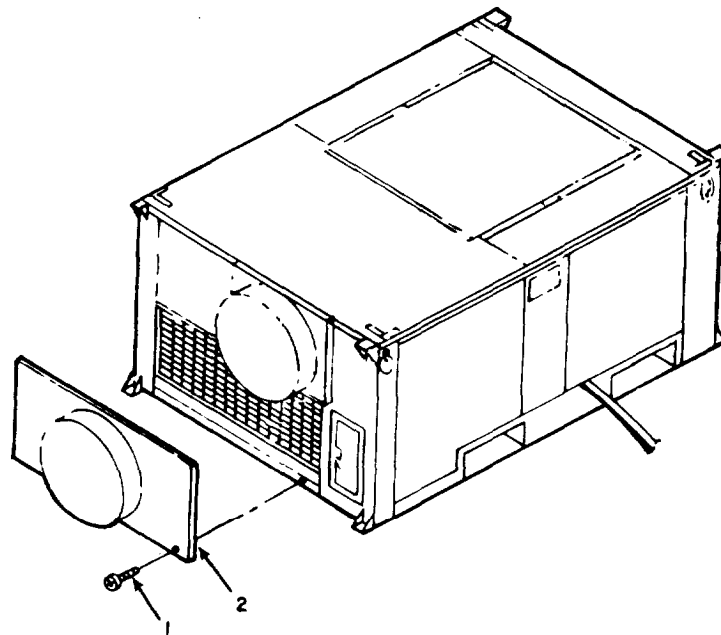


Figure 4-15. Return Duct Adapter duct

4-21. AIR FILTER

This task covers: a. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

voltages used can kill Always disconnect power cord to air Conditioner before performing any internal maintenance, Shutting unit off at its control panel does not disconnect unit power.

a. Removal.

- (1) Open the evaporator access door (1) by unscrewing four turnlock fasteners.
- (2) Remove the filter (2).

b. Installation.

- (1) Install filter (2) in air conditioner.
- (2) Close and secure evaporator accesss door (1) with four turnlock fasteners.

4-21. AIR FILTER (cont)

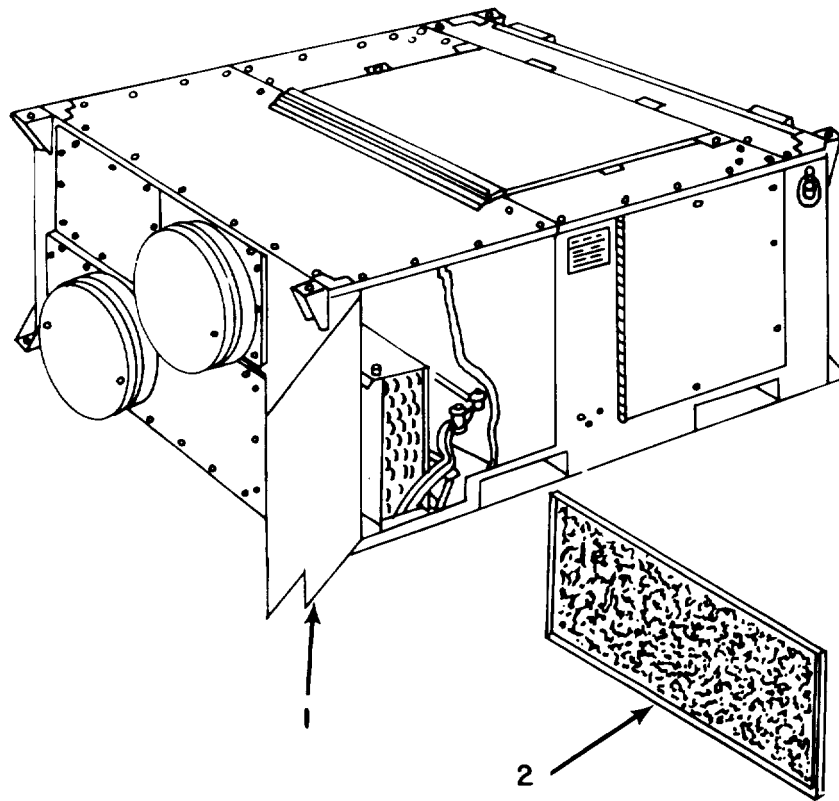


Figure 4-16. Air Filter

4-22. FRESH AIR DAMPER

This task covers a. Repair
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Tools

Tool kit refrigeration SVC
Riveter, blind, hand

Materials/Parts

Solvent (Item 15 Appendix E)
Adhesive (Item 1 Appendix E)
Gasket (TM9-4120-398-24P)
Cleaning cloths (Item 12 Appendix E)

General Safety Instructions

WARNINGS

Voltages used can kill, Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

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. Removal.

- (1) Remove the six rivets (1) holding the fresh air damper assembly (2) to the frame.
- (2) Remove the fresh air damper assembly (2) from the frame.

b. Repair.

- (1) To repair closing chain:
 - (a) Remove pendant (3) from end of chain (4).
 - (b) Remove screw (5), two washers (6), lockwasher (7), and nut (8) securing chain (4) to damper door (9).
 - (c) Replace damaged puts.

4-22 FRESH AIR DAMPER (cont)

(2) To repair broken hinge:

- (a) Remove four rivets (10),
- (b) Replace with new hinge (11).

(3) To replace gasket

- (a) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

W A R N I N G

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).

(b) Using solvent (item 15 Appendix E) and a cleaning cloth (item 12 Appendix E), clean off remaining adhesive.

(c) Coat the mating surfaces of the metal and gasket or insulation (if applicable) with adhesive (item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

(d) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

c. Installation.

- (1) Aline the mounting holes with the air conditioner frame.
- (2) Set the six rivets (1) to secure damper (2) to the frame assembly.

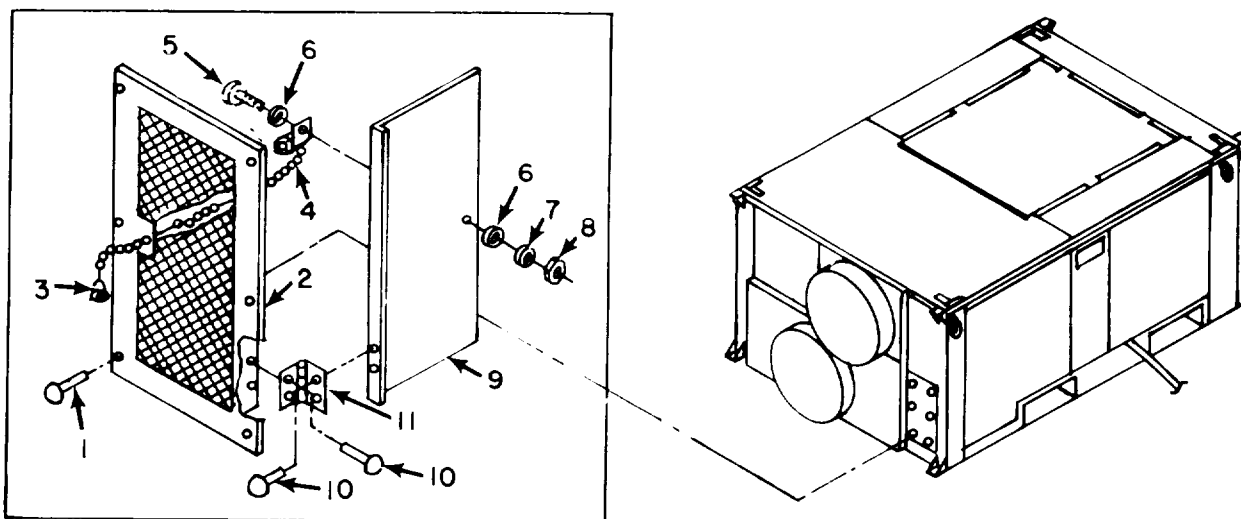


Figure 4-17. Fresh Air Damper

4-23. CONDENSATE TRAPS AND DRAIN HOSES

This task covers: a. Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Removal.

(1) Disconnect the two 15-foot drain hoses (1) (one located in each forklift opening) attached to the 1/2 in. barbed hose connection (2).

(2) Remove barbed hose connection (2).

b. Installation.

(1) Install barbed hose connection (2).

(2) Connect the two 15-foot drain hoses (1) to the mating barbed hose connection (2) located in the fork lift opening,

4-23. CONDENSATE TRAPS AND DRAIN HOSES (cont)

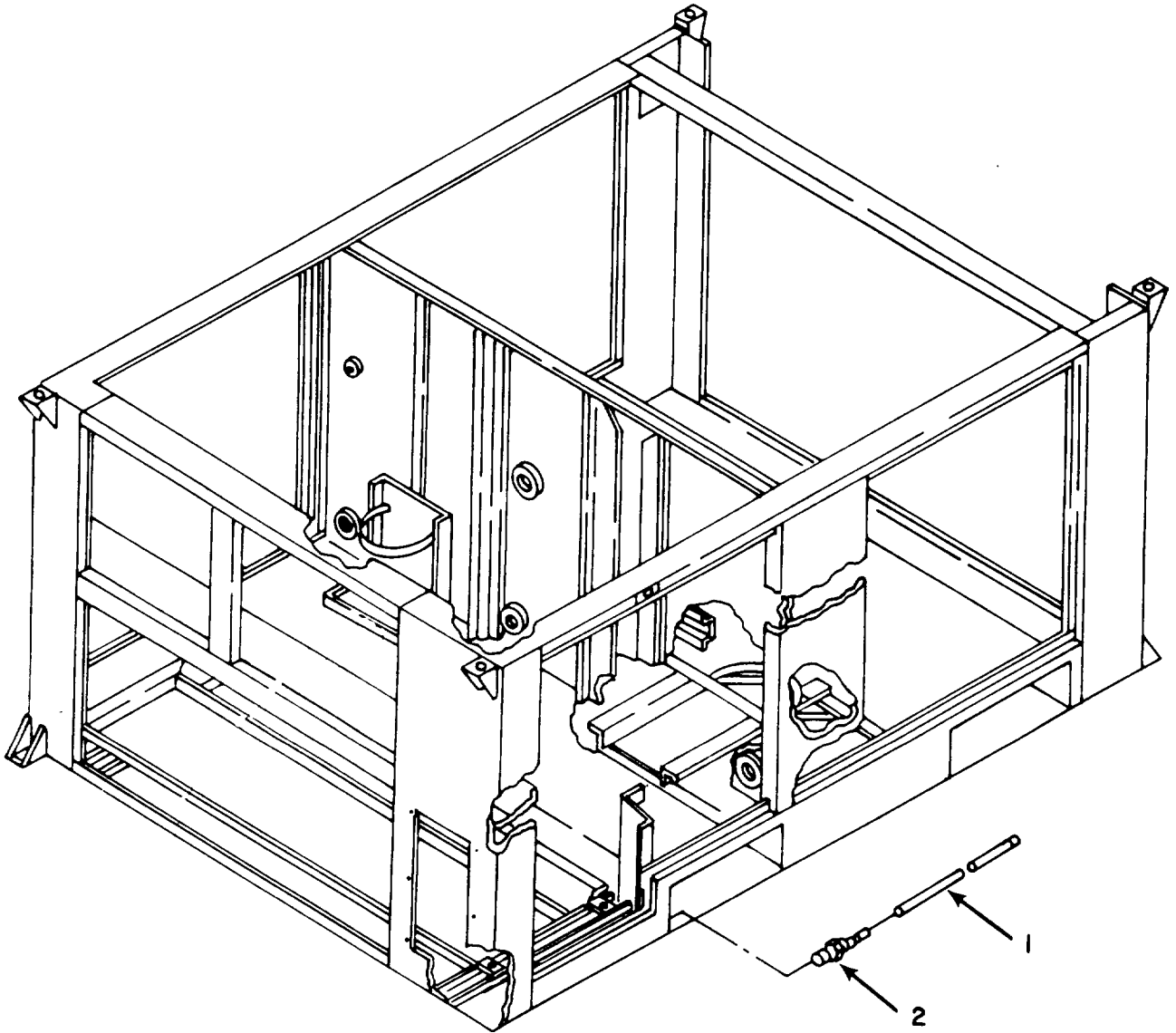


Figure 4-18. Condensate Traps and Drain Hoses

4-24. EXTERNAL CONTROL PANEL

This task covers: Replacement

INITIAL SETUP

Equipment Condition

Power OFF

Tools

Tool kit, refrigeration SVC
1/8" Flat tip screwdriver

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance, Shutting unit off at its control panel does not disconnect unit power.

a. Removal.

- (1) Loosen two tumlock fasteners (1) and open door.
- (2) Remove temperature control knob (2).
- (3) Remove four screws (3).
- (4) Remove external control panel (4).

b. Installation.

- (1) Aline external control panel (4) with frame.
- (2) Secure panel (4) with four screws (3).
- (3) Install temperature control knob (2),
- (4) Close door and secure two tumlock fasteners (1).

4-24. EXTERNAL CONTROL PANEL (cont)

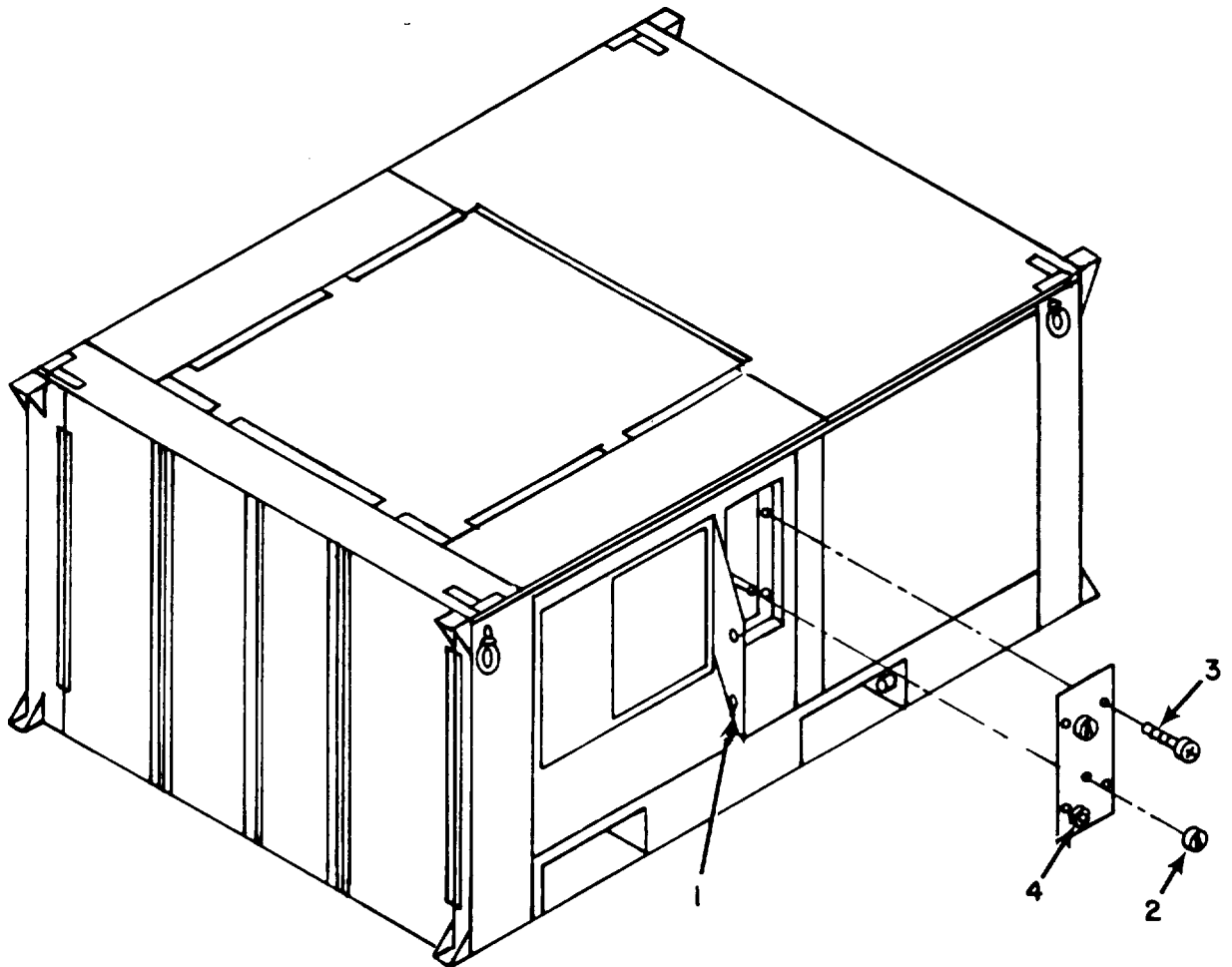


Figure 4-19. External Control Panel

4-25. MODE SELECTOR SWITCH

This task cover's

- a. Inspection
- b. Test
- c. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
 External control panel removed
 (Paragraph 4-24)

Tools

Tool kit, refrigeration SVC
 1/8" Flat tip screwdriver

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Inspection.

- (1) Check for loose or missing hardware and leads. Tighten and replace as needed.
- (2) Check that switch terminals are not too loose, broken or corroded.
- (3) Check switch for evidence of overheating or visible damage.

b. Test(Installed).

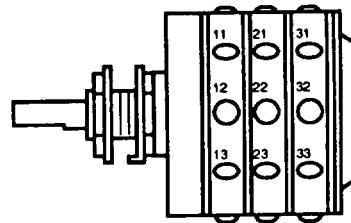
- (1) Tag and remove leads.
- (2) Using multimeter and switch position chart shown in figure 4-20, check continuity at contacts indicated. With switch position closed, continuity should be indicated. With switch position open, no continuity should be indicated. Check between each set of contacts and at each switch position.
- (3) If continuity requirements are not met, replace mode selector switch.

c. Removal.

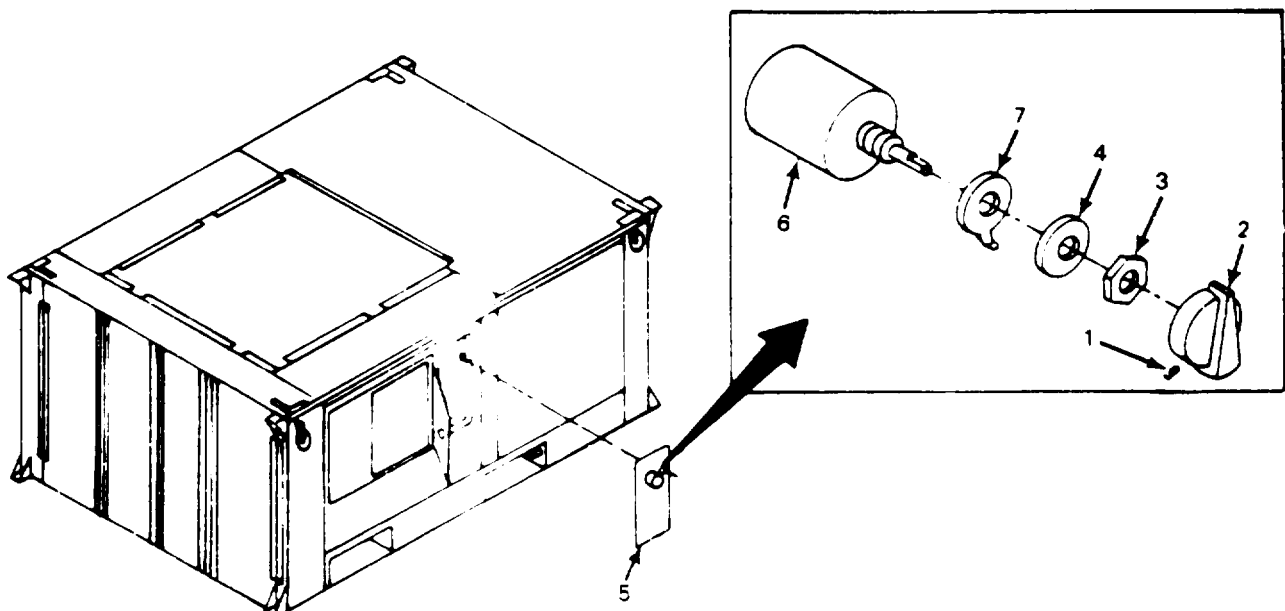
- (1) Loosen setscrew (1) and remove knob (2), nut (3) and washer (4).
- (2) Separate external control panel (5) from mode selector switch (6).
- (3) Remove keying washer (7).

4-25. MODE SELECTOR SWITCH (cont)**d. Installation.**

- (1) Slip keying washer (7) over shaft of mode selector switch (6).
- (2) Slide mode selector switch shaft into external control panel (5).
- (3) Secure with nut (4), washer (3), knob (2) and tighten set screw (1)
- (4) Install external control panel (See paragraph 4-25.)



SELECTOR SWITCH POSITION	SWITCH WAFERS AND TERMINALS CONNECTED		
	A	B	C
OFF	31 & 33 NONE	21 & 22 21 & 23	11 & 12 11 & 13
VENT	--	21 & 22 22 & 23	11 & 12 11 & 13
AUTO	31 & 33	21 & 22 21 & 23	11 & 12 11 & 13

Figure 4-20. Switch Position and Terminal Location**Figure 4-21. Mode Selector Switch**

4-26. THERMOSTAT

This task Covers	a. Inspection
	b. Test
	c. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
 External control panel removed
 (paragraph 4-24)
 Condenser access door open
 (Paragraph 4-14)
 Flexible ducts removed
 (Paragraph 4-6)
 Evaporator access panel removed
 (Paragraph 4-13)
 Control board panel removed
 (Paragraph 4-17)

Tools

Tool kit refrigeration SVC

Material/Parts

Silicone Adhesive (item 13 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioned before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Inspection.

- (1) Check for loose or missing hardware and leads. Tighten and replace as needed,
- (2) Check that terminals are not loose, broken or corroded.
- (3) Check thermostat for evidence of overheating or other visible damage.
- (4) Replace damaged or defective thermostat.

b. Test (Installed).

- (1) Temperature test.
 - (a) Position thermostat in maximum cool position and apply heat (in excess of 80°) to sensing bulb.
 - (b) Listen for clicking sound from thermostat control.

4-24. THERMOSTAT (cont)

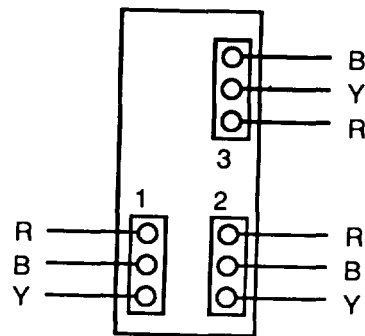
(c) If clicking sound is not heard, do continuity test.

(2) Continuity test.

(a) Tag and remove leads.

(b) Using multimeter and chart shown in figure 4-22. Check continuity at contacts indicated.

(c) If continuity requirements are not met, replace thermostat.



CONTINUITY

MAX COOL	R1-Y3	R1-Y1	R2-Y2
MAX HEAT	R1-B1	R2-B2	R3-B3

Figure 4-22. Thermostat Terminal Location and Continuity Points

4-26. THERMOSTAT (cont)

c. Removal.

- (1) Remove screw (1), lockwasher (2), washer (3), nut (4), and clamp (5) to disengage sensing bulb (6).
- (2) Remove sensing bulb (6) and four fasteners (7).
- (3) Remove four nuts (8) and lockwashers (9).
- (4) Remove thermostat (10).

d. Installation.

- (1) Position thermostat (10).
- (2) Install four nuts (8) and lockwashers (9).
- (3) Feed sensing bulb (6) through unit carefully and replace four fasteners (7).
- (4) Install sensing bulb (6), clamp (5), screw (1), lockwasher (2), washer (3), and nut (4).

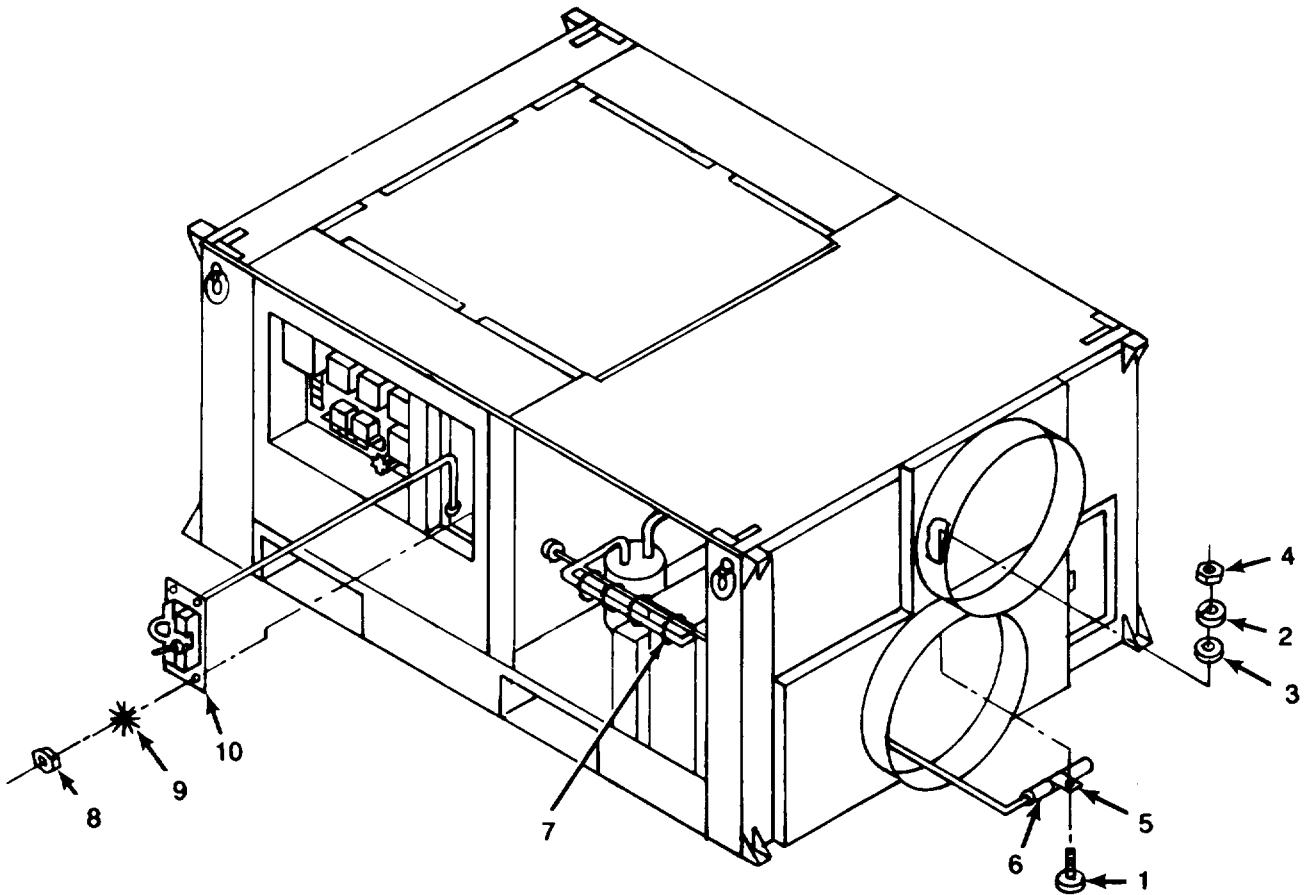


Figure 4-23. Thermostat

4-27. CIRCUIT BREAKER

This task covers:

- a. Inspection
- b. Test
- c. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
External control panel removed
(Paragraph 4-24)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Inspection.

- (1) Check for loose or missing hardware and leads. Tighten and replace as needed.
- (2) Check that switch terminals are not too loose, broken or corroded.
- (3) Check circuit breaker for evidence of overheating or other visible damage.
- (4) Replace damaged or defective circuit breaker.

b. Test (Installed).

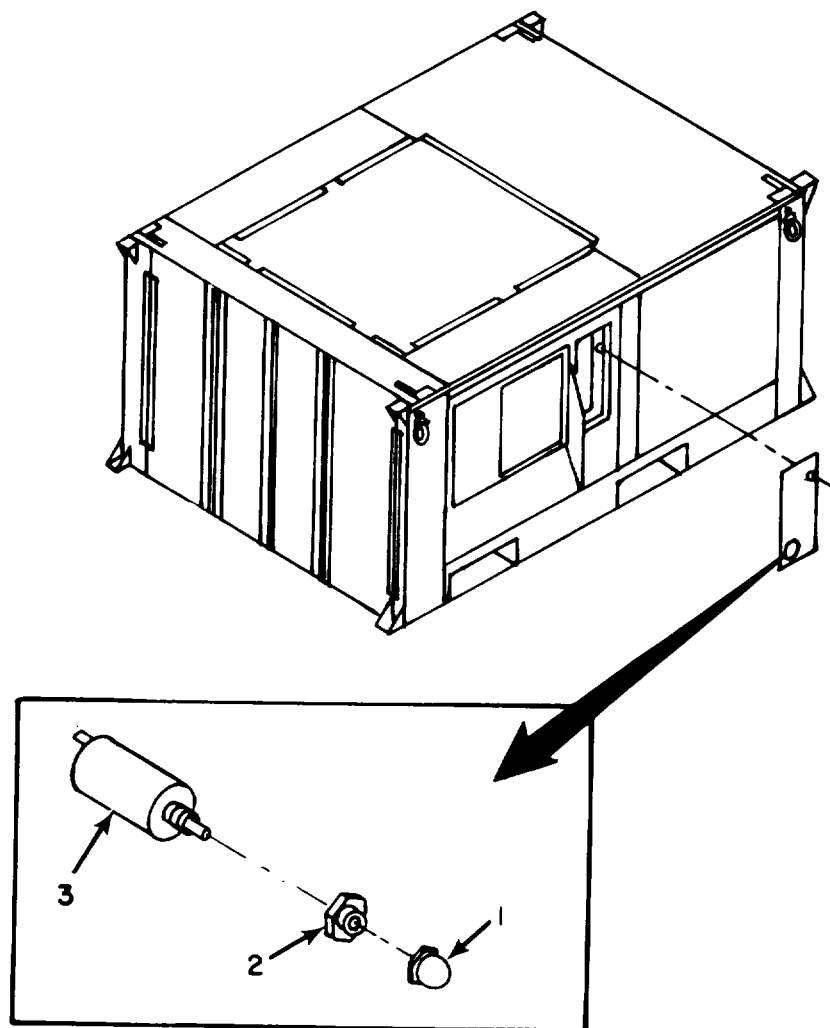
- (1) Tag and remove leads.
- (2) Using multimeter, conduct a continuity test across the two switch terminals. No continuity reading indicates a defective circuit breaker.
- (3) Press reset switch and repeat continuity test.
- (4) If continuity requirements are not met, replace circuit breaker.

c. Removal.

- (1) Remove boot (1) and insert (2).
- (2) Remove circuit breaker (3) from external control panel.

4-27. CIRCUIT BREAKER (cont)**d. Installation.**

- (1) Position circuit breaker (3) on external control panel.
- (2) Install boot (1) and insert (2).
- (3) Install external control panel. (See paragraph 4-24.)

**Figure 4-24. Circuit Breaker**

4-28. INTERNAL CONTROL BOARD

This task covers

- a. Inspection
- b. Test
- c. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Extenal control panel removed
(Paragraph 4-24)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Inspection.

- (1) Check for loose or missing hardware and leads. Tighten and replace as needed.
- (2) Check that terminals are not loose, broken or corroded.
- (3) Check components for evidence of overheating or other visible damage.
- (4) Replace damaged or defective components.

b. Test.

- (1) Contactor (K1, K2, K7, and K8) (See Figure 4-25).
 - (a) Test for continuity between points L1-T1, L2-T2, and L3-T3 while pressing in on cents bar.
 - (b) If no continuity, replace defective contractor.

4-28. INTERNAL CONTROL BOARD (cont)

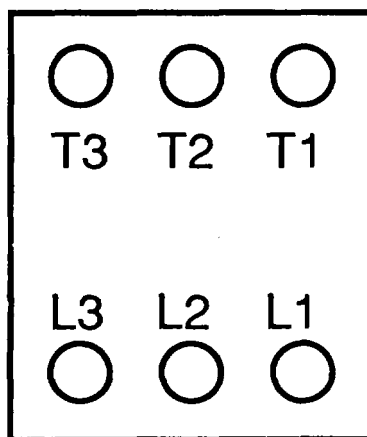


Figure 4-25. Contactor (K1, K2, K7, and K8)

(2) Motor starter (K3). (See Figure 4-26.)

- (a) Test for continuity between points L1-T1, L2-T2, L3-T3 while pressing in on center bar.
- (b) If no continuity, replace defective motor starter.
- (c) Test for continuity on micro switches, top and bottom leads.

NOTE

Center bar should not be depressed.

- (d) If zero resistance replace defective motor starter.
- (e) Depress center bar and microswitch should open or infinite resistance.

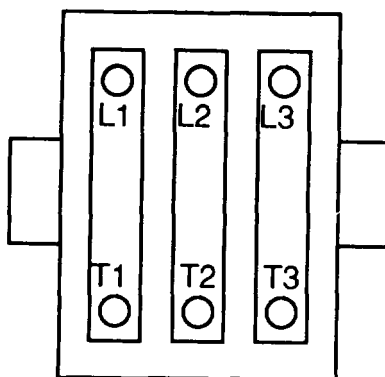


Figure 4-26. Motor Starter (K3)

4-28. INTERNAL CONTROL BOARD (cont)

(3) Relays K4 and K5. (See figure 4-27.)

- (a) Test for continuity between points 7-1,8-2, and 9-3.
- (b) Depress center bar and test for continuity between points 7-4,8-5, and 9-6.
- (c) If continuity is not found in either test, replace relay.

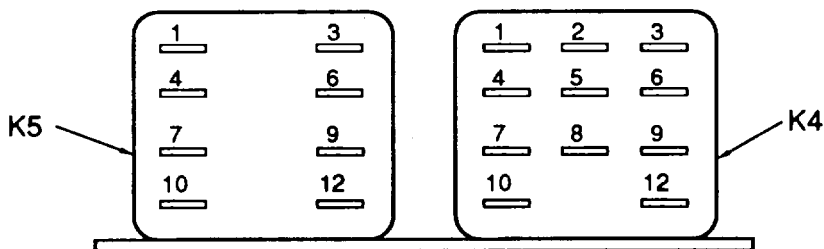


Figure 4-27. Relays K-4 and K-5

(4) Time delay relay (K6). (See Figure 4-28.)

- (a) Test for continuity between two leads.
- (b) If continuity is found, replace time delay relay (K6).

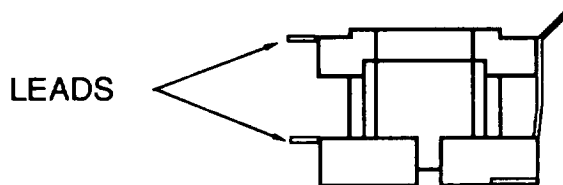


Figure 4-28. Time Delay Relay K6

c. Removal (see figure 4-29).

- (1) Tag and disconnect five power cable leads (1).
- (2) Remove four nuts (2), lockwashers (3) and panel (4).
- (3) Disengage terminal board from unit.
- (4) Remove four screws (5), lockwashers (6), nuts (7), and motor starter (K3) (8).
- (5) Remove two screws (9), lockwashers (10), and nuts(11) for each contactor (K1, K2, K7, and K8) (12).
- (6) Remove screw (13), lockwasher (14), nut (15), and time delay relay (K6) (16).
- (7) Remove two screws (17). and lockwashers (18) for each relay (K5 and K4) (19).
- (8) Remove two screws (20), lockwashers (21), nuts (22), and TB2 (23).

4-28. INTERNAL CONTROL BOARD (cont)

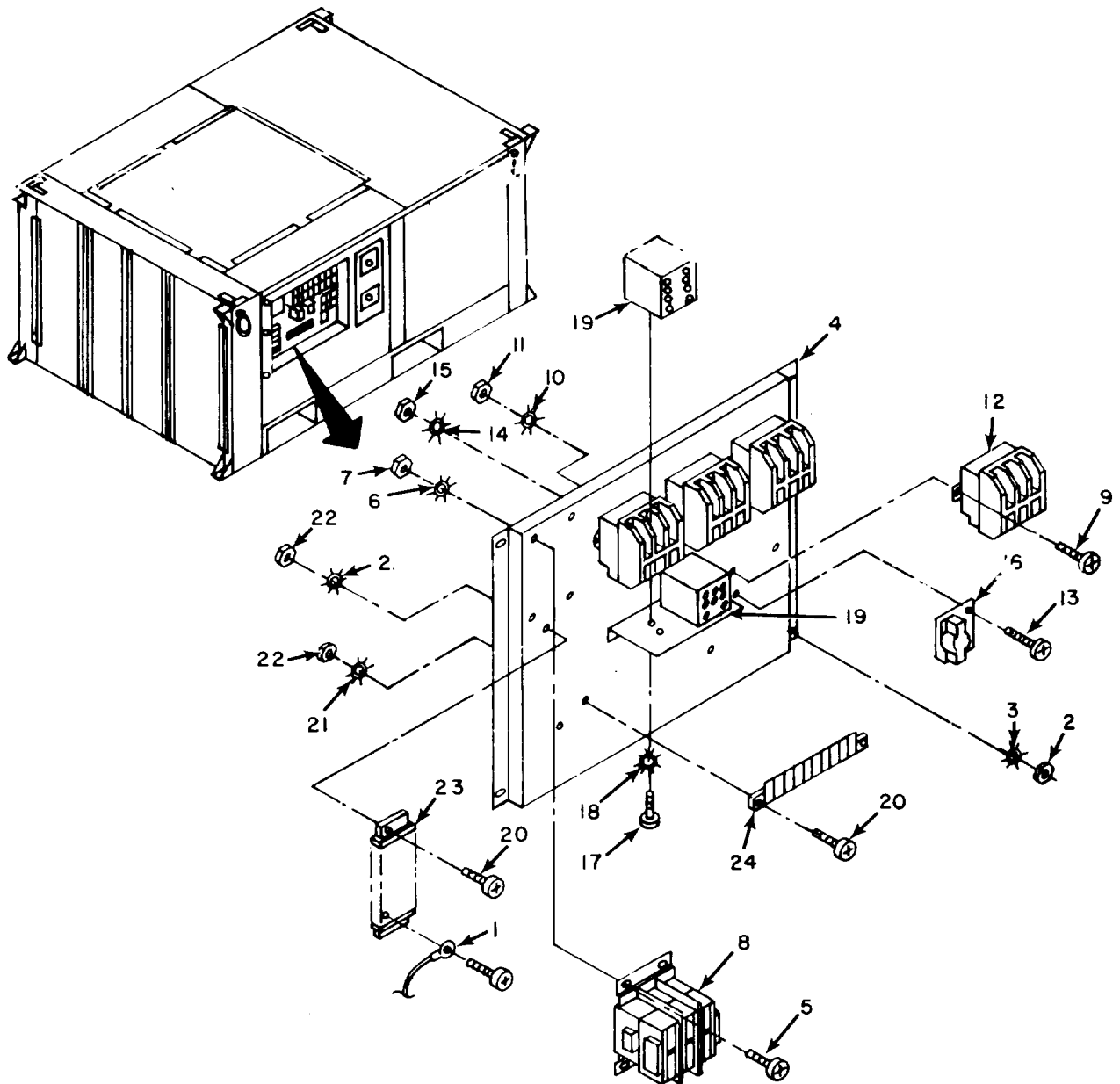


Figure 4-29. Internal Control Board

4-28. INTERNAL CONTROL BOARD (cont)

(9) Remove two screws (20), lockwashers (21), nuts (22), and TB1 (24).

d. Installation.

- (1) Aline TB1 (24) and secure with two screws (20), lockwashers (21) and nuts (22).
- (2) Aline TB2 (23) and secure with two screws (20), lockwashers (21) and nuts (22).
- (3) Aline relays (K4 and K5) (19) and secure with two screws (17), and lockwashers (18).
- (4) Aline contactors (K1, K2, K7, and K8) (12) and secure with two screws (9), lockwashers (10) and nuts (11).
- (5) Aline motor starter (K3) (8) and secure with four screws (5), lockwashers (6), and nuts (7).
- (6) Attach leads to terminal board.
- (7) Secure panel (4) with four nuts (2), and lockwashers (3).
- (8) Attach 5 power cable leads (1).
- (9) Install external control panel. (See paragraph 4-25.)

4-29. ELECTRICAL WIRING REPAIR GENERAL. Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending ends to form terminals, and other make-shift procedures; although the latter may be appropriate for emergency field repairs. Determine the proper size and length of wire, or the terminal, or connector to be used for replacement by referring to table 4-3, "Wire List", and to the schematic diagram (figure 1-5).

a. Soldering connections. Wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-14256, rosin base flux, item 16 Appendix E, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be rosin-core electrical solder. If an uncured solder is used, it should be a lead-tin solder, item 14, Appendix E, conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder "gobs" on the joint should be avoided or removed.

b. Insulating joints. The preferred method of insulating electrical joints is by the use of heat-shrink tubing. To apply, cut a piece of heat-shrink tubing of suitable diameter to a one-inch length for covering joints at terminals or connectors, or to a length about 1/2 inch (13 mm) longer than the joint to be insulated, and slide the tubing over the wire before making the joint. After the joint is made, slide the tubing so that it covers the joint, and shrink in place with moderate heat.

c. Splicing wires. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the end to join them, or a "Western Union" wire splice can be made. The latter is made by stripping 1/4 – 1/2 inch (0.6 – 13mm) of insulation from the wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns. Solder and apply insulation as described above.

d. Crimping terminals. To install a terminal on the end of a wire, strip 1/4 – 1/2 inch (0.6 – 13mm) of insulation from the end of the wire, 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. Crimp the shank, and install heat-shrink tubing, if necessary.

e. Voltage and resistance test points. Tables 4-4 and 4-5 contain a listing of terminals on TB1 thru TB3 that provide test points for the air conditioner voltage, resistance and continuity measurements. In table 4-4, a measurement of 120 Vac indicates normal voltage is applied. In table 4-5, a measurement of zero ohms indicates satisfactory circuit continuity. To prevent false ohmmeter readings due to a sneak circuit, continuity measurements are to be made with S-1 in the OFF-RESET position.

NOTE

All safety controls listed in Table 1-1 reset automatically. Allow time for controls to cool off and reset normally before making measurements.

4-29. ELECTRICAL WIRING REPAIR GENERAL (cont)

Table 4-3. Wire List

Wire Run No.	Length (In/Cm)	From	To	Wire Run No.	Length (In/Cm)	From	To
X1A10A	6 / 15	TB2-1	K3-L3	X14B18V	6-3/4 / 17	K1-COIL-1	K4-6
X1B10A	11 / 28	TB2-1	K8-L3	X14C18V	2-1/2 / 6	K4-6	K4-A
X1C12A	5 / 13	K3-L3	K1-L3	X15A18V	27-1/2 / 70	S1-33	K4-7
X1D12A	7-3/4 / 20	K3-L3	K2-L3	X16A18V	18 / 46	S2-R1	K4-4
X1E12A	9-1/2 / 24	K7-L3	K8-L3	X16B18V	16 / 41	S2-R1	K6-1
X1G18A	42 / 107	CB1-1	TB2-1	X16C18V	2-1/2 / 6	S2-R9	S2-R2
X2A10B	6 / 15	TB2-2	K3-L2	X16D18V	3-1/2 / 9	S2-R1	S2-R2
X2B10B	10-3/4 / 27	TB2-2	K8-L2	X17A18V	17 / 43	K6-3	K3-1
X2C12B	5 / 13	K3-L2	K1-L2	X17B18V	5-1/2 / 14	K3A-N0	K3-1
X2D12B	7-3/4 / 20	K3-L2	K2-L2	X18A18V	20 / 51	K2-COIL-1	S2-Y3
X2E12B	8-1/2 / 22	K7-L2	K8-L2	X18B18V	12 / 30	K2-COIL-1	K3A-COM
X3A10C	6 / 15	TB2-3	K3-L1	X19A18V	14 / 36	K6-H4	K3A-NC
X3B10C	11-1/2 / 29	TB2-3	K8-L1	X20A18V	14 / 36	S2-B2	K7-COIL-2
X3C12C	5 / 13	K3-L1	K1-L1	X21A18V	21 / 53	S2-B1	K8-COIL-2
X3D12C	7-3/4 / 20	K3-L1	K2-L1	X22A18N	81 / 206	TB1-6	HR7
X3E12C	9 / 23	K7-L1	K8-L1	X23A18V	81 / 206	TB1-13	HR7
X4A18N	2-1/2 / 6	TB2-4	TB1-6	X24A18V	80 / 203	TB1-7	S3
X4B18N	15-1/2 / 39	TB1-6	K3-2	X25A18V	80 / 203	TB1-8	S3
X4C18N	9 / 23	K5-B	TB1-6	X25B18V	50 / 127	TB1-8	TB3-7
X4D18N	8 / 20	K5-B	K1-COIL-2	X25C18V	49 / 124	TB1-10	TB3-8
X4E18N	3-1/4 / 8	K1-COIL-2	K2-COIL-2	X26B18V	81 / 206	TB1-10	B2-RED
X4F18N	9 / 23	K2-COIL-2	K4-B	X27A18V	71 / 180	TB1-11	B1-RED
X4G18N	9 / 23	K6-H2	K4-B	X28A18V	70 / 178	TB1-12	B1-RED
X4J18N	12-1/2 / 32	K7-COIL-1	TB1-6	X29A18V	84 / 213	TB1-11	B2-RED
X4K18N	6 / 15	K8-COIL-1	K7-COIL-1	X29A10A	89 / 226	K3-T3	B3-L1
X5A8N	4-1/4 / 11	TB2-5	GRD	X30A10B	95 / 241	K3-T2	B3-L2
X6A18V	25 / 64	CB1-2	K3B CON	X3A10C	97 / 246	K3-T1	B3-L3
X6B18V	11 / 28	CB1-2	S1-OFF-31	X32A12A	90 / 229	K1-T3	B1-T1
X7A18V	12-3/4 / 32	TB1-13	K3B-NC	X33A12B	90 / 229	K1-T2	B1-T2
X8A18V	3 / 8	S1-22	S1-23	X34A12C	90 / 229	K1-T1	B1-T3
X9A18V	28-1/2 / 72	S1-22	K4-8	X35A12A	102 / 260	K2-T3	B2-T1
X9B18V	4-1/2 / 11	K4-8	K5-7	X36A12B	102 / 260	K2-T2	B2-T2
X10A18V	2-1/2 / 6	K5-4	K5-A	X37A12C	103 / 262	K2-T1	B2-T3
X10B18V	4 / 10	K5-4	K4-5	X38A12A	54-1/2 / 138	K8-T3	TB3-1
X11A18V	20 / 51	S1-12	TB1-11	X39A12B	54 / 137	K8-2	TB3-2
X12A18V	29 / 74	S1-13	TB1-7	X40A12C	54 / 137	K8-T1	TB3-3
X13A18V	6 / 15	TB1-12	K5-9	X41A12A	50 / 127	K7-T3	TB3-4
X13B18V	4-1/2 / 11	K5-9	K4-9	X42A12B	48-1/2 / 123	K7-T2	TB3-5
X14A18V	5-3/4 / 15	K1-COIL-1	K5-3	X43A12C	48 / 122	K7-T1	TB3-6

4-29. ELECTRICAL WIRING REPAIR GENERAL (cont)

Table 4-4. Voltage and Resistance Test Points

Measurement	Resistance Power OFF (Ohms)	Voltage	Test Points	
			From	To
Phase A	280	120	TB2 (1)	TB2 (4)
Phase B	0	120	TB2 (2)	TB2 (4)
Phase C	0	120	TB2 (3)	TB2 (4)
Power to Heater HR1	18	208	TB3 (4)	TB3 (5)
Power to Heater HR2	18	208	TB3 (4)	TB3 (6)
Power to Heater HR3	18	208	TB3 (5)	TB3 (6)
Power to Heater HR4	18	208	TB3 (1)	TB3 (2)
Power to Heater HR5	18	208	TB3 (1)	TB3 (3)
Power to Heater HR6	18	208	TB3 (2)	TB3 (3)
Power to Heater HR7	280	120	TB1 (6)	TB1 (13)
Power to Evaporator	120	120	TB1 (6)	TB1 (12)
Fan Motor Starter				

f. Continuity measurement test points. Table 4-5 provides continuity measurement test points.

Table 4-5. Continuity Measurement Test Points

Continuity Through*	Test Points	
	From	To
High Pressure Cutout S3	TB1 (7)	TB1 (8)
High Temperature Cutout S4	TB3 (7)	TB3 (8)
Condenser Fan Temperature Cutout	TB1 (10)	TB1 (11)
Evaporator Fan Temperature Cutout	TB1 (11)	TB1 (12)
All Overloads OK	TB1 (7)	TB1 (12)
All Safety Cutouts OK	TB1 (7)	TB1 (12)

* With S-1 in OFF-RESET position

4-30. POWER CABLE

This task covers: a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
External control panel removed
(Paragraph 4-24)
Condenser access door open
(Paragraph 4-14)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Test.

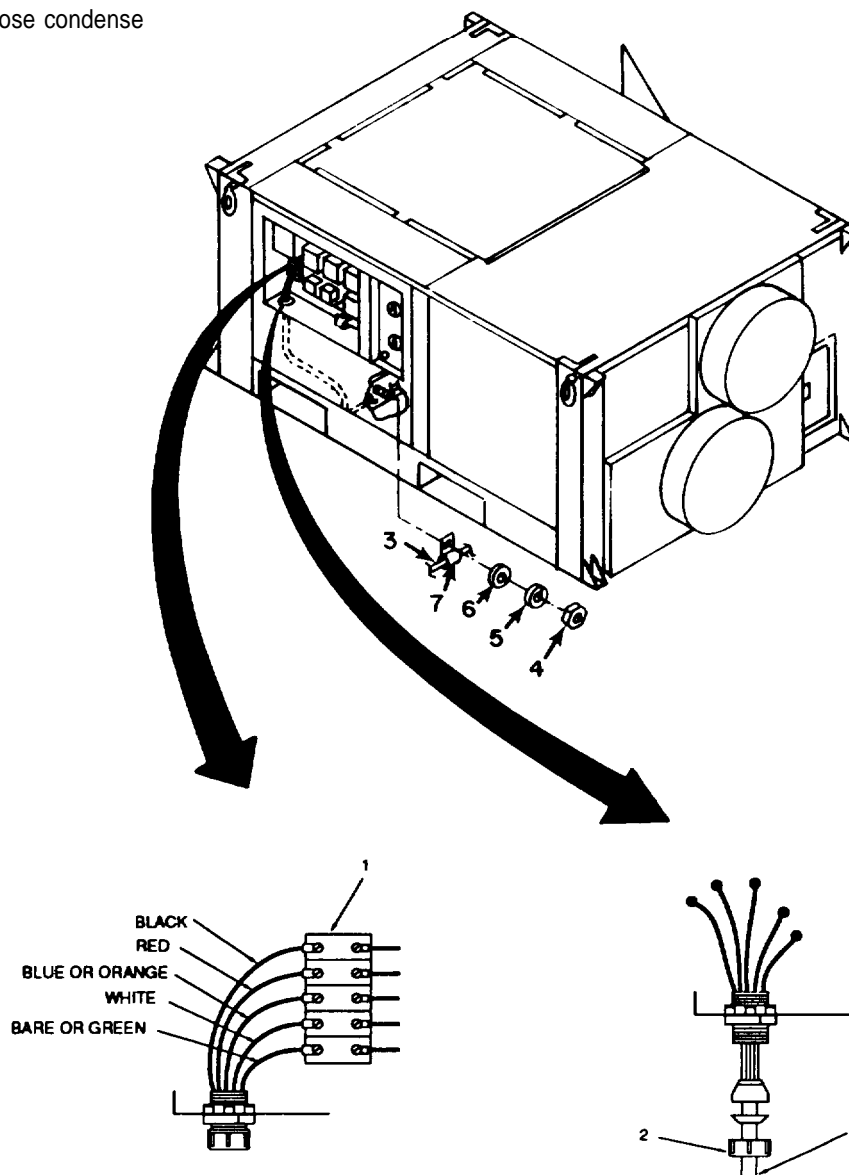
- (1) Tag and disconnect wires.
- (2) Continuity test all wires.
- (3) If no continuity, replace defective cable.

b. Removal.

- (1) Disconnect wire leads from TB2 (1).
- (2) Loosen gland nut (2).
- (3) Slide cable (3) through opening.
- (4) Remove two nuts (4), lockwashers (5), washers (6), and clamps (7).
- (5) Remove cable (3) from unit.

4-30. POWER CABLE (cont)**c. Installation.**

- (1) Position cable (3) in unit.
- (2) Install two nuts (4), lockwashers (5), washers (6), and clamps (7).
- (3) Tighten gland nut (2).
- (4) connect wire leads to TB2 (1).
- (5) Install external control board panel. (See paragraph 4-17.)
- (6) Close condense

**Figure 4-30. Power Cable**

4-31. EVAPORATOR BLOWER MOTOR

-
- This task covers a. Test
 b. Replacement
-

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access door open
(Paragraph 4-12)
Evaporator access panel removed
(Paragraph4-13)
Belt removed
(Paragraph 4-33)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance, Shutting unit off at its control panel does not disconnect unit power.

a. **Test.**

- (1) Check for continuity between motor and motor casing.
- (2) If continuity is present replace defective motor.

b. **Removal.**

- (1) Remove motor pulley (1) by loosening setscrew (2).
- (2) Remove two bolts (3), lockwashers (4) and washers (5) from top of motor mounting bracket (6).
- (3) Remove bolt (7), washer (8), lockwasher (9), nut (10), and adjusting bolt (11).
- (4) Rotate motor (12) to access motor electric box (13).
- (5) Loosen screw (14) to remove cover (15).
- (6) Tag and disconnect wires.
- (7) Remove motor (12) from unit.

4-31. EVAPORATOR BLOWER MOTOR (cont)

(8) Remove mounting bracket (6) by removing four bolts (16), lockwashers (9), and washers (8).

c. Installation.

(1) Secure mounting bracket (6) with four bolts (16), lockwashers (9), and washers (8).

(2) Install motor (12) in unit.

(3) Connect wires.

(4) Secure cover (15) with screw (14).

(5) Rotate motor (12) into position and secure to top of mounting bracket (6) with two bolts (3), lockwashers (4) and washers (5).

(6) Secure adjusting bolt (11) with bolt (7), washer (8), handwasher (9) and nut (10).

(7) Attach motor pulley (1) and tighten setserew (2).

(8) Install belt. (See paragraph 4-33.)

(9) Install evaporator access panel. (See paragraph 4-12.)

(10) Close evaporator access door.

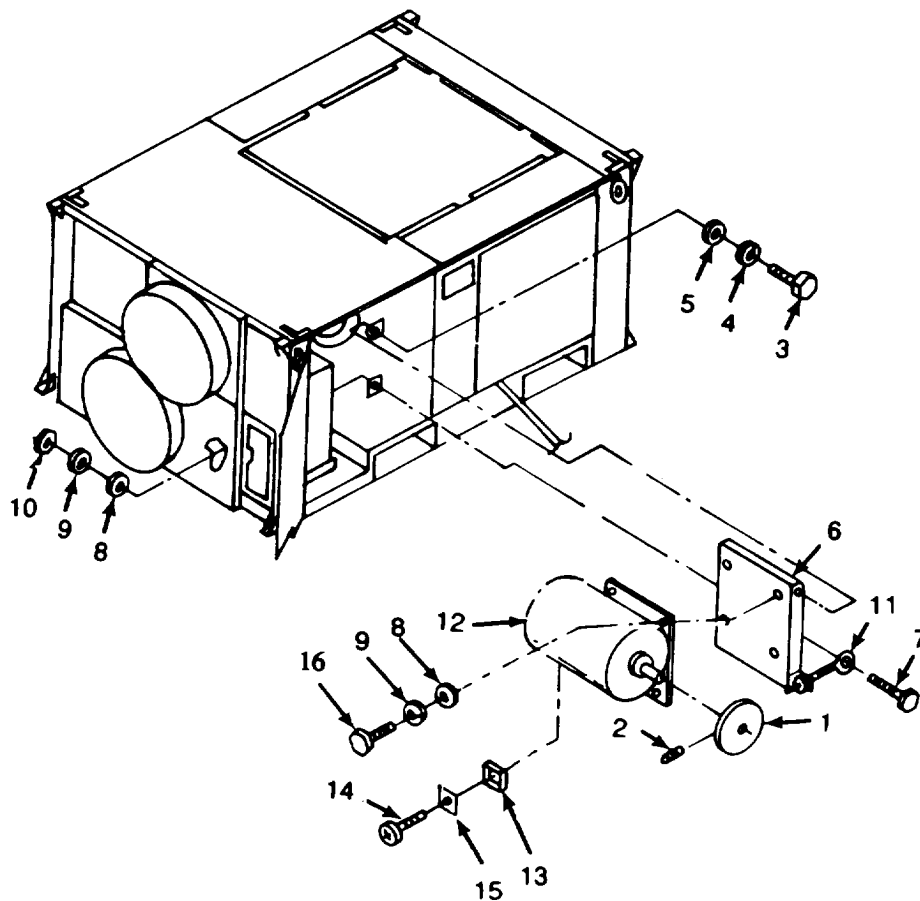


Figure 4-31. Evaporator Blower Motor Replacement

4-32 EVAPORATOR BLOWER

This task covers: Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Supply flexible duct removed
(Paragraph 4-26)
Supply duct adapter removed
(Paragraph 4-19)
Belt removed
(Paragraph 4-33)
Top front panel removed
(Paragmph 4-16)
Evaporator access door open
(Paragmph 4-12)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

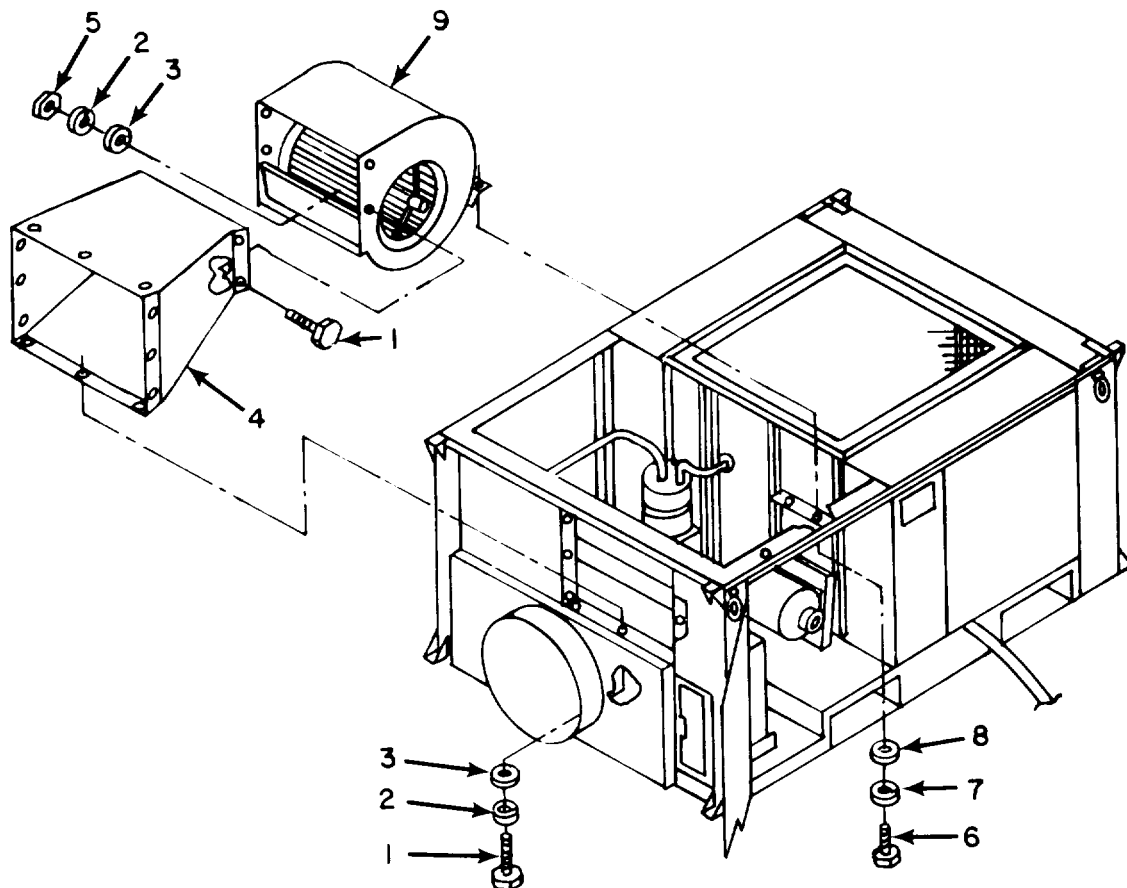
Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. **Removal.**

- (1) Remove 12 bolts (1), lockwashers (2), and washers (3) from front edge of blower plenum (4).
- (2) Remove 10 bolts (1), lockwashers (2), washers (3), and nuts (5) from rear edge of blower plenum (4).
- (3) Remove blower plenum (4).
- (4) Remove two bolts (6), lockwashers (7), and washers (8) holding blower (9) to unit.
- (5) Remove evaporator blower through top of unit.

4-32. EVAPORATOR BLOWER (cont)**b. Installation.**

- (1) Install evaporator blower (10) through top of unit.
- (2) Secure blower (9) to unit with two bolts (6), lockwashers (7), and washers (8).
- (3) Install blower plenum (4).
- (4) Secure rear edge of blower plenum (4) with 10 bolts (1), lockwashers (2), washers (3), and nuts (5).
- (5) Secure front edge of blower plenum (4) with 12 bolts (1), lockwashers (2), and washers (3).
- (6) Install belt. (See paragraph 4-33.)
- (7) Install top front panel. (See paragraph 4-16.)
- (8) Install supply duct adapter. (See paragraph 4-19.)
- (9) Install supply flexible duct. (See paragraph 4-6.)

**Figure 4-32. Evaporator Blower Replacement**

4-33. EVAPORATOR BLOWER BELT

This task covers: Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access door open
(Paragraph 4-12)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Removal.

- (1) Loosen adjusting nut (1).
- (2) Raise motor (2).
- (3) Remove belt (3).

b. Installation.

- (1) Install belt (3) on pulleys.
- (2) Tighten adjusting nut (1).
- (3) Close evaporator access door.

4-33. EVAPORATOR BLOWER BELT (cont)

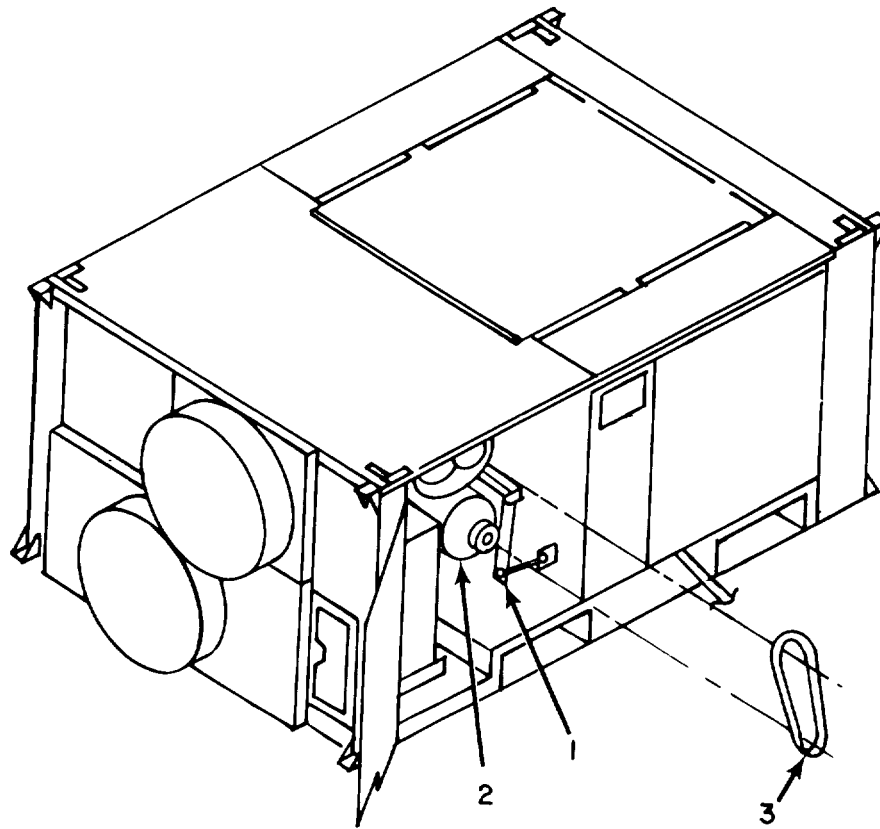


Figure 4-33. Evaporator Blower Belt Replacement

4-34. PULLEYS

This task covers: a. Replacement
 b. Adjustment

INITIAL SETUP

Equipment Condition

Power OFF
Belt removed
(Paragraph 4-33)
Evaporator access door open
(Paragraph 4-12)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Removal. Remove two grooved pulleys (1) and (2) and bushing (3).

b. Installation.

 (1) Install two grooved pulleys (1) and (2) and bushing (3).

 (2) Install belt (para 4-33).

 (3) Close evaporator access door.

c. Adjustment. To allow evaporator fan speed selection, two side-by-side pulleys are provided on the blower drive shaft and an adjustable sheave pulley is provided on the fan motor. Moving the fan belt from one pulley to the other provides a gross adjustment. Fine adjustment is obtained by the adjustable pulley.

4-34 PULLEYS (cont)

Speed	Fan Belt Engaged in Fan Pulley Size	Speed Adjustment Range Available, RPM
Low	6-inch	910-1230
High	4-inch	1200-1620

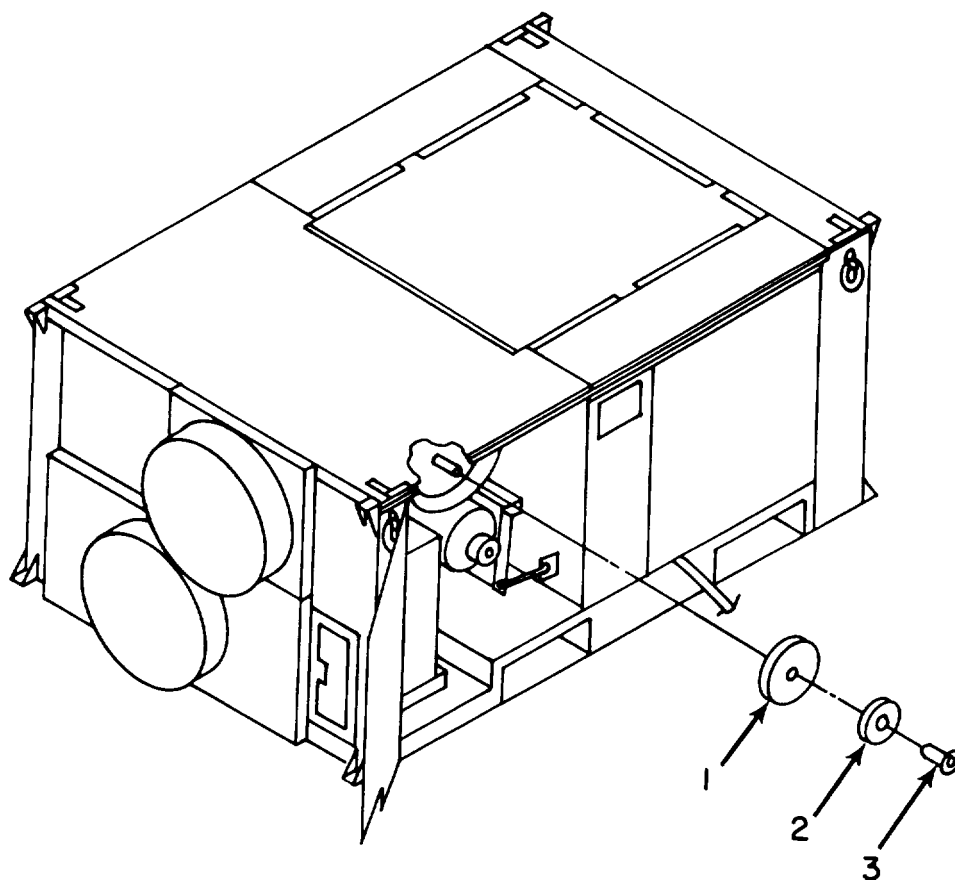


Figure 4-34. Evaporator Blower and Motor Speed Adjustment

4-35. HEATING ELEMENT

This task covers: a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access door open
(Paragraph 4-12)
Evaporator access panel removed
(Paragraph 4-13)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power card to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. **Test.**

- (1) Tag and disconnect wire leads.
- (2) Check continuity between TB3 and leads. Repeat for all wire leads.

NOTE

Using the low range ohmmeter function of a multimeter, measure the heating element resistance. (To avoid sneak circuit error, measure the resistance only with the heating element leads disconnected from the remainder of the circuit). Normal resistance is 27 ohms. A meter reading of ∞ indicates an open circuit.

- (3) Replace heating element if no continuity is indicated.

b. **Removal.**

- (1) Remove the four screws (1) in the cover (2) on the heater end terminal box (3). Remove the cover (2).
- (2) Remove the hex nut (4) from the defective heating element (5) threaded sleeve.

4-35. HEATING ELEMENT (cont)

(3) Remove the screw (6), lockwasher (7), nut (8), and clamp (9) to the heater end support (10).

(4) Remove the heating element (5).

c. Installation.

(1) Slide clamp (9) onto end of heating element (5), and secure with screw (6), lockwasher (7), and nut (8).

(2) Install threaded end of heating element (5) into terminal box (3), and secure with hex nut (4),

(3) Secure cover (2) to terminal box (3) with four screws (1).

(4) Install evaporator access panel. (See paragraph 4-13.)

(5) Close evaporator access door.

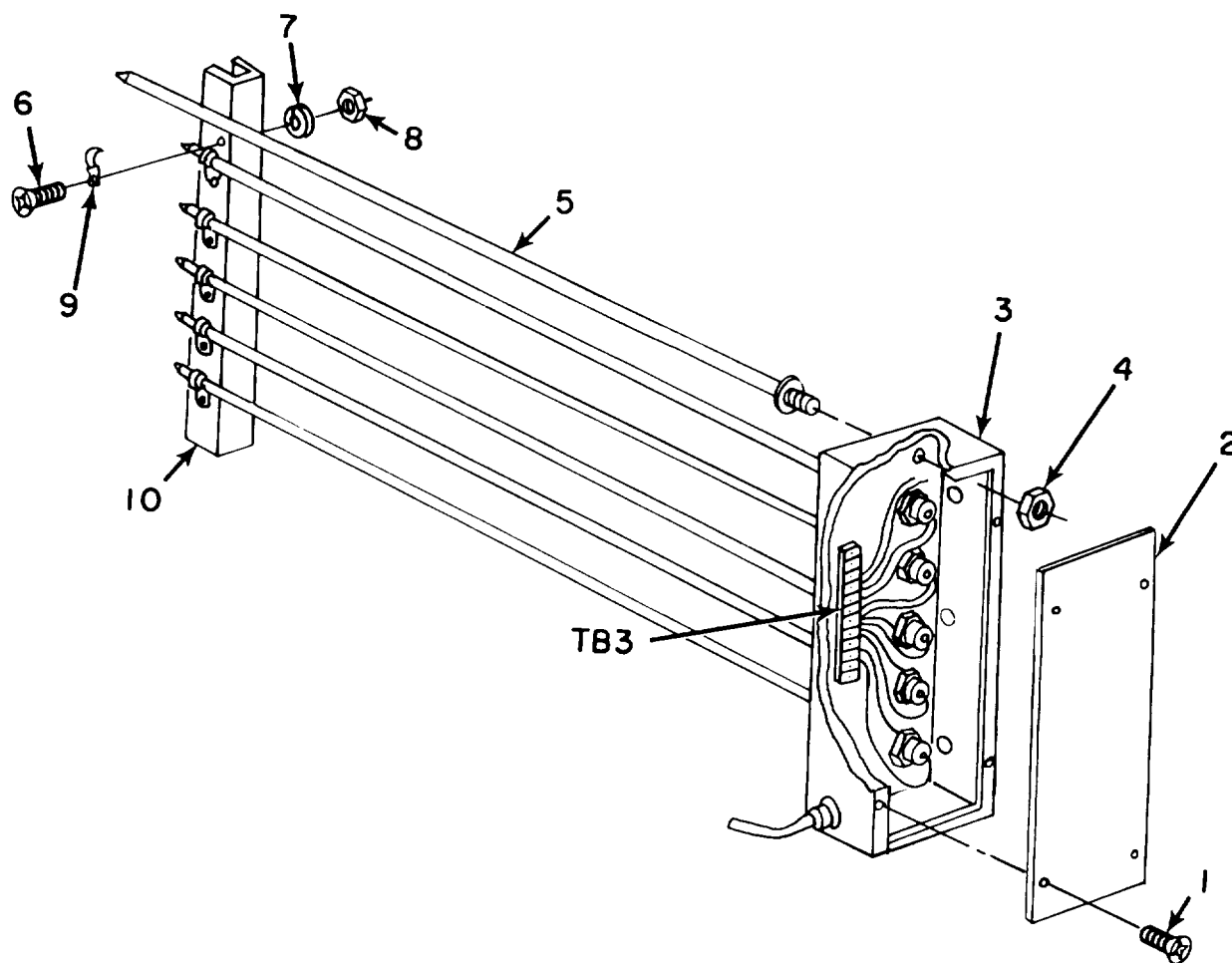


Figure 4-35. Heating Element

4-36. CONDENSER IMPELLER

This task covers: a. Adjustment
b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Top panel open, grille removed
(Paragraph 4-15)

Tools

Tool kit, refrigeration SVC
Wheel puller

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance, Shutting unit off at its control panel does not disconnect unit power.

NOTE

An unbalanced impeller causes a vibration and noisy operation, Bent or broken blades resulting in an unbalanced condition require impeller replacements.

a. Removal.

(1) Loosen the two setscrews (1) in the hub of the impeller (2).

(2) Remove the impeller (2) from the motor shaft using a wheel puller, if necessary. Ensure that the drive key remains in the keyway on the motor shaft.

b. Installation.

(1) Install impeller (2) on the motor shaft. The tips of the blade ends should extend 9/16inch above the venturi at the airflow exit.

(2) Tighten both setscrews (1).

(3) Install top panel and grille. (See paragraph 4-15.)

c. Adjustment If the fan hub rubs against the bolt heads on the motor end bell, lower the motor as described in paragraph 4-31 to provide adequate clearance between impeller and motor.

4-36. CONDENSER IMPELLER (cont)

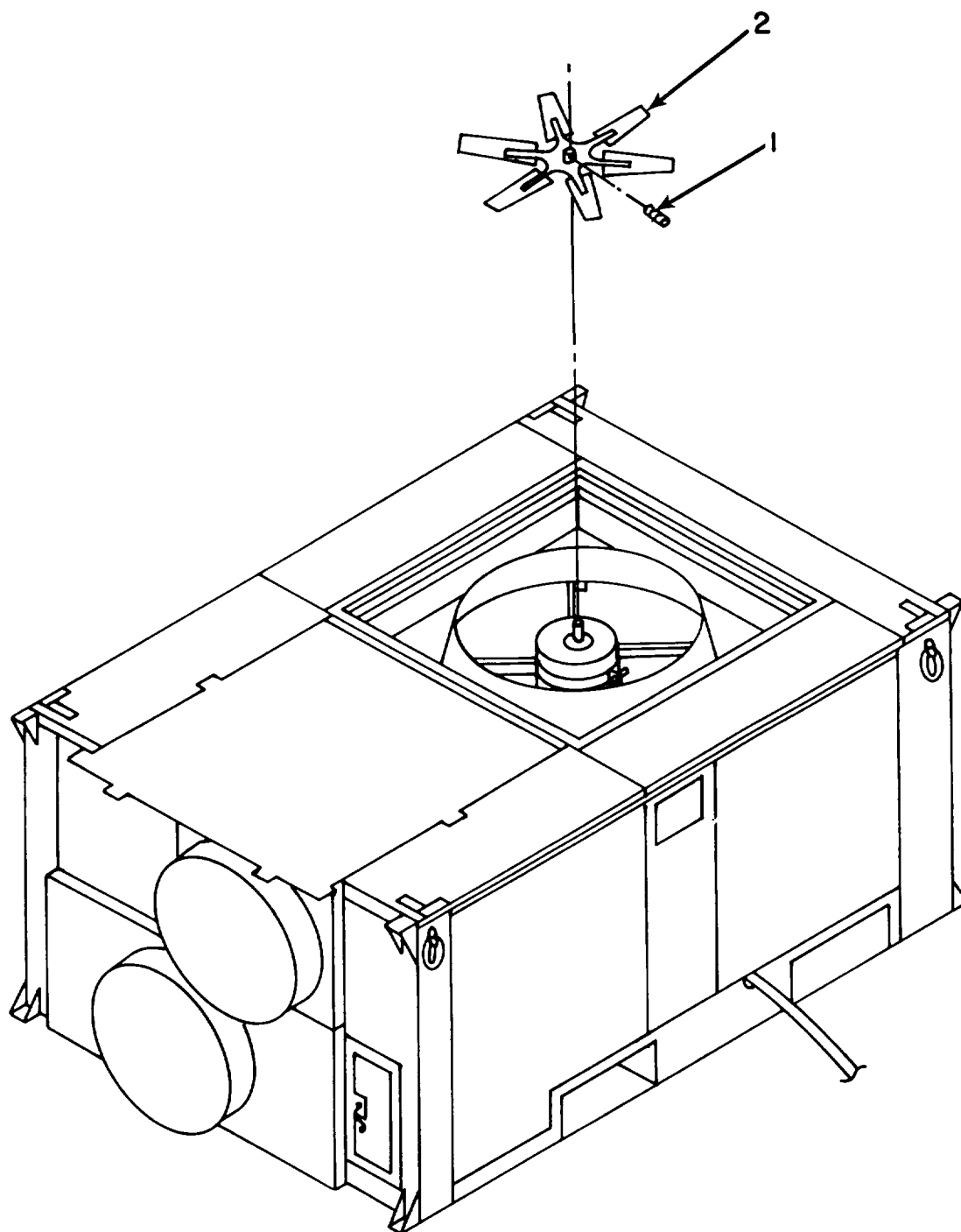


Figure 4-36. Condenser Impeller

4-37. CONDENSER FAN MOTOR

This task covers: a. Test
 b. Replacement

INITIAL SETUP

<u>Equipment Condition</u>	<u>Tools</u>
Power OFF	Tool kit, refrigeration SVC
Condenser access door open (Paragraph 4-14)	General Safty InstruText
Condenser impeller removed (Paragraph 4-36)	

WARNING

Voltages used can kill, Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. **Test.**

- (1) Check for continuity between motor and motor casing.
- (2) If continuity is present, replace defective motor.

b. **Removal.**

- (1) Loosen bolt (1) in motor mounting bracket (2). Lower motor (3) down and out of clamp ring.
- (2) Remove the cover (4) from the electrical junction box (5).
- (3) Tag and disconnect wires
- (4) Loosen the clamp on the cable connector and pull line wires out of junction box.
- (5) Remove motor (3).

c. **Installation.**

- (1) Connect wires to motor (3).
- (2) Replace cover (4) on electrical junction box (5).
- (3) Aline motor (3) with mounting bracket (2) and tighten bolt (1).
- (4) Install condenser impeller. (See paragraph 4-36.)

4-37. CONDENSER FAN MOTOR (cont)

(5) Close condenser access door.

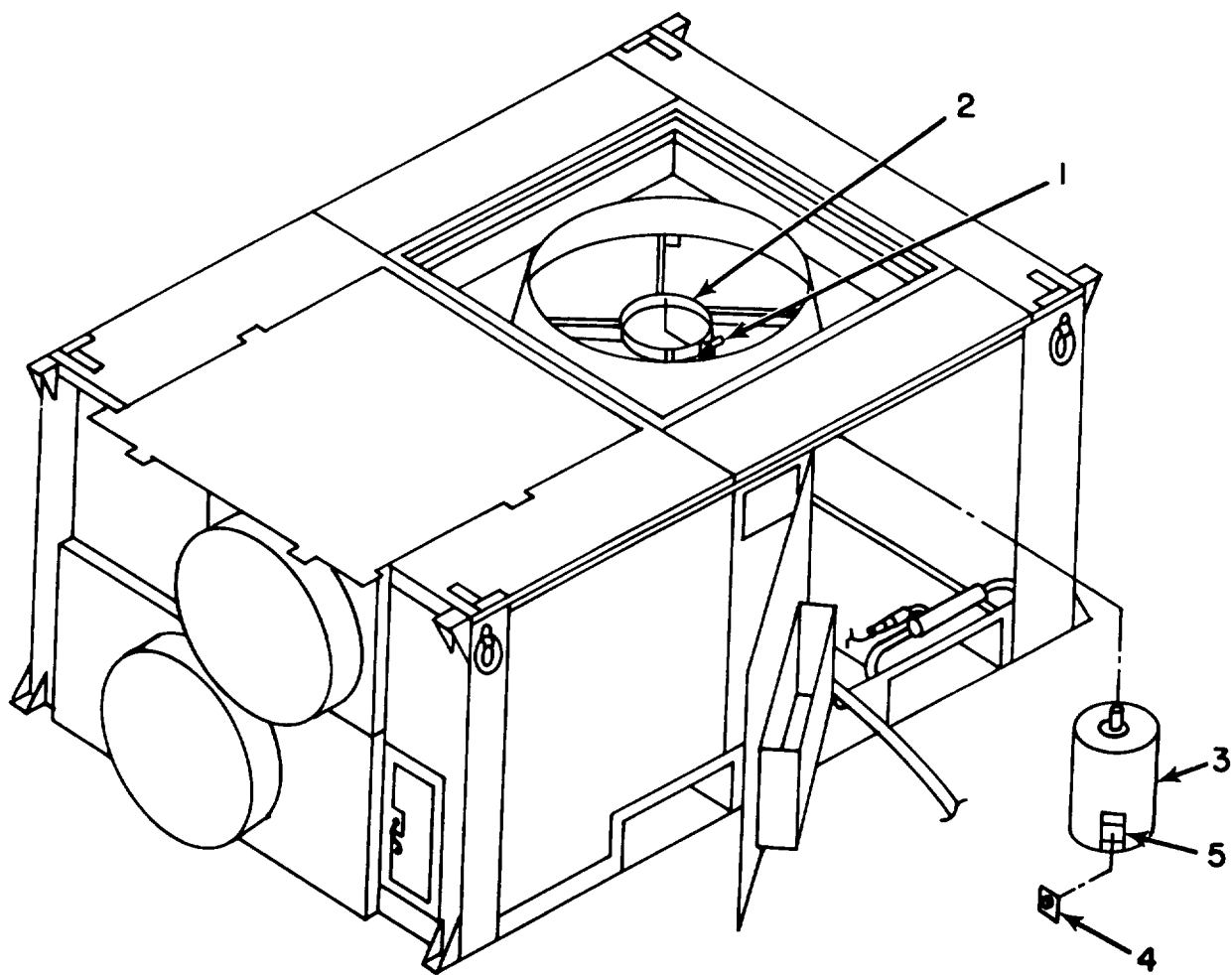


Figure 4-37. Condenser Fan Motor

4-38. HIGH TEMPERATURE CUTOUT SWITCH

This task covers: a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access panel removed
(Paragraph 4-13)
Thermostat terminal box cover removed
(Paragraph 4-35)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance, Shutting unit off at its control panel does not disconnect unit power.

a. Test.

NOTE

Upon sensing a temperature exceeding 155 °F, S4 opens, de-energizing the air conditioner as described in paragraph 1-13. When the temperature sensed by the HTCO drops to 125 °F, the cutout closes, restoring circuit continuity. Air conditioner reset is as described in paragraph 1-13.

- (1) Disconnect high temperature cutout switch wires from TB3.
- (2) Check for continuity.
- (3) If continuity is not present, replace defective high temperature cutout switch.

b. Removal.

- (1) Remove two screws (1), lockwashers (2), and nuts (3) holding high temperature cutout switch (4) to bracket (5) on evaporator coil frame.
- (2) Remove high temperature cutout switch (4).

4-38. HIGH TEMPERATURE CUTOUT SWITCH (cont)**b. Installation.**

- (1) Aline high temperature cutout switch (4) with bracket (5).
- (2) Secure high temperature cutout switch (4) to bracket (5) with two screws (1), lockwashers (2), and nuts (3).
- (3) Install thermostat terminal box cover. (See paragraph 4-36.)
- (4) Install evaporator access panel. (See paragraph 4-13.)

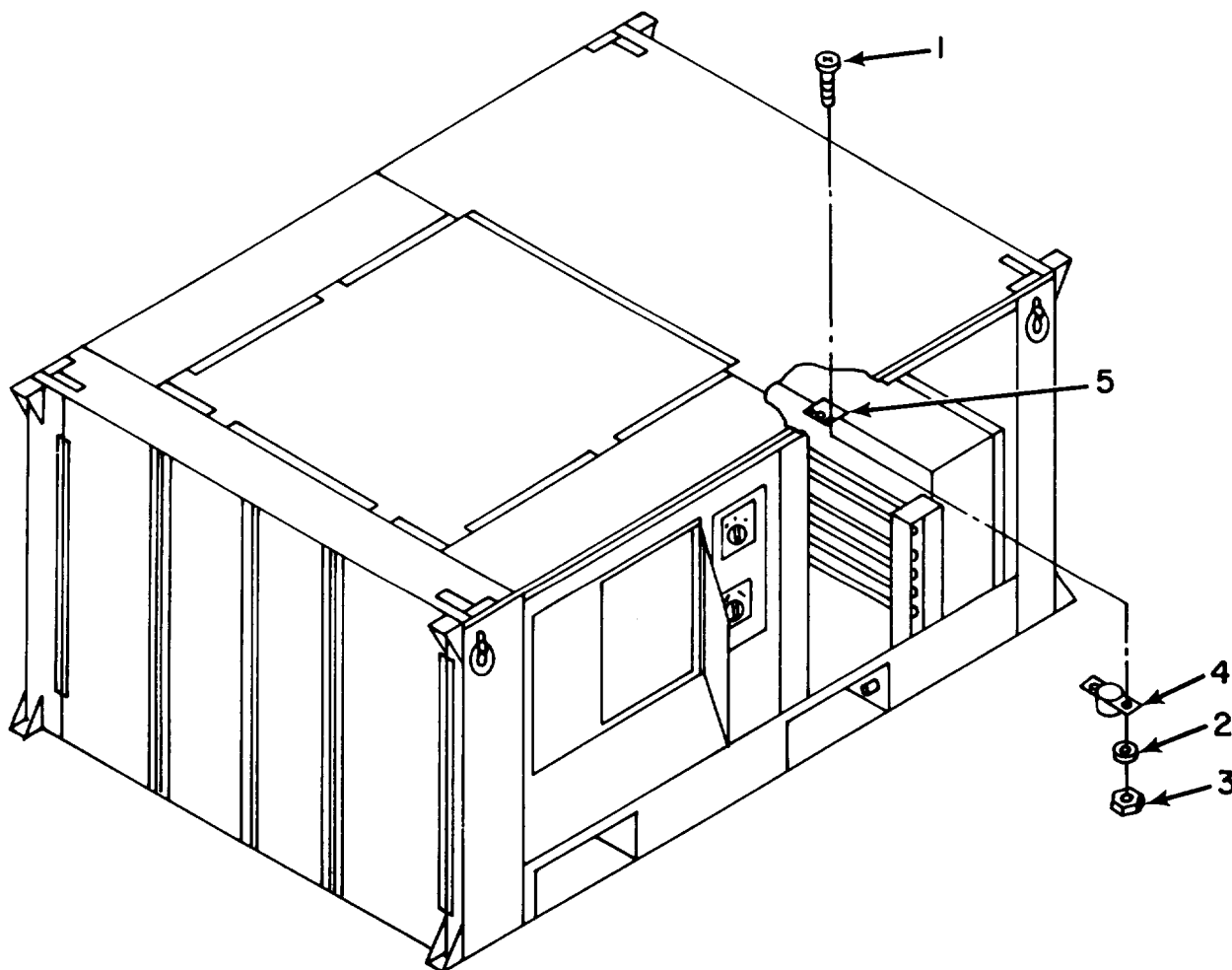


Figure 4-38. High Temperature Cutout S witch

Section VI PREPARATION FOR STORAGE OR SHIPMENT

4-39. PREPARATION FOR STORAGE

NOTE

Drain couplings are removed from unit before using a forklift

a. Administrative storage of equipment. See Administrative Storage of Equipment, TM 740-90-1. Administrative storage is short term storage – 1 to 45 days. It covers a storage of equipment which can be readied for mission performance within 24 hours. Before placing an item in administrative storage, the next scheduled preventive maintenance checks and services should be performed, all known deficiencies corrected, and all current modification work orders applied. The storage site should provide required protection from the elements and allow access for visual inspection when applied. Store the ducts in the condenser storage compartment.

b. Intermediate storage -46 to 180 days. No special handling is required other than protection from damage and the elements.

(1) Store the ducts in the condenser storage compartment.

(2) Place the air conditioner in a dry, covered area.

c. Long term or flyable storage. There is no time limit for this type of storage.

(1) Store the ducts in the condenser storage compartment.

(2) Bolt the unit to a skid base, preferably the original used to ship the unit if it has been preserved.

(3) Wrap the unit with two layers of heavy plastic sheet or barrier paper.

(4) Tape and strap the wrapping in place.

(5) Mark the air conditioner per standard Army procedures.

CHAPTER 5**DIRECT SUPPORT MAINTENANCE INSTRUCTIONS****Section I. REPAIR PARTS, SPECIAL TOOLS, TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT****5-1. GENERAL**

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

b. Special tools, TMDE, and support equipment. Test, Measurement and Diagnostic Equipment (TMDE) and support equipment include electrical test equipment, standard pressure and vacuum gages, vacuum pumps, and charging manifolds found as standard equipment in any direct support refrigeration shop. No special tools are required for maintenance of this equipment.

c. Repair parts. Repair parts are listed and illustrated in the TM 9-4120-398-24P, Repair Parts and Special Tools List, (RPSTL), covering unit direct support and general support maintenance for this equipment.

Section II. DIRECT SUPPORT TROUBLESHOOTING

5-2. USE OF TROUBLESHOOTING TABLE

- a. The troubleshooting table (Table 5-1) lists the most common malfunctions which you may find during the operation or maintenance of the air conditioner. You should perform the test/inspections and corrective actions in the order listed.
- b. For a specific malfunction, perform the troubleshooting procedures listed in Table 4-2 before performing the procedures listed in table 5-1.
- c. This manual cannot list all malfunctions which may occur. However, all tests or inspections and corrective actions are listed for most common malfunctions.
- d. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

WARNING

Disconnect power from the air conditioner before doing any maintenance work to the electrical system.

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

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

TABLE 5-1. DIRECT SUPPORT TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. COMPRESSOR WILL NOT START.

Inspect and check compressor for burnout. (See Paragraph 5-23.)

Replace burned out compressor,

TABLE 5-1. DIRECT SUPPORT TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2. COMPRESSOR SHORT CYCLES.		
Step 1. Check for obstructions in front of condenser grille.		
Remove obstructions.		
Step 2. Check for dirt in condenser coil. (See Paragraph 5-19.)		
Clean condenser coil.		
WARNING		
Death or serious injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and reversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye contact is possible.		
Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous and corrosive gas.		
Step 3. Check head pressure (high pressure side). (See paragraph 5-11.)		
a. If pressure is too high, check HIGH PRESSURE cutout switch and replace if defective. See paragraph 5-17.)		
b. If pressure is excessive and sight glass is clear, release excess refrigerant. (See paragraph 5-5.) See refrigerant charging (Paragraph 5-10) for pressure requirement.		
Step 4. Check head pressure (low pressure side). (See paragraph 5-11.)		
Add refrigerant if low. (See paragraph 5-10.)		
Step 5. Check quench valve. (See paragraph 5-14.)		
Replace if defective.		

TABLE 5-1. DIRECT SUPPORT TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<hr/>		
3.	INSUFFICIENT COOLING ACTION.	
	Step 1. Check for proper refrigeration charge.	Assure proper charge.
	Step 2. Check for dirt-dogged evaporator.	Clean evaporator coil. (See paragraph 5-12.)
	Step 3. Check for dirt-clogged condenser coil.	Clean condenser coil. (See paragraph 5-19.)
4.	REFRIGERANT SYSTEM CONTINUOUSLY LOSING REFRIGERANT.	
	<div>WARNING</div>	
	Death or serious injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversable tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye contact is possible.	
	Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous and corrosive gas.	
	Step 1. Check refrigerant tubing and components for leaks using a leak detector. (See paragraph 5-6.)	Repair or replace as required.
	Step 2. Check fusible plug for rupture. (See paragraph 5-22.)	Replace if ruptured.

TABLE 5-1. DIRECT SUPPORT TROUBLESHOOTING (cont)

MALFUNCTION		TEST OR INSPECTION	CORRECTIVE ACTION
<hr/>			
5.	SIGHT GLASS APPEARS YELLOW INSTEAD OF GREEN.		
<div>WARNING</div>			
<p>Death or serious injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye contact is possible.</p> <p>Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous and corrosive gas.</p>			
Step 1.	Yellow appearance of sight glass is caused by contamination in the refrigerant.		
	<ul style="list-style-type: none">a. Release refrigerant. (See paragraph 5-5.)b. Remove filter-drier. (See paragraph 5-21.)c. Purge and dry system. (See paragraph 5-6.)d. Install new filter-drier. (See paragraph 5-21.)e. Leak test system. (See paragraph 5-8.)f. Evacuate system. (See paragraph 5-9.)g. Recharge with refrigerant. (See paragraph 5-10.)		
Step 2.	Check for yellow in sight glass after allowing compressor to run for at least 1 hour.		
	Repeat corrective action in step 1.		
6.	AIR CONDITIONER NOISY DURING OPERATION.		
Step 1.	Check expansion valve. (See paragraph 5-13.)		
	Replace if defective.		

TABLE 5-1. DIRECT SUPPORT TROUBLESHOOTING (cont)

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Check quench valve. (See paragraph 5-14.)	Replace if defective.
	Step 3. Check compressor for internal noise and loose mounting. (See paragraph 5- 23.)	a. Repair loose mounting. b. Replace compressor if defective.
7.	AIR CONDITIONER STOPS - AUTO MODE.	Check for continuity in high pressure cutout switch. Replace defective cutout. (See paragraph 5-17.) If problem still exists, refer to supervisor.

Section III. DIRECT SUPPORT MAINTENANCE PROCEDURES

5-3. GENERAL. The procedure-s in this section have been arranged in the order in which the items appear in the direct support (F) maintenance level column of the Maintenance Allocation Chart (MAC).

5-4. REFRIGERATION SYSTEM REPAIRS GENERAL. The refrigeration system must be totally discharged before any maintenance action that requires opening of the pressurized system. Leak testing and dehydrator replacement are required after any system component has been removed and replaced. The system must be evacuated before it is charged. The system must be properly charged to function properly.

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

DANGEROUS CHEMICAL (R22)
is used in this equipment

DEATH

or severe injury may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin-eye contact is possible. Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes refrigerant to break down and form carbonyl chloride (phosgene), a highly poisonous and corrosive gas.

WARNING

REFRIGERANT UNDER PRESSURE

Is used in the operation of this equipment

DEATH

or severe injury may result if you fail to observe safety precautions. Never use a heating torch on any part that contains refrigerant -22. Do not let liquid refrigerant touch you, and do not inhale refrigerant gas.

NOTE

In accordance with 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.

Operation of the recovery/cycling unit must be by AUTHORIZED PERSONNEL ONLY.

Whenever available, use recycled refrigerant for charging the refrigeration system.

5-5. DISCHARGING THE REFRIGERANT SYSTEM

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)

Tools

Tool kit, refrigeration SVC
Recovery and recycling unit, refrigerant

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Service

- a. Unscrew hose connection protective caps.

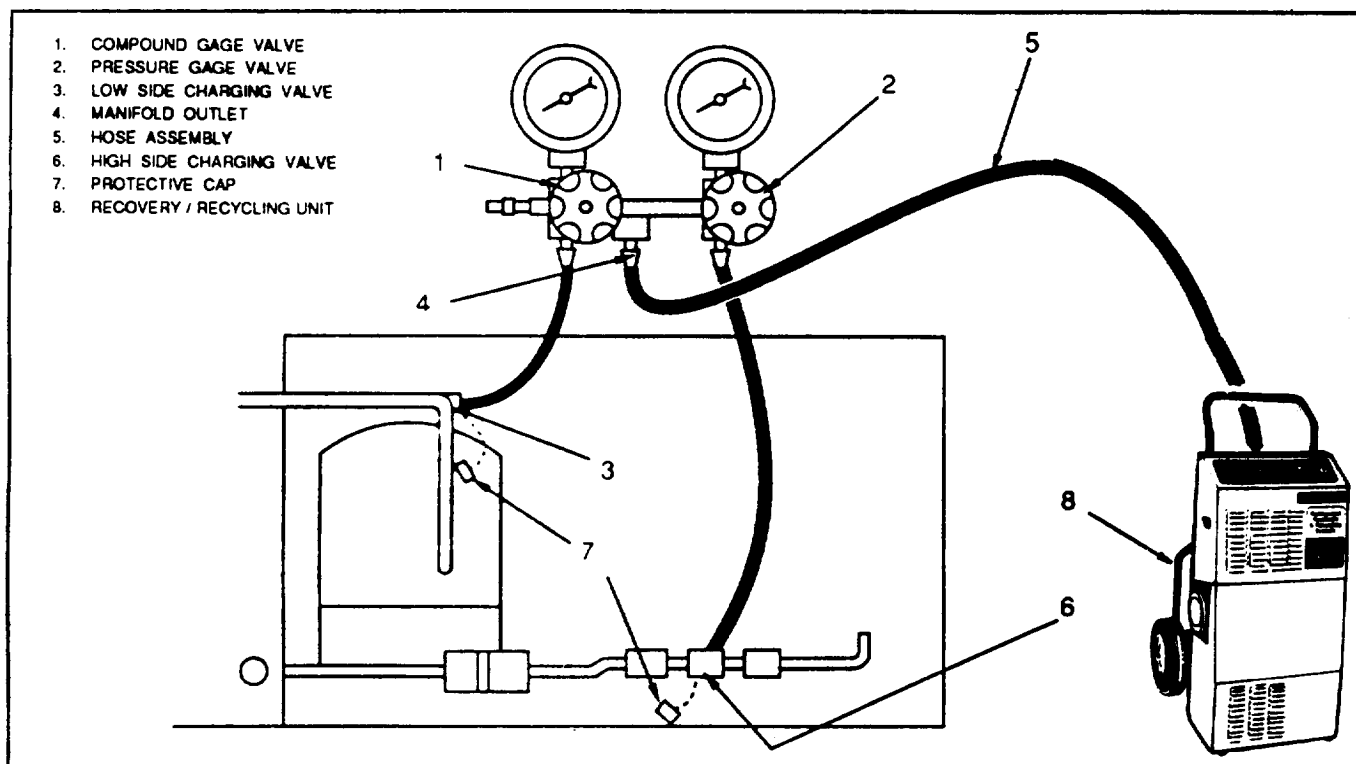


Figure 5-1. Discharging Refrigerant

5-5. DISCHARGING THE REFRIGERANT SYSTEM (cont)**NOTE**

In accordance with 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.

Operation of the recovery/recycling unit must be by AUTHORIZED PERSONNEL ONLY.

- b. Connect the charging manifold hoses to the manifold and air conditioner charging valves.
- c. Connect and operate the recovery/recycling unit in accordance with manufacturer's instructions.

5-6. PURGING THE REFRIGERANT SYSTEM

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
 Condenser access door open
 (Paragraph 4-14)
 Refrigerant Discharged
 (Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Nitrogen cylinder
 (Item 9 Appendix E)

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Service.

WARNING

Nitrogen is an inert gas. However, it also presents danger as a suffocant and, therefore, must also be discharged in a ventilated location.

CAUTION

Nitrogen cylinders are pressurized containers. The pressure in the cylinder can exceed 2000 psi. A nitrogen pressure regulator should be used at all times when nitrogen is used for leak check or purge operations.

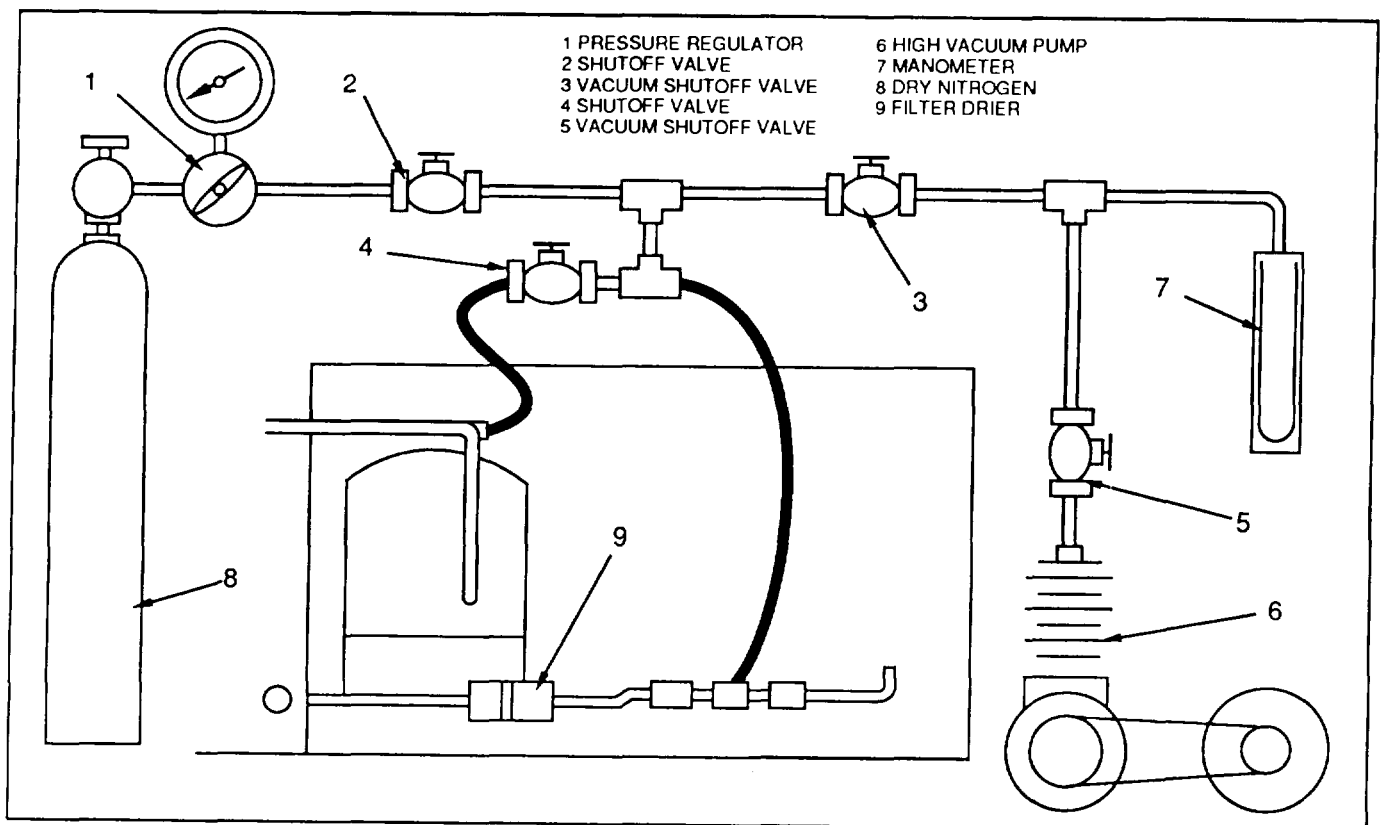
NOTE

The refrigeration system must be purged with dry nitrogen, Item 9, Appendix E, before any brazing is performed on any component. A flow of dry nitrogen between 1 and 2 cfm (0.028-0.057m3/minutes) should be continued during all brazing operations to minimize internal oxidation and scaling.

- a. Connect the center hose from the charging manifold to a nitrogen regulator and dry nitrogen tank.
- b. The hose from the high pressure service valve to the charging manifold must be connected.
- c. The hose from the low pressure service valve must be disconnected from the charging manifold.

5-6. PURGING THE REFRIGERANT SYSTEM (cont)

- d. Close the unused valve on the charging manifold, and open the one with the nitrogen tank hook up.
- e. Open the nitrogen cylinder valve and adjust the regulator so that 1 to 2 cfm (0.028-0.057 m³/minute) of nitrogen flows through the system.
- f. Check discharge from hose attached to the low pressure charging valve to be sure that no oil is being forced out of the system.
- g. Allow nitrogen to sweep through the system at the rate of less than 1–2 cfm (0.028– 0.057 m³/minute) for a minimum of 5 minutes, before starting any brazing operation. Then allow it to continue to flow at the same rate until all brazing operations are completed (See Paragraph 5-7 for brazing/debrazing procedures).
- h. After installation brazing operations are completed, allow nitrogen to flow for a minimum of 5 minutes.
- i. Close nitrogen cylinder valve, nitrogen regulator and charging manifold valve.
- j. Disconnect the hose from the nitrogen tank.
- k. Replace filter drier (see Paragraph 5-21).
- l. Leak test system (see Paragraph 5-8).

**Figure 5-2. Nitrogen Purging Connection**

5-7. BRAZING/DEBRAZING PROCEDURES

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
Refrigerant Discharged
(Paragraph 5-5)
System nitrogen purged
(Paragraph 5-6)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Nitrogen cylinder
(Item 9 Appendix E)
Brazing alloy (silver)
(Items 2 and 3 Appendix E)
Brazing flux
(Item 6 Appendix E)
Abrasive cloth
(Item 4 Appendix E)
Rags (Item 12 Appendix E)

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Service.

- a. General. All tubing in the refrigeration system is seamless copper with a bright internal finish that permits thorough cleaning and prevents entrapment of moisture or other impurities. Rigid grade copper is used for straight sections and soft grade for sections that must be bent. All interconnecting fittings, such as elbows, tees, etc., are also copper. The bodies of all valves and all connections on other components are brass. All joints, except those provided with flare fittings, are made by brazing in accordance with MIL-B-7883, except that radiographic examination is not required.
- b. Filler Alloy. Grade IV or VI brazing alloy and type B flux, as specified in MIL-B-7883, must be used for all copper to brass joints. Grade III brazing alloy may be substituted for Grade IV or VI for copper to copper joints; flux is not required for copper to copper joints.
- c. De-brazing. Debraze joints for removal of refrigeration system components as follows:

WARNING

All refrigerant -22 must be discharged from system and entire system must be purged with dry nitrogen before beginning any debrazing operation.

5-7. BRAZING/DEBRAZING PROCEDURES (cont)

- (1) Determine which joints are to be debrazed.
- (2) Before debrazing a joint on a valve, disassemble the valve to the extent possible, then apply a wet rag (Item 12 Appendix E) to all but joint.

WARNING

Polyurethane foam used as insulation in air conditioner will break down to form toxic gases if exposed to flame of a torch at brazing temperature.

- (3) Protect insulation, wiring harnesses, cabinet, and other surrounding components with appropriate shields.
 - (4) Be sure the work area is well ventilated and that dry nitrogen is flowing through the refrigeration system at a rate of 1 to 2 cfm (0.028-0.057 m³/minute).
 - (5) Apply sufficient heat uniformly around the joint to quickly melt the filler alloy. If heat is applied slowly or only on one side, the entire component or length of tubing will be heated and filler alloy in adjacent joints may also be melted. Remove heat as soon as the joint separates.
- d. Cleaning debrazed joints. All filler alloy must be cleaned from debrazed joints before reassembly. Heat each piece of the pint until the filler alloy is melted and then wipe it away with a damp cloth.

CAUTION

Be sure no filler alloy or other debris are left inside any tubing, fitting, or component.

e. Reassembly. If tubing sections or fittings were removed with a component, debraze them from the component, clean the pints, and braze them to the new component before reinstallation.

f. Brazing. Braze joints within the air conditioner as follows

- (1) Position the component to be installed.
- (2) To prepare a joint on a valve for brazing, disassemble the valve to the extent possible. Then apply a wet rag (Item 12 Appendix E) to all but the joint.
- (3) Protect insulation, wiring harnesses, and surrounding components with appropriate shields.
- (4) Be sure the work area is well ventilated and that dry nitrogen is flowing through the refrigeration system at a rate of 1 to 2 cfm (0.028-0.057 m³/minute).
- (5) Apply sufficient heat uniformly around the joint to quickly raise it to a temperature that will melt the filler alloy. Remove heat as soon as brazing is completed.

5-8. LEAK TESTING THE REFRIGERANT SYSTEM

This task cover: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
Conducted after repair involving

opening of the refrigerant system

Tools

Tool kit, refrigeration SVC

Materials/Parts

Nitrogen cylinder
(Item 9 Appendix E)
Refrigerant -22
(Item 8 Appendix E)

General Safty Instructions

WARNING

Voltages used can kill. Always
disconnect power cord to air conditioner
before performing any internal
maintenance. Shutting unit off at its
control panel does not disconnect
unit power.

Service.

a. The entire repaired area should be thoroughly leak tested after repair or replacement of any component, before it is recharged with refrigerant – 22. Leak testing is also the method, for troubleshooting when a system has lost all or part of its refrigerant charge through an undetermined cause.

b. Testing Method. There are two acceptable methods for leak testing the refrigeration system.

(1) Refrigerant gas leak detector. If an electronic refrigerant gas leak detector is available, it should be used in accordance with the procedures contained in TM 9-4940-435–14, “Leak Detector, Refrigerant Gas.”

NOTE

The electronic refrigerant gas leak detector is highly sensitive to the presence of a minute quantity of gas in the air, and due to this factor is quite effective in the detection of small leaks. However, due to the rapid dispersion of refrigerant gas into the surrounding air, difficulty may be encountered in pinpointing large leaks. The detector must be used in a well ventilated but draft free area.

(2) Soap solutions. In this method, a strong solution of a liquid detergent and water is brushed onto all points of possible leakage while closely watching for the formation of bubbles.

5-8. LEAK TESTING THE REFRIGERANT SYSTEM (cont)**CAUTION**

If the soap solution testing method is used, thoroughly rinse with fresh water after using is completed.

A residual soap film will attract and accumulate an excessive amount of dust and dirt during operation.

c. Testing procedures. To perform leak testing by use of the electronic detector, it is necessary that the system be pressurized with a proportion of refrigerant gas. To perform leak testing by use of the soap solution method, the system may be pressurized with dry nitrogen alone.

(1) To pressurize a system that has some refrigerant charge, for either leak testing method:

- (a) Remove the hose connection protective caps from the high and low pressure service valves.
- (b) Connect the hoses from a charging manifold to the service valves.

NOTE

If it is possible that the problem may not be a leak and that you may not have to replace a refrigeration system component, refrigerant -22 may be substituted for the nitrogen in the following test. If nitrogen is used, you will have to discharge, evacuate and re-charge the system after this test is completed.

(c) Connect a nitrogen pressure regulator and nitrogen bottle to the center hose connection of the charging manifold.

(d) Open the charging manifold valves.

(e) Open the nitrogen tank valve and pressurize the system to 350 psi (24.7 kg/cm²).

(f) Perform leak tests.

(g) If a leak is found, discharge and purge the system and repair leak. See specific instructions for components to be removed.

(h) If a leak was not found and refrigerant -22 was used to pressurize the system, see charging instructions (See Paragraph 5-10).

(2) To pressurize a system that has been discharged and purged for leak testing with an electronic detector:

- (a) Remove the hose connection protective caps from the high and low pressure service valves.
- (b) Connect the hoses from a charging manifold to the service valves.

5-8. LEAK TESTING THE REFRIGERANT SYSTEM (cont)

CAUTION

Connect the refrigerant-22 drum so that only gas will be used for pressurization.

(c) Connect a drum of refrigerant -22 to the center hose connection of the charging manifold

(d) Open the charging manifold valves.

(e) Open the refrigerant drum valve slightly and adjust as necessary to prevent formation of frost and allow system pressure to buildup until the gages read 40-50 psi (2.8-3.5 kg/cm²).

(f) Close the charging manifold valves and the refrigerant drum valve.

(g) Remove the refrigerant -22 drum from the center hose connection.

(h) Connect a nitrogen regulator and cylinder and cylinder of dry nitrogen to the center hose connection.

(i) Open the charging manifold valves and the nitrogen cylinder and regulator valve. Allow system pressure to buildup until gages read 350 psi (24.7 kg/cm²).

(j) Perform leak tests, then discharge and purge the system, in accordance with paragraphs 5-5 and 5-6 before performing maintenance, or before evacuating and charging the system, as appropriate.

(3) Final Leak Testing. Always perform a final leak test after performing any repair or replacement of components before the air conditioner is reassembled and the refrigeration system is evacuated and charged.

5-9. EVACUATING THE REFRIGERANT SYSTEM

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
Refrigerant Discharged
(Paragraph 5-5)
Leak tested
(Paragraph 5-8)
New filter-drier installed
(Paragraph 5-21)

Tools

Tool kit, refrigeration SVC

General Safty Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Service.

CAUTION

Don't evacuate a leaking system. The vacuum created can cause air, moisture, and dirt to enter system.

- a. Check that both charging manifold valves are closed.
- b. Attach hose assemblies to service valves and charging manifold valves.
- c. Attach center hose assembly to vacuum pump.
- d. Start vacuum pump.
- e. Open charging manifold valves.
- f. Run the vacuum pump until at least 29 inches of mercury, measured on the gage, is reached.

NOTE

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

5-9. EVACUATING THE REFRIGERANT SYSTEM (cont)

g. Continue running the pump for one more hour, while observing the gage. If the gage needle moves back and forth, you have a leak which must be located and corrected first.

h. Close charging manifold valves.

i. Stop vacuum pump.

j. Disconnect pump from center hose connection.

k. Charge the refrigeration system (See paragraph 5-10.)

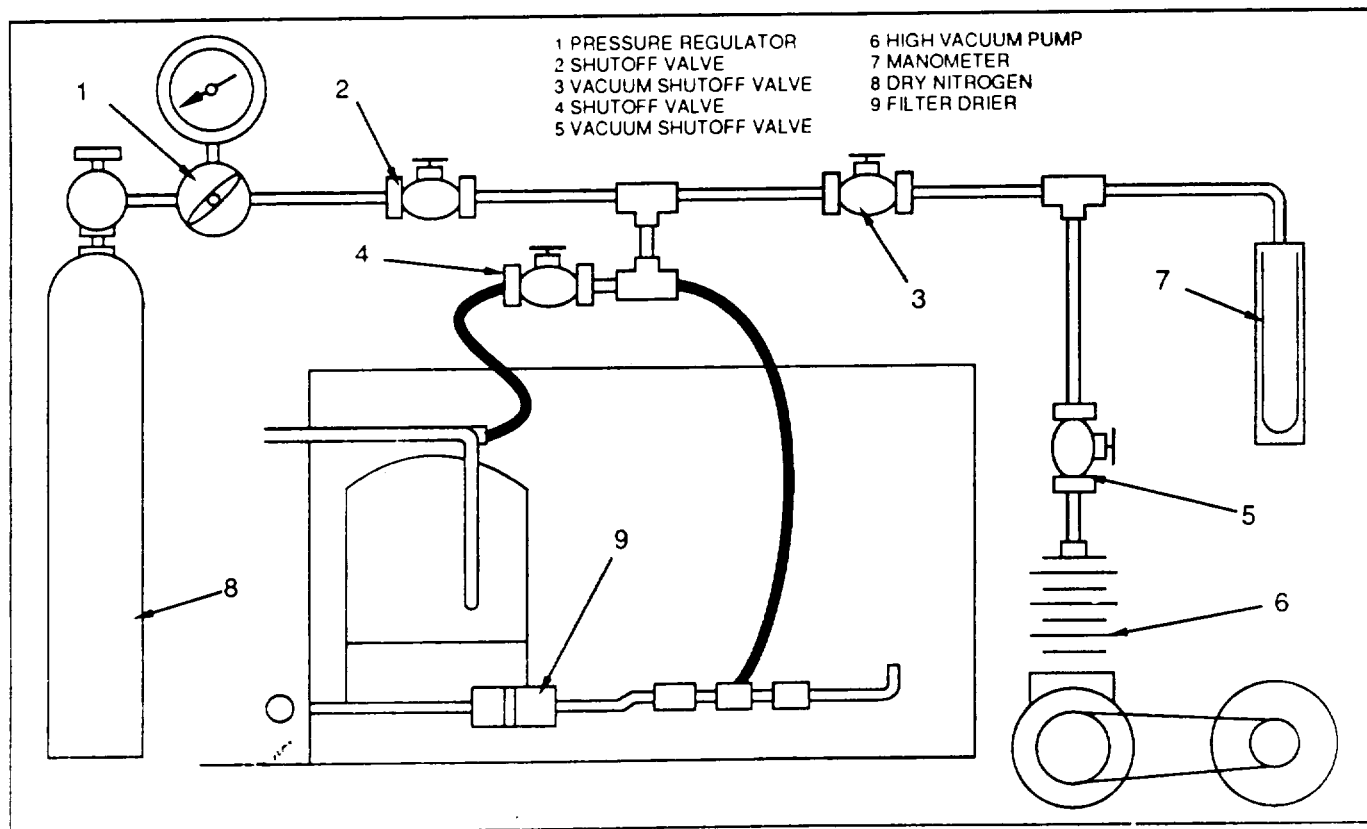


Figure 5-3. Evacuation of Refrigeration System

5-10. CHARGING THE REFRIGERATION SYSTEM

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
Refrigerant Discharged
(Paragraph 5-5)
Leak tested
(Paragraph 5-8)
New filter-drier installed
(Paragraph 5-21)
System evacuated
(Paragraph 5-9)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Materials/Parts

Filter-drier
Refrigerant -22
(Item 8 Appendix E)

Service.

After the system has been satisfactorily evacuated, it must be fully charged with refrigerant -22.

CAUTION

Never introduce liquid refrigerant into the low pressure (suction) service valve.

NOTE

The system must be evacuated before charging. Use only refrigerant -22 to charge the unit.

Whenever available, use recycled refrigerant for charging the refrigeration system.

a. Check that the hose from the low pressure charging valve is connected to the compound gage side of the charging manifold. The hose from the high pressure charging valve should be connected to the pressure gage side of the charging manifold.

b. Connect the center hose from the charging manifold to a well charged drum of refrigerant -22.

5-10. CHARGING THE REFRIGERATION SYSTEM (cont)

- c. Loosen the hose connections to the two air conditioner charging valves slightly.
- d. Open the two charging manifold valves.
- e. Open the refrigerant -22 drum valve slightly to allow a small amount of refrigerant to purge air from the hoses. Tighten the hose connections at the air conditioner charging valves.
- f. Close the low pressure (suction) charging manifold valve. Never introduce liquid refrigerant into the low pressure (suction) charging valve.
- g. Position the refrigerant -22 drum so that the liquid will be used for charging. (Some drums must be inverted and some are equipped with a selector valve).
- h. Using accurate scales, measure and record the weight of the refrigerant -22 drum.
- i. Open the refrigerant -22 drum valve.
- j. Allow liquid refrigerant to enter the system until the drum weight has decreased by 11.0 pounds (5.0 kg) or until system pressure has equalized.
- k. Close the refrigerant drum valve and the high pressure (discharge) manifold valve.

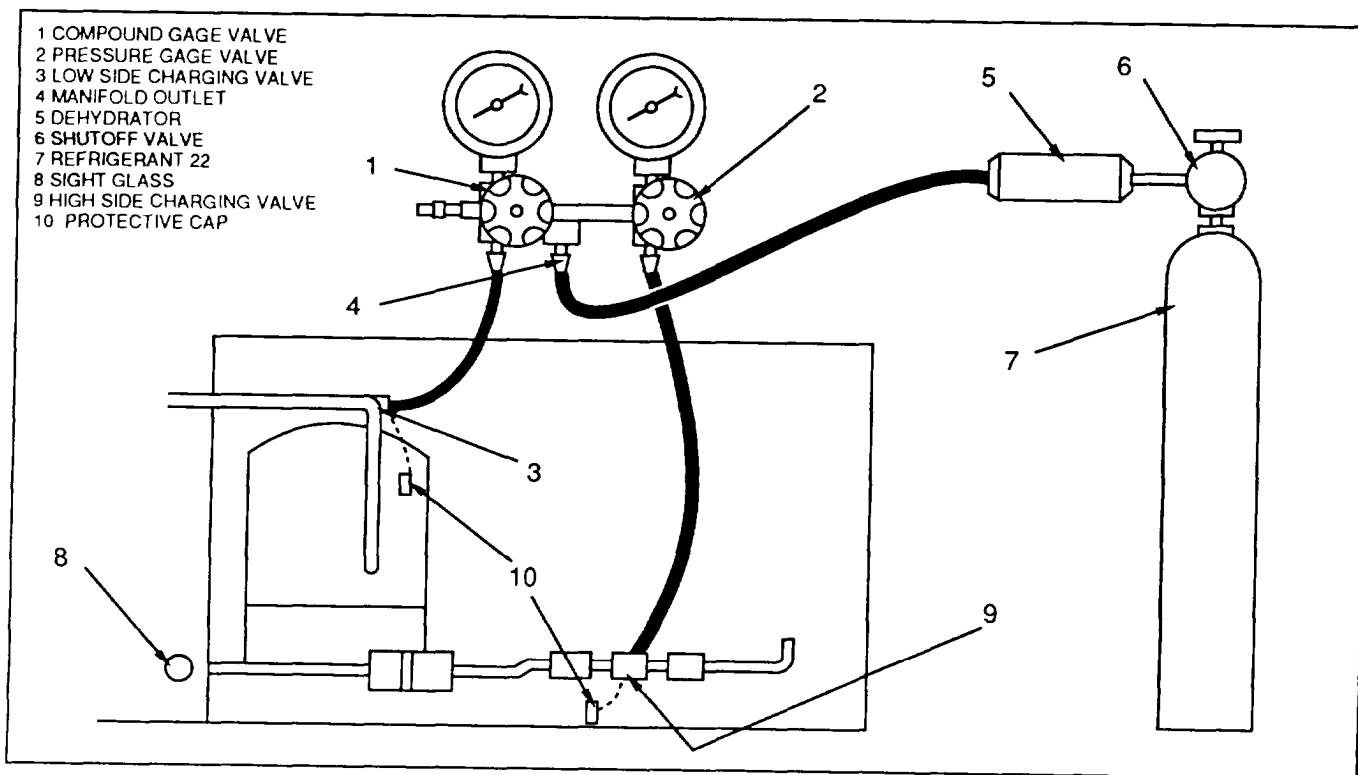


Figure 5-4. Refrigerant Charging

5-10. CHARGING THE REFRIGERATION SYSTEM (cont)

- l. Connect power.
- m. Be sure circuit breakers are on.
- n. Press and release both pressure switch reset buttons.
- o. Turn air conditioner on and operate in the COOL mode with the temperature control thermostat set at a maximum DECREASE position.
- p. If the 11.0 pound (5.0 kg) full charge was obtained, skip steps q thru s. If the system pressure equalized prior to obtaining a full charge of 11.0 pounds (5.0 kg), proceed with step q.
- q. Switch the refrigerant drum to the gas only position.
- r. Be sure that the refrigerant drum has been switched to the gas position and open the refrigerant drum valve and the low (suction) pressure charging manifold valve.
- s. Monitor the weight of the refrigerant drum as the air conditioner compressor pulls additional refrigerant gas into the system until the full 11.0 pound (5.0 kg) charge is obtained. When the system is fully charged, immediately close the refrigerant drum valve.
- t. Run the air conditioner in COOL mode (with temperature control thermostat in full COOLER position) for 15 minutes.

CAUTION

Do not skip the next step.

- u. After 15 minutes, observe the sight glass on back of condenser section. Green center means the refrigerant moisture content is acceptable. Yellow center means there is too much moisture in the system. It must be discharged, evacuated, and charged again.

NOTE

Milky white or bubbly liquid means the system has a low charge. Clear bubble-free liquid around the center means the system is fully charged.

- v. If charge is low, add gas refrigerant.
 - (1) Be sure that drum is switched to gas position. Open the drum valve.
 - (2) Continue to charge until sight glass is clear and bubble free.
 - (3) Close the refrigerant drum valve.
- w. Check air conditioner for proper cooling. There should be at least a 15°F temperature difference between evaporator discharge air and the inlet air. Turn the mode selector switch to OFF.

5-10. CHARGING THE REFRIGERATION SYSTEM (cont)**WARNING**

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

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

- x. Remove the charging manifold hoses from the air conditioner charging valves.
- y. Install service valve protective caps.
- z. Close condenser access door.

5-11. REFRIGERANT PRESSURE CHECK

This task covers: Service

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)

Tools

Tool kit, refrigeration SVC

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

Service. Except in cases where it is obvious that the refrigerant charge has been lost, the first step in troubleshooting problems in the refrigeration system should be to check discharge and suction pressures under operating conditions. Check pressures as follows.

- a. Turn the mode selector switch to OFF.
- b. Remove protective caps from charging valves.
- c. Connect individual pressure gages, or a refrigeration charging manifold and hoses to the high (discharge) and low (suction) charging valves.

CAUTION

Take care that only a very small amount of refrigerant is allowed to escape during hose purging.

- d. Loosen hose connections at gages or charging manifold.
- e. Open high (discharge) pressure manifold valve slightly to purge air from hose. Tighten low pressure hose connection at gage fitting as soon as a hissing sound is heard.
- f. Open low (suction) pressure manifold valve slightly to purge air from hose. Tighten low pressure hose connection at gage fitting as soon as a hissing sound is heard.
- g. Open the low (suction) and high (discharge) manifold valves.

5-11. REFRIGERANT PRESSURE CHECK (cont)

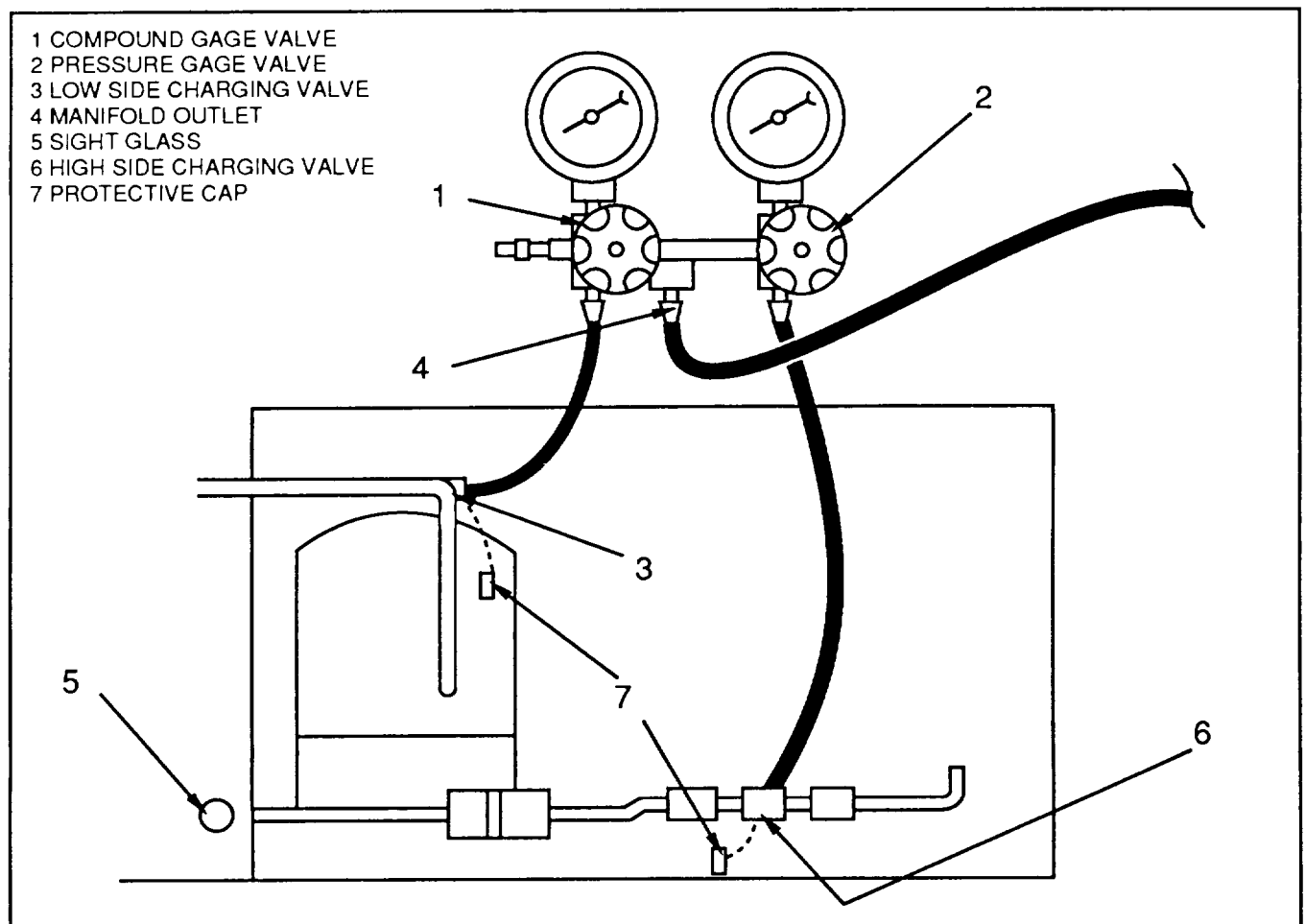


Figure 5-5. Pressure Test Connection.

5-11. REFRIGERANT PRESSURE CHECK (cont)

h. Both gages should read the same. Check the reading with the appropriate column in table 5-2. If the system is even partially charged, the pressure should be approximately equal to that shown in the table for the appropriate ambient temperature. If the pressure is considerably less than shown in the table, the system does not contain enough refrigerant to continue the pressure check; go to leak testing.

TABLE 5-2. PRESSURE-TEMPERATURE RELATIONSHIP OF SATURATED REFRIGERANT -22

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	Psig	kg/cm2	Deg G	Deg C	Psig	kg/cm2
10	-123	32.93	2.315	66	18.9	114.2	8.029
12	-11.1	34.68	2.439	68	20.0	118.3	8.318
14	-10.0	36.89	2.593				
16	-8.9	38.96	2.739	70	21.1	122.5	8.612
18	-7.8	41.09	2.889	72	22.2	126.8	8.915
				74	23.3	131.2	9.225
20	-6.6	43.28	3.043	76	24.4	135.7	9.541
22	-5.5	45.23	3.180	78	25.6	140.3	9.864
24	4.3	47.85	3.364				
26	-3.4	50.24	3.532	80	26.7	145.0	10.195
28	-2.2	52.70	3.705	82	27.8	149.8	10.522
				84	28.9	154.7	10.877
30	-1.1	55.23	3.883	86	30.0	159.8	11.236
32		57.83	4.066	88	31.1	164.9	11.594
34	1.1	60.51	4.254				
36	2.2	63.27	4.448	90	32.2	170.1	11.960
38	3.3	66.11	6.648	92	33.3	175.4	12.332
				94	34.5	180.9	12.719
40	4.4	69.02	4.853	96	35.6	186.5	13.113
42	5.5	71.99	5.062	98	36.7	192.1	13.506
44	6.6	75.04	5.276				
46	7.7	78.18	5.497	100	37.8	197.9	13.914
48	8.8	81.40	5.723	102	38.9	203.8	14.329
				104	40.0	209.9	14.758
50	10.0	84.70	5.955	106	41.4	216.0	15.187
52	11.1	88.10	6.257	108	42.2	222.3	15.630
54	12.2	91.5	6.433				
56	13.3	95.1	6.686	110	43.3	228.7	16.080
58	14.5	98.8	6.947	112	44.4	235.2	16.537
				114	45.6	241.9	17.008
60	15.6	102.5	7.206	116	46.7	248.7	17.486
62	16.7	106.3	7.474	118	47.8	255.6	17.971
64	17.8	110.2	7.748				

i. Turn the mode selector switch to the COOL mode with the temperature control thermostat in the full DECREASE setting for a few minutes.

j. With the unit operating, allow gages to stabilize. Take readings of the two gages.

k. Refer to table 5-1 (Troubleshooting) to isolate malfunction.

5-11. REFRIGERANT PRESSURE CHECK (cont)

- l. When pressure tests are completed, proceed with the maintenance action indicated.
- m. Turn unit OFF.
- n. Close manifold valves.

WARNING

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

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

- o. Remove gages or service manifold hoses from charging valves.
- p. Install charging valve protective caps.
- q. Close condenser access door.

5-12. EVAPORATOR COIL

This task covers a. Replacement
 b. Repair

INITIAL SETUP

Equipment Condition

Power OFF
Flexible ducts removed
(Paragraph 4-22)
Return duct adapter removed
(Paragraph 4-20)
Supply duct adapter removed
(Paragraph 4-19)
Evaporator access door open
(Paragraph 4-12)
Evaporator access panel removed
(Paragraph 4-13)
Evaporator plenum and blower removed
(Paragraph 4-32)
Heater removed
(Paragraph 4-35)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC
Straightener, fin
(Item 3 Appendix B Section III)

Materials/Parts

Air filter
Filter-drier
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Rags
(Item 12 Appendix E)
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

5-12. EVAPORATOR COIL (cont)

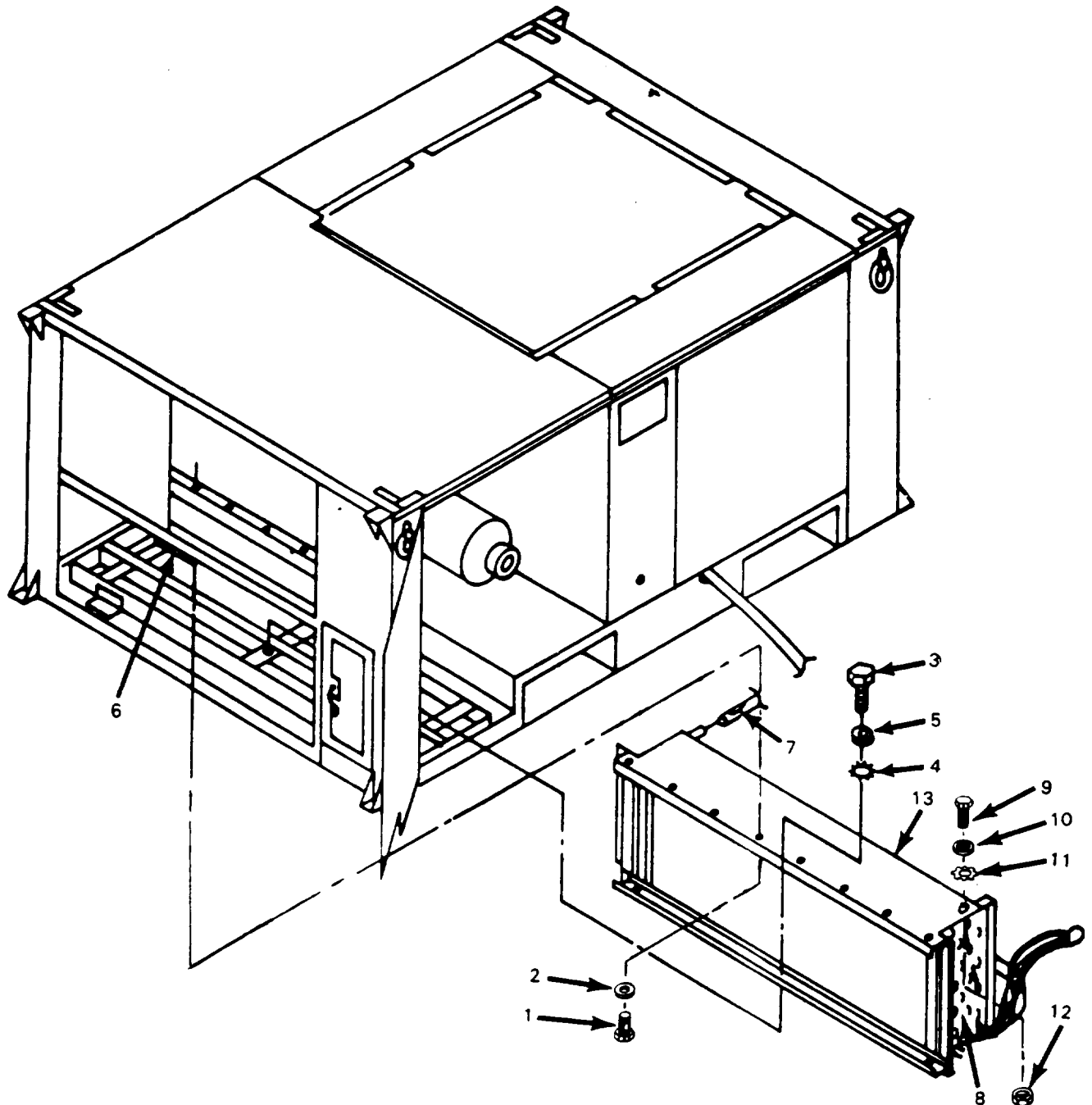


Figure 5-6. Evaporator Coil

5-12. EVAPORATOR COIL (ant)

WARNING

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

a. Removal.

- (1) Remove eight bolts (1) and lockwashers (2) from front top of coil.
- (2) Remove six bolts (3), lockwashers (4), and washers (5) from bottom of coil.
- (3) Carefully remove thermostat bulb (6) and position out of the way.
- (4) Cut insulation (7) back to expose tubing.
- (5) Debraze tubing connections.
- (6) Remove evaporator coil (8) from unit.
- (7) Remove four bolts (9), lockwashers (10), washers (11), nuts (12) and mounting plate (13).

b. Repair.

- (1) Repairs are limited to straightening of mashed fins.
- (2) If fins are mashed or dented so that air flow across coil would be blocked, straighten them using a plastic fin straightener (Item 3 Appendix B Section III).

c. Installation.

- (1) Install mounting plate (13), four nuts (12), washers (1 1), lockwashers (10) and bolts (9),
- (2) Position evaporator coil (8) in unit.
- (3) Secure top of coil with six bolts (3), lockwashers (4) and washers (5).
- (4) Secure top of coil with eight bolts (1) and lockwashers (2).
- (5) Install heater. (See paragraph 4-35.)
- (6) Replace filter-drier. (See paragraph 5-21.)
- (7) Purge system. (See paragraph 5-6.)
- (8) Braze tubing connections. (See paragraph 5-7.)
- (9) Leak test system. (See paragraph 5-8.)
- (10) Evacuate system. (See paragraph 5-9.)
- (11) Charge system. (See paragraph 5-10.)
- (12) Install blower plenum and fan. (See paragraph 4-32.)

5-12. EVAPORATOR COIL (ant)

- (13) Install return duct adapter. (See paragraph 4-20.)
- (14) Install supply duct adapter. (See paragraph 4-19.)
- (15) Install flexible ducts. (See paragraph 4-6.)
- (16) Close evaporator access door. (See paragraph 4-12.)
- (17) Install evaporator access panel. (See paragraph 4-13.)

5-13. THERMOSTATIC EXPANSION VALVE

This task covers: a. Inspection
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access door open
(Paragraph 4-12)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Tape
(Item 16 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Rags
(Item 12 Appendix E)
Filter-drier
Insulation
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

a. Inspection.

(1) Inspect for evidence of leaks, kinked, or otherwise damaged capillary line.

5-13. THERMOSTATIC EXPANSION VALVE (cont)

- (2) Check thermal bulb to see that it is securely clamped to the suction line.
- (3) If a leak is suspected or indicated, test per paragraph 5-8.
- (4) Replace a faulty expansion valve.

b. Removal.

- (1) Discharge the refrigerant system per paragraph 5-5.
- (2) Unwrap insulation tubing (1) from suction line (2) so that sensing bulb (3) is exposed. Note location and position of bulb for reinstallation.
- (3) Debraze tubing. (See paragraph 5-7.)
- (4) Remove screw (4), lockwasher (5), two washers (6), nut (7), and clamp (8).
- (5) Remove thermostatic expansion valve.

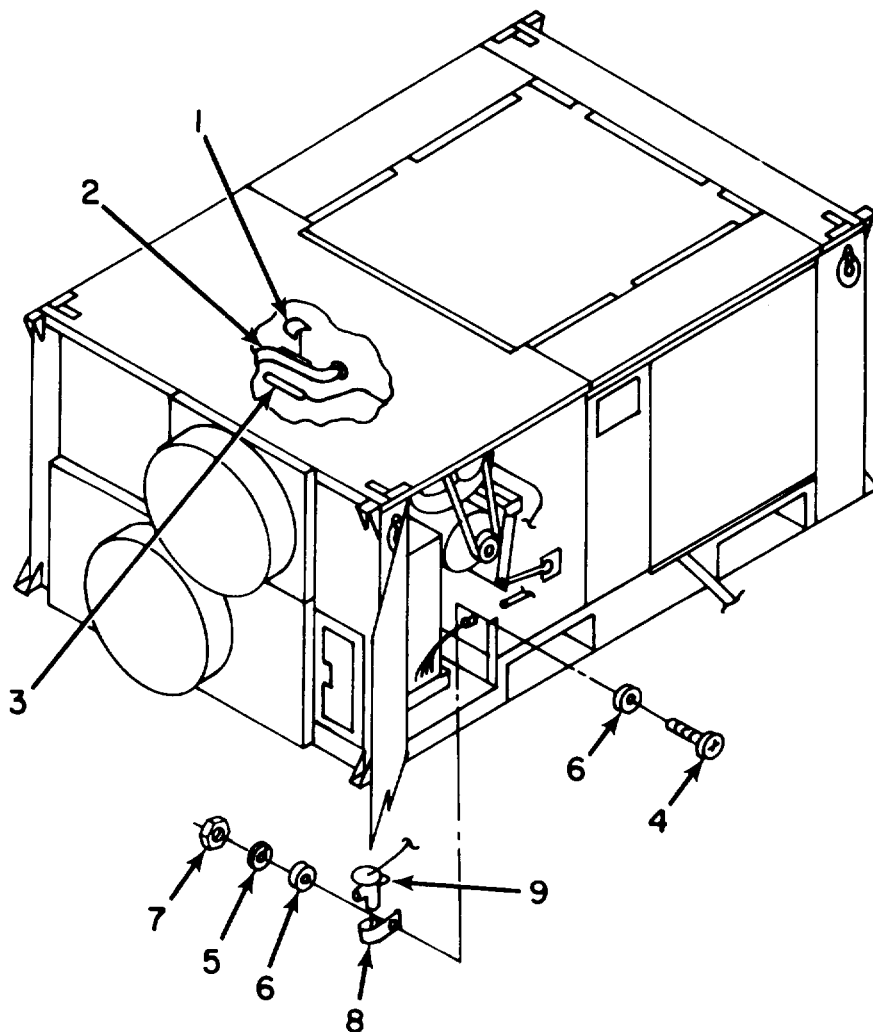


Figure 5-7. Thermostatic Expansion Valve

5-13. THERMOSTATIC EXPANSION VALVE (cont)

c. Installation.

- (1) Insert sensing bulb (3) into its original position.

NOTE

Be sure sensing bulb is installed in the original position and is making good metal-to-metal contact with suction line.

(2) Install insulation tubing (1) that was removed from sensing bulb and thermostatic expansion valve connections. Secure insulation tubing with tape, item 16, Appendix E.

- (3) Replace the filter-drier. (See paragraph 5-21.)
- (4) Purge the system with nitrogen. (See paragraph 5-6.)
- (5) Braze connections. (See paragraph 5-7.)
- (6) Leak test all newly connected joints and those in the repaired area. (See paragraph 5-8.)
- (7) Evacuate per Paragraph 5-9 and charge the refrigerant system. (See paragraph 5-10.)
- (8) Install clamp (8) and secure with screw (4), lockwasher (5), two washers (6), and nut (7).
- (9) Close evaporator access door (See paragraph 4-12).

5-14. LIQUID QUENCH VALVE

This task covers a. Inspection
 b. Replacement

INITIAL SETUP**Equipment Condition**

Power OFF
Evaporator access door open
(Paragraph 4-12)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Tape
(Item 16 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Rags
(Item 12 Appendix E)
Filter-drier
Insulation
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions**WARNING**

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

a. Inspection.

- (1) Inspect for evidence of leaks, kinked, or otherwise damaged capillary line.

5-14. LIQUID QUENCH VALVE (cont)

- (2) Check thermal bulb to see that it is securely clamped to the suction line.
- (3) If a leak is suspected or indicated, test per paragraph 5-8.
- (4) Replace a faulty quench valve.

b. Removal.

- (1) Discharge the refrigerant system per paragraph 5-5.
- (2) Unwrap insulation tubing (1) from suction line (2) so that sensing bulb (3) is exposed. Note location and position of bulb for reinstallation.
- (3) Debraze tubing per paragraph 5-7.
- (4) Remove liquid quench valve (4).

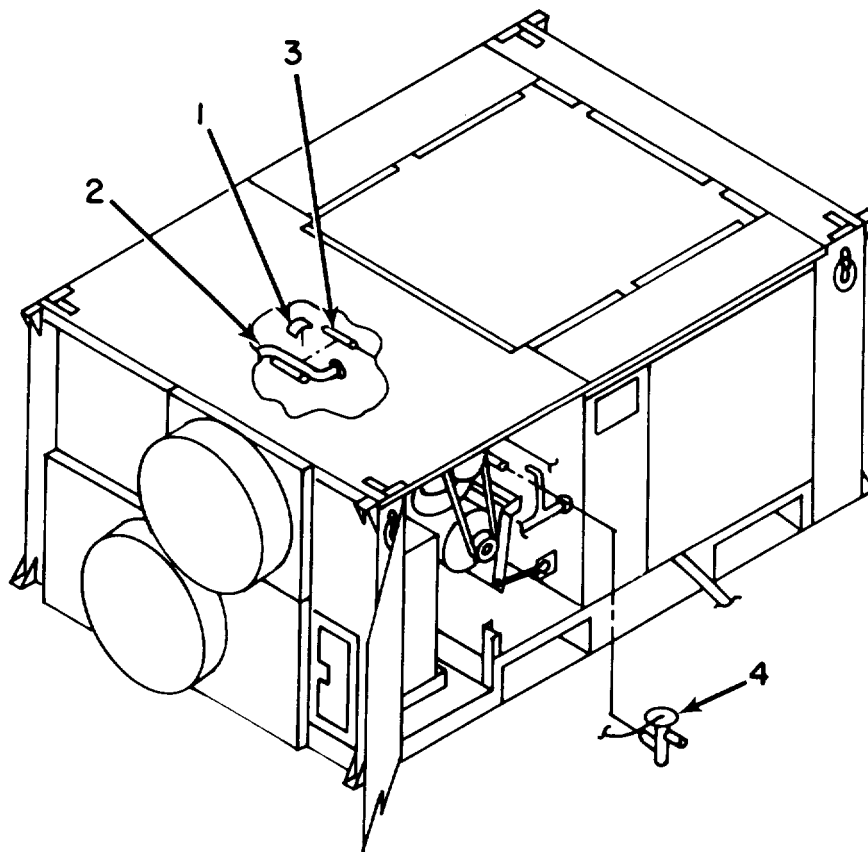


Figure 5-8. Liquid Quench Valve.

5-14. LIQUID QUENCH VALVE (cont)**c. Installation.**

(1) Insert sensing bulb (3) into its original position. Be sure sensing bulb is installed in the original position and is making good metal-to-metal contact with suction line.

(2) Install insulation tubing (1) that was removed from sensing bulb and liquid quench expansion valve connections. Secure insulation tubing with tape, item 16, Appendix E.

(3) Replace the filter-drier. (See paragraph 5-21.)

(4) Purge the system with nitrogen. (See paragraph 5-6.)

(5) Install liquid quench valve (4).

(6) Braze connections. (See paragraph 5-7.)

(7) Leak test all newly connected joints and those in the repaired area. (See paragraph 5-8.)

(8) Evacuate per paragraph 5-9 and charge the refrigerant system. (See paragraph 5-10.)

(9) Evaporator access door closed. (See paragraph 4-12.)

5-15. ACCUMULATOR

This task covers Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Evaporator access door open
(Paragraph 4-12)
Evaporator access panel removed
(Paragraph 4-13)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Tape
(Item 16 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Rags
(Item 12 Appendix E)
Adhesive
(Item 1 Appendix E)
Filter-drier
Insulation
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

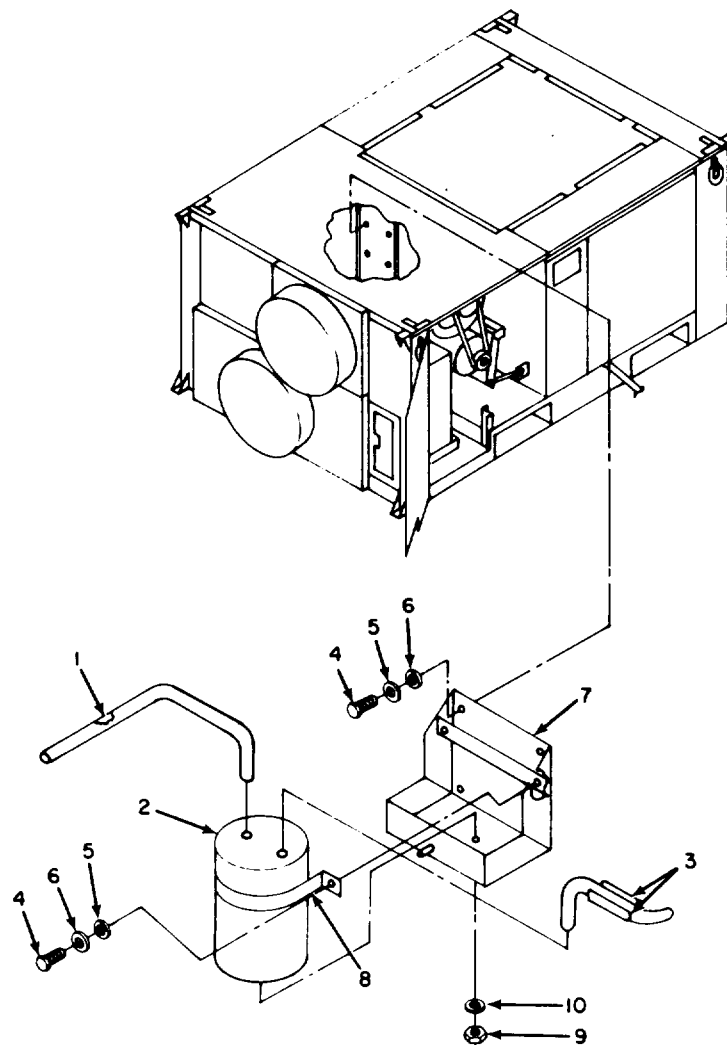
WARNING

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

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

5-15. ACCUMULATOR (cont)**a. Removal.**

- (1) Remove the insulation (1) covering the refrigerant line attachment to the accumulator (2).
- (2) Remove the TCV bulbs (3) and debraze the two refrigerant lines attached to the accumulator per paragraph 5-7.
- (3) Remove the two bolts (4), lockwashers (5), and washers (6) holding the bracket (7) to the bulkhead. Remove bracket and accumulator.
- (4) Remove the two bolts (4), lockwashers (5), and washers (6) in the accumulator strap (8). Remove the strap.
- (5) Remove the nut (9) and lockwasher (10) on the bottom of the accumulator bracket. Remove the accumulator.

**Figure 5-9. Accumulator**

5-15. ACCUMULATOR (cont)

b. Installation.

- (1) Install accumulator (2) to bracket (7) with nut (9) and lockwasher (10).
- (2) Install two bolts (4), lockwashers (5), washers (6), and strap (8) to the bracket.
- (3) Install two bolts (4), lockwashers (5), and washers (6) to bracket (7) and bulkhead.
- (4) Purge system per paragraph 5-6.
- (5) Braze refrigerant lines to accumulator using the procedures given in paragraph.

5-7.

- (6) Install insulation over lines. Cover slit in insulation with plastic electrical tape.
- (7) Leak test using the procedures given in paragraph 5-8. Repair leaks as necessary.
- (8) Evacuate system using the procedure given in paragraph 5-9.
- (9) Recharge system with refrigerant R-22 using the procedure given in paragraph 5-10.
- (10) Attach the evaporator access panel (See paragraph 4-13.)
- (11) Close evaporator access door. (See paragraph 4-12.)

5-16. CRANKCASE HEATER

This task covers: a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Sealing compound
(Item 5 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Test.

- (1) Tag and disconnect leads.
- (2) Test for continuity between leads. If continuity is not present, replace crankcase heater.

b. Removal. Remove heater element (1).

c. Installation.

- (1) Install heater element (1).
- (2) Reconnect leads.
- (3) Seal with scaling compound (Item 5 Appendix E).
- (4) Close condenser access door. (See paragraph 4-4.)

5-16. CRANKCASE HEATER (ant)

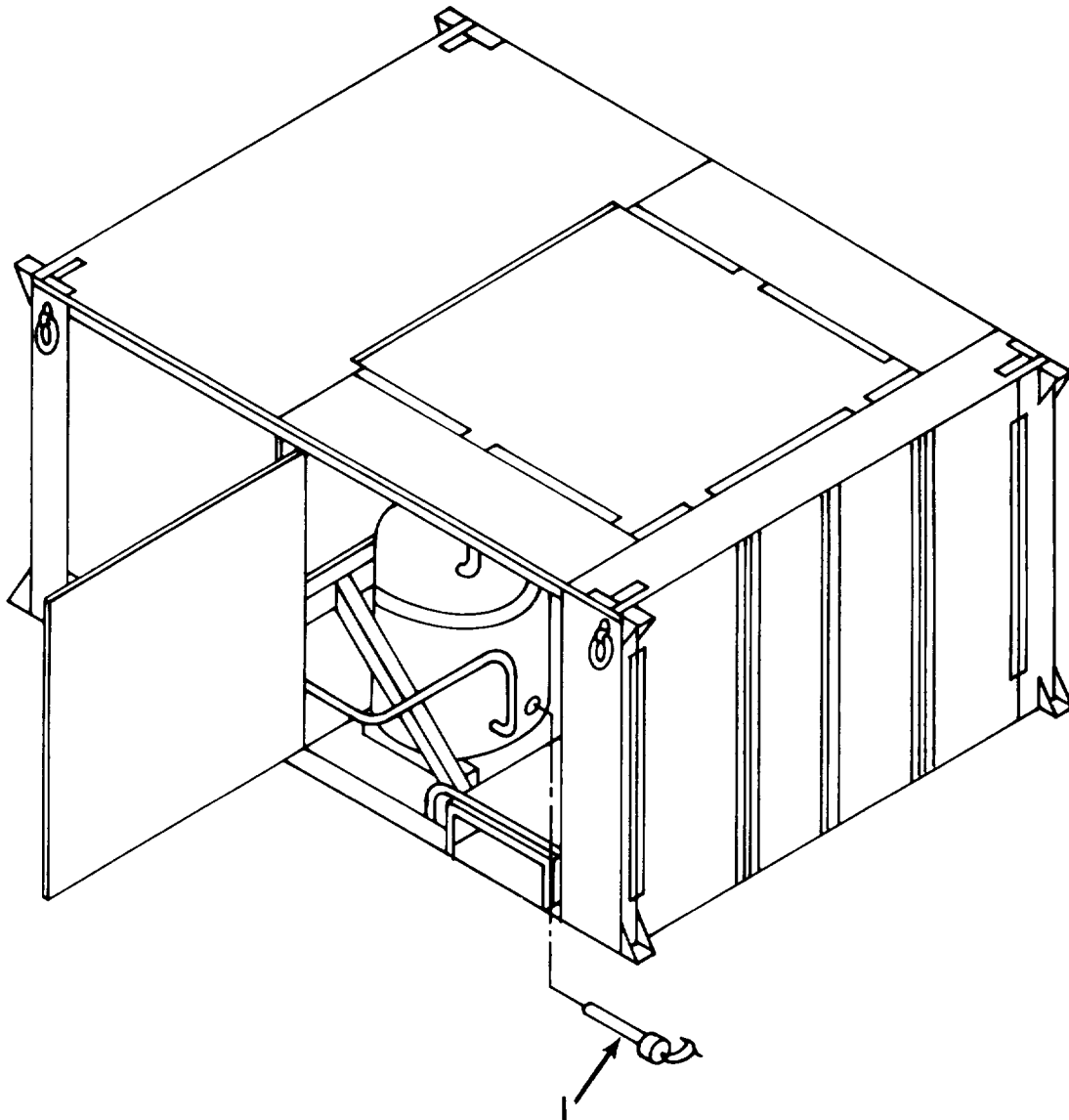


Figure 5-10. Crankcase Heater

5-17. HIGH PRESSURE CUT-OUT SWITCH

This task covers a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
Control board panel removed
(Paragraph 4-17)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Filter-drier
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Test.

(1) Check continuity of high pressure cut-out switch in two bottom leads 7 and 8 of TB1. A reading of ∞ indicates a defective cutout.

(2) Replace defective high pressure cut-out switch.

b. Removal.

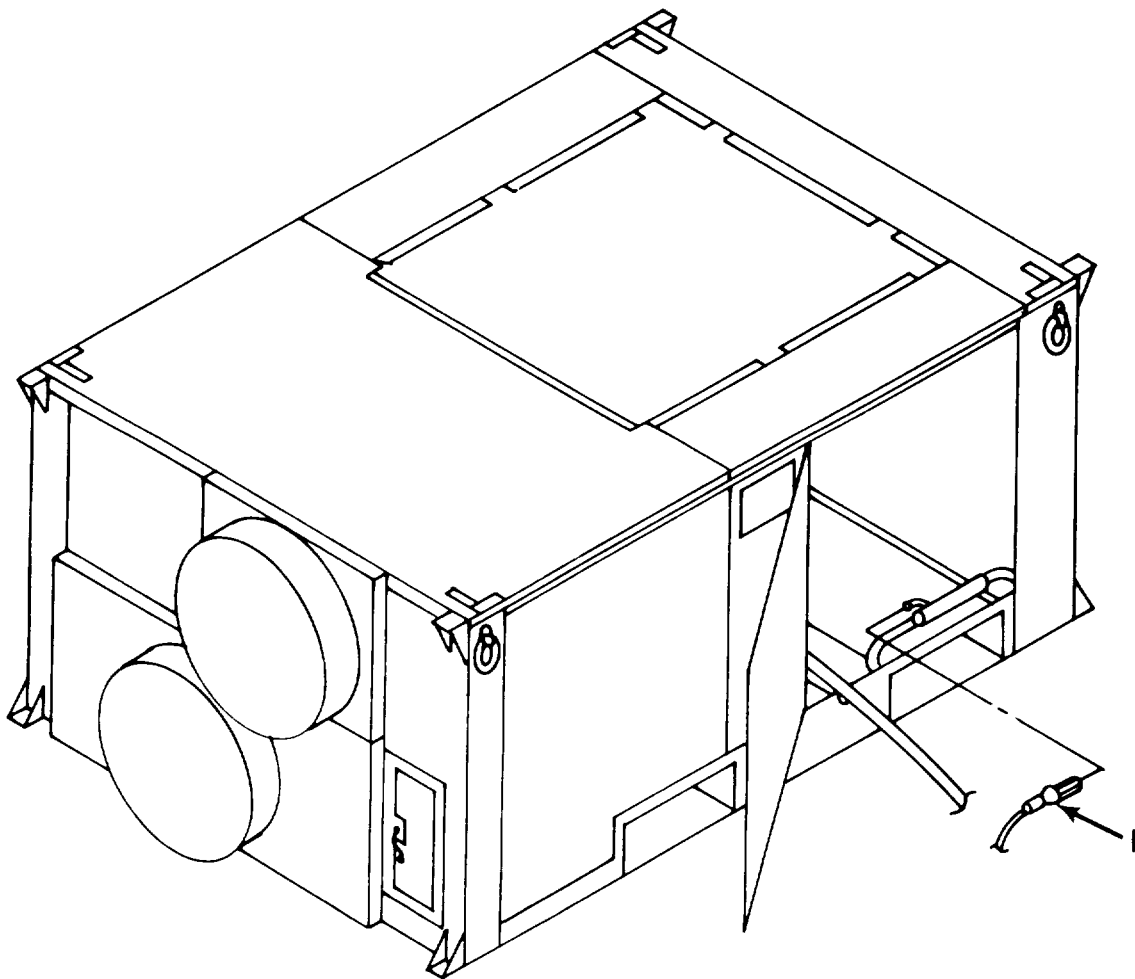
(1) Tag and disconnect wires near high pressure cut-out switch (1).

(2) Unscrew high pressure cut-out switch brass fitting from refrigeration line.

(3) Remove high pressure cut-out switch (1).

5-17. HIGH PRESSURE CUT-OUT SWITCH (cont)**c. Installation**

- (1) Install high pressure cut-out switch (1).
- (2) Reconnect leads.
- (3) Replace filter drier. (See paragraph 5-21.)
- (4) Purge system. (See paragraph 5-6.)
- (5) Leak test system. (See paragraph 5-8.)
- (6) Evacuate system. (See paragraph 5-9.)
- (7) Charge system. (See paragraph 5-10.)
- (8) Install control board panel. (See paragraph 4-17.)
- (9) Close condenser access door.

**Figure 5-11. High Pressure Cut-out Switch**

5-18. CHARGING VALVES

This task covers:

- a. Inspection
- b. Removal
- c. Installation

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Filter-drier
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

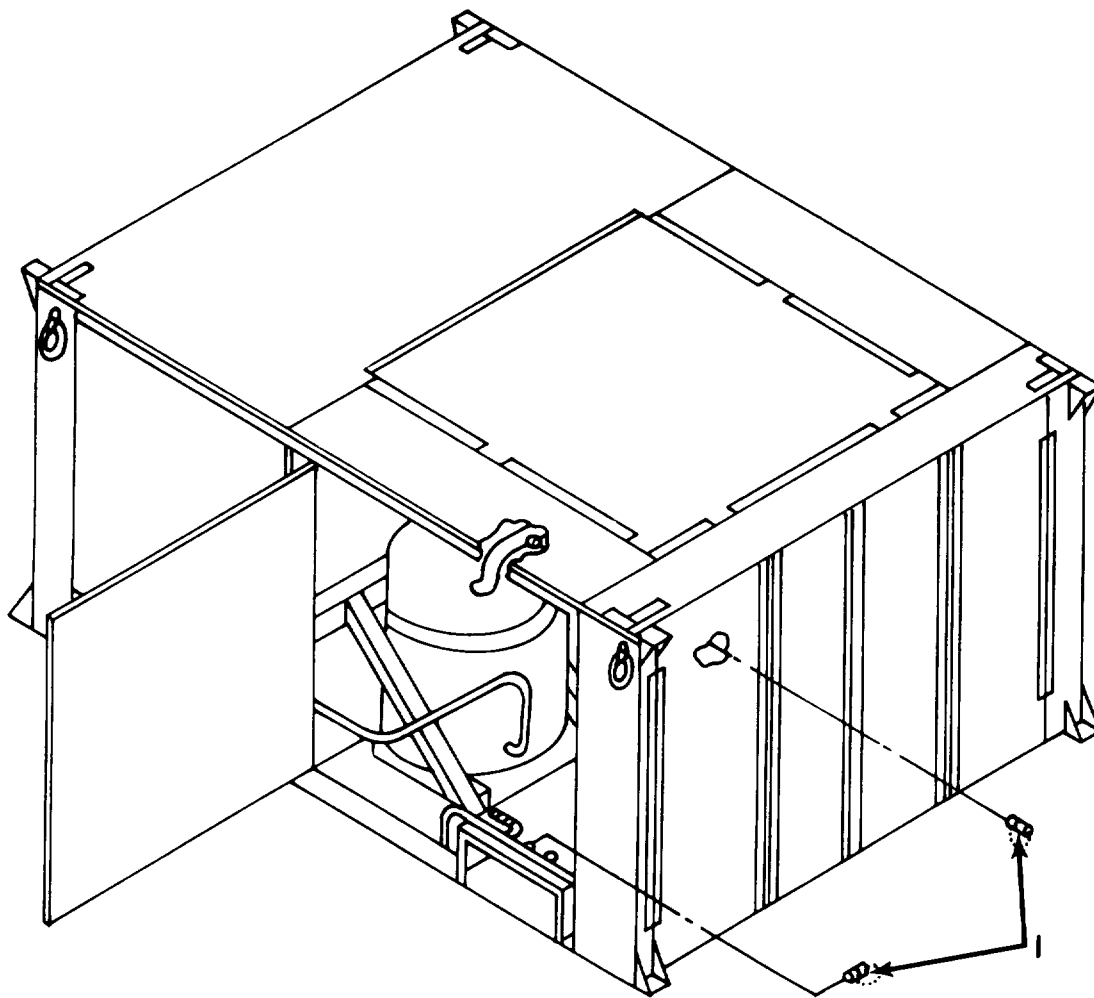
Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

a. Inspection.

- (1) Check that caps are in place and that keeper rings are not damaged. Replace if missing or damaged.
- (2) Check for signs of leakage. Leak test per paragraph 5-8, if leak is suspected.

b. Removal.

- (1) Debraze the charging valve (1).
- (2) Observe position of valve for proper installation.
- (3) Remove charging valve (1).

5-18. CHARGING VALVES (cont)**Figure 5-12. charging valves****c. Installation.**

- (1) Position valve in unit as noted during disassembly.
- (2) Replace filter drier. (See paragraph 5-21.)
- (3) Purge the system with nitrogen. (See paragraph 5-6.)
- (4) Braze the charging valve in place. (See paragraph 5-7.)
- (5) Leak test the newly connected joints and all connections in those areas. (See paragraph 5-8.)
- (6) Evacuate the system. (See paragraph 5-9.)
- (7) Charge system. (See paragraph 5-10.)
- (8) Close condenser access door.

5-19. CONDENSER COIL

This task covers a. Replacement
 b. Repair

INITIAL SETUP

Equipment Condition

Power OFF
 Condenser access door removed
 (Paragraph 4-11)
 Condenser impeller removed
 (Paragraph 4-36)
 Condenser motor removed
 (Paragraph 4-37)
 Top panel and grille removed
 (Paragraph 4-15)
 System discharged
 (Paragraph 5--5)

Materials/Parts

Air filter
 Filter-drier
 Brazing Alloy
 (Items 2 and 3 Appendix E)
 Flux, Brazing
 (Item 6 Appendix E)
 Nitrogen
 (Item 9 Appendix E)
 Rags
 (Item 12 Appendix E)
 Refrigerant -22
 (Item 8 Appendix E)

Tools

Tool kit, refrigeration SVC
 Straightener, fin
 (Item 3 Appendix B Section III)

Personnel

2 people

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

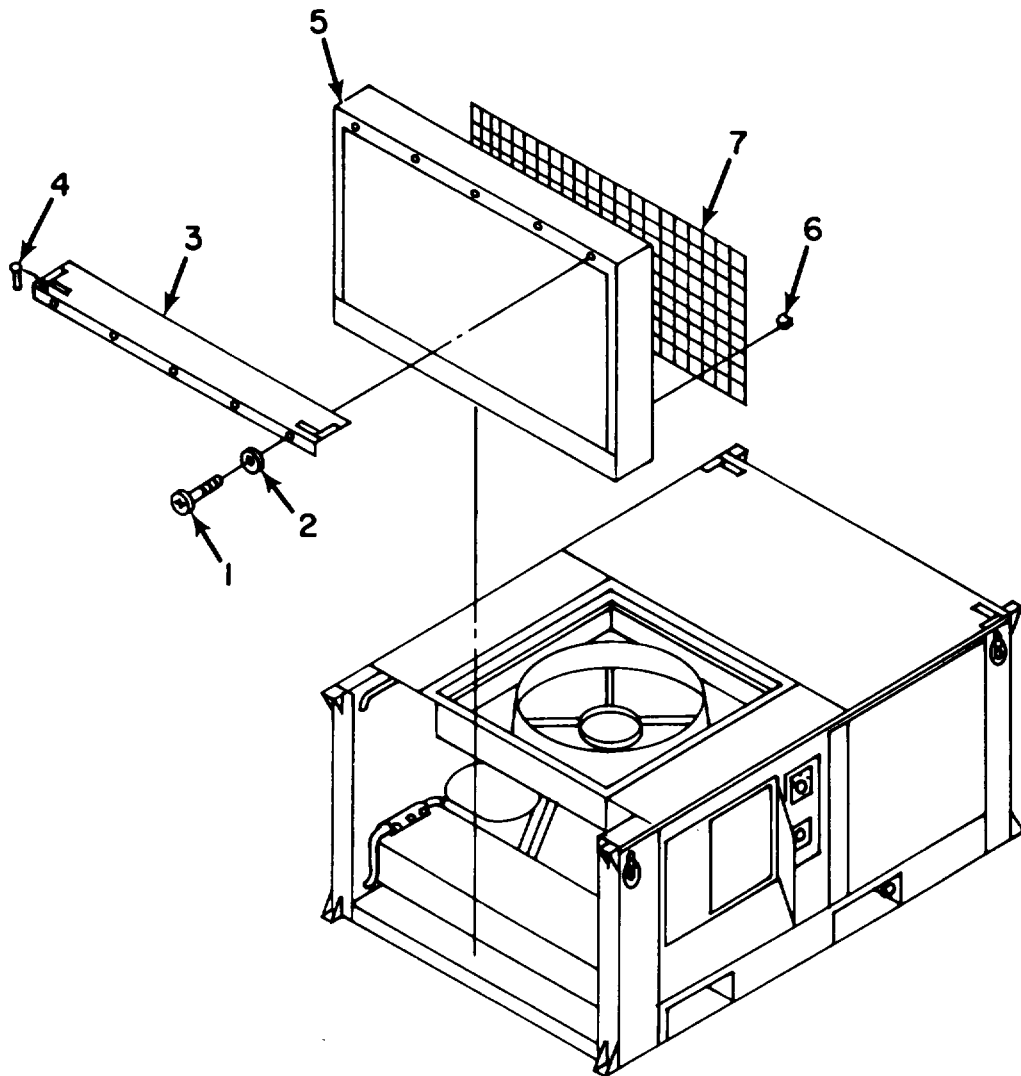
WARNING

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

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

5-19. CONDENSER COIL (ant)**a. Removal.**

- (1) Remove five screws (1) and lockwashers (2) from rear of top rear panel (3).
- (2) Remove two rear stacking bolts (4).
- (3) Remove top rear panel (3).
- (4) Debraze tubing connections.
- (5) Remove condenser coil (5) from top of unit.
- (6) Remove eight clips (6).
- (7) Remove condenser coil guard (7).

**Figure 5-13. Condenser Coil**

5-19. CONDENSER COIL (cont)

b. Repair.

(1) Repairs are limited to straightening of mashed fins.

(2) If fins are mashed or dented so that air flow across coil would be blocked, straighten them using a plastic fin straightener (Item 3 Appendix B Section III).

c. Installation.

- (1) Position condenser coil guard (7).
- (2) Install eight clips (6).
- (3) Position condenser coil (5) in unit.
- (4) Purge system. (See paragraph 5-6.)
- (5) Braze tubing connections. (See paragraph 5-7.)
- (6) Leak test system. (See paragraph 5-8.)
- (7) Evacuate system (See paragraph 5-9.)
- (8) Charge system. (See paragraph 5-10.)
- (9) Position Top rear panel (3).
- (10) Install two rear stacking bolts (4).
- (11) Install five screws (1) and lockwashers (2) into top rear panel (3).
- (12) Install condenser motor. (See paragraph 4-37.)
- (13) Install condenser impeller. (See paragraph 4-36.)
- (14) Install top panel and grille. (See paragraph 4-15.)
- (15) Install condenser access door. (See paragraph 4-14.)

5-20. SIGHT LIQUID INDICATOR

This task covers: Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Filter drier
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

a. Removal.

(1) Remove two screws (1), four washers (2), two lockwashers (3), and nuts (4) securing gasket (5) and bracket (6) to frame.

(2) Debraze the tubing. (See paragraph 5-7.)

(3) Remove liquid sight indicator (7).

5-20. SIGHT LIQUID INDICATOR (cont)**b. Installation.****NOTE**

Do not disassemble liquid sight indicator.

- (1) Position liquid sight indicator (7) on tubing.
- (2) Replace the filter-drier. (See paragraph 5-21.)
- (3) Install two screws (1), four washers (2), two lockwashers (3), and two nuts (4) to secure gasket (5) and bracket (6) to frame.
- (4) Purge the system with nitrogen. (See paragraph 5-6.)
- (5) Braze the tubing joint. (See paragraph 5-7.)
- (6) Leak test all newly connected joints and those in the repair area. (See paragraph 5-8.)
- (7) Evacuate system. (See paragraph 5-9.)
- (8) Charge the refrigerant system. (See paragraph 5-10.)
- (9) Close condenser access door.

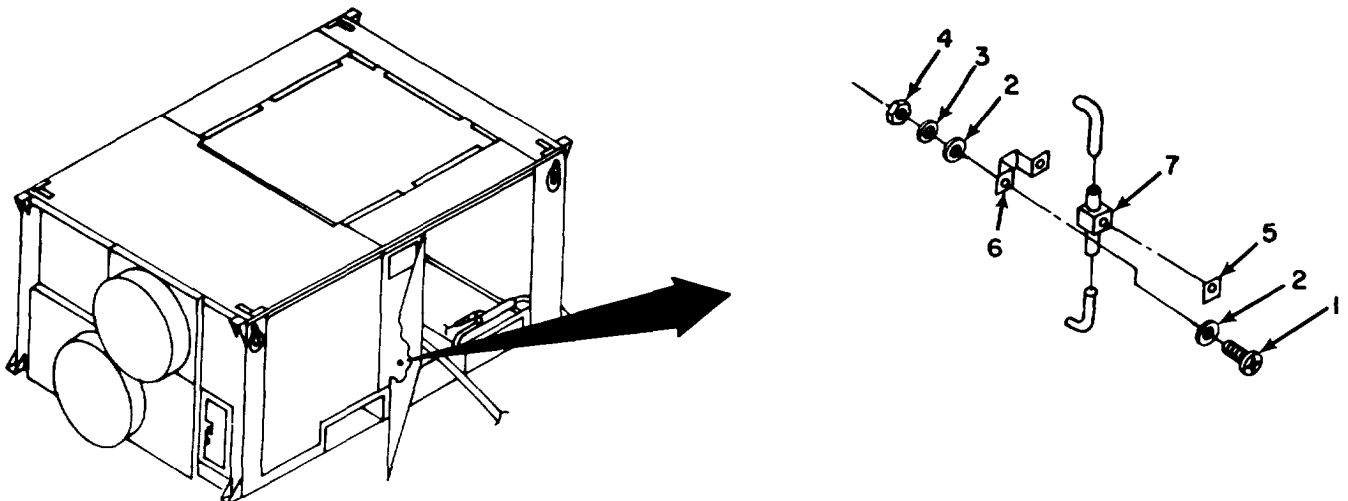


Figure 5-14. Sight Liquid Indicator

5-21. FILTER, DRIER

This task covers: a. Inspection
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

a. Inspection.

- (1) Check for general condition and signs of leakage. If leakage is suspected, leak test per paragraph 5-8.
- (2) Check that mounting is secure.

5-21. FILTER, DRIER (cont)

(3) The filter-drier unit must be replaced each time the refrigeration system has been opened. It should be installed just before unit is leak tested.

b. Removal.

- (1) Debraze connections.
- (2) Remove screw (1), lockwasher (2), washer (3), and clamp (4).
- (3) Remove filter-drier (5).

c. Installation.**CAUTION**

Replacement filter-driers are packaged with sealing caps on the flare fittings to prevent moisture contamination of the desiccant filtering media. Remove these caps immediately prior to installation. Never install a filter-drier from which caps have been removed for an extended or unknown period of time, because of possible contamination.

- (1) Place filter-drier (5) in position.
- (2) Be sure that flow arrow is pointing in the proper position.
- (3) Purge system. (See paragraph 5-6.)
- (4) Braze connections. (See paragraph 5-7.)
- (5) Install clamp (4) with screw (1), lockwasher (2), and washer (3).
- (6) Leak test all newly connected joints and those in the repaired area. (See paragraph 5-8.)
- (7) Evacuate the system. (See paragraph 5-9.)
- (8) Charge the refrigerant system. (See paragraph 5-10.)
- (9) Close condenser access door.

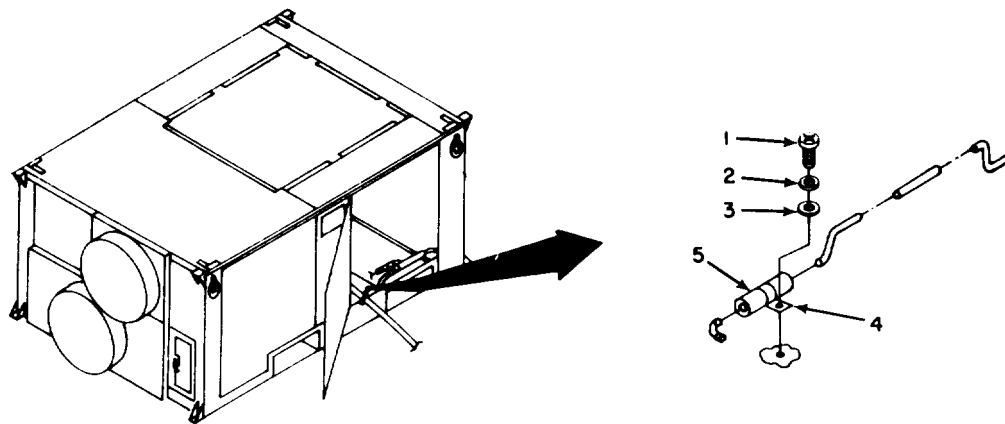


Figure 5-15. Filter, Drier

5-22. FUSIBLE PLUG

This task covers a. Inspection
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Filter, drier
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

a. Inspection.

(1) Check for rupture of the fuse surface. Replace if ruptured.

5-22 FUSIBLE PLUG (cont)

(2) Check for signs of leakage. Leak test per paragraph 5-8, if leak is suspected.

b. Removal.

(1) Discharge the refrigerant system. (See Paragraph 5-5.)

(2) While purging the system with nitrogen, debraise the fusible plug (1).

(3) Remove fusible plug (1).

c. Installation.

(1) Position fusible plug (1) in unit.

(2) Replace filter, drier. (See paragraph 5-21.)

(3) Purge the system with nitrogen. (See paragraph 5-6.)

(4) Leak test the newly connected joints. (See paragraph 5-8.)

(5) Evacuate the system. (See paragraph 5-9.)

(6) Charge the system. (See paragraph 5-10.)

(7) Close condenser access door.

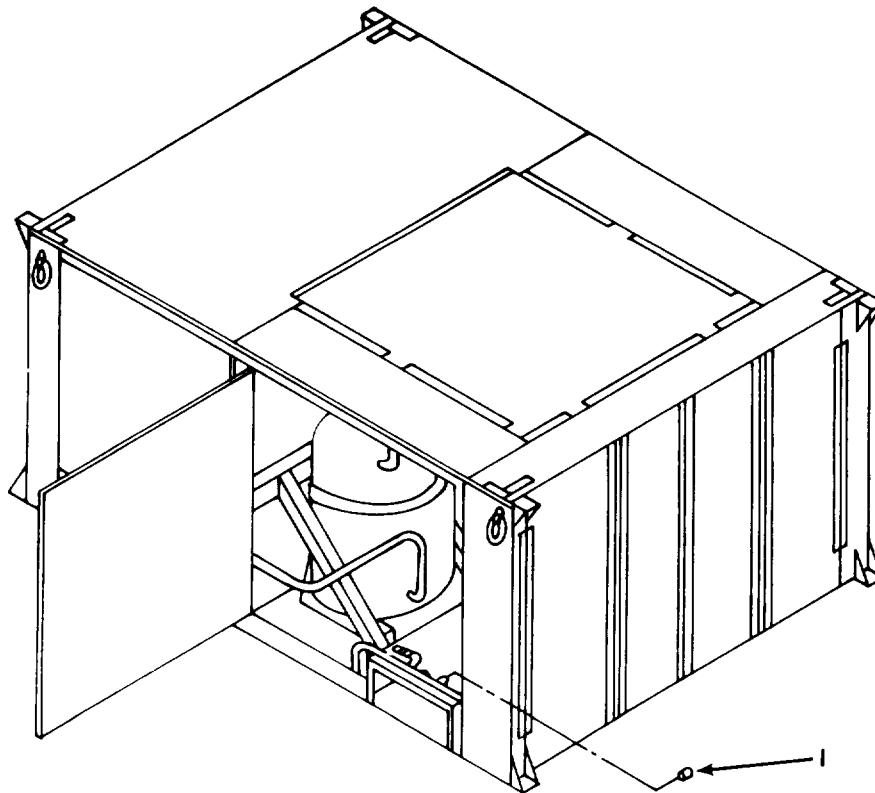


Figure 5-16. Fusible Plug

5-23. COMPRESSOR

This task covers a. Test
 b. Replacement

INITIAL SETUP

Equipment Condition

Power OFF
Condenser access door open
(Paragraph 4-14)
System discharged
(Paragraph 5-5)

Tools

Tool kit, refrigeration SVC

Materials/Parts

Rags
(Item 12 Appendix E)
Brazing Alloy
(Items 2 and 3 Appendix E)
Flux, Brazing
(Item 6 Appendix E)
Nitrogen
(Item 9 Appendix E)
Filter, drier
Refrigerant -22
(Item 8 Appendix E)

General Safety Instructions

WARNING

Voltages used can kill. Always disconnect power cord to air conditioner before performing any internal maintenance. Shutting unit off at its control panel does not disconnect unit power.

WARNING

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

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

During the following procedure, wear rubber gloves to avoid bodily contact with compressor sludge containing acid. Be especially cautious to prevent refrigerant from coming in contact with the eyes. Provide adequate ventilation to fully carry away discharged refrigerant gas.

5-23. COMPRESSOR (cont)**a. Test.**

(1) Continuity test.

(a) Remove terminal box.

(b) Tag and disconnect wires.

(c) Test for continuity. If continuity is present, replace compressor.

WARNING

During the following procedure, wear rubber gloves to avoid bodily contact with compressor sludge containing acid. Be especially cautious to prevent refrigerant from coming in contact with the eyes. Provide adequate ventilation to fully carry away discharged refrigerant gas.

(2) Burnout. Using a charge hose with an integral core depressor, allow a small amount of refrigerant gas to escape through the high side charging valve. The acrid odor of scorched insulation indicates a burnout.

b. Removal.

(1) Remove insulation (1) from tubing.

(2) Debraze connections. (See paragraph 5-7.)

(3) Remove two bolts (2), lockwashers (3), washers (4), bushings (5), and strap (6).

(4) Remove four bolts (2), lockwashers (3), bushings (5), nuts (7), and eight washers (4) from compressor base.

(5) Remove compressor (8).

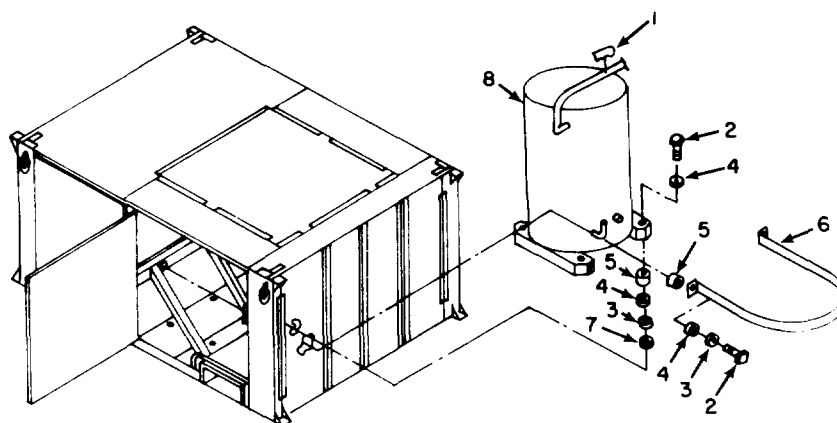


Figure 5-17. Compressor

5-23. COMPRESSOR (cont)

c. Installation.

- (1) Position compressor (8) in unit.
- (2) Install four bolts (2), lockwashers (3), bushings (5), nuts (7), and eight washers (4) to secure compressor base to unit.
- (3) Install two bolts (2), lockwashers (3), washers (4), bushings (5), and strap (6).
- (4) Replace falter, drier. (See paragraph 5-21.)
- (5) Inspect thermostatic expansion valve. (See paragraph 5-13.)
- (6) Inspect liquid quench valve. (See paragraph 5-14.)
- (7) Purge system. (See paragraph 5-6.)
- (8) Braze compressor connections. (See paragraph 5-7.)
- (9) Leak test system (See paragraph 5-8.)
- (10) Evacuate system. (See paragraph 5-9.)
- (11) Charge system. (See paragraph 5-10.)
- (12) Close condenser access door.

5-24. TUBING AND FITTINGS. The refrigeration system contains a number of pieces of copper tubing in a variety of material grades, sizes, lengths, and shapes, and a number of elbows, tees, and adapters in several sizes. Observe the following when replacing any piece of tubing or fitting in the systems:

Preliminary procedure: Remove covers and panels as necessary to have access to repair area.

a. Removal.

- (1) Discharge the refrigeration system in accordance with Paragraph 5-5.
- (2) Debraze the tube connections. (See paragraph 5-7.)
- (3) Remove the part.

b. Installation.

- (1) Replace the replacement part on the tube ends.
- (2) Replace the filter-drier. (See paragraph 5-21.)
- (3) Purge the system with nitrogen, and braze the tube joints. (See paragraph 5- 6.)
- (4) Leak test all newly connected joints and those in the repair area. (See paragraph 5-8.)
- (5) Evacuate system. (See paragraph 5-9.)
- (6) Charge system. (See paragraph 5-10.)

CHAPTER 6

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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

6-1 GENERAL. Repair parts are listed and illustrated in TM 5-4120-398-24P. No special tools are required for general support maintenance of the air conditioner. Test, Measurement, and Diagnostic Equipment (TMDE), and support equipment, include standard electrical test equipment, and standard pressure and vacuum gages, vacuum servicing manifolds found in any general support maintenance and refrigeration facility.

Section II. AUTHORIZED GENERAL SUPPORT MAINTENANCE ACTIONS

6-2. GENERAL. The only items restricted to general support maintenance level by the Maintenance Allocation Chart (MAC) are the repair of cracked or broken welds, repair or replacement of blind nuts, nut plates, and lifting handles in casing, and blind nuts and nut plates in base. However, general support maintenance maybe called upon, at times to perform any or all of the MAC items listed for unit and direct support maintenance for rehabilitation or overhaul of an air conditioner.

6-3. CASING, REPAIR

a. Blind nuts and nut plates.

(1) To replace blind nuts (rivnuts) use a drill slightly smaller than the body of the blind nut.

(a) Carefully drill the old blind nut out.

(b) Install replacement part.

(2) To replace nut plates, use a drill slightly smaller than the body of the rivets securing the nut plate.

(a) Carefully drill the rivets loose.

(b) Remove the old nut plate.

(c) Install new nut plate with properly sized rivets.

b. Insulation Casing.

(1) Inspection.

(a) Check for broken welds, badly bent or dented parts, and cracked or broken parts.

(b) Check that plate nuts and blind nuts are in place and secure.

6-3. CASING, REPAIR (cont)

(c) Check that insulation is not loose, missing, burnt, or otherwise damaged. Replace if missing or damaged. Reglue if loose.

(2) Insulation/removal.

NOTE

Prior to removal of old insulation, cut the new replacement material to size using the old item as a sample.

(a) Remove as much old insulation material as possible, by pulling or scraping it away from the metal surface.

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).

(b) Soften and remove old adhesive and insulation residue, using dry cleaning solvent (Item 15 Appendix E) and a stiff brush.

(3) Installation.

NOTE

Prior to removal of old insulation, cut the new replacement material to size using the old item as a sample.

(a) Cut to size.

(b) Be sure that the surface to which the insulation is to be applied is clean and free of paint and old adhesive material.

(c) Coat the mating surfaces of the metal and the insulation with adhesive (Item 1 Appendix E). Let both surfaces air dry until the adhesive is tacky, but will not stick to the fingers.

(d) Starting with an end, carefully attach the insulation to the metal. Press into firm contact all over.

APPENDIX A**REFERENCES****A-1. SCOPE**

This Appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS

Recommended Changes to DA Publications	DA Form 2028-2
Equipment Inspection and Maintenance Work Sheet	DA Form 2404
Quality Deficiency Report	SF 368
Report of Discrepancy	SF 364

A-3. FIELD MANUALS

Electric Motor and Generator Repair	FM20-31
First Aid and Safety	FM21-11

A-4. MANUALS

Hand Portable Fire Extinguishers Approved for Army Users	TB 5-4200-200-10
The Army Maintenance Management System (TAMMS)	DA Pam 738-750
Painting Instructions for Field Use	TM 43-0139
Unit, Direct Support and General Support	
Maintenance Repair Parts, and Special Tools List	TM5-4120-398-24P
Administrative Storage of Equipment	TM 740-90-1
Procedures for Destruction of Equipment to Prevent Enemy Use	TM 750-244-3

APPENDIX B**MAINTENANCE ALLOCATION CHART****Section I. INTRODUCTION****B-1. GENERAL**

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

b. The Maintenance Allocation Chart (MAC) in Section II designates overall 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 consistent with the capacities and capabilities of the designated maintenance categories.

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

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS

Maintenance functions will be limited to and defined as follows:

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

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i e., to clean (includes decontaminate when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

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

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

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

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place, "Replace" is authorized by the MAC and is shown as the third position code of the SMR code.

i. Repair. The application of maintenance services¹, including fault location/ troubleshooting², removal/installation, and disassembly/assembly³ procedures, and maintenance actions⁴ to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

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

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

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

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00."

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

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph B-2.)

¹Services – Inspect, test service, adjust, aline, calibrate, and/or replace.

²Fault locate/troubleshoot – the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test ((UUT).

³Disassembly/assembly – encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i e., assigned an SMR code) for the category or maintenance under consideration.

⁴Actions - welding, grinding, riveting, straightening, facing, remachinery, and/or resurfacing.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the category of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures will be shown for each level. 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 task identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

C	Operator or Crew
O	Unit Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

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

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic 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

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

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment

d. Column 4, National Stock Number. The National stock number of the tool or test equipment,

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

B-5. EXPLANATION OF COLUMNS IN SECTION IV

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
00	AIR CONDITIONER								
01	FRAME ASSEMBLY								
	Frame	Repair				120		1, 2	
	Information Plates	Inspect Replace	0.1	0.5				1, 2	
02	HOUSING COV- ERS, PANELS, GRILLES, DOORS, SCREENS								
	Covers, Doors, Panels & Screens	Inspect Service Repair Replace	0.1	0.1 0.5 0.5 0.5	0.5			1 1	
	Grilles	Inspect Repair Replace	0.1	0.5 0.3				1 1	
03	AIR CIRCU- LATING AND CONDENSATE DRAIN SYSTEM								
	Air Filter	Inspect Service Replace		0.2 0.5 0.5					
	Flexible Ducts	Inspect Replace	0.2	0.2 0.5					
	Fresh Air Damper	Inspect Repair Replace	0.5	0.8 1.0				2	
03 (cont)	Condensate Traps and Drain Hose	Inspect Service Replace	0.2 0.5	0.5					

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
04	ELECTRICAL	Inspect Replace	0.5	0.5					
				2.0					
		Test Replace		0.5					
				1.0					
		Thermostat		0.5					
				1.5					
		Circuit Breaker		0.5					
				0.5					
		Internal Control Board		0.5					
				0.5					
				2.0					
		Electrical Leads		0.5					
				0.5					
				0.5					
		Contactors and Relays		0.2					
				1.0					
				1.5					
		Cable, Power		0.5					
				0.2					
				2.0					
05	EVAPORATOR BLOWER, MOTOR AND HEATERS	Inspect Adjust Replace		0.5					
				0.4					
					1.0				

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
05 (cont)	Evaporator Blower Motor	Inspect		0.5					
		Test		0.5					
		Replace		1.0					
	Evaporator Blower and Plenum	Inspect		0.5					
		Replace		2.0					
	Belt and Pulleys	Inspect		0.5					
		Adjust		0.4					
		Replace			1.0				
	Heater Assembly	Inspect		0.3					
		Test		0.8					
		Replace		1.0					
06	Heater Elements	Test		0.3					
		Replace		1.0					
	CONDENSER FAN MOTOR AND IMPELLER								
		Inspect		0.5					
		Adjust		0.5					
	Condenser Impeller	Replace		0.8					
		Inspect		0.5					
		Test		0.5					
	Condenser Motor	Replace		1.5					
07		REFRIGERA- TION SYSTEM							
	Evaporator Coil Section								
	Evaporator Coil	Inspect		0.5					
		Service		1.0					
		Test			1.0				
		Repair			2.0				
		Replace			4.0				
Thermostatic Expansion Valve		Inspect		0.8					
	Test			0.3					
	Replace			2.0					
Liquid Quench Valve	Inspect		0.2						
	Test			0.3					
	Replace			2.0					

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
07 (cont)	Accumulator and Bracket	Inspect		0.2				3	
		Replace			2.0				
	Crankcase Heater	Test			0.5				
		Replace			1.2				
	Condenser Coil Section								
	High Pressure Cutout Switch	Inspect			0.5				
		Test			1.0				
		Replace			2.0				
	High Temperature Cutout Switch	Inspect	0.5	0.5					
		Test		0.5					
		Replace		1.0					
	Valve, Charging	Inspect			0.3				
		Replace			2.0				
	Condenser Coil	Inspect		0.5					
		Service		1.0					
		Repair			3.0				
		Replace			3.0				
	Indicator, Sight Liquid	Inspect	0.2	0.2					
		Replace			2.0				
	Filter, Drier	Inspect			0.2				
		Replace			2.0				
	Fusible Plug	Inspect			0.2				
		Replace			2.0				
	Compressor	Inspect		0.2					
		Test			1.5				
		Replace			2.5				
	Tubes, Fittings	Inspect			0.2				
		Replace			2.0				

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE STOCK NUMBER	(4) NATIONAL/NATO NUMBER	(5) TOOL
1		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 (SF5180-90-CL-N18)	5180-00-596-1474	
2		Riveter, Blind, Hand	5120-00-017-2849	
3		Straightener, Fin	5120-00-157-2180	
4	F-H	Recovery and Recycling Unit Refrigerant	4130-00-338-2707	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 AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists components of end item and basic issue items for the air conditioner to help you inventory items required for safe and efficient operation.

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

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the air conditioner in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the air conditioner during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/ requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION. The following provides an explanation of columns found in the tabular listings:

a. Column(1)- Illustration Number (illus. Number). This column indicates the number of the illustration in which the item is shown.

b. Column(2)- National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGEC (in parentheses) followed by the part number.

d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operation/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea., in, pr.).

e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipm

Section II. COMPONENTS OF END ITEMS

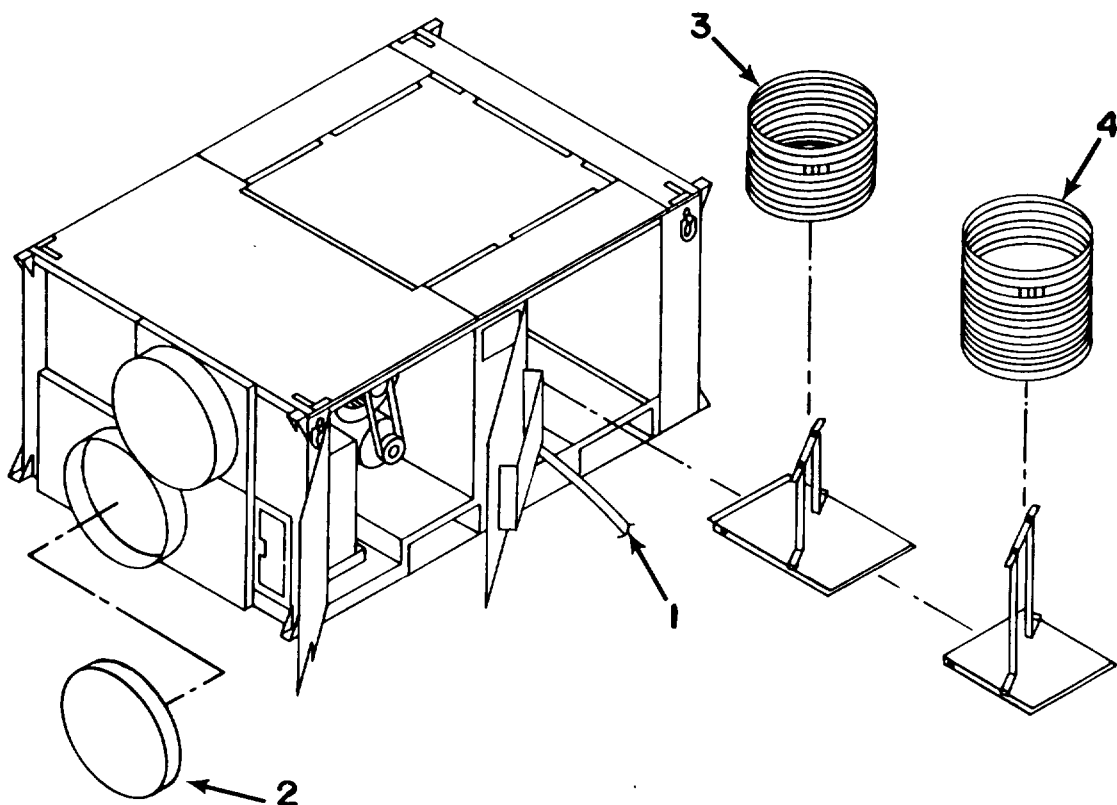


Figure C-1. Components of End Item

(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/M	(5) Qty rqr
1		CABLE, POWER (90598) 12139-100		EA	1
2		COVER, DUCT (90598) 12057-1		EA	2
3		DUCT, FLEXIBLE -7 FT (90598) 12006-100		EA	1
4		DUCT, FLEXIBLE -9 FT (90598) 1200-101		EA	1

Section III. BASIC ISSUE ITEMS

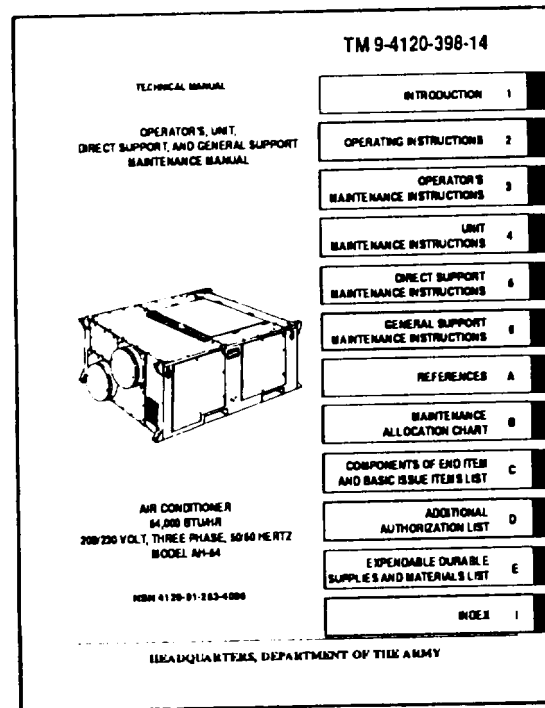


Figure C-2. Basic Issue Items

(1) Illus. Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/M	(5) Qty rqr
1		Department of Army Technical Manual Operator's Unit, Direct Support and General Support Maintenance Manual, TM 9-4120-398-14		EA	1

APPENDIX D**ADDITIONAL AUTHORIZATION LIST****section I. INTRODUCTION**

- D-1. SCOPE.** This appendix lists additional items you are authorized for the support of the air conditioner.
- D-2. GENERAL.** This list identifies items that do not have to accompany the air conditioner and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.
- D-3. EXPLANATION OF LISTING.** National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorized the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

Not Applicable

APPENDIX E**EXPENDABLE DURABLE SUPPLIES AND MATERIALS LIST****Section I. INTRODUCTION****E-1. SCOPE.**

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

E-2. EXPLANATION OF COLUMNS

a. Column (1) – Item Number, This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., Use silicone adhesive sealant Item 13, Appendix E“).

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

C - operator/crew

F - Direct Support Maintenance

O - Unit Maintenance

H – General Support Maintenance

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

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

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

Section II. EXPENDABLE DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	National Stock Number	(4) Description	(5) U/M
1	F	3040-00-664-0439	Adhesive, General Purpose 1 pint container	ea
2	F	3439-00-224-3573	Brazing Alloy, silver QQ-B-654, grade 0, I or II	to

Section II. EXPENDABLE DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
3	F	3439-00-853-9276	Brazing Alloy, silver QQ-B-654, grade III	to
4	F	5350-00-192-5047	Cloth, Abrasive	pg
5	F	8034-04-481-3825	Compound, Sealing Grade H MIL-S-22473	qt
6	F	3439-00-640-3713	Flux, brazing O-F-499, type B	qt
7	O	4130-00-860-0042	Lubricant, Air Filter Rosin Base, MIL-F-14256	qt
8	F	6850-00-837-9927	Monochlorodifluoromethane, Technical: w/cylinder 22 lb (Refrigerant-22) BB-F-1421 type 22 (81348)	cy
9	F	6830-00-292-0732	Nitrogen	cy
10	O	9150-00-181-9858	Oil, Lubricating MIL-L-2104	gl
11	F	9150-00-058-2301	Oil, Vacuum pump, Duo-seal	qt
12	F	7920-00-205-1711	Rags	ea
13	O	8040-00-142-9823	Sealant, Silicone Adhesive RTV General Purpose MIL-A-46106, Type I	qt
14	O	3422-00-269-6110	Solder, Lead-Tin, QQ-S-571 Type SN60WRP2	lb
15	O, F	6850-00-274-5421	Solvent, Dry Cleaning P-D-680 (81348)	gl
16	O	5640-00-103-2254	Tape PPP-T-60, type IV, Class I	roll

Section II. EXPENDABLE DURABLE SUPPLIES AND MATERIALS LIST (cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
17	F	8030-00-889-3534	Tape, Antisieze Polytetrafluoroethylene MIL-T-27730, size I	roll
18	F	6830-00-872-5120	Trichloromonofluoromethane Technical: w/cylinder 50 lb (Refrigerant-11) BB-F-1421 type 11 (81348)	cy

GLOSSARY

COMPRESSOR	Compresses low pressure refrigerant vapor from the evaporator into high pressure, high temperature vapor.
CONDENSER	Cools the hot, high pressure refrigerant gas causing it to condense into high pressure liquid refrigerant.
CRANKCASE HEATER	Prevents migration of liquid refrigerant into the compressor in cold weather.
EVAPORATOR	Cools and dehumidifies air before it enters the room
FILTER DRYER	Removes any traces of moisture from the refrigerant system.
HIGH PRESSURE CUTOUT	Interrupts power to the compressor when the refrigerant system pressure becomes too high.
LIQUID QUENCH VALVE	Meters liquid refrigerant into the evaporator coil distributor.
SERVICE VALVES	Valves for suction and discharge when air conditioner refrigerant is being tested and serviced.
SIGHT LIQUID INDICATOR	A diagnostic tool to observe refrigerant flow and refrigerant level.

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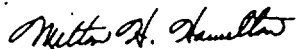
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PUBLICATION TITLE

AIR CONDITIONER

BE EXACT PIN-POINT WHERE IT IS

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NOTABLE
NO

6

2-1
aIN THIS SPACE TELL WHAT IS WRONG
AND WHAT SHOULD BE DONE ABOUT IT:

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

B1

4-3

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

125

line 20

I ordered a gasket, item
19 on figure B-16 by NSN
2 910-00-762-3001. I got a
gasket but it doesn't fit.
Supply says I got what
I ordered, so the NSN is
wrong. Please give me a
good NSN

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COMMANDER
U.S. ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MMTS
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

TEAR ALONG PERFORATED LINE

The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile -

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

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