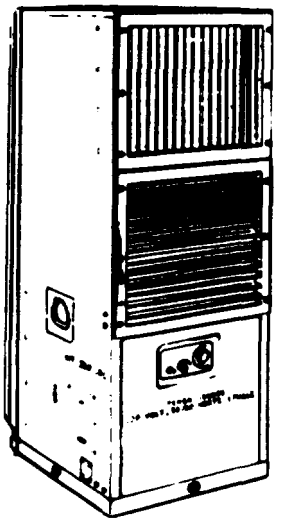
TECHNICAL MANUAL

OPERATOR UNIT, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE
MANUAL

FOR

AIR CONDITIONER, VERTICAL COMPACT TYPE I, VERTICAL, SIZE C, 18,000 BTU/HR, CLASS 1,208 VOLT, 3 PHASE, 50/60 HERTZ KECO MODEL F18T-2 NSN 4120-00-168-1781



* This manual supersedes TM 5-4120-360-14, dated 21 December 1979

HEADQUARTERS, DEPARTMENT OF THE ARMY
15 SEPTEMBER 1993

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 electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

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

Be careful not to contact high-voltage connections of 208 volt ac input connections when installing or operating this equipment. Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body. Do not operate the equipment without louvers, top covers, and guards in place and tightly secured. Warning: *Do not be misled by the term "Low voltage". Potentials as low as 50 volts may cause death under adverse conditions.*

WARNING

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.

WARNING

The burning of polyurethane foams is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation near by. you should take care to ventilate the area thoroughly. An exhaust system like that of a paint spray booth should be used. Air-supplied respirators, approved by the National Institute for Occupational Safety and Health or the US Bureau of Mines, should be used for all welding in confined spaces and in places where ventilation is inadequate. Persons who have chronic or recurrent respiratory conditions, including allergies and asthma, should not work in these areas.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed. Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C). Wear eye protection when blowing solvent from parts. Air pressure should not exceed 30 psig (2.1 kg/cm^2).

TECHNICAL MANAL

TM 9-4120-360-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 15 September 1993

Operator, Unit, Direct Support and General Support Maintenance Manual for Air Conditioner, Vertical Compact Type I, Vertical, Size C, 18,000 BTU/HR, Class 1, 208 Volt, 3 Phase, 50/60 Hertz KECO Model F18T-2 NSN 4120-00-168-1781

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual.if you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 20:28 (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 Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

Section L GENERAL INFORMATION

1.1. Scope

a. This manual contains information on the operation. servicing and maintenance of the compact vertical air conditioner, Model F18T-2, manufactured by Keco Industries, Inc.. Cincinnati, Ohio.

b. The purpose of the air conditioner is to circulate, cool or heat filtered air in a room or other enclosure in which it is installed (see figure 1-1). The unit provides 18,000 Btu/hr. of cooling or 12.000 Btu/hr. of heating capacity. A two-speed fan can be set for either low-or high-speed operation, using a manually operated switch on the control panel; however, an automatic, pressure-operated switch may override the manual switch when it is set for low speed. This feature provides automatic control of head pressure, and increases cooling efficiency.

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. Reporting Equipment Improvement Recommendation (EIR'S)

ElR's can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just simply tell why the design is unfavorable or why a procedure is difficult. ElR's may be submitted on Standard Form (SF) 368. Mail directly to AMSAT-I-MDO, US Army Aviation and Troop Command. 4300 Good fellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished to you.

Section II. EQUIPMENT DESCRIPTION

1.4. Capabilities and Features

a. Major Components:

(1) Compressor

(2) Evaporator Coil

(3) Condenser Coil

(4) Evaporator/Condenser Fans

(5) Solenoid Values

(6) Expansion Valves

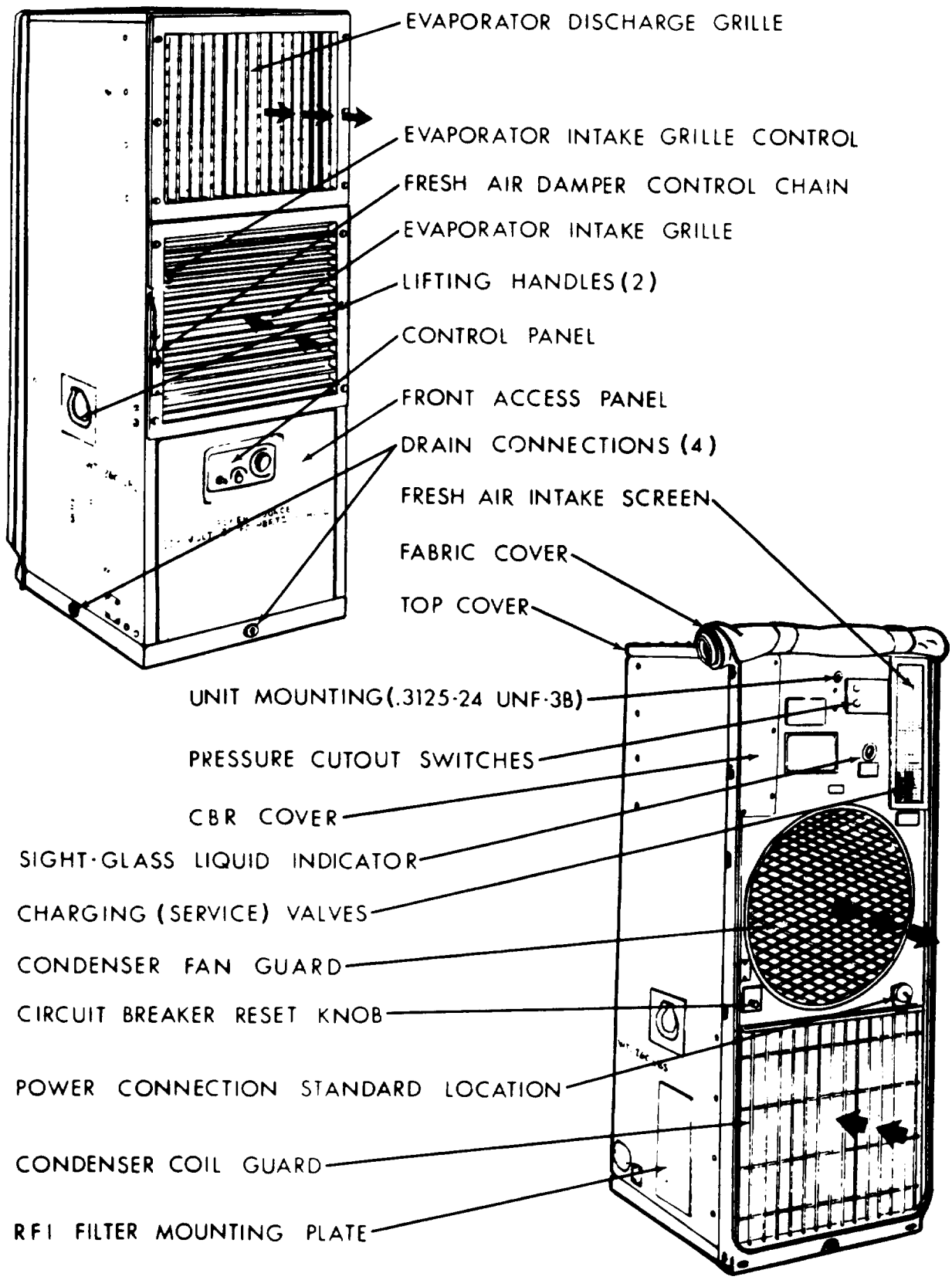


Figure 1-1. Air Conditioner

(7) Pressure Cutout Switches

(8) Sight-glass Liquid Indicator

(9) Circuit Breaker

b. Special Features

Remote Control Capability

1.5. Location and Description of Major Components (see figure 1-2)

Compressor (1). It consists of a reciprocating compressor driven by an electric motor, hermetically sealed into a steel container with a lifetime charge of oil. A crankcase heater surrounds the lower part of the container. The heater is thermostatically controlled to prevent migration of liquid refrigerant into the crankcase where it would become mixed with the oil.

Evaporator Coil (2). Is made up of interconnected parallel copper tubes retained in a series of multiple, closely spaced aluminum fins. Each end of the coil is enclosed and supported by a steed plate, which provides the means for mounting the coil in the air conditioner. and for supporting the mist eliminator.

Condenser Coil (3). Similar in construction to the freed, multiple-tube evaporator coil.

Evaporator Condenser Fans (4). The evaporator fan impeller is centrifugal, and the condenser fan impeller is of the axial type.

Solenoid Values. There are two solenoid valves. The liquid line solenoid valve, which closes the line to the evaporator coil when energized, is located in the lower chamber of the air conditioner, to the right of and behind the compressor. The pressure equalizer solenoid valve is located at the top rear portion of the air conditioner.

Expansion Values. The valve controlling refrigerant flow to the evaporator coil, is located behind the evaporator coil, and can be identified by the three distribution lines that connect it to the coil. The quench line expansion valve is located near the back wall in the upper part of the air conditioner.

Pressure Cutout Switches (5). They are both manually reset limit switches, and are connected through capillary tubes to the discharge and suction lines of the refrigeration system. If refrigerant pressure falls below the minimum set for the low-pressure cutout switch, or the pressure exceeds the maximum set for the high-pressure switch. the electrical connection through the compressor relay is opened to stop the compressor.

Control Panel (6). Contains the following electrical controls; fan speed switch, thermostat and mode selector switch.

Fresh Air Damper Control (7). Is a bead chain that connects to a spring loaded door that controls fresh air intake, Lift chain and pull to close fresh air door.

Sight-glass Liquid Indicator (8). The condition of liquid refrigerant flowing through the system can he observed through this window when the compressor is operating in the cooling mode. A small data plate below the sigh–glass displays three colors for comparison with that of the refrigerant; green. chartreuse and yellow. Green indicates that the refrigerant contains no moisture. Chartreuse and yellow indicate the presence of moisture, and the need to replace the filter-drier and refrigerant. A milky or bubbly appearance of the refrigerant indicates that the system contains insufficient refrigerant, and that more must be added.

Circuit Breaker Reset Knob (9). The circuit breaker controls power to the air conditioner. A push-pull flexible cable connects the circuit breaker to the control knob.

1.6. Performance Data

OPERATING TEMPERATURES	
LOW	-50°F (-45°C)
HIGH	+120°F(+49°C)
PERFORMANCE	
COOLING CAPACITY	18,000 Btu/hr
HEATING CAPACITY	12,000 Btu/hr
POWER REQUIRED	
VOLTAGE	208
PHASE	3
HERTZ	50/60
DIMENSIONS	
WIDTH	17.25 in. (43.8 cm)
DEPTH	20.00 in. (50.8 cm)
HEIGHT	46.5 in. (118 cm)
WEIGHT	260 pounds (118 kg)
REFRIGERANT	
TYPE	R22
CHARGE	4.0 + 0.2-0. pound (1.8 + 0.1-0.0 kg)

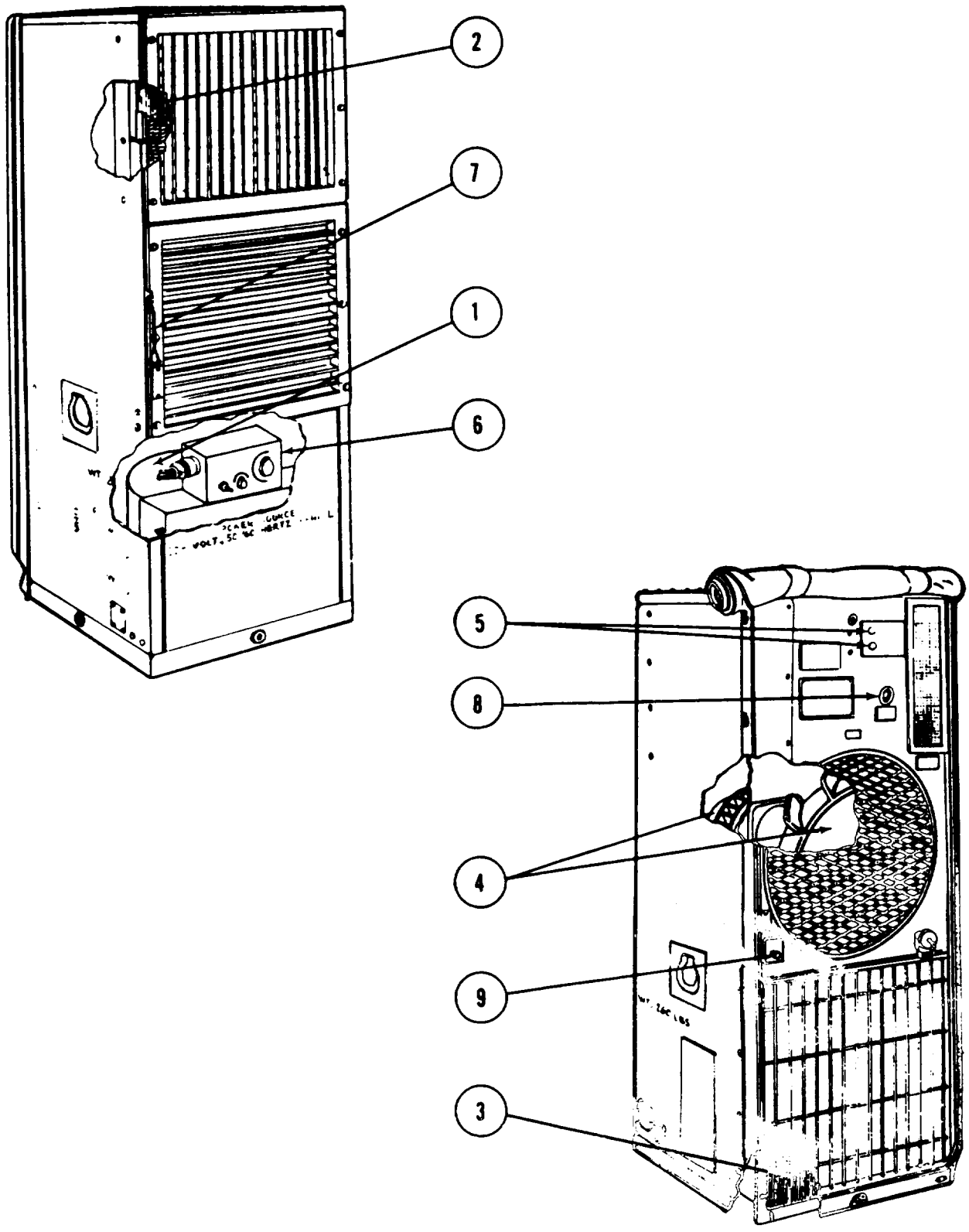


Figure 1-2. Location of Major Components

CHAPTER 2

OPERATING INSTRUCTIONS

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

2.1. Operator's Controls and Technical Principles of Operation

CAUTION

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

CAUTION

The compressor crankcase heater must be energized at least 4 hours before the compressor is allowed to start. Liquid refrigerant and oil migration to the compressor crankcase can cause severe damage to compressor instantly on startup in this condition. This condition and damage can be prevented by applying power to unit at least 4 hours prior to startup of compressor. The crankcase beater will vaporize liquid refrigerant in compressor crankcase where energized and allowed enough time to heat compressor to cut out temperature of crankcase heater thermostat. Unit may be operated in ventilation mode during time of crankcase beating which will prove power is applied to unit. When this unit is used with an enclosure that has a main circuit breaker and an air condition circuit breaker and is connected to a continuous power source, the two circuit breakers should be left in on position so compressor will stay at operation temperature and ready for instant use without danger of severe damage at startup.

a. Control Panel The control panel is the small rectangular panel located in the upper middle part of the lower panel. It contains the following operating controls. (See figure 2-1).

(1) Mode Selector Switch. The mode selector switch is a rotary, five-position switch on the right hand side of the control panel. The positions are marked OFF, VENTILATE, COOL, LO HEAT and HI HEAT.

(a) Ventilating Mode. When the mode selector switch is set at VENTILATE, only the two-speed fan will operate. Volume of airflow can be varied to either HI SPEED or LO SPEED by setting the two-speed fan switch on the control panel to the desired position. Outside air can be admitted through the fresh sir damper, controlled by a pull-chain located about halfway up the left side of the sir conditioner.

NOTE

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

(b) Cooling Mode. When the selector switch is set at COOL, power is connected to the two-speed fan, the compressor, and the various controls and relays needed to operate and control the refrigeration system. When the temprahue control thermostat is turned to a setting below the ambient temperature in the room, the typical cooling cycle begins to operate in the following manner. (See refrigeration diagram, figure 2-2).

1 Cooling Cycle. Cooling takes place when the liquid refrigerant changes to vapor in the evaporator coil (12). This change from liquid to vapor absorbs heat from the air passing over the outside surfaces of the evaporator coil. thereby cooling the air. The vaporized refrigerant is piped from the evaporator coil (12) to the compressor (1) where it is increased in density and temperature. The compressed vapor is then piped to the condenser coil (2A) where air passing over the outside surfaces of the coil extracts the heat of evaporation and compression from the vapor, thereby recondensing it to a liquid. The liquid refrigerant flows through a filter-drier (7) and the sight-glass liquid indicator (9) as it goes to the expansion valve (10) which meters the refrigerant into the evaporator coil to repeat the cycle. A pressure regulating valve (15) prevents the development of too low a pressure in the compressor suction line, by opening at a preset pressure to adjust compressed vapor into the suction line. Pressure switch (17) closes at a preset pressure to override the manual two-speed fan switch if set at LO SPEED.

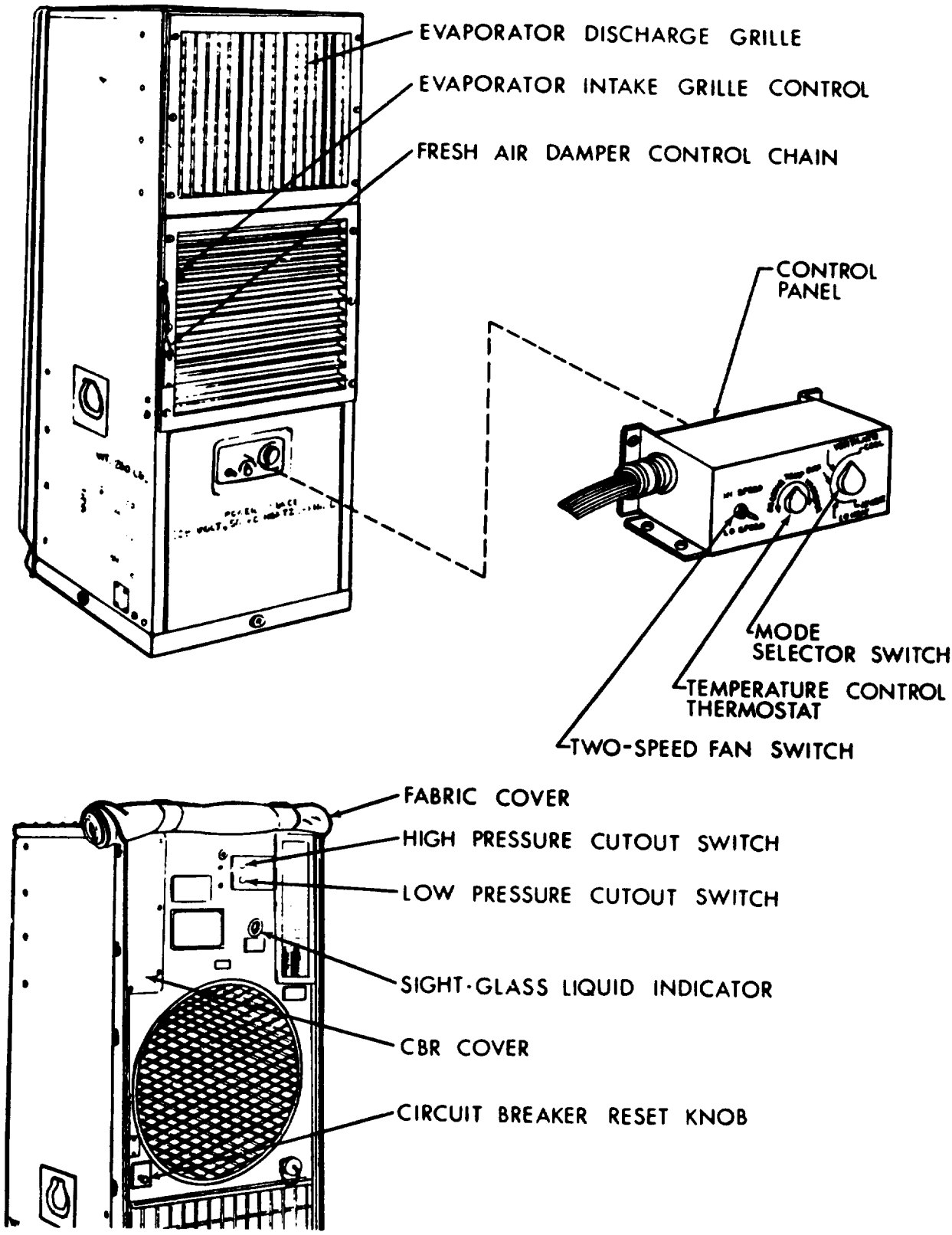


Figure 2-1. Operator's Controls

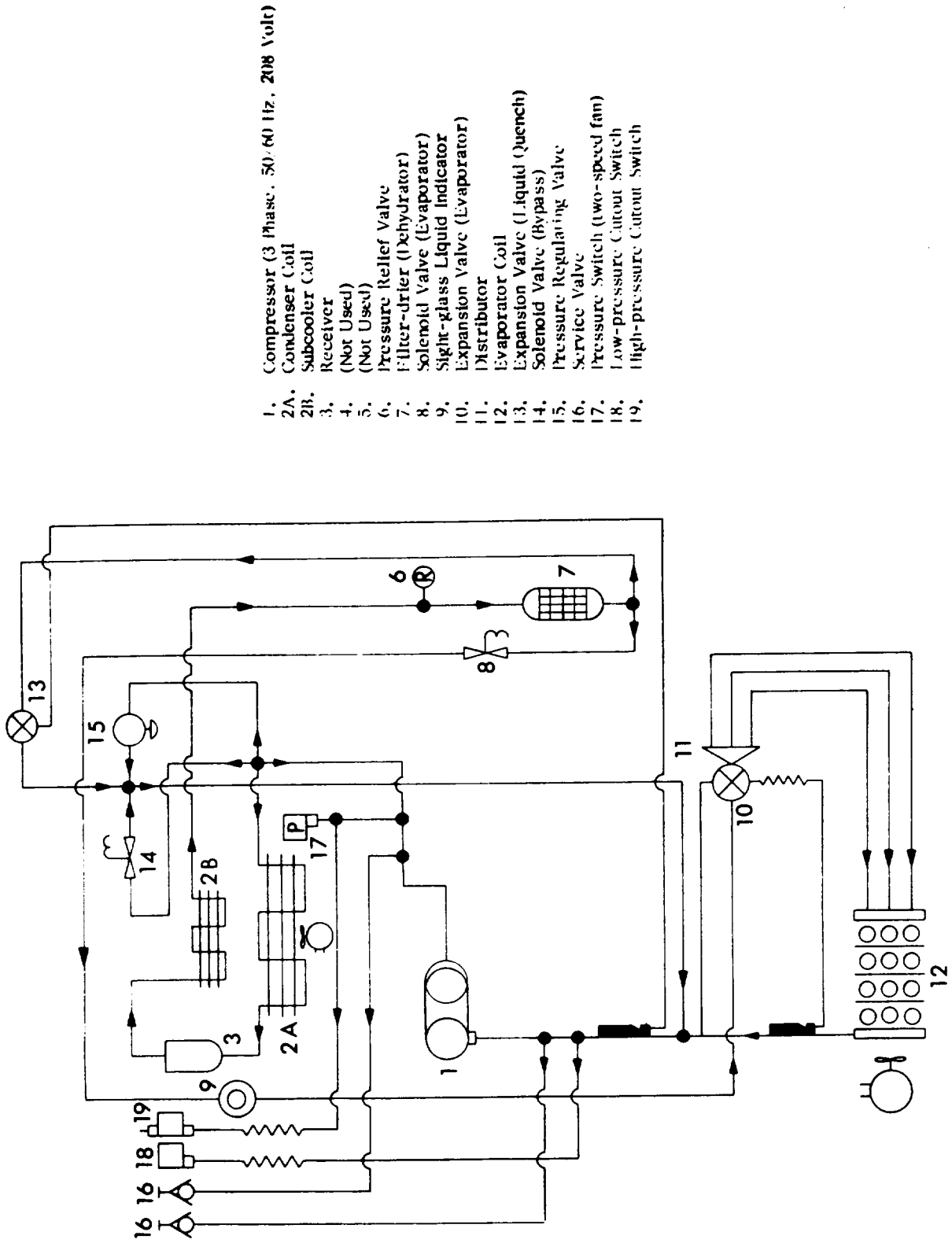


Figure 2-2. Refrigeration Diagram

2 Bypass Cycle. The compressor (1) operates continuously when the selector switch is set at COOL. When actual cooling is not required the system goes into bypass operation to prevent build-up of excessive pressures. Bypass operation is initiated when the temperature control thermostat causes the liquid line solenoid valve (8) to shut off refrigerant flow to the evaporator coil (12), and as the suction pressure drops, hot gas bypasses thru the pressure regulating valve (15). In the bypass configuration. vapor is piped from the discharge side of the compressor to the suction side. To prevent the development of excessive heat by constant recompression, a second expansion valve is used in the system. This expansion valve (13) injects liquid refrigerant into the suction side of the bypass circuit to reduce, or quench the heat.

.(c) Heating Mode. When the selector switch is set at HI HEAT, six heating elements, located behind he evaporator coil, are energized. These elements are protected from overheating by a thermal cutout witch, Three of the elements are controlled by the temperature control thermostat, while the remaining three are on at all times. The ventilating fan also operates at all times. When the selector switch is set at LO HEAT, only the three thermostatically controlled elements are energized.

(2) Temperature Control Thermostat. The temperature control thermostat is a rotary, continuously variable control located in the middle of the control panel. It is marked DECREASE TEMP INCREASE above a semi-circular double-ended pointer. The thermostat controls the degree of heating and cooling and should be set at a point at which alI inhabitants of the area agree, or the ranking person decides, is comfortable.

(3) Two-speed Fan Switch. The two-speed fan switch is located at the left-hand end of the contro lpanel. It is a two-position toggle switch, marked HI SPEED and LO SPEED. When set at LO SPEED the evaporator/condenser fan motor operates at 1725 rpm. At HI SPEED, the fan speed is increased to 3450 rpm. The switch may be set at either position, as desired, for any mode of operation; however, if it is set at LO SPEED when the air conditioner is operating in the COOL mode, an automatic pressure switch may over-ride the manual switch to operate the fans at the higher speed.

b, Airflow Controls. Airflow is controlled by the proper adjustment of louver blades in the evaporator intake and discharge grilles, the fresh air damper, and when installed, the chemical-biological-radiological (CBR) filtering system.

(1) Evaporator Intake Grille. When the air conditioner is operating in any mode, and is recirculating room air exclusively, the evaporator intake louvers should be in their fully open position. When either the fresh air damper is open or the CBR filter is attached, the evaporator intake grille should be partially closed to compensate for the outside air being introduced. (see figure 2-l).

(2) Evaporator Discharge Grille. The evaporator discharge grille, located at the top part of the air conditioner, should always be open. The louvers are provided to control the direction of airflow, and should never be closed to the extent that they would obstruct free passage of air. Two sets of louvers are incorporated in the grille: vertical and horizontal. The vertical louvers should be individually adjusted to direct the conditioned air to one or both sides, as desired. The inner horizontal louvers should be adjusted to direct the conditioned air upward or downward. (See figure 2-l).

NOTE

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

(3) Fresh Air Damper. Fresh air is introduced through the rectangular screened oprning in the upper right-hand corner of the rear surface of the air conditioner. A damper inside the screened opening controls the volume of air admitted. The variable opening of the damper located to the left of the evaporator intake grille is controlled by means of a ball chain and detent slot to retain its position. The evaporator intake grille should be closed about halfway to promote the introduction of fresh air. (See figure 2-l).

NOTE

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

c. Resetting Automatic Controls. Three automatic controls can stop the air conditioner, and can be manually reset. They are the following:

(1) Circuit Breaker. The circuit breaker is designed to trip whenever an electrical overload or short circuit exists in the compressor circuit. The circuit breaker itself is located in the junction box, but it is reset by means of a push–pull flexible cable. (See figure 2-1). When it is suspected that the circuit breaker has tripped, pull then push the operating knob to re-establish current to the air conditioner. If the circuit breaker cannot be reset, or if it trips as soon as it is reset, report the trouble to Unit maintenance.

(2) High-pressure Cutout Switch. The high-pressure cutout switch is mounted in the upper section of the rear surface of the air conditioner. A manual reset button and instruction plate provide for resetting the switch after it has tripped, Press and release the button to reset the switch. If ineffective, report the trouble to Unit maintenance. (See figure 2-l).

(3) low-presswe Cutout Switch. The low-pressure cutout switch is located next to the high-pressure cutout switch, but trips when refrigerant pressure drops below a preset minimum. Press and release the button to reset the switch. If ineffective, report the trouble to Unit maintenance. (See figure 2- 1).

2.2. Indicators

Only one indicator is incorporated in the air conditioner: the sight-glass liquid indicator. This circular window into the refrigerant liquid line shows the condition of the refrigerant. and should be inspected periodically, as directed in Section II. A color comparison plate is mounted below the sight glass on the upper part of the rear casing. It shows green, chartreuse and yellow bands to aid in evaluating the dryness of the refrigerant. If chartreuse or yellow colors are indicated, the refrigerant contains moisture. If the sight glass shows a milky or bubbly appearance, the refrigerant volume is low. Both conditions should be reported to Unit maintenance. (See figure 2-l).

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

2.3. General

Preventive maintenance checks and services are required to keep the air conditioner operating efficiently and to prevent damage caused by neglect. Table 2-1 contains the listing of periodic checks and services required.

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

b. *While You Operate.* Always keep in mind the CAUTIONS and WARNINGS. Perform your during PMCS.

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

d. *If Your Equipment Fails To Operate.* Troubleshoot with proper equipment. Report any deficiencies using the proper DA Form 2404 or refer to DA PAM 738-750.

Table 2-1. **Operator Preventive Maintenance Checks and Services**

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Fully Mission Capable If:
1	Before	Louvers and Grilles (see figure 2-1).	Check all louvers and grilles for unobstructed openings or damage.	Grilles are damaged.
2	During	Sight-glass liquid indicator (see figure 2-1).	Check sight-glass for damage, bubbles, milkiness, or yellow color.	Sight-glass broken or indicates low refrigerant level or moisture.
3	Weekly	Air Filters	Check for obstruction, dirt or damage.	

Table 2-1. Operator Preventive Maintenance Checks and Services

Item No.	Interval	Item To Be Checked Or Serviced	Procedure	Not Fully Mission Capable If:
4	Weekly	Operating controls (see figure 2-1).	Check control knobs for security and damage.	Control knobs missing or damaged.
5	Weekly	Fresh air damper (see figure 2-1).	Check for freedom of operation.	
6	Monthly	Fabric cover (see figure 2-1).	Check cover for tears, punctures and damaged fasteners.	

Section III. OPERATION UNDER USUAL CONDITIONS

2.4. Operating Check

CAUTION

Do not perform the following operating checks until at least four hours after power has been connected to the air conditioner if it has been stored at below-freezing temperatures within the past 24 hours. If knocking or pounding noises are heard when the compressor is started, shut down at once. Leave power connected to the unit, and wait an additional two hours before attempting another start.

Check operation of the air conditioner in each operating mode as directed in the following steps:

a. Unzip and roll up the fabric cover on the rear of the unit. Secure with two straps, and fasten with two turnbutton - fasteners.

b. Using the operating lever, open the louvers of the evaporator air intake grille to their fully open positions. Open both the vertical and the horizontal louvers in the evaporator air discharge grille to their open position.

c. Position the two-speed fan switch on the control panel at LO SPEED, and turn the mode selector switch to VENTILATE. Check airflow with smoke or a paper streamer at both evaporator discharge and condenser discharge grilles.

d. Position the two-speed fan switch at HI SPEED. and observe increased airflow.

e. Turn mode selector switch to LO HEAT and turn temperature control thermostat to its full INCREASE position. Feel evaporator discharge air with the hand to check for warmth. Turn mode selector switch to HI HEAT, and note increase in warmth of airflow.

f. Turn selector switch to VENTILATE for one minute, then turn it to COOL. Turn the temperature control thermostat to its full DECREASE position. Note that cool air is discharged from evaporator discharge grille.

g. Turn mode selector switch to OFF and observe that all functions cease.

2.5. Operating Procedure

a. *General. AU* modes of operation are controlled from the control panel in the upper middle part of the lower panel. Delivery airflow is controlled by the setting of louver blades in the evaporator discharge grille, and does not require - changing except for minor adjustment to accommodate seasonal change or a desired change in the pattern of coverage.

b. Starting, Normally, the air conditioner will start whenever the mode selector switch is turned to any of the four operating positions: VENTILATE, COOL. LO HEAT or HI HEAT. provided that it is connected to the proper power supply (208-volt, 3-phase, 50/60 Hertz. ac). If the air conditioner fails to start. reset the circuit breaker by means of the pull-push - knob on the back of the unit. If the air conditioner still fails to start, and you have determined that the proper electrical power is connected to the unit, report the trouble to Unit maintenance.

c. *Stopping. You can* stop the air conditioner from any mode of operation by turning the mode selector switch to OFF. Do not disconnect power supply.

d. *Modes of Operation.* Refer to Table 2-2 for the control settings required to obtain the desired mode of operation.

CAUTION

The fabric cover must be rolled up and secured while the air conditioner is operating in any mode.

2.6. Preparation for Movement

No exceptional preparation is required when the air conditioner is to be routinely moved to a new location. Simply close the evaporator intake and discharge louvers. and close the fabric cover with the slide fastener.

2.7. Decals and Instruction Plates

The air conditioner incorporates the following decals and instruction plates: (See figure 2-3.)

a. Military Identification Plate. This plate. mounted just to the left of the sight-glass liquid indicator. displays the description, NSN, Part No. and name of the manufacturer of the equipment.

b. Refrigerant Type and Charge Plate. This plate contains the type and charge (by weight) of the refrigerant. It is located above the military identification plate. It contains the following message: THIS UNIT CHARGED WITH 4 LB OF REFRIGERANT 22. CAUTION: TO PREVENT COMPRESSOR DAMAGE DO NOT ADD LIQUID REFRIGERANT THRU THE SUCTION SERVICE VALVE.

c. Pressure Cutout Switch Plate. This plate identifes the high- and low-pressure cutout switch reset buttons. and states, PUSH TO RESET. It is located above the sight-glass liquid indicator.

d. Sight-glass Color Change Plate. This plate is located immediately below the sight-glass liquid indicator. It displays three colors for comparison to the color of the liquid refrigerant. green (dry). chartreuse (caution) and yellow (wet).

e. Fan Rotation Plate. This plate, located at the 12:00 o'clock position above the condenser vanguard, displays an arrow indicating the proper fan direction.

f. Circuit/Breaker Reset Plate. This plate. located above the circuit breaker reset knob, contains the instructions PULL AND PUSH TO RESET CB.

g. Gauge Access Plate. This plate, located below the fresh air screen states, REMOVE SCREEN TO INSTALL SERVICE GAGES.

h. Damper Control Plate. Mounted on the left side of the evaporator intake grille, this plate states: FRESH AIR DAMPER CHAIN PULL TO CLOSE.

i. *Control Panel Plate. This* plate is the face plate of the control panel. It contains the two-speed fan switch (HI SPEED, LO SPEED), the temperature control thermostat (DECREASE TEMP INCREASE) and the mode selector switch (COOL, VENTILATE, OFF, LO HEAT, HI HEAT).

j. Refrigeration Diagram. This plate. located on the junction box cover, contains a schematic diagram of the refrigeration system.

k. Access Plate. Located at the front of the lower right side, this plate contains the words: CIRCUIT BREAKER MOVE HANDLE UP TO RESET.

/. Wring Diagram P/ate. This plate is located on the inside surface of the lower panel.

Table 2-2. Operating Settings

MODE	Selector Switch	Thermostat	Outdoor Air Damper	Evaporator Intake Grille	Fabric Cover
Cooling- 100% Recirculated Air	COOL	Desired Temperature	Closed	Open	Open
Cooling- with fresh makeup air	COOL	Desired Temperature	Partially or fully open	Partially or fully closed*	Open
Cooling- with fresh makeup air through CBR filter	COOL	Desired Temperature	Closed	Partially or fully open*	Open
Heating- 100% Recirculated Air	LO HEAT or HI HEAT	Desired Temperature	Closed	Open	Open
Heating- with fresh makeup air	LO HEAT or HI HEAT	Desired Temperature	Partially or fully open	Partially or fully closed*	Open
Heating- with fresh makeup air through CBR filter	LO HEAT or HI HEAT	Desired Temperature	Closed	Partially or fully open*	Open
Ventilation- Maximum outdoor air	VENTILATE	Any Setting	Open	Closed	Optional

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

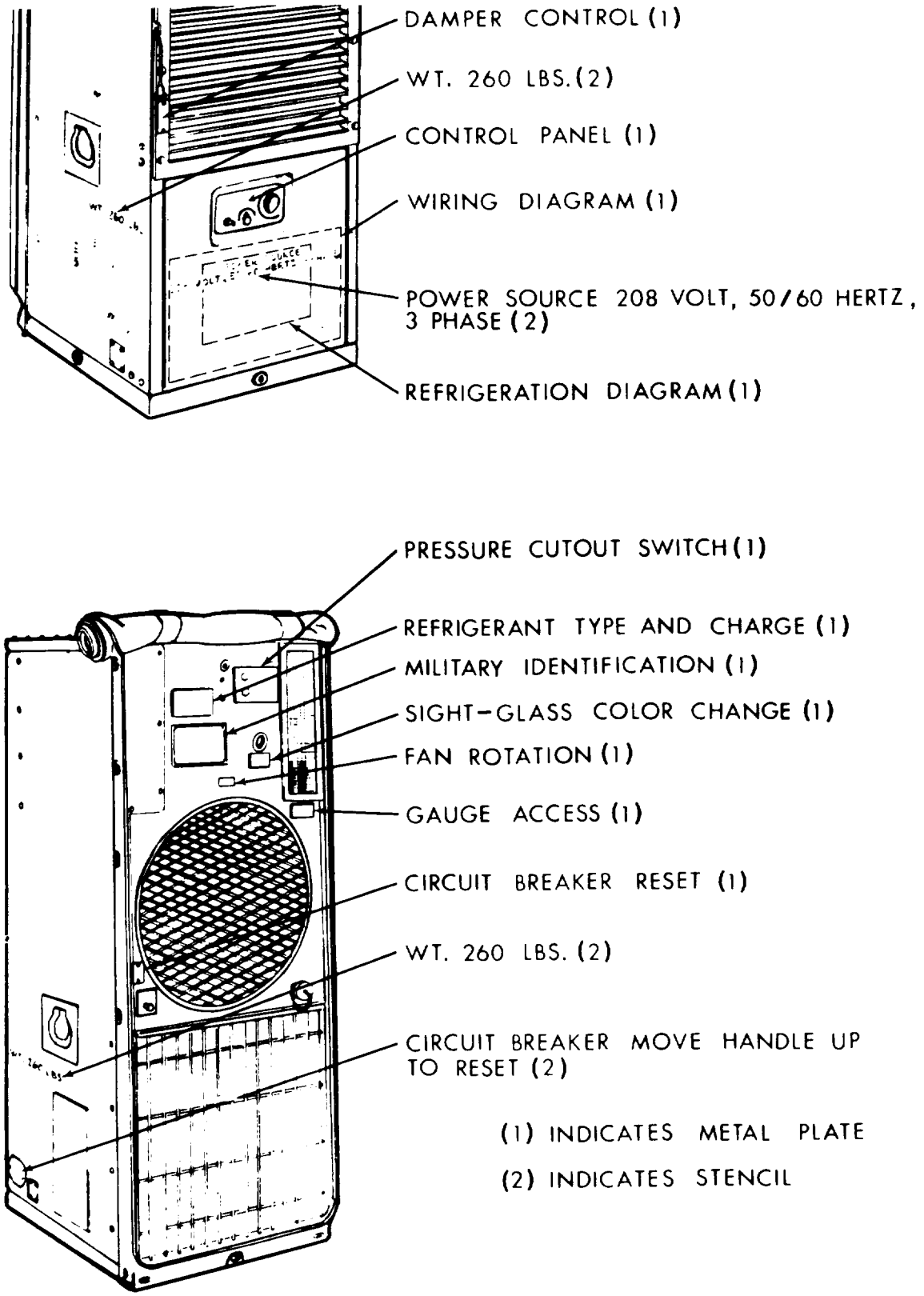


Figure 2-3. Stencils and in.struction Plates

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2.8. 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 maintain high efficiency and to prevent undue strain or wear of the equipment.

2.9. Operation in Extreme Heat

NOTE

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

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

b. Protection.

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

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

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

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

NOTE

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

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

2.10. Operation in Extreme Cold

The air conditioner is designed to operate in temperatures as low as -50°F (-45°C). At extremely low temperatures. extra care should be taken to reduce heat loss of the enclosure, by weather-stripping windows and doors, insulating surfaces exposed to the outside, and limiting the amount of outside air drawn in through the fresh air vent of the air conditioner. Do not disturb wiring during extremely cold weather. Wire and insulation become brittle, and are easily broken.

2.11. Operation in Dusty or Sandy Conditions

NOTE

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

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

CAUTION

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

b. Protection.

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

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

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

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

c. Cleaning.

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

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

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

2.12. Operation in Unusually Wet Conditions

The air conditioner is designed to be exposed to the elements, so it is reasonably weatherproof. However, during periods of extremely wet, windy weather, the fabric cover should be closed when the air conditioner is not in use. The fabric cover should be opened during dry spells, to permit the interior to dry out.

2.13. Operation in Salt Air or Sea Spray

To prevent the accumulation of salt on exposed surfaces. the fabric cover should be kept closed when the air conditioner is not operating. Exposed areas should be spray-rinsed or sponged with clear water periodically to remove salt encrustations.

2.14. Emergency Procedures

a. CBR Hazard. When operating under chemical-biological-radiological (CBR) conditions, attach a CBR filtering unit to the intake on upper right rear surface of the unit. Close fresh air damper completely, and make sure that evaporator intake and discharge louvers are open.

b. Power Reduction. To conserve available power during periods when full 208-volt, 3-phase power is not available, the air conditioner should be operated in the VENTILAT'E mode only.

***2.15.* Administrative Storage**

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

b. Before placing equipment in administrative storage, current maintenance services and equipment serviceable criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWO'S) should be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks. vans, conex containers and other containers may be used.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section L LUBRICATION INSTRUCTIONS

3-1. General

The compressor is hermetically sealed, with a charge of oil included. The condenser fan and evaporator fan motors incorporate sealed bearings, so that no Lubrication is required, When necessary to relieve binding of louver blades, fasteners, etc., an application of light machine oil maybe worked into the joint or pivot. Excess oil should be blotted up with a cloth or paper towel.

SECTION II. TROUBLESHOOTING

3-2. Use of Table

The troubleshooting Table contains information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner.

a. The Table lists the common malfunctions which you may find during the operation or maintenauce of the air conditioner or its components, You should perform the test/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions 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. Any trouble or corrective action beyond the scope of operator maintenance shall be reported to Unit maintenance.

Table 3-1, Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. AIR CONDITIONER DOES NOT START

Step 1. Check power supply to be sure it is on.
Turn on power.

Step 2. Verify that circuit breaker is on.
Pull then push circuit breaker reset knob.

2. COMPRESSOR FAILS TO START.

Step 1. Check mode selector switch for proper setting.
Set switch at COOL.

Step 2. Verify that low- or high-pressure cutout switches have not tripped.
Press and release cutout switch reset buttons.

3. COMPRESSOR STARTS NORMALLY, BUT STOPS ON OVERLOAD.

Step 1. Check evaporator intake and discharge grilles to be sure they are open and unobstructed.
Open louvers or remove obstructions.

Step 2. Check fabric cover to be sure that it is open.
Open fabric cover.

Step 3. Check condenser air inlet screen for dirt or obstruction.
Clean condenser air inlet screen or remove obstruction.

Table 3-1. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

4. REDUCED COOLING CAPACITY.

Step 1. Check temperature control thermostat setting.
Set thermostat at maximum DECREASE.

Step 2. Check fresh air damper to be sure that it is not admitting too much hot, humid air.
Adjust fresh air damper.

Step 3. Check for open doors, windows or operating exhaust fans in conditioned area.
Close doors and windows. Turn off or reduce speed of exhaust fans.

Step 4. Verify that evaporator intake and discharge louvers are properly adjusted (open).
Adjust louvers correctly.

Step 5. Make sure that fabric cover is rolled up and stowed.
Open fabric cover.

Step 6. Check condenser intake screen for dirt or obstruction.
Clean screen or remove obstruction.

Step 7. Make sure that all cover plates and panels are in position and are sealing the lower casing.
Cover and seal any non-functional openings.

5. REDUCED HEATING CAPACITY.

Step 1. Check selector switch setting.
Set selector switch to HI HEAT.

Step 2. Check fresh air damper position to be sure that it is not admitting too much cold air.
Close fresh air damper.

Step 3. Check evaporator intake and discharge louvers for proper (open) position.
Open louvers.

Step 4. If thermostat is remotely located, check to be sure that it is not close to light bulbs or other heat-producing equipment.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

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

4.1. General

Repair parts are listed and illustrated in TM 9-4120-360-24P. No special tools are required for maintenance of the equipment. Test, maintenance and diagnostic equipment (TMDE) and support equipment include standard pressure and vacuum gages, vacuum pump and charging manifolds found as standard equipment in any refrigeration shop.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

4.2. Unpacking

The air conditioner is bolted to the wood shipping pallet, which must be removed when the unit is to be installed in a permanent location. Proceed as follows:

a. Cut the steel strapping. and carefully remove the wooden crating and plastic wrapping from the unit.

b. With the help of at least one assistant, lay the air conditioner on either side, supported by cushioned support blocks such as two 2-foot lengths of 4 x 4 lumber.

c. Remove four 7/16-14 bolts securing the shipping pallet to the air conditioner's base plate. These bolts shouId be retained if needed for permanent mounting of the unit. (See figure 1-1.)

d. Return the unit to the upright position, ready for installation.

4.3. Checking Unpacked Equipment

Check the air conditioner in accordance with the following instructions:

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

b. Check the equipment against the packing slip to see if the shipment incomplete. Report all discrepancies in accordance with the instructions in DA PAM 738-750.

c. Check to see whether the equipment has been modified.

d. Perform all weekly and monthly preventive maintenance checks and services, as indicated in Table 2-1.

4.4. Installation Instructions.

Observe the following requirements arid recommendations when installing the air conditioner.

a. The unit should be installed on a level supporting surface to permit uniform condensate drainage. If a level surface is not obtainable, the unit maybe mounted on an angle not greater than 5 degrees from the horizontal. If this type of mounting is unavoidable, be sure to connect the condensate drain to the drain opening in the lowest side of the base plate. Drain plugs are located in the middle of each side of the baseplate. Standard 1/2-14 NPT fittings can be installed in place of one or more of these plugs to conduct condensate drainage to a drain, storm sewer or dry sump, or a standard garden hose may be used.

b. Rough-in Dimensions. An opening 18-1/2 ± 1/2 inches (47 ± 1 cm) wide, and 49 ± 1/2 inches (124.5 ± 1 cm) high is required for installation of the air conditioner. A removable filler plate should be installed above the unit to permit ready removal of the top panel for servicing. Space between the air conditioner and the wall may be filled with flexible plastic foam and sealed with pressure-sensitive tape.

c. *Mounting* The air conditioner should be bolted or lag-screwed to a flat, level surface. The base plate contains four mounting holes. equipped with 7/16-14 clinch nuts if bolting from below is required. These nuts may be driven out if bolting or lag-screwing from above is necessary. (See figure 4-1.)

CAUTION

If utilizing the four clinch nuts for mounting, a new bolt, with no lubrication, should be used. The mounting bolts shall not be torqued more than 15 foot-pounds to prevent deforming the clinch nut plate or dislodging the clinch nut from the plate.

d. The air conditioner must have an unobstructed flow of air in order to operate efciently. Make use of terrain features, trees, and other buildings impossible to provide a shaded location without obstruction of air. This minimizes the cooling load on the refrigeration system.

e. The unit should be located as near as possible to a source of 208-volt, 3-phase. 50/60hertz, ac electric power. The main power input receptacle is located on the rear surface of the air conditioner at the 4:30 o'clock position below the condenser fan guard. If the normal location is inconvenient. the receptacle maybe moved to either side or to the space between the evaporator intake grille and the air filter by removing four screws, lock washers and nuts from the flange of the receptacle, and transferring it to the desired location. Also, transfer the cover plate from the new location of the receptacle to the original location. Secure each with four screws, lock washers and nuts.

f. A ground connection should be made between the casing and the earth, using bare wire (No. 10 AWG). The ground end of the the may be connected to a cold water pipe or to a copper or brass rod driven at least 14 inches into the earth.

g. Before operating the air conditioner make sure that the fabric cover is rolled up and secured, and that the evaporator air intake and discharge louvers are fully open.

h. If delivery and/or return air is to be ducted to a remote location. remove the evaporator air intake and discharge grilles from the unit. Install ductwork as required, and install grilles on the outer ends of the ducts. Be sure to incorporate provisions for access to air falter and mist eliminator in the ductwork.

i. If the control panel is to be remotely located, remove it from the air conditioner as directed in the following steps:

(1) Disconnect power source from unit.

(2) Remove the front access panel and the evaporator intake grille from the air conditioner to provide access (figure 1-1).

(3) Disconnect the wiring harness connector from the receptacle on the left end of the control panel assembly (figure 4-2).

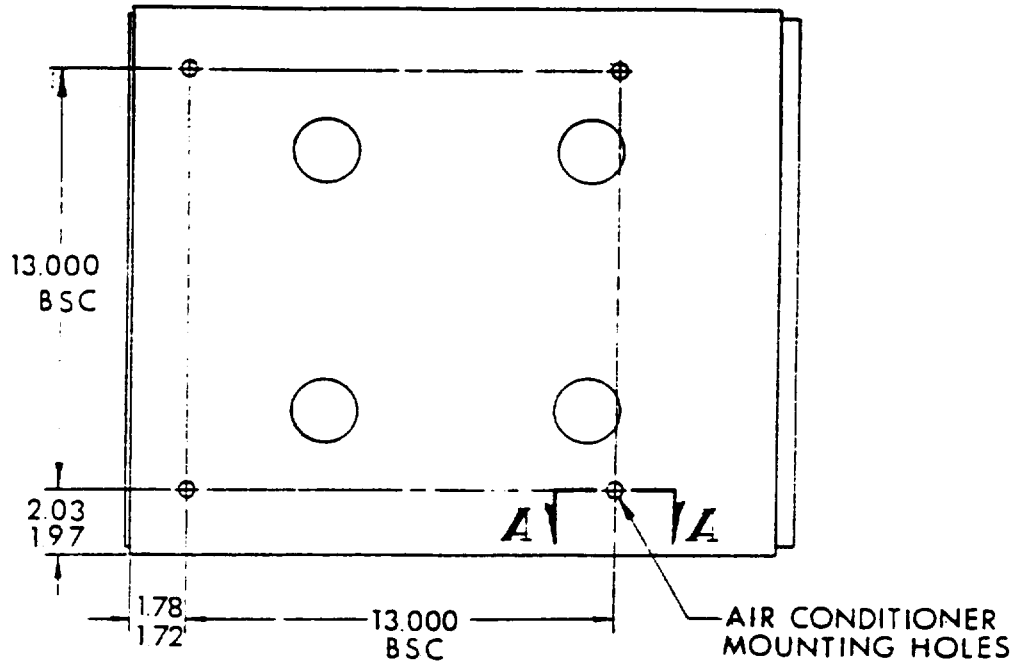
(4) Remove the four screws securing the control panel assembly to the junction box. Retain the screws.

(5) Remove the air falter.

(6) Loosen the loop clamp which retains the temperature control thermostat sensor bulb on the right. hand side of the evaporator fan. Lead the bulb and capillary tube carefully through the grommet while removing the control panel from the air conditioner. Coil the capillary tube carefully, and mount the sensor bulb in the outside cavity of the control panel housing, using the loop clamp from its original location.

(7) Install a block-off assembly on top of the junction box, in the same position as that from which the control panel assembly was removed. Secure with the four screws retained in step (4). (See figure 4-3).

(8) Mount the control panel assembly in the desired remote location, and mount a new receptacle, MS3106R-28-11S, in the appropriate position in either the block-off plate or the partition between the evaporator intake louver and the air filter.



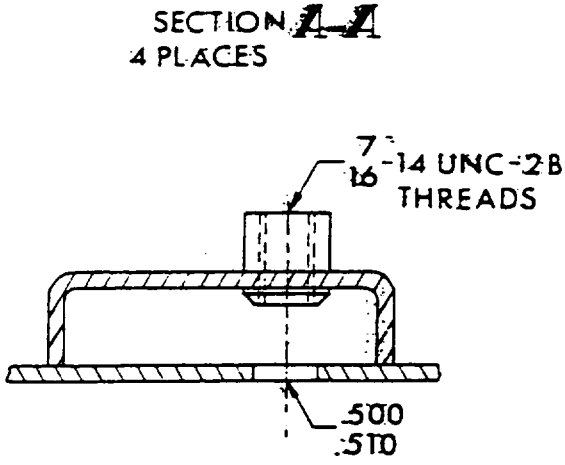


Figure 4-1. Mounting Details

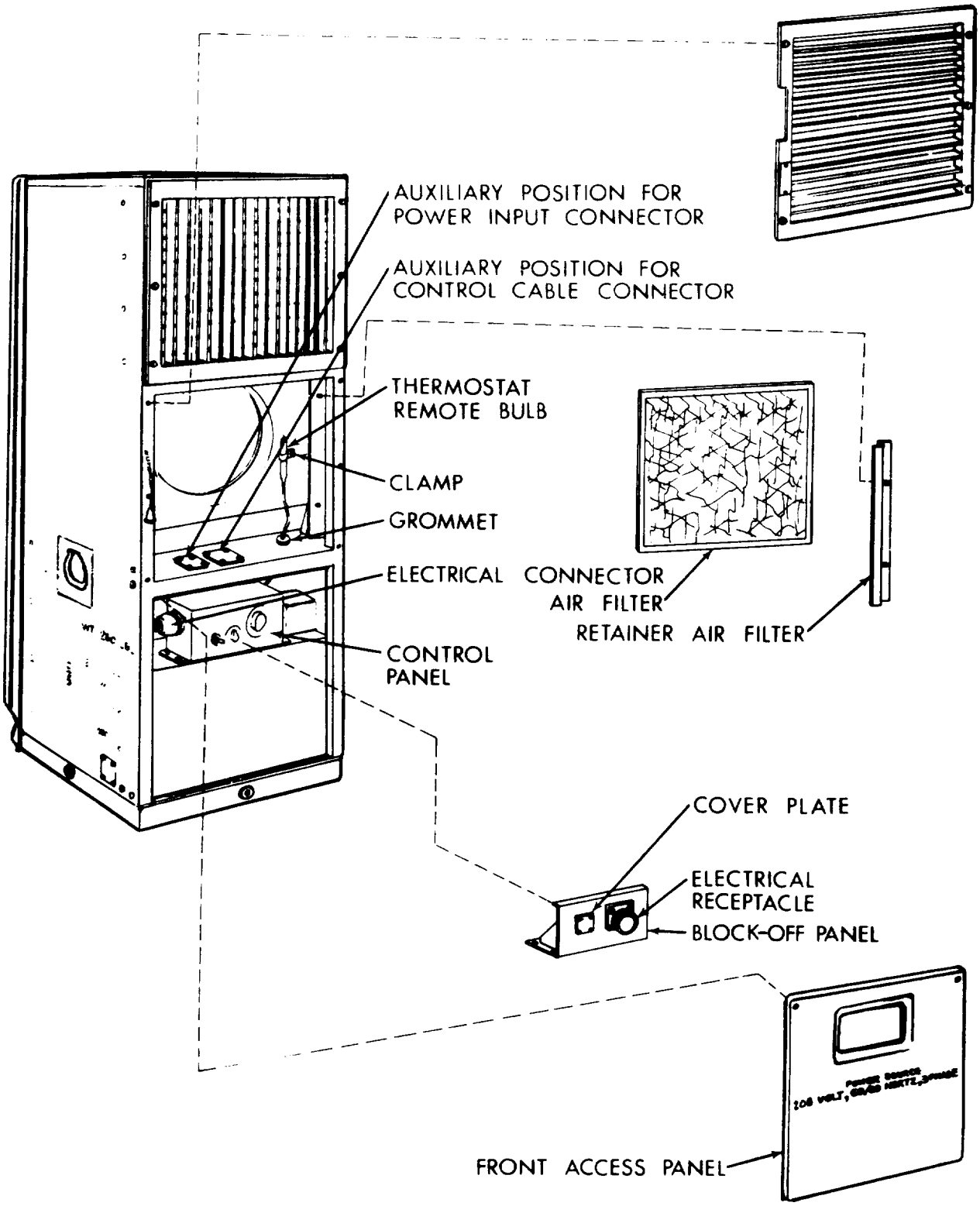


Figure 4-2. Remote Control

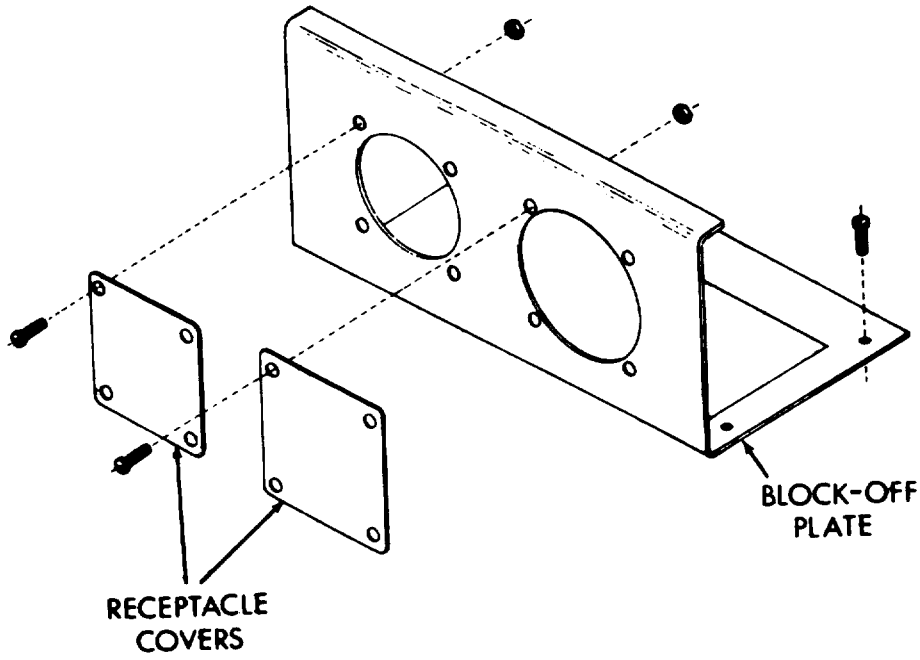


Figure 4-3. Block-Off Panel

(9) Locally manufacture an extension cable long enough to reach from the remote control panel assembly to the air conditioner. (See Wiring Diagram figure FO-1).

NOTE

The power supply cable may be transferred to a position next to the control panel cable, if desired.

(10) Replace filter, grille and panel on the air conditioner. and plug in remote cables.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4.5. Use of the Table

Table 4-1 is arranged in the sequence that will be most convenient for you. For example, maintenance of the air filter, Item 2, follows maintenance of grilles, Item 1, which must be removed for access. Panels and grilles may be left off until all checks have been completed. Electrical power should be disconnected from the air conditioner for all checks except the final operating check of the controls.

Table 4-1. Unit Preventive Maintenance Checks and Services — Quarterly Schedule

Item Number	Item to be Inspected	Procedures	Not Fully Mission Capable If:
1	Grilles and louvers	Check for bent or damaged louver blades and frames. Check freedom of operation. Straighten bent blades or frame by hand, if possible. To remove grilles for repair or replacement, turn six cam-lock studs a quarter-turn clockwise. Apply light machine oil to pivots of louver blades to restore freedom of operation, if necessary. Blot up excess oil with cloth or paper towel.	Louver blades bent beyond repair, or missing. Frame deformed, torn or broken.
2*	Air Filter	Clean and service, or replace if perforated, torn or otherwise damaged. Clean filter by agitating in detergent solution or dry cleaning solvent (Fed Spec P D-680). Shake or blow dry. **WARNING** Disconnect power from the air conditioner before exposing the electrical system. The voltage used can be lethal.	Filter is perforated (1/4-inch hole or larger) through center thickness, or frame is bent or damaged beyond repair.
3*	Mist Eliminator	Remove 18 screws and washers from top panel, and remove top panel. Slide mist eliminator up out of channels. Clean by agitating in detergent solution and rinsing in clear water. Inspect for punctures, tears or deformation. Replace if damaged. Install in channels in front of evaporator coil, making sure that TOP mark is up, and that airflow arrows point outward.	Mist eliminator is missing or damaged.

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

Item Number	Item to be Inspected	Procedures	Not Fully Mission Capable If:
4*	Condensate drain tubes and check valves	Test flow (para 4.23).	
5*	Fresh air inlet screen	Remove five screws and washers from screen. Clean the wire mesh by agitating it in detergent solution or dry cleaning solvent (Fed Spec P-D-680). Blow dry with compressed air. Replace if the wire mesh is cut or broken. Realign wires if displaced.	Fresh air inlet screen is damaged or missing.
6*	Condenser coil guard.	Inspect for damage. Replace if rods are cut, broken or displaced, or if screen is damaged. To remove, unscrew eight screws and washers, and four lockwashers from top and bottom edges. Clean by agitating in dry cleaning solvent (Fed Spec P-D-680). Blow dry.	Guard is broken or screen is torn or perforated.
7	Rear cover	Clean with detergent solution, Inspect for tears, punctures and damaged slide fasteners. Repair or replace damaged cover. Lubricate slide fastener. if necessary, with wax stick (candle or crayon) or spray lubricant.	Rear cover is torn, slide fastner is broken, or cover is irreparably damaged.
8	Condenser fan guard	Check for deformation, tears or broken mesh. Replace if necessary. Clean by agitating in detergent solution. **NOTE** Condenser fan guard is designed so that bolt holes match in only one position. Do not force or re-drill holes to fit.	Broken or deformed mesh is not repairable.
9	Controls	Connect power to air conditioner. Check controls for proper operation. looseness or damage. Tighten or replace as necessary.	Controls are damaged or do not operate properly.

*Service monthly or more often as required when operating in extremely dusty or sandy environments.

Section IV. TROUBLE SHOOTING

4.6. General

a. This Section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner. 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 occor, 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. 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 testinspections and corrective actions in the order listed.

NOTE

Before you use this Table, be sure you have performed all applicable operating checks.

Table 4-2. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. AIR CONDITIONER FAILS TO OPERATE

Step 1. Check to be sure that main power cable is connected.
Connect cable.

Step 2. Check mode selector switch for correct setting.
Turn selector switch to COOL.

Step 3. Verify that circuit breaker has not tripped.
Pull then push the circuit breaker resset knob.

Step 4. Make sure that you are using 208-volt, 50/60 cycle, 3-phase current.
Check each phase of supply line with voltmeter.

Step 5. Inspect main power receptacle connector for breakage.
Replace broken connector.

Step 6. Cheek for loose electrical connections.
Tighten connections.

Step 7. Verify that high- and low-pressure cutout switches have not opened.
Press and release reset buttons on high- and low-pressure cutout switches.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage used can be lethal.

Step 8. Check continuity of fuses XF1 and XF2.
Replace bad fuses.

Step 9. Check transformer: 208-volt primary, 30-volt secondary.
Replace bad transformer.

Step 10. Check rectifier assembly by applying 30 + 3-volt ac to input terminals, and observing voltmeter attached to (+) and (-) terminals. Voltmeter should read 24–28 volts, dc.
Replace bad rectifier assembly.

2. INSUFFICIENT COOLING

Step 1. Check evaporator intake and outlet louvers to be sure they are open and not obstructed.
Open louvers or remove obstruction.

Step 2. Make sure that mode selector switch is positioned properly.
Set switch at COOL.

Step 3. Verify that temperature selector switch is properly set.
Set switch at maximum DECREASE.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

step 4. Make sure that condenser intake screen is not clogged or obstructed.
Clean intake screen.

Step 5. Remove evaporator intake grille, remove air filter and inspect for dirt or clogging of any kind.
Clean filter.

Step 6. Inspect condenser coil for dirt or obstruction.
Clean coil with vacuum cleaner and brush attachment, or use 30 psi compressed air from inside of coil to blow out dirt, keeping air nozzle at least eight inches from coil.

Step 7. Check sight glass liquid indicator for bubbles. If bubbles exist check system for leaks.
Repair leaks, and recharge system.

Step 8. Feel drier-strainer (dehydrator) to see whether it is cold to the touch, or is frosted or sweating. Cold discharge indicates obstruction.
Discharge system over a period of 5-6 hours to prevent oil being blown out of system, then replace drier-strainer.

Step 9. Check inlet and discharge sides of solenoid valves for temperature difference. Abnormally cold discharge indicates leakage or obstruction.
Repair or replace faulty solenoid valve.

Step 10. Check evaporator coil for over-all temperature. If part of coil is relatively warm, and evaporator refrigerant inlet is sweaty or frosty, expansion valve may be damaged or obstructed.
Replace faulty expansion valve.

3. FAN MOTOR DOES NOT OPERATE

Step 1. Make sure that power cable is properly connected and that 3-phase power is supplied.
Connect cable.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage used can be lethal.

Step 2. Check connectors P3 and P9 for proper tightness.
Tighten as necessary and retry starting.

Step 3. Check continuity of fuses XF1 and XF2.
Replace bad fuses.

Step 4. Remove lower panel, junction box cover, and control panel. Tag wires to mode selector switch for identification, and disconnect wires from switch. Using an ohmmeter or continuity tester, check continuity in each position in accordance with the following switch-position tabulation.

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

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Replace faulty mode selector switch.

Step 5. Check continuity of electrical leads from relay (K5) terminals A2, B2, C2 and D2 to fan motor connector P9. terminals D, E, H and G. If continuity is not shown in one or more leads. check from relay (K5) terminals A2, B2, C2 and D2 to connector J3, terminals *h*, S, T and P to connector P9, terminals b, E, H and G If continuity is shown in all these leads, motor is bad.

Replace open wire leads, or replace motor.

4. EVAPORATOR AIR OUTPUT VOLUME LOW

Step 1. Inspect filters for dirt and clogging.

Clean and replace filters.

Step 2. Inspect mist eliminator for dirt and clogging

Clean and replace mist eliminator

Step 3. Check evaporator blower impeller for looseness, binding or damage.

Tighten setscrews or relieve binding as necessary, or replace damaged impeller.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage can be lethal.

Step 4. Check wiring connections to fan motor, relay K5, and connector plugs for looseness.

Tighten loose connections.

5. EXCESSIVELY NOISY OPERATION

CAUTION

If knocking or hammering is heard when air conditioner is started up, shut down at once and report the condition to direct support maintenance. The compressor maybe pumping liquid refrigerant, which will cause severe damage.

Step 1. Listen for knocking or hammering sounds. Install gauge set, and check for high discharge pressure.

Bleed off some refrigerant.

Step 2. Check evaporator and condenser fan impellers for looseness, vibration or interference.

Tighten setscrews. Check impellers for damage which would cause out-of-balance condition, and replace impeller and guard, shroud, etc.

Step 3. Check fan and blower motor for wear, as indicated by noisy operation or excessive end-or side-play.

Replace bearings, or motor.

6. COMPRESSOR WILL NOT START

Step 1. Check continuity of circuit breaker. Unscrew four panel fastener screws, and remove front access panel from air conditioner. Unscrew four panel fastener screws, and remove junction box cover. Tag and disconnect leads from circuit breaker, and check continuity of each pair of terminals. using an ohmmeter or continuity tester.

Replace circuit breaker if bad.

Step 2. Check continuity of fuses.

NOTE

If a fuse indicates no continuity it may have blown because of a short circuit or overload in the transformer or one of the other components. Using an ohmmeter or continuity tester, remove fuses from fuse blocks and check continuity. Replace fuses that show no continuity, and proceed to Step 3.

Step 3. Check condition of high- and low-pressure cutout switches by pressing reset buttons.

Replace faulty pressure cutout switches.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WARNING

Disconnect power from the air conditioner before doing any maintenance work on the electrical system. The voltage used can be lethal.

Step 4. Check for loose electrical connections or faulty wiring.
Tighten loose connections. Replace bad wiring.

Step 5. With lower panel and junction box cover removed, disconnect transformer leads from fuse block, XF1, terminals 2 and 3. Also disconnect transformer secondary leads from rectifier CR1, terminals 1 and 4. Apply 208 volts, ac, to input leads which were disconnected from fuse block. Check voltage at secondary leads to be sure it is 28-30 volts ac.
Replace faulty transformer.

Step 6. With lower panel and junction box cover off, disconnect rectifier leads from fuse block XF2, terminal 1, and from terminal block TB2, terminal 6. Apply power to transformer to obtain 27-30 volts ac to rectifier, and check disconnected leads to be sure that 24-28 volts dc is indicated. Positive (+) terminal is at XF2, terminal 1; negative (–) terminal is at TB2, terminal 6.
Replace faulty rectifier.

Step 7. With lower panel and junction box cover off, tag wires at K1 for identification, and disconnect. Apply 24-28 volts dc to terminals X1 and X2 of relay K1, and check continuity of pairs A1-A2, B1-B2 and C1-C2. Each pair should indicate continuity.
Replace faulty relay.

Step 8. Disconnect transformer leads, and check continuity of H1-H2, X1-X2, H1-X1, H2-X2 and each lead to transformer casing or common ground. H1-H2 and X1-X2 should show continuity; others should not show continuity.
Replace transformer if continuity requirements are not met.

Step 9. Disconnect leads of rectifier. Apply 28-30 volts ac to leads 1-4, and check leads 2-3 for 24-28 volt dc output.
Replace bad rectifier.

Step 10. Disconnect compressor relay, K1. Apply 24-28 volts dc to terminals X1-X2, and check continuity of terminals A1-A2, B1-B2, C1-C2. All should indicate continuity.
Replace faulty compressor start relay, K1.

Step 11. With lower panel and junction box cover off, tag wires to time delay relay, K3, for identification and disconnect. Apply 28 volts, dc, to primary terminals: positive (+) to terminal 1, and negative [-) to terminal 5. Check continuity across secondary terminals 3 and 1 to see that contact is made within 25 ± 6 seconds of energizing.
Replace bad time delay relay.

Step 12. Disconnect plug, P4, from compressor receptacle. Using an ohmmeter or continuity tester, teat receptacle points A-B, A-C, B-C, and D-E. Continuity should be indicated. Test points A, B and C to compress or casing or common ground. No continuity should be indicated.
Replace compressor that does not meet continuity requirements.

7. COMPRESSOR STARTS BUT STOPS AT ONCE —"SHORTCYCLES"

Step 1. Check sight-glass liquid indicator for bubbles while compressor is operating. If bubbles appear, check refrigeration system for leaks.
Repair leaks, and add refrigerant until sight-glass is clear when compressor is running.

Step 2. Connect pressure gauges to suction and discharge service valves. Check system pressures as indicated in the following Table:

NORMAL TEMPERATURE - RESSURE RELATIONSHIPS

95°F (36°C) dry bulb return air to unit					
Outdoor ambient temperature	**50°F 10°C**	75°F 24°C	100°F 38°C	110°F 43.5°C	125°F 52°C
Gauge Pressures					
Suction (psig)	**56-60**	56-65	65-75	70-80	75-90
(Kg/Cm²)	**3.93-4.22**	3.93-4.57	4.57-5.27	4.92-5.62	5.27-6.33
Discharge (psig)	**135-155**	185-205	275-295	375-380	400-420
(Kg/Cm²)	**9.50-10.90**	13.00-14.41	19.33-20.74	26.36-26.72	28.12-29.53
80°F (27°C) dry bulb return air to unit					
Outdoor ambient temperature	**50°F 10°C**	75°F 24°C	100°F 38°C	125°F 52°C	
Gauge Pressures					
Suction (psig)	**56 min.**	56 min.	56-65	65-75	
(Kg/Cm²)	**3.93"**	3.93"	3.93-4.57	4.57-5.27	
Discharge (psig)	**130-150**	180-200	270-290	290-410	
(Kg/Cm²)	**9.14-10.55**	12.65-14.06	18.98-20.39	20.39-28.82	

NOTE: Dry bulb temperatures are measured with an ordinary thermometer

Table 4-2. Troubleshootmg - (Cont.)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

If pressures are too low, cheek for leaks and add refrigerant; if too high, bleed off refrigerant until pressure is normal.

Step 3. If pressures are normal, turn off power, and short-circuit high- or low-pressure cutout switch. Turn on power for maximum of 12 seconds, and see whether compressor operates normally.

CAUTION

Do not exceed 12-second operating time, or vacuum may be formed in suction side of refrigeration system and damage compressor.

Bleed off refrigerant over a period of 5-6 hours to prevent oil being blown out of system, then replace faulty pressure cutout switch and recharge system.

8. COMPRESSOR STARTS, BUT GOES OFF ON OVERLOAD.

Step 1. Check condenser intake screen for obstructions.
Clean screen or remove obstructions.

Step 2. Check condenser coil for dirt or obstruction.
Clean coil with vacuum cleaner, or remove obstruction.

Step 3. Visually check to be sure that condenser fan is operating properly.
Tighten setscrews on loose impeller. Replace bad motor.

9. COMPRESSOR RUNS BUT DOES NOT COOL

Step 1. Check sight-glass liquid indicator for bubbles indicating low charge of refrigerant. If bubbles are present, check refrigeration system for leaks.
Discharge system over a period of' 5-6 hours to prevent oil being blown out of system, then repair leaks or replace leaking component.

Table 4-2 Troubleshooting-(Cont.)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 2. Remove evaporator air discharge grille and check for evaporator coil icing. If icing is present check hot gas bypass pressure regulating valve setting (suction pressure).

CAUTION

Do not use steam, open flame, heat gun or any other high-temperature heat source to thaw an iced evaporator coil.

Thaw an iced coil with a lamp bulb (75-watt maximum), hair dryer or electric fan, and adjust pressure regulating valve.

Step 3. Check compressor fan for noisy operation, high suction pressure, or excessively low discharge pressure. indicating leaky internal valves.

10. SUCTION PRESSURE TOO LOW OR TOO HIGH

	DISCHARGE	SUCTION
HIGH	1. Ensure condenser coil is not dirty or partially blocked.	1. Check for high return air temperature.
	2. Check for loose or missing lower front panel, connector cover plate, circuit breaker access cover, or filter mounting plate.	2. Ensure equalizing solenoid valve is open.
	3. Check for excessive recirculation of hot condenser discharge air back into condenser intake,	3. Ensure compressor is running.
	4. Check for overcharge of refrigerant.	4. Check for expansion valve bulb damage or poor contact with suction line.
	5. Check for air in refrigerant system.	5. Test compressor.
	6. Ensure fan motor is operating.	6. Test quench valve.
	7. Ensure condenser fan is not loose on shaft.	7. Check for defective regulating valve.
	8. Check for too much oil in refrigerant system.	8. Test expansion valve.
	9. Check for high suction pressure.	
LOW	1. Check for low outside air temperature.	1. Ensure return air filter is clean.
	2. Check for low refrigerant charge.	2. Check for partially blocked discharge or return air ducts or openings.
	3. Ensure compressor is operating.	3. Ensure evaporator coil is clean.
	4. Test equalizing solenoid valve.	4. Check for low return air temperature.
	5. Check for defective pressure regulating valve.	5. Ensure refrigerant is fully charged.
	6. Test compressor.	6. Ensure liquid solenoid valve is closed.
		7. Ensure fan motor is operating.
		8. Check for loose evaporator fan.
		9. Test expansion valve.

	DISCHARGE	SUCTION
LOW (continued)		10. Check for excessive expansion valve superheat. 11. Check for plugged for kinked distributor tube. 12. Check for suction line or evaporator coil tubing restriction. 13. Ensure dehydrator (falter-drier) is not clogged. 14. Ensure there is no moisture in refrigerant system.

Table 4-2. Troubleshooting-(Cont.)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

11. UNIT FAILS TO HEAT

Step 1. Check mode selector switch for incorrect setting.
Set selector switch to LO HEAT and HI HEAT.

Step 2. Make sure that temperature control thermostat is set properly.
Set switch at INCREASE.

Step 3. Inspect for dirty or obstructed air filter.
Clean filter.

Step 4. Remove top, and check for dirty or obstructed mist eliminator,
Clean or replace mist eliminator.

WARNING

Disconnect power from the air conditioner before doing maintenance on the electrical system. The voltage used can be lethal.

Step 5. With top cover removed, check electrical connections to heating element and thermostat, and visually check elements for damage.
Tighten loose connections. Replace damaged elements.

Step 6. Disconnect each element in turn, and check continuity. Also check continuity of thermostat point to point. Continuity should exist when temperature is below 142°F (61°C).
Replace faulty heating element or thermostat.

Step 7. Remove front panel and junction box cover. Tag wires to relay K2 for identification, and disconnect. Apply 28 volts dc to terminals X1 and X2 on relay K2, and check continuity of pairs A1-A2, B1-B2 and C1-C2. Continuity should exist in each pair. Check continuity of each terminal to ground. Continuity should not exist.
Replace bad relay.

Section V. MAINTENANCE PROCEDURES

4.7. Fabric Cover (See figure 4-4).

a. Description. The fabric cover is made of vinyl impregnated nylon and is supported on a framework of aluminum rod around all four sides. The cover assembly is mounted on the air conditioner casing by 18 screws and washers through eyelets in the fabric. Two tapes are incorporated in the top edge of the cover, and are equipped with eyelets for holding the rolled-up cover by means of turnbutton fasteners. The cover is fastened in the closed position by means of a heavy-duty slide fastener.

b. Removal. Remove the fabric cover as follows:

(1) Roll the cover down, and fasten all around with the slide fastener.

(2) Remove 18 screws and washers from the four edges of the cover,

(3) Slide the cover off the air conditioner by pulling or pushing on the aluminum frame near the corners. If the cover is stuck to the casing with dried mud or other debris, carefully insert a putty knife, paint scraper or similar blade between the cover and the casing to separate them. If difficulty is still encountered, place a clean wood block near each comer in turn, and drive the cover off with a light hammer.

c. Cleaning. Clean the fabric cover and the portion of the casing from which it was removed, using a detergent solution and viscose sponge or cloth. Use a soft scrubbing brush if necessary to remove caked-on dirt. Rinse with clear water, and air dry.

d. Inspection/Repair Inspect the fabric cover for rips, cuts. tears or punctures in the fabric, and for damaged or missing parts of the slide fastener. Repair punctures and minor cuts, rips or tears up to 3 inches or 7.5 cm long by patching the inside surface. For damage of greater extent, or missing parts of slide fasteners, replace the cover.

e. Lubrication. Lubricate the slide and the interlocking fingers of the slide fastener with a wax stick (crayon or candle) or spray lubricant. Operate the slide several times in each direction to distribute the lubricant.

f. Installation. With the flap closed and fastened, place the fabric cover on the air conditioner with the two tapes at the top, inside. Press the aluminum frame-work around all four edges to seat the cover on the casing. When the eyelets in the cover are aligned with the screws holes in the casing, install 18 screws and washers to secure the cover.

4.8. Top Panel Assembly (See figure 4-4).

a. Description. The top panel is a flat aluminum plate which encloses the top of the air conditioner. Mating edges are equipped with radio frequency interference (RFI) gaskets, and other areas are insulated to minimize heat gain/loss and sound transmission. Internally threaded rivets are incorporated in the top rear edge of the top panel to support the upper part of the fabric cover.

b. Removal. With the fabric cover removed, as instructed above, remove five screws from the rear flange of the top panel. Remove 15 screws and packing washers from the top surface of the panel. Remove the panel.

WARNING

Dry cleaning solvent (Fed. Spec. PD-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).

c. Cleaning. Clean the outside surface of the top panel with a cloth dampened with detergent solution or dry cleaning solvent (Fed Spec P-D-680). Clean internal insulated surface with a dry dusting brush or a vacuum cleaner with a brush attachment. Clean the surface of the gaskets with a cloth moistened in dry cleaning solvent (Fed Spec P-D-680).

d. Inspection/Repair. Inspect the top panel for dents, nicks, gouges or deformation. Inspect interior surface for torn, loose or missing insulation and gasket material. Repair dents. nicks, gouges or deformation, using conventional sheet-metal repair methods. Replace damaged gaskets or insulation in the following manner:

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

WARNING

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

(2) Soften and remove old adhesive and the residue of insulation or gaskets, using acetone or MEK and a stiff brush.

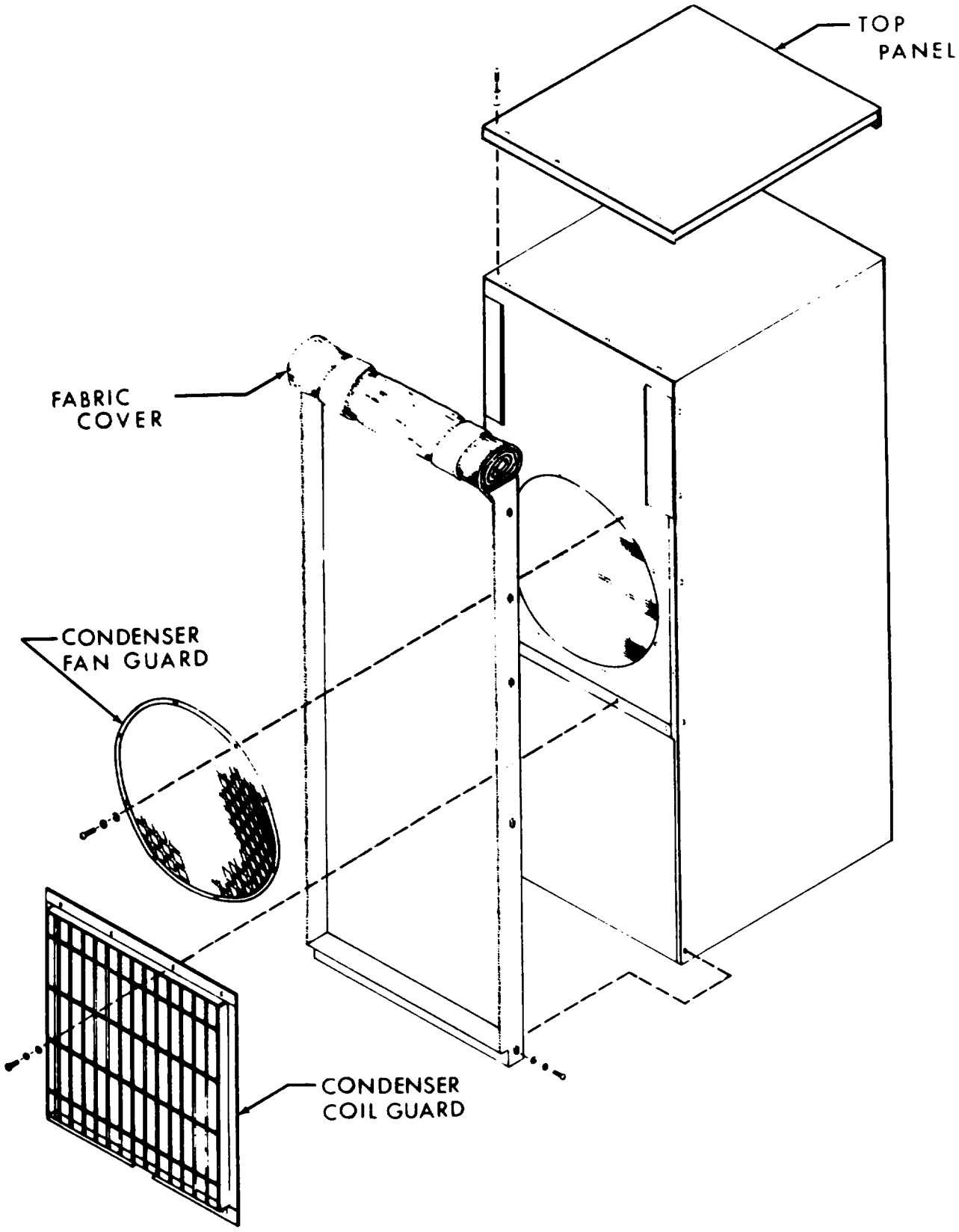


Figure 4-4. Screens, Covers and Guards

(3) Coat the mating surfaces of the metal and the insulating/gasketing material with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to the finger.

(4) Starting with an end or corner, carefully attach the insulation/gasket to the metal. Press into firm contact all over.

e. Installation. Position the top panel on the air conditioner. and secure with 15 screws and packing washers through the top surface. and five screws through the rear flange Install the fabric cover, and secure with 18 screws and washers.

4.9. Air Intake and Discharge Grilles (See figure 4-5).

a. Description. The evaporator air intake grille is equipped with vanes *or* blades which are connected by an operating linkage so that all blades open *or* close together. This design is used *to* control the volume of air passing through the grille so as to control. in turn. the volume of air drawn in through the fresh air screen when the damper is open. The evaporator air discharge grille is equipped with two sets of independently mounted vanes. The horizontal vanes can be positioned to direct the air upward or downward. The vertical vanes can be positioned to direct the air to one or both sides of the center.

b. Removal. Both evaporator grilles are retained on the casing in the same way; with three cam-lock fasteners in each side. Remove each grille by turning the cam-lock studs counter-clockwise, and pulling the grille outward.

WARNING

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

c. Cleaning. Clean the grilles by agitating indetergent solution or dry cleaning solvent (Fed Spec PD-680). Use a soft brush if necessary to dislodge caked-on dirt.

d. Inspection/Repair. Inspect grilles for bent louver blades. deformed frames, or damaged blades or operating linkage. Repair deformation by hand bending if possible. Replace grilles if blades are missing, broken or damaged beyond repair. Inspect gasket material for hardening, permanent set, and cuts, tears or missing pieces. Replace gaskets as directed in the following procedure:

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

WARNING

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

(2) Soften and remove old adhesive and gasket residue, using acetone or MEK and a stiff brush.

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

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

e. Lubrication. Apply a small amount of light machine oil *to* the blade pivots and operating linkage. Work in, then blot up excess oil with a cloth or paper towel.

f. Installation. Position the grilles on the front of the air conditioner. Turn the cam-lock stud fasteners clockwise to engage them.

4.10. Lower Panel (See figure 4-5).

a. Description. The lower panel encloses and seals the lower front area of the air conditioner. It contains a depressed cutout opening to provide access to the control panel. The opening is sealed with an RFI-ground gasket.

b. Removal. Remove the lower panel by unscrewing two panel fastener screws in the upperedge. and pulling the panel outward and upward.

c. Disassembly. The lower panel assembly consists of the metal panel itself, strips of wire-mesh-covered foam rubber gasket material, a refrigeration flow diagram information plate riveted to the inner surface over a layer of foam insulation, a strip of gasket material along the bottom edge. and two panel fastener screws in the top edge. Disassemble as follows, but only to the extent necessary to effect repairs.

WARNING

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

(1) Remove gasket material by inserting a putty knife or similar blade between the gasket and the metal. Soften and remove adhesive residue with acetone or MEK and a stiff brush.

(2) Drill out rivets, and remove information plate.

(3) Remove retaining washers from panel fastener screws by cutting and bending, or support the face of the panel firmly with the head of the panel fastener screw over a hole at least as deep as the screw is long, and driving the screw out from the inner surface.

WARNING

Dry cleaning solvent (Fed. Spec PD-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).

d. Cleaning. Clean the lower panel with a cloth dampened in dry cleaning solvent (Fed Spec PD-680).

e. inspection. Inspect the panel for dents, gouges, cuts or openings through which air could enter the casing. Inspect gaskets for looseness or missing sections.

f. Repair. Repair the lower panel, using conventional sheet metal repair methods, as required, if damage does not exceed minor dents or perforations. Replace the panel if major damage exists.

g. Assembly. Assemble the lower panel as directed in the following steps:

(1) Insert panel fastener screws through the holes in the upper edge of the panel, from the outside. Place retaining washers over the threaded portions of the screws from inside the panel. Lay the panel on a firm, flat surface, and stake the ID of the retaining washers flat around the shanks of the screws.

(2) Install the information plate on the inside of the lower panel, using blind rivets through the matching holes.

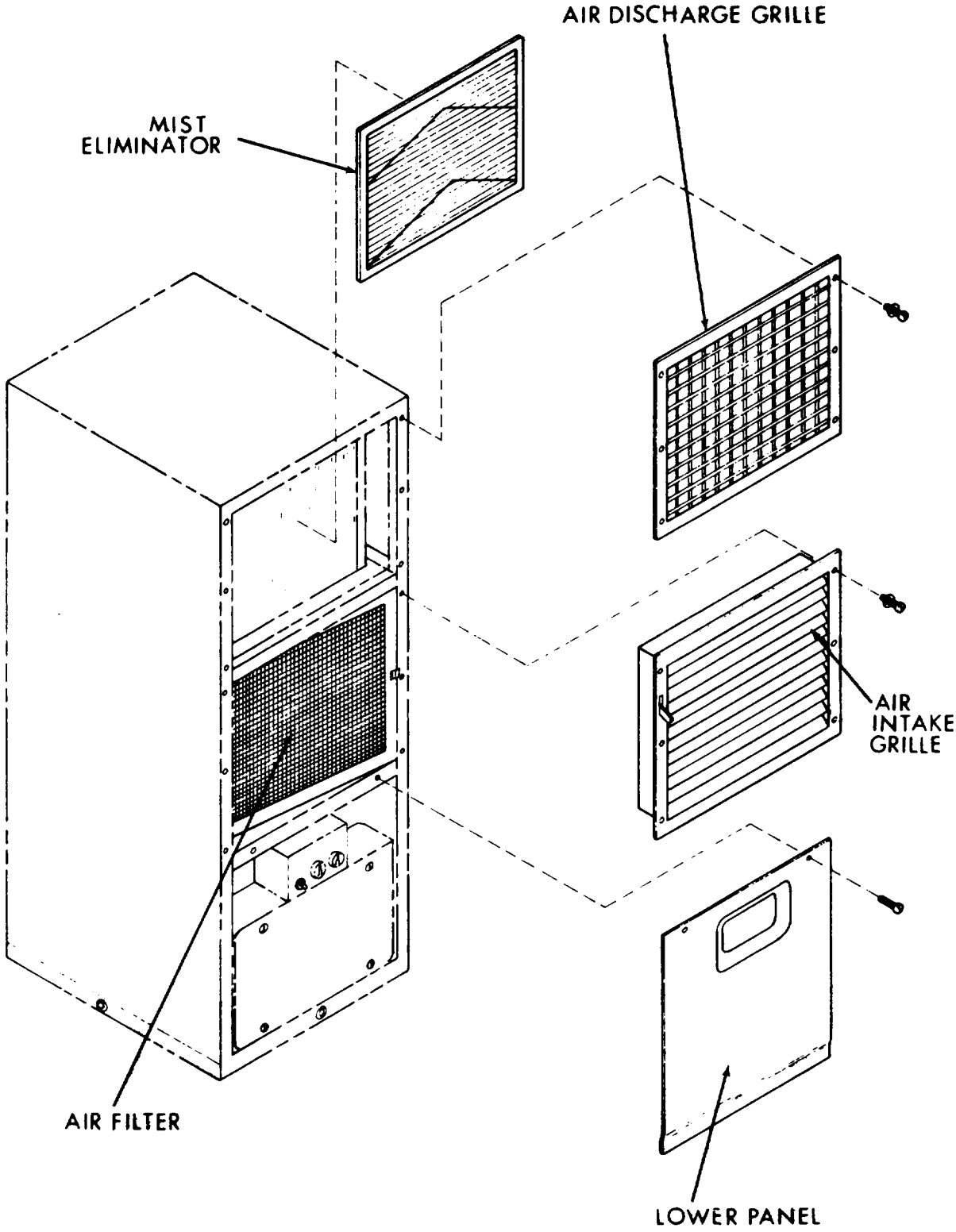


Figure 4-5. Panels, Louvers and Filters

CAUTION

There must be metal-to-metal contact between vertical and horizontal sections of-the RFI gasket material surrounding the control panel opening.

(3) Cut five pieces of RFI gasket to length, as follows:

(a) Cut two pieces to the height of the control panel opening.

(b) Cut two pieces to the width of the control panel opening plus the additional thickness of the two pieces cut previously.

(c) Cut one piece to the length of the bottom lip (offset) of the lower panel.

(4) Apply a coating of RFI adhesive to the mating surfaces of both the metal panel and the gasket material. Let both surfaces air-dry until they are tacky but will not stick to the fingers. Carefully press each piece into firm contact with the panel.

h. lnstallation. Place the lower lip of the lower panel behind the step in the base plate of the air conditioner. Press the panel into position so that the panel fastener screws engage the sheet spring nuts on the casing. Tighten the screws.

4.11. CBR Cover (See figure 1-1).

a. Description. The chemical-biological -radiological (CBR) air filter connection to the air conditioner is located in the upper left corner of the rear surface of the air conditioner. When CBR equipment is not connected. the opening is closed by a sheetmetal cover, (figure 1-1).

b. Removal. Remove five screws from the rim of the CBR cover, and remove the cover.

c. inspection. Inspect the CBR cover for obvious damage. Repair if damage is minor. Replace if necessary.

d. Installation. Position the CBR cover on the air conditioner, and secure with five screws.

4.12. Fresh Air Screen (See figure 1-1).

a. *Description.* The fresh air screen is mounted on the upper right corner of the rear surface of the air conditioner. It encloses the two refrigeration service valves, and screens out leaves and other debris from the fresh air intake when the fresh air damper is open.

b. Removal. Remove five screws from the rim of the fresh sir screen. and remove the screen.

c. Inspection. Inspect the screen for broken or displaced wires or other damage. Replace the screen if damage is evident.

d. lnstallation. Position the fresh air screen on the air conditioner, and secure with five screws.

4.13. Condenser Coil Guard (See figure 4-4).

a. Description. The condenser coil guard occupies the bottom one-third of the rear surface of the air conditioner. It is aluminum fabrication, consisting of a grid of 3/16-inch aluminum rods in a frame of aluminum angle. The face of the guard is covered with 16-mesh aluminum wire cloth to prevent the entry of leaves and other small debris. The guard is secured to the casing of the air conditioner with screws and washers.

b. Removal. Remove four screws and flat washers from the top of the condenser coil guard frame. and four screws, flat washers and lockwashers from the bottom of the frame. Pull the guard outward to remove.

c. Cleaning. Brush or blow loose dirt from the surface of the screen, then agitate the condenser coil guard in detergent solution or dry cleaning solvent (Fed Spec P-D-680). Blow or wipe dry.

d. lnspection/Repair. Inspect wire screen for cuts, and broken or displaced wires. Pry off edge clips, and replace wine screen if remainder of guard is serviceable. Replace guard if rods or frame are broken or bent beyond the limits of simple repair.

e. Installation. Position the condenser coil guard on the air conditioner, with the semicurcular drain plug cutout and the oval screw holes at the bottom. Secure with four screws and flat washers through the top of the frame. and four screws, flat washers and lock-washers through the bottom of the frame.

4.14. Condenser Fan Guard (See figure 4-4).

a. *Description.* The condenser fan guard is mounted near the middle of the rear surface of the air conditioner. The guard is fabricated from heavy-weight expanded metal mesh mounted in a circular sheet-metal frame. The attaching screw holes in the frame are purposely arranged in an unsymmetrical pattern. so that the fan guard can be installed in only one way. This installation is necessary to orient the angle of the expanded metal so that hot exhaust air will be deflected upward, away from the condenser coil intake.

b. Removal. Remove eight screws and lockwashers from the frame of the fan guard, and remove the guard.

WARNING

Dry cleaning solvent (Fed. Spec PD-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).

c. Cleaning. Agitate the fan guard in detergent solution or dry cleaning solvent (Fed Spec P-D-680). Wipe or blow dry.

d. Inspection/Repair. Inspect for broken, cut or deformed metal, and for broken tack-welds between frame and screen. Straighten minor deformation being careful to avoid flattening the screen. Replace the guard if broken or cut.

e. Installation. Position the condenser fan guard on the air conditioner so that all screw holes match. Secure with eight screws and lockwashers.

4.15. Back Panel and Motor Support (See figure 4-6).

a. Description. The two-speed fan motor support is a welded fabrication of tubing and formed sheet metal which supports the rear end of the motor. It is attached to the back panel with rivet nuts which are used to attach the condenser fan guard to the unit. The back panel is attached to the sides of the casing with blind rivets.

b. Removal. Remove the back panel and motor support assembly from the air conditioner as directed in the following procedure:

(1) With the fabric cover closed, remove 18 screws and washers from the four edges, and remove the fabric cover.

(2) Remove five screws from the rear flange of the top panel, and 15 screws and packing washers from the top. Remove the top panel.

(3) Remove four screws and washers from the top of the condenser coil guard. It is not necessary to remove the guard.

(4) Remove five screws from the fresh air screen, and remove the screen.

(5) Remove five screws from the CBR cover, and remove the cover.

(6) Remove two screws and lockwashers from both sides of the sight-glass liquid indicator. Hold the bracket inside the casing while removing the second screw, to prevent loss of the bracket.

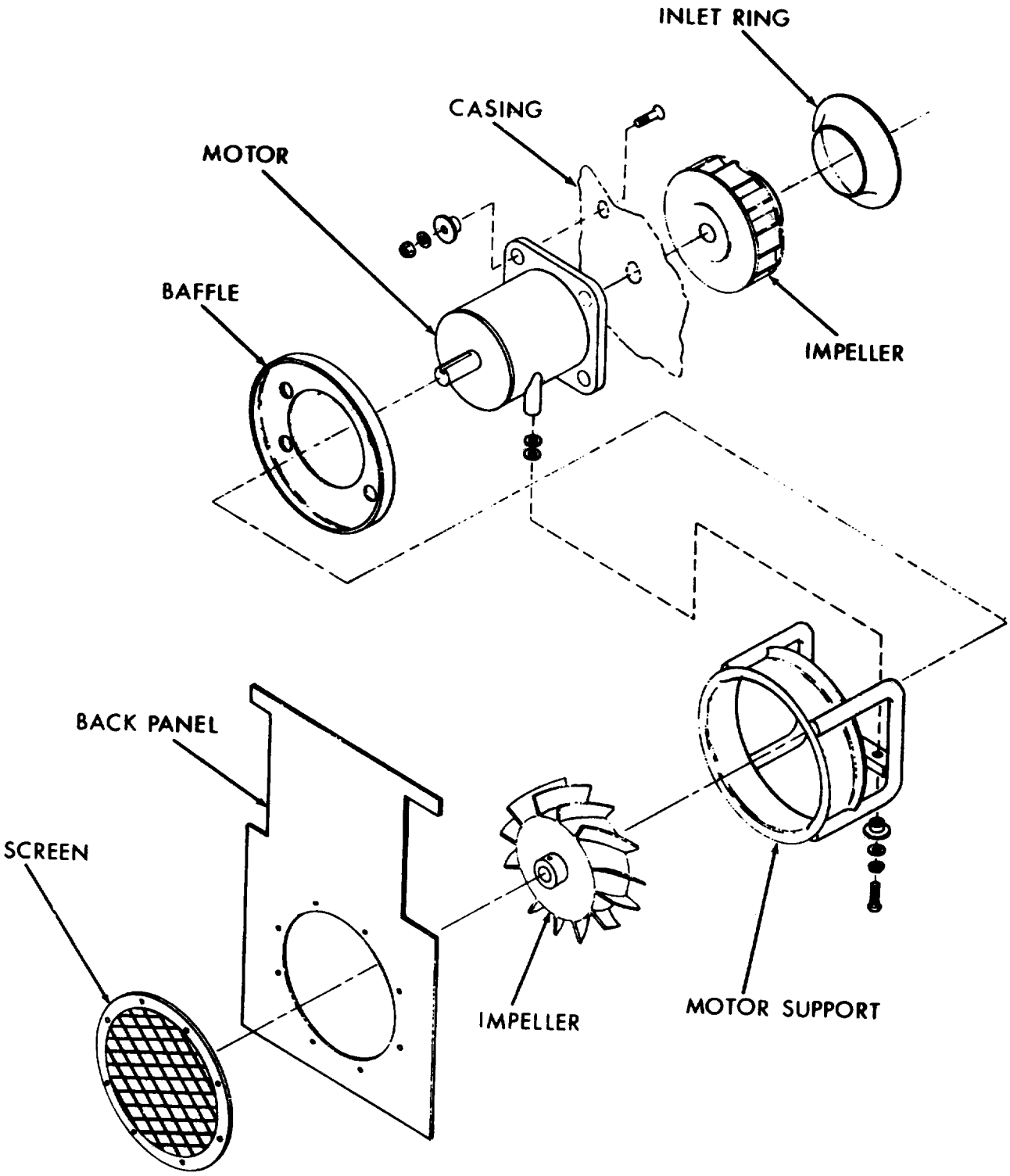


Figure 4-6. Back Panel and Motor Support.

(7) Remove two screws from each end of the pressure cutout switch housing. Be careful to avoid kinking capillary tubes.

(8) Remove the four screws, lockwashers and nuts from the corners of the power input receptacle.

(9) Pull knob of circuit breaker reset flexible cable all the way out (about 2-1/2inches). Grip the shaft firmly with copper-jawed pliers, and unscrew the knob. Remove panel mounting nut and lockwasher from ferrule of cable assembly, so that cable is free of panel.

(10) Remove eight screws and lockwashers from the rim of the condenser fan guard. Remove the guard.

(11) Loosen the two setscrews in the hub of the condenser fan impeller; and remove the impeller from the motor shaft. Use two 1/4-20 jackscrews in the threaded holes in the hub if necessary to remove the impeller.

(12) Unscrew but do not remove four screws which attach the baffle to the motor mount assembly. Remove the baffle carefully to avoid losing spacers and screws.

(13) Carefully remove two socket-head cap. screws, lockwashers, flat washers and bushings which secure the motor mounting feet to the cross-bar of the mounting assembly.

(14) Drill out 23 rivets in the sides of the back panel and remove the back panel and motor mount assembly from the air conditioner.

c. Disassembly. Disassemble the back panel and motor mount assembly as follows:

(1) Separate the motor mount assembly from the back panel by drilling out eight internally threaded blind rivets from the circumference.

(2) Remove information and data plates by drilling out rivets at the corners or ends of the plates.

d. Inspection. Inspect the back panel for dents. cuts or perforations, and for deformation. Inspect motor mount assembly for deformation or broken welds. Replace parts exhibiting major damage.

e. Repair. Repair dented or bent panel, using conventional sheet-metal repair methods. Re-weld broken welds in motor mount assembly if no misalignment will result.

f. Assembly. Assemble the back panel and motor mount assembly as indicated in the following steps:

(1) Position information and data plates in the proper locations, and secure with blind rivets.

(2) Clamp the flange of the motor mount assembly against the inner surface of the back panel, using two or more drift pins, or equivalent, to align rivet holes. Install eight internally threaded blind rivets from the outside surface.

g. Installation. Install the back panel and motor mount assembly on the air conditioner in accordance with the following procedure:

(1) Wire or tie the assembly in its appropriate position on the back of the air conditioner, so that the panel hangs from its top to pen&it to swing outward far enough to allow room to work inside.

(2) Position the pressure cutout switch housing against the inside of the panel, and secure with two screws in each end.

(3) Place the spacer over the window side of the sight-glass liquid indicator, and the mounting bracket over the back of the indicator. Work the hole in the panel into position over the sight-glass, and thread two screws and lockwashers into the bracket, finger tight.

(4) Install the power supply receptacle in the hole in the lower right-hand corner of the back panel. Secure with four screws, lockwashers and nuts.

(5) Install the ferrule of the circuit breaker reset cable assembly through the hole in the lower left-hand comer of the back panel. Secure with a lock-washer and panel mounting nut. Grip shaft in a copper strip held inpliers, and screw on knob firmly.

(6) Align holes in back panel with holes in sides of casing, using at least two drift pins or the equivalent. Cut temporary attaching wire or cord, and secure panel to casing with 23 blind rivets.

(7) Tighten screws in sight-glass liquid indicator bracket and pressure cutout switch housing to final torque.

(8) Install four screws and washers in top rail of condenser coil guard.

(9) Position the fresh air screen on uppright corner of back panel, and secure with five screws.

(10) Position the CBR cover on the upper left-hand corner of the back panel, and secure with five screws.

(11) Loosen four nuts attaching the fan motor flange to the partition if necessary to insert washer between mounting feet of motor and motor mount assembly. Assemble mounting hardware as shown in figure 4-7. Select proper thickness of resilient washer to fit. Tighten four nuts on motor flange when mounting is complete.

CAUTION

Do not hammer impeller onto motor shaft; motor bearings would be damaged. Dress out roughness with a fine file, stone or abrasive cloth. Apply a coating of light machine oil to ease assembly.

4.16. Air Filter (See figure 4-5).

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

b. Removal. Remove the air filter for servicing and maintenance as direct in the following steps:

(1) Turn six cam-lock studs in the frame of the evaporator air intake grille counter -clockwise to unlock them. Remove the grille.

(2) Remove two screws from the retaining strip at the right hand side of the air intake compartment. and release the air filter. Pull filter forward and to the right to remove it from left-hand retaining channel.

WARNING

Dry cleaning solvent (Fed. Spec PD-880) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

c. Cleaning. Immerse the filter in detergent solution or dry cleaning solvent (Fed Spec P-D-680). Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on-dirt. Rinse in clearwater or clean dry cleaning solvent. Drain, then hold filter horizontal and tap each edge on bench or floor to dislodge droplets.

d. Inspection. Inspect the filter for damage such as perforations or punctures in the screen and aluminum foil maze that could permit passage of unfiltered air. Inspect for areas of packed or crushed maze material that would obstruct airflow through the falter. Check for deformation of the frame. and straighten if possible without crushing maze material. Replace filter if crushed punctured, badly deformed or broken.

e. Installation. Install the air filter in accordance with the following instructions:

CAUTION

Make sure that airflow arrows on frame point inward toward the fan intake when installing filter.

(1) Place the left-hand edge of the filter in the channel at the left side of the evaporator air intake chamber. Install the retaining strip on the right-hand side of the filter, and secure with two screws.

(2) Position air intake grille on the front of the air conditioner. Secure it by turning six cam-lock studs in the frame counterclockwise.

4.17. Fresh Air Damper Control (See figure 4-8).

a. Description. The fresh air damper is a door spring-loaded to open, which is closed to any desired degree by a ball-chain assembly. The ball chain is held at its desired position by a detent washer which accepts the links between balls in a slot, thereby grabbing the chain by the balls. A coil spring keeps some slack in the chain at all positions except fully closed. and acts as a snubber to minimize the shock of sudden closing of the damper door.

b. Removal. Remove the damper control chain and snubber spring as follows:

(1) Remove the fresh air screen from the rear surface of the air conditioner. (figure 1-1) and prop the fresh air damper door closed with a piece of wood or other suitable object.

(2) Unhook the coil spring from the clip which attaches the chain to the door. Drill out rivet, and remove clip, chain and coil spring.

c. Lubrication. Lubricate the hinge of the fresh air damper door with a few drops of light machine oil. Work the door back and forth a few times to work the oil into the hinge joints. When the door operates freely, wipe off excess oil with a cloth or paper towel.

d. Installation. Install and adjust the fresh air damper control chain and spring as directed in the following steps:

(1) Fasten the clip-end of chain assembly to the damper door with a rivet and flat washer.

(2) Hook one end of the coil spring into the hole just above the chain attachment, and attach the remaining end of the coil spring to the chain between the ninth and tenth balls from the attachment.

(3) Thread the free end of the chain through the hole in the edge of the casing, and lower it into the detent slot.

(4) Thread the free end of the chain through the top of the pendant, and crimp the retaining sleeve over the last ball on the chain.

(5) Remove the door prop, if still in place, and attach fresh air screen to back of air conditioner with five screws.

(6) Position the air intake grille on the front of the air conditioner, and secure by turning the six cam-lock studs counterclockwise.

4.18. Mist Eliminator (See figure 4-5).

a. Description. The mist eliminator is composed of eight double layers of aluminum mesh held between 1/4-inch mesh panels in an aluminum frame. The purpose of the mist eliminator is to trap droplets of condensate water formed on the evaporator coil, so that they will not be blown into the air conditioned space.

b. Removal. To remove the mist eliminator from the air conditioner for servicing and inspection, perform the following steps:

(1) Remove 18 screws and washers from the four edges of the fabric cover, and remove the fabric cover.

(2) Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange of the panel. Remove the top panel.

(3) Pry or lift up the mist eliminator at the outer ends of the bottom member of the frame. Slide the mist eliminator out of channels to remove.

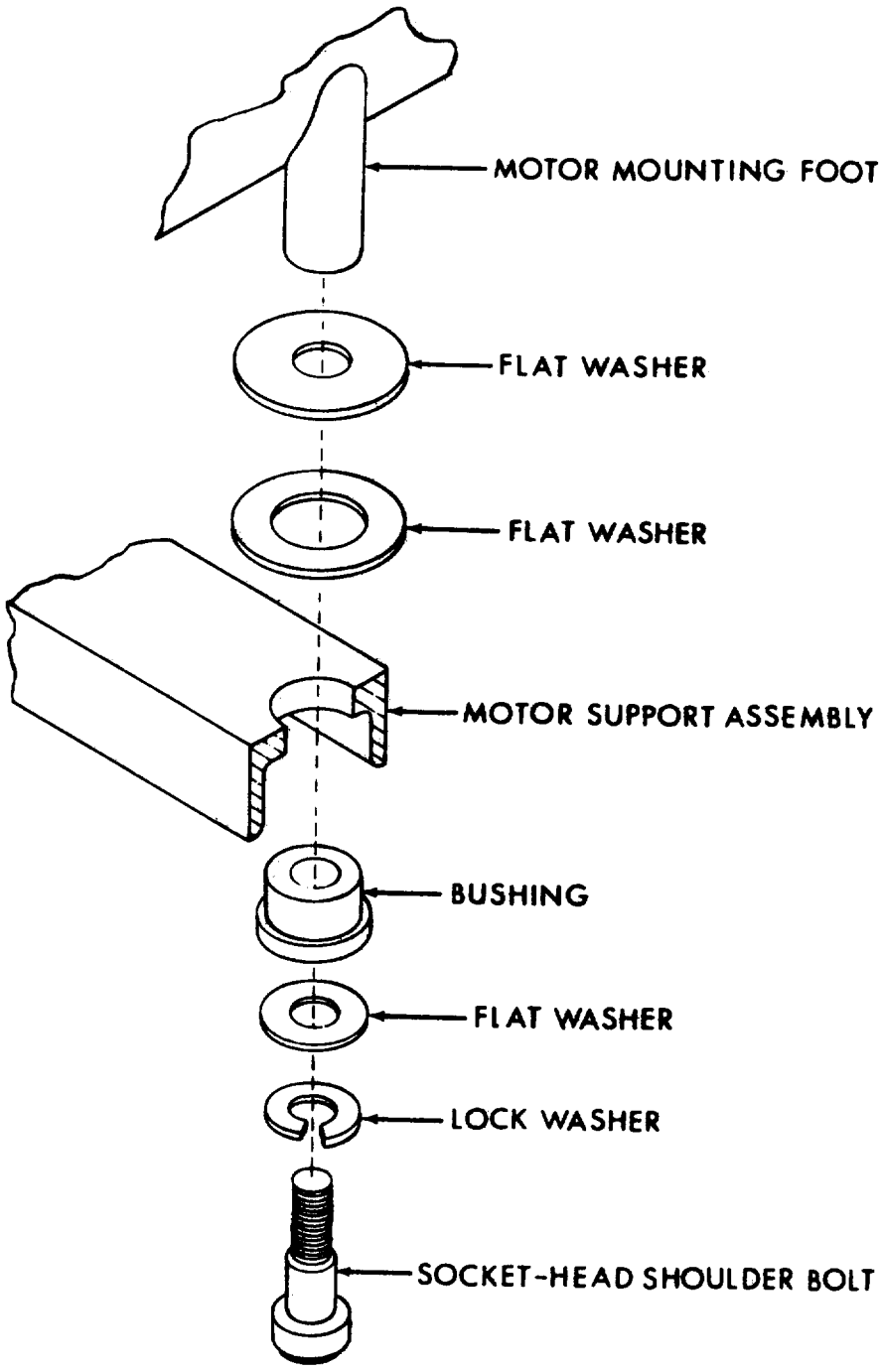


Figure 4-7. Motor Mounting Details

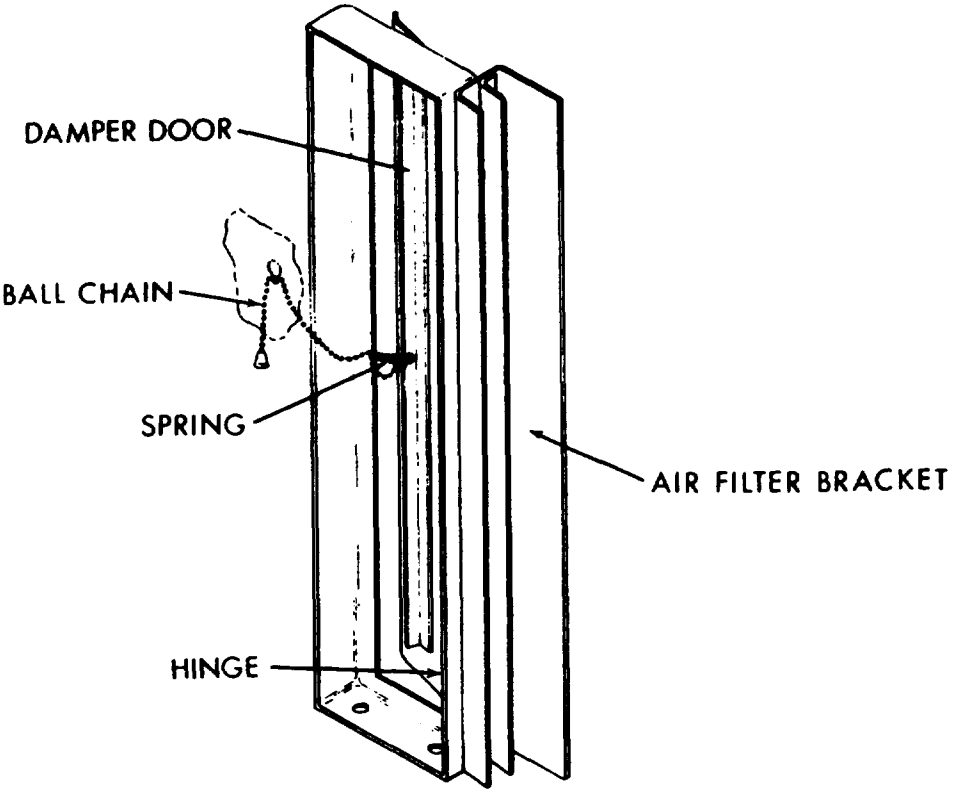


Figure 4-8. Fresh Air Damper Details.

c. Cleaning. Clean the mist eliminator by agitating in detergent solution. Rinse in clear water, and blow dry with compressed air, or tap each side on the bench or floor while holding the mist eliminator horizontal, to dislodge droplets.

d. Inspection. Inspect the mist eliminator for obvious damage, such as cuts, large perforations (serious deformation. Accept perforations up to 3/8 inch diameter. Straighten bent or deformed sections impossible. Replace the mist eliminator if damage exceeds repairable limits.

e. Installation. Install the mist eliminator in the air conditioner as directed in the following steps.

(1) Orient the mist eliminator with the TOP mark up, and the airflow arrows pointing outward, away from the evaporator coil. Slide the mist eliminator downward between the side channels.

(2) Position the top panel on the air conditioner, and secure with 15 screws and packing washers through the top surface and five screws through the rear flange.

(3) Fit the fabric cover around four sides of the air conditioner casing so that the eyelets and screw holes match. Secure with 18 screws and washers.

4.19. Block-Off Panel

a. Description. The block-off panel is a right-angled sheet-metal fabrication designed to block the control panel opening in the lower panel when the control panel is mounted in a remote location. (See figure 4-3). The control panel opening must be blocked to prevent air from being drawn into the condenser area of the air conditioner. thus bypassing the condenser coil and reducing the efficiency of the unit. The block-off panel contains two covered openings for optional use as connector openings for power supply and control wiring harness receptacles.

b. Installation. After the control panel assembly has been removed from the air conditioner, install the block-off panel in accordance with the following directions.

NOTE

It is presumed that an extension control cable with mating connectors has been fabricated locally to extend from the air conditioner to the remote location of the control panel.

(1) Mount the block-off panel in position with the vertical face forward, on top of the junction box. Use four screws removed from the control panel assembly to secure the block-off panel.

(2) Remove four screws from the corners of the control wiring harness receptacle opening, and remove the cover. Install the wiring harness receptacle in the opening. If the power supply cable is to be connected at the block-off panel, transfer the power input receptacle to the remaining opening in the block-off panel, and transfer the cover plate to the original location of the receptacle.

(3) Install the lower panel, and secure with two panel fasteners screws. Connect wiring harness plugs.

4.20. Instruction Plates (See figure 2-3).

a. Removal. Drill out the rivets securing the instruction plate to the casing or panel. If the plate is infront of a functional part of the air conditioner (e.g. the pressure cutout switches) be careful to avoid drilling into the functional part.

b. Installation. Position the instruction plate on the casing or panel, and secure with blind rivets.

4.21. Casing Assembly

a. General. The casing assembly supports or surrounds all functional components of the air conditioner. Therefore, if damage is extensive enough to require replacement of the casing assembly, it is also extensive enough to have caused significant damage to major components. In such a case it is necessary to procure a new casing assembly, and to dismantle the damaged unit completely, test all components, and install serviceable components in the new casing. Unserviceable components must be replaced.

b. Inspection. Inspect the casing assembly for dents. gouges. cuts or tears. and major deformation. Remove panels as necessary to determine whether internal components such as coils. wiring, piping or other components or sub-systems have been damaged. If damage is apparent. leak-test all parts of the refrigeration system and make an operating check of controls and functional components. If the unit is functionally OK. repair the casing.

c. Repair Straighten dents by using a sheet-metal hammer and back-up dolly, using care to avoid stretching the metal more than necessary. Fill gouges with body putty. fiberglass-epoxy filler, or weld. Weld cuts or tears impossible, or fabricate a patch and attach it with blind rivets. Sand paint to a feather edge around the repair, and paint as directed in TM 43-0139.

4.22. Insulation

a. Description. Insulation consists of sheets of foam plastic or foam rubber, attached with adhesive.

b. Inspection. Inspect insulation for areas of 1ooseness or separation from the metal panel, and for missing areas. Replace damaged or missing insulation.

WARNING

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

c. Removal. Scrape or pull off as much of the damaged insulation as possible. Soften the remaining insulation and adhesive with acetone or MEK, and remove with a putty knife, paint scraper or similar tool. Repeat the softening and scraping process as required, then clean up the metal surface with a cloth moistened in acetone or MEK.

d. Installation. Cut a sheet of the proper insulating material to the correct shape, and coat the attaching side with adhesive. using a brush to ensure complete coverage. Also, brush adhesive on the metal to which the insulation is to be attached. Let both surfaces air-dry until the adhesive become tacky but will not stick to the fingers. Starting at one corner or at a narrow edge, carefully bring the insulation into full contact with the metal. Press into firm contact all over.

4.23. Condensate Drainage System (See figure 4-9).

a. Description. The condensate drainage system consists of a drip pan, mounted beneath the evaporator coil, and two tubes leading from the ends of the drip pan to the baseplate. The tubes are equipped with spring-loaded ball check valves at their bottom ends, to prevent the bypassing of air through the tubes and around the evaporator intake. The baseplate of the air conditioner is fitted with pipe-threaded holes for the attachment of standard plumbing fittings or hose to conduct the condensate of a remote location.

b. Access. Since the condensate drainage system occupies both sides of the front of the air conditioner from top to bottom, the top panel, lower panel and both evaporator grilles must be removed to the system. Also, the air filter and the mist eliminator must be removed. Proceed as follows:

(1) Remove 18 screws and washers from the four edges of the fabric cover. and remove the fabric cover.

(2) Remove 15 screws and packing washers from the top surface of the top panel, and five screws through the rear flange. Remove the top panel.

(3) Both the evaporator discharge and intake grilles are removed by turning six cam-lock studs in their frames counter-clockwise to unlock them. Remove the grilles.

(4) Remove the mist eliminator by pulling it straight up.

(5) Remove the air filter by removing two screws from the retaining strip on the right-hand edge of the filter. Pull the right-hand edge of the filter outward and to the right to remove it.

(6) Remove the lower panel by unscrewing the two panel fastener screws in the top edge. and pulling the panel upward and out.

c. Flow-testing. Place a 3/4-inch board under one side of the air conditioner to tilt it slightly, then pour about one pint (one-half liter) of water into the lower end of the drip pan below the evaporator coil. Verify that the water flows out of the drip pan through the drain tube. Tilt the air conditioner the opposite direction, and repeat the flow test on the other side. Water should drain freely through both tubes. If it does not. remove and repair or replace the drain tube.

d. Disassembly Disassemble the drain tube assembly in the following manner. (See figure 4-9).

(1) Loosen the two hose clamps (2) on the side to be disassembled. SIide them downward, off the hose.

(2) Bend the two retaining clips far enough to pull the tube away from the casing.

(3) Twist and pull the tube downward to remove it from the hose. If hose remains attached to the lower tube, remove from the air conditioner and twist or cut the hose from the tube.

(4) Place a container below the end of the upper drain tube (1) and repeat the water flow-test to make sure that the obstruction is not in the upper tube. If it is. remove it with a flexible wire with a small hook on the upper end.

(5) If the obstruction is in the lower drain tube, straighten the ends of the cotterpin, hold one hand over the lower end of the check valve assembly to prevent loss of the spring (7), and withdraw the cotterpin (5). Remove the ball (6), and push a flexible wire upward through the tube to dislodge the obstruction. Flush the tube thoroughly with hot running water.

e. Assembly. Assemble the drain tube assembly in accordance with the following procedure:

(1) Insert ball and spring into body of check valve.

(2) Compress the spring below the level of the cotterpin, insert the cotterpin through both walls of the check valve, and spread the ends of the cotterpin.

(3) Slide a length of hose over the upper drain tube, install a hose clamp over the upper part of the hose, and tighten the hose clamp.

(4) Slide a second hose clamp over the lower part of the hose, and insert the upper end of the lower drain tube into the hose. Align the lower end of the drain tube along the side of the casing, and press tube into the clips in the front corner. Bend clips slightly to retain tube in position then tighten the lower hose clamp.

(5) Install mist eliminator by pushing down into channels in front of the evaporator coil. Make sure that airflow arrows point away from the coil, and that TOP marking is up.

(6) Install air filter in front of evaporator fan intake. Make sure that airflow arrows point inward, and engage the left side of the filter in the channel beside the fresh air damper. Install the retaining strip on the right-band side, and secure with two screws.

(7) Install the air intake and discharge louvers, and secure in place with six cam-lock studs each, by turning them clockwise.

(8) Position the top panel on the air conditioner, and secure with 15 screws and packing washers in the top surface and five screws through the rear flange.

(9) Fit the fabric cover over the rear surface of the air conditioner so that eyelets match the screw holes in the casing. Secure with 18 screws and washers.

(l0) Install the lower panel on the air conditioner, and secure with two panel fastener screws in the upper edge.

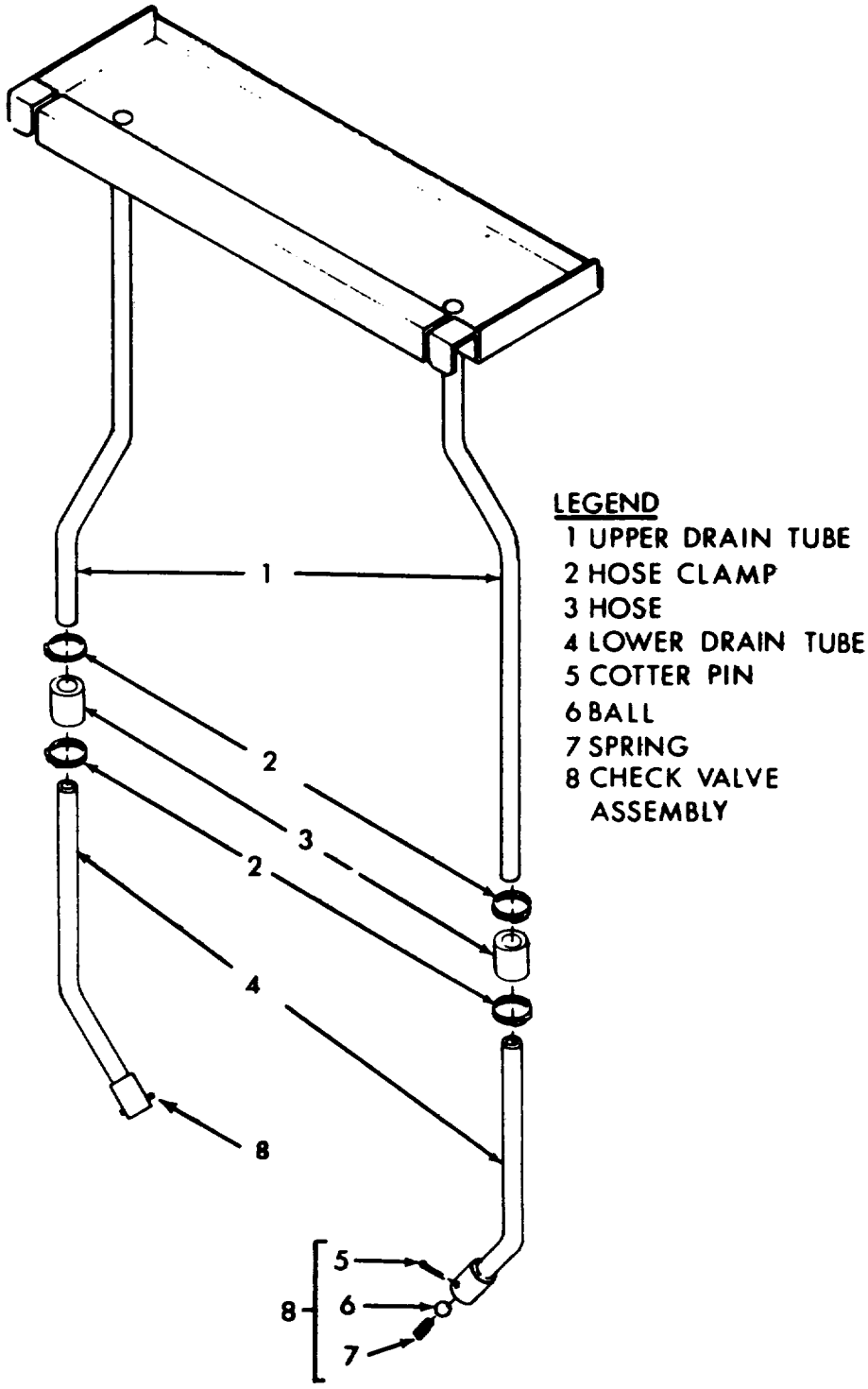


Figure 4-9. Condensate Drain

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I CONTROL PANEL

5.1. Description (See fIgure 5-1).

The control panel assembly is mounted on top of the junction box behind the lower panel. It Contains the three controls by means of which all functions of the air conditioner are controlled. These controls comprise the following:

a. Mode Selector Switch. This is a five-position rotary switch consisting of four "wafers" or individual five-position elements. Each position of the switch connects various functional units in each mode of operation.

b. Temperature Control Thermostat This thermostat is set at the desired temperature level to heat or cool the conditioned area in accordance with a feedback signal from a sensing bulb which causes the switch to open or close on temperature rise or temperature drop.

c. Two-speed Fan Switch. This two-position switch connects or disconnects an auxiliary set of windings in the evaporator/condenser fan motor. When connected, these windings double the speed of the motor from 1725 to 3450 rpm. thereby increasing airflow.

5.2. Removal

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical syste64m. The voltage used can be lethal.

Remove the control panel assembly from the air conditioner in accordance with the following instructions.

a. Unscrew two panel fastener screws from the top edge of the lower panel, and remove the panel.

b. Unscrew and disconnect the electrical connector plug from the receptacle on the left end of the control panel housing.

c. Disconnect the evaporator air intake grille by turning six can-lock studs in the frame a quarter-tum counter-clockwise. Remove the grille. Remove the air filter by unscrewing two screws in the retaining strip. Remove the strip and pull out the filter.

d. Remove one screw from the loop clamp holding the thermostat sensor bulb.

e. Remove four screws from the comers of the control panel mounting flange, and carefully withdraw the control panel assembly while leading the sensor bulb and its associated capillary tube through the grommet hole to remove it. Coil the capillary tube without kinking.

5.3. Disassembly

Disassemble the control panel only to the extent required for repair or replacement. Proceed as directed in the following steps:

a. Pull the knobs off the mode selector switch and the temperature control thermostat.

b. Remove the panel mounting nuts from the two-speed fan switch and mode selector switch

c. Remove four screws and self-locking nuts that secure the back panel to the housing. Carefully separate the panel from the housing.

d. Tag and remove wires from the two-speed switch.

e. Remove the four screws and self-locking nuts that secure the mounting flanges of the temperature control thermostat to the rear cover. Press the capillary tube and grommet out of the notch in the rear cover to separate the temperature control thermostat from the control panel assembly.

f. Remove four screws and self-locking nuts from the wiring harness receptacle, and remove the wiring harness from the control panel assembly.

5.4. Inspect/Test

Inspect non-functional parts of the control panel assembly for damage. Replace damaged parts. Test operating components as follows, using an ohmmeter, multi-meter or other continuity tester.

a. Check continuity of the mode selector switch in all positions, in accordance with the following Table:

b. Attach the continuity test leads to the red and yellow contacts of the temperature control thermostat, and place the sensor bulb in a container of warm water (85° - 100° F or 30° - 40°C), Check the continuity of the thermostat throughout the DECREASE range, Continuity should be indicated.

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

c. Attach the continuity test leads to the red and blue contacts of the temperature control thermostat, and place the sensor bulb in a container of cold water (40° - 65°F or 50° - 18°C). Check the continuity of the thermostat throughout the INCREASE range. Continuity should be indicated.

d. Check cotinuity of the two-speed fan switch in both positions. Continuity should be indicated in the ON position, but not in the OFF position.

e. Check the continuity of each pin and attached wire in the wiring harness. Continuity should be indicated. Check from each pin to the plug or shell, Continuity should not be indicated.

f. If any component or part does not meet continuity requirements. replace it.

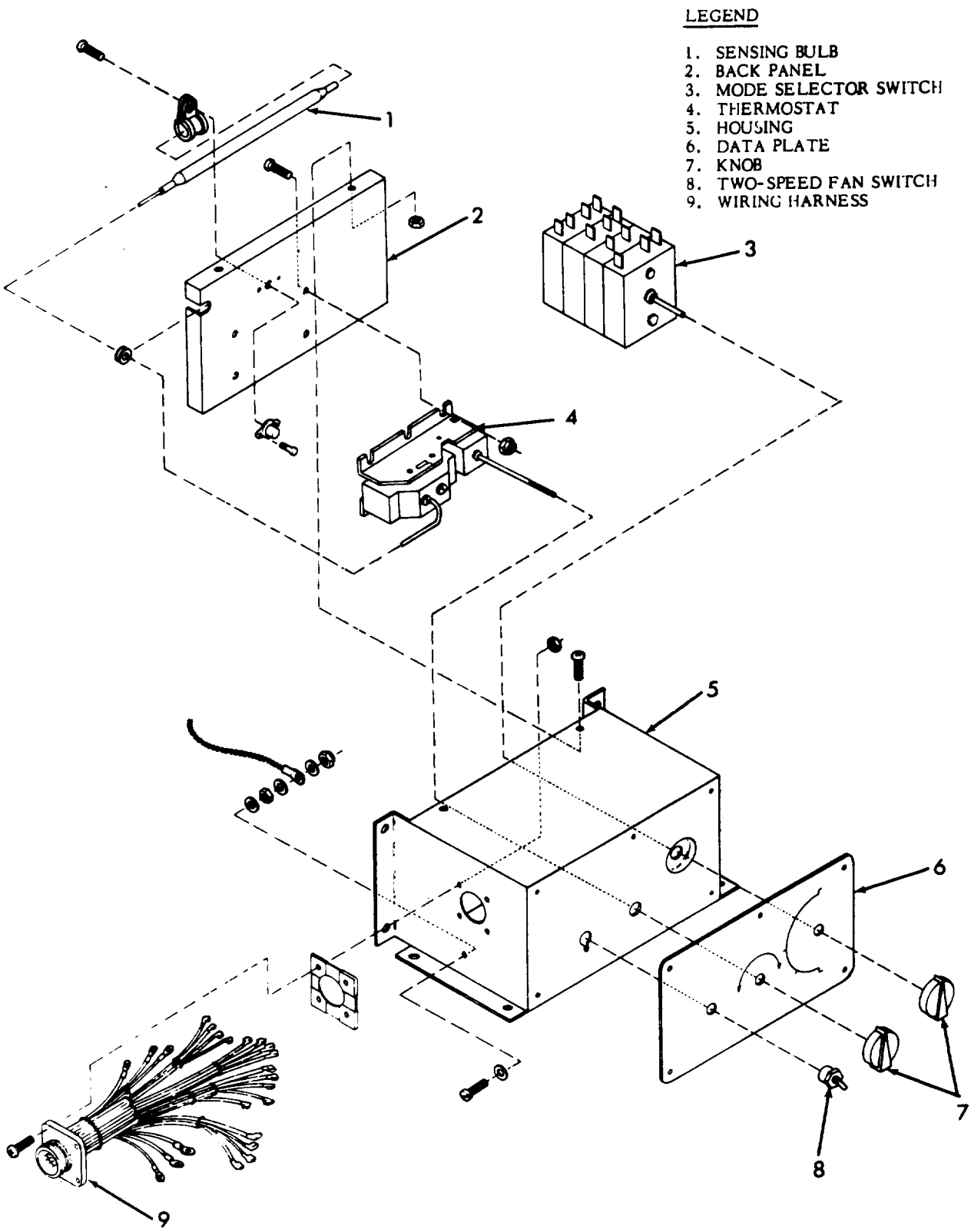


Figure 5-1. Control Panel Details.

5.5. Assembly

Assemble the control panel in accordance with the following instructions.

a. Install the wiring harness receptacle in the wall of the control panel housing, and secure with four screws and self-locking nuts.

b. Connect leads to the grounding stud and to the two-speed fan switch. Install the switch through the hole in the front of the control panel. Secure with a lockwasher and panel mounting nut.

c. Connect wire leads to the mode selector switch, and install the switch through the hole in the front of the control panel. Secure it, with a lockwasher and panel mounting nut.

d. Attach the temperature control thermostat to the rear cover of the control panel assembly, using four screws and self-locking nuts. Connect wire leads to the thermostat. Split and install grommet on capillary tube and install tube and grommet in notch in rear cover.

e. Carefully install rear cover in control panel housing. Secure with four screws and self-locking nuts.

5.6. Installation

Install the control panel assembly in the air conditioner as directed in the following steps:

a. If the control panel is not to be remotely mounted. lead the thermostat sensor bulb and capillary tube through the hole in the right-hand corner of the evaporator air intake chamber. Mount the bulb on the wall, using a loop clamp and screw. Split a rubber grommet radially from the center outward, and install around the capillary tube in the hole. Seal with caulking compound.

b. Position the control panel on the junction box, and secure with four screws through the corners of the mounting flange.

c. Connect plug, P7, to the wiring harness receptacle.

d. Position the lower panel on the air conditioner, and secure with the two panel fastener screws.

e. Install the air filter in retaining channel and spring clip in the air intake chamber, and position the air intake grille on the air conditioner. Secure with the six cam-lock studs in the frame.

Section II. JUNCTION BOX

5.7. Description (See figure 5-2).

The junction box is located just inside the lower panel. It provides housing or mounting facilities for the electrical components that control the automatic switching of power and control circuits to the various operating components of the air conditioner. These components include the control transformer. rectifier, armature relays, the time delay relay, the circuit breaker, and associated fuses and terminal blocks.

5.8. Removal

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

a. Unscrew two panel fastener screws in the top edge of the low panel, and remove the panel.

b. Disconnect plug P7 from the left end of the control panel assembly, then remove four screws from the corners of the control panel mounting flange. Support the control panel out of the way. being careful to avoid kinking the thermostat sensor capillary tube.

c. Unscrew four panel fastener screws in the mounting flanges at each end of the junction box.

d. Bend the end of the push-pull circuit breaker reset flexible cable(8) straight. Loosen the setscrew (6) in the end of the core end fitting (5), and slide off the end fitting.

e. Remove screw from the two loop clamps (9) holding the flexible cable, and remove the flexible cablefrom the junction box and the circuit breaker actuator arm connector plate (7).

f. Full the junction box forward. and disconnect the two wiring harness plugs, P2 and P3. from receptacles (19 and 20) on the junction box.

g. Remove the junction box from the air conditioner.

5.9. Disassembly

Disassemble the junction box only to the extent necessary to test and replace components. in accordance with the following procedure:

a. Unscrew four panel fastener screws from the top and bottom edges of the junction box cover, and remove the cover.

b. Pull fuses (17 and 18, figure 5-2) out of fuse holders.

c. Tag and disconnect wire leads from components.

d. Remove four screws, washers and self-locking nuts from the mounting flanges of each wiring harness receptacle.

NOTE

Components can be tested without removing them from the junction box. Unless complete replacement is necessary, remove only those components that fail to pass inspection/test

e. Remove mounting hardwtue from components as necessary to dismount them from the junction box, and remove the components.

5.10. Inspection/Test

Inspect all parts of the junction box and its components for obvious damage. missing parts, and evidence of electrical failure such as burnt spots or spattered metal. Perform continuity and functional tests on components as indicated in the following steps:

a. Fuses. Remove fuses, one at a time, from fuse holder clips and check continuity with an ohmmeter, multimeter or other continuity tester. Continuity should exist. If it does not. replace the fuse.

NOTE

When continuity testing of components is required, the ohmmeter multi-tester or other continuity tester should be set on low resistance (ohms) for checking continuity of coils, direct connections, etc. For checking possible short circuits, as between coil and casing or common ground, a high-resistance (ohms) setting should be used.

b. Circuit Breaker. Reset the circuit breaker by pressing the handle up, then down. Check continuity of each phase (A1-A2. B1-B2 and C1-C2) and the auxiliary switch (C-NO). If continuity is not indicated in all circuits, replace the circuit breaker. If load testing equipment is available. test each phase (A, B, C) of the circuit breaker. The circuit breaker should hold 20 amperes continuously, and should trip within 0.5-4.0 seconds when a 25-ampere load is applied. If load testing equipment is not available, and circuit breaker trips frequently. substitute a circuit breaker known to be good, and check operation.

c. Heater and Compressor Relays. (K1, K2) Check continuity of terminals X1-X2. If continuity is indicated. apply 26-28 volts dc to terminals X1-X2, and check continuity of terminals A1-A2, B1-B2 and C1-C2. Continuity should exist. If it does not, replace the relay.

d. Two-speed Motor Relays (K4, K5) Check continuity of terminals. X1-X2, A2-A3, B2-B3, C2-C3 and D2-D3. All should indicate continuity. Apply 26-28 volts, dc. to terminals X1-X2, and check continuity of terminals A1-A2, B1-B2, C1-C2 and D1-D2. All should indicate continuity. If continuity requirements are not met, replace the day.

e. Time Delay Relay. (K3). In addition to your usual continuity testing equipment, you will need a clock or watch on which seconds can be read for this test. Proceed as follows:

(1) With the time delay relay disconnected, check continuity between terminals 2 and 4. Continuity should be indicated.

(2) Semi-permanently connect the test prods to terminals 2 and 3. While observing the clock or watch, apply a source of 26-28-volt dc power to the dc terminals of the time delay relay, making sure to apply positive (+) to positive and negative (-) to negative.

(3) Continuity should be indicated after a delay of 19 to 31 seconds. If the delay is not within limits, or if continuity requirements are not met, replace the time delay relay.

f. Transformer (T.) Check continutiy of terminals H1-2 and X1-X2. Continuity should exist. Check continuity between H1 and casing or common ground, and between X-1 and casing or common ground. Continuity should not exist. Connect the test leads of a voltmeter to terminals X1-X2, and apply 208 volts, 50/60 hertz to terminals H1-H2. The voltmeter should indicate 30 ± 3 volts (rms). If transformer does not meet both continuity and voltage requirements, replace it.

g. Terminal Boards, (TB1, *TB2).* Inspect the terminal boards for obvious damage and evidence of electrical failure. Check continuity across each pair of terminals. Replace if damaged or if continuity requirements are not met.

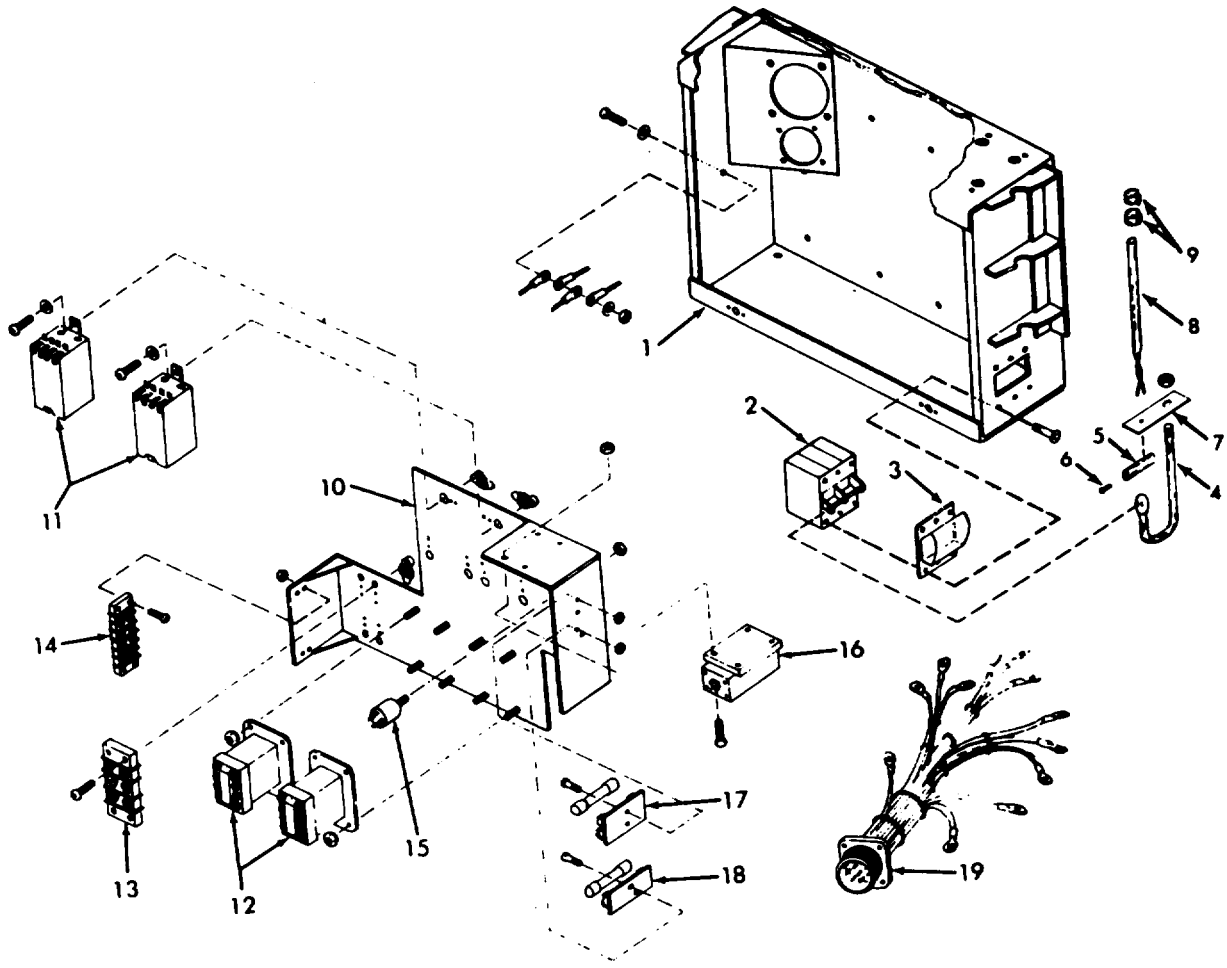
h. Electrical Receptacles. Inspect for deformation. damaged threads and cracked or broken wafers. Check continuity from each pin of the connector to the terminal end of its associated wire lead. Continuity should exist. Check continuity from each pinto the shell of the connector, Continuity should not exist. Replace the receptacles if they indicate damage. or if continuity requirements are not met.

i. Rectifier (CR 1) With an ohmmeter set at 2000 ohms, check for continuity between each terminal and the mounting stud. No continuity should exist. Connect 27-33 volts, 50/60hertz to ac terminals 1 and 4. Using a dc voltmeter, Check terminals 2 (-) and 3 (+) for 26-32 volt dc output. Replace the rectifer if both the continuity and the voltage requirements are not met.

j. Diode Semiconductor (CR2) Apply the test leads of an ohmmeter to the leads of the diode, and observe the meter. Then reverse the leads. and again observe the meter. The meter should indicate resistance in one direction. and show no indication in the other. If the ohmmeter indicates resistance in both directions, the diode is short-circuited; if there is no reading in either direction, the circuit is open. Replace the diode if short- or open-circuit exists.

5.11. Assembly

Position components over studs or anchor nuts, as required, and secure with the appropriate mounting hardware. Install wiring harness receptacles in mounting holes, and secure with four screws, washers and self-locking nuts in each. Connect terminals of wiring harnesses to components as required. (See wiring diagram, figure FO-1 for proper connections.)



LEGEND

1. JUNCTION BOX
2. CIRCUIT BREAKER
3. CIRCUIT BREAKER COVER
4. ACTUATOR ARM
5. END FITTING
6. SETSCREW
7. CONNECTOR PLATE
8. FLEXIBLE CABLE
9. LOOP CLAMP
10. PANEL
11. RELAY
12. RELAY
13. TERMINAL BOARD
14. TERMINAL BOARD
15. RECTIFIER
16. TIME DELAY RELAY
17. FUSE AND FUSE HOLDER
18. FUSES AND FUSE HOLDER
19. WIRING HARNESS
20. WIRING HARNESS
21. COVER

Figure 5-2. Junction Box Details

5.12. Installation

Install the junction box in the air conditioner as directed in the following steps:

a. Connect wiring harness plugs, P2 and P3, to their respective receptacles on the junction box.

b. Insert the end of the circuit breaker reset cable (8, figure 5-2) through the hole in the connector plate (7). Install core end fitting on end of cable, then attach the sheath of the cable to the junction box with two loop clamps (9) and screws, leaving at least 1/4-inch of cable sheath below the bottom loop clamp.

c. Attach the junction box to the support brackets, using four panel fastener screws.

d. Adjust the cable and fitting on the circuit breaker reset cable so that there is 0.12-0.25 inch (3-5mm) between the end fitting and the connector plate when the circuit breaker handle is down and the flexible cable fully extended. Tighten the setscrew in the end fitting, and bend 0.12-0.25 inch (3-5 mm) of the end of the cable 90 degrees.

Section III. RFI FILTER

5.13. Description

Essentially, suppression of radio frequency interference (RFI) is attained by providing a low-resistance path to ground for stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors. The air conditioner's RFI filter consists of a 73 uH choke coil in series with each phase, and capacitors between phases and between each phase and ground. The RFI filter is housed in a metal box mounted at the lower middle of the right side of the casing. It is connected into the power input circuit by means of two wiring harness receptacles.

5.14. Removal

Remove the radio frequency interference (RFI) filter from the air conditioner as indicated in the following proecdure: (see figure 5-3).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Remove eight screws from the four edges of the filter mounting plate.

b. Pull the filter housing and mounting plate outward as far as possible, and disconnect electrical plugs, P10 and P11, from receptacles on the top of the filter housing.

c. Remove six screws near the top and bottom edges of the mounting plate to release the filter housing. Separate the housing from the mounting plate.

5.15. Inspection/Test

Inspect the housing and mounting plate for physical damage such as dents. punctures or cuts. Look for evidence of overheating or burning, melted potting compound, arcing at terminals, etc. Replace the filter if such evidence is fared. Check point-to-point continuity between connector pins as shown in the following Table:

From receptacle J10, pin	To receptacle J11, pin	Indication
A	A	Continuity
A	B	None
A	C	None
A	D	None
B	B	Continuity
B	C	None
B	D	None
C	C	Continuity
C	D	None
D	D	Continuity

If filter does not meet continuity requirements, replace it.

NOTE

Continuity testing does not necessarily predict the behavior of capacitors under load. If the filter still does not operate properly after passing the continuity test, substitute a filter known to be good, and check RFI emission.

5.16. Installation

Install the RFI filter as follows:

a. Position the filter housing (figure 5-3) on the mounting plate and secure with six screws.

b. Connect wiring harness plugs, P10 and P11, to receptacles on top of the filter housing.

c. Insert filter into air conditioner opening, and position mounting plate on casing. Secure with eight screws around edge of mounting plate.

Section IV. COMPRESSOR

5.17. Description

The refrigeration compressor is a self-contained unit which incorporates a reciprocating compressor. a drive motor and a lifetime charge of oil hermetically sealed into a dome-shaped steel housing. A resistance type crankcase heater is mounted around the outside of the compressor housing near the base. The purpose of the crankcase heater is to prevent migratiom of liquid refrigerant into the compressor in cold weather. Liquid refrigerant could mix with the oil, causing the oil to be pumped throughout the system. Also, fluids are incompressible and would cause serious damage to the compressor if permitted to enter it while operating.

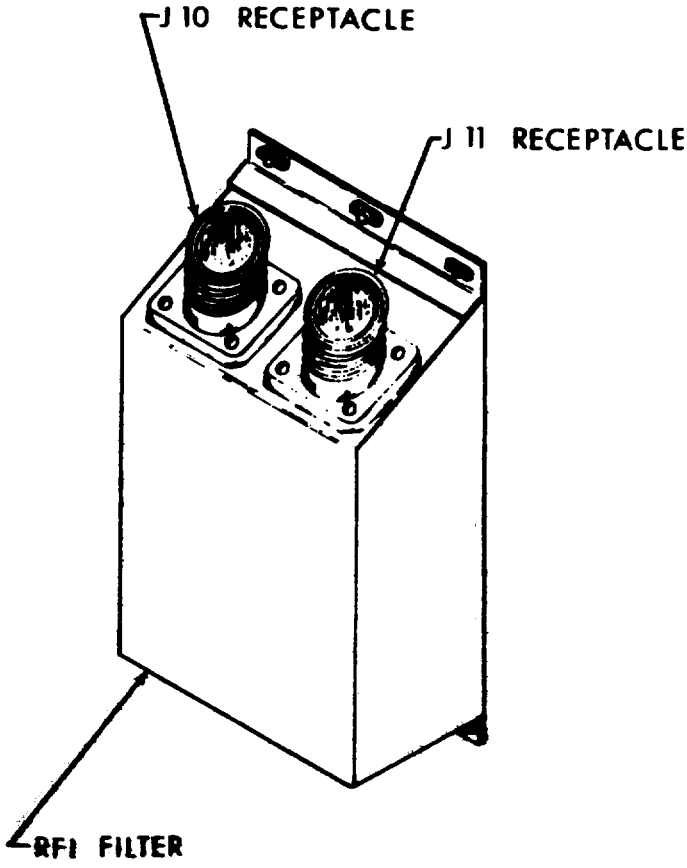


Figure 5-3. RFI Filter Details

5.18. Access

Gain **access** to the compresor as directed in the following procedure:

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

a. Unscrew two panel fastener screws in the upper edge of the lower panel and remove the panel.

b. Straighten the end of the circuit breaker reset cable, loosen the setscrew in the end of the cable end fitting, and remove the end fitting.

c. Remove screws from two loop clamps securing the flexible cable to the junction box, and remove cable from junction box and circuit breaker actuating arm connector plate.

d. Unscrew two panel fastener screws in the mounting flanges at each end of the junction box.

e. Disconnect wiring harness plug from receptacle on left end of control panel assembly, and remove four screws from the corners of the contro lpanel mounting flanges. Reconnect the wiring harness plug to support the control panel assembly.

f. Swing junction box out and disconnect wiring harness plugs from receptacles on near surface. Remove junction box.

5.19. Inspection/Test

Inspect the compresso rfor damage and loose mounting bolts. If damage is evident, test for leaks, using an electronic leak detector, or soap solution to detect bubbles. If mounting bolts are loose, tighten them. If leaks are detected in,@ compressor, discharge the refrigeration system and replace the compressor. If electrical trouble is indicated, check continuity as follow:

a. Disconnect plug, P4, from the electrical junction box on the compressor.

b. Check continuity of the following pain of pins in receptacle J4: Compressor motor windings A-B, B-C and A-C, and the normally closed thermal overload on pins D and E. Also check crankcase heater and thermostat on Pins F and G. Continuity should exist. Continuity should not exist between compressor housing and pins A,B,C, and D. If continuity requirements are not met for pins A,B, and C or pins D and E, replace the compressor. If continuity requirements are not met for pins F and G, replace only the crankcase heater or thermostat as required.

5.20. **Removal of Crankcase Heater**

Remove the crankcase heater from the compressor as directed in the following steps:

a. Remove the retaining spring (7, figure 5-4) from the ends of the crankcase heating element(6).

b. Remove compressor junction box cover (4) and remove electrical receptacle (2) by removing four screws.

c. Unsolder wire lead from heating element at receptacle pin G and cut splice to heater thermostat lead.

d. Spring the ends of the heating element apart slightly so that the heating element can be maneuvered around and over the top of the compressor housing to remove it.

5.21. Installation of Crankcase Heater

Install the crankcase heater as follows:

a. Maneuver the crankcase heating element over the top of the compressor, and down to the lower part of the compressor housing. Do not spread the ends of the heating element any more than necessary. Install retaining spring (7) over both ends of the heating element (6) to hold it in position.

b. Lead electrical wires from heating element (6) into the compressor junction box (3). Slide a one-inch length of heat-shrink tubing over one wire lead, and solder wire to pin G of receptacle (2). Slide heat-shrink tubing over connection, and heat with a match to shrink in place. Splice the other heater lead to the thermostat lead and insulate as necessary.

c. Install the receptacle (2) in the junction box (3), using four screws to secure. Install cover (4) on junction box. Connect wiring harness to receptacle (2).

5.22. Removal of Compressor

Remove the compressor from the air conditioner in accordance with the following procedure.

a. System Discharge. Before removing any refrigeration component from the air conditioner, all refrigerant gas must be discharged from the system. Proceed as follows:

(1) Remove five screws from the frame of the fresh air screen in the upper right-hand corner of the rear surface of the air conditioner. Remove the fresh air screen to obtain access to the suction and discharge service valves.

W A R N I N G

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

NOTE

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 system.

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

(2) Refer to figure 5-8 for identification service valves. Remove caps from both service valves.

(3) Connect and operate a recovery/recycling unit in accordance with manufacturer's instructions.

NOTE

Dry nitrogen is always used to purge the refrigeration system before brazing or debrazing connections, in order to prevent internal oxidation and scaling.

b. Debrazing. Connect a cylinder of dry nitrogen to the gauge port of the discharge service valve. Open *the* cylinder shutoff valve and the discharge service valve slightly, and completely open the suction service valve to purge the system of refrigerant gas. Use 1-2 cfm (0.1-0.2 M^3/minute). With dry nitrogen flowing through the system, debraze tubing connections at any fitting near the compressor that will permit convenient removal. Tubing and fittings attached to the compressor after its removal can be transferred to the replacement compressor before installation in the air conditioner.

c. Dismounting the Compressor.

CAUTION

When hoisting the air conditioner by means of a sling through the handles, use a spreader bar to prevent the sling damaging the casing.

(1) Hoist the air conditioner onto support blocks of sufficient height to permit insertion of a socket wrench through the compressor mounting holes in the base plate.

(2) Remove four shoulder bolts (9) and nuts, (13), four bushings (11) and eight of each size of washers (l0& 12) the four support legs of the compressor (See figure 5-4).

(3) Lever the compressor up, and slide it out of the air conditioner.

5.23. Installation of Compressor

Install the compressor in the air conditioner as directed in the following procedure:

NOTE

If refrigeration piping was disconnected with the compressor being replaced, transfer the piping to the replacement compressor before installing it in the air conditioner.

a. *Mounting.* Set the compressor in position on the base plate of the air conditioner. Lever the compressor up, and insert bushings and washers under support feet (See figure 5-4). Install shoulder bolt and washers from below, and install nut and washer on top of mounting foot.

b. Tubing Connection. Provide a 1-2 cfm (0.1-0.2 M^3/min) flow of dry nitrogen through the refrigeration system, and braze tubing joints to connect the compressor.

c. Replacement of Filter-drier.

NOTE

When the refrigeration system has been opened, a new filter-drier must be installed before re-charging

(1) Unscrew flare nuts from top and bottom connections of the filter-drier.

(2) Remove screw from the band clamp which holds the falter-drier, and remove band clamp and filter-drier.

CAUTION

Do not remove caps from the connections of a new filter-drier until ready to connect system tubing.

(3) Place band clamp on a new filter-drier in such a position that the direction-of-flow arrow will point up when installed. Attach the filter-drier and band clamp to the casing with the screw previously removed, or equivalent.

(4) (Connect tubing to top and bottom of the filter-drier with flare nuts on tubing.

***5.24. Leak* Testing**

Leak test the refrigeration system after repair or replacement of any component. Proceed as follows:

a. Refer to figure 5-8 for identification of service valves. Connect a pressure gauge to the suction service valve, and a cylinder of refrigerant R22 to the discharge service valve. Open both service valves and the cylinder shutoff valve. Let refrigerant flow into the system until the pressure gauge indicates 50 psig (3.5 kg /cm^2). Close cylinder shutoff valve and discharge service valve, and disconnect the refrigerant cylinder.

b. Connect a cylinder of dry nitrogen to the discharge service valve. Open the cylinder shutoff valve and the discharge service valve, and pressurize the system to 350 psig (22 kg/cm^2). Close all three valves and test for leaks, using an electronic leak detector, or the soap bubble method as described below:

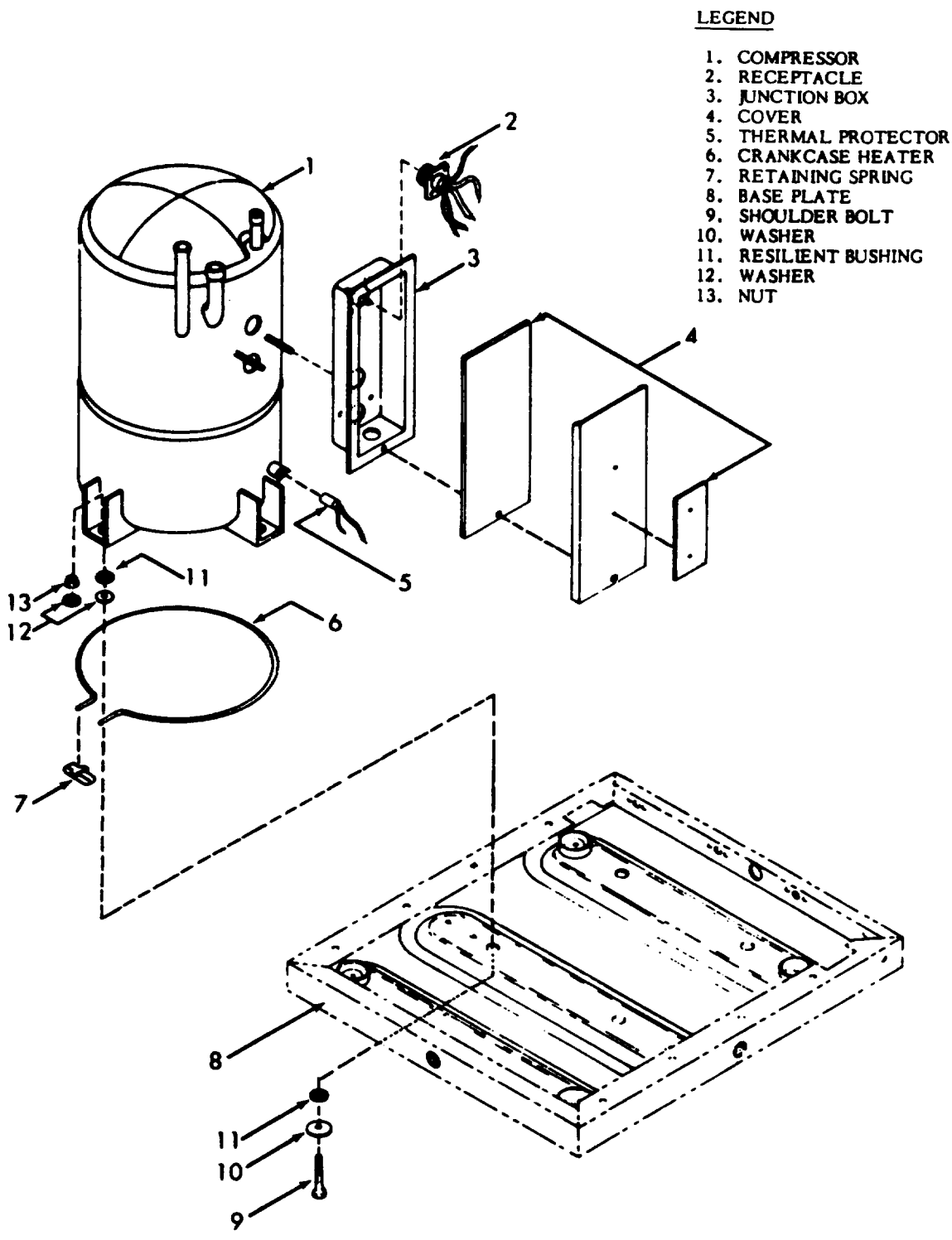


Figure 5-4. Compressor Details

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well ventilated but draft-free area.

(1) Electronic Leak Detector. Turn the electric unit on, and slowly pass the probe around all points of the refrigeration system at which a leak could exist. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections.

(2) Soap Solution. Brush soap solution on all possible points of leakage, and watch for bubbles. Follow a definite sequence to avoid missing any points that should be tested. Wipe the solution from all joints, and mark any point at which a leak is found.

c. If leaks were detected,discharge the system (paragraph 5.22. a), repair leaks and retest as directed above. If the system is leak-tight. double evacuate and charge the system as directed below.

5.25. **Evacuating The System**

Before the system is charged with refrigerant, it must be completely evacuated to exhaust water vapor, non-condensable gases and other impurities which would prevent the system from operating. Proceed as follows:

NOTE

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

a. Refer to figure 5-8 for identification of service valves. Connect a vacuum pump to the suction service valve gauge port, and a vacuum gauge to the discharge service valve gauge port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more thsn 500-microns. Close the suction service valve, and turn the vacuum pump off. Let the unit stand in this condition for at least three hours. If the system holds the vacuum without change of pressure. continue with step b. If the 500-microns vacuum cannot be held for three hours, break the vacuum with dry nitrogen and retest for leaks. If 500-micron vacuum cannot be achieved, one or more of the following reasons may account for the problem.

(1) Presence of water vapor in the system. Continued pumping will correct this condition.

(2) Leaks in the refrigeration system. Break the vacuum with dry nitrogen, and retest fcr leaks.

(3) Internal leakage of vacuum pump. Test the pump by connecting a vacuum gauge directly to the vacuum pump intake and continue to pump. If pump still fails to reach 500 microns. the pump is faulty.

b. With the suction line service valve closed, disconnect the vacuum pump attach a cylinder of dry nitrogen. Leave the connection to the suction service valve somewhat loose, and open the nitrogen cylinder shutoff valve slightly for a few seconds to purge the line of air. Tighten the connection and crack the suction servicevalveopem slightly to break the vacuum. Leave in this configuration until the system reaches atmospheric pressure (760 mm) then close the suction service valve and the cylinder shutoff valve, and disconnect the nitrogen cylinder.

c. Reconnect the vacuum pump to the suction service valve gauge port, and start the pump. Open the suction service valve, and again pump until a 500-micron vacuum is achieved. This double evacuation will remove all traces of water vapor and non-condensable gas from the system. Close the suction service valve, and disconnect the vacuum pump. Close the discharge service valve, and remove the vacuum gauge.

5.26. Charging The System

Refer to figure 5-8 for identification of service valves. Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and open the cylinder shutoff valve for a few seconds to purge the line of air. lighten the service vslve connection. Charge the refrigeration system as directed in the following steps:

CAUTION

Do not attempt to charge liquid refrigerant into the suction line. The compressor would be damaged.

NOTE

Two kinds of refrigerant cylinders are in general use. One is equipped with a single shutoff valve, and must be inverted when charging liquid refrigerant. The other is equipped with a vapor valve and a liquid valve, which makes it possible to charge either liquid or vapor when the cylinder is upright. When using the two-valve cylinder; disregard instructions to position the shutoff valve down, and connect the service line to the liquid valve instead.

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

a. Place there frigerant cylinder on a scale of sufficient capacity. with the shutoff valve down, or suspend the cylinder from a spring or beam scale. with the valve end down

b. Weigh the cylinder, and record the weight.

c. Open the discharge service valve, and slightly open the cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 4.0+0.2-O.l pounds (1.8 + 0.1-0.0kg) of refrigerant have flowed into there refrigeration system, close the discharge service valve and the cylinder shutoff valve.

NOTE

The junction box and control panel assemblies and the lower panel must be in place to operate the air conditioner and to complete the charging operation. If they were removed for maintenance, install them now, in accordance with Chapter 5, Sections I and II

d. Check operation and top off refrigerant as necessary. in the following manner.

CAUTION

If knocking or pounding Is heard when starting the air conditioner, shut down at once and release some refrigerant before attempting another start.

(1) With power connected to the air conditioner, turn the mode selector switch to COOL and the temperature control thermostat to the maximum DECREASE position. Let the air conditioner operate for 15 minutes in this mode. then observe the sight-glass liquid indicator while the air conditioner is running. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(2) Connect the cylinder of refrigerant. R22, loosely to the gauge port of the suction sevice valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright.

(3) With the air conditioner compressor operating, open the suction service valve and the cylinder shutoff valve to charge refrigerant gas into the system. Continue to observe the sight-glass liquid indicator.

(4) When the liquid in the sight-glass liquid indicator runs clear and free of bubbles,close the suction service valve and the cylinder shutoff valve.

(5) Disconnect the refrigerant cylinder. and pressure-test the air conditioner.

5.27. Pressure Testing

Pressure testing the refrigeration system is an important diagnostic procedure which you should perform whenever the system has been newly recharged after replacement of a component or when the air conditioner is operating inefficiently. Pressure testing is accomplished by connecting individual pressure gauges or a refrigeration servicing manifold to the suction line and discharge line service valves. (See figure 5-8 for identification of service valves).

a. Description. Every refrigeration system has its own specific operating pressures for the suction and discharge sides of the compressor at a given ambient temperature.l%e temperature-pressure relationships for the Model F18T-2 air conditioner are shown in Table 5-1.

TABLE 5-1

NORMAL TEMPERATURE - PRESSURE RELATIONSHIPS

95°F (36°C) dry bulb return air to unit					
Outdoor ambient temperature	50°F 10°C	75°F 24°C	100°F 38°C	110°F 43.5°C	125°F 52°C
Gauge Pressures					
Suction (psig) (Kg/Cm^2)	56–60 3.93–4.22	56–65 3.93–4.57	65–75 4.57–5.27	70–80 4.92–5.62	75–90 5.27–6.33
Discharge (psig) (Kg/Cm^2)	135–155 9.50–10.90	185–205 13.00–14.41	275–295 19.33–20.74	375–380 26.36–26.72	400–420 28.12–29.53
	80°F (27°C) dry bulb return air to unit				
Outdoor ambient temperature	50°F 10°C	75°F 24°C	100°F 38°C	125°F 52°C	
Gauge Pressures					
Suction (psig) (Kg/Cm^2)	56 min. 3.93″	56 min. 3.93″	56–65 3.93–4.57	65–75 4.57–5.27	
Discharge (psig) (Kg/Cm^2)	130–150 9.14–10.55	180–200 12.65–14.06	270–290 18.98–20.39	290–410 20.39–28.82	

NOTE: Dry bulb temperatures are measured with an ordinary thermometer

b. Set-up. Prepare the air conditioner for pressure-testing as directed in the following steps:

(1) Make sure that the fresh air damper is completely closed, and that the evaporator air intake and discharge grilles are fully open.

(2) Hang inaccurate thermometer directly in front of the evaporator air intake grille to register “dry bulb return air to unit” temperature.

(3) Hang an accurate thermometer directly in front of the condenser coil guard, making sure that the thermometer is shaded from direct sunlight, to record “outdoor ambient temperature.”

(4) Connect a set of Bourdon-type refrigeration pressure gauges or a refrigeration service manifold to the suction and discharge service valve ports.

(5) If indoor ambient temperature is too low, provide a space heater to raise the “dry bulb return air to unit” temperature to 80°F (27°C).

c. Procedure. Perform the pressure test in the following manner:

(1) Turn the selector switch to COOL, and the temperature control thermostat to maximum DECREASE.

(2) Slowly open the suction line and discharge line service valves to which pressure gauges have beenconnected.

(3) Let the air conditioner operate for at least 15 minutes in the cooling mode, so that all parts of the system are stabilized.

(4) Record the temperatures indicated by both thermometers and the pressures indicated by both pressure gauges.

(5) Compare the readings obtained from pressure testing with the normal ranges shown in Table 5-1.

d. Analysis of Discrepancies. If actual pressure-temperature relationships differ from those shown in Table 5-1, consider the following reasons, and take appropriate action.

(2) If pressures are too low: Check for leaks (paragraph 5.24). repair, recharge the system and repeat the pressure test (paragraphs 5.26 and 5.27).

(2) If pressures are too high: Close the suction service valve, remove the pressure gauge, and bleed off the appropriate amount of refrigerant. Repeat the pressure test.

(3) If discharge pressure is extremely high and suction pressure is extremely low. blockage may exist in the refigeration system. Troubleshoot, correct the trouble. recharge if necessary. and repeat the pressure teat.

e. Completion. After pressure testing has been successfully completed. close both service valves, remove " gauges, install caps on service valves. and install fresh air screen, using five screws to secure it. Remove thermometers from the unit.

5.28. Compressor Motor Burnout.

Burnout of a compressor motor is indicated by lack of continuity of the motor windings and the condition of compressor oil. which must be determined after the compressor has been removed from the refrigeration system. Causes of compressor motor burnout include the following:

a. Low line voltage, which causes motor windings to over heat. Before burning out completely, the overheated windings cause chemical breakdown of the refrigerant and the oil to form sludge and other system contaminants.

b. Loss of refrigerant. An inadequate charge of refrigerant gas in system reduces the amount of cooling gas within the compressor. resulting in gradual overheating of the motor and failure of the winding.

c. High head pressure. High head pressures can be caused by clogged or dirty condenser coils or screens, or by an inoperative condenser fan. High head pressure requires the compressor to work harder, creating additional heat which ultimately can result in motor burnout. Poor ventilation around the condenser. and extremely high ambient temperatures can also cause motor failures.

d. Moisture in system. Leakage of air into the refrigeration system starts a chain reaction which can result in motor burnout. Air contains oxygen and moisture which combine with refrigerant gas to form hydrochloric and hydrofluoric acids. These combine with compressor oil to form an acid sludge which is carried throughout the system, and which attacks the motor windings, causing short circuits and burnout.

5.29. Diagnosing Compressor Motor Burnout

It is important to diagnose the type of compressor motor failure for two reasons. Simple failure, without motor burnout, does not require the extensive cleaning of the entire refrigeration system that burnout requires. Also, motor burnout indicates other problems that have contributed to the failure, and these problems must be corrected or avoided to prevent repetition of the burnout. After removal of a bad compressor from the refrigeration system, remove all external tubing and tip the compressor toward the discharge port to drain a small quantity of oil into a clear glass container. If the oil is clean and clear, and does not have an acrid smell, the compressor did not fail because of motor burnout. If the oil is black, contains sludge and has an acrid odor, the compressor failed because of motor burnout, and the refrigeration system must be cleaned to prevent residual contaminants from causing repeated burnouts when the compressor is replaced.

5.30. Cleaning Out The Refrigeration System After Burnout

You must clean the entire refrigeration system after a burnout has occurred, since contaminants will have been carried to many corners and restrictions in the piping and fittings. These contaminants will soon mix with new refrigerant gas and compressor oil to cause repeated burnouts. To clean the system thoroughly, act as follows:

a. Remove the filter-drier, and blow down each leg of there frigeration system. To do this, connect a cylinder of dry nitrogen to each filter-drier connection, in turn, and open the cylinder shutoff valve for at least 30 seconds at 50 psig (3.5 kg/cm^2) pressure.

b. Connect the two filter-drier fittings with a jumper locally manufactured from refrigerant tubing and fittings, and install a pump. reservoir and filter in place of the compressor. (See figure 5-5).

c. Disassemble both expansion valves and temporarily remove the valve cages. Re-install shell of power assembly, using a locally manufactured gasket between power assembly and body to prevent leakage. Tag and retain valve cages for use at re-assembly.

NOTE

An unused filter-drier or other suitable medium may be used as the filter.

d. Fill reservoir with fluorocarbon refrigerant, R11, and start the pump. Continue filling the reservoir with refrigerant, R11, until it begins to pour out of the return line. Continue flushing for at least 15 minutes.

NOTE

During flushing and back-flushing operations, apply 24 *volts, dc, to the bypass line solenoid valve for a total of approximately 10 minutes of each cycle. This will ensure that the cleaning solvent is forced through all parts of the system.*

e. Reverse the pump connections, replace the filter with a new filtering medium, and back-flush the systemfor an additional 15 minutes.

f. Remove the pump, reservoir, filter and filter-drier jumper. Place an empty container below the compressor connections, and connect a cylinder of dry nitrogen to each filter-drier connection in turn. Blow down each leg of the system at 50 psig (3.5 kg/cm^2) for at least 30 seconds.

g. Disassemble both expansion valves and re-install the valve cages. Install new gaskets, and assemble the valves, making sure that projections on valve cages fit in notches in valve bodies.

h. Disconnect the dry nitrogen cylinder, and immediately install a new filter-drier, making sure that the direction-of-flow arrow points up. Cap or plug compressor connections if compressor is not to be installed immediately.

Section V. PRESSURE SWITCH

5.31. Description

The pressure switch is a SPST switch which is connected in parallel with the manual two-speed fan switch on the control panel. Its function is to connect power to the auxiliary windings of the two-speed fan motor when system pressure increases to a preset point. The increased fan speed, and the resulting increase in airflow around both the condenser and the evaporator coils has a tendency to decrease system pressure. which limits it to a safe and efficient level. Since the pressure switch is connected in parallel with the manual two-speed fan switch it functions only when the manual switch is set at LO SPEED and the air conditioner is operating in the cooling mode. The pressure switch is connected to the refrigeration system at a tee fitting on the discharge side of the compressor. It closes at a pressure of 400 ± 16 psi (28. 12 ± 1.12 kg/cm^2), and opens at a pressure of 350 ± 16 psi (24.6 ± 1.12 kg/cm^2).

5.32. Removal

Remove the pressure switch from the air conditioner in accordance with the following directions:

a. Remove five screws from the frame of the fresh air damper screen, and remove the screen.

b. Refer to figure 5-8 for identification of service valves. Remove the cap from the suction service valve, and discharge the system in accordance with paragraph 5.22.a.

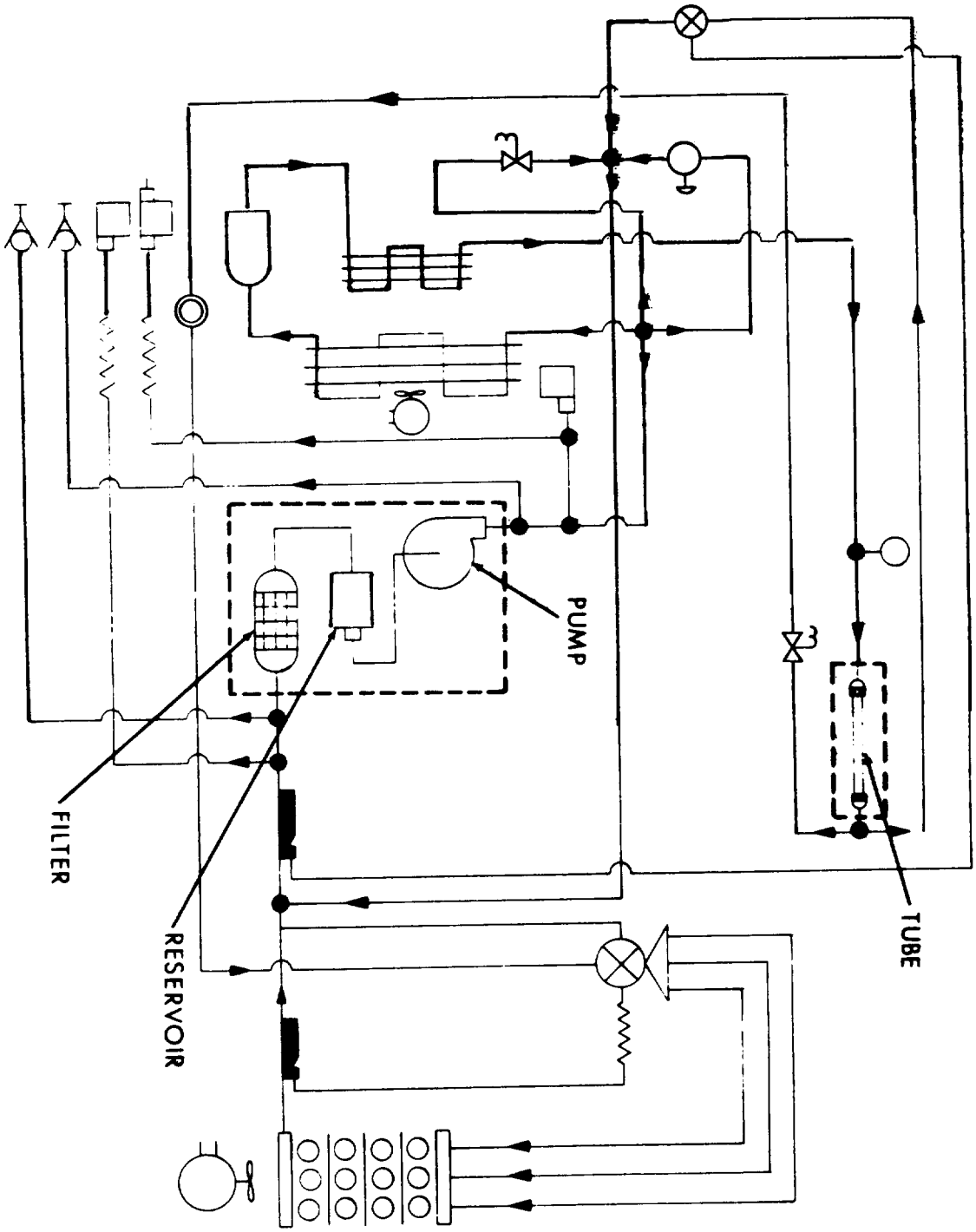


Figure 5-5. Typical Flushing Hook-up.

W A R N I N G

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 or eye-contact is possible.

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

c. Unscrew the two panel fastener screws in the upper edge of the lower panel, and remove the panel.

d. Unfasten six cam-lock stud fasteners from the evaporator intake grille by turning them counterclockwise. Remove the grille and the air filter.

e. Disconnect the wiring harness plug from the receptacle on the left end of the control panel assembly.

f. Remove four screws from the corners of the control panel mounting flanges

g. Remove the screw from the loop clamp holding the thermostat sensor bulb to the wall of the evaporator air intake chamber. Withdraw the control panel assembly from the air conditioner while carefully leading the thermostat sensor bulb and capillary tube through the grommet and hole in the floor of the intake chamber.

h. Loosen the setscrew in the end of the core end fitting on the circuit breaker reset cable. Straighten the end of the cable. and slide off the core end fitting.

i. Remove two screws. and remove two loop clamps holding the circuit breaker reset cable to the junction box. Remove the reset cable from the actuator arm connector plate.

j. Lean the junction box outward, and disconnect the two wiring harness plugs from the rear.

k. From connector plug, P3, which has been disconnected from the junction box, unsolder wires from pins O and g. Release or cut wire ties, and separate wires from cable.

W A R N I N G

Do not perform the following step until all refrigerant has been discharged from the system.

l. Using a wrench on each hex (presssure switch and tee fitting) remove the pressure switch.

5.33. Inspection/Test

Inspect the pressure switch for physical damage, cut or broken wires or missing insulation. Replace if damaged. Test the pressure switch as directed in the following procedure:

a. Connect an ohmmeter, multimeter or other continuity testing device to the wire leads of the switch.

CAUTION

Do not use compressed air to pressurize the switch. Traces of oil, moisture and other contaminants could be carried into the refrigeration system.

b. Connect a cylinder of dry nitrogen to the body of the pressure switch, and slowly pressurize the switch.

c. Observe the pressure gauge and the meter of the continuity tester. Continuity should be indicated when pressure reaches 400 ± 16 psi (28.12 ± 1.13 kg/cm^2).

d. Gradually reduce pressure to the switch while observing the pressure gauge and the continuity tester. Continuity should drop out at 350 ± 16 psi (24.6 ± 1.13 **kg/cm^2).**

e. Replace the pressure switch if it does not meet pressure and continuity requirements.

5.34. Installation

Install the pressure switch in the air conditioner in accordance with the following instructions:

a. Slide a one inch long piece of heat-shrink tubing over each wire lead of the switch, and connect wire leads to pins O and g of connector plug, P3. Solder connections, slide heat-shrink tubing over connection, and use a match or other heating device to shrink tubing onto connection.

b. *C*onnect switch body to tee fitting, using two wrenches to tighten flare nut on switch.

c. Replace falter-drier (dehydrator) as directed in the following procedure:

(1) Unscrew flare nuts from top and bottom connections of the filter-drier.

(2) Remove the screw holding the band clamp to the casing and remove band clamp and falter-drier.

CAUTION

Do not remove caps from the connections of a new filter-drier until ready to connect system tubing.

(3) Place band clamp on a new filter-drier in such a position that the direction-of-flow arrow will point up when installed. Attach the falter-drier and band clamp to the casing with the screw previously removed, or equivalent.

(4) connect tubing to top and bottom of the filter-drier with the flare nuts on the tubing.

d. *Leak* test the refrigeration system in accordance with the instructions in paragraph 5.24.

e. Evacuate and charge the system as directed in paragraphs 5.25 and 5.26. Pressure test as indicated in paragraph 5.27.

5.35. Final Assembly

After successful completion of pressure testing, close both service valves, remove gauges or manifold, and install caps on valves. Assemble the air conditioner as follows:

a. Install the junction box as directed in the following procedure:

(1) Connect electrical wiring harness plugs to receptacles on the rear surface of the junction box.

(2) Insert the end of the circuit breaker reset cable through the hole in the actuator arm connector plate, and install core-end fitting on end of cable.

(3) Attach circuit breaker reset cable to the junction box with two loop clamps and screws. Let atleast 1/4 inch of the cable sheath extend below the bottom loop clamp.

(4) Install the junction box in the air conditioner by securing the mounting flanges to the brackets with four panel fastener screws.

(5) Adjust the circuit breaker flexible cable and the core end fitting by pressing the circuit breaker down,and pressing the actuating knob all the way in. Position the core end fitting 0.12-0.25 inch (3-6 mm) below the connector plate. Bend the last 118-1/4 inch of the cable at right angles.

b. Install the control panel assembly in the air conditioner in the following manner.

(1) Carefully uncoil the capillary tube of the temperature control thermostat, and lead the sensor bulb through the hole and grommet in the floor of the air intake chamber. Secure the sensor bulb with a loop clamp and screw.

(2) Secure the control panel assembly to the mounting braclcets on top of the junction box, using four screws through the corners of the mounting flange.

(3) Connect wiring harness plug to the receptacle on the left end of the control panel assembly.

c. Insert the air filter into the retaining channel, and install retaining strip, the a position the air intake grille on the air conditioner. Secure it by turning six cam-lock studs clockwise.

d. Install the lower panel on the air conditioner, and secure it with the two panel fastener screws in the upper edge.

e. Evacuate and charge the system as directed in paragraphs 5.25 and 5.26. pressure teat as indicated in paragraph 5.27.

f. Close service valves and remove gauges. Install caps on valves. Install fresh air screen and secure with five screws.

Section VI. PRESSURE CUTOUT SWITCHES

5.36. Description

The high-pressure and the low-pressure cutout switches are protective devices which interrupt electrical power to the compressor wherever refrigerant system pressure becomes too high or too low to permit safe, efficient operation. The pressure Connections to the switches are made by means of capillary tubes to the discharge side and suction side of the compressor. Electrically, the two switches are. connected in series between the mode selector switch and the compressor. Both switches reequipped with manual reset buttons. The pressure cutout switches are located next to the fresh air inlet screen on the back of the air conditioner.

5.37. Preliminary Check

Check electrical operation of the pressure cutout switches in the following manner.

a. With the air conditioner operating in the cooling mode, install a yoke-type ammeter around the power supply cable. Note the reading.

b. Press then release each of the pressure cutout met buttons while watching the ammeter. The ammeter reading should drop when each reset button is pressed, and return to its original reading when the button is released.

c. If the ammeter does not respond when each button is pressed and released, replace the proper presure cutout switch.

5.38. Removal

Remove the pressure cutout switches from the air conditioner as indicated below:

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

a. Remove five screws from the frame of the fresh air screen, and remove the screen.

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 system.

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

b. Discharge all refiigerant from the system in accordance with the following instructions:

(1) Refer to figure 5-8 for identification service valves. Remove caps from both service valves.

(2) Connect and operate a recovery/recycling unit in accordance with manufacturer's instructions.

c. Remove 18 screws and washers from the four edges of the fabric cover, and remove the cover.

d. Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

e. Unscrew two panel fastener screws from the upper edge of the lower panel. Remove the lower panel.

f. Release six cam-lock studs in the frame of the air intake grille by turning them clockwise. Remove the grille. Remove two screws and the retaining strip from the right edge of the air filter, and remove the air filter.

g. Remove the control panel assembly from the air conditioner as follows:

(1) Disconnect and remove the wiring harness plug from the left end of the control panel assembly.

(2) Remove the screw and loop clamp which attaches the temperature control thermostat sensing bulb to the wail of the air intake chamber.

(3) Remove four screws from the corners of the control panel mounting range.

CAUTION

Be careful to avoid kinking the capillary tube when removing the thermostat sensor bulb.

(4) Withdraw the sensor bulb and capillary tube through the hole and grommet while removing the control panel assembly from the air conditioner. Carefully coil the capillary tube, and tape it in the cavity in the control panel to protect it from damage.

h. Remove the junction box from the air conditioner as directed below:

(1) Loosen the setscrew in the end of the circuit breaker reset cable end fitting. Straighten the end of the cable, and remove the end fitting.

(2) Remove two loop clamps and screws from the circuit breaker reset cable, and remove the cable from the actuator arm connector plate and the junction box.

(3) Unscrew the four panel fastener screws that secure the mounting flanges of the junction box to the mounting brackets in the air conditioner.

(4) Pull the junction box forward, and disconnect and remove two wiring harness connector plugs from the receptacles on the rear of the junction box. Remove the junction box from the air conditioner.

i. Remove two screws near each end of the pressure cutout switch reset information plate. Leave pressure cutout switch housing in place at this time.

WARNING

Do not perform the following operation until all refrigerant has been discharged from the system.
Escaping refrigerant gas under pressure can cause permanent tissue damage from sudden freezing.

j. Both pressure cutout switch connections to the refrigeration system are located near the compressor the low-pressure-cutout switch in a cross-fitting in the suction line. and the high-pressure switch in a tee fitting (across from the pressure control switch) in the discharge line. Use a wrench on each side of the joint. and unscrew both pressure cutout switch connections.

k. Carefully withdraw pressure cutout switch housing from the air conditioner, leading capillary tubes and electrical wires out as the housing is withdrawn.

539. Disassembly

Disassemble tbe pressure cutout switches and housing as directed below: (See figure 5-6).

a. Remove four screws in the end of the housing, and remove both pressure cutout switches. Becareful to avoid kinking the capillary tubes when removing them from the notches in the edge of the housing.

b. Pry off spring clip on end of pressure cut out switch, and remove the spring clip and the coverfrom the wire connections. Disconnect wires as necessary.

5.40. Inspection/Test

Inspect the housing for physicaJ damage and deformation. Replace if necessary. Inspect the pressure cutout switches for breakage or missing parts. Test the switches as follows:

u. Connect the high-pressure cutout switch to an ohmmeter, multirmeter or other continuity testing device.

CAUTION

Do not use compressed air for testing the pressure cut out switches. Oil, moisture and other impurities could be carried into the refrigeration system.

b. Comect the capillary flare nut to a cylinder of dry nitrogen, and slowly pressurize the switch assembly.

c. When pressure gauge indicates 415 psig (29.17 kg/cm^2)press and release reset button. Continuity should be indicated.

d. Continue the slow pressurization of high-pressure cutout switch: When pressure reaches 460 ± 10 psig (32.34 ± 0.7 kg/cm^2), continuity should drop out.

e. Slowly reduce prssure to 415 ± 10psig (29.17± 0.7 kg/cm^2) and press reset button. Continuity should be indicated.

f Connwt the low-pressure cutout switch to the continuity tester and the source of dry nitrogen, as directed in steps a and b above.

g. Slowly pressurize the switch to 12 psig (0.9km/cm^2) and press reset button. Continuity should be indicated.

h. Continue to pressurize the switch to 415 psig (29.17 km/cm^2). Continuity should be indicated at all times.

i. Slowly reduce pressure. Continuity should drop out at 7 ± 5 psig (0.5 ± 0.35 kg/cm^2).

j. If pressure-continuity requirements are not met, replace the pressure cutout switch.

5.41. Assembly

Assemble the pressure cutout switch housing as follows:

a. Install a 7/16-inch grommet in the hole in one end of the housing. Cement in place. Pull two wire leads through the hole in the grommet.

b. With terminal covers removed from both pressure cutout switches, connect the short wire from terminal 1 of the high-pressure switch to terminal 2 of the low-pressure switch.

c. Connect wire leads to terminal 2 of the high-pressure switch and to terminal 1 of the low-pressure switch. Tag the leads for identification. Install both terminal covers and retaining clips.

d. Install a split grommet on both capillary tubes, and insert the low-pressurecutout switch in the lowerpartof the housing. Secure with two screws. Form the capillary tube along the back and comer of the housing to the left-hand notch. Tag connecting end for identification.

e. Insert the high-pressure cutout switch in the upper part of the housing. Lead capillary tube up to comer and to remain@ notch, Secure switch with two screws. Install capillary tubes and grommets in notches. Tag connecting end for identification.

5.42. Installation

Install the pressure cutout switches in the air conditioner as directed in the following steps:

a. Carefully lead ends of the wire leads and capillary tubes down inside the back of the air conditioner while - placing the switch housing in position. Secure the housing with four screws through the casing into nut plates on the housing.

b. Connect capillary tube from the high-pressure cutout switcb to the tee fitting in the discharge line from the compressor. hand tight. Connect the capillary tube from the low-pressure switch to the cross fitting in the suction line to the compressor, hand tight. Using two wrenches. one on each side of the joint. tighten the connections.

c. Tape or wire-tie wire leads to the wiring harness bundle. Coil slack capillary tubing into 3-inch or larger coils, and tape to a nearby tube or other support.

d. Replace falter-drier (dehydrator) as directed in the following procedure:

(1) unscrew flare nuts from top and bottom connections of falter-drier.

(2) Remove the screw holding the band clamp to the casing. and remove band clamp and filter-drier.

CAUTION

Do not remove caps from the connections of a new filter-drier until ready to connect system tubing.

(3) Place band clamp on a new filter-drier in such a position that the direction-&flow arrow will point up when installed. Attach the falter-drier and band clamp to the casing with the screw previously removed. or equivalent.

(4) Connect tubing to top and bottom of the filter-drier with the flare nuts on the tubing. Use a back-up wrench on the falter-drier connections when tightening flare nuts.

e. Leak-test the system in accordance with the instructions in paragraph 5.24.

f. When the system has been verified free from leaks, install the junction box and control panel assemblies as instructed in paragraph 5.35, steps a and b.

g. Install grilles, panels and fabric cover as directed in the following procedures:

(1) Place top panel in position on top of the air conditioner. Secure with 15 screws and packing washers top, and five screws through the rear flange.

(2) Fit the fabri ccover to the back of the air conditioner, and adjust until eyelets register with screw holes. Secure with 18 screws and washers.

(3) Insert the air filter into the retaining channel and clip. Then position the air intake grille on the air conditioner. Secure it by turning the six cam-lock fasteners clockwise.

(4) Install the lower panel on the air comditioner, and secure it with the two panel fastener screws in the upper edge.

h. Evacuate and charge the refrigeration system as directed in paragraphs 5.25 and 5.26. Pressure test as indicated in paragraph 5.27.

i. Close service valves, and remove gauges. Install caps on valves. Install fresh air screen, and secure with five screws.

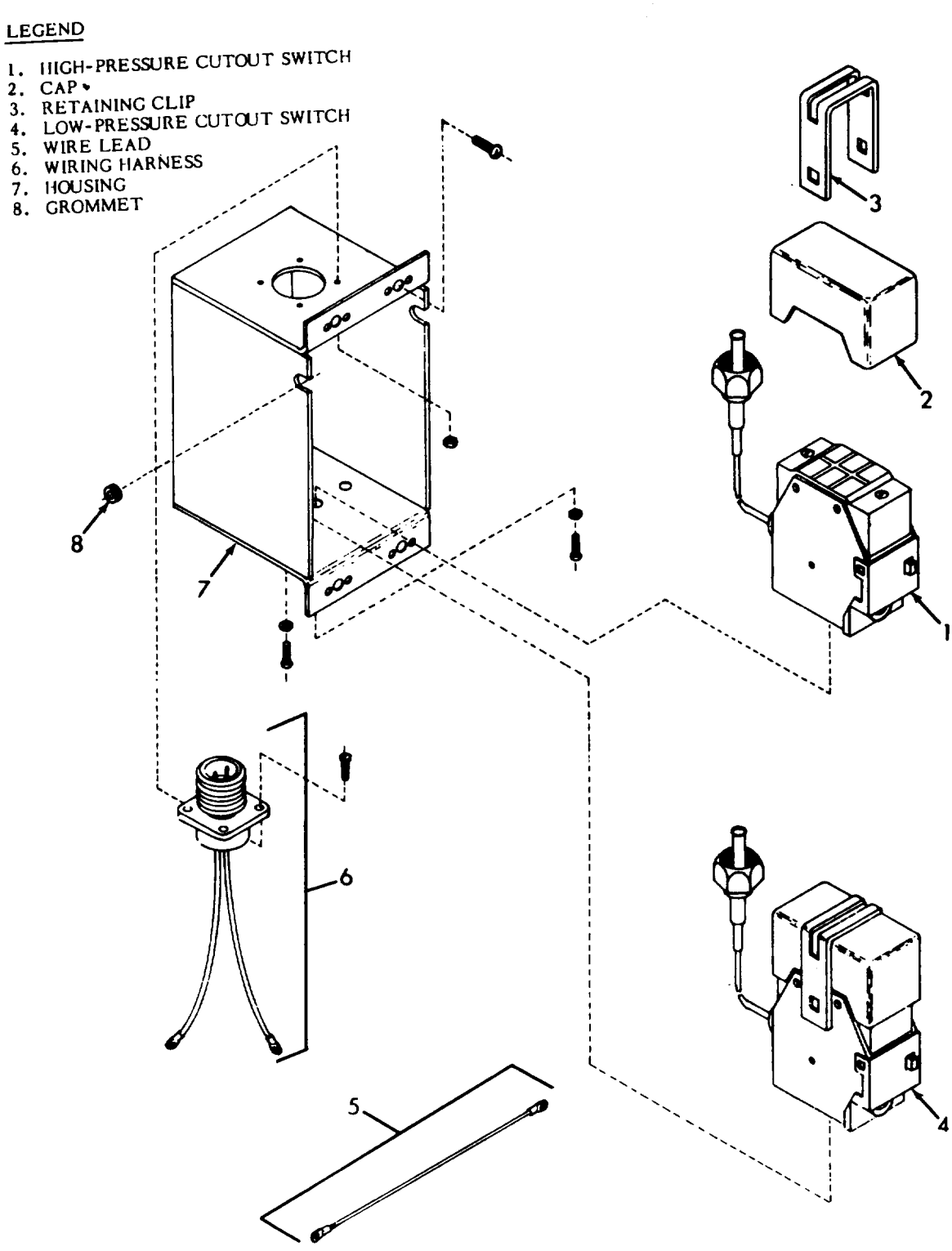


Figure 5-6. Pressure Cut-Ot Switches

Section VII. REFRIGERANT TUBING AND FITTINGS

5.43. Description

Refrigerant tubing is seamless copper which has a bright internal finish to permit thorough cleaning and to prevent entrapment of moisture or other impurities. Both rigid and soft grades are used, depending upon whether the tubing is to be bent or is to remain straight. Sharp changes of direction are accomplished by the use of fittings, such as elbows, tees and creases. Connections are made by silver soldering or brazing, and by flare fittings.

5.44. Inspection/test

Inspect tubing and fittings visually for nicks, cuts, cracks or kinks. If damage appears to be minor, test for leaks. (Refer to paragraph 5.24). If no leaks are detected, consider the tubing serviceable.

5.45. Removal/Installation

a. General. There refrigeration system must be completely discharged (paragraph 5.22.a) before removing any part of the system. If debrazing is required for removal a flow of oil pumped dry nitrogen must be introduced through the system before the joint is heated to brazing temerature. Any refrigerant gas. air or moisture in the system would cause serious corrosion at brazing or debrazing temperature

b. Heating. Sufficient heat should be applied uniformly around the joint to reach the melting point of the filler metal quickly. Slow or non-uniform heating permits heat to be conducted away from the joint, sometimes melting an adjacent joint at the same time as the one intended.

c. Cleaning. Residual filler metal can be removed from a debrazed tube in the folIowing manner.

WARNING

Wear welders gloves or other thermal protective gloves when performing the following operation.

(1) Fold apiece of fiber-glass cloth about 6x6 inches and wrap it loosely around the tubing, a few inches away from the tubing end to be cleaned.

(2) Heat the tubing at the end to recleaned, until the braze filler metal is throughly melted.

(3) Grasp the fiber-glass wrapping firmly, and pull it over the tubing end with a twisting motion.

d. Protection from heat.

WARNING

Polyurethane foam insulation breaks down to form toxic gases when heated to brazing temperature.

(1) When brazing/debrazing refrigerant tubing or fitting near an insulated wall of the air condition, fabricate a sheet metal shield to deflect the flame of the torch away from the insulation. Perform the operation a well ventilated are.a.

(2) When brazing/debrazing to bing from expansion valves, solenoid valves or other component a that could be warped or damaged by brazing temperature, the component should be disassembled to the extent possible, and & body alone brazed/debrazed. If disassembly is impractical or impossible. the entire compontent except for the joints to be heated. should be wrapped in wet cloth to act as a heat sink.

Section VIII. SOLENOID VALVES

5.46. Description (see figure 5-7).

Two solenoid valves are used in the air conditioner, one to close/open the liquid refrigerant line from the condenser coil to the evaporator coil expansion valve, the other to close/open the pressure equalization circuit from the discharge side of the compressor to the suction side. Both valves are alike; however the liquid line solenoid valve is located above and behind the filter-drier in the lower part of the unit, while the pressure equalizer solenoid valve is located in the upper rear part of the air conditioner.

5.47. Acces

a. Gain access to the liquid line solenoid valve in accordance with the following instructions.

(1) Unscrew two panel fastener screws in the upper edge of the lower panel, and remove the panel.

(2) Unfasten six cam-lock studfasteners from thee evaporator air intake grille by turning them counterclockwise. Remove the grille. Remove two screws from the air filter retainer and remove the air filter.

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

(3) Disconnect the wiring harness plug from the receptacle on the left end of the control panel assembly.

(4) Remove four screws from the corners of the control panel mounting flanges.

(5) Remove the screw and loop clamp holding the thermostat sensor bulb to the wall of the evaporator air intake chamber. Withdraw the control panel assembly from the air conditioner while carefully leading the thermostat sensor bulb and capillary tube through the grommet and hole in the floor of the intake chamber.

(6) Loosen the set screw with in end of the core end fitting on the circuit breaker reset cable. Straighten the end of the rest cable, and slide the core end fitting off the cable.

(7) Remove two screws and loop clamps attaching the circuit breaker reset cable to the junction box. Remove the cable from the hole in the actuator arm connector plate.

(8) Unscrew four panel mounting screws from the two end mounting flanges of the junction box.

(9) Lean the junction box outward, disconnect the two wiring harness plugs from the receptacles on the back of the junction box. Remove the junction box from the air conditioner.

b. Gain access to the pressure equalizer solenoid valve as directed in the following procedure:

(1) Remove 18 screws and washers from the four sides of the fabric cover, and remove the cover from the air conditioner.

(2) Remove 15 Screws and packing washers from the top of the panel and five screws from the rear flange. Remove the top panel.

5.48. Inspection/test

Inspect the solenoid valves visually for physical damage, loose connectors, loose coil and housing and broken or frayed wires or missing insulation. Test operation by applying 24-28 volts to to the pins of the electrical connector, and listening for a sharp click which indicates that the solenoid plunger is working properly. If damage is evident or solenoid plunger fails to operate. replace the coil assembly. If valve still does not operate properly, as indicated by pressure testing or troubleshooting, replace the diaphragm or the entire valve, as necessary.

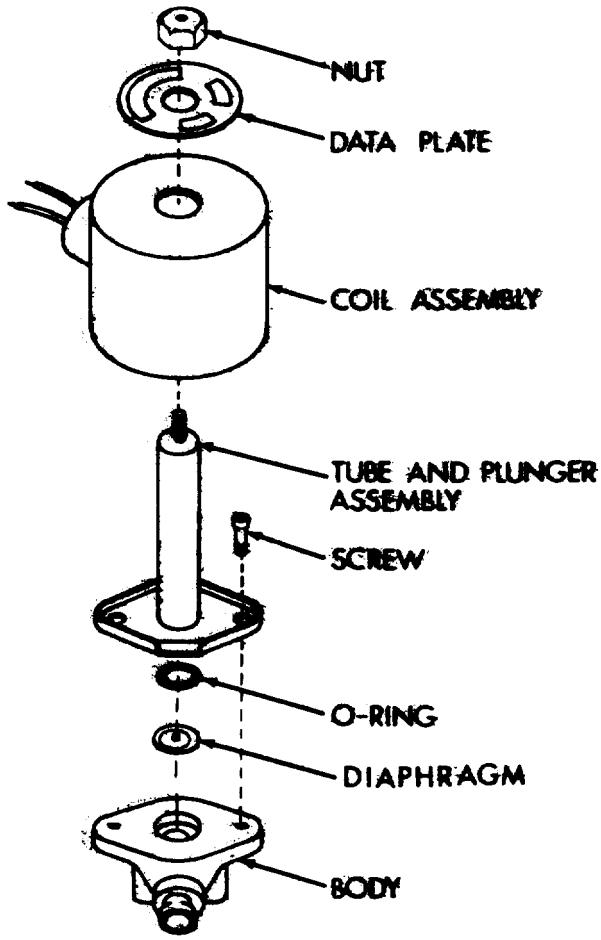


Figure 5-7. Typical Solenoid valve

5.49. Coil Replacement

a. *Removal* Remove the coil assembly in accordance with the following instructions: (See figure 5-7).

(1) Disconnect wiring harness plug from receptacle.

(2) Remove nut and data plate from top of coil assembly, and lift off coil assembly.

b. Installation. If electrical connector is serviceable, transfer it to a new coil assembly, and install the coil assembly on the solenoid valve as follows:

(1) Place coil assembly over tube and plunger assembly. and position data plate on coil assembly. Secure with nut.

(2) Retest plunger operation by applying 24.28 volts dc topins A and B of receptacle. If no click is heard, replace the tube and plunger assembly. diaphragm and O-ring, or if valve body is damaged, replace the entire valve assembly.

(3) If a click is heard when 24-28 volts dc is applied to the solenoid coil, connect the wiring harness electrical plug.

5.50. Valve Replacement

If it is necessary to replace the tube and plunger assembly, diaphragm and O-ring, or the entire valve. proceed as directed in the following procedure:

a. Disassembly. Disassemble the solenoid valve as follows:

C A U T I O N

All gas must be discharged from the refrigeration system before the system is opened for maintenance.

(1) Remove five screws from the fresh hair screen, and remove the screen to gain access to the refrigeration service valves.

(2) Refer to figure 5-8 for identification of service valves. Discharge the system in accordance with paragraph 5.22.a.

(3) Remove coil assembly as directed in paragraph 5.49.

(4) When refrigerant is completely discharged from the system, remove the two screws that fasten the tube and plunger assembly to the body. Remove tube and plunger assembly, O-ring and diaphragm, and discard.

(5) If valve body is serviceable install replacement parts. If valve body is warped or is othewise unserviceable, connect acylinder of dry nitrogen to the discharge service valve, and establish a flow of 1-2cfm (0.1 - 0.2 M^3/min) through the system. Debraze the valve body from the refrigerant tubing.

(6) Remove two mounting screws attaching the valve body to the mounting bracket. Remove the solenoid valve body.

b. Assembly. If valve body was removed, install new body, secure to mounting bracket with two screws, and attach piping connections to body, disassembled from remainder of valve. Proceed as follows:

(1) Wrap the body be tween the tubing connection in wet cloth, and start a 1-2cfm (0.1 -0.2 M^3/min) flow of dry nitrogen through the system. Braze connections. When cool, remove cloth and continue assembly.

(2) Install O-ring in groove in tube and plunger assembly, and place diaphragm in recess in valve body with the metal buffer plate and seat on top.

(3) Carefully place tube and plunger assembly on valve body, and secure with two screws. Tighten uniformly.

(4) Install coil assembly as instructed in paragraph 5.49.

(5) Install a new filter-drier (paragraph 5.55), and leak test as directed in paragraph 5.24.

5.51. Final Assembly

Assemble the air conditioner, evacuate and charge in accordance with the following procedure:

a. Install the top panel, and secure with 15 screws and packing washers in the top surface and five screws in the rear flange.

b. Fit fabric cover onto back of air conditioner, and secure with 18 screws and washers.

c. Install the junction box in the air conditioner as follows:

(1) Connect the two wiring harness plugs to their respective receptacles in the rear surface of the junction box.

(2) Position the junction box against the mounting brackets in the air conditioner, and secure with two panel fastener screws in the mounting flanges at each end.

(3) Insert the end of the circuit breaker cable through the hole in the connector plate, and slide core and fitting over the end of the cable. Tighten the setscrew temporarily to retain cable in place.

(4) Place two loop clamps over the cable sheath, and attach them to the junction box with two screws. Leave at least 1/4 inch between lower edge of bottom loop clamp and end of cable sheath.

(5) Adjust core end fitting so that 0.12-0.25 inch (3-6mm) of clearance is left between the bottom of the connector plate and the core end fitting when the circuit breaker handle is down and the reset cable frilly extended. Bend 0.12-0.25 inch (3-6 mm) of the end of the Cable 90 degrees.

d. Install the control panel assembly as directed in the following steps:

(1) Carefully push the temperature control thermostat sensor bulb through the hole and grommet in the floor of the air intake chamber while positioning the control panel assembly on the junction box. Attach the sensor bulb with a loop clamp and screw.

(2) Mount the control panel assembly on the junction box ans secure through the corners of the mounting flang.

(3) Connect wiring harness plug to receptacle on left end of control pad assembly.

(4) Install air filter in retaining channel and bracket. Tighten two screw in retaining bracket. Position air. intake grille on air conditioner, and secure by turning the six cam-lock studs clockwise.

(5) Install the lower panel on the air conditioner, and secure with two panel fastener screws in the upper edge.

(6) Purge the refrigeration system for 15 minutes with dry nitrogen, then evacuate (paragraph 5.25) and change the system as directed in paragraph 5.26.

(7) Pressure test the system in accordance with paragraph 5.27.

(8) Close both service valves, remove gauges, and place caps on valves. Position fresh air screen on air conditioner, and secure with five screws.

Section IX. FILTER-DRIER (DEHYDRATOR)

5.52. Description (See figure 5-8).

The filter-drier assembly is a metal container which contains dehydrating and filtering media through which the liquid refrigerant must flow from the condenser coil to the evaporator coil. A new filter-drier must be installed in the system whenever the system has been opened. The fiter-drier is located above and to the right of the compressor in the lower part of the air conditioner. It is connected to the refrigerant piping by flare nuts for easy removal and installation.

5.53. Access

Obtain access to the filter-drier as directed in the following procedure:

a. Unscrew two panel fastener screws in the upper edge of the lower panel and remove the panel.

b. Dismount the air in take grille by turning the six cam-lock fasteners counter-clockwise. Remove the grille.

c. Remove the control panel assembly as follows:

(1) Disconnect wiring harness plug from receptacle on left end of control panel assembly.

(2) Remove four screws from the corner of the mounting flanges of the control panel.

(3) Remove a screw from the loop clamp holding the temperature control thermostat bulb, and remove the loop clamp.

(4) Withdraw the control panel assembly from the air conditioner while carefully leading the sensor-bulb and capillary tube through the grommet and hole.

d. Remove the junction box assembly from the air conditioner in the following manner:

(1) Loosen the setscrew in the end of the core end fitting on the circuit breaker reset cable. Straighten the end of the cable, and remove the core end fitting.

(2) Remove two screws from two loop clamps holding the circuit breaker reset cable, and remove the cable from the juntion box.

(3) Unscrew two panel fasteners from each of the two mounting flanges at the ends of the junction box.

(4) Lean the junction box forward, and disconnect the two wiring harness plugs from the receptacles on the back of the junction box. Remove the junction box from the air conditioner.

5.54. Removal

Remove the filter-drier from the air conditioner as directed in the following procedure:

WARNING

All refrigerant gas must be discharged from the system before proceeding with the removal of the filter-drier.

a Discharge refrigerant as directed in paragraph 5.22.a. When all refrigerant has been discharged, remove one screw from the outside of the casing, that holds the filter-drier band clamp.

b. Unscrew the tubing flare nuts from the top and bottom connections of the filte-drier. Remove the filter-drier and band clamp.

c. Loosen the clamping screw on the band clamp, and slide the band clamp from the filter-drier.

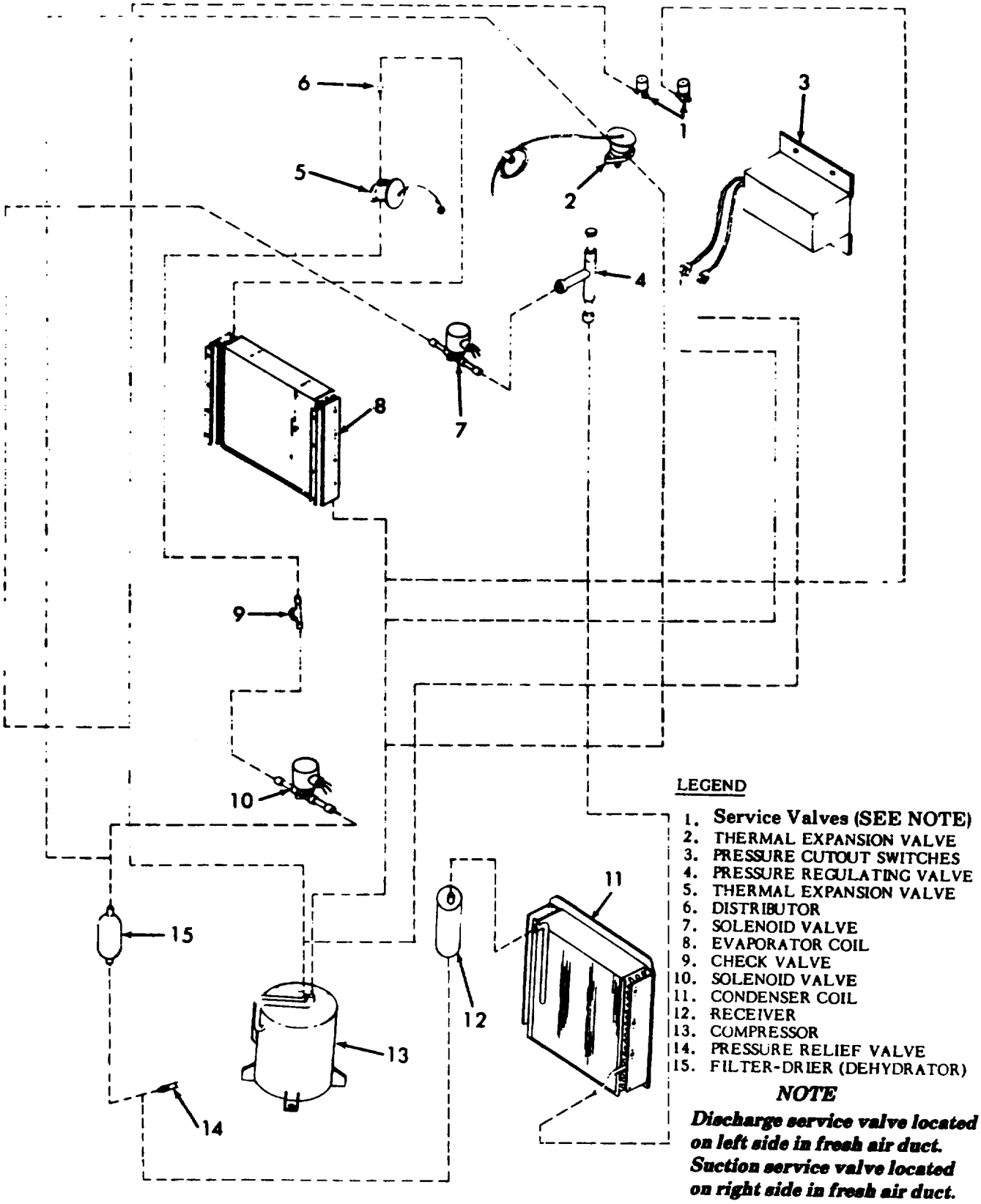


Figure 5-8. Refrigeration Component Layout

5.55. Installation

Install a new fIlter-drier in accordance with the following instructions:

a. Install a new filter-drier in the bandclamp in such away that the direction-of-flow arrow will point up when installed.

b. Install the falter-drier and band clamp in the air conditioner, and secure with the screw removed previously. Check again to be sure that the direction-of-flow arrow is pointing up.

c. Connect refrigerant tubing to the flare fittings on the top and bottom of the filter-drier.

d. Leak test in accordance with paragraph 5.24.

e. Install the juncticm box as directed below:

(1) Connect the two wiring harness plugs to the proper receptacles on the back of the junction box.

(2) Attach the junction box to the mounting brackets in the air conditioner with two panel fastener screws in each end.

(3) Insert the in of the circuit breaker cable in the hole in the connector plate, and slide the core end fitting over the end of the cable. Tighten the setscrew to retain cable in place temporarily.

(4) Place two loopclamps on the reset cable sheath, and attach them to the junction box with two screws. Leave at least 114 inch of sheath extending below the lower loop clamp.

(5) Adjust the core end fitting to provide 0.12-0.25 inch (3-6mm) clearance between the connector plate and the core end fitting when the circuit breaker handle is down and the reset cable is fully extended. Bend 0.12-0.25 inch of the end of the cable 90 degrees.

f. Install the control panel assembly in accordance with the following instructions:

(1) Uncoil the temperature control thermostat capiliary tube, and lead the sensor bulb through the hole in the grommet in the floor of the air intake chamber as you position the control panel assembly on the junction box.

(2) Secure the control panel to the junction box with four screws through the corners of the mounting flange. Secure the thermostat sensor bulb to the wall of the air intake chamber with a loop clamp and screw.

g. Replace panels and grilles as follows :

(1) Install air filter in retainer and spring clip, then install the air intake grille on the front of the air conditioner. secure by turning six cam-lock studs clockwise.

(2) Install the lower panel, and secure with the two panel fastener screws in the upper edge.

h. Evacuate and charge the air conditiouer as directed in paragraphs 5.25 and 5.26.

i. Pressure test the system as instructed in paragraph 5.27.

j. Remove gauges. and replace caps on service valves. Install fresh air screen, and secure with five screws.

Section X. SIGHT-GLASS LIQUID INDICATOR

5.56. Description (See figure 2-1).

The sight-glass liquid indicator is a circular sealed window in the liquid side of the system between the liquid line solenoid valve and the evaporator coil expansion valve. The indicator is located on the rear surface of the air conditioner, below the pressure cutout switches.

5.57. Inspection

Visually inspect the sight-glass liquid indicatcr for physical damage, cracked or broken sight-glass or similar defects.

5.58. Access

Before removing the sight-glass liquid indicator from the refrigeration system. the system must be completely discharged. Proceed-as follows:

a. Remove five screws from the fresh air screen, and remove the screen.

b. Refer to figure 5-8 for indenification of service valves. Discharge the system in accordance with paragraph 5.22.a.

c. While waiting for the system to discharge, remove panels and grilles as follows:

(1) Remove 18 screws and washers from the four sides of the fabric cover, and remove the fabric cover.

(2) Remove 15 screws and packing washers from the top panel, and five screws from the rear flange. Remove the top panel.

(3) Remove the air intake grille by turning six can-lock studs clockwise. Remove the air filter by removing two screws from the retainer and pulling out the filter.

(4) Unscrew two panel fastener screws in the upper edge of the lower panel, and remove the panel.

d. Remove the control panel assembly and the junction box in accordance with paragraph 5.53.

e. Remove the four screws from the ends of the pressure cutout switch housing, and move the housing aside to permit access to the sight-glass liquid indicator.

5.59. Removal

Remove the sight-glass liquid indicator from the air conditioner as follows:

WARNING

All refrigerant gas must be discharged from the system, and a flow of dry nitrogen connected to the discharge service valve before removing the sight-glass.

a. Remove two screws and lockwashers from the sides of the bracket, and remove the bracket and spacer from inside the air conditioner.

b. With dry nitrogen flowing through the system, debraze joints of the sight-glass liquid indicator, and remove the indicator from inside the air conditioner.

5.60. Installation

Install the sight-glass liquid indicator as directed in the following procedure.

a. Connect tubing to sight-glass, and place spacer between sight-glass and casing.

b. Place bracket over back of sight-glass assembly, and secure through the casing with two screws and lockwashers.

c. With dry nitrogen flowing through the system at 1-2 cfm (0.1 -0.2 M^3/min), braze tubing joints to sight-glass liquid indicator.

d. Leak-test as directed in paragraph 5.24.

5.61. Assembly

a. Assembly and charge the air conditioner in accordance with the following procedure:

b. Position the pressure cutout switch housing properly, and secure with four screws.

c. Install a new filter-drier, and complete the assembly of the air conditioner as directed in paragraph 5.55.

Section XI. PRESSURE REGULATING VALVE

5.62. Description (See figure 5-8).

The pressure regulating valve is functionally apart of the bypass circuit, and opens when suction pressure drops below a preset level. When the valve opens, it bypasses refrigerant gas to the suction side of the compressor to prevent the formation of low suction pressures. If pressure testing indicates that the suction pressure is out of limits, adjustment of the pressure regulating valve will usually correct the trouble. The pressure regulating valve is located in the top of the air conditioner, in front of the pressure equalizer solenoid and liquid quench expansion valves.

5.63. Access

In order to adjust or to replace the pressure regulating valve, gain access to it as described below:

a. Remove 18 screws and washers from the four sides of the fabric cover, and remove the cover.

b. Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

c. Remove five screws from the fresh air screen, and remove the screen.

5.64. Inspection/Test

visually inspect the pressure regulating valve for physical damage. Test for proper operation of the valve by pressure testing the system in accordance with paragraph 5.27. If minimum suction pressure is out of limits, adjust the pressure regulating valve.

8-23. Adjustment

Adjust the valve by removing the knurled screw-cap from the top of the pressure regulating valve, and adjusting the internal screw while observing the suction line gauge. Turning adjustment clockwise raises the suction pressure. When the gauge indicates the proper suction pressure, replace the knurled screw-cap snugly on the valve.

8-24. Removal

WARNING

All refrigerant gas must be discharged from the system before removing the valve.

a. Discharge the system in accordance with paragraph 5.22.a.

NOTE

While discharging the system, you can remove additional panels and grilles, junction box and control panel assembly, which provide access to the filter-drier.

b. Remove the air intake grille by turning six cam-lock studs clockwise. Remove the air filter by removing two screws in retainer and pulling out the filter.

c. Unscrew two panel fastener screws in the upper edge of the lower panel, and remove the panel.

d. Remove the control panel assembly and the junction box in accordance with paragraph 5.53.

e. Connect a cylinder of dry nitrogen to the discharge service valve, and initiate a 1-2 cfm (0.1-0.2 M^3/min) flow through the system.

f. Debraze the two tubing joints at the pressure regulating valve, and remove the valve.

5.65. Installation

Install the pressure regulating valve in the air conditioner as follows:

a. Connect tubing ends to the valve, and braze in place. Wrap valve in wet cloths to act as a heat sink.

b. Leak-test as instructed in paragraph 5.24.

c. Install a new filter-drier, and complete the assembly of the air conditioner as directed in paragraph 5.55.

Section XII. PRESSURE RELIEF VALVE

5.66. Description (See figure 5-8).

The pressure relief valve is a conventional spring-loaded relief valve. located on a tee fitting just below the filter-drier. The relief valve is preset at 540±54 psi (38±3.8 kg/cm^2). The valve is equipped with 1/4 - 18 NPTF Dryseal pipe threads so that it can be screwed into the tee.

5.67. Access

Obtain access to the pressure relief valve and the be refrigeration service valves in accordance with the folbwing instructions:

a. Unscrew two panel fastener screws from the upper edge of the lower panel, and remove the panel.

b. Remove the air intake grille by turning six camlock studs counter-clockwise to release the grille. Remove two screws from the filter retaining strip and remove the strip and filter.

c. Remove five screws from the fresh air screen, and remove the screen.

d. Remove the control panel assembly by disconnecting the wiring harness plug from the left end of the control panel assembly.

(1) Remove four screws from the corners of the mounting flange.

(2) Remove the screw and loop clamp securing the temperature control thermostat sensor bulb to the wall of the air intake chamber.

(3) Carefully lead the sensor bulb and capillary tube out through the grommet and hole while with-drawing the control panel assembly from the air conditioner.

e. Remove the junction box from the air conditioner as follows:

(1) Loosen the setscrew in the nd of the core end fitting. Straighten the end of the circuit breaker reset cable, and remove the amend fitting.

(2) Remove the two screws and loop clamps securing the circuit breaker reset cable to the junction box, and withdraw the reset cable from the actuator arm connecting plate.

(3) Unscrew two panel fastener screws from the mounting flanges on each end of the junction box.

(4) Pull the junction box forward, and disconnect the two wiring harness plugs from the receptacles or the rear surface of the junction box.

(5) Remove the junction box from the air conditioner.

5.68. Removal.

Refer to figure 5-8 for identification of service valves, proceed to remove the pressure relief valve as follows:

a. Discharge the refrigeration system in accordance with paragraph 5.22.a.

b. When all refrigerant gas has been discharged from the system, unscrew and remove the pressure relief valve. Use a back-up wrench to prevent damage to refrigeration system tubing.

5.69. Installation

a. Wrap Teflon pipe tape around the threads of the replacement pressure relief valve, and screw the valve into the tee. Use a backup wrench on the tee to prevent damage when tightening the valve.

b. Replace the filter-drier, and complete the assembly of the air conditioner as directed in paragraph 5.55.

Section XIII. RECEIVER

5.70. Description (See figure 5-8).

The receiver is a small cylindrical tank in the line between the condenser coil and the sub-cooler section of the condenser coil. Its function is to act as a reservoir for liquid refrigerant, which tends to stabilize operation of the refrigeration system. The receiver is located on the left side of the air conditioner, just in front of the condenser coil.

5.71. Access

To gain access to the receiver, it is necessary to remove the lower panel and the compressor (Refer to paragraphs 5.18 and 5.22).

5.72. Removal

Remove the receiver from the air conditioner as instructed below:

a. Remove two screws and lock washers that secure the receiver support bracket from the outside of the casing.

b. With a flow of dry nitrogen connected to the discharge service valve, and the compressor discharge connection capped or plugged to prevent escape of the nitrogen at that point, debraze the tubing connections from the receiver, starting with the top connection.

c. Withdraw the receiver, band clamp and support bracket as a unit.

d. Loosen the clamping screw in the band clamp, and slide the clamp from the receiver.

5.73. Installation

Install the receiver as directed in the following procedure:

a. Place the receiver in the band clamp, and tighten the clamping screw finger tight.

b. Install the receiver, band clamp and support bracket into the air conditioner as a unit. Secure the support bracket with two screws and lock washers from outside the casing.

c. Make tubing connections from the condenser coil to the receiver, and tighten the clamping screw in the band clamp.

d. Restart the flow of dry nitrogen, and braze tubing joints to the receiver.

e. Install the compressor and a new falter-drier as directed in paragraph 5.23.

f. Leak-test in accordance with paragraph 5.24.

g. Install the junction box in accordance with the following instructions:

(1) Connect the two wiring harness plugs to the receptacles on the rear surface of the junction box.

(2) Temporarily disconnect the wiring harness lug from the control panel assembly, and install the control panel assembly on the junction box. Position the temperature control thermostat sensor bulb through the hole and grommet in the floor of the air intake chamber and attach in place. Secure with four screws through the corners of the control panel mounting flange. Reconnect the wiring harness plug to the control panel receptacle.

(3) Insert the end of the circuit breaker reset cable into the hole in the actuator arm connector plate. Slide the core end fitting over the end of the cable, and tighten the setscrew finger-tight.

(4) Install two loop clamps on the circuit breaker reset cable, leaving at least 1/4inch of sheath below the bottom loop clamp, Secure with two screws.

(5) Adjust core end fitting to provide 0.12-0.25 inch (3-6 mm) clearance below actuator arm connector plate when circuit breaker handle is down and cable is fully extended.

h. Install the lower panel, and secure with two panel fastener screws in the upper edge of the panel.

i. Evacuate and charge the refrigeration system as directed in paragraphs 5.25 and 5.26.

j. Pressure-test the system in accordance with paragraph 5.27.

k. Close both service valves, remove gauges, and inatall caps on valves. Install fresh air screen, and secure with five screws.

Section XIV. SYSTEM SERVICE VALVES

5.74. Description (See figure 5-8).

Access to the internal refrigeration system is provided by the two system service valves, located just inside the fresh air screen. The valves are connection points for pressure and vacuum gauges, nitrogen for purging and leak-testing, and for charging refrigerant into the system.

8-35. Inspection/Test

Visually inspect the service valves for physical damage, broken chains and missing caps. Replace missing or broken parts or damaged valves. Test for leaks, both with caps snugly screwed on and with caps off, in accordance with paragraph 5.24. If leaks are detected with caps off, the valves are faulty. If leaks are detected with the caps on, the flare nut connections are probably faulty.

8-36. Removal

Remove the service valves from the air conditioner in accordance with the following instructions:

a. Remove five screws from the fresh air screen, and remove the screen.

b. Refer to figure 5-8 for identification of service valves. Discharge the system in accordance with paragraph 5.22.a.

WARNING

Make sure that all refrigerant gas has been discharged from the system before proceeding.

c. The inner end of each service valve is connected to the refrigeration piping with a flare nut. Disconnect by unscrewing the flare nut.

d. Two screws and lock washers hold each valve body to the floor of the fresh air intake chamber. Gain access to these screws by removing the condenser fan guard and impeller in the following manner.

(1) Remove eight screws and lock washers from the rim of the condenser fan guard, and remove the fan guard.

(2) Loosen two setscrews in the hub of the condenser fan impeller, and pull off the impeller. Use two jack-screws in the threaded holes in the face of the hub if necessary to remove the impeller.

e. Remove two screws and lock washers from below each service valve body, and remove the valves.

5.75. Installation

Install the system service valves in the air conditioner as directed in the following procedure:

a. Screw the flare nut onto the connecting end finger tight.

b. Install two screws in each valve body through the floor of the fresh air chamber from below.

c. Tighten the flare nuts.

d. Replace the filter-drier, leak-test, evacuate and charge the system as instructed in paragraphs 5.53 through 5.55.

Section XV. THERMAL EXPANSION VALVES

5.76. Description (See figure 5-9).

Two thermal expansion valves amused in the F18T-2 Air Conditioner. One meters liquid refrigerant into the evaporator coil, through a distributor which disperses the liquid refrigerant into several parts of the coil. The other injects liquid refrigerant into the recirculating gas in the bypass circuit to maintain the temperature of the gas below its extreme limit. Both valves respond to temperature changes in the refrigerant suction line to which their remote bulbs are attached. The effects of pressure-drop across the evaporator coil are canceled by a pressure equalization line from the evaporator thermal expansion valve to the downstream (suction) end of the evaporator coil just beyond the sensing bulb. This pressure equalization permits the valve to respond more quickly to temperature variations alone. Since pressure-drop in the liquid quench circuit is insignificant, the liquid injection expansion valve is equalized internally. Both valves are hermetically sealed to their sensing bulbs and capillary tubes.

5.77. Access

To gain access to the two thermal expansion valves, and their associated sensing bulbs, proceed as follows:

a. Remove 18 screws and washers from the four sides of the fabric cover, and remove the cover.

b. Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

c. Remove eight screws and lock washers from the condenser from guard, and remove the fan guard.

d Loosen two setscrews in the hub of the condenser fan impeller, and pull off the impeller. Use two jackscrews in the holes in the face of the hub to start removal, if-necessary.

e. Cut insulation away from sensing bulb and band clamp. Remove clamping screw from band clamp. and remove sensing bulb.

5.78. Testing

Both expansion valves are tested in the same manner. Proceed as follows:

NOTE

Because the condenser fan impeller and the top panel were removed for access, the condenser coil will be without airflow. Provide temporary airflow for the following test, by placing a high-velocity fan or centrifugal blower directly in front of the condenser coil, and as close to it as possible.

a. With the air conditioner stopped, let the suction line warmup to ambient temperature.

b. Remove the sensing bulb from its location against the suction line, and place it in a container of ice water or crushed ice (32°F or 0°C.

CAUTION

Do not let liquid refrigerant flood back into the compressor any longer than 1-2 seconds. The expansion valve will be wide open during the following procedure. Excessive flood-back of liquid refrigerant will damage the compressor.

c. Start the air conditionerby setting the selector switch at COOL, and the temperature control thermostat maximum DECREASE. Remove the sensing bulb from the ice water, and hold it in one hand to warm it while feeling the suction line. If the suction line temperate drops, the valve is operating properly. Stop the air conditioner at once, and re-install the sensing bulb. If the temperature of the suction line does not drop, stop the air conditioner and replace the expansion valve.

5.79. Adjusting Superheat

A refrigerant gas is said to be superheated when its temperature is higher than the evaporating temperature corresponding to its pressure at saturation. When a thermal expansion valve is set for optimum superheat (in this case 6°F or 3.3°C above the evaporating temperature of the refrigerant at a given pressure) the evaporator coil operates at maximum efficiency. That is, the refrigerant gas does not become warm before reaching the end of the coil, which would reduce the coil's cooling capacity, and the refrigerant does not remain in the liquid state after passing completely through the coil, which could result in severe damage to the compressor. When the expansion valve is properly adjusted, the temperature difference (TD) across the evaporator should be 18-22 degrees F while the air conditioner is operating normally. Compare the dry bulb temperatures of air entering and leaving the evaporator to find the TD. The temperature at the evaporator discharge grill will depend upon the return air temperature. The superheat setting of a thermal expansion valve can be adjusted by varying the setting of a compression spring (7, figure 5-9) in the power assembly of the valve. This spring tends to hold the valve closed against the pressure in the sensing bulb and capillary tube; therefore, the greater the spring pressure, the higher the superheat. Check superheat, and adjust if necessary, in accordance with the following procedure:

CAUTION

Adjusting the expansion valve to increase refrigerant flow lowers evaporator discharge temperature; however, this could cause a floodback and damage the compressor. If refrigerant is fed too quickly, the evaporator will flood, causing "sweatback" or "frostback" down the suction line.

a. Remove insulation from a spot on the suction line near the sensing bulb of the thermal expansion valve to be adjusted.

b. Install an accurate thermometer or the probe of a thermocouple on the bare spot, using a small gob of thermal mastic, if available to improve conductivity. Tape the thermometer bulb or thermocouple junction in position, and cover with insulating material.

c. Connect a suitable pressure gauge to the suction service valve, and open the valve.

Table 5-2. Pressure-Temperature Relationship of Saturated Refrigerant-22

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	Psig	kg/cm²	Deg F	Deg C	Psig	kg/cm²
10	-12.3	32.93	2.315	66	18.9	114.2	8.029
12	-11.1	34.68	2.439	68	20.0	118.3	8.318
14	-10.0	36.89	2.593				
16	- 8.9	38.96	2.739	70	21.1	122.5	8.612
18	- 7.8	41.09	2.889	72	22.2	126.8	8.915
				74	23.3	131.2	9.225
20	- 6.6	43.28	3.043	76	24.4	135.7	9.541
22	- 5.5	45.23	3.180	78	25.6	140.3	9.864
24	- 4.3	47.85	3.364				
26	- 3.4	50.24	3.532	80	26.7	145.0	10.195
28	- 2.2	52.70	3.705	82	27.8	149.8	10.522
				84	28.9	154.7	10.877
30	- 1.1	55.23	3.883	86	30.0	159.8	11.236
32	0	57.83	4.066	88	31.1	164.9	11.594
34	1.1	60.51	4.254				
36	2.2	63.27	4.448	90	32.2	170.1	11.960
38	3.3	66.11	4.648	92	33.3	175.4.	12.332
				94	34.5	180.9	12.719
40	4.4	69.02	4.853	96	35.6	186.5	13.113
42	5.5	71.99	5.062	98	36.7	192.1	13.506
44	6.6	75.04	5.276				
46	7.7	78.18	5.497	100	37.8	197.9	13.914
48	8.8	81.40	5.723	102	38.9	203.8	14.329
				104	40.0	209.9	14.758
50	10.0	84.70	5.955	106	41.1	216.0	15.187
52	11.1	88.10	6.257	108	42.2	222.3	15.630
54	12.2	91.5	6.433				
56	13.3	95.1	6.686	110	43.3	228.7	16.080
58	14.5	98.8	6.947	112	44.4	235.2	16.537
				114	45.6	241.9	17.008
60	15.6	102.5	7.206	116	46.7	248.7	17.486
62	16.7	106.3	7.474	118	47.8	255.6	17.971
64	17.8	110.2	7.748				

d. Operate the air conditioner in the cooling mode for about 30 minutes, observing the thermometer or thermcouple dial to see that the temperate has stabilized. When the temperature remains unchanged for at least two minutes, record the temperature and pressure.

e. Compare the recorded temperature and pressure with those in Table 5-2. Each expansion valve should register higher than the values in the Table by the following amount.

(1) Evaporator expansion valve: 6° ± 1.5° For 3.3° ± 0.8°C

(2) Quench expansion valve: 30.4° ± 0.5° For 16.7° ± 0.3°C

f. If the superheat setting is not within the limits shown above (higher than values in Table 5-2), adjusting the expansion valve as follows: (See figure 5-9).

(1) Remove the hexagonal seal cap (2, figure 5-9) from the side of the powe rassembly (1), and loosen the bonnet seal (3).

(2) Turn the adjusting stem (5) two complete turns to change superheat one degree F. Turn clockwise to raise, and counterclockwise to lower. the superheat setting. Do not turn more than two full turns. then wait two minutes for temperature to stabilize before observing temperature and pressure readings.

(3) When the proper setting is obtained, replace the screw cap and seal on the valve adjusting stem (5).

g. Remove the thermometer or thermocouple probe from the suction line. and replace the insulating material. Close the suction service valve, remove the pressure gauge, and install the capon the service valve gauge pat.

5.80. Removal

Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system (paragraph 5.22.a). Refer to figure 5-8 for identification of service valves. Remove the expansion valve from the air conditioner as directed in the following steps: (See figure 5-9).

a. Remove insulation and band clamp from sensing bulb. Carefully detach bulb and capillary tube.

b. Remove two capscrews (10) securing the power assembly (1) to the valve body (9). Remove the power assembly, capillary tube and sensing bulb.

c. Remove two cap screws that secure the vavle body to the support bracket. Detach equalizer line, if applicable.

CAUTION

Maintain a 1-2cfm (0.1 -0.2M3/min) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components

d. Debraze tubing connections. Remove valve body (9).

5.81. Installation

Install the expansion valve in accordance with the following procedure:

a. Disassemble the valve by removing two capsccrews (10) that secure the power assembly (1) to the valve body (9), and separate the two.

b. Install the valve body in the support bracket, and secure with two capscrews, finger tight. Connect tubing.

c. With dry nitrogen flowing through the refrigeration system raze tubing joints. Let cool. Tighten capscrews.

d. Install power assembly (1, figure 5-9) on valve body, being careful to fit lugs on the cage assembly (7) into the cavities in the body (9). Secure with two capscrews (10). Connect equalizer line,if applicable.

e. Wrap thecapillary tubewith a double thickness of insulating tape, being careful to avoid kinking the tube.

f. Carefully lead the sensing tube to its position on the suction line. Clamp in position to the suction line. Cover suction line, sensing bulb and clamp with insulating material.

g. Carefully form the capillary tube along adjacent piping, and tape to support.

h. Leak-test in accordance with paragraph 5.24.

5.82. Final Assembly

When the air conditioner has been successfully leak-tested replace the filter-drier as directed in paragraphs 5.53 through 5.55. This procedure includes evacuation, charging and pressure-testing the system. Complete the assembly as follows:

a. Position the top panel on the air conditioner and secure with 15 screws and packing washers in the top surface and five screws through the rear flange.

b. Fit the fabric cover over the back of the air conditioner, and secure with 18 screws and washers.

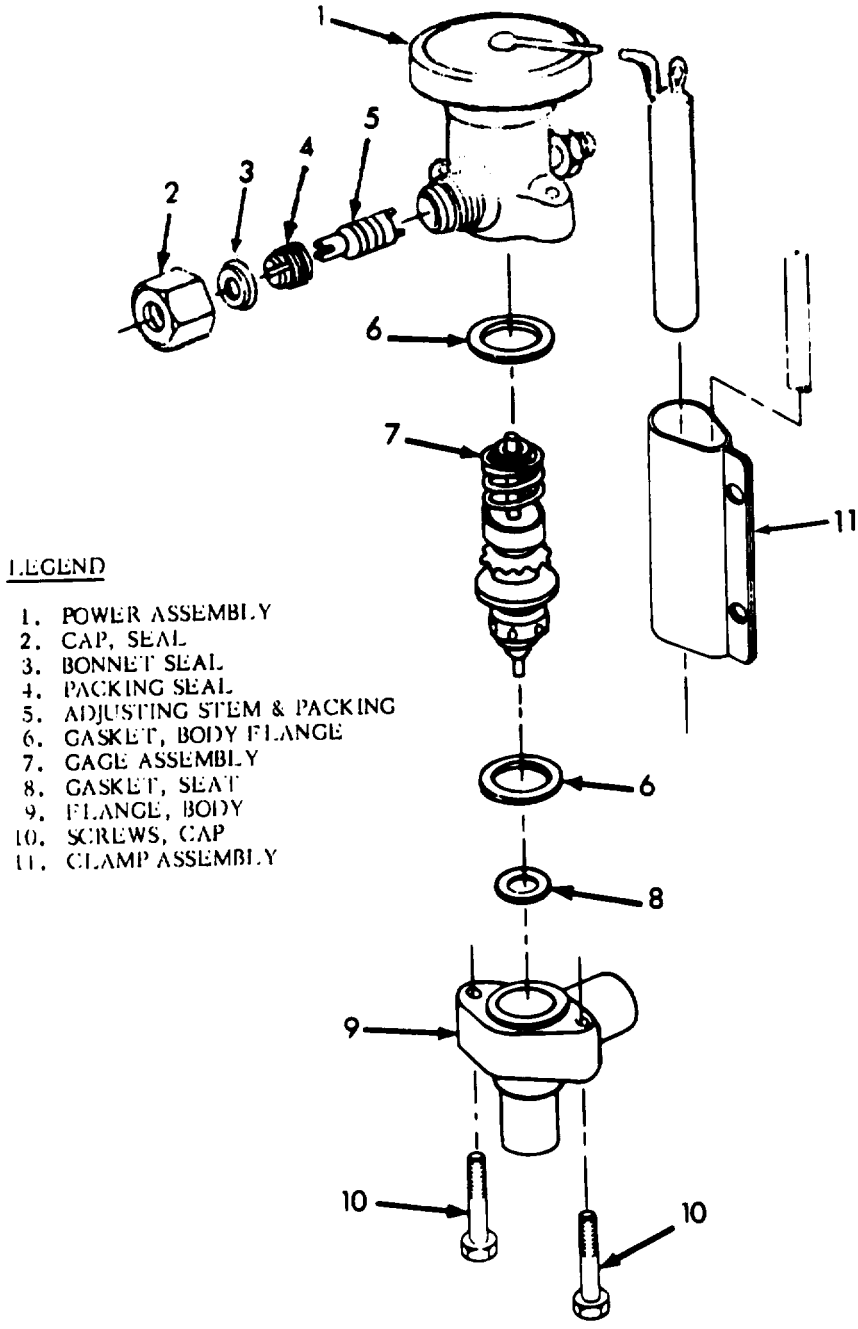


Figure 5-9. Typical Therma¹ Expansion Valve

Section XVI. CONDENSER COIL

5.83. Description

The condenser coil assembly consists of two coils with a common set of fins: the condenser coil itself, and the subcooler coil. (See Refrigeration Diagram. figure 2-2). The condenser coil assembly is located at the bottom rem section of the air conditioner, and is covered by a grille and screen assembly to protect it from damage and dirt.

5.84. Removal

Before removing the condenser coil, the refrigerant system must be completely discharged in accordance with paragraph 5.22.a. (Refer to figure 5-8 for idenfication of service valves). After the refrigerant has been completely discharged proceed with the removal of the condenser coil as directed in the following procedure:

a. Unscrew two panel fastener screws, and remove the lower panel.

b. Obtain access to the falter-drier, and remove it as instructed in paragraphs 5.53 and 5.54.

c. Remove the screw which secures the receiver band-clamp to the bracket.

d. Remove 18 screws and washers from the four sides of the fabric cover. and remove the fabric cover.

e. Remove four screws and washers from the upper edge o fthe condenser coil guard, and four screws, washers and lock washers from the lower edge. Remove the condenser coil guard.

f. Remove four screws in a vertical line on each side of the casing.These screws secure the condenser coil to the casing.

g. Provide a 1-2cfm(0.1 -0.2 M'/min) flow o fdry nitrogen through the system at the discharge service valve. After three minutes of nitrogen purging, debraze the tubing coming from the compressor and to the liquid line going to the sight-glass liquid indicator. It is not necessary to debraze the receiver at this time. Withdraw the condenser coil from the air conditioner.

5.85. Servicing

Service the condenser coil after removal from the air conditioner as directed below:

a. Cleaning. Caper plug all openings. and tape caps or plugs to prevent accidental removal. No water must be permitted to enter the coil. When thoroughly sealed, immerse the coil in a warm detergent solution for five minutes to soak loose caked-on dirt, then agitate the coil vigorously in the solution to remove dirt from between the fins. Rinse thoroughly in clear water.

b. Fin Aligmnent. If fins are bent o rcrushed, straighten them with a wood or plastic blade so that they are straight and parallel. Badly bent or crushed fins can cause serious distortion of airflow, resulting in inefficient operation of the air conditioner.

5.86. Installation

Install the condenser coil in the air conditioner as directed in the following steps:

NOTE

If the receiver was removed, or a new coil is being installed, install the receiver to the coil assembly and braze joints before installing the coil in the air conditioner

a. Position the condenser coil in, the air conditioner with all tubing joints meeting properly. Secure the coil with four screws through each side of the casing.

b. Start a flow of 1-2 cfm (0.1 0.2 M^3/min) of dry nitrogen through the system at 'the discharge service valve. After three minutes of nitrogen purging, braze joints.

c. Install anew filter-drier, and complete the assembly and charging of the air conditioner in accordance with paragraph 5.55.

Section XVII. EVAPORATOR COIL

5.87. Description

The evaporator coil receives liquid refrigerant from the expansion valve, and evaporates the liquid to a gas by absorbing heat from the airflow passing over the outside surface of the coil. The evaporator coil is located in the top front section of the air conditioner.

5.88. Access

Gain access to the evaporator coil as directed in the following procedure:

a. Remove 18 screws and washers from the four sides of the fabric cover, and remove the cover.

b. Remove 15 screws and paeking washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

c. Detach the evaporator discharge grille by turning six cam-lock fasteners counter-clockwise 1/4 turn. Remove the grille.

d. Remove the mist eliminator by pulling it straight up out of channels.

e. Tag and disconnect wires to heating elements. Remove hold-down clamps from six heating elements by unscrewing the panel fastener screw in each. Remove heating elements by pulling straight up.

f. Remove th eevaporator/condenser fans and motor. (Refer to Chapter 5. Section XXthrough XXII).

5.89. Removal

Remove the evaporator coil front the air conditioner in accordance with the following instructions:

a. Refer to figure 5-8 for identification of service valves. All refrigerant must be discharged before opening the system (paragraph 5.22. a).

b. Dismantle the liquid line expansion valve as directed below, but do not debraze the distributor from the valve body at this time.

(1) Unscrew the equalizer tube flare nut from the power assembly of the valve. (See figure 5-9).

(2) Remove two mounting screws (10, figure 5-9) from the bracket and valve body. Carefully separate the power assembly (1) from the valve body (9), and remove gaskets (6 and 8) and cage assembly (7).

(3) Provide a flow of 1-2 cfm (0.1 -0.2 M^3/min) of dry nitrogen through the system from the discharge service valve for at least three minutes, then debraze the liquid line from the expansion valve.

c. Remove evaporator/condenser fan motor to gain access to suction line flange connection (Refer to Chapter5. sections XX through XXII).

d. Remove tbree capscrews from the rear of the suction line flange connection, and separate the two halves of the flange connection slightly. Remove and discard the O-ring.

e. Remove four screws and packing washers from th casing and evaporator coil bracket on each side of the air conditioner. Lift the coil straight up, and remove it from the air conditioner.

5.90. Servicing

Service the evaporator coil after removal from the air conditioner, as directed below:

a. Cleaning. Cap or plug all openings, and tape caps or plugs to prevent accidental removal. No water must be permitted to enter the coil. When thoroughly sealed, immerse the coil in warm detergent solution for five minutes to soak loose caked-on dirt, then agitate the coil vigorously in the solution to remove dirt from between the fins. Rinse thoroughly in clear water.

b. Fin Aligmnent. If fins are bent or crushed, straighten them with a wood or plasti blades so that they are straight and parallel. Badly bent or crushed fins can cause serious distortion of airflow, resulting in inefficient operation of the air conditioner.

5.91. Disassembly

If a new coil is to be installed, debraze the distributor assembly front the old coil at three places. Remove miste eliminator retaining channels from the coil by removing four screws from each channel.

5.92. Assembly

Assemble the evaporator coil in the following manner.

a. Position the mist eliminator channels on the front of the evaporator coil, at each end, and secure with four screws through each channel.

b. Install a new O-ring in th egroov eof the suction line connecting flange, and assemble the halves of the flange. Secure with three capscrews from the back of the partition.

NOTE

If a new liquid line expansion valve *body is to be installed, braze the distributor body into the discharg port of the expansion valve before assembling the valve.*

c. Position the liquid line expansion valve body (9, figure 5-9)on its support bracket, and align by securing with two screws (10) and slave nuts. Do not install power assembly at this time. Braze liquid line to valve body.

d. Install new gaskets (6) and seat (8) in valve body.

Place cage assembly (7) in power assembly (1), remove screws (10) and fit bosses of cage assembly into recesses in valve body. Secure power assembly (1) to valve body (9) with screws (10). Connect the equalizer line flare nut.

f. Install the evaporator/condenser fans and motor. (Refer to Chapter 5, Sections XX through XXII.)

g. Purge the refrigeration system with dry nitrogen at 1-2 cfm (0.1 -0.2 M^3/min) for 15 minutes.

h. Install heating elements in accordance with paragraph 5.97.

i. Install the mist eliminator by sliding it straight down in the channels in front of the evaporator coil. Make sure that TOP mark is up. and that airflow arrows point outward.

Install a new filter-drier, leak-test, and charge the refrigeration system as instructed in paragraphs 5.53 through 5 .55.

k. Position *the top panel* on the air conditioner. Secure it with 15 screws and packing washers through the top surface, and five screws through the rear flange.

l. Place the evaporator air discharge grille in the opening, and secure it by turning the six cam-lock studs clockwise.

m. Fit the fabric cover over the back of the air conditioner. and secure it with 18 screws and washers on all four sides.

Section XVIII. HEATING ELEMENTS

5.93. Description (See figure 5-10).

The six steel sheathed resistance heating elements are located immediately behind the evaporator coil, and extend all the way across the width of the air conditioner. Three of the elements are energized when the selector switch is set at LO HEAT, and all six elements are energized when the selectors switch is set at HI HEAT, The temperature control thermostat controls only the elements energized by the LO HEAT setting. All six elements are protected against overheating by a thermal overload protector (heater thermostat).

5.94. Access

a. Obtain access to the-heating elements as directed in the following steps:

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

b. Remove 18 screws and washers from the four sides of the fabric cover, and remove the cover.

c. Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

5.95. Removal

Remove the heating elements from the air conditioner in the following manner: (See figure 5-10).

a. Tag and disconnect wire leads from the ends of each element by unscrewing terminal nuts.

NOTE

Continuity testing of each element can be performed at this time if further disassembly is not required. (Refer to paragraph 5.96).

b. Unscrew the panel fastener screw in each hold down clamp and remove the clamp. Pull heating element straight up to remove.

5.96. Inspection/Test

Visually inspect each heating element for damage. deformation. damaged terminal threads, cracked or broken sheath, or burnt-out spots. If damaged, replace. Using an ohmmeter, multimeter or other continuity tester, check continuity of each heating element. Replace elements that do not indicate continuity.

5.97. Installation

Install the heating elements in accordance with the following procedure:

a. Insert each heating element down between the heater mounting bar and the evaporator coil, with each mounting arm equidistant from the panel fastener screw hole. Place hold-down clamp over both mounting arms, and secure with the panel fastener screw.

b. Make proper wiring connections. (See wiring diagram, figure FO-1).

c. Position the top panel on the air conditioner. Secure it with 15 screws an packing washers in the top surface, and five screws through the rear flange.

d. Fit the fabric cover over the backoftbe air conditioner, and secure all four sides with 18 screws and washers.

Section XIX. HEATER THERMOSTAT

5.98. Description

The heates thermostat is a thermal overload protector, located behind and between the heating elements. It is electrically connected to the heating elements in such a way that if temperature exceeds a preset maximum, the heater thermostat opens to the circuits. When the temperature has returned to normal. the thermostat automatically resets, thereby closing the circuits to the heating elements.

5.99. Access

Obtain access to the heater thermostat as directed below:

a. Remove 18 screws and washers from the four sides of the fabric cover. and remove the cover.

b. Remove 15 screws and packing washers from the top surface of the top panel, and five screws from the rear flange. Remove the top panel.

5.100. Removal

Remove the heater thermostat from the air conditioner as follows:

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal.

NOTE

If desired, two heating elements maybe removed for greater convenience in manipulating the thermostats attaching hardware.

a. Tag and disconnect wire leads from the heating elements to the heater thermostat.

b. Remove two screws and self-locking nuts from the heater thermostat. Remove the thermostat.

5.101. Inspection/Test

a. Visually inspect the heater thermostat for cracks in the housing, missing pieces or other damage. Replace if damaged. Test as follows:

b. Using an ohmmeter or other continuity tester, check continuity of the wire leads attached to terminals 4-5. 5-6 and 4-6 of the heater thermostat. Continuity should be indicated.

c. Tape the bulb of a thermometer or junction of a thermocouple to the body of the heater thermostat, and leave the continuity tester connected to any two of the wire leads. Gradually apply heat. and observe both the thermometer and the continuity tester. Continuity should drop out at 194° ± 9°F (90° ± 5°C). While still continuing to watch the thermometer and the continuity test, let the heater thermostat cool. Continuity should be re-established at 142° ± 17°F (61° ± 9°C).

d. Repeat step b with the continuity tester connected to each of the other two pairs of terminals.

e. If the heater thermostat does not meet temperature and continuity requirements, replcae it.

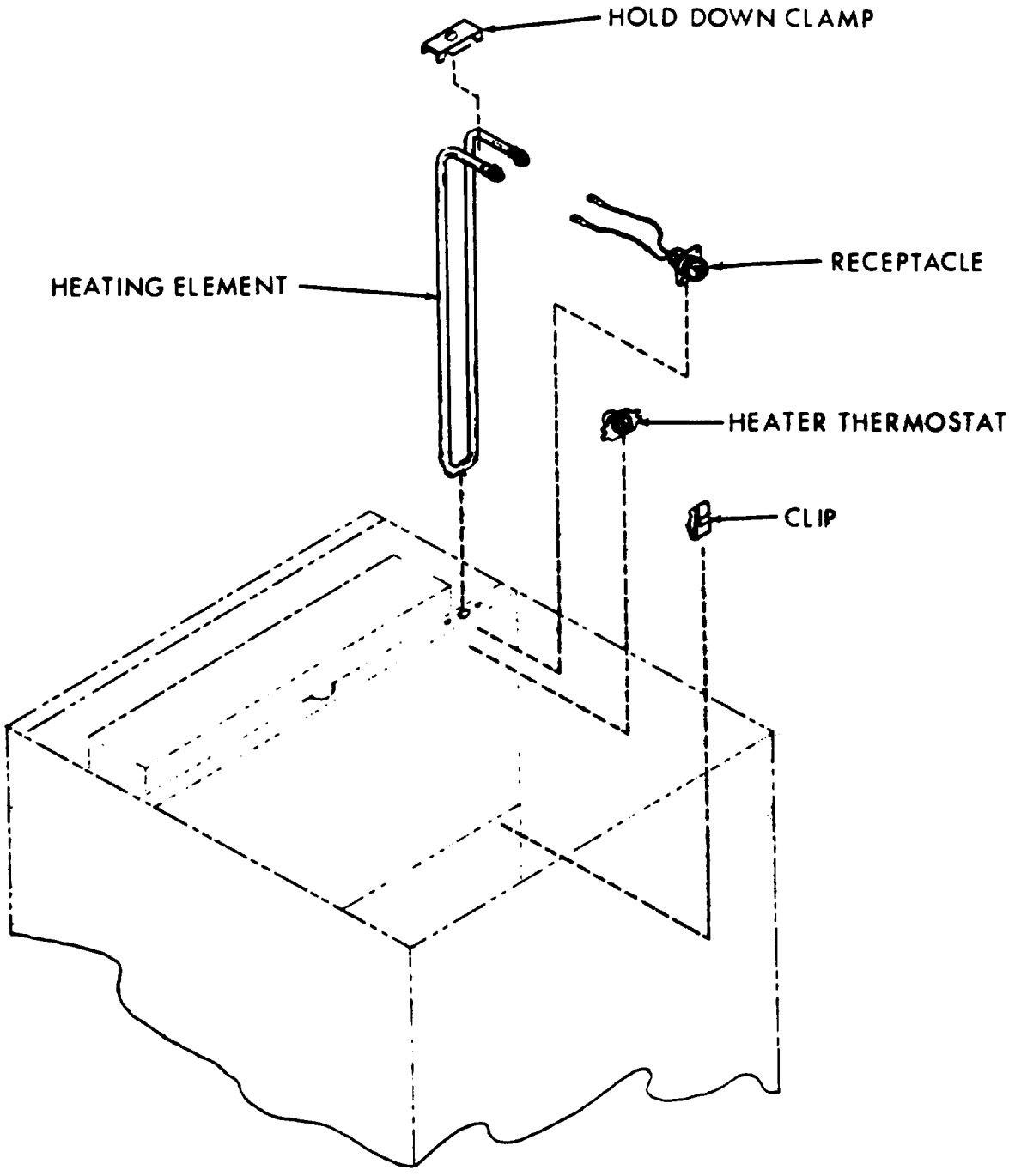


Figure 5-10. Heater Assernbly.

5.102. Installation

Place the body of the heater thermostat in the mounting hole of the heater assembly support, and secure with two screws and self-locking nuts. Continue the installation as follows:

NOTE

If two heating elements were removed for convenience, replace them at this time.

a. Connect wire leads as required. (See wiring diagram, figure FO-1)

b. Place the top panel on the air conditioner, and secure with 15 screws and packing washers in the top surface, and five screws through the rear flange.

c. Fit the fabric cover over the back of the air conditioner, and secure all four sides with 18 screws and washers.

Section XX. EVAPORATOR FAN

5.103. Description

The evaporator fan is located behind the evaporator intake grille and the air filter. The fan is driven by a double-shafted two-speed motor, and consists of a centrifugal impeller and an inlet ring. Airflow from the evaporator fan is directed upward into the space behind the heating elements and evaporator coil, and is discharged through those components before passing out through the evaporator discharge grille.

5.104. Removal

Remove the evaporator fan from the air conditioner in accordance with the following instructions. (See figure 5-11).

a. Remove the evaporator air intake grille by turning six cam-lock studs counter-clockwise to unlock, and remove the grille.

b. Remove the air falter by unscrewing two screws from the retaining strip on the right-hand side of the filter. Pull the right-hand side of the falter outward to the right to release it from the left-hand retaining channel.

c. Remove eight screws from the circumference of the inlet ring, and remove the inlet ring.

d. Loosen the two setscrews at right angles to each other in the hub of the impeller. Pull the impeller from the motor shaft impossible. If the impeller cannot be pulled from the shaft, thread two 5/16-18 screws into threaded holes in the face of the hub to act as jackscrews. Tighten both in equal increments until impeller is free.

5.105. Inspection

Inspect the inlet ring for nicks, dents, gouges, deformation or evidence of rubbing. Replace the inlet ring if damaged. Inspect the impeller for gouges, deformation, evidence of rubbing, or broken welds. Replace the impeller if damaged, or if repair would unbalance its rotation.

5.106. Installation

Install the evaporator fan as directed in the following steps:

CAUTION

Do not hammer the impeller onto the motor shaft. The motor bearings would be damaged. In case of difficulty, dress out rough spots on the shaft with a fine file, stone or abrasive cloth. Apply a coating of light oil to ease assembly.

a. Place key in the shaft keyway, and install the impeller on the shaft. The end of the shaft should be even with the face of the hub.Tighten the setscrews over the key first, finger tight, then tighten the remaining setscrew. Tighten both setscrews to a final torque of 78-82 pound-inches (898-945 gram-meters).

b. Position the inlet ring, flat edge up, into the circular fan opening. Secure with eight screws. Rotate the impeller by hand to be sure that no rubbing exists. Adjust inlet ring if necessary.

c. Install air falter in left-hand retaining channel, and install retaining strip with two screws.

d. Position evaporator air intake grille on the air conditioner, and secure by turning six cam-lock studs clockwise.

Section XXI. CONDENSER FAN

5.107. Description

The condenser fan is located behind the cirular fan guard on the back of the air conditioner. The fan is driven by one end of a double-shafted two-speed motor. It consists of an aluminum axial impeller which rotates within a shroud which is part of the motor support (See figure 5-12). Air is drawn into the lower chamber through the condenser coil, and is exhausted through the fan guard.

5.108. Removal

Remove the condenser fan from the air conditioner in accordance with the following procedure:

a. Remove eight screws and lock washers from the rim of the condenser fan guard, and remove the fan guard.

b. *Loosen* two setscrews in the hub of the fan impeller, and pull the impeller off the motor shaft.

NOTE

The two 1/4-20 holes *in the face of the impeller hub can be used to attach a wheel puller if necessary.*

5.109. Inspection

visually inspect the condenser fan impeller for nicks, gouges, cracked welds, missing pieces and deformation. Check outer ends of blades for evidence of rubbing or scraping. If there is damage sufficient to unbalance the impeller, replace it.

5.110. Installation

Install the condenser fan as directed in the following procedure:

CAUTION

Do not hammer the impeller onto the motor shaft. The motor bearings would be damaged. If difficulty is encountered, dress out rough spots on the shaft with a fine file, stone or abrasive cloth. Apply a coating of light oil to ease assembly.

a. Align keyways in shaft and impeller, install key, and press impeller onto shaft. The end of the motor shaft should be even with the face of the hub when the impeller is completely in position. Tighten setscrews finger tight. Starting with the keyway setscrew, tighten to a fnal torque of 78-82 pound-inches (898-945 gram meters).

NOTE

In order to direct the condenser exhaust upward, away from the intake, the condenser fan guard is designed so that it can be installed in only one way. All screw holes must match to permit proper installation.

b. Position the condenser fan guard properly on the air conditioner, and secure it with eight screws and lock washers.

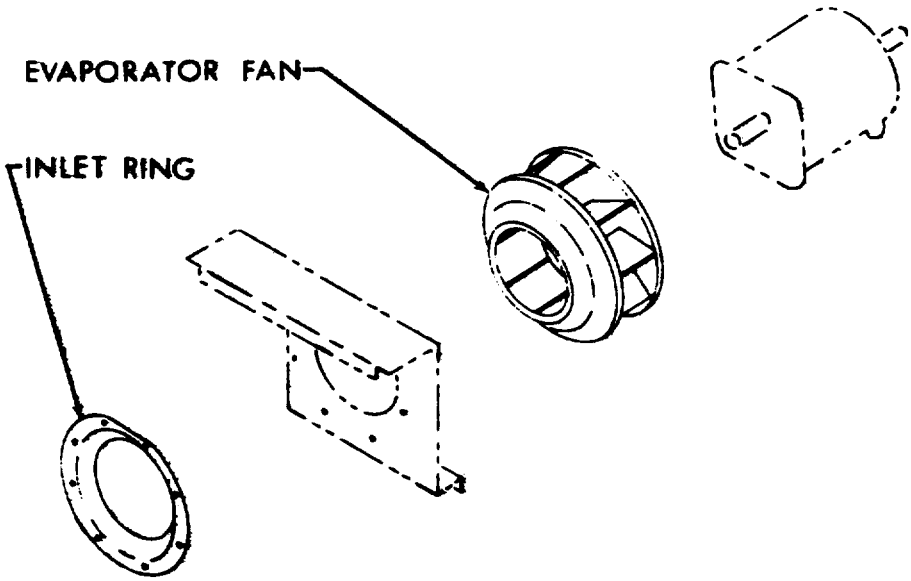


Figure 5-11. Evaporator Fan Details.

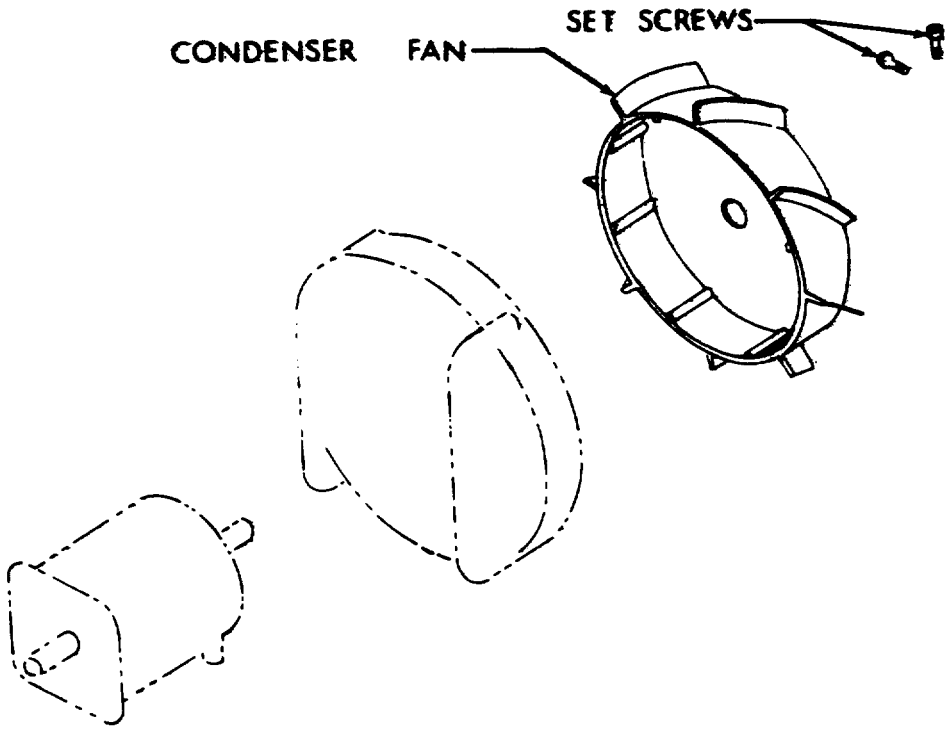


Figure 5-12. Condenser Fan Details.

Section XXII. FAN MOTOR

5.111 Description

The fan motor is double shafted to drive the evaporator fan impeller at one end, and the condenser fan impeller at the other. The motor contains two sets of windings, which permits two-speed operation. The speed, using one set of windings, is 1725 rpm. When the second set of windings is switched on, the speed is doubled to 3450 rpm. The motor contains permanently lubricated anti-friction bearings, and is protected against overheating by a thermal overload protector.

5.112. Removal (See figure 5-13).

Remove the fan motor in accordance with the following procedure:

WARNING

Disconnect power from the air conditioner before performing maintenance work on the electrical system. The voltage used can be lethal.

a. Remove the evaporator intake grille by turning the six cam-lock studs 1/4-turncounter-clockwise to unlock, then lift off the grille.

b. Remove the air falter retaining strip by removing two screws. Remove strip and air falter.

c. Remove eight screws from the evaporator fan inlet ring, and remove the inlet ring.

d. Loosen two setscrews in the hub of the evaporator fan impeller, and pull the impeller off the motor shaft. If the impeller cannot be pulled off manually, thread two 5116-18 screws into the threaded holes in the face of the hub to use as jackacrews or to attach a wheel puller.

e. Remove eight screws and lock washers from the rim of the condenser fan guard, and remove the guard.

f. Loosen the two setscrews in the hub of the condenser fan impeller, and pull the impeller off the motor shaft. If difficulty is encountered, the two 1/4-20 threaded holes in the faces of the hub can be used to attach a wheel puller.

g. Unscrew but do not remove four screws attaching the baffle (figure 5-13) to the mounting assembly. Remove the baffle, with screws and spacers attached, as a unit.

h. Disconnect wiring harness plug, P9, from the receptacle, J9, on the motor junction box.

i. Carefully remove two socket head capscrews, lock washers, flat washers and bushings which secure the motor mounting feet to the mounting crossbar.

j. Remove four self-locking nuts, flat washers, bushings and flat-head screws from the corners of the motor mounting flange.

k. Carefully withdraw the motor through the condenser fan shroud.

5.113. Inspection/Test

Inspect the motor as follows:

a. Spin the rotor, and listen for bearing noise indicating rough operation. If present, turn the shaft slowly backward and forward by hand to feel roughness. Replace bearings if roughness is evident.

b. Grip the rotor shaft, and attempt to pull it in and out to check for end-play. If there is, replace load spring or shim(s).

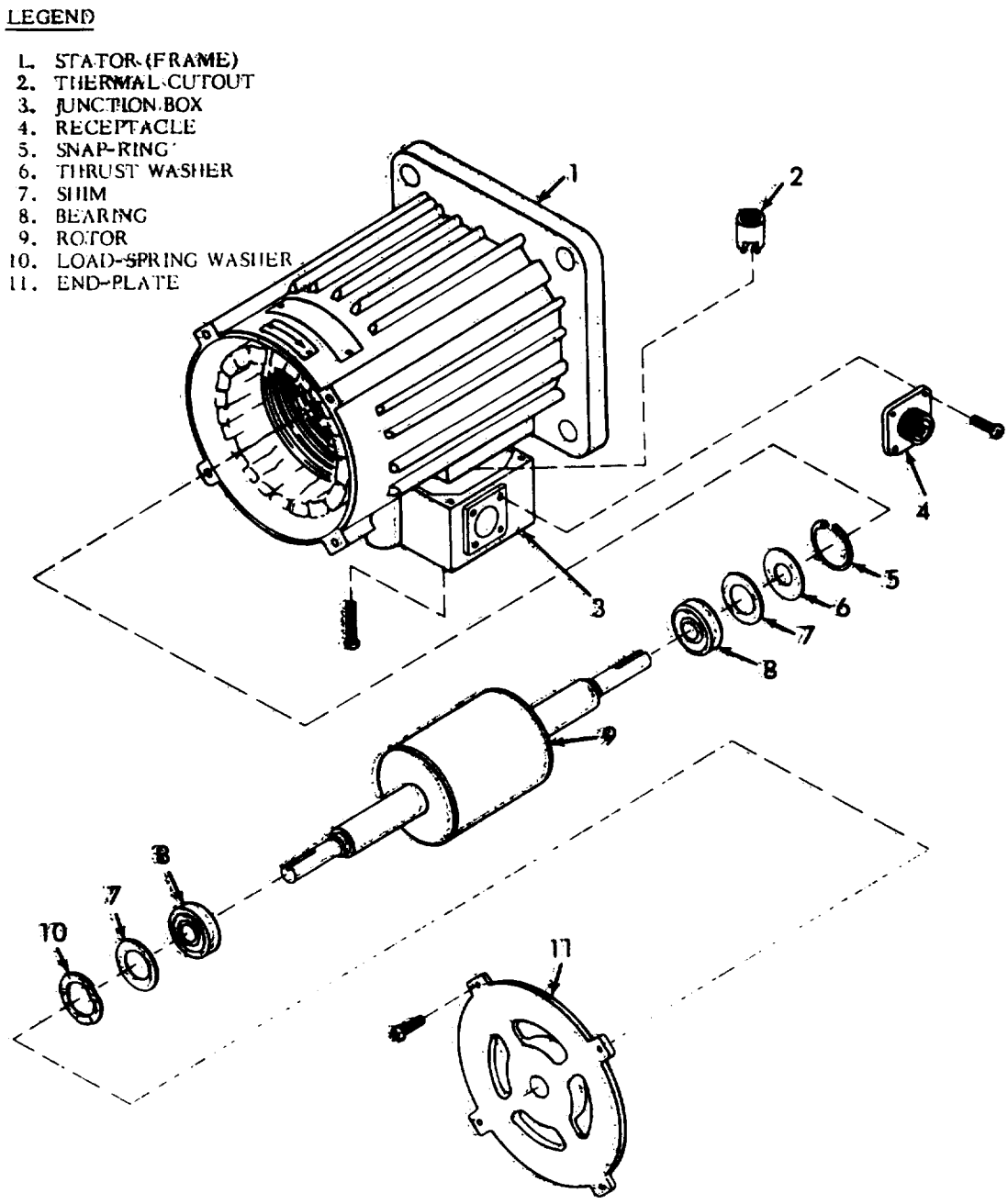


Figure 5-13. Fan Motor Details.

c. Using an ohmmeter or other continuity testing device, check continuity between connector pins E-D, E-F and D-F, and between G-H, H-J and G-J. Continuity should be indicated. Also check to be sure that no continuity exists between each pin and the motor frame (stator). If continuity requirements are not met, replace the motor.

5.114. Disassembly

Disassemble the motor only to the extent necessary to effect repairs. Proceed as follows:

a. Remove four screws from the 3-3/4-inch bolt diameter of the end plate (11, figure 5-13), and remove the end plate.

CAUTION

Keep load spring, shims and washers in their proper relationships at disassembly if they will be needed at assembly.

b. Withdraw the rotor (9) from the stator (1), and put aside until needed for assembly.

c. Using an arbor press or equivalent. press the bearings (8) out of the end plate and the stator. being careful to avoid cocking.

d. Remove four screws from the corners of the junction box (3, figure 5-13) and lift box away from stator.

e. Tag wires for identification, and unsolder from connector.

f. Remove four screws from corners of connector, and remove connector from junction box (3).

5.115. Cleaning

WARNING

Dry cleaning solvent (Fed. Spec PD-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).

CAUTION

Bearings are permanently lubricated and sealed at the time of manufacture. Do not attempt to clean or relubricate them. Keep bearings in plastic bags or wrap securely in grease-proof paper until needed for assembly.

Blow loose dirt from cavities and windings. Wipe external surfaces with a cloth moistened with dry cleaning solvent (Fed Spec. P-D-680).

5.116. Assembly

Assemble the motor as directed in the following procedure (See figure 5-13).

a. Pull wires through connector hole in junction box (3), and solder them to their respective connector pins. (See wiring diagram, figure FO-1, for proper connections.)

b. Install receptacle (4, figure 5-13) injunction box (3), and secure with four screws.

c. Position junction box (3) on motor frame (stator); and secure with four screws through corners.

d. Install a bearing (8), shim (7) and washer (6), in that order, on the shorter shaft of the rotor (9). Insert the rotor into the stator (1). and guide the bearing into the bearing recess in the stator.

e. Place a bearing (8), shim (7) and load spring (10) in that order. over the longer shaft of the rotor (9). Carefully fit end-plate (11) over the assembly, guiding the bearing into the bearing recess.

f. Secure the end plate (11) to the stator (1) with four screws, tightened uniformly in increments. Attempt to turn shaft by hand. If shaft does not turn freely, check assembly of end plate on stator, and adjust if necessary.

5.117. Installation

Install the motor in the air conditioner as directed in the following procedure: (See figure 4-7).

a. Position the flange end of the motor against the partition. Install four flat-head screws through the partition and the holes in the comers for the motor's mounting flange. Place a bushing, a washer and a self-locking nut on each screw, and tighten finger-tight.

NOTE

Trial-fit resilient washers of the same thickness at first, then replace with different sizes if necessary to center impellers.

b. Place a lock washer. flat washer and bushing (flange end toward bolt head) on a socket-head shoulder bolt, and partially insert bolt into hole in cross-bar. On top of cross-bar, place a resilient washer, large flat washer and small flat washer between the cross-bar and the motor mounting foot. Push bolt and bushing up through the resilient washer, and screw bolt into the motor mounting foot. Repeat assembly in the same order for the other mounting foot. Tighten both bolts uniformly, and check for concentricity of impellers and openings. Adjust by replacing resilient washers with those of a different thickness, as required. When satisfactory, tighten all mounting bolts, including the four bolts and nuts in the corners of the flange.

c. Connect wiring harness plug, P9, to the receptacle on the motor's junction box. Temporarily connect power to the air conditioner, and turn mode selector switch to VENTILATE. Check operation and direction of rotation of motor at LO SPEED, and HI SPEED settings.

d. Place a lock washer and flat washer on each concave side of baffle. Place a spacer over each screw on the convex surface, and tape in place with masking tape. Carefully position the convex side of the baffle against the mounting bracket, and secure by tightening the four screws.

CAUTION

Do not hammer impeller onto shaft. Motor bearings would be damaged.

Dress out roughness on the shaft with a fine file, stone or abrasive cloth. Apply a coating of light oil to ease assembly.

e. Place key in shaft keyway and press condenser fan impeller onto shaft. End of shaft should be flush with face of hub. Tighten both setscrews finger-tight. Starting with the keyway setscrew, tighten both set-screws to a fmal torque of 78-82 pound-inches (898-945 gram-meters).

NOTE

The fan guard is designed 50 that it can be installed only one way. All screw holes must match to permit proper installation.

f. Place the condenser fan guard on the air conditioner, and secure it with eight screws and lock washers.

g. Install key in shaft keyway, and press evaporator fan impeller onto shaft. End of shaft should be flush with the hub face when installed. Tighten both setscrews finger-tight, then tighten to final torque of 78-82 pound-inches (898-945 gram-meters) torque, starting with the keyway setscrew.

h. Place the air filter imposition, and install retaining strip with two screws.

i. Position evaporator air intake grille on air conditioner, and secure by turning the six cam-lock studs 1/4 turn clockwise.

Section XXIII. WIRE LEADS AND WIRING HARNESSES

5.118. Repair Methods

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 maybe appropriate for emergency field repairs. Determine the proper size and length of wire, terminal or connector to be used for replacement by referring to Table 5-3, Wire List, and to the wiring diagram (figure FO-1).

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-4995, Type I, rosin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be rosin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive build-up of solder "gobs" on the joint should be avoided or removed.

b. lnsulating 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 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 over the joint, and shrink in place with moderate heat.

c. Spiking Wires. To repair broken or cut wires that are otherwise sound. the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the ends to joint them, or a "Western Union" wire splice can be made. The latter is made by stripping one 1-1/4 inch 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 of insulation f rom the end of the wire, apply a one-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.

Table 5-3

WIRE LIST

Wire ID. No.	FROM Terminal Type	FROM Term. No.	TO Terminal Type	TO Term. No.	Length (Inches)	Wire Size
	Wiring Harness - Control Module					
X36A16N	MS3102R28-11P	J7-A	MS25036-108	E2	3	16
X3E14B	MS3102R28-11P	J7-M	Both in	S1-41	8	14
X3F16B	13211E8288	S1-31	13211E8288	S1-41	2.62	16
V3E16	13211E8288	J7-X	Both in	S1-11	10	16
V3F16	13211E8288	S1-11	MS25036-153	S2-1	8.5	16
V5A16	MS3102R28-11P	J7-W	13211E8288	S1-10	10	16
X4E14C	MS3102R28-11P	J7-K	13211E8288	S1-4	9	14
V10A16	MS3102R28-11P	J7-N	13211E8288	S1-1A	11	16
X2E14A	MS3102R28-11P	J7-J	Both in	S1-22	10.37	14
X2F16A	13211E8288	S1-32	13211E8288	S1-22	1.75	16
V11A16	MS3102R28-11P	J7-T	13211E8288	S1-1B	11	16

Table 5-3 (Con't)

WIRE LIST

Wire I.D. No.	FROM Terminal Type	FROM Term. No.	To Terminal Type	To Term. No.	Length (Inches)	Wire Size
		Wiring Harness — Control Module (Con't)				
X6A16A	MS3102R28-11P	J7-I	13211E8288	S1-2B	10.37	16
X11A16B	MS3102R28-11P	J7-C	13211E8288	S1-2C	9.37	16
X9A16A	MS3102R28-11P	J7-V	13211E8288	S1-3A	9.62	16
X10A16B	MS3102R28-11P	J7-U	13211E8288	S1-3C	8.62	16
X8A16C	MS3102R28-11P	J7-E	13211E8288	S1-4A	9	16
X7A16B	MS3102R28-11P	J7-D	13211E8288	S1-4C	8	16
X4F16	MS3102R28-11P	J7-B	MS25036-106	S8-2	4	16
X13C16B	MS3102R28-11P	J7-H	13211E8288	S1-21	9.47	16
V6A16	13211E8288	S1-12	MS25036-153	S2-2	4.5	16
V3G16	MS25036-153	S2-1	MS25036-106	S8-1	5	16
		Electrical Lead Pressure Cutout Switches				
V7A16	MS25036-153	S6-1	MS25036-153	S7-2	3.00	16
		Wiring Harness — Power Input to RFI Filter				
X2A10A	MS3100R22-22P	J1-A	MS3106R22-22S	P10-A	35.5	10
X3A10B	MS3100R22-22P	J1-B	MS3106R22-22S	P10-B	35.5	10
X4A10C	MS3100R22-22P	J1-C	MS3106R22-22S	P10-C	35.5	10
X5A10N	MS3100R22-22P	J1-D	MS3106R22-22S	P10-D	35.5	10
		Wiring Harness — Junction Box Power Input				
X2B10A	MS3102R22-22P	J2-A	MS25036-112	TB1-1	6.25	10
X3B10B	MS3102R22-22P	J2-B	MS25036-112	TB1-2	6.75	10
X4B10C	MS3102R22-22P	J2-C	MS25036-112	TB1-3	7.25	10
X5B10N	MS3102R22-22P	J2-D	MS25036-112	E1	4.50	10
		Wiring Harness — Power Input from RFI Filter				
X2L10A	MS3106R22-22P	P11-A	MS3106R22-22S	P2-A	30.5	10
X3L10B	MS3106R22-22P	P11-B	MS3106R22-22S	P2-B	30.5	10
X4L10C	MS3106R22-22P	P11-C	MS3106R22-22S	P2-C	30.5	10
X5C10N	MS3106R22-22P	P11-D	MS3106R22-22S	P2-D	30.5	10
		Wiring I Harness — Heater				
X15C16A	MS3100R14S-6P	J8-A	MS25036-108	HR1-A	13.75	16
X19C16B	MS3100R14S-6P	J8-B	MS25036-108	HR2-A	11.25	16
X17C16C	MS3100R14S-6P	J8-C	MS25036-108	HR3-A	8.75	16
X8C16C	MS3100R14S-6P	J8-D	MS25036-108	HR4-A	6.25	16
X7C16B	MS3100R14S-6P	J8-E	MS25036-108	HR5-A	3.75	16
X9C16A	MS3100R14S-6P	J8-F	MS25036-108	HR6-A	5.75	16
X24B16A	MS25036-108	HR1-B	MS25036-108	HR6-B	16.5	16
X21B16B	MS25036-108	HR2-B	MS25036-108	HR5-B	9.0	16
X22B16C	MS25036-108	HR3 B	MS25036-108	HR4 B	5.0	16

Table 5-3 (Con't)

WIRE LIST

Wire I.D. No.	FROM Terminal Type	FROM Term. No.	TO Terminal Type	TO Term. No..	Length (Inches)	Wire Size
		Wiring Harness—Junction Box				
X43A16A	MS3102R36-7S	J3-P	MS25036-153	K5-A2	7.87	16
X44A16B	MS3102R36-7S	J3-P	MS25036-153	K5-B2	7.25	16
X28A16A	MS3102R36-7S	J3-S	MS25036-153	K5-C2	6.63	16
X23A16B	MS3102R36-7S	J3-h	MS25036-153	K5-D2	6.00	16
X25A16A	MS3102R36-7S	J3-U	MS25036-153	K5-C1	6.63	16
Z20A16B	MS3102R36-7S	J3-R	MS25036-153	K5-D1	6.00	16
V4D16	MS3102R36-7S	J3-Z	MS25036-153	K5-X2	6.25	16
X39A16A	MS25036-153	K5-A1	MS25036-153	K4-A1	6.00	16
V4C16	MS25036-153	K5-X2	MS2S036-153	K4-X2	8.12	16
X41A16B	MS25036-153	K5-B1	MS25036-153	K4-B1	6.63	16
X40A16B	MS25036-153	K5-D3	MS25036-153	K4-B3	7.62	16
X38A16A	MS25036-153	K5-C3	MS25036-153	K4-A3	8.50	16
X6C16A	MS3102R36-7S	J3-c	MS25036-153	K4-A2	10.63	16
X10C16B	MS3102R36-7S	J3-a	MS25036-153	K4-B2	10.00	16
X42A16C	MS3102R36-7S	J3-X	MS25036-153	K4-C2	9.37	16
X29A16C	MS3102R36-7S	J3-W	MS25036-153	K4-D2	8.75	16
X27A16C	MS3102R36-7S	J3-V	MS25036-153	K4-D1	8.75	16
V4B16	MS3102R36-7S	J3-O	MS25036-153	K4-X2	9.00	16
V8B16N	MS25036-153	K4-X1	MS25036-153	K5-X1	9.00	16
V3C16	MS3102R36-7S	J3-f	MS25036-153	XF2-2	14.75	16
V3A16	MS3102R36-7S	J3-g	MS25036-153	XF2-2	14.75	16
V5D16	MS3102R36-7S	J3-C	MS25036-106	TB2-1	7.25	16
V12C16	MS3102R36-7S	J3-E	MS25036-106	TB2-2	7.62	16
V14C16	MS3102R36-7S	J3-G	MS25036-106	TB2-3	8.00	16
V11D16	MS3102R36-7S	J3-H	MS25036-106	TB2-4	8.38	16
V9B16	MS3102R36-7S	J3-1	MS25036-106	TB2-5	8.75	16
V9C16	MS3106R36-7S	J3-J	MS25036-106	TB2-5	8.75	16
V8D16N	MS3106R36-7S	J3-K	MS25036-106	TB2-6	9.12	16
V8A16N	MS25036-153	K5-X1	MS25036-106	TB2-6	9.12	16
V16A12B	MS3102R36-7S	CB1-B1	MS25036-112	K1-B2	12.95	12
X30A12A	MS3102R36-7S	J3-v	13216E6191-3	CB1-A2	20.62	12
X32A12C	MS3102R36-7S	J3-w	13216E6191-3	CB1-C2	20.62	12
V5C16	MS3102R36-7S	J3-D	MS25036-106	TB2-1	7.50	16
V13A16N	MS3102R36-7S	J3-F	MS25036-153	K1-X1	17.37	16
X15A16A	MS3102R36-7S	J3-L	MS25036-108	K2-A1	16.63	16
X19A16B	MS3102R36-7S	J3-M	MS25036-108	K2-B1	15.95	16
X17A16C	MS3102R36-7S	J3-N	MS25036-108	K2-C1	15.50	16
X37A12N	MS3102R36-7S	J3-t	MS25036-112	E1	4.75	12
X36C16N	MS3102R36-7S	J3-Y	MS25036-108	E1	4.75	16
X11C16B	MS3102R36-7S	J3-p	MS25036-106	XF1-4	16.25	16

Table 5-3 (Con't)

WIRE LIST

Wire ID. No.	FROM Terminal Type	Term. No.	TO Terminal Type	Term. No.	Length (Inches)	Wire Size
	Wiring Harness– Junction Box (Con't)					
V11C16	MS3102R36-7S	J3-d	MS25036-106	TB2-4	10.88	16
V10C16	MS3102R36-7S	J3-e	MS25036-153	K2-X2	17.37	16
X13A16B	MS3102R36-7S	J3-b	13216E6192	CB1-NO	20.62	16
X2C14A	MS3102R36-7S	J3-x	MS25036-108	TB1-1	12.37	14
X4C14C	MS3102R36-7S	J3-y	MS25036-108	TB1-3	13.50	14
X3C14B	MS3102R36-7S	J3-z	MS25036-108	TB1-2	12.25	14
V13F16N	MS25036-153	K2-X1	MS25036-106	TB2-6	11.49	16
V8C16N	13216E6191-2	CR1-2	MS25036-106	TB2-6	15.62	16
X3G12B	MS25036-112	TB1-2	MS25036-112	K1-B1	13.45	12
X2G12A	MS25036-112	TB1-1	MS25036-112	K1-A1	13.75	12
X4F12C	MS25036-112	TB1-3	MS25036-112	K1-C1	13.75	12
X3H16B	13216E619-2	CB1-C	MS25036-153	K1-B1	4.30	16
X12A12A	13216E6191-3	CB1-A1	MS25036-112	K1-A2	10.88	12
X14A12C	13216E6191-3	CB1-C1	MS25036-112	K1-C2	9.75	12
V12A16	MS25036-153	K1-X2	MS25036-106	TB2-2	16.24	16
V13E16N	MS25036-153	K1-X1	MS25036-153	K2-X1	13.24	16
X2H12A	MS25036-112	K1-X1	MS25036-112	K2-A2	15.01	12
X3J12B	MS25036-112	K1-B1	MS25036-112	K2-B2	12.75	12
X4G12C	MS25036-112	K1-C1	MS25036-112	K2-C2	13.65	12
X4H16C	MS25036-153	K4-D3	MS25036-108	K2-C2	17.00	16
X4K16C	MS25036-153	K4-D3	MS25036-153	K4-C1	3.88	16
X2J16A	MS25036-106	XF1-1	MS25036-108	K2-A2	25.38	16
X13D16N	MS3102R-36-7S	K3-5	MS25036-153	K1-X1	25.37	16
V14B16	MS3102R36-7S	K3-2	MS25036-106	TB2-3	18.50	16
V14A16	MS3102R36-7S	K3-2	MS3102R36-7S	K3-1	4.00	16
V12B16	MS3102R36-7S	K3-3	MS25036-106	TB2-2	18.12	16
V2A16	13216E6191-2	CR1-3	MS25036-106	XF2-1	6.50	16
X35A16A	13216E6191-2	CR1-1	MS25036-106	T1-X2	6.75	16
X34A163	13216E6191-2	CR1-4	MS25036-106	T1-X1	6.75	16
X33A16A	MS25036-106	T1-H2	MS25036-106	XF1-2	3.75	16
X31A16B	MS25036-106	T1-H1	MS25036-106	XF1-3	4.25	16
X20A12B	MS25036-112	CB1-B2	MS3102R36-7S	J3-4	17.50	12
V8F16N	MS25036-106	TB2-6	MS25036-108	E1	6.75	16
X3L16B	MS3102R36-7S	J3-A	MS25036-108	TB1-2	10.75	16
X4L16C	MS3102R36-7S	J3-B	MS25036-108	TB1-3	10.75	16

Table 5-3 (Con't)

WIRE LIST

Wire I.D. No.	FROM Terminal Type	FROM Term. No.	TO Terminal Type	TO Term. No.	Length (Inches)	Wire Size
	Wiring Harness - System Interconnecting					
V3B16*	MS3106R36-7P	P3-g		S3-1	46.00	16
V4A16*	MS3106R36-7P	P3-O		S3-2	46.00	16
X27B16C	MS3106R36-7P	P3-V	MS3106R20-27S	P9-C	40.00	16
X4D14C	MS3106R36-7P	P3-y	MS3106R28-11S	P7-K	19.00	14
V5E16	MS3106R36-7P	P3-C	MS25036-153	S7-1	68.00	16
X13B16B	MS3106R36-7P	P3-b	MS3106R36-7P	P7-H	19.00	16
X29B16C	MS3106R36-7P	P3-W	MS3106R20-27S	P9-F	40.00	16
V5B16	MS3106R36-7P	P3-D	MS3106R28-11S	P7-W	19.00	16
X6B16A	MS3106R36-7P	P3-c	MS3106R28-11S	P7-1	19.00	16
X19B16B	MS3106R36-7P	P3-M	MS3106R14S-6S	P8-B	60.00	16
X20B16B	MS3106R36-7P	P3-R	MS3106R20-27S	P9-A	40.00	16
X25B16A	MS3106R36-7P	P3-U	MS3106R20-27A	P9-B	40.00	16
X15B16A	MS3106R36-7P	P3-L	MS3106R14S-6S	P8-A	60.00	16
V4E16	MS3106R36-7P	P3-Z	MS3106R28-11S	P7-B	19.00	16
V10B16	MS3106R36-7P	P3-e	MS3106R28-11S	P7-N	19.00	16
X32B12C	MS3106R36-7P	P3-w	MS3106R20-15S	P4-C	31.00	12
X26B12B	MS3106R36-7P	P3-u	MS3106R20-15S	P4-B	31.00	12
V11E16	MS3106R36-7P	P3-H	MS3106R12S-3S	P5-B	35.00	16
V13B16N	MS3106R36-7P	P3-F	MS3106R12S-3S	P6-B	68.00	16
V12D16	MS3106R36-7P	P3-E	MS3106R12S-3S	P6-A	68.00	16
X37B12N	MS3106R36-7P	P3-t	MS25036-157	E3	17.00	12
V14D16	MS3106R36-7P	P3-G	MS3106R20-15S	P4-D	31.00	16
V8E16N	MS3106R36-7P	P3-K	MS3106R12S-3S	P5-A	35.00	16
V9D16	MS3106R36-7P	P3-J	MS3106R20-15S	P4-E	31.00	16
X30B12A	MS3106R36-7P	P3-v	MS3106R20-15S	P4-A	31.00	12
X17B16C	MS3106R36-7P	P3-N	MS3106R14S-6S	P8-C	60.00	16
V11B16	MS3106R36-7P	P3-d	MS3106R28-11S	P7-T	19.00	16
X36B16N	MS3106R36-7P	P3-Y	MS3106R28-11S	P7-A	19.00	16
V3D16	MS3106R36-7P	P3-f	MS3106R28-11S	P7-X	19.00	16
X2D14A	MS3106R36 7P	P3-x	MS3106R28-11S	P7-J	19.00	14
X3D14B	MS3106R36-7P	P3-z	MS3106R28-11S	P7-M	19.00	14
X10B16B	MS3106R36-7P	P3-a	MS3106R28-11S	P7-U	19.00	16
X9A16	MS53106R36-7P	P3-I	MS25036-153	S6-2	68.00	16
X28B16A	MS3106R36-7P	P3-S	MS3106R20-27S	P9-E	40.00	16
X23B16B	MS3106R36-7P	P3-h	MS3106R20-27S	P9-D	40.00	16
X11B16B	MS3106R36-7P	P3-p	MS3106R28-11S	P7-C	19.00	16
X8B16C	MS3106R14S-6S	P8-D	MS3106R28-11S	P7-E	69.00	16
X7B16B	MS3106R14S-6S	P8-E	MS3106R28-11S	P7-D	69.00	16

Table 5-3 (Con't)

WIRE LIST

Wire I.D. No.	FROM Terminal Type	FROM Term. No.	TO Terminal Type	TO Term. No.	Length (Inches)	Wire Size
	Wiring Harness — System interconnecting (Con't)					
X9B16A	MS3106R14S-6S	P8-F	MS3106R28-11S	P7-V	69.00	16
X43B16A	MS3106R36-7P	P3-P	MS3106R20-27S	P9-G	40.00	16
X44B16B	MS3106R36-7P	P3-T	MS3106R20-27S	P9-H	40.00	16
X42B16C	MS3106R36-7P	P3-X	MS3106R20-27S	P9-J	40.00	16
X3M16B	MS3106R36-7P	P3-A	MS3106R20-15S	P4-G	31.00	16
X4M16C	MS3106R36-7P	P3-B	MS3106R20-15S	P4-F	31.00	16

* Part of pressure switch assembly . . . . .

CHAPTER 6

GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

6.1. General

The only items restricted to general support maintenance level by the Maintenance Allocation Chart (MAC) are the repair or replacement of insulation or lifting fittings on the housing, and replacement of the cabinet base. However, general support maintenance may be called upon, at times, to perform any or all of the MAC items listed for unit and direct support maintenance for rehabilitation or overhaul of an air conditioner.

Section II. CASING

6.2. Inspect

CAUTION

Use disconnect switch (NOT POWER CABLE) to disconnect power to unit. Damage to cable connector pins will result if cable is used.

a. Disconnect power at power source.

b. Check casing for visible signs of damage, cracks, broken welds, or punctures. Repair as indicated.

6.3. Repair

NOTE

Repairs are limited to rework of broken or cracked welds, straightening of bent or dented sheet metal and replacement of handles, gaskets, insulation, and rivnuts and some small sheet metal parts by drilling out rivets and installation of replacement parts.

Minor dents and bent edges can be straightened using common sheet metal repair procedures.

Should touch up or refinishing be necessary, see TM 43-0139.

a. Disassemble unit as necessary and make repairs as indicated.

b. Gasket and insulation replacement.

W A R N I N G

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

NOTE

Use only gaskets, insulation, or name plates identified in TM 9-4120-360-24P.

(1) Soften and remove old adhesive and gasket residue using adhesive remover and a stiff brush.

(2) Identify and fabricate gasket or insulation to be replaced.

(3) Coat the mating surfaces of the metal and new gasket material with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to fingers.

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

c. Blind nut (rivnut) replacement.

(1) Drill out old blind nut using a drill bit slightly smaller than the body of the blind nut. Remove blind nut.

(2) Install new blind nut.

d. Nut plate replacement..

(1) Drill out rivets securing old nut plate using a drill bit slightly smaller than the rivet. Remove nut plate.

(2) Position new nut plate in place and secure using new rivets.

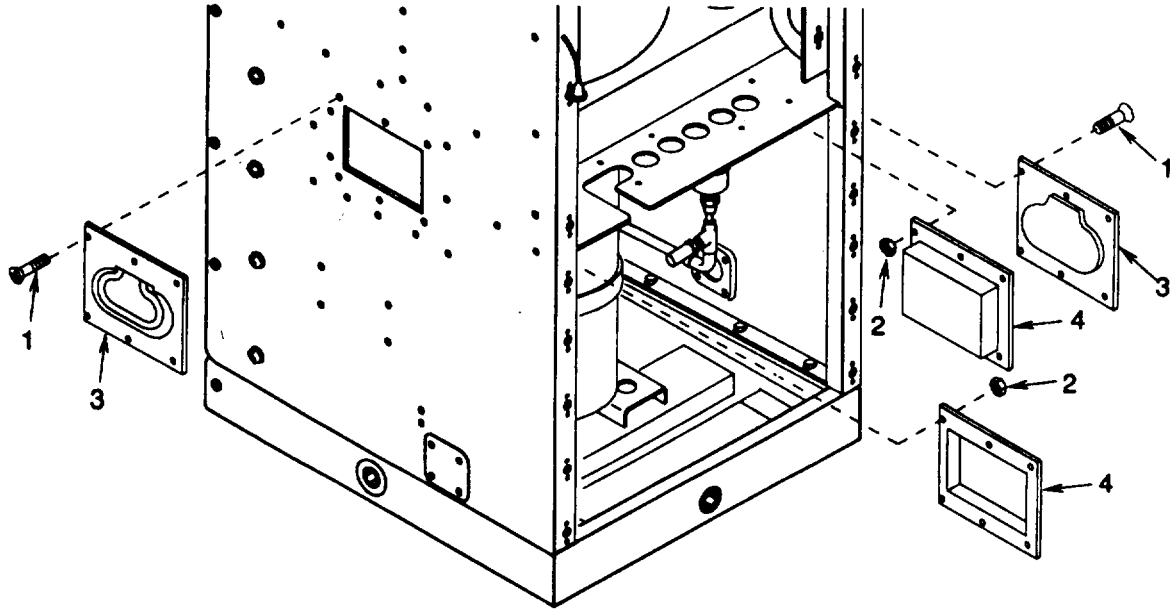


Figure 6-1. Lifting Handles

e. Lifting handle replacement.

(1) Remove six screws (1) and nuts (2). Remove handle (3) and enclosure (4).

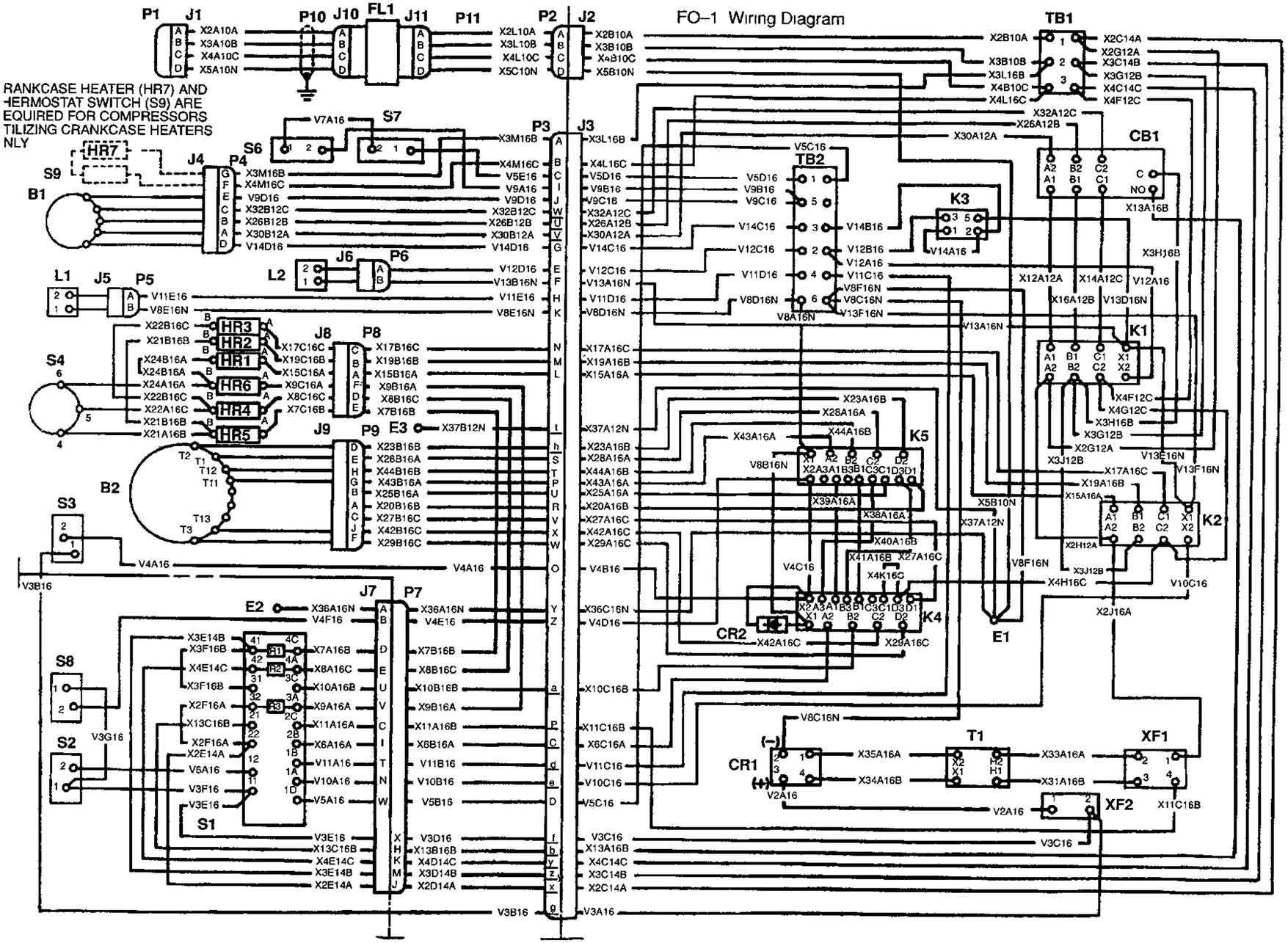
(2) Position enclosure (4) on the inside and handle (3) on the outside of enclosure.

(3) Aline mounting holes and secure using six screws (1) and nuts ***(2).***

(4) Reassemble unit.

NOTE

FOLLOW-ON MAINTENANCE: Conntect power at power source.



FO-1. Wiring Diagram.

COMPONENT REFERENCE LIST		
ELEC REF. DESIG	PART NUMBER	DESCRIPTION
B1	13211E3793-4	COMPRESSOR ROTARY
B2	13214E3728-15	MOTOR FAN
CB1	13216E6205-3	CIRCUIT BREAKER COMPRESSOR
CR1	C13214E3652	RECTIFIER, SEMICONDUCTOR DEVICE
CR2	C13216E7689	DIODE SEMICONDUCTOR
E1	MS35207-266	TERMINAL STUD (JUNCTION BOX GRD)
E2	MS35207-266	TERMINAL STUD
		(CONTROL MODULE GRD)
E3	MS90726-6	TERMINAL STUD (SYSTEM GRD)
HR1-6	C13211E8353-1	HEATER ELEMENT
J1	MS3100R-22-22P	CONNECTOR RECEPTACLE
		POWER UNIT
J2	MS3102R-22-22P	CONNECTOR RECEPTACLE JUNCTION BOX
J3	MS3102R-36-7S	CONNECTOR RECEPTACLE JUNCTION BOX
J4	MS3102R-20-15P	CONNECTOR RECEPTACLE
		COMPRESSOR
J5	MS3102R-12S-3P	CONNECTOR RECEPTACLE
		SOLENOID VALVE LIQUID LINE
J6	MS3102R-12S-3P	CONNECTOR RECEPTACLE
		SOLENOID VALVE LIQUID LINE
J7	MS3102R-28-11P	CONNECTOR RECEPTACLE
		CONTROL MODULE
J8	MS3100R-14S-6P	CONNECTOR, RECEPTACLE, HEATER
J9	MS3102R-20-27P	CONNECTOR RECEPTACLE FAN MOTOR
K1	MS24192-D1	RELAY COMPRESSOR START
K2	MS24192-D1	RELAY HEATER
K3	C13216E6182	RELAY TIME RELAY
K4	C13215E9921	RELAY ARMATURE
K5	C13215E9921	RELAY ARMATURE
L1	C13214E3971	VALVE SOLENOID LIQUID LINE
L2	C13214E3971	VALVE SOLENOID
		PRESSURE EQUALIZER
P1	MS3106R-22-22S	CONNECTOR PLUG POWER INPUT
P2	MS3106R-22-22S	CONNECTOR PLUG JUNCTION BOX
P3	MS3106R-36-7P	CONNECTOR PLUG JUNCTION BOX
P4	MS3106R-20-15S	CONNECTOR PLUG COMPRESSOR
P5	MS3106R-12S-3S	CONNECTOR PLUG SOLENOID VALVE
		LIQUID LINE
P6	MS3106R-12S-3S	CONNECTOR PLUG SOLENOID VALVE
		EQUALIZER
P7	MS3106R-28-11S	CONNECTOR PLUG CONTROL MODULE
P8	MS3106R-14S-6S	CONNECTOR PLUG HEATER
P9	MS3106R-20-27S	CONNECTOR PLUG FAN MOTOR
R1 R2	RCR32G274JR	RESISTER FIXED COMPOSITION
R3	MIL-R-39008/3	
S1	13216E6201-1	SWITCH ROTARY SELECTOR
S2	C13211E8301-1	THERMOSTAT
S3	C13216E7690-1	SWITCH PRESSURE
S4	B13211E8265	SWITCH HEATER CUTOUT
S6	C13211E8404	SWITCH HIGH PRESSURE CUTOUT
S7	C13214E4309	SWITCH, LOW PRESSURE CUTOUT
S8	MS35058-22	SWITCH TOGGLE FAN MOTOR
T1	D13214E3818-6	TRANSFORMER
TB1	C13213E0636	TERMINAL BOARD JUNCTION BOX
TB2	37TB6	TERMINAL BOARD JUNCTION BOX
	MIL-T-55164/1A	
XF1	B13211E3784	FUSEHOLDER
XF2	B13214E3811	FUSEHOLDER
FL1	D13218E9877	FILTER, RADIO FREQUENCY
J10	MS3102R22-22P	CONNECTOR RECEPTACLE FILTER
J11	MS3102R22-22S	CONNECTOR RECEPTACLE
P10	MS3106R22-22S	CONNECTOR PLUG FILTER INPUT
P11	MS3106R22-22P	CONNECTOR PLUG FILTER

APPENDIX A

REFERENCES

A-1.	**Fire Protection**	
	TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
A-2.	**Lubrication**	
	C91OO1L	Fuels, Lubricants, Oil and Waxes
A-3.	**Painting**	
	TM 43-0139	Painting Instructions for Field Use
A-4.	**Maintenance**	
	DA PAM 738-750	The Army Maintenance Management System **(TAMMS)**
	TM9-4120-360-24P	Unit, Direct and General Support Maintenance Repair Parts and Special Tools Lists including Depot Maintenance Repair Parts and Special Tools)
A-5.	**Cleaning**	
	Fed. Spec P-D-680	Dry cleaning solvent
A-6.	**Destruction**	
	TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use
A-7.	**Radio Suppression**	
	TM 11-483	Radio Interference Suppression

APPENDIX B

MAINTENANCE ALLOCATION CHART

B-1. General

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

b. The Maintenance Allocation Chart (MAC) designates overall responsibility for the performanace of maintenance functions on the identifed end item or component. The implementation of the maintenanance functions upon the end item or component will be consistent with the assigned maintenance functions.

B-2. Maintenance Functions

a. *Inspect.* To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

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

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

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

g. Install, The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly. module (component or assembly), end item, or system.

j. *Overhaul.* That maintenance effort (services/actions) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. T'he rebuild operation includes the act of returning to zero those age measmements (hours/miles, etc.) considered in classifying Army equipments components.

B-3. Column Entries.

Columns used in the maintenance allocation chart will be limited to those shown. Entries for those columns are explained below.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun 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.

d. Column 4, *Maintenance Category. Column 4 specifies,* by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time' 'figures will be shown for each category. The number of manhours specifled by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart.

e. *Column 5, Tools and Equipment. Column 5* specifies, by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column six *(6)* (VI) contains au alphabetic code which leads to the network in section W, Remarks, which is pertinent to the item opposite the particular code.

APPENDIX B

MAINTENANCE ALLOCATION CHART

18,000 Btu Vertical Compact Air Conditioner

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipmt	(6) Remarks
01	*Casings & Related Parts*								
	Fabric Cover	Replace		1.0					
	Top Panel Assembly	Replace		0.5					
	Air Discharge & Intake Grille	Inspect		0.6					
		Service		2.2					
		Replace		3.0					
		Repair		3.0					
	Lower Panel	Replace		2.0					
		Repair		3.0					
	CBR Cover	Replace		0.5					
	Fresh Air Screen	Inspect		0.2					
		Service		0.5					
		Replace		0.2					
	Condenser Coil Guard	Inspect		0.2					
		Service		0.5					
		Replace		0.2					
	Condenser Fan Guard	Inspect		0.2					
		Service		0.5					
		Replace		0.2					
	Back Panel & Motor Support	Replace		0.2					
	Air Filter	Inspect		0.2					
		Service		0.2					
		Repair		0.5					
	Fresh Air Damper Control	Inspect		0.2					
		Adjust	0.1						
		Replace		0.5					
	Mist Eliminator	Inspect		0.5					
		Service		0.5					
		Replace		0.5					
	Block-off Panel	Replace		1.0					
	Instruction Plates	Replace		1.0					
	Casing Assembly	Repair		3.0					
	Insulation	Replace		0.5					
	Condensate Drainage	Inspect		1.5					
		Service		1.5					
		Replace		4.0					
02	*Control Panel and Junction Box*								
	Control Panel	Replace		12					
		Repair		6.0					
	Junction Box	Replace		20					
		Test		15					
	RFI Filter Assembly	Test		1.0					
		Replace		1.5					

MAINTENANCE ALLOCATION CHART (Cont.)

18,000 Btu Vertical Compact Air Conditioner

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipmt	(6) Remarks
03	*Compressor Assembly*								
	Compressor	Service			5.0				
		Test			3.5				
		Replace			15				
04	*Pressure Control Switches*								
	Pressure Switch	Test			2.0				
		Replace			3.0				
	Cut-Out Switches	Replace			4.0				
		Test			6.0				
05	*Refrigerant Components*								
	Refrigerant Tubing	Inspect			3.0				
	and Fittings	Test			2.0				
		Replace			3.0				
	Solenoid Valves	Test			3.0				
		Replace			5.0				
	Filter-drier (Dehydrator)	Replace			4.0				
	Sight-glass Liquid Indicator	Inspect			0.5				
		Replace			4.0				
	Pressure Regulating Valve	Adjust			2.0				
		Replace			3.0				
	Pressure Relief Valve	Replace			3.0				
	Receiver	Replace			2.0				
	Service Valves	Inspect			1.0				
		Replace			3.0				
	Thermal Expansion Valves	Test			1.8				
		Adjust			2.5				
		Replace			3.5				
	Condenser Coil	Service			1.0				
		Replace			13				
	Evaporator Coil	Service			1.0				
		Replace			13				
06	*Heater Assembly*								
	Electric Heating	Test			1.0				
	Elements	Replace			1.5				
	Heater Thermostatic Switch	Test			1.0				
		Replace			1.5				

MAINTENANCE ALLOCATION CHART (Cont.)

18,000 Btu Vertical Compact Air Conditioner

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipmt	(6) Remarks
07	*Fans and Motor*								
	Evaporator Fan Assembly	Replace			2.5				
	Condenser Fan Assembly	Replace			2.5				
	Fan Motor	Test			.75				
		Replace			3.2				
		Repair			2.0				
		Inspect			1.0				
08	*Wiring Harnesses & Leads*								
	Wiring Harnesses	Inspect			5.0				
		Test			3.0				
		Replace			13				
		Repair			3.5				

Subcolumns are as follows: C-Operator/Crew O-Unit F-Direct Support H-General Support D-Depot

MAINTENANCE ALLOCATION CHART

18,000 BTU Vertical Compact Air Conditioner

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference Code	(2) Maintenance Category	(3) Nomenclature	(4) National Stock Number (NSN)	(5) Tool Number
	F	Thermometer Set, Super-Heat Serviceman, (38508) 211-001	6685-00-874-5834	
	O	Tool kit, Service, Refrigeration Unit (SC 5180-90-CL-N18)	5180-00-597-1474	
	O	Soldering Gun Kit	3439-00-930-1638	
	F-H	Recovery and Recycling Unit, Refrigeration	4310-01-338-2707	17500B (07295)

Section IV. REMARKS

NONE

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

C-1. Scope

This appendix lists Expendable Supplies and Materials you will need to operate and maintain the Air Conditioner. These items are authorized to you by CTA50-970, Expendable Items (except Medical, Class V, Repair Parts and Heraldic Items).

C-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.

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

c. Column 3 - National Stock Number. This is the national stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. Column 5 - Unit of Measure (UM). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two- character alphabetical abbreviation (e.g., each (ea), inch (in), pair (pr), etc.). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) UM
1	F	9150-00-823-7905	Lub. Oil Ref. VV-L-825	GL
2	C	6850-03-264-9037	Dry Cleaning Solvent P-D-680 (81348)	GL
3	F	6850-0837-9927	Monochlordifluoromethane, Technical: w/cylinder 22 lb. (Refrigerant-22) BB-F-1421, type 22(81348)	CY

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By Order of the Secretary of the Army:

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

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
05254

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FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT 22 August 1992

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1-1520-250-10	15 June 1992	Operator's manual MH60K Helicopter

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	

IN THIS SPACE, TELL WHAT IS WONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointed at a bolt. In key to figure 4-3, item 16 is calle a shim. Please correct one or the other

EXAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

SIGN HERE

JOHN DOE John Doe

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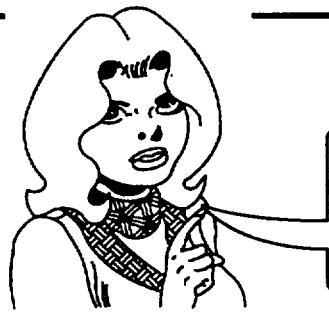

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PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-5430-219-23P	28 February 1995	TANK, FABRIC, COLLAPSIBLE, POL

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

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The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*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