TECHNICAL MANUAL

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

AIR CONDITIONER, COMPACT, VERTICAL 208-VOLT, 3 PHASE, 60,000 BTU/HR 50/60 HERTZ

KECO MODEL F60T-2
NSN 4120-00-935-5416 (EIC: VTN)

HARVEY W. HOTTEL, INC.
MODEL CV 60-6/6-08
NSN 4120-00-935-5416

KECO MODEL F60T-2A
NSN 4120-01-181-6060

UNIFAB INDUSTRIES, MODEL CV-60-5/6-08
NSN 4120-01-213-5980

- **This manual supersedes TM 5-4120-357-14, dated 9 May 1980.**

HEADQUARTERS, DEPARTMENT OF THE ARMY
31 August 1993

WARNING

Dangerous toxic fumes are released when polyurethane foam is burned. If it is accidentally burned or heated indoors, the area must be thoroughly ventilated with an exhaust system like that used in a paint-spray booth. When welding in confined spaces or in areas with poor ventilation, use air supplied respirators approved by the National Institute for Occupational Safety and Health or by the U. S. Bureau of Mines. Persons with chronic or recurrent respiratory conditions, including allergies or asthma, should not work in these areas.

WARNING

HIGH VOLTAGE
is used in the operation of this equipment.
DEATH ON CONTACT

or severe injury may result if you fail to observe safety precautions. Always disconnect the air conditioner from power source before working on it. Do not operate the air conditioner without grilles, top covers, and guards in place and tightly secured.

WARNING

Extreme caution should be exercised whenever unit must be operated with protective panels or grillwork removed, as evaporator fans are rotating at 3450 RPM and condenser fan is rotating at 1725 RPM.

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

Acetone (Fed. Spec. O-A-51) and methyl-ethyl ketone (Fed. Spec. TT-M-261), used for general manual cleaning and softening of adhesives, varnishes, etc., are toxic and extremely flammable. Their vapors are explosive. Avoid prolonged contact with skin or inhalation of vapors. Use in a well-ventilated area, and keep away from sparks or open flame.

WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed. Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

WARNING

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

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm). Do not direct compressed air against the skin. Use goggles or full face shield.

WARNING

Avoid inhaling fumes and burns from any acid formed by burn out of oil and refrigerant. Wear gas mask if area is not thoroughly ventilated. Wear protective goggles or glasses to protect eyes. Wear rubber gloves to protect hands. Use care to avoid spilling compressor burn out sludge. If sludge is spilled, clean area thoroughly.

Technical Manual
No. 9-4120-357-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 August 1993

OPERATOR'S, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL AIR CONDITIONER, COMPACT, VERTICAL 208-VOLT, 3 PHASE, 60,000 BTU/HR 50/60 HERTZ KECO MODEL F60T-2 NSN 4120-00-935-5416 HARVEY W. HOTTEL, INC. MODEL CV 60-6/6-08 NSN 4120-00-935-5416 KECO MODEL F60T-2A NSN 4120-01-181-6060 UNIFAB INDUSTRIES, MODEL CV-60-5/6-08 NSN 4120-01-213-5980

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 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army 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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* This manual supersedes TM 5-4120-357-14, dated 9 May 1980.

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CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope.
This manual is issued for the use of personnel who have the responsibility for service, operation and maintenance of the Air Conditioner, Compact, Vertical, Model F60T-2 and F60T-2A, manufactured by Keco Industries, Inc., Cincinnati, Ohio; Model CV-60-5/6-08, manufactured by Unifab Industries, Inc., Red Lion, Pennsylvania. Chapters 1 through 3 provide information required for set-up, operation and servicing of the equipment by the operator. Chapter 4 contains detailed maintenance instructions for the use of unit maintenance personnel. Chapters 5 and 6 provide detailed instructions for repair and replacement of components authorized at direct support and general support maintenance levels.

1-2. Purpose.
The air conditioner provides ventilation by either circulating inside air or a mixture of inside and outside air, and is equipped to utilize air passed through a chemical biological-radiological (CBR) filtering system if required. The air conditioner also provides 60,000 Btu/Hr of cooling or 49,000 Btu/Hr heating, both of which are thermostatically controlled to maintain desired comfort levels. During cooling operation, a percentage of dehumidification also occurs, the amount depending upon the degree of humidity present in the atmosphere.

1-3. Special Limitations on Equipment.
The air conditioner is designed to operate at all ambient temperatures between -50°F (-45.6°C) and 120° F (48.9°C) as follows:

	Mode	Temperature	
		Min.	Max
A.	Heating	-50°F(-45.6°C)	90°F(32.2°C)
B.	Cooling	0°F(-17.8°C)	120°F(48.9°C)

This does not necessarily mean that a desirable comfort level can be maintained at extreme temperatures, since the comfort level is dependent upon the heat loss or heat gain of the space to be heated or cooled, and upon whether such heat loss or gain is within the capacity of the air conditioner to supply. When the air conditioner is stopped while in the cooling mode, a period of one minute should be allowed to elapse before attempting to re-start. This period will permit pressures to equalize so that the compressor will not encounter high head-pressures.

1-4. 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).

1-5. Reporting Equipment Improvement Recommendations.
Equipment Improvement Recommendations (EIR'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. EIR's may be submitted on SF 368. Mail directly to AMSAT-I-MDO, U.S. Army Aviation and Troop Command, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished to you.

1-6. Difference Between Models.
There is no difference between Keco Model F60T-2, F60T-2A and Unifab Industries, Model CV-60-5/6-08.

Section II. EQUIPMENT DESCRIPTION

1-7. Equipment Purpose, Capabilities and Features.
The purpose of the air conditioner is to ventilate, heat, or cool the air in an enclosure, and to provide a comfortable environment for personnel occupying the enclosure. (See Figures 1-1 through 1-4). The unit may

also be utilized to maintain a constant temperature for heat producing equipment such as electrical or electronic apparatus, biological or chemical specimens, and other controlled atmospheres. The modes of operation and the thermostatically controlled temperature are set by a rotary switch and a thermostat mounted on a small control panel in the lower front area of the unit. Controlled amounts of outside air may be mixed into the return air to provide freshness, and delivered air can be ducted to remote spaces, using standard duct work, if required. The control panel of the unit may also be placed in a remote location, if desired.

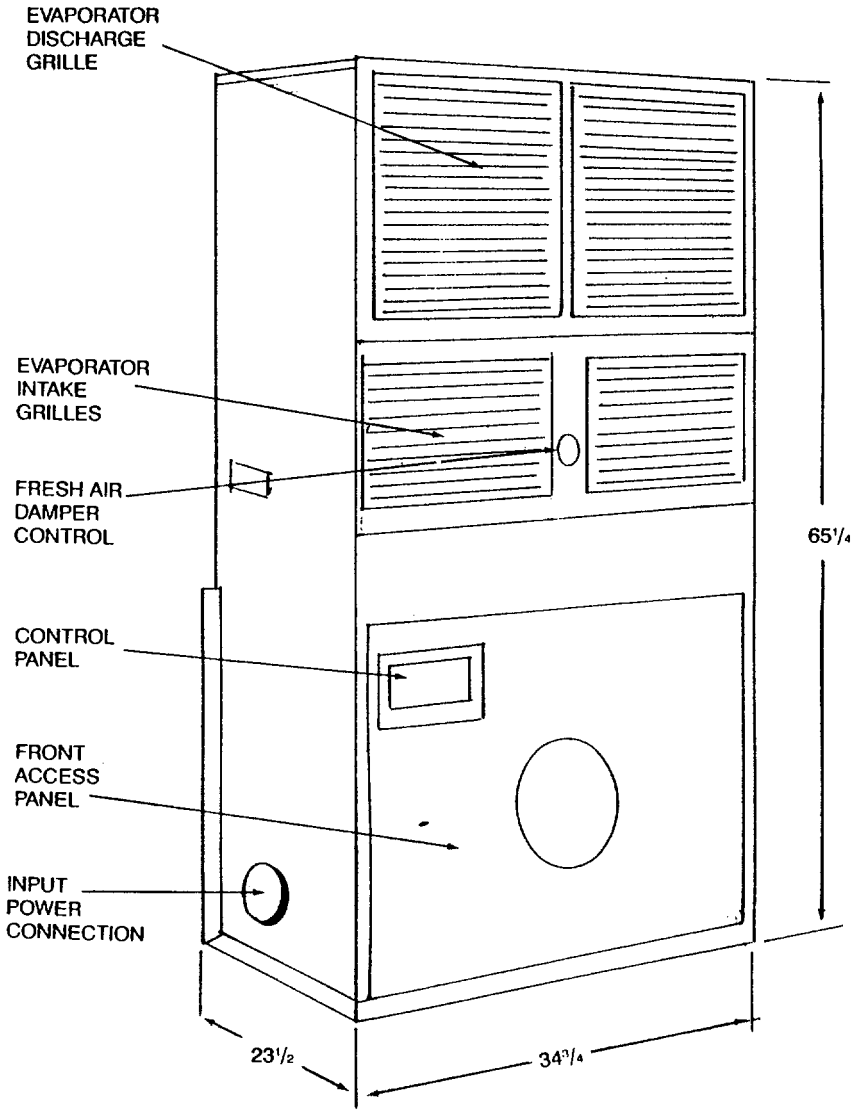

Figure 1-1. Air Conditioner, Front View
(With Shipping Dimensions)

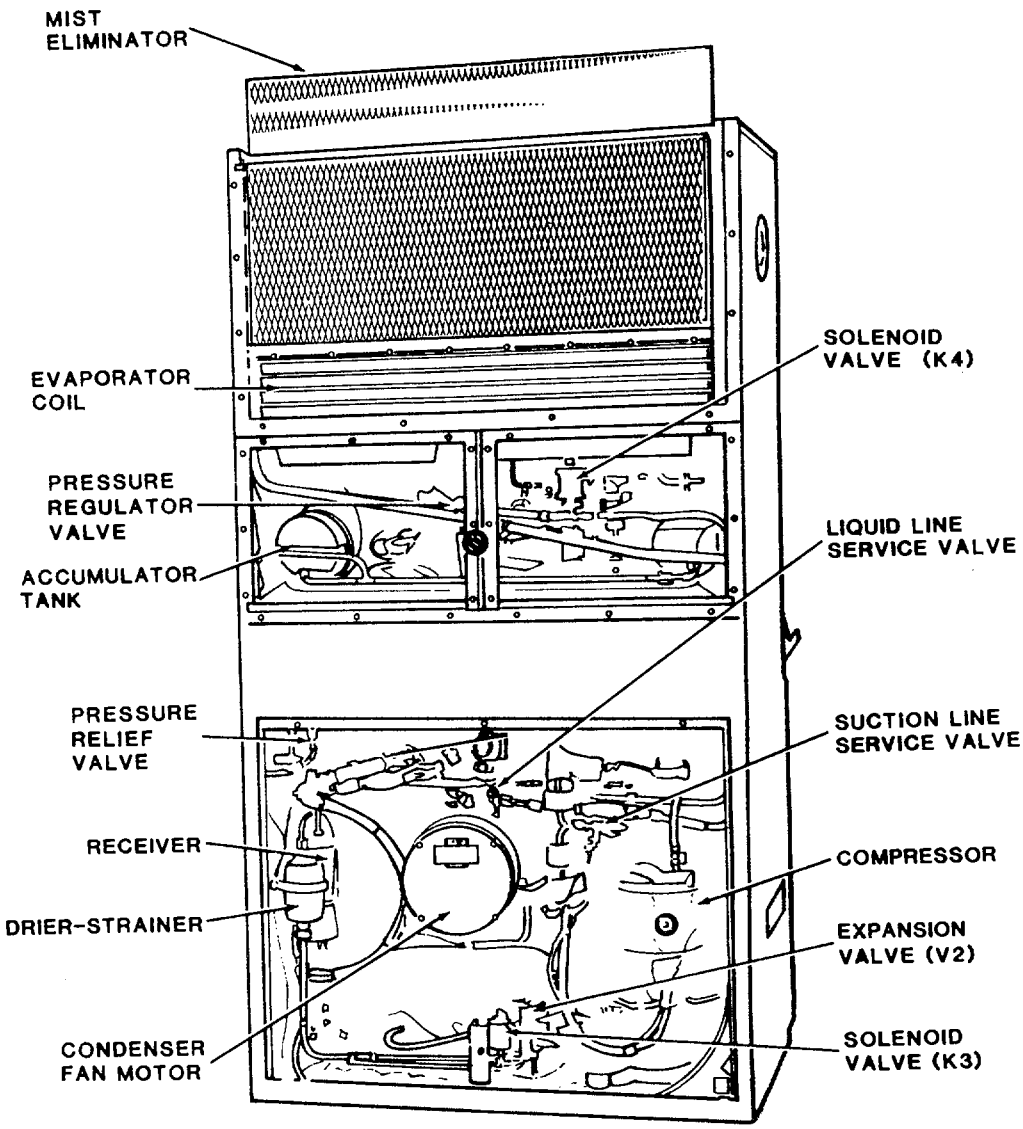

Figure 1-2. Location Major Components (Front)

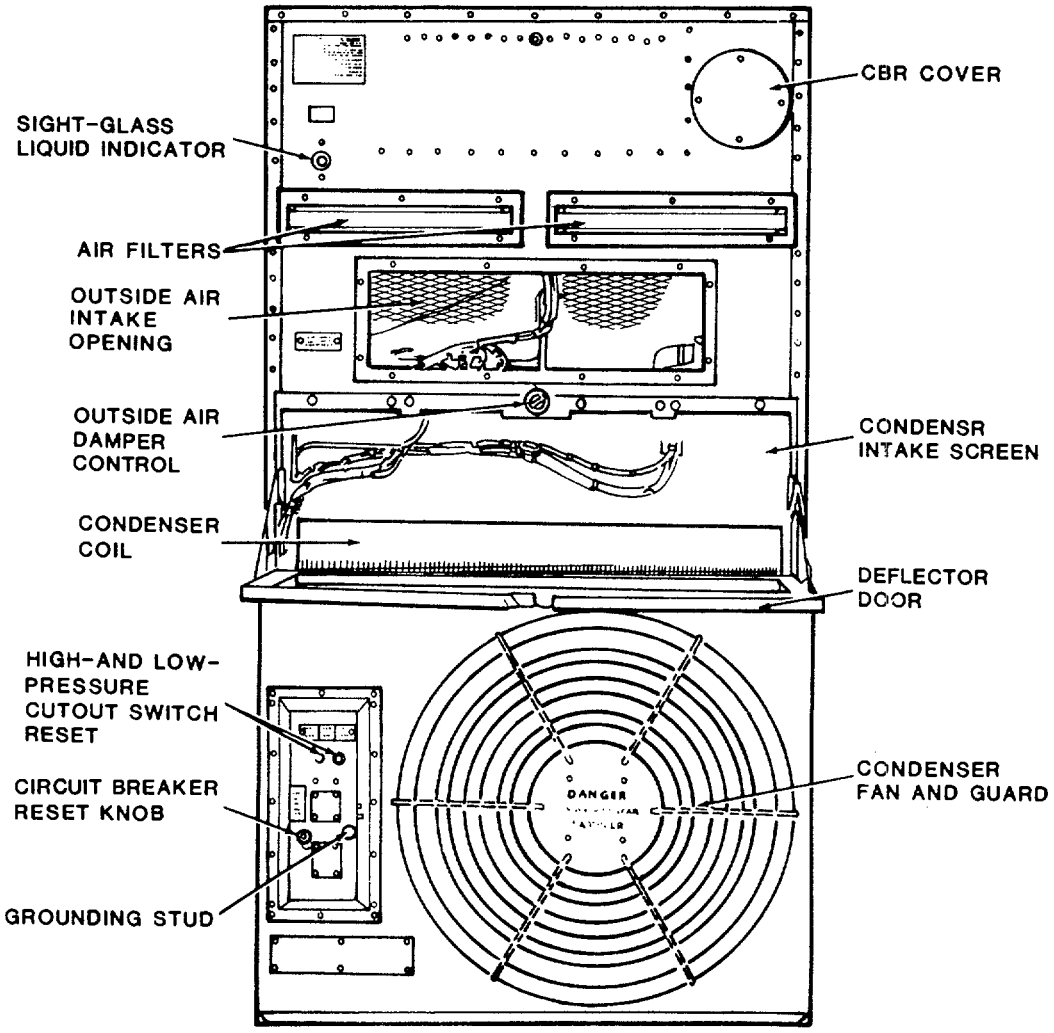

Figure 1-3. Location Major Components (Rear)

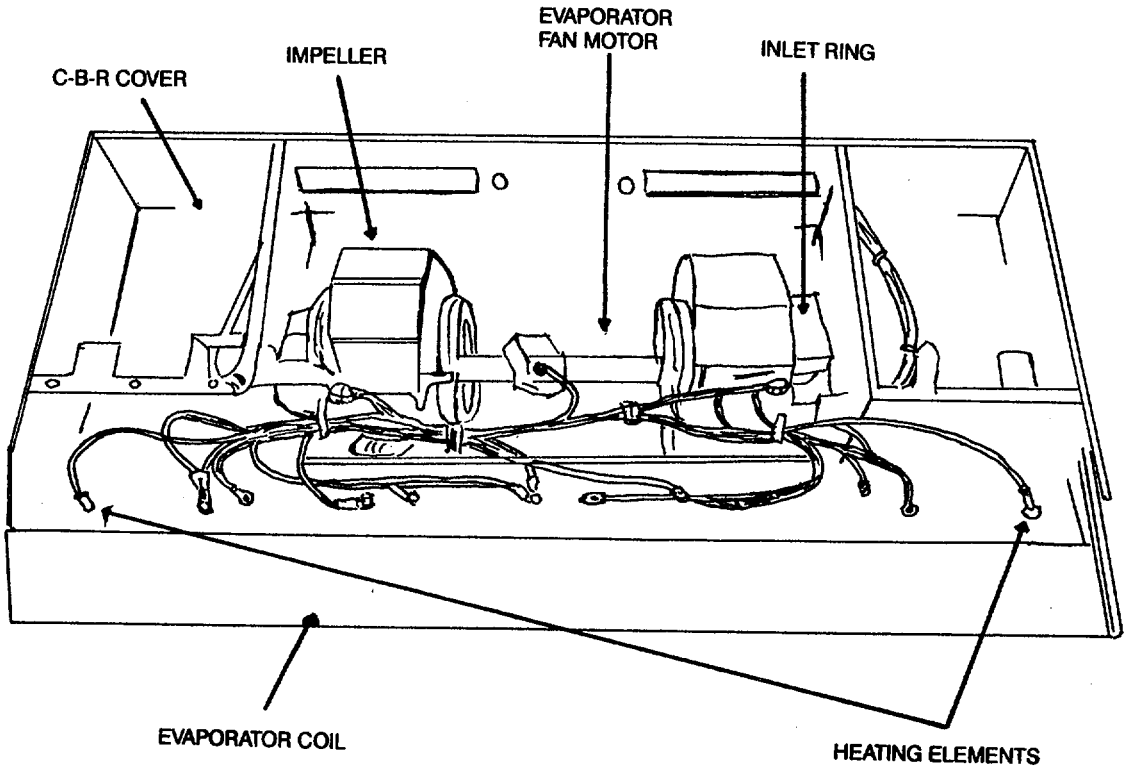

Figure 1-4. Location Major Components (Top)

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-8. Functional Description.

a. Cooling. When the selector switch is set at COOL, and the temperature control thermostat is set at DECREASE, the air conditioner is in the cooling mode of operation. Liquid refrigerant is metered into the evaporator coil at the front face of the air conditioner through a thermostatic expansion valve (V5, Fig. 1-5). Warm room air forced around the finned tubs of the evaporator coil (E) causes the liquid refrigerant to vaporize and absorb heat from the air, thereby cooling the air. The vaporized refrigerant is then piped to the compressor (B1) where the gas increases in both temperature and density as it is compressed. The hot compressed gas is then piped to the condenser coil (C) where a flow of outside air is forced around finned tubs to remove the heat that has been absorbed during evaporation and compression. Removal of the heat causes the compressed gas to liquefy to a high temperature liquid. Excess refrigerant, not required by the evaporator, is stored in receiver tank (R1). The liquid refrigerant is returned to the expansion valve (V5) evaporator coil (E) through the check valve (V6) dehydrator (D), liquid line solenoid valve (K3) and liquid indicator (G). Here the cycle is repeated. Any liquid that is not. immediately required for cooling is stored indefinitely in a pair of accumulator tanks (R2-R3) between the condenser and evaporator coils for use when the refrigerant pressure is too low for low temperature operation. Since the compressor runs continuously, it is necessary to prevent evaporator coil freeze up during the low heat load operation. The equivalent pressure for refrigerant 22 at 32° F (0° C) is approximately 58 psig (4.08 kg/cm2). With the low heat load on the evaporator (suction) pressure will reduce and as it approaches 58 psig (4.08 kg/cm2) the pressure regulating valve (V2) begins to open allowing hot gas from the discharge line of the compressor to bypass to the suction line thereby maintaining suction pressure and evaporator coil temperature above freezing point. To prevent the development of excessive heat in suction line which could overheat compressor motor, a second thermostatic expansion valve injects liquid refrigerant into suction line to cool gas to a safe operating temperature.

b. Bypass-Cooling. When the temperature of the air returning to the air conditioner is below set point of temperature control thermostat, the cooling is stopped even though the compressor continues to operate. To accomplish this, the liquid line solenoid valve (K3) which is a normally open valve, is energized by the temperature control and closes the valve stopping refrigerant flow to the evaporator coil (E). As the compressor continues to operate the suction pressure reduces to the point where the pressure regulating valve (V2) opens to create a bypass condition of refrigerant being pumped. As in the "low load" condition described in the cooling operation above, the repeated compression caused by this bypass increases temperature of the refrigerant vapor. To prevent the development of excessive heat in the suction line which would overheat and damage the compressor motor, the thermostatic expansion valve (V4) injects liquid refrigerant from the liquid line, ahead of liquid line solenoid valve (K3), into the suction line to cool the refrigerant vapor to a safe operating temperature for the compressor motor.

c Cooling Control. The refrigeration compressor operates continuously when the mode selector switch is set at COOL. When the room or return air temperature is higher than the setting of the temperature control thermostat (S1, Fig. 4-16), solenoid valve (K3) is open to permit liquid refrigerant to flow to the evaporator coil, through expansion valve (V5). Suction pressure to the compressor is maintained above a minimum level by the pressure regulating valve,(V2) which bypasses compressed gas to the suction side of the compressor on demand. When the room temperature falls to the setting of the temperature control thermostat (S1, Fig. 4-16), solenoid valve (K3) closes to shut off refrigerant to evaporator coil, and refrigerant is by-passed through the pressure regulating valve (V2). This bypass circuit prevents build-up of excessive pressure differentials, but by bypassing the evaporator coil, it permits heat to build-up in refrigerant gas. To reduce heat build-up, a second expansion valve (V4) opens when its sensor bulb detects excessive heat, thereby injecting liquid-refrigerant into the compressor suction line to act as coolant. If failure of control or loss of refrigerant results in pressures beyond normal limits, the high-pressure cutout switch (S5) or the low-pressure cutout switch (S6) will open to stop operation of compressor. The solenoid valve (K4), a normally open valve, is open only when the compressor is not operating for system pressure equalization.

d. Heating Mode. Placing the mode selector switch in HI HEAT or LO HEAT provides two levels of heat. The temperature control thermostat only controls half of the heating elements. With the selector switch in HI HEAT position, three of the six heating elements are constantly energized and the remaining three heating elements are controlled by the temperature control thermostat. While it is possible to select HI HEAT whenever heating is desired it is not practical for use in only moderately cool weather since three of the six heating element

remain energized when the temperature is satisfied and the conditioned space would become over-heated. When the LO HEAT mode is selected only three of the six heating elements are energized when the temperature control is not satisfied and all heat is off when the temperature control is satisfied. In both cases the temperature control thermostat controls and deenergizes or shuts off three of the six heating elements when the room or return air is warmer than the thermostat setting. When overheating occurs, turn the mode selector switch to LO HEAT.

LEGEND		
SYMBOL	PART NO.	DESCRIPTION
B1	13217E6806	COMPRESSOR, RECIP, PDVN
C	13214E4241	COIL, CONDENSER
D	13214E4209	DEHYDRATOR, DESICCANT
E	13214E4242	COIL, EVAPORATOR
G	13214E3969	INDICATOR, SIGHT, LIQUID
K3, K4	13214E3971	VALVE, SOLENOID
R1	13214E4028	RECEIVER
R2	13214E4247	TANK, LEFT HAND
R3	13214E4248	TANK, RIGHT HAND
S5	13211E8404	SWITCH, HIGH PRESSURE CUTOUT
S6	13214E4309	SWITCH, LOW PRESSURE CUTOUT
V1	13219E2828	VALVE, ANGLE
V2	13211E3800	VALVE, PRESSURE REGULATING
V3	13211E8369	VALVE, PRESSURE RELIEF
V4	13214E3974	VALVE, EXPANSION
V5	13214E4246	VALVE, EXPANSION
V6	13214E3967	VALVE, CHECK

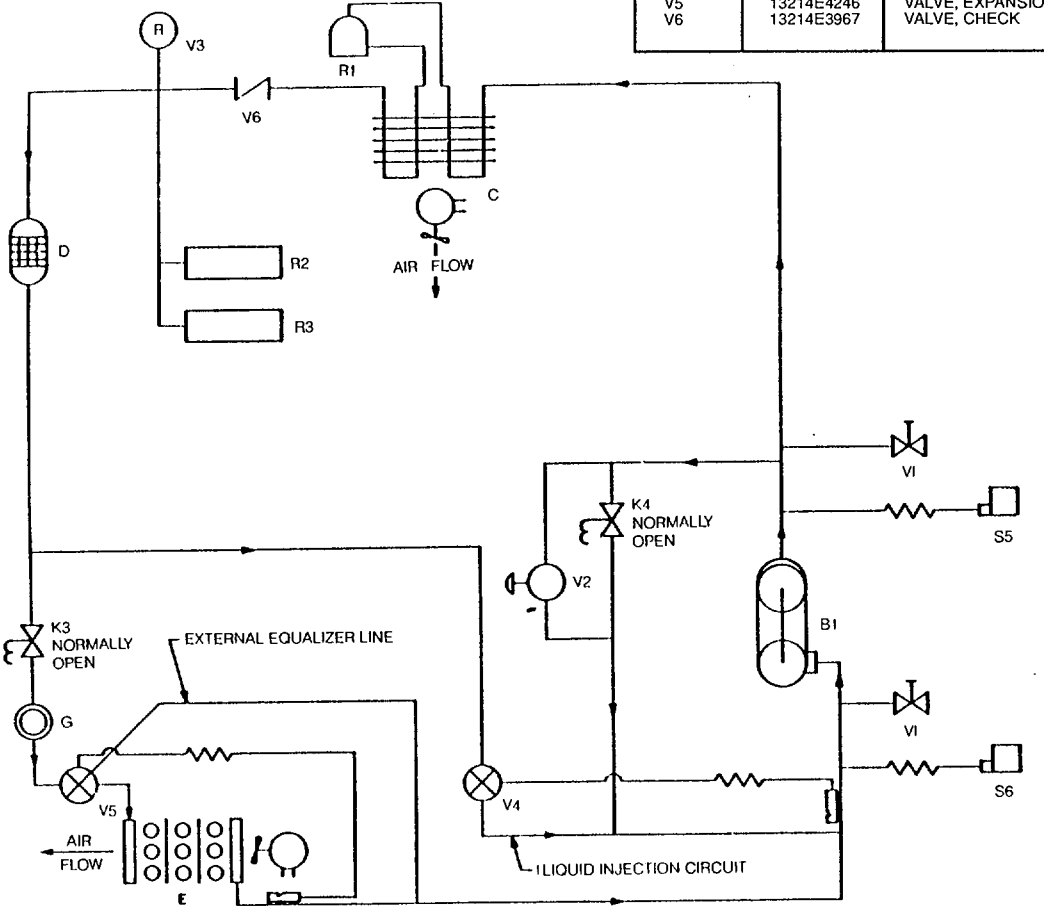

Figure 1-5. Refrigeration Diagram

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CHAPTER 2
OPERATING INSTRUCTIONS

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

2-1. Front Control Panel.(See Figure 2-1)

The control panel is located in the upper left quadrant of the front access panel. A rotary switch and a thermostat are mounted side by side on the panel. The left-hand rotary switch knob operates a five-position mode selector switch. The right-hand knob operates a continuously variable temperature control thermostat. Normally, all operations of the air conditioner are controlled by the switch and thermostat. Operating position of the selector switch, and their functions are as follows:

***a*. *Off*.** All functions.

b*. *Ventilate. Only the evaporator fan operates.

***c*. *Cool*.** The ventilating system and the refrigeration system operate automatically.

d*. *Lo heat. The ventilating system and three of the six heating elements operate under thermostatic control.

***e*. *Hi heat*.** The ventilating system and all six heating elements operate. Three elements continuously and three under thermostatic control.

2-2. Dampers and Grilles.

Control of air direction and volume is achieved by proper setting of the various dampers and grilles incorporated in the air conditioner. The function of each of these is described in the following paragraphs:

a. Evaporator discharge grille. (See Figure 1-1) The evaporator discharge grille is located at the top of the front face of the air conditioner, and extends across the entire width of the unit. Each side of the grille is equipped with adjustable vanes to direct the airflow from the ventilating blower. These vanes should always be kept open when the air conditioner is operating in any mode, so that the output of the air will not be obstructed. When the air conditioner is operating in the cooling mode, the delivered air will be denser that the room air, and will have a tendency to sink downward. To offset this tendency, the grille vanes should be directed slightly upward. When heating, the delivered air will be less dense, and will have a tendency to float upward. This tendency may be offset by directing the grilles downward.

b. Evaporator intake grilles. (See Figure 1-1). The intake grille is located just below the discharge grille, and it consists of two vaned grilles. Both sets of vanes should be fully open during operation of the air conditioner in any mode, except when outside air is being drawn in. The opening or closing of the vanes is controlled by operating tabs projecting from the left side of the left grille and the right side of the right grille.

c. Fresh air damper. The fresh air damper, which can be opened to adjust outside air through the rear of the air conditioner, is controlled by knobs on each end of an operating shaft: One knob just below the middle of the evaporator intake grille, and the other in a similar position in the back of the unit. The knobs are marked for the proper direction to turn for open or close. It is often desirable to keep the fresh air damper partially open during all modes of operation to add enough fresh, outside air to the conditioned room to prevent constant recirculation of stale air.

2-3. Covers.

a. Deflector doors. (See Figure 1-3). The deflector door is located above the round condenser fan guard at the bottom of the rear surface of the air conditioner. The door encloses the condenser coil, and helps to seal out cold air, rain or snow during the heating season. During the cooling season, the open deflector door prevents recirculation of heated exhaust air into the condenser coil area. The deflector door must be open during operation of the air conditioner in the cooling mode.

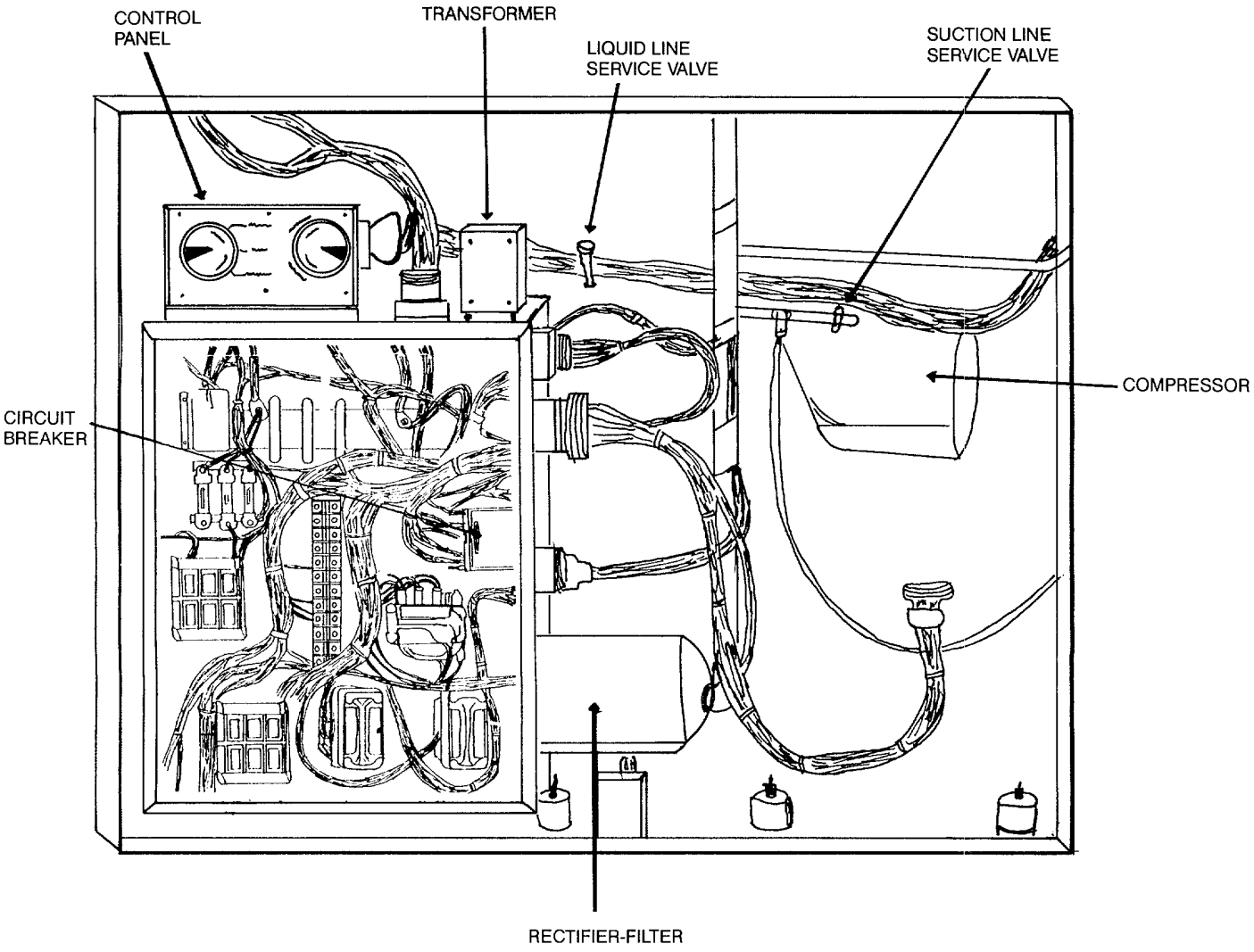


Figure 2-1. Control Panel

b. Air conditioner cover. The air conditioner cover encloses the lower rear section of the air conditioner, including the condenser fan outlet. The cover is retained in the closed position by a zipper around both sides and the bottom. It is retained in the open position (rolled up) by two flaps fastened by turnbutton fasteners at the top of the panel. The cover must be open at all times when the air conditioner is operating in the cooling mode.

c. CBR cover plate. The chemical-biological-radiological (CBR) cover plate is the circular plate located in the upper right-hand portion of the air conditioner's rear surface. The plate covers the CBR intake when a CBR air filtering system if not used.

2-4. Rear Surface Controls and Indicators.

a. Circuit breaker reset. The circuit breaker reset knob is located on the rectangular recessed panel at the 9 o'clock position from the condenser fan. The circuit breaker automatically disconnects electric power from the compressor and 24 v DC control circuit in case of an internal overload or short circuit of the compressor motor. It can be reset by pulling then pushing the reset knob. If the circuit breaker trips repeatedly, or cannot be reset, report the trouble to unit maintenance.

b. High- and low-pressure cutout switches. The pressure cutout switches are located at the top of the rectangular recessed panel at the 10 o'clock position from the condenser fan. One or the other switch may open when refrigerant pressure becomes too high or too low. To reset the switches, press then release each of the reset buttons. If one of the switches trips repeatedly, report the trouble to direct support maintenance at once.

c. Sight-glass liquid indicator. The sight-glass liquid indicator is a circular gage located in the upper left-hand portion of the rear surface of the air conditioner. The sight-glass shows the condition of the liquid refrigerant in the system. Shortage of refrigerant is indicated by bubbles or a milky appearance of the liquid. Moisture is indicated by a change of color from green to yellow. Either condition should be reported to direct support maintenance at once.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Bubbles may appear in the sight-glass when the hot gas bypass valve is in operation with normal charge. To verify that the refrigerant charge is in low, operate unit at full load condition without the bypass open. If bubbles appear at full load condition with bypass closed, addition of refrigerant is required.

2-5. Operating Settings.

The proper settings for air conditioning controls are as shown in Table 2-1.

Table 2-1. OPERATING SETTINGS

Mode	Selector Switch Deflector Door	Thermo-stat	Outdoor Air Damper	Return Air Damper	Air Conditioner and
Cooling - 100% Recir-culated Air	COOL	Desired Temper-ature	Closed	Open	Open
Cooling - with fresh makeup air	COOL	Desired Temper-ature	Partially or Fully Open	Partially or Fully Closed	Open
Cooling - with fresh makeup air through CBR filter	COOL	Desired Temper-ature	Closed	Partially or Fully Open	Open
Heating - 100% Recir-culated air	LO HEAT or HI HEAT	Desired Temper-ature	Closed	Open	Optional
Heating - with fresh makeup air	HI HEAT	LO HEAT or ature	Desired Temper-	Partially or Fully Open	Partially or Optional Fully Closed
Heating - with fresh makeup air through CBR filter	LO HEAT or HI HEAT	Desired Temper-ature	Closed	Partially or Fully Open	Optional
Ventilation - Maximum Outdoor Air	VENTILATE	Any Setting	Open	Closed	Optional

2-6. Starting.

CAUTION

If the air conditioner has been stopped after running in the cooling mode, let pressure equalize for at least one minute before restarting.

a. Cooling. Before starting the air conditioner in the cooling mode, make sure that the following covers and grilles are open:

(1) Air conditioner
(2) Deflector door
(3) Evaporator air intake grille
(4) Evaporator air discharge grille

Turn the mode selector switch to COOL, and the temperature control thermostat to DECREASE. Check air delivery to verify that it is cool, then adjust temperature control thermostat and outside air damper as desired.

b. Heating. Make sure that evaporator air intake and discharge grilles are open, then turn selector switch to LO HEAT or HI HEAT, as required. Adjust outside air damper to add fresh air if desired.

c. Ventilating. Make sure that evaporator air discharge and intake grilles are open, then turn selector switch to VENTILATE. Open fresh air damper, and close evaporator air intake grilles to obtain maximum outside air if desired.

2-7. Stopping.

CAUTION

Do not disconnect the air conditioner from the power source immediately after stopping. Liquid refrigerant can condense in the crankcase of the compressor and mix with oil, if the crank-case heater is disconnected before the refrigerant is completely vaporized. If the air conditioner has been disconnected, allow up to 12 hours at 0°F (-17.8°C) for vaporization of refrigerant before starting.

To stop the air conditioner from any mode of operation, turn the selector switch to off.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-8. General. Preventive Maintenance Checks and Services (PMCS) means systematic caring, inspecting, and servicing of equipment to keep it in good condition and to prevent breakdowns. As the equipment's operator, your mission is to:

a. Be sure to perform your PMCS each time you operate the equipment. Always do your PMCS in the same order, so it gets to be a habit. Once you've had some practice, you'll quickly spot anything wrong.

b. Do your BEFORE PMCS just before you operate the equipment. Pay attention to WARNINGs. CAUTIONs, and NOTEs.

c. Do your DURING PMCS while you operate the equipment. During operation means to monitor the equipment and its related components while it is actually being operated. Pay attention to WARNINGs, CAUTIONs, and NOTEs.

d. Do your AFTER PMCS right after operating the equipment. Pay attention to WARNINGs, CAUTIONs, and NOTEs.

e. Do your WEEKLY PMCS once a week.

f. Do your MONTHLY PMCS once a month.

g. Use DA Form 2404 (Equipment Inspection and Maintenance Worksheet) to record any faults that you discover before, during or after operation, unless you can fix them. You DO NOT need to record faults that you fix.

2-9. PMCS Procedures.

a. Your Preventive Maintenance Checks and Services lists inspections and care required to keep your equipment in good operating condition. It is set up so you can make your BEFORE operation checks as you walk around the equipment.

b. The "INTERVAL" column tells you when to do a certain check or service.

c. The "PROCEDURE" column tells you how to do required checks and services. Carefully follow these instructions. If you do not have tools, or if the procedure tells you to, notify your supervisor.

NOTE

Terms "ready/available" and "mission capable" refer to same status: Equipment is on hand and ready to perform its combat missions. (See DA Pam 738-750)

d. The "NOT FULLY MISSION CAPABLE IF:" column tells you when your equipment is nonmission capable and why the equipment cannot be used.

e. If the equipment does not perform as required, refer to Chapter 3, Section II, Troubleshooting.

f. If anything looks wrong and you can't fix it, write it on your DA Form 2404. IMMEDIATELY, report it to your supervisor.

g. When you do your PMCS, you will always need a rag or two. Following are checks that are common to the entire equipment system:

WARNING

- DO NOT use diesel fuel, gasoline, or benzene (benzol) for cleaning.
- DO NOT SMOKE when using cleaning solvent. NEVER USE IT NEAR AN OPEN FLAME. Be sure there is a fire extinguisher nearby and use cleaning solvent only in well-ventilated places. Flash point of solvent is 138°F (60°C).
- USE CAUTION when using cleaning solvents. Cleaning solvents evaporate quickly and can irritate exposed skin if solvents contact skin. In cold weather, contact of exposed skin with cleaning solvents can cause frostbite.

CAUTION

Keep cleaning solvents, gasoline, and lubricants away from rubber or soft plastic parts. They will deteriorate material.

NOTE

Only use those authorized cleaning solvents or agents listed in Appendix C.

(1) Keep It Clean. Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (SD-2) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) Rust and Corrosion. Check equipment body and frame for rust and corrosion. If any bare metal or corrosion exists, report it to your supervisor.

(3) Bolts, Nuts, and Screws. Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find a bolt, nut, or screw you think is loose, tighten it or report it to your supervisor.

(4) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.

(5) Electric Wires and Connectors, Look for cracked, frayed, or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors. Report any damaged wires to your supervisor.

(6) Hoses and Lines. Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to your supervisor.

(7) Treating Mildewed Areas. Canvas that has mildewed can be cleaned by scrubbing with a dry brush. If it is necessary to use water to remove dirt, it should not be used until mildew has been removed. After removing mildew, examine fabric. Look for evidence of deterioration. If canvas has deteriorated, it should be replaced.

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

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

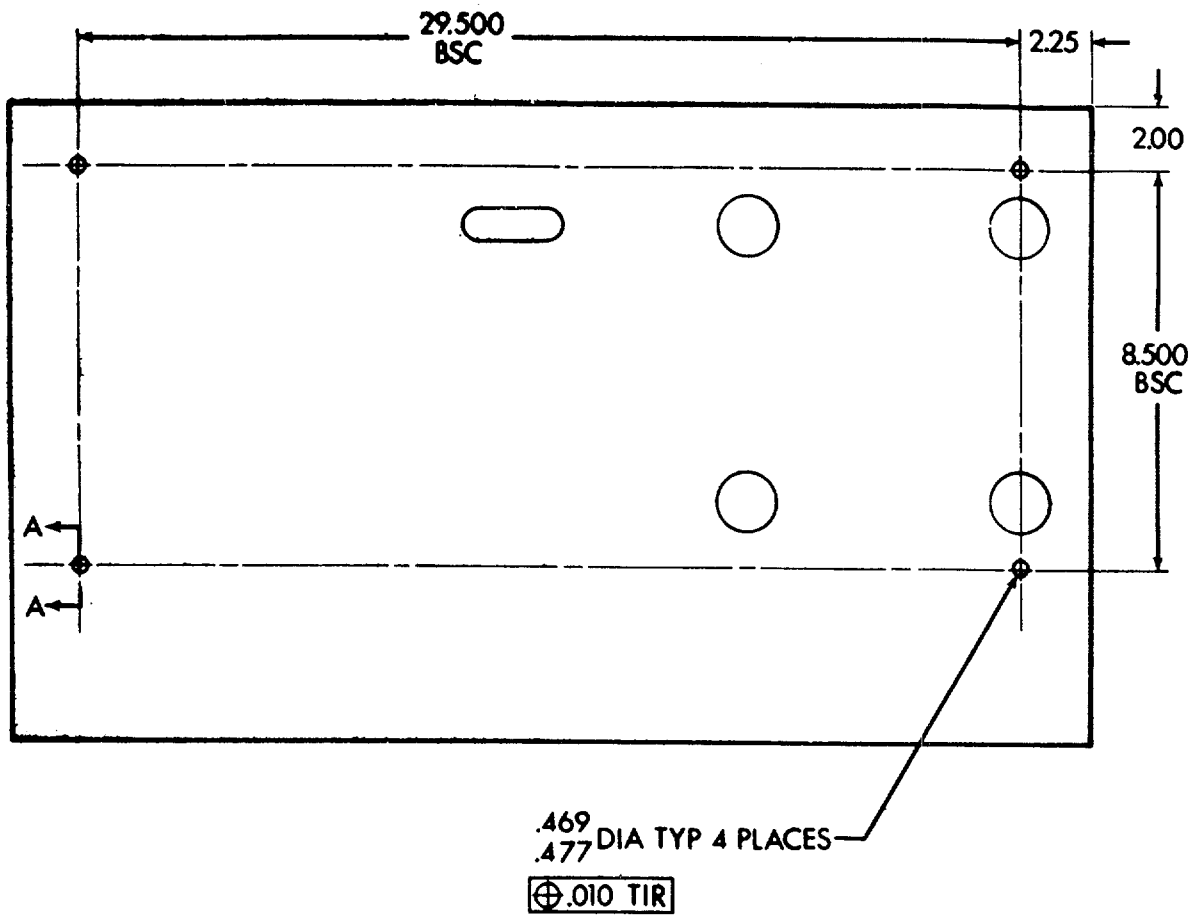
Item No	Interval	Item To Be Checked Or Serviced	Procedure	Not Fully Mission Capable If:
1	Before	Grilles	Check all grilles for obstructed openings or damage.	Grilles are damaged.
2	During	Sight-glass liquid	Wait at least 15 mins. after start up. indicator Check sight-glass for damage, bubbles, milkiness or yellow color.	Sight-glass broken or indicates low refrigerant level or moisture
3	After	Air filters	Check for obstructions, dirt or damage .	
4	After	Operating controls	Check control knobs for security and damage.	Control knobs missing or damaged.
5	Weekly	Air filters	Check for obstructions, dirt or damage.	
6	Weekly	Operating controls	Check control knobs for security and damage .	Control knobs missing or damaged.
7	Weekly	Fresh air damper	Check freedom of operation.	
8	Monthly	Air conditioner cover	Check cover for tears, punctures or damaged fasteners	

Section III. OPERATION UNDER USUAL CONDITIONS

2-10. Set-up and Preparation For Use.

a Location. The air conditioner is designed to have the entire rear surface exposed to the outside of the building. An unobstructed flow of air is necessary to permit efficient operation of the unit and to supply make-up air for ventilation of the interior space. A shaded location should be chosen whenever possible, to minimize the cooling load on the refrigeration system.

b. Electrical service. The air conditioner requires electric power of 208 volts, 50/60 hertz, 3-phase AC. The main power input receptacle is located on the lower part of the left side of the unit. However, if this location is not convenient, alternate locations exist on the rear and right-hand panels, and in the block-off plate (Figure 4-8), which replaces the control panel assembly when it is remotely located. The power input receptacle can be transferred to any of these locations by removing four (each) screws and nuts from both the receptacle and the cover plate at the new location. The cover plate should always be installed in the location from which the receptacle was removed, to prevent bypass-leakage of condensing air. The air conditioner must be grounded by connecting the grounding stud (Figure 1-3), on the rear side motor mount bracket to a copper rod driven at least 18 inches into the earth.



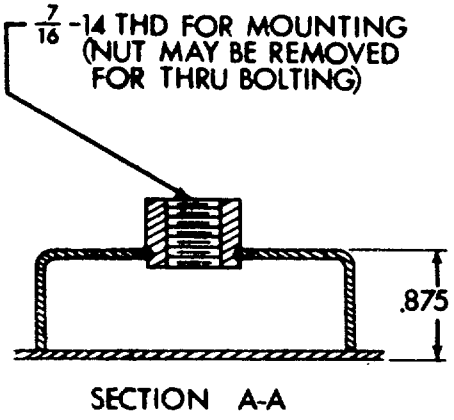


Figure 2-2. Mounting Details.

c. Drainage. The air conditioner has four plugged drain holes, one in the middle of each side of the base plate. Water vapor in the air is condensed to liquid form when the air conditioner operates in the cooling mode. The condensate is collected in a drain pan below the evaporator coil, and is piped to the base plate. The condensate should be conducted from one of the base plate drainage holes to a drain, storm sewer or dry sump. Standard half-inch plumbing fittings and hoses may be used.

d. Mounting and framing. The air conditioner can be mounted directly on the floor, or on a platform. (See Figure 2-2 for mounting details of the base.) The unit measures 23-1/4 inches (59.06 cm) deep, 34 inches (86.36 cm) wide, and 65 inches (165.1 cm) high. It is recommended that wall framing be at least 36 x 72 inches to accommodate the unit. The spaces at each side can be filled with plastic foam insulating material or the equivalent. The top space should be closed with a removable filler strip, so that the top of the unit can be easily removed for servicing when necessary. Satisfactory material for the filler strip may be locally fabricated of sheet metal or plywood.

e. Transit. If a unit is to be transported while mounted in a shelter, it is necessary to secure the top of the unit to the shelter for stability. This is accomplished using the flush door rings located on each side of the unit close to the top.

2-11. Initial Adjustments and Daily Checks.

a. Cooling. During the cooling season, the condenser fan must have an unrestricted supply of air. Therefore, check to be sure that the deflector door and the air conditioner cover are open before starting the unit. The evaporator intake and discharge grilles must be open during all modes of operation except when 100 percent outside air is used. The evaporator intake grille may be closed, and the fresh air damper open. Evaporator discharge grille blades may be adjusted at any time to direct air as desired.

b. Heating. During the heating season, the condenser fan does not operate. Therefore, the deflector door and the air conditioner cover should be closed to reduce heat loss and to protect internal parts from the weather.

2-12. Operating Procedure.

Operating the air conditioner is extremely simple: set the selector switch to the desired mode (COOL, VENTILATE, LO HEAT OR HIGH HEAT), and set the temperature control thermostat to provide the desired temperature. To stop the unit, turn the selector switch to OFF.

2-13. Preparation For Movement.

The operator's responsibility for preparing the air conditioner for movement consists of turning the selector switch to off, and closing all covers, dampers and grilles. If the unit has been operating in the cooling mode, it should not be disconnected from the power supply until several hours after it has been stopped. Refrigerant could condense in the compressor and mix with the crankcase oil unless the crankcase heater remains on.

2-14. Operating Instructions on Decals and Instruction Plates.

The following instruction plates and decals are attached to the air conditioner. (See Figure 2-3, both sheets.)

a. Military identification plate. This plate contains information about the name, part number NSN, manufacturer, contract number and serial number of the equipment. It is located on the upper left-hand corner of the rear surface.

b. Weight plate. Two weight plates, one near the middle of each side, indicate the gross weight of the air conditioner.

c. Refrigerant type and charge plate. This plate specifies the type and weight of refrigerant (R22) used to charge the air conditioner's refrigeration system. The plate is located to the left of the fresh air intake grille on the condenser side of the air conditioner.

d. Power supply plate. Three power supply plates, one near the bottom of the rear panel, and one about a foot from the bottom of each side, specify the electric power to be connected to the air conditioner.

e. Control panel instruction plate. This plate, located in the upper left-hand corner of the front access panel, displays five positions of the mode selector switch (HI-HEAT, LO HEAT, OFF, VENTI LATE, COOL), and the range of temperature adjustments for the temperature control thermostat (INCREASE, DECREASE).

f Damper control plate. One damper control plate is attached to the knob on each end of the damper control rod. Each indicates the direction for OPEN, TURN, CLOSE.

g. Sight-glass color change plate. This plate displays three color bands: green (dry), chartreuse (caution) and yellow (wet). For use in comparing the color of the moisture indicator in the liquid in the sight-glass liquid indicator.

h. Pressure cutout switch plate. Located above the pressure cutout switch reset buttons on the rear control panel, this plate provides PUSH TO RESET instructions for re-setting the low- and high-pressure cutout switches.

i. Circuit breaker reset plate. This plate, located on the rear control panel displays PULL THEN PUSH TO RESET instructions.

j. ***Circuit breaker access plate.*** This plate identifies the circular plate on the front access panel.

k. Fan warning plate. Located in the center of the condenser fan guard, this plate contains the words DANGER, KEEP HANDS CLEAR, DANGER.

l. ***Wiring diagram plate.*** (See Figure 4-16) A plate showing the wiring diagram of the air conditioner is mounted on the face of the junction box cover.

m. Refrigeration diagram plate. A plate showing the refrigeration diagram is mounted on the inside surface of the junction box cover.

n. Compressor data plate. A plate mounted on the compressor identifies the model number, part and serial numbers, refrigerant, and electrical characteristics of the compressor.

o. Condenser fan motor plate. Mounted on the end bell of the condenser fan motor, this plate specifies the horsepower, type, serial number and electrical characteristics of the condenser fan motor.

p. Evaporator fan motor plate. This plate identifies the horsepower, type, serial number and electrical characteristics of the evaporator fan motor.

q. Hearing protection required plate. This plate requires that hearing protection be worn when the air conditioner is in operation for maintenance.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-15. Unusual Weather.

a. Snow. When operating in an environment of heavy snowfall, the fresh air damper should normally be kept closed to avoid snow and ice buildup in the fresh air inlet grille and baffle. However, when cooling is required down to 0°F, the air conditioner cover and deflector door should remain open. Also the fresh air damper may have to be open for cooling and heating.

b. Sand and dust storms. Clean the air filters, mist eliminator, condenser coil and screen, and evaporator coil weekly or more often if necessary. Disconnect power, remove front access panel, and flush out bottom panel carefully to remove mud accumulation. Use care to avoid wetting electrical components.

c. Extreme heat. The air conditioner is designed to operate satisfactorily at temperatures up to 120° F (48.9°C). Make sure that all condenser and evaporator grilles and screens are fully open and unobstructed.

d. Extreme cold. The unit is designed to operate at a maximum low temperature of -50°F (-45.6°C). Do not disturb wiring during periods of extreme cold; the insulation and wires become brittle at low temperatures, and are easily broken. The air conditioner cover and deflector door should normally be closed during cold weather when the unit is not in operation.

e. Salt air and sea spray. Wash the outside of the air conditioner frequently with clear fresh water, being careful to avoid damaging electrical equipment. Coat exposed metal surfaces with corrosion resistant material as follows: use touch up paint on damaged painted surfaces. Refinish or replace damaged plated parts.

f. Rain or extreme humidity. Keep air conditioner cover and deflector door closed when the unit is not in use for cooling during rainy weather. Open covers to permit drying inside surfaces whenever possible before operating. Use care when operating electrical equipment in damp or wet areas to avoid shock hazard.

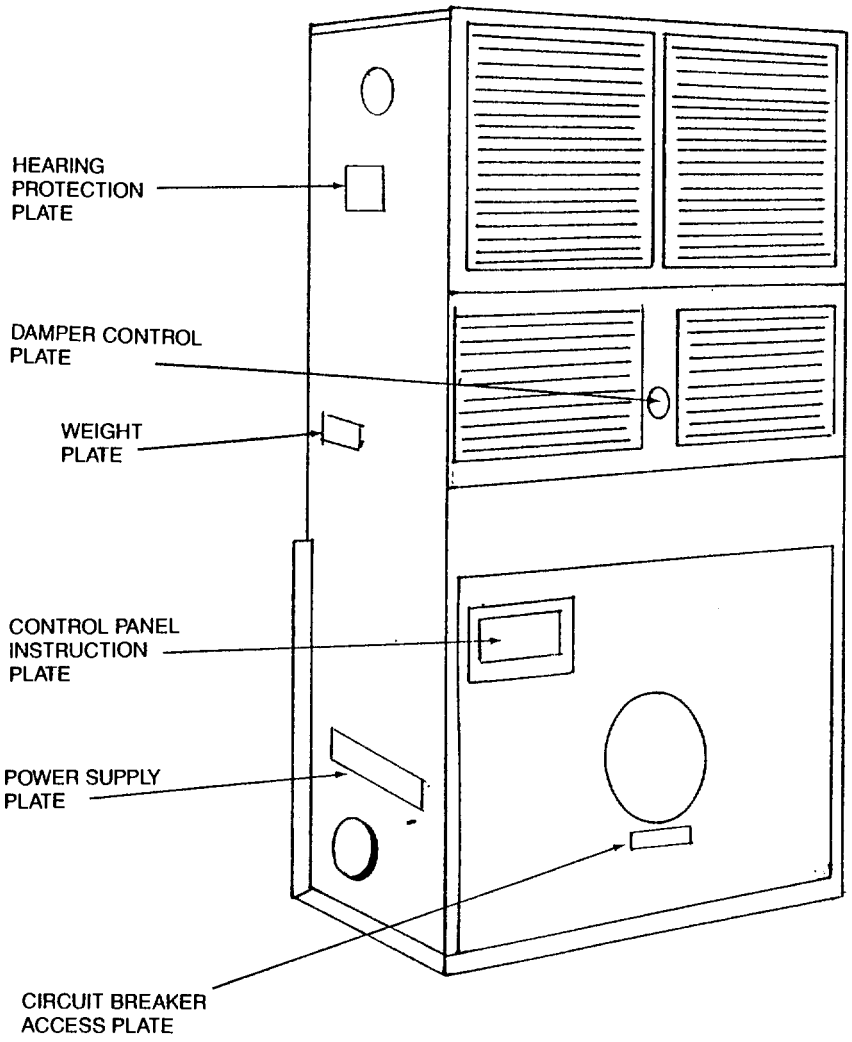


Figure 2-3. Decals and Instruction Plates (Sheet 1 of 2)

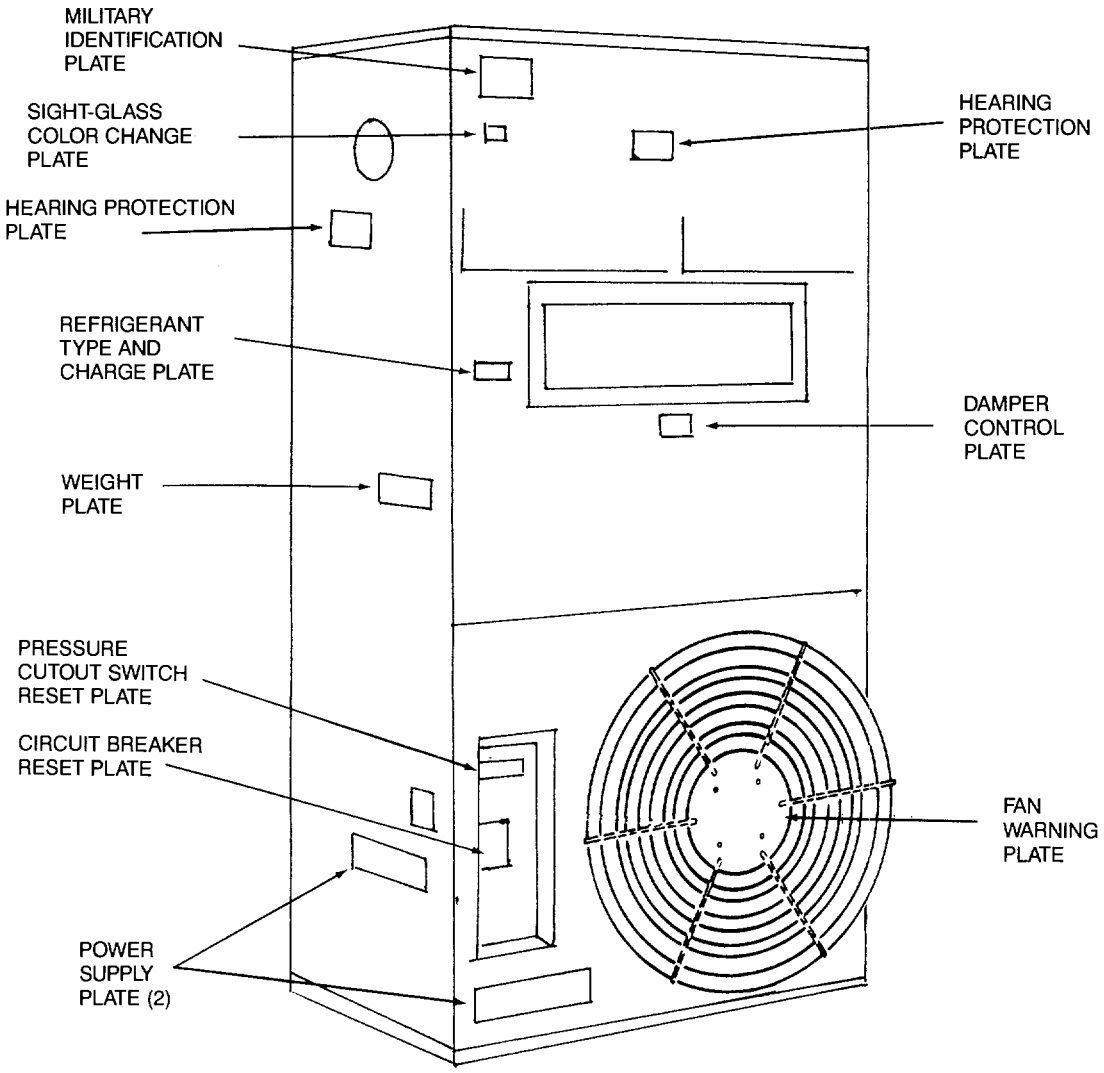


Figure 2-3. Decals and Instruction Plates (Sheet 2 of 2)

2-16. Emergency Procedures.

a. CBR hazard. When operating under chemical-biological-radiological (CBR) conditions, attach a CBR filtering unit to the intake or upper right rear surface of the unit. Close fresh air damper completely, and make sure that evaporator intake and discharge grilles 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 VENTILATE mode only.

2-17. Administrative Storage.

a. 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, 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 MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. General.

The compressor is hermetically sealed, with a charge of oil included. The condenser fan evaporator fan motors incorporate sealed bearings, so that no lubrication is required. When necessary to relieve binding of grille blades, fasteners, etc., an application of light machine oil (SAE 10 Lubricating Oil) may be worked into the joint or pivot. Excess oil should be bottled up with a cloth or paper towel.

Section II. TROUBLESHOOTING

3-2. Use of Table.

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

b. The table lists the common malfunctions which you may find during the operation or maintenance of the air conditioner or its components. You should perform the tests/inspections and corrective actions in the order listed.

c. 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.

d. 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

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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.

Table 3-1. Troubleshooting (Cont')

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

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 grilles or remove obstructions.

Step 2. Check deflector door and air conditioner to be sure that they are open.
Open deflector door and air conditioner cover.

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

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 grilles are properly adjusted (open).
Adjust grilles correctly.

Step 5. Make sure that deflector door is open, and that air conditioner cover is rolled up and stowed.
Open deflector door and air conditioner 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.

Table 3-1. Troubleshooting (Cont')

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

CAUTION

Bubbles may appear in the sight-glass when the hot gas bypass valve is in operation with normal charge. To verify that the refrigerant charge is low, operate unit at full load condition without the pass open. If bubbles appear at full load condition with bypass closed, addition of refrigerant is required.

Step 8. Check sight-glass liquid indicator for bubbles or milky appearance of liquid.
If bubbles are observed, report condition to unit maintenance.

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 grilles for proper (open) position.
Open grilles.

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

Step 5. Check function of the thermostat by turning to higher or lower settings.
Notify your supervisor.

CHAPTER 4
UNIT MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. Inspecting and Servicing the Equipment

After removal from the shipping container, inspect the outside of the air conditioner for damage. There should be no dents, gauges, deformation or scuffed paint. The air conditioner is shipped ready for operation. No servicing is required.

4-2. Installation.

a. Location. The air conditioner models F60T-2, F60T-2A, and CV-60-5/6-08 are designed to be mounted in an outside wall of the enclosure that it is to cool or heat, with the front surface approximately flush with the inside wall. The supporting structure may be made of wood, structural steel or concrete, resting or below-grade footings if necessary to prevent settling. For greatest efficiency, the unit should be located on the north wall of the enclosure, or in a shaded area. The area behind the unit must be kept clear of obstructions to permit unrestricted airflow.

NOTE

The area behind the condenser fan should be kept free of shrubbery for at least 10 feet. The hot air discharged by the condenser fan will kill most plant life.

b. Mounting. The air conditioner can be bolted to the floor or supporting surface by 7/16-14 bolts, threaded through holes in the base plate. (See Figure 2-2.) Adequate clearance should be left between the top of the unit and the wall to permit removal of the top for service and maintenance. The space can be filled with a removable strip of any satisfactory material such as sheet metal or plywood.

c. Transit. If a unit is to be transported while mounted in a shelter, it is necessary to secure the top of the unit to the shelter for stability. This is accomplished using the flush door rings located on each side of the unit close to the top.

d. Drainage. Provisions for drainage of condensate water from the evaporator coil must be made. Pipe plugs (1/2-14 NPT) are located in each side of the bottom panel so that standard plumbing fittings can be installed in the most convenient location(s) for drainage. The condensate can be conducted to a storm sewer, dry sump or other facility by means of a hose or rigid plumbing.

e. Service. A source of 208-Volt, 50/60 Hertz, 3 phase (4-wire) electric power must be supplied to operate the air conditioner. The power input receptacle is located on the left side of the unit, about six inches above the drain plug. If this location is unsuitable, alternate locations are provided. The receptacle can be removed from its normal location and installed in the lower front panel beside the control panel, in the rear panel at the 8 o'clock position beside the condenser fan, in the lower rear quarter of the right-hand side, or in a receptacle behind the left-hand return air grille. A ground wire should be attached to the grounding stud at 8:30 position beside the condenser fan. The other end of the ground wire must be connected to a copper rod driven at least 18 inches (45.7 CM) into the earth.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Make sure that the deflector door above the condenser fan is open, and that the air conditioner cover is rolled up and secured, before operating the air conditioner in the cool mode.

f. Operating Check. After the unit is installed, perform the following checks to be sure that it operates properly.

(1) Turn the selector switch (Figure 2-1) to ventilate, and make sure that air is flowing from the evaporator discharge grille.

(2) Turn the selector switch to cool, and the temperature control thermostat to the full decrease position. The condenser fan starts immediately. The compressor fan should operate after a 25 plus or minus 6 second time delay. Visually check rotation of the condenser fan.

(3) Turn the selector switch to lo heat and the temperature control thermostat to the full increase position. The compressor and the condenser fan should stop, and within 30-40 seconds warm air should be flowing from the evaporator discharge grille.

(4) While the unit is operating in each mode, listen for rubbing, grating or knocking noise. If such noises are heard, stop the unit, troubleshoot and correct the problem before continuing operation.

Section II. MOVEMENT TO A NEW WORKSITE'

4-3. Dismantling for movement.

a. Disconnect the main power cable from the receptacle, and screw the captive dust cover onto the receptacle.

b. Disconnect the drain line(s), and replace pipe plugs in drain holes.

c. Disconnect the ground wire.

d. Disconnect air ducts, if prevent, and install evaporator air intake and discharge grilles on unit.

e. Close the deflector door and the condenser fan discharge air conditioner cover.

f. Remove hold-down bolts, if used, and remove shimming, weather stripping or packing from space between the wall and the casing of the air conditioner.

g. If the air conditioner is to be moved over a long distance, or stored for an indefinite period, wrap the unit in waterproof paper or plastic sheet, and crate it for proper protection.

CAUTION

When lifting the unit with a hoist and sling attached to the lift rings, use a spreader bar to keep the sling from damaging the casing.

4-4. Reinstallation after movement.

To install the air conditioner in a new location, follow the instructions in paragraph 4-2.

Section III. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

4-5. Repair Parts.

Repair parts are listed and illustrated in the unit, direct support, and general support maintenance repair parts and special tools list covering this equipment. (Refer to TM 9-4120-357-24P.)

4-6. Special Tools and Equipment.

No special tools or equipment are needed for the servicing and maintenance of the models F60T-2, F60T-2A and CV-60-5/6-08 air conditioner.

Section IV. LUBRICATION INSTRUCTIONS

4-7. No lubrication beyond that described in Chapter 3, Section I, is required.

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-8. General.

Periodic maintenance checks permit unit maintenance personnel to check the effectiveness of the daily preventive maintenance program. Additional periodic maintenance services beyond the scope of the operator's maintenance are also performed at this time.

4-9. Quarterly preventive maintenance services.

a. Table 4-1 lists the preventive maintenance services to be performed by unit maintenance personnel at quarterly intervals. A quarterly interval is equal to 250 hours of operation or three calendar months, whichever occurs first.

b. Some services are required at shorter intervals in dusty or sandy areas, and are so indicated. Service intervals should be shortened under extreme or unusually severe conditions.

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly
Total man-hours required: 4.7

Sequence Number	Item To Be Inspected Procedure	Work time (man-hours)
	WARNING **Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.**	
1	EVAPORATOR INLET AND DISCHARGE LOUVERS Check for bent or damaged blades and frame, and for freedom of operation. Straighten bent blades or frame by hand, if possible. To remove the louvers for repair or replacement, remove 12 screws and washers from edges of each intake louver frame, and 16 screws and washers from the discharge louver frame. Apply light machine oil to pivots of louver blades to restore freedom of operation, if necessary. Blot up any excess oil with cloth or paper towel.	0.4
2*	AIR FILTERS **WARNING** **Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59°C).** Clean and service, or replace if damaged. Remove filter covers by unscrewing six panel fastening screws from each cover. Slide filters out for servicing. Clean filters by agitating them in a bath of detergent solution or dry cleaning solvent (Fed Spec P-D-680). Shake or blow dry.	0.5
3*	MIST ELIMINATOR Clean, or replace if damaged. Remove the mist eliminator by removing 31 screws and washers from the top panel, and remove top panel. Mist eliminator slides up out of brackets. Clean the mist eliminator by agitating it in detergent solution and rinsing it in clear water. Install it in brackets in front of the evaporator coil, making sure that the top mark is up, facing forward. Install the top panel, and secure with 31 screws and washers.	0.7
4	EVAPORATOR COIL Inspect for bent or crushed fins. Straighten with a plastic or wood blade if necessary. Clean with compressed air.	0.2

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly
Total man-hours required: 4.7

Sequence Number	Item To Be Inspected Procedure	Work time (man-hours)
5*	FRESH AIR INLET GRILLE	0.5
	WARNING **Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59ºC).** Disconnect linkage. Remove 12 screws and washers from screen and baffle frame, and lift out baffle frame. Clean the wire mesh by agitating it in dry cleaning solvent (Fed Spec P-D-680) or in detergent solution. Blow baffles clean with compressed air, or agitate in detergent solution. Replace the wire mesh if damaged. Install baffles and screen with 12 screws and washers. Reconnect linkage.	
6*	CONDENSER INTAKE SCREEN	0.3
	WARNING **Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59ºC).** Inspect for damage. Replace if wires are cut or broken. Remove by unscrewing 12 screws from top and bottom edges of frame. Clean by agitating in dry cleaning solvent (Fed Spec P-D-680). **NOTE** **Clean the condenser coil (sequence number 7) while the condenser intake screen is removed. Install the intake screen, and secure with 12 screws.**	
7	CONDENSER COIL With the condenser intake screen removed for access, clean the condenser coil by vacuum cleaning with a brush attachment.	0.2

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly
Total man-hours required: 4.7

Sequence Number	Item To Be Inspected Procedure	Work time (man-hours)
	CAUTION **When using compressed air, keep nozzle at least eight inches (20.3 CM) from coil. If vacuum cleaning equipment is not available, remove the front access panel and use compressed air from underside of coil to blow out dirt. Use a soft brush if necessary to dislodge impacted dirt. Inspect for bent or crushed fins and if necessary, straighten with a wooden or plastic blade.**	
8	CONDENSER FAN AND GUARD	0.2
	WARNING **Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 590C).** Inspect for damage. Replace if damaged or broken beyond repair. Clean by brushing or wiping with a cloth saturated in dry cleaning solvent (Fed Spec P-D-680).	
9	CONDENSER FAN COVER. Clean with detergent solution. Inspect for tears, punctures and damaged zipper, repair or replace damaged cover. Lubricate zipper, if necessary, with wax stick, (candle or crayon or spray-lubricant.)	0.2
10	CONTROLS Check for proper operation, looseness or damage. Tighten or replace as necessary.	0.2
11	WIRING AND CONNECTORS Remove access panel by unscrewing four panel fastener screws and lifting out panel. Remove junction box front cover by unscrewing four panel fastener screws. Inspect wiring for scuffs, breaks or missing insulation. Check connectors for tightness. Install junction box cover, and secure with four captive panel mounting screws. Install front panel, and secure with four panel mounting screws.	0.3

Table 4-1. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Q-Quarterly
Total man-hours required: 4.7

Sequence Number	Item To Be Inspected Procedure	Work time (man-hours)
12	REFRIGERATION SYSTEM With lower front panel removed, check all tubs for kinks or damage. Check compressor mounting bolts for tightness, and tighten if necessary. Report damage to direct support maintenance.	0.3
13	DRAINAGE SYSTEM **WARNING** **Disconnect electrical power from unit before flushing out drains and base plate.** Remove front access panel by unscrewing four panel fastener screws, and remove evaporator discharge grilles by removing 16 (each) screws and washers from the grille frame. Slowly pour about one quart (0.95 liter) of cool water into each end of drain pan under evaporator coil and observe lower end of drain tube to verify that water runs through. If bottom panel contains sludge or slime. Flush out with cool water. Make sure that external drain lines are not obstructed. Replace grilles and front access panel, and reconnect electrical power to unit.	0.7

* Service monthly or more frequently when required by operation in extremely dusty or sandy environment.

Section VI. TROUBLESHOOTING

4-10. 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 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. The table lists the common malfunctions which you may find during the operation or maintenance of the air conditioner or its components. You should perform the tests/inspections and corrective actions in the order listed.

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.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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 reset 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. Check for loose electrical connections.
Tighten connections.
Step 7. Verify that high- and low-pressure cutout switches have not opened.
Press reset buttons on high- and low-pressure cut out 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 filter-rectifier assembly by applying 35+ 3-volt ac to input terminals, and observing voltmeter attached to (+) and (-) terminals. Voltmeter should read 24-28 volts, dc.
Replace bad filter-rectifier assembly.

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. INSUFFICIENT COOLING.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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.
Step 4. Make sure that deflector door is open, and that condenser intake screen is not clogged or obstructed.
Open door and clean intake screen.
Step 5. Remove filter access covers, remove filters and inspect for dirt or clogging of any kind.
Clean filters.
Step 6. Inspect condenser coil for dirt or obstruction.
Clean coil with vacuum cleaner and brush attachment, or use compressed air from bottom of coil to blow out dirt, keeping air nozzle at least eight inches (20.3 cm) from coil.
Step 7. Check sight-glass liquid indicator to see that liquid is clear and green while compressor is running. Milky or bubbly refrigerant indicates low level.
Report condition to direct support maintenance.
Step 8. Disconnect power, and check condenser and evaporator fan impellers for looseness or binding.
Tighten setscrews if loose. Determine cause of binding and correct

3. CONDENSER FAN DOES NOT OPERATE.

Step 1. Make sure that power cable is properly connected.
Connect cable.
Step 2.Check circuit breaker by pulling then pushing reset knob.

WARNING

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

Replace bad circuit breaker.

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check continuity of fuses XF1 and XF2.
Replace bad fuses.
Step 4. Remove front access 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 switch-position tabulation on wiring diagram.
Replace faulty mode selector switch.
Step 5. Remove front access panel and junction box cover, and expose relay, K7, controlling condenser fan motor. Tag wires for identification, and disconnect from relay. Apply 24-28 volts dc to terminals X1 and X2, and check continuity of terminal pairs A1-A2, B1-B2 and C1-C2, using an ohmmeter or continuity tester.
Replace bad relay.
Step 6. Check continuity of electrical leads from relay (K7) wires Al, B1 and C1 to condenser fan motor connector P2, terminals A, B and C. If continuity is not shown in one or more leads, check from relay (K7) wire Al, B1, C1 to connector J4, terminals E, G and J. If continuity is shown in all three leads, check continuity from connector P2, terminals A, B and C to connector P4, terminals E, G and J. If continuity is shown in all three leads, motor is bad.
Replace open wire leads, or replace motor.

4. EVAPORATOR FAN DOES NOT OPERATE.
Step 1. Make sure that power cable is properly connected.

WARNING

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

Step 2. Check circuit breaker by pulling then pushing reset knob.
Replace bad circuit breaker.
Step 3. Check continuity of fuses XF1 and XF2.
Replace bad fuses.
Step 4. Remove front access 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 switch-position tabulation on wiring diagram.
Replace faulty mode selector switch.

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Remove front access panel and junction box cover, and expose relay, K8, controlling evaporator fan motor. Tag wires for identification, and disconnect from relay K8. Apply 24-28 volts dc to terminals X1 and X2, and check continuity of pairs A1-A2, B1-B2 and C1-C2, using an ohmmeter or continuity tester.
Replace bad relay.

Step 6. Check continuity of electrical leads from relay K8, terminals A2, B2 and C2 to connector P15, terminals A, B and C. If leads all indicate continuity. Motor is bad.
Replace faulty motor.

Step 7. If continuity of electrical leads in Step 6 is not indicated isolate the faulty lead by checking continuity from relay K8 terminals A2, B2 and C2 to connector J10, terminals U, V and I. Continue checking continuity if necessary, from connector P10, terminals U, V and I to connector J3, terminals C, D and E, and in turn to connector J9, terminals A, B and C, and finally in turn to connector P15, terminals A, B and C until the faulty electrical lead is isolated.
Replace faulty electrical lead.

5. COMPRESSOR WILL NOT START.

Step 1. Make sure that power cable is connected, that circuit breaker is reset, that mode selector switch is set at cool and that temperature control thermostat is set at full decrease.
Set controls properly.

Step 2. Check condition of high- and low-pressure cutout switches by pressing reset buttons. Report failure to direct support maintenance if condition continues and no other corrective action is effective.

WARNING

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

Step 3. Check for loose electrical connections or faulty wiring.
Tighten loose connections. Replace bad wiring.

Step 4. With front access panel and junction box cover removed, disconnect transformer leads from fuse block, XF1, terminals 2 and 4. Also disconnect transformer secondary leads from rectifier-filter, cr, 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 5. With front access panel and junction box cover off, disconnect rectifier-filter leads from fuse block XF2, terminal 1, and from terminal block TB2, terminal 1. Apply power to transformer to obtain 27-30 volts ac to rectifier filter, 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 1.
Replace faulty rectifier-filter.

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 6. With front access panel and junction box cover off, tag wires at K9 for identification and disconnect. Apply 24-28 volts dc to terminals X1 and X2 of relay K9, and check continuity of pairs A1-A2, B1-B2 and C1-C2. Each pair should indicate continuity.
Replace faulty relay.

Step 7. With front panel and junction box cover off, tag wires to time delay relay, K6, 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 to see that contact is made within 25+ 6 seconds of energizing.
Replace bad time delay relay.

6. COMPRESSOR STARTS, BUT GOES OFF ON OVERLOAD.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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

NOTE

Make sure that deflector door is fully open.

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.

7. EVAPORATOR AIR OUTPUT VOLUME LOW.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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 impellers for looseness, binding or damage.
Tighten setscrews or relieve binding as necessary, or replace damaged impeller(s).

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

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

Step 4. Check wiring connections to evaporator fan motor, relay K8, and connector plugs for looseness.
Tighten loose connections.

Step 5. Disconnect plug, P15, from motor connector. Using an ohmmeter or continuity tester check terminals A-B, B-C, C-A, and A, B and C to motor frame or common ground. Continuity should be indicated on terminal-to-terminal check, but should not be indicated between terminals and ground.
Replace defective motor.

8. UNIT FAILS TO HEAT.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

Step 1. Check mode selector switch for incorrect setting.
Set selector switch to LO HEAT or 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 filters.
Clean filters.

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

WARNING

Disconnect power from the air conditioner before doing maintenance work 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.

TABLE 4-2. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

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 the thermostat.

Step 7. Remove front panel and junction box cover. Tag wires to relays K1 and K2 for identification, and disconnect. Apply 28 volts dc to terminals X1 and X2 on relay K1, 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. Repeat procedure with relay K2.
Replace bad relay.

9. EXCESSIVE NOISE

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

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 may be pumping liquid refrigerant, which will cause severe damage.

Step 1. 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. Establish proper clearance between impeller. Establish proper clearance between impeller and guard, shroud, etc.

Step 2. Check fan and blower motors for wear, as indicated by noisy operation or excessive end- or side-play.
Replace bearings, or replace motor.

Section VII. RADIO INTERFERENCE SUPPRESSION

4-11. General.

a. Essentially suppression 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.

b. In the air conditioner, filters are used to absorb current surges in the dc control system. All make/break current components such as switches, relays and solenoids are shielded in metal casings which are bonded to each other and to the casing with grounding wires. The casing is grounded through the junction box to the ground wire of the electrical supply cable, and through an external grounding stud on the rear control panel beside the condenser fan guard.

4-12. Interference Suppression Components.

The four filters making up the primary interference suppression component are identical. They are composed of a choke coil, each end of which is grounded to the non-magnetic metal case through a capacitor. The operating characteristics of the filters are as follows:

Current	5.0 amperes
Voltage	600 volts dc
	250 volts at 60 cycle ac
Maximum ambient temp.	257° (125°C)
Maximum dc resistance	0.035 ohms
Inductance, minimum	180 MH
Capacity	1.11-1.8 mf
Insertion loss, minimum	0.15 mc - 60 dB
	0.5 mc - 90 dB
	1.0 mc - 100 dB
	10.0 mc- 80 dB
	100.0 mc - 80 dB
	400.0 mc- 80 dB

4-13. Replacement of Suppression Components.

a. Remove the filter assembly as follows:

(1) Remove the front access panel (figure 1-1) from the air conditioner by unscrewing four panel fastener screws.

(2) Remove the junction box cover (figure 4-1) by unscrewing four panel fastener screws.

WARNING

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

(3) Tag wires leading from filter for identification, and disconnect them from their outer components(transformer fuse block, XF1, and terminal block, TB2).

(4) Remove the filter assembly (figure 2-1) from the junction box by removing four (each) screws, washers and lock washers.

b. Disassemble the filter assembly as directed in the following steps. (See figure 4-2).

(1) Remove four screws (6) and four washers (5) from the top end cap (4), and carefully pull the end cap away from the tube (9) far enough to expose the wires connected to the rectifier (8). Tag wires for identification.

(2) Slide wire terminals from the rectifier terminals, and set the end plate aside.

(3) Slide the filters (10,11,17,18) out of the tube if testing indicates need for replacement.

(4) Unsolder wires from a defective filter, and solder the same wires to a new filter.

c. Reassemble the filter assembly in accordance with the following instructions.

(1) Group the filter elements together, and align them with the holes in the bottom end cap (13) of the filter canister.

(2) Press the grouped filter elements straight into the canister so that the terminals extend through the holes in the end cap, keeping wires from buckling inside the tube (9).

(3) Connect the terminal ends of wires to the terminals of rectifier (8), being careful to match connections properly.

(4) Install top end cap (4) and new gasket (7) on tube, with screw holes matching.

(5) Secure end cap with four (each) screws (6) and washers (5).

d. Re-install filter assembly as follows:

(1) Position the filter assembly on the junction box (22, figure 4-3) drawing the wires into the junction box through the four access holes.

(2) Secure the filter assembly, to the junction box with four screws, washers and lock washers.

(3) Connect wires, previously tagged for identification, to the appropriate components.

e. Install the cover (3, figure 4-3) on the junction box, and secure it with four panel fastener screws (1).

f. Position the front access panel (figure 1-1) on the air conditioner, and secure it with four panel fastener screws.

4-14. Testing of Radio Interference Suppression Components.

Test each filter element for continuity, using an ohmmeter or continuity tester. Continuity should be indicated. An alternative method of isolating a bad filter element is to substitute a filter element known to be good for each element in turn until interference is located and eliminated, since the continuity test is not conclusive for capacitors under load.

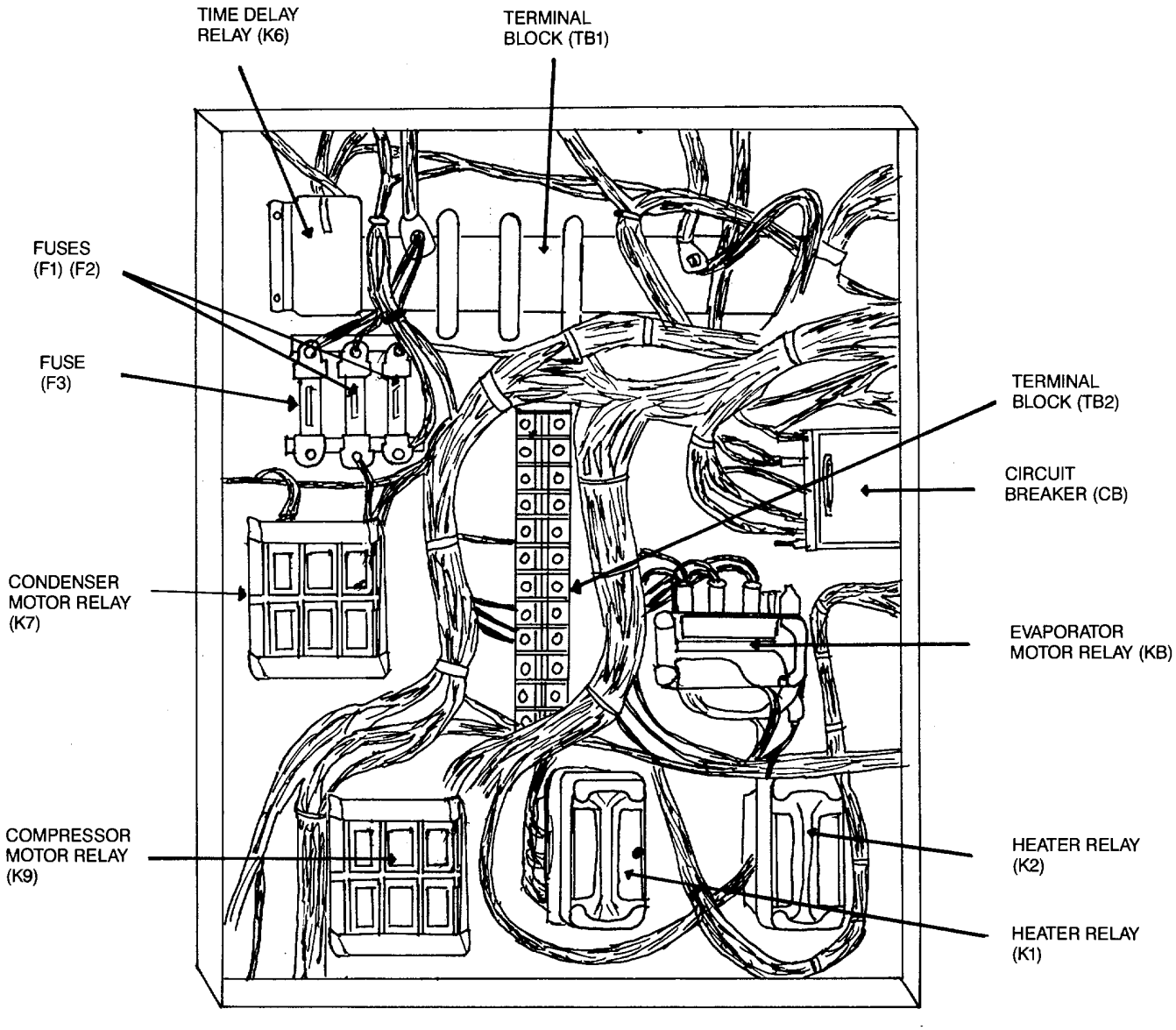
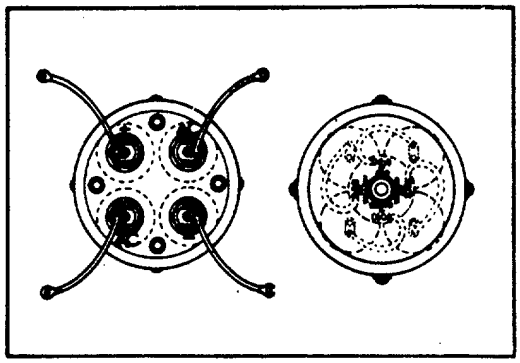


Figure 4-1. Junction Box (cover removed)



END CONNECTIONS

1. Nut, hex, 1/4–20
2. Washer, lock, 1/4 in.
3. Washer, flat 1/4 in.
4. End cap, top
5. Washer, flat, 3/8 in.
6. Screw, slotted head, No. 6–32 x 3/8
7. Gasket, RFI
8. Rectifier
9. Tube
10. RFI filter assy.
11. RFI filter assy.
12. Gasket, RFI
13. End cap, bottom
14. Rivet, blind
15. Washer, flat, 7/17 in.
16. Nut, hex, 7/16 20 NF–2A
17. RFI filter assy.
18. RFI filter assy.

Figure 4-2. Interference Suppression Components F60T-2-127

Section VIII. MAINTENANCE OF COVERS, GRILLES AND FILTERS

4-15. General.

This section covers the evaporator intake and discharge louvers, air filters, mist eliminator, condenser fan inlet and discharge grilles, fresh air intake, and condenser cover. These parts must be serviced regularly or removed frequently to gain access to other parts of the air conditioner.

4-16. Air Conditioner Cover.

The fabric air conditioner fan cover protects the condenser fan and internal refrigeration components from severe weather when the air conditioner is used only for heating or ventilating. When not in use, the cover is rolled up and held in place by fabric straps which are retained by turn button fasteners. In use, the cover is closed on the bottom and two sides with a zipper.

a. Removal Remove the air conditioner cover from the air conditioner by removing 12 screws and washers from the edges, and two turn button fasteners from the top of the cover. Carefully work the cover off the mounting flange.

b. Installation. Work the cover over the mounting flange until eyelets are aligned with threaded holes in the mounting flange. Secure with 12 screws and washers and two turn button fasteners, finger tight. Check operation of the zipper and retaining tapes, and adjust as required. Tighten screws.

4-17. Top Panel Assembly.

The top panel encloses the top of the air conditioner, and provides access to the mist eliminator, heating elements and evaporator blower. The inside surface of the panel is fitted with sealing strips along the sides and around the air intake plenums, and the remainder of the area is insulated to minimize noise and heat transfer.

a. Removal Remove 16 screws and washers from the frame of the evaporator discharge louver. Remove the louver. Remove 22 screws and washers from the top, and nine screws and washers from the rear flange of the top panel. Lift the panel off the casing.

b. Inspection. Inspect the panel for dents, holes or deformation. Inspect sealing strips for tears and missing pieces, and check insulation for completeness and adherence.

CAUTION

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Use in a well ventilated space, and take precautions against fire.

c. Repair. Straighten deformation and patch holes in the panel, using standard sheet-metal repair methods. Replace damaged sealing strips and insulation as required, by scraping damaged material from inside of panel, and cleaning out residue with acetone or methyl-ethyl ketone and a stiff brush or wooden scraper. Apply adhesive to panel and mating surface of sealing strip or insulation. When tacky, install carefully.

d. Installation. Position the top panel on the air conditioner, and press down until seated. Install 22 screws and washers in top of panel, and nine screws and washers in rear flange. Position the air discharge grille on the front of the front of the air conditioner. Secure it with 16 screws and washers through edges of the frame.

4-18. Air Discharge Grille.

The air discharge grille is located at the top front of the air conditioner. Each side of the grille is independently adjustable for controlling the direction of the discharged air.

a. Removal. Remove 16 screws and washers from the frame of the grille. Remove the grille.

b. Inspection. Inspect the grille for bent blades and missing or damaged gasket material. Check operation of the blades for binding or interference.

c. Servicing. Apply a coating of light machine oil, (SAE 10 lubricating oil) to the pivots of the blades and swivel the blades to work oil into pivots. Blot up excess oil with cloth or paper towel.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Use in a well ventilated area and take precautions against fire.

d. Repair. Straighten bent grille blades by hand if possible. Replace missing gasket material by scraping out remaining material and removing residue with acetone or methyl-ethyl ketone and a stiff brush or wooden scraper. Apply a coating of adhesive to both mating surfaces. Install new gasket material when adhesive becomes tacky but not sticky.

e. Installation. Position the air discharge grille on the air conditioner. Secure it with 16 screws and washers.

4-19. Air Intake Grilles.

Two air intake grilles are located site-by-site below the air discharge grille. Each intake grille is equipped with a lever-controlled set of adjustable grilles to assist the fresh air damper in controlling the intake of fresh outside air.

a. Removal Remove 12 screws and washers from the frame of each grille, and remove the grilles.

b. Inspection. Inspect the air intake grilles for bent grille blades or other distortion. Check operation to be sure that grille operates freely. Inspect gasket material for tears, missing sections or poor adhesion.

c. Servicing. Apply a coating of light machine oil, (SAE 10 lubricating oil) to the pivots of grille blades. Operate the blades several times to work oil into joints. Blot up excess oil with cloth or paper towel.

CAUTION

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Use in a well ventilated area, and take precautions against fire.

d. Repair. Straighten bent grille blades by hand, if possible, replace missing gasket material by scraping out remaining material and removing residue with acetone or methyl-ethyl ketone and a stiff brush or wooden scraper. Apply a coating of adhesive to both mating surfaces. Install new gasket material when adhesive becomes tacky but not sticky.

e. Installation. Position the intake grilles on the air conditioner, and secure with 12 screws and washers through the frame of each grille.

4-20. Front Access Panel.

The front access panel, located on the lower front of the air conditioner, provides access to the junction box assembly, control panel assembly, high- and low-pressure charging (service) valves, compressor, and other refrigeration components. The front access panel is secured by a lip, which fits behind the base panel assembly at the bottom, and by four panel fastener screws, three along the top edge and one near the center of the panel.

a. Removal. Unscrew four panel fastener screws, three along the top edge and one near the center of the panel. Remove the panel by pulling the top forward and up.

b. Inspection. Inspect the panel for gouges, dents, or other deformation, and for missing or damaged fasteners, seal strips, insulation or information plate.

c. Repair. Straighten dents or other deformation, using conventional sheet-metal repair methods. Replace missing or damaged fasteners. Replace other items as follows:

(1) Replace insulation by straightening tabs of six insulation clips, and pulling off insulation. Using new clips if necessary, press new insulation onto clips and bend tabs to retain.

CAUTION

Acetone and methyl-ethyl ketone (MEK) are flammable, and their vapors can be explosive. Use in a well ventilated area, and take precautions against fire.

(2) Replace damaged or missing seal strips by scraping off the remaining material and removing residue with acetone or methyl-ethyl ketone and a stiff brush or wooden scraper. Apply a coating of adhesive to both mating surfaces. Install the new gasket material. When adhesive becomes tacky but not sticky.

(3) Replace damaged turnlock fastener receptacles by drilling out existing rivets, replacing fastener and securing with new rivets.

(4) Replace damaged panel fastener screws by cutting off and removing damaged screw. Insert new screw in hole, and place retaining washer over threads and shank. Stake washer to retain on screw.

(5) Replace damaged or missing information plate by drilling out rivets, positioning new information plate on panel, and securing with new rivets.

d. Installation. Install the front access panel by placing the lower lip behind the front of the base panel and pushing panel into position. Secure by tightening four panel fastener screws.

4-21. CBR cover.

The CBR cover is located in the upper right corner of the rear surface of the air conditioner. (See figure 1-3.) it covers an auxiliary opening into one plenum of the evaporator fan. It is opened and attached to a supply of specially filtered air when necessary to use air that is chemically-biologically-radiologically (CBR) safe.

a. Removal Remove four screws and washers from the CBR cover, and remove cover.

b. Installation. Position the CBR cover on the air conditioner. Secure with four screws and washers.

4-22. Fresh Air Filters.

The fresh air filters are located behind the two rectangular access covers on the rear surface of the air conditioner. (See figure 1-3.) Operating efficiency of the air conditioner is directly dependent upon keeping filters clean, so that air circulation through the evaporator coil or heating elements is not obstructed. The air conditioner should never be operated without air filters. Without them, dirt would be blown directly into the evaporator coil, and would seriously reduce the efficiency of the unit.

a. Removal. Unscrew six panel fastener screws from each air filter cover, and remove cover. Pull the filter upward and outward to remove.

b. Inspection. Inspect the filtering medium for displacement, punctures or other damage which would permit unfiltered air to pass through the filter. Inspect the frame for dents or deformation. Replace filter if damaged.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59ºC).

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm2). Do not direct compressed air against the skin. Use goggles or full face shield.

c. Servicing. Clean filter by agitating in dry cleaning solvent (FED SPEC P-D-680). Drain, and blow dry with compressed air at 25-30 psi (1.75-2.1 KG/CM 2).

d. Installation. Slide filters into slots, with cutoff corner toward left front. Position covers on air conditioner, and secure with attached panel fasteners.

4-23. Condenser Air Inlet Screen.

The condenser air inlet screen prevents dust and airborne debris from being sucked into the condenser air intake. The screen must be kept clean at all times while the air conditioner is operating on the cooling cycle. Clogging will reduce the air-flow through the condenser coil, and will seriously reduce efficiency of the unit.

a. Removal. Remove 12 screws from the top and bottom edges of the air inlet screen frame, and remove the screen.

b. Inspection. Inspect screen for broken or displaced wires, cut or ruptured screen mesh, and bent or deformed frame.

c. Servicing. Clean the screen by agitating in a bath of detergent solution. Use a stiff brush if necessary to dislodge stubborn deposits of dirt.

d. Installation. Position the screen on the air conditioner, and secure with 12 screws through the top and bottom edges of the frame.

4-24. Back Panel and Motor Support.

The back panel and motor support assembly is a welded assembly. If the assembly sustains major damage, it must be replaced. To gain access to the motor support assembly, it is necessary to remove several panels and assemblies from the air conditioner. Proceed as directed in the following steps:

a. Removal of Air Conditioner Cover. With the cover rolled down, remove 12 screws and washers from the edges, and two turn button fasteners from the top. Carefully work the cover off the mounting flange and retain for re-assembly if it is in serviceable condition.

b. Removal of Deflector Door. With the deflector door closed, remove six screws from the hinge at bottom of door. For model CV-60-5/6-08 remove eight screws from the hinge at bottom of door. With door open, remove two screws and nuts from the front of the shelf bracket at each end of the door. Retain for re-assembly if the door is in serviceable condition. For model CV-60-5/6-08 drill out rivets from the front of shelf bracket at each end of the door.

c. Removal of Fan Guard. Remove six screws from the attaching loops of the fan guard, and pull off the guard.

d. Removal of Fan Impeller. With the fan guard off, loosen the two setscrews in the fan hub and pull off the impeller. Use a gear- or pulley-puller if necessary to remove the impeller from the motor shaft.

e. Removal of Front Panel. Unscrew four panel fastener screws from the front panel (three along top edge, and one near the center of the panel.) Remove the panel by pulling the top outward and upward.

f. Removal of Junction Box and Control Panel Assembly.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

(1) Disconnect electrical cables from control panel and junction box.

CAUTION

Be careful to avoid kinking or pinching the capillary tube which connects the control panel assembly to the temperature control thermostat sensing bulb.

(2) Remove four screws from the corners of the control panel assembly mounting feet, and move control panel assembly out of the way.

(3) Loosen the setscrew in the core end fitting (14, figure 4-3) and slide the end fitting of the cable core. Remove two screws and washers from the hold-down clamp (16), and move cable out of the way.

(4) Remove six screws (7) from the junction box mounting flange, and two screws (8) and washers (9) from the mounting bracket. Remove ground wire and connectors J17 and J19. Remove the junction box.

g. Removal of Condenser Fan Motor. Remove the condenser fan motor as follows: (See figure 4-4.)

(1) Disconnect the electrical connector from the fan motor receptacle (3).

(2) Remove four screws, lockwashers and washers from bottom of motor support plate. Lift out motor from back of unit.

(3) If motor is to be re-installed, note position of shims (11 & 12, figure 4-4), and retain on motor support.

h. Removal of Pressure Cutout Switches. The high-low-pressure cutout switches are mounted behind the rectangular panel at the left of the condenser fan motor. (See figure 1-3.) They are connected by capillary tubes to the refrigeration system; therefore, they must be handled with care to prevent kinking or breaking the capillary tube.

(1) Remove four screws above and below the pressure cutout switch reset buttons.

(2) Reach through the upper part of the fan shroud to grasp the pressure cutout switch box. Rock it gently to be sure that it is free from the panel and adequately supported by electrical leads and capillary tubes.

i. Removal of Circuit Breaker Actuator. Remove circuit breaker actuator from rear panel as follows:

(1) Pull knob (18, figure 4-3) and actuator rod out slightly, and grip the rod firmly with a copper or brass strip held in a pair of pliers.

(2) Unscrew the knob by hand, if possible, or by gripping lightly with a second pair of pliers.

(3) Unscrew and remove retaining nuts and lock washer from ferrule (17), and ferrule through hole in panel.

j. Removal of Grounding Stud. (See figure 1-3.) Remove nuts and washers from grounding stud and press stud through hole in panel.

k. Removal of Back Panel. Remove 36 screws from top, bottom and sides of back panel and motor mount assembly, and remove the panel assembly and condenser intake screen from the casing.

l. Installation of Pressure Cutout Switches. With the back panel and motor support assembly leaning against the back of the air conditioner, position the pressure cutout switches against the inside of the panel. Secure with four screws from the outside.

m. Installation of Grounding Stud. Attach grounding wire from junction box to grounding stud with a washer on each side of the terminal. Push stud through hole in panel and install a washer, nut, two more washers and another nut on outside end of stud. Tighten the nut nearest the panel.

n. Installation of Circuit Breaker Actuator. Insert ferrule of circuit breaker actuator (17, figure 4-3) through hole in panel, and install retaining nuts. Screw knob on end of shaft, holding shaft firmly with pliers while tightening knob hand tight.

o. Installation of Back Panel and Motor Support Assembly. Position the back panel and condenser inlet screen on the air conditioner casing, and push into place until screw holes are aligned. Secure with 36 screws on top, bottom and both sides.

p. Installation of Motor. Insert the motor through the back panel and position it on the motor support plate. Install shims (11 & 12, figure 4-4) as required. Secure with four screws and washers through bottom of support plate. Connect the electrical plug to the receptacle on motor.

KEY to Figure 4–3

A. Cover Assembly
1. Screw, Panel Fastener
2. Washer, Retaining
3. Cover, Junction Box
4. Instruction Plate, Wiring Diagram
5. Instruction Plate, Refrigeration Diagram
6. Insulation
7. Screw, Mounting
8. Screw, Mounting
9. Washer
10. Wiring Harness
11. Wiring Harness
12. Wiring Harness
13. Wiring Harness
14. Fitting, Cable Core End
15. Actuator Arm, Circuit Breaker
16. Clamp, Hold–down
17. Ferrule, Flexible Cable
18. Knob, Operating
19. Screw
20. Circuit Breaker
21. Cover, Circuit Breaker
22. Filter Assembly, RFI Suppression
23. Transformer, Control Circuit
24. Insulation, Electrical

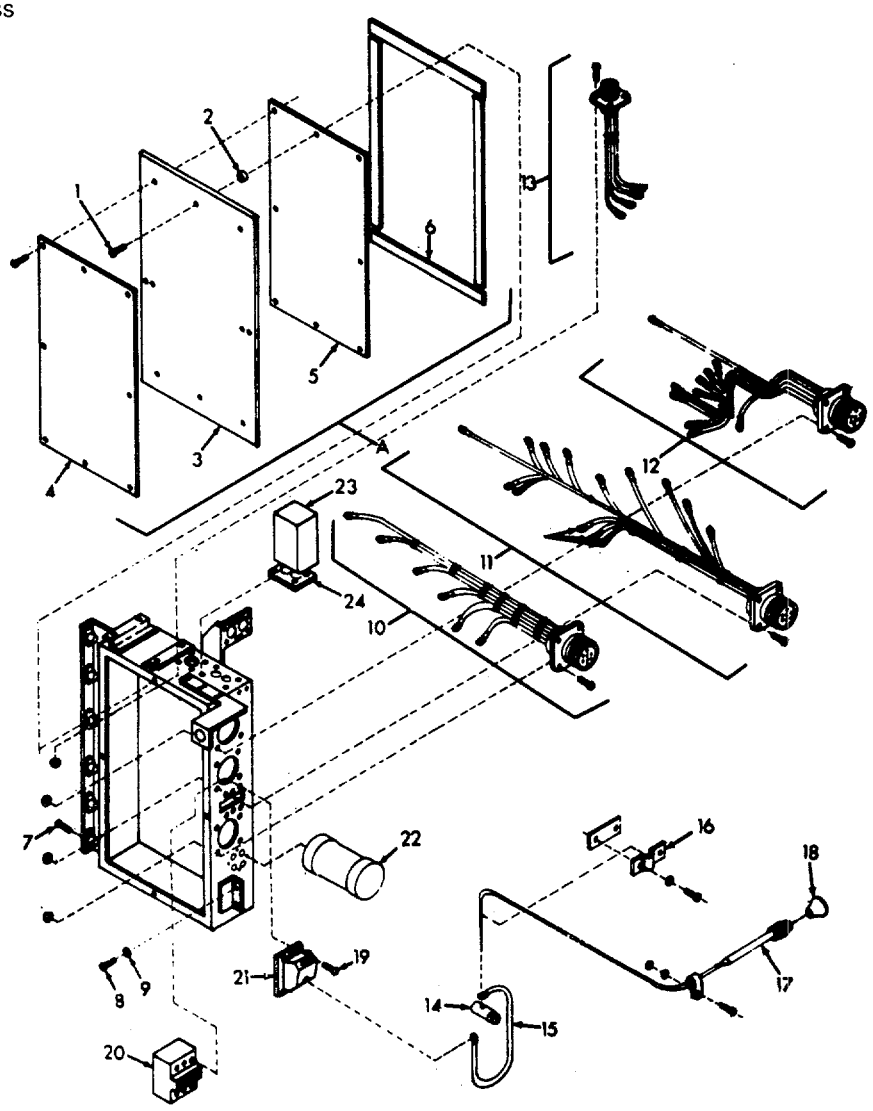
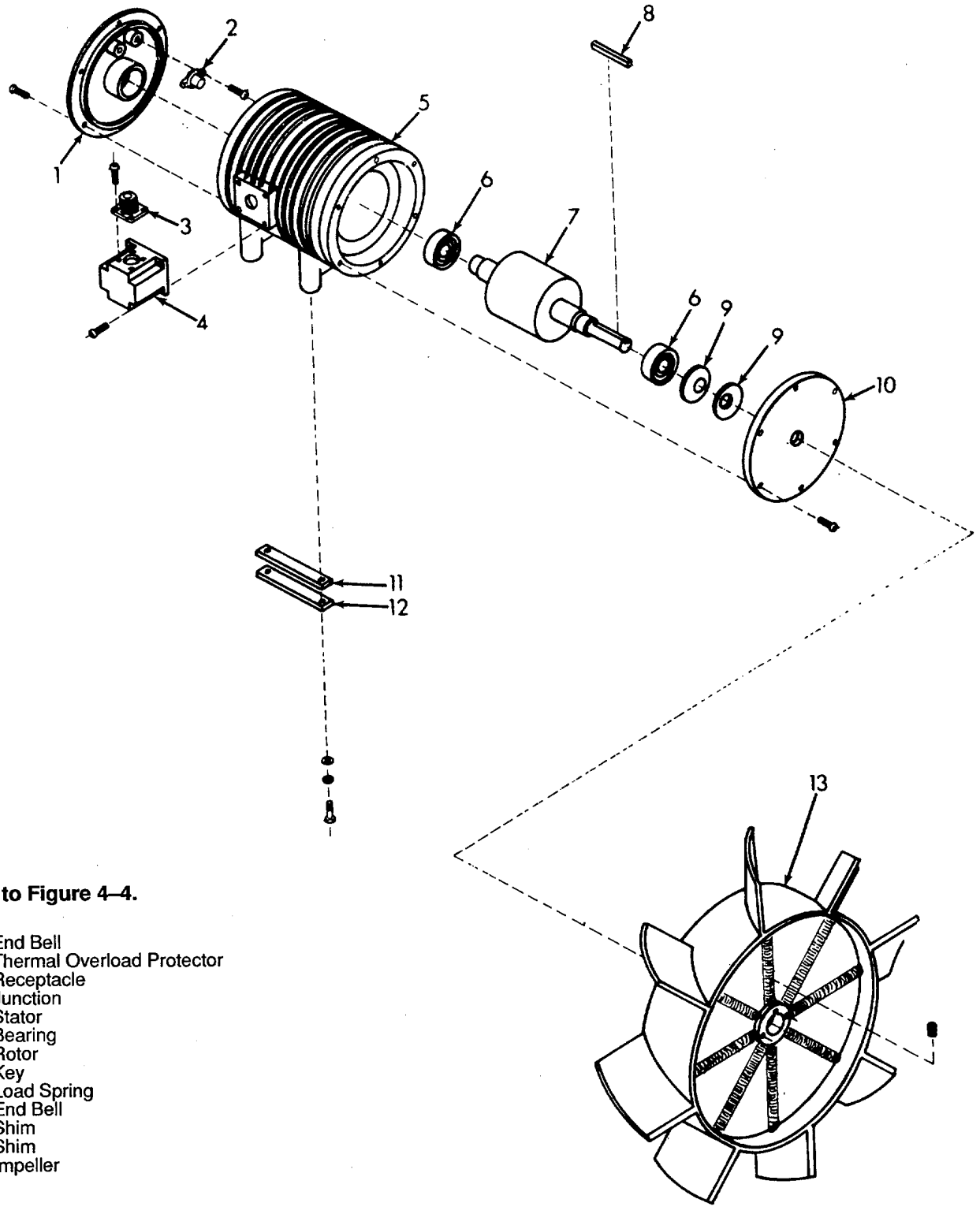


Figure 4-3. Junction Box, External Components.



KEY to Figure 4–4.

1. End Bell
2. Thermal Overload Protector
3. Receptacle
4. Junction
5. Stator
6. Bearing
7. Rotor
8. Key
9. Load Spring
10. End Bell
11. Shim
12. Shim
13. Impeller

Figure 4-4. Condenser Fan and Motor

q. Installation of Junction Box and Control Panel Assembly. Position in the air conditioner, and attach the control panel assembly to the mounting flanges on top of the junction box with four screws. Complete the installation as follows: (See figure 4-3.)

(1) Secure the junction box to the air conditioner casing with six screws (7) through the casing, and two screws (8) and washers (9) through the bracket. Install connectors J17 and J19 and ground wire.

(2) Insert cable core through the hole in the circuit breaker actuator arm (15), and install core end fitting (14) on cable core temporarily.

(3) Attach cable to junction box with holddown damp (16). Adjust core end fitting to provide clearance of 0.12-0.25 inch (3-6 mm) between fitting (14) and actuator arm (15) with core fully extended and circuit breaker in the off (down) position. Secure with four panel fastener screws.

r. Installation of Front Panel. Place lip of bottom edge of panel behind rim of base plate, and press panel into vertical position. Secure with four panel fastener screws.

CAUTION

Do not hammer impeller onto shaft; motor bearings could be damaged. If impeller does not slide into position readily, dress shaft with a file, stone or abrasive paper, and apply a thin coating of machine oil, (SAE 10 Lubricating Oil).

s. Installation of Fan Impeller. (see figure 4-4) Align key and keyways in motor shaft and impeller, and press impeller onto shaft. Tighten two setscrews in hub of impeller to secure.

t. Installation of Fan Guard. (See figure 4-5) Orient the fan guard (10) so that information plate (11) reads properly, and align attaching loops with screw holes in shroud. Secure with six screws.

u. Installation of Deflector Door. Position the deflector door (3) on the unit and secure it with six screws through the hinge (7) on lower edge of door. Attach feet (6) of shelf brackets (5) with two screws and nuts through each bracket. For model CV-60-5/6-08 secure with eight screws through hinge on lower edge of door and four rivets.

v. Installation of Air Conditioner Cover. Fit cover (9) over mounting frame, and align eyelets with screw holes in frame. Secure with 12 screws and washers. Install two turn button fasteners **in** top edge.

4-25. Condenser Fan Guard.

The condenser fan guard (10, figure 4-5) is made of spot-welded stainless steel rod, and should be maintenance free except for damage.

a. Inspection. Visually inspect the fan guard for bending, deformation, or broken spot welds. Make sure that danger information plate (11) is legible and undamaged.

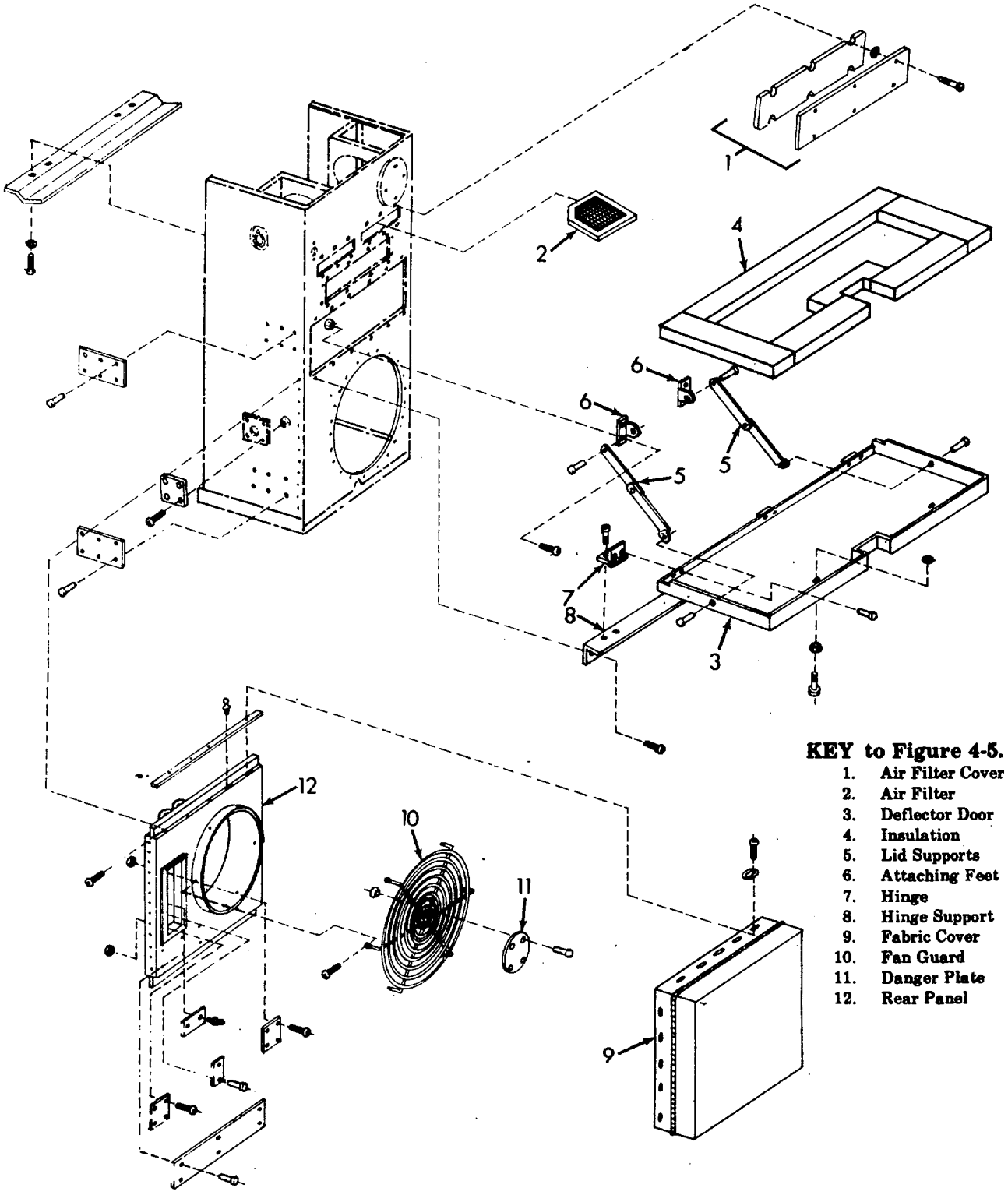
b. Removal. Remove six screws from looped ends of radial support rods. Remove guard.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59°C).

c. Servicing. Clean guard by immersing in dry cleaning solvent (FED SPEC P-D-680), using a stiff brush to remove caked on accumulations of dirt, if necessary. Wipe or blow dry.

d. Installation. Place guard over opening, oriented so that danger information plate is correctly positioned and attaching loops at ends **of** radial support rods match screw holes in shroud. Secure with six screws.



KEY to Figure 4-5.

1. Air Filter Cover
2. Air Filter
3. Deflector Door
4. Insulation
5. Lid Supports
6. Attaching Feet
7. Hinge
8. Hinge Support
9. Fabric Cover
10. Fan Guard
11. Danger Plate
12. Rear Panel

Figure 4-5. Rear Cover, Door and Guard)

4-26. Fresh Air Damper Control.

a. General The fresh air damper control adjusts the position of the fresh air damper through a worm and pinion. (See figure 4-6.) The worm is pinned to the operating shaft which extends through holes in the front and rear surfaces of the air conditioner casing. The pinion is attached to an actuating arm which opens or closes the fresh air damper through a connecting rod and ball joint linkage. Except for the knobs at each end of the operating shaft, the entire control is housed within the air conditioner casing.

b. Inspection. Inspect the control for missing operating knobs, and looseness or binding of the linkage.

c. Removal Remove the fresh air damper control in accordance with the following directions: (See figure 4-6.)

(1) Loosen setscrews, and remove knobs (9) from both ends of operating shaft (16).

(2) Remove 12 screws and washers from each air intake (return air) grille, and remove the grilles from the front of the unit.

(3) Remove 12 screws from the top and bottom edges of the condenser inlet screen (2) and remove the screen from the back of the unit.

(4) Reach through the front air intake opening, and loosen the binding nut on the ball joint (21) at end of actuator arm (18, A).

(5) Remove 12 screws and washers from the fresh air intake screen (4) and baffle (5) and lift out the screen and baffle with damper plate (6) attached.

(6) Remove four screws and self-locking nuts from the corners of the step plate (7) on which the operating mechanism is mounted.

(7) Move the entire assembly toward the front of the air conditioner until the rear end of the operating shaft (16) is free of the grommet (10) and hole. Pull the assembly out through the outside air intake opening.

d. Disassembly. Disassemble the fresh air damper control only to the extent necessary to replace damaged parts. Proceed as follows (See figure 4-6).

(1) Remove the nut and washer from bolt (15), and withdraw bolt from bracket (8). Remove actuator arm assembly (A). Spacers (23) and spring washers (24).

(2) Drive spring pin (12) out of the worm gear (11), and slide operating shaft (16) out of worm gear and spring washers (13).

(3) Remove three screws (19) and lock washers (20) from pinion (17) and actuating arm (18).

(4) Remove the self-locking nut from ball joint (21), and remove ball joint from actuator arm (18) or damper plate (6).

(5) Remove four screws and self-locking nuts fastening bracket (8) to step plate (7).

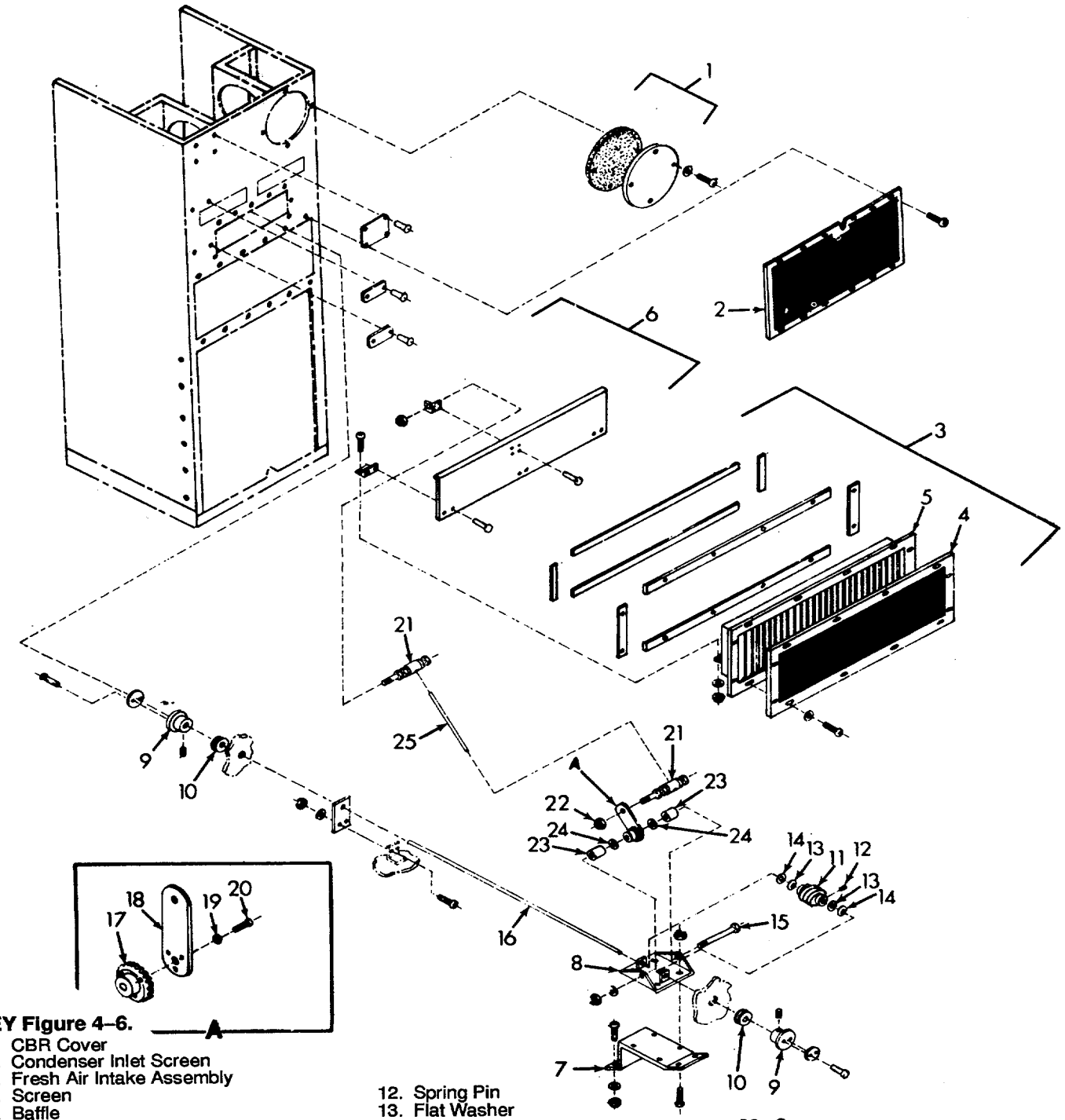
(6) Remove six screws, washers and nuts from the hinges attaching damper plate (6) to baffle (5).

(7) Loosen screw of ball joint (21), and slide out connecting rod (25).

WARNING

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38ºC to 59°C).

e. Cleaning and Lubrication. Clean moving parts in dry cleaning solvent (FED SPEC P-D-680), using a soft brush if necessary to dislodge stubborn accumulations of dirt, dried grease, etc. Clean the intake screen and baffle in detergent solution. Rinse and blow dry. Apply a thin coating of grease (specification MIL-L-4343) to moving parts during assembly. Lubricate ball joints and hinges on the damper plate with a light-weight machine oil, (SAE 10 Lubricating Oil) and work in. Wipe off excess oil.



KEY Figure 4–6.

1. CBR Cover
2. Condenser Inlet Screen
3. Fresh Air Intake Assembly
4. Screen
5. Baffle
6. Fresh Air Damper Assembly
7. Step Plate
8. Bracket
9. Knob Assembly
10. Grommet
11. Worm
12. Spring Pin
13. Flat Washer
14. Spring Washer
15. Bolt
16. Operating Shaft
17. Worm Wheel Gear
18. Actuator Arm
19. Lock Washer
20. Screw
21. Ball Joint Assembly
22. Self–locking nut
23. Spacer
24. Spring Washer
25. Connecting Rod

Figure 4-6. Fresh Air Intake and Damper

f. Assembly. Assemble the fresh air damper control in accordance with the following steps: (See figure 4-6.)

(1) Attach the bracket (8) to the step plate (7), and secure with four screws and self locking nuts.

(2) Place worm gear (11) in bracket (8), with a spring washer (14) and flat washer (13) at each end of worm gear. Push operating shaft (16) through bracket, spring washers and worm gear until pin holes in worm gear and shaft are aligned. Press spring pin (12) into holes.

(3) Attach actuator arm (A, 18) to worm wheel gear (17) with three screws (20) and lock washers (19).

(4) Place actuating arm assembly (A) in bracket assembly with a spring washer (24) on each side, and a spacer (23) between each spring washer and the bracket. Insert bolt (15) through the aligned holes, and assemble the flat washer and self-locking nut on threaded end of bolt. Tighten nut until a slight drag is felt when rotating the operating shaft.

(5) Install ball joint through hole in end of the actuator arm.

(6) Install the operating shaft assembly into the air conditioner casing through the outside air intake opening. Insert the long end of the shaft into the grommet (10) and hole in the front of the casing. Fit the short end of the shaft into the grommet and hole in rear of casing.

(7) Attach the step plate (7) to the floor of the compartment with four screws, washers and self-locking nuts.

(8) Attach hinges of damper plate (6) to flange of fresh air baffle (5) using six screws, washers and self-locking nuts.

(9) Install ball joint in bracket on damper plate, and secure with self-locking nut. Insert connecting rod (26) into hole in ball joint, and lock in place.

(10) Install baffle and damper plate assembly in casing. Position outside screen (4) on baffle, and secure with 12 screws and washers.

(11) Insert free end of connecting rod in hole of ball joint on actuator arm, but do not tighten locknut at this time.

(12) Plate knob (9) on both ends of the operating shaft, and tighten setscrews.

(13) Turn the operating shaft (16) as necessary to place the actuating arm (A, 18) in a vertical position. Press the damper plate (6) closed, and tighten the locknut on the ball joint.

(14) Turn the operating shaft (16) through a full cycle of opening and closing the fresh air damper. Make final adjustments if necessary.

(15) Position the condenser coil inlet screen (2) on the unit, and secure with 12 screws.

(16) Position the evaporator air intake grilles on front of unit, and secure with 12 screws and washers through the frame of each grille.

4-27. Mist Eliminator.

The mist eliminator is a fine-mesh screen (1, Figure 4-7) which is located between the evaporator coil (2) and the evaporator air outlet grille. Its purpose is to trap droplets of condensate water formed on the evaporator coil to prevent their being blown through the grille into the room. The mist eliminator must be inspected and serviced periodically to prevent clogging. Proceed as follows:

a. Removal. Remove 16 screws and washers from the frame of the evaporator discharge grille, and remove the grille. Remove 22 screws and washers from the top, and nine screws and washers from the rear flange of the top panel, and lift the top panel off of casing. Slide the mist eliminator up, out of guides, to remove.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm2). Do not direct compressed air against the skin. Use goggles or full face shield.

b. Cleaning. Agitate the mist eliminator in detergent solution, using a soft brush if necessary to dislodge stubborn accumulations of dirt. Blow dry with compressed air at 25-30 psi (1.76-2.11 KG/CM2).

c. Inspection. Inspect for broken or displaced wires, bent or deformed frame, or broken spot-welds, replace if damaged.

d. Installation. Slide the mist eliminator into position between guides, keeping the top mark up and facing forward. Position the top panel on the unit, and secure with 22 screws and washers through the top panel, and nine screws and washers through the rear flange. Install the evaporator air discharge grille with 16 screws and washers through the frame.

4-28. Block-Off Assembly.

The block-off assembly (figure 4-8) is used only when the control panel is removed to a remote location. The block-off assembly fills the opening in the lower front access panel to prevent intake of air through the opening, which would bypass the condenser coil.

a. Removal of Control Panel. Remove the control panel from the unit in accordance with the following procedure.

(1) Unscrew four panel fastener screws from the front access panel, and remove the panel by pulling outward and upward.

WARNING

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

(2) Remove the electrical plug (P8) from the end of the control panel assembly.

(3) Remove evaporator air intake (return air) grilles by removing 12 screws and washers from each grille.

(4) Reach through the evaporator air intake opening, and remove the nut and screw holding the loop clamp which supports the thermostat bulb on the bottom of the filter support channel. Carefully remove the loop clamp from the thermostat bulb.

CAUTION

When removing the control panel assembly from the unit, be careful to avoid kinking the capillary tube connecting the thermostat bulb to the assembly.

(5) Carefully remove the control panel assembly from the unit while leading the capillary tube and thermostat bulb around obstructions and through the grommet.

(6) Coil the capillary tube evenly to avoid kinking, and fit it with the bulb into the cavity on rear surface of box. Secure the bulb with a loop clamp, screw and nut.

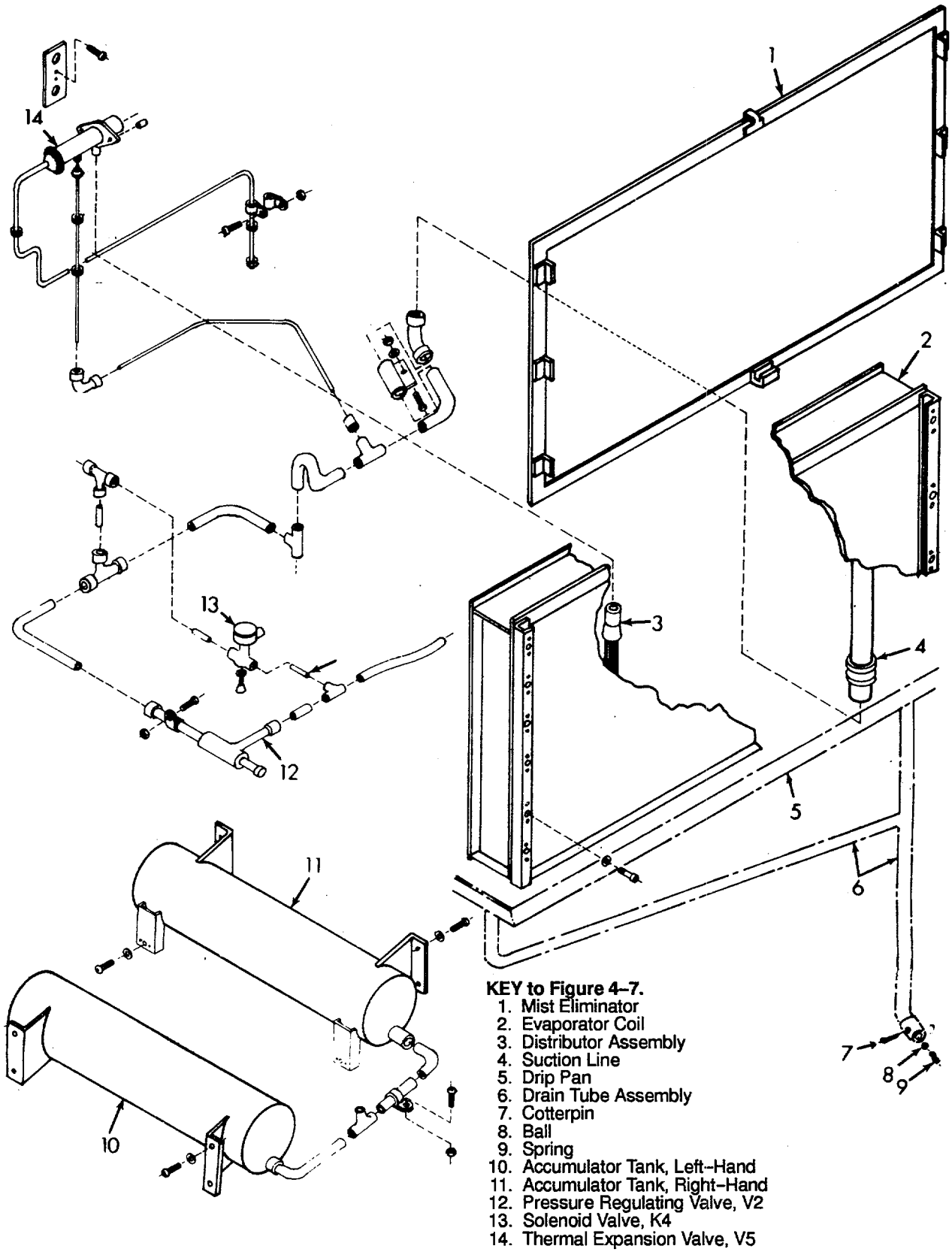
b. Installation of Block-off Assembly. Install the block-off assembly (figure 4-8) as follows:

(1) Remove the cover and install the control panel assembly in opening.

(2) Place the block-off assembly in position on the junction box, and secure with four screws.

(3) Install the front access panel on the air conditioner by placing the lower edge of the panel behind the step of the base plate, and pushing downward and inward. Secure with four panel fastener screws.

(4) Position the evaporator air intake grille on the unit, and secure each with 12 screws and washers.



KEY to Figure 4–7.

1. Mist Eliminator
2. Evaporator Coil
3. Distributor Assembly
4. Suction Line
5. Drip Pan
6. Drain Tube Assembly
7. Cotterpin
8. Ball
9. Spring
10. Accumulator Tank, Left–Hand
11. Accumulator Tank, Right–Hand
12. Pressure Regulating Valve, V2
13. Solenoid Valve, K4
14. Thermal Expansion Valve, V5

Figure 4-7. Evaporator Section

4-29. Instruction Plates.

Replace damaged or illegible instruction plates by drilling out old rivets and removing the damaged plate. Install a new instruction plate and secure with blind rivets.

4-30. Drip Pan and Drain Tube.

The drip pan (5, figure 4-7) is located under the evaporator coil (2) and mist eliminator (1). Water condensed from the water vapor in the air is collected in the drip pan. The water is drained into the base plate of the air conditioner through tubes (6) at each end of the drip pan. The passage of air through the tubes is prevented by a spring-loaded ball check valve (7, 8, 9,) at the bottom of the vertical drain tube. Access to the drainage system is obtained by removing the top panel and all panels and grilles from the front of the unit as follows:

a. Removal of panels. Remove panels as follows:

(1) Remove 16 screws and washers from the frame of the evaporator discharge grille, and remove the grille.

(2) Remove 22 screws from top, and nine screws from the rear flange of the top panel, and remove the panel.

(3) Remove 12 screws and washers from the frames of both evaporator intake grilles. Remove grilles.

(4) Slide the mist eliminator up out of guides to remove it.

(5) Unscrew four panel fastener screws from the front access panel. Pull the panel upward and outward to remove it.

b. Inspection. Visually inspect the drip pan and drain tubs for obvious damage. Pour water into each end of the drip pan. Make sure the water flows freely through both the cross-over tube and the vertical tube. If water does not flow freely, remove the cotterpin, spring and ball from the check valve. Inspect for obstructions by repeating the water-flow test.

c. Servicing. If water flows freely from the drain pan to the bottom plate through both tubes. No servicing is necessary. **If** the tubes are blocked, blow out obstruction with compressed air after removing the cotterpin, spring and ball from check valve.

d. Assembly. Replace the ball (8), spring (9) and cotterpin (7) in the check valve, if removed. Replace panels and grilles on the air conditioner as follows:

(1) Position the front access panel on the unit by placing the bottom lip behind the step in the base plate. Push the panel into place and secure it with four captive panel fastener screws.

(2) Slide the mist eliminator (1) into position between the guides; making sure that the top mark faces out.

(3) Position the top panel on the unit, and secure it with 22 screws through the top and nine screws through the rear flange.

(4) Place the evaporator air discharge grille on the unit, and secure it with 16 screws and washers.

(5) Position the evaporator air intake grilles on the unit, and secure them with 12 screws and washers through the frame of each grille.

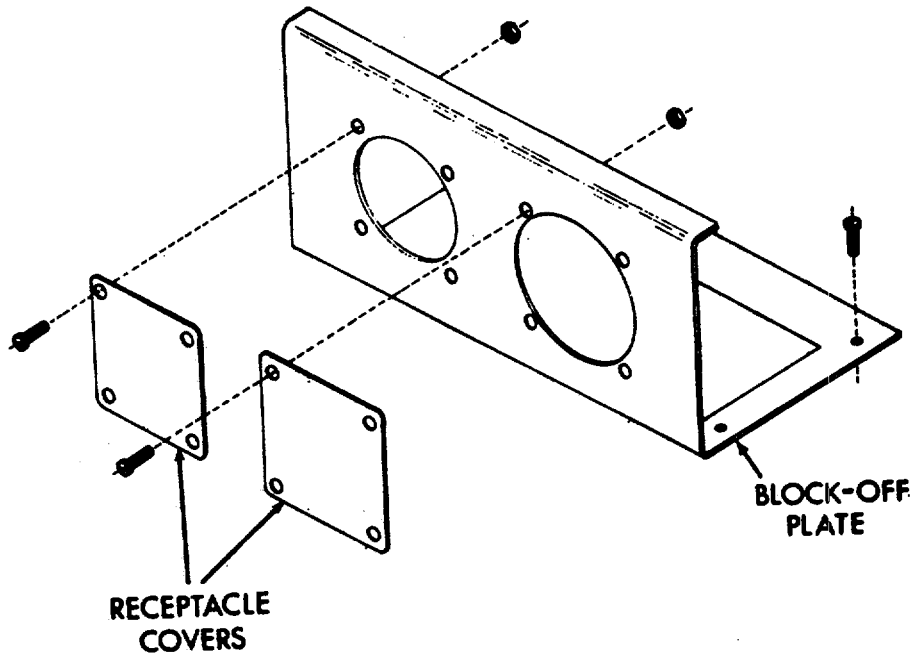


Figure 4-8. Block-Off Assembly)

Section IX. MAINTENANCE OF CONTROL PANEL AND JUNCTION BOX.

4-31. Control Panel.

a. General. The control panel contains the mode selector switch, the temperature control thermostat and the electrical receptacle through which the controls are connected to the junction box. (See figure 4-9.)

b. Removal. Remove the control panel in accordance with the following instructions:

(1) Unscrew four panel fastener screws, three along the top edge, and one near the center of the panel, and remove the front access panel by pulling it upward and outward.

(2) Remove 12 screws and washers from the frames of the evaporator intake grilles and remove the grilles.

(3) Remove the self-locking nut and screw from the loop clamp holding the thermostat sensor bulb to the bottom of the air filter channel.

CAUTION

Be careful to avoid kinking the capillary tube of the thermostat sensor when handling it.

WARNING

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

(4) Disconnect wiring harness connector from receptacle on control panel assembly.

(5) Remove four screws (7, figure 4-9) from the corners of the control panel mounting plange, and carefully withdraw the assembly from the unit.

c. Disassembly. Disassemble the control panel as directed in the following procedure: (See figure 4-9.)

(1) Remove four screws and self-locking nuts from the rear cover of the control panel assembly.

(2) Loosen the socket head setscrews in each of the knobs (14), and remove the knobs from their shafts.

(3) Press the shaft of temperature control thermostat (5) inward to push the end of rear cover (2) out of box. Grasp the rear cover, and remove.

(4) Tag wire leads for identification, and disconnect them from the temperature control thermostat.

(5) Remove four screws and nuts from the mounting flange of the temperature control thermostat, and remove it from the rear cover (5).

NOTE

If the control panel has been placed in a remote location, remove screw nut and loop clamp from sensor bulb to release temperature control thermostat (5) from cover (2).

(6) Tag wires for identification, and disconnect them from the selector switch (4).

(7) Remove the panel mounting nut and lock washer from the ferrule of the selector switch, and remove the switch.

(8) Remove four screws and self-locking nuts from the corners of the receptacle of the wiring harness (9).

(9) Remove one self-locking nut (18), two aluminum flat washers (17), two steel flat washers (11), two lock washers (12), a nut (18), and the grounding wire from the right-hand end of the box (15).

(10) Withdraw the receptacle of the wiring harness (9) from the box, and remove two beveled spacers (8).

d. Inspection Test. Visually inspect all parts for obvious physical damage. Repair or replace as required. Test electrical functions as directed in the following procedure.

KEY to Figure 4–9.

1. Wire Lead
2. Cover
3. Grommet
4. Selector Switch
5. Temperature Control Thermostat
6. Insulation, Electrical
7. Screw (Attaching to Junction Box)
8. Beveled Spacer
9. Wiring Harness
10. Screw, Grounding Stud
11. Lockwasher
12. Flat Washer
13. Instruction Plate
14. Knob
15. Housing Assembly
16. Nut
17. Flat Washer
18. Nut, Self-locking

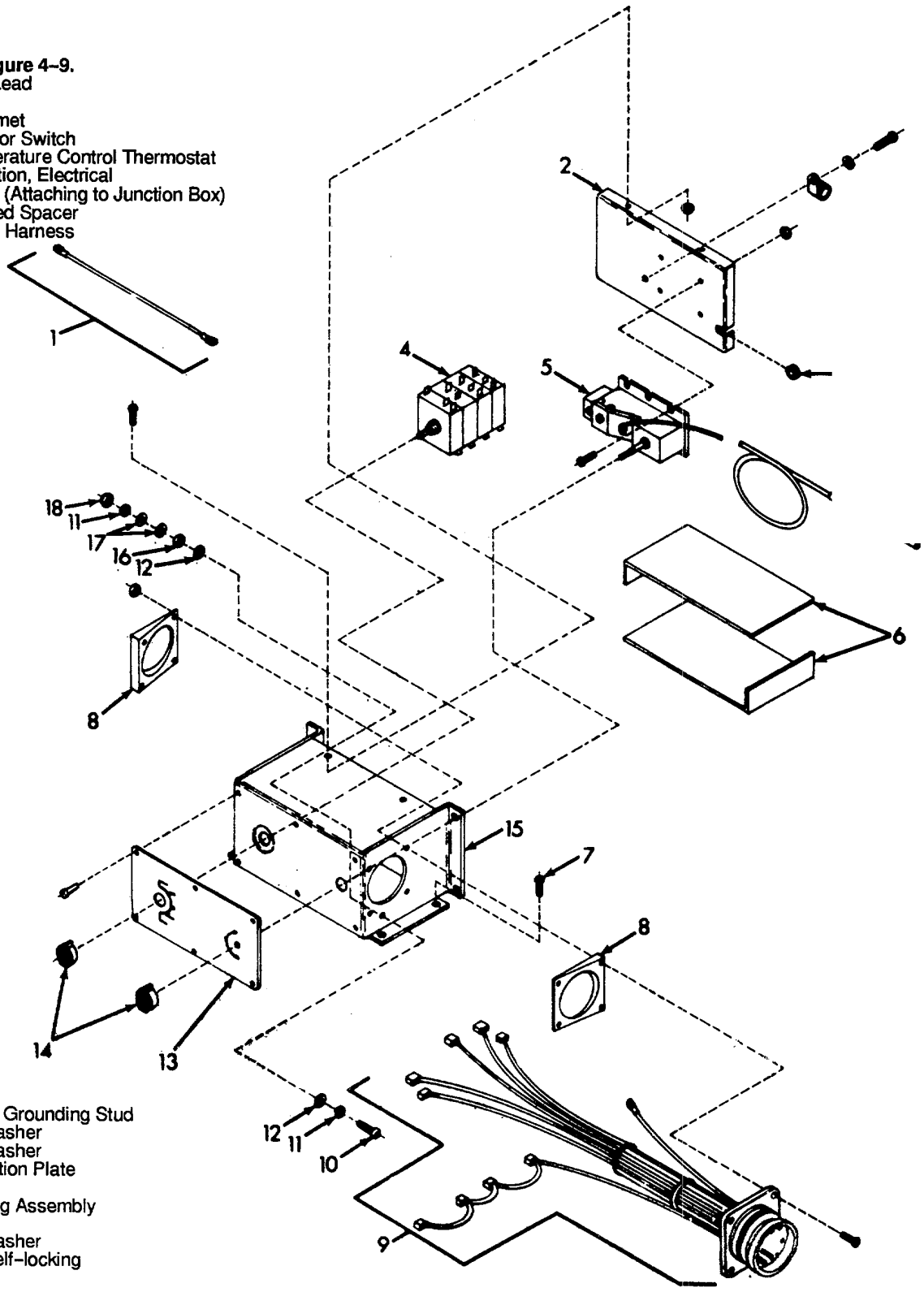


Figure 4-9. Control Panel Assembly

(1) Using an ohmmeter or continuity tester, check continuity of the mode selector switch (4) in all positions in accordance with the following table:

(2) Using an ohmmeter or continuity tester, check continuity of the temperature control thermostat (5).

(a) Place the sensor bulb in a container of warm water (85°-1 00°F or 30°-400C). Check the continuity of the red and yellow contacts throughout the decrease range. Continuity should be shown.

(b) Place the sensor bulb in a container of cold water (40-65°F or 5-18°C). Check the continuity of red and blue contacts throughout the increase range. Continuity should be shown.

(3) Check the continuity of wires from terminal to terminal in the wiring harness.

e. Assembly. Assemble the control panel as follows:

(1) Place a lock washer (11) and flat washer (12) on screws (10), and install in a control panel. Install a flat steel washer (12) nut (16), two aluminum flat washers (17), lock washer (11) and self-locking nut (18) on outer end of screw.

(2) Install wiring harness (9) in box (15), with the two beveled spacers (8) oriented so that the thin edge of the outer spacer is toward the front of the control panel, and the thin edge of the inner spacer is toward the rear of the box. Secure with four screws and self-locking nuts.

Table 4-3. SWITCH POSITIONS

Unit	Contact Number	1 Hi Heat	2 Lo Heat	3 Off	4 Ventilate	5 Cool
S/W 1	12 & 1A	Closed	Closed	Open	Open	Open
	12 & 1B	Open	Open	Open	Open	Closed
	11 & 1D	Open	Open	Open	Open	Closed
S/W 2	22 & 2B	Closed	Closed	Open	Closed	Closed
S/W 4	41 & 4C	Closed	Open	Open	Open	Open

(3) Make electrical connections to the selector switch (4) and attach the grounding wire to the grounding stud assembly with terminal between the two aluminum washers (17).

(4) Make electrical connections to the temperature control thermostat (5), and attach thermostat to the rear cover (2) with four screws and self-locking nuts.

(5) Install the mode selector switch (4) in the box (15), and secure with lock washer and mounting nut.

(6) Split a grommet (3) and place it over the capillary tube of the thermostat, then insert the grommet and tube in the notch in the rear cover (2). If the control panel is to be used in a remote location, attach the sensor bulb to the rear cover with a loop clamp, screw and flat washers.

(7) Install the rear cover (2) on the box (15), guiding the shaft of the temperature control thermostat through the hold in the box. Secure the rear cover with four screws and self-locking nuts.

(8) Install knobs (14) on shafts, and tighten setscrews.

f. Installation.

CAUTION

Handle the capillary tube carefully during installation. To prevent kinking.

(1) Lead the sensor bulb of the temperature control thermostat carefully through the hole in the casing partition. Attach it to the filter channel with a loop clamp, screw and self-locking nut. Split a grommet from the center out, and place around the capillary tube in the hole.

(2) Attach the control panel assembly (figure 4-9) to the mounting flanges on top of the junction box. Secure with four screws (7).

(3) Connect plugs of wiring harness to the receptacle on control panel assembly.

(4) Install the front access panel on the air conditioner by placing the lower edge behind the step of the base plate. Push panel into position, and secure with four captive panel fastener screws.

4-32. Junction Box.
The junction box contains or supports the electrical controls that operate the air conditioner. It is located behind the front access panel, in the lower left corner of the air conditioner.

a. Removal. Remove the junction box from the air conditioner as directed in the following procedure.

(1) Unscrew four panel fastener screws from the front access panel and remove the panel.

WARNING

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

(2) Disconnect all electrical plugs from the receptacles on the junction box (See 10,11,12,13, figure 4-3).

(3) Detach circuit breaker actuator as following:

(a) Loosen the screw in the core end fitting (14), and slide the fitting from core wire.

(b) Remove two screws and lock washers from the cable hold-down clamp (16), and detach the cable from the actuator arm (15) and junction box.

(4) Remove four screws (7, figure 4-9) from the corners of the control panel assembly, and stow the control panel assembly out of the way.

(5) Remove six screws (7, figure 4-3) through the left-hand edge of the casing to the junction box mounting flange. Remove two screws (8) and washers (9) from the lower right-hand mounting bracket. Remove the junction box from the unit.

b. Disassembly. Disassemble the junction box in accordance with the following steps; however, disassemble only to the extent necessary to repair or replace components.

(1) Unscrew four panel fastener screws (1, figure 4-3) and lift off cover assembly (A).

(2) Tag wires for identification, and disconnect from components.

(3) Remove electrical receptacles by removing four screws and self-locking nuts from the corners of each receptacle.

(4) Remove six screws (19) from circuit breaker (20) and cover (21). Slide cover over actuator arm (15), and remove actuator arm from circuit breaker by removing tie-bolt from handle. Remove circuit breaker and cover from junction box.

(5) Remove filter-rectifier assembly (22) from junction box by removing four screws and lock washers from inside the junction box.

(6) Remove transformer (23) and insulation (24) from top of junction box by removing four self-locking nuts from transformer mounting studs.

(7) Remove panel (23, figure 4-10) from junction box by removing four screws. Remove panel with electrical components attached.

(8) Remove components from panel, if damaged or failed test requirements, by removing nuts or screws as shown in figure 4-10.

c. Inspection/Test. Visually inspect the junction box and its components for obvious damage, including evidence of electrical short circuits or burnouts. Test components as directed in the following steps:

(1) Fuses. Remove fuses (12, 13, figure 4-10) from fuse blocks, and test for continuity with an ohmmeter or continuity tester. Replace fuses that do not indicate continuity.

(2) Circuit Breaker. Turn the circuit breaker on, and check the continuity of each line-load pair on the three main breaker units, and of points 3-5 on the auxiliary switch, using an ohmmeter or continuity tester. Continuity should be indicated between each pair tested.

NOTE

The continuity test does not necessarily indicate performance of the circuit breaker under load. If the circuit breaker continues to trip after passing the continuity test, substitute a circuit breaker known to be good, and check operation in normal use.

(3) Armature relays (K1, K2, K7, K8, K9). Using an ohmmeter or continuity tester, and a source of 24-28 volt dc power, check continuity of relays (17, 18, 19, 21 and 22) as follows:

(a) Apply 24-28 volt dc power to terminals X1-X2 to actuate relay.

(b) Check continuity of pairs A1-A2, B1-B2 and C1-C2. Continuity should exist.

(c) Check continuity from each terminal to ground, with power disconnected from terminals X1-X2. Continuity should not exist.

(d) Replace relay if continuity check indicates malfunction.

(4) Time delay relay (K6). Test the time delay relay (9, figure 4-10) with an ohmmeter or continuity tester, a source of 24-28 volt dc power, and a watch or clock on which seconds can be read. Proceed as follows:

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

(b) Connect the test probes to terminals 2 and 3. While monitoring the time, apply a source of 24-28 volt dc power to the dc terminals of the time delay relay (positive (+) to positive, and negative (-) to negative).

(c) Continuity should be indicated after a delay between 19 and 31 seconds. If the delay is not within limits, replace the time delay relay.

(5) Transformer. Test the transformer (23, figure 4-3) using a volt-ohmmeter or multimeter and a source of 208-volt power. Proceed as follows:

(a) With the meter set on ohms, and the transformer disconnected. Check continuity of the primary (input) windings. Continuity should be indicated.

(b) Check for continuity between on input terminal and casing or common ground. Continuity should not exist. If it does replace the transformer.

(c) Check continuity of secondary (output) windings. Continuity should be indicated.

(d) Check for continuity between one output terminal and casing or common ground. Continuity should not exist. If it does, replace the transformer.

(e) Connect the primary leads of the transformer to a source of 208-volt, 60 hz power, and check output at the secondary leads with an ac voltmeter. Secondary voltage should be 28-30 volts dc. If out of limits, replace transformer.

(6) Terminal Boards. (See 7, 8, figure 4-10) Visually inspect terminal boards for obvious damage and evidence of electrical burns. If damaged, replace.

(7) Electrical Receptacles. Inspect electrical receptacles for damaged shell, bent or missing pins, broken wafers and broken terminals. Replace if damaged.

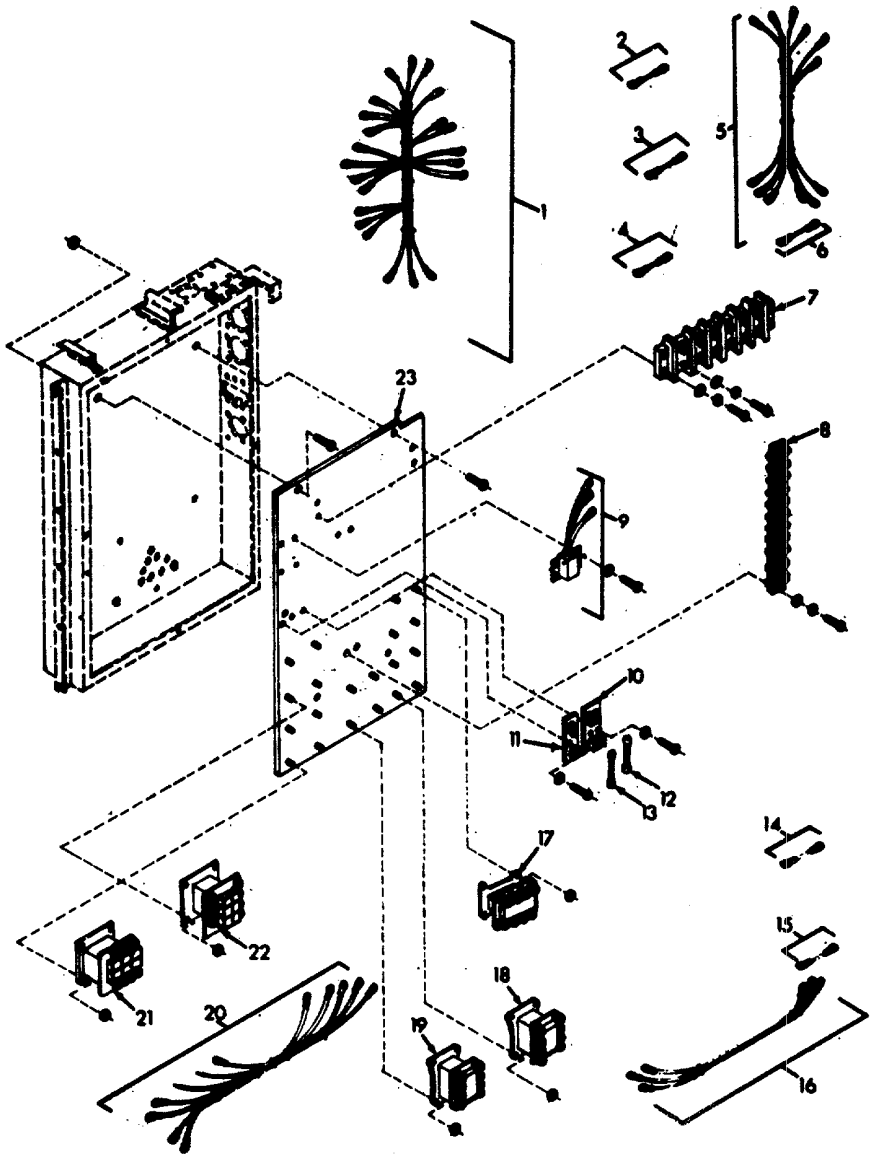
(8) Filter and Rectifier Assembly. (Figure 4-2.) Remove four screws (6) and lock washers (5), and carefully remove end cap (4). Inspect for loose internal connections, broken wires or other damage.

(9) RFI Filters. Disconnect leads from rectifier (8). Using an ohmmeter, check continuity between leads of each filter. If no continuity is shown, replace the filter.

(10) Rectifier. With rectifier (8) Disconnected from filters, connect a source of 28-volt ac power to the ac terminals. Check dc terminals with a dc voltmeter. Voltage should read 24+5 volts, dc. If output voltage is less than specified, replace the rectifier.

d. Installation. Install the junction box in the air conditioner in accordance with the following steps:

(1) Place the junction box in approximate position in the air conditioner, and insert the core of the circuit breaker control cable through the hole in top of the actuating arm (15, figure 4-3.)



KEY to Figure 4–10

1. Wiring Harness
2. Wire Lead
3. Wire Lead
4. Wire Lead
5. Wiring Harness
6. Wire Lead
7. Terminal Block, TB1
8. Terminal Block, TB2
9. Time Delay, K6
10. Fuseholder, XF1
11. Fuseholder, XF2
12. Fuse, F1, F2
13. Fuse, F3
14. Wire lead
15. Wire Lead
16. Wiring Harness
17. Relay, Evaporator, K8
18. Relay, Heater, H2
19. Relay, Heater, K1
20. Wiring Harness
21. Relay, Compressor, K9
22. Relay, Condenser, K7
23. Panel, Mounting

Figure 4-10. Junction Box, Internal Components

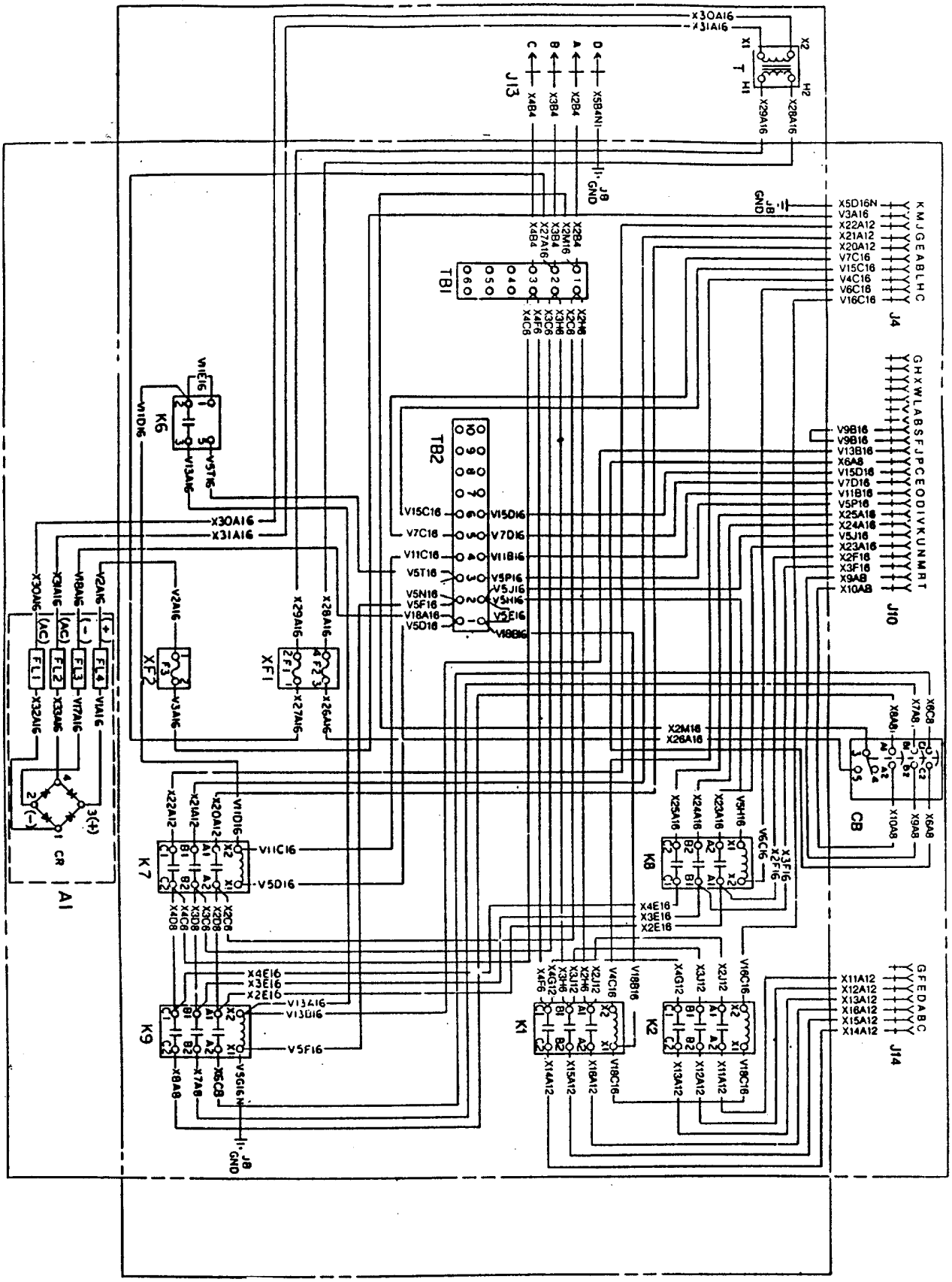


Figure 4-11. Junction Box Wiring Diagram

(2) Slide the core end fitting (14) over the cable core, and secure it temporarily by tightening the setscrew. Loosely attach the hold-down clamp (16) with two screws and lock washers.

(3) Install the control panel assembly on the top mounting flanges, and secure with four screws.

(4) Secure the junction box in position with six screws (7, figure 4-3) through the casing into the side mounting flange, and two screws (8) and washers (9) into the lower right-hand bracket.

(5) Adjust the circuit breaker cable as required, and tighten screws, clearance between the core end fitting (14) and the actuator arm hole (16) should be 0.12-0.25 inch (3-6 mm).

(6) Install fuses (12 and 13, figure 4-10) in clips on fuse blocks (10 and 11).

(7) Connect wiring harness plugs to their associated receptacles on junction box. Connect power supply to the air conditioner, and check operation.

(8) Place the cover assembly (a, figure 4-3) on junction box, and secure with four panel fastener screws (1).

(9) Position the front access panel on the air conditioner by inserting its lower edge behind the step in the front of the base plate. Push the panel into position, and secure it with four panel fastener screws.

Section X. MAINTENANCE OF COMPRESSOR ASSEMBLY

4-33. General.

The compressor assembly is a hermetically sealed unit containing the compressor, drive motor and thermostatic overload switch, and a lifetime charge of oil. The compressor assembly is equipped with a thermostatically-controlled crankcase heater, which maintains a temperature in the crankcase above the boiling point of refrigerant R-22. By this means, migration of refrigerant into the compressor, and liquefaction of refrigerant inside the compressor is prevented. Liquid Refrigerant, being incompressible, would seriously damage the compressor during start-up and operation. Because the compressor is a sealed unit, internal repairs cannot be made; if faulty, the unit must be replaced. However, the crankcase heater and thermostat can be replaced, since they are mounted externally.

a. Testing. Test the compressor assembly as indicated in the following procedure: (See figure 4-12.)

(1) Unscrew four panel fastener screws from the front access panel, and remove the panel.

WARNING

Disconnect the power supply before performing maintenance work on the air conditioner. The voltage used can be lethal.

(2) Disconnect electrical plug, P11, from the receptacle on the side of the compressor (3), remove the compressor junction box cover (4, figure 4-12) by removing wing nut and washers.

(3) Remove electrical receptacle, J11, (6) from the flange of the compressor junction box by removing four screws, nuts and washers.

NOTE

The compressor crankcase heater is controlled by a thermostat (9, figure 4-12). Therefore, the following continuity check must be made when the compressor is cold enough to close the contacts of the thermostat. If necessary, apply a plastic bag of dry ice to the area of the thermostat well for a few minutes before checking continuity of G-H.

(4) Using an ohmmeter or continuity tester, check continuity of points G-H (crankcase heater) and A-B (thermal overload switch). Check continuity of points D-E, E-F, and F-D. All of the foregoing should show continuity. Check to be sure that no continuity exists between points A, B, D, E, F, G and H and compressor housing or common ground. If continuity is not indicated at points G-H, or if continuity from G or H to ground is indicated, replace the crankcase heater and thermostat. If continuity is not indicated between point D-E, E-F, or F-D, or if continuity is indicated between D, E, and F and ground, report the trouble to direct support maintenance.

b. Replacement of crankcase heater. Replace the crankcase heater as follows:

(1) Disconnect wires to the crankcase heater (7, figure 4-12).

(2) Remove the retaining spring (8) from the hooked ends of the heating element (7), and spring the ends apart just enough to work the heater off the compressor housing to remove.

(3) Carefully spread the replacement heating element (7) just enough to work it around the compressor housing. Retain by hooking the spring (8) over both ends of the heating element.

(4) Connect lead wires to terminal.

c. Assembly. Assemble the air conditioner in the following manner:

(1) Install electrical receptacle (6, figure 4-12) in the flage of the compressor junction box, and secure it with four screws, lock washers, and nuts.

(2) Place the junction box cover (4) on the compressor, and secure it with wing nut and washer.

(3) Connect plug, Pll11, to receptacle, J 1.

(4) Install the front access cover on the air conditioner by placing the lower edge of the cover behind the step in the base plate, and pushing into position. Secure with four panel fastener screws.

Section XI. MAINTENANCE OF PRESSURE CUTOUT SWITCHES

4-34. General.

The high- and low-pressure cutout switches are operated by internal pressure of the refrigeration system, and serve to protect the air conditioner from extremes of pressure. No conclusive test can be performed without opening the refrigeration system. If either high- or low-pressure cutout switch trip off frequently, of if resetting them does not restore normal operation, check for electrical operation as follows:

Place a yoke type ammeter on the power supply cable, and turn the selector switch to cool and the temperature control thermostat to maximum decrease. While observing the ammether, press one pressure cutout switch reset button, then release. Repeat with the other reset button. If the switches are electrically ok, the ammeter will indicate a lower amperage when each reset button is pressed, and will return to its original indication when each button is released. If the trouble persists, report it to direct support maintenance.

Section XII. MAINTENANCE OF REFRIGERATION COMPONENTS

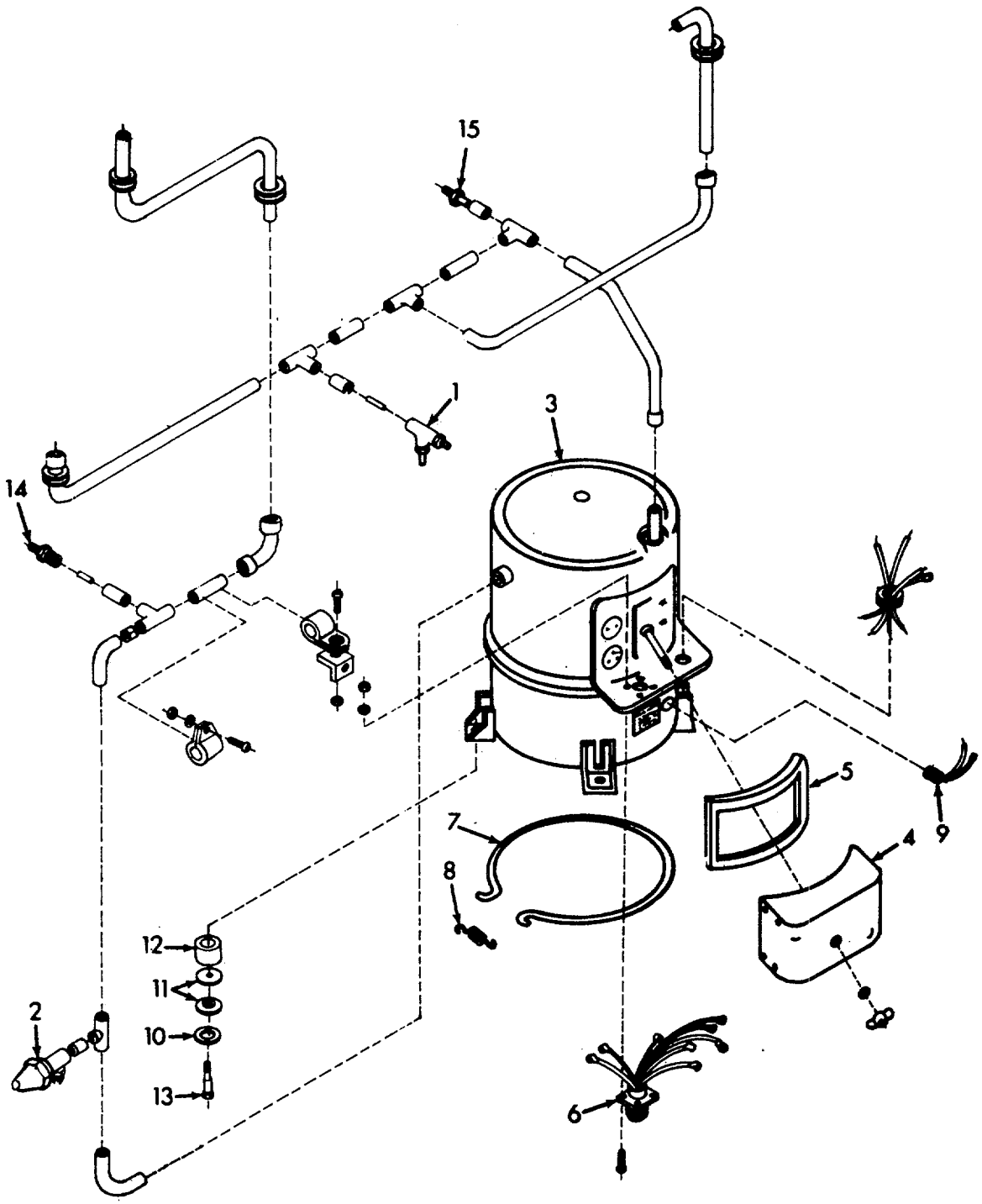
4-35. General.

Only maintenance of refrigeration components which can be performed without opening the refrigeration system is included in this section. Testing and replacement of solenoid valve coils, and servicing of evaporator and condenser coils are included.

4-36. Solenoid Valves.

The two solenoid valves, K3 and K4, are identical. Coil replacement procedure is the same for both.

a. Access. Solenoid valve, K3, is located between the compressor and the junction box in the lower part of the air conditioner. Valve, K4, in the bypass circuit is located about halfway between the two reservoir tanks behind the evaporator air intake grille. To obtain access to K3, unscrew four panel fastener screws from the front access panel, and remove panel. To obtain access to K4, remove 12 screws and washers from each evaporator air intake grille ant remove both grilles.



KEY to Figure 4–12

1. Discharge Service Valve
2. Suction Service Valve
3. Compressor
4. Junction Box Cover
5. Gasket
6. Wiring Harness
7. Crankcase Heater
8. Retaining Spring
9. Thermostat
10. Washer, Stell
11. Washer, elastomeric
12. Spacer
13. Bolt, Shoulder
14. Nipple, Low–pressure cutout switch
15. Nipple, high–pressure cutout switch

Figure 4-12. Compressor Section

WARNING

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

b. Testing. Disconnect the electrical connector from the housing of the solenoid valve, and apply a source of 24-28 volt dc power to the leads. A click should be heard if the valve is operating properly. If no click is heard, check continuity of the coil with an ohmmeter or continuity tester. If no continuity is indicated, replace the coil; if continuity is indicated, report the trouble to direct support maintenance for correction.

c. Coil replacement. Replace coils in the solenoid valves as directed in the following procedure: (See figure 4-13.)

(1) Disconnect wire leads from the connector receptacle.
(2) Remove the coil retaining nut from the top of coil housing.
(3) Lift the coil assembly straight up to remove it from the tube and plunger assembly.
(4) Place the new coil assembly over the tube and plunger assembly.
(5) Secure the data plate and housing assembly with the nut.
(6) Install the coil wire leads in connector, and tighten connector on housing.
(7) Connect the wiring harness plug to the receptacle.

d. Final assembly. Install the evaporator air intake grilles, and secure with 12 screws and washers in each grille. Install front access panel by placing lower edge behind step in base plate. Push panel into position, and secure with four panel fastener screws.

4-37. Sight-glass liquid indicator. (See figure 1-3.)

Visually inspect the sight-glass liquid indicator for obvious damage. Report condition to direct support maintenance if it is damaged. Replace moisture indicator data plate if damaged.

4-38. Condenser Coil. (See figure 1-3.)

With the deflector door open, remove 12 screws from top and bottom edges of the condenser intake screen. Remove screen, using a vacuum cleaner with brush attachment clean fins of condenser coil. If fins are bent or crushed, straighten with a plastic or wooden blade such as a tongue depressor or equivalent. Replace intake screen, and secure with 12 screws.

4-39. Evaporator Coil. (See figure 1-2.)

Service the evaporator coil in accordance with the following steps:

(1) Remove 16 screws and washers from the evaporator discharge grille, and remove the grille.
(2) Remove 31 screws from top and rear flange of the top panel, and remove the top panel or slide it back.
(3) Remove the mist eliminator by pulling it straight up.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm2). Do not direct compressed air against the skin. Use goggles or full face shield.

(4) Clean the fins of the evaporator coils with compressed air at 25-30 psi (1.75-2.1 Okg/cm2) or with a fine spray of cool water.
(5) Check the fins for bending or crushing. Straighten them if necessary, using a plastic or wooden blade such as a tongue depressor.
(6) Replace the mist eliminator by sliding it down into channels.
(7) Position the top panel on the unit. Secure it with 31 screws in top and rear flange.
(8) Position the evaporator discharge grille on the unit. Secure it with 16 screws and washers.

Section XIII. MAINTENANCE OF HEATER ASSEMBLY

4-40. General.

The heater assembly consists of six w-shaped rod-type heating elements. (See figure 4-14.) Three of the elements (10) are energized when the selector switch is set at lo heat, through a heater relay and an over-temperature thermostat (7). The remaining three elements are energized when the selector switch is set on hi heat. The lo heat elements are controlled by the temperature control thermostat on the control panel when the selector switch (also on the control panel) is set at lo heat. The hi heat elements are not thermostatically controlled. The elements are located across the width of the air conditioner just behind the evaporator coil, and are separated from the blower plenum by a perforated diffusing baffle.

4-41. Maintenance of Heating Elements.

a. Access. Obtain access to the heating elements as directed in the following steps:

(1) Remove 16 screws and washers from the evaporator discharge grille. Remove the grille.

(2) Remove 31 screws from the top and rear flange of the top panel. Remove or push back the top panel.

WARNING

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

b. Inspection/Test. Without removing the elements, disconnect wires from the each element in turn and check continuity. Use an ohmmeter or continuity tester at the terminals of each element, and make sure that continuity exists. No continuity should exist between, and make element and around. Visually inspect elements for obvious damage. Replace any element(s) that do not indicate continuity.

c. Removal. To remove a heating element, disconnect electrical leads, unscrew two panel fastener screws captive on the channel from the heater support. Remove element (10) by pulling straight up.

d. Installation. Insert heating element (10) straight down into the space between the heater support assembly (8) and the evaporator coil. Place heater support (9), with notches mating with heating elements (10), and secure with two captive panel fastener screws. Connect electrical leads to terminals of element.

e. Assembly. Assemble the air conditioner as follows:

(1) Position the top panel on the air conditioner. Secure it with 31 screws through the top and rear flange.

(2) Position the evaporator air discharge grille on the front of the air conditioner. Secure it with 16 screws and washers.

4-42. Maintenance of Heater Thermostatic Switch.

The heater thermostatic switch (7, Figure 4-14) acts to protect the heating elements against burnout. This condition can occur when the temperature control thermostat on the control panel is set at maximum increase for an extended period while airflow is obstructed or the evaporator blower is not operating. Perform maintenance on the heater thermostatic switch as follows:

a. Access. Obtain access to the heater thermostatic switch in accordance with the following procedure:

(1) Remove 16 screws and washers from the evaporator discharge grille. Remove the grille.

(2) Remove 31 screws from the top and rear flange of the top panel. Remove or push back the panel.

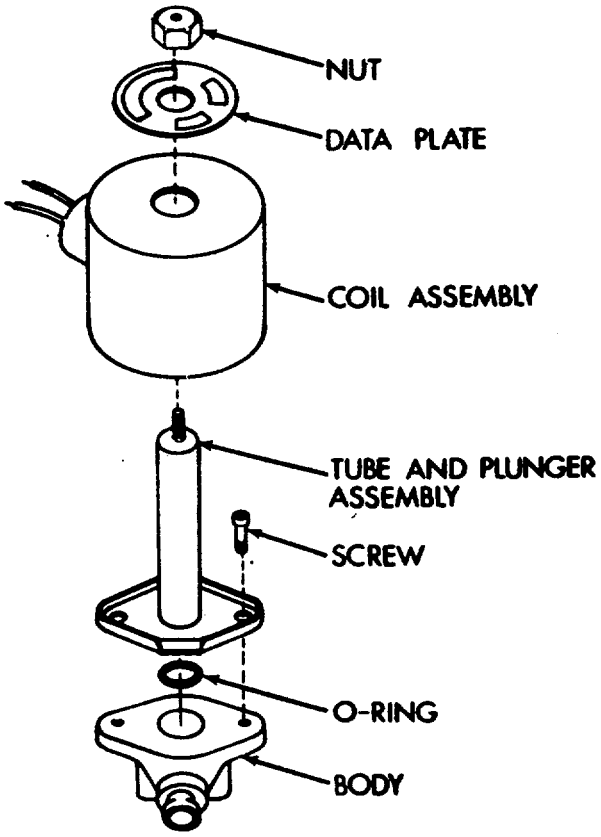


Figure 4-13. Typical Solenoid Valve

WARNING

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

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

b. Removal. Remove the thermostatic switch (7, figure 4-14) from the bracket on the rear surface of the heater support assembly (8), by disconnecting three wires and removing two screws, rivets and washers from the mounting flange.

c. Inspection/Test. Inspect the heater thermostat for obvious physical damage. Test as follows:

(1) Tape a thermometer on the junction of a thermocouple to the body of the thermostat.

(2) Connect an ohmmeter or continuity tester to any two leads of the thermostat.

(3) Gradually apply heat to the thermostat, using a heat lamp or other convenient source, and observe the continuity tester. Continuity should exist until the temperature shown by the thermometer or thermocouple reaches 185-203°F (85-95°C), then drop out.

(4) Remove the heat source and observe the continuity tester as the thermostat cools. Continuity should be re-established at 125-158°F (52-700C).

(5) Disconnect the ohmmeter or continuity tester from one of the thermostat wires, and connect it to the remaining wires. Repeat steps (3) and (4). Replace thermostat if it does not meet continuity requirements.

d. Installation. Position the thermostatic switch (7, figure 4-14) in hole in bracket, and secure with two screws, washers and nuts. Connect wires to terminals of heating elements (10).

e. Final Assembly. Assemble the air conditioner as follows:

(1) Position the top panel on the unit. Secure it with 31 screws through the top and rear flange.

(2) Position the evaporator discharge grille on the unit. Secure it with 16 screws and washers.

Section XIV. MAINTENANCE OF FANS AND MOTORS

4-43. General.

Airflow through the condenser is provided by motor-drive axial fan. The condenser fan is driven by a horsepower (2.98 kw), 208-volt, 50/60 Hz, 3-phase, 1725 rpm motor. The centrifugal evaporator blowers are driven by a 1.25 horsepower (0.9325 kw), 208-volt, 50/60 Hz, 3-phase, 3450 rpm, doubleshaft motor.

4-44 Maintenance of Evaporator Fan and Motor.

a. Access. Obtain access to the evaporator fan and motor assembly as directed in the following steps:

WARNING

Extreme caution should be exercised whenever unit must be operated with protective panels or grillwork removed, as evaporator fans are rotating at 3450 RPM and condenser fan is rotating at 1725 RPM.

(1) Remove 16 screws and washers from the frame of the evaporator discharge grille. Remove the grille.

(2) Remove 12 screws and washers from each evaporator intake grille. Remove both grilles.

(3) Remove 31 screws from the top and rear flange of the top panel. Remove the panel.

KEY to Figure 4–14

1. Wire Lead
2. Wire Lead
3. Wire Lead
4. Wiring Harness
5. Insulation
6. Baffle
7. Thermostatic Switch
8. Heater Support Assembly
9. Heater Support
10. Heater Element

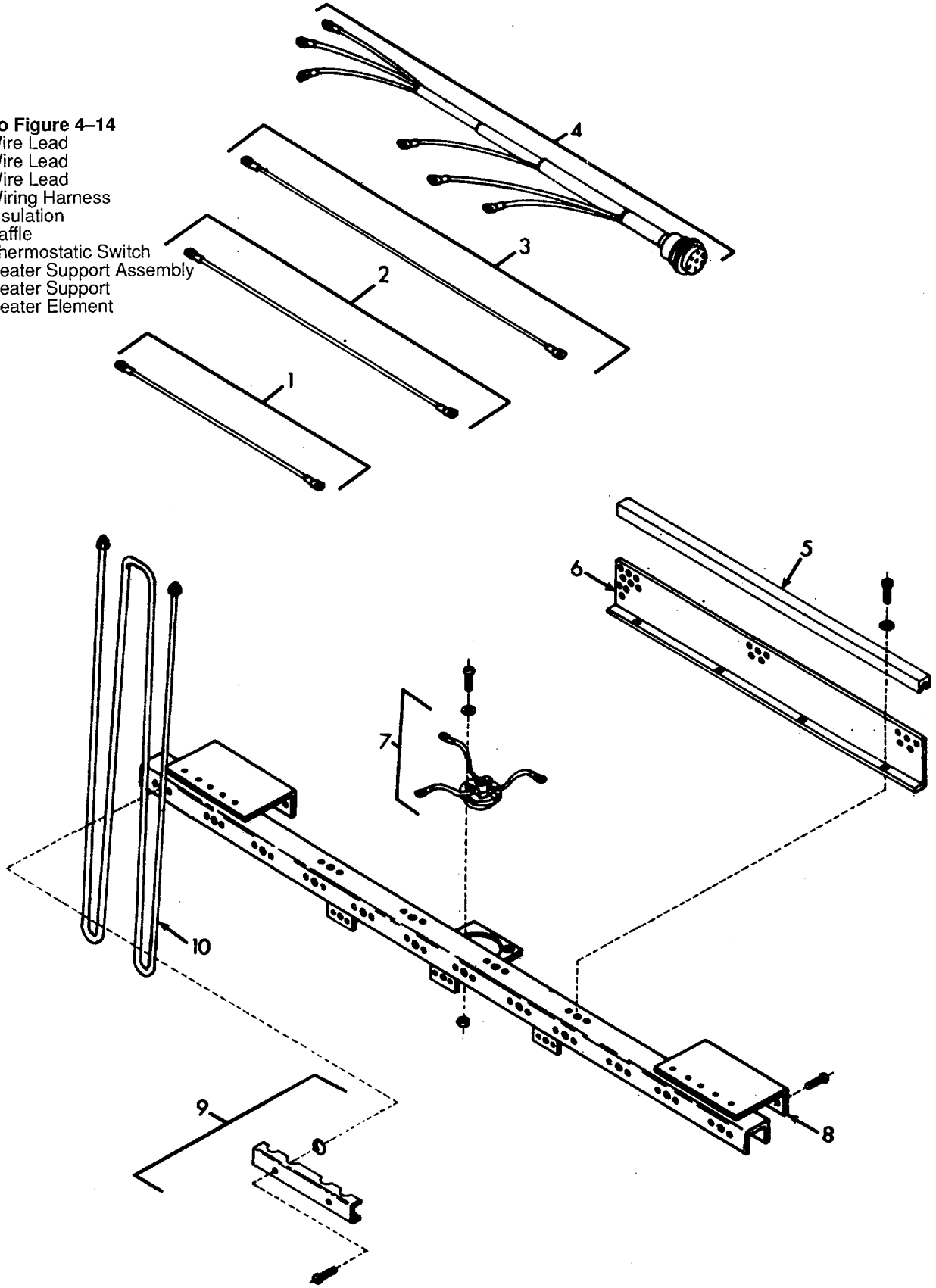


Figure 4-14. Heater Section

b. Removal (See figure 4-15.) Remove the evaporator fan and motor assembly from the air conditioner as follows:

WARNING

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

(1) Disconnect the wiring harness from motor at receptacle J15 (18, figure 4-15).

(2) Remove four screws and eight washers from the flange of each inlet ring (12 & 13, figure 4-15) and remove the inlet rings.

(3) Remove four capscrews and washers from the motor support (2). Carefully lift out fan and motor assembly.

c. Disassembly. Disassemble the evaporator fan and motor assembly in the following manner:

(1) Loosen two socket-head setscrews in the hubs of both centrifugal fan impellers (10,11), and slide the centrifugal fan impellers from the motor shaft. Use two 5/16-18 screws as jackscrews in the hub flange if the centrifugal fan impellers are difficult to remove. Tape keys (14,15) to the shaft to prevent loss.

(2) Remove four capscrews, washers and lock washers from the support plate (2). Remove the motor.

(3) Remove four screws from each end bell (4,9). Carefully remove end bells. Use a brass drift, tapping it around the circumference of each end bell to break it loose from the motor stator (3) if necessary.

(4) Withdraw 1 each bearings (6) from end bells (4,9), using a bearing puller if necessary.

CAUTION

Do not clean bearings with solvent. Bearings are permanently lubricated and sealed at time of manufacture.

(5) If bearings are to be re-used, place them in clean plastic bags or wrap them in grease-proof paper until needed.

(6) Remove four screws from the corners of the junction box (16). Carefully lift the junction box away from motor stator (3).

(7) Remove two screws from the thermal overload protector (17). Tag wires for identification, and disconnect them from overload protector.

(8) Remove four screws. Remove the receptacle (18) from the junction box (16).

d. Inspection/Test. Inspect/test the evaporator fan and motor assembly as directed in the following steps:

(1) Inspect the impellers for dents, nicks, gouges or deformation. Replace them if damage is sufficient to cause imbalance or interference.

(2) Inspect the motor shaft for end-play, side-play or runout, and listen for clicking or grinding noises when being rotated by hand. If runout exceeding 0.001-inch (0.025mm) TIR exists, replace the rotor. If other indications are found, replace the bearings.

(3) Using an ohmmeter or continuity tester, check continuity at receptacle (18, figure 4-15) from points A to B, B to C and A. If continuity does not exist in one or more pairs, remove the thermal overload protector and test each pair of contacts for continuity. If continuity does not exist in one or more pairs, replace the thermal overload protector. Check continuity of each pair of winding leads, and of each lead to the motor frame. If continuity does not exist in one or more pairs, or if continuity does not exist between any lead and the motor frame, replace the motor.

e. Assembly. Assemble the evaporator fan and motor assembly in accordance with the following instructions: (see figure 4-15.)

(1) Install receptacle (18) in junction box (16). Secure with fours screws.

(2) Install the thermal overload protector (17) in the junction box (16), and solder connections. (See figure 4-16, Wiring Diagram.) Secure it to the junction box with two screws.

(3) Install the junction box (16, figure 4-15) on the motor stator (3) and secure it with four screws.

(4) Slide a bearing (6) and two load springs (8) onto fan end of rotor (5), and slide a bearing onto other end of rotor. Insert rotor into motor frame.

(5) Carefully install the end bells over the ends of rotor and bearings, aligning screw holes in end bells and frame. Secure with four screws at each end.

NOTE

Balance fans and motor as an assembly in a two plane running balance to a maximum allowable unbalance of 0.03 ounce inches per plane at the high operating speed of the motor. Balancing weights shall be tight on fans and shall not be capable of falling off due to fan rotation.

(6) Orient the motor support (2) with the two nut plates forward, and attach the motor with its electrical receptacle facing forward. Secure with four capscrews, lock washers and flat washers.

CAUTION

The right and left centrifugal impellers are mirror images of each other. Make that each is installed on the correct end of the motor. Looking into the open ends of the impellers, the right-hand one must have the blades angled with the leading (outer) edge clockwise from the trailing edge.

(7) Align keyways, and press impellers onto motor shaft. Surface of hub should be flush with end of motor shaft. Tighten setscrews in the hub of each impeller. Then install fan and motor assembly in air conditioner.

f. Installation. Install the evaporator fan and motor assembly in air conditioner as follows:

(1) Position the assembly in the air conditioner, and secure with two screws and flat washers through the casing partition into the nut plates of the support, finger tight. Install two screws and flat washers through the upper flange of the support into the nut plate of the casing, finger tight. Tighten all four screws.

(2) Install inlet rings (12 & 13, figure 4-15) through holes in air intake plenums. Secure with four screws and eight washers through the flange of each inlet ring.

(3) Check clearances between impellers and inlet rings, and tighten capscrews through motor support plate.

(4) Connect electrical plug, P15, to the receptacle on the motor. Connect power to the air conditioner, turn the mode selector switch to VENTILATE, and check the operation of the fan and motor assembly. If airflow is low or non-existent, remove the assembly and interchange impellers. If rubbing, grating or binding is evident, adjust clearance as necessary.

(5) Position the top panel on the air conditioner. Secure it with 31 screws through the top and rear flange.

(6) Position the evaporator air discharge grille on the air conditioner. Secure it with 16 screws and washers.

(7) Position the two evaporator air intake grilles on the air conditioner. Secure each with 12 screws and washers.

Key to Figure 4-15:

1. Baffle
2. Motor Support
3. Motor Stator
4. End Bell
5. Rotor
6. Bearing
7. Fan
8. Load Springs
9. End Bell
10. Centrifugal Fan Impeller, Right Side
11. Centrifugal Fan Impeller, Left Side
12. Inlet Ring, Ring Side
13. Inlet Ring, Left Side
14. Key
15. Key
16. Junction Box
17. Thermal Overload Protector
18. Receptacle

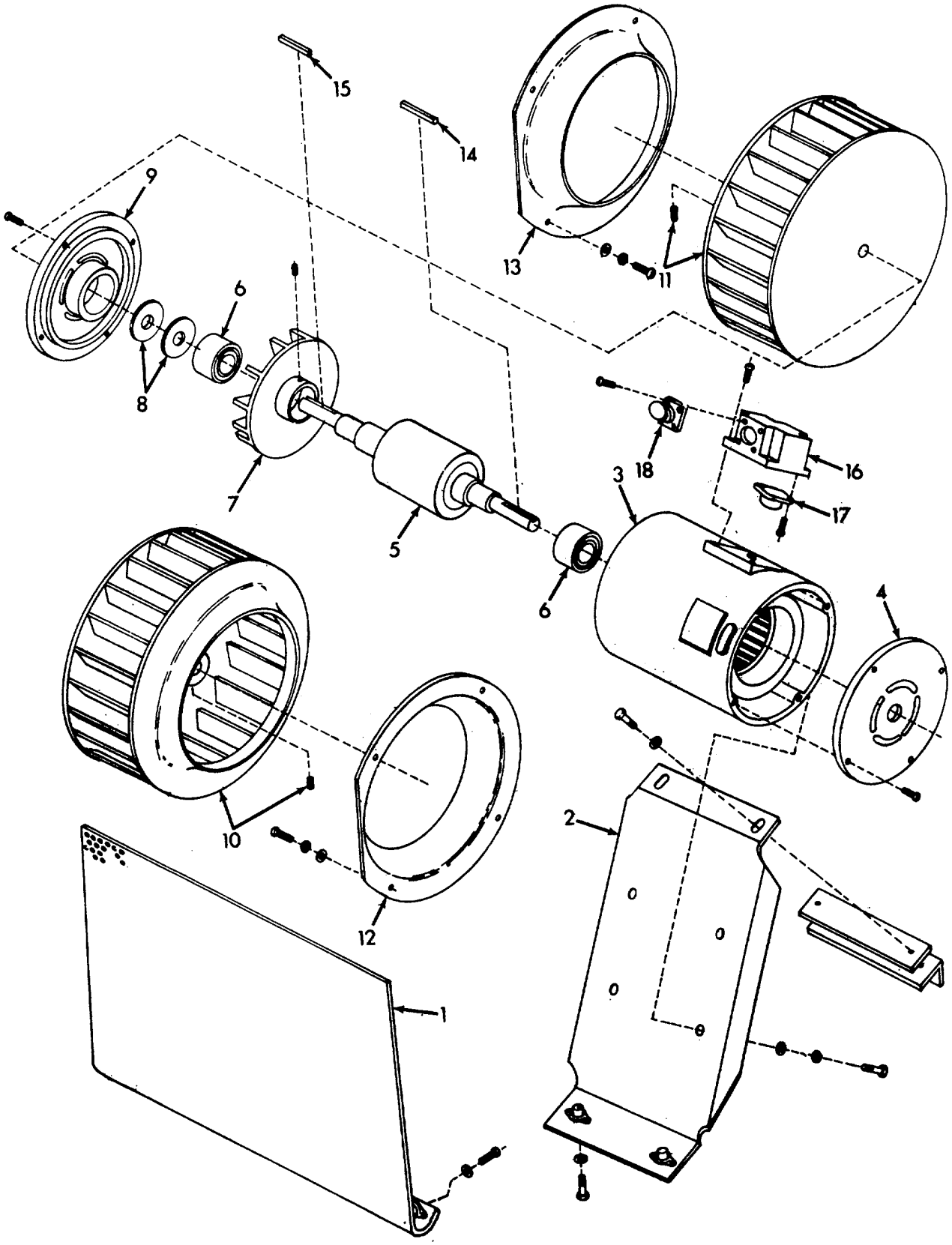


Figure 4-15. Evaporator Fan Assembly

4-45. Maintenance of Condenser Fan and Motor.

a. Access. In order to obtain access to the condenser fan and motor assembly, the front access panel, junction box and control panel, and the rear fan guard must be removed. Proceed in accordance with the following directions.

(1) Unscrew four panel fastener screws in the front access panel. Remove the panel.

WARNING

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

(2) Disconnect all electrical plugs from their receptacles on the junction box and control panel assembly.

(3) Loosen the small setscrew in the core end fitting (14, figure 4-3) and slide the end fitting off of the cable core.

(4) Remove two screws and washers from the hold-down clamp (16) near the top of the junction box. Remove the clamp. Place the flexible cable to one side, out of the way.

(5) Remove six screws (7) on the left side of the casing, and remove two screws (8) and washers (9) from the lower right corner bracket of the junction box. Remove the junction box and control panel assembly from the air conditioner being careful to avoid kinking capillary tube from thermostat to sensing bulb. Store in a safe place.

(6) With fabric cover rolled up and tied in place, remove six screws from the looped ends of the condenser fan guards. Remove the guard.

b. Removal. Remove the condenser fan and motor from the air conditioner as directed in the following steps:

(1) Loosen two setscrews in the hub of the impeller (13, figure 4-4), and pull the impeller from the motor shaft. Use a wheel puller if necessary. Tape key to motor shaft to prevent loss.

(2) Disconnect electrical plug, P2, from receptacle (3, figure 4-4) on motor junction box (4).

(3) Remove four capscrews, washers and lock washers from the bottom of the motor mounting assembly, and carefully remove the motor through the fan opening in back of the air conditioner. Identify for position, and retain shims (11 & 12) if motor is to be re-installed.

c. Inspection/Test. Inspect and test the condenser fan motor as follows:

(1) Inspect the motor and impeller for obvious damage, such as broken, gouged or bent parts. Replace the impeller if it is damaged.

(2) Check the shaft for freedom of rotation and excessive side- or end-play. Replace the bearings if they are rough or noisy.

(3) Using a surface plate and dial indicator, measure shaft runout. The OD of the shaft shall not indicate more than 0.001 inch) (0.025 mm) TIR runout. Replace the rotor if runout is excessive.

(4) Using an ohmmeter or continuity tester, check continuity at receptacle, J2 (3, figure 4-4). Check A to B, B to C and C to A. Also check from each point to the motor frame or common ground. Continuity should be indicated in all point-to-point checks, but should not be indicated from any point to ground.

d. Disassembly. Disassemble the condenser fan motor only to the extent necessary lo effect repairs. Proceed as follows: (See figure 4-4.)

(1) Remove six screws from each end bell (1 & 10), and carefully remove end bells from the motor stator (5). Use a brass drift and light hammer to tap around the edge of the end bell if difficult to remove.

(2) Withdraw the rotor (7) from the stator (5) and pull bearings (6) from end bell bearing cavities with a bearing puller if necessary.

CAUTION

Do not clean bearings in solvent. They are permanently lubricated and sealed at time of manufacture.

(3) If the bearings are to be re-used, store them in plastic bags or wrap in grease-proof paper until needed for assembly.

(4) Remove two screws, and remove the thermal overload protector (2) from the end bell (1). Tag wires for identification and unsolder them.

(5) Remove four screws from the electrical receptacle (3), and carefully pull the receptacle away from the junction box (4). Tag wires for identification, and unsolder them.

(6) Remove four screws that attach the junction box (4) to the motor stator (5). Remove the junction box.

e. Assembly. Assemble the condenser fan motor as indicated in the following procedure: (See figure 4-4.)

(1) Lead wires from the motor stator (5) through the junction box (4), and attach the junction box to the motor frame with four screws.

(2) Solder wires to the proper connections in receptacle (3). (See figure 4-16, Wiring Diagram.) Attach the receptacle to the junction box with four screws.

(3) Solder wire connections to the thermal overload protector (2, figure 4-4), and attach the protector to bosses in the end bell (1) with two screws.

CAUTION

Bearings are lubricated and sealed at time of manufacture. Do not clean with solvent or attempt to relubricate them at time of assembly.

(4) Install bearing (6) in end bell bearing cavity, and place end bell on motor frame. Secure end bell with six screws, tightened in increments in alternating sequence. Tap all around end bell with a plastic or rawhide mallet before final tightening.

(5) Set motor on end, with open end up, and carefully install rotor (7). Secure end bell with six screws tightened in increments in alternating sequence. Tap all around end bell with a plastic or rawhide mallet before final tightening. Turn shaft by hand to check for freedom of rotation before installing.

(6) Connect a source of 208-volt, 3-phase, 60 Hz power, and check for proper operation before installing.

f. Installation. Install the condenser fan and motor in the air conditioner as follows:

(1) Install the motor on the motor mount by inserting it through the fan discharge hole in back of unit. Attach it to the mounting plate with four capscrews, flat washers and lock washers, finger tight.

CAUTION

Do not hammer impeller onto shaft. Motor bearings would be damaged. If difficulty is encountered, clean shaft and dress out nicks or rough spots with a fine file, stone or abrasive paper, then apply a film of light machine oil, (SAE 10 lubricating oil or equivalent).

(2) Align keyways, and press the impeller (13, figure 4-4) onto the motor shaft. Tighten the setscrews in the hub of the impeller.

(3) Check the clearance between the impeller blades and the fan shroud. Clearance should be 0.080-0.150 inch (2.03-3.81 mm) and should be evenly divided, top and bottom, and side to side. Adjust with shims (11 and 12) under the mounting feet of the motor until clearance is evenly divided. Tighten motor mounting screws. Rotate the impeller by hand to be sure that no interference or binding exists.

(4) Install the electrical plug, P2, in the receptacle on the motor junction box.

(5) Install the junction box and control panel assembly in the air conditioner. Secure with six screws (7, figure 4-3) through the casing into the mounting flange, and two screws (8) and washers (9), through the lower right-hand mounting bracket.

(6) Route the circuit breaker flexible cable (17, figure 4-3) to the top of the junction box, and attach it loosely with the hold-down clamp (16) and two screws. Insert the end of the cable core through hole in the actuating arm (15). Install the core end fitting (14) over the cable core, allowing 0.12-0.25 inch (3-6 rmm) clearance between end fitting and actuator arm, and tighten setscrew. Check operation of the flexible cable and circuit breaker by pulling and pushing the operating knob (18). Tighten screws when the adjustment is satisfactory.

(7) Lead thermostat sensing bulb and capillary tube carefully around right end of condenser coil to loop clamp in center of air intake chamber. Do not kink capillary tube.

(8) Connect all electrical plugs to their receptacle on the junction box and control panel assemblies.

(9) Install the front access panel by placing its lower edge behind the step in the base plate, pushing into position, and securing the four panel fastener screws.

Section XV. MAINTENANCE OF WIRING HARNESSES

4-46. General.

The electrical components of the air conditioner are interconnected by wiring harnesses, most of which terminate at one or both ends in connector assemblies. Two basic circuits are involved in the electrical system the 24-28-volt dc control circuit, and the 208-volt, 3-phase, ac operating circuit which powers the heaters, compressor, and evaporator and condenser fan motors. which powers the heaters, compressor, and evaporator and condenser fan motors.

4-47. Inspection.

Inspect the wiring harnesses for physical damage, including breaking, cutting, burning, missing insulation, deformed terminals and damaged connector assemblies. Repair or replace, as required.

4-48. Testing.

WARNING

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

Disconnect plugs from receptacles, and test each wire for continuity, end to end, by using an ohmmeter or continuity tester. (See figure 4-16, Wiring Diagram, and refer to table 4-4, Wire List, for routing and terminations of individual wires.) Replace individual wires that do not indicate continuity. Also test continuity from each pin connector to the connector shell. Continuity should not be indicated. If it is, replace the connector.

4-49. Replacement.

Each wire in the electrical system of the air conditioner is identified at both ends by a letter-number code. This same code is used for identification in both the wiring diagram (figure 4-16) and the wire list (table 4-4).

a. Removal When removing an entire wiring harness, proceed as indicated in the following steps, as applicable.

(1) Unscrew retaining sleeve of plug, and pull plug straight out of receptacle.

(2) Remove four screws and nuts, if used, from corners of receptacle to disconnect it from box of panel.

(3) Remove binding screws from screw-type terminals, or pull spade-type terminals straight off of flat connectors.

(4) Unsolder connections by melting solder with a soldering pencil or gun while pulling wire from terminal.

(5) Remove screws from loop clamps, spread clamps to remove from harness, and replace clamps in position for use at re-assembly.

(6) Press grommets out of partitions, and open at split-line to remove from harness.

b. Installation. Install wiring harnesses in accordance with the following steps, as applicable.

(1) Form harness to approximate its final configuration in the air conditioner.

(2) Make connections at each end, as indicated in the wiring diagram (figure 4-16) and wire list (table 4-4).

(a) Solder connections that do not have provision for other terminal connections.

(b) Attach lug-type terminals to binding screws, and tighten screws.

(c) Push on spade-type terminals.

(d) Connect plugs to receptacles, and screw on retaining sleeve.

(e) Install receptacles in openings, and secure with four screws through corners, and self-locking nubs if required.

(3) Install loop clamps as required, and secure with screws and nuts.

(4) Install rubber grommets as follows:

(a) Form split grommet around wiring harness on one side of hole.

(b) Insert a loop of tough string or flexible wire all around the circumferential groove of the grommet, and pass ends of string through hole.

(c) Press grommet against hole on one side, and pull string completely through from other side. This will seat the grommet in the hole.

4-50. Repair.

Repair defective wiring harnesses by replacing faulty parts, as appropriate, in accordance with the following steps:

(1) Measure a length of new wire of equivalent gauge and length to the wire being replaced.

(2) Remove 1/4-5/16 inch (6-8 mm) of insulation from both ends of wire.

(3) If connecting to a plug or receptacle without an insulation grommet, slip a one-inch length of heat-shrink tubing over insulation. Solder connection to pin or socket, and slide heat-shrink tubing over soldered connection. Heat tubing with a match or use other suitable means to shrink it in place.

(4) If connecting to a terminal lug, slip lug onto bare end of wire until wire bottoms in lug. Crimp lug to secure.

(5) Form replaced wire along outside of wiring harness, and lace or tie at 3-inch intervals.

(6) If replacing a defective plug or receptacle, cut away heatshrink tubing being careful to avoid cutting into insulation of the wire. Unsolder each connection, one at a time, and install a new one-inch length of heat-shrink tubing over wire. Insert wire into the same pin or socket on the new connector as it came from on the old connector. Solder the connection, slip tubing over the connection, and heat tubing to shrink it onto connection. Repeat for each wire until complete.

SWITCH POSITION						
	CONTACT NO.	1 HI HEAT	2 LO HEAT	3 OFF	4 VENT	5 COOL
S/W1	T2 AND 1A	CLOSED	CLOSED	OPEN	OPEN	OPEN
	12 AND 1B	OPEN	OPEN	OPEN	OPEN	CLOSED
	11 AND 1D	OPEN	OPEN	OPEN	OPEN	CLOSED
S/W2	22 AND 3B	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
S/W4	41 AND 4C	CLOSED	OPEN	OPEN	OPEN	OPEN

LEGEND		
SYMBOL	PART NO.	DESCRIPTION
A1	D13216E4611	FILTER, ASSEMBLY
B1	D13217E6806-2	COMPRESSOR
B2	D13214E3977-1	CONDENSER MOTOR
B3	D13214E3976-1	EVAPORATOR MOTOR
CX	D13217EXX03-1	CIRCUT BREAKER
F1,	2 MIL-F-15160	FUSE (XXXX250V16 10A)
F3	B13211E3765	FUSE
HR1-6	D13214E4XX1	HEATING ELEMENT
HR7	WITH COMPRESSOR	HEATING ELEMENT
J1	MS 3100R-32-17P	CONNECTOR, RECEPTACLE
J2	MS 3102R-16-10P	CONNECTOR, RECEPTACLE
J3	MS 3100R-18-11S	CONNECTOR, RECEPTACLE
J4	MS 3102R-20-19S	CONNECTOR, RECEPTACLE
J5	MS 3102R-12S-3P	CONNECTOR, RECEPTACLE
J6	MS 3102R-12S-3P	CONNECTOR, RECEPTACLE
J7	MS 3100R-20-15SZ	CONNECTOR, RECEPTACLE
J8	C13211EXXXXC28-4P	CONNECTOR, RECEPTACLE
J9	MS 3100R-16-10S	CONNECTOR, RECEPTACLE
J10	MS 3102R-32-6S	CONNECTOR, RECEPTACLE
J11	MS 3102R-24-11P	CONNECTOR, RECEPTACLE
J12	MS 3100R-20-15SW	CONNECTOR, RECEPTACLE
J13	MS 3102R-32-17PX	CONNECTOR, RECEPTACLE
J14	MS 3102R-20-15S	CONNECTOR, RECEPTACLE
J15	MS 3102R-14S-7P	CONNECTOR, RECEPTACLE
J16	MS 3102R-12S-3PY	CONNECTOR, RECEPTACLE
K1,2	MS 24192-D1	RELAY, HEATER
K3,4	C13214EXX71	VALVE, SOLENOID
K6	C132116E6182-1	RELAY, TIME DELAY
K7	MS 24193-D1	RELAY, CONDENSER
K8	MS 24192-D1	RELAY, EVAPORATOR
K9	MS 24193-D1	RELAY, COMPRESSOR
P1	MS 3106R-32-17S	CONNECTOR, PLUG
P2	MS 3106R-16-10S	CONNECTOR, PLUG
P3	MS 3106R-18-11P	CONNECTOR, PLUG
P4	MS 3106R-20-19P	CONNECTOR, PLUG
P5	MS 3106R-12S-3S	CONNECTOR, PLUG
P6	MS 3106R-12S-3S	CONNECTOR, PLUG
P7	MS 3106R-20-1SPZ	CONNECTOR, PLUG
P8	MS 3100R-28-4S	CONNECTOR, RECEPTACLE
P9	MS 3106R-16-10P	CONNECTOR, PLUG
P10	MS 3106R-32-6P	CONNECTOR, PLUG
P11	MS 3106R-24-11S	CONNECTOR, PLUG
P12	MS 3106R-20-15WP	CONNECTOR, PLUG
P13	MS 3106R-32-17SX	CONNECTOR, PLUG
P14	MS 3106R-20-15P	CONNECTOR, PLUG
P15	MS 3106R-14S-7S	CONNECTOR, PLUG
P16	MS 3106R-12S-3SY	CONNECTOR, PLUG
S	C13211E8298	SWITCH, ROTARY
S1	C13211E8301-1	THERMOSTAT
S3	C13214E4036	SWITCH, THERMOSTATIC
S4	WITH COMPRESSOR	THERMOSTAT
S5	C13211E8404	SWITCH, HIGH PRESSURE CUTOUT
S6	C13214E4309	SWITCH, LOW PRESSURE CUTOUT
S8	WITH COMPRESSOR	THERMOSTAT (WHEN REQUIRED)
T	D13214E3818-5	TRANSFORMER
TB1	C13214E4013	TERMINAL BOARD
TB2	MIL-T-55164/3	TERMINAL BOARD (TYPE 39TB10)
XF1	B13211E3784	FUSEHOLDER
XF2	B13214E3811	FUSEHOLDER
J1T	C13211E8399C32-17S	CONNECTOR, RECEPTACLE
J18	MS 3100F32-17P	CONNECTOR, RECEPTACLE
J19	C13211E8399C20-4P	CONNECTOR, RECEPTACLE
J20	MS 3100R18-1S	CONNECTOR, RECEPTACLE

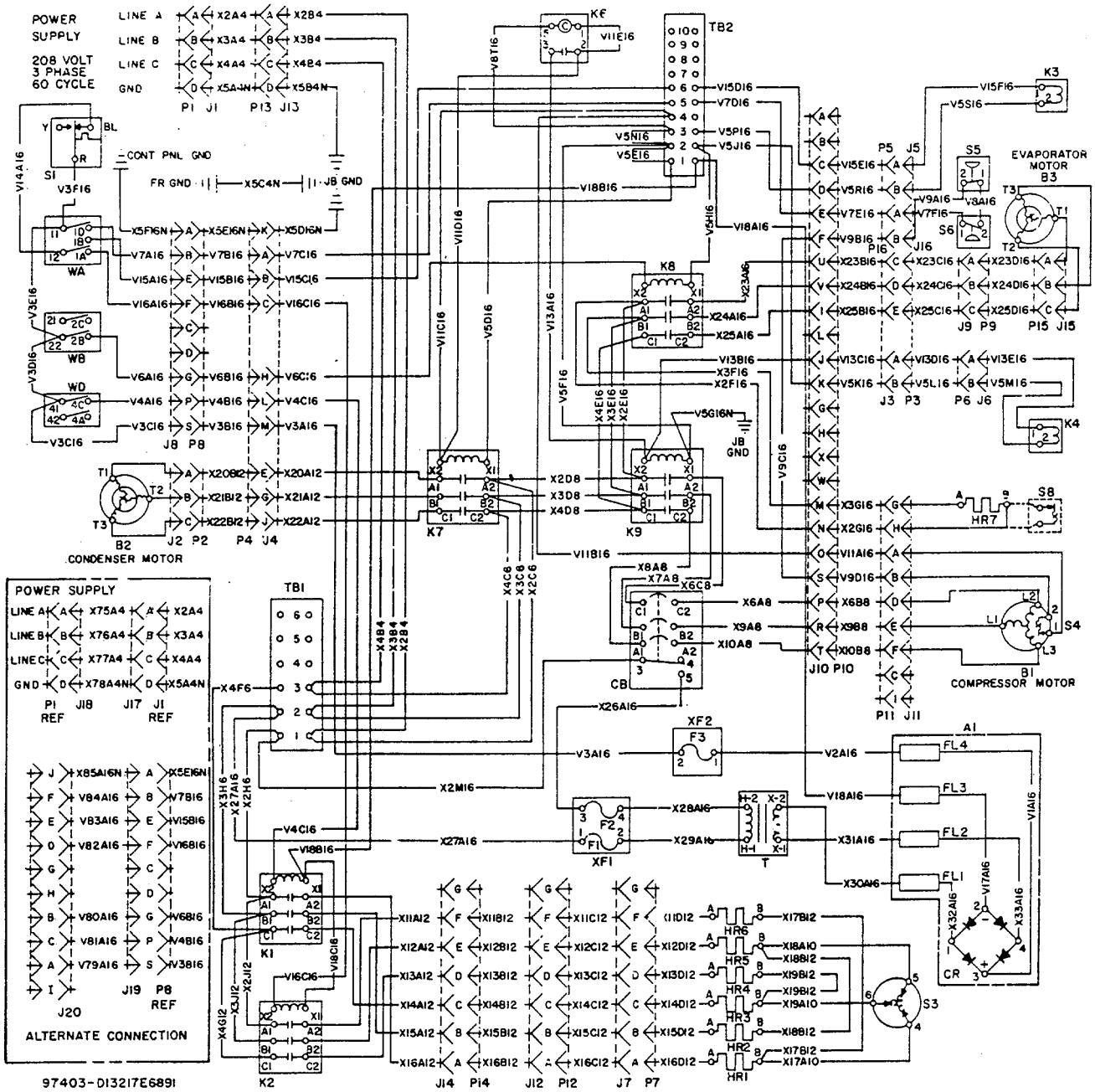


Figure 4-16. Wiring Diagram.

Table 4-4. Wire List

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X2A4	MS3100R-32-17P	J1 -A	MS3106R-32-17SX	P13-A	35.00-4
X3A4	MS3100OR-32-17P	J1 -B	MS3106R-32-17SX	P13-B	35.00-4
X4A4	MS3100OR-32-17P	J1 C	MS3106R-32-17SX	P13-C	35.00-4
X5A4N	MS3100R-32-17P	J1 -D	MS3106R-32-17SX	P13-D	35.00-4
X2B4	MS3102R-32-17PX	J13-A	MS25036-123	TBI-1	8.00-4
X3B4	MS3102R-32-17PX	J13-B	MS25036-123	TB1 -2	8.00-4
X4B4	MS3102R-32-17PX	J1 3-C	MS25036-123	TB1 -3	8.00-4
X5B4N	MS3102R-32-17PX	J13-D	MS25036-123	J8-GND	8.00-4
X5F16N	13211E8399C28-4P	J8-A	MS25036-103	GND	10.00-16
V7A16	13211E8399C28-4P	J8-B	13211E8288	S/WA-1D	9.50-16
V15A16	13211E8399C28-4P	J8-E	13211E8288	S/WA-1B	9.50-16
V16A16	13211E8399C28-4P	J8-F	13211 E8288	S/WA-1A	9.50-16
V6A16	13211E8399C28-4P	J86	B211 E8288	S/WB-2B	9.50-16
V4A16	13211 E8399C28-4P	J8-P	13211 E8288	S/WD-4C	9.50-16
V3C16	13211E8399C28-4P	J8-S	13211 E8288	S/WD-41	9.50-16
V3D16	Install in same terminal with V3C16.		S/WB-22	4.00-16	
V3E16	Install in same terminal with V3D16.		S/WA-11	3.00-16	
V3F16	Install in same terminal with V3E16. other end in MS25036-153.		S1-R	6.50-16	
V7B16	MS3106R-28-19P	P4-A	MS31 O00R-28-4S	P8-B	16.00-16
V15B16	MS3106R-28-19P	P4-B	MS31 O00R-28-4S	P8-E	16.00-16
V16B16	MS3106R-28-19P	P4-C	MS31OOR-28-4S	P8-F	16.00-16
X20B12	MS3106R-28-19P	P4-E	MS3106R16-10S	P2-A	15.00-12
X21B12	MS3106R-28-19P	P4-G	MS3106R16-10S	P2-B	15.00-12
V6B16	MS3106R-28-19P	P4-H	MS3100R-28-4S	P8-G	16.00-16

Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X22B12	MS3106R-28-19P	P4-J	MS3106R16-10S	P2-C	15.00-12
X5E16N	MS3106R-28-19P	P4-K	MS31 00R-28-4S	P8-A	16.00-16
V4B16	MS3106R-28-19P	P4-L	MS31 O0R-28-4S	P8-P	16.00-16
V3B16	MS3106R-28-19P	P4-M	MS31 O00R-28-4S	P8-S	16.00-16
V7C16	MS3102R-28-19S	J4-A	MS25036-153	TB2-5	14.25-16
V15C1 6	MS3102R-28-19S	J4-B	MS25036-153	TB2-6	13.25-16
V16C16	MS3102R-28-19S	J4-C	MS25036-153	K2-X2	22.00-16
X20A12	MS3102R-28-19S	J4-E	MS25036-112	K7-A1	13.25-12
X21A12	MS3102R-28-19S	J4-G	MS25036-112	K7-B1	13.75-12
V6C16	MS3102R-28-19S	J4-H	MS25036-153	K8-X2	17.25-16
X22A12	MS3102R-28-19S	J4-J	MS25036-112	K7-C1	14.25-12
X5D16N	MS3102R-28-19S	J4-K	MS25036-153	J8-GND	10.75-16
V4C16	MS3102R-28-19S	J4-L	MS25036-153	K1-X2	19.50-16
V3A16	MS3102R-28-19S	J4-M	MS25036-153	XF2-2	14.50-16
V15E16	MS3106R-32-6P	P10-C	MS3106R-12S-3S	P5-A	19.00-16
V5R16	MS3106R-32-6P	P1 O-D	MS3106R-12S-3S	P5-B	19.00-16
V7E16	MS3106R-32-6P	P1 0-E	MS3106R-12S-3SY	P16-S	26.00-16
V9B1 6	MS3106R-32-6P	P10-F	MS3106R-12S-3SY	P16-B	26.00-16
X25B16	MS3106R-32-6P	P10-1	MS31OOR-18-11S	J3-E	47.00-16
X13C16	MS3106R-32-6P	P10-J	MS3100R-18-11S	J3-A	47.00-16
V5K16	MS3106R-32-6P	P1 0-K	MS31OOR-18-11S	J3-B	47.00-16
X3G16	MS3106R-32-6P	P10-M	MS3106R-24-11S	P11-G	23.00-16
X2G16	MS3106R-32-6P	P10-N	MS3106R-24-11S	P11-H	23.00-16
V11A16	MS3106R-32-6P	P10-O	MS3106R-24-11S	P11-A	23.00-16

Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X6B8	MS3106R-32-6P	P10-P	MS3106R-24-11S	P11-D	23.00-8
X9B8	MS3106R-32-6P	P10-R	MS3106R-24-11S	P11-E	23.00-8
V9D16	MS3106R-32-6P	P10-S	MS3106R-24-11S	P11-B	23.00-16
X10B8	MS3106R-32-6P	P10-T	MS3106R-24-11S	P11-F	23.00-8
X23B16	MS3106R-32-6P	P10-U	MS3106R-24-11S	J3-C	47.00-16
X24B16	MS3106R-32-6P	P10-V	MS3100OR-18-11S	J3-D	47.00-16
V13D16	MS3106R-18-11P	P3-A	MS3106R-12S-3S	P6-A	7.50-16
V5L1 6	MS3106R-1 8-11P	P3-B	MS3106R-1 2S-3S	P6-B	7.50-16
X23C16	MS3106R- 18-11P	P3-C	MS3106R-16-10S	J9-A	765.00-16
X24C1l 6	MS3106R-18-11P	P3-D	MS3106R-16-10S	J9-B	65.00-16
X25C16	MS3106R-18-11P	P3-E	MS3106R-16-10S	J9-C	65.00-16
X16A12	MS3102R-20-15S	J1 4-A	MS25036-112	K1-A2	28.50-12
X15A12	MS3102R-20-15S	J14-B	MS25036-112	K1-B2	28.00-12
X14A12	MS3102R-20-15S	J14-C	MS25036-112	K1-C2	28.00-12
X13A12	MS3102R-20-15S	J1 4-D	MS25036-112	K2-C2	14.50-12
X12A12	MS3102R-20-15S	J1 4-E	MS25036-112	K2-B2	14.00-12
X11A12	MS3102R-20-15S	J1 4-F	MS25036-112	K2-A2	13.50-12
X16D12	MS3106R-20-15PZ	P7-A	MS25036-112	HR1-A	38.00-12
X15D12	MS3106R-20-15PZ	P7-B	MS25036-112	HR2-A	31.50-12
X14D12	MS3106R-20-15PZ	P7-C	MS25036-112	HR3-A	26.50-12
X13D12	MS3106R-20-15PZ	P7-D	MS25036-112	HR4-A	15.50-12
X1 2D12	MS3106R-20-15PZ	P7-E	MS25036-112	HR5-A	8.50-12
X11D12	MS3106R-20-15PZ	P7-F	MS25036-112	HR6-A	9.50-12
X1 6C12	MS3106R-20-15PW	P12-A	MS31 00R-20-15SZ	J7-A	51.00-12

Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X15C12	MS3106R-20-15PW	P12-B	MS3100R-20-15SZ	J7-B	51.00-12
X1 4C12	MS3106R-20-15PW	P12-C	MS3100R-20-15SZ	J7-C	51.00-12
X13C12	MS3106R-20-15PW	P12-D	MS31 00R-20-15SZ	J7-D	51.00-12
X1 2C12	MS3106R-20-15PW	P1 2-E	MS31 00R-20-15SZ	J7-E	51.00-12
Xl1C12	MS3106R-29-15PW	P12-F	MS31 00R-20-15SZ	J7-F	51.00-12
X1 6B12	MS3106R-20-15P	P1 4-A	MS31 00R-20-15SW	J12-A	56.00-12
X15B12	MS3106R-20-15P	P14-B	MS3100R-20-15SW	J12-B	56.00-12
X14B12	MS3106R-20-155P	P14-C	MS31 00R-20-15SW	J12-C	56.00-12
X13B12	MS3106R-20-15P	P14-D	MS3100R-20-15SW	J12-D	56.00-12
X12B12	MS3106R-20-15P	P14-E	MS3100R-20-15SW	J12-E	56.00-12
X11B12	MS3106R-20-15P	P14-F	MS3100R-20-15SW	J12-F	56.00-12
X4G12	MS25036-102	K1 -C1	MS25036-102	K2-Cl	7.00-12
X3J12	MS25036-102	K1-B1	MS25036-102	K2-B1	8.00-12
X2J12	MS25036-102	K1 -Al	MS25036-102	K2-A1	9.00-12
X2C6	MS25036-120	TB1-1	MS25036-119	K7-A2	16.25-6
X3C6	MS25036-120	TB1 -2	MS25036-199	X7-B2	15.75-6
X4C6	MS25036-120	TB1-3	MS25036-119	K7-C2	13.25-6
X2H6	MS25036-120	TB1 -1	MS25036-119	K1 -Al	16.25-6
X3H6	MS25036-120	TB1-2	MS25036-119	K1-B1	15.75-6
X4F6	MS25036-120	TB1 -3	MS25036-119	K1 -C1	13.25-6
X23D16	MS3106R-16-10P	P9-A	MS3106R-1 4S-7S	P15-A	12.00-16
X24D16	MS3106R-16-10P	P9-B	MS3106R-14S-7S	P15-B	12.00-16
X25D16	MS3106R-16-10P	P9-C	MS3106R-14S-7S	P15-C	12.00-16
X26A16	Bare	CB-5	MS25036-153	XF1 -3	14.50-16

Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X28A16	MS25036-105	T-H-2	MS25036-153	XF1-4	15.00-16
X28A16	MS25036-105	T-H-1	MS25036-153	XF1 -2	15.50-16
V5G16N	MS25036-153	JB-GND	MS25036-153	K9-X1	12.00-16
X2M16	MS25036-154	TB1-1	Bare	CB-3	11.00-16
X27A16	MS25036-154	TB1 -2	MS25036-153	XF1-1	20.00-16
X19A10	13214E4036	S3-6	MS25036-112	HR3-B	10.00-10
X17A10	13214E4036	S3-4	MS25036-112	HR1-B	12.00-10
X18A10	13214E4036	S3-5	MS25036-112	HR5-B	13.00-10
X30A16	MS25036-153	T-X-2	13216E4517	FL1	23.00-16
X32A16	13216E4517	FL1	13211 E8288	CR-1	5.50-16
X31 A16	MS25036-153	T-X-1	13216E4517	FL2	23.00-16
X33A16	13216E4517	FL2	13211E8288	CR-4	5.50-16
V18A16	MS25036-153	TB2-1	13216E4517	FL3	17.50-16
V17A16	13216E4517	FL3	13211 E8288	CR-2	5.50-16
V2A16	MS25036-153	XF2-1	13216E4517	FL4	17.50-16
V1A16	13216E4517	FL4	13211E8288	CR-3	5.50-16
V7F16	MS3102R-12S-3PY	J16-A	MS25036-153	S6-1	4.50-16
V9A16	MS3102R-12S-3PY	J1 6-B	MS25036-153	S5-4	4.50-16
V15D16	MS3102R-32-6S	J10-C	MS25036-153	TB2-6	11.00-16
V5P16	MS3102R-32-6S	J10-D	MS25036-153	TB2-3	13.00-16
V7D16	MS3102R-32-6S	J10-E	MS25036-153	TB2-5	11.50-16
V9C16	MS3102R-32-6S	J10-F	MS3102R-32-6S	J10-S	21.00-16
V13B16	MS3102R-32-6S	J10-J	MS25036-153	K9-X2	20.50-16
V5J16	MS3102R-32-6S	J10-K	MS25036-153	TB2-2	13.50-16

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Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
X23A16	MS3102R-32-6S	J10-U	MS25036-108	K8-A2	17.00-16
X24A16	MS3102R-32-6S	J10-V	MS25036-108	K8-B2	16.00-16
X25A16	MS3102R-32-6S	J10-1	MS25036-108	K8-C2	16.00-16
X3F16	MS3102R-32-6S	J10-M	MS25036-108	K8-B1	15.50-16
V11B16	MS3102R-32-6S	J1 0-	MS25036-153	TB2-4	12.00-16
X6A8	MS3102R3-32-6S	J10-P	MS25036-115	CB-C2	14.50-8
X9A8	MS3102R-32-6S	J10-R	MS25036-115	CB-B2	7.00-8
X10A8	MS3102R-32-68	J10-T	MS25036-115	CB-A2	4.00-8
V5H16	MS25036-153	TB2-2	MS25036-153	K8-X1	10.50-16
X4D8	MS25036-115	K7-G2	MS25036-115	K9-C1	6.25-8
X7A8	MS25036-115	K9-B2	MS25036-115	CB-B1	20.25-8
X8A8	MS25036-115	K9-G2	MS25036-115	CB-A1	20.50-8
V5D16	MS25036-153	K7-X1	MS25036-153	TB2-1	6.50-16
X2E16	MS25036-108	K9-A1	MS25036-108	K8-A1	20.25-16
X2D8	MS25036-115	K7-A2	MS25036-115	K9-A1	6.25-8
X3E16	MS25036-108	K9-B1	MS25036-108	K8-B1	19.50-16
X3D8	MS26036-115	K7-B2	MS25036-115	K9-B1	6.50-8
X4E16	MS2603B-108	K9-C1	MS25036-108	K8-C1	19.00-16
X6C8	MS25036-115	K9-A2	MS25036-115	CB-C1	18.25-8
X75A4	13211 E8399C32-17S	J1 7-A	Bare	J18-A	90.50-4
X76A4	13211E8399C32-17S	J17-B	Bare	J18-B	90.50-4
X77A4	13211E8399C32-17S	J17-C	Bare	J18-C	90.50-4
X78A4N	13211E8399C32-17S	J17-D	Bare	J18-D	90.50-4
X85A16N	13211E8399C28-4P	J19-A	Bare	J20-J	90.50-16

Table 4-4. Wire List (Cont.)

Wire	From Terminal Type	From Term No.	To Terminal Type	To Term No.	Wire Size & Length
V84A16	13211 E8399C28-4P	J19-B	Bare	J20-F	90.50-16
V83A16	13211 E8399C28-4P	J19-E	Bare	J20-E	90.50-16
V82A16	13211E8399C28-4P	J19-F	Bare	J20-D	90.50-16
V80A16	13211E8399C28-4P	J1 9-G	Bare	J20-B	90.50-16
V81A-16	13211 E8399C28-4P	J1 9-P	Bare	J20-C	90.50-16
V79A16	13211E8399C28-4P	J19-S	Bare	J20-A	90.50-16
V11D16	13216E6182-1	K6-2	MS25036-153	K7-X2	9.00-16
V13A16	13216E6182-1	K6-3	MS25036-153	K9-X2	7.50-16
V8T16	13216E6182-1	K6-5	MS25036-153	TB2-3	11.00-16
V11E16	13216E6182-1	K6-1	13216E6182-1	K6-2	2.00-16
X5C8N	MS25036-116	FR-GND	MS25036-116	JB-GND	36.00-8
V11G16	MS25036-153	K7-X2	MS25036-153	TB2-4	3.50-16
V5H16	MS25036-153	TB2-2	MS25036-153	TB2-1	3.00-16
V5M16	MS25036-153	TB2-2	MS25036-153	TB2-3	3.00-16
X4G14	MS25036-154	TB1 -3	MS25036-154	TB1 -6	4.50-14
X3J14	MS25036-154	TB1-2	MS25036-154	TB1-5	4.50-14
X2J14	MS25036-154	TB1 -1	MS25036-154	TB1 -4	4.50-14
X19B14	MS25036-108	HR3-B	MS25036-108	HR4-B	6.00-15
X18B14	MS25036-108	HR2-B	MS25036-108	HR5-B	16.00-14
X17B14	MS25036-108	HR1-B	MS25036-108	HR6-B	24.50-14
V8A16	MS25036-153	S5-1	MS25036-153	S6-2	4.00-16
X19B12	MS25036-112	HR3-B	MS25036-112	HR4-B	6.25-12
V14A16	13211 E8288	S/W1 -2	MS25036-153	S1 -BL	6.00-16
X18B12	MS25036-112	HR2-B	MS25036-112	HR5-B	16.00-12

Table 4-4. Wire List (Cont.)

	From		To		Wire Size
Wire	Terminal Type	Term No.	Terminal Type	Term No.	& Length
V11C16	MS25036-153	K7-X2	MS25036-153	TB2-4	3.50-16
V5E16	MS25036-1 53	TB2-1	MS25036-1 53	TB2-2	2.00-16
V5F16	MS25036-153	TB2-2	MS25036-153	K9-X1	7.00-13
V18C16	MS25036-153	K2-X1	MS25036-153	K1 -X1	4.50-16
V18B16	MS25036-153	K1 -X1	MS25036-153	TB2-1	4.00-16
X17B12	MS25036-112	HR1 -B	MS25036-112	HR6-B	28.00-12
V5N16	MS25036-153	TB2-3	MS25036-153	TB2-2	2.00-16
X5C4N	MS25036-123	FR-GND	MS25036-123	JB-GND	36.00-4

CHAPTER 5
DIRECT SUPPORT
MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. Repair Parts.

Repair parts are listed and illustrated in TM 9-4120-357-24P.

5-2. Special Tools and Equipment.

No special tools or equipment as required for maintenance of the air conditioner.

Section II. TROUBLESHOOTING

5-3. General.

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the refrigeration system of 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 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. The table lists the common malfunctions which you may find during the operation or maintenance of the refrigeration system of the air conditioner or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

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

TABLE 5-1. TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this Warning can result in hearing loss or injury. Disconnect power from the air conditioner before performing maintenance on the electrical system. The voltage used can be lethal. Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can occur from sudden freezing.

1. COMPRESSOR WILL NOT START.

Step 1. Check continuity of circuit breaker. Unscrew four panel fastener screws, and remove front 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. 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 4. Disconnect leads of rectifier-filter. Apply 28-30 volts ac to leads 1-4, and check leads 2-3 for 24-28 volt dc output.

Replace bad rectifier-filter.

Step 5. Disconnect compressor relay, K9. Apply 24-28 volts dc to terminals A1-A2, B1-B2, C1-C2. All should indicate continuity.

Replace faulty compressor relay, K9.

TABLE 5-1. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 6. Disconnect time delay relay, K6. Apply 24-26 volts dc to terminals 1-5, and check to see that continuity exists in terminals 2-3 within 19 to 31 seconds.

Replace defective time delay relay, K6.

Step 7. Disconnect plug, P11, from compressor receptacle. Using an ohmmeter on continuity tester, test receptacle points D-E, D-F and E-F. Continuity should be indicated. Test points D, E and F to compressor casing or common ground. No continuity should be indicated. Replace compressor that does not meet continuity requirements.

2. COMPRESSOR STARTS BUT STOPS AT ONCE - "SHORT CYCLES".

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 follows:

If pressures are too low, check 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 cutoff 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 to 6 hours to prevent oil being blown out of system, then replace faulty pressure cutout switch and recharge system.

NOTE

Use the Pressure-Temperature Relationship Table that follows.

TABLE 5-1. TROUBLESHOOTING (Cont)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

PRESSURE-TEMPERATURE RELATIONSHIP TABLE

AMBIENT-DEGREE F	50°	76°	100°	125°
AMBIENT-DEGREE C	10°	21°	38°	52°
90°F (320C) DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	75-90
(kg/cm2)	4.08-4.57	4.08-4.92	4.22-5.27	5.27-6.33
Discharge line (psig)	120-160	175-210	255-295	370-410
(kg/cm2)	8.43-11.25	12.3-14.76	17.92-20.74	26.01-28.82
80°F (26.7°C) DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	65-75
(kg/cm2)	4.08-4.57	4.08-4.92	4.22-5.27	4.57-5.27
Discharge line (psig)	120-155	170-205	250-290	370-410
(kg/cm2)	8.43-10.9	11.95-14.41	17.58-20.39	26.01-28.82

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

TABLE 5-1. TROUBLESHOOTING (Cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. INSUFFICIENT COOLING.

Step 1. Check sight glass liquid indicator for bubbles. If bubbles exist check system for leaks.

Repair leaks, and recharge system.

Step 2. 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 3. Check inlet and discharge side of solenoid valves for temperature difference. Abnormally cold discharge indicates a leakage or obstruction.

Repair or replace solenoid valve.

Step 4. Check evaporator coil for over-all temperature. If part of coil is relatively warm, and evaporator refrigerant inlet is sweaty of frosty, expansion valve may be damaged or obstructed.

Discharge system over a period of 5-6 hours to prevent oil being blown out of the system, then replace expansion valve.

4. 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.

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.

TABLE 5-1. TROUBLESHOOTING (Cont)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

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

Replace compressor and recharge system.

5. COMPRESSOR EXCESSIVELY NOISY.

Step 1. Listen for knocking or hammering sounds. Install gauge set, and check for high discharge pressure indicating that liquid refrigerant is returning to compressor.

Shut down at once. Replace faulty expansion valve.

Step 2. Install gauge set and check for high discharge pressure, indicating overcharge of refrigerant or presence of air or other non-condensible gas in system.

Bleed refrigerant gas from system over a period of 5-6 hours to prevent blowing oil out of system. Purge system with dry nitrogen, replace drier-strainer, evacuate and recharge.

6. SUCTION PRESSURE TOO LOW OR TOO HIGH

Step 1. Stop compressor and check thermostatic expansion valve as follows:
a. Remove insulating compound from remote bulb, and remove bulb from refrigerant line.
b. Place bulb in ice water for 1-2 minutes.
c. Start compressor.

CAUTION

Do not let liquid flood back into compressor for more than 2-3 seconds or the compressor will be seriously damaged.

d. Remove bulb from ice water and hold it on one hand to warm it. At the same time, start the compressor and feel the suction line for a rapid change of temperature, which indicates flood-through of liquid refrigerant. If liquid floods through valve, it is operating satisfactorily. If not, valve or remote bulb is faulty.

Discharge refrigerant from system over a period of 5-6 hours to prevent blowing oil out of system. Replace faulty expansion valve and drier-strainer. Purge with dry nitrogen and recharge.

Step 2. Feel drier-strainer for temperature difference. Discharge end will feel cooler than input end if clogged, or discharge end may be sweaty or frosty.

Discharge refrigeration system over a period of 5-6 hours to prevent blowing oil out of system. Replace drier-strainer, purge with dry nitrogen, and recharge.

Section III. GENERAL REFRIGERATION SYSTEM MAINTENANCE

5-4. Refrigeration System.

Maintenance of the refrigeration system consists of replacement of components, cleaning the system, purging air and moisture from the system, and recharging tile system with refrigerant. Removal and installation of major components is covered in Section IV.

5-5. Testing for Leaks.

Whenever bubbles appear in the sight-glass liquid indicator after the air conditioner has been running for some time, or whenever a component of the refrigeration system has been replaced, the system must be tested for refrigerant leaks.

Three methods are available for detecting leaks; the electronic leak detector, the Halide torch, and the soap bubble method. The preferred method is to use an electronic leak detector, GE type H-10 or equivalent.

CAUTION

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

a. Electronic Leak Detector. Turn the electronic 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 deflection.

b. Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable, light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

c. 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 pint at which a leak is found.

5-6. Discharging the System.

NOTE

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

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

Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system. To do this, connect and operate a recovery/recycling unit in accordance with the manufacturer's instructions.

5-7. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the suction service valve.

Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 -1 M3) through the system. Purge for at least 30 minutes to expel all other gages, impurities and water vapor.

Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

5-8. Charging the System.

Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surface; lethal phosgene gas can be formed.

NOTE

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

a. Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

b. Open both service valves and the cylinder shutoff valve. Charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5KG/CM2). Close the suction service valve and the cylinder shutoff valve.

c. Transfer the charging line to a cylinder of dry nitrogen. Open cylinder shutoff valve and suction service valve. Let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2): Turn off suction and discharge service valves and cylinder shutoff valve. Disconnect charging line from suction service valve.

d. Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. Discharge the system by attaching a hose to the discharge valve gage port, and discharging the gas slowly to avoid blowing oil out of the system. If leaks are detected, repair and retest as directed above. If system is leak-tight proceed as follows:

e. Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500 microns. Close suction line service valve, and turn vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with Step F. If 500-Micron 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 problem.

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

(3) Internal leakage in vacuum pump. Test pump by installing gage directly on vacuum pump intake and continuing to pump. If pump still fails to reach 500 Microns, pump is faulty.

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

g. Reconnect vacuum pump to suction line service valve gage port, and start pump. Open suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close suction line service valve, and remove vacuum gage.

h. Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and turn cylinder shutoff valve on for a few seconds to purge line of air. Tighten service valve connection. Charge refrigeration system as directed in the following steps:

(1) Place the refrigerant cylinder on a scale of sufficient capacity, with the shutoff valve down, or suspend the cylinder from a spring scale or beam scale, with the valve end down.

NOTE

If cylinder is equipped with both liquid and vapor valves, connect line to liquid valve.

(2) Weigh the cylinder, and record the weight.

(3) Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

i. With power connected to the air conditioner, turn mode selector switch to cool, and turn temperature control thermostat to maximum decrease position. With compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(1) Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

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

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

(4) Disconnect refrigerant cylinder, and replace caps on both service valves.

5-9. 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 winding to overheat. 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 the system reduces the amount of cooling gas within the compressor, resulting in gradual overheating of the motor and failure of the winding.

c. High headpressure. 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, operating with the deflector door closed, 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.

5-10. 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.

5-11. Cleaning Out the Refrigeration System After Burnout.

WARNING

Avoid inhaling fumes and burns from any acid formed by burn out of oil and refrigerant. Wear gas mask if area is not thoroughly ventilated. Wear protective goggles or glasses to protect eyes. Wear rubber gloves to protect hands. Use care to avoid spilling compressor burn out sludge. If sludge is spilled, clean area thoroughly.

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, proceed as follows:

a. Remove the drier-strainer, and blow down each leg of the refrigeration system. To do this connect a cylinder or dry nitrogen to each drier-strainer connection, in turn, and open the cylinder shutoff valve for at least 30 seconds at 50 PSIG (3.5 KG/CM2) pressure.

b. Connect the two drier-strainer 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 5-1).

c. Disassemble both expansion valves (V4 and V5, Figure 5-1) and temporarily remove the valve cages. Reinstall 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 drier-strainer 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 (K4) for a total of approximately 10 minutes to 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 system for an additional 15 minutes.

f. Remove the pump, reservoir, filter and drier-strainer jumper. Place an empty container below the compressor connections, and connect a cylinder of dry nitrogen to each drier-strainer connection in turn. Blow down each leg of the system at 50 PSIG (3.5 KG/SM2) for at least 30 seconds.

g. Disassemble both expansion valves (V4 and V5, Figure 5-1) and re-install the valve cages. Install new gaskets, and assemble the valves, making sure the projections on valve cages fit in notches in valve bodies.

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

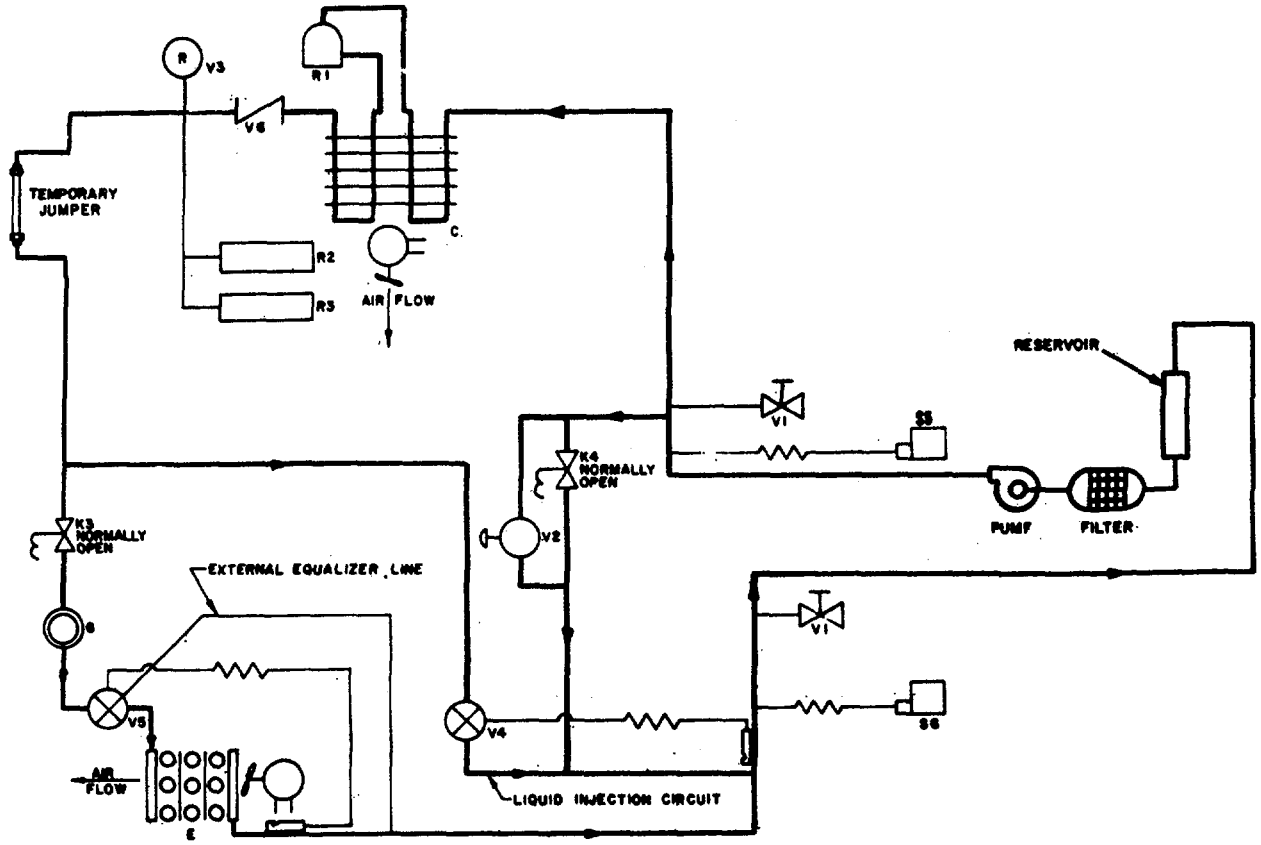


Figure 5-1. Typical Flushing Hook-up.

5-12. Brazing/Soldering Tubing Connections.

Most of the tubing connections to fittings and components are soldered or brazed to provide mechanical strength and to ensure complete freedom from leaks under pressure. To achieve trouble-free leak--tight tubing connections, the following practices are recommended.

a. Clean solder or filler material from tubing ends that have been debrazed, in the following manner:

(1) Wrap a piece of fiberglass cloth around the tubing below the end to be cleaned.

(2) Wearing welder's gloves, heat the tubing end evenly all around to the melting point of the filler material.

(3) Grasp the fiberglass cloth firmly in the gloved hand, and pull it over the tubing end with a twisting -motion.

b. Form wires, capillary tubes or other parts subject to heat damage away from the brazing area, or protect them with a sheet-metal shield.

c. To prevent melting connections adjacent to the one being crazed, use a hot enough flame to achieve the melting point quickly, and move the flame around all sides of the joint.

d. When brazing expansion valves or other components that can be warped or damaged by excessive heat, wrap all parts except the joint to be brazed in wet cloth.

e. Always provide a flow of dry nitrogen through the tubing and joint where brazing, to prevent internal oxidation and scaling.

WARNING

Never heat tubing or components in which there is refrigerant gas. The gas decomposes at high temperatures to form carbonyl chloride (phosgene) which is toxic and corrosive.

5-13. 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 pressure gages to the gage ports of the suction line and discharge line service valves, operating the refrigeration compressor, and determining that pressures are within normal ranges for the temperatures encountered. Proceed as follows:

a. Access to Service Valves. Unscrew four panel fastener screws which secure the front access panel to the lower part of the air conditioner. Remove the panel. The service valves are located as shown in Figure 1-2.

b. Installation of Instruments. Unscrew caps from gage ports of service valves, and connect a set of bourdon-type refrigeration pressure gages to the gage ports. Install the front access panel, and route the gage lines through the circuit breaker reset opening. Close the opening with the plastic sheet and tape to ensure normal air circulation through the condenser coil. Position an accurate thermometer in the return air intake to the evaporator fan section, and another in the air intake to the condenser for indicating the ambient temperature. The condenser thermometer should not be exposed to direct sunlight when the reading is made. If necessary, provide a space heater to obtain an adequate supply of warm return air to the unit.

c. Performing the Test.

(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 gages have been attached.

(3) Record the temperatures indicated by both thermometers, and the pressures indicated by both pressure gages. Compare the readings with the normal ranges indicated in the following table:

TABLE 5-2. NORMAL OPERATING PRESSURES

PRESSURE-TEMPERATURE RELATIONSHIP TABLE

AMBIENT-DEGREE F	50°	75°	100°	125°
AMBIENT-DEGREE C	10°	21°	38°	52°
90°F (32°C) DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	75-90
(kg/cm2)	4.08-4.57	4.08-4.92	4.22-5.27	5.27-6.33
Discharge line (psig)	120-160	175-210	255-295	370-410
(kg/cm2)	8.43-11.25	12.3-14.76	17.92-20.74	26.01-28.82
80°F (26.7°C) DRY-BULB RETURN AIR TO UNIT				
Suction line (psig)	58-65	58-70	60-75	65-75
(kg/cm2)	4.08-4.57	4.08-4.92	4.22-5.27	4.57-5.27
Discharge line (psig)	120-155	170-205	250-290	370-410
(kg/cm2)	8.43-10.9	11.95-14.41	17.58-20.39	26.01-28.82

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

d. Corrective Action.

(1) If pressures are too low, check for leaks, repair, recharge the system, and repeat the pressure test.

(2) If pressures are too high, close the suction line service valve. Remove the pressure gage and bleed off an appropriate amount of refrigerant. Repeat the pressure test.

e. Reassembly. Remove the pressure gages, and reassemble the air conditioner as follows:

(1) Close both service valves, and replace caps on gage ports.

(2) Remove thermometers from evaporator and condenser intake grilles.

(3) Replace front access panel on air conditioner by inserting lower edge of panel behind step in base plate. Press into position, and secure with four panel fastener screws.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND ASSEMBLIES.

5-14. General.

This section covers the removal and installation of all major components of the air conditioner which require opening the refrigeration system. The F60T-2 air conditioner's refrigeration system does not incorporate provisions for pumping down the refrigerant into a receiver for storage; therefore, the refrigerant must be discharged in accordance with paragraph 5-6 whenever the system is opened for replacement of components.

5-15. Replacement of the Compressor.

a. Access to Compressor. Dismantle the air conditioner to the extent necessary to obtain access to the compressor, in accordance with the following steps:

(1) Unscrew four panel fastener screws from the front access panel. Remove the panel.

(2) Disconnect all wiring harnesses from the junction box, control panel, compressor, and condenser fan motor.

(3) Remove the flexible cable from the circuit breaker actuator arm (15, Figure 4-3) as follows:

(a) Loosen the setscrew in the end of the cable core end fitting (14) and slide the end fitting off of the cable core. Withdraw the cable core from the actuator arm, and replace core end fitting for safekeeping.

(b) Remove two screws and washers from the cable clamp (16), and move the cable aside. Replace the clamp (16) two screws and washers on the junction box for safekeeping.

(4) Remove six screws (7) from side of casing, and remove two screws (8) and washers (9) from lower right mounting bracket on junction box. Remove the junction box and control panel assembly from the air conditioner, and tie the wiring harnesses out of the way.

(5) Cut insulating material away from compressor suction line and sensor bulb of expansion valve, V4. Remove clamp, and coil the capillary tube out of the way.

b. Removal of Compressor. Remove the compressor from the air conditioner as directed in the following procedure:

(1) Discharge refrigerant gas from the system in accordance with paragraph 5-6.

(2) After the refrigerant is completely discharged, connect a cylinder of dry nitrogen to the gauge port of the discharge service valve. Open the suction service valve completely to the backseat position, and open the discharge service valve and cylinder shutoff valve slightly to establish a flow of nitrogen through the system for 3-5 minutes.

(3) Debraze refrigerant connections to the compressor.

NOTE

Connections may be debrazed at any convenient point that will permit removal of the compressor. Tubing and fittings that remain attached to the compressor may be transferred to the new unit on the bench before it installed.

(4) Attach a hoist and sling to the lift eyes on each side of the air conditioner. Insert a spreader bar between the sides of the sling. To prevent damage to the casing, and lift the entire air conditioner high enough to permit timbers or blocks to be placed under the base, at least eight inches high. Keep bolt hole openings in the base plate free, and let the air conditioner down to rest on blocks. Keep tension on hoist to prevent the unit from tipping.

(5) Remove four shoulder bolts from the compressor mounting feet by inserting a socket wrench through holes in the base plate. Nuts are welded to the upper surfaces of the feet.

(6) Reposition the air conditioner on the floor, and slide a 2 x 4 about four feet long, or a similar board, under the compressor to act as a skid. Place another short length of 2 x 4 under the first, even with the front of the base plate.

(7***) With the help of an assistant, lever the compressor up and pull it out of the air conditioner.***

c. Installation of Compressor. Install compressor in air conditioner in accordance with the following steps:

(1) Attach tubing and fittings removed with the previous compressor, and braze joints as required.

(2) Place a steel washer (10, Figure 4-12) and rubber washer (11) on each of the four shoulder bolts (13).

(3) With the air conditioner hoisted onto blocks, insert the bolts, steel washers and rubber washers through the compressor mounting bolt holds from the bottom of the base panel. Install another rubber washer and spacer (12) on the bolt from above.

(4) With the air conditioner on the floor, place the compressor assembly on a 2 x 4 or similar skid, and work it into position in the casing with the mounting feet over the shoulder bolts and the proper tubing connections made.

(5) Hoist the air conditioner onto blocks, and install the shoulder bolts (13) into the mounting feet of the compressor.

(6) Connect a cylinder of dry nitrogen to the suction service valve, open both service valves and the cylinder shutoff valve to establish a 1-2 CFM (0.5 -1 M3). Braze tubing connections.

(7) Replace the drier-strainer (dehydrator) as follows:

(a) **Unscrew top and bottom flare nuts (9, Figure 5-2) from drier-strainer (8).**

(b) Remove screw, nut and washer from band clamp (10) which is secured to the casing, and remove and discard drier-strainer.

CAUTION

When installing a new drier-strainer, make sure that the direction-of-flow arrow is pointing down.

(c) Place band clamp (10) around new drier-strainer, and connect top and bottom flare nuts (9), finger tight.

(d) Secure band clamp to casing with a screw, washer and nut.

(c) Using two wrenches, one on drier-strainer connection and one on flare nut, tighten top and bottom flare nuts.

(8) Connect a cylinder of dry nitrogen to the gage port of the suction line service valve, open both service valves and the cylinder shutoff valve, and purge the refrigeration system for 3-5 minutes at (0.5 - 1 M3) CFM flow.

d. Test the system for leaks. Whenever a component of the refrigeration system has been replaced, the system must be tested for refrigerant leak Three methods are available for detecting leaks: the electronic leak detector, the Halide torch, and the soap bubble method. The electronic leak detector method is preferred. Use GE type H10 electronic leak detector or equivalent.

CAUTION

The electronic and the Halide torch leak detectors are 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 electronic 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) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(3) 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.

e. Discharge the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system. Discharge in accordance with paragraph 5-6.

f. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve.

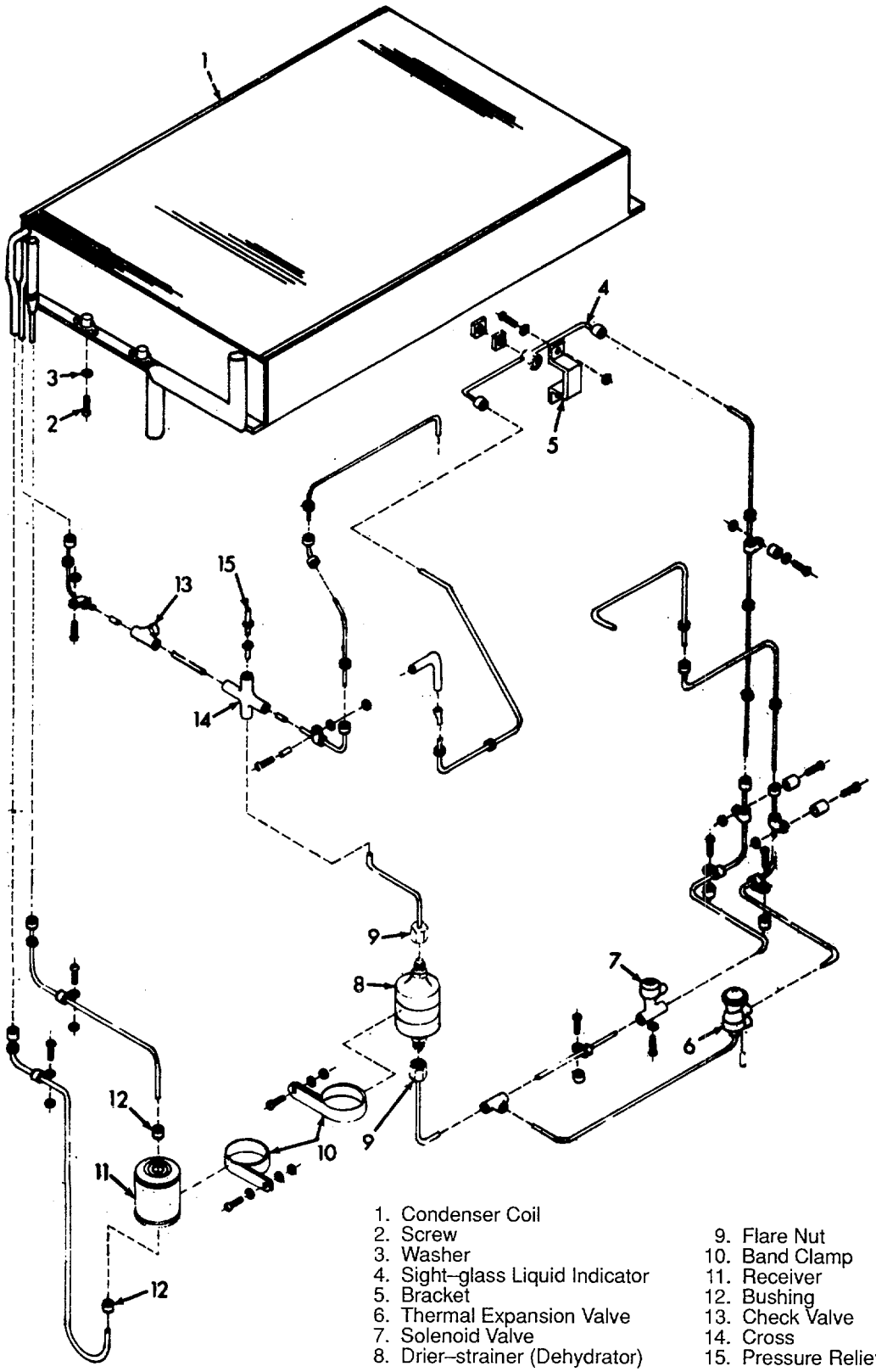


Figure 5-2. Condenser Section.

Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

g. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gauge on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2). Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen, open cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gauge reads 350 PSI (21.4 KG/CM2). Close the suction and discharge service valves and cylinder shutoff valve. Disconnect charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. Discharge the system by attaching a hose to the discharge valve gauge port, and discharging the gas slowly to avoid blowing oil out of the system. If leaks are detected repair and retest as directed above. If system is leak-tight proceed as follows:

(5) 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 than 500 microns. Close the suction line 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, continue with step (6). If 500-Micron 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:

(a) Presence of water vapor in the system. Continued pumping will correct this problem.

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

(c) Internal leakage of vacuum pump. Test the pump by connecting gage directly to the vacuum pump intake and continuing to pump. If the pump still fails to reach 500-Microns, the pump is faulty.

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

(7) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line valve, and remove the vacuum gage.

(8) 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. Tighten the service-valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

(b) Weigh the cylinder, and record the weight.

(c) Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

h. Reassembly. After charging the refrigeration system with a basic quantity of refrigerant as above, the air conditioner must be returned to operating condition for final checking. Proceed as follows:

(1) Position the junction box and control panel assembly in the air conditioner, and secure with six screws (7, Figure 4-3) through the left side of the casing, and two screws (8) and washer (9) through the lower right mounting bracket.

(2) Carefully lead thermostat sensing bulb and capillary tube around condenser coil to position in middle of evaporator intake chamber.

(3) Insert the core of the flexible cable assembly (17) through the hole in the top of the circuit breaker actuating arm (15). Install the core end fitting (14), and tighten setscrew.

(4) Connect all electrical harnesses to the junction box, control panel and compressor. Temporarily prop front access panel across opening.

i. Operating check.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(1) With power connected to the air conditioner, turn the mode selector switch to cool. Turn the temperature control thermostat to maximum decrease position. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(a) Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

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

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

(d) Disconnect the refrigerant cylinder, and replace caps on both service valves..

(2) Replace the front access panel on air conditioner, and secure with four panel fastener screws.

5-16. Replacement of Pressure Cutoff Switches.

a. Access to Switches. Dismantle the air conditioner to the extent necessary to remove the high and low pressure cutoff switches in accordance with the following procedures:

(1) Unscrew four panel fastener screws from the front access panel, and remove the panel.

(2) Connect a hose to the gage port of the suction service valve, and crack the valve open to discharge refrigerant gas over a period of 5-6 hours. Too rapid discharge will cause oil to be blown out of the system. Use a hose of sufficient length to conduct the refrigerant gas to a safe area.

WARNING

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

(3) Disconnect plug, P2, from the condenser fan motor, and disconnect plug (P16) from the top of the pressure cutout switch housing (7, Figure 5-3).

CAUTION

Do not disconnect capillary tubes or pressure tube connections until refrigerant is completely discharged from system.

(4) Unscrew flare nuts from the connections of both capillary tubes, and carefully coil capillary tubes up to the pressure cutout switch housing (7).

(5) Remove the four screws above and below the cutout switch reset buttons while an assistant holds the switch housing from inside the casing. Remove the housing, switches, and attached capillary tubes.

b. Removal. Remove four screws and lock washers from the bottom of the housing (7). Press out grommet (8) and carefully remove both pressure cutout switch assemblies. Pry off the metal retainer clip (3) from the top, remove the insulating cover (2) and unscrew electrical terminal screws to disconnect the wiring harness (6) and wire lead (5).

c. Testing.

CAUTION

Do not use compressed air for pressure testing refrigeration components. It contains traces of oil and moisture which can contaminate the refrigerant.

(1) Connect a cylinder of dry nitrogen and a 0-500 PSI. (0.35 KG/CM2) pressure gage to the high-pressure cutout switch capillary tubes.

(2) Connect an ohmmeter or continuity tester across the terminals of the high-pressure cutout switch.

(3) Slowly apply pressure to the tube connection. When pressure reaches 415 PSIG, (29.2 KG/CM2) press reset button. Continuity should be indicated.

(4) Continue applying pressure to the tube connection. Continuity should drop out at 460+ 10 PSIG (32.3 + KG/CM2). If continuity requirements are not met, replace the high-pressure cutout switch.

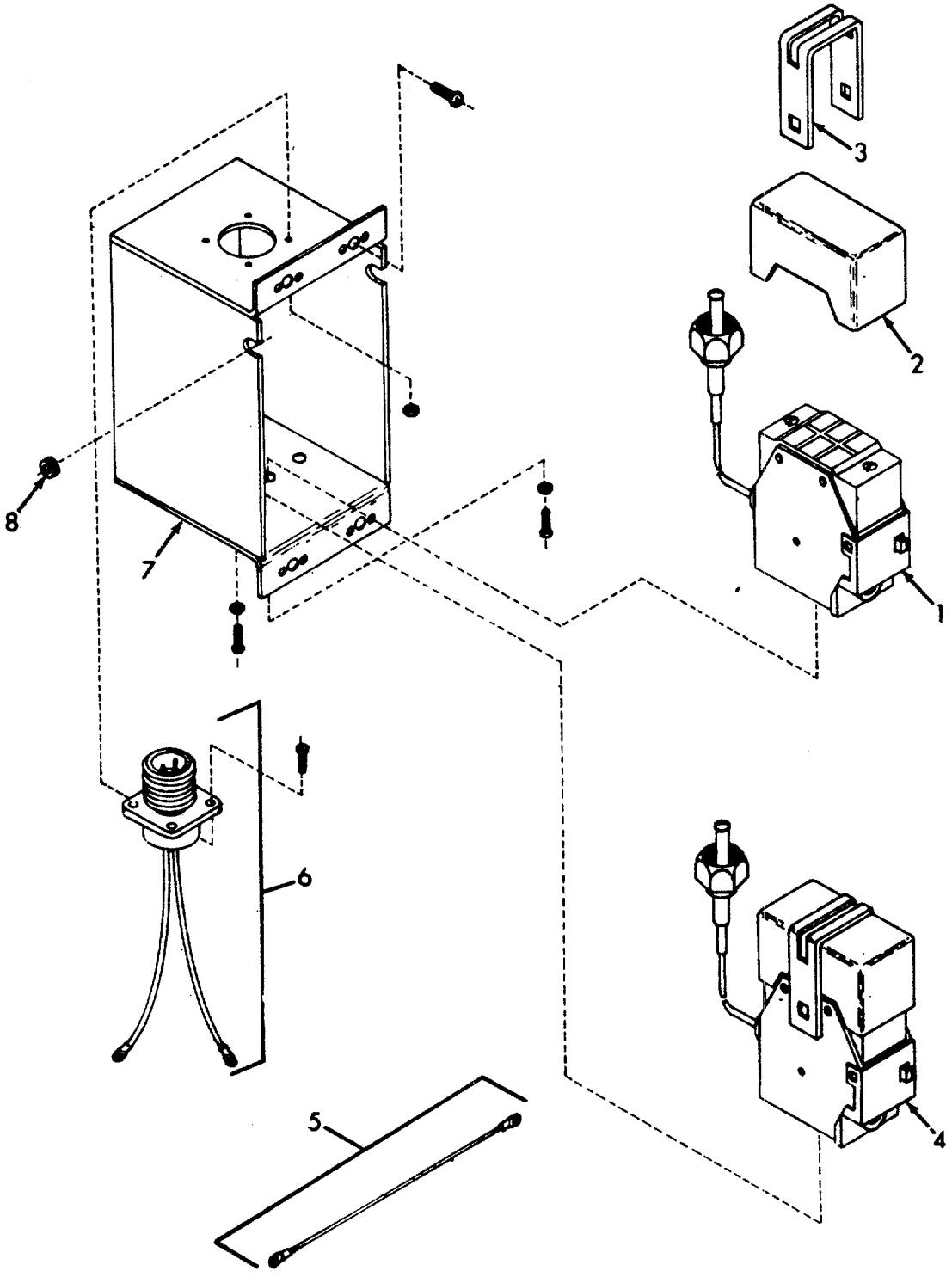
(5) Transfer the dry nitrogen and ohmmeter or continuity tester to the low-pressure cutout switch.

(6) Slowly apply pressure to the tube connection. When pressure reaches 20 + 5 PSIG (1.4 + 0.35 KG/CM2), press reset button. Continuity should be indicated.

(7) Reduce pressure slowly. Continuity should drop out at 7 + 5 PSIG (0.49 + 0.35 KG/CM2). If continuity requirements are not met, replace the low-pressure cutout switch.

d. Assembly. With the insulating covers removed from both pressure cutout switches assemble as follows:

(1) Facing the reset button sides of the pressure cutout switches, place the high-pressure switch (1, Figure 5-3) on the right-hand side of the low-pressure switch (4), and connect electrical lead (5, Figure 5-2) from terminal 1 of high-pressure cutout switch (1) to terminal 2 of switch (4).



1. High–pressure Cutout Switch, S5
2. Insulating Cap
3. Retaining Clip
4. Low–pressure Cutout Switch, S6
5. Wire lead
6. Wiring Harness
7. Housing
8. Grommet

Figure 5-3. Pressure Cutout Switches.

(2) Connect lead A of the wiring harness (6) to terminal 1 of low-pressure cutout switch (4), and lead B to terminal 2 of high-pressure cutout switch (1). Position insulating caps (2) on both switches, and secure with spring clips (3).

CAUTION

When handling capillary tubes, be extremely careful to avoid sharp bends or kinks.

(3) Place a split grommet (8) over each capillary tube, and install switches in housing (7). Press grooves of grommets into notches in walls of housing. Secure switches with four screws and washers.

e. Installation. Install the pressure cutout switch assembly in the air conditioner as directed in the following procedure:

(1) With the help of an assistant, position the switch assembly against the inside of the rear panel, and install four screws and washers.

(2) Connect plug, P16, to receptacle, J16, on top of pressure cutout switch housing.

(3) Carefully lead capillary tube connection of high-pressure cutout switch to the fitting on the compressor discharge line and the low-pressure capillary tube connection to the fitting on the compressor suction line.

(4) Tighten flare nuts, and coil the surplus capillary tubing out of the way. Tape tubing to adjacent refrigerant piping for support.

f. Testing for Leaks. Whenever a component of the refrigeration system has been replaced, you must test the system for refrigerant leaks. Three methods are available for detecting leaks; the electronic leak detector, the Halide torch, and the soap bubble method. The preferred method is the electronic leak detector. Use GE type H10 electronic leak detector or equivalent.

CAUTION

The electronic and Halide torch leak detectors are 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 electronic 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) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

***(3) 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.

g. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 -1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

h. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gauge to the high-pressure service valve gauge port, and a pressure hose and drier-strainer, loosely, to the suction service valve gauge port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve. Charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2). Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve. Let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.4 KG/CM2). Turn off the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. Discharge the system by attaching a hose to the discharge valve gage port, and discharging the gas slowly to avoid blowing oil out of the system. If leaks are detected, repair and retest as directed above. If system is leak-tight proceed as follows:

(5) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (6). If 500-Micron 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:

(a) Presence of water vapor in the system. Continued pumping will correct this problem.

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

(c) Internal leakage of vacuum pump. Test the pump by connecting gage directly to vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(7) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum gage.

(8) 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. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

(a) Place the refrigerant cylinder on a scale of sufficient capacity, with the shutoff valve down, or suspend the v cylinder from a spring scale or beam scale, with the valve end down.

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

(b) Weigh the cylinder, and record the weight.

(c) Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(9) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to maximum decrease position. Temporarily prop the front access panel across the opening. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

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

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

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

(d) Disconnect the refrigerant cylinder, and replace the caps on both service valves.

i. Final Assembly. After replacement of the high and low pressure switches is complete, and the refrigeration system is recharged, replace the front access panel as follows:

(1) Position the front access panel on the air conditioner with the lower edge behind the stop of the base plate, and push the panel into an upright position.

(2) Secure the panel with four panel fastener screws.

5-17. Solenoid Valves.

There are two solenoid valves, K3 and K4, in the refrigerant control system. (See Figure 1-5.) Both valves are normally open, and close only when energized by the control circuit. Valve K3 is located in the bottom of the air conditioner, between the compressor and the junction box. Valve K4 is located in the evaporator fan intake compartment beside the right-hand accumulator tank, R3. When malfunction of the valves is not due to failure of the electrical coil or internal operating parts, the faulty valve must be replaced. Replacement procedures are the same for each solenoid valve, except for access. Proceed as follows:

a. Access.

(1) Obtain access to the bypass solenoid valve by removing 12 screws and washers from each evaporator intake grille, and removing the grilles.

(2) Obtain access to the liquid line solenoid valve by unscrewing four panel fastener screws from the front access panel, and removing the panel.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

b. Removal. Before removing the solenoid valve(s), you must discharge all refrigerant in accordance with paragraph 5-6. After all refrigerant has been discharged from the system, connect a cylinder of dry nitrogen to the discharge line service valves, open the suction line service valve completely, and establish a flow of dry nitrogen through the system at 1-2 CFM (0.5 - 1 M3) for 3-5 minutes to purge all refrigerant, then disassemble the operating parts from the valve body and remove as follows: (See Figure 4-13.)

(1) Disconnect the wiring harness from the receptacle on the valve coil housing.

(2) Remove the nut and data plate from top of coil housing and lift off the housing and coil from other tube and plunger assembly.

(3) Remove the two body screws that secure the tube and plunger assembly to the body. Lift off the tube and plunger assembly, O-ring and diaphragm.

(4) With dry nitrogen flowing through the system, debraze the valve body from the piping on each side.

c. Installation. Install the solenoid valve as indicated in the following procedure:

CAUTION

Make certain that the direction-of-flow arrow on the valve body is pointing in the proper direction before brazing.

(1) With the replacement solenoid valve disassembled, install the valve body in position, start the flow of dry nitrogen through the system and braze connections.

(2) Place the diaphragm in the body, with the pilot port extension up. Install O-ring in recess in tube and plunger assembly, and lower the tube and plunger assembly onto the valve body. Secure with two body screws, and tighten uniformly.

(3) Install the coil and housing assembly over the enclosing tube, as shown in Figure 4-13. Place the data plate on top of the housing, and secure the assembly with the retaining nut.

(4) Connect electrical leads of coil to receptacle. Connect plug of wiring harness to the receptacle on solenoid valve.

d. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install drier-strainer (dehydrator) before purging and recharging the system.

When the refrigeration system has been discharged, attach a hose to the gage port of the suction service valve. Connect a cylinder of oil-pumped dry nitrogen to the gauge port of the high-pressure service valve. Open the high-pressure service valve. Crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.6 -1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

e. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder or refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gauge on the discharge (high-pressure) service valve registers 70 PSI (5 KG/SM2). Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen, open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2). Turn off the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using a electronic leak detector, Halide torch or soap bubble method. The electronic leak detector method is preferred. Use GE type H10 or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks were detected repair and retest as directed above. If system is leak-tight proceed as follows:

(a) Connect a vacuum pump to the suction service valve port and a vacuum to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close suction line service valve, and turn vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b). If 500-Micron 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 problem.

2. Leaks in the Refrigeration System. Break vacuum with dry nitrogen, and retest for leaks.

3. Internal Leakage of the Vacuum Pump. Test the pump by connecting gage directly to the vacuum pump intake and continuing to pump. If the pump still fails to reach 500-Microns the pump is faulty.

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

(c) Reconnect the vacuum pump to other suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and open the cylinder Bag shutoff valve for a few seconds to purge line of air. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn the mode selector switch to cool. Turn the temperature control thermostat to its maximum decrease position. Temporarily prop the front access panel across the opening. With compressor operating, observe the sight glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect the refrigerant cylinder. Replace the caps on both service valves.

f. Final Assembly. Replace the appropriate grilles and panels on the air conditioner as follows:

(1) Position the front access panel on the air conditioner by placing the lower edge behind the step of the base plate, and pushing the panel into contact with the casing. Secure with four panel fastener screws.

(2) Position two evaporator intake grilles on the front of the air conditioner, and secure with 12 screws and' washers in the frame of each grille.

5-18. Sight-Glass Liquid Indicator.

a. Access. Obtain access to the sight-glass liquid indicator by removing 31 screws and washers from the top panel and removing the panel. Unscrew four panel fastener screws from the front access panel, and remove the panel.

b. Discharge the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal. Remove the sight-glass liquid indicator from the air conditioner as directed in the following procedure:

(1) Connect a cylinder of dry nitrogen to the gage port of the discharge service valve. Open both service valves, and crack the nitrogen cylinder shutoff valve open to provide a 1-2 CFM (0.5 -1 M3) flow.

(2) Debraze connections to the sight-glass liquid indicator (4, Figure 5-2).

(3) Remove two screws, nuts and washers from the retaining bracket (5), and remove the bracket and sight-glass liquid indicator (4).

d. Installation. Install the sight-glass liquid indicator in accordance with the following steps:

(1) Position the indicator inside the air conditioner casing, and install the retaining bracket (5) with two screws, washers and nuts, finger-tight. Insert tubing ends into ends of sight-glass indicator tubes.

(2) Provide a flow of dry nitrogen through the system, and braze the joints.

(3) Tighten screws and nuts to secure retaining bracket.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5-1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge house.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve. Charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2). Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.4 KG/CM2). Close the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector method is preferred. Use a GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (8). If 500-Micron 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 problem.

2. Leaks in the Refrigeration System. Break vacuum with dry nitrogen, and retest for leaks.

3. Internal Leakage of Vacuum Pump . Test pump by connecting gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect vacuum pump to the suction line service valve gage port, and start pump. Open suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system, close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve. Open cylinder shutoff valve for a few seconds to purge line or air. Tighten service valve connection. Charge refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn mode selector switch to cool, and turn temperature control thermostat to maximum decrease position. With compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to the vapor valve.

2. With the air conditioner compressor operating, temporarily prop the front access panel across the opening. Open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect refrigerant cylinder, and replace caps on both service valves.

g. Final Assembly. Replace panels on the air conditioner as follows:

(1) Position the top panel on the air conditioner, and secure with 31 screws and washers.

(2) Position front access panel on unit by placing lower edge behind the step of the base plate. Push into contact with the casing, and secure with four panel fastener screws.

5-19. Drier-Strainer (Dehydrator).

a. Access. Obtain access to the drier-strainer in accordance with the following procedure:

(1) Unscrew four panel fastener screws from the front access panel. Remove the panel.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

(2) Disconnect wiring harness plugs from all receptacles on the junction box and control panel assembly.

(3) Disconnect the circuit breaker operating cable as follows:

(a) Loosen the setscrew in the end of the core end fitting (14, Figure 4-3) and slide the fitting off the cable core.

(b) Remove two screws and washers from the hold-down clamp (16). Remove the clamp.

(c) Lift the cable core out of hole in actuator arm (15) and tie or tape the flexible cable to one side, out of the way.

(4) Remove six screws (7) from the casing and mounting flange of the junction box, and remove two screws (8) and washers (9) from the mounting bracket.

(5) Detach thermostat sensing bulb from loop clamp in middle of evaporator intake chamber. Carefully coil capillary tube as you lead bulb toward control panel to avoid kinking tube.

(6) Remove the junction box and control panel assembly from the air conditioner.

b. Discharge the System. Whenever a leak is detected or a refrigerant component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal. After refrigerant has been completely discharged from the system, remove the drier-strainer as follows:

(1) Unscrew tubing flare nuts (9, Figure 5-2) from top and bottom of the drier-strainer (8).

(2) Remove a screw, nut and lock washer from the air conditioner casing and clamp (10), and remove the clamp and drier-strainer.

(3) Open clamp (10) slightly, and slide it off of drier strainer.

d. Installation. Install a new drier-strainer as directed in the following steps:

CAUTION

Leave caps on the threaded connections f the drier-strainer until ready to connect the tubing flare nuts. Make certain that the direction-of-flow arrow is pointing down before making tubing connections.

(1) Slide clamp (10, Figure 5-2) over drier-strainer, and secure to casing with a screw, washer and nut.

(2) Remove caps from the drier-strainer connections, and connect tubing flare nuts (9). Use a back-up wrench on the hex of the drier-strainer connections when tightening flare nuts.

e. Purging the System. With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both the service valve and the cylinder shutoff valves, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2). Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2). Turn off the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(**a)** Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (8) . If 500-Micron 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 problem.

2. Leaks in the Refrigeration System. Break vacuum with dry nitrogen, and retest for leaks.

3. Internal Leakage of Vacuum Pump. Test pump by connecting gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) 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. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and cap (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

(6) Install the junction box to permit an operational check of the air conditioner. Proceed with the following steps:

(a) Place the junction box and control panel assembly in position in the unit, and secure with six screws (7, Figure 4-3) through the casing into the mounting flange, and two screws (8) and washers (9) through the mounting bracket.

(b) Insert the end of the flexible cable core through the hole in the top of the circuit breaker actuator arm (15) , and slide the core end fitting (14) onto the cable. Tighten the setscrew finger tight. Install the cable hold-down clamp (16) over the cable, and secure it to the upper right side of the junction box with two screws and lock washers. Adjust the core end fitting (14) to provide 0.12 - 0.25 inch (3-6 MM) clearance under hole in actuator arm (15) when cable is fully extended and circuit breaker is off. Tighten the setscrew.

(c) Connect all wiring harness plugs to their corresponding receptacles on the junction box and control panel assembly. Drop front access panel across opening temporarily. Connect power to the air conditioner.

(7) Check operation, and top off refrigerant if necessary, as follows:

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(a) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to maximum decrease position. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder or refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system while observing the sight-glass liquid indicator.

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

4. Disconnect the refrigerant cylinder. Replace caps on both service valves.

g. Final Assembly. Replace the front access panel on the air conditioner by inserting lower edge of panel behind step in base plate, and pushing into contact with casing. Secure with four panel fastener screws.

5-20. Pressure Regulating Valve.

a. **Access**. Remove panels and grilles to obtain access to the pressure regulating valve (V2) and the system service valves as follows:

(1) Remove the circuit breaker access cover from the front access panel by turning the four camlock fasteners a quarter-turn counterclockwise.

(2) Unscrew four panel fastener screws from the front access panel. Remove the panel.

(3) Remove 12 screws and washers from each evaporator intake grille. Remove the two grilles.

b. Pressure-Test and Adjustment. Test and adjust regulator as directed in the following steps:

(1) Remove caps from the suction and discharge line service valves, and connect pressure gages to the gage ports.

(2) Open both service valves.

(3) Replace front access panel on unit, leading gage lines out through circuit breaker access opening.

(4) Block off evaporator intake and fresh air intake to cause suction pressure to drop below normal.

(5) Provide temperature conditions of 50-75° F (10-24°C) at the condenser let, and start the air conditioner. Turn the mode selector switch to cool, and the temperature control thermostat to maximum decrease.

(6) If suction line pressure gage reads higher or lower than the normal pressure 58 PSIG (4.08 KG/CM2) , remove flat, knurled cap from pressure regulating valve (12, Figure 4-7) and adjust pressure regulating screws with a screwdriver until 58 PSIG (4.08 KG/CM2) is obtained. Replace knurled cap.

(7) If pressure requirements cannot be met, close both system service valves, remove the pressure gages, and replace the pressure regulating valve.

c Removal. Remove the pressure regulating valve from the air conditioner in accordance with the following procedure:

(1) Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

CAUTION

Wrap the valve body in wet cloth when brazing or debrazing joints. Excessive heat can damage internal parts.

(2) Debrazing Connections. Provide a 1-2 CFM (0.5 - 1 M3) flow of dry nitrogen to the discharge line service valve, and opening the cylinder shutoff valve and both service valves slightly. After the nitrogen has flowed through the system for 2-3 minutes, debraze connections, and remove the pressure regulating valve.

d. Installation. Install a serviceable pressure regulating valve in the system, making sure that the direction of-flow arrow is pointing in the proper direction. Establish a 1-2 CFM (0.5 - 1 M3) flow of dry nitrogen through the refrigeration system, and braze the joints.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 -1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

CAUTION

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes, avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (6 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Close the suction and discharge service valves and cylinder shutoff valve. Disconnect the charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch and soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(**a) Electronic Leak Detector**. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(**a)** Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line service valve, and turn vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b) . If 500-Micron 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 problem.

2. Leaks in the Refrigeration System. Break vacuum with dry nitrogen, and retest for leaks.

3. Internal Leakage of Vacuum Pump. Test pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close suction line service valve, and disconnect vacuum pump. Close discharge line service valve, and remove vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and turn cylinder shutoff valve on for a few seconds to purge the line of air. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is hear at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to maximum decrease position. Temporarily prop front access panel across the opening. With compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder up-right, or connect line to the vapor valve.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect the refrigerant cylinder, and replace caps on both service valves.

g. Final Assembly. Replace panels and grilles on the air conditioner as follows:

(1) Position the front access panel on the unit by placing its lower edge behind the step in the front of the base plate and pushing into position, secure with four panel fastener screws.

(2) Position the evaporator intake grilles on the air conditioner. Secure them with 12 screws and washers each.

5-21. Pressure Relief Valve.

a. Access. The pressure relief valve is located behind the junction box in the upper part of the lower compartment. To obtain access to the pressure relief valve, proceed as follows:

(1) Unscrew four panel fastener screws in the front access panel. Remove the panel.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

(2) Disconnect all wiring harness plugs from the junction box and control panel assembly.

(3) Loosen the setscrew in the end of core end fitting (14, Figure 4-3) and remove the end fitting from the flexible cable core. Remove two screws and washers from the hold-down clamp (16) , and move the cable out of the way. Remove six screws that secure the junction box mounting flange to the casing, and remove two screws (8) and washers (9) from the lower right mounting bracket. Detach control thermostat sensing bulb and capillary tube from air conditioner, and carefully coil capillary tube to prevent kinking. Remove the junction box and control panel assembly.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5--6.

c. Removal.

CAUTION

If unscrewing torque would place an undue strain on adjacent piping and fittings, use a back-up wrench to hold the fitting steady. Unscrew and remove the pressure relief valve (16, Figure 5-2) from the cross fitting (14) .

d. **Installation**. Apply teflon pipe-thread tape to threads of the pressure relief valve. Screw the pressure relief valve (15) into the cross fitting (14) as far as possible by hand. Tighten with two wrenches: One on the fitting and one on the valve, to prevent strain.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a 1-2 CFM (0.5 --1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Turn off the' suction and discharge service valves and cylinder shutoff valve. Disconnect the charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(**a) Electronic Leak Detector**. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line service valve, and turn the vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b) . If 500-Micron 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 problem.

2. Leaks in the Refrigeration System. Break vacuum with dry nitrogen, and retest for leaks.

3. Internal Leakage of Vacuum Pump. Test pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and open the cylinder shutoff valve a few seconds to purge line of air. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

(e) Install junction box and control panel assembly in the air conditioner as follows: (See Figure 4-2) .

1. Position the assembly in the air conditioner, and secure with six screws (7) and two screws (8) and washers (9) .

2. Insert cable core into hole in circuit breaker actuator arm (15) . Install core end fitting (14) on cable core, finger tight.

3. Install hold-down clamp (16) over cable, and secure to top of junction box with two screws and washers.

4. Adjust core end fitting (14) to provide 0.14 - 0.25 inch (3-6 MM) clearance below the actuator arm (15) when the cable is fully extended and the circuit breaker is off.

5. Connect wiring harness plugs to the junction box and the control panel assembly.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(f) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to the maximum decrease position. Prop the front access panel across the opening. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect the line to the vapor valve.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight glass liquid indicator.

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

4. Disconnect the refrigerant cylinder. Replace caps on both service valves.

5-22. Check Valve.

The check valve (13, Figure 5-2) is located in the upper left corner of the lower compartment, just behind the pressure relief valve (15) . Functionally, it is just downstream of the condenser coil (1) and prevents pressure in the expansion section from forcing refrigerant back through the condenser coil when the compressor is in bypass operation.

a. Access. Obtain access to the check valve in accordance with the following directions:

(1) Unscrew four panel fastener screws from the front access panel, and remove the panel.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

(2) Disconnect all wiring harness plugs from the junction box and control panel assembly. Tie harnesses out of the way.

(3) Loosen the setscrew in the end of core end fitting (14, Figure 4-3) and slide the end fitting off of cable hold-down clamp (16) . Remove the cable from hole in top end of actuator arm (15) .

(4) Remove six screws (7) from left side of casing and junction box mounting flange, and two screws (8) and washers (9) from mounting bracket. Detach the control thermostat sensing bulb and capillary tube from the air conditioner, and carefully coil capillary tube to prevent kinking. Remove the junction box and control panel assembly from the air conditioner.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

CAUTION

Disconnect power input cable from the air conditioner before doing maintenance work on the unit. The voltage used can be lethal.

c. Removal. Connect a cylinder of dry nitrogen to the discharge line service valve, and establish a 1-2 CFM (0.5 -1 M3) flow through the system for 3-5 minutes. Debraze joints of the check valve, and remove it from the system.

d. Installation.

CAUTION

Make sure that the direction-of-flow arrow is pointed toward the pressure relief valve before brazing the check valve connections. Install the check valve with the direction-of-flow arrow pointing in the proper direction, and braze connections.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 -1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentration of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Turn off suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line service valve, and turn the vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b) . If 500-Micron 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 problem.

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

3. Internal leakage of vacuum pump. Test pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) 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 tile line of air. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressure begin to equalize. When 25 pounds (11.4KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

g. Assembly and Operating Test. The junction box and control panel assembly must be installed so that the air conditioner can be operated for testing. Proceed as follows:

(1) Position the junction box and control panel assembly in the air conditioner, and secure with six screws (7, Figure 4-3) through the casing into the mounting flange, and two screws (8) and washers (9) through the mounting bracket.

(2) Carefully lead control thermostat sensor bulb and capillary tube around condenser coil to middle of evaporator intake chamber. Install bulb in loop clamp.

(3) Install the circuit breaker operating cable as follows:

(a) Insert the end of the flexible cable core through the hole in the top of the actuator arm (15, Figure 4-3) . Slide the core end fitting (14) over cable core, and tighten the setscrew temporarily.

(b) Place the hold-down clamp (16) over the cable (17) , and attach it to the junction box with two screws and washers.

(c) Adjust the core end fitting to provide 0.120 - 0.250 inch (3-6MM) clearance below the actuator arm when the cable is fully extended and the circuit breaker turned off.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(4) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to maximum decrease position. Temporarily prop the front access panel across the opening. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(a) Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

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

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

(d) Disconnect the refrigerant cylinder, and replace caps on both service valves.

h. Final Assembly. Replace the front access panel on the air conditioner by placing the bottom edge behind the step in the base plate, then pushing into position. Secure with four panel fastener screws.

5-23. Service Valves.

The suction line service valve and the discharge service valve are identical, and are located in the front center area of the lower compartment. (See Figure 1-2.) The service valves are used for charging and discharging refrigerant into or out of the system.

a. Access. Obtain access to the service valves by removing the front access panel as follows:
(1) Unscrew four panel fastener screws securing the front access panel.
(2) Pull the panel forward and upward to remove.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, discharge all gas from the refrigeration system in accordance with paragraph 5-6.

CAUTION

Wrap the body of the valve to be brazed or debrazed; in wet cloth. Excessive heat can damage internal parts.

c. Removal. Connect a cylinder of dry nitrogen to whichever of the service valves is not to be removed, and establish a 1-2 CFM (0.5-1 M3) flow through the system for 3-5 minutes. Debraze joint of valve to be removed, and remove valve.

d. Installation. With nitrogen flowing through the system, set the service valve in place and braze the joint.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gauge port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gauge port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with the liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder or refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.
(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 (5KG/ CM2) . Close the suction service valve and the cylinder shutoff valve.
(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Turn off suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-1 0 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A leakage leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (b) . If 500-Micron 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 problem.

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

3. Internal leakage of vacuum pump. Test the pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to other suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) 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. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to the maximum decrease position. Temporarily prop the front access panel across the opening. With compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear top off the refrigeration charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service to purge air from the line. Tighten the connection. Leave the cylinder upright or connect the line to the vapor valve.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect the refrigerant cylinder, and replace caps on both service valves.

g. Final Assembly. Place the front access panel in position, with the lower edge behind the step of the base plate, and push into contact with the casing. Secure with four panel fastener screws.

5-24. Receiver.

The receiver (11, Figure 5-2) is a small tank, located just behind the drier-strainer (8) and mounted on the wall of the casing with two band clamps (10) . Functionally, the receiver is located between the condensing and subcooling coils of the condenser (1) .

a. Access. Obtain access to the receiver as indicated in the following instructions:

(1) Unscrew four panel fastener screws from the front access panel, and remove the panel.

WARNING

Disconnect power input cable from the air conditioner before doing maintenance work on the unit.

(2) Disconnect all wiring harness plugs from their receptacles on the junction box and control panel assemblies.

(3) Disconnect the circuit breaker operating flexible cable from the junction box as follows:

(a) Loosen the setscrew in the end of the core end fitting (14, Figure 4-3) and slide the end fitting off of the cable core.

(b) Remove two screws and washers from the cable hold-down clamp (16) , and pull the end of the cable out of the hole in actuator arm (15) . Tie or tape the cable out of the way

(4) Remove six screws (7) from the casing and mounting flange of the junction box, and remove two screws (8) and washers (9) from the mounting bracket. Remove the junction box from the unit.

b. Discharging the System. Whenever a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal. Remove the receiver from the air conditioner in accordance with the following directions:

(1) Remove a screw, two flat washers and a nut from each of the two band clamps (10, Figure 5-2) holding the receiver (11) to the wall of the casing.

(2) Connect a cylinder of dry nitrogen to the discharge service valve, and establish a flow of 1-2 CFM (0.5 - 1 M3) through the refrigeration system.

(3) Debraze connections to the receiver, making sure to remove bushings (12) as well as tubing connections.

(4) Remove receiver (11) from the air conditioner, and retain band clamps (10) and other attaching hardware for re-use.

d. Installation. With nitrogen flowing through the system, attach two band clamps to the receiver and connect tubing and bushing (12) . Braze in place. Secure band clamps (10) to the air conditioner with a screw, two washers and a nut in each clamp.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage-port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be extra careful to protect the eyes. Do not inhale high concentrations of refrigerant gas. Keep gas from coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hoses. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to the cylinder of dry nitrogen. Open the cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Close the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) Soap Solution. Brush soap solution on all possible points of leakage, and watch for bubbles. Follow a definite sequence from all joints, and mark any point at which a leak is found.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (b) . If 500-Micron 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 problem.

2. Leak in the refrigeration system. Break vacuum with try nitrogen, and retest for leaks.

3. Internal leakage of vacuum pump. Test pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) 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. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

g. Assembly and Operating Check. Prepare the air conditioner for an operating check by installing the junction box and control panel assembly in the following manner:

(1) Place the junction box and control panel assembly in the air conditioner, and secure with six screws (7, Figure 4-3) through the casing and into the mounting flange, and two screws (8) and washers (9) through the mounting bracket.

(2) Connect the flexible circuit breaker operating cable to the actuator arm as follows:

(a) Insert the end of the flexible cable core through the hole in the top of the actuator arm (15) , and slide the core end fitting (14) over the end. Tighten the setscrew temporarily to keep the fitting in place.

(b) Place the hold-down clamp (16) over the cable, and secure it to the junction box with two screws and washers.

(c) Adjust the core end fitting (14) to provide 0.12 - 0.25 inch (3-6 MM) clearance below the actuator arm (15) when the cable is fully extended and the circuit breaker is off.

(3) Carefully lead control thermostat sensor bulb and capillary tube around condenser coil to middle of evaporator intake chamber. Secure bulb in loop clamp.

(4) Connect all wiring harness plugs to their associated receptacles on the junction box and control panel.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. 7 Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(5) With power connected to the air conditioner, turn the mode selector switch to cool, and turn the temperature control thermostat to maximum decrease position. Temporarily prop the front access panel across the opening. With compressor operating, observe the sight-glass indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(a) Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect the line to the vapor valve.

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

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

(d) Disconnect the refrigerant cylinders, and replace caps on both service valves.

h. Final Assembly. Position the front access panel, with its lower edge behind the step on the base plate, and push into contact with the casing. Secure with four panel fastener screws.

5-25. Accumulator.

The accumulator consists of two cylindrical tanks (10, 11, Figure 4-7) , one mounted on each wall of the casing behind the evaporator intake grille. Functionally, the accumulator serves to increase capacity for liquid refrigerant, and to support the discharge pressure during low-ambient operation.

a. Access. Obtain access to the two accumulator tanks and the service valves as directed in the following procedure:

(1) Remove 12 screws and washers from each of the evaporator intake grilles, and remove the grilles.

(2) Unscrew four panel fastener screws from the front access panel, and remove the panel.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal. Connect a cylinder of dry nitrogen to the gage port of the discharge service valve, and establish a flow of 1-2 CFM (0.5-1 M3) through the system. Remove the accumulator tank(s) in accordance with the following procedure: (See Figure 4-7.)

(1) Remove four screws and washers from the casing and side-mounting brackets, and remove two screws and washers from the inner mounting bracket.

(2) Debraze the tubing connection, and remove the accumulator tank(s) (10 & 11) .

d. Installation. Install the accumulator tank(s) as follows:

(1) Fit tubing into the tank connection, and attach the mounting flanges to the casing and the inner mounting bracket with six screws and washers, finger tight.

(2) With dry nitrogen flowing through the system, braze the tubing connection.

(3) Tighten the six mounting screws.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Close the suction and discharge service valves and cylinder shutoff valve. Disconnect the charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) Soap Solution. With the air conditioner in operation. 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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 changes, continue with step (b) . If 500-Micron 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. Leaks in the refrigeration system. Break vacuum with dry nitrogen, and retest for leaks.

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

3. Internal leakage of vacuum pump. Test pump by blocking off vacuum pump intake and continuing to pump. If the pump still fails to reach 500-Microns, the pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) 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. Tighten the service valve connection. Charge refrigeration system as directed in the following steps:

1. Place the refrigerant cylinder on a scale of sufficient capacity, with the shutoff valve down, or suspend the cylinder from a spring scale or beamscale, with the valve end down.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

e. With power connected to the air conditioner, turn the mode selector switch to COOL, and turn the temperature control thermostat to maximum DECREASE Position. With compressor operating, observe the sight glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder up-right.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect the refrigerant cylinder, and replace caps on both service valves.

g. Final Assembly. Install panels and grilles on the air conditioner in accordance with the following steps:

(1) Position the two evaporator intake grilles on the front of the air conditioner, and secure with 12 screws and washers in each.

(2) Place the lower edge of the front access panel behind the step in the base plate, and push into contact with the air conditioner casing. Secure with four panel fastener screws.

5-26. Thermal Expansion Valves.

Two thermal expansion valves are used in the refrigeration system: one which meters refrigerant to the evaporator coil (V5) and the other which injects liquid refrigerant into the compressor suction line (V4) . (See Figure 1-5.) Both valves respond to temperature changes in the refrigerant 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 (V5) 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 injection circuit is insignificant, valve V4 is equalized internally. Both valves are hermetically sealed to their sensing bulbs and capillary tubes. (See Figure 5-4.)

a. Access. Obtain access to the thermal expansion valves as indicated below:

(1) Evaporator Expansion Valve. Obtain access to the evaporator expansion valve and its associated sensing bulb in accordance with the following steps:

(a) Remove 31 screws and washers from the top panel. Remove the top panel.

(b) Remove 12 screws and washers from each of the two evaporator intake grilles. Remove the grilles.

(2) Liquid Injection Expansion Valve. Gain access to the liquid injection expansion valve by unscrewing four panel fastener screws that secure the front access panel. Remove the panel.

b. Testing. Both expansion valves are tested in the same manner, as follows:

(1) Stop the air conditioner. Let the suction line warm up to ambient temperature.

(2) 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 longer than 1-2 seconds. The expansion valve will be wide open during the following procedure. An excessive flood-back of liquid refrigerant will damage the compressor.

(3) Start the air conditioner by setting the selector switch to cool, and the temperature control thermostat to 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 temperature 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.

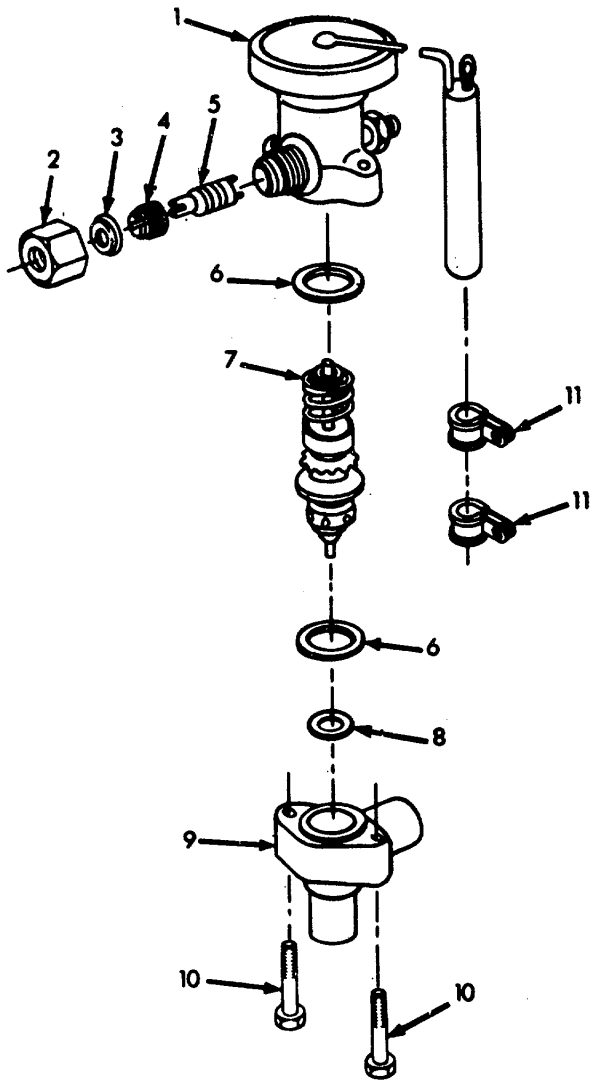
c. Adjusting Superheat. A refrigerant gas is said to be superheated when its temperature is higher than the evaporating temperature corresponding to its pressure at saturation. When a thermal expansion valve is set for optimum superheat (in this case 10 F or 5.5 C above the evaporating temperature of 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. The superheat setting of an expansion valve can be adjusted by varying the setting of a compression spring (7, Figure 5-4) in the power assembly of the valve. This spring tends to hold the valve dosed 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:

(1) Remove insulation from a spot on the suction line near the sensing bulb of the expansion valve.

(2) 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 in position, and cover with insulating material.

(3) Connect a suitable pressure gage to the gage port of the suction service valve, and open the valve.

(4) Operate the air conditioner in the cooling mode for about 30 minutes, observing the thermometer or thermocouple dial to see that the temperature has stabilized. When the temperature has remained the same for at least two minutes, record the temperature and pressure.



1. POWER ASSEMBLY
2. CAP, SEAL
3. BONNET SEAL
4. PACKING SEAL
5. ADJUSTING STEM & PACKING
6. GASKET, BODY FLANGE
7. CAGE ASSEMBLY
8. GASKET, SEAL
9. FLANGE, BODY
10. SCREWS, CAP
11. CLAMP ASSEMBLIES

Figure 5-4. Typical Expansion Valve

Table 5-3. 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	40	4.4	69.02	4.853
12	-11.1	34.68	2.439	42	5.5	71.99	5.062
14	-10.0	36.89	2.593	44	6.6	75.04	5.276
16	-8.9	38.96	2.739	46	7.7	78.18	5.497
18	-7.8	4i .09	2.889	48	8.8	81.40	5.723
20	-6.6	43.28	3.043	50	10.0	84.70	5.955
22	-5.5	45.23	3.180	52	11.1	88.10	6.257
24	-4.3	47.85	3.364	54	12.2	91.5	6.433
26	-3.4	50.24	3.532	56	13.3	95.1	6.686
28	-2.2	52.70	3.705	58	14.5	98.8	6.947
30	-1.1	55.23	3.883	60	15.6	102.5	7.206
32	0	57.83	4.066	62	16.7	106.3	7.474
34	1.1	60.51	4.254	64	17.8	110.2	7.748
36	2.2	63.27	4.448	66	18.9	114.2	8.029
38	3.3	66.11	4.648	68	20.0	118.3	8.318

Table 5-3 (Cont'd)

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	Psig	kg/cm2	Deg F	Deg C	Psig	kg/cm2
70	21.1	122.5	8.612	90	32.2	170.1	11.960
72	22.2	126.8	8.915	92	33.3	175.4	12.332
74	23.3	131.2	9.225	94	34.5	180.9	12.719
76	24.4	135.7	9.541	96	35.6	186.5	13.113
78	25.6	140.3	9.864	98	36.7	192.1	13.506
80	26.7	145.0	10.195	100	37.8	197.9	13.914
82	27.8	149.8	10.522	102	38.9	203.8	14.329
84	28.9	154.7	10.877	104	40.0	209.9	14.758
86	30.0	159.8	11.236	106	41.1	216.0	15.187
88	31.1	164.9	11.594	108	42.2	222.3	15.630
110					43.3	228.7	16.080
112					44.4	235.2	16.537
114					45.6	241.9	17.008
116					46.7	248.7	17.486
118					47.8	255.6	17.971

(5) Compare the pressure and temperature readings with those in Table 5-3. Temperature should be approximately 10° F (5.5° C) higher than that shown in the table for the equivalent pressure reading.

(6) If superheat setting is less than 10°F (5.5°C) above saturation temperature shown in the table, adjust the expansion valve as follows: (See Figure 5-4.)

(a) Remove the hexagonal seal cap (2) from the side of the power assembly (1) and loosen bonnet set (3) .

(b) 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 complete turns, then wait for two minutes for temperature to stabilize before observing temperature and pressure readings.

(c) When the proper setting is obtained, replace the screw cap and seal on the valve adjusting stem (5) .

(7) Remove the thermometer or thermocouple probe from the suction line, and replace insulating material. Turn the suction service valve off, and remove the pressure gage. Replace cap on gage port.

d. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

e. **Removal**. Remove the expansion valve from the air conditioner as directed in the following steps: (See Figure 5-4.)

(1) Remove insulation and band clamp from sensing bulb. Carefully detach bulb and capillary tube.

(2) Remove two capscrews (10) securing the power assembly (1) to the valve body (9) . Remove the power assembly, capillary tube and sensing bulb.

(3) Remove two capscrews that secure the valve body to the support bracket. Detach equalizer line, if applicable.

CAUTION

Maintain a 1-2 CFM (0.5 - 1M3) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components.

(4) Debraze tubing connections. Remove valve body (9) .

f. Installation. Install the expansion valve in accordance with the following procedures:

(1) Disassemble the valve by removing two capscrews (10) that secure the power assembly (1) to the valve body (9) , and separate the two.

(2) Install the valve body in the support bracket, and secure with two capscrews, finger tight. Connect tubing.

(3) With dry nitrogen flowing through the refrigeration system braze tubing joints. Let cool. Tighten capscrews.

(4) Install power assembly (1, Figure 5-4) on valve body, being careful to fit lugs on the cage assembly (7) into the cavities in the body (9) . Secure the two capscrews (10) . Connect equalizer line, if applicable.

(5) Wrap the capillary tube with a double thickness of insulating tape, being careful to avoid kinking the tube.

(6) Carefully lead the sensing tube to its position on the suction line. Clamp in position 45 degrees below the horizontal centerline of the suction line. Cover suction line, sensing bulb and clamp with insulating material.

(7) Carefully form the capillary tube along adjacent piping, and tape to support.

g. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 -1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

h. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connections to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve. Charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Close the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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 use, a leak will be indicated by an audible signal, a light, or by meter deflections.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close suction line service valve, and turn vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b) . If 500-Micron 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 problem.

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

3. Internal leakage of vacuum pump. Test pump by blocking off vacuum intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and turn the cylinder shutoff valve on for a few seconds to purge the line of air. Tighten service valve connection. Charge refrigeration system as directed in the following steps:

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

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn the mode selector switch to cool. Turn the temperature control thermostat to maximum decrease position. With compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve, and open the cylinder shutoff valve for a few seconds to purge the air from the line.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

3. When liquid in sight-glass indicator runs clear and free of bubbles close the suction line service valve and the cylinder shutoff valve.

4. Disconnect refrigerant cylinder, and replace caps on both service valves.

i. Final Assembly. Replace external panels, as applicable in the following manner:

(1) Position top panel on the air conditioner, and secure with screws and washers.

(2) Position front access panel, with its lower edge behind the step in the base plate, and push into contact with the casing. Secure with four panel fastener screws.

5-27. Condenser Coil. The condenser coil consists of two separate coil circuits: The condensing coil and the sub-cooling coil. These coils are assembled into a single unit with a common set of aluminum fins and steel end-plates. (See Figure 5-2.) The condenser is mounted horizontally, and occupies approximately the entire cross-sectional area of the air conditioner above the lower third of the unit.

a. Access. Remove the front access panel and the rear panel, motor mounting bracket assembly, and deflector door and condenser intake screen as directed in the following steps:

(1) Unscrew four panel fastener screws, and remove the front access panel.

(2) Disconnect wiring harness plug, P2, from the receptacle on the condenser fan motor.

(3) Remove six screws from the hinge support bracket (8, Figure 4-5) , and remove two screws from each lid support bracket mounting foot (6) . Remove the deflector door assembly (3) .

(4) Remove 12 screws from the frame of the condenser intake screen, and remove the screen.

(5) Remove six screws from the bottom flange of the motor mounting bracket assembly (12, Figure 4-5) , and place wood blocks under the fan shroud for support during further disassembly.

(6) Remove four screws from top and bottom of pressure cutout switch enclosure attachment to rectangular panel.

(7) Pull the circuit breaker control cable all the way out. Grip the shaft with a brass of copper strip held in a pair of pliers, and unscrew the operating knob from the shaft. Remove nut, jam nut and lock washer from mounting ferrule of control cable. Push cable assembly inside the panel.

(8) Remove the alternate power connection receptacles, if used, by removing four screws and self-locking nuts.

(9) Remove nine screws from each side-flange of the rear panel. Carefully work the panel off the casing with the help of an assistant. Store panel outer-face-down on corner support blocks.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal of Coil. Remove the condenser coil from the air conditioner in accordance with the following procedure:

(1) From beneath each end of the coil (1, Figure 5-2) remove four screws and washers that secure the mounting flanges of the coil to the support flange of the casing.

(2) With dry nitrogen flowing through the system, debraze and separate the large tubing connection from the compressor, near the front of the air conditioner, and the three tubing connections near the rear of the air conditioner.

NOTE

If necessary to gain sufficient clearance for removal, debraze tubing and fittings that interfere with coil removal, and remove them.

WARNING

Wear leather-palm gloves when handling the fins of the coil. They are sharp and can inflict multiple cuts.

(3) With the help of an assistant, push the connecting end of the coil upwards far enough for the ends of the tubing connections to clear the supporting flange, and pull the coil out from the rear of the air conditioner.

d. Installation. Install the condenser coil (1, Figure 5-2) in the air conditioner as follows:

(1) With an assistant holding each end of the coil, push the coil into the air conditioner, keeping the weight off of the tubing connections, until it is completely in position. Assemble tubing connections.

(2) Secure the mounting flanges with four screws and washers through the support flange of the casing.

(3) Initiate a 1-2 CFM (0.5 - 1 M3) flow of dry nitrogen through the system, and braze tubing connections.

e. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere. you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction service valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

f. Charging the System. Prepare gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder of refrigerant, R22, to the pressure hose, open the cylinder shutoff valve slightly to purge the hose of air, the tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 10 PSI (0.7 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and the suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Close the suction and discharge service valves and the cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

The electronic leak detector and the Halide torch are sensitive to the presence of refrigerant gas is present in the atmosphere of the work area. False indications can result. Use in a well ventilated but draft-free area.

(a) Electronic Leak Detector. Turn the electronic 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.

(b) Halide Torch. Turn on the gas from the cylinder and the light torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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 retested. With the solution from all joints, and mark any point at which a leak is found.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected repair and retest as directed above. If system is leak-tight proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line service valve, and turn vacuum pump off. Let the unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (b) . If 500-Micron vacuum cannot be held for three hours, breaks 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 problem.

2. Leaks in the refrigeration system. Break vacuum with dry nitrogen and retest for leaks.

3. Internal leakage of vacuum pump. Test pump by connecting gage directly to the vacuum pump intake and continuing to pump. If pump fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to suction line service valve gage port, and start the pump. Open the suction line service valve and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and then remove vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve, and turn the cylinder shutoff valve on for a few seconds to purge the line of air. Tighten the service valve connection. Charge the refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

g. Assembly and Operating Test. The air conditioner must be partially re-assembled to permit an operating test to be made. Proceed as follows:

(1) Place the motor mounting bracket and rear panel assembly upright on blocks just behind the panel opening.

(2) Push the circuit breaker operating cable through the hole in the panel. Install lock washer, jam nut and outer nut on ferrule. Pull the cable all the way out, grip the shaft with a brass or copper strip held in a pair of pliers, and screw knob onto shaft.

(3) Position pressure cutoff switch housing against inside of panel. Secure with four screws.

(4) Install the motor mounting bracket and the rear panel assembly on casing. Secure with nine screws through each side flange. Remove blocks, and install six screws through bottom flange.

(5) Position the deflector door assembly over the coil opening. Secure with six screws. Attach lid support mounting feet to casing, and secure with two screws and nuts through each foot.

(6) Install condenser intake screen, and secure with 12 screws.

(7) Connect electrical harness plug, P2, to receptacle on condenser fan motor.
(8) Connect power input plug to air conditioner.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(9) With power connected to the air conditioner, turn mode selector switch to cool. Turn temperature control thermostat to maximum decrease position. Temporarily prop the front access panel across the opening. With compressor operating, observe-the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

(a) Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to the vapor valve.

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

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

(d) Disconnect the refrigerant cylinder. Replace caps on both service valves.

h. Final Assembly. Position the front access panel on the air conditioner. Secure with four panel fastener screws.

5-28. Evaporator Coil.

a. Access. Obtain access to the evaporator coil as indicated in the following instructions:
(1) Remove 31 screws and washers from the top panel, and remove top panel.
(2) Remove 16 screws and washers from the frame of evaporator outlet grille and remove the grille.
(3) Remove the mist eliminator (1, Figure 4-7) by pulling it straight up.
(4) Unscrew four panel fastener screws from the front access panel, and remove panel.
(5) Remove 12 screws and washers from the right-hand evaporator intake grille, and remove the grille.

b. Discharging the System. Whenever a leak is detected or a refrigeration component must be replaced, discharge all gas from the refrigeration system in accordance with paragraph 5-6.

c. Removal. Remove the evaporator coil (2, Figure 4-7) in accordance with the following procedure:
(1) Disconnect heater assembly wiring harness plug, P7, from its receptacle in the wall of the right-hand return air plenum.
(2) Remove two screws which secure the heater support bracket, (8, Figure 4-14) . Pull the entire heating assembly up, and remove it from the air conditioner.
(3) Remove six screws from the mounting brackets on each side of the evaporator coil.
(4) Remove the two capscrews holding the power assembly of expansion valve, V5 (14, Figure 4-7) to the valve body.
(5) Remove the two capscrews that secure the expansion valve body to the support bracket.
(6) Remove insulation from the suction line.

CAUTION

Maintain a 1-2 CFM (0.5 - 1M3) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components.

(7) Debraze the expansion valve body from the liquid line coming from the sight-glass liquid indicator.

(8) Working inside the evaporator intake chamber insert a sheet of scrap metal between the casing insulation and the brazed joint of the suction line to act as a heat shield. With an assistant pulling up on the evaporator coil (2, Figure 4-7) debraze the joint.

(9) Carefully lift the evaporator coil up and out of the air conditioner.

d. Disassembly. Debraze and remove the expansion valve body (14) from the coil (2) and distributor assembly (3) . Debraze and remove the suction tube extension (4) from the header.

e. Installation. Install the evaporator coil as directed in the following steps:

(1) Assemble and braze and header extension tube (4) to the coil (2) .

(2) Assemble the expansion valve body (14) , liquid line connector and distributor assembly (3) . Braze joints.

(3) Install coil assembly into air conditioner, and secure with six screws and washers at each end of the coil.

NOTE

It may be convenient to disconnect the equalizer line from the expansion valve power assembly to facilitate assembly of the valve.

(4) Install the cage assembly (7, Figure 5-4) in the expansion valve power assembly (1) . Make sure that the lugs on the cage assembly fit into the recesses in the body (9) . Assemble the valve body (9) and the power assembly (1) , using new gaskets (8) and (6) . Secure with two capscrews. Reconnect Equalizer line to power assembly, if removed.

CAUTION

Maintain a 1-2 CFM (0.5-1 M3) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components.

(5) Use a sheet metal heat shield between the joint and the insulation in the casing. Braze the joint from the header to the suction line (4) inside the evaporator intake chamber.

(6) Install the heater assembly (Figure 4-14) behind the evaporator coil. Secure with two screws through each return air chamber into the heater support bracket (8) . Connect wiring harness plug, P7, to receptacle in wall of right-hand return air chamber.

f. Purging the System.

CAUTION

Whenever the refrigeration system has been opened to the atmosphere, you must install a new drier-strainer (dehydrator) before purging and recharging the system.

With the refrigeration system discharged and a hose attached to the gage port of the suction valve, connect a cylinder of oil-pumped dry nitrogen to the gage port of the high-pressure service valve. Open the high-pressure service valve, and crack open the cylinder shutoff valve to establish a flow of 1-2 CFM (0.5 - 1 M3) through the system. Purge for at least 30 minutes to expel all other gases, impurities and water vapor. Turn off both service valves before disconnecting the nitrogen cylinder and the discharge hose.

g. Charging the System. Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port. Connect a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flame or hot metal surfaces; lethal phosgene gas can be formed.

(1) Connect a cylinder or refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then, tighten the hose connection to the suction service valve gage port.

(2) Open both service valves and the cylinder shutoff valve. Charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2) . Close the suction service valve and the cylinder shutoff valve.

(3) Transfer the charging line to a cylinder of dry nitrogen. Open the cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 350 PSI (21.44 KG/CM2) . Turn off suction and discharge service valves and cylinder shutoff valve. Disconnect the charging line from suction service valve.

(4) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred. Use GE type H-10 electronic leak detector or equivalent.

CAUTION

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

(a) Electronic Leak Detector. Turn the electronic 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, or by meter deflections.

(b) Halide Torch. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with a red tip, or the torch may be extinguished.

(c) 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.

(5) Discharge the system in accordance with paragraph 5-6. If leaks are detected repair and retest as directed above. If system is leak-tight proceed as follows:

(a) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate the vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close the suction line 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, continue with step (b) . If 500-Micron 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 problem.

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

3. Internal leakage of vacuum pump. Test the pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

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

(c) Reconnect the vacuum pump to the suction line service valve gage port, and start the pump. Open the suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(d) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve. Open the cylinder shutoff valve for a few seconds to purge line of air. Tighten the service valve connection. Charge refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid valve.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(e) With power connected to the air conditioner, turn the mode selector switch to cool. Turn the temperature control thermostat to maximum decrease position. Temporarily prop front across panel across opening. With the compressor operating, observe the sight-glass liquid indicator. If bubbles or milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from the line. Tighten the connection. Leave the cylinder upright, or connect line to vapor valve.

2. With the air conditioner compressor operating. Open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

3. When liquid in sight-glass indicator runs clear and free of bubbles. Close the suction line service valve and the cylinder shutoff valve.

4. Disconnect refrigerant cylinder. Replace caps on both service valves.

h. Final Assembly. Final assembly of the air conditioner consists of replacing external grilles and panels. Proceed as follows:

(1) Install insulation on suction line.
(2) Slide mist eliminator into channels in front of evaporator coil, making sure that mark is facing front.
(3) Position top panel on air conditioner, and secure with 31 screws and washers.
(4) Place evaporator discharge grille on front of air conditioner and secure with 16 screws and washers.
(5) Install right-hand evaporator intake grille on air conditioner with 12 screws and washers.
(6) Position front access panel on air conditioner, with lower edge behind step in base plate. Push into position against casing, and secure with four panel fastener screws.

CHAPTER 6
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

6-1. General.

Repair of operating components of the air conditioner is achieved by replacing parts. Information on replacement procedures is contained in Chapters 4 and 5. Repair instructions for the casing and insulation are included here for reference.

6-2. Insulation and Gaskets.

a. Disassemble the air conditioner only to the extent necessary to obtain access to damaged insulation or gaskets.

b. Using a putty knife, paint scraper or similar tool, scrape as much of the insulation or gasket to be replaced from the structural surface as possible.

WARNING

Acetone and methyl-ethyl ketone (MEK) are extremely flammable, and their vapors are explosive when mixed with air. Also, they are slightly toxic upon prolonged breathing or contact with the skin. Use in a well ventilated area, avoid excessive inhalation or contact with the skin, and take precautions against sparks or open flame.

c. Using a cloth or sponge, saturate the residual insulation and adhesive with acetone or MEK until soft. Scrape the softened residue from the structural support with a wood or fibre blade. Repeat, if necessary, until bare metal is exposed.

d. Obtain a replacement part of insulation, or locally manufacture a section or patch from the same kind of material. Lay it on a flat surface with the attaching side up. Brush a coat of adhesive on the exposed surfaces.

e. Brush a coat of adhesive on the metal surface to which the insulation or gasket is to be attached. Let the adhesive dry until it is tacky but will not stick to the finger when touched.

f. Starting with one corner, attach one edge of the insulation to its place on the casing. Hold the opposite side away from the casing, and progressively press the insulation into contact until it is all attached.

g. Reassemble the air conditioner as required.

6-3. Sheet-Metal Parts

NOTE

Cuts, tears or punctures in the casing or panels must be repaired to prevent bypass leakage of air. Leakage will severely reduce operating efficiency.

a. Disassemble the air conditioner only to the extent necessary to expose the damaged area for repair.

b. Remove insulation from the area to be repaired. (Refer to Paragraph 6-2.)

WARNING

Toxic fumes are emitted by burning or overheated insulation, and heated refrigeration piping can burst with explosive force. Shield wiring and piping, and remove insulation in the area if weld-repair is necessary.

c. Repair damage, using standard sheet-metal repair procedures as necessary. Rivet or weld patches to the inside surface when required.

d. Prepare surface for priming and painting, using wet abrasive paper to remove dead paint, and to feather-edge remaining paint area. Paint as directed in TM 43-0139.

e. Replace insulation as necessary, and reassemble the air conditioner.

6-4. **Casing Assembly.**

To replace the casing assembly, it is necessary to remove all external panels, grilles and information plates, and all functional components and retaining hardware from the inside of the air conditioner. New insulation must be applied to the inside of the casing before installation of functional components and external panels and grilles. (See Figure 6-1).

NOTE

It is not necessary to debraze all joints in the refrigeration system in order to disassemble it. When instructions to debraze and remove an item are given in the following procedure, any joint that will permit convenient disassembly can be debrazed.

CAUTION

Cap or plug ends of all refrigeration components and tubing to prevent contamination after disassembly.

a. ***Information Plates***. Drill out rivets in information plates to remove them. Position the information plates in the equivalent location on the new casing, and secure with blind rivets.

b. ***Insulation***. Insulation cannot be removed from the interior surfaces of the old casing without destroying it; therefore, new insulation must be applied to the new casing. To apply, brush a coat of adhesive onto the surfaces of both the insulation and the casing. Let set until the adhesive is tacky but not sticky, then position the insulation in the casing, and press firmly into place all over.

c. ***Disassembly***. Disassemble components of the unit whose casing is to be replaced, as follows:

NOTE

It is recommended that attaching hardware for each component be collected in a small cloth or plastic bag, and tied or taped to the component for convenience at assembly.

Unscrew four panel fastener screws from the front access panel. remove the panel.

d. ***Discharging the System***. Whenever a refrigeration component must be replaced, you must discharge all gas from the refrigeration system in accordance with paragraph 5-6.

(1) Remove 31 screws and washers from the top panel and remove the top panel. (See Figure 1-4).

(2) Remove 16 screws and washers from the evaporator discharge grille, and remove the grille. (See Figure 1-1).

(3) Remove 12 screws and washers from each of the two evaporator intake grilles, and remove the grilles. (See Figure 1-1).

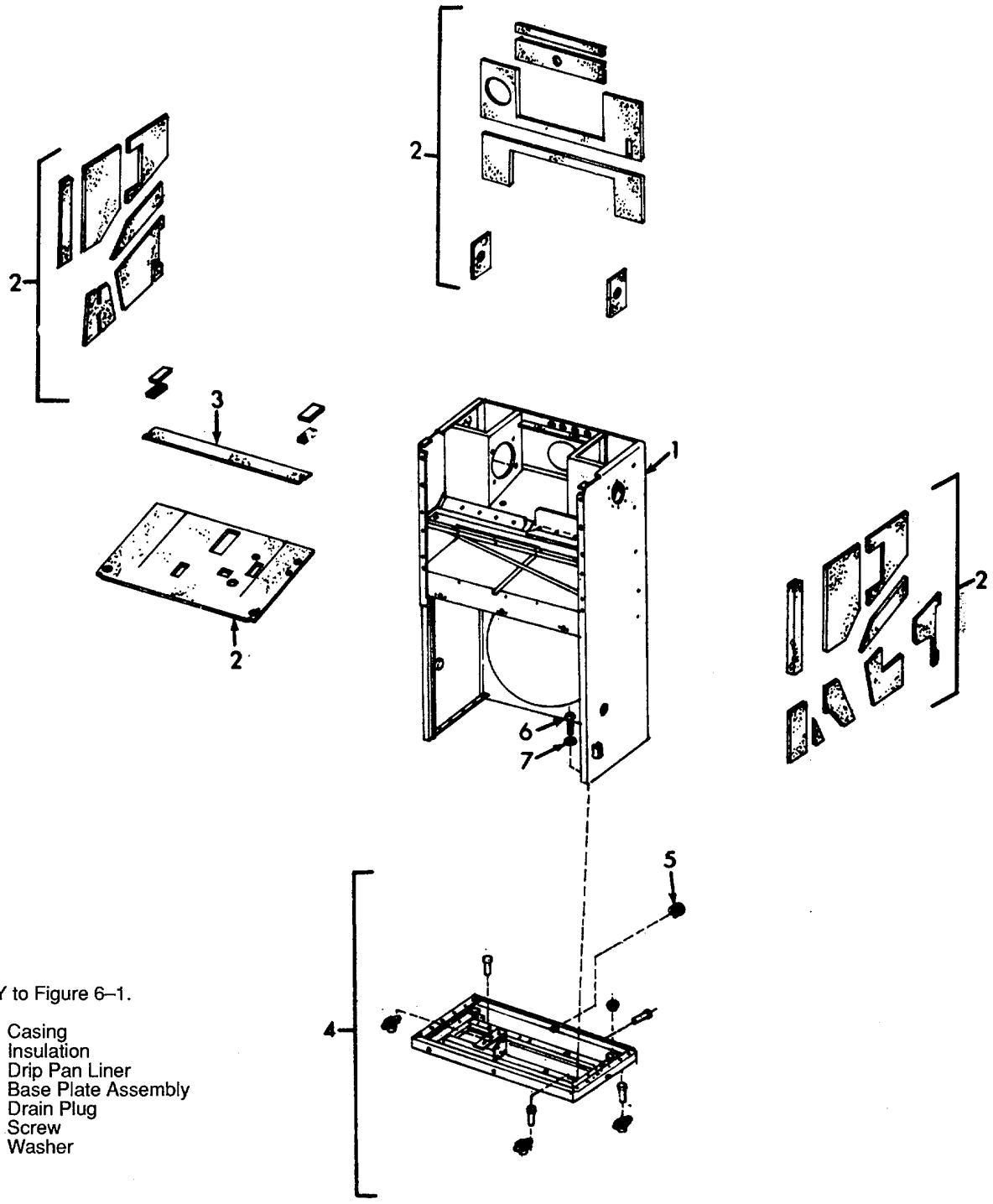
(4) Remove four screws and washers from the circular CBR cover plate to new casing. Secure with four screws and washers. (See Figure 1-3).

(5) Unscrew six panel fastener screws from each of the air filter covers, and remove the covers and the air filters. (See Figure 1-3).

(6) Remove 12 screws and washers from the fresh air intake and baffle. Loosen clamping screw from ball joint holding connecting rod, and remove fresh air grille assembly. (See Figure 4-6).

(7) Remove six screws from the deflector door hinge support bracket. Remove four screws and washers from the mounting feet of the lid supports. Remove the deflector door assembly. (See Figure 4-5).

(8) Remove 12 screws from the condenser air intake screen, and remove the screen. (See Figure 4-6).



KEY to Figure 6–1.

1. Casing
2. Insulation
3. Drip Pan Liner
4. Base Plate Assembly
5. Drain Plug
6. Screw
7. Washer

Figure 6-1. Casing and Insulation.

(9) Remove the motor mount assembly (rear panel) as follows: (See Figure 4-5).

(a) Remove six screws from bottom flange of motor mount assembly, and place wood blocks under the fan shroud for support during further disassembly.

(b Remove four screws from top and bottom of pressure cutout switch enclosure attachment to rectangular panel.

(c) Disconnect grounding stud and cable by removing a screw, two nub and five washers from rectangular panel.

(d) Pull circuit breaker control cable all the way out. Grip shaft with a brass or copper strip held in a pair of pliers, and unscrew operating knob from shaft. Remove nut, jam nut and lock washer from ferrule of control cable, and push cable assembly inside the panel.

(e) Disconnect wiring harness plug, P2, from receptacle on condenser fan motor.

(f) Remove nine screws from each side flange of the rear panel, and carefully work the entire motor mounting bracket (rear panel) assembly off the casing with the help of an assistant. Store on corner wood blocks, outer face down.

(10) Remove evaporator blower assembly as follows: (See Figure 4-15).

(a) Disconnect wiring harness plug, P9, from receptacle in wall of left-hand return air plenum.

(b) Remove fan inlet rings from the walls of both return air plenums by removing four screws, and four each of two kinds of flat washers from the flange of each ring.

(c) Remove four capscrews and washers from the motor mount. Remove the blower assembly, including motor, mounting bracket and both impellers.

(11) Remove heater assembly as directed in the following steps: (See Figure 4-14).

(a) Disconnect wiring harness plug, P7, from receptacle on wall of right-hand return air plenum.

(b) Remove two screws which secure the heater mounting bracket, from the inner front wall of each return air plenum. Remove the heater assembly by pulling it straight up.

(12) Tag all wiring harness interconnections, disconnect and remove. Remove grommets from partitions, and leave on wiring harnesses for use at assembly.

(13) Remove the junction box and control panel assembly as a unit. Being careful to avoid kinking the control thermostat's capillary tube as you lead it from its mounting in the evaporator intake chamber. Remove six screws from casing and mounting flange, and two screws and washers from the mounting bracket. Remove the loop clamps holding the circuit breaker flexible cable. Leave loop clamps on cable for use at assembly.

(14) Unscrew flare nuts at the pressure cutout switch connections to refrigeration piping. (See 13 & 14, Figure 4-12). Cut or remove supporting tape from capillary tubes, and remove pressure switch assembly as a unit.

(15) Unscrew flare nuts (9, Figure 5-2) from top and bottom of drier-strainer (dehydrator) (8). Remove a screw, nut and washer from band clamp (10) and remove drier-strainer and clamp from casing. Discard drier-strainer.

(16) Remove the mist eliminator (1, Figure 4-7) by pulling straight up. Remove four screws from the mounting brackets on each side of the evaporator coil.

(17) Remove two capscrews from the bracket of the evaporator coil expansion valve (14, Figure 4-7). Remove two capscrews securing the power assembly to the valve body.

(18) Unscrew the flare nut of the equalizer connection to the expansion valve bonnet.

(19) Carefully remove the expansion valve sensing bulb and capillary tube from their attachment to the suction line, and remove the expansion valve power assembly.

CAUTION

Maintain a 1-2 CFM (0.5-1M3) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components.

(20) Debraze the valve body from the liquid line.

(21) Debraze the header extension tube (4, Figure 4-7) from the evaporator coil (1) while an assistant pulls up on the coil to separate the joint. Remove the coil and attached tubing.

(22) Debraze tubing from sight-glass liquid indicator (4, Figure 5-2). Remove two screws, lock washers and nuts from bracket. Remove the sight-glass liquid indicator assembly.

(23) Remove six screws and washers from each of the accumulator tank mounting brackets. Debraze tubing joints, and remove accumulator tank mounting brackets. Debraze tubing joints, and remove accumulator tanks (10,11,Figure 4-7).

(24) Debraze joints, and remove pressure regulator valve (12, Figure 4-7).

(25) Debraze joints, and remove evaporator solenoid valve. (13, Figure 4-7).

(26) Remove four screws from below each mounting flange of the condenser coil (1, Figure 5-2). Debraze tubing joints as required, and slide coil out through opening in back of casing with the help of an assistant.

(27) Debraze tubing joints as necessary, and remove check valve (13) and pressure relief valve (15).

(28) Remove a screw, two washers and nut from each of two band clamps (10) holding the receiver (11). Remove the receiver and attached tubing.

(29) Remove all loop clamps, band clamps, spacers and other hardware securing tubing or refrigeration components to walls of casing.

(30) Remove six screws (6, Figure 6-1) and washers (7) from each side flange holding casing to base plate assembly (4).

(31) Attach a hoist, sling and spreader bar to the lift eyes on each side of casing, and place a slight amount of tension on the hoist.

(32) Debraze tubing connections above the level of the compressor to detach casing from base plate and base-plate-mounted equipment.

e. ***Assembly***. Assemble the air conditioner into the new casing as indicated in the following procedure:

(1) Using a hoist, sling and spreader, set the new casing down over the baseplate and base-plate-mounted equipment. Secure casing to base plate with six screws and washers through the mating flanges on each side.

(2) With the old and new casings side-by-side, remove drip pan and drain tube assembly, damper control assembly, baffle, and other parts not removed from old casing at disassembly, and transfer them to new casing.

(3) Position condenser coil in new casing and secure with four screws into each flange from below. (See Figure 5-2).

CAUTION

Maintain a 1-2 CFM (0.5 - 1M3) flow of dry nitrogen through the refrigeration system to prevent oxidation and scaling when brazing or debrazing components

(4) Assemble tubing connections of receiver (11), check valve (13) and pressure relief valve assembly (15), drier-strainer (8) and compressor discharge line to condenser, and braze joints.

(5) Install two accumulator tanks (10 & 11, Figure 4-7). Connect tubing joints, secure with six screws and washers and braze joints.

(6) Install sight-glass liquid indicator (4, Figure 5-2), gaskets and bracket (5). Secure with two screws, washers and self-locking nuts. Assemble tubing connections, and braze.

(7) With the help of an assistant, install evaporator coil (2, Figure 4-7). Assemble suction tube connection (4) and braze joint. Secure coil with six screws through each end flange.

(8) Form distributor lines (3, Figure 4-7) close to inside surface of evaporator coil (2), and connect expansion valve body (14) to liquid line from sight-glass liquid indicator. Braze joint.

(9) Using new gaskets (6 & 8, Figure 5-4). Install the expansion valve body (9), taking care to align projections on the cage with recesses in the body. Secure with two capscrews (10).

(10) Connect equalizer line to expansion valve, and tighten flare nut.

(11) Carefully lead sensing bulb and capillary tube to band clamp on suction line between the elbow from the evaporator coil suction tube extension (4, Figure 4-7) and the tee connection to the equalizer line. Mount sensing bulb 45 degrees below the horizontal centerline of the suction tube, and tighten band clamp. Loop surplus capillary tubing carefully to prevent kinking, and secure to equalizer line with tape.

(12) Install a new drier-strainer (dehydrator) (8, Figure 5-2) with the direction-of-flow arrow pointing down. Connect flare nuts (9), and tighten using a back-up wrench to prevent damaging the connections.

(13) Attach all band clamps (10), loop clamp, spacers ant other attaching hardware to refrigerant tubing and adjacent structural members.

(14) Connect capillary tubes from pressure cutout switches to their respective fittings on liquid (high-pressure) ant suction (low-pressure) lines, if they were disconnected at disassembly. Tighten flare nuts.

(15) Connect a cylinder of oil-pumped dry nitrogen to the compressor discharge service valve. Connect a hose of sufficient length to carry exhausted gas to a safe area to the suction line service valve gage port, and open both valves. Open the nitrogen cylinder shutoff valve slightly to create a flow of 1-2 CFM (0.5 - 1M3) through the system to purge it while continuing the assembly procedure.

(16) Install evaporator fan, motor and support bracket assembly in casing, and secure with four cap screws and washers.

(17) Install the two evaporator fan inlet rings (12 & 13, Figure 4-15) on the walls of the return-air plenums, small diameter facing toward center, and flat of OD facing forward. (See Figure 4-15). Secure with four screws and eight flat washers in each.

(18) Install heater assembly (Figure 4-14) as a unit by lowering the assembly down between the perforated baffle and the inner surface of the evaporator coil. Secure with two screws through each return air plenum into the bracket supports (8).

(19) Install wiring harnesses in casing, making sure that grommets are installed in holes to prevent chafing and air leakage. Secure harnesses to structural members with loop clamps where appropriate.

(20) Install the fresh air grille and baffle assembly (3, Figure 4-6) in the upper rectangular opening in the back of the casing. Secure with 12 screws and washers. Insert the connecting rod (26) into the ball joint (21), and adjust so that damper (6) is closed when actuating arm (A, 18) is vertical, then tighten locknut on ball joint.

(21) Install the deflector door assembly by securing the hinge support bracket to the casing with six screws. Secure the mounting feet (6, Figure 4-5) of the lid supports (5) to the casing with two screws through each foot.

(22) Slide air filters (2) into slots in back surface of casing, and install covers (1) by tightening six panel fastener screws in each cover.

(23) Prepare the refrigeration system for charging by attaching a pressure gage to the high-pressure service valve gage port, and a pressure hose and drier-strainer, loosely, to the suction service valve gage port. Leave both valves closed. Proceed as follows:

WARNING

Avoid contact with liquid refrigerant or escaping refrigerant gas. Irreversible tissue damage can result from sudden freezing. Be especially careful to protect the eyes. Avoid inhaling high concentrations of refrigerant gas, and prevent gas coming into direct contact with flames or hot metal surfaces; lethal phosgene gas can be formed.

(a) Connect a cylinder of refrigerant, R22, to the pressure hose. Open the cylinder shutoff valve slightly to purge the hose of air, then tighten the hose connection to the suction service valve gage port.

(b) Open both service valves and the cylinder shutoff valve, and charge the system with refrigerant gas until the gage on the discharge (high-pressure) service valve registers 70 PSI (5 KG/CM2). Close the suction service valve and the cylinder shutoff valve.

(c) Transfer the charging line to a cylinder of dry nitrogen. Open cylinder shutoff valve and suction service valve, and let nitrogen flow into the refrigeration system until the discharge pressure gage reads 360 PSI (21.44 KG/CM2). Turn off suction and discharge service valves and cylinder shutoff valve. Disconnect the charging line from the suction service valve.

(d) Test the refrigeration system for leaks, using an electronic leak detector, Halide torch or soap bubble method. The electronic leak detector is preferred.

CAUTION

The electronic leak detector and the Halide torch are 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 electronic 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. ***Halide Torch***. Turn on the gas from the cylinder and light the torch. Adjust to obtain a stable light-blue flame. Pass the open end of the sensing tube slowly around all locations at which a leak could exist. A small leak will be indicated by the flame turning from blue to green. A large leak will be indicated by the flame turning from blue to indigo with red tip, or the torch may be extinguished.

3. ***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.

(e) Discharge the system in accordance with paragraph 5-6. If leaks are detected, repair and retest as directed above. If system is leak-tight, proceed as follows:

(f) Connect a vacuum pump to the suction service valve gage port, and a vacuum gage to the discharge service valve gage port. Start the pump, and open both service valves. Operate vacuum pump until pressure in the system is reduced to not more than 500-Microns. Close suction line service valve, and turn vacuum pump off. Let unit stand in this condition for at least three hours. If the system holds the vacuum without change, continue with step (g). If 500-Micron 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 problem.

2. Leaks in refrigeration system. Break vacuum with dry nitrogen and retest for leaks.

3. Internal leakage of vacuum pump. Test pump by connecting the gage directly to the vacuum pump intake and continuing to pump. If pump still fails to reach 500-Microns, pump is faulty.

(g) With suction line service valve closed, disconnect the vacuum pump and attach a cylinder of dry nitrogen. Leave connection to suction service valve loose. Turn on cylinder shutoff valve for a few seconds to purge the line of air. Tighten connection, and crack the suction line service valve open slightly until system reaches atmospheric pressure (760 MM). Close the suction service valve and cylinder shutoff valve, and disconnect the nitrogen cylinder.

(h) Reconnect vacuum pump the suction line service valve gage port, and start pump. Open suction line service valve, and again pump until a 500-Micron vacuum is achieved. This double evacuation will remove all traces of water vapor from the system. Close the suction line service valve, and disconnect the vacuum pump. Close the discharge line service valve, and remove the vacuum gage.

(i) Connect a cylinder of refrigerant, R22, loosely to the discharge line service valve. Open the cylinder shutoff valve for a few seconds to purge line of air. Tighten service valve connection. Charge refrigeration system as directed in the following steps:

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

NOTE

If cylinder is equipped with both liquid and gas (vapor) valves, connect the line to the liquid value.

2. Weigh the cylinder, and record the weight.

3. Open the discharge line service valve, and slightly open the refrigerant cylinder shutoff valve. Liquid refrigerant will be sucked into the refrigeration system rapidly at first, then more slowly as pressures begin to equalize. When 25 pounds (11.4 KG) of refrigerant have flowed into the refrigeration system, as indicated by the scale, close the discharge line service valve and the cylinder shutoff valve.

(24) Position the motor support bracket assembly (rear panel) (12, Figure 4-5) on blocks behind the opening in the casing, and attach associated items as follows:

(a) Position the pressure cutout switch housing behind the small rectangular panel, and secure with four screws.

(b) Place a lock washer and flat washer on grounding bolt, and insert bolt through terminal lug of grounding cable from junction box. Place a flat washer over the terminal lug, and insert the bolt through the panel. Place a flat washer, a nut, two flat washers, and another nut on the grounding bolt, in that order.

(c) Push the shaft and ferule of the circuit breaker flexible actuating cable through the hole in the rectangular panel. Install a lock washer, nut and jam nut, and tighten nut and jam nut. Pull shaft all the way out, and grip with a brass or copper strip held in a pair of pliers. Screw knob onto shaft.

(25) Push motor support bracket assembly (rear panel) into position on casing, and secure with nine screws through each side flange. Remove support blocks, and install six screws into base plate and six screws through upper flange.

(26) Install the junction box and control panel assembly and secure it with six screws through the casing into the side mounting flange, and two screws and washers through lower right hand mounting bracket. Carefully lead control thermostat sensing bulb and capillary tube around condenser coil, and mount bulb in loop clamp in middle of evaporator intake chamber.

(27) Connect all wiring harness plugs to their associated receptacles. (See the wiring diagram on the junction box cover or Figure 4-16).

(28) Install the condenser intake screen. Secure with 12 screws.

(29) Slide the mist eliminator into channels in front of evaporator coil.

(30) Position the top panel on the air conditioner. Secure it with 31 screws and washers.

(31) Position the evaporator air discharge grille on the unit, and secure with 16 screws and washers.

(32) Position two evaporator air intake grilles on air conditioner, and secure with 12 screws and washers in each.

(33) Connect power to air conditioner, pull then push circuit breaker operating knob, and press and release reset buttons on both pressure cutout switches. Check operation as follows:

WARNING

Hearing protection must be worn when maintenance is performed while air conditioner is in operation. Failure to heed this warning can result in hearing loss or injury.

CAUTION

Connect power to unit as soon as possible after charging or any period when power has been disconnected. Allow heater time to vaporize refrigerant in compressor before operation in COOL mode. If knocking or pounding is heard at start of COOL mode, turn selector switch to OFF or VENTILATE at once and allow additional warm up time.

(a) With power connected to the air conditioner, turn mode selector switch to cool. Turn temperature control thermostat to maximum decrease position. With compressor operating, observe the sight-glass liquid indicator. If bubbles of milkiness appear, top off the refrigerant charge as follows:

1. Connect a cylinder of refrigerant, R22, loosely to the gage port of the suction line service valve. Open the cylinder shutoff valve for a few seconds to purge air from line. Tighten the connection. Leave the cylinder upright.

2. With the air conditioner compressor operating, open the suction line service valve and the cylinder shutoff valve to charge refrigerant gas into the system, while observing the sight-glass liquid indicator.

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

4. Disconnect refrigerant cylinder, and replace caps on both service valves.

(34) Position front access cover on air conditioner by inserting lower edge behind step in base plate. Push into contact with casing, and secure with four panel fastener screws.

APPENDIX A
REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguisher Approved for Army Users

A-2. Lubrication

C91001L	Fuels, Lubricants, Oil and Waxes

A-3. Painting

TM 43-0139	Painting Instructions for Field Use

A-4. Maintenance

DA Pamphlet 738-750	The Army Maintenance Management System (TAMMS)
TM 9-4120-357-24P	Unit, Direct and General Support Maintenance Repair Parts and Special Tools List (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

Section I. INTRODUCTION

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) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

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

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 instrument 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. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

B-3. **Column Entries Used in the MAC**

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 names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. ***Column 3, Maintenance Functions***. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph B-2.)

d. ***Column 4, Maintenance Level***. Column 4 specifies, by 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 of complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate "work time" figures will be shown for each level. The number of manhours specified 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. The symbol designations for the various maintenance levels are as follows:

C	Operator or Crew
O	Unit Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

e. ***Column 5, Tools and Equipment***. Column 5 specified, by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated functions.

B-4. **Column Entries Used in Tool and Test Equipment Requirements**

(Not applicable).

B-5. **Explanation of Columns in Section IV**

a. ***Reference Code***. The code scheme recorded in Column 6, Section II.

b. ***Remarks***. This column lists information pertinent to the maintenance function being performed as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIP	(6) REMARKS
01	Related Exterior Parts								
0101	Canvas Cover	Install		0.5					
		Replace		0.7					
0102	Top Panel Assembly	Replace		0.3					
	Gasket	Replace		0.6					
	Insulation	Replace		1.0					
0103	Air Discharge Grille	Inspect		0.1					
		Service		0.2					
		Replace		0.2					
		Repair		0.3					
	Gasket	Replace		0.6					
0104	Air Intake Grilles	Inspect		0.2					
		Service		0.4					
		Replace		0.4					
	Gasket	Replace		0.6					
0105	Front Access Panel	Replace		0.2					
		Repair		1.0					
	Gasket	Inspect		0.2					
		Replace		0.6					
	Insulation	Inspect		0.2					
		Replace		0.8					
0106	Circuit Breaker Access Cover	Replace		0.2					
0107	CBR Cover	Replace		0.2					
0108	Fresh Air Filter	Inspect		0.1					
		Service		0.3					
		Replace		0.4					
0109	Condenser Air Inlet Screen	Inspect		0.2					
		Service		0.4					
		Replace		0.4					
0110	Back Panel and Motor Support	Replace		4.0					
0111	Fan Guard, Condenser	Inspect		0.1					
		Service		0.3					
		Replace		0.5					
0112	Air Conditioning Filters	Inspect		0.3					
		Service		0.5					
		Replace		0.3					
0113	Fresh Air Damper Control	Inspect		0.4					
		Adjust		0.5					
		Replace		1.5					
		Service		0.5					
		Repair		2.0					
0114	Mist Eliminator	Inspect		0.5					
		Service		0.6					
		Replace		0.4					
0015	Blockoff Plate	Install		0.6					
0116	Instruction Plates	Replace		3.0					
0117	Casing Assembly	Replace		48.0					
		Repair		6.0					
	Insulation	Replace		6.0					
02	Control Panel and Junction Box								
0201	Control Panel	Replace		1.0					
		Repair		2.5					
	Selector Switch	Test		1.0					
	Temperature	Test		0.7					
	Control	Replace		1.5					

Section II. MAINTENANCE ALLOCATION CHART (Cont'd)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIP	(6) REMARKS
0202	Junction Box Fuse	Replace		1.6					
		Test		0.2					
		Replace		0.2					
	Circuit Breaker Test			1.5					A
		Replace		1.5					
	Heater and Motor Relays	Test		1.5					C
		Replace		1.3					C
	Time Delay Relay	Test		1.5					
		Replace		1.3					
	Transformer	Test		0.6					
		Replace		1.0					
0209	Terminal Boards	Inspect		0.7					C
		Replace		1.5					C
	Electrical Receptacles	Inspect		0.5					C
		Replace		2.0					C
	Filter and Rectifier Assembly	Test		1.5					
		Replace		0.7					
	RFI Filter Assy.	Test		2.0					
		Replace		1.0					
	Rectifier	Test		1.5					
		Replace		1.0					
03	Compressor Assembly								
0301	Compressor	Test		1.2					A
		Replace			10.0				B
0302	Compressor Crankcase Heater	Test		1.0					A
		Replace		2.4					
04	Pressure Control Switch								
0401	High Pressure Cutout Switch	Test		1.0					
		Replace			3.0				
05	Refrigeration System								
0501	Refrigeration Tubing and Fittings	Inspect			2.0				
		Test			2.0				
		Replace			40.0				B
0502	Pressure Equalizer Solenoid Valve	Test		1.0					B
		Replace			3.0				
	Coil	Test		1.0					
		Replace		1.2					
0503	Liquid Line Solenoid Valve	Test		1.0					
		Replace			3.0				B
	Coil	Test		1.0					
		Replace		1.2					
0504	Sight-Glass Liquid Indicator	Inspect		0.2					
		Replace			3.0				B
0506	Drier-Strainer Dehydrator	Replace			3.0				B
0507	Back Pressure Regulating Valve	Adjust			2.0				
		Replace			3.0				B
0508	Pressure Relief Valve	Replace			3.0				B
0509	Check Valve	Replace			3.0				B
0510	System Access (Service) Valves	Inspect			0.2				
		Replace			3.0				B
0511	Receiver	Replace			3.5				B
0512	Accumulator Tanks	Replace			3.0				B
0513	Thermal Expansion Valves	Test			2.0				C
		Adjust			3.0				C
		Replace			4.0				B,C
0514	Condenser Coil	Service		1.0					
		Replace			6.0				B
0515	Evaporator Coil	Service		1.3					
		Replace			4.0				B

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIP	(6) REMARKS
06	Electric Heating Elements	Test		0.6					
		Replace		1.1					
0602	Heater Thermostatic Switch	Test		1.0					
		Replace		1.0					
07	Fans and Motors								
0701	Evaporator Fan and Motor								
	Assembly	Replace		2.6					
	Evaporator Fans	Replace		2.5					
	Evaporator Fan Motor	Inspect		0.7					
		Test		0.8					A
		Replace		2.7					
		Repair		3.5					
0702	Condenser Fan and								
	Motor Assembly	Replace		4.0					
	Condenser Fan Impeller	Replace		1.5					
	Condenser Fan Motor	Inspect		0.8					
		Test		0.8					A
		Replace		2.7					
		Repair		3.5					
08	Wiring Harnesses								
0801	Wiring Harnesses	Inspect		0.5					C
		Test		1.0					C
		Replace		1.0					C
		Repair		2.0					C
	Wire Leads	Inspect		0.4					C
		Test		0.5					C
	Replace			0.6					C
	Repair			0.6					C
0803	Receptacle Connectors	Inspect		0.3					C
		Test		0.4					C
		Replace		1.5					C
0804	Plug Connectors	Inspect		0.3					C
		Test		0.3					C
		Replace		1.5					C

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NSN	(5) TOOL NUMBER
	F-H	Recovery and Recycling Unit, Refrigerant	4130-01-382707	17500B 07295)

Section IV.. REMARKS

Reference Code	Remarks
A	In-place electrical continuity test, only
B	Does not include 12-hour (min.) system discharge and recharge time.
C	Time required per unit (average).

APPENDIX C
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

C-1. SCOPE

Section II of this appendix lists expendable/durable supplies and materials you will need to operate and maintain the air conditioner. These items are authorized to you by CTA 50-970, Expendable Items. (Adjust when higher category maintenance requirements are involved).

C-2. EXPLANATION OF COLUMNS IN SECTION II

a. Column 1, Item Number. This number is assigned to the entry 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 - Operator/Crew
O - Unit Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column 3, National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4, Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.

e. Column 5, Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) National Level	(3) Stock Number	(4) Description	(5) U/M
1	F	5350-00-192-5047	Abrasive cloth	pg
2	F	3040-00-664-0439	Adhesive, General Purpose 1 pint container	ea
3	F		Brazing alloy, silver QQ-B-564, grade O, I or II	
4	F		Brazing alloy, silver QQ-B-564, grade III	
5	F	3949-00-640-3713	Flux, brazing O-F-499, type B	
6	O	3439-01-045-7940	Flux, Soldering, Liquid Rosin Base MIL-F-14256	qt
7	F		Lubricating Oil VV-L-825, type IV	qt
8	F	6850-00-837-9927	Monochlorodifluoromethane, Technical: w/cylinder 22 lb. (Refrigerant-22) BB-F-1421 type 22, (81348)	cy
9	F	6930-00-292-0732	Nitrogen	cy
10	F	9150-00-058-2301	Oil Vacuum pump, Duo-seal	qt
11	F	7920-00-205-1711	Rags	
12	O		Silicone Adhesive Sealant RTV General Purpose MIL-A-46106, Type I	
13	O,F	6850-00-264-9037	Solvent, Dry Cleaning P-D-680 (81348)	pt
14	O		Solder, Lead-Tin, QQ-S-571 Type SN60WRP2	
15	F		Tape PPP-T-60, type IV, Class I	roll
16	F	8030-00-889-3534	Tape, Antisieze, Polytetrafluoroethylene MIL-T-27730, size I	roll
17	F	6830-00-872-5120	Trichloromonofluoromethane Technical: w/cylinder 50 lb. (Refrigerant-11) BB-F-1421 Type II (81348)	cy

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Chief of Staff

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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 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

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

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