TM 5-4120-222-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DS, AND GS MAINTENANCE MANUAL

AIR CONDITIONER: COMPACT, VERTICAL

208, 3 PHASE: 18,000 BTUH COOLING 12,000 BTUH HEATING (TRANE MODELS)

50/60 HERTZ MODEL CE20VAL6

FSN 4120-00-973-4589

400 HERTZ MODEL CE20VAL4

FSN 4120-00-858-5795

This copy is a reprint which includes current pages from Changes 1 through 4.

HEADQUARTERS, DEPARTMENT OF THE ARMY

21 NOVEMBER 1969

TAGO 20053A

WARNING

GAS UNDER PRESSURE

is used in the operation of this equipment.

DEATH

or serious injury may result if personnel fail to observe the following safety precautions.

Do not perform maintenance on components when power is applied to the equipment.

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

Be careful that Refrigerant-22 does not come in contact with eyes. If leak occurs, ventilate the area immediately.

WARNING

The burning of polyurethane foams is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation in its proximity, precautions should be taken to adequately ventilate the area An exhaust system equivalent to that of a paint spray booth should be used. Air supplied respirators approved by the National Institute for Occupational Safety and Health or the US Bureau of Mines, should be used for all welding in confined spaces and when ventilation is inadequate, Individuals who have chronic or recurrent respiratory conditions, including allergies and asthma, should not be employed in this type of environment.

CHANGE

No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 20 NOVEMBER 1990

Operator, Organizational, Direct Support and General Support Maintenance Manual

AIR CONDITIONER, COMPACT VERTICAL, 208 V, 3 PHASE:
18,000 BTUH COOLING, 12,000 BTUH HEATING (TRANE MODELS)
50/60 HERTZ. MODEL CE20VAL6, NSN 4120-00-973-4589
400 HERTZ MODEL CE20VAL4, NSN 4120-00-858-5795

Approved for public release; distribution is unlimited

TM 5-4120-222-14, 21 November 1969 is changed as follows:

Page 18, paragraph 2–13 is superseded as follows:

2-13. Operation in Extreme Heat.

NOTE

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

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

b. Protection.

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

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

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

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

NOTE

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

c. Cleaning.

(1) Clean outside grilles, coils, filters, and mist eliminator more frequently.

Page 19, paragraph 2–14 is superseded as follows:

2–14. Operation in Dusty or Sandy Conditions.

NOTE

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

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

CAUTION

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

b. Protection.

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

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

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

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

c. Cleaning.

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

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

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

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

THOMAS F. SIKORA
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12–25E, (qty rqr block no. 0178)

* U.S. GOVERNMENT PRINTING OFFICE: 1991 554-1 23/20228

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CHANGE

NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D, C, *24 February 1978*

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

AIR CONDITIONER: COMPACT, VERTICAL, 208, 3 PHASE, 18,000 BTUH COOLING, 12,000 BTUH HEATING, (TRANE MODELS) 50/60 HERTZ, MODEL CE20VAL6, NSN 4120-00-973-4589, 400 HERTZ, MODEL CE20VAL4, NSN 4120-00-858-5795

TM 5-4120-222-14, 21 November 1969, is changed as follows:

APPENDIX C, Section II. MAINTENANCE ALLOCATION CHART is superseded as follows:

Section II. MAINTENANCE ALLOCATION CHART

AIR CONDITIONER TRANE MODEL CE20VAL4 AND MODEL CE20VAL6

(1) Group No.	(2) Assembly group	(3) Maintenance Functions A Inspect	B Test	C Service	D Adjust	E Aline	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
01	FRAME													
	Base assembly	F							F					
	Casing assembly	F							F					
	Guard, condenser fan	O							O					
	Screen, drain	O							O					
02	PANELS													
	Baffle	F							F					
	Chain and damper control	O							O					
	Cover assemblies	O							O					
	Damper assembly	F							F					
	Grilles	O							O					
	Insulation	F							F					
	Sound attenuator	O							O					If required
03	ACCESSORY ITEMS													
	Remote control	O							O					
04	ELECTRIC MOTOR													
	Motor assembly, blower		F						O	F				
	Rotor, blower motor	F							F					
	Stator, blower motor	F							F					
	Cover, stator housing	F							F					
	Endbell, housing	F							F					
	Housing, stator	F							F					
	Bearings	F							F					

AIR CONDITIONER TRANE MODEL CE20VAL4 AND MODEL CE20VAL6—Continued

(1) Group No.	(2) Assembly group	(3) Maintenance Functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
05	STARTING AND PROTECTING DEVICES.													
	Overload protector		F						F					
	Fuse		C						C					
	Phase relay		F						F					
	Control box	F							F					
	Connector, receptacle	F							F					
	Control panel assembly								F	F				
	Electrical leads	O							O					
	Receptacle	F							F					
	Circuit breaker		F						F					
	Switch, pressure		F						F					
	Thermostats		F						F					
06	ELECTRICAL EQUIPMENT													
	Heater elements	F							F					
	Rectifier		F						F					
07	GAGES													
	Sight glass	O							F					
08	REFRIGERATION AND AIR CONDITIONING COMPONENTS.													
	Compressor assembly		F	F					F					A
	Tubing and fittings	F	F						F					
	Valve, regulating				F				F					
	Valve, service								F					
	Valve, pressure relief								F					
	Valves, solenoid		F						F	F				
	Condenser assembly			C						F				B
	Dehydrator								F					
	Evaporator assembly	O		C					F	F				C
	Mist eliminator			C					O					
	Expansion valve				F				F					
	Fan assemblies								O					
	Air filters			C					O					D

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25C, Operator maintenance requirements for Environmental Equipment: Air Conditioners, 18,000 BTU, Compact.

TM 5-4120-222-14
C 3

CHANGE
No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *13 March 1975*

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

AIR CONDITIONER: COMPACT, VERTICAL, 208, 3 PHASE, 18,000 BTUH COOLING, 12,000 BTUH HEATING, (TRANE MODELS) 50/60 HERTZ, MODEL CE20VAL6, NSN 4120-00-973-4589, 400 HERTZ, MODEL CE20VAL4, NSN 4120-00-858-5795

TM 5-4120-222-14, 21 November 1969, is changed as follows:

Title is changed as shown above.

Page 2 of cover. Add the following warning:

WARNING

The burning of polyurethane foams is dangerous. Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation in its proximity, precautions should be taken to adequately ventilate the area. An exhaust system equivalent to that of a paint spray booth should be used. Air supplied respirators, approved by the National Institute for Occupational Safety and Health or the US Bureau of Mines, should be used for all welding in confined spaces and when ventilation is inadequate. Individuals who have chronic or recurrent respiratory conditions, including allergies and asthma, should not be employed in this type of environment.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25C (qty rqr block No. 541), operator maintenance requirements for environmental equipment: air conditioners, 18,000 BTU, compact.

GPO 907-577

TM 5-4120-222-14
C 2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *22 May 1972*

Operator, Organizational, Direct Support, and General Support Maintenance Manual

AIR CONDITIONER, COMPACT, VERTICAL; 280V, 3 PHASE, 18,000 BTU COOLING, 12,000 BTUH HEATING (TRANE MODELS) 50/60 HERTZ, MODEL CE20VAL6, FSN 4120-973-4589; 400 HERTZ, MODEL CE20VAL4, FSN 4120-858-5795

TM 5-4120-222-14, 21 November 1969, is changed as follows:

Page B1. Appendix B is superseded as follows:

APPENDIX B—BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section I. INTRODUCTION

B-1. Scope

This appendix lists items required by the operator for operation of the air conditioner.

B-2. General

This list is divided into the following sections:

a. Basic Issue Items List—Section II. Not applicable.

b. Items Troop Installed or Authorized List—Section III. A list of items in alphabetical sequence which, at the discretion of the unit commander, may accompany the air conditioner. These items are not subject to turn-in with the air conditioner when evacuated.

B-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR).

(1) *Source code.* This code indicates the source for the listed item. Source codes are:

Code	*Explanation*
P	Repair parts, special tools, and test equipment supplied from GSA/DSA or Army supply system and authorized for use at indicated maintenance levels.
P2	Repair parts, special tools, and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.

(2) *Maintenance code.* This code indicates the lowest level of maintenance authorized to install the listed item. The maintenance level codes is:

Code	*Explanation*
C	Crew/Operator

(3) *Recoverability code.* This code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

Code	*Explanation*
R	Applied to repair parts (assemblies and components), special tools, and test equipment which are considered economically reparable at direct support and general support maintenance levels.
S	Repair parts, special tools, test equipment, and assemblies which are economically reparable at DSU and GSU activities and which normally are furnished by supply on an exchange basis.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based; e.g., *ft*, ea, pr; etc.

e. Quantity Authorized. This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal stock number	(3) Description: Ref No. & mfr code	(3) Description: Usable on code	(4) Unit of meas	(5) Qty auth
PC	7520-559-9618	CASE, maintenance and operation manuals.		ea	1

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-25C (qty rqr block No. 542), Organizational Maintenance Requirements for Air Conditioners: 18,000 BTU Compact.

GPO 907-575

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *6 May 1971*

Operator, Organizational, DS and GS Maintenance Manual
AIR CONDITIONER: COMPACT, VERTICAL, 208 V, 3 PHASE: 18,000 BTUH COOLING, 12,000 BTUH HEATING (TRANE MODELS) 50/60 HERTZ MODEL CE20VAL6, FSN 4120-973-4589 400 HERTZ MODEL CE20VAL4, FSN 4120-858-5795

TM 5-4120-222-14, 21 November 1969, is changed as follows:

Page 53, paragraph 5-33*d*. Note is superseded as follows:

NOTE

To install charge hoses, remove condenser fan and outside air thermostat. Insert hoses through the thermostat hole. Attach hoses to service valves. Install fan prior to operation. Capacity of refrigeration system is 3.7 pounds refrigerant-22, FSN 6830-174-9677.

Page A-1, paragraph A-2. TM 38-750 is changed to read:

TM 38-750 The Army Maintenance Management System

Page B-1. In Section II delete all columns of the following items:

Item 1. BINDER, Looseleaf
Item 4. ATTENUATOR
Item 5. BLOCKOFF PANEL
Item 6. RECEPTACLE, Electrical

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:
To be distributed in accordance with DA Form 12-25, (qty rqr block No. 542) Section III, Organizational Maintenance requirements for Air Conditioners, 18,000 BTU Compact.

GPO 907-476

TECHNICAL MANUAL
No. 5-4120-222-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 21 November 1969

OPERATOR, ORGANIZATIONAL, DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL

AIR CONDITIONER: COMPACT, VERTICAL; 208 V, 3 PHASE; 18,000 BTUH COOLING, 12,000 BTUH HEATING (TRANE MODELS) 50/60 HERTZ MODEL CE20VAL6 FSN 41 20-973-4589; 400 HERTZ MODEL CE20VAL4 FSN 4120-858-5795

☆ This manual supersedes TM 5-4120-222-15, 18 July 1966 .

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual is published for the use of personnel to whom Military Models CE20VAL4 and CE20VAL6 air conditioners are issued. Information is provided on operation, preventive maintenance services, destruction, and organizational, direct. and general support maintenance of equipment, accessories, components, and attachments. Also included are descriptions of main units and their relationship to other components.

b. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

1-2. Forms and Records

a. DA Forms and procedures used for equipment maintenance will be only those prescribed by TM 38-750.

b. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, MO. 63120.

Section II. DESCRIPTION AND DATA

1-3. Description

a. General. The air conditioner (figs. 1–1 and 1-2) is used primarily in van type enclosures for providing filtered, conditioned, or heated air as required to maintain service conditions necessary for the efficient operation of electronic equipment and for the comfort of operating personnel housed within the vans. It is a completely self-contained, air cooled, electric motor driven unit designed for continuous operation with varying loads. It is equipped with internal ducting to the low side of the evaporator fan so that ventilation air from the chemical and biological filter unit may be supplied by the evaporator fan.

b. Condensing Section. The condensing section, located at the bottom of the unit, contains the hermetically sealed compressors, condensing coil, condenser air intake opening, condenser air discharge opening, control panel, control box, thermostatic switch, power receptacle connector, condenser fan, blower motor, dehydrator, suction and discharge valves, and solenoid valves.

c. Evaporator Section. The evaporator section, located in the top of the unit, contains an evaporator coil, evaporator fan, air conditioning filter, intake and discharge grilles, evaporator coil drain pan, expansion valves, electrical heaters, sight glass, and a damper to regulate the amount of outdoor air entering the air conditioner.

1-4. Identification and Tabulated Data

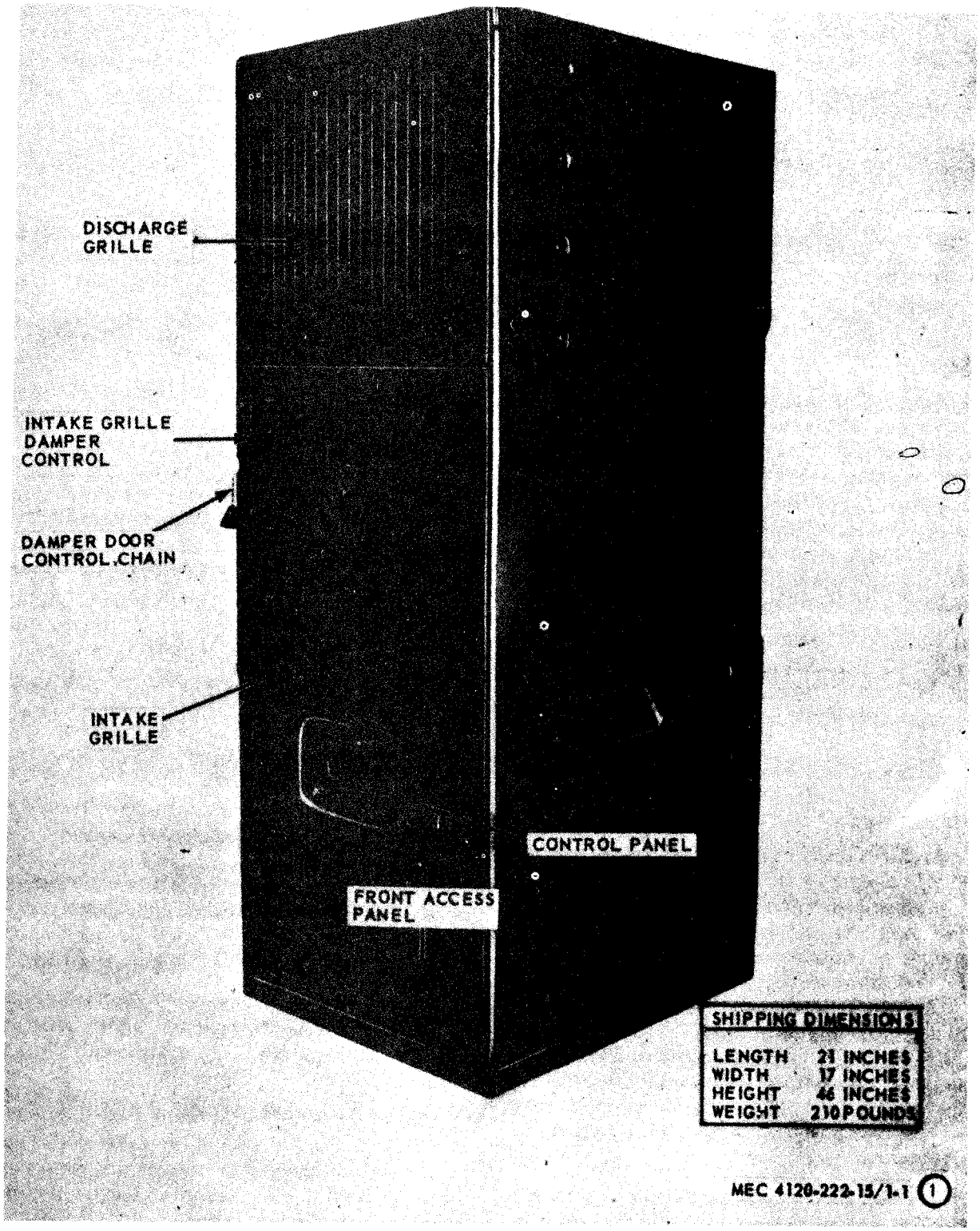
a. Identification. The air conditioners have eleven major identification and instruction plates. Information contained on these plates is listed below.

(1) Air conditioner (Model CE20VAL4)

(a) Corps of Engineers plate A. Located near top of back panel. Specifies nomenclature, manufacturer, model number, serial number, dimensions, weight and capacity

(b) Manufacturer's identification plate. Located on rear panel just below sight glass. Specifies model number and serial number of the unit.

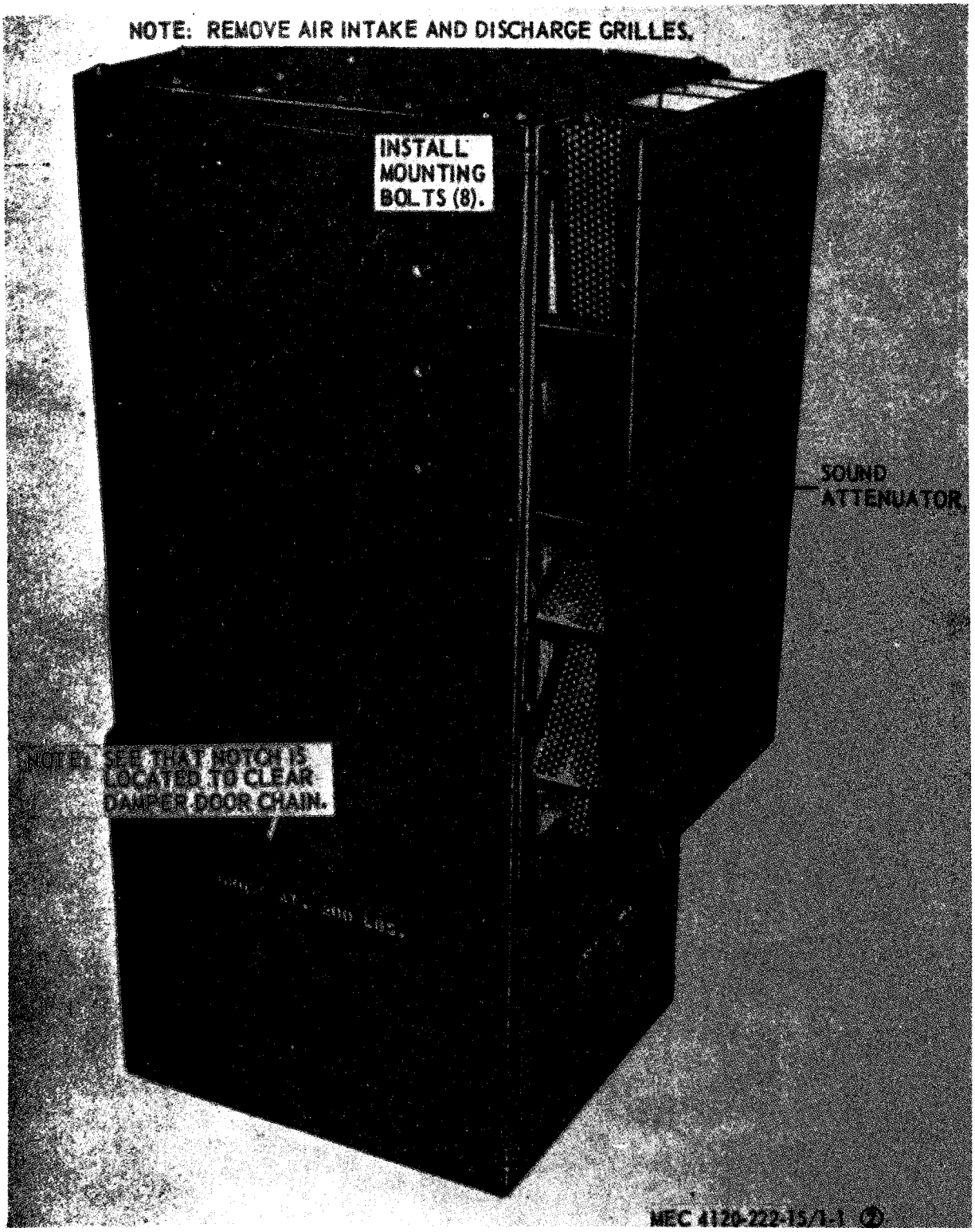
(c) Compressor identification plates. Located on front of compressor housing. Specifies compressor model number, part number, serial number, refrigerant, oil type and capacity, manufacturer, and complete electrical data.



① Left front three-quarter view, with shipping dimensions

Figure 1-1 ① Air conditioner, left front three-quarter view, with shipping dimensions. (Sheet 1 of 2)

Figure 1-1. Air conditioner.



② Eight front three-quarter view, with sound attenuator

Figure 1-1 ②. Air conditioner, right front three-quarter view, with sound attenuator. (Sheet 2 of 2)

Figure1-1—Continued.

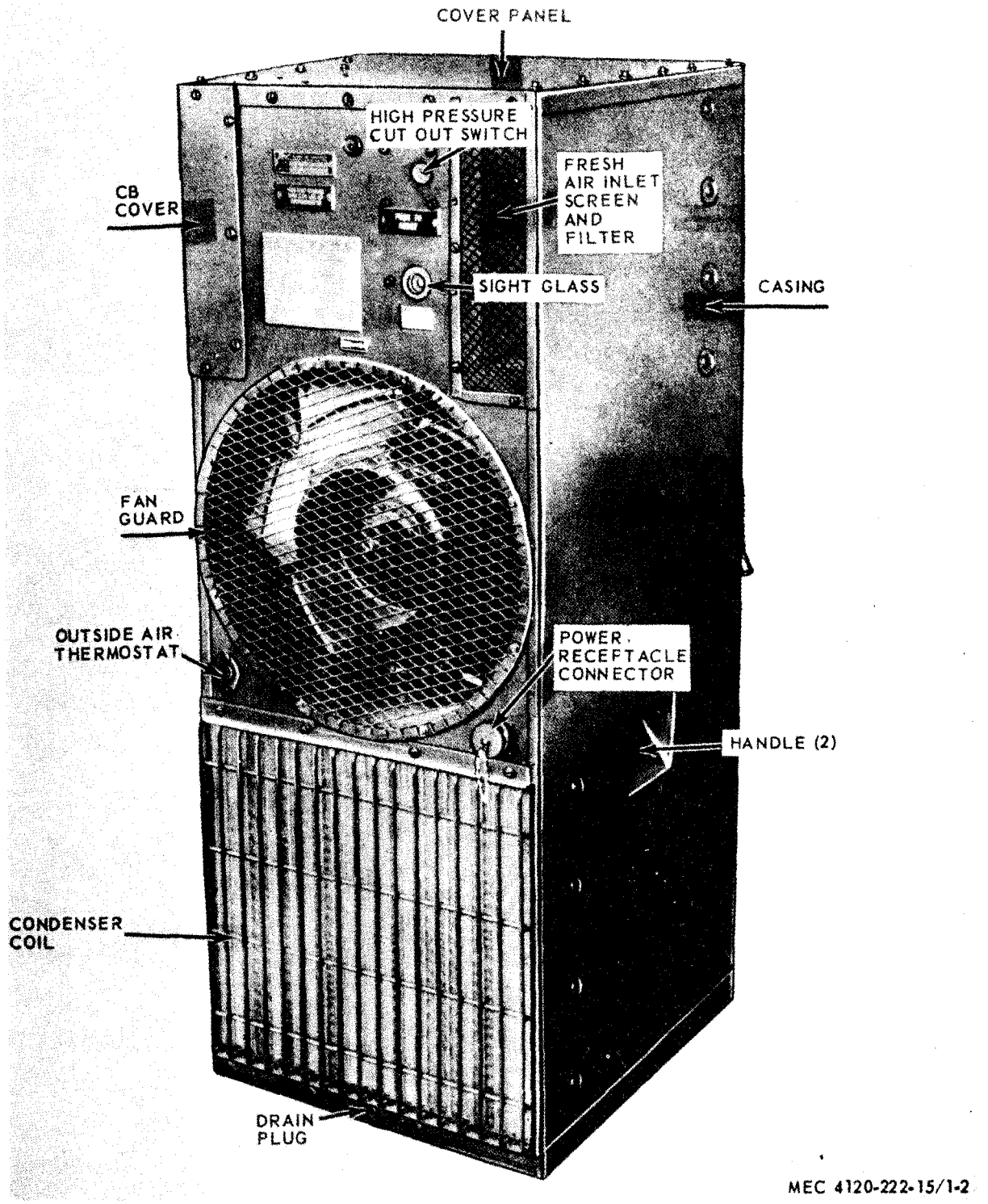


Figure 1-2. Air conditioner, right rear three-quarter view.

(2) Air conditioner (Model CE20VAL6).

(a) Corps of Engineers plate A. Located above fan guard on back panel of unit. Specifies nomenclature, manufacturer, model number, aerial number, dimensions, weight, and capacity.

(b) Manufacturer's identification plate. Located above fan guard on rear panel. Specifies model number and serial number of the unit.

(c) Cornpressor identification plates. Located on front of compressor housing and compressor crankcase. Specifies compressor model number, part number, serial number, refrigerant, manufacturer, and complete electrical data.

(3) *Identification applicable to both models.*

(a) Blower motor identification. Located on top of the blower motor. Specifies motor horsepower, type, serial number, rpm's (revolutions per minute), part number, order number and electrical characteristics.

(b) Control panel legend plate. Located on front of unit control panel. Indicates unit temperature setting for cooling or heating purposes.

(c) Wiring diagram plate. Located on inside of front access panel, illustrates complete unit wiring.

(d) Refrigerant -22 plate. Located on rear panel above condenser fan guard. It states that the unit is charged with 3.50 pounds of Refrigerant -22,

(e) *Color indicating plate.* Located on rear panel immediately below the refrigerant sight glass. It haa three color bands: green, chartreuse, and yellow, which are used in conjunction with the liquid line sight glass to indicate moisture condition of dehydrator.

(f) High pressure cutout control reset plate. Located on rear panel just below high pressure cutout control reset button with nomenclature: PUSH TO RESET

(g) Indicating arrow plate. Located on rear panel just above condenser fan guard; arrow indicates direction of condenser fan rotation.

b. Tabulated Data.

(1) *Air conditioner (Model CE20VAL4)*

(a) Corps of Engineers plate A.

1. Air Conditioner, Self Contained, Base Mtg, 208 VAC, 400 Hertz 3-Phase, Air Cooled.

Stock No-------	FSN 4120-858-5795
Manufacturer ----------	Trane
Model ----------	CE 20 VAL4
Length----------	19 in. (inches)
Width ----------	17 in.
Height----------	46 in.
Capacity----------	18,000 BTU/HR (British Thermal Units/Hour)
Shipping weight----------	210 lb (pounds)

2. Air Conditioner, Self Contained, Base Mtg, 208 VAC, 50/60 Hertz 3-Phase, Air Cooled.

Stock No---------- FSN 4120-973-4589
Manufacturer ---------- The Trane Co.
Model ---------- CE 20 VAL6
Length---------- 19 in.
Width ---------- 17in
Height ---------- 46 in.
Capacity ---------- 18,000 BTU/HR
Shipping weight ---------- 200 lb (pounds)

(b) Manufacturer's identification plate.

Manufacturer ---------- The Trane Company

(c) Evaporator and condenser *fan motor.*

1. Procurement on Trane Model.

Manufacturer ----------	U.S. Electrical Motors, Inc.
HP (horse power) ----------	1.62
Type ----------	Double extended shaft
Volts----------	208
Amps (amperes)----------	0.8
Frame ----------	7234
Frequency----------	400 hertz
Phase----------	3
Part No.----------	405835
RPM ----------	3800
Duty ----------	Continuous
Drive ----------	Direct

2. *Alternate.*

Manufacturer ----------	Welco
HP----------	1.65
Type ----------	Double extended shaft
Volts----------	208
Frequency----------	400 hertz
Phase----------	3
RPM ----------	3700
Duty ----------	Continuous
Drive----------	Direct
Part No.----------	856008

(d) Compressor.

1. Data on.

Manufacturer ----------	Whirlpool
Model ----------	WHP422-H18-208-8
Part No.----------	474843
Type ----------	Rotary Vane
Lubrication ----------	Slinger
Phase----------	3
RPM ----------	3660
Frequency ----------	400 hertz
Voltage ----------	208
Lra (locked rotor amperage) -	64.0

2. *Data on.*

Manufacturer ----------	Bendix-Westinghouse
Model ----------	422H-18
Part No.----------	2101 C2WO65
Type ----------	Hermetically sealed recipro-cating
Lubrication ----------	Forced feed
RPM----------	3750

Displacement	7.0 cfm (cubic feet per minute)
Phase	9
Frequency	400 hertz
Voltage	208
Fla (full load amperage)	20.5
Lra	70.0

(e) Performance data.

Cooling Capacity	18,000 BTU/HR nominal; 19,800 BTU actual at 125°F.(Fahrenheit)DB (Dry Bulb), air to condenser, 90°F. DB, return air to unit at 1.0 SHR (Sensible Heat Ratio) 12,000 BTU/HR (Hi-heat poeition) 6,000 BTU/HR (Lo-heat position).

(f) Dimensions and weight (fig. 1-1).

Length	21 in. (inches)
Width	17 in.
Height	46 in.
Weight (crated)	210 lbs.

(2) *Air Conditioner (Model CE20VAL6)*

(a) *Corps of Engineers plate A. Air Conditioner, Self Contained, Base Mtg, 208 VAC, 50/60 Hertz, 3-Phase, Air Cooled.*

Stock No.	FSN 4120-973-4589
Manufacturer	Trane
Length	19 in.
Width	17 in.
Height	46 in.
Capacity	18,000 BTU/HR
Shipping weight	200 lbs.

(b) Manufacturer's identification plate.

Manufacturer	The Trane Company
Model	CE 20 VAL6

(c) *Evaporator and condenser fan motor.*

1. Procurement on Trane Models.

Manufacturer	U.S. Electrical Motora, Inc.
Type	Double extended shaft
HP	1.42
Volts	208
Amps	4.1
Frame	7244
Frequency	50/60 hertz
Phase	3
PartNo.	405832
RPM	3450
Duty	Continuous
Drive	Direct
Electricaloverload protection.	Automatic reset thermal overload and overcurrent.
Connector	MS3102R14S-7P

2. Alternate.

Manufacturer	Welco
Type	Double extended shaft
HP	1.42
Volts	208
Frequency	50/60 hertz
Phase	3
Part No.	856007
RPM	3450
Duty	Continuous
Drive	Direct
Overload Protection	Automatic reset thermal overload and overcurrent

(d) Compressor.

Manufacturer	Whirlpool
Model	WHP622-H18-208-3
Part No.	474837
Type	Rotary Vane
Lubrication	Forced feed
RPM	3390
Phase	3
Frequency	50/60 hertz
Volts	208
Lra	67.0

Data on.

Manufacturer	Bendix-Westinghouse
Model	MYH700TA-3
Part No.	42594 K200003
Type	Hermetically sealed, reciprocating
Lubrication	Forced feed
RPM	3450
Displacement	6.5 cfm
Phase	3
Frequency	50/60 hertz
Volts	208
Fla	8.5
Lra	61

(e) Performance Data.

Cooling Capacity	18,000 BTU/HR nominal, 19,800 BTU/HR actual at 125 F. DB, air to condenser, 90°F. DB, return air to unit at 1.0 SER.
Heating Capacity	12,000 BTU/HR (Hi-heat position) 6,000 BTU/HR. (Lo-heat position).

(f) Dimensions and Weight.

Length	21 in.
Width	17 in.
Height	46 in.
Weight (crated)	223 lbs.

c. *Data Applicable to Models CE20VAL6 and CE20VAL4.*

(1) *Evaporator and condenser fans.*

Mfg	The Trane Company
Type	Condeneer-propeller Evaporator-Centrifugal
No.perUnit	1 each
Rotation (facing condeneer air discharge grille).	Clockwise

(2) Condenser and evaporator coils.

Mfg	The Trane Company
Type	Brazed aluminum
No. Per Unit	1 each

(3) Motor and heater contractors.

Mfg---------- Cutler-Hammer
Part number---------- 9565ED3
Amps---------- 25
Type---------- 3 pole, single throw, N.O.
Coil---------- Pickup at 170VDC continuous operation at 230 VDC

Operating ambient temperature. +65" to +125°F.

(4) Thermostat control.

Mfg---------- Penn
Type---------- 229XC
Action---------- Single pole double throw
Range---------- +40° to +90°F.
Electrical rating---------- 120 VAC

(5) Selector switch.

Mfg---------- Cutler-Hammer
Type---------- Rotary (manual)
Part No.---------- 8912K216
No. of positions---------- 5 (hi-heat, lo-heat, off, ventilate, cool)
Electrical rating---------- 15 Amps, 250 VAC

(6) Outside air thermostat.

Mfg---------- Stevens Mfg. Co. Inc.
Type---------- NPT25SPDT (single pole, double throw)
Electrical rating---------- 208 VAC, pilot duty 20 VAC.
Operation---------- Contacts open on temperature decrease
Range---------- Contacts open 50° ±3°F.), differential 10 F. maximum

(7) Heater thermostat.

Mfg---------- Metals and controls, Inc.
Type---------- Kilxon MWA1256 automatic reset
Electrical rating---------- 208 V, 60 and 400 hertz, 3 phase resistive load.
Contacts open---------- 90°C. (Centigrade)
Contact close---------- 61°C.

(8) Electric heaters.

Mfg---------- The Trane Company
Type---------- Stainless Steel Sheath
Voltage---------- 120 VAC
Watts---------- 600 each
No. per unit---------- 6

(9) Pressure relief valve.

Mfg---------- Superior
Part No.---------- 3001X3
Setting---------- 540 psi

(10) *Back pressure regulating valve.*

Mug---------- Controls Company of America
Model---------- 104A
Part No---------- 70034-105
Setting---------- 58 psi

(11) *Service valves (suction and discharge).*

Rating---------- 600 psi
No. per unit---------- 2

(12) Solenoid valves.

No. per unit---------- 3 (1 liquid line, 1 hot gas bypass, 1 quench line)
Watts---------- 10
Voltage---------- 187 (DC)
Refrigerant---------- R-22

(13) *Thermo expansion valve (evaporator).*

Mfg---------- Alco
Model---------- TCL50H
Type---------- Angle
Inlet ---------- $^{1}/_{4}$in. OD
Outlet---------- $^{3}/_{8}$in. OD
Setting---------- 10° superheat
Capacity---------- $^{1}/_{2}$ton
Superheat setting---------- 10°F.

(14) *Liquid line sight glass.*

Mug---------- Sporlan
Type---------- SAK13

(15) *High pressure cutout control.*

Mfg---------- Penn
Model---------- 210AP40
Connection---------- $^{1}/_{4}$in. SAE flare
Cutout point---------- 445±10 psi
Manual reset---------- 400 psig

(16) Dehydrator.

Mfg---------- Sporlan
Type---------- C083S

(17) Capacities.

Compressor crankcase------- Oil $3^{1}/_{2}$pts.
Refrigerant charge---------- 3.50 1bs. (R-22)

(18) *Dimensions and weight.*

Length---------- 21 in.
Width ---------- 17 in.
Height ---------- 46 in.
Weight (crated)---------- CE20VAL4 210 lbs.
CE20VAL6223 lbs.

(19) *Base plan.* Refer to figure *1-3* for the base plan.

(20) *Wiring diagrams.* Refer to figure 1-4 for the wiring diagram.

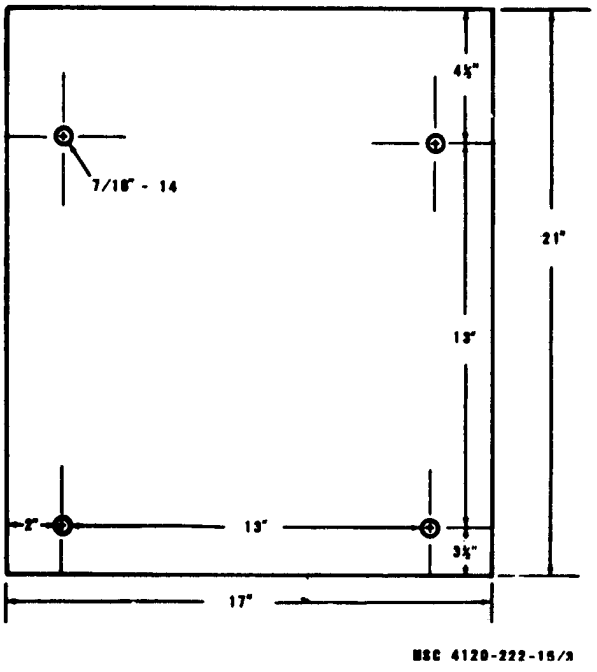


Figure 1-3. Base plan.

Figure 1-4 ①. Practical wiring diagram.

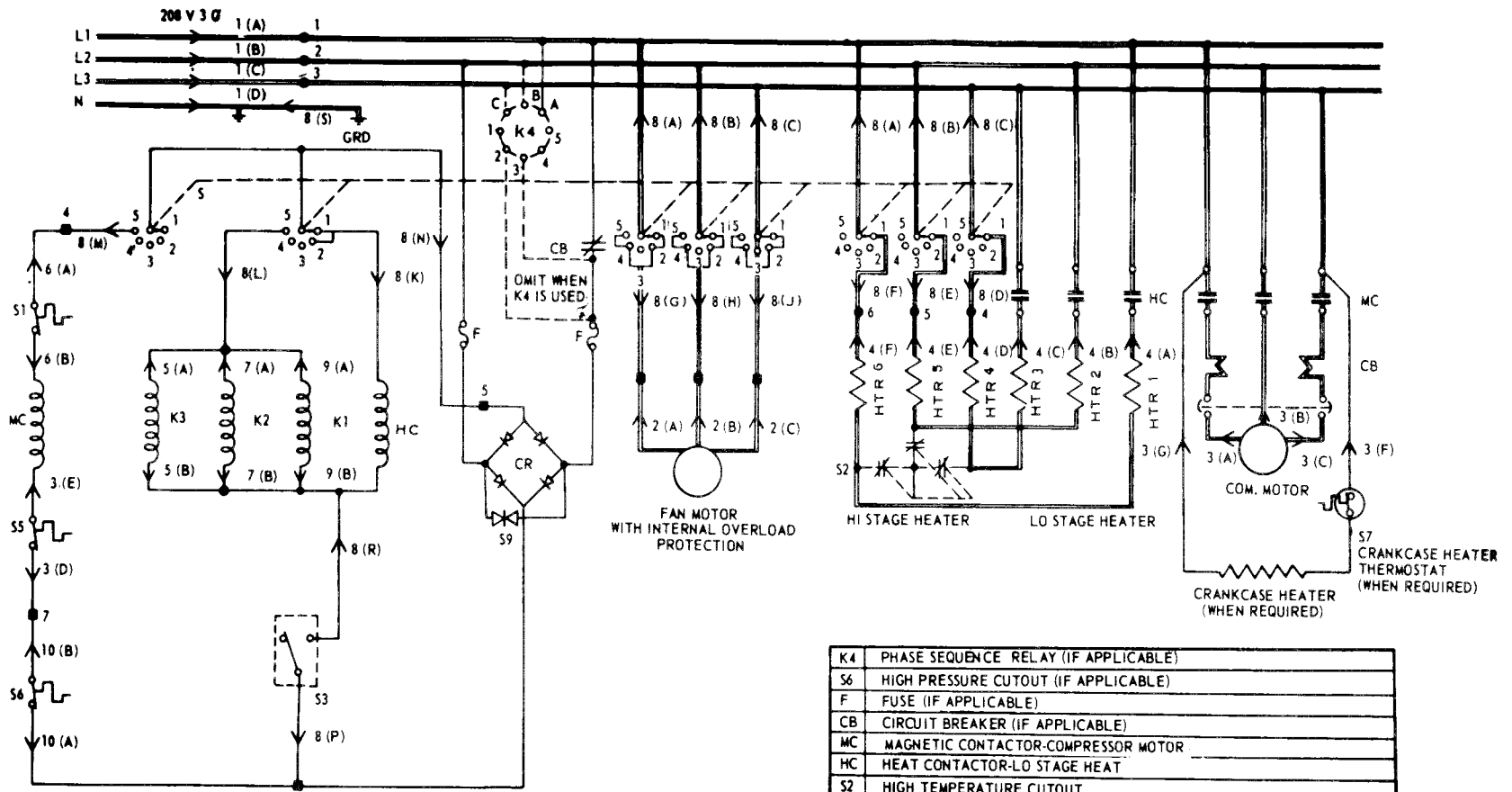
Located in back of manual

1-5. Difference in Models

a. This manual covers Models CE20VAL4 and CE20VAL6 Air Conditioners. Difference between the models are in the blower motors, compressors, and control circuits. Where differences exist, each model is covered separately in the applicable section of this manual. The CE20VAL4 air conditioner has a 400 hertz blower motor and compressor, while the CE20VAL6 has a 50/60 hertz blower motor and compressor. Both models may be equipped with either a Bendix-Westinghouse or Whirlpool compressor. If the unit has a Whirlpool compressor, it will have a phase sequence relay. The Bendix-Westinghouse compressor has a crankcase heater and thermostat.

b. Model CE20VAL4 air conditioners in the following serial number range 259827 through 259944, 264148 through 264189, 280747 and 280748, 280754 through 280765, 292448 through 292452, 298409 and 298410, 298420 through 298480, 303133 through 303157, 308223, 308225 through 308232, 410653 through 410724, 413831 through 413867 have a surge suppressor, rectifier, and circuit breaker but have no high pressure cutout switch, fuses, or the new air foil evaporator and condenser fans. Model CE20VAL4 air conditioners in the following serial number range 450442 through 404510 have a solid state rectifier, two 5 amp fuses, high pressure cutout switch, air foil evaporator and condenser fans, Whirlpool compressor and Welco fan motor. They do not have a surge suppressor.

c. Model CE20VAL6 air conditioners in the following serial number range 283755 through 283764, 292428 through 292437, 292439 through 292445, 292447, 303326 through 303329, 303331 through 303337, 303341 and 303342, 315122 and 315124, 303344 have a surge suppressor and rectifier but have no fuses, circuit breaker, high pressure cut-out switch, solid state rectifier, or the new air foil evaporator and condenser fans. Model CE20VAL6 air conditioners in the following serial number range 432476 through 432485, 450516 through 450668, 481947 through 481962 have a solid state rectifier, two 5 amp fuses, circuit breaker, high pressure cutout switch, Welco fan motor, and the new air foil evaporator and condenser fan but have no surge suppressor. Not all units are equipped with a fresh air filter.



Practical wiring diagram

● TERMINALS OF TB1
■ TERMINALS OF TB2
^ CONNECTOR PIN SYBMOL

SWITCH POSITIONS

1. HI HEAT
2. LO HEAT
3. OFF
4. VENTILATE
5. COOL

K4	PHASE SEQUENCE RELAY (IF APPLICABLE)
S6	HIGH PRESSURE CUTOUT (IF APPLICABLE)
F	FUSE (IF APPLICABLE)
CB	CIRCUIT BREAKER (IF APPLICABLE)
MC	MAGNETIC CONTACTOR-COMPRESSOR MOTOR
HC	HEAT CONTACTOR-LO STAGE HEAT
S2	HIGH TEMPERATURE CUTOUT
CR	BRIDGE RECTIFIER
S3	TEMPERATURE CONTROL
S	SWITCH- 5 POSITION-4 SECTION
K1	SOLENOID VALVE-LIQUID VALVE N.O.
K2	SOLENOID VALVE-LIQUID VALVE N.O.
K3	SOLDNOID VALVE-GAS BY-PASS N.C.
S5	MOTOR TEMP. CUTOUT
S1	OUTSIDE AIR THERMOSTAT OPENS ON TEMP. FALL
S7	CRANKCASE HEATER THERMOSTAT (IF APPLICABLE)
S9	DIODE SURGE SUPPRESSOR (IF APPLICABLE)

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Figure 1-4 ②. Practical wiring diagram. (Sheet 2 of 2)

CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

2-1. Inspecting and Servicing Equipment

a. Perform daily preventive maintenance services (para 3-4).

b. Perform quarterly preventive maintenance service (para 3-4).

c. Inspect entire air conditioner for signs of damage, paying particular attention to evaporator and condenser coils.

d. The air conditioner contains a full operating charge of refrigerant and compressor oil. No further service is required.

2-2. Installation of Separately Packed Components

a. General. The air conditioner is basically a self-contained unit, however, in certain 'installations it may become desirable to utilize the sound attenuator and/or the remote control blockoff plate with an electrical receptacle.

b. Sound Attenuator. The sound attenuator will provide a sound dampening effect and is mounted on the front of the air conditioner (fig. 1–1 (2)). The sound attenuator replaces the air intake and discharge grilles and air is taken in and discharged through the attenuator bases. Air is taken in through the bottom and discharged through the top of the attenuator. Refer to figure 1–1 (2), and install the sound attenuator as follows :

(1) Remove the intake and exhaust grilles (para. 3-17).

(2) Inspect the attenuator for breaks, cracks, or other damage.

(3) Place the sound attenuator in position on the front of the unit by aligning the grille mounting holes with the attenuator mounting holes.

Note. Make sure that the notched edge of the attenuator frame matches the damper door control chain location.

(4) Install the mounting bolts.

(5) Store the grilles so as to avoid possible damage.

c. Blockoff Plate. The blockoff plate is provided for installation when the controls are removed for remote control operation. The blockoff plate provided must be used so that no air will enter the lower compartment. Refer to figure 2–1, and install the blockoff plate.

2-3. Installation or Setting-Up Instructions

a. General. Set air conditioner in a level position to allow proper condensate draining (operation will be satisfactory with unit setting at a slight angle, and using one of the alternate drain connections).

b. Locating the Unit. The front access panel and discharge and intake grilles are removable for normal service and maintenance, and must always be unobstructed to allow sufficient air for condensing purposes. The discharge and intake openings at front of unit should be relatively free from obstruction to permit maximum unit capacity.

Note. Remove discharge and intake grilles and filter, if unit is to be used with ducts carrying air to and from the conditioned space. Install grilles and filter in the duct.

Note. Remove intake cover (fig. 1-2) if a Chemical and Biological filter unit is to be attached to the unit.

c. Installing Unit. Bolt unit to floor or other flat surf ace. Refer to base plan (fig. 1-3) for dimensions. Connect drain hose to drain nipple at bottom of unit to lead condensate away from unit. Alternate $^{1}/_{2}$NPT condensate drain connections are provided at both sides and front of unit. If one of these are used, insert a $^{1}/_{2}$-inch square head plug in the rear connection. Some units are provided with *4* drain plugs installed. Remove the desired drain plug prior to installing the drain hose.

d. Power Source.

(1) Model CE20VAL4. Operates on 208 volt, *400* hertz, 3 phase power.

(2) *Model CE20VAL6.* Operates on 208 volt, 50/60 hertz, 3 phase power.

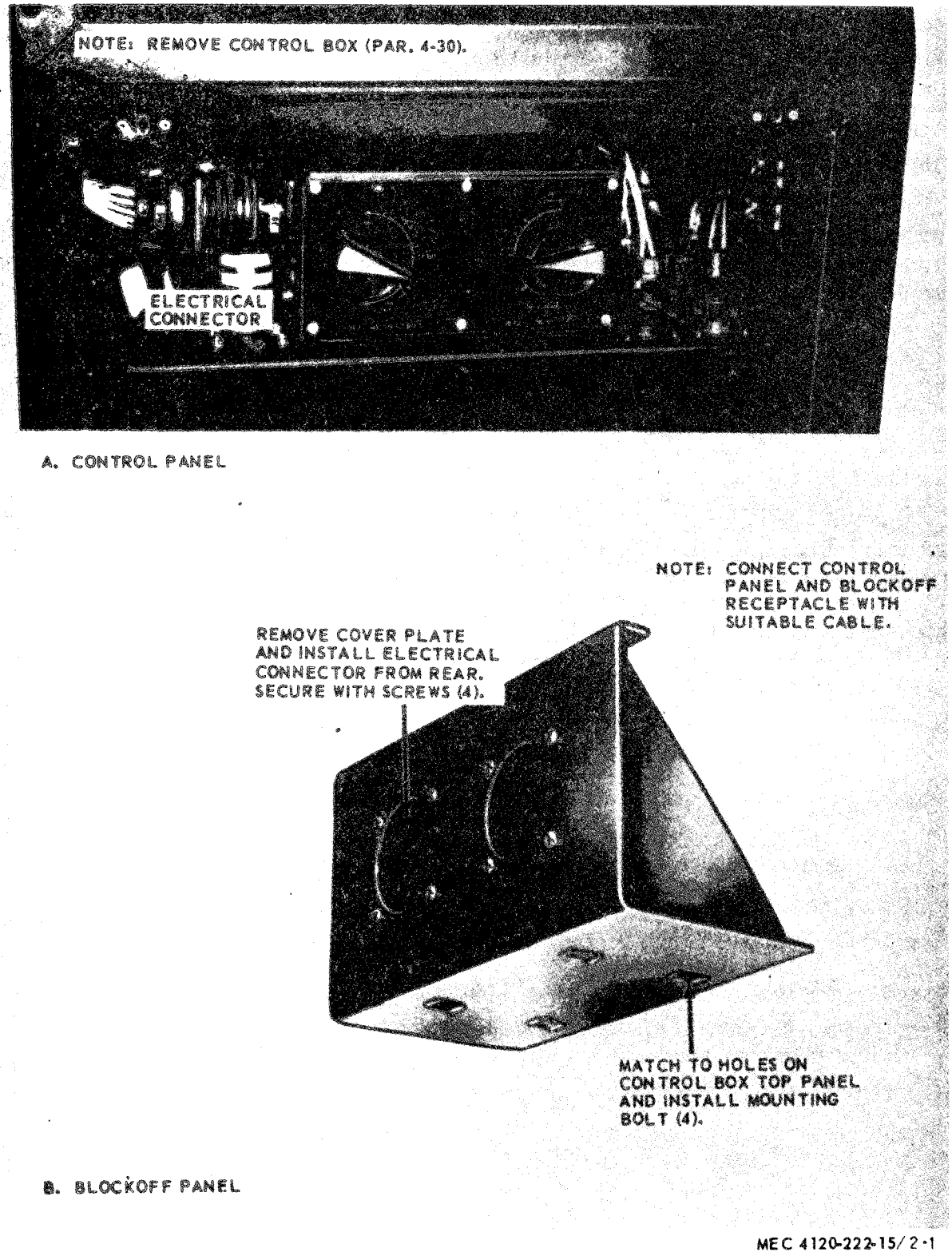


Figure 2-1. Remote control connection installation.

(3) *Power receptacle connector.* An MS3100R–22-22P receptacle is located at rear of unit abve the condenser coil air inlet. Connect the proper electrical power supply source to this receptacle using a MS3106R-22-22S plug or receptacle alternate. Alternate electrical power connections are provided at both sides of the unit, any location may be used by interchanging the power receptacle at rear of unit and one of the cover plates at side of unit. Be sure to attach cover plate over unused location at rear of unit to prevent air from being drawn through the opening.

Caution: **To insure proper electrical power supply connection, momentarily move the selector switch to ventilate. The air flow should be through the intake grille (see fig. 1-1(1)) and out the discharge grille. If the air flow is incorrect, interchange any two power leads. (See wiring diagram.)**

e. Remote control.

(1) *General.* The control panel may be removed from the unit and used as a remote control for operation of the air conditioner. The remote control connection and blockoff plate provided must be used when the control panel is used as a remote control.

(2) Remote control connection.

(a) Disconnect power source from unit.

(b) Refer to figure 2-1, and install the remote control connection.

(3) *Inspection.* Inspect remote control panel for breaks, cracks, or other damage prior to installation.

Section II. MOVEMENT TO NEW WORKSITE

2-4. Dismantling for Movement

a. General.

(1) Shut off electrical power supply to air conditioner and disconnect power cable from unit.

(2) Disconnect drain hose from unit.

Note. Disconnect all duct work and remote control cable if used with unit.

(3) Unbolt unit from mounting surface.

b. Short distance movement. Use a forklift and lift unit at base, or carry unit to new worksite using the recessed handles at sides of unit.

c. Long distance movement. Crate the air conditioner, providing adequate protection to grilles and control panel. Refer to TM 38–230–1 for instruction in crate fabrication. Provide suitable blocking and tie-downs to prevent unit from shifting during transfer.

2-5. Reinstallation After Movement

Reinstall the air conditioner as instructed in paragraph 2–3.

Section III. CONTROLS AND INSTRUMENTS

2–6. General

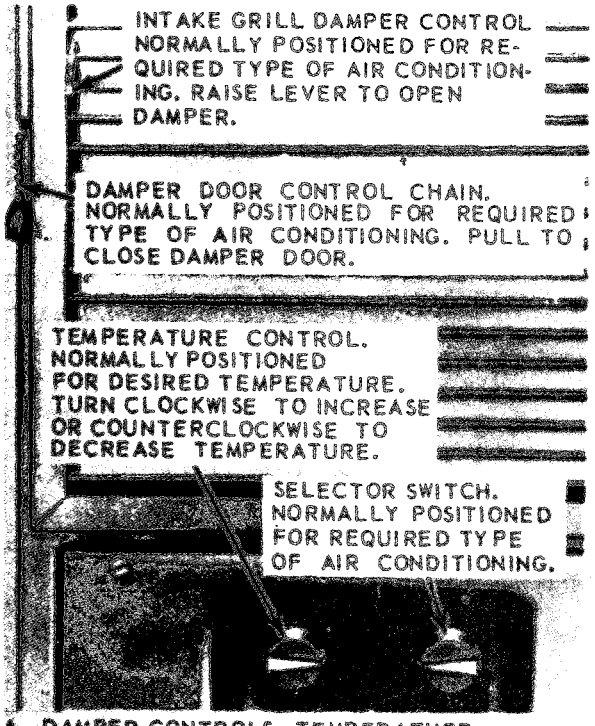
This section describes, locates, illustrates, and furnishes the operator, crew or organizational maintenance personnel sufficient information about the various controls and instruments for proper operation of the air conditioner.

2-7. Controls and Instruments

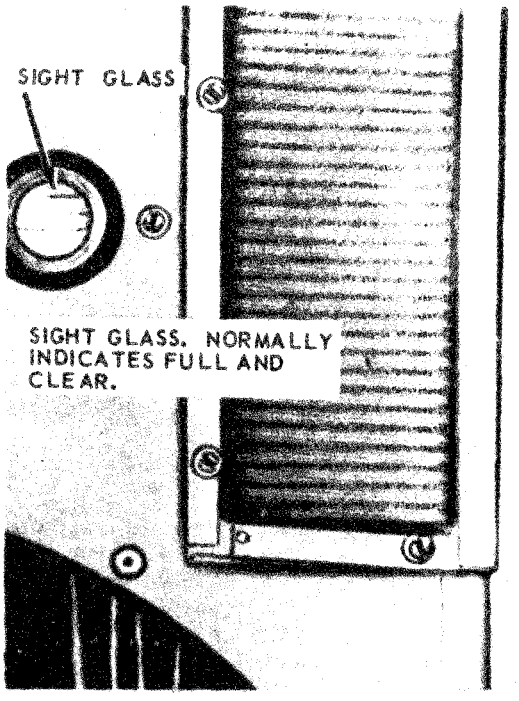
a. The controls and instruments on the air conditioner are illustrated on figure 2–2.

b. High pressure cutout control. The high pressure cutout located at the rear of the unit (fig. 5–15) is designed to sense line pressure from the compressor and will cutout at 445 psig (pounds per square inch gage). When the line pressure has reduced to 400 psi, the high pressure cutout control can be reset by pushing the reset button.

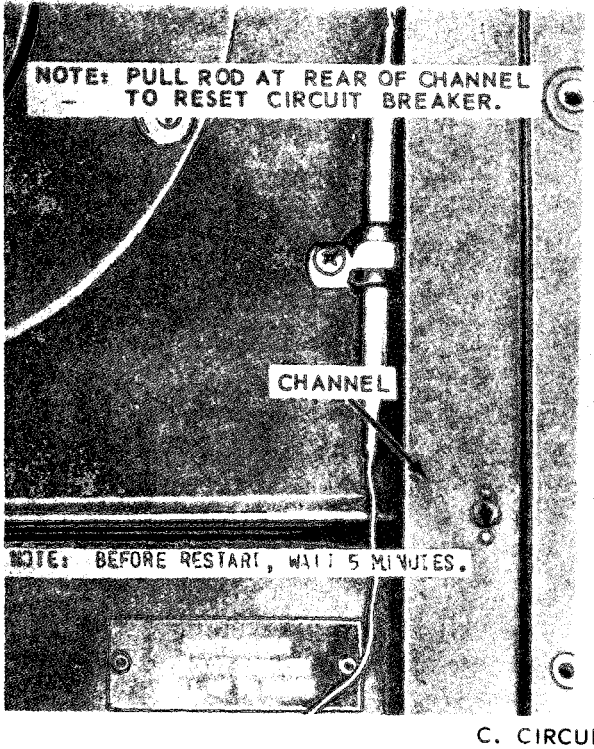
c. Liquid line sight glass. The sight glass (fig. 2–2) indicates dryness of the system. Moisture in the refrigerant is shown by the indicator turning from green to yellow. A shortage of refrigerant is indicated by bubbles in the sight glass.

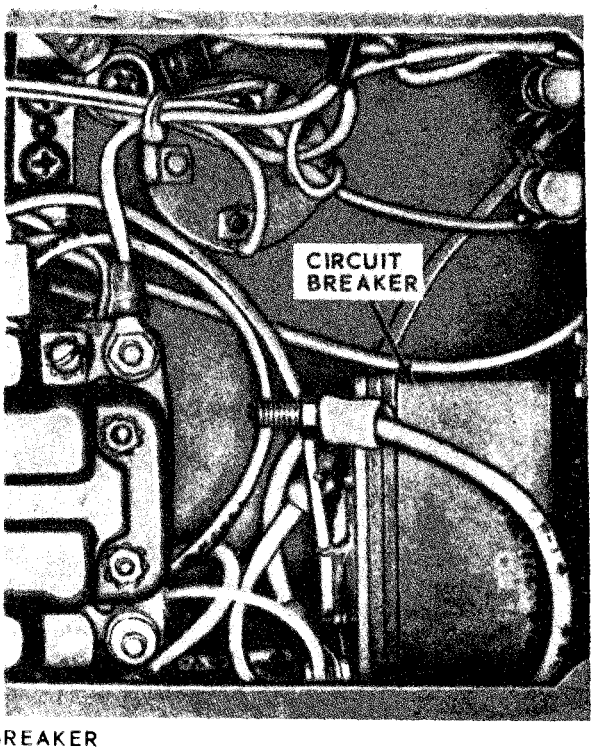


A. DAMPER CONTROLS, TEMPERATURE CONTROL AND SELECTOR SWITCH.



B. SIGHT GLASS.





C. CIRCUIT BREAKER

Figure 2-2. Controls and instruments.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-8. General

a. The instructions in this section are published for the information and guidance of personnel responsible for the operation of the air conditioner.

b. The operator must know how to Perform every operation of which the air conditioner is capable. This section gives instructions on starting, stopping, and operating details of the air conditioner. Since nearly every application pre-

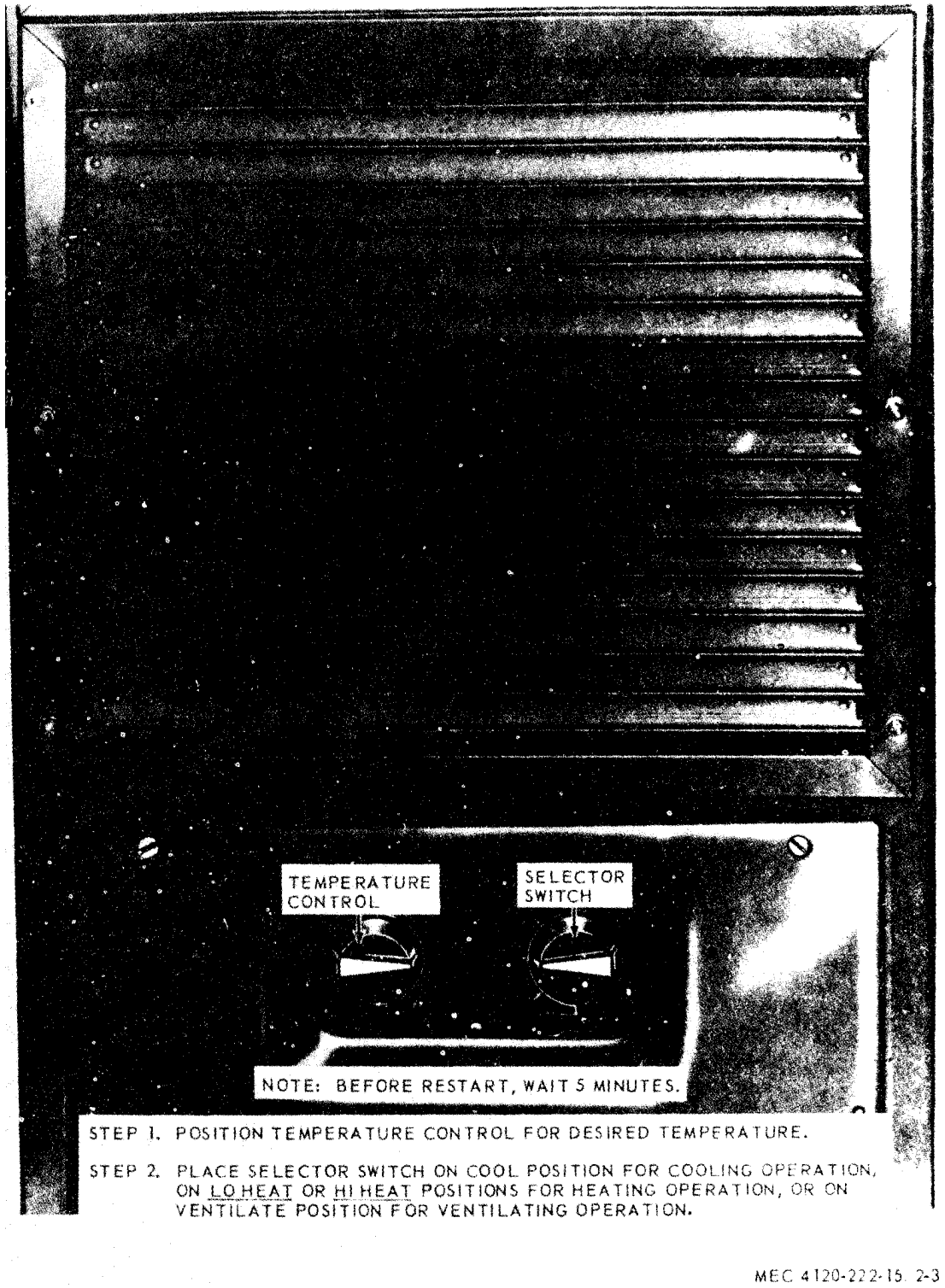


Figure 2–3. Starting instructions.

sents a different problem, the operator may have to vary given procedure to fit the individual job.

2-9. Starting

a. Perform the daily preventive maintenance checks and services (para 3-4).

b. Refer to figure 2-3, and start the air conditioner. If the unit fails to start, pull the circuit breaker reset rod behind air filter and push high press switch reset.

Caution: **Wait 5 minute before restarting the unit after operation.**

2-10. Stopping

Refer to figure 2-4, and stop the air conditioner.

2-11. Operation of Equipment

Refer to figure 2-5 for instructions on operation of the air conditioner.

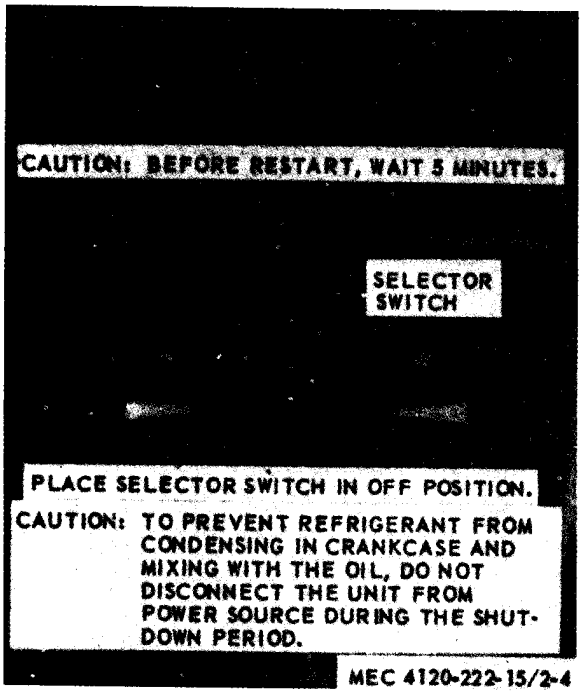
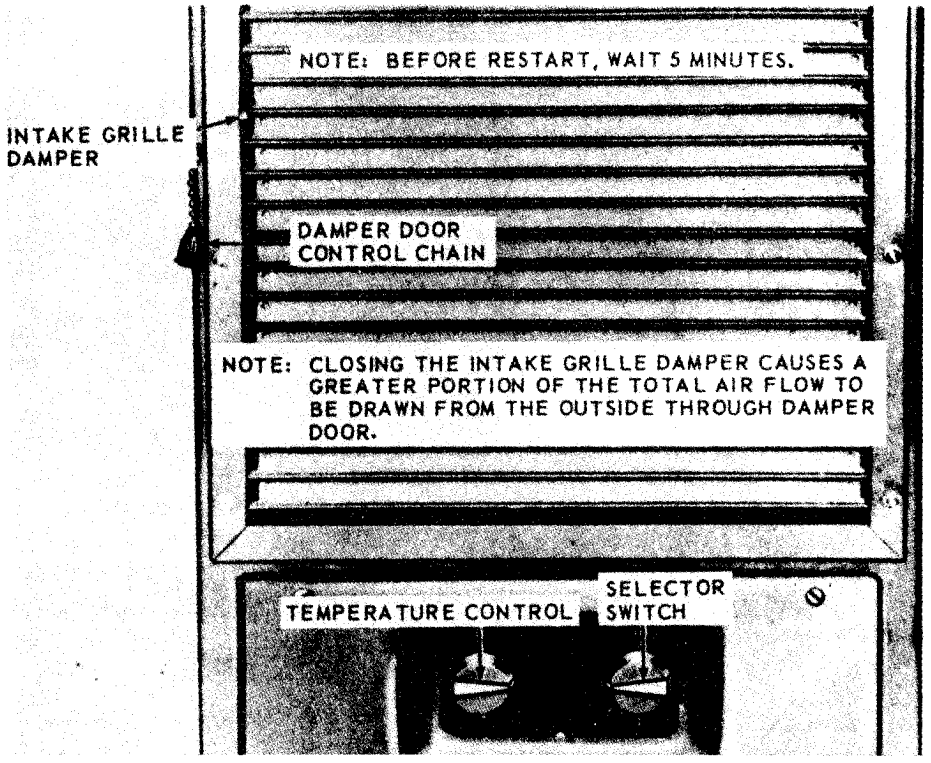


Figure 2-4



A. COOLING OPERATION:
STEP 1. POSITION TEMPERATURE CONTROL FOR DESIRED TEMPERATURE.
STEP 2. PLACE SELECTOR SWITCH ON COOL POSITION.
STEP 3. FOR COOLING WITH 100 PERCENT RECIRCULATED AIR, CLOSE DAMPER DOOR AND OPEN INTAKE GRILLE DAMPER.
STEP 4. FOR COOLING WITH FRESH MAKEUP AIR, OPEN DAMPER DOOR AND PARTIALLY CLOSE INTAKE GRILLE DAMPER
STEP 5. FOR COOLING WITH FRESH MAKEUP AIR DRAWN THROUGH CHEMICAL, BIOLOGICAL, FILTER UNIT WHEN OUTDOOR AIR IS CONTAMINATED, CLOSE DAMPER DOOR AND PARTIALLY CLOSE INTAKE GRILLE DAMPER.

B. HEATING OPE RATION:
STEP 1. POSITION TEMPERATURE CONTROL FOR DESIRED TEMPERATURE.
STEP 2. PLACE SELECTOR SWITCH ON LO HEAT OR HI HEAT POSITION.
STEP 3. FOR HEATING WITH 100 PERCENT RECIRCULATED AIR, CLOSE DAMPER DOOR AND OPEN INTAKE GRILLE DAMPER.
STEP 4. FOR HEATING WITH FRESH MAKEUP AIR, OPEN DAMPER DOOR AND PARTIALLY CLOSE INTAKE GRILLE DAMPER.
STEP 5. FOR HEATING WITH FRESH MAKEUP AIR DRAWN THROUGH CHEMICAL, BIOLOGICAL, FILTER UNIT WHEN OUTDOOR AIR IS CONTAMINATED, CLOSE DAMPER DOOR AND PARTIALLY CLOSE INTAKE GRILLE DAMPER.

C. VENTILATING OPERATION:
STEP 1. PLACE SELECTOR SWITCH IN VENTILATE POSITION.
STEP 2. FOR VENTILATING OPERATION, OPEN DAMPER DOOR AND CLOSE INTAKE GRILLE DAMPER.

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Figure 2-5. Operating instructions.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-12. Operation in Extreme Cold

a. *General.* The air conditioner is designed to operate at a maximum low temperature of -65°F, (Fahrenheit). Be sure that all thermostatic controls and dampers are in working order.

b. Electrical System. Make sure the electrical system is free of ice and moisture.

Caution: Do not disturb the wiring during cold weather unless absolutely necessary. Cold temperatures make wiring and insulation brittle and easily broken.

2-13. Operation in Extreme Heat.

NOTE

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

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

b. Protection.

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

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

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

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

NOTE

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

c. Cleaning.

(1) Clean outside grilles, coils, filters, and mist eliminator more frequently.

2-14. Operation in Dusty or Sandy Conditions.

NOTE

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

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

CAUTION

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

b. Protection.

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

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

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

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

c. Cleaning.

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

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

(3) In extreme conditions, daily cleaning of condenser, filters, and outside grilles maybe necessary.

2-15 Operation Under Rainy or Humid Conditions

If the unit is outside and not operating, protect it with a canvas *or* other waterproof material. Remove cover during dry periods. Open the front access panel to allow unit to dry before operating. Use caution when operating electrical equipment

2-16. Operation in Salt Wafer Areas

Wash the exterior of the unit with clean, fresh water at frequent intervals. Do not damage the electrical equipment during the cleaning operation. Coat exposed metal surfaces with rust proofing material. Remove corrosion and paint the exposed metal surface.

CHAPTER 3

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S AND ORGANIZATIONAL MAINTENANCE REPAIR PARTS, TOOLS AND EQUIPMENT

3-1. Tools and Equipment

Basic issue tools and repair parts issued with or authorized for the air conditioner are listed in the Basic Issue Items List, Appendix B of this manual.

3-2. Organizational Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-4120-222-24P.

Note. **This unit requires no lubrication.**

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-3. General

To insure that the air conditioner is ready for peration at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive checks and services to be performed are listed and described in table 3–1. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation, which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

3-4. Preventive Maintenance Checks and Services

Refer to table 3-1 for daily and quarterly preventive maintenance checks and services.

Table 3-1. Preventive Maintenance **Checks *and Services***

B-Before Operation D-During Operation A-After Operation W-Weekly M-Monthly Q-Quarterly

Item Number	Interval						Item to be Inspected	Procedure	Reference
	Operator			ORG.					
	Daily			W	M	Q			
	B	D	A						
1			X			X *	Air inlet filter----------	Wash and dry fresh air inlet filter. Tighten loose mounting. * Replace a damaged filter.	Paragraph 3-9
2			X			X *	Air conditioner filter--	Clean air conditioning filter. * Tighten loose mounting. Replace a damaged filter.	Paragraph 3-7
3			X			X *	Controls----------	Check for damage and proper operation. *Tighten loose mountings.	
4			X				Condenser screen----	Clean condenser screen.	
5						X	Sight glass----------	Check for damage or broken glass. Check for full condition of unit.	Paragraph 2-7
6						X	Fan----------	Tighten loose mounting. Check for damage. Replace a damaged fan.	Paragraph 3-20 and 3-21

Note. During operation observe for any unusual noise or vibration.

Section III. OPERATOR'S MAINTENANCE

3-5. General

The instructions in this section are published for the information and guidance of the operator to maintain the air conditioner.

Warning: **Disconnect the air conditioner from the power source before performing any maintenance on the components of the unit.**

3-6. Mist Eliminator Service

a. General. The mist eliminator is located under the top panel, between the evaporator air discharge grille and the evaporator coil. It removes moisture from the air after it has passed *over* the evaporator coil, thereby reducing the amount of moisture in air discharged into the conditioned area.

b. Removal. Remove the cover panel and discharge grille (para 3–17).

c. Servicing. Refer to figure 3-1 and service the mist eliminator.

d. Installation. Refer to paragraph 3-17, and install cover panel and discharge grille.

3-7. Filter, Air Conditioning Service

a. *Removal.* Remove the intake grille (para 3-17).

b. Servicing. Refer to figure 3-1 and service the air conditioning filter.

c. Installation. Install intake grille in reverse order of removal (para 3–17).

3-8. Evaporator Coil and Condenser Coil Service

a. *Removal.* Refer to paragraph 3–18 and remove mist eliminator. Refer to paragraph 3–19, and remove condenser coil grille and screen.

b. Servicing. Refer to figure 3–2 and service the evaporator coil and condenser coil.

c. *Installation.* Install condenser coil grille and screen and mist eliminator in reverse order of removal (para 3-18 and 3-19).

3-9. Servicing Fresh Air Inlet Filter

a. *Removal.* Remove the fresh air inlet screen (para 3-19).

b. Servicing. Clean with compressed air. Replace damaged filter.

c. *Installation.* Refer to paragraph 3–19 and install the fresh air inlet screen.

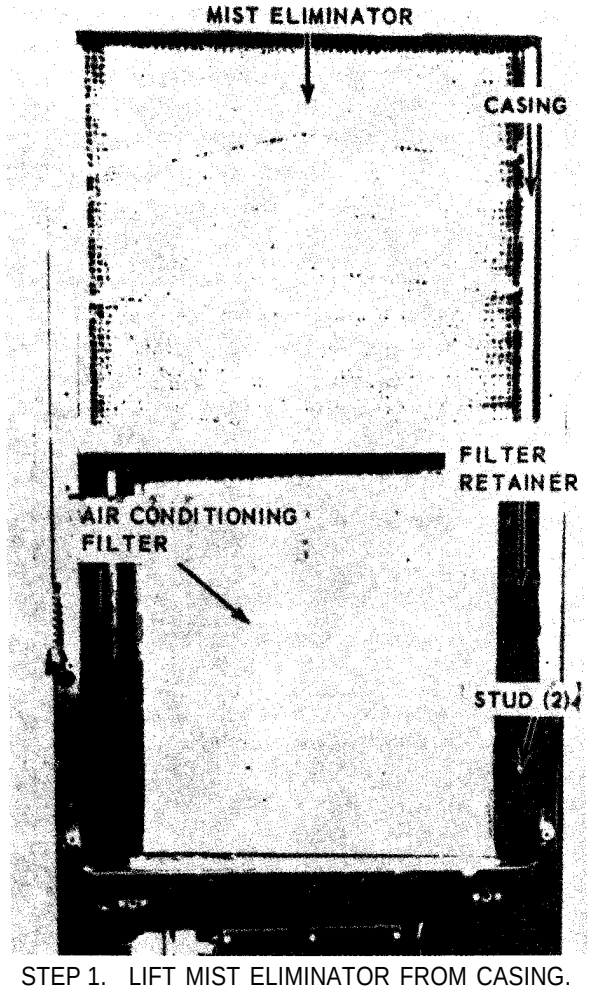
3-10. Fuse Replacement

a. *General.* The earlier Models of CE20VAL6 and CE20VAL4 have no fuses. The new models have two 5-amp cartridge fuses mounted in the upper right corner of the control box.

b. Removal Remove fuses from fuse holder.

c. Installation. Snap in new fuses of proper amperage and size.

d. Testing. Use an ohmmeter and test fuse for open.



STEP 1. LIFT MIST ELIMINATOR FROM CASING.
STEP 2. REMOVE STUD (2). FILTER RETAINER, AND AIR CONDITIONING FILTER.
STEP 3. WASH FILTER AND MIST ELIMINATOR WITH AN APPROVED CLEANING SOLVENT AND DRY WITH CLEAN, LOW-PRESSURE COMPRESSED AIR.
STEP 4. DIP OR SPRAY FILTER WITH FILTERKOTE OR OIL OF SPECIFICATION MILITARY 0-2104 GRADE 20, 30, OR BETTER. DRAIN OFF EXCESS OIL BEFORE INSTALLATION.
STEP 5. REINSTALL AIR FILTER MIST ELIMINATOR IN ACCORDANCE WITH STAMPED ARROW DIRECTION.

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Figure 3-1. Servicing *mist eliminator and air conditioning filter.*

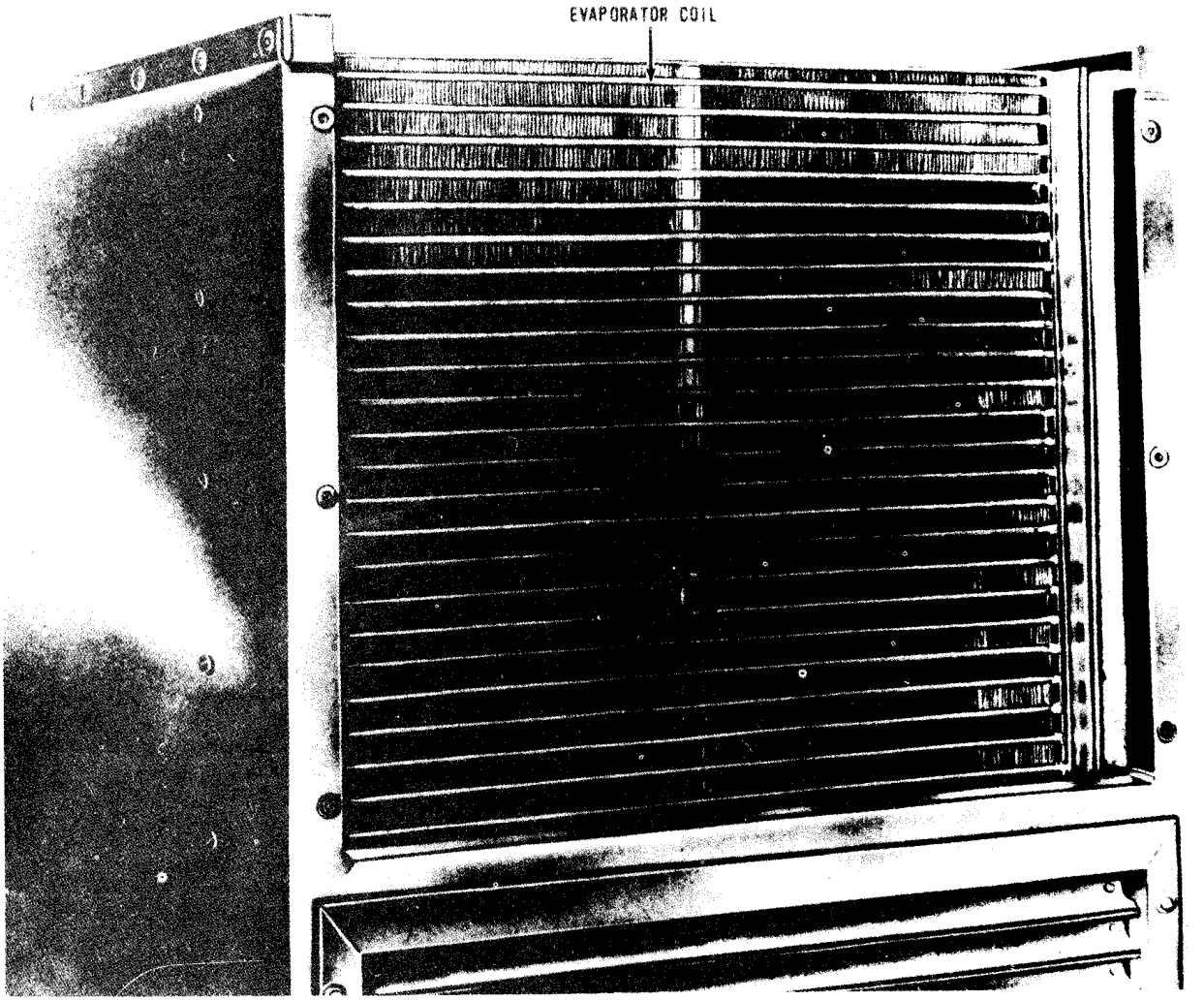


Figure 3–2. Servicing evaporator coil and condenser coil.

Section IV. TROUBLESHOOTING

3-11. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner.

3–12. Troubleshooting Procedure

Malfunctions which may occur are listed in table 3–2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

Table 3-2. *Troubleshooting*

Malfunction	Probable cause	Corrective action
1. Compressor fails to start	*a.* Selector switch improperly adjusted *b.* Circuit breaker contacts open c. Contacts of high pressure cutout switch open.	a. Set switch to COOL position. *b.* Reset circuit breaker. c. Push reset button to reset cutout switch.

Table 3-2. Troubleshooting-Continued

Malfunction	Probable cause	Corrective action
2. Compressor starts but goes out on overload.	*a.* Temperature control setting too low.	Raise temperature control setting.
	b. Suction pressure too low.	Service the mist eliminator, air conditioning filter, condenser screen, and condenser and evaporator coils (para 3-6, 3-7, and 3-8).
	c. Discharge pressure too high.	Service the evaporator and condenser coils (para 3-8).
	d. Blower motor defective.	Replace motor (para 3-25).
3. Little or no heating capacity.	*a.* Selector switch improperly adjusted.	Adjust switch to proper setting.
	b. Air movement over evaporator insufficient.	Service the mist eliminator, air conditioning filter, condenser screen, condenser and evaporator coils (paras 3-6, 3-7, and 3-8).
4. Suction pressure inadequate.	*a.* Temperature control setting too low.	Raise temperature control setting.
	b. Air temperature in air conditioned space excessively low.	Service the mist eliminator, air conditioning filter, condenser screen, condenser and evaporator coils (paras 3-6, 3-7, and 3-8).
5. High discharge pressure.	Insufficient volume of air passing through condenser coil.	Service condenser evaporator coils and screen (para 3-8).
6. Suction and discharge pressure low.	Lack of refrigerant.	Check sight glass for appearance of bubbles. Report low refrigerant charge to direct support maintenance personnel.

Section V. FIELD EXPEDIENT REPAIRS

3-13. General

Operator and organizational maintenance trouble may occur while the air conditioner is operating in the field where supplies and repair parts are not available and normal corrective action cannot be performed. When this condition exists, the following expedient repairs may be used in emergencies, upon the decision of the unit commander. Equipment so repaired must be removed from operation as soon as possible and properly repaired before being placed in operation again.

3-14. Compressor Inoperative

Trouble	*Expedient Remedy*
(Compressor overload protector.	Bypass the protector by installing three insulated jumper wires between the connection terminals on the compressor (para 5-6).

Note. If compressor does not start when the air conditioner is connected to the power source, the compressor is defective and must be replaced. Report this condition to direct support maintenance.

3-15. Compressor Heater Inoperative

Trouble	*Expedient Remedy*
Compressor heater thermostat defective.	Disconnect thermostat from compressor power receptacle connector and from the heater. Connect the lead directly to the power receptacle lead. Refer to wiring diagrams.

Note. If the heater is not activated when the air conditioner is connected to the power source, the heater is defective and must be replaced. Report this condition to direct support maintenance.

Section VI. PANELS, GRILLES, SCREENS, FAN GUARD, MIST ELIMINATOR, AIR CONDITIONING FILTER, AND DAMPER DOOR CONTROL SPRING AND CHAIN

3-16. General

The air conditioner is constructed with removable aluminum panels. The front access panel provides access to the control box, control panel, and charging valves. A discharge grille protects the evaporator and mist eliminator and controls the discharge of conditioned air. The intake grille protests the air conditioning filter and regulates the amount of air returned to the unit. The condenser coil grille and fan guard protects the condenser coil and fan. A fresh air inlet screen permits the entry of outside air and is controlled by the damper door with the control spring and chain. An intake cover provides for attachment of a Chemical and Biological Filter Unit. The cover panel covers the top of the unit.

Warning: **Disconnect the air conditioner from the power source before performing any maintenance on the components of the unit.**

3-17. Cover Panel, Discharge Grille, Intake Grille, and Front Access Panel

a. Removal. Refer to figure 3-3 and remove the cover panel, discharge grille, intake grille, and front access panel.

b. Installation. Install the cover panel, discharge grille, intake grille, and front access panel in reverse order of removal as illustrated on figure 3-3.

3-18. Mist Eliminator and Air Conditioning Filter

a. Removal. Refer to figure 3-4 and remove the mist eliminator and air conditioning filter.

b. Installation. Replace defective mist eliminator and filter. Refer to figure 3-4 and install the mist eliminator and air conditioning filter in reverse removal order.

3-19. Fresh Air Inlet Screen, Chemical and Biological Cover, Fan Guard, and Condenser Coil Grille and Screen

a. Removal. Refer to figure 3-5 and remove the fresh air inlet screen, C B (chemical and biological) cover, fan guard, and condenser coil grille and screen.

b. Installation. Install the fresh air inlet screen, C B cover, fan guard, and condenser coil grille and screen in reverse order of removal as illustrated on figure 3-5.

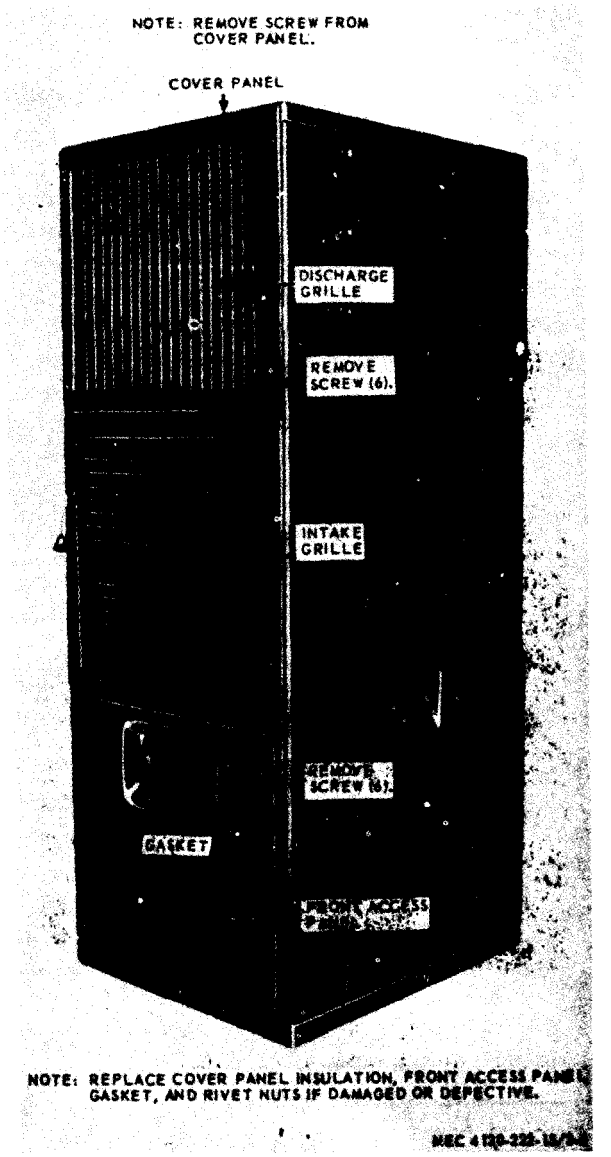


Figure 3-3. Cover panel, discharge grille, intake grille, and front access panel, removal and installation.

3-20. Evaporator Fan and Inlet Ring

a. General. New models of CE20VAL6 and CE20VAL4 air conditioner have air foil evaporator fan. The air foil fan reduces excessive vibration and noise.

b. Removal. Refer to figure 3-6 and remove the inlet ring and evaporator fan.

c. Installation. Install the inlet ring and evaporator fan in reverse order of removal as illustrated on figure 3-6.

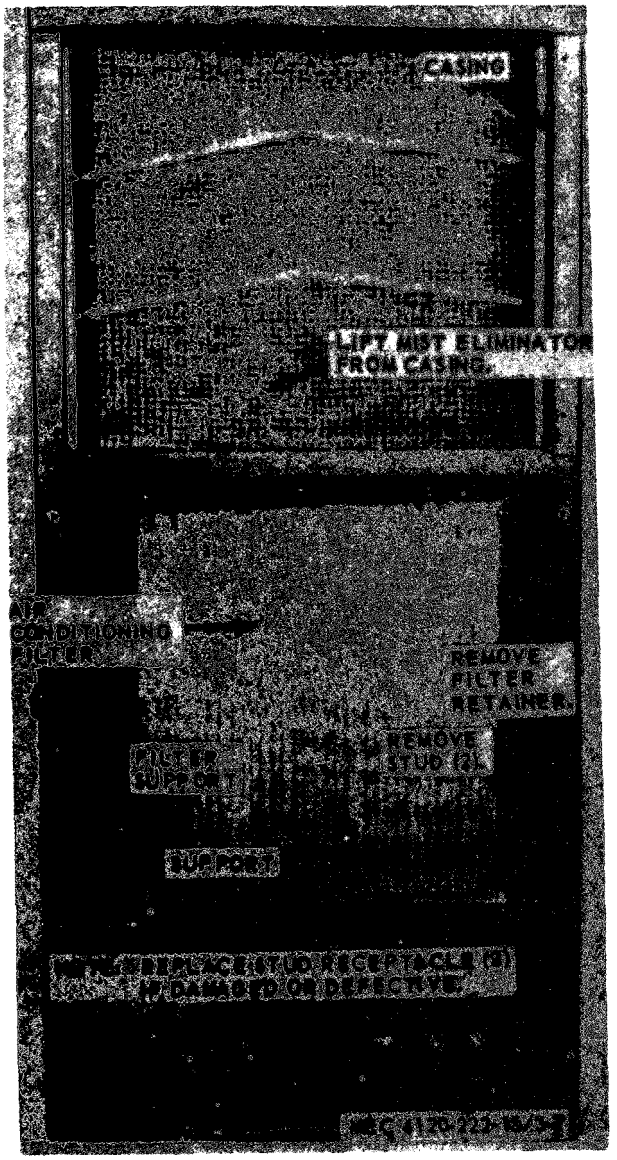


Figure 3-4. Mist eliminator and air conditioning filter, removal and installation.

3-21. Condenser Fan

a. General. The condenser fan, figure 3-7 (1), has been replaced on new model air conditioners with an air foil fan and baffle, figure 3-7(2). The air foil fan and baffle reduces excessive vibration and noise.

b. Removal. Refer to figure 3-7 and remove the condenser fan.

c. Installation. Install the condenser fan in reverse order of removal as illustrated on figure 3-7.

3-22. Damper Door Control Spring and Chain

a. General. The damper door control should give continuous service with little attention. Should the spring malfunction, replacement is simple as is chain replacement.

b. Removal

(1) Remove the air intake grille (para 3-17).

(2) Disconnect spring from the clip and chain.

(3) Disconnect chain from clip. and remove chain from front of unit.

(4) Remove pendent from chain if required.

c. Installation. Install replacement parts by reversing order of disassembly.

Note. Inspect the panels, grilles, screens, fan guard, mist eliminator, damper door control spring and chain for breaks, cracks, or other damage.

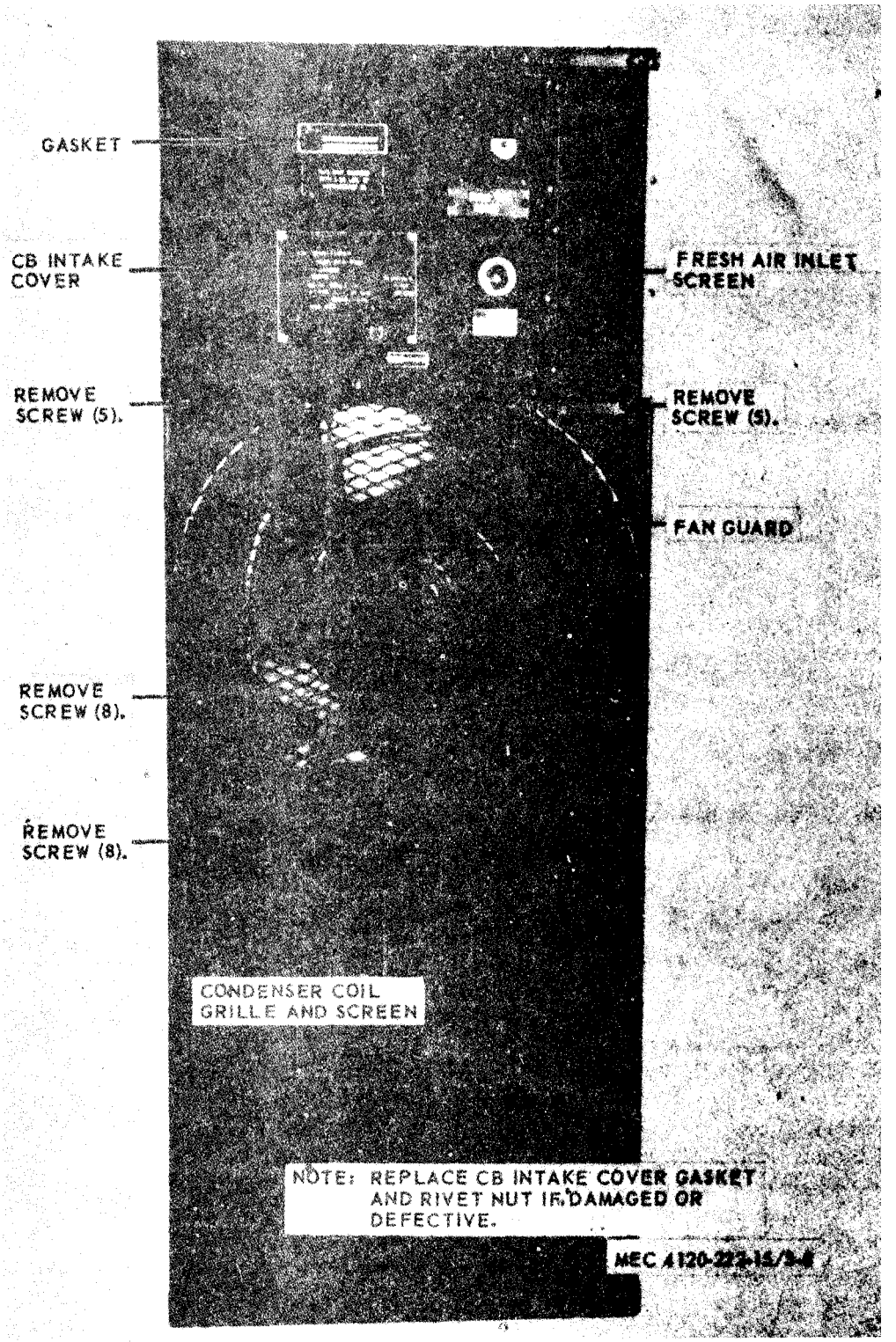


Figure 3-5. *Fresh air inlet screen, chemical and biological cover, fan guard,* and *condenser grille and screen,* removal and *installation.*

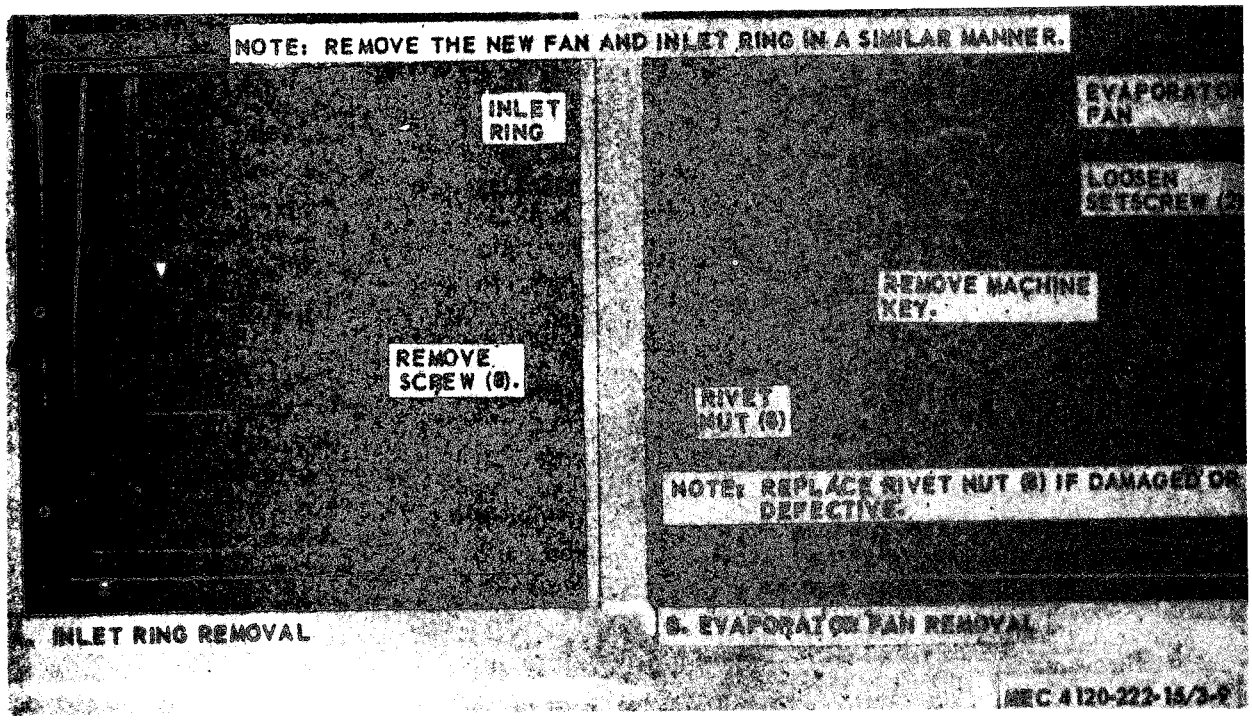
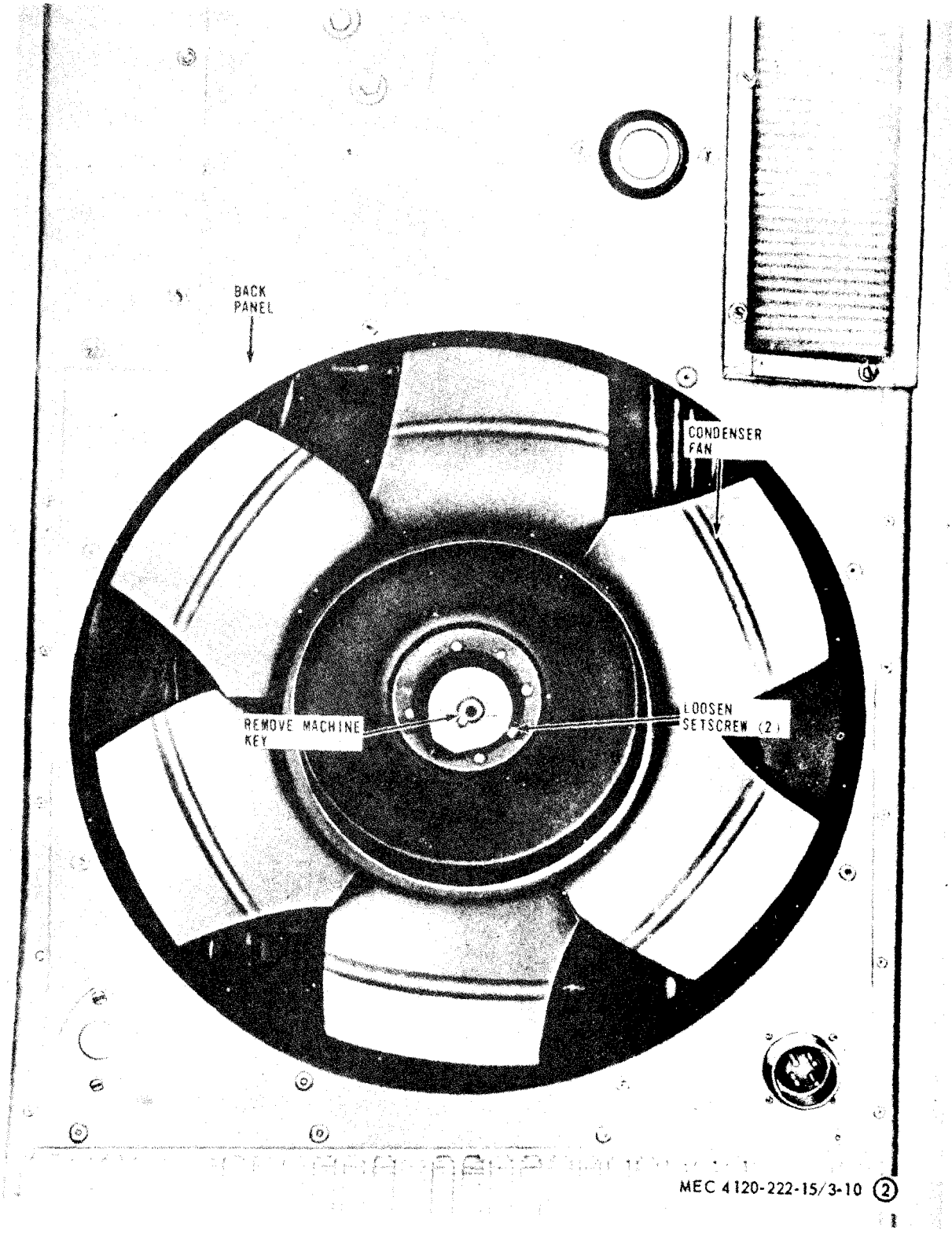


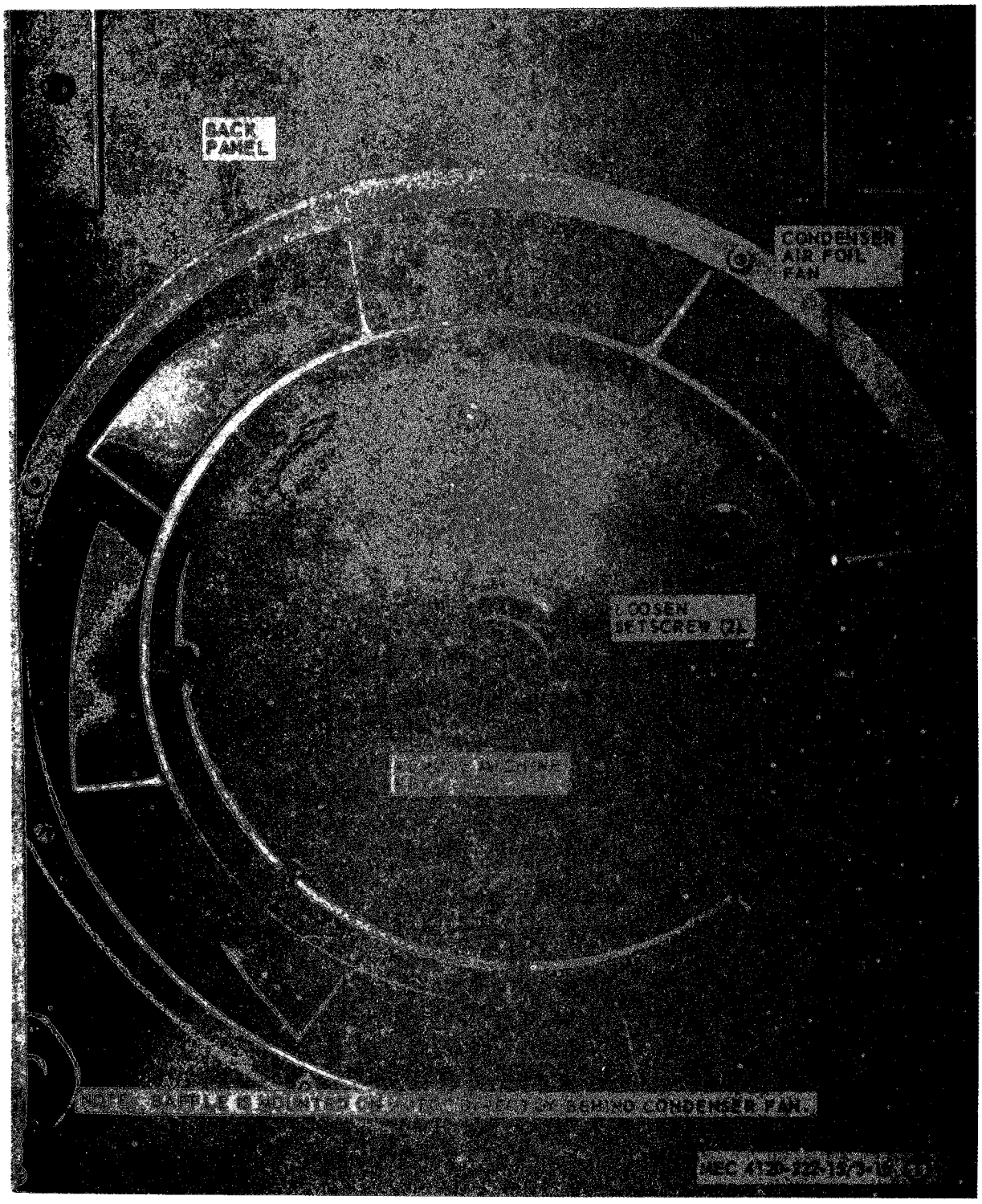
Figure 3-6. Evaporator fan inlet ring removal and installation.



(1) Earlier type

Figure 3–7. Condenser fan removal and installation.

Figure 3–7. Condenser fan (earlier type) removal and installation. (Sheet 1 of 2)



(2)

Figure 3–7—Continued.

Figure 3–7. Condenser fan removal and installation. (Sheet 2 of 2)

3-23. General

The electrical system (fig. 1-4) consist of the commpressor, blower motor, selector switch, relay, rectifier, contactors, fuses, heaters, evaporator heater thermostat, thermostatic switch, and all internal wiring. A compressor overload protector prevents the compressor from being damaged by electrical overload. The compressor heater ther-

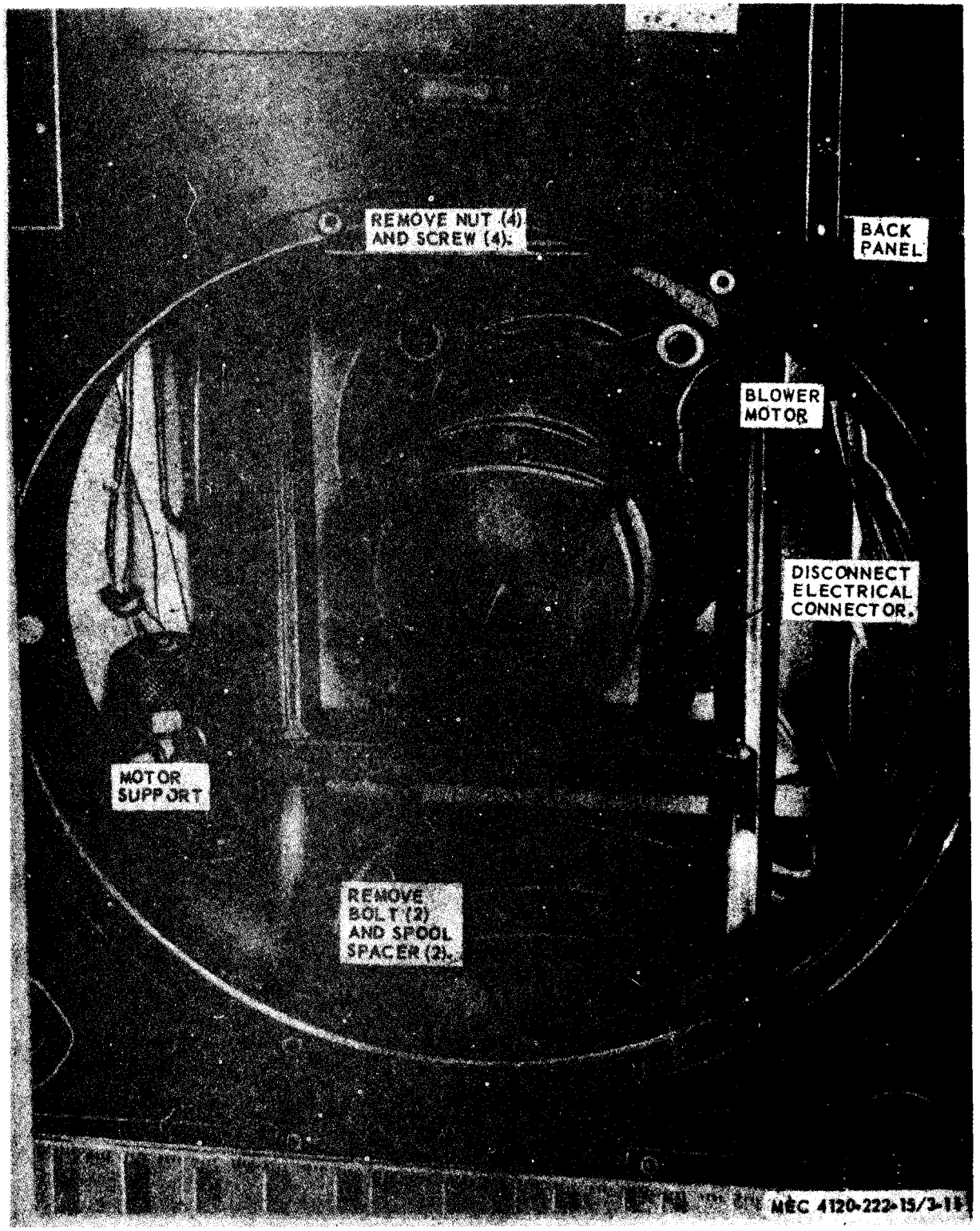


Figure 3-8. Blower motor, removal and installation.

mostat cuts off the power to the compressor heater when the compressor reaches safe operating temperature and also activates the heater when required. Both fans are driven by the blower motor which has integral overload protection. The evaporator heater thermostat prevents overheating when the unit is operating on the heating cycle. A thermostatic switch prevents the compressor from being started when the outdoor temperature is below 50°F.

3-24. Electrical Leads

When removing or replacing components of the air conditioner, always inspect condition of all wires and cables. Repair or replace any defective wiring. (See wiring diagram.)

3-25. Blower Motor

a. Removal. Refer to figure 3–8 and remove the blower motor.

b. Installation. Install the motor in reverse order of removal as illustrated on figure 3-8.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. GENERAL

4-1. Scope

These instructions are for direct and general support maintenance personnel. They contain information on equipment maintenance that is beyond the scope of the tools, equipment, personnel, or supplies normally available to organizational maintenance personnel.

4-2. Forms and Records

Refer to paragraph 1-2 for forms and records applicable to this equipment.

Section II. DESCRIPTION AND DATA

4-3. Description

For a complete description of the air conditioner refer to paragraph 1-3.

4-4. Tabulated Data

The tabulated data applicable to the air conditioner is referenced in paragraph 1-4.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-5. Special Tools and Equipment

No special tools or equipment are required to perform direct and general support maintenance on the air conditioner.

4-6. Direct and General Support Maintenance Repair Parts

Direct and general support maintenance repair parts are listed and illustrated in TM 5-4120-222-24P.

4-7. Specially Designed (Fabricated) Tools and Equipment

No specially designed (fabricated) tools or equip ment are required to perform direct or general support maintenance on the air conditioner.

Section IV. TROUBLESHOOTING

4-8. General

This section provides information useful to direct and general support maintenance personnel in diagnosing and correcting unsatisfactory operation or failure of the air conditioner.

4-9. Troubleshooting Procedure

Malfunctions which may occur are listed in table 4-1. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

Table 4-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Compressor fails to start	a. Circuit breaker defective	*a.* Replace (para 5-12).
	b. Compressor defective	*b.* Replace (para 5-30).
	c. Wiring and wiring harness defective	*c.* Replace (para 5-19).
	d. Temperature control defective	*d.* Replace (para 5-9).

Table 4-1. Trobleshooting-Continued

Malfunction	Probable cause	Corrective action
	e. Compressor motor and evaporator heater contactors defective.	*e.* Replace contactor (para 5-15).
	f. Compressor overload protector defective	*f.* Replace protector (para 5-6).
	g. Thermostatic switch de fective	*g.* Replace (para 5–7].
	h. Phase sequence relay contacts open	*h.* Interchange two lines wires to reverse phase sequence.
2. Compressor starts but goes out on overload.	*a.* Expansion valve de fective	*a.* Replace (para 5-21).
	b. Discharge pressure too high	*b.* Remove small amount of refrigerant charge (para 5–33).
	c. Compressor de fective	*c.* Replace (para 5-30).
3. Little or no heating capacity	*a.* Wiring and wiring harness de fective	*a.* Replace wiring or wiring harness (para 5-19),
	b. Blower motor de fective	*b.* Repair (para 5-4).
4. Suction pressure inadequate	*a.* Expansion valve not adjusted properly	*a.* Adjust (para 5-21).
	b. Expansion valve de fective	*b.* Replace (para 5-21).
	c. Dehydrator de fective	*c.* Replace (para 5-25).
5. Discharge pressure inadequate	Compressor defective	Replace (para 5-30).
6. Suction pressure too high	Liquid line bypass solenoid valve defective.	Replace valve (para 5-24),
	Hot gas bypass solenoid valve defective	Replace valve (para 5-23).
	Superheat adjustment incorrect	Adjust thermostatic expansion valve (para 5-21).
	Expansion valve defective	Replace (para 5-21).
	Compressor defective	Replace (para 5-30).
7. Discharge pressure too high	Overcharge of refrigerant	Remove small amount of refrigerant charge (para 5–33).
8. Suction and discharge pressure low	Lack of refrigerant	Check refrigerant level in sight glass. Test for leaks and charge system (para 5-33).
9. High suction pressure with low discharge pressure.	Compressor defective	Replace (para 5-30).
10. System losing cooling capacity	System operating pressure incorrect	Install pressure gages on gage parts of suction and discharge line charging valves and turn valves two turns to open, exposing gages to system pressure. Compare gage readings with normal ranges of system pressures listed in tble 4-2.

Table 4-2. Normal Operating Pressures

90°F. DB RETURN AIR TO UNIT

Outdoor ambient temperature	50°F.	75°F.	100°F.	125°F.
GAGE PRESSURE:				
Suction	58-60	58-65	65-75	75-90
Discharge	135-155	185-205	275-295	400-420

Table 4-2. Normal Operating Pressures

80°F. DB RETURN AIR TO UNIT

Outdoor ambient temperature	50°F.	75°F.	100°F.	125°F.
GAGE PRESSURE:				
Suction	58	58	58-65	65-75
Discharge	130-150	180-200	270-290	390-410

CHAPTER 5

REPAIR INSTRUCTIONS

Section I. GENERAL

5-1. General

The air conditioner, after it is started, is automatic in operation. The relationship of the automatic components, controls, and instruments, is explained in the operation analysis for maintenance of the air conditioner (para 5–2). A refrigerant flow diagram (fig. 5-1) and practical wiring diagrams (fig. 1-4) are included to assist in the maintenance of the electrical components, wiring harness, wire leads, and refrigerant components.

Warning: **Disconnect the air conditioner from the power source before performing any maintenance on the components of the unit.**

5-2. Analysis of Operation

a. General. The type and degree of air conditioning provided by the unit is controlled by a five-position selector switch and a temperature control (temperature control thermostat).

(1) On units with Whirlpool compressors when the selector switch is in the OFF position the entire circuit is dead. On units with the Bendix-Westinghouse compressors the crankcase heater is in constant operation, being cycled on and off as required by its thermostat.

(2) Placing the selector switch in the HI-HEAT position actuates the blower motor with the two banks of evaporator heaters being under the control of the temperature control. If the air temperature falls below the set point of the temperature control, the control contacts close, energizing the evaporator contactor which supplies power to the heaters through the normally closed contacts of the evaporator heater thermostat.

(3) Moving the selector switch to the LO-HEAT position presents the same control sequence but reduces the heating capacity of the unit by supplying power to a single bank of heaters only.

(4) The blower motor starts when the selector switch is placed in the VENTILATE position.

(5) In the COOL position, the blower motor is in operation and the compressor motor contactor is energized through the contacts of the thermostatic switch. The energized contactor supplies power to the compressor through the normally closed contacts of the circuit breaker and the compressor overload protector. After the blower motor and compressor have started, the flow within the refrigerant circuit is controlled by the temperature control. Sensing a rise in the air temperature above the set point, the temperature control opens its contacts, deenergizing the solenoid valves. This positions the valves for cooling service, Sensing a fall in the air temperature below the set point, the contacts of the temperature control close, energizing the valves. This positions the valves for bypass service.

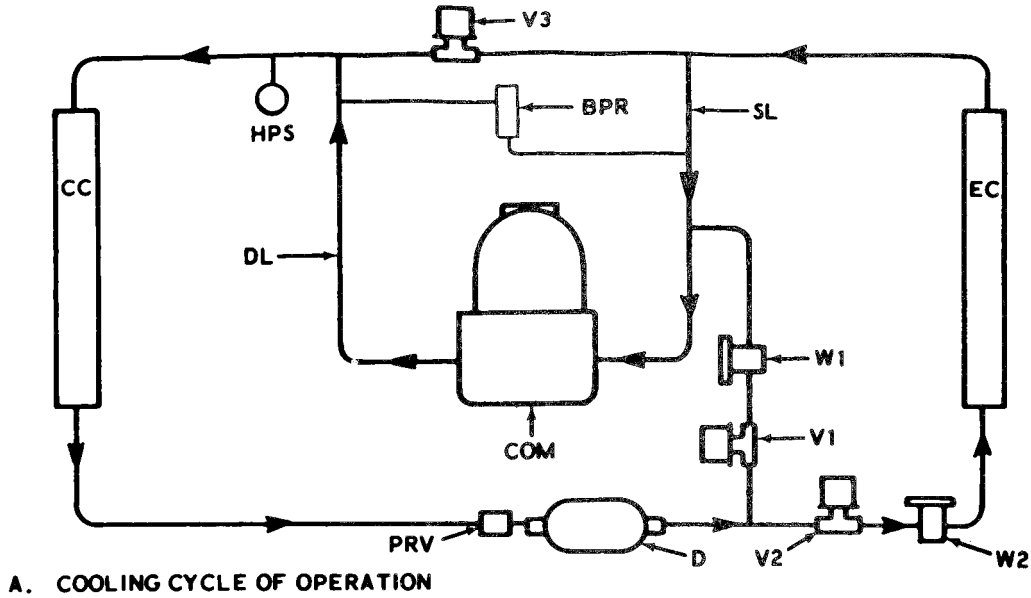
b. Cooling Cycle of Operation. The blower motor and compressor run continuously, whether the temperature control is calling for cooling or not, when the unit is adjusted to operate on the cooling cycle of operation. This feature provides a constant electrical load thus preventing voltage fluctuations within the system.

c. Bypass *Cycle of Operation.* When the conditioned air temperature falls below the temperature control setting, the circuit which controls the solenoid valves is energized causing:

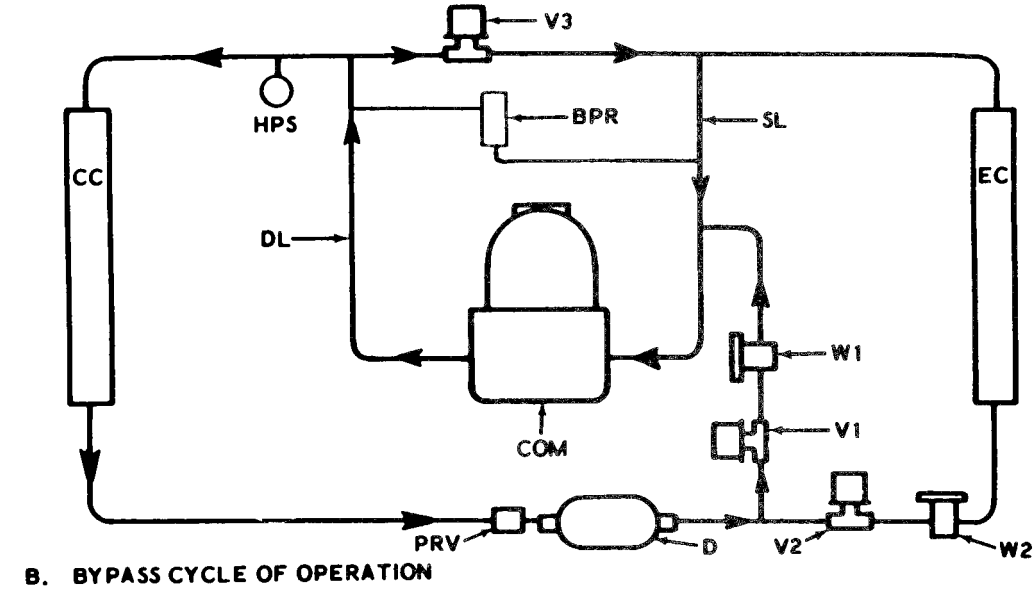
(1) The liquid line solenoid valve (V2) to close, stopping the flow of refrigerant to the evaporator coil, thus stopping the cooling function completely.

(2) The hot gas bypass line solenoid valve (V3) to open, bypassing a major part of the compressed refrigerant vapor directly back to the suction side of the compressor.

(3) The liquid line bypass solenoid valve (V1) to open, bypassing a small amount of liquid refrigerant, through an expansion valve, into the suction tubing.



A. COOLING CYCLE OF OPERATION



B. BYPASS CYCLE OF OPERATION

DEVICE LEGEND:

BPR	BACK PRESSURE REGULATOR
CC	CONDENSER COIL
COM	COMPRESSOR
D	DEHYDRATOR
DL	DISCHARGE LINE
EC	EVAPORATOR COIL
HPS	HIGH PRESSURE CUTOUT SWITCH
PRV	PRESSURE RELIEF VALVE
SL	SUCTION LINE
V1	LIQUID LINE BYPASS SOLENOID VALVE
V2	LIQUID LINE SOLENOID VALVE
V3	HOT GAS BYPASS SOLENOID VALVE
W1	ONE-HALF TON THERMOSTATIC EXPANSION VALVE
W2	ONE-TON THERMOSTATIC EXPANSION VALVE

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Figure 5–1. Refrigerant flow diagram.

(4) To prevent frost from forming on the evaporator, a back pressure regulating valve is provided to prevent the suction pressure from decreasing to a pressure which corresponds to a temperature of less than 32°F. (Fahrenheit).

d. Heating Operation. Placing the selector switch in the LO-HEAT position actuates half of the evaporator heaters mounted, in the conditioned air stream, directly behind the evaporator coil. When the selector switch is placed in the HI-

HEAT position, the remaining heaters are energized, providing maximum heating capacity (12,000 BTUH).

5-3. Repair Procedures

a. If the system must be opened for repair or replacement of parts, connect a hose line to the suction service valve and purge the refrigerant to an outside area.

b. After purging the system allow the tubing to warm to the ambient temperature before opening the system; this delay will help prevent the formation of condensation on the inside walls of the tubing. Plug or cap all openings as a part is removed to minimize the entry of dirt and moisture.

c. Use a silver solder on all soldered connections. Easy-Flo silver solder (or equivalent) with a 50 percent silver capacity and a melting point of approximately 1160°F. is recommended. Continually pass dry nitrogen through the tubing or connections being soldered to prevent formation of harmful copper oxides.

d. No metal to metal contact on capillary tubes is allowable; use tape to prevent such contact.

Section II. REMOVAL AND INSTALLATION OF COMPONENTS

5-4. Blower Fan Motor

a. On-Equipment Testing. Before removing the motor for replacement, test the motor windings for opens and grounds:

(1) Disconnect receptacle connector from motor junction box.

(2) Test continuity across each combination of two motor terminals. Lack of continuity indicates an open winding.

(3) Place one contact of the tester against motor housing and the other against one of the motor terminals. If a circuit is indicated, the motor is grounded.

(4) Test the motor stator for insulation resistance as instructed in TM 5-764. The insulation resistance should measure not less than 0.5 megohms for the motor on either model.

Note. The resistance measurement should be used only as a general guide, taking into consideration the accuracy of the instrument used, test lead resistance, and ambient temperature at time of test. If more precise measurement is required, an instrument such as a Kelvin or Whetstone bridge should be used, or comparative measurement between the suspected component and a like item known to be good should be utilized. In all cases where a megohmeter is used for testing, make certain that the unit is thoroughly dry. Wet condemnation tolerances should be considered.

(5) Connect the motor leads to a proper source of power. Use a hook-type ammeter and read the amperage flowing in each of the motor leads. On Model CE20VAL4 the ammeter should indicate between 1.45 and 2.2 amperes at no load. The ammeter should indicate between 1.75 and 2,5 amperes at no load on Model CE20VAL6. Start the unit and check the ammeter reading. If the readings are not equal, the motor bearings are worn or the stator winding is defective. Follow the instructions in c below and disassemble the motor for further testing and repair.

b. Removal. Refer to paragraph 3–32, and remove blower motor.

c. Disassembly. Refer *to* figure 5-2, and disassemble the blower motor.

d. Testing.

(1) *Overload protector.* Disconnect the electrical leads from the overload protector. Test the protector with a multimeter set on OHMS. If continuity does not exist, replace the overload protector.

(2) *Motor bench test.* Perform the growler tests on the stator as instructed in TM 5–764. Replace a defective stator.

e. Cleaning, Inspection and Repair.

(1) Clean all parts with a cloth dampened in approved cleaning solvent.

(2) Inspect the stator housing for cracks, breaks, or other defects. Replace a damaged or defective housing.

(3) Inspect bearings for pits, scoring, wear, and out-of-round. Replace worn or defective bearings.

(4) Inspect the rotor shaft for cracks, wear, and misalinement. Replace a damaged or defective rotor.

(5) Inspect the rotor for cracks, breaks, and damaged laminations. Replace the rotor and stator if they are damaged, Replace the stator if it does not meet test standards *(d* above).

(6) Inspect all threaded parts for damage. Replace as necessary.

f. Reassembly. Refer to figure 5-2, and reassemble the blower motor.

g. Installation. Refer to paragraph 3-25, and install the blower motor.

5-5. Power Receptacle Connector

a. Removal. Refer to figure 5–3, and remove the power receptacle connector.

b. Inspection. Inspect connector for breaks, cracks, or other damage.

c. Installation. Replace defective receptacle and install the power receptacle connector in reverse removal order as illustrated in figure 5-3.

5-6. Compressor Overload Protector and Heater Thermostat

a. Removal. Refer to figure 5-4(1), and remove the compressor overload protector and heater thermostat from the Bendix-Westinghouse compressor assembly.

Note. The overload protector is not removable on the Whirlpool compressor. See figure 5-4 for wiring of Whirlpool model.

b. Installation. Replace defective parts as necessary and install the Bendix-Westinghouse compressor overload protector and heater thermostat in reverse order of removal as illustrated in figure 5-4.

c. Field expedient repair.

(1) Compressor overload protector. When the protector is defective, bypass it by installing three insulated jumper wires between the connection terminals on the compressor (see wiring diagram).

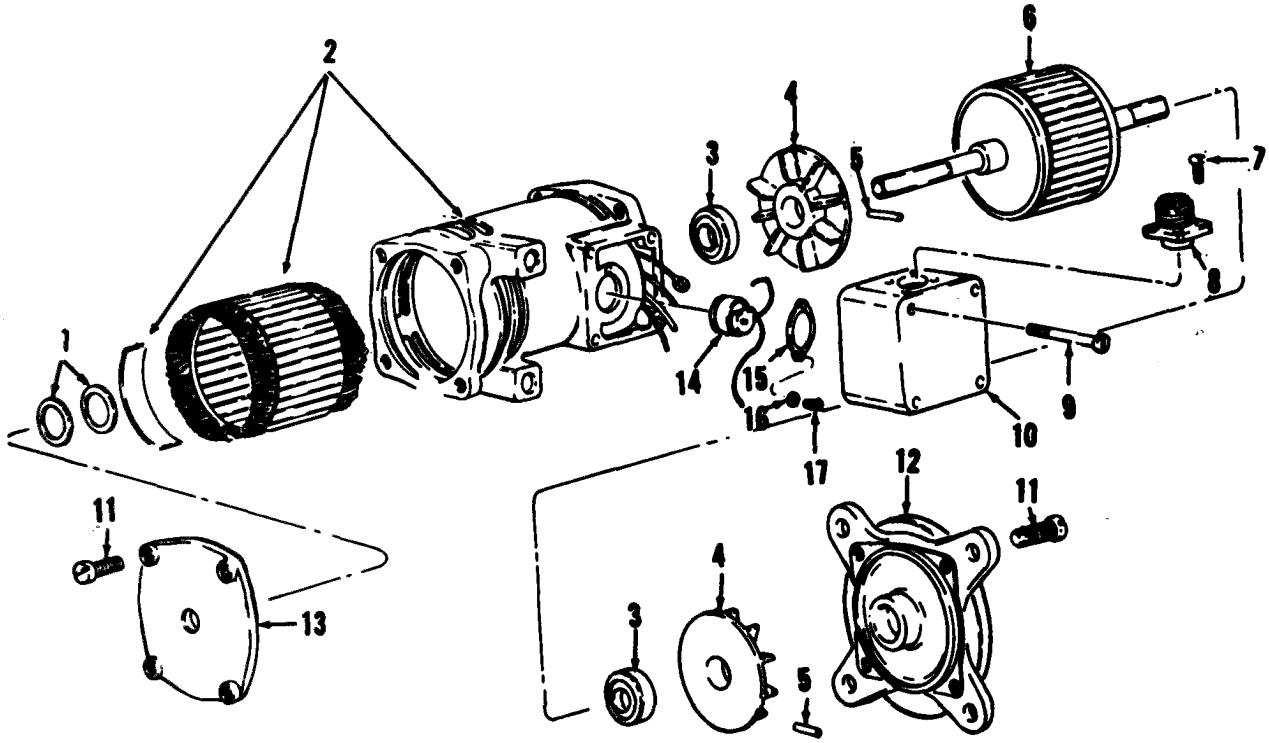
Note. If the compressor doea not start when the air conditioner is connected to the power source, the compressor is defective and must be replaced.

(2) *Compressor heater thermostat.* When the thermostat is defective, disconnect it from the compressor power receptacle and from the heater. Connect the heater lead directly to the power receptacle connector lead (see wiring diagram).

Note. If the heater is not activated when the air conditioner is connected to the power source, the heater is defective and must be replaced.

5-7. Outdoor Thermostat

a. General. The outdoor thermostat is mounted to the rear housing of the air conditioner. It prevents the compressor from being started when the outside temperature is below 50°F. This prevents the unit from being operated at a time when low condensing and suction pressures will hamper system operation.



NOTE: DISASSEMBLE THE BLOWER MOTOR ON THE MODEL CE20VAL4 AIR CONDITIONER IN A SIMILAR MANNER.

MEC 4120-222-15/4-2

1 Spring washer (spec) (2 rqr)
2 Stator motor assy.
3 Ball bearing (2 rqr)
4 Motor fan (2 rqr)
5 Grooved pin (2 rqr)
6 Rotor
7 Screw, machine
8 Receptacle connector
9 Screw machine
10 Overload protector cover
11 Screw, machine
12 Housing mouting endbell
18 Housing_cover endbell
14 Overload protector
15 Retaining plate
16 Washer flat
17 Screw, machine

Figure 5-2. ***Blower motor, disassembly and reassembly (Model CE20VAL4).***

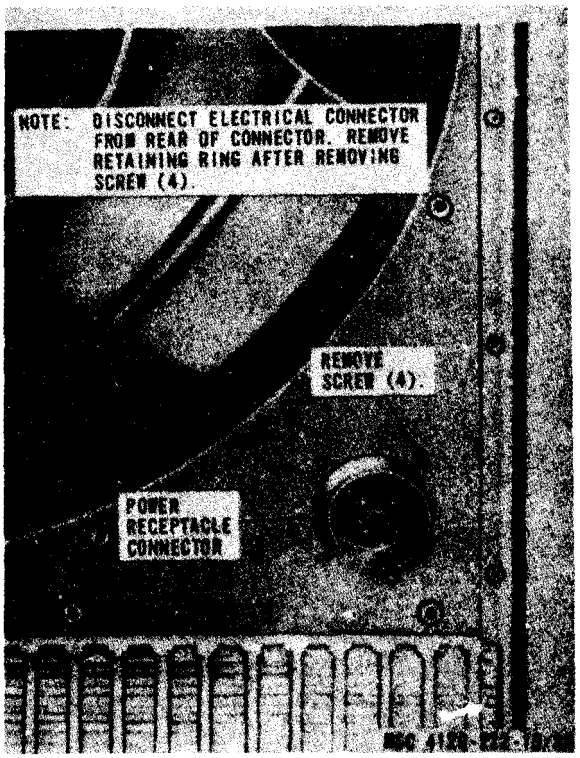


Figure 5-3. Power receptacle connector removal and installation.

b. Removal. Remove outdoor thermostat as illustrated on figure 5-5.

c. Testing. Test the thermostat for continuity with a multimeter set on OHMS. Refer to the wiring diagram for the points to establish continuity.

d. Installation. Replace defective thermostat and install in reverse order of removal as illustrated in figure 5-5.

5-8. Electrical Heater Thermostat

a. Testing. Tag and disconnect the leads and test the electrical heater thermostat for continuity with a multimeter set on OHMS. Refer to the wiring diagram for the points to establish continuity.

b. Removal. Refer to figure 5-6, and remove the electrical heater thermostat.

c. Installation. Replace a defective thermostat and make sure all electrical connections are clean and secure. Refer to figure 5-6, and install the electrical heater thermostat in reverse order of removal as illustrated.

5-9. Control Box and Control Panel

a. General. The control panel houses the selector switch and temperature control and is mounted on the control box. The selector switch is a manually operated, five-position switch. Automatic control of both the heating and cooling cycles is provided by the temperature control. The control panel may be used in a remote position by utilizing a block off plate and a remote control cable (fig. 2-1).

b. Removal. Refer to figure 5-7, and remove the control box front panel and control panel,

c. *Disassembly.* Refer to figure 5-8, and disassemble the control panel.

d. Reassembly. Replace defective parts and reassemble the control panel in reverse order of removal as illustrated on figure 5-8.

e. Installation. Install the control panel and control box front panel in reverse order of removal as illustrated on figure 5-7.

5-10. Tubing and Fittings

The refrigerant tubes used on the air conditioner consist of copper tubing and the necessary fittings. The joints of the refrigerant tubes are soldered. Inspect the tubing for cracks and breaks. Replace any defective tubing with tubes of the same length, size, shape, and material When removing and installing the solenoid valves, direct the flame away from the valve body to protect it from heat damage. Keep the flame at the outside of the distributor when disassembling or reassembling the expansion valve. Test the installation of tubes and fittings for leaks. Replace rubber insulation as necessary.

Note. If the refrigerant system has been open to the atmosphere, replace the dehydrator. Pressure test and evacuate the system before charging. When removing tubing, pass dry nitrogen through lines when soldering for prevention of copper oxides.

5-11. Phase Sequence Relay

a. General. The phase sequence relay is used when the air conditioner has a Whirlpool compressor. It is not required when the unit has a Bendix-Westinghouse Compressor. The phase sequence relay prevents operation of the unit unless the phase sequence is correct and the fan and compressor motor rotate in the proper direction. It is located in the upper left corner of the control box.

b. Removal. Refer to figure 5-9, and remove phase sequence relay.

c. Installation. Replace a defective phase sequence relay. Install the phase sequence relay in reverse order of removal as illustrated on figure 5-9.

d. Test. Test phase sequence relay by referring to wiring diagram and checking for continuity or open circuit across the normal] y closed or normally open contacts. Also test the relay solenoid for continuity.

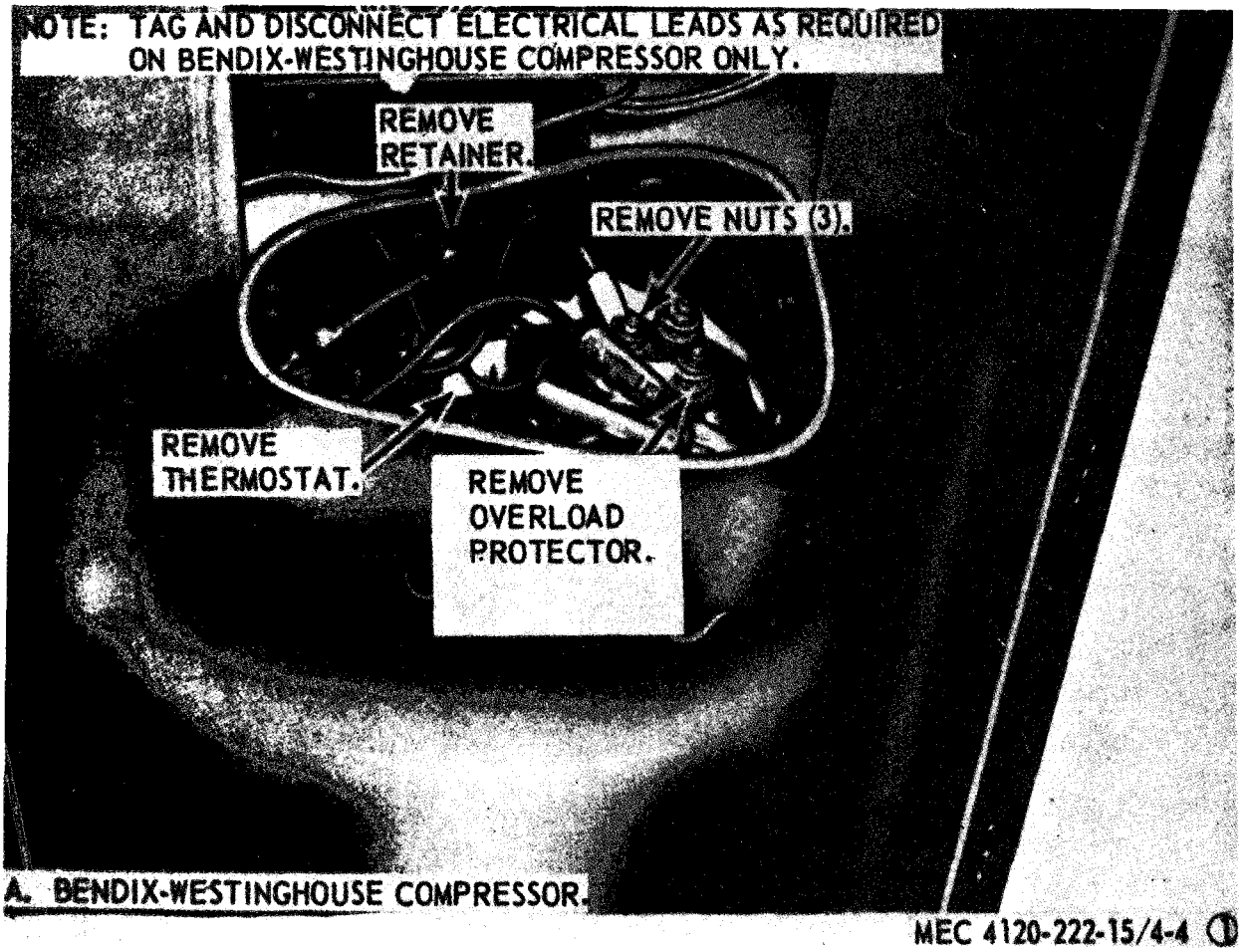


Figure 5–4. Compressor overload protector and heater thermostat removal and wiring. (Sheet 1 of 2)

5-12. Circuit Breaker

a. General. Some of the earlier model CE20VAL6 air conditioner do not have circuit breaker. The circuit breaker protects the compressor from continuous overcurrent and short circuits. It is located in the lower right corner of the control box. Refer to paragraph 2–9 for reset procedure.

b. Testing. Refer to figure 5-9, tag and disconnect the leads and test the circuit breaker for continuity with a multimeter set on OHMS. Refer to the wiring diagram for points to establish continuity.

c. Removal.

(1) Refer to figure 5-9 (1), and remove the circuit breaker.

(2) Refer to figure 5-9 (2), and disconnect the circuit breaker linkage as follows:

(a) Remove snap ring (1) from pin (4).

(b) Pull pin (4) and spacer (3) from switch arm (2).

(c) Remove linkage rod (6) and connector (5).

d. Installation. Replace a defective circuit breaker in reverse order of removal as illustrated on figure 5-9.

5-13. Rectifier

a. General. New models of CE20VAL6 and CE20VAL4 air conditioners have a solid state rectifier, figure 5–9. The earlier models have a rectifier and a surge suppressor. Both are located in the control box at the upper right corner and are removed in a similar manner. The rectifier changes alternating current to direct current.

b. Testing. Disconnect the electrical leads. Use a multimeter and test the front to back resistance of the rectifier. A resistance of infinity in both directions indicates an open rectifier. Replace a defective rectifier or surge compressor.

c. *Removal.* Refer to figure 5-9, and remove the rectifier.

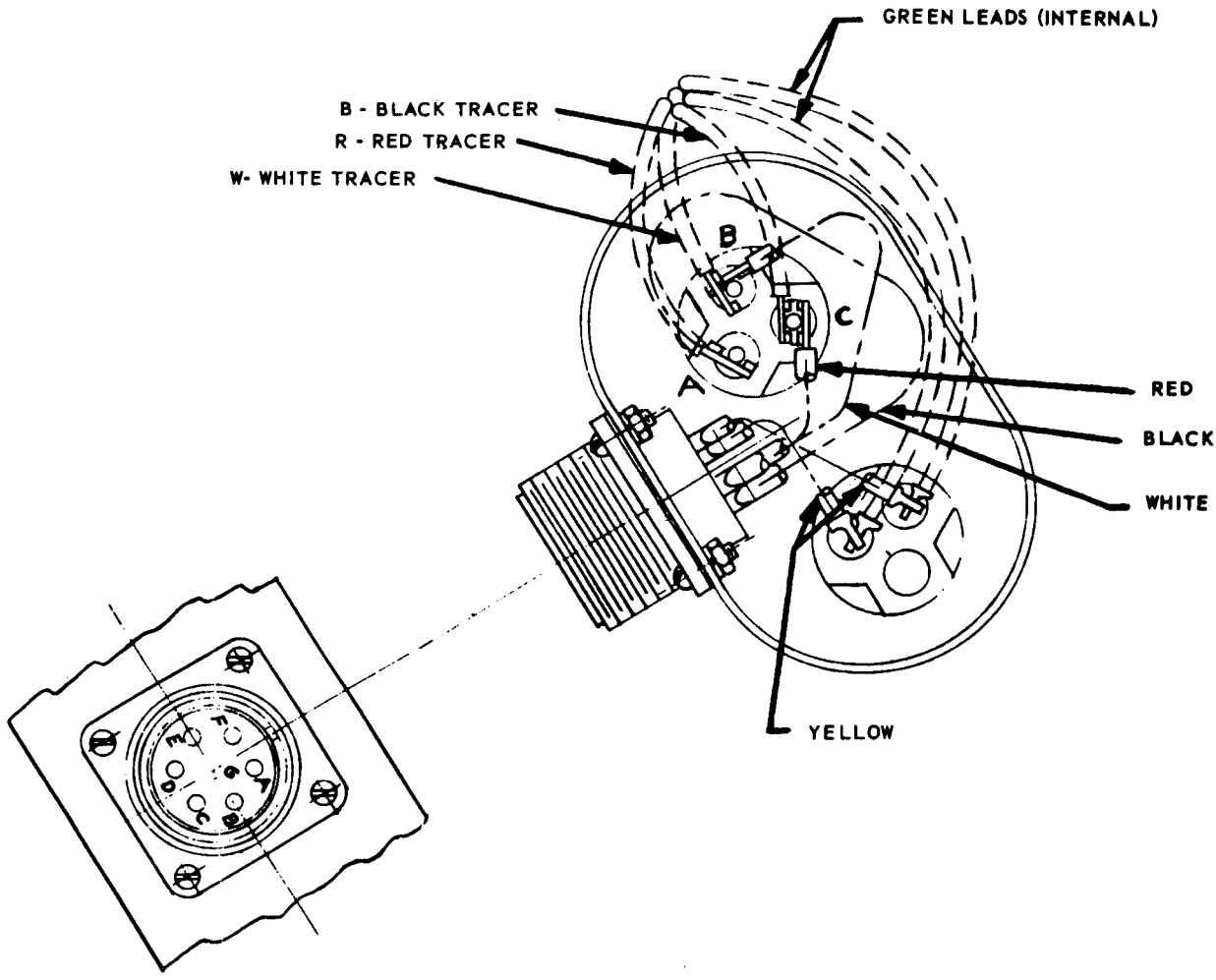


Figure 5-4. Compressor overload protector and heater thermostat removal and wiring. (Sheet 2 of 2).

d. Installation. Replace a defective rectifier in reverse order of removal as illustrated on figure 5-9.

5-14. Terminal Blocks

a. General. There are three terminal blocks on model CE20VAL6 and only two on model CE20VAL4. They are all mounted in the control box. Power is distributed from these terminal blocks to all electrical components of the air conditioner. All terminal blocks are removed and installed in a similar manner.

b. Removal. Remove terminal blocks as illustrated on figure 5-9.

c. Installation. Replace defective terminal blocks

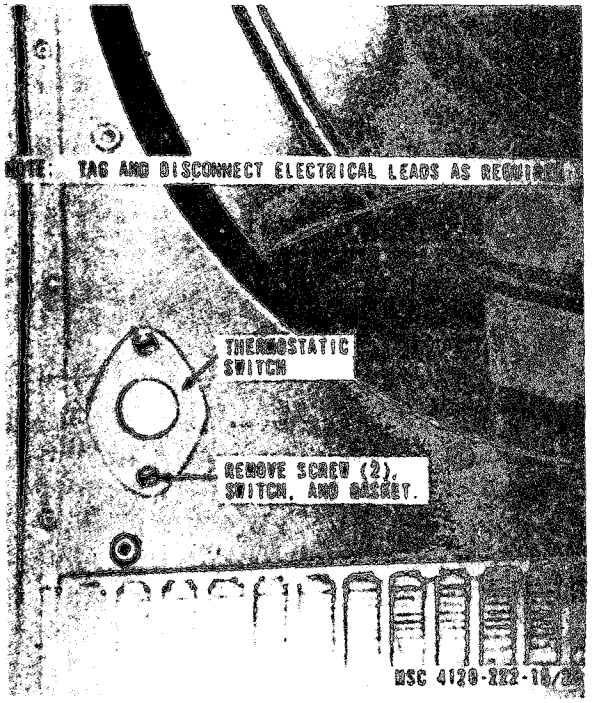


Figure 5-5. Outdoor themostat removal and installation.

and install in reverse order of removal as illustrated on figure 5-9.

d. Inspection. Inspect terminal blocks for cracks, breaks, or other damage.

5-15. Compressor Motor Contactor and Electrical Heater Contactor

a. General. Both Contactors are located in the control box, figure 5-9. A motor contactor starts the compressor motor and a heater contactor is connected to the electrical heaters.

b. Removal. Remove contractors as illustrated on figure 5-9.

e. Installation. Replace defective Contractors and install in reverse order of removal as illustrated on figure 5-9.

5-16. Control Box and Receptacles

a. Removal. Refer to figure 5–9, and remove the control box and receptacles.

b. Installation. Replace defective (control box and receptacles and install in reverse order of removal as illustrated on figure 5-9.

Caution: **Do not remove control box until the circuit breaker linkage is disconnected.**

5-17. Electric Heater Elements

a. General. The two banks of electrical resistance heaters are mounted directly behind the evaporator coil. These heaters provide the heat called for by the temperature control to maintain the required temperature of the conditioned air. The two banks of heaters provide two ranges of heating and are manually controlled by placing the selector switch in the proper position (LO-HEAT or HI-HEAT) to maintain the required temperature.

b. Inspection. Inspect elements for breaks, cracks, or other damage.

c. Removal. Remove electric heater elements as illustrated in figure 5-10.

d. Installation. Replace a defective heater and install in reverse order of removal as illustrated in figure 5–10.

5–18. Back Pressure Regulating Valve

a. General. Back pressure regulating valve figure 5–10 regulates refrigerant pressure in the evaporator to prevent coil freeze up. Valve is preset to establish a minimum pressure in the evaporator of 57.8 psig.

b. Adjusting. Adjust the back pressure regulating valve by loosening the lock nut at, the top of the valve and turning the adjusting screw. Tighten the lock nut after adjustment.

c. Removal. Refer to figure 5-10, and remove the back pressure regulator valve.

Note. Discharge the refrigerant before removing back pressure valve.

d. Installation. Replace a defective back pressure regulating valve and install in reversing order of removal as illustrated on figure 5-10. Evacuate, and recharge refrigerant system (para 5-33).

5-19. Wiring Harness and Wire Leads

a. General. The electrical circuits in the air conditioner are completed by individual wire leads or by wire leads laced or enclosed in a loom to fom a wiring harness. All of the wiring carries code numbers. When testing, repairing or replacing the wiring harness or individual wires, refer to the practical wiring diagrams, figures 1-4. Inspect all wiring installations for cracked or frayed insulation material. Pay particular attention to the wires passing through holes in the frame or around sharp edges. Repair or replace defective wiring.

b. Testing. Test for continuity by disconnecting each end. Touch the test probes of a multimeter to each end of wire. If continuity is not indicated, repair or replace wire.

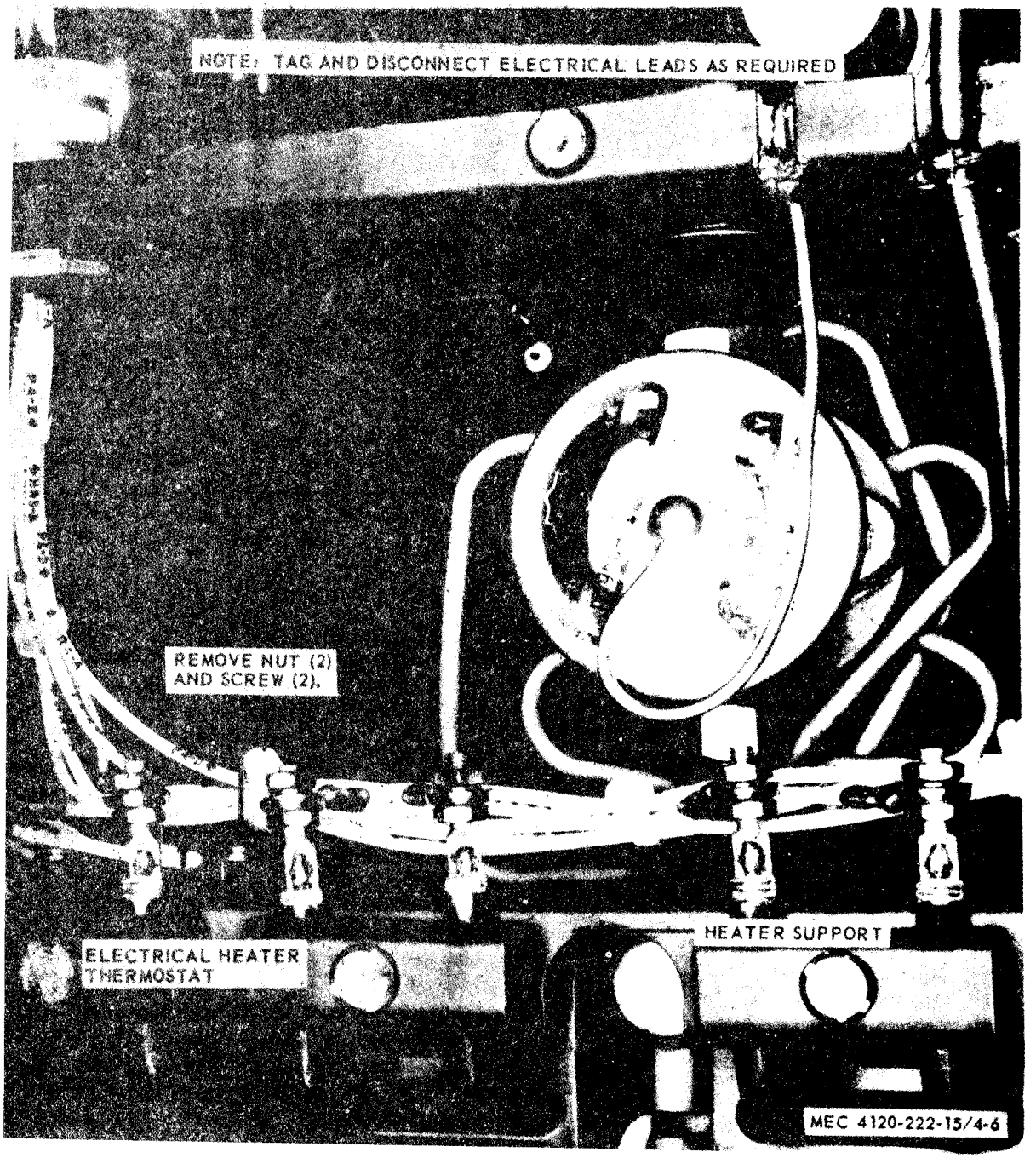


Figure 5-6. Electrical heater thermostat removal and installation.

c. Repair. Remove insulation to expose $^{1}/_{2}$ inch of bare wire on each side of break. Twist the wire ends together and solder the connection. Cover the connection with electrical tape and friction tape making certain to cover all the exposed area. Replace broken terminal lugs with, exact duplicates.

d. Replacement. Replace single wire by using exact duplicates of terminal lugs from old wire. If the wire is part of a harness assembly, disconnect the wire at both ends and cap ends. Attach the replacement wire to the outside of the harness with electrical tape. Refer to figure 1-4 for practical wiring diagrams.

5–20. Service Valves

a. General. The two angle type service valves (suction tube and discharge tube) provide access to the refrigerant system.

b. Removal. Discharge the refrigerant system and refer to figure 5-11 and remove the service valves.

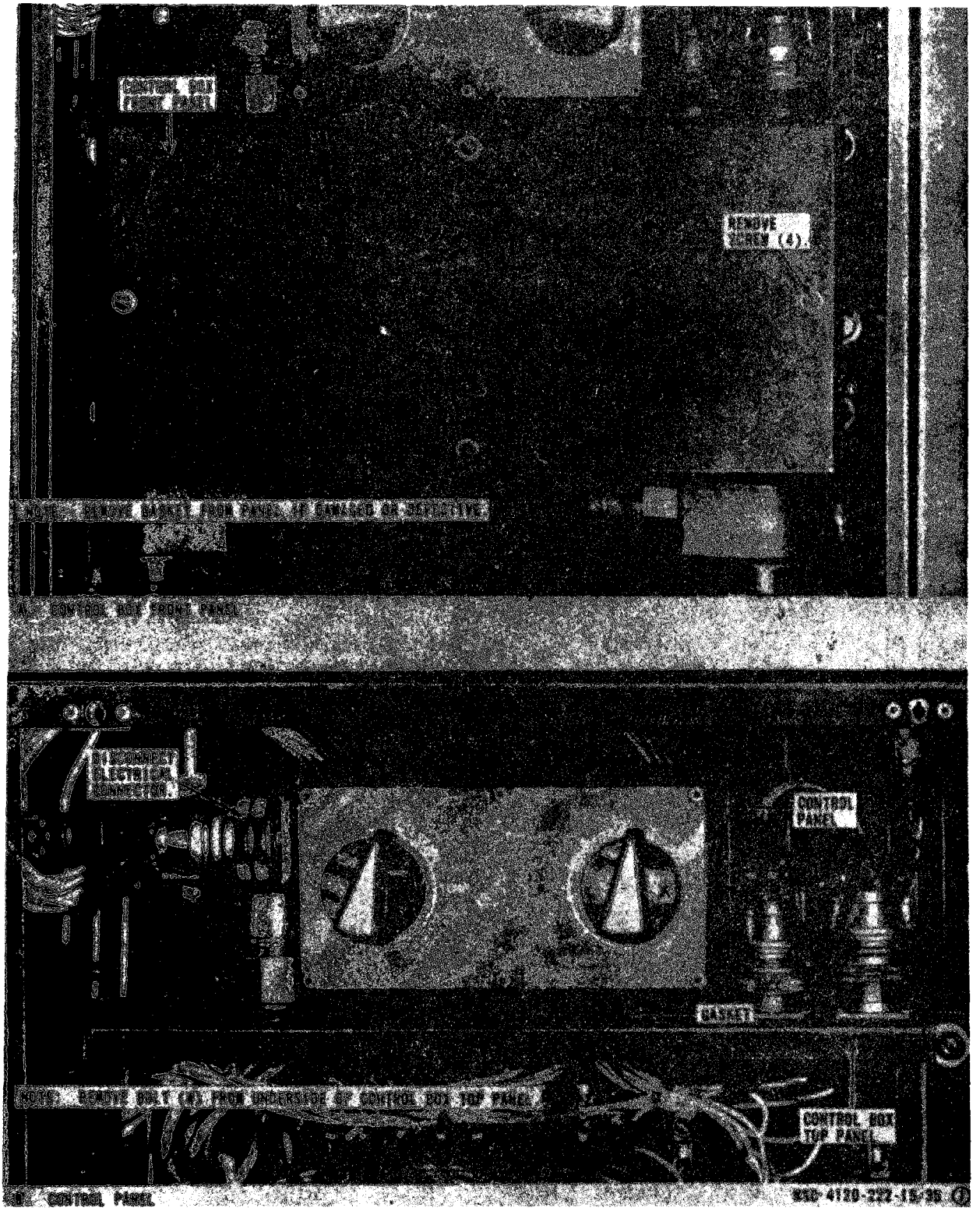
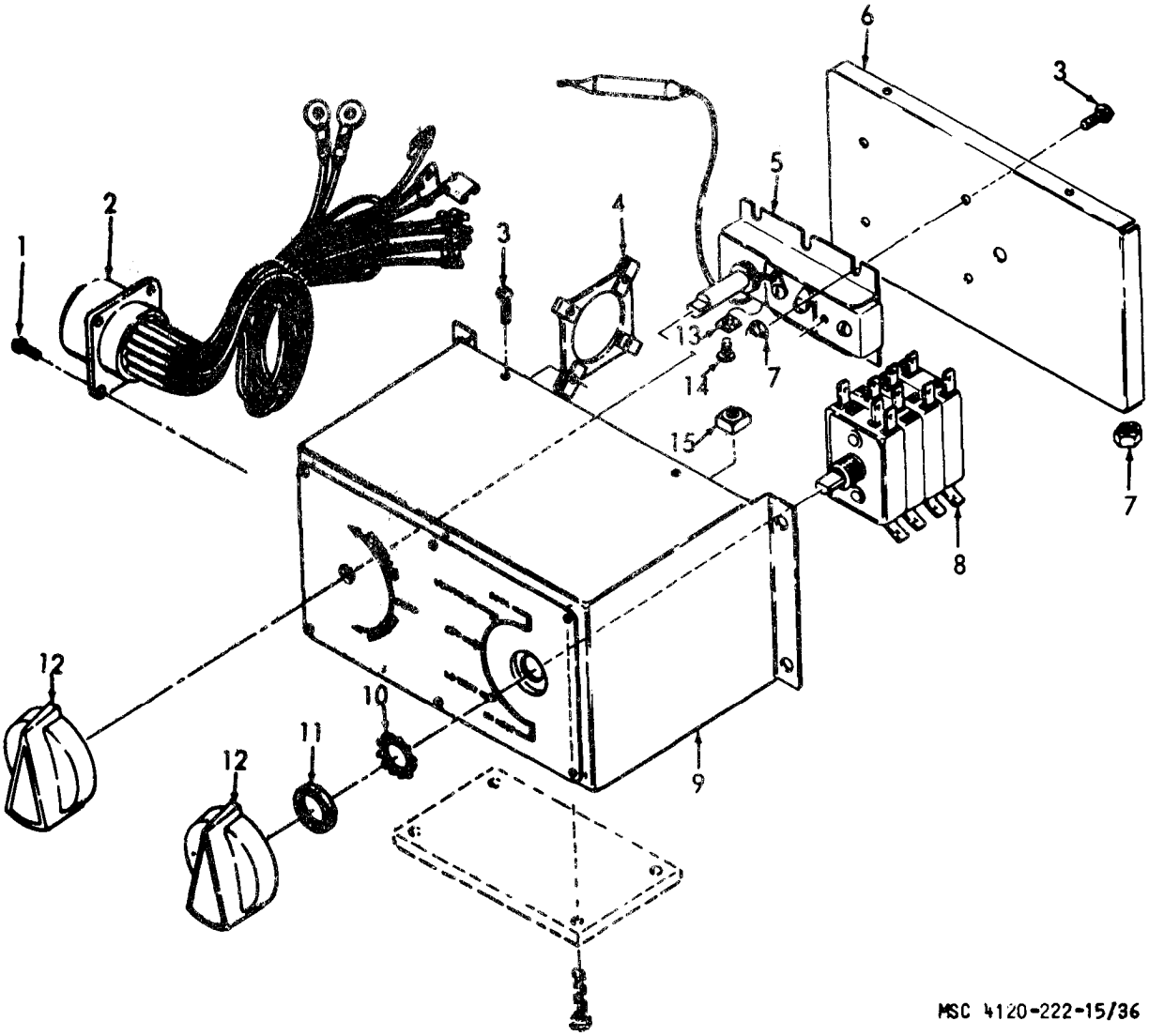


Figure 5–7. Control box front panel and control panel removal and installation.

c. Installation. Replace a defective valve and install valves in reverse order of removal. Evacuate and recharge the unit refrigeration system (para 5–33).

5–21. Thermostatic Expansion Valves

a. General. A 1-ton thermostatic expansion valve controls the rate of flow of liquid refrigerant into the evaporator coil during the cooling cycle of



1 Screw, machine, rd-hd forming No. 4 X ⅜ in. (4 rqr)
2 Receptable connector
3 Screw, machine rd-hd, No. 8–32 X ½ in. (8 rqr)
4 Retaining ring
5 Temperature control (temperature control thermostat)
6 Control panel plate
7 Nut, hex, No. 8–32 (8 rqr)
8 Selector switch
9 Control panel casing
10 Washer, lock IT (spec)
11 Nut, hex (spec)
12 Knob (2 rqr)
13 Tube clip
14 Screw, machine, No. 6–32 X ¼ in.
15 Nut, retainer, No. 10–32 (4 rqr)

Figure 5–8. Control panel, disassembly and reassembly.

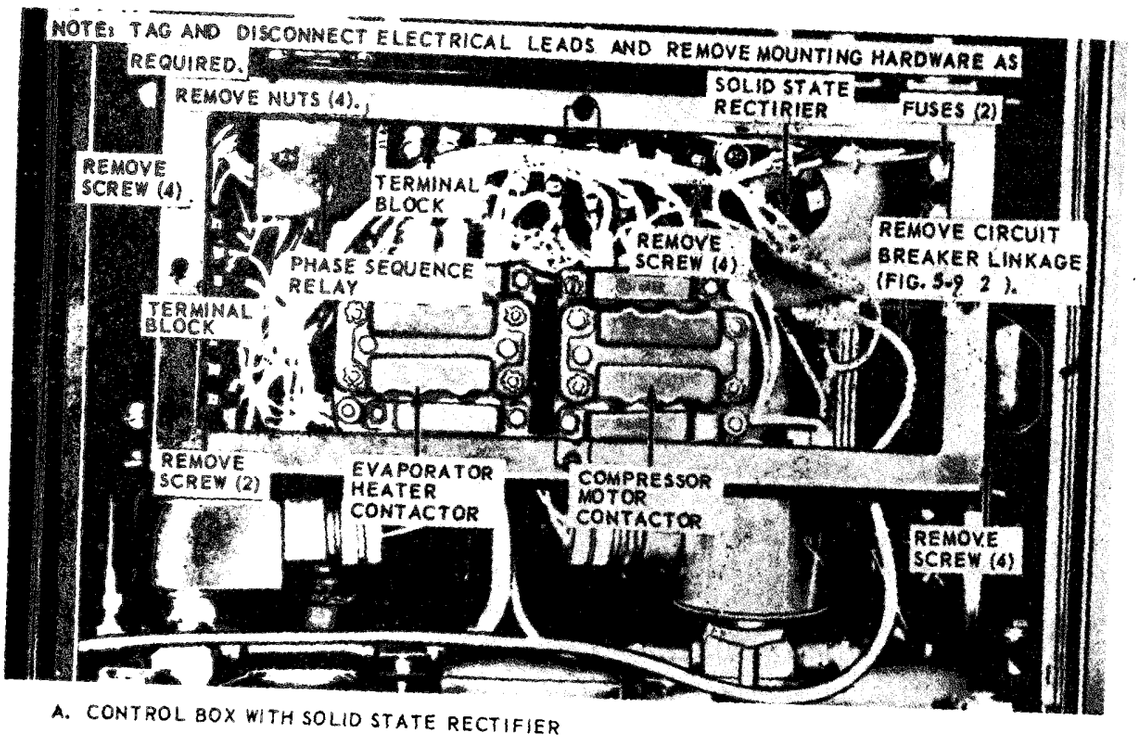
operation. The one-half ton thermostatic expansion valve functions when the unit is in the bypass cycle of operation. Each expansion valve is provided with a super heat setting adjustment (10°F. for each model) to assure efficiency in the refrigerant system.

b. Removal. Discharge the refrigerant system, refer to figure 5-12, and remove the themostatic expansion valves.

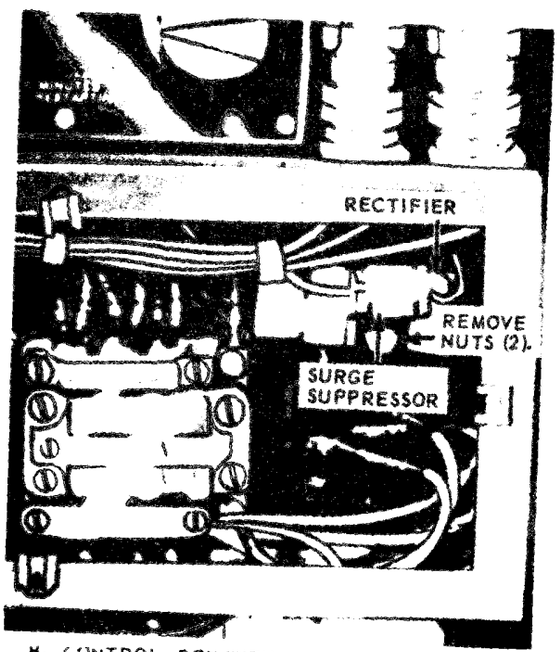
c. Adjustment. Refer to figures 5-13 and 5-14, and check and adjust the superheat setting of the 1-ton thermostatic expansion valve, The $^{1}/_{2}$-ton thermostatic expansion valve adjusta in the same manner.

d. Installation. Replace defective expansion valves and install in reverse order of removal as illustrated in figure 5-12. Evacuate and recharge the unit refrigerating system (para 5-33).

Note. A gas is superheated whenever its temperature is higher than the temperature, corresponding to its pressure at saturation. Example: Refrigerant -22 at 69 pounds pressure has a temperature of 40" F. If the suction pressure gage reads 69 pounds and the temperature of the suction tube reads 50°F., the gas is superheated 10°F.



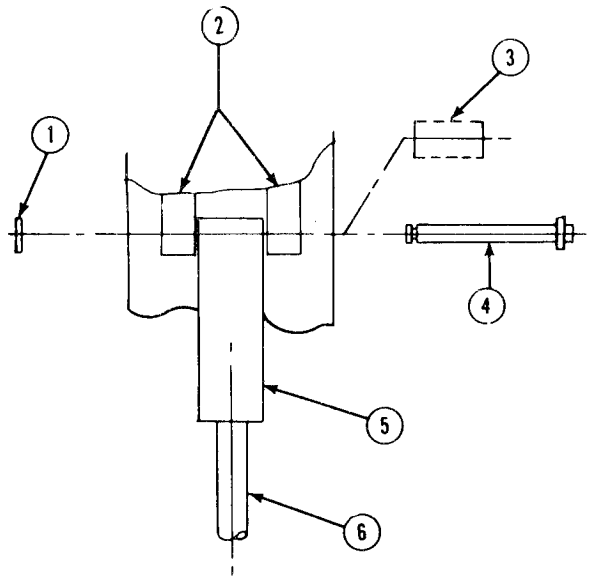
A. CONTROL BOX WITH SOLID STATE RECTIFIER



B. CONTROL BOX WITH SURGE SUPPRESSOR AND RECTIFIER.

ME 4120-222-14/5.9 (1)

Figure 5-9. Phase sequence relay, circuit breaker, rectifier, terminal blocks, contactors, receptacle connectors, and control box, removal and installation, Model CE20VAL4 (Sheet 1 of 2).



C. CIRCUIT BREAKER LINKAGE

MEC 4120-222-15/4-9 (2)

1 Snap ring
2 Switch arms
3 Phenolic spacer
4 Pin
5 Linkage connector
6 Linkage rod

Figure 5-9-Continued. (Sheet 2 of 2).

5–22. High Pressure Cutout Switch

a. General. Some of the earlier model CE20VAL6 and CE20VAL4 air conditioners do not have a high pressure cutout switch. The high pressure cutout switch prevents the compressor from operating if the head pressure exceeds 445 psig (pounds per square inch gage).

b. Removal. Discharge the refrigerant system and remove high pressure cutout switch as illustrated in figure 5-15.

c. Testing. Test the pressure switch for continuity with a multimeter set on OHMS. Press the reset button and recheck. Refer to the wiring diagram for the points to establish continuity.

d. Installation. Replace a defective high pressure cutout switch in reverse order of removal as illustrated in figure 5–15. Evacuate and recharge the unit refrigerant system (para 5-33).

5-23. Hot Gas Bypass Solenoid Valve

a. General. Solenoid valves are automatically actuated by the temperature control and control the flow of refrigerant through the system.

b. On-Equipment Testing. Start the air conditioner. In the bypass mode of operation the tubing from the discharge side of valve should become warm immediately. If not, stop the unit and check the electrical connection and solenoid valve coil. If the valve fails to click upon start of the by-pass mode of operation, stop the unit and check the electrical connection and coil. Refer to figure 5-16 and disconnect the electrical connector. Test the solenoid valve coil for continuity with a multimeter set on OHMS. Continuity should exist between the coil leads. Connect one lead of the multimeter to the air conditioner casing and touch the other lead to either of the coil leads. Continuity should not exist.

c. Removal and Disassembly. Discharge the refrigerant system, refer to figure 5-15 and 5-16, and remove and disassemble the hot gas bypass solenoid valve.

Caution: **The hot gas bypass solenoid valve must be disassembled before disconnecting the tubing from the valve to avoid heat distortion.**

d. Reassembly and Installation. Replace any defective parts, Reassemble and install in reverse order of removal as illustrated on figures 5-16 and 5–16. Evacuate and recharge the unit refrigerating system (para 5–33).

Caution: **Solder the tubing to the valve before reassembling the valve to avoid heat distortion.**

5–24. Liquid Line Solenoid Valve and Liquid Line Bypass Solenoid Valve

a. On-Equipment Testing. Start the air conditioner. If the solenoid valves fail to click upon start of operation, stop the unit and check the electrical connection and coils. Test the solenoid valve coils in the same manner as the hot gas bypass solenoid valve coil (para 5-23).

b. Removal and Disassembly. Refer to figures 5–17 and 5–18, and remove and disassemble the liquid line solenoid valve and liquid line bypass solenoid valve.

Caution: **The solenoid valves must be disassembled before disconnecting the tubing from the valve to avoid heat distortion.**

c. Reassembly and Installation. Pressure test, evacuate and recharge the refrigerant system (para 5-33).

Caution: **Solder the tubing to the valves before reassembling the valves to avoid heat distortion.**

5–25. Dehydrator

a. General. The dehydrator prevents the accumulation of moisture and contaminants within the refrigerant tubing. The dehydrator must be replaced each time the system is exposed to the atmosphere.

b. Removal. Refer to figure 5–19, and remove the dehydrator.

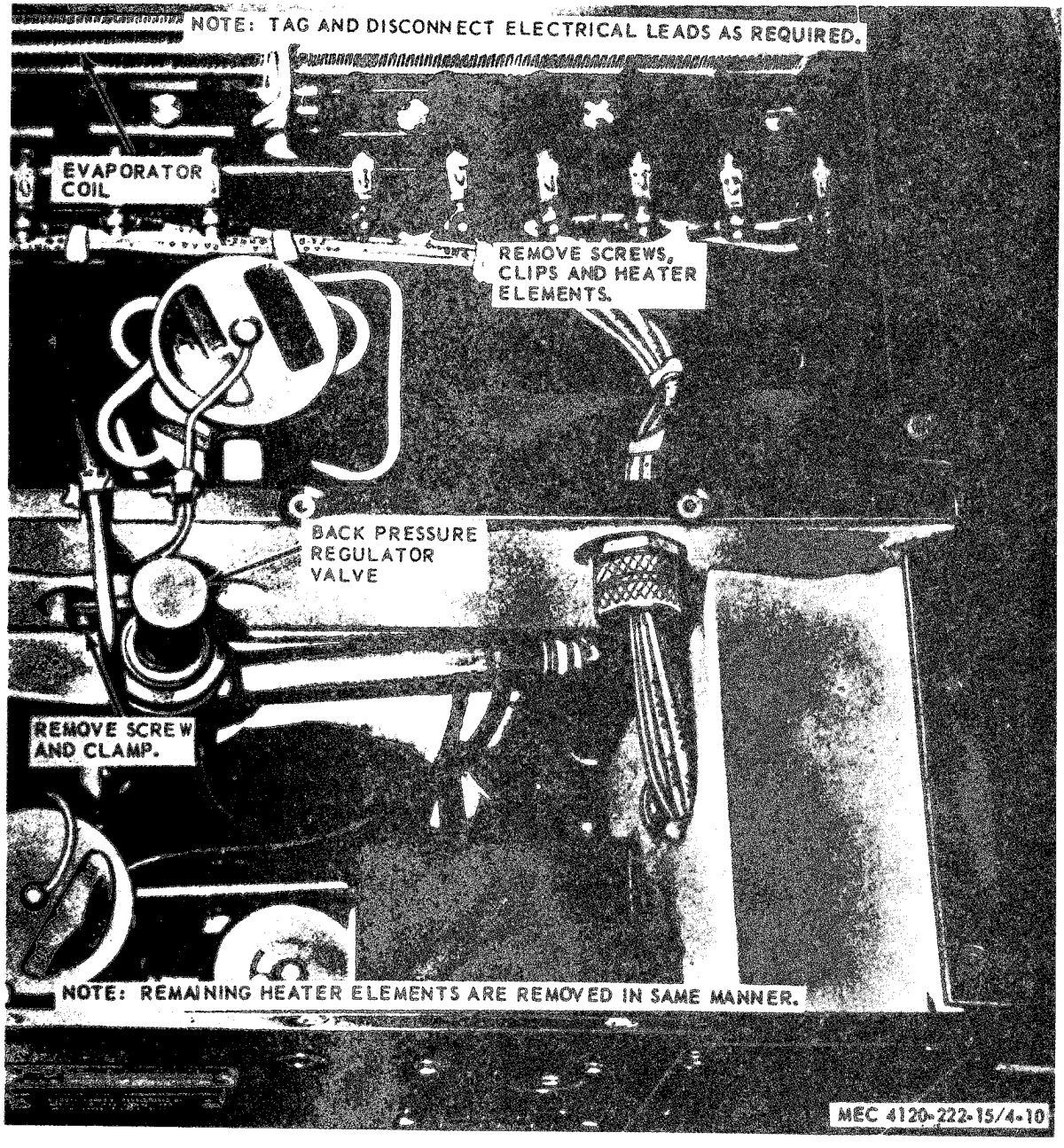


Figure 5–10. *Electric heater elements and back pressure regulating valve removed and installation.*

c. Installation. Install *a* new dehydrator by reversing removal order as illustrated on figure 5-19. Evacuate and recharge the unit refrigerating system (para 5-33).

5-26. Pressure Relief Valve

a. General. Pressure relief valve (fig. 5–19) is located on a tee just below the dehydrator. The pressure relief valve protects the refrigerant system from excessive pressure.

b. Removal. Discharge the refrigerant system, refer to figure 5-19, and remove the pressure relief valve.

c. Installation. Replace a defective pressure relief valve by reversing order of removal as illustrated on figure 5-19. Pressure test, evacuate and recharge refrigerating system (para 5-33).

5-27. Sight Glass

a. General. The sight glass indicates the refrigerant moisture content. A shortage of refrigerant is indicated by bubbles in sight glass.

b. Inspection. Inspect sight glass for cracks, breaks, or other damage.

c. Removal. Remove top panel, air conditioner.

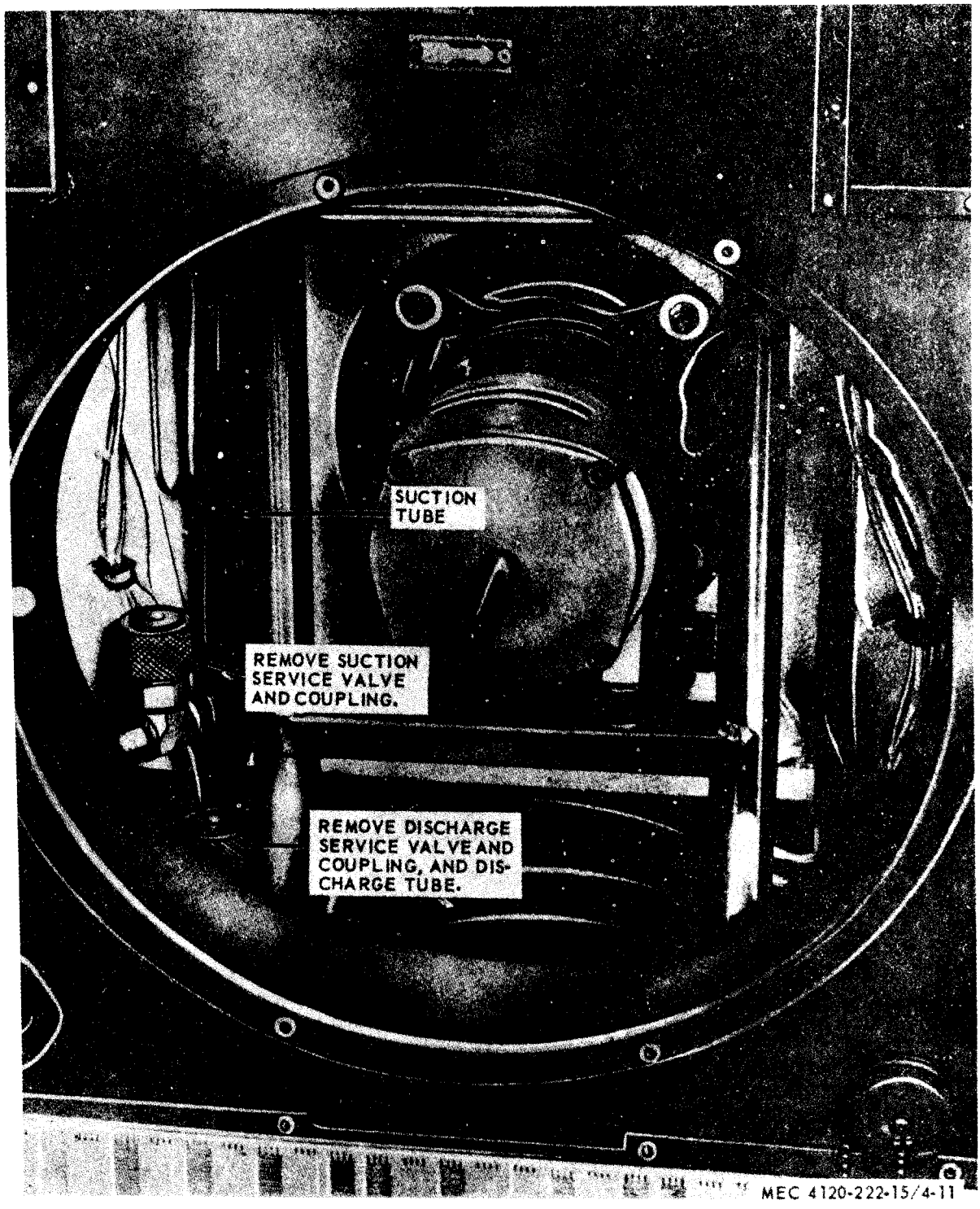


Figure 5-11. Service valves, removal and installation.

Remove the two screws holding the bracket, unsolder the sight glass connections and remove (fig. 5-20) .

d. Installation. Place a new liquid line sight glass in position and solder connections. Since the replacement glass opened the refrigerant system the system must be completely evacuated and then fully charged. See figure 5–26 for instructions on evcuation and charging system.

5–28. Evaporator Coil

a. General. The evaporator coil is mounted on the casing, directly behind the discharge grill and mist eliminator. The coil must be removed from

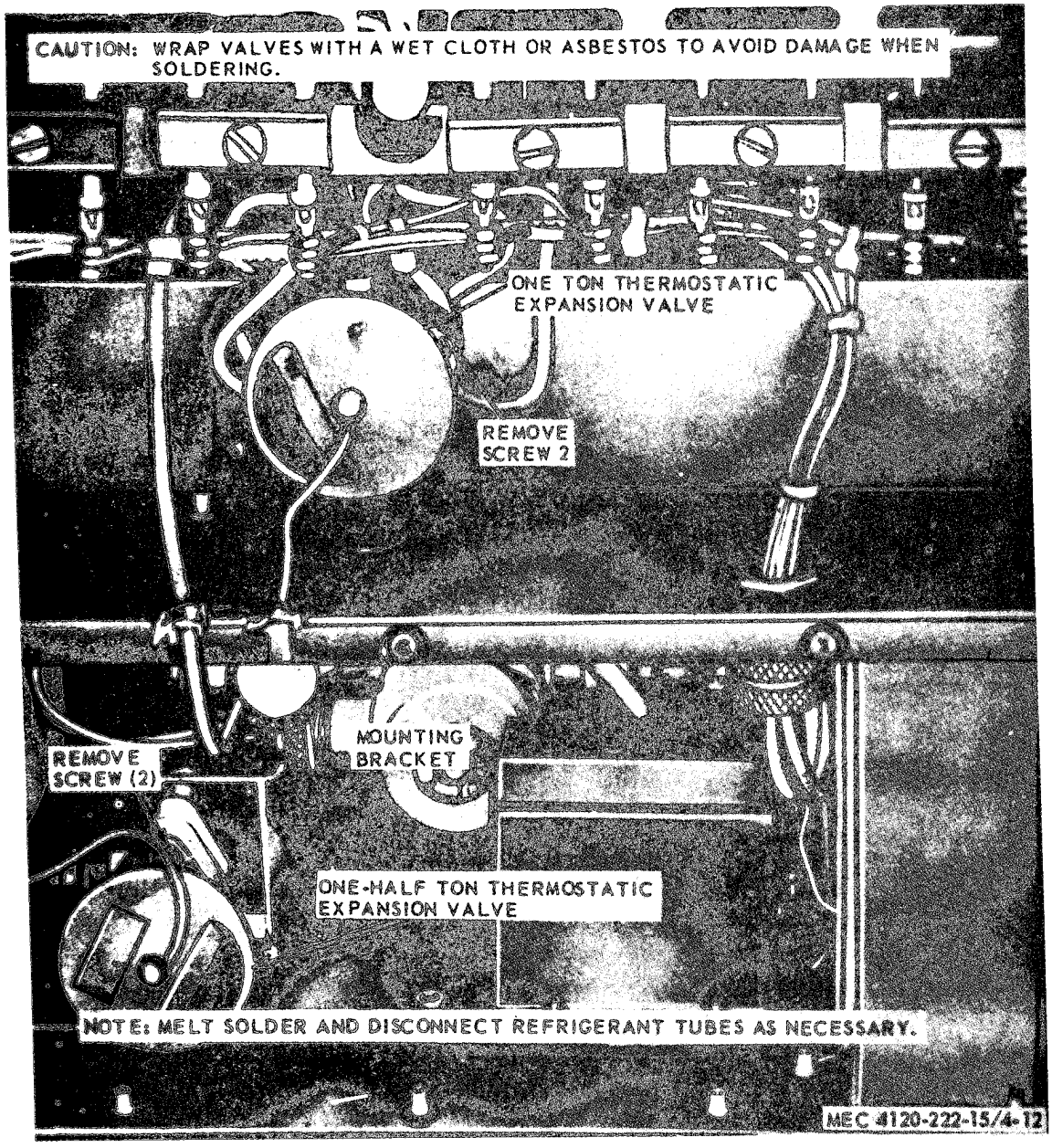


Figure 5–12. Thermostatic expansion valves removal and installation.

the air conditioner for repair or replacement. The coil is made of aluminum and is of the plate-fin configuration.

b. Removal. Refer to figure 5-21, and remove evaporator coil.

c. Cleaning, Inspection and Repair. Use a wire brush and brush off evaporator coil; blow dirt out with compressed air. Wipe with cloth dampened with an approved cleaning solvent. Inspect coil for bent fins, damaged coil runs and interval leaks. straighten bent fins with needle nose pliers. A damaged coil or an internally leaking coil cannot be repaired.

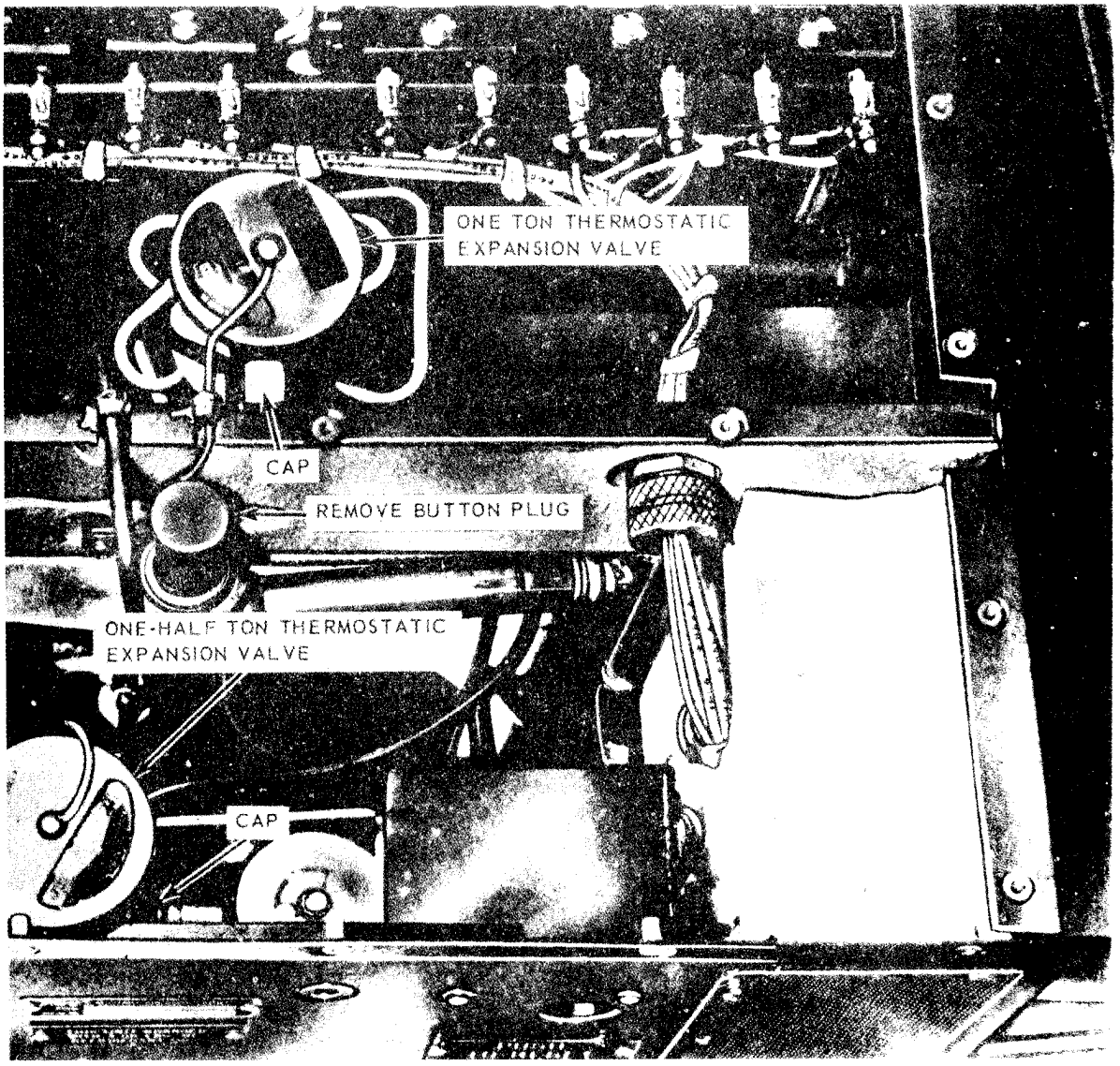
d. Installation. Replace a defective coil assembly and install in reverse order of removal as illustrated in figure 5–21. Evacuate and recharge refrigerating system (para 5-33).

5-29. Condenser Coil

a. General. The condenser coil is mounted on the bottom rear of the casing, directly beneath the condenser fan. The coil must be removed from the air conditioner for repair or replacement. The coil is made from aluminum and is of the plate-fin configuration.

b. Removal. Refer to figure 5-22, and remove condenser coil.

CAUTION. NEVER ADJUST THE EXPANSION VALVE UNLESS IT IS ABSOLUTELY NECESSARY. WHEN ADJUSTING THE EXPANSION VALVE. ALLOW AT LEAST 20 MINUTES BETWEEN EACH ADJUSTMENT. THIS TIME ELEMENT IS VERY IMPORTANT AND MUST BE OBSERVED.



ADJUSTMENT

STEP 1. TAPE THE BULB OF A THE THERMOMETER TO SUCTION TUBE NEAR SENSING ELEMENT. INSULATE THERMOMETER BULB.

STEP 2. INSTALL A SUITABLE PRESSURE GAGE AT SUCTION TUBE SERVICE VALVE (PAR. 5-20).

STEP 3. OPERATE THE UNIT (PAR. 2-11) FOR APPROXIMATELY 30 MINUTES (THERMOMETER READING MUST STABILIZE).

STEP 4. CHECK THERMOMETER AND PRESSURE GAGE READINGS. COMPARE READINGS WITH FIGURE 5-14 THERMOMETER READING SHOULD BE APPROXIMATELY 10 F HIGHER THAN TEMPERATURE GIVEN ON FIGURE.

STEP 5. REMOVE BUTTON PLUG (SHOWN ABOVE). REMOVE CAP AND TURN ADJUSTING SCREW ONE TURN CLOCKWISE TO INCREASE SUPERHEAT 4 F. OR ONE TURN COUNTERCLOCKWISE TO DECREASE SUPERHEAT. INSTALL CAP. INSTALL BUTTON PLUG.

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Figure 5–13. One-tan thermostatic expansion valve, adjustment.

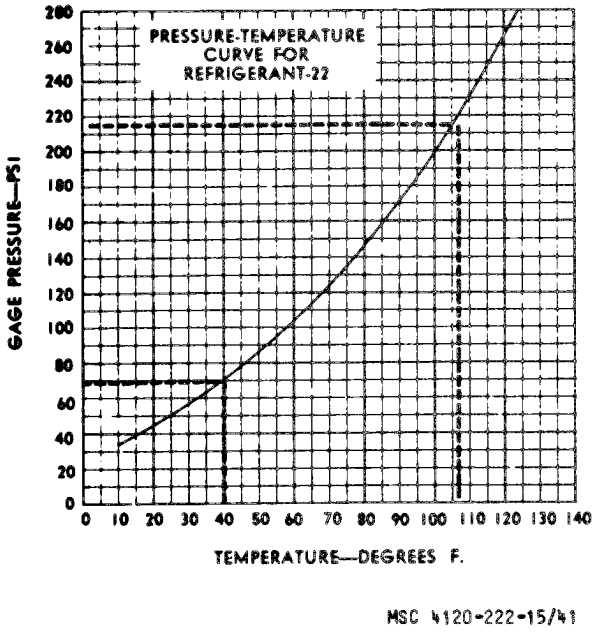


Figure 5–14. Pressure-temperature curve for refrigerant -22.

c. Cleaning, Inspection, and Repair. Refer to paragraph 5-28 and clean and inspect the condenser coil in a similar manner.

d. Installation. Replace a defective coil assembly and install in reverse order of removal as illustrated in figure 5-22. Evacuate and recharge refrigerating system (para 5-33).

5-30. Compressor and Motor Assembly

a. General. The sole purpose of the compressor is to raise the pressure of refrigerant gas from evaporator pressure to condensing pressure. The function of the compressor is to deliver refrigerant to the condenser at a pressure and temperature at which the condensing process can readily be accomplished. The motor/compressor is a hermetically sealed unit and is not repairable in the field. An inoperative compressor is usually due to a mechanical failure causing the compressor to freeze, control failure, or a motor burnout. If the motor/compressor is mechanically frozen or there has been a motor burnout, the compressor must be removed and replaced. When the motor of a hermatic compressor fails, high temperatures may develop within the compressor causing a breakdown of the oil and refrigerant, resulting in formation of acid, moisture, and sludge. All these are extremely corrosive and must be flushed from the system. Repeated burnouts will occur if all of the contiminants are not removed.

b. Cleaning and Inspection. The immediate area around the compressor mounting should be thoroughly cleaned with a suitable solvent and dried. Examine all connections for foreign matter of any kind. Inspect area thoroughly.

Warning: **Avoid bodily contact with the refrigerant, especially eye contact. Avoid inhalation of refrigerant fumes.**

c. Removal. Discharge the refrigerant system, refer to figure 5-23, and remove the compressor.

d. Installation. Instill a replacement compressor in reverse order of removal, as illustrated in figure 5-23. Pressure test, evacuate and recharge refrigerating system (para 5-33).

5-31. Compressor Heater and oil Level Plug (Bendix-Westinghouse)

a. General. The heater is to prevent refrigerant sludging. The compressor heater is controlled by the compressor heater thermostat. It provides heat to prevent sludging and oil pumping problems when the compressor is exposed to low ambient temperatures. It is a 208 volt, 250 watt resistance heater enclosed within tubing. Oil capacity of the compressor is $3^{1}/_{2}$ pints FSN 9150–823-7905. The compressor comes from the manufacturer full of oil.

b. Removal and Disassembly. Refer to paragraph 5-30, and remove the compressor. Refer to figure 5-24, and disassemble the heater and oil plug.

c. Reassembly and Installation. Replace defective heater and oil plug and instill in reverse order of removal as illustrated in figure 5-24. Refer to paragraph 5–30, and install the compressor. Evacuate and charge the refrigerant system (para 5-33) .

Note. Proper oil level is even with the bottom of the oil plug. Add slowly to bring oil level to normal position. Use oil of specification VV–L-825, Type IV, (FSN 9150-823-7905),

5-32. Casing, Base and Duct Assembly

a. General. The casing and base support protects the components of the air conditioner. They also provide air control around the components of the unit. A duct assembly permits control of the source of ventilation air. Baffles provide additional automatic air control while the damper is manually adjusted.

b. Removal. Refer to figure 5-25 and remove the casing, base and duct assembly.

c. Installation. Install casing, base and dudt assembly in reverse order of removal as illustrated in figure 5-25.

d. Inspection. Inspect the baffle, damper assembly and insulator for signs of wear, breaks, cracks or other damage.

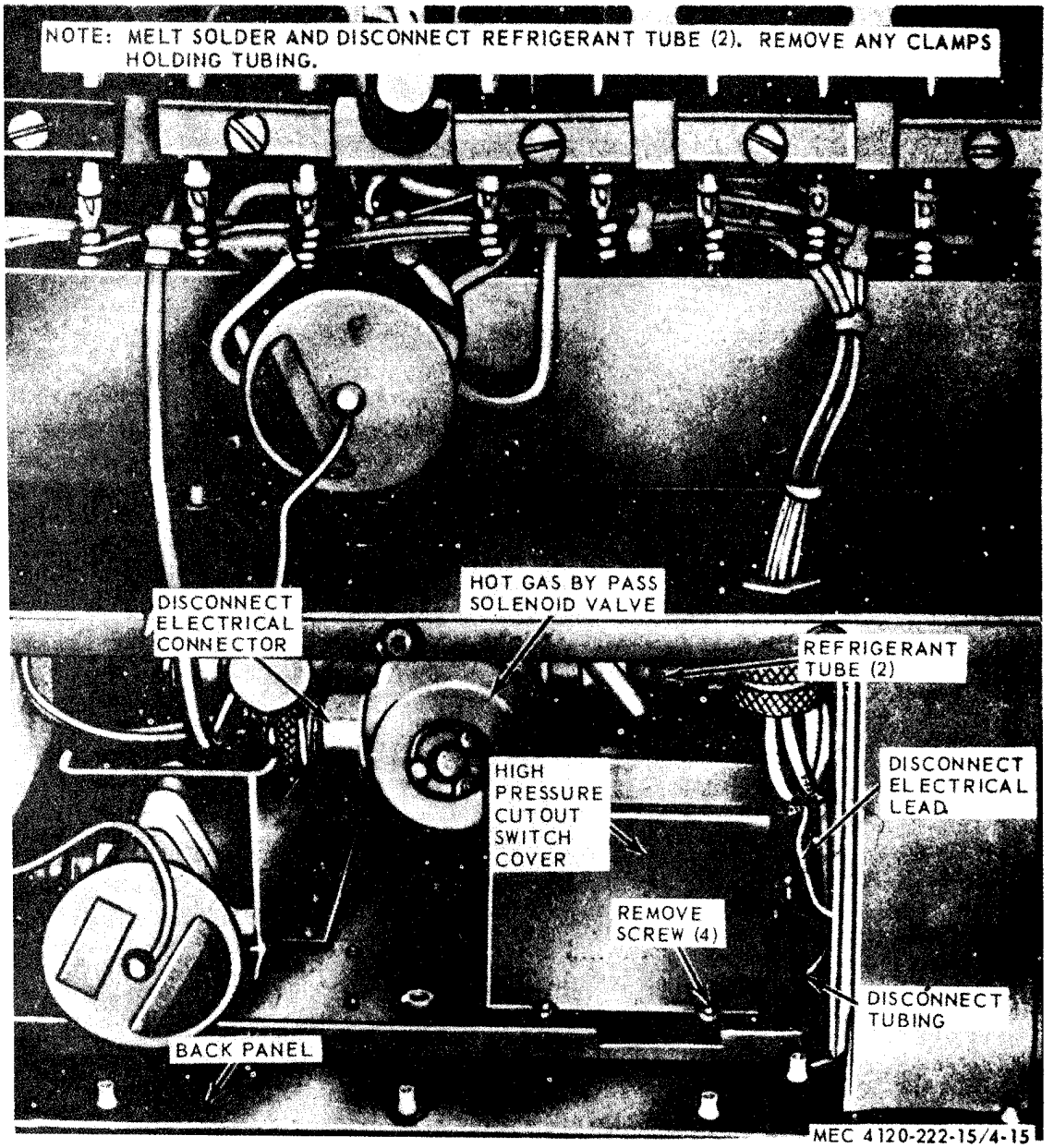


Figure 5-15. Hot gas bypass solenoid valve, and high pressure cutout switch, removal and installation.

5-33. Servicing the Refrigerant System

a. Testing Refrigerant System for Leaks.

(1) *Electronic or halide torch leak detector.* The preferred method of testing for leaks in the refrigerant system is by using a halide torch. A halide detector is used by passing the exploring tube over sweat fittings, all mechanical couplings, and valves. If refrigerant is leaking from the system, the flame of the halide torch will change from blue to green when the leak is small. If the leak is large, the flame will be dense blue with a reddish tip; or, a large leak may extinguish the torch, Mark all spots where leaks are noticed. Drain the refrigerant system and repair the leak, and pressure test.

Warning: **Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas. Be especially careful that refrigerant -22 does not come in contact with the eyes. In case of refrigerant leaks, ventilate the area immediately.**

(2) *Soap solution method.* Operate the air conditioner, brush all possible points of leakage with soap solution, and watch for bubbles. Follow a definite sequence so all points will be thoroughly

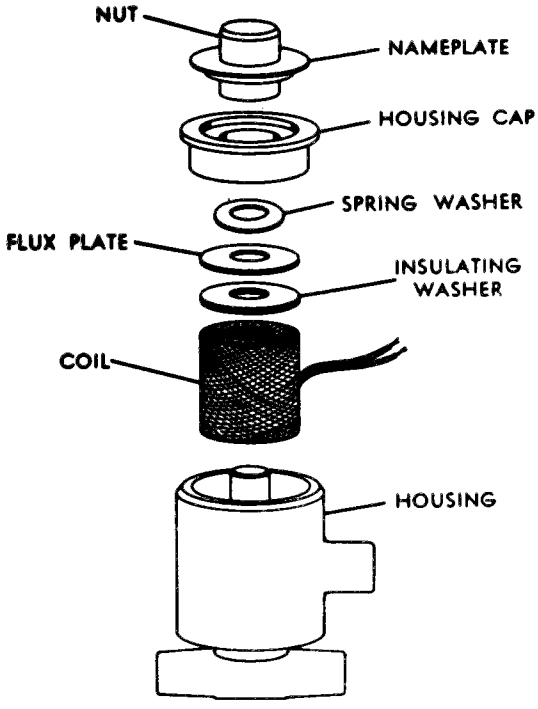


Figure 5–16. Hot gas bypass solenoid valve, disassembly and reassembly.

tested. Wipe the soap solution from all joints and mark any spot where a leak occurs. Drain the refrigerant system and repair lead and pressure test.

b. Purging. Attach a suitable hose *to* the suction service valve and discharge the refrigerant into a safe area.

c. Pressure testing and evacuating. Refer to figure 5-26, and pressure test and evacuate the refrigerant system.

d. Charging. Refer to figure 5-27 and 5-28, charge the refrigerant system.

NOTE: To install charge hoses, remove condenser fan and outside air thermostat Insert hoses through the thermostat hole. Attach hoses to service valves. Install fan prior to operation. Capacity of refrigeration system is 3.7 pounds refrigerant-22, FSN 6830-174-9677.

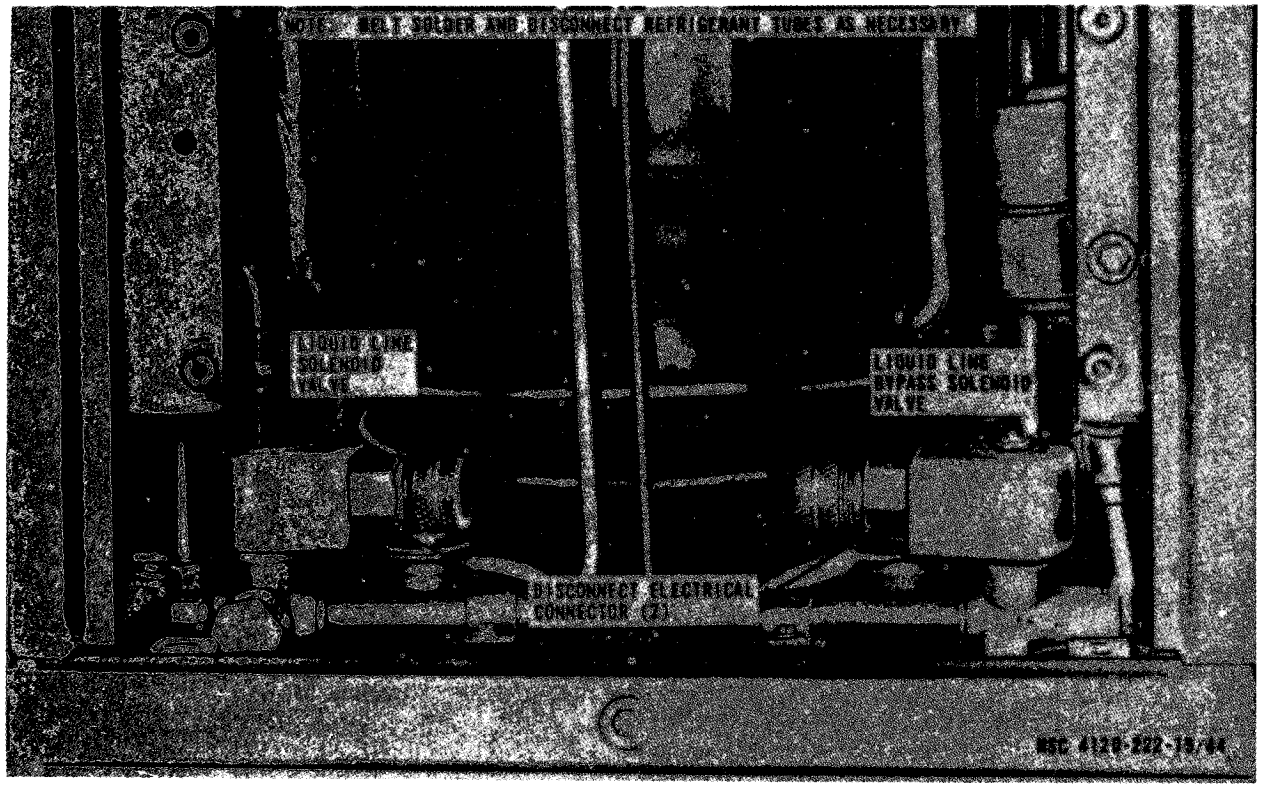
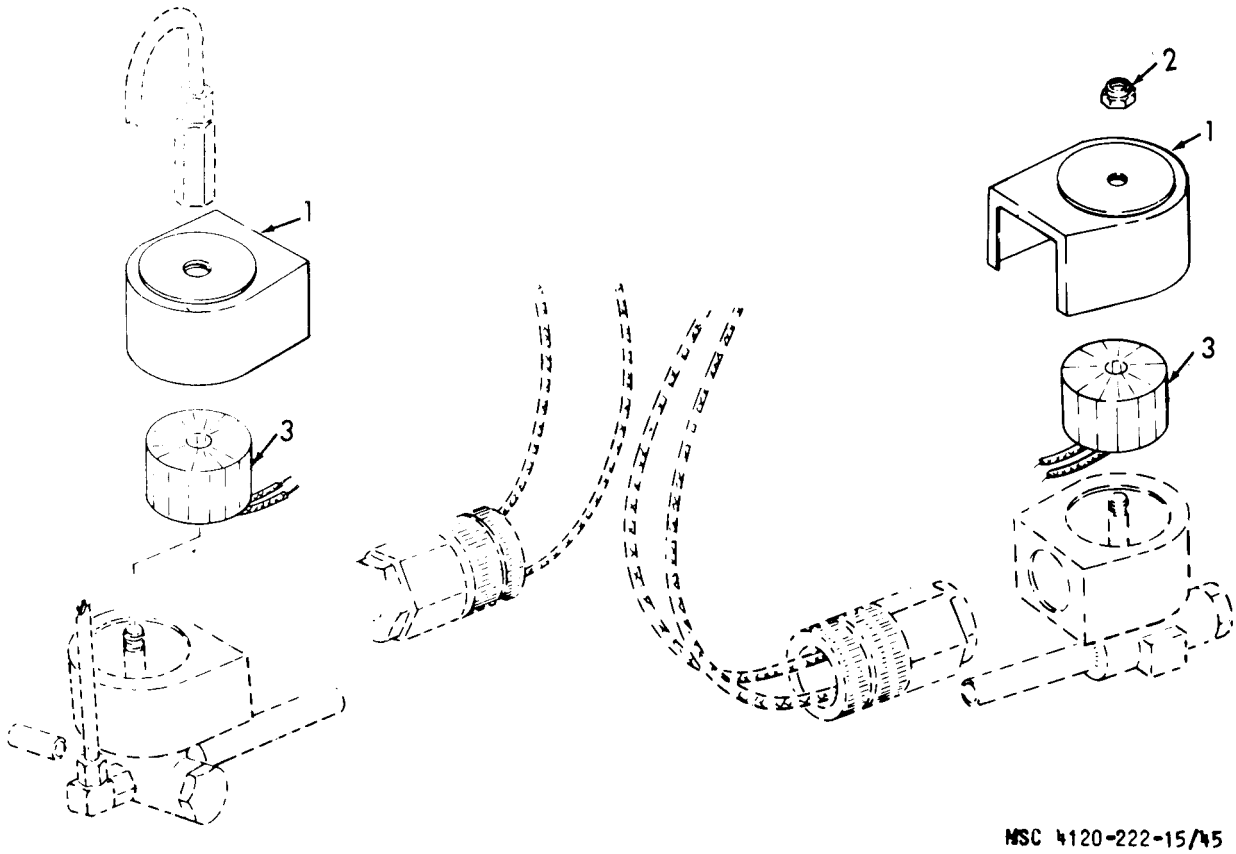


Figure 5-17. Liquid line solenoid valve, removal and installation.



1 Coil cover (2 rqr) 2 Cover retaining nut (spec) 3 Solenoid valve coil (2 rqr)

Figure 5-18. *Liquid line solenoid valve, disassembly and reassembly.*

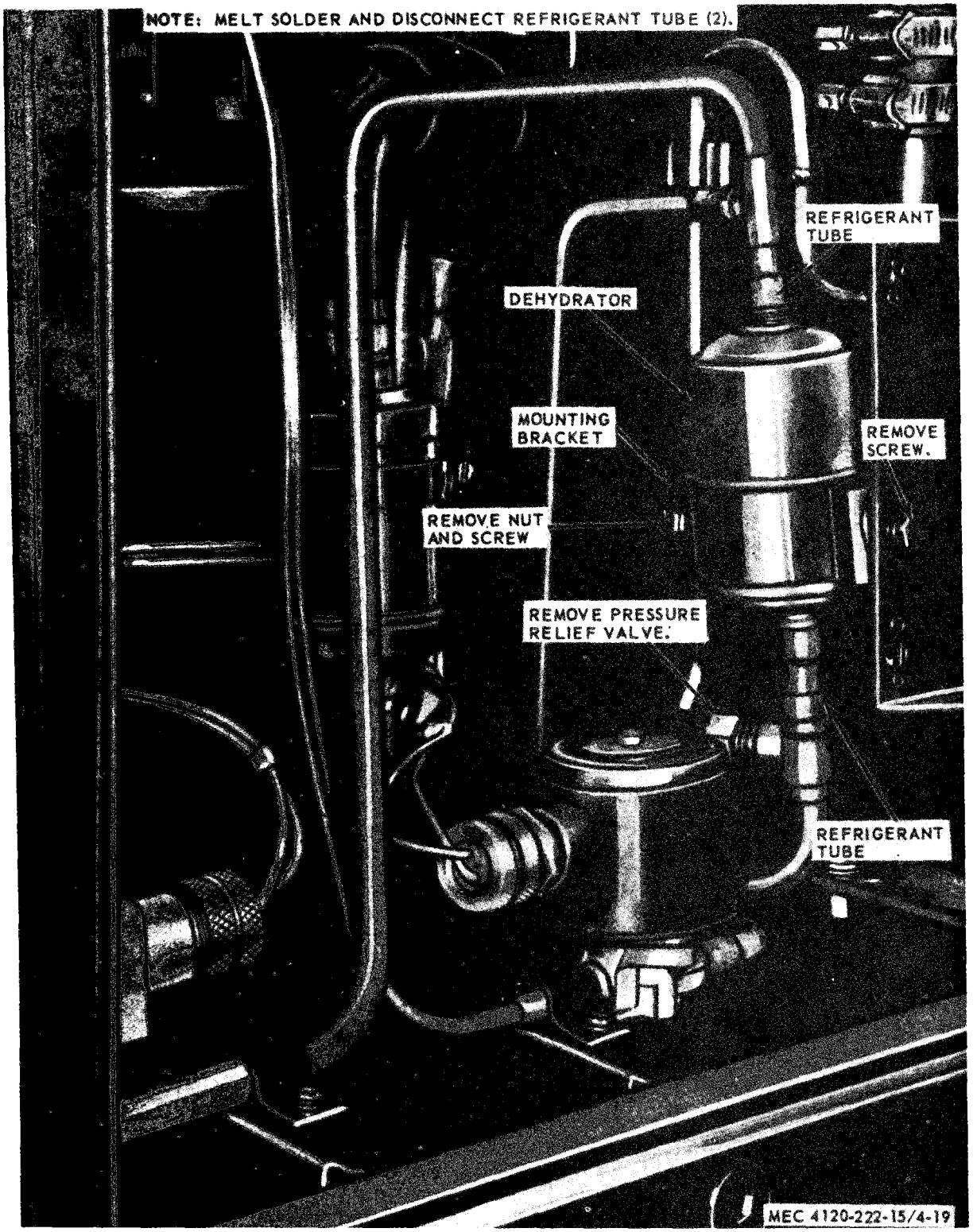


Figure 5-19. Dehydrator and pressure relief valve, removal and installation.

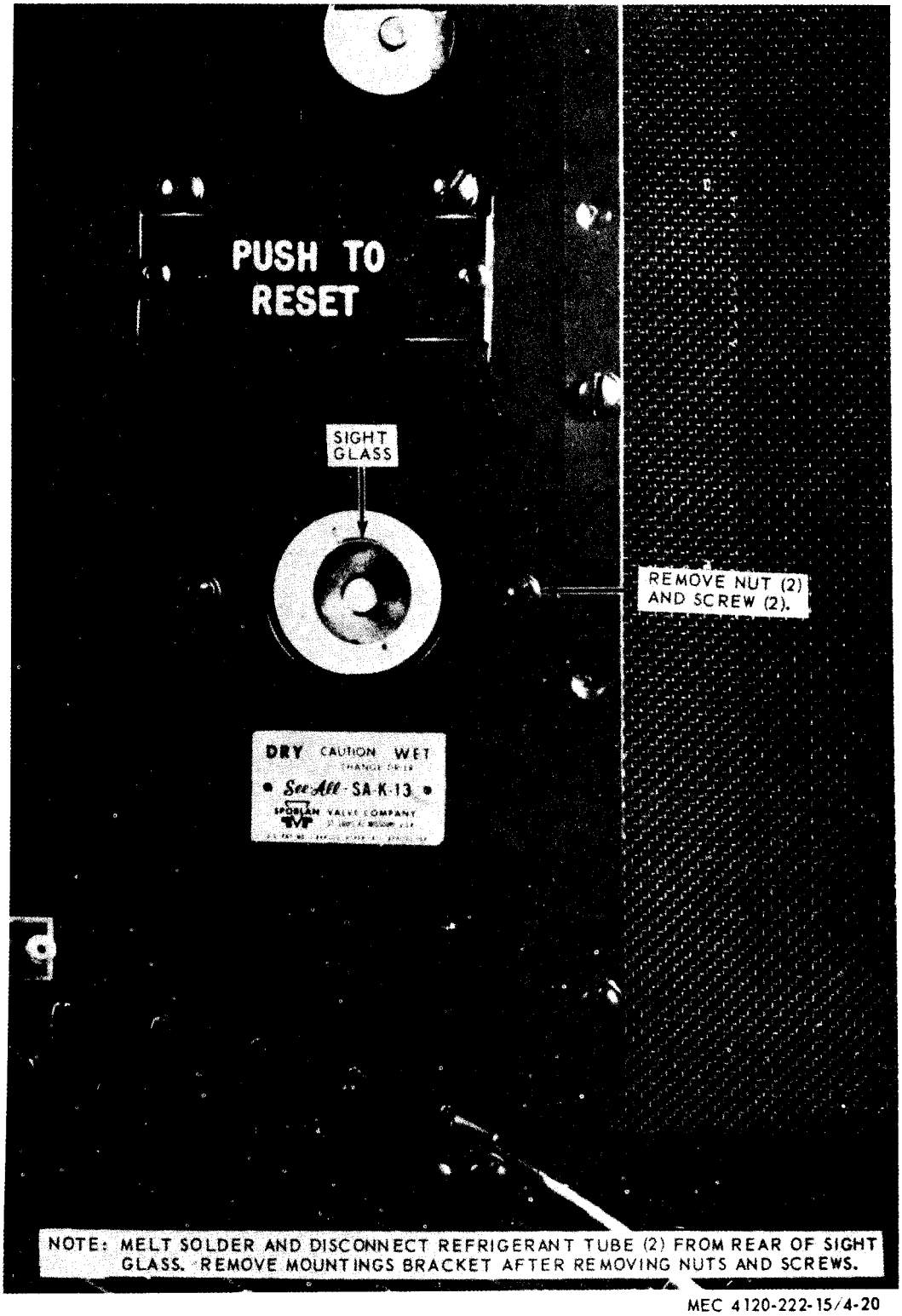


Figure 5-20. *Sight glass removal and installation.*

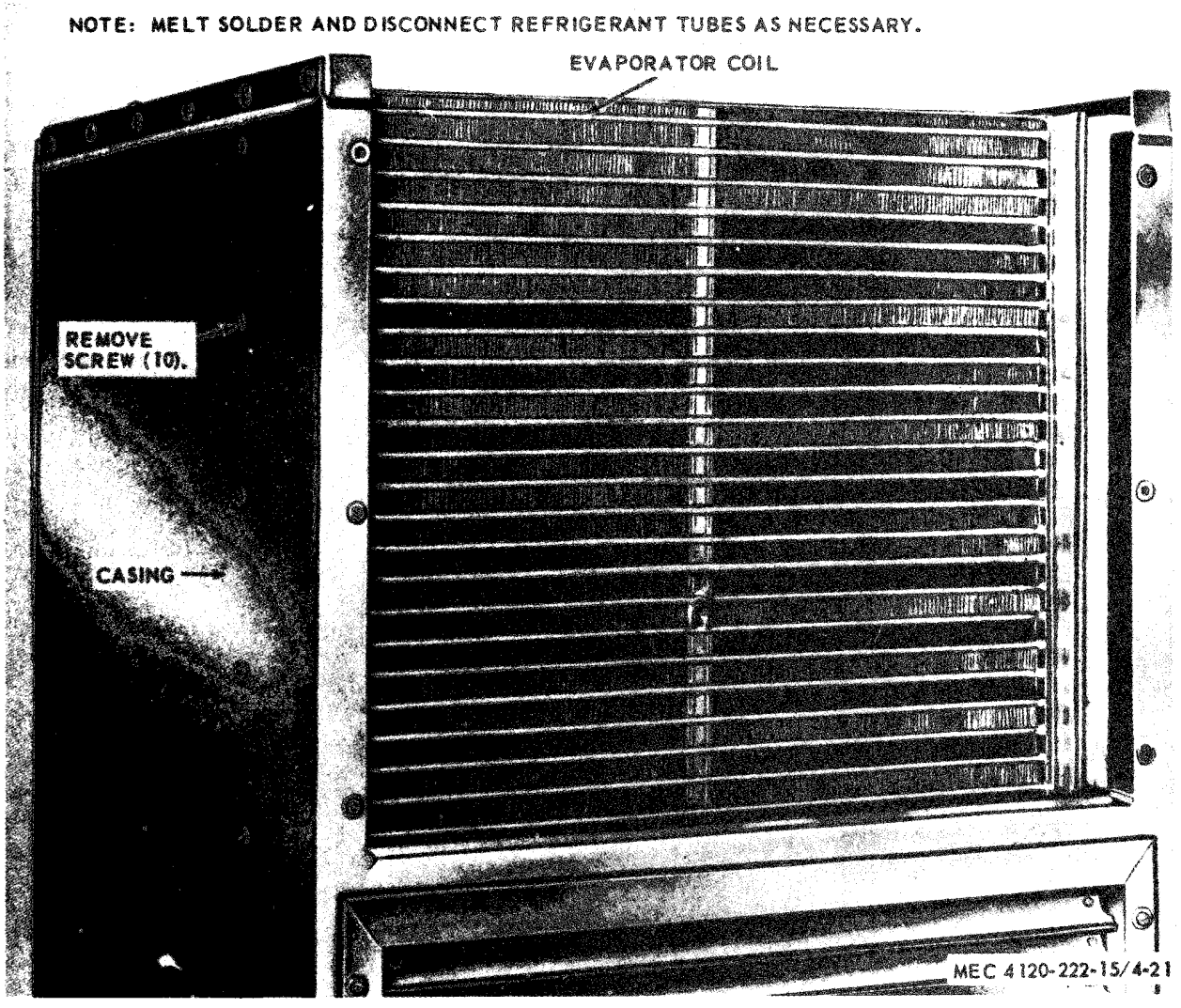


Figure 5-21. Evaporator coil removal and installation.

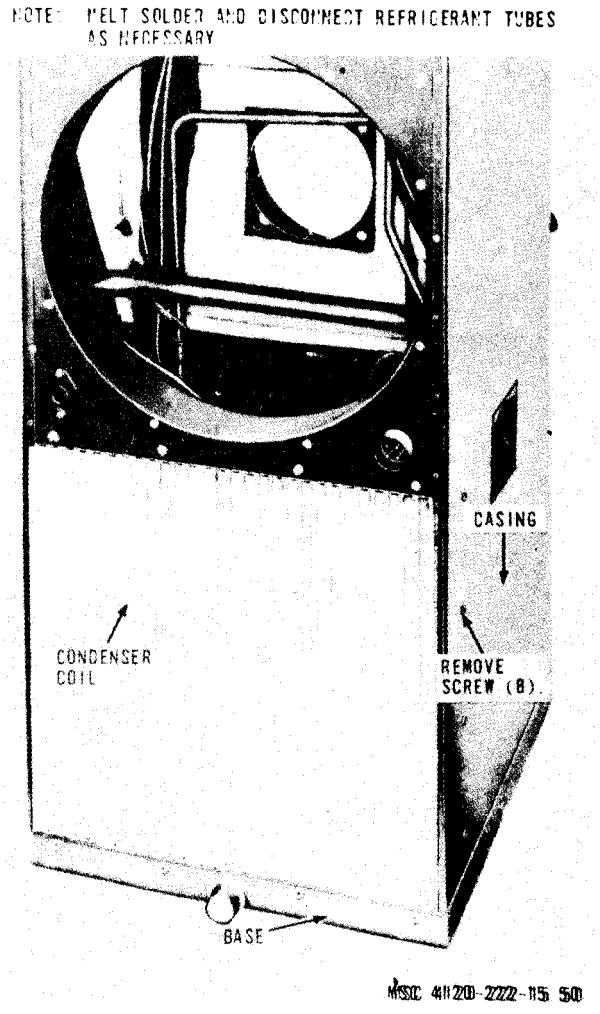


Figure 5-22. Condenser coil, removal and installation.

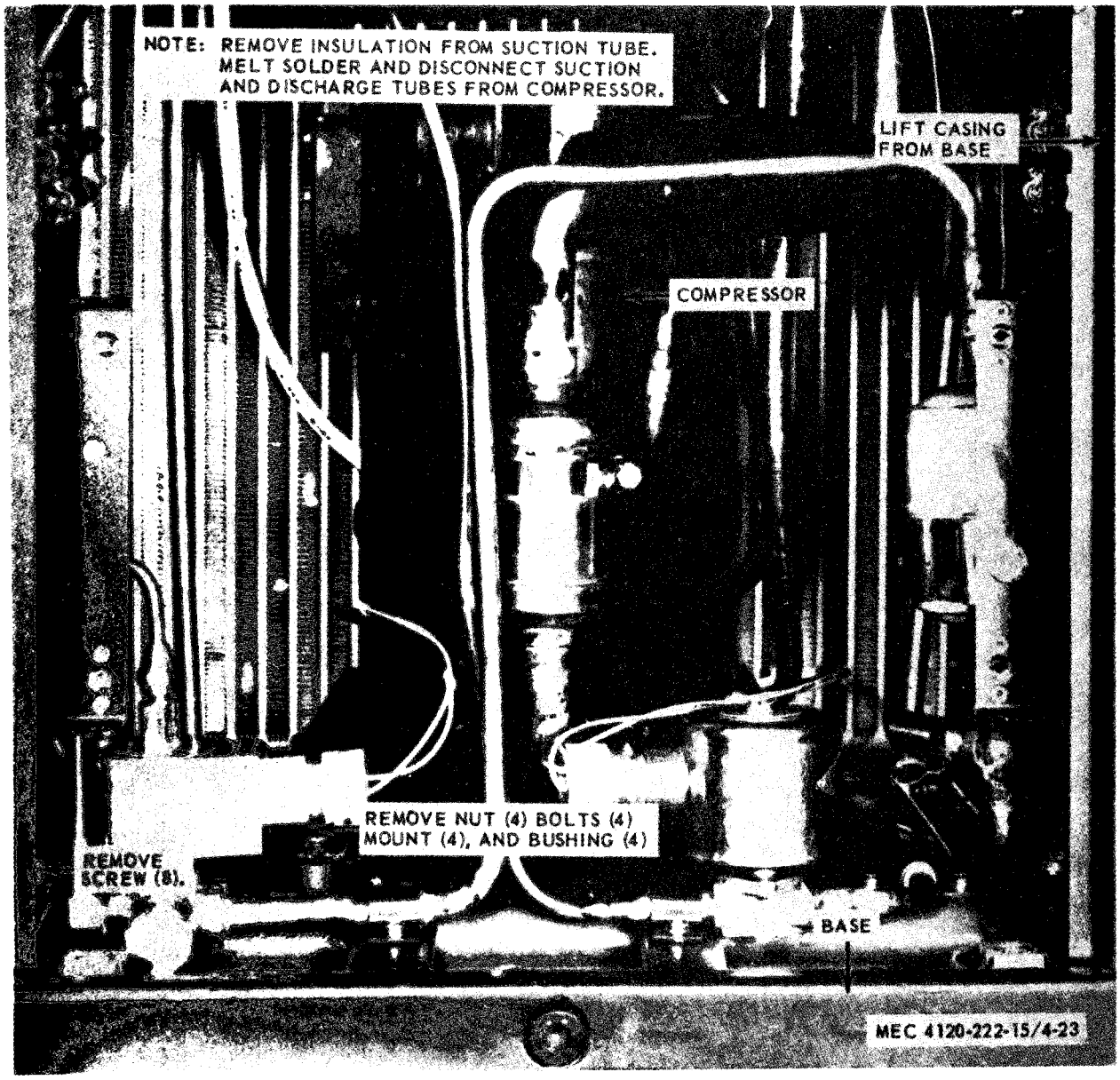


Figure 5-23. Compressor, removal and installation.

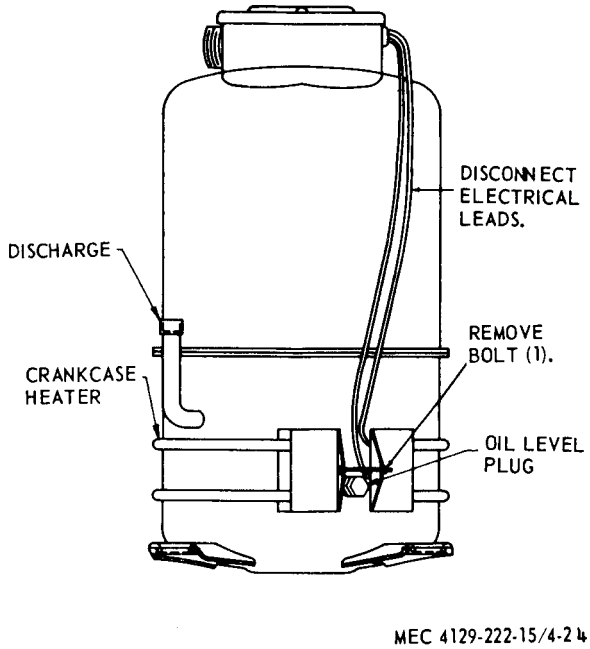
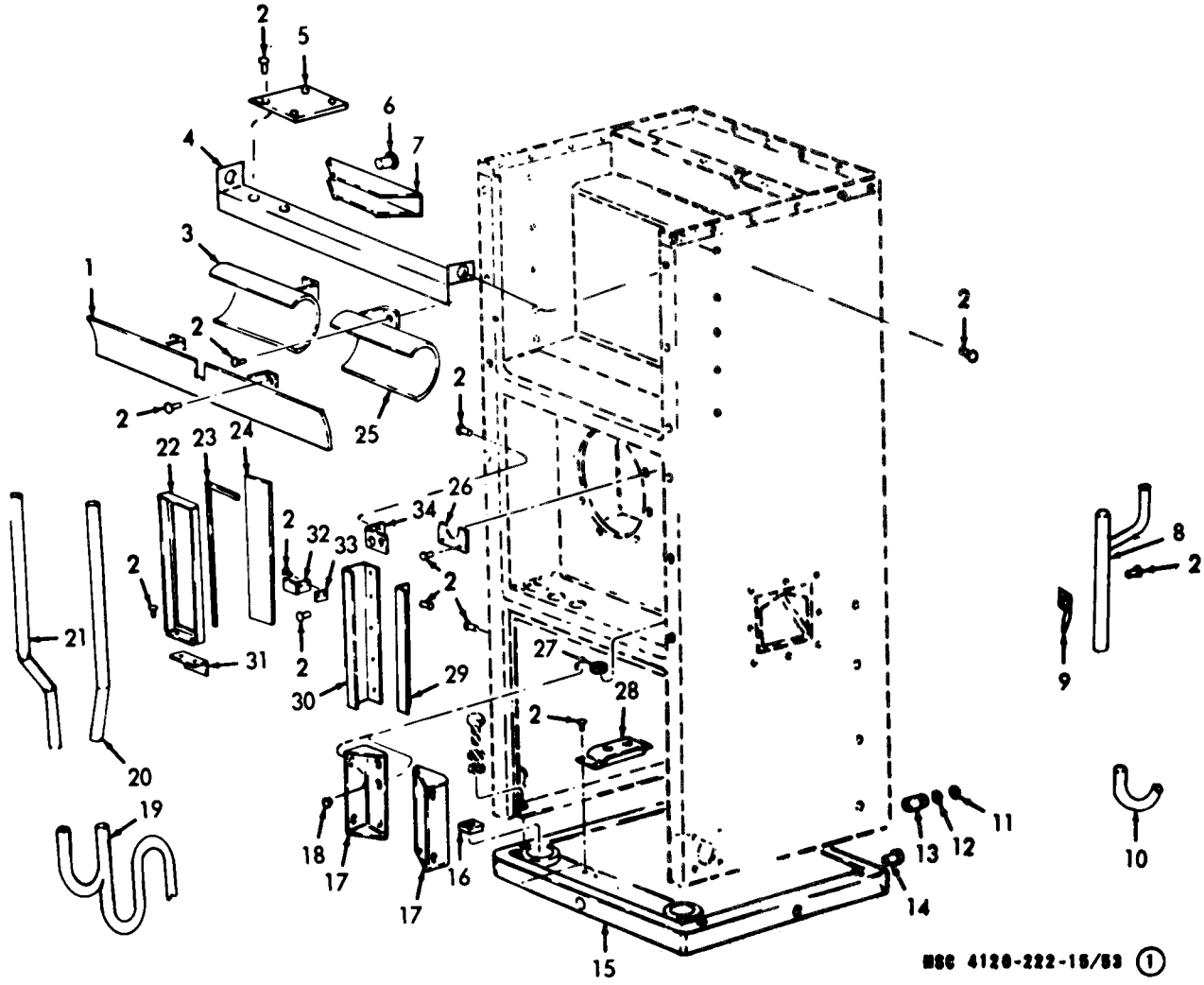
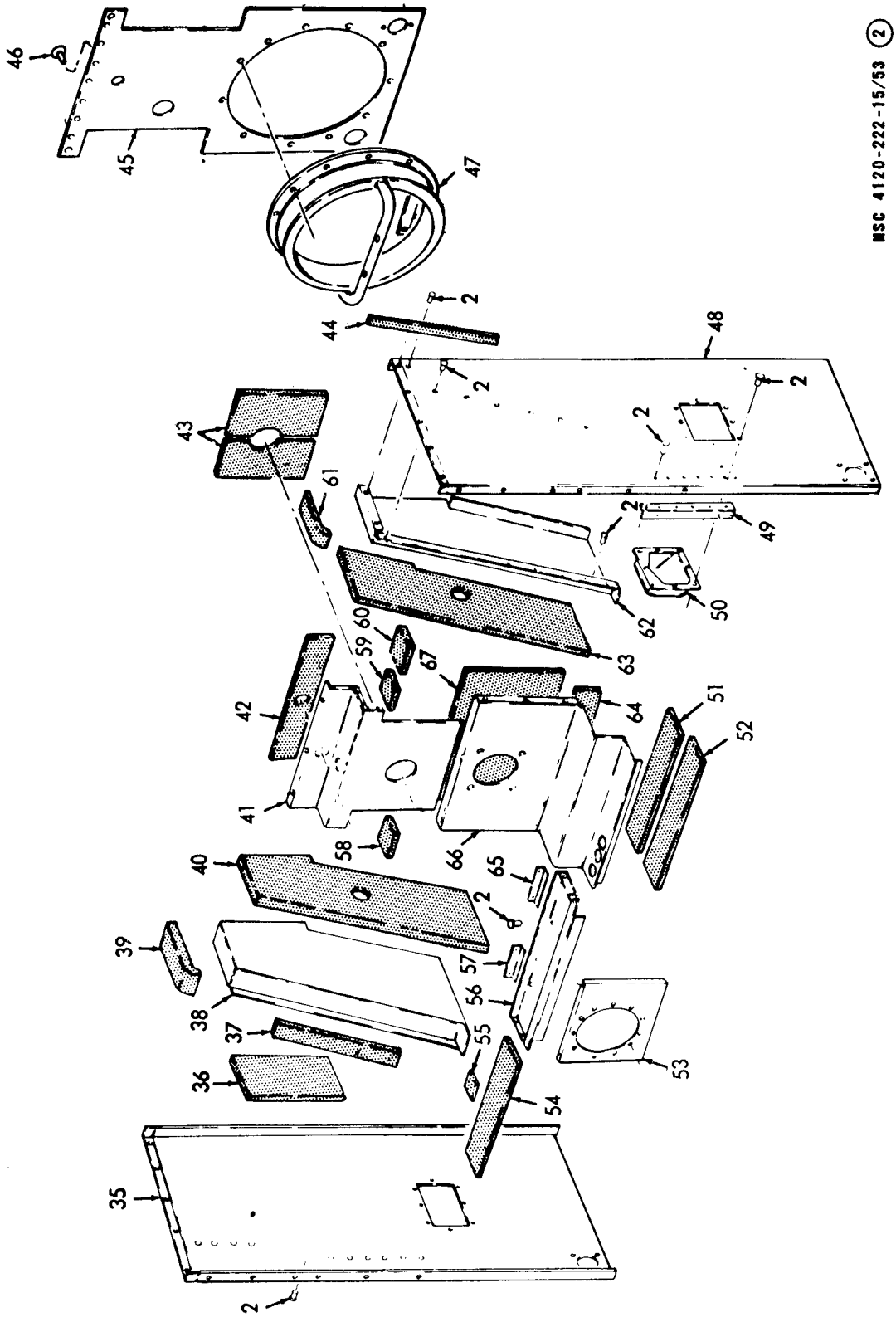


Figure 5-24. Compressor heater and compressor oil level plug, removal, disassembly and installation.



1 Lower baffle
2 Pop rivet. 1/2 in. X 0.063 in. (239 rqr)
3 Top left baffle
4 Evaporator heater support
5 Evaporator heater thermostat bracket
6 Pop rivet (4 rqr)
7 Back panel support
8 Right drain tube
9 Drain tube clamp (4 rqr)
10 Bottom right drain tube
11 Retainer ring
12 Drain screen
13 Drain nipple
14 Rivet nut, No. 8-22 (4 rqr)
15 Base
16 Nut, s uare (7/16-14 (4 rqr))
17 Contrd box support (2 rqr)
18 Rivet nut, 1/4-20 (4 rqr)
19 Bottom left drain tube
20 Rear left drain tube
21 Front left drain tube
22 Damper door frame
23 Gasket
24 Damper blade
25 Top right Wile
26 Blockoff plate
27 Grommet
28 Support channel (2 rqr)
29 Filter support
30 Filter support
31 Blockoff angle
32 Hinge door spring (2 rqr)
33 Shim (4 rqr)
34 Chain guide angle

Figure 5–25. Casing, base and duct assembly, removal, disassembly, reassembly and installation. (Sheet 1 of 2)



35 Right side panel
36 Rubber insulation
37 Rubber insulation
38 Right hand duct
39 Rubber insulation
40 Rubber insulation
41 Top partition panel
42 Rubber insulation
43 Rubber insulation
44 Rubber insulation
45 Back panel
46 Rivet nut, 5/16–18
47 Motor support and cone assembly
48 Left side panel
49 Filter support
50 Handle (2 rqr)
51 Rubber insulation
52 Rubber insulation
53 Intake panel
54 Rubber insulation
55 Rubber insulation
56 Drain pan
57 Drain pan right hand angle
58 Rubber insulation
59 Rubber insulation
60 Rubber insulation
61 Rubber insulation
62 Left hand duct
63 Rubber insulation
64 Rubber insulation
65 Drain pan left hand angle
66 Partition panel
67 Rubber insulation

Figure 5-25.-Continued. (Sheet 2 of 2)

Section III. HOSE CLAMPS, HOSES, TUBE RETAINING STRAPS, PIPE PLUGS, RECEPTACLE HOLE COVERS AND TUBE CLIPS

5-34. General

When refrigerant system is opened for maintenance, all hoses and tubes disconnected should be removed, cleaned, inspected, and reinstalled securely.

5-35. Hose Clamps, Hoses, Tube Retaining Straps, Pipe Plugs, Receptacle Hole Covers and Tube Clip

a. Removal.

(1) Remove the front access panel (para 3-17).

(2) Remove the air conditioning filter (para 3-18).

(3) Discharge the refrigerant system.

(4) Remove the hose clamps, hoses, tube retaining straps, pipe plugs, receptacle hole covers and tube clip by removing standard hardware as required.

b. Cleaning and Inspection.

(1) Clean all parts with an approved solvent and dry thoroughly.

(2) Inspect hoses for signs of wear. Inspect all parts for cracks, breaks or other defects. Inspect threaded parts for worn or damaged threads.

(3) Replace damaged or defective parts.

c. Installation. Install all internal parts by reversing order of removal.

d. Pressure test system.

e. Recharge the system.

f. Install panel.

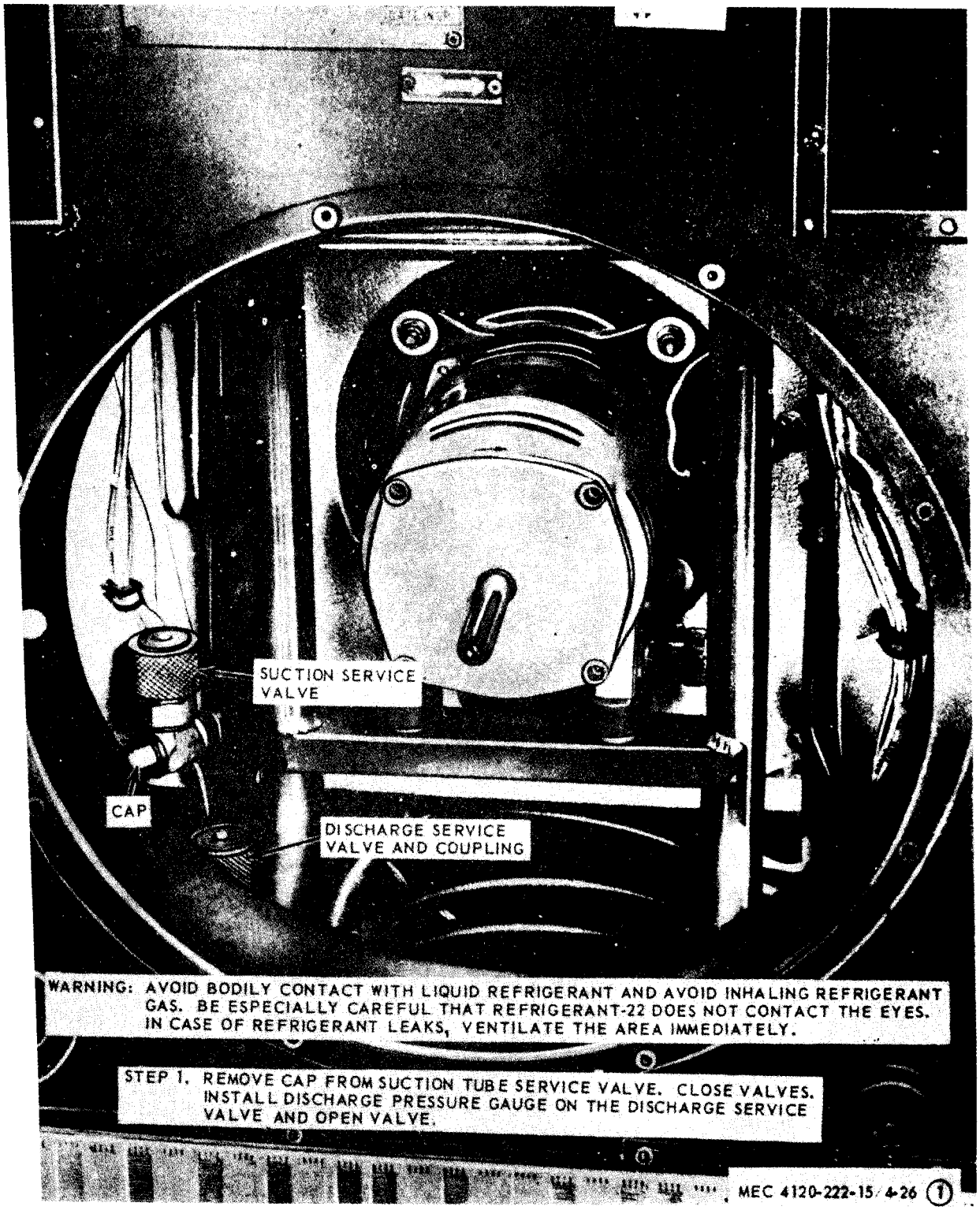
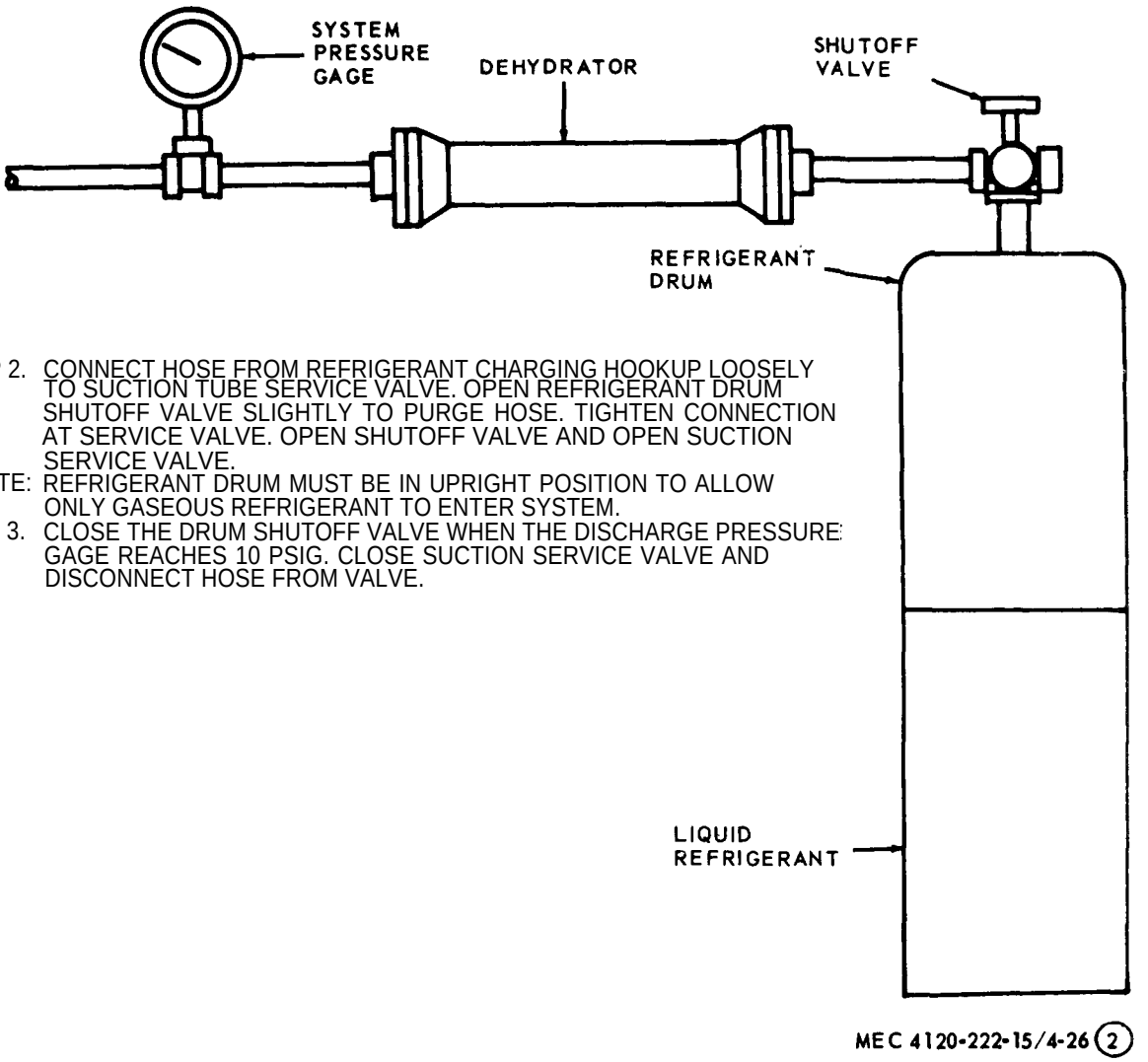


Figure 5-26. Pressure testing and evacuating the refrigerant system. (Sheet 1 of 3)

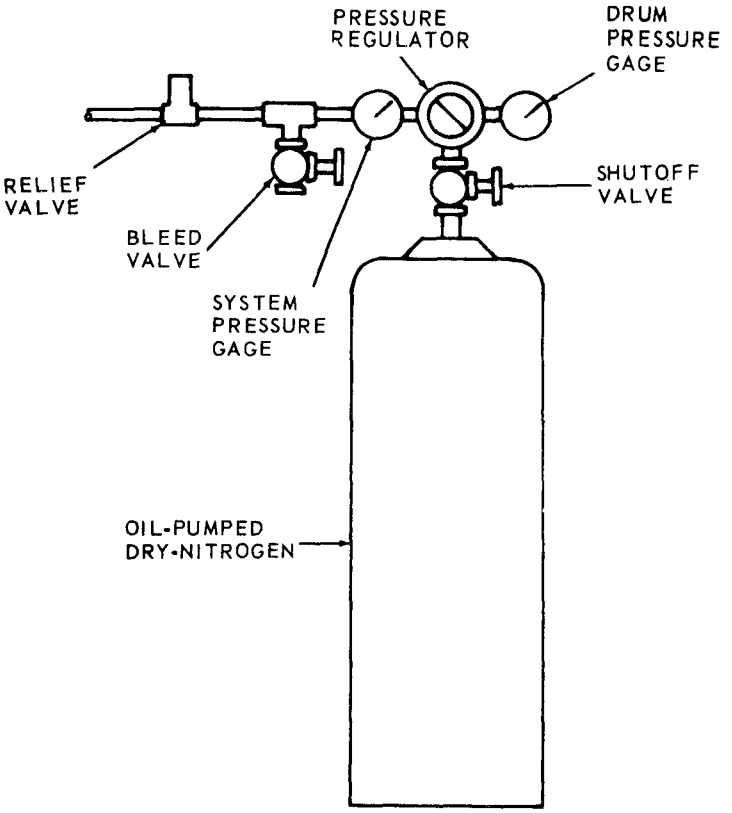


STEP 2. CONNECT HOSE FROM REFRIGERANT CHARGING HOOKUP LOOSELY TO SUCTION TUBE SERVICE VALVE. OPEN REFRIGERANT DRUM SHUTOFF VALVE SLIGHTLY TO PURGE HOSE. TIGHTEN CONNECTION AT SERVICE VALVE. OPEN SHUTOFF VALVE AND OPEN SUCTION SERVICE VALVE.

NOTE: REFRIGERANT DRUM MUST BE IN UPRIGHT POSITION TO ALLOW ONLY GASEOUS REFRIGERANT TO ENTER SYSTEM.

STEP 3. CLOSE THE DRUM SHUTOFF VALVE WHEN THE DISCHARGE PRESSURE GAGE REACHES 10 PSIG. CLOSE SUCTION SERVICE VALVE AND DISCONNECT HOSE FROM VALVE.

Figure 5-26-Continued. (Sheet 2 of 3)



STEP 4. CONNECT HOSE FROM PRESSURE TESTING HOOKUP LOOSELY TO SUCTION SERVICE VALVE OPEN/NITROGEN DRUM SHUTOFF VALVE SLIGHTLY TO PURGE HOSE. TIGHTEN CONNECTION AT SUCTION SERVICE VALVE. OPEN SHUTOFF VALVE AND SUCTION SERVICE VALVE. BUILD UP SYSTEM PRESSURE UNTIL THE DISCHARGE PRESSURE REACHES 150 PSIG. CLOSE SUCTION SERVICE VALVE AND SHUTOFF VALVE. DISCONNECT HOSE FROM SUCTION SERVICE VALVE. CLOSE DISCHARGE SERVICE VALVE AND REMOVE GAGE.

STEP 5. TEST FOR LEAKS (2 ABOVE). PURGE THE REFRIGERANT SYSTEM (3 ABOVE).

STEP 6. REMOVE CAP FROM DISCHARGE SERVICE VALVE. ATTACH A SUITABLE VACUUM PUMP TO SUCTION SERVICE VALVE ANO A MANOMETER TO THE DISCHARGE SERVICE VALVE. OPEN THE SERVICE VALVES AND OPERATE THE VACUUM PUMP UNTIL THE MANOMETER INDICATES 2.5 MM HG. ABS. (MILLIMETERS OF MERCURY, ABSOLUTE).

STEP 7. CLOSE THE SUCTION SERVICE VALVE AND STOP THE PUMP. ATTACH HOSE FROM REFRIGERANT DRUM, PURGE AIR FROM LINE WITH REFRIGERANT AND SLOWLY BREAK THE VACUUM BY OPENING THE SUCTION SERVICE VALVE UNTIL 760 MM HG ABS. CLOSE SUCTION SERVICE VALVE.

STEP 8. REMOVE REFRIGERANT DRUM AND CONNECT VACUUM PUMP TO SUCTION SERVICE VALVE. PURGE AIR FROM HOSE, START PUMP AND OPEN SUCTION SERVICE VALVE. OPERATE PUMP UNTIL MANOMETER AGAIN READS 2.5 MM HG ABS.

STEP 9. CLOSE SUCTION SERVICE VALVE AND ALLOW UNIT TO STAND UNDER VACUUM FOR APPROXIMATELY 12 HOURS. IF NO NOTICABLE RISE IN PRESSURE OCCURS, THE SYSTEM IS READY FOR CHARGING. CLOSE SERVICE VALVES AND REMOVE VACUUM PUMP AND MANOMETER. INSTALL CAPS.

NOTE: RISE IN PRESSURE WILL BE INFLUENCED BY AM BIENT TEMPERATURE. MAKE SURE VACUUM IN SYSTEM IS COMPLETELY RELIEVED BEFORE CHARGING.

NOTE: THE CONDENSER FAN MOTOR SUPPORT HAS BEEN REDESIGNED ON LATER MODELS. THE BENDIX-WESTINGHOUSE OVERLOAD PROTECTOR AND HEATER THERMOSTAT REMAINS UNCHANGED.

MEC 4120-222-1574-26 ③

Figure 5-26. -Continued, (Sheet 3 of 3)

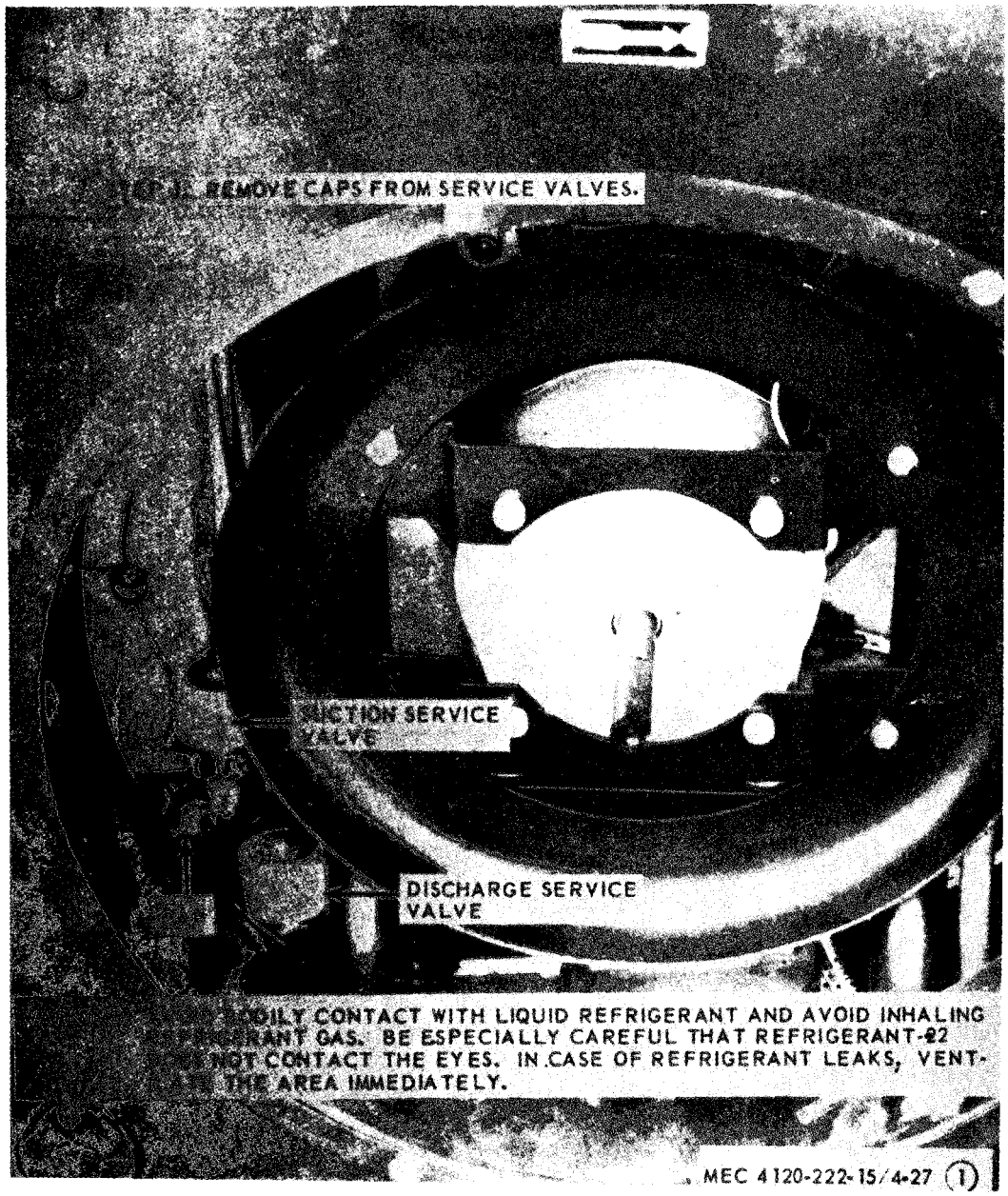


Figure 5-27. Charging the refrigerant system. (Sheet 1 of 3)

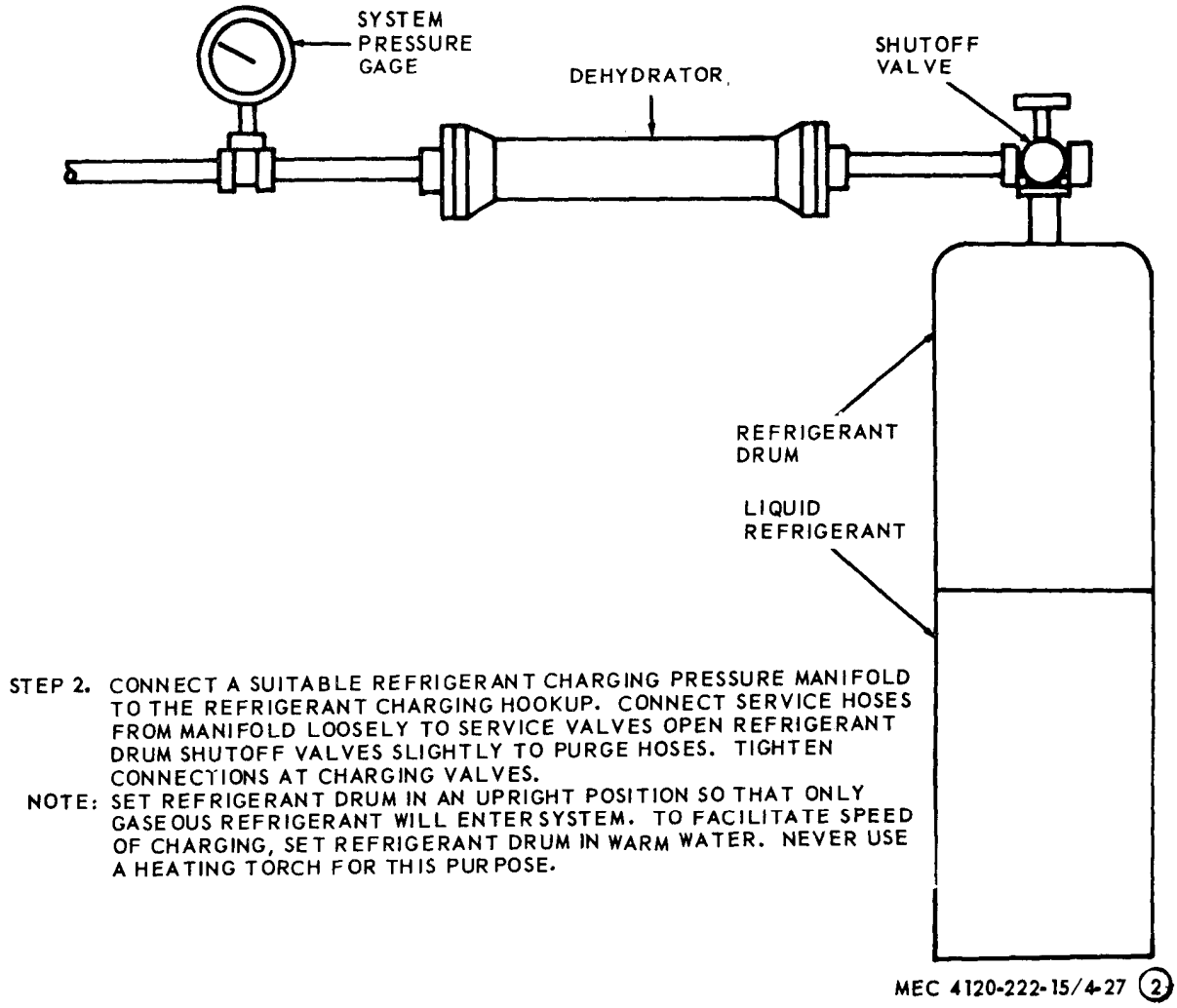
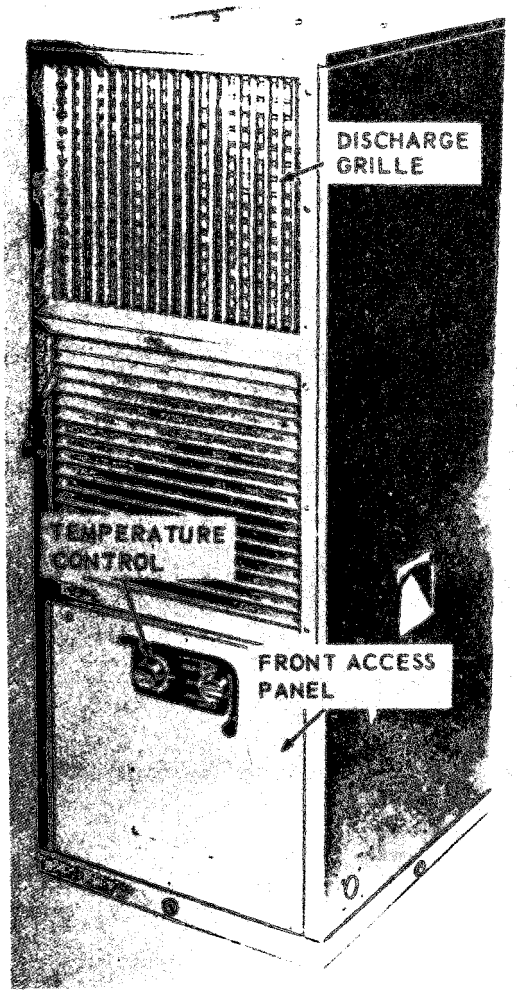
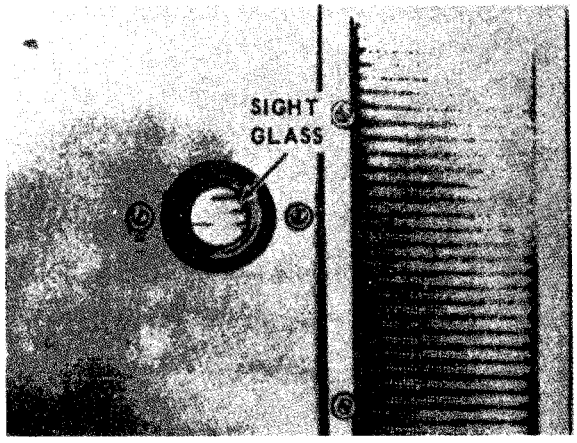


Figure 5-27.-Continued. (Sheet 2 of 3)



NOTE: SET TEMPERATURE CONTROL ABOVE AMBIENTOR ROOM TEMPERATURE.



STEP 3. OPEN REFRIGERANT DRUM SHUTOFF VALVE AND OPEN BOTH SERVICE VALVES. CLOSE HIGH PRESSURE SIDE OF MANIFOLD. OPERATE UNIT (PAR. 2-11)AND WEIGH IN 3.5 LB CHARGE OF REFRIGERANT-22. CONTINUE ADDING REFRIGERANT SLOWLY UNTIL SIGHT GLASS INDICATES FULL.

NOTE: OPERATE UNIT IN COOL POSITION ONLY DURING SERVICING OPERATION.

STEP 4. PARTIALLY BLOCK DISCHARGE GRILLE WITH A CARDBOARD BAFFLE. ADJUST BAFFLE UNTIL SUCTION PRESSURE GAGE READS 55 PSIG. CONTINUE ADDING REFRIGERANT SLOWLY, WHILE MAINTAINING 55 PSIG SUCTION PRESSURE BY ADJUSTING THE BAFFLE, UNTIL THE DISCHARGE PRESSURE GAGE READING CORRESPONDS TO THE AMBIENT TEMPERATURE IS OBTAINED.

STEP5. CLOSE SERVICE VALVES AND CLOSE REFRIGERANT DRUM SHUTOFF VALVE. STOP THE UNIT (PAR. 2-10). DISCONNECT MANIFOLD HOSES FROM SERVICE VALVES. INSTALL CAPS (STEP 1).

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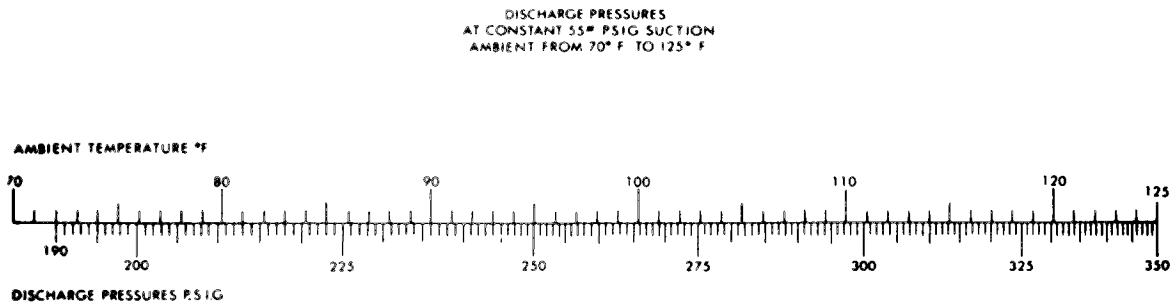
Figure 5-27-Ccintinued. (Sheet 3 of 3)



MEC 4120-222-15/4-28

Figure 5–28. Discharge pressures at constant 55 lb psi suction, ambient temperatures from 70°F. to 120°F.

CHAPTER 6

ADMINISTRATIVE STORAGE AND INSTRUCTIONS FOR DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

Section I. ADMINISTRATIVE STORAGE

Refer to TM 740-90-1 for instructions on the administrative storage of air conditioner.

Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

6-1. General

When capture or abandonment of the air conditioner is imminent, the responsible unit commander must make the decision to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all air conditioners and all corresponding repair parts.

6-2. Demolition by Mechanical Means

To render the air conditioner inoperative by mechanical means, use sledge hammers, crowbars, picks, axes, or other heavy tools which are available to destroy the following:

a. Compressor and compressor motor,

b. Condenser assembly (including condenser fan motor).

c. Evaporator assembly.

d. Temperature control box and circuit breaker.

6-3. Demolition by Explosives or Weapons Fire

a. Explosives. Place as many charges as the situation permits, and detonate them simultaneously with a detonating cord and suitable detonator. Position charges as follows:

(1) One $^1/_2$ pound charge inside the circuit breaker panel.

(2) One $^1/_2$ pound charge on the condenser fan.

(3) One $^1/_2$ pound charge on the compressor.

(4) One $^1/_2$ pound charge on the evaporator assembly.

b. Weapons Fire. Fire on the air conditioner using the heaviest practicable weapons available.

6-4. Other Demolition Methods

a. Scattering *and Concealment.* Remove all easily accessible parts and scatter them through dense foliage, bury them or throw them in a body of water.

b. Burning. Pack rags, clothing, or canvas under and around the unit and inside the condenser and evaporator frames. Saturate this packing with gasoline, oil, or diesel fuel and ignite.

c. Submersion. Completely submerge the unit in a body of water to provide water damage and concealment. Salt water does greater damage to metal parts than fresh water.

6-5. Training

All operators should receive thorough training in the destruction of the equipment. Refer to FM 5–25. Simulated destruction using all methods listed should be included in the operator training program. It must be emphasized, in training, that demolition operations are usually necessitated by critical situations when time available for carrying out destruction are limited. For this reason, operators must be thoroughly familiar with all methods of destruction of equipment, and must be able to carry out demolition instructions without reference to this or any other manual.

APPENDIX A

REFERECNCE

A-1. PAINTING

TM 9-213	Painting Instructions for Field Use.

A-2. MAINTENANCE

TM 38-750	The Army Maintenance Management System ~~Army Equipment Record Procedures.~~
TM 5-4120-222-24P	Organizational, Direct and General Support Repair Parts and Special Tool Lists.
TM 5-764	Electric Motor and Generator Repair.

A-3. SHIPMENT AND STORAGE

TM 740-90-1	Administrative Storage of Equipment

APPENDIX B

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists items which accompany the Air Conditioner or are required *for* installation, operation, or operator's maintenance.

B-2. General

This Basic Issue Items List in divided into the following sections:

a. Basic Issue Items-Section II. A list of items which accompany the Air Conditioner and are required by the operator/crew for installation, operation, or maintenance.

b. Maintenance and Operating Supplies-Section Ill. NOT APPLICABLE.

B-2. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

a. Source, Maintenance and Recoverability Codes (SMR) .

(1) Source code, indicates the selection status and source for the listed item. Source code is:

Code	Explanation
P	Repair parts which are stocked in or supplied from the GSA/ DSA or Army supply system and authorized for use at indicated maintenance categories.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Operator/crew

(8) Recoverability code indicates whether unserviceable items should be returnce for recovery or salvage. Items not coded are expendable.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be wed for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A 2 character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowance are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated Unit. This column indicates the quantity *of the item* used in the assembly group.

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment

g. Illustration. This column is divided as follows :

(1) *Figure Number.* Indicates the; figure number of the illustration in which the item is shown.

(2) Item Number. Indicates the callout number used to reference the item in the illustration.

Section II. BASIC ISSUE ITEMS

(1) Smr Code	(2) Federal stock No.	(3) Description Ref No. & Mfr Code	Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration (A) Fig No.	(7) Illustration (B) Item No.
~~PC~~	~~7510-889-3494~~	~~BINDER, Looseleaf~~						
PC	7520-559-6918	CASE, Maintenance and Operation Manuals ARMY TECHNICAL MANUAL TM 5-4120-222-14				1		
						1		

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal stock number	(3) Description Ref No. & mfr code	Usable on code	(4) Unit of meas	(5) Qty auth
PC	7520-559-9618	CASE, maintenance and operation manuals.		ea	1

(1) Smr Code	(2) Federal stock No.	(3) Description Ref No. & Mfr Code	Usable on code	(4) Unit of meas	(5) Qty inc in unit	(6) Qty furn with equip	(7) Illustration (A) Fig No.	(7) Illustration (B) Item No.
PC		ATTENUATOR (97403) 13215E9885		ea		1		
PC		BLOCKOFF PANEL (97403) 13215E9885		ea		1		
PC	5935-846-2328	RECEPTACLE, Electrical (96906) MS3106R22-22S		ea		1		

APPENDIX C

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

C-1. General

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

b. 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, explanatory notes and/or illustrations required for a particular maintenance function.

C-2. Explanation of Columns in Section II

a. Group Number. Column 1. The assembly group is a numerical group assigned to each assembly in a top down breakdown sequence. The applicable assembly groups are listed on the MAC in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. Assembly Group. Column 2. This column contains a brief description of the components of each assembly group.

c. Maintenance Functions. Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:

C—Operator or crew
O—Organizational maintenance
F—Direct support maintenance
H—General support maintenance

The maintenance functions are defined as follows:

A-Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B-Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C-Service. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D-Adjust. To rectify to the extent necessary to bring into proper operating range.

E-Align. To adjust specified variable elements of an item to bring to optimum performance.

F-Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the 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 with the certified standard.

G-Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H-Replace. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I-Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J-Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

K-Rebuild. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parta or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. Tools and Equipment. Column 4. This column is provided for referencing by code the special tools and test equipment, (Section III) required to perform the maintenance functions (Section II).

e. *Remarks. Column 5.* This column is provided for referencing by code the remarks (Section IV) pertinent to the maintenance functions.

C-3. Explanation of Columns in Section III

a. *Reference Code.* This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Category. This column shows the lowest level of Maintenance authorized to use the special tool or test equipment.

c. *Nomenclature.* This column lists the name or identification of the tool or test equipment.

d. *Tool Number.* This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

C-4 Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function, column 3, A through K.

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

AIR CONDITIONER TRANE MODEL CE20VAL4 AND MODEL CE20VAL6

(1) Group No.	(2) Assembly group	(3) Maintenance Functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and prmen	(5) Remarks
01	FRAME													
	Base assembly	F							F					
	Casing assembly	F							F					
	Guard, condenser fan	O							O					
	Screen, drain	O							O					
02	PANELS													
	Baffle	F							F					
	Chain and damper control	O							O					
	Cover assemblies	O							O					
	Damper assembly	F							F					
	Grilles	O							O					
	Insulation	F							F					
	Sound attenuator	O							O					If required
03	ACCESSORY ITEMS													
	Remote control	O							O					
04	ELECTRIC MOTOR													
	Motor assembly, blower		F						O	F				
	Rotor, blower motor	F							F					
	Stator, blower motor	F							F					
	Cover, stator housing	F							F					
	Endbell, housing	F							F					
	Housing, stator	F							F					
	Bearings	F							F					

(1) Group No.	(2) Assembly group	(3) Maintenance Functions A Inspect	B Test	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
05	STARTING AND PROTECTING DEVICES.							
	Overload protector		F	F				
	Fuse		C	C				
	Phase relay		F	F				
	Control box	F		F				
	Connector, receptacle	F		F				
	Control panel assembly			F	F			
	Electrical leads	O		O				
	Receptacle	F		F				
	Circuit breaker		F	F				
	Switch, pressure		F	F				
	Thermostats		F	F				
06	ELECTRICAL EQUIPMENT							
	Heater elements	F		F				
	Rectifier		F	F				
07	GAGES							
	Sight glass	O		F				
08	REFRIGERATION AND AIR CONDITIONING COMPONENTS.							
	Compressor assembly		F	F				A
	Tubing and fittings	F	F	F				
	Valve, regulating			F				
	Valve, service			F				
	Valve, pressure relief			F				
	Valves, solenoid		F	F	F			
	Condenser assembly			C	F			B
	Dehydrator			F				
	Evaporator assembly	O		C	F			C
	Mist eliminator			C	O			
	Expansion valve			F	F			
	Fan assemblies			O				
	Air filters			C	O			D

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance level	Nomenclature	Tool No.
No special tools or test equipment required to perform maintenance on the air conditioner.			

Section IV. REMARKS

Reference code	Remarks
A–C	Service includes check of oil level and add oil using clean, fresh, dry oil of Specification (FSN 9150–823–7905).
A–B	Testing includes the use of the Halide Torch Leak Detector, or a soap solution to detect leaks.
B–C	Clean with approved solvent, dry thoroughly.
C–C	Clean with approved solvent, dry thoroughly.
D–C	Clean with approved solvent, dry thoroughly, and recoat with oil or filter-coat.

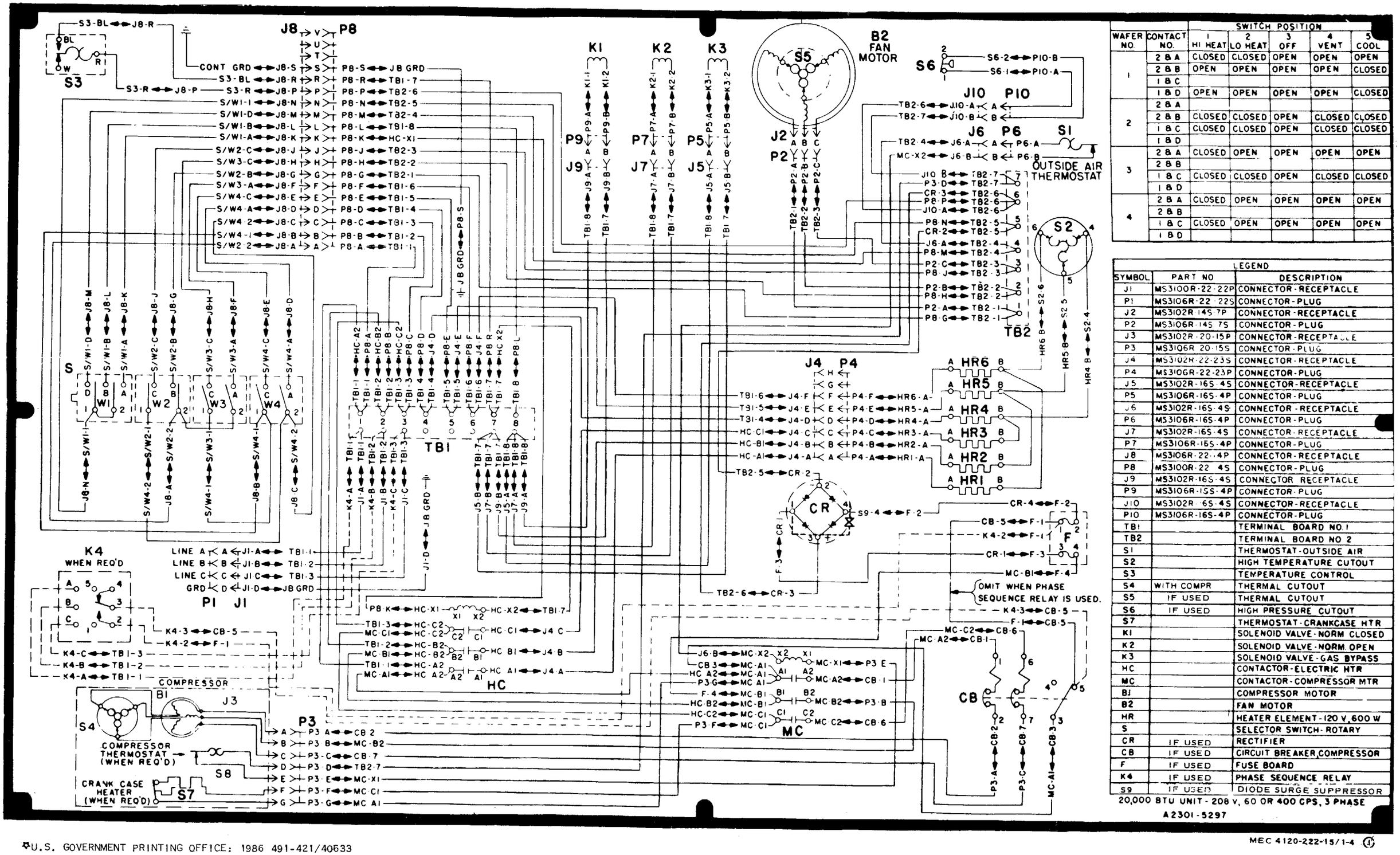
INDEX

A

B

C

D



WAFER NO.	CONTACT NO.	SWITCH POSITION 1 HI HEAT	2 LO HEAT	3 OFF	4 VENT	5 COOL
1	2 & A	CLOSED	CLOSED	OPEN	OPEN	OPEN
	2 & B	OPEN	OPEN	OPEN	OPEN	CLOSED
	1 & C					
	1 & D	OPEN	OPEN	OPEN	OPEN	CLOSED
2	2 & A					
	2 & B	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
	1 & C	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
	1 & D					
3	2 & A	CLOSED	OPEN	OPEN	OPEN	OPEN
	2 & B					
	1 & C	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
	1 & D					
4	2 & A	CLOSED	OPEN	OPEN	OPEN	OPEN
	2 & B					
	1 & C	CLOSED	OPEN	OPEN	OPEN	OPEN
	1 & D					

SYMBOL	PART NO	DESCRIPTION
J1	MS3100R-22-22P	CONNECTOR-RECEPTACLE
P1	MS3106R-22-22S	CONNECTOR-PLUG
J2	MS3102R-14S-7P	CONNECTOR-RECEPTACLE
P2	MS3106R-14S-7S	CONNECTOR-PLUG
J3	MS3102R-20-15P	CONNECTOR-RECEPTACLE
P3	MS3106R-20-15S	CONNECTOR-PLUG
J4	MS3102R-22-23S	CONNECTOR-RECEPTACLE
P4	MS3106R-22-23P	CONNECTOR-PLUG
J5	MS3102R-16S-4S	CONNECTOR-RECEPTACLE
P5	MS3106R-16S-4P	CONNECTOR-PLUG
J6	MS3102R-16S-4S	CONNECTOR-RECEPTACLE
P6	MS3106R-16S-4P	CONNECTOR-PLUG
J7	MS3102R-16S-4S	CONNECTOR-RECEPTACLE
P7	MS3106R-16S-4P	CONNECTOR-PLUG
J8	MS3106R-22-14P	CONNECTOR-RECEPTACLE
P8	MS3100R-22-4S	CONNECTOR-PLUG
J9	MS3102R-16S-4S	CONNECTOR RECEPTACLE
P9	MS3106R-16S-4P	CONNECTOR-PLUG
J10	MS3102R-16S-4S	CONNECTOR-RECEPTACLE
P10	MS3106R-16S-4P	CONNECTOR-PLUG
TB1		TERMINAL BOARD NO.1
TB2		TERMINAL BOARD NO 2
S1		THERMOSTAT-OUTSIDE AIR
S2		HIGH TEMPERATURE CUTOUT
S3		TEMPERATURE CONTROL
S4	WITH COMPR	THERMAL CUTOUT
S5	IF USED	THERMAL CUTOUT
S6	IF USED	HIGH PRESSURE CUTOUT
S7		THERMOSTAT-CRANKCASE HTR
K1		SOLENOID VALVE-NORM CLOSED
K2		SOLENOID VALVE-NORM OPEN
K3		SOLENOID VALVE-GAS BYPASS
HC		CONTACTOR-ELECTRIC HTR
MC		CONTACTOR-COMPRESSOR MTR
B1		COMPRESSOR MOTOR
B2		FAN MOTOR
HR		HEATER ELEMENT-120 V, 600 W
S		SELECTOR SWITCH-ROTARY
CR	IF USED	RECTIFIER
CB	IF USED	CIRCUIT BREAKER,COMPRESSOR
F	IF USED	FUSE BOARD
K4	IF USED	PHASE SEQUENCE RELAY
S9	IF USED	DIODE SURGE SUPPRESSOR

20,000 BTU UNIT - 208 V, 60 OR 400 CPS, 3 PHASE

A2301-5297

MEC 4120-222-15/1-4 (4)

U.S. GOVERNMENT PRINTING OFFICE: 1986 491-421/40633

Figure 1-4(1). Practical wiring diagrams. (Sheet 1 of 2)

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, *United States Army,*
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

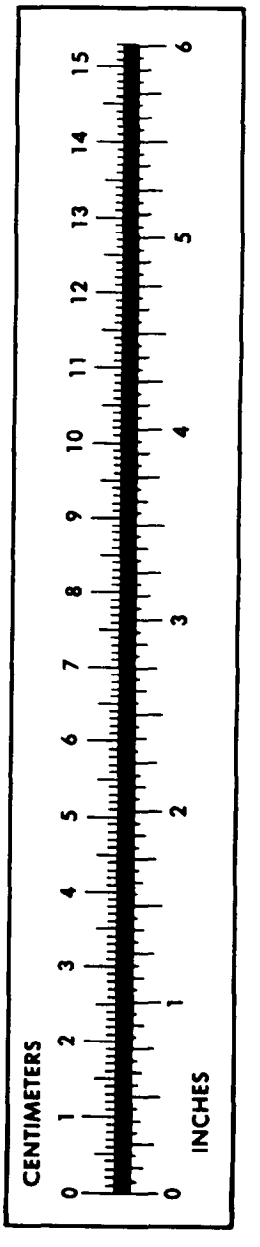
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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