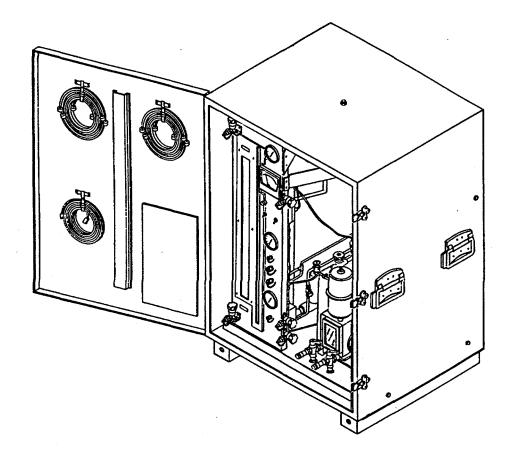
# OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL



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DIRECT SUPPORT

MAINTENANCE

REFRIGERATION SYSTEM (MUST) SERVICE UNIT

**MODEL RTS-2** 

NSN 4130-01-152-2755

PAGE 5-1

Approved for public release. Distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY 17 MARCH 1989

#### WARNING

HIGH VOLTAGE is used in the operation of this equipment. DEATH ON CONTACT may result if operating personnel fail to observe safety precautions.

The power to the equipment shall be shut off before beginning work on the equipment.

Do not attempt to evacuate refrigerant tank utilizing RFGT CHARGE SOV port. Liquid refrigerant can be pumped into the vacuum pump and an explosion can occur. This may cause injury to personnel and damage to the equipment.

Perform all refrigerant venting and draining in a well ventilated area. Refrigerant gas can displace oxygen and will not support life. Suffocation may result.

Wear protective goggles and use extreme caution in disconnecting service hose when pressurized with refrigerant. Avoid getting refrigerant in the eyes. Permanent damage to the eyes may result.

Wear protective goggles and use extreme caution if RFGT VENT is opened to speed filling. Avoid getting pressurized gas and liquid exhaust from RFGT VENT SOV port in the eyes. Permanent damage to the eyes may result. To avoid fire damage, clean oil fill or oil vent sov and tube assembly with hot soapy water prior to using the oxy-acetylene torch.

Dry cleaning solvent is toxic and flammable. Do not breathe vapors. Use in well ventilated area, free from sparks, flame or hot surfaces. Wear splash goggles, solvent resistant gloves, and other protective gear. In case of eye contact, flush with water and seek medical attention. In case of skin contact, wash with soap and water.

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

Compressed air used for cleaning purposes will not exceed 30psi (2.1kg/cm). Do not use compressed air against the skin.

Solutions will be disposed of in accordance with local State Water Pollution Control Laws. Consult local Medical Service for guidance.

TECHNICAL MANUAL .No. 5-4130-236-13

# HEADQUARTERS DEPARTMENT OF THE ARMY Washington, D. C., 17 March 1989

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

## REFRIGERATION SYSTEM (MUST) SERVICE UNIT

## MODEL RTS-2 NSN 4130-01-152-2755

Approved for public release. Distribution is unlimited.

# REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

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#### **CHAPTER 1**

#### INTRODUCTION

#### **SECTION I GENERAL INFORMATION**

#### 1-1. SCOPE

This manual covers Operating Instructions and Operator Organizational and Direct Support Maintenance instructions for Refrigeration System Service Unit, Model RTS-2.

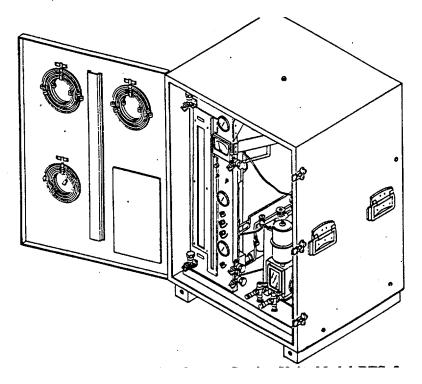


Figure 1-1. Refrigeration System Service Unit, Model RTS-2.

The Refrigeration System Service Unit, Model RTS-2 (referred to as the Service Unit), is designed to dehydrate, evacuate (pump down), and charge a refrigeration system with a precisely measured quantity of refrigerant. The Service Unit also has provisions to service a refrigeration system's compressor with a measured quantity of lubricating oil.

## 1-2. MAINTENANCE FORMS AND RECORDS

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

# 1-3. HAND RECEIPT (-HR) MANUALS

This manual has a companion document with a TM number followed by "-HR" (which stands for Hand Receipt). The TM 5-4130-236-13-HR consists of pre-printed hand receipts (DA - FORM 2062) that lists end item related equipment (i.e. COEI, BII and AAL) you must account for. As an aid to proper accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in chapter 3, AR-310-2.

The U.S. Army Adjutant General Publication Center ATTN: SFIS-APC-8 2800 Eastern Boulevard Baltimore, MD 21220-2896

#### 1-4. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE

- a. Destruction of Refrigeration Equipment.
- (1) Mechanical. Using an ax, pick, mattock, sledge or any other heavy implement, damage all vital elements such as controls, switches and valves, electric motors and any other major assemblies and components.
- (2) Explosives. Place a 1/2-pound charge between the vacuum pump and tank assembly, detonate with detonating cord and detonator.

WARNING

Point blank firing at equipment with weapons should not be attempted unless the safety of all personnel in the area is assured.

- (3) Weapons. Fire on the refrigeration service unit with the heaviest suitable weapons available.
- b. For additional data on procedures for destruction of equipment to prevent enemy use refer to TM 750-244-3.

# 1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS)

If your Service Unit needs improvement, let us know. Send us your EIR. You, the user are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF368 (Quality Deficiency Report). Mail it to us at Commander Headquarters, U.S. Army Troop Support Command, Attention AMSTR-QX, 4300 Goodfellow Boulevard, St. Louis Missouri 63120-1798. We will send you a reply.

#### 1.6. WARRANTY

ACL Technologies extends the following warranties:

ACL Technologies will repair or replace all component parts that are defective, without charge, for a period of 90 days after delivery of the equipment to the customer's dock. Said materials are to be returned to the point of manufacture, transportation charges pre-paid.

ACL Technologies will extend these same warranties for all equipment of its own design and/or manufacture for a period of one (1) year from the date of delivery to the customer's dock.

Components, equipment and/or other materials purchased from others and furnished with our units are guaranteed by us only to the extent of the original manufacturer's written guarantee.

The option to repair or replace will be solely ACL Technologies'. Written authorization must be tendered by ACL Technologies prior to return of equipment.

The provisions of this warranty shall not apply if equipment has been altered or repaired by others, in such a manner as to adversely affect its performance or reliability, nor to equipment subjected to misuse, negligence, accident or operated contrary to instructions supplied as normal procedure for the type of equipment involved.

This warranty being expressly in lieu of all other warranties, expressed or implied, and of all other obligations or liabilities on our part, contractual or otherwise, either to the original purchaser or any other person. We assume no liability for consequential damages of any kind, and the purchaser, by placing an order with us, shall be deemed to assume all liability for any or all damages consequential upon the use or misuse of the equipment by the purchaser, its employees or others. No agent is authorized to assume for us any liability except as above set forth.

#### 1.7. GLOSSARY

All abbreviations and acronyms used in this manual are in accordance with MIL-STD-12.

# 1.8. PREPARATION FOR STORAGE OR SHIPMENT

For instructions regarding preparation for storage or shipment, refer to paragraph 4-51.

#### **SECTION II EQUIPMENT DESCRIPTION**

#### 1-9. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

## a. Characteristics.

- 1. Self-contained service unit requiring only an electrical power source for operation.
- 2. Provides for checking a refrigeration system.
- 3. Provides for evacuating a refrigeration system.
- 4. Provides for charging a refrigeration system with refrigerant.
- 5. Provides for charging a refrigeration system with oil.

## b. Capabilities and Features.

- 1. Highly portable (four crew members).
- 2. Self-contained refrigerant supply.
- 3. Self-contained lubricating oil supply.
- 4. Panel mounted electrical power convenience outlet.
- 5. All required operating accessories furnished.
- 6. Air pressure equalizing valve.

## 1-10. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

a. Location and description of Service Unit components

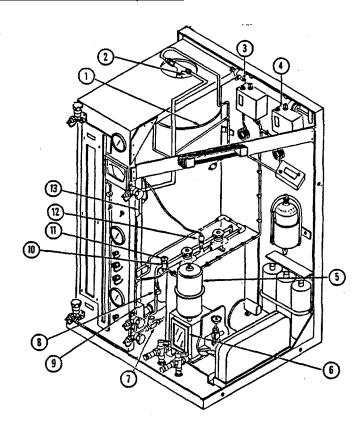


Figure 1-2. Location and Description of Service Unit Components

REFRIGERANT TANK (1). Storage capacity of refrigerant tank is 90 pounds (40.9Kg)

RELIEF VALVE (2). In the event of refrigerant system overpressurization, limits refrigerant system pressure to 150psig ± 5 psig.

PRIMARY PRESSURE SWITCH (3). Normally closed, opens at increasing pressure, breaking input power to refrigerant heater. Switch set to open at 65psig + 2psig.

SECONDARY PRESSURE SWITCH (4). Normally closed, opens at increasing pressure, breaking input power to refrigerant heater in event of failure of primary pressure switch. Switch set to open at 75psig ±2psig.

OIL MIST ELIMINATOR (5). Prevents oil mist discharge from vacuum pump exhaust.

VACUUM PUMP (6). Provides means to evacuate (pump-down) refrigeration system being serviced.

REFRIGERANT FILL CHECK VALVE (7). Prevents reverse flow of refrigerant in fill system.

REFRIGERANT CHARGE CHECK VALVE (8). Prevents reverse flow of refrigerant in charge system.

REFRIGERANT HEATER (9). Immersion type heater with preset, built-in thermostat. Provides the means to drive refrigerant out of reservoir and into refrigeration system being serviced.

FILTER/ DRYER ELEMENT (10). Filter/Dryer replaceable element cleans and removes moisture from refrigerant before it enters refrigeration system being serviced.

MOISTURE INDICATOR (11). Indicates condition of Filter/Dryer element (pink - wet, blue - dry).

VACUUM PRESSURE TRANSDUCER (12). Vacuum gage pressure sensing element.

ELECTRICAL OUTLET (13). Electrical outlet supplies 115 VAC power for vacuum gage and external use.

# b. Location and Description of Accessory Equipment

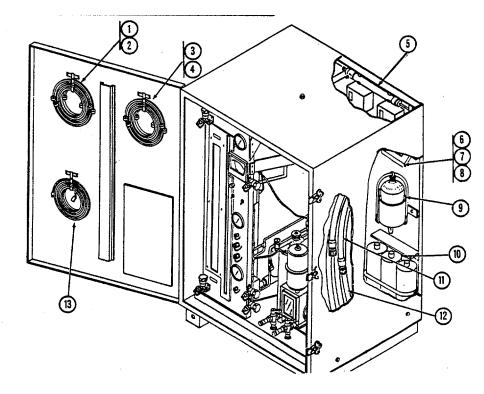


Figure 1-3. Location and Description of Accessory Equipment

- -3 SERVICE HOSE (1). 3/8-inch x 5 feet long. End connections 3/8-inch female flare.
- -4 SERVICE HOSE (2). 1/4-inch diameter x 5 feet long. End connections 1/4- and 3/8-inch female . flare (Quantity: two).
- -5 SERVICE HOSE (3). 1/4-inch diameter x 20 feet long. End connections 1/4- and 3/8-inch female flare.
- -6 SERVICE HOSE (4). 1/4-inch diameter x 3 feet long. End connections 1/4-inch female flare.

# OIL HANDPUMP (5)

GASKET (6). Service hose, 1/4-inch (Qty. 10).

GASKET (7). Service hose, 3/8-inch (Qty. 10).

GASKET (8). Service hose, 1/2-inch (Qty. 10).

CENTRIFUGE TUBE (9). For checking oil quantity in refrigeration system being serviced.

VACUUM PUMP OIL (10). Three quarts (2.84 liters).

-2 VACUUM HOSE (11). 1/2-inch I.D. x 20 feet long. End connections 3/8- and 1/2- inch female flare.

-1 VACUUM HOSE (12). 1/2-inch I.D. x 6 feet long. End connections 3/8- and 1/2-inch female flare.

EXTENSION CORD (13). Twenty-five feet long.

## 1-11. EQUIPMENT DATA

# Units of Measure

All measurements will be in English units and where practical will be followed by Metric units in parenthesis.

#### Table 1-1. SERVICE UNIT SPECIFICATIONS

WEIGHTS	AND	DIMEN:	SIONS
---------	-----	--------	-------

 Weight
 300 lbs, dry (136.2Kg)

 Height
 41 inches. (104.14cm)

 Width
 30 inches. (76.2cm)

 Depth
 25 inches. (63.5cm)

**EXTERNAL POWER** 

Input electrical power 115 volts, single phase, 60Hz, 15 Amps full load

**TEMPERATURES** 

Operating temperature +50°F to 120°F (+10°C to 48.9°C)
Storage temperature -60°F to +160°F (-15°C to +71.2°C)

**VACUUM SYSTEM** 

Pump type Air-cooled, electric motor driven,

two-stage, rotary piston type

Pump capabilities 3 cfm (84.9 lpm) free air
Blank off vacuum 29.99 inches.(76.2cm) Hg
Vacuum gage Panel mounted, electronic type

0-1000 microns Hg range

REFRIGERANT CHARGING SYSTEM

Refrigerant R114

System pressure 180 psig operating, 120 psig maximum

Refrigerant dispensing scale 0-100 lbs (0-45.360Kg), overall range, 1/2

lb (.227Kg) increments

Refrigerant Charging System and High Panel mount, 30 inches (76.2cm) Hg,

Pressure Gages 0-150 psig range, 2 1/2-inches (6.4cm) dial,

1 percent coursely

1 percent accuracy

Low Pressure Gage Panel mount, 30 in. (76.2cm) Hg,

0-60 psig range, 2 1/2-inches. (6.4cm) dial,

1 percent accuracy

Refrigerant Tank capacity 90 lbs (40.9Kg) R114 at 135°F (57.3°C)

# 1-11. EQUIPMENT DATA (Continued)

# Table 1-1. SERVICE UNIT SPECIFICATIONS (Continued)

Refrigerant Heater Immersion type, integral adjustable

thermostat, capable of heating refrigerant from 60°F to 145°F (15.7'C to 62.8°C) in

one hour

OIL CHARGING SYSTEM

Oil

Oil dispensing scale

Compressor lube oil

0-1000 mililiter (ml.) overall range,

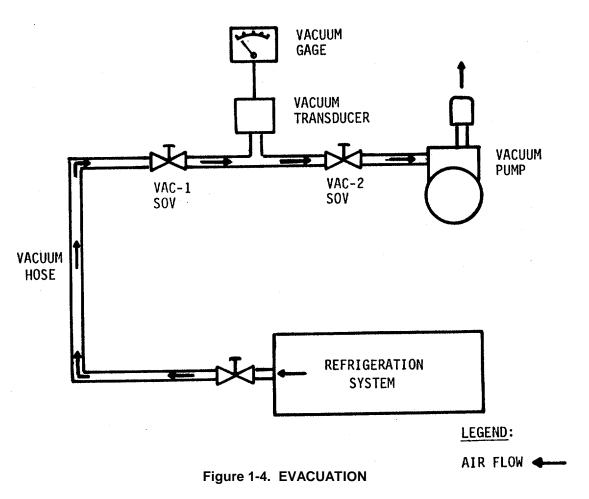
10ml. Graduations

Oil Metering Tube capacity

>1000ml.

#### Section III TECHNICAL PRINCIPLES OF OPERATION

#### 1-12. EVACUATION.



With all shut-off valves closed, the heater and vacuum pump switches off, and the power cord disconnected, the following sequence of events takes place:

- a. Operator connects vacuum port to refrigeration service port of the system being serviced using a vacuum hose.
- b. Operator turns on vacuum pump with VAC PUMP switch, opens VAC-2 valve first, then opens VAC-1. As vacuum is being developed, operator opens service port to system being evacuated. This procedure will prevent air from entering the system being evacuated.
  - c. Draw the desired inches of vacuum required, and maintain until the proper time has elapsed.
- d. When vacuuming is completed, close the post valve to the refrigeration system, shut off vacuum pump, shut off valves VAC-1 and VAC-2, disconnect hoses, cap each side of the hose with a plug to prevent contamination. Store hoses in their proper place.

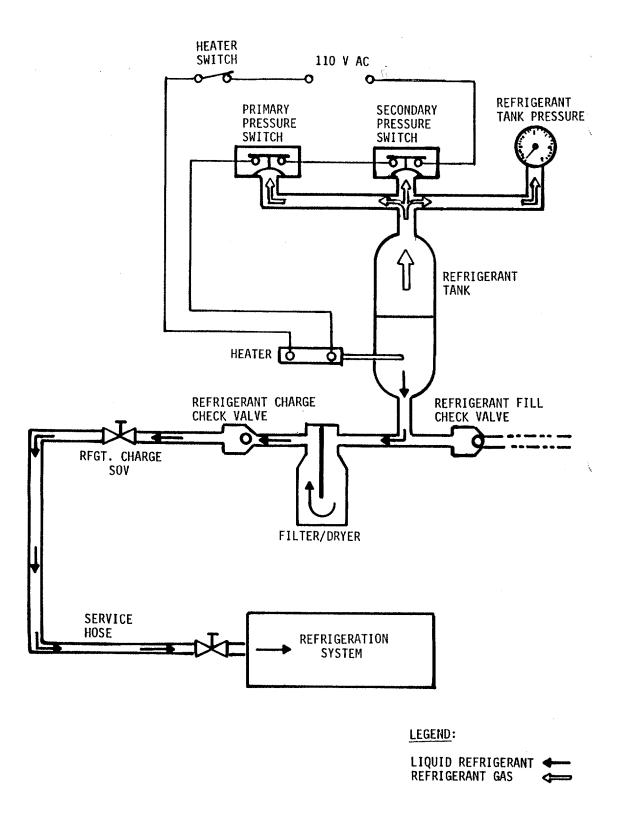


Figure 1-5. Refrigerant Charging

#### 1-13. REFRIGERANT CHARGING CYCLE.

With all shut-off valves closed, heater and vacuum pump switches off, power cord connected and refrigeration tank filled, the following sequence of events takes place:

- a. Operator connects RFGT CHARGE SOV to refrigeration system being serviced with a service hose.
- b. Operator turns HTR switch ON. Heat from thermostat-controlled heater warms liquid refrigerant causing an increase in refrigerant tank pressure as read on the RFGT TK PRESS gage.

#### NOTE

If pressure exceeds working pressure, primary or secondary pressure opens to allow heater and liquid refrigerant temperatures to drop. At a pre-set low pressure, the pressure switch closes and heater warms again.

- c. Operator opens RFGT CHARGE SOV and allows refrigerant to flow through filter/dryer. Crack open the refrigeration system port side of the charging hose and allow water and particle contamination to bleed off into the atmosphere. After all contaminants are dispelled tighten hose and open the service port to the refrigeration system being serviced.
- d. To secure the system from the charging mode first close the service port to the refrigeration system. Turn off heater switch, close all valves and remove charging hoses. Cap hoses with plugs to prevent contamination. Replace hoses in their proper place.

# 1-14. LUBE OIL CHARGING CYCLE.

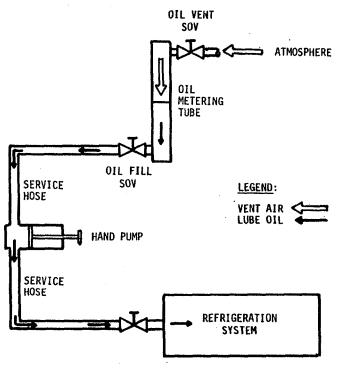


Figure 1-6. Lube Oil Charging

With OIL VENT and OIL Fill SOVs closed, Oil Metering Tube filled, the following sequence of events takes place:

- a. Operator connects handpump between OIL FILL SOV and refrigeration system being serviced with two service hoses.
- b. Operator opens OIL VENT and OIL FILL SOV. Operator cracks the hose connected to the refrigeration system (use rag or container to catch oil) and uses handpump to fill hoses, operator should observe cracked charging hose and tighten only when all air/contaminants have been cleared from the hose.
- c. To secure the system after charging with oil, first close the port valve to the refrigeration system. Close the OIL FILL SOV. Drain oil from lines into containers and disconnect lines from the system. Plug each end of the charging hoses to prevent contamination.

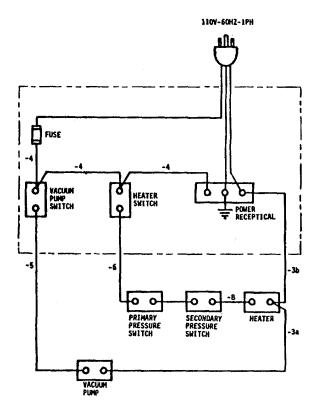


Figure 1-7. Electrical System

#### 1-15. ELECTRICAL SYSTEM.

With ambient pressure in refrigerant charging system and power cord connected, the following sequence of events takes place:

- a. Input hot lead is fused and then distributed to the Electrical Outlet, Vacuum Pressure Gage, the Vacuum Pump Circuit and the Heater Circuit.
- b. Electrical Outlet and Vacuum Pressure Gage are on anytime power cord is connected regardless of type of servicing taking place.
- c. During evacuation cycles, operator sets VAC PUMP switch ON, energizing Vacuum Pump and drawing a vacuum through the vacuum system.
- d. Prior to charging cycles, operator sets TK HTR switch ON to supply current to the Primary and Secondary Pressure Switches and the thermostatically-controlled Heater. If refrigerant pressure is below a preset limit, the pressure switches are closed, supplying current direct to the Heater. If refrigerant pressure is above a pre-set limit, one or both pressure switches open stopping current to the heater. If both pressure switches are closed and the Heater element becomes too hot, the thermostat inside the Heater opens, stopping current and allowing the Heater to cool. After Heater cools, thermostat closes to start the cycle again.

## CHAPTER 2

# **OPERATING INSTRUCTIONS**

# 2-1. GENERAL

This chapter covers the operation of the Refrigeration System Service Unit. The chapter is divided into 4 sections as listed below:

- 1. Description and use of Operator's Controls and Indicators
- 2. Preventive Maintenance Checks and Services
- 3. Operation under Usual Conditions
- 4. Operation under Unusual Conditions

# 2-2. OPERATING CONTROLS AND INDICATORS

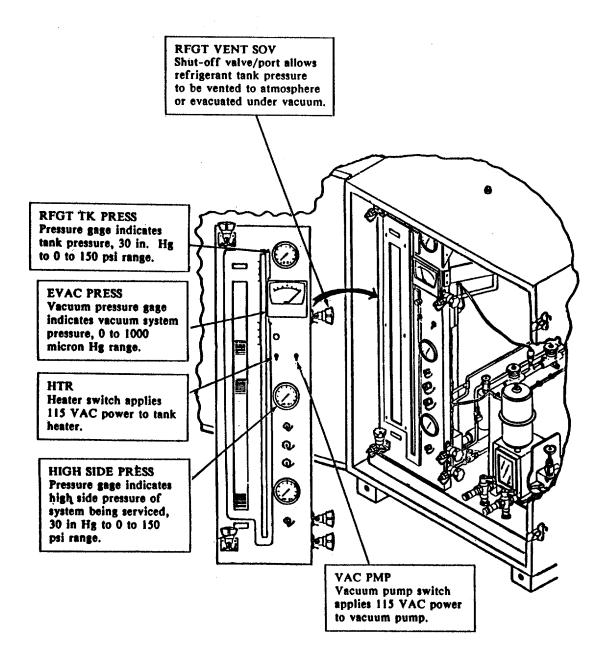


Figure 2-1. Operator's Controls and Indicators (sheet 1 of 2)

# 2-2. OPERATING CONTROLS AND INDICATORS (Continued)

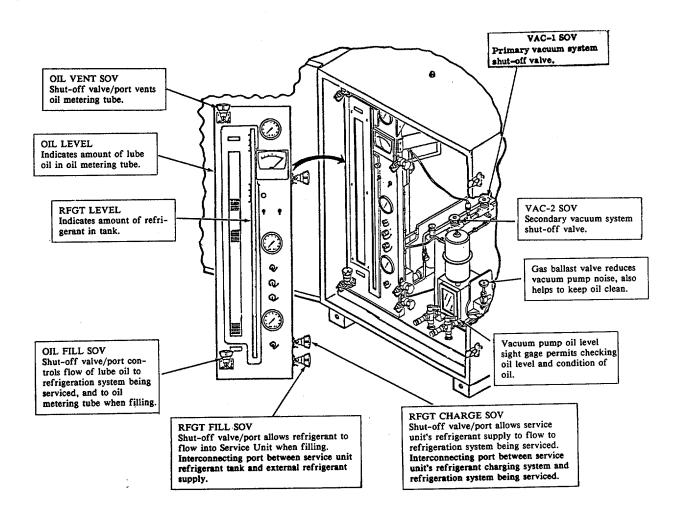


Figure 2-1. Operator's Controls and Indicators (sheet 2 of 2)

# Section II OPERATOR PREVENTATIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

#### 2-3. INTRODUCTION

#### A. General.

- a. BEFORE YOU OPERATE. Always keep in mind the CAUTIONS and WARNINGS. Perform your Before (B) PMCS.
- b. WHILE YOU OPERATE. Always keep in mind the CAUTIONS and WARNINGS. Perform your During (D) PMCS.
  - c. AFTER YOU OPERATE. Be sure to perform your After (A) PMCS.
- d. IF YOUR EQUIPMENT FAILS TO OPERATE. Notify supervisor. Report any deficiencies using proper forms. See DA PAM 738-750.

#### B. PMCS Procedures.

- a. Preventative maintenance checks and services are performed to keep equipment in good operating condition. Checks are to find, correct, or report problems. PMCS Table 2-1 lists those checks that are to be performed by operating maintenance personnel at various time intervals to maintain the equipment in a ready condition. If corrective action is not authorized at the operating level, notify your supervisor. Perform Weekly PMCS whether equipment has been operated or not.
  - b. A brief description of the column entries used in PMCS is as follows:
- (1) "Item No. Column",. Contains number of each item to be inspected. Items are numbered in the order in which they are to be checked. This column is used as a source of item numbers for "TM Item Number" Column on DA Form 2404, Equipment and Maintenance worksheet for recording results of PMCS.
  - (2) "Interval" Columns. Indicates when PMCS is performed.
- (3) "ITEM TO BE INSPECTED/Procedures" Column. Identifies part of equipment to be inspected and procedure for performing check.
- (4) For readiness reporting, "Equipment is NOT READY/AVAILABLE if' Column. Contains conditions that make equipment unable to perform it's primary mission.
  - c. If anything looks wrong and you cannot correct it yourself, write it on DA Form 2404.
- d. Before you begin to check specific items, remember that there are some things to be checked that are common to all areas of equipment. Keep these items in mind as you make inspections and perform PMCS.

# b. PMCS Procedures (continued)

- (1) Loose Bolts. A loose bolt can be difficult to spot without using a wrench. Signs of looseness are loose or chipped paint around the bolt head and bare metal or rust at base of bolt head.
  - (2) Welds. Damaged welds are indicated by rust or chipped paint around cracks.
- (3) Hoses and Fluid Lines. Check all hoses and lines for signs of wear, leaks, loose clamps, and loose fittings. Stains around fittings may be a sign of a leak. Fitting should be tightened, repaired, or replaced.
- (4) Electrical Wires, Connectors, and Harnesses. Look for cracked or broken insulation, bare wire, and loose or broken connectors. Make sure harnesses are secure. Tighten loose connections and bolts.
- (5) Correct Assembly and Stowage. Look for items that are not assembled or stowed properly. Be alert for signs of trouble. Your senses help here. You can feel, smell or see most problems. Be alert during your time with the equipment.

#### 2-4. SPECIAL INSTRUCTIONS

No refrigerant leakage allowed.

Table 2-1. Preventative Maintenance Checks and Services

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
		Accessory Equipment.	
1	• •	Vacuum Hoses (2 ea). Inspect vacuum hoses for damage and wear.	Vacuum Hoses are worn, damaged or missing.
2	• •	Service Hoses (5 ea). Inspect service hoses for damage and wear.	Service Hoses are worn, damaged or missing.
3	• •	Extension Cord. Inspect extension cord for damage and wear.	Extension Cord is worn damaged or missing.
4	• •	Hand Pump. Inspect hand pump for damage and wear.	Hand Pump is worn, damaged or missing.
5	• •	Centrifuge Tube. Inspect centrifuge tube for damage. See that level marks are readable.	Centrifuge Tube is damaged, missing, or level marks not readable.
6	• •	Vacuum Pump Oil (3 ea). See that there are three (3) 1 quart bottles of clean, uncontaminated vacuum pump oil.	Vacuum Pump Oil is missing or contaminated.
7	• •	Gaskets 1/4" (10 ea). See that there are ten (10), 1/4" gaskets in the spare gasket box. Inspect gaskets for damage.	1/4" Gaskets are damaged or missing.
8	• •	Gaskets 3/8" (10 ea). See that there are ten (10), 3/8" gaskets in the spare gasket box. Inspect gaskets for damage.	3/8" Gaskets are damaged or missing.
9	• •	Gaskets 1/2" (10 ea). See that there are ten (10), 1/2" gaskets in the spare gasket box. Inspect gaskets for damage.	1/2" Gaskets are damaged or missing.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
		Instrument Panel	
10	• •	Refrigerant Metering Scale. See that level marks on refrigerant metering scale are clean, and that level marks and refrigerant level in metering tube can be read through the safety shield. Clean safety shield as required using a clean soft cloth.	Refrigerant Metering Scale level marks or refrigerant level not readable.
11	• •	Oil Metering Tube. See that level marks on oil metering tube are clean and that level marks and oil level in the tube can be read through the safety shield. Check oil metering tube for leaks. Clean safety shield as required using a clean soft cloth.	Oil Metering Tube level marks or oil level not readable. Tube leaking.
12	• •	Oil Vent SOV and Cap. See that Oil Vent SOV is securely mounted to bracket. Check valve stem movement. Remove cap from valve port and inspect cap and port for contamination and damage. Close Oil Vent SOV and reinstall cap.	Oil Vent SOV is loose, binding, contaminated or damaged. Oil Vent SOV cap is contaminated.
13		Oil Fill SOV and Cap. See that the Oil Fill SOV is securely mounted to bracket. Check for leaks. Check valve stem movement. Remove cap from valve port and inspect cap and port for contamination and damage. Close Oil Fill SOV and reinstall cap.	Oil Fill SOV is loose, binding, contaminated or damaged. Oil Fill SOV cap is contaminated. Valve leaking.
14	• • •	Refrigerant Tank Pressure Gage. See that refrigerant tank pressure gage is securely mounted to the instrument panel. See that the gage cover glass is not broken and that the gage needle and dial marks are readable. See that gage needle operates smoothly with no sticking or binding. Clean cover glass as required with a clean soft cloth.	Refrigerant Tank pressure gage is loose or damaged. Gage is not readable. Gage needle sticks or binds during operation.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
		Instrument Panel (Continued)	
15	• • •	Vacuum Gage. See that the vacuum gage is securely mounted to the instrument panel. See that the gage cover glass is not broken and that the gage needle and dial marks are readable. See that gage needle operates smoothly with no sticking or binding. Clean cover glass as required with a clean soft cloth.	Vacuum Gage is loose or damaged. Gage is not readable. Gage needle sticks or binds during operation.
16	• • •	High Pressure Gage. See that high pressure gage is securely mounted to the instrument panel. See that the gage cover glass is not broken and that the gage needle and dial marks are readable. See that gage needle operates smoothly with no sticking or binding. Clean cover glass as required with a clean soft cloth.	High Pressure gage is loose or damaged. Gage is not readable. Gage needle sticks or binds during operation.
17		Low Pressure Gage. See that the low pressure gage is securely mounted to the instrument panel. See that the gage cover glass is not broken and that the gage needle and dial marks are readable. See that gage needle operates smoothly with no sticking or binding. Clean cover glass as required with a clean soft cloth.	Low Pressure Gage is loose or damaged. Gage is not readable. Gage needle sticks or binds during operation.
18		High Pressure Port and Cap. Remove cap from high pressure port and inspect cap and port for contamination and damage. Reinstall cap.	High Pressure Port and Cap contaminated or damaged. Cap is missing.
19	• •	Low Pressure Port and Cap. Remove cap from low pressure port and inspect cap and port for contamination and damage. Reinstall cap.	Low Pressure Port and Cap contaminated or damaged. Cap is missing.
20	• •	Vacuum Pump Switch. See that the vacuum pump switch is securely mounted to the instrument panel and not damaged.	Vacuum Pump Switch is loose or damaged.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
		Instrument Panel (Continued)	
21	• •	Heater Switch. See that the heater switch is securely mounted to the instrument panel and not damaged.	Heater Switch is loose or damaged.
22	•	Electrical Outlet Box. See that the electrical outlet box is securely mounted to the rear of the instrument panel.	Electrical Outlet Box is loose.
23	•	Fuse Holder. See that the fuse holder is securely mounted to instrument panel and not damaged. Remove fuse holder cap and check for fuse.	Fuse Holder loose or damaged. Fuse missing.
24	•	Instrument Panel. See that instrument panel is securely mounted to the Service Unit Liner. Inspect instrument panel for damage and readability of stenciled labels.	Instrument Panel is loose or damaged. Stenciled labels are unreadable.
		Refrigerant Charging System	
25	• •	Primary Pressure Switch. Inspect pressure switch for damage. See that capillary tubing is not broken, linked, or bent in sharp angles. See that pressure switch wiring is secure and not damaged. See that pressure switch is securely attached to liner wall.	Pressure switch is loose or damaged. Capillary tubing is loose or damaged. Wiring is loose or damaged.
26	• •	Secondary Pressure Switch. Inspect pressure switch for damage. See that capillary tubing is not broken, linked, or bent in sharp angles. See that pressure switch wiring is secure and not damaged. See that pressure switch is securely attached to liner wall.	Pressure switch is loose or damaged. Capillary tubing is loose or damaged. Wiring is loose or damaged.
27	•	Relief Valve. Inspect relief valve for cleanliness or damage.	Relief valve is damaged.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
28		Refrigerant Charging System (Continued) Refrigerant Vent SOV and Cap. See that refrigerant vent SOV and cap is securely mounted to Instrument Panel. Check valve stem movement. Remove cap from valve port and inspect cap and port for contamination and damage. Close Refrigerant Vent SOV and reinstall cap. See that there is no leakage during operation.	Refrigerant Vent SOV is loose, binding, contaminated or damaged. SOV leaks during operation. Refrigerant Vent SOV cap is contaminated, damaged or missing.
29		Refrigerant Fill SOV and Cap. See that refrigerant fill SOV and cap is securely mounted to Instrument Panel. Check valve stem movement. Remove cap from valve port and inspect cap and port for contamination and damage. Close Refrigerant Fill SOV and reinstall cap. See that there is no leakage during operation.	Refrigerant Fill SOV is loose, binding, contaminated or damaged. SOV leaks during operation. Refrigerant Fill SOV cap is contaminated, damaged or missing.
30	•	Refrigerant Fill Check Valve. Inspect check valve for cleanliness or damage.	Check Valve is damaged.
31		Filter/Dryer. Inspect filter/dryer moisture indicator and element for cleanliness or damage. See that the color of filter/dryer moisture indicator is BLUE.	Filter/Dryer moisture indicator or element is damaged or is PINK.
32	•	Refrigerant Charge Check Valve. Inspect check valve for cleanliness or damage.	Check Valve is damaged.
33		Refrigerant Charge SOV and Cap. See that refrigerant charge SOV and cap is securely mounted to Instrument Panel. Check valve stem movement. Remove cap from valve port and inspect cap and port for contamination and damage. Close Refrigerant Charge SOV and reinstall cap. See that there is no leakage during operation.	Refrigerant Charge SOV is loose, binding, contaminated or damaged. SOV leaks during operation. Refrigerant Charge SOV cap is contaminated, damaged or missing.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
		Vacuum System	
34	•	Vacuum Pressure Transducer. See that vacuum pressure transducer is securely mounted to vacuum line and not damaged.	Vacuum Pressure Transducer is loose or damaged.
<b>3</b> 5	•	Vacuum I SOV. Inspect VAC-1 for cleanliness or damage. Check valve stem movement. See that valve is securely mounted to bracket.	Vacuum 1 SOV valve is loose, damaged or valve stem binding.
36	•	Vacuum 2 SOV. Inspect VAC 2 for cleanliness or damage. Check valve stem movement. See that valve is securely mounted to bracket.	Vacuum 2 SOV valve is loose, damaged, or valve stem binding.
37	• •	Vacuum Pump. Inspect Vacuum Pump sight gage for evidence of oil condition.	Vacuum Pump oil contaminated.
	•	Inspect vacuum pump site for proper oil level. or low.	Vacuum Pump oil level high
		Electrical	
<b>3</b> 8	• •	Power Cord. Inspect power cord for damage and wear.	Power Cord damaged or worn.
		Cabinet Assembly	
39	•	Information Plate. See that information plate is securely mounted to the service unit door. Inspect information plate for damage, cleanliness, and readability. Clean plate as required.	Information Plate is loose, damaged or missing. Plate information is unreadable.
40	• •	Handles. See that handles are securely mounted to cabinet. Inspect handles for damage or corrosion. Check handle movement.	Handles are loose, damaged, missing, or corroded.

Table 2-1. Preventative Maintenance Checks and Services (Continued)

Item No.	Interval B D A	Item To Be Inspected and Procedure	Equipment Not Ready/ Available if
41	• •	Cabinet exterior. Inspect cabinet exterior for signs of damage or corrosion.	Cabinet is damaged or corroded.
42		Door Fasteners. See that door fasteners are securely mounted to cabinet. See that fastener catches are securely mounted to door. Inspect door fasteners for damage and corrosion. Check door fastener movement.	Door Fasteners are loose, damaged, missing, nonfunctional or corroded.
43		Door Hinge. See that door hinge is securely mounted to cabinet and door. Inspect hinge for damage or corrosion. Check hinge movement.	Door hinge loose, damaged, binding or corroded.
14		Door Gasket. See that door gasket is securely attached to cabinet and is not damaged.	Door Gasket is loose or damaged.
45	•	Shock Mounts. See that shock mounts are securely mounted between the cabinet and inner liner. Inspect shock mounts for damage.	Shock Mounts are loose or damaged.
46	• •	Inner Liner. Inspect inner liner for cleanliness, security, damage or corrosion.	Inner liner is loose, damaged or corroded.
47		Pressure Equalizing Valve. Inspect pressure equalizing valve for security of mounting and damage.	Pressure Equalizing Valve is loose or damaged.

# Section III OPERATION UNDER USUAL CONDITIONS

## 2-5. PREPARATION FOR USE

- a. Perform procedures in paragraph 3-7, "Vacuum Pump Oil Level Inspection."
- b. Perform procedures in paragraph 4-36, "Vacuum Pump Oil Level Service" as required.
- c. Perform procedures in paragraph 3-8, "Filter/Dryer Moisture Indicator Inspection."
- d. Perform procedures in paragraph 4-31, "Filter/Dryer Element and Vacuum Drying Test" as required.
- e. Remove stopper from port on top of Vacuum Pump Oil Mist Eliminator.
- f. Perform all before PMCS procedures.
- g. Locate Service Unit where 115 VAC power is available.
- h. Perform procedures in paragraph 2-6. "Preliminary Operating Procedures."

# 2-6. PRELIMINARY OPERATING PROCEDURES

# A. Evacuate Refrigerant Tank.

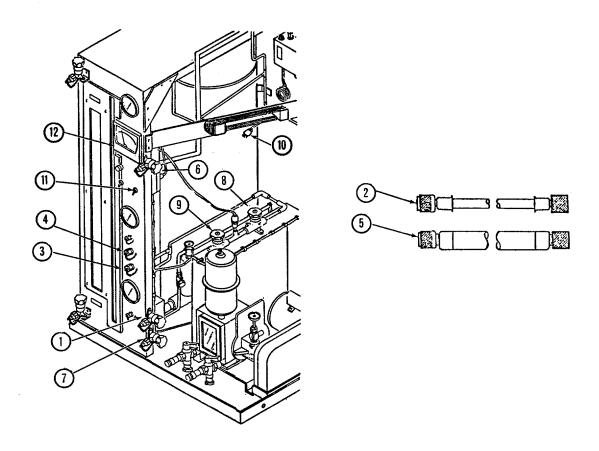


Figure 2-2. Refrigerant Tank Evacuation

<sup>1.</sup> Remove cap from RFGT CHARGE SOV port (1) and connect a -4 Service Hose (2). Place free end of Service Hose in a suitable container for drainage.

#### **WARNING**

PERFORM ALL REFRIGERANT VENTING AND DRAINING IN A WELL VENTILATED AREA. REFRIGERANT GAS CAN DISPLACE OXYGEN AND WILL NOT SUPPORT LIFE. SUFFOCATION MAY RESULT.

2. Open RFGT CHARGE SOV and allow R114 refrigerant to drain from system. Close RFGT CHARGE SOV.

#### WARNING

DO NOT ATTEMPT TO EVACUATE REFRIGERANT TANK UTILIZING RFGT CHARGE SOV PORT. LIQUID REFRIGERANT CAN BE PUMPED INTO THE VACUUM PUMP AND AN EXPLOSION CAN OCCUR. THIS MAY CAUSE INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

- 3. Remove cap from either vacuum port (3,4) and connect a -1 Vacuum Hose (5). Remove cap from RFGT VENT SOV (6) port and connect free end of Vacuum Hose.
- 4. Remove Service Hose from RFGT CHARGE SOV port and replace cap. Remove cap from RFGT FILL SOV (7) and connect Service Hose.
- 5 Remove free end of Service Hose from drainage container and connect to refrigerant bottle port.
- 6. See that VAC-1 SOV (8), VAC-2 SOV (9), RFGT CHARGE SOV (1), and refrigerant bottle valves are closed. Open RFGT FILL SOV (7) and RFGT VENT SOV (6).
- 7. Connect power cord (10) to power source. Set VAC PUMP switch (11) ON.
- 8. Open VAC-2 SOV and then VAC-I SOV. Evacuate system to 500 microns minimum, as indicated on EVAC PRESS. gage (12).

# NOTE

SYSTEM SHOULD REQUIRE NO MORE THAN FIVE MINUTES TO REACH APPROXIMATELY 30 INCHES HG. OF VACUUM AS READ ON THE RFGT TK PRESS GAGE OR 20 MINUTES TO REACH 500 MICRONS AS READ ON VACUUM GAGE.

- 9. Close RFGT VENT SOV. Disconnect Vacuum Hose from RFGT VENT SOV port to allow vacuum system to equalize.
- 10. Set VAC PUMP switch to OFF.

- 11. Close VAC-I SOV and VAC-2 SOV.
- 12. Remove Vacuum Hose from VAC port.
- 13. Reinstall caps on VAC port and RFGT VENT SOV port.
- 14. Disconnect and stow power cord.
  - b. Fill Refrigerant Tank With R114 Refrigerant

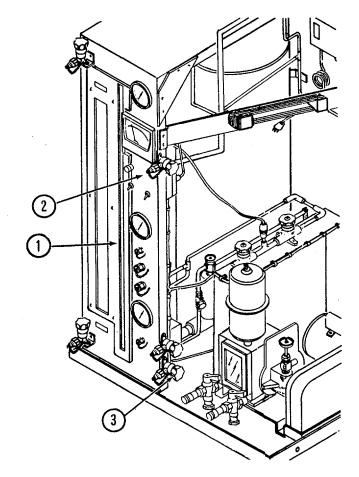


Figure 2-3. Refrigerant Tank Fill

- 1. Perform steps listed in "a" above.
- 2. Warm liquid refrigerant bottle using warm water only.
- 3. Invert refrigerant bottle and open valve. Observe refrigerant metering tube (1) for proper fill level.

#### NOTE

Elevate refrigerant bottle to speed filling.

## WARNING

PERFORM ALL REFRIGERANT VENTING AND DRAINING IN A WELL VENTILATED AREA. REFRIGERANT GAS CAN DISPLACE OXYGEN AND WILL NOT SUPPORT LIFE. SUFFOCATION MAY RESULT.

WEAR PROTECTIVE GOGGLES AND USE EXTREME CAUTION IF RFGT VENT SOV IS OPENED TO SPEED FILLING. AVOID GETTING PRESSURIZED GAS AND LIQUID EXHAUST FROM RFGT VENT SOV PORT IN THE EYES. PERMANENT DAMAGE TO THE EYES MAY RESULT.

4. If refrigerant does not reach desired level, remove cap from RFGT VENT SOV port and open RFGT VENT SOV (2). When level of refrigerant reaches the correct level, close RFGT FILL SOV (3), RFGT VENT SOV (if applicable), and refrigerant bottle valve.

### **WARNING**

WEAR PROTECTIVE GOGGLES AND EXERCISE EXTREME CAUTION IN DISCONNECTING SERVICE HOSE WHEN PRESSURIZED WITH REFRIGERANT. AVOID GETTING REFRIGERANT IN THE EYES. PERMANENT DAMAGE TO THE EYES MAY RESULT.

5. Carefully remove the Service Hose from the refrigerant bottle port and RFGT FILL SOV port. Reinstall cap(s) on RFGT FILL SOV port and RFGT VENT SOV port (if applicable).

# c. Evacuate Oil Metering Tube,

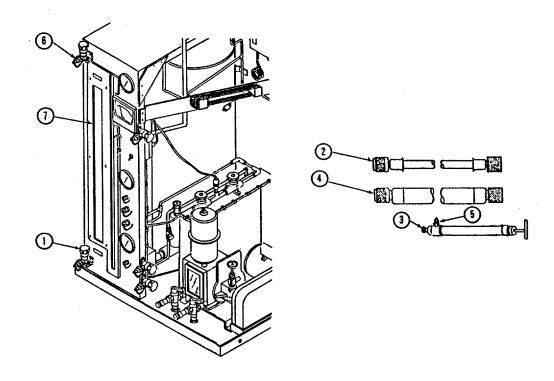


Figure 2-4. Evacuate Oil Metering Tube

- 1. Remove cap from OIL FILL SOV port (1) and connect a -6 Service Hose (2). Connect free end of Service Hose to Hand Pump inlet fitting (3).
- 2. Connect a -4 Service Hose (4) to Hand Pump outlet fitting (5). Place free end of Service Hose in a suitable container for drainage.
- 3. Remove cap from OIL VENT SOV port (6). Open OIL VENT SOV and OIL FILL SOV.
- 4. Operate Hand Pump until all oil is evacuated from the metering tube (7).
- 5. Close OIL FILL SOV and OIL VENT SOV.
- 6. Remove Service Hose from OIL FILL SOV port.
- 7. Reinstall caps on OIL FILL SOV port and OIL VENT SOV port.
- 8. Remove Service hoses from Hand Pump. Drain and stow hoses and pump.

#### d. Fill Oil Metering Tube

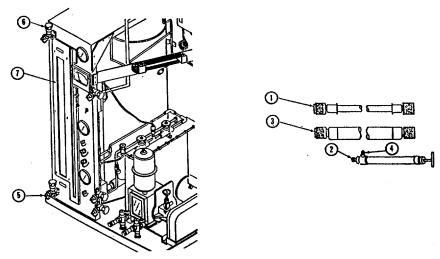


Figure 2-5. Oil Metering Tube Fill

#### **CAUTION**

USE CARE IN STORAGE AND HANDLING OF COMPRESSOR LUBE OIL TO PREVENT CONTAMINATION WITH MOISTURE AND OTHER ATMOSPHERIC CONTAMINANTS.

1. Connect a -4 Service Hose (1) to the Hand Pump inlet fitting (2) and place free end of Service Hose in a container of compressor lube oil.

#### **CAUTION**

INSURE FREE END OF SERVICE HOSE IS FREE OF DIRT OR OTHER CONTAMINANTS.

- 2. Connect a -6 Service Hose (3) to the Hand Pump outlet fitting (4) and place opposite end in a suitable container for drainage.
- Operate the Hand Pump a few strokes to purge both Service Hoses and the Hand Pump of dirt and/or other contaminants.
- 4. Remove cap from OIL FILL SOV port (5). Remove end of -6 Service Hose from drainage container and connect it to OIL FILL SOV port. Open OIL FILL SOV.
- 5. Remove cap from OIL VENT SOV port (6). Open OIL VENT SOV.
- 6. Operate the Hand Pump while watching the OIL METERING TUBE (7) gage tube for proper level.
- 7. When proper level has been reached, close OIL FILL SOV and OIL SOV.
- 8. Remove -6 Service Hose from OIL FILL SOV port. Reinstall caps on OIL FILL SOV and OIL VENT SOV ports.
- 9. Remove both Service Hoses from Hand Pump. Drain and stow hoses and pump.

#### 2-7. OPERATING PROCEDURE

The following procedures are general. The number of hoses and ports used may vary according to the refrigeration system being serviced. Refer to applicable refrigeration system Technical Manual for specific information.

a. Evacuate Refrigeration System.

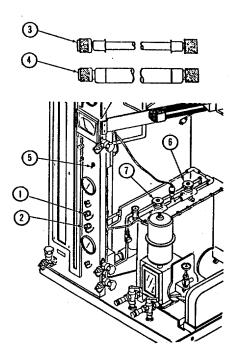


Figure 2-6. Refrigeration System Evacuation

- 1. Purge refrigeration system in accordance with refrigeration system Technical Manual. After purging, leave refrigeration system at ambient pressure.
- 2. Remove cap(s) from VAC port(s) (1,2) and connect Vacuum Hose(s) (3,4).
- 3. Connect free end(s) of Vacuum Hose(s) to refrigeration system service port(s) as specified by the refrigeration system Technical Manual.
- Connect power cord to power source.
- 5. Set VAC PUMP switch (5) ON.
- 6. Check Vacuum Pump sight gage for proper oil level. If required, add pump oil in accordance with paragraph 2.5.
- 7. Open VAC-1 SOV (6) and VAC-2 SOV (7). Open refrigeration system service valve(s) as specified in the refrigeration system Technical Manual.

- 8. Evacuate refrigeration system in accordance with refrigeration system Technical Manual.
- 9. Close refrigeration system service valve(s).
- 10. Remove Vacuum Hose(s) from VAC port(s) and allow vacuum system to equalize.
- 11. Set VAC PUMP switch to OFF.
- 12. Close VAC-1 SOV and VAC-2 SOV.
- 13. Remove Service Hose(s) from refrigeration system service port(s). Stow hose(s).
- 14. Reinstall cap(s) on VAC port(s).
- 15. Disconnect and stow power cord.

b. Charge Refrigeration System With Compressor Lube Oil.

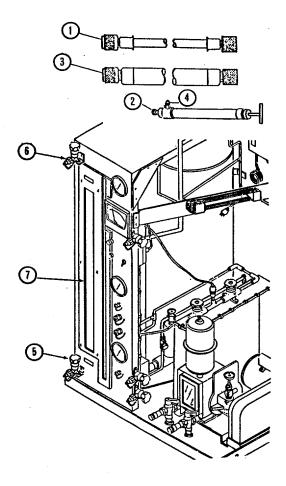


Figure 2-7. Refrigeration System Oil Charging

#### CAUTION

USE CARE IN STORAGE AND HANDLING OF COMPRESSOR LUBE OIL TO PREVENT CONTAMINATION WITH MOISTURE AND OTHER ATMOSPHERIC CONTAMINANTS

1. Connect a -6 Service Hose (1) to the Hand Pump inlet fitting (2). Place the free end of Service Hose in a container of compressor lube oil.

#### CAUTION

INSURE FREE END OF SERVICE HOSE IS FREE OF DIRT OR OTHER CONTAMINANTS

- 2. Connect a -5 Service Hose (3) to the Hand Pump outlet fitting (4) and place the opposite end in a suitable container for drainage.
- 3. Operate the Hand Pump a few strokes to purge both Service Hoses and the Hand Pump of dirt and/or other contaminants.

- 4. Remove cap from OIL FILL SOV port (5) and OIL VENT SOV port (6).
- 5. Remove -6 Service Hose from compressor lube oil container and connect to OIL FILL SOV port.
- 6. Remove free end of -5 Service Hose from the drainage container and loosely connect it to the refrigeration system oil service port as specified in the refrigeration system Technical Manual.
- 7. Open OIL FILL SOV and OIL VENT SOV. Operate the hand pump to purge air from the hoses and pump.
- 8. Tighten Service Hose connection at the refrigeration system oil service port.
- 9. Open refrigeration system oil service valve.
- 10. While watching OIL LEVEL (7), operate the Hand Pump to fill the refrigeration system to proper level.
- 11. When proper oil level has been reached, close refrigeration system oil service valve, OIL FILL SOV, and OIL VENT SOV.
- 12. Remove Service Hose from OIL FILL SOV port. Reinstall caps on OIL FILL SOV port and OIL VENT SOV port.
- 13. Remove Service Hose from refrigeration system oil service port.
- 14. Remove Service Hoses from Hand Pump. Drain and stow hoses and pump.

#### c. Charge Refrigeration System With Refrigerant



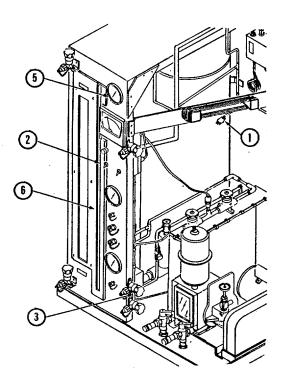


Figure 2-8. Refrigeration System Refrigerant Charging

- 1. Connect power cord (1) to power source.
- 2. Set TK HTR switch (2) ON.
- 3. Remove cap from RFGT CHARGE SOV port (3).
- 4. Connect a -3, -4, or -5 Service Hose (4) (as appropriate to match the refrigeration system being charged) to RFGT CHARGE SOV port.
- 5. Connect free end of Service Hose loosely to refrigeration system service port specified in the refrigeration system Technical Manual.
- 6. Slowly open RFGT CHARGE SOV to purge Service Hose of air. Close RFGT CHARGE SOV. Tighten Service Hose fitting at refrigeration system service port.
- 7. Allow Refrigerant Tank pressure to stabilize, as indicated on RFGT TK PRESS Gage (5).
- 8. Set TK HTR switch to OFF.

9. Open refrigeration system service valve and then slowly open RFGT CHARGE SOV to regulate fluid charge rate while noting RFGT LEVEL (6).

#### **NOTE**

During charging, occasionally close RFGT CHARGE SOV to allow refrigerant level to stabilize.

10. When refrigeration system is fully charged to the specifications listed in the refrigeration system Technical Manual, close RFGT CHARGE SOV and refrigeration system service valve.

WARNING

EXERCISE EXTREME CAUTION IN DISCONNECTING SERVICE HOSE WHEN PRESSURIZED WITH REFRIGERANT. WEAR PROTECTIVE GOGGLES TO AVOID GETTING REFRIGERANT IN THE EYES. PERMANENT DAMAGE TO THE EYES MAY RESULT.

- 11. Carefully remove Service Hose from RFGT CHARGE SOV port and reinstall cap.
- 12. Remove Service Hose from refrigeration system service port. Stow hose.
- 13. Disconnect and stow power cord.
- d. Leak Check System.
  - 1. Pressurize service system to be tested in accordance with Leak Detector Technical Manual.
  - 2. Connect Leak Detector power cord to power source.
  - 3. Leak check in accordance with Leak Detector Technical Manual.
  - 4. System shall not have a leak greater than 0.1 pound per year.
- e. Check Oil Quantity In Refrigerant System.
  - 1. Operate refrigeration system for 15 minutes to mix refrigerant thoroughly with oil.
  - 2. Connect hose to service valve on refrigeration system receiver.

#### NOTE

Do not hold centrifuge tube by stem. Use gloves or cloth while holding centrifuge tube to protect hands from cold refrigerant.

3. Open service valve in refrigerant system and direct flow of refrigerant-oil mixture into centrifuge tube.

- 4. Close service valve when level in the centrifuge tube reaches 100ml.
- 5. Place centrifuge tube in a warm area and allow liquid refrigerant to boil off. Oil remaining in the tube should read at a specific quantity as specified in the Refrigeration System Technical Manual.

#### 2-8. INSTRUCTION PLATES



Figure 2-9. Identification Plate



Figure 2-10. Warning Plate

#### 2-8. INSTRUCTION PLATES (Continued)

Remove cap from Dib FILL SDV port and connect a -b Service Hose. Connect free and of Service Hose to Hand Pump Inlet Stiling.

2. Rameve cap from Oit VENT SOV port. Open OHL VENT SOV and Oit FML SOV.

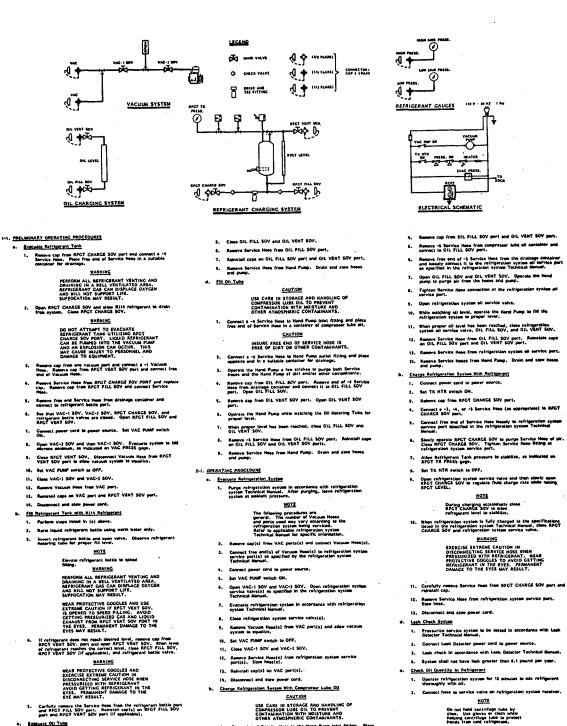


Figure 2-11. Operating Instruction Plate

CAUTION

Connect a -5 Service Hose to the Hand Pump methot Riting and place the appoints and in a solidate curtainer for draftings.
 Operate the Hand Pump a few strates to pump both Service those and the Hand Pump of dirt confort where contentions.

INSURE PREE END OF SERVICE HOSE IS PREE OF DIRT OR OTHER CONTAMINANTS.  Open service valve in refrigerent system and direct flow of refrigerent-oil mixture into contribuge letter.

to Close service valve when level to the contribuge tube reaches

Place centrifuge tube in a norm area and allow liquid refrigorant to bell off. Oir remaining in the tube should read at specific quantity.

#### Section IV OPERATION UNDER UNUSUAL CONDITIONS

#### 2-9. GENERAL

- a. PMCS must be done under all conditions. In unusual temperatures, other services and checks must be done in addition to PMCS. Constant maintenance keeps the service unit operating properly and controls wear.
- b. See Table 2-1 for operator's preventative maintenance checks and services.
- c. Report constant failures caused by unusual conditions on DA Form 2407, Maintenance Request.

#### 2-10. EXTREME COLD WEATHER

Check service unit prior to operating in extremely cold weather. Extreme cold can: (1) cause lubricants to thicken or become solid; (2) crack insulation and cause electrical short circuits; (3) cause some materials to harden or become brittle. If service unit is not in use, cover and protect service unit from extreme cold.

#### 2-11. HUMID OR SALTY AREAS

Check service unit prior to operation in humid or salty areas for moisture, corrosion, and fungus growth. Dry all exposed surfaces and lubricate as instructed in PMCS.

#### 2-12. DUSTY AND SANDY AREAS

Whenever possible, do not operate the service unit in dusty or sandy areas. Keep service unit well covered and protected in dusty and sandy areas. Lubricate service unit as instructed in PMCS to avoid contamination by sand and dust. Prior to operating, thoroughly clean (removing any dust or sand) exterior, interior, and accessories of service unit.

#### 2-13. EXTREME DRY HEAT

The service unit is capable of operating in any ambient temperature from  $\pm 50^{\circ}$ F (10°C) to 127°F (52.7°C). However, should temperatures greatly exceed the temperatures indicated, do not operate service unit. Protect unit from extreme dry heat with tarps, if no other suitable shelter is available.

#### 2-14. EMERGENCY PROCEDURES

There are no special emergency procedures for the service unit. Should a reduction in power, partial failure, or malfunction occur during operation, discontinue operation and refer to Chapter 3, Section II, Troubleshooting Procedures, to determine the problem.

#### **CHAPTER 3**

#### **OPERATOR'S MAINTENANCE INSTRUCTIONS**

#### Section I LUBRICATION INSTRUCTIONS

#### 3-1.GENERAL

Section I of this chapter contains lubrication procedures to be performed by the operator. Section II is the troubleshooting procedures and Section III is the maintenance procedures that can be performed by the operator.

#### **3-2.LUBRICATION**

No operator lubrication required.

#### Section II TROUBLESHOOTING

#### 3-3.INTRODUCTION

This section contains the instructions necessary to allow the operator to efficiently troubleshoot the service unit.

Table 3-1 lists the common malfunctions which you may find during operation or maintenance of the service unit or its components. You should perform the tests/inspections and corrective actions in the order listed.

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

Only those corrective procedures that can be performed by the operator are listed in Table 3-1.

#### 3-4. OPERATOR'S TROUBLESHOOTING

#### Table 3-1. Operator's Troubleshooting Table

#### MALFUNCTION

# TEST OR INSPECTION CORRECTIVE ACTION

#### 1. VACUUM PUMP AND HEATER WILL NOT OPERATE

Step 1. Verify input power cable is connected to input power source. Connect power cable to power source.

Step 2. Power not on at power source.

Turn source power on.

Step 3. System power fuse is blown.

Notify supervisor.

#### 2. VACUUM PUMP WILL NOT START

Step 1. System power fuse is blown.

Notify supervisor.

Step 2. Pump is flooded with oil.

Notify supervisor.

# 3. VACUUM PUMP STALLS

Step 1. Insufficient oil.

Check oil level at Vacuum Pump sight gage. If oil level is low, notify supervisor.

Step 2. Mist eliminator outlet blocked.

Notify supervisor.

#### 4. OIL DISCHARGE FROM MIST ELIMINATOR

Step 1. Excess oil on discharge side of mist eliminator.

Notify supervisor.

#### 5. EXCESSIVE PUMP NOISE AT LOW PRESSURE

Step 1. Hydraulic noise of pump discharge.

Open gas ballast valve.

# Section III OPERATOR'S MAINTENANCE

# 3-5.INTRODUCTION

The maintenance procedures in this section are the responsibility of the operator.

# 3-6.INSPECTION

Inspect the service unit in accordance with procedures outlined in the Preventive Maintenance Checks and Services (PMCS) Table 2-1.

# 3-7.VACUUM PUMP OIL LEVEL INSPECTION This task covers: Inspection INITIAL SETUP Equipment Condition Tools Paragraph None None Condition Description



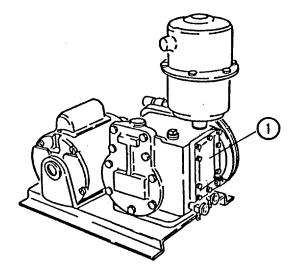


Figure 3-1. Vacuum Pump Oil Level Inspection

#### NOTE

Oil level in the vacuum pump should be checked during operation at vacuum. Check oil level sight gage (1). If oil level is below level mark, notify supervisor.

# 3-8.FILTER/DRYER MOISTURE INDICATOR INSPECTION This task covers: Inspection INITIAL SETUP Equipment Condition Tools Paragraph None None Personnel Required 1

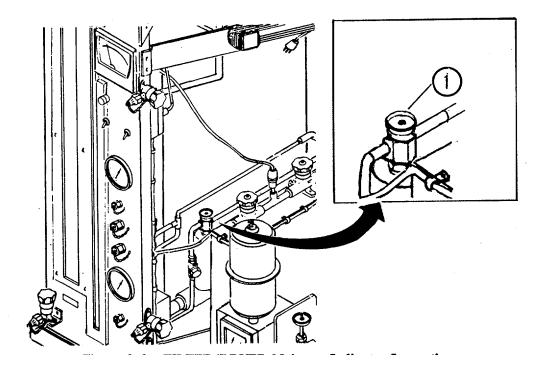


Figure 3-2. FILTER/DRYER Moisture Indicator Inspection

Check moisture indicator (1). If color of moisture indicator is blue, element (3) is usable. If moisture indicator color is pink, notify supervisor.

3-9.CLEANING		
This task covers:	Inspection	
INITIAL SETUP Equipment Condition Tools Paragraph None None		Condition Description
Materials Cloth, Cleaning (Item 2, Appendix D)		General Safety Instructions  Compressed air for cleaning shall not exceed 30 psi
Soap (Item 1, Appendix D)		
<u>Personnel Required</u> 1		

#### WARNING

COMPRESSED AIR USED FOR CLEANING PURPOSES WILL NOT EXCEED 30 POUNDS PER SQUARE INCH (PSI). DO NOT DIRECT COMPRESSED AIR AGAINST THE SKIN.

- 1. Remove spilled fluid, grease, or foreign matter from the interior of the Service Unit with a clean, dry cloth and a low pressure jet of dry compressed air (15 to 30 psi).
- 2. Clean cover glass on all pressure gauges, safety shield (not shown), and oil metering tube with a clean soft cloth and warm soapy water. Dry thoroughly with a clean soft cloth.

#### **CHAPTER 4**

#### **ORGANIZATIONAL MAINTENANCE**

\_\_\_\_\_\_

#### SECTION I REPAIR PARTS, SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT

#### 4-1. COMMON TOOLS AND EQUIPMENT

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

#### 4-2. SPECIAL TOOLS

No special tools are required.

#### 4-3.REPAIR PARTS

Repair parts are listed and illustrated in the repair parts and special tool list (TM 5-4130-236-23P) covering organizational maintenance for this equipment.

#### Section II SERVICE UPON RECEIPT

#### 4-4. SERVICE UPON RECEIPT OF MATERIAL

- a. Remove Service Unit from shipping container.
- b. Inspect equipment for damage incurred during shipment. If equipment has been damaged, report damage on DD Form 6, Packing Improvement Report.
- c. Check equipment against packing slip to see if shipment is complete. Report all discrepancies in accordance with instructions of DA PAM 738-750.
- d. Verify receipt of accessory equipment and inspect its condition.
- e. Check to see whether equipment has been modified.
- f. Tighten vacuum pump V-belt in accordance with paragraph 5-20.
- g. Fill vacuum pump with oil per paragraph 4-36.
- h. Perform Operator's PMCS in Table 2-1.

#### 4-5.INSTALLATION

Position Service Unit in an area that will allow the enclosure door to swing 180 degrees and provide connections to power source.

#### Section III ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

#### 4-6. GENERAL

To keep the service unit in its best operating condition and ready for use, perform Preventive Maintenance Checks and Services (PMCS) as listed in Table 4-1.

- a. Monthly and guarterly PMCS are important checks to keep serious problems from happening suddenly.
- b. Stowing items not in use and covering unused receptacles are not listed as PMCS checks. These are things that should be done anytime they become necessary.
- c. When troubleshooting, use proper equipment. Report any deficiencies using proper forms. See DA PAM 738-750.
- d. A brief description of the column entries used in PMCS is as follows:
  - (1) "Item Number" Column. Checks and services are numbered in chronological order regardless of interval. This column shall be used as a source of item numbers for the "TM Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.
  - (2) "Item to be Inspected" Column. The items listed in this column are divided into groups indicating the portion of the equipment of which they are a part (for example, "Instrument Panel", "Vacuum System"). Under these groupings, the items to be inspected are identified by as few words (usually the common name) that will clearly identify the item (for example "tank pressure gage", "vacuum pump", etc.).
  - (3) "Procedures" Column. This column contains a brief description of the procedure by which the check is to be performed. It contains all the information required to accomplish the checks and services, including appropriate tolerances, adjustment limits, and instrument and gage readings.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item Interval Items to be

No. M Q Inspected Procedure

#### Accessory Equipment

Perform Operator's PMCS, Table 2-1. 1 Vacuum Hoses (2 ea) 2 Service Hoses (5 ea) Leak test vacuum hoses in accord-

3 Extension Cord ance with paragraph 4-10.

4 Hand Pump Leak test service hoses in accord-

5 Centrifuge Tube ance with paragraph 4-11.

Vacuum Pump Oil (3 qt) 6 Test hand pump in accordance with 7

Gaskets, 1/4-inch (10 ea) paragraph 4-12. 8 Gaskets, 3/8-inch (10 ea) As required: Gaskets, 1/2-inch (10 ea) Clean items.

Replace missing items.

Remove and replace damaged items.

Remove and replace worn or damaged gaskets

in hose assemblies in accordance with

paragraph 4-13.

Remove and replace leaking hose

assemblies.

Instrument Panel

9

10 • Refrigerant Metering

Scale As required:

Secure metering scale to

instrument panel.

Remove and replace metering scale

in accordance with paragraph

4-15.

11 • Refrigerant Metering

> Tube As required:

Perform Operator's PMCS, Table 2-1.

Perform Operator's PMCS, Table 2-1.

Secure refrigerant tube to

instrument panel.

Remove and replace tube in accordance with paragraph 4-16.

12 • Oil Metering Tube Perform Operator's PMCS, Table 2-1.

As required:

Secure oil metering tube to instrument panel. Remove and replace in accordance with

paragraph 4-17.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item No. M	Interval Items to be Q Inspected	Procedure	
13 • 14 •	Oil Vent SOV and Co Oil Fill SOV and Co As required:		Perform Operator's PMCS, Table 2-1. Test for positive valve action.  Secure valve to mounting bracket.
15 •	Refrigerant Tank	Perform Operator's PMCS, Table 2 Pressure, High Pressure, and Low Pressure Gage	As required: Secure gage to instrument panel.
16 •	Vacuum Gage As required:	Perform Operator's PMCS, Table 2	Secure gage to instrument panel. Remove and replace gage
17 •	High Pressure and		in accordance with paragraph 4-20.  Perform Operator's PMCS, Table 2-1.
10	Pressure Port and 0	·	As required: Secure port to instrument panel. Clean port and cap. Remove and replace port in accordance with paragraph 4-21.
18 • 19 •	Vacuum Pump Swi Heater Switch As required:	tcn Test for positive switch action.	Perform Operator's PMCS, Table 2-1.  Secure switch to instrument panel. Remove and replace switch in accordance with paragraph 4-22.
20 •	Electrical Outlet Bo	x	Perform Operator's PMCS, Table 2-1. Test for power at power receptacle in accordance with paragraph 4-23 As required: Secure electrical outlet box to instrument panel.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item Interval Items to be

No. M Q Inspected Procedure

21 • Fuse Holder Perform Operator's PMCS, Table 2-1.

As required:

Remove and replace fuse.

Secure fuse holder to instrument

panel.

Remove and replace fuse holder in accordance with paragraph 4-24.

22 • Instrument Panel Perform Operator's PMCS, Table 2-1.

As required:

Secure instrument panel to Service

Unit liner.

Touch up stenciled labels.

Refrigerant Charging

<u>System</u>

23 • Primary Pressure Switch Perform Operator's PMCS, Table 2-1.

24 • Secondary Pressure As required:

Switch Clean pressure switch(es).

Secure pressure switch to Service Unit liner.

Secure capillary tubing. Secure switch wiring.

Remove and replace pressure switch in

accordance with paragraph 4-26.

25 • Relief Valve Perform Operator's PMCS, Table 2-1.

As required:

Clean relief valve port.

Clean valve port and cap.

Remove and replace valve in accordance with

paragraph 4-27.

26 • Refrigerant Vent SOV Perform Operator's PMCS, Table 2-1.

and Cap As required:

Refrigerant Fill SOV and

Cap Repair valve in accordance with

28 • Refrigerant Charge SOV paragraph 4-28.

and Cap

27 •

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item Interval Items to be

No. M Q Inspected Procedure

29 • Refrigerant Fill Check

30 •

Perform Operator's PMCS, Table 2-1.

Valve As required:

Refrigerant Charge Check

Valve paragraph 4-29.

Remove and replace valve in accordance with Paragraph 4-30.

31 • Filter/Dryer Perform

Perform Operator's PMCS, Table 2-1.

cover glass.

Vacuum dry element in accordance with

Clean filter/dryer moisture indicator

Repair check valve in accordance with

paragraph 4-31.

Remove and replace filter/dryer element in accordance with paragraph 4-32.

32 • Heater Inspect exposed portion of heater for cleanliness

and damage. With refrigerant in tank, turn heater switch ON and check for pressure increase on the refrigerant tank gage. Turn heater switch OFF.

As required:

Clean exposed portion of heater.

33 • Refrigerant Tank Inspect refrigerant tank for cleanliness, damage, or

corrosion. See that tank is securely mounted to Service Unit liner. See that insulation is securely

attached to tank and not damaged.

As required:

Clean refrigerant tank.

Secure tank to Service Unit liner.

Secure insulation to tank

Vacuum System

34 • Vacuum Pressure Perform Operator's PMCS, Table 2-1.

Transducer As required:

Tighten transducer mounting. Remove and replace transducer in accordance with paragraph 4-34.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item No. M	Interval Items to be Q Inspected	Procedure	
35 • 36 •	Vacuum 1 SOV Vacuum 2 SOV As required:	Perform Operator's PMCS, Table 2-1. Test for positive valve action.  Clean valve. Secure valve to bracket. Repair valve in accordance with paragraph 4-35.	
37 •	Vacuum Pump	Perform Operator's PMCS, Table 2-1. Inspect  vacuum pump for cleanliness and damage. See that vacuum pump is securely mounted to Service Unit liner. Inspect oil mist eliminator for an accumulation of oil inside or an obstruction of the port. Inspect ballast valve and drain valves for damage. Test vacuum pump in accordance with paragraph 4-37.  As required:  Clean vacuum pump.  Secure vacuum pump to Service Unit liner.  Clean (empty) oil mist eliminator.  Drain vacuum pump oil in accordance with paragraph 4-36.  Fill vacuum pump oil in accordance with paragraph 4-36.	
	□la atria a l		

# Electrical

38 • Input Power Cord Perform Operator's PMCS, Table 2-1.

With power cord connected to a power source, operate vacuum pump briefly to test power cord. As required:

Repair power plug.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item No. M	Interval Items to be Q Inspected	Procedure	
39 •	Wiring Harness	Se an cle co	r deteriorated ring. See that Wiring Harness is secured in ervice Unit and that all cable clamps are present id secure. Inspect wire connections for eanliness, security of terminal lugs, and wire nnections. required: Tighten cable clamps. Replace cable clamps. Clean wire connections. Tighten wire connections. Replace wire terminal lugs.
	Cabinet Assembly		
40 •	Information Plate As required:	Perform Operator's PMCS, Table 2-1.	Secure plate to Service Unit door. Clean information plate. Tighten or replace loose or missing hardware. Remove and replace information plate in accordance with paragraph 4-39.
41 •	Handles As required:	Perform Operator's PMCS, Table 2-1.	Tighten or replace loose or missing hardware. Lubricate in accordance with local corrosion control procedures. Remove and replace handles in accordance with paragraph 4-40.
42 •	Cabinet Exterior As required:	Perform Operator's PMCS, Table 2-1.	Clean cabinet. Touch-up paint. Remove and replace liner in accordance with paragraph 4-45.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item No. M	Interval Items to be Q Inspected	Procedure	
43 •	Door Fasteners As required:	Perform Operator's PMCS, Table 2-1.	Tighten or replace loose or missing hardware. Lubricate in accordance with local corrosion control procedures. Remove and replace door fasteners in accordance with paragraph 4-41.
44 •	Door Hinge As required:	Perform Operator's PMCS, Table 2-1.	Lubricate in accordance with local corrosion control procedures. Remove and replace door assembly in accordance with paragraph 4-42. Remove and replace cabinet assembly in accordance with paragraph 4-42. Remove and replace door and cabinet assembly.
45 •	Door Gasket	Perform Operator's PMCS, Table 2-1. As	s required: Secure gasket to cabinet. Remove and replace gasket in accordance with paragraph 4-43.
46 •	Shock Mounts As required:	Perform Operator's PMCS, Table 2-1.	Secure shock mounts. Remove and replace shock mounts in accordance with paragraph 4-44.
47 •	Inner Liner As required:	Perform Operator's PMCS, Table 2-1.	Clean liner. Secure liner.
48 •	Pressure Equalizing As required:	g Valve Pe	erform Operator's PMCS, Table 2-1.  Clean valve. Secure valve to cabinet. Remove and replace valve in accordance with paragraph 4-46.

#### Table 4-1. Organizational Preventive Maintenance Checks and Services

#### M - Monthly Q- Quarterly

Item Interval Items to be

No. M Q Inspected Procedure

Tubing Assemblies

49 • Refrigerant System Inspect tubing assemblies for the following items:

Tubing Security of mounting.

Security of soldered joints.

Security of flared fittings and nuts.

Leaks and damage.

Legibility of orange color coding.

As required:

Secure tubing.

Secure flared fittings and nuts.

Re-paint orange code color on tubing

assembly.

Remove and replace tubing assembly in

accordance with paragraph 4-48. Inspect tubing assemblies for the following items:

50 • Oil Metering System

Tubing Security of mounting.

Security of soldered joints.

Security of flared fittings and nuts.

Leaks and damage.

Legibility of yellow color coding.

As required:

Secure tubing.

Secure flared fittings and nuts. Re-paint yellow code color on tubing

assembly.

51 • Vacuum System Tubing Inspect tubing assemblies for the following items:

Security of mounting. Security of soldered joints.

Security of flared fittings and nuts.

Leaks and damage.

Legibility of green color coding.

As required:

Secure tubing.

Secure flared fittings and nuts.
Re-paint green code color on tubing

assembly.

Remove and replace tubing assembly in

accordance with paragraph 4-49

#### Table 4-1. Organizational Preventive Maintenance Checks and Services

#### M - Monthly Q- Quarterly

Item Interval Items to be

No. M Q Inspected Procedure

As required:

52 • High Pressure Gage

Tubing Security of mounting.

Security of soldered joints.

Security of flared fittings and nuts.

Inspect tubing assemblies for the following items:

Leaks and damage.

Legibility of red color coding.

Secure tubing.

Secure flared fittings and nuts.
Re-paint red code color on tubing

assembly.

Remove and replace tubing assembly in accordance with paragraph 4-50.

53 • Low Pressure Gage

Tubing Security of mounting.

Inspect tubing assemblies for the following items:

Security of soldered joints.

Security of flared fittings and nuts.

Leaks and damage.

Legibility of blue color coding.

Secure tubing.

Secure flared fittings and nuts. Re-paint blue code color on Tubing

assembly.

Remove and replace tubing assembly in accordance with paragraph 4-50.

As required:

#### Section IV ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING

#### 4-7.GENERAL

Table 4-2 lists troubleshooting procedures for organizational maintenance personnel.

Table 4-2. Organizational Maintenance Troubleshooting

#### **MALFUNCTION**

TEST OR INSPECTION

CORRECTIVE ACTION

- 1. VACUUM PUMP DOES NOT OPERATE, VACUUM PUMP MOTOR RUNS
  - Step 1. V-Belt tension incorrect.

Notify supervisor

Step 2. V-Belt broken Notify supervisor

- 2. VACUUM PUMP WILL NOT OPERATE
  - Step 1. Check for defective vacuum pump switch (VAC PMP) Remove and replace switch.
  - Step 2. Vacuum pump or drive motor defective Notify supervisor
- 3. VACUUM PRESSURE INSUFFICIENT, VACUUM PUMP OPERATES
  - Step 1. Vacuum shutoff valve(s) (VAC-I SOV, VAC-2 SOV) leaking Repair valve(s)
  - Step 2. Check for defective vacuum pressure transducer Remove and replace transducer
  - Step 3. Vacuum pump defective

Notify supervisor

- Step 4. Tube leaking
  - 1. Check security of all flared fittings and nuts on tubing assembly.
  - 2. Notify supervisor
- 4. REFRIGERANT TANK HEATER WILL NOT OPERATE
  - Step 1. Check for defective heater (HTR) switch Remove and replace switch if defective
  - Step 2. Heater defective Notify supervisor

# Table 4-2 Organizational Maintenance Troubleshooting (continued)

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

#### 5. REFRIGERANT WILL NOT HOLD PRESSURE

Step 1. Defective relief valve Remove and replace

Step 2. Tank leaking Notify supervisor Step 3. Tubing leaking

Remove and replace Tubing Assembly
Step 4. RFGT (Refrigerant) Vent or Charge shutoff valve leaking Repair shutoff valve(s)

#### Section V ORGANIZATIONAL MAINTENANCE PROCEDURES

#### 4-8.GENERAL

This section contains the Organizational Maintenance Procedures authorized for the Service Unit.

#### 4-9. ACCESSORY EQUIPMENT

Table 4-3. Accessory Equipment Maintenance Procedures Index

PROCEDURE	PARAGRAPH		
	Vacuum Hose Testing	4-10	
	Service Hose Testing	4-11	
	Hand Pump Testing	4-12	
	Hose Gasket Replacement	4-13	

#### 4-10. VACUUM PUMP OIL LEVEL INSPECTION

This task covers: Inspection

**INITIAL SETUP** 

Equipment Condition

Tools Paragraph

None None

Condition Description

Personnel Required

1

- a. Remove caps from VAC (Vacuum) ports. Connect Vacuum Hoses to VAC ports. Connect ends of Vacuum Hoses together with a 3/8" flared union.
- b. See that TK HTR (Tank Heater) and VAC PUMP (Vacuum Pump) switches are OFF.
- c. Connect power cable to power source.
- d. Open VAC-1 and VAC-2 SOVs.
- e. Set Vac Pump switch to ON.
- f. Allow pump to run for 15 minutes.

- g. System shall read 100 microns or less.
- h. Remove Vacuum Hose from Vac Port and allow vacuum system to equalize.
- Set Vac Pump switch to OFF.
- Close VAC-1 and VAC-2 SOVs.
- k. Disconnect hoses and stow.
- I. Reinstall caps on VAC ports.

#### 4-11. SERVICE HOSE TESTING

This task covers: Inspection

**INITIAL SETUP** 

Equipment Condition

Tools Paragraph

Tool Kit, Refrigeration

Unit Service (Item 1, Appendix B)

**Condition Description** 

None

Materials/Parts

Gas, Nitrogen/Refrigerant (Item 7, Appendix D)

Personnel Required

1

- a. Remove power cord from power source.
- Remove caps from RFGT VENT, RFGT FILL and RFGT CHARGE SOV ports.
- c. Drain and vent refrigerant system in accordance with paragraph 2-6.
- d. Connect -5 Service Hose to RFGT FILL SOV port. Connect -4 Service Hose to RFGT CHARGE SOV port.
- e. Connect -6 Service Hose between -5 and -4 Service Hoses using two 1/4 inch flared unions.
- f. Connect -3 Service Hose to RFGT SOV port.
- g. Connect free end of -3 Service Hose to a 100 psig source of dry nitrogen containing refrigerant gas detectable with a halogen-sensitive electronic leak detector.
- h. Pressurize system to 100 psig.
- i. Calibrate leak detector for the type and percentage of mixture employed.
- j. Check all hoses for distortion, deformation or a leakage rate of more than 0.1 ounce per year.
- k. Turn off pressure source and carefully loosen one SOV port connection to release system pressure.

- I. Disconnect all Service Hoses and stow.
- m. Reinstall caps on all RFGT SOV ports.

This task covers:	Inspection	
INITIAL SETUP Equipment Condition Tools Paragraph None None		Condition Description
Personnel Required		

Perform "Evacuate Compressor Lube Oil Tube" or "Fill Compressor Lube Oil Tube" procedures, paragraph 2-7.

4-13. HOSE GASKET REPLACEMENT	
This task covers: Inspection	
INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)  Materials/Parts	Condition Description  None
Hose Gaskets (Items 3, 4, 5, Appendix D)	
<u>Personnel Required</u> 1	

NOTE

This procedure applicable to both Vacuum and Service Hoses

a. Remove worn or damaged gasket from hose connector.

- b. Inspect hose connector for damaged threads or pieces of gasket material caught in threads.
- c. Clean connector threads as required.
- d. Using correct size gasket, install new gasket in hose connector.

# 4-14. INSTRUMENT PANEL

Table 4-4. Instrument Panel Maintenance Procedures Index

PROCEDURE	PARAGRAPH	
Refrigerant Metering Scale Replacement	4-15	
Refrigerant Metering Tube Replacement	4-16	
Oil Metering Tube Replacement	4-17	
Oil Vent and Oil Fill SOV Repair	4-18	
Refrigerant Tank Pressure, High Pressure, and Low Pressure Gage Replacement	4-19	
Vacuum Gage Replacement	4-20	
High Pressure Port and Low Pressure Port Replacement	4-21	
Vacuum Pump Switch and Heater Switch Replacement	4-22	
Electrical Outlet Testing and Replacement	4-23	
Fuse/Fuse Holder Replacement	4-24	

# 4-15. REFRIGERANT METERING SCALE REPLACEMENT This task covers: Inspection INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required 1

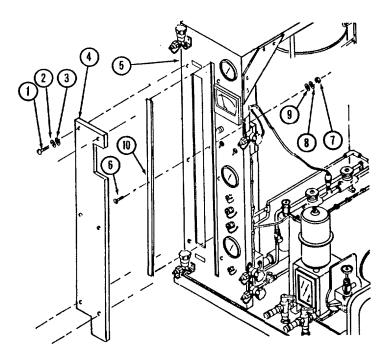


Figure 4-1. Refrigerant Metering Scale

#### a. Removal.

- 1. Remove six screws (1), six lockwashers (2), and six flat washers (3) securing safety shield (4) to instrument panel (5).
- 2. Remove safety shield from instrument panel.
- 3. Remove three screws (6), three nuts (7), three lockwashers (8), and three flat washers (9).
- 4. Remove refrigerant metering scale (10) from front of instrument panel.

# b. Installation.

- 1. Install refrigerant metering scale (10) on front of instrument panel (5).
- 2. Secure refrigerant metering scale with three screws (6), three flat washers (9), three lockwashers (8), and three nuts (7).
- 3. Install safety shield (4) on instrument panel.
- 4. Secure safety shield with four screws (1), four lockwashers (2), and four flat washers (3).

4-16. REFRIGERANT METERING TUBE REPLACEMENT			
This task covers:	nspection		
INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Append	<u>Condition Descript</u> 2-6 lix B)	tion Refrigerant system drained and vented.	
Personnel Required  1  4-15 Refrigerant scale removed.	4-45	Inner Liner removed.	

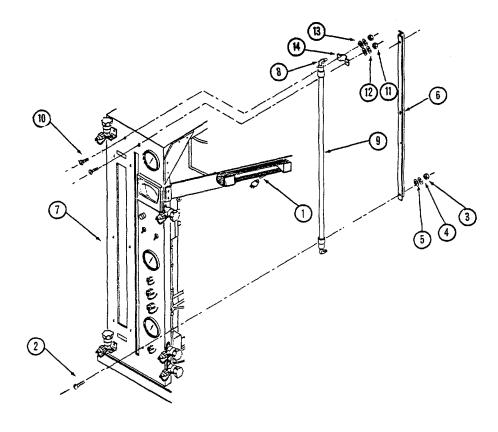


Figure 4-2. Refrigerant Metering Tube

# a. Removal.

1. Disconnect power cord (1) from power source.

- 2. Drain and vent refrigerant system in accordance with paragraph 2-6.
- 3. Remove inner liner in accordance with Inner Liner Removal Procedure, paragraph 4-45.
- 4. Remove refrigerant metering scale in accordance with paragraph 4-15.
- 5. Remove two screws (2), two nuts (3), two lockwashers (4), and two flat washers (5), securing shield (6), to rear of instrument panel (7).
- 6. Disconnect tubing flare nuts from elbow fittings (8) at top and bottom of refrigerant metering tube (9).
- 7. Remove two screws (10), two nuts (11), two lockwashers (12), and two flat washers (13), from top and bottom brackets (14), securing refrigerant metering tube to instrument panel.
- 8. Remove refrigerant metering tube.
- 9. Remove elbow fittings (8) from refrigerant metering tube.

- 1. Install elbow fittings (8) in refrigerant metering tube (9) with elbow ports facing the same direction.
- 2. Position refrigerant metering tube in rear of instrument panel (7) with top and bottom elbow fittings pointing away from panel.
- 3. Install brackets (14) at top and bottom of refrigerant metering tube. Secure brackets and metering tube with two screws (10), two flat washers (13), two lockwashers (12), and two nuts (11) each.

### NOTE

Mounting screw used in the upper right position (next to the RFGT TK PRESS gage) uses a round head screw instead of a truss head screw for gage clearance.

- Connect tubing flare nuts to top and bottom elbow fittings (8) on refrigerant metering tube and secure.
- 5. Install shield (6) and secure to rear of instrument panel with two screws (2), two flat washers (5), two lockwashers (4) and two nuts (3).
- 6. Install refrigerant metering scale and safety shield in accordance with paragraph 4-15.
- 7. Install inner liner in accordance with Inner Liner Installation procedures, paragraph 4-45.
- 8. Connect power cord to power source or stow.

### This task covers: Inspection INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required Tools METERING TUBE REPLACEMENT Condition Condition Description 4-45 Inner Liner removed.

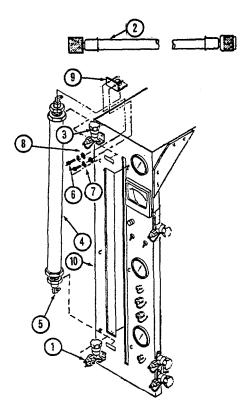


Figure 4-3. Oil Metering Tube

### a. Removal.

1

- 1. Disconnect power cord from power source.
- 2. Remove cap from Oil Fill SOV port (1) and connect -6 Service Hose (2). Place free end of Service Hose in a suitable container for drainage.

- 3. Open Oil Fill SOV. Remove cap and open Oil Vent SOV (3) to drain oil metering tube (4). When drained, remove Service Hose, drain and stow.
- 4. Remove inner liner assembly in accordance with paragraph 4-45.
- 5. Disconnect tubing flare nuts from elbow fittings (5) on top and bottom of metering tube.
- 6. Remove two screws (6), two lock washers (7), and two flat washers (8) from bracket (9), securing top of oil metering tube.
- 7. Remove oil metering tube and bracket from rear of instrument panel (10). Remove bracket from oil tube.
- 8. Remove elbows and reducers (11) from oil tube.

1. Install reducers (11) and elbows (5) in top and bottom ports of oil metering tube (4).

### NOTE

Elbows must be placed in proper position to connect with valve tubing. Place elbows with ports facing away from the tube metering marks.

- 2. Place bracket (9) over top of oil metering tube. Place bottom of oil metering tube into bottom mounting bracket. Turn tube so that metering marks will show through instrument panel (10).
- 3. Secure top bracket to instrument panel using two screws (6), two lockwashers (7), and two flat washers (8).
- 4. Connect valve tubing flare nuts to top and bottom elbows and secure.
- 5. Install inner liner assembly in accordance with paragraph 4-45.

## 4-18. OIL VENT AND OIL FILL SOV REPAIR This task covers: Inspection INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required 1

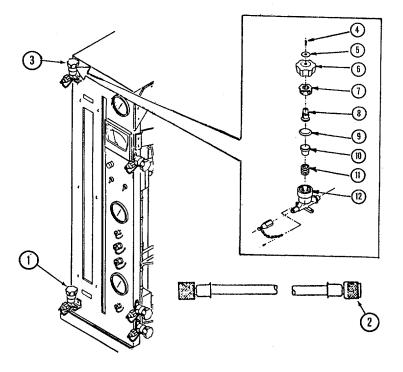


Figure 4-4. Oil Vent/Fill SOV Repair

NOTE

The instructions given here are applicable to both Oil Vent SOV and Oil Fill SOV although Figure 4-4 shows only the Oil Vent SOV breakdown.

### a. Disassembly.

1. Remove cap from Oil Fill SOV port (1) and connect -6 Service Hose (2). Place free end of Service Hose in a suitable container for drainage.

- 2. Remove cap from Oil Vent SOV (3). Open Oil Vent SOV and Oil Fill SOV to drain Oil Metering Tube.
- 3. Remove Service Hose from SOV port. Drain hose and store. Reinstall caps on SOV's.
- 4. Remove screw (4), plate (5), and hand wheel (6).
- 5. Remove bonnet (7) and upper stem (8) assembly.
- 6. Remove diaphragm (9), lower stem (10), and spring (11) from valve body (12).
- 7. Clean or replace parts as required.

### b. Assembly.

- 1. Install spring (11), lower stem (10), and diaphragm (9) into valve body (12).
- 2. Install assembled upper stem (8) and bonnet (7). Secure bonnet in valve body.
- 3. Install hand wheel (6), plate (5), and secure with screw (4).

### 4-19. TANK PRESSURE, HIGH PRESSURE, AND LOW PRESSURE GAGE REPLACEMENT

This task covers:

a. Removal b. Installation

### **INITIAL SETUP**

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Personnel Required

Condition Description
None

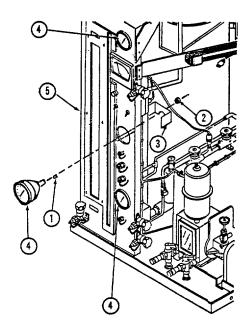


Figure 4-5. Pressure Gages

### **NOTE**

The instructions given here are applicable to High Pressure, Low Pressure and Tank Pressure Gages although Figure 4-5 shows only the High Pressure Gage removed.

### a. Removal.

- 1. Vent any pressure in the system by removing the cap and opening the appropriate valve(s).
- 2. Disconnect tubing flare nut from reducer fitting (1).
- 3. Remove two locking nuts (2) securing the bracket (3) and gage (4) to instrument panel (5).

- 4. Remove gage with reducer fitting from front of instrument panel.
- 5. Remove reducer fitting from gage.

- 1. Install reducer fitting (1) onto gage (4).
- 2. Install gage into front of instrument panel (5) and secure with bracket (3), and two locking nuts (2).
- 3. Connect tubing flare nut to reducer fitting and secure.

### 4-20. **VACUUM PRESSURE GAGE REPLACEMENT** This task covers: a. Removal Installation b. **INITIAL SETUP** Equipment Condition **Tools** Paragraph **Condition Description** Tool Kit, Refrigeration None Unit Service (Item 1, Appendix B) Personnel Required

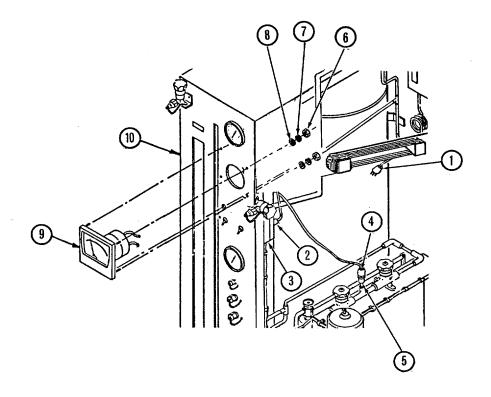


Figure 4-6. Vacuum Gage

### a. Removal.

1. Remove power cord (1) from power source.

1

- 2. Remove vacuum gage power cord (2) at electrical outlet (3).
- 3. Remove connector (4) from vacuum pressure transducer (5).

- 4. Remove four nuts (6), four lockwashers (7) and four flat washers (8) from vacuum gage (9).
- 5. Remove vacuum gage from front of instrument panel (10).

- 1. Install vacuum gage (9) through front of instrument panel (10) and secure with four flat washers (8), four lockwashers (7), and four nuts (6).
- 2. Attach connector (4) to vacuum pressure transducer (5).
- 3. Connect vacuum gage power cord (2) to electrical outlet (3).
- 4. Connect power cord (1) to power source or stow.

### 4-21. HIGH PRESSURE, LOW PRESSURE, AND VACUUM PORT REPLACEMENT

This task covers:

a. Removal

b. Installation

### **INITIAL SETUP**

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Linit Service (Item 1, Appendix

Unit Service (Item 1, Appendix B)

Condition Description
None

Personnel Required

1

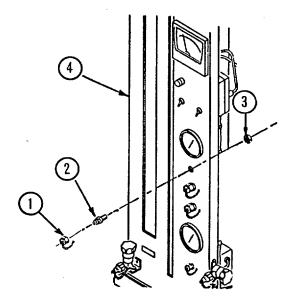


Figure 4-7. Pressure Ports

### **NOTE**

The instructions given here are applicable to all ports listed although Figure 4-7 shows only the High Pressure Port removed.

### a. Removal.

- 1. Remove cap (1) from port (bulkhead fitting) (2).
- 2. Disconnect tubing flare nut from rear of pressure port and remove bulkhead fitting nut (3).
- 3. Remove pressure port from front of instrument panel (4).

- 1. Install pressure port (2) on front of instrument panel (4) and secure with bulkhead fitting nut (3).
- 2. Connect tubing flare nut to rear of pressure port and secure.
- 3. Install cap (1) on pressure port.

### 4-22. VACUUM PUMP AND HEATER SWITCH REPLACEMENT

This task covers:

a. Removal b. Installation

**INITIAL SETUP** 

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Personnel Required
1

ragraph Condition Description
None

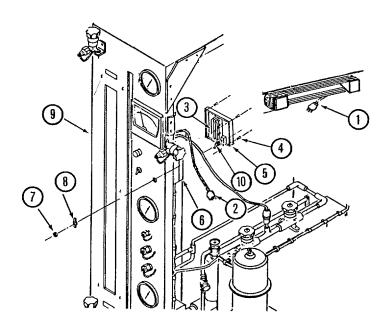


Figure 4-8. Power Switches

### **NOTE**

The instructions given here are applicable to both HTR and VAC PUMP switches although Figure 4-8 shows only the VAC PUMP switch removed.

### a. Removal.

- 1. Disconnect power cord (1) from power source.
- 2. Disconnect vacuum pressure gage power cord (2) from electrical outlet (3).

- 3. Remove two screws (4) from outlet box cover (5). Remove cover from electrical outlet box (6).
- 4. Remove nut (7) and information plate (8) from front of instrument panel (9). Remove switch (10) from rear of outlet box.
- 5. Disconnect electrical wiring from terminals of switch and remove switch.

- 1. Connect electrical wiring to terminals of switch (10).
- 2. Place switch into electrical outlet box (6) and secure to front of instrument panel (9) with information plate (8) and nut (7).
- 3. Secure electrical outlet box cover (5) to electrical outlet box with two screws (4).
- 4. Connect vacuum gage power cord (2) to electrical outlet (3).
- 5. Connect power cord (1) to power source or stow.

### 4-23. ELECTRICAL OUTLET TESTING AND REPLACEMENT

This task covers:

a. Testing b. Removal c. Installation

**INITIAL SETUP** 

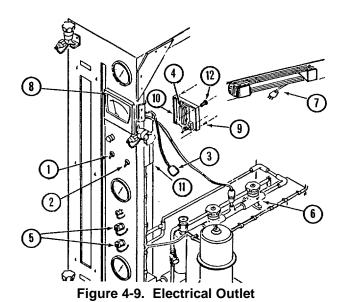
Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Condition Description
None

Personnel Required

1



### a. Testing.

- 1. See that the HTR (1) and VAC PUMP (2) switches are OFF.
- 2. Remove vacuum pressure gage power cord (3) from electrical outlet (4).
- 3. Remove cap from one VAC port (5) and open VAC-I SOV (6).
- 4. Connect Service Unit power cord (7) to power source.
- 5. See that vacuum pressure gage needle (8) reads below ATM mark on gage face.
- 6. Connect vacuum pressure gage power cord to electrical outlet.
- 7. See that vacuum pressure gage needle reads at ATM mark on gage face. If needle reads the

same as in step 5, electrical outlet is defective.

### b. Removal.

- 1. Disconnect power cord (7) from power source.
- 2. Disconnect vacuum pressure gage power cord (3) from electrical outlet (4).
- 3. Remove two screws (9) from outlet box cover (10). Remove cover from electrical outlet box (11).
- 4. Tag and disconnect electrical wires from terminals of electrical outlet.
- 5. Remove screw (12) securing electrical outlet to electrical outlet box cover. Remove electrical outlet.

- 1. Remove tags and connect electrical wires to terminals on electrical outlet (4).
- 2. Install electrical outlet to outlet box cover (10) with screw (12).
- 3. Install outlet box cover onto electrical outlet box (11) and secure with two screws (9).
- 4. Connect vacuum gage power cord (3) to electrical outlet.
- 5. Connect power cord (7) to power source or stow.

### 4-24. FUSE HOLDER REPLACEMENT

This task covers:

a. Removal b. Installation

### **INITIAL SETUP**

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Personnel Required

Condition Description
None

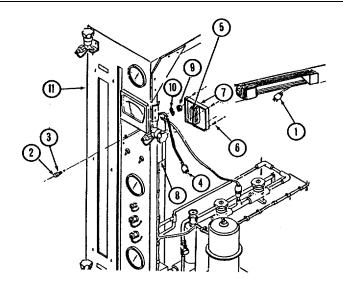


Figure 4-10. Fuse Holder

### a. Removal.

- 1. Disconnect power cord (1) from power source.
- 2. Remove fuseholder cap (2) by rotating cap counterclockwise (CCW), and remove fuse from holder (3).
- 3. Disconnect vacuum pressure gage power cord (4) from electrical outlet (5).
- 4. Remove two screws (6) from outlet box cover (7). Remove cover from electrical outlet box (8).

- 5. Tag and disconnect electrical wires from terminals on fuseholder.
- 6. Remove nut (9) and lockwasher (10) from rear of fuseholder. Remove fuse holder from front of instrument panel (11).

- 1. Install fuseholder (3) on instrument panel and secure with lockwasher (10) and nut (9).
- 2. Connect electrical wires to terminals on fuseholder.
- 3. Install outlet box cover (7) onto electrical outlet box (8). Secure outlet box cover to electrical outlet box with two screws (6).
- 4. Insert fuse into fuseholder.
- 5. Secure fuse in place by installing fuse cap (2) onto fuseholder. Push cap in and rotate cap clockwise (CW).
- 6. Connect vacuum pressure gage power cord (4) to electrical outlet (5).
- 7. Connect power cord (1) to power source or stow.

### 4-25. REFRIGERANT CHARGING SYSTEM

Table 4-4. Refrigerant Charging System Maintenance Procedures Index

PROCEDURE PARAGRAPH	
Primary and Secondary Pressure Switches Replacement	4-26
Relief Valve Removal and Replacement	4-27
Refrigerant Vent, Refrigerant Fill, and Refrigerant Charge SOV Replacement	4-28
Check Valve Repair	4-29
Check Valve Replacement	4-30
Filter/Dryer Element Vacuum Drying	4-31
Filter/Dryer Replacement	4-32

4-26. PRIMARY AND SECONDARY PRESSURE SWITCH REPLACEMENT				
This task covers:				
a. Removal b. Installation				
INITIAL SETUP				
Tools  Tool Kit, Refrigeration  Unit Service (Item 1, Appendix B)	Equipment Condition Paragraph 2-6	Condition Description Refrigerant Tank drained and vented.		
Personnel Required 1	4-45	Inner Liner removed.		

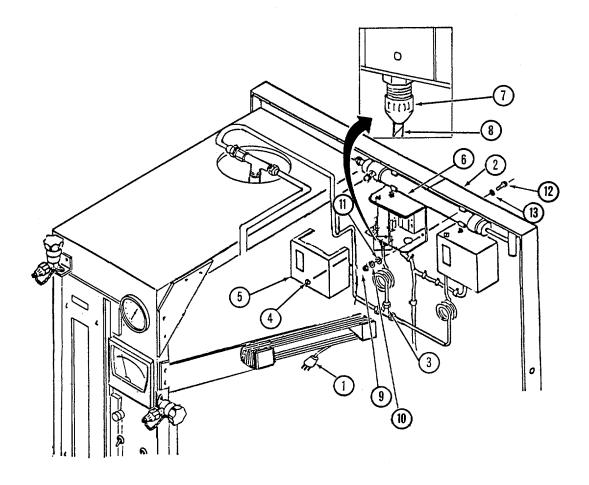


Figure 4-11. Pressure Switches

### **NOTE**

The instructions given here are applicable to both Primary and Secondary Pressure Switches although Figure 4-11 shows only the Primary Pressure Switch removed.

### a. Removal.

- 1. Disconnect power cord (1) from power source.
- Drain and vent Refrigerant System in accordance with paragraph 2-6.
- 3. Remove inner liner (2) in accordance with Inner Liner Removal Procedure, paragraph 4-45.
- 4. Disconnect flare nut (3) from tee.
- 5. Unscrew captive screw (4) and remove pressure switch cover (5).
- 6. Disconnect electrical wiring from LINE and MI terminals in pressure switch (6).
- 7. Loosen strain relief (7) to free wiring harness (8).
- 8. Remove two nuts (9), two lockwashers (10), and two flat washers (11) securing pressure switch to liner.
- 9. Remove two bolts (12) and two flat washers (13) from liner and remove pressure switch.

- 1. Aline pressure switch (6) with mounting holes on inner liner (2).
- 2. Install two flat washers (13) and two bolts (12) in mounting holes from rear of liner.
- 3. Secure pressure switch to liner using two flat washers (11), two lockwashers (10), and two nuts (9).
- 4. Route wiring (8) through strain relief.
- 5. Connect electrical wiring to LINE and MI terminals of pressure switch.
- 6. Install pressure switch cover (5), then tighten captive screw (3).
- 7. Connect flare nut (3) and tighten.
- 8. Install inner liner in accordance with Inner Liner Installation Procedure, paragraph 4-45.
- 9. Connect power cord (1) to power source.

Condition Description

drained and vented.

Refrigerant Tank

### 4-27. PRESSURE RELIEF VALVE REPLACEMENT

This task covers:

a. Removal b. Installation

### **INITIAL SETUP**

Equipment Condition
Tools Paragraph
Tool Kit, Refrigeration 2-6
Unit Service (Item 1, Appendix B)

Materials/Parts
Tape, Teflon
(Item 9, Appendix D)

Personnel Required

1

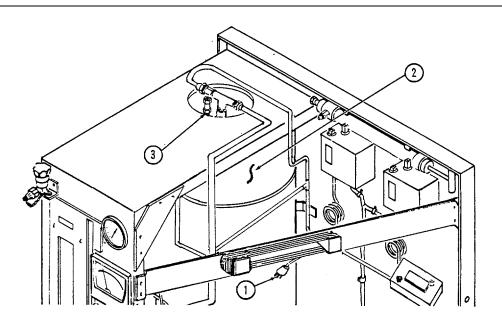


Figure 4-12. Relief Valve

### a. Removal.

- 1. Disconnect power cord (1) from power source.
- 2. Drain and vent refrigerant tank (2) in accordance with paragraph 2-6.
- 3. Unscrew and remove relief valve (3) from tank.

- 1. Clean threads of relief valve (3).
- 2. Apply two or three turns of Teflon tape to threads of relief valve.
- 3. Insert relief valve and thread into tank flange.
- 4. Tighten relief valve in tank.

### **NOTE**

Relief valve is pre-set at the factory. No field adjustment is required.

### 4-28. REFRIGERANT VENT, REFRIGERANT CHARGE, AND REFRIGERANT FILL SOV REPAIR

This task covers:

a. Disassembly b. Reassembly

### **INITIAL SETUP**

Equipment Condition Paragraph 2-6

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

<u>Condition Description</u>
Refrigerant system
drained and vented.

Personnel Required 1

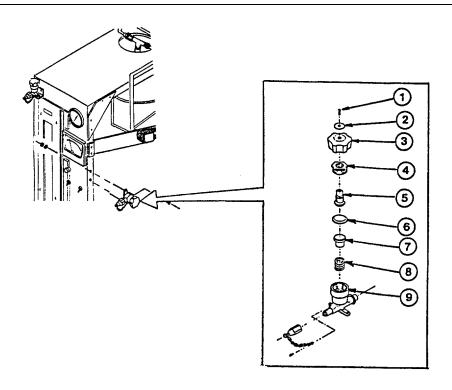


Figure 4-13. Refrigerant Valve Repair

### **NOTE**

The instructions given here are applicable to all SOVs listed although Figure 4-13 shows only the RFGT VENT SOV breakdown.

### a. Disassembly.

- 1. Drain and vent Refrigerant System in accordance with paragraph 2-6.
- 2. Remove screw (1), plate (2), and handwheel (3).
- 3. Remove bonnet (4) and upper stem (5) assembly.
- 4. Remove diaphragm (6), lower stem (7), and spring (8) from valve body (9).
- 5. Clean or replace parts as required.

### b. Reassembly.

- 1. Install spring (8), lower stem (7), and diaphragm (6) into valve body (9).
- 2. Install assembled upper stem (5) and bonnet (4). Secure bonnet in valve body.
- 3. Install handwheel (3), plate (2), and secure with screw (1).

### 4-29. CHECK VALVE REPAIR

This task covers:

a. Disassembly b.

Reassembly

### **INITIAL SETUP**

Tools
Tool Kit, Refrigeration
Unit Service
(Item 1, Appendix B)

Personnel Required

1

Equipment Condition Paragraph 2-6

Condition Description Refrigerant System drained and vented

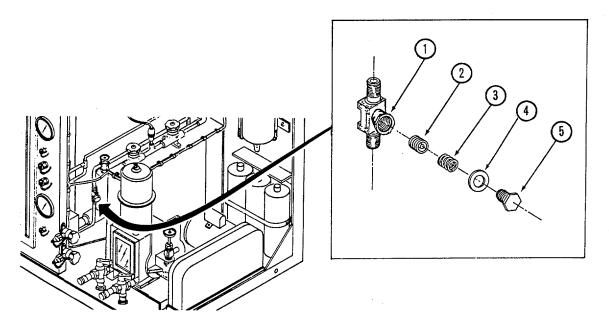


Figure 4-14. Check Valve Repair

### **NOTE**

The instructions given here are applicable to both check valves although Figure 4-14 shows only the RFGT CHARGE Check Valve breakdown.

### a. Disassembly.

- 1. Drain and vent Refrigerant System in accordance with Paragraph 2-6.
- 2. Remove cap (1).

- 3. Remove gasket (2), spring (3), and stem and seat (4) from valve body (5).
- 4. Clean or replace parts as required.

### b. Reassembly.

- 1. Install stem and seat (4) into valve body (5).
- 2. Install spring (3) and gasket (2) and secure with cap (1). Tighten cap.

### 4-30. CHECK VALVE REPLACEMENT

This task covers:

a. Removal b.

**INITIAL SETUP** 

Equipment Condition Paragraph 2-6

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Installation

Personnel Required

1

Condition Description
Refrigerant System
drained and vented.

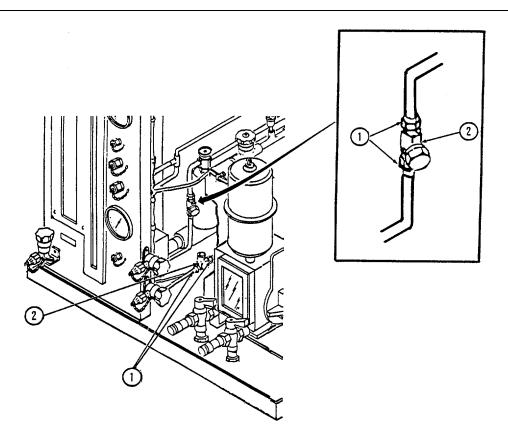


Figure 4-15. Check Valves

### **NOTE**

The instructions given here are applicable to both Check Valves although Figure 4-15 shows only the Refrigerant Fill Check Valve removal.

### a. Removal.

- 1. Drain and vent Refrigerant System in accordance with paragraph 2-6.
- 2. Disconnect power cord from power source.
- 3. Disconnect two flare nuts (1) from valve housing. Remove check valve (2).

### **CAUTION**

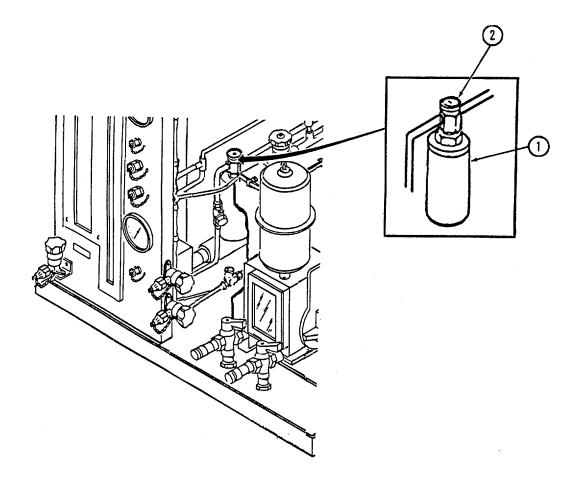
Note flow direction arrow on valve body during removal.

- 1. Install check valve (2) and connect flare nuts (1).
- 2. Verify that flow direction arrow is positioned as noted at removal. Tighten flare nuts.

4-31. FILTER/DRYER ELEMENT VACUUM DRY	ING TEST	
This task covers:  a. Testing		
INITIAL SETUP		
Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)	Equipment Condition <u>Paragraph</u>	Condition Description None
Personnel Required 1		

- 1. Follow steps 1-8, paragraph 2-6a, "Evacuate Refrigerant Tank".
- 2. When vacuum pressure gage reaches 500 microns, inspect Filter/Dryer moisture indicator. If indicator is BLUE proceed to step 3. If indicator is PINK continue to evacuate for 1 hour. If indicator is still PINK, remove and replace Filter/Dryer element in accordance with paragraph 4-32.
- 3. Follow steps 9-14, paragraph 2-6a.

### 4-32. FILTER/DRYER ELEMENT REPLACEMENT This task covers: a. Removal b. Installation **INITIAL SETUP** Equipment Condition Tools Tool Kit, Refrigeration <u>Paragraph</u> **Condition Description** 2-6 Refrigerant System Unit Service (Item 1, Appendix B) drained and vented.



Personnel Required
1

Figure 4-16. Filter/Dryer

### a. Removal.

- 1. Remove power cord from power source.
- 2. Drain and vent Refrigerant System in accordance with Paragraph 2-6.
- 3. Unscrew Filter/Dryer Element (1) from Filter/Dryer moisture indicator (2). Remove element.

### b. Installation.

- 1. Install Filter/Dryer Element (1) on Filter/Dryer moisture indicator (2).
- 2. Secure element.

### 4-33. VACUUM SYSTEM

### Table 4-5. Vacuum System Maintenance Procedures Index

4-34
4-35
4-36
4-37

**Condition Description** 

None

### 4-34. VACUUM PRESSURE TRANSDUCER REPLACEMENT

This task covers:

a. Removal

b. Installation

### **INITIAL SETUP**

Equipment Condition Paragraph

**Tools** 

Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Materials/Parts

Tape, Teflon (Item 9, Appendix D)
Paper, Waterproof (Item 19, Appendix D)
Tape, Waterproof (Item 20, Appendix D)

Personnel Required

1

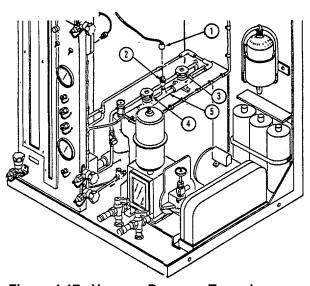


Figure 4-17. Vacuum Pressure Transducer

### a. Removal.

- 1. Remove vacuum gage connector (1) from Vacuum Pressure Transducer (2).
- 2. See that VAC-1 (3) and VAC-2 (4) SOVs are closed.
- 3. Unthread Vacuum Pressure Transducer from pipe fitting (5).
- 4. Cover pipe fitting hole with waterproof paper and tape.

- 1. Apply two or three turns of teflon tape to threads of vacuum pressure transducer (2).
- 2. Remove waterproof paper and tape, then thread vacuum pressure transducer into pipe fitting (5). Do not overtighten.
- 3. Attach vacuum gage connector (1) to vacuum pressure transducer (2).
- 4. Evacuate system in accordance with paragraph 2-6.

**Condition Description** 

None

### 4-35. **VACUUM 1 AND VACUUM 2 SOV REPAIR**

This task covers:

a. Removal Installation b.

**INITIAL SETUP** 

Equipment Condition <u>Paragraph</u>

<u>Tools</u> Tool Kit, Refrigeration

Unit Service (Item 1, Appendix B)

Personnel Required

1

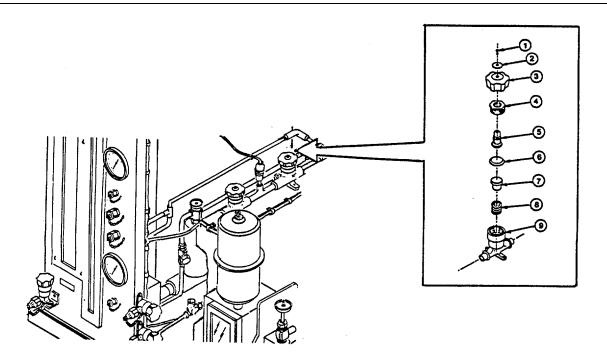


Figure 4-18. Vacuum SOV Repair

### NOTE

The instructions given here are applicable to both VAC-1 and VAC-2 SOVs although Figure 4-18 shows only the VAC-1 SOV breakdown.

### a. Disassembly.

- 1. Remove screw (1), plate (2), and handwheel (3).
- 2. Remove bonnet (4) and upper stem (5) assembly.
- 3. Remove diaphragm (6), lower stem (7), and spring (8) from valve body (9).
- 4. Clean or replace parts as required.

### b. Assembly.

- 1. Install spring (8), lower stem (7), and diaphragm (6) into valve body (9).
- 2. Install assembled upper stem (5) and bonnet (4). Secure bonnet in valve body.
- 3. Install handwheel (3), plate (2), and secure with screw (1).

**Condition Description** 

None

### 4-36. VACUUM PUMP OIL SERVICE

This task covers:

a. Drain

b. Fill

### **INITIAL SETUP**

Equipment Condition Paragraph

**Tools** 

Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Materials/Parts
Oil, Vacuum Pump

Personnel Required

(Item 6, Appendix D)

1

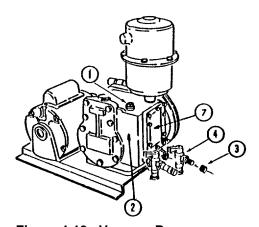


Figure 4-19. Vacuum Pump

### a. Drain.

- 1. Remove power cord from power source.
- 2. Remove fill plug (1) from vacuum pump housing (2).
- 3. Remove caps (3) from vacuum pump oil drain valves (4).

- 4. Connect 1/4 inch end of the -4 Service Hose (5) and the -6 Service Hose (6) to the drain valves.
- 5. Place free ends of hoses in a suitable container for drainage.
- 6. Open both drain valves and drain vacuum pump.

### b. Fill.

- 1. Close vacuum pump drain valves (4).
- 2. Disconnect Service Hoses (5,6) from valves. Drain hoses and store.
- 3. Install caps (3) on drain valves.
- 4. While watching oil level sight gage (7), add vacuum pump oil to fill port until fluid level reaches mark on sight gage.
- 5. Install fill plug (1).
- 6. Close either vacuum SOV and start vacuum pump. When turbulence in pump oil subsides, note oil level. Stop vacuum pump.
- 7. Remove fill plug, add 2 ounces of pump oil as required.
- 8. Repeat steps 5,6 and 7 as required.

# This task covers: a. Testing INITIAL SETUP Equipment Condition Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required 1 Condition Paragraph Personnel Required

- Connect power cord to power source.
- b. Close VAC-1 SOV. Open VAC-2 SOV.
- c. Set VAC switch to ON.
- d. Observe vacuum pressure gage. See that vacuum reaches a minimum of 30 microns.
- e. Remove cap from vacuum port. Open VAC-1 SOV to equalize vacuum.

- f. Set VAC switch to OFF. Reinstall cap on vacuum port. Close VAC-1 and VAC-2 SOVs.
- g. Remove power cord from power source.

### 4-38. CABINET ASSEMBLY

Table 4-6. Cabinet Assembly Maintenance Procedures Index

PROCEDURE PARAGRAPH	
Information Plate Replacement	4-39
Cabinet Handles Replacement	4-40
Door Fastener and Catch Replacement	4-41
Door Hinges Replacement	4-42
Door Gasket Replacement	4-43
Shock Mounts Replacement	4-44
Inner Liner Replacement	4-45
Pressure Equalizer Replacement	4-46

#### 4-39. INFORMATION PLATE REPLACEMENT

This task covers:

a. Removal b. Installation

#### **INITIAL SETUP**

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

aragraph Condition Description
None

Personnel Required

1

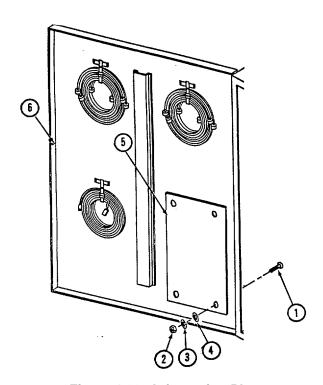


Figure 4-20. Information Plate

#### a. Removal.

- 1. Remove four screws (1), four nuts (2), four lockwashers (3), and four flat washers (4) securing information plate (5) to Service Unit door assembly (6).
- 2. Remove information plate.

#### b. Installation.

- 1. Install information plate (5) into Service Unit door assembly (6).
- 2. Secure information plate with four screws (1), four flat washers (4), four lockwashers (3), and four nuts (2).

## 4-40. CABINET HANDLE REPLACEMENT This task covers: a. Removal b. Installation INITIAL SETUP Equipment Condition Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) CABINET HANDLE REPLACEMENT Equipment Condition Paragraph None

Personnel Required
1

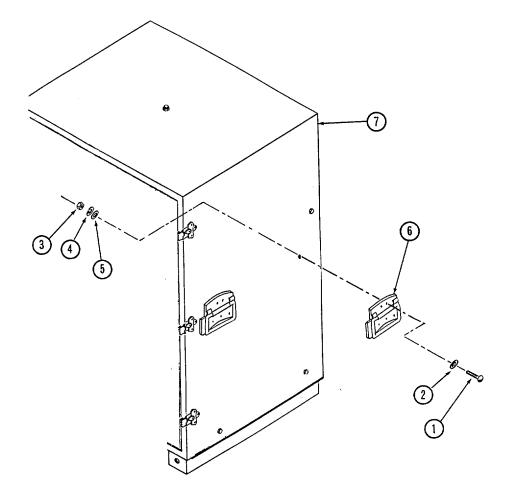


Figure 4-21. Cabinet Handles

- 1. Remove five screws (1), five flat washers (2), five nuts (3), five lockwashers (4), and five flat washers (5) securing handle (6) to side of cabinet (7).
- 2. Remove handle.

#### b. Installation.

- 1. Install handle (6) on side of cabinet (7).
- 2. Secure handle with five screws (1), five flat washers (2), five flat washers (5), five lockwashers (4), and five nuts (3).

# 4-41. DOOR FASTENER AND CATCH REPLACEMENT This task covers: a. Removal b. Installation INITIAL SETUP Equipment Condition Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required 1

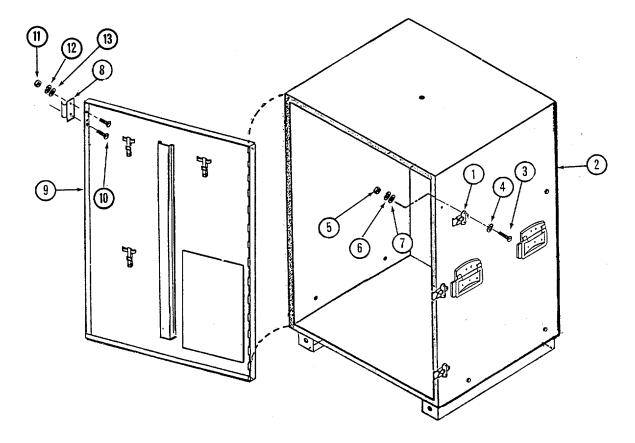


Figure 4-22. Door Fastener and Catch

- 1. Remove door fastener (I) from cabinet (2) by removing three screws (3), three flat washers (4), three nuts (5), three lockwashers (6), and three flat washers (7).
- 2. Remove door catch (8) from edge of door (9) by removing two screws (10), two nuts (11), two lockwashers (12), and two flat washers (13).

#### b. <u>Installation</u>.

- 1. Install door catch (8) to edge of door (9) and secure with two screws (10), two flat washers (13), two lockwashers (12), and two nuts (11).
- 2. Install door fastener (1) and secure to cabinet (2) with three screws (3), three flat washers (4), three flat washers (7), three lockwashers (6), and three nuts (5).

#### 4-42. DOOR HINGE REPLACEMENT

This task covers:

a. Removal b. Installation

#### **INITIAL SETUP**

Equipment Condition Paragraph

Tools
Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)
Drill, Electric, 3/8" Chuck
NSN 5130-00-853-4480

Personnel Required

1

Condition Description

None

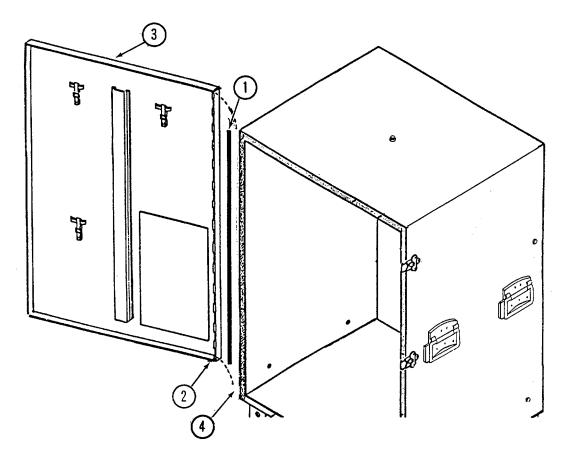


Figure 4-23. Door Hinge

- 1. Drive hinge pin (1) from bottom of hinge (2) until approximately 1-inch of pin is visible at top of hinge.
- 2. Attach electric drill to top of pin, and while turning slowly, pull up to remove pin.
- 3. Remove door (3) from cabinet (4).

#### b. Installation.

- 1. Position door (3) on cabinet (4).
- 2. Insert hinge pin (1), attached to electric drill, into hinge (2).
- 3. Rotate electric drill slowly while pushing hinge pin down into hinge.
- 4. Remove electric drill and drive remaining 1-inch of pin into hinge.

#### 4-43. DOOR GASKET REPLACEMENT

This task covers:

a. Removal b. Installation

#### **INITIAL SETUP**

<u>Tools</u>

Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Materials/Parts Solvent, Dry Cleaning (Item 8, Appendix D)

Personnel Required

1

Equipment Condition Paragraph

General Safety Instructions
Perform solvent cleaning in a
well-ventilated area.

Condition Description None

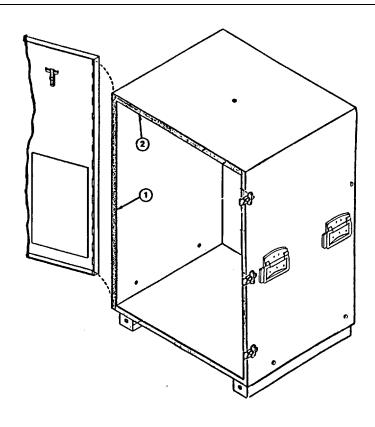


Figure 4-24. Door Gasket

- 1. Peel off old gasket (1) from around cabinet lip (2).
- 2. Remove any remaining adhesive or any gasket material on cabinet lip.

#### b. Installation.

#### **WARNING**

DRY CLEANING SOLVENT IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA, FREE FROM SPARKS, FLAME OR HOT SURFACES. WEAR SPLASH GOGGLES, SOLVENT RESISTANT GLOVES, AND OTHER PROTECTIVE GEAR. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

- 1. Clean cabinet lip (2) thoroughly with solvent. Surface must be clean and free from dirt or oil.
- 2. Remove protective tape from adhesive side of gasket material, (1).
- 3. Install gasket to cabinet lip.

None

#### 4-44. SHOCK MOUNT REPLACEMENT

This task covers:

a. Removal b. Installation

#### **INITIAL SETUP**

Equipment Condition

<u>Tools</u> **Paragraph Condition Description** 

Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)

Personnel Required

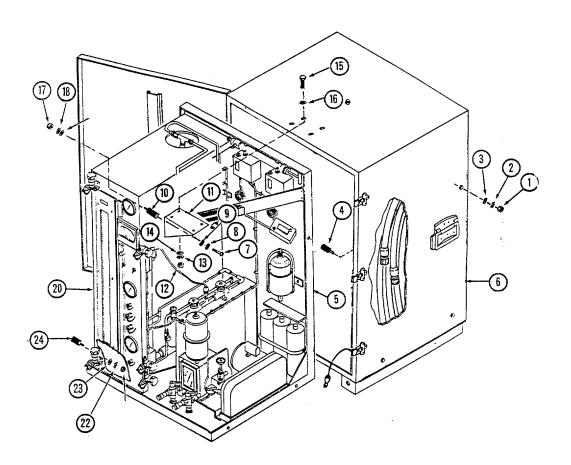


Figure 4-25. Shock Mounts

1. Cabinet and Liner Mounted Shock Mounts

#### **NOTE**

The following procedure is applicable to all shock mounts except instrument panel center shock mount and lower right front shock mount.

- (a) Perform Inner Liner Removal procedure, paragraph 4-45.
- (b) Remove nut (1), lockwasher (2), and flat washer (3), securing shock mount (4) to liner (5) or cabinet (6).
- (c) Remove shock mount from liner or cabinet.
  - 2. Instrument Panel Center Shock Mount.
- (a) Remove bolt (7), lockwasher (8), and flat washer (9), securing shock mount (10) to bracket (11).
- (b) Remove four nuts (12), four lockwashers (13), and four flat washers (14), securing bracket to cabinet.
- (c) Remove four bolts (15) and four flat washers (16) from bracket and cabinet.
- (d) Remove bracket from cabinet.
- (e) Remove nut (17), lockwasher (18), and flat washer (19), securing shock mount to Instrument Panel (20).
- (f) Remove shock mount from Instrument panel.
  - 3. Lower Right Front Shock Mount.

Perform Inner Liner Removal Procedure, paragraph 4-45, a., 1 through 11.

#### b. Installation.

1. Cabinet Mounted Shock Mounts.

#### NOTE

The following steps are applicable to the bottom right rear and upper right rear shock mounts only.

- (a) Install shock mount (4) stud in cabinet mounting hole.
- (b) Secure shock mount with flat washer (3), lockwasher (2) and nut (1). Tighten nut.
- (c) Perform Inner Liner Installation procedure, paragraph 4-45.

2. Liner Mounted Shock Mounts.

#### **NOTE**

The following steps are for all left side shock mounts.

- (a) Install shock mount (24) stud in liner mounting hole.
- (b) Secure shock mount with flat washer (23), lockwasher (22), and nut (21). Tighten nut.
- (c) Perform Inner Liner Installation procedure, paragraph 4-45.
  - 3. Instrument Panel Center Shock Mount.
- (a) Install shock mount (10) stud in Instrument Panel (20) mounting hole.
- (b) Secure shock mount with flat washer (19), lockwasher (18) and nut (17). Tighten nut.
- (c) Align bracket (11) with cabinet mounting holes (6) and install four flat washers (16) and four bolts (15).
- (d) Secure bracket to cabinet using four flat washers (14), four lockwashers (13) and four nuts (12). Tighten nuts.
- (e) Secure bracket to shock mount using flat washer (9), lockwasher (8), and bolt (7). Tighten bolt.
  - 4. Lower Right Front Shock Mount.

Perform Inner Liner Installation procedure, paragraph 4-45. b., 3 through 19.

#### 4-45. INNER LINER REPLACEMENT This task covers: a. Removal b. Installation **INITIAL SETUP** Equipment Condition Tools Tool Kit, Refrigeration Condition Description Paragraph Instrument Panel Center 4-44 **Unit Service** Shock Mount removed. (Item 1, Appendix B) Personnel Required **General Safety Instructions** Inner Liner weighs approx. 220 pounds. Three people

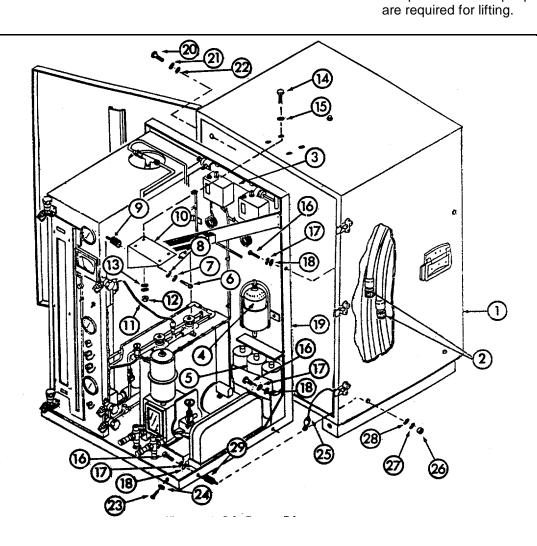


Figure 4-26. Inner liner

- 1. Open cabinet (1) and remove vacuum hoses (2), handpump (3), centrifuge tube (4) and oil bottles (5)
- 2. Close cabinet door.
- 3. Lay cabinet on its back.
- 4. Open cabinet door.
- 5. Remove bolt (6), lockwasher (7), and flatwasher (8), securing shock mount (9) to bracket (10).
- 6. Remove four nuts (11), four lockwashers (12), and four flat washers (13), securing bracket to cabinet.
- 7. Remove four bolts (14) and four flat washers (15) from bracket and cabinet.
- 8. Remove bracket.
- 9. Remove three bolts (16), three lockwashers (17), and three flat washers (18), securing the liner (19) to the right side shock mounts.

#### **NOTE**

The vacuum pump V-belt guard may be removed to assist access.

- 10. Remove four bolts (20), four lockwashers (21), and four flat washers (22) securing the left side shock mounts to cabinet.
- 11. Remove screw (23), lockwasher (24), and grounding strap (25) from liner.
- 12. Slide inner liner to bottom of cabinet.
- 13. Remove nut (26), lockwasher (27), and flat washer (28), securing lower right front shock mount (29) to cabinet.
- 14. Remove the lower right front shock mount from cabinet.

#### WARNING

## INNER LINER ASSEMBLY WEIGHS APPROXIMATELY 220 LBS. THREE PEOPLE ARE REQUIRED FOR LIFTING.

15. Lift liner from cabinet.

#### b. Installation.

#### WARNING

INNER LINER ASSEMBLY WEIGHS APPROXIMATELY 220 LBS. THREE PEOPLE ARE REQUIRED FOR LIFTING.

#### **NOTE**

Insure that the liner mounted shock mounts and the cabinet mounted shock mounts are installed in accordance with procedures listed in paragraph 4-44.

- 1. Place cabinet (1) on its back.
- 2. Lift liner (19) into cabinet.
- 3. Slide liner to bottom of cabinet.
- 4. Install lower right front shock mount (29) stud in cabinet mounting hole.
- 5. Secure lower right front shock mount to cabinet using flat washer (28), lockwasher (27), and nut (26). Tighten nut.
  - 6. Align lower left rear shock mount with mounting hole in cabinet.
  - 7. Secure shock mount to cabinet using flat washer (22), lockwasher (21) and bolt (20). Do not tighten.
  - 8. Align the lower right rear shock mount with mounting hole in liner.
- 9. Secure the lower right rear shock mount to liner using flat washer (18), lockwasher (17), and bolt (16). Do not tighten.
  - 10. Install all remaining shock mount hardware.
  - 11. Tighten all mounting hardware.
  - 12. Align bracket (10) with cabinet mounting holes and install four flat washers (15) and four bolts (14).
- 13. Secure bracket to cabinet using four flat washers (13), four lockwashers (12), and four nuts (11). Tighten nuts.
  - 14. Secure bracket to shock mount (9) using flat washer (8), lockwasher (7), and bolt (6). Tighten bolt.
  - 15. Secure ground strap (25) to liner using lockwasher (24) and screw (23).
  - 16. Set cabinet upright.
- 17. Stow vacuum hoses (2), handpump (3), centrifuge tube (4) and oil bottles (5) in stowage location (5) and close cabinet.

**Condition Description** 

None

#### 4-46. PRESSURE EQUALIZER VALVE REPLACEMENT

This task covers:

a. Removal b. Installation

**INITIAL SETUP** 

Equipment Condition Paragraph

Tools

Tool Kit, Refrigeration
Unit Service (Item 1, Appendix B)

Personnel Required

1

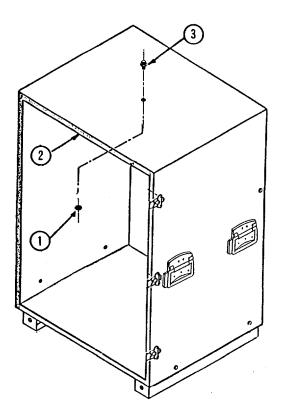


Figure 4-27. Pressure Equalizer Valve

#### a. Removal.

- 1. Remove nut (1) from inside of cabinet (2).
- 2. Remove pressure equalizer valve (3) from top of cabinet.

#### b. Installation.

- 1. Install pressure equalizer valve (3) on top of cabinet (2).
- 2. Secure valve to cabinet with nut (1).

#### 4-47. SYSTEM TUBING ASSEMBLIES

Table 4-7. System Tubing Maintenance Procedures Ind
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PROCEDURE	PARAGRAPH
Refrigerant System Tubing Replacement	4-48
Vacuum System Tubing Replacement	4-49
High and Low Pressure Tubing Replacement	4-50

4-48. REFRIGERANT SYSTEM TUBING REPLACEMENT		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)	Equipment Condition <u>Paragraph</u> 2-6 4-45	Condition Description Refrigerant system drained and vented. Inner Liner removed.
<u>Personnel Required</u> 1		

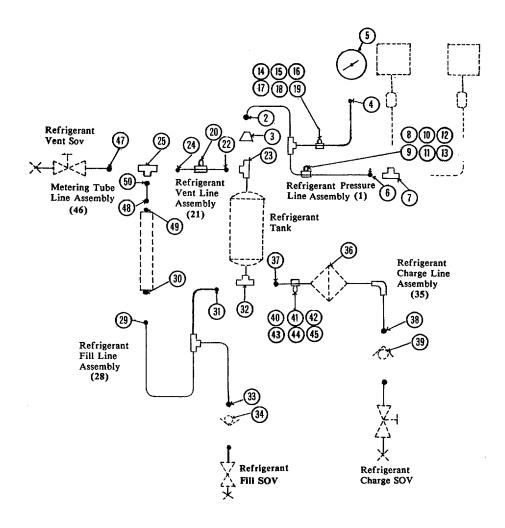


Figure 4-28. Refrigerant System Tubing

#### **NOTE**

Refrigerant System tubing is painted orange.

- 1. Remove power cord from power source.
- 2. Drain and vent Refrigerant System in accordance with paragraph 2-6.
- 3. Perform Inner Liner removal Procedure, paragraph 4-45.
- 4. Remove Pressure Line Assembly (1) as follows:
- (a) Disconnect flare nut (2) from reservoir tee reducer (3).
- (b) Disconnect flare nut (4) from tank pressure gage (5).

- (c) Disconnect flare nut (6) from pressure switch tee (7).
- (d) Remove bolt (8), flat washer (9), nut (10), lockwasher (11) and flat washer (12) from clamp (13) securing pressure line to liner bracket.
- (e) Remove bolt (14), flat washer (15), nut (16), lockwasher (17) and flat washer (18) from clamp (19) securing pressure line to vent line clamp (20).
- (f) Remove pressure line.
  - 5. Remove vent line (21) as follows:
- (a) Disconnect flare nut (22) from reservoir tee (23).
- (b) Disconnect flare nut (24) from tee (25).
- (c) Remove vent line.
  - 6. Remove fill line (28) as follows:
- (a) Disconnect flare nut (29) from metering tube lower elbow (30).
- (b) Disconnect flare nut (31) from tee (32).
- (c) Disconnect flare nut (33) from check valve (34).
- (d) Remove fill line.
- a. Removal (continued).
  - 7. Remove charge line (35) as follows:
  - (a) Remove element from Filter/Dryer (36).
  - (b) Disconnect flare nut (37) from tee (32).
  - (c) Disconnect flare nut (38) from check valve (39).
  - (d) Remove bolt (40), flat washer (41), nut (42), lockwasher (43) and flat washer (44) from clamp (45) securing charge line to vacuum line clamp.
  - (e) Remove charge line.
  - 8. Remove metering tube line assembly (46) as follows:
  - (a) Disconnect Refrigerant Vent SOV Assembly flare nut (47) from tee (25).
  - (b) Disconnect flare nut (48) from metering tube elbow (49).
  - (c) Remove metering tube line assembly.
  - (d) Remove tee (25) from flare nut (50).

#### b. Installation.

- 1. Install metering tube line assembly as follows:
- (a) Connect tee (25) to flare nut (50).
- (b) Install line assembly and connect flare nut (48) to metering tube elbow (49).
- (c) Connect Refrigerant Vent SOV flare nut (47) to tee (25).
- (d) Tighten flare nuts.
- 2. Install charge line (35) as follows:
- (a) Install charge line in service unit.
- (b) Connect flare nut (38) to check valve (39).
- (c) Connect flare nut (37) to tee (32).
- (d) Install bolt (40), flat washer (41), flat washer (44), lockwasher (43) and nut (42) in clamp (45) securing charge line to vacuum line clamp.
- (e) Tighten flare nuts.
- (f) Install and tighten Filter/Dryer element (36).
- 3. Install fill line (28) as follows:
- (a) Install fill line in service unit.
- (b) Connect flare nut (33) to check valve (34).
- (c) Connect flare nut (31) to tee (32).
- (d) Connect flare nut (29) to metering tube lower elbow (30).
- (e) Tighten flare nuts.
- 4. Install vent line (21) as follows:
- (a) Install vent line in service unit.
- (b) Connect flare nut (24) to tee (25).
- (c) Connect flare nut (22) to reservoir tee (23).
- (d) Tighten flare nuts.
- 5. Install pressure line (1) as follows:
- (a) Install pressure line in service unit.
- (b) Connect flare nut (6) to pressure switch tee (7).
- (c) Connect flare nut (4) to tank pressure gage (5).

- (d) Connect flare nut (2) to reservoir tee reducer (3).
- (e) Install bolt (8), flat washer (9), flat washer (12), lockwasher (11) and nut (10) securing pressure line clamp (13) to liner bracket.
- (f) Install bolt (14), flat washer (15), flat washer (18), lockwasher (17) and nut (16) securing pressure line clamp (19) to vent line clamp (20).
- (g) Tighten flare nuts.
- 6. Perform Inner Liner installation procedures, paragraph 4-45.

4-49. VACUUM SYSTEM TUBING REP	. VACUUM SYSTEM TUBING REPLACEMENT		
This task covers:			
a. Removal b. Inst	allation		
INITIAL SETUP			
Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)  Personnel Required 1	Equipment Condition <u>Paragraph</u>	Condition Description None	

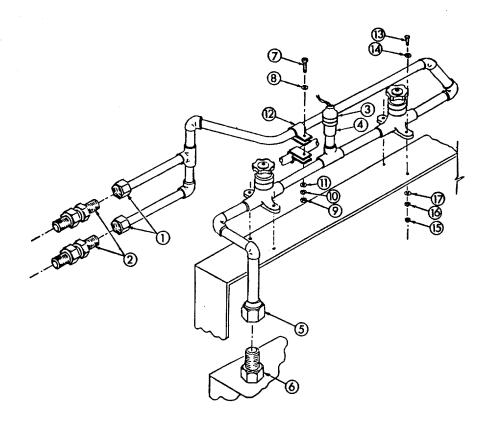


Figure 4-29. Vacuum System Tubing
NOTE

Vacuum System tubing is painted green.

#### a. Removal.

- 1. Remove power cord from power source.
- 2. Vent vacuum system.
- 3. Disconnect flare nuts (1) at bulkhead fittings (2).
- 4. Remove vacuum pressure gage connector (3) from vacuum pressure transducer (4).
- 5. Disconnect flare nut (5) from vacuum pump inlet fitting (6).
- 6. Remove bolt (7), flat washer (8), nut (9), lockwasher (10) and flat washer (11) from clamp (12) securing vacuum line to refrigerant charge line clamp.
- 7. Remove two screws (13), two flat washers (14), two nuts (15), two flat washers (16) and two flat washers (17) securing each vacuum SOV (18) to bracket.
- Remove vacuum system tubing assembly.

#### b. Installation.

1. Install vacuum tubing assembly in Service Unit.

- 2. Connect flare nut (5) to vacuum pump inlet fitting (6).
- 3. Connect flare nuts (1) to bulkhead fittings (2).
- 4. Tighten flare nuts.
- 5. Secure VAC-1 and VAC-2 SOVs (18) to bracket using two screws (13) and two flat washers (14); two flat washers (16), two lockwashers (17), and two nuts (15).
- 6. Install bolt (7), flat washer (8), flat washer (11), lockwasher (10) and nut (9) in clamp (12) securing vacuum line to refrigerant line clamp.
- 7. Connect vacuum pressure gage connector (3) to pressure transducer (4).

#### 4-50. HIGH AND LOW PRESSURE TUBING REPLACEMENT

This task covers:

a. Removal b. Installation

**INITIAL SETUP** 

Equipment Condition Paragraph

Condition Description

None

Tools
Tool Kit, Refrigeration

Unit Service (Item 1, Appendix B)

Personnel Required

1

#### **NOTE**

This procedure is applicable to both High and Low pressure systems.

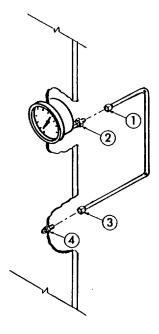


Figure 4-30. Gage Tubing

#### a. Removal.

- 1. Remove power cord from power source.
- 2. Disconnect flare nut (1) from reducer fitting (2) attached to gage port.
- 3. Disconnect flare nut (3) from pressure port (4) (bulkhead fitting).
- 4. Remove tubing assembly.

#### b. Installation.

- 1. Install tubing assembly in Instrument Panel.
- 2. Connect flare nut (3) to pressure port (4).
- 3. Connect flare nut (1) to reducer fitting (2) on gage port.
- 4. Secure both flare nuts.

#### 4-51. PREPARATION FOR STORAGE OR SHIPMENT

This section contains the instructions for the storage or shipment of the Service Unit.

#### 4-52. PREPARATION FOR STORAGE

- 1. Drain oil from vacuum pump as described in paragraph 4-36.
- 2. Release tension on vacuum pump V-Belt in accordance with paragraph 5-20 a.
- 3. Install stopper in oil mist eliminator.
- 4. Drain and vent refrigerant tank.
- 5. Drain and vent oil measuring tube.
- Service or replace filter/dryer element as described in paragraphs 4-29 and 4-30.
- 7. Close all valves and install caps on SOV and instrument panel ports.
- 8. Verify that oil stop plug is securely installed on top of vacuum pump mist eliminator.
- 9. Refer to operators PMCS and check accessory equipment.
- 10. Seal openings into hoses, hose fittings and oil pump fittings with plastic plugs or caps conforming to MIL-C-5501 or tape conforming to PPP-T-60, Type IV.
- 11. Secure all accessory equipment in their appropriate storage areas.
- 12. Thoroughly clean Service Unit.
- 13. Close pressure equalizer valve, then close and secure Service Unit door.
- 14. Place Service Unit in selected storage area and store in upright position.

#### 4-53. STORAGE CONDITIONS

The Service Unit will not be damaged or its operation impaired if stored at an ambient temperature of + 160° F (71.1° C) for 4 hours out of each 24 hours, no solar radiation, and at -65° F (-53.8° C) for 6 out of each 24 hours, no solar radiation.

#### Section VI PREPARATION FOR SHIPMENT OR SHIPMENT

#### 4-54. PREPARATION FOR SHIPMENT

a. Prepare Service Unit for shipment in accordance with procedures outlined in paragraph 4-52, Preparation for Storage, steps 1 through 13.

#### **NOTE**

If Service Unit is being shipped by air, open pressure equalizing valve. Close pressure equalizing valve for all other modes of transportation.

- b. Transport Service Unit lying down on its back with the centerline of the Service Unit parallel to the centerline of the vehicle.
- c. Package Service Unit in accordance with MIL-R-3593C, Level B.

#### **CHAPTER 5**

#### **DIRECT SUPPORT MAINTENANCE INSTRUCTIONS**

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

#### 5-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment refer to the Modified Table of Organizational and Equipment (MOTE) applicable to your unit.

#### 5-2. SPECIAL TOOLS

No special tools are required.

#### 5-3. REPAIR PARTS

Table 5-1 lists the troubleshooting procedures to be performed by direct support maintenance personnel. Schematic and electrical diagrams from the Service Unit are provide on Figure 5-1 and Figure 5-2.

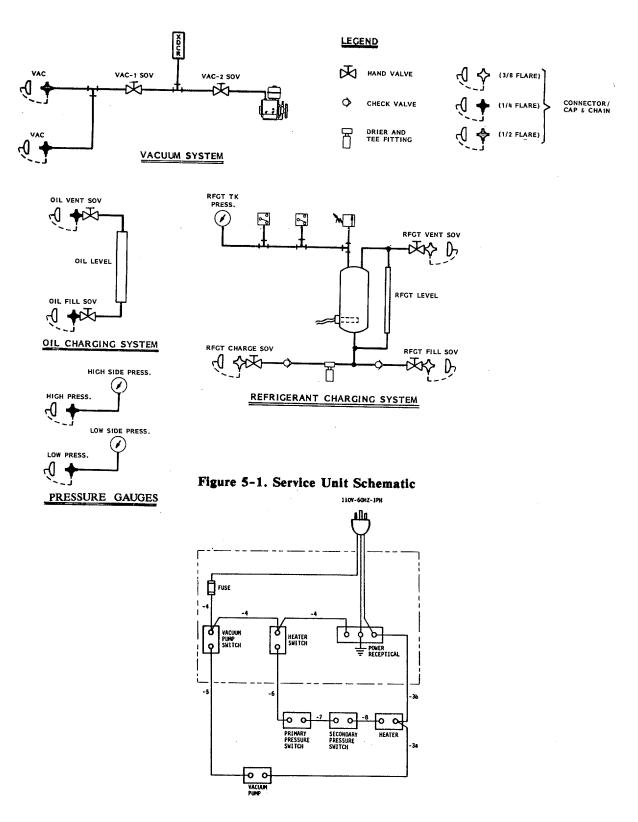


Figure 5-2. Electrical Wiring Schematic

#### Section II DIRECT SUPPORT TROUBLESHOOTING

#### Table 5-1. Direct Support Troubleshooting

## MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

#### 1. VACUUM PUMP MOTOR WILL NOT OPERATE

Step 1. Defective capacitor in motor Remove and replace motor

Step 2. Open motor windings Remove and replace motor

#### 2. VACUUM PUMP WILL NOT PUMP DOWN

Step 1. Improper oil flow
Disassemble pump and clean

Step 2. Defective discharge valves
Disassemble pump and replace defective valve(s)

Step 3. Shaft seal defective
Disassemble pump and replace seal

Step 4. Damaged or worn internal pump parts/components

Disassemble pump, remove and replace damaged or worn parts/components

Step 5. Vacuum pump defective Replace pump if unable to repair or determine malfunction

#### 3. REFRIGERANT CHARGING SYSTEM LOW PRESSURE

Step 1. Defective thermostat Remove and replace heater

Step 2. Defective primary pressure switch Remove and replace pressure switch

#### 4. TANK HEATER WILL NOT OPERATE

Step 1. Defective thermostat Remove and replace heater

Step 2. Heater element open Remove and replace heater

Step 3. Defective pressure switch Remove and replace pressure switch

#### Table 5-1. Direct Support Troubleshooting (Continued)

#### **MALFUNCTION**

### TEST OR INSPECTION CORRECTIVE ACTION

#### 5. REFRIGERANT TANK SUSPECTED OF LEAKING

Step 1. Check all welded seams, couplings, fittings, etc. with an electronic leak detector Remove and replace tank if defective (leaking)

#### NOTE

Refrigerant tank is ASME coded. No repair authorized.

#### 6. REFRIGERANT TUBING SUSPECTED OF LEAKING

Step 1. Use electronic leak detector and check all flare nuts, joints, fittings, etc. for leaks. Repair or replace defective tubing as required.

#### Section III DIRECT SUPPORT MAINTENANCE PROCEDURES

#### 5-5. GENERAL

This section contains maintenance procedures authorized at direct support level of maintenance.

#### Table 5-2 MAINTENANCE PROCEDURES INDEX

**PROCEDURE PARAGRAPH** 5-6 **Extension Cord Testing** Oil Vent and Oil Fill Shut Off Valve (SOV) Replacement 5-7 Pressure Gage Testing 5-8 Vacuum Pressure Gage and Vacuum Pressure Transducer Testing 5-9 Instrument Panel Replacement 5-10 Pressure Switch Testing and Adjustment 5-11 Relief Valve Testing 5-12 Refrigerant Vent, Charge, and Fill SOV Replacement 5-13 Check Valve Testing 5-14 Moisture Indicator Replacement 5-15 Heater Replacement 5-16 Refrigerant Tank Replacement 5-17 Vacuum SOV Replacement 5-18 5-19 Vacuum Pump Assembly Replacement Vacuum Pump Disassembly, Assembly, Inspection and Cleaning 5-20 Input Power Cord Replacement 5-21 Wiring Harness Replacement 5-22 **Tubing Assembly Repair** 5-23

5-6. EXTENSION CORD TESTING  This task covers:			
<u>INITIAL SETUP</u>			
	Equipment		
<u>Tools</u>	Condition <u>Paragraph</u>	Condition Description	
Tool Kit, Refrigeration	<u>i diagrapii</u>	None	
Unit Service (Item 1, Appendix B)			
Personnel Required			
1			

#### a. Continuity Testing.

- 1. Set Ohmmeter to lowest ohms scale.
- 2. Check for continuity (zero ohms) from female ground connection to male ground connection.
- 3. Check for continuity from female high connection to male high connection.
- 4. Check for continuity from female neutral connection to male neutral connection.

#### b. Insulation Testing.

- 1. Set Ohmmeter to highest ohms scale.
- 2. See that there is no continuity (infinite ohms) between the ground connection and the high and neutral connections.
- 3. See that there is no continuity between the high and neutral connections.

#### 5-7. OIL VENT AND OIL FILL SOV REPLACEMENT This task covers: a. Removal b. Installation **INITIAL SETUP** Equipment Condition <u>Tools</u> **Paragraph Condition Description** Tool Kit, Refrigeration 2-6 Oil Metering Tube drained **Unit Service** and vented. 4-45 (Item 1, Appendix B) Inner Liner removed. **General Safety Instructions** Materials/Parts Paint, Yellow Clean Oil Vent or Oil Fill (Item 14, Appendix D) SOVs prior to heating with torch. Personnel Required

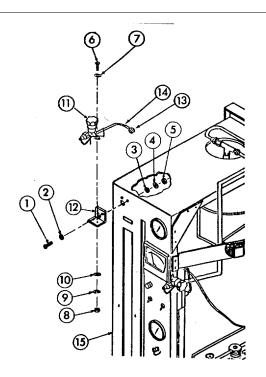


Figure 5-3. Oil Metering Tube SOVs

#### **NOTE**

This procedure applies to both the Oil Vent and Oil Fill valves although Figure 5-3 shows only the Oil Vent valve removed.

1. Drain and vent the oil metering tube.

#### NOTE

Step 3 applies to Oil Vent Valves only.

- Remove inner liner from cabinet in accordance with paragraph 4-45.
- 3. Remove two screws (1), two washers (2), Oil Vent Valve and bracket, two washers (3) two lockwashers (4) and two nuts (5) from instrument panel.
- 4. Remove two screws (6), two washers (7), two nuts (8), two lockwashers (9), and two flat washers (10) from valve housing (11) and bracket (12).
- 5. Disconnect flare nut (13) and remove valve with tube (14) from bracket and instrument panel (15).
- 6. Disassemble valve in accordance with paragraph 4-18.

**WARNING** 

TO AVOID FIRE HAZARD, CLEAN OIL FILL OR OIL VENT SOV VALVE AND TUBE ASSEMBLY WITH HOT SOAPY WATER PRIOR TO USING THE OXYACETYLENE TORCH. KEEP HEAT AWAY FROM VALVE.

- 7. Note any angles of tube to be removed from valve joint.
- 8. Using a properly adjusted oxy-acetylene torch apply heat evenly around the circumference of valve slip-joint and tube.
- 9. When solder is free-flowing, remove tube from valve body.

#### b. Installation.

- 1. Disassemble valve (11) in accordance with paragraph 4-18.
- 2. Prepare tube (14) and valve joint for brazing.
- 3. Install tube in valve joint and turn to match any angle noted in step 5 of "Removal."
- 4. Braze valve/tubing joint using Grade I brazing alloy in accordance with local brazing procedures.

#### NOTE

Grade I brazing alloy is 45% silver, 30% copper, and 25% zinc as specified by QQ-B-654A. This alloy is for copper to brass joints.

- 5. Allow valve/tube to cool to the touch.
- 6. Assemble valve in accordance with paragraph 4-18.
- 7. Touch up yellow paint on tubing assembly.
- 8. Install valve with tube into bracket (7). Secure in place with two screws (1), two flat washers (2), two flat washers (5), two lockwashers (4), and two nuts (3). Secure flare nuts (8) to elbow on oil metering tube.

#### NOTE

Step 9 applies to the Oil Vent Valves only.

- 9. Secure valve and bracket to instrument panel with two screws (1), two flat washers (2), two flat washers (3), two lockwashers (4), and two nuts (5).
- 10. Install inner liner in accordance with paragraph 4-45.

5-8. PRESSURE GAGE TESTING				
This task covers:	This task covers:			
a. Vacuum Testing	a. Pressure Testing			
INITIAL SETUP	INITIAL SETUP			
Test Equipment Tester, Pneumatic Pressure 65B-5A-0031  Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendi  Personnel Required 1	Equipment Condition <u>Paragraph</u> x B)	Condition Description None		

#### **NOTE**

These procedures apply to the Refrigerant Tank, High, and Low Pressure gages.

#### a. Vacuum Testing.

- 1. Remove flare nut from gage port reducer and move tubing and flare nut away from reducer.
- 2. Connect a test vacuum hose from a pneumatic pressure tester to the gage port reducer and secure tube to reducer.
- 3. Set vacuum to points corresponding to graduations on gage face.

- 4. Slowly vent vacuum to atmosphere.
- 5. Disconnect test vacuum hose from gage port reducer.
- 6. Gage vacuum accuracy shall be 1% of full scale reading.

#### b. Pressure Testing.

- 1. Connect a test pressure hose from a pneumatic pressure tester to the gage port reducer and secure hose to reducer.
- 2. Set tester at points corresponding to graduations on gage face.
- 3. Slowly vent pressure to atmosphere.
- 4. Disconnect test pressure hose from gage port reducer.
- 5. Gage accuracy shall be 1% of full scale reading.
- 6. Connect tubing flare nut to gage port reducer and secure.

a. Testing		
INITIAL SETUP		
<u>Test Equipment</u> Vacuum Test Box TD01153	Equipment Condition <u>Paragraph</u> 4-34	Condition Description Pressure Transducer removed.
<u>Tools</u> Tool Kit, Refrigeration Unit Service (Item 7, Appendix B)		remereu.

- a. Remove vacuum pressure transducer in accordance with paragraph 4-34.
- b. Connect vacuum pressure transducer to a vacuum test box.
- c. Connect vacuum gage power cord to power source.
- d. Determine the accuracy of the gage/transducer at 100, 200, 500, and 1000 microns of vacuum.

e. Gage/transducer accuracy shall be as follows:

100 microns±15 microns200 microns±25 microns500 microns and up±10% of reading

- f. Slowly vent vacuum to atmosphere.
- g. Disconnect vacuum gage power cord from power source.
- h. Disconnect vacuum pressure transducer from vacuum test box.
- i. Install vacuum pressure transducer in vacuum plumbing assembly in accordance with paragraph 4-34.

5-10.	INSTRUMENT PANEL REPLACE	MENT	
	This task covers:		
	a. Removal b. Ins	tallation	
	INITIAL SETUP		
		Equipment Condition	
	<u>Tools</u>	<u>Paragraph</u>	Condition Description
	Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)	2-6	Oil Metering System drained and vented.
	Personnel Required 1	2-6	Refrigerant System drained and vented.
		4-45	Inner Liner removed.

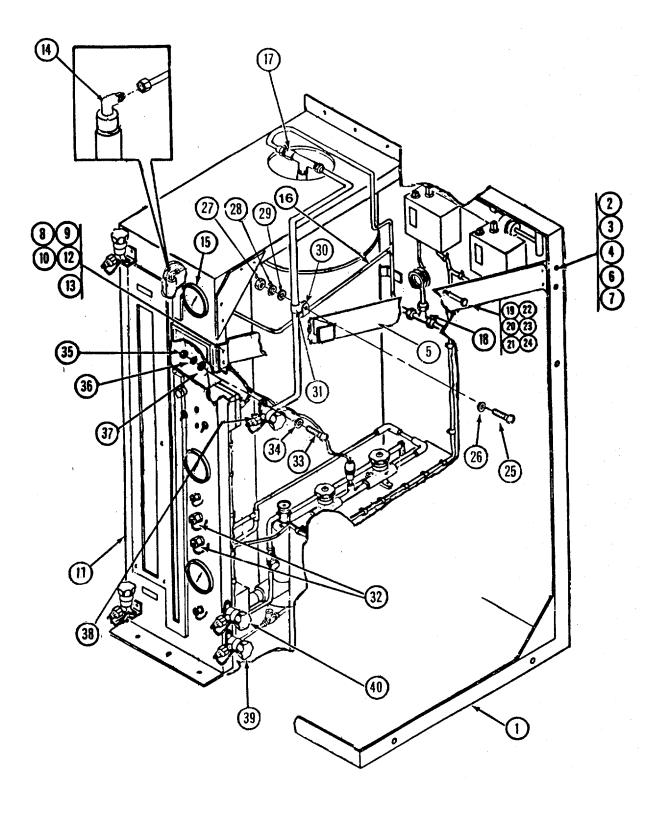


Figure 5-4. Instrument Panel (Sheet 1 of 2)

# a. Removal.

- 1. Disconnect power cord from power source.
- 2. Drain and vent oil metering system.
- 3. Drain and vent refrigerant charging system.
- 4. Remove inner liner (1) from cabinet in accordance with Inner Liner Removal procedure, paragraph 4-45.
- 5. Unwind Power Cord.
- 6. Remove two nuts (2), two lockwashers (3), and two flat washers (4) securing brace (5) to liner.
- 7. Remove two bolts (6) and two flat washers (7) from brace and liner.
- 8. Remove two nuts (8), two lockwashers (9), and two flat washers (10) securing brace to instrument panel (11).
- 9. Remove two bolts (12) and two flat washers (13) from brace and instrument panel.
- 10. Remove brace.
- 11. Disconnect flare nuts from elbows at top and bottom of refrigerant metering tube (14).
- 12. Disconnect flare nut from tank pressure gage (15) port reducer.
- 13. Disconnect pressure line assembly (16) flare nut from refrigerant tank tee reducer (17).
- 14. Disconnect pressure line assembly flare nut from pressure switch tee (18).
- 15. Remove bolt (19), flat washer (20), nut (21), lockwasher (22), and flat washer (23) from clamp (24), securing pressure line assembly to inner liner bracket.
- 16. Remove bolt (25), flat washer (26), nut (27), lockwasher (28), and flat washer (29), from clamp (30), securing pressure line assembly to vent line assembly clamp (31).
- 17. Remove pressure line assembly.
- 18. Disconnect flare nuts from vacuum (bulkhead) ports (32).
- 19. Remove two bolts (33), two flat washers (34), two nuts (35), two lockwashers (36), and two flat washers (37) from Refrigerant Vent SOV (38), Refrigerant Fill SOV (39), and Refrigerant Charge SOV (40).

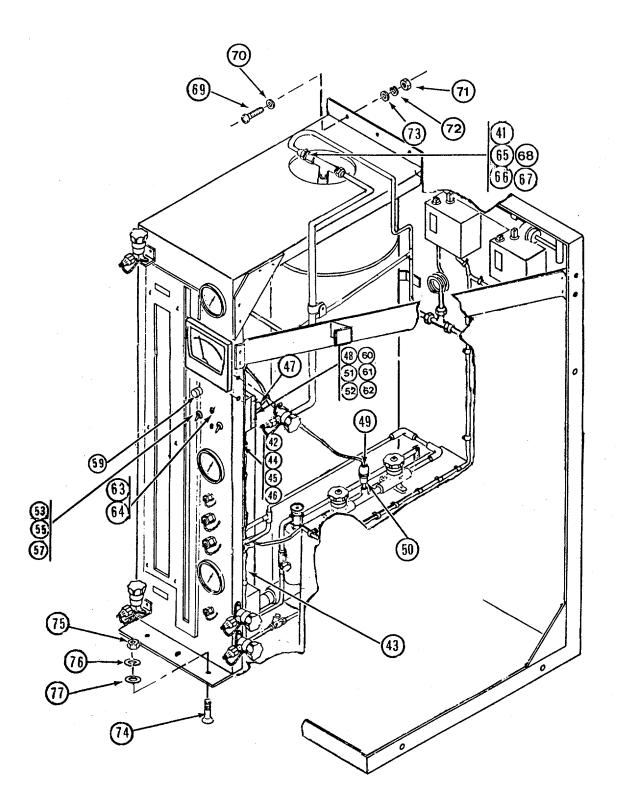


Figure 5-4. Instrument Panel (Sheet 2 of 2)

- 20. Remove vent line assembly flare nut from refrigerant tank tee (41).
- 21. Remove vent line assembly.
- 22. Remove six cable clamps (42) securing wiring harness (43) to side of instrument panel by removing six bolts (44), six lockwashers (45), and six flat washers (46).
- 23. Disconnect vacuum gage power cord (47) from electrical outlet box (48).
- 24. Disconnect vacuum transducer electrical connector (49) from vacuum pressure transducer (50).
- 25. Remove two screws (51) securing electrical box cover (52) to electrical outlet box.
- 26. Remove two nuts (53, 54) securing heater switch (55), vacuum pump switch (56) and switch plates (57, 58) to instrument panel.
- 27. Disconnect wires from fuseholder (59).
- 28. Remove two nuts (60), two lockwashers (61), two flat washers (62), two flat washers (63), and two screws (64) securing electrical outlet box to instrument panel.
- 29. Remove electrical box from instrument panel.
- 30. Remove reducer (65) from refrigerant tank tee (66).
- 31. Remove tee and coupling (67) from refrigerant tank nipple (68).
- 32. Remove three bolts (69), three flat washers (70), three nuts (71), three lockwashers (72), and three flat washers (73) securing top of instrument panel to rear panel of inner ,liner.
- 33. Remove three bolts (74), three nuts (75), three lockwashers (76), and three flat washers (77) securing bottom of instrument panel to base of inner liner.
- 34. Pull instrument panel from inner liner and remove.

- 1. Install instrument panel (11) into inner liner (1).
- 2. Secure bottom of instrument panel to base of inner liner with three bolts (74), three flat washers (77), three lockwashers (76), and three nuts (75).
- 3. Secure top of instrument panel to rear of inner liner with three bolts (69), three flat washers (70), three flat washers (73), three lockwashers (72), and three nuts (71).
- 4. Wrap threads of tank nipple (68) with two or three turns of teflon tape.
- 5. Install tee fitting and half coupling (67) onto tank nipple.
- 6. Install reducer (65) on tee fitting.

- 7. Secure electrical outlet box (48) to instrument panel (11) using two screws (64), two flat washers (63), two flat washers (62), two lockwashers (61) and two nuts (60).
- 8. Install heater switch (55), vacuum pump switch (56), switch plates (57, 58), and secure with two nuts (53, 54).
- 9. Connect wiring to terminals of fuseholder (59).
- 10. Install electrical box cover (52) and secure with two screws (51).
- 11. Install six cable clamps (42) securing wiring harness to side of instrument panel with six flat washers (46), six lockwashers (45), and six bolts (44).
- 12. Install vent line assembly and connect flare nut to refrigerant tank tee and secure.
- 13. Secure Refrigerant Charge SOV (40), Refrigerant Fill SOV (39), and Refrigerant Vent SOV (38) to instrument panel using two bolts (33), two flat washers (19), two flat washers (34), two flat washers (37), two lockwashers (36), and two nuts (35) for each valve.
- 14. Connect vacuum system flare nuts to vacuum ports (32) and secure.
- 15. Install pressure line assembly (16) and connect flare nut to refrigerant tank tee reducer and secure.
- 16. Connect flare nut to tank pressure gage (15) port reducer and secure.
- 17. Connect pressure line assembly flare nut to pressure switch tee (18) and secure.
- 18. Secure pressure line clamp (24) to liner bracket using bolt (19), flat washer (20), flat washer (23), lockwasher (22), and nut (21).
- 19. Secure pressure line clamp (30) to vent line assembly clamp (31) using bolt (25), flat washer (26), flat washer (29), lockwasher (28) and nut (27).
- 20. Connect flare nuts to elbows on top and bottom of refrigerant metering tube (14) and secure.
- 21. Align brace (5) with liner mounting holes.
- 22. Install two bolts (6), two flat washers (7), two flat washers (4), two lockwashers (3) and two nuts.
- 23. Align brace with instrument panel mounting holes.
- 24. Install two bolts (12), two flat washers (13), two flat washers (10), two lockwashers (9) and two nuts (8).
- 25. Tighten brace mounting hardware.
- 26. Connect vacuum transducer electrical connector (49) to vacuum pressure transducer (50).
- 27. Connect vacuum gage power cord (47) to electrical outlet.

- 28. Install inner liner in accordance with Inner Liner Installation procedure, paragraph 4-45.
- 29. Connect power cord to power source or stow.

Personnel Required

# 5-11. PRESSURE SWITCH TESTING AND ADJUSTMENT This task covers: a. Testing b. Adjustment **INITIAL SETUP** Equipment Condition Test Equipment <u>Paragraph</u> Condition Description Tester, Pneumatic Pressure 2-6 Refrigerant System drained and vented. 65B-5A-0031 Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)

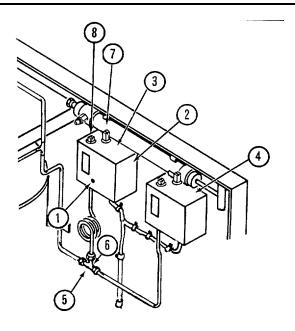


Figure 5-5. Pressure Switches

# NOTE

The instructions given here are applicable to both Primary and Secondary Pressure Switches.

## a. Testing.

- 1. Remove power cord from power source.
- 2. Remove screw (1) and cover (2) from primary pressure switch (3) or secondary pressure switch (4) as required for test.
- 3. Connect an ohmmeter between the LINE and MI terminals of the switch.
- 4. For pressure switch being tested, remove capillary tube flare nut (5) from tee (6) and connect capillary to a test pressure hose from a pneumatic pressure tester.
- 5. Observe that the ohmmeter reads zero ohms at zero psi.
- 6. Increase the test pressure slowly while watching the ohmmeter.
- When ohmmeter reads infinite ohms, note test pressure reading. Pressure shall be 65 pounds per square inch gage for primary switch. Pressure shall be 75 psig +2 psig for secondary switch.
- 8. Decrease test pressure slowly while watching ohmmeter.
- 9. When ohmmeter shows zero ohms, note the test pressure reading. Pressure shall be 60 psig +2 psig for primary switch and less than 40 psig for secondary switch.
- 10. Vent test pressure.

## b. Adjustment.

#### NOTE

The instructions given here are applicable to both pressure switches although Figure 5-5 shows only Primary Pressure Switch adjustments.

1. Set test pressure at points specified below:

Primary switch - 65 psig Secondary switch - 75 psig

- 2. If ohmmeter reads zero ohms, proceed to step 4.
- 3. Turn cut out adjustment (7) clockwise (CW) until ohmmeter reads zero ohms.
- 4. Slowly turn cut out adjustment (7) counterclockwise (CCW) until ohmmeter reads infinite ohms.
- 5. Slowly reduce pressure to points specified below:

Primary switch - 60 psig Secondary switch - proceed to step 9

6. If ohmmeter reads infinite ohms, proceed to step 8.

- 7. Turn cut in adjustment (8) until ohmmeter reads infinite ohms.
- 8. Slowly turn cut in adjustment (8) until ohmmeter reads zero ohms.
- 9. Vent test pressure.
- 10. For secondary pressure switch, turn cut in adjustment (8) fully clockwise (CW). See that ohmmeter reads zero ohms.
- 11. Test pressure switch in accordance with Pressure Switch Testing procedure, paragraph 5-11 a above, steps 5 through 10.

# 5-12. RELIEF VALVE TESTING This task covers: a. Testing **INITIAL SETUP** Equipment Condition Condition Description Test Equipment Paragraph Calibration Set, Deadweight 4-27 Relief Valve removed. Pressure Standard 6-201-001 **Tools** Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required 1

- 1. Remove relief valve from refrigerant tank in accordance with Relief Valve Removal procedure, paragraph 4-27.
- 2. Connect test pressure hose from a deadweight tester to the pressure port of the relief valve.
- 3. Place a clean rag around the relief valve and place valve and hose into a suitable container for catching fluid discharge.
- 4. Increase test pressure slowly, noting on test gage the point the relief valve opens.
- 5. Reduce test pressure by approximately 25 psig and repeat step 4 to verify relief valve setpoint.
- 6. Vent test pressure.
- 7. Relief valve setpoint shall be 150 psig +/-5 psig.
- 8. Remove relief valve from deadweight tester and clean valve.

9. Install relief valve in refrigerant tank in accordance with Relief Valve Installation procedure, paragraph 4-27.

# 5-13. REFRIGERANT VENT, CHARGE AND FILL SOV REPLACEMENT This task covers: b. Installation a. Removal **INITIAL SETUP** Equipment Condition <u>Tools</u> <u>Paragraph</u> Condition Description Tool Kit, Refrigeration 2-6 Refrigerant System **Unit Service** drained and vented. (Item 1, Appendix B) Materials/Parts Paint, Orange (Item lb Appendix D) Personnel Required

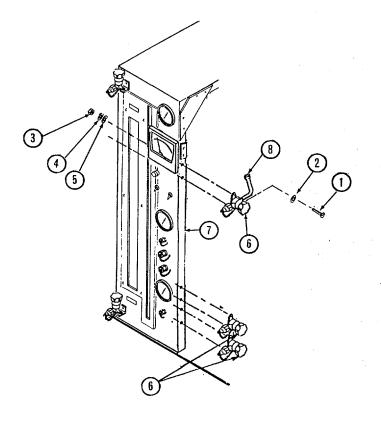


Figure 5-6. Refrigerant SOVs

#### **NOTE**

The instructions given here are applicable to all refrigerant SOV'S although Figure 5-6 shows Refrigerant Vent SOV detail only.

#### a. Removal.

- 1. Drain and vent refrigerant charging system in accordance with paragraph 2-6.
- 2. Remove two screws (1), two flat washers (2), two nuts (3), two lockwashers (4), and two flat washers (5) securing valve (6) to side of instrument panel (7).
- 3. Disconnect flare nut (8) and remove valve and tube.
- 4. Disassemble valve in accordance with paragraph 4-28.
- 5. Note any angles of tube to be removed from valve joint.
- 6. Using a properly adjusted oxy-acetylene torch, apply heat evenly around the circumference of the valve/tube joint.
- 7. When solder is free-flowing, remove tube from valve.

#### b. Installation.

- 1. Disassemble the valve in accordance with paragraph 4-28.
- 2. Prepare tube and valve joint for brazing.
- 3. Install tube in valve joint and turn to match any angle noted in step 5 of "Removal".
- 4. Braze valve/tubing joint using Grade 1 brazing alloy in accordance with local brazing procedures.

#### **NOTE**

Grade 1 brazing alloy is 45% silver, 30% copper, and 25% zinc as specified by QQ-B-654A. This alloy is for copper to brass joints.

- 5. Allow valve/tube to cool to the touch.
- 6. Assemble valve in accordance with paragraph 4-28.
- 7. Touch up orange paint on tubing assembly.
- 8. Connect flare nut (8) loosely to tubing assembly.
- 9. Secure valve (6) to instrument panel (7) using two screws (1), two flat washers (2), two flat washers (5), two lockwashers (4), and two nuts (3). Tighten flare nut to tubing assembly.

Condition Description

Check Valve removed

# 5-14. CHECK VALVE TESTING

This task covers:

a. Testing

**INITIAL SETUP** 

Equipment Condition Paragraph 4-30

Test Equipment Calibration Set, Deadweight

Sandard 6-201-001

**Tools** Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)

Personnel Required

- 1. Remove check valve in accordance with Check Valve Testing procedure, paragraph 4-30.
- 2. Connect pneumatic tester to check valve in the direction of flow.
- 3. Apply test pressure. No pressure buildup shall be seen.
- 4. Disconnect pneumatic tester from check valve.
- 5. Connect pneumatic tester to check valve against the direction of flow.
- 6. Apply 100 psig test pressure. Allow pressure to stand for fifteen (15) minutes. There shall be no leakage allowed.
- 7. Vent test pressure and disconnect check valve from tester.
- 8. Install check valve in accordance with Check Valve Installation procedure, paragraph 4-30.

5-15. MOISTURE INDICATOR	REPLACEMENT			
This task covers:				
a. Removal	b. Installation			
INITIAL SETUP  Tools Tool Kit, Refrigeration Unit Service (Item 1, Appendix B)  Materials/Parts Paint, Orange (Item 16, Appendix D)  Personnel Required 1		Equipment Condition <u>Paragraph</u> 2-6	Condition Description Refrigeration System drained and vented.	

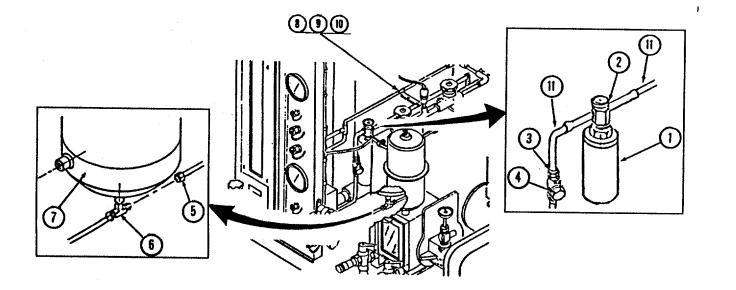


Figure 5-7. Moisture Indicator

# a. Removal.

- 1. Remove inner liner from cabinet in accordance with paragraph 4-45.
- 2. Disconnect power cord from power source.
- 3. Drain and vent refrigerant charging system.
- 4. Unthread filter/dryer element (1) from moisture indicator (2).

- 5. Disconnect flare nut (3) from check valve (4). Remove flare nut (5) from tee (6) at bottom of refrigerant tank (7).
- 6. Remove screw (8) and nut (9) from tubing clamps (10) securing refrigerant charge tubing assembly to vacuum tubing.
- Remove moisture indicator and refrigerant charge tubing assembly from Service Unit. Note any angles of tubing to be removed from moisture indicator.

## **CAUTION**

Do not direct heat at moisture indicator housing.

8. Using a properly adjusted oxy-acetylene torch, heat tubing joints on moisture indicator to remove each tube assembly (11).

#### b. Installation.

- 1. Prepare moisture indicator (2) and tubing assemblies for brazing.
- 2. Install tubing in moisture indicator and turn to match any angle noted in step 6 of "Removal."
- 3. Braze moisture indicator/tube joint using Grade I brazing alloy in accordance to local brazing procedures.

#### NOTE

Grade I brazing alloy is 45% silver, 30% copper, and 25% zinc as specified by QQ-B-654A. This alloy is for copper to brass joints.

- 4. Touch up orange paint on soldered joints.
- 5. Install refrigerant tubing assembly in Service Unit.
- 6. Loosely connect flare nut (5) to tee (6) at bottom of refrigerant tank (7).
- 7. Loosely connect flare nut (3) to check valve (4).
- 8. Install clamps (10) between the vacuum tubing and the refrigerant charge tubing assembly. Secure clamps with screw (8) and nut (9).
- 9. Install Filter/Dryer element (1) on moisture indicator.
- 10. Secure flare nuts at check valve and refrigerant charge tee.
- 11. Install inner liner in accordance with paragraph 4-45.

# 5-16. HEATER REPLACEMENT

This task covers:

a. Removal b. Installation

# **INITIAL SETUP**

Equipment Condition

ToolsParagraphCondition DescriptionTool Kit, Refrigeration 2-6Refrigerant System

Unit Service drained and vented.

(Item 1, Appendix B)

4-45 Inner Liner removed.

Materials/Parts

Tape, Teflon 5-10 Instrument panel removed. (Item 9, Appendix D)

# Personnel Required

1

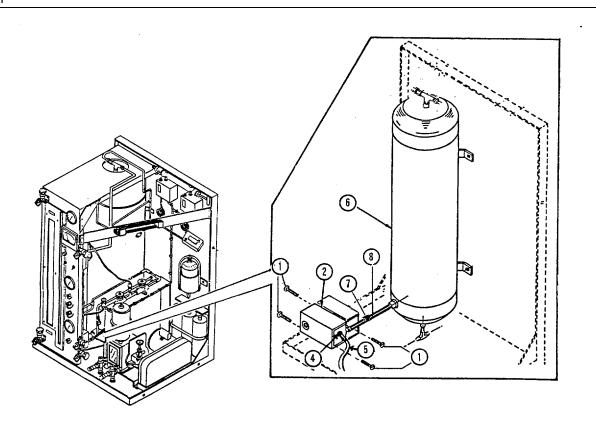


Figure 5-8. Heater

# a. Removal.

1. Drain and vent refrigerant charging system in accordance with paragraph 2-6.

- 2. Remove inner liner in accordance with Inner Liner Removal procedure, paragraph 4-45.
- 3. Remove instrument panel in accordance with Instrument Panel Removal procedures, paragraph 5-10.
- 4. Remove refrigerant fill line assembly in accordance with paragraph 4-48.
- 5. Remove two screws (1) securing heater cover (2) and remove cover.
- 6. Disconnect electrical wiring from terminals on heater control (3).
- 7. Loosen strain relief (4) and remove wiring harness (5).
- 8. Unscrew heater from refrigerant tank (6).
- 9. Remove coupling (7) and nipple (8).

- 1. Clean threads on coupling (7), nipple (8), and tank (6).
- 2. Apply two to three turns of Teflon tape to pipe threads of heater and nipple. Install nipple and coupling in tank.
- Thread heater into coupling. Tighten until there is less than 3 inches between edge of tank flange and rear of heater box.
- 4. Run wiring cable through strain relief (4) and secure.
- 5. Connect electrical wiring to terminals on heater control (3).
- 6. Install-heater cover (2) and secure with two screws (I).
- 7. Verify that heater thermostat is set to 140° F (60° C). Set as required.
- 8. Install Refrigerant Fill Line assembly in accordance with paragraph 4-48.
- Install instrument panel in accordance with Instrument Panel Installation procedures, paragraph 5-10.
- 10. Install inner liner in accordance with Inner Liner Installation procedure paragraph 4-45.

# 5-17. REFRIGERANT TANK REPLACEMENT

This task covers:

a. Removal b. Installation

# **INITIAL SETUP**

Equipment Condition

Tools Paragraph
Tool Kit, Refrigeration 2-6

Unit Service (Item 1, (Item 1, Appendix B)

4-45 Inner Liner removed.

Materials/Parts

Tape, Teflon 5-10 (Item 9, Appendix D)

Personnel Required

1

Condition Description

Refrigerant System

Instrument panel removed.

drained and vented.

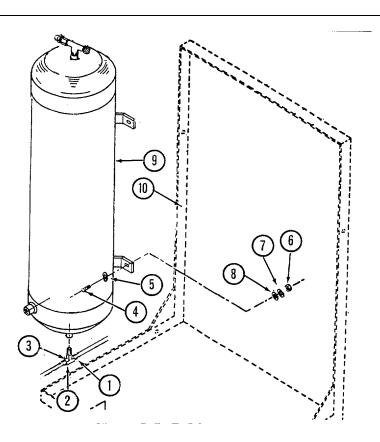


Figure 5-9 Refrigerator Tank

# a. Removal.

1. Drain and vent refrigerant charging system in accordance with paragraph 2-6.

- 2. Remove Inner Liner in accordance with Inner Liner Removal procedure, paragraph 4-45.
- 3. Remove Instrument Panel in accordance with Instrument Panel Removal procedure, paragraph 5-10.
- 4. Disconnect refrigerant charge and refrigerant fill line flare nuts (1, 2) from refrigerant tank lower tee (3).
- 5. Remove Heater in accordance with paragraph 5-16.
- 6. Remove four bolts (4), four flat washers (5), four nuts (6), four lockwashers (7), and four flat washers (8) securing tank (9) to rear panel of inner liner (10).
- 7. Remove Refrigerant Tank.

- 1. Install Refrigerant Tank (9) into inner liner (10). Secure to rear panel with four bolts (4), four flat washers (5), four flat washers (8), four lockwashers (7), and four nuts (6).
- 2. Install Heater in accordance with paragraph 5-16.
- 3. Connect refrigerant charge and refrigerant fill flare nuts (1,2) to refrigerant tank lower tee (3).
- 4. Install Instrument Panel in accordance with Instrument Panel Installation procedure, paragraph 5-10.
- 5. Install Inner Liner in accordance with Inner Liner Installation procedure, paragraph 4-45.
- 6. Connect power cord to power source or stow cord.

# 5-18. . VACUUM SOV REPLACEMENT

This task covers:

a. Removal

b.Installation

#### **INITIAL SETUP**

Equipment Condition

**Tools** 

Paragraph Paragraph Tool Kit, Refrigeration 4-45

Unit Service

(Item 1, Appendix B) 5-10

Materials/Parts

Paint, Green

Item 15, Appendix D)

Personnel Required

**Condition Description** Inner Liner removed

Instrument panel removed

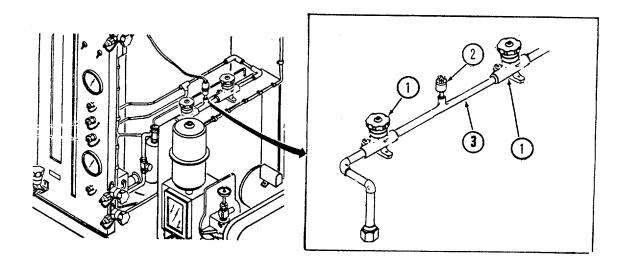


Figure 5-10. Vacuum SOVs

#### a. Removal.

- 1. Remove Vacuum System Tubing Assembly in accordance with paragraph 4-49.
- 2. Disassemble valve (1) in accordance with paragraph 4-35.
- 3. Note any angles of tube to be removed from joint.
- 4. Remove Transducer (2) from Vacuum System Tubing Assembly.

- 5. Using a properly adjusted oxy-acetylene torch, apply heat evenly around valve joint and tube.
- 6. When solder is free flowing, remove valve from tube (3).

# b. Installation.

- 1. Disassemble valve (1) in accordance with paragraph 4-35.
- 2. Install tube (3) in valve joint and turn to match any angle noted in step 3 of "Removal."
- 3. Braze valve/tubing joint in using grade 1 brazing alloy in accordance with local brazing procedures.

# NOTE

Grade 1 brazing alloy is 45% silver, 30% copper, and 25% zinc as specified by QQ-B-654A. This alloy is for copper to brass joints.

- 4. Allow tubing assembly to cool to touch.
- 5. Assemble valve in accordance with paragraph 4-35.
- 6. Touch up green paint on tubing assembly.
- 7. Install Transducer (2) in Vacuum System Tubing Assembly.
- 8. Install Vacuum System Tubing Assembly in accordance with paragraph 4-49.

# 5-19. VACUUM PUMP ASSEMBLY REPLACEMENT

This task covers:

a. Removal b. Installation

# **INITIAL SETUP**

Equipment Condition

Tools Paragraph
Tool Kit, Refrigeration 4-45

Unit Service

(Item 1, Appendix B)

Personnel Required

1

Condition Description
Inner Liner removed

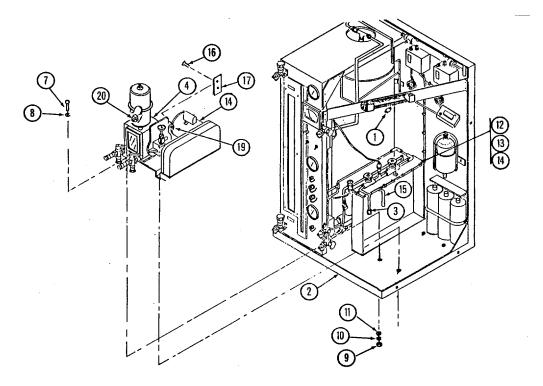


Figure 5-11. Vacuum Pump

# a. Removal.

- 1. Disconnect power cord (1) from power source.
- 2. Remove inner liner (2) in accordance with Inner Liner Removal procedure, paragraph 4-45.
- 3. Disconnect flare nut (3) from vacuum pump assembly (4).

- 4. Remove screws (12), lockwashers (13) and flat washers (14) securing harness (15) to vacuum valve bracket.
- 5. Remove four bolts (7), four flat washers (8), four nuts (9), four lockwashers (10), and four flat washers (11) securing vacuum pump assembly to base of inner liner.
- 6. Remove two screws (16) securing wire cover (17) on vacuum pump motor (18).
- 7. Disconnect electrical wires from vacuum pump motor wire.
- 8. Loosen strain relief (19) to remove cable harness (15).
- 9. Remove vacuum pump assembly from inner liner.
- 10. Remove nipple (20) from pump inlet. Cap vacuum pump inlet.

- 1. Wrap two or three turns of Teflon tape around pipe threads of vacuum pump nipple (2). Remove cap and secure nipple in vacuum pump inlet.
- 2. Route cable harness (15) through strain relief (19). Tighten strain relief.
- 3. Connect electrical wires to vacuum pump motor wires.
- 4. Install wire cover (17) and secure with two screws (16).
- 5. Secure vacuum pump assembly (4) to base of inner liner (2) with four bolts (7), four flat washers (8), four flat washers (11), four lockwashers (10), and four nuts (9).
- 6. Secure harness (15) with screw (12) flat washer (13) and lockwasher (14).
- 7. Connect flare nut (3) to vacuum pump assembly (4).
- 8. Install inner liner in cabinet in accordance with Inner Liner Installation procedure, paragraph 4-45.
- 9. Connect power cord to power source or stow.

5-20. VACUUM PUMP SERVICE AND REPAIR

This task covers:

a. Removal b. Installation

**INITIAL SETUP** 

Equipment Condition

Tools Paragraph

Tool Kit, Refrigeration 5-19

Unit Service

(Item 1, Appendix B)

**General Safety Instructions** 

Materials/Parts

Loctite cleaning in a well

(Item 17, Appendix D)

**Condition Description** 

Vacuum Pump removed

ventilated area

Perform solvent

(Compound, Vacuum Pump Sealing

(Item 18, Appendix D)

Personnel Required

1

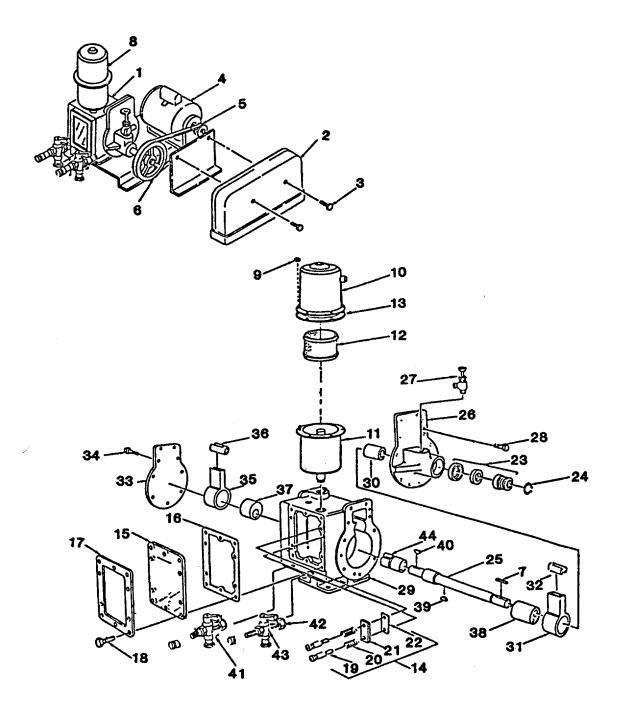


Figure 5-12. Vacuum Pump Breakdown

#### a. Disassembly

- 1. Remove vacuum pump assembly (I) in accordance with paragraph 5-19, Vacuum Pump Assembly Replacement.
- 2. Remove belt guard (2) by removing two screws (3).
- 3. Loosen motor mounting bolts and slide motor (4) towards vacuum pump (1).
- 4. Remove V-belt (5).
- 5. Remove vacuum pump pulley (6) and drive key (7).
- 6. Unscrew oil mist eliminator (8) from top of vacuum pump (1). Disassemble oil mist eliminator by removing nuts (9), and separating tank cover (10) from tank (11) and removing filter element (12) and gasket (13).
- 7. Remove discharge valve assembly (14) as follows
  - (a). Remove cylinder cover (15), gasket (16) and cylinder cover stiffener (17) by removing ten capscrews (18).
  - (b). Remove guide rods (19), discharge valve springs (20), discharge valve block (21), and discharge valve (22).

# **NOTE**

Be sure to observe disassembly sequence so discharge assembly (14) can be assembled correctly.

- 8. Remove shaft seal assembly (23) as follows:
  - (a). Remove shaft seal retaining ring (24) from shaft (25), then remove rotating portion of shaft seal from shaft.

### NOTE

Removal of the rotating portion of the shaft seal may require a heavy pull, especially if the unit is heat bonded to the shaft.

- (b). Remove stationary portion of shaft seal from open head (26).
- 9. Unscrew gas ballast valve (27) from open head (26).
- 10. Remove open head by removing nine capscrews (28.) then breaking the seal between open head and cylinder (29).
- 11. Press bearing (30) from open head.
- 12. Remove open head piston (31) and slide pin (32).

#### **NOTE**

Mark piston and slide pin so they can be assembled in the same position.

- 13. Remove closed head (33) by removing nine capscrews (34), then breaking the seal between closed head and cylinder.
- 14. Remove closed head piston (35) and slide pin (36).

#### **NOTE**

Mark piston and slide pin so they can be assembled in the same position.

- 15. Remove shaft (25) and cams (37, 38) as follows:
  - (a). Remove closed head cam (37). If required, tap shaft through cam using a lead mallet or hammer with wood block.
  - (b). Remove shaft with open head cam (38) attached.

#### **NOTE**

Do not remove open head cam unless replacement of shaft or cam is required. If cam removal is required, proceed to step c.

- (c). Press open head cam from shaft.
- (d). Remove open head cam key (39) and closed head cam key (40) from cylinder.
- 16. Unscrew oil drain valves (41), couplers (42), and nipples (43) from cylinder.
- 17. Press center wall bearing (44) from cylinder.

#### b. Inspection.

- 1. Visually inspect all metal parts for nicks, scratches, and corrosion.
- 2. Visually inspect threaded parts for crossed threads or otherwise damaged threads.
- 3. Visually inspect seating and mating surfaces for visible galling, excessive wear, corrosion or damage.
- 4. Check springs for distortion, corrosion, and evidence of permanent set.

# c. Cleaning

#### **WARNING**

DRY CLEANING SOLVENT IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA, FREE FROM SPARKS, FLAME OR HOT SURFACES. WEAR SPLASH GOGGLES, SOLVENT RESISTANT GLOVES, AND OTHER PROTECTIVE GEAR. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

- Clean outside of metal parts with solvent, wipe dry with clean lint-free cloth or dry using compressed air (10-15 psi maximum).
- 2. Dislodge stubborn accumulation of dirt and/or grime using soft bristle brush dampened with solvent. Wipe dry with clean lint-free cloth or dry using compressed air (10-15 psi maximum).
- 3. Remove stubborn accumulation of dirt and/or grime on parts/components using soft bristle brush dampened in solvent. Wipe dry with clean lint-free cloth or dry using compressed air (10-15 psi maximum).

#### d. Assembly.

#### **NOTE**

As the vacuum pump is assembled, coat the cylinder (25) and internal moving parts with oil, Mil-L-2105 to facilitate assembly and to insure that all parts are lubricated when the pump is first started.

- 1. Press tapered end of center wall bearing (44) into cylinder (29). Insure that 1/8-inch hole matches oil coring hole in cylinder, and 3/32-inch hole (groove) in bearing points toward closed head end of cylinder.
- 2. Install new bearing (30) in open head (26).
- 3. Install shaft (25) and cams (37, 38) as follows:
  - (a). Install cam key (39) and press open head cam (38) onto shaft (25). Use securing compound such as Loctite as required.
  - (b). Install shaft (25) into cylinder (29) through center wall bearing (44).
  - (c). Insert cam key (40) and tap closed head cam (37) onto shaft (25). Rotate shaft to check that cams (37, 38) do not bind on center wall.
- 4. Position piston (35) so that inlet ports in piston slide are facing away from discharge valve side of pump.

- 5. Install closed head slide pin (36) on piston (35) with flat side down and closed end of slide pin toward center wall.
- 6. Install piston (35) and slide pin (36) into pump.
- 7. Check that sealing faces of closed head (33) and cylinder (29) are clean and free of all sealant.

#### **CAUTION**

Use sealing compound sparingly. If too much or too thick an application is used, it will squeeze into the pump during assembly and cause the working parts to stick or clog the small oil ducts.

- 8. Carefully apply a thin coat of vacuum sealing compound to sealing surfaces of cylinder (29) and closed head (33).
- 9. Install closed head (33) on cylinder (29) and secure with nine capscrews (34).
- 10. Position open head piston (31) with inlet ports in piston slide facing away from discharge side of pump.
- 11. Install open head slide pin (32) on piston slide with flat side down and closed end towards center wall.
- 12. Install open head piston (31) and slide pin (32) into pump.
- 13. Check that open head end of cylinder and mating surfaces are both free of all sealing compound.

#### **CAUTION**

Use sealing compound sparingly. If too much or too thick an application is used, it will squeeze into the pump during assembly and cause the working parts to stick or clog the small oil ducts.

- 14. Apply thin coat of vacuum pump sealing compound to sealing surfaces of cylinder (29) and open head (26).
- 15. Install open head (26) on cylinder (29) and secure with nine capscrews (28).
- 16. Rotate shaft (25) to check that there is no binding.

## NOTE

If shaft (25) binds, a few gentle taps on either end will usually free it. If problem still exists, remove heads (26, 33) one at a time and correct problem.

- 17. Assemble shaft seal assembly (23) as follows:
  - (a). Apply light coat of oil to seat of shaft seal assembly (23).
  - (b). Install seat gasket on seat and carefully slide seat and gasket over shaft (20) into position on pump.
  - (c). Press in both pieces until they are seated uniformly against shoulder. Use extreme care to not damage gasket or mar face of seat.
  - (d). Coat rotating portion of shaft seal (face, shell, band, and friction ring) with oil. Cover retaining ring groove with plastic tape or fabricate a thin metal cover over the shaft.
  - (e). Coat shaft and cover with oil and carefully push rotating portion of shaft seal over shaft (25) using pipe sleeve or large washer. Use extreme care to avoid damaging seal face or cut the seal.
  - (f). Remove cover from shaft (25).
  - (g). Install spring and spring holder on shaft. Compress spring beyond retaining ring groove.
  - (h). Slide retaining ring (24) over shaft (25) until it snaps into its groove.
- 18. Assemble discharge valve assembly (14) by replacing discharge valve (22), valve block (21), valve springs (20), and guide rods (19) in the order they were removed.
- 19. Install gasket (16), cylinder cover (15), and cylinder cover stiffener (17). Secure with ten capscrews (18).
- 20. Install gas ballast valve (27) onto pump and tighten securely.
- 21. Assemble oil mist eliminator (8) by installing filter element (12) in tank (11) and securing tank cover (10) and gasket (13) to tank using nuts (9).
- 22. Install oil mist eliminator assembly (8) to top of pump and tighten securely.
- 23. Install oil drain valves (41), couplings (43), and nipples (42) into cylinder and tighten securely.
- 24. Install vacuum pump (1) onto base and secure with mounting bolts. Install drive key (7) and pump pulley (6).
- 25. Install V-belt (5) on pump and motor pulleys.
- 26. Tighten drive by moving motor (4) until belt will depress no more than it's own thickness under normal thumb pressure. Tighten motor mounting bolts.
- 27. Install belt guard (2) and secure with two screws (3).
- 28. Check that oil drain valves (41) are closed. Fill vacuum pump (1) in accordance with paragraph 4-36.

# 5-21. INPUT POWER CORD REPLACEMENT This task covers: a. Removal b. Installation INITIAL SETUP Equipment Condition Tools Paragraph Tool Kit, Refrigeration Unit Service (Item 1, Appendix B) Personnel Required

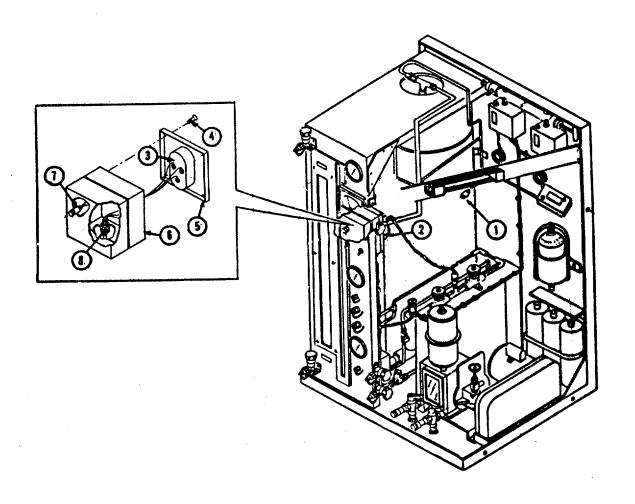


Figure 5-13. Power Cord

# a. Removal.

- 1. Disconnect power cord (1) from power source.
- 2. Disconnect vacuum gage power cord (2) from electrical outlet (3).
- 3. Remove two screws (4) and remove cover (5) from electrical outlet box (6).
- 4. Disconnect wires from terminals on electrical outlet and from terminals on fuseholder (7).
- 5. Loosen strain relief (8) then remove input power cord from electrical outlet box.

- 1. Route input power cord through strain relief (8).
- 2. Connect wires to terminals on fuseholder (7) and to terminals on electrical outlet (3).
- 3. Tighten strain relief.
- 4. Install cover (5) and secure with four screws (4).
- 5. Connect vacuum gage power cord plug (2) to electrical outlet.

5-22. WIRING HARNESS REPLA	CEMENT		
This task covers:			
a. Removal	b. Installation		
INITIAL SETUP Equipment			
Condition Tools Paragraph Tool Kit, Refrigeration Switches removed	d	Condition Description 4-22	Vacuum Pump and Heater
Unit Service (Item 1, Appendix B)		5-10	Instrument panel removed.
Personnel Required 1			

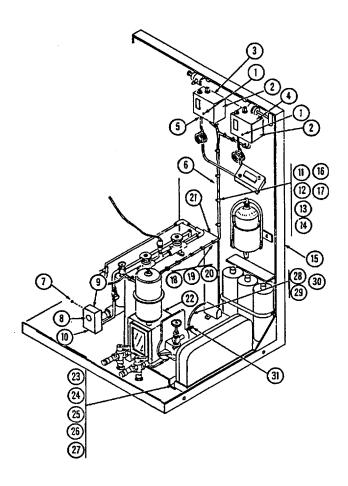


Figure 5-14. Wiring Harness

#### a. Removal.

- 1. Remove vacuum pump and heater switches in accordance with Vacuum Pump and Heater Switch Removal procedures, paragraph 4-22.
- 2. Remove instrument panel in accordance with Instrument Panel Removal procedures, paragraph 5-10.
- 3. Remove screws (1) and covers (2) from primary and secondary pressure switches (3, 4).
- 4. Disconnect wires from LINE and MI terminals of primary and secondary pressure switches.
- 5. Loosen strain relief (5) at each pressure switch. Remove wiring harness (6).
- 6. Remove two screws (7) and cover (8) from heater (9).
- 7. Disconnect wires from heater wires. Loosen strain relief (10) and remove wiring harness from heater.
- 8. Remove nuts (11), lockwashers (12), and flat washers (13), securing cable clamps (14) to inner liner (15).
- 9. Remove bolts (16), flat washers (17) and cable clamps from inner liner.
- 10. Remove bolts (18), lockwashers (19), and flat washers (20) securing cable clamps and wiring harness to vacuum valve bracket (21).
- 11. Disconnect flare nut from inlet fitting on top of vacuum pump assembly (22). Cap vacuum pump inlet fitting.
- 12. Remove four bolts (23), four flat washers (24), four nuts (25), four lockwashers (26), and four flat washers (27) from base of vacuum pump assembly.
- 13. Remove vacuum pump assembly from inner liner so that wire cover (28) on vacuum pump motor (29) is accessible.
- 14. Remove two screws (30) securing wire cover and remove cover.
- 15. Loosen strain relief (31).
- 16. Disconnect wires from vacuum pump motor wires and remove wiring harness.

- Install wiring harness (6) in inner liner (15).
- 2. Route wiring harness through strain relief (31) on vacuum pump motor (29).
- 3. Connect wires from wiring harness to vacuum pump motor wires.
- 4 Install cover (28) and secure cover to vacuum pump motor with two screws (30).

- 5. Install vacuum pump assembly (22) in inner liner and align holes in base of vacuum pump with holes in base of inner liner.
- 6. Secure vacuum pump assembly with four bolts (23), four flat washers (24), four flat washers (27), four lockwashers (26), and four nuts (25).
- 7. Remove cap from vacuum pump inlet fitting. Connect flare nut to inlet fitting of vacuum pump (22) and tighten.
- 8. Route wiring harness through strain relief (10) on heater (9).
- 9. Connect wiring to heater wires.
- 10. Install cover (8) on heater and secure with two screws (7).
- 11. Route wiring through strain relief (5) on pressure switches (3,4).
- 12. Connect wiring to pressure switch LINE and MI terminals.
- 13. Tighten strain relief at each pressure switch.
- 14. Install covers (2) on pressure switches and secure with screws (1).
- 15. Install wiring harness with cable clamps on vacuum valve bracket (21) and secure with flat washers (20), lockwashers (19) and bolts (18).
- 16. Install wiring harness with cable clamps on Inner Liner and secure with bolts (16), flat washers (17), flat washers (13), lockwashers (12) and nuts (11).
- 17. Install instrument panel in accordance with Instrument Panel Installation procedure, paragraph 5-10.
- 18. Install vacuum pump and heater switch in accordance with Vacuum Pump and Heater Switch Installation procedure, paragraph 4-22.

#### 5-23. TUBING ASSEMBLY REPAIR

This task covers:

a. Flared Assembly Repair

b. Brazed Assembly Repair

c. Color Code

#### **INITIAL SETUP**

Equipment Condition

Tools Paragraph
Tool Kit, Refrigeration

Condition Description

None

Unit Service (Item 1, Appendix B)

Materials/Parts

Coating, Epoxy, Polyamide

Items 12,13,14,15,16, Appendix D)

Personnel Required

1

#### **NOTE**

For tubing assemblies brazed to SOVs, see specific valve Replacement procedures.

# a. Flared Assemblies.

- 1. Duplicate bend angles and dimensions of original assembly.
- 2. Flare tubing according to the following:
  - (a). Vacuum, High, and Low Pressure ports 37°
  - (b). All other flares 45°

## b. Brazed Assemblies.

- 1. Note any angles of tube to be removed from joint.
- 2. Using a properly adjusted oxy-acetylene torch, apply heat evenly around circumference of tubing joint.
- 3. When solder is free flowing, remove tube from joint.
- 4. Allow to cool to the touch.
- 5. Duplicate bend angles and dimensions of original tube.
- 6. If required, flare tube according to instructions in "Flared Assemblies" above.
- 7. Prepare tube and tubing assembly for brazing.

- 8. Install tube in assembly and turn to match any angle noted in step 1.
- 9. Braze tubing joint using grade 3 brazing alloy in accordance with local brazing procedures.

# **NOTE**

Grade 3 brazing alloy is 15% silver, 80% copper, and 5% phosphorous as specified by QQ-B-654A. This alloy is for copper to copper joints.

# c. System Color Code.

All systems in the Service Unit are color coded. Tubing assemblies shall be painted according to Table 5-2.

Table 5-2. System Color Coding

CVCTEM	COLOR	FED STD FOR
SYSTEM	COLOR	FED. STD. 595
		COLOR NO
Refrigerant System	Orange	12473
Oil Metering System	Yellow	13538
Vacuum System	Green	14062
High Pressure Gage	Red	11105
Low Pressure Gage	Blue	15123

#### **APPENDIX A**

# **REFERENCES**

# A-1. SCOPE

This Appendix lists all forms, field manuals, technical manuals, miscellaneous publications, ARMY regulations, Military Specifications and Federal Standards referenced in this manual.

# A-2 FORMS

Equipment Inspection and Maintenance Worksheet	.DA FORM 2404
Hand Receipts DA FORM 2062	
Maintenance Request	.DA FORM 2407
Packing Improvement Report	.DD FORM 6
Quality Deficiency Report	.SF 368

# A-3. FIELD MANUALS

Artificial Respiration ......FM21-11

# A-4. TECHNICAL MANUALS

Leak Detector, Refrigerant Gas	TM 9-4940-435-14
Painting Instructions for Field Use	TM 43-0139
Procedures for Destruction of Equipment	
to Prevent Enemy Use	TM 750-244-3
Repair Parts and Special Tool List	TM 5-4130-236-23P

# A-5 MISCELLANEOUS PUBLICATIONS

The Army Maintenance Management System	(TAMMS) DA PAM 738-750
Solder, Silver Brazing	QQ-B-654A

# A-6. ARMY REGULATIONS

-HR Requisition AR-310-2

# A-7. MILITARY SPECIFICATIONS

Packaging MIL-R-3593C

#### A-8. FEDERAL STANDARDS

Colors FED.STD.595

## **APPENDIX B**

## MAINTENANCE ALLOCATION CHART

### Section I. INTRODUCTION

## B- 1. General

- a. The maintenance allocation chart identifies the maintenance operations that must be performed. It assigns each of those operations to the lowest level of maintenance authorized to perform the complete task, or any part of the task, in terms of availability of time, tools, test and support equipment, skills and employment of subsystem.
- b. The Maintenance Allocation Chart (MAC) in section II designates overall responsibility for the performance of maintenance functions for the Refrigeration System Service Unit, RTS-2.
- c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.
  - d. Section IV contains supplemental instructions on explanatory notes for a particular maintenance function.

### B-2. Maintenance Functions.

- a. <u>Inspect</u>. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.
- b. <u>Test.</u> To verify serviceability and detect incipient failure by measuring the mechanical and electrical characteristics of an item and comparing those characteristics with prescribed standards.
- c. <u>Service.</u> Operations required periodically to keep an item in proper operating condition i.e., to clean (decontaminate), preserve, drain, paint or replenish fuel, lubricants, hydraulic fluids, or compressed air supplied.
- d. <u>Adjust.</u> To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.
  - e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.
- f. <u>Calibrate.</u> To determine and cause correction to be made or to be adjusted on instruments or test, measuring and diagnostic equipment's used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

## **B-2.** Maintenance Functions (Continued)

- g. <u>Install</u>. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly in a manner to allow the proper functioning of an equipment or system.
- h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.
- i. Repair. The applications of maintenance services<sup>1</sup> or other maintenance actions<sup>2</sup> to restore serviceablility to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and items, or system.
- j. <u>Overhaul</u>. The maintenance effort (services/actions) necessary to restore an item to a completely servicable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publication. Overhaul is normally the highest level of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
- k. <u>Rebuild.</u> Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment's/components.

### B-3. Column Entries Use in the MAC.

- a . <u>Column 1. Group Number</u>. Column I lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.
- b. <u>Column 2. Component/Assembly</u>. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
- c. <u>Column 3. Maintenance Functions</u>. Column 3 lists the functions to be performed on the item listed on column 2. (For detailed explanation of these functions, see para. B-2.)

## d. Column 4. Maintenance Category.

(1) Column 4 specifies, by the listing of a "work time" figure in the appropriate sub-column(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function, at the indicated level of maintenance.

<sup>&</sup>lt;sup>1</sup>Services - inspect, test, service, adjust, align, calibrate, or replace.

<sup>&</sup>lt;sup>2</sup>Action - welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

### B-3. Column Entries in the MAC - Continued

- (2) If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate "work time" figures will be shown for each level. The number of man-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, e troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:
  - C Operator or crew
  - O Organizational maintenance
  - F Direct support maintenance
- e. <u>Column 5. Tools and Equipment</u>, Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.
- f. <u>Column 6.</u> Remarks. Column 6, when applicable, contains a letter code in alphabetical order which is keyed to the remarks contained in section IV.

## B-4. Column Entries Used in Tool and Test Equipment Requirements (Section III.)

- a. <u>Column 1. Tool or Test Equipment Reference Code</u>. The tool and test equipment code correlates with a code used in the MAC, section 11, column 5.
  - b. Column 2. Maintenance Category. The lowest level of maintenance authorized to use the tool or test equipment.
  - c. Column 3. Nomenclature. Name or identification of the tool or test equipment.
  - d. Column 4. National/NATO Stock Number. The National or NATO stock number of tool or test equipment.
  - e. Column 5. Tool Number, The manufacturer's part number.

## B-5. Explanation of Columns in Section IV.

- a. Reference Code. The code scheme recorded in column 1, section III.
- b. Remarks. This column lists information to the maintenance function being performed as indicated on the MAC, section II.

# **APPENDIX B**

(1) (2) (3) (4) (5) GROUP MAINTENANCE NUMBER COMPONENT/ASSEMBLY C O F 01 ACCESSORIES	(6) MAINTENANCE TO FUNCTION	OLS AND CATEGORY EQUIPMENT	REMARKS
0101 VACUUM HOSE, 1/2 inch id x 20 ft ig, 3/8 and 1/2 female (1) Replace	Inspect Test Repair	0.1 0.8 0.1 0.1	
0102 VACUUM HOSE, 1/2 inch id x 6 ft lg, 3/8 and 1/2 female (1) Replace	Inspect Test Repair	0.1 0.8 0.1 0.1	
0103 REFRIGERANT HOSE, 1/4 inch dia x 20 ft lg, 1/4 and 3/8 female (1) Replace	Inspect Test Repair	0.1 0.7 0.1 0.1	
0104 REFRIGERANT HOSE, 1/4 inch dia x 5 ft Ig, 1/4 and 3/8 female (2) Replace	Inspect Test Repair	0.1 0.7 0.1 0.1	
0105 REFRIGERANT HOSE, 1/4 inch dia x 3 ft Ig, 1/4 female (1) Replace	Inspect Test Repair	0.1 0.7 0.1 0.1	
0106 REFRIGERANT CHARGE, HOSE, 3/8 inch dia x 5 ft lg, 3/8Repair female (1) Replace	Inspect Test	0.1 0.7 0.1 0.1	
0107 EXTENSION CORD, 25 ft (1)Test Replace	Inspect 0.1	0.1 0.2	

(1) (2 GROUNUME C O	BER COMPONENT/ASSEMBLY	(6) MAINTENANCE TO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
0108	CENTRIFUGE TUBE (1)	Inspect Replace	0.1		
0109	OIL HANDPUMP (1)	Inspect Test Service Replace	0.1 0.5 0.2 0.1		
0110	VACUUM PUMP OIL (3 qt)	Inspect Replace	0.1		
0111	GASKET, 1/4 inch refrigerant hose (10)	Inspect Replace	0.1		
0112	GASKET, 3/8 inch refrigerant hose (10)	Inspect Replace	0.1		
0113	GASKET, 1/2 inch refrigerant hose (10)	Inspect Replace	0.1 0.1		
02 IN	ISTRUMENT PANEL				
0201	Metering Scale	Inspect Service Repair Replace	0.1 0.1 0.1 0.2		
0202	Refrigerant Metering Tube	Inspect Service Repair Replace	0.1 0.1 0.2 2.0		
0203	Oil Metering Tube	Inspect Service Repair Replace	0.1 0.1 0.1 0.5		
0204	Oil Vent Valve	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		

(1) (2) GROU NUMB C O	ER COMPONENT/ASSEMBLY	(6) MAINTENANCE TO FUNCTION	OOLS AND CATEGORY	EQUIPMENT	REMARKS
0205	Oil Fill and Charge Valve	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		
0206	Tank Press. Gage	Inspect Service Test Replace	0.1 0.1 0.9 0.4		
0207	Vacuum Gage	Inspect Service Test Replace	0.1 0.1 0.7 0.4		
0208	Vacuum Port	Inspect Service Replace	0.1 0.1 0.4		
0209	High Press. Gage	Inspect Service Test Replace	0.1 0.1 0.9 0.4		
0210	Low Press. Gage	Inspect Service Test Replace	0.1 0.1 0.9 0.4		
0211	High Press. Port	Inspect Service Replace	0.1 0.1 0.4		
0212	Low Press. Port	Inspect Service Replace	0.1 0.1 0.4		
0213	Vacuum Pump Switch	Inspect Test Repair Replace	0.1 0.1 0.1 0.8		

(1) (2) GROU NUMB C O	ER COMPONENT/ASSEMBLY	(6) MAINTENANCE TO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
0214	Heater Switch	Inspect Test Repair Replace	0.1 0.1 0.1 0.8		
0215	Electrical Outlet	Inspect Test Replace	0.1 0.1 0.8		
0216	Fuse Holder	Inspect Repair Replace	0.1 0.1 0.8		
0217	Instrument Panel	Inspect Service Repair Replace	0.1 0.2 0.2 2.0		
03	REFRIGERANT CHARGING SYSTEM				
0301	Press. Switch	Inspect Service Test Adjust Replace	0.1 0.1 0.6 0.8 1.5		
0302	Press. Switch	Inspect Service Test Adjust Replace	0.1 0.1 0.6 0.8 1.5		
0303	Relief Valve	Inspect Test Replace	0.1 0.3		
0304.	Refrigerant Vent Valve	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		

(1) (2) GROU NUMB C O	ER COMPONENT/ASSEMBLY	(6) MAINTENANCE TO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
0305	Refrigerant Fill Valve	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		
0306	Check Valve	Inspect Test Service Repair Replace	0.1 0.3 0.1 0.4 0.4		
0307	Filter/Dryer Moisture Indicator Replace	Inspect Service	0.1 0.1 1.2		
0308	Filter/Dryer Element	Inspect Service Replace	0.1 1.3 0.1		
0309	Check Valve	Inspect Test Service Repair Replace	0.1 0.3 0.1 0.4 0.4		
0310	Refrigerant Charg- ing Valve	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		
0311	Heater	Inspect Test Service Replace	0.1 0.2 0.1 2.5		
0312	Refrigerant Tank Replace	Inspect Service	0.1 1.5 2.7		

(1) (2) GROU NUMB C O	ER COMPONENT/ASSEMBLY	(6) MAINTENANCE TOO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
04	VACUUM SYSTEM				
0401	Press. Transducer	Inspect Test Service Replace	0.1 0.7 0.1 0.2		
0402	Vacuum Shutoff Valve VAC-	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		
0403	Vacuum Shutoff Valve VAC-2	Inspect Test Service Repair Replace	0.1 0.1 0.1 0.6 2.1		
0404	Vacuum Pump	Inspect Test Service Repair Replace	0.1 0.2 0.6 20.0 1.5		
05	ELECTRICAL				
0501	Input Power Cord	Inspect Test Replace	0.1 0.2 0.8		
0502	Wiring Harness	Inspect Service Repair Replace	0.1 0.1 0.2 3.4		
06	CABINET ASSEMBLY				
0601	Information Plate	Inspect Service Repair Replace	0.1 0.1 0.1 0.2		

(1) (2) GROU NUMB C O	ER COMPONENT/ASSEMBLY	(6) MAINTENANCE TO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
0602	Handles	Inspect Service Repair Replace	0.1 0.1 0.1 0.2		
0603	Cabinet Exterior	Inspect Service Replace	0.1 0.2 0.4		
0604	Door Fastener	Inspect Service Repair Replace	0.1 0.1 0.1 0.2		
0605	Door Hinge	Inspect Service Repair Replace	0.1 0.1 0.2 0.2		
0607	Door Gasket	Inspect Service Replace	0.1 0.2 0.4		
0608	Shock Mounts	Inspect Service Replace	0.1 0.2 1.0		
0609	Inner Liner	Inspect Service Replace	0.1 0.2 1.0		
0610	Pressure Equalizer	Inspect Service	0.1 0.1 0.2		
07	REFRIGERANT CHARGING SYSTEM TUBING	Replace	0.2		
0701	Refrigerant Pressure Line	Inspect Repair Replace	0.1 1.2 0.4		
0702	Refrigerant Vent Line Replace	Inspect Repair	0.1 1.2 0.		

` GROU NUMB		(6) MAINTENANCE TOO FUNCTION	OLS AND CATEGORY	EQUIPMENT	REMARKS
0703	Refrigerant Fill Line	Inspect Repair Replace	0.1 1.2 0.4		
0704	Refrigerant Charge Line	Inspect Repair Replace	0.1 1.2 0.4		
0705	Metering Tube Line	Inspect Repair Replace	0.1 1.2 0.4		
08	VACUUM SYSTEM TUBING ASSEMBLY Replace	Inspect Repair	0.1 1.2 0.4		
09	OIL METERING TUBING ASSEMBLY	Inspect Repair Replace	0.1 1.2 0.4		
10	HIGH PRESSURE GAUGE TUBING ASSEMBLY	Inspect Repair Replace	0.1 1.2 0.2		
11	LOW PRESSURE GAUGE TUBING ASSEMBLY	Inspect Repair Replace	0.1 1.2 0.2		

# SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

# FOR REFRIGERATION SYSTEM SERVICE UNIT RTS-2

TOOL EQUIP			NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER	
						<u>-</u> -
1	0	Tool Kit, Refriger- ation Unit Service	5180-00-596-1474			
2	0	Drill, Electric 5130-00-853-44 3/8" Chuck	80			
3	0	Vacuum Test Box	4920-00-140-5746			
4	0	Tester, Pneumatic Pressure	6685-00-252-6606			
5	0	Calibration Set 6695-01-053-93 Deadweight Pressure Std.	51			

### **APPENDIX C**

### COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

### **SECTION I. INTRODUCTION**

## C-1. SCOPE

This appendix lists components of end item and basic issue items for the Refrigeration Service Unit to help you inventory items required for safe and efficient operation.

### C-2. GENERAL

The components of End Item and Basic Issue Items Lists are divided into the following sections:

- a Section II. Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.
- b. Section III. Basic Issue Items. These are the minimum essential items required to place the Refrigeration Service Unit in operation, to operate it, and to perform emergency repairs. Although shipped separately packed, BII must be with the Refrigeration Service Unit during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to- identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

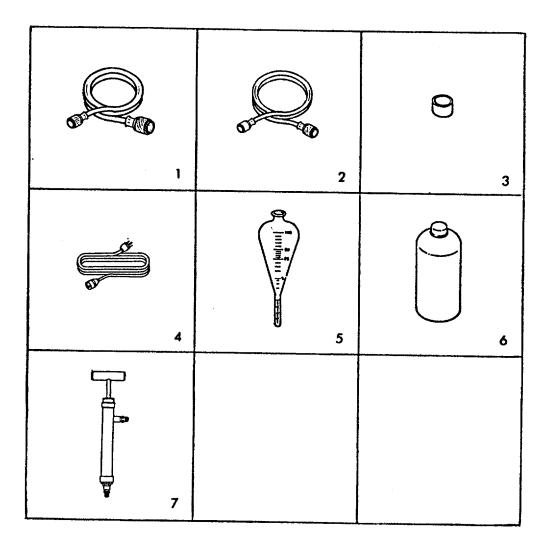
## C-3. EXPLANATION OF COLUMNS

The following provides an explanation of columns found in the tabular listings:

- a. Column (1) Illustration Number (Ills Number). This column indicates the number of the illustration in which the item is shown.
- b. Column (2) National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning purposes.
- c. Column (3) Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.
- d. Column (4) Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).
- e. Column (5) Quantity required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

# Section II. COMPONENTS OF END ITEM Not Applicable

# Section III. BASIC ISSUE ITEMS



(1) (2) (3) (4) (5)

	.TIONAL STOCK DESCRIPTION ER NUMBER FSCM AND PART NUMBER	२	QTY U/M	RQR
1	Hose, Vacuum 1/2" I.D.x20' 3/8"-1/2" female flare 11284, P/N C-240	ea	1	
1	Hose, Vacuum 1/2" I.D.x 6' 3/8"-1/2" female flare 11284, P/N C-72	ea	1	

2	4720-01-009-8585 Hose, Refrigerant, 1,	/4" I.D.	
	x20', 1/4-3/8" female flare		
	11284, P/N HB-240	ea	1
2	4720-01-008-3600 Hose, Refrigerant, 1,	/4" I.D.	
	x 5', 1/4"-3/8" female flare		
	11284, P/N HB-60	ea	2
	4720-01-007-8892 Hose, Refrigerant, 1,	/4" I.D.	
	_ 11284, P/N B-60	ea	1
3	5330-01-011-1528 Gasket, Refrigerant	Hose,	
	1/4" dia.		
	11284, P/N CH-20	ea	10
3	5330-01-064-7651 Gasket, Refrigerant	Hose,	
	3/8" dia.		
	11284, P/N CH-11	ea	10
3	5330-01-064-7650 Gasket, Refrigerant	Hose,	
	1/2" dia.		
	11284, P/N CH-80	ea	10
4	Cord, Extension, 15 feet		
	16428, P/N 17475S	ea	1
5	Tube, Centrifuge, 100 ml.		
	08219, P/N 45245	ea	1
6	9150-00-273-8663 Oil, Vacuum Pump		
	81349, P/N MIL-L-83767	qt.	3
7	Pump, Hand, Oil		
	05172, P/N 1751-1	ea	1

## **APPENDIX D**

## **EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST**

### **SECTION I. INTRODUCTION**

## D-1. SCOPE

This appendix lists expendable supplies and materials you will need to operate and maintain the Refrigerant System Service Unit. These items are authorized to you by CTA 50-970, Expendable items (Except Medical, Class V, Repair Parts, and Heraldic Items).

## D-2. EXPLANATION OF COLUMNS

- a. Column (1) Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. D").
  - b. Column (2) Level. This column identifies the lowest level of maintenance that requires the listed item.

(enter as applicable)

- C Operator/Crew
- 0 Organizational Maintenance
- F Direct Support Maintenance
- H General Support Maintenance
- c. Column (3) National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.
- d. Column (4) Description. Indicates the Federal item name and, if required, a description to identify the item. The last line of each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.
- e. Column (5) Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea. in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

# **SECTION II.**

# TABLE D-1. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

	(1)	(2) (3) (4)	(5)		
	EM JMB	NATIONAL STOCK ER LEVEL	NUMBER	DESCRIPTION	U/M
1	С	Soap			
2	С	Cloth, Cleaning			
3	0	Gasket, 1/4 inch	ea.		
4	0	Gasket, 3/8 inch	ea.		
5	0	Gasket, 1/2 inch	ea.		
6	0	Oil, Vacuum Pum	p qt.		
7	0	Gas Bottle, Refrig	erant		
8	0	Solvent, Dry Clear	ning		
9	0	Tape, Teflon			
		Prozina Alloy OO	D GEAN		

- 10 O Paper, Waterproof
- 11 O Tape, Waterproof
- 12 F Grade 1
- 13 F Grade 3
  - F Coating, Epoxy, Polyamide, MIL-C-22750

Brazing Alloy, QQ-B-654A

- 14 F Red #11105
- 15 F Blue #15123
- 16 F Yellow #13538
- 17 F Green #14062
- 18 F Orange #12473
- 19 F Locktite
- 20 F Compound, Vacuum Pump Sealing

# **APPENDIX E**

# **TORQUE LIMITS**

# **E-1. TORQUE LIMITS**

The following torque is applied with dry threads. For oiled bolts and nuts the torque required is approximately 30-40% less than that indicated in Table E-1.

# **TABLE E-1. TORQUE LIMITS**

Thread Size	e	Torque (FT-LBS.)		
1/4 - 20 2				
5/16- 18	4			
3/8- 16 7				
7/16- 14	12			
1/3- 13 19				

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By Order of the Secretary of the Army:

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

Official:

WILLIAM J. MEEHAN, II Brigadier General, United States Army The Adjutant General

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# RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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## The Metric System and Equivalents

### Linear Measure

## Liquid Measure

1	centimeter =	10	millimeters	<ul> <li>39 inch</li> </ul>
	- CELIUILIEUE -	- 10	111111111111111111111111111111111111111	55 111611

1 decimeter = 10 centimeters = 3.94 inches

1 meter = 10 decimeters = 39.37 inches

1 dekameter = 10 meters = 32.8 feet

1 hectometer = 10 dekameters = 328.08 feet

1 kilometer = 10 hectometers = 3,280.8 feet

## Weights

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

1 centiliter = 10 milliters = .34 fl. ounce

1 deciliter = 10 centiliters = 3.38 fl. ounces

1 liter = 10 deciliters = 33.81 fl. ounces

1 dekaliter = 10 liters = 2.64 gallons

1 hectoliter = 10 dekaliters = 26.42 gallons

1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

- 1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
- 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
- 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
- 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
- 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47
- 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

### **Cubic Measure**

- 1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
- 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
- 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## **Approximate Conversion Factors**

To changeTo Multiply b	y To change	То	Multiply by	
inches centimeters 2.540 feet meters .305 centimeters	ounce-inches inches	Newton-meters .394	.007062	
yards meters .914 meters	feet	3.280		
miles kilometers 1.609	meters	yards	1.094	
square inches square centimeters	6.451	kilometers	miles	.621
square feet square meters	.093	square centimeters	square inches	.155
square yards square meters	.836	square meters	square feet	10.764
square miles square kilometers	2.590	square meters	square yards	1.196
acres square hectometers	.405	square kilometers	square miles	.386
cubic feet cubic meters	.028	square hectometers	acres	2.471
cubic yards cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces milliliters	29,573	cubic meters	cubic yards	1.308
pints liters .473 milliliters	fluid ounces	.034		
quarts liters .946 liters	pints	2.113		
gallonsliters 3.785 liters	quarts	1.057		
ouncesgrams 28.349	liters	gallons	.264	
pounds kilograms .454	grams	ounces	.035	
short tons metric tons	.907	kilograms	pounds	2.205
pound-feet Newton-meters	1.356	metric tons	short tons	1.102
pound-inches Newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	$^{\circ}C$
	temperature	subtracting 32)	temperature	

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