D E P A R T M E N T O F T H E A R M Y T E C H N I C A L M A N U A L

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST)

SERVICE UNIT, REFRIGERATION SYSTEM (MUST)
(AIRESEARCH MODEL 909228-1-1)
FSN 4130-473-9787

H E A D Q U A R T E R S , D E P A R T M E N T O F T H E A R M Y

27 DECEMBER 1974

WARNING

Exercise care when flushing or cleaning parts with refrigerant to prevent refrigerant from getting in the eyes or permanent damage to the eyes may result.

WARNING

Exercise care in disconnecting hose assembly from refrigerant bottle and valve to prevent refrigerant from getting in the eyes or permanent damage to the eyes may result.

WARNING

Do not hold centrifuge tube by the stem; hold with gloves or cloth to protect hands from cold refrigerant.

WARNING

Before working inside the equipment, turn power off and ground points of high voltage before touching them.

TECHNICAL MANUAL 1
NO. 5-4130-234-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *27 December 1974*

OPERATOR, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST) SERVICE UNIT, REFRIGERATION SYSTEM (MUST) (AIRESEARCH MODEL 909228-1-1) FSN 4130-473-9787

CURRENT AS OF *30 OCTOBER* 1974

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope
This manual is for your use in operating and maintaining the Refrigeration System Service Unit (AiResearch Model 909228-1-1) manufactured by AiResearch Manufacturing Company.

1-2. Maintenance Forms and Records
Maintenance forms and records in the (2400 Series) you are required to use are explained in TM 38-750.

1-3. Reporting of Errors
You can improve this manual by calling attention to errors and by recommending improvements, using DA Form 2028 (Recommended Changes to Publications), or by a letter, and mail directly to the Commander, U.S. Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, Missouri 63120. A reply will be furnished directly to you.

1-4. Equipment Serviceable Criteria (ESC)
This equipment is not covered by an ESC.

1-5. Destruction of Army Material to Prevent Enemy Use
a. Destruction of Refrigeration Equipment.

(1) Mechanical. Using an axe, nick 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.

1-6. Administrative Storage
Preparation, care and removal of equipment in administrative storage will be in accordance with the applicable requirements of TM 740-90-1 (Administrative Storage of Equipment).

Section II. DESCRIPTION AND DATA

1-7. Description
The Refrigeration System Service unit (figure 1-1) is contained in a steel cabinet, which is sealed against inclement weather conditions. The cabinet is equipped with shock isolator leg pads and tie-down provisions for transportation.

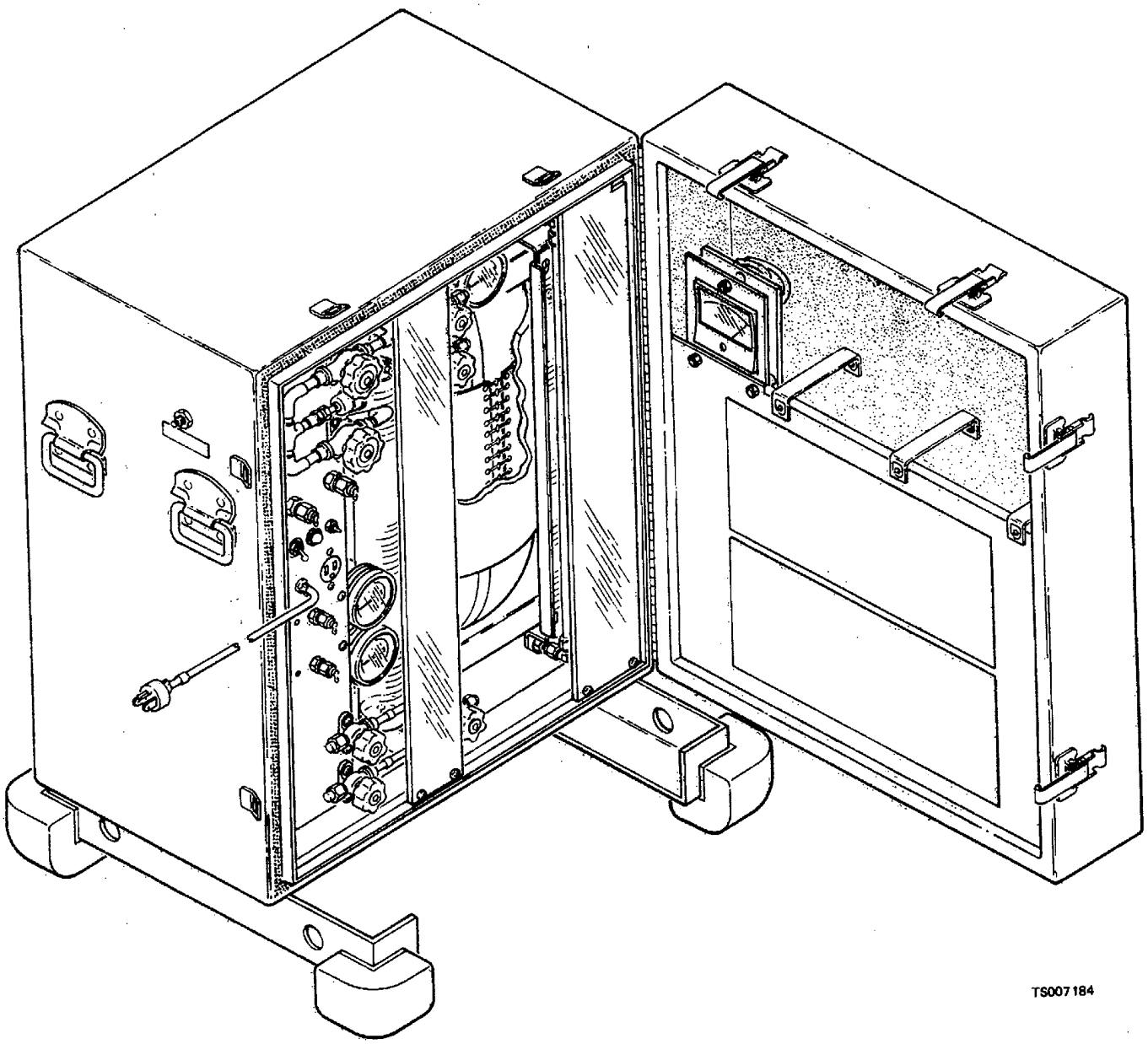


Figure 1-1. Refrigeration system service unit

1-8. Differences in Models

This manual covers the AiResearch Unit, Refrigeration System (MUST). No known unit differences exist for the model covered in this manual.

1-9. Tabulated Data

Electrical Requirements .....115-vac 60 Hz single phase 15 amp
Refrigerant Capacity .....95 lb refrigerant 114 (Federal Specification BBF-1421)
Envelope Dimensions ..... 30.25 in. X 26.00 in. X 37.75 in. (approx)
Location of Plates and Decal:
Service Unit
- Identification Plate ..... outside of cabinet door
- Warning Decal ..... adjacent to pressure equalizer valve on the side of cabinet
- Electrical and Fluid Schematic . ..... inside cabinet door
- Operating Instruction Plate ... inside cabinet door

Weight (Dry) .... 265 lb (max)

CHAPTER 2

OPERATING INSTRUCTIONS

NOTE

If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

2-1. General

a. The service unit has five modes of operations: filling the service unit reservoir, leak checking a refrigeration system, evaluation of a refrigeration system, charging a refrigeration system with oil, and charging a refrigeration system with refrigerant. A brief theory of operation for each mode of operation is presented in the following paragraphs. (See fig. 2-1 and 2-2.)

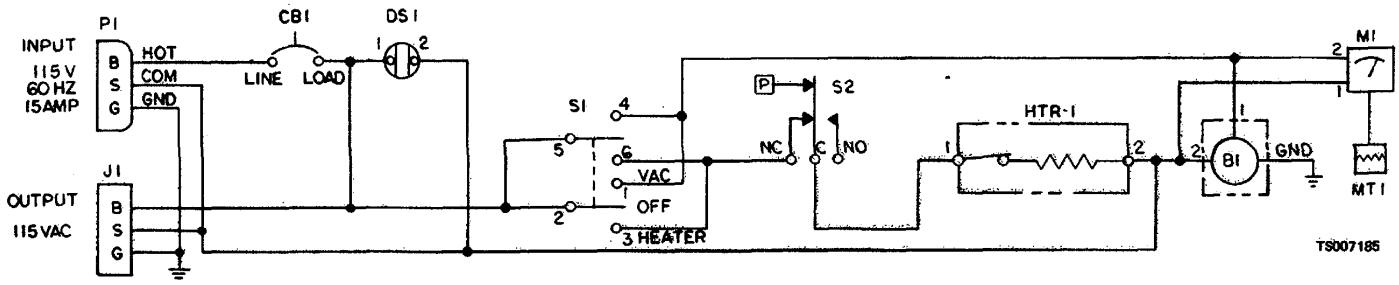


Figure 2-1. Electrical schematic

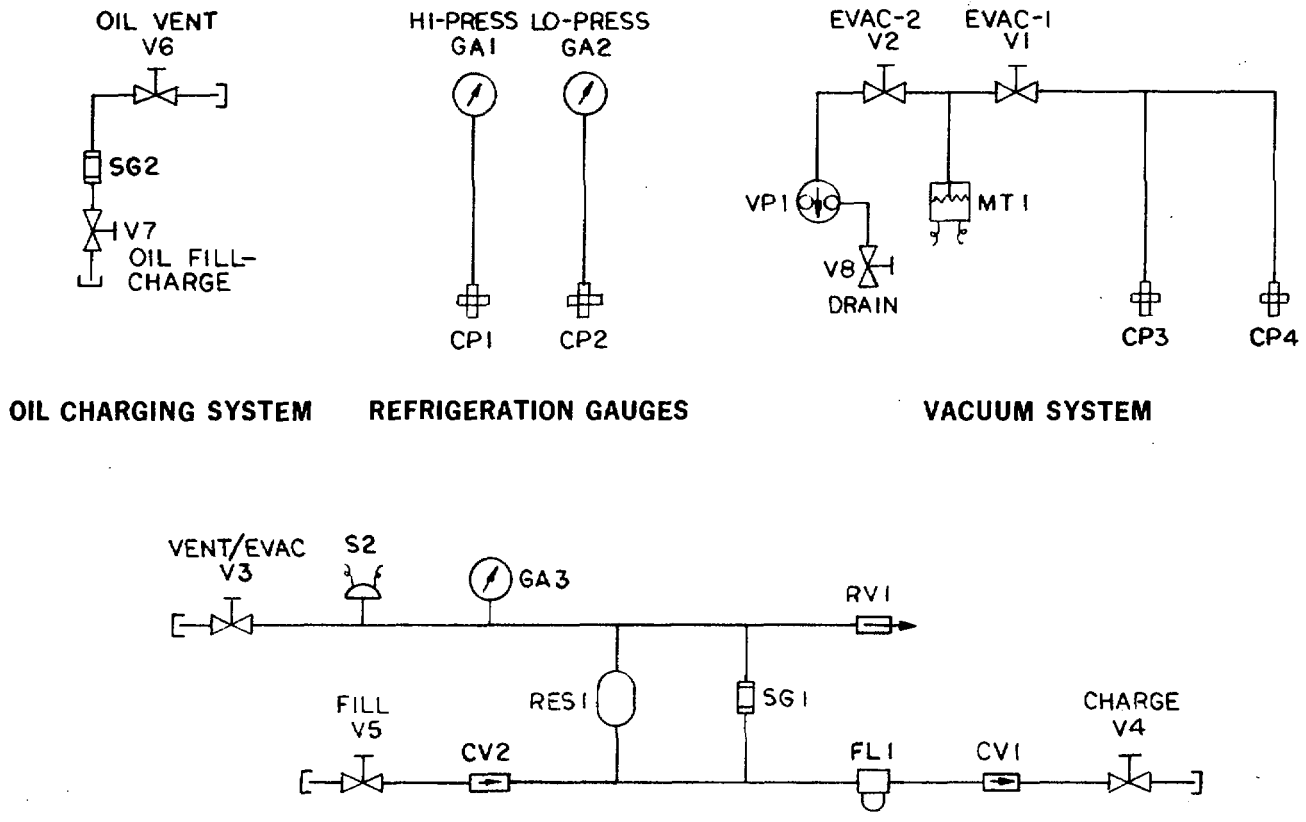


Figure 2-2. Fluid Schematic

b. Filling the Service Unit Reservoir: The service unit fluid system is first vented to atmosphere to relieve any pressure buildup from any refrigerant left in the fluid system. The fluid system is then evacuated to check for leakage. A bottle of refrigerant is connected to the FILL connection, the valve on the refrigerant bottle is opened, the FILL valve is opened, and the VENT/EVAC valve is carefully controlled to allow the reservoir to fill by venting the pressure buildup in the reservoir to atmosphere. When the reservoir is full, all valves are closed, hoses disconnected, and fittings capped.

c. Leakage Checking Refrigeration System: The refrigeration system is first pressurized to approximately 15 psig with nitrogen. The refrigeration system charge valve is connected to the service unit LOW PRESS gage and the refrigeration system charge valve is opened. The pressure indicated on the low pressure gage is monitored for rapid decay. If pressure decays rapidly, the leak detector, furnished with the

service unit, is connected to the service unit 115 OUTPUT connection, and leaks are isolated, using the leak detector.

d. Evacuation of a Refrigeration System: The refrigeration system suction and receiver valves are opened and the system is purged with dry nitrogen to remove any contaminants. Vacuum hoses are attached to the suction and receiver valves and to the EVAC fittings on the service unit. The system is then evacuated to 200 microns, as monitored on the service unit vacuum gage, for two hours. At the end of two hours evacuation, suction and receiver valves are closed, retaining vacuum in the system: then the vacuum pump is shut off and hoses disconnected. It is now necessary to proceed directly to system oil and refrigerant charging operation.

e. Charging Refrigeration System with Oil: The hose assembly, furnished with the service unit, is loosely connected to the refrigeration system receiver valve. Air is purged from the graduated oil fill beaker, using oil used in the refrigeration system; then the line is tightened on the receiver valve. The breaker is then filled with enough oil to charge the refrigeration system and have enough oil left over to prevent air from entering the system. The receiver valve is then closed and the hose assembly disconnected.

f. Charging a Refrigeration System with Refrigerant: To charge a refrigeration system with refrigerant, the service unit CHARGE fitting is loosely connected to the refrigeration system receiver valve with a charge hose, and the charge hose is purged with refrigerant and tightened on the receiver valve connection. The other fittings in the fluid system of the service unit are capped and the valves in the fluid system are closed during this operation. After connecting the hose between the service unit CHARGE fitting and the refrigeration system receiver valve, the heater surrounding the service unit reservoir is turned on, heating the refrigerant and causing it to expand, increasing the pressure within the reservoir. When the pressure in the reservoir has stabilized at approximately 65 psig, the hose is purged and tightened at the receiver valve. The CHARGE valve is opened; then closed. The quantity of refrigerant contained in the reservoir is noted. The receiver valve is opened and the service unit CHARGE valve is controlled to allow the required amount of refrigerant to enter the refrigeration system, as noted on the service unit reservoir sight scale. When the proper amount of refrigerant has entered the refrigeration system, the service unit CHARGE valve is closed; then the receiver valve is closed and the hose is disconnected. The refrigeration system is now ready for operation.

Section I. OPERATING PROCEDURES

2-2. Preliminary Operating Procedures (See fig. 2-3 and table 2-1.)

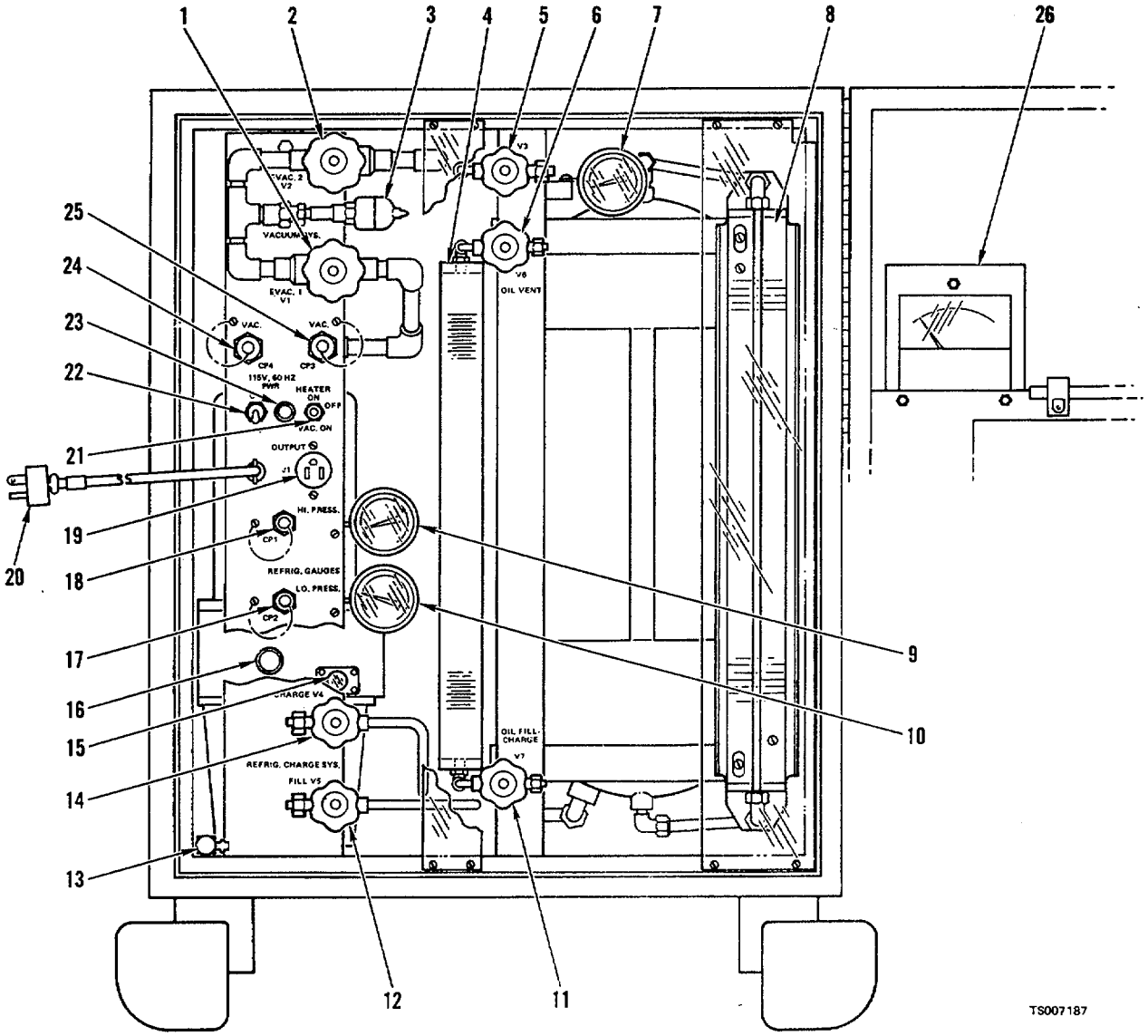


Figure 2-3. Controls, indicators, and connectors

a. Before connecting connector (20) to electrical source, make certain that circuit breaker 122) and switch /21) are OFF.

b Check vacuum pump oil level at glass disk (15). Oil level must be maintained within sight of glass disk. Oil level will indicate higher while pump is running.

Table 2-1. Functions of Controls, Indicators, and Connections

Index No. (Fig. 2-3)	Panel Marking and/or Reference Designation	Control, Indicator or Connection	Function
1	EVAC 1 V1	Valve	To control vacuum at unions CP3 and CP4.
2	EVAC2 V2	Valve	To control vacuum at vacuum pump.
3	MT1	Thermistor	Combination heater and thermocouple sensing element to provide signal to gage M1.
4	SG2	Beaker	Scale on beaker displays quantity of refrigeration oil
5	VENT/EVAC V3	Valve	To control ventilation or evacuation of reservoir.
6	OIL VENT V6	Valve	To control vent for refrigeration oil in beaker.
7	GA3	Gage	Measures pressure contained in reservoir.

Table 2-1 Functions of Controls, Indicators, and Connections (cont)

Index No. (Fig. 2-3)	Panel Marking and/ or Reference Designation	Control, Indicator or Connection	Function
8	SG1	Scale	Displays quantity of refrigerant in reservoir.
9	REFRIG. GAUGE GA1	Gage	Measures high pressure.
10	REFRIG. GAUGE GA2	Gage	Measures low pressure.
11	OIL FILL-CHARGE V7	Valve	To control refrigeration oil from beaker.
12	REFRIG. CHARGE SYS FILL V5	Valve	To control filing of refrigerant reservoir.
13	V8	Valve	To provide vacuum pump oil dram.
14	REFRIG. CHARGE SYS V4	Valve	To control charging of refrigeration system with refrigerant.
15	---	Glass Disk	To provide oil level indication for vacuum pump.
16	---	Vented-Exhaust	Valve To provide vent for vacuum pump.
17	LOW PRESS CP2	Union	To connect gage GA2 to a pressure source.
18	HI PRESS CP1	Union	To connect gage GA1 to a pressure source.
19	OUTPUT J1	Connector	Provides electrical connection for leak detector.
20	PI	Connector	Provides for connection of service unit to electric source.
21	HEATER ON OFF VAC ON S1	Switch	Selects reservoir heater or vacuum pump for operation.
22	115 V 60 HZ PWR ON-OFF CB1	Circuit Breaker	Controls electrical power to service unit.
23	115 V 60 HZ PWR,	Lamp	Indicates electrical power is applied to service unit, when lit.
24	VAC CP4	Union	To connect refrigeration system to vacuum system.
25	VAC CP3	Union	To connect refrigeration system to vacuum system.
26	M1	Gage	Measures vacuum pressure from sensing element of thermistor MT1.

c. Check that vacuum pump exhaust valve (16) is finger torqued to closed (clockwise).

d. Close valve 113. Set circuit breaker (22) to ON: lamp (231 must light. Set switch (21) to VAC ON and observe gage (26) to make certain system will evacuate to 50 microns.

e. Set switch (21) and circuit breaker (22) to OFF.

WARNING

Exercise care when flushing or cleaning parts with refrigerant to prevent refrigerant from getting in the eyes or permanent damage to the eyes may result.

f. Make certain all hose assemblies and lines are free from contamination. If any doubt exists as to the cleanliness of hose assemblies and lines, flush each part with refrigerant before connection to service unit of refrigeration system.

NOTE

Since there are five basic modes of operation of the service unit and each modes is not necessarily dependent on the others, operating instructions for each mode are presented separately. See plate (182, fig. 5-2) for operating instructions and figures 2-1 and 2-2 for electrical and fluid schematics. See figure 2-3 for controls, indicators, and connections and table 2-1 for their functions

2-3. Filling Reservoir with Refrigerant

NOTE

When reservoir is partially full omit steps a and b and proceed directly to step c.

a. Vent reservoir by uncapping and opening valves (5, 12, 14, fig. 2-3).

b. Evacuate reservoir and lines as follows:

(1) Cap union (25).

(2) Connect hose assembly (8, fig. 2-4) with gaskets (2, 3) between union (24, fig. 2-3) and valve (5).

(3) Open valves (1, 2).

(4) Close and cap valves (12, 14).

(5) Set circuit breaker (22) to ON and switch (21) to VAC ON. Evacuate system to 200 microns as indicated on gage (26).

(6) Close valve (5) and set switch (21) to OFF.

c. Warm or elevate liquid refrigerant bottle (Type F114, Federal Specification BB-F-1421)) to expedite filling.

d. Remove hose assembly between union (24) and valve (5), and remove cap from valve (12).

e. Loosely connect hose assembly (5, fig. 2-4) with gaskets (3) to valve (12. fig. 2-3) and connect other end of hose assembly to the inverted refrigerant bottle.

Key to fig. 2-4:

1. Cable Assembly
2. Gasket
3. Gasket
4. Gasket
5. Hose Assembly
6. Hose Assembly
7. Hose Assembly
8. Hose Assembly
9. Hose Assembly
10. Tube, Centrifuge
11 Detector, Leak
12. Oil
13. Pump, Oil

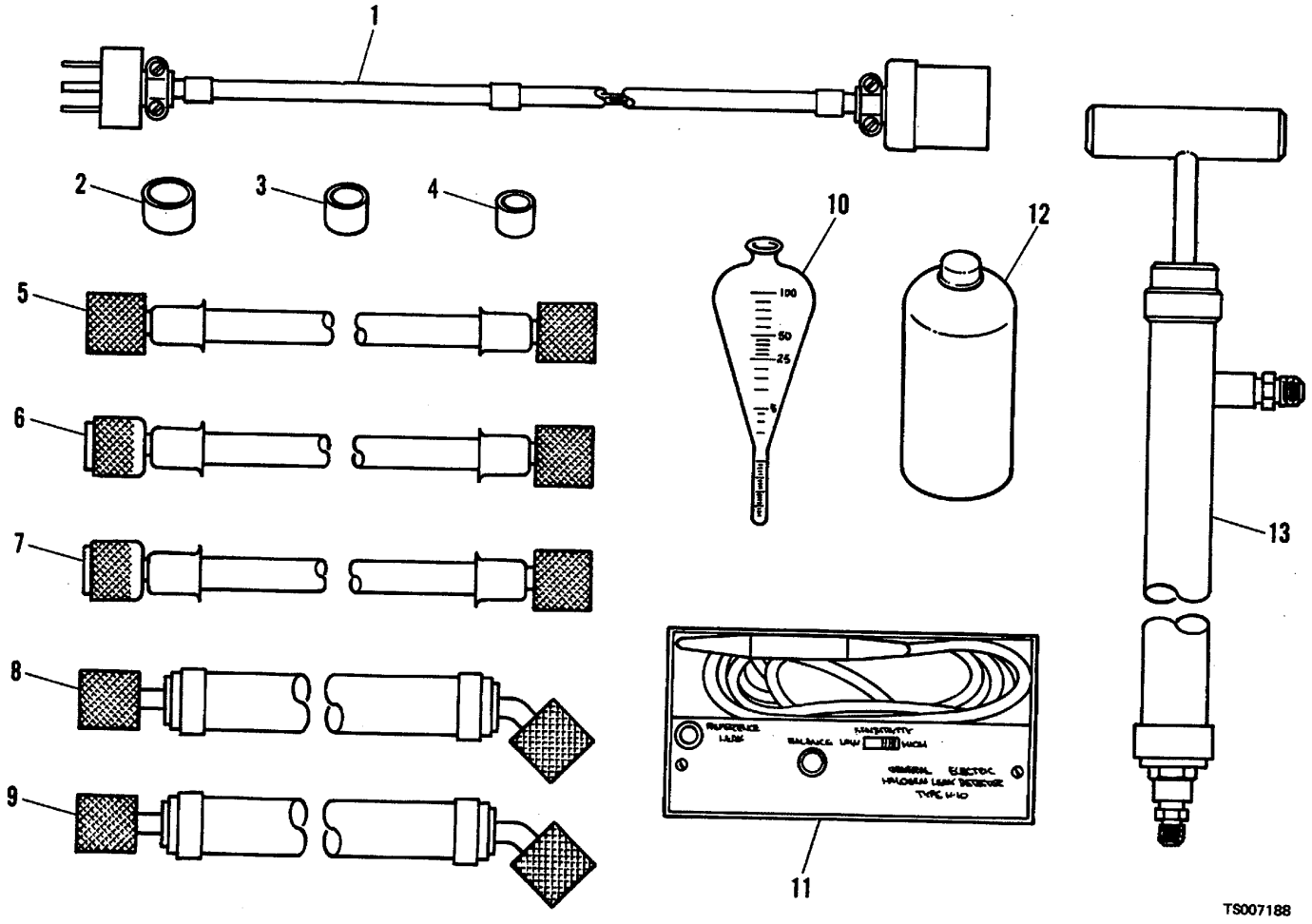


Figure 2-4 Auxiliary equipment

f. Crack the refrigerant bottle valve to purge the hose assembly of air, then tighten hose assembly fitting on valve (12).

g. Open valve (12) and refrigerant bottle valve.

h. Fill reservoir to desired level as indicated on scale (8); slowly open valve (5) as required to expedite filling.

WARNING

Exercise care in disconnecting hose assembly from refrigerant bottle and valve to prevent refrigerant from getting in the eyes or permanent damage to the eyes may result.

i. Close valves (5, 12) and refrigerant bottle valve. Disconnect hose assembly and cap valves (5, 12).

2-4. Leak Checking Refrigeration System

a. Pressurize refrigeration system to approximately 15 psig, using dry nitrogen and refrigerant or refrigerant.

b. Connect refrigeration system charge valve to union (18), using hose assembly (6, fig. 2-4) with gaskets (3, 4).

c. Connect leak detector (11) to connector (19, fig. 2-3).

d. Ventilate area -of refrigeration system to be leak-checked.

e. If leak detector is being used for the first time, remove and discard screw from cap of REFERENCE LEAK bottle and allow REFERENCE LEAK to stabilize for 15 minutes. Make certain REFERENCE LEAK bottle contains a quantity of refrigerant, as observed through window in chassis.

f. Point probe of leak detector toward floor and observe airflow ball, located in probe; ball must rise and float above tip of probe. If ball fails to rise, tap probe lightly to make certain ball is not stuck.

g. Set leak detector SENSITIVITY switch to LOW (used when element is new and when detecting large leaks), place tip of probe close to opening in REF LEAK cap, and adjust BALANCE control until neon lamp in probe just ceases flashing.

h. Hold leak detector probe as close as possible to the area being checked and move the tip at a rate no greater than one inch per second along seams and joints suspected of leakage. When the probe encounters a leak, the flashing rate of the neon lamp will increase and will continue to flash at the faster rate as long as the probe is held near the leak.

2-5. Evacuation of Refrigeration System

a. Open suction and receiver valves of the refrigeration system and purge system with dry nitrogen.

b. Connect hose assembly (8, fig. 2-4) with gaskets (2, 3) between refrigeration system receiver valve and valve (14, fig. 2-3).

c. Connect hose assembly (9, fig. 2-4) with gaskets (2, 3) between refrigeration system suction valve and union (24, fig. 2-3).

d. Open refrigeration system receiver and suction valves, and open valves (1, 2).

e. Set circuit breaker (22) to ON and switch (21) to VAC ON.

NOTE

Application of heat to refrigeration system will expedite evacuation.

f. Evacuate refrigeration system for two hours to 200 microns or lower as indicated on gage (26).

NOTE

To determine level of vacuum in refrigeration system, close valve (2) and observe indication of gage (26).

g. At end of the two hour evacuation period, close refrigeration system suction and receiver valves. Set switch (21) and circuit breaker (22) to OFF.

h. Remove hose assemblies and proceed directly to charging refrigeration system with oil or charging refrigeration system with refrigerant.

2-6. Charging Refrigeration System with OIL

CAUTION

Use care in storage and handling of refrigeration oil to prevent absorption of moisture and other atmospheric contaminants.

a. Uncap and open valve 16).

b. Open valves (1, 2), cap union (25), and uncap union (24).

c. Connect hose assembly (6, fig. 2-4) between union (24, fig. 2-3) and valve (6), using a 1/2 X 3/8 inch reducer on union (24).

d. Cap and close valve (11).

e. Connect hose assembly (6, fig. 2-4) with gaskets 13, 4) between valve (11, fig. 2-3) and container filled with refrigeration oil.

f. Set circuit breaker (22) to ON and switch (21) to VAC ON.

g. Observe gage (26) until reading is slightly below 1000 microns; then close valve (1). Slowly open valve (11) and observe scale on beaker (4) until oil level reaches 1000 ML graduation. Close valves (6, 11).

h. Set switch (21) and circuit breaker to OFF.

i. Disconnect hose assemblies from oil container and union (24), and open valve (6).

j. Loosely connect other end of hose assembly from valve (11) to refrigeration system receiver valve.

k. Slowly open valve (11) until oil starts leaking from refrigeration system receiver valve, then tighten fitting on hose assembly and crack receiver valve.

I. Open refrigeration system receiver valve and charge system with oil from beaker (4).

m. Close refrigeration system receiver valve and valve (11). Remove hose assemblies and proceed to refrigerant charging procedure.

2-7. Charging Refrigeration System with Refrigerant

a. Set circuit breaker (22) to ON and switch (21) to HEATER ON.

b. Cap and close valves (5, 12).

c. Close valve (14) and connect hose assembly (5, fig. 2-4) with gaskets (3) to valve (14, fig. 2-3).

d. Close refrigeration system receiver valve and connect other end of hose assembly loosely on receiver valve.

e. Allow pressure to stabilize at 59 to 69 psig as indicated on gage (7).

f. Crack valve (14) to purge air from hose assembly; then tighten fitting on hose assembly at receiver valve.

g. Open valve (14) fully and note liquid level on scale (8). Open receiver valve fully to charge refrigeration system with specified amount refrigerant as measured on scale (8).

h. Close valve (14), then close refrigeration system receiver valve.

WARNING

Exercise care in disconnecting hose assembly from service unit and from receiver valve to prevent refrigerant from getting in the eyes or permanent damage to the eyes may result.

i. Remove hose assembly and recap and close valve (14).

2-8. Checking Oil Quantity in Refrigeration System

a. Operate refrigeration system for 15 minutes to mix refrigerant thoroughly with the oil.

b. Connect charge line to service valve on refrigeration system receiver.

WARNING

Do not hold centrifuge tube by the stem; hold with gloves or cloth to protect hands from cold refrigerant.

c. Open service valve and direct flow of refrigerant-oil mixture into centrifuge tube (10, fig. 2-4).

d. Close service valve when level in centrifuge tube reaches 100 cc.

e. Place centrifuge tube in a warm area and allow liquid refrigerant to boil off.

f. Oil remaining in centrifuge tube should read at a specific quantity.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-9. Auxilliary Equipment

List of auxiliary equipment which is part of the end item is shown in figure 2-4. Operation of the auxiliary equipment is incorporated in Section I.

CHAPTER 3

OPERATOR/ CREW MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. General

Lubrication of the service unit consists of filling, changing, and flushing the vacuum pump oil.

3-2. Fill vacuum pump oil as follows:

NOTE

The oil level indication through glass disk (7, fig. 6 11 will be slightly higher with the pump running than when pump is stopped. Overfilling the pump above glass disk level will tend to create splashing during the passage of free air through the pump.

a. Remove cap (12) and using oil (12, fig. 5-2), fill pump to indicate on bottom of glass disk. Replace cap.

3-3. Flush and charge vacuum pump oil as follows:

NOTE

Oil will drain more easily if oil is warm. To accelerate draining, operate vacuum pump in accordance with Chapter 2 to warm oil.

a. Place a container, of at least one-half gallon capacity, under valve (30, fig. 5-2).

b. Stop vacuum pump, and open valve (30) to drain oil.

CAUTION

Do not completely close exhaust valve (3, fig. 6-1); undue pressure will be built up within pump.

c. To accelerate oil draining, operate vacuum pump and partially cover exhaust valve (3) with finger. After completion of oil draining, stop vacuum pump and close valve (30, fig. 5-2).

CAUTION

Do not use solvents or light flushing oils. Their complete removal is difficult and their higher vapor pressure will prevent the attainment of a good vacuum.

d. To flush the vacuum pump, remove cap (12, fig. 6-1) and pour 3 to 4 ounces of clean oil from container (12, fig. 5-2). Leave exhaust valve port open and operate vacuum pump for a short period to completely circulate the new oil. Open valve (30) to drain and force out residue.

e. Repeat flushing procedure until flushing oil remains clean and free from discoloration and foreign matter. Stop vacuum pump and close valve (3, fig. 6-1).

f. Remove cap (12) and using oil from container (12, fig. 5-2), fill vacuum pump to indicate on bottom of glass disk. Replace cap.

g. Start vacuum pump. A gurgling noise is characteristic when high pressure air is drawn through vacuum pump. Noise should disappear quickly as the intake pressure is reduced. If vacuum pump continued to gurgle, the oil level may be too low. Add oil until glass disk indicates proper level. Oil level must be maintained within the limits of glass disk, with the vacuum pump running.

Section II. OPERATOR/ CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-4. General

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

3-5. Preventive Maintenance Checks and Services

The operator/crew preventive checks and services are listed in table 3-1.

Section III. TROUBLESHOOTING

3-6. General

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

3-7. Malfunctions

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

3-8. Troubleshooting Refer to table 3-2 for troubleshooting information.

NOTE

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

Table 3-1. Operator/Crew Preventive Maintenance Cheeks and Services

B - Before Operation Time required: 1.6			D - During Operation	A - After Operation Time required	
Interval and Sequence No. B	D	A	Item to be Inspected Procedure		Work Time (M H) 1.6
1	6		VACUUM PUMP		
			Inspect pump oil through glass disk for proper oil level. Oil level must be at bottom of glass disk.		0.1
			Inspect pump oil through glass disk for foreign matter and vapors formed sludges.		0.1
2			ACCESSORIES		
			Inspect all accessory hose assemblies for cleanliness.		0.2
3			GAGES AND GLASS SCALE		
			Inspect gages for broken glass and for broken pointers.		0.3
			Inspect glass tube and beaker for cracks or leakage.		0.1
			Inspect glass parts for cleanliness.		0.1
4			VALVES AND UNIONS		
			Check valves for binding and insecure mounting.		0.2
			Inspect valves and unions for damaged or crossed threads.		0.3
5			FRONT OF ENCLOSURE		
			Inspect all components for security.		0.1
			Inspect enclosure and attached components for cleanliness.		0.1

Table 3-2. Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. SERVICE UNIT FAILS TO REACH ULTIMATE VACUUM.
   - Step 1. After vacuum pump has been running for at least 15 minutes, check the oil level through glass window. The level must be within sight of glass window while the pump is in operation. In general, the oil level will be slightly higher while the pump is running. If oil level is not within view of glass window, stop pump and fill to proper level.
   - Step 2. Inspect oil for contamination through glass window. Contamination is caused by condensation of vapors and by foreign matter entering the pump. If oil appears contaminated, drain, flush and replace vacuum pump oil.
   - Step 3. Check plumbing for leaks using the leak detector. If leakage is detected, isolate and repair leak.
   - Step 4. Inspect vacuum pump for oil leaks between motor and pump, oil case, and sight glass. Repair leakage in accordance with chapter 6.

Table.3-2 Troubleshooting (cont)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. VACUUM GAGE FAILS TO INDICATE LEVEL OF VACUUM.
   - Step 1. Check vacuum gage in accordance with chapter 5, section 3.
     If required, replace vacuum gage in accordance with chapter 5, section 3.
   - Step 2. Test for leakage in vacuum system in accordance with chapter 2, paragraph 2-4.
     If required, repair leakage or replace defective compartment in accordance with chapter 5, section 3.
   - Step 3. Check for defective wiring in vacuum gage wiring circuit. See figure 2-1 for electrical schematic.
     If required, repair defective wiring connections in accordance with chapter 5, section 4.
3. PRESSURE FAILS TO RISE IN RESERVOIR WHEN HEATER IS ON.
   - Step 1. Test pressure switch in accordance with chapter 5, section 3.
     If required, replace pressure switch in accordance with chapter 5, section 4.
   - Step 2. Test for defective heater in accordance with chapter 5, section 3.
     If required, replace defective heater in accordance with chapter 5, section 4.
   - Step 3. Test for defective gages.
     If required, replace defective gages in accordance with chapter 5, section 4.
4. VACUUM PUMP MOTOR FAILS TO OPERATE.
   - Step 1. Check for defective wiring or defective switch (61, fig. 5-2).
     If required, repair wiring or replace defective switch.
   - Step 2. Check that lamp (59) is lit, check for defective wiring and circuit breaker.
     If required, repair wiring or replace defective circuit breaker.
   - Step 3. Check for defective vacuum pump motor.
     If required, replace entire vacuum pump.
5. PRESSURE IN RESERVOIR FAILS TO STABILIZE AT APPROXIMATELY 65 PSIG.
   - Step 1. Check pressure switch (96, fig. 5-2).
     If required, replace pressure switch.
   - Step 2. Check relief valve (109).
     If required, replace relief valve.
6. DETECTOR DOES NOT RESPOND TO "REF LEAK"
   - Step 1. Check for REF LEAK bottle leakage.
     If required, refill REF LEAK bottle.
   - Step 2. Check detector probe for exposure of excessive quantities of refrigerant.
     If required, operate detector in clean air for several minutes allowing probe to purge itself.
7. "BALANCE" CONTROL DOES NOT STOP PROBE LAMP FROM FLASHING ON EITHER "SENSITIVITY" RANGE.
   - Step 1. Check for dirt in sensitive element.
     If required, remove sensitive element from probe and blow out with clean air at 10 psig (max).
   - Step 2. Check for element short circuited.
     If required, replace sensitive element.
8. DETECTOR PROBE LAMP CANNOT BE MADE TO FLASH.
   - Step 1. Check for defective probe lamp.
     If required, replace probe.
9. VAPOR SLUDGES FORM IN VACUUM PUMP SIGHT GLASS.
   - Step 1. Check for contaminated vacuum pump oil.
     If required, flush and refills vacuum pump oil.
   - Step 2. Check for oil leakage at vacuum pump case.
     If required, replace vacuum pump case gasket.
   - Step 3. Check for vacuum pump shaft seal leakage.
     If required, replace shaft seal.

Section IV. MAINTENANCE PROCEDURES

3-9. Perform periodic maintenance of service unit as follows:

a. Inspect gages for broken glass and for bent or broken pointers.
b. Inspect vacuum pump oil for proper level.
c. Inspect inner and outer surfaces for dents and obvious damages.
d. Clean all indicators with a lint-free cloth.
e. Clean all plumbing and components with a clean lint-free cloth.
f. Check conditions of accessory equipment (1 thru 13, fig. 5-2).
g. Perform entire operation of service unit in accordance with Chapter 2, Section I.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. Inspecting and Servicing the Equipment

a. Inspect the outer surfaces of service unit for dents or other evidence of mishandling.

b. Inspect all gages, scale, and beaker for broken glass and for bent or broken pointers in gages.

c. Inspect all accessories (1 thru 13, fig. 5-2) for condition.

d. Check that vacuum pump oil level is within glass window.

e. Close valve (161) while service unit is being used or in storage. Open valve only when service unit is being shipped by air.

4-2. Installation

a. Position service unit in area that will allow enclosure door to swing 180 degrees and provide connection for facility electrical power.

Section II. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-3. Special Tools and Equipment

a. No special tools and equipment are required.

4-4. Maintenance Repair Parts

a. Repair parts are listed and illustrated in Appendix C.

Section III. LUBRICATION INSTRUCTIONS

4-5. Lubrication

Refer to Chapter 3, Section I for lubrication instructions for the vacuum pump.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. Special Tools and Equipment
No special tools and equipment are required.

5-2. Maintenance Repair Parts
Repair parts are listed and illustrated in appendix C.

Section II. TROUBLESHOOTING

5-3. General
Perform troubleshooting in accordance with chapter 3, section III.

Section III. GENERAL MAINTENANCE

5-4. General
a. Maintenance instructions for the major components of the service unit are given in the following paragraphs. If required, the component is tested in the system prior to replacement. See figure 5-2 for illustrated parts breakdown of service unit.

CAUTION

Before applying open flame to soldered joint on fluid lines, disconnect line fittings, open valves, or remove caps as required to vent fluid lines. Purge fluid lines and adjacent enclosed area with nitrogen to remove gases and contaminant residue. Applying open name to contaminant area may create toxic gas or explosion.

b. To replace fluid lines and fittings which are soldered together, apply heat, using a gas soldering torch, to solder joint of parts and separate parts before joint can cool.

c. To connect fluid lines and fittings with solder, tin parts together, using solder.

d. To install fluid fitting with male pipe threads, tape pipe threads where pressure seal is required, using thread lubricant before threading in place.

5-5. Electrical Wiring. (fig. 5-1.)

NOTE

WIRES CODED △ ARE PART OF 3-WIRE CONDUCTOR FROM CONNECTOR P1.

REFERENCE DESIGNATOR FOLLOWED BY NUMBER/S ENCLOSED IN A PARENTHESIS ( ) INDICATES COLOR OF WIRE AND IS CODED AS FOLLOWS:

0 - BLACK,	1 - BROWN,	2 - RED,	3 - ORANGE
4 - YELLOW,	5 - GREEN,	6 - BLUE,	7 - PURPLE
8 - GRAY,	9 - WHITE		

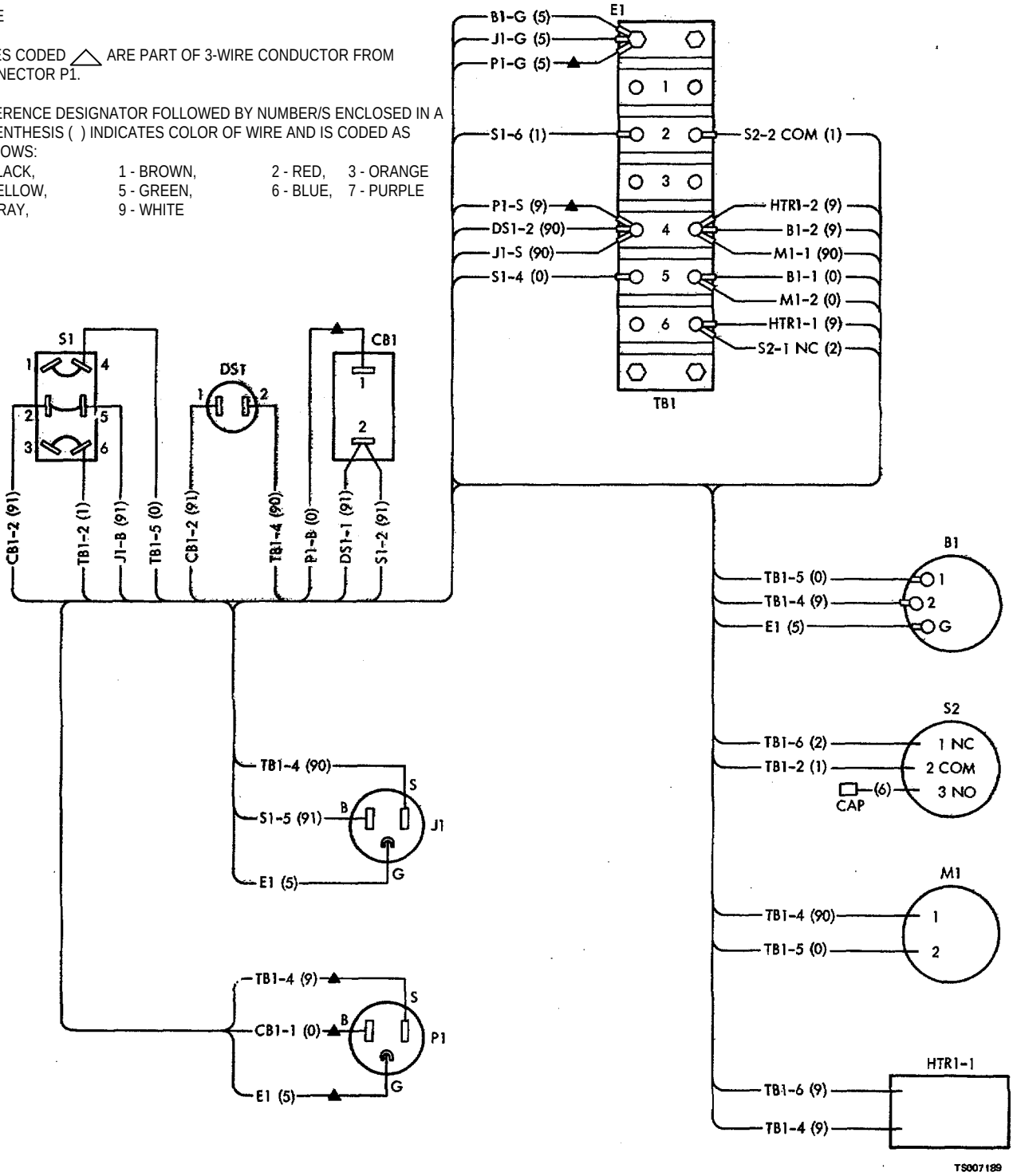


Figure 5-1. Wiring diagram

a. Replace defective insulated wire, as required with 19 strands, AWG 18 of same color and length high temperature insulated electrical wire. See figure 2-1 for electrical schematic.

b. Replace defective solid wire, as required, with AWG 18 of same length solid electrical wire.

c. Replace defective wire lugs.

d. Solder all electrical connections, as required, using solder.

5-6. Thermocouple Gage Control (14, fig. 5-2).

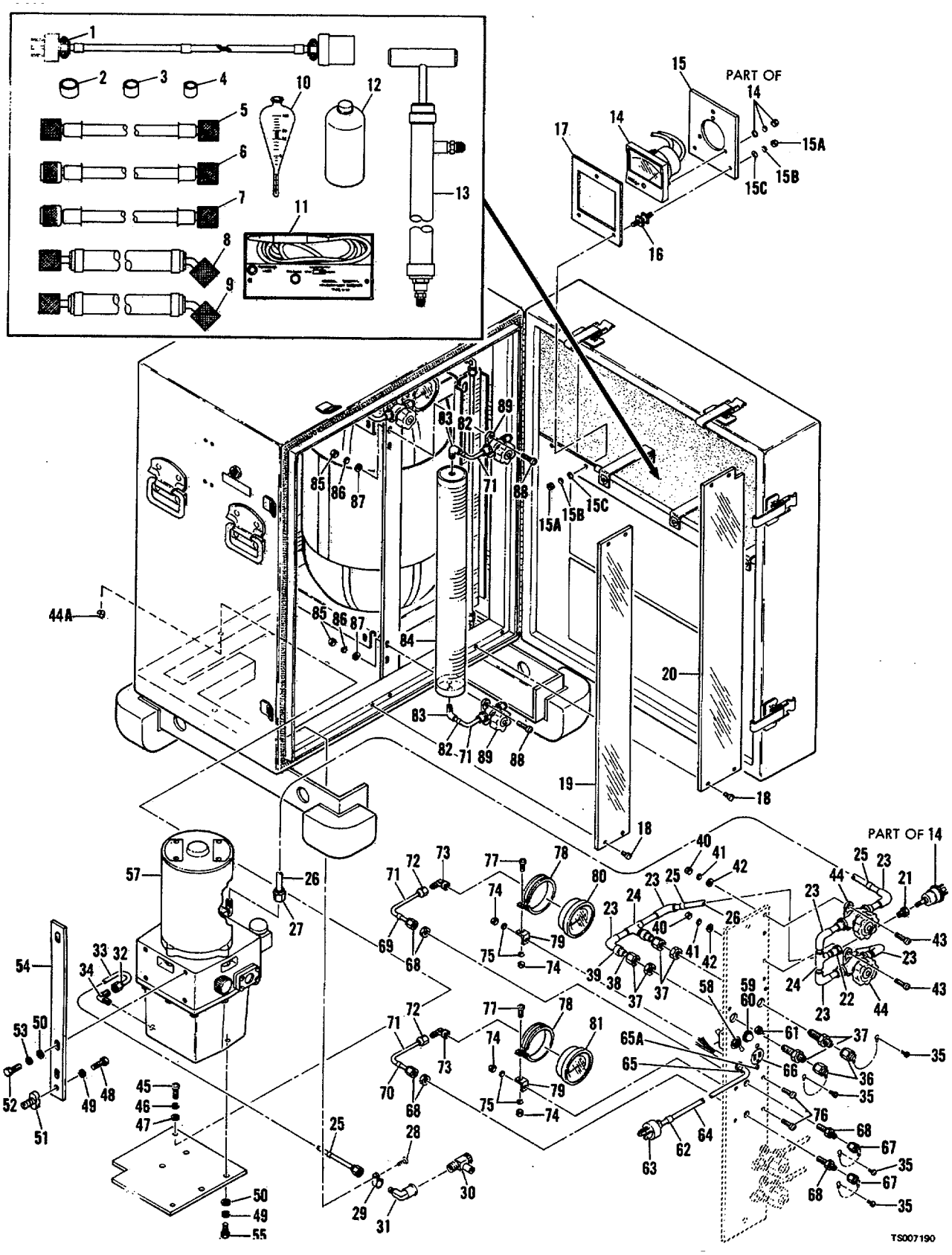


Figure 6-2. Refrigeration system service unit (sheet 1 of 2) TS07190

Key to figure 5-2: (sheet 1 of 2)

1. Cable Assembly
2. Gasket
3. Gasket
4. Gasket
5. Hose Assembly
6. Hose Assembly
7. Hose Assembly
8. Hose Assembly
9. Hose Assembly
10. Tube
11. Detector, Leak
12. Oil
13. Pump, Oil
14. Control Thermocouple Gage
15. Bracket
15A. Nut
15B. Lockwasher
15C. Washer
16. Isolator, Shock
17. Panel
18. Screw
19. Shield
20. Shield
21. Bushing
22. Adapter
23. Elbow
24. Tee
25. Tape
26. Tubing
27. Nut
28. Screw
29. Clamp
30. Valve
31 Elbow
32. Nut
33. Tubing
34. Elbow
35. Screw
36. Cap
37. Union
38. Tubing
39. Bushing
40. Nut
41. Washer
42. Washer
43. Screw
44. Valve
44A. Nut
45. Screw
46. Washer
47. Washer
48. Bolt
49. Washer
50. Washer
51. Nut
52. Screw
53. Lockwasher
54. Bracket
55. Bolt
56. Bracket
57. Vacuum Pump
58. Circuit Breaker
59. Lamp
60. Lamp Assembly
61. Switch
62. Strap
63. Connector
64. Conductor
65. Cord Grip
65A. Screw
66. Connector
67. Cap
68. Union
69. Tape
70. Tape
71. Tubing
72. Nut
73. Elbow
74. Nut
75. Washer
76. Screw
77. Screw
78. Clamp
79. Bracket
80. Gage
81. Gage
82. Tape
83. Elbow
84. Beaker
85. Nut
86. Washer
87. Washer
88. Screw
89. Valve

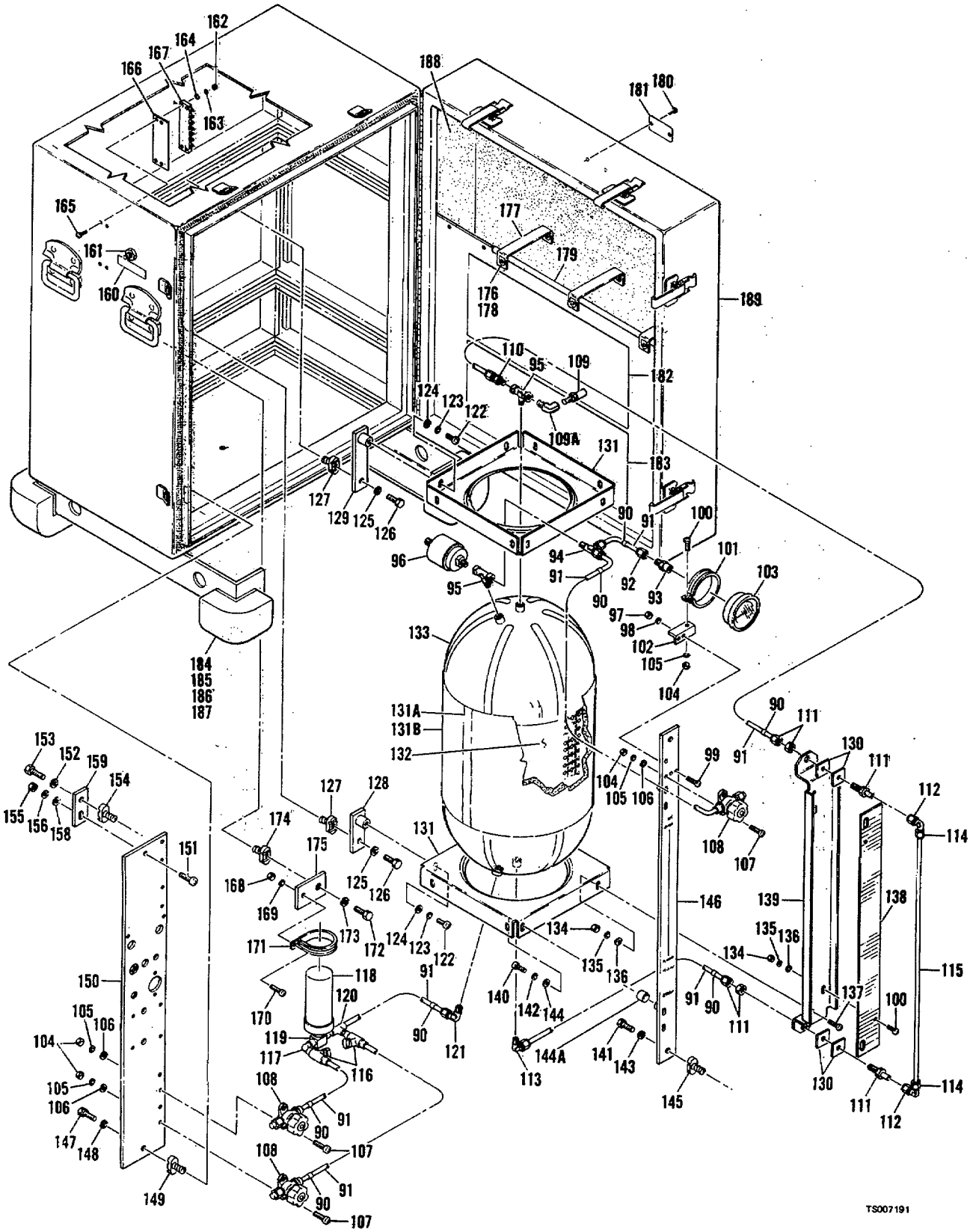


Figure 5-2. Refrigeration system service unit (sheet 2 of 2) TS007191

Key to figure 5-2: (sheet 2 of 2)
90. Tape
91. Tubing
92. Nut
93. Adapter
94. Tee
95. Tee
96. Switch
97. Nut
98. Washer
99. Screw
100. Screw
101. Clamp
102. Bracket
103. Gage
104. Nut
105. Washer
106. Washer
107. Screw
108. Valve
109. Relief Valve
109A. Elbow
110. Connector
111. Adapter
112. Elbow
113. Elbow
114. Ferrule set
115. Tubing
116. Check Valve
117. Elbow
118. Filter Drier
119. Connector
120. Tee
121. Elbow
122. Screw
123. Washer
124. Washer
125. Washer
126. Bolt
127. Nut
128. Bracket
129. Bracket
130. Plate Fitting
131. Support Assembly
131A. Tape
131B. Insulation
132. Tank Heater
133. Tar k Assembly
134. Nut
135. Washer
136. Washer
137. Screw
138. Graduated Scale
139. Bracket
140. Screw
141. Bolt
142. Washer
143. Washer
144. Washer
144A. Spacer
145. Nut
146. Panel
147. Bolt
148. Washer
149. Nut
150. Panel
151. Screw
152. Washer
153. Bolt
154. Nut
155. Nut
156. Washer
157. (Not Used)
158. Washer
159. Bracket
160. Decal
161. Valve
162. Nut
163. Washer
164. Washer
165. Screw
166. Market Strip
167. Terminal Strip
168. Nut
169. Washer
170. Screw
171. Clamp
172. Bolt
173. Washer
174. Nut
175. Bracket
176. Screw
177. Strap Assembly
178. Stud
179. Rubber Extrusion
180. Screw
181. Plate
182. Plate
183. Plate
184. Bolt
185. Washer
186. Washer
187. Shock Isolator
188. Foam
189. Enclosure

a. Verify thermocouple gage control for defect and inaccuracy before replacement as follow s: (Refer to reference designator M1 and MT1 of fig. 2-1 .1

(1) Connect service unit to electrical source in accordance with chapter 2, Operating Instruction s.

(2) Connect a certified vacuum gage to union (25, fig. 2-3) and cap union (24).

(3) Open valves (1, 2), set circuit breaker (22) to ON, and set switch (21) to VAC ON.

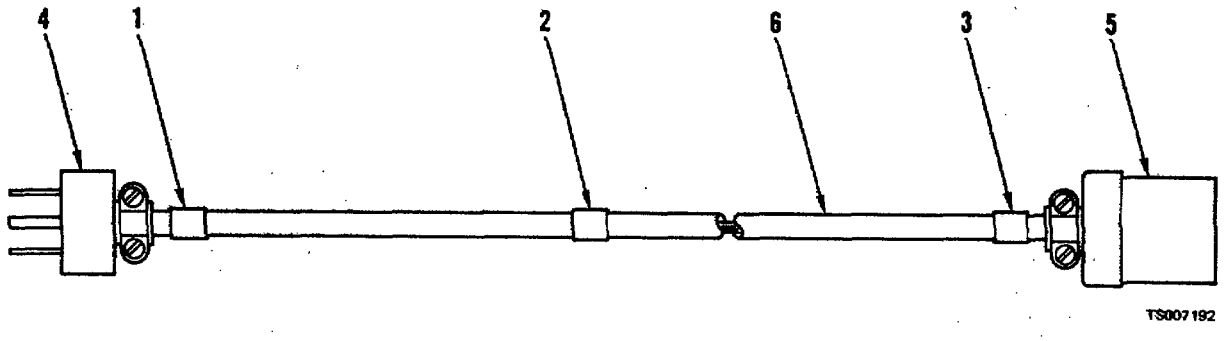
(4) Compare vacuum indication between gage (26) and certified vacuum gage at 1000, 500, 50, and 20 microns. The minimum accuracy of gage (26) must be 500 ±50 microns.

(5) Close valve (1). Gage (26) must indicate less than 50 microns.

(6) If gage (26) fails this test, replace entire thermocouple gage control (14, figure 5-2) in accordance with section IV.

5-7. Cable Assembly (1, fig. 5-2).

a. If cord (6, fig. 5-3) or connectors (4, 5) required replacement, strip both ends of wires on cord (6) and connect end of black wire to terminal B of each connector. Connect end of white wire to terminal S of each connector and connect end of green wire to terminal G of each connector. Secure connectors over outer insulation of cord (6).



1. Identification Tie
2. Identification Tie
3. Identification Tie
4. Connector
5. Connector
6. Power Cord

Figure 5-3. Power cable assembly

5-8. Oil Pump (13, fig. 5-2)

a. Before replacing oil pump (13), verify pump for defect as follows:

(1) Fill beaker (4, fig. 2-3) with refrigeration oil in accordance with operating procedure in chapter 2.

(2) Using hose assembly connect suction inlet of oil pump to valve (ill.

(3) Using hose assembly (6, fig. 5-2) with gaskets (3, 4), connect discharge fitting of oil pump to a nitrogen pressurized container of 100 psig.

(4) Open valve (11, fig. 2-3) and hand pump oil from valve (1) into pressurized container. Container pressure must not exceed 120 psig. Operate oil pump in a vertical position.

(5) Failure to hand pump 1000 ML of refrigeration oil into container within five minutes determines a defective oil pump.

(6) Close valve (11). Relieve oil pressure and remove hose assemblies.

(7) If oil pump (13, fig. 5-2) is defective, replace oil pump.

5-9. Drain Valve (30, fig. 5-2)

a. If drain valve (30) required replacement, hold elbow (31) and unthread drain valve.

b. Tape lubricate threads of new: drain valve, hold elbow (31) and thread new drain valve into fitting to position drain opening as shown in figure 5-2.

5-10. Vacuum System Plumbing and Components (8, 9, 21 thru 57, fig. 5-2)

a. Isolate defective parts by leak checking vacuum system as follows:

(1) Connect hose assemblies (8, 9) with gaskets (2, 3) to unions (24, 25, fig. 2-3). Connect other end of hose assemblies together, using a male union.

(2) Open valves (1, 2), set circuit breaker (22) to ON and switch (21) to VAC ON.

(3) Allow vacuum pump to operate for 15

minutes and observe indication on gage (26). Indication must be less than 100 microns.

(4) If gage (26) indicates more than 100 microns, vacuum system leakage is excessive. Locate leakage with leak detector in accordance with Chapter 2, paragraph 2-4. If required, replace defective parts.

5-11. Valves (44, fig. 5-2)

a. Remove valves (44) as follows:

(1) Unplug to separate thermistor (part of item 14) and set thermistor half with wiring aside.

(2) Apply heat to solder joints of valves (44) to be separated, and separate parts (21 thru 24) with thermistor half from valves (44) before solder joints can cool.

(3) Remove nuts (40), washers (41, 42), and screws (43).

(4) Apply heat to remaining solder joint of valve to be separated, and separate valve from elbow (23) or tubing (26) before solder joint can cool.

b. Replace valves (44) in reverse of removal order. Tin solder joints with solder. Secure valves with attaching parts and plug-in thermistor halves.

5-12. Vacuum Pump (57, fig. 5-2)

a. Verify vacuum pump for defects as follows:

(1) Connect hose assembly (8) with gaskets (2, 3) between union (25, fig. 2-3) and valve (5). Cap union (24).

(2) Open valves (2, 5) and close valves (12, 14).

(3) Set circuit breaker (22) to ON and switch (21) to VAC ON. Open valve (1) slowly.

(4) Operate vacuum pump for 1 hour. Operation must be at an ambient temperature of 80 ° to 110 OF (26.7 ° to 43.3 °C). Open valve (5) to break vacuum to allow pressure to return to atmospheric pressure. Before breaking vacuum, record indication on gage (26), the ambient temperature, terminal voltage and amperage at vacuum pump motor.

(5) If gage (26) records greater than 100 microns after one hour of evacuation, vacuum pump motor amperage is greater than given on nameplate, or the vacuum system does not operate continuously for one hour. Replace vacuum pump in accordance with Section IV. If minor repair of the vacuum pump is required, refer to Chapter 6.

(6) Close valve (2), set switch (21) to OFF, and disconnect hose assembly.

5-13. Gages (80, 81, fig. 5-2)

a. Verify gages for defects before replacement as follows:

(1) Uncap unions (17, 18, fig. 2-3) and connect certified gages covering the ranges of gages (9, 10) into a pressure line between unions (17, 18) and a pressure regulator. Calibrate in 20 psig intervals to 60 psig for gage (10), and 140 psig for gage (9).

(2) Gages (9, 10) must indicate within two percent of their respective certified gages.

b. If gages are defective, replace as follows:

(1) Remove attaching parts (74 thru 79, fig. 5-2).

(2) Hold elbow (73) with gage and loosen nut (72) .

(3) Remove elbow (73) from defective gage.

(4) Tape lubricate threads of new gage before threading elbow (73) in place.

(5) Thread nut (72) into elbow (73) and install attaching parts (74 thru 79).

5-14. Beaker (84, fig. 5-2)

a. If beaker is defective, apply heat to solder joints of valves (89) and separate beaker (84) with elbows (83) and tubing (71) from valves (89) before solder joint can cool.

b. Unthread elbows (83) with tubing (71) from beaker (84).

c. Clean threads of elbows (83) and tape lubricate threads before threading elbows (83) with tubing (71) on new beaker (84).

d. Tin tubing (71) and valves (89) together, using solder.

5-15. Valves (89, fig. 5-2)

a. If valves are defective, remove attaching parts (85 thru 88).

b. Apply heat to solder joint of valves and separate valves from tubings (71) before solder joint can cool.

c. Tin tubings (71) and new valves (89) together, u sin g solder.

d. Install attaching parts (85 thru 88) to secure valves.

5-16. Pressure Switch (96, fig. 5-2)

a. Verify pressure switch for defects before replacing. Perform test as follows:

(1) Connect a 120-volt light bulb between terminals 4 and 6 of terminal strip (167). (See fig. 5-1 for wiring diagram.)

(2) Set circuit breaker (22, fig. 2-3) to ON and switch /21) to HEATER ON, light bulb must light.

(3) Allow tank heater to cycle on and off while observing gage (7). Light bulb must not light when gage (7) indicates 69 ± 5 psig and must light when gage (7) indicates 58 ± 5 psig. Light bulb must go out when gage (7) indication exceeds 69 ± 5 psig.

(4) If pressure switch fails this test, pressure switch is defective.

(5) Set switch (21) and circuit breaker of OFF, and disconnect light bulb from terminal strip.

b. Replace defective pressure switch as follows:

(1) Remove wires from pressure switch S2. (See fig. 5-1.)

(2) Hold tee (95 fig. 5-2) and remove pressure switch (96) from tee.

(3) Tape lubricate threads of new pressure switch (96), and thread pressure switch into tee (95) while holding tee.

(4) Connect wiring to pressure switch S2 in accordance with figure 5-1.

5-17. Gage (103, fig. 5-2)

a. Verify gage for defects before replacement as follows:

(1) Close valves (12, 14, fig. 2-3) and open valve (5).

(2) Uncap valve (5) and connect a certified gage-covering the range of gage (7) into a pressure line between valve (5) and a pressure regulator. Calibrate gage (7) in 20 psig intervals to 80 psig.

(3) Gage (7) must indicate within two percent of certified gage.

b. If gage is defective' replace as follows:

(1) Loosen attaching parts (100, 101, 104, 105, fig. 5-2).

(2) Hold adapter (93) with gage and loosen nut (92).

(3) Remove adapter (93) from defective gage.

(4) Tape lubricate threads of new gage, before threading adapter (93) in place.

(5) Thread nut (92) into adapter (93) and tighten attaching parts (100, 101, 104, 105) to secure gage (103).

5-18. Valves (108, fig. 5-2)

a. If valves are defective, remove attaching parts (104 thru 107).

b Apply heat to solder joint of valves and separate valves from tubings (91) before solder joint can cool.

c. Tin tubings (91) and new valves (108) together using solder.

d. Install attaching parts (104 thru 107) to secure valves.

5-19. Relief Valve (109, fig. 502)

a. If relief valve is defective, hold tee (95) and remove relief valve.

b. Tape lubricate threads of new relief valve and thread new relief valve into tee (95) while holding tee.

5-20. Tubing (115, fig. 5-2)

a. If tubing (115) is defective, loosen nuts on elbows (112) and remove tubing (115) with ferrule sets (114).

b. Install new tubing (115) with new ferrule sets (114) in place and tighten nuts on elbows (112).

5-21. Check Valves (116, fig. 5-2)

a. If check valves are defective, remove hardware attaching V4 and V5 valves (108).

b. Apply heat to solder joint of check valves (116) and separate check valves with tubing and valves (108) from elbow (117) and tubing (91) before solder joint can cool.

c. Apply heat to solder joint of check valves (116) and separate check valves from tubing with valves (108).

d. Tin tubings with valves (108) and new check valves (116) together, using solder.

e. Tin elbow (117) or tubing (91) and check valves (116) with attached valves (108) together, using sold-en

f. Secure valves (108) with parts (104 thru 107).

5-22. Filter Drier (118, fig. 5-2)

a. Replace filter drier by loosening clamp (171) and while holding tee (119), remove filter drier.

5-23. Tank Heater (132, fig. 5-2)

a. Verify tank h eater for defect before replacing. Perform test as follows:

(1) Place service unit in an ambient temperature environment of 60° to 70°F (15.6° to 21.1 °C}.

(2) Fill reservoir with refrigerant in accordance with Chapter 2.

(3) Connect a jumper wire across terminals 2 and 6 of terminal strip (167). See figure 5-1 for wiring diagram.

(4) Set circuit breaker (22, fig. 2-3) to ON and switch (21) to HEATER ON.

(5) Allow reservoir to heat until pressure of 85 ± 5 psig is indicated on gage (7). Failure of gage (7) to reach 82 ± 5 psig within one hour indicates a defective heater.

(6) Set switch (21) and circuit breaker (22) to OFF and remove jumper wire from terminals of terminal strip.

b. Replace defective tank heater as follows:

(1) Remove heater wiring from terminals 4 and 6 of terminal strip (167, fig. 5-2). See wiring diagram, fig. 5-1).

(2) Remove tape (131A, fig. 5-2) and insulation (131B), and unlace and remove tank heater from tank assembly (133).

(3) Wrap and lace new tank heater (132) around tank assembly (133).

(4) Route heater wires and connect ends to terminals 4 and 6 of terminal strip (167). See figure 5-1.

(5) Wrap insulation (131B) around tank heater and secure insulation with tape (131A).

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND ASSEMBLIES

5-24. Thermocouple Gage Control (14, fig. 5-2) &. Remove thermocouple gage control (14) as follows:

(1) Remove M1 gage wires from terminals 4 and 5 of terminal strip (167). (See wiring diagram, fig. 5-1).

(2) Unplug thermistor half (part of 14, fig. 52) located near bushing (21). While holding bushing (21), unthread other half of thermistor from bushing (21).

(3) Cut wire ties and remove thermistor and wiring leading to gage.

(4) Remove shock isolator (16), bracket (15) and thermocouple gage control (14) from panel (17).

b. Install new thermocouple gage control (14) as follows:

(1) Install gage with bracket (15) and chock isolators (16) on panel (17).

(2) Route wires from gage to terminal 4 and 5 of terminal strip (167). (M1 wiring to TB1, fig. 5-1).

(3) Route wiring with thermistor (part of 14, fig. 5-2) to bushing (21). Unplug thermistor, tape lubricate male thread of thermistor half and thread into bushing (21) while holding bushing. Plug thermistor halves together.

5-25. Vacuum Pump (57, fig. 5-2)

a. Remove vacuum pump as follows:

(1) Position a container of one-half gallon capacity under drain valve (30) and drain vacuum pump oil.

(2) Remove wiring from top of vacuum pump motor. (Refer to B1 motor in fig. 5-1).

(3) Loosen nut (27, fig. 5-2) to disconnect intake line.

(4) Hold elbow (34) and loosen nut (32) to dis connect drain line.

(5) Remove attaching parts (104 thru 107) and separate valves (108) from panel (150). Remove attaching parts and move panel (150) to gain access to vacuum pump.

(6) Remove attaching parts (45 thru 56) and vacuum pump (57).

b. Install vacuum pump as follows:

(1) Position vacuum pump in service unit and install attaching parts (45 thru 56).

(2) Install panel (150). Hold elbow (34) and tighten nut (32) to connect drain line.

(3) Tighten nut (27) to connect intake line.

(4) Install wiring on top of vacuum pump motor (Refer to wiring installation of B1 motor in fig. 5-1).

(5) Install valves (108, fig. 5-2) on panel (150) with attaching parts (104 thru 107).

5-26. Tank Assembly (133, fig. 5-2)

a. Remove tank assembly (133) as follows:

(1) Remove attaching parts (141 thru 144A) and panel (146) with attached valves (89) and beaker (84).

(2) Remove tape (131A) and insulation (131B), and unlace tank heater (132) and remove from tank assembly (133).

(3) Loosen nut on tee (95) from connector (110).

(4) Loosen nut on tee (95) from tee (94).

(5) Loosen nut (92) from elbow (121).

(6) Loosen nut on elbow (113) to disconnect nut and tubing from elbow (113).

(7) Remove attaching parts (128 thru 130) (140 thru 144A) and tank assembly (133) with relief valve (109) and switch (96).

(8) Remove relief valve (109) and switch (96) with tees (95) from tank assembly (133).

b. Install tank assembly (133) as follows:

(1) Tape lubricate threads of tees (95) and thread tees (95) with relief valve (109) and switch (96) into tank assembly (133).

(2) Install tank assembly in enclosure and secure with parts (128 thru 130) (140 thru 144).

(3) Tighten nut on elbow (113) to secure elbow to tubing.

(4) Tighten nut (92) on elbow (121) to secure tubing.

(5) Tighten nut on tee (95) to secure tee (95) to tee (94).

(6) Tighten nut on tee (95) to secure tee (95) to connector (110).

(7) Wrap and lace tank heater (132) around tank assembly.

(8) Wrap insulation (131B) around tank heater and secure insulation with tape {131A).

(9) Install panel (146) and attached valves

189) and beaker (84) with attaching parts (141 thru 144) 5-27. Panel (150, fig. 5-2)

a. Replace panel (150) as follows:

(1) Remove attaching parts (40 through 43) and separate valves (44) with attaching fittings and tubings from panel (150).

(2) Loosen nuts (part of item 37) and remove unions (part of item 37).

(3) Separate circuit breaker 158), lamp and lamp assembly (59, 60). and switch (61) from panel (150).

(4) Remove connector (63) from conductor (64) and loosen cord grip (65) and pull conductor through panel (150). (See wiring diagram figure .5-1 for wire connection on connector P1.)

(5) Loosen nuts {part. of item 68, fig . 5 -2) and remove unions (part of item 68).

(6) Remove screws {65A) and separate connector (66) with attached wiring from panel (150).

(7) Remove attaching parts (74 through 76\ and separate gages (80, 81) from panel (150).

(8) Remove attaching parts (104 through 107) and separate valves (108) from panel. (150).

(9) Remove attaching parts (147, 148, 151, 155, 156. 158) and remove panel (150).

b. Install panel (150) as follows:

(1) Position panel (150) under gages and values and align panel holes with nut (149) and bracket (159). Install parts (147, 14&, 151, 155, 156, 158 to secure panel (150) to enclosure.

(2) Reinstall valves (108, 44), gages (80, 81), connectors (63, 66). unions (37, 68), circuit breakers (58), lamp and lamp assembly (59, 60), and switch (61) in reverse sequence given in paragraph 5-27*a*, steps (1) through (8)

CHAPTER 6
REPAIR OF VACUUM PUMP

6-1. General

Repair of the vacuum pump is limited to minor repair which consists of seals and gaskets replacement. Parts constituting the internal mechanism of the vacuum pump which would require complete pump disassembly is not included. (See Appendix C for the affected repair parts.)

6-2. Repair

Replace shaft seal (22, fig. 6-1) as follows:

a. Place vacuum pump in vertical position and remove nuts (34), washers (33), and slide motor (29) from mounting plate (8).

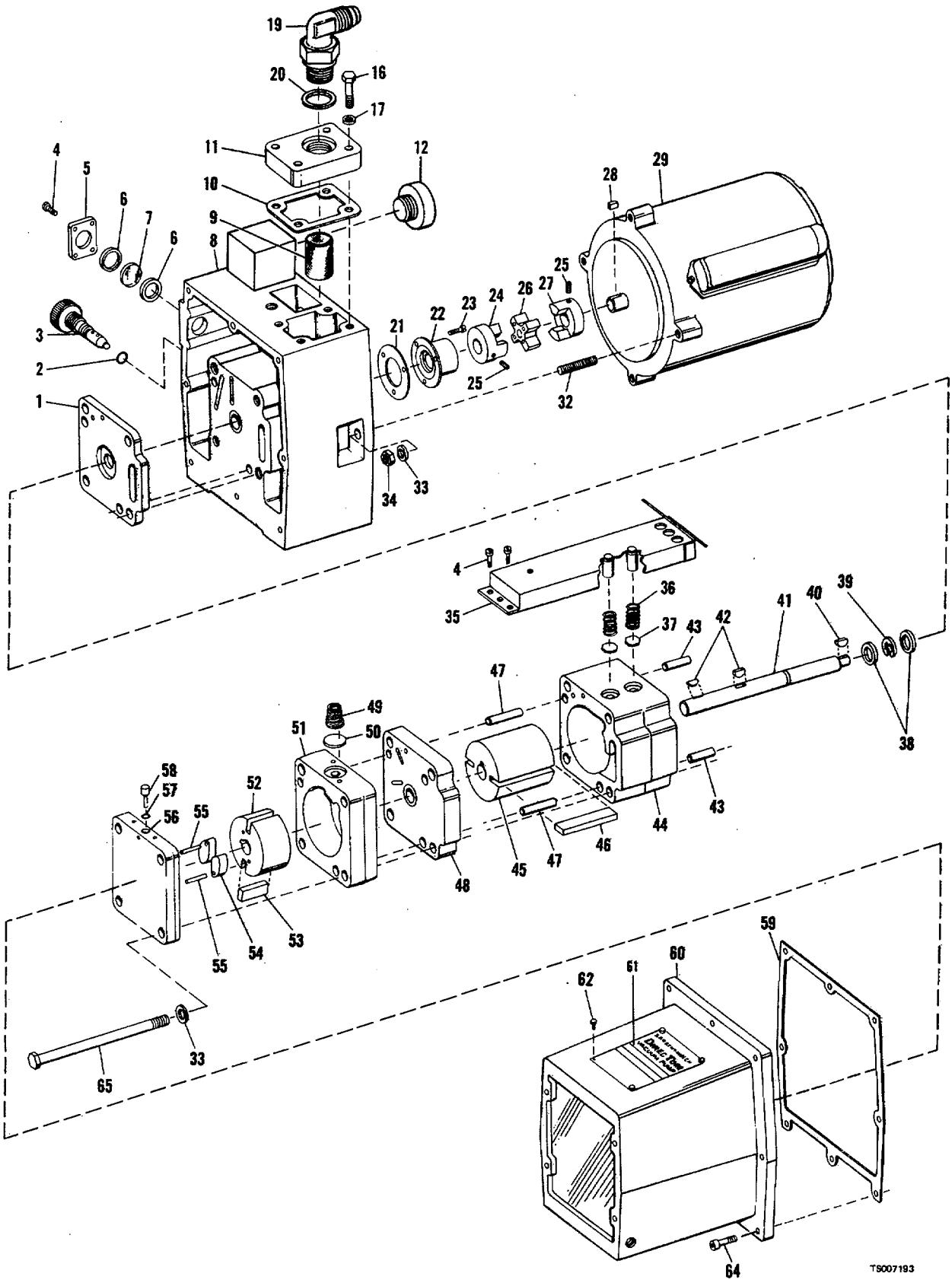


Figure 6-1. Vacuum pump

Key to figure 6-1:

1. Wear Plate
2. O-Ring
3. Vented-Exhaust Valve
4. Screw
5. Oil Level Cover
6. Seal Ring
7. Glass Disk
8. Mounting Plate
9. Intake Screen
10. Intake Cover Gasket
11. Intake Cover
12. Cap
13. {Not used)
14. (Not used)
15. (Not used)
16. Cap Screw
17. Washer
18. (Not used}
19. Fitting
20. Washer
21. Seal Gasket
22. Shaft Seal
23. Screw
24. Coupling Body
25. Setscrew
26. Coupling Spider
27. Coupling Body
28. Motor Shaft Key
29. Motor
30. {Not used)
31. (Not used)
32. Motor Stud
33. Washer
34. Nut
35. Exhaust Duct Assembly
36. Intake Valve Spring
37. Intake Valve
38. Thrust Washer
39. Truarc-Ring
40. Coupling Key
41. Shaft
42. Woodruff Key
43. Dowel Pin
44. Large Intake Ring
45. Large Intake Rotor
46. Large Vane
47. Dowel Pin
48. Center Plate
49. Exhaust Valve Spring
50. Exhaust Verve
51. Exhaust Ring
52. Exhaust Rotor
53. Small Vane
54. Hinged Cam
55. Dowel Pin
56. End Plate
57. O Ring
58. Oil Feed Plunger
59. Oil Case Gasket
60. Small 0;1 Case
61. Nameplate
62. Screwstick
63. (Not used)

b. Loosen setscrew (25) and remove coupling body (24).

c. Remove screws (23) and pry shaft seal (22) with gasket (21) from mounting plate (8).

d. Wipe shaft (41) area clean of sediment and carefully hone any damaged areas of shaft with a fine emery stone. Be sure to remove any sharp edges which might cut the rubber elements of the shaft seal.

e. Place new seal gasket (21) to align with screw holes. Lubricate new shaft seal (22) with film of oil (12, fig. 5-2) and carefully slide new shaft seal over shaft and position against seal gasket. Align screw holes, center shaft seal on shaft and tighten screws (23, fig. 6-1) uniformly.

f. Reinstall coupling body (24) and tighten setscrew (25).

g. Reinstall motor (29) with washers (33) and nuts (34).

6-3. Replace glass disk (7) and seal rings (6) as follows:

a. Remove screws (4), cover (5), seal rings (6), and disk (7).

b. Insert new seal rings (6) in counterbore seat in mounting plate (8).

c. Place disk (17) over inner seal and position new outer seal rings (6) over disk 17) and into seat.

d. Place cover (5) in position and secure in place with screws (4).

6-4. Replace oil case gasket (59) as follows:

a. Remove screws (64), gasket (59), and oil case (60) from mounting plate (8).

b. Thoroughly clean sealing surfaces of oil case and mounting plate.

c. Apply varnish to new gasket (59) and position in place.

d. Position oil case in place and secure screws (64).

APPENDIX A
REFERENCES

A-1. Fire Protection and Safety	
TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
A-2. Lubrication	
C91001L	Fuels, Lubricants. Oils, and Waxes
A-3. Painting	
TM 9-213	Painting Instructions for Field Use
A-4. Maintenance	
FM 29-2	Organizational Maintenance Management
TM 38-750	The Army Maintenance Management System
A-5.	Shipment and Storage
TM 740-90-1	Administrative Storage of Equipment
A-6. Demolition	
TM 750-244-3	Destruction of Equipment to Prevent Enemy Use

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

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

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

B-2. Explanation of Columns in Section II

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

b. *Column 2. Functional Group.* This column contains a brief description of the components of each numerical group.

c. Column 3. Maintenance Functions. This column lists the various maintenance functions (A through K). The lowest maintenance level authorized to perform these functions is indicated by a symbol in the appropriate column. Work measurement time standards (the active repair time required to perform the maintenance function) are shown directly below the symbol identifying the maintenance level. The symbol designations for the various maintenance levels are as follows:

C-Operator or crew
O-Organization maintenance
F-Direct support maintenance
H-General support maintenance
D-Depot maintenance

The maintenance functions are defined as follows:

a. *Inspect.* To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and com paring those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean, to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

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

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

f. Calibrate. To determine and cause corrections to he made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. *Install.* The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part. subassembly, or module (component or assembly) for an unserviceable counterpart.

i. *Repair.* The application of maintenance services (in specs, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding riveting, straightening, facing. remachining or resurfacing) to restore serviceability to an item by correcting specific damage fault, malfunction. or failure in a part subassembly module (component or assembly) end item. or system.

j. *Overhaul*. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publication. Overhaul is normally the highest degree of

maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. *Rebuild*. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest-degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment components.

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

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

Section IV. MAINTENANCE ALLOCATION CHART

(1)	(2)	(3) MAINTENANCE FUNCTIONS											(4)	(5)
		a	b	c	d	e	f	g	h	i	j	k		
GROUP NO.	FUNCTIONAL GROUP	INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD	TOOLS AND EQUIPMENT	REMARKS
01	Cover, Doors, Panels,	C	. .	. .	. .	. .	. .	F	F					
.		0.3	. .	. .	. .	. .	. .	8.0	16.0					
02	Refrigeration Charge System	C	. .	. .	. .	. .	. .	F	F					
		0.5	. .	. .	. .	. .	. .	8.0	16.0					
03	Vacuum System	C	F	. .	. .	. .	. .	F	F	F				
.		0.5	1.0	. .	. .	. .	. .	12	24.0	24.0				
04	Gages	C	. .	. .	. .	. .	. .	F	F					
.		0.4	. .	. .	. .	. .	. .	1.0	2.0					
05	Oil Charge System	C	. .	. .	. .	. .	. .	F	F					
		0.3	. .	. .	. .	. .	. .	0.5	1.0					
06.	Electrical System	C	. ..	. .	. .	. .	. .	F	F					
		0.5	. .	. . .	. .	. .	. .	2.0	4.0					
07	Accessories	C	F	. .	. .	. .	. .	F	F					
		0.5	1.0	. . .	. .	. .	. .	0.1	0.3					

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APPENDIX C
REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

C-1. Scope
This appendix lists repair special tools, test, measurement, and diagnostic equipment (TMDE), and other support equipment required for operation and performance of organizational and direct support maintenance of the Refrigeration System Service Unit.

C-2. General
a. *Section II-Repair Parts List.* A list of repair parts authorized for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending numerical sequence, with the parts in each group listed in figure and item number sequence. Bulk materials are listed in FSN sequence, as the last group in Section II.

b. *Section III-Special [tools List. (Not applicable)* .

c. *Section IV-Federal Stock Number and Part Number Index*. A list, in ascending numerical sequence, of all Federal stock numbers appearing in the listings, followed by a list, in alphanumeric sequence, of all part numbers appearing in the listings. Federal stock number and part numbers are cross-referenced to each illustration figure and item number appearance.

C-3. Explanation of Columns
The following provides an explanation of colognes found in the tabular listings:

a. *Illustration.* This column is divided as follows:

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

(2) *Item Number*. The number used to identify each item called out in the illustration.

b Source. Maintenance. and Recoverability Codes (SMR).

(1) *Source Code.* Source codes are assigned to support items to indicate the manner of acquiring support items for maintenance. repair. or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	*Definition*
PA	Item procured and stocked for anticipated or known usage.
PB	Item procured and stocked for insurance purpose because essentially dictates that a minimum quantity be available in the supply systems.
PC	Item procured and stocked and which otherwise would be coded PA except that it is deteriorative in nature.
PD	Support item, excluding support equipment, procured for initial issue or outfitting and stocked only for subsequent or additional initial issues or outfittings. Not subject to automatic replenishment.
PE	Support equipment procured and stocked for initial issue or outfitting to specified maintenance repair activities.
PF	Support equipment which will not be stocked but which will be centrally procured on demand.
PG	Item procured and stocked to provide for sustained support for the life of the equipment. It is applied to an item peculiar to the equipment which, because of probable discontinuance or shutdown of production facilities, would prove uneconomical to reproduce at a later time.
KD	An item of a depot overhaul/repair kit and not purchased separately. Depot kit defined as a kit that provides items required at the time of overhaul or repair.
KF	An item of a maintenance kit and not purchased separately. Maintenance kit defined as a kit that provides an item that can be replaced at organizational or intermediate levels of maintenance.
KB	Item included in both a depot overhaul/repair kit and a maintenance kit.
MO	Item to be manufactured or fabricated at organizational level.
MF	Item to he manufactured or fabricated at the direct support maintenance level.
MH	Item to be manufactured or fabricated at the general support maintenance level.
MD	Item to be manufactured or fabricated at the depot maintenance level.
AO	Item to be assembled at organizational level.
AF	Item to be assembled at direct support maintenance level.
AH	Item to be assembled at general support maintenance level.
AD	Item to be assembled at depot maintenance level.
XA	Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.
XB	Item is not procured or stocked. If not available through salvage, requisition.
XD	A support item that is not stocked. When required item will be procured through normal supply channels.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded XA OR XD.

(2) *Maintenance Code.* Maintenance codes are assigned to indicate the levels of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(a) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third position will indicate one of the following levels of maintenance:

Code	*Application/Explanation*
C	Crew or operator maintenance performed within organizational maintenance.
O	Support item is removed, replaced, used at the organizational level.
I	Support item is removed, replaced, used by the direct support element of integrated direct support maintenance.
F	Support item is removed, replaced, used at the direct support level.
H	Support item is removed, replaced, used at the general support level.
	Support items that are removed, replaced, used at depot, mobile depot, specialized repair activity only.

NOTE

Codes "I" and "F" will be considered the same by direct support units.

(b) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete repair (i.e., all authorized maintenance functions). This position will contain one of the following maintenance codes:

Code	*Application/Explanation*
O	The lowest maintenance level capable of complete repair of the support item is the organizational level.
F	The lowest maintenance level capable of complete repair of the support item is the direct support level.
H	The lowest maintenance level capable of complete repair of the support item is the general support level.
D	The lowest maintenance level capable of complete repair of the support item is the depot level.
L	Repair restricted to designated specialized repair activity.
Z	Nonreparable. No repair is authorized.
B	No repair is authorized. The item may be reconditioned by adjusting, lubricating, etc., at the user level. No parts or special tools are procured for the maintenance of this item.

(3) *Recoverability Code.* Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Recoverability Codes	Definition
Z	Nonreparable item. When unserviceable, condemn and dispose at the level indicated in position 3.
O	Reparable item. When uneconomically reparable, condemn and dispose at organizational level.
F	Reparable item. When uneconomically reparable, condemn and dispose at the direct support level.
H	Reparable item. When uneconomically reparable, condemn and dispose at the general support level.
D	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot level.
L	Reparable item. Repair, condemnation, and disposal not authorized below depot/specialized repair activity level.
A	Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. *Federal Stock Number.* Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

d. *Part Number.* Indicates the primary number used by the manufacturer which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

NOTE

When a stock numbered item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. *Federal Supply Code for Manufacturer (FSCM).* The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. *Description.* Indicates the Federal item name and, if required, a minimum description to identify the item. Items that are included in kits and sets are listed below the name of the kit or set with the quantity of each item in the kit or set indicated in the quantity incorporated in unit column. When the part to be used differs between serial numbers of the same model, the-effective serial numbers are shown as the last line of the description. In the Special Tools List, the initial basis of issue (BOI) appears as the last line in the entry for each special tool, TMDE, and support equipment. When density of equipments sup

ported exceeds density spread indicated in the basis of issue, the total authorization is increased accordingly.

g. Unit of Measure (U/M). Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two character alphabetical abbreviation (e.g., ea. in, pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable, (e.g., shims, spacers, etc.).

C-4. How to Locate Repair Parts.

a. When Federal Stock Number or Part Number is Unknown:

(1) *First*. Using the table of contents, determine the functional group within which the repair part belongs. This is necessary since illustrations are prepared for functional groups, and listings are divided into the same groups.

(2) *Second.* Find the illustration covering the functional group to which the repair part belongs.

(3) *Third*. Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(4) *Fourth*. Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. *When Federal Stock Number or Part Number is Known*.

(1) *First.* Using the Index of Federal Stock Numbers and Part Numbers, find the pertinent Federal stock number or part number. This index is in ascending FSN sequence followed by a list of part numbers in ascending alphanumeric sequence, cross-referenced to the illustration figure number and item number.

(2) *Second*. After finding the figure and item number, locate the figure and item number in the repair parts list.

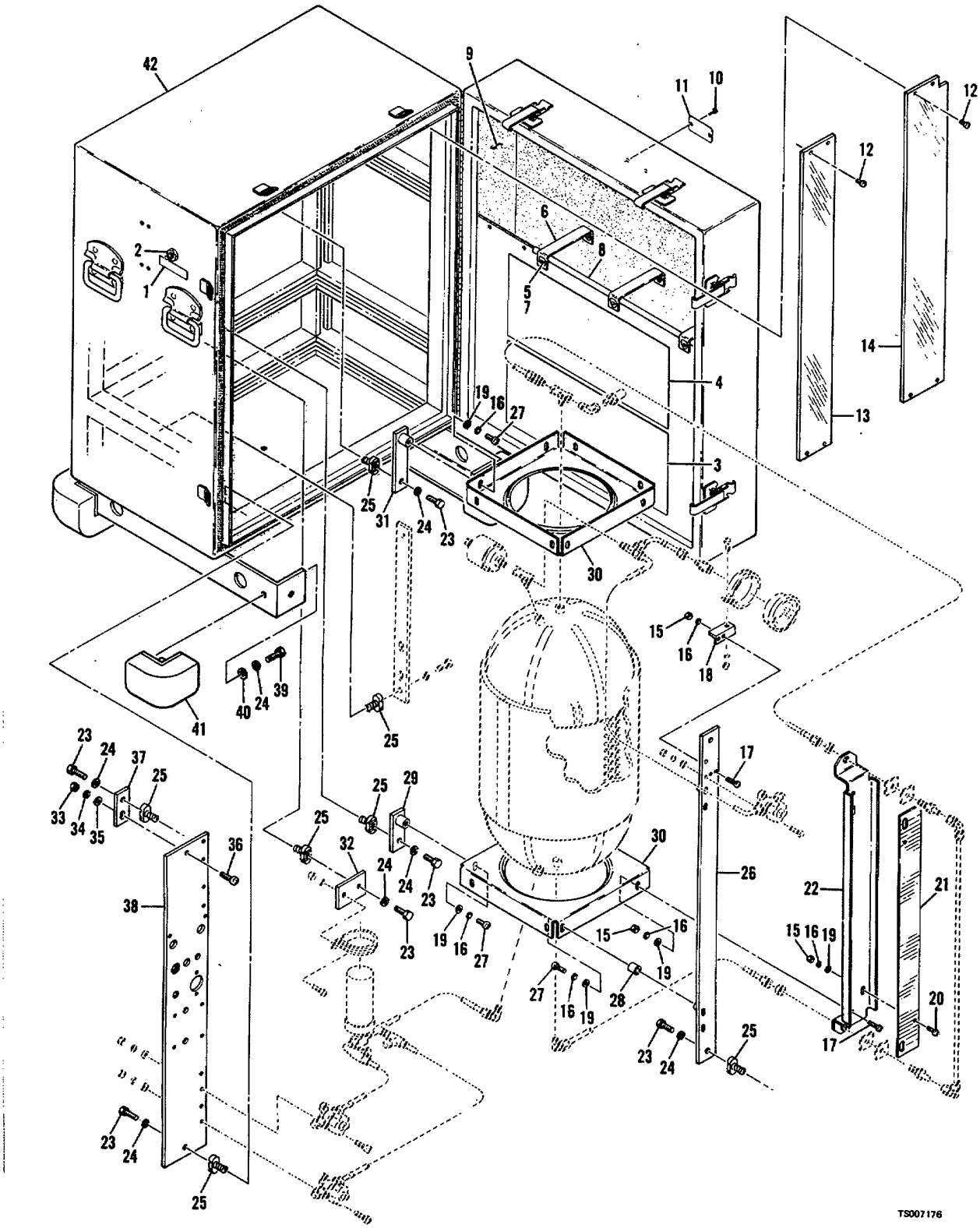

Figure C-1. Cover, doors, and panels

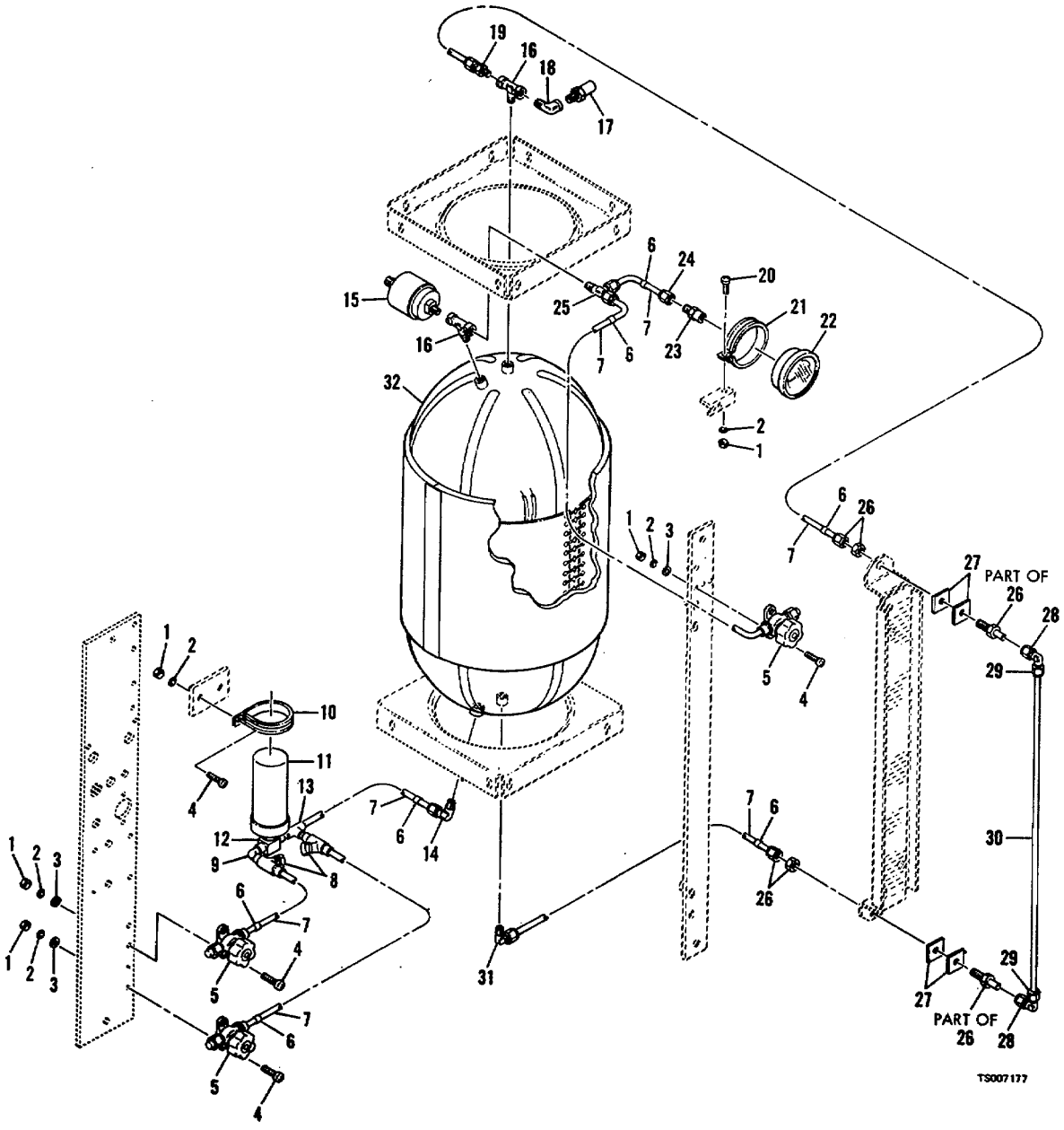

Figure C-2. Refrigeration charge system

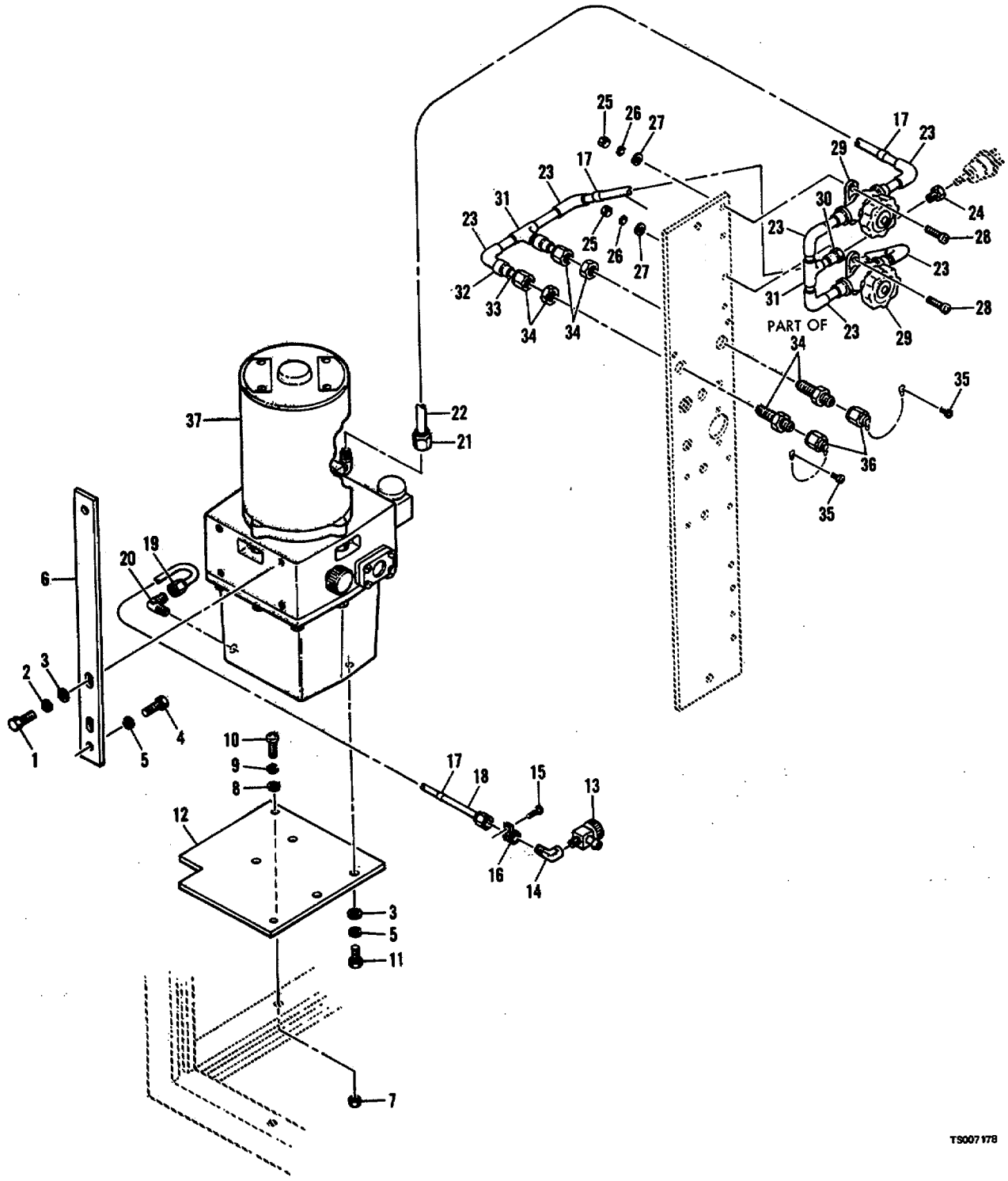

Figure C-3. Vacuum system {sheet 1 of 2)

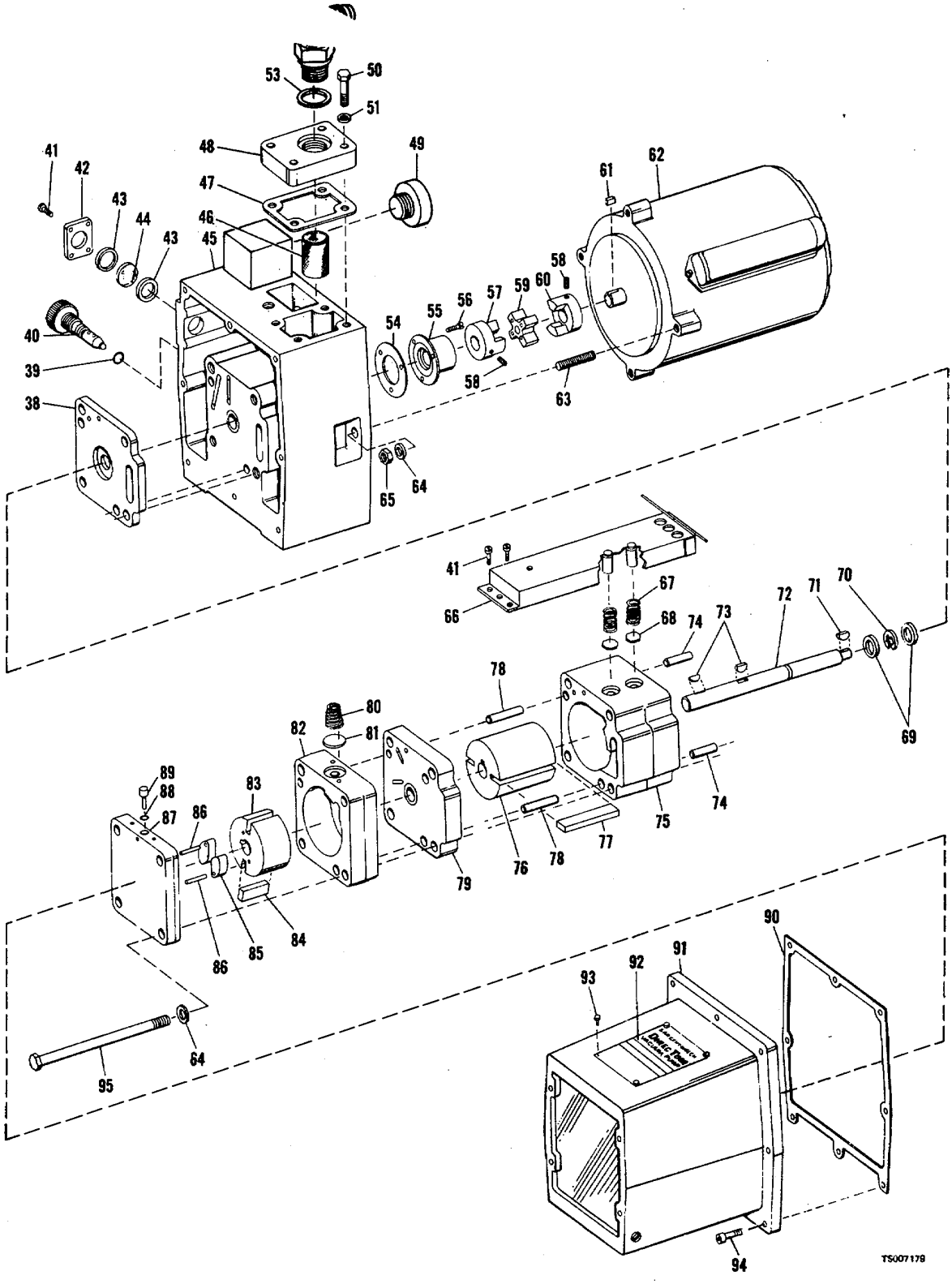

Figure C-3. Vacuum system (sheet 2 of 2)

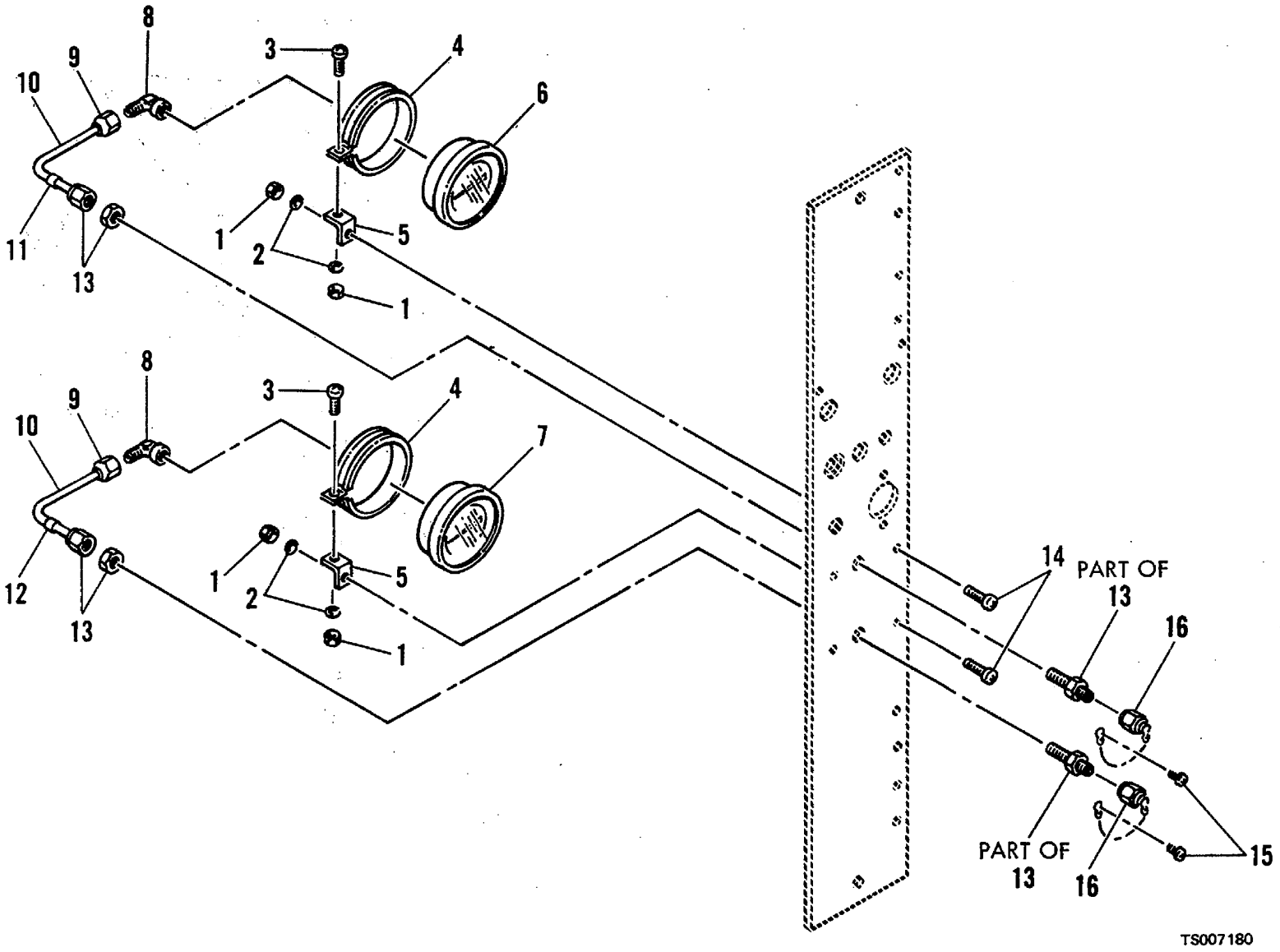

Figure C-4. Gages

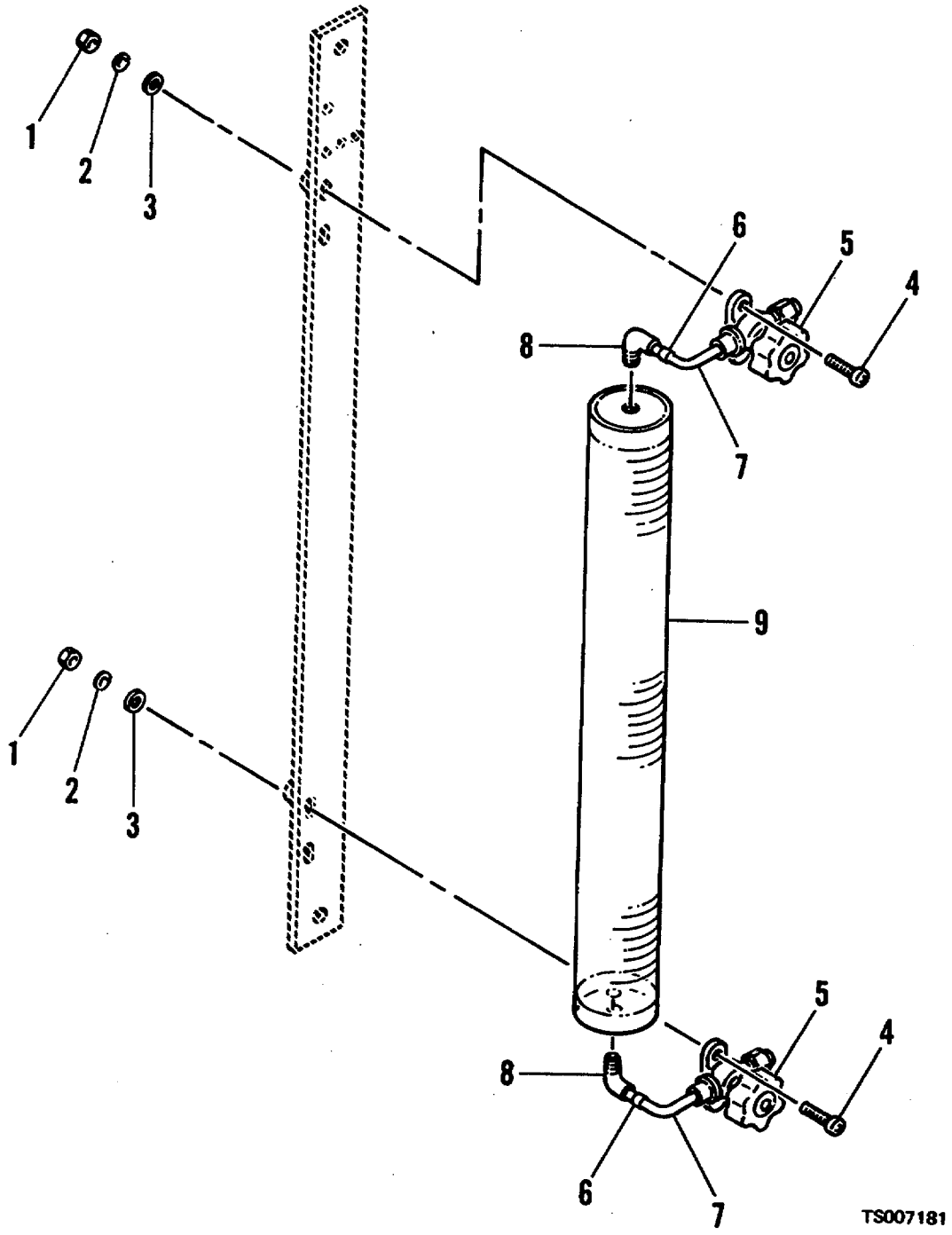

Figure C-5. Oil change system

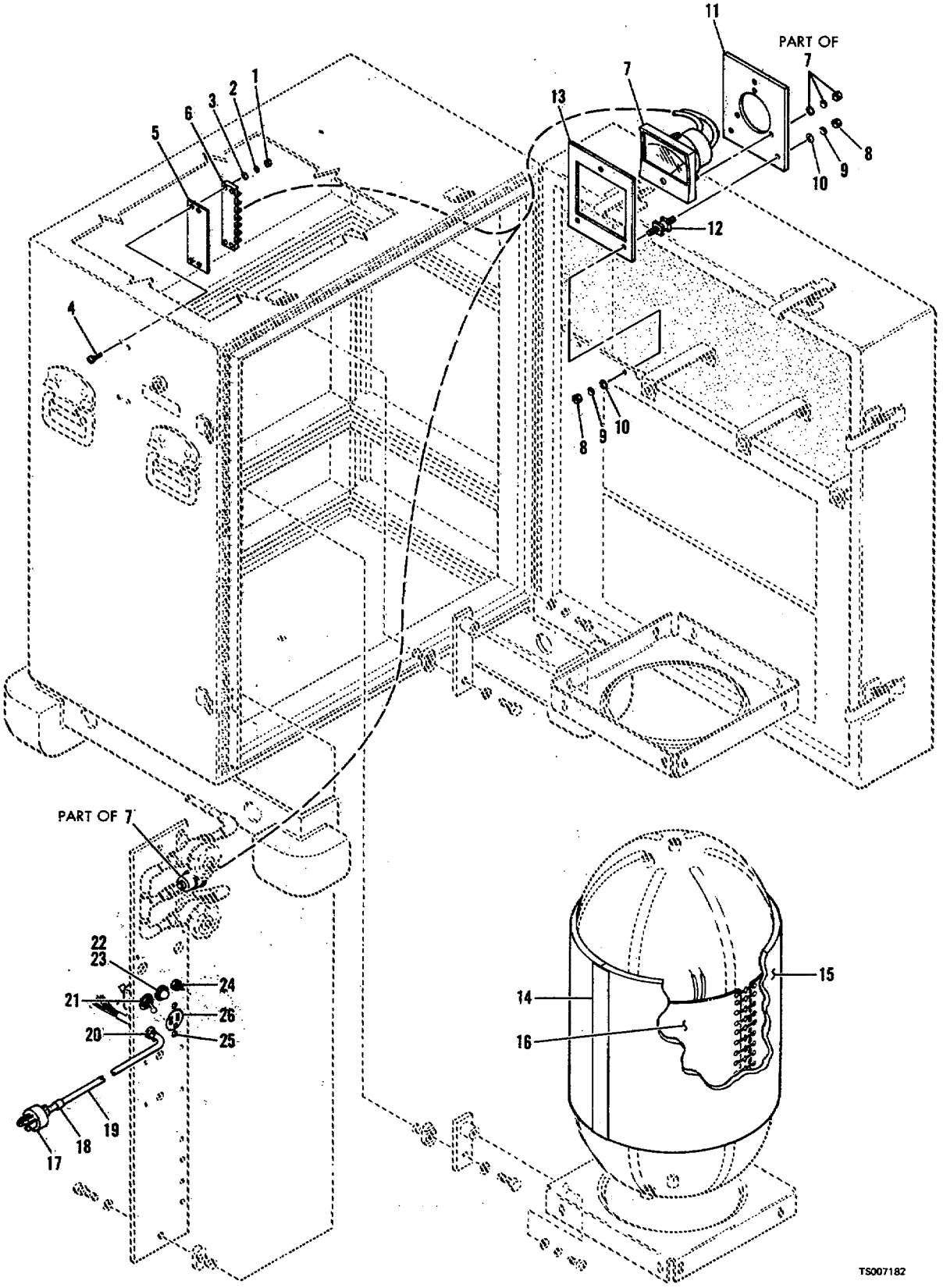

Figure C-6. Electrical system

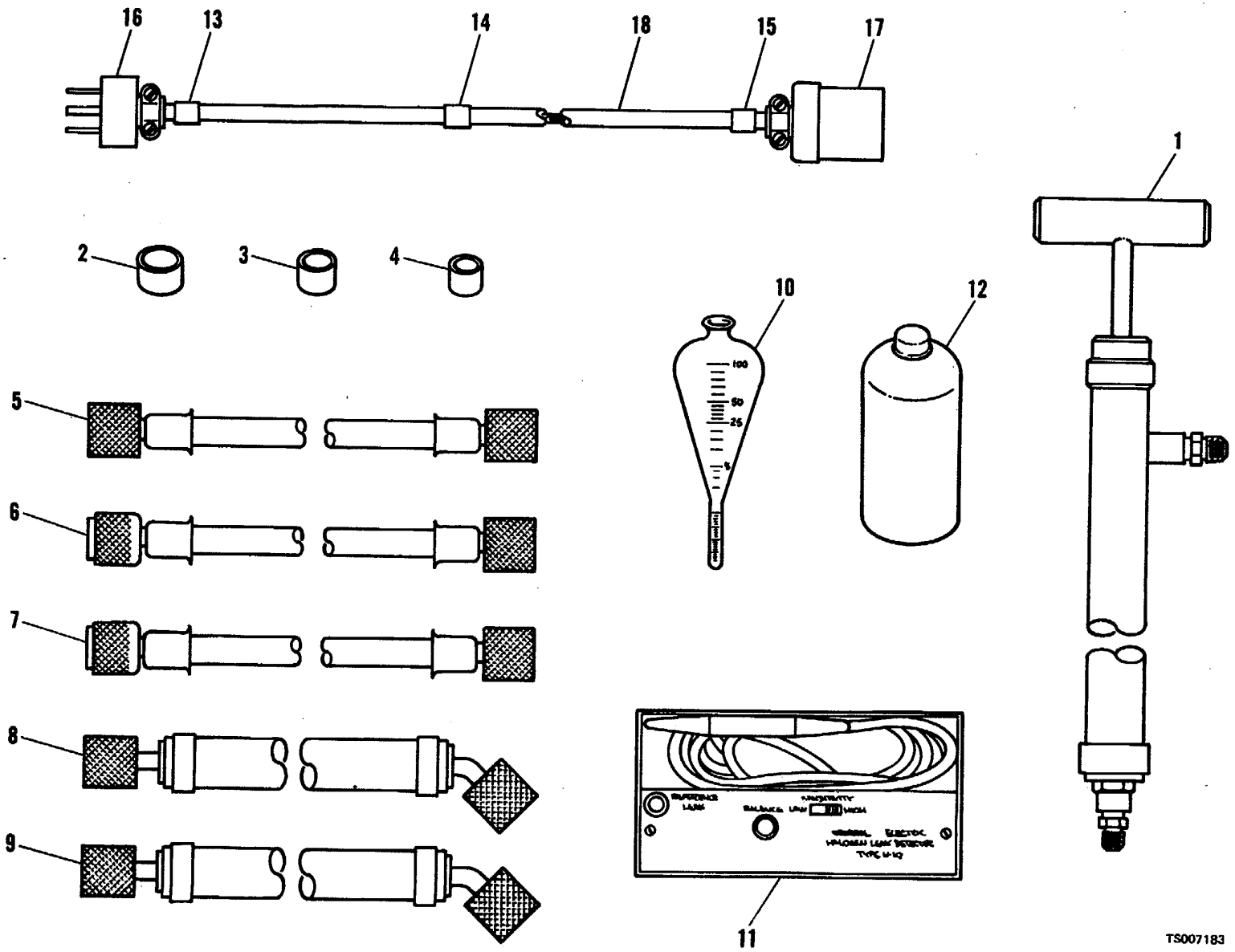

Figure C-7 Accessories

Section II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
.						REPAIR PARTS FOR ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE E GROUP 01 - COVER, DOORS, PANELS		
C-1	1	XBFZZ.		SK-M829	72484	DECAL, WARNING	EA	1
C-1	2	XBFZZ		SK-M279	72484	VALVE, CLAMP ON	EA	1
C-1	3	XBFZZ		908528-1	70210	PLATE,, ELECTRICAL AND FL-UID SCHEMATIC	EA	1
C-1	4	XBFZZ,		908538-1	70210	PLATE, OPERATING INSTRUCTION	EA	1
C-1	5	PAFZZ		MS52957-27	96906	SCREW, 5-16 in. lg, 6-32	EA	6
C-1	6	XBFZZ		908540-1	70210	STRAP ASSEMBLY	EA	3
C-1	7	PAFZZ	5325-171-4692	AN227-48	88044	STUD	EA	6
C-1	8	XBFZZ		1331 x 19. 0 in.	77969	EXTRUSION, RUBBER 1331 x19.0 in. lg	EA	V
C-1	9	XBFZZ		1-2 in. x 2-4 lb	72484	POLYURETHANE FOAM, 1/ 2 in.. thick, 2-4 lb Density	EA	1
C-1	10	PAFZZ	5305-227-6723	AN530C2-3	88044	SCREW	EA	2
C-1	11	XBFZZ		908539-1	70210	PLATE, SERVICE UNIT IDENTIFICATION	EA	1
C-1	12	PAFZZ	5305-815-8897	AN530C10-8	88044	SCREW	EA	8
C-1	13	XBFZZ		908536-2	70210	SHIELD	EA	1
C-1	14	XBFZZ.		908536-1	70210	SHIELD	EA	1
C-1	15	PAFZZ	5310-934-9751	MS35650-302	96906	NUT, 10-32	EA	4
C-1	16	PAFZZ	5310-933-8120	MS35338-138	96906	WASHER, LOCK, No.10	EA	7
C-1	17	PAFZZ	5305 059 3660	MS59158-63	98906	SCREW, 3/4 in. lg, 10-32	EA	2
C-1	18	XBFZZ		908535-8	70210	BRACKET	EA	1
C-1	19	PAFZZ	5310-167-0812	AN960C10L	88044	WASHER, FLAT, No. 10	EA	6
C-1	20	PAFZZ	5305-059-3659	MS51958 63	96906	SCREW, 1/2in. lg, 10-32	EA	2
C-1	21	XBFZZ		908467-1	70210	SCALE, FREON SERVICE UNIT GRADUATED	EA	1
C-1	22	XBFZZ		908469-1	70210	BRACKET	EA	1
C-1	23	PAFZZ	5306-226-4827	MS90728-34	96906	BOLT, 1.0 in. lg,, 5/16-18	EA	14
C-1	24	PAFZZ	5310-974-6623	MS35338-140	96906	WASHER,, LOCK, 5/16 in,	EA	14
C-1	25	XBFZZ	5310-331-9467	P1007	96195	NUT. UNISTRUT	EA	13
C-1	26	XBFZZ		908541-1	70210	PANEL	EA	1
C-1	27	PAFZZ	5305-050 9231	MS51957-65	98906	SCREW, 3/4 in. lg, 10-24	EA	10
C-1	28	XBFZZ		S8168-21S0500	70210	SPACER	EA	2
C-1	29	XBFZZ		908535-2	70210	BRACKET	EA	4
C-1	30	XBFZZ		908470-l	70210	SUPPORT ASSEMBLY	EA	2
C-1	31	XBFZZ		908535-1	70210	BRACKET	EA	4
C- I	32	XBFZZ		908535-5	70210	BRACKET	EA,	1
C-1	33	PAFZZ	5310-043-0520	MS35650-3252	96906	NUT, 1/4-28	EA	1
C-1	34	PAFZZ	5310-933-8121	MS35338-139	96906	WASHER, LOCK, 1/4 in.	EA	1
C-1	35	PAFZZ	5310-205-8924	AN960C416L	88044	WASHER, FLAT. 1/4 in	EA	1
C-1	36	PAFZZ	5305-059-5432	MS51958-82	96906	SCREW, 7/8 in, lg, 1/4-28	EA	1
C-1	37	XBFZZ		908535-3	70210	BRACKET	EA	1
C-1	38	XBFZZ		908534-1	70210	PANEL, CONTROL	EA	1

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
C-1	39	PAFZZ	5306-226-4824	MS90728-31	96906	BOLT, 5/8 in. lg,, 5/16-18	EA	12
C-1	40	PAFZZ	5310-167-0814	AN960C516L	88044	WASHER, FLAT, 5/16 in.	EA	12
C-1	41	PAFZZ		908533-1	70210	SHOCK ISOLATOR	EA	4
C-1	42	XAFZZ		908516-1	70210	ENCLOSURE, SERVICE UNIT	EA	1
						GROUP 02 - REFRIGERATION CHARGE SYSTEM		
C-2	1	PAFZZ	5310-934-9751	MS35650-302	96906	NUT, 10-32	EA	7
C-2	2	PAFZZ	5310-933-8120	MS35338-138	96906	WASHER, LOCK, No. 10	EA	7
C-2	3	PAFZZ	5310-167-0815	AN960C10L	88044	WASHER, FLAT, No. 10	EA	6
C-2	4	PAFZZ	5305-059-3660	MS51958-64	96906	SCREW, 3/4 in. lg, 10-32	EA	7
C-2	5	PAFZZ		234A6	58553	VALVE	EA	3
C-2	6	XBFZZ		WCBT-OR1	13476	TAPE, PIPE BANDING, Orange	EA	V
C-2	7	XBFZZ		908530-52	70210	TUBING, 3/8 in. O.D. x 0.032 in. wall	EA	V
C-2	8	PAFZZ		802AGS	58553	CHECK VALVE	EA	2
C-2	9	XBFZZ	4730-818-5201	W2009	41947	ELBOW, 90 Degree	EA	1
C-2	10	XBFZZ	5340-419-7847	NAS1713D32N	80205	CLAMP	EA	1
C-2	11	PAFZZ		T8	87698	FILTER DRIER	EA	1
C-2	12	XBFZZ		TC35	87698	CONNECTOR, TEE	EA	1
C-2	13	XBFZZ	4730-263-6460	W4000	41947	TEE	EA	1
C-2	14	XBFZZ		B600-2-8	02570	ELBOW	EA	1
C-2	15	PAFZZ		612G70	09049	SWITCH, PRESSURE	EA	1
C-2	16	XBFZZ		B4BT	02570	TEE	EA	2
C-2	17	XBFZZ		3001-125	58553	RELIEF VALVE, ATMOSPHERIC	EA	1
C-2	18	XBFZZ		4SE	11647	ELBOW	EA	1
C-2	19	XBFZZ		B600-1-4	02570	CONNECTOR, MALE	EA	1
C-2	20	PAFZZ	5305-059-3659	MS51958-63	96906	SCREW, 1/2 in. lg, 10-32	EA	1
C-2	21	XBFZZ		NAS1713D42N	80205	CLAMP	EA	1
C-2	22	PAFZZ		25-1009AC02B-	04146	GAGE, 30 in. vac x 150 psig	EA	1
C-2	23	XBFZZ	4730-189-2739	W1215	41947	ADAPTER	EA	1
C-2	24	XBFZZ		NS4-6	58553	NUT, FLARE	EA	1
C-2	25	XBFZZ		B600-3TMT	02570	TEE	EA	1
C-2	26	XBFZZ		B600A1-6	02570	ADAPTER, BULKHEAD	EA	2
C-2	27	XBFZZ		A1063	96195	PLATE FITTING	EA	4
C-2	28	XBFZZ		B600-9	02570	ELBOW, UNION	EA	2
C-2	29	PAFZZ		NY600	02570	FERRULE SET, NYLON	EA	2
C-2	30	PAFZZ		908530-55	70210	TUBING	EA	1
C-2	31	PAFZZ		B600-2-4	02570	ELBOW	EA	1
C-2	32	XBFZZ		908468-1	70210	TANK ASSEMBLY	EA	1
						GROUP 03 - VACUUM SYSTEM		
C-3	1	XBFZZ		2-01-0310	64484	SCREW, CAP, 5/8 in. lg, 5/16-18	EA	4
C-3	2	XBFZZ		2-63-0356	64484	WASHER, LOCK, 5 16 in.	EA	4

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
C-3	3	PAFZZ		AN960C5166	88044	WASHER,, FLAT, 5/16in.	EA	8
C-3	4	PAFZZ	5306-226-4827	MS90728-34	96906	BOLT, 1.0 In. lg, 5/16-18	EA	4
C-3	5	PAFZZ	5310-974-6623	MS35338-140	96906	WASHER,, LOCK, 5/16in.	EA	9
C-3	6	XBFZZ		908535-4	70210	BRACKET	EA	2
C-3	7	PAFZZ	5310-997-1888	MS35649-2252	96906	NUT, 1/4-20	EA	2
C-3	8	PAFZZ	5310-209-0355	AN960C416L	88044	WASHER,, FLAT, 1/4 In.	EA	2
C-3	9	PAFZZ	5310-933-8121	MS35338-139	96906	WASHER, LOCK,, 1/4 in.	EA	2
C-3	10	PAFZZ		MS51957-81	96906	SCREW, 3/4 in. lg,, 1/4-20	EA	2
C-3	11	PAFZZ		MS90728-31	96906	BOLT, 5/8 in. lg,, 5/16-18	EA	4
C-3	12	XBF ZZ	5306- 226-4824	90853 5- 7	70210	BRACKET	EA	1
C-3	13	XBFZZ		41-1734	64484	VALVE, DRAIN	EA	1
C-3.	14	XBFZZ		U3-6B	58553	ELBOW	EA	1
C-3	15	PAFZZ	5305-067-9908	AN530C10-8	88044	SCREW	EA	1
C-3	16	XBFZZ		NAS1713D14N	80205	CLAMP	EA	1
C-3	17	XBFZZ		WCBT-GR-1	13476	TAPE, PIPE BANDING, Green	EA	V
C-3	18	XBFZZ		908530-52	70210	TUBING, COPPER, 3/8 in. O.Dx0.032 in.. wall	EA	V
C-3	19	XBFZZ	4730-189-2739	NS4-6	58553	NUT, FLARE	EA	2
C-3	20	XBFZZ	4730-288-9438	El-8B	58553	ELBOW, 90 Degree	EA	1
C-3	21	XBFZZ	4730-189-2742	NS4-10	58553	NUT, FLARE	EA	1
C-3	22	XBFZZ'		908590-54	70210	TUBING, COPPER, 5/8 in.,O.D. x 0.035 in. wall	EA	V
C-3	23	XBFZZ	4730-254-6450	W-2022	41947	ELBOW, 90 Degree	EA	5
C-3	24	XBFZZ		R1-AB	58553	BUSHING	EA	1
C-3	25	PAFZZ	5310-934-9751	MS35650-302	96906	NUT, 10-32	EA	4
C-3	26	PAFZZ	5310-933-8120	MS35338-138	96906	WASHER, LOCK, No. 10	EA	4
C-3	27	PAFZZ	5910-167-0812	AN960C10L	88044	WASHER, FLAT, No. 10	EA	4
C-3	28	PAFZZ		MS51958-64	96906	SCREW, 3/4 in. lg, 10-32	EA	4
C-3	29	PAFZZ	4820-866-4619	256-t0S	58553	VALVE, HAND EXPANSION	EA	2
C-3	30	XBFZZ	4730-988-9139	W-1233	41947	ADAPTER ,	EA	1
C-3	31	XBFZZ	4730-263-6472	W-4006	41947	TEE	EA	2
C-3	32	XBFZZ	4730-277-7542	W-1315	41947	BUSHING	EA	2
C-3	33	XBFZZ		908530-53	70210	TUBING, COPPER, 1/2 in. O.D, xO.032in, wall	EA	V
C-3	34	XBFZZ		B810-61-BAN	02570	UNION. BULKHEAD	EA	2
C-3	35	PAFZZ	5305-054-5647	MS51957-13	96906	SCREW, 1/4 in. lg, 4-40	EA	2
C-3	36	XBFZZ		6209-8-4-2	20282	CAP, TUBE FITTING AND CHAIN	EA	2'
C-3	37	PAFFF		908532-1	20210	VACUUM PUMP (See figure D-3, sheet 2.)	EA	1
C-3	38	XBFZZ		41-2742	64484	WEAR PLATE	EA	1
C-3	39	XBFZZ		41-1742	64484	O-Ring	EA	1
C-3	40	XBFZZ		41-1736	64484	VALVE, VENTED-EXHAUST	EA	1
C-3	41	XBFZZ		2-90-2606	64484	SCREW, 3/8 In. lg, 8-32	EA	6
C-3	42.	XBFZZ		41-2721	64484	COVER, OIL LEVEL	EA	1
C-3	43	PAFZZ		41-2720	64484	SEAL RING	EA	2
C-3	44	PAFZZ		41-2719	64484	DISK. GLASS	EA	1

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C-3	45	XBFZZ		41-2700	64484	PLATE, MOUNTING	EA	1
C-3	46	XBFZZ		41-2745	64484	SCREEN, INTAKE	EA	1
C-3	47	XBFZZ		41-2744	64484	GASKET, INTAKE COvER	EA	1
C-3	48	XBFZZ		41-4743	64484	COVER, INTAKE	EA	1
C-3	49	XBFZZ		41-0612	64484	CAP, DUST	EA	1
C-3	50	XBFZZ		2-010116	64484	SCREW, CAP, 1.0in. lg,, 1/4-20	EA	4
C-3	51	XBFZZ		2-61-0000	64484	WASHER, FLAT, 3/16 in.	EA	4
C-3	52	XBFZZ		908532-52	70210	FITTING	EA	1
C-3	53	XBFZZ		41-0491	64484	WASHER, ALUMINUM	EA	1
C-3	54	XBFZZ	5330-911-9639	41-0643	64484	GASKET, SEAL	EA	1
C-3	55	PAFZZ	4310-515-0554	1401E	64484	SEAL, SHAFT, (including Item 54 and 56)	EA	1
C-3	56	XBFZZ		2-00-2705	64484	SCREW, 5/16 in. lg, 10-32	EA	3
C-3	57	XBFZZ		41-2730	64484	COUPLING BODY, (including Item 56)	EA	1
C-3	58	XBFZZ		2-01-9104	64484	SETSCREW, 1/4 in. lg, 1/4-20	EA	2
C-3	59	XBFZZ		41-2731	64484	COUPLING SPIDER	EA	1
C-3	60	XBFZZ		41-2729	64484	COUPLING BODY, (including Item 58))	EA	1
C-3	61	XBFZZ		3-16x3-16x3-8	64484	KEY, MOTOR SHAFT, 3/16x3/16x3/8 in.	EA	1
C-3	62	XBFZZ		41-2000	64484	MOTOR, 1/3 hp. 115 v, 60 Hz	EA	1
C-3	63	XBFZZ		41-2726	64484	STUD, MOTOR	EA	4
C-3	64	XBFZZ		2-61-0571	64484	WASHER, FLAT, 3/8 x 5/8 x 0.071 in.	EA	8
C-3	65	XBFZZ		2-31-2521	64484	NUT, 3/8-16	EA	4
C-3	66	XBFZZ		41-2715	64484	DUCT ASSEMBLY, EXHAUST	EA	1
C-3	67	XBFZZ		41-2722	64484	SPRING, INTAKE VALVE	EA	2
C-3	68	XBFZZ		41-2718	64484	VALVE, INTAKE	EA	2
C-3	69	XBFZZ		41-1285	64484	WASHER, THRUST	EA	2
C-3	70	XBFZZ		41-1150	64484	RING, TRUARC	EA	I
C-3	71	XBFZZ		41-2732	64484	KEY, COUPLING	EA	1
C-3	72	XBFZZ		41-2710	64484	SHAFT	EA	1
C-3	73	XBFZZ	5315-402-4697	41-0613	64484	KEY, WOODRUFF	EA	2
C-3	74	XBFZZ		4-21-9001	64484	PIN. DOWEL, 1.0in.Ig, 3/8in. Dia.	EA	2
C-3	75	XBFZZ		41-2701	64484	RING, LARGE INTAKE	EA	1
C-3	76	XBFZZ		41-2706	64484	ROTOR, LARGE INTAKE	EA	1
C-3	77	XBFZZ		41-2708	64484	VANE, LARGE	EA	2
C-3	78	XBFZZ		4-21-9002	64484	PIN, DOWEL, 1-1/4in. lg.. 3/8 in. Dia.	EA	2
C-3	79	XBFZZ		41-2703	64484	CENTERPLATE	EA	1
C-3	80	XBFZZ		41-2723	64484	SPRING, EXHAUST VALVE	EA	1
C-3	81	XBFZZ		41-2777	64484	VALVE, EXHAUST	EA	1
C-3	82	XBFZZ		41-2702	64484	RING, EXHAUST	EA	1
C-3	83	XBFZZ		41-2707	64484	ROTOR, EXHAUST	EA	1
C-3	84	XBFZZ		41-2709	64484	VANE, SMALL	EA	2
C-3	85	XBFZZ		41-2713	64484	CAM, HINGED	EA	2
C-3	86	XBFZZ		4-21-3012	64484	PIN, DOWEL, 34 in. Ig. 1/8 In. Dia.	EA	2
C-3	87	XBFZZ		41-2704	64484	END PLATE	EA	1

(1) ILLUSTRATION (a) FIG NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
C-3	88	XBFZZ		41-4465	84484	O-RING	EA	1
C-3	89	XBFZZ		41-2712	64484	PLUNGER, OIL FEED	EA	1
C-3	90	PAFZZ		41-2714	64484	GASKET, OILCASE	EA	1
C-3	91	XBFZZ		41-2705	64484	OILCASE, SMALL	EA	1
C-3	92	XBFZZ		41-2607	64484	NAMEPLATE	EA	1
C-3	93	XBFZZ		2-09-1204	64484	SCREWSTICK, SELF-TAPPING,1/8in.lg, 3-48	EA	4
C-3	94	XBFZZ.		2-01-6112	64484	SCREW, 3/4in. lg, 1/4-20	EA	8
C-3	95	XBFZZ		2-01-0588	64484	SCREW, 5-1/2 in. lg, 3/8-16	EA	4
						GROUP 04 - GAGES		
C-4	1	PAFZZ	5310-934-S751	MS35650-302	96906	NUT, 10-32	EA	4
C-4	2	PAFZZ	5310-933-8120	MS35338-138	96906	WASHER, LOCK, No. 10	EA	4
C-4	3	PAFZZ	5305-059-3659	MS51958-63	96906	SCREW, 1/2 in. lg, 10-32	EA	2
C-4	4	XBFZZ		NAS1713D42N	80205	CLAMP	EA	2
C-4	5	XBFZZ		908535-9	70210	BRACKET	EA	2
C-4	6	PAFZZ		25-1009AC02B	04146	GAGE, 30 in.. vac x 150 psig	EA	1
C-4	7	PAFZZ		25-1009AC02B	04146	GAGE, 30 in. vac x 60 ,psig	EA	1
C-4	8	XBFZZ		E3-4B	58553	ELBOW, 90 degree	EA	2
C-4	9	XBFZZ	4730-189-2767	NS4-4	58553	NUT, FLARE	EA	2
C-4	10	XBFZZ		908530-51	70210	TUBING, COPPER, 1/4 in. O.D. x 0.030 in. wall	EA	V
C-4	11	XBFZZ		WCBT-RD-1	13476	TAPE, PIPE BANDING, Red	EA	V
C-4	12	XBFZZ		WCBT-BL-1	13476	TAPE, PIPE BANDING, Blue	EA	V
C-4	13	XBFZZ		B400-61-4AN	02570	UNION, BULKHEAD	EA	2
C-4	14	PAFZZ	5305-059-3660	MS51958-64	96906	SCREW, 3/4 in. lg, 10-32	EA.	2
C-4	15	PAFZZ	5305-054-5647	MS51957-13	96906	SCREW, 1/4 in. lg, 4-40	EA	2
C-4	16	XBFZZ	6920-783-0768	6209-4-4-2	20282	CAP, TUBE FITTING AND CHAIN	EA	2
						GROUP 05 - OIL CHARGE SYSTEM		
C-5	1	PAFZZ	5310-934-9751	MS35650-302	96906	NUT, 10-32	EA	4
C-5	2	PAFZZ	5310-933-8120	MS35338-138	96906	WASHER, Lock, No, 10	EA	4
C- 5	3	PAFZZ	5310-167-0812	AN960C10L	88044	WASHER, FLAT, No. 10	EA	4
C-5	4	PAFZZ	5305-059-3660	MS61958-64	96906	SCREW, 3/4 in. lg, 10-32	EA	4
C-5	5	PAFZZ	4820-789-0417	234A4	58553	VALVE	EA	2
C- 5	8	XBFZZ		WCBT-YLI	13476	TAPE, PIPE BANDING, Yellow	EA	V
C- 5	7	XBFZZ		908530-- 51	70210	TUBING, COPPER, 1/4 in. O. D. x 0.030 in. wall	EA	V
C-5	8	XBFZZ		W2106	41947	ELBOW, 90 degree	EA	2
C-5	9	PAFZZ		908466-1	70210	BEAKER, GRADUATED	EA	1
						GROUP 06 - ELECTRICAL SYSTEM i		
C-6	1	PAFZZ	5310-934-9747	MS35649-262	96906	NUT, 6-32	EA	4
C- 6	2	PAFZZ	5310-933-8119	MS35338-137	96906	WASHER, LOCK, No. 8 '	EA	4
C-6	3	PAFZZ	5310-880-5975	NAS620C8L	80205	WASHER, FLAT, No. 8	EA	4
C- 6	4	PAFZZ	5305-054-667i	MS51957-46	96906	SCREW, 5/8 in. lg, 10-32	EA	4
C-6	5	XBFZZ		MS8-141	76530	MARKER STRIP	EA	1
C- 6	6	XBFZZ		354-11-08-001	76530	TERMINAL STRIP	EA	1
C- 6	7	PAFZZ		NRC 801	07687	THERMOCOUPLE GAGE CONTROL	EA	1

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C-6	8	PAFZZ	5310-934-9757	MS35649-282	96906	NUT, 8-32	EA	6
C-6	9	PAFZZ	5310-933-8119	MS35338-137	96906	WASHER, LOCK,No.8	EA	6
C 6	10	PAFZZ	5310-880-5975	NAS620C8L	80205	WASHER, FLAT,No.8	EA	6
C-6	11	XBFZZ		903535-6	70210	BRACKET	EA	1
C-6	12	PAFZZ		10ZI-323B	14519	SHOCK ISOLATOR (Mid by Uniroyal General)	EA	3
C- 6	13	XBFZZ		908537-1	70210	PANEL	EA	1
C-6	14	XBFZZ		Type 425	26066	TAPE, ALUMINUM	EA	V
C- 6	15	XBFZZ		PF314	26002	INSULATION. FIBERGLASS	EA	v
C-6	16	PAFZZ		760-4152	11416	TANK HEATER	EA	1
C- 6	17	PAFZZ	5935-832-5865	5266	74545	CONNECTOR, ELECTRICAL PLUG POLARIZED 2-POLE, 3 Wire Grounding	EA	1
C- 6	18	XBFZZ		TY-52	59730	STRAP, IDENTIFICATION	EA	1
C-6	19	XBFZZ		Type SO-16/3	70903	CONDUCTOR, NEOPRENE JACKET	EA	V
C- 6	20	XBFZZ		No. 112	74545	CORD GRIP	EA	1
C- 6	21	PAFZZ	5925-842-7298	MS24509-15	96906	CIRCUIT BREAKER	EA	1
C- 6	22	PAFZZ		NE- 51H	72619	LAMP	EA	1
C-6	23	XBFZZ	6210-682-3412	95-0463-0931-	72619	LAMP ASSEMBLY	EA	1
C-6	24	PAFZZ	5930-615-9376	MS35059-21	96906	SWITCH	EA	1
C-6	25	PAFZZ	5305-054-6656	MS51957-32	96906	SCREW. 3/4 in. lg, 6-32	EA	2
C- 6	26	PAFZZ	5935-901-7397	5284	74545	CONNECTOR, POLARIZED 3-WIRE GROUNDING, 2-Pole Electrical Receptacle	EA	1
						GROUP 07 - ACCESSORIES		
C-7	1	PAFZZ.		908531-1	70210	OIL PUMP	EA,	1
C-7	2	PAFZZ		CH20-1/2	11284	GASKET. TUBULAR	EA	10
C-7	3	PAFZZ		CH20-3/8	11284	GASKET, TUBULAR	EA.	10
C-7	4	PAFZZ!		CH20-1/4	11284	GASKET, TUBULAR	EA	10
C-7	5	PAFZZ		B60	11284	HOSE ASSEMBLY, REFRIGERATION, 3/8 in.. Flare x 3/8 in Flare, 60 in. lg	EA	1
C-7	6	PAFZZ		HB60	11284	HOSE ASSEMBLY, REFRIGERATION. 1/4 in. Flare x 3/8 in. Flare. 60 in. lg	EA	2
C-7	7	PAFZZ		HB240	11284	HOSE ASSEMBLY, REFRIGERATION 1/4 in.. Flare x3/8 in.. Flare, 240 in. lg		
C-7	8	PAFZZ		3267-1-0720	21392	HOSE ASSEMBLY. REINFORCED Vinyl 72 in. Lg	EA	1
C-7	9	PAPZZ		3267-1-2400	21392	HOSE ASSEMBLY, REINFORCED Vinyl 240 in. lg	EA	1
C-7	10	PAFZZ		21119-001	08455	TUBE, CENTRIFUGE. 100 ML	EA	1
C-7	11	PAFZZ	5940-625-0198	H10	97424	LEAK DETECTOR	EA	1
C-7	12	PAFZZ	9150-273-8663	1407K	64484	OIL, DUO-SEAL, 1 Quart	EA	1
C-7	13	XBFZZ	5975-444-0635	TY50	59730	TIE, IDENTIFICATION (P2 TO J2 MUST UNIT)	EA	1
C-7	14					TIE, IDENTIFICATION (908542-1 115 vac 60 Hz)	EA	1
C-7	15					TIE, IDENTIFICATION	EA	1
C-7	16	PAFZZ			74545 88342 04009	CONNECTOR	EA	1
C-7	17	PAFZZ	5935-647-3546	5269	74545 88342 04009	CONNECTOR	EA	1
C-7	18	PAFZZ	6145-284-0079	1935/3	70331	CORD, POWER 300 in. lg	EA	1

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P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

NEAR MEASURE

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

WEIGHTS

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

LIQUID MEASURE

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

SQUARE MEASURE

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

CUBIC MEASURE

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

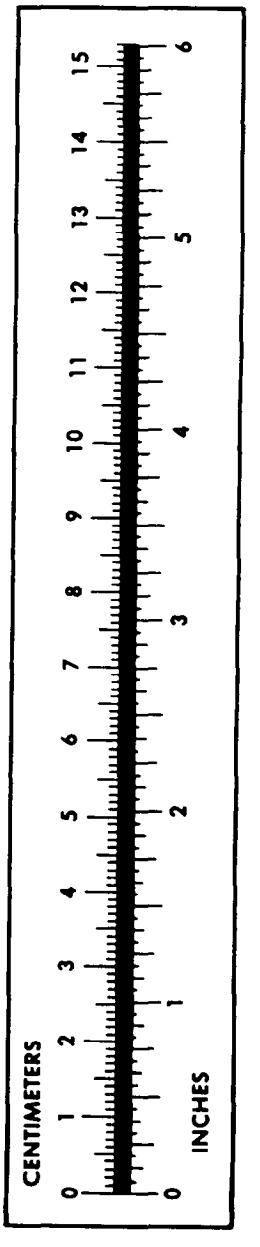
TEMPERATURE

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

APPROXIMATE CONVERSION FACTORS

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

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



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