

TM 5-4320-251-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT  
AND GENERAL SUPPORT MAINTENANCE MANUAL

PUMP, RECIPROCATING, POWER DRIVEN  
DIAPHRAGM, GAS ENGINE DRIVEN, WHEEL

MOUNTED, 100 GPM

THE GORMAN-RUPP COMPANY

MODEL 4D-2A016

FSN 4320-407-2582

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HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1971

## **WARNING**

**Shut off the engine before filling the fuel tank. Take care to prevent spilling gasoline on a hot engine. The gasoline can ignite, causing severe injury or death to the operator.**

## **WARNING**

**If the fuel tank must be repaired by any method involving heat or flame, steam-clean the tank thoroughly to assure that all traces of gasoline are removed before starting repairs. Failure to purge the tank of all traces of fuel fumes before applying heat or flame may result in a severe explosion.**

## **WARNING**

**The exhaust fumes from the engine contain carbon monoxide, a colorless, odorless, deadly poisonous gas. Do not operate this pump in an enclosed area unless the exhaust gasses are piped to the outside of the enclosure.**

TECHNICAL MANUAL }  
 No. 5-4320-251-14 }

HEADQUARTERS,  
 DEPARTMENT OF THE ARMY  
 WASHINGTON, D. C., 25 March 1971

**OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT,  
 AND GENERAL SUPPORT MAINTENANCE MANUAL  
 PUMP, RECIPROCATING, POWER-DRIVEN,  
 DIAPHRAGM, GAS-ENGINE-DRIVEN, WHEEL  
 MOUNTED, 100 GPM  
 THE GORMAN-RUPP CO. MODEL 4D-2A016**

**FSN 4320-407-2582**

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# CHAPTER 1

## INTRODUCTION

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### Section I. GENERAL

#### 1-1. Scope

This technical manual covers the operation and operator's maintenance, organizational maintenance, and direct and general support maintenance for Pump, Reciprocating, Power-Driven, Diaphragm, Gas-Engine-Driven, Wheel Mounted, 100 GPM, Federal Stock No. 4320-407-2582, German-Rupp Model 4D-2A016, manufactured by German-Rupp Company, Mansfield, Ohio.

#### 1-2. Forms and Records

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Equipment Serviceability Criteria  
Not Applicable.

#### 1-4. Reporting of Errors

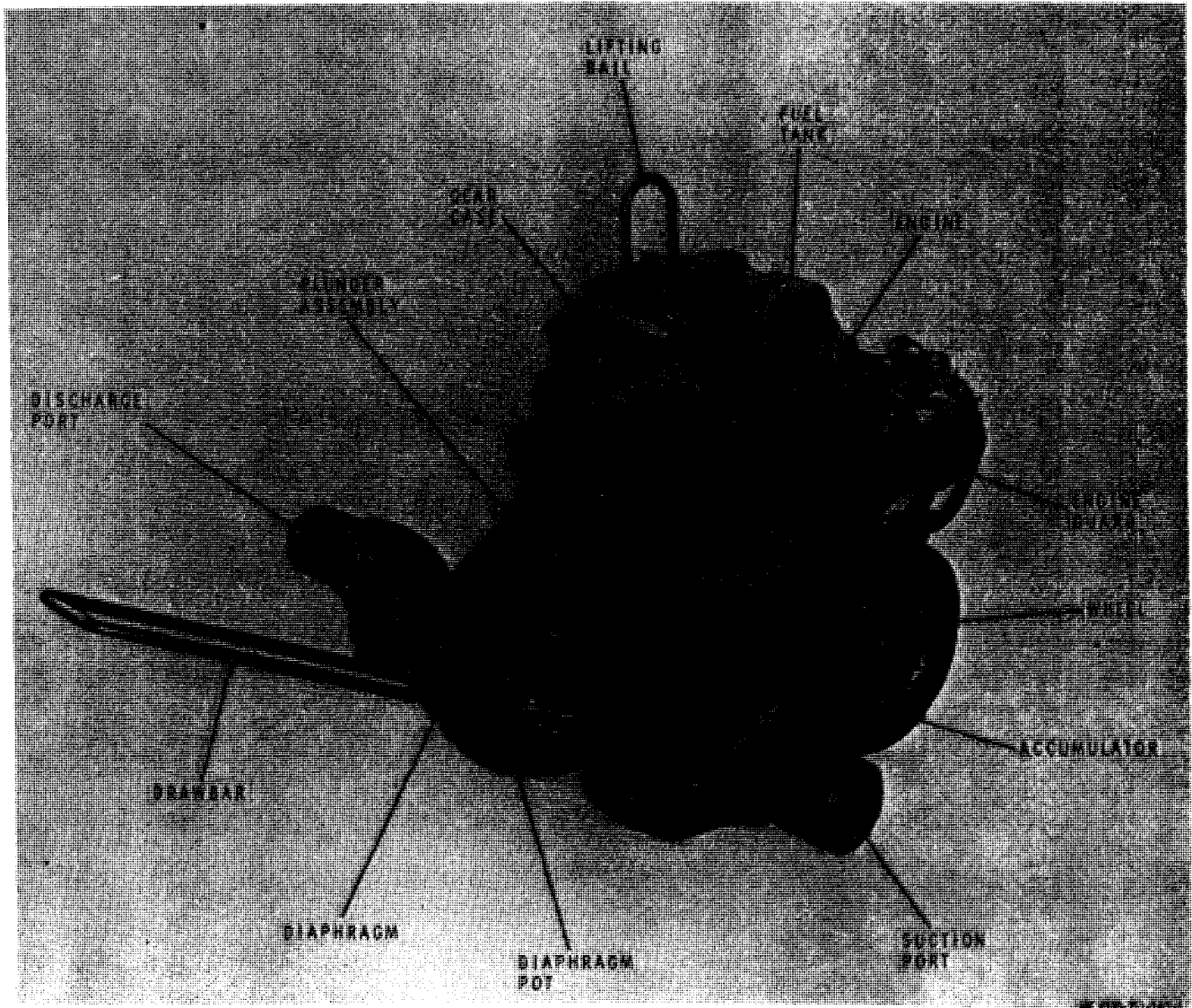
Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded direct to Commanding General, U.S. Army Mobility Equipment Command, ATTN : AMSME-MPP, 4300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

### Section II. DESCRIPTION AND DATA

#### 1-5. Description

a. Reciprocating Pump Model 4D-2A016 (fig. 1-1) is driven by an air-cooled, two-cylinder, Military Standard gasoline engine. The torque

from the engine is transferred to the pump through a flexible coupling. The engine and pump are bolted to a two-wheeled steel trailer.



**Figure 1-1. Reciprocating pump, left front view,**

**b.** The pump has one suction port and one discharge port. These are threaded to receive suction and discharge hoses, Thread size is 4-inch npt male. Four 10-foot suction hoses are provided with the pump. The pump is capable of pumping 100 gallons per minute at a total dynamic head of 35 feet.

**1-6. Differences between Models**

This technical manual covers only Reciprocating Pump Model No. 4D-2A016, manufactured by German-Rupp Company, Mansfield, Ohio. No known differences exist on the pumps procured under this model number.

**1-7. Identification and Tabulated Data**

**a. Identification.** The reciprocating pump has three identification plates.

(1) *Army data plate.* The army data plate is

located on the coupling guard between the pump and engine. It specifies the nomenclature, contract number, model number, manufacturer, capacity, dimensions, weight, and cubage.

(2) *Engine plate.* The engine plate is located on the flywheel housing. It specifies the number of cylinders, displacement, Federal Stock Number, serial number, and model number. It lists the date of manufacture, contract number, and applicable technical manuals.

(3) *Pump plate.* The pump plate is located on the gear case on the right side of the pump. It specifies the manufacturer, model number, serial number, and patent information.

**b. Tabulated Data.**

(1) *Pump.*

Manufacturer . . . . . German-Rupp Company  
 Model . . . . . 4D-2A016

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## CHAPTER 2

### OPERATING INSTRUCTIONS

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#### Section I. SERVICE UPON RECEIPT OF MATERIEL

##### **2-1. Assembling, Inspection, and Servicing the Equipment**

*a. Assembly.* New pumps are shipped from the factory with the diaphragm removed. Notify organizational maintenance personnel for installation of the separately packed diaphragm.

*b. Inspection.* Inspect the pump assembly and hoses as follows:

(1) Inspect the pump assembly for cracks, dents, and other damage which may have occurred during shipment.

(2) Inspect for loose or missing hardware.

(3) Check for damaged threads on the suction and discharge ports.

(4) Using the starting rope, turn the engine over with the ignition switch in the OFF position. The engine and pump shall turn freely without any binding, scraping, or other signs of faulty operation.

(5) If the pump had been in service previously, turn the engine over as directed in (4) above and carefully check the diaphragm for cuts, tears, and leaks.

(6) Insert a hand into the suction and discharge ports and check for free operation of the suction and discharge valves. The valves must move freely and seal tightly.

(7) Inspect the hoses for cuts, collapsed walls, and damaged threads on end fittings.

(8) Tighten any loose hardware. Report any other damage to the required authority.

*c. Servicing.* Service the equipment as follows:

(1) Service the engine as directed in TM 5-2805-257-14.

(2) Lubricate the pump as directed in the current L.O.

(3) Perform all the daily preventive maintenance checks and services indicated in table 3-1.

##### **2-2. Installation**

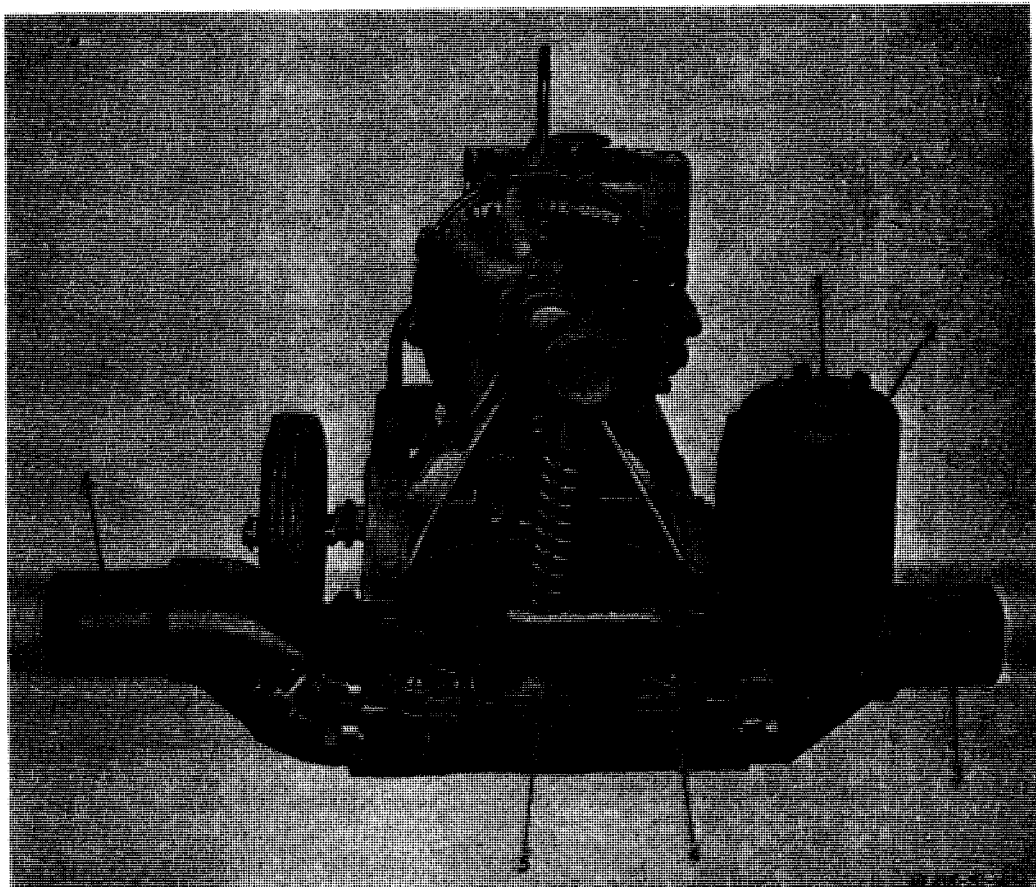
Install the reciprocating pump as follows:

*a.* Locate the pump on a level surface as close to the liquid supply as possible.

*b.* Block the wheels of the pump trailer to prevent the pump from shifting during operation.

*c.* Connect the female end of the suction hose to the suction port (3, fig. 2-1) on the pump. Use thread sealant on all threaded connections. If more than one length of hose is required, add additional lengths to the end of the first hose attached to the pump.

*Note:* Use the shortest possible length of suction hose. Suction hose exceeding 20 feet will reduce the pump capacity. Under any circumstances, the suction lift of the pump must not exceed 25 feet. When the suction lift is greater than 5 feet, a 3-inch suction hose can be used in place of a 4-inch hose without any loss of efficiency. Use a suitable reducer. The 3-inch hose will reduce priming time and will cause less surging during operation. Make sure the suction hose has rigid walls to prevent the hose from collapsing when suction is applied.



1. Accumulator cap
2. Accumulator
3. Suction port

4. Drain plug
5. Drawbar
6. Discharge port

*Figure 2-1. Front view of reciprocating pump.*

*d.* Install a strainer on the intake end of the suction hose.

**Caution.** A strainer must be used on the end of the suction hose to prevent rocks and other unbreakable material from being sucked up into the pump. These could cause severe damage to the pump.

*e.* Connect a discharge hose to the discharge port

(6, fig. 2-1) of the pump. The length of the discharge hose shall not exceed 50 feet. A 4-inch discharge hose must be used.

*f.* Make sure the end of the suction hose and strainer are completely submerged in the liquid to be pumped. Make sure the end of the discharge hose is free from any restrictions.

## Section II. MOVEMENT TO A NEW WORKSITE

### 2-3. Dismantling for Movement

Dismantle the pump for movement to a new worksite as follows:

*a.* Remove the drain plug (4, fig. 2-1 ) to drain the fluid from the pump.

*b.* Disconnect the discharge hose from the discharge port (6).

*c.* Disconnect the strainer from the end of the

suction hose. Disconnect the suction hose from the suction port (3) of the pump.

*d.* Use a shipping dock or use wood planks as a ramp to load the pump on the bed of a suitable truck to transport the pump. Grasp the drawbar (5) when moving the pump, Secure the pump to the side of the truck to prevent it from shifting. Lay the hoses on the bed of the truck.

**Caution:** The wheels and axle of the pump are designed to move the pump into position at the worksite and are not designed for use

during road or highway movement of the pump.

#### 2-4. Reinstallation after Movement

Refer to paragraph 2-2 for installation instructions.

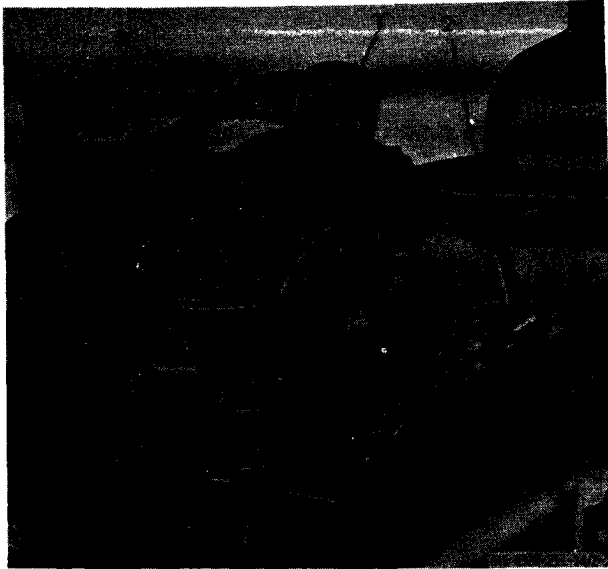
### Section III. CONTROLS

#### 2-5. General

This section describes the various controls and provides the operator / crew sufficient information to insure proper operation of the reciprocating pump.

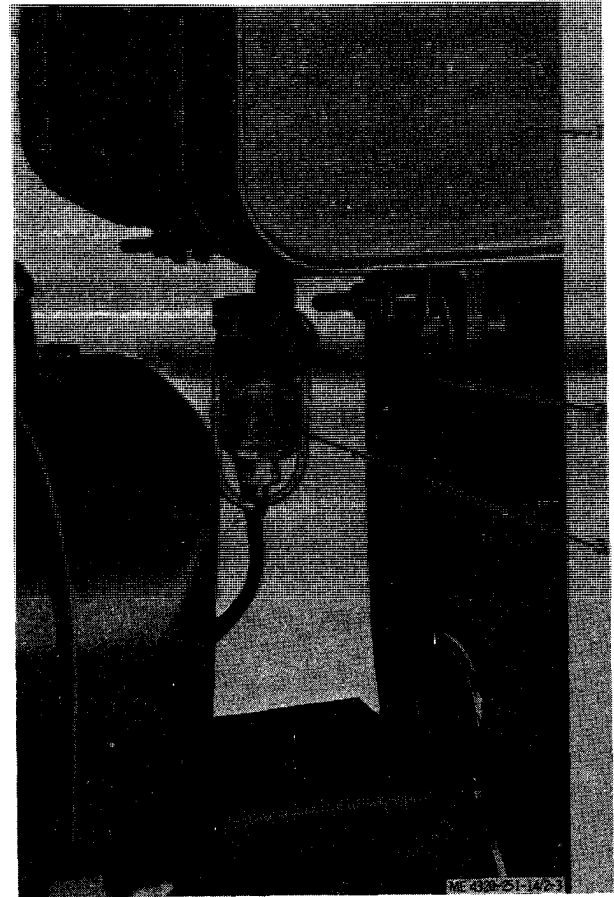
#### 2-6. Controls

The controls necessary for operation of the reciprocal pump are illustrated in figures 2-2 through 2-4, and described in table 2-1.



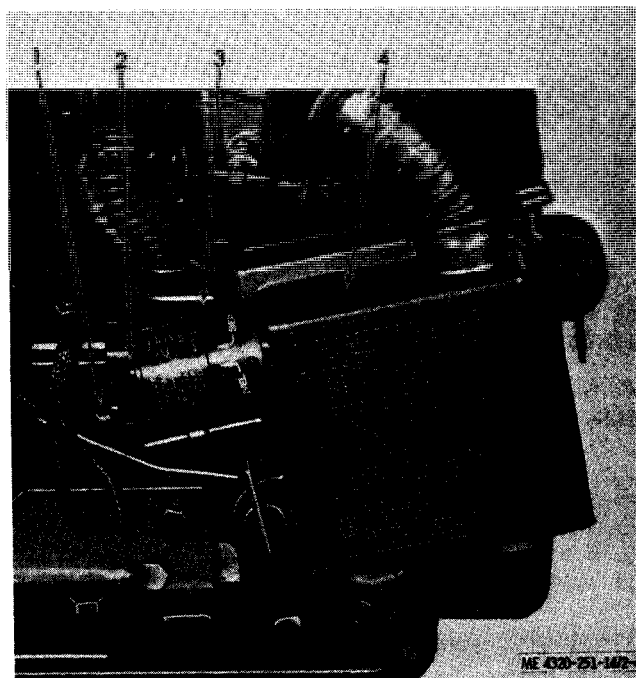
1. Throttle lever
2. Ignition switch
3. Choke lever

*Figure 2-2. Engine fuel and ignition controls*



1. Fuel tank
2. Fuel shutoff valve
3. Fuel strainer

*Figure 2-3. Fuel shutoff valve and related parts.*



1. Inlet temperature control
2. Reset button
3. Air filter service indicator
4. Air filter

Figure 2-4. Inlet temperature control and related parts.

Table 2-1. Controls

| Fig. & index no. |                           | Operation and use  |
|------------------|---------------------------|--|
| 2-2 2            | Ignition switch           | In the OFF (down) position, the ignition switch grounds the magneto, preventing the engine from running. In the RUN (UP) position, it allows normal starting and operation of the engine. Moving the switch to the OFF position stops engine operation.  |
| 2-2 3            | Choke lever               | In the counterclockwise position, the choke lever supplies an extra-rich fuel mixture to the engine to facilitate starting and warmup. In the clockwise position, the choke lever provides a fuel mixture for normal operation after warmup.   |
| 2-2 1            | Throttle lever            | The throttle lever controls engine speed within the operating range of the governor. Loosening the locking nut on the throttle lever releases the lever so that it can be positioned as required. Tighten the nut to lock the adjustment. When moved to the far right, the lever is positioned for start and idle. When moved to the far left, the lever is positioned for full governed speed operation. Positioning the lever in intermediate positions will cause the engine to run at speeds proportional to the lever position. |
| 2-3 1            | Fuel shutoff valve        | Controls the flow of fuel from the fuel tank. Turn counterclockwise to open the valve; clockwise to close it.  |
| 2-4 1            | Inlet temperature control | Controls temperature of inlet air to carburetor. Pull control out for operation in temperatures above 50° F. Push control in for operation in temperatures below 25° F. Position control in midposition for operation in temperatures between 25° and 50° F.   |

## Section IV. OPERATION UNDER USUAL CONDITIONS

### 2-7. General

a. The instructions in this section are for the information and guidance of personnel responsible for operation of the reciprocating pump.

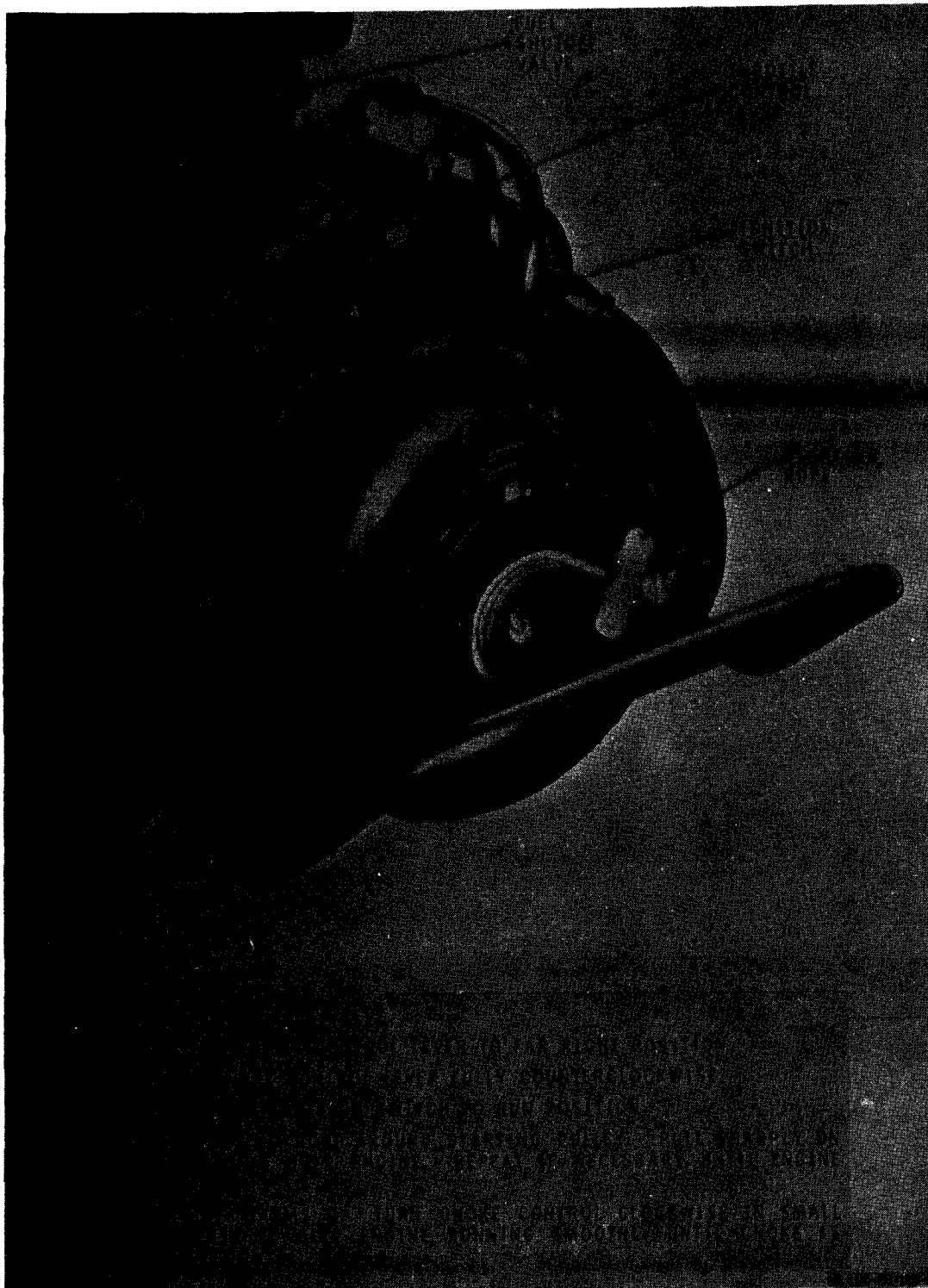
b. The operator must know how to perform every operation of which the reciprocating pump is capable. This section contains instructions on starting and stopping the reciprocating pump, on

operation of the reciprocating pump, and on coordinating the basic motions to perform the specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

## **2-8. Starting**

a. Perform all before operation preventive maintenance checks and services (table 3-1).

b. Start the reciprocating pump as shown in figure 2-5.



*Figure 2-5. Starting the pump.*

## 2-9. Stopping

To stop the pump, shut down the engine by moving the ignition switch (2, fig. 2-2 ) to the OFF (down) position. Close the fuel shutoff valve.

*Note:* If the engine and pump have been running under heavy load for an extended period of time, move the throttle control level slowly to START & IDLE position, allowing the engine to run for several minutes at lower speeds to distribute the engine heat and prevent warping of the engine parts.

## 2-10. Operation

Operate the reciprocating pump under usual conditions as follows:

a. Make sure the strainer at the end of the suction hose and the end of the suction hose are fully submerged. Make sure that the end of the discharge hose is not restricted.

b. Start the engine (para 2-8). After warmup, operate the throttle control to full-speed operating position.

c. If the suction lift is less than 15 feet, pump priming is normally not necessary. If the suction lift is greater than 15 feet, remove the accumulator cap (1, fig. 2-1 ) and pour two gallons of water into the accumulator to prime the pump. Install the accumulator cap and tighten securely, making sure the gasket is in place.

d. After running for a time, the pump will suck the fluid up into the pump pot and will discharge it through the discharge hose. The time before the actual pumping operation begins depends upon the height of the suction lift and the condition of the pump.

e. If the pump fails to start pumping after a reasonable time, consult the troubleshooting chart (table 3-2) to diagnose and correct the trouble.

f. After pumping operation has started, adjust the throttle lever (1, fig. 2-2) on the engine to provide an operating speed that will give the required pumping rate.

g. Clean the strainer from time to time to prevent obstructions from disrupting the pumping operations.

h. Check the fuel level from time to time and fill the tank if necessary to prevent the engine from running out of fuel.

**Warning: Shut off the engine before filling the fuel tank. Take care to prevent spilling gasoline on a hot engine. The gasoline can ignite, causing severe injury or death to the operator.**

i. If the temperature changes markedly during the operating cycle, adjust the inlet temperature control to compensate for the change.

## Section V. OPERATION UNDER UNUSUAL CONDITIONS

### 2-11. Operation in Extreme Cold (Below 0° F (−18° C) )

To operate the pump in conditions of extreme cold, proceed as follows:

a. Keep the fuel tank filled when the unit is not in operation.

b. Service the fuel filter frequently to prevent ice crystals from clogging the filter element.

c. Refer to the current L.O. for the lubricants required during operation in extreme cold.

d. Take care to allow the engine to reach operating temperature before operating it at full speed.

e. Make sure the engine inlet temperature control (1, fig. 2-4) is pushed in all the way.

f. Drain the fluid from the pump and hoses immediately upon shut-down. To drain the pump, remove the drain plug (4, fig. 2-1 ) in the diaphragm pot. Lift the suction hose from the fluid being pumped and allow it to drain. Drain all fluid from the discharge hose.

**Caution: Always drain the pump when freezing temperatures may be encountered. Solid ice in the pump will delay pump operation until it can be completely thawed, and freezing of the trapped fluid may result in the cracking of the metal parts.**

### 2-12. Operation in Extreme Heat

To operate the pump in extreme heat, proceed as follows :

a. Do not run the engine faster than necessary to pump water at the required rate.

b. Refer to the current L.O. for the lubricants required during operation in extreme heat.

c. Protect the unit from direct sunlight. Provide shade for the unit whenever possible.

d. Make sure the engine inlet temperature control (1, fig. 2-4) is pulled out all the way.

e. Take special care to run the engine at a slower speed before shutdown to distribute the engine heat and minimize the possibility of warping the metallic parts.

### 2-13. Operation in Dusty or Sandy Areas

Note the following when operating the reciprocating pump in dusty or sandy areas:

a. Use extreme caution to prevent the lubricants from becoming contaminated with dust or sand.

b. Check the engine air filter service indicator (3, fig. 2-4) frequently and service the air cleaner when necessary.

c. Prevent dust and sand from entering the fuel system. Service the fuel strainer frequently to prevent dust and sand from accumulating in the fuel bowl.



#### 2-14. Operation under Rainy or Humid Conditions

Note the following when operating the reciprocating pump in rainy or humid conditions:

a. Take care to prevent moisture from entering the fuel system. Keep the fuel tank filled when the unit is not in use to prevent moisture from condensing in the fuel tank.

b. Service the fuel strainer frequently to prevent moisture from accumulating in the fuel bowl.

#### 2-15. Operation at High Altitudes

Note the following when operating the

reciprocating pump at high altitudes:

a. The efficiency of internal combustion engines decreases because of the reduced supply of available oxygen necessary to burn the fuel in the engine. Keep the engine tuned up and running at the greatest possible efficiency during high-altitude operation.

b. Because of the reduced atmospheric pressure at high altitudes, the pumping capacity of the pump is reduced. Keep suction lifts as short as possible by locating the pump as close to the fluid supply as possible.



## CHAPTER 3

# OPERATOR'S MAINTENANCE INSTRUCTIONS

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### Section I. BASIC ISSUE ITEMS

#### 3-1. Basic Issue Items.

Tools, equipment, and repair parts issued with or

authorized for the reciprocating pump are listed in the Basic Issue Items List, Appendix B.

### Section II. LUBRICATION INSTRUCTIONS

#### 3-2. General Lubrication Information

*a.* Proper lubrication is the most important single factor in a good preventive maintenance plan. Follow lubrication instructions provided in this section exactly to assure trouble-free, long-life operation of the reciprocating pump.

*b.* The current L.O. provides detailed information regarding the points of lubrication, lubrication interval and recommended lubricant.

#### 3-3. Detailed Lubrication Information

*a. General.* Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign

material to mix with the lubricants. Keep all lubrication equipment clean and ready to use.

*b. Cleaning.* Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

*c. Points of Lubrication.* Service the lubrication points of the pump at proper intervals as illustrated in the current L.O.

*d. Engine Lubrication.* Lubricate the engine as directed in LO 5-2805-257-12.

### Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

#### 3-4. General

To insure that the reciprocating pump 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 maintenance checks and services to be performed are listed as described in paragraph 3-5. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction to be made as soon as operation has ceased. Stop

operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and short-comings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

#### 3-5. Preventive Maintenance Checks and Services

Refer to table 3-1 for a listing of operator's preventive maintenance checks and services. Service the engine as directed in TM 5-2805-257-14.

Table 3-1. Preventive Maintenance Checks and Services

| Operator Maintenance Category |                  |                 | Daily Schedule                 |   |  |
|-------------------------------|------------------|-----------------|--------------------------------|---|--|
| Interval and sequence no.     |                  |                 |                                |   |  |
| Before operation              | During operation | After operation | Item to be inspected           | Procedure   | Paragraph reference  |
| 1                             |                  | 13              | Fuel tank                      | Fill tank if necessary. Check for secure mounting.  | See current L.O.<br>See figure 5-1.<br>Paragraph 3-9.<br>See figure 4-1.<br>Paragraph 2-1 b (4).<br>Paragraph 2-1 b (5).<br>Paragraph 2-1 b (6).<br>Paragraph 2-1 b (7). |
| 2                             |                  |                 | Oil in pump gear case          | Add oil if necessary.   |  |
| 3                             |                  |                 | Engine mounting                | Tighten loose hardware.   |  |
| 4                             |                  |                 | Fuel strainer                  | Check for dirt and water. Service if necessary.   |  |
| 5                             |                  |                 | Fuel lines and fittings        | Tighten fittings to correct leaks.  |  |
| 6                             |                  |                 | Pump rotation                  | Use starting rope to check for free rotation. Report binding or restriction to organizational maintenance.  |  |
| 7                             |                  |                 | Pump diaphragm                 | Check for cracks, tears, holes, and leaks. Report damage to organizational maintenance.                     |  |
| 8                             | 10               |                 | Suction and discharge assembly | With hoses removed, check for free movement and proper seating of suction and discharge valves.             |  |
| 9                             |                  |                 | Hoses                          | Check for cracks, leaks, and damaged threads. Replace damaged hoses.  |  |
|                               | 11               |                 | Pump rod and bearings          | Check for unusual noise, vibration, and overheating. Report faulty operation to organizational maintenance. |  |
|                               | 12               |                 | Water leaks                    | Tighten fittings to correct leaks.  |  |

## Section IV. TROUBLESHOOTING

### 3-6. General

This section describes troubles which might occur during operation of the reciprocating pump, along with the probable causes and corrective actions relating to the troubles. Only those malfunctions which are within the maintenance scope of the operator / crew are included in this chart. If the

corrective actions given in this chart do not correct the malfunction, report the trouble to organizational maintenance.

3-7. Operator / Crew Troubleshooting Chart  
Refer to table 3-2 for troubleshooting which is allocated to the operator/ crew level of maintenance.

*Table 3-2. Troubleshooting Chart*

| Malfunction                              | Probable cause   | Corrective action  |
|--|--|--|
| 1. Engine turns over but fails to start. | <ul style="list-style-type: none"> <li>a. Fuel tank empty.</li> <li>b. Water in fuel.</li> <br/> <li>c. Ignition switch in OFF position</li> </ul>   | <ul style="list-style-type: none"> <li>a. Fill fuel tank.</li> <li>b. Drain fuel tank. Service fuel strainer para 3-9). Refill tank with fresh, uncontaminated fuel.</li> <li>c. Operate switch to ON position (fig. 2-2).</li> </ul>  |
| 2. Engine starts but then stops.         | <ul style="list-style-type: none"> <li>a. Fuel filter clogged.</li> <li>b. Insufficient fuel supply.</li> </ul>  | <ul style="list-style-type: none"> <li>a. Service fuel strainer (para 3-9).</li> <li>b. Fill fuel tank.</li> </ul>   |
| 3. Engine starts but pump fails to pump. | <ul style="list-style-type: none"> <li>a. Suction hose or strainer clogged.</li> <li>b. Suction leak.</li> <li>c. Suction strainer and hose not fully submerged.</li> <li>d. Suction lift too high.</li> <br/> <li>e. Pump not primed (suction lifts 15 to 25 feet).</li> <li>f. Foreign material lodged under valve.</li> <li>g. Static discharge head too high.</li> </ul> | <ul style="list-style-type: none"> <li>a. Clean hose or suction strainer.</li> <li>b. Tighten all suction connections.</li> <li>c. Submerge suction strainer and hose.</li> <li>d. Reduce suction lift to less than 25 feet.</li> <li>e. Prime pump (para 2-10c).</li> <li>f. Remove foreign material from valve.</li> <li>g. Lower discharge head.</li> </ul> |
| 4. Pump output to low.                   | <ul style="list-style-type: none"> <li>a. Suction hose or strainer clogged.</li> <li>b. Suction leak.</li> <li>c. Throttle lever not in full-speed position.</li> <br/> <li>d. Diameter of discharge hose too small.</li> <li>e. Foreign material lodged under valve.</li> <li>f. High static discharge head.</li> </ul>   | <ul style="list-style-type: none"> <li>c. Operate throttle lever so that engine operates at full governed speed (fig. 2-2).</li> <li>d. Use 4-inch discharge hose.</li> <br/> <li>e. Remove foreign material from valve.</li> <li>f. Lower discharge head.</li> </ul>  |

## Section V. MAINTENANCE OF FUEL STRAINER

### 3-8. General

The fuel strainer is installed in the fuel system between the fuel tank and the engine carburetor. It filters dirt, sand, and moisture from the fuel, preventing these foreign materials from disrupting the operation of the carburetor.

### 3-9. Fuel Strainer Service

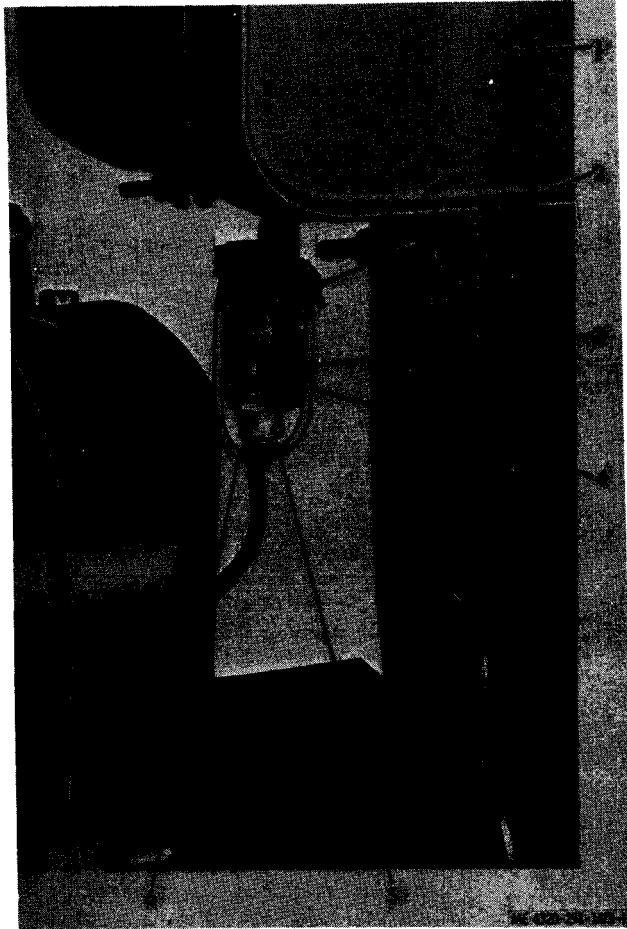
- a. Close fuel shutoff valve (2, fig. 3-1).
- b. Loosen bail nut (5) and swing the bail (6) to

release the fuel bowl (3). Remove the fuel bowl and gasket. Empty the contents of the fuel bowl and wipe it clean with a lint-free cloth.

c. If necessary, remove the fuel filter element (4) and clean it with an approved cleaning solvent. Shake out excess solvent.

d. Reassemble the fuel strainer parts and tighten the bail nut to position the fuel bowl

e. Open the fuel shutoff valve and check for leaks. Correct any leaks.



1. Fuel tank
2. Fuel shutoff valve
3. Fuel bowl
4. Fuel filter element
5. Bail nut
6. Bail

*Figure 3-1. Fuel strainer service*

## CHAPTER 4

# ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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### Section I. SERVICE UPON RECEIPT OF MATERIEL

#### 4-1. General

Inspection and servicing of received equipment is described in paragraph 2-1. New pumps are shipped from the factory with the diaphragms removed and packed separately. Organizational maintenance is normally responsible for the assembly of the diaphragms into the pumps prior to installation.

#### 4-2. Diaphragm Installation

Install the diaphragm in a new pump as follows:

*a.* With the ignition switch (2, fig. 2-2) in **OFF** position, turn over the engine so that the diaphragm plunger is in the bottom position.

*b.* Remove the suction and discharge assemblies (para 4-14).

*c.* Remove the nuts (6, fig. 4-4) and lock washers (7) that secure the diaphragm pot (9) to the diaphragm ring (20); remove the diaphragm pot.

*d.* Remove the four nuts ( 10 ) that secure the lower diaphragm plate (11 ) to the upper diaphragm plate (18); remove the lower diaphragm plate.

*e.* Make sure all parts are clean. If necessary, wire-brush the upper and lower diaphragm plates and rinse with water. Remove any sharp edges with a fine file or stone.

*f.* The natural configuration of the diaphragm is dish-shaped. Install the diaphragm on the upper diaphragm plate (18) with the bottom of the dish toward the floor. Aline the holes in the diaphragm with the holes in the upper diaphragm plate and install the lower diaphragm plate (11). Secure with four nuts (10). Tighten the nuts evenly and alternately to prevent diaphragm distortion.

*g.* Position the diaphragm pot (9) on the pump, taking care that the edges of the diaphragm are evenly spaced around the periphery of the pot and diaphragm ring (20). Secure with nuts (6) and lock washers (7). Tighten the nuts evenly and alternately to prevent diaphragm distortion.

*h.* Install the suction and discharge assemblies (para 4-16).

*i.* Turn over the engine and pump a number of revolutions to make sure all parts are free.

### Section II. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

#### 4-3. Special Tools and Equipment

No special tools or equipment is required for organizational maintenance of the reciprocating pump.

#### 4-4. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering organizational maintenance for this pump. Refer to TM 5-4320-251-24P.

### Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (QUARTERLY)

#### 4-5. General

This section lists the preventive maintenance checks and services which shall be performed on a quarterly basis by organizational maintenance personnel. It includes and expands upon the preventive maintenance services performed daily by operator/ crew and includes additional services which are allocated to organizational maintenance.

#### 4-6. Preventive Maintenance Checks and Services

Refer to table 4-1 for a listing of the preventive maintenance checks and services which are allocated to organizational maintenance. Service the engine as directed in TM 5-2805-257-14.

Table 4-1. Preventive Maintenance Checks and Services

| Organizational Maintenance Category |                                | Quarterly Schedule   |   |
|-------------------------------------|--------------------------------|--|---|
| Sequence number                     | Item to be inspected           | Procedures   | Paragraph reference   |
| 1                                   | Fuel tank                      | Drain and refill tank if fuel is dirty or contaminated. Replace fuel tank if interior is rusted or corroded, or if tank leaks or is severely dented. | See paragraphs 4-10 through 4-12 for fuel tank replacement. |
| 2                                   | Oil in pump gear case          | Check for contamination. Make sure oil was changed at recommended interval.  | See current L.O.  |
| 3                                   | Engine mounting                | Tighten loose hardware. Replace missing hardware.  | See figure 5-1.   |
| 4                                   | Fuel strainer                  | Check for dirt and water in bowl. Replace strainer if damaged.   | See paragraph 3-9.  |
| 5                                   | Fuel line and fittings         | Replace damaged fuel lines and fittings.   | See paragraphs 4-10 through 4-12.                           |
| 6                                   | Pump rotation                  | Use starting rope to check for free rotation. Determine cause of binding and repair or report to direct support maintenance.                         | See paragraph 2-1 b (4).                                    |
| 7                                   | Pump diaphragm                 | Check for cracks, tears, holes, and leaks. Replace if damaged.   | See paragraphs 4-18 through 4-20.                           |
| 8                                   | Suction and discharge assembly | Remove valves and check for free movement and for proper seating. Replace defective parts.   | See paragraphs 4-14 through 4-16 for parts replacement.     |
| 9                                   | Plunger rod and bearings       | Replace parts if play is excessive, or parts are distorted or damaged.   | See paragraphs 4-18 through 4-20.                           |
| 10                                  | Wheels and axle                | Repair or replace damaged parts if wheels fail to roll easily.   | See paragraphs 4-22 through 4-24.                           |
| 11                                  | Hoses                          | Replace hoses if cut, punctured, or abraded, or if fittings are damaged.   | See paragraph 2-1 b (7).                                    |
| 12                                  | Water leaks                    | Tighten fittings and hardware to correct leaks. Replace gaskets if necessary.  |   |

**Section IV. TROUBLESHOOTING**

**4-7. General**

This section describes troubles which might occur during operation of the reciprocating pump, along with the probable causes and corrective actions relating to the troubles. Only those malfunctions which are within the scope of organizational maintenance are included in this chart. If corrective actions given in this chart do not correct the

malfunction, report the trouble to direct support maintenance. Refer to TM 5-2805-257-14- for troubles that relate solely to the engine.

**4-8. Organizational Maintenance Troubleshooting Chart.**

Refer to table 4-2 for troubleshooting which is allocated to the organizational level of maintenance.

Table 4-2. Organizational Maintenance Troubleshooting Chart

| Malfunction                              | Probable cause   | Corrective action  |
|--|--|--|
| 1. Engine fails to start                 | a. Fuel line clogged.<br>b. Fuel filter element clogged.   | a. Clear or replace fuel line.<br>b. Replace fuel filter element.  |
| 2. Engine starts but pump fails to pump. | a. Defective suction or discharge valve.<br>b. Defective diaphragm.<br>c. Cracked diaphragm pot. | a. Replace defective valve (para 4-14 through 4-16).<br>b. Replace diaphragm (para 4-18 through 4-20).<br>c. Replace diaphragm pot (para 4-18 through 4-20). |
| 3. Pump fails to produce rated output.   | a. Suction or discharge valve not seating properly.  | a. Repair or replace valve (para 4-14 through 4-16).   |



Table 4-2. Organizational Maintenance Troubleshooting Chart—Continued

| Malfunction                                     | Probable cause   | Corrective action   |
|---|--|---|
| 4. Pump is noisy                                | <ul style="list-style-type: none"> <li>b. Slight leak in diaphragm.</li> <li>c. Cracked diaphragm pot.</li> <li>a. Plunger bearing defective.</li> <li>b. Plunger spring length too long, allowing plunger to strike pot.</li> <li>c. Debris caught in diaphragm pot.</li> </ul> | <ul style="list-style-type: none"> <li>b. Replace diaphragm (para 4-18 through 4-20).</li> <li>c. Replace diaphragm pot (para 4-18 through 4-20).</li> <li>a. Replace plunger bearings (para 4-18 through 4-20).</li> <li>b. Adjust spring length (para 4-20).</li> </ul> |
| 5. Wheels fail to turn or turn with difficulty. | <ul style="list-style-type: none"> <li>a. Wheel defective.</li> <li>b. Axle bent.</li> </ul>   | <ul style="list-style-type: none"> <li>c. Clean pot of debris.</li> <li>a. Replace wheel.</li> <li>b. Straighten or replace axle (para 4-22 through 4-24).</li> </ul>   |

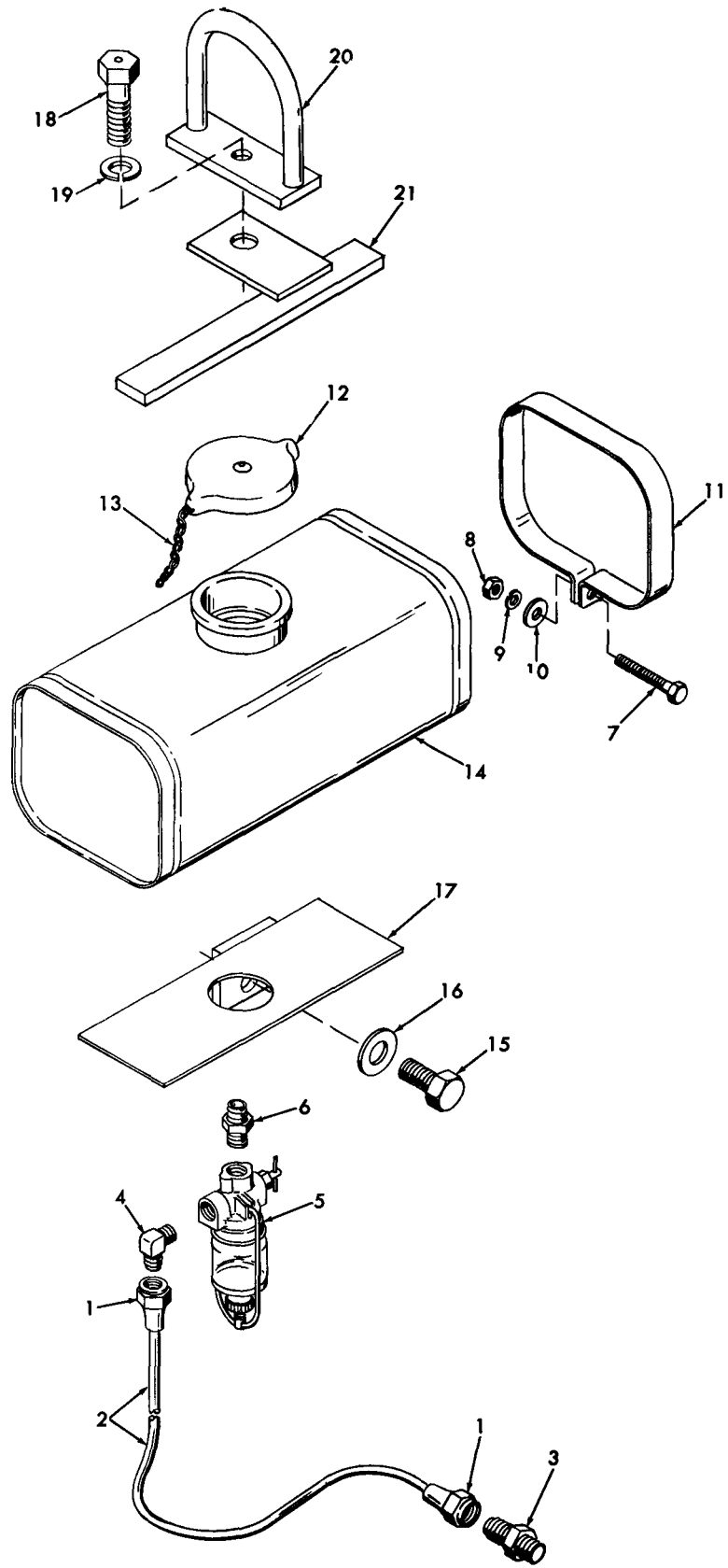
## Section V. MAINTENANCE OF FUEL SYSTEM

### 4-9. Description

The fuel system consists of the fuel tank, fuel strainer with shutoff valve, and the fuel lines and fittings. The fuel tank is mounted with straps which secure it to brackets that are bolted to the pump assembly.

### 4-10. Disassembly

Disassemble the fuel tank, lines, fittings, and fuel strainer in the sequence shown in figure 4-1. Drain the fuel tank prior to removing it from the equipment. Unless chain or cap is damaged val of permanently secured cap is unnecessary.



ME 4320-251-14/4-1

Figure 4-1. Fuel tank, lines, and fittings, disassembly and reassembly.

KEY to fig. 4-1:

- |                  |                             |
|------------------|-----------------------------|
| 1. Tube nut      | 11. Fuel tank strap         |
| 2. Copper tube   | 12. Fuel tank cap           |
| 3. Adapter       | 13. Chain                   |
| 4. Elbow         | 14. Fuel tank               |
| 5. Fuel strainer | 15. Cap screw               |
| 6. Nipple        | 16. Flat washer             |
| 7. Cap screw     | 17. Lower fuel tank bracket |
| 8. Nut           | 18. Cap screw               |
| 9. Leek washer   | 19. Lock washer             |
| 10. Flat washer  | 20. Lifting bail            |
|                  | 21. Upper fuel tank bracket |

#### 4-11. Cleaning and Inspection

a. Clean all parts with an approved cleaning solvent. Flush the fuel line with solvent and blow it out with clean, filtered compressed air.

**Warning: The fuel tank is normally replaced if damaged. However, if expediency requires that the fuel tank be repaired by any method involving heat or flame, steam-clean the tank thoroughly to assure that all traces of gasoline are removed before starting repairs. Failure to purge the tank of all traces of fuel fumes before applying heat or flame may result in a severe explosion.**

b. Inspect the fuel tank for cracks, leaks, and

severe dents. Make sure the cap and chain are present and are in good condition,

c. Inspect the fuel strainer for a cracked bowl or body, damaged threads, and distorted bowl bail. Make sure the bowl glass is clear so that the fuel is visible in the bowl. Check the fuel shutoff valve on the fuel strainer. Make sure it operates freely and effectively.

d. Inspect the fuel line for cracks, dents, damaged tube nuts, clogging, and other damage; replace the fuel line.

e. Inspect the fuel tank straps for cracks, distortion, and other damage; replace damaged straps:

f. Inspect all other parts for cracks, distortion, and damaged threads; replace damaged parts.

#### 4-12. Reassembly

a. Reassemble the fuel system as shown in figure 4-1.

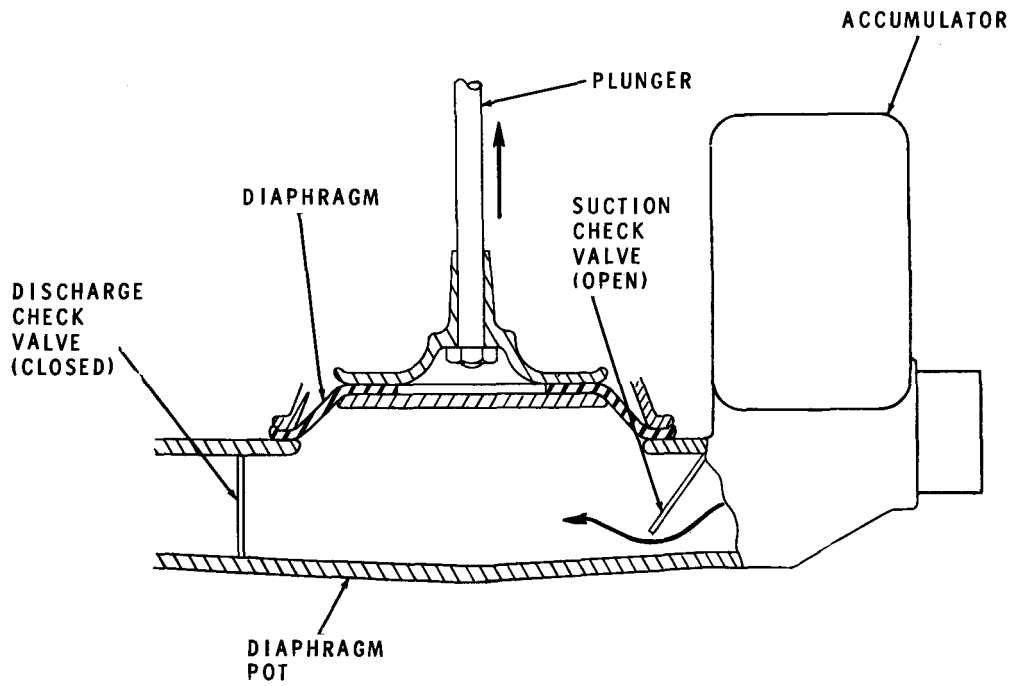
b. After reassembly, fill the fuel tank with fuel, making sure the fuel shutoff valve on the fuel strainer is open. Check the entire fuel system for leaks. Correct any leaks before restoring the unit to service.

## Section VI. MAINTENANCE OF PUMP SUCTION AND DISCHARGE ASSEMBLIES

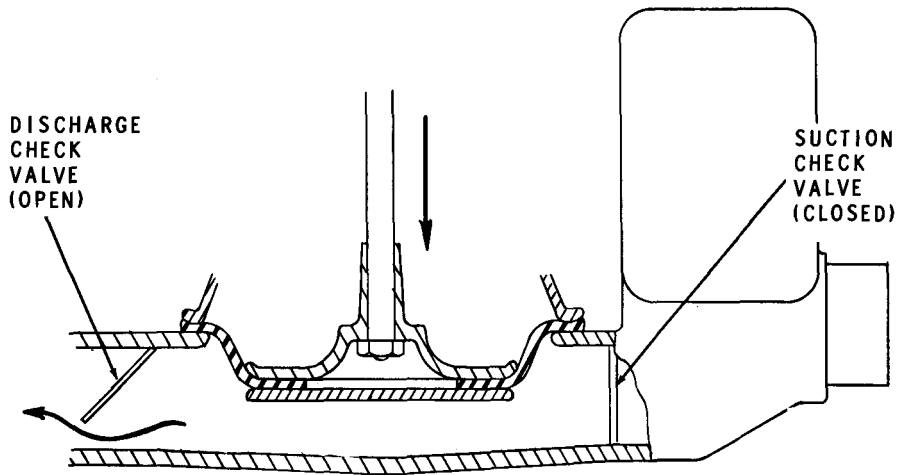
#### 4-13. Description

a. The pump suction assembly is mounted on one side of the diaphragm pot to control the fluid movement at the inlet side of the pump. It consists mainly of a check valve mounted in a housing. This check valve allows water to flow into the pump to

relieve the vacuum caused by the diaphragm as it is pulled upward (A, fig. 4-2 ). It prevents reverse movement of the water as the diaphragm is pushed downward, since the check valve is pushed tightly against its seat, presenting the water from escaping from the suction port (B, fig. 4-2).



**A. INTAKE**



**B. DISCHARGE**

ME 4320-251-14/4-2

Figure 4-2. Schematic diagram showing operation of reciprocating pump.

b. The pump discharge assembly is mounted on the side of the diaphragm opposite the suction assembly. It controls the fluid movement at the outlet side of the pump. It consists mainly of a check valve mounted in a housing. This check valve allows water to flow out of the pump as the diaphragm is forced downward into the diaphragm

pot (B, fig. 4-2 ). It closes to prevent discharged water from returning to the diaphragm pot on the upward stroke of the diaphragm (A, fig. 4-2).

c. An accumulator is mounted on the suction check valve housing. This accumulator reduces the surging of the fluid as the pump diaphragm changes stroke direction. At the end of the intake

part of the pump cycle, a column of fluid in the suction line is in movement toward the pump. As the diaphragm reverses its stroke, the column of fluid is suddenly stopped. This would normally result in a surge in the suction line. This surge is minimized because the shock is absorbed by the cushion of air in the accumulator. In this manner,

the accumulator minimizes the rocking of the pump and lines resulting from the starting and stopping of the fluid column.

**4-14. Disassembly**

*a.* Disassemble the discharge assembly as shown in figure 4-3, items 1 through 17.

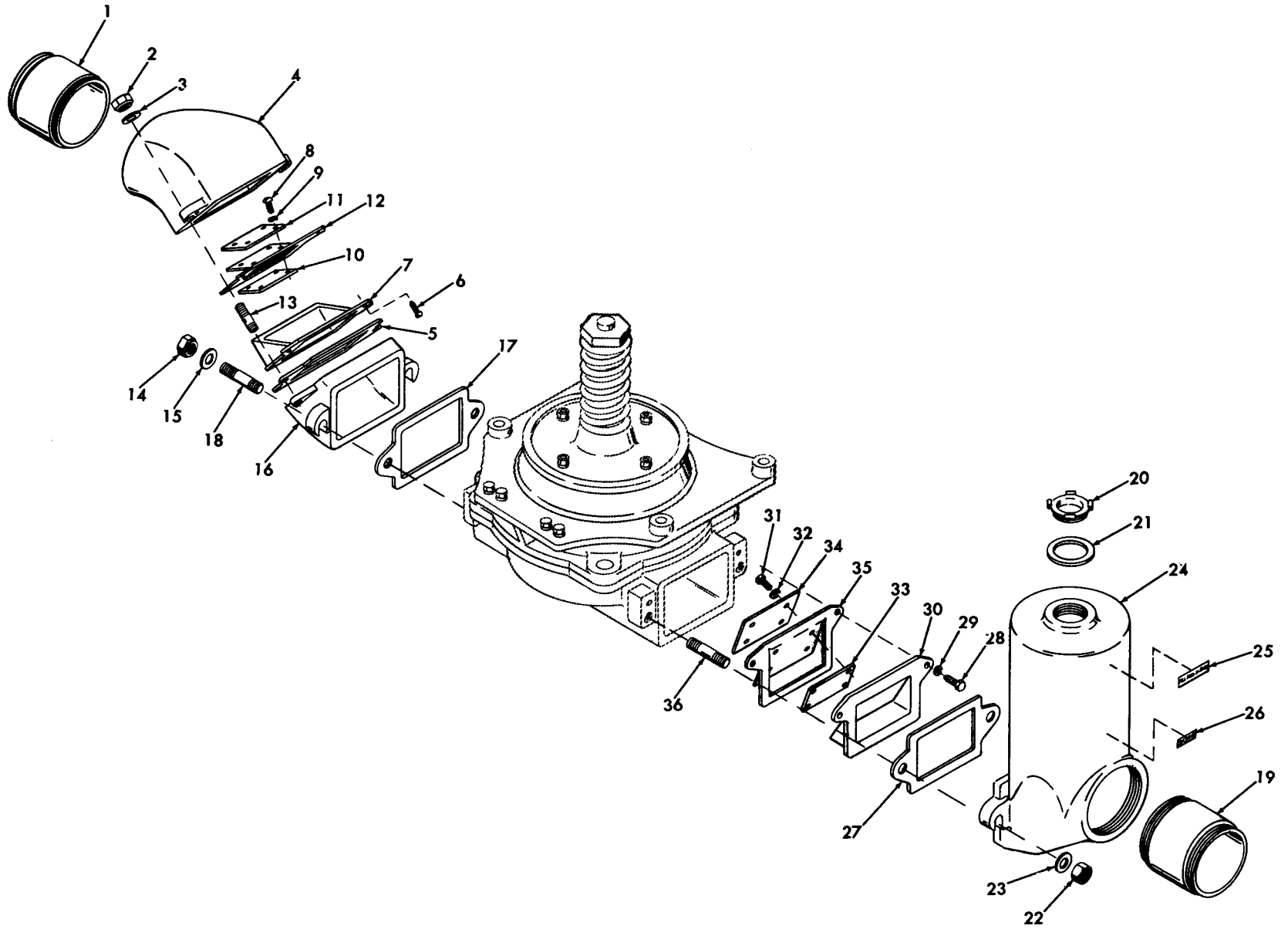


Figure 4-3. Suction and discharge systems, disassembly and reassembly.

KEY to fig. 4-3:

- |                      |                              |
|----------------------|------------------------------|
| 1. Discharge nipple  | 19. Suction nipple           |
| 2. Nut               | 20. Accumulator cap          |
| 3. Washer            | 21. Gasket                   |
| 4. Discharge elbow   | 22. Nut                      |
| 5. Gasket            | 23. Flat washer              |
| 6. Screw             | 24. Accumulator              |
| 7. Check valve seat  | 25. FILL HERE TO PRIME label |
| 8. Screw             | 26. SUCTION label            |
| 9. Lock washer       | 27. Gasket                   |
| 10. Valve weight     | 28. Cap screw                |
| 11. Valve weight     | 29. Lock washer              |
| 12. Valve flap       | 30. Check valve seat         |
| 13. Stud             | 31. Machine screw            |
| 14. Nut              | 32. Lock washer              |
| 15. Flat washer      | 33. Valve weight             |
| 16. Discharge flange | 34. Valve weight             |
| 17. Gasket           | 35. Valve flap               |
| 18. Stud             | 36. Stud                     |

*b.* Disassemble the accumulator and suction assembly as shown in figure 4-3, items 19 through 35.

*c.* Do not remove the studs (36) from the diaphragm pot unless they are damaged and require replacement.

#### 4-15. Cleaning and Inspection

*a.* Clean the rubber parts by wiping with a clean dry cloth.

*b.* Clean all remaining parts with an approved cleaning solvent; dry thoroughly.

*c.* Inspect the suction and discharge valve flaps for cracks, deterioration, brittleness, and other imperfections which could result in valve leakage. Replace damaged valve flaps.

*d.* Inspect the check valve seats for cracks, distortion, and damage to the valve seating area. Remove small nicks with a fine file or stone. Replace a damaged seat.

*e.* Inspect the accumulator for cracks, distortion, dam aged threads, and damaged gasket surfaces; replace a damaged accumulator.

*f.* Inspect all other parts for cracks, distortion, and damaged threads; replace damaged parts.

#### 4-16. Reassembly

*a.* Reassemble the accumulator and suction assembly as shown in figure 4-3, items 19 through 35.

**Note.** Take care when assembling the discharge and suction assemblies. Make sure the valve flaps (12 and 35) are centered on the valve seats (7 and 30) and that the flaps are free from distortion and puckering when the related parts are assembled and secured into place.

*b.* Reassemble the discharge assembly as shown in figure 4-3, items 1 through 17.

## Section VII. MAINTENANCE OF DIAPHRAGM AND PLUNGER ASSEMBLY

#### 4-17. Description

*a.* The diaphragm is a tough, flexible rubber ring which is mounted between the diaphragm pot and the diaphragm ring which is secured to the frame. The center of the diaphragm is secured to the plunger assembly which forces the center of the diaphragm into and out of the diaphragm pot. On the upward stroke, a partial vacuum is created between the diaphragm and the pot. This sucks water through the suction valve and into the pot. On the downward stroke, the suction valve closes and the water in the pot is forced out through the discharge valve. In this manner water is transferred, under pressure, from the suction to the discharge side of the pump to cause the required pumping action.

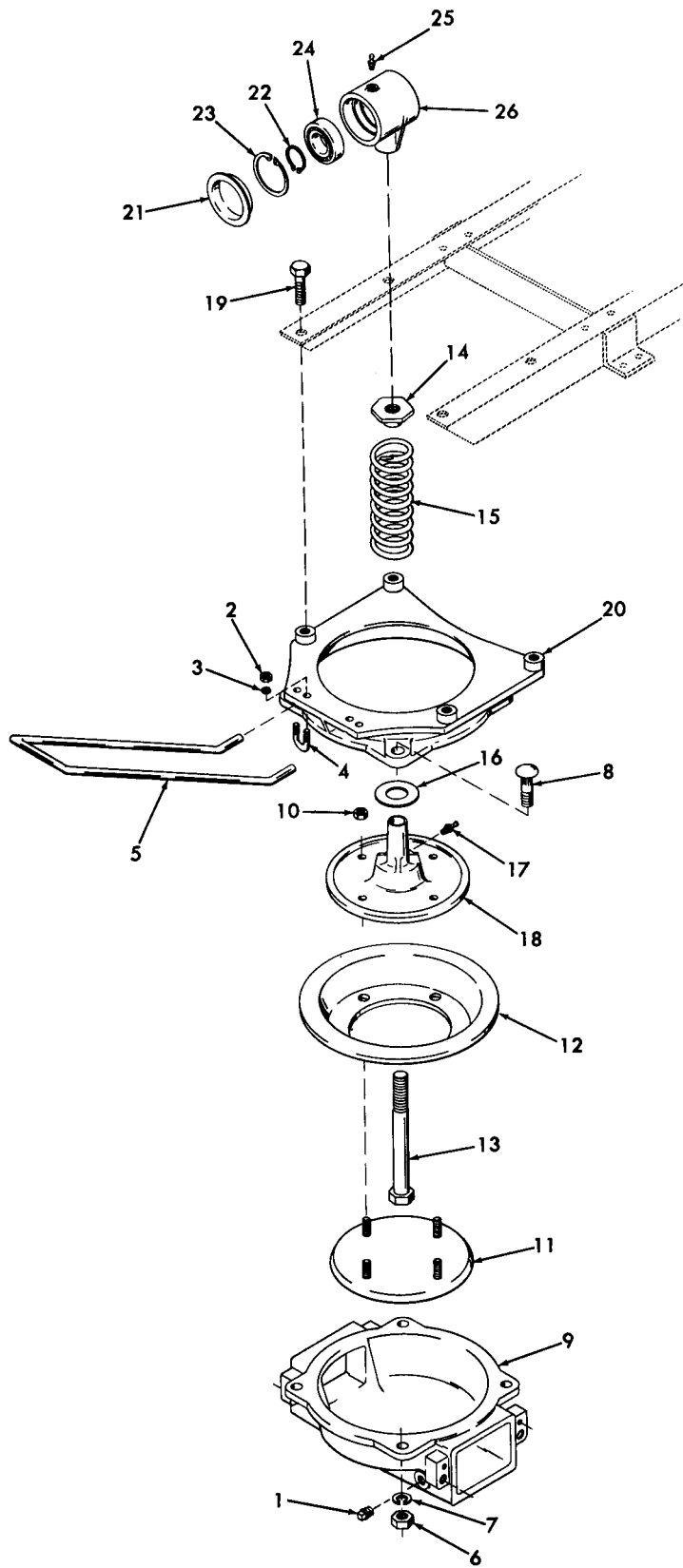
*b.* The plunger assembly is powered by the crankshaft of the pump gear case. The bearing

housing and bearing assembly mounted at the top of the plunger assembly is also mounted on the end of the crankshaft so that it rotates with the shaft. This imparts an up-and-down reciprocating motion to the plunger assembly. On the upward stroke, the plunger rod pulls the upper diaphragm plate and the diaphragm up. On the downward stroke, the heavy plunger spring pushes the diaphragm plate downward. By spring-loading the downward stroke, damage to the pump will be minimized if rocks or other debris is pulled into the pump during operation.

#### 4-18. Disassembly

*a.* Remove the suction and discharge assembly (para 4-14).

*b.* Disassemble the diaphragm and plunger assembly following the sequence shown in figure 4-4.



ME 4320-251-14/4-4

Figure 4-4. Diaphragm and plunger, disassembly and reassembly.



KEY to fig. 4-4.

- |                           |                           |
|---------------------------|---------------------------|
| 1. Plug                   | 14 Plunger nut            |
| 2. Nut                    | 15. Spring                |
| 3. Lock washer            | 16. Spring washer         |
| 4. U-bolt                 | 17. Lubrication fitting   |
| 5. Drawbar                | 18. Upper diaphragm plate |
| 6. Nut                    | 19. Cap screw             |
| 7. Leek washer            | 20. Diaphragm ring        |
| 8. Ribbed bolt            | 21. Protective cap        |
| 9. Diaphragm pot          | 22. Retaining ring        |
| 10. Nut                   | 23. Retaining ring        |
| 11. Lower diaphragm plate | 24. Roller bearing        |
| 12. Diaphragm             | 25. Lubrication fitting   |
| 13. Plunger rod           | 26. Bearing housing       |

c. To remove the bearing housing (26) and bearing (24), pry out the protective cap (21) to provide access to the parts. Remove the retaining ring (22), and pull the assembled bearing and housing from the end of the crankshaft with a bearing puller.

d. Remove the retaining ring (23) and slip the bearing (24) from the housing (26).

#### 4-19. Cleaning and Inspection

a. Clean the bearing by placing it in a wire basket and immersing it into a container of approved cleaning solvent. Agitate it thoroughly. If necessary to dislodge caked or hardened grease, strike the flat of the bearing against a soft wooden block. When the bearing is clean, blow it dry with filtered compressed air. Do not allow bearing to spin. Dip it in light engine oil and wrap it in lint-free paper to protect it from dust and dirt.

b. Wash the diaphragm with water and wipe dry.

c. Clean all remaining parts with approved cleaning solvent; dry thoroughly.

d. Inspect the bearing for rough, catching, and binding operation, excessive looseness between balls and races, scoring, and other damage; replace a damaged bearing.

e. Inspect the diaphragm for wear, cracks, brittleness, deterioration, damage to seating surfaces, cuts, bruises, and signs of leaking; replace a damaged diaphragm.

f. Inspect the diaphragm pot and diaphragm ring for cracks, distortion, and damaged threads. Clean up slightly damaged threads. Replace damaged parts.

g. Inspect the lower diaphragm plate and upper diaphragm plate for cracks and distortion. Inspect the studs on the upper diaphragm plate for looseness and for damaged threads. Replace damaged parts.

h. Inspect the plunger spring for cracks, distortion, and compression. Free length of the spring should be  $8\frac{1}{4}$  inch. Replace a damaged spring.

i. Inspect the plunger rod for distortion and worn or damaged threads. Replace if damaged.

j. Inspect the bearing housing for cracks, distortion, worn or damaged threads, and worn bearing seating surfaces. Replace a damaged bearing housing.

k. Check the end of the crankshaft of the pump gear case. If the bearing surface is damaged or if the end of the crankshaft is distorted or misaligned, report the condition to direct support maintenance.

#### 4-20. Reassembly

a. Reassemble the diaphragm and plunger assembly as shown in figure 4-4.

b. Pack the roller bearing( 24) with grease and slip it into the bearing housing (26) until it is fully seated. Be sure to press against the outer race of the bearing only. Secure the bearing with a retaining ring (23).

c. Drive the assembled bearing and housing onto the end of the crankshaft. Secure by installing the retaining ring (22).

d. After the diaphragm ring (20) is installed on the frame, position the upper diaphragm plate (18), spring washer (16), plunger spring (15), and plunger nut (14) on the plunger rod (13). During assembly, lubricate the lower end of the plunger rod with grease. Tighten the plunger nut onto the rod so that the spring is compressed to a length of  $8 \pm 1 / 32$  inch.

e. Turn the assembled plunger and spring into the threaded bore of the bearing housing (26) on the crankshaft. Tighten the plunger nut (14) against the bearing housing to lock the parts. Take care not to disrupt the length adjustment of the spring.

f. Install the diaphragm on the pump as directed in paragraph 4-2.

g. Refer to current lubrication order and lubricate all lube fittings.

## Section VIII. MAINTENANCE OF WHEELS AND AXLE

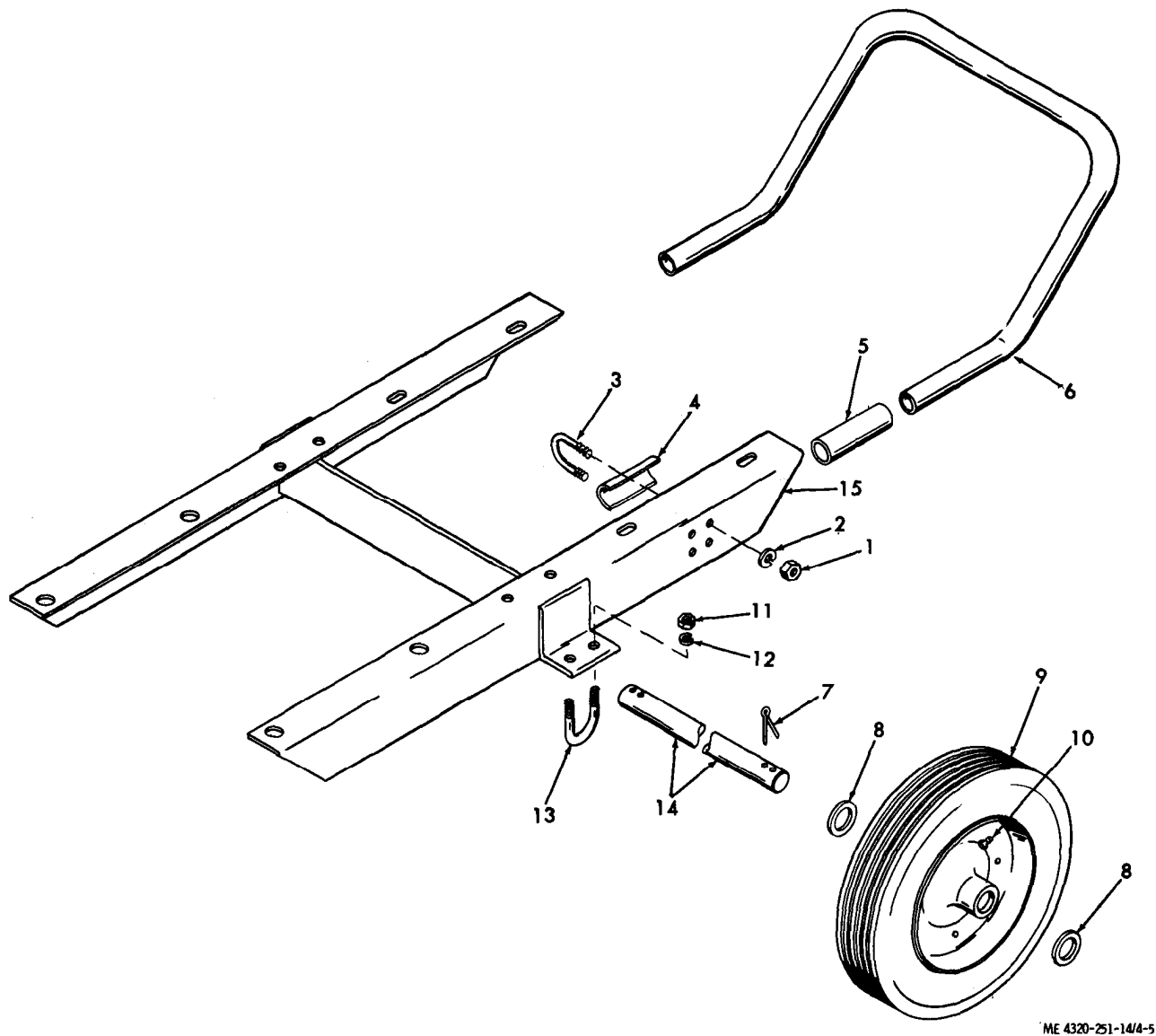
#### 4-21. Description

The pump wheels are mounted on a one-piece, round, bar-stock axle which, in turn, is mounted on the pump frame with U-bolts. The wheels have semi-pneumatic tires. Each wheel, tire, and bearing unit is treated only as a complete assembly and should not be disassembled for maintenance or repair.

#### 4-22. Disassembly

a. Lift the pump assembly and place blocking under the pump frame so that the pump wheels just clear the ground.

b. Disassemble the wheels and axle from the pump assembly as shown in figure 4-5.



ME 4320-251-14/4-5

- |                |                  |                 |
|----------------|------------------|-----------------|
| 1. Nut         | 6. Engine guard  | 11. Nut         |
| 2. Lock washer | 7. Cotter pin    | 12. Lock washer |
| 3. U-bolt      | 8. Washer        | 13. U-bolt      |
| 4. Clamp       | 9. Wheel         | 14. Axle        |
| 5. Hose        | 10. Lube fitting | 15. Base        |

Figure 4-5. Wheels and axle, disassembly and reassembly.

#### 4-23. Cleaning and Inspection

a. Clean the wheel and tire assembly with a cloth dampened lightly with an approved cleaning solvent.

b. Clean all remaining parts with cleaning solvent; dry thoroughly.

c. Inspect the wheel and tire assembly for wear, cuts, and damage to the tire, distortion of the wheel, and rough, binding, or catching operation of the wheel bearing. Replace a damaged wheel and tire assembly.

d. Inspect the axle for wear or scoring of the wheel mounting surfaces, for misalignment, and for cracks. Replace a damaged axle.

#### 4-24. Reassembly

a. Reassemble the wheels and axle as shown in figure 4-5.

b. Remove the blocking from under the pump frame. Lubricate the wheels as indicated in the current lubrication order. Check that the pump wheels roll freely and easily. Correct any deficiencies.

## CHAPTER 5

### DIRECT SUPPORT AND GENERAL SUPPORT

#### MAINTENANCE INSTRUCTIONS

##### Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

###### 5-1. Special Tools and Equipment

No special tools and equipment are required for the direct support and general support maintenance of the reciprocating pump.

###### 5-2. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct support and general support maintenance for this pump. Refer to TM 5-4320-251-24P.

##### Section II. TROUBLESHOOTING

###### 5-3. General

This section describes troubles which might occur during operation of the reciprocating pump, along with the probable causes and corrective actions relating to the troubles. Only those functions which are solely within scope of direct support and general support maintenance are listed. For troubleshooting procedures which are within the

scope of organizational maintenance and operator / crew maintenance, refer to the applicable chapters of this publication.

###### 5-4. Direct Support and General Support Maintenance Troubleshooting

Refer to table 5-1 for troubleshooting which is allocated to the direct support and general support levels of maintenance.

Table 5-1. Direct Support and General Support Maintenance Troubleshooting

| Malfunction  | Probable cause   | Corrective action  |
|--|--|--|
| 1. Engine seised, binds or scrapes when turned over.       | Engine requires overhaul.  | Replace engine.  |
| 2. Pump seized, binds or scrapes when turned over.         | a. Defective bearing in gear case.<br>b. Defective gears in gear case. | a. Repair or overhaul gear case (para 6-2 through 6-4).<br>b. Repair or overhaul gear case (para 6-2 through 6-4). |
| 3. Pump is noisy or vibrates excessively during operation. | Defective gears or bearings.   | Replace defective gears of bearings (para 6-2 through 6-4).  |
| 4. Pump heats up during operation.                         | Defective bearings.  | Replace defective bearings (para 6-2 through 6-4).   |
| 5. Engine labors excessively to drive pump.                | a. Pump and engine misaligned.<br>b. Bearings seizing in gear case.    | a. Aline pump and engine (para 5-9).<br>b. Replace defective bearings (para 6-2 through 6-4).                      |

##### Section III. GENERAL MAINTENANCE

###### 5-5. General

This section describes general maintenance practices which must be considered when performing direct support and general support maintenance on the reciprocating pump. Follow the instructions contained herein to help assure the success of the repairs or overhaul.

###### 5-6. Cleanliness

- Take care to assure that the workplace is clean before starting to disassemble the gear case.
- Steam-clean the exterior of the gear case before starting disassembly to prevent the dirt from entering the bearings.
- If compressed air is used to clean the parts,

make sure the compressed air is free from dirt and contaminants.

d. Protect disassembled parts from blowing sand and dust which could later cause rapid wear of the gears and bearings.

### 5-7. Care of Bearings

a. Clean bearings by placing them in a wire basket and immersing them into a container of

fresh cleaning solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.

b. After the bearings are cleaned, dry them with clean, filtered compressed air. Take care to prevent spinning the bearings with the compressed air jet.

c. Dip the cleaned bearings in clean engine oil and immediately wrap them in lint-free paper to prevent the entry of dust and dirt.

## Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

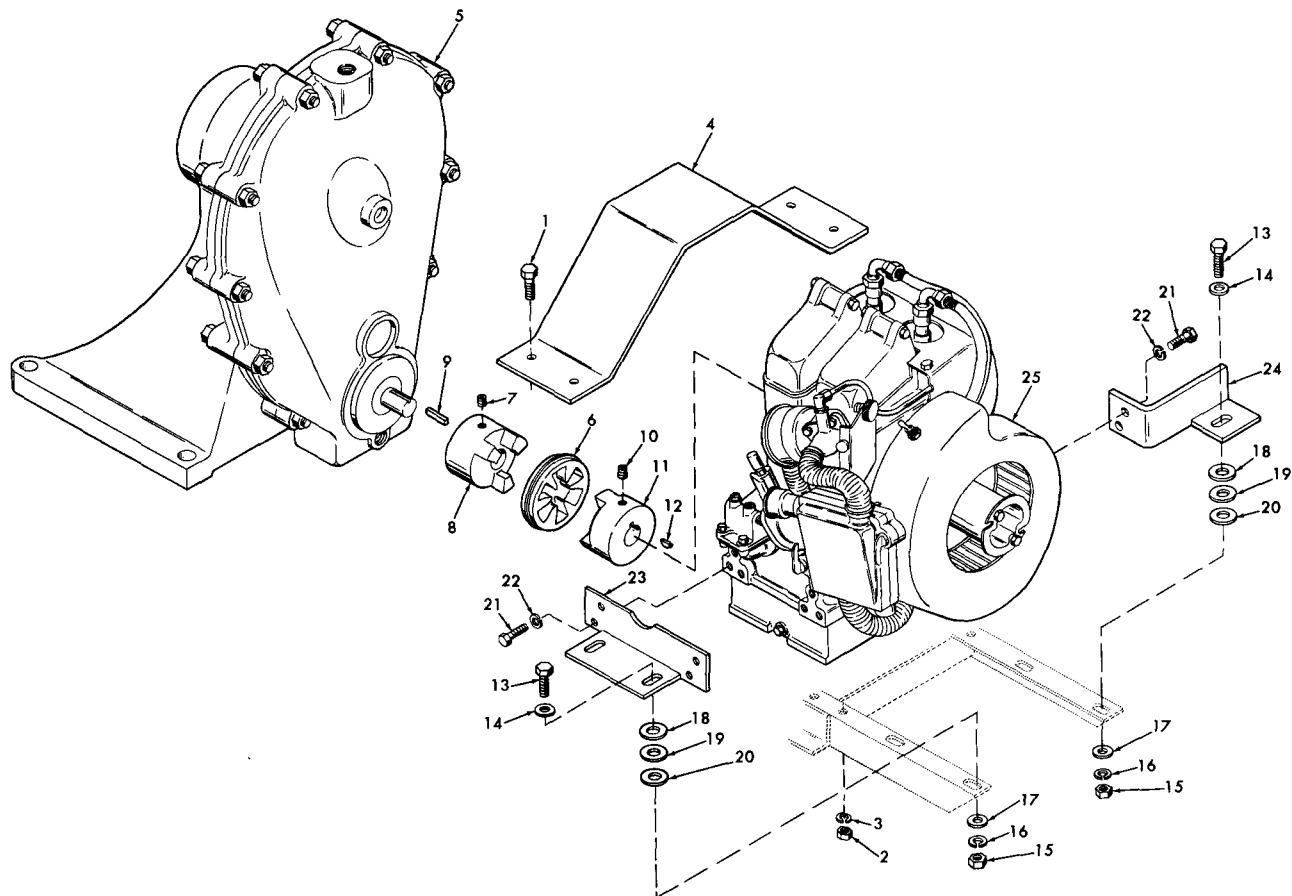
### 5-8. Removal

a. Disassemble the fuel system components from the pump (para 4-10).

b. Disassemble the suction and discharge assemblies (para 4-14).

c. Disassemble the diaphragm and plunger assembly from the pump (para 4-18).

d. Remove the cap screws (1, fig. 5-1), nuts (2), and lock washers (3) that secure the coupling guard (4) to the frame: remove the coupling guard.



ME 4320-251-145-1

Figure 5-1. Major components of reciprocating pump.

KEY to fig. 5-1:

|                   |                             |
|-------------------|-----------------------------|
| 1. Cap screw      | 13. Cap screw               |
| 2. Nut            | 14. Flat washer             |
| 3. Lock washer    | 15. Nut                     |
| 4. Coupling guard | 16. Lock washer             |
| 5. Pump gear case | 17. Flat washer             |
| 6. Damper spider  | 18. Shim                    |
| 7. Setscrew       | 19. Shim                    |
| 8. Coupling half  | 20. Shim                    |
| 9. Key            | 21. Cap screw               |
| 10. Setscrew      | 22. Lock washer             |
| 11. Coupling half | 23. Engine mounting bracket |
| 12. Key           | 24. Engine mounting bracket |
|                   | 25. Engine                  |

*e.* The pump gear case mounting hardware was removed when the diaphragm ring of the diaphragm and plunger assembly was removed. Pull straight out on the pump gear case to remove it. This will free the damper spider (6) of the coupling.

*f.* Remove the coupling halves (8 and 11) and keys (9 and 12) from the gear case and engine shaft.

*g.* Remove the cap screws (13), flat washers (14), nuts (15), lock washers (16), and flat washers (17) that secure the engine mounting brackets (23 and 24) to the frame; lift the assembled engine and mounting brackets from the frame.

*h.* Remove the cap screws (21) and lock washers (22) that secure the engine mounting brackets (23 and 24) to the engine (25); remove the brackets.

### 5-9. Installation

*a.* Position the assembled pump gear case (5, fig. 5-1) on the pump frame. Position the diaphragm ring (21, fig. 4-4) on the pump frame. Secure both parts to the frame with four cap screws (20).

*b.* Install the keys (9 and 12, fig. 5-1) and the coupling halves (8 and 11) on the shafts of the gear case and engine; secure with setscrews (7 and 10).

*c.* Install the engine mounting brackets (23 and 24) on the engine (25) with cap screws (21) and lock washers (22).

*d.* Install the damper spider (6) on the gear case coupling half (8).

*e.* Position the engine (25) with assembled mounting brackets (23 and 24) on the pump frame. Slide it toward the pump gear case, checking the alinement of the engine coupling half (11) with the damper spider (6) on the gear case coupling half (8). If necessary, add shims (18, 19, and 20) between the engine mounting brackets and pump frame if necessary to bring the parts into alinement. Make sure the centerline of the gear case input shaft is alined with the centerline of the engine shaft and secure the engine mounting brackets (23 and 24) to the pump frame with cap screws (13), flat washers (14), nuts (15), lock washers (16), and flat washers (17).

*f.* Rotate the engine crankshaft several revolutions to check that no binding exists between the engine and pump gear case.

*g.* Install the coupling guard (4) over the pump coupling.

*h.* Install the diaphragm and plunger assembly on the pump (para 4-20).

*i.* Install the suction and discharge assemblies on the pump (para 4-16).

*j.* Install the fuel system components on the pump (para 4-12).



## CHAPTER 6

### REPAIR OF RECIPROCATING PUMP GEAR CASE

---

#### **6-1. Description**

a. The pump gear case provides the torque multiplication and speed reduction necessary to drive the pump plunger at the rate of speed necessary for efficient operation. The coupling half, which is driven by the engine, is mounted on the input shaft of the pump and drives the gear case at engine speed. This input shaft has integral pinion teeth which engage the internal gear to provide an initial speed reduction of 8.083:1.

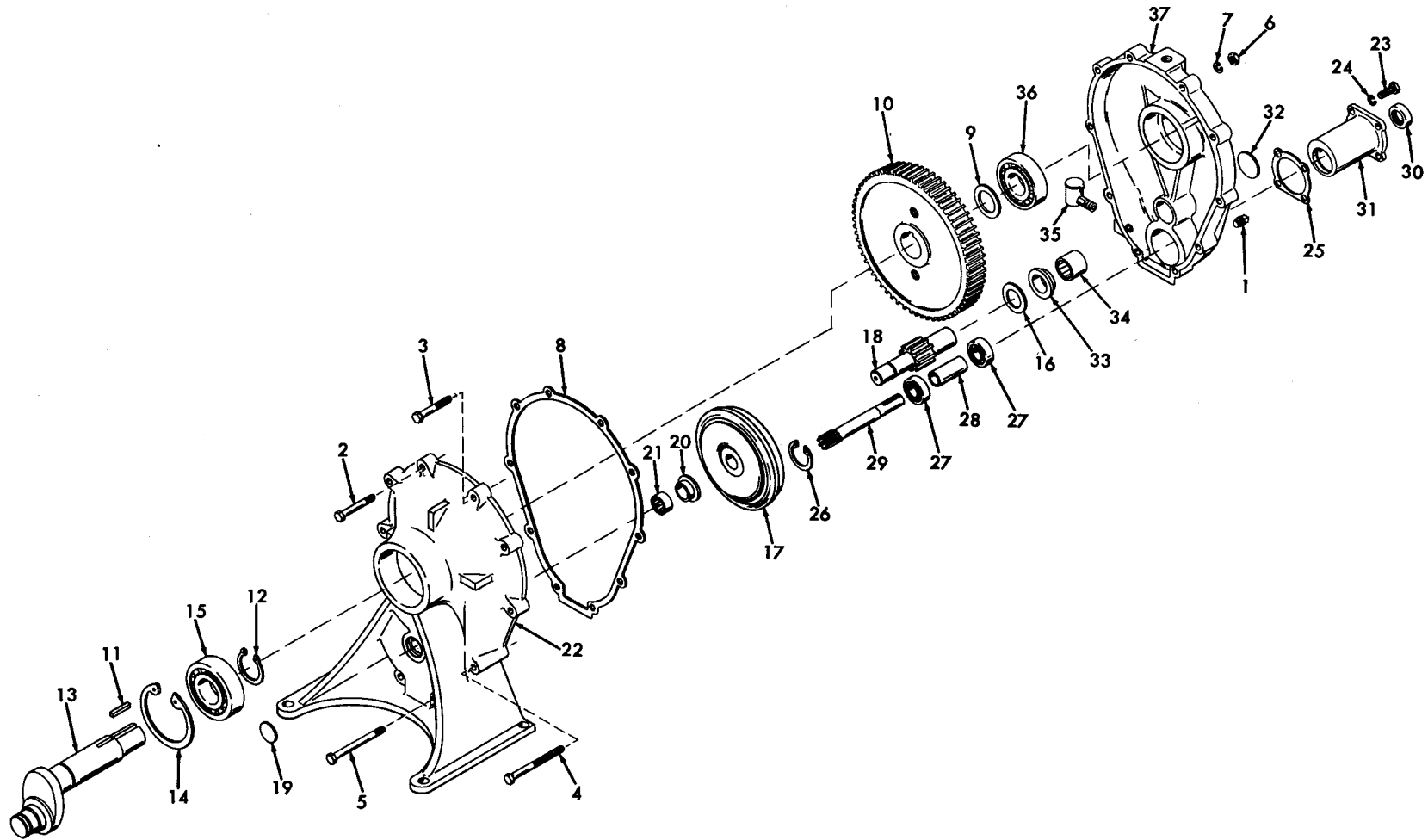
b. The internal gear is pressed onto and drives a pinion shaft. This pinion shaft is roller bearing mounted in the housing and drives a spur gear. This engagement provides the second speed reduction, this one having a 7.56:1 ratio. The spur

gear is keyed to the ball-bearing-mounted crankshaft which drives the pump plunger and diaphragm assembly. The total speed reduction through the gear case is approximately 61:1. If the engine is operating at 3000 rpm, the pump plunger will cycle approximately 49 times per minute.

c. The gear case in which the shafts and gears are installed is sealed and contains gear oil to keep the parts lubricated. The lubrication fitting on the lower side of the case regulates the level of lubricant which can be poured into the case.

#### **6-2. Disassembly**

a. Disassemble the gear case following the sequence shown in figure 6-1.



ME 4320-251-14/6-i

Figure 6-1. Gear case, disassembly and reassembly.



KEY to fig. 6-1:

|                    |                        |
|--------------------|------------------------|
| 1. Pipe plug       | 19. Expansion plug     |
| 2. Shoulder bolt   | 20. Sleeve bearing     |
| 3. Cap screw       | 21. Roller bearing     |
| 4. Cap screw       | 22. Gear housing       |
| 5. Shoulder bolt   | 23. Cap screw          |
| 6. Nut             | 24. Lock washer        |
| 7. Lock washer     | 25. Eccentric gasket   |
| 8. Gasket          | 26. Retaining ring     |
| 9. Washer          | 27. Ball bearing       |
| 10. Spur gear      | 28. Spacer             |
| 11. Key            | 29. Input shaft        |
| 12. Retaining ring | 30. Grease seal        |
| 13. Crankshaft     | 31. Eccentric housing  |
| 14. Retaining ring | 32. Expansion plug     |
| 15. Ball bearing   | 33. Sleeve bearing     |
| 16. Washer         | 34. R oiler bearing    |
| 17. Internal gear  | 35. Lubrication cup    |
| 18. Spur gearshaft | 36. Ball bearing       |
|                    | 37. Gear housing cover |

*b.* Remove the pipe plug (1) to drain the gear oil from the gear case prior to disassembly.

*c.* After removing the cap screws (3 and 4), shoulder bolts (2) and (5), nuts (6), and lock washers (7), screw a 5/8-11 x 3-inch fully threaded bolt in the threaded bore in the gear housing cover (37) opposite the crank end of the crankshaft. Continue to turn the screw until the gear housing cover with its assembled parts is freed from the gear housing (22). Remove the gasket (8).

*d.* Use a conventional gear puller having two 5/8 - 1 1/4 inch puller screws to pull the spur gear (10) from the crankshaft (13) ; remove the key (11).

*e.* Remove the retaining ring (12) and press the crankshaft (13) from the gear housing (22). Remove the retaining ring ( 14) and press the ball bearing (15) from its seat in the gear housing.

*f.* Do not press the gearshaft (18) from the internal gear (17) unless either part is damaged and requires replacement.

*g.* If the sleeve bearing (20) or roller bearing (21) requires replacement, pierce the expansion plug (19) with a sharp punch and pry the plug from the gear housing. Use a driver with a slightly smaller outside diameter than the needle bearing and press the sleeve bearing and roller bearing from the gear housing.

*h.* After removing the eccentric housing (31) containing the input shaft assembly, remove the retaining ring (26 ) and press the assembled input shaft (29), bearings (27 ) and spacer (28 ) from the eccentric housing.

*i.* Press the bearings (27) and spacer (28) from the input shaft (29).

*j.* Pry the gease sea (30) from the eccentric housing (31 ).

*k.* If the sleeve bearing (33) and roller bearing (34) in the gear housing cover are damaged, use a sharp punch to pierce the expansion plug (32) in the cover and pry out the plug. Press the sleeve

bearing and roller bearing from the gear housing cover.

*l.* If the ball bearing (36) seated in the gear housing cover is damaged and requires replacement, use an internal puller to pull it from the cover.

### 6-3. Cleaning and Inspection

*a.* Discard and replace expansion plugs, oil seals, and gaskets.

*b.* Clean the bearings as directed in paragraph 5-7.

*c.* Clean all remaining parts with an approved cleaning solvent. Use a fiber-bristled brush if necessary to remove caked or hardened lubricants from the gear teeth or other parts.

*d.* Inspect the gears for chipped, cracked, or missing gear teeth, distortion, worn bores, and other damage; replace damaged gears.

*e.* Inspect the input shaft and pinion shaft for misalignment, damaged gear teeth, and scored or worn bearing mounting surfaces; replace damaged parts.

*f.* Inspect the crankshaft for cracks, misalignment, damaged retaining ring seat, worn or damaged keyway, and damaged bearing mounting seats; replace a damaged crankshaft.

*g.* Inspect the gear housing and gear housing cover for cracks, distortion, damaged gasket surfaces, damaged threads, and worn or scored bearing seats. Check that oil passages to roller bearing seats are open. Remove burrs and nicks with a fine file or stone. Replace a damaged gear housing or cover.

### 6-4. Reassembly

*a.* Reassemble the pump gear case as shown in figure 6-1.

*b.* When installing the ball bearing (36) in the gear housing cover (37), press only against the outer race of the bearing. Make sure the bearing is fully seated in the cover.

*c.* Press the roller bearing (34) and the sleeve bearing (33) into the bearing bore of the gear housing cover (37). Make sure that the shoulder of the sleeve bearing is fully seated against the cover.

*d.* When assembling the input shaft (29) and bearing (27 ), press the one bearing tightly against the side of the pinion teeth. Secure the bearing in place with Loctite bearing mount (manufactured by Loctite Corporation, Newington, Connecticut, as Part Number 18771-035). Install the spacer (28 ) and press on the second bearing. Seal it in place with Loctite bearing mount. Make sure the first bearing is rigidly against the pinion teeth and that the second bearing holds the spacer tightly between the bearings. Allow the Loctite bearing mount to cure for 15 minutes to 4 hours before assembling the parts into the bearing housing (31).

e. After the assembled input shaft and bearings are pressed into the eccentric housing (31), secure them in place with the retaining ring (26). Press the seal (30) into the seal seat on the eccentric housing, taking care to prevent the shaft keyway from cutting the inner lip,

**Note:** Do not install the assembled input shaft and eccentric housing on the gear housing cover until the gear housing cover is installed on the gear housing.

f. If the gearshaft (18) was removed from the internal gear (17), press the gear onto the shaft until the hub on the inside of the gear is snug against the pinion teeth of the shaft.

g. Press the roller bearing, (21) and the sleeve bearing (20) in the gear housing (22) so that the shoulder of the sleeve bearing is seated tightly against the housing.

h. Press the ball bearing (15) onto the crankshaft (13); secure with a retaining ring (12). Press the assembled bearing and crankshaft into position in the bore of the gear housing. Use the retaining ring (14) to position the parts in the housing.

i. Install the key (11) in the keyway of the crankshaft and press the spur gear (10) onto the crankshaft until it is seated against the shaft shoulder.

j. Position the gear housing on the bench with the flange facing upward. Position the assembled internal gear (17) and gearshaft (18) in place on the gear housing. Install the washers (9 and 16) on the ends of their respective shafts.

k. Place the gasket (8) on the gear housing flange. Position the gear housing cover with assembled parts over the gear housing so that the ends of the shafts engage their respective bearings. Use a plastic mallet to drive the gear housing cover into place.

l. Secure the gear housing cover to the gear housing with cap screws (3 and 4), shoulder bolts (2 and 5), nuts (6), and lock washers (7). Install the shoulder bolts (2 and 5) first and tighten them evenly and alternately until they are snug, making sure the shafts and the internal gears rotate freely without gear lash. Install the cap screws (3 and 4), lock washers (7), and nuts (6) and tighten them evenly and alternately. After all hardware is tightened, check again to assure that the shafts rotate freely.

m. Position the assembled input shaft (29), eccentric housing (31), and gasket (25) on the gear housing cover. The thicker part of the eccentric housing marked TOP must be up when the pump gear case is in the upright position. This will provide proper engagement between the pinion of the input shaft and the internal gear. Secure the eccentric housing with cap screws (23) and lock washers (24). Tighten the cap screws evenly and alternately to prevent distorting the housing.

n. Position the expansion plugs (19 and 32) in their respective bores with the convex side outward. Strike the convex side sharply with a hammer to expand each plug into place.

o. Install the gear case on the pump (para 5-9).

## CHAPTER 7

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

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### Section I. ADMINISTRATIVE STORAGE

**7-1. Administrative Storage** shall be in accordance with TM 740-90-1.  
Administrative storage for the reciprocating pump

### Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

**7-2. Destruction of Materiel to Prevent Enemy Use** For procedures regarding destruction of equipment to prevent enemy use, refer to TM 750-244-3.



## APPENDIX A

### REFERENCES

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#### **A-1. Fire Protection**

TB 5-4200-200-10

Hand portable fire extinguishers approved for Army users.

#### **A-2. Lubrication**

LO 5-2805-257-12

C9100-IL

FSC Group 91

Engine, Gasoline 3 HP, Military Standard Model 2A016-3.

Fuels, oils, lubricants and waxes.

#### **A-3. Painting**

TM 9-213

Painting instructions for field use.

#### **A-4. Radio Interference Suppression**

TM 11-483

Radio Interference Suppression.

#### **A-5. Maintenance**

TM 5-2805-257-14

TM 5-2805-257-14P

TB ENG 347

Engine, Gasoline, 3 HP, Military Standard Model 2A016-3, FSN 2805-072-4871.

Winterization Techniques for Engineer Equipment.

TM 9-207

Operating and Maintenance of Army Materiel in Extreme Cold Weather (0° to -65° F).

TM 38-750

The Army Maintenance Management System.

#### **A-6. Shipment and Storage**

TB 740-93-2

Preservation of USAMECOM Mechanical Equipment for Shipment and Storage.

TM 740-90-1

Administrative Storage of Equipment.

TM 38-230

Preservation, Packaging and Packing of Military Supplies and Equipment.



## 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. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II. (Not Applicable)

d. Section IV contains supplemental instructions, explanatory notes and / or illustrations required for a particular maintenance function.

##### B-2. Explanation of Columns in Section II

a. *Group Number, Column (1)*. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes ) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. *Functional Group, Column (2)*. This column contains a brief description of the components of each functional group.

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

- C — Operator or crew
- O — Organizational 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.
- B — Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

- C — Service. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.
- D — Adjust. To rectify to the extent necessary to bring into proper operating range.
- E — Align. To adjust specified variable elements of an item to bring to optimum performance.
- F — Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
- G — Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.
- H — Replace. To replace unserviceable items with serviceable assemblies, sub-assemblies, or parts.
- I — Repair. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.
- J — Overhaul. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.
- K — Rebuild. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts of components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent re-assembly of the item.

d. *Tools and Equipment, Column (4)*. This column is provided for referencing by code the special tools and test equipment, (sec. III)

required to perform the maintenance functions (sec. II). (Not Applicable)

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

**B-3. Explanation of Columns in Section III**

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

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

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

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

**B-4. Explanation of Columns in Section IV**

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

b. *Remarks.* This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

| (1)<br>Group No. | (2)<br>Functional group                   | (3)<br>Maintenance functions |      |         |        |       |           |         |         |        |          |         | (4)<br>Tools and equipment | (5)<br>Remarks |    |    |    |    |
|------------------|---|------------------------------|------|---------|--------|-------|-----------|---------|---------|--------|----------|---------|----------------------------|----------------|----|----|----|----|
|                  |   | A                            | B    | C       | D      | E     | F         | G       | H       | I      | J        | K       |                            |                |    |    |    |    |
|                  |   | Inspect                      | Test | Service | Adjust | Align | Calibrate | Install | Replace | Repair | Overhaul | Rebuild |                            |                |    |    |    |    |
| 01               | ENGINE                                    |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Engine Assembly .....                     | C                            | O    | C       | ..     | ..    | ..        | ..      | F       | F      | H        | ..      | ..                         | ..             | .. | .. | .. | A  |
| 02               | FUEL SYSTEM                               |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Tanks, Lines, Fittings .....              | ..                           | ..   | C       | ..     | ..    | ..        | ..      | O       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
| 03               | REAR AXLE                                 |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Rear Axle Assembly .....                  | ..                           | ..   | ..      | ..     | ..    | ..        | ..      | O       | F      | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
| 04               | WHEELS AND TRACKS                         |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Wheel Assembly .....                      | ..                           | ..   | ..      | ..     | ..    | ..        | ..      | ..      | O      | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
| 05               | FRAME, TOWING ATTACHMENTS AND DRAW BAR    |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Frame Assembly .....                      | ..                           | ..   | ..      | ..     | ..    | ..        | ..      | ..      | ..     | F        | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Towing attachments .....                  | ..                           | ..   | ..      | ..     | ..    | ..        | ..      | O       | F      | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
| 06               | BODY CHASSIS OR HULL AND ACCESSORY ITEMS  |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Accessory items .....                     | C                            | ..   | ..      | ..     | ..    | ..        | ..      | C       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Data plates and Instruction Holders ..... | ..                           | ..   | ..      | ..     | ..    | ..        | ..      | O       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
| 07               | PUMPS                                     |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Pump Assembly .....                       | C                            | ..   | C       | ..     | ..    | ..        | ..      | ..      | F      | H        | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Rods, Bearings and Diaphragm .....        | C                            | ..   | O       | ..     | ..    | ..        | ..      | O       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Suction and / or Discharge Assembly ..... | C                            | ..   | C       | ..     | ..    | ..        | ..      | O       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Pump Drive:                               |                              |      |         |        |       |           |         |         |        |          |         |                            |                |    |    |    |    |
|                  | Reduction Gear Case .....                 | ..                           | ..   | O       | ..     | ..    | ..        | ..      | ..      | F      | H        | ..      | ..                         | ..             | .. | .. | .. | .. |
|                  | Lubricators .....                         | C                            | ..   | O       | ..     | ..    | ..        | ..      | O       | ..     | ..       | ..      | ..                         | ..             | .. | .. | .. | .. |



Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

| Reference code | Maintenance category | Nomenclature   | Tool number |
|----------------|----------------------|----------------|-------------|
|                |                      | Not Applicable |             |

Section IV. REMARKS

| Reference code | Remarks  |
|----------------|--|
| A — F<br>A — J | Refer to TM 5-2805-257-14 and TM 5-2805-257-24P for ENGINE maintenance and repair. |



# APPENDIX C

## BASIC ISSUE ITEMS LIST

### Section I. INTRODUCTION

#### C-1. Scope

This appendix lists items which accompany the reciprocating pump or are required for installation, operation, or operator's maintenance.

#### C-2. General

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

*a. Basic Issue Items—Section II.* A list of items which accompany the reciprocating pump and are required by the operator / crew for installation, operation, or maintenance.

*b. Maintenance and Operating Supplies—Section III.* A listing of maintenance and operating supplies required for initial operation.

#### C-3. Explanation of Columns

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

*a. Source, Maintenance, and Recoverability Codes (SMR), Column (1).*

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

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

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

| <i>Code</i> | <i>Explanation</i> |
|-------------|--------------------|
| C           | Operator / crew    |

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

*b. Federal Stock Number, Column (2).* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

*c. Description, Column (3).* This column indicates the Federal item name and any additional description of the item required. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

*d. Unit of Measure (U/M), Column (4).* A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

*e. Quantity Incorporated in Unit, Column (5).* This column indicates the quantity of the item used in the reciprocating pump.

*j. Quantity Furnished with Equipment, Column (6).* This column indicates the quantity of an item furnished with the equipment.

*g. Illustration, Column (7).* This column is divided as follows:

(1) *Figure Number, Column (7)(a).* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number, Column (7) (b).* Indicates the callout number used to reference the item in the illustration.

#### C-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III

*a. Component Application, Column (1).* This column identifies the component application of each maintenance or operating supply item.

*b. Federal Stock Number, Column (2).* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

*c. Description, Column (3).* This column indicates the item name and brief description.

*d. Quantity Required for Initial Operation, Column (4).* This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

*e. Quantity Required for 8 Hours Operation, Column (5).* This column indicates the estimated quantities required for an average 8 hours of operation.

*f. Notes, Column (6).* This column indicates informative notes keyed to data appearing in a preceding column.

#### C-5. Federal Supply Code for Manufacturers

| <i>Code</i> | <i>Manufacturer</i>  |
|-------------|--|
| 97403       | Army Engineer Research and Development Laboratories, Fort Belvoir, Va. |



### Section III. MAINTENANCE AND OPERATING SUPPLIES

| (1)<br>Component<br>application | (2)<br>Federal<br>stock number | (3)<br>Description  | (4)<br>Quantity<br>required<br>F initial<br>operation | (5)<br>Quantity<br>required<br>F/ 8 hrs<br>operation | (6)<br>Notes  |
|---------------------------------|--------------------------------|---|---|--|---|
| Drive Pump                      | 9150-265-9433                  | Oil, Engine, SAE 30, 1<br>qt can                          |   |  | (1) For additional data on<br>Federal Stock Numbers and<br>requisitioning procedures see<br>C9-100-IL |
| Fuel Tank                       | 9130-160-1818                  | Gasoline Automotive;<br>Type 1, bulk                      | 1.5 gal   | 2.7 gal (2)  |   |
| Lubrication                     | 9150-190-0904                  | Grease, Automotive and<br>Artillery: GAA, 1 lb<br>per can | 0.25 lb   | 0.125 lb   | (2) Average fuel consumption<br>0.35 gal per hour.  |



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