TM 5-4930-228-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING

(ADVANCED INDUSTRIES MODEL 1800)

FSN 4930-070-1181

This copy is a reprint which includes current pages from Changes 1,3,4,5,6,7 and 8.

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1972

WARNING

FLAMMABLE FUEL

DEATH

**or serious injury
may result if personnel fail to
observe safety precautions**

**Do not smoke or use open flame within 50 feet
of the tank and pump unit.**

**Be sure proper grounding procedures have been
followed prior to operating the equipment.**

**Do not refuel the pump assembly fuel tank while
the engine is operating; stop engine and allow
to cool before refueling.**

**If fuel is spilled, wash the area of spillage
thoroughly with water.**

**After fueling operation is completed, replace
the filler cap securely before removing the
nozzle bonding wire.**

CHANGE
NO. 9

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 1 February 1994

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

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800) NSN 4930-00-070-1181

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Page 2-3, paragraph 2-3a(2) and (3) are superseded as follows:

WARNING

DEATH or serious injury may result if proper grounding procedures are not followed prior to operating the equipment.

(2) Bonding is the process that equalizes the charge on two unlike objects such as an aircraft and a refueling nozzle. It is done in order to prevent arcing, in the presence of flammable vapors, as the two objects are joined.

(a) Extend the grounding cable from the ground reel assembly so the plug (if present) can be inserted into the vehicle receptacle. Otherwise, attach one of the grounding clips to a bare metal surface of the receiving vehicle. Attach the remaining dip to the grounding rod. Bond before the dust cap or gas tank cap is removed to prevent a spark occurring when fuel vapor is present. Do not disconnect the bond until refueling is complete and the gas tank cap and nozzle dust cap are replaced.

(3) Grounding of equipment is a means to provide a conductive path into the ground so a static charge isn't trapped on the surface of the equipment where it could discharge as a spark.

(a) Insert the grounding rod into the soil to the required depth (refer to table 2-1). Drive the rod into the soil to reach below the permanent ground moisture level.

(b) If the top of the rod is level with the surrounding surface, scoop out an area around the top to allow attachment of the ground dips to the rod. Attach the clip from the grounding wheel to the exposed portion of the grounding rod. The refueler and vehicle are now grounded and the refueling process may begin.

Table 2-1. Required Depths for Ground Rods

Type of Soil	Depth of Ground Rod
Coarse ground, cohesionless sands and gravels	6 feet
Inorganic clay, claying gravels, gravel-sand-clay, claying sands, sandy clay, gravelly clay, and silty clay	4 feet
Silty gravel, gravel-sand-silt, silty sand, sand, silt, peat, muck, and swamp soil	3 feet

(c) Methods of Grounding. There is no quick or easy way to test the adequacy of a ground. The testing procedures (See FM 10-66 Appendix E) are complex and the equipment is bulky and expensive; therefore, several levels or methods of grounding and bonding are required to meet the various operational needs of the Army. The three methods/levels are listed in order of preference.

1 Method 1: equipment is grounded to a rod or rods that have measured resistance to ground equal to or less than 10,000 ohms. Ground the refueling system or vehicle and aircraft to this tested ground rod. Bond the nozzle to the vehicle/aircraft. This method is required, unless conditions, as described below, prevent its use. This method is the only standard of grounding acceptable, without authorization, at any fixed airfield or refueling point. It is the safest method.

2 Method 2: If equipment is not available to test resistance to ground, use method 2. Method 2 uses an untested ground - a grounding system based on the knowledge that damp earth will accept and drain off an electrical charge. Use method 2 when the location, tactical situation, or type of operation makes it impossible to test ground rods. Ground equipment to a rod or rods driven a specific depth into the ground depending on the type of soil at the site (see table 2-1). The depth to which the rods must be driven is determined by the normal depth of permanent ground moisture in the various types of soils. The commander of the operating unit must authorize the use of method 2. This method is less desirable. Employ method 2 when impossible to use method 1.

WARNING

Death or serious injury may occur if proper bonding procedures are not followed. While using method 3, an object with a different electrical potential (any object that is not part of the bonded system) should not come into contact with the bonded equipment when a flammable vapor-air mixture may be present.

3 Method 3: When the climate, terrain, or tactical condition makes it impossible to secure a satisfactory ground rod, requirements to ground the fuel dispenser (system or refueler) maybe waived; **however, the requirement to bond the fuel dispenser to the aircraft/vehicle may not be waived under any circumstances.** Method 3 relies on bonding alone. Bonding is made between the aircraft/vehicle and the refueling system or refueler along with the nozzle and the aircraft/vehicle. A contact between an unbended object and the system could produce a spark that could set off an explosion or fire. Method 3 procedures are authorized by the commander of the unit one organizational level above the operating unit. This is the least desirable method since it involves bonding only.

Page A-1, add to paragraph A-3: FM 10-68 Aircraft Refueling

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the Secretary of the Army
06153

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TM 5–4930–228–14
C 8

CHANGE
NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 6 February 1991

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

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800) NSN 4930–00–070–1181

Approved for public release; distribution is unlimited

TM 5–4930–228–14, 1 August 1972, is changed as follows:

Page 2–4, paragraph 2–4c(2). Add the following note immediately after paragraph 2–4c(2):

NOTE

Continuous operation of the motor for more than 30 minutes will cause the thermo protector to activate. The motor will then shut off until it has cooled down.

Page 4–1, paragraph 4–2a is deleted.

Page 4–2, Figure 4–1 is deleted.

Page 4–3, paragraph 4–2b(1) is changed to read:
"(1) Lower tailgate of truck and remove tarpaulin, bows, and racks with seats."

Page 4–3, paragraph 4–2b(2) is deleted.

Page 4–3, paragraph 4–2c(3) is changed to read:
"Refer to figure 4–2 and install the tanks and pumping assembly in truck."

Appendix C, Section III. BASIC ISSUE ITEMS is superseded as follows:

SECTION III. BASIC ISSUE ITEMS

(1) ILLUS/ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
C–1/1	4930–01–159–4437	Adapter Assembly, Water Detector (97403) 13220E9406–3	EA	1
C–1/2	4930–01–169–5287	Adapter Probe, Water Detector Kit (97403) 13220E9914–3	EA	1
C–1/3	5975–01–050–5707	Ground Rod	EA	1

Appendix D, Additional Authorization List, and Appendix E, Expendable/Durable Supplies and Materials List, are added immediately after Appendix C, Components of End Item and Basic Issue Item List:

APPENDIX D
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists additional items you are authorized for the support of the Tank and Pump Unit.

D-2. GENERAL

This list identifies items that do not have to accompany the Tank and Pump Unit and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (ie. CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

SECTION II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION FSCM AND PART NUMBER / USABLE ON CODE	(3) U/M	(4) QTY AUTH
	MTOE AUTHORIZED ITEMS		
5120-01-013-1676	Slide Hammer Kit	EA	1

APPENDIX E
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E–1. SCOPE

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

E–2. EXPLANATION OF COLUMNS

a. Column (1) – Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g. "Use cleaning compound, item 5. App. D").

b. Column (2) – Level. This column identifies the lowest level of maintenance that requires the listed item.

C – Operator/Crew
O – Organizational Maintenance
F – Direct Support Maintenance
H – General Support Maintenance

c. Column (3) – National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) – Description. Indicates the Federal item name, and, if required, a description to identify the item. The last line for each item indicates the part number followed by Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column (5) – Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by two–character alphabetical abbreviations (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

APPENDIX E

SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION FSCM and Part Number	(5) U/M
1	O	6950–00–281–1985	Dry cleaning solvent, P–D–680	GAL
2	C	9150–00–190–0904	Grease, Automotive and Artillery, GAA, MIL–G–10924	LB
3	C	9150–00–188–9864	Lubricating Oil, OE HDO, MIL–L–2104C	QT
4	O	7930–00–526–2919	Detergent, General Purpose Liquid 5 gal. pail	GAL
5	O	3439–01–046–4850	Solder, Tin Alloy (81348) SN 60WRAP 2 0.0321	LB
6	O	8030–00–889–3535	Tape, Antiseize 11–1/2" x 260" (18876) 11072502 (81349) MIL–T–27730	RL
7	F	6810–00–281–1858	Trisodium – Phosphate (81348) O–S–642D	LB
8	O	8030–00–543–4384	Sealing Compound (81349) MIL –S–7916	LB
9	O	6850–00–880–7616	Silicone Compound (81349) MIL–S–8660	EA

By Order of the Secretary of the Army:

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

Official:

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

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Changes in force: C1, C3, C4, C5, C6 and C7

TM 5-4930-228-14
C7

CHANGE NO. 7

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

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

TANK AND PUMP UNIT, LIQUID DISPENSING;
FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800)
NSN 4930-00-070-1181

Approved for public release; distribution is unlimited.

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Page 3-4, Table 3-2. Operator's Troubleshooting continued, following 7. PRODUCT DISCHARGE IS DIRTY, add the following:

8. ELECTRIC MOTOR WILL NOT OPERATE
   Check vehicle power supply;
   If quality of reception improves, notify Organizational Maintenance to test further.

9. AM RECEPTION IS POOR
   Step 1. Turn off EMD unit to see if quality of communication reception improves. If quality improves, notify Organizational Maintenance to test further.
   Step 2. Replace EMD unit; if necessary.

Page 23, following c. K-1 Relay Test Procedures, 3 (e), add the following:

d. RF Filter Test Procedure.
   (1) Disconnect Power Cable (J2).
   (2) Unscrew and remove Junction Box Cover with O-ring.
   (3) Tag and remove wires from Terminals 4, 5, and 6.
   (4) Remove four screws from top cover of RF Filter exposing Terminals 1, 2, and 3.
   (5) Tag and remove motor wires from Terminals 1, 2, and 3.

NOTE

Continuity indicates shorted RF Filter and a need for replacement.

   (6) Test RF Filter wires for continuity across Terminals 4 and 6; and across Terminals 5 and 6.

Page 30, Section II Maintenance Allocation Chart, Line 12, column (2) Assembly group. ADD RF Filter. Column (3) B Test. Add 1.0; Column (3) H Replace. Add 1.0.

Appendix C, Section III, Basic Issue Items, is superseded as follows:

(1) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
1	4930-01-159-4437	Adapter Assembly, Water Detector (97403) 13220E9406-3	EA	1
2	4930-01-169-5287	Adapter Probe, Water Detector Kit (97403) 13220E9914-3	EA	1
3	2540-00-670-2459	Bag, Pamphlet	EA	1
4	4210-00-775-0127	Fire Extinguisher Type 2, Class 2 w/Bracket	EA	1
5	5975-01-050-5707	Rod, Ground (97403) 13219E0462	EA	1
6	2990-00-972-7950	Rope, Starter (GED only)	EA	1
7	N/A	Technical Manual TM 5-4930-228-14	EA	1

By Order of the Secretary of the Army:

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

Official:

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

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted, (2000)

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 May 1988

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

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800) NSN 4930-00-070-1181

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Inside of front cover, warnings are superseded as follows:

WARNING

HIGH TENSION SPRING

When hose reel is turned to remove hose, the recoil spring tension is increased. Before performing maintenance on the hose reel, carefully unwind reel to release spring tension.

Do not disassemble spring housing assembly. The spring is under tension and can cause serious injury or death if disassembled improperly. Repair of spring housing assembly is by replacement only.

WARNING

FLAMMABLE FUEL

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

Do not smoke or use open flame within 50 feet (15.24 meters) of the tank and pump unit.

Be sure proper grounding procedures have been followed prior to operating the equipment.

Do not refuel the GED pump assembly fuel can while the engine is operating; stop engine and allow to cool before refueling.

If fuel is spilled, wash the area of spillage thoroughly with water.

After refueling operation is completed, replace the filler cap securely before removing the nozzle bonding wire.

WARNING

Operation of this equipment presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits for unprotected personnel. Wear ear muffs or earplugs which were fitted by a trained professional.

WARNING

All aircraft fuel must be dispensed through a filter/separator unit. It is mandatory that the performance of filter/separators on all aircraft refueling equipment be checked every 30 days through submission of samples taken from the effluent stream of the filter/separator.

WARNING

DEATH or SERIOUS INJURY may result if personnel fail to heed Safety Precautions for welding. Prior to welding, read welding instructions contained in Chapter 6, on repair of the Tank Assembly.

If conditions require fuel tank repairs by welding or other methods involving heat or flame, be sure that all fumes are purged from the tank or fill tank with water before commencing the repair. If possible, tank should be filled with water prior to welding after being thoroughly purged of fumes. Applying heat or flame to a fuel tank containing residue may result in a violent explosion, causing injury or death to personnel.

Personnel engaged in purging operations will not wear wool, nylon, silk, rayon, or other similar static electricity generating clothing. Clean cotton clothing with no metal buttons or fittings will be worn. All contents will be removed from pockets.

The tank being purged must have static ground during all operations. Precautions should be taken with all tools and metal objects around the tank to ensure no spark will be made. Conduct a combustible vapor test reading prior to purging the tank using an acceptable explosive meter.

Only competent personnel thoroughly instructed in the proper handling and reading of the explosive meter will conduct vapor tests. Conduct a combustible vapor test reading immediately after purging. Under no circumstances will repair of the tank begin until declared safe be safety personnel. Discontinue all operations if an electrical storm is threatening or in progress. Eliminate conditions that could cause explosions.

WARNING

Operate GED engine in a well ventilated location. Carbon monoxide is a deadly gas that is given off by a gasoline engine. It is odorless and tasteless. The first evidence of its presence is that the operator of the equipment will have a headache or suffer from a feeling of dizziness.

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 degrees F to 138 degrees F (38 degrees C to 59 degrees C).

WARNING

Do not touch metal parts with bare skin during cold weather. The skin may stick to the metal.

WARNING

For the electric motor driven pumping assembly, disconnect power cable from vehicle slave receptacle before replacing or repairing motor or electrical components. When connecting power cable be sure Remote ON-OFF Switch is in "OFF" position. Low voltage can cause Severe Shock or Death.

WARNING

Equipment must not be used for other than the intended purpose. Failure to heed this warning can cause damage to equipment and/or injury or death to personnel.

WARNING

Transportation or storage of liquid, other than petroleum products, is hazardous to personnel and can damage the equipment.

Page 1-1, Paragraph 1-7a is superseded by the following paragraph:

1-7a. General. The tank and pump unit (figure 1-1) consists of a 50 gpm (189 liters per minute) pumping assembly, two 600-gallon (2271-liter) tanks and related items. It is designed for use with 5-ton Cargo Trucks such as M-54, M-55, M813A1, M814, M923, M924, M925, and M926. When installed in a cargo truck, the tank and pump unit is used in the field as a bulk carrier and dispenser. It carries 1200 gallons (4542 liters). The purpose of the tank and pump unit is to convert a general purpose military cargo vehicle into the bulk refueler. The maintenance paragraphs contain detailed descriptions of its components. (NOTE: Electric Motor Driven Pump requires Slave Receptacle mounted at right rear side of cab).

Page 1-1, following paragraph 1-7a, delete the note.

Page 1-7, paragraph 1-7c.1, change paragraph title and first sentence to read: "Electric Motor Driven Pump. The electric motor driven pump (Fig. 1-4.1) is a self-priming unit, with the impeller mounted on the extended shaft of the electric motor."

Page 1-7, Paragraph 1-7d.1, change "1.3 hp" to "1.5 hp." Add the following sentence to paragraph 1-7d.1: "The electric motor driven pump assembly requires two cables (Fig. 1-4.1)."

Page 1-7, immediately after paragraph 1-7d.1, add the following note:

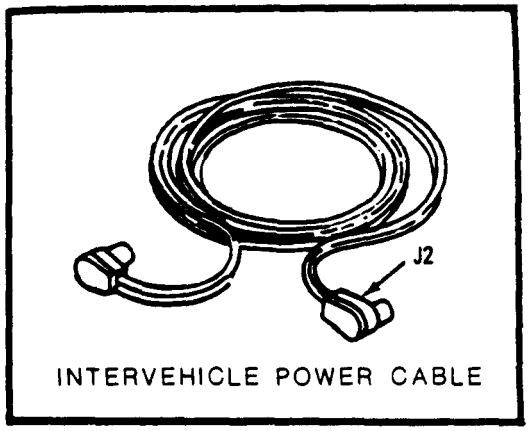
NOTE

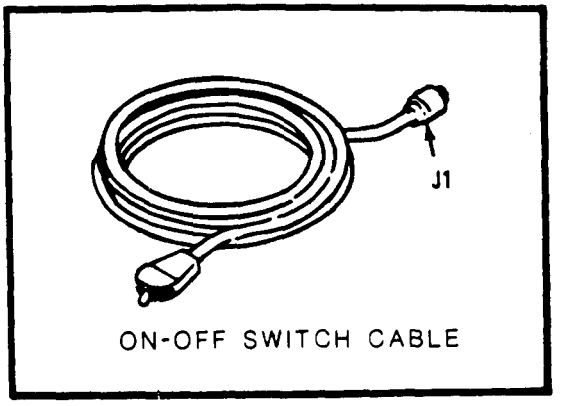
Electric Motor Drive Pump requires slave receptacle mounted at right rear side of cab.

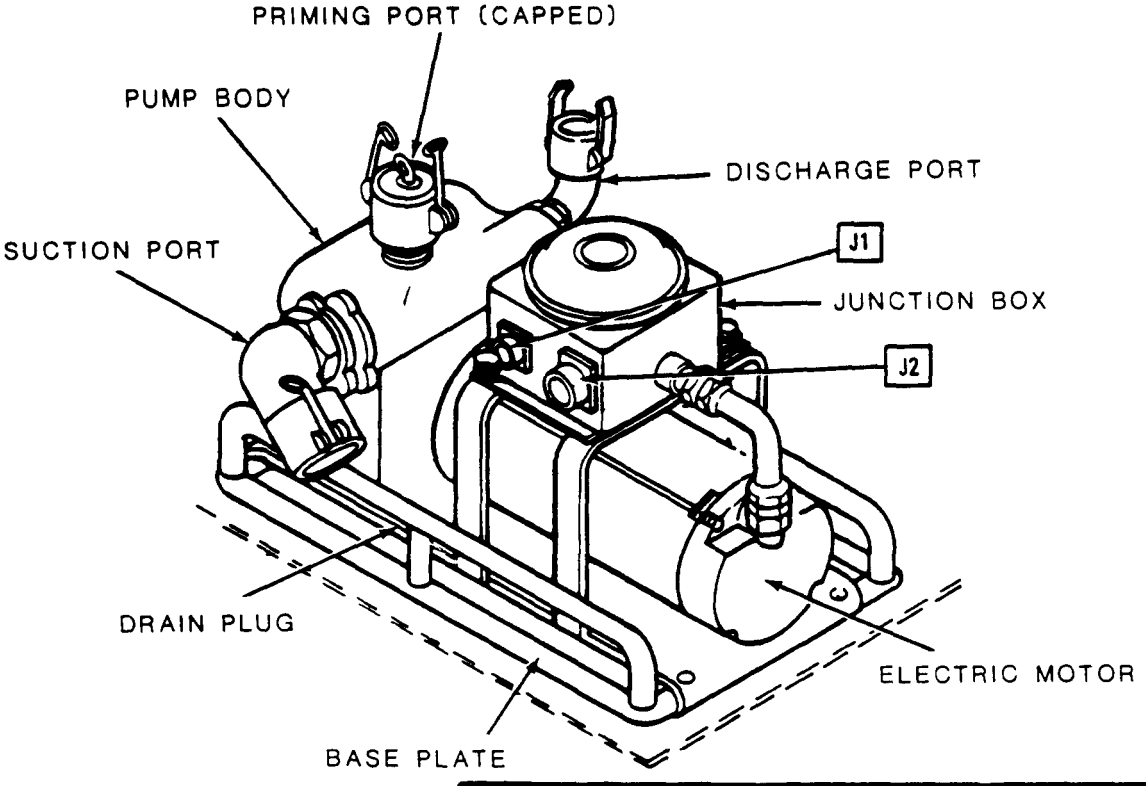
Page 1-8, Paragraph 1-8a (1.1) is superseded as follows:

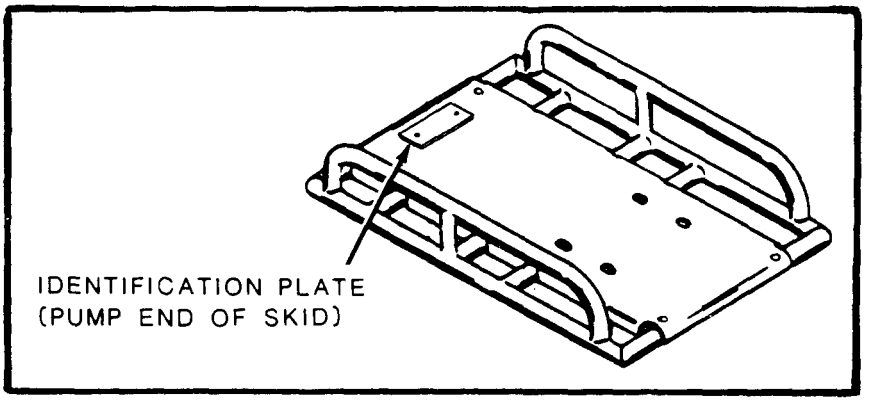
1-8a (1.1). Electric motor pump assembly. Located on the pump end of the skid (See Fig. 1-4.1).

Page 1-8, after paragraph 1-8a(3), add figure 1-4.1.









PUMP (EMD)

Figure 1-4.1. Pump Assembly (EMD)

Page 1-9, Paragraph 1-8c, Tabulated Data for the Electric Motor is superseded as follows:

Electric Motor

Length	16.58 in. (42.11 cm)
Width	5.59 in. (14.46 cm)
Height	6.34 in. (16.10 cm)
Weight	86.5 lb. (39.32 kg)
Input	24 Vdc
Rated current (at 1.5 hp load)	55A
Rated Speed (with motor at 35°C)	
3600 rpm	
Operating speed	3100 rpm

Page 1-9. Paragraph 1-8c(6) and figure 1-5.1 are deleted.

Page 2-2, Paragraph 2-2. The third line is changed to read "figures 2-1 through 2-1.6."

Page 2-2. Figure 2-1 and 2-1.1 are superseded by figures 2-1 through 2-1.5.

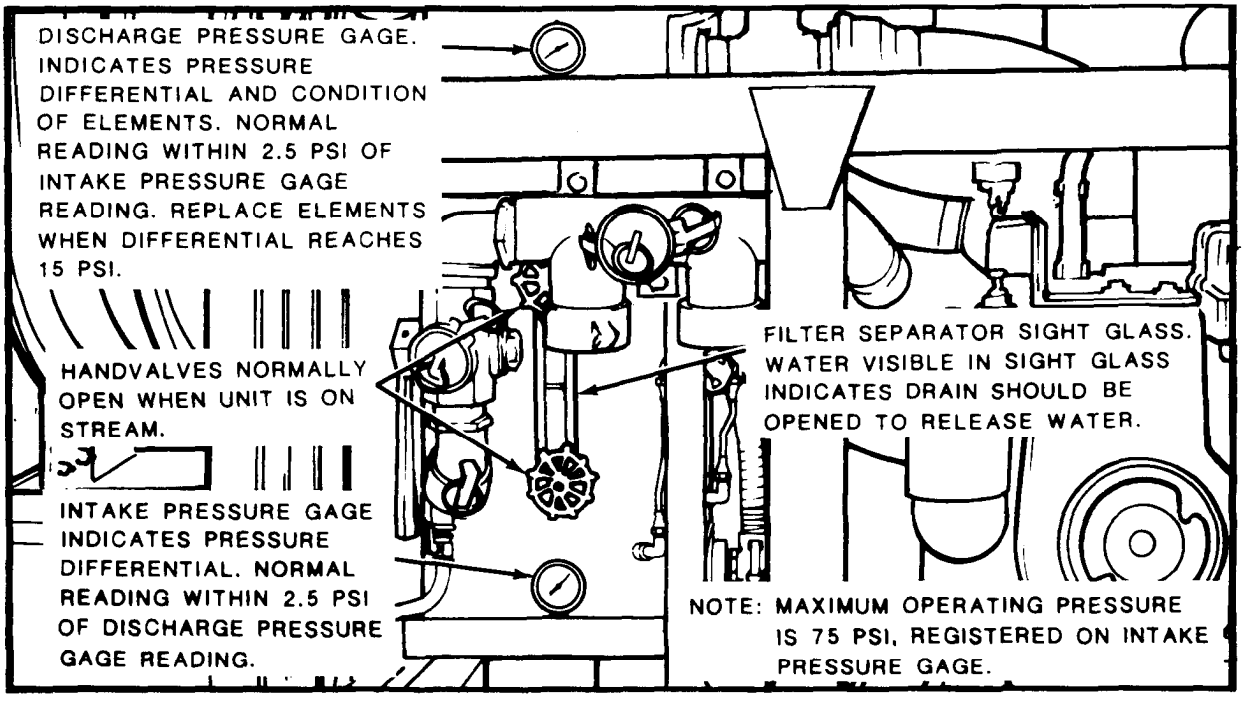


Figure 2-1. Pressure Gages and Sight Glass.

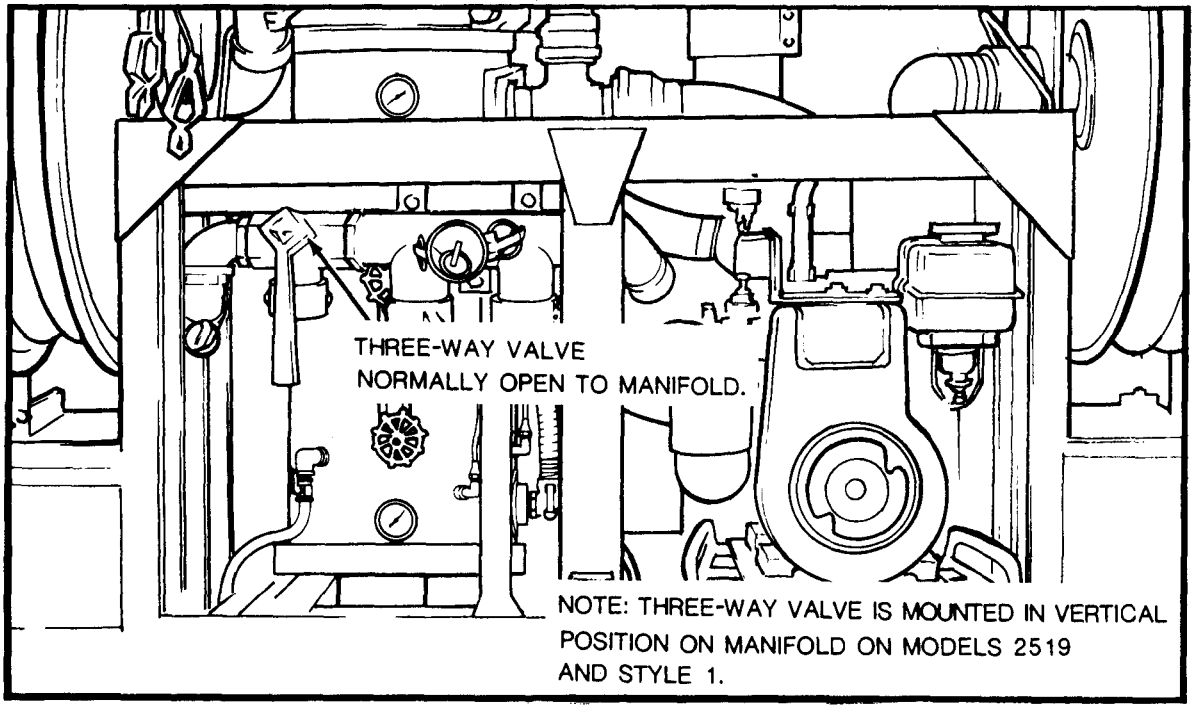


Figure 2-1.1 Three-Way Valve (Models 2938 and 36W50).

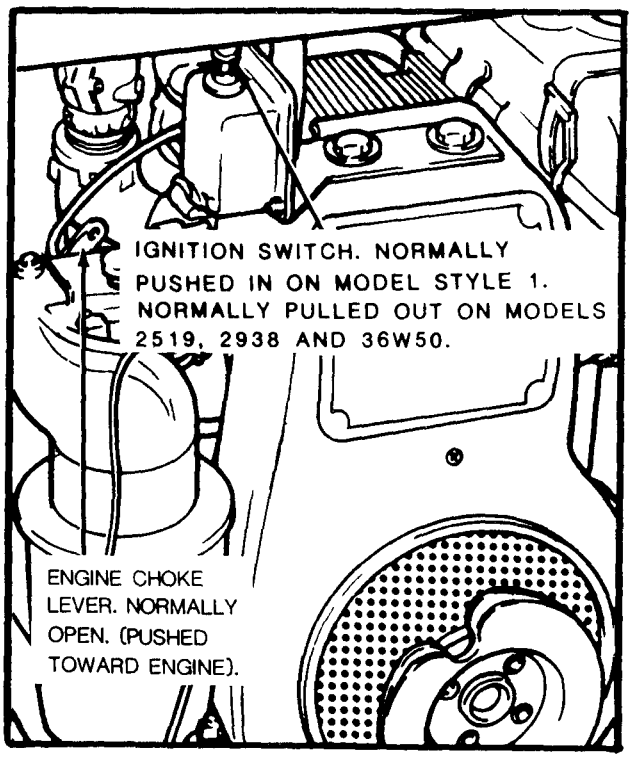


Figure 2-1.2. Engine Choke Lever and Ignition Switch.

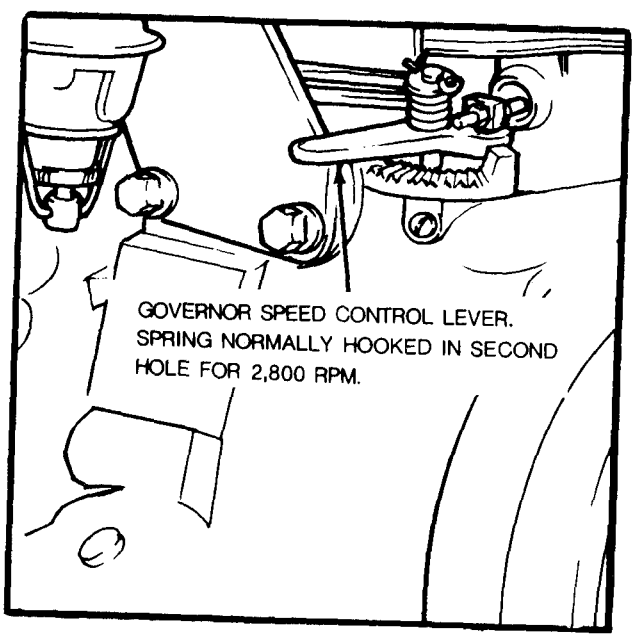


Figure 2-1.3. Governor Speed Control Lever.

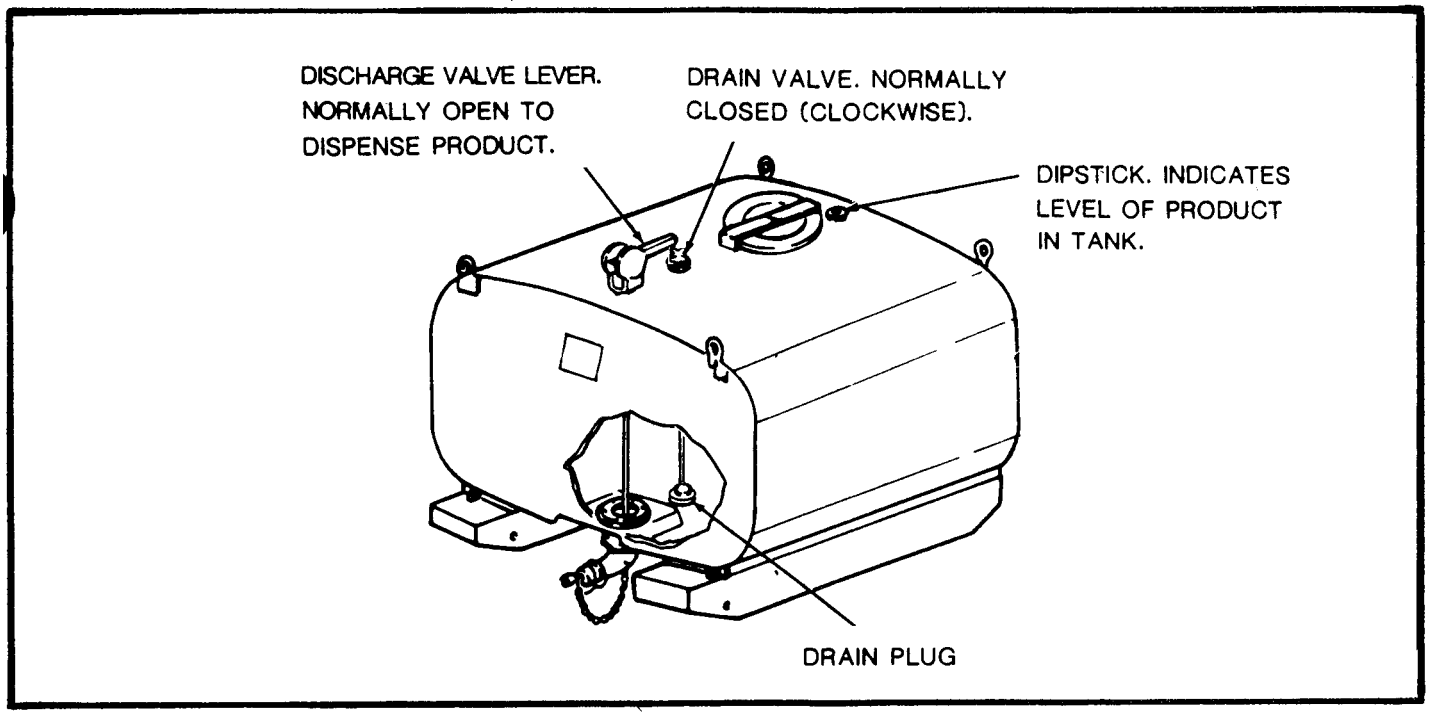


Figure 2-1.4. Tank Dipstick, Drain Valve, and Discharge Valve Lever.

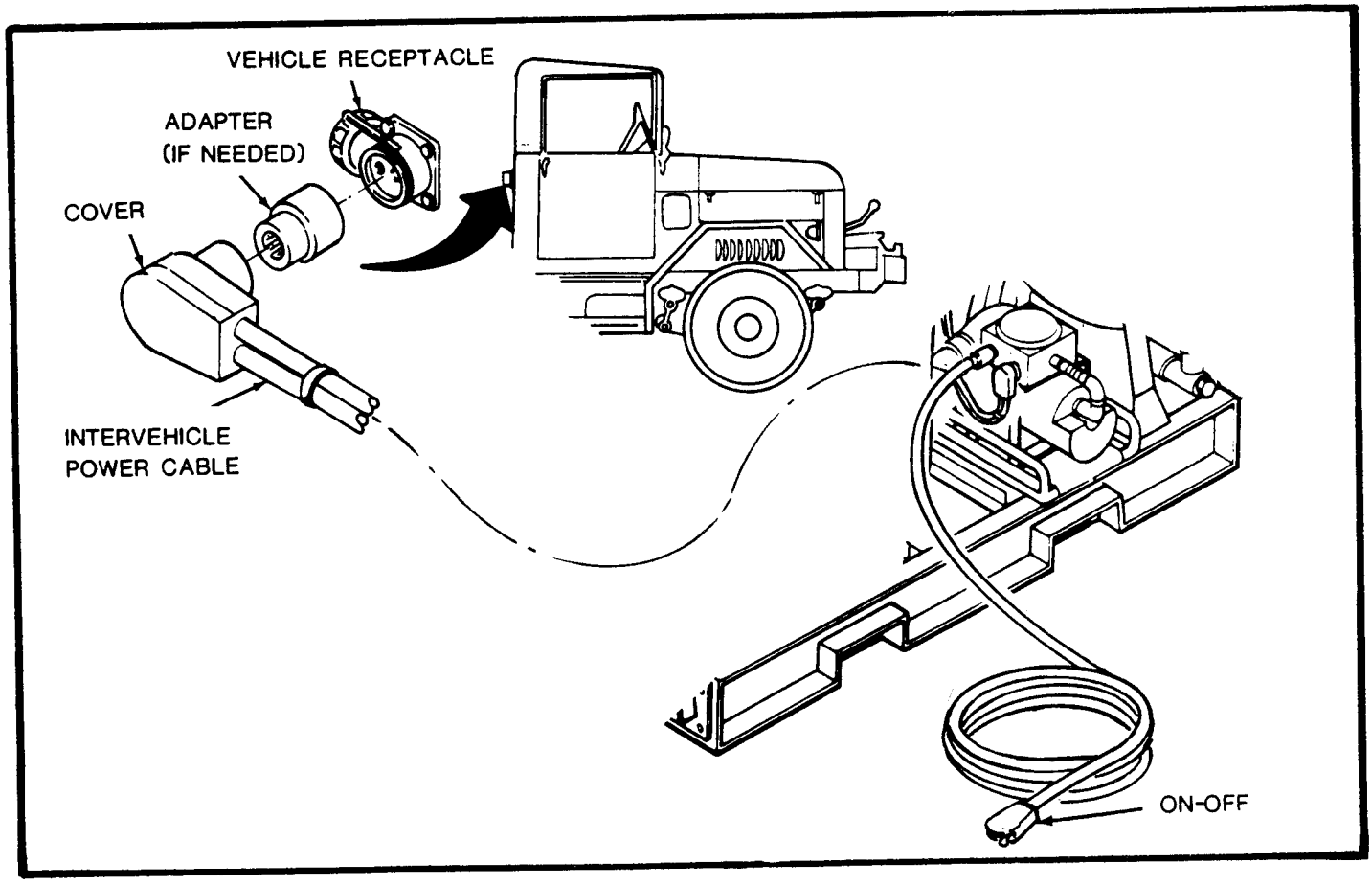


Figure 2-1.5. Electric Motor Driven Pumping Assembly.

Page 2-3. After subparagraph a(8) and note, add subparagraph a(9) as follows:

(9) To prepare to start electric motor driven pumping assembly, connect intervehicular power cable, with adapter (if needed), to vehicle receptacle and junction box receptacle J2 (Fig. 1-4.1). Then connect ON-OFF switch cable to junction box receptacle J1.

Page 2-4. Paragraph 2-4c and figure 2-2.1 is superseded by the following paragraph 2-4c and figure 2-2.1:

2-4c. Starting Electric Motor Driven Pumping Assembly

(1) Adjust truck hand throttle for proper engine RPM (approximately 1000 RPMs) to maintain adequate charge rate during pumping operations.

(2) Turn ON-OFF switch to on position. Refer to Figure 2-2.1.

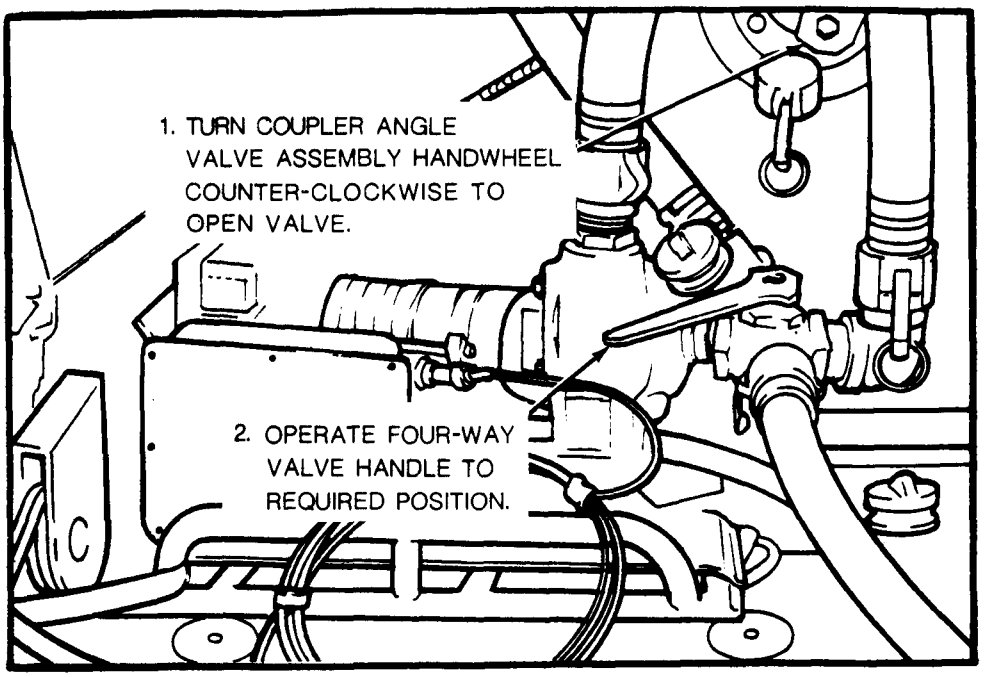


Figure 2-8. Electric Motor Driven Pumping Assembly.

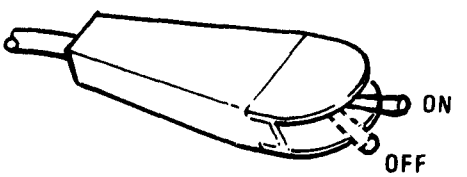


Figure 2-2.1 ON-OFF Switch.

Page 2-5. Paragraph 2-5.1 is superseded as follows:

2-5.1. Stopping Electric Motor Driven Pumping Assembly.

a. To stop the electric motor driven pumping assembly, turn the remote pump switch to its off position (Fig. 2-2.2).

b. Reduce hand throttle setting to idle.

c. When moving to a new location:

(1) Disconnect ON-OFF switch cable from junction box receptacle J1 (Fig. 1-4.1).

(2) Disconnect intervehicular power cable from vehicle receptacle and junction box receptacle J2.

Page 2-7, Paragraph 2-11d (3). Change "1800 RPM" to "approximately 1000 RPM."

Page 2-7, Paragraph 2-11e, last sentence delete "in cold weather."

Page 2-7, Paragraph 2-11e. Immediately after paragraph 2-11e, add the following paragraph:

2-11f. Electric Motor. Take special precautions to protect equipment in frigid climates or during cold periods. Use care in handling cables and wire insulation. These items become hard and brittle and are easily damaged. Avoid sharp bends or unnecessary loops in cables and wires.

Page 2-8, Paragraph 2-12. Add the following subparagraph:

f. Electric Motor. Hot, dry periods subject connectors, receptacles and binding posts to damage from dust and dirt. If possible, operate electric motor in the shade. Make more frequent PMCS.

Page 3-2, Table 3-1. Add the following PMCS procedures, with "Before and After operation" requirements:

14. INTERVEHICLE POWER CABLE (EMD).

Check cable assembly and connector for damage.

15. ON-OFF SWITCH CABLE ASSEMBLY (EMD).

Check switch for proper operation. Check cable and connector for damage.

Page 3-3, Table 3-2. Add the following troubleshooting procedure after Item 3:

3.1. ELECTRIC MOTOR WILL NOT OPERATE.

Check vehicle power supply.
—If batteries are discharged, contact Organizational Maintenance.

Delete existing Item 6 and add the following troubleshooting procedures:

6. PUMP FAILS TO PUMP PRODUCT.

Step 1. Check that tank dispensing valve is open.
—If pump does not prime, contact Organizational Maintenance.

Step 2. Check ON-OFF switch connection.
—Connect cable properly to connector J1.

Step 3. Check to see that intervehicle cable is connected properly.
—Connect cable and adapter to vehicle receptacle and connector J2.

6.1. PUMP WILL NOT PUMP FUEL AT RATED CAPACITY.

Step 1. Check for low pump engine speed.
—Adjust engine speed. (GED)

Step 2. Check truck engine R.P.M. for proper charge rate. (EMD)

—Adjust engine R.P.M. to approximately 1000 R.P.M.

Step 3. Check level in 600 gallon fuel tanks.
—Fill tanks if empty.

Step 4. Check that tank cam lever is fully open.
—Open cam lever.

Page 3-4. Add the following paragraph 3-9.1 and figure 3-3.1 immediately after paragraph 3-9:

3-9.1. PUMP ASSEMBLY (EMD).

WARNING

Disconnect intervehicle power cable before maintaining or replacing component parts.

a. The electric motor requires an intervehicular power cable.

(1) Unplug and inspect intervehicle power cable (figure 3-3.1) for damaged or corroded connectors.

(2) Clean connectors to obtain a good connection at J2 connector at Junction Box and connector and adapter at the vehicle receptacle.

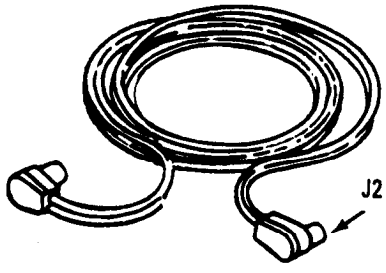
(3) Replace cable assembly if damaged.

b. The electric motor is controlled by an ON-OFF switch cable.

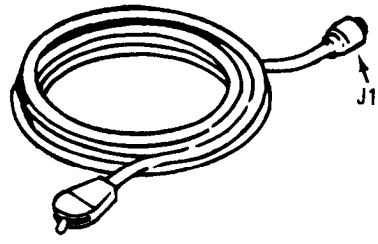
(1) Inspect ON-OFF switch cable (figure 3-3.1) for damage or corroded connectors, damaged or frayed cable, or damaged switch.

(2) If cable or switch are damaged, replace cable assembly.

(3) Remove connector from J1 receptacle. Clean connectors to obtain a good connection at J1 connector at Junction Box. If connector is damaged, notify Organizational Maintenance for replacement.



INTERVEHICLE POWER CABLE



ON–OFF SWITCH CABLE

Figure 3-3.1. Pump Assembly Cables.

Page 4-1, Paragraph 4-1a(5) changed to read as follows:

(5) For the Gasoline Engine Driven Unit, turn the engine with the starter rope to make sure all moving parts are free.

Page 4-1, Paragraph 4-2a. In lines 8 and 9, delete "and in the 2½ ton 6 X 6 cargo trucks M-35 and M-211."

Page 4-3, Paragraph 4-2b(2). In lines 2 and 3, delete "or on 2½ ton cargo trucks, against rear end of truck body."

Page 4-12, Table 4-1. Add the following warning and monthly PMCS procedures to Table 4-1:

M	Q	
		WARNING **Disconnect intervehicle cable from vehicle before maintaining or replacing electrical components.**
8.1.		**ELECTRIC MOTOR (EMD)** Check for proper connections or loose mounting hardware. Check for proper operation. If motor is defective, notify Direct Support Maintenance.
8.2.		**ELECTRICAL JUNCTION BOX (EMD).** Check for damaged receptacles, housing, or cover gasket. Inspect relay switch inside junction box for loose or corroded terminals and connectors. Clean corroded connections, replace defective parts.
8.3.		**INTERVEHICLE CABLE.** Check cable assembly and connectors for damage. Test for continuity. Replace defective part.
8.4.		**ON-OFF SWITCH CABLE ASSEMBLY (EMD).** Check switch for proper operation. Check cable and connector for damage. Replace switch and cable assembly or defective connector.
8.5.		**VEHICLE POWER SUPPLY (EMD).** Check batteries on transporting vehicle to assure adequate power supply for operation of electric motor. (Refer to appropriate TM- for transporting vehicle)

Page 4-13, Table 4-2. Item 7 is superseded as follows:

7. PUMP WILL NOT PUMP FUEL AT RATED CAPACITY.

Step 1. Check for low pump engine speed.

Adjust engine speed. (GED)

Step 2. Check truck engine RPM for proper charge rate. (EMD)

Adjust engine RPM to approximately 1000 RPM.

Step 3. Check level in 600 gal fuel tanks.

Fill tanks if empty.

Step 4. Check that tank cam lever is fully open.

Open cam lever.

Page 4-13, Table 4-2. Item 9 is superseded as follows and warning is added:

WARNING

Disconnect Intervehicle Power Cable from vehicle before maintaining or replacing electrical components.

9. ELECTRIC MOTOR WILL NOT OPERATE.

Step 1. Check vehicle power supply.

Insure vehicle batteries and charging system are operating properly.

Step 2. Check power cables.

Test for continuity of Intervehicle cable and ON-OFF switch cable.

Step 3. Check electric motor.

WARNING

Disconnect Power Cable.

a. Remove junction box cover.

b. Remove 3 screws holding K1 Relay and RF1 filter to floor of junction box.

c. Carefully lift K1 Relay out of junction box (with all leads attached).

d. Remove 4 screws from RFI filter cover, and remove cover.

e. Disconnect both "TH" leads from RFI Filter terminals #2 & #3.

f. Multimeter should read continuity across both "TH" leads indicating a good thermostic switch in electric motor.

If continuity is not recorded, replace motor.

WARNING

MAKE SURE ALL TERMINALS ARE FREE OF GROUND.

g. Connect Power Cable and turn Remote Cable "ON."

h. Battery voltage should be read across RFI filter terminals #1 and #3.

If full battery voltage is present, replace electric motor.

If anything less than battery voltage is recorded, check RFI filter.

Page 4-13, Table 4-2. Item 10, "Electric Motor Speed To Slow," is deleted.

Page 4-14. Delete Figure 4-4.1. "Interference suppression filter location, removal and installation."

Page 4-14, Paragraph 4-14. The first sentence is changed to read: "The gasoline engine driven pumping assembly is mounted on an aluminum frame that will slide out."

Page 4-15, Paragraph 4-15.1 and Figures 4-5.1 through 4-5.6 is superseded by the following paragraph 4-15.1 and Figure 4-5.1:

4-15.1. CONVERSION OF GASOLINE ENGINE DRIVEN PUMPING ASSEMBLY TO ELECTRIC MOTOR DRIVEN PUMPING ASSEMBLY.

a. Equipment Removal:

(1) Remove existing suction and discharge hoses from the unit.

(2) Remove existing pump and engine and attaching hardware from unit.

(3) Remove and dispose of any instruction plate pertaining to the gasoline engine driven pumping assembly from the unit.

b. Installation of Kit:

(1) Remove and retain cable assemblies from the pump assembly.

(2) Install pump assembly (1) using provided ⅜ X 2 inch cap-screws (2) and lock-washers (3).

(3) Assemble tee (4) and coupling halves (5 and 6). Apply antiseize tape to all male pipe threads before assembly.

(4) Remove and retain male cam lock plug from front of manifold and install tee assembly (4, 5, & 6). Install gasket and retained male plug into lower coupling half (6).

(5) Install gaskets into female fittings of hose assemblies (7 & 8).

(6) Install 2-inch hose assembly (7) between suction manifold and inlet port on pump.

(7) Install 1½-inch hose assembly (8) between pump discharge and inlet of filter separator.

(8) Install cam lock cap (9) with gasket onto end of manifold fitting.

(9) Reinstall cable assemblies supplied with pump assembly.

(10) Install operating information plate (10) on pump unit frame using the plate as a template. Drill 6 mounting holes using a no. 29 (.136) drill. Attach plate using provided drive screws (11).

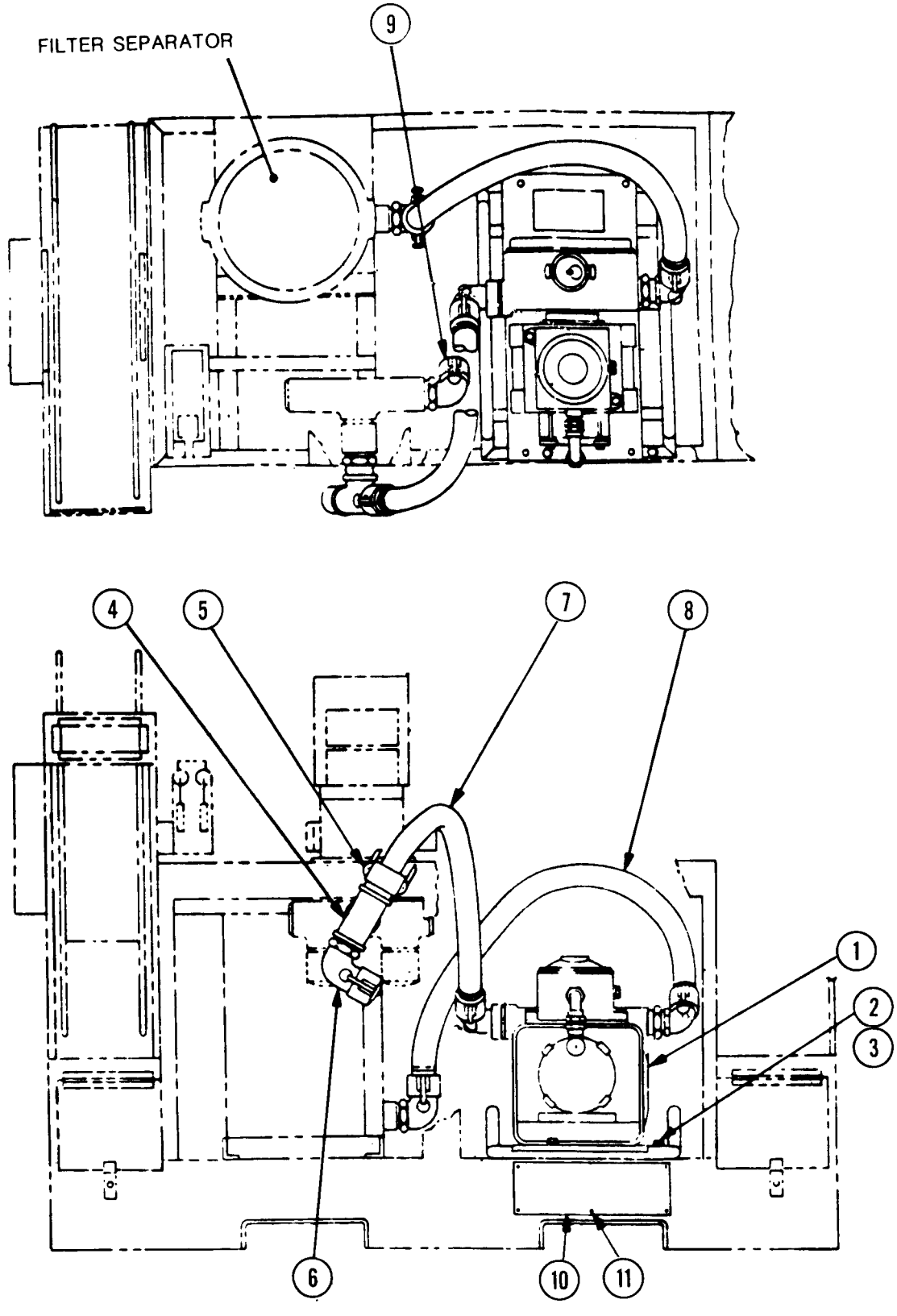


Figure 4-5.1 Conversion of Gasoline Engine Driven Pumping Assembly to Electric Motor Driven Pumping Assembly.

Page 4-15. Paragraph 4-15.2 and Figure 4-5.7 and 4-5.8 are deleted.

Page 4-27. Immediately after paragraph 4-29, add the following paragraphs and figures:

4-29.1. PUMP AND MOTOR ASSEMBLY.

The pump and motor assembly is mounted on an aluminum frame that will slide out of the pump unit. This mounting arrangement provides easy access to the pump and motor for maintenance and servicing purposes.

a. Removal.

WARNING

Disconnect power before working on the electric motor. Under certain conditions, low voltage causes severe shock or death.

(1) Close dispensing valves on tanks.

(2) Open drain cock on filter/separator. Allow liquid to drain into container.

(3) Pull out on cam arms to disconnect filter/separator-to-pump outlet hose from coupling.

(4) Pull out on cam arms to disconnect manifold-to-pump inlet hose from couplings.

NOTE

Manifold-to-pump inlet hose may be hard to remove. If so, leave hose on coupling until pumping assembly is removed.

(5) Remove pump assembly base plate (figure 4-18.1) from A-frame by removing four screws, four lockwashers, four flatwashers and four nuts.

(6) Remove pump drain plug and drain pump volute.

(7) Lift pump assembly with base from frame.

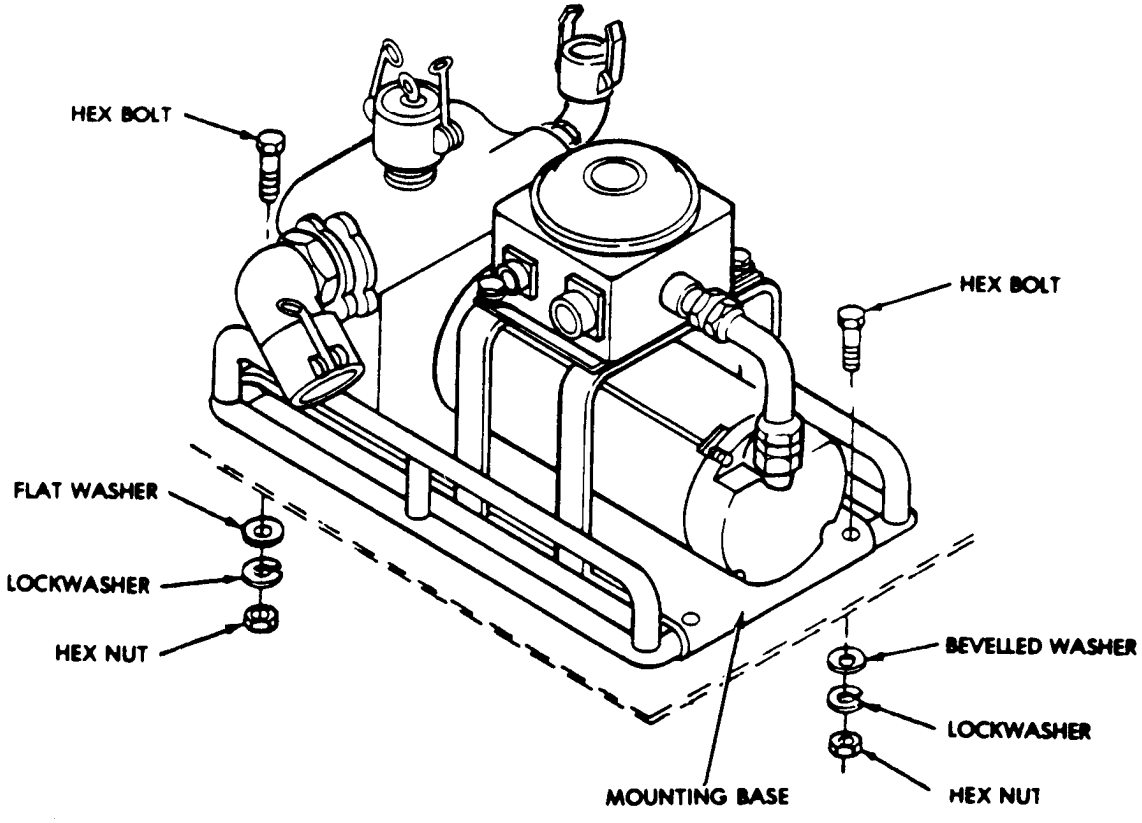


Figure 4-18.1. Pump and Electric Motor Assembly.

(8) To remove pump and motor from base plate first remove four hex bolts, lockwashers, flat washers, and hex nuts.

b. Installation.

(1) Install the pump and motor unit on the mounting base (figure 4-18.1) and secure the mounting brackets to the base with four screws, lockwashers, flat washers and nuts.

(2) Ensure that the drain plug is installed in the pump and tightened.

(3) Install the manifold-to-pump inlet hose on the pump inlet and secure by pushing in on the cam arms.

(4) Position the pump assembly on the frame and secure with four screws, four lockwashers, four flat washers, and four nuts.

(5) Install other end of manifold-to-pump inlet hose on the manifold coupling and secure by pushing in on cam arms.

(6) Install filter/separator-to-pump outlet hose on couplings and secure by pushing in on cam arms.

(7) Close drain cock on filter/separator.

(8) Turn lock on vent valve to close position.

(9) Open dispensing valves on tanks.

4-29.2. ON-OFF SWITCH CABLE, J1.

a. Test for continuity.

(1) Use multimeter with switch in the ON position.

(2) If reading is other than 0 ohms, replace cable or defective connector.

b. Connector Removal.

(1) Loosen screws.

(2) Unscrew connector.

(3) Tag and unsolder leads.

c. Connector Replacement.

(1) Solder leads. Use solder.

(2) Tighten connector.

(3) Tighten screws.

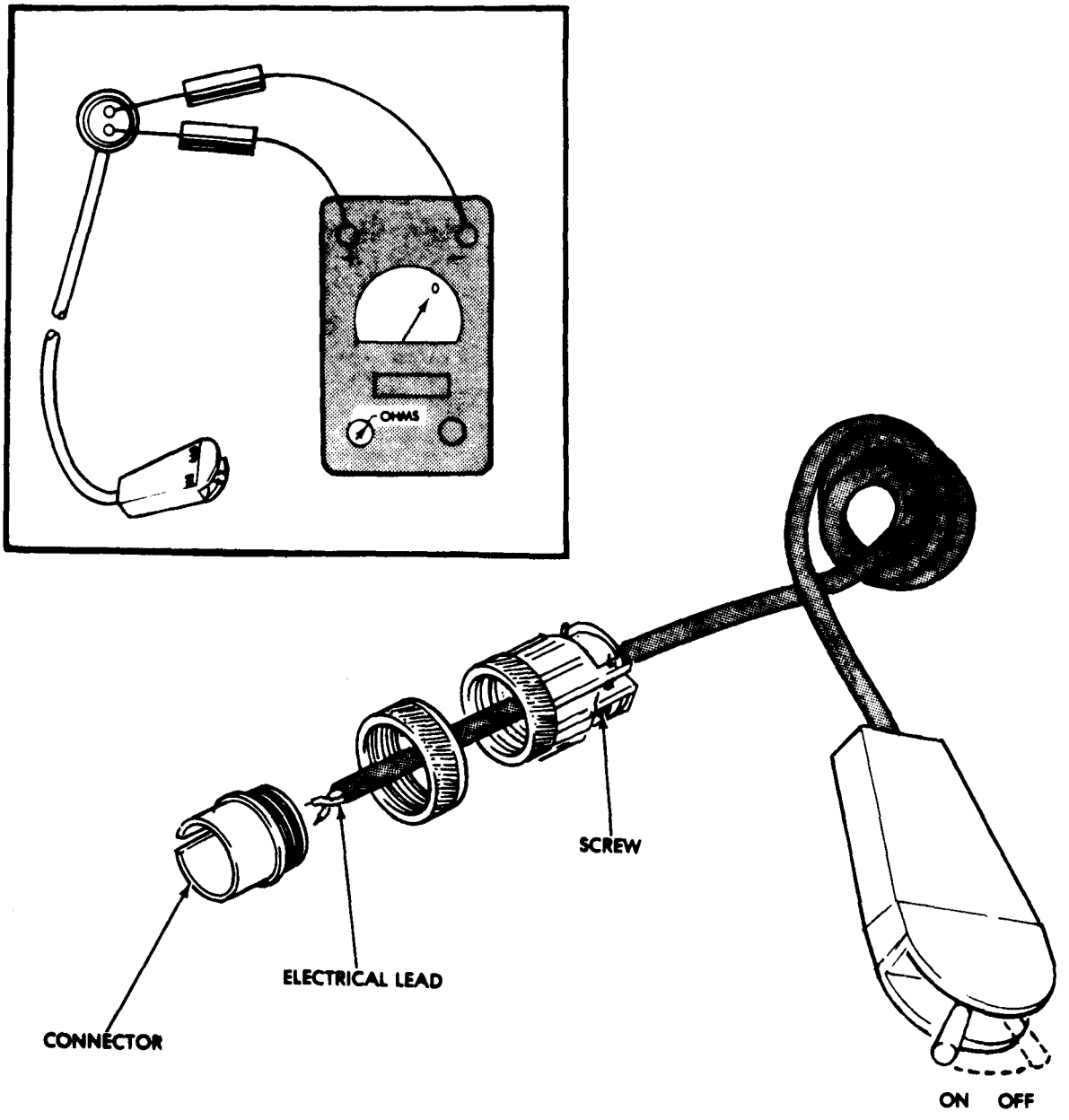


Figure 4-18.2. ON-OFF Switch Cable.

4-29.3. INTERVEHICLE POWER CABLE, J2.

a. Test for continuity.

Use multimeter to check both positive and negative sides of the connector. There should be a zero resistance reading. If the reading is other than 0 ohms, replace defective parts. (See figure 4-18.3)

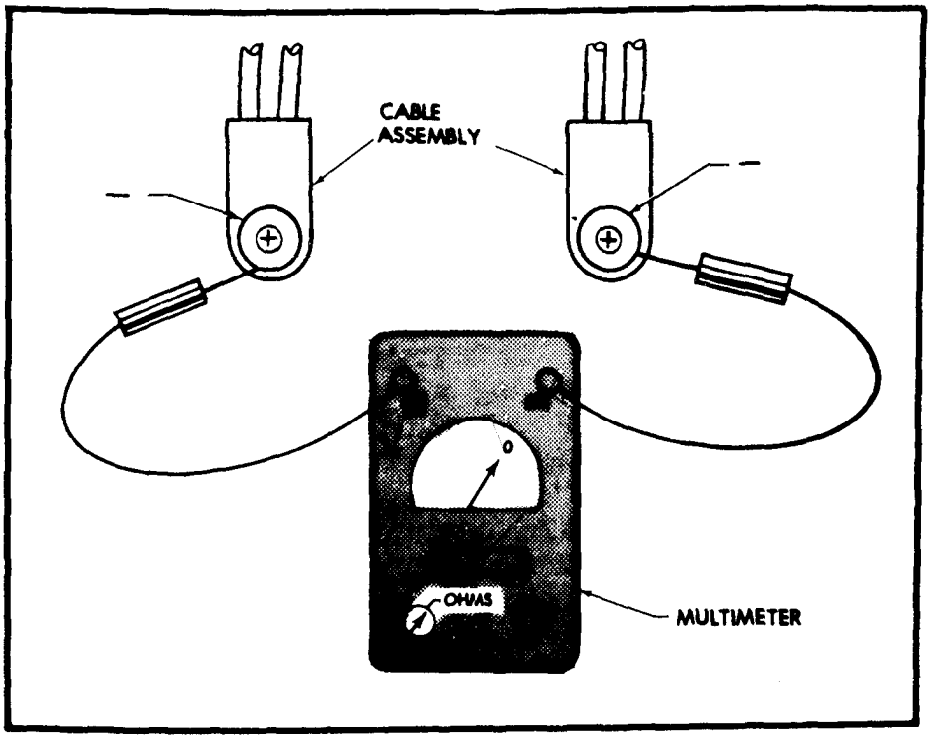


Figure 4-18.3. Test for Continuity.

b. Connector Assembly Removal. (See figure 4-18.4.)

(1) Remove the cover from connector by removing screws.

(2) Remove the cables from connector by removing bolt and lockwashers.

c. Connector Assembly Replacement. (See figure 4-18.4.)

(1) Attach cables to connector with lockwashers and bolts.

(2) Attach cover to connector with screws.

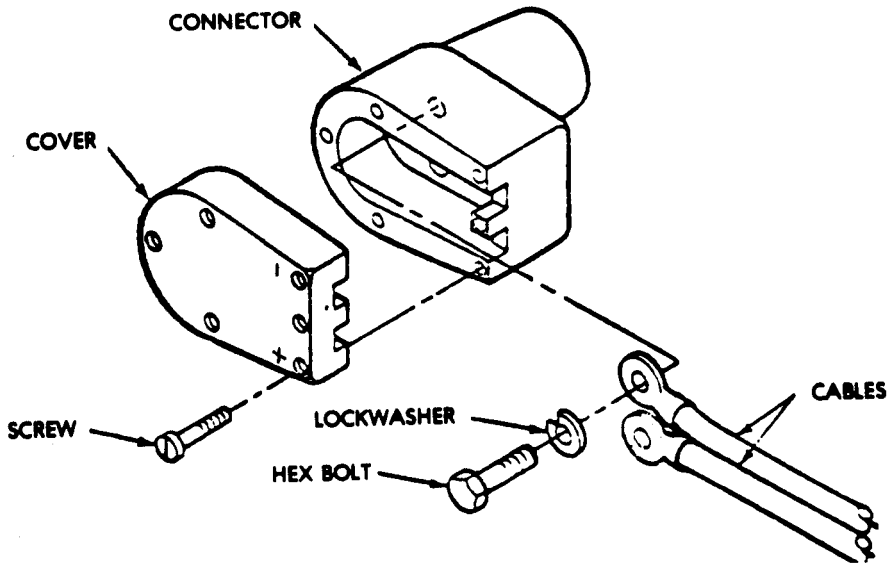


Figure 4-18.4. Connector Assembly.

d. Lug terminal replacement.

To replace lug terminals, see figure 4-18.5.

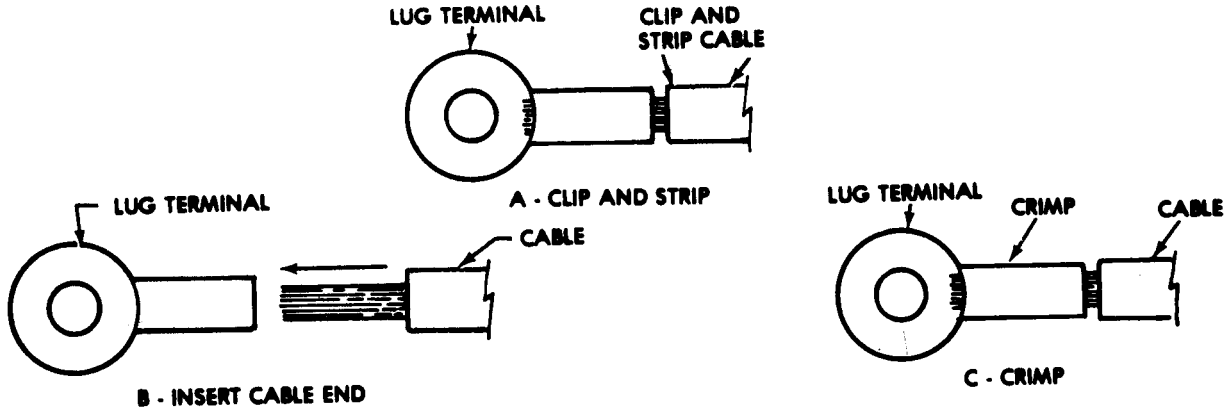


Figure 4-18.5. Lug Terminal Removal and Replacement.

4-29.4. CONDUIT ASSEMBLY.

a. Disassembly.

(1) Disconnect motor electrical leads from RF filter.

(2) Unscrew union from Junction Box.

(3) Unscrew union from motor fitting.

b. Reassembly.

NOTE

Wrap pipe threads once or twice with tape.

(1) Insert fittings over motor electrical leads.

(2) Screw union nuts onto motor and Junction Box fittings.

(3) Reconnect motor electrical leads to connector J2. (See figure 4-18.7.)

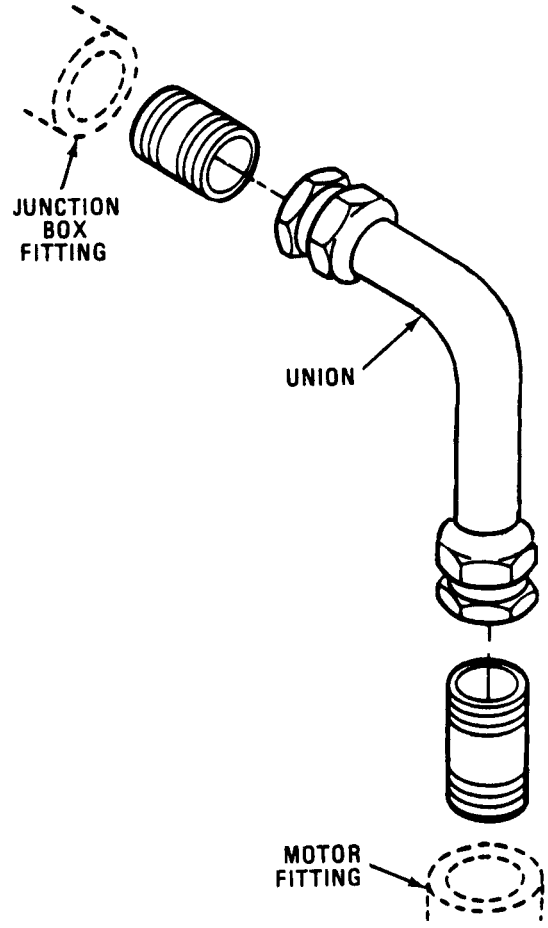


Figure 4-18.6. Conduit Assembly.

4-29.5. JUNCTION BOX ASSEMBLY.

a. Disassembly.

(1) Remove cover and gasket from junction box.

(2) Tag and remove electrical leads.

(3) Tag and remove electrical leads from connector J2.

(4) Tag and unsolder electrical leads from connector J1.

(5) Disassemble conduit assembly.

(6) Remove hex bolts, hex nuts, lockwashers, and flat washers holding junction box to mount.

(7) Remove screws, lockwashers, and flat washers holding connector J2 to junction box. Insulator and gasket should be removed with connector J2.

(8) Remove screws, lockwashers, and flat washers holding connector J1 to junction box.

b. Reassembly.

(1) Attach connector J1 to junction box with screws, lockwashers, and flat washers.

NOTE

Insure that insulator and gasket are seated on connector J2.

(2) Attach connector J2 to junction box with screws, lockwashers, and flat washers.

(3) Attach junction box to mount with hex bolts, hex nuts, lockwashers, and flat washers.

(4) Reassemble conduit assembly (paragraph 4-18.4.)

(5) Solder electrical leads to connector J1. Use solder.

(6) Attach electrical leads to connector J2.

(7) Replace cover and O-ring on junction box.

NOTE

• The electric motor lead identification marking varies depending on manufacturer. (Refer to Figure 4-18.7).

• When replacing the electric motor on the pumping assembly (refer to installation instructions and wiring diagram). Rotation of the motor clockwise may result (viewing from the impeller end). The correct rotation is counterclockwise.

• To change the rotation from clockwise to counterclockwise, switch the two leads marked A1, with the two leads marked A2. These leads are attached to the RFI filter terminals marked #1 and #3.

• The leads marked TH are to remain as shown in the wiring diagram.

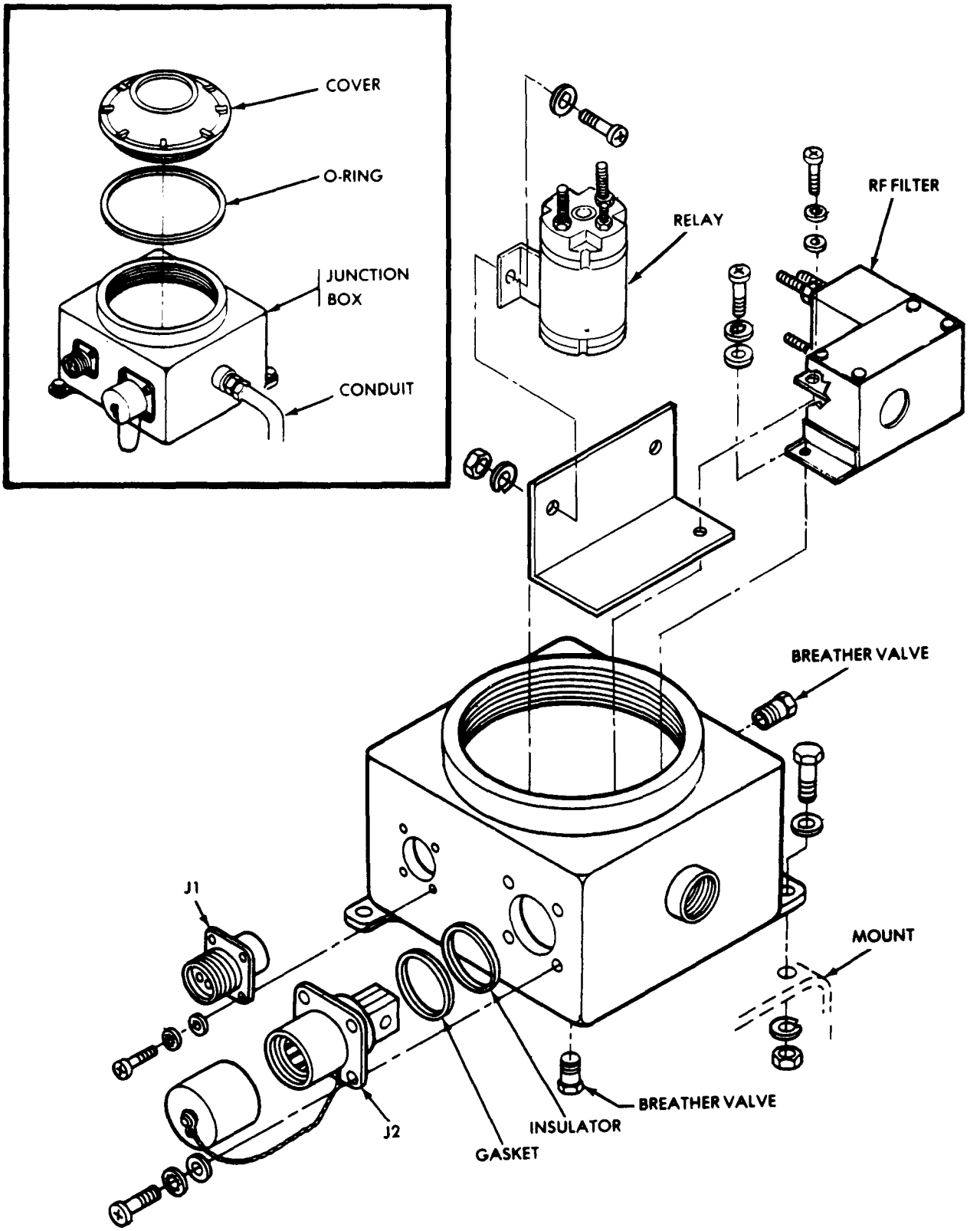


Figure 4-18.7. Junction Box Assembly (Sheet 1 of 2).

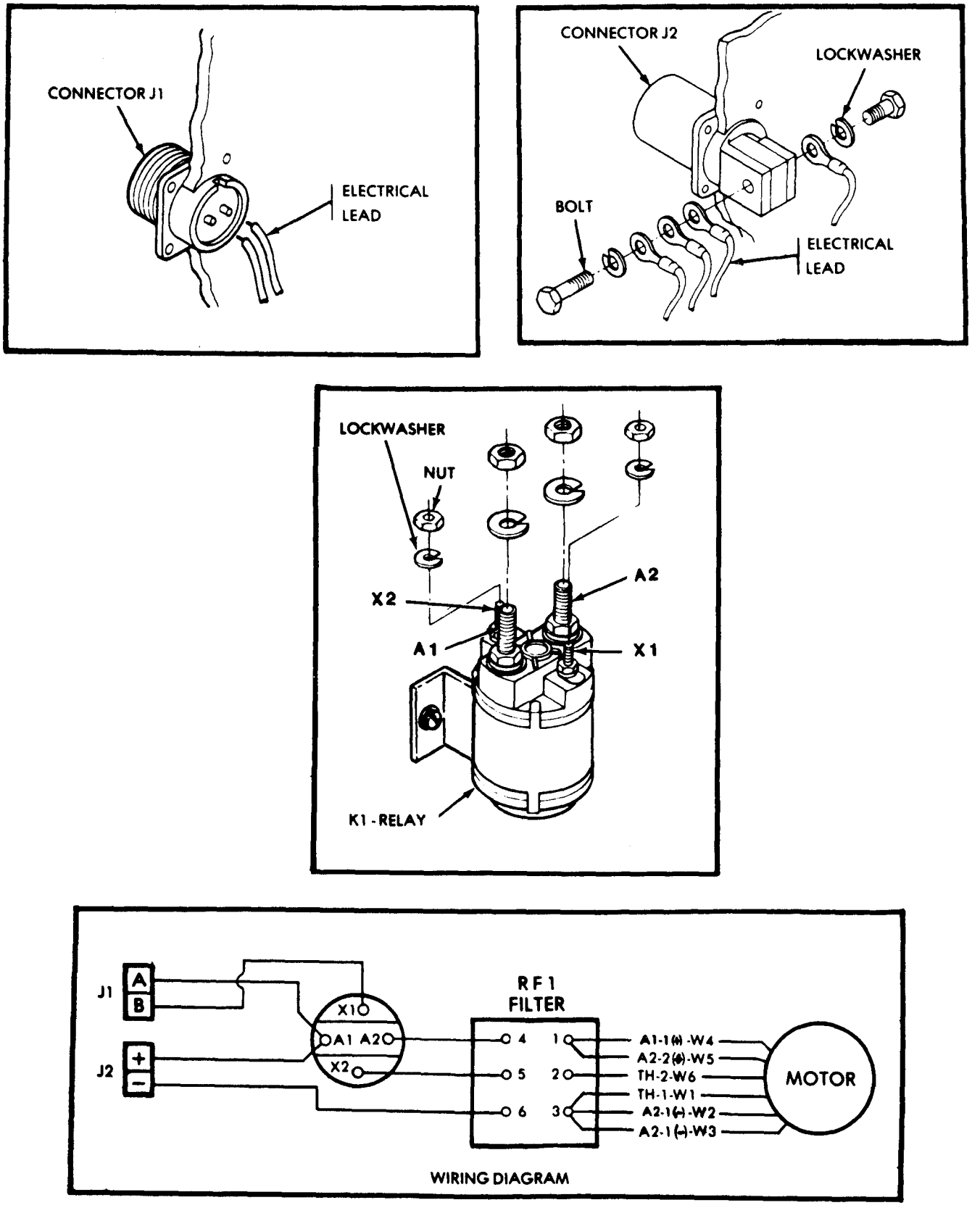


Figure 4-18.7. Junction Box Assembly (Sheet 2 of 2).

c. K-1 Relay Test Procedures.

(1) Step 1.

(a) Place ON-OFF switch in OFF position.

(b) Disconnect Power Cable (J2).

(c) Unscrew and remove Junction Box Cover with O-ring.

(2) Step 2. (See figure 4-18.8.)

NOTE

Failure of Motor Thermostatic Switch can prevent relay operation.

(a) The "X" circuit of the relay is grounded through the thermostatic switch in the motor. To check continuity, put probe on "X2" terminal of relay, and other probe on negative (-) terminal of the J2 Connector. (See wiring diagram in figure 4-18.7 for wire connections.)

CAUTION

The following tests require the power cable, J2, be connected as in normal pumping procedure. Exercise care in use of multimeter test probes.

(b) Connect Power Cable (J2).

(c) Hold negative (-) probe of multimeter on inner threaded portion of the junction box to ground.

(d) Touching positive (+) probe of multimeter to "A-1." Terminal of relay should give 24 volt reading.

(e) All other relay terminals should have "O" readings.

(3) Step 3.

(a) Place ON-OFF Switch in ON position.

(b) Ground negative (-) probe of multimeter.

(c) Touching positive (+) probe of multimeter to "X-1" terminal of relay should give 24 volt reading.

(d) Touching positive (+) probe of multimeter to "A-1" terminal of relay should give 24 volt reading.

(e) Touching positive (+) probe of multimeter to "A-2" terminal of relay should give 24 volt reading.

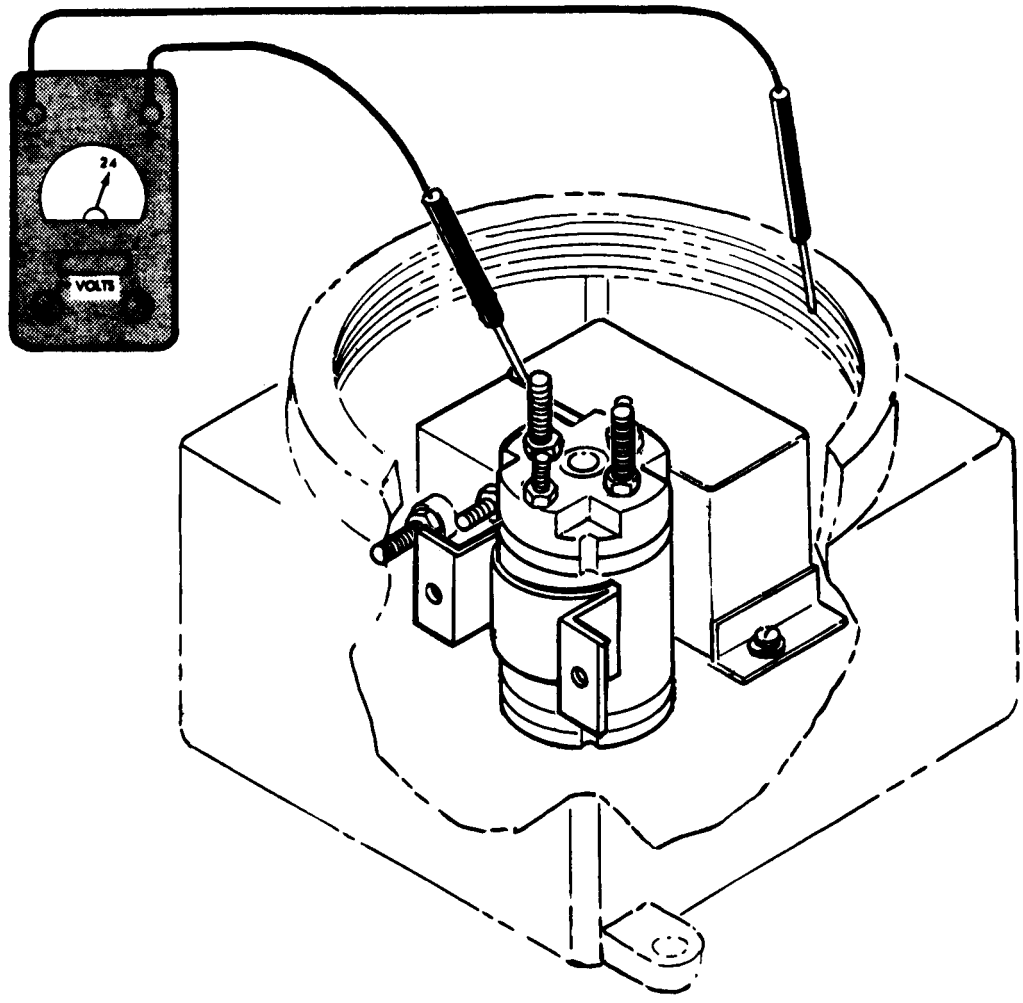


Figure 4-18.8. K-1 Relay Test.

Page 5-1, Table 5-1. Delete Items 8, 9, 10 and 11 from Table 5-1.

Page 5-2. Paragraphs 5-7b.1, 5-7b.2, and 5-7c.1 are deleted.

Page 6-3. Immediately after paragraph 6-2c, add the following paragraph 6-2.1 and figures 6-2.1 and 6-2.2:

6-2.1. CENTRIFUGAL PUMP (Electric Motor Driven)

WARNING

Disconnect intervehicle power cable from vehicle and close tank dispensing valve before maintaining or replacing electrical components; otherwise, electrical sparks could occur, creating a fire hazard.

The pump is a centrifugal-type unit that is directly coupled to the motor. The pump case houses the impeller, wear plate, seal, and adapter shaft, and serves as a liquid chamber with suction and dispensing ports. The check valve assembly consists of a large weight, gasket, and a small weight to prevent fluid backflow through the pump case and thereby retain the prime. Repair of the pump consists primarily of replacing damaged or worn components.

a. Removal. Remove the Electric Motor Driven Pumping Assembly (paragraph 4-29.1).

b. Disassembly. (Figure 6-2.1)

(1) Remove pump drain plug (1) and drain into suitable container.

(2) Remove nuts (2) and washers (3) and remove volute (4) and O-Ring (5).

(3) Remove center screw (6) and seal (7).

(4) Remove impeller (8) by unscrewing counterclockwise while holding shaft stationary. Hold armature shaft stationary with screwdriver in slot.

(5) Remove shims (9), screws (10) and wear plate (11).

(6) Remove O-Ring packing (12) and seal assembly (13).

(7) Extract four screws (14) and compression inserts (15), remove pump from motor.

(8) Remove adapter shaft (16) and Woodruff key (17) from motor shaft (18).

(9) Remove nuts (26), suction flange (25), screw (24), small weight (23), gasket (22), large weight (21) and studs (20) and (27) from pump case (19).

c. Cleaning, Inspection and Repair.

WARNING

Drycleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Avoid repeated and prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 degrees F-138 degrees F (38 degrees C-59 degrees C).

(1) Clean parts with drycleaning solvent.

(2) Dry parts thoroughly.

(3) Inspect the impeller, seal, coupling, and other components for damage or defects.

(4) Replace worn or defective parts.

(5) Replace all seals, gaskets, compression inserts, and O-Rings.

NOTE

Items (5, 7, 12, 13, 15) MUST be replaced each time the pump is removed and disassembled.

d. Reassembly (Figure 6-2.1).

(1) Attach studs (20) and (27) to pump case.

(2) Install large weight (21), gasket (22), small weight (23), screw (24), suction flange (25) and nuts (26).

NOTE

Item (15) is a compression insert that will not reseal after once compressed. Replace with new compression inserts.

(3) Install key (17) and attach pump (19) to motor with four screws (14) and new compression inserts (15). Torque evenly to 32 ft. lbs. (36.90 cm-kg).

(4) Install adapter shaft (16) onto armature shaft. Seat stationary seal into Rubber Seal and slide onto adapter shaft and pump cavity. Install Rotating Seal over adapter shaft (see figure 6-2.1).

NOTE

When the Seal, Assembly, Shaft is ordered, an alternate configuration of the Rotating Seal may be received. The uncaged spring and carbon seal is fit and functionally the same as the caged Rotating Seal, and is installed in the same way. An illustration of the Alternate Rotating Seal is included in Figure 6-2.1.

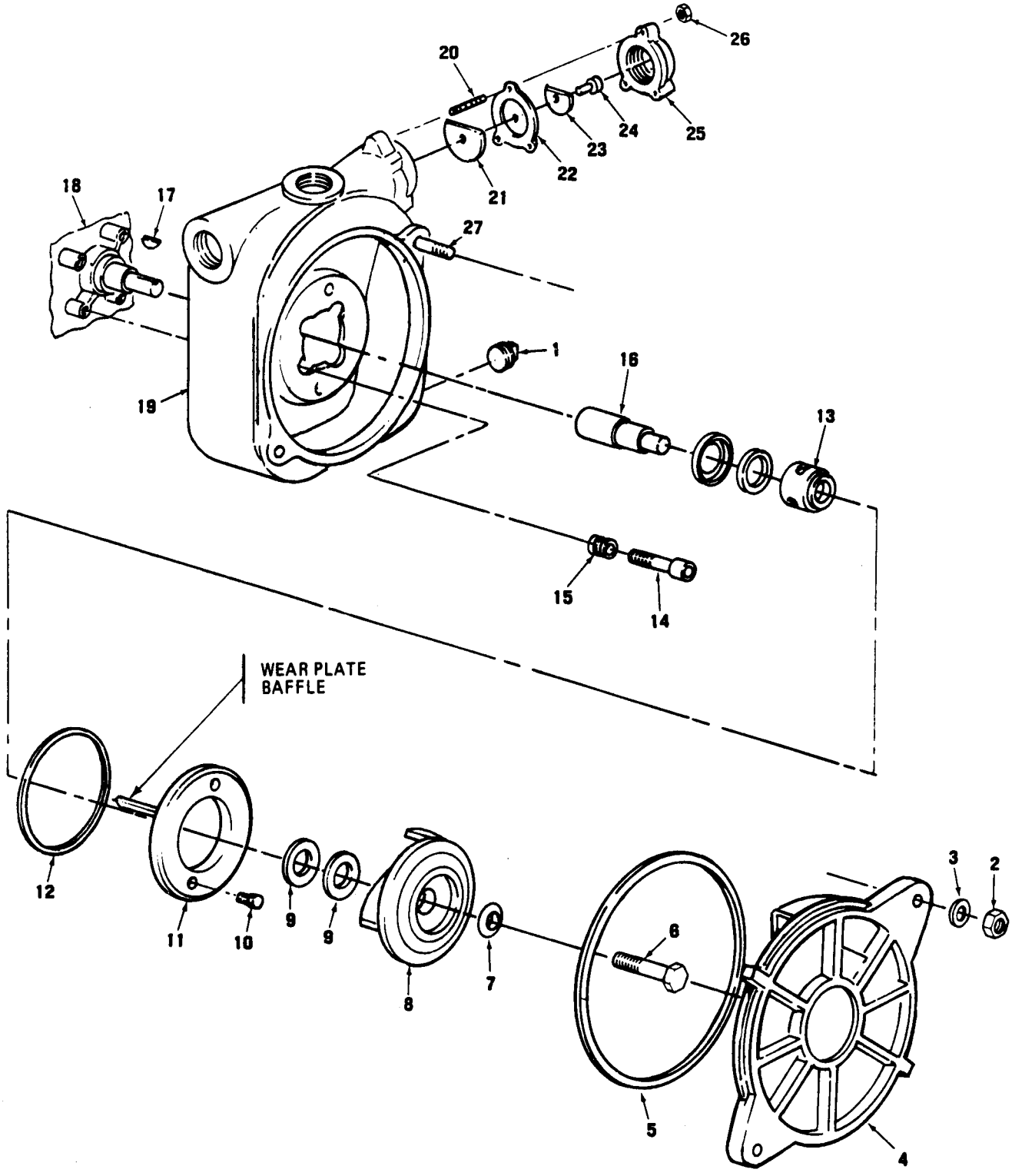


Figure 6-2.1. Centrifugal Pump and Check Valve.

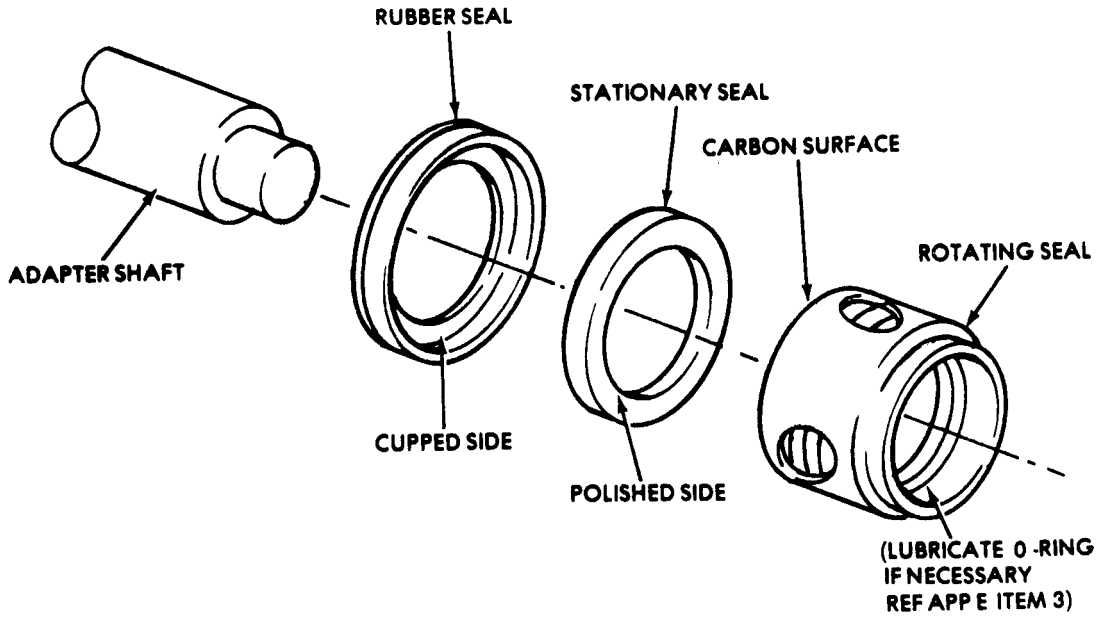


Figure 6-2.2. Adapter Shaft Seal Assembly.

(5) Using lubricating oil, lubricate and install O-Ring packing (12, figure 6-2.1) onto wear plate (11).

(6) Install wear plate (11) and screws (10). (Inspect for bent or defective baffle on back side of wear plate).

(7) Install shims (9) as required to maintain impeller-to-wear plate clearance at 0.010 to 0.015 inch (0.025 to 0.038 CM).

(8) Install impeller (8), new retaining packing (7) and center screw (6).

(9) Lubricate and install O-Ring (5), volute (4) and fasten with washer (3) and nut (2).

(10) Connect inlet elbow, discharge elbow, and priming port.

(11) Install pump drain plug (1).

e. Installation. Install Electric Motor Drive Pumping Assembly (paragraph 4-29.1).

Page 6-16, paragraph 6-15.1 is deleted.

Page A-1 is superseded as follows:

APPENDIX A
REFERENCES

A-1. FIRE PROTECTION AND SAFETY

TB5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
TB MED 251	Noise and Conservation of Hearing
TB ORD 1047	Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks

A-2. LUBRICATION

LO 10-4930-204-12	Lubrication Order

A-3. PAINTING

TM 43-0139	Painting Instructions for Army Materiel

A-4. MAINTENANCE

DA PAM 738-750	The Army Maintenance Management System
TB ORD 1047	Eliminating Combustibles From Interiors of Metal or Plastic Gasoline or Diesel Fuel Tanks
TM9-237	Operator Manual—Welding Theory and Application
FM 10-69	Petroleum Handling Equipment Operations
FM 10-70	Inspecting and Testing Petroleum Products
TM10-1113	Petroleum Tank—Vehicle Operations
TM10-4930-204-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools Lists: Tank and Pump Unit, Liquid Dispensing, For Truck Mounting (United Manufacturing and Engineering Corp. Model Style 1) NSN 4930-00-542-2800, (Model 2519) NSN 4930-00-987-8576, (Model 2938) NSN 4930-00-078-4939, (Bowser Inc. Model 36W50) NSN 4930-00-078-4938 (Orr and Sembower Inc. Model BL-100) NSN 4930-00-926-3692 (Altech Inc. Model 4000) NSN 4930-00-926-3581

A-5. RADIO INTERFERENCE SUPPRESSION

TM11-483	Radio Interference Suppression

A-6. DEMOLITION

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use

Page B-2. Section II, Appendix B, The Maintenance Allocation Chart, is superseded as follows:

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Assembly group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
	Hoses, Inlet and Outlet	0							0	0				
		0.2							0.2	0.2				
	Hoses, Filter to Pump & Manifold	0							0	0				A-1
		0.2							0.2	0.2				
0101A	Engine & Pump	0							0	F				B-H
		0.5							1.2	16.0				
	Engine	0	F	0	0				F	F	H			E-H
		1.0	0.5	1.0	1.0				1.2	16.2	24.0			
	Muffler Exhaust	0							0					
		0.3							0.4					
	Fuel Tank and Strainer	0		C					0	F				F-C
		0.2		0.1					0.5	8.0				
	Carburetor, Manifold	0		0					0					
		0.3		0.3					0.6					
	Air Cleaner			C										
				0.1										
	Magneto	0			0				0	0				G-H
		0.5			0.5				0.5	0.5				
	Pulley, Starting Rope	0							0					
		0.2							0.2					
	Switch	0							0					G-H
		0.6							0.6					
	Shroud, Air	0		C					0					H-H
		0.6		0.1					0.6					
	Flywheel, Engine	F							F					I-H
		1.4							1.4					
	Spark Plug	0							0					
		0.3							0.3					
	Cylinder Head	F							F					J-H
		0.3							0.3					
	Cover, Valve Inspection	0							F					
		0.1							2.8					
	Valves, Engine	0							F	F				K-I
		3.4							3.4	3.6				
	Engine Base & Oil Pump	F							F					
		0.5							0.5					
	Pistons & Connecting Rods	F							F	F				L-H
		4.0							4.0	4.0				
	Plate Front, Crankshaft bearing	F							F					M-H
		1.0							1.0					
	Retainer, Rear Crankshaft bearing	F							F					N-H
		1.0							1.0					
	Crankshaft, Engine	F							F					O-H
		2.5							2.5					
	Camshaft & Governor	F							F					P-A
		3.5							3.5					
	Block, Engine	F							F					Q-A
		8.6							8.6					Q-H
0101B	Pump Motor Assembly	0	0						0	F				
	(EMD)	0.5	1.5						1.0	1.5				
	Electric Motor		F						F					
			1.0						1.5					

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Assembly group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
	Power Cable	C	0	...	...	...	...	...	C	0	...	...	.....	.....
		0.1	0.5	...	...	...	...	...	0.1	0.5	...	...	.....	.....
	ON-OFF Switch Cable Assembly	C	0	...	...	...	...	...	C	0	...	...	.....	.....
		0.1	0.5	...	...	...	...	...	0.1	0.5	...	...	.....	.....
	Junction Box Assembly	...	0	...	...	...	...	...	0	0	...	...	.....	.....
		...	1.0	...	...	...	...	...	1.0	1.0	...	...	.....	.....
10101A	Pump, Centrifugal	0	...	...	...	...	...	...	F	F	...	...	.....	C-H
	(GED)	0.5	...	...	...	...	...	...	0.5	8.0	...	...	.....	.....
	Elbows and tee inlet & outlet	0	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.2	...	...	...	...	...	...	0.4	...	...	...	.....	.....
	Impeller	F	...	...	...	...	...	...	F	...	...	...	.....	D-H
		1.0	...	...	...	...	...	...	1.0	...	...	...	.....	.....
	Seal Assembly	F	...	...	...	...	...	...	F	...	...	...	.....	D-H
		0.8	...	...	...	...	...	...	0.8	...	...	...	.....	.....
	Coupling, Intermediate	F	...	...	...	...	...	...	F	...	...	...	.....	D-H
		0.6	...	...	...	...	...	...	0.6	...	...	...	.....	.....
010101B	Pump, Centrifugal	0	...	...	...	...	...	...	F	F	...	...	.....	.....
	(EMD)	0.2	...	...	...	...	...	...	2.0	4.0	...	...	.....	.....
	Impeller	F	...	...	...	...	...	...	F	...	...	...	.....	.....
		0.5	...	...	...	...	...	...	1.0	...	...	...	.....	.....
	Seal Assembly	F	...	...	...	...	...	...	F	...	...	...	.....	.....
		1.0	...	...	...	...	...	...	1.5	...	...	...	.....	.....
0102	Filter Separator	C	...	C	...	...	...	...	0	F	...	...	.....	R-C
		1.0	...	1.6	...	...	...	...	1.0	8.0	...	...	.....	.....
	Element, Filter	C	...	...	...	...	...	...	C	...	...	...	.....	F-I
		0.6	...	...	...	...	...	...	0.6	...	...	...	.....	.....
	Cover, Tank	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.3	...	...	...	...	...	...	0.3	...	...	...	.....	.....
	Coupling, Cover	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.3	...	...	...	...	...	...	0.3	...	...	...	.....	.....
	Gasket, Cover	C	...	...	...	...	...	...	C	...	...	...	.....	.....
		0.3	...	...	...	...	...	...	0.3	...	...	...	.....	.....
	Canisters	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.5	...	...	...	...	...	...	0.5	...	...	...	.....	.....
	Retainer	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.5	...	...	...	...	...	...	0.5	...	...	...	.....	.....
	Drain Cock	C	...	C	...	...	...	...	0	...	...	...	.....	.....
		0.2	...	0.1	...	...	...	...	0.2	...	...	...	.....	.....
	Window Sight, Water Level	C	...	...	...	...	...	...	0	0	...	...	.....	S-I
		0.3	...	...	...	...	...	...	0.5	0.2	...	...	.....	.....
	Indicator, Differential pressure	0	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.3	...	...	...	...	...	...	0.5	...	...	...	.....	.....
	Coupling, Quick Disconnect	C	...	...	...	...	...	...	0	0	...	...	.....	A-I
		0.2	...	...	...	...	...	...	0.3	0.3	...	...	.....	.....
0103	Manifold, Liquid Distributor	0	...	...	...	...	...	...	0	0	...	...	.....	A-I
		0.2	...	...	...	...	...	...	0.5	0.3	...	...	.....	.....
0104	Reel Assembly, Ground	0	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.2	...	...	...	...	...	...	0.3	...	...	...	.....	.....

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Assembly group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
0105	Nozzle Assembly Fuel Dispensing	0	...	...	...	...	...	...	0	0	...	...	.....	T-I
		0.1	...	...	...	...	...	...	0.2	0.5	...	...	.....	.....
0106	Reel Assembly Fuel Dispensing Hose Left & Right (ea)	0	...	...	...	...	...	...	0	F	...	...	.....	.....
		1.5	...	...	...	...	...	...	1.0	2.0	...	...	.....	.....
	Spring Hose Reel (ea)	0	...	...	...	...	...	...	F	...	...	...	.....	.....
		0.3	...	...	...	...	...	...	0.5	...	...	...	.....	.....
	Wheel, Ratchet (ea)	0	...	...	...	...	...	...	F	...	...	...	.....	.....
		0.4	...	...	...	...	...	...	0.4	...	...	...	.....	.....
0107	Frame, Tank & Pump Unit	0	...	...	...	...	...	...	F	F	...	...	.....	U-H
		4.0	...	...	...	...	...	...	9.0	16.0	...	...	.....	U-I
	02 GROUP, TANKS, LIQUID STORAGE BULK FUEL													
	Tanks Liquid Storage	C	...	...	...	...	...	...	0	0	...	...	.....	F-I
		1.0	...	...	...	...	...	...	2.0	16.0	...	...	.....	.....
	Cover, Manhole	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.5	...	...	...	...	...	...	1.0	...	...	...	.....	.....
	Dump Valve	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.2	...	...	...	...	...	...	0.2	...	...	...	.....	.....
	Valve Drain	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.2	...	...	...	...	...	...	0.2	...	...	...	.....	.....
	Hose, Interconnecting	C	...	...	...	...	...	...	0	0	...	...	.....	A-I
		0.1	...	...	...	...	...	...	0.2	0.2	...	...	.....	.....
0301	03 GROUP, ACCESSORY ITEMS													
	Fire Extinguishers	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.1	...	...	...	...	...	...	0.2	...	...	...	.....	.....
0302	Kit, Tie-Down Tank Liquid Storage	C	...	...	...	...	...	...	0	...	...	...	.....	.....
		0.1	...	...	...	...	...	...	0.5	...	...	...	.....	.....
0303	Kit, Rough Terrain Tie-Down	C	...	...	...	...	...	...	0	F	...	...	.....	V-I
		0.1	...	...	...	...	...	...	0.5	1.0	...	...	.....	.....

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists components of end item and basic issue items for the tank and pump unit to help inventory items for safe and efficient operation.

C-2. GENERAL

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

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the pumping assembly in operation, to operate it, and to perform emergency repairs. Although shipped separately, packaged BII must be with the pumping assembly during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTDE authorization of the end item.

C-3. EXPLANATION OF COLUMNS

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

a. Column (1)—Illustration Number. (Illus Number) This column indicates the number of the illustration in which the item is shown.

b. Column (2)—National Stock Number. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3)—Description. Indicates the National item name and , if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4)—Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr).

e. Column (5)—Quantity required (Qty rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

APPENDIX C
SECTION II. COMPONENTS OF END ITEMS

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
C-1/1	6150-01-022-6004	Cable Assembly, Power (Electric Motor Driven) (19207) 11682336-1	EA	1
C-1/2	6150-01-191-9732	Cable Assembly, Remote Switch (Electric Motor Driven) (97403) 13217E2964	EA	1

SECTION III. BASIC ISSUE ITEMS

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(4) U/M	(5) QTY RQR
C-1/1	4930-01-159-4437	Adapter Assembly, Water Detector (97403) 13220E9406-3	EA	1
C-1/4	4930-01-169-5287	Adapter Probe, Water Detector Kit (97403) 13220E9914-3	EA	1

By Order of the Secretary of the Army:

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

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and General Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted (2000)

CHANGE NO. 5

HEADQUARTERS
DEPARTMENTS OF THE ARMY
WASHINGTON, D.C., 14 April 1988

Operator, Organizational, Direct Support and
General Support Maintenance Manual

**TANK AND PUMP UNIT, LIQUID
DISPENSING; FOR TRUCK MOUNTING
(ADVANCED INDUSTRIES MODEL 1800)
NSN 4930-00-070-1181**

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Page 1-1, Paragraph 1-2, change "TM 38-750" to "DA PAM 738-750."

Page 1-1, Paragraph 1-3, is superseded as follows:

1-3. Reporting of Errors. You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

Page 1-1, Paragraph 1-6, is superseded as follows:

1-6. Administrative Storage.

a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.

b. Before placing equipment in administrative storage, current maintenance services and equipment serviceable criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWO's) should be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.

Page 1-2, Figures 1-1, 1-2 (Sheets 1 and 2 of 2), 1-3, (Sheets 1 and 2 of 2) and 1-4 are superseded as follows:

Page 2-2, Figures 2-1 and 2-1.1 (Sheets 1 and 2 of 2) are superseded as follows:

Page 2-4, Figure 2-2.1 is superseded as follows.

Page 2-5, Figue 2-3, is superseded as follows.

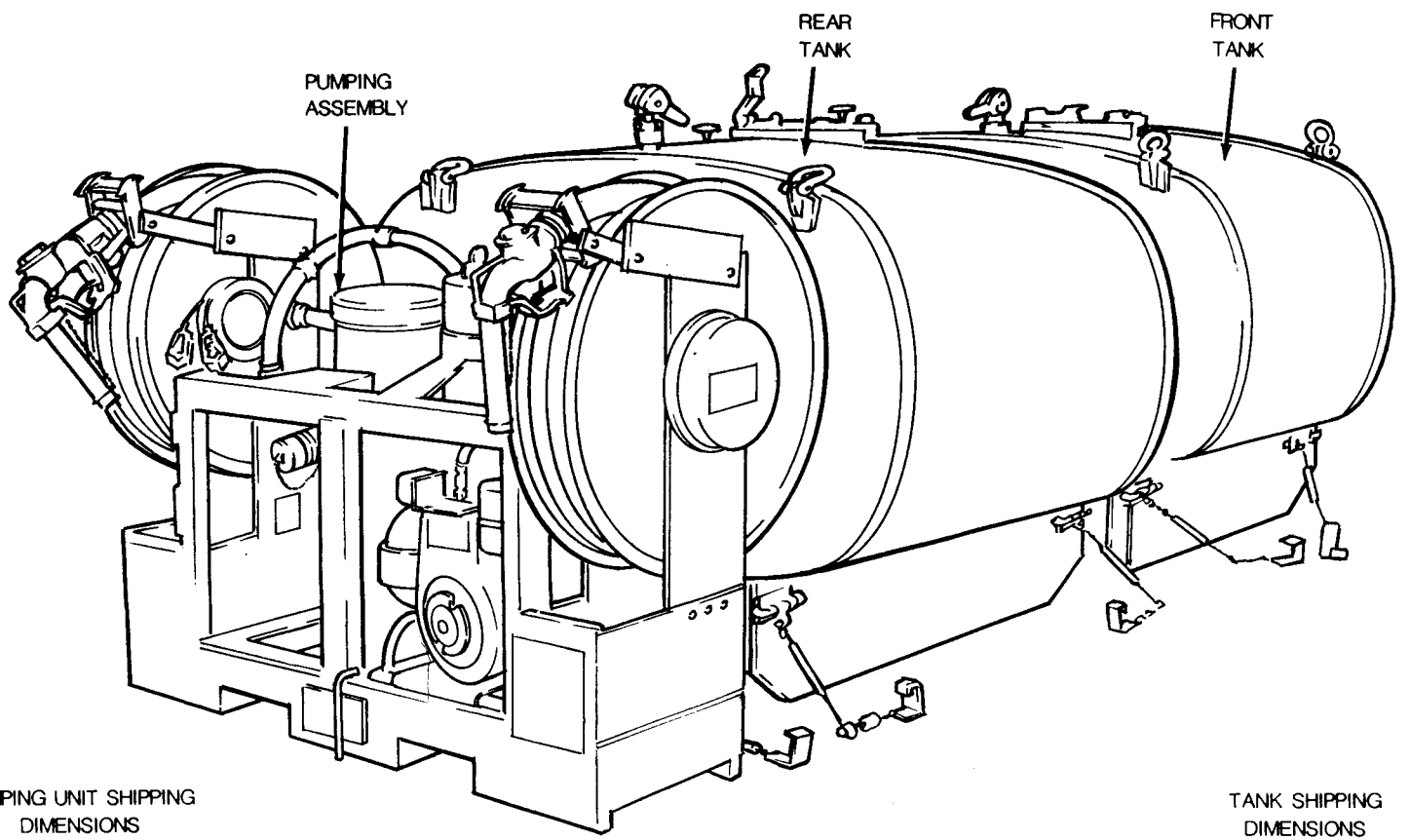
Page 4-14, Paragraph 4-12, delete second sentence.

Page 4-15, Figures 4-5.1, 4-5.2, 4-5.3, 4-5.4, 4-5.5 and 4-5.6 are superseded as follows.

Page A-1, Appendix A is superseded as follows:

APPENDIX A
REFERENCES

A-1.	Fire Protection TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
A-2.	Lubrication FSG 9100	Identification List for Fuels, Lubricants, Oils and Waxes
	LO 5-4930-228-12	Lubrication Order
A-3.	Maintenance TB ORD 1047	Elimination of Combustibles in Fuel Tanks
	FM 10-20	Military Petroleum Pipelines, Tanks and Related Equipment
	FM 10-69	Petroleum Supply Point Equipment and Operations
	FM 10-71	Petroleum Tank-Vehicle Operations
	DA PAM 738-750	The Army Maintenance Management System
A-4.	Shipment and Storage TB 740-97-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
A-5.	Destruction to Prevent Enemy Use TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use



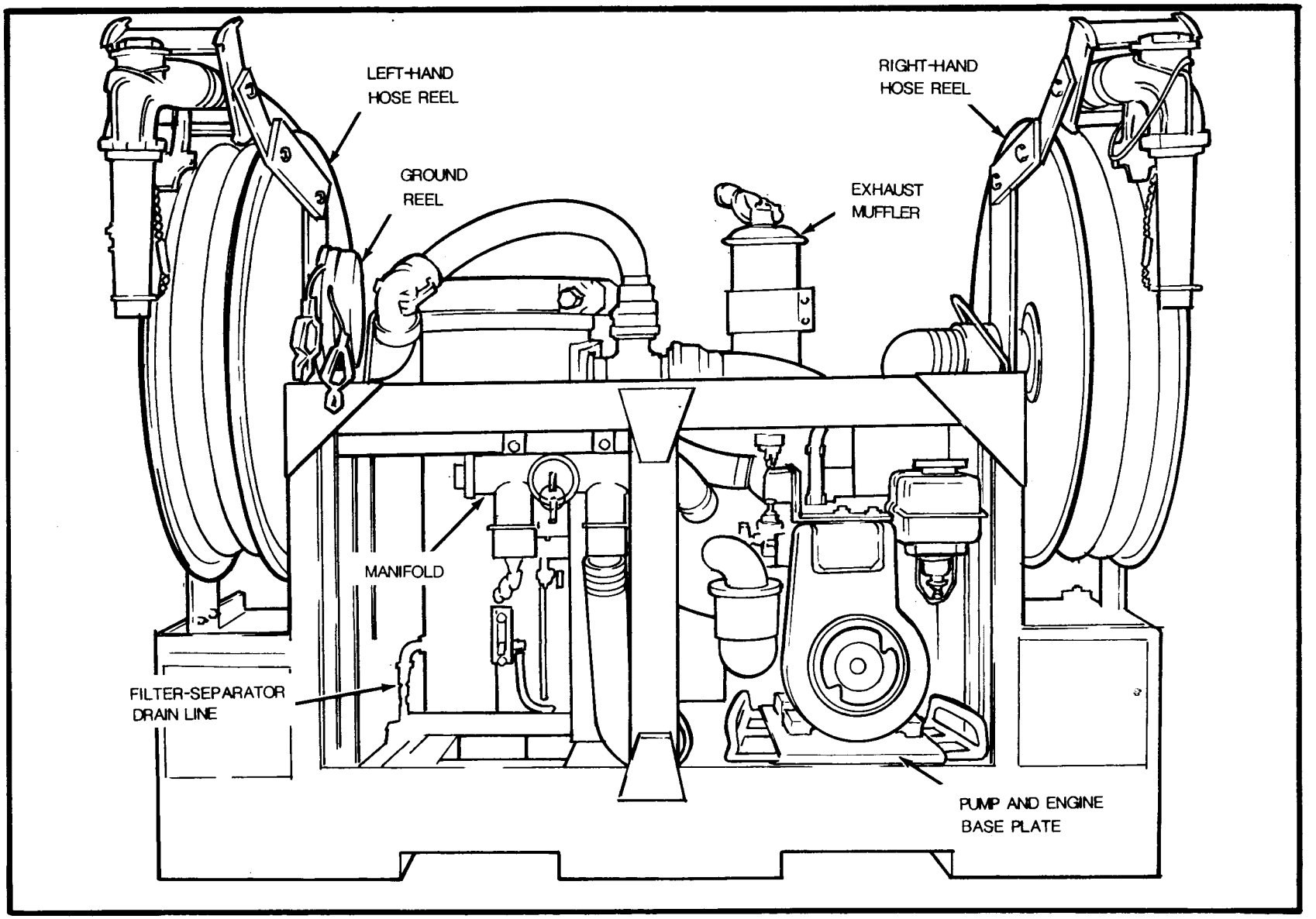
PUMPING UNIT SHIPPING DIMENSIONS

LENGTH	64 INCHES
WIDTH	28 INCHES
HEIGHT	49 INCHES
WEIGHT	680 POUNDS

TANK SHIPPING DIMENSIONS

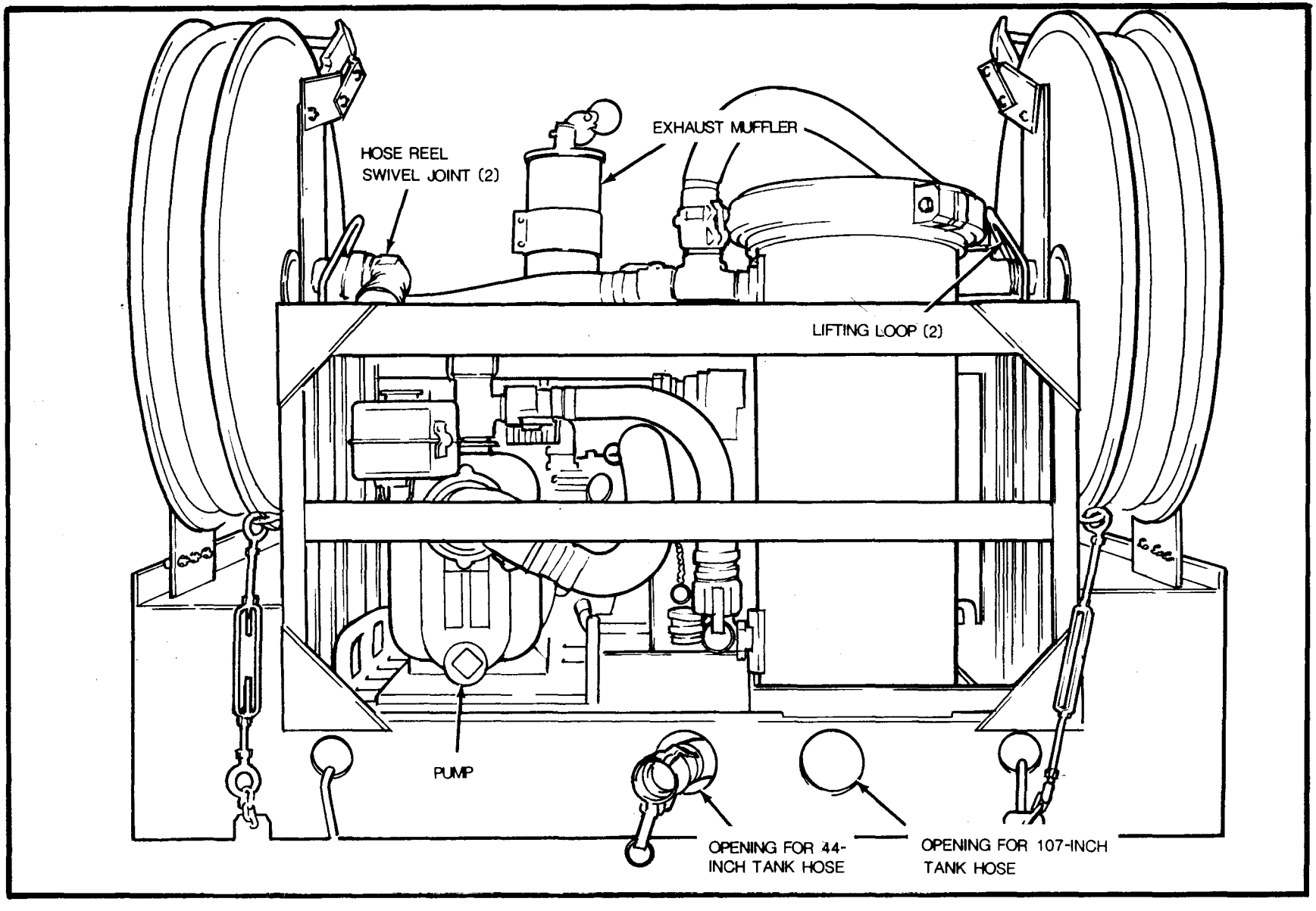
LENGTH	56 INCHES
WIDTH	72 INCHES
HEIGHT	56 INCHES
WEIGHT	390 POUNDS

Figure 1-1. Tank and pump unit, with shipping dimensions.



FRONT VIEW

Figure 1-2. Pumping assembly front and rear view. (sheet 1 of 2).



REAR VIEW

Figure 1-2. Pumping assembly, front and rear view (sheet 2 of 2).

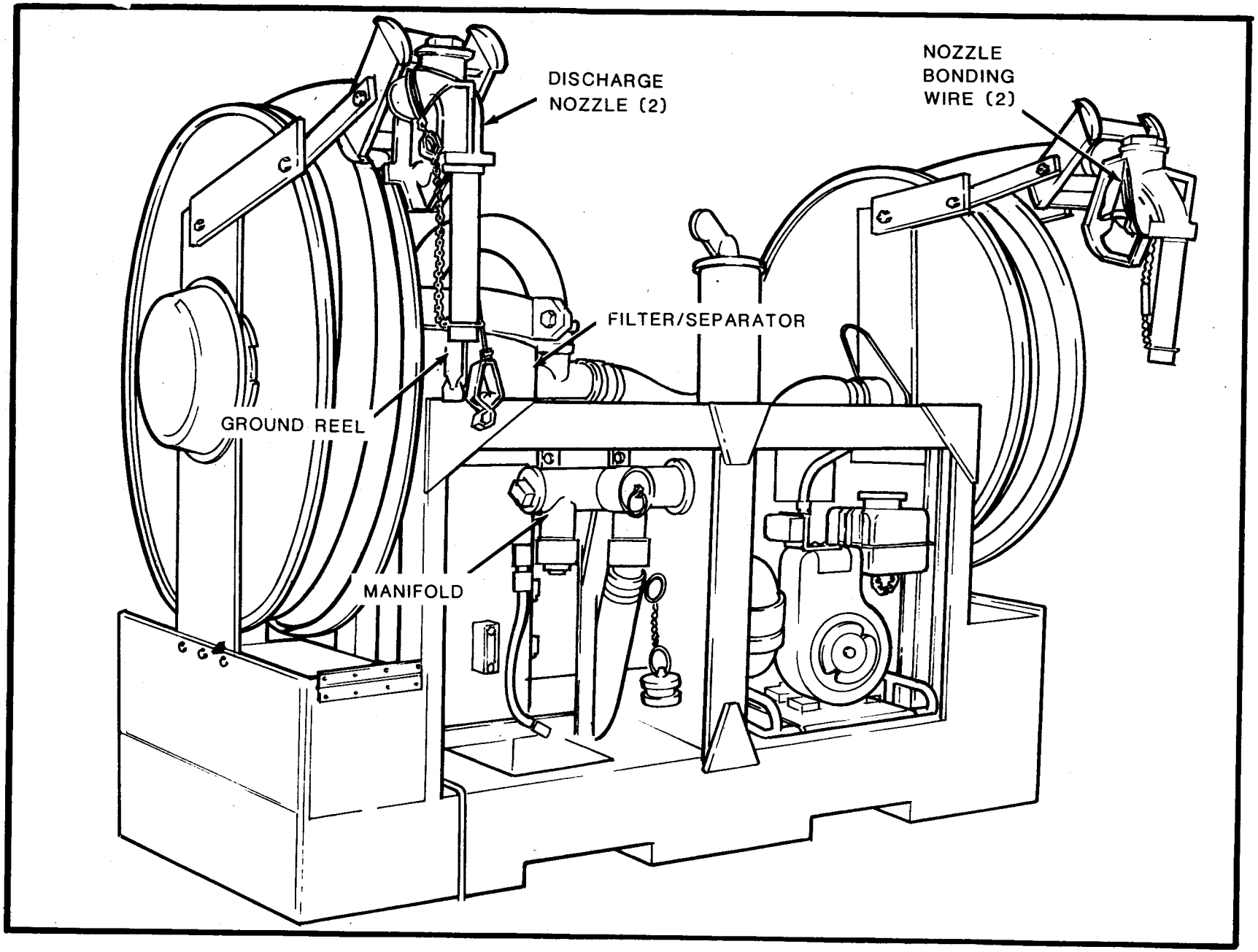


Figure 1-3. Pumping assembly, front and rear, three-quarter view. (sheet 1 of 2).

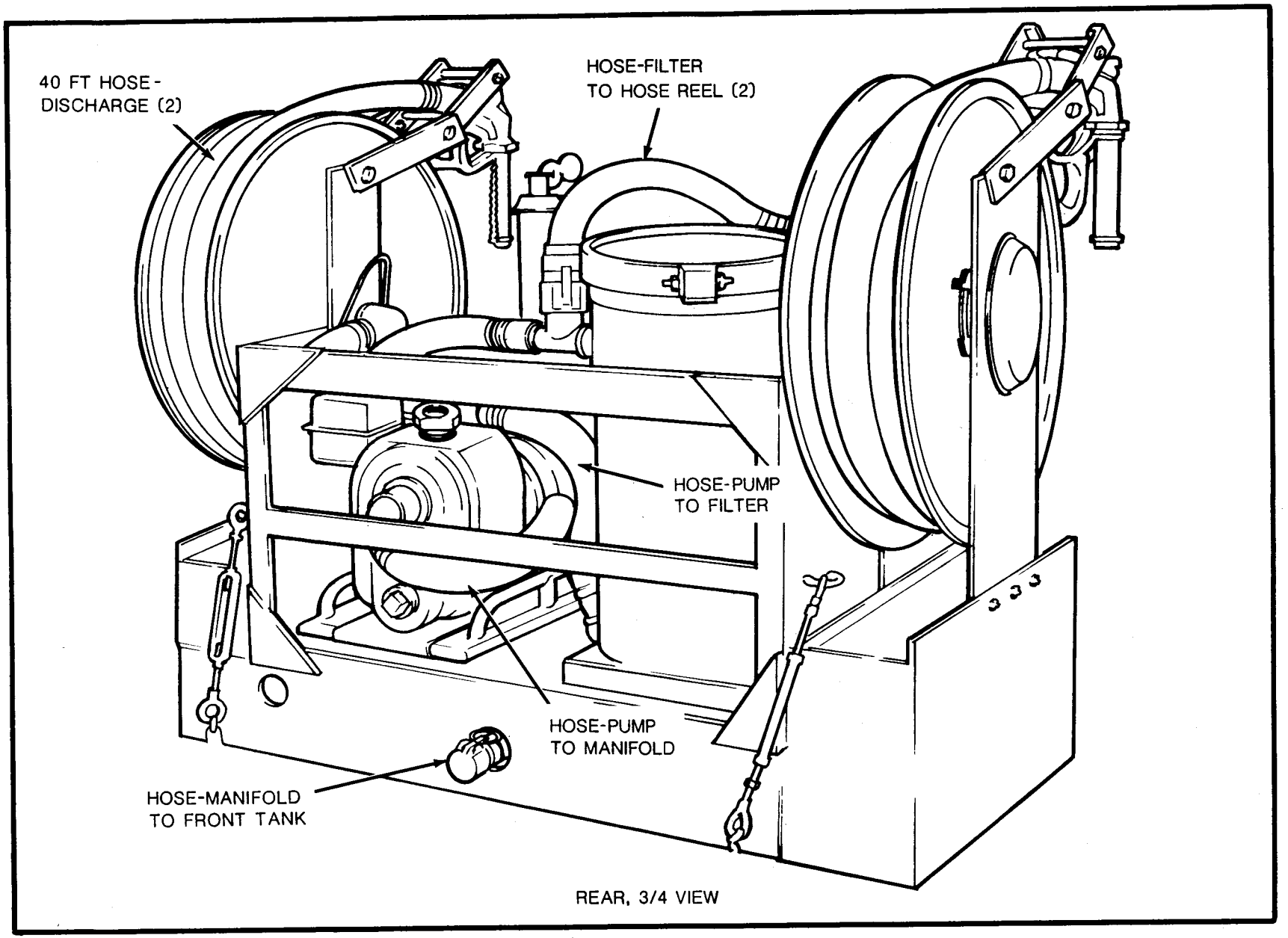


Figure 1-3. Pumping assemply, front and rear, three-quarter view. (sheet 2 of 2).

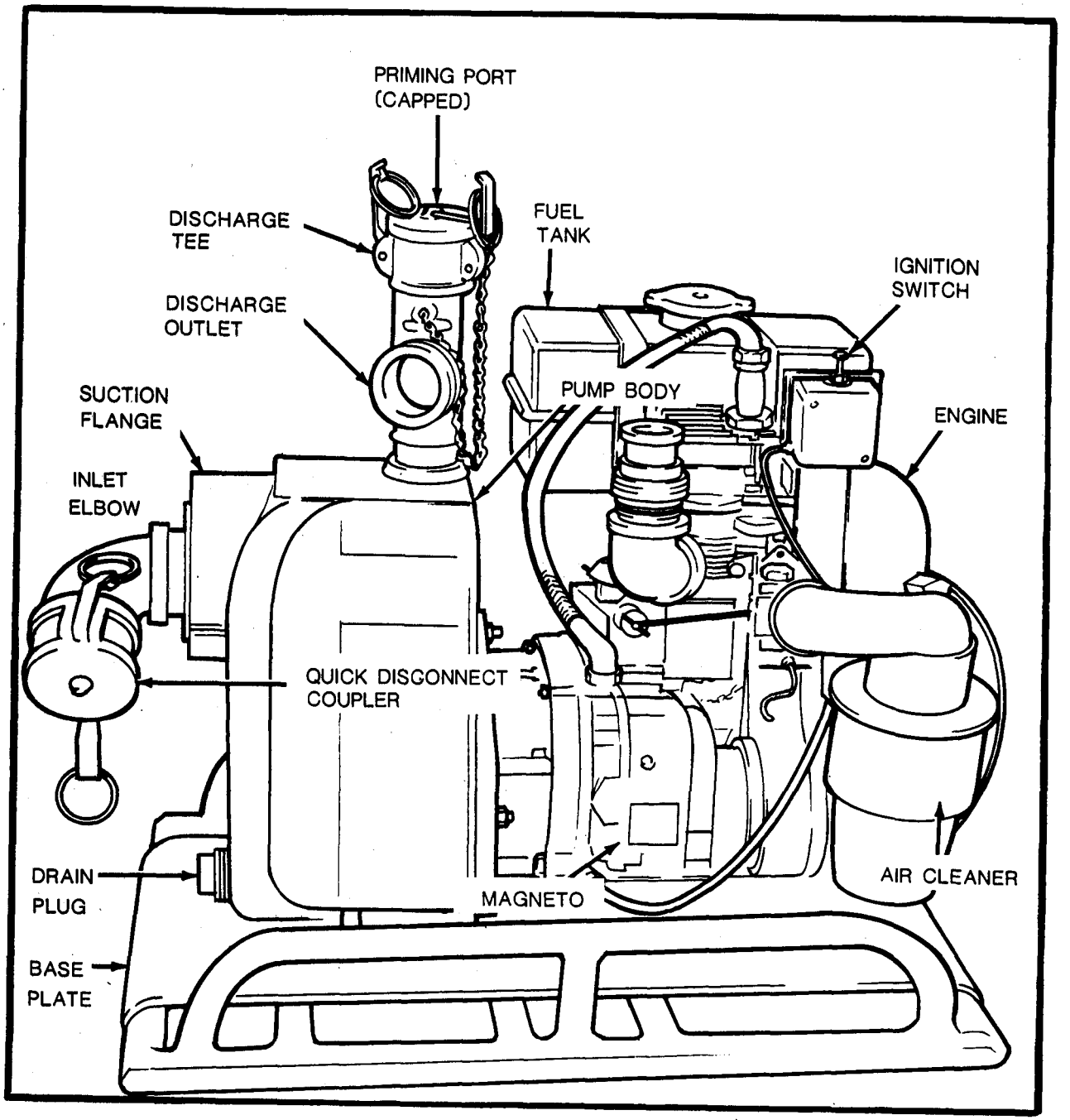


Figure 1-4. pump and engine assembly, three quarter view.

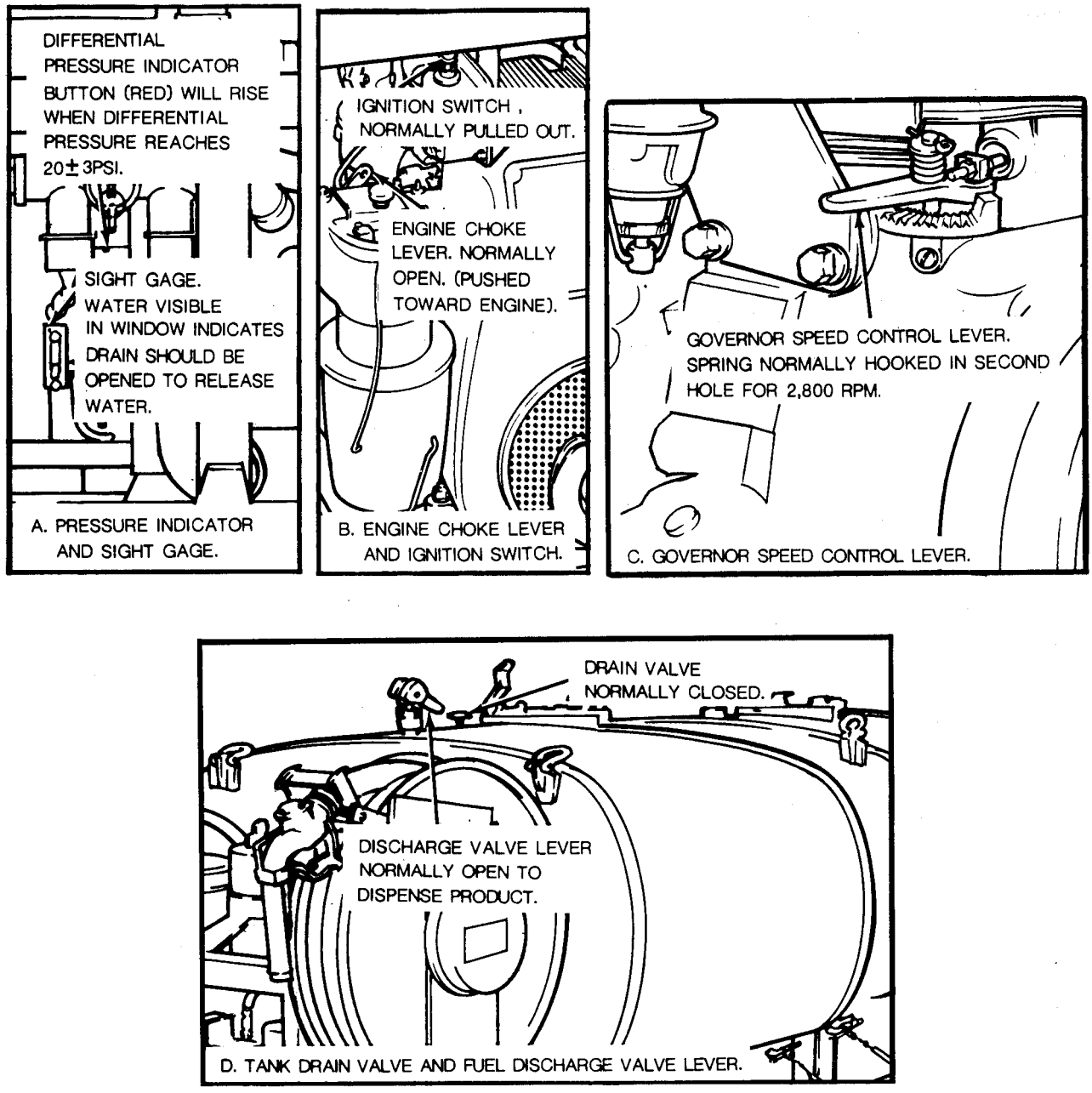


Figure 2-1. Controls and instruments.

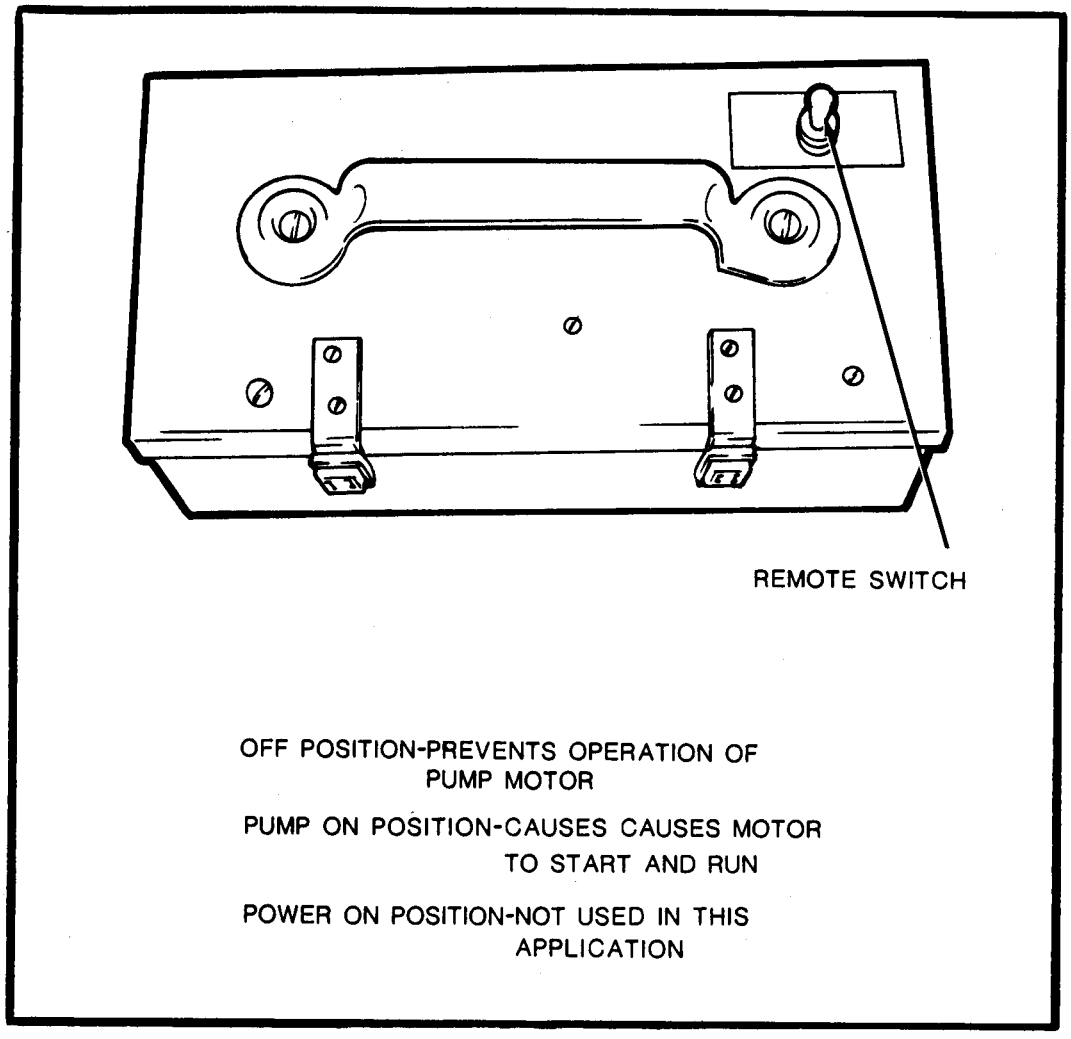


Figure 2-1.1. Controls and instruments (sheet 1 of 2).

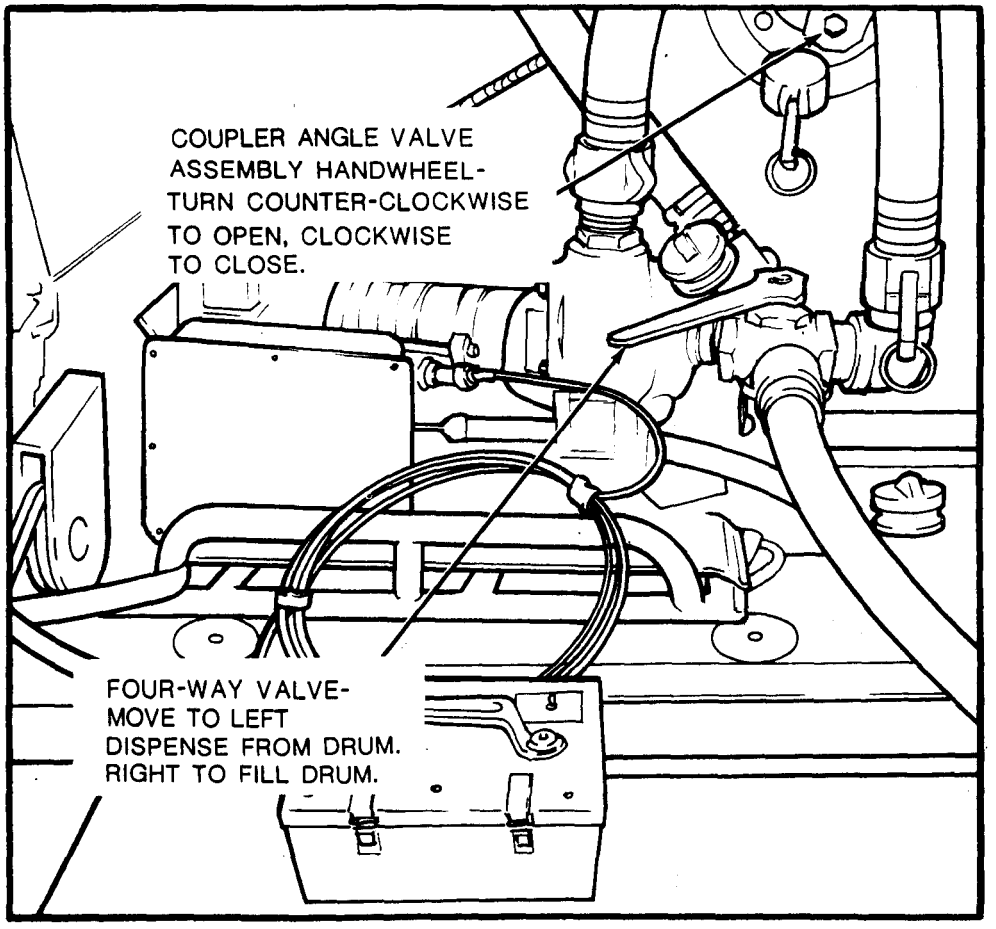


Figure 2-1.1. Controls and instruments (sheet 2 of 2).

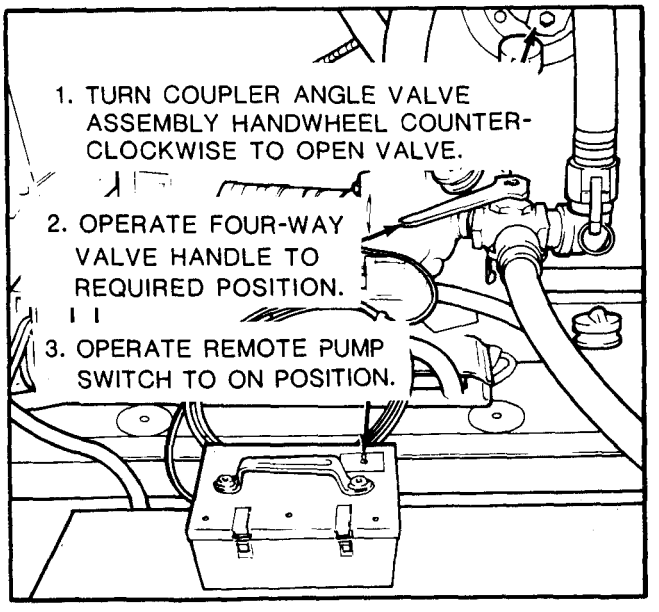
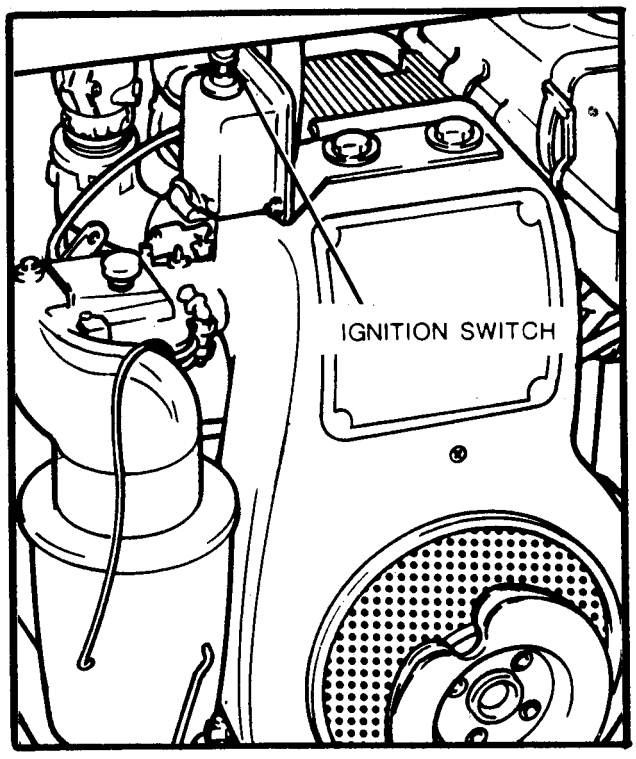


Figure 2-2.1. Starting instruction.



STOPPING:

STEP 1. CLOSE DISCHARGE VALVES ON THE TANKS AND ALLOW ENGINE TO IDLE AT 1,000-1,200 RPM FOR 3 TO 5 MINUTES

STEP 2. AFTER ENGINE HAS COOLED, PUSH IGNITION SWITCH IN TO STOP.

STEP 3. CLOSE FUEL SHUTOFF VALVE, (TURN CLOCKWISE).

Figure 2-3 Engine stopping instruction.

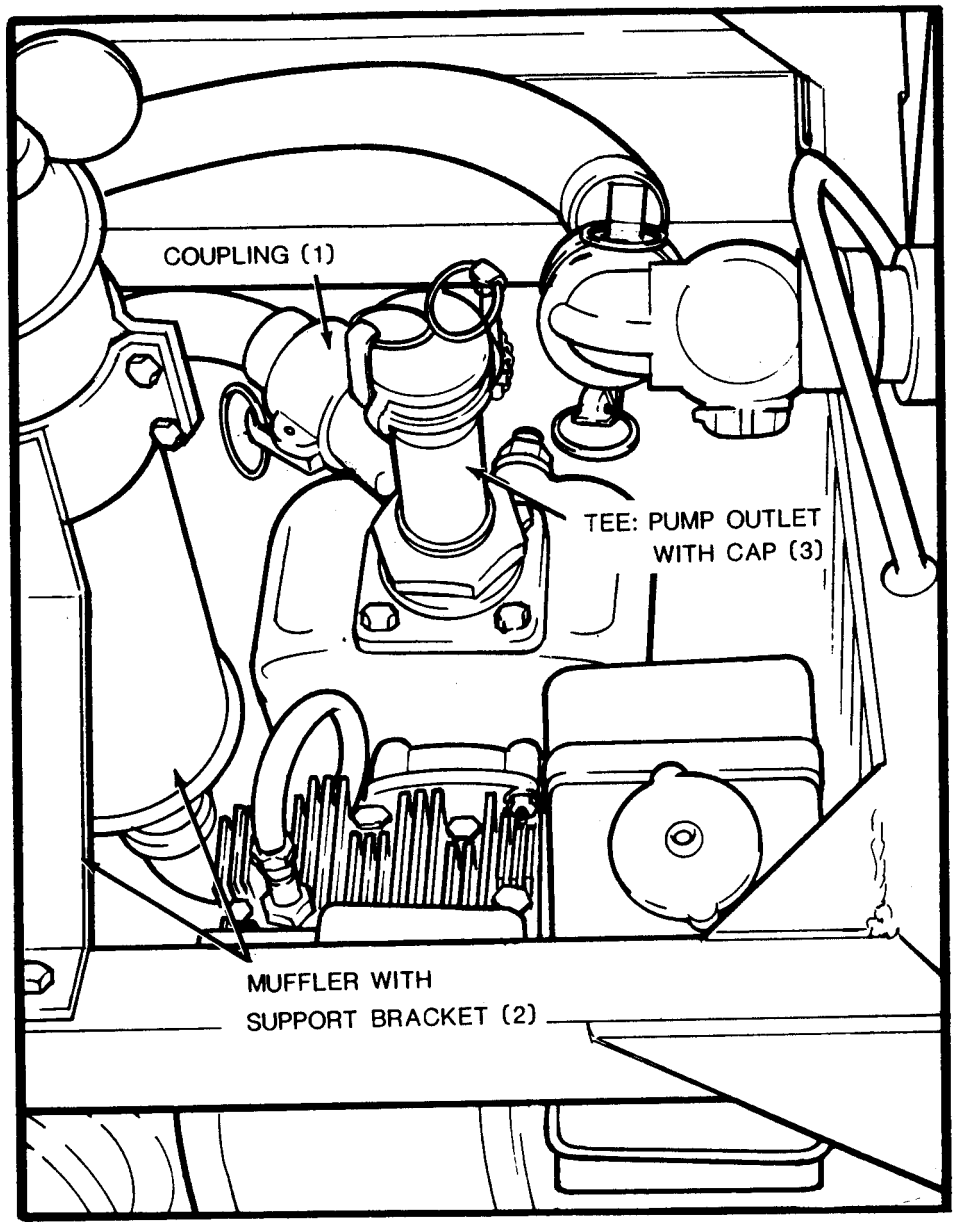


Figure 4-5.1. Pump and engine unit.

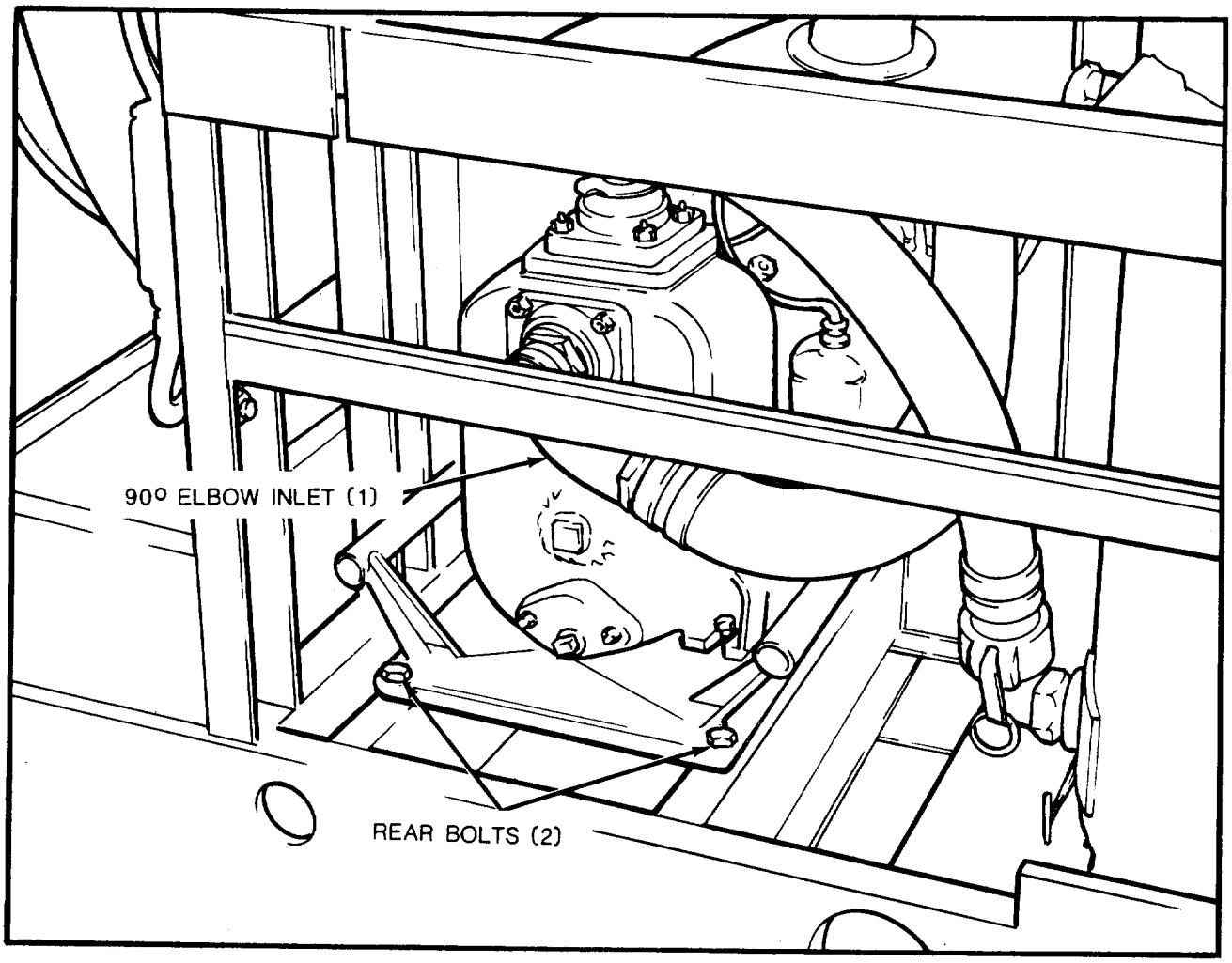


Figure 4-5.2. Pump and engine unit.

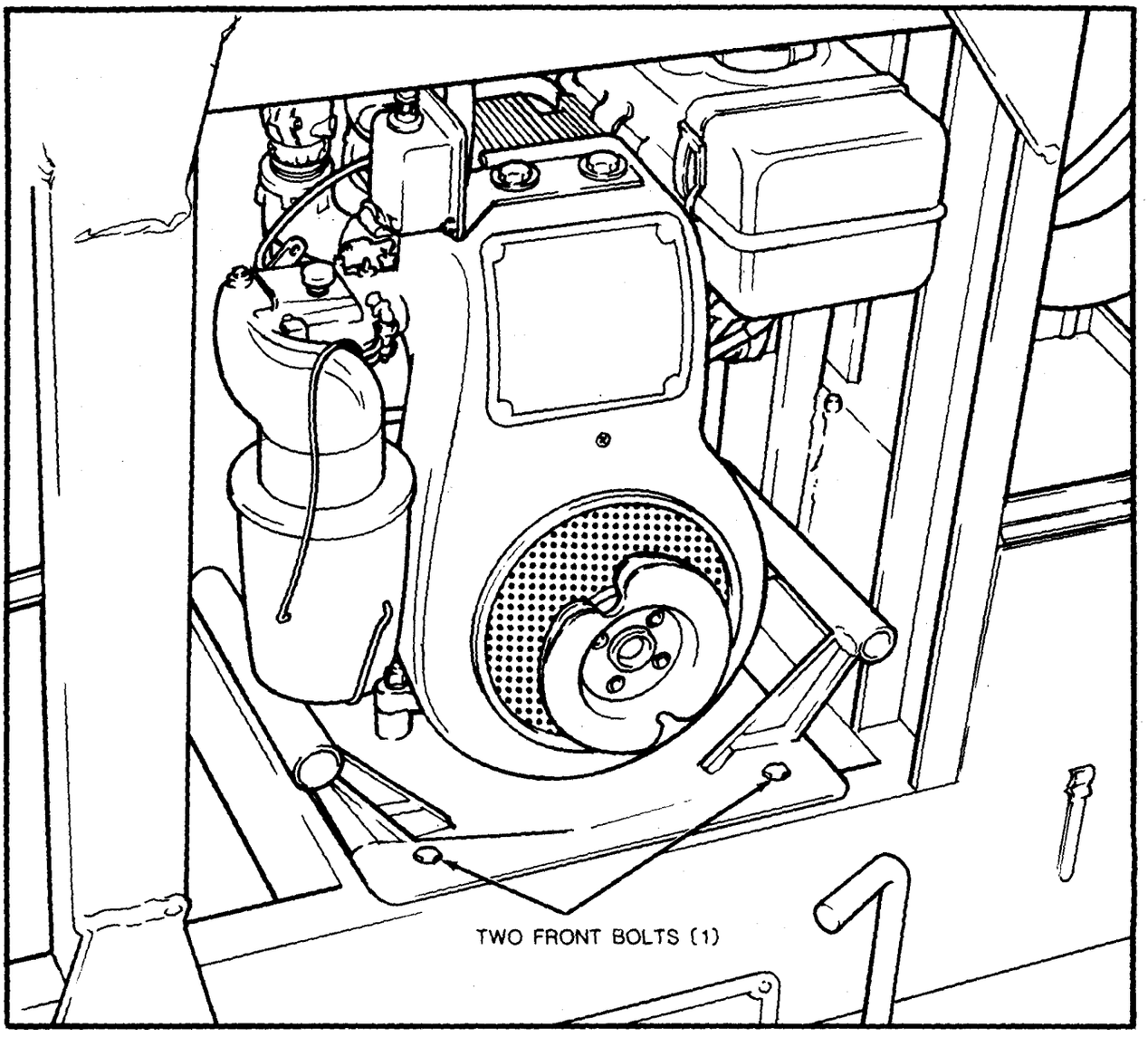


Figure 4-5.3. Pump and engine unit.

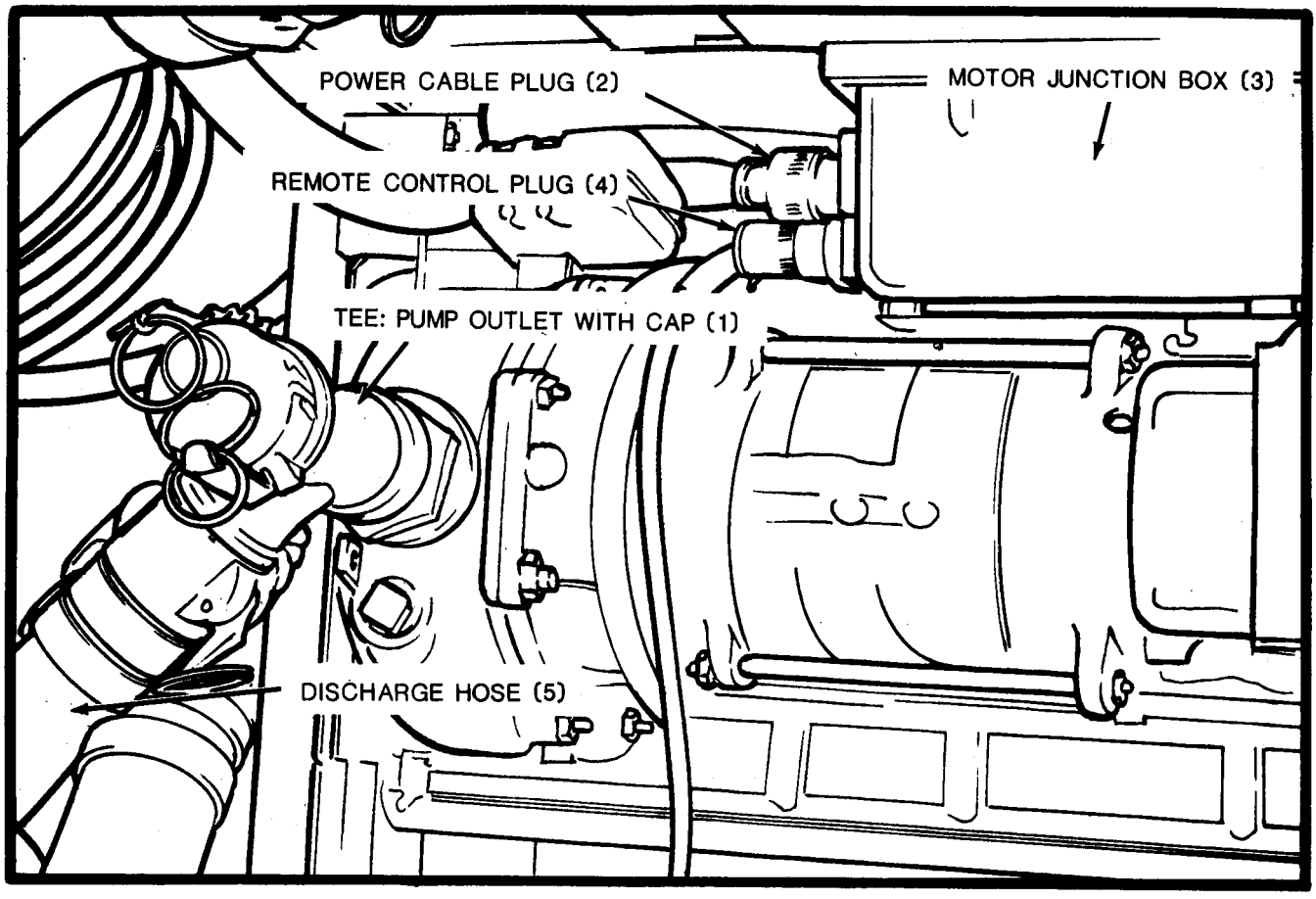


Figure 4-5.4. Pump and engine unit.

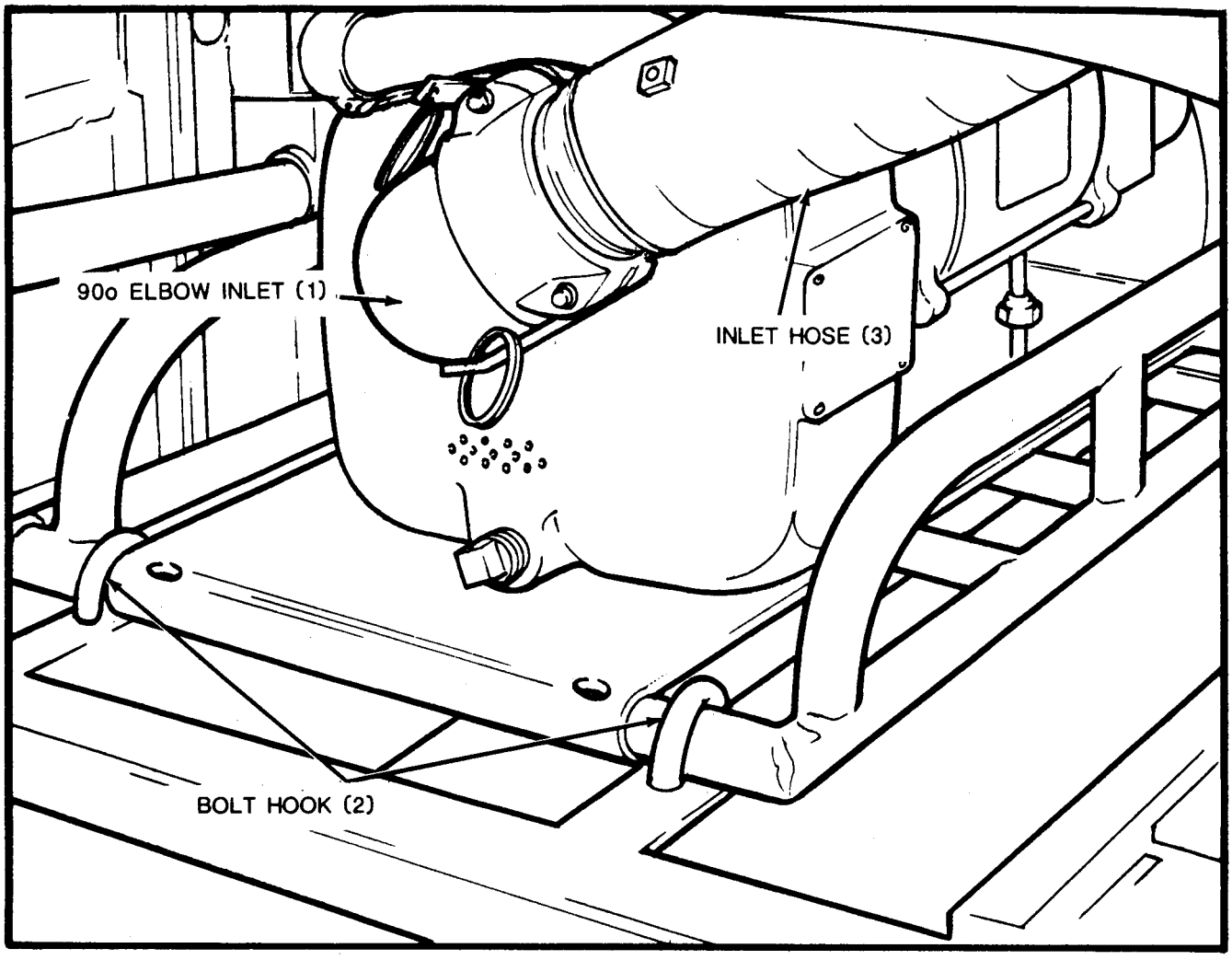


Figure 4-5.5. Pump and engine unit.

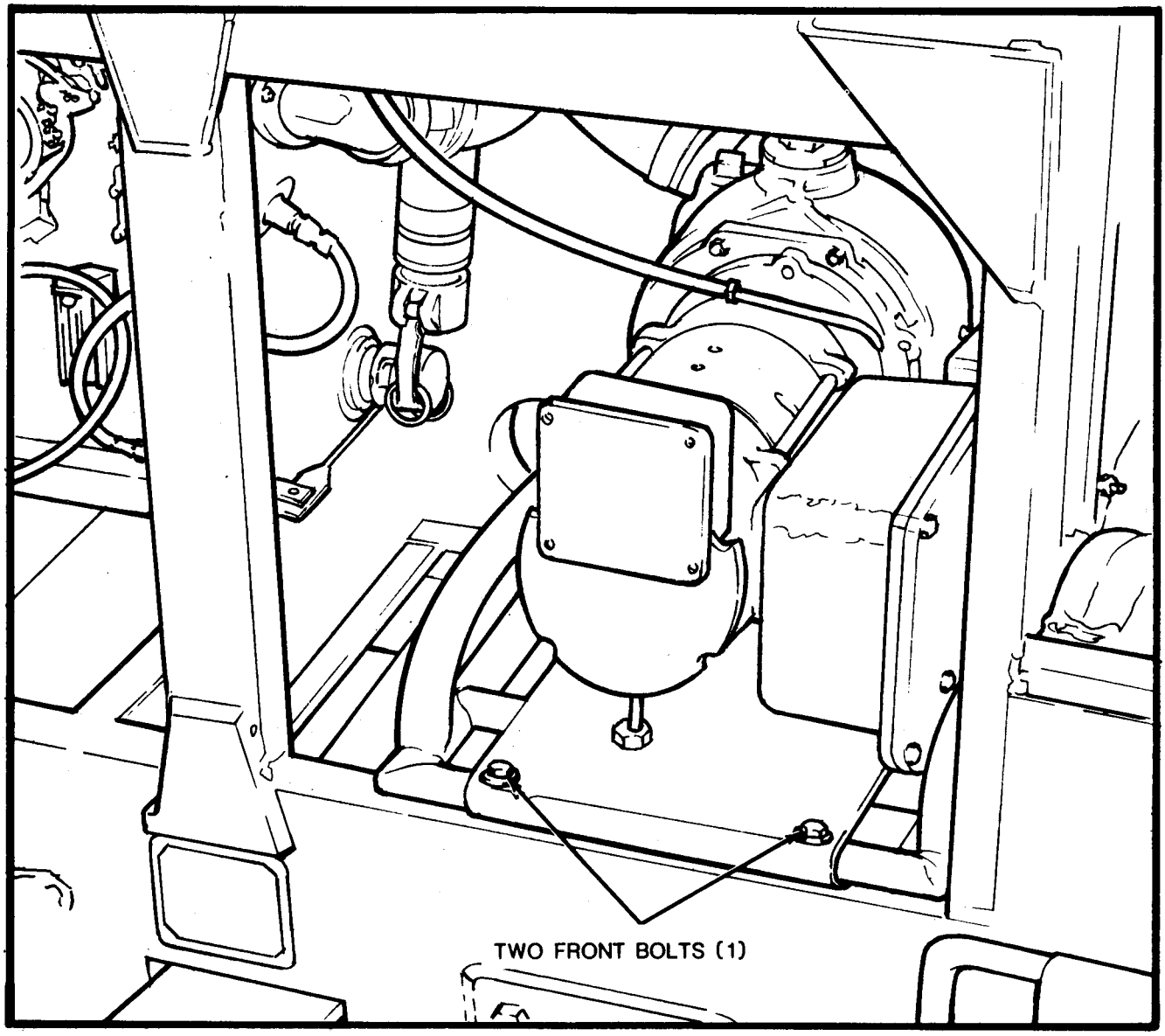


Figure 4-5.6. Pump and engine unit.

By Order of the Secretary of the Army:

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

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Unit, Direct Support and general Support Maintenance requirements for Tank and Pump Unit, Liquid Dispensing, Truck Mounted (2000)

URGENT

Changes in force: C1, C3 and C4

TM 5-4930-228-14
C4

CHANGE NO. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 22 May 1978

Operator, Organizational, Direct Support and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800) NSN 4930-00-070-1181

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Inside of Front Cover. Add to Warning Page:

WARNING

Prior to welding, read welding instructions contained in Chapter 6, Section V, on maintenance of the Tank Assembly. DEATH or SERIOUS INJURY may result if personnel fail to heed Safety Precaution for welding.

Page 6-18. Paragraph 6-19a is superseded as follows:

a. Tanks. No repair will be initiated until the tank has been thoroughly vented and cleaned. Before attempting any welding repair on the tank, drill four 1-1/2 inch diameter holes in each skid, (total of 8 holes required), for location of drilling points (See fig. 6-18). A combustible vapor test reading will be taken prior to purging the tank and skids, using an acceptable explosive meter such as MSA Vapor Tester, NSN 6665-00-664-4650 or equivalent. Purge the skids by steam cleaning or other suitable method. Vapor test again and repurge as required. After completion of repair, provide corrosion protection to drilled holes and leave holes open. Refer to d below for welding precautions.

Page 6-19. After paragraph 6-19c, add paragraph 6-19d as follows:

d. Welding Precautions.

(1) Completely drain all fuel from tank to be purged; be sure the drained fuel is removed from the area where work will be performed.

(a) Remove all fuel from floor; remove all fuel-soaked rags and waste from area.

(b) If electrical welding is to be performed, be sure you have adequate shielding to protect other workers from injury.

(c) This process is to be undertaken by field and depot maintenance units. Supporting agencies will furnish additional skills and equipment when required.

(2) Essentials:

(a) Efficient purging of fuel tanks, pipe lines, pump housings, hoses, and distribution manifolds may be accomplished by adherence to procedures outlined herein.

(b) Materials required:

1. Adequate source of water with a large diameter hose long enough to reach the vehicle or fuel tank.

2. Compressed air source and air hose of sufficient length to reach depth of fuel tank.

3. Sufficient quantity of gas tank purger obtainable through local procurement. Only known source available to date: Product-Sol, Inc., 2010 Cole, Birmingham, Mich.

(3) Safety precaution:

WARNING

Prior to and during all operations outlined in this bulletin, coordinate with safety, medical, and fire departments to comply with safeguards contained herein and other applicable directives.

(a) The tank being purged must have a static ground during all operations; caution should be taken with all tools and metal objects around tank to insure no contact of sufficient force is made to create a spark.

(b) Conduct a combustible vapor test reading prior to purging the tank, using an acceptable explosive meter, such as MSA explosive meter 6665-664-4650 or Davis Vapotester 6665-562-8103.

(c) Only competent personnel, thoroughly instructed in the proper handling and reading of the vapor-indicating instruments (explosion meter), will perform vapor tests.

(d) Conduct a combustible vapor test reading immediately after purging. Under no circumstances will repair of fuel tank being until declared safe by safety personnel.

(e) Discontinue all operations if an electrical storm is threatening or in progress.

(f) Eliminate all possible causes of explosion.

(g) Personnel engaged in purging operations will:

1. NOT wear wool, nylon, silk, rayon or other similar static electricity-generating clothing.

2. Wear clean cotton clothing with no metal buttons or fittings. Remove all contents from pockets.

3. Wear rubber boots.

4. Use cotton waste for cleaning purposes. Other material may generate static electricity.

(4) Preparation of equipment:

(a) Completely drain each fuel tank or fuel tank compartment, all piping, pumps, meters, filters, and segregators, as applicable.

(b) Remove all accessory items, such as gages and floats, which might entrap fuel.

(c) Close or seal all drains (it may be necessary to locally fabricate covers for some types of drains).

(d) Fill fuel tank and overflow for five minutes with cold water.

(e) Drain fuel tank completely.

(f) Close or seal drains.

CAUTION

Insufficient amount of chemical will result in an incomplete purging. Accurate computations of amount of chemical to be added must be made prior to the purging. Once purging has begun, do not stop until process is complete.

(g) For each 100 gallon capacity, add 40 fluid ounces to the fuel tank. (This is equivalent to 8 fluid ounce of concentrate for a 20-gallon fuel tank).

(h) Fill fuel tank to top with water. Do not overflow.

(i) Insert air line into fuel tank filler neck opening and agitate solution with 3 to 5 psi of air for five minutes. Frequently move air hose around in tanks, covering as much area as possible, especially near the bottom and around baffles.

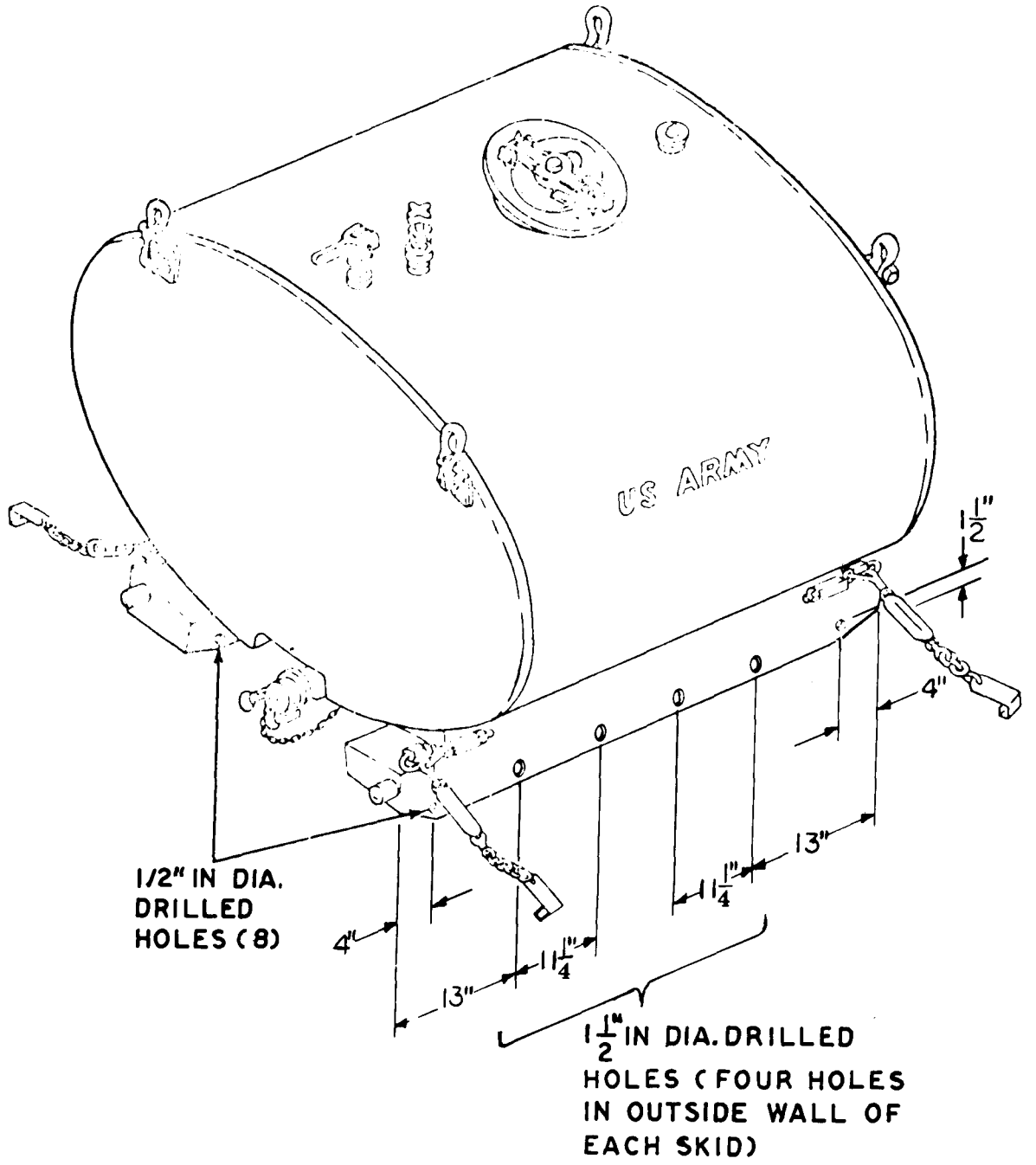
(j) Remove air line and drain solution from fuel tank.

(k) Fill fuel tank and overflow for five minutes with cold water or until water is clear.

(l) Drain fuel tank completely.

(m) Conduct a combustible vapor test reading to determine if fuel tank is safe to repair, clean, or paint, store or change material. If combustible vapor test reading indicates tank is not safe, repeat procedures as cited in h through m, above.

Page 6-18. Figure 6-18 is superseded as follows:



TS 4930-228-14/6-18 C4

Figure 6-18. Skid drain holes diagram.

By Order of the Secretary of the Army:

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

Official:

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

Distribution:
To be distributed in accordance with DA Form 12-25A, Operator maintenance requirements for Petroleum Distribution.

TM 5-4930-228-14
*C 3

CHANGE
NO. 3

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

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

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800) NSN 4930-00-070-1181

TM 5-4930-228-14, 1 August 1972, is changed as follows:

The title is changed as shown above.

Page 2 of Cover is superseded as follows:

WARNING

Do not touch metal parts with bare hands in extremely cold weather.

WARNING

Do not disassemble the spring housings. The spring is under tension and can cause serious injury or death if disassembled improperly. Repair of the spring housing is by replacement only.

WARNING

Prior to welding, read welding instructions contained in chapter 6, section V or maintenance of the tank assembly. DEATH or SERIOUS INJURY MAY result if personnel fail to heed safety precautions for welding.

WARNING

Dry cleaning solvent, PD 680, used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F (38°C) — 138°F (59°C).

Page 1-1, paragraph 1-7. Add the following note below subparagraph *a*.

NOTE

Extreme caution should be taken in filling tanks to avoid exceeding cross-country payload limits of transporting vehicle.

Example: The M-34, M-35, and M-211, 2½-Ton, 6x6 cargo trucks cross-country payload is 5000 lbs.

Page 2-7, paragraph 2-11*d*(1), line 2. Change "FSN 6850-823-7861" to read "NSN 6850-00-823-7861."

Page 3-1, paragraph 3-2. Add the following warning below subparagraph *b*.

WARNING

Dry cleaning solvent, PD-680, used for cleaning is a POTENTIALLY DANGEROUS CHEMICAL. Do not use near open flame. Flash point is 100°F — 138°F.

*This change supersedes change 2, 28 June 1974.

By Order of the Secretary of the Army:

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

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

Distribution:
To be distributed in accordance with DA Form 12-25A (qty rqr block No. 154), organizational maintenance requirements for petroleum distribution.

CHANGE
NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C. *18 January 1974*

Operator, Organizational, Direct Support and General Support Maintenance Manual

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1180)

FSN 4930-070-1181

TM 5-4930-228-14, 1 August 1972, is changed as follows:

Inside Front Cover add:

"Interlock rings on cam levers on all priming caps to assure against poppings."

Page 1-1. Paragraph 1-3 is superseded as follows:

1-3. Reporting of Equipment Publication Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes of Publications) and forwarded direct to Commander US Army Troop Support Command Attn AMSTS-MPP St. Louis MO 63120.

Paragraph 1-7 *a*, add the following:

The electric motor driven pump is intended for use in cold weather climates on an "as required basis:"

Page 1-7. After paragraph 1-7 *c* add paragraph 1-7 *c*.1:

c. 1. *Electric Pump.* The Gorman-Rupp electric motor driven pump, is a self-priming unit, with the impeller mounted on the extended shaft of the electric motor. Both pump and motor are mounted on a base plate to facilitate removal and use in auxiliary pumping operations.

Page 1-7. After paragraph 1-7 *d* add paragraph 1-7 *d*. 1.

d. 1. *Electric Motor.* The electric motor is explosion proof. The motor operates on 28 volts *dc* (Direct current) and is rated at 1.33 hp (horsepower).

Page 1-8. After paragraph 1-8 *a* (1) add paragraph 1-8 *a* (1.1):

a. (1.1). *Electric motor pump unit.* Located above motor plate, specifies the nomenclature, manufacturer, model, serial number and rating.

After paragraph 1-8 *a* (2) add paragraph 1-8 *a* (2.1).

After paragraph 1-8 *a* (2) add paragraph 1-8 *a* (2.1).

a. (2.1) *Electric motor plate.* Located on the unit. Specifies the nomenclature, manufacturer, serial number and rating.

Page 1-9. Paragraph 1-8 *c*, add the following:

Electric Motor.

Manufacturer	Master Electric Division, Reliance Electric and Engineering company
Identification No.	X242-3A
Type	Fully enclosed, explosion Proof
Speed	3600 rpm
Maximum operating temperature	75° c over 40° ambient
Thermal overload Protection	Opens at 20° below maximum operation temperature

Paragraph 1-8c (6) added:

(6) *Wiring diagram.* A practical wiring diagram of the electrical system is illustrated in figure 1-5.1.

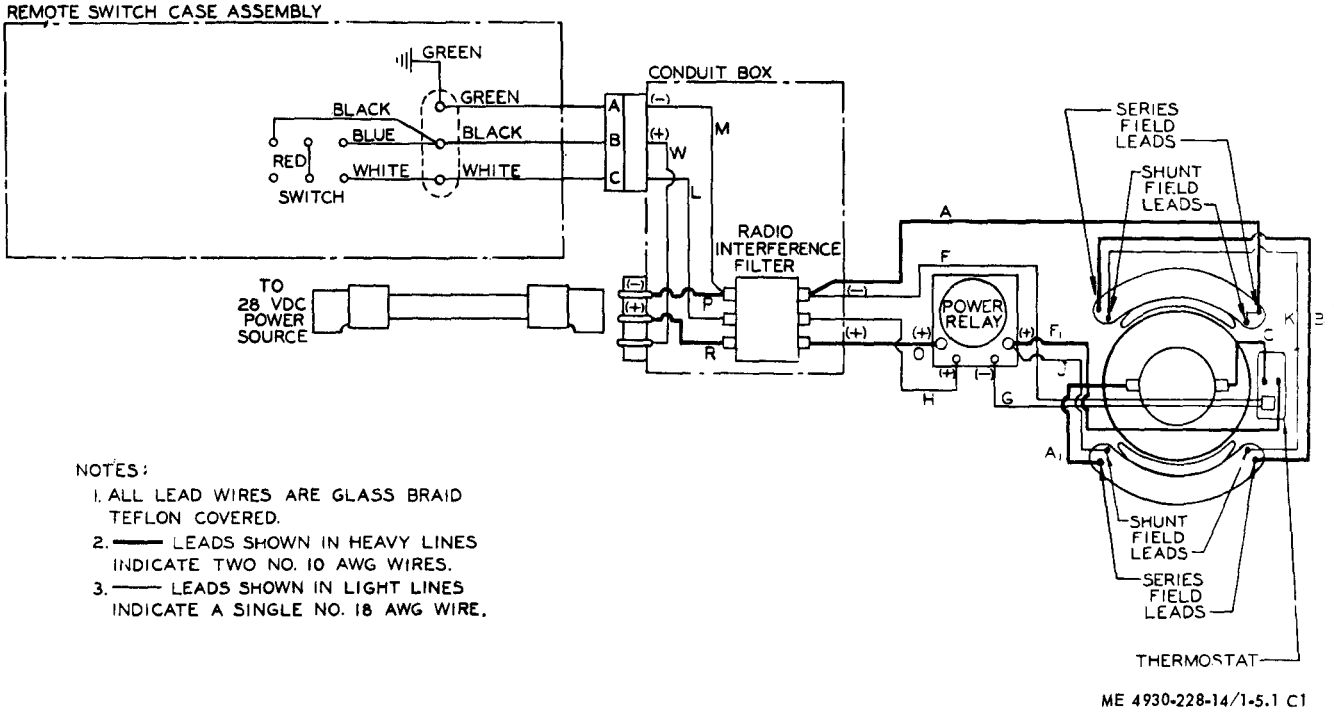


Figure 1-5.1. Practical wiring diagram.

Page 2-2. **Paragraph 2-2, The third line is changed to read " * * * by figures 2-1 and 2-1.1."**

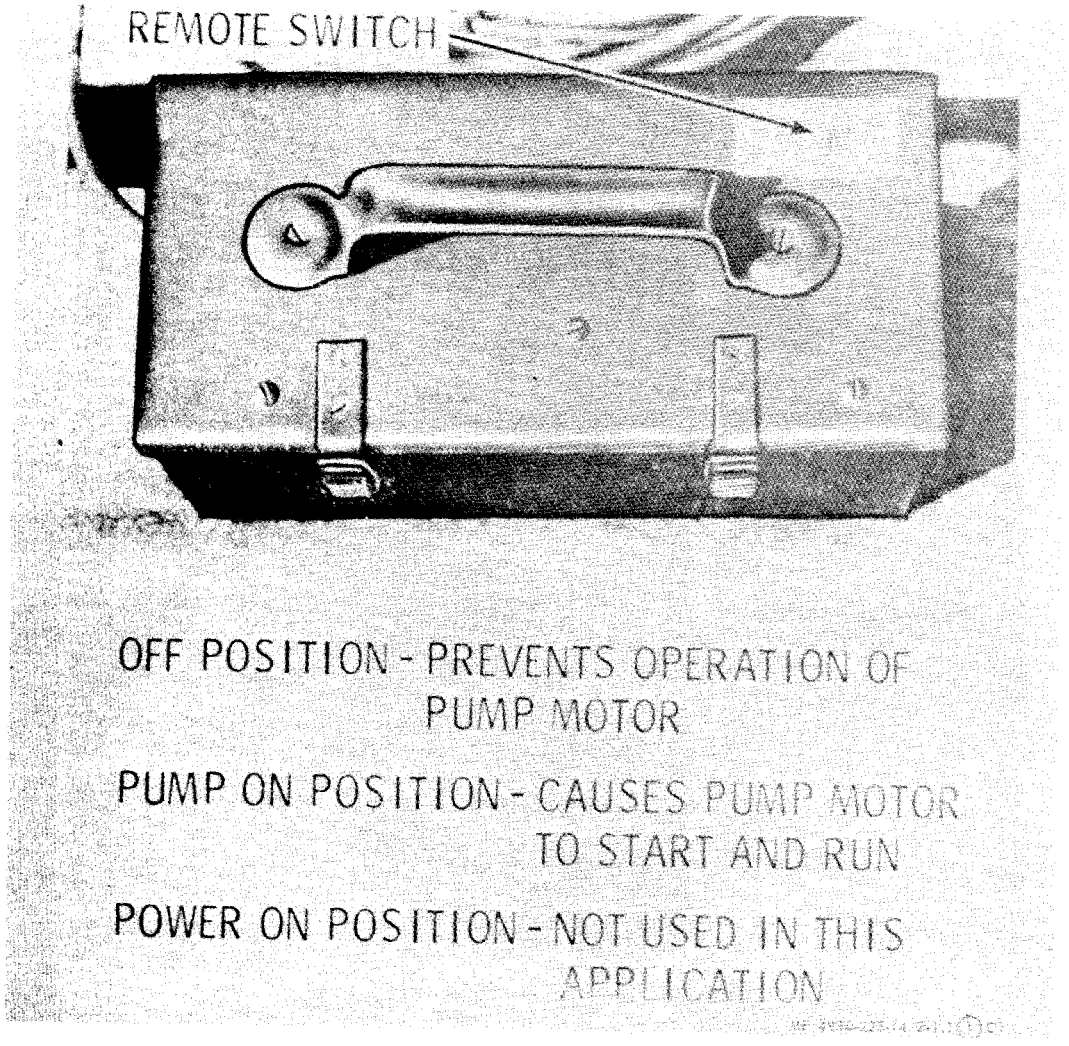


Figure 2-1.1. Controls and instruments (sheet 1 of 2).

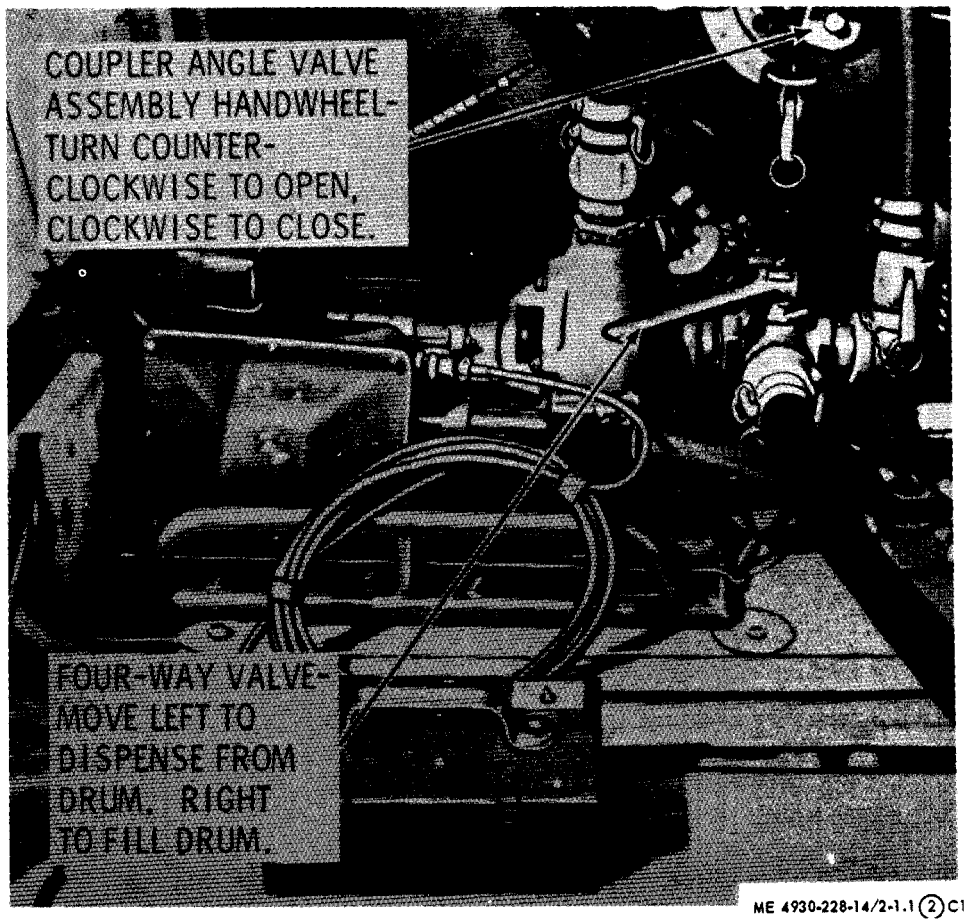


Figure 2-1.1. Controls and instruments (sheet 2 of 2).

Page 2-4. Paragraph 2-4 *c* is added.

c. Starting Electric Motor Driven Pump. Refer to figure 2-2.1 and start operation of the electric motor driven pump unit.

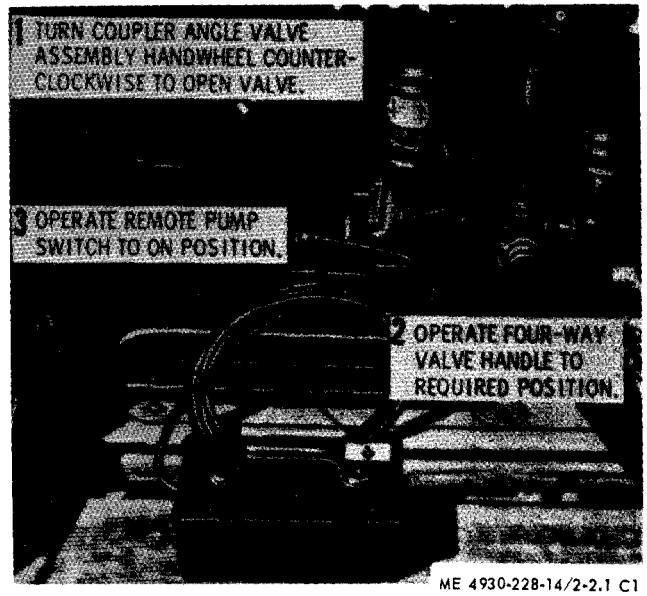
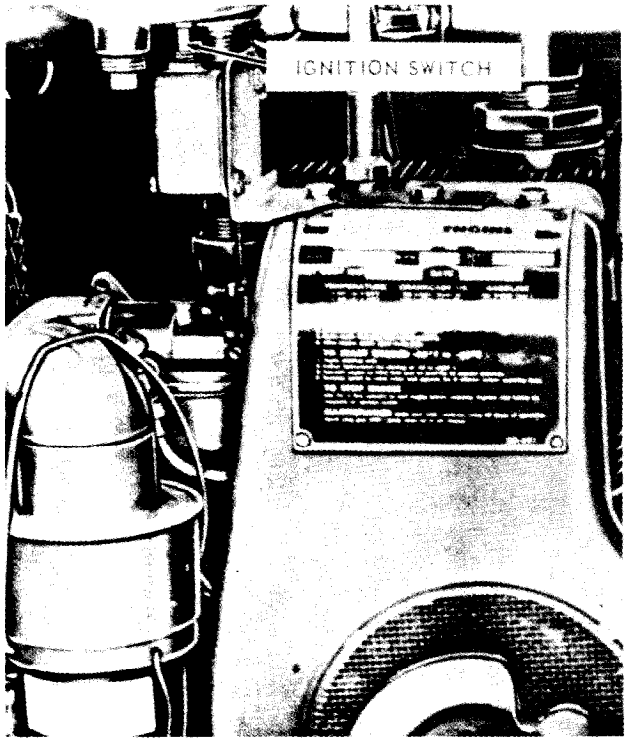


Figure 2-2.1. Starting instruction.

Page 2-5. Figure 2-3 is superseded.



STOPPING:

STEP 1. CLOSE DISCHARGE VALVES ON THE TANKS AND ALLOW ENGINE TO IDLE AT 1,000-1,200 RPM FOR 3 TO 5 MINUTES.
STEP 2. AFTER ENGINE HAS COOLED, PUSH IGNITION SWITCH IN TO STOP.
STEP 3. CLOSE FUEL SHUT-OFF VALVE, (TURN CLOCKWISE).

ME 4930-228-14/2-3 C1

Figure 2-3. Engine stopping instruction.

Page 2-5. Paragraph 2-5.1 is added.

2-5.1. Stopping Electric Motor Driven Pump

To stop electric motor driven pump, operate remote pump switch to OFF position (fig. 2-1.1).

Page 2-7. Paragraph 2-11 *e* is added.

e. The efficiency of electric batteries decreases greatly as the temperature decreases. Operate the engine of the carrier while running the electric pump motor to assure full pump out-put in cold weather.

Page 4-13. Add the following to table 4-2.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
9. ELECTRIC PUMP MOTOR FAILS TO RUN
a. Power not connected to pump motor *a.* Connect motor to power source (para 4-15.1 (12)
b. Circuit breaker or fuse at power source open *b.* Close circuit breaker or replace fuse
10. ELECTRIC MOTOR SPEED TO SLOW
Power source voltage too low Connect unit to proper power source.

Page 4-14. After paragraph 4-13 add the following.

4-13.1. Interference Suppression Components

a. Primary Suppression Components. The primary suppression components are those whose primary function to suppress radio interference. The primary component is described and located in figure 4-4.1

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary function.

4-13.2. Replacement of Suppression Components

Refer to figure 4-4.1 to replace the radio interference suppression components.

4-13.3. Testing of Radio Interference Suppression Components

Test the interference filter by substitution. Replace a suspected faulty filter with one known to be good.

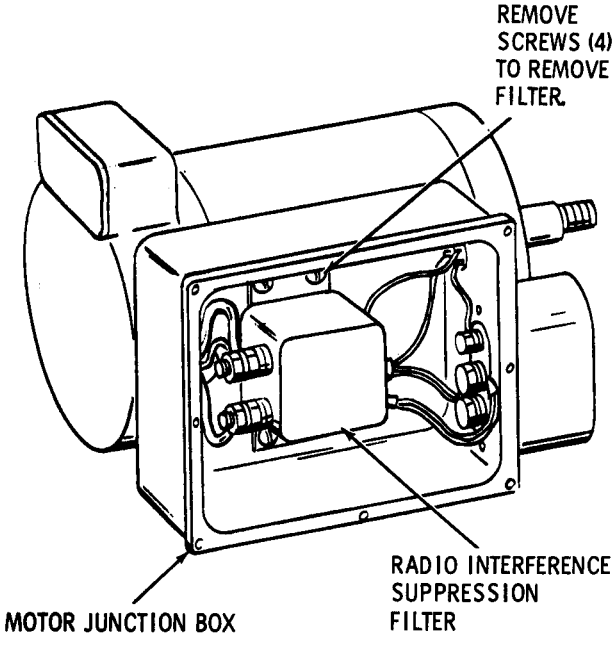


Figure 4-4.1. Interference suppression filter, location, removal and installation.

Page 4-15. After paragraph 4-15 add paragraph 4-15.1 and paragraph 4-15.2.

4-15.1. Conversion of Gasoline Engine Driven Pump to Electric Motor Driven Pump

(1) Disconnect the quick disconnect hose coupling from pump inlet (1, fig. 4-5.1). Disconnect discharge hose (1, fig. 4-5.2).

(2) Remove muffler support bracket and muffler (2, fig. 4-5.1).

(3) Remove 2 front bolts (1, fig. 4-5.3) and 2 rear bolts (2, figure 4-5.2).

(4) Remove pump and engine assembly by sliding out through front of frame assembly.

(5) Remove 90° elbow (1, fig. 4-5.2) from inlet of pump and remove tee (3, fig. 4-5.1) with cap from discharge end.

(6) Install tee (1, fig. 4-5.4) in pump discharge outlet with cap, into pump.

(7) Install 90° elbow (1, fig. 4-5.5) into inlet of pump.

(8) Slide pumping assembly into frame assembly.

(9) Secure the 2 front bolts (1, fig. 4-5.6).

(10) If the 2 rear bolts will not line up, use 2⅜" x 1" x 1" x 2" hook bolts, to secure pumping unit hose to tank and pump unit frame (2, fig. 4-5.5).

(11) Connect the inlet hose (3, figure 4-5.5) and discharge hose (5, figure 4-5.4) assemblies to pump assembly.

(12) Insert the power cable plug into receptacle provided on vehicle cab.

(13) Insert power cable plug (2, figure 4-5.4) into motor junction box (3).

CAUTION

Make certain that the remote switch is in OFF position.

(14) Secure the remote control plug (4, fig. 4-5.4) to the motor junction box.

Page 4-15:

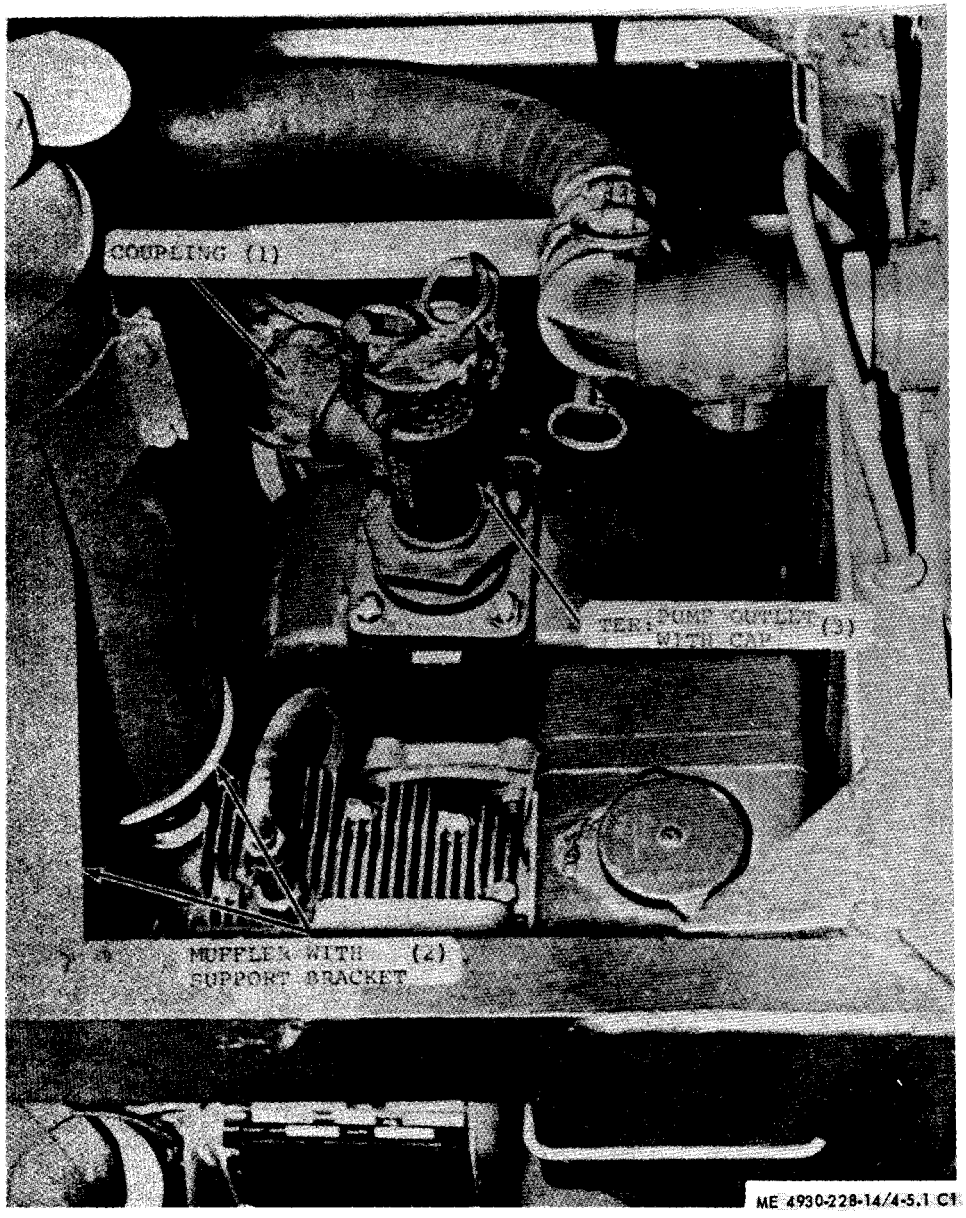


Figure 4-5.1. Pump and engine unit.

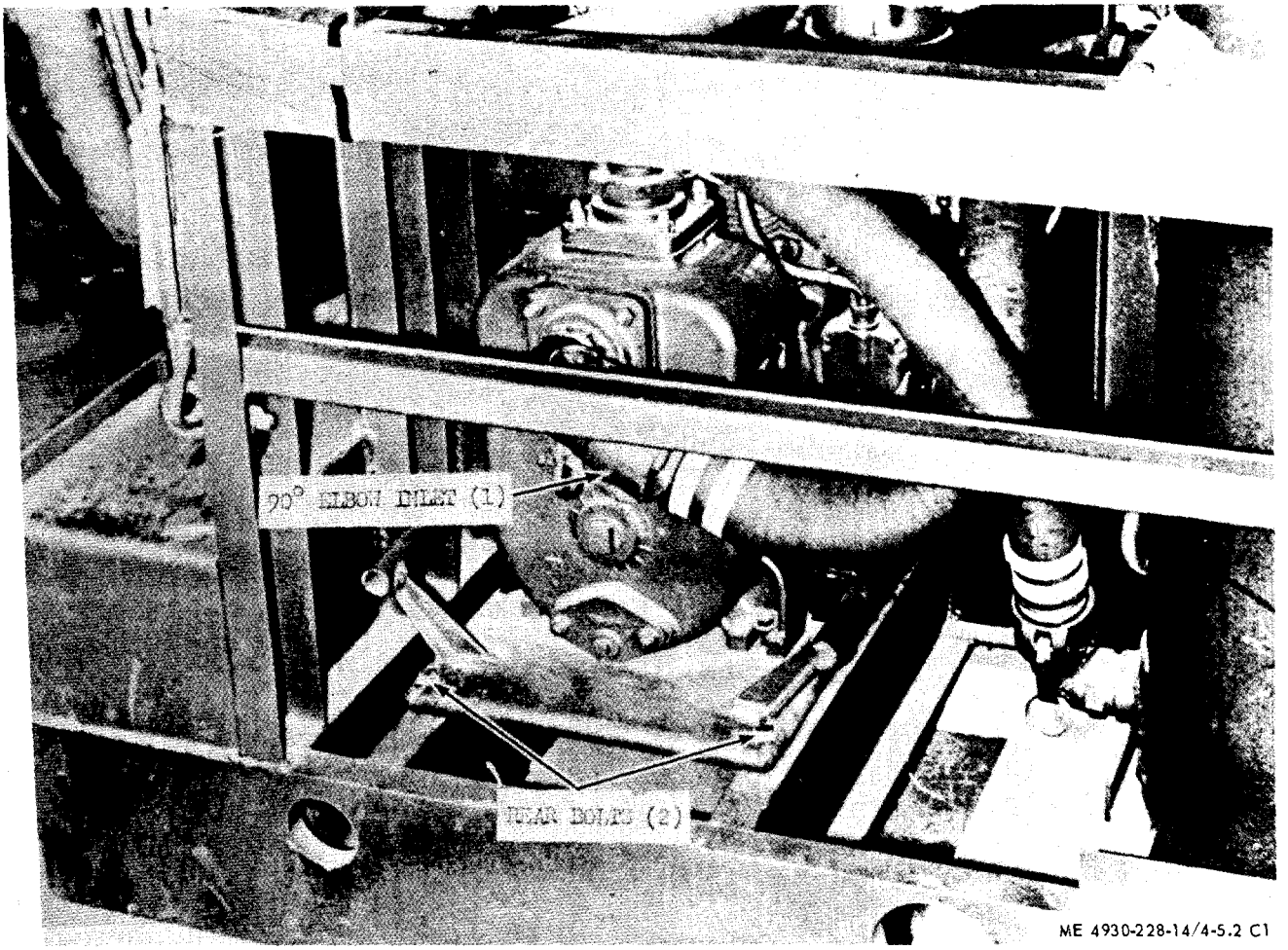
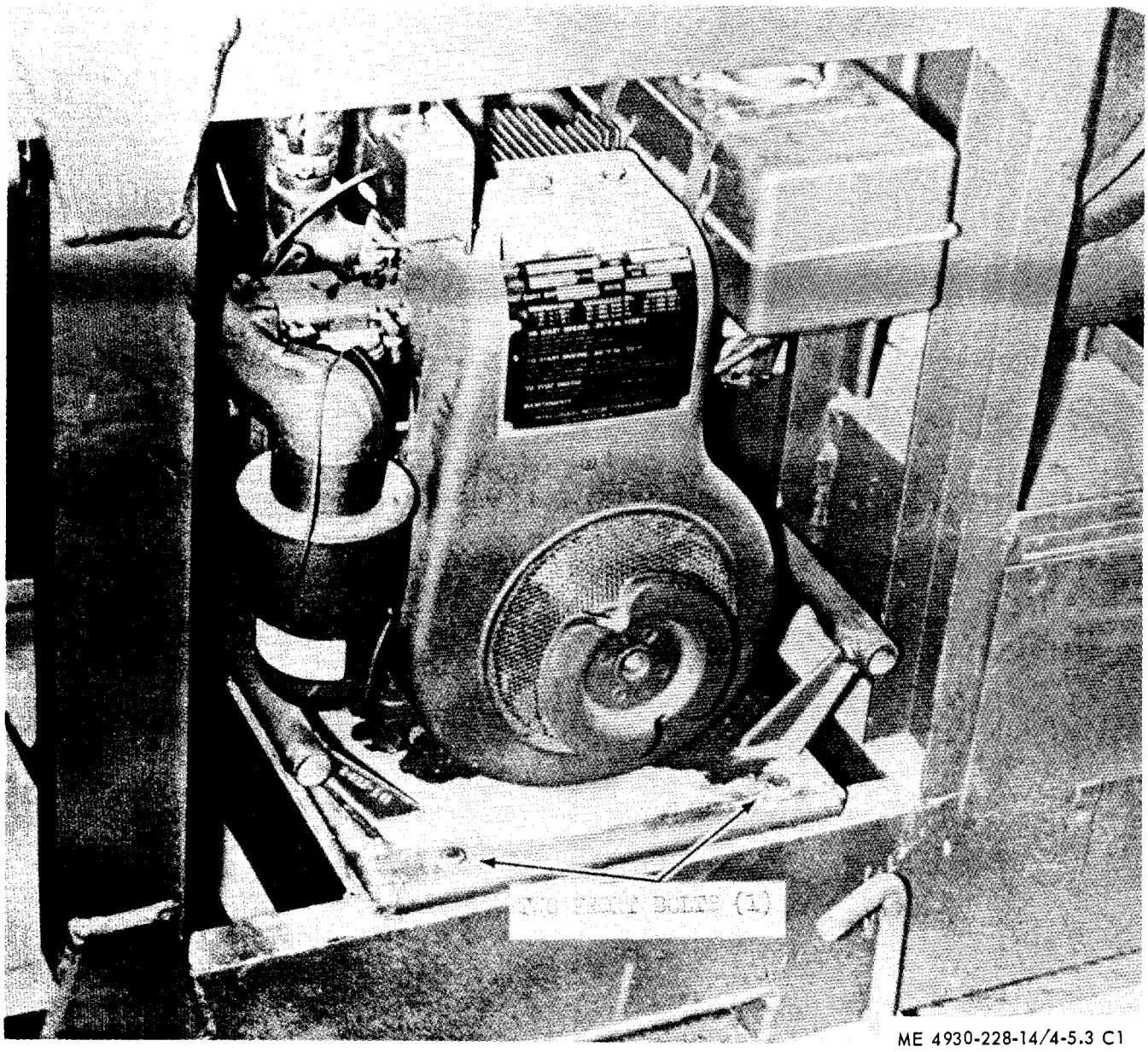


Figure 4-5.2. Pump and engine unit.



ME 4930-228-14/4-5.3 C1

Figure 4-5.3. Pump and engine unit.

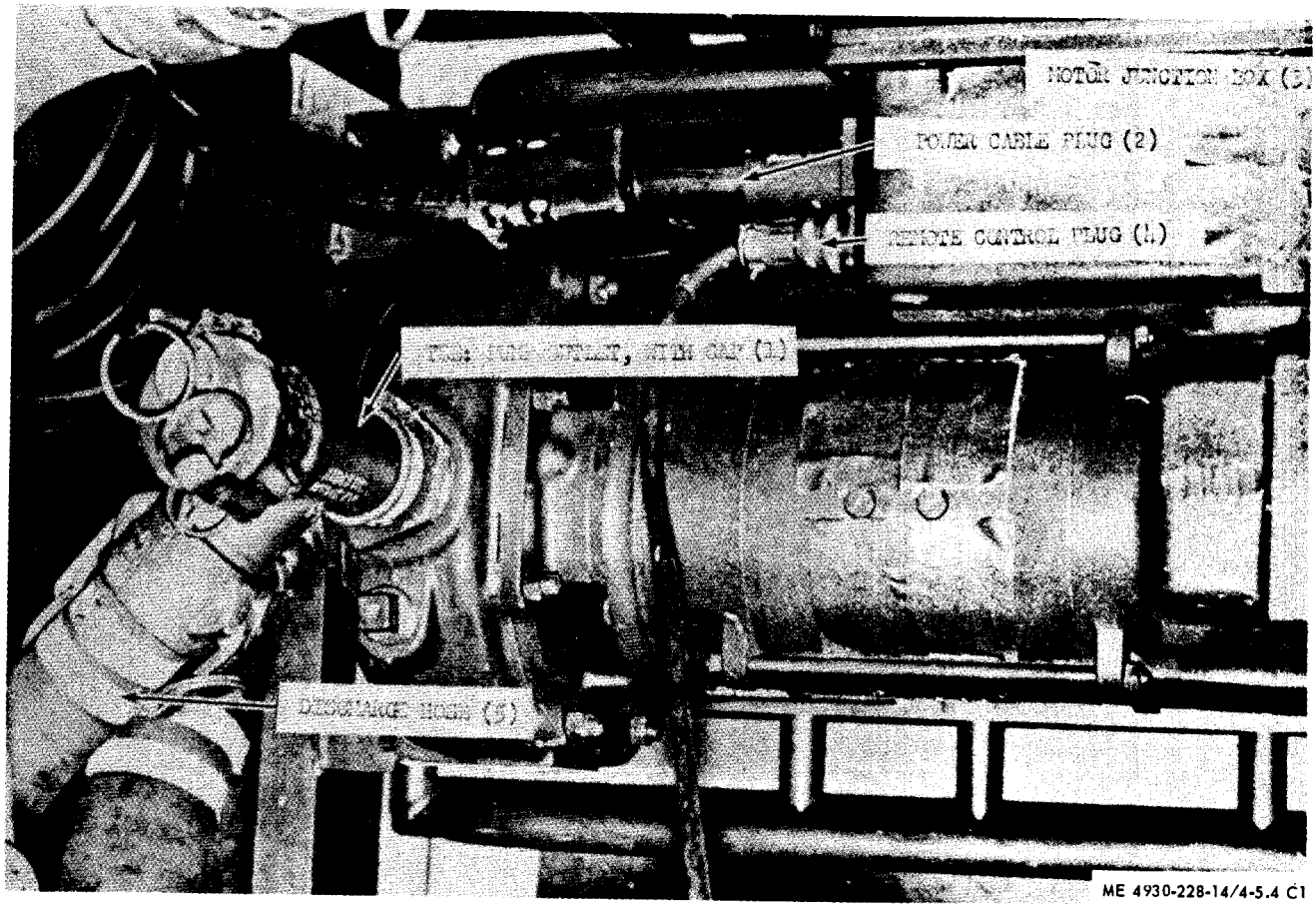
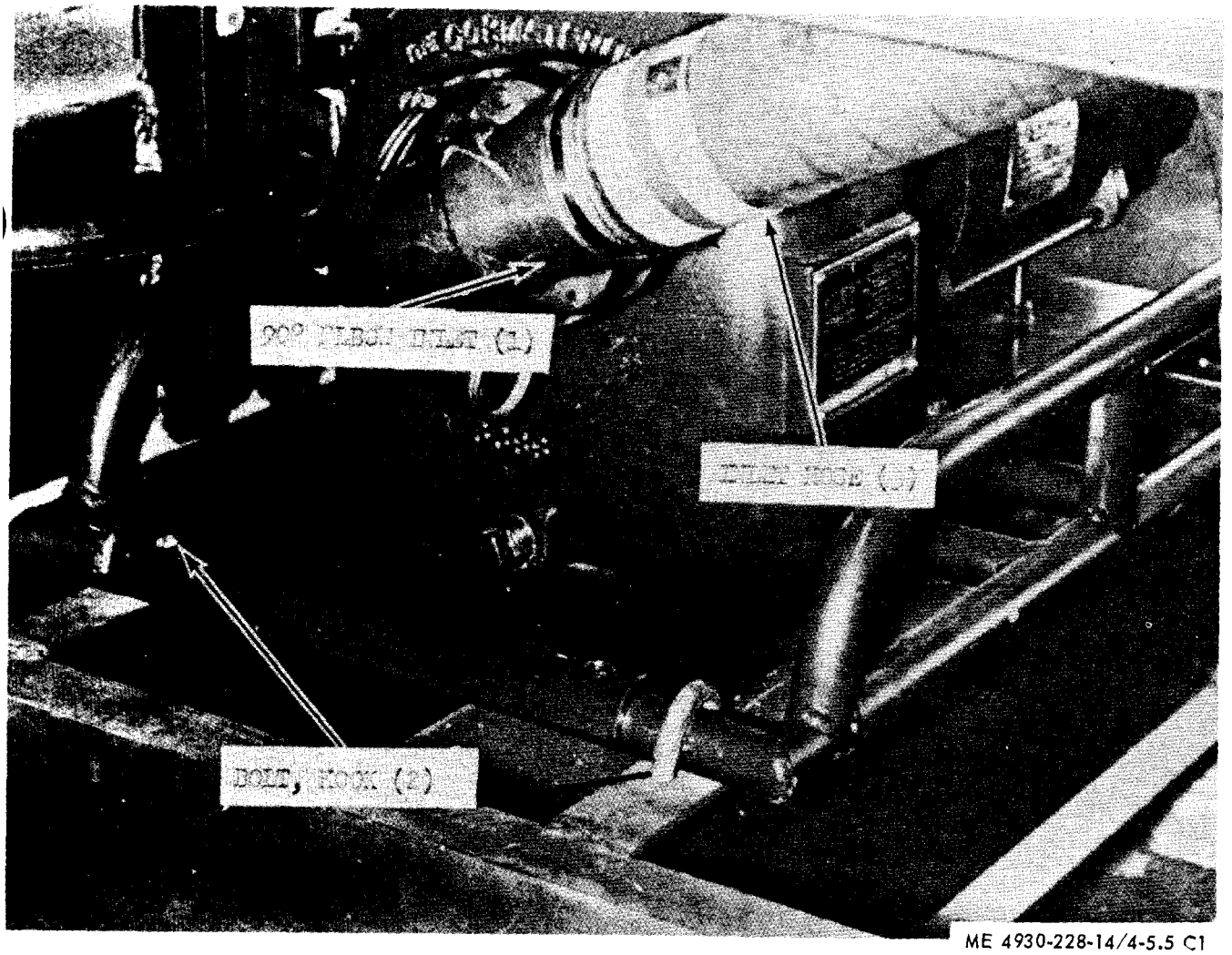


Figure 4-5.4. Pump and engine unit.



ME 4930-228-14/4-5.5 C1

Figure 4-5.5. Pump and engine unit.

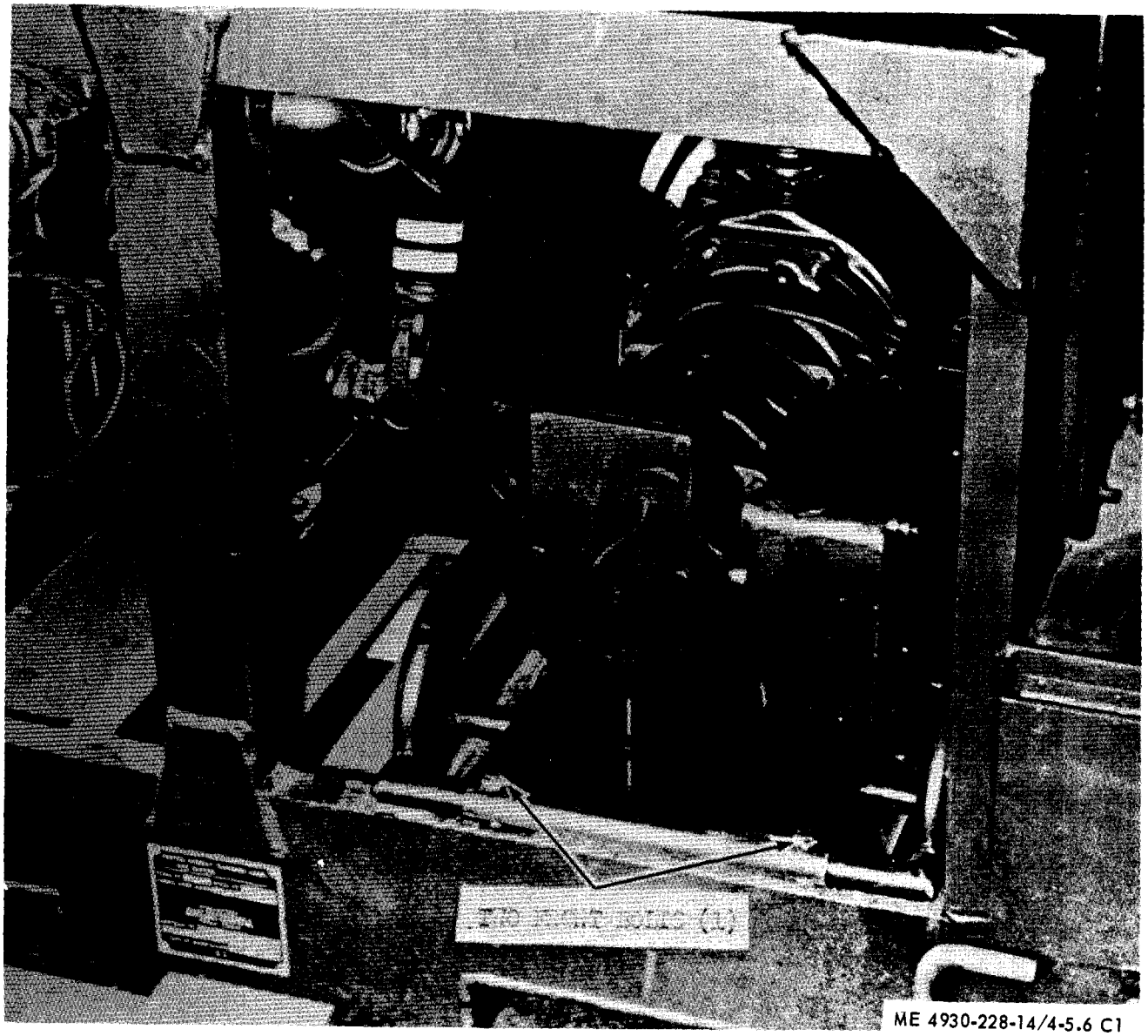


Figure 4-5.6. Pump and engine unit.

4-15.2. Electric Motor and Pump

a. Disassembly. To disassemble the pump proceed as follows:

(1) Disconnect hoses from pump unit and remove it from carrier.

(2) Refer to figure 4-5.7 and disassemble pump and remove motor.

CAUTION

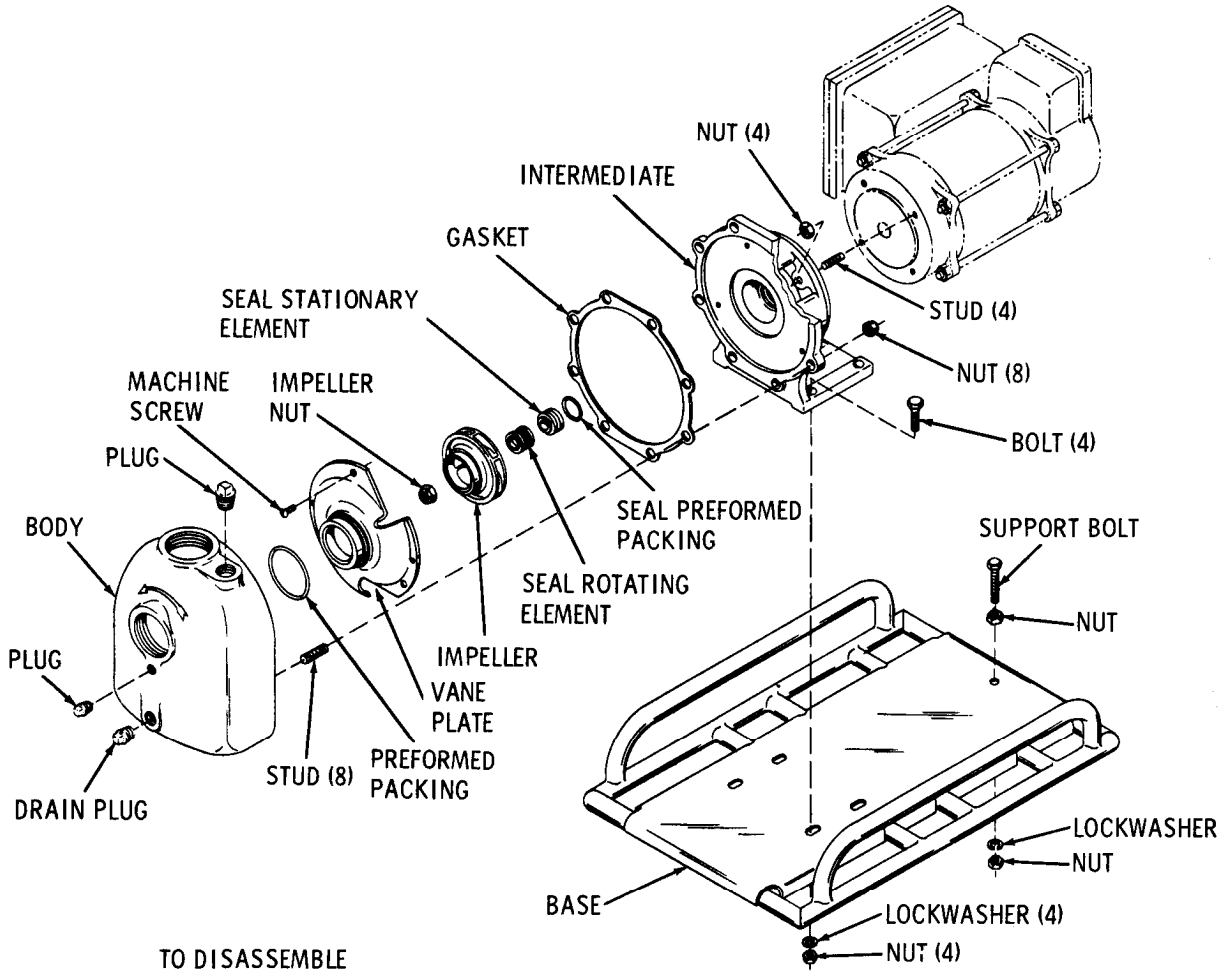
Prior to removal of seal, wipe shaft area clean all particles.

b. Cleaning and Inspection. Clean and inspect the pump as follows:

(1) Clean all parts as required; dry thoroughly with clean compressed air.

(2) Inspect all parts for excessive wear, cracks, scoring, and other damage. Replace all gaskets and seals, and all other defective parts.

c. Reassembly. Refer to figure 4-5.7 and reassemble the pump. Figure 4-5.8 shows clearance requirements between impeller and intermediate and provides instructions for seal installation.



TO DISASSEMBLE

1. REMOVE DRAIN PLUG TO DRAIN BODY.
2. REMOVE EIGHT NUTS SECURING BODY TO INTERMEDIATE; PULL FORWARD ON BODY TO REMOVE IT. REMOVE GASKET.
3. REMOVE THREE MACHINE SCREWS SECURING VANE PLATE TO INTERMEDIATE; REMOVE VANE PLATE.
4. INSERT SCREWDRIVER IN SLOT AT END OF MOTOR SHAFT TO PREVENT ROTATION. REMOVE IMPELLER NUT AND IMPELLER FROM SHAFT.
5. SLIDE SEAL ROTATING ELEMENT FROM SHAFT.
6. REMOVE FOUR NUTS SECURING MOTOR TO INTERMEDIATE; REMOVE MOTOR.
7. REMOVE FOUR BOLTS, NUTS, AND LOCKWASHERS SECURING INTERMEDIATE TO BASE: REMOVE INTERMEDIATE.
8. REMOVE SUPPORT BOLT, TWO NUTS, AND LOCKWASHER FROM BASE.

TO REASSEMBLE

1. REVERSE DISASSEMBLY PROCEDURE TO REASSEMBLE. REFER TO FIGURE 6-2 FOR CLEARANCE INFORMATION AND SEAL REPLACEMENT .INSTRUCTIONS.
2. USE EC847 SEALANT, MANUFACTURER'S CODE (94959) BETWEEN VANE PLATE AND INTERMEDIATE.
3. AFTER REASSEMBLY, ADJUST POSITION OF SUPPORT BOLT TO SUPPORT END OF MOTOR.

ME 4930-228-14/4-5.7 C1

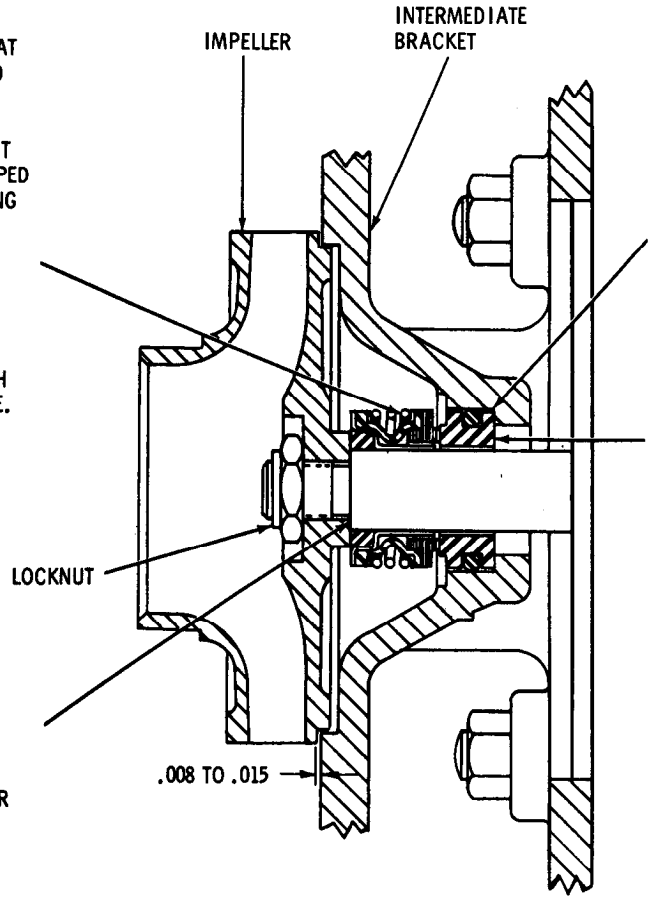
Figure 4-5.7. Centrifugal pump, disassembly and reassembly.

3. CLEAN AND APPLY LIGHT COAT OF OIL TO MOTOR SHAFT AND LAPPED SURFACE OF SEAL ROTARY ELEMENT. INSTALL ASSEMBLED ROTARY ELEMENT ON MOTOR SHAFT WITH LAPPED SURFACE OF ELEMENT FACING MOTOR.

CAUTION: PRESS ONLY ON TAIL SECTION OF DRIVING BAND. IF ROTARY ELEMENT WILL NOT SLIDE INTO PLACE WITH FINGERS, USE SMOOTH SLEEVE TO PUSH INTO PLACE. MAKE SURE NO DUST OR FOREIGN MATERIAL IS ON LAPPED SURFACES OF SEAL AS SURFACES ENGAGE.

4. ADD SHIMS AS NECESSARY TO OBTAIN .008 TO .015 IN. BETWEEN BACK OF IMPELLER AND INTERMEDIATE BRACKET. CHECK CLEARANCE WITH FEELER GAGE WHEN IMPELLER IS TIGHTLY SECURED TO SHAFT.

NOTE: IF ONLY SEAL HAS BEEN REPLACED, SHIM THICKNESS WILL BE SAME AS BEFORE DISASSEMBLY.



1. APPLY LIGHT COAT OF OIL, MIL-L-2104, GRADE 10 TO BORE OF INTERMEDIATE BRACKET.

2. INSTALL STATIONARY RING AND O-RING ON MOTOR SHAFT AND INTERMEDIATE BRACKET WITH LAPPED (POLISHED) SURFACE FACING TOWARD IMPELLER.

CAUTION: TAKE CARE DURING INSTALLATION OF STATIONARY RING TO AVOID DAMAGE TO LAPPED SURFACE. STATIONARY RING MUST BOTTOM SQUARELY IN BORE. A MARRED SURFACE OR IMPROPERLY SEATED STATIONARY RING WILL RESULT IN LEAKAGE WHEN PUMP IS RESTORED TO SERVICE.

ME 4930-228-14/4-5.8 C1

Figure 4-5.8. Centrifugal pump, seal and impeller installation.

Page 5-1. Add the following to table 5-1:

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
8. ELECTRIC MOTOR FAILS TO RUN, OR FAILS TO REACH RATED SPEED
Step 1. *Inspect for worn or stuck brushes.* Free or replace brushes
Step 2. Inspect for burned, pitted or dirty commutator. Clean or turn down commutator.
Step 3. Armature shorted or open Repair or replace armature
Step 4. Stator shorted or open Repair or replace stator winding
Step 5. Thermal unit open Replace thermal unit buried in stator winding
Step 6. Power relay coil open Replace power relay.
9. ELECTRIC MOTOR NOISY OR VIBRATE EXCESSIVELY
Step 1. Motor bearing worn, dry or damaged Overhaul motor
Step 2. Armature laminations rubbing overhaul motor
10. ELECTRIC MOTOR OVERHEATS
Step 1. Bearings dry or damaged. Overhaul motor
Step 2. Armature or stator shorted Replace or repair armature or stator.
11. ELECTRIC MOTOR RUNS FOR SHORT WHILE THEN STOPS
Step 1. Thermal overload protector imbedded in stator defective. Replace thermal overload protector

Page 5-2. Paragraphs 5-7 *b.* 1, 5-7 *b* 2, and 5-7 *c.* 1 are added.

b. 1. *Electric Motor Classifications and Ratings*

Horsepower	1.33 hp (horsepower)
Voltage (dc)	28 volts
Amperes (at no load)	45 amps
No-load speed	4200 rpm
Rotation	Counterclockwise facing drive end
Type of enclosure	Explosion-proof
Lubrication	Sealed bearings
Thermal protector cutout temperature	250° F (120° C)

b. 2. *Electric Motor Rewinding Information*

Armature:	
Number of slots	18
Number of commutator segments	18
Number of single coils	18
Conductor copper size	4 No. 16
Turns per coil	4
Feet of wire per coil	18
Conductor insulation	MIL-W-583 Type HPF
Insulating materials	
Slot cell (basic ground)	.010 in. E.I. DuPont "Nomex" polyamide paper
Slot cell (basic ground) (alternate)	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Shaft insulation	.010 in. E.I. DuPont "Nomex" polyamide paper
Shaft insulation (alternate)	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
End fiber laminations	1/16 in. polyester glass (NEMA G.P. GPO-1)
End fiber laminations	Glass-Melamine (MIL-P-15037 Type GME)
Slot wedge	1/16 in. polyester glass (NEMA G.P. GPO-1)
Slot wedge	Glass-Melamine (MIL-P-15037 Type GME)
Coil overlap insulation	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Under leads to commutator	.007 in., varnished glass cloth (MIL-I-17205)
Coil lead sleeving	Braided glass (MIL-I-13190)

Adhesive tape	.006 in. woven glass (MIL-I-15126 Type GFT)
Coil lead ties	.015 in. thk, ½ in. wide Dacron-glass tie tape
Commutator washer	Dacron-Mylar-Dacron D-100 3/14/3 (MIL-I-22834)
Commutator lead band	Glass cord
Dipping compounds	Varnish, Schenectady No. 31 (MIL-I-24092CL. 155 Type M)
Dipping and baking procedures	Preheat armature for two hours at 315 to 325°F. Repeat two more times, extending last baking time to 6 hours.
Stator shunt winding	
Conductor copper size	No. 23
Turns per coil	1000
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	1200
Stator series winding	
Conductor copper size	No. 14
Turns per coil	2
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	21
Stator intercoil winding	
Conductor copper size	No. 14
Turns per coil	24
Conductor insulation	MIL-W-583 Type HPF
Feet of wire per coil	47
Stator	
Insulating materials	
Inner periphery strip	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Between shunt and series	Dacron-Mylar-Dacron D-100 2/2/2/ (MIL-I-22834)
Glass adhesive tape	.007 in. woven glass (MIL-I-15126)
Coil lead sleeving	Acrylic glass
Interpole flanges	Glass-Melamine (MIL-P-15037, Type GME)
Glass tape	.007 in. woven (MIL-Y-1140 Class C ECAA)
Interpole ground insulation	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Field coil insulation	Dacron-Mylar-Dacron D-100 3/5/3 (MIL-I-22834)
Ground insulation collar	Dacron-Mylar-Dacron D-100 2/2/2 (MIL-I-22834)
Lead cable	MIL-W-583 Type L-2 AWG No. 10 (Beldon)
Dipping compound	Varnish, Schenectady, No. 31 (MIL-I-24092 CL 155 Type M)
Dipping and baking procedures.	Preheat field winding for 2 hours at 315 to 325°F. Dip in varnish and bake for 1 hour at 315 to 325° F. Repeat two more times, extending the last baking time to 6 hours

c. 1. Electric Motor Repair and Replacement Standards

Shunt field winding resistance	41.87 ohms
Series field winding resistance	.0063 ohm
Interpole winding resistance	.0129 ohm

Page 6-16. Paragraph 6-15.1 is added:

6-15.1. Electric Motor

a. Removal and Disassembly. To remove and disassemble the pump drive motor, proceed as follows:

(1) Remove the pump as shown in figure 4-5.7.

(2) Refer to figure 6-16.1 and disassemble the motor. The sequence of disassembly is indicated by the index numbers assigned.

(3) Do not remove the stator coils (58) unless inspection indicates that they are open, shorted, grounded or have low insulation resistance.

b. Cleaning and Inspection. To clean and inspect the unit, proceed as follows:

(1) Clean all metallic parts as required; dry thoroughly.

(2) Clean the exterior of electrical parts as required. Take care to prevent saturation of electrical winding, leads, and contacts.

(3) Inspect the armature shaft (55) for worn or damaged bearing seats, bent shaft extension, windings broken away from the commutator risers, and worn or burned commutator.

(4) Use test equipment listed in table 6-1 to perform electrical tests of motor components.

CAUTION

Remove electrical leads from item 31, figure 6-16.1 prior to removal of rear head, item 35.

Table 6-1. Test Equipment

Item	FSN or Part no.	Use
Multimeter	6625-242-5023	Check continuity of circuits and resistance of stator
Megger	6625-246-5880 Model ZM-2A / U	Check dielectric strength of winding insulation.

(5) Check the armature for shorts with a growler. Use a multimeter to check for grounds by checking for continuity between the armature shaft and each commutator bar. No continuity should exist. Check for open armature windings with a multimeter. Continuity should exist between all adjacent commutator bars.

(6) Inspect brushes (38) for cracks, chips, oil saturation and wear. If brushes are damaged or worn to less than ½ inch long, replace them.

(7) Inspect the brush ring (41) for cracks, distortion, bent or loose brushholder studs. Inspect the brush boxes on the brush ring for distortion and wear. Replace a damaged brush ring.

(8) Inspect the stator assembly for cracks distortion, and damaged winding insulation. Check the stator coils (58) for continuity by using a multimeter. Continuity must exist across the coils. Check field resistance with a multimeter. Resistance values are given in Maintenance Data, paragraphs 5-7. Check for ground with a multimeter. No continuity should exist between the winding terminals and an unpainted portion of the stator frame (59). With radio frequence interference suppression filter (23) disconnected, apply 1500 volts for one second between ground and stator leads to check insulation resistance. Repair or replace a damaged stator.

CAUTION

Failure to disconnect radio frequency interference suppression filter before applying high insulation resistance test voltage will burn out the filters.

(9) Inspect the power relay (31) for binding armature movement and for burned or worn contact points. If points are dirty, insert a piece of card stock between the points and manually operate the armature. Pull out the card stock to burnish the points. Repeat as necessary. Apply 24 volts dc to the operating coil of the relay and check relay operation. Points should close instantly and firmly when the coil is energized and should release immediately when the coil is deenergized.

(10) Check the interference filter (23) for cracks and dents. Check for continuity across each of the three circuits of the filter using a multimeter. Continuity must exist across each circuit. Replace a faulty filter, part number JN-14828A.

(11) Inspect electrical connector (11) and the plug assembly (14 for cracks, damaged threads, loose or broken terminals, damaged insulation and other damage; replace damaged parts.

(12) Inspect the front head (44), rear head (35), conduit box (26) and cover (2) for cracks, distortion, worn or damaged threads, and other damage; replace damaged parts.

(13) Inspect all other parts for cracks, distortion, damaged threads, and other damage; replace damaged parts.

c. Repair. To repair the unit, proceed as follows:

(1) If armature shaft windings are damaged, rewind the armature as follows:

(a) Refer to the motor rewinding information in the tabulated data, paragraph 5-7.

(b) Stack laminations on the shaft with 3 / 32 inch glass-polyester mat lamination end fibers in place. Place slot Figure 6-16.2 cells in the core to insulate the shaft. Use glass adhesive tape to hold shaft insulation in place.

(c) Use a piece of 2 / 2 / 2 dacron-mylardacron per MIL-I-22834 to insulate the overlap coils on the end turns.

(d) Separate commutator leads with a layer of .007 inch (minimum) varnished glass cloth per MIL-I-17205.

(e) Hold coils in place with wedges of polyester-glass mat per NEMA G.P. GPO-1.

(f) Dip and bake the armature as indicated in paragraph 5-7.

(2) Repair a slightly burned or pitted commutator with 00 sandpaper. If the commutator is badly scored, pitted, or burned, turn down the commutator on a lathe. Take light cuts and remove only enough metal to assure that the commutator is clean and smooth. Finish the commutator with 00 sandpaper held against the commutator with a block of wood. After finishing, undercut the mica separators to a depth of 1 / 32 inch, using a hacksaw blade 0.035 inch wide. Smooth com-

mutator with 00 sandpaper after undercutting.

(3) If stator windings are shorted, burned, or grounded, rewind the stator as follows:

(a) Refer to motor rewinding information in tabulated data, paragraphs 5-7.

(b) Wind the field coils on forms with the inner periphery strip placed around the form before winding. Refer to figure 6-16.3.

(c) Wind the shunt winding first, then position the insulation around the shunt winding before winding the series windings around the shunt windings.

(d) Weld leads to coil ends. Insulate welds with acrylic sleeving. Insulate pole connection coil leads with acrylic sleeving.

(e) Tape coils overall ½ inch with glass tape lapped one-half its width every turn. Tape leads securely to the coils. Insert the taped coils and ground insulation into the field structure before impregnation with varnish per MIL-I-24092, CL 155, Type M.

(f) When unwinding the interpole coil, carefully note the position of the thermal overload protector imbedded within the windings to assure that it will be replaced in the same position from which it was removed.

(g) When winding the interpole coils, place the ground insulation around the interpole iron before winding. Also install the top and bottom flanges before winding. While winding, carefully imbed the thermal overload protection in the coils in the same position from which it was removed, (subpara *(f)* above).

(h) Insulate the interpole leads with acrylic sleeving.

(i) Assemble the interpole coils into the field structure before varnish impregnation.

(j) Dip and bake the field windings as indicated in paragraph 5-7.

d. Reassembly and installation. To reassemble and install proceed as follows:

(1) Reassembly is essentially the reverse of disassembly. Refer to figure 6-16.1.

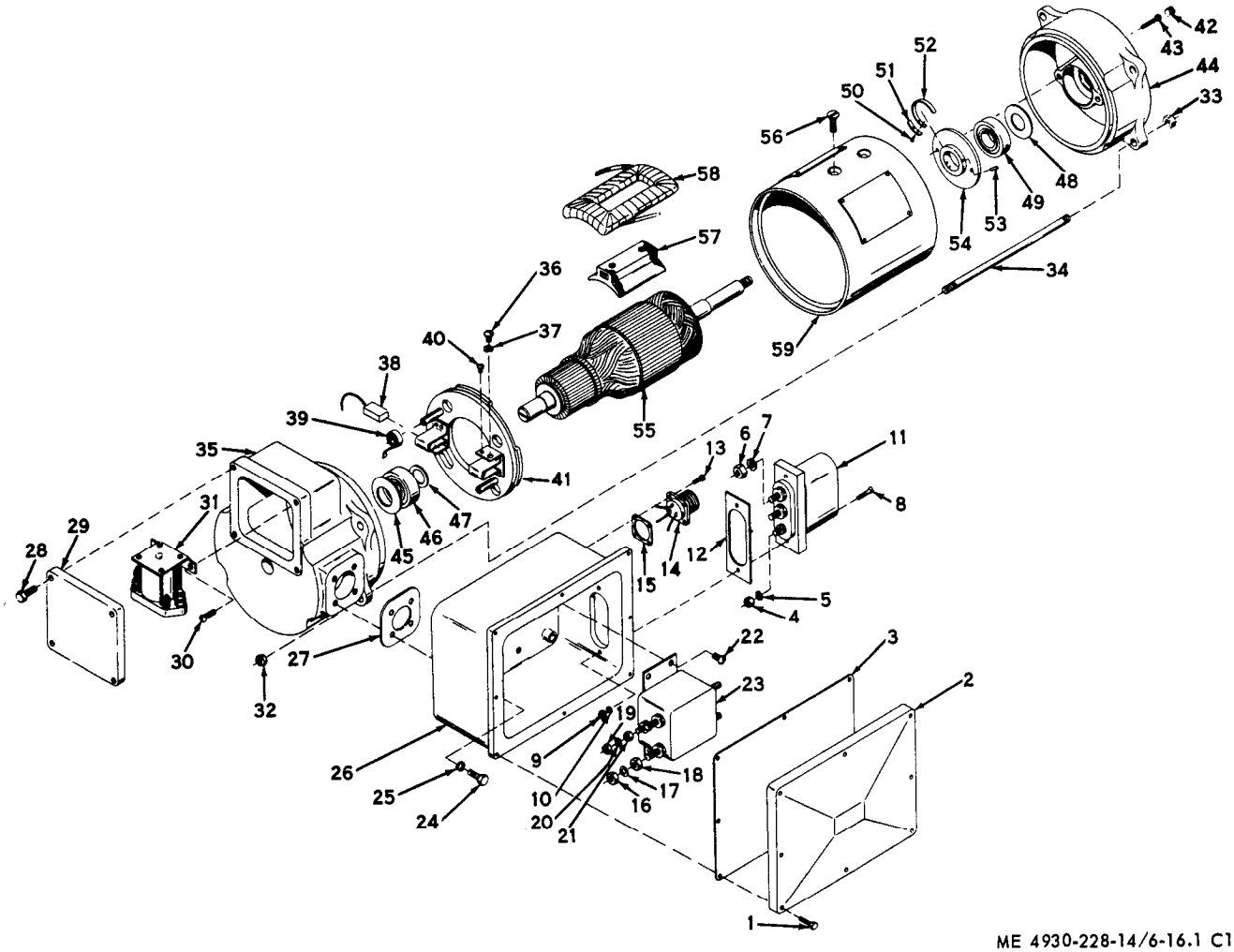
(2) When pressing the bearings (46 and 49) onto the armature shaft (55), use a sleeve that will fit over the end of the shaft and will engage the inner race of the bearing. The end of the sleeve must be square with the length to assure that equal force is applied to all parts of the inner race. Use an arbor press to install the bearings.

(3) When installing the stator coils (58), use a pole-shoe spreader to assure that pole shoes are properly seated in the stator frame.

(4) After pulling the wires from the relay (31) through the head-to conduit port in the rear head, the port must be sealed around the wires. Sealing is done with wicking and sealing compound (70020) Bi-Wax 510, to the dimensions shown in figure 6-16.4.

(5) After reassembly, rotate the armature shaft through several rotations to assure that it rides freely in the bearings and that it does not rub or bind.

(6) Install the pump on the motor (para 4-15.2).



1 Screw, machine (8 rqr)
2 Conduit box cover
3 Gasket
4 Nut
5 Washer, lock
6 Nut (2 rqr)
7 Washer, lock (2 rqr)
8 Screw, flat head (2 rqr)
9 Nut (2 rqr)
10 Washer, lock (2 rqr)
11 Connector, electrical
12 Gasket
13 Screw, fillister head
14 Plug assembly
15 Gasket
16 Nut (4 rqr)
17 Washer, lock (4 rqr)
18 Nut (4 rqr)
19 Nut (2 rqr)
20 Washer, lock (2 rqr)
21 Nut (2 rqr)
22 Screw, machine (4 rqr)
23 Interference filter
24 Screw cap (4 rqr)
25 Washer, lock (4 rqr)
26 Conduit box
27 Gasket
28 Screw, cap (4 rqr)
29 Inspection cover
30 Screw, machine (2 rqr)
31 Power relay
32 Nut (4 rqr)
33 Nut (4 rqr)
34 Thru stud (4 rqr)
35 Rear head
36 Machine screw (2 rqr)
37 Washer, lock (2 rqr)
38 Brush (4 rqr)
39 Brush spring (4 rqr)
40 Screw, machine (2 rqr)
41 Brush ring
42 Pipe plug (2 rqr)
43 Screw, machine (2 rqr)
44 Front head
45 Thrust spring
46 Ball bearing
47 Bearing back plate
48 Shim
49 Ball bearing
50 Screw, machine (2 rqr)
51 Spring clip
52 Spring
53 Carbon brush
54 Bearing clamp and grounding ring
55 Armature shaft
56 Screw, flat head (4 rqr)
57 Pole shoe (2 rqr)
58 Stator coil
59 Stator frame

Figure 6-16.1. Electric Motor, exploded view.

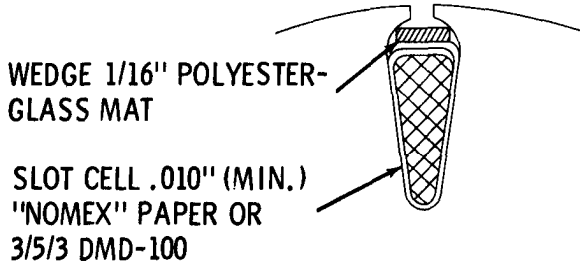


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Figure 6-16.2. Armature slot detail.

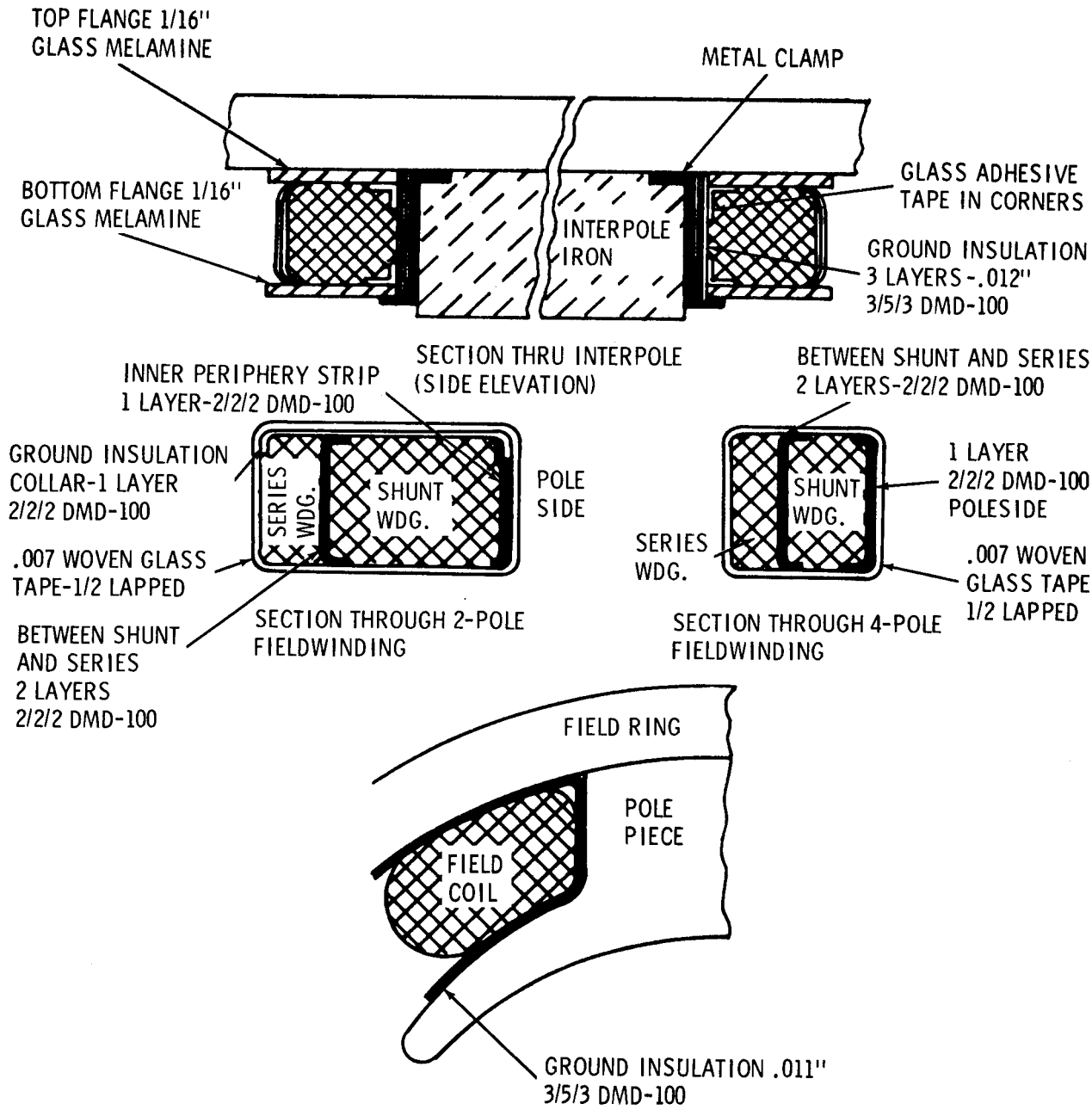

Figure 6-16.3. Stator winding detail.

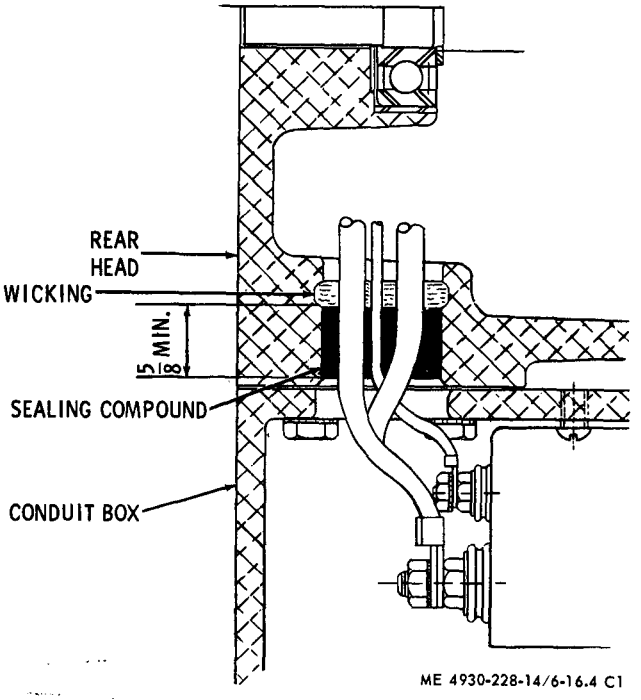

Figure 6-16.4. Sealing dimensions for rear head port.

By Order of the Secretary of the Army:

CREIGHTON · W. ABRAMS
General, United States Army
Chief of Staff

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

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NO. 5-4930-228-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *1 August 1972*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TANK AND PUMP UNIT, LIQUID DISPENSING; FOR TRUCK MOUNTING (ADVANCED INDUSTRIES MODEL 1800)

FSN 4930-070-1181

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is for your use in operating and maintaining the liquid dispensing tank and pump unit.

1-2. Maintenance Forms and Records

Maintenance forms and records that 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 Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

1-4. Equipment Serviceability Criteria (ESC's)

This equipment is not covered by an ESC.

1-5. Destruction of Army Materiel to Prevent Enemy Use

Procedures to be used for destruction of the equipment to prevent enemy use are in TM 750-244-3.

1-6. Administrative Storage

For administrative storage instructions, refer to TM 740-90-1.

Section II. DESCRIPTION AND DATA

1-7. Description

a. General. The tank and pump unit consists of a 50 gpm (gallons per minute) pumping assembly (fig. 1-1), two 600-gallon tanks, and related items. It is designed for use with 2½-ton, 6 x 6 cargo trucks M-34, M-35, and M-211; and with 5-ton, 6 x 6 cargo trucks M-41 and M-54. When installed in a cargo truck, the tank and pump unit is used in the field as a bulk carrier and dispenser. It carries 1,200 gallons. The purpose of the tank and pump unit is to convert a general purpose military cargo vehicle into a bulk refueler for other military vehicles or aircraft.

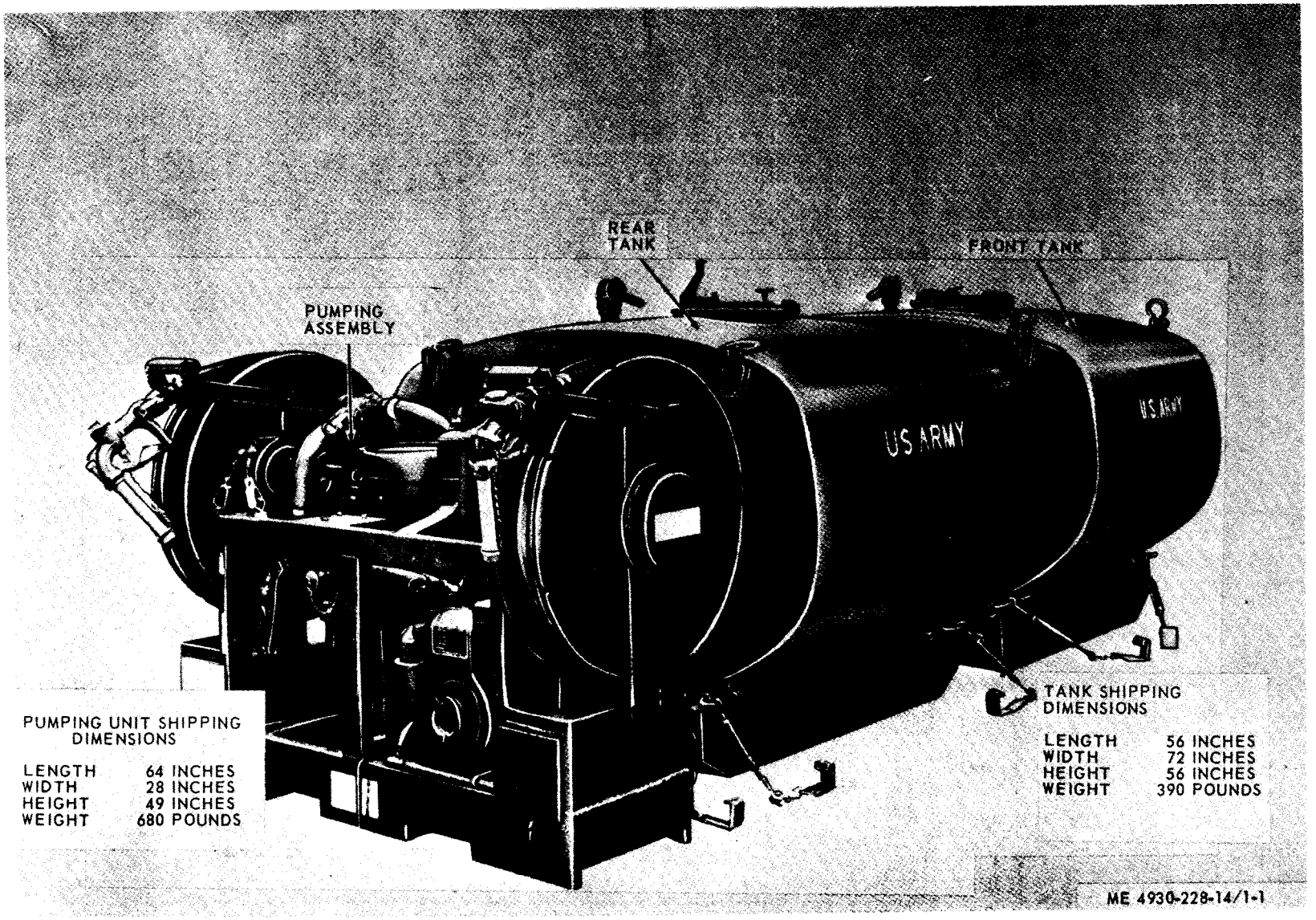


Figure 1-1. Tank and pump unit, with shipping dimensions.

b. Pumping Assembly. The pumping assembly of the Tank and Pump Unit, includes the engine, pump, filter / separator, reels and hose, and other related items of equipment (fig. 1-2 and 1-3).

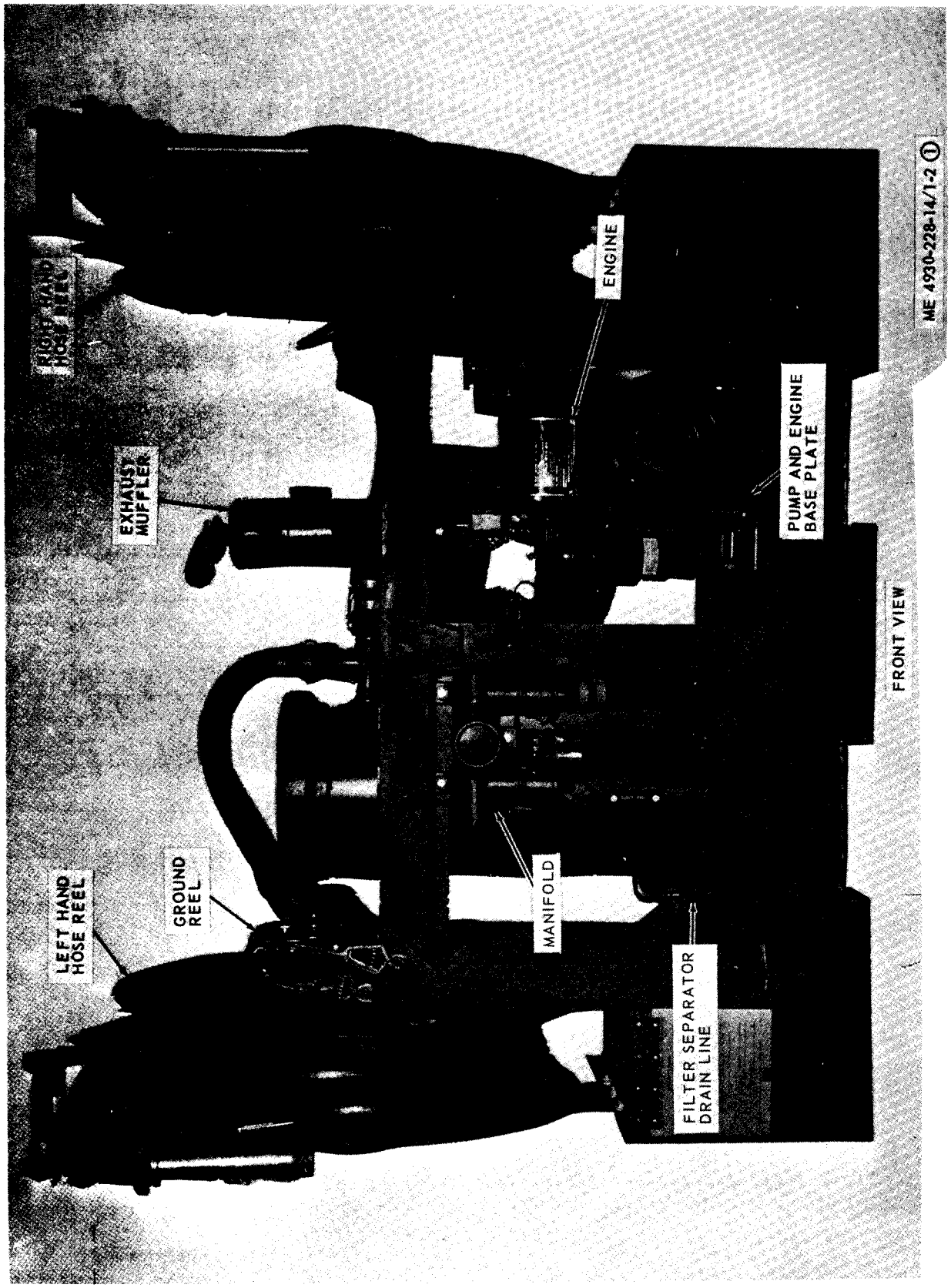


Figure 1-2. Pumping assembly, front and rear view. (sheet 1 of 2).

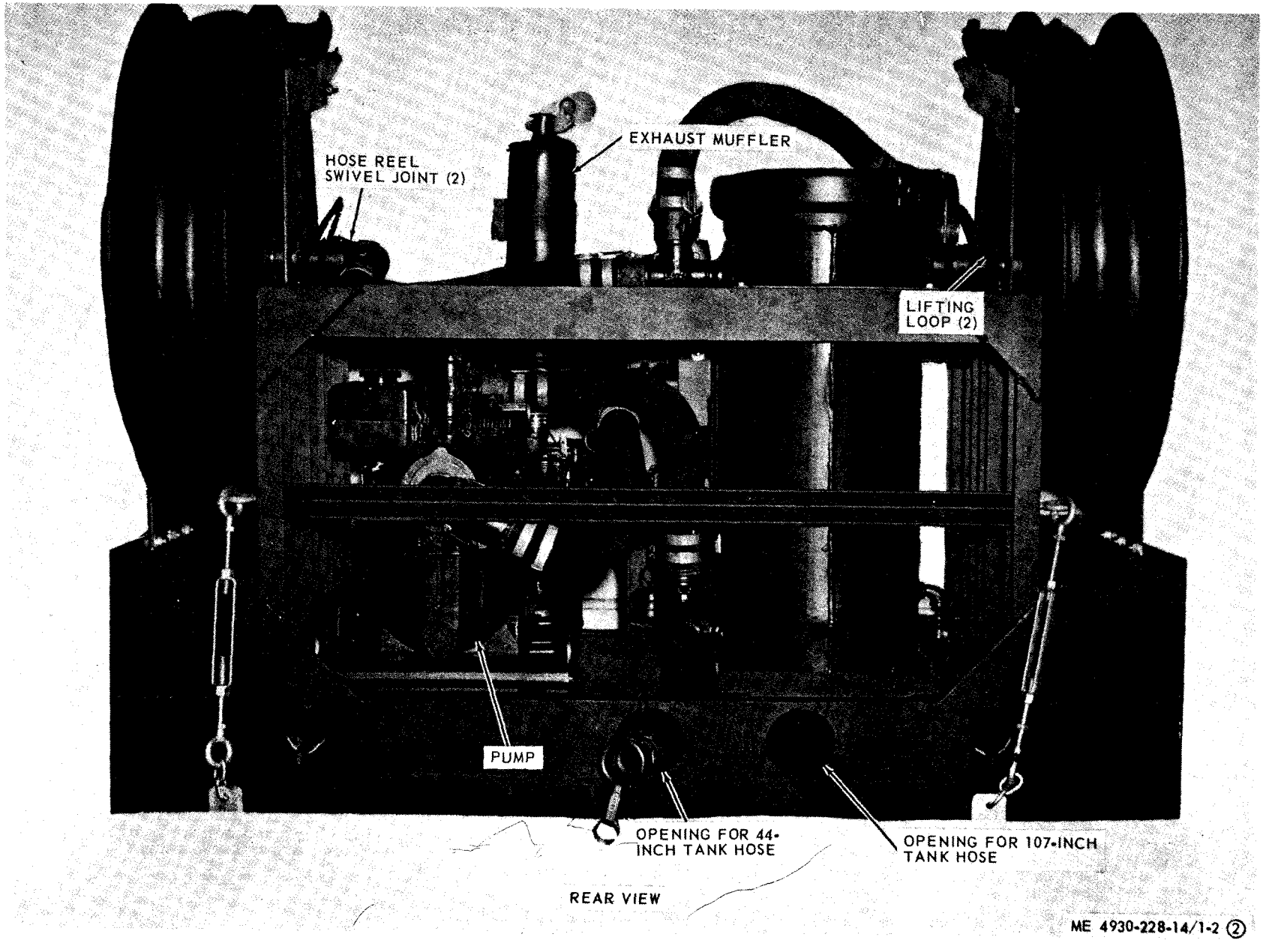


Figure 1-2. Pumping assembly, front and rear view (sheet 2 of 2).

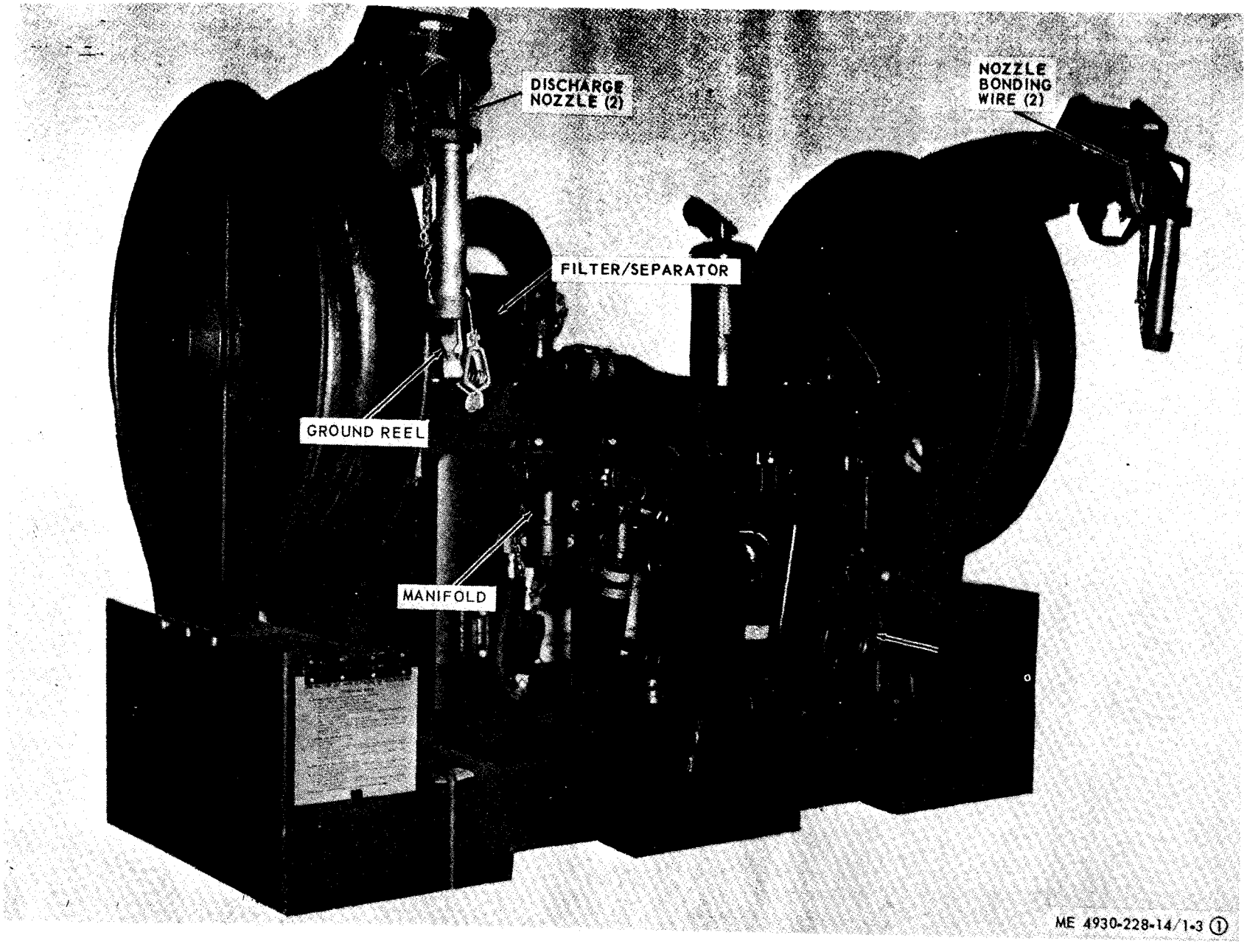


Figure 1-3. Pumping assembly, front and rear, three-quarter view. (sheet 1 of 2).

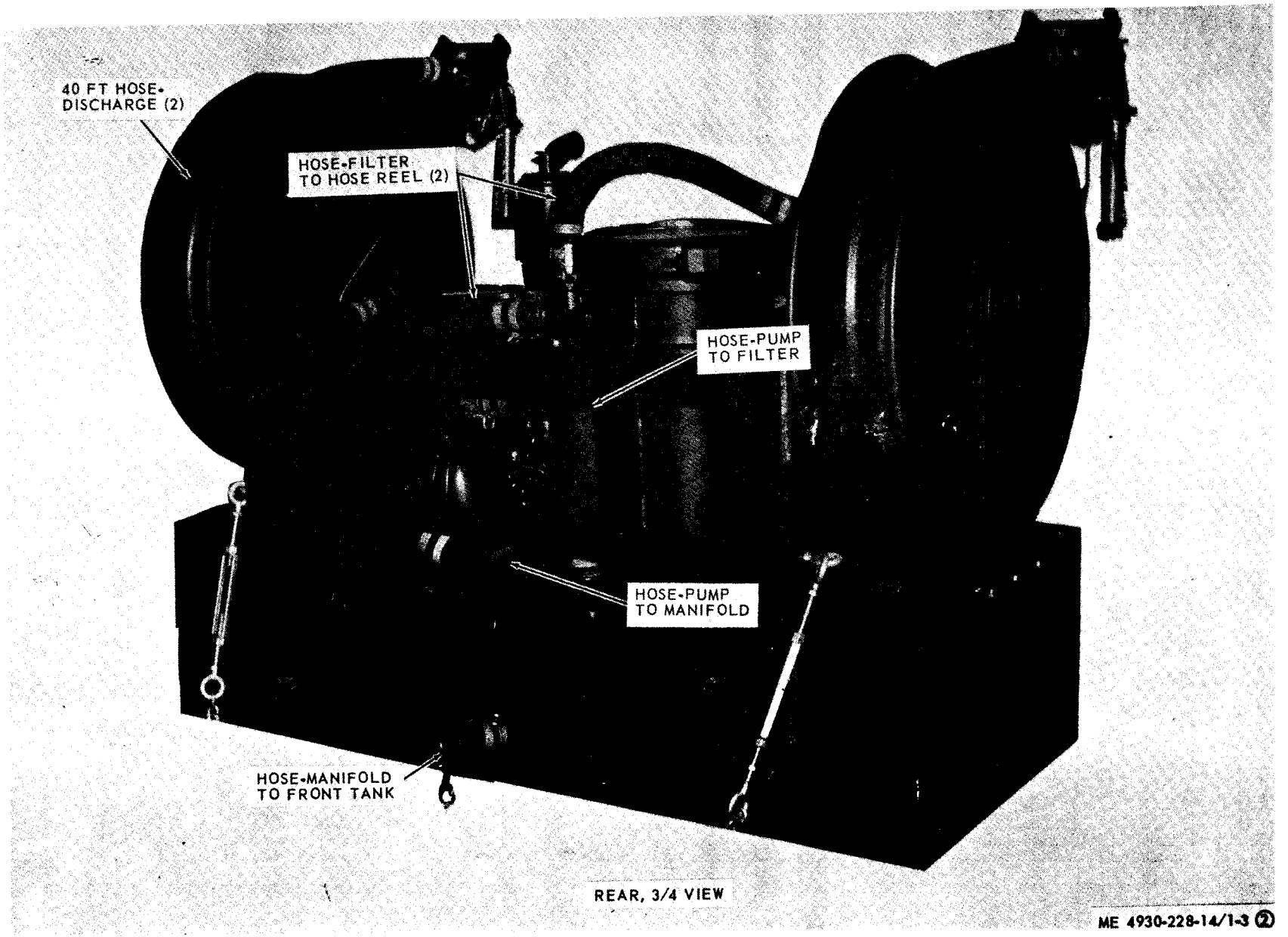


Figure 1-3. Pumping assembly, front and rear, three-quarter view. (sheet 2 of 2).

c. Pump. The pump (fig. 1-4) is self-priming unit, with the impeller screwed directly on the extension of the engine crankshaft. The pump and engine are mounted on a base plate to facilitate removal for use in auxiliary pumping operations.

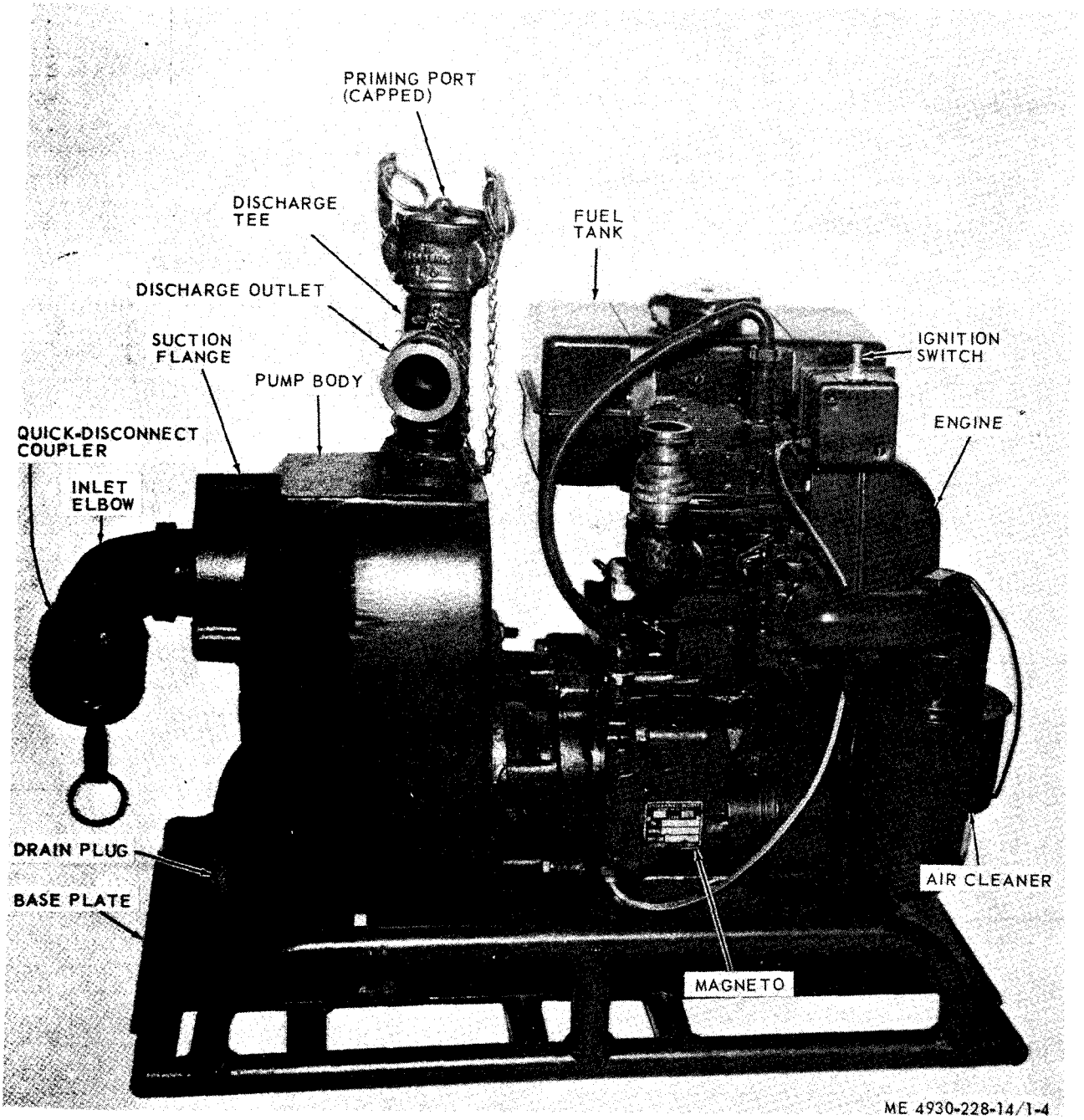


Figure 1-4. Pump and engine assembly, three-quarter view.

d. Engine. The engine (fig. 1-2) is a one-cylinder, 4-cycle, air-cooled, hand-cranked, gasoline engine. It is provided with a radio-interference suppressed magneto and a governor that controls engine speeds to suit pump loads as the throttle setting is varied.

e. Filter/Separator. The filter / separator (fig. 1-3) is a vertical, 50-gpm unit designed for a maximum operating pressure of 75 psi (pounds per square inch). Both solids and water (free from entrained water) are removed from the fuel through coalescing and filtering medium of the elements inside the filter separator. The filter / separator has four canisters and filter elements, one differential pressure indicator, one water sight gage, and one

drain cock. Solid contaminants are deposited in the elements. The emulsified or entrained water coalesces within the elements and settles to the deck plate where it is removed periodically, through the drain as free water. Clean product builds up in the shell and is pumped to the hose reels. Refer to figure 1-5 for the flow of the pumped product.

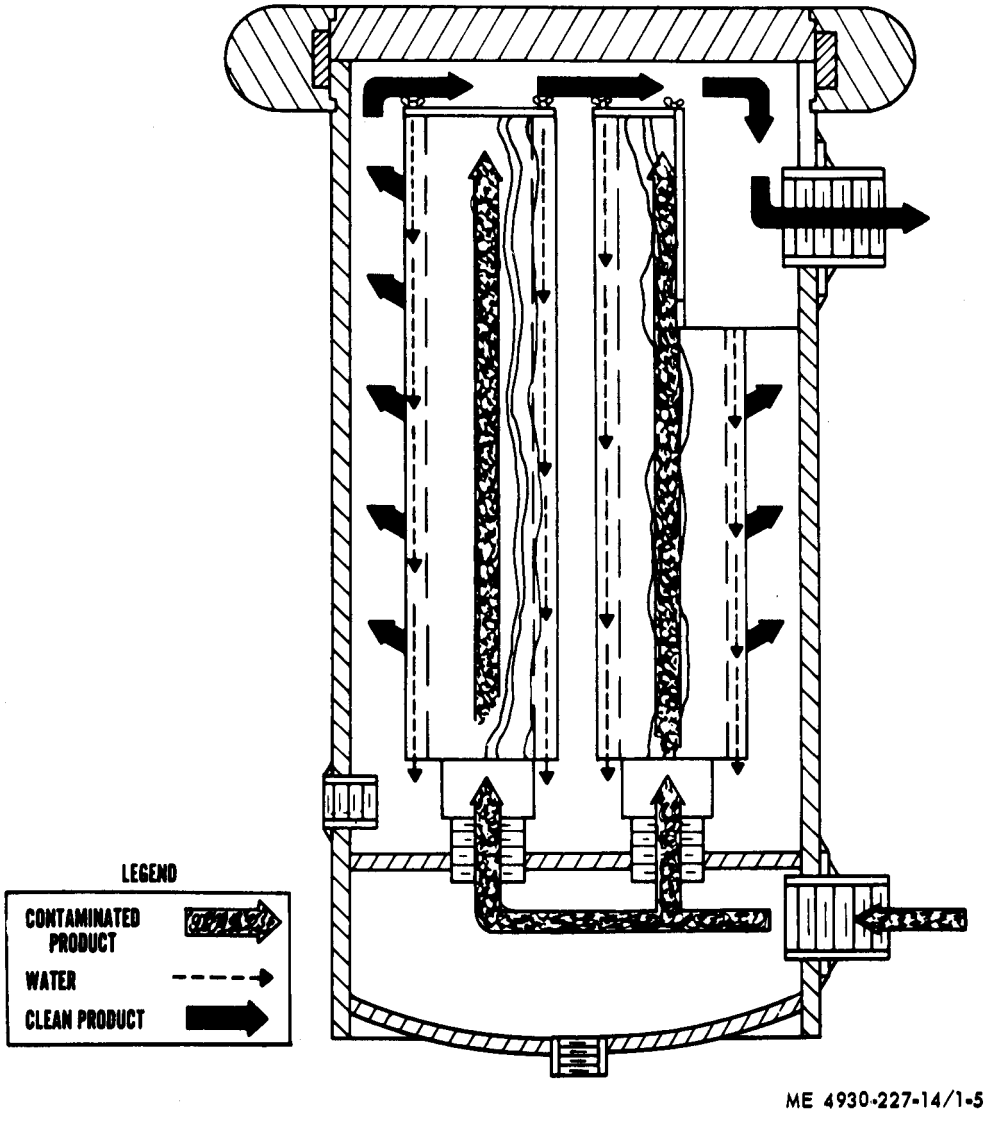


Figure 1-5. Filter / separator flow chart.

1-8. Tabulated Data

a. Identification. The tank and pump unit has three major identification and instruction plates,

(1) *Engine manufacturers identification plate.* This plate is located on the top front of the engine shroud. It specifies the model, serial number, size, rpm, specification number, net continuous brake horsepower, and date of manufacture,

(2) *Tank and pump unit operation data plate.* Located on the lower left frame, the plate specifies pre-operation procedures, engine starting and stopping instructions, and pumping instructions.

(3) *Tank identification plate.* This plate is located on the top-center, rear of each of the two tan ks. It specifies capacity, Federal stock number, serial number, manufacturer, date of manufacture, contract number, weight (empty), and note of fuel weight (in pounds per gallon).

b. Operator's Tabulated Data.

(1) *Capacities:*

Engine fuel tank . . . . . 1 gal. (gallon)
Engine air cleaner . . . . . 1 gal.
Engine crankcase . . . . . 1 qt. (quart)
Tank . . . . . 600 gal.

(2) *Dimensions and Weights:*

(a) Pumping assembly:

Length	64 in. (inches)
Width	28 in.
Height	49 in.
Weight	690 lb. (pounds)

(b) Tank:

Length	56 in.
Width	72 in.
Weight	410 lb.

c. Organizational Maintenance Tabulated Data.

(1) *Engine:*

Manufacturer	Teledyne Wisconsin Motor
Model	MBKND
Specification	.352934
RPM	3,000
Net continuous bhp (brake horsepower)	4.49 at 3,000 rpm
Type	4 cycle
Bore	.2 7/8 in.
Stroke	2 3/4 in.
Displacement	17.8 cu. in. (cubic inch)
Lubrication.	splash
Cooling	Air

(2) *Carburetor;*

Manufacturer	Zenith Carburetor Company
Model	11193-A
Type	Float feed

(3) *Spark plug:*

Manufacturer	Auto-lite Division, Ford Motor Co.
Number	BR8S

(4) *Magneto:*

Manufacturer	Fairbanks Morse
Model	FMPE1B7

(5) Adjustment data :

Spark plug gap	0.030 In.
Magneto point gap	0.015 in.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. OPERATING PROCEDURES

2-1. General

This section contains instructions required for operation of the tank and pump unit. It provides the instructions that are required by the operator for efficient operation of the unit under normal conditions.

2-2. Controls and Instruments

The purpose of the controls and instruments and their normal position and readings are shown by figure 2-1.

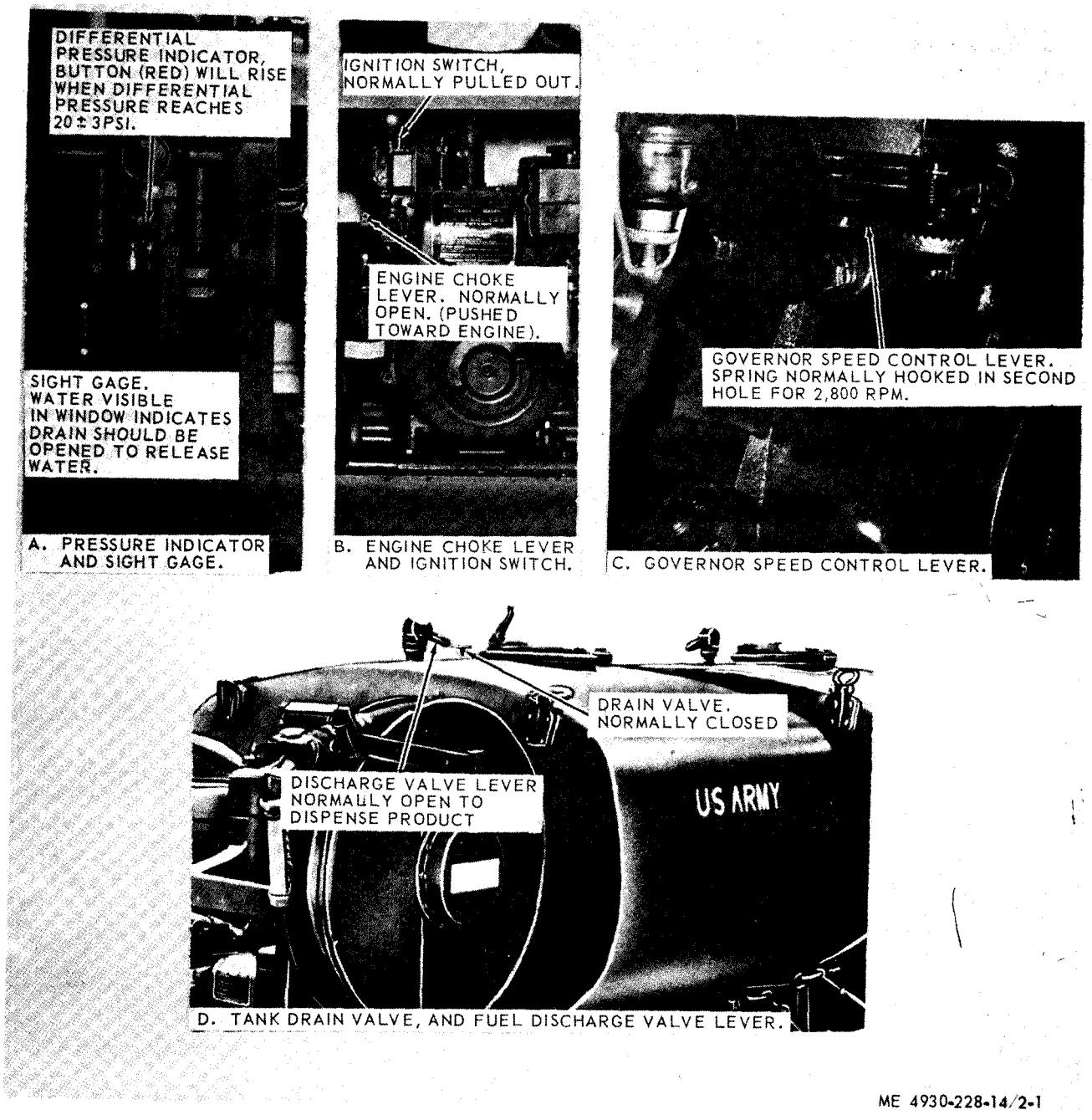


Figure 2-1. Controls and instruments.

2-3. Starting

a. Preparation for Starting.

(1) See that suction hoses connecting tanks to pumping assembly are properly secured. Ground pumping assembly before starting to fill the 600 gallon tanks.

(2) Drive ground rod into earth near pumping assembly.

(3) Pull ground wires from ground reel (fig. 1-2) and ground one wire securely to ground rod. Attach other wire to vehicle being fueled.

CAUTION

Always clip lead to ground rod before attaching lead to vehicle being fueled.

(4) Open only the fuel cap of the tank being filled. Do not fill two tanks at the same time unless operator has an assistant. Do not over-fill the tanks. If fuel is spilled, wash the area of spillage thoroughly with water.

(5) Maintain a distance of 25 feet between vehicles being fueled.

(6) Observe the water sight-gage window (fig. 2-1). Water should not be visable in sight window.

(7) Check window frequently for presence of water and drain when necessary.

NOTE

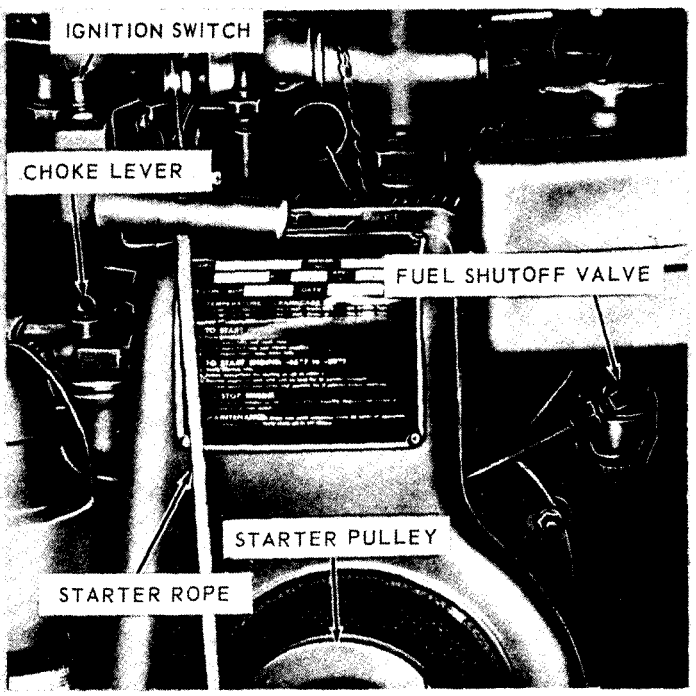
A drain cock is located at the bottom of the left side of the filter / separator for draining water.

(8) Prime pump through priming port (fig. 1-4) if necessary.

NOTE

Priming should not be necessary when tanks are full.

b. Starting. Refer to figure 2-2 and start the engine.



STARTING:

STEP 1. OPEN FUEL SHUTOFF VALVE (TURN COUNTERCLOCKWISE).
STEP 2. PULL IGNITION SWITCH OUT.
STEP 3. PULL OUT CHOKE LEVER TO CLOSE CHOKE.
STEP 4. WIND ROPE CLOCKWISE AROUND PULLEY AND PULL SHARPLY.
STEP 5. OPEN CHOKE HALFWAY, REWIND ROPE, AND PULL HARD AGAIN. UNDER NORMAL CONDITIONS, ENGINE SHOULD START AFTER ONE OR TWO ATTEMPTS.
STEP 6. ALLOW ENGINE TO RUN AT MODERATE SPEED FOR SEVERAL MINUTES TO WARM UP. FULLY OPEN CHOKE.

CAUTION: NEVER RACE THE ENGINE DURING WARM-UP PERIOD.

ME 4930-228-14/2-2

Figure 2-2. Engine starting instructions.

2-4. Unit Operation

a. General.

(1) The tank and pump unit is used to dispense all types of automotive and aviation fuel. However, only one grade of fuel should be carried in and dispensed from the unit at a time. Since the pumping assembly is highly adaptable, dispensing with the tank and pump unit may be done in a variety of ways to meet different situations in the field. This paragraph covers some common operational procedures for the tank and pump unit in the field.

WARNING

All aircraft fuel must be dispensed through a filter / separator unit. It is mandatory that the performance of filter / separators on all aircraft refuel ing equipment be checked every 30 days through submission of samples taken from the effluent stream of the filter / separator.

(2) Upon request, the petroleum representative will furnish sample containers to components of the Army, Army National Guard, or Reserve operating aircraft refueling equipment. Samples will be sent to the petroleum laboratory designated by the petroleum representative. In the event that a sample indicates unsatisfactory performance of filter / separator equipment, the submitting activity will be notified by telephone and will be advised to change the filter / separator elements (AR 703-1, 1 Apr 1971).

b. Dispensing from Truck Tanks Through Reels.

WARNING

Be sure proper grounding procedures have been followed prior to performing any of the following operations.

(1) Lower tailgate and ground the unit (para 2-3). Attach one end of the ground wire to the aircraft or vehicle to be fueled.

(2) Pull out dispensing hoses to desired length. Attach nozzle bonding wires (fig. 1-3) to aircraft or vehicle before opening filler caps and inserting nozzles.

(3) Insert nozzles in vehicle or equipment fuel tanks carefully, but firmly, to form a bond; observe safe fueling rates stenciled near fuel tanks.

CAUTION

When dispensing fuel, attend the nozzles constantly; do not wedge open or block the control lever.

(4) Open a tank discharge valve and start pump. Opening a discharge valve with full tanks should prime the pump.

(5) Be sure that fuel to be dispensed to an aircraft is the same grade as that stenciled near the aircraft filler caps; note tank capacities and ask the pilot or flight engineer for estimate of quantities needed to avoid spillage.

NOTE

When topping off small tanks, it may be necessary to reduce engine speed in order to reduce pressure surging at the hose and nozzle.

WARNING

Replace filler cap securely before removing the nozzle bonding wire.

NOTE

Recap, wind, and secure nozzle bonding wire around nozzles when through dispensing.

(6) Open second discharge valve just before first tank is emptied, and close first discharge valve when the tank is empty.

(7) Open drain valve to completely drain tank, then close drain valve.

(8) Stop pump when operation is completed; drain hoses if shutting down for longer than overnight; rewind hoses, rewind ground wire and remove nozzles and stow.

(9) Refill tanks at the end of the day's operation to reduce condensation during overnight storage.

2-5. Stopping

Refer to figure 2-3 and stop the engine.

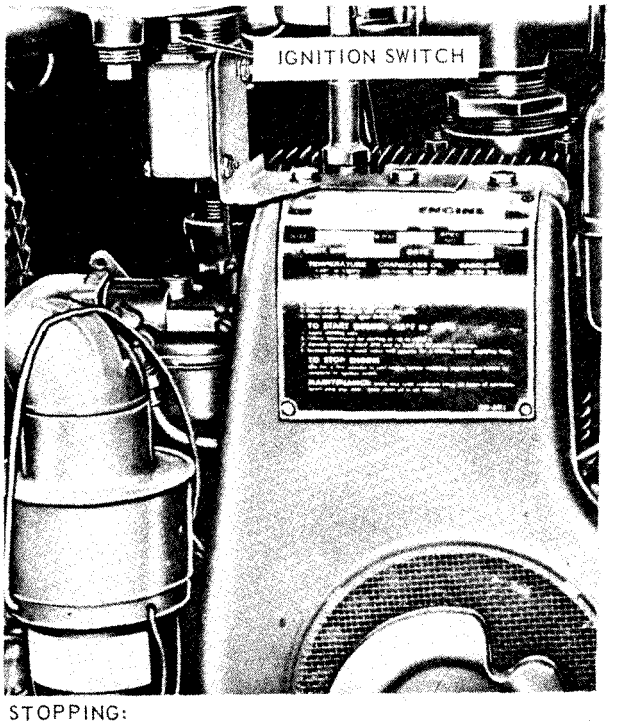


Figure 2-3. Engine stopping instructions.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-6. General

This section contains information on the fueling meter. The fueling meter is a volumetric, positive-displacement, liquid-measuring device, used when refueling aircraft or any vehicle which requires a specific measurement of the product. It is equipped with a five-figure reset counter and a non-setback totalizer that registers to 9,999,999 gallons.

2-7. Fire Extinguisher (Dry-Chemical Type)

a. Description. The dry-chemical type fire extinguisher is suitable for electrical and flammable liquid fires.

b. Operation. Remove fire extinguisher from mounting bracket. Release nozzle from holster. Pull pin. Press lever all the way down to pressurize extinguisher. Hold extinguisher upright, squeeze nozzle lever to fully open and direct discharge at base of flame, using rapid side-to-side sweeping motion. Always keep flames ahead of dry chemical charge.

2-8. Metering Kit

A metering kit (FSN 4930-088-7665) is available for pumping assemblies on an as required basis. Refer to figure 2-4.

2-9. Meter Register Operation

To reset indicating wheels to zero, push in and turn reset knob on right side of register.

CAUTION

Do not start delivery unless shutter is in full open position. If numbers on indicating wheels are not in full view, resetting operation has not been completed; in which case, turn reset knob until shutter disappears and reset knob returns to its normal position. Instructions for adjustments and repairs are furnished with the metering kit.

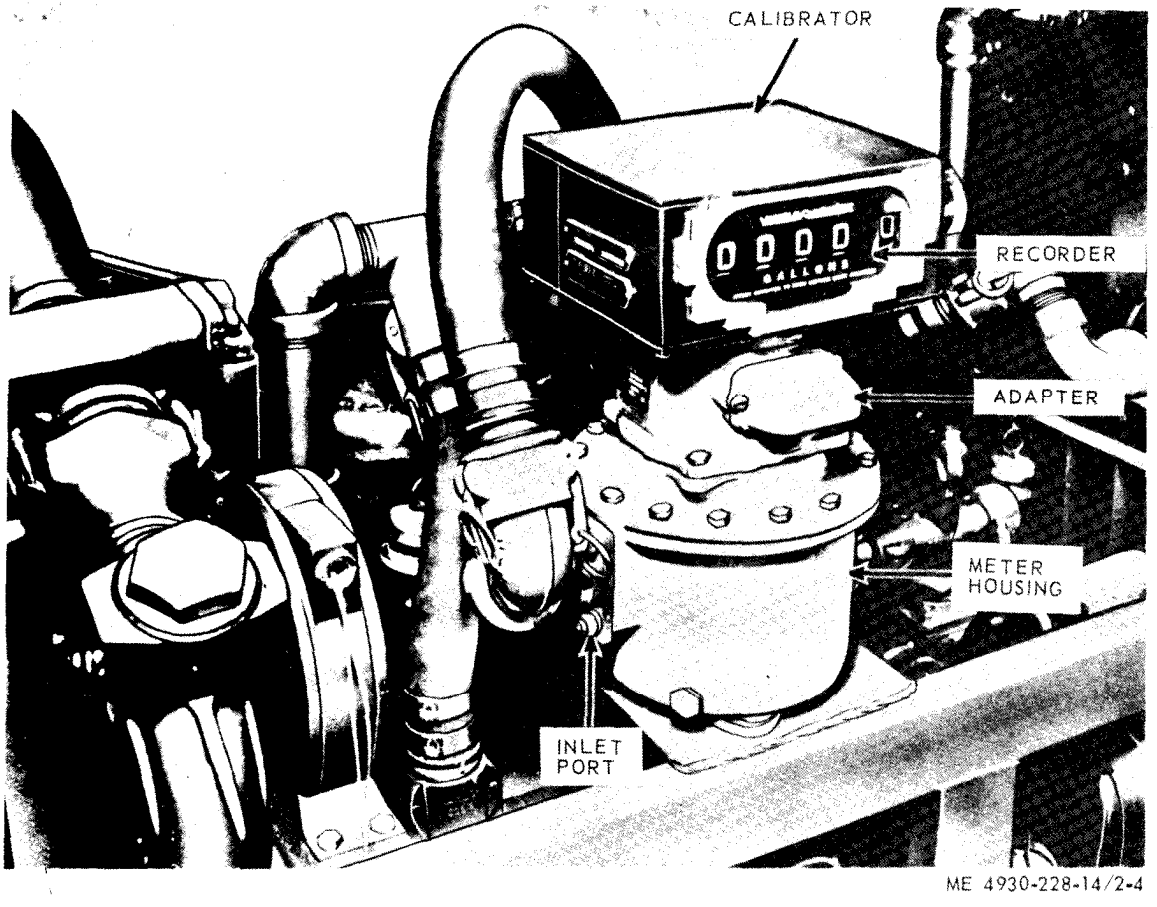


Figure 2-4. Metering kit.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

2-10. General

This section contains instructions for operation of the equipment under unusual conditions. These instructions supplement those given under usual conditions which in most instances must still be followed.

2-11. Operation in Extreme Cold

a. General. In extreme cold weather it may be necessary to reduce the volume of cooling air flowing through the engine. This may be accomplished by obstructing the air intake at the flywheel. Exercise care not to cause engine overheating.

b. Fuel System. Keep the fuel tank full to reduce condensation of moisture inside the tank. Clean the fuel filter bowl more frequently. Keep the fuel tank cap free of ice and snow.

c. Ignition System. Before starting, remove all accumulated snow and ice from the spark plug, ignition cable, and magneto.

WARNING

Do not touch metal parts with bare hands in extremely cold weather.

d. Starting (-25° to -65°F).

CAUTION

Be sure the pump is full of product before starting. Prime, if necessary.

(1) Spray a small amount of engine primer fuel (FSN 6850-823-7861) in the opening of the engine air cleaner.

(2) Follow the instructions for starting under normal conditions (para 2-3).

(3) Operate the engine at 1800 rpm (medium speed) without load for a minimum of 3 minutes.

2-12. Operation in Extreme Heat

a. General. Accumulated dirt on engine reduces radiation of heat. Keep the unit clean to avoid overheating.

b. Cooling System.

(1) Keep the engine cooling fins clean.

(2) Keep all exposed surfaces of the engine clean.

(3) Remove all obstructions to the flow of air across the engine.

c. Lubrication. Refer to the current lubrication order and lubricate the unit.

d. Pumping Unit. Where possible, operate the pumping unit in the shade to avoid overheating and do not run the engine too hard. If the engine overheats, remove the load and idle the engine at 1,000 rpm for five minutes. If fuel vapor lock occurs, wait until the engine cools off.

e. Tanks and Hoses. Locate the tanks in the shade, where possible, and wet down with water to reduce heat.

2-13. Operation in Dusty or Sandy Areas

a. Protection. Take advantage of natural barriers to blowing sand and dust; or, if necessary, erect artificial barriers.

b. Air Cleaner. Service the air cleaner frequently (fig. 3-1).

c. Filter/Separator Element. Service the filter / separator frequently (fig. 3-4).

d. Cleaning. Clean the tank and pump unit with an approved cleaning solvent, giving special attention to cavities, corners, and partially exposed interior spaces. Dry thoroughly. Keep the tank and area around the discharge valve and controls free from sand and dust.

2-14. Operation Under Rainy or Humid Conditions

When the unit is outside and not operating, keep the fuel tank full to prevent the forming of condensate. Give special care to keeping all components free from moisture. Clean and paint all surfaces not otherwise protected.

2-15. Operation in Salt Water Areas

Salt water corrodes metal. If unpainted equipment parts are exposed to salt water, clean them off immediately with an approved cleaning solvent, and dry thoroughly. All surfaces should be cleaned daily.

2-16. Operation at High Altitudes

The unit is designed to operate at 8,000 feet above sea level without special adjustments. However. at higher altitudes, the carburetor may require adjustment (fig. 4-14).

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. General Lubrication

Refer to Lubrication Order for general lubrication information.

3-2. Detailed Lubrication

a. Operation After Lubrication. If the crankcase oil has been changed, operate the engine for approximately 5 minutes before checking the oil level. Inspect the engine for oil leaks.

b. Air Cleaner Service. Refer to figure 3-1 and service the air cleaner.

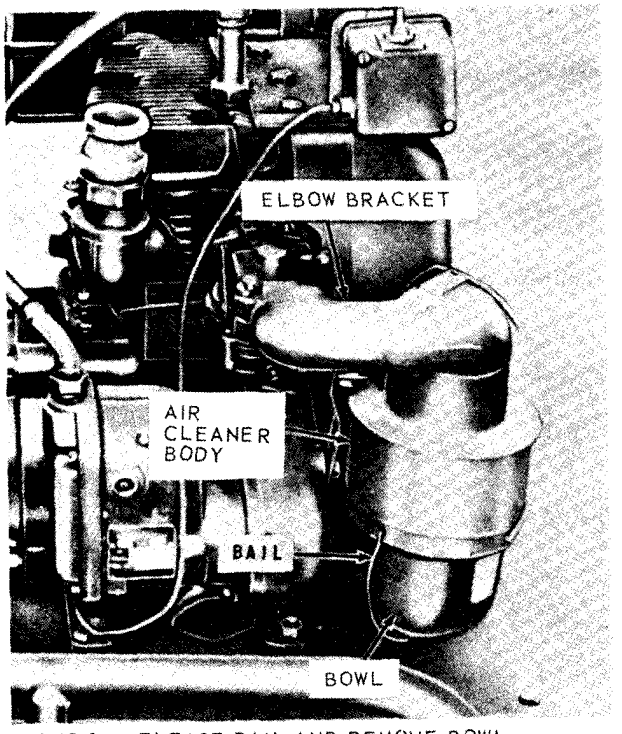


Figure 3-1. Air cleaner service.

Section II. OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-3. General

To insure the tank and pump 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 preventive maintenance checks and services to be performed by the operator are listed and described in paragraph 3-4. The sequence numbers indicate the sequence of minimum inspection requirements. Defects discovered during operations 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. Only those faults that cannot be corrected by the operator / crew, or that are corrected by replacing parts will be recorded on DA Form 2404 (Equipment Inspection and Maintenance Worksheet).

3-4. Operator's Preventive Maintenance Checks and Services

a. Table 3-1 contains a tabulated list of preventive maintenance checks and services which must be performed by the operator.

b. The interval and sequence column indicates the required service interval.

Table 3-1. Operator's Preventive Maintenance Checks and Services

B-Before operation Time required: 0.6 | D-During operation Time required: 0.2 | A-After operation Time required: 0.3 | **W-Weekly** Time required: 0.6

Interval and sequence no.				Item to be inspected procedure	Work time (M / H)
B	D	A	W		
1			9	FUEL TANK Inspect the fuel tanks for leaks and damage. Inspect the screen for dirt. Clean a dirty screen. Add fuel as required.	0.1
2			10	FUEL STRAINER Inspect the fuel strainer for dirt. Clean if dirty.	0.1
3			11	AIR SHROUD SCREEN Inspect the air shroud screen for dirt. Clean if dirty.	0.1
4		7	12	OIL LEVEL GAGE Inspect the oil level gage for proper oil level. Refer to the current lubrication order and add oil if necessary.	0.1
5	6	8	13	FILTER / SEPARATOR Inspect the filter / separator for leaks and damage. Inspect the sight window for accumulation of water. Open drain cock and drain water. In no event should accumulated water be allowed to get higher than the line marked on the sight window. Observe pressure differential indicator during operation. Replace filter elements when differential pressure indicator button is in raised position during normal operation.	0.2

Section III. OPERATOR'S TROUBLESHOOTING

3-5. General

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the tank and pump 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 causes and corrective actions to take. You should perform the tests / inspections and corrective actions in the order listed.

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

3-6. Operator's Troubleshooting

For operator's troubleshooting information, refer to table 3-2.

Table 3-2. Operator's Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. ENGINE FAILS TO START
Step 1. Check ignition switch for ON position. Turn ignition switch on.
Step 2. Check for empty fuel tank. Refill fuel tank if empty or low.
2. ENGINE STARTS BUT FAILS TO CONTINUE RUNNING
Step 1. Check to determine that choke lever is in proper position. Position choke lever to obtain smooth running.
Step 2. Check for empty fuel tank. Refill fuel tank if empty or low.
Step 3. Check to see if fuel strainer is dirty. Clean fuel strainer if dirty.
3. ENGINE OVERHEATS
Step 1. Check for dirty air shroud screen. Clean screen if dirty.
Step 2. Check engine for dirty exterior. Clean engine if dirty.
4. FUEL FLOW FROM NOZZLE LOW
Step 1. Check pump for correct operation and engine speed. Adjust engine speed.
Step 2. Check suction hose couplings for leakage. Replace non-metallic washers.
Step 3. Check for dirt in screen of nozzle spout. Remove screen and clean with solvent.
5. FILTER/SEPARATOR LEAKS FUEL
Step 1. Check filter / separator at top for fuel leaks. Replace cover gasket.
Step 2. Check filter / separator for other leaks. If other leaks are found, notify your supervisor.
6. PUMP FAILS TO PUMP PRODUCT
Step 1. Check to see that engine speed is not too low. Increase engine speed if low.
Step 2. Check to see that pump is primed. Prime pump if necessary.
Step 3. Check suction hose couplings for leakage. Replace the non-metallic gaskets.

Table 3-2. Operator's Troubleshooting-continued

MALFUCNTION TEST OR INSPECTION CORRECTIVE ACTION
7. PRODUCT DISCHARGE IS DIRTY
Step 1. Check for excessive differential pressure. Service filter/separator if dirt is causing high pressure.
Step 2. Check to find loose filter element. Seat filter element if loose.
Step 3. Check to find if inside of filter /separator is dirty. Clean inside of filter separator if dirty.
Step 4. Check for ruptured filter elements. Replace ruptured elements.

Section IV. FUEL TANK SCREEN, FUEL STRAINER, AND FILTER / SEPARATOR MAINTENANCE PROCEDURES

3-7. General

This section contains the maintenance instructions for the tank and pump unit that are applicable to the operator.

3-8. Fuel Tank Screen Service

Refer to figure 3-2 and service the fuel tank screen.

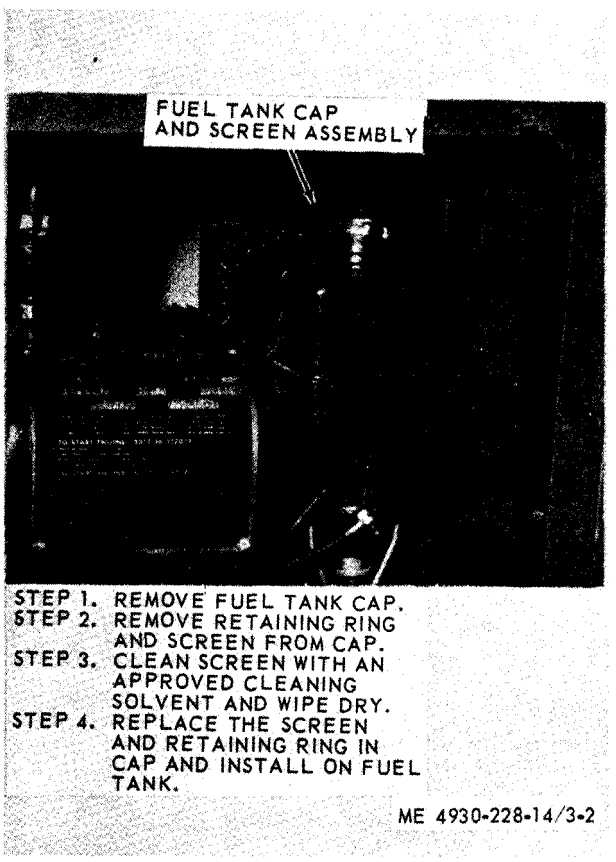


Figure 3-2. Fuel tank screen service.

3-9. Fuel Strainer Service

Refer to figure 3-3 and service the fuel strainer.

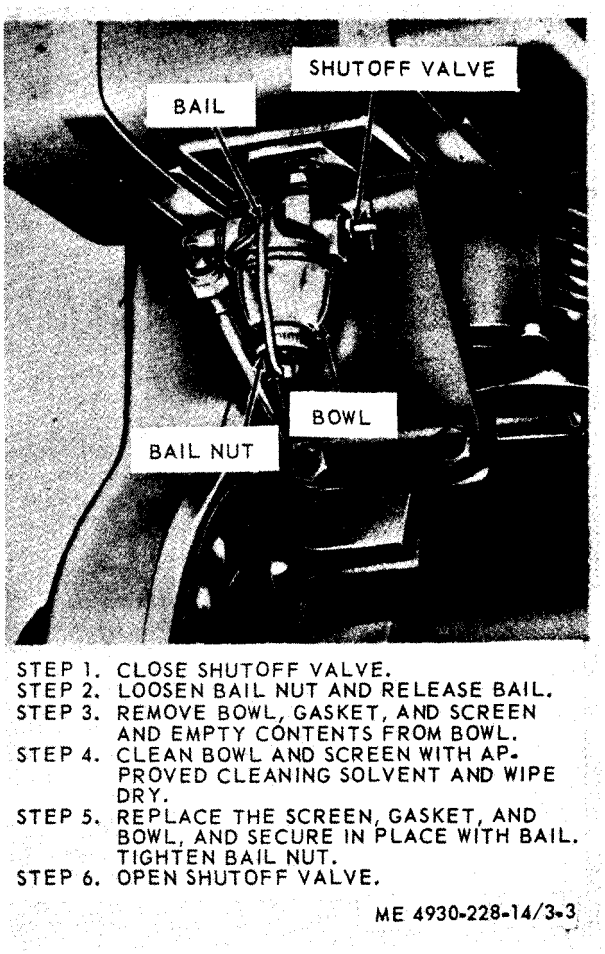
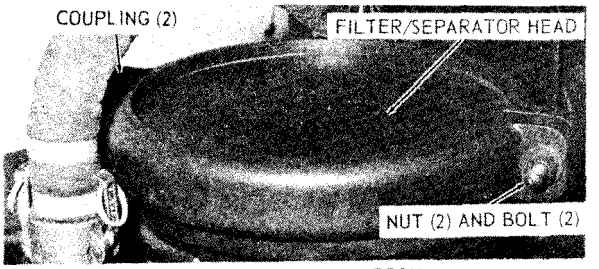


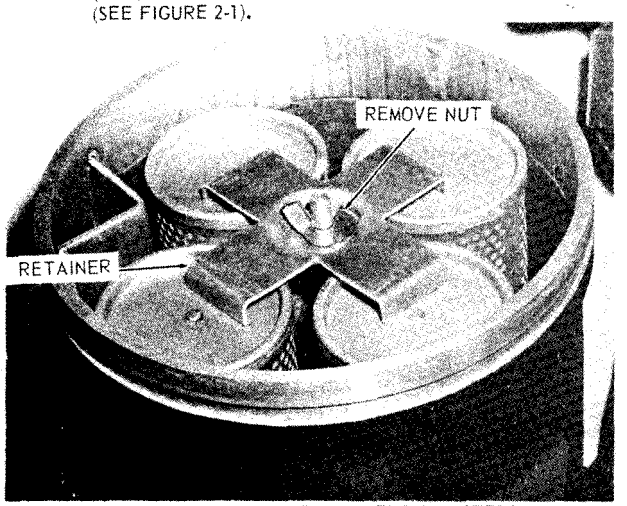
Figure 3-3. Fuel strainer service.

3-10. Filter / Separator Service

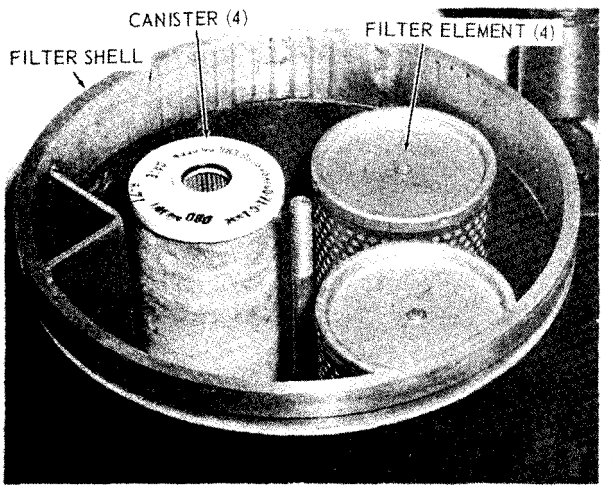
Refer to figure 3-4 and service the filter / separator.



STEP 1. REMOVE NUT (2) AND BOLT (2) FROM COUPLINGS AND REMOVE COUPLINGS.
STEP 2. REMOVE FILTER/SEPARATOR HEAD.
NOTE: ELEMENTS SHOULD BE REPLACED IF DIFFERENTIAL PRESSURE BUTTON (RED) POPS UP DURING OPERATION. (SEE FIGURE 2-1).



STEP 3. REMOVE THE RETAINER FROM THE CANISTERS



STEP 4. REMOVE THE FOUR CANISTERS AND FILTER ELEMENTS. REMOVE AND DISCARD THE ELEMENTS.
STEP 5. CLEAN THE FILTER SHELL WITH APPROVED CLEANING SOLVENT. INSTALL NEW ELEMENTS. REPLACE CANISTERS, HEAD, AND COUPLINGS.

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Figure 3-4. Filter / separator service.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

4-1. Inspecting and Servicing Equipment

a. Inspection.

(1) Inspect the identification plates for positive identification of the equipment.

(2) Make a thorough inspection of the pumping assembly and tanks for damage which may have occurred during shipment,

(3) Check the equipment against the packing list to make certain all items are accounted for and in serviceable condition.

(4) Inspect the components for loose or missing mounting hardware and loose connections.

(5) Turn the engine with the starter rope to make sure all moving parts are free.

b. Servicing.

(1) Lubricate the engine in accordance with the current lubrication order.

(2) Perform preventive maintenance checks and services (para 4-9).

4-2. Installation.

a. General. The tank and pump unit is designed for mounting in trucks. Three types of blocking frames have been devised to prevent shifting of the tank and pump unit during movement, particularly on rough terrain. Section 1 (fig. 4-1) is used in the 5-ton. 6 x 6 cargo truck M-54 and prevents longitudinal movement. Sections 2 and 3 are also used in the M-54 cargo truck, and in the 2 1 / 2-ton, 6 x 6 cargo trucks M-35 and M-211. They are designed to prevent side movements of the tank and pump unit. Construct frames in empty truck bed for ease in measuring lengths of lumber and assembling frames. Install tank and pump unit between the frames when the frames are constructed. Complete installation instructions are given in b below. Dimensions shown in figure 4-1 must be altered slightly to take care of individual differences in dimensions of equipment. Before constructing blocking frames, check measurements of the track bed and tank skids to determine centerline for mounting of tanks. The tanks must be centered so that section 2 blocking frames will fit properly. Also determine centerline of pumping assembly so that section 3 blocking frames will fit properly. As an alternate method, tank and pump unit may be temporarily centered in truck bed and an outline made along sides of tank skids and pumping assembly to check dimensions used in constructing blocking frames.

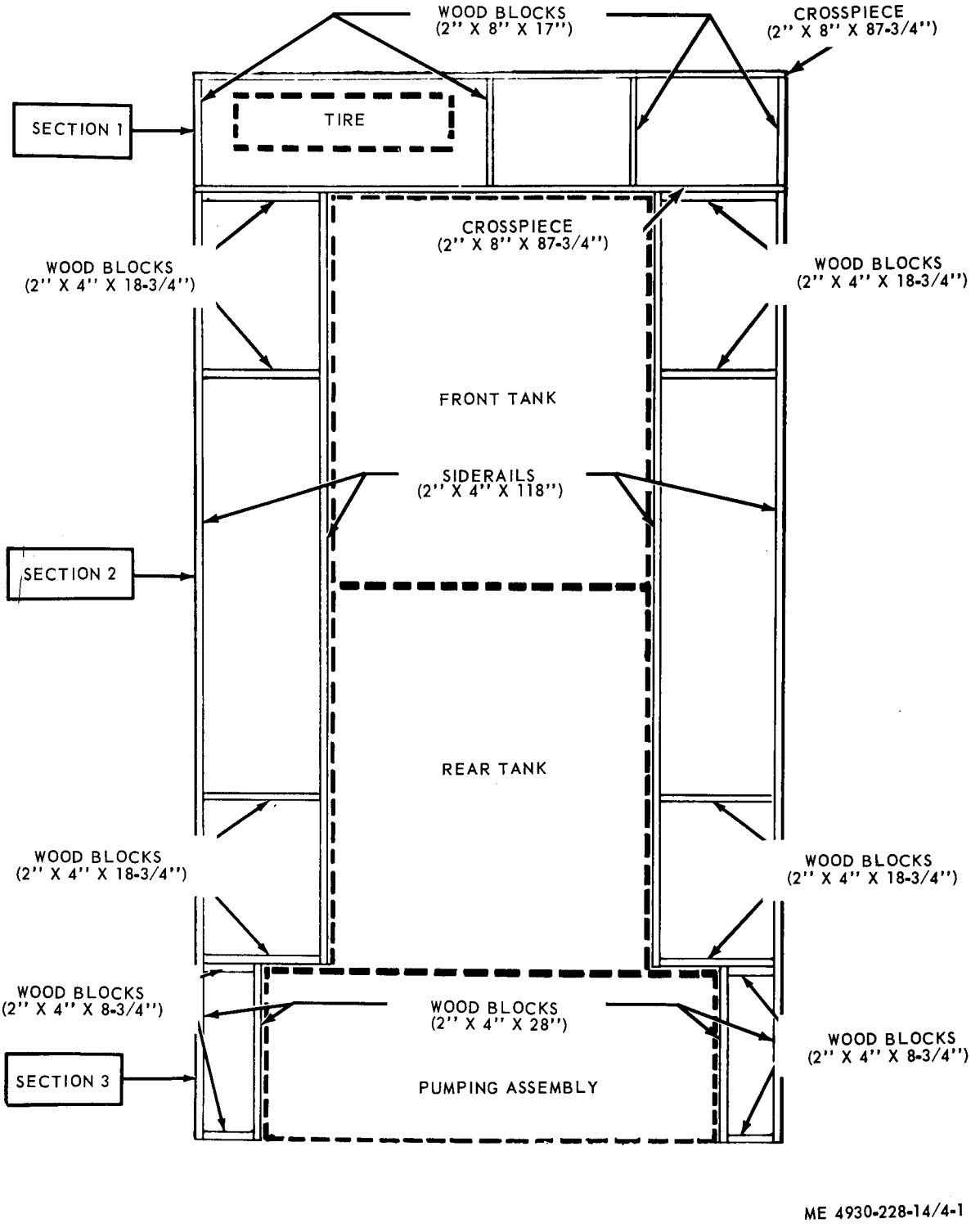


Figure 4-1. Blocking instructions.

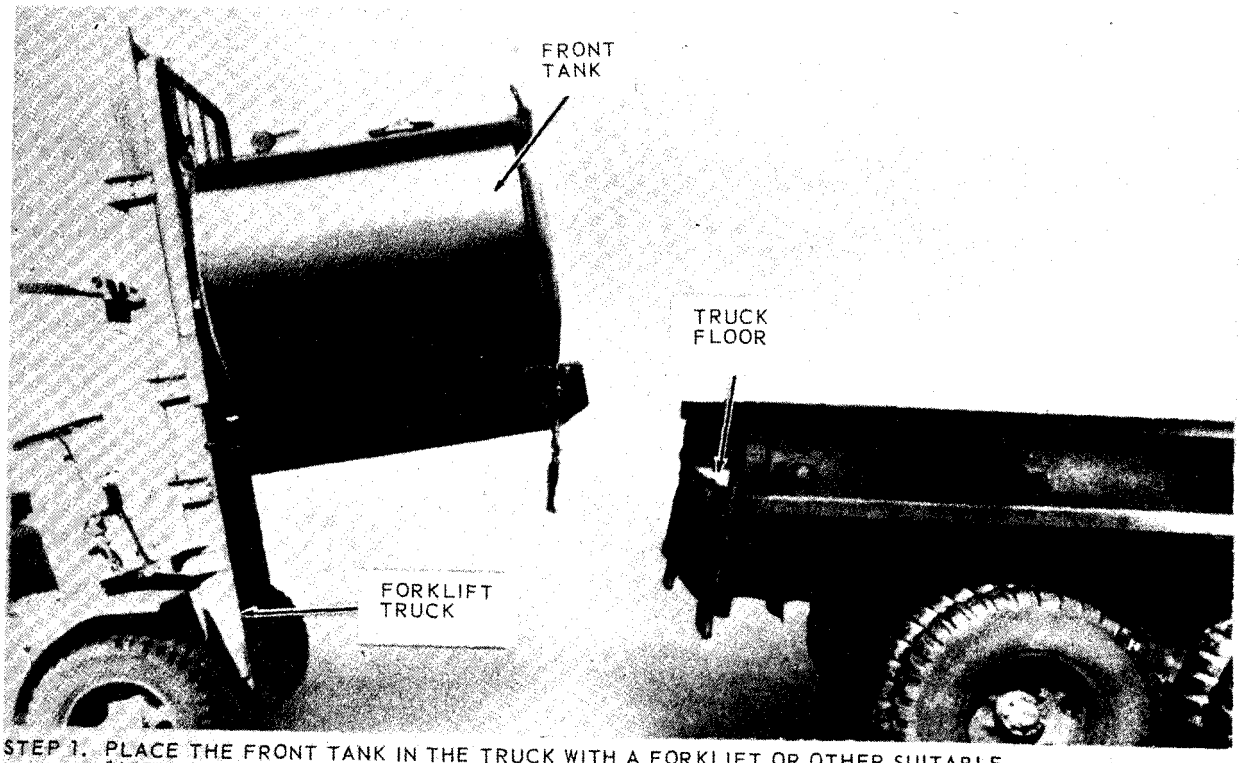
b. Installation.

(1) Lower tailgate of truck and remove tarpaulin, bows, and racks with seats. Install sectional blocking frame support in M-54 cargo truck by lifting spare tire assembly and sliding the blocking frame to a position against the rear end of the truck body. Let spare tire rest against rear crosspiece.

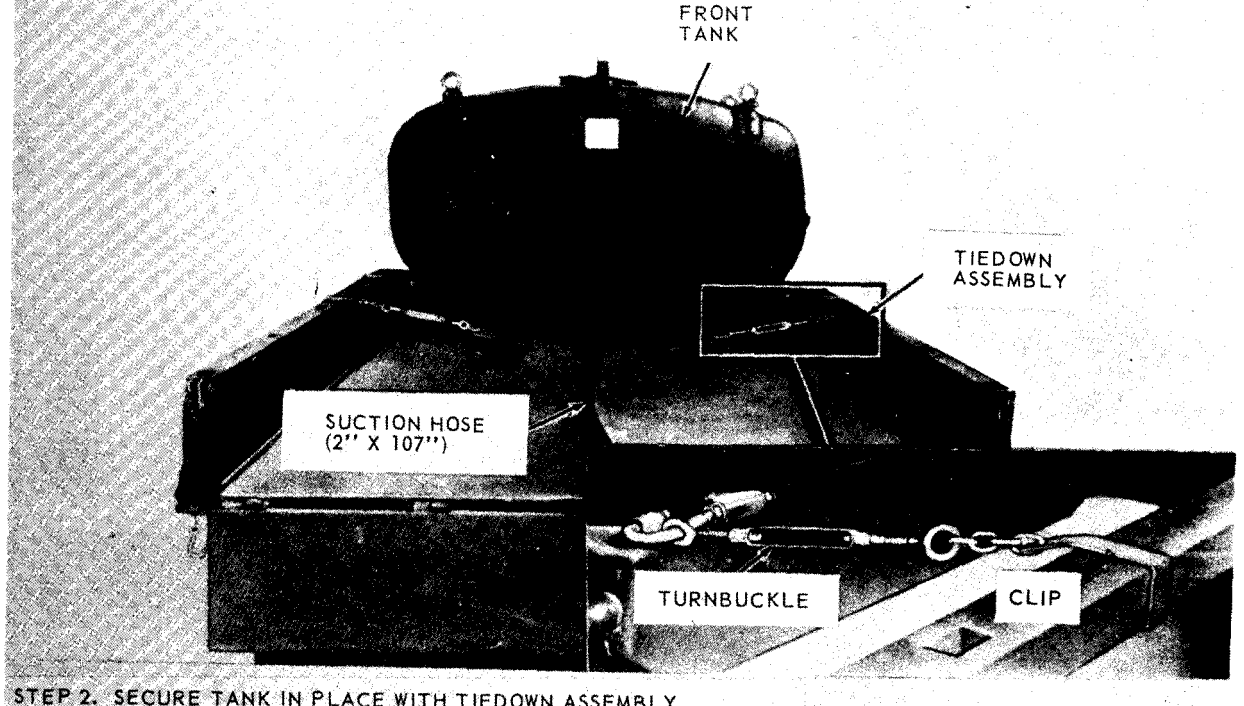
(2) Install the two parts of section 2 against section 1, or on 2 1/2 ton cargo trucks, against rear end of truck body.

(3) Refer to figure 4-2 and install the tanks and pumping assembly in truck. Add the two parts of section 3 along sides of pumping assembly and against section 2 of blocking frame.

(4) Secure tanks and pumping assembly to sides of truck bed with horizontal tiedown assemblies. Handtight only.



STEP 1. PLACE THE FRONT TANK IN THE TRUCK WITH A FORKLIFT OR OTHER SUITABLE LIFTING DEVICE.



STEP 2. SECURE TANK IN PLACE WITH TIEDOWN ASSEMBLY.
STEP 3. CONNECT THE 2 INCH X 107 INCH HOSE TO THE DISCHARGE VALVE AND CONNECT THE 3/4 INCH X 10 FT DRAIN HOSE (NOT SHOWN) TO THE DRAIN VALVE ELBOW (NOT SHOWN) OF THE FRONT TANK.

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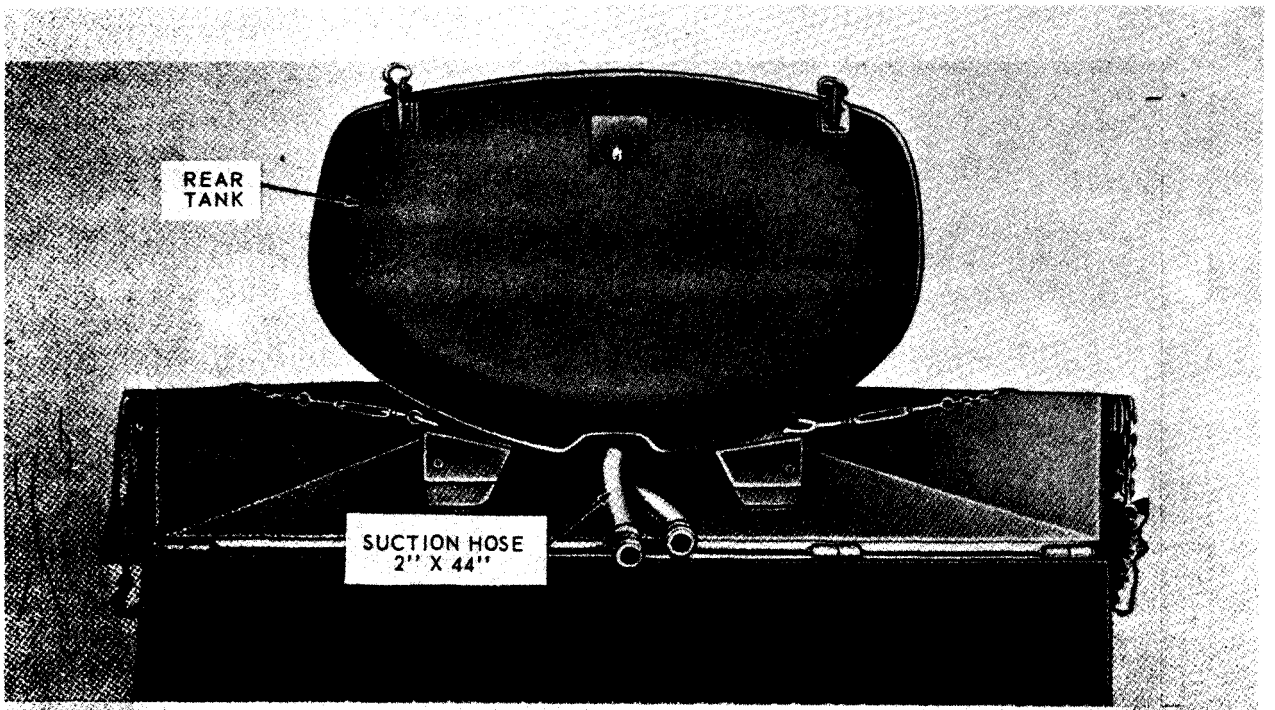
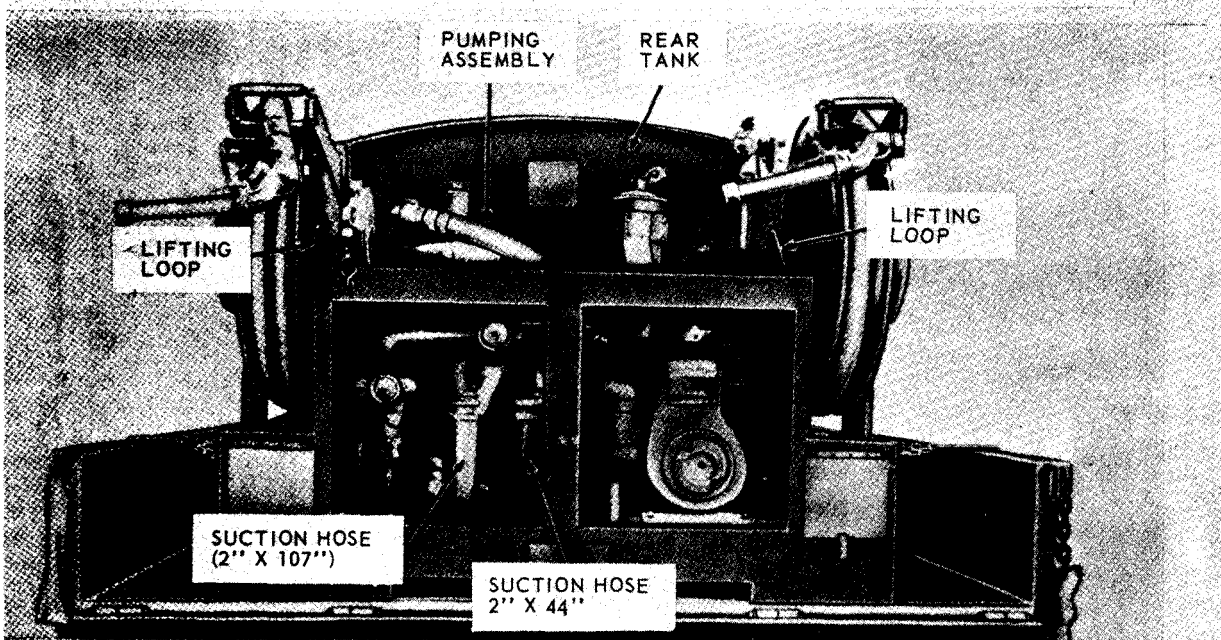
Figure 4-2. Installing tanks and pump in truck (sheet 1 of 3).



STEP 4. INSTALL THE REAR TANK IN THE SAME MANNER DESCRIBED IN STEPS 1 AND 2.
STEP 5. INSTALL THE 2 INCH X 44 INCH HOSE ON THE DISCHARGE VALVE AND THE 3/4 INCH X 5 FT HOSE (NOT SHOWN) ON THE DRAIN VALVE ELBOW (NOT SHOWN) OF THE REAR TANK.



STEP 6. PLACE THE PUMPING ASSEMBLY ON REAR OF TRUCK.
STEP 7. CONNECT THE 44-INCH AND 107-INCH HOSES TO THE MANIFOLD OF THE PUMPING ASSEMBLY.

ME 4930-228-14/4-2 ②

Figure 4-2. Installing tanks and pump in truck (sheet 2 of 3).

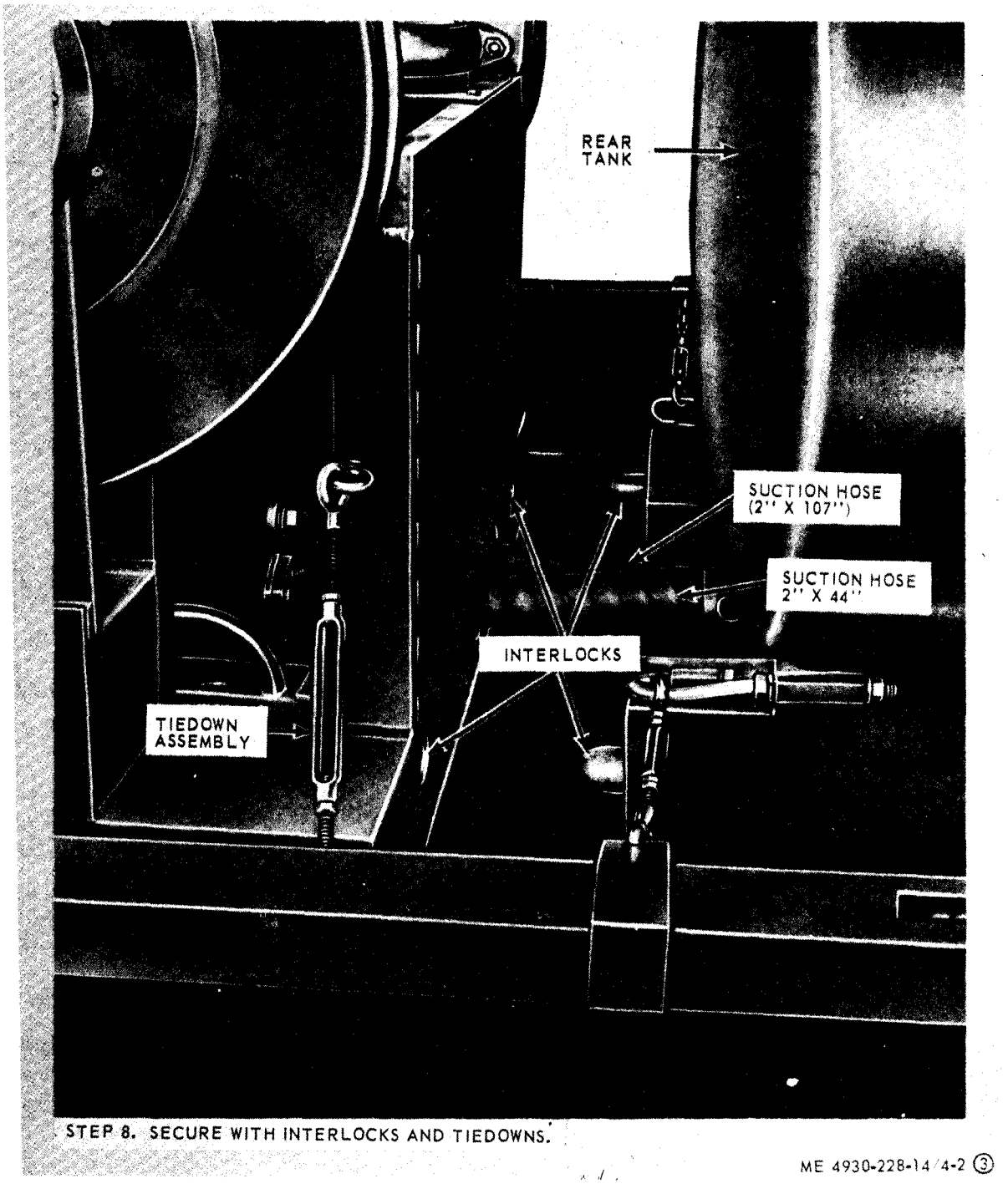


Figure 4-2. Installing tanks and pump in truck (sheet 3 of 3).

c. Tank Vertical Tiedown.

(1) Refer to figure 4-3 for identification of tiedown strap assemblies.

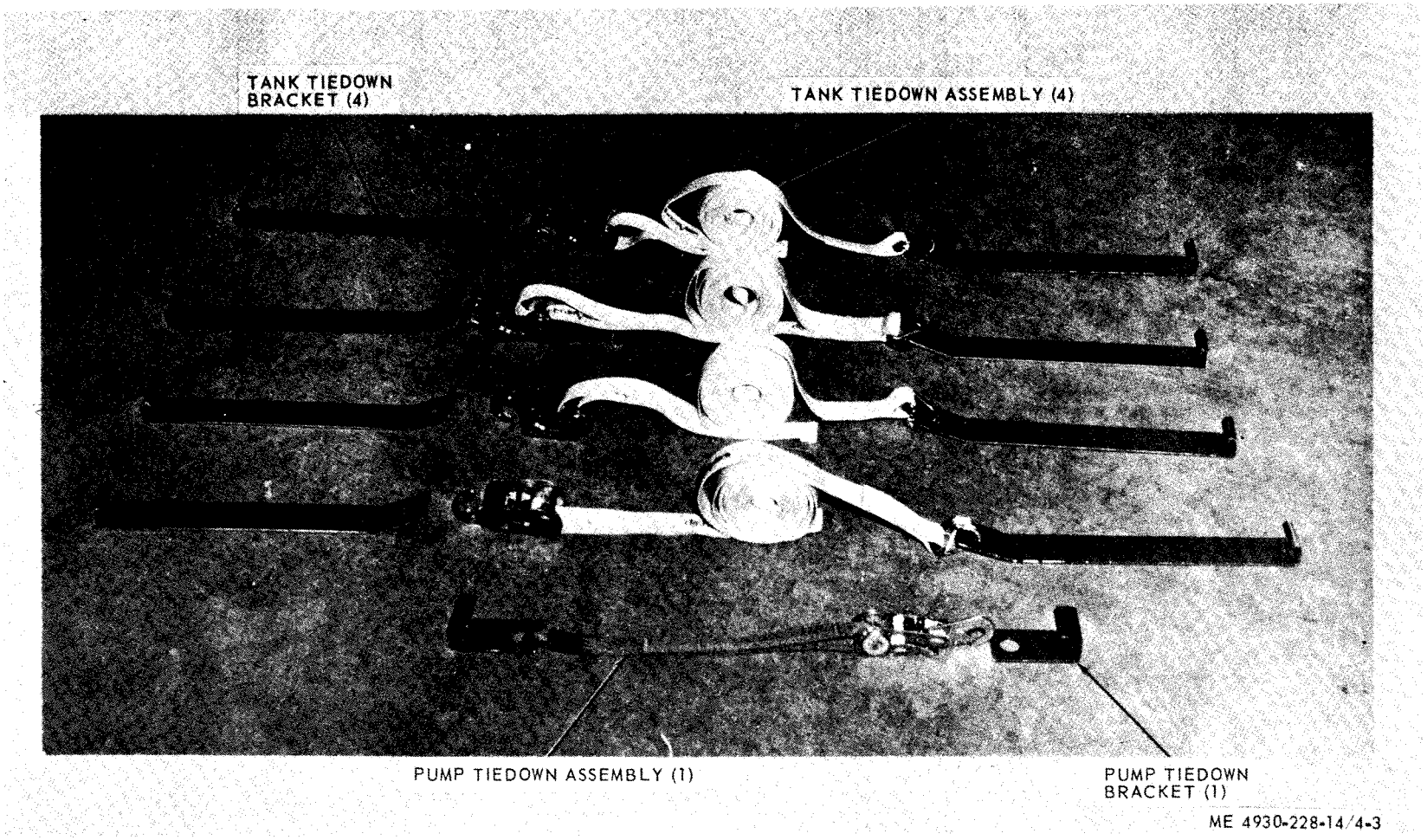


Figure 4-3. Tank and pump unit vertical tiedown strap assembly.

(2) To unlock or release ratchet, press release in ratchet handle. Hold release, pull handle down until side cams engage and push static ratchet locks up from ratchet dogs. This allows center ratchet spool to rotate in either direction.

(3) To aid in unrolling the nylon strap, turn ratchet hook opening down on a flat surface. Press down in the center of ratchet, while pulling nylon strap away from ratchet.

(4) Refer to figure 4-4 and place tiedown straps over tank ends. Attach brackets to sides of truck. Connect strap end and ratchet to brackets. Move ratchet handle up and down until strap is tight. Push ratchet handle to the lock position.

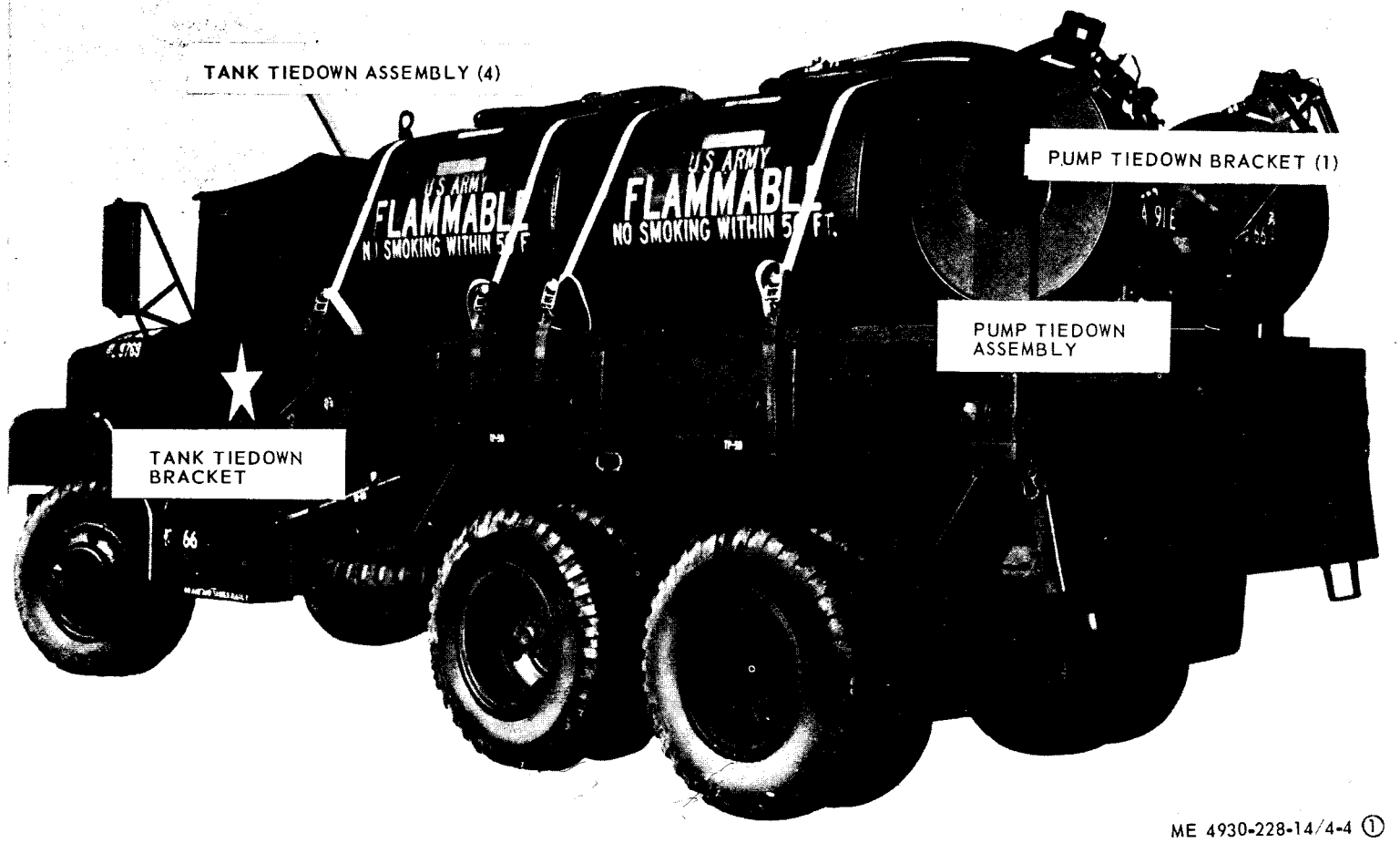


Figure 4-4. Tank and pump vertical strap assembly installed (sheet 1 of 2).

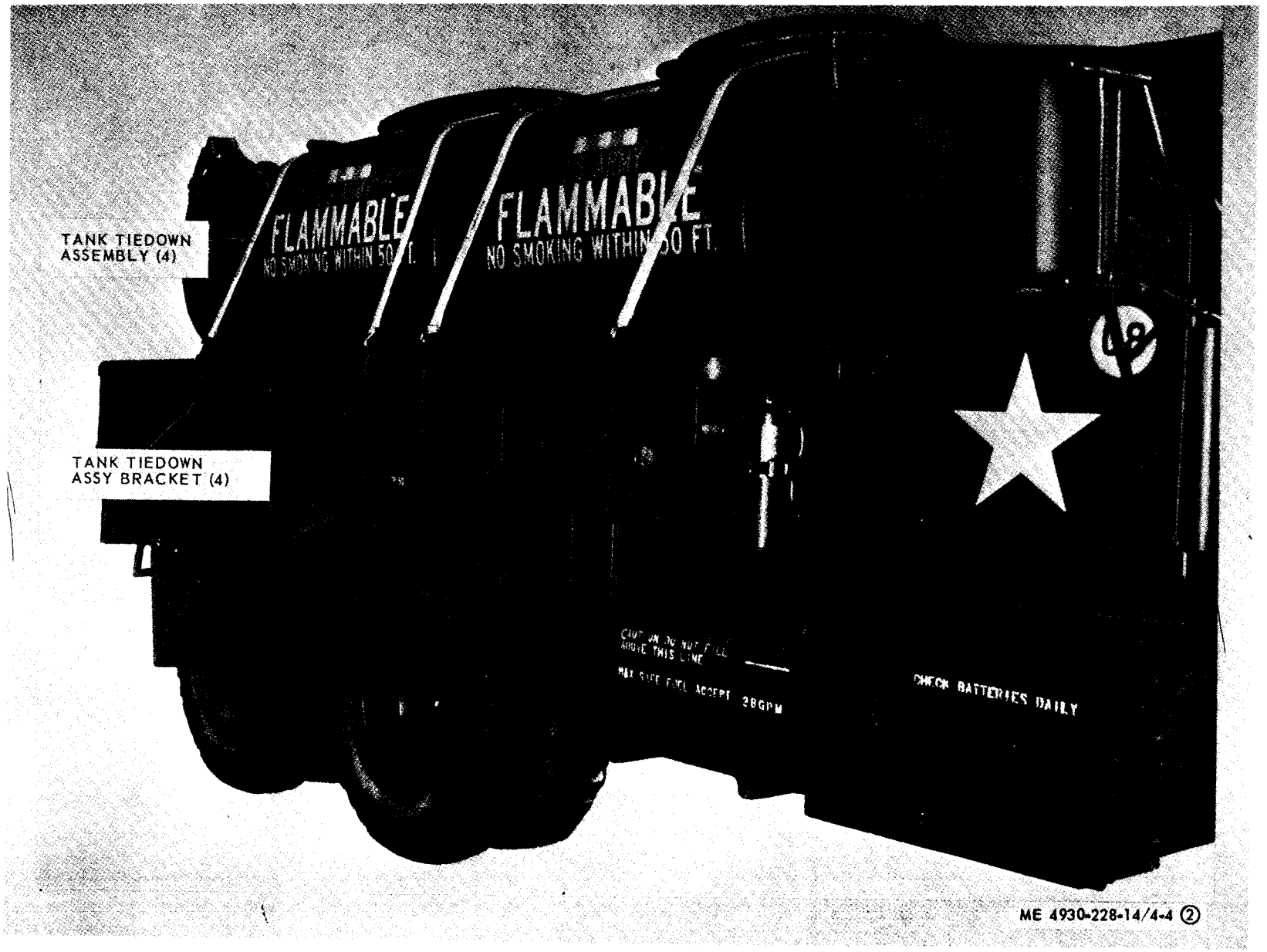


Figure 4-4. Tank and pump vertical strap assembly installed (sheet 2 of 2).

d. Pump Unit Rear Tiedown Strap Assembly.

(1) Refer to figure 4-3 for identification of tiedown strap assembly.

(2) Refer to figure 4-4 and hook loose bracket over top of reel frame, long side with hole out and down. Hook bracket attached to strap end beneath rear truck from 8-to 10-inches right of center.

(3) Pass strap end up through space between tailgate and truck body. Insert strap end, rear-to-front, thru slot in center of ratchet spool. Pull all slack through ratchet spool by strap end.

(4) Unlock ratchet, move ratchet, move ratchet handle in an up-and-down motion until strap is tight. Push ratchet handle to closed position.

(5) Raise the tailgate.

Section II. MOVEMENT TO A NEW WORKSITE

4-3. Dismantling for Movement

a. Short Distance Movement. The tank and pump unit is truck-mounted and does not require dismantling for short distance movement. Move the tank and pump unit to the new worksite with the vehicle.

b. Long Distance Movement.

(1) Provide a suitable container for the tank and pump unit. Refer to TM 38-230 for instructions in container fabrication.

(2) Provide suitable blocking and tiedowns to prevent the unit from shifting during transport.

4-4. Reinstallation After Movement

Reinstall the tanks and pump unit after movement to a new worksite as instructed in paragraph 4-2.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-5. Tools and Equipment

There are no basic issue tools or repair parts issued with or authorized for the tank and pump unit.

4-6. Special Tools and Equipment

No special tools or equipment are required by organizational maintenance personnel for the maintenance of the tank and pump unit.

4-7. Organizational Maintenance Repair Parts

Repair parts and equipment are listed in the repair parts and special tools list covering organizational maintenance for this equipment (TM 5-4930-228-24P).

Section IV. ORGANIZATIONAL MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-8. General

To insure the tank and pump 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 preventive maintenance checks and services to be performed by organizational maintenance personnel are listed and described in paragraph 4-9. The sequence numbers indicate the sequence of minimum inspection requirements. All deficiencies and shortcomings will be recorded, together with the corrective action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

4-9. Organizational Maintenance Checks and Services

a. Table 4-1 contains a tabulated list of preventive checks and services which must be performed by the organizational maintenance personnel.

b. The interval and sequence columns designates the required service interval. A quarterly interval is equal to 3 calendar months or 250 hours of operation, whichever occurs first.

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

M-Monthly
Total man-hours required 1.3

Q-Quarterly
Total man-hours required 1.7

Interval and sequence no. M	Interval and sequence no. Q	Item to be inspected procedure	Work time (M / H)
1	10	HOSES AND NOZZLES Inspect hoses for leaks, breaks, cuts, and worn areas. Replace damaged hose. Inspect nozzles for distortion, corrosion, and leaks. Clean, repair, or replace distorted, corroded or leaking nozzles.	0.3
2	11	GROUND CABLE AND REEL Inspect cable for worn, frayed, or corroded condition. Inspect reel for ease of operation. Replace a defective ground cable and reel.	0.1
3	12	FILTER / SEPARATOR Inspect for leaks, cracks, and other damage. Inspect for leaking, damaged, or dirty sight window. Replace gasket to correct leak.	0.2
	13	MAGNETO Inspect magneto for pitted or burned points. Replace points and condenser if points are burned. Proper gap adjustment is 0.015 inch.	0.2
	14	SPARK PLUG Inspect spark plug for cracked insulators and burned electrodes. Clean spark plugs and set gap 0.030 inch. Replace lead that is frayed or broken.	0.2
4	15	FUEL TANK Inspect for leaks and loose mounting. Tighten loose mounting. Replace a leaking fuel tank. Replace defective cap gasket. Clean cap vent hole.	0.1
5	16	FUEL STRAINER Inspect strainer for dirt, water, and leakage. Clean screen if dirty. Tighten bail nut if gasket leaks. Replace a defective fuel strainer.	
6	17	INLET STRAINER SCREEN Inspect screen for dirt or damage. Clean or replace a dirty or damaged inlet strainer screen.	0.1
7	18	DISCHARGE VALVE AND CONTROL LEVER Inspect control lever for binding or damage. Inspect discharge valve for leaks. Replace a damaged control lever. Tighten or replace a leaking discharge valve.	0.2
8	19	AIR VENT ASSEMBLY Inspect the air vent assembly for dirt or damage. Clean or replace a dirty or damaged air vent assembly.	0.1

Section V. ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING

4-10. General

a. This section contains troubleshooting information for locating and correcting trouble which may develop in the tank and pump unit that are within the scope of organizational maintenance. 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 causes of trouble and corrective actions to take. You should perform the tests / inspections and corrective actions in the order listed.

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

4-11. Organizational Maintenance Troubleshooting

For organizational maintenance troubleshooting refer to table 4-2.

Table 4-2. Organizational Maintenance Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. ENGINE HARD TO START OR FAILS TO START
   - Step 1. Inspect for dirty or defective spark plug.
     Clean or replace spark plug.
   - Step 2. Inspect for obstructed fuel lines.
     Clean or replace fuel line.
   - Step 3. Check for defective ignition switch or cable.
     Replace defective ignition switch or cable.
   - Step 4. Check for improper fuel mixture.
     Adjust or replace carburetor.

2. ENGINE MISSES, OPERATES ERRATICALLY, OR LOSES POWER
   - Step 1. Check for pitted, burned, or defective points or defective magneto.
     Replace defective points or magneto.
   - Step 2. Check for improper fuel mixture.
     Adjust or replace carburetor.
   - Step 3. Inspect for clogged or defective muffler.
     Clean or replace muffler.
   - Step 4. Inspect for loose, dirty, or defective spark plug.
     Tighten, clean, or replace spark plug.
   - Step 5. Inspect for loose or improperly adjusted governor controls.
     Adjust or replace governor controls.

3. ENGINE OVERHEATS OR KNOCKS
   - Step 1. Inspect for clogged or defective muffler.
     Clean or replace muffler.
   - Step 2. Inspect for dirt in engine radiation fins.
     Clean fins for proper ventilation.
   - Step 3. Inspect for out-of-time magneto.
     Time magneto properly.

4. ENGINE BACKFIRES
   - Step 1. Inspect for too lean fuel mixture.
     Adjust or replace carburetor.
   - Step 2. Inspect for sticking intake valve.
     Remove spark plug. Pour ½-to 1-ounce of penetrating oil (Fed Spec VV-P-216) into cylinder. Let stand 5 minutes and crank engine. If intake valve remains stuck refer the problem to Direct Support Maintenance.
   - Step 3. Test condenser.
     Replace weak condenser.

5. ENGINE EXHAUST SMOKE EXCESSIVE
   - Step 1. Inspect for excessively rich fuel mixture.
     Adjust or replace carburetor.
   - Step 2. Inspect for carburetor flooding caused by sticking float.
     Replace carburetor.

6. PUMP FAILS TO PRIME
   - Step 1. Inspect for leaking or kinked suction hose.
     Repair or replace connections or replace defective suction hose.
   - Step 2. Inspect for leak at filter / separator.
     Repair leak or replace filter / separator.

7. PUMP FAILS TO DELIVER CAPACITY
   - Step 1. Inspect for low engine speed caused by improperly adjusted or defective carburetor.
   - Step 2. Inspect for low engine speed caused by out-of-time or defective magneto.
     Replace points and condenser, retime, or replace magneto.

8. PRODUCT FLOW SLOWS DURING OPERATION
   - Step 1. Inspect for kinked or leaking hose or connection.
     Repair or replace connection or replace defective hose.
   - Step 2. Inspect for defective nozzle. Repair or replace nozzle.

Section VI. RADIO INTERFERENCE SUPPRESSION

4-12. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. For general information applicable to radio suppression. refer to TM 11-483.

4-13. Replacement of Suppression Components

The engine of the tank and pump unit is provided with a shielded spark plug cable and ignition ground cable. For replacement of these components, refer to paragraph 4-20.

Section VII. PUMP AND ENGINE UNIT

4-14. General

The pump and engine unit is mounted on an aluminum frame that will slide out. from the pumping assembly. This mounting arrangement provides easy access to the pump and engine for maintenance and servicing purposes. An intermediate coupling connects the pump to the engine. Removal of either pump or engine requires disassembly of the pump and intermediate coupling; therefore, procedures for removal, installation, disassembly, and reassembly of the pump assembly and engine assembly is covered in Chapter 6.

4-15. Pump and Engine Unit

a. Removal.

(1) Disconnect suction hose and discharge hose from pump.

(2) Refer to figure 4-5 and remove muffler and pump and engine unit.

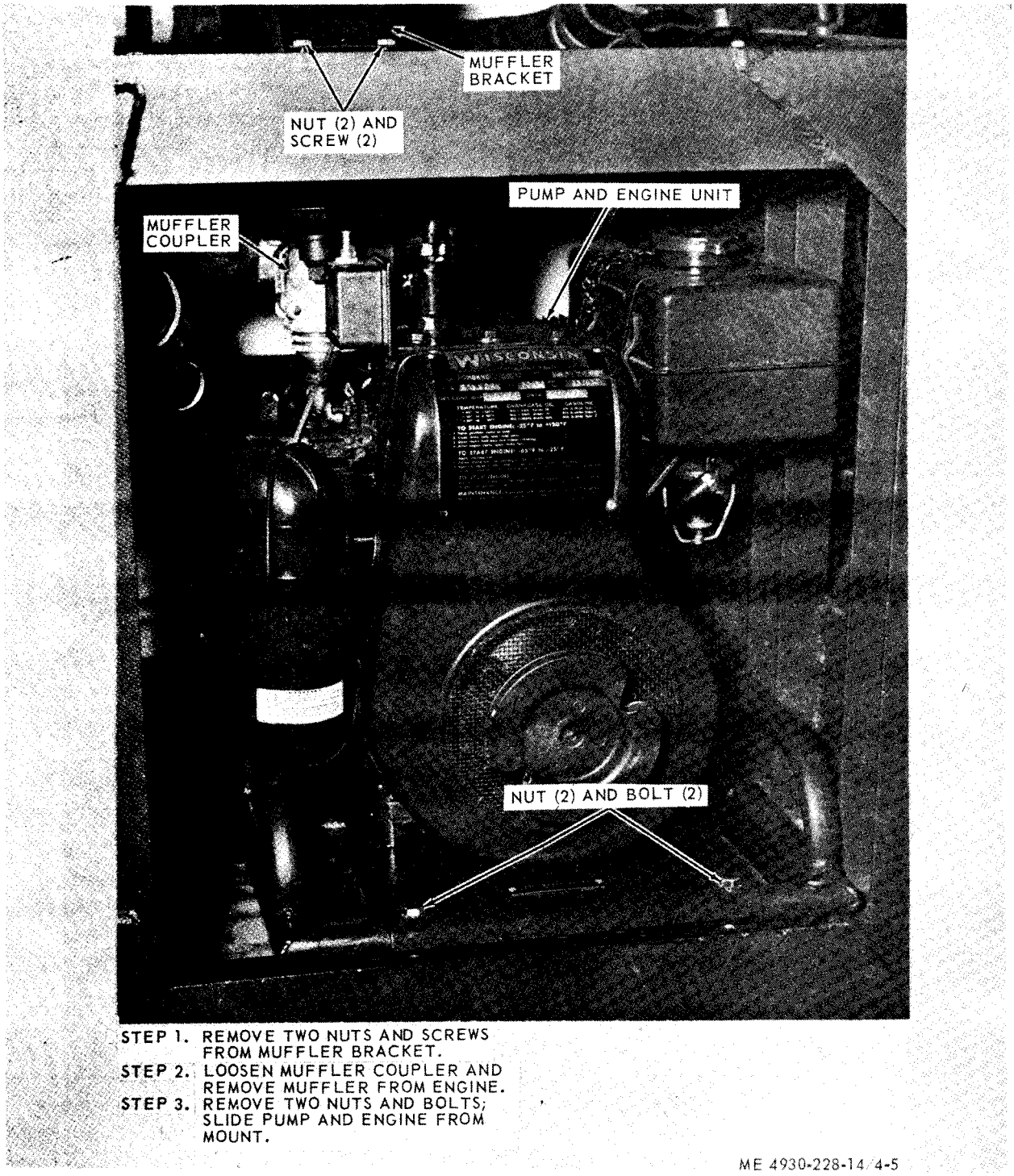


Figure 4-5. Pump and engine unit and muffler, removal.

b. Installation. Refer to figure 4-5 and install the pump and engine unit. Installation procedure is reverse of removal.

Section VIII. ENGINE STARTING AND COOLING SYSTEM

4-16. General

Starting is accomplished by using a rope and rope pulley. The engine flywheel is inclosed by the air shroud. The flywheel acts as a fan, forcing into the air shroud which distributes this cooling air around the crankcase and cylinder head.

4-17. Starter Pulley

a. Removal. Refer to figure 4-6 and remove the starter pulley.

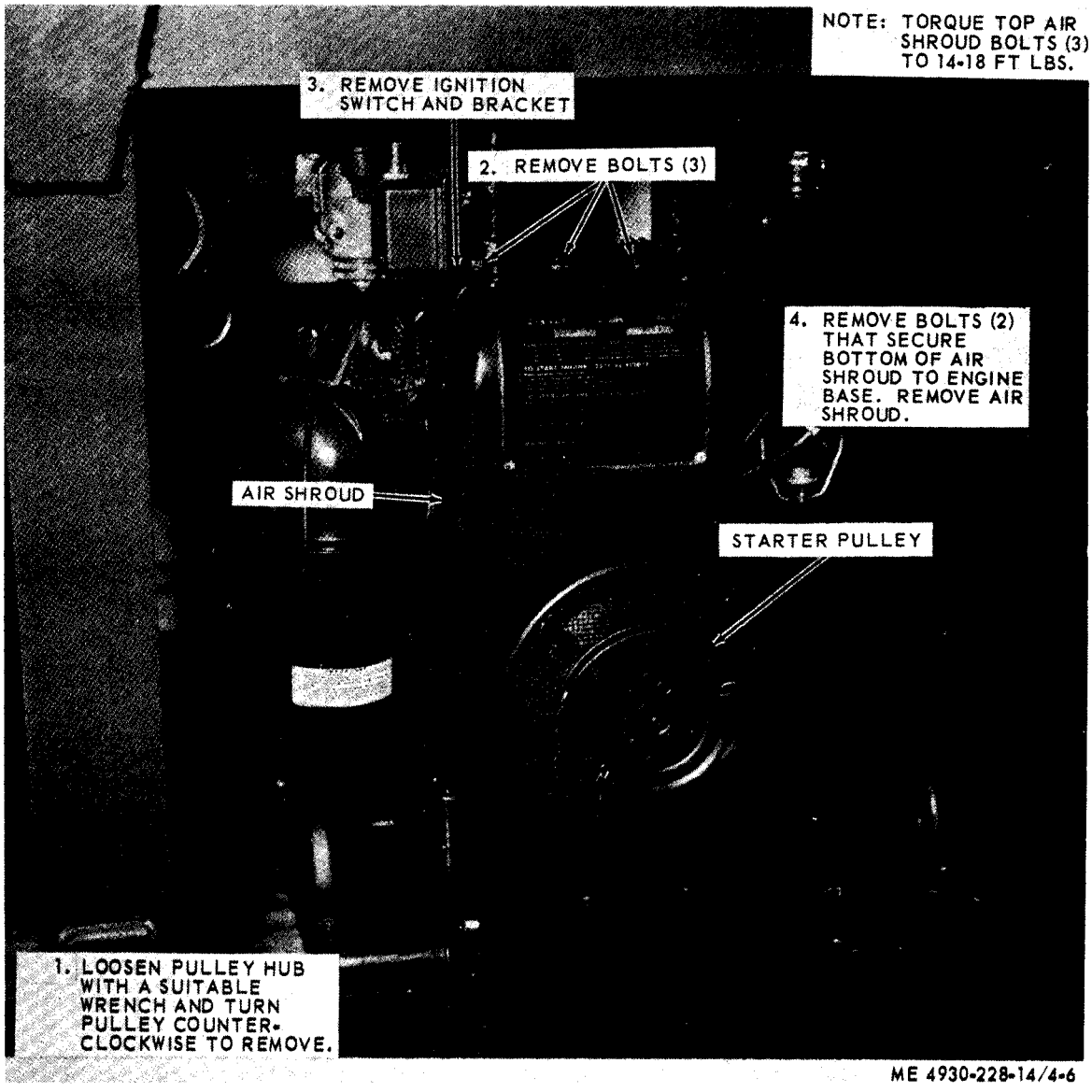


Figure 4-6. Starter pulley, air shroud, and ignition switch bracket, removal.

b. Cleaning and Inspection.

(1) Clean the pulley thoroughly.

(2) Inspect the pulley for cracks, breaks, dam aged threads, and other damage.

c. Installation. Refer to figure 4-6 and install the starter pulley. (Installation procedure is reverse of rem oval).

4-18. Air Shroud

a. Removal.

(1) Remove the starter pulley (para 4-17).

(2) Refer to figure 4-6 and remove the air shroud, ignition switch, and bracket.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the air shroud for cracks, breaks, dents, and distortion.

(3) Inspect the mounting hardware for cracks and for damaged threads. Replace defective parts.

c. Installation.

(1) Refer to figure 4-6 and install the air shroud. ignition switch, and bracket (installation procedure is reverse of removal).

(2) Install the starter pulley (para 4-17).

Section IX. ENGINE IGNITION SYSTEM

4-19. General

The ignition system consists of the magneto, spark plug, ignition cable, and the ignition switch. These are all shielded to provide radio suppression.

4-20. Spark Plug, Ingnition Cable, and Ignition Switch with Ground Cable

a. Removal. Refer to figure 4-7 and remove the spark plug, ignition cable, and ignition switch and ground cable.

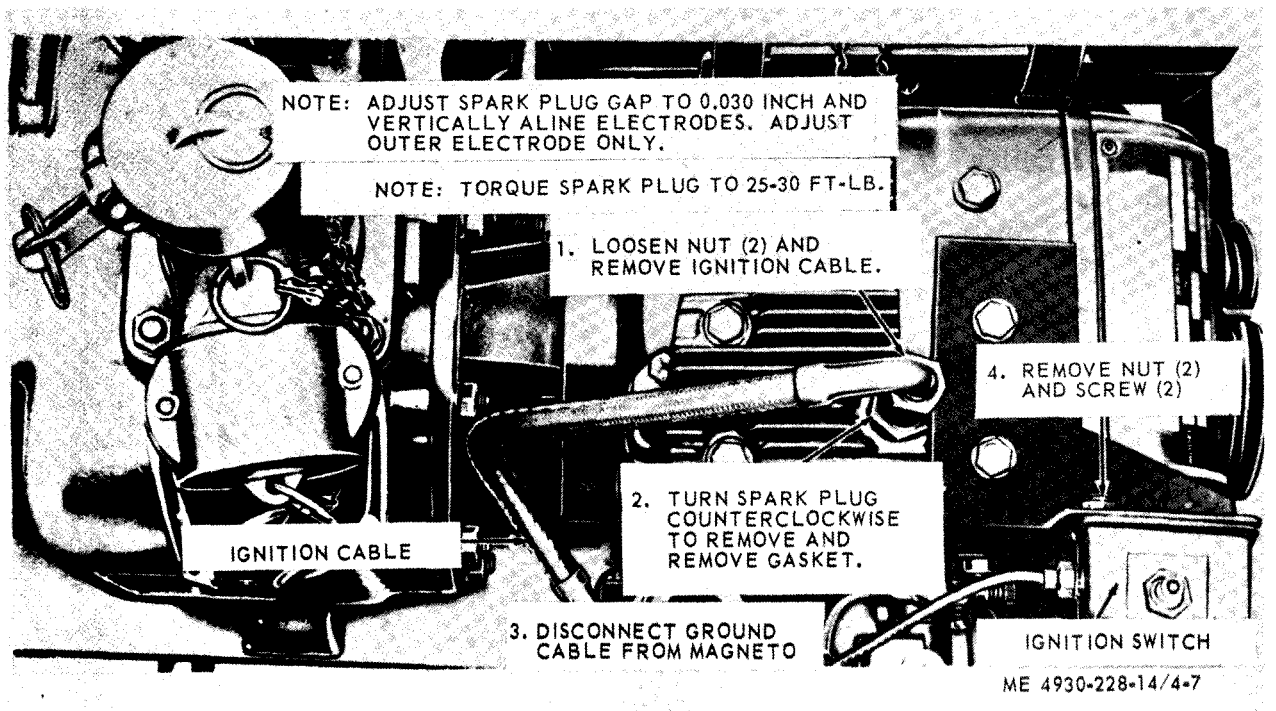


Figure 4-7. Spark plug, ignition cable, ignition switch and ground cable.

b. Cleaning and Inspection.

(1) Clean all parts thoroughly.

(2) Inspect the spark plug for broken or burned insulator, excessively burned electrodes, damaged threads, and other damage.

(3) Inspect the ignition cable for signs of burning, frayed, shielding, and other damage.

(4) Inspect the ignition switch for signs of burned areas, frayed ground cable, and other damage.

(5) Replace all defective parts.

c. Installation. Refer to figure 4-7 and install the spark plug, ignition cable, and ignition switch in reverse of removal.

4-21. Magneto

a. Removal.

(1) Refer to paragraph 4-18 and remove the air shroud.

(2) Refer to figure 4-8 and remove the magneto.

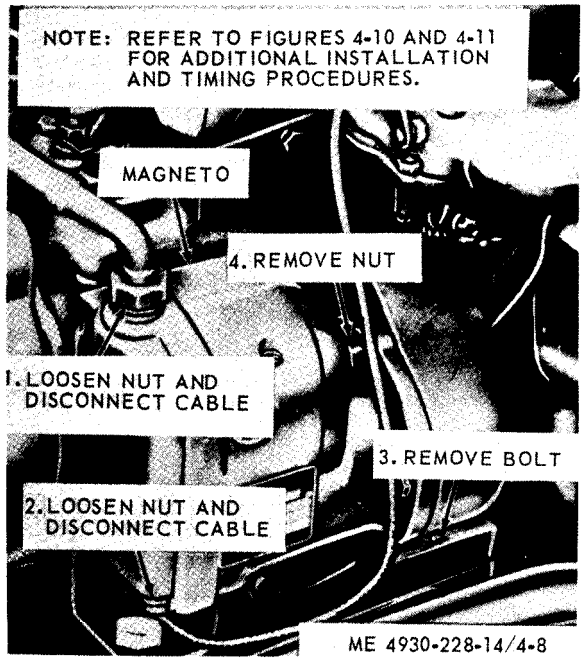


Figure 4-8. Magneto, removal.

b. Cleaning and Inspection.

(1) Clean the magneto thoroughly.

(2) Inspect the magneto for cracks, breaks, damaged threads, signs of burned areas, and other damage.

(3) Replace a defective magneto.

c. Magneto Breaker Points and Capacitor Replacement. Refer to figure 4-9 and replace the magneto points and capacitor.

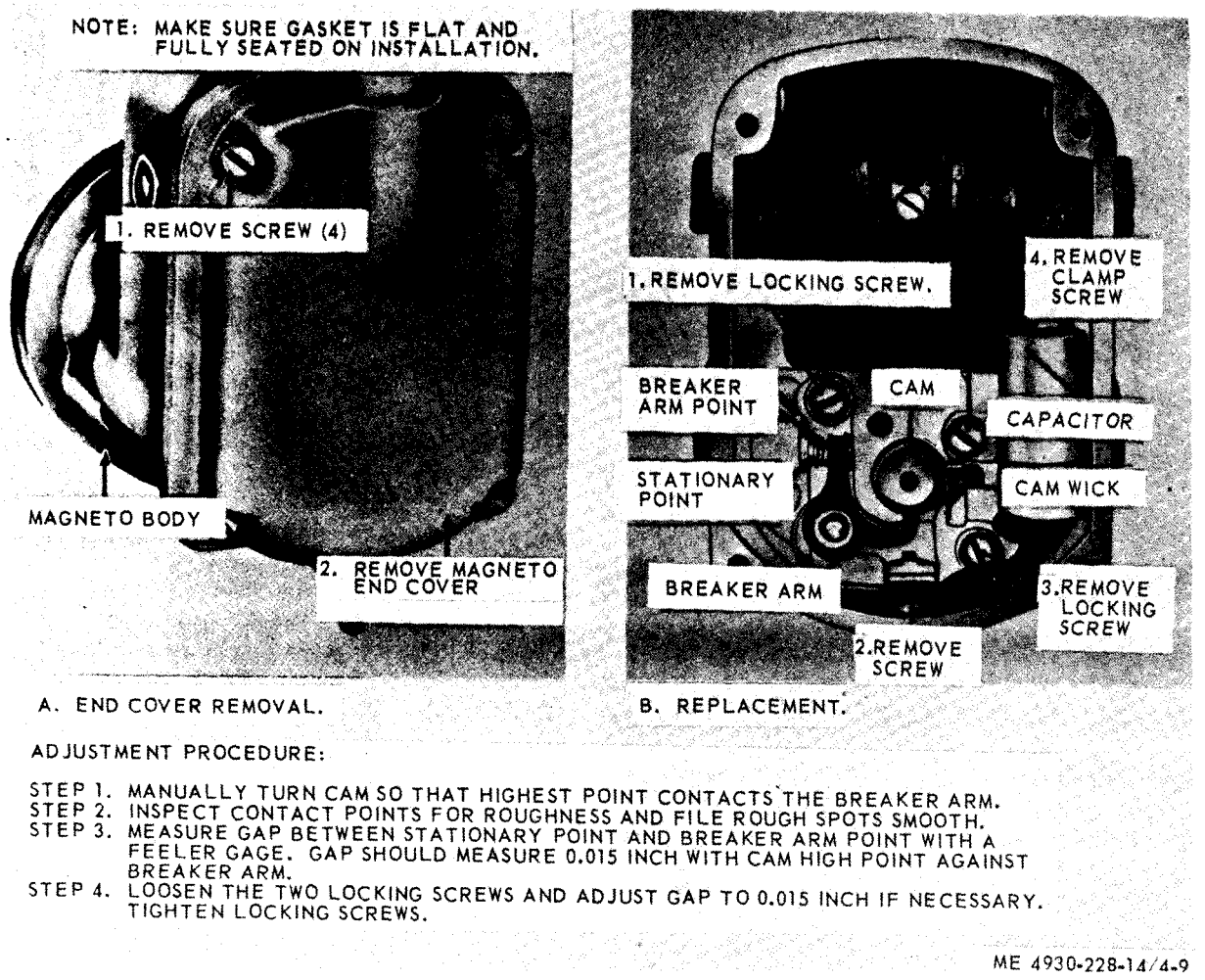


Figure 4-9. Magneto points and capacitor replacement.

d. Magneto Drive Gear Replacement. Refer to figure 4-10 and remove and install the magneto drive gear.

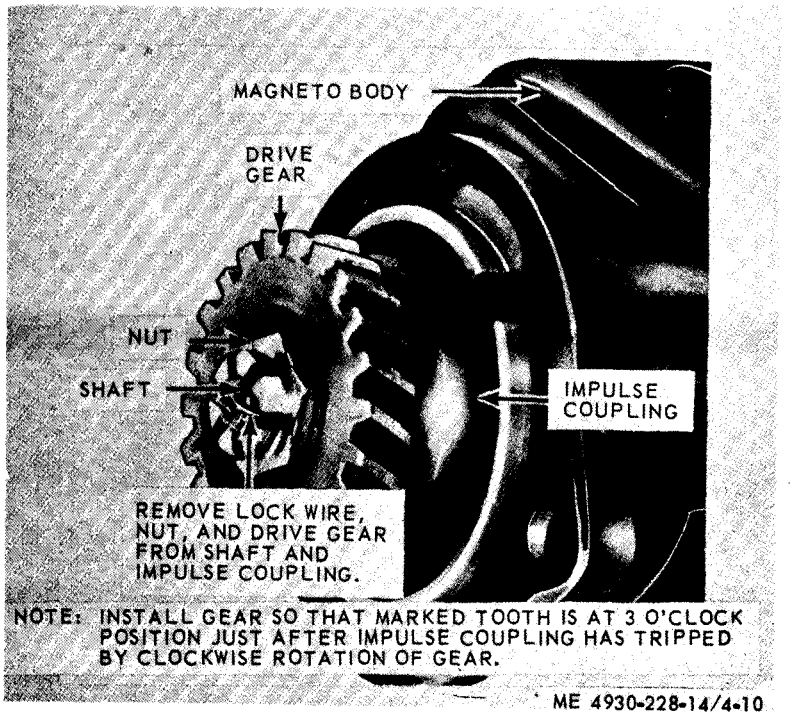


Figure 4-10. Magneto drive gear, removal and installation.

e. Installation.

(1) Refer to figure 4-8 and install the magneto (installation procedure is reverse of removal).

(2) Install the air shroud (para 4-18).

f. Timing the Magneto. Refer to figure 4-11 and time the magneto.

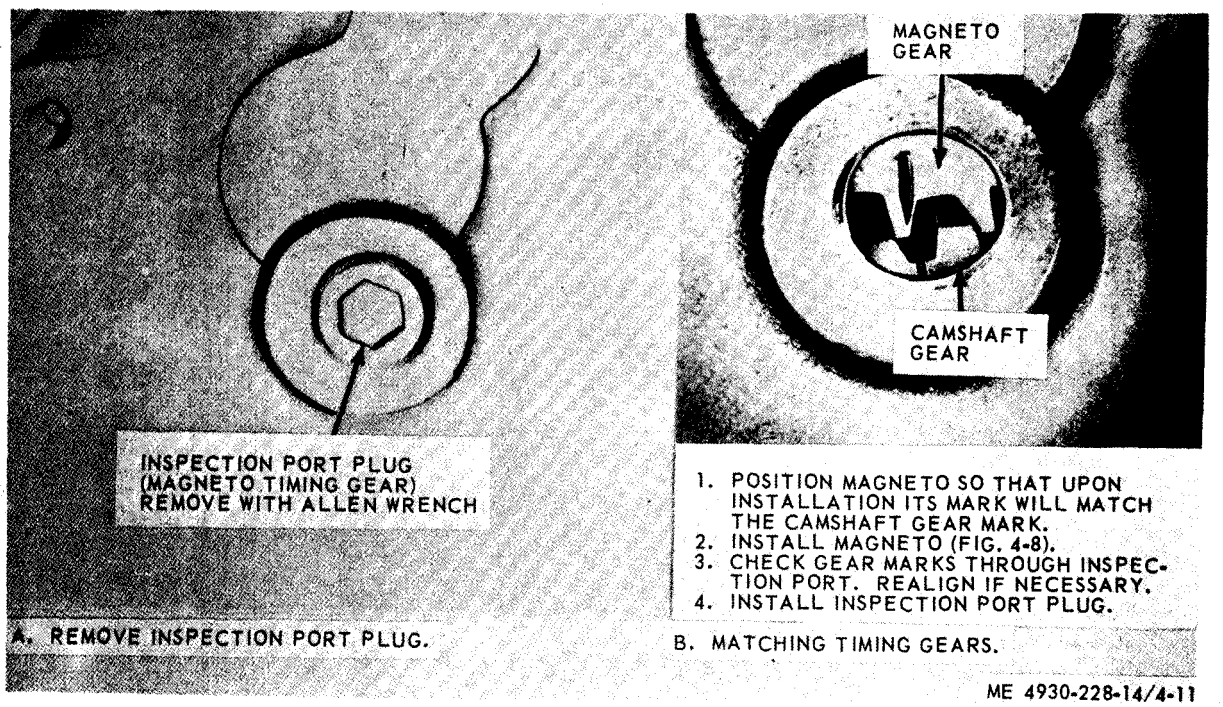


Figure 4-11. Timing the magneto.

Section X. ENGINE FUEL SYSTEM

4-22. General

The fuel system is of the gravity-flow-type. Fuel flows through the fuel valve and fuel strainer and is delivered to the carburetor. An oil-bath-type air filter is provided to remove foreign matter from the intake air. This section contains the maintenance instructions for the fuel system.

4-23. Fuel Tank, Bracket, Fuel Strainer, and Shutoff Valve

a. Removal. Refer to figure 4-12 and remove the fuel strainer and shutoff valve, fuel tank, and fuel tank bracket.

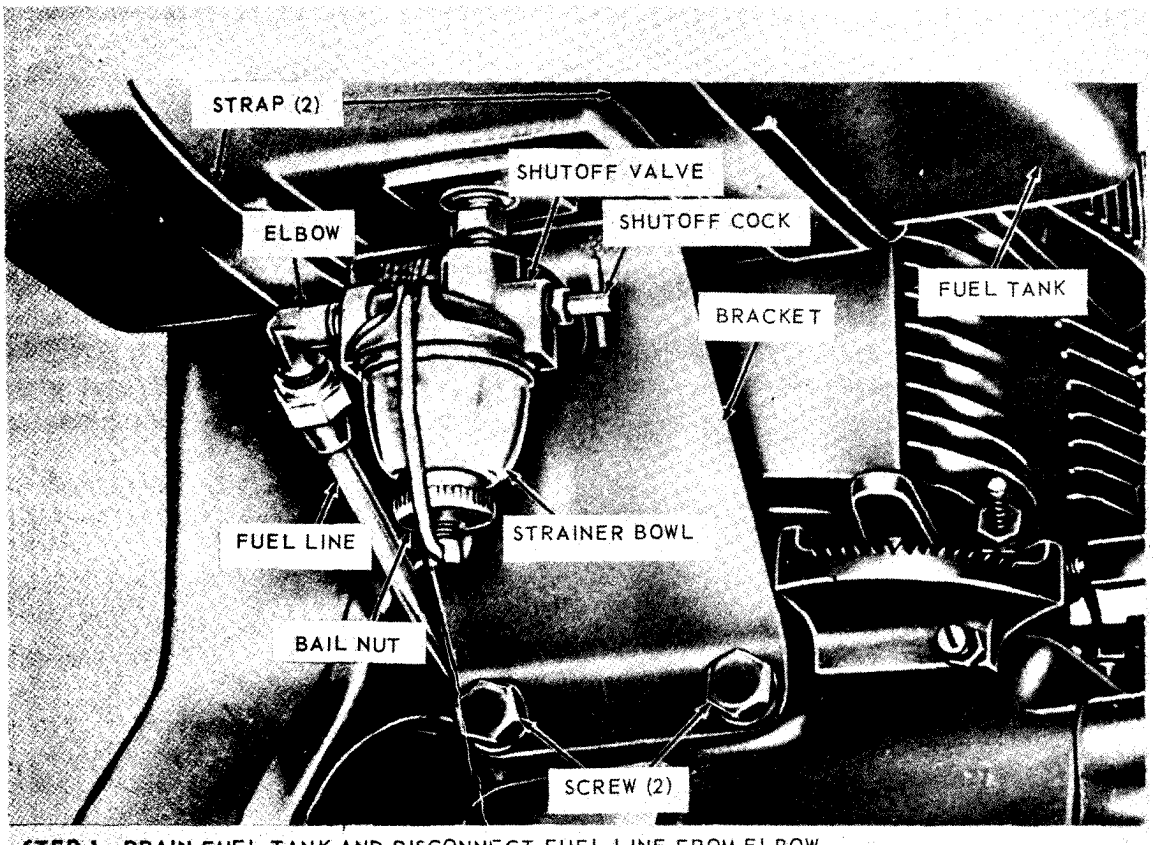


Figure 4-12. Fuel strainer, shutoff valve, fuel tank, and bracket, removal.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the fuel tank for cracks, breaks, distortion, and broken seams.

(3) Inspect the bracket for cracks and distortion.

(4) Inspect the fuel strainer and shutoff valve for defective threads, cracked strainer bowl distortion, and other damage.

(5) Replace all defective parts.

c. Installation. Refer to figure 4-12 and install the fuel strainer and shutoff valve, fuel tank, and fuel tank bracket. (Installation procedure is reverse of removal).

4-24. Air Cleaner and Bracket

a. Removal. Refer to figure 4-13 and remove the air cleaner and bracket.

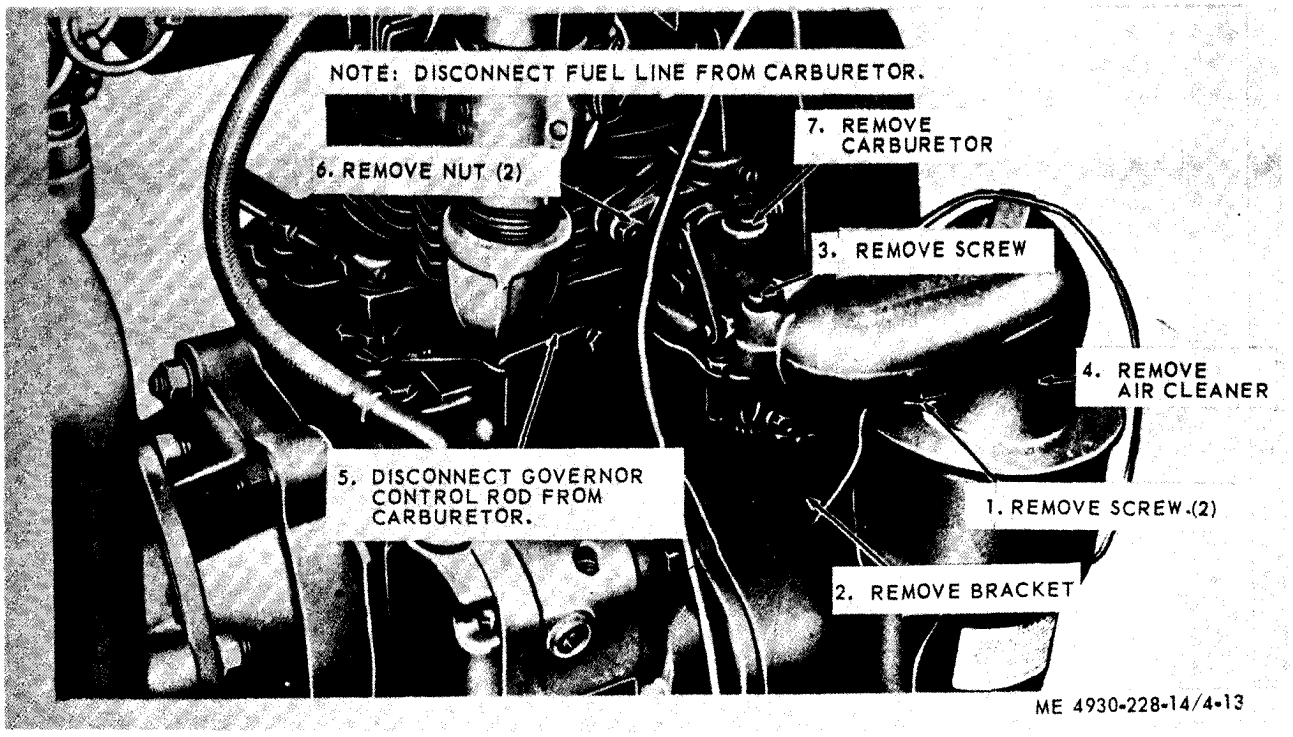


Figure 4-13. Air cleaner, bracket, and carburetor, removal.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the air cleaner for dents, distortion, cracks, and other damage.

(3) Inspect the bracket for cracks and distortion.

(4) Replace defective parts.

c. Installation. Refer to figure 4-13 and install the air cleaner and bracket. (Installation procedure is reverse of removal).

4-25. Carburetor

a. Removal.

(1) Remove the air cleaner (para 4-24).

(2) Refer to figure 4-13 and remove the carburetor.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the carburetor for cracks, breaks, loose or missing screws, damaged gasket, or other damage.

(3) Tighten a loose bowl.

(4) Replace defective parts.

c. Installation.

(1) Refer to figure 4-13 and install the carburetor. (Installation procedure is reverse of removal.)

(2) Install the air cleaner (para 4-24).

d. Adjustment. Refer to figure 4-14 and adjust the carburetor.

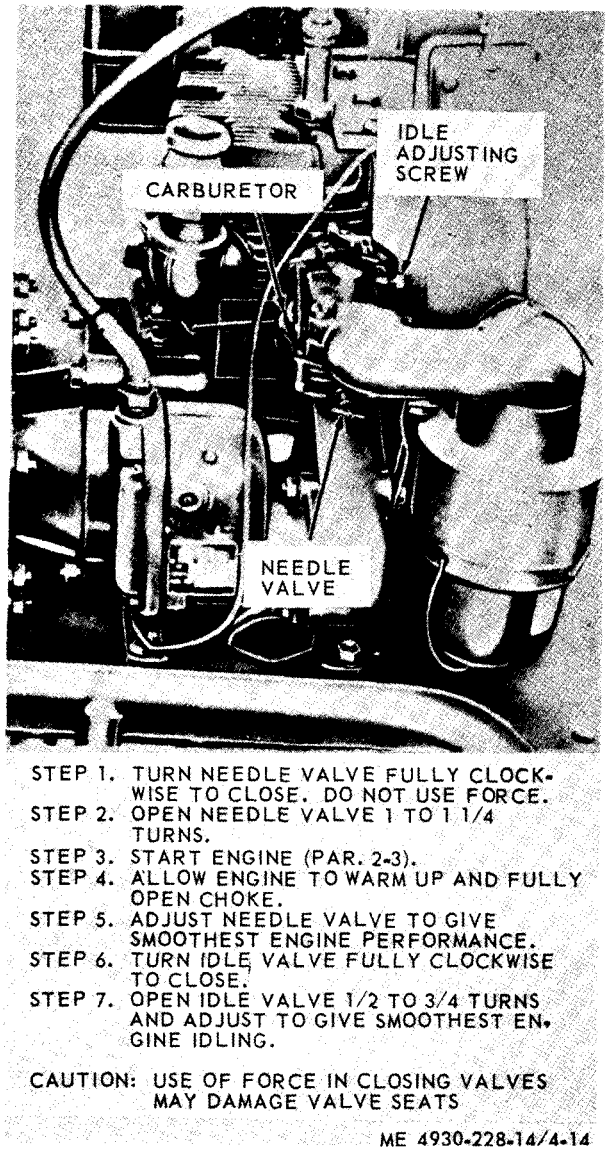


Figure 4-14. Carburetor adjustment.

4-26. Governor Controls

a. Removal. Refer to figure 4-15 and remove the governor controls.

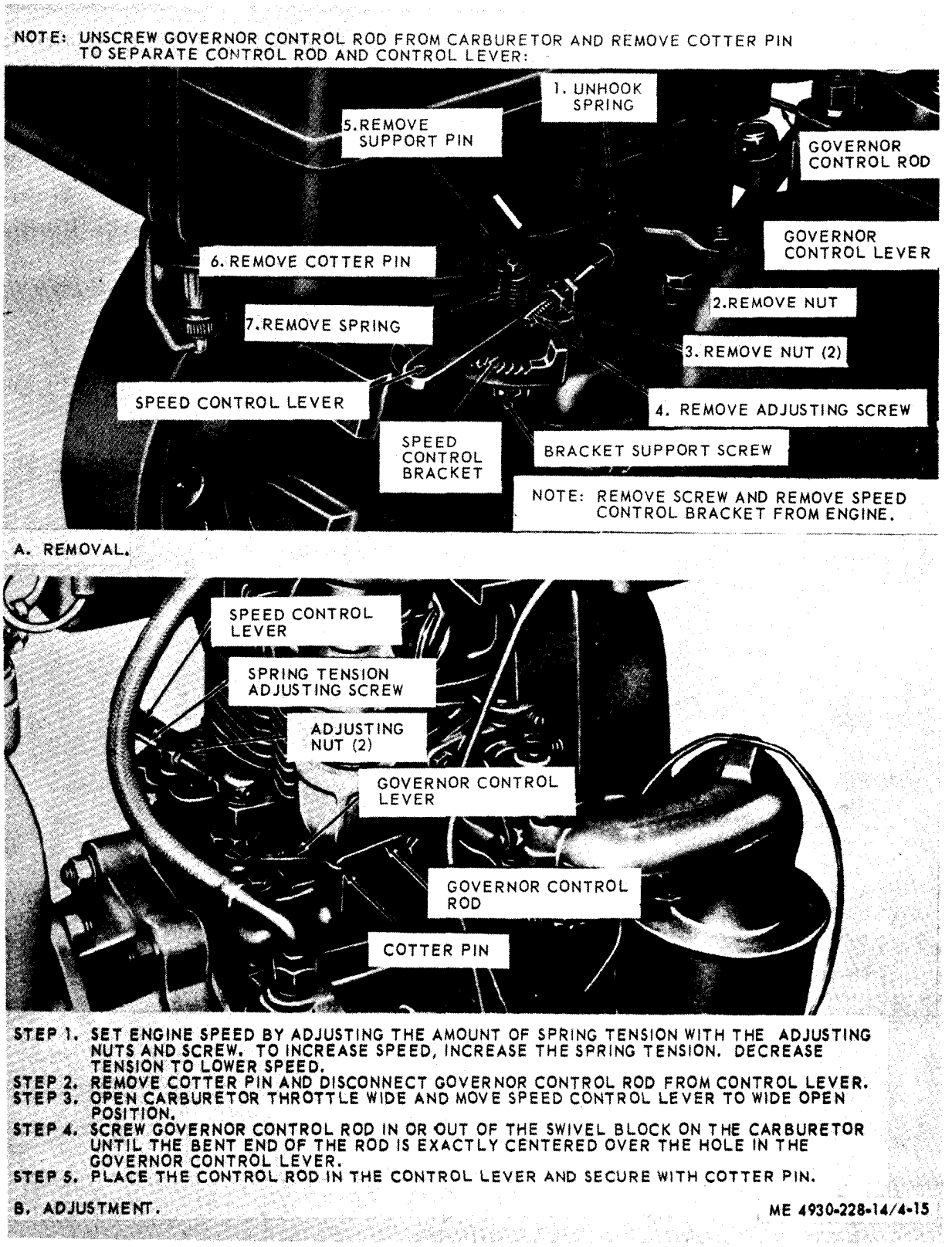


Figure 4-15. Governor controls, removal, and adjustment.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect all parts for cracks, breaks, excessive wear, and other damage.

(3) Replace defective parts.

c. Installation and Adjustment. Refer to figure 4-15. Install and adjust the governor controls (installation procedure is reverse of removal).

NOTE

Hook the spring into the outermost of the three holes in the governor lever.

Section XI. EXHAUST MUFFLER AND ELBOW, OIL FILLER AND DRAIN PLUG, AND CRANKCASE BREATHER

4-27. General

This section contains the maintenance instructions for the muffler, oil filler and drain plugs, and the crankcase breather.

4-28. Muffler, Exhaust Elbow and Crankcase Breather

a. Removal.

(1) Refer to figure 4-5 and remove the muffler.

NOTE

Remove wire from coupler before releasing.

(2) Refer to figure 4-16 and remove the exhaust elbow male coupling half, and crankcase breather.

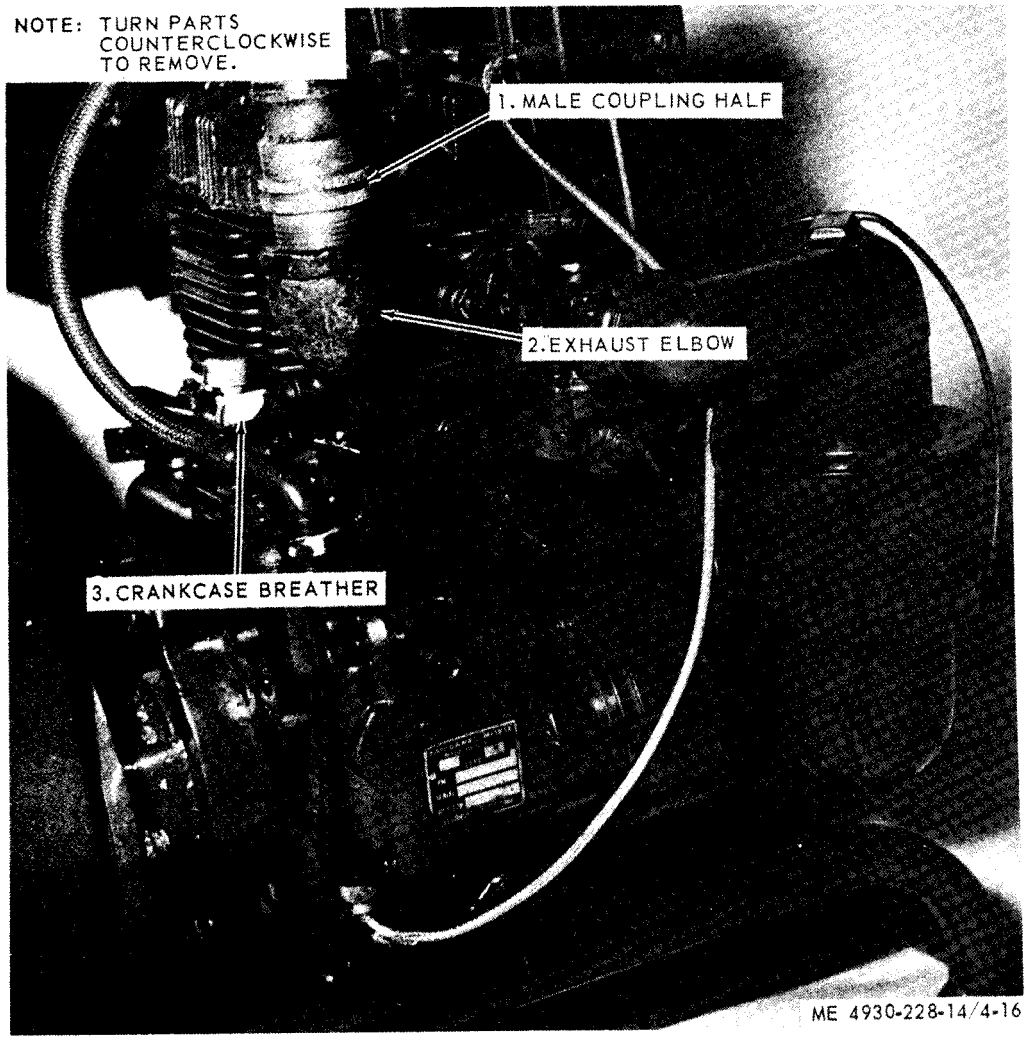


Figure 4-16. Exhaust elbow and crankcase breather, removal.

b. Disassembly. Refer to figure 4-17 and disassemble the muffler.

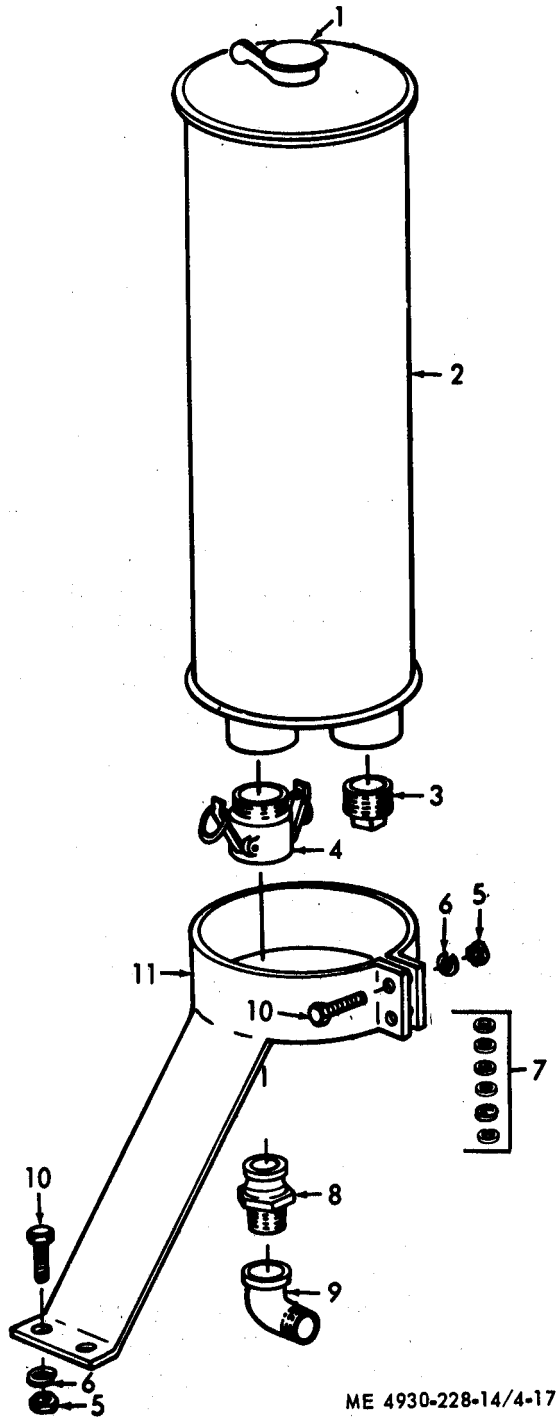


Figure 4-17. Muffler and attaching hardware, exploded view.

Key to figure 4-17:

1 Cap
2 Muffler
3 Plug
4 Coupling half
5 Nut
6 Washer
7 Gasket set
8 Coupling half
9 Elbow
10 Screw
11 Bracket

c. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the muffler for cracks, broken seams. damaged threads, and other damage.

(3) Inspect the crankcase breather and other threaded parts for damaged threads, cracks, distortion, and other damage.

(4) Replace all defective parts.

d. Reassembly. Refer to figure 4-17 and reassemble the muffler.

e. Installation.

(1) Refer to figure 4-16 and install the exhaust elbow, male coupling half, and crankcase breather.

(2) Refer to figure 4-5 and install the muffler.

4-29. Oil Filler and Drain Plug

a. Removal. Refer to figure 4-18 and remove the oil filler and drain plug.

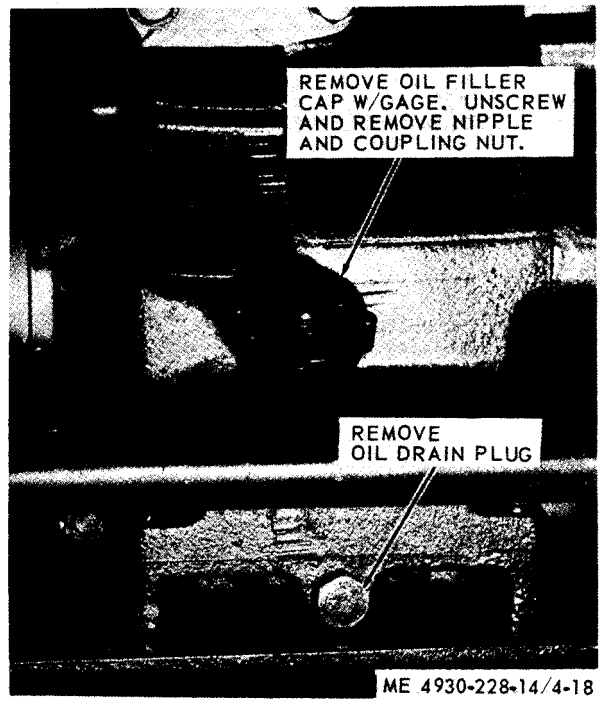


Figure 4-18. Oil filler and drain plug, removal and installation.

b. Cleaning and Inspection.

(1) Clean and dry the parts thoroughly.

(2) Inspect the oil filler for cracks and damaged threads.

(3) Inspect the cap for loose or broken dipstick and for defective gasket.

(4) Inspect the nipple for damaged threads and other damage.

(5) Replace defective parts.

c. Installation. Refer to figure 4-18 and install the oil filler and drain plug.

Section XII. FILTER / SEPARATOR, HOSES, NOZZLES, AND GROUND REEL

4-30. General

The filter / separator functions as a device for separating both water and solid contaminates from the product being dispensed. Refer to paragraph 1-7 for detailed description of the filter / separator. The hoses connect the unit pump to filter / separator and are used to dispense the product through the nozzles. This section also covers the ground reel used to ground the unit when it is in use.

4-31. Sight Window, Differential Pressure Indicator, and Petcock

a. Removal.

(1) Drain the filter / separator.

(2) Refer to figure 4-19 and remove the sight window, differential pressure indicator, and draincock.

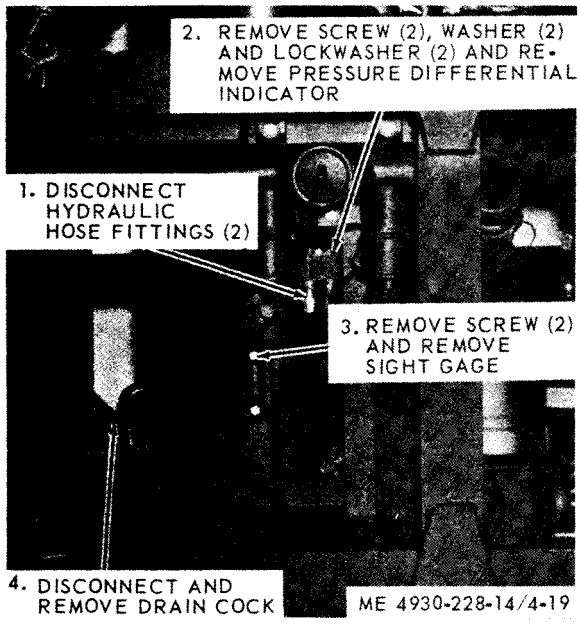


Figure 4-19. Sight window, differential pressure indicator, and drain cock, removal.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the sight window for cracks, breaks, and transparency. Inspect the ball for damage.

(3) Inspect the gasket for breaks.

(4) Inspect the differential pressure indicator for signs of external damage.

(5) Inspect the petcock for cracks, damged threads, and other damage.

(6) Inspect the hoses for cracks, breaks, abraided areas, and other damage.

(7) Replace all defective parts.

c. Installation. Refer to figure 4-19 and install the sight window, differential pressure indicator, and draincock in reverse order of removal.

4-32. Filter / Separator

a. Removal.

(1) Drain the filter / separator.

(2) Refer to figure 4-20 and remove the filter / separator.

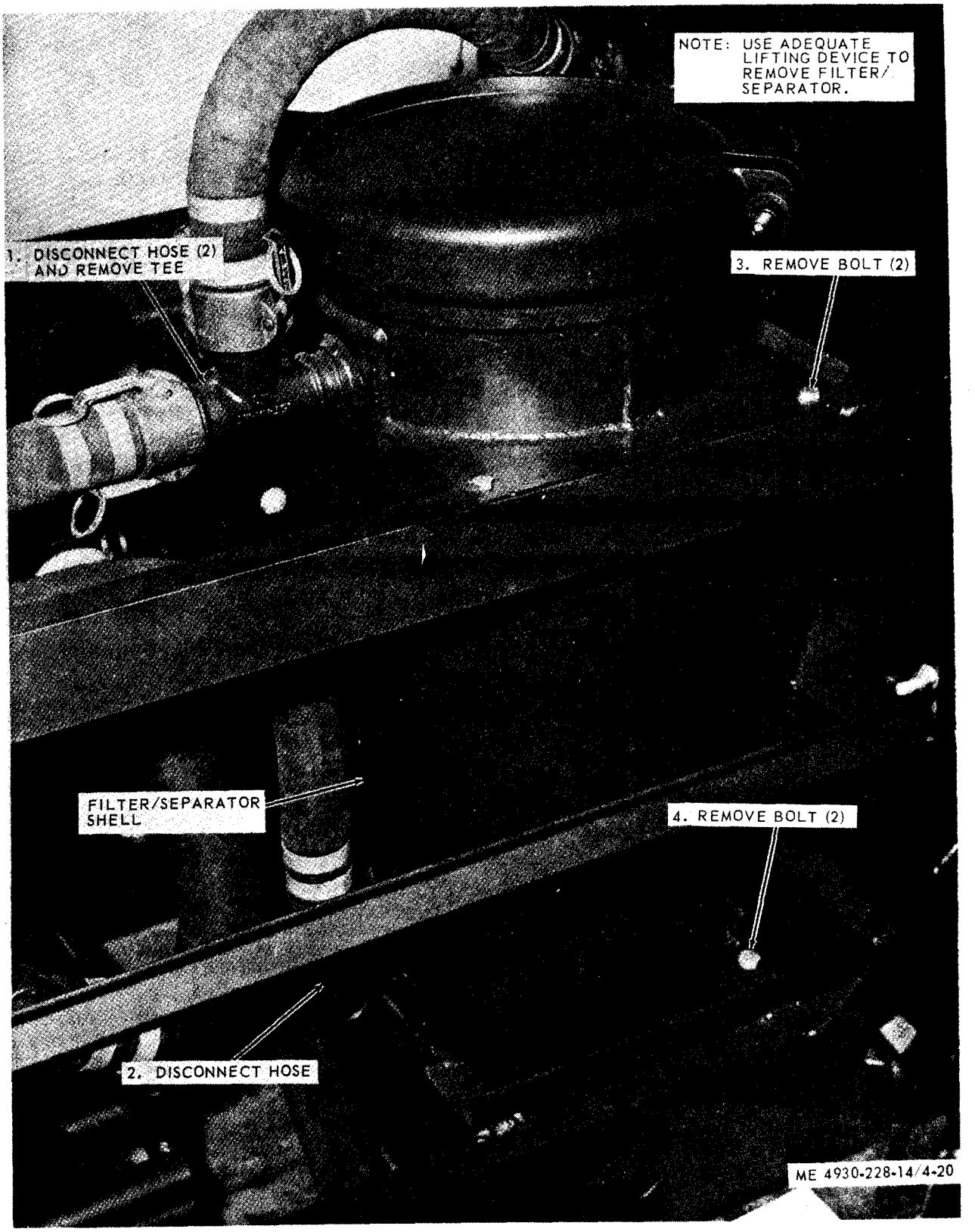


Figure 4-20. Filter / separator, removal.

b. Cleaning and Inspection.

(1) Clean the filter separator and dry thoroughly.

(2) Inspect the filter/ separator for distortion, broken welds, dents, and other damage.

(3) Replace a defective filter/ separator.

c. Installation. Refer to figure 4-20 and install the filter / separator in reverse order of removal.

4-33. Hoses, Nozzles and Bonding Wires

a. Removal. Refer to figure 4-21 and remove the hoses, nozzles, and bonding wires.

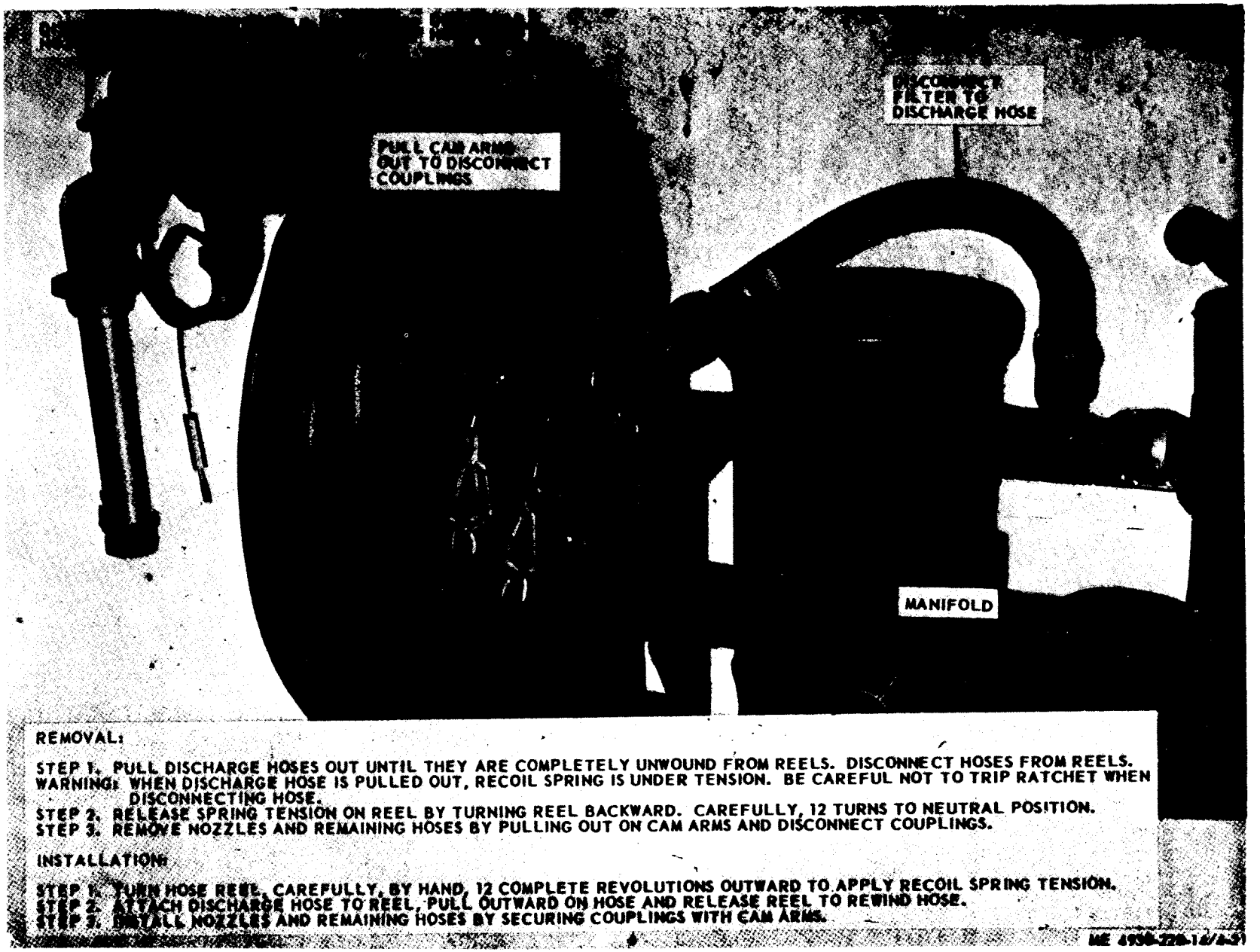


Figure 4-21. Hose, nozzles, and bonding wires, removal and installation.

b. Cleaning and Inspection.

(1) Clean hoses, coupling, and parts thoroughly.

(2) Inspect the hoses for abraided areas, cracks, breaks, and other deterioration or defects.

(3) Inspect coupling gaskets for excessive compression and wear.

(4) Inspect the couplings for cracks, breaks, distortion, and other damage.

(5) Replace defective parts.

c. Installation. Refer to figure 4-21 and install the hoses, nozzles, and bonding wires.

4-34. Hose Reels, Rollers, and Spring Housings

a. General. The two hose reels have a recoil tension springs to wind the 40-foot discharge hoses on the reels. The product enters each reel from the filter / separator through a pipe at the hub of the reel and is discharged through the hoses.

b. Removal.

(1) Remove the discharge hoses and nozzles (para 4-33).

(2) Refer to figure 4-22 and remove the hose reels and spring housings.

WARNING

Do not disassemble the spring housings. The spring is under tension and can cause serious injury or even death if disassembled improperly. Repair of spring housing is by replacement only.

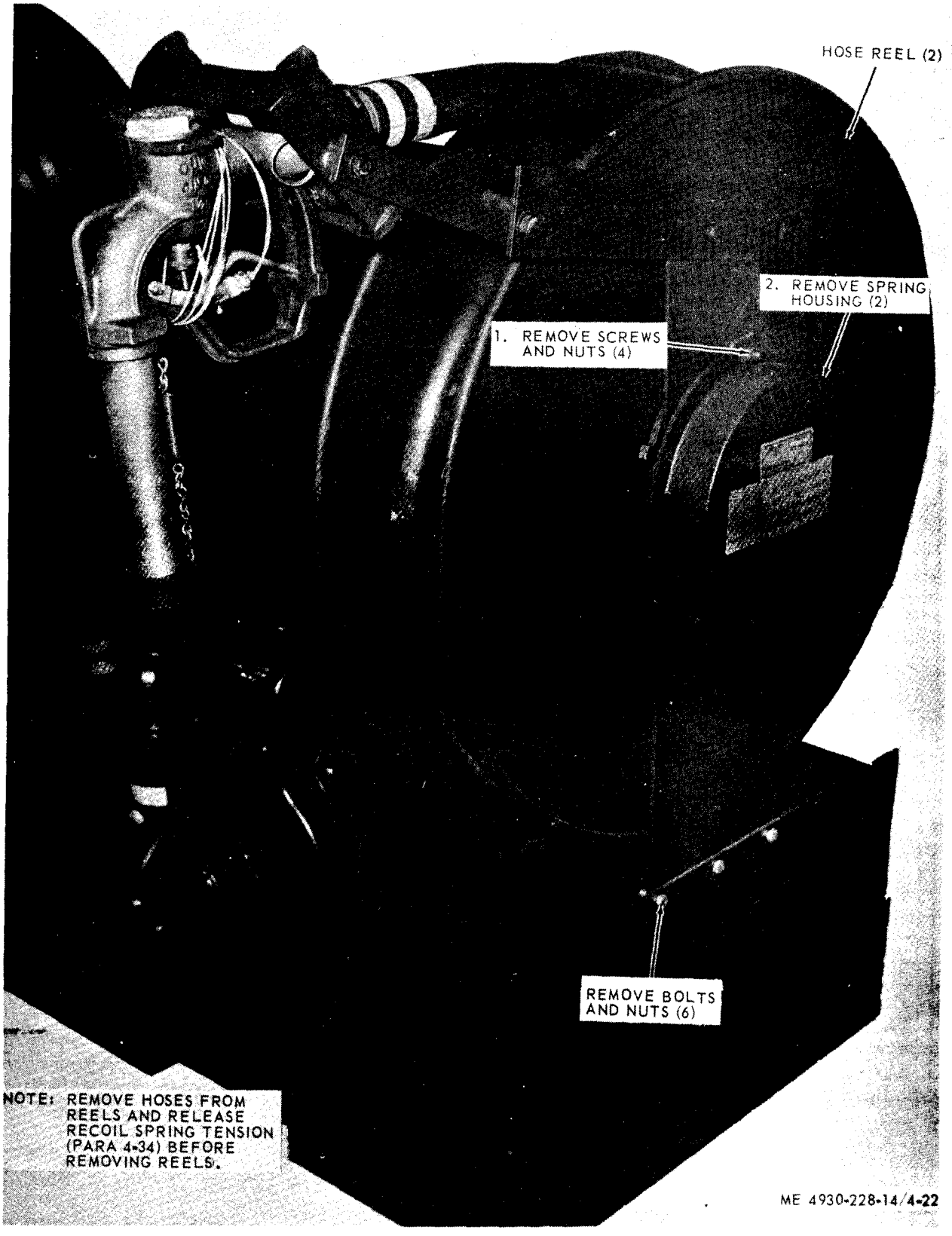


Figure 4-22. Hose reels and spring housing, removal.

c. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the spring housings for broken welds, dents, distortion, and other damage.

(3) Inspect the reels for leakage, distortion, dents, defective ratchet, and other damage.

(4) Replace a defective reel and spring housing.

d. Installation.

(1) Refer to figure 4-22 and install the hose reels and spring housings in reverse order of removal.

(2) Install the discharge hoses and nozzles (para 4-33).

4-35. Nozzle Assembly

a. Removal. Refer to figure 4-21 and remove nozzles.

b. Disassembly.

(1) Pull dustcap (9, fig. 4-23) from end of tube assembly (13).

(2) Unscrew tube assembly (13) from body (29).

(3) Unscrew and remove cap (1) from body (29).

(4) Remove spring (2) from the body.

(5) Remove upper poppet (3) from body.

(6) Remove the disc holder (4), disc (5), and washer disc (6).

(7) Remove nut (7) and stem (8) from the body.

(8) Remove lever (18) by removing the cotter pin (16) and pin (17).

(9) Unscrew and remove the packing nut (19).

(10) Remove packing (21) from the body.

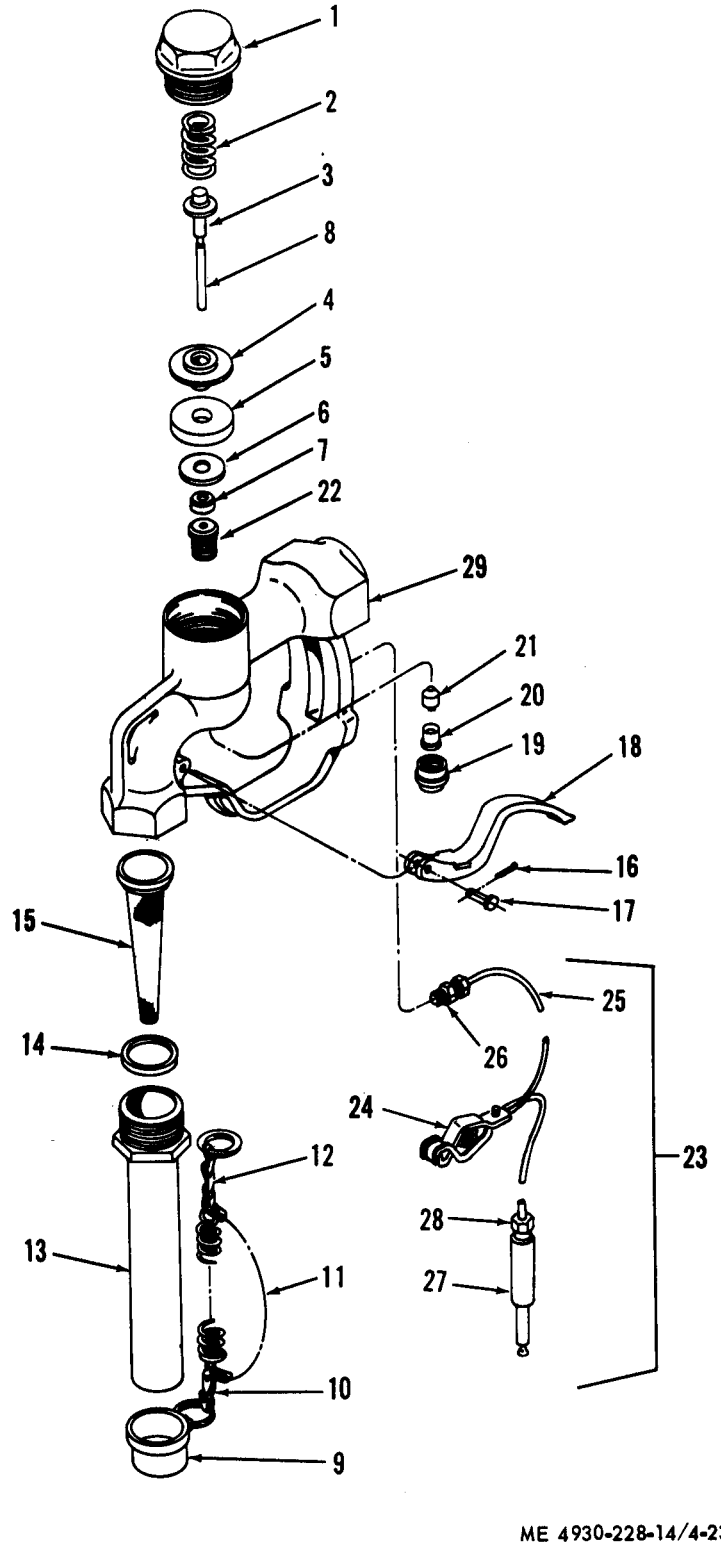


Figure 4-23. Nozzle, exploded view.

Key to figure 4-23.

1 Cap
2 Spring
3 Upper poppet
4 Disk holder
5 Disk
6 Washer disk
7 Nut
8 Stem
9 Dust cap
10 Chain
11 Spring
12 Hook
13 Tube assembly
14 Gasket
15 Strainer
16 Cotter pin
17 Pin
18 Lever
19 Packing Nut
20 Nut
21 Packing
22 Guide
23 Bonding wire assembly
24 Clip
25 Wire
26 Nut
27 Plug
28 Nut
29 Body

c. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the spring for cracks and rust.

(3) Inspect the upper poppet for damage.

(4) Inspect the dish and washer disk for distortion.

(3) Inspect the washer disk for excessive groove caused by wear and for splits or tears.

(6) Inspect the body for cracks, breaks, dents, distortion, and damaged threads.

(7) Inspect other parts for damage.

(8) Replace all defective parts.

d. Reassembly. Use a new or serviceable poppet assembly and stem packing and reverse the procedure in *b* above.

NOTE

Nozzle strainer must be cleaned daily. Remove the tube assembly (13) from the body (29) and remove strainer (15) to clean.

e. Installation. Refer to figure 4-21 and install nozzles.

4-36. Ground Reel

a. General. A ground reel is attached to the frame of the pumping assembly to provide a means of grounding the tank and pump unit. One section of the ground wire must be clipped to a ground connection near the tank and pump unit before the other section is connected to the vehicle being fueled.

b. Removal. Refer to figure 4-24 and remove the ground reel.

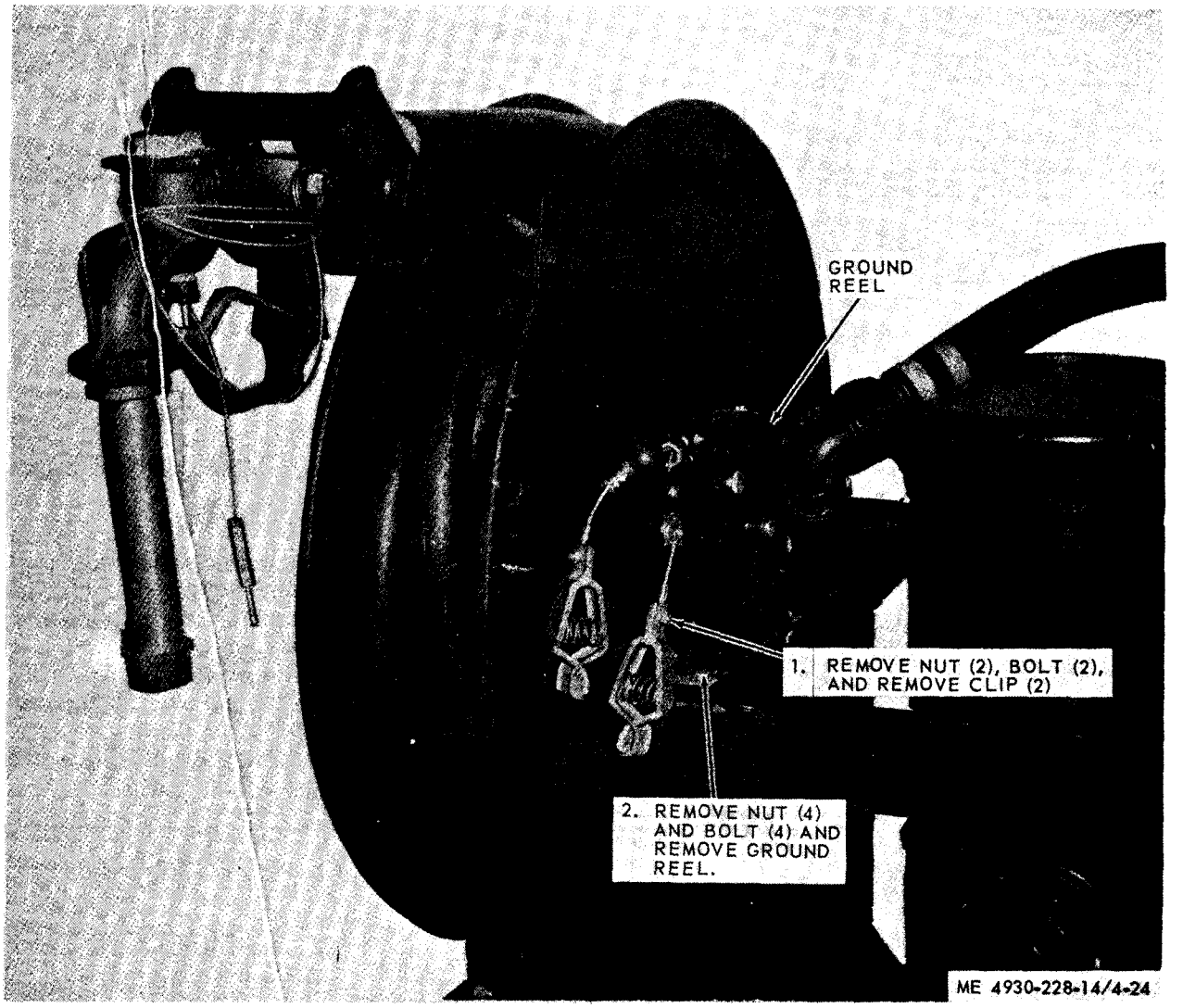


Figure 4-24. Ground reel, removal.

c. Cleaning and Inspection.

(1) Clean the ground reel thoroughly.

(2) Inspect the outside of the ground reel for dents, distortion. and other damage.

(3) Inspect the rubber cable stops for torn or broken rubber balls.

(4) Inspect the clips for broken springs.

(5) Pull out the cables and inspect for frayed. abraided, broken, and rusty areas.

(6) Replace a defective ground reel.

d. Installation. Refer to figure 4-24 and install the ground reel in reverse order of rem-oval.

Section XIII. INLET ELBOW, OUTLET TEE, AND MANIFOLD

4-37. General

The pump and filter / separator are each equipped with an inlet elbow and outlet tee. They route the product into and out of the pump and filter / separator. The manifold controls the flow of the product to the suction side of the pump. Two quick-disconnect couplings provide inlets for the tank suction lines. A flow of the product from either or both tanks is conducted to the pump suction through the manifold outlet and a suction hose.

4-38. Inlet Elbow and Outlet Tee

a. Removal. Refer to figure 4-25 and remove the inlet elbow and outlet tee.

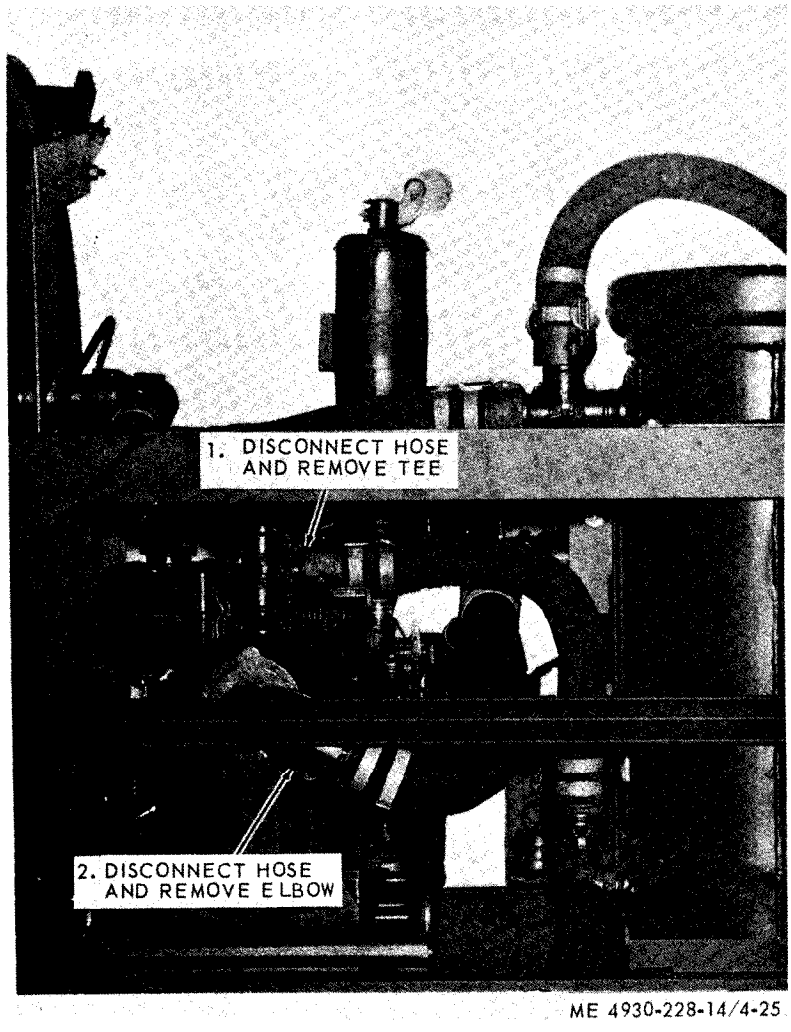


Figure 4-25. Inlet elbow and outlet tee, removal.

b. Cleaning and Inspection.

(1) Clean and dry all parts thoroughly.

(2) Inspect the inlet tees and outlet elbows for cracks, breaks, and other damage.

(3) Inspect for worn or broken gaskets.

(4) Replace defective parts.

c. Installation. Refer to figure 4-25 and install the inlet elbow and outlet tee in reverse order of removal.

4-39. Manifold

a. Removal. Refer to figure 4-26 and remove the manifold.

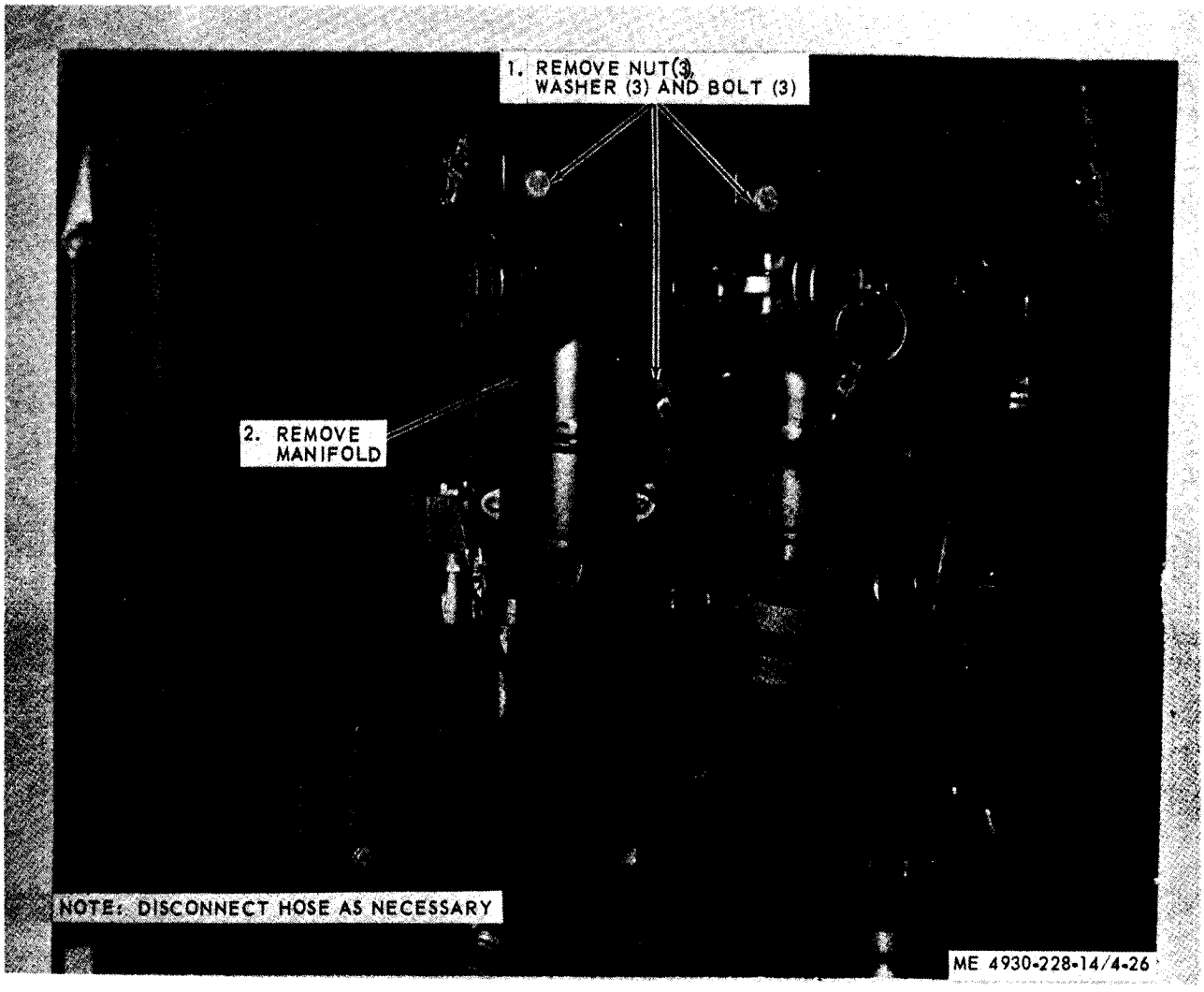


Figure 4-26 Manifold, removal.

b. Cleaning and Inspection.

(1) Clean and dry the manifold throughly.

(2) Inspect the manifold for cracks, breaks, distortion, defective threads, and for other damage.

(3) Inspect for worn or broken gasket.

(4) Replace defective parts.

c. Installation. Refer to figure 4-26 and install the manifold in reverse order of removal.

Section XIV. TANKS AND COMPONENTS

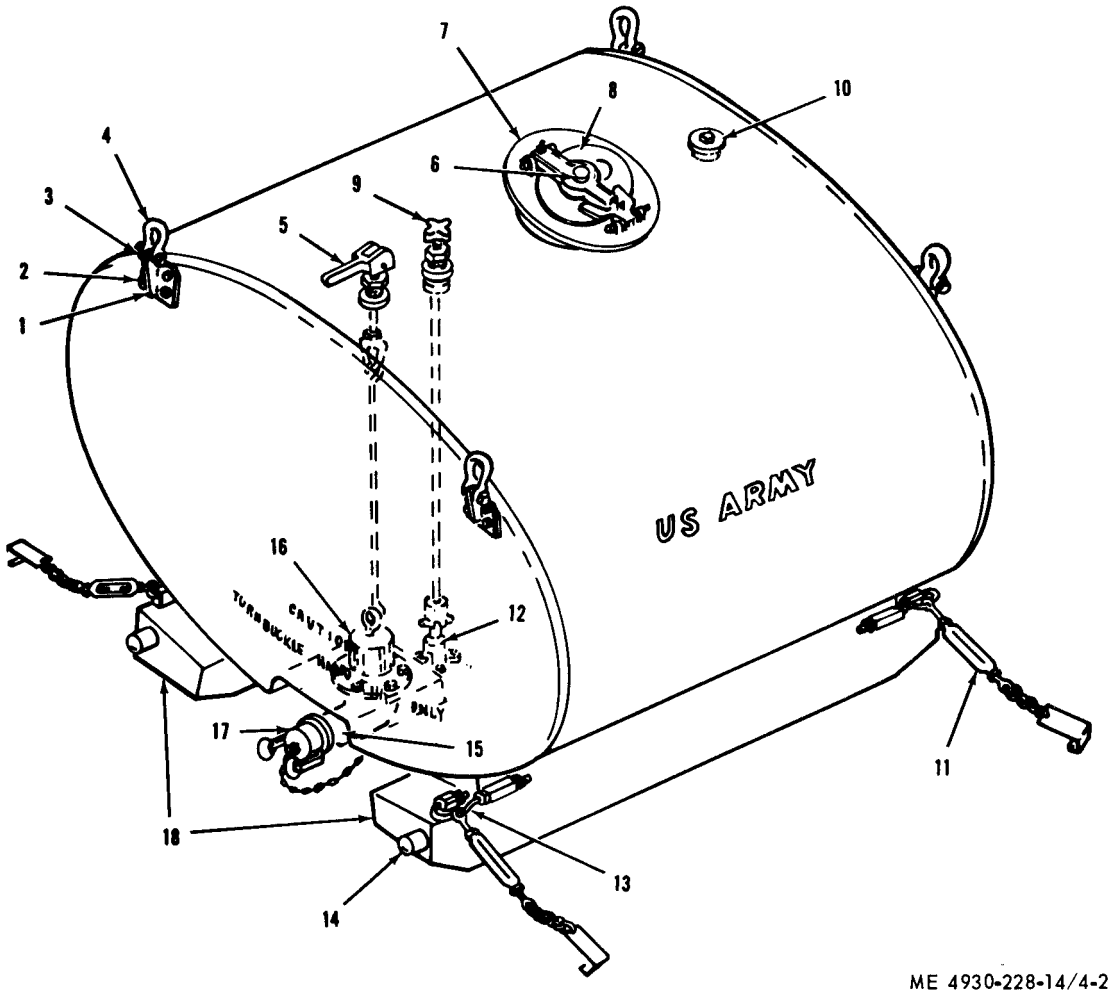
4-40. Cleaning Tanks and Components

a. General. The tank and tank components must be cleaned before any repair is initiated. Each time a major component is removed for repair, inspection, or other service, all parts must be thoroughly cleaned. Clean the discharge valve each time the tank is drained. Clean the tank interior and exterior prior to repair.

b. Components. Clean metal parts with cleaning solvent. Federal Specification P-D-680. Immerse each part in solvent and remove contaminants by brushing. Allow parts to dry thoroughly. Coat parts with a thin film of light lubricating oil or perservative oil before assembly.

4-41. Manhole Assembly

a. Vent Assembly. The manhole cover assembly (7, fig. 4-27) is provided with a vent assembly (6) located in the cover.



1 Bracket (4)
2 Bolt (16)
3 Nut(4)
4 Lifting eye (4)
5 Control lever
6 Vent assembly
7 Cover assembly
8 Cover
9 Drain valve handle
10 Pump port
11 Tiedown assembly
12 Drain valve
13 Drag loop
14 Interlock
15 Valve body
16 Inlet strainer screen
17 Dust cap
18 Skids

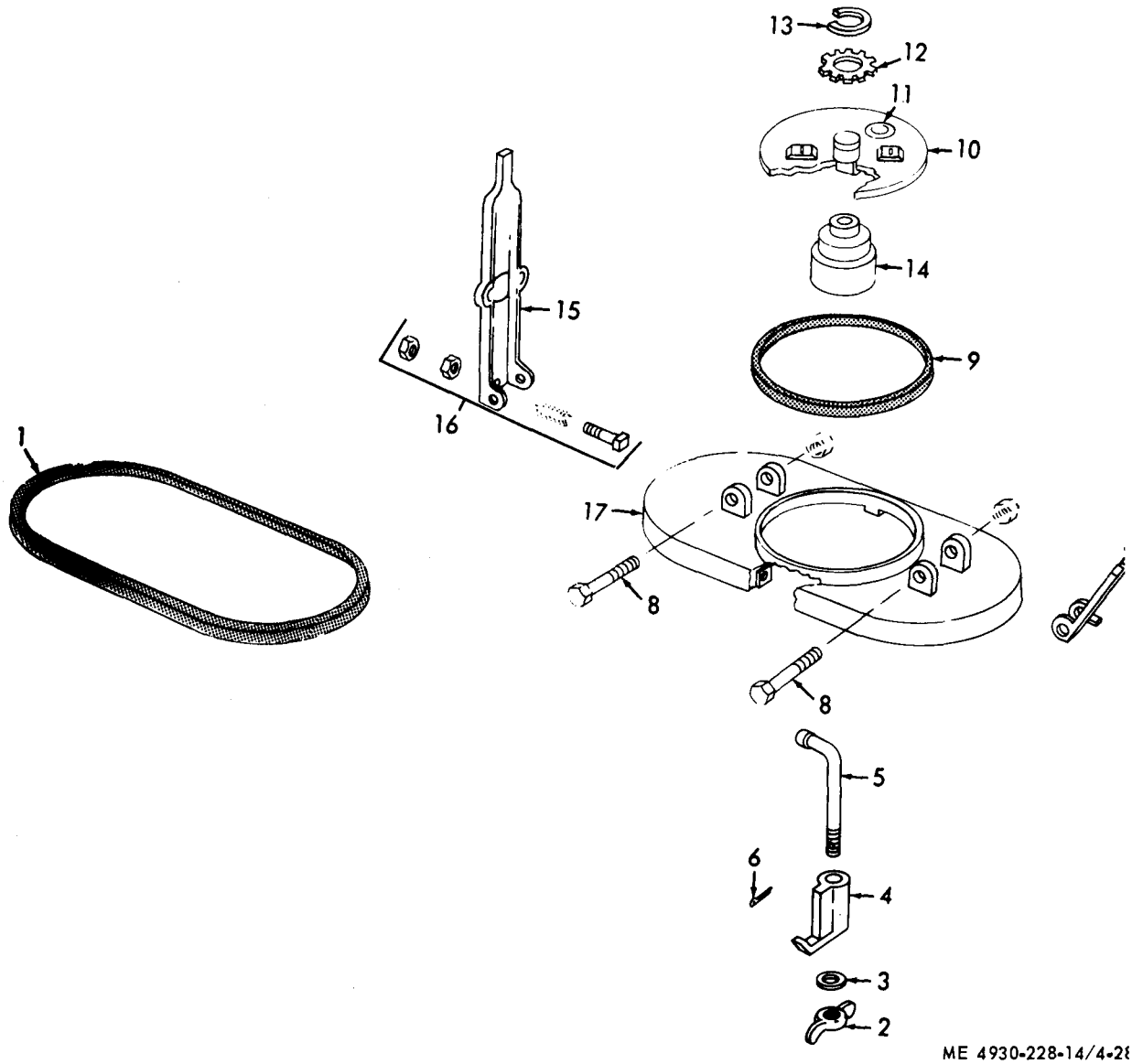
Figure 4-27. Tank assembly service.

b. Removal.

(1) Refer to figure 4-28, release cam (7), and raise hinge (15).

(2) Open manhole cover (10) and loosen the six nuts (2) so that hooks (4) will drop free of tank rim.

(3) Lift manhole cover from tank.



Key to figure 4-28.

1 Gasket	10 Cover
2 Nut	11 Plug
3 Washer	12 Spring
4 Hook	13 Ring
5 Bolt	14 Vent
6 Pin	15 Hinge
7 Cam	16 Adjusting Assembly
8 Bolt	17 Cover
9 Gasket	

Figure 4-28. Manhole cover, exploded view.

c. Disassembly. Refer to figure 4-28 and disassemble manhole cover.

d. Cleaning and Inspection.

(1) Clean parts with cleaning solvent and dry thoroughly.

(2) Inspect parts for breaks, cracks, damaged threads, and defects. Replace a defective part.

e. Reassembly. Refer to figure 4-28 and reassemble the manhole cover.

f. Installation.

(1) Replace manhole cover on tank.

(2) Position hooks (4) on tank rim and tighten nuts (2).

(3) Close cover (10), drop hinge (15) into position, and lock cam (7).

4-42. Pump Port

a. General. A pump port (55 gallon plug) cover assembly (10, fig. 4-27) is provided so that a hand pump may be used.

b. Service. Remove pump port cover and examine gasket. Replace if defective.

4-43. Drain Valve Assembly

a. General. A drain valve assembly is provided for draining accumulated water from the tanks.

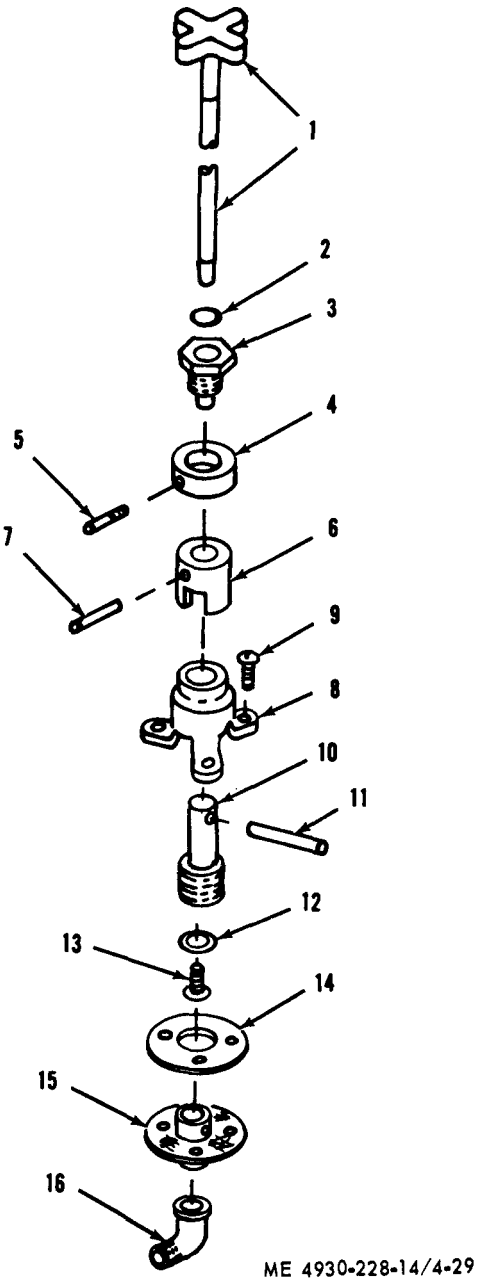
b. Removal.

(1) Remove manhole cover (para 4-41).

(2) Insure that tank has been completely drained and flushed thoroughly to remove fumes and fuel before entering tank.

(3) Enter tank through manhole opening.

(4) Refer to figure 4-29 and loosen setscrew (5).



1 Rod and handle	9 Screw (3)
2 O-ring	10 Stem
3 Support	11 Stem pin
4 Collar	12 Washer
5 Setscrew	13 Screw
6 Key	14 Gasket
7 Pin	15 Base
8 Stem retainer	16 Elbow

Figure 4-29. Drain valve, exploded view.

d. Disassembly. Refer to figure 4-29 and disassemble drain valve.

e. Cleaning and Inspection.

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

(2) Inspect all parts for breaks, cracks, and clam aged threads. Replace a damaged part.

f. Reassembly. Refer to figure 4-29 and reassemble drain valve.

g. Installation.

(1) Tighten setscrew (5).

(2) Replace manhole cover (para 4-41).

4-44. Discharge Valve Assembly

a. Removal.

(1) Remove manhole cover (para 4-41).

(2) Pull control lever (5, fig. 4-27) to CLOSE position and remove dust cap (17).

(3) Insure that tank has been completely drained and thoroughly flushed before entering tank.

(4) Enter tank thru manhole opening.

(5) Refer to figure 4-30. Loosen adjusting bale (6), disengage lift rod (7) from adjusting bale and remove lift rod.

(6) Outside the tank, remove six nuts (24) holding valve to sump ring (8) and remove valve assembly.

Key to figure 4-30.

1 Control lever
2 Pin
3 Lever rod
4 Support
5 O-ring
6 Adjusting bale
7 Lift rod
8 Sump ring
9 Gasket
10 Gasket
11 Screen
12 Bale
13 Stem
14 Cap
15 Spring
16 Seat
17 Disk
18 Nut
19 Setscrew
20 Valve body
21 Gasket
22 Dust cap
23 Chain
24 Nut

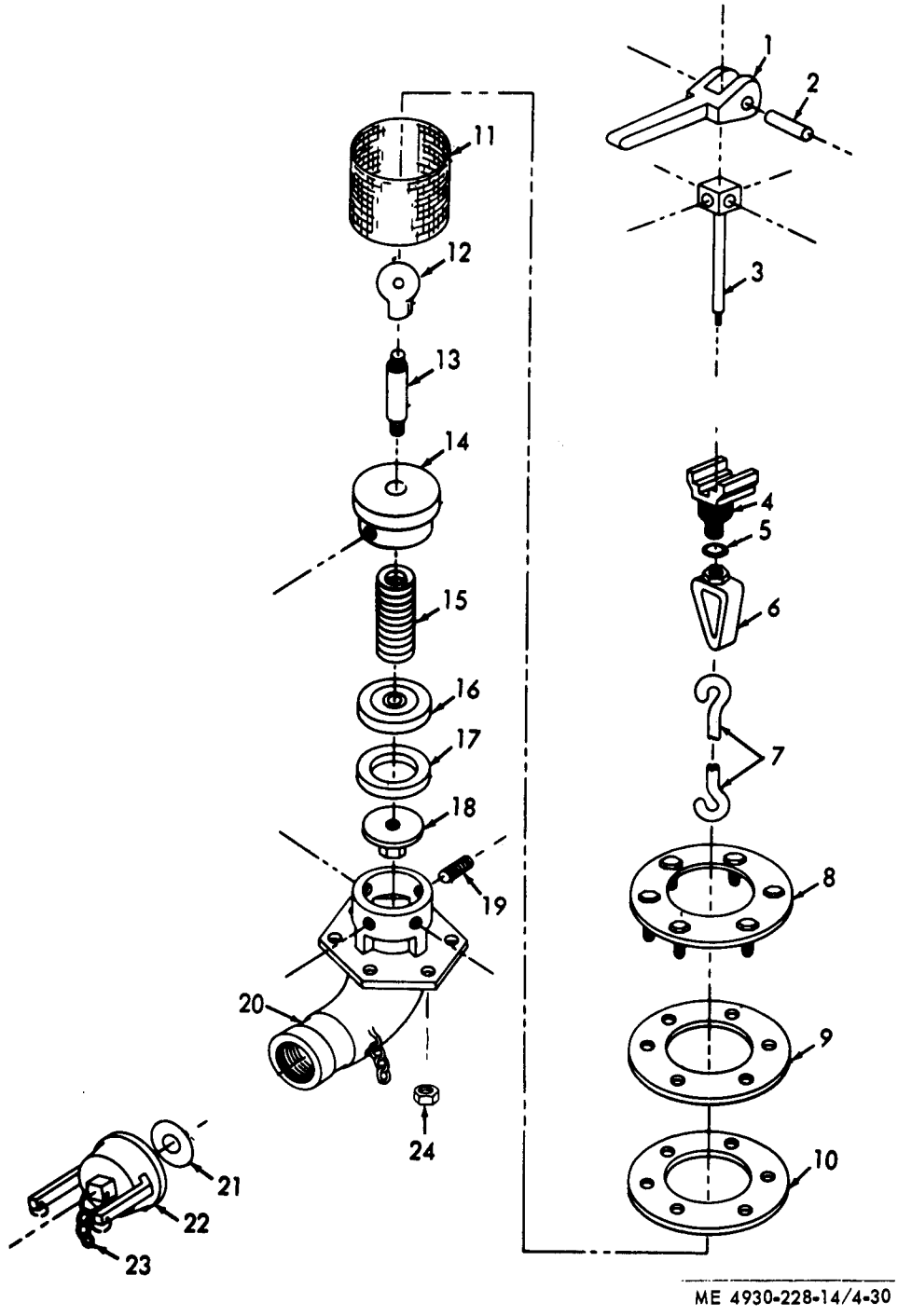


Figure 4-30. Discharge valve assembly, exploded view.

b. Disassembly. Refer to figure 4-30 and disassemble valve.

c. Cleaning and Inspection.

(1) Clean all parts with cleaning solvent and dry throughly.

(2) Inspect all parts, for cracks, breaks, or other damage. Replace a defective part.

d. Reassembly. Refer to figure 4-30 and reassemble discharge valve.

e. Installation.

(1) Position valve body (20) on sump ring (8) and install nuts (24).

(2) Inside tank, place lift rod (7) in stem (12) and adjusting bale (6), and tighten adjusting bale.

(3) Replace manhole cover (para 4-41).

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

5-1. Tools and Equipment

There are no direct support or general support tools or repair parts issued with or authorized for the tank and pump unit.

5-2. Special Tools and Equipment

No special tools or equipment are required by direct support or general support maintenance personnel for the maintenance of the tank and pump unit.

5-3. Direct Support and General Support Maintenance Repair Parts

Repair parts and equipment are listed in the repair parts and special tools list covering direct support and general support maintenance for this equipment (TM 5-4930-228-24P).

Section II. DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE TROUBLESHOOTING

5-4. General

a. This section contains troubleshooting information for locating and correcting troubles which may develop in the tank and pump 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 causes of trouble and corrective actions to take. You should perform the tests / inspections and corrective actions in the order listed.

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

5-5. Direct Support and General Support Maintenance Troubleshooting

For direct support and general support maintenance troubleshooting, refer to table 5-1.

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

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. PUMP FAILS TO PUMP.
Step 1. Inspect for broken or defective impeller. Replace defective impeller.
Step 2. Inspect for cracked, broken, or defective housing. Replace defective housing.
2. PUMP LEAKS.
Step 1. Inspect for defective gasket. Replace defective gasket.
Step 2. Inspect for broken or worn seal. Replace defective seal.
3. PUMP NOISY.
Step 1. Inspect for defective seal. Replace defective seal.
Step 2. Inspect for loose and defective impeller. Replace defective impeller.

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

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
4. ENGINE HARD TO START OR FAILS TO START
Step 1. Inspect for defective valves or valve seat.
Replace defective valves or valve seat.
Step 2. Inspect for worn, stuck, or broken piston rings.
Replace defective piston rings.
Step 3. Inspect for defective timing gear or camshaft.
Replace defective timing gear or camshaft.
5. OIL CONSUMPTION EXCESSIVE
Step 1. Inspect for worn, stuck, or broken piston rings.
Replace defective piston rings.
Step 2. Inspect for worn or scored cylinder wall.
Replace worn or scored engine block.
Step 3. Inspect for defective seal.
Replace defective seal.
6. ENGINE KNOCKS
Step 1. Inspect for defective connecting rod bearing.
Replace defective connecting rod bearing assembly.
Step 2. Inspect for defective piston pin.
Replace defective piston assembly.
Step 3. Inspect for defective piston.
Replace defective piston.
Step 4. Inspect for defective main bearing.
Replace defective main bearing.
Step 5. Inspect for stuck valve.
Grind or replace defective valve.
7. ENGINE SMOKES EXCESSIVELY.
Step 1. Inspect for stuck, worn, or broken piston rings.
Replace defective piston rings.
Step 2. Piston worn or broken.
Replace defective piston.
Step 3. Inspect for worn or scored cylinder walls.
Replace defective engine block.

Section III. GENERAL MAINTENANCE

5-6. General

This section contains direct support maintenance data that will be needed by direct support maintenance personnel and may be referenced for repair of the tank and pump unit.

5-7. Tabulated Data

a. Nut and Bolt Torque Data. For nut and bolt torque data, refer to table 5-2.

b. Engine Overhaul Data.

Bore	2 7/8 in.
Stroke	2 ¾ in.
Displacement	17.8 cu. in.
Rotation	Clockwise (flywheel end)
Brake horsepower	4.49 at 3000 rpm
Spark plug gap	0.030 in.
Magneto points	0.015 in.
Carburetor	Idle at 1,000-1,200 rpm

c. Repair and Replacement Standards. Table 5-3 lists the manufacturer's sizes, tolerances, desired clearances, and maximum allowable wear and clearances.

Table 5-2. Nut and Bolt Torque Data

Cylinder head screw	14-18 ft-lb
Oil pan screw	6-8 ft-lb
Connecting rod cap bolt	14-18 ft-lb
Main bearing cap bolt	14-18 ft-lb

Table 5-3. Repair and Replacement Standards

Component points of measurement	Manufacturer's dimensions and tolerances in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Crankshaft					
Diameter of Journal	1.001	1.001			
Clearance to connecting rod			0.007	0.002	0.002
Width of journal	1.000	1.005			
Connecting rod side clearance			0.006	0.013	0.013
End play (cold)			0.002	0.004	0.004
Piston					
Ring gap			0.012	0.022	0.022
Ring side clearance in grooves:					
Top ring			0.002	0.0035	0.0035
2nd and 3rd ring			0.001	0.0025	0.0025
Oil ring			0.0025	0.004	0.004
Cylinder-to-skirt clearance			0.006	0.0065	0.0065
Pin-to-connecting rod clearance			0.002	0.0003	0.0008
Tappet-to-valve clearance (cold)					
Intake					0.008
Exhaust					0.014
Valve stem-to-guide clearance			0.003	0.005	0.007

CHAPTER 6

REPAIR INSTRUCTIONS

Section I. PUMP AND INTERMEDIATE COUPLING

6-1. General

The pump is coupled to the engine by an intermediate coupling. One side of the coupling bolts to the engine; the pump housing bolts to the opposite side. The pump impeller is threaded and screws directly to the engine crankshaft. Impeller-to-wear plate clearance is regulated by gaskets and shims. A seal assembly is installed between the engine crankshaft and coupling head to prevent fluid from leaking around the rotating shaft.

NOTE

Evidence of leakage between the intermediate coupling and engine will indicate a defective seal.

6-2. Pump and Intermediate Coupling

a. Disassembly. Refer to figure 6-1 and remove pump housing.

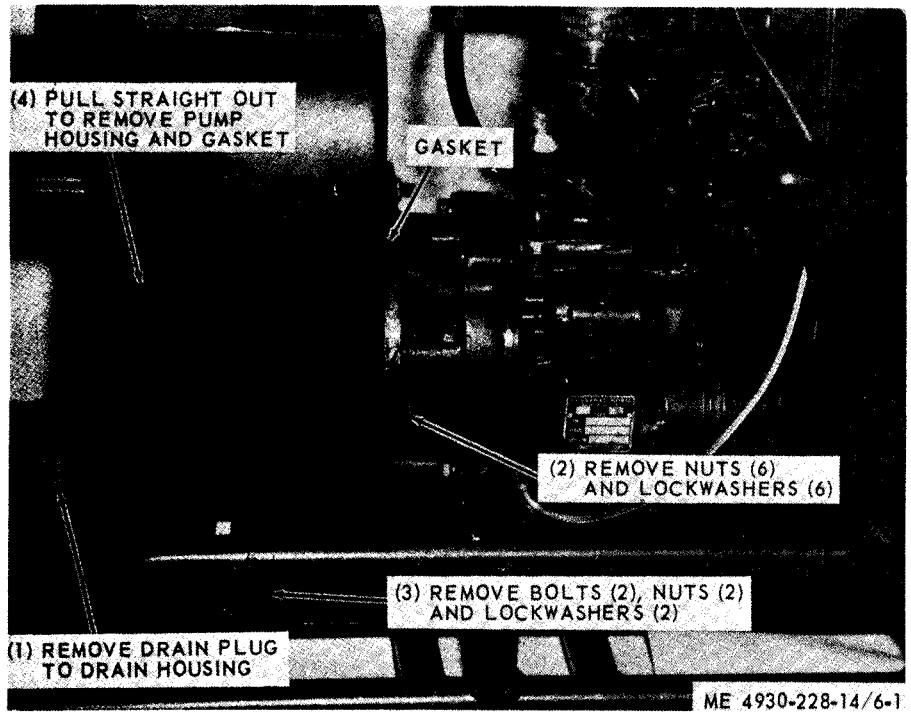


Figure 6-1. Pump housing removal.

b. Disassembly. Refer to figure 6-2 and disassemble pump and intermediate coupling.

DISASSEMBLY:

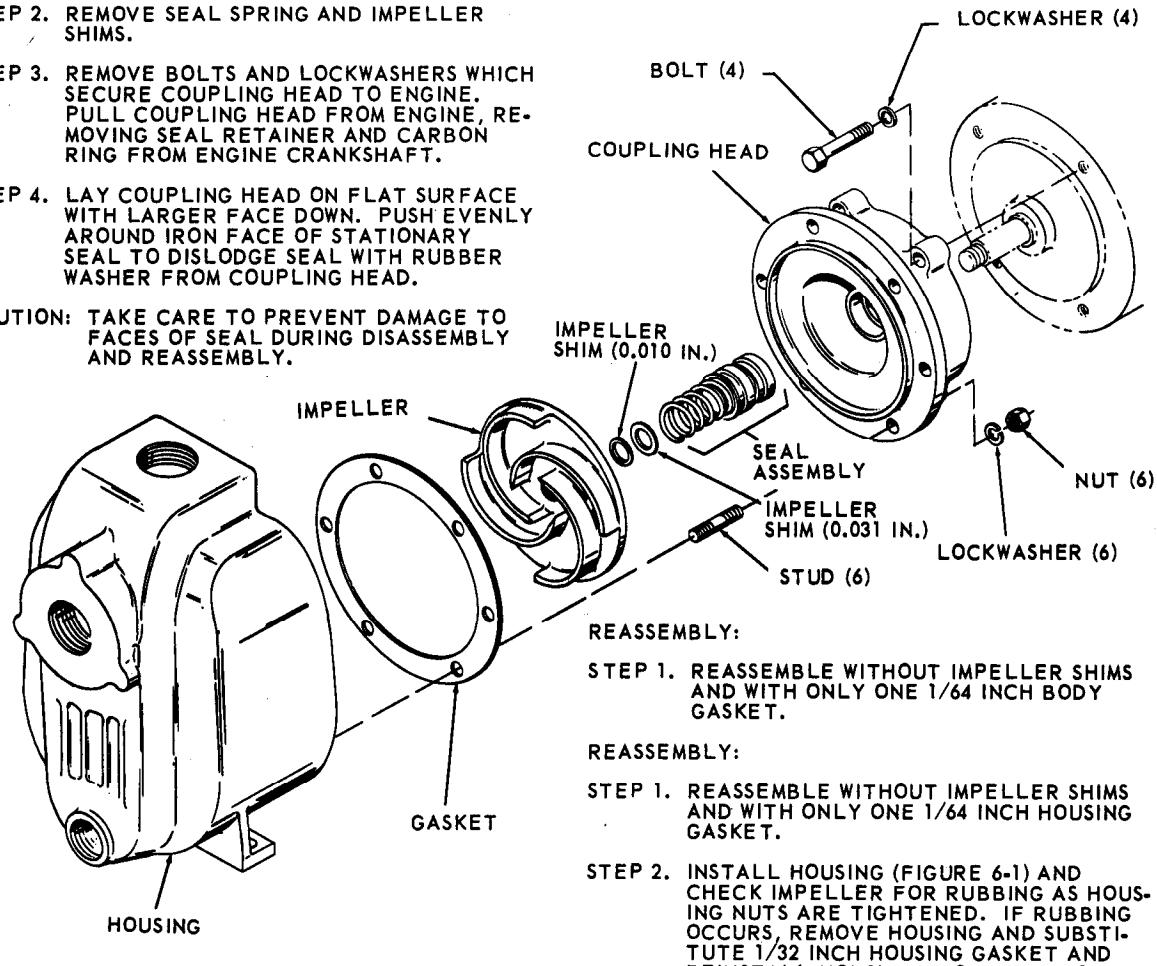
STEP 1. PLACE BLOCK OF WOOD ØN END OF IMPELLER BLADE AND STRIKE SHARPLY TO LOOSEN IMPELLER THREADS FROM ENGINE CRANKSHAFT. SLOWLY UNSCREW IMPELLER FROM SHAFT.

STEP 2. REMOVE SEAL SPRING AND IMPELLER SHIMS.

STEP 3. REMOVE BOLTS AND LOCKWASHERS WHICH SECURE COUPLING HEAD TO ENGINE. PULL COUPLING HEAD FROM ENGINE, REMOVING SEAL RETAINER AND CARBON RING FROM ENGINE CRANKSHAFT.

STEP 4. LAY COUPLING HEAD ON FLAT SURFACE WITH LARGER FACE DOWN. PUSH EVENLY AROUND IRON FACE OF STATIONARY SEAL TO DISLODGE SEAL WITH RUBBER WASHER FROM COUPLING HEAD.

CAUTION: TAKE CARE TO PREVENT DAMAGE TO FACES OF SEAL DURING DISASSEMBLY AND REASSEMBLY.



REASSEMBLY:

STEP 1. REASSEMBLE WITHOUT IMPELLER SHIMS AND WITH ONLY ONE 1/64 INCH BODY GASKET.

REASSEMBLY:

STEP 1. REASSEMBLE WITHOUT IMPELLER SHIMS AND WITH ONLY ONE 1/64 INCH HOUSING GASKET.

STEP 2. INSTALL HOUSING (FIGURE 6-1) AND CHECK IMPELLER FOR RUBBING AS HOUSING NUTS ARE TIGHTENED. IF RUBBING OCCURS, REMOVE HOUSING AND SUBSTITUTE 1/32 INCH HOUSING GASKET AND REINSTALL HOUSING. CONTINUE TO ADD HOUSING GASKET THICKNESSES IN 1/64 INCH INCREMENTS UNTIL RUBBING CEASES AND IMPELLER IS FREE.

STEP 3. REMOVE HOUSING AND INSTALL 0.010 INCH THICK IMPELLER SHIM AND REASSEMBLE. IF RUBBING OCCURS, REMOVE IMPELLER SHIM. IF IMPELLER REMAINS FREE LEAVE SHIM IN PLACE.

STEP 4. IF RUBBING DOES NOT OCCUR AS INDICATED IN STEP 2, ADD IMPELLER SHIMS UNTIL RUBBING DOES OCCUR, THEN REDUCE THICKNESS OF SHIMS IN 0.010 INCH INTERVALS UNTIL IMPELLER ROTATES FREELY.

ME 4930-228-14/6-2

Figure 6-2. Pump and intermediate coupling, disassembly and reassembly.

c. Cleaning and Inspection.

(1) Clean parts with cleaning solvent; dry thoroughly.

(2) Inspect impeller for cracks, wear, scoring, damaged blade, worn or damaged threads, distortion or other damage.

(3) Inspect pump housing for cracks, scoring caused by a rubbing impeller, worn or damaged threads, or other damage.

(4) Inspect intermediate coupling for cracks, broken mounting flanges, damaged seal seat, or other damage.

(5) Inspect the seal assembly parts for warping or deterioration. Carefully check the seal faces for scratches or scoring. If any seal parts are damaged, replace seal assembly.

(6) Inspect attaching hardware for cracks, worn or damaged threads, distortion, or other damage: replace damaged parts.

d. Reassembly. Refer to figure 6-2 and reassemble pump and intermediate coupling.

e. Installation. Refer to figure 6-1 and install pump housing. (Installation procedure is reverse of removal).

Section II. ENGINE COMPONENTS

6-3. General

This section contains instructions for removing and installing the engine assembly, and for repair of the fuel tank and strainer, flywheel, cylinder head, valves and tappets, engine base oil pump, piston and connecting rod, crankshaft, camshaft, and governor.

6-4. Fuel Tank

a. Refer to paragraph 4-24 for removal, exterior cleaning and inspection, and installation of fuel tank.

b. Repair fuel tank by soldering or welding. (Refer to para 6-19 for tank welding instructions.)

6-5. Engine Removal and Installation

a. Removal.

(1) Remove pump and intermediate coupling (para 6-2).

(2) Remove fuel tank (para 4-24).

(3) Refer to figure 6-3 and remove the engine assembly.

b. Installation,

(1) Refer to figure 6-3 and install the engine assembly.

(2) Install the fuel tank (para 4-24).

(3) Install the pump and intermediate coupling (para 6-2).

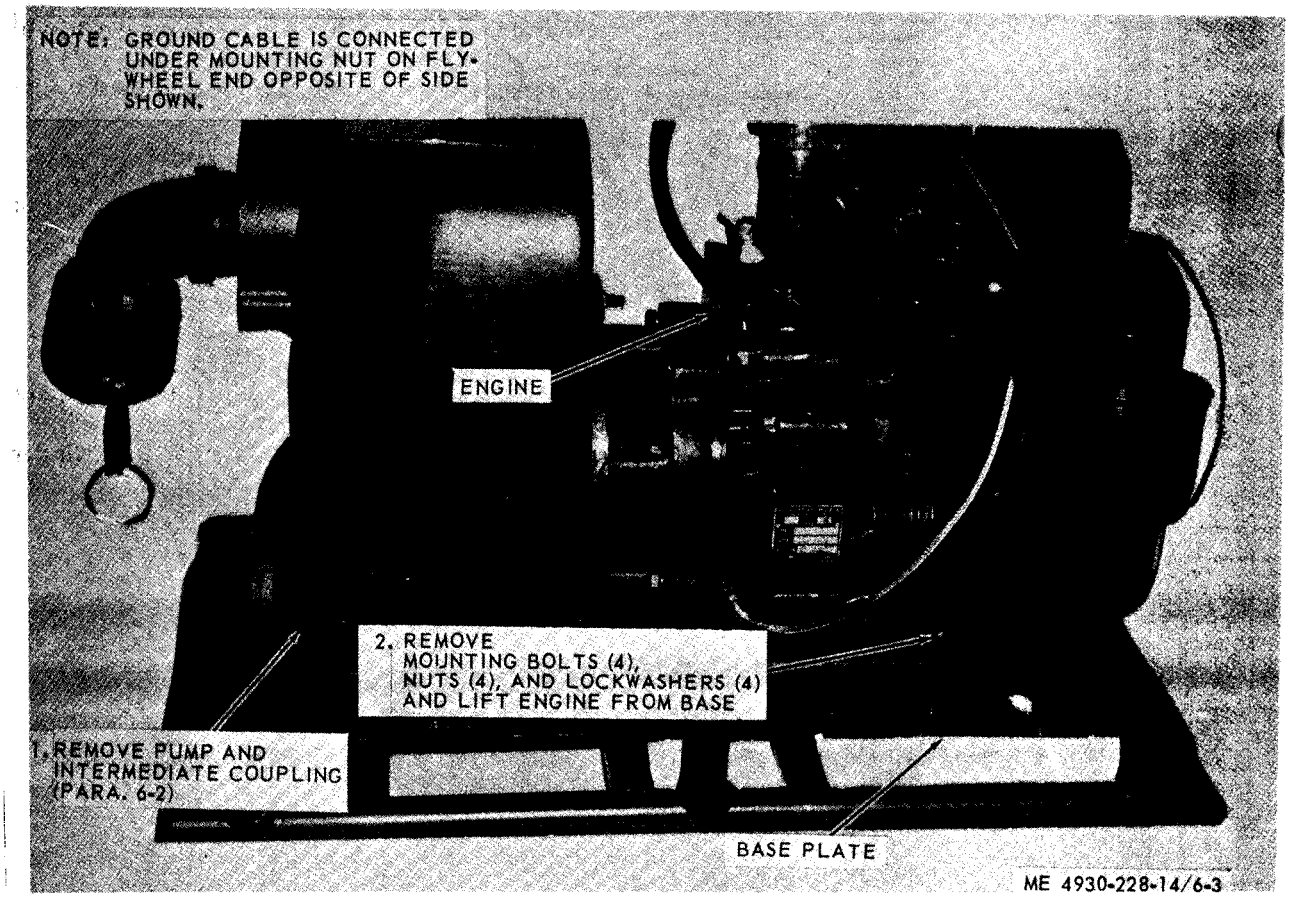


Figure 6-3. Engine assembly removal.

6-6. Flywheel

a. Removal.

(1) Remove air shroud (para 4-18).

(2) Refer to figure 6-4 and remove flywheel.

Figure 6-4. Flywheel removal.

b. Cleaning and Inspecting.

(1) Clean flywheel with cleaning solvent and dry thoroughly.

(2) Inspect for cracks, breaks, and other damage.

(3) Replace a defective flywheel.

c. Installation.

(1) Refer to figure 6-4 and install flywheel in reverse order of removal.

(2) Install air shroud (para 4-18).

6-7. Cylinder Head

a. Removal.

(1) Remove the spark plug (para 4-20).

(2) Remove the air shroud and bracket (para 4-18).

(3) Refer to figure 6-5 and remove the cylinder head and gasket.

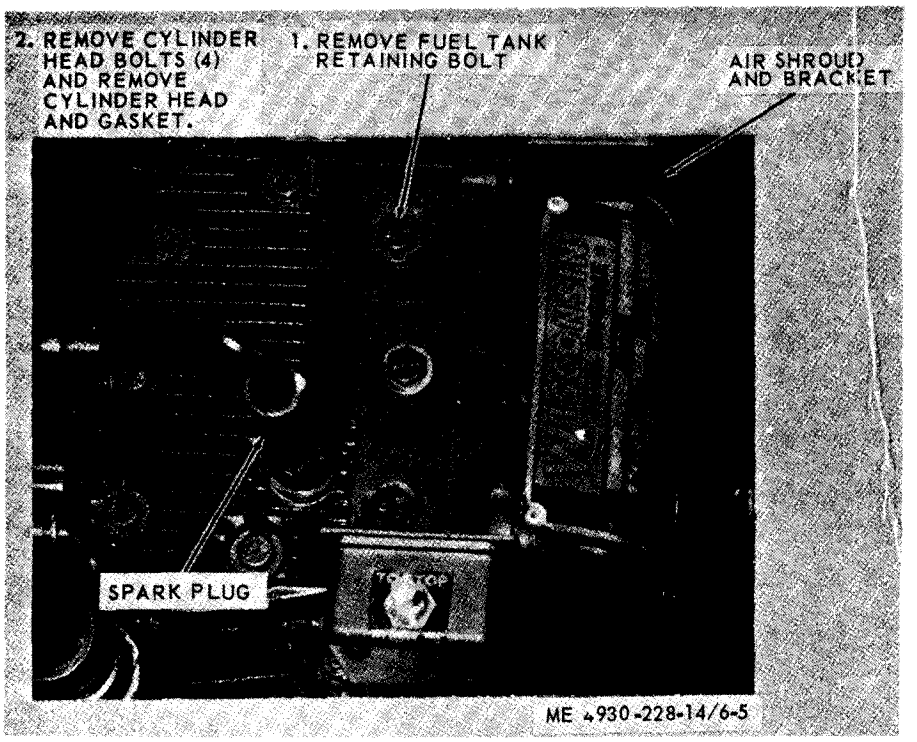


Figure 6-5. Cylinder head removal.

b. Cleaning and Inspection.

(1) Discard the cylinder head gasket. Clean the cylinder head and cylinder head bolts with cleaning solvent; scrape carbon deposits from the cylinder head, taking care not to scratch sealing surfaces.

(2) When the cylinder head is removed, clean the top of the cylinder block, carefully removing carbon from piston tops and from around the valve head and seats. Take care not to scratch or score valve seats.

(3) Inspect the cylinder head for cracks, warping, broken cooling fins, spark plug port threads, and other damage. Straighten bent cooling fins. Replace a dam aged cylinder head.

c. Installation.

(1) Refer to figure 6-5 and install the cylinder head, using a new gasket. (Installation procedure is reverse of removal.)

(2) Install the air shroud (para 4-18).

(3) Install the spark plug (par 4-21).

(4) After installation of air shroud, torque all cylinder head mounting bolts, following the sequence shown in figure 6-6.

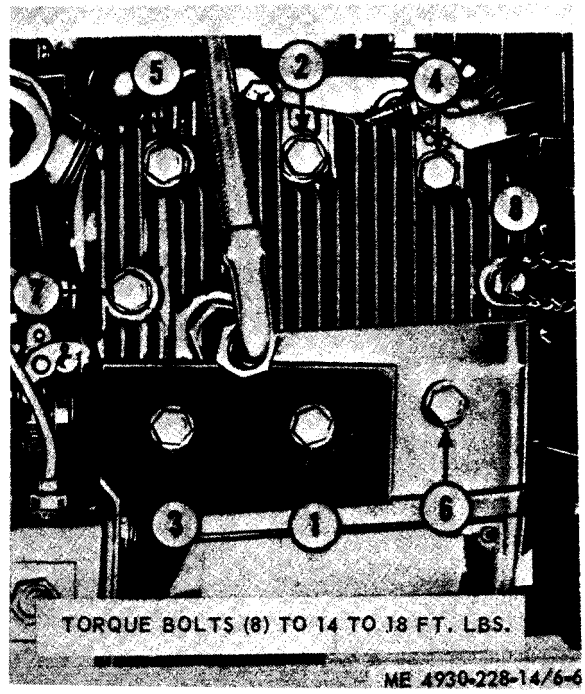


Figure 6-6. Cylinder head bolts tightening sequence.

6-8. Valve Inspection Cover and Tappets

a. Removal. Refer to figure 6-7 and remove the valve inspection cover.

b. Cleaning and Inspection.

(1) Clean the cover and accessible metal parts with cleaning solvent and dry thoroughly.

(2) Measure valve clearance (fig. 6-7) and inspect for defective valve springs, tappets, rotators, and seats.

c. Installation. Refer to figure 6-7 and install the valve inspection cover in reverse order of removal.

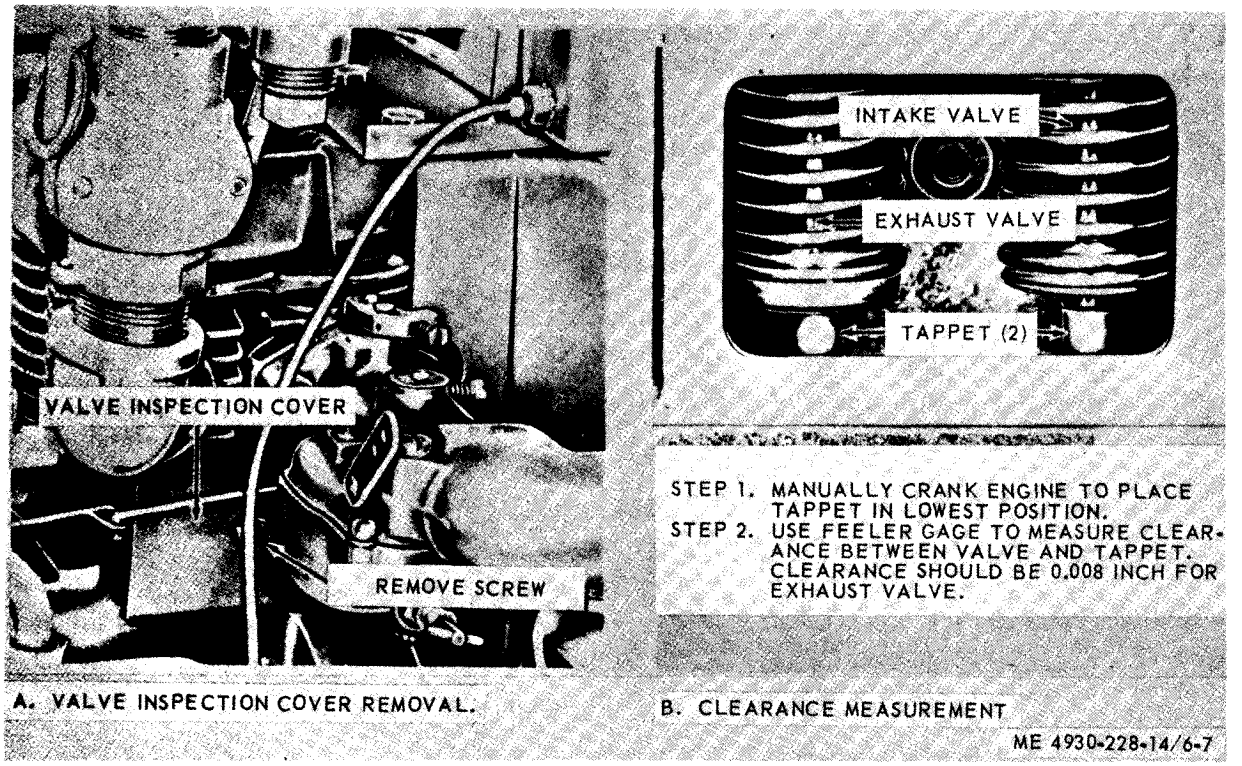


Figure 6-7. Valve inspection cover removal and valve clearance measurement.

6-9. Valves, Valve Seats, Guides, and Springs

a. Removal.

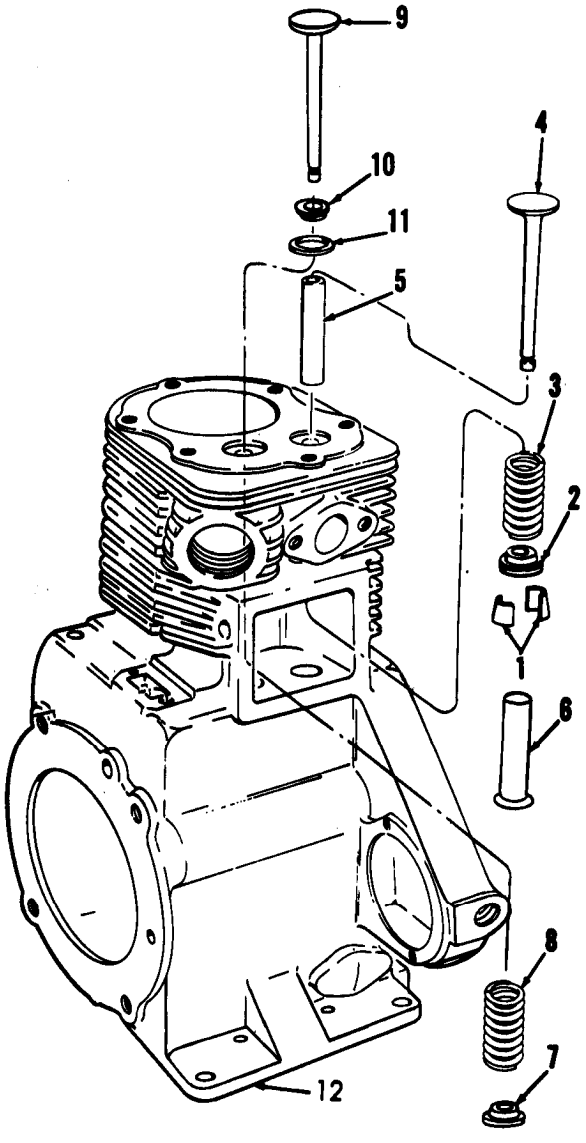
(1) Remove the engine (para 6-5).

(2) Remove the carburetor (para 4-25).

(3) Remove the cylinder head (para 6-7).

(4) Remove the valve inspection cover (para 6-8).

b. Disassembly. Refer to figure 6-8 and disassemble the valves, valve seats, guides, and springs.



1 Lock (4)
2 Spring seat
3 Spring
4 Intake valve
5 Guide
6 Tappet (2)
7 Rotator
8 Spring
9 Exhaust valve
10 Cup (2)
11 Insert
12 Crankcase

Figure 6-8. Valves, exploded view.

c. Cleaning, Inspection, and Repair.

(1) Clean the valves with a wire brush to remove all carbon deposits. Clean valve seats, ports, and guides in cylinder block; clean top of cylinder block. Wash springs with cleaning solvent and dry thoroughly.

(2) Inspect valves for burned, pitted, or cracked faces: replace a burned, cracked, or deeply pitted valve.

(3) Inspect valves springs for cracks or pitting. Replace cracked or pitted springs.

(4) Inspect valve seat insert for looseness and pitting. Replace a defective valve seat insert in the following manner:

(a) Use a puller to remove the insert from the exhaust valve opening.

(b) Clean all carbon out of the insert counterbore in the cylinder block and clean the valve stem guide bore.

(c) Finish the counter bore in the cylinder block to provide the correct bore-to-insert interference. Chill the insert with dry ice and, using a pilot driver, tap the insert into place with light blows. Peen the insert to anchor in place.

(d) Reface the insert, if necessary, to make its seat concentric with the valve. Check concentricity with a dial indicator.

(c) Lap valve in seat to form a gas-tight seat.

d. Regrinding Valves.

(1) Using a valve seat grinding tool, grind the seats at a 45° angle and then grind the valve faces at a 45° angle with a valve refacer grinder.

(2) Valves must be lapped with a suitable lapping compound or they will leak within the first few hours of operation because of improper seating.

(3) Clean valve seat and faces with cleaning solvent and dry thoroughly.

(4) After lapping the valves, remove them from the block and wash the valves and block with cleaning solvent.

e. Reassembly. Refer to figure 6-8 and reassemble valves.

f. Installation.

(1) Install valve inspection cover (para 6-8).
(2) Install cylinder head (para 6-7).
(3) Install carburetor (para 4-25).
(4) Install engine (para 6-5).

6-10. Engine Base and Oil Pump

a. Removal.

(1) Remove the engine (para 6-5).

(2) Refer to figure 6-9 and remove the engine base and oil pump.

b. Disassembly. Refer to figure 6-10 and disassemble the engine base and oil pump.

c. Cleaning, Inspection, and Repair.

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

(2) Inspect all parts for cracks, breaks, and other damage.

(3) Inspect all hardware for damaged or stripped threads.

(4) Replace a damaged or defective part.

d. Reassembly. Refer to figure 6-10 and reassemble the engine base and oil pump.

e. Installation.

(1) Refer to figure 6-9 and install the engine base and oil pump, in reverse order of removal.

(2) Install the engine (para 6-5).

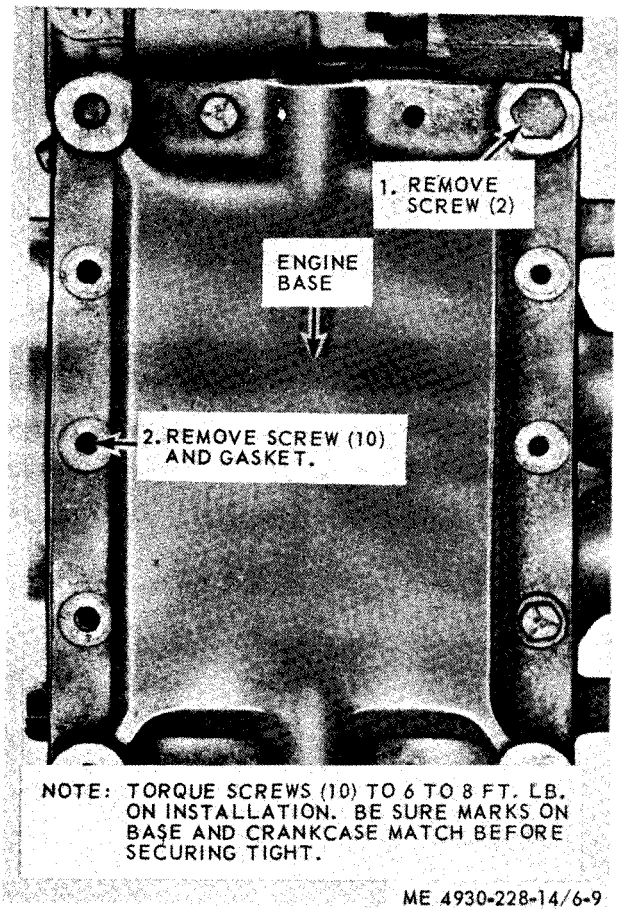
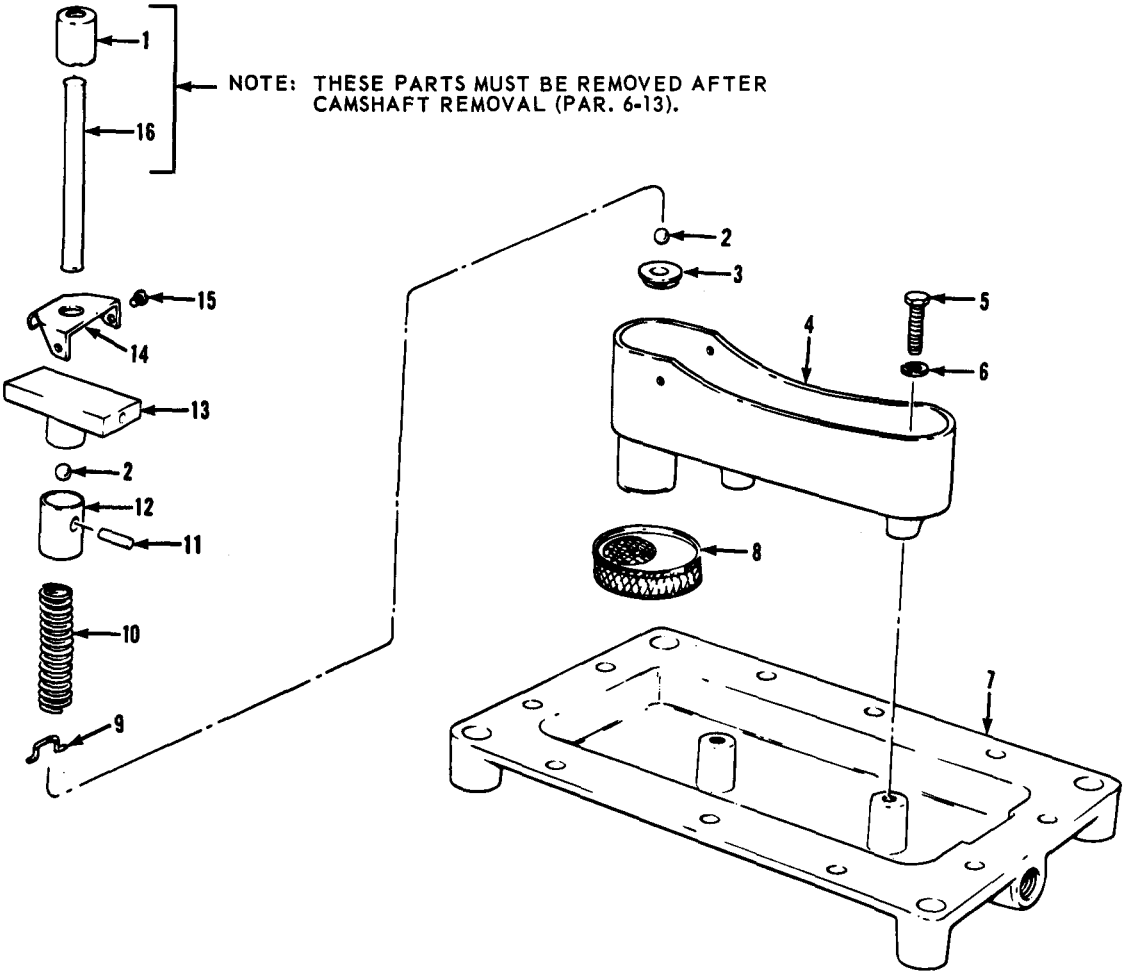


Figure 6-9. Engine base and oil pump removal.



1 Cap
2 Ball (2)
3 Seat
4 Body
5 Screw (2)
6 Washer
7 Engine base
8 Strainer
9 Retainer
10 Spring
11 Pin
12 Plunger
13 Cap
14 Cover
15 Screw (2)
16 Rod

Figure 6-10. Engine base and oil pump, exploded view.

6-11. Piston and Connecting Rod

a. Removal.

(1) Remove engine base and oil pump (para 6-10).

(2) Remove cylinder head (para 6-7).

(3) Refer to figure 6-11 and remove the piston and connecting rod.

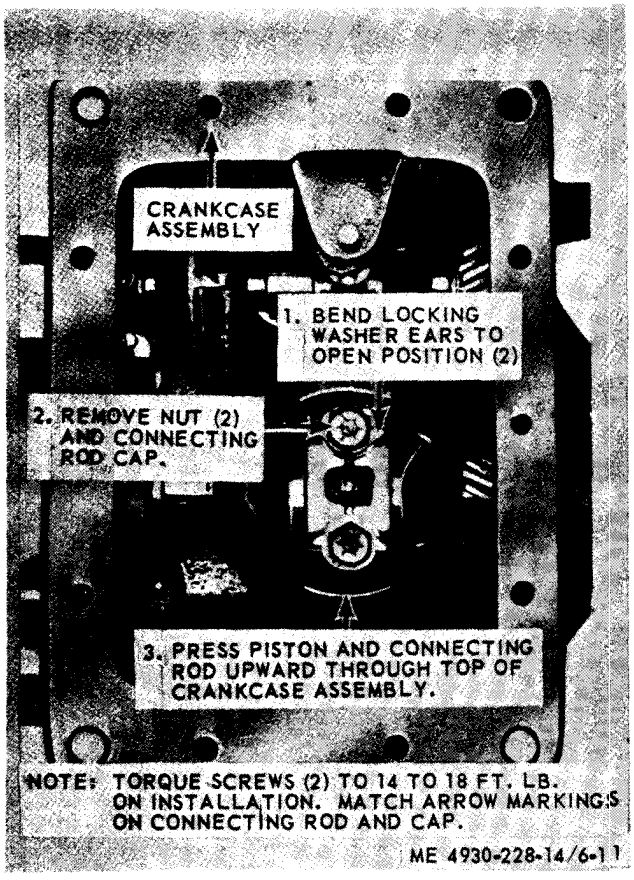
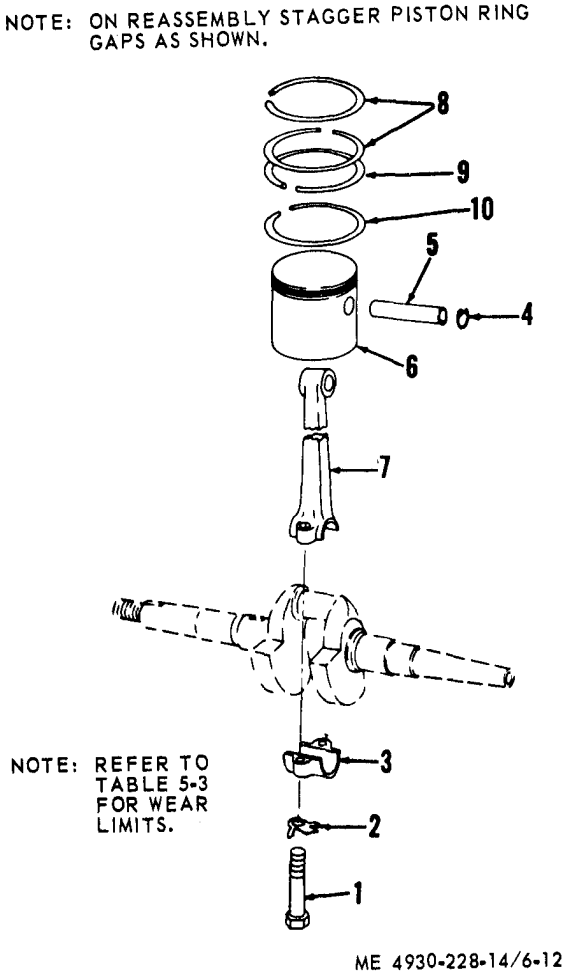


Figure 6-11. Piston and connecting rod removal.

b. Disassembly. Refer to figure 6-12 and disassemble the piston and connecting rod.



1 Screw
2 Washer
3 Cap
4 Retainer
5 Piston pin
6 Piston
7 Connecting rod
8 Compression ring
9 Scraper ring
10 Oil ring

Figure 6-12. Piston and connecting rod, exploded view.

c. Cleaning, Inspection, and Repair.

(1) Clean parts with cleaning solvent and dry thoroughly.

(2) Inspect parts for cracks, breaks, and other damage. Replace damaged or defective parts.

(3) Inspect mounting hardware for damaged or stripped threads. Replace damaged or defective part.

d. Reassembly. Refer to figure 6-12 and reassemble the piston and connecting rod.

e. Installation.

(1) Refer to figure 6-11 and install the piston and connecting rod in reverse order of removal.

(2) Install the cylinder head (para 6-7).

(3) Install engine base (para 6-10).

6-12. Crankshaft

a. Removal.

(1) Remove the piston and connecting rod (para 6-11).

(2) Refer to figure 6-13 and remove the crankshaft.

b. Disassembly. Refer to figure 6-14 and disassemble the crankshaft.

c. Cleaning, Inspection, and Repair.

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

(2) Inspect crankshaft for scoring. Hone crankshaft to remove any slight scoring or replace a damaged or defective crankshaft.

(3) Inspect the bearing cones and cups. Replace a defective assembly.

(4) Inspect the gear and woodruff key for wear or other damage. Replace defective parts.

(5) Inspect the hardware for stripped or damaged threads, rust, or damage incurred during removal. Replace damaged or defective parts.

d. Reassembly. Refer to figure 6-14 and reassemble the crankshaft.

e. Installation.

(1) Refer to figure 6-13 and install the crankshaft in reverse order of removal.

(2) Install the piston and connecting rod (para 6-11).

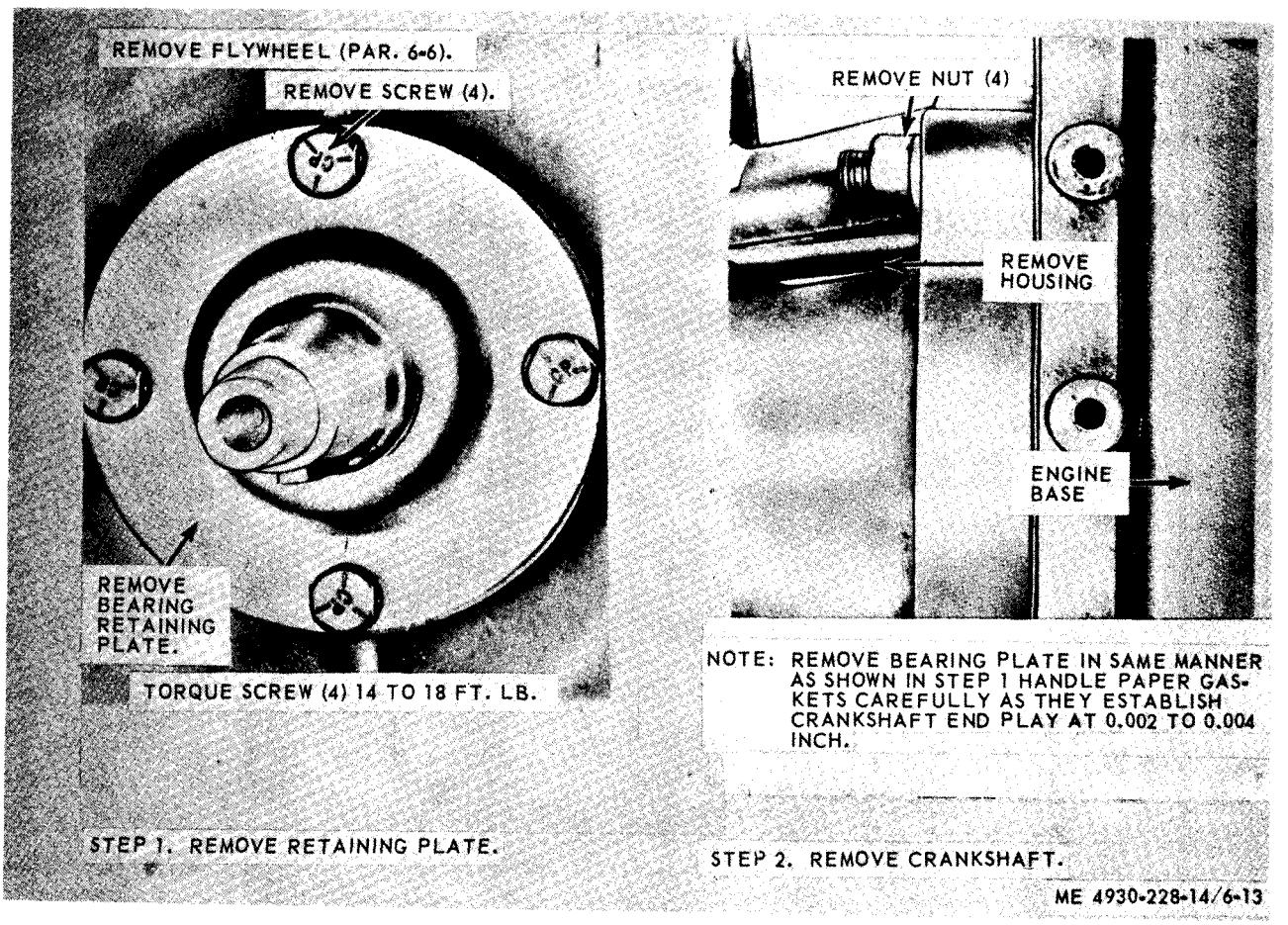


Figure 6-13. Crankshaft removal.

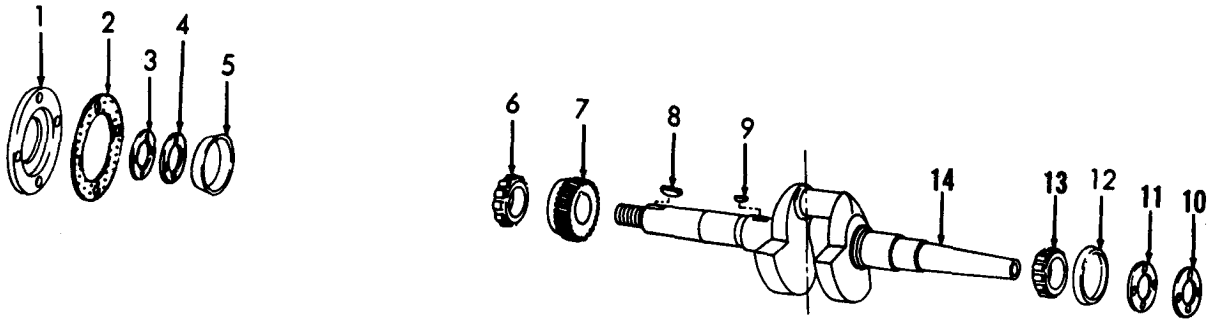


Figure 6-14. Crankshaft, exploded view.

6-13. Camshaft and Governor Assembly

a. Removal.

(1) Remove the crankshaft (para 6-12).

(2) Refer to figure 6-15 and remove the camshaft.

b. Disassembly. Refer to figure 6-15 and disassemble the camshaft and governor.

c. Cleaning, Inspection and Repair.

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

(2) Inspect the camshaft for alinement, scoring, roughness, or damaged or chipped gear teeth.

(3) Repair any slight roughness by honing or replace a damaged or scored camshaft.

(4) Replace a badly damaged or worn sleeve bearing, spacer, or pin.

d. Reassembly. Refer to figure 6-15 and reassemble the camshaft and governor.

e. Installation.

(1) Refer to figure 6-15 and install camshaft.

(2) Install the crankshaft (para 6-12) in reverse order of removal.

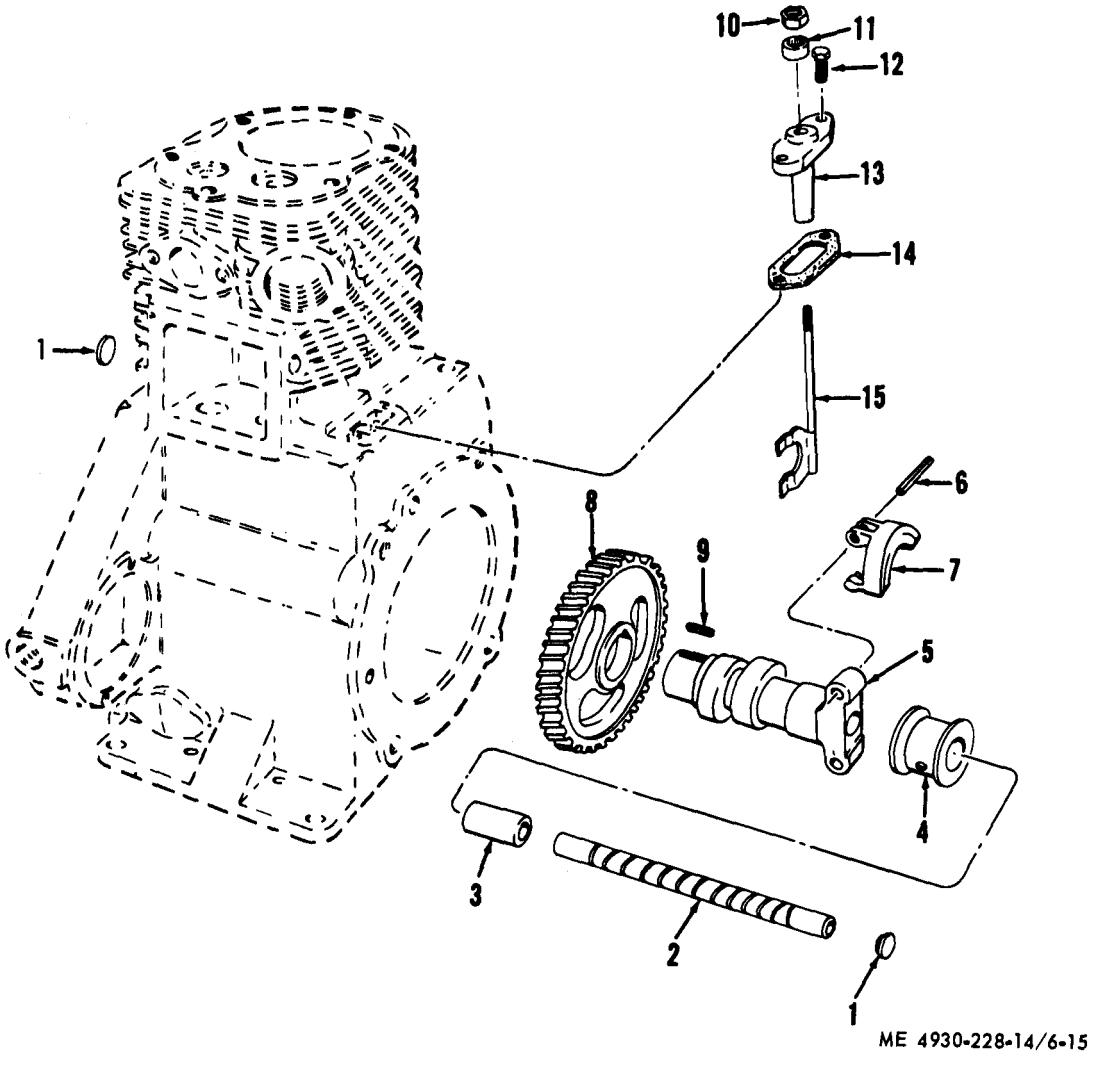


Figure 6-15. Camshaft and governor, exploded view.

Section III. FILTER / SEPARATOR

6-14. General

a. Refer to paragraph 1-7 for a general description of the filter / separator.

b. Repair of filter / separator consists primarily of replacement of damaged or worn parts.

6-15. Filter / Separator

a. Removal. Refer to paragraph 4-32.

b. Disassembly. Refer to figure 6-16 and disassemble the filter / separator.

Key to figure 6-16.

1 Nut
2 Washer
3 Bolt
4 Clamp
5 Cover
6 Gasket
7 Nut
8 Washer
9 Retainer
10 Canister
11 Element
12 Rod
13 Nut
14 Sight-gage
15 Indicator
16 Elbow
17 Adapter
18 Hose w / fittings
19 Hose, drain
20 Cock
21 Elbow
22 Filter

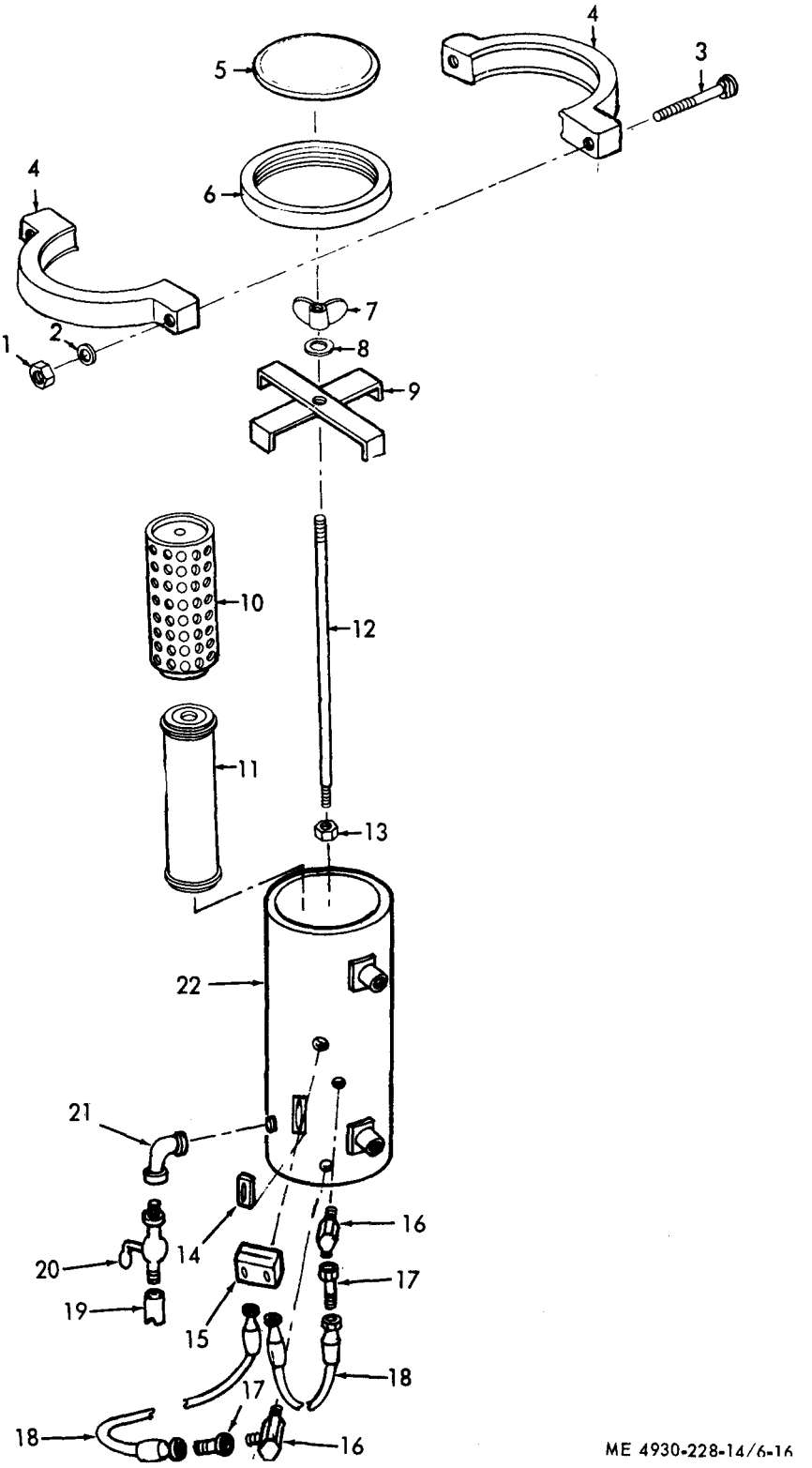


Figure 6-16. Filter / separator, exploded view.

c. Cleaning, Inspection, and Repair.

(1) Clean parts with cleaning solvent and dry thoroughly. Flush interior of filter/ separator.

(2) Inspect parts for cracks, breaks, damaged threads and defects. Replace defective parts.

d. Reassembly. Refer to figure 6-16 and reassemble filter / separator.

e. Installation. Refer to paragraph 4-32.

Section IV. HOSE REEL ASSEMBLY

6-16. General

a. Refer to paragraph 4-34 for a general description of the hose reel assembly.

b. Repair of the reel assembly consists of replacement of damaged or defective parts.

6-17. Hose Reels

a. Removal. Refer to paragraph 4-34.

b. Disassembly. Refer to figure 6-17 and disassemble the hose reels.

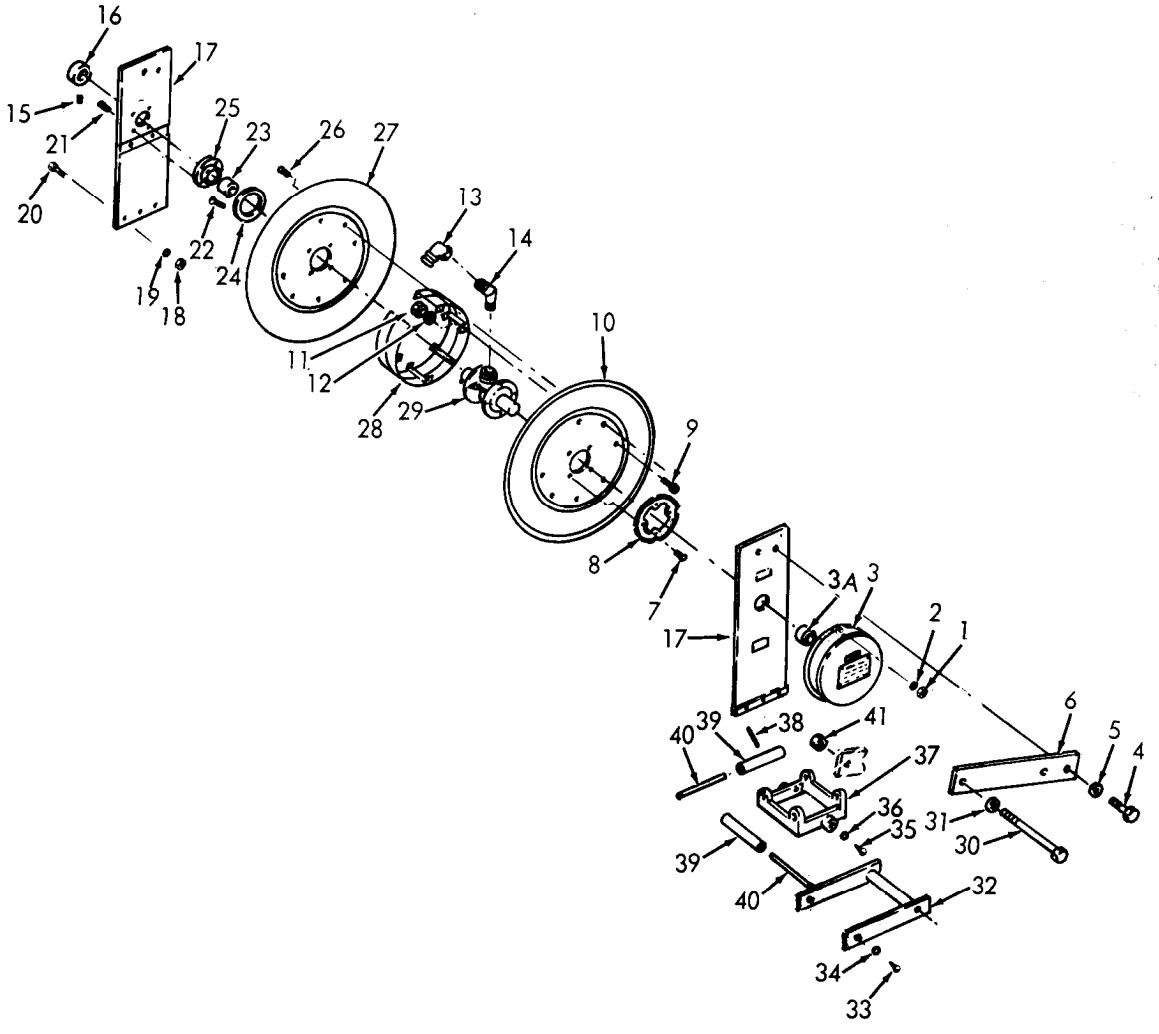
c. Cleaning, Inspection and Repair.

(1) Clean parts with cleaning solvent and dry thoroughly.

(2) Inspect for damaged or defective parts. Replace damaged or defective parts.

d. Reassembly. Refer to figure 6-17 and reassemble hose reels.

e. Installation. Refer to paragraph 4-34.



ME 4930-228-14/6-17

1 Nut
2 Washer
3 Housing assembly, spring
3A Bearing, sleeve
4 Screw, cap
5 Washer
6 Bracket, plate
7 Screw, cap
8 Wheel, ratchet
9 Screw, cap
10 Rim, reel
11 Nut
12 Washer, lock
13 Coupling, half
14 Pipe, angle
15 Setscrew
16 Collar, hub
17 Plate (inside and outside)
18 Nut
19 Washer
20 Screw
21 Screw, cap
22 Screw, cap
23 Bearing, sleeve
24 Rim, support
25 Flange, bearing
26 Screw, cap
27 Rim, reel
28 Spindle, spacer, reel
29 Hub assembly
30 Bolt
31 Washer
32 Bracket
33 Screw
34 Washer
35 Screw
36 Washer
37 Bracket
38 Pin, spring
39 Roller
40 Axle
41 Nut

Figure 6-17. Hose reel, disassembly.

Section V. TANKS AND FRAME

6-18. General

The tank shells are of durable aluminum construction; the frame is of welded sheet metal. The tank and frames will require a minimum of maintenance. Make certain every safety precaution is taken prior to attempting any repair on a tank.

6-19. Welding Repairs

a. Tanks. No repair will be initiated until the tank has been thoroughly vented and cleaned. Before attempting any welding repair on the tank. drill four ½ inch diameter drain holes in each skid (total of 8 holes required). See figure 6-18 for location of drilling points. If there is evidence of fuel inside the skids when holes are drilled, purge the skids by steam cleaning or other suitable method. Test for leaks by filling the tank approximately ¼ full of water; seal all holes in skid except one and apply compressed air. Observe interior of tank for bubbles. Observe necessary precautions and weld damaged area in accordance with standard techniques. Refer to paragraph 6-19d for welding precautions.

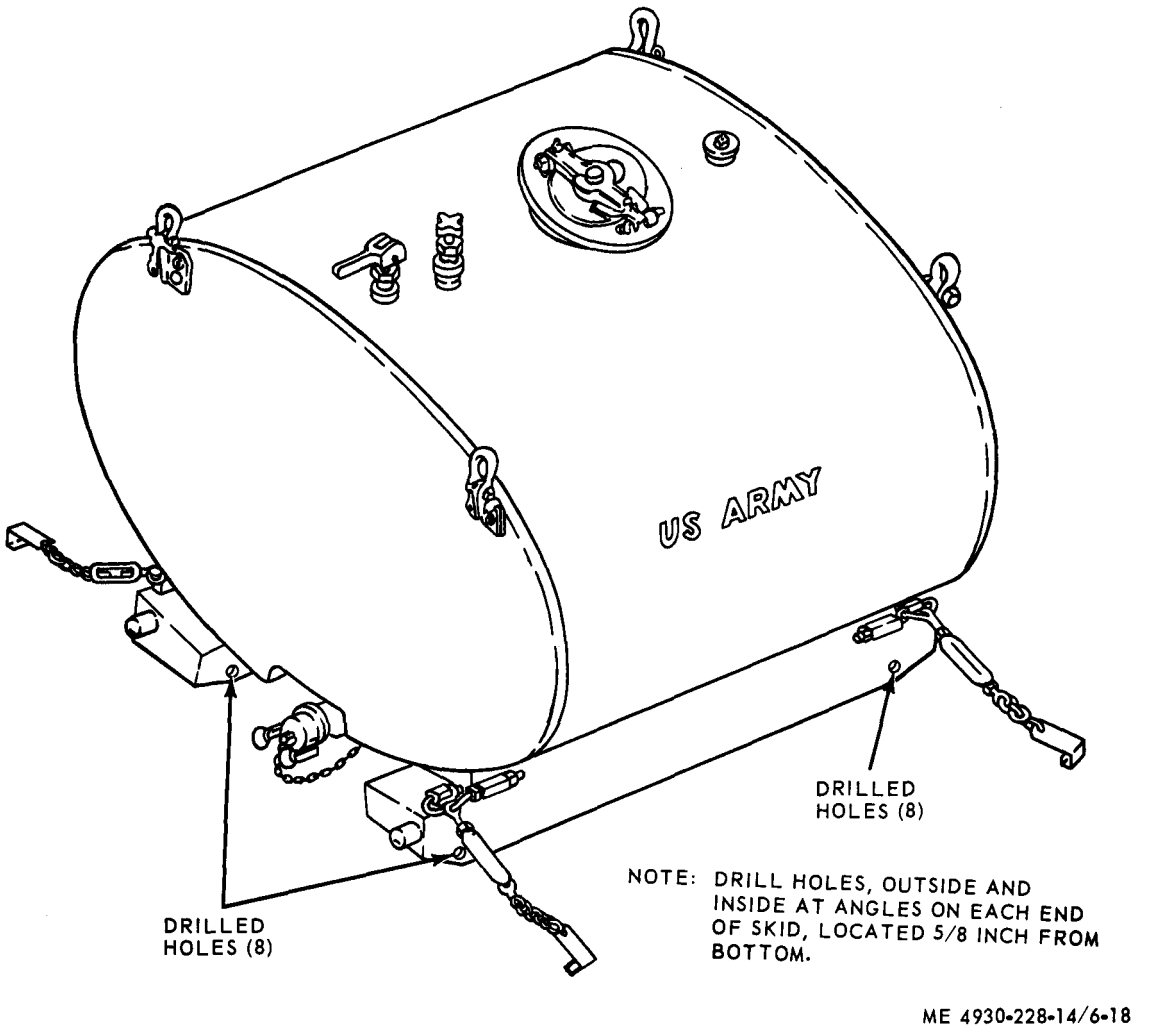


Figure 6-18. Skid drain holes diagram. (8 holes required).

b. Frame. Make certain the frame is free of dirt, oil, grease, or other foreign matter, and bare metal is exposed for welding. Remove necessary components before welding.

c. Tank Cleaning. The tank must be free of explosive vapors and thoroughly cleaned before any repairs are attempted; drain the tank of all contents and open filler plug, allow filler to remain open for several minutes. If compressed air is available, blow out the tank. Clean the tank interior with solvent and dry thoroughly. Precautions and procedures outlined in TB-ORD 1047 will be adapted to the tank. Areas of the tank to be subjected to severe heat must be cleaned to the bare metal; use a stiff stainless steel wire brush or other suitable tool for this purpose. Pay particular attention to the seams; heat from a welding torch tends to volatilize tetraethylened deposits, causing toxic fumes. The tank exterior must be cleaned of all dirt, sand, oil, or other foreign matter with a solution of trisodium phosphate and water; rinse with plain water and dry. Remove paint from any area to be welded.

6-20. Protective Finish

All normally painted exterior surfaces of the tank must he protected by enamel at all times. A primer and semi-gloss enamel shall be used. The primer should comform to specification TT-P-666, and the enamel to specification TT-E-529. Use standard Army olive drab color 2430.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users

A-2. Lubrication

C9100-IL	Identification List for Fuels, Lubricants, Oils and Waxes
LO 5-4930-228-12	Lubrication Order

A-3. Maintenance

TB ORD 1047	Elimination of Combustibles in Fuel Tanks
TM 10-1101	Petroleum Handling Equipment Operations
TM 10-1109	Military Petroleum Pipelines, Tanks, and Related Equipment
TM 10-1113	Petroleum Tank-Vehicle Operations
TM 38-750	The Army Maintenance Management System

A-4. Radio Interference Suppression

TM 11-483	Radio Interference Suppression

A-5. Shipment and Storage

TB 740-90-1	Administrative Storage of Equipment
TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage

A-6. Destruction to Prevent Enemy Use

TM 750-244-3	Procedures for 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. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III is not applicable.

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

B-2. Explanation of Columns in Section II

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

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

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

C—Operator or crew
O—Organizational maintenance
F—Direct support maintenance
H—General support maintenance
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, 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 measurements. Consists of the comparison 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 like item.

I-Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage or a specific failure. Repair may be accomplished at each level of maintenance.

J-Overhaul. Normally, the highest degree of maintenance performed by the Army in order to minimize time work is in process consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

K-Rebuild. The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance level. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

d. Work Measurement Time. The active repair time required to perform the maintenance function is included directly below the symbol identifying the level of maintenance. This time includes preparation time, fault isolation / diagnostic time, and QA / QC time in addition to the time required to perform specific maintenance functions identified for the tasks authorized. This time is expressed in man-hours and carried to one decimal place (tenths of hours).

e. 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).

f. 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 IV.

a. Reference Code. This column consists of two letters separated by a dash (entered from col. 5 of

sec. II). The first letter references alpha sequence in column 5 and the second letter references a maintenance function, column, column 3, A through K.

b. Remarks. This column lists information pertinent to the maintenance function to performed (as indicated in Sec. II).

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild		
0101	01 GROUP, PUMPING ASSEMBLY													
	Pump & Engine W / Base Plate													
	Hoses, Inlet & Outlet	0	..	..	..	..	..	..	0	0	..	..		A-1
		0.2	..	..	..	..	..	..	0.2	0.2				
	Hoses, Filter to Pump & Manifold	0	..	..	..	..	..	..	0	0	..	..		A-1
		0.2	..	..	..	..	..	..	0.2	0.2				
	Engine & Pump	0	..	..	..	..	..	..	0	F	..	..		B-H
		0.5	..	..	..	..	..	..	1.2	16.0				
	Pump, Centrifugal	0	..	..	..	..	..	..	F	F	..	..		C-H
		0.5	..	..	..	..	..	..	0.5	8.0				
	Elbows and tee inlet & outlet	0	..	..	..	..	..	..	0					
		0.2	..	..	..	..	..	..	0.4					
	Impeller	F	..	..	..	..	..	..	F	..	..	..		D-H
		1.0	..	..	..	..	..	..	1.0					
	Seal Assembly	F	..	..	..	..	..	..	F	..	..	..		D-H
		0.8	..	..	..	..	..	..	0.8					
	Coupling, Intermediate	F	..	..	..	..	..	..	F	..	..	..		D-H
		0.6	..	..	..	..	..	..	0.6					
	Engine	0	F	0	0	..	..	..	F	F	H	..		E-H
		1.0	0.5	1.0	1.0	..	..	..	1.2	16.2	24.0			
	Muffler Exhaust	0	..	..	..	..	..	..	0					
		0.3	..	..	..	..	..	..	0.4					
	Fuel Tank and Strainer	0	..	C	..	..	..	..	0	F	..	..		F-C
		0.2	..	0.1	..	..	..	..	0.5	8.0				
	Carburetor, Manifold	0	..	0	..	..	..	..	0					
		0.3	..	0.3	..	..	..	..	0.6					
	Air Cleaner	..	..	C										
		..	..	0.1										
	Magneto	0	..	..	0	..	..	..	0	0	..	..		G-I
		0.5	..	..	0.5	..	..	..	0.5	0.5				
	Pulley, Starting Rope	0	..	..	..	..	..	..	0					
		0.2	..	..	..	..	..	..	0.2					
	Switch	0	..	..	..	..	..	..	0	..	..	..		G-H
		0.6	..	..	..	..	..	..	0.6					
	Shroud, Air	0	..	C	..	..	..	..	0	..	..	..		H-H
		0.6	..	0.1	..	..	..	..	0.6					
	Flywheel, Engine	F	..	..	..	..	..	..	F	..	..	..		I-H
		1.4	..	..	..	..	..	..	1.4					
	Spark Plug	0	..	..	..	..	..	..	0					
		0.3	..	..	..	..	..	..	0.3					
	Cylinder Head	F	..	..	..	..	..	..	F	..	..	..		J-H
		0.3	..	..	..	..	..	..	0.3					
	Cover, Valve Inspection	0	..	..	..	..	..	..	F					
		0.1	..	..	..	..	..	..	2.8					
	Valves, Engine	0	..	..	..	..	..	..	F	F	..	..		K-I
		3.4	..	..	..	..	..	..	3.4	3.6				
	Engine Base & Oil Pump	F	..	..	..	..	..	..	F					
		0.5	..	..	..	..	..	..	0.5					

(1) Group No.	(2) Assembly group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
	Pistons & Connecting Rods	F							F	F				L-H
		4.0							4.0	4.0				
	Plate Front, Crankshaft bearing	F							F					M-H
		1.0							1.0					
	Retainer, Rear Crankshaft bearing	F							F					N-H
		1.0							1.0					
	Crankshaft, Engine	F							F					O-H
		2.5							2.5					
	Camshaft & Governor	F							F					P-A
		3.5							3.5					
	Block, Engine	F							F					Q-A
		8.6							8.6					Q-H
0102	Filter Separator	C		C					0	F				R-C
		1.0		1.6					1.0	8.0				
	Element, Filter	C							C					F-I
		0.6							0.6					
	Cover, Tank	C							0					
		0.3							0.3					
	Coupling, Cover	C							0					
		0.3							0.3					
	Gasket, Cover	C							C					
		0.3							0.3					
	Canisters	C							0					
		0.5							0.5					
	Retainer	C							0					
		0.5							0.5					
	Drain Cock	C		C					0					
		0.2		0.1					0.2					
	Window Sight, Water Level	C							0	0				S-I
		0.3							0.5	0.2				
	Indicator, Differential pressure	0							0					
		0.3							0.5					
	Coupling, Quick Disconnect	C							0	0				A-I
		0.2							0.3	0.3				
0103	Manifold, Liquid Distributor	0							0	0				A-I
		0.2							0.5	0.3				
0104	Reel Assembly, Ground	0							0					
		0.2							0.3					
0105	Nozzle Assembly Fuel Dispensing	0							0	0				T-I
		0.1							0.2	0.5				
0106	Reel Assembly Fuel Dispensing Hose Left & Right (ea)	0							0	F				
		1.5							1.0	2.0				
	Spring Hose Reel (ea)	0							F					
		0.3							0.5					
	Wheel, Ratchet (ea)	0							F					
		0.4							0.4					
0107	Frame, Tank & Pump Unit	0							F	F				U-H
		4.0							9.0	16.0				U-I

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Assembly group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild		
	02 GROUP, TANKS, LIQUID STORAGE BULK FUEL													
	Tanks Liquid Storage	C	..	..	..	..	..	..	0	0	..	..	.....	F-I
		1.0	..	..	..	..	..	..	2.0	16.0				
	Cover, Manhole	C	..	..	..	..	..	..	0					
		0.5	..	..	..	..	..	..	1.0					
	Dump Valve	C	..	..	..	..	..	..	0					
		0.2	..	..	..	..	..	..	0.2					
	Valve Drain	C	..	..	..	..	..	..	0					
		0.2	..	..	..	..	..	..	0.2					
	Hose, Interconnecting	C	..	..	..	..	..	..	0	0	..	..	.....	A-I
		0.1	..	..	..	..	..	..	0.2	0.2				
0301	03 GROUP, ACCESSORY ITEMS													
	Fire Extinguishers	C	..	..	..	..	..	..	0					
		0.1	..	..	..	..	..	..	0.2					
0302	Kit, Tie-Down Tank Liquid Storage	C	..	..	..	..	..	..	0					
		0.1	..	..	..	..	..	..	0.5					
0303	Kit, Rough Terrain Tie-Down	C	..	..	..	..	..	..	0	F	..	..	.....	V-I
		0.1	..	..	..	..	..	..	0.5	1.0				

Section IV. REMARKS

Reference Code	Remarks
A-I	Repair by replacing gasket.
B-H	Includes moving assembly from frame
C-H	Pumping unit removed from engine.
D-H	Includes removing & replacing seal assembly and casing.
E-H	Pumping unit-removed from engine.
F-C	Including removing fuel filter & cap.
F-I	Purging, cleaning & welding.
G-H	Adjust & replace points & condenser.
H-H	Includes removing & replacing starting pulley and ignition switch.
I-H	Includes removing & replacing starting pulley, ignition and air shroud.
J-H	Includes removing & replacing air shroud, fuel tank, spark plug and ignition switch.
K-I	Includes removing & replacing cylinder head & valve inspection cover.
L-H	Includes removing & replacing engine base & cylinder head.
M-H	Includes removing & replacing air shroud & starting pulley.
N-H	Includes removing & replacing pump.
O-H	Includes removing & replacing front bearing plate, rear bearing retainer & disconnecting the connecting rods.
P-A	Includes removing & replacing crankshaft & inspection when disassembled.
Q-A	Includes removing & replacing camshaft & tappets, crankshaft, valves, & all external parts.
Q-H	
R-C	Service includes replacing the filter elements.
F-I	Includes removing & replacing filter head & filter head coupling assembly.
S-I	Repair is limited to replacement of gasket.
T-I	Repair by replacing kit.
U-H	Includes removing & replacing engine & pump, reels, filter / separator, hoses, couplings, and all other attached hardware. Repair consists of straightening or replacing bent frame members and welding.
U-I	
V-I	Repair consists of sewing nylon webbing to ratchets and hooks.

ALPHABETICAL INDEX

By Order of the Secretary of the Army:

BRUCE PALMER, JR.
General, United States Army
Acting Chief of Staff

Official:

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

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