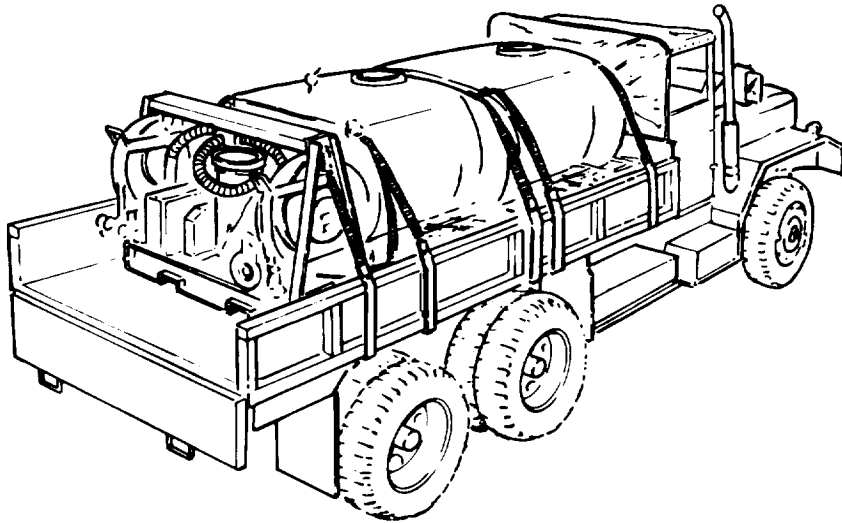


TECHNICAL MANUAL

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



**TANK AND PUMP UNIT,
LIQUID DISPENSING:
FOR TRUCK MOUNTING
MIL DESIGN TANK AND PUMP UNITS**

**GASOLINE ENGINE DRIVEN
MODEL (97403) 13217E7100
NSN 4930-00-426-9960**

**ELECTRIC MOTOR DRIVEN
MODEL (97403) 13217E7130
NSN 4930-01-130-7281**

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17 JULY 1984

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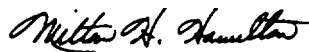
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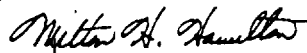
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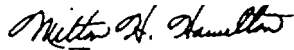
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FOR TRUCK MOUNTING
MIL DESIGN TANK AND PUMP UNITS

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MIL DESIGN TANK AND PUMP UNITS
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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 5, 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 a 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 by 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

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.

CAUTION

Place switch in "OFF" position before connecting "Remote ON-OFF" switch cable.

OPERATOR'S, ORGANIZATIONAL AND
DIRECT SUPPORT MAINTENANCE MANUAL

**TANK AND PUMP UNIT, LIQUID DISPENSING:
FOR TRUCK MOUNTING
MIL DESIGN TANK AND PUMP UNITS
GASOLINE ENGINE DRIVEN
MODEL (97403) 13217E7100
NSN 4930-00-426-9960
ELECTRIC MOTOR DRIVEN
MODEL (97403) 13217E7130
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*This manual supersedes TM 5-4930-230-13, 27 April 1979.

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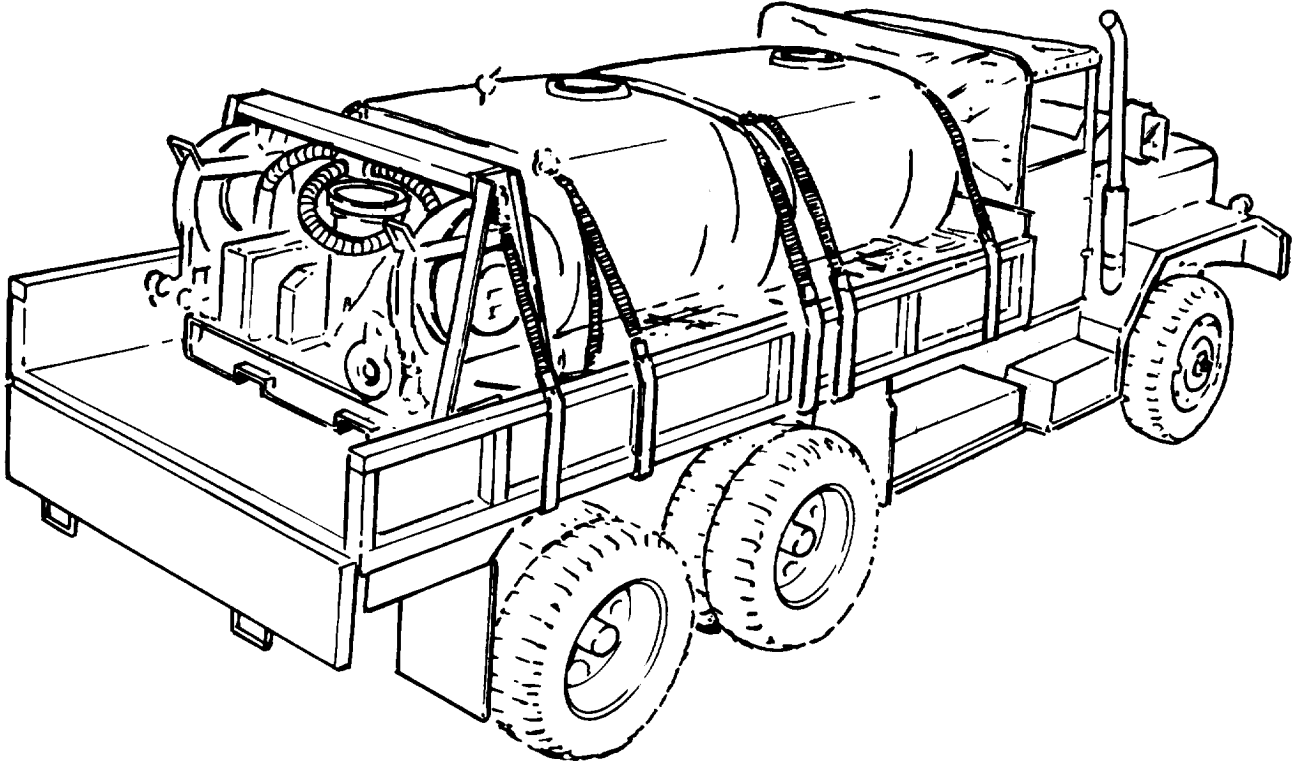


Figure 1-1. Tank and Pump Unit, Truck Mounted.

CHAPTER 1**INTRODUCTION****Section I. GENERAL****1-1. SCOPE**

- a. Type of Manual. Operator's, Organizational, and Direct Support Maintenance Manual.
- b. Model Number and Equipment Name. Tank and Pump Unit, Liquid Dispensing; for Truck Mounting, MIL Design Tank and Pump Units, Gasoline Engine Driven Model 13217E7100, NSN 4930-00-426-9960; Electric Motor Driven Model 13217E7130, NSN 4930-01-130-7281 (figure 1-1).
- c. Purpose of Equipment. The purpose of the tank and pump unit is to convert a general purpose military cargo vehicle into the bulk refueler.

1-2. MAINTENANCE FORMS AND RECORDS

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

1-3. HAND RECEIPT MANUAL

This manual has a companion document with a TM number followed by -HR (which stands for Hand Receipt). The TM 5-4930-230-13-HR consists of preprinted hand receipts (DA Form 2082) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the following source in accordance with procedures in Chapter 3, AR 310-2:

US Army Adjutant General Publications Center
ATTN: AGLD-OD
2800 Eastern Blvd.
Baltimore, MD 21220

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your tank and pump unit needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a SF 368, Quality Deficiency Report. Mail it to us at Commander, US Army Troop Support Command, ATTN: AMSTR-MOF, 4300 Goodfellow Blvd., St. Louis, MO 83120-1798. We will send you a reply.

1.5 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

CAUTION

Demolition of the tank and pump unit will not be attempted, except upon receipt of orders from proper authority.

a. General. Methods of destruction should achieve such damage to equipment and repair parts that it will not be possible to restore the equipment to usable condition in the combat zone either by repair or cannibalization.

(1) Mechanical Destruction. Using an axe, pick, sledge hammer, or any heavy implement, damage the engine, pump, filter, and all other vital parts.

(2) Destruction by Explosives. Place as many charges as time permits in vital areas such as under engine, separator, tanks, or any other place that will assure complete destruction of the tank and pump unit. Use a suitable detonator to detonate all charges simultaneously.

b. Additional information. For additional information on procedures for destruction of equipment to prevent enemy use, refer to TM 750-244-3.

1.6. PREPARATION FOR STORAGE OR SHIPMENT

Contact organizational maintenance for tank and pump unit preparation for storage or shipment (paragraph 4-36).

Section II. EQUIPMENT DESCRIPTION AND DATA

1.7. CHARACTERISTICS, CAPABILITIES, AND FEATURES

CAUTION

Caution should be taken when filling the tanks to avoid exceeding cross-country payload limits of transporting vehicles.

The tank and pump unit (figures 1-1 and 1-2) consists of a 50gpm (189 liters per minute) pumping assembly, two 600-gallon (2271-liter) tanks and related items. It is designed for use on 5-ton series M39, M809, and M939 Cargo Trucks, with either rigid or drop sides. 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).

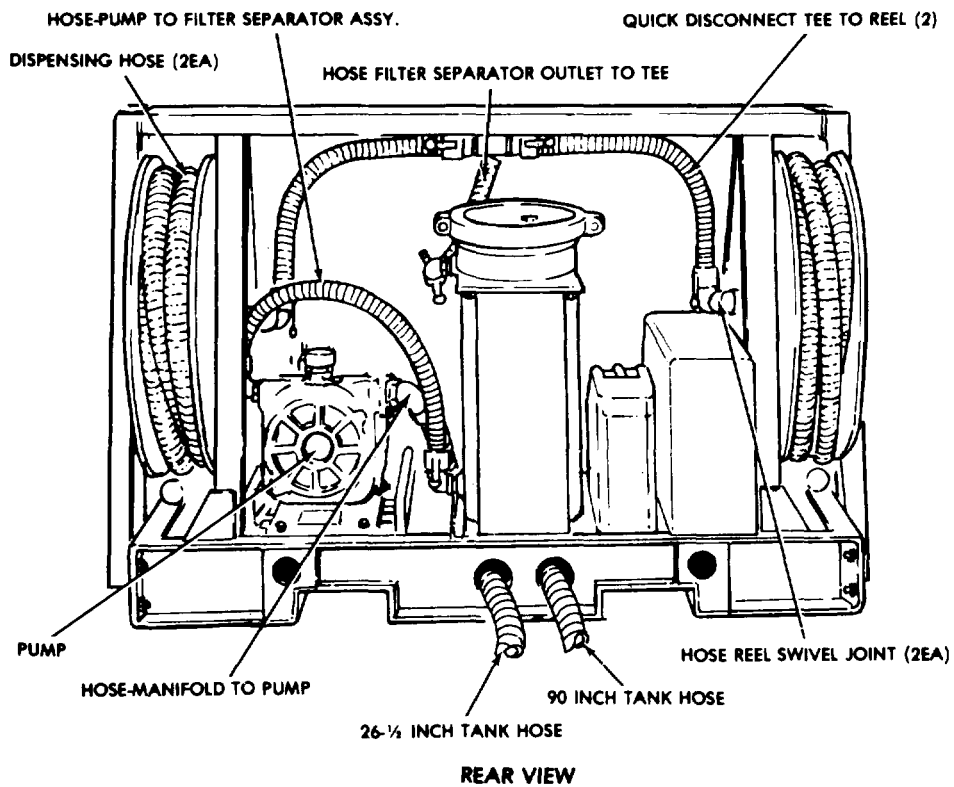
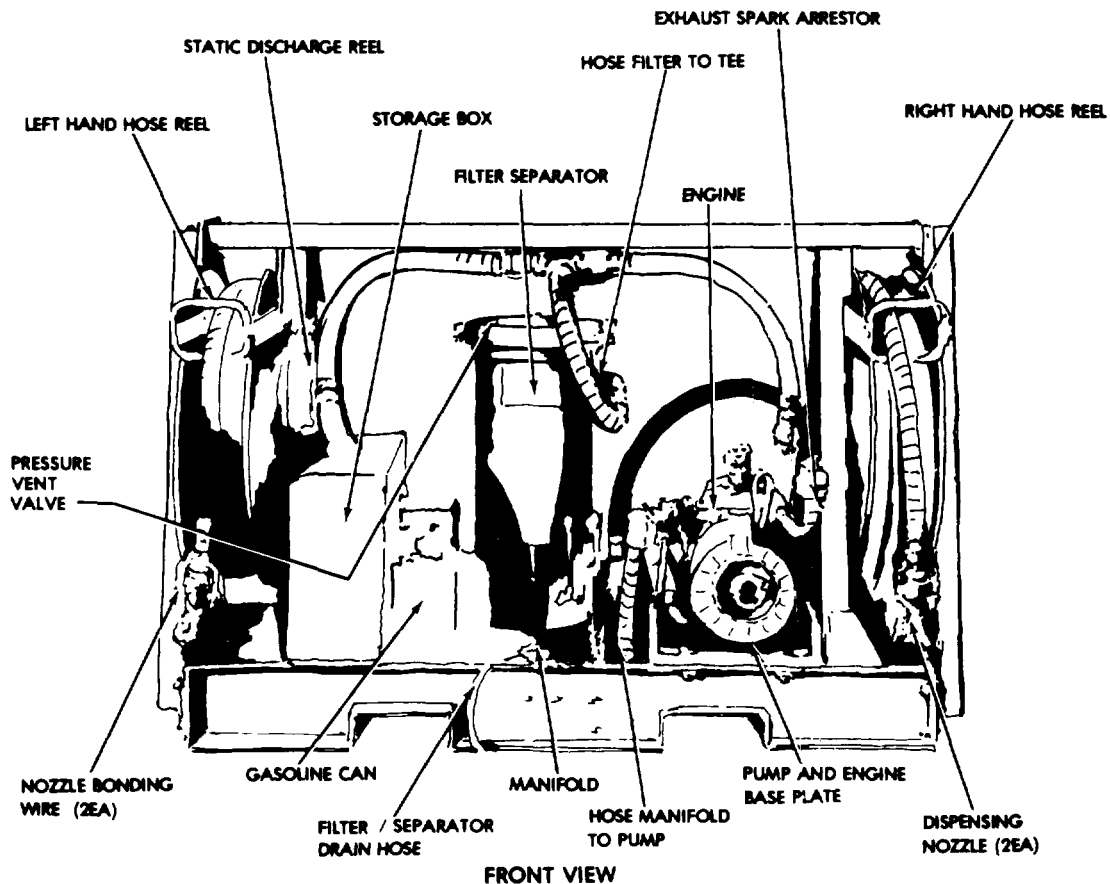


Figure 1-2. Pumping Unit (GED).

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

- a. Pumping Unit. The pumping unit of the tank and pump unit includes the engine/motor, pump, filter/separator, reels and hose, storage box, and other related items of equipment (figures 1-2 and 1-3).
- b. Motor. The electric motor is a 1.5 hp motor (figure 1-3).
- c. Cables. The electric motor driven pump assembly requires two cables (figure 1-4).

NOTE

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

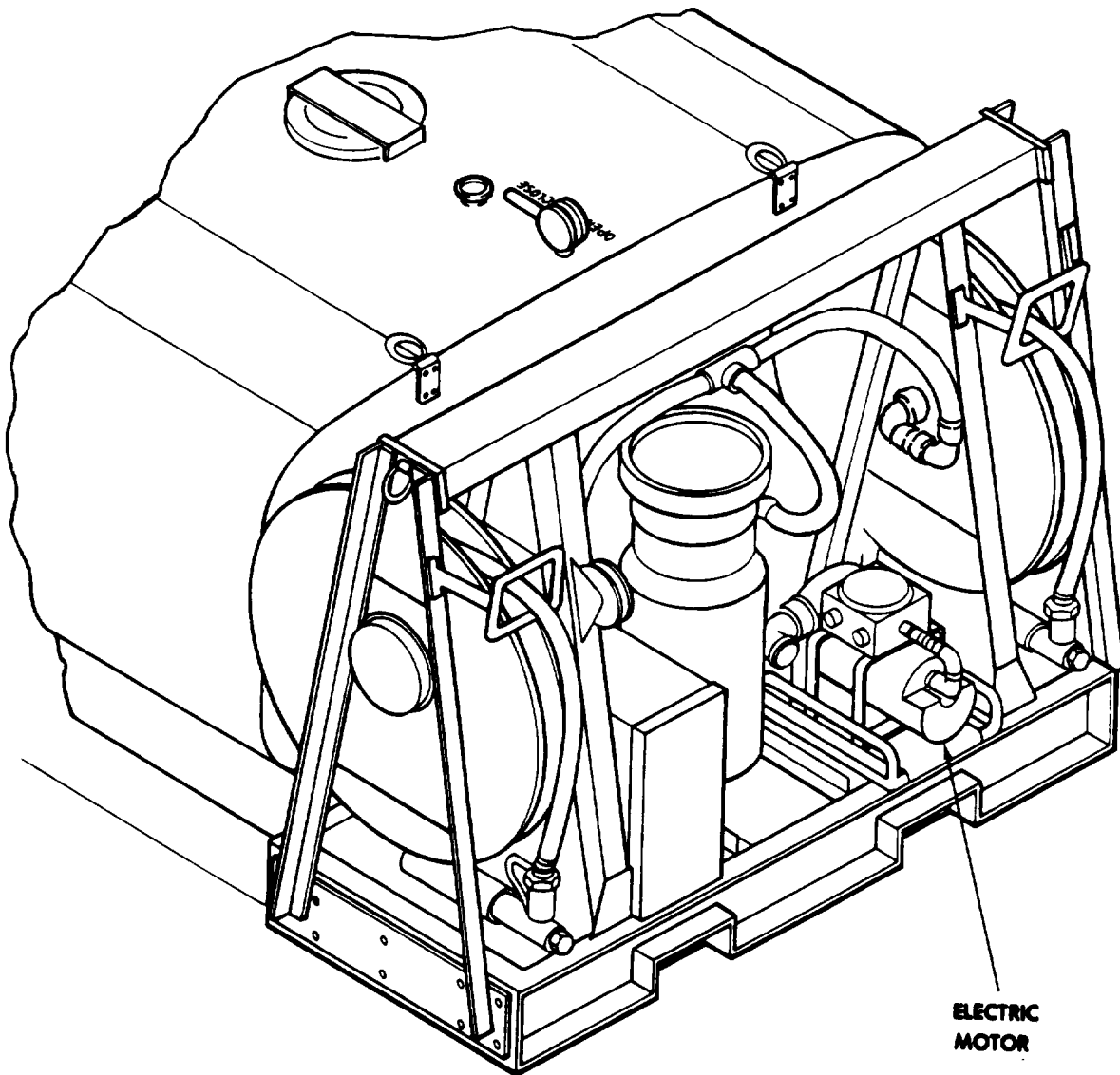


Figure 1-3. Tank and Pump Unit with Electric Motor.

d. Pump. The pump is a self-priming unit, with the impeller screwed directly on the extension of the engine crankshaft/motor armature shaft. The pump and motor (figure 1-4) pump and engine (figure 1-5) are mounted on a base plate to facilitate removal for use in auxiliary pumping operations.

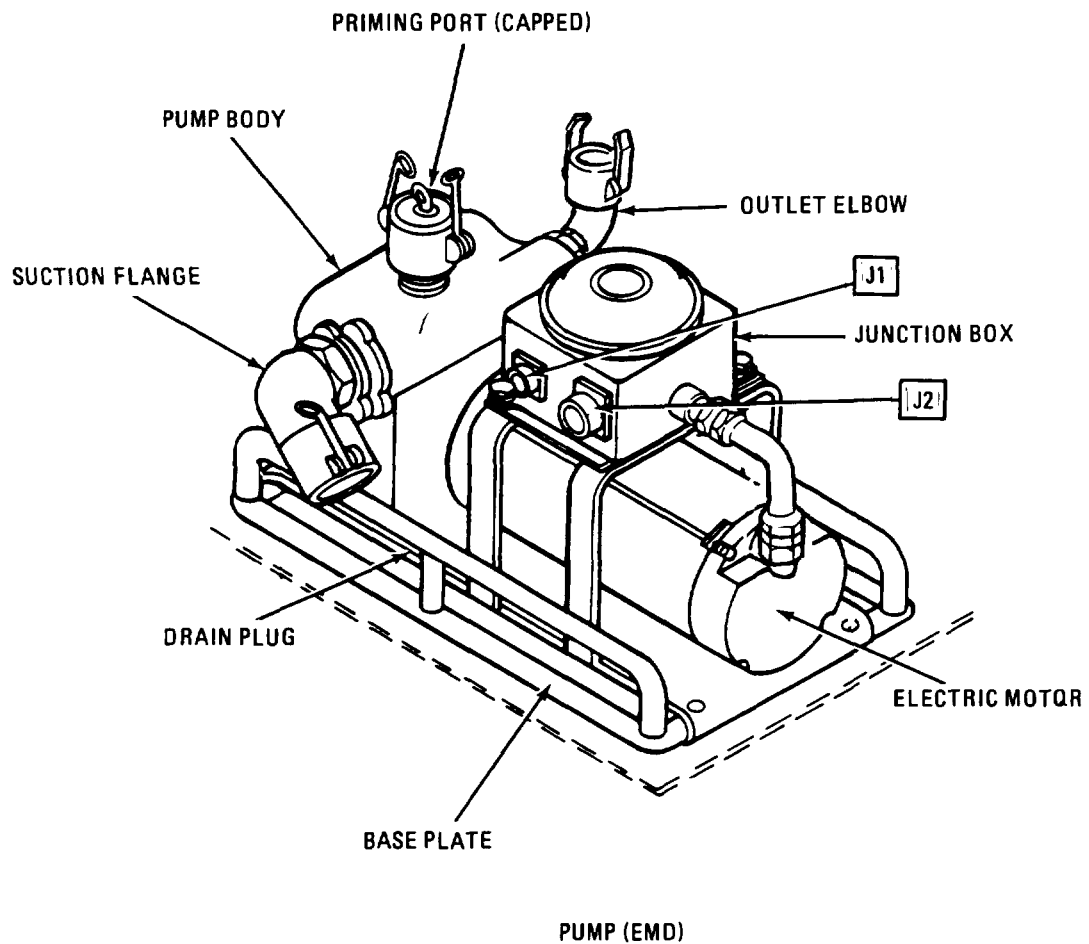
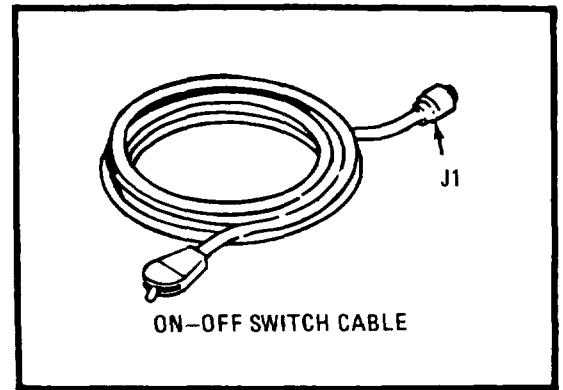
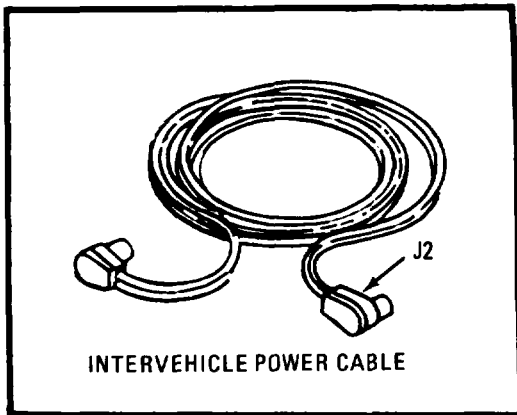


Figure 1-4. Pump Assembly (EMD)

e. Engine. The model 2A016-3 Military Standard engine is gasoline-fueled, 2-cylinder, 4-stroke cycle, overhead-valve, air-cooled type. This engine is fully radio-interference suppressed and fungus-proofed, with a development of 3 hp at 3600 rpm. For engine descriptive and maintenance data, refer to TM 5-2805-257-14.

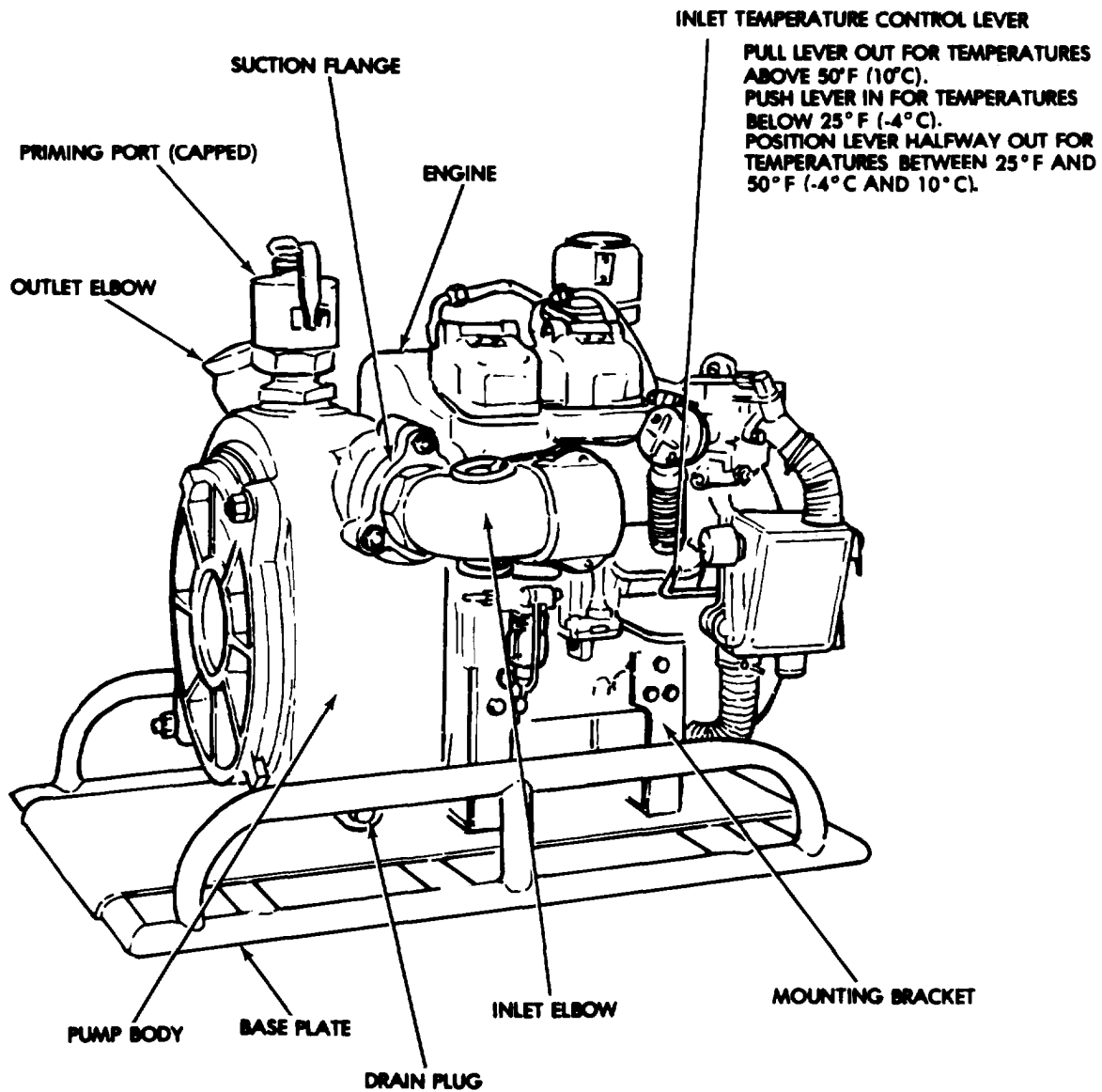


Figure 1-5. Pump Assembly (GED).

f. Filter/Separator. The filter/separator (figure 1-8) is a vertical, 50 gpm (189 liters per minute) unit designed for maximum operating pressure of 75 psi (5.273 kg/sq cm). Both solids and water are removed from the fuel through the (blending) and filtering medium of the elements inside the filter/separator. The filter/separator consists of:

- (1) Four canisters.
- (2) Four filter elements.
- (3) One differential pressure gage.
- (4) One water sight gage.
- (5) One draincock.

Any solid impurities and water in the liquid being pumped is trapped in the filter elements. The elements hold the solid particles and the water collects and settles to the deck plate where it can be periodically removed through the drain. Clean product builds up in the shell and is pumped to the hose reels. Refer to figure 1-7 for flow of the pumped liquid through the filter/separator.

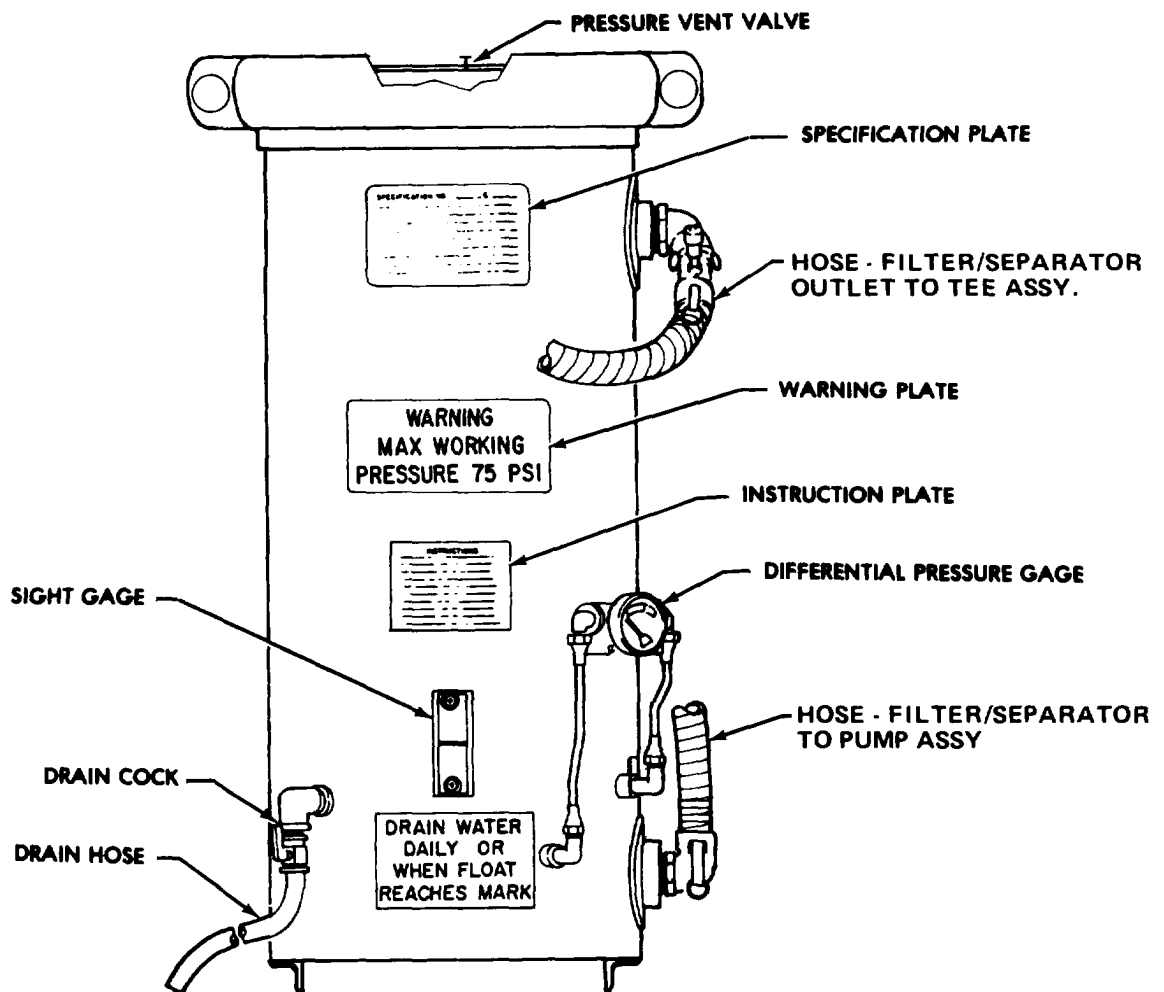


Figure 1-6. Filter Separator.

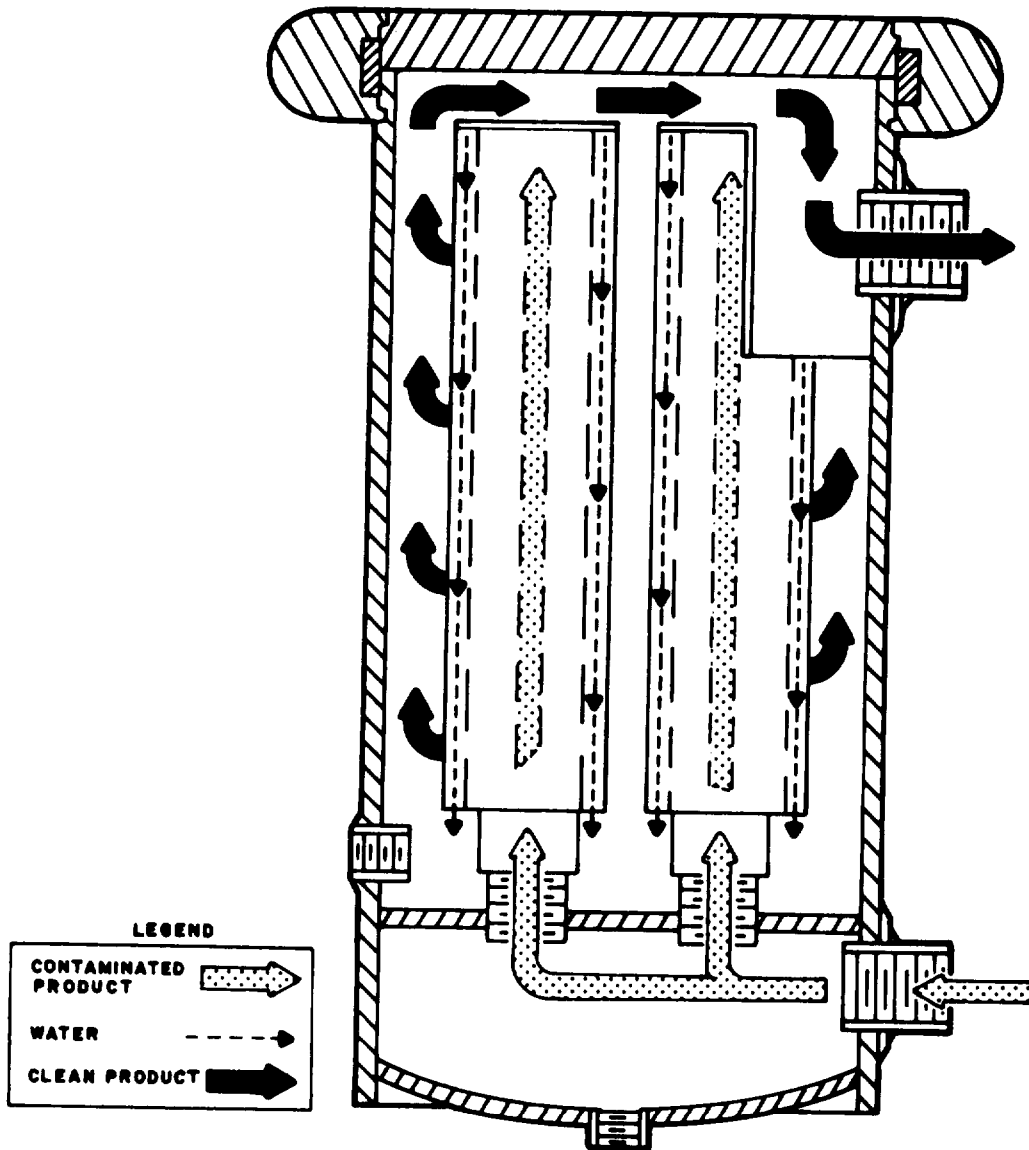


Figure 1-7. Filter/Separator Flow Chart.

1-9. TABULATED DATA

a. Identification. I.D. Plates are: (figures 1-8 and 1-9).

(1) Engine Manufacturer's I.D. Plate is located on the motor and specifies the serial number, size, rpm, specification number, displacement, and date of manufacture (GED ONLY).

(2) Tank and Pump Unit I.D. Plate is located on the lower left frame.

(3) Tank I.D. Plate is located on the top-center, front of each of the two tanks. It specifies capacity, national stock number, serial number, manufacturer, date of manufacture, weight (empty), and fuel weight (in pounds-per-gallon).

(4) Pump Unit I.D. Plate is located on the lower right frame.

(5) Pump Assembly (EMD) I.D. Plate is located on top of base plate.

b. Dimensions and Weight.

(1) Pumping Assembly.

Length	78 in. (198.12 cm)
Width	37 in. (93.98 cm)
Height	50 in. (127.00 cm)
Weight	765 lb. (347.00 kg)

(2) Tank.

Capacity	600 gal. (2271.00 liters)
Length	56 in. (142.24 cm)
Width	72 in. (182.88 cm)
Height	56 in. (142.24 cm)
Weight	525 lb. (238.14 kg)

(3) 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

(4) Gasoline Engine. Refer to TM 5-2805-257-14 for data.

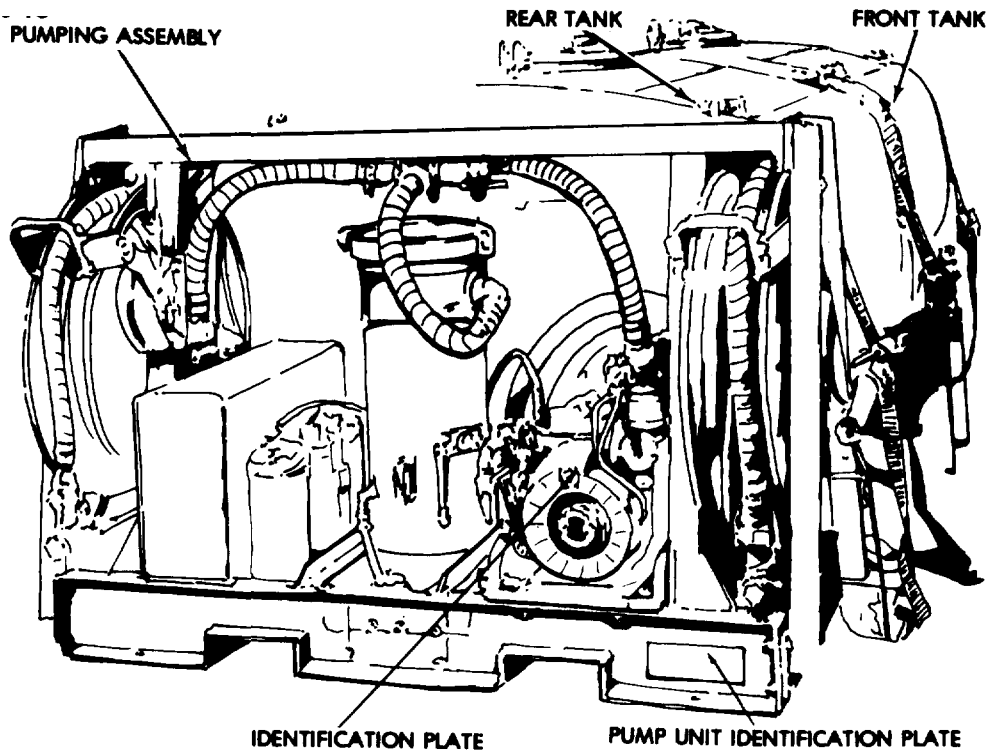


Figure 1-8. Pump Unit I.D. (GED).

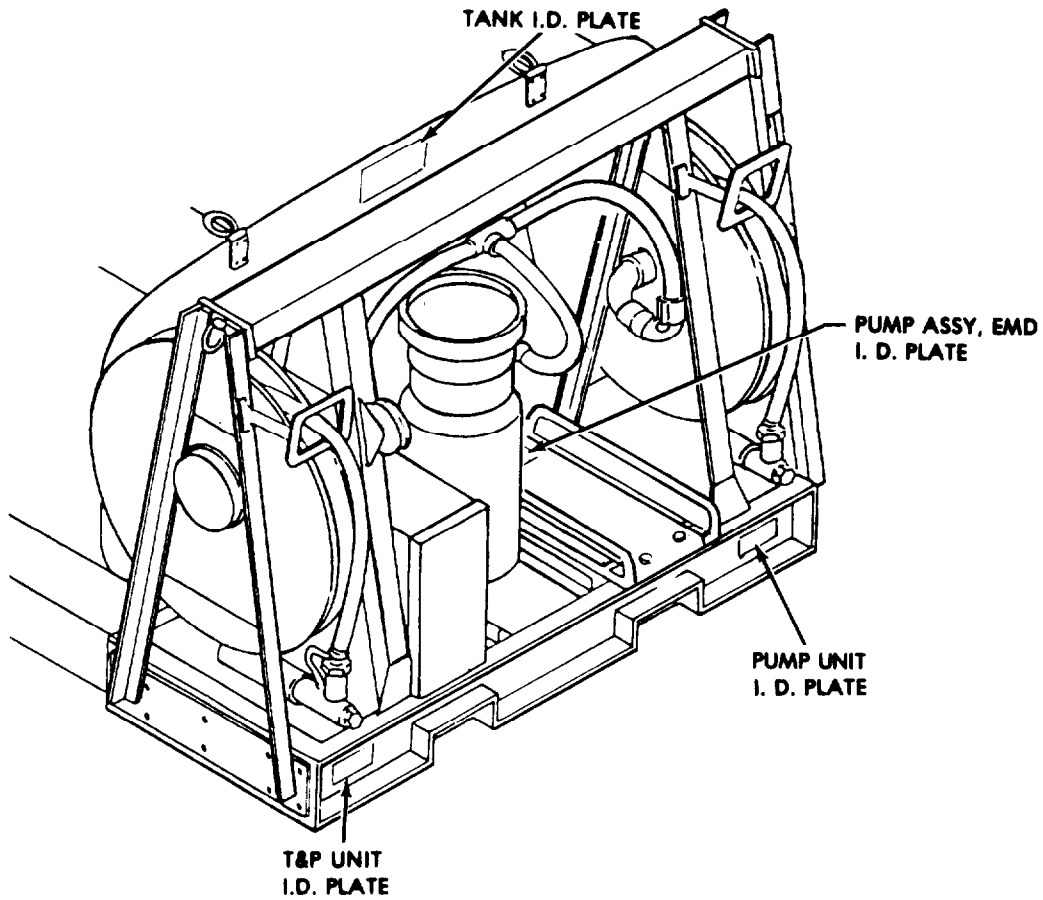


Figure 1-9. Pump Unit I.D. (EMD).

CHAPTER 2**OPERATING INSTRUCTIONS****Section I. DESCRIPTION AND USE OF OPERATOR'S
CONTROLS AND INDICATORS.****2-1. GENERAL**

This section contains instructions 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. OPERATOR'S CONTROLS

See figure 2-1 for a general description of the controls that an operator will normally be concerned with. For specific operating instructions, see Sections III and IV of this chapter.

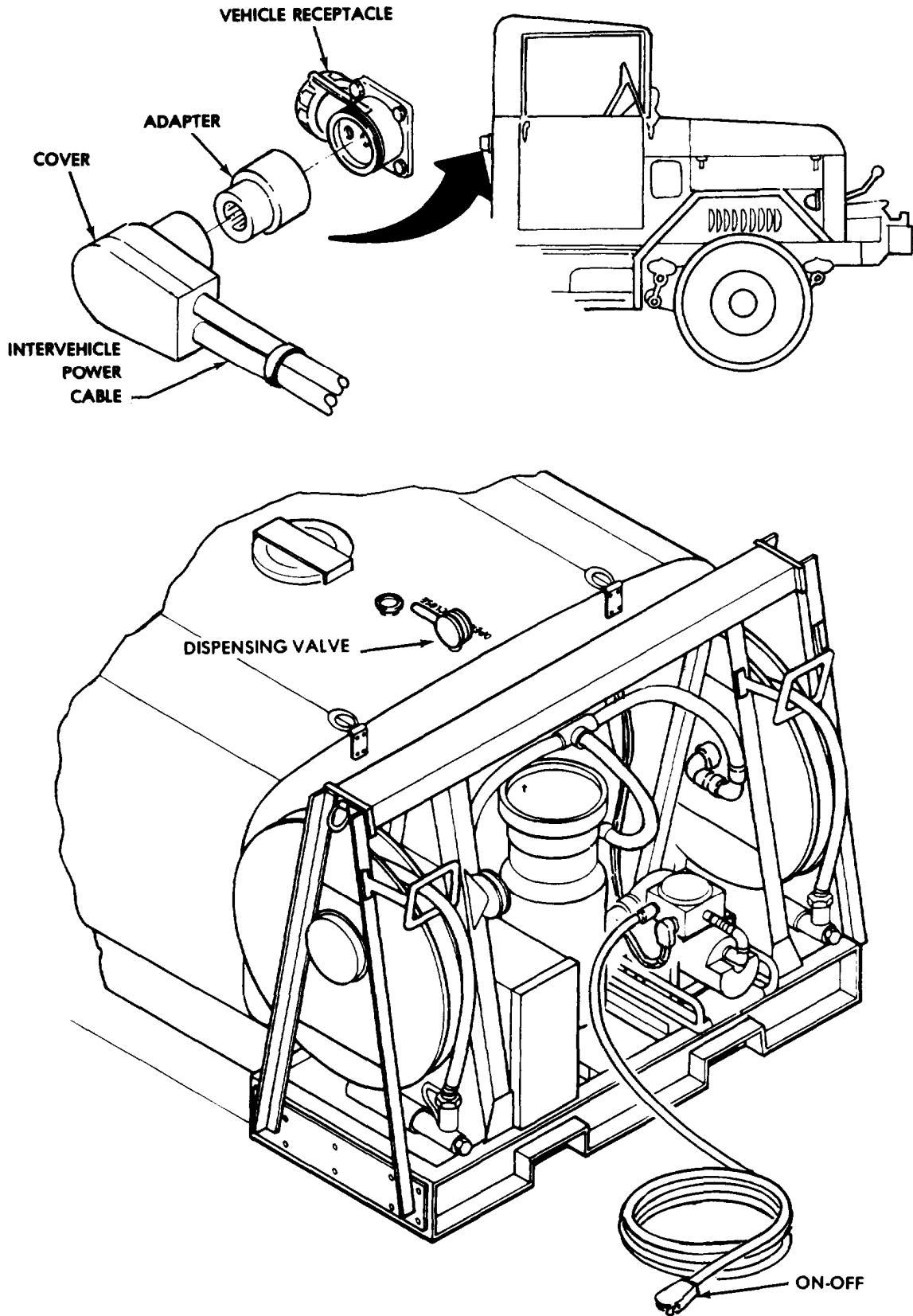


Figure 2-1. Tank and Pump Unit with Electric Motor.

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

2-3. GENERAL

Preventive Maintenance Checks and Services (PMCS) are essential to the efficient operation of the tank and pump unit and to prevent possible damage that might occur through neglect or failure to observe warning symptoms in a timely manner. Checks and services performed by operators are limited to those functions which are described in table 2-1.

- a. Before You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS. Perform your before (B) PMCS.
- b. While You Operate. Always keep in mind and observe the WARNINGS and CAUTIONS. Perform your during (D) PMCS.
- c. After You Operate. Be sure to perform your after (A) PMCS.
- d. If Your Equipment Fails to Operate. Troubleshooting with proper equipment. Report any deficiencies using DA Form 2404. See DA PAM 738-750 for instructions.

Table 2-1. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

B-Before D-During A-After W-Weekly M-Monthly

Item No.	B	D	A	W	M	ITEM TO BE INSPECTED PROCEDURE	Equipment is Not Ready/Available If
1.	Ž	•	•			<p>Hoses and fittings - Visual Inspection. Inspect hoses for damage, cracking, signs of leakage. Inspect couplings for secure connections, damage, signs of leakage at hose or gaskets.</p> <p style="text-align: center;"><u>WARNING</u></p> <p>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 that correct grounding procedures have been followed prior to operating the equipment. If nozzles are leaking and fuel is spilled, wash the area of spillage thoroughly with water, and notify the appropriate safety personnel.</p> <p style="text-align: center;"><u>CAUTION</u></p> <p>Recoil spring under high tension when dispensing hose is extended.</p>	Evidence of fuel leakage.
2.	•	•	•			<p>Dispensing Reels, Nozzles, and Related Parts - Visual/Operational Inspection. Check operation of hose dispensing reels and related parts. Inspect nozzles for proper operation and damage or missing parts. Inspect static discharge grounding wire to assure proper connection to nozzle assembly.</p>	Both nozzles are inoperative or one nozzle is leaking fuel.
3.	•	•	•			<p>Filter/Separator - Visual/Operational Inspection. Inspect for leaks or damage. Check sight gage for float ball location. Open drain cock and drain water. Float ball must not be higher than line marked on the sight window. Observe differential pressure gage. If gage reading is other than green, notify organizational maintenance for filter element replacement.</p>	Evidence of leakage.
4.	•	•	Ž			<p>Gasoline Engine Assembly - Check for damage to engine assembly and components.</p> <p>Insure spark arrestor is present and in working condition.</p> <p>Insure engine starts and runs properly. Check for fuel leaks. (Refer to TM 5-2805-257-14 for additional checks).</p> <p>Notify organizational maintenance for component parts replacement.</p>	<p>Evidence of fuel leaking.</p> <p>Missing or defective spark arrestor.</p> <p>Engine inoperative.</p>

Table 2-1. OPERATOR Preventive Maintenance CHECKS AND SERVICES(Con't)

Item No.	Interval					Item to be Inspected Procedure	Equipment is Not Ready/ Available If:
	B	D	A	W	M		
5	•	•	•			<p>Pump Assembly. Check pump and components for damage or leakage.</p> <p>Notify organizational maintenance for repair.</p> <p>CAUTION</p> <p>In freezing weather, ensure pressure vent valve is protected by being located under Fill Plug Hinge. While pumping operation is in process blockage of this vent system (e.g., with ice) can cause the aluminum tanks to either collapse or rupture.</p>	<p>Evidence of fuel leakage.</p> <p>Pump inoperative.</p>
6	•		•			<p>Tank Assemblies. Visual Inspection. Inspect for damage or signs of leakage. Check for proper location of vent valve manhole cover gasket, and secure manhole latches. Check for proper operation of dispensing valve. Inspect for missing or damaged hardware. Check all tank and pump unit tiedowns for serviceability and insure that they are secure.</p> <p>NOTE</p> <p>Electric motor has thermo protection. Thirty minutes is considered maximum operation time. Electric motor may stop for 10–15 minutes until motor cools.</p>	<p>Leakage of fuel is present, dispensing valve will not open, or tiedown procedure cannot be accomplished.</p>
7	•		•			<p>Electric Motor check for proper connections. Check for loose or missing mounting bolts. Check for proper operation.</p> <p>Notify organizational maintenance if motor is inoperative.</p>	<p>Electric motor is inoperable.</p> <p>Electrical spark at exterior of motor.</p>
8	•		•			<p>Electrical Cables, Switch and Junction Box. Check for loose connections, damaged cables, connectors or switch. Check junction box for defective cover seal, or damaged connectors.</p> <p>Notify organizational maintenance for replacement of defective parts.</p>	<p>Excessively damaged cables or connectors (which could cause electrical spark).</p>

Table 2-1. OPERATOR Preventive Maintenance CHECKS AND SERVICES (Con't)

B – Before D –During A – After W – Weekly M – Monthly

Item No.	Interval					Item to be Inspected Procedure	Equipment is Not Ready/ Available If:
	B	D	A	W	M		
9	•		•			Vehicle Power Supply. Adjust vehicle throttle at beginning of Pumping Mode (Approx 1000 RPM) Inspect vehicle battery indicator gage for charge condition. Return vehicle throttle to normal idle after completion of pumping process. (EMD ONLY).	Batteries discharged. Battery charge rate is not adequate.
10	•		•			Static Discharge Reel. Check for broken clamp or cable.	Broken cable or clamp which would not allow a proper ground.
11	•		•			Grounding Rod. In absence of ground point, drive ground rod into ground, full length, and attach static reel clamp to it. Remove and stow grounding rod after pumping and before moving truck.	Inadequate grounding.
12	•	•	•			Fire Extinguisher. Check for broken seal. Check pressure gage/cylinder weight.	Missing or discharged cylinder.

Section III. OPERATING UNDER USUAL CONDITIONS.

2-4. GENERAL

The instructions in this section are for personnel who operate the tank and pump unit. How the unit is started and stopped in normal weather conditions is described.

2-5. STARTING THE EQUIPMENT

Before you operate. Always keep in mind the CAUTIONS and WARNINGS. Filling 600-Gallon (2271 Liter) Tanks.

CAUTION

if tank and pump unit is mounted on any vehicle other than a 5 ton vehicle, extreme caution must be taken when filling the tanks to avoid exceeding cross-country payload limits.

- a. Be sure that suction hoses connecting tanks to the pump assembly are properly secured. Ground pumping assembly before starting to fill the 600-gallon (2271 Liter) tanks.
- b. Bonding and grounding procedures areas follows:

WARNING

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

(1) 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 dips 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.

(2) 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 2-2). 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 dip 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 2-2. 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

(3) 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.

(a) 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.

(b) 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 2-2). 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.

(c) 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 (see paragraph 2-12b). 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.

c. Open only the manhole cover fill plug of the tank being filled. Do not fill two tanks at the same time unless operator has an assistant. If fuel is spilled, wash the area of spillage thoroughly with water.

2-6. UNIT OPERATION

a. General.

(1) The tank and pump unit is used to dispense automotive, aviation and burner 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. The following paragraphs cover some common operational procedures for the tank and pump unit in the field (see figures 2-1 and 2-2).

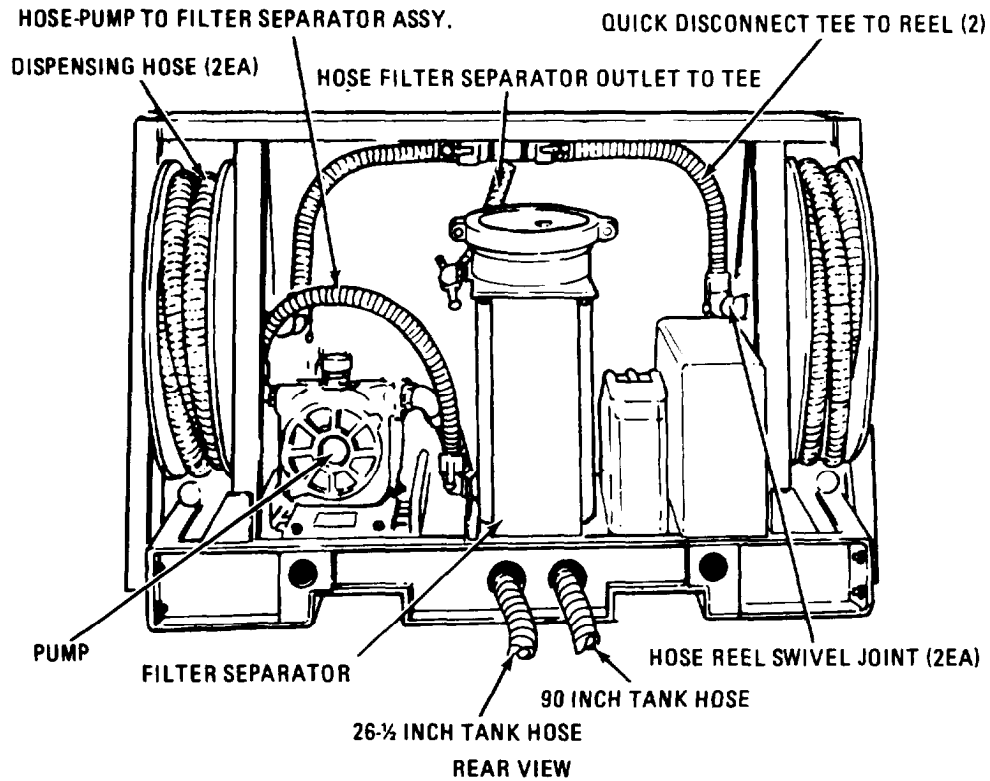
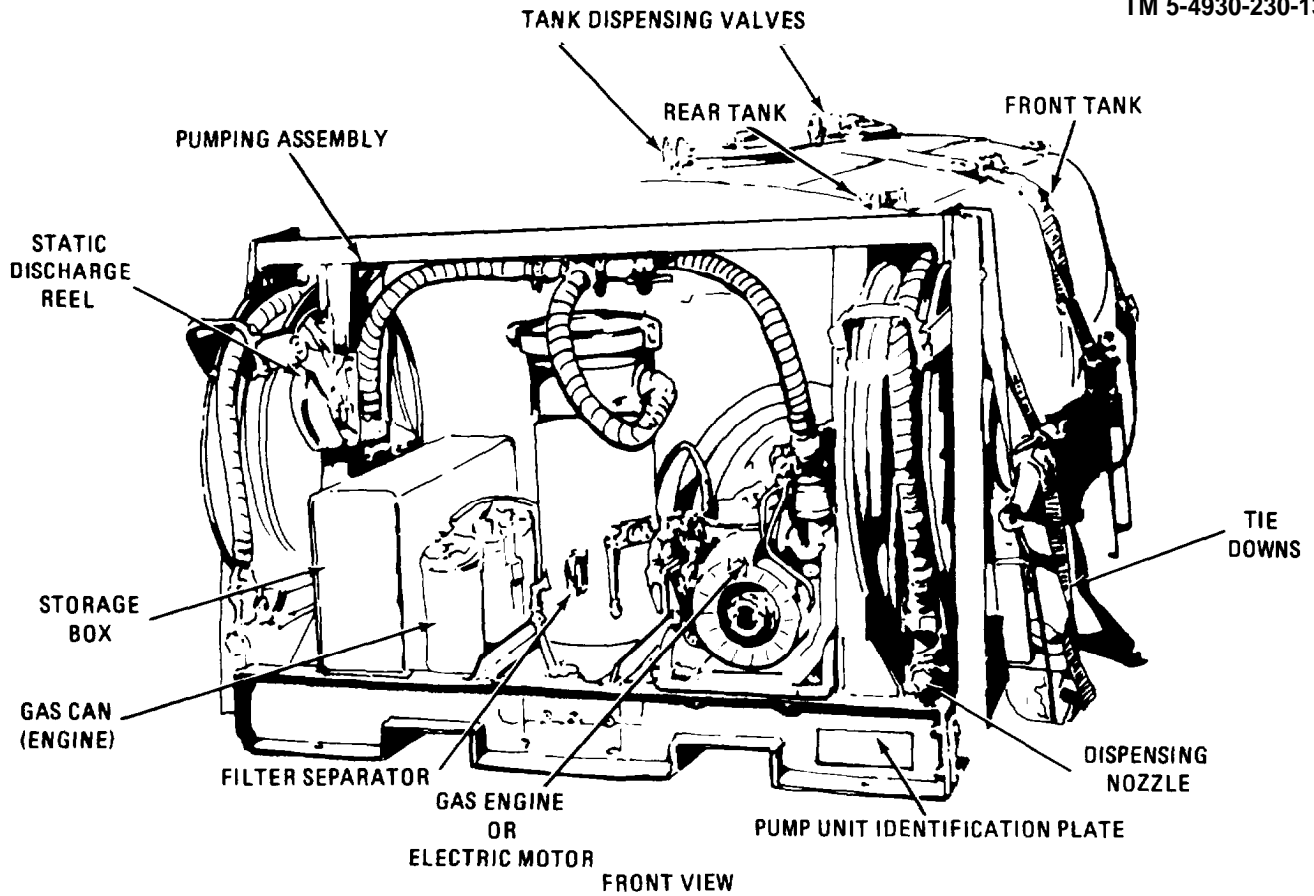


Figure 2-2. Operating the Pump Unit.

WARNING

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

(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. (Refer to AR 703-1.)

WARNING

Install adapter away from gas engine to avoid fire. Adapter may be installed at left hose reel swivel.

(3) The adapter for a water detector kit (figure 2-3) and probe is issued for use with the tank and pump unit. The kit with probe is to assist the operator in obtaining a fuel sample. The adapter with probe must be installed after the filter separator. The adapter will couple into the fuel line at the outlet of the filter separator without any additional adapters or modification.

b. Dispensing from Truck Tanks through Reels.

WARNING

- **Be sure proper grounding procedures have been followed prior to dispensing fuel. Maintain a distance of 25 feet (7.6m) between vehicles being fueled.**
- **Operation of the gasoline engine powered model 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.**

CAUTION

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

(1) Lower tailgate of truck.

(2) Electric motor powered units.

(a) Connect intervehicular power cable, with adapter, to vehicle receptacle and junction box receptacle J2 (figure 2-1).

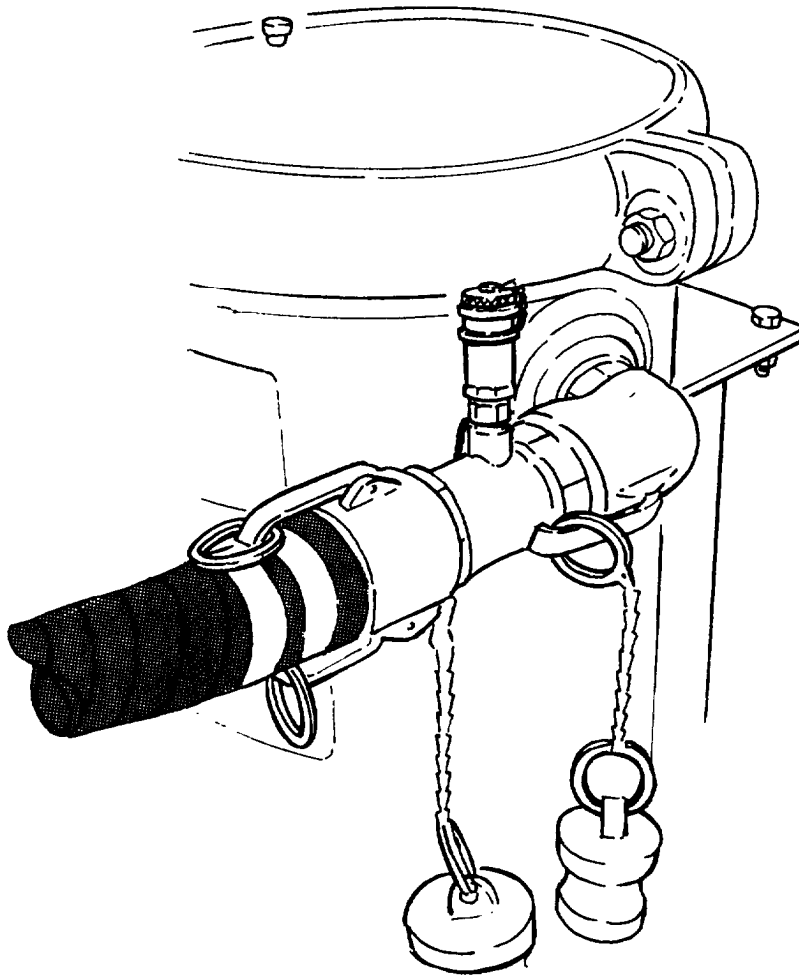


Figure 2-3. Adapter Probe, Water Detector Kit.

- (b) Connect ON-OFF switch cable to junction box receptacle J1 (figure 2-1).
- (c) Ground the unit by attaching clip of static discharge securely to a ground point.

NOTE

If ground is not present, use 3 Section Ground Rod, App B, Sec III; and Slide Hammer Kit, Add Auth List.

- (d) Check truck hand throttle for proper engine RPM to maintain adequate charge rate during pumping operation.
- (e) Pull out dispensing hoses to desired length. Attach nozzle bonding wires to aircraft or vehicle before opening filler caps and inserting nozzles.

NOTE

Alternate nozzle for dispensing unleaded fuel is listed in Appendix D, Additional Authorized List, Sec. II, Item 2.

(f) Insert nozzles in vehicle or equipment fuel tanks carefully. Observe safe fueling rates stenciled near fuel tanks.

CAUTION

Be sure nozzle is operating correctly before starting electric motor.

(g) Open the tank dispensing valve and place motor start switch in the ON position (figure 2-1).

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 is cool.

(h) Turn switch OFF when not dispensing fuel.

NOTE

Opening tank dispensing valve on full tanks should prime the pump. If not, manual priming can be done through the priming port (figures 1-4 and 1-5).

(i) The float ball inside the water sight gage window located on the filter/separator should not be above the line mark on the window (figure 2-4).

(j) Check the window frequently for the location of the float ball and drain the filter/separator when the ball reaches the line mark.

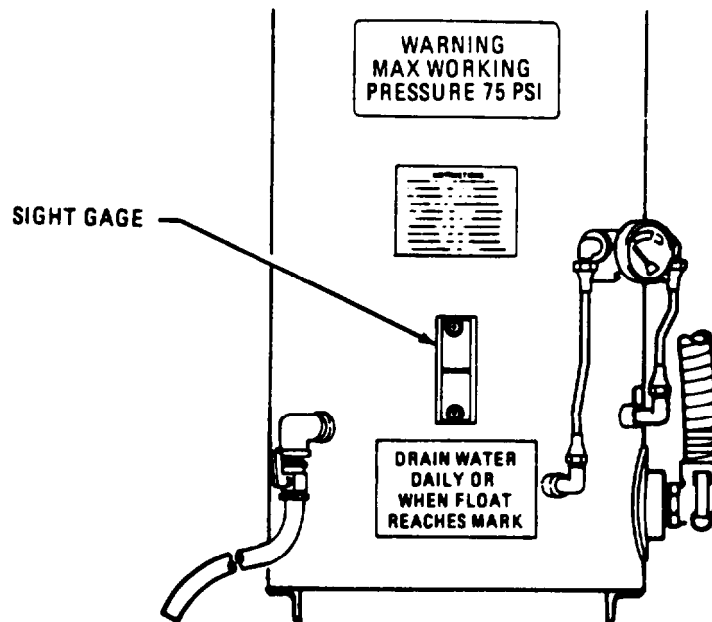


Figure 2-4. Sight Gage.

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

WARNING

Replace filler cap securely before removing the nozzle bonding wire.

NOTE

ŽWhen filling small tanks, it may be necessary to reduce engine speed in order to reduce pressure surging at the hose and nozzle. (GED)

ŽRecap, wind and secure nozzle bonding wire around nozzles when dispensing is completed.

(l) Open second tank dispensing valve just before first tank is emptied and close first dispensing valve when the tank is empty.

(m) Stop pumping when operation is complete, drain hoses if shutting down for longer than overnight; rewind hoses and ground wire.

CAUTION

If tank and pump unit is mounted on other than a 5 ton vehicle, caution should be taken in filling tanks to avoid exceeding cross-country payload limits of transporting vehicle.

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

(o) Close dispensing valves on both tanks to reduce spills during overnight storage.

(3) Gasoline engine powered units. Open the tank dispensing valve and start the engine. (Refer to TM 5-2805-257-14, Chapter 2)

2-7. STOPPING

a. Gasoline Engine. (Refer to TM 5-2805-257-14, Chapter 2.)

b. Electric Motor. Place motor ON-OFF switch in the OFF position. (figure 2-5)

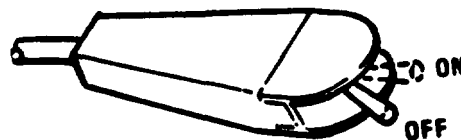


Figure 2-5. ON-OFF Switch

c. When moving to a new location:

(1) Disconnect ON-OFF switch cable from junction box receptacle J1. (figures 1-4 and 2-1)

(2) Disconnect intervehicular power cable from vehicle receptacle and junction box receptacle J2. (figures 1-4 and 2-1)

2-3. FIRE EXTINGUISHER

The fire extinguisher (see figure 2-6.) is a dry chemical type suitable for electrical and flammable liquid fires. To operate:

- a. Remove from mounting bracket.
- b. Release nozzle from holster.
- c. Press lever all the way down to pressurize.
- d. Hold upright.
- e. Squeeze nozzle lever to open.
- f. Direct discharge at base of flame. Use rapid side-to-side sweeping motion.
- g. Always keep dry chemical charge behind flames.

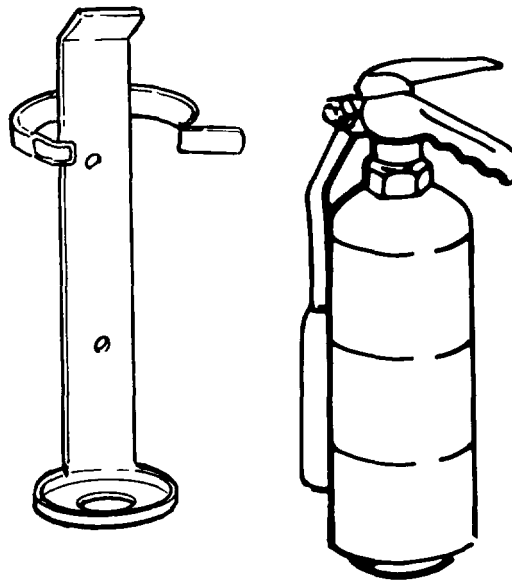


Figure 2-6. Fire Extinguisher.

Section IV. OPERATING UNDER UNUSUAL CONDITIONS.

2-9. 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 be followed.

2-10. OPERATION IN EXTREME COLD

WARNING

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

⚠ Operation of the gasoline engine powered model presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits of unprotected personnel. Wear ear muffs or earplugs which were fitted by a trained professional.

CAUTION

Ensure that pump is full of fuel before starting. Prime, if necessary.

a. Gasoline Engine. In extremely 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 to overheat.

(1) Engine Fuel System. Keep the fuel tank full to reduce condensation inside the tank. Clean the fuel filter bowl more frequently. Keep the fuel tank cap free of ice and snow.

(2) Ignition System. Before starting engine, remove all accumulated snow and ice from the spark plug, ignition cable and magneto.

(3) Engine Operation (- 25°F to - 65°F (- 32°C to - 54 °C)). For operating procedures, refer to TM 5-2805-275-14, Chapter 2.

b. 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.

2-11. OPERATION IN EXTREME HEAT

WARNING

Operation of the gasoline engine powered model 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.

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

(1) Cooling System. Keep engine cooling fins clean. Keep all exposed surfaces of engine clean. Remove all obstructions to the flow of air to the engine.

(2) Pumping Unit. Where possible, operate the pumping unit in the shade to avoid overheating. If the engine overheats, remove the load and idle the engine at 1000 rpm for five minutes. If fuel vapor lock occurs, wait until engine cools.

(3) Engine Operation. For operating procedures, refer to TM 5-2805-257-14, Chapter 2.

b. 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. Do not remove front panel or chassis components unless required. Make more frequent PMCS.

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

d. Lubrication. Refer to Lubrication Order, paragraph 3-1, and lubricate the tank and pump unit,

2-12. OPERATION IN DUSTY OR SANDY AREA

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

b. Air Cleaner. Service the engine air cleaner frequently. (Refer to TM 5-2805-257-14, Chapter 4.)

c. Filter/Separator Element. Service the filter/separator frequently (figure 3-2).

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°F to 138°F (38°C to 59°C).

d. Cleaning. Clean the tank and pump unit with drycleaning solvent (item 1, Appendix E) giving special attention to cavities, corners, and partially exposed interior spaces. Dry thoroughly. Keep the tank and area around the discharge valve and cam lever free from sand and dust.

2-13. OPERATION UNDER RAINY OR HUMID CONDITIONS

WARNING

Operation of gas engine powered model 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.

2-14. OPERATION IN SALTWATER AREAS

Saltwater corrodes metal. If unpainted equipment parts are exposed to saltwater, clean them immediately with drycleaning solvent (item 1, Appendix E) and dry thoroughly. All surfaces should be cleaned daily.

2-15. OPERATION AT HIGH ALTITUDES

WARNING

Operation of the gasoline engine powered model presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits for unprotected personnel. Wear earmuffs or earplugs which were fitted by a trained professional.

The unit is designed to operate at 8000 feet (2438 m) above sea level without special adjustments. However, at high altitudes, the carburetor may require adjustment. Notify organizational maintenance for carburetor adjustment.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS.

3-1. GENERAL

This section contains lubrication instructions for the tank and pump unit.

3-2. DETAILED LUBRICATION INFORMATION

a. General. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

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

c. Points of Lubrication. Lubricate the tank and pump unit in accordance with instructions in this manual and LO 5-2805-257-12 for engine lubrication instructions.

Section II. TROUBLESHOOTING.

3-3. 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 corrective actions to take.

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.

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

NOTE

- **Before you use table 3.1, be sure you have performed all applicable operating checks. If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.**
- **Refer to TM 5-2805-257-14 for operator troubleshooting to be performed on the gasoline engine.**

Table 3-1. Operator Troubleshooting

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. PUMP WILL NOT PUMP FUEL AT RATED CAPACITY.

- Step 1. Check for low pump engine speed.
 —Adjust engine speed. (GED)
 Check truck engine R.P.M. for proper charge rate. (EMD)
- Step 2. Check level in 600 gallon fuel tanks.
 —Fill tanks if empty.
- Step 3. Check that tank cam lever is fully open.
 —Open cam lever.

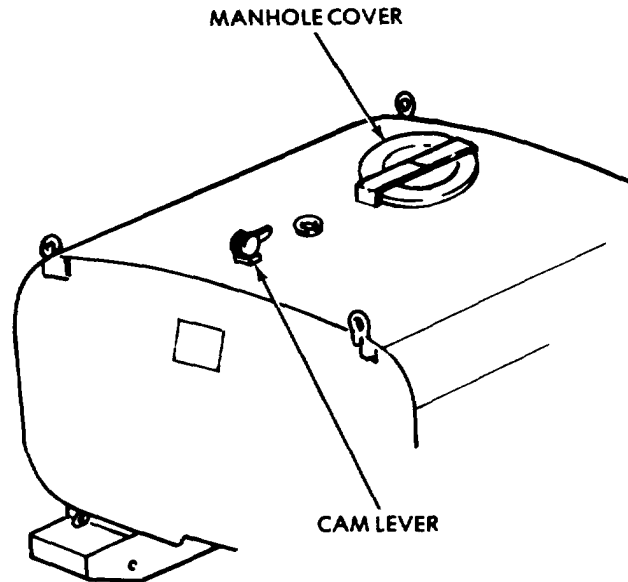


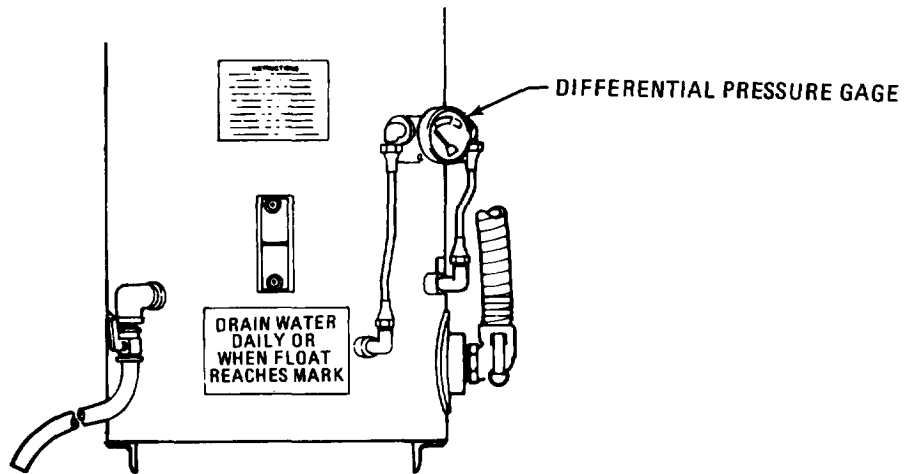
Table 3-1. Operator Troubleshooting (Cont.)

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

- Step 4. Check differential pressure gage on filter/separator to determine if filters are clogged or dirty.
 —Notify Organizational Maintenance for replacement of filter elements.



- Step 5. Check for kinked or damaged hoses that connect tanks to pump unit.
 —Notify Organizational Maintenance to replace hoses.

Table 3.1. Operator Troubleshooting (Cont.)

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

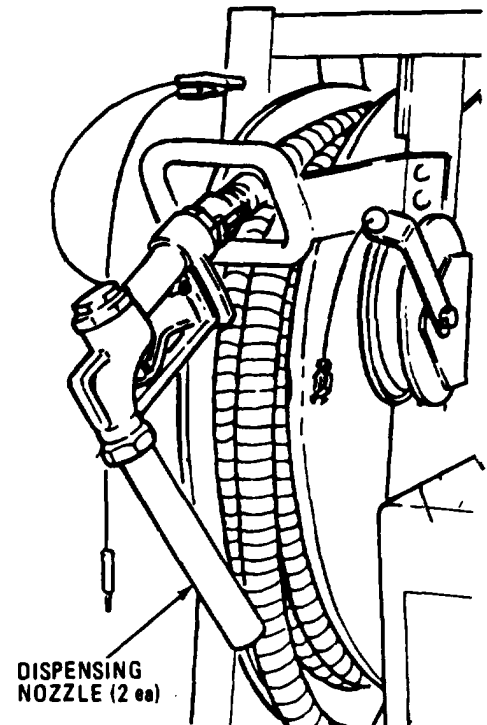
- Step 6. Check for defective nozzle assembly.
 - Replace nozzle.
 Contact Organizational Maintenance for repair of nozzle assembly.

2. GAS ENGINE WILL NOT OPERATE.

- Step 1. Check fuel supply.
 - Refuel if required.
 (Refer to TM5-2805-257-14 for additional troubleshooting instructions).

NOTE

Electric motor has thermo protection. 30 minutes is considered maximum operation time. Electric motor may stop for 10-15 minutes until motor cools.

**3. ELECTRIC MOTOR WILL NOT OPERATE.**

- Step 1. Check fuel supply.
 - If batteries are discharged, contact Organizational Maintenance.

3.1. AM RECEPTION IS POOR.

- Step 1. Turn off EMD unit to sea if quality of communication reception improves.
 - If quality improves, notify Organizational Maintenance to test further.

- Step 2. Replace EMD unit, if necessary.

4. PUMP FAILS TO PRIME.

- Step 1. Check that tank dispensing valve is open.
 - If pump does not prime, fill pump housing through priming port.

Table 3.1. Operator Troubleshooting (Cont.)

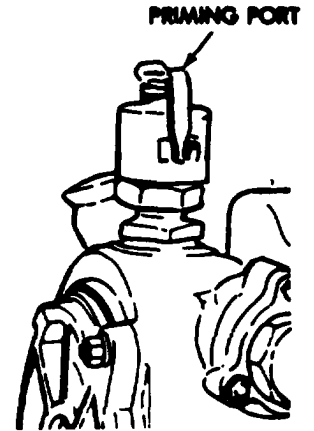
MALFUNCTION

**TEST OR INSPECTION
CORRECTIVE ACTION**

- 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 and connector J2.

5. HOSES LEAKING

- Step 1. Check hose assemblies for damaged hose, couplings or gaskets.
- Replace gasket or hose assembly.



Section III. MAINTENANCE PROCEDURES.

3-4. GENERAL

This section contains instructions for maintenance procedures which the operator may perform on the tank and pump unit.

3-5. FILTER/SEPARATOR

Inspect for damage or defects (figure 3-1). Clean as required. If repairs are necessary refer to Organizational Maintenance.

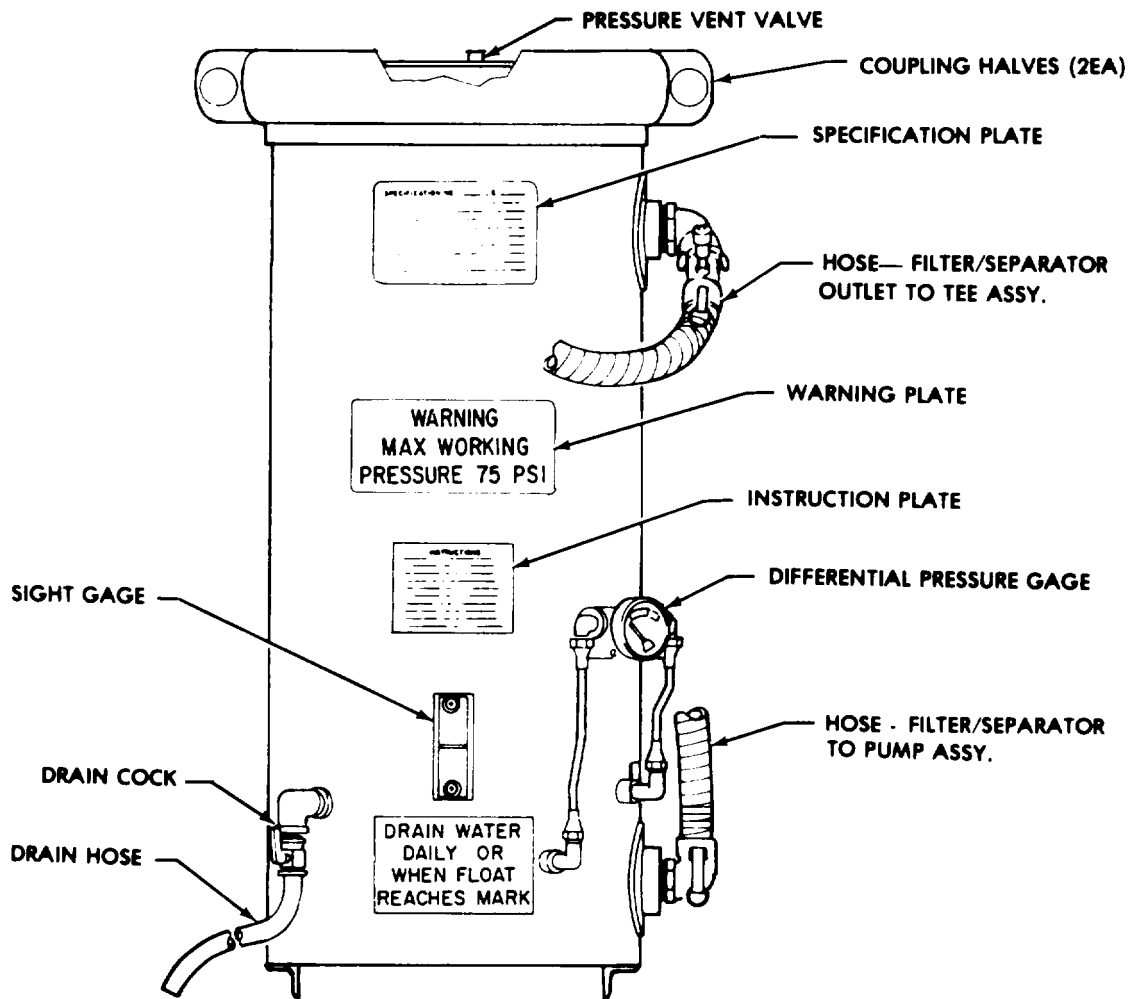


Figure 3-1. Filter/Separator

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°F to 138°F (38°C to 59 °C).

- a. Clean parts with drycleaning solvent (item 1, Appendix E) and dry thoroughly.
- b. Inspect the drain cock for damage or defects. Clean as required. If replacement is necessary, notify Organizational Maintenance.
- c. Check the ball in the water sight gage. It should not be above the line mark on the window. If ball is above the link mark, drain the filter/separator by opening the drain cock. Do not allow the fuel to spill on pump unit or vehicle bed.
- d. Inspect differential pressure during operation. If gage is not shown in the green, notify Organizational Maintenance for replacement of filter elements.

3-6. GASOLINE CAN

- a. Inspect the engine gasoline can for leaks and damage. Refer to figure 1-2 for location.
- b. Replace defective can.

3-7. POWER CABLES

- a. Inspect for damage or defects.
- b. Replace defective cables.

3-8. FUEL DISPENSING NOZZLE ASSEMBLY

a. Inspect nozzle assembly (figure 3-2) for freedom of lever, or missing parts. If lever does not operate freely or if ground strap is broken or missing, replace nozzle.

(1) Removal. Open nozzle and drain fuel into suitable container. Remove nozzle by pulling out on cam arms and disconnecting coupling.

(2) Installation. Connect couplings and close cam arms.

- b. Inspect gasket on coupler end of nozzle. If damaged, replace gasket.

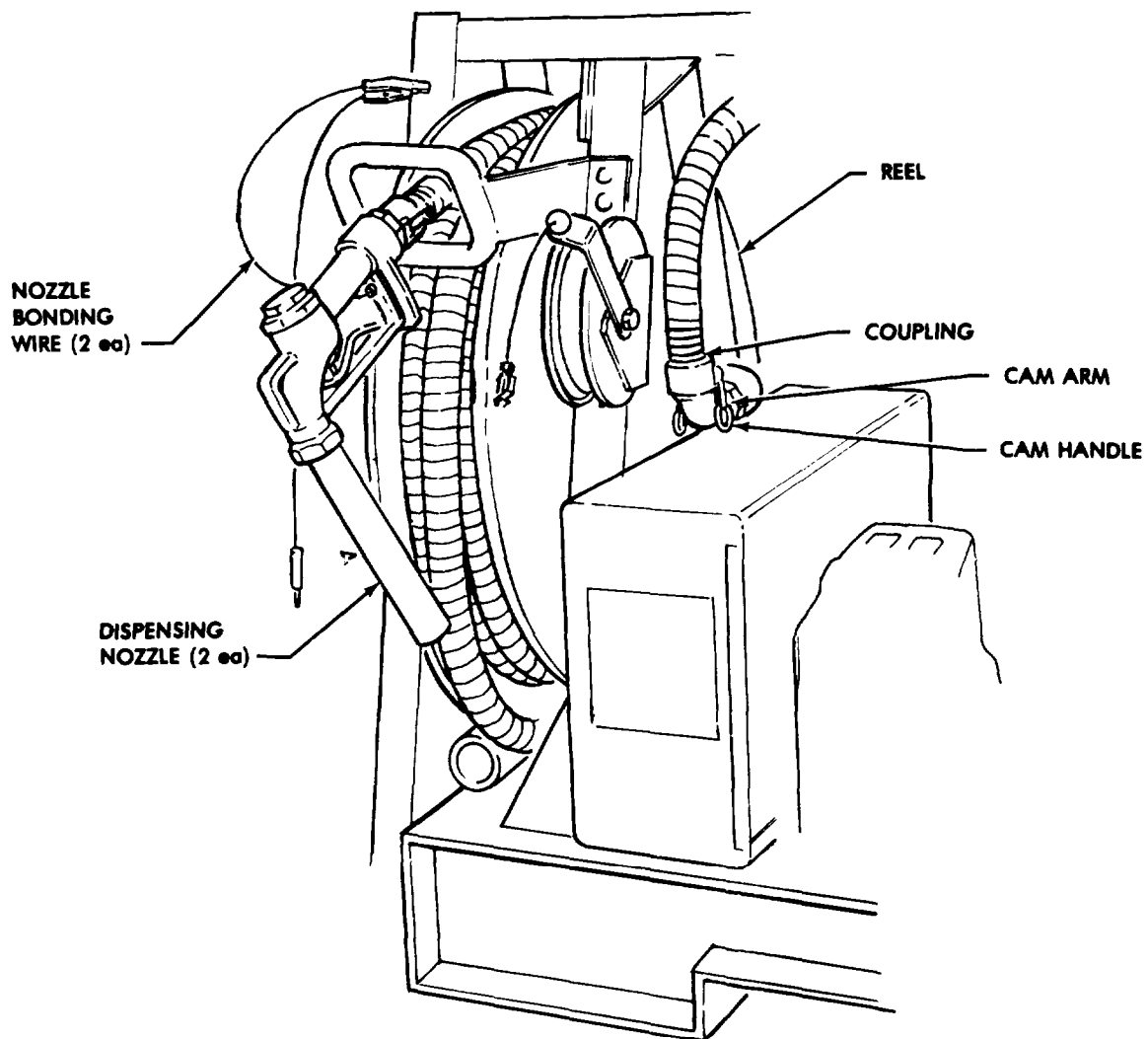


Figure 3-2. Nozzle Assembly

3-9. PUMP ASSEMBLY (GED)

Refer to TM 5-2805-257-14 for operator's maintenance procedures for the engine assembly.

WARNING

Disconnect intervehicle power cable before maintaining or replacing component parts.

3-10. PUMP ASSEMBLY (EMD)

a. The electric motor requires an intervehicular power cable.

(1) inspect intervehicle power cable (figure 3-3) 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) If cable is damaged, notify Organizational Maintenance for repair of cable assembly.

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

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

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

(3) Remove connectors from J1 receptacle and vehicle receptacle. Install new cable in reverse order. Clean connectors to obtain a good connection at J1 connector at Junction Box. If connector is damaged, notify Organizational Maintenance for replacement.

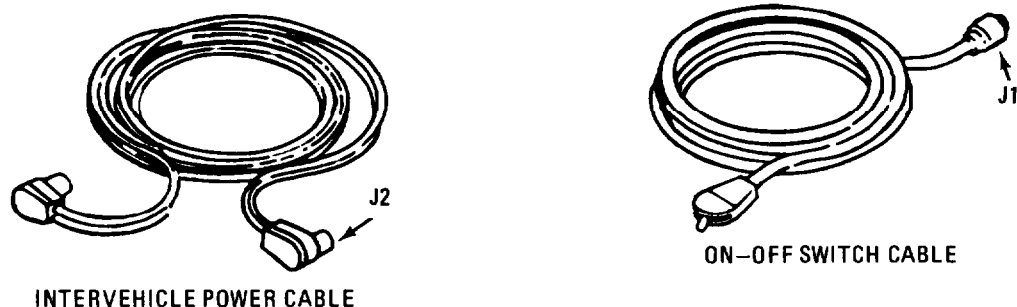


Figure 3-3. Pump Assembly Cables.

3-11. STATIC DISCHARGE REEL AND GROUNDING ROD

a. The Static Discharge Reel (figure 3-4) houses the grounding cable.

(1) Inspect the static discharge reel by pulling the cable out completely and check for broken or frayed cable.

(2) If cable is defective, notify Organizational Maintenance for repair or replacement.

NOTE

If ground is not present, use 3 section ground rod, App B, Sec. IV, and slide hammer kit, ADD AUTH LIST. The Grounding Rod is used to assure safe ground.

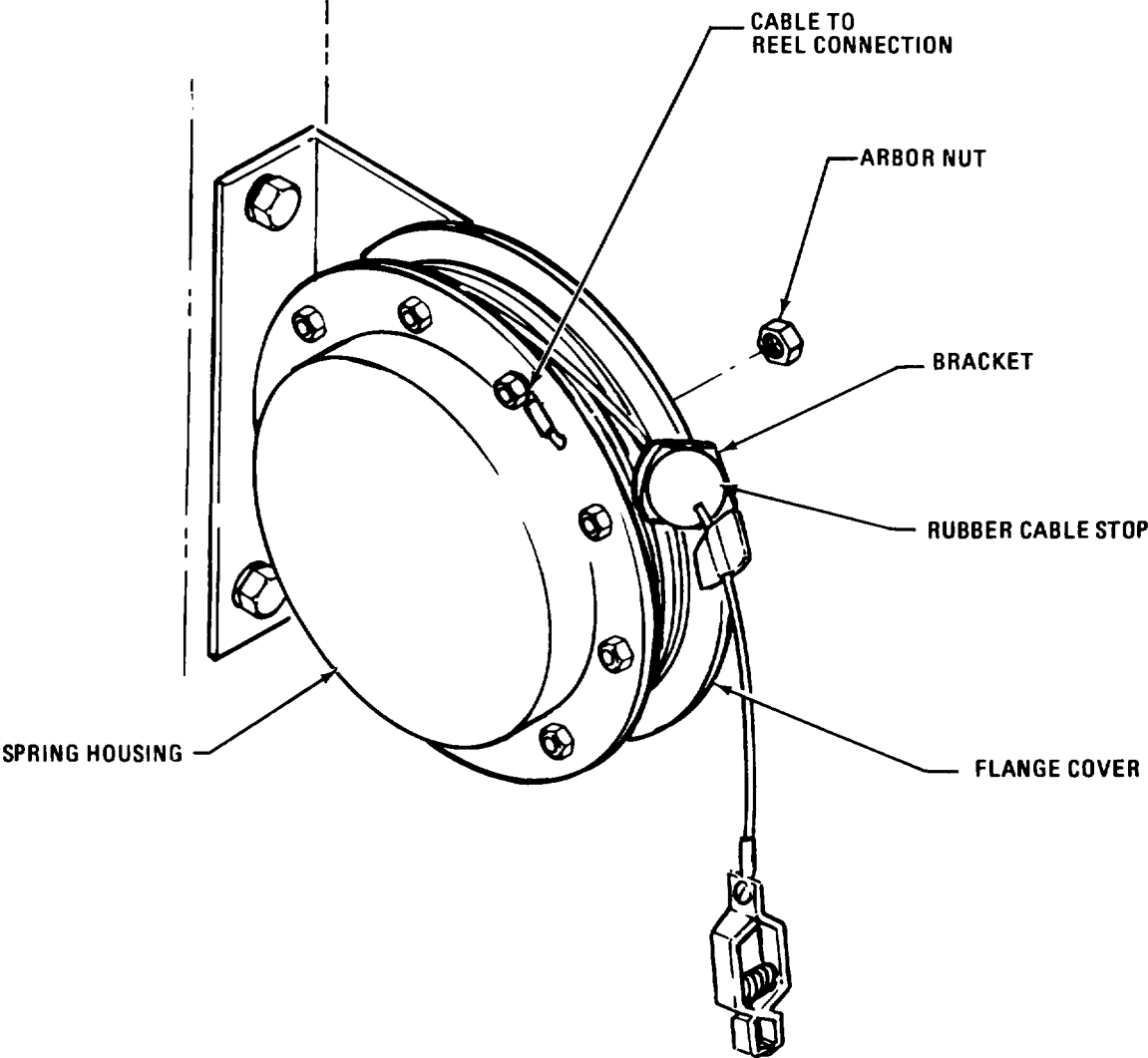


Figure 3-4. Static Discharge Reel.

- (3) Inspect Ground Rod assembly for missing components.
- (4) If the grounding is not complete, install missing components.

3-12. TANK ASSEMBLIES

NOTE

The turnbuckles must be only handtight. Straps tend to loosen when damp or wet.

a. Tiedown straps and turnbuckles are used to secure the tanks (figure 3-5) to the transporting vehicle.

- (1) Inspect tanks for missing or damaged lifting shackles and tiedown hardware.
- (2) Install or replace missing or damaged hardware.
- (3) Tighten loose tiedown straps and turnbuckle.

b. The cam lever and dispensing valve are used to dispense fuel from tank to pump unit.

- (1) Inspect tank dispensing valves and cam levers for proper operation.
- (2) If cam lever is dry, lubricate cam lever (item 2, Appendix E).
- (3) If cam lever or dispensing valve is damaged or not operating, notify Organizational Maintenance.

c. The manhole cover has a gasket which prevents vapor escape.

- (1) Inspect manhole cover gasket for cracks or breaks.
- (2) If gasket is defective, notify Organizational Maintenance.

3-13. PUMP UNIT

a. The A-frame mounted pump unit pumps fuel from the tanks, filters the fuel, and dispenses the fuel through nozzles.

- (1) Inspect pump unit for missing or damaged tiedown hardware.
- (2) Install or replace missing or damaged hardware.
- (3) Tighten loose tiedown straps.

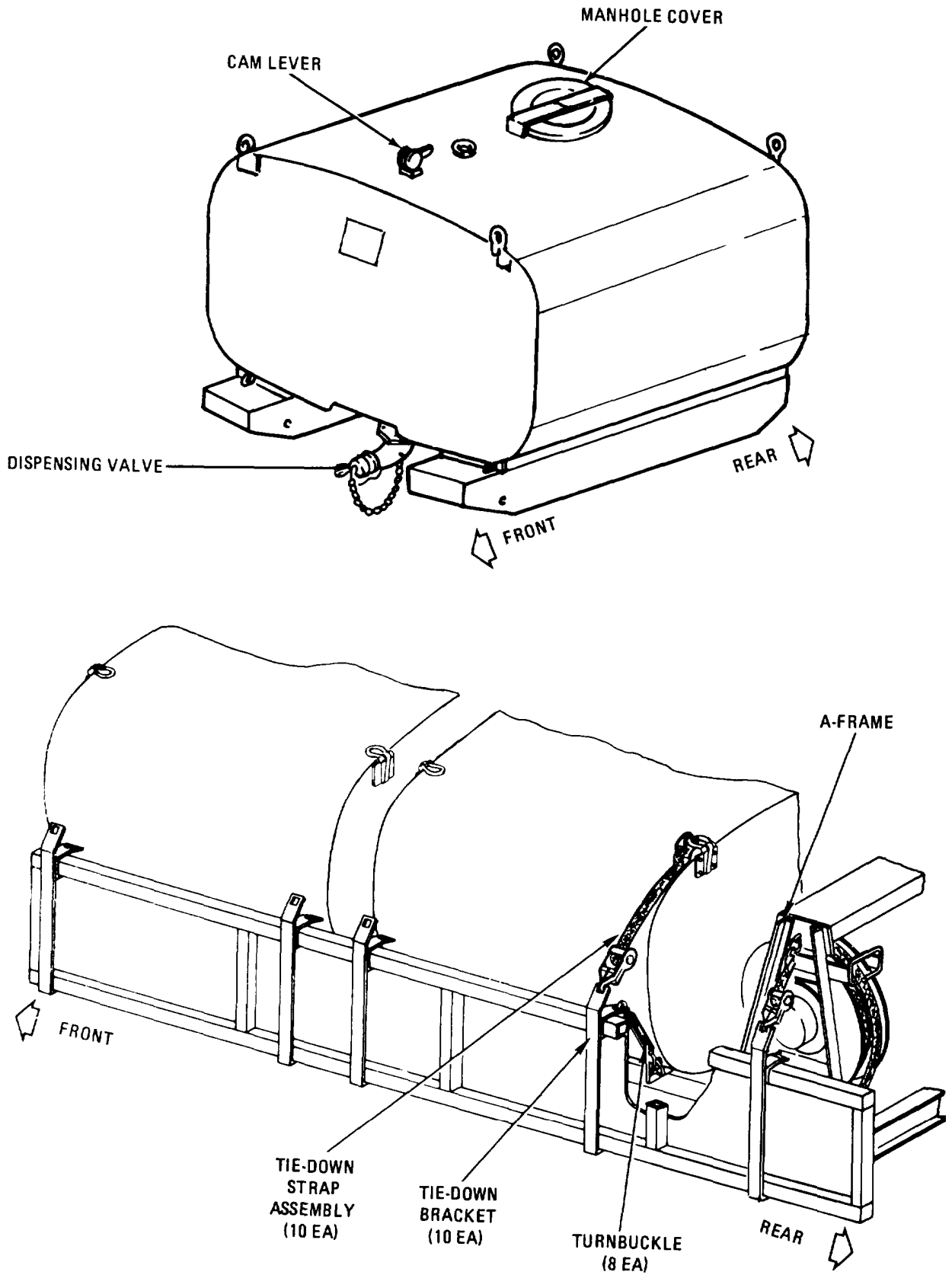


Figure 3-5. Tank Assembly.

CHAPTER 4**ORGANIZATIONAL MAINTENANCE INSTRUCTIONS****Section I. REPAIR PARTS, SPECIAL TOOLS,
TMDE, AND SUPPORT EQUIPMENT****4-1. GENERAL**

Repair parts are listed and illustrated in TM 5-4930-230-23P. No special tools are required for maintenance of the equipment. Test, measurement and diagnostic equipment (TMDE) and support equipment include standard test equipment found in any organizational maintenance shop.

Section II SERVICE UPON RECEIPT OF EQUIPMENT**4-2. RECEIVING INSPECTION**

Inspect the tank and pump unit in accordance with the following instructions.

- a. Inspect the identification plates for positive identification of the equipment (figures 1-8 and 1-9).
- b. Make a thorough inspection of the pumping assembly and tanks for damage which may have occurred during shipment.
- c. Check the equipment against the packing list to make certain all items are accounted for and in serviceable condition.
- d. Inspect the components for loose or missing mounting hardware and loose connections.
- e. Inspect the engine in accordance with TM 5-2805-257-14.

4-3. PREPARATION FOR INSTALLATION

- a. Lubricate the tank and pump unit in accordance with instructions in this manual.
- b. Lubricate the engine in accordance with current lubrication order in TM 5-2805-257-14.
- c. Perform preventive maintenance checks and services (table 4-1).

4-4. INSTALLATION INSTRUCTIONS

CAUTION

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

- a. Lower tailgate of truck and remove tarpaulin, bows, and racks with seats.
- b. Place a tank on the truck bed near the cab (or situate near tailgate according to truck configuration) with tank dispensing valve pointing toward rear of truck (figures 1-1 and 3-5).
- c. Install the 2-inch (5.08 cm) by 90-inch (228.6 cm) hose on the tank dispensing valve.

NOTE

Four tiedown assemblies are used on each tank and two tiedown assemblies are used on the pumping assembly. Turnbuckles are not used on the pumping assembly (figure 4.1).

- d. Connect one tiedown bracket between the truck and each tiedown link on the tank skids, using turnbuckles (figure 4-1).

NOTE

The turnbuckles must be only handtight. Periodically check tiedown assemblies for tightness. Straps have a tendency to loosen when becoming damp or wet.

- e. Connect each lifting eye of the tank to the top of adjacent tiedown bracket, using tiedown strap assemblies.
- f. To unlock or release ratchet of tiedown strap assembly, 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.
- g. To aid in unrolling the nylon strap, turn ratchet hook opening down on a flat surface. Press down in the center of the ratchet while pulling nylon strap away from ratchet.
- h. Connect hooks of tiedown straps to tank lifting eyes. Connect ratchets to tiedown brackets. Move ratchet handle up and down until strap is tight. Push ratchet handle to the locked position.
- i. Place remaining tank in truck so skids straddle the 90-inch hose stretched out on truck bed. Push tank toward previously installed tank until the tank interlocks (on the skids) are engaged and seated.
- j. Install the 2-inch (5.08 cm) by 26-1/2-inch (67.31 cm) hose on the dispensing valve of the second tank.
- k. Repeat steps d thru j to tie the second tank down.
- l. Place pump unit on truck with hose nozzles toward rear of truck.

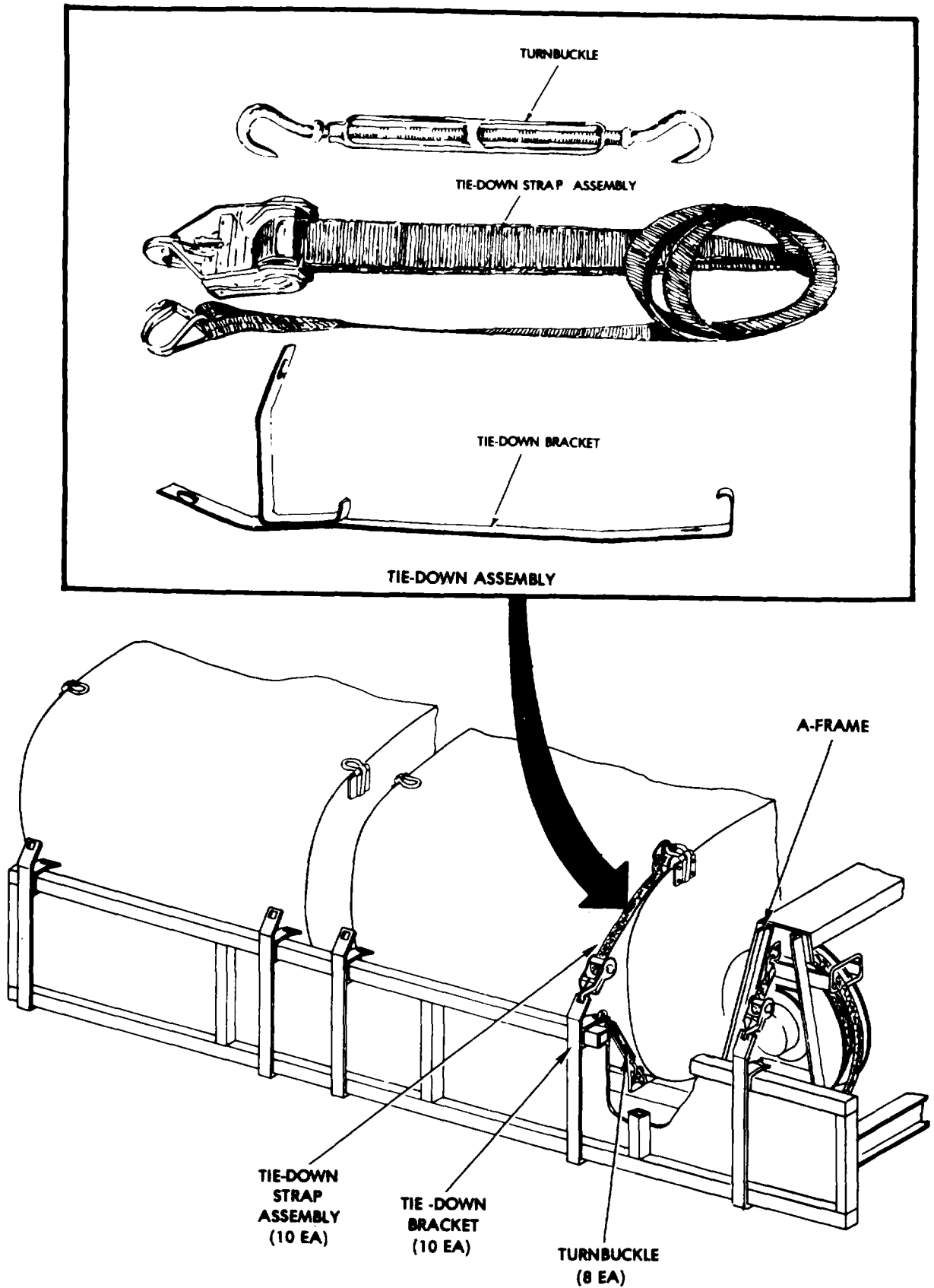


Figure 4-1. Tank and Pump Unit Tiedown Installation.

m. Connect 90-inch (228.6 cm) and 26-1/2-inch (67.31 cm) suction hoses to pumping assembly manifold. Refer to figure 1-2 for location.

n. Use tiedown strap assembly to attach a tiedown bracket between each side of truck and tiedown link at top of pumping assembly.

o. Repeat steps f thru h with each ratchet.

p. Raise the tailgate.

4-5. PREPARATION 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 38-230-2, Chapter 6 for container fabrication instructions.

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

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-6. GENERAL

To ensure that 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 necessary preventive maintenance checks and services are listed in table 4-1 and shown on figure 4-2. Defects discovered during operation of the system shall 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. If the equipment fails to operate, troubleshoot with the proper equipment. Report any deficiencies using the proper forms. (See DA Pam 738-750).

4.7. INSPECTION AND SERVICE

Refer to table 4-1 for a listing of preventive maintenance checks and services which must be performed by organizational maintenance. An explanation of the tabular columns is as follows:

a. Item Number. The number appearing in this column indicates the chronological order of the checks and services regardless of interval. This column is used as a source of item numbers for the TM Number column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of preventive maintenance checks and services.

b. Item to be Inspected. This column contains an entry which identifies the item to be inspected.

c. Procedures. This column contains a brief description of the checks to be performed.

d. For Readiness Reporting, Equipment is not Ready/Available if. This column contains the criteria which will cause the equipment to be classified as not ready because of inability to perform its primary mission.

NOTE

Refer to TM 5-2805-257-14 for organizational preventive maintenance checks and services to be performed on the gasoline engine.

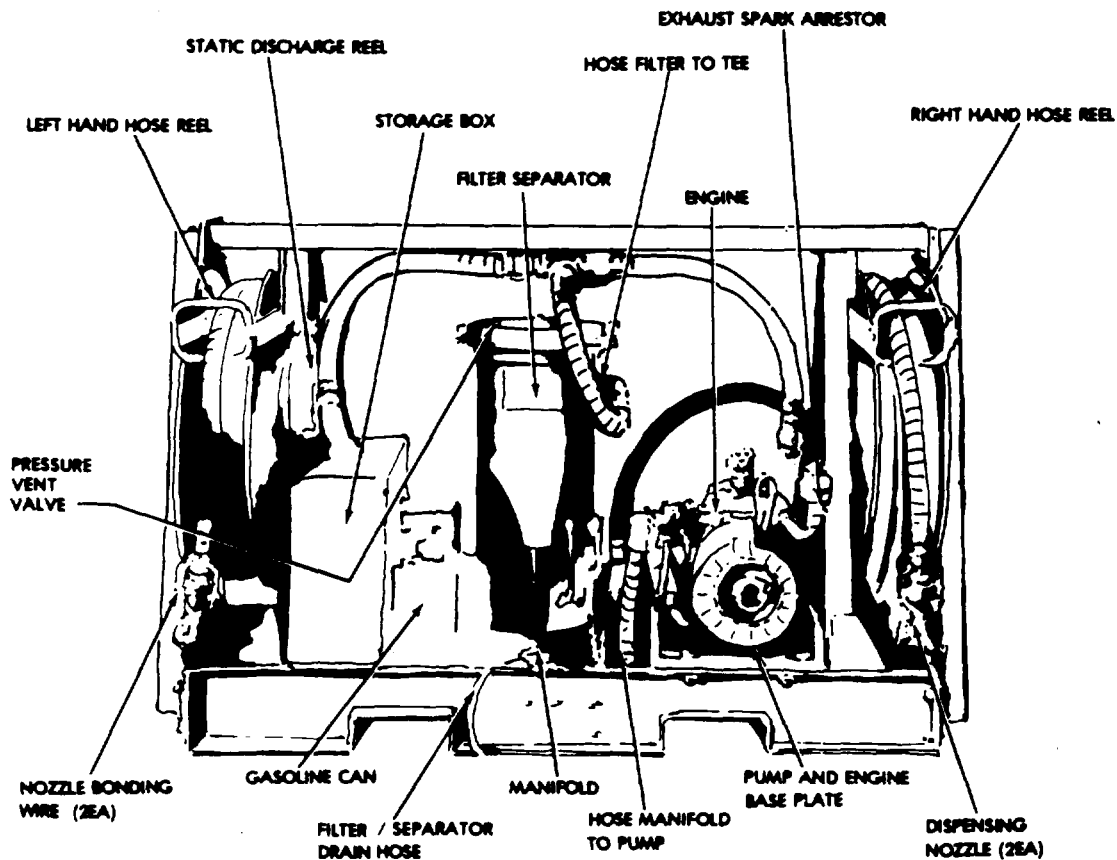


Figure 4-2. Location of PMCS Items.

Table 4-1. *Organizational Preventive Maintenance Checks and Services Monthly Schedule.*

Item No.	Item To Be Inspected	Procedures Check for and have Repaired, Replaced, Adjusted as necessary	For Readiness Reporting, Equipment is Not Ready/ Available If:
1	HOSES, NOZZLES, AND REELS	Inspect hoses for leaks, breaks, cuts, and worn areas, Replace damaged hose. Inspect nozzles for corrosion, and leaks. Repair corroded or leaking nozzles. Inspect reels for ease of operation. Replace defective reel.	violence of fuel leaking from hoses or nozzle Both nozzles are inoperative
2	STATIC DISCHARGE CABLE AND REEL ASSEMBLY	Inspect cable and clamp for worn, frayed, or corroded condition. Inspect reel for ease of operation. Repair or replace a defective reel assembly.	Item missing or defective. preventing proper grounding during operation, or re-fueling.
3	FILTER/SEPARATOR	Inspect for leaks, cracks and other damage. Inspect for leaking, damaged, or dirty sight gage. Check differential pressure gage during operations. If reading on gage shows other than green replace filter elements. Replace defective parts. CAUTION In freezing weather, ensure pressure vent valve is protected by being located under Fill Plug Hinge. While pumping operation is in process blockage of this vent system (e.g. , with ice) can cause the aluminum tanks to either collapse or rupture.	Evidence of fuel leaking
4	PRESSURE VENT VALVE	Inspect the pressure vent valve for dirt or damage. Clean or replace a dirty or damaged pressure vent valve. Inspect O-ring for damage.	Evidence of fuel leaking from valve or gasket
5	MANIFOLD	Inspect for worn or broken gaskets and damaged sealing surfaces. Replace defective manifold. Replace defective gasket	Fuel leaking from defective manifold or gasket.

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

Item No.	Item To Be Inspected	Procedures Check for and have Repaired Replaced, Adjusted as necessary	For Readiness Reporting. Equipment is Not Ready/ Available If:
6	TIEDOWN ASSEMBLIES	Inspect for frayed, missing, or loose straps and turnbuckles. Replace defective assemblies. Tighten loose straps and turnbuckles.	Defective tiedown assemblies
7	TANK ASSEMBLIES	Inspect for damage, or signs of leakage. Inspect cam lever and dispensing valve for binding or damage. Inspect for damaged, or missing lifting shackles, tiedown links, brackets, and gaskets: Repair or replace binding, or defective parts.	Evidence of fuel leaking. At least one dispensing valve will not open.

*U.S. GOVERNMENT PRINTING OFFICE: 1986 652-126/20170

Table 4-1. Organizational Preventive Maintenance Checks and Services Monthly Schedule — Continued

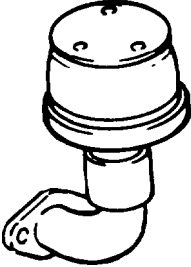
Item No.	Item To Be Inspected	Procedures Check for and have Repaired, Replaced, Adjusted as Necessary	For Readiness Reporting, Equipment is Not Readly Available If:
8	GASOLINE ENGINE ASSEMBLY 	Check for damage to engine assembly and components. Insure spark arrestor is present and in working condition. Insure engine starts and runs properly. Check for fuel leaks. (REFER TO TM 5-2805-257-14.) Replace defective spark arrestor. Locate fuel leaks, repair or notify Direct Support Maintenance.	Evidence of fuel leaking. Missing or defective spark arrestor. Engine inoperative.
<u>WARNING</u>			
Disconnect intervehicle cable from vehicle before maintaining or replacing electrical components.			
9	ELECTRIC MOTOR (EMD)	check for proper connections, loose mounting hardware. Check for proper operation. If motor is defective, notify Direct Support Maintenance.	Motor inoperative. Electrical spark at exterior of motor.
10	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.	Defective relay switch. Electrical spark at exterior of junction box.
11	INTER- VEHICLE CABLE	Check cable assembly and connectors for damage. Test for continuity. Replace defective parts	Excessively damaged cable or connectors which could cause electrical spark, or create an unserviceable condition.
12	ON-OFF SWITCH CABLE ASSEMBLY (EMD)	Check switch for proper operation. Check cable and connector for damage and continuity Replace switch and cable assembly of defective connector.	Switch inoperative. Damaged cable assembly which could cause electrical spark.

Table 4-1. Organizational Preventive Maintenance Checks and Services Monthly Schedule — Continued

Item No.	Item To Be Inspected	Procedures Check for and have Repaired, Replaced, Adjusted as Necessary	For Readiness Reporting, Equipment is Not Ready/ Available It
13	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)	Batteries damaged or low on charge. Vehicle charging system inoperative.
14	P U M P ASSEMBLY	Check pump and components for damage, leakage or notify Direct Support Maintenance for repair of internal pump components.	Pump inoperative. Pump leaking fuel.

Section IV. TROUBLESHOOTING

4-8. GENERAL

a. Table 4-2 lists the common malfunctions which you may find during the operation or maintenance of the tank and pump unit. 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.

Table 4-2. Organizational Maintenance Troubleshooting.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. FILTER/SEPARATOR LEAKS FUEL.	<p>Step 1. Check filter/separator at top for leaks.</p> <p>Replace cover gasket. (Paragraph 4-15.)</p> <p>Step 2. Check filter/separator for other leaks.</p> <p>If other leaks are found, refer to paragraph 4-15.</p>	
2. PRODUCT DISCHARGE IS DIRTY.	<p>Check for loose or dirty filter elements.</p> <p>Reseat or replace filter elements. (Paragraph 4-14.)</p>	
3. PRODUCT FLOW SLOWS DURING OPERATION.	<p>Step 1. Inspect for kinked or leaking hose or connection.</p> <p>Disconnect hoses and inspect and replace gaskets as necessary. Replace any kinked hoses. Refer to paragraphs 4-10a and 4-10C.</p> <p>Step 2. Inspect for defective nozzle.</p> <p>Repair a defective nozzle in accordance with paragraph 4-18.</p> <p>Step 3. Inspect for dirty filter/separator elements.</p> <p>Replace filter/separator elements. (Paragraph 4-14.)</p>	
4. GAS ENGINE WILL NOT OPERATE.	<p>Refer to TM 5-2805-257-14 Troubleshooting Guide.</p>	

WARNING

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

Table 4-2. Organizational Maintenance Troubleshooting — Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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5. 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. (Paragraph 4-31 and 4-32.)

6. PUMP WILL NOT PUMP FUEL AT RATED CAPACITY.

Step 1. Check for low pump engine speed.

Adjust engine speed. (GED) Check truck engine RPM for proper charge rate. (EMD)

Step 2. Check level in 600 gal fuel tanks.

Fill tanks if empty.

Step 3. Check that tank cam lever is fully open. Open cam lever.

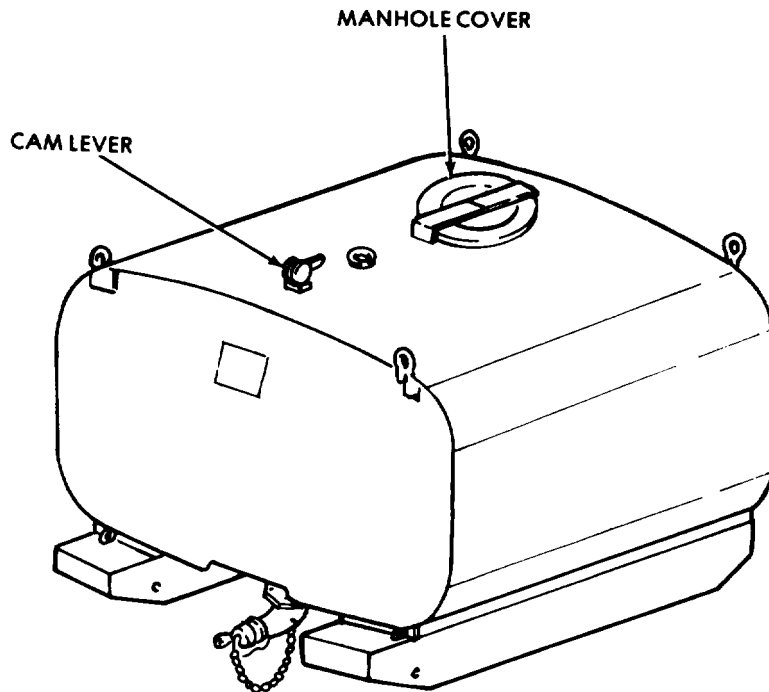
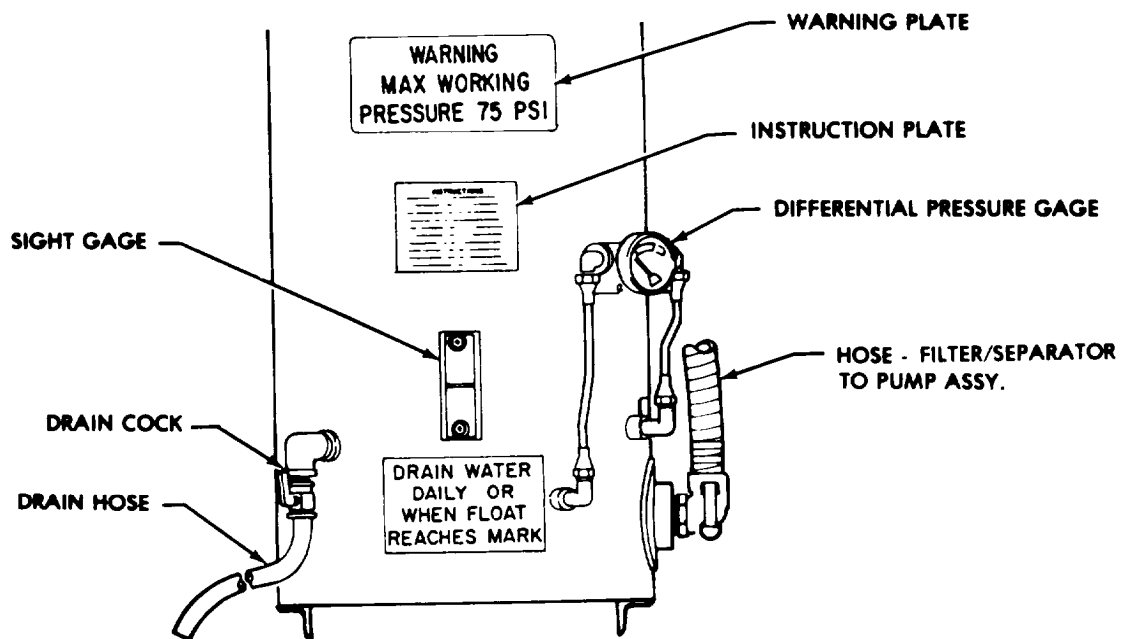


Table 4-2. Organizational Maintenance Troubleshooting — Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 4. Check differential pressure gage or filter/separator to determine if filters are clogged or dirty, replace filters. (Paragraph 4-14.)



Step 5. Check for kinked or damaged hoses that connect tanks to pump unit.

Notify Organizational Maintenance to replace hoses.

Step 6. Check for defective nozzle assembly.

Replace nozzle. (Paragraph 4-18.) Contact Direct Support Maintenance for repair of nozzle assembly.

Table 4-2. Organizational Maintenance Troubleshooting — Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Step 7. Check that cam lever on dispensing valves are opening.

Replace defective parts.

Step 8. Check for leaks in suction lines. Check for leaking gaskets.

Replace defective hose or gasket.

Section V. MAINTENANCE PROCEDURES.

4-9. GENERAL

This section provides maintenance instructions for the electric motor, gas engine, pumping assembly, and hoses that are applicable to organizational maintenance. Components of the pumping assembly and hoses consist of all hoses, the engine, electric motor, pump, filter/separator, manifold, static discharge reel, fuel dispensing nozzle assembly, fuel dispensing reel assembly, and nozzle assembly.

4-10. HOSES

The tank and pump unit contains nine flexible rubber hoses with quick-disconnect coupling male or female. Refer to figure 1-2 for location. The tanks-to-manifold hoses, one 90 inches (228.6 cm) and one 26-1/2 inches (67.31 cm), connect each tank to the pumping assembly manifold. The tank-to-pump hose connects the manifold to the pump inlet connection. The pump-to-filter/separator hose connects the pump outlet to the inlet of the filter/separator. The filter/separator-to-quick-disconnect hose connects the filter/separator outlet to the quick-disconnect tee. Two hoses connect the quick-disconnect tee to the left and right dispensing reels. A dispensing hose is connected to and works with each dispensing reel and has a nozzle connected to the dispensing end.

a. Removal.

(1) Remove all hoses except dispensing reel hose as follows:

(a) Close dispensing valves on tanks by setting cam levers to CLOSE position.

- (b) Open drain cock on filter/separator and allow liquid to drain into a suitable container.
 - (c) Open pressure vent valve on filter/separator and allow liquid to drain into a suitable container.
 - (d) Disconnect hose from couplings by pulling out on cam arms. Remove hose.
- (2) Remove dispensing reel hoses as follows:
- (a) Close dispensing valves on tanks by setting cam levers to CLOSE position.
 - (b) Open drain cock on filter/separator and allow liquid to drain into a suitable container.
 - (c) Open pressure vent valve on filter/separator by depressing and locking valve.

WARNING

When dispensing hose is pulled out, recoil spring is under tension. Be careful not to trip ratchet when disconnecting hose as sudden release of spring tension could cause serious injury. Secure reel to prevent sudden recoil where applicable (figure 4-3).

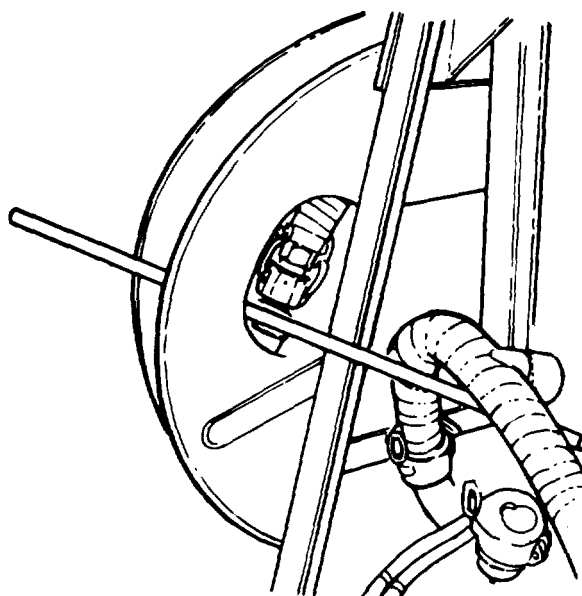


Figure 4-3. Securing Hose Reel With Bar.

(d) Pull dispensing hose out until it is completely unwound from the reel. Open nozzle and drain the fuel into a suitable container.

(e) Disconnect hose from reel by pulling out on cam arms.

(f) Remove nozzle from hose by pulling out on cam arms and disconnecting couplings.

(g) Release spring tension on reel by carefully turning the reel backwards nine turns to a neutral position.

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

(1) Clean hoses, couplings, and parts thoroughly using drycleaning solvent (item 1, Appendix E).

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

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

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

(5) Replace defective parts.

c. Installation.

(1) Install all hoses except dispensing reel hoses as follows:

(a) Position hose on couplings and secure by pushing in on cam arms.

(b) Close drain cock and pressure vent valve on filter/separator.

(2) Install dispensing reel hoses as follows:

WARNING

When hose reel is under recoil spring tension, be careful not to trip ratchet when connecting hose as a sudden release of spring tension could cause serious injury.

(a) Turn hose reel carefully, by hand, nine complete revolutions outward to apply recoil spring tension. Secure reel to prevent sudden recoil where applicable.

(b) Attach dispensing hose to reel coupling and secure by pushing in on cam arms.

- (c) Wire cam handles flat on hub coupling.
- (d) Pull outward on hose and release reel to rewind hose.
- (e) Install nozzle on hose coupling and secure by pushing in on cam arms.

4-11. PUMP AND ENGINE/PUMP AND MOTOR ASSEMBLY

The pump and engine/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 engine/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) Depress and lock valve on filter/separator to open pressure vent valves.
- (4) Pull out on cam arms to disconnect filter/separator-to-pump outlet hose from coupling.
- (5) 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.

- (6) Remove pump assembly base plate (figure 4-4 or 4-5) from A-frame by removing four screws, four lockwashers, two flatwashers (rear), two bevelled washers (front), and four nuts.
- (7) Remove pump drain plug and drain pump volute.
- (8) Lift pump assembly with base from A-frame.

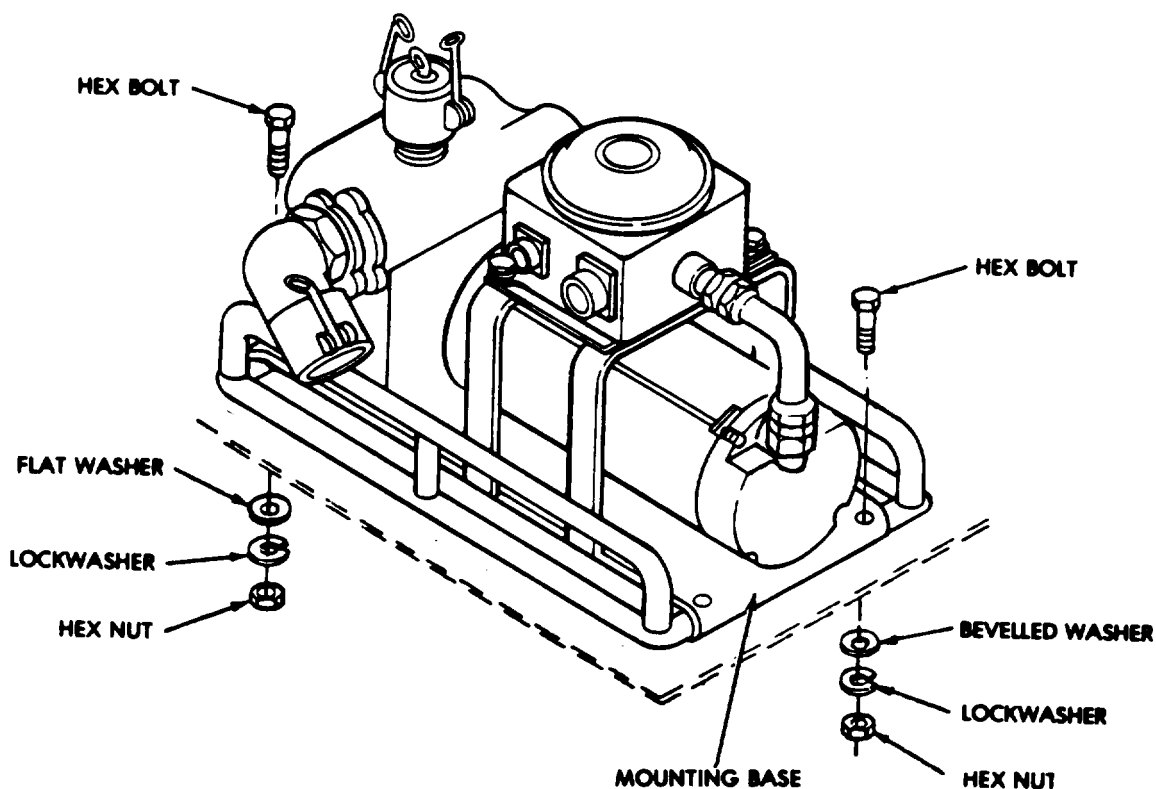


Figure 4-4. Pump and Electric Motor Assembly.

(9) To remove pump and engine or pump and motor from base plate first remove four hex bolts, lockwashers, flat washers, and hex nuts (figure 4-6).

(10) To change oil in the engine, remove the four screws, nuts, and washers that hold the pump and engine base plate in place. Slide the pump and engine assembly out far enough so the magnetic oil drain plug can be removed. Remove the plug through the base plate hole and drain the oil into a suitable container. After the oil has drained, replace the magnetic plug and fill the crankcase with the proper amount of oil (item 3, Appendix E). Slide the pump and engine assembly back in place and secure in the reverse order of removal.

b. Installation.

(1) Install the pump and engine or pump and motor unit on the mounting base (figure 4-4 or 4-5).

(a) Position mounting brackets on the engine and secure each with six screws and lockwashers.

(b) Position the pump and engine or pump and motor unit on the mounting base 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.

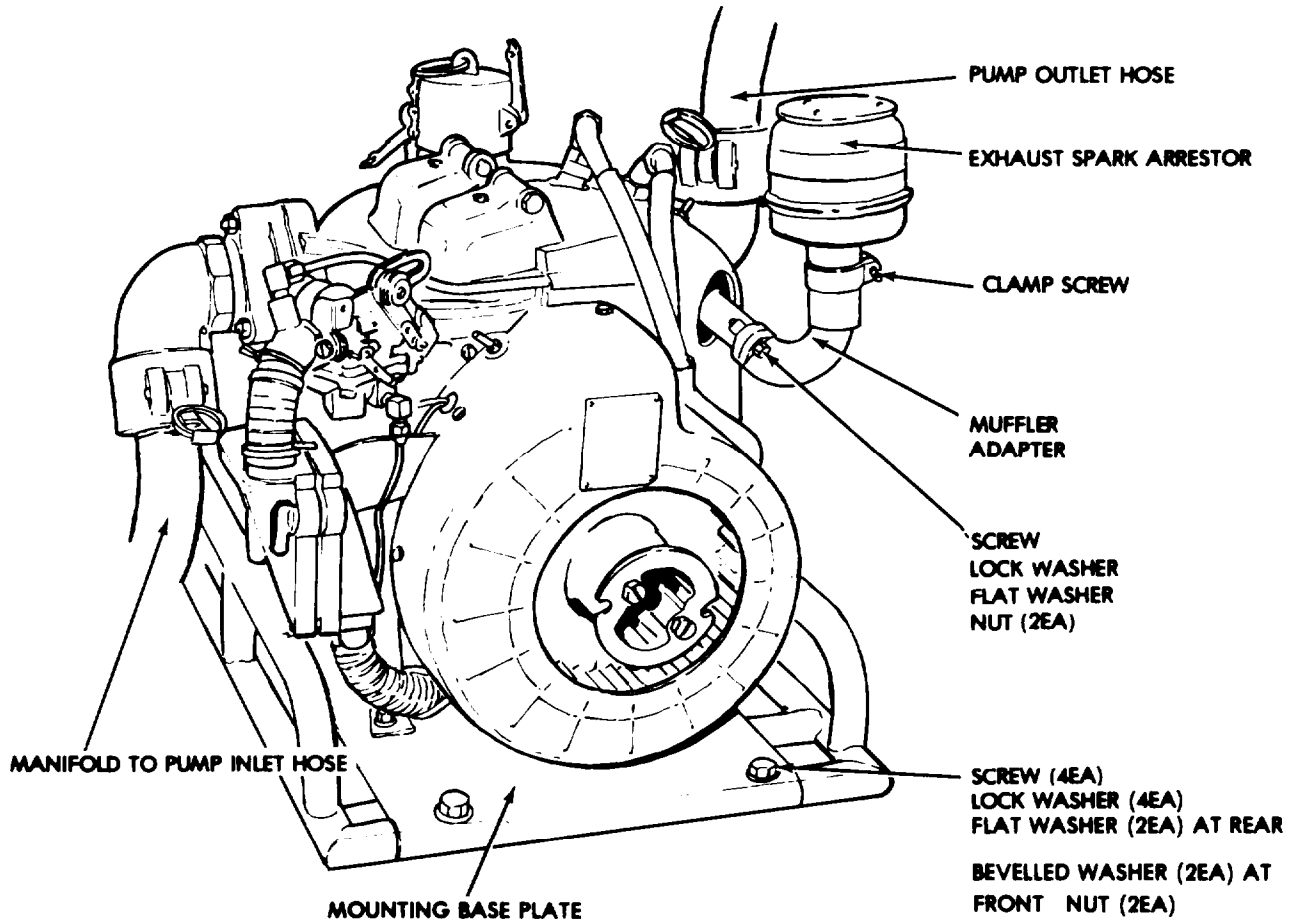


Figure 4-5. Pump and Engine Assembly.

(4) Position the pump assembly on the A-frame and secure with four screws, four lockwashers, two flat washers at the rear and with two square bevelled washers at the front and four nuts.

NOTE

Ensure that the two bevelled washers are used at the front end.

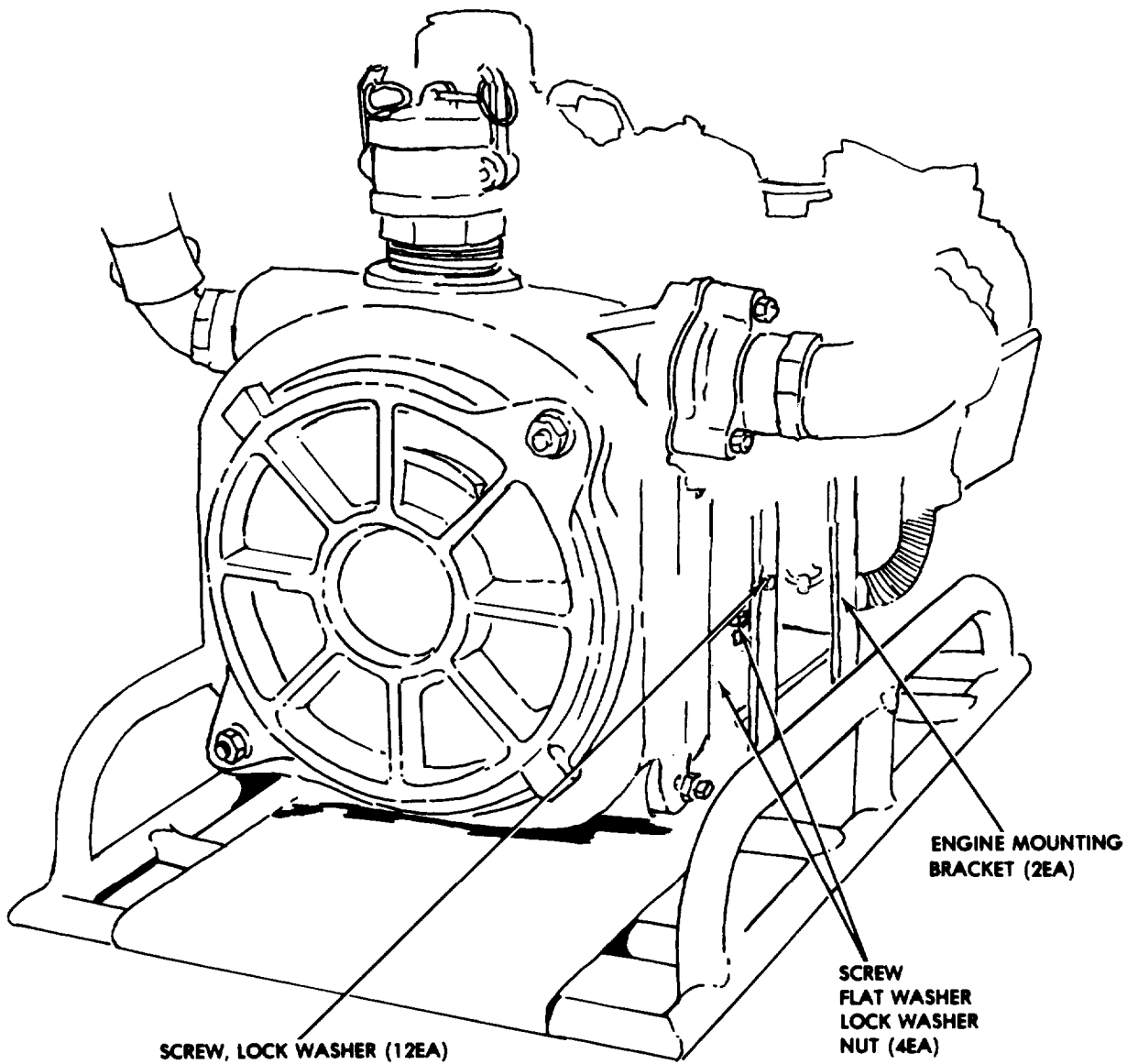


Figure 4-6. Pump and Engine Assembly, Removal from Mounting Base. (Pump side),

- (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.

4-12. ELBOWS AND TEE (INLET/OUTLET)

The pump and filter/separator are each equipped with an inlet elbow and outlet elbow. They route the product into and out of the pump and filter/separator. A tee, to which the filter/separator outlet connects, routes the product to the two hose reels.

a. Removal.

- (1) Disconnect hoses indicated on figure 4-7.
- (2) Remove elbows and tee.

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

- (1) Clean all parts with drycleaning solvent (item 1, Appendix E).
- (2) Dry all parts thoroughly.
- (3) Inspect the tee and elbows for cracks, breaks, and other damage.
- (4) Inspect for worn or broken gaskets,
- (5) Replace defective parts.

c. Installation,

- (1) Install elbows and tee (figure 4-7).
- (2) Connect hoses.

4-13. CENTRIFUGAL PUMP

Inspect the centrifugal pump for cracks, breaks, wear, evidence of leakage or other damage. Any discrepancies should be reported to direct support maintenance.

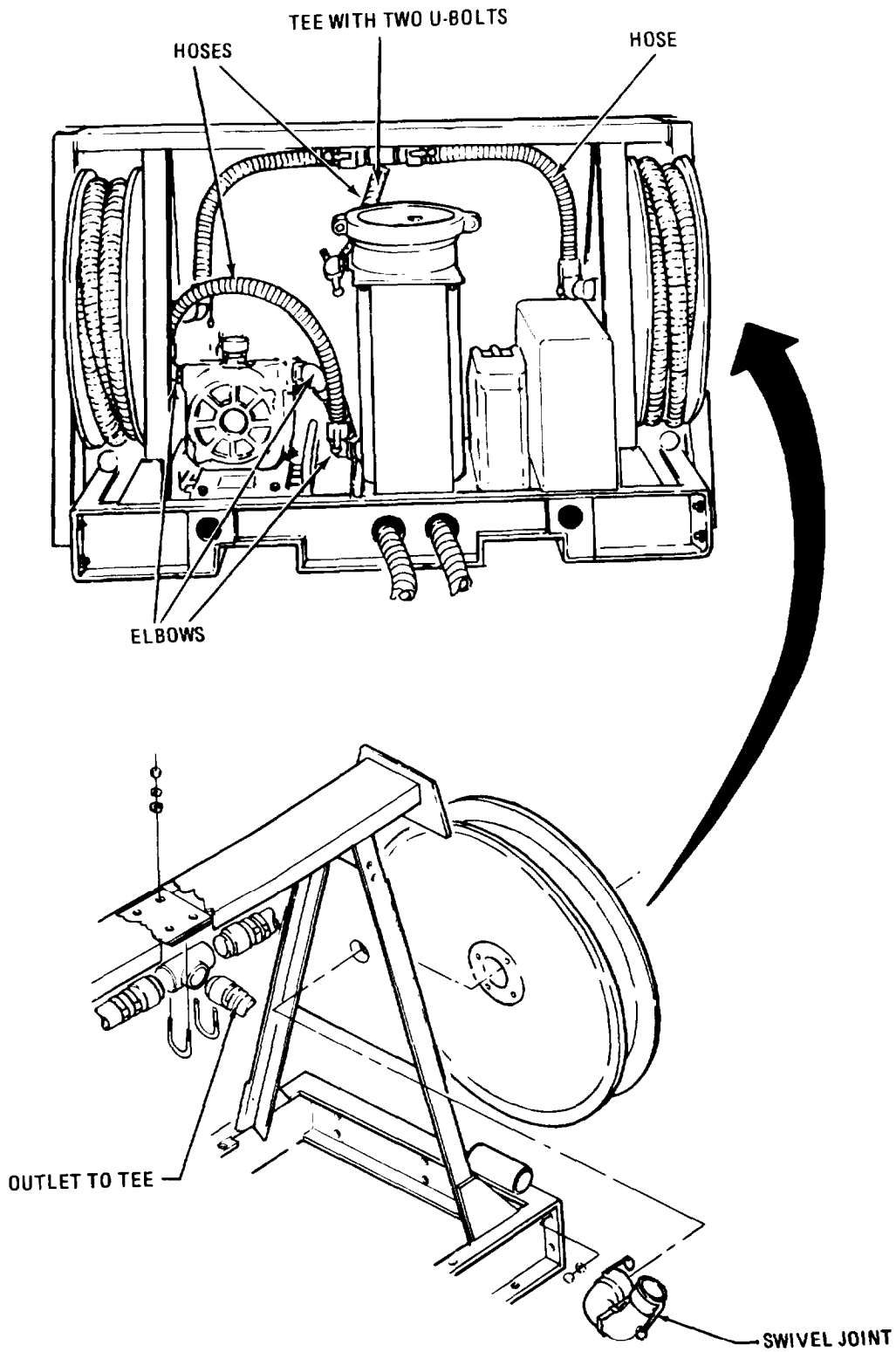


Figure 4-7. Elbows and Tee, Removal and Installation.

4.14. FILTER/SEPARATOR

A filter/separator is used for separating both water and solid contaminants from the product being dispensed. A hose connects the pump unit to the filter/separator.

a. Removal.

- (1) Open the drain cock and drain the solution into a suitable container.
- (2) Open pressure vent valve by depressing it and locking it.
- (3) Disconnect the hoses.
- (4) Remove six screws, flat washers, lockwashers, and nuts to detach filter/separator from the A-frame assembly.
- (5) Remove filter/separator from the A-frame assembly.
- (6) To disassemble the filter/separator, remove two carriage bolts, washers and nuts to remove the two coupling clamp halves and the coupling gasket (figures 4-8 and 4-9).
- (7) Remove wingnut and lockwasher (figure 4-9).
- (8) Remove canister retainer and clamp band.
- (9) Remove four canisters by turning and pulling upward.
- (10) Remove filter elements from canister by holding upside down and tapping firmly at an angle until element pops out (figure 4-10).

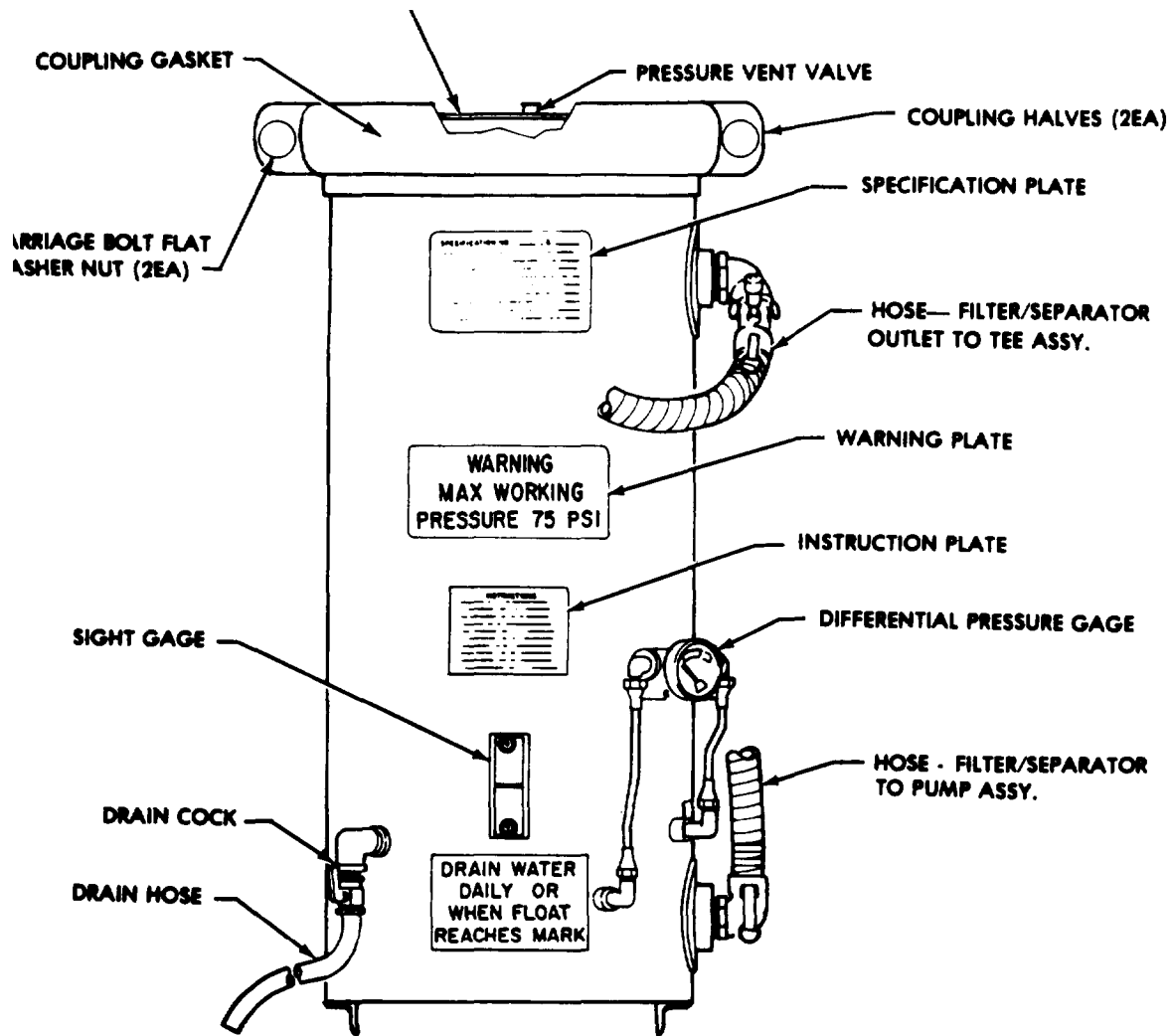


Figure 4-8. Filter Separator (Front).

b. Cleaning and Inspection.

WARNING

Drycleaning solvent, P-D-689, 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°F to 138°F (38°C to 59°C).

- (1) Clean the filter/separator in drycleaning solvent (item 1, Appendix E).
- (2) Dry thoroughly.
- (3) Inspect the filter/separator for distortion, broken welds, dents, and other damage.

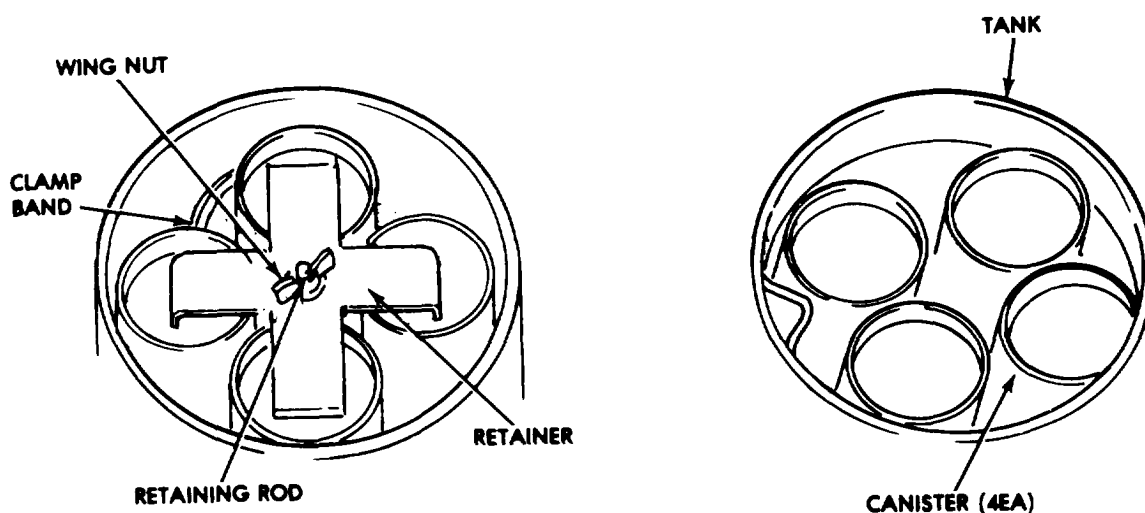


Figure 4-9. Filter Elements.

- (4) Inspect to assure tightness of retainer rod at bottom of tank.
- (5) Replace a defective filter/separator.

c. Installation.

- (1) Assemble filter elements into canisters and install in filter/separator (figures 4-8 and 4-9).

NOTE

Before installing new filter elements, ensure the O-ring in each end of each element is properly seated in its groove. Lubricate the O-rings with a light coat of GAA grease (item 2, Appendix E) to prevent displacement during element installation.

- (2) Install clamp band and canister retainer.
- (3) Fasten retainer with lockwasher and wingnut.
- (4) Install coupling gasket, head, and coupling halves and fasten with two nuts, flat washers, and carriage bolts.
- (5) Install filter/separator on the A-frame and secure with six screws, flat washers, lockwashers, and nuts.
- (6) Install elbows and connect hoses.
- (7) Close drain cock.
- (8) Close pressure vent valve.

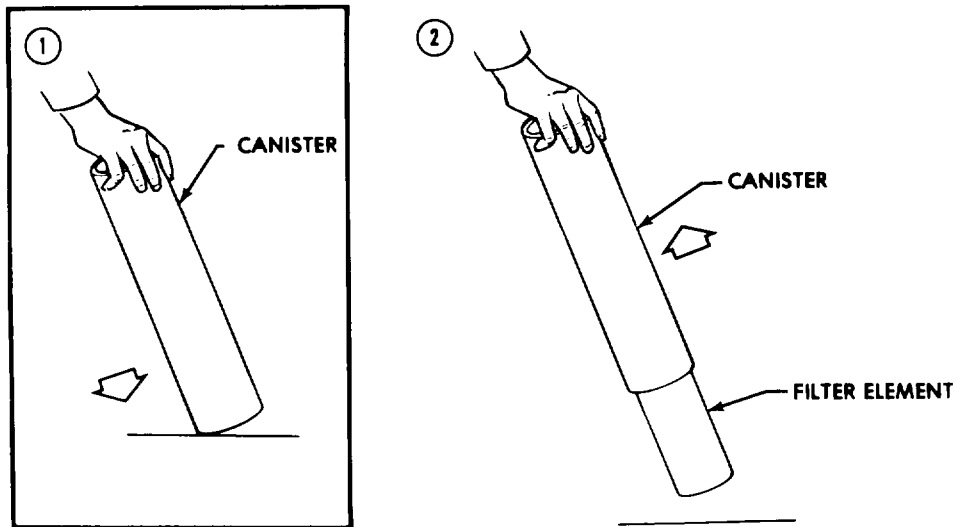


Figure 4-10. Filter Element Removal

4-15. SIGHT GAGE, DIFFERENTIAL PRESSURE GAGE, PRESSURE VENT VALVE, DRAIN COCK, AND COVER GASKET.

a. Removal.

- (1) Open the filter/separator drain cock and drain the solution into a suitable container. (Figure 4-8.)
- (2) Open pressure vent valve by depressing and locking it.
- (3) Remove two screws and washers, and remove the sight gage, gasket, and float ball.
- (4) Disconnect flare nut couplings from the differential pressure gage.
- (5) Remove two screws and washers, and remove differential pressure gage.
- (6) Remove drain cock and hose.
- (7) Remove pressure vent valve.

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

- (1) Clean all parts in drycleaning solvent (item 1, Appendix E).
- (2) Dry all parts thoroughly.
- (3) Inspect the sight gage for cracks, breaks, and transparency. Inspect the float ball for damage.
- (4) Inspect the gasket for breaks.
- (5) Inspect the differential pressure gage for signs of damage.
- (6) Inspect the drain cock for free movement of the drain cock handle.
- (7) Inspect the tubing for kinks, breaks, abraded areas and other areas.
- (8) Inspect the pressure vent valve and O-ring for damage.
- (9) Replace all defective parts.

c. Installation.

- (1) Install pressure vent valve (figure 4-8).
- (2) Install drain cock and hose.
- (3) Install differential pressure gage.
- (4) Connect flare nut couplings to the differential pressure gage.
- (5) Install gasket, float ball, and sight gage.
- (6) Close drain cock.
- (7) Close pressure vent valve.

4-16. MANIFOLD, LIQUID DISTRIBUTOR

The manifold permits the flow of the product to the suction side of the pump. Two quick-disconnect couplings provide inlets for the tank suction lines. The product from either or both tanks is conducted to the pump inlet through the manifold outlet and a suction hose.

a. Removal.

- (1) Close tank dispensing valves.
- (2) Remove four nuts, flat washers, and lockwashers (figure 4-11).
- (3) Remove two U-bolts which hold the manifold to the frame.
- (4) Remove the gaskets from the three female couplings.

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

- (1) Clean all parts with drycleaning solvent (item 1, Appendix E). Dry all parts thoroughly.
- (2) Inspect the manifold for cracks or other damage.
- (3) Inspect for worn or broken gaskets and damaged sealing surfaces.
- (4) Replace defective parts.

c. Installation.

- (1) Install gaskets in three female couplings (figure 4-11).
- (2) Attach manifold to frame with U-bolts, lockwashers, flat washers, and nuts.

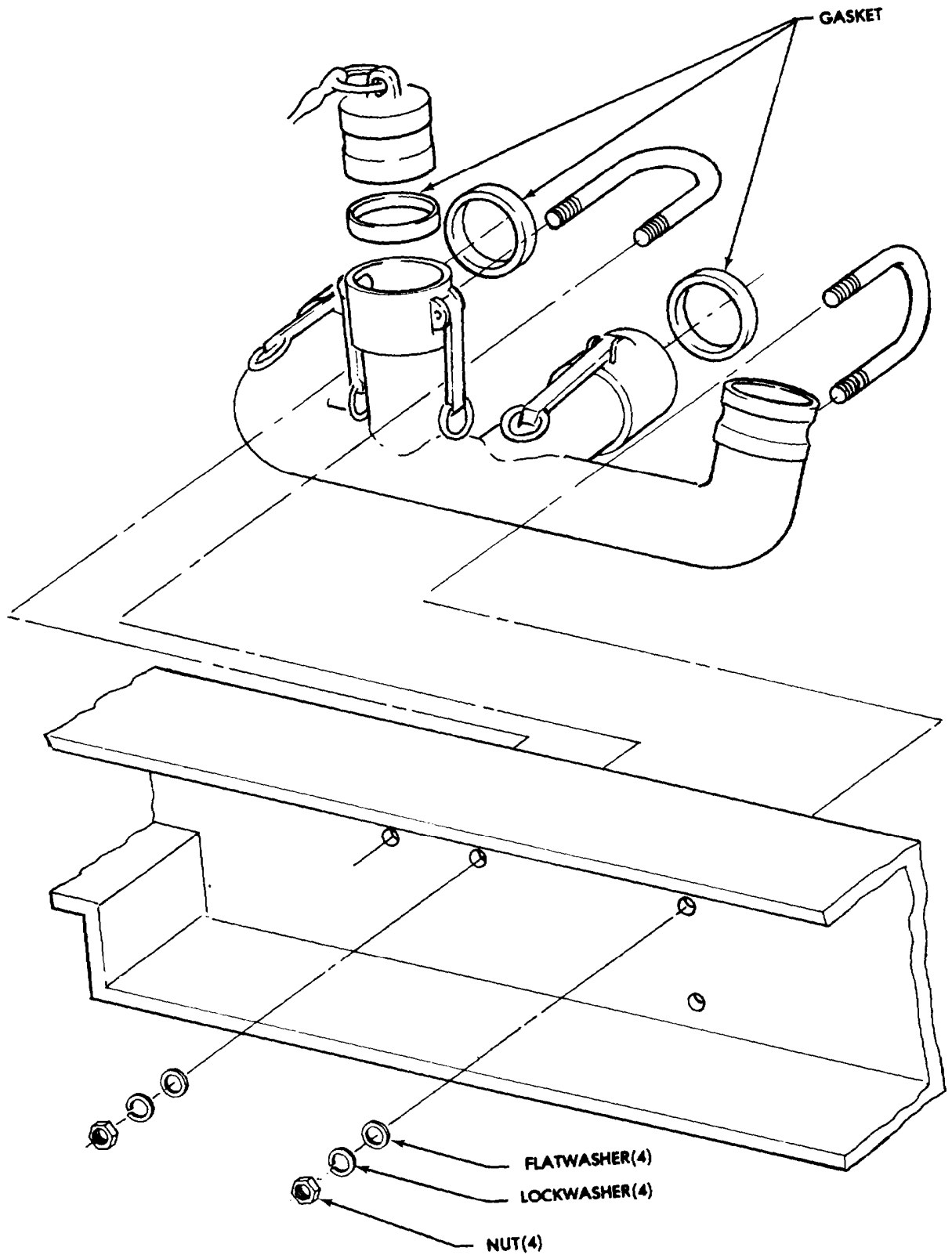


Figure 4-11. Manifold, Removal and Installation.

4-17. STATIC DISCHARGE REEL

a. General. A static discharge reel is attached to the frame of pumping unit to provide a means of grounding the tank and pump unit. The ground wire must be clipped to a ground connection near the tank and pump unit.

b. Removal.

- (1) Remove arbor nut and cable guide bracket (figure 4-12).
- (2) Remove two bolts, flat washers, lockwashers, and nuts, and remove bracket.

c. Inspection.

- (1) Inspect the outside of the reel for dents, distortion, and other damage.
- (2) Inspect the rubber cable stop for torn or broken rubber.
- (3) Inspect the connector for broken spring.
- (4) Pull out the cable and inspect for frayed, abraded, broken, and rusty areas.
- (5) Replace a defective Static Discharge Reel.

d. Installation.

- (1) Install bracket with two bolts, flat washers, lockwashers, and nuts (figure 4-12).
- (2) Attach bracket and arbor nut.

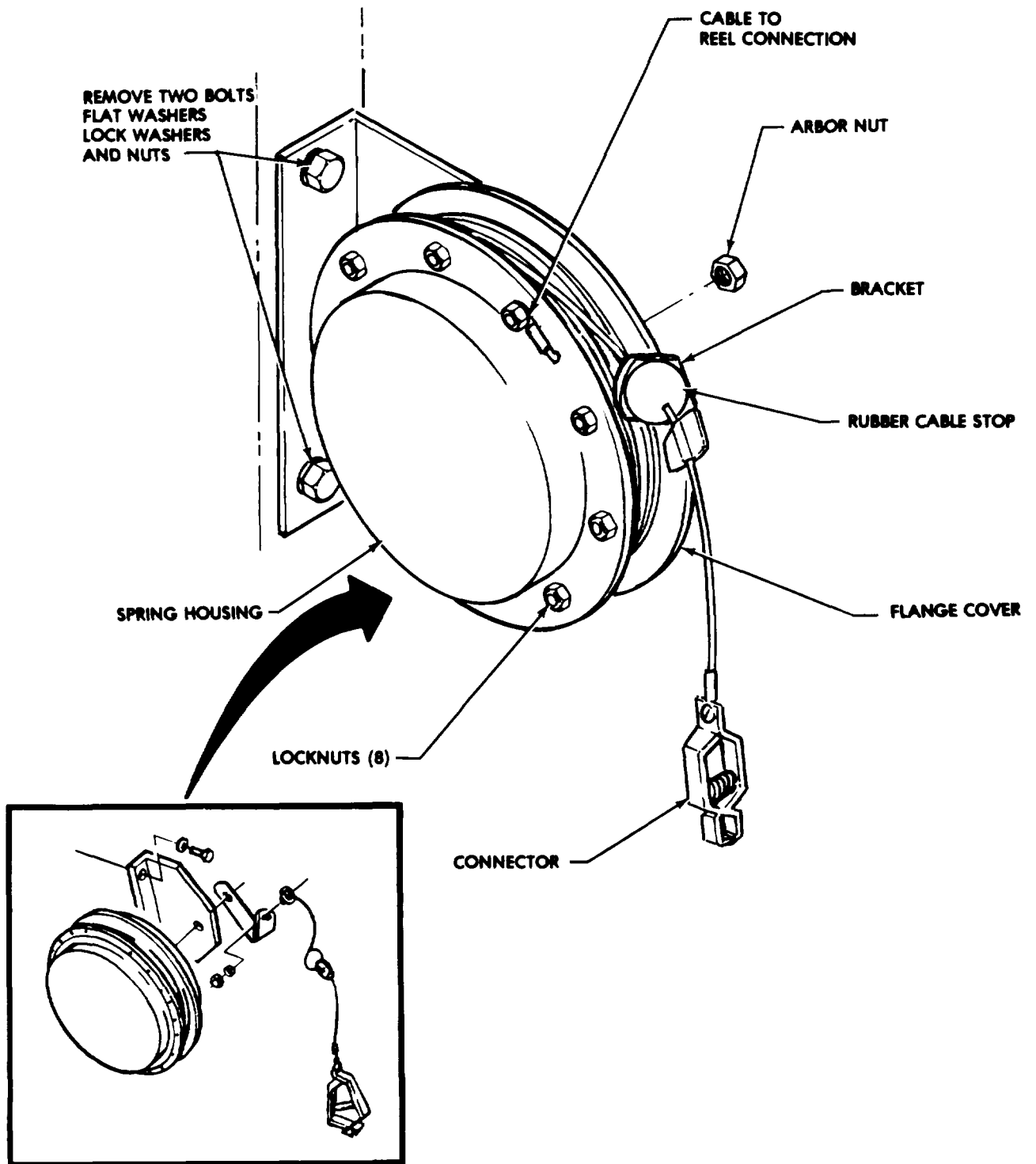


Figure 4-12. Static Discharge Reel.

4-18. FUEL DISPENSING NOZZLE ASSEMBLY.

a. Removal.

- (1) Close dispensing valves on tanks by setting cam levers to CLOSE position.
- (2) Open nozzles and drain hoses into a suitable container.
- (3) Remove nozzles by pulling out on cam arms and disconnect couplings. (Figure 4-13.)

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

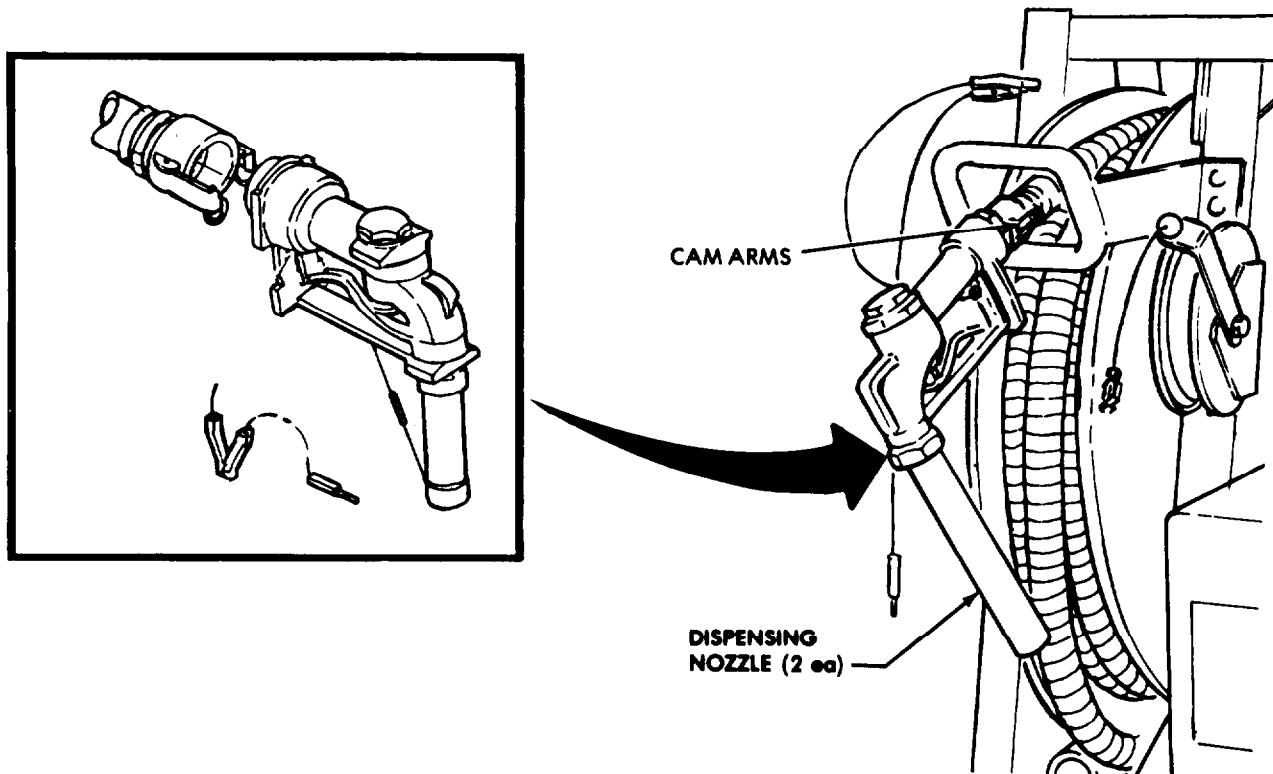


Figure 4-13. Fuel Dispensing Nozzle Assembly.

- (1) Clean parts in drycleaning solvent (item 1, Appendix E).
- (2) Inspect coupling gaskets for damage or wear.
- (3) Inspect the couplings for cracks, breaks, distortion, and other damage.
- (4) Inspect the nozzles for cracks, breaks, and other damage.
- (5) Replace defective nozzle assembly.

c. Installation.

- (1) Install nozzles by connecting couplings and close cam arms (figure 4-13).
- (2) Open dispensing valves on tanks.

4-19. DISPENSING VALVE AND CAM LEVER ASSEMBLY.

The cam lever assembly operates the dispensing valve which allows the fuel to flow from the tank to the pumping unit. (Figure 4-14.)

4-20. DISPENSING VALVE ASSEMBLY.

a. Safety Precautions Before Entering Tank.

- (1) Personnel will not wear wool, nylon, silk, rayon or other similar static electricity generating clothing.
- (2) Clean cotton clothing with no metal buttons or fittings will be worn. All contents will be removed from pockets.
- (3) Rubber boots will be worn.
- (4) Cotton rags will be used for cleaning. Material that may generate static electricity will not be used.

b. Removal.

WARNING

Be sure that tank has been completely drained and thoroughly flushed before entering tank.

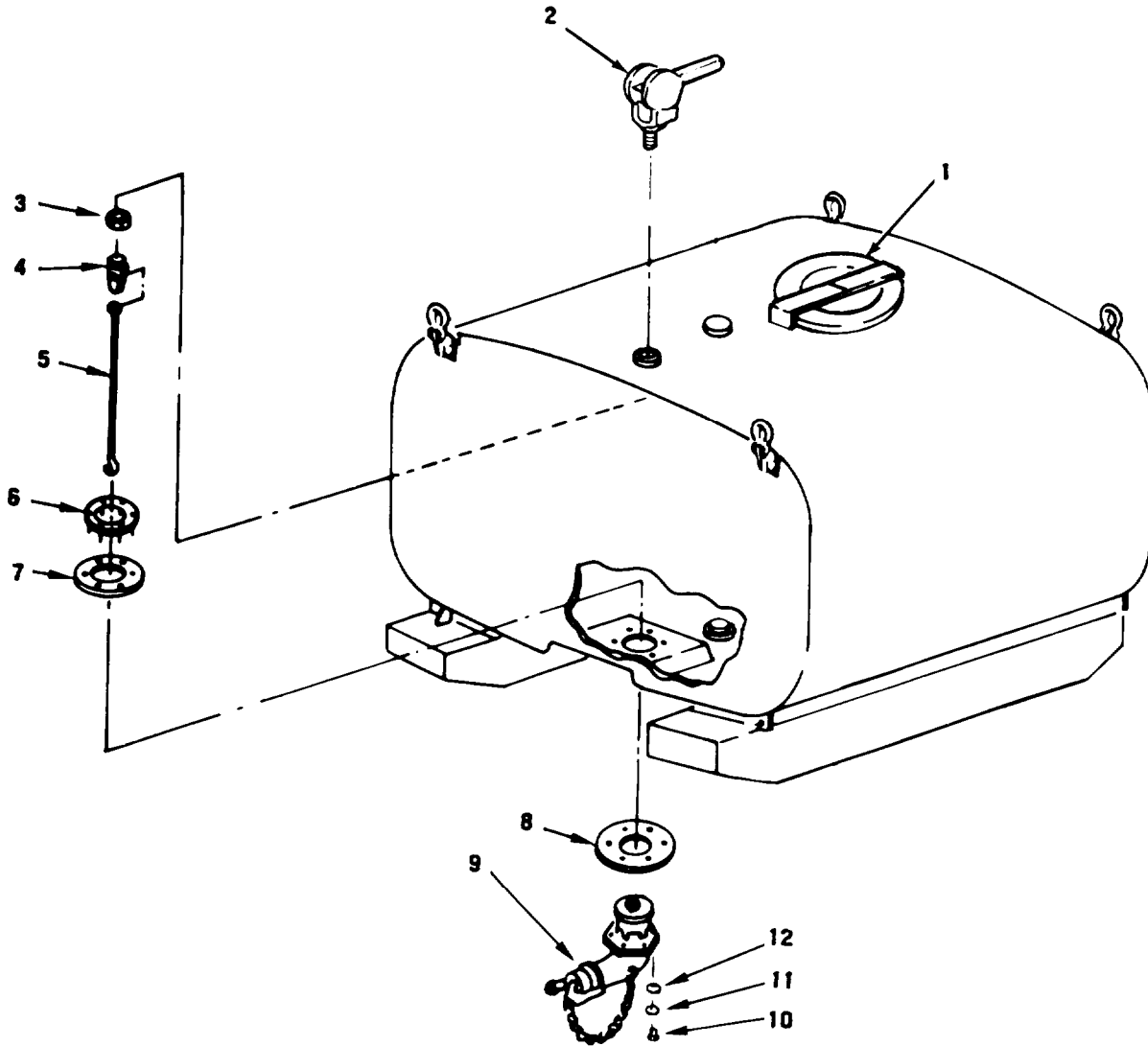


Figure 4-14. Dispensing Valve Assembly

- (1) Remove manhole cover. (1)
- (2) Pull cam lever (2) to CLOSE position and remove dust cap.
- (3) Enter tank through manhole opening.
- (4) Loosen yoke (4), disengage operating rod (5) from yoke, and remove operating rod.
- (5) Outside the tank, remove six nuts (10), lockwashers (11) and flat washers (12) holding valve (9) to valve mounting ring (6) and remove valve.

c. Installation.

- (1) Install valve assembly (9) and gasket (8) and fasten with flatwashers (12), lockwashers (11) and nuts (10).
- (2) Enter the tank and attach operating rod (5) to yoke and to valve assembly. Tighten yoke.
- (3) Replace manhole cover.

Section VI. MAINTENANCE OF TANK ASSEMBLY

4-21. GENERAL.

This section contains organizational maintenance instructions for the tank assembly, certain parts and components.

4-22. LIFTING SHACKLES.

The four lifting shackles on each tank are used for both tank lifting and tiedown. Replace shackles as follows:

- a. Remove cotter pins, nuts, flat washers, and screws, and remove lifting shackles (figure 4-15).
- b. Inspect for cracks, breaks, rust, corrosion or other damage.
- c. Replace damaged or defective shackles.
- d. Install with screws, flat washers, nuts, and cotter pins.

4-23. TIEDOWN LINKS.

The four tiedown links are installed on the skids on each tank. Replace links as follows:

- a. Remove screws, lockwashers, and retainer, and remove tiedown links (figure 4-15).
- b. Inspect for cracks, breaks, rust, corrosion, or other damage.
- c. Replace damaged or defective tiedown links.
- d. Install with retainers, screws, and lockwashers.

4-24. TIEDOWN ASSEMBLIES.

Each tiedown assembly consists of a tiedown strap, tiedown bracket and turnbuckle. Four assemblies are used on each tank and two on the pumping assembly. Turnbuckles are not used on the pumping assembly. Inspect and replace tiedown assemblies as follows:

- a. Inspect for cracks, breaks, abraded or torn webbing, and other deterioration or damage,
- b. Replace damaged or defective tiedown straps, tiedown brackets or turnbuckles (figure 4-15).

4-25. MANHOLE COVER ASSEMBLY.

NOTE

Newer model, see figure 4-16. Older model, see figure 4-17.

- a. Removal.
 - (1) Refer to figure 4-16 and release cam (9), and raise hinge (8).
 - (2) Open cover (20) and loosen the six wingnuts (2) so that hooks (4) will drop free of tank rim.
 - (3) Lift manhole cover (1) and cover gasket (6) from tank.

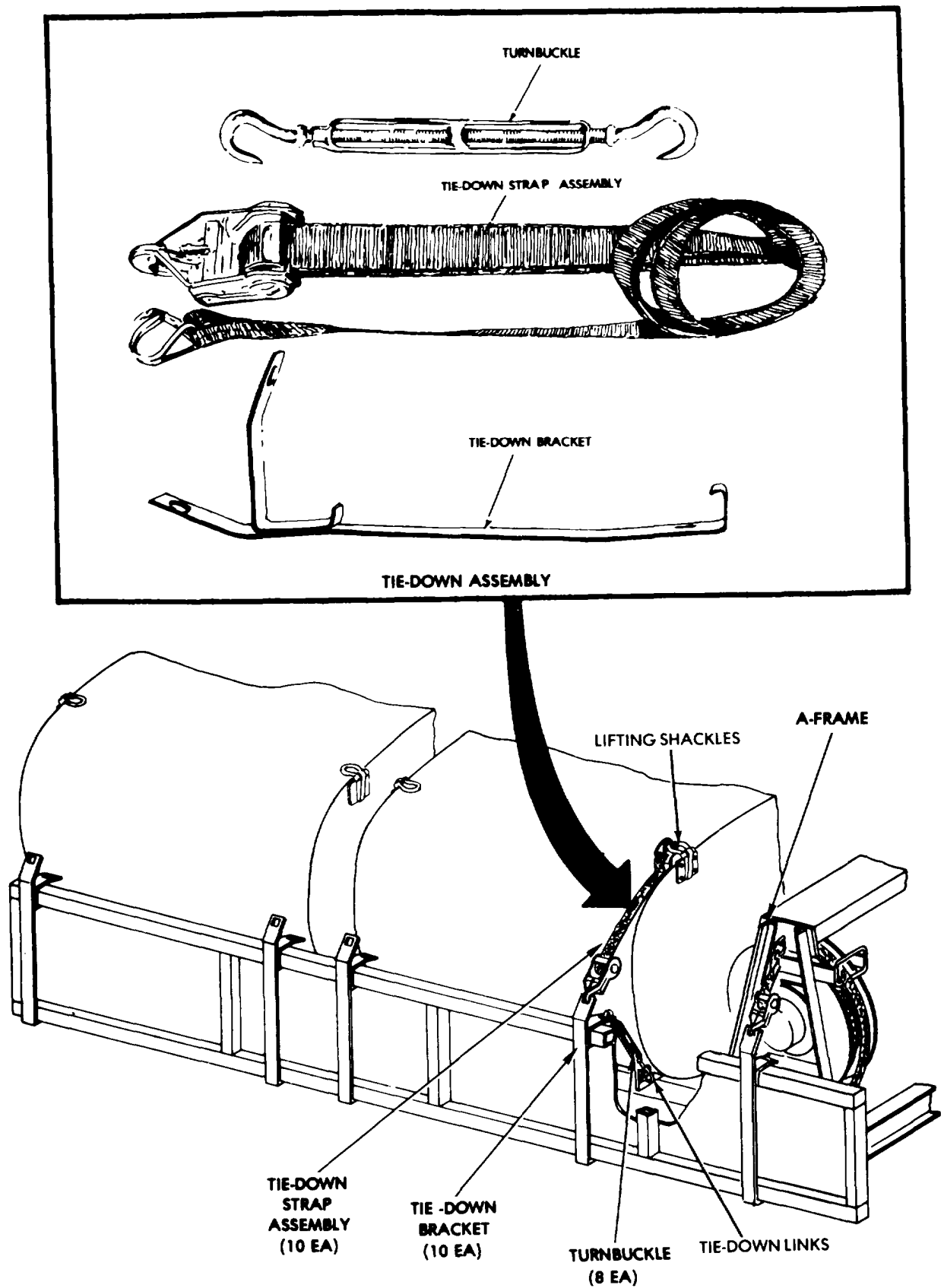


Figure 4-15. Tank and Pump Unit Tiedown Installation.

b. Disassembly.

- (1) Remove and disassemble wingnuts (2), lockwashers (3), hooks (4), hook bolts (5), and gasket (6).
- (2) Disassemble latch assembly by removing hinge bolts and nuts (7) closing cam (8), and locking lever (9).
- (3) Remove nut (10), washer (11), bolt (12), washer (13), two washers (14), and spacer (15) and remove closing cam (8). Remove Fuse Plug, gasket and nut (16). Remove Vent Assembly (17). Remove metal gasket retainer (18) and rubber gasket (19).

c. Cleaning and Inspection.

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 dry cleaning solvent (item 1, Appendix E) and dry thoroughly.
- (2) Inspect parts for breaks, cracks, damaged threads, and other defects.
- (3) Inspect gasket.
- (4) Replace defective parts.

d. Installation.

- (1) Position cover gasket (6), and install manhole cover (1) on tank,
- (2) Space hook assemblies around inner perimeter of manhole cover and tighten wingnuts (2).
- (3) Lower hinge (8) over cover and lock with release cam (9).

4-26. VENT ASSEMBLY AND FUSE PLUG.

The manhole cover assembly (figure 4-16) is provided with a vent assembly located in the cover which vents at approximately 0.5 psi (0.0352 kg/sq cm) of internal pressure. It is also equipped with fuse plug which will melt at 170 degrees F to 190 degrees F (77 degrees C to 88 degrees C).

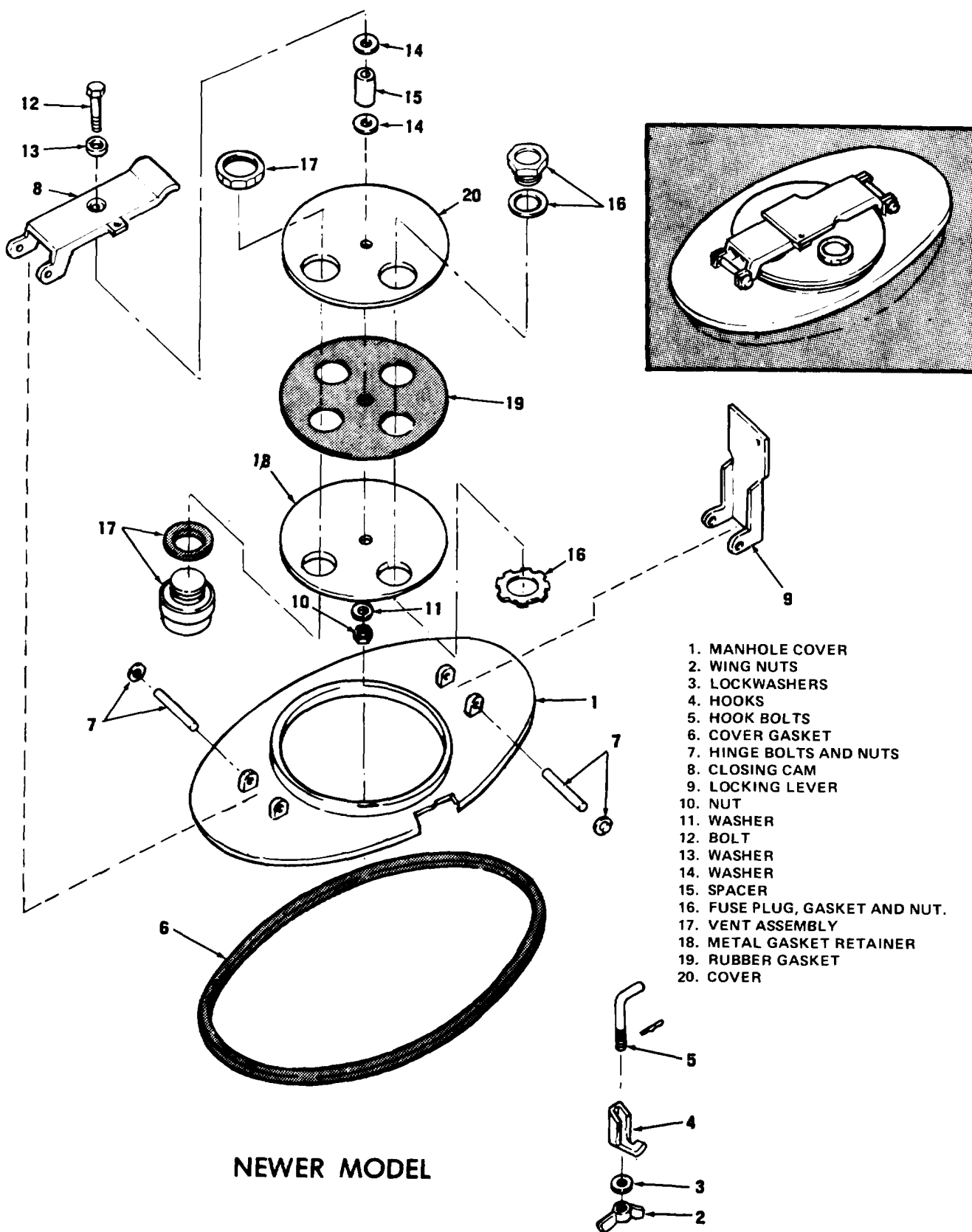
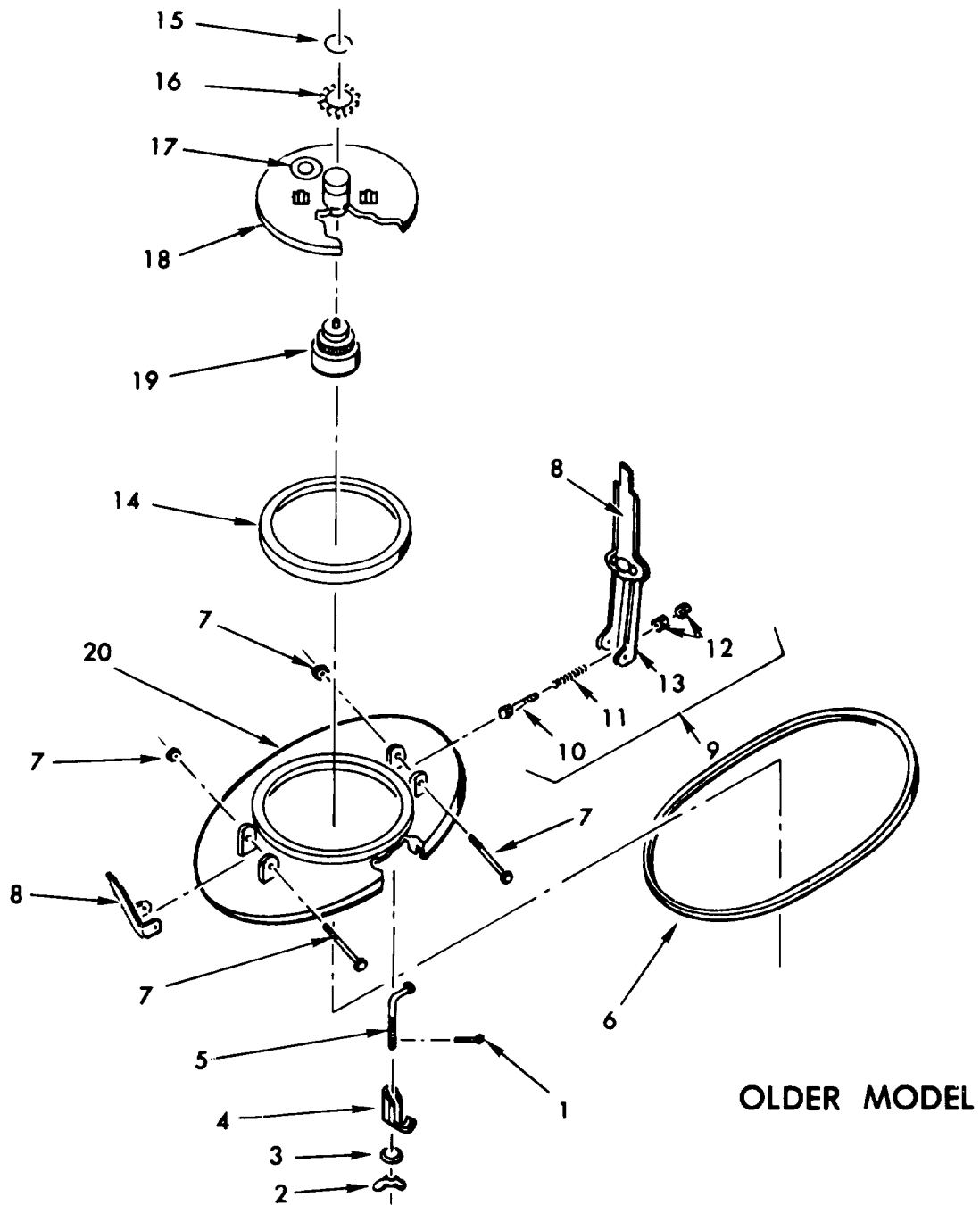


Figure 4-16. Manhole Cover (New Model).



OLDER MODEL

- | | | | |
|---------------|-----------------------|------------------|-------------------|
| 1. Cotter pin | 6. Cover gasket | 11. Spring | 16. Spring washer |
| 2. Wingnut | 7. Hinge bolt and nut | 12. Nut | 17. Fuse plug |
| 3. Lockwasher | 8. Closing cam | 13. Hinge | 18. Cover |
| 4. Hook | 9. Hinge assembly | 14. Cover gasket | 19. Vent |
| 5. Hook bolt | 10. Bolt | 15. Lockring | 20. Manhole cover |

Figure 4-17. Manhole Cover (Old Model).

4-27. FILL PLUG GASKET.

The manhole cover fill plug has a gasket to seal the opening. Replace gasket as follows:

- a. Release hinge assembly and open fill plug. (Figure 4-16.)
- b. Inspect for cracks, brakes, abrasion, and defects.
- c. Replace damaged or defective gasket by removing nut and gasket retainer plate, pressure vent valve, and fuse plug.
- d. Reassemble as follows:

Align holes in retainer plate, gasket and cover as shown.

Install vent & fuse plug.

Place cover on closing cam, position pressure vent under cam at hinge end. (Figure 4-16.)

4-28. PUMP PORT.

- a. General. A pump port (55 gallon drum plug) cover assembly is provided so that a hand pump may be used. (Figure 4-18.)
- b. Service. Remove pump port cover and examine gasket. Replace if defective.

4-29. DRAIN PLUG.

- a. General. The drain plug is used for removing remaining liquid accumulation after the tank is drained through the dispensing valve. (Figure 4-18.)
- b. Removal. Remove drain plug and gasket.
- c. Cleaning and Inspection.
 - (1) Clean parts with drycleaning solvent (Item 1, App. E) and dry thoroughly.
 - (2) Inspect for breaks, cracks, and damaged threads. Replace a damaged drain plug. Replace the gasket.

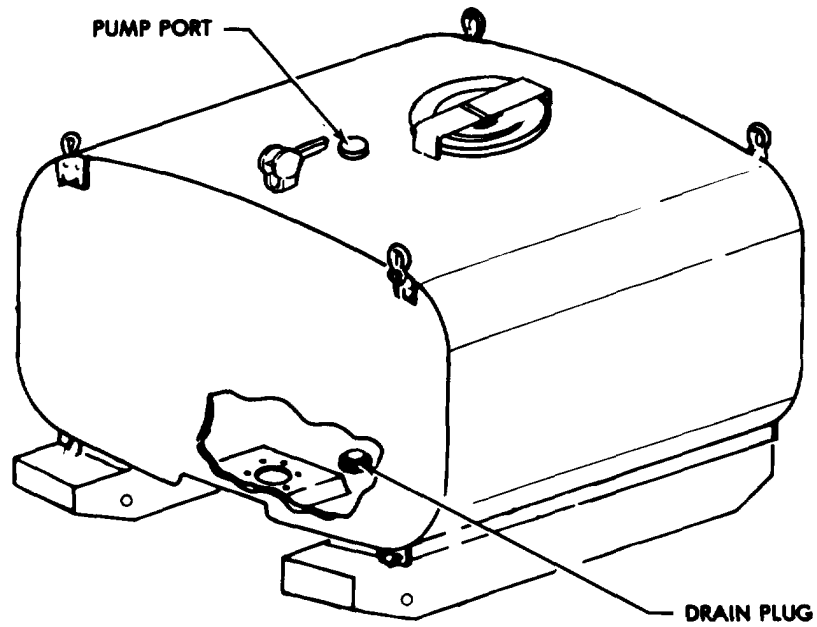


Figure 4-18. Pump Port and Drain Plug.

Section VII. REPAIR OF ELECTRIC MOTOR ASSEMBLY.

4-30. GENERAL.

This section covers repair of the electric motor assembly.

4-31. ON-OFF SWITCH CABLE, J1. (figure 4-19.)

- 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 (item 6, App. E.)
- (2) Tighten connector.
- (3) Tighten screws.

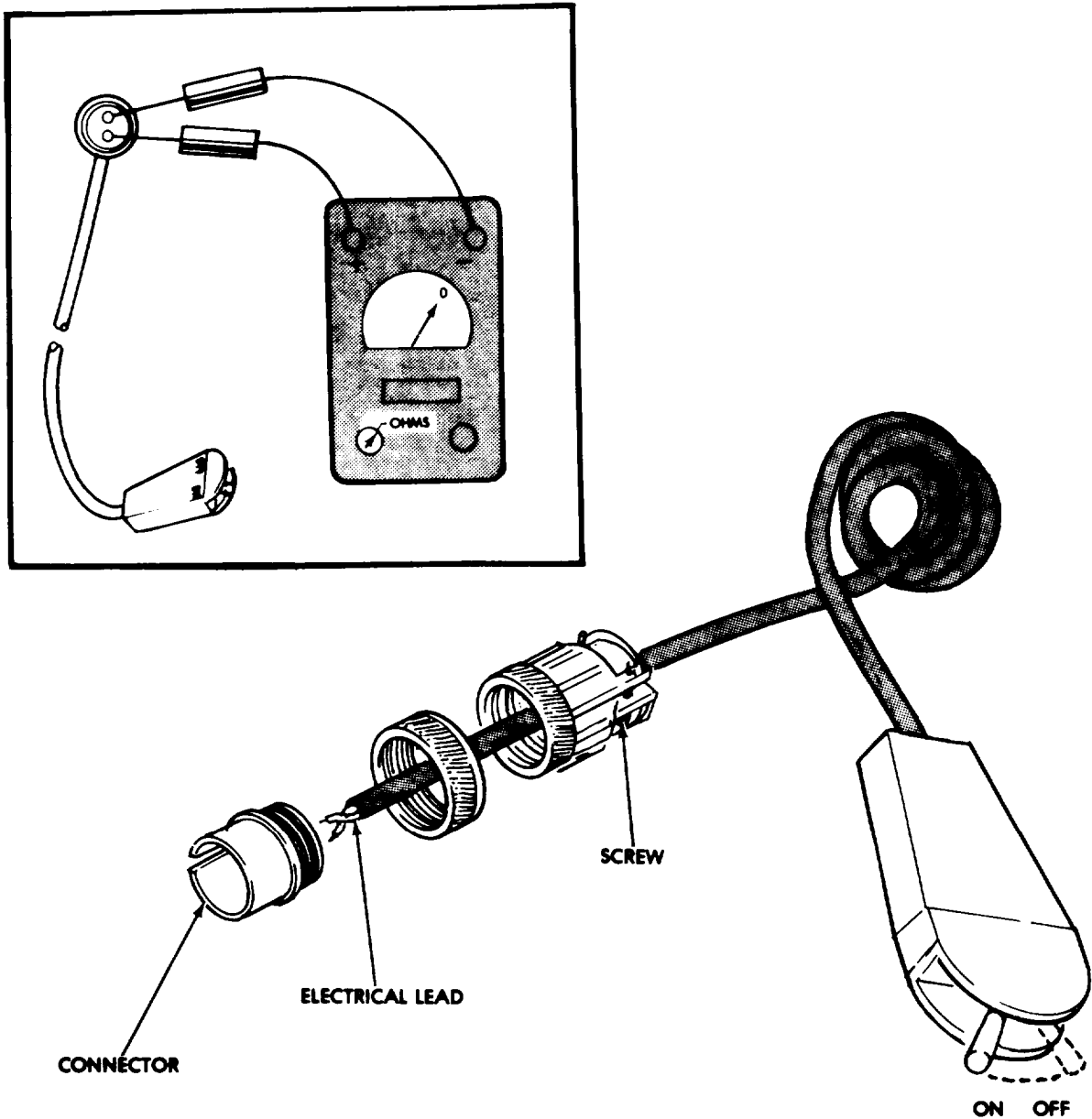


Figure 4-19. ON/OFF Switch Cable.

4-32. 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 4-20.)

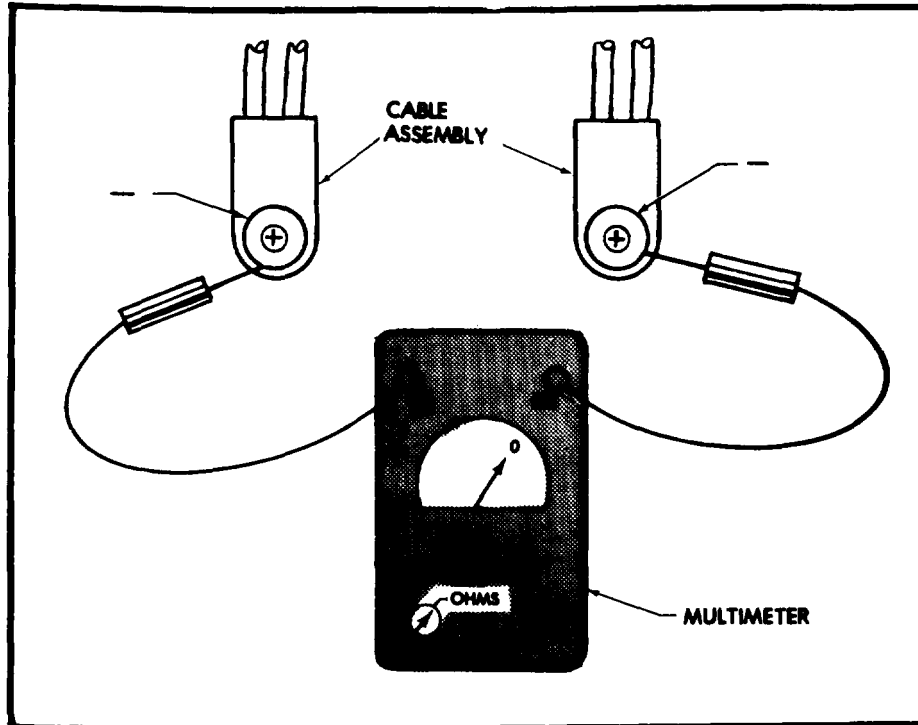


Figure 4-20. Test for Continuity.

- b. Connector Assembly Removal. (See figure 4-21.)

- (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 4-21.)

- (1) Attach cables to connector with lockwashers and bolts.
- (2) Attach cover to connector with screws.

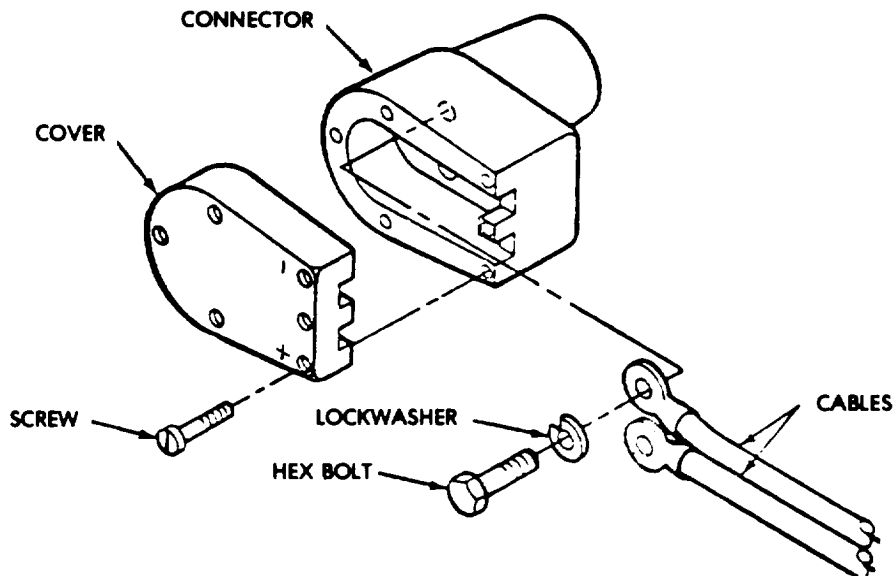


Figure 4-21, Connector Assembly.

d. Lug terminal replacement.

To replace lug terminals, see figure 4-22.

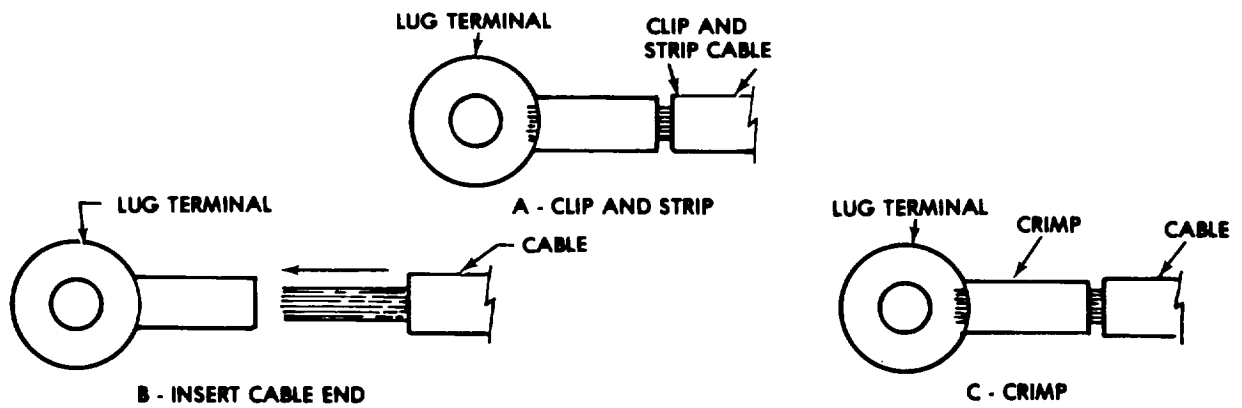


Figure 4-22. Lug Terminal Removal and Replacement.

4-33. CONDUIT ASSEMBLY. (figure 4-23.)

a. Disassembly.

- (1) Disconnect motor electrical leads from connector J2 and relay K-1.
- (2) Unscrew union from Junction Box.
- (3) Unscrew union from motor fitting.

b. Reassembly.

NOTE

Wrap pipe threads once or twice with tape (item 7, App. E).

- (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 4-24.)

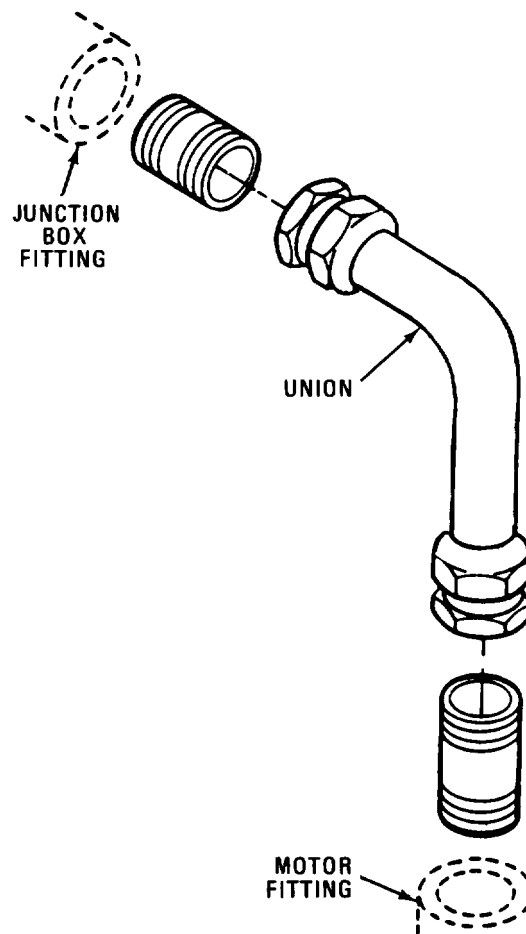


Figure 4-23. Conduit Assembly.

4-34. JUNCTION BOX ASSEMBLY. (figure 4-24.)

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 4-33).
- (5) Solder electrical leads to connector J1. Use solder (item 6, App. E).
- (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 4-24).

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 counter clockwise.

To change the rotation from clockwise to counter clockwise, 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.

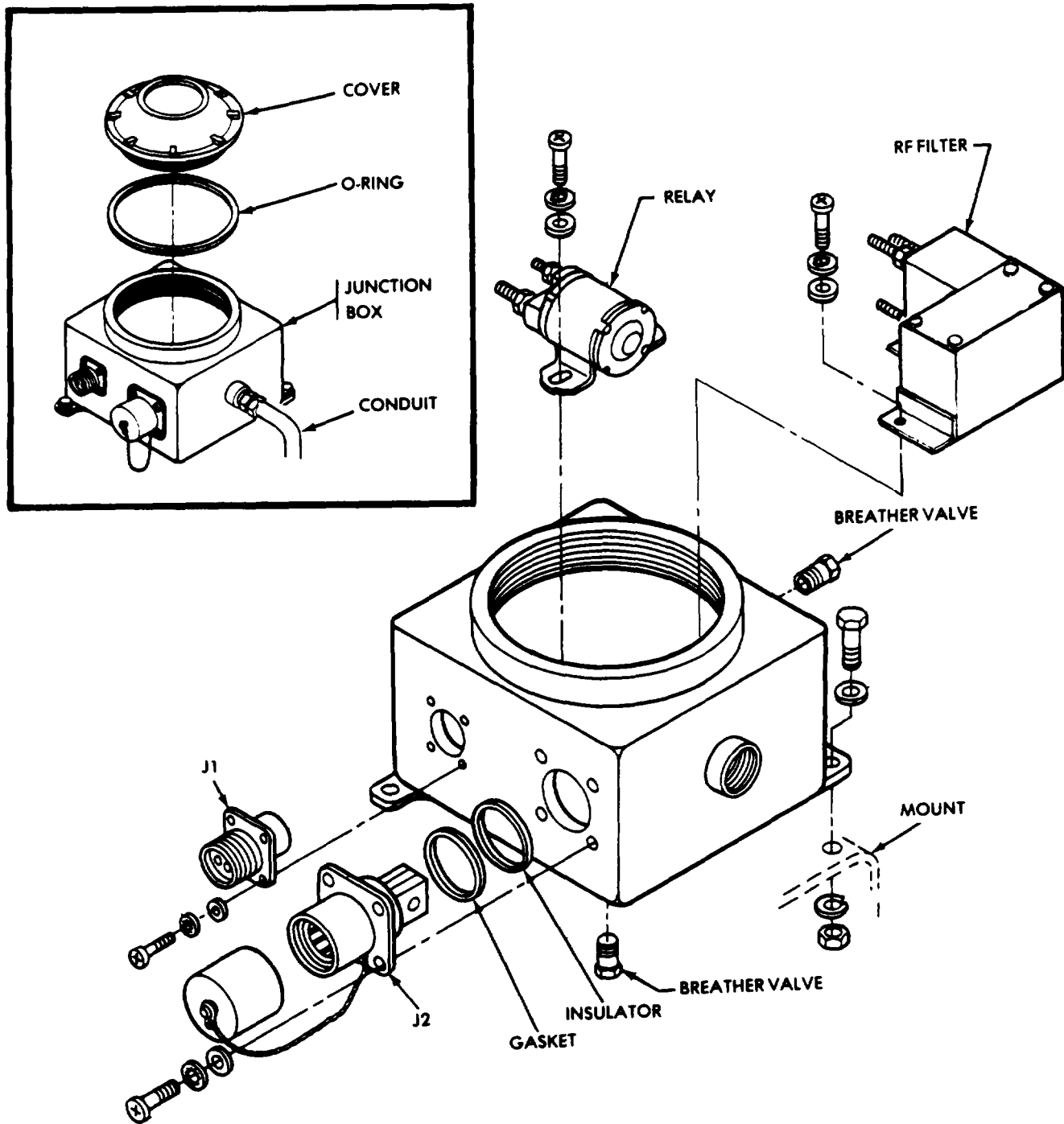


Figure 4-24. Junction Box Assembly (Sheet 1 of 2).

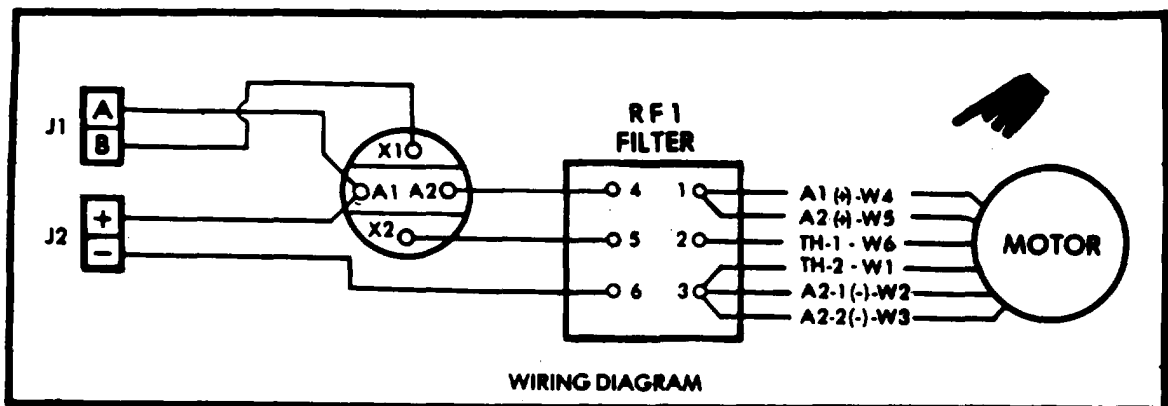
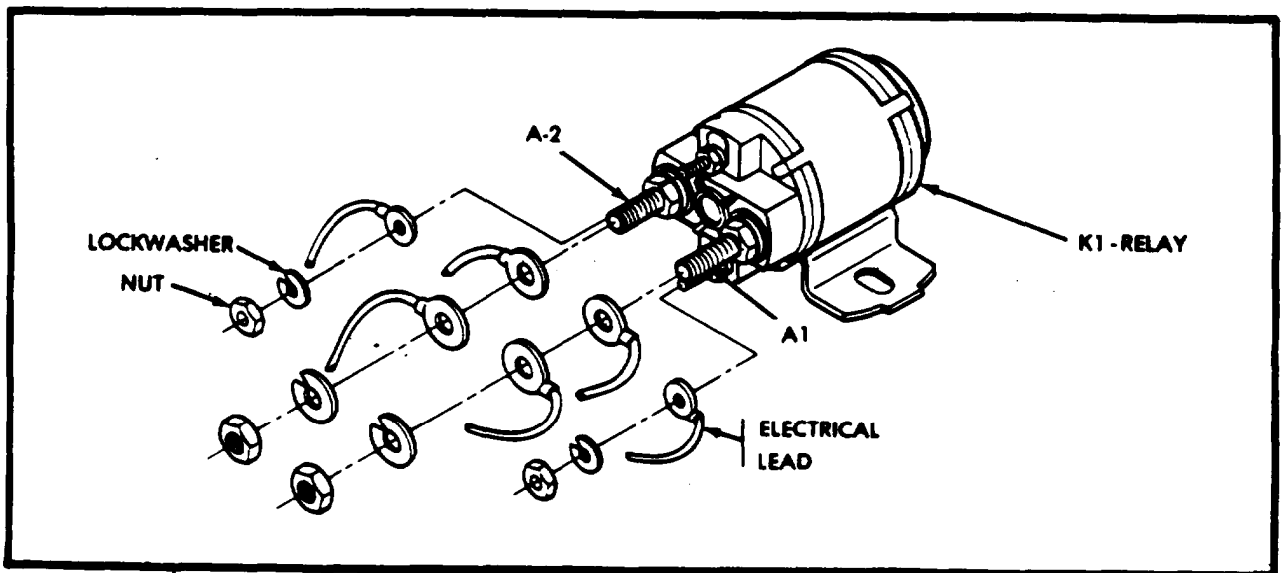
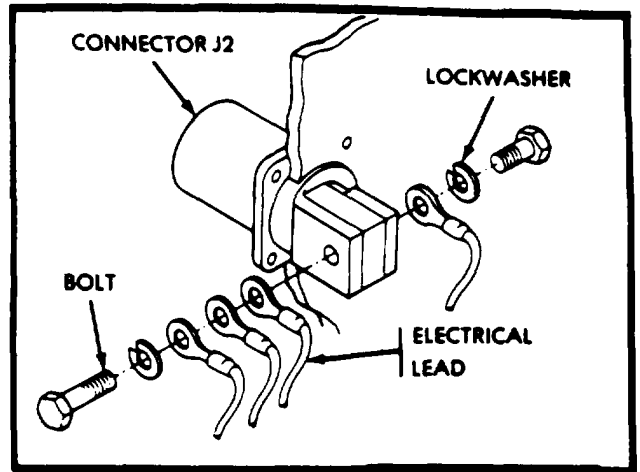
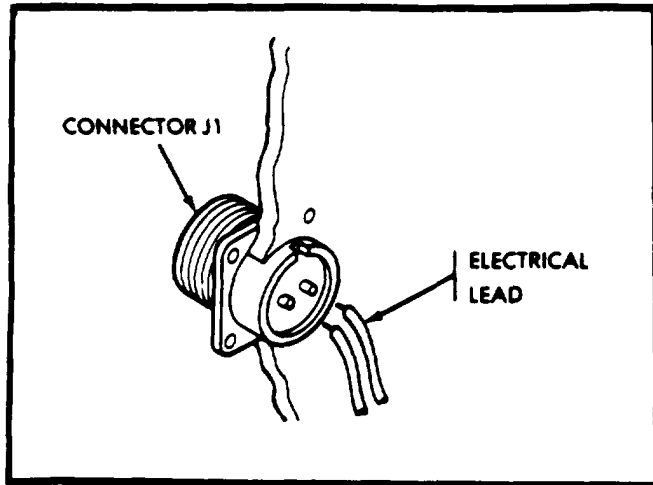


Figure 4-24. Junction 80X Assembly (Sheet 2 of 2).

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 4-25.)

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 4-24 for wire connections.)

CAUTION

The following tests require the power cable, J2, be connected as in normal pumping procedure. Exercise care in use of multi meter 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 "A1". 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.

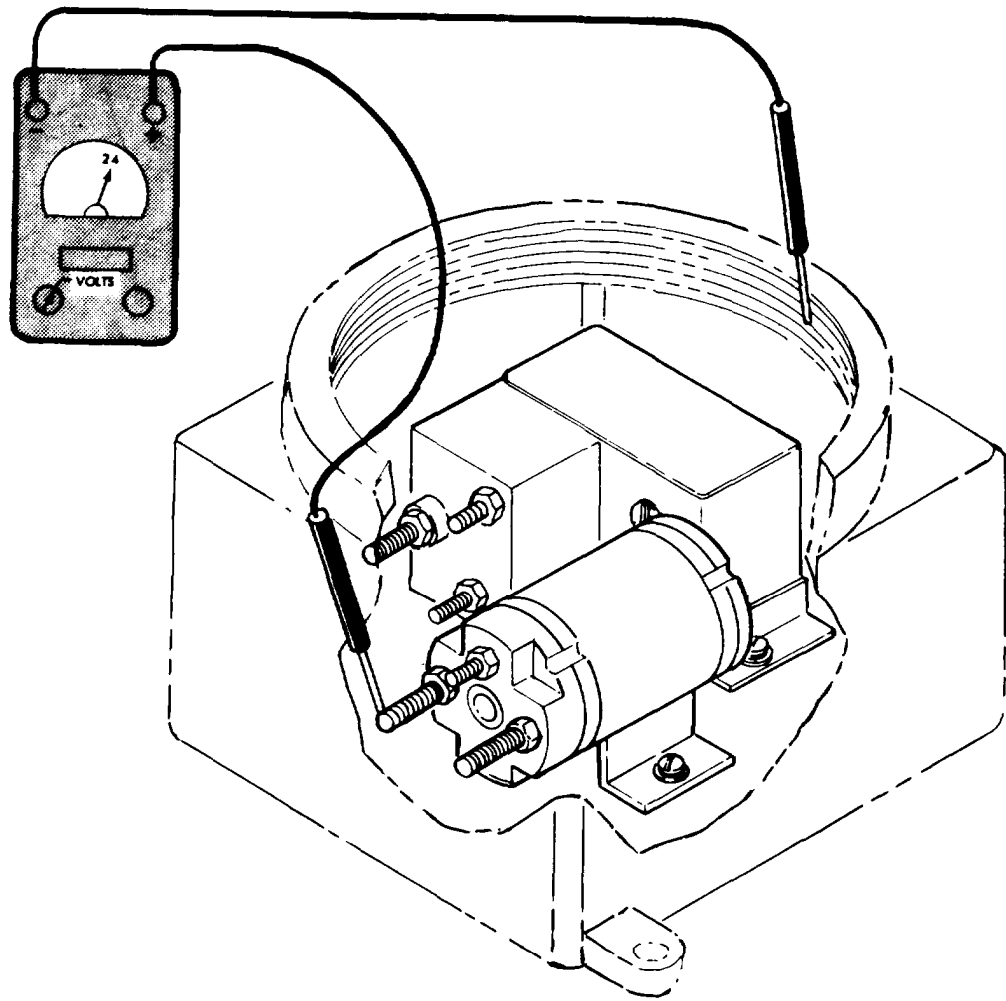
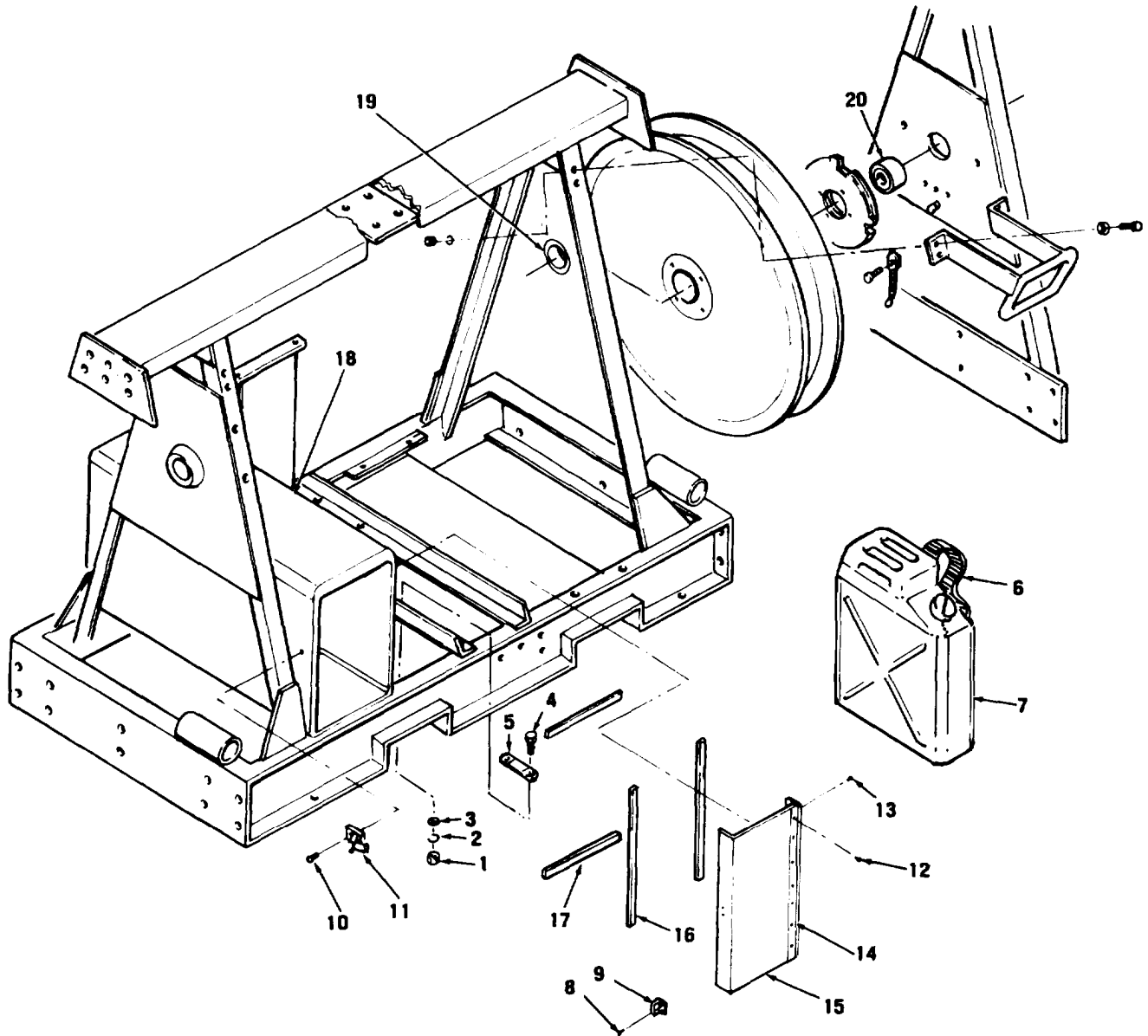


Figure 4-25. K-1 Relay Test.

4-35. TANK AND PUMP UNIT FRAME.

a. General. The unit frame (figure 4-26) is of welded extruded aluminum except for the outer A-frames and hose guides which are bolted to the frame.

b. Inspection. Inspect the frame for distortion, broken welds, cracks, dents, and other damage. Refer to figure 4-26 for location of frame assembly. Report any damage to Direct Support Maintenance.



- | | |
|------------------------|--------------------|
| 1. Nut, plain, hex | 11. Strike |
| 2. Washer, lock | 12. Rivet, solid |
| 3. Washer, flat | 13. Rivet |
| 4. Screw, machine | 14. Hinge |
| 5. Loop, strap fastner | 15. Door |
| 6. Strap | 16. Seal, rubber |
| 7. Can, gasoline (GED) | 17. Seal, rubber |
| 8. Rivet | 18. Box, storage |
| 9. Latch | 19. Bushing, brass |
| 10. Rivet | 20. Bearing, ball |

Figure 4-26. Pump Unit Frame.

Section VIII. PREPARATION FOR STORAGE OR SHIPMENT**4-36 PREPARTATION FOR STORAGE**

a. Storage Site.

(1) 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.

(2) 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.

(3) 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.

b. Storage Plan.

(1) Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance, and exercising. Anticipate removal or deployment problems and take suitable precautions.

(2) Take into account environmental conditions, such as extreme heat or cold; high humidity; blowing sand, dust, or loose debris; soft ground; mud, heavy snows, earthquakes; or combinations thereof, and take adequate precautions.

(3) Establish a fire plan and provide for adequate fire fighting equipment and personnel.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

5-1. GENERAL

- a. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.
- b. Test, Maintenance, and Diagnostic Equipment (TMDE) and support equipment include electrical test equipment, standard pressure and vacuum gages, vacuum pumps, and charging manifolds found as standard equipment in any direct support maintenance shop.
- c. Repair parts are listed and illustrated in the Repair Parts and Special Tools List, (RPSTL), TM 4930-230-23P covering organizational and direct support maintenance for this equipment.

Section II. TROUBLESHOOTING

5-2. GENERAL

- a. Table 5-1 lists the common malfunctions which you may find during the operation or maintenance of the tank and pump unit. 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.

Table 5-1. Direct Support Maintenance Troubleshooting.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

1. GAS ENGINE WILL NOT OPERATE

Refer to TM5-2805-257-14 Troubleshooting Guide

WARNING

Disconnect intervehicle power cable from vehicle before maintaining or replacing electrical components.

Table 5-1. Direct Support Maintenance Troubleshooting – Continued

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

2. ELECTRIC MOTOR WILL NOT OPERATE

Step 1. Check vehicle power supply.

Insure charging systems are operating properly. Refer to TM applicable to the transporting vehicle.

3. ELECTRIC MOTOR WILL NOT RUN

Step 1. Check for foreign material in volute housing that would prevent the impeller from turning.

Remove foreign material.

Step 2. Check Electric motor for proper operation.

Repair or replace defective parts.

4. PUMP IS NOISY

Step 1. Check for foreign material in volute housing.

Remove foreign material.

Step 2. Check for loose impeller.

Tighten impeller or replace defective parts.

5. PUMP LEAKS

Step 1. Inspect for defective gaskets, O-rings and seals or mounting screw compression inserts.

Replace defective parts.

Section III. MAINTENANCE PROCEDURES.

Centrifugal Pump	5-3
Filter/Separator	5-4
Static Discharge Reel,	5-5
Fuel Dispensing Nozzle	5-6
Fuel Dispensing Reel	5-8
A-Frame	5-9
Electric Motor	5-11
Dispensing Valve	5-12
Tank Assembly	5-13



NOTE

- Before performing Maintenance Procedures check the following:**
- Disconnect Power Cable.
 - Close Tank Dispensing Valves.

5-3. CENTRIFUGAL PUMP

The pump is a centrifugal-type unit that is directly coupled to the engine. 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 and Disassembly. (figure 5-1.)
 - (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. (on EMD units, 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 engine.
 - (8) Remove adapter shaft (16) and Woodruff key (17) from engine 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).

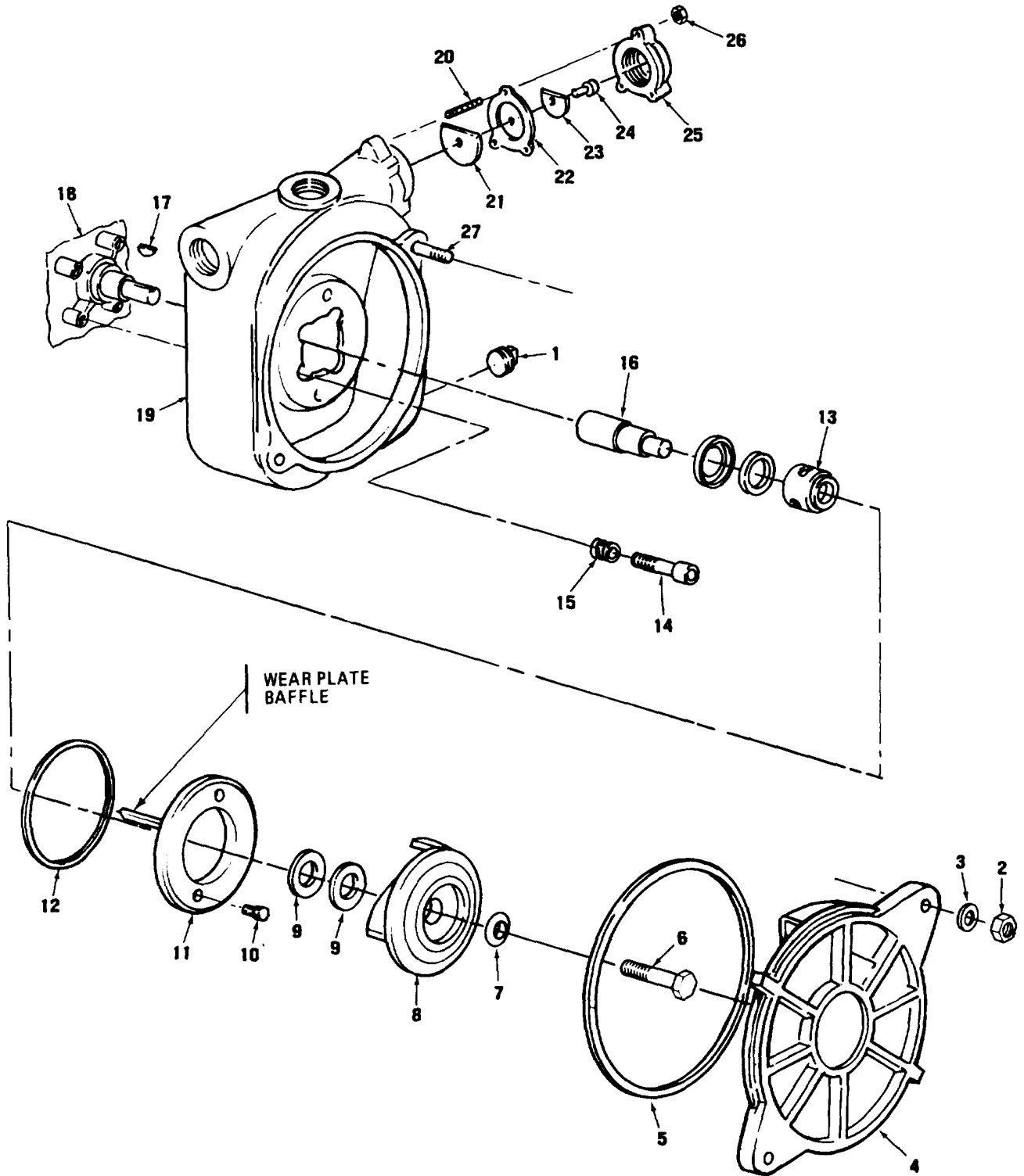


Figure 5-1. Centrifugal Pump and Check Valve.

b. Cleaning, Inspection and Repair.

WARNING

Drycleaning solvent, P-D680, 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 (Item 1, App. E).
- (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.

c. Assembly and Installation (figure 5-1).

- (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 engine/motor with four screws (14) and new compression inserts (15). Torque evenly to 32 ft. lbs. (36.90 cm–kg). Lubricate rubber seal (item g, App E).
- (4) Install adapter shaft (16) onto armature/crank shaft. Seat stationary seal into Rubber Seal and slide onto adapter shaft and pump cavity. Install Rotating Seal over adapter shaft (see figure 5-2).

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 5-2.

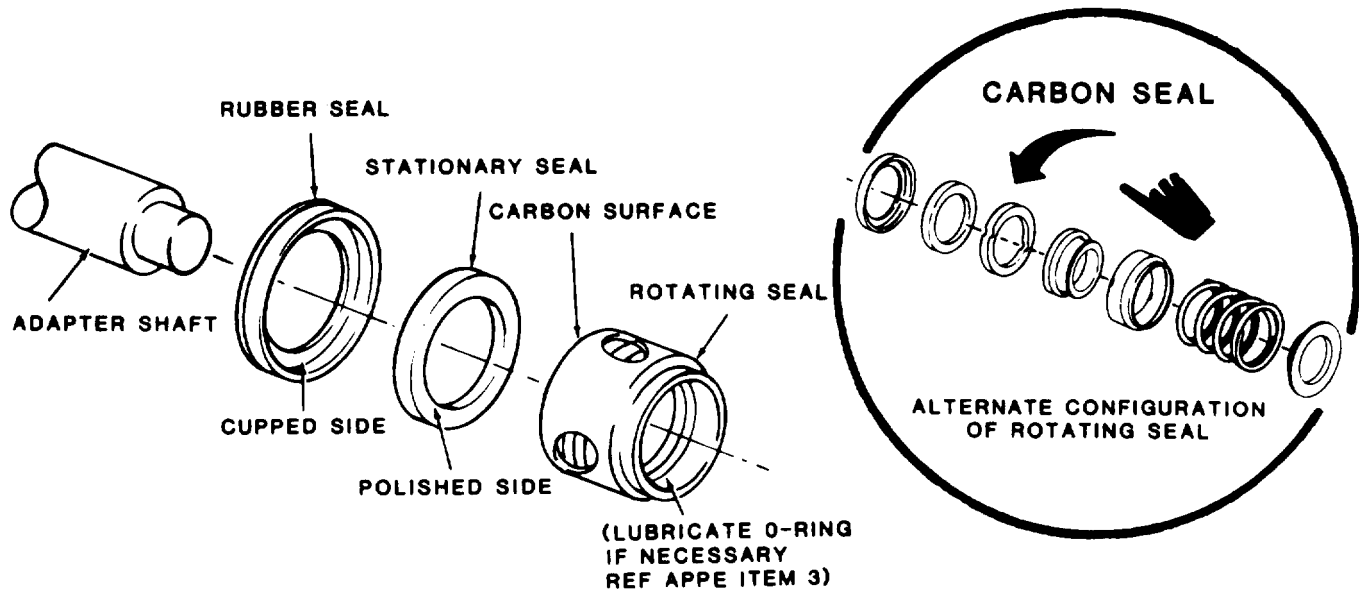


Figure 5-2. Adapter Shaft Seal Assembly.

(5) Lubricate and install O-Ring packing (12, figure 5-1) onto wear plate (11) (Item 3, App E).

(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) (item 10, App E).

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

(11) Install pump drain plug (1).

5-4. FILTER/SEPARATOR

The filter/separator is a device for separating both water and solid contaminants from the product being dispensed. Repair of the filter/separator consists primarily of replacing damaged or worn parts.

a. Removal (figure 5-3).

(1) Open drain cock and drain filter/separator effluent into a suitable container.

(2) Disconnect inlet and discharge hoses.

(3) Remove screws, washer, and nuts, and detach filter/separator from A-frame.

(4) Remove elbows.

b. Disassembly. (figure 5-4)

- (1) Remove clamp (1), hose (2), drain cock (3), and elbow (4).
- (2) Remove screws (5), washers (6), sight gage (7), float ball (8), and gasket (9).
- (3) Remove tube assemblies (10) and elbows (11 and 12).
- (4) Remove screws (13), washers (14 and 15), and differential pressure gage (16).
- (5) Remove bolts (17), washers (18), nuts (19), to remove coupling halves (20), tank cover (21), and packing (22).
- (6) Remove pressure vent valve (23) and packing (24) from tank cover.

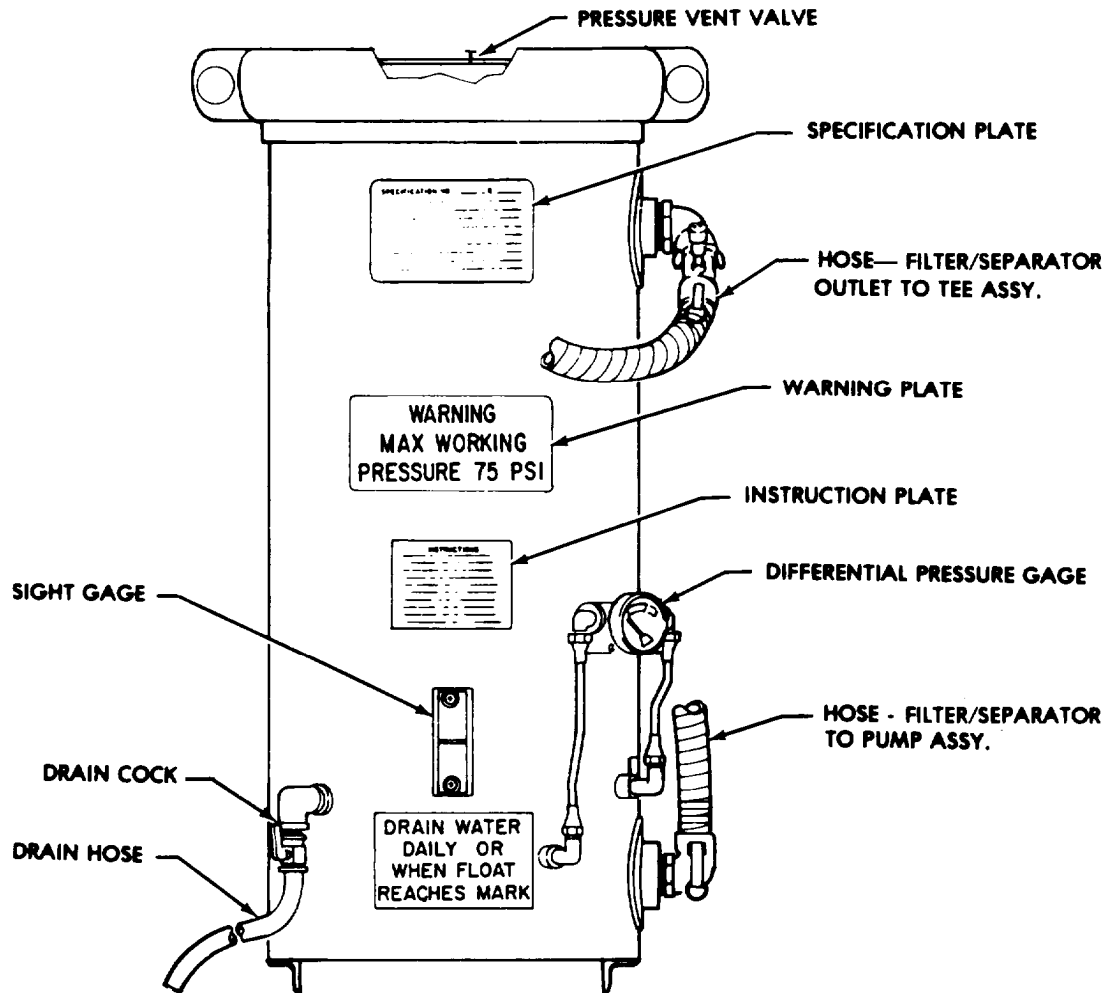
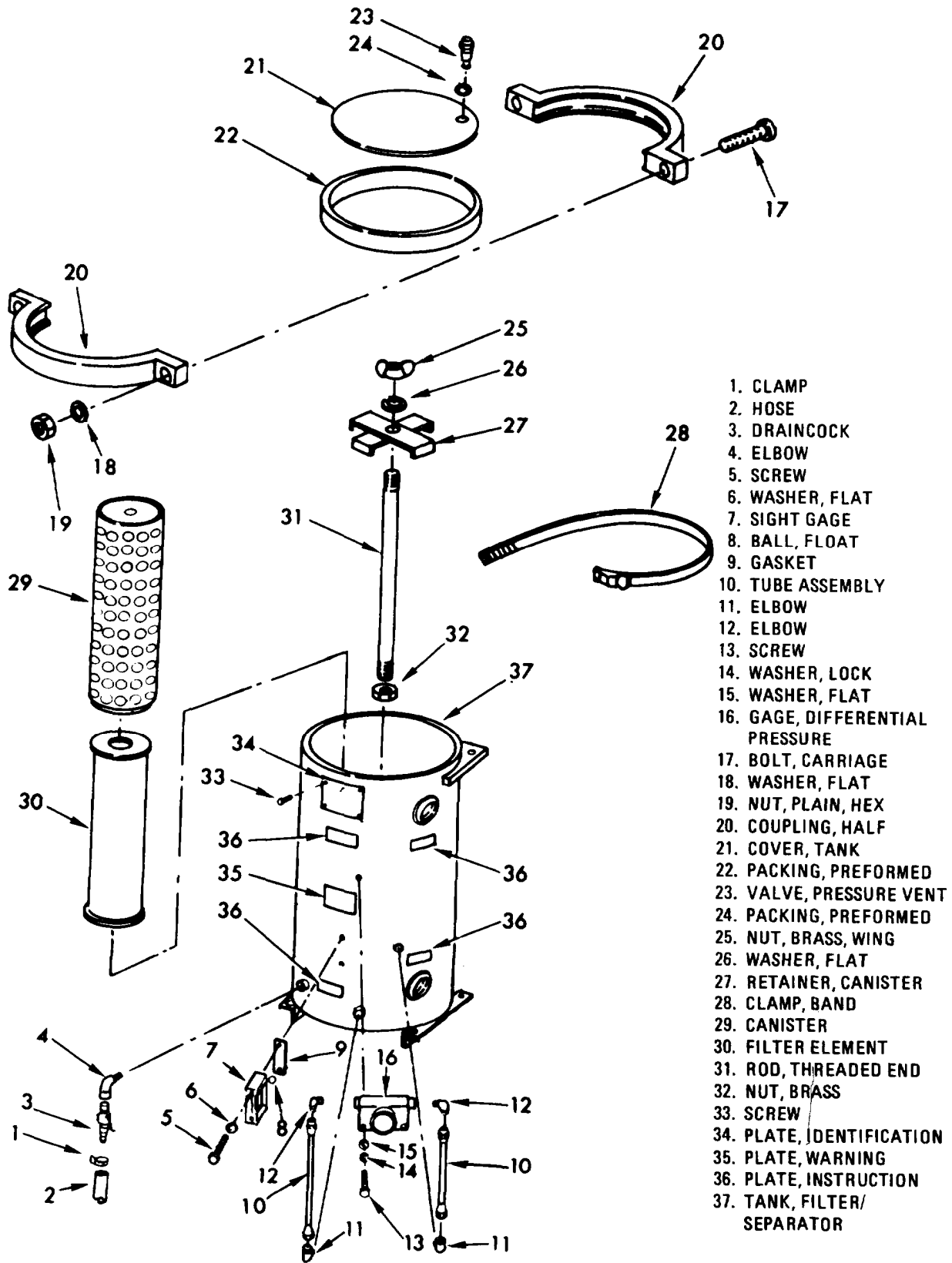


Figure 5-3 Filter/Separator



- 1. CLAMP
- 2. HOSE
- 3. DRAINCOCK
- 4. ELBOW
- 5. SCREW
- 6. WASHER, FLAT
- 7. SIGHT GAGE
- 8. BALL, FLOAT
- 9. GASKET
- 10. TUBE ASSEMBLY
- 11. ELBOW
- 12. ELBOW
- 13. SCREW
- 14. WASHER, LOCK
- 15. WASHER, FLAT
- 16. GAGE, DIFFERENTIAL PRESSURE
- 17. BOLT, CARRIAGE
- 18. WASHER, FLAT
- 19. NUT, PLAIN, HEX
- 20. COUPLING, HALF
- 21. COVER, TANK
- 22. PACKING, PREFORMED
- 23. VALVE, PRESSURE VENT
- 24. PACKING, PREFORMED
- 25. NUT, BRASS, WING
- 26. WASHER, FLAT
- 27. RETAINER, CANISTER
- 28. CLAMP, BAND
- 29. CANISTER
- 30. FILTER ELEMENT
- 31. ROD, THREADED END
- 32. NUT, BRASS
- 33. SCREW
- 34. PLATE, IDENTIFICATION
- 35. PLATE, WARNING
- 36. PLATE, INSTRUCTION
- 37. TANK, FILTER/SEPARATOR

Figure 5-4. Filter/Separator, Disassembly and Reassembly.

(7) Remove wingnut (25), washer (26), and canister retainer (27).

(8) Remove clamp (28), canisters (29), and filter elements (30).

(9) Remove rod (31) and nut (32).

(10) Remove screws (33) and identification plate (34).

(11) Warning plate (35) and instruction plate (36) are not removed from tank (37) unless defaced, deteriorated, or otherwise damaged.

c. Cleaning and Inspection.

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 (Item 1, App. E),

(2) Dry all parts thoroughly.

(3) Flush the interior of the filter/separators.

(4) Discard filter elements, O-rings, gaskets, and tubing.

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

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

(7) Inspect the differential pressure gage for signs of damage.

(8) Inspect the drain cock for cracks, thread damage, and other damage.

(9) Inspect the pressure relief valve for damage,

d. Overhaul.

(1) Replace filter elements, O-rings, gaskets, hoses, tubing, and band clamp.

(2) Replace sight gage if sight window shows any fogging or other damage.

(3) Replace a defective pressure gage.

(4) All metal parts shall be repaired, if possible, or replaced.

(5) Replace warning plate and instruction plate if defaced or deteriorated.

e. Assembly. (figure 5-4)

- (1) Install identification plate (34) with screws (33).
- (2) Install rod (31) and nut (32).

NOTE

Before installing new filter elements, ensure that O-ring in each end of each element is properly seated in its groove. Lubricate the O-rings with GAA grease ((tern 2, App E) to prevent displacement during element installation.

- (3) Install filter elements (30) and canisters.
- (4) Attach band clamp (28).
- (5) Install canister retainer (27), washer (26), and wingnut (25).
- (6) Install pressure vent valve (23) and packing (24) in tank cover.
- (7) Install packing (22), cover (21), and coupling halves (20), and fasten with bolts (17), washers (18), and nuts (19).
- (8) Install differential pressure gage (16), washers (14 and 15), and screws (13).
- (9) Install elbows (11 and 12) and tube assemblies (10).
- (10) Insert float ball (8) into sight gage (7) and install with gasket (9), washers (6), and screws (5).
- (11) Install elbow (4), drain cock (3), hose (2), and clamp (1),

f. Installation.

- (1) Install elbows at inlet and discharge holes of filter/separator (figure 5-3).
- (2) Attach filter/separator to A-frame with screws, washers, and nuts.
- (3) Connect inlet and discharge hoses.
- (4) Close drain cock.

g. RF Filter Test. (figure 4-24)

- (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.

5.5 STATIC DISCHARGE REEL

DELETED

All data on pages 5-11 and 5-12, including Figures 5-5 and 5-6 deleted.

5-6. FUEL DISPENSING NOZZLE ASSEMBLY

The fuel dispensing nozzles control the flow of fuel being dispensed through the hose reels. Each nozzle is equipped with a bonding wire to attach to the vehicle being serviced to prevent static discharge sparking. Repair of the nozzle assembly consists of replacing damaged or defective parts.

5-7. FUEL DISPENSING NOZZLE

a. Removal. (Figure 5-7)

- (1) Open nozzles and drain fuel into suitable container.
- (2) Remove nozzles by pulling out on cam arms and disconnecting coupling.
- (3) Remove nozzle bonding wires.

b. Disassembly. (Figure 5-7)

(1) Remove cap (1), spring (2) upper poppet (3), disk holder (4), disk (5), washer disk (6), nut (7), and stem (8).

- (2) Remove dust cap (9), chain (10), spring (11), and hook (12).
- (3) Remove spout (13), gasket (14), and strainer (15).
- (4) Remove cotter pin (16), pin (17), and lever (18).
- (5) Remove packing nut (19), nut (20), packing (21), and guide (22).
- (6) Remove clip (23), wire (24), nut (25), plug (26), and nut (27) from body (28).

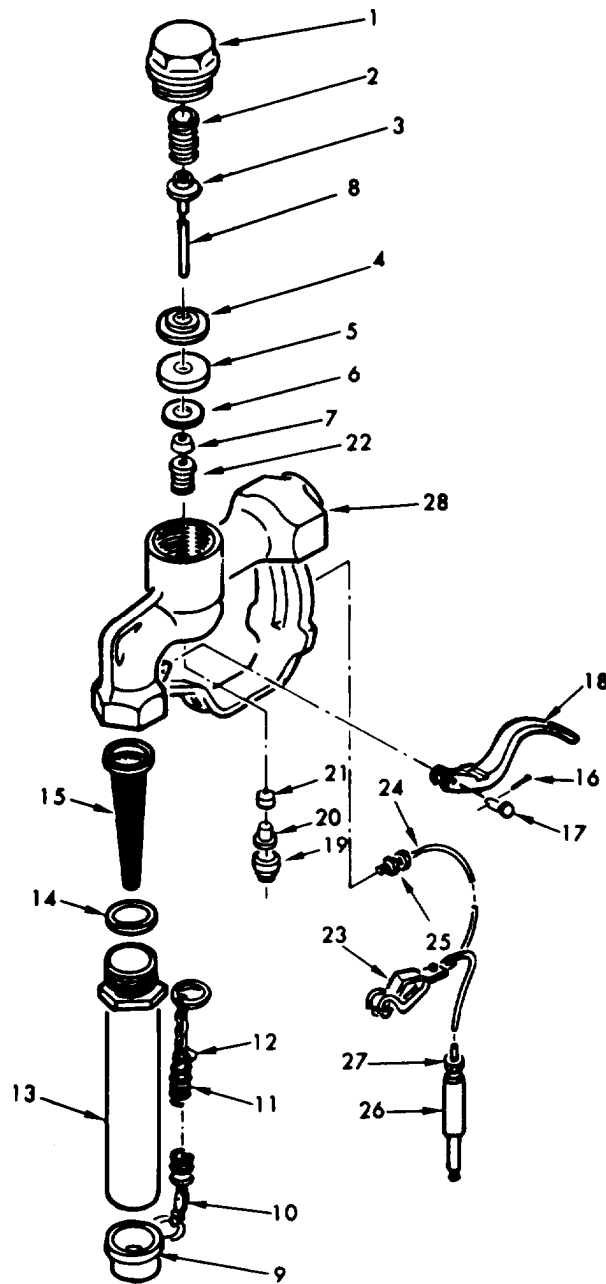


Figure 5-7. Nozzle, Disassembly and Reassembly.

c. Cleaning and Inspection.

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 in drycleaning solvent (Item 1, App. E)
- (2) Dry all parts thoroughly.
- (3) Inspect the spring for cracks and rust.
- (4) Inspect the upper poppet for damage.
- (5) Inspect the disk and washer disk for distortion.
- (6) Inspect the washer disk for excessive groove caused by wear and for splits or tears.
- (7) Inspect the body for cracks, breaks, dents, distortion, and damaged threads.
- (8) Inspect other parts for damage.
- (9) Replace all defective parts.

d. Reassembly. (Figure 5-7)

- (1) Assemble clip (23), wire (24), nut (25), plug (26), and nut (27), and attach to body (28).
- (2) Install guide (22), packing (21), nut (20), and packing nut (19).
- (3) Install lever (18), pin (17), and cotter pin (16).
- (4) Install strainer (15), gasket (14), and spout (13).
- (5) Install hook (12), spring (11), chain (10), and dust cap (9).
- (6) Assemble and install stem (8), nut (7), washer disk (6), disk (5), disk holder (4), upper poppet (3), spring (2), and cap (1).

e. Installation.

- (1) Install nozzle bonding wires (figure 5-7).
- (2) Install nozzles by connecting couplings and closing cam arms.

5-8. FUEL DISPENSING REEL ASSEMBLY

The two hose reels have recoil tension springs to wind the 40-foot discharge hoses on the reels.

NOTE

Maintenance procedures are identical for both hose reels.

a. Removal.

- (1) Close dispensing valves on tanks by setting cam levers to CLOSE position.

WARNING

When discharge hose is pulled out, recoil spring is under tension. Be careful not to trip ratchet when disconnecting hose as sudden release of spring tension could cause serious injury.

- (2) Pull dispensing hoses out until they are completely unwound from reels. Open nozzles and drain fuel into a suitable container.

- (3) Disconnect hoses from reels by pulling out on cam arms.

- (4) Release spring tension on reel by carefully turning the reel backwards nine turns to a neutral position.

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.

- (5) Remove swivel pipe fitting and coupling half (figure 5-8).

CAUTION

Be sure spring recoil tension has been released before removing reel.

- (6) Remove two screws, lockwashers, flat washers, and nuts to remove spring housing (figure 5-9).

- (7) Remove four lockwashers, flat washers, nuts, and the hose guide from A-frames.

- (8) Remove two screws, flat washers, lockwashers, and nuts to detach tiedown link and retainer from outer A-frame.

- (9) Remove 14 screws, lockwashers, flat washers, and nuts to remove outer A-frame.
- (10) Slide outer A-frame off reel hub.
- (11) Pull reel from inner A-frame bearing.

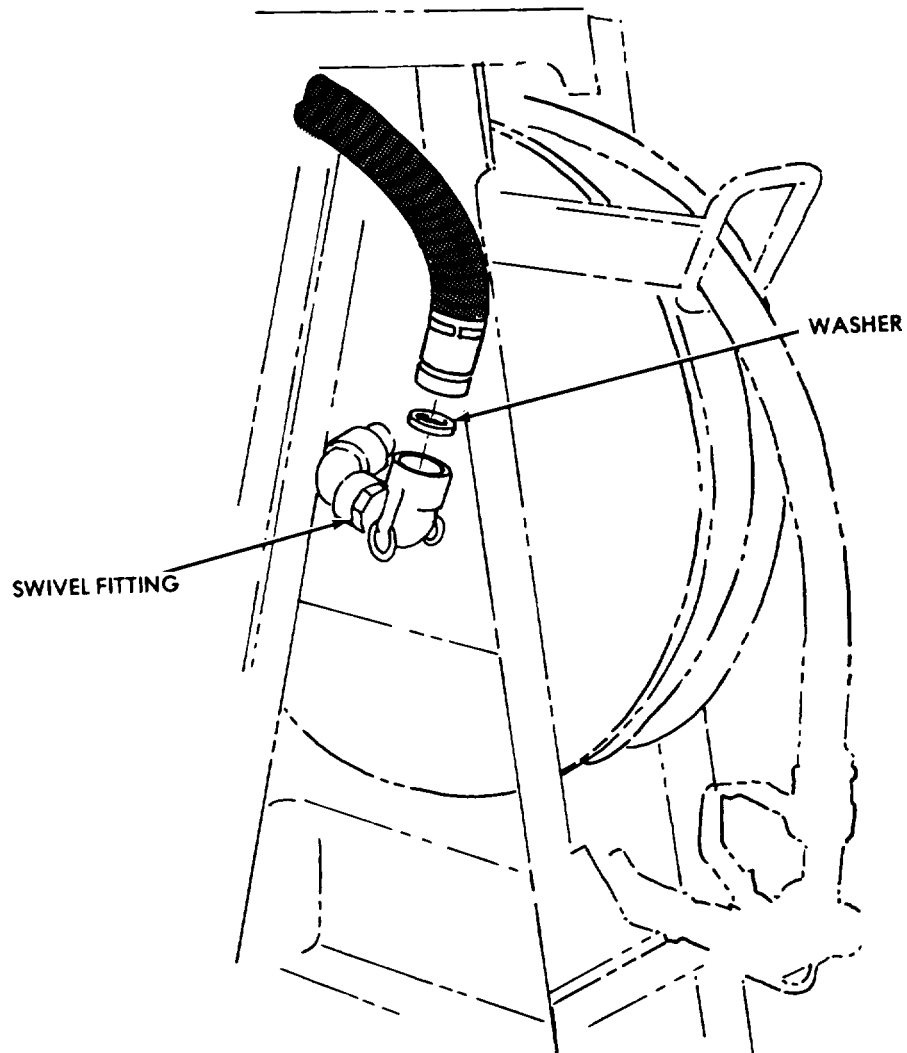


Figure 5-8 Swivel Fitting.

b. Cleaning and Inspection.

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°F to 138°F (38°C to 59°C).

- (1) Clean parts with drycleaning solvent (Item 1, Appendix E) .
- (2) Dry all parts thoroughly.
- (3) Inspect spring housing for broken welds, dents, distortion, and other damage.
- (4) Inspect the reel for leakage, distortion, dents, defective ratchet, pawl assembly, and other damage (Figure 5-10).
- (5) Replace a defective reel assembly.
- (6) Replace a defective hose reel spring housing or ratchet.

c. Installation.

- (1) Install reel on inner A-frame bearing (figure 5-9).
- (2) Slide outer A-frame onto reel hub.
- (3) Install outer A-frame with hardware.
- (4) Attach tiedown link and retainer to outer A-frame.
- (5) Attach hose guide to A-frames.
- (6) Install spring housing on A-frames.
- (7) Install swivel pipe fitting and coupling half (figure 5-8).
- (8) Turn hose reel carefully, by hand, nine complete revolutions outward to apply recoil spring tension. When hose reel is under recoil spring tension, be careful not to trip ratchet when connecting hose as a sudden release of spring tension could cause serious injury.
- (9) Attach dispensing hose to reel coupling and secure by pushing in on cam arms.
- (10) Wire cam handles flat on hub coupling.
- (11) Pull outward on hose and release reel to rewind hose.

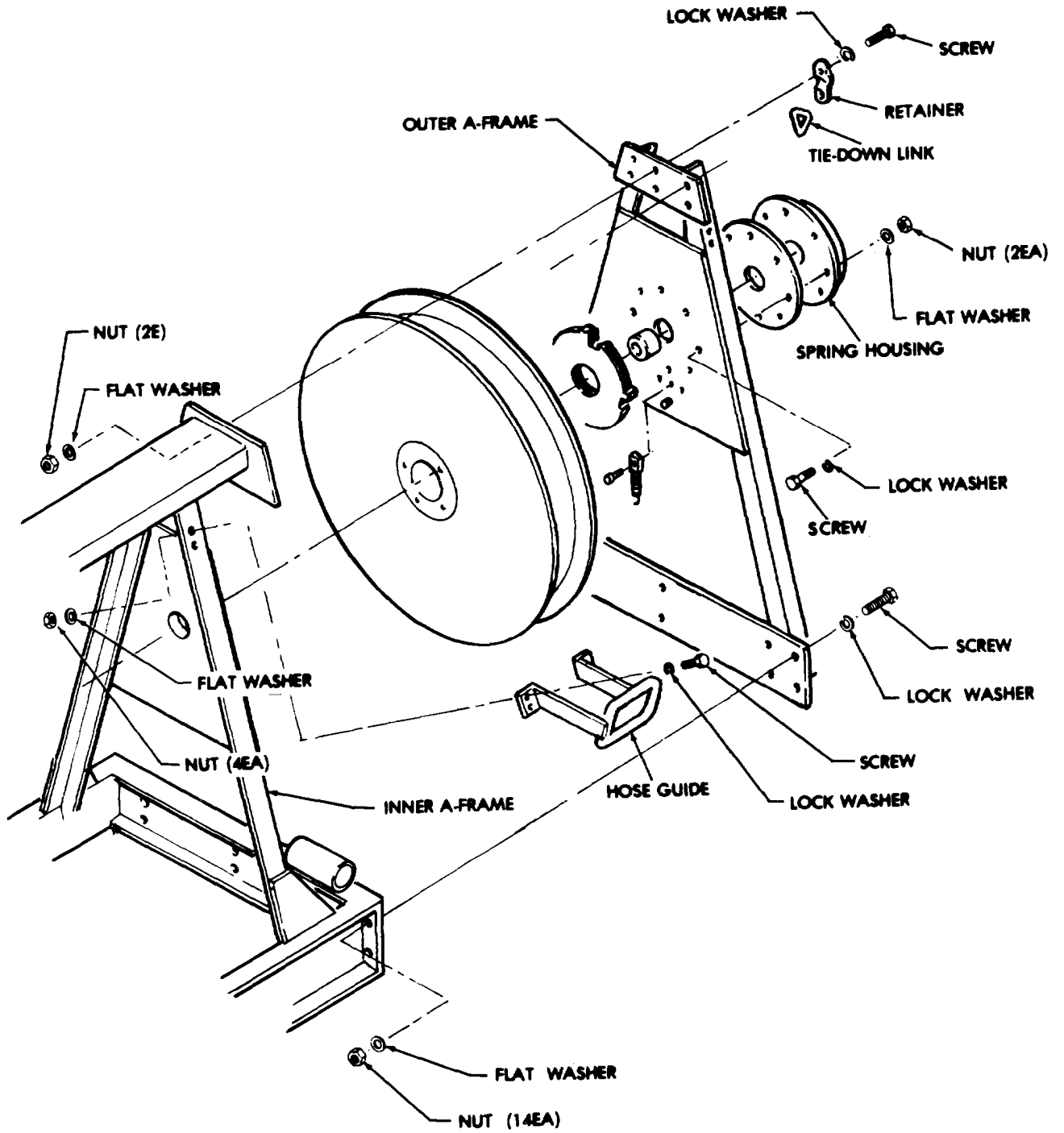


Figure 5-9. Reel Assembly.

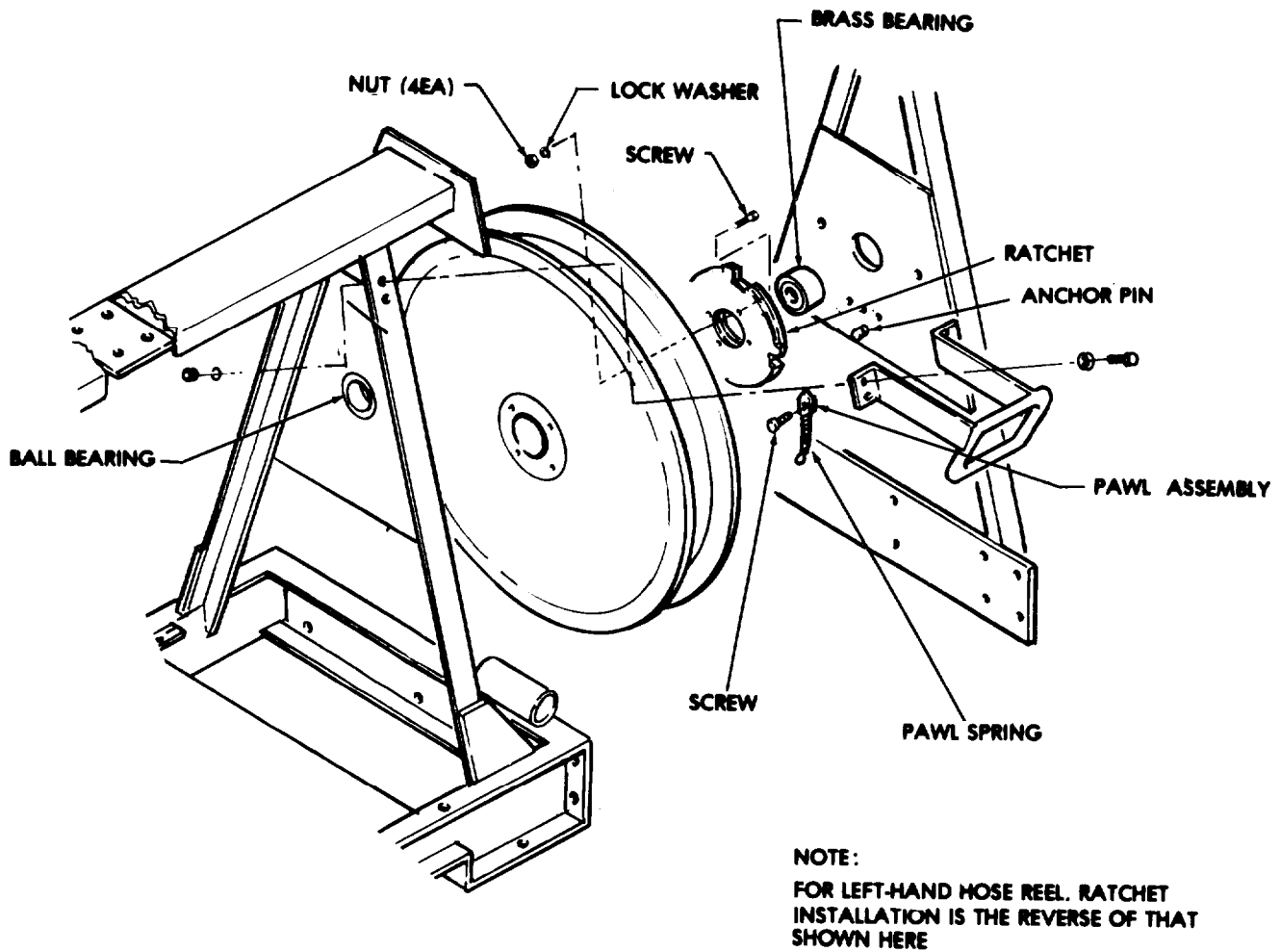


Figure 5-10. Hose Reel Ratchet and Pawl Assemblies.

5-9. TANK AND PUMP UNIT FRAME WELDING REPAIRS

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.

5-10. TANK AND PUMP UNIT FRAME

The frame is of welded, extruded aluminum construction and should require a minimum of maintenance. Repair of the frame consists of repair or replacement of damaged parts.

- a. Removal. Refer to paragraph 5-8 for procedures to remove the A-frame.

b. Disassembly. (figure 5-11)

(1) Remove nuts (1), lockwashers (2), flat washers (3), and screws (4) attaching strap fastener loop (5) to frame.

(2) Remove strap (6) and gasoline can (7).

(3) Rivets (8) attach latch (9) to storage box (18). They are not removed unless necessary for repair or replacement of damaged parts.

(4) Rivets (10) attach strike (11) to door (15). They are not removed unless necessary for repair or replacement of damaged parts.

(5) Rivets (12) attach hinge (14) to door. They are not removed unless necessary for repair or replacement of damaged parts.

(6) Rivets (13) attach hinge to storage box. They are not removed unless necessary for repair or replacement of damaged parts.

(7) If necessary, remove rubber seals (16 and 17) from opening of storage box.

(8) The brass bearings (19) in inner A-frames, and ball bearings (20) in outer A-frames are pressed in. To replace, knock defective bearing out of A-frame and press in new bearing.

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 (Item 1, App. E) and dry thoroughly.

(2) Inspect for damaged or defective parts.

(3) Repair or replace defective parts.

(4) If necessary to weld frame, make certain the frame is free of dirt, oil, grease, or other foreign matter, and bare metal is exposed for welding.

NOTE

The reel bearing in each inner and outer A-frame is pressed in. To replace, knock defective bearing out of A-frame and press in new bearing.

d. Reassembly. (figure 5-11)

- (1) Replace rubber seals (16 and 17) around door opening.
- (2) If hinge (14) was removed from door (15), replace rivets (12).
- (3) If hinge was removed from storage box (18), replace rivets (13).
- (4) If strike (11) was removed from door, replace rivets (8).
- (5) If latch (9) was removed from storage box, replace rivets (8).
- (6) Install gasoline can (7) and strap (6).
- (7) Attach strap loop (5) to frame with screws (4), washers (2 and 3), and nuts (1). Attach strap to loop.

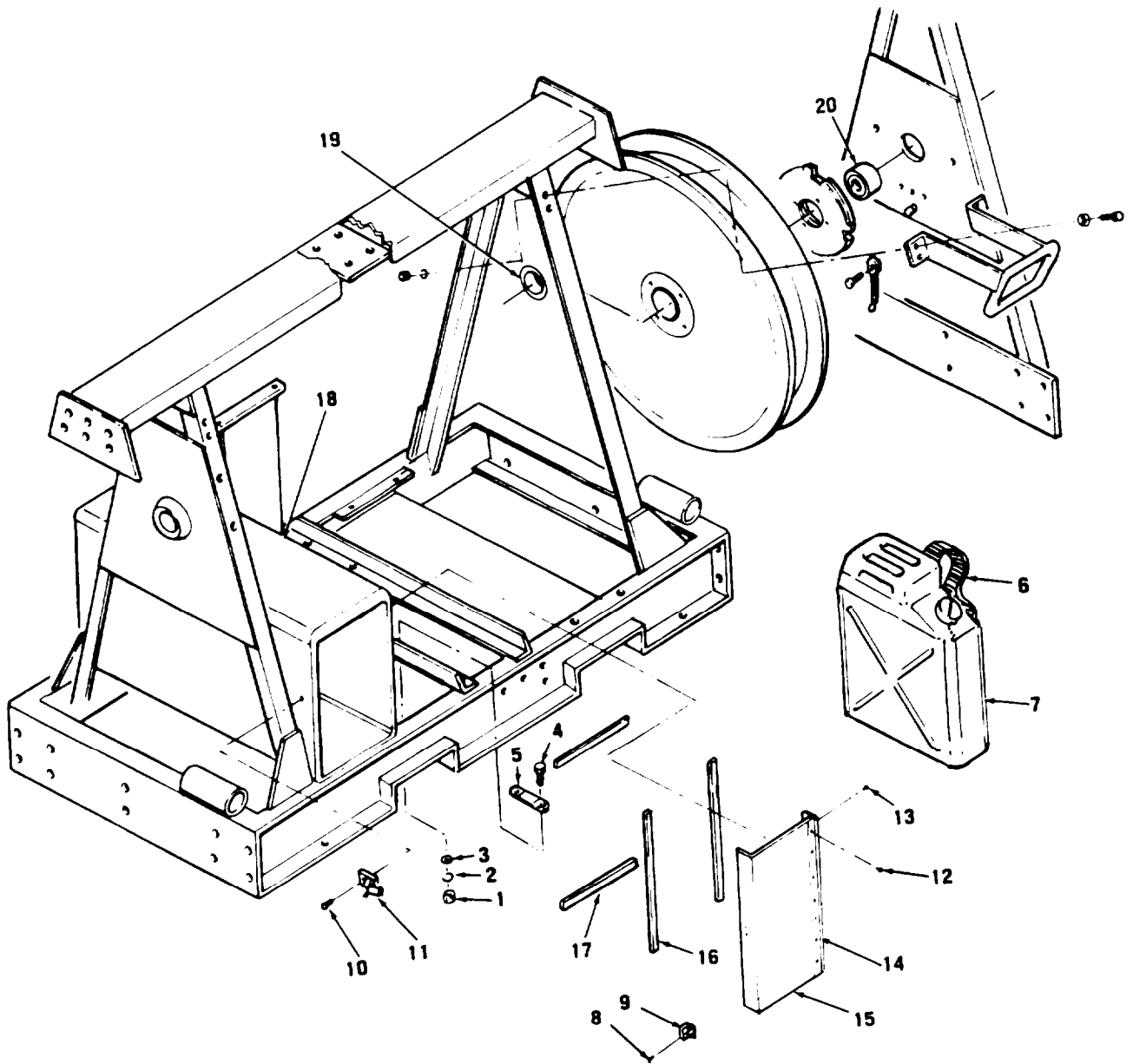
c. Installation.

- (1) Place reel over inner A-frame bearing (figure 5-9).
- (2) Slide outer A-frame onto reel hub.
- (3) Attach A-frame with 14 screws, lockwashers, flat washers, and nuts.
- (4) Attach tiedown link and retainer to outer A-frame with two screws, flat washers, lockwashers, and nuts.
- (5) Attach hose guide to A-frame with four lockwashers, flat washers, and nuts.
- (6) Attach spring housing with two screws, lockwashers, flat washers, and nuts.
- (7) Attach swivel pipe fitting and coupling half (figure 5-8).
- (8) Turn hose reel carefully by hand nine complete revolutions to apply recoil spring tension.

WARNING

When hose reel is under recoil spring tension, be careful not to trip ratchet when connecting hose as a sudden release of spring tension could cause serious injury.

- (9) Attach discharge hose to reel, wire cam handles flat on hub coupling, pull outward on hose, and release reel to rewind hose. Cam lever handles on pump inlet must be wired flat against the coupling.



- | | |
|-------------------------|--------------------|
| 1. Nut, plain, hex | 11. Strike |
| 2. Washer, lock | 12. Rivet, solid |
| 3. Washer, flat | 13. Rivet |
| 4. Screw, machine | 14. Hinge |
| 5. Loop, strap fastener | 15. Door |
| 6. Strap | 16. Seal, rubber |
| 7. Can, gasoline (GED) | 17. Seal, rubber |
| 8. Rivet | 18. Box, storage |
| 9. Latch | 19. Bushing, brass |
| 10. Rivet | 20. Bearing, ball |

Figure 5-11. Pump Unit Frame.

Pages 5-24 through 5-26, including Figure 5-12, have been deleted.

5-12. DISPENSING VALVE ASSEMBLY

NOTE

For removal see para 4-20.

a. Disassembly. (figure 5-13)

(1) Remove screen (1) and eyenut (2). Loosen setscrews (3) to release bonnet (4) and remove bonnet.

(2) Remove spring (5), stem (6), retainer (7), disk (8) and nut (9).

b. Cleaning and Inspection.

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, (Item 1, App. E) and dry thoroughly.

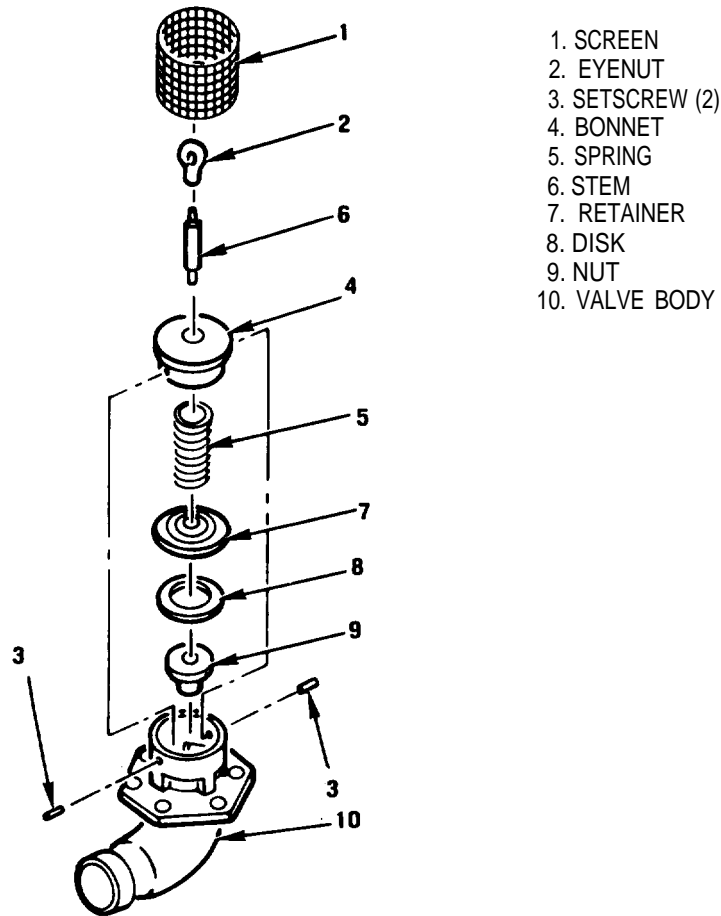
(2) Inspect all parts for cracks, breaks, or other damage. Replace a defective part. Replace all gaskets and packing, as necessary.

c. Reassembly. (figure 5-13)

(1) Assemble nut (9) disk (8), retainer (7), spring (5) and bonnet (4) together by compressing spring and securing in valve body (10) with setscrews (3).

(2) Attach stem (6) and eyenut (2).

(3) Install screen (1) before installing valve on tank.



- 1. SCREEN
- 2. EYENUT
- 3. SETSCREW (2)
- 4. BONNET
- 5. SPRING
- 6. STEM
- 7. RETAINER
- 8. DISK
- 9. NUT
- 10. VALVE BODY

Figure 5-13. Dispensing Valve,

5-13. TANK ASSEMBLY: GENERAL

The tank and its components (figure 5-14) must be cleaned before any repair is initiated. Each time a component is removed for repair, inspection, or other service; it must be cleaned thoroughly. Make certain every safety precaution is taken prior to attempting any repair on a 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 tetraethylene deposits, causing toxic fumes.

5-14. TANK ASSEMBLY: 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).**
- **Trisodium-Phosphate is a strong caustic material. Avoid skin contact and protect eyes. Have water available to flush eyes if any trisodium phosphate is splashed into them.**
- **Tanks used for flammable liquids must be purged in accordance with the safety precautions set forth in this paragraph before welding.**

a. **Cleaning Exterior.** Wash all exterior metal surfaces with a solution of trisodium-phosphate (Item 8, App. E) and water; rinse thoroughly and dry. Parts removed during disassembly may be cleaned by immersing in or wiping with drycleaning solvent (Item 1, App. E).

b. **Cleaning.**

(1) **Materials required.**

- (a.) Adequate water supply with a large diameter hose long enough to reach the vehicle or tank.
- (b.) Compressed air supply and air hose of sufficient length to reach the depth of the tank.
- (c.) A sufficient quantity of suitable detergent solution (Item 4, App. E).

(2) **Safety precautions.**

(a.) The tank being purged must have a static ground during all operations. Caution should be taken with all tools and metal objects around the tank to ensure no spark will be made.

(b.) Conduct a combustible vapor test reading prior to purging the tank using an explosive meter.

(c.) Only competent personnel, thoroughly instructed in the proper handling and reading of the explosive meter will conduct vapor tests.

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

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

(f.) Eliminate conditions that could cause explosions.

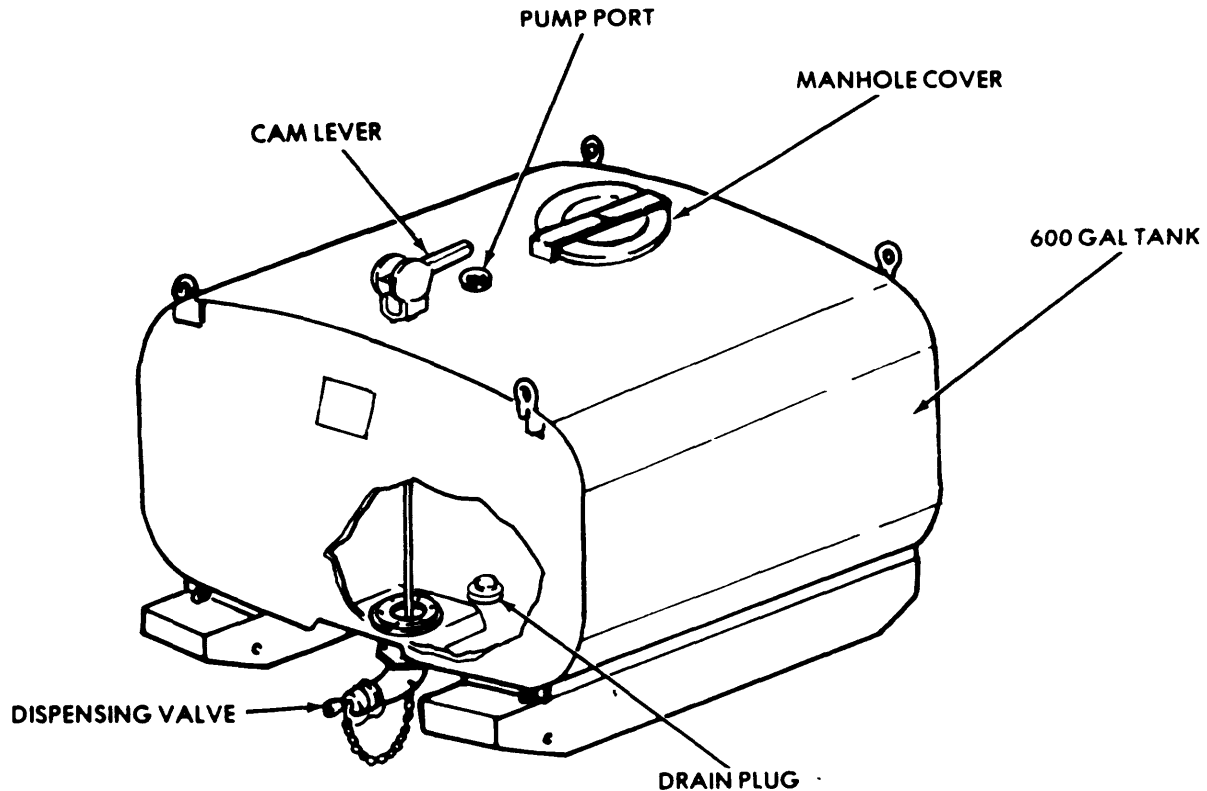


Figure 5-14. Tank Assembly.

(3) Safety precautions for personnel.

- (a.) Personnel engaged in purging operations will not wear wool, nylon, silk, rayon or other similar static electricity generating clothing.
- (b.) Clean cotton clothing with no metal buttons or fittings will be worn. All contents will be removed from pockets.
- (c.) Rubber boots will be worn.
- (d.) Cotton rags will be used for cleaning. Material that may generate static electricity will not be used.

(4) purging procedures.

- (a.) Completely drain all liquid from the tank to be purged. Be sure the drained liquid is removed from the area where work will be performed. Remove all flammable liquid from the floor and liquid-soaked waste from the area.
- (b.) Remove all accessory items that might entrap liquid and close or seal all drains.
- (c.) Fill the tank and overflow with cold water for five minutes. Drain the tank completely.

(d.) Conduct a combustible vapor test reading to determine if the tank is safe to repair. If combustible vapor test reading indicates tank is not safe, repeat procedure of subparagraph (C).

c. Inspection of the Tank Assembly.

(1) Check the tank for the condition of the paint.

(2) Check the tank for dents that require repairs. Check dents on welds for breaks in the weld seam. Check for any damage or wear that has caused a rupture or leak.

(3) Check the interior of the tank for general cleanliness and the presence of contaminants.

WARNING

When using compressed air, wear safety goggles or glasses and ensure air blast is not directed at another person. Do not direct compressed air against the skin.

(4) When testing tank, completely dry and clean the interior and exterior of the tank of all foreign matter. When the tank is completely dry and clean, close all openings such as valves and fill cap, plug and fill cap vent, and subject the tank to a constant internal air pressure of 3 to 5 pounds per square inch gage (PSIG). Spray liquid detergent conforming to P-D-223 over the entire exterior surface of the tank at a pressure of not less than 70 PSIG (hand sprayer). Applying the liquid detergent by brush or other means is not acceptable. Observe the exterior of the tank. Leaks as evidenced by fizzing or bubbling of the liquid detergent, surface rupture, deformation, or broken hardware shall constitute failure.

d. Repair of the Tank Assembly.

WARNING

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

(1) Repair all dents, cracks, breaks, and holes in the tank. Weid ruptured weld seams and other damage. Replace badly damaged parts.

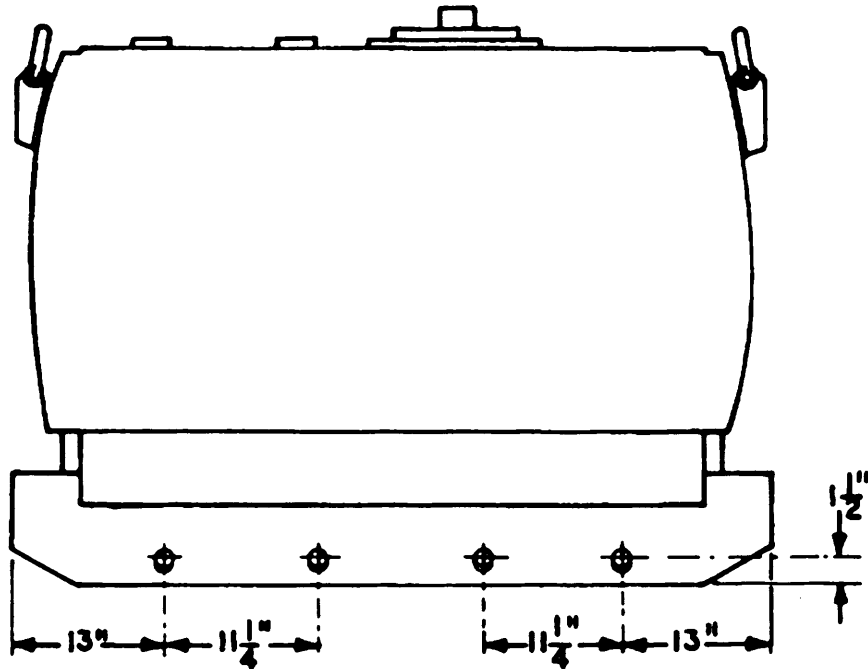
WARNING

When using compressed air, wear safety goggles or glasses and ensure air blast is not directed at another person. Do not direct compressed air against the skin.

(2) No repair will be initiated on the tank until it has been thoroughly vented and cleaned. Before attempting to do any welding repair on the tank, drill four 1-½ in. dia. drain holes in each skid (total of 8 holes required). For the location of drilling points, see figure 5-15. Provide corrosion protection to drilled holes and leave open. 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, sealing all holes in skid except one and applying compressed air (not

to exceed 30 PSI) to remaining skid hole. Observe interior of tank for bubbles. Observe necessary precautions and weld damaged area in accordance with standard techniques.

(3) After tanks have been repaired, cleaned, and dried, exteriors will repainted with one coat of rust-inhibiting enamel and one coat of alkyd enamel. Refer to MIL-STD-704R for painting guidelines.



DRILL $1\frac{1}{2}$ " DIA. HOLES ON OUTSIDE OF EACH SKID (AT AN ANGLE SEE CROSS SECTION), LOCATED AS INDICATED (A TOTAL OF 8 HOLES).

SKID CROSS SECTION



Figure 5-15. Tank Assembly, Skid Drain Holes.

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 Heating

A-2. LUBRICATION

C9100-1L	Identification List for Fuels, Lubricants, Oils and Waxes
LO5-2805-257-12	Engine, Gasoline, 3 Hp Military Standard Models (Model 24016-1) (Model 2A016-2) (Model 2A016-3)

A-3. PAINTING

MIL-STD-704R	Treatment and Painting of Material
TM 9-213	Painting Instructions for Field Use

A-4. MAINTENANCE

TB ORD 1047	Eliminating Combustibles From Interiors of Metal or Plastic Gasoline or Diesel Fuel Tanks
FM 10-20	Military Petroleum Pipelines, Tanks, and Related Equipment
FM 10-68	Aircraft Refueling
FM 10-69	Petroleum Handling Equipment Operations
DA PAM 738-750	The Army Maintenance Management System
TM 5-2805-257-14	Operator, Organizational, Intermediate (Field) (Direct and General Support), and Depot Maintenance Manual; Engine, Gasoline, 3 Hp, Military Standard Models (Model 2A016-1, NSN 2805-00-601-5127) (Model 2A016-2, NSN 2805-00-714-8553) (Model 2A016-3, NSN 2805-00-072-4871).
TM 5-2805-257-24P	Organizational Intermediate (Field) Direct and General Support and Depot Maintenance Repair Parts List: Engine, Gasoline, 3 Hp, Military Standard Models (Models 2A016-1. NSN 2805-00-601-5127) (Model 2A016-2 NSN 2805-00-714-8553) (Model 2A016-3, NSN 2805-00-072-4871) SL-4-03521A; to 38G2-103-4.
TM 5-4930-230-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools Lists: Tank and Pump Unit, Liquid Dispensing for Truck Mounting (All Makes and Models).

A-5. RADIO INTERFERENCE SUPPRESSION

TM 11-483 Radio Interference Suppression

A-6. SHIPMENT AND STORAGE

TM 740-90-1 Administrative Storage of Equipment

TM 38-230-2 Preservation, Packaging, and Packing of Military Supplies and Equipment
(Packing)

A-7. DEMOLITION

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

APPENDIX B**MAINTENANCE ALLOCATION CHART****Section 1. INTRODUCTION.****B-1. GENERAL**

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

b. The Maintenance Allocation Chart (MAC) in section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS

Maintenance functions will be limited to and defined as follows:

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

b. Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

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

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

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

B-2. MAINTENANCE FUNCTIONS - Continued

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

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

i. Repair. The application of maintenance services¹ or other maintenance actions² to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

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

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see paragraph C-2.)

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field

¹Services - inspect, test, service, adjust, align, calibrate, or replace.

²Actions - welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II - Continued

operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

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

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF REFERENCE CODES, SECTION IV

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

APPENDIX B

Section II. MAINTENANCE ALLOCATION CHART, TANK AND PUMP UNIT.

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
01	Pump Unit								
0101	Hoses, Pump Outlet to Filter Separator	Inspect		0.2				3	A, B
		Replace		0.5					
	Hose, Dispensing	Inspect		0.2				3	A, B
		Replace		0.2					
Hoses, Tank to Manifold	Inspect		0.2				3	A, B	
	Replace		0.2						
0102	Hoses, Pump Inlet to Manifold	Inspect		0.2				3	A, B
		Replace		0.5					
	Pump Assy. (GED) (For Gas Engine Repair See TM5-2805-257-14)	Inspect		0.5					K
		Replace		1.0				3	G
Service	Inspect		2.0				2,3	D	
	Repair			16.0			1,4	G	
Elbows and Tee Inlet and Outlet	Inspect		0.2					3	A, G
	Replace		0.4						
Pump Centrifugal	Inspect	Inspect		0.5				3	K
		Replace			2.5			1, 4	
	Repair			8.0			1, 4	G	
Impeller	Inspect				1.0				K
	Replace				2.0		1, 4	G	
Seal Assembly	Inspect				1.0		4	K	
	Replace				2.0		1, 4	G	
Coupling Intermediate	Inspect				0.5			3	A, G
	Replace				1.0				
0103	Pump Assy.(EMD)	Inspect		0.5				3	A, C, F, G, H, I, J, K, L
		Replace		0.5				3	
		Repair			8.0			1, 4	
Elbows and Tee Inlet and Outlet	Inspect		0.2					3	A, G
	Replace		0.4						

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equip- ment	(6) Remarks
			C	O	F	H	D		
0104	Pump Centrifugal	Inspect		0.5					K
		Replace			2.5			1,4	
		Repair			8.0			1,4	G
	Impeller	Inspect			1.0				K
		Replace			2.0			1,4	G
	Seal Assembly	Inspect			1.0				K
		Replace			2.0			1,4	G
	Coupling Intermediate	Inspect			0.5				
		Replace			1.0			1,4	A, G
	Electric Motor	Inspect		0.5					
		Replace			1.5			1,4	
	On-Off Switch	Inspect	0.1						K
	Cable Assembly	Replace	0.1						
		Repair		1.0				2,3	H, I, L
	Intervehicle	Inspect	0.1						K
	Power								
	Cable and Plug	Replace	0.1						
	Assembly	Repair		1.0				2,3	H, I, J, L
	Conduit Assy.	Inspect		0.1					
		Replace		1.0				3	
		Repair		1.0				2	G
	Junction Box	Inspect		0.1					
	Assembly	Replace		1.0				2,3	G
	Repair		1.0				2,3	H, I, L, J	
Relay K1	Test		1.0				2,3	H, I, K, L	
	Replace		1.0				2,3	H, I, K, L	
RF Filter	Test		1.0						
	Replace		1.0						
Filter Separator	Inspect	0.5							
	Replace		1.0				3		
	Repair		2.0	8.0			4	G	
	Service		1.5				3		
Element Filter	Inspect		0.5						
	Replace		0.5					D	
Cover Tank	Inspect		0.2						
	Replace		0.5				3	G	
Coupling, Cover	Inspect		0.2						
	Replace		0.3				3	G	

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks	
			C	O	F	H	D			
0105	Gasket Cover	Inspect		0.1						
		Replace		0.2				3	A, G	
	Canisters	Inspect		0.2						
		Replace		0.5				3	G	
	Retainer	Inspect		0.5						
		Replace		0.5				3	G	
	Drain Cock	Inspect	0.2						K	
		Replace		0.3				3	G	
		Service	0.1						K	
	Sight Gage	Inspect	0.2						K	
		Replace		0.5				3		
		Repair		0.2					G	
	Differential	Inspect	0.1						K	
		Pressure Gage	Replace		0.5			3	G	
	Coupling Quick	Inspect		0.2						
		Disconnect	Replace		0.3			3	G	
	0106	Manifold, Liquid Distribution	Inspect		0.2					
			Replace		1.0			3	A, G	
0107	Reel, Static Discharge	Inspect	0.2	0.5					K	
		Replace					3			
		Repair			1.5		4	G		
0108	Cable	Inspect	0.2						K	
		Replace		0.5			3			
		Repair		0.3			3	G, J		
0109	Nozzle Assembly Fuel Dispensing	Inspect	0.2						K	
		Replace	0.5					A		
		Repair			2.0		4	G		
0110	Reel Assembly Fuel Dispensing	Inspect		1.5					K	
		Replace			2.6		1,4	B		
		Repair			2.0		1,4	G		
0111	Spring Hose Reel	Inspect		0.3						
		Replace			1.5		1,4	M		
0112	Wheel Ratchet	Inspect			0.4					
		Replace			2.0		1, 4	G		
0113	Frame Assy.	Inspect		0.5						
		Replace			4.0		1,4	G		
		Repair			6.0		1,4	E		
0114	Can Gasoline	Inspect	0.1							
		Replace	0.2						G, A	

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category					(5) Tools & Equipment	(6) Remarks
			C	O	F	H	D		
02 0201	Tanks	Inspect		0.2					
		Replace		0.3				3	G
	Lifting Shackles	Inspect		0.2					
		Replace		0.3				3	G
	Tiedown Links	Inspect		0.2					
		Replace		0.3				3	G
	Gasket Fill Plug	Inspect	0.1						
		Replace	0.2					3	A
	Dispensing Valve Assembly	Inspect	0.2						
		Replace		2.0				3	
		Repair			2.0			4	G
	Cam Lever Assy.	Inspect	0.2						
		Replace		2.0				2,3	G
	Tank	Inspect	0.2						
		Replace		1.0				3	
		Repair			4.0			1,4,6	E
	Manhole Cover	Inspect	0.2						
		Replace		0.5				3	K
Repair			0.5				3	G	
Gasket, Manhole	Inspect	0.2							
	Replace	0.2						A	

APPENDIX B

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS
 MAINTENANCE ALLOCATION CHART.

(1) Tool/Test Equip. Ref. Code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO stock number	(5) Tool number
1	F	Shop Equipment, Automotive Maintenance and Repair: Field Maintenance, Basic Less Power (19204)	4910-00-754-0705	SC 4910-95CL-A 31
2	0	Shop Equipment, Automotive Maintenance, and Repair: Organizational Maintenance Common No. 1 Less Power	4910-00-754-0654	SC 4910-95CL-A 74
3	0	Tool Kit, General Mechanics, Automotive	5180-00-177-7033	SC 5180-90-CL-N26
4	F	Tool Kit Master Mechanics	5180-00-699-5273	SC 5180-90-CL-N05
6	F	Tester Combustion Vapor	6665-00-664-4650	

APPENDIX B

**Section IV. REMARKS FOR
MAINTENANCE ALLOCATION CHART.**

Reference code	REMARKS
A	Replace Gaskets
B	Replace Defective Hose Assembly
C	Replace Seal Assembly
D	Replace Filter Elements
E	Weld
F	Insulation Breakdown & Continuity Test
G	Repair by Replacing Defective Components
H	Test for Opens, Grounds, and Shorts
I	Continuity Test
J	Repair by Replacing Defective Wire
K	Operational Test
L	Test for Known Voltage
M	Replace Assembly

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 required 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. If item needed differs for different models of this equipment, the model is shown under "Usable On" heading in this column. These codes are identified as:

<i>Code</i>	<i>Used On</i>
DPF	Model 13217E7130
BXQ	Model 13217E7100

- 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.

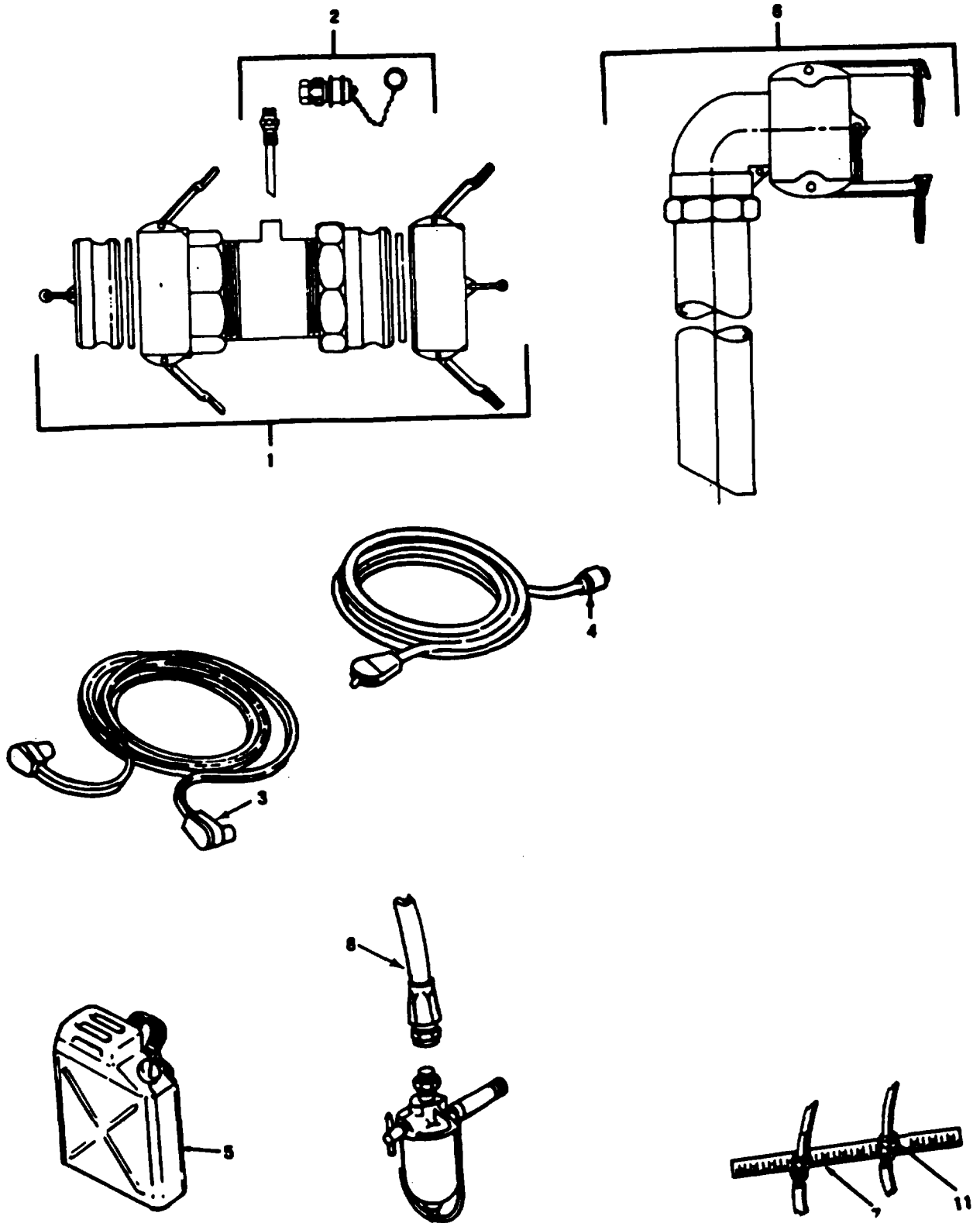


Figure C-1 Components of End Items (Sheet 1 of 2)

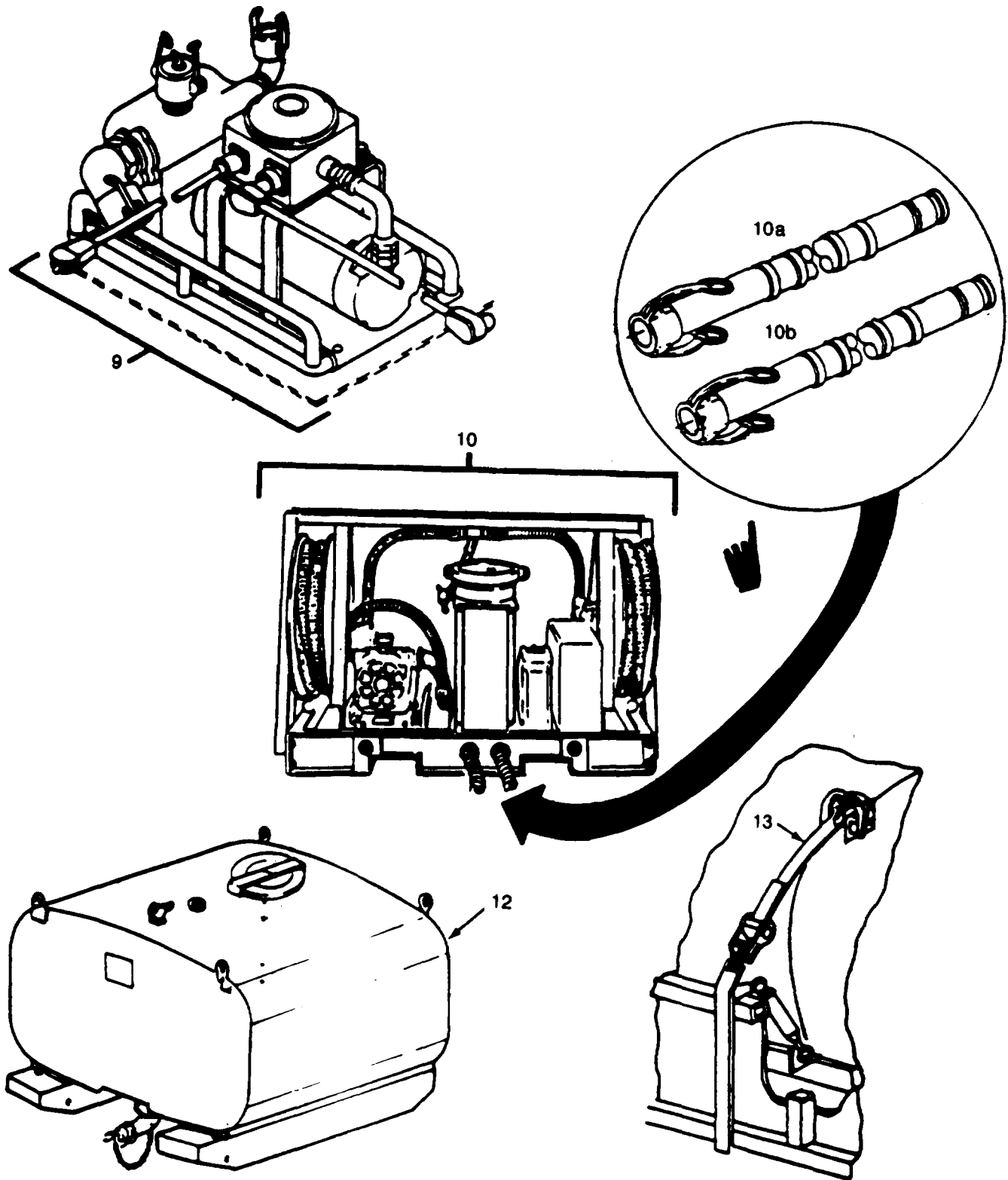


Figure C-1. Components of End Items (Sheet 2 of 2)
C-4 Change 11

APPENDIX C

SECTION II. COMPONENTS OF END ITEMS

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQR
C-1/1	4930-01-159-4437	Adapter Assembly (97403) 13220E9406-3		EA	1
C-1/2	4930-01-169-5287	Probe Assembly, Water Detector (97403) 13220E9914-3		EA	1
C-1/3	6150-01-022-6004	Cable Assembly, Power (19207) 11682336-1	DPF	EA	1
C-1/4	6150-01-191-9732	Cable Assembly, Remote Switch (97403) 13217E2964	DPF	EA	1
C-1/5	7240-00-222-3088	Can, Gasoline (81349) MIL-C-1283	BXQ	EA	1
C-1/6		Drum Unloader, Stub Assembly (97403) 13217E2987		EA	1
C-1/7	5210-01-083-2926	Gage Stick, Petroleum (97403) 13217E7144		EA	1
C-1/8	4720-00-879-4093	Hose Assembly (96906) MS28741-5-0554	BXQ	EA	1
C-1/9		Pump Unit (EMD) (97403) 13217E7105	DPF	EA	1
C-1/10		Pump Unit (GED) (97403) 13217E7110	BXQ	EA	1
C-1/10a	4720-0 1-022-6016	Hose Assembly, Tank to Manifold, 90 inches long M370B06B2A0890		EA	1
C-1/10 b	4720-01-021-2006	Hose Assembly, Tank to Manifold, 26 inches long M370B06B2A0260		EA	1
C-1/11	5340-00-530-5021	Strap Assembly (97403) 13220E5288-2		EA	2
C-1/12	5430-00-585-2529	Tank (97403) 13217E7080		EA	2
C-1/13	3990-01-015-8457	Tie-Down Assembly, Right Side Cargo Truck (97403) 13217E7150		EA	10

APPENDIX C

SECTION III. BASIC ISSUE ITEMS LIST

(1) ILLUS./ ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	(4) U/M	(5) QTY RQR
1	2540-00-670-2459	Bag, Pamphlet	E A	1
2	4210-00-775-0127	Fire Extinguisher Type 2, Class 2w/Bracket	E A	1
3	5975-00-878-3791	Rod, Ground	EA	1
4	2990-00-972-7950	Rope, Starter BXQ	EA	1
5	N/A	Technical Manual TM 5-4930-230-13	EA	1
6	5975-00-924-9927	Drive Head	EA	1

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, MTDE, TDA, or JTA.

D-3. EXPLANATION OF LISTINGS

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. If the item required differs for different models of this equipment, the model is shown under the "Usable on" heading in the description column. These codes are identified as:

<i>Code</i>	<i>Used On</i>
DPF	Model 13217E7130
BXQ	Model 13217E7100

Section II ADDITIONAL AUTHORIZATION LIST

(1) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part Number	Usable on Code	(4) U/M	(5) QTY RQR
1	4240-00-022-2946	Protector, Aural	(BXQ)	PR	1
2		Nozzle Assembly No-Lead MIL-N-52110F (81349) Ty II, SZ2, CLB		EA	1
3		Reducer, External Pipe Thread X Quick Disconnect (1" pipe to 1 1/2" quick disconnect) MS49002-17 (81348)		EA	1
4	5120-01-013-1676	Slide Hammer		EA	1
5	5340-01-004-5180	Padlock, Key Operated		EA	2
6	3990-01-169-5286	Tie Down Assembly Vehicle, (Hinge Side used with 5 ton dropside vehicle)		EA	10
7	5935-00-322-8959	Connector (Prong to NATO Slave cable adapter) 11677570 (19207)		EA	1

APPENDIX E
EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

E-1. SCOPE

This appendix lists expendable 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 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			DELETED	
6	O	3439-01-046-4850	Solder, Tin Alloy (81348) SN60WRAP 2 0.0321	LB
7	O	8030-00-889-3535	Tape Antiseize 11-1/2" X 260" (18876) 11072502 (81349) MIL-T-27730	RL
8	F	6810-00-281-1858	Trisodium - Phosphate (81348) O-S-642D	LB
9	F		Sealing Compound (81349) MIL-S-7916	LB
10	F	6850-00-880-7616	Silicone Compound (81349) MIL-S-8660	EA

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BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
6	2-1 a			<i>In line 6 of paragraph 2-1a the manual states the engine has <u>6</u> Cylinders. The engine on my set only has <u>4</u> Cylinders. Change the manual to show <u>4</u> Cylinders.</i>
B1		4-3		<i>Callout 16 on figure 4-3 is pointing at a <u>bolt</u>. In key to figure 4-3, item 16 is called a <u>shim</u> - Please correct one or the other.</i>
125	line 20			<i>I ordered a gasket, item 19 on figure B-16 by NSN 2 910-05-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a <u>good NSN</u></i>

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PENALTY FOR PRIVATE USE \$300

COMMANDER
US ARMY TROOP SUPPORT COMMAND
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4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



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FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER
TM 5-4930-230-13

PUBLICATION DATE
17 Jul 84

PUBLICATION TITLE Tank and Pump Unit,
Liquid Dispensing;

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
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DA FORM 2028-2
1 JUL 79

PREVIOUS EDITIONS ARE OBSOLETE.
DRSTS-M Overprint 2, 1 Nov 80.

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

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

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

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	square kilometers	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F Fahrenheit temperature 5/9 (after subtracting 32) Celsius temperature °C

PIN: 005969-000