TECHNICAL MANUAL

OPERATOR'S, UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

SEMITRAILER, TANK: 5000 GALLON,
(POTABLE WATER DISPENSING)
XM1098 (NSN 2330-01-330-2779)

Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY SEPTEMBER 1993

FOR FIRST AID INFORMATION, REFER TO FM 21-11.

WARNING

If incorrectly used, this equipment can cause severe injury or death. Those who use and maintain the equipment should be trained in its proper use and warned of its dangers. Read manual before attempting to set up, operate, adjust, or service the equipment.

WARNING

Frequent inspection of equipment, safety devices, and working areas must be performed to ensure personal and operational safety and to correct potential or actual hazards.

WARNING

The semitrailer must not be operated if any of the following conditions exist:

- Damage to lighting fixtures, wiring, or electrical conduits or lights inoperative.
- Damage to towing vehicle or semitrailer.
- Primary or parking brake systems inoperative.
- Vents plugged, inoperative, or removed. Pressure and vacuum vents are installed to meet code requirements and protect the semitrailer from damage. A plugged or inoperative vent cause extensive shell damage if design pressure or vacuum, is exceeded.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes with water and get medical aid.

WARNING

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). Wear protective clothing (goggles and gloves) and use caution to avoid injury to personnel.

WARNING

Carbon monoxide can be deadly. DO NOT operate engine in an enclosed area unless it is adequately ventilated. Carbon monoxide is a colorless, odorless, and deadly poisonous gas which occurs in the exhaust fumes of the auxiliary power engine. Exposure to air contaminated with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and coma. Permanent brain damage or death can result from severe exposure to carbon monoxide gas.

WARNING

DO NOT allow Diesel Engine Injector nozzle spray to contact skin. Diesel fuel under pressure can penetrate flesh and cause serious injury and infection.

WARNING

Run engine on diesel fuel only. Use of gasoline can cause an explosion, causing death or injury to personnel and damage to equipment.

WARNING

Be careful when removing the impeller from the centrifugal pump. The spring load on the mechanical seal may cause the impeller to fly off the shaft as it is being removed, causing serious injury to personnel.

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

WARNING

Run engine on diesel fuel only. Use of gasoline can cause an explosion, causing death or injury to personnel and damage to equipment.

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No. 9-2330-388-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 1 September 1993

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is for your use in operating and maintaining the M1098 5000 gallon potable water tank dispensing semitrailer. The water tanker engine and dispensing equipment are unique in Army applications to this vehicle. It also includes references, components of end item lists, an additional authorization list, a maintenance allocation chart, and an expendable supplies and materials list.

1-2. Maintenance Forms and Records

Equipment maintenance forms and procedures for their use are contained in DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. Preparation for Storage or Shipment

For information on preparing the M1098 water tank semitrailer for storage or shipment, refer to chapter 4 Section XX.

1-4. Destruction of Army Materiel to Prevent Enemy Use

Refer to TM 750-244-6 for information and instructions on destroying this equipment.

1-5. Reporting of Equipment Improvement Recommendations (EIRs)

If your semitrailer needs improvement. let us know. Send us an EIR. You, the user, are the only one who can tell is what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (quality deficiency report). Mail it to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MP, Warren, MI 48397-5000. A reply will be furnished to you.

1-6. Quality Assurance/Quality Control (QA/QC)

Quality assurance inspections shall be performed in accordance with requirements in TM 750-245-4.

Section II. DESCRIPTION AND DATA

1-7. Description, Fig. 1-1.

a. Basic Configuration The trailer is designed to be towed by a truck tractor equipped with a fifth wheel. Authorized 5-ton truck tractors are the M52A2, M818, M931, M931A1, M932, and M932A1. When driving on hard surface highways only, the 5-ton military-adapted commercial 6X4 truck tractors, M915 and M915A1, are also authorized.

b. Common Operations The M1098 water tank semitrailer can be loaded through the bottom or through the top fill opening. The potable water tank is also designed to provide self-load/unload capability to load through a one-cylinder, four-stroke diesel engine, and unique pump assembly.

c. Construction The trailer has a stainless steel, single compartment baffled tank of 5000 gallon capacity, plus 3% capacity for product expansion. The chassis is constructed of welded steel and is equipped with full floating tandem axles and manually operated landing gear.

d. M 1098 Water Tank Semitrailer The M1098 water tank semitrailer is equipped with pressure and vacuum vents, hose troughs, sealed manhole, bulk hoses, and spare tire. A ladder is provided at the rear of the semitrailer for access to the top manhole. It has an engine/pump combination unique to the water tank. The one-cylinder, four stroke diesel engine, rated at 10 HP, and centrifugal pump are the major pumping components. At maximum engine horsepower, the self-priming pump has a performance rating of 250 gpm at 15psi and 50 gpm at 96 psi.

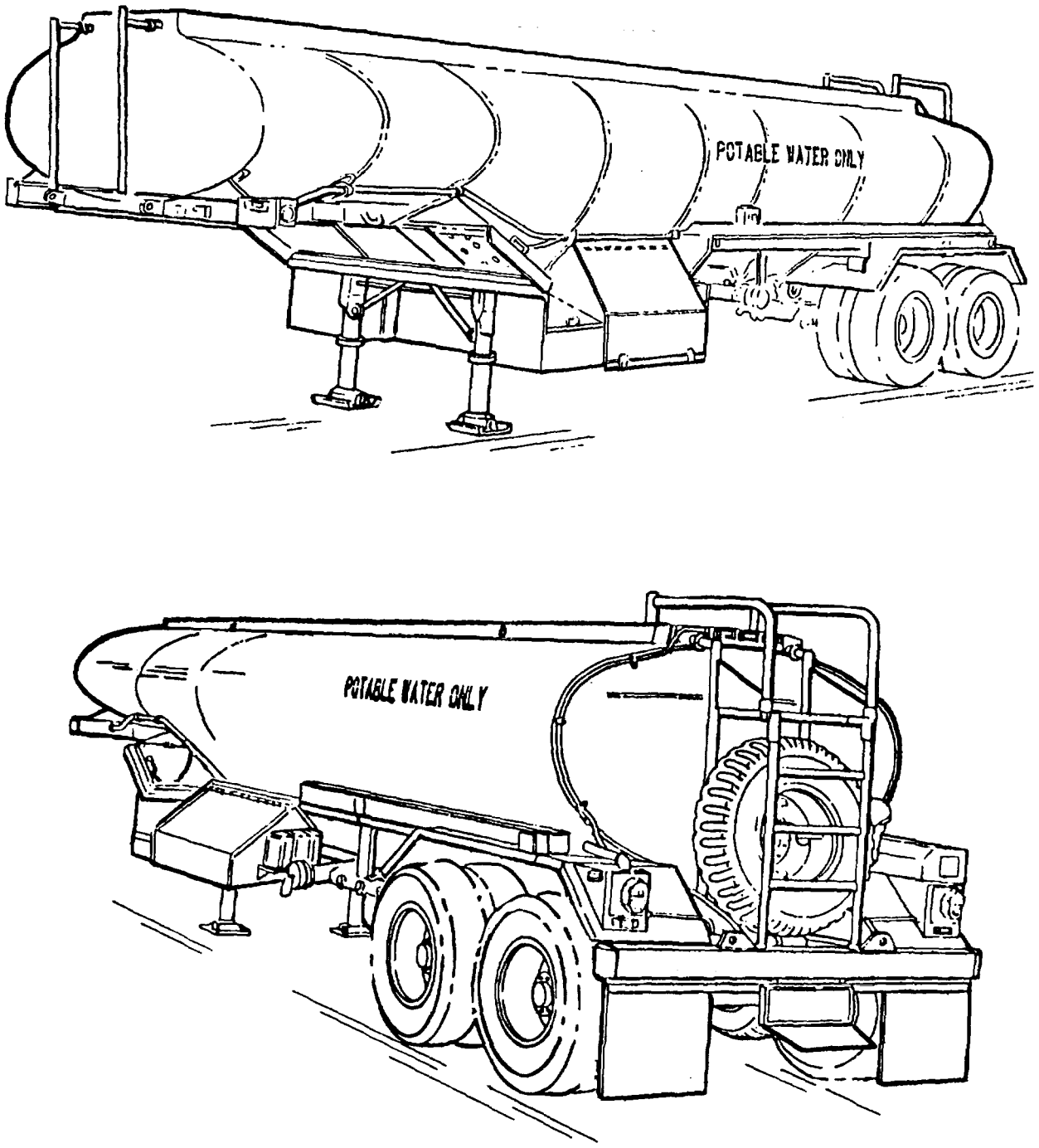


Figure 1-2. M1098 Water Tank Semitrailer, Left Front and Rear Views

1-8. Tabulated Data

Angle of departure ..... 60°

Bridge Classification:
- Empty weight with tractor ..... Class. 14
- Empty weight without tractor ..... Class. 30
- Cross-country loaded without tractor ..... Class. 18
- Highway load with tractor ..... Class. 30
- Highway loaded without tractor ..... Class. 22

Capacities of Tank (Vehicle Capacity):
- Hard surface road and cross-country ..... 5000 gal.
- 20% maximum side slope without leakage ..... 5000 gal.
- 10% maximum longitudinal slope without leakage ..... 5000 gal.

Center of Gravity:
- Empty (vertical) ..... 54 in.
- Empty (horizontal from kingpin) ..... 198 in.
- Loaded (vertical) ..... 66.5 in.

Loaded (horizontal from kingpin) ..... 170 in.

Dimensions Overall:
- Height ..... 104 in.
- Length ..... 368 in.
- Width ..... 96 in.
- To outside of tires ..... 98 in.
- Weights:
  - ..... Empty: 12,960 lb
  - ..... Loaded: 54,460 lb

Kingpin Location, Fig. 1-3.
- From front left side of tank ..... 17 in.
- T landing gear to Kingpin (center to center) ..... 80 in.

Portable Fire Extinguisher:
- Type ..... Purple -K, dry chemical
- Size ..... 10 lb.
- No. per vehicle 1

Tires:
- Quantity (including spare) 9
- Type ..... Military non-directional, cross-country
- Size ..... 11.00 X 20-12 ply rating

Tube equipped ..... Yes

Tire Pressures:
- Cross-country and sand ..... 35 psi, 20mph max.
- Hard Surface ..... 70 psi Highway to 65 mph
- Towing Facility ..... Kingpin

Towing Vehicle (Prime Mover):
- 5-ton ..... M52A2, M818, M931, ... M931A1, M932, and M932A1
- 10-ton (hard surface highway only) ..... M915 and M915A1

Track
- (Center to center of dual wheels ..... 72in.

Transfer Hose:
- Type ..... Flexible
- Storage ..... Trough

Axles and Suspension:
- Axle Model Number A21T-7CT7R-DW10A
- Capacity ..... 25,000lb. Suspension
- Model Number H900-50
- Type ..... Tandem overslung axle

Springs:
- Type ..... Semi-elliptic multi-leaf
- Shaft ..... Semi -elliptic

Brakes:
- Quantity ..... 4 Sets
- Type ..... Fail-safe
- Actuation ..... Full air "S"-type cam
- Operating pressure ..... 75-95 psi

Electrical System - Engine:
- Type ..... 12V direct current
- Alternator ..... Combination with Starter & Stator
- Battery 12V

Electrical System - Vehicle:
- Voltage ..... 12V & 24V

Lamps
- Clearance lights ..... 3 CP
- Taillights(service) ..... 3 CP
- Taillights (blackout) ..... 3 CP
- Stoplights (service) ..... 32 CP

Engine (ACME MOTOR)
- Type ..... 1 cyl, 4-stroke cycle, diesel, air-cooled
- Model ..... ADN 43 W
- Horsepower 10
- Bore ..... 85 MM
- Stroke ..... 75 MM
- Oil Capacity Crankcase:
  - Without filter change (quarts) .....
  - With filter change (quarts) ..... 1.5 litre (.40 gal)
- Displacement ..... 426 cu. cm., 26.0 cu. in
- Peak RPM 3600

Throttle Control; Stop Lever
- Operation ..... Hand Operated
- Type ..... Cable, Flexible
- Type ..... Push-pull w/locking handle

Engine Air Cleaner:
- (Air-flow) ..... Dry Type, Replaceable Element

1-8. Tabulated Data (cont'd)

Dispensing Hose
- Length ..... (Each)1680 in.
- Quantity 2
- Nominal Size ..... 2 in. and 4 in

Bulk Servicing Hose:
- (Two w/male and female connectors, One w/female connector, both ends)
  - Length ..... (1) 165 in. (2) 168 in
  - Quantity 3
  - Nominal Size ..... 4 in

Landing Gear:
- Type ..... Vertical support w/foot pads
- Operation ..... Hand crank, two-speed

Pump (3 in. Hale Type, Model 30 FB)
- Type ..... High pressure, centrifugal
- Drive ..... Shaft from engine

Emergency Valve Control:
- Type ..... Full release
- Control ..... Flexible Cable

1-9. Identification and Instruction Plates (Fig. 1-2 through 16)

a. Vehicle Identification Plate. Plate is mounted on frame on left side and near the front of vehicle. It identifies vehicle model, weight, dimensions, vehicle identification number, and contract number.

b. D.O.T. Data Plate. Plate is mounted on front frame on the right side between the service brake coupling and the front marker light. It identifies manufacturer's serial number, D.O.T. (Department of Transportation) specifications, shell material, welding specification, and lining.

c. Tire Pressure Plate. Plate is mounted on left side of vehicle on frame between and above two tanker axles. It identifies tire pressures for highway and sand driving conditions.

d. Nuclear, Biological, Radiological (NBC) Plate. Plate is mounted of front cover of water dispensing unit on left side of vehicle. It warns "If NBC exposure is suspected, all air filter media will be handled by personnel wearing full NBC protective equipment. See operator/ maintenance manuals."

e. Transportation Plate. It is mounted on left side of vehicle on front lower panel of tool box below latch. It provides tiedown information for rail or air shipment.

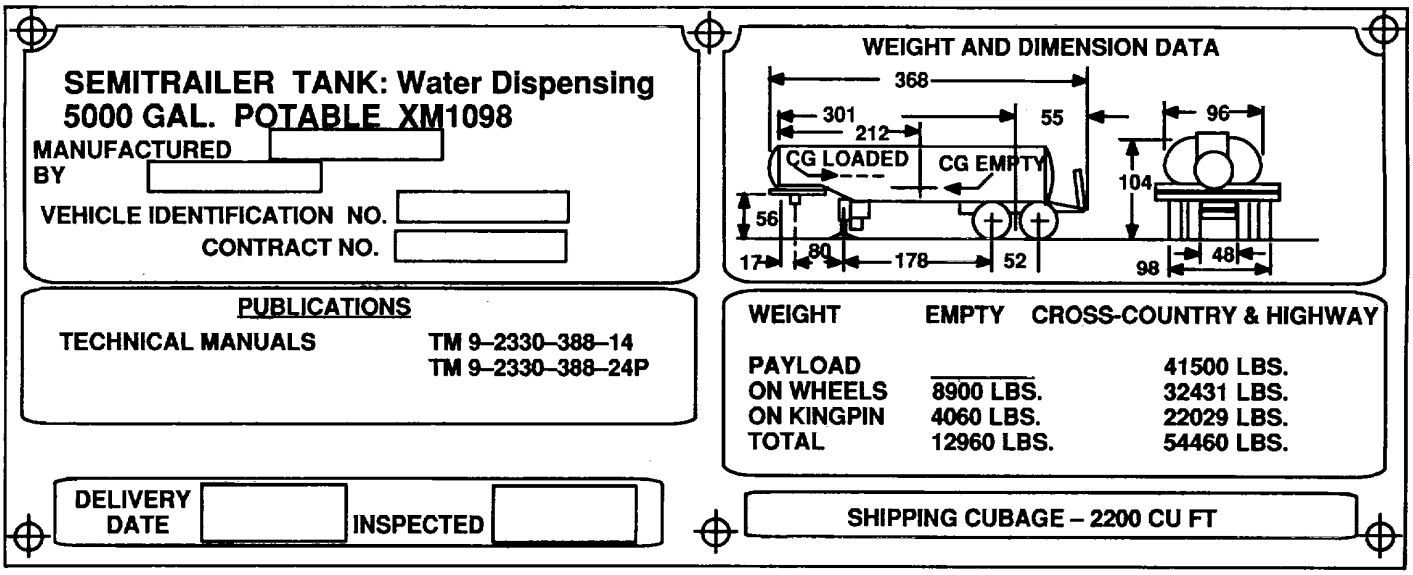


Figure 1-3. Identification Plate

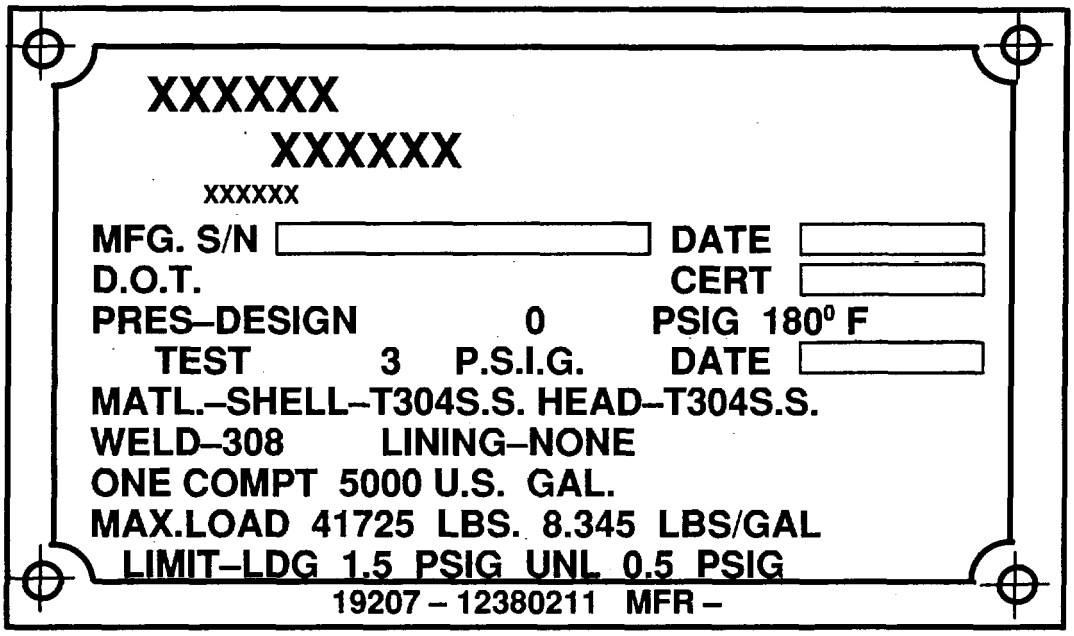


Figure 1-4. Department of Transportation (DOT) Transportation Data Plate

Figure 1-5. Nuclear, Biological, Chemical (NBC) Warning Plate

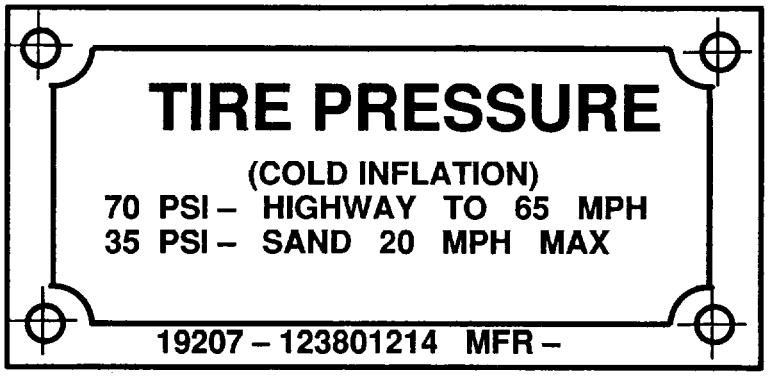


Figure 1-6. Tire Pressure Plate

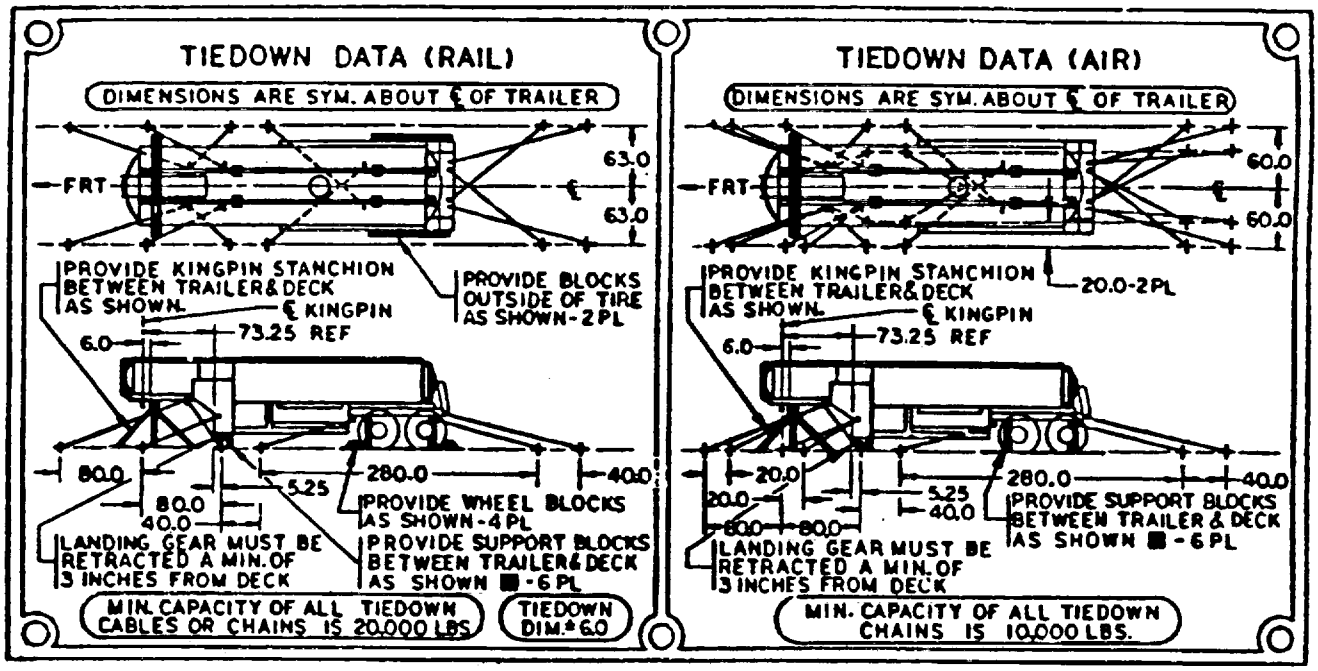


Figure 1-7. Transportation Plate

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. MOVING AND STATIONING THE WATER TANK SEMITRAILER

WARNING

If Incorrectly used, this equipment can cause severe Injury or death. Those who use and maintain the equipment should be trained in its proper use and should read the entire manual before attempting to set up, operate, adjust, or service the equipment.

2-1. General

This chapter contains three sections that cover the following topics in order: 1. Moving and Stationing the M1098 Water Tank Semitrailer; 2. Operation of auxiliary equipment; 3. Tanker Operation Under Unusual Conditions.

Section II provides operator/crew instruction for operation and proper use of the M1098 water tanker semi-trailer.

2-2. Before-Operation Service

WARNING

Frequent inspection of equipment, safety devices, and working areas must be performed to ensure personal and operational safety and to correct potential or actual hazards.

The semitrailer must not be operated if any of the following conditions exist:

a. Damage to lighting fixtures, wiring or electrical conduits, or lights Inoperative.

b. Damage to towing vehicle or semitrailer.

c. Primary or parking brake systems inoperative.

d. Vents plugged, Inoperative, or removed. Pressure, vacuum and vents are installed to meet code requirements and to protect the semitrailer from damage. A plugged or inoperative vent can cause extensive shell damage if design pressure or vacuum Is exceeded.

a. This is a brief service to make sure that the semitrailer is ready for operation, and that conditions affecting the semitrailer's readiness have not changed since the previous after-operation service. The before-operation services specified in table 3-1, Operator/ Crew Preventive Maintenance Checks and Services, Chapter 3, must be performed before using the semi-trailers.

b. You must follow approved practices and precautions. A detailed study of Section III, Tanker Operation Under Unusual Conditions, is essential for use of this material under unusual conditions.

2-3. Coupling Semitrailer to Towing Vehicle (Figs. 2-1 through 2-3)

a. Back the towing vehicle slowly to the front of the semitrailer. Maneuver the towing vehicle so that the kingpin on the semitrailer is in line with the fifth wheel jaws on the towing vehicle. Before the upper coupler (kingpin) plate of the semitrailer starts to ride on the fifth wheel of the towing vehicle, stop the towing vehicle. Make sure the kingpin and the fifth wheel are properly aligned. Do not ram tractor into semitrailer pick-up plate. You may need to raise or lower the landing legs to align the level of the semitrailer kingpin plate with the tractor fifth wheel. Back towing vehicle under upper coupler (kingpin) plate until the kingpin and fifth wheel hook automatically. Make sure the kingpin and fifth wheel are engaged and locked.

b. Remove dummy couplings from the service air couplings and emergency air couplings, fig. 2-1. Couple the towing vehicle air line marked SERVICE, and the air line-marked EMERGENCY to the semitrailer coupling bearing a like tag.

CAUTION

Proper operation of semitrailer primary brake system is essential for safe operation of vehicle and must be maintained. Functional system check is necessary before putting trailer into service. Semitrailer parking brakes are provided to maintain braking and holding requirements whether semitrailer is fully loaded or empty. The system will automatically apply the parking brakes when air pressure in primary reservoir falls below specified pressure.

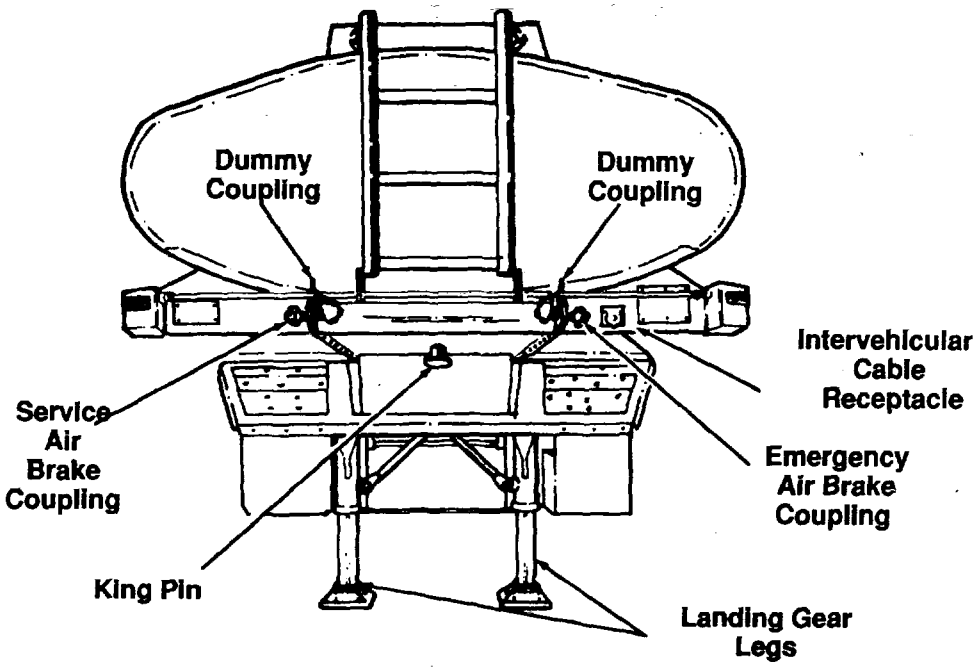


Figure 2-1. Connections Used in Coupling Semitrailer to Towing Vehicle

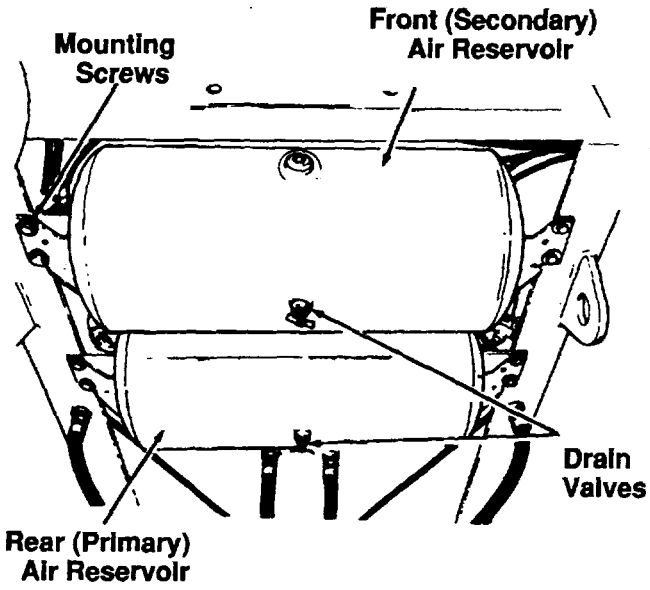
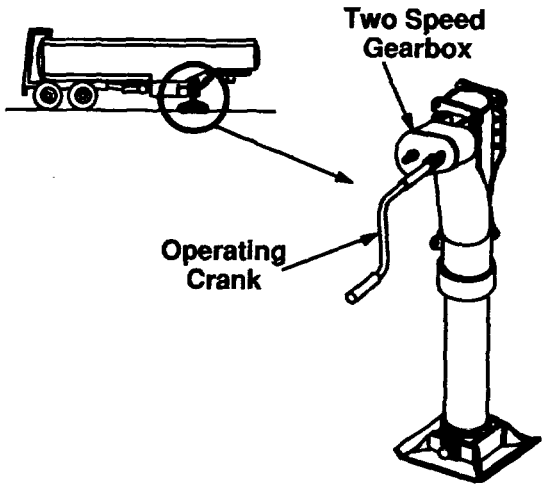


Figure 2-2. Drain Valves on Air Reservoirs



1. Push Crank IN for low speed operation.
2. Pull crank OUT for high speed operation.
3. Rotate crank counterclockwise to lower landing gear legs.
4. Rotate crank clockwise to raise landing gear legs.

Figure 2-3. Operation of Two-Speed Landing Gear.

1. Push crank IN for low speed operation.

2. Pull crank OUT for high speed operation.

c. Close the drain valves on front and rear reservoir tanks, fig. 2-2. Open the shut-off valves on the air lines of the towing vehicle.

d. Plug the intervehicular cable into receptacle, fig. 2-1. Operate lights from towing vehicle to make sure that all semitrailer lights are working properly.

e. Release the landing gear operating crank from its clip and engage the crank on its shaft, fig. 2-3. When there is no load, pull out on the crankshaft to engage high-speed gears for fast raising or lowering of the telescoping legs. When greater power is needed, push in on the operating shaft to engage the low-speed gears to lower or raise the legs. Rotate the crank clockwise to raise the landing gear legs. Replace crank in clip.

3. Rotate crank counterclockwise to lower landing gear legs.

4. Rotate crank clockwise to raise landing gear legs.

f. If coupling to an M931A1 or M932A1 towing vehicle, secure sand shoes in a swing-a-way position rearward to the semitrailer, using chain assembly provided.

g. If ground boards were used, stow them in their brackets at each side of semitrailer.

2-4. Manual Release of Fail-Safe Brake

Manual Release - Caging - fig. NO TAG To manually release the fail-safe brakes when no air is available use the following procedures:

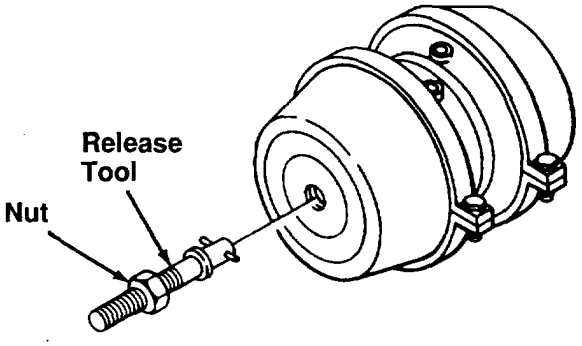


Figure 2-4. Manual Release of Fail-Safe Brake

(1) Block wheels to prevent semitrailer movement.

(2) Remove nut and the release tool from mounting hole in the fail-safe unit.

(3) Remove plug.

(4) Insert the release tool into the hole and turn 1/4-turn to seat release tool in pressure plate.

(5) Install nut on release tool, and tighten until 2-1/2 to 2-3/4 inches of release tool is exposed.

(6) Repeat steps (2) through (5) for remaining fail-safe units.

(7) As soon as air is available to refill the reservoirs, remove the release tool and nut from each of the four fail-safe units, and install in mounting hole. Install plugs in place.

2-5. Operating Towing Vehicle With Semitrailer Coupled

a. Driving. The overall length of the towing vehicle and semitrailer must be kept in mind when passing other vehicles and when turning. Because the unit is hinged in the middle, turning and backing are affected. The surge of the load also affects stopping.

c. Stopping. In normal operation, the brakes of the towing vehicle and those of the semitrailer are applied at the same time. Brake pressure should be applied gradually and smoothly. On steep grades and slippery surfaces, the semitrailer brakes should be applied first; then the brakes of the towing vehicle should be applied. This procedure will reduce the possibility of the semitrailer "jack-knifing".

CAUTION

Never use the air brakes on the semitrailer when parking if the brake drums are hot. The brake drums will contract (shrink) as they cool and may crack as the applied brakes prevent normal contracting.

d. Parking. When the towing-vehicle-with-semitrailer combination is to be parked and left unattended, set the emergency control valve.

2-6. Uncoupling Semitrailer From Towing Vehicle

a. If the semitrailer is to be uncoupled in mud, sand, or snow, or if the towing vehicle is an M931A1 or M932A1, position ground boards approximately centered beneath landing gear shoes.

b. Close shut-off valves on the service and emergency air lines at the rear of the towing vehicle. Uncouple the two air brake hoses from the air brake hose couplings on the semitrailer, fig. 2-1. The semitrailer brakes will set automatically when the emergency air

brake hose is uncoupled. Fit dummy couplings on semitrailer air brake hose couplings. Open drain valves on front and rear reservoirs, fig. 2-2.

c. Disconnect intervehicular cable from receptacle on semitrailer, fig. 2-I.

d. If sand shoes are secured in a swing-a-way position rearward to the semitrailer, release chain assembly.

e. Release the landing gear operating crank from its clip, fig. 2-3. Engage crank on shaft, and rotate the crank counterclockwise to lower the landing gear until the foot pads are firmly on either the ground or the ground board, para NO TAG Replace the crank in its clip and secure.

f. Release the semitrailer kingpin from the towing vehicle's fifth wheel hook by pulling out on the lockjaw handle. If the hook is binding and will not release, pull the hook handle harder to force release. Drive the towing vehicle forward until the semitrailer is disengaged from the towing vehicle and is resting on its landing gear.

2-7. Jacking Procedures

A jack is not part of the on-vehicle equipment. If you have to change a flat during operations, use the towing vehicle jack. Place jack under axle on side of semitrailer with the flat tire. Jack up axle until both tires on that end of axle clear the ground, para 4-51. Replace flat tire and wheel with spare tire and wheel. When lug nuts have been put on and tightened, lower wheels and remove jack. Recheck lug nuts for tightness, and stow jack in towing vehicle.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-8. General Instructions

a. The engine control panel for M1098 is located on the roadside of the semitrailer. Control functions and gage readings are explained in the following paragraphs.

b. Emergency Valve Operation. The emergency valve controls the tank outlet, fig. 2-5. The emergency valve is mechanically operated by a lever in the piping control assembly. Engaging the lever opens the emergency valve to permit water flow to/from the tank sump. At the same time, the vent at the top of the tank opens to relieve pressure/vacuum during loading/unloading.

(1) The emergency valve must be open for all loading/unloading operations except top loading.

(2) In an emergency, close the emergency valve by disengaging operator handle.

b. Turning. When turning corners, remember that the semitrailer has a shorter turning radius than the towing vehicle. To make a right turn at a road intersection, the towing vehicle must continue forward to about the center of the crossroads, and then turn sharply to the right to allow for the shorter turning radius of the semi trailer. To back the semitrailer to the right, turn the steering wheel of the towing vehicle to the left or counterclockwise. The front of the semitrailer will be pushed to the left, and the semitrailer wheels will steer to the right.

2-9. Operation Of Water Dispensing Unit

WARNING

Potable water is to be tested on a daily basis. Refer to FM 21-10 and TB MED 577. Only food-grade quality gaskets and hoses are to be used in dispensing components/lines. Failure to do so could result in illness to personnel.

2-10. Operating Terms

An understanding of the following terms may be helpful in the operation, diagnosis and maintenance of the pump:

a. Engine

Throttle lever: A hand throttle is furnished to control engine speed and pump pressure.

Stop lever: A control that cuts off fuel to the fuel injector and stops the engine.

Governor: This engine component limits speed and is set to factory specifications.

b. Pump, Potable Water Dispensing

Impeller: The working part of a centrifugal pump which imparts energy to the water.

Check Valve: A one-way check valve on the discharge side of the pump that permits water to flow out only, prohibiting excessive pump back pressure.

Drain Valve: A valve provided for draining the pump for storage or cleaning.

This section provides operator/crew instructions for operation of the water dispensing unit diesel engine and its external pump. The operator should have a thorough understanding of engine an pump operation before using this equipment. Information pertinent to the vehicle in which the water dispensing unit is mounted was previously discussed in this chapter.

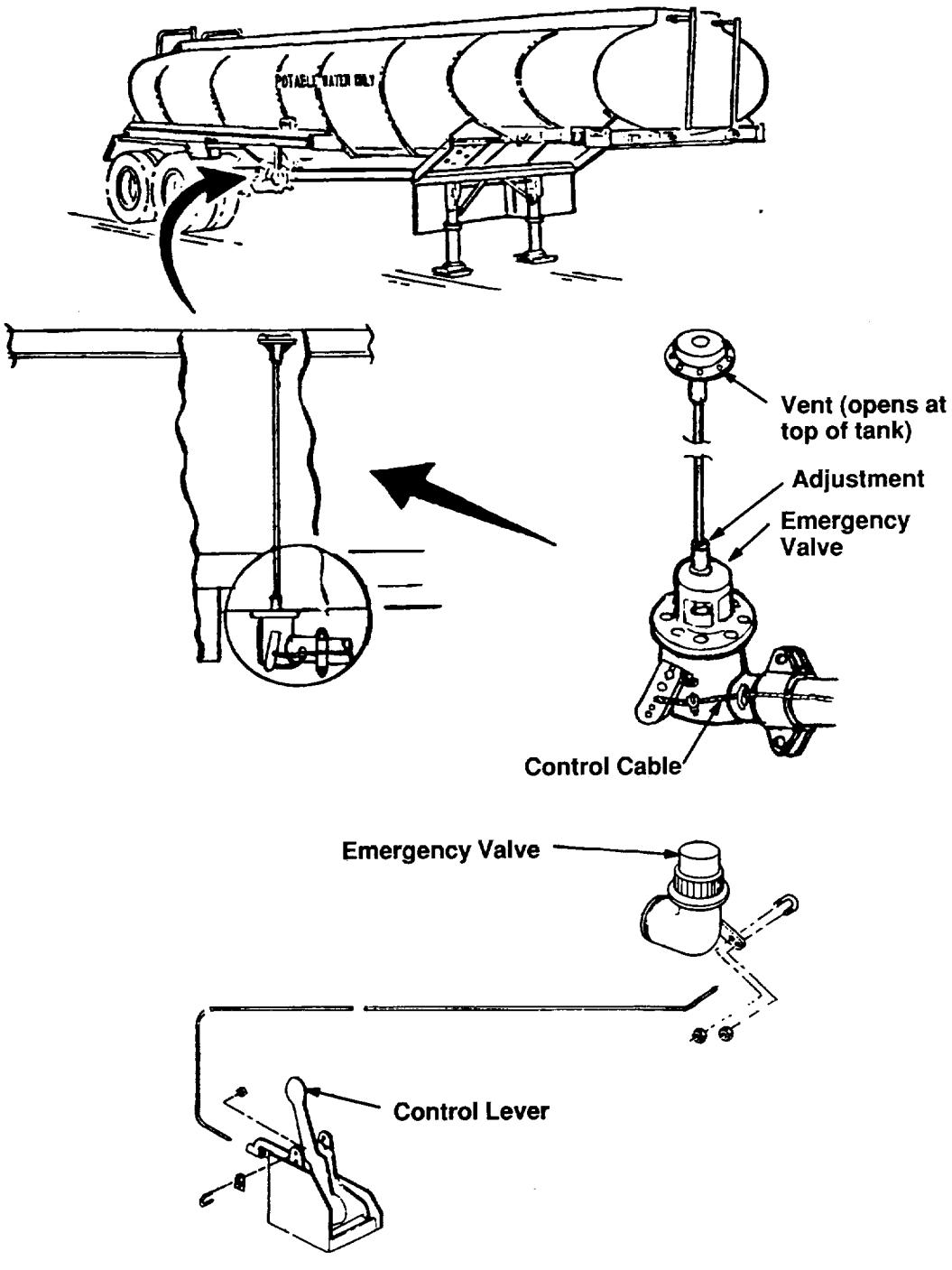


Figure 2-5. Emergency Valve Operation Mechanism

2-11. Starting Engine Using Electric Starter

WARNING

Run engine on diesel fuel only. Use of gasoline can cause an explosion, causing death or injury to personnel and damage to equipment.

CAUTION

Make sure water is flowing through the pump within two minutes of starting dispensing unit engine, to prevent damage to food grade mechanical seal. Open discharge valve to start water flow, and check by briefly opening one of the faucets on a nearby manifold. If water flows from open faucets, water should be present at pump. If tank water has been permitted to drop below the emergency valve level an re-fill, open discharge valve to assure a normal quantity and flow of water before starting engine.

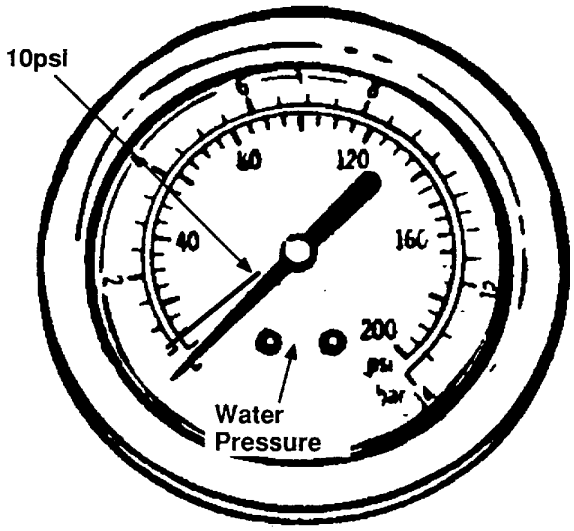


Figure 2-6. Pressure Gage

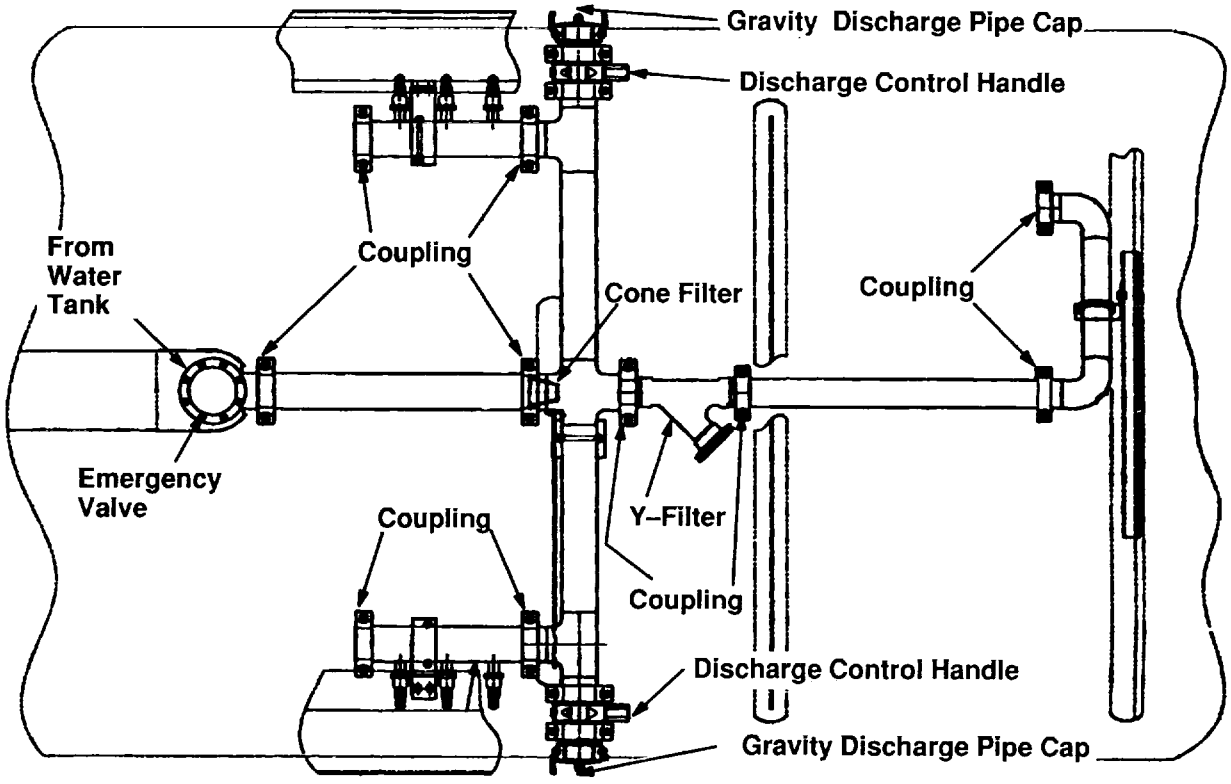


Figure 2-7. M1098 Water Piping

When water pressure on control panel gage drops below 10 psi, shut engine down to vent pump damage, Fig. 2-6.

1. Open emergency valve that feeds water to all water outlets, fig. 2-7. Briefly open nearby faucet to check for presence of water, then close faucet.

2. Be sure engine fuel tank is filled with diesel fuel only.

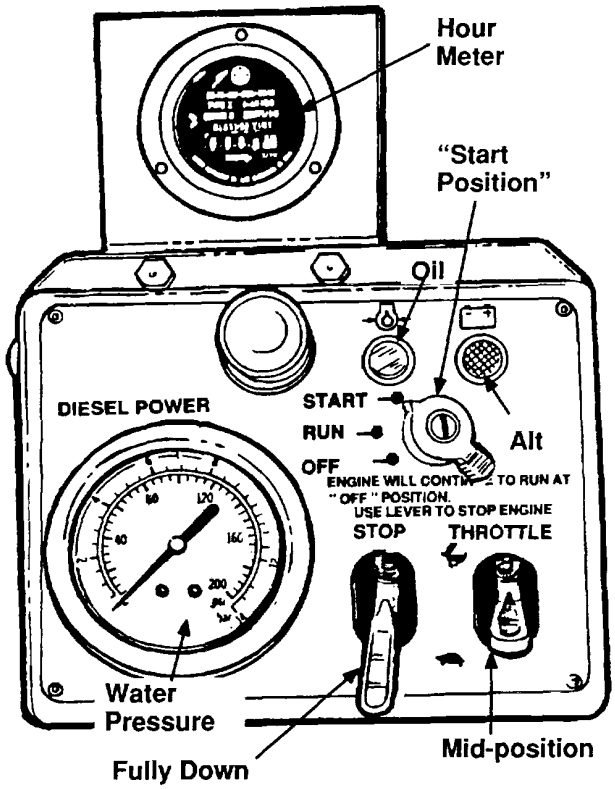


Figure 2-8. Control Panel - Electric Start

3. Be sure all drain cocks are closed.

4. Be sure crankcase is filled to level with oil.

5. Be sure all connections are air tight by observing for leaks.

6. Be sure discharge valve is closed, fig. 2-7.

7. Start engine:

a. Put throttle in mid-position and run-stop lever fully down in run, fig. 2-8.

CAUTION

Although the engine can be started without using compression release, this will put a heavy load on the starter and battery leading to rapid discharge of battery and reduced starter life. IT IS THEREFORE MANDATORY TO USE THE COMPRESSION RELEASE WHENEVER STARTING.

b. Push compression release lever on top of engine toward the rear of trailer and hold, fig. 2-9.

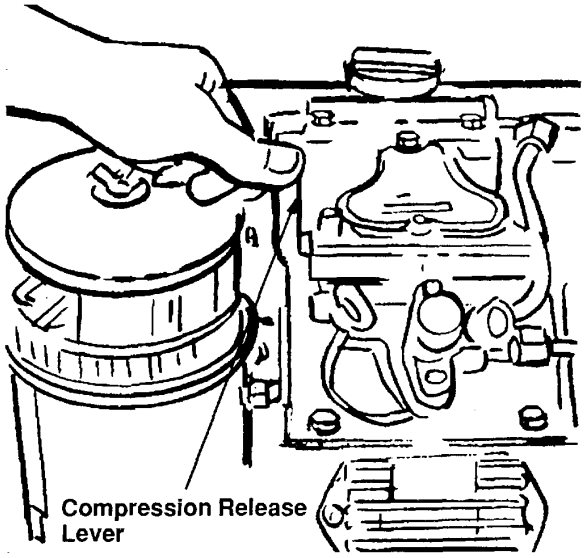


Figure 2-9. Activating Compression Release Lever

c. Crank engine by turning starter switch to "start" position, fig. *d*. When engine starts. after a couple of revolutions, release compression release lever, fig. 2-9.

e. When engine starts, let starter switch spring back to "run" position.

f. If Alt or oil pressure lights remain on, stop unit and refer to unit maintenance.

CAUTION

Make sure water Is flowing through the pump within two minutes of starting dispensing unit engine, otherwise pump mechanical seal can be damaged.

8. Open discharge valve. Shut unit off if pump is not delivering water within two minutes of ignition. If water pressure gage does not show 10 psi or more, shut engine off.

2-12. Rope Starting Engine

WARNING

Run engine on diesel fuel only. Running engine on gasoline or mixture of diesel fuel and ten per-cent or more gasoline will damage engine.

CAUTION

Make sure water is flowing through the pump within two minutes of starting dispensing unit engine, otherwise pump mechanical seal can be damaged.

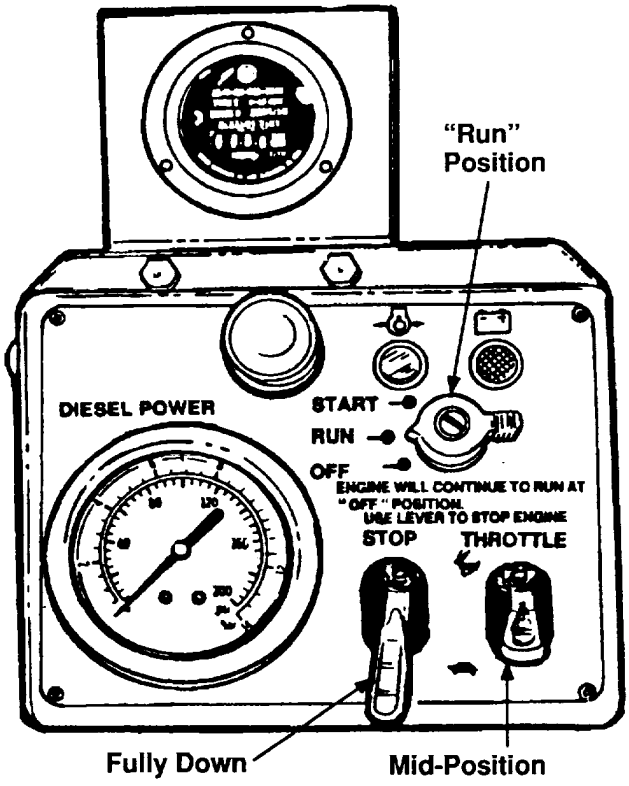


Figure 2-10. Control Panel - Rope Start

1. Open emergency valve that feeds water to all water outlets, fig. 2-5.

2. Be sure fuel tank is filled with diesel fuel only.

3. Be sure all drain cocks are closed.

4. Be sure crankcase is filled to level with oil.

5. Be sure no connections are leaking.

6. Be sure discharge valve is closed.

7. Start engine:

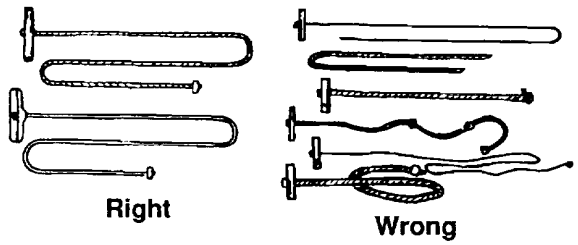
a. Put throttle in mid-position and run-stop lever fully down in run, fig. 2-10.

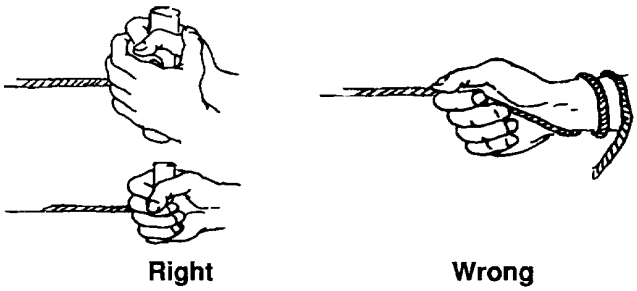
b. Put ignition in "Run" position.

c. Prepare to rotate pulley.

CAUTION

Use proper pull rope and grip to prevent personnel injury. While performing this operation, be prepared to release the rope quickly if grip is pulled in toward pulley.





d. Rotate the pulley manually, in a clockwise direction, as viewed from the pulley side, until you find strong resistance. Then, wind the rope up on the starting pulley in a clockwise rotation, fig. 2-11.

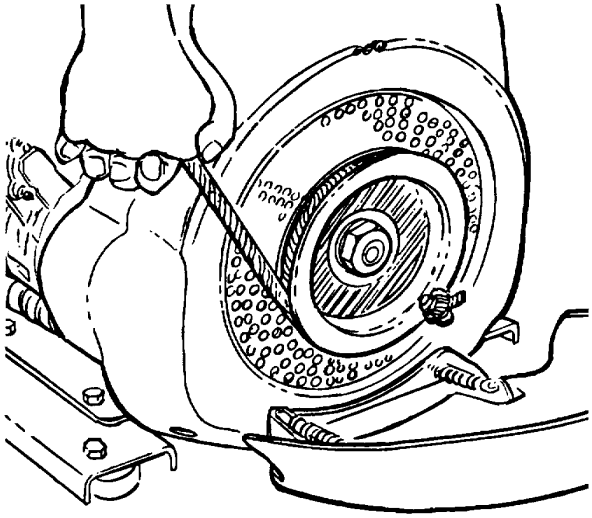


Figure 2-11. Rope Starting

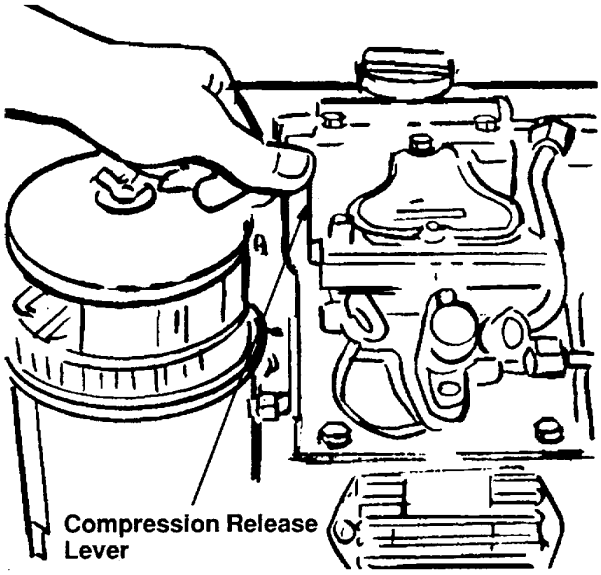


Figure 2-12. Activating Compression Release Lever

WARNING

Compression release relieves a heavy load on the starter while cranking. IT IS THEREFORE MANDATORY TO USE THE COMPRESSION RELEASE WHENEVER STARTING.

e. Push compression release lever on top of engine toward the rear of the trailer and hold, Fig. 2-12.

f. While holding down compression release lever, give the rope a smooth, fast pull.

g. When engine is up to speed, after a couple of revolutions, release compression release lever.

h. If Alt or oil pressure lights remain on, stop unit and refer to Unit Maintenance.

CAUTION

Make sure to prime pump within two minutes of starting engine, otherwise pump mechanical seal can be damaged.

8. Open discharge valve. Shut unit off if pump is not delivering water within two minutes of ignition.

2-13 Cold Starting

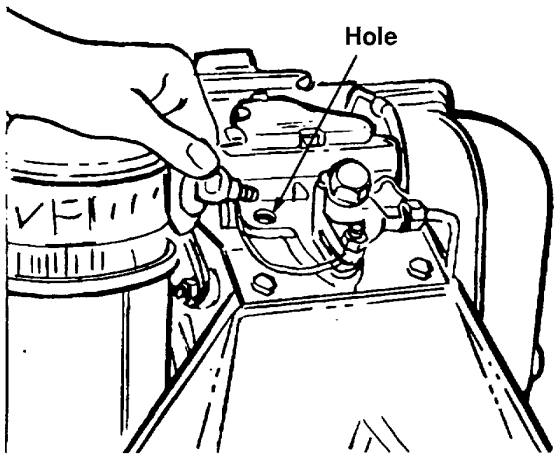


Figure 2-13. Cold Weather Oil Add Hole

At low temperatures it is advisable to operate as follows: Remove the rubber plug; insert in the hole about three cubic centimeters of same type engine oil (1/4 ounce or 1.5 teaspoons); reinsert the plug and start engine, fig. 2-13.

2-14. Stopping The Engine

1. Idle engine before stopping by pushing throttle lever in fully down position.

2. Turn ignition off.

3. Move the run-stop lever to stop, fig. 2-14.

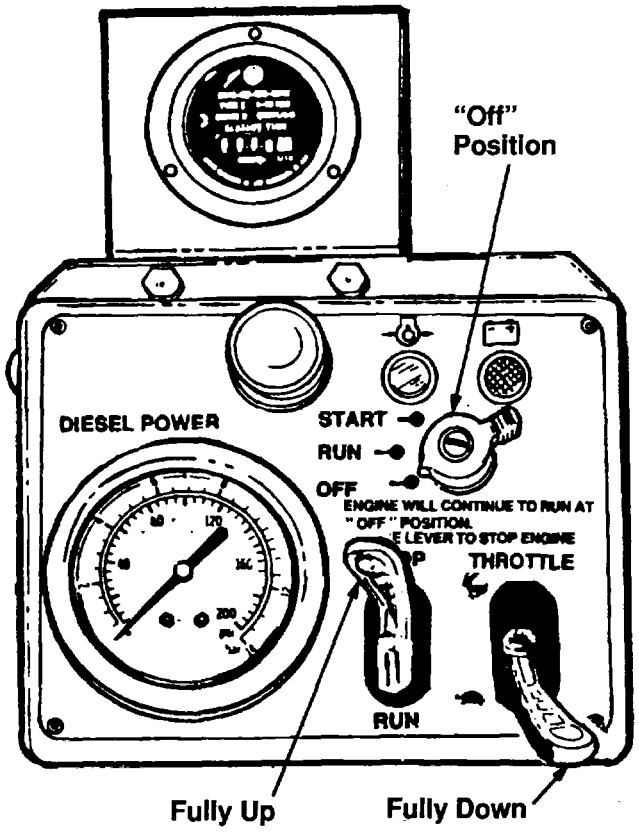


Figure 2-14. Control Panel-Stopping the Engine

2-15. Engine Run-on

If engine does not stop when stop lever is pushed to the "stop" position, the inner cable may have broken, come loose, or be out of adjustment. To stop the engine, use engine run-on stop tool, mounted on main discharge valve handle or push a small screw driver or rod of approximately 1/8-inch diameter through the small hole near where the throttle cable (upper cable) goes into the engine. Immediately inside this hole is an internal lever. Push this lever in as far as it will go and the engine will stop fig. 2-15.

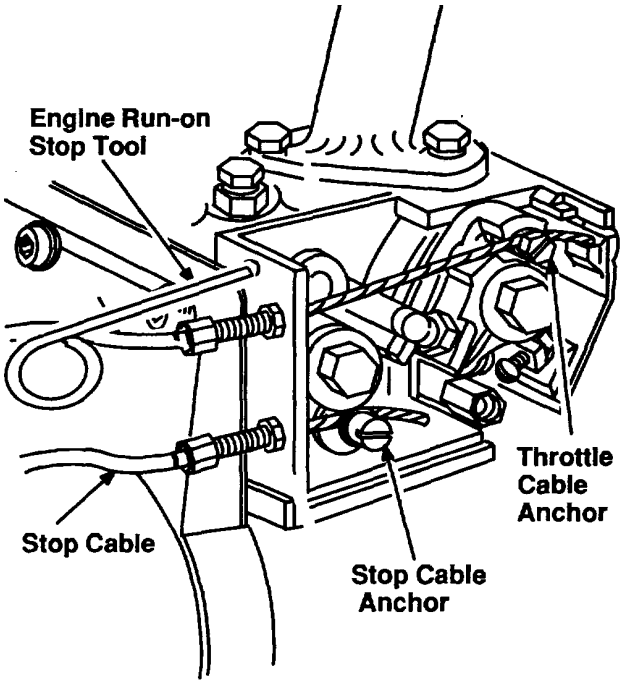


Figure 2-15. Throttle and Stop Lever Adjustments

2-16. Filling Own Tank From Source Not Under Pressure

NOTE

If the pump is used to move potable water from an external source that Is at a lower level and not under pressure the operation is termed "working from draft".

1. Check level of water in tank. It must at least fill the pipes and emergency valve. If not, the pump must be primed, by opening emergency valve and filling through top opening with buckets, Fig. 2-16.

2. Close emergency valve. Close both gravity discharge valves, discharge valve and any other outlet.

3. Attach inlet hose to one of the discharge valves with the other end at the source of water.

4. Attach outlet hose to discharge valve and place other end in top opening.

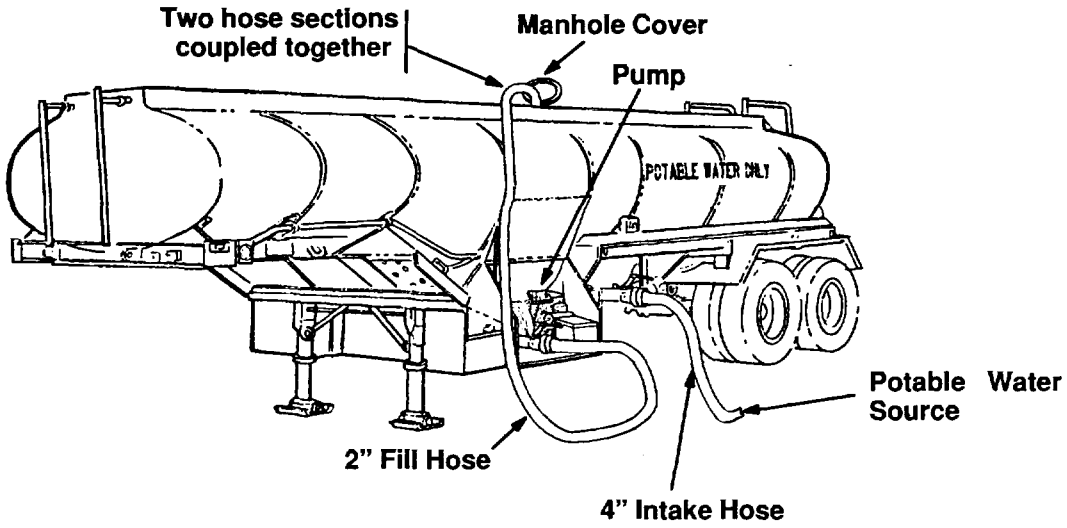


Figure 2-16. Self-filling From Source Not Under Pressure

5. Start engine as described in para 2-11. Open discharge valve (outlet attachment) first and open gravity discharge valve (inlet attachment) immediately after.

6. Fill tank.

7. When tank is filled open emergency valve and shut off gravity discharge valve.

8. Shut off discharge valve.

9. Shut off engine.

10. Disconnect external inlet hose from gravity discharge valve and outlet hose from discharge valve.

11. Open discharge valve and permit enough water to discharge to determine that flow and quantity is normal.

2-17. Special Operating Instructions

a. Pumping a Large Volume

When using the pump for volume at low pressure, as in filling a tank, open the throttle slowly until maximum volume is obtained.

b. Running Engine When Not Emitting Water

When maintaining pressure without water flowing through the discharge line, as when running the pump with the discharge valve closed, the water in the pump will tend to overheat. Under these conditions, bleed off a little water at the discharge valve periodically.

c. Cold Weather Operation

CAUTION

If temperature falls below 32°F (0°C) water sealed inside pipes can freeze and burst pipes and/or seals.

In freezing weather, when pump is not in operation, close emergency valve and drain all water from pump, piping system and tank.

2-18. Water Dispensing Unit - Detecting Water Delivery Problems

CAUTION

Air leaks on the suction side of the pump will cause high engine speed In relation to pump pressure. They will also cause a ragged stream and an irregular pulsation of the suction and discharge hose.

a. Priming and Pump Output

Ordinarily, priming is not a concern as supply water from the tank is at a higher level than the pump. However,

if the pump is used to move water from an external source that is at a lower level and not under pressure, (termed "working from draft") remarks in this paragraph and paragraph b are pertinent. An example of working from draft is discussed in para 2-16.

1. Start engine and open discharge valve.

2. Regulate engine speed to a reasonable value so it creates enough flow.

b. Additional Priming Information

CAUTION

A pump pressure gage reading of 10 psi or less indicates the lack of water In the pump. To prevent damage to pump food grade mechanical seal, do not run pump at less than 10 psi for more than two or three minutes.

NOTE

Pump pressure gage on engine control panel indicates presence of water at pressure reading of at least 10 psi. In a closed system, trapped air can create a pressure reading In the system approximating 10 psi.

If, when throttle is opened, speed increases without a corresponding increase in pump pressure, the pump is not fully primed; in this case, continue to run engine so the self-priming action is completed and a steady flow is obtained from the discharge nozzle.

c. Operating from Water Source under Pressure

If flow seems inadequate during this operation or if foreign matter is suspected in the outlet, flush outlet before attaching pump to water source. Set up your equipment as follows:

1. Attach one end of suction hose to source outlet and the other end to the pump.

2. Open emergency valve.

3. Start engine.

4. Open discharge valve (if used).

5. Open throttle gradually until desired pressure is obtained.

Watch the pressure gauge as you increase engine speed. If the engine speed continues to increase without a corresponding increase in pressure, you have passed the most efficient operating point. In this case, close the throttle slowly until the pressure begins to drop and the engine speed becomes reasonable. This unit is designed to optimally supply 50 gpm at 96 psi and 250 gpm at 15 psi. The pump's ability to develop a higher pressure at a given rpm is controlled by the orifice size of the discharge nozzles; using smaller discharge nozzles will increase pressure and decrease volume; likewise larger nozzles will decrease pressure and increase volume.

An air leak in the suction line will make the priming take too long. This leak can often be detected by stopping the engine and listening for air rushing into a system under vacuum.

If a shut-down of water flow is desired while the dispensing unit engine is running and the vehicle's own water tank is being filled, close the discharge valve and slow down to about 50 pounds discharge pressure. To resume operation, simply open the discharge valve and increase throttle.

WARNING

Only National Sanitation Foundation (NSF) approved or U.S. Department of Agriculture (USDA) listed food grade components (i.e. pumps, gaskets, pipes, hoses, silicon, grease or valves) should be used in direct contact with potable water.

d. Foreign Material

1. Gaskets and Washers: If suction hose is used, check suction hose rubber washers frequently as foreign matter under these washers will cause air leaks which may prevent getting water when priming. Even if you do get water, the air will cause an irregular stream.

2. To remove foreign material from pump, flush it with clear water and then follow the cleaning and sanitizing procedures in para 4-36.

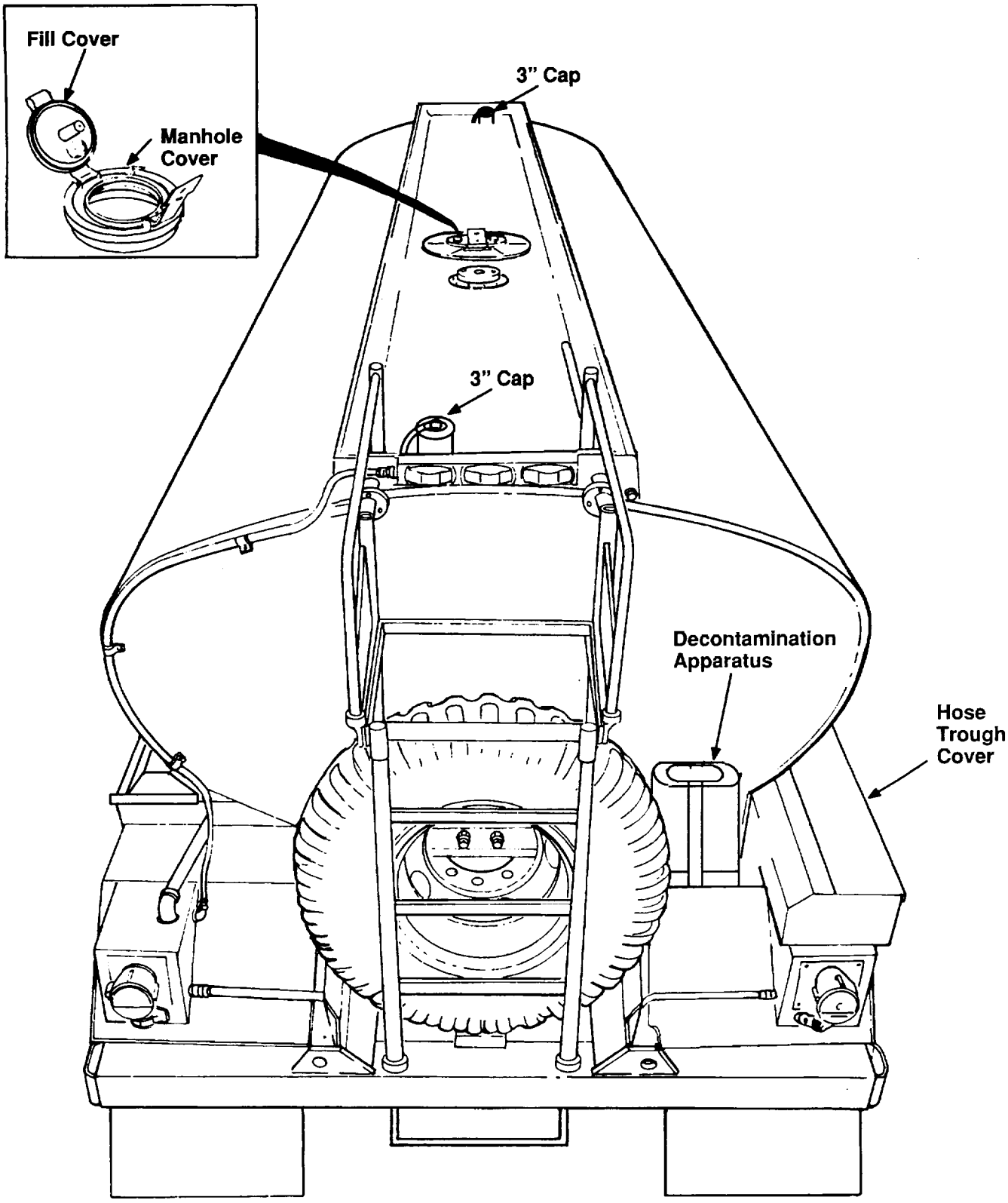


Figure 2-17. M1098 Top, Rear View

2-19 Operator Controls

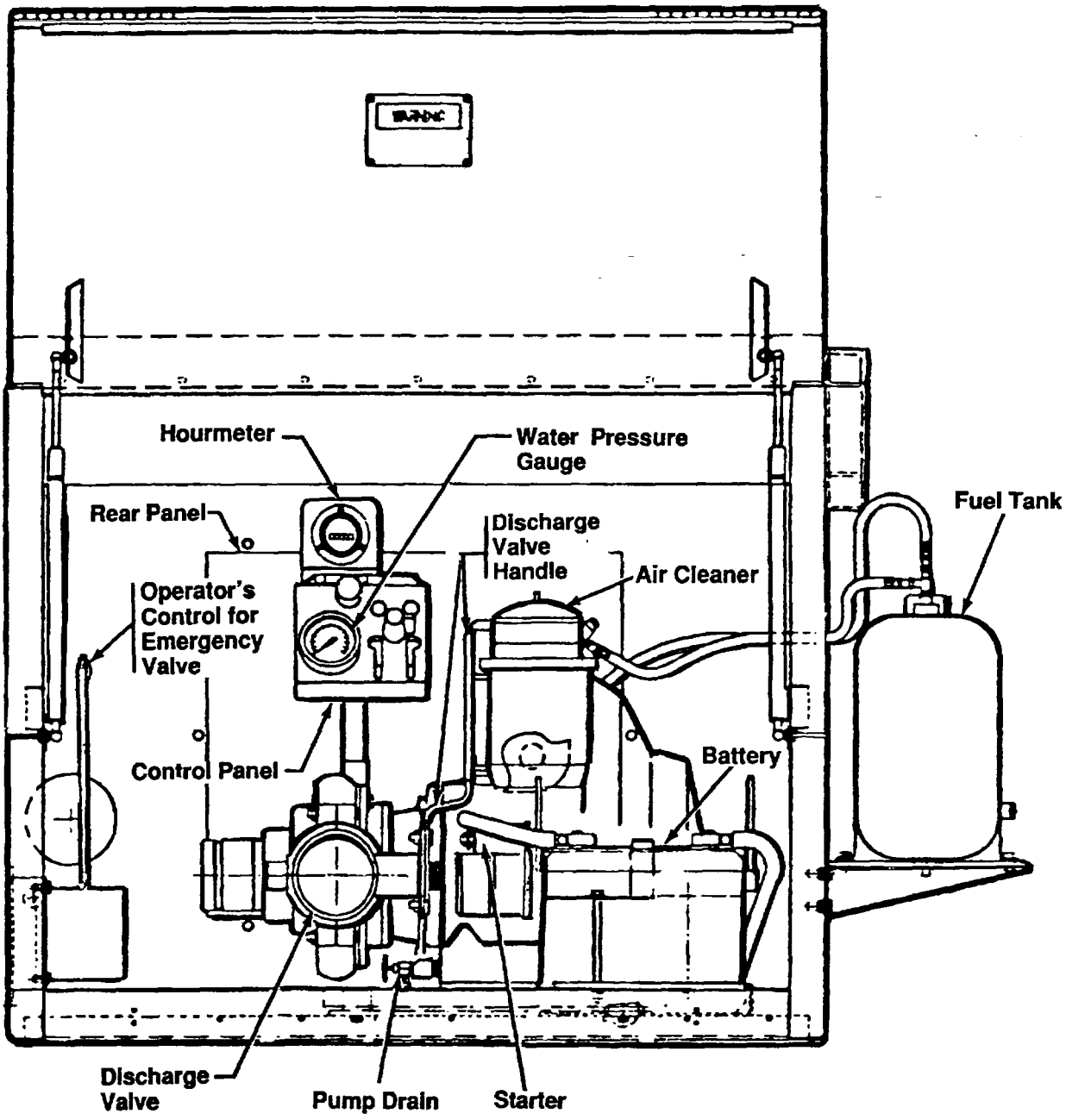


Figure 2-18. Water Dispersing Unit Operator Controls

Section III. WATER TANK SEMITRAILER OPERATION UNDER USUAL CONDITIONS

2-20. General

a. You must follow the approved practices and precautions. A detailed study of FM 21-305 and FM 55-30 is essential for use of this material under unusual conditions.

b. For description of operations in extreme cold, refer to FM 9-20-7.

2-21. Extreme Cold Weather Operation

a. Drain Water. During cold weather operations, the accumulated water in the semitrailer piping system may freeze. It is important to drain the water from the entire system after each operation to prevent damage to the components. Remove drain plug from engine fuel tank and drain any accumulated water from tank.

b. Frozen Parts. The driver must be alert to frozen systems while pulling the semitrailer after shutdown. Congealed lubricants may cause failure of parts. Tires frozen to the ground, or frozen to the shape of the flat spot while under-inflated must be considered. One or more brake shoes may be frozen fast and may require preheating to avoid damage to the internal parts and brake drums. A warm air blower may be used to preheat the brake shoes.

c. Driving. Refer to FM 21-305 for special instructions on driving hazards in snow, ice, and unusual terrain encountered under extreme cold weather conditions.

d. Engine Operations. For operating instruction of the engine in extreme cold weather, see para NO TAG Antifreeze should not be used to winterize any component of the M1098 Water Tanker which is in direct contact with potable water.

2-22. Extreme Hot Weather Operation

a. Parking. When practical, park the semitrailer under cover to protect it from sun, sand and dust.

b. Effects of Humidity. Vehicles parked for long periods in hot, humid weather are subject to rapid rusting and accumulation of fungus growth. Inspect often, clean, and lubricate to prevent deterioration.

2-23. Operation on Unusual Terrain

a. Sand. Inspection, cleaning and lubrication of working parts must be made often when operating under extremely dusty or sandy conditions. Wheel bearings should be cleaned and repacked with lubricants as specified on the lubrication order after operation under extremely dusty or sandy conditions.

b. Rocky Terrain. Use extreme caution when traveling over rocky terrain. Specified tire inflation should be maintained to minimize the possibility of internal rupture of the tire and damage to the tube.

c. Flooded Road Surfaces. When the unit is subjected to flooded road surfaces, the vehicle can withstand a depth of 24-inches. However, wheel bearings should be cleaned and repacked if this happens. Electrical cables and terminals must be protected by spraying with ignition insulation compound.

d. Salt Water Operation. After driving through exterior salt water, inspect parts. Salt water causes corrosion of exposed parts. After operation is complete, wash with fresh water.

e. Operation Under any Unusual Terrain (all of a through b). After operating the M1098 water tanker in unusual terrain, inspect, clean and sanitize critical areas of the undercarriage, fig. 2-19. Also consult fig. 2-20. These illustrations locate critical areas: couplings; Y-filter and valves. Sanitizing procedures are presented in para 4-37.

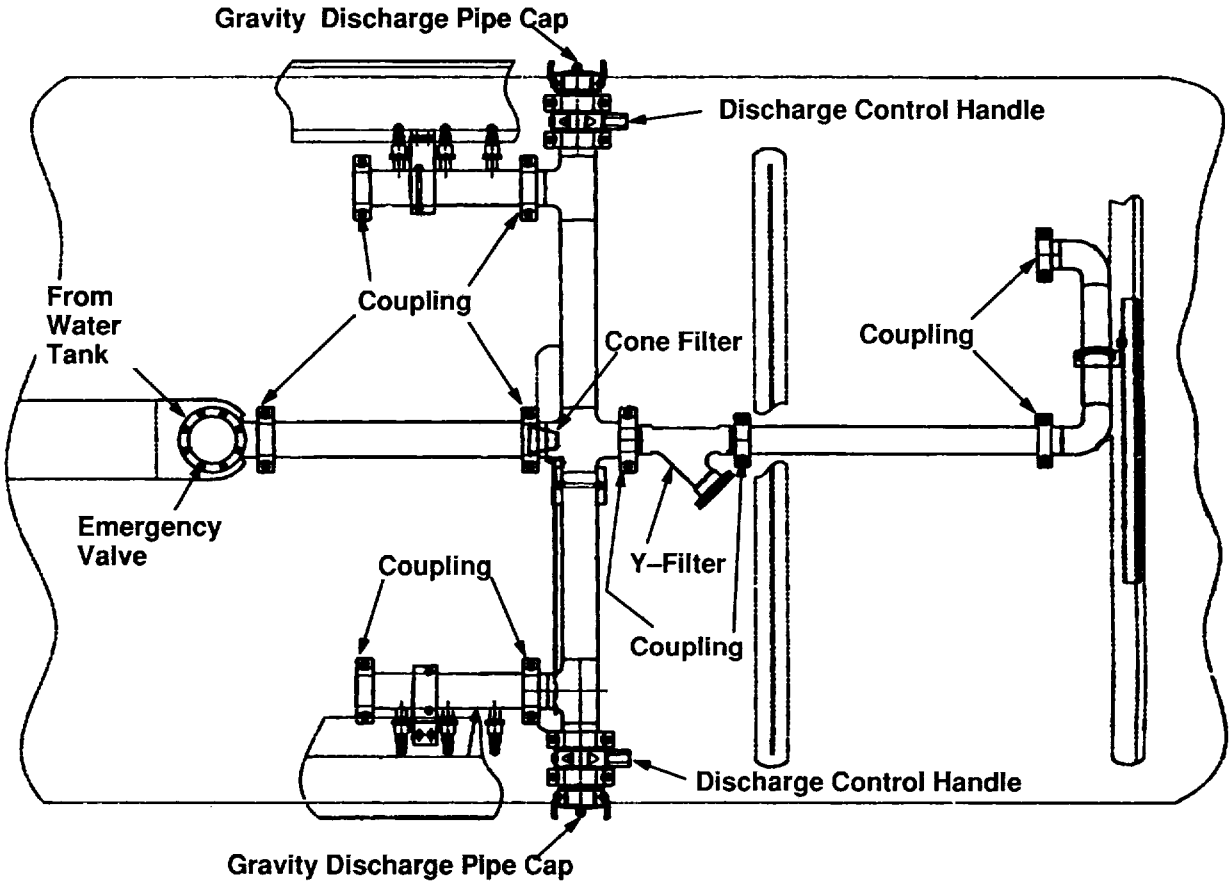


Figure 2-19. M1098 Water Tanker Piping

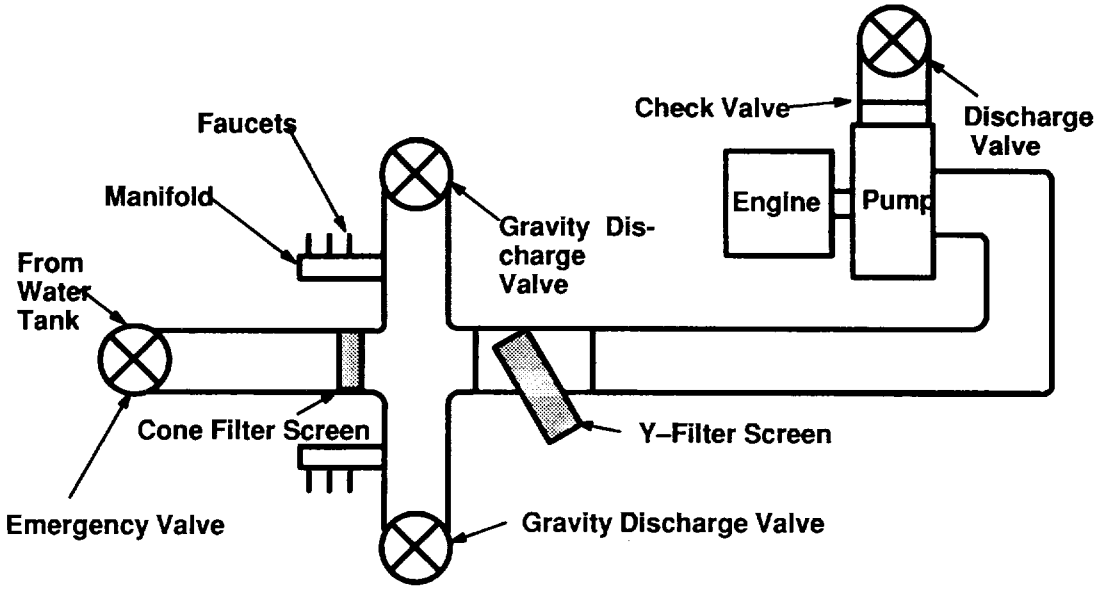


Figure 2-20. M1098 Water Tanker Piping Schematic

CHAPTER 3

OPERATOR/CREW MAINTENANCE INSTRUCTIONS

SECTION I LUBRICATION INSTRUCTIONS

3-1. Lubrication

This section has lubrication requirements for the M1098 Water Tanker semitrailer.

a. For lubrication under usual conditions, refer to figure 3-1 for general areas and lubrication intervals. Refer to figures 3-2 through 3-10 for specific lubrication points.

b. For instructions on lubrication in weather below 0°F, refer to FM 9-207.

c. For lubrication after fording, refer to TM 9-238.

d. After operating under dusty or sandy conditions, clean and inspect all lubrication points for fouled lubricants. Lubricate if fouled.

LUBRICATION CHART

SEMITRAILER, TANK (POTABLE WATER DISPENSING): 5000 GALLON M1098 (2330-01-330-2779)

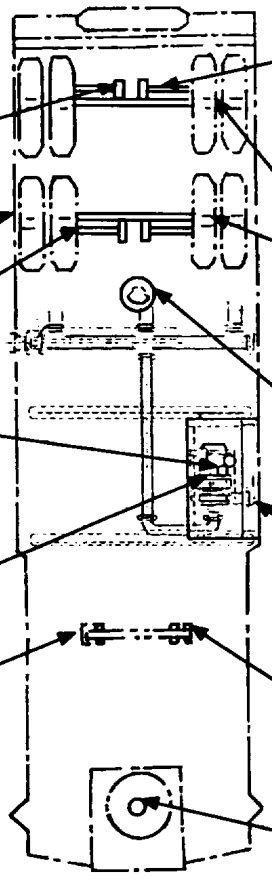
Intervals (on-condition or hard time) and related man-hour times are based on normal operation. The man-hour time specified is the time you need to do all services prescribed for a particular interval. Decrease the intervals if your lubricants are contaminated, or if you are operating equipment under adverse conditions, including longer-than-usual operating hours. The intervals may be extended during periods of low activity. If extended, adequate preservation precautions must be taken. Dotted leader lines indicate lubrication is required on both sides of the equipment.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-130°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

The lowest level of maintenance authorized to lubricate a point is indicated in parentheses by use of the following: (C) Operator/Crew; or (O) Unit Maintenance. Clean all fittings and area around lubrication points with dry cleaning solvent (Item 11, Appendix E) or equivalent before lubricating equipment. After lubrication, wipe off excess oil or grease to prevent accumulation of foreign matter.

		LUBRICANT	INTERVAL
G Fig. 3-6	Slack Adjuster (O) (Front and rear axles)	GAA	M
H Fig. 3-7	Brake shoe roller (O) (Front and rear axles)	PL	Q
I Fig. 3-7	Brake Anchor Pin (O) (Front and rear axles)	GAA	Q
B Fig. 3-3	Engine Oil Drain (O)	OE/ HDO	H-50: Desert Operation H-100: Standard Operation
C Fig. 3-3	Engine Crankcase Fill (O)	OE/ HDO	W
D Fig. 3-4	Landing Gear Handle (C)	OE/ HDO	W



INTERVAL	LUBRICANT		
M	GAA	Camshaft bearings (O) (Front and rear axles)	J Fig. 3-8
A	GAA	Wheel Bearings (O) (Every 12,000 miles or annually remove, clean, dry, and repack)	K Fig. 3-9
W	OE/ HDO	Manhole Hinges (C)	A
W	OE/ HDO	Cabinet Hinges (C)	L Fig. 3-10
W	OE/ HDO	Landing Gear Foot Pads (C)	E Fig. 3-4
W	GAA	Pick-up and Kingpin (C)	F Fig. 3-5

TOTAL MAN - HR	
INTERVAL	MAN - HR
A	1.0
W	0.6
M	0.4

TOTAL MAN - HR	
INTERVAL	MAN - HR
Q	0.4
H-100	0.3

Figure 3-1. Lubrication Chart (M1098) (Sheet 1 of 2).

KEY

LUBRICANT	REFILL CAPACITY	EXPECTED TEMPERATURE				INTERVAL
		Above 32°F	40° to –10°F	0°F to 65°F		
OE/HDO Lubricating oil (MIL–L–2104) internal combustion engine or **OEA** Engine (MIL–L–46167) crankcase	1.6 gal 1.5 liter	OE15W–40			For Artic Operation, Refer to FM9–207.	D – Daily W – Weekly M – Monthly Q – Quarterly A – Annually H – Hours
GAA Grease, Automotive (MIL–G–10924) and Artillery	As req'd	All Temperature				
PL Preservative Oil (PS – S – VV – L – 800) or (PL – M – MIL – L – 3150)		PL – Medium	PL – Special	PL – Special		

Figure 3-1. Lubrication Chart (M1098) (Sheet 2 of 2)

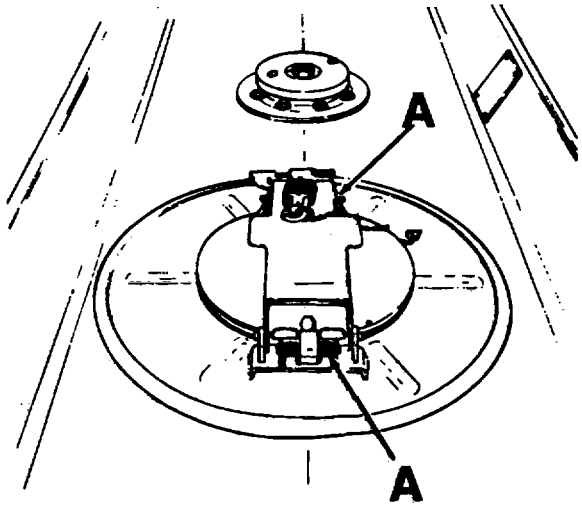


Figure 3-2. Lubrication Points for Manhole Hinges

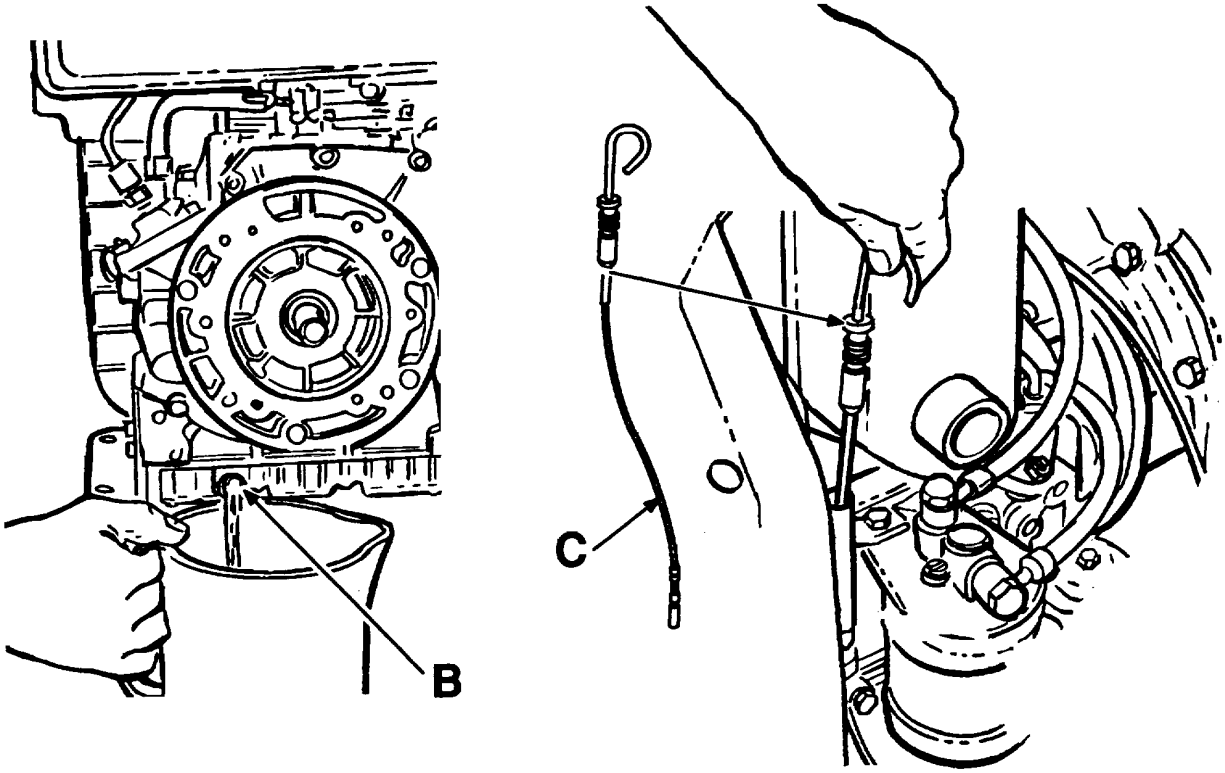


Figure 3-3. Engine Lubrication Points

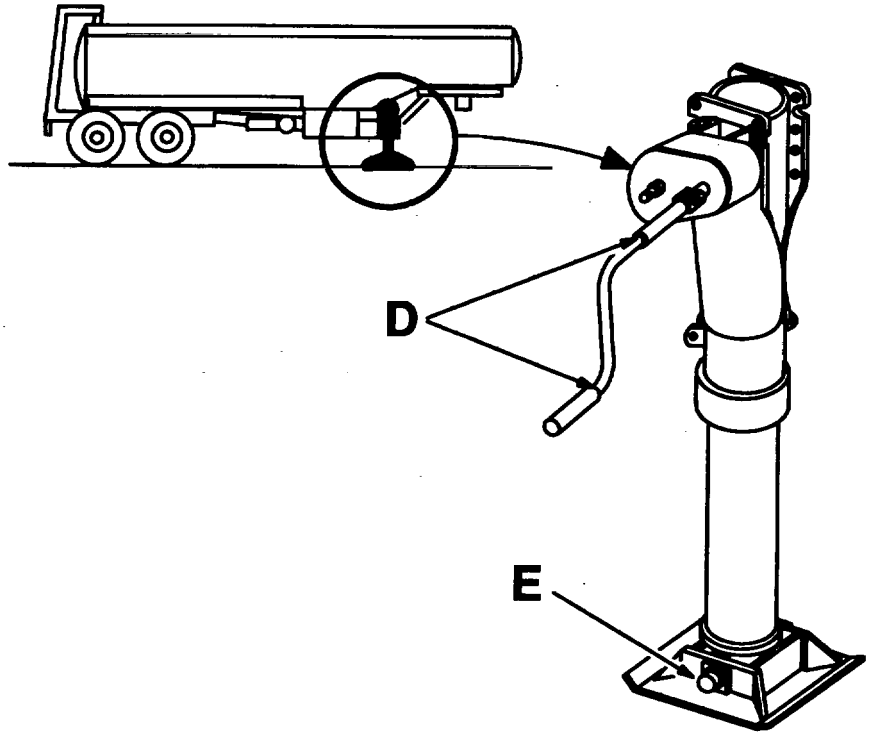


Figure 3-4. Landing Gear Lubrication Points

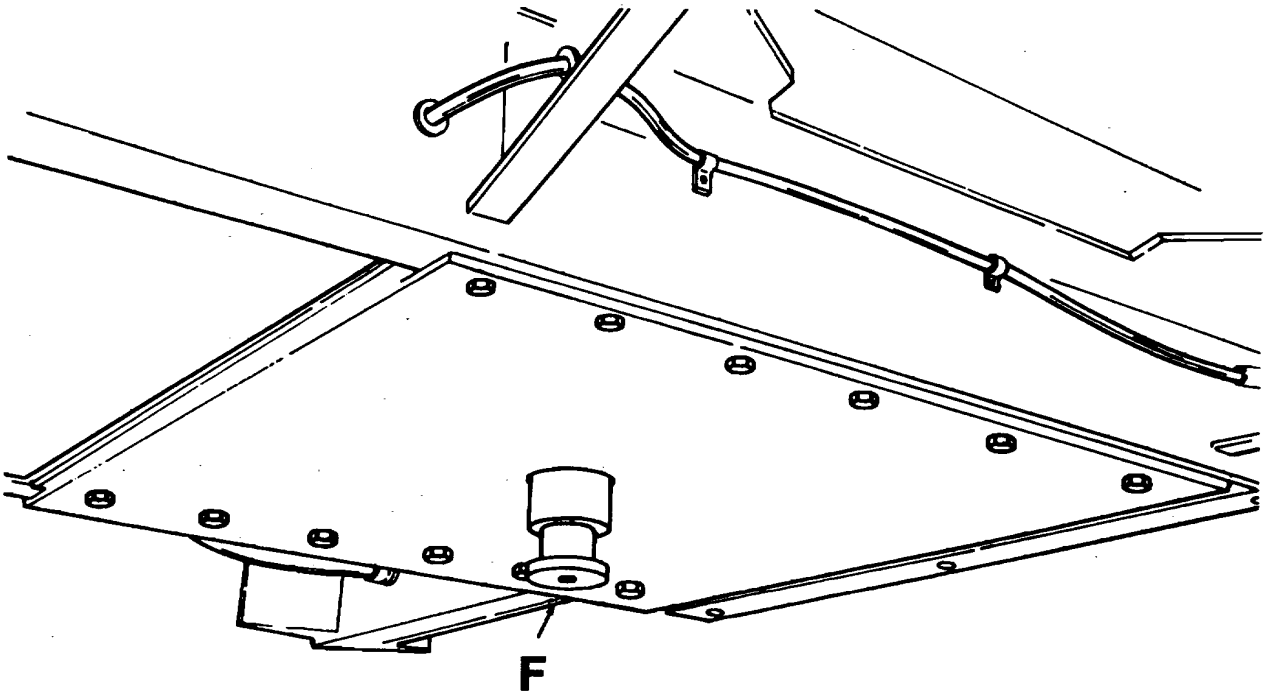


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Figure 3-5. Lubrication of Pick-Up and Upper Coupler (Kingpin) Plate

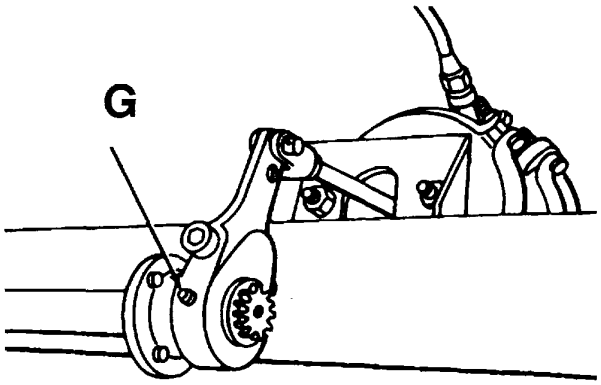


Figure 3-6. Location of Lubrication Fitting for slack Adjuster

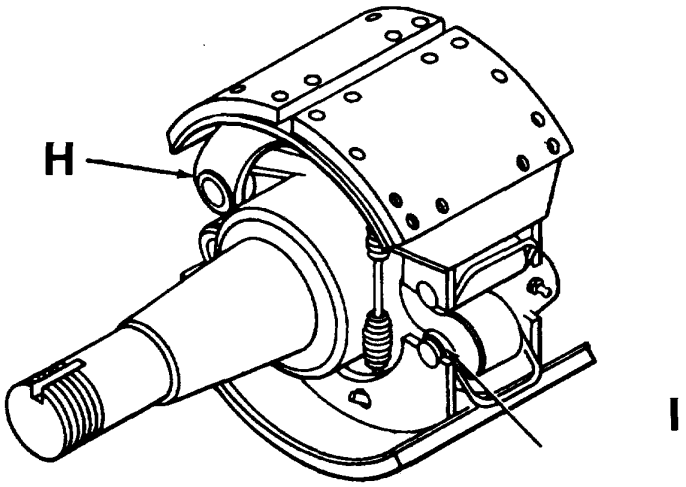


Figure 3-7. Location of Brake Shoe Roller and Brake Anchor pin (M1098)

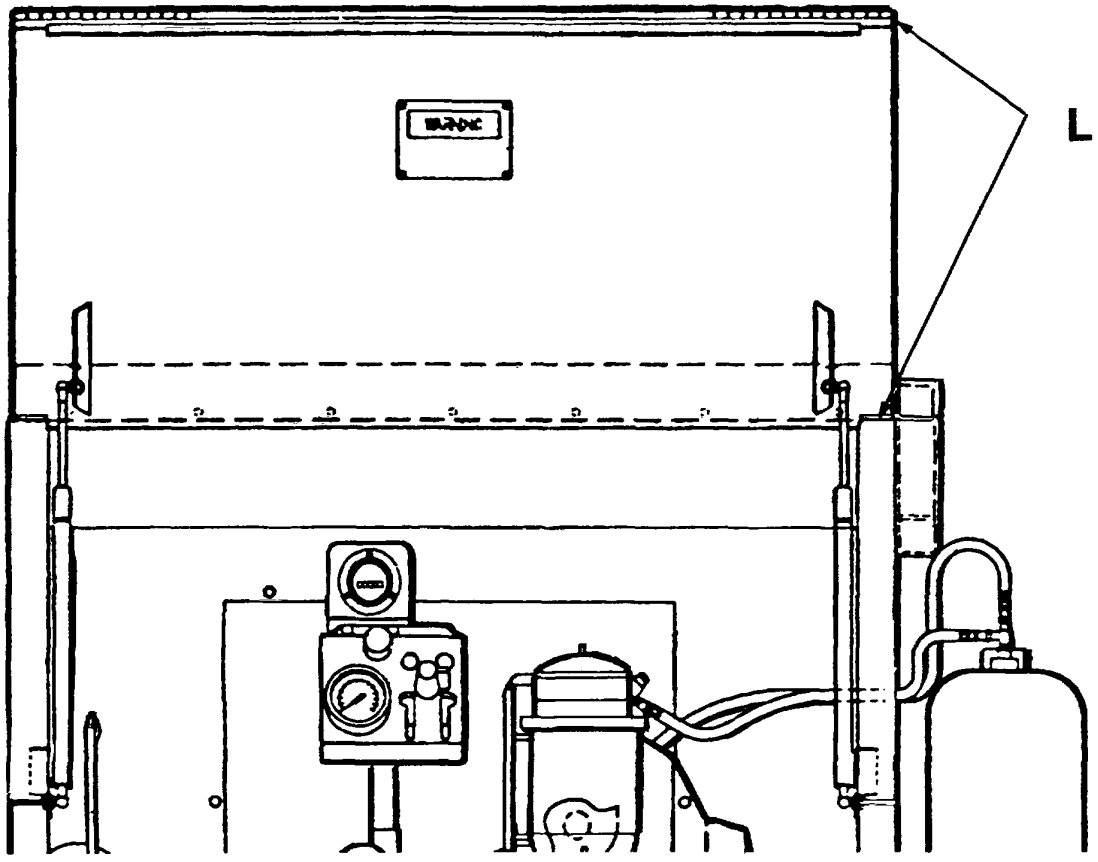


Figure 3-8. Location of Hinges

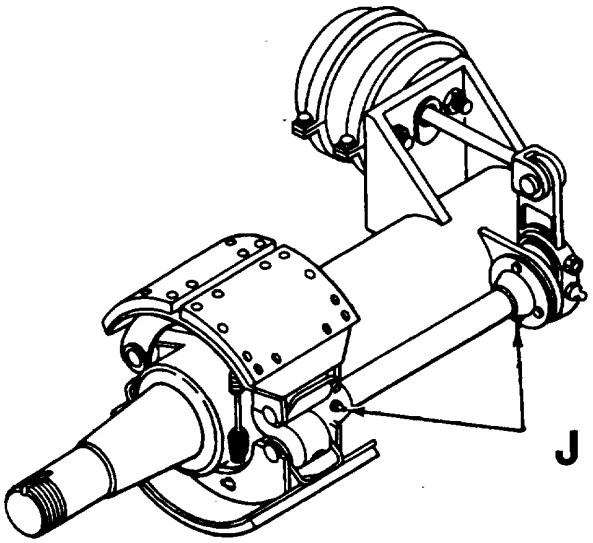


Figure 3-9. Location of Camshaft Lubrication Points

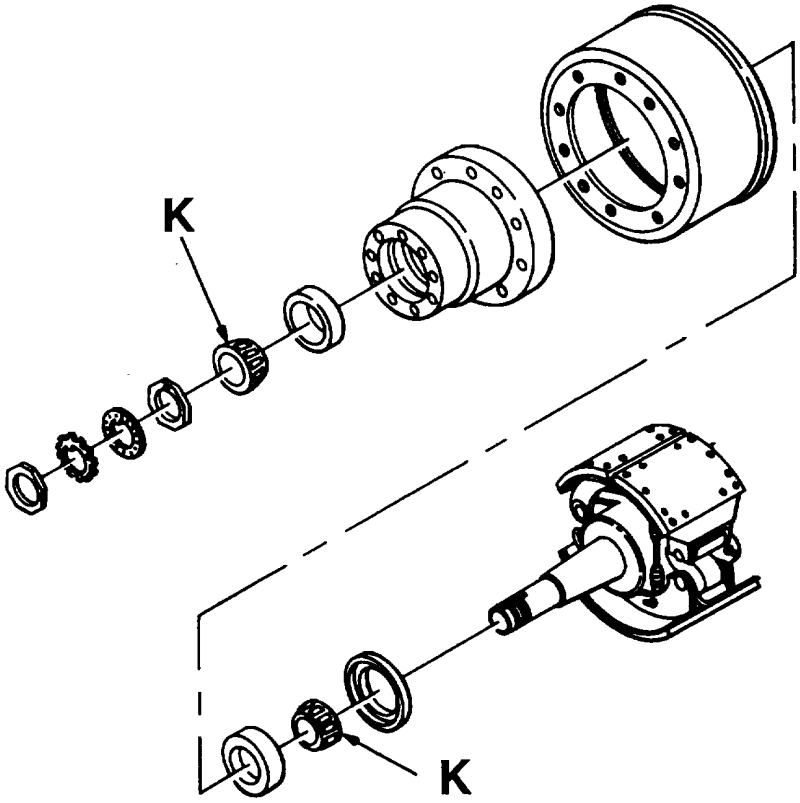


Figure 3-10. Location of Wheel Bearing

Section II. OPERATOR/CREW PREVENTIAVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-2. Maintenance Forms and Records

Every mission begins and ends with paperwork. Th isn't much of it, but you have to keep it up. The for and records you will fill out have several uses. They a permanent record of the services, repairs, and modifications made on your vehicle. They are reports to u maintenance and to your commander. And they are a checklist for you when you want to know what is wrong with the vehicle after its last use, and whether th(faults have been fixed. For the information you need forms and records, see DA PAM 738-750.

3-3. Preventive Maintenance Checks and Services

a. Always pay attention to the WARNINGs and CAUTIONs while doing the PMCS checks.

b. Do your BEFORE (B) PREVENTIVE MAINTENANCE just before you operate the vehicle.

c. Do your DURING (D) checks and services PREVENTIVE MAINTENANCE while the equipment and/or its component systems are in operation.

d. Do you AFTER (A) PREVENTIVE MAINTENANCE right after operating the vehicle.

e. Do your WEEKLY (W) PREVENTIVE MAINTENANCE once a week.

f. Do your MONTHLY (M) PREVENTIVE MAINTENANCE once a month.

g. If something doesn't work, troubleshoot it with the instructions in this manual, or notify your supervisor.

h. Always do your PREVENTIVE MAINTENANCE CHECKS in the same order so that it ;gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

i. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to unit maintenance RIGHT NOW.

j. When you do your PREVENTIVE MAINETENANCE, take along the tools you need to make all the checks. You'll always need a rag or two.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100° F-138°F (38° C-59° C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

WARNING

Under no circumstances Is dry cleaning solvent to be used on an area that is used to store or pass water. No preservatives of any type are to be used on water carrying surfaces.

(1) Keep It Clean. Dirt, grease, oil, and debris only ;get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry clean- ing solvent (item 11, Appendix E) on all metal surfaces. Use soap and water when you clean rubber or plastic material.

(2) Bolts, Nuts, and Screws. Check them all for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, of course, but look for chipped paint, bare ;metal, or rust around bolt heads. If you find one you think is loose, tighten it, or report it to unit maintenance if you can't tighten it.

(3) Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to unit maintenance.

(4) Electric Wires and Connectors. Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure wires are in good shape.

(5) Hoses and Fluid Lines. Look for wear, dam- age, and leaks and make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to unit maintenance.

k. You must know how fluid leakage affects the status of your vehicle. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your vehicle. Learn, then be familiar with them and REMEMBER: WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR!

Leakage Definitions for Crew/Operator PMCS

CLASS I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.		enough to cause drops to drip from item being checked/ inspected.
CLASS II	Leakage of load great enough to form drops but not great	CLASS III	Leakage of fluid great enough to form drops that fall from the item being checked/ inspected.

CAUTION

Equipment operation is allowable with minor leaks (Class I or II). Of course, consideration must be given to the fluid capacity In the item/system being checked/inspected. When in doubt, notify your supervisor.

Table 3-1. Preventive Maintenance Checks and Services for Model M1098

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			WARNING **Failure to set parking brake and block wheels, can allow tanker to move and could result in personnel injury or death. Always set parking brake and block wheels before performing PMCS.** **NOTE** **Perform your WEEKLY as well as BEFORE PMCS if: You are the assigned operator but have not operated the carrier since your last weekly Inspection, you are operating the water tanker for the first time.** **THINK SAFETY** Inspect and work safely. Protect yourself and your crew members. Read and observe all warnings.	

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			DRIVER	
1	Before	Vehicle Exterior	a. Check for evidence of leakage on or under semitrailer. b. Check fire extinguishers for proper gage reading and check security of mounting bracket. Red button should be down.	
2	Before	Tires	Inspect tires for unusual wear or damage.	Tires have damage which could result in failure.
3	Before	Kingpin	Inspect upper coupler (kingpin) plate for damage or loose mounting bolts.	Upper coupler (kingpin), plate damaged or mounting bolts loose.
4	Before	Hose Connections	Visually inspect hose connections for obvious damage or missing parts.	
5	Before	Tank Exterior and Tank Interior (when dry)	a. Inspect tank shell for dents and leaks. b. Check for leaks around vent caps. Tighten caps if loose.	Tank shell has class III leak evident
			c. Check for leaks around manhole cover. If leaks are evident, check for damaged cover gasket, loose mounting ring, and that cover is securely latched.	Manhole cover is damaged.
			d. Inspect the interior of the tank for cleanliness (i.e., free of debris and surface rust).	

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
6	Before	Water Pump Access Door up.	DRIVER Check the crankcase oil level. if oil level is low, it must be filled to proper level.	

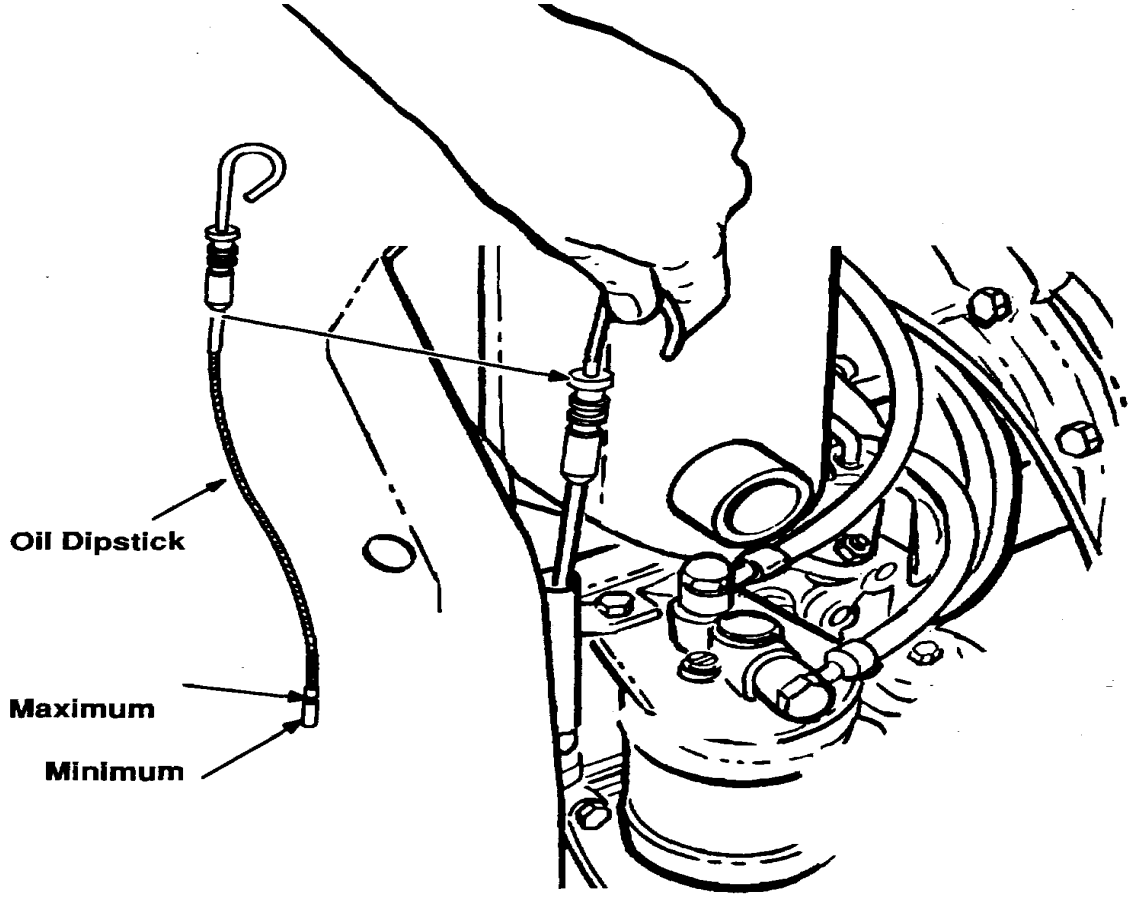


Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
7.	Before	Water Pump Access Door up Air Cleaner	DRIVER **WARNING** **If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.** Check the air cleaner. Clean pre-filter by emptying the plastic cup. Lightly tap air cleaner element to knock off excess dirt. Any damage to filter must be corrected at unit maintenance.	

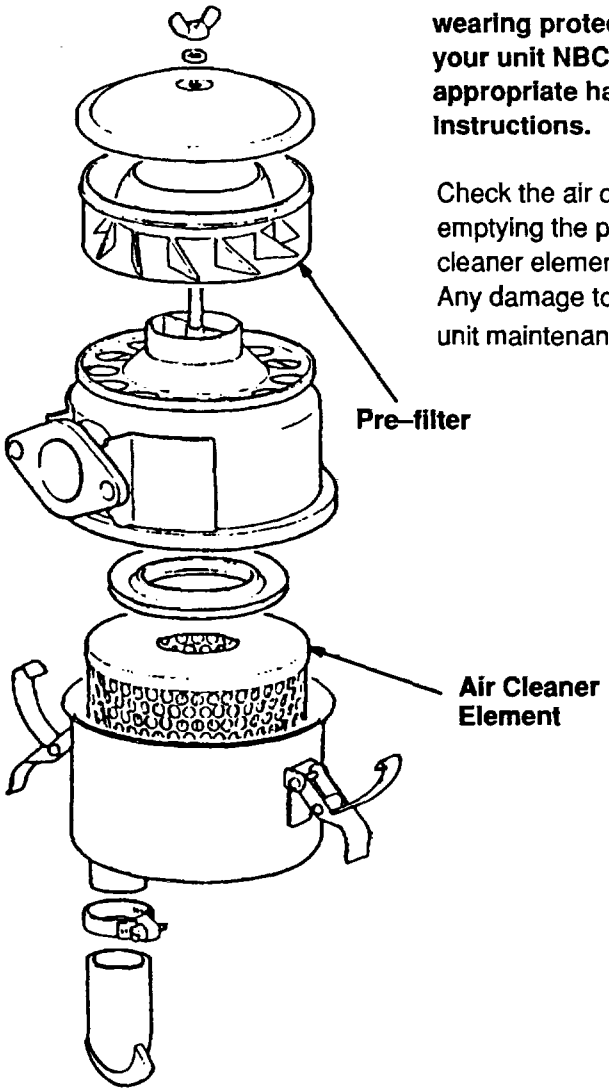


Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

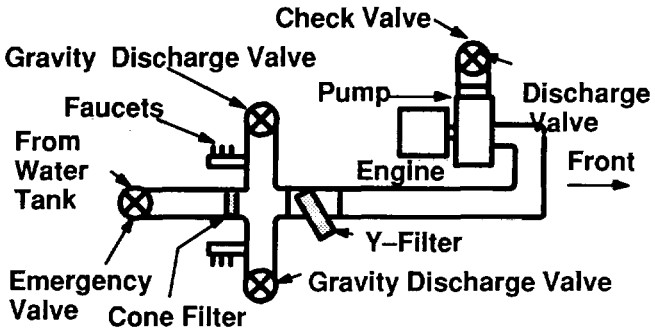
Item No.	Interval	~~Location~~ Item to Check/ Service	Crewmember Procedure	Not Fully Mission ~~Capable If:~~
			DRIVER	
8	Before	Water Pump Access Door Up Flow, and Leak Check	Open emergency valve. Check faucets of discharge valves. Water should flow freely. If water does not flow freely, refer to unit maintenance if pump is required for mission.	
				
			Inspect pump for leaks, especially around gas area. If considered a class III leak (drops of water are falling to ground) refer to unit maintenance upon completion of mission.	
9	During	Air Lines to Couplings on semitrailer	a. Connect towing vehicle air lines to couplings on semitrailer. With towing vehicle engine running, check air lines and couplings for air leaks.	Air leaks are evident.
			b. Connect towing vehicle intervehicular cable to receptacle on semitrailer. Check all lights for damage. Check that all lights are operating. If not operating, check tightness of connection at receptacle. If tight, have unit maintenance test and repair lights.	Turn signal and stop lights not operating. Towing vehicle intervehicular cable is damaged (cuts, cracks, broken wires, etc.)

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			DRIVER	
10	During	Landing Gear	After coupling towing vehicle to semitrailer, engage landing gear handle and raise and lower landing gear legs.	
11	During	Piping System Leaks, Operation	a. Check all valves and couplings for leaks. b. Check valves for proper operation	
12	During	Hose Troughs	Inspect troughs for debris. Remove any debris found and check that water drain holes are open.	
13	During	Intake/ Fill Hoses	a. Inspect outer casings and connector gaskets for wear and cuts. b. Inspect hoses for run-over damage (flattening). c. Replace worn or damaged gaskets.	
14	During	Catwalk Drains	Inspect for clogged drains. Remove foreign matter.	
15	During	Valve and Vent	Ensure that all valves are closed. Operate control lever to ensure cable is actuating the emergency valve and opens the vent on top of semitrailer.	Vent fails to open.

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			DRIVER	
16	During	Brake System	a. With towing vehicle coupled to semitrailer, apply semitrailer, apply semitrailer brakes and inspect all air lines and fittings for leaks. b. Apply semitrailer brakes and observe operation.	Brakes do not stop semitrailer or semitrailer pulls to one side.
17	During	Rear Axles	During movement of semitrailer, be aware of wander or side pull, listen for excessive noise. These are indications of improper axle alinement.	Semitrailer wanders, has side pull, or axles have excessive noise.
18	During	Water Pump Access Door Up Check Control Panel	a. Check switches for proper operation. b. Check indicator lights. Alt and Oil Pressure Lights should light with ignition in run position and engine off. c. Start engine (para 2-11). d. Indicator lights should not remain lit with engine running. e. With engine running, water pump pressure gage should read a minimum 10 psi with engine at idle to indicate water is in tank. f. Hourmeter should operate when engine is running.	

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			DRIVER	
19	During	Engine Assembly	a. With engine running, visually inspect for loose engine cowling or shrouding. b. Listen for excessive engine noise which indicates the muffler or exhaust pipes need replacing. Then shut off engine.	
20	After	Piping System	Inspect all pipes for dents and cracks.	

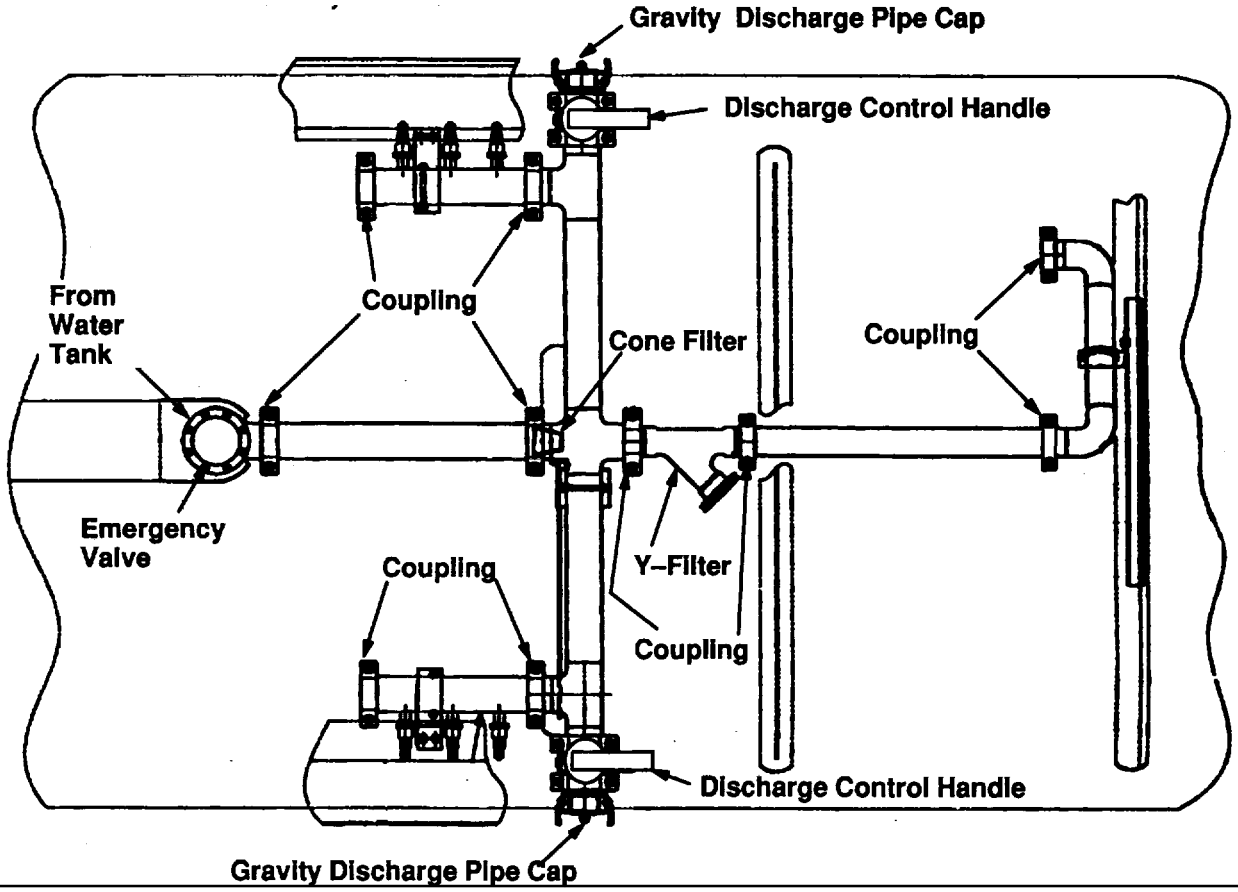


Table 3-1. Preventive Maintenance Checks and Services for Model M1098

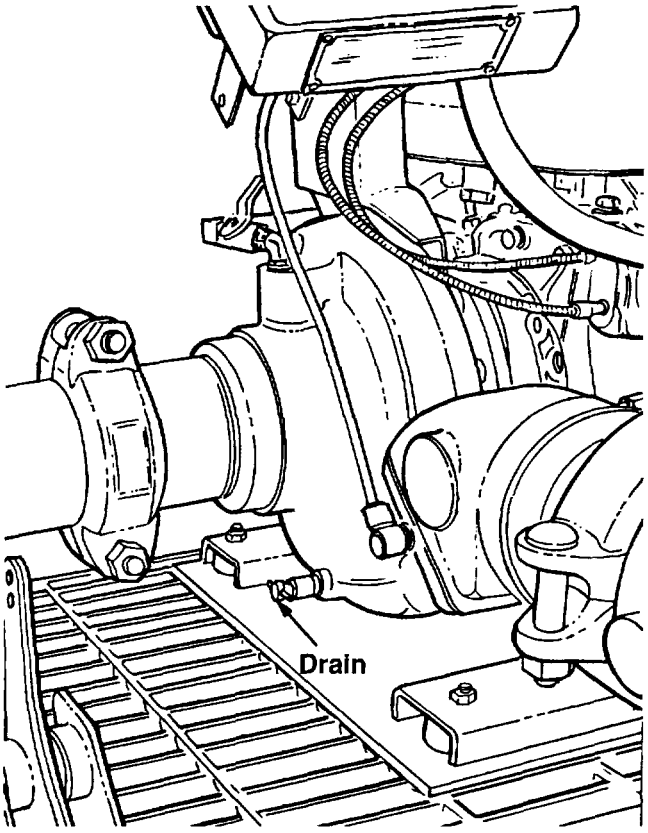
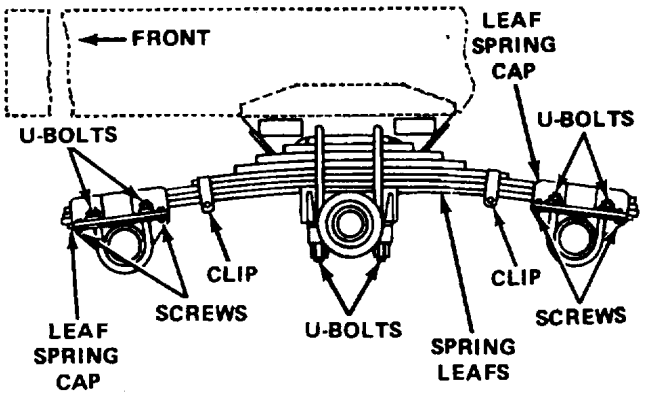
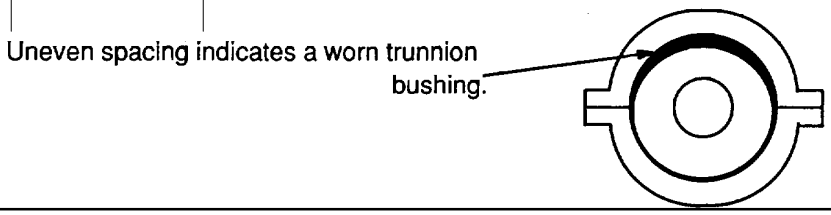
Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
21	After		Drain the water pump case daily during cold weather. Leave drain open only during cold weather. There are no lubrication points.  	

Table 3-1. Preventive Maintenance Checks and Services for Model M1098

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
22	After	Brake System	Drain water from both air reservoirs by opening the air reservoir drain cocks.	
23	Weekly	Tires and Wheels	Check for proper air pressure. Hard road surfaces: 70 psi Cross country and sand: 35 psi.	
24	Weekly	Landing Gear	Inspect for loose shoes, bent or damaged landing gear legs, and loose or missing mounting bolts.	
25	Weekly	Battery	Check electrolyte level in each cell. If low, notify unit maintenance. Check for corrosion. Check for damage.	
26	Weekly	Battery Cables	Check for corrosion at terminals. Check cable tightness on terminals. Check for cable damage.	
27	Monthly	Tires and Wheels	Inspect wheels for cracks or other damage. Check tightness of wheel nuts.	Wheel damaged or wheel nuts missing.

Table 3-1. Preventive Maintenance Checks and Services for Model M1098 (Cont'd)

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable If:
			DRIVER	
28	Monthly	Suspension	a. Visually inspect bogie for obvious damage or leaks.	
				
			NOTE **The three bottom leaves are the main leaf springs.**	
			b. Inspect springs for broken main leaves.	Any broken main leaf
			c. Visually inspect running gear hardware for obvious damage.	Loose or missing running gear hardware
			d. Inspect trunnion for worn bushing.	Worn trunnion bushing
				

Section III. TROUBLESHOOTING

3-4. General

NOTE

Before doing any troubleshooting, make sure you have performed all PMCS that address the problem area or system.

a. This section contains troubleshooting information for locating and correcting the operating troubles that may develop in the semitrailer.

b. Each malfunction for an individual component or system is followed by an initial setup block that will list any tools, supplies, or additional personnel needed, plus a list of equipment conditions. The equipment condition list will tell you things you need to do before performing the actual troubleshooting.

c. The initial setup block is followed by a list of checks (tests or inspections), in the form of a branch- ing logic tree that will help you determine corrective actions to take.

d. Starting with block A, perform the checks in the order given, then answer the question that follows with either a "YES" or a "NO". Follow the "YES" or "NO"

path to the next block, and so on until the problem is fixed or referred to support maintenance for correction.

e. This manual cannot list all malfunctions that may occur, nor all the tests, inspections, or corrective actions. If a malfunction is not listed or corrected by the information given, notify unit maintenance.

TRAILER ELECTRICAL SYSTEM

Table 3-2. Operator/Crew Troubleshooting.

No.	Malfunction	No.	Malfunction
1.	**One or more lights (but not all) do not work.**	**2.**	**Dim or flickering lights.**

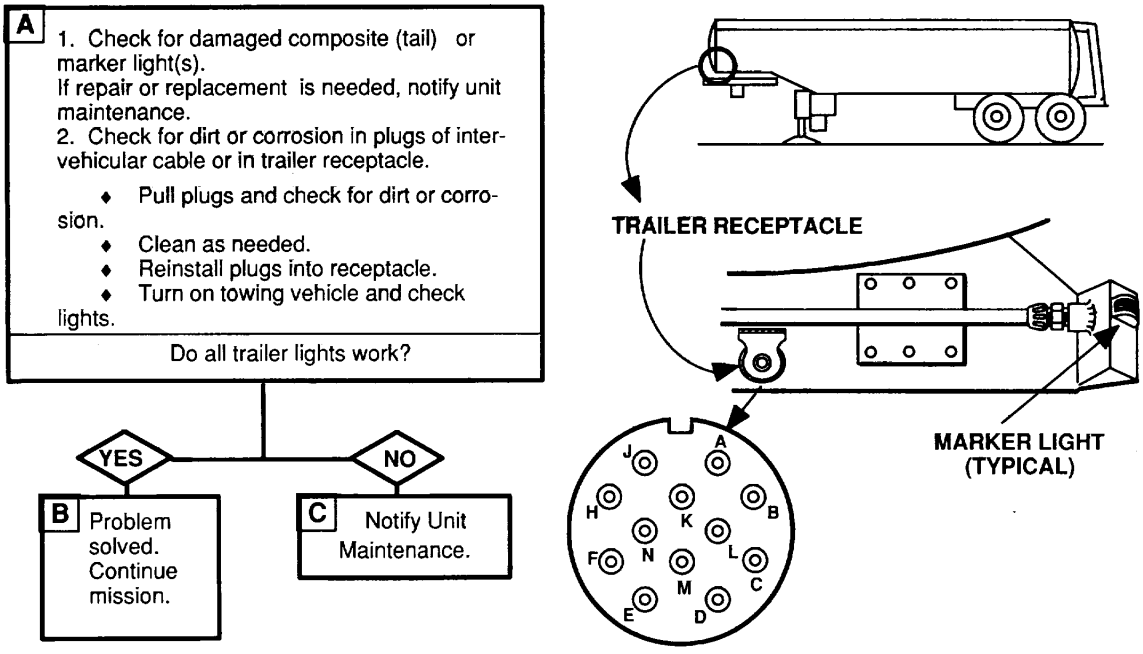
Initial Setup

Tools
None

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Intervehicular cable connected.
- Towing Vehicle power turned OFF.



TRAILER ELECTRICAL SYSTEM (Continued)

Table 3-2. Operator/Crew Troubleshooting (Continued).

No. Malfunction
3. No lights work on trailer.

Initial Setup

Tools
None
Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Intervehicular cable connected.
- Towing Vehicle power turned OFF.

A 1. Check light switch in towing vehicle for proper setting.
- Set light switch to proper setting.

Do all trailer lights work?

YES → **B** Problem solved. Continue mission.

NO → **C** Check for dirt or corrosion in plugs of intervehicular cable or in trailer receptacle.
- Pull plugs and check for dirt or corrosion.
- Clean as needed.
- Reinstall plugs into receptacle.
- Turn on towing vehicle and check lights.

Do all trailer lights work?

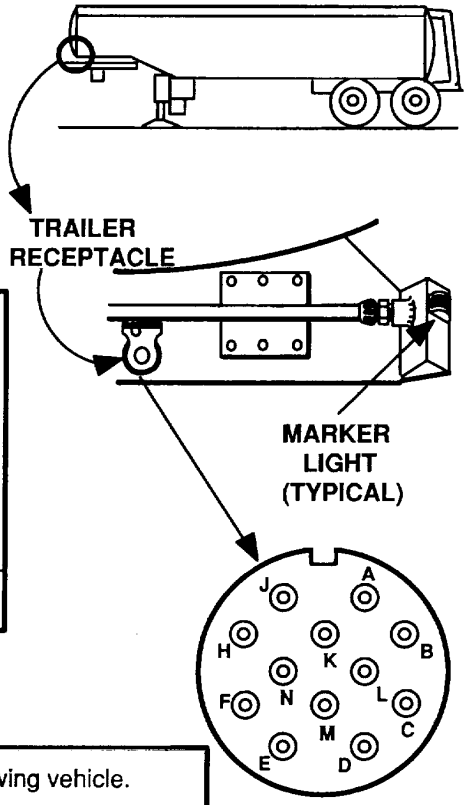
YES → **D** Problem solved. Continue mission.

NO → **E** Check fuse/ circuit breaker in towing vehicle.
- If fuse is blown, notify unit maintenance.
- If resetting the circuit breaker does not correct the problem, notify unit maintenance.
- If circuit breaker is tripped,reset circuit breaker.

Do all trailer lights work?

YES → **F** Problem solved. Continue mission.

NO → **G** Notify Unit Maintenance.



TRAILER ELECTRICAL SYSTEM (Continued)

Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
3.	No lights work on trailer.

Initial Setup

Tools
None

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Intervehicular cable connected.
- Towing Vehicle power turned OFF.

A 1. Check light switch in towing vehicle for proper setting.
- Set light switch to proper setting.

Do all trailer lights work?

YES → **B** Problem solved. Continue mission.

NO → **C** Check for dirt or corrosion in plugs of intervehicular cable or in trailer receptacle.
- Pull plugs and check for dirt or corrosion.
- Clean as needed.
- Reinstall plugs into receptacle.
- Turn on towing vehicle and check lights.

Do all trailer lights work?

YES → **D** Problem solved. Continue mission.

NO → **E** Check fuse/ circuit breaker in towing vehicle.
- If fuse is blown, notify unit maintenance.
- If resetting the circuit breaker does not correct the problem, notify unit maintenance.
- If circuit breaker is tripped,reset circuit breaker.

Do all trailer lights work?

YES → **F** Problem solved. Continue mission.

NO → **G** Notify Unit Maintenance.

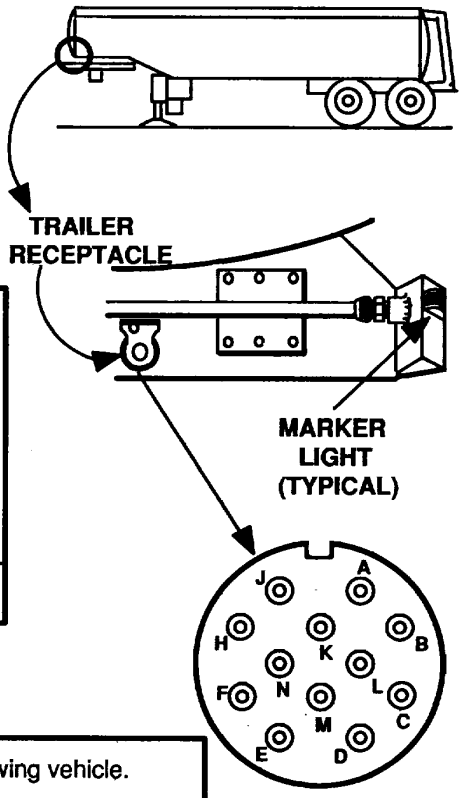


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
4.	**Brakes will not release.**

G Check for damaged Emergency air hose from towing vehicle, or for damaged Emergency air service line on trailer.

Is Emergency air hose from towing vehicle or air line on trailer damaged?

YES → **H** Notify Unit Maintenance.

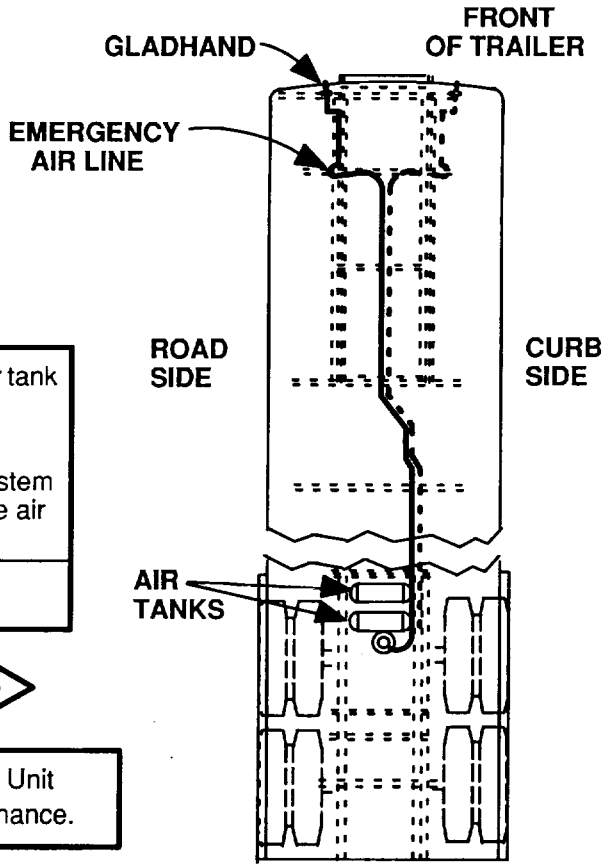
NO → **C** Check if rear air (main) reservoir tank drain valve is open fig. 2-2

- Close the drain valve.
- Recharge the air brake system from towing vehicle or from outside air source (see towing vehicle-10TM).

Do brakes release?

YES → **D** Problem solved. Continue mission.

NO → **H** Notify Unit Maintenance.



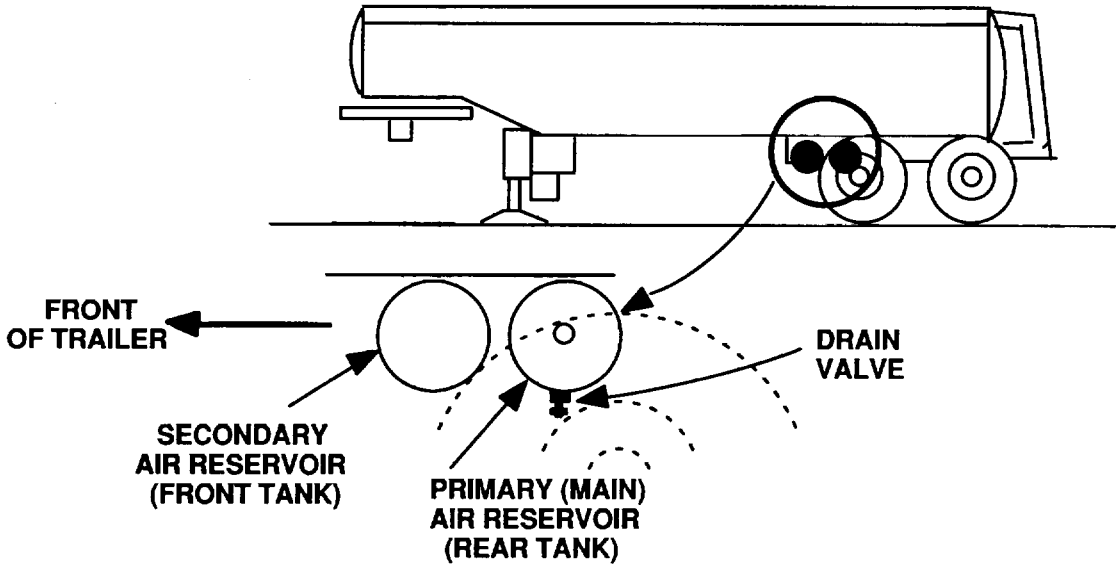


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
5.	No brakes or weak brakes on semitrailer.

Initial Setup	Equipment Conditions
Tools None **Personnel** One	♦ Trailer hooked to towing vehicle. ♦ Towing Vehicle power turned OFF ♦ Parking brakes set and wheels chocked. ♦ Intervehicular cable connected

A Check the following:

1. Check if shut–off valves are closed and that trailer hand brake is released in towing vehicle.
   - ♦ Open valves and/ or release hand brake (see towing vehicle-10TM).
2. Check if air hose couplings are properly connected (see towing vehicle-10TM).
   - ♦ Remove couplings and reconnect properly (see towing vehicle-10TM).
3. Check for damaged service air lines (see locator).
   - ♦ If damaged, notify unit maintenance.
   - ♦ If no damage was found, carefully road test to check system.

Are brakes OK?

YES → **B** Problem solved. Continue mission.

NO → **C** Notify Unit Maintenance.

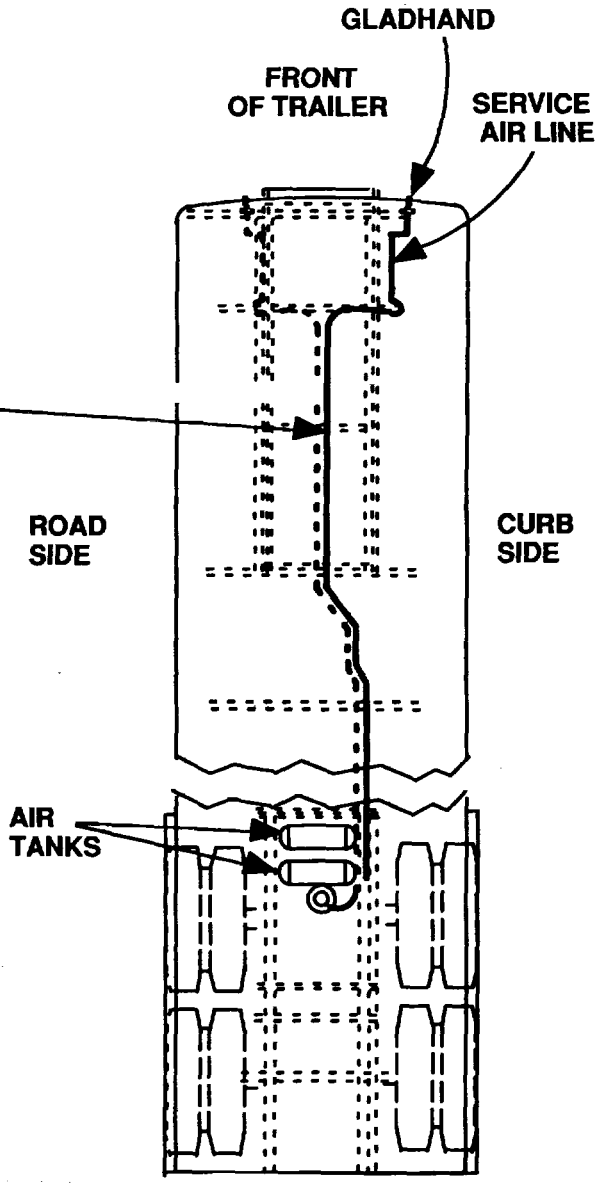


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
6.	**Slow release or application of brakes.**

Notify unit maintenance.

No.	Malfunction
7.	**Grabbing brakes.**

Initial Setup

Tools
None

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle. charged with air.
- Engine of towing vehicle OFF.
- Wheels chocked.
- Emergency brake released.

A Check the following:

1. Check for moisture in rear air reservoir (fig. 2-2).
   - Drain rear air reservoir (fig. 2-2)
   - Perform road test.

Are brakes OK?

YES → **B** Problem solved. Continue mission.

NO → **C** Notify Unit Maintenance.

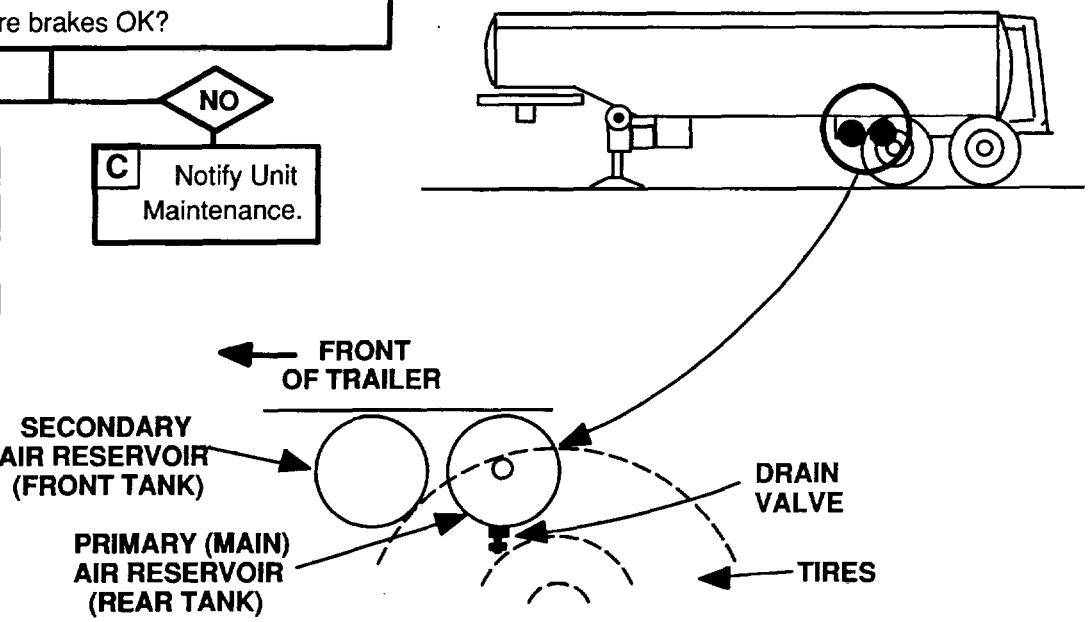


Table 3-2. Operator/Crew Troubleshooting (Continued).

No. Malfunction
8. Tire become noticably worn, scuffed, or cupped during operation.

Initial Setup

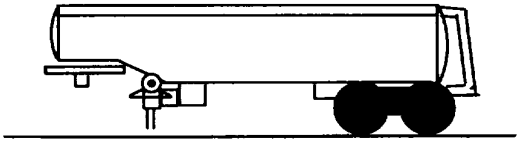
Tools
None
Personnel
One

Equipment Conditions

- Trailer parked.
- Brakes set.
- Wheels chocked.

A Check for obvious damage to suspension.

Is there any damage to suspension.



YES → **B** Notify Unit Maintenance.

NO → **C** Check for bent or broken wheel(s).

Are any wheels bent or broken?

YES → **D**
1. If only one wheel is bent or broken, replace with spare tire.
   - Continue mission.
   - Have bad wheel repaired or replaced as soon as possible.
2. If more than one wheel is bent or broken, notify unit maintenance.

Was bent or broken wheel replaced?

YES → **F** Problem solved. Continue mission.

NO → **G** Notify Unit Maintenance.

NO → **E** Check for loose wheels, or loose or missing wheel stud nuts.

- Tighten loose wheel stud nuts. **(After completing mission, notify unit maintenance for proper torquing of steel stud nuts.)**
- If more than one wheel stud nut is missing, remove one nut from each of the other trailer wheels, as needed, and install on wheel with missing nuts to secure wheel.
- Proceed with caution and continue mission. Replace missing wheel stud nuts as soon as possible.

WARNING

Do not operate semitrailer if more than one wheel stud nut is missing from any one wheel.

Were loose wheel stud nuts tightened?

YES → **H** Problem solved. Continue mission.

NO → Go To Block J

Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
8.	**Tires become noticeably worn, scuffed, or cupped during operation (Continued).**

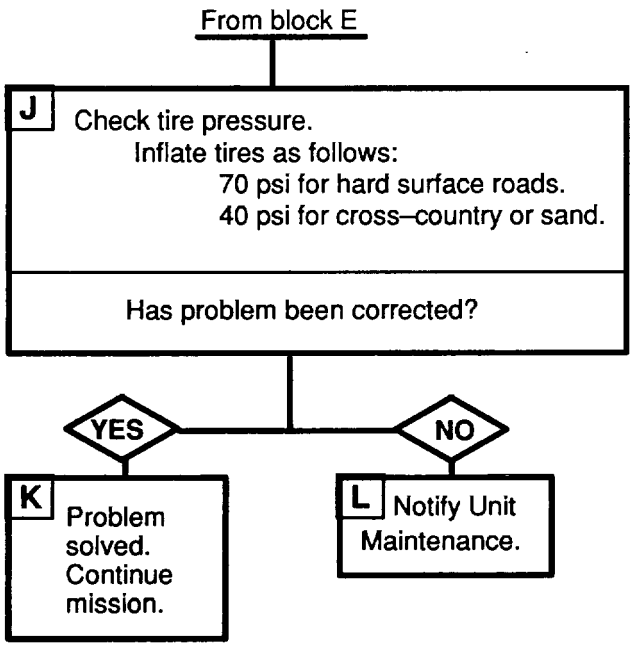


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
9.	DIFFICULTY IN TURNING LANDING GEAR OPERATING CRANK.

Initial Setup	Equipment Conditions
Tools None **Personnel** One	♦ Trailer hooked to towing vehicle. ♦ Towing vehicle engine off. ♦ Brakes set.. ♦ Wheels chocked.

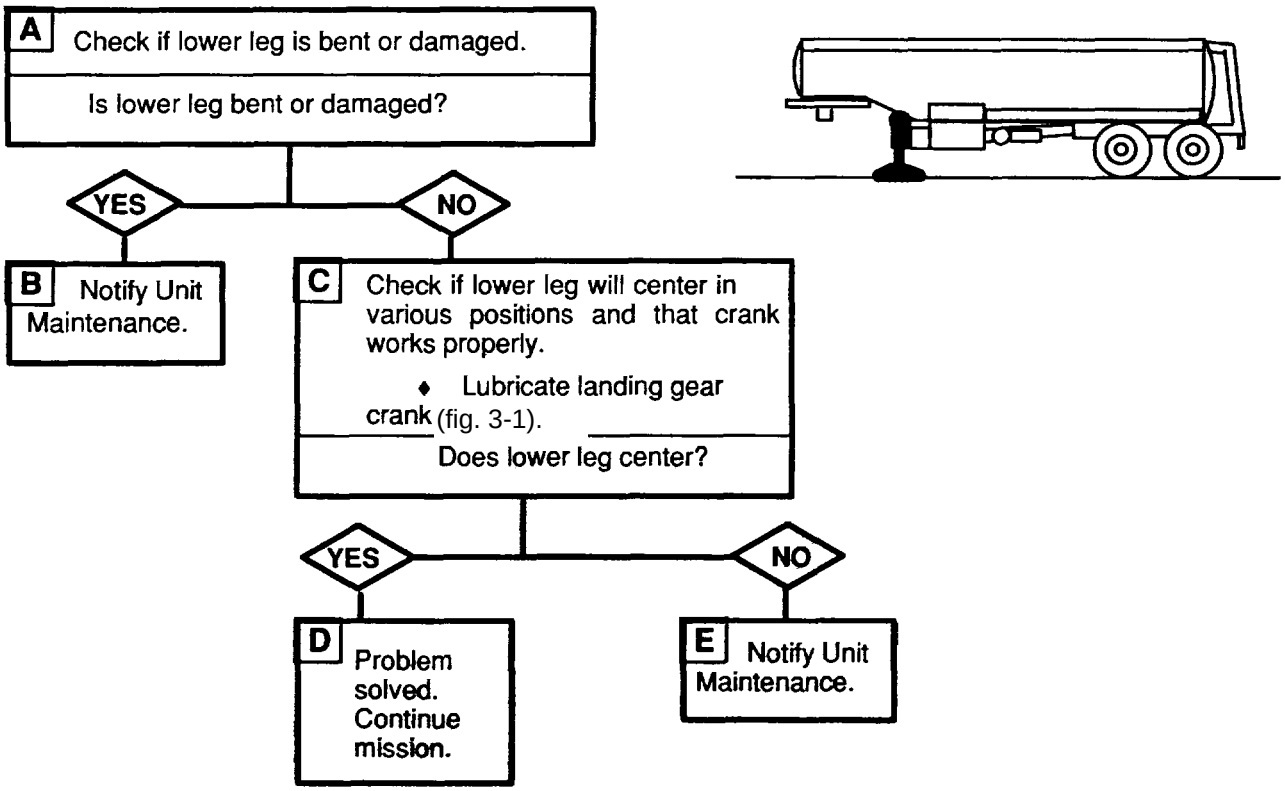


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
10.	ENGINE WILL NOT TURN OVER.

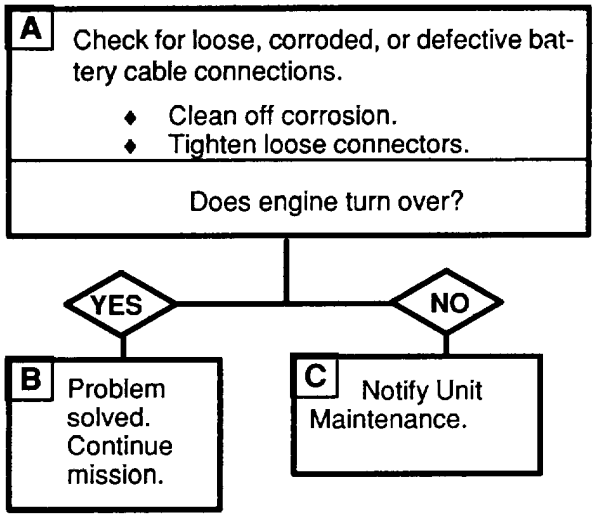
Initial Setup

Tools
None

Personnel
One

Equipment Conditions

- Trailer parked.
- Brakes set.
- Wheels chocked.



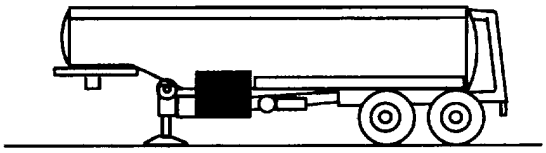
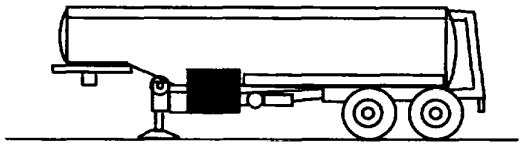


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
11.	ENGINE HARD TO START OR TURNS OVER SLOWLY.

Initial Setup	Equipment Conditions
Tools None **Personnel** One	♦ Trailer parked. ♦ Brakes set. ♦ Wheels chocked



A Check for weak (partially discharged) or defective battery.

♦ Remove battery cell caps and check for loss of electrolyte. If electrolyte is low, notify Unit Maintenance.

♦ If electrolyte is OK, have battery recharged.

Does engine turn over?

YES → **B** Problem solved. Continue mission.

NO →

WARNING

IF NBC EXPOSURE IS SUSPECTED, ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT.SEE OPERATOR / MAINTENANCE MANUALS.

C Check air cleaner filter element for clogging.

♦ Service air cleaner (see Table 3-1).

♦ Replace air filter element if clogged or dirty.

Does engine start?

YES → **B** Problem solved. Continue mission.

NO → **C** Notify Unit Maintenance.

Table 3-2. Operator/Crew Troubleshooting (Continued).

No. Malfunction
12. ENGINE TURNS OVER BUT FAILS TO START.

Initial Setup

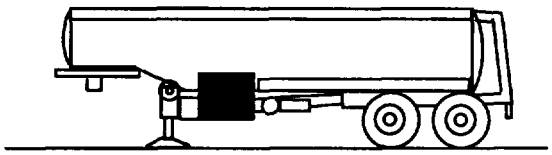
Tools
None
Personnel
One

Equipment Conditions

- Trailer parked.
- Brakes set.
- Wheels chocked.

A Check level of fuel in fuel tank.
- Add fuel if needed.

Does engine turn over?



YES → **B** Problem solved. Continue mission.

NO → **C** Check for leaking or damaged fuel lines.
- If leaks can't be stopped by tightening fuel line clamps, notify Unit Maintenance.

Does engine start properly?

YES → **D** Problem solved. Continue mission.

NO → **E** Notify Unit Maintenance.

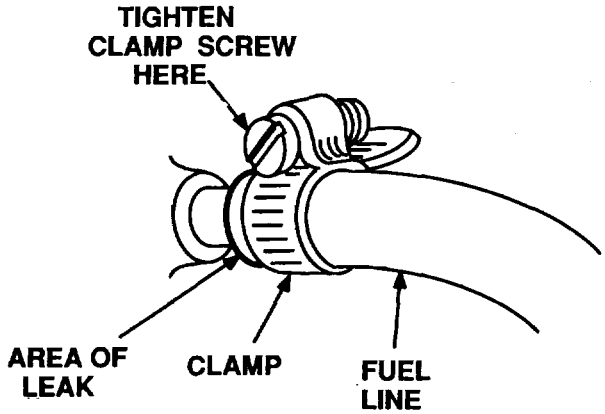


Table 3-2. Operator/Crew Troubleshooting (Continued).

No. Malfunction
13. LOW ENGINE POWER.

Initial Setup

Tools
None
Personnel
One

Equipment Conditions

- Trailer parked.
- Brakes set.
- Wheels chocked.

WARNING

IF NBC EXPOSURE IS SUSPECTED, ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT.SEE OPERATOR / MAINTENANCE MANUALS.

A Check air cleaner filter element for clogging.

- Service air cleaner (see Table 3-1).
- Replace air filter element if clogged or dirty.

Does engine start?

YES

B Problem solved. Continue mission.

NO

C Check for leaking or damaged fuel lines.

- If leak is located at end of hose secured by a screw–type hose clamp, tighten until clamp is snug, but does not cut into hose.
- If leaks can't be stopped by tightening fuel line clamps, notify Unit Maintenance.

Does engine start properly?

YES

D Problem solved. Continue mission.

NO

E Notify Unit Maintenance.

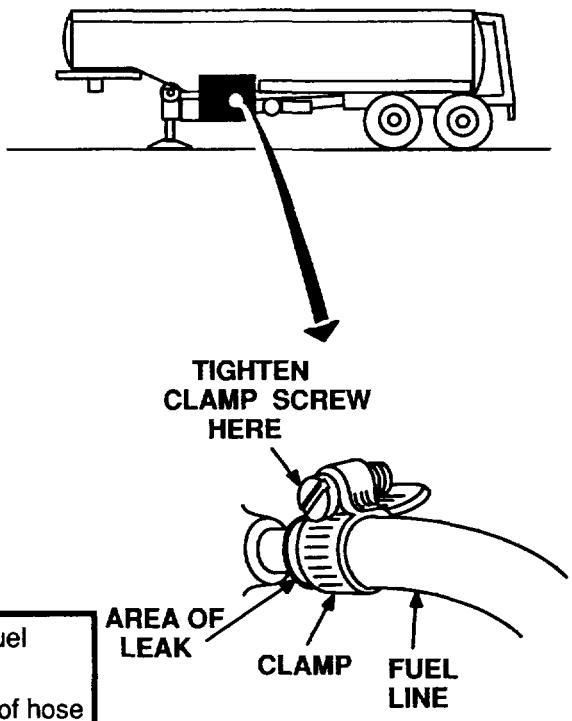


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
14.	**Low pressure indicator light stays on.**

Initial Setup	**Equipment Conditions**
Tools	♦ Trailer parked.
None	♦ Brakes set.
Personnel	♦ Wheels chocked.
One	♦ Engine stopped

A Check for proper engine oil level (see Fig.3-1).
- ♦ Check engine oil level
- ♦ Add oil as needed.

Does engine low oil pressure light go out?

YES → **B** Problem solved. Continue mission.

NO → **C** Notify Unit Maintenance.

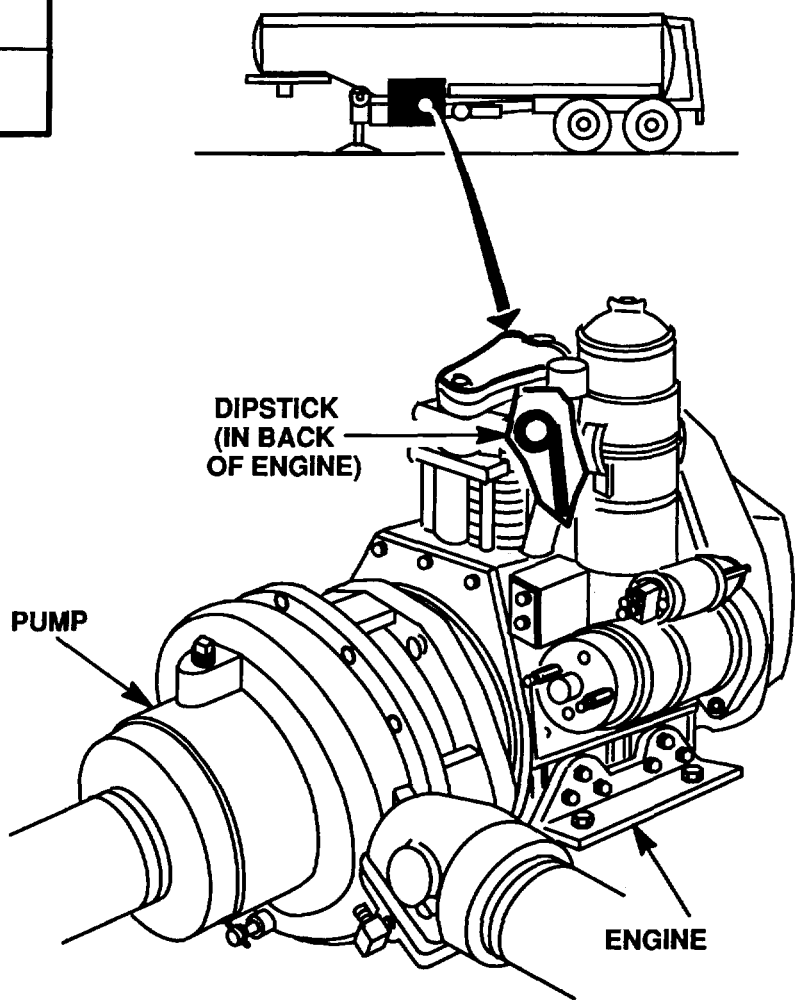


Table 3-2. Operator/Crew Troubleshooting (Continued).

No.	Malfunction
15.	**WATER DOES NOT FLOW DURING OPERATION.**

Initial Setup	**Equipment Conditions**
Tools	♦ Trailer parked.
None	♦ Brakes set.
Personnel	♦ Wheels chocked.
One	♦ Water in tanker (at least 300 -500 gallons).

A Check if emergency valve is open.

♦ Open valve by pulling down emergency valve control handle (in engine compartment).

♦ If valve does not operate properly, notify Unit Maintenance.

Does water flow freely?

YES → **B** Problem solved. Continue mission.

NO → **C** Check that main supply valve is open.

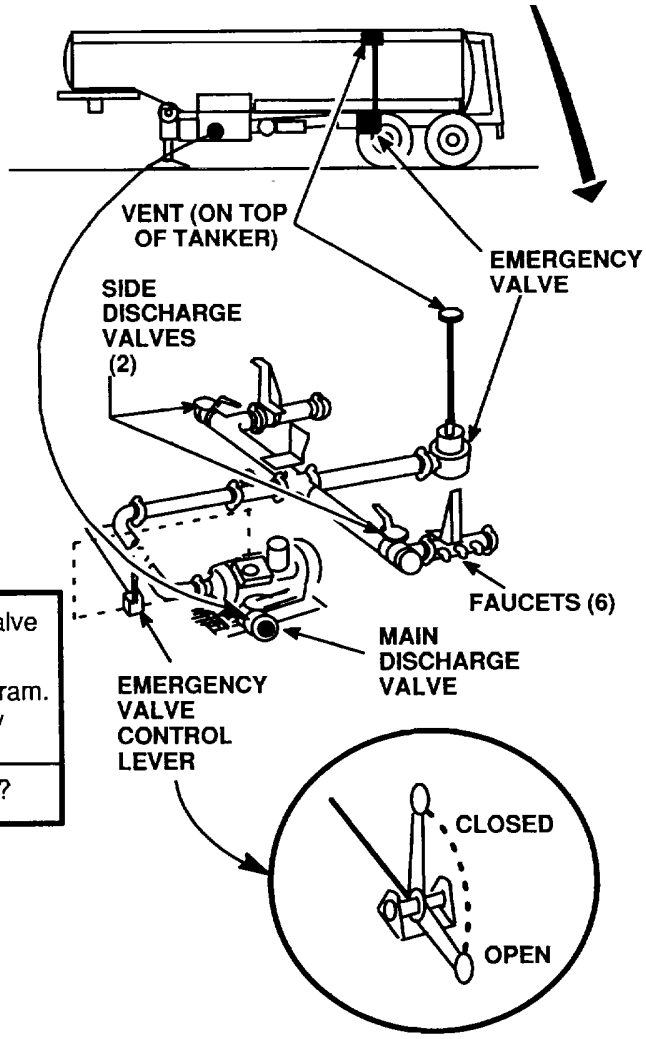
♦ Refer to flow diagram.

♦ Open main supply valve if needed.

Does water flow freely?

YES → **D** Problem solved. Continue mission.

NO → **E** Notify Unit Maintenance.



Section IV. WATER TANKER OPERATOR/CREW MAINTENANCE PROCEDURES

3-4. General

This section provides maintenance instructions for those items which are the responsibility of the operator/crew. The maintenance functions are limited to those operations that are authorized by the Maintenance Allocation Chart (MAC), Appendix B of this manual.

3-5. Batteries, Terminals and Cables

The battery terminals and cables should be inspected for excessive dirt and corrosion, loose connections, and damage each time before this vehicle is put into operation. Dirt, combined with electrolyte or moisture on top of battery, can result in a continuous battery discharge.

a. Inspection Steps and Services

(1) Inspect battery are for excessive dirt and corrosion. Clean battery area using instructions in *b* below.

(2) Check cables for frayed insulation. If insulation is worn or frayed, notify unit maintenance.

(3) Check for loose terminals. Tighten if loose.

(4) Remove vent fill covers and check electrolyte level. Electrolyte level must be just below the ring at the bottom of each cell opening. If electrolyte level is low, fill using instructions in b below.

b. Maintenance Instructions

(1) Cleaning Battery Area. Use baking soda ammonia, then flush battery and cables with water.

WARNING

Batteries contain sulfuric acid that causes severe burns. If acid contacts eyes, skin, or clothing, flush well with water. For contact with eyes, get immediate medical attention.

(2) Filling Battery Cells. Add distilled or any other clean water to each cell until the fluid level rises to just below the ring at the bottom of the cell opening. Do not overfill. Too much water can cause poor performance and corrosion around the battery.

3-6. Air Reservoirs

a. Draining Water From Reservoir. The reservoirs are located beneath the semitrailer in front of the axle fig. 2-2. Both air reservoirs have a drain cock for removal of water from the tanks. Open each drain cock every day and allow water to flow out. Then, close the drain cocks.

b. Inspect. Check that mounting screws holding the reservoirs are tight and that brackets and water drain cocks are not bent or damaged. Notify unit maintenance if any parts need replacing or tightening.

3-7. Hose Troughs

a. Cleaning. Dirt and water may collect in the hose troughs after a period of time. Remove the hoses from trough and remove any debris. Check that water drain holes are open.

b. Inspect. Check hose troughs from damage and missing parts. If found, notify unit maintenance.

3-8. Cabinets and Cabinet Doors

a. Piping Assembly

(1) *Cleaning.* Remove daily any dirt and debris that may collect in the piping assembly.

(2) *Inspect.* Report any damage to the piping to unit maintenance.

(3) *Lubrication.* Lubricate the cabinet door hinges and latches weekly with engine oil.

3-9. Tool Box

a. Cleaning. Periodically clean tool box of dirt and debris. Make sure drain holes are open.

b. Inspect. Inspect tool box cover and tool box for damage. Report any damage to unit maintenance.

3-10. Intake/Fill Hoses

Cleanliness of the intake/fill hoses which are part of the dispensing unit is the key to safe water supply. Microbial growth and contamination in new and used hoses requires cleaning and disinfecting. During operation hoses should not be sub merged or buried. The discharge end or dispensing nozzle should b e clean and off the ground. Prior to disassembly the operator should flush, clean and drain hoses. Hoses should be protected from contamination during transport or storage. Prior to assembly operators should inspect, clean and sanitize hoses/connectors. Once assembled the hoses must be flushed and disinfected prior to use.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. Inspecting and Servicing the Equipment

a. General. When material is received by the using organization, it is the responsibility of the officer in charge to determine whether the material has been properly prepared for service by the supplying organization and to be sure it is in condition to perform its function. Whenever practical, the operator/crew will assist unit maintenance personnel in the performance of these services. Services to be performed are listed below.

WARNING

Type 1 Dry cleaning solvent P-D-680 toxic and flammable. The solvent's flash point is 100°F-138°F (38°C-59°C). In a hot arid environment, type 2 solvent, which has a higher flashpoint, should be used. When using either type, observe the following:

Always wear chemical splash goggles, full face shield, nitrile rubber or polyvinyl alcohol gloves and protective apron. Contact nearest safety office or industrial hygienist for guidance on appropriate respiratory protection.

Adequate ventilation must be provided. Work should be performed out of doors or in a well ventilated area. If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help.

Avoid solvent contacts with skin, eyes an clothes and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. If solvent contacts eyes or skin, immediately wash the effected area. Eyelids should be held open during washing. Seek medical attention immediately. Continue eye washing during transport to medical treatment facility.

b. Servicing. If exterior surfaces are coated with rust-Preventive compound, remove with dry cleaning solvent (item 11, Appendix E). Read "Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines" tag (DD Form 1397) and follow all directions carefully (para c).

WARNING

DO NOT paint or apply any type of material to the interior of the tank.

c. Water Trailer Equipment Cleaning Requirements

The owning unit will maintain the cleanliness of unit water trailers and other water purification, storage and distribution equipment. Water trailers will be clean upon arrival at a water point. Water purification and distribution personnel will refuse to fill unclean containers. Unit commanders will ensure water trailers and other potable water containers are inspected for cleanliness, tightness of seals and seams, and overall ability to perform their intended purpose. The unit Field Sanitation Team (FST) will coordinate the regular maintenance and cleaning of water containers to ensure that the quality of potable water is not altered. The unit FST is responsible for inspecting potable water containers to ensure that the containers are medically accept- able for deployment. Periodic inspection will assist in identifying the requirement for maintenance and cleaning of water containers.

d. Water Trailer New equipment Cleaning and Sanitizing. New equipment will be cleaned and sanitized prior to initial use. Cleaning instructions are described n para 4-36. Sanitation directions are in para 4-37. Once new equipment has been designated for use with potable water, it will not be contaminated with any non- potable water or fuel. Stencil the words POTABLE WATER ONLY on both sides of the equipment's exterior.

e. Equipment decontamination.

(1) Water purification and supply persons and the unit field sanitation team must be prepared to protect potable water supplies from contamination Such contamination is not limited to only chemical agents, but may include biological agents and radioactivity from nuclear weapons. The staff chemical officer coordinates decontamination operations within the appropriate combat element. In addition most units have an NBC officer or non-commissioned officer who teaches elements of NBC defense and decontaminate to members of the unit.

f. Procedures. Procedures for cleaning, sanitizing and decontamination are described in Section XIV.

g. Water Dispensing Unit. Every pumping unit is thoroughly tested at the factory and shipped properly adjusted, with lubricant in all parts needing lubrication. except the engine crankcase. Check level of oil, in the crankcase. Check crankcase and fill (see lubrication chart).

h. Road Preparation Procedures

(1) Lubricate all points illustrated in lubrication chart, regardless of interval, fig. 3-1.

(2) Couple an authorized prime mover to semitrailer, para 1-7. Perform a "break-in" by driving 25-30 miles at speeds up to 30 miles per hour. Check the following:

(a) While in motion, apply service brakes to ensure that brakes are working properly.

(b) Inspect marker lights, stop and turn signal lights, blackout lights, and the control panel lights. Replace if faulty.

(3) All deficiencies which appear to involve unsatisfactory design shall be reported on DA Form 2404 (DA PAM 738-750).

i. Missing or Defective Parts. Check to see if any parts are missing or have been broken in shipment.

j. Correction of Deficiencies. Deficiencies disclosed during preliminary inspection and servicing or during the "break-in" period shall he corrected by using organization or supporting maintenance activity. Deficiencies shall he reported in accordance with DA PAM 738-750.

4-2. Material Pertinent to Unit Maintenance.

This section contains unit troubleshooting for water delivery, engine mechanical and engine electrical system, water dispensing unit removal and installation and pump service procedures for the M1098 Water Dispensing Unit. Further M1098 material can be located through the Table of Contents and Index. Briefly, other material pertinent to the M1098 Water Dispensing Unit is shown in:

Chapter 2 - Operation of Water Dispensing Unit for Operator/Crew;

Chapter 3 - Lubrication Chart and Operator/Crew PMCS;

Chapter 4 - Unit PMCS Unit PMCS Sections contain information on components used on both fuel and water tankers or that are unique to the water tanker and this section;

Chapter 7 - Service procedures for the engine.

Section II. REPAIR PART< SPECIAL TOOLS AND EQUIPMENT

4-3. Special Tools and Equipment

Special tools and equipment required for unit maintenance are listed in TM 9-2330-388-24P. General rmechanics tool sets and common tool sets required for maintenance are authorized by the Table of Allowance (TA) and the Table of Organization and Equipment (TOE).

4-4. Repair Parts

Repair parts authorized for use by unit maintenance are listed and illustrated in TM- 9-2330-388-24P.

4-6. Fabricated Tools and Equipment Table 4-1 contains fabrication instructions for non-run stop tool. Use plastic tie to attach tool on handle of main discharge tool.

Section III. UNIT PREVENTIVE MAINTENANCE CKECKS AND SERVICES (PMCS)

4-6. General

Preventive maintenance is detecting/correcting Problems before they happen, or fixing little problem before they become big problems. A list of Preventive maintenance checks and services to be performed by unit maintenance personnel are described in Table 4-1. Attention to these checks and services will increase the useful life of the equipment, but every possible problem cannot be covered in the PMCS. You need to be alert for anything that might cause a problem. If anything does look wrong, and you cannot fix it, write it on DA Form 2404 and report it to your Supervisor. Be sure to record any corrective action.

a. Perform the checks and services at the intervals shown in table 4-7.

(1) Do your QUARTERLY (Q) PREVENTIVE MAINTENANCE once each three months.

(2) Do your SEMIANNUAL (S) PREVENTIVE MAINTENANCE twice a year, or each six month

(3) Do your ANNUAL (A) PREVENTIVE MAINTENANCE twice each year.

(4) Do your BIENNIAL (B) PREVENTIVE MAINTENANCE once each two years.

(5) Do your HOURS (H) PREVENTIVE MAINTENANCE at the hour interval listed.

b. Ensure that all safety precautions listed in the Warning Summary are followed while performing PMCS. Pay close attention to all WARNINGS and CAUTIONS.

c. If the semitrailer doesn't work properly and you see what is wrong, refer to for troubleshooting instructions Section I

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). if you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. if solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

d. Make cleanup a part of your preventive maintenance. Dirt, grease, oil, and debris may cover up a serious problem. Use dry cleaning solvent (item 11, Appendix E) to clean metal surfaces. Wipe off excess grease and spilled oil. Use soap and water when you clean rubber or plastic material.

Watch for and correct anything that might cause a problem with the equipment. Some things you should watch for are:

(1) Bolts, nuts, and screws that are loose, missing, bent, or broken.

(2) Welds that arc poor or broken.

(3) Electrical wires and connectors that are bare, broken, or loose.

(4) Hoses and fluid lines that leak, or show signs of damage or wear.

f. You should know how fluid leaks affect the status of. your equipment. Learn and be familiar with the following types/classes of leakage. When in doubt, notify your supervisor!

Leakage definitions for PMCS:

CLASS I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II Leakage of fluid great enough to form drops but not great enough to cause drops to drip from the item being checked/inspected.

CLASS III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation Is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

g. When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

h. Class III leaks should be corrected before releasing equipment for operation.

Table 4-1. Unit Preventive Maintenance Checks and Services

Q-Quarterly S - Semiannually A - Annually B - Biennially H - Hours

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
						Perform operator/crew PMCS prior to or in conjunction with unit PMCS if:
						a. There is a delay between daily operation of semitrailer and unit PMCS.
						b. Regular operator Is not assisting/participating.
1						**Tank.**
	•					Check inside of tank thoroughly:
	•					a. Check manhole cover for rust or debris. If rust or debris are found, for cleaning, refer to to para 4-36. For sanitizing, refer to para 4-37.
	•					b. Check tank for rust at intersections where brackets are welded to tank. If rust is found, notify unit medical personnel for re-certification.
	•					c. Check condition of paint. Notify direct support maintenance of any damage found.
2						**Electrical System.**
	•					a. Check chassis electrical harness connections for security and condition. Check harness for worn or frayed insulation.
	•					b. Inspect intervehicular cable receptacle for damage or corrosion.
3						**Bogie Assembly.**
	•					a. Tighten loose cross tube U-bolts.
	•					b. Check spring leaves, clips, and spring U-bolts.
4						**Towing Connections.**
			•			Inspect condition of kingpin for wear. Kingpin should be replaced when any of the following conditions exist:
						a. Wear of 1 /1 6-inch over 1/4 of the circumference of the kingpin. This would be a condition of uneven wear on one or more sides of the kingpin wear surface.

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q - Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

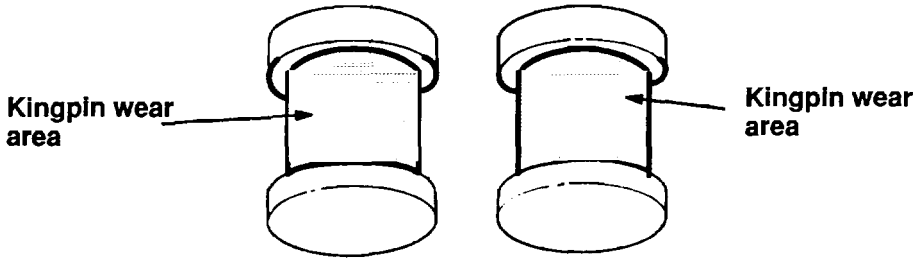
ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
						b. Even wear over the kingpin surface causing the diameter to be reduced by 1/16-inch. c. When a crack of any size is noted anywhere on the pin or associated welds. d. When a nick, chip, or gouge deeper than 1/8-inch is noted anywhere on the wear surface of the pin. 
	•					e. Check air line glad hand coupling packing rings for damage. Replace if damaged.
5						**Wheels and Hubs**
			•			a. Check for cracked wheels or hubs and missing or loose wheel nuts.
			•			b. Check hub and drum for scratches, pitting, cracks, or other damage and check bearing race inside hub for looseness. Replace if damaged, para 4-51.
			•			c. Clean and inspect wheel bearings. Replace worn or damaged bearings. Repack, para 4-51.
6		•				**Brakes**
						a. Check brake shoe lining thickness. Replace if lining is within 1/16-inch of rivet heads. Check drum for damage or indication of overheating.
	•					b. With air in system, check air line couplings for leaks. Tighten if loose. Replace if damaged.

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd.)

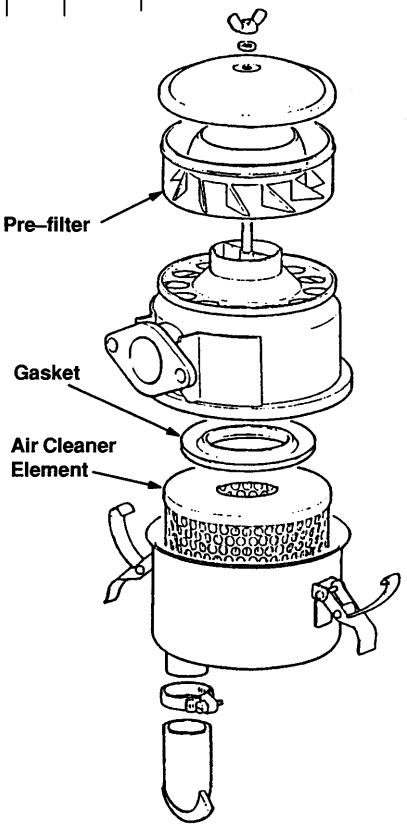
Q - Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
7						**Landing Gear**
	•					Check condition and operation of landing gear. Inspect for damage or wear. Replace damaged parts.
8						**Batteries and Cables**
		•				a. Check electrolyte specific gravity.
	•					b. Check for damaged battery cables and terminals. Replace cables or battery if damaged.
9						**Fire Extinguishers**
						WARNING **Handle charged fire extinguisher cylinders with care. DO NOT jar or expose to temperature above 140° F (60° C).**
						NOTE **Refer to TB 5-4200-200-10 for guidance on fire extinguisher servicing.**
	•					a. Remove fire extinguisher from mounting bracket and weigh. Fill out maintenance request (DA Form 2407) or exchange request (DA Form 2407) for cylinders requiring recharging.
	•					b. Check mounting bracket for secure attachment to semitrailer. Check that lockup handle moves freely and is not damaged.
	•					c. Check that plastic indicator on top of fire extinguisher is intact.
						NOTE **Some fire extinguishers have a safety wire-lead or plastic seal attached to pull pin.**
						d. Check that safety wire-lead or plastic seal is not broken or missing.
	•					e. Check that tube is not kinked and nozzle is free of obstructions.

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q - Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
	•					f. Check that the fire extinguisher tag is securely attached. Check for date of last inspection/recharge.
	•					g. Cover and install fire extinguisher on mounting bracket. Ensure that lockup handle holds fire extinguisher securely to mounting bracket.
10					50-Standard 25-desert	**M1098 Water Dispensing Unit - Engine** Change air cleaner element. Check gaskets.



WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q - Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

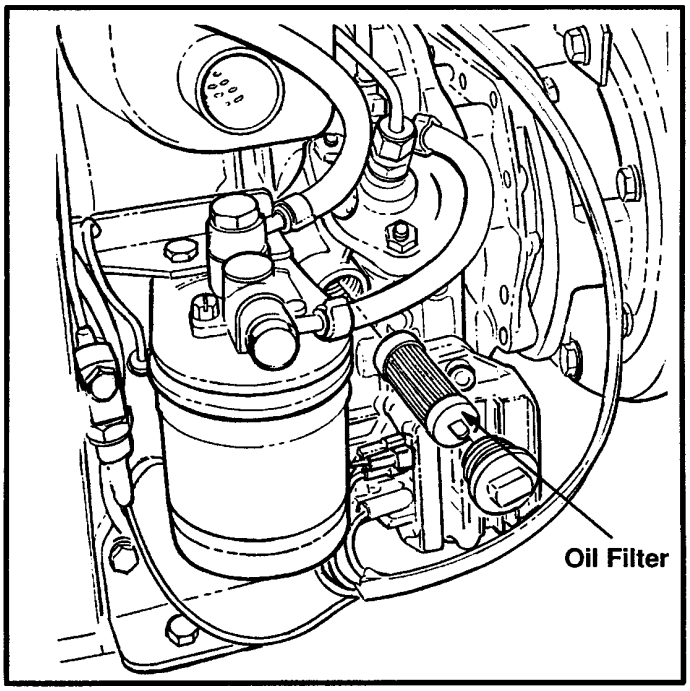
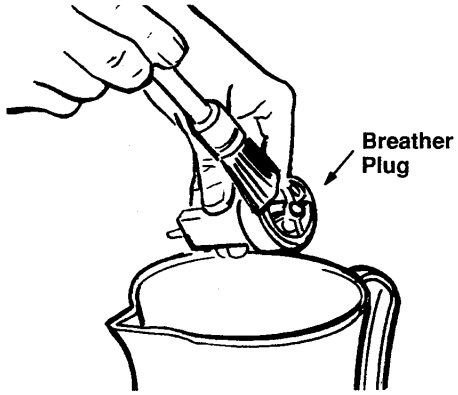
ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
10						**M1098 Water Dispensing Unit - Engine**
					100 standard operation 50 desert operation	Remove rear access panel. Replace the oil filter.  **NOTE** **Shown with rear access panel removed.**
					100	Clean the oil filler breather plug. 

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
10						**M1098 Water Dispensing Unit - Engine**
						CAUTION **Do not use wire brush or other metal object to clean fins, To do so could damage fins.**
					100	Clean the cylinder head fins and cylinder fins.

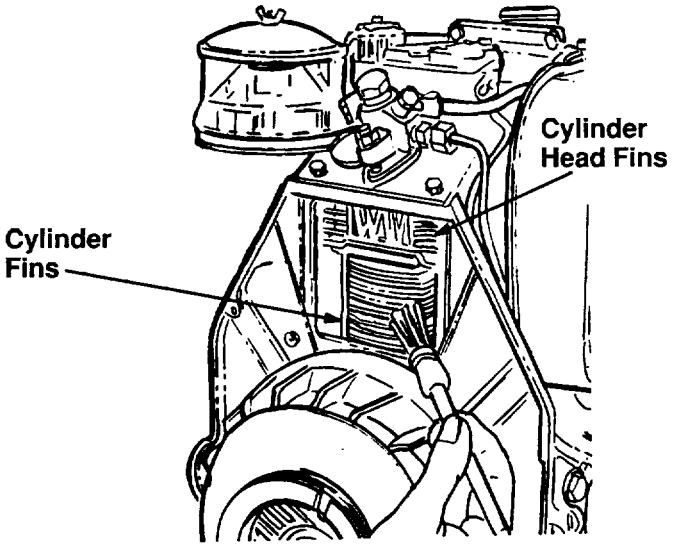


Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
					500 standard operation 200 desert operation	Change fuel filter element.

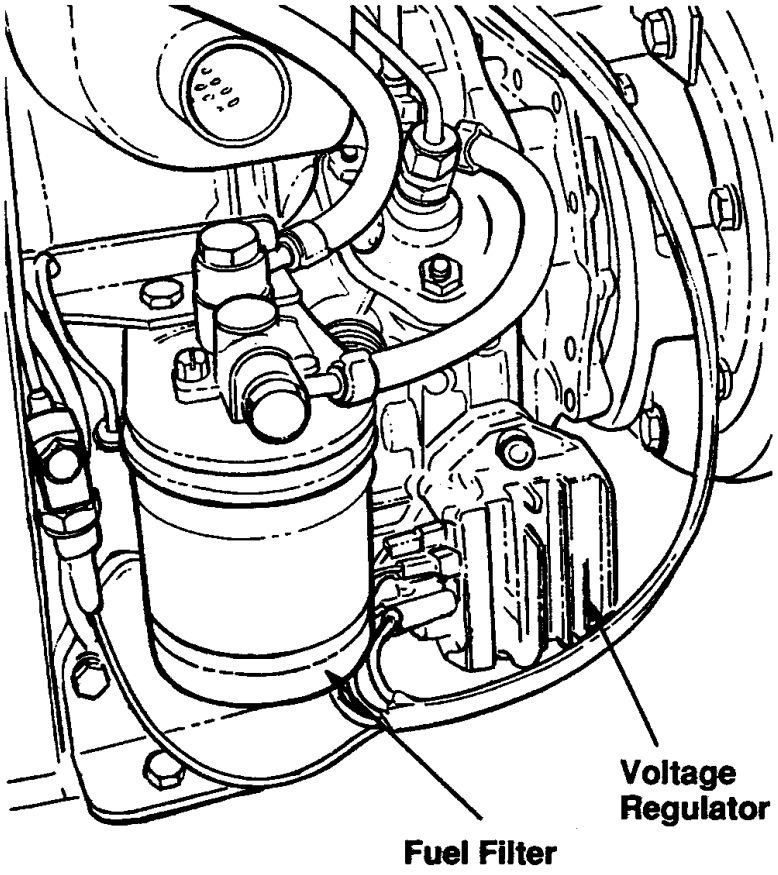
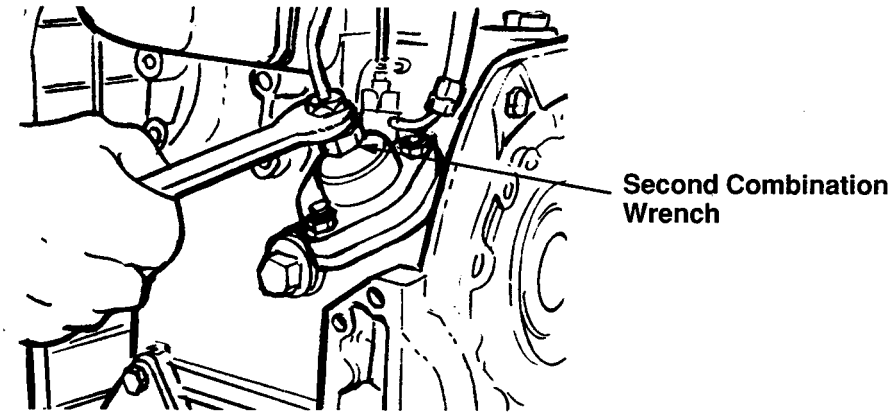


Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly S - Semiannually A - Annually B - Biennially H - Hours

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
10						**M1098 Water Dispensing Unit - Engine**
					300	Check the fuel pipe form the injector pump to the injector for looseness, using a second combination wrench at injector pump below fitting to prevent line damage. If necessary , tighten.
					300	Notify Direct Support maintenance. Adjust valve clearance as described in para 7-4.



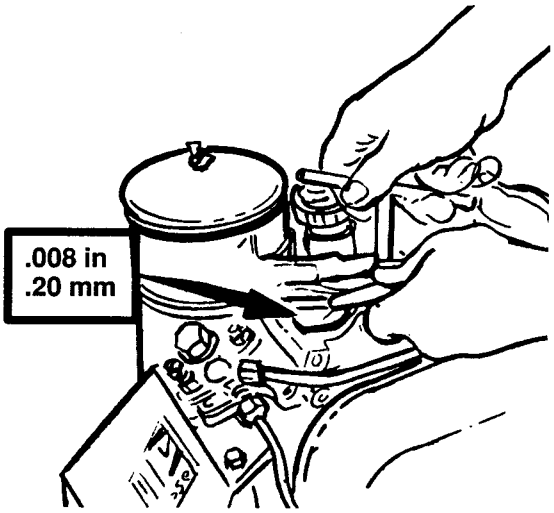


Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
10						**M1098 Water Dispensing Unit - Engine**
					300	Check the feed hose and pipe for leaks or other damage.

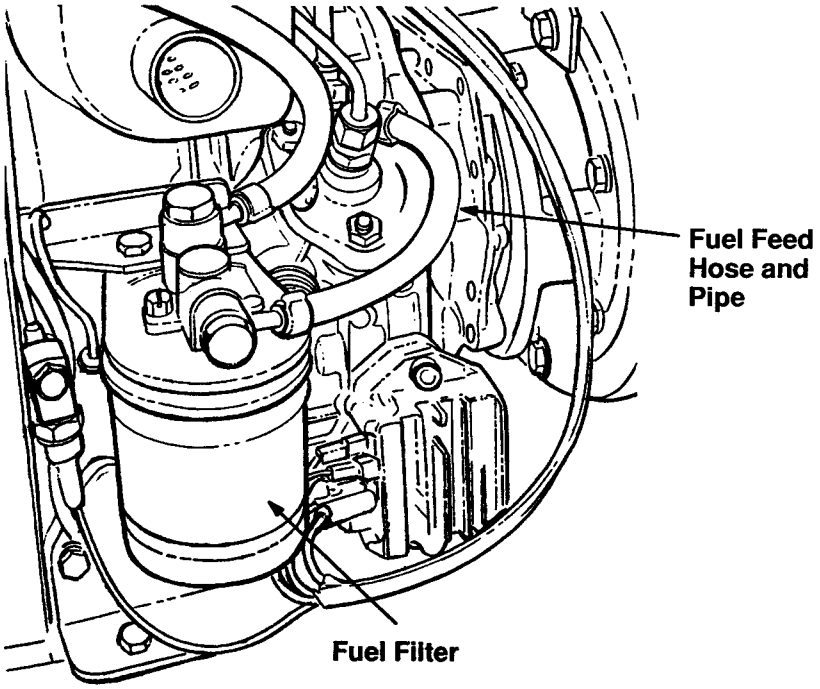


Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

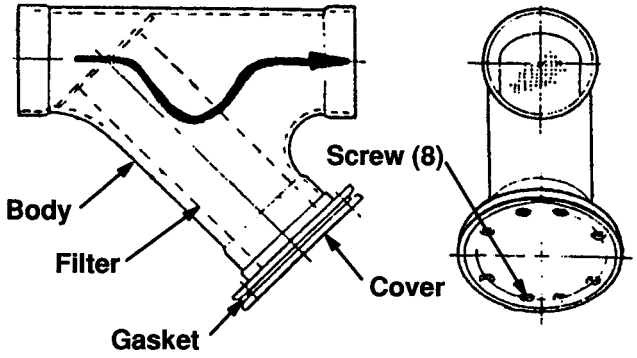
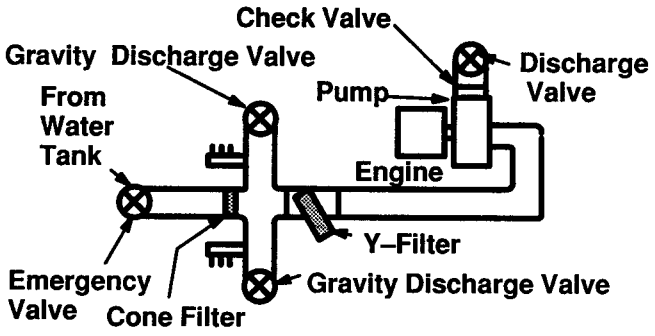
ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
						M1098 Water Dispensing Unit - Engine
11						**Piping**
	•					Check piping for leaks.
12	•					Remove Y-filter and check for damage. Replace as necessary. If not damaged, clean Y-filter using steam or water, para 4-28.
						
13	•					Remove cone filter and check for damage. Replace as necessary. If not damaged, clean cone filter, para 4-28.
						

Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q-Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
13			•			Drain the water pump case each winter and clean out. There are no lubrication points.

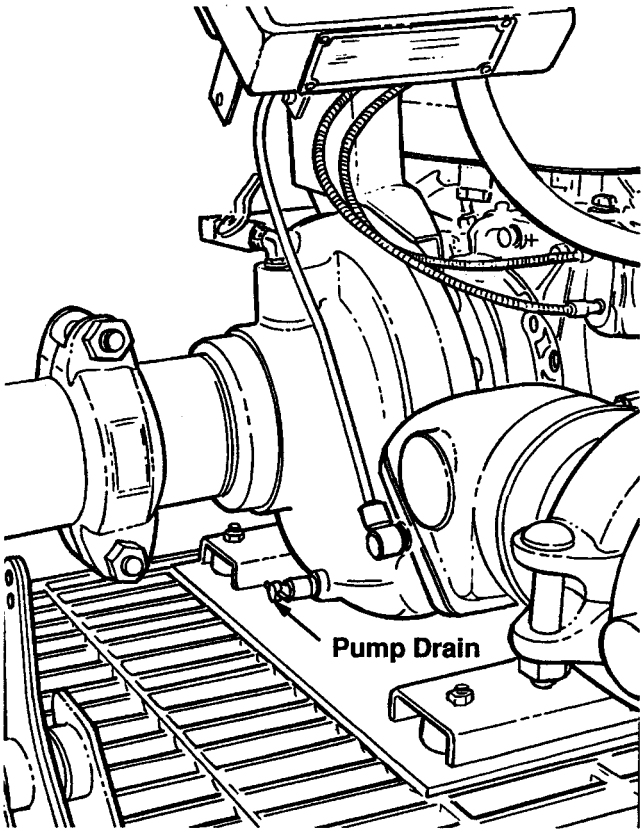
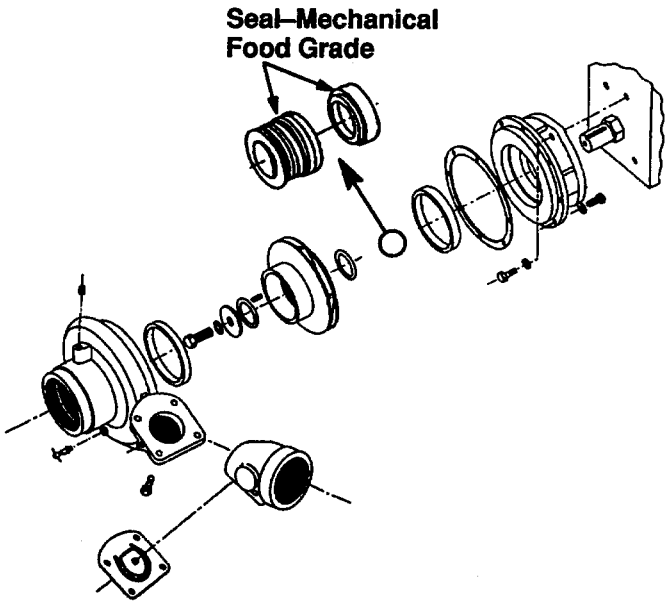


Table 4-1. Unit Preventive Maintenance Checks and Services (Cont'd)

Q - Quarterly **S - Semiannually** **A - Annually** **B - Biennially** **H - Hours**

ITEM NO	INTERVAL Q	S	A	B	H	ITEM TO BE INSPECTED PROCEDURE: Check for and have repaired, filled, adjusted as needed
14					2000	Notify Direct Support Maintenance. Replace water pump mechanical seal in accordance with para 7-9.



SECTION IV. UNIT TROUBLESHOOTING
GENERAL TROUBLESHOOTING INSTRUCTIONS

4-7. General

NOTE

Before doing any troubleshooting, make sure you have performed all the PMCS that address the problem area or system.

(a) This section contains troubleshooting information for locating and correcting the troubles that may develop when operating the semitrailer. Unit Troubleshooting Fault Symptom Index follows the general instructions as listed at the beginning of Section V. Fault symptoms are listed by SYSTEM, a FAULT NUMBER, and a FAULT SYMPTOM. Under FAULT SYMPTOM you will find a brief description, such as "Grabbing Brakes", or a brief description, followed by additional, specific information, such as, " Low Oil Pressure Indicator Light Fails To Light (Engine Starts Normally)."

(b) Each malfunction for a component or system is followed by an initial setup block that lists tools, supplies, or additional personnel needed, plus a list of equipment conditions. The equipment condition list will tell you things you need to do before performing the actual troubleshooting procedure.

(c) Before you begin any troubleshooting you are required to review the warning summary pages in the front of this book and heed all warnings related to the area you are going to work on. In addition to the warnings on the summary pages, other WARNING, CAUTION, and NOTE entries will follow the initial setup block, but will precede the step to which they apply, and are to be considered part of the task.

(d) The initial setup block is followed by a list of checks (tests or inspections), in the form of a branching logic tree that will help you determine corrective actions to take. In many cases, illustrations and diagrams have been added to further assist you isolating and correcting the fault.

(e) Before starting the written procedure, do a brief, but thorough inspection of the system/subsystems you are dealing with. Look for obvious damage or indications of problems, such as burned or charred wires or paint, broken wires, or loose or missing hardware. Next, starting with block A, perform the checks in the order given, then answer the question that follows with either a "YES" or a "NO". Follow the "YES" or "NO" path to the next block, and so on, until the problem is either fixed or referred to support maintenance for correction. Follow-on maintenance is listed at the end of the task, if needed. A fault is considered corrected only when the end item has been repaired and is returned to a a fully mission capable condition.

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

(g) The auxiliary engine on the potable water tanker is directly coupled to the water pump, and, therefore, turns at the same speed as the engine does, at all times. When performing any test that requires the water tanker engine to be running, water must flow through the pump to prevent damage to water pump, food grade seals, Fig, 4-1. Make sure tank contains at least 300 to 500 gallons of potable water. Connect one end of a hose to the main discharge valve outlet, and the other end to the side discharge valve outlet. Open emergency and main discharge valves before starting engine for testing. (See following illustration.) This will allow water to circulate through the water pump in a closed loop, which will provide the needed lubricant for the water pump seals.

(h) When troubleshooting the electrical system, before you make any continuity checks with your meter, you must disconnect the negative (-) battery cable from the battery, and set it aside. Since you must test the engine at times during the course of performing your checks, you could disconnect and reconnect the battery a number of times. This is a safety requirement and shall be followed at all times.

CAUTION

Since the water pump is directly coupled to the engine, anytime engine Is run for more than one (1) minute, water must flow through the pump to prevent damage to foot grade seals within the pump. There must be sufficient water Inside tanker to maintain steady water flow (approximately 300 to 500 gallons).

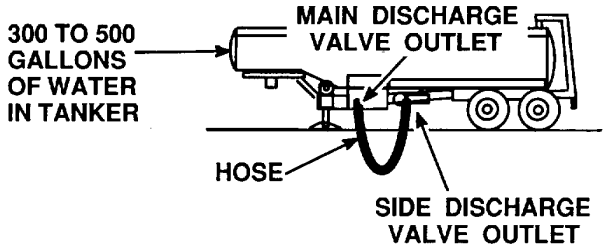


Figure 4-1. Setting up closed loop for engine testing.

UNIT TROUBLESHOOTING
SECTION V.

FAULT SYMPTOM INDEX

SYSTEM	FAULT NUMBER	FAULT SYMPTOM
Electrical		
	1	No Lights Work On Trailer
	2	Some Lights Work, Some Do Not
	3	Dim Or Flickering Lights
Brake		
	4	Brakes Will Not Release.
	5	No Brakes Or Weak Brakes.
	6	Brake Application Or Release Is Slow.
	7	Grabbing Brakes.
	8	Brake Drag (One Or More Brake Drums Running Hot).
Landing Gear		
	9	Difficulty In Turning Crank
Manhole Cover		
	10	Excessive Leakage Around Manhole.
	11	Fill Cover Latch Inoperative
Engine		
	12	Engine Starter Does Not Work (Engine Starts Using Manual Start Procedure).
	13	Engine Turns Over But Fails To Start.
	14	Engine Hard To Start, Or Low Engine Power
	15	Low Oil Pressure Indicator Light Stays On.
	16	Blue-gray Exhaust Smoke Is Noted During Engine Operation
	17	Engine Misfires Under Heavy Load
	18	Engine Speed Is Not Constant (High Or Low Speed; Hunting Or Loss Of Control).
	19	Black Engine Exhaust Smoke Or Excessive Fuel Consumption.
Potable Water Pump		
	20	Pump Fails To Pump Water
	21	Water Flow Less Than Normal.
	22	Emergency Valve Control Operates Improperly
	23	Battery/ Generator Light Fails To Light (Engine Starts Normally).
	24	Low Oil Pressure Indicator Light Fails To Light (Engine Starts Normally).
	25	Indicator and Panel Lights Fail To Light (Engine Starts Normally).
	26	Battery/Generator Indicator Light Stays On, Or Flickers Intermittently

UNIT TROUBLESHOOTING
SECTION V.

FAULT SYMPTOM INDEX (cont'd)

SYSTEM	FAULT NUMBER	FAULT SYMPTOM
	27	Panel Light And Hour Meter Do Not Work; Low Oil Pressure Indicator Light Stays On (Engine Starts Normally).
	28	Panel Light Comes On and Hour Meter Does Not Work (Engine Starts Normally).
	29	Panel Light Does Not Work (Hour Meter Works Normally).

Table 4-1. SECTION V Unit Troubleshooting

TRAILER ELECTRICAL SYSTEM

No.	Malfunction	No.	Malfunction
1.	NO LIGHTS WORK ON TRAILER	2.	SOME LIGHTS WORK, SOME DO NOT

Initial Setup

Tools
General Mechanic's tool kit
Multimeter with probes

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Intervehicular cable connected.
- Towing Vehicle power turned ON.

NOTE

If troubleshooting malfunction No. 2, start at Block E.

A Check for 24 vdc output from towing vehicle intervehicular cable.

Is 24 vdc output present?

YES / NO

B Check for loose receptacle ground leads.

1. Remove front access cover.
2. Check for loose ground leads.
   - Tighten if loose.
   - Recheck system.

Do all lamps light?

YES / NO

D Problem solved; Continue Mission

Go To Block E

C Problem is in intervehicular cable, or in towing vehicle electrical system.

1. Check fuses or circuit breakers in towing vehicle.
   - If fuse is blown, notify Unit Maintenance.
   - If circuit breaker is tripped, reset circuit breaker.
2. Troubleshoot towing vehicle systems and make repairs as needed.
3. If problem is not corrected, continue with troubleshooting until problem is solved.

Do lamps light?

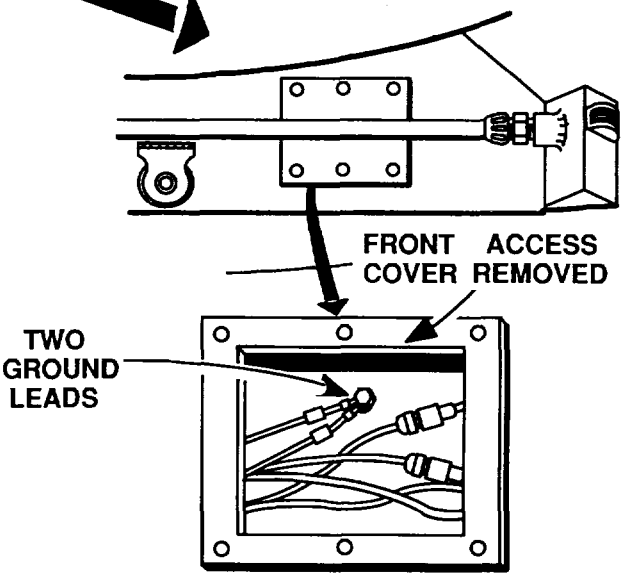


Table 4-1. SECTION V Unit Troubleshooting (Continued)

TRAILER ELECTRICAL SYSTEM

No.	Malfunction	No.	Malfunction
1.	NO LIGHTS WORK ON TRAILER	2.	SOME LIGHTS WORK, SOME DO NOT

From Block B

E If some lights work, but one or more do not come on:

- Check for burned out bulb(s), or for dirty/ corroded/ damaged sockets or wiring.
- Clean dirty or corroded sockets/ connectors.
- Replace burned out bulb or damaged hardware.
- If lights still do not work, check wiring harness using multimeter, Fig. 4–7.

Do all lights come on?

YES

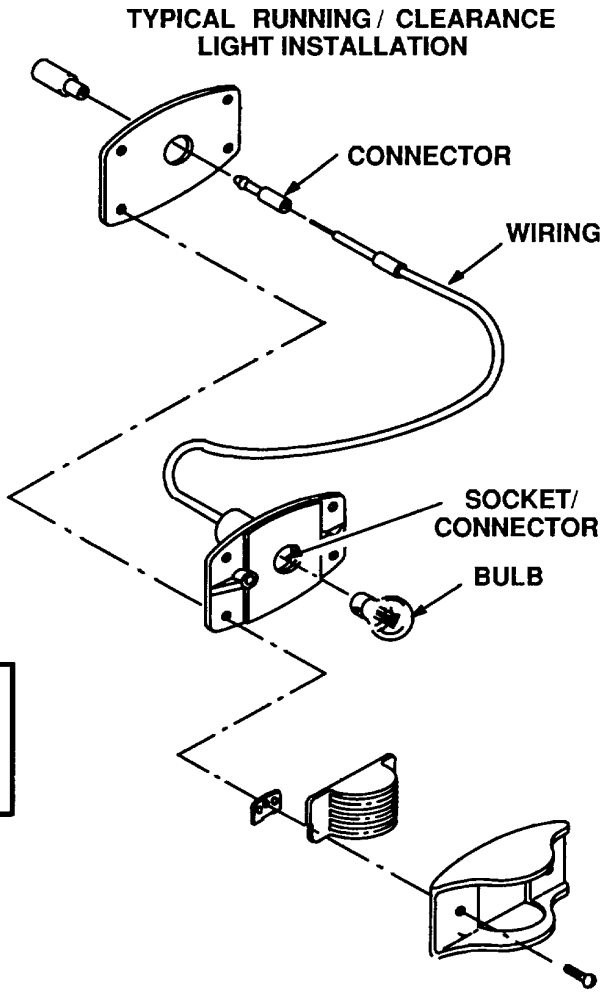
E Problem solved;

- Install access cover removed in block B.

Continue Mission.

NO

G Return to block A and repeat checks until problem is solved.



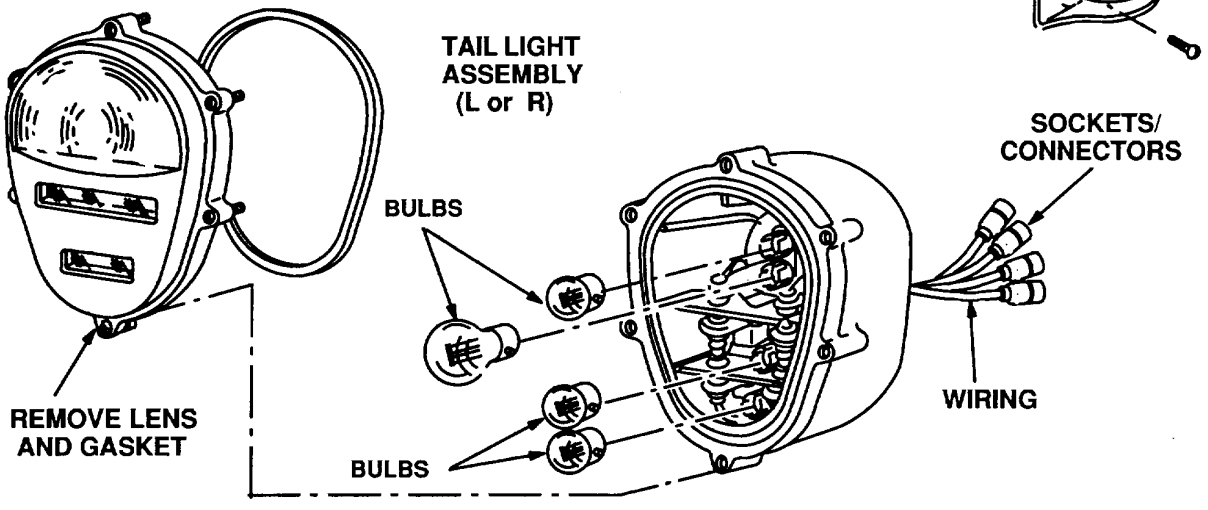


Table 4-1. SECTION V Unit Troubleshooting (Continued)

TRAILER ELECTRICAL SYSTEM (Continued)

No.	Malfunction
3.	DIM OR FLICKERING LIGHTS

Initial Setup	Equipment Conditions
Tools General Mechanic's tool kit Multimeter with probes **Personnel** One	♦ Trailer hooked to towing vehicle. ♦ Parking brakes set and wheels chocked. ♦ Intervehicular cable connected. ♦ Towing Vehicle power turned ON. ,

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

A

1. Check towing vehicle intervehicular cable for proper connection or damage that could cause problem.
   - ♦ Repair or replace bad cable (see towing vehicle TM).
2. Check trailer receptacle for damage, dirt, or corrosion.
   - ♦ Repair or replace damaged hardware; clean as needed.

Are lights still dim or flickering?

YES → **B**

NO → **C** Problem solved. Continue Mission.

B Check for loose receptacle ground leads.

1. Remove front access cover.
2. Check for loose ground leads.
   - ♦ Tighten if loose.
   - ♦ Recheck system.

Are any lights still dim or flickering?

YES → Go To Block E

NO → **D** Problem solved;
- ♦ Install access cover removed in block B.

Continue Mission.

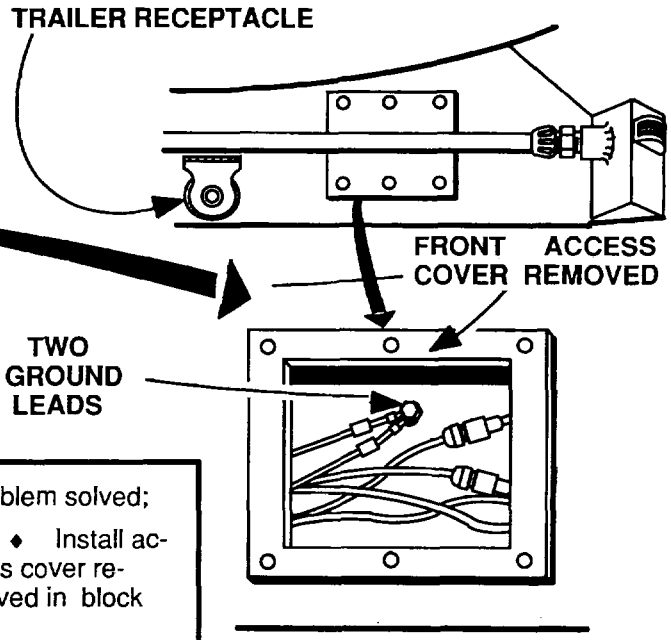
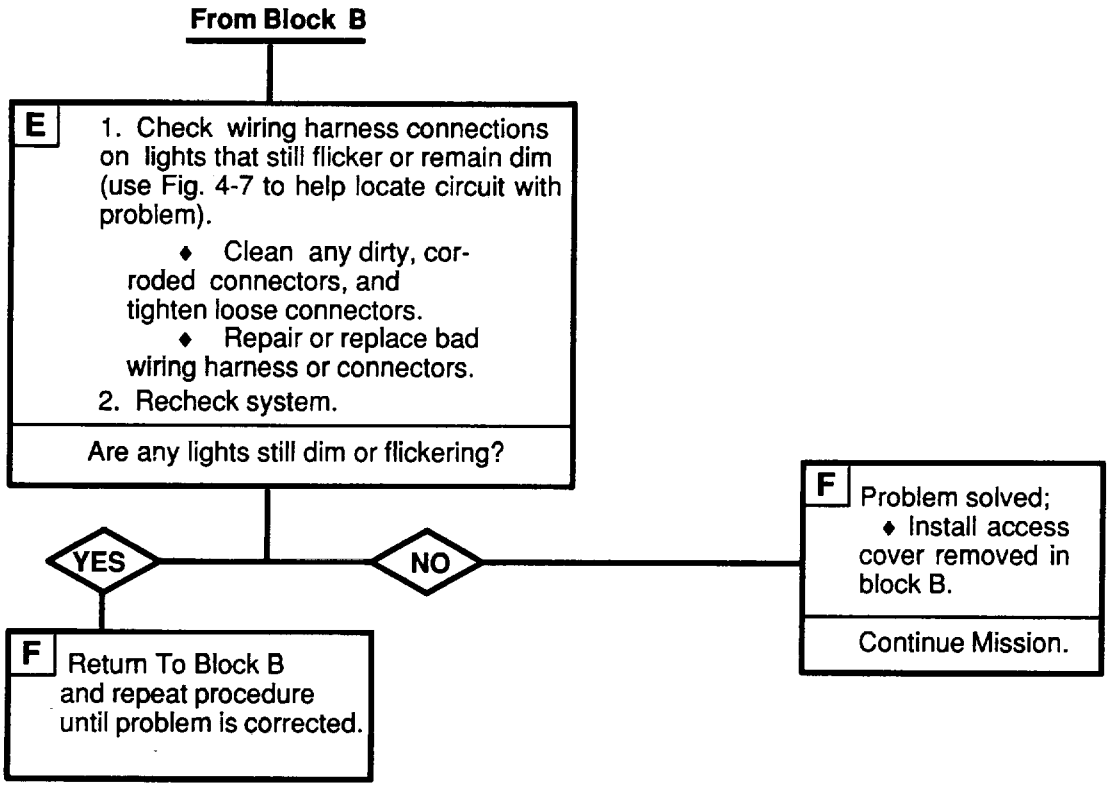


Table 4-1. SECTION V Unit Troubleshooting (Continued)

TRAILER ELECTRICAL SYSTEM (Continued)

No.	Malfunction
3.	DIM OR FLICKERING LIGHTS (Continued)



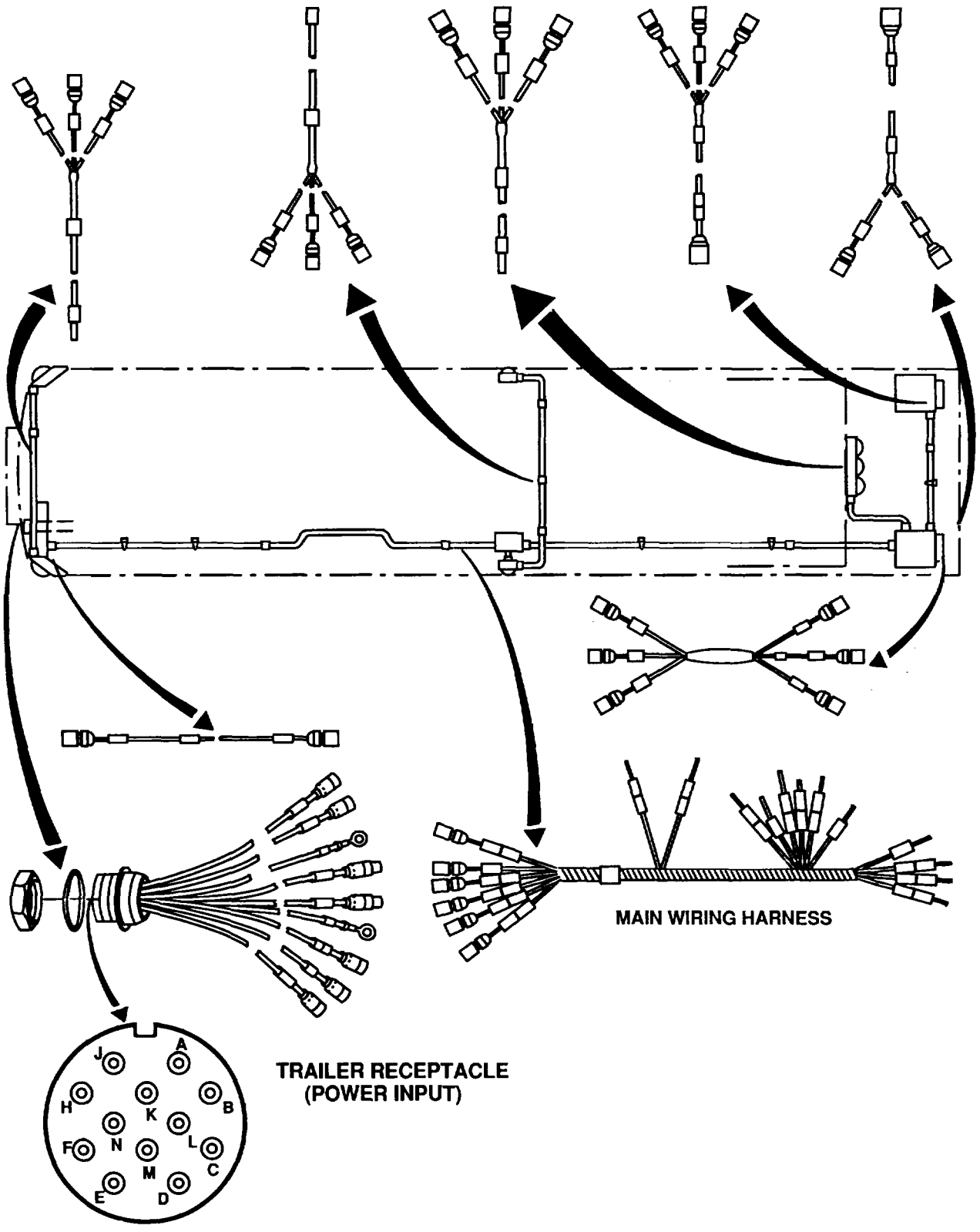

MAIN WIRING HARNESS
TRAILER RECEPTACLE
(POWER INPUT)
A
B
C
D
E
F
H
J
K
L
M
N

Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No. Malfunction
4. BRAKES WILL NOT RELEASE.

Initial Setup	Equipment Conditions
Tools General Mechanic's tool kit	♦ Trailer hooked to towing vehicle. ♦ Parking brakes set and wheels chocked. ♦ Air lines connected.

Personnel
One

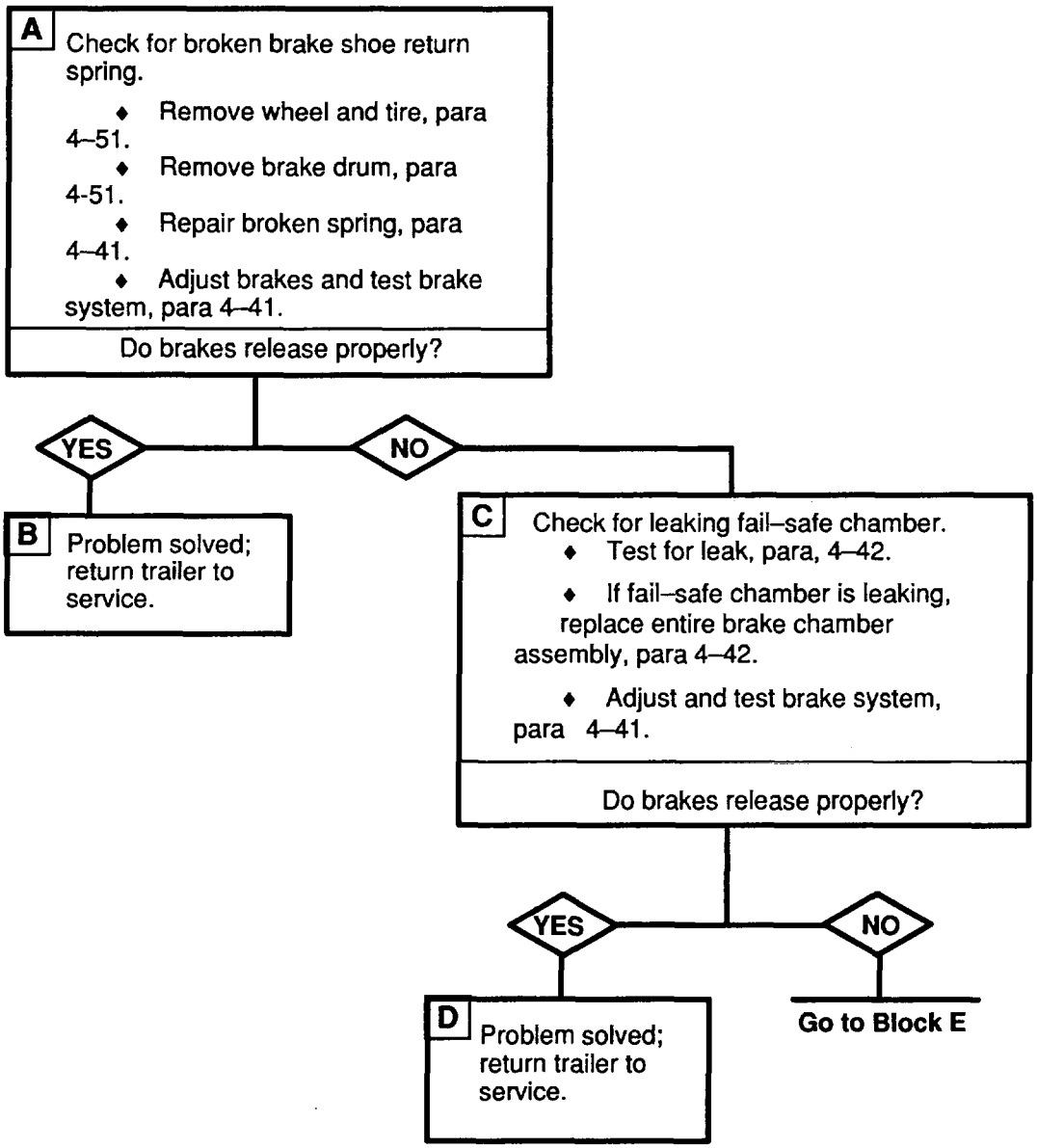


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No.	Malfunction
4.	BRAKES WILL NOT RELEASE.

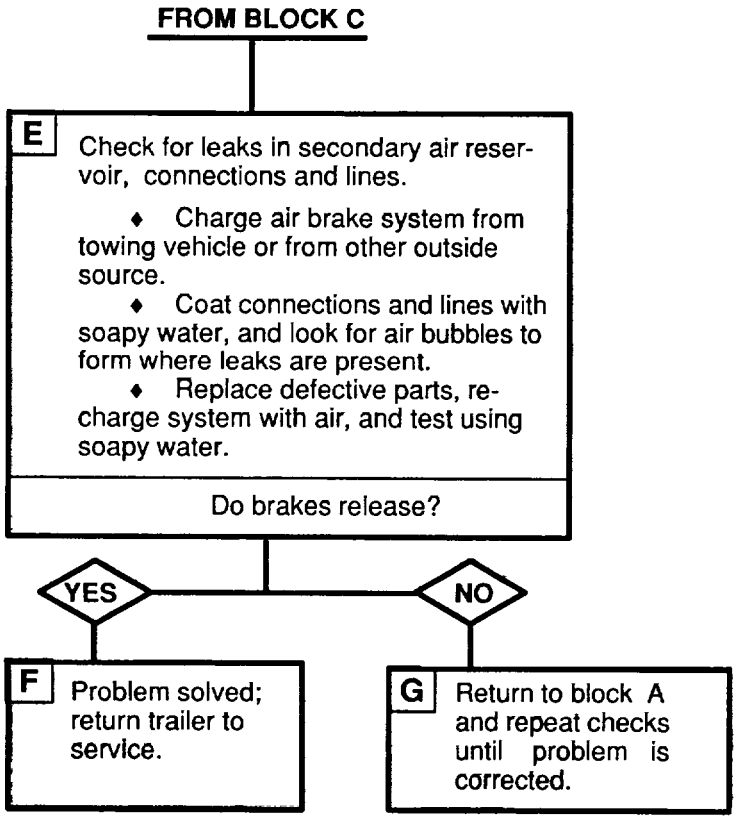


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No.	Malfunction
5.	NO BRAKES OR WEAK BRAKES.

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Air lines connected.

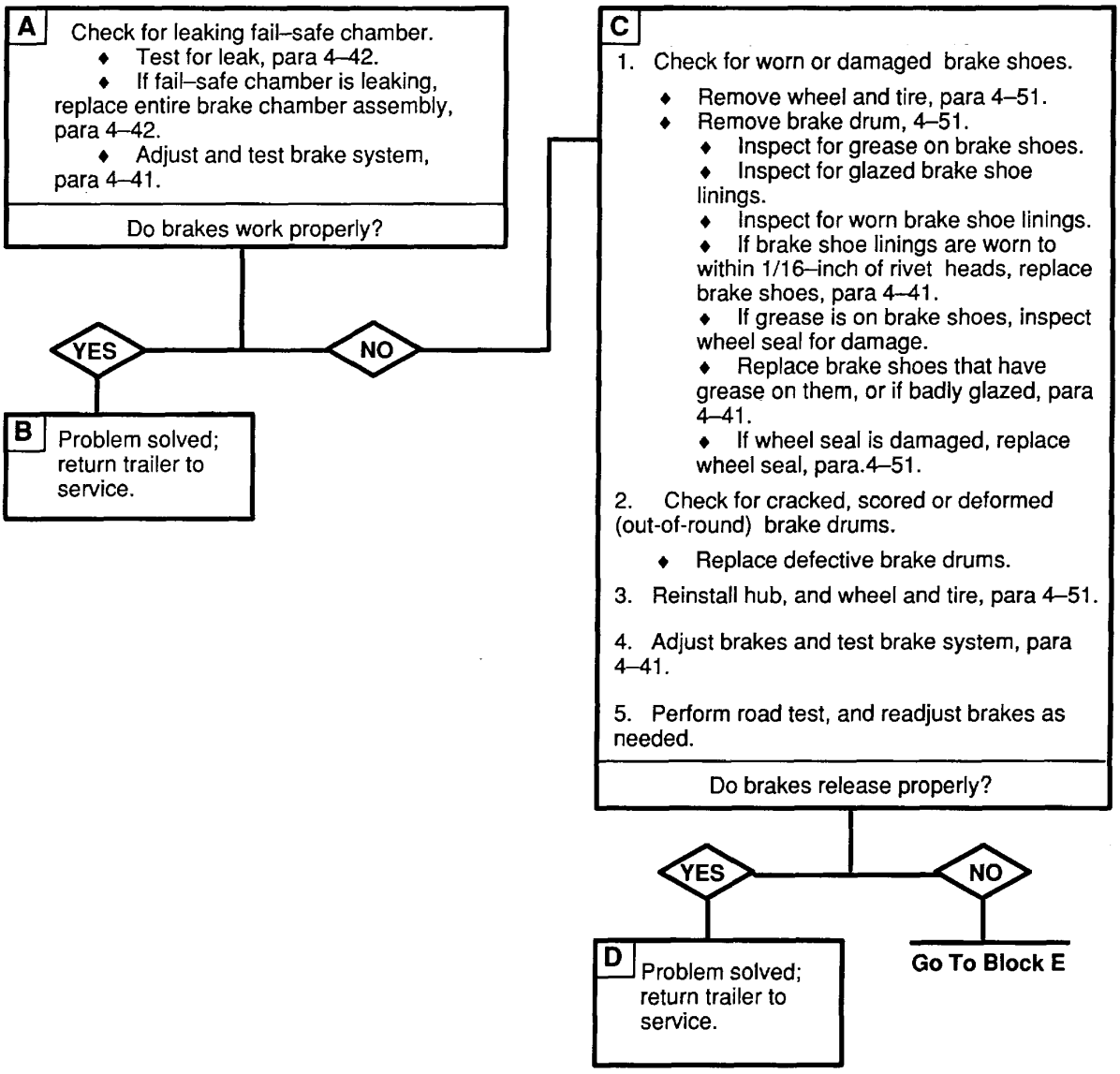


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No.	Malfunction
5.	NO BRAKES; OR WEAK BRAKES

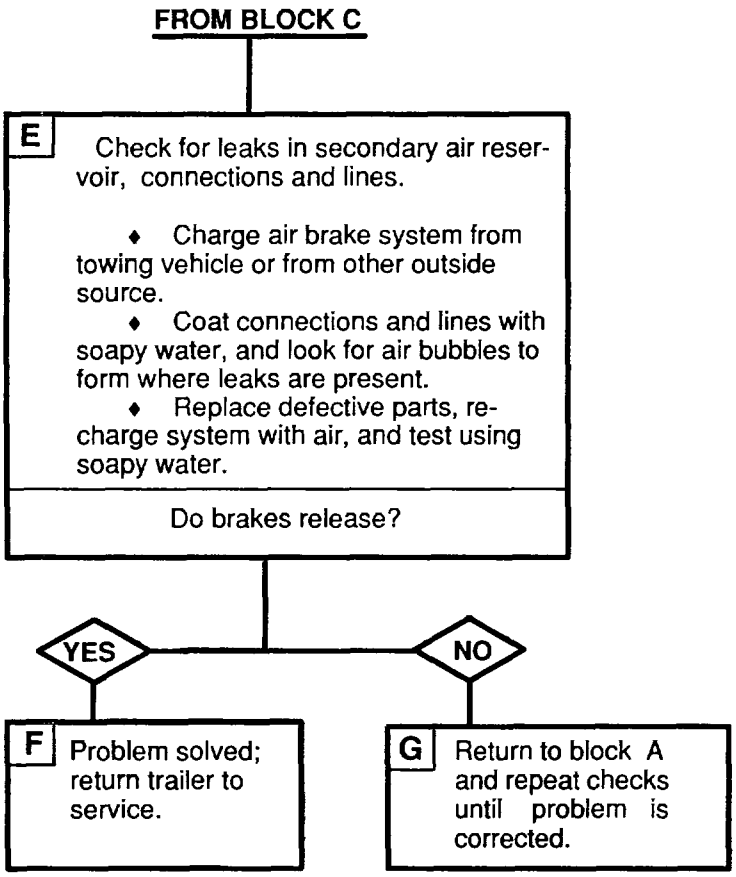


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No.	Malfunction
6.	BRAKE APPLICATION OR RELEASE IS SLOW.

Initial Setup	Equipment Conditions
Tools General Mechanic's tool kit **Personnel** One	♦ Trailer hooked to towing vehicle. ♦ Parking brakes set and wheels chocked. ♦ Air lines connected.

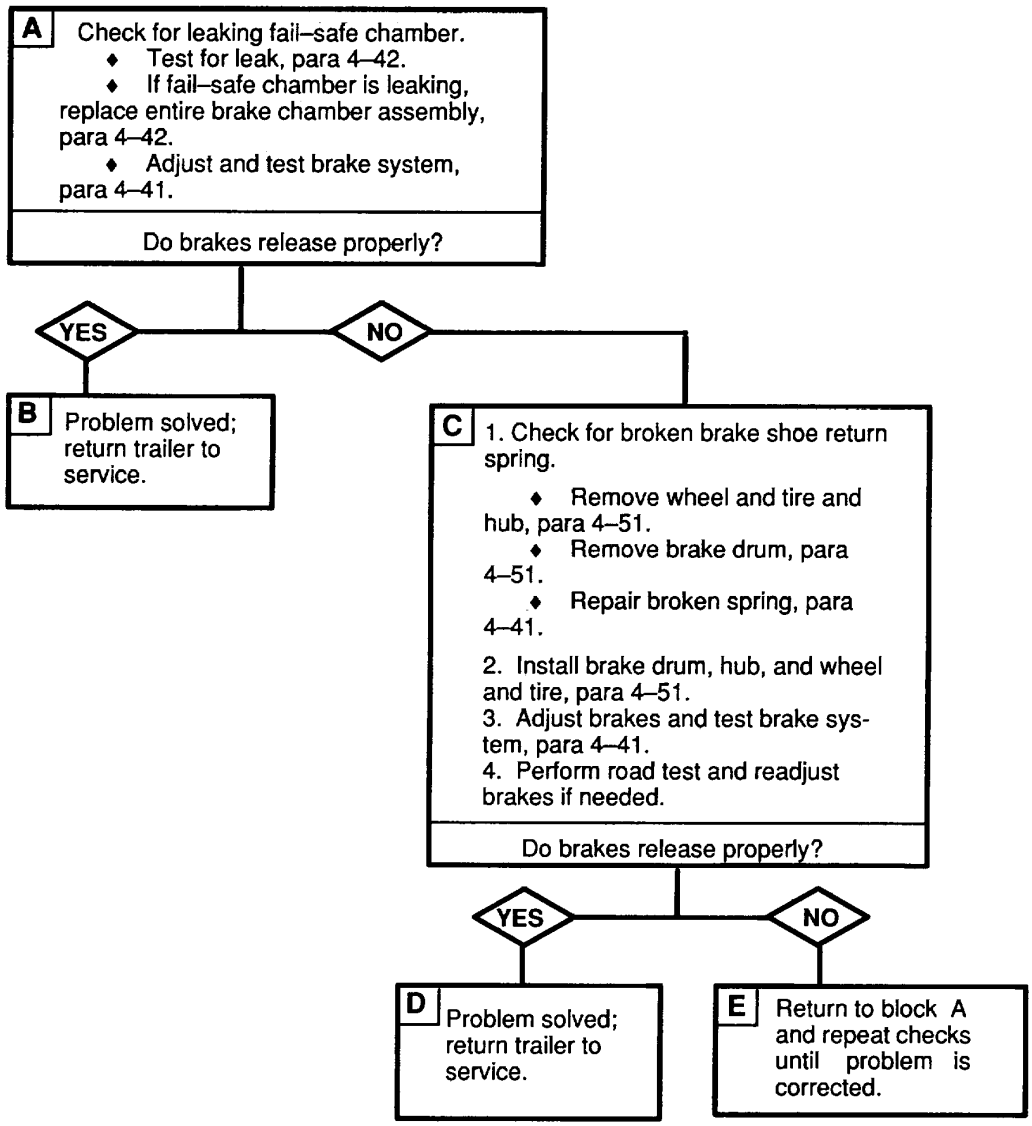


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

BRAKE SYSTEM (Continued)

No.	Malfunction
7.	GRABBING BRAKES.

Initial Setup

Tools
General Mechanic's tool kit

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.
- Air lines connected.

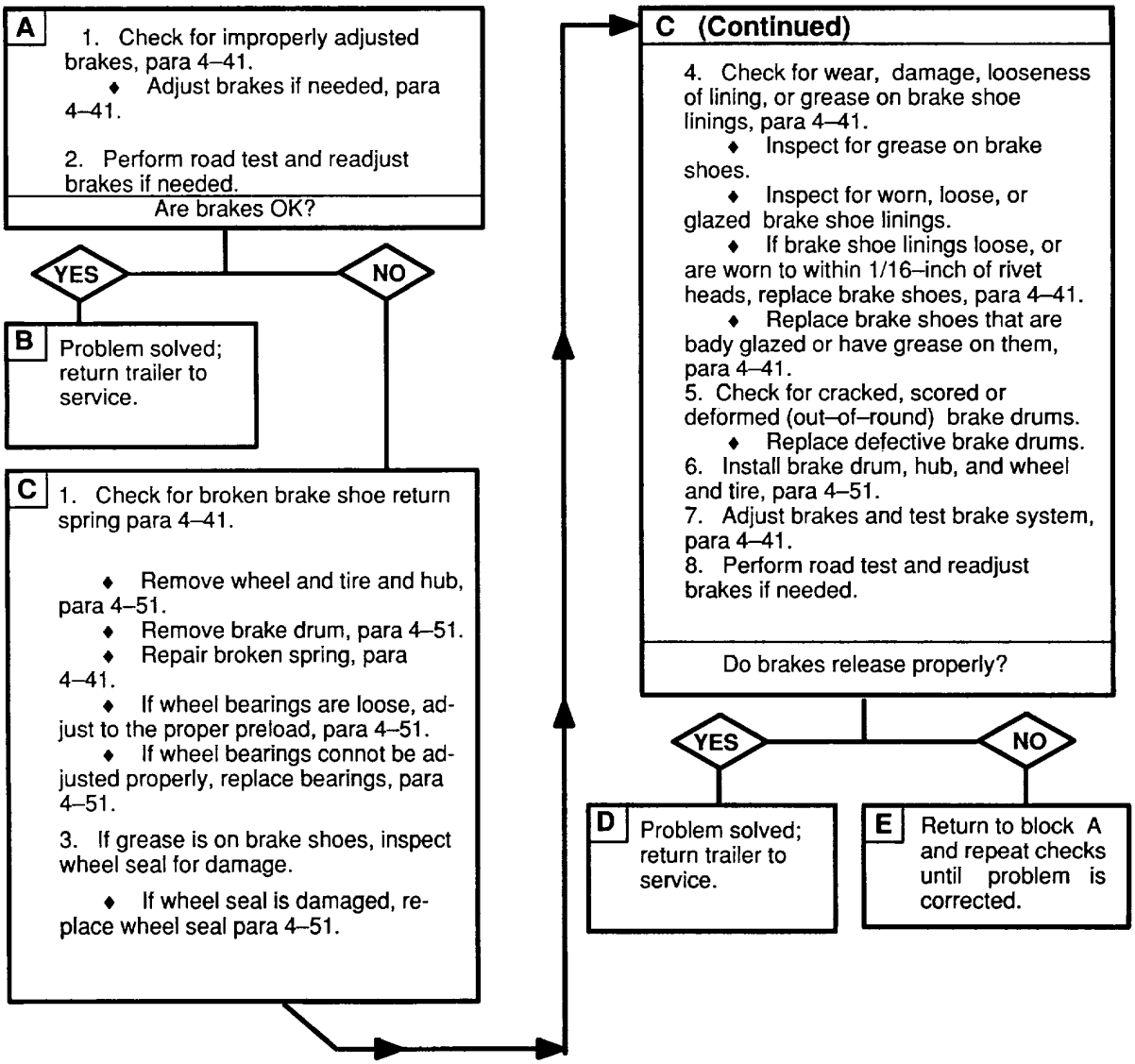


Table 4-8. SECTION V Unit Troubleshooting (Continued)

TRAILER BRAKE SYSTEM (Continued)

No.	Malfunction
8.	BRAKE DRAG (ONE OR MORE BRAKE DRUMS RUNNING HOT).

Initial Setup

Tools
General Mechanic's tool kit

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.

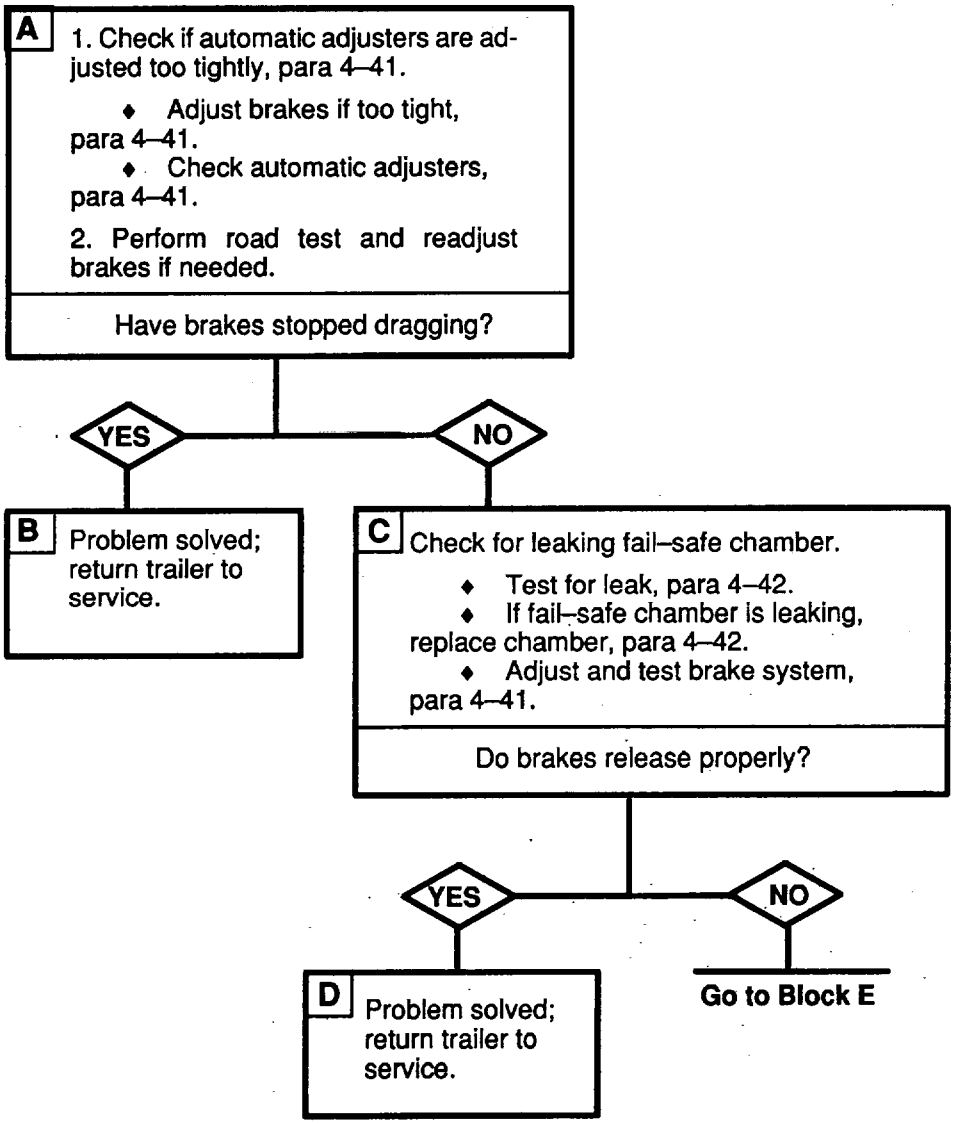


Table 4-8. SECTION V Unit Troubleshooting (Continued)

TRAILER BRAKE SYSTEM (Continued)

No.	Malfunction
8.	BRAKE DRAG (ONE OR MORE BRAKE DRUMS RUNNING HOT). (Continued)

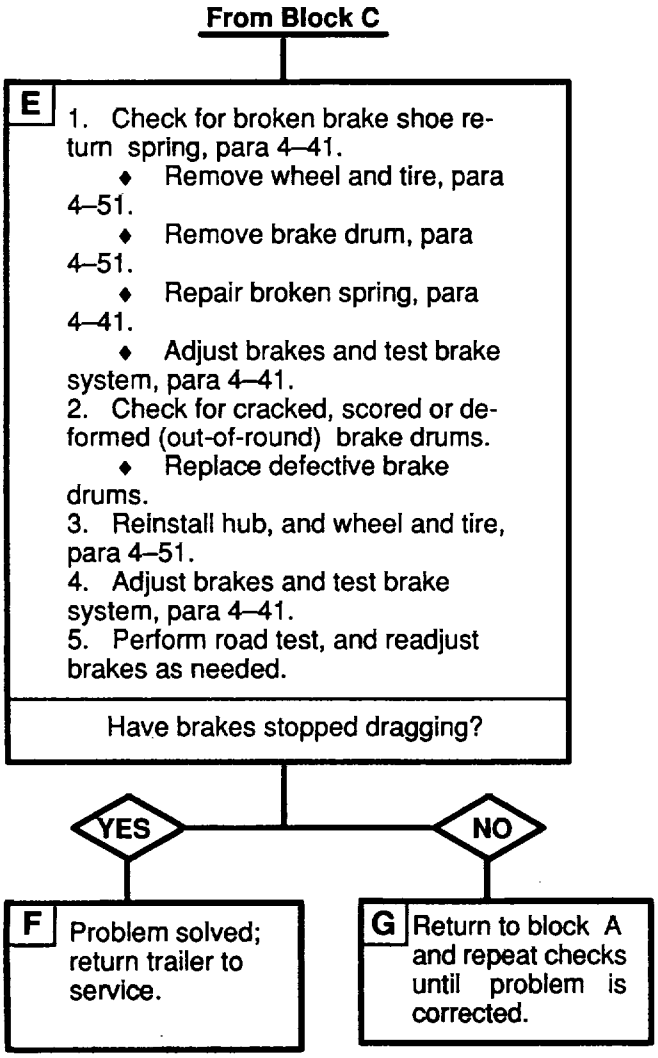


Table 4-8. SECTION V Unit Troubleshooting (Continued)

LANDING GEAR

No.	Malfunction
9.	DIFFICULTY IN TURNING CRANK

Initial Setup

Tools
General Mechanic's tool kit

Personnel
One

Equipment Conditions

- Trailer hooked to towing vehicle.
- Parking brakes set and wheels chocked.

A Check for proper lubrication of landing gear hand crank.
- Lubricate landing gear hand crank. See fig. 3–1.

Does crank turn without difficulty?

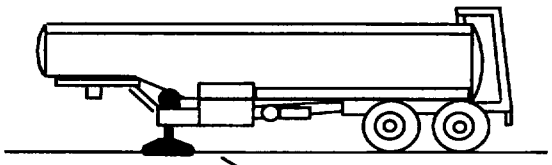
YES → **B** Problem solved; return trailer to service.

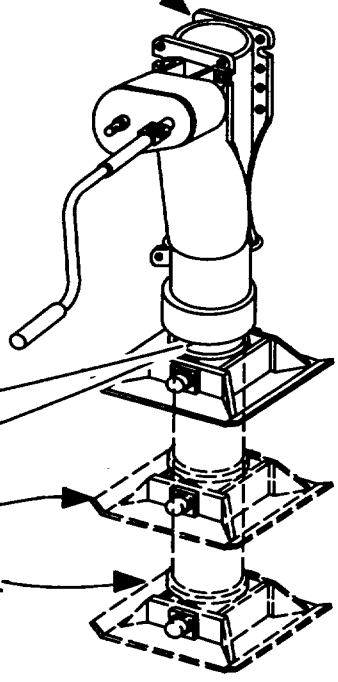
NO → **C** Check for bent lower leg.
- If bend is not clearly visible, check in several positions for centering of lower leg were it comes out of upper leg housing. (See detail view.)

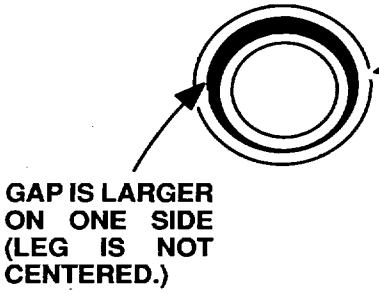
Is lower leg bent?

YES → **D** Replace entire leg assembly, para 4–55.
Return trailer to service.

NO → **E** Replace hand crank angle drive unit, para 4–55.
Return trailer to service.







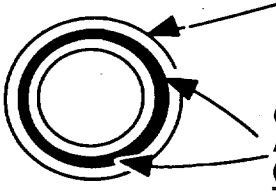


Table 4-8. SECTION V Unit Troubleshooting (Continued)

MANHOLE COVER

No.	Malfunction
10.	EXCESSIVE LEAKAGE AROUND MANHOLE.

Initial Setup

Tools
None
Personnel
One

Equipment Conditions
- Trailer parked.
- Parking brakes set and wheels chocked.

A 1. Check that manhole and fill cover can close properly.

- Check for damage to fill cover hinge parts and latch.
- Check fill cover gasket for damage.
- Replace any damaged parts, para 4–62.
- If loose, tighten nut and bolt.
- Replace gasket if damaged, para 4–62.

Has leakage stopped?

YES → **B** Problem solved; return trailer to service.

NO → **C** Return to block A and repeat checks until problem is corrected.

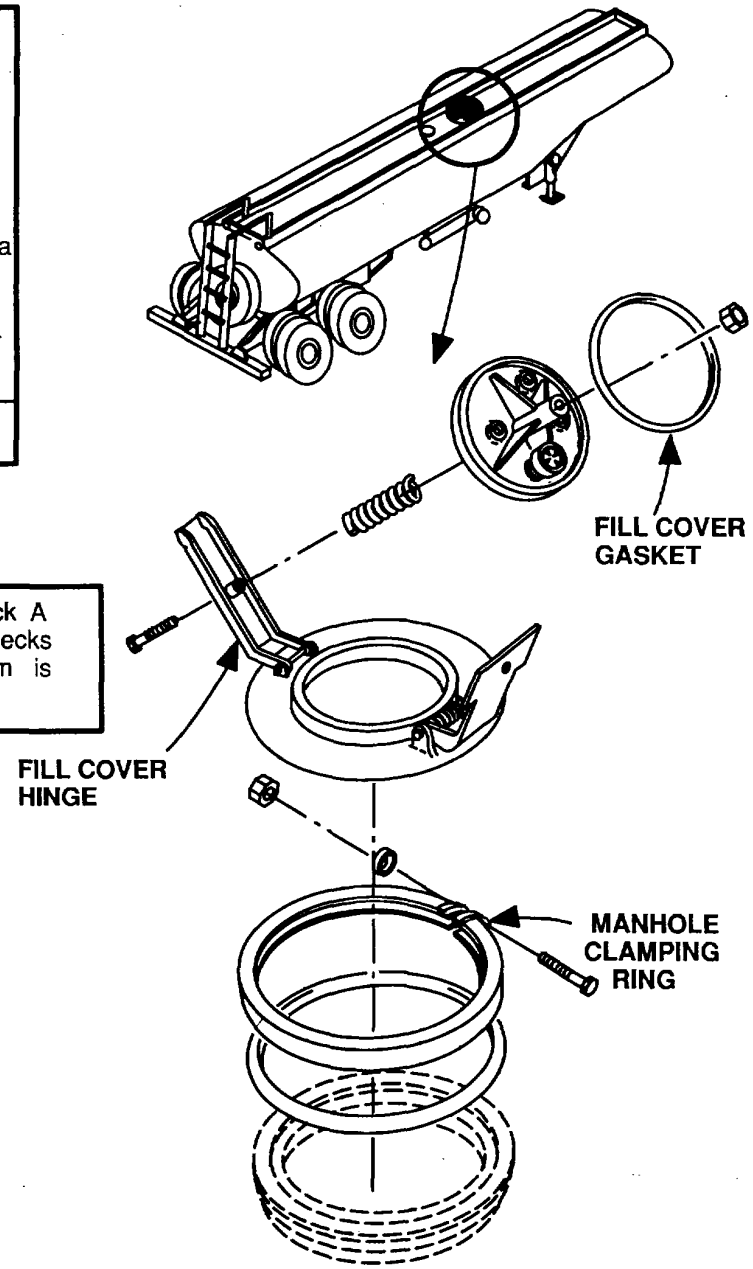


Table 4. SECTION V Unit Troubleshooting (Continued)

MANHOLE COVER (Continued)

No.	Malfunction
11.	FILL COVER LATCH INOPERATIVE.

Initial Setup

Tools
None

Personnel
One

Equipment Conditions
- Trailer parked.
- Parking brakes set and wheels chocked.

A	1. Check for broken spring in fill cover latch. ♦ If broken, replace spring, para 4–62. 2. Check for bent, broken, or missing spring pin. ♦ If spring pin is bent, broken or missing, replace pin, para 4–62.
	Problem solved, return trailer to service.

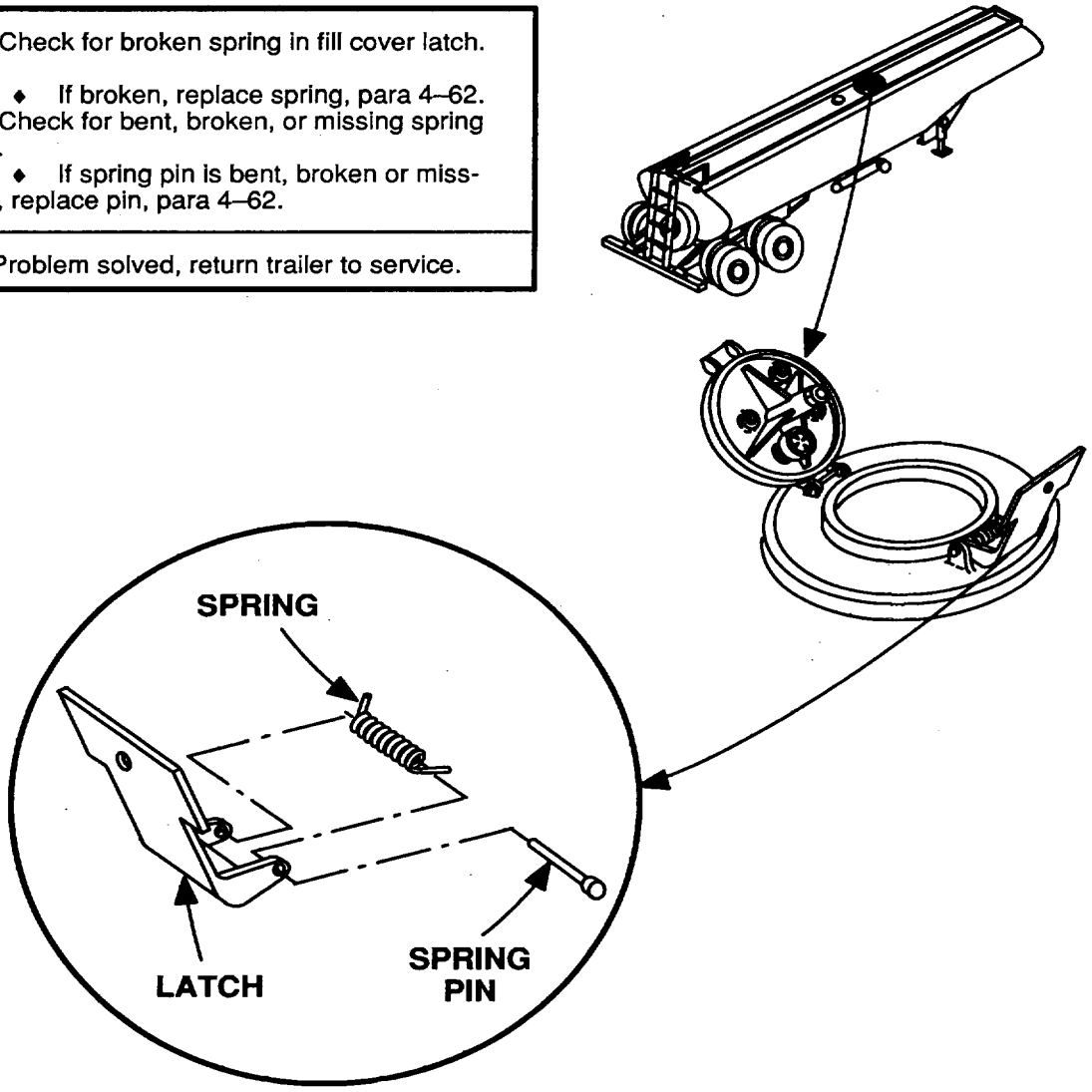


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE

No.	Malfunction
12.	ENGINE STARTER DOES NOT WORK (ENGINE STARTS USING MANUAL START PROCEDURE).

Initial Setup

Tools
Multimeter or 1 2v test light
Personnel
7.
One

Equipment Conditions
- Trailer parked.
- Parking brakes set and wheels chocked.
- Approximately 300 - 500 gallons water in tank.
- Hoses and valves set up to pump water, para. 4-

NOTE
Read paragraph 4–7 before doing any work.

A Check battery and battery cables, para. 3–5.
- If battery is damaged, replace battery.
- If battery cables are loose, tighten connectors.
- If cables are corroded, clean as needed.
- If battery is discharged, recharge battery.

Does starter work?

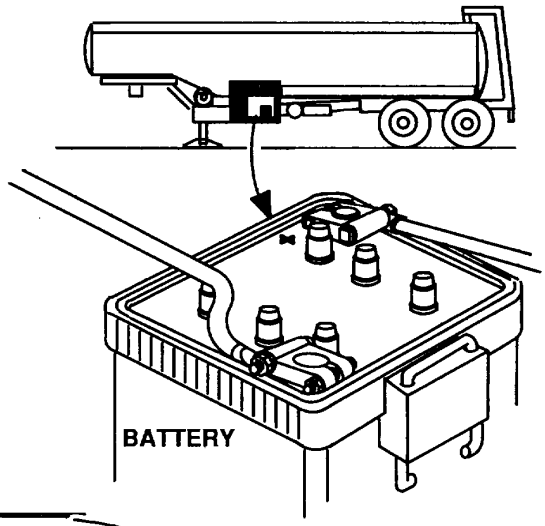
YES → **B** Problem solved; return trailer to service.

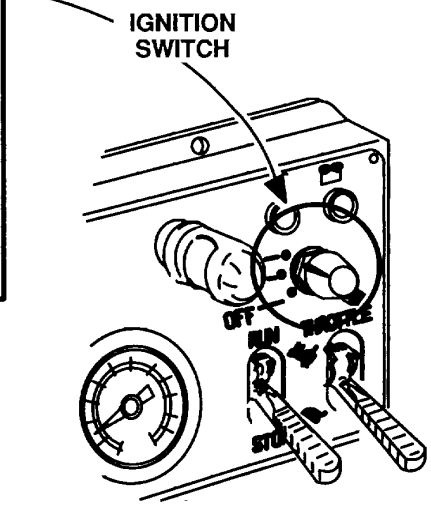
NO → **C** Check for defective ignition switch on engine control panel.
- With ignition switch in the START position,use multimeter or 24v test light to test for 12 vdc at contacts of igintion switch.
- If 12 vdc is not present across closed contacts, switch is defective. Replace switch.

Does starter work?

YES → **D** Problem solved; return trailer to service.

NO → GO TO BLOCK E





ENGINE CONTROL PANEL

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
12.	ENGINE STARTER DOES NOT WORK (Continued).

FROM BLOCK C

E Check for defective starter.

♦ If starter spins, or if a clicking sound is heard, but starter does not engage, replace starter.

Does starter work?

YES

F Problem solved; return trailer to service.

NO

G Return to block A and repeat checks until problem is corrected.

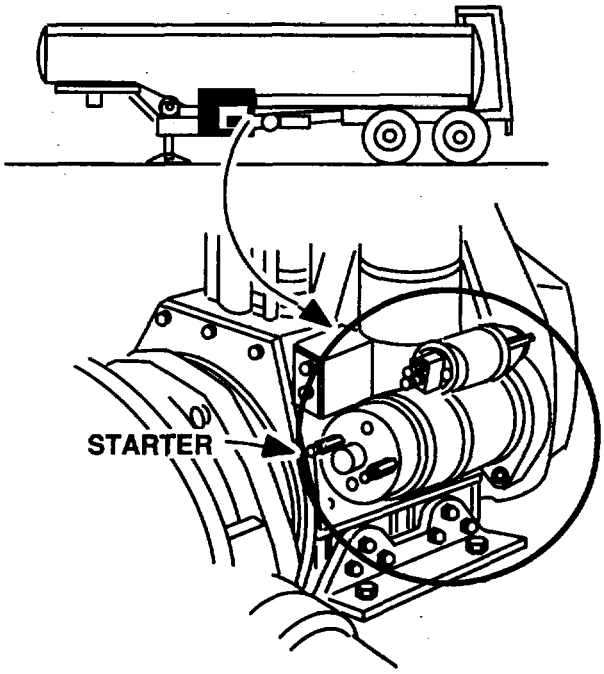


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE

No.	Malfunction
13.	ENGINE TURNS OVER BUT FAILS TO START.

Initial Setup	Equipment Conditions
Tools Multimeter or 12v test light **Personnel** One	♦ Trailer parked. ♦ Parking brakes set and wheels chocked. ♦ Approximately 300 - 500 gallons water in tank. ♦ Hoses and valves set up to pump water, para. 4-7.

NOTE
Read paragraph 4–7 before doing any work.

A Check for fuel line leaks.
♦ Tighten all connections, and replace or repair any damaged fuel lines.
Does engine start?

YES → **B** Problem solved; return trailer to service.

NO →

WARNING

IF NBC EXPOSURE IS SUSPECTED, ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT.SEE OPERATOR / MAINTENANCE MANUALS.

C Check air cleaner for clogged/ dirty air cleaner intake and/ or fuel filter element.
♦ Clean dirt and debris form air cleaner intake.
♦ Replace air filter element if clogged or dirty (see Table 3-1).
Does engine start?

YES → **D** Problem solved; return trailer to service.

NO → **Go To Block E**

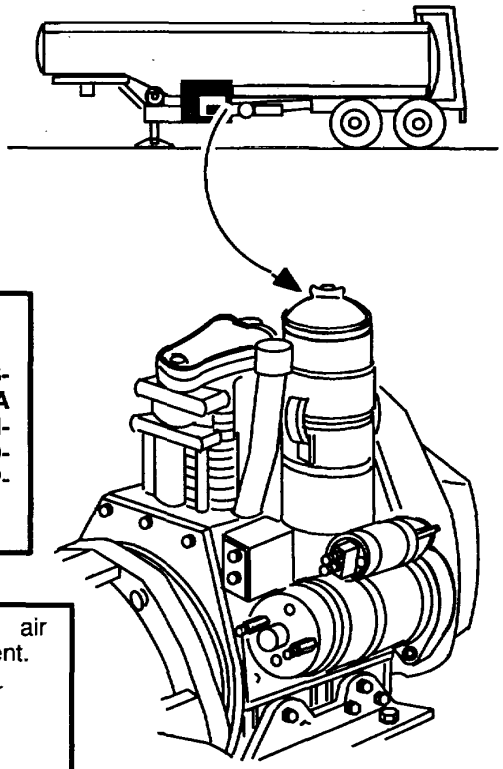


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE

No.	Malfunction
13.	ENGINE TURNS OVER BUT FAILS TO START (Continued).

From Block C

E 1. Check for dirty fuel and for dirty/ clogged fuel filter element.

- Remove engine compartment, rear access cover.
- If fuel is dirty, drain fuel tank and lines, and refill tank with clean fuel.
- Replace fuel filter element.
- Replace access cover.

Does engine start?

YES

F Problem solved; return trailer to service.

NO

G Return to block A and repeat checks until problem is corrected.

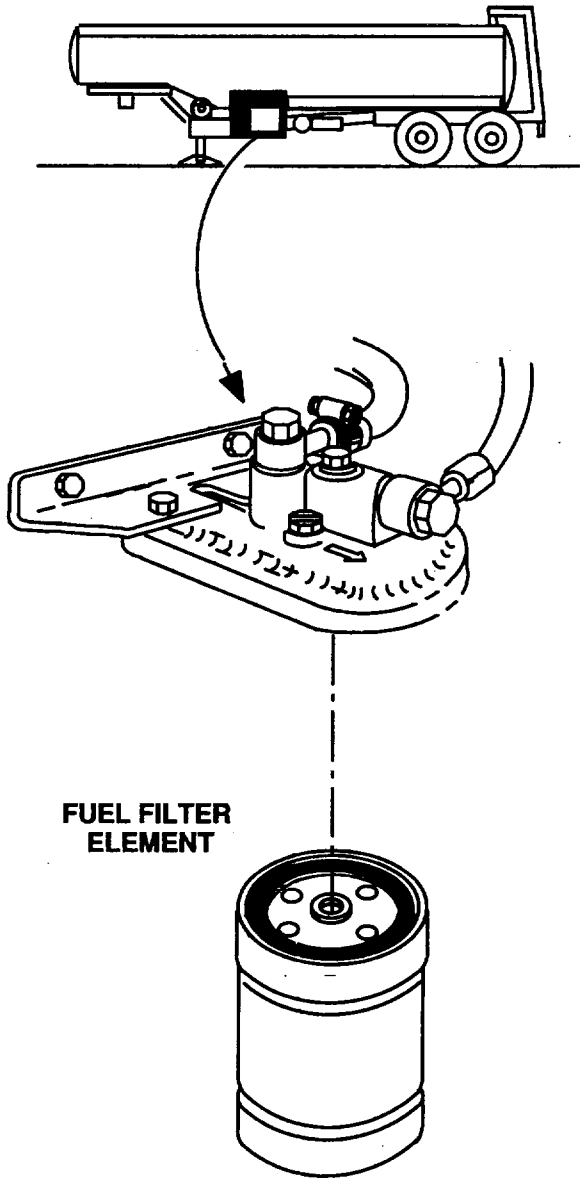


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
14.	ENGINE HARD TO START, OR LOW ENGINE POWER

Initial Setup	Equipment Conditions
Tools None **Personnel** One	♦ Trailer parked. ♦ Parking brakes set and wheels chocked. ♦ Approximately 300 - 500 gallons water In tank. ♦ Hoses and valves set up to pump water, para. 4-7.

NOTE
Read paragraph 4–7 before doing any work.

A 1. Check that engine oil is the proper grade for the ambient temperature.
- ♦ Check oil specification charts for proper grade of oil, fig. 3–1.
- ♦ If needed change to proper grade of oil, and test engine operation.

Does engine start properly and have full engine power?

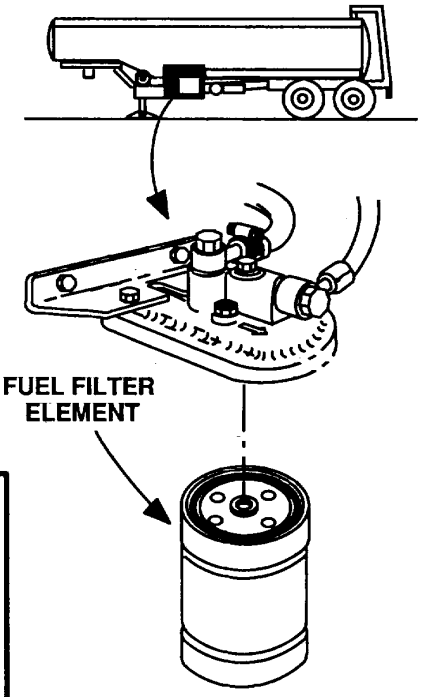
YES → **B** Problem solved; return trailer to service.

NO → **C** Check for dirty fuel and for dirty/clogged fuel filter element.
- ♦ Remove engine compartment rear access cover.
- ♦ If fuel is dirty, drain fuel tank and lines, and refill tank with clean fuel.
- ♦ Replace fuel filter element.
- ♦ Replace access cover.

Does engine start properly and have full engine power?

YES → **D** Problem solved; return trailer to service.

NO → Go To Block F



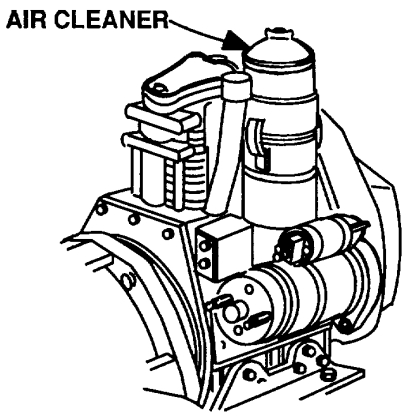


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE

No.	Malfunction
14.	ENGINE HARD TO START, OR LOW ENGINE POWER (Continued)

From Block C

WARNING

IF NBC EXPOSURE IS SUSPECTED, ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT.SEE OPERATOR / MAINTENANCE MANUALS.

E Check air cleaner for clogged/ dirty air cleaner intake and/ or fuel filter element.

- Clean dirt and debris form air cleaner intake.
- Replace air filter element if clogged or dirty, Table 3–1.

Does engine start properly and have full engine power?

YES → **F** Problem solved; return trailer to service.

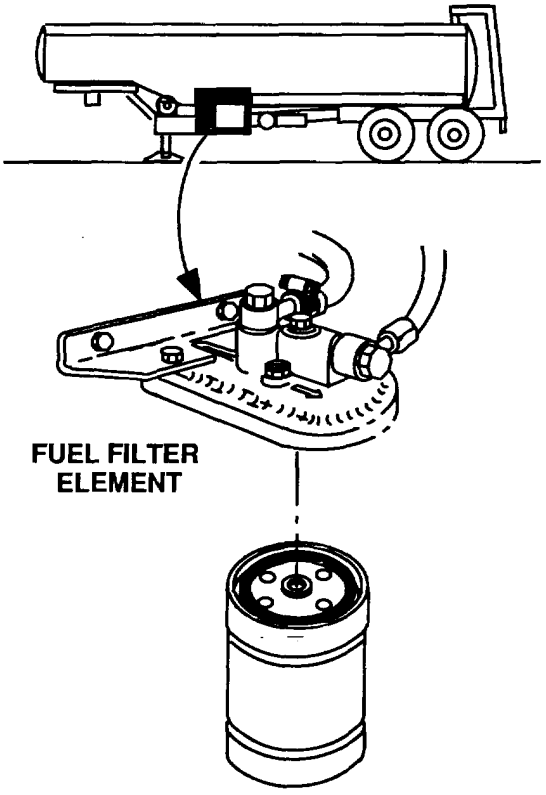
NO → **G** Check for dirty fuel and for dirty/ clogged fuel filter element.

- Remove engine compartment, rear access cover.
- If fuel is dirty, drain fuel tank and lines, and refill tank with clean fuel.
- Replace fuel filter element.
- Replace access cover.

Does engine start properly and have full engine power?

YES → **H** Problem solved; return trailer to service.

NO → **J** Notify support maintenance.



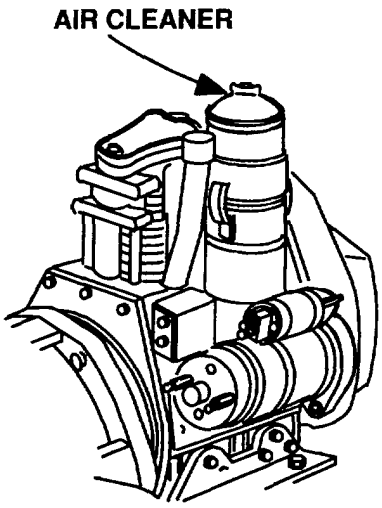


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE

No.	Malfunction
15.	LOW OIL PRESSURE INDICATOR LIGHT STAYS ON.

Initial Setup	Equipment Conditions
Tools STE/ICE **Personnel** One	♦ Trailer parked. ♦ Parking brakes set and wheels chocked. ♦ Approximately 300 - 500 gallons water in tank. ♦ Hoses and valves set up to pump water, para. 4-7.

NOTE
Read paragraph 4–7 before doing any work.

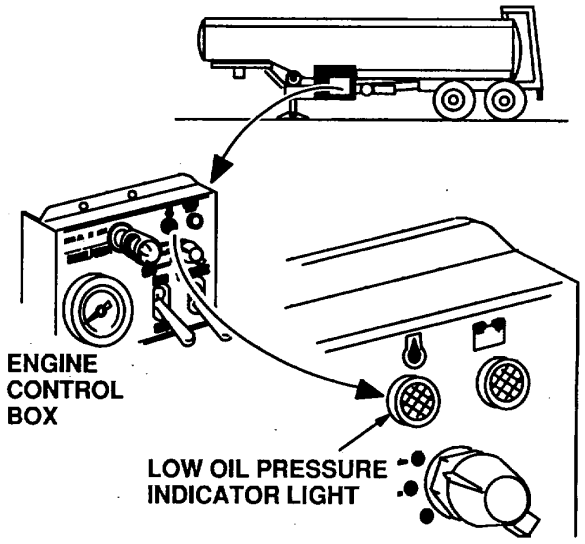
A

1. Check engine for proper oil level.
   - ♦ If low, check for loose oil sump drain plug or external leaks that could cause loss of oil.
   - ♦ If oil sump drain plug is loose, tighten.
   - ♦ If leaks are noted, notify support maintenance.
   - ♦ If no leaks are noted, add oil as needed, fig. 3–1.
2. Start engine and watch low oil pressure indicator light.
   - ♦ If low oil pressure indicator light stays on, stop engine.

Does low oil pressure indicator light work properly (light goes off after engine starts)?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C



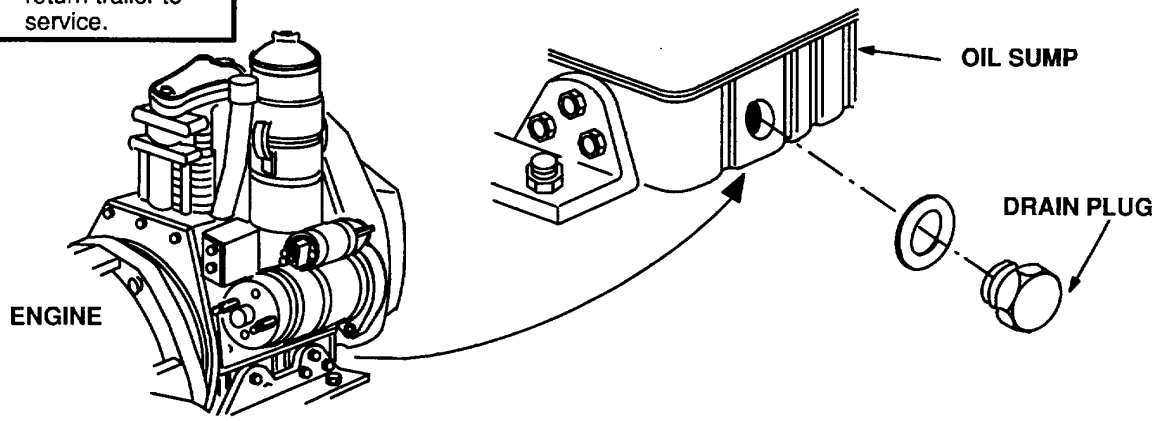


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
15.	LOW OIL PRESSURE INDICATOR LIGHT STAYS ON (Continued.)

From Block A

C Check that oil filter is not clogged.

- Remove oil filter from the back of the engine and inspect for clogging.
- If filter is clogged, clean thoroughly before reinstalling. Install filter.
- Start engine and check indicator light.

Does low oil pressure indicator light work properly (light goes off after engine starts)?

YES → **D** Problem solved; return trailer to service.

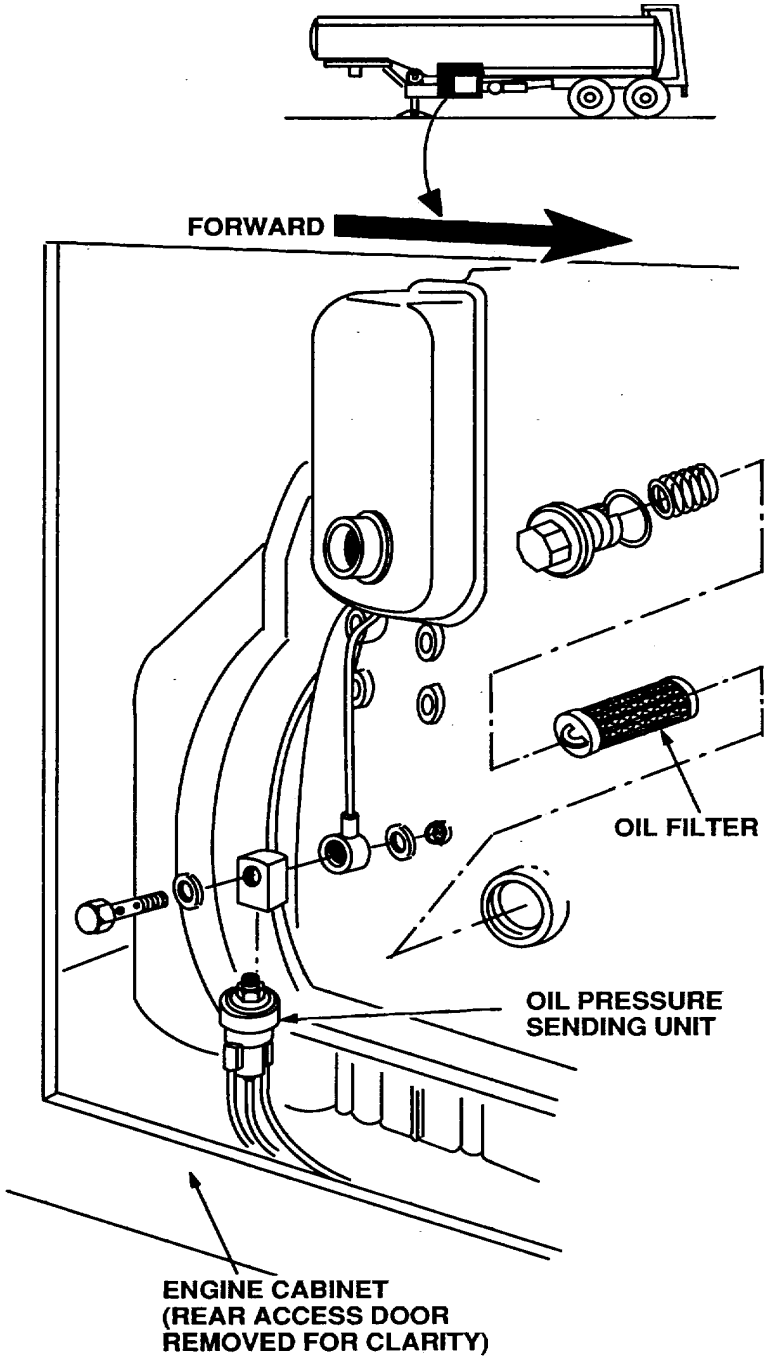
NO → **E** Check for defective oil pressure sending unit.

- Remove oil pressure sending unit and perform oil pressure test using STE/ICE.
- If oil pressure is below 20 psi, replace engine.
- If oil pressure is above 20 psi, replace oil pressure sending unit.
- If oil pressure sending unit was replaced, start engine and observe low oil pressure indicator light.

Does low oil pressure indicator light work properly (light goes off after engine starts)?

YES → **F** Problem solved; return trailer to service.

NO → **G** Replace engine



ENGINE AND PUMP ASSEMBLY (Continued)

Table 4-8. SECTION V. Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
16.	BLUE-GRAY EXHAUST SMOKE IS NOTED DURING ENGINE OPERATION

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two (Mechanic and Helper)

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Approximately 300-500 gallons water in tank.
- Hoses and valves set up to pump water, para. 4-7.

NOTE
Read paragraph 4–7 before doing any work.

A Check for overfilling and proper grade of engine oil.

1. Check engine oil, fig. 3–1.
   - If overfilled, drain until oil in engine is at proper level.
   - If oil is too thin in viscosity, drain and refill with proper grade of oil, fig. 3–1.
   - If oil level and grade were OK, notify support maintenance.
2. If oil was drained or changed, start and run engine to test system.

NOTE

If oil was overfilled or too thin in viscosity, engine exhaust will continue to smoke for a short time after it begins to run , and then clear up as excess oil is burned off (3–5 minutes, usually).

Has excessive exhaust smoking stopped?

YES → **B** Problem solved; return trailer to service.

NO → **C** Replace engine.

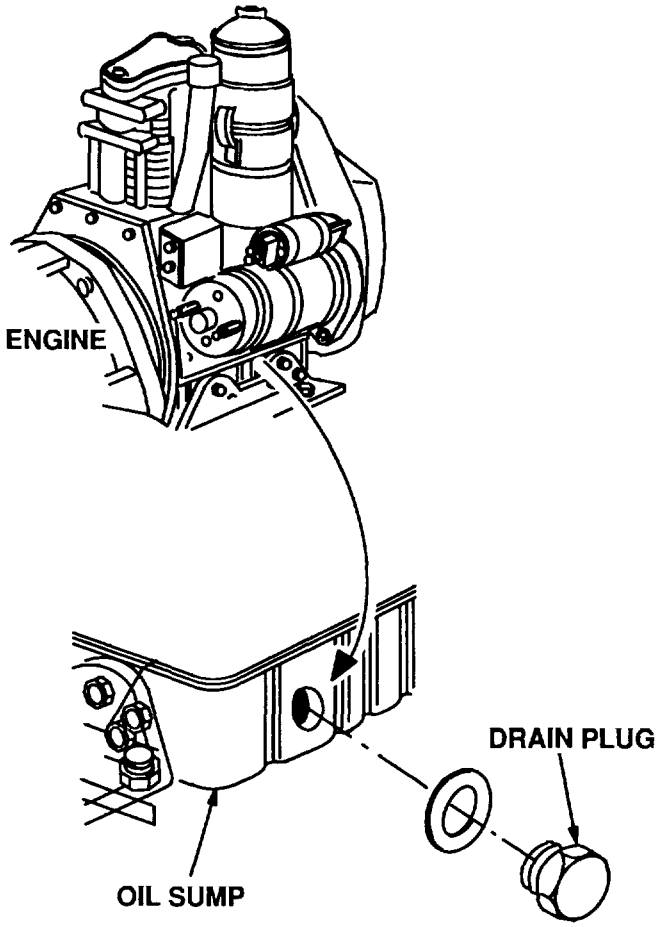


Table 4-8. SECTION V. Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
17.	ENGINE MISFIRES UNDER HEAVY LOAD

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two (Mechanic and Helper)

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Approximately 300 - 500 gallons water in tank.
- Hoses and valves set up to pump water, para. 4-7.

NOTE
Read paragraph 4–7 before doing any work.

A Check fuel lines for leaks.
- Tighten loose connections.
- Repair or replace damaged fuel lines.
- Start engine and test system.

Has engine misfiring stopped?

YES → **B** Problem return trailer to service.

NO →

WARNING
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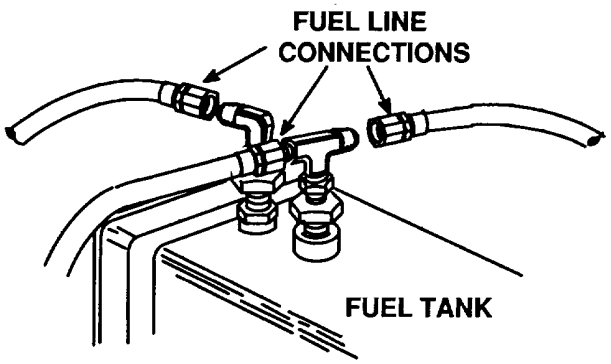
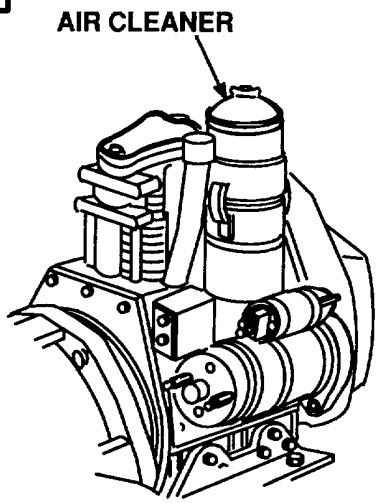
C Check air cleaner for clogged/ dirty air cleaner intake and/ or air filter element.
- Clean dirt and debris from air cleaner intake.
- Replace air filter element if clogged or dirty, Table 3–1.

Does engine start properly and have full engine power?

YES → **D** Problem solved; return trailer to service.

NO → **Go To Block E**





ENGINE AND PUMP ASSEMBLY (Continued)

Table 4-8. SECTION V. Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
17.	ENGINE MISFIRES UNDER HEAVY LOAD (Continued).

From Block C

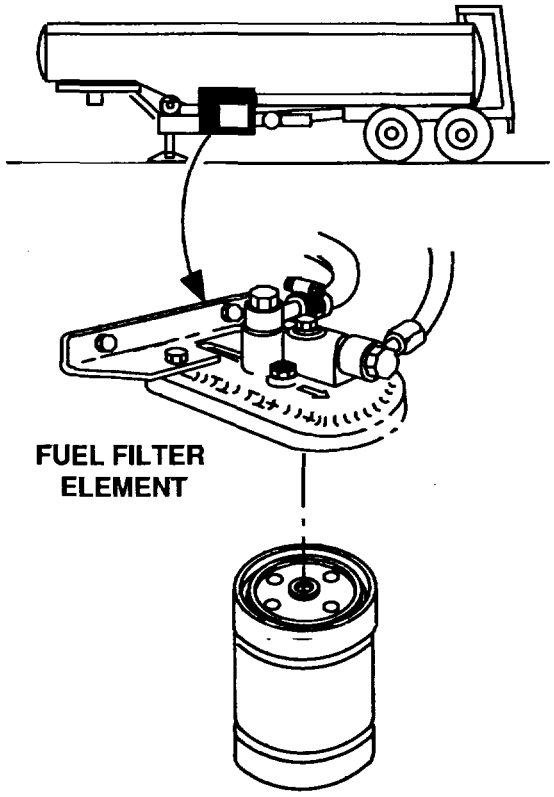
E Check for dirty fuel and for dirty/clogged fuel filter element.

- Remove engine compartment, rear access cover.
- Remove and inspect fuel filter element, and check for presence of water or dirt in fuel.
  - If fuel is dirty, drain fuel tank and lines, and refill tank with clean fuel.
  - Replace fuel filter element.
- Replace access cover.

Does engine start properly and have full engine power?

YES → **F** Problem solved; return trailer to service.

NO → **G** Notify support maintenance.



ENGINE AND PUMP ASSEMBLY (Continued)

Table 4-8. SECTION V. Unit Troubleshooting (Continued)

ENGINE (Continued)

No.	Malfunction
18.	ENGINE SPEED IS NOT CONSTANT (HIGH OR LOW SPEED; HUNTING OR LOSS OF CONTROL).

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two (Mechanic and Helper)

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Approximately 300 - 500 gallons water in tank.
- Hoses and valves set up to pump water (see para. 4-7).

NOTE
Read paragraph 4–7 before doing any work.

A Check fuel lines for leaks.
- Tighten loose connections.
- Repair or replace damaged fuel lines.
- Start engine and test system.

Is engine speed constant?

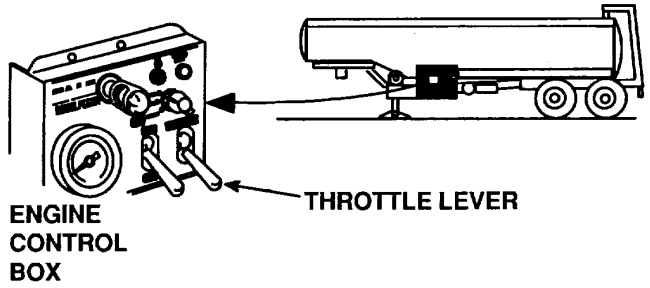
YES → **B** Problem return trailer to service.

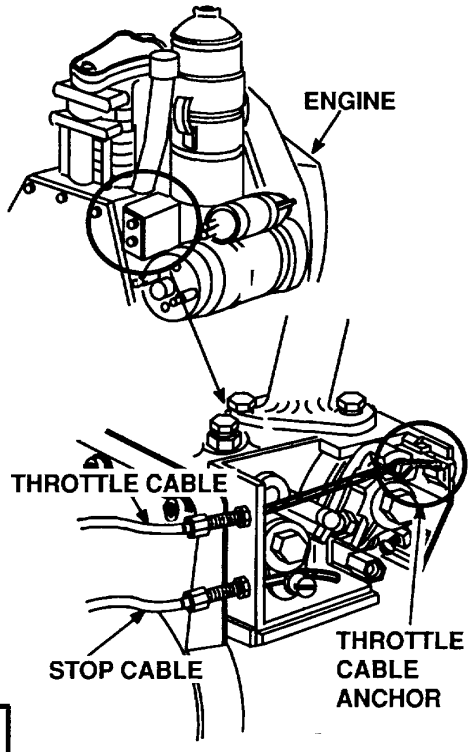
NO → **C**
1. Check for loose, binding, disconnected or loose throttle linkage.
   - Remove socket head screw and dust cover from engine throttle control.
   - Check throttle linkage by moving throttle lever on engine control box.
     - If linkage is loose, tighten.
     - If linkage is disconnected, reconnect.
     - If linkage is binding or broken, replace linkage.
2. Check throttle adjustment.
   - Adjust throttle linkage, para 4–25.
3. Start engine and test system.

Is engine speed constant?

YES → **D** Problem solved; return trailer to service.

NO → **E** Notify support maintenance.





ENGINE AND PUMP ASSEMBLY (Continued)

Table 4-8. SECTION V Unit Troubleshooting

ENGINE (Continued)

No. Malfunction

19. BLACK ENGINE EXHAUST SMOKE or EXCESSIVE FUEL CONSUMPTION.

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two (Mechanic and Helper)

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Approximately 300 - 500 gallons water in tank.
- Hoses and valves set up to pump water (see para. 4-7.)

NOTE

The black or brown color in the exhaust is from tiny, solid particles of pure carbon. A darker exhaust indicates a higher carbon content. The exhaust color may vary from a light gray haze to a brown or black, which indicates varying stages of incomplete combustion. Since combustion is never absolutely complete, the exhaust gases will never be invisible, but an increase (thicker and/or darker) exhaust smoke may indicate trouble, especially if there is no visible change in engine condition.

NOTE
Read paragraph 4–7 before doing any work.

WARNING

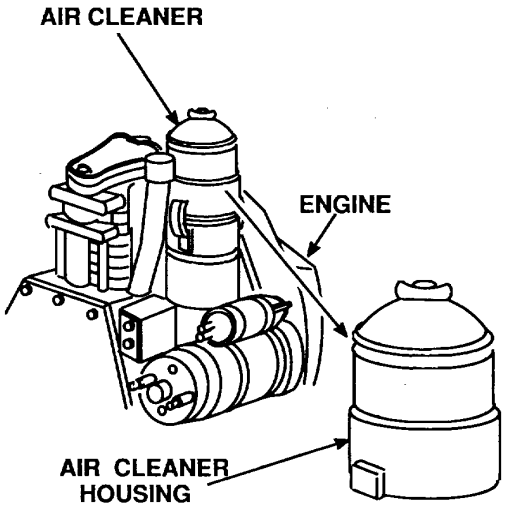
IF NBC EXPOSURE IS SUSPECTED, ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT. SEE OPERATOR / MAINTENANCE MANUALS.

A Check air cleaner for clogged/ dirty air cleaner intake and/ or air filter element.
- Clean dirt and debris form air cleaner intake.
- Replace air filter element if clogged or dirty (see Table 3-1).

Does engine start properly and have full engine power?

YES → **B** Problem return trailer to service.

NO → Go To Block C



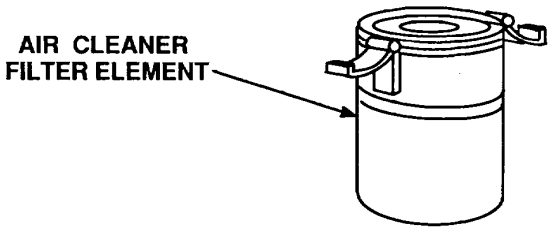


Table 4-8. SECTION V Unit Troubleshooting

ENGINE (Continued)

No.	Malfunction
19.	BLACK ENGINE EXHAUST SMOKE or EXCESSIVE FUEL CONSUMPTION.

From Block A

C 1. Check for binding water pump or engine.

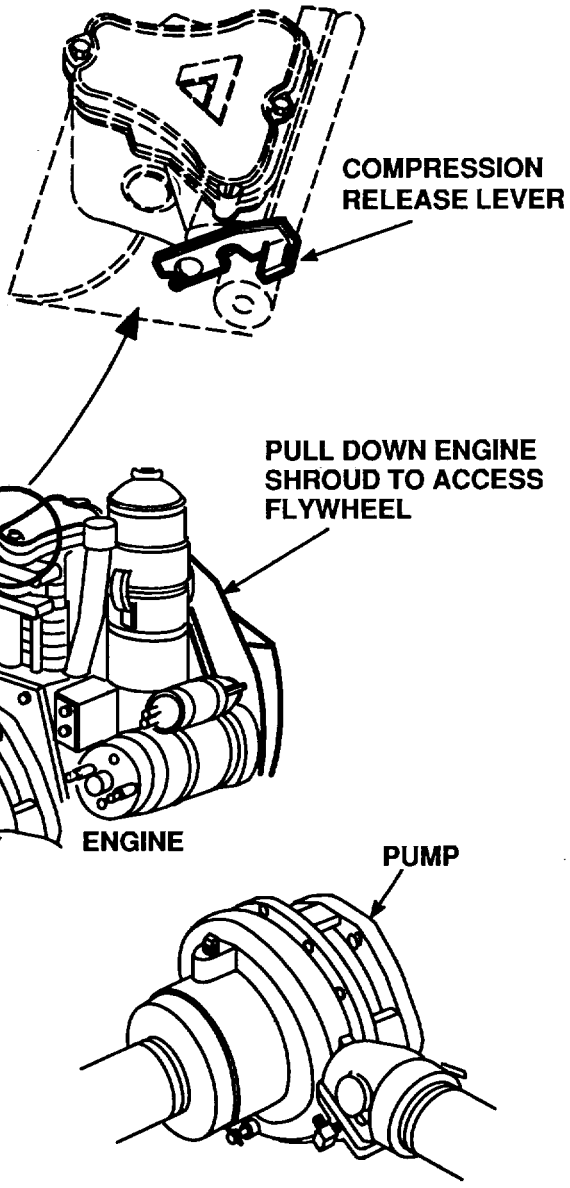
- ♦ Release pressure from engine cylinder by holding up compression release lever on top of engine.
- ♦ Turn flywheel by hand.
- ♦ If flywheel is binding, or requires excessive force to turn, or if noise is heard from inside pump, remove pump from engine, When pump is removed, try once again to turn flywheel by hand.
- ♦ If flywheel is binding with pump removed, replace engine.
- ♦ If flywheel is not binding with pump removed, disassemble and inspect pump for damage.
- ♦ Repair pump by replacing damaged parts, and reassemble pump.
- ♦ Install repaired pump on engine.

2. Test system.

Is engine exhaust and fuel consumption normal?

YES → **D** Problem solved; return trailer to service.

NO → **E** Notify support maintenance.



POTABLE WATER PUMP

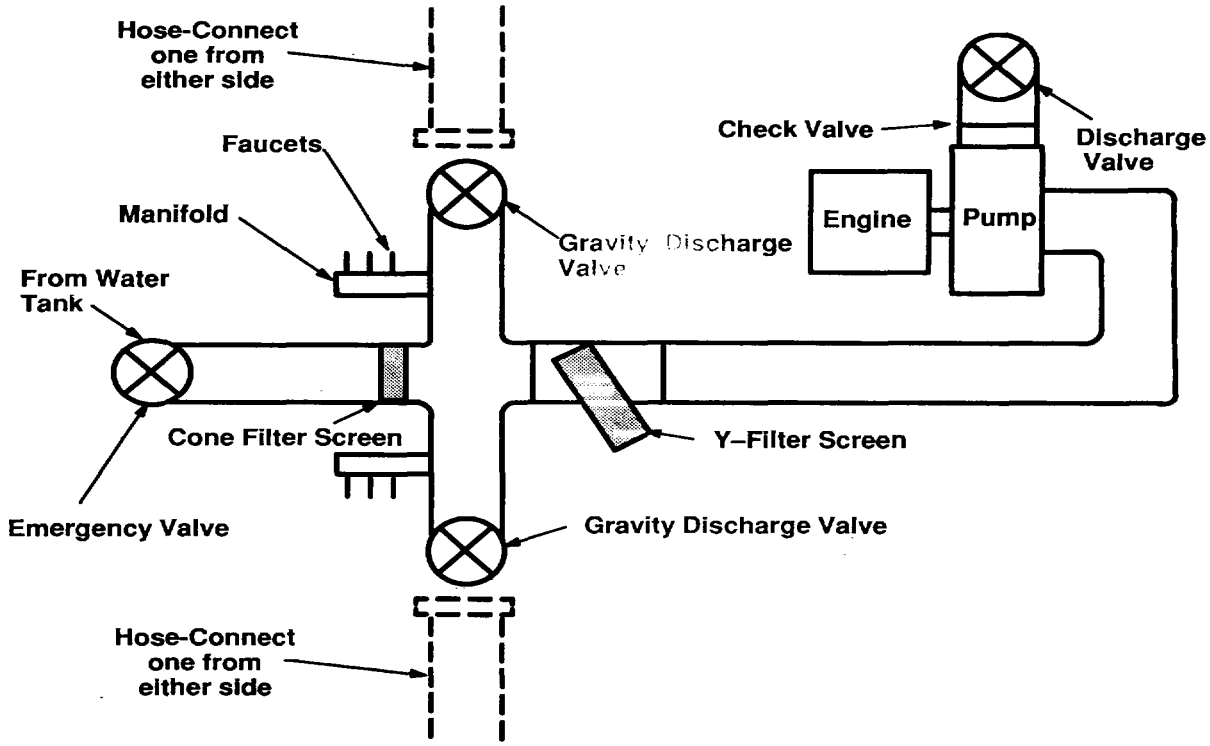


Figure 4-3. Pump Piping Schematic

4-8. Hydrostatic Test

Leaks which are invisible or inaudible can usually be detected by a hydrostatic test. This consists of plugging all pump openings and closing the discharge and connecting the pump to a water pressure source-not over 100 psi. With water pressure on, open the discharge for a few seconds until water runs out. This allows air to escape. Then, by closing the discharge valve, the pressure rise in the pump will cause leaks to become visible.

NOTE

Clean and sanitize the pump immediately following the hydrostatic test. Cleaning is described in para 4-36. Sanitizing is reviewed in para 4-37.

TRAILER ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP

No.	Malfunction	No.	Malfunction
20.	PUMP FAILS TO PUMP WATER	21.	WATER FLOW LESS THAN NORMAL.

Initial Setup

Tools
General Mechanic's tool kit
STE/ICE

Personnel
Two (Mechanic and Helper)

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- All valves closed.
- Enough water in tank to perform test (approximately 300 - 500 gallons.)

WARNING
After maintenance is completed, medical personnel have to certify the tanker fit for potable water usage prior to start of next mission.

NOTE
Read paragraph 4–7 before doing any work.

NOTE
If tanker has been in cold weather, problem may have been caused by ice in lines or valves. If needed, put tanker in warm area to thaw ice.

A Check for free (normal) water flow.
- Open emergency and main discharge valves.
- Observe water flow.

Does water flow freely?

YES → Go To Block D

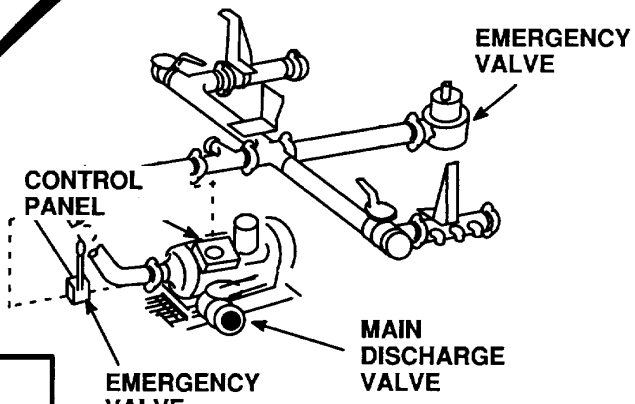
NO →

CAUTION
If control panel pressure gage does not read 10 psi or more, stop engine to prevent possible damage to pump's food–grade seals.

B Start pump engine and observe control panel pressure gage.
- If control panel pressure gage reads 10 psi or more, stop engine and go to Block P.
- If gage reads less than 10 psi, stop engine, and go to Block C.

Go To Block P

Go To Block C



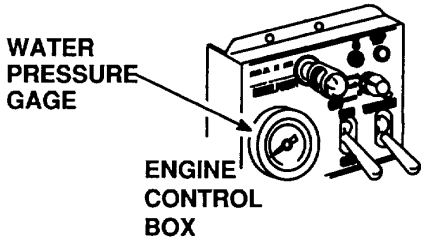


Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP (Continued)

No.	Malfunction	No.	Malfunction
20.	PUMP FAILS TO PUMP WATER (Cont.)	21.	WATER FLOW LESS THAN NORMAL (Cont.).

From Block A

C Check operation of emergency valve and vent on top of tanker.

1. Make sure control cable for the emergency valve is not loose, broken or stretched, or that control lever on the emergency valve housing is not loose on mounting shaft.
   - ♦ Tighten or replace control cable if needed, para 4–34.
   - ♦ If control lever was loose, position lever on valve housing so that emergency valve and emergency valve control lever located in the engine compartment are both in the closed position.
   - ♦ Tighten bolt and nut on control lever on valve housing.
2. Check for loose tube coupling nut and leaks between emergency valve body and valve control lever.
3. Emergency valve control lever on valve housing should move freely and the vent on top of tanker should open and close as lever is operated.
   - ♦ Make repairs or replacements as needed, then readjust control cable, para 4–34.

Does emergency valve and vent work properly, and has original problem been corrected?

YES

E Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

Return tanker to service.

NO

GO TO BLOCK F

From Block A

D Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

Return tanker to service.

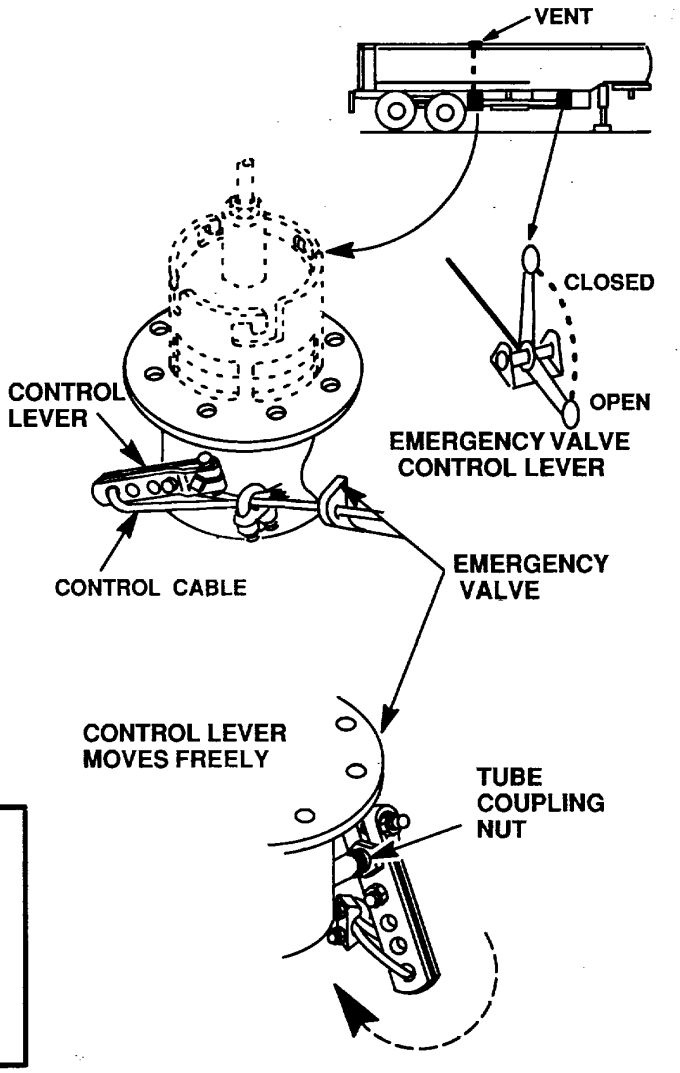


Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP (Continued)

No.	Malfunction	No.	Malfunction
20.	PUMP FAILS TO PUMP WATER (Cont.).	21.	WATER FLOW LESS THAN NORMAL(Cont.).

From Block C

F Check for flow of water through side discharge valves and faucets.

Does water flow freely?

YES — NO

G Check for blockage at "Y" filter.

- Remove "Y" filter and check fo clogging, para 4–29.
- Clean if needed, and replace filter.

Does water flow freely?

YES — NO

J Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

Return tanker to service.

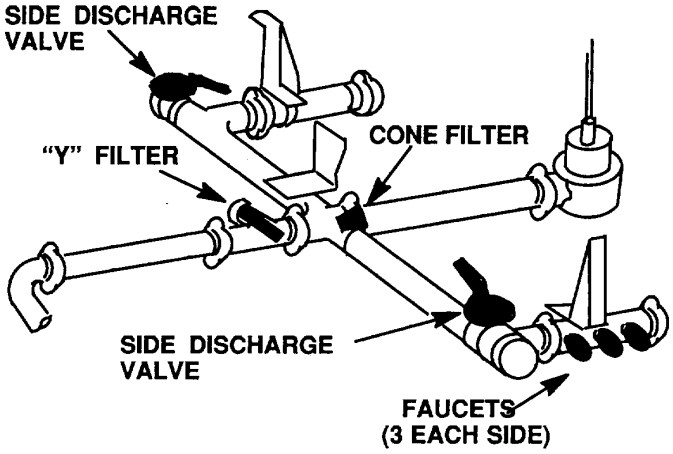
K Check for blockage between "Y" filter section and water pump inlet.

- Remove piping between "Y" filter section and water pump and check for clogging.
- Clean out piping to remove blockage, if needed.
- Install piping and test system.

Does water flow freely?

YES — GO TO BLOCK J

NO — GO TO BLOCK M



H Check for blockage at cone filter.

- Remove cone filter and check for clogging.
- Clean if needed, and replace filter.

Does water flow freely?

YES — NO

L Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

NO — GO TO BLOCK N

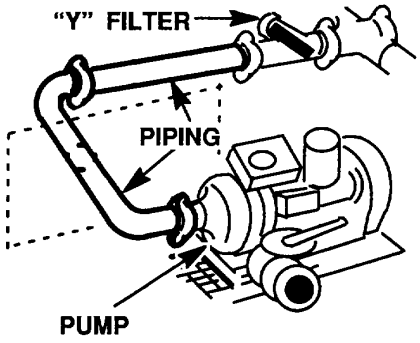


Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP (Continued)

No.	Malfunction	No.	Malfunction
20.	PUMP FAIL S TO PUMP WATER (Cont.).	21.	WATER FLOW LESS THAN NORMAL (Cont.).

From Block L

M

1. Remove pump housing and impeller, para 7-9, and check for clogging or for a broken key (shear pin) that connects the engine drive shaft to the pump impeller.
   - If clogged, remove debris.
   - If key is sheared, replace key.
   - If pump is damaged, repair or replace as needed, para 7-9.
2. Reassemble and test system.

Return tanker to service.

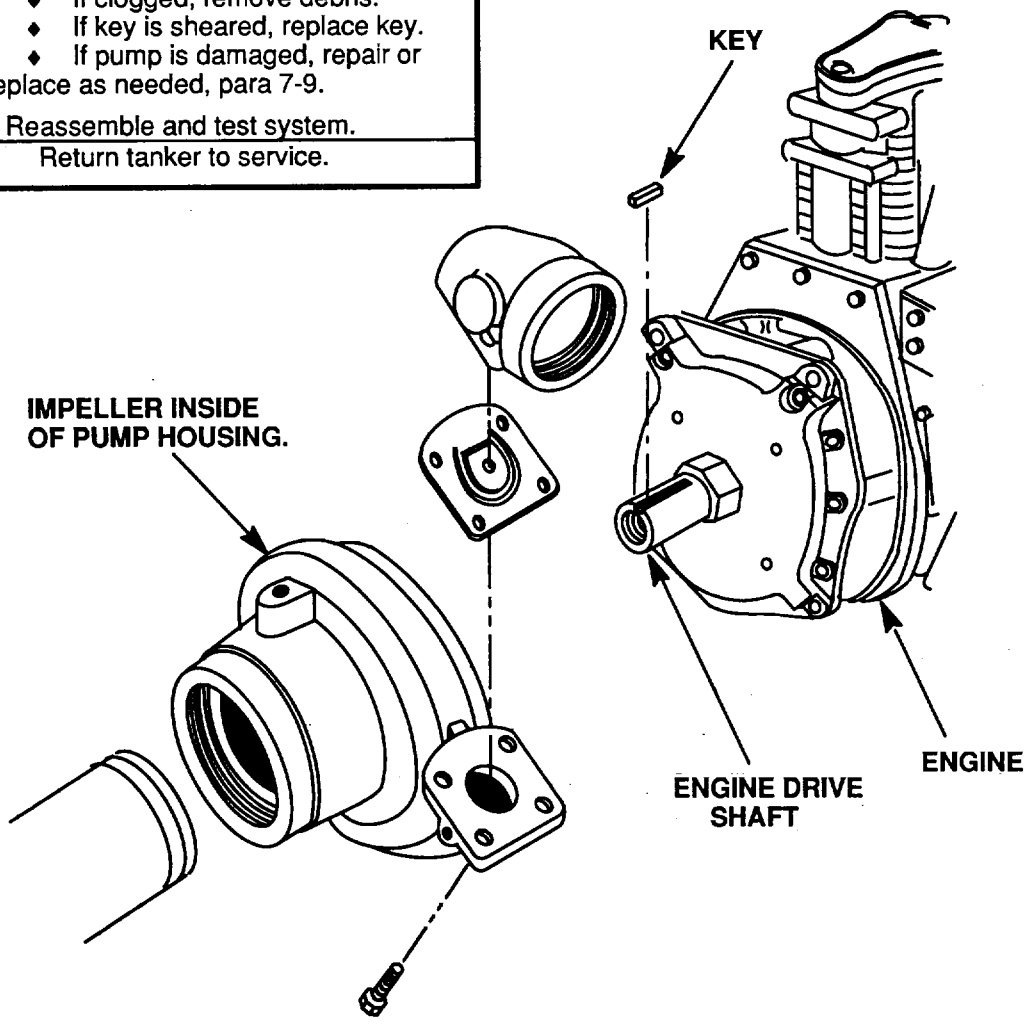


Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP (Continued)

No.	Malfunction	No.	Malfunction
20.	PUMP FAILS TO PUMP WATER (CONT.).	21.	WATER FLOW LESS THAN NORMAL (CONT.).

From Block H

N 1. Drain all water from tanker.
2. Remove and inspect emergency valve for damaged or clogged valve, para 4–33.
- ♦ Repair or replace as needed, para 4–33.
- ♦ If clogged, remove debris and clean as needed.

3. Check for blockage around emergency valve opening.
- ♦ If clogged, remove debris and clean as needed.

4. Reassemble and test system.

5. Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

From Block B

P Check that main discharge valve (butterfly valve) works properly, and is not clogged by debris.
- ♦ If bolt securing handle is loose, tighten bolt and continue test; if handle cannot be tightened, replace valve.
- ♦ Open and close butterfly valve handle several times to insure that valve works properly.
- ♦ If valve does not work properly, replace valve.

Does water flow freely?

YES → **Q** Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

NO → **R** Check one–way valve on pump adapter.
- ♦ Remove adapter at pump.
- ♦ Check for blockage or defective valve flap.
- ♦ If blocked, remove debris.
- ♦ If the valve flap is defective, replace one–way valve.

S Flush out and sanitize tanker. Have medical personnel certify tanker fit for potable water use.

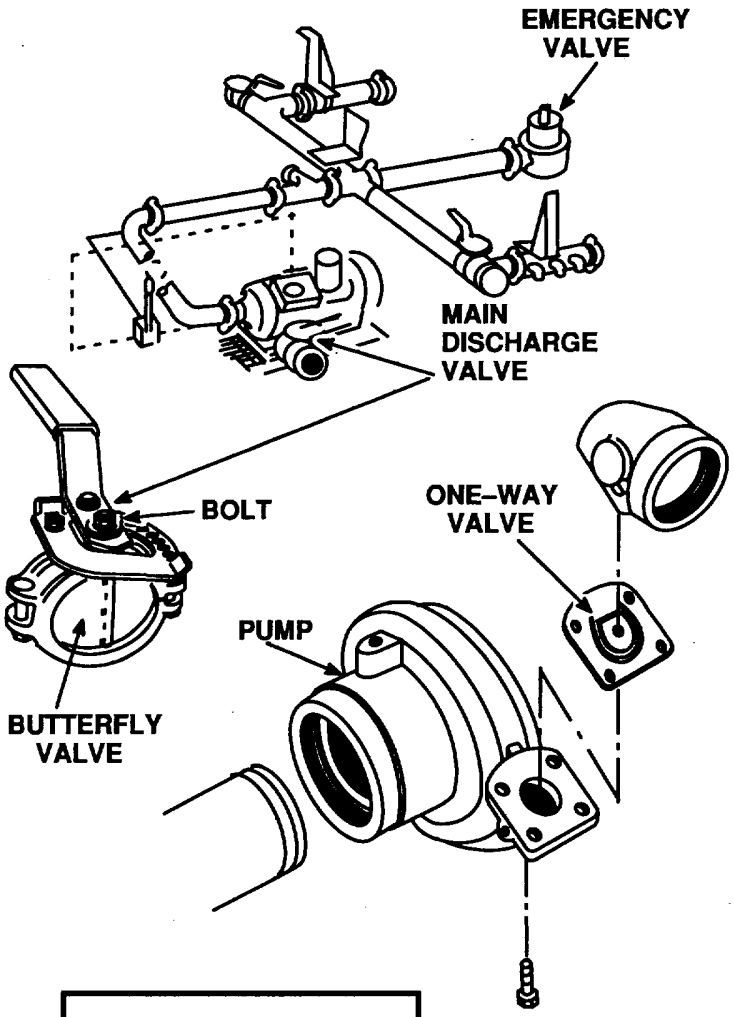


Table 4-8. SECTION V Unit Troubleshooting (Continued)

POTABLE WATER PUMP (Continued)

No.	Malfunction
22.	EMERGENCY VALVE CONTROL OPERATES IMPROPERLY

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- All valves closed.
- Enough water in tank to perform test (approximately 300 - 500 gallons).

NOTE
Read paragraph 4–7 before doing any work.

A Check emergency valve control for proper operation and damage/ missing parts.

- Check for missing or broken pins and mounting hardware.
- Check that control lever mounting bracket is firmly attached to side of engine compartment.
- Check that cable guide behind engine compartment is not damaged.
- Check for loose, stretched or broken control cable.
- Replace missing or damaged hardware. Tighten loose mounting hardware.
- If control cable is stretched or damaged, replace cable.
- Repair damaged cable guide, if needed.
- Adjust cable tension, para 4–34.

Does emergency valve control work OK?

YES → **B** Problem solved; return trailer to service.

NO → **C** Replace control lever and mount, then return to block A.

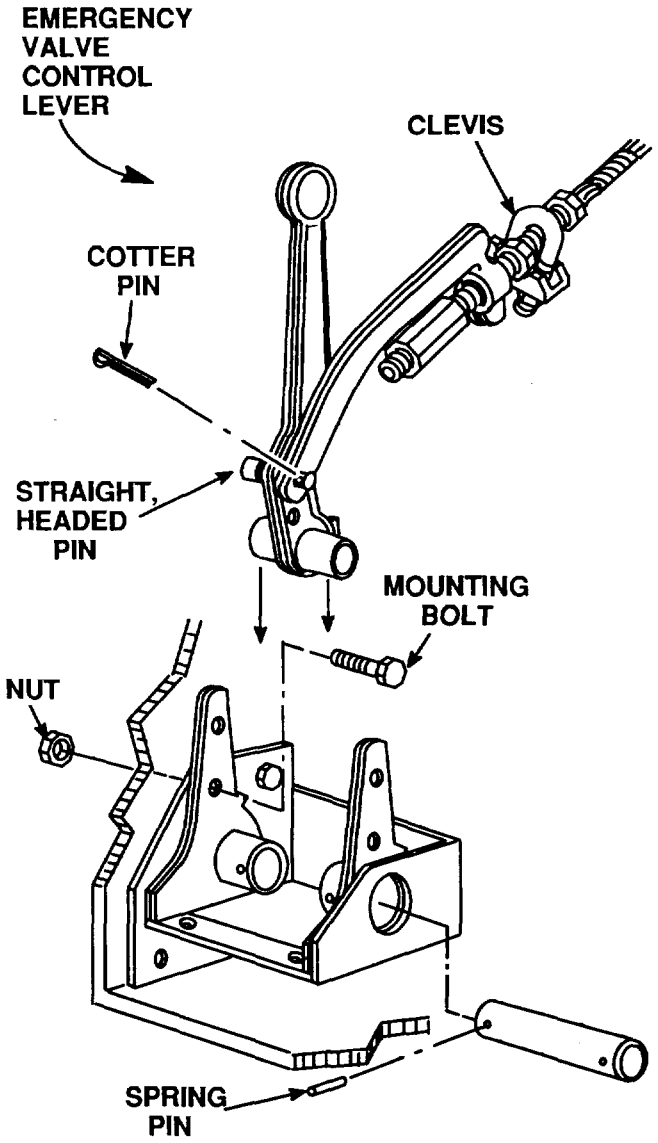


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL

No.	Malfunction
23.	**BATTERY/GENERATOR INDICATOR LIGHT FAILS TO LIGHT (Engine Starts Normally).**

Initial Setup	Equipment Conditions
Tools General Mechanic's tool kit Multimeter **Personnel** Two (Mechanic and Helper)	♦ Tanker parked on level ground. ♦ Parking brakes set and wheels chocked. ♦ All valves closed. ♦ Enough water in tank to perform test (approximately 300 - 500 gallons).

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE

Read paragraph 4–7 before doing any work.

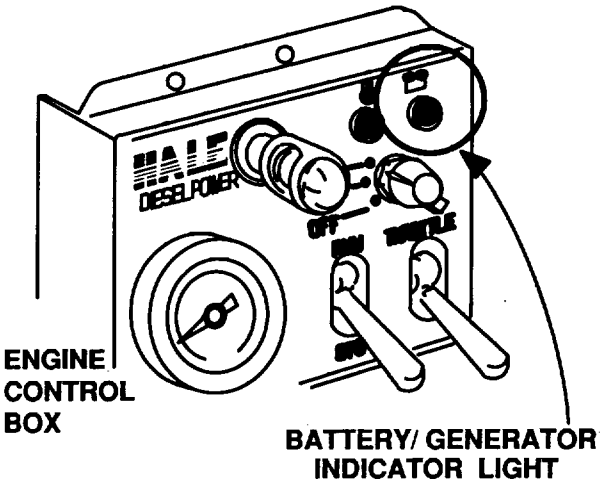
A Check for loss of ground at voltage regulator.

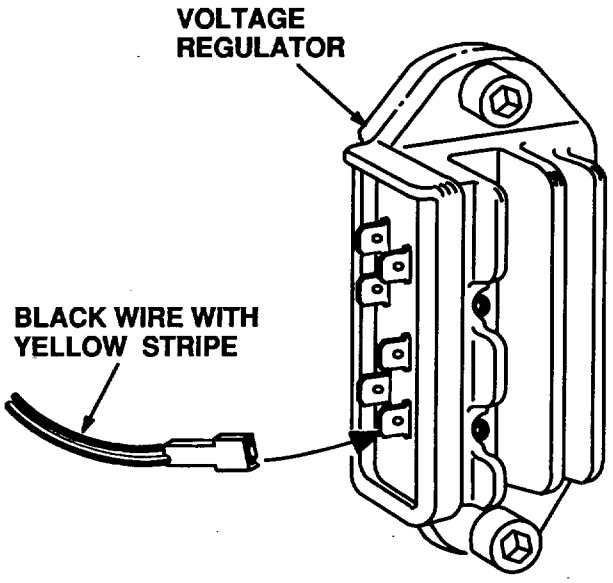
- ♦ Remove engine compartment rear access panel.
- ♦ Check connection between clip on black wire with yellow stripe and voltage regulator for corrosion, damage or loose connection.
  - ♦ Clean off corrosion.
  - ♦ If clip is disconnected, reconnect.
  - ♦ If clip cannot be tightened or if it is damaged, replace clip.
- ♦ Start engine and check indicator light.

Does Battery/Generator indicator light work properly?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C





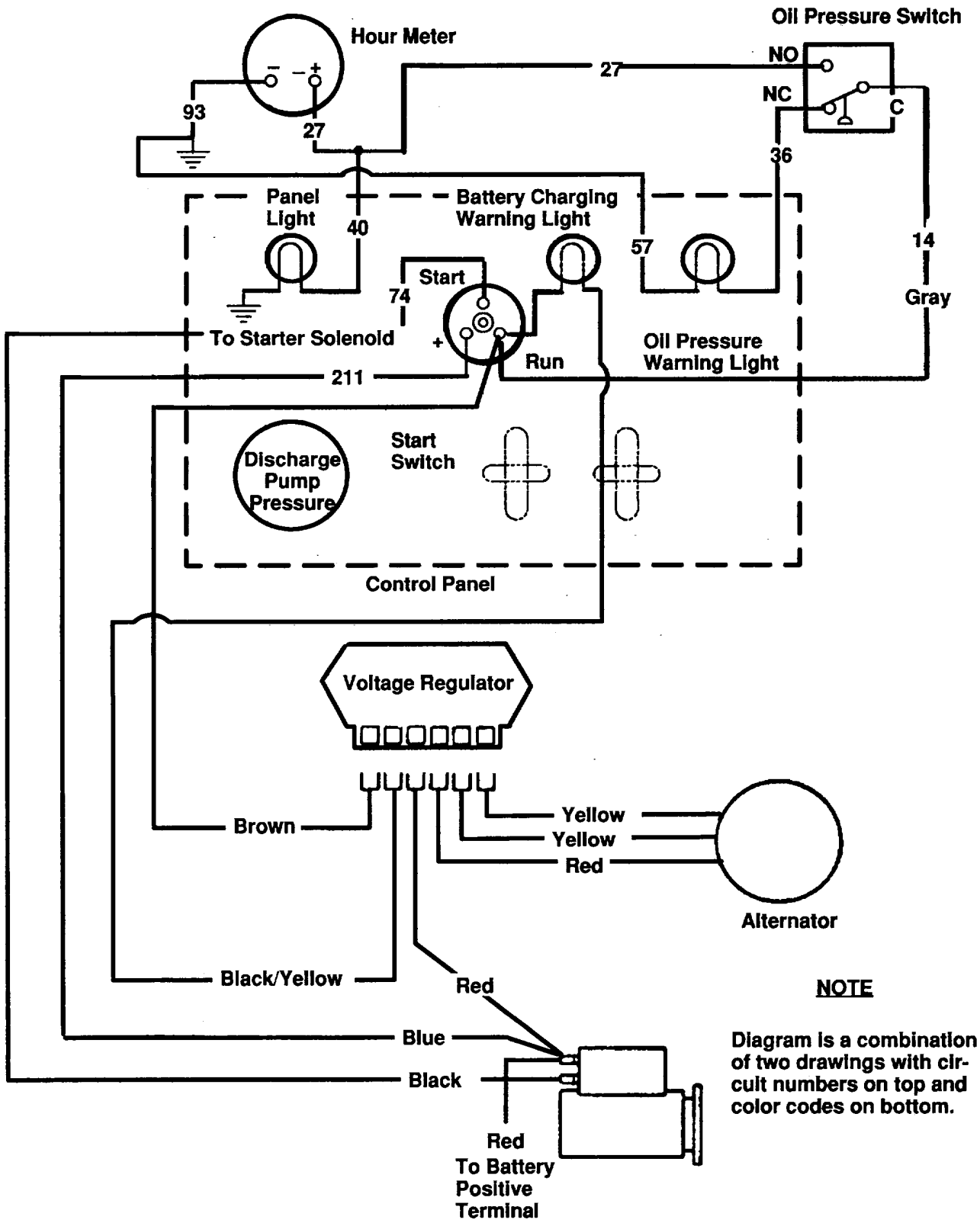


Figure 4-4. Water Dispensing Unit Charging Circuit Diagram

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
23.	BATTERY/GENERATOR INDICATOR LIGHT FAILS TO LIGHT (Engine Starts Normally) (Continued).

From Block A

C Check Battery/Generator indicator light on engine control panel.

- ♦ Remove control panel from mounting bracket to gain access to panel wiring.
- ♦ Check for loose, broken or otherwise damaged wiring and end connectors/ terminals.
- ♦ Tighten, repair, or replace wiring or connectors as needed.
- ♦ Check for dirt/ corrosion at points of connection.
- ♦ Clean dirt or corrosion.
- ♦ Using multimeter set to the Rx1 scale (ohms), disconnect clips at back of indicator light, and check for continuity (0 - to - 5 ohms) between clips. If meter indicates an open (if there is no meter movement to indicate a complete electrical path within the light), replace the defective indicator light.
- ♦ Using multimeter set to the Rx1 scale (ohms) check for continuity (0 -to - 5 ohms) between points 1 and 2, and between points 3 and 4, as shown on the accompanying illustration. If meter indicates an open (if there is no meter movement to indicate a complete electrical path within the wire), replace the the defective wire.

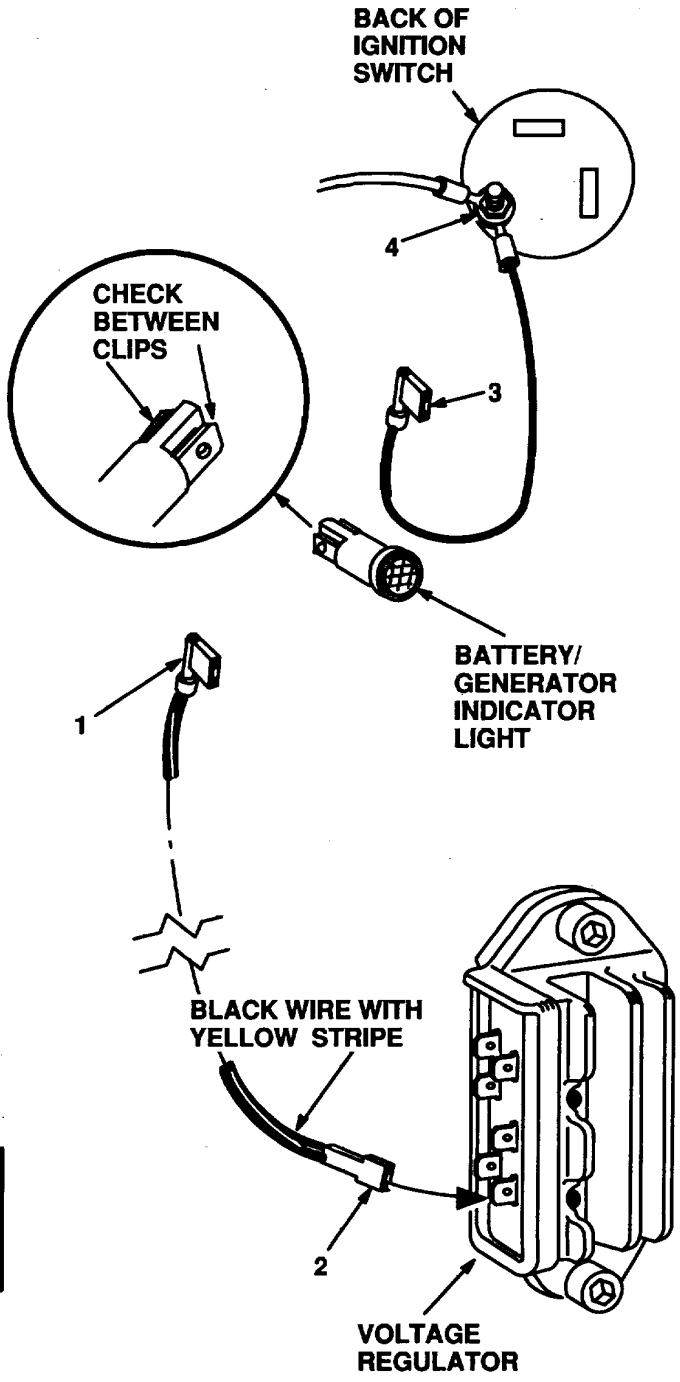
Does Battery/ generator Indicator light work properly?

YES

D Problem solved; return trailer to service.

NO

E Return to block A and repeat checks until problem is corrected.



ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
24.	**LOW OIL PRESSURE INDICATOR LIGHT FAILS TO LIGHT (Engine Starts Normally).**

Initial Setup	Equipment Conditions
Tools General Mechanic's tool kit Multimeter **Personnel** Two (Mechanic and Helper)	♦ Tanker parked on level ground. ♦ Parking brakes set and wheels chocked. ♦ All valves closed. ♦ Enough water in tank to perform test (approximately 300 - 500 gallons).

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE
Read paragraph 4–7 before doing any work.

A Check connection at oil pressure switch.

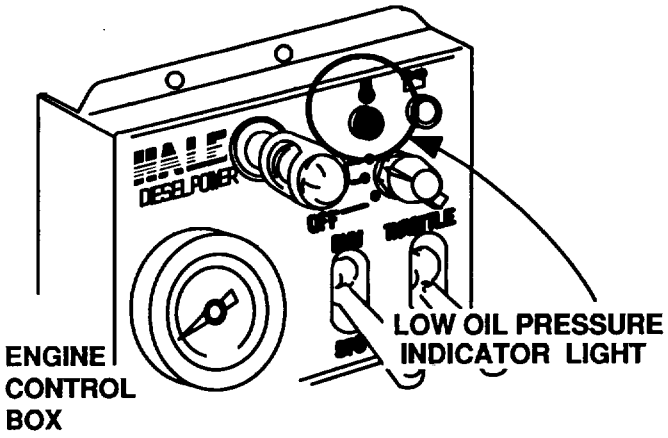
- ♦ Remove engine compartment rear access panel.
- ♦ Check clips connected to bottom of oil pressure switch.
- ♦ Clean off corrosion.
- ♦ If any clip is disconnected, reconnect.
- ♦ If clip cannot be tightened or if it is damaged, replace clip.

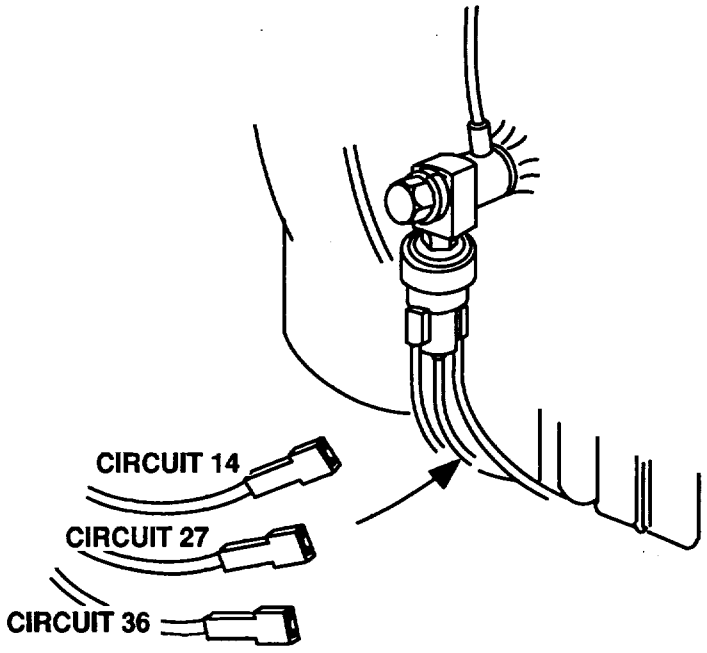
Start engine and check indicator light. Indicator light should come on, then go out after a short time as pressure builds up.

Does oil pressure indicator light work properly?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C





ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
24.	LOW OIL PRESSURE INDICATOR LIGHT FAILS TO LIGHT (Engine Starts Normally).

From Block A

C Check for loss of ground at hour meter.

- Check for loose, damaged, or corroded hardware that could cause a loss of the ground connection.
- Replace damaged hardware.
- Clean off corrosion.
- Tighten loose hardware.

Does low oil pressure Indicator light work properly?

YES → **D** Problem solved; return trailer to service.

NO → **E** Check low oil pressure indicator light on engine control panel.

- Remove control panel from mounting bracket to gain access to panel wiring.
- Check for loose, broken or otherwise damaged wiring and end connectors/ terminals.
- Tighten, repair, or replace wiring or connectors as needed.
- Check for dirt/ corrosion at points of connection.
- Clean dirt or corrosion.
- Using multimeter set to the Rx1 scale (ohms), disconnect clips at back of indicator light, and check for continuity (0 – to – 5 ohms) between clips. If meter indicates an open (if there is no meter movement to indicate a complete electrical path within the light), replace the defective indicator light.

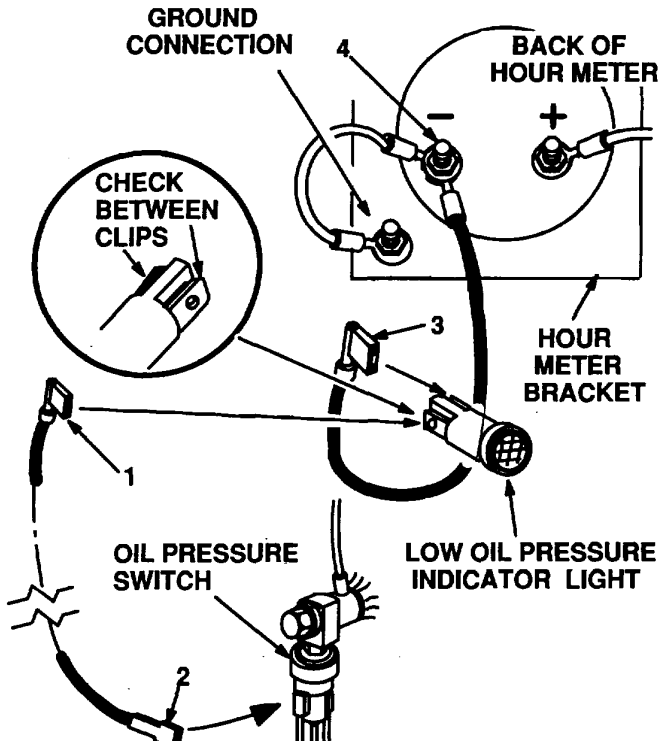
E (Continued)

- Using multimeter set to the Rx1 scale (ohms) check for continuity (0 – to – 5 ohms) between points 1 and 2, and between points 3 and 4, as shown on the accompanying illustration. If meter indicates an open (if there is no meter movement to indicate a complete electrical path within the wire), replace the the defective wire.

Does low oil pressure Indicator light work properly?

YES → **F** Problem solved; return trailer to service.

NO → **G** Return to block A and repeat checks until problem is corrected.



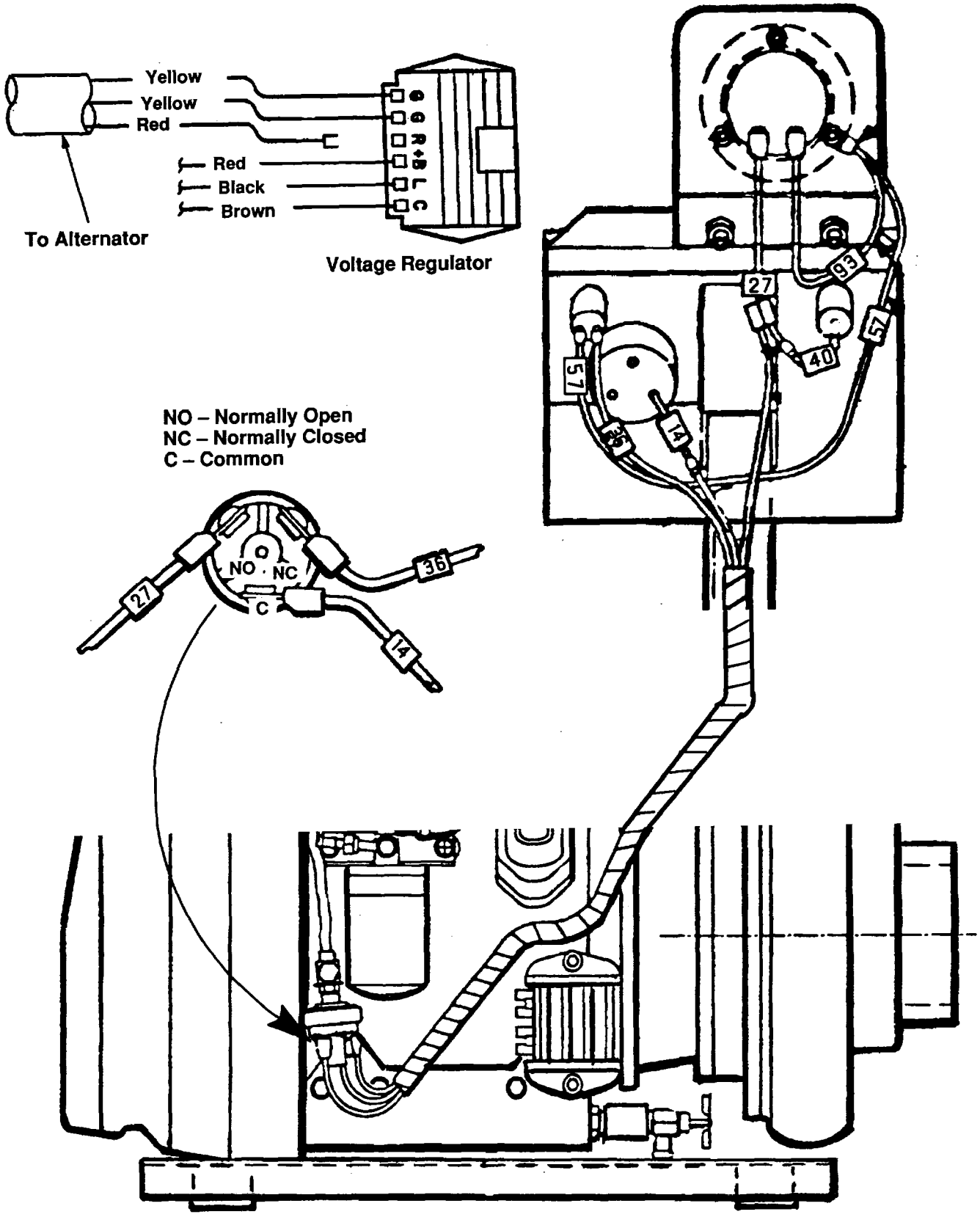


Figure 4-5. Charging Circuit Component Location.

ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No. Malfunction

25. INDICATOR AND PANEL LIGHTS FAIL TO LIGHT (Engine Starts Normally).

Initial Setup

Tools
General Mechanic's tool kit
tank. Multimeter

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Approximately 300 - 500 gallons water in
- Hoses and valves set up to pump water see para. 4-7.

WARNING
Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE
Read paragraph 4–7 before doing any work.

A 1. Check connection at oil pressure switch and at voltage regulator.
- Remove engine compartment rear access panel.
- Check wiring to voltage regulator and to bottom of oil pressure switch.
- Clean off any dirt or corrosion.
- If any clip is disconnected, reconnect.
- If clip cannot be tightened or if it is damaged, replace clip.

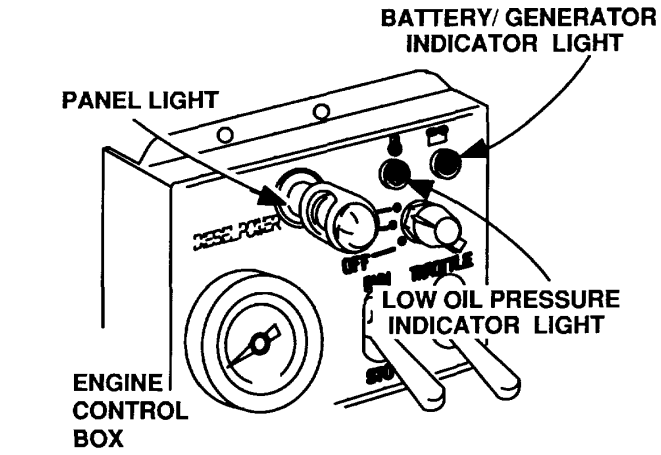
2. Check that voltage regulator is firmly in place and makes good, clean contact (ground connection) with the engine housing.
- If regulator is loose, tighten mounting bolts.
- If there appears to be corrosion between the regulator and the engine housing, carefully remove regulator, clean corrosion, then remount regulator.

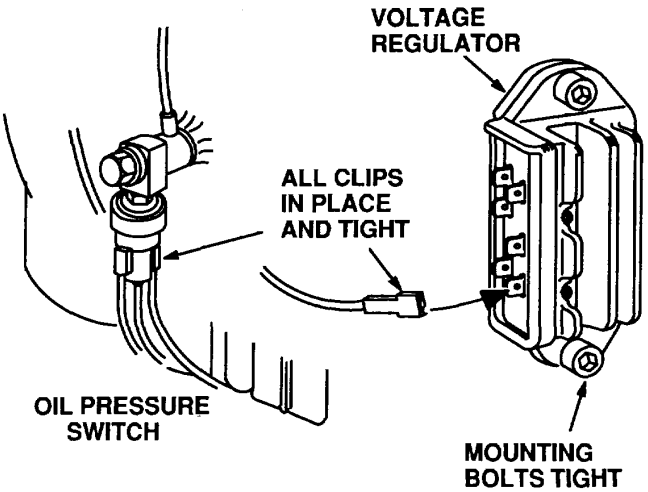
3. Start engine and check indicator and panel lights. Indicator lights should come on briefly, then go out ; the panel light should come on and stay on.

Do indicator lights and panel light work properly?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C





ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
25.	INDICATOR AND PANEL LIGHTS FAIL TO LIGHT (Engine Starts Normally) (Continued).

From Block A

C Check for good ground connection between engine control box mounting bracket where it is attached to pump flange.

- ♦ If bracket is not tightly mounted, tighten mounting hardware.
- ♦ If dirt and/ or corrosion present, clean.

Do indicator lights and panel light work properly?

YES → **D** Problem solved; return trailer to service.

NO →

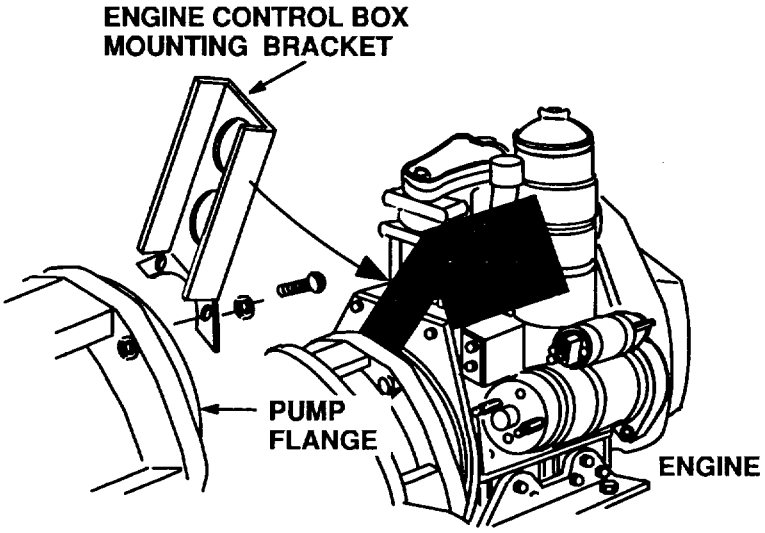
E Check for defective/ broken or disconnected wiring inside engine control box.

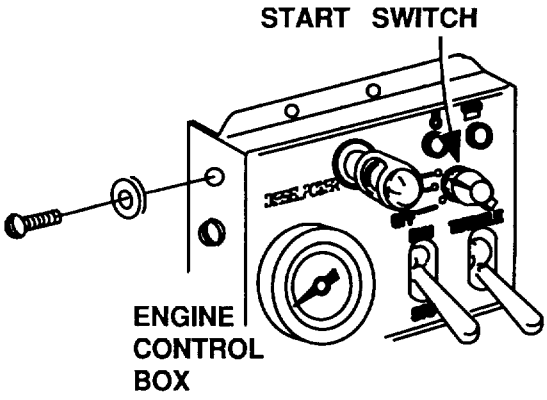
- ♦ Remove two mounting screws from each side of control box to gain access.
- ♦ Using multimeter, check for continuity (0 to 5 ohms) of circuit number 211 (brown wire), between rear of ignition switch and battery positive (+) terminal.
- ♦ If continuity is not present, replace circuit number 211.

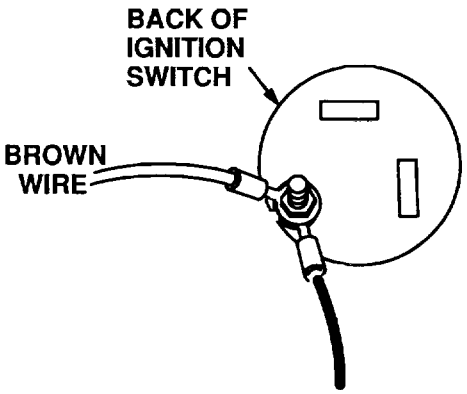
Do indicator lights and panel light work properly?

YES → **F** Problem solved; return trailer to service.

NO → **G** Return To Block A and repeat checks.







ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
26.	BATTERY/GENERATOR INDICATOR LIGHT STAYS ON, OR FLICKERS INTERMITTENTLY.

Initial Setup

Tools
General Mechanic's tool kit
STE/ICE

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Enough water in tank to perform test
- (approximately 300 - 500 gallons).

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE

Read paragraph 4–7 before doing any work.

A Check wiring and connections starter and regulator (red wire).

- Check for broken wires, loose or missing hardware or corrosion, and make sure voltage regulator is firmly mounted (grounded) to engine housing.

CAUTION

If red wire (positive (+) power lead) is disconnected from the voltage regulator, the other red wire, leading from the voltage regulator to the alternator must also be disconnected until after the positive power lead is reconnected to the regulator. Failure to do so may damage the voltage regulator.

- Clean off corrosion.
- If any terminal is disconnected, reconnect.
- Replace defective or missing parts.
- Start engine and check system.

Does battery/ generator light work properly?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C

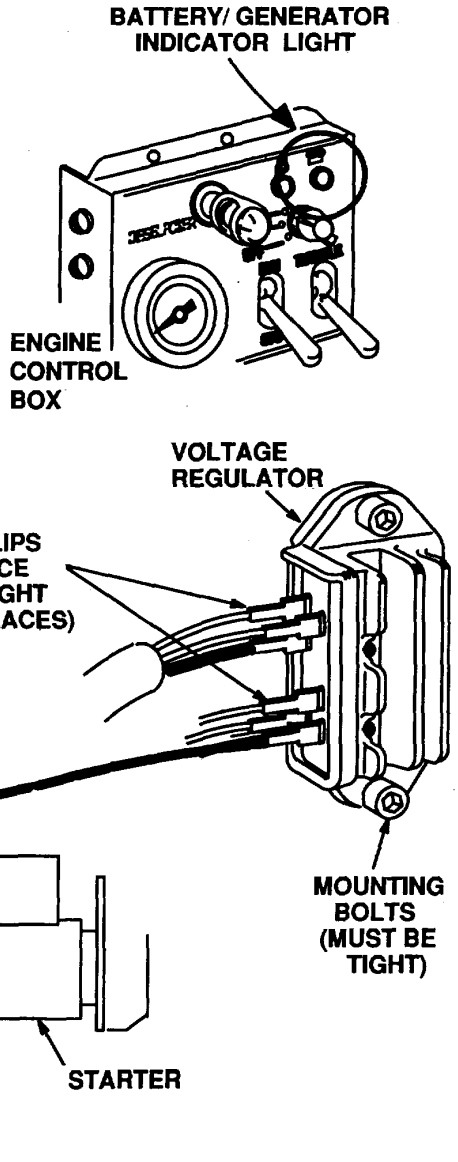


Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
26.	BATTERY/GENERATOR INDICATOR LIGHT STAYS ON, OR FLICKERS INTERMITTENTLY (Continued).

From Block A

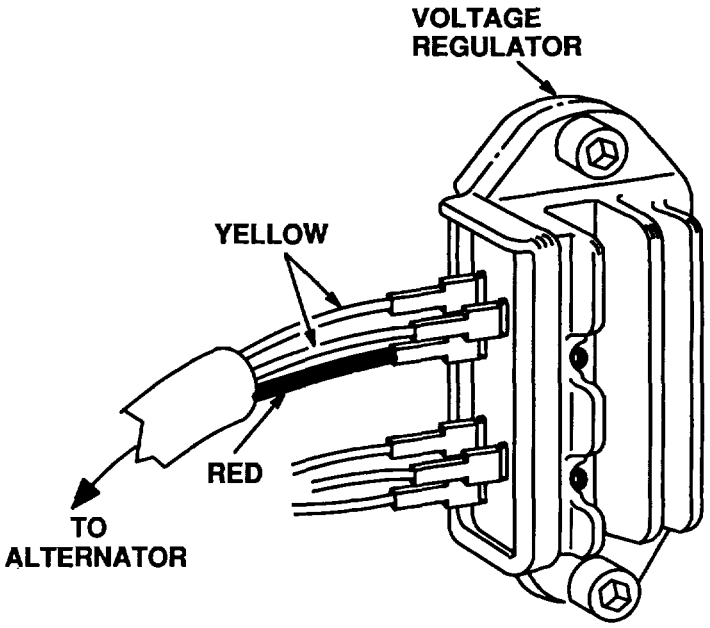
C Check wires (two yellow and one red) and connections between top three contacts of voltage regulator and alternator.

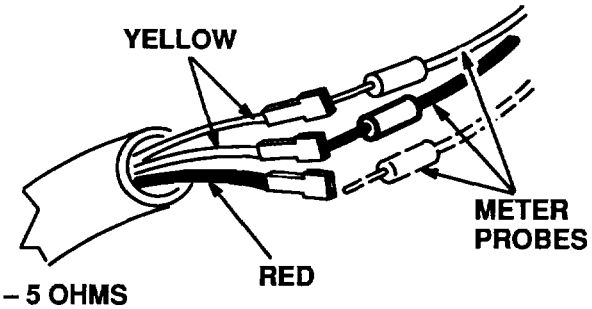
- ♦ Check for broken wires, loose or missing hardware or corrosion.
  - ♦ Clean off corrosion.
  - ♦ Replace defective or missing parts.
- ♦ Using multimeter set to the RX1 scale, check for continuity (0 to 5 ohms) between one red and two yellow wires (there should be continuity between all three wires).
  - ♦ If continuity is not present between all three wires, replace voltage regulator.
- ♦ Using multimeter, check for continuity (0 to 5 ohms) between ground (engine housing) and each of the three wires (i.e. one red and two yellow wires).
  - ♦ If continuity is found between any of the wires and ground (i.e. engine housing) the alternator needs to be replaced. Notify support maintenance.
- ♦ Start engine and check system.

Does battery/ generator light work properly?

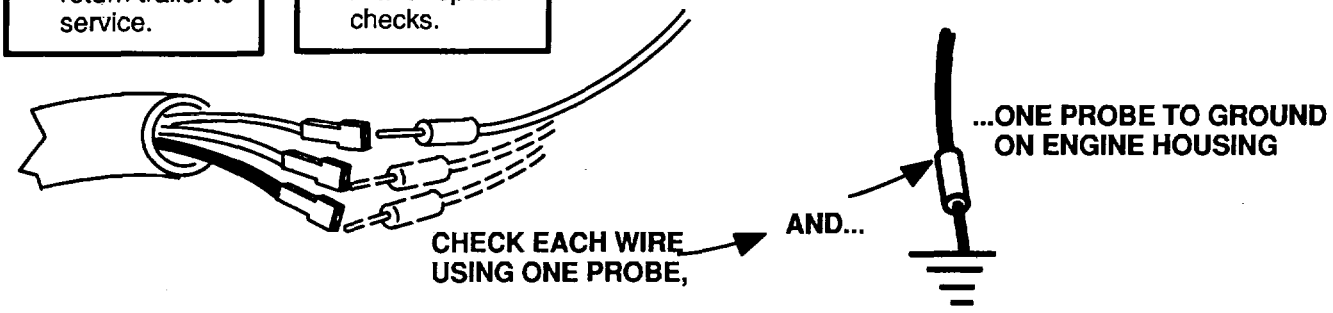
YES → **D** Problem solved; return trailer to service.

NO → **E** Return To Block A and repeat checks.





0 – 5 OHMS BETWEEN EACH OF THREE LEADS (CONTINUITY)



ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
27.	PANEL LIGHT AND HOUR METER DO NOT WORK; LOW OIL PRESSURE INDICATOR LIGHT STAY ON (Engine Starts Normally).

Initial Setup

Tools
General Mechanic's tool kit
STE/ICE

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Enough water in tank to perform test
- (approximately 300 - 500 gallons).

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE

Read paragraph 4–7 before doing any work.

A Check connections on hour meter for loss of ground.

- Check for broken wires, loose or missing hardware or corrosion.
- Clean off corrosion.
- If any terminal is disconnected, reconnect.
- Replace defective or missing parts.
- Start engine and check panel light, low oil pressure indicator light, and hour meter for proper operation.

Do hour meter and panel lights work properly?

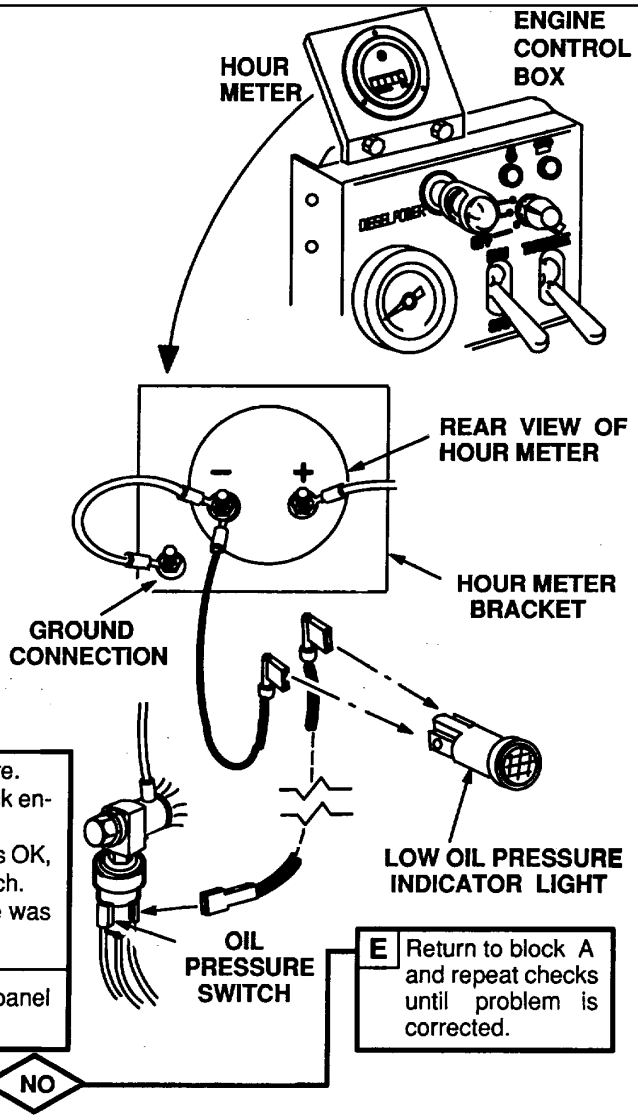
YES → **B** Problem solved; return trailer to service.

NO → **C** Check engine oil pressure.
Using STE /ICE, check engine oil pressure.
If engine oil pressure is OK, replace oil pressure switch.
If engine oil pressure was low, replace engine.

Do hour meter and panel light work properly?

YES → **D** Problem solved; return trailer to service.

NO → **E** Return to block A and repeat checks until problem is corrected.



Follow–On Maintenance: Connect negative battery cable to negative battery post.

ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
28.	PANEL LIGHT COMES ON AND HOUR METER DOES NOT WORK (Engine Starts Normally).

Initial Setup

Tools
General Mechanic's tool kit
♦

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- ♦ Tanker parked on level ground.
- ♦ Parking brakes set and wheels chocked.
- ♦ Enough water in tank to perform test (approximately 300 - 500 gallons).

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE
Read paragraph 4–7 before doing any work.

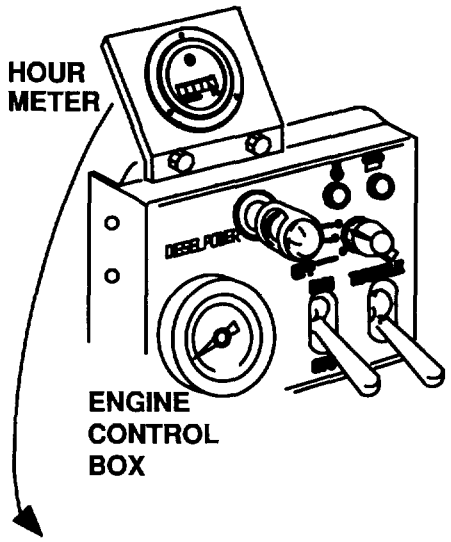
A Check hour meter for loss of ground.

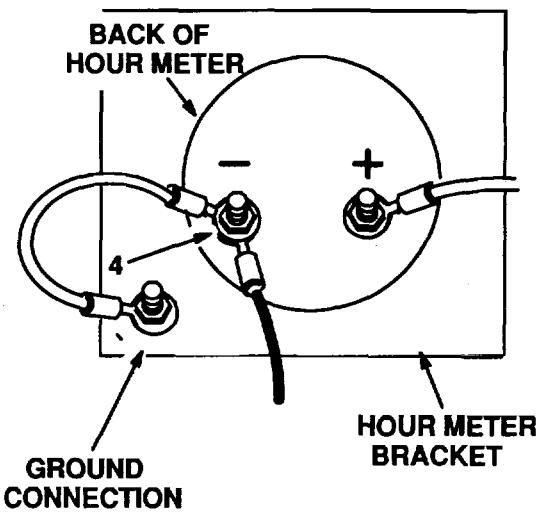
- ♦ Check for loose, damaged, or corroded hardware that could cause a loss of the ground connection.
- ♦ Replace damaged hardware.
- ♦ Clean off corrosion.
- ♦ Tighten loose hardware.

Does low oil pressure Indicator light work properly?

YES → **B** Problem solved; return trailer to service.

NO → **C** Return to block A and repeat checks until problem is corrected.





Follow–On MAINTENANCE: Connect negative battery cable to negative battery post.

ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
29.	PANEL LIGHT DOES NOT WORK (Hour Meter Works Normally).

Initial Setup

Tools
General Mechanic's tool kit
Multimeter

Personnel
Two (Mechanic and Helper)

Equipment Conditions

- Tanker parked on level ground.
- Parking brakes set and wheels chocked.

WARNING

Always disconnect negative battery cable at battery when performing any kind of electrical troubleshooting or maintenance.

NOTE
Read paragraph 4–7 before doing any work.

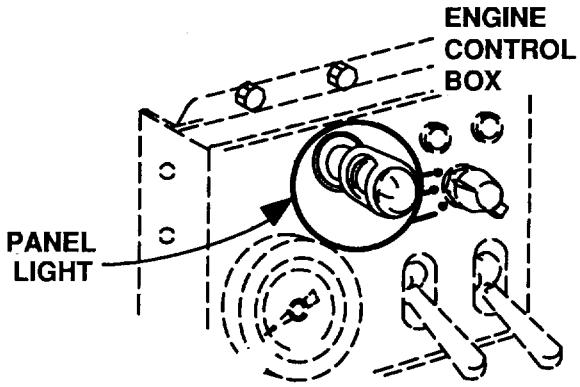
A Check for burned out light bulb or corroded socket.

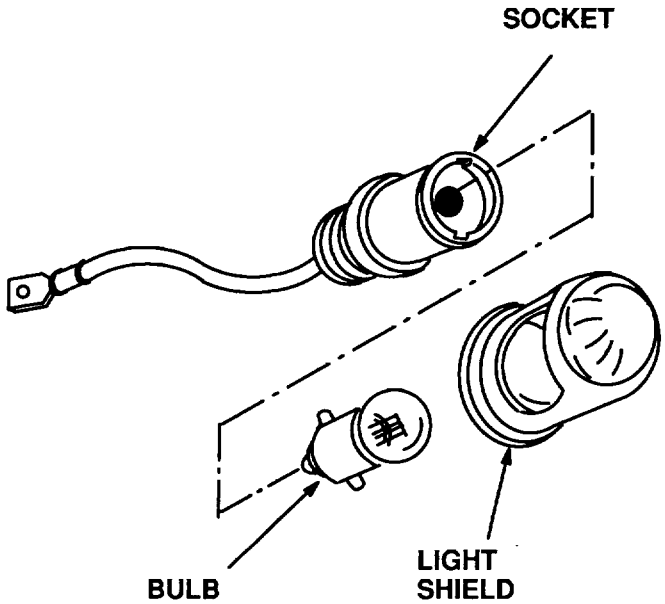
- Remove shield from panel light and remove bulb.
- If filament of bulb looks intact, use multimeter to check for continuity (0–to–5 ohms) in filament circuit.
- Check inside socket for damage or dirt/ corrosion that could cause a loss of contact between the bulb and the socket contacts.
- If bulb is burned out, replace bulb.
- If socket is dirty or corroded, clean socket.
- If socket is damaged, replace socket.

Does panel light work properly?

YES → **B** Problem solved; return trailer to service.

NO → Go To Block C





ENGINE ELECTRICAL SYSTEM (Continued)

Table 4-8. SECTION V Unit Troubleshooting (Continued)

ENGINE CONTROL PANEL (Continued)

No.	Malfunction
29.	PANEL LIGHT DOES NOT WORK (Hour Meter Works Normally).

From Block A

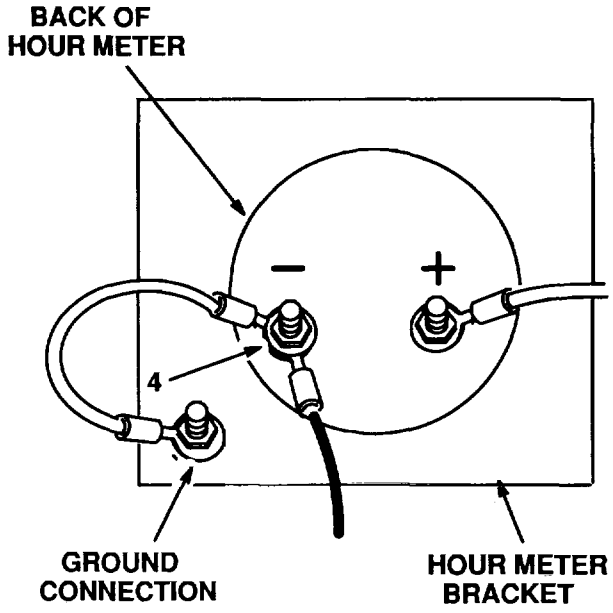
C Check hour meter for loss of ground.

- Check for loose, damaged, or corroded hardware or wiring that could cause a loss of the ground connection.
  - Replace damaged hardware.
  - Clean off corrosion.
  - Tighten loose hardware.

Does panel light work properly?

YES → **D** Problem solved; return trailer to service.

NO → **E** Return to block A and repeat checks until problem is corrected.



Follow–On Maintenance: Connect negative battery cable to negative battery post.

Section VI. PAINTING AND STENCILING

4-9. Painting and Stenciling

WARNING

DO NOT paint or apply any type of material to the Interior of the tank.

a. General instructions included in TB 43-0209 and TM43-0139.

b. Spot painting and marking (stenciling of tactical vehicles will be performed under the control of unit maintenance personnel.

c. Painting of a complete tactical vehicle can be authorized and performed only by direct support maintenance or by higher support elements.

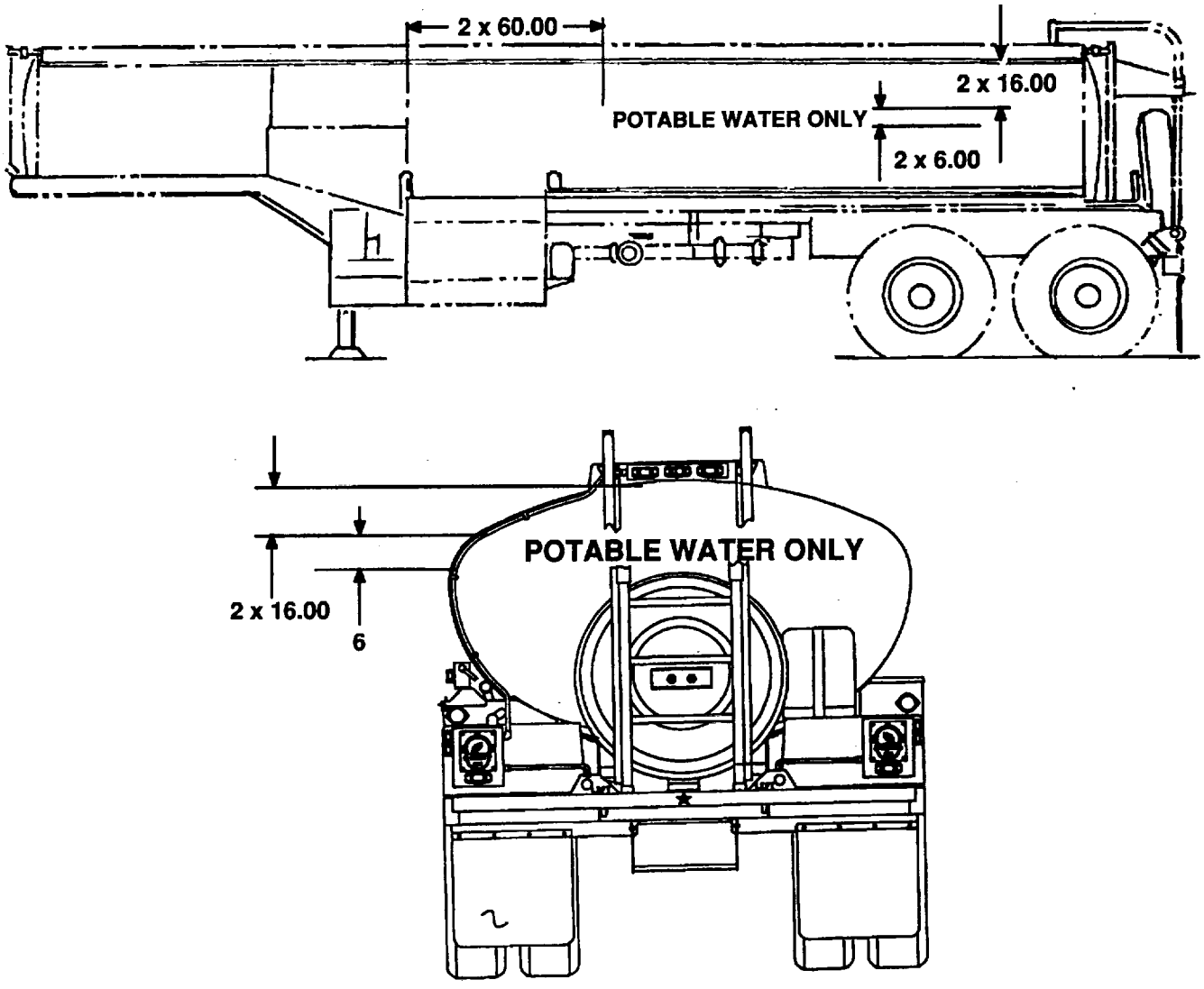


Figure 4-6. M1098 Stenciling, Roadside and Curbside

Section VII. MAINTENANCE OF CHASSIS ELECTRICAL SYSTEM

4-10. Chassis Wiring

WARNING

When troubleshooting an electrical malfunction or performing electrical maintenance, always disconnect Intervehicular electrical cable from semitrailer, and negative battery cables at batteries. Failure to follow this warning may allow a spark and subsequent explosion, resulting in serious injury or death to personnel.

a. *General.* The chassis wiring of the semitrailer: consists of one wiring harness, seven electrical lead assemblies, and one receptacle assembly. Refer to figure 4-13 and 4-14 for schematic diagram and wire connections of chassis electrical system. Wiring is as follows:

(1) Receptacle Assembly. The receptacle mounted on the left front side of the semitrailer, fig. 4-8. It connects the electrical system of the towing vehicle with that of the semitrailer. The main wiring harness of the semitrailer connects to the receptacle.

(2) Wiring Harness. This harness runs the tire length of the semitrailer through conduit, the rear composite light box, to the right rear composite. light box, fig. 4-8. It connects to various leads which in turn connect to the lights on the semitrailer.

(3) Rear Triple Marker Light Lead Assembly. This lead is threaded from the triple marker box through conduit to the left composite light box, fig. 4-8. There it connects to one of six leads of the connector lead assembly.

(4) Right Front Marker Light Lead. This lead is threaded from the right front marker box through conduit to the left side of the semitrailer, fig. 4-8. There it connects into the receptacle wiring, the wiring harness and lead from the left front marker light.

(5) Left Front Marker Light Lead Assembly. This lead connects to the left front marker light and to the right front marker light lead, fig. 4-8.

(6) Right Side Marker Light Lead Assembly. This lead is threaded from the right center marker light box through conduit to the left center marker light box. There it connects to the wiring harness and to the left center marker light, fig. 4-8.

(7) Right Rear Composite Light Lead Assembly. This lead is located in the right rear composite light box. It connects to the two marker lights and to the composite light, fig. 4-8.

(8) Left Rear Composite Lift Lead Assembly. This lead (fig. 416) is located in the left rear composite light box. It connects to the wiring harness in two places and to the left composite light, fig. 4-8.

(9) Connector Lead Assembly. This lead is located in the left rear composite light box, fig. 4-8. It is made up of six different leads, of which two connect to left rear marker lights, two to the wiring harness, one to triple marker light lead, and one to left composite light.

b. Repair. Most of the wiring can be repaired without removing the harness and leads from the semitrailer.

(1) Clean end of harness leads with a damp cloth.

(2) Check ends of wire harness for frayed insulation and broken wires. Tape or replace frayed wires.

(3) Inspect wires for bent, broken, or missing terminals. Replace missing or damaged terminals.

c. Replacement of Chassis Wiring.

(1) Composite Light and Connector Lead Assemblies Replacement.

(a) Remove six screws that secure composite light box cover to the light box, fig. 4-15. Remove cover and gasket.

(b) Start removing the old lead terminals one connection at a time. As each lead terminal is removed, connect the correct lead terminal of the replacement lead before removing the next one. Continue this process until the old lead is removed and the new one is completely connected into the circuit.

(c) Replace composite light cover and gasket. Secure with six screws.

(d) Test operation of lights.

(2) *Triple Marker Light Lead Assembly Replacement.*

(a) Remove six screws that secure composite light box cover to the light box, fig. 4-15. Remove cover and gasket.

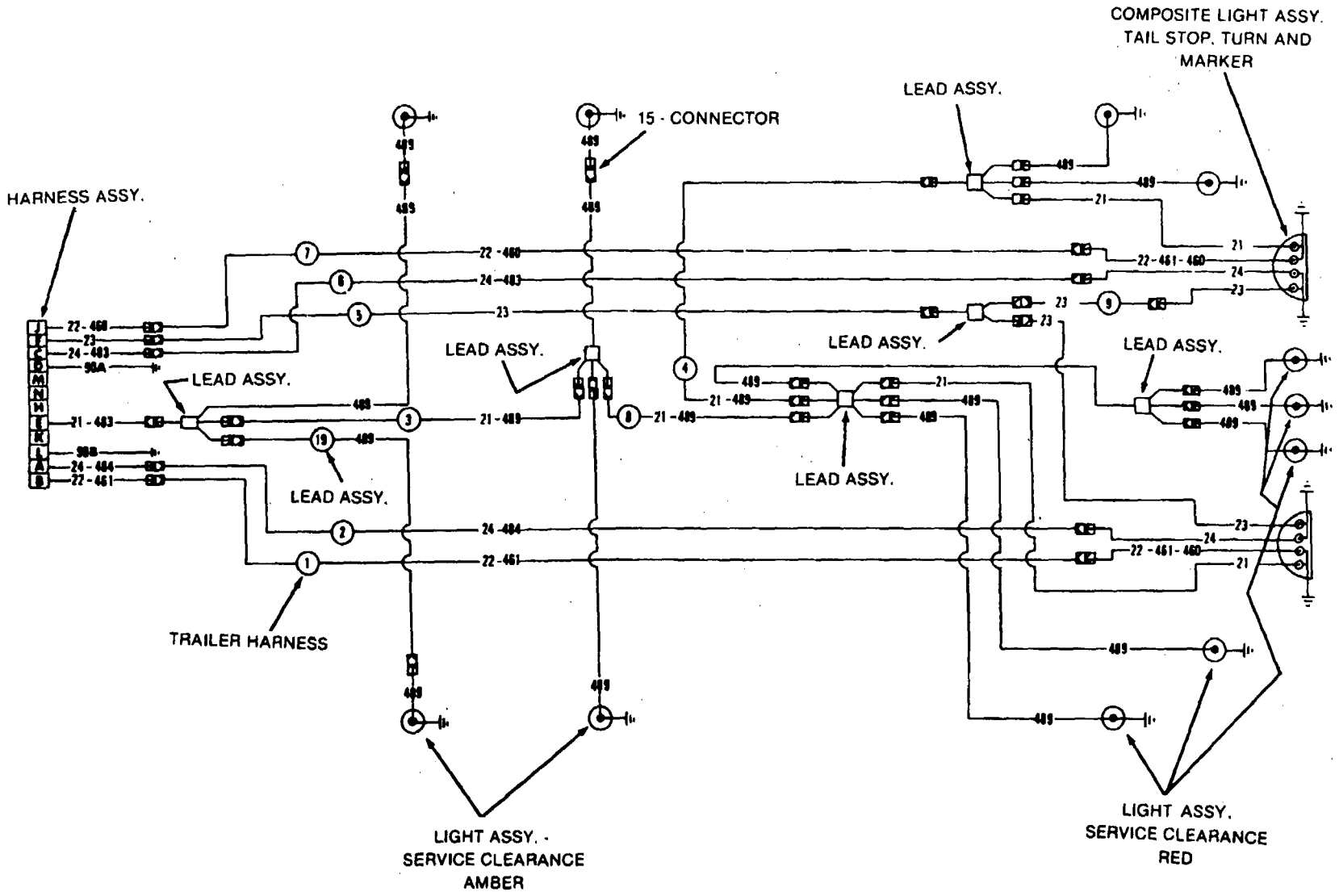


Figure 4-7. Chassis Wiring Diagram

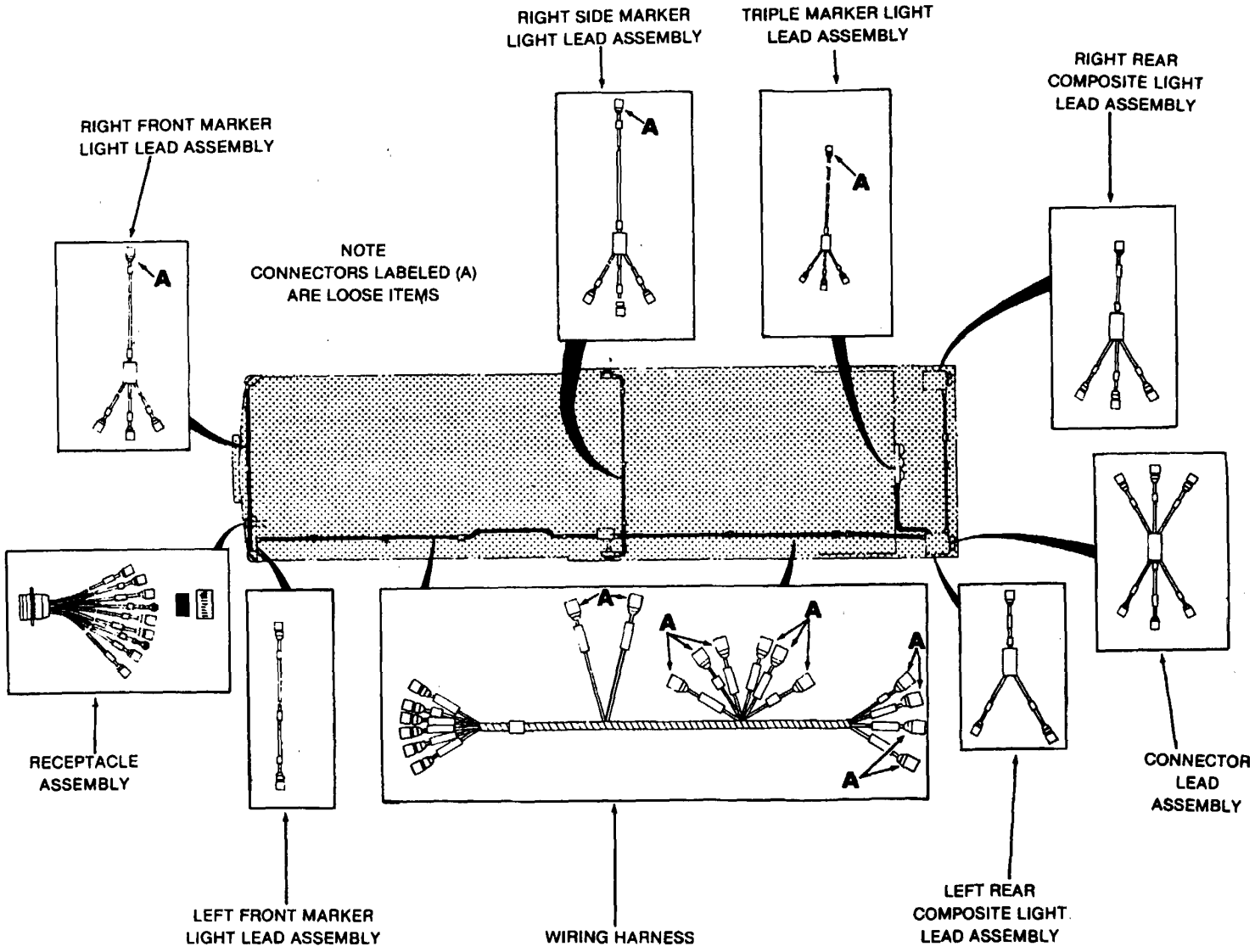


Figure 4-8. Wiring Harness and Electrical Lead Installation

(b) In the composite light box, locate the lead that comes from the triple marker box, fig.412. Disconnect this wire from the connector lead assembly. Cut th terminal from the lead.

(c) Remove the three marker lights from the triple marker box, but do not remove the washer and shell from the light leads, para 4-12.

(d) Pull old wire lead through conduit and out through one of the openings in the triple marker box.

(e) Starting at left composite light box, thread a lacing wire through conduit into triple light box. Attach lacing wire to lead and pull lead through conduit into composite light box.

(f) Install new terminal onto lead. Connect the marker light lead assembly to connector lead assembly, fig. 4-8.

(g) Replace composite light box covers and gasket. Secure with six screws.

(h) Connect the marker light leads to the triple marker light lead assembly.

(i) Replace triple marker lights, para 4-12.

(j) Test operation of Lights.

(3) Right Side Marker Light Lead Assembly Replacement.

(a) Remove four screws that secure right marker light box cover to the light box, fig. 4-14.

(b) Disconnect the marker light lead from the right center marker light lead assembly, then remove the cover and gasket.

(c) Cut the terminal from the marker light lead assembly.

*(d) R*emove the four screws that secure left side marker light box cover to the light box. Remove cover and gasket.

(e) Disconnect the marker light lead and remove gasket and cover.

(f) Disconnect the marker light lead assembly from the two wire harness leads.

(g) Pull the old marker light lead assembly through the conduit and out the left marker light box.

(h) Thread a lacing wire through conduit from the light box to the other. Attach lead assembly to lacing wire and pull the lead into the right marker box.

*(i) I*nstall new terminal onto the lead assembly.

(j) Connect right center marker light lead to the lead assembly. Replace gasket and cover. Secure with four screws.

(k) In the left marker box, connect the two harness leads (No. 21489) to the new lead assembly. Connect the left marker light lead (No. 489) to the lead assembly. Replace gasket and cover. Secure with four screws.

(I) Test operation of lights.

(4) *Front Marker Light Lead Assemblies Replacement.*

(a) Remove both front marker light box covers and gaskets by removing eight screws from each box cover and disconnecting the marker light electrical lead (No. 489), fig. 4-13.

(b) Remove six screws from the front electrical access cover, remove cover and gasket.

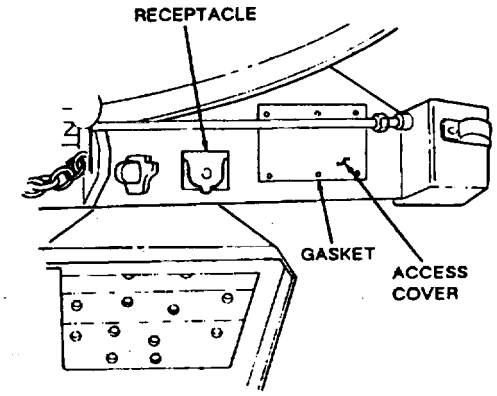


Figure 4-9. Front Access Cover

(c) From inside electrical access hole, disconnect the left marker light lead assembly from the right marker light lead assembly. Disconnect right marker light lead assembly from receptacle wire lead (No. 21-489) and wire harness lead (No. 21 - 489).

(d) Cut the terminal from the right marker light lead assembly in the right marker box.

(e) From inside the left marker light box, pull the old right marker light lead assembly from the conduit.

(f) Starting at the right marker light box, thread a lacing wire through the conduit. Attach the lead assembly to the lacing wire, and pull the lead into right marker box.

(g) Install new terminal onto the lead assembly.

(h) Place the three ends of the lead assembly the left marker box into the access hole.

(i) Connect the right marker light lead to the lead assembly. Replace the gasket and cover, fig. 4-1. Secure with eight screws.

(j) Through the front access hole, connect the left marker light lead assembly (No. 489) to the right marker light lead assembly. Connect the other two leads to the receptacle lead (No. 21 - 489) and the wire harness lead (NO. 21 - 489).

(k) Replace the gasket and the front access cover by securing with six screws, fig. 4-9.

(I) Connect the left marker light lead 489) to the lead assembly. Replace the receptacle box cover and gasket by securing with eight screws.

(m) Test operation of lights.

(5) Wiring Harness Replacement.

NOTE

The terminals must be removed to pull harness through the conduit.

(a) One at a time, remove each marker light be cover and gasket on the semitrailer's left side, then composite light box cover and gaskets. Disconnect all wiring harness leads and cut the terminals from the wiring harness leads.

(b) Pull the portion of wiring harness that run across rear of the semitrailer out through the left rear composite light box.

(c) Remove the front access cover and disconnect all wire harness leads from the receptacle and marker light leads, fig. 4-9.

(d) Pull the wiring harness out through the front access hole.

NOTE

As harness is being pulled Into conduit, coat harness with a silicon lubricant or mild soap solution. Do not coat entire harness at one time.

(e) Starting at left rear composite light box, thread a lacing wire through conduit and out the front access hole. Attach lacing wire to new harness, then pull harness through conduit and out the composite light box.

(f) Disconnect lacing wire and thread it through right composite light box, conduit, and out left composite light box. Attach lacing wire to wire harness and pull wiring harness out right composite light box.

(g) In each light box, pull wiring harness leads out of conduit and into light box. Install new terminals onto each wiring harness lead.

(h) Connect all light leads to wiring harness leads fig. 4-7.

(i) Replace all light box covers and gaskets.

(j) In the front access hole, connect harness leads to receptacle and marker light leads.

(k) Replace front access hole cover and gasket. Secure with six screws.

(l) Test operation of semitrailer lights.

(6) Receptacle Assembly Replacement.

(a) Remove six screws from front access cover, fig. 49. Remove cover and gasket.

(b) Inside access hole, disconnect all electrical leads from the receptacle electrical leads. Remove screw that fastens the receptacle ground leads to the semitrailer.

(c) Remove four screws and lockwashers from the receptacle mounting plate and remove the receptacle and gasket, fig. 410.

(d) To install receptacle, reverse steps (a) through (c).

(e) Test operation of semitrailer lights.

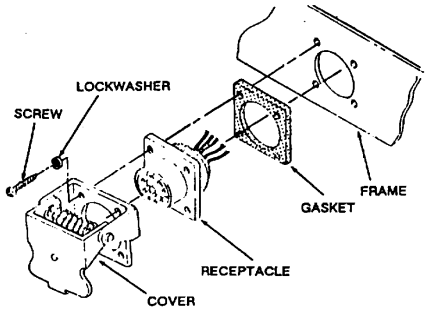


Figure 4-10. Receptacle Installation

4-11. Conduit for Chassis wiring

a. Removal. A wiring conduit should only be removed when repairs are warranted. Remove wiring harness and electrical leads as needed, para 4-10. Use a reference when removing conduit, fig. 4-11. Where conduit passes under clips, bend these clips back far enough to remove conduit, but do not break clips off Should enough of these clips break off to hamper installation of conduit, contact direct support maintenance to weld on new clips.

b. .Installation. Install new conduit.

4-12. Marker Lights

a. Replacement of Lamps. The front, center, and rear marker lights are constructed the same, except that the front and side marker lights have an amber lens while the rear marker lights have a red lens.

(1) Remove two screws that hold lens housing to body. Remove lens housing, fig. 4-16.

(2) Press down on lamp and turn counterclockwise to remove lamp.

(3) Install new lamp.

(4) Replace lens housing. Secure with two screws.

b. Removal.

(1) Remove two screws that secure lens housing to body. Remove lens housing, fig. 4-16.

(2) Remove four screws that fasten marker light body to plate. Be careful not to lose the four spacer washers between gasket and body.

(3) Disconnect marker light lead and remove marker light.

(4) Remove washer and shell from marker light lead.

c. Installation.

(1) Replace washer and shell on marker light lead.

(2) Connect marker light lead to chassis wiring.

(3) Attach marker light body to trailer with four screws. Be sure spacer washers are installed between gasket and body.

(4) Install lamp if needed, and replace lens housing by securing with two screws.

4-13. Composite Tall Stop Lights

a. Lamp or Lens Replacement.

(1) Loosen six captive screws which fasten door and lens to body, fig. 4-17.

(2) Remove door and lens and preformed packing.

(3) Remove defective lamp and install a new lamp.

(4) Inspect preformed packing and replace if damaged.

(5) Inspect door and lens assembly. If damaged, replace. Secure door and lens assembly to body assembly with six screws.

b. Removal

(1) Loosen six self-tapping screws that fasten cover plate to semitrailer. Remove cover plate and gasket, fig. 4-15.

(2) Disconnect light wires from harness.

(3) Remove the two capscrews and lockwashers that attach composite light to plate, fig. 4-17.

(4) Remove composite light and gasket.

c. Installation

(1) Fasten composite light and gasket to cover plate with two lockwashers and capscrews, fig. 4-17.

(2) Connect light wires to the harness.

(3 Install cover plate and secure with six self tapping screws.

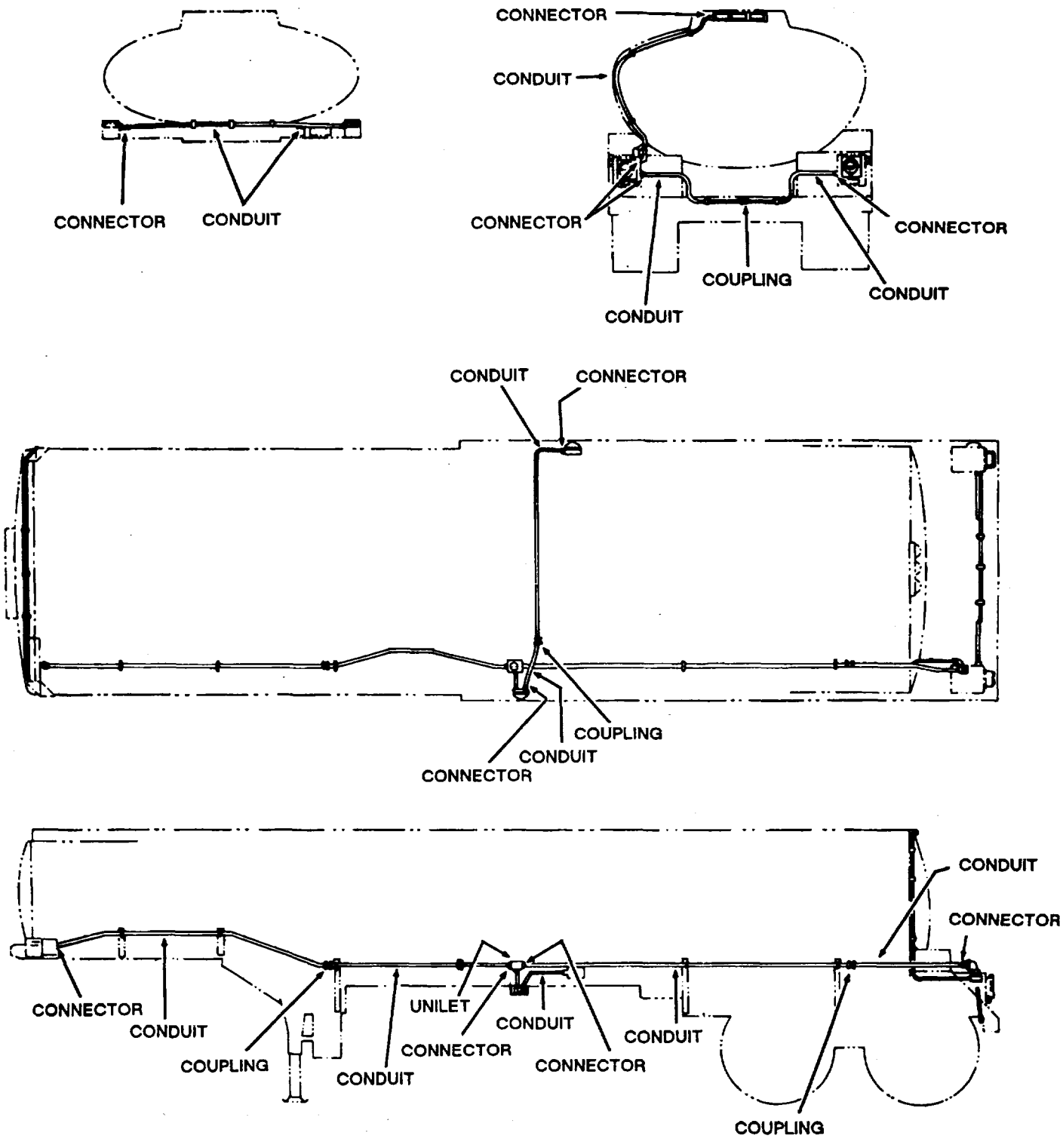


Figure 4-11. Chassis Wiring Conduit Installation

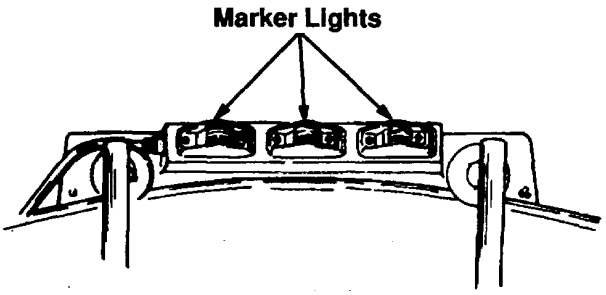


Figure 4-12. Triple Marker Box

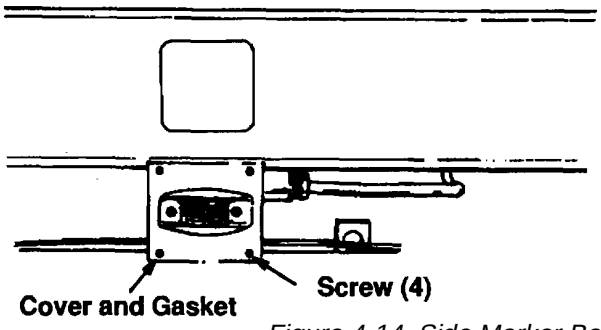


Figure 4-14. Side Marker Box

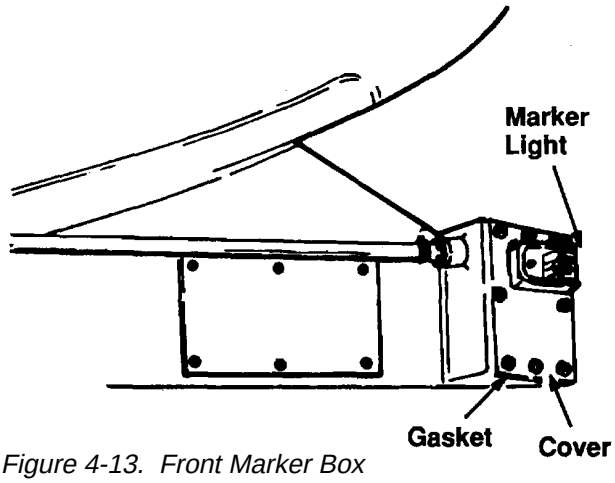


Figure 4-13. Front Marker Box

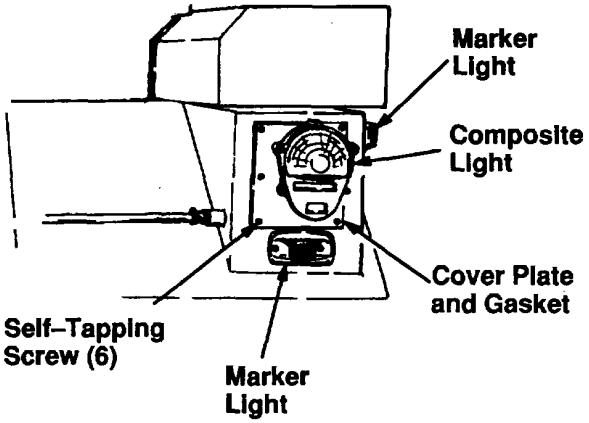


Figure 4-15. Composite Light

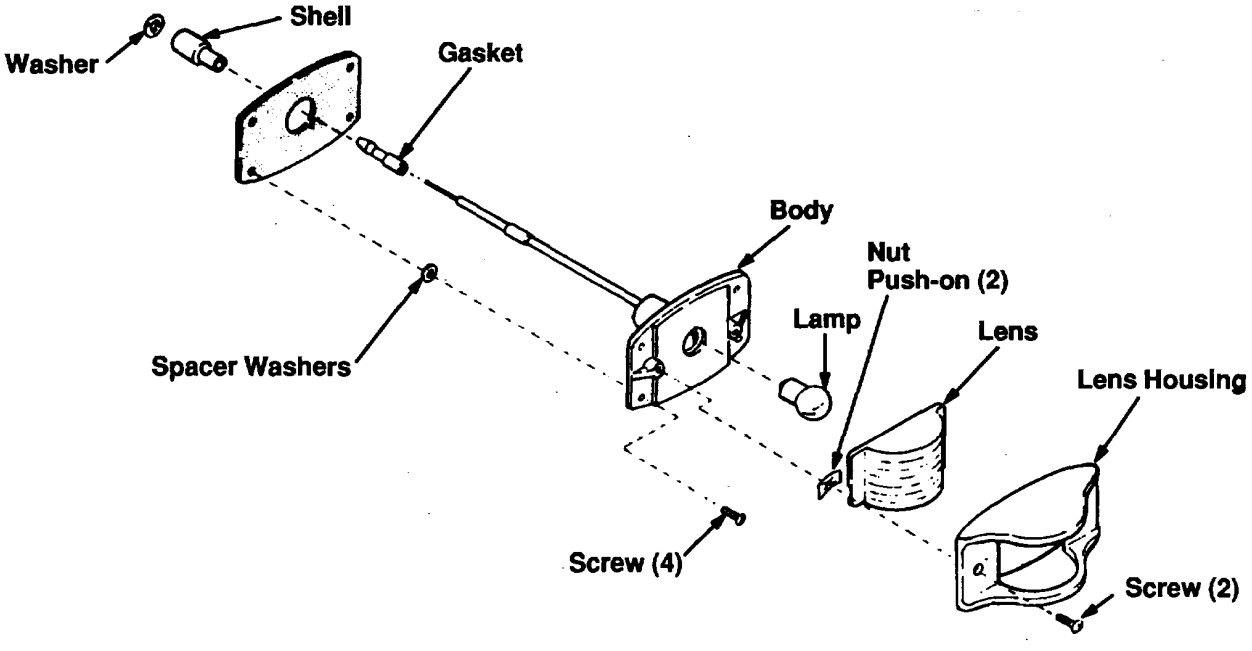


Figure 4-16. Exploded View of Marker Light

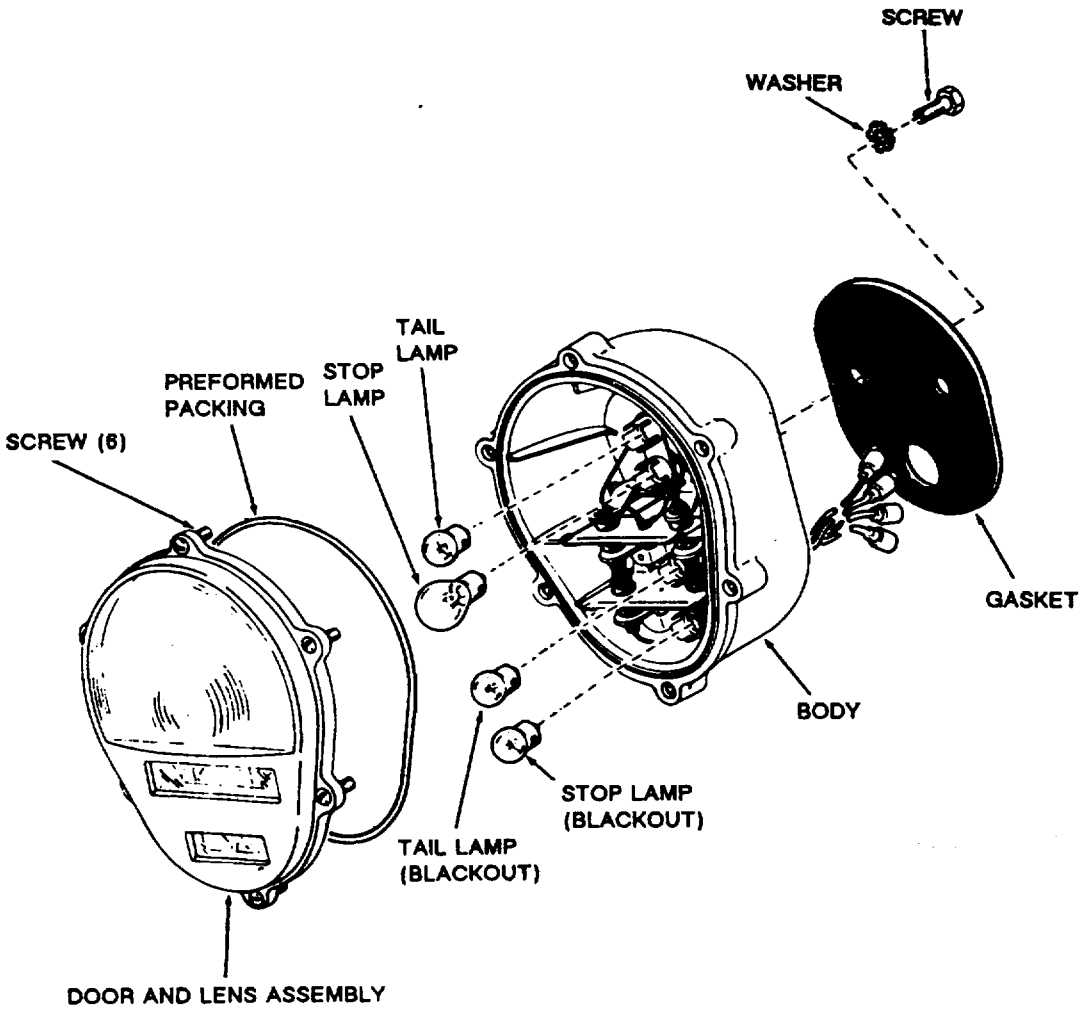


Figure 4-17. Exploded View of Composite Light

Section VIII. MAINTENANCE OF ENGINE ELECTRICAL WIRING

4-14. Engine Wiring

a. General. The engine wiring provides an electrical path to: provide battery output to crank the engine excite the generator charging circuit; monitor through tell tale lights engine oil pressure and charging circuit problems; provide panel lights.

b. Replacement. Refer to figures as a guide in removing any engine wiring. Repair or remove and replace any wire that is cut, frayed or or has broken terminals.

Section IX. MAINTENANCE OF ENGINE CONTROL PANEL

4-15. Switches, Gages, and Indicator Light

a. Testing Instruments, Switches, and Indicator Light. When an instrument shows an abnormal indication, the trouble should be checked immediately and either corrected or referred to proper authority to make the necessary correction.

(1) Make a continuity test of wiring and switches using a multimeter.

(2) Visually check instruments for broke glass, damaged terminals, corrosion, and damage t cases and capillary tubes. Check wiring for broken o damaged insulation and for broken wires. Check fur and oil gages for looseness and damage.

(3) Check conduit at back of panel for kinks o breaks. Check conduit fittings for tightness. Make sure decals are in place, clean and readable. Check that all switches are tight and no fasteners are missing or loose.

4-16. On-Off and Throttle Lever Cable Removal and Installation

a. Removal

1. Disconnect cable at switch on side of engine.

2. Remove screw at lever and remove tanged bezel.

3. Pull lever from shaft and remove flat washer on other side of lever.

4. Pull cable guide from shaft.

5. Pull inner cable from cable sheath, cable guide and lever.

b. Installation

1. Separate cable from sheath and install through lever, cable guide and sheath.

2. Position cable guide to align with cable shaft.

3. Install flat washer on lever and install both on shaft. If plastic bushing comes out of lever pivot, re-position it.

4. Position screw on tanged bezel and position on lever so tang on bezel enters slot on cable guide. Secure with screw.

5. Connect cable at switch on side of engine.

6. Adjust cable as described in para 4-25.

4-17. Hour Meter

a. Removal

1. Disconnect two connector wires at hour meter.

2. Remove two bolts and washers securing hour meter bracket to panel.

3. Remove three machine screws and nuts securing bracket to hour meter. One of these nuts also retains the oil pressure tell-tale light and hour meter ground wire.

b. Installation

1. Install hour meter in bracket and secure with three nuts on the hour meter studs. One of the nuts has a ground wire beneath it.

2. Install two bolts and washers securing hour meter bracket to panel.

3. Attach two connector wires at hour meter.

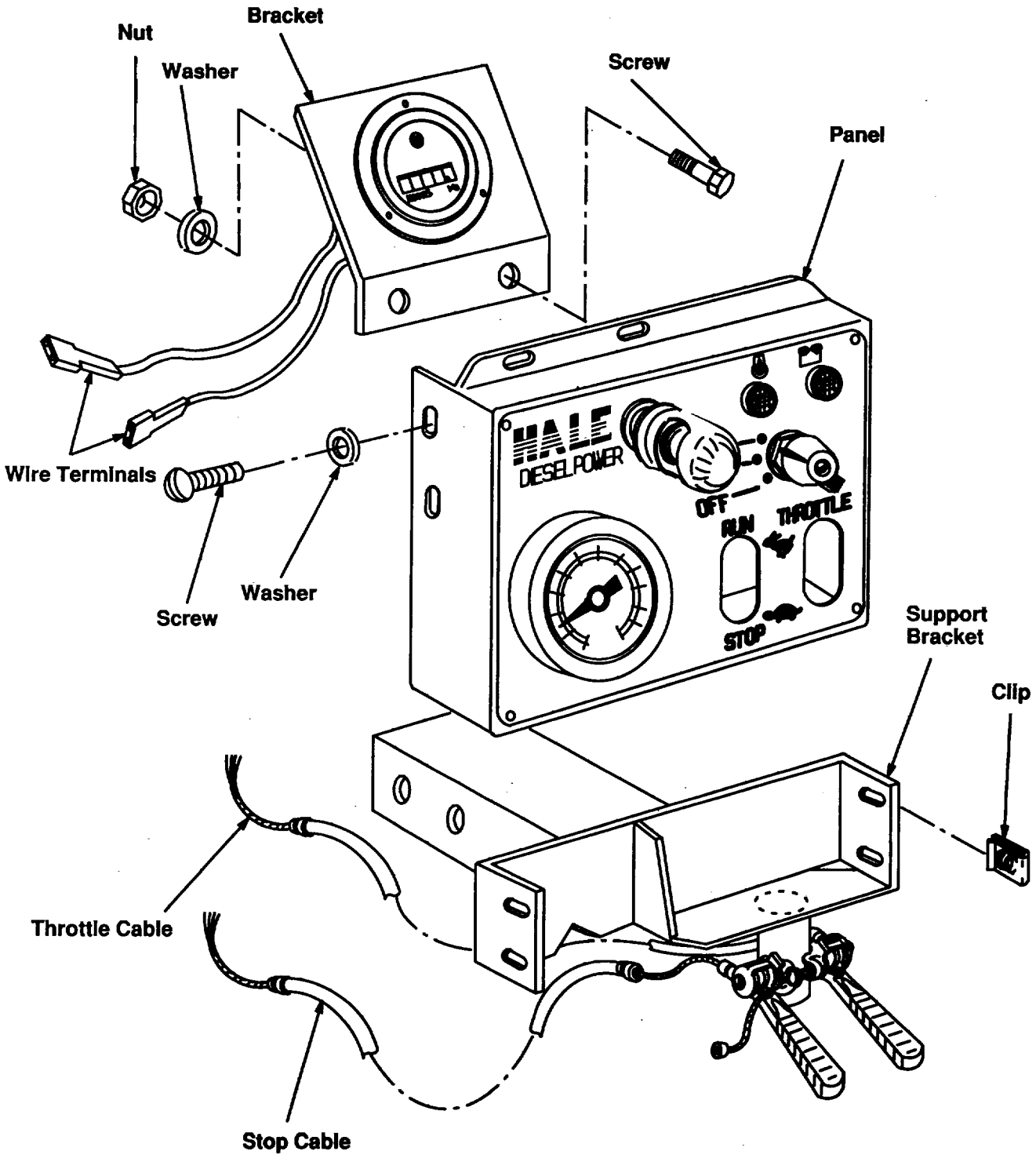


Figure 4-18. Hour Meter, panel and Engine Control Cables.

4-18. Indicator Lamp Replacement

1. Remove two lamp wires at back of lamp. Press in plastic tabs on side of socket to remove lamp.

2. Push new lamp in from front of panel. Connect two lamp wires.

4-19. Panel Lamp Bulb and Lamp Replacement

a. Bulb Replacement
1. Pull shield from lamp and replace bulb.

b. Lamp Replacement
1. Disconnect wire from panel lamp.

2. Remove nut and washer securing lamp to panel and remove lamp.

3. Install lamp into front of panel and secure with washer and nut.

4-20. Panel Ignition Switch Removal and Installation.

a. Removal
1. Remove four screws, flat washers and lock washer, and sheet metal nuts that secure panel cover to base.

2. Remove three wires from panel ignition switch, marking position of wires.

3. Remove screw and lock washer that hold switch selector to shaft and remove selector lever.

4. Remove nut and retaining washer securing switch to panel and remove switch from back of panel.

b. Installation
1. Install switch base from back of panel and secure with nut and retaining washer.

2. Install selector lever on shaft and retain with lock washer and screw.

3. Install three ignition wires to switch.

4. Install four screws, flat washers, lock washers and sheet metal nuts that secure panel cover to base.

4-21. Water Pressure Gage

a. Removal

1. Disconnect water pressure hose from back of gage and plug hose.

2. Remove two plastic nuts and washers that secure water pressure gage to panel. Pull gage forward to remove.

b. Installation

1. Insert water pressure gage from front of panel and secure gage studs with two plastic washers and nuts.

2. Free hose of plug and install at back of water pressure gage.

4-22. Oil Pressure Switch

a. Removal.

1. Remove three screws and wires at bottom of switch.

2. Remove switch.

b. Installation

1. Install replacement switch so that the number of turns for installation is counted. Remove switch.

2. Feed shrink tape on all three wires. Position shrink tape up wires temporarily.

3. Install wires at switch with screw at each correct location, Fig. 4-19.

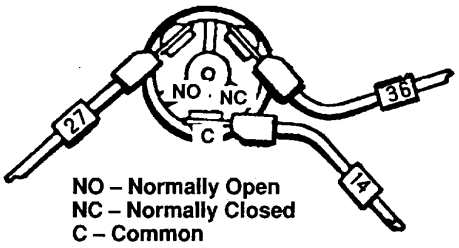


Figure 4-20. Oil Pressure Switch Connections.

4. Rotate switch in same direction as you removed it in step 1 with the same number of turns. Insert the switch into the housing and installed it. Blly doing operation in this manner, wires should not be twisted upon installation.

5. Use heat gun to heat shrink tape on wires.

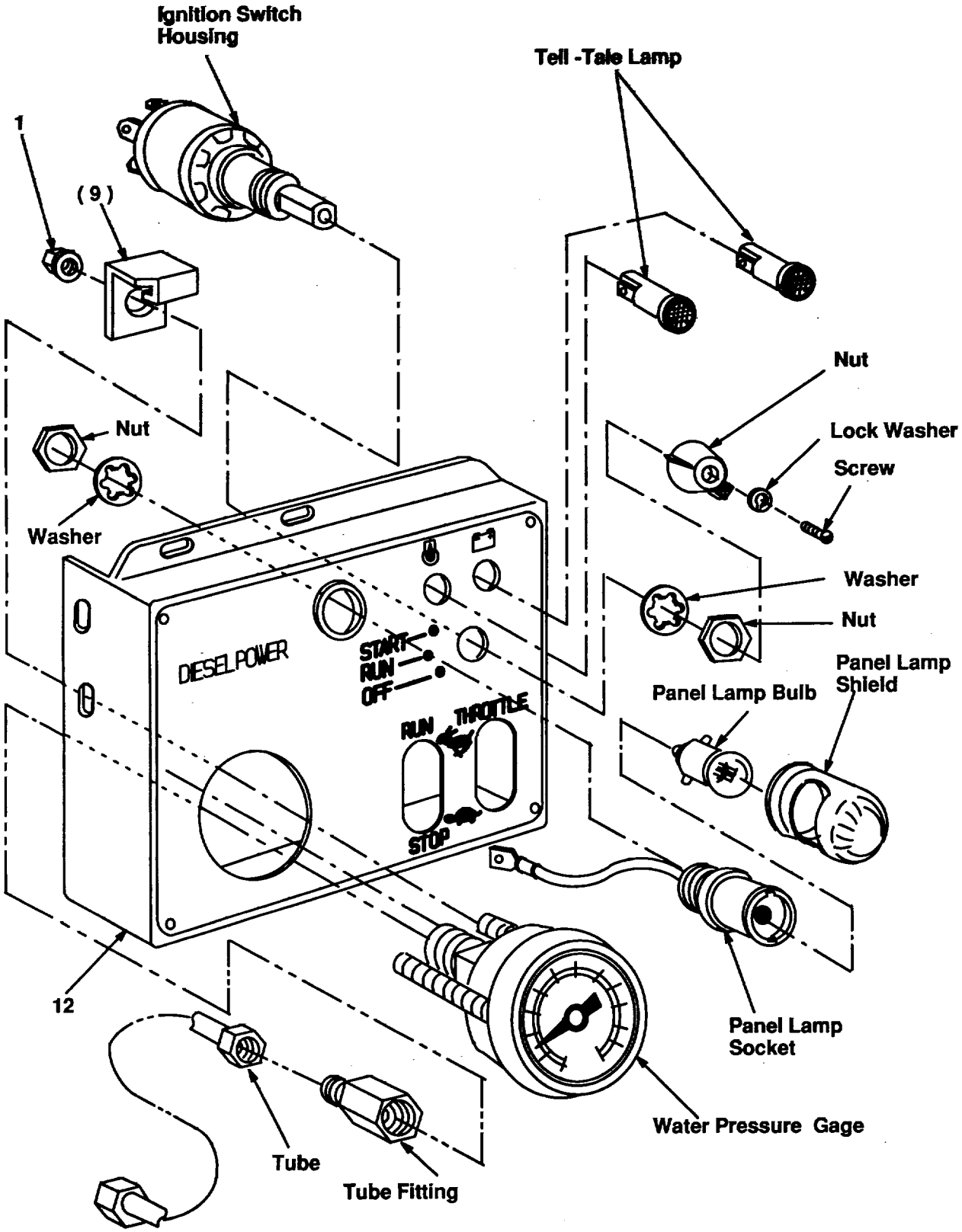


Figure 4-21. Control Panel disassembled.

SECTION X. MAINTENANCE OF CHARGING CIRCUIT

4-23. Water Dispensing Unit Engine Electrical Components

The following are the principle components of the engine electrical system:

Starting Motor: A 12-volt 1.1 KW starting motor is mounted to the engine block.

Alternator: A 12-volt 220W alternator is rated at 16.4 amps at 3000 rpm. It utilizes a magnetized rotor and fixed stator located beneath the engine flywheel.

Voltage Regulator: Electronic, controlled diode type, with charge warning light connection.

Battery: a 12-volt battery rated at 60/80 ampere-hours is used.

4-24. Voltage Regulator Removal and Installation

a. Voltage Regulator Removal

1. Disconnect all wires at voltage regulator.

2. Remove two Allen screws and voltage regulator.

b. Voltage Regulator Installation

2. Connect all wires at voltage regulator except red stator-to-regulator wire at upper part of regulator.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

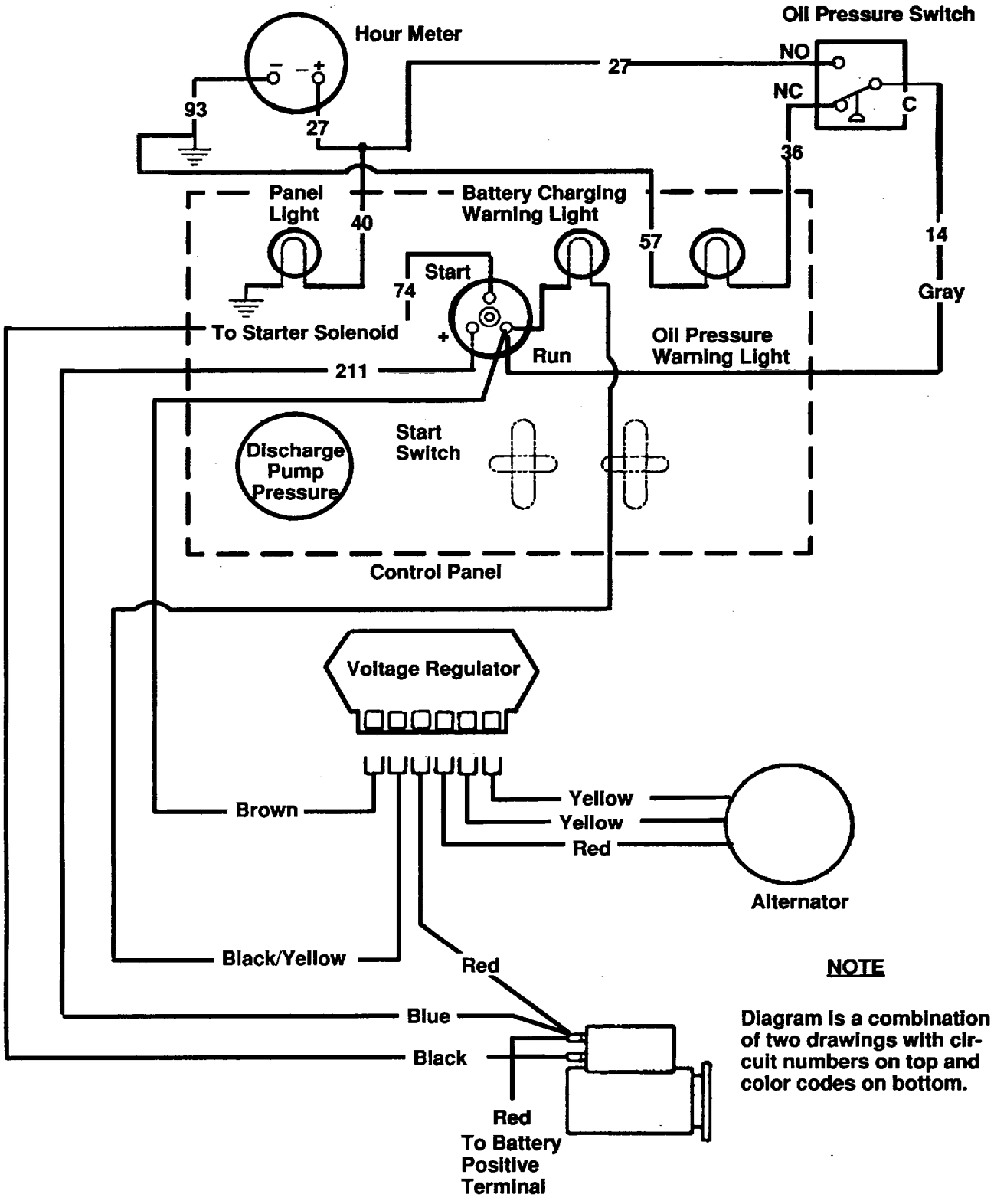


Figure 4-22. Water Dispensing Unit Charging Circuit Diagram

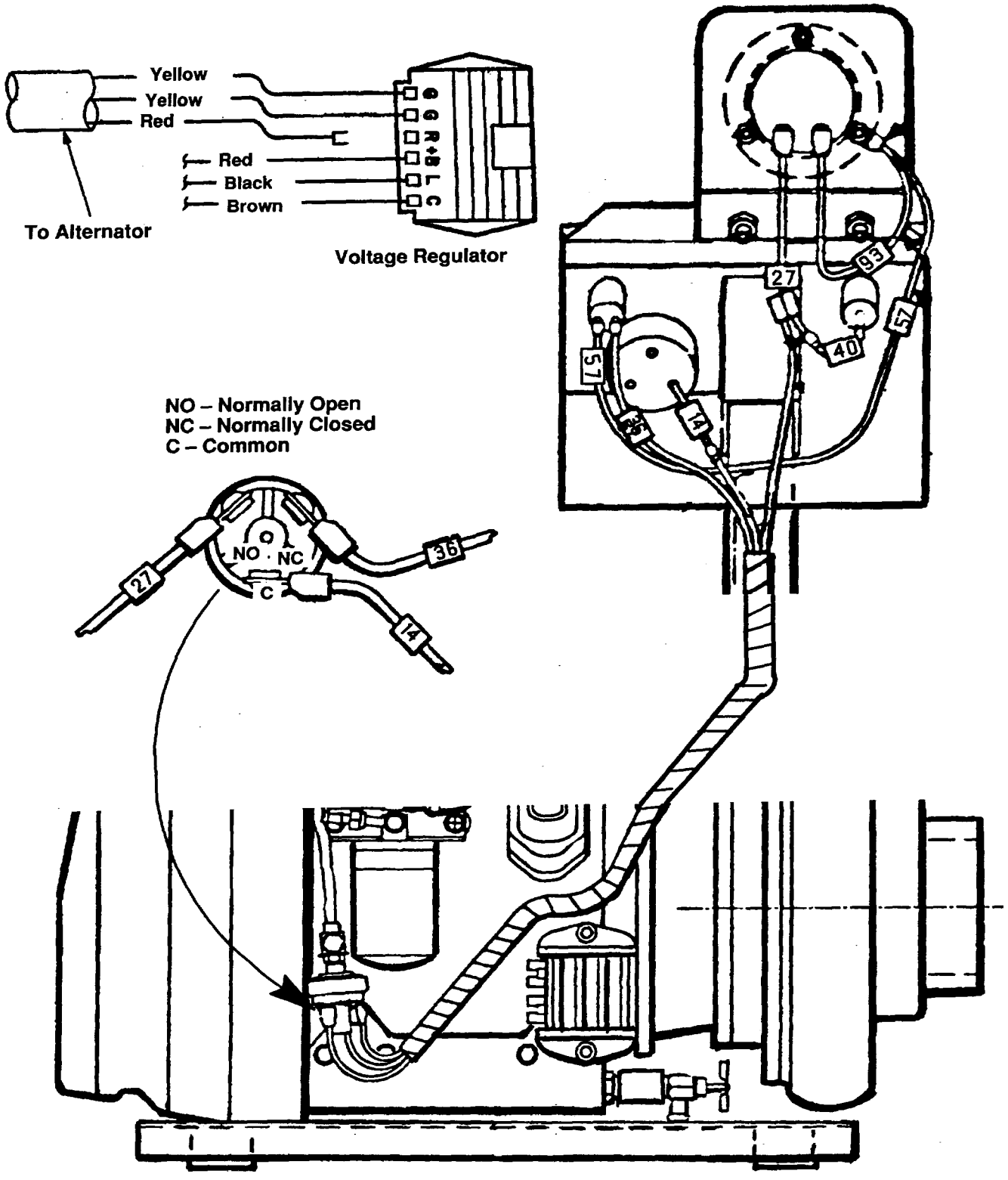


Figure 4-23. Charging Circuit Component Location.

Section XI. MAINTENANCE OF ENGINE AND PUMP

4-25. Water Dispensing Unit Engine Throttle Adjustments

a. *Throttle Inspection* If the pump is not providing high enough pressure, the throttle cable may need adjustment. When throttle is properly adjusted, control panel lever should have a springy feel when pushed a the way to the fast position. The throttle linkage should hit the stop inside the engine before the lever contacts the stop on the lever assembly (inner cable tightly stretched). If this is not so, engine may not be at fu throttle even though lever is pushed all the way forward.

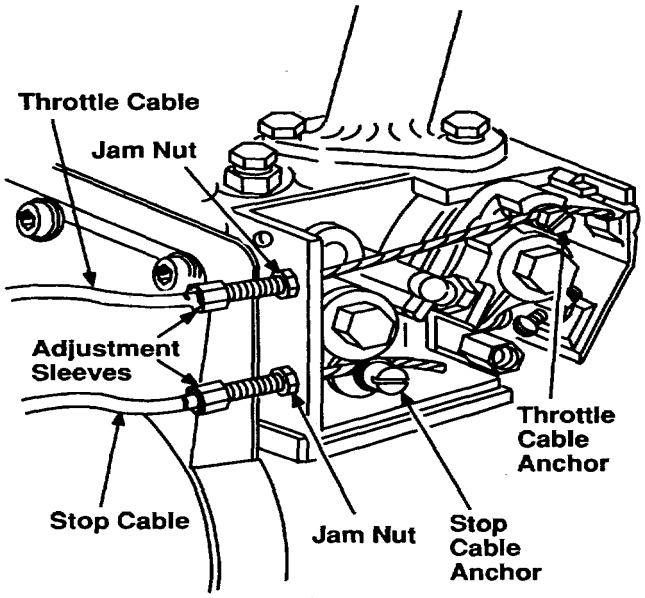


Figure 4-24. Throttle and Stop Lever Adjustments

b. *Throttle Adjustment* There are two threaded adjustment sleeves where the throttle and stop cables go into the engine; the upper one is for the throttle. Loose the jam nut on the sleeve that is up against the engine housing. Then turn the adjustment sleeve counter clockwise a couple of turns. Holding the sleeve, retighten the jam nut. This should make the inner cable tight when the panel lever is turned fully counter clock-wise to tighten inner cable and clockwise to loosen it.

c. *Stop Adjustment* The stop cable (lower cable) can be adjusted in a similar manner to the throttle cable.

NOTE

Air leaks on the suction side of the pump will cause high engine speed in relation to pump pressure. They will also cause a ragged stream and an Irregular pulsation of the suction and discharge hose.

4-26. Water Dispensing Unit Removal and Installation from Tanker

WARNING

Wash oil or fuel from skin as soon as possible after contact. Remove or disconnect battery before working on engine or pump set. Never disconnect any wire unless the engine is stopped and all switches are in the "OFF" position

a. Removal

1. Open pump cabinet door.

2. Remove six screws attaching rear panel to cabinet.

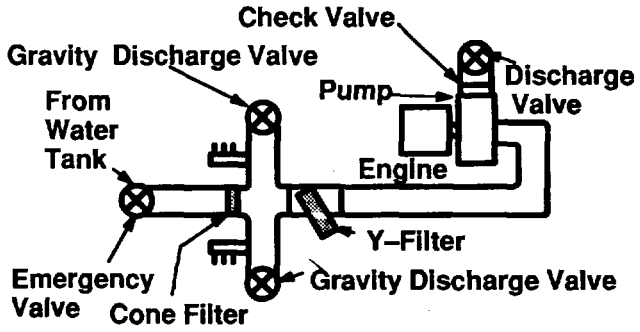


Figure 4-25. M1098 Water Dispensing Schematic

3. Close emergency valve and open discharge valve to drain water from pump and water pipes.

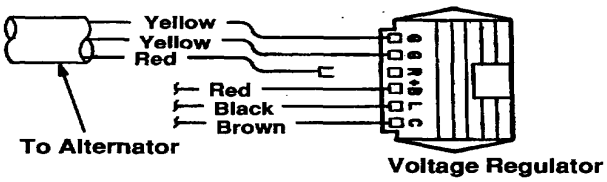


Figure 4-26. Voltage Regulator Harness

4. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

5. Disconnect first negative, then positive battery cab from battery.

6. Remove battery hold-down brace by removing nut and washer from each of two studs.

7. Remove battery.

8. Tag and disconnect one fuel line and two return lines from engine. Plug tank and lines. Mark hoses for identification and pull out of way.

9. Drain oil from engine.

10. Disconnect skid from mounting plate by removing: four nuts and washers from bolts attaching engine/pump assembly to engine compartment floor.

11. Remove two bolts and coupler that holds pump outlet and discharge valve. Separate from pump.

12. Disconnect and remove coupler between "U"-tube water outlet and pump inlet adaptor.

13. Slide water dispensing unit engine and pump assembly out front door of cabinet by pivoting around water outlet and lifting unit out.

b. Installation

CAUTION

Observe correct polarity when connecting the battery cables: positive cable to positive post and negative to negative. If cables are reversed, even momentarily, the voltage regulator and alternator will be damaged immediately and must be replaced.

A loose or intermittent ground connection between battery negative terminal and voltage regulator frame will cause a varying charge current and damage to the voltage regulator may occur.

1. Lift water dispensing unit engine and pump into front door. Slide and pivot assembly to line up with water inlet.

2. Install two bolts to connect coupler between "U"-tube water outlet and pump inlet adaptor.

3. Connect discharge valve to pump outlet by securing coupler with two bolts.

4. Connect skid to mounting plate with four bolts and washers.

5. Install one fuel supply line and two return feed lines at tank.

6. Install battery, carefully observing that negative terminal is to front.

7. Install battery hold-down brace and secure with nut and washer at each of two studs.

CAUTION

Make sure red wire Into the "R" terminal at regulator Is disconnected before connecting battery. Then re-connect the red wire after battery is connected and before operating unit.

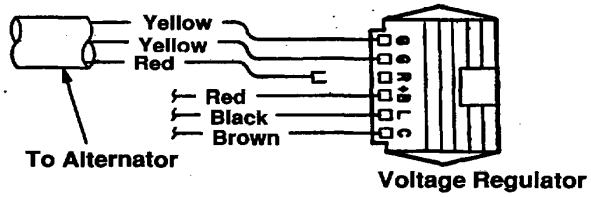


Figure 4-27. Voltage Regulator Harness

8. Connect battery cables, first positive and then negative, carefully observing polarity. Positive cable goes to connection at starter.

9. Connect upper red alternator-to-voltage regulator wire at voltage regulator.

10. Fill engine with oil.

11. Install rear panel on cabinet with six screws.

12. Open emergency valve and discharge valve and let unit discharge until stream runs normal.

CAUTION

Water must run normally to avoid a fluid stoppage caused by air pockets. Such an Incident while the engine is running could damage the food grade seal in the pump.

Make sure water is flowing through the pump within two minutes of starting dispensing unit engine, otherwise pump mechanical seal can be damaged. Open discharge valve to check.

13. Test run and check for leaks.

CAUTION

14. Prior to placing the pump back into service, it must be cleaned and sanitized. Cleaning is described in para 4-36. Sanitizing is reviewed in para 4-37.

4-27. Torque Setting

Table 4-3. M1098 Engine Torque Settings

APPLICATION	BOLT SIZE	Nm	Lb-Ft.
Alternator	M 6	8	6
Rocker Arm Cover	M 6	5	4
Intake Manifold	M 8	20	15
Exhaust Manifold	M 8	20	15
Engine Front Cove	M 8	25	18
Flywheel Nut	M 22X 1.5	275	203
Oil Filter Plug	M 27 X 1.5	25	18
Oil Pump Cover	M 5	8	6
Starting Motor	M 10	33	25
Engine Mount	M 8	20	15
Fuel Pump	M 8	25	18
Injection Pump	M 8	20	15
Injector	M 8	20	15
Cylinder Head	M 10 X1.25	49	35
Oil Sump Screw	M 6	10	7
Valve Clearance Adjustment Screw	M 6	10	7
Crankshaft Support (flywheel side) Screw	M 8	23	17
Connecting Rod Cap Screws	M 8 X 1	34	25

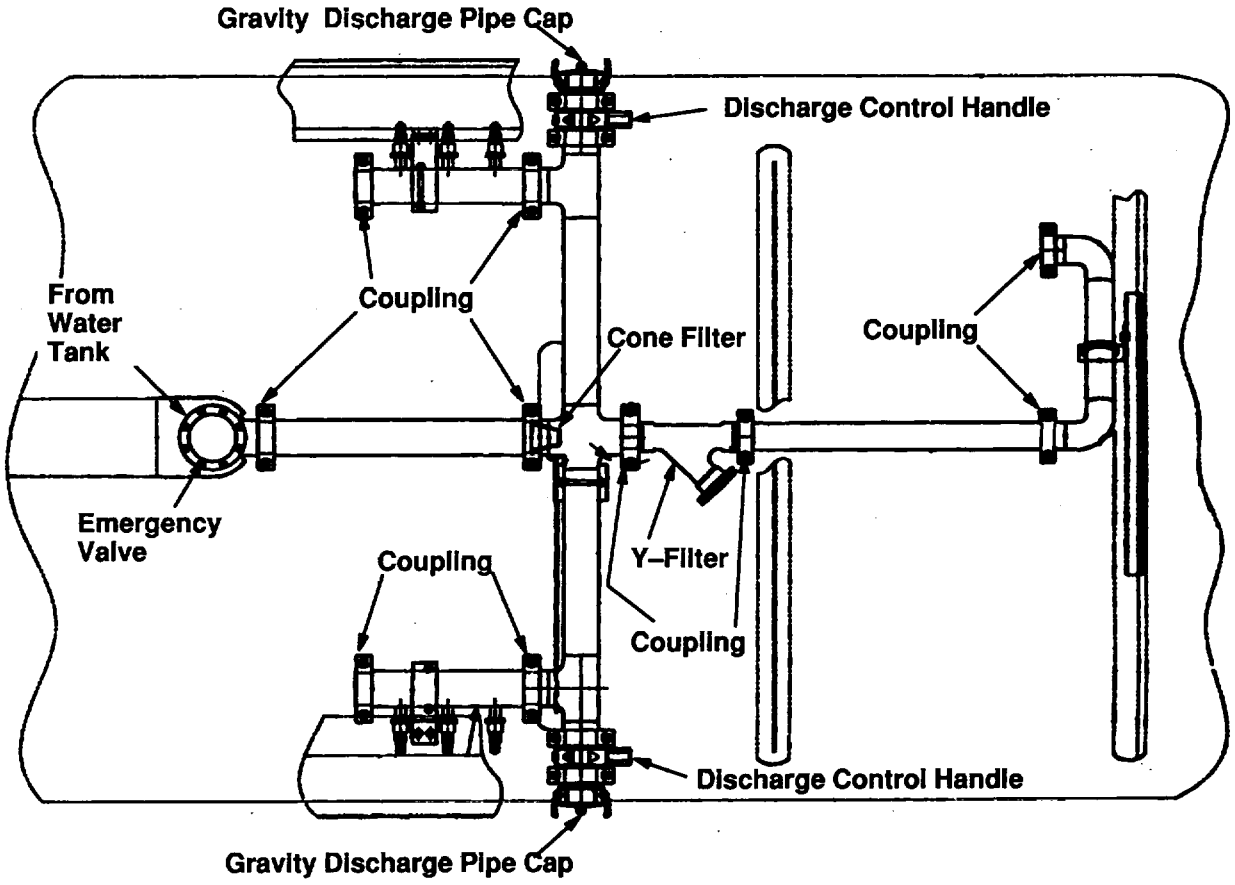


Figure 4-28. M1098 Water Piping

4-28. Cone Filter Screen Service

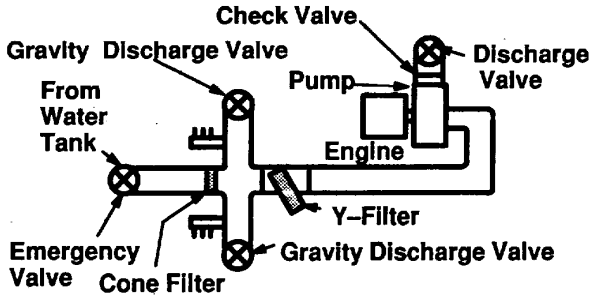


Figure 4-29. M1098 Water Dispensing Schematic

(1) Close emergency valve.

(2) Open discharge valve and drain water from path of emergency valve through discharge valve.

(3) Remove two bolts that secure coupling to pipe at cone filter, fig. 4-28. Loosen or remove coupling bolts at other end of pipe so that cone filter can be removed. If pipe is not removed, support at both ends after filter is removed.

(4) Inspect filter for damage. Replace if damaged. Clean with water if not damaged.

(5) Install cone filter into pipe and support pipe at both ends. Secure coupling with two bolts at each end of pipe.

(6) Close discharge valve and open emergency valve.

(7) Open discharge valve and allow air to expel until a free flow of water is observed. Then close discharge valve and emergency valve.

4-29. Y-Filter Service

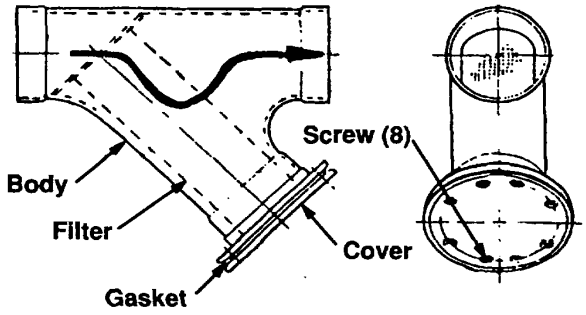


Figure 4-30. Y-pipe Filter

(1) Close emergency valve.

(2) Open discharge valve and drain water from path of emergency valve through discharge valve.

(3) Remove eight screws that secure cover to Y-pipe body and remove cover, filter and gasket.

(4) Inspect filter for damage. Replace if damaged. Clean with water if not damaged

(5) Install filter, gasket and cover. Secure cover with eight screws.

(6) Close discharge valve and open emergency valve.

(7) Open discharge valve and allow air to expel until a free flow of water is observed. Then close discharge valve and emergency valve.

4-30. Emergency Valve Removal and Installation, Fig. 4-31.

a. Removal

(1) Loosen, but do not remove, two nuts from U-bolt on emergency valve lever and disconnect emergency valve cable.

CAUTION

Support large outlet tube before removing coupling.

(2) Remove two nuts and bolts from coupling and remove coupling. Slide gasket onto emergency valve.

(3) Remove eight nuts from studs securing emergency valve to sump on tank.

(4) Remove emergency valve, pipe, adapter, and gasket from tank sump.

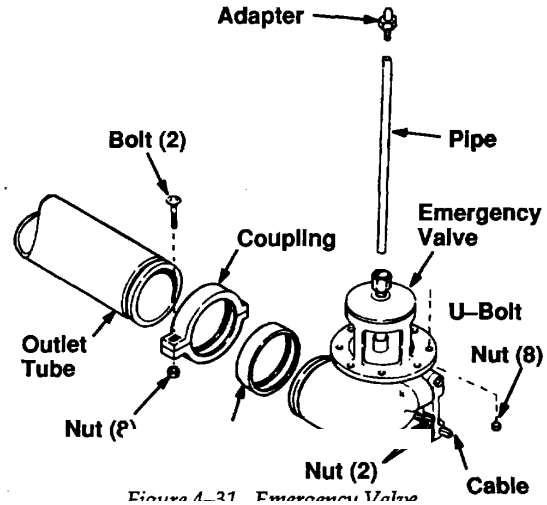


Figure 4-31. Emergency Valve

(5) Remove coupling gasket from emergency valve.

b. Installation

(1) Slide coupling gasket onto emergency valve.

NOTE
Be sure pipe is engaged with vent.

(2) Install valve, pipe, adapter, and gasket to tank sump and attach eight nuts. Tighten nuts to 50-75 lb-ft.

(3) Slide gasket over joint and attach coupling. Tighten nuts to 104 - 116 lb-ft.

(4) Reconnect emergency valve cable to the emergency valve lever. Tighten the two U-bolt nuts. Check for proper operation of emergency valve and cable adjustment, part c of para 4-34.

4-31. Emergency valve Disassembly and Assembly, Fig. 4-32.

a. Disassembly

(1) Remove lever (1) from stem (7) by loosening nut (3) screw (2) and pulling lever from shaft.

(2) Unscrew stuffing box nut (4), and remove O-ring (5) and two packing glands (6) from stuffing box nut (4).

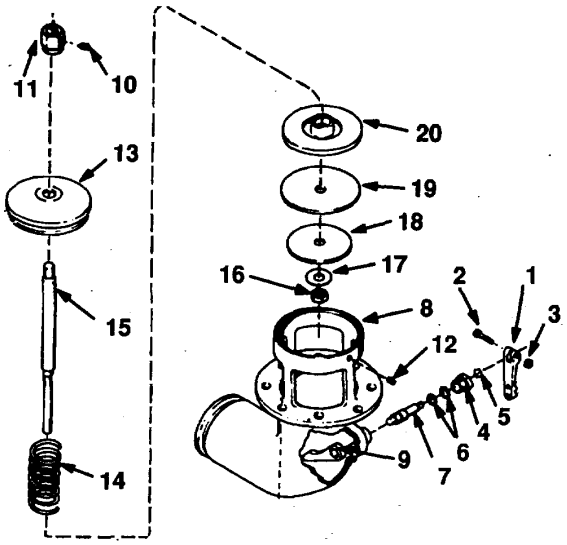
(3) Pull stem (7) from body (8). Cam (9) will fall into body. Remove cam.

(4) Loosen set screw (10) and remove adapter (11).

(5) Loosen three set screws (12) and remove bonnet (13).

(6) Remove spring (14), then pull stem (1 along with assembled disc assembly, out through top of valve.

(7) Remove nut (16), washer (17), retaining plate (18), plunger disc (19), and disc holder (20) from stem (15).



1. Lever
2. Screw
3. Nut
4. Stuffing Box Nut
5. O-ring
6. Packing Glands (2)
7. Stem
8. Body
9. Cam
10. Set Screw
11. Adapter
12. Set Screw
13. Bonnet
14. Spring
15. Stem
16. Nut
17. Washer
18. Retaining Plate
19. Plunger Disc
20. Holder

Figure 4-32. Emergency Valve Disassembled

b. Cleaning and Inspection.

(1) Clean all metal parts and dry thoroughly.

(2) Replace gaskets. Inspect valve for cracks, distortion, and wear. Inspect all parts for damage and replace any damaged part.

c. Assembly.

(1) Position cam (9) inside the body (8), and install stem (7) into body.

(2) Install 0-ring (5) and two packing glands (6) into stuffing box nut (4). Install stuffing box nut fly sliding over stem (7), and screw into body.

(3) Install lever (1) onto stem (7) and tighten screw (2) and nut (3).

(4) Install disc holder (20), plunger disc (19), retaining plate (18) and washer (17) onto stem (15). Install and tighten nut (16).

(5) Install assembled stem and disc into top of body. Install spring (14).

(6) Install bonnet (13) and secure in place by tightening three set screws (12).

(7) Install adapter (11), and tighten set screw (10) to secure adapter to stem (15).

4-32. Draining Pump

The pump is drained through the discharge valve and drain valve, fig. 4-33.

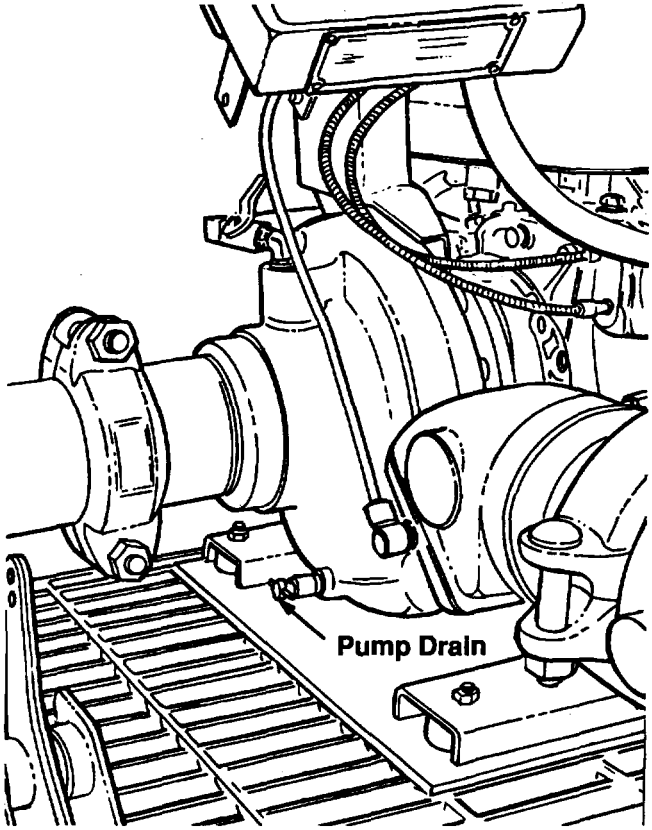


Figure 4-33. Pump Drain

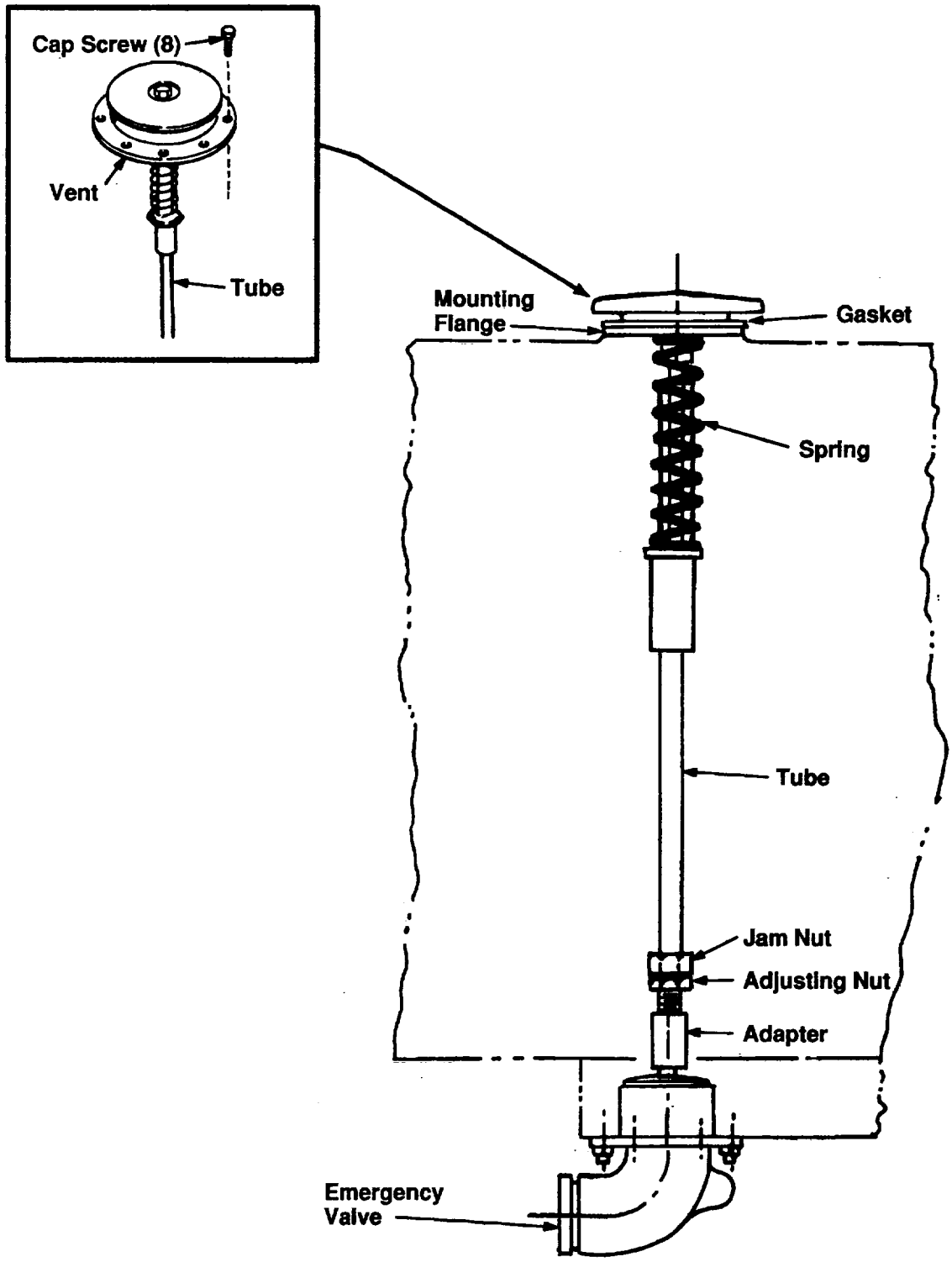


Figure 4-34. Emergency Valve Vent Installation

4-33. Emergency Valve Vent Overhaul

a. *General*. The emergency valve vent is attached to the top of the tank near the manhole cover. It is connected to the emergency valve by an actuating tube 4-34. Before the vent can be removed or adjusted water must be drained from the semitrailer tank.

b. Removal

(1) Make sure emergency valve is closed.
(2) Remove manhole cover to aid in removal of the emergency valve vent, para 4-62.

NOTE

When vent is being removed, the connector and tube will separate from the vent. Hold the tube while the vent is being removed to keep It from falling Into tank, then remove the tube.

(3) Remove eight capscrews that fasten vent to the top of the tank. Remove the vent and gasket.

c. Cleaning and Inspection
Clean vent

d. Installation
(1) Install tube and connector into adapter. Hold in place by hand.
(2) Position gasket on top of vent mount place on to of tank, aligning the connector with the vent. Hold complete assembly in place and install eight capscrews.

e. Adjustment
(1) Emergency valve vent must be open whenever the emergency valve is opened.
(2) If vent does not open, adjust vent as follows:

WARNING

Entry into the tank through the one manhole is extremely hazardous. Workers must contact the supporting safety office and comply with confined space entry requirements. DO NOT ENTER the tank unless you are trained in confined space entry, all entry requirements have been met and a permit issued.

(a) Adjustment must be done from inside tank.

(b) Close the emergency valve.

(c) Loosen jam nut and turn adjusting nut until tube has 1/8-inch vertical travel.

(d) Tighten jam nut.

(e) Open emergency valve and ensure that emergency valve vent also opens.

4-34. Emergency Valve Control and Cable Service, Fig. 4-35.

a. Cleaning and Inspection

(1) Clean control handle of valve and connecting parts cable and emergency valve.
(2) Inspect for cracks in control handle, frayed cables, loose U-bolts, loose or bent cable runways, cotter pins and control mounting bolts.

b. Service

(1) Tighten any loose U-bolt cable connectors, adjusting bolts, and bracket mounting bolts at each end of cable. Adjust if necessary.
(2) Lubricate all linkage.

c. Adjustment

(1) Ensure that control handle is pushed in and that the emergency valve is closed.
(2) Loosen U-bolt connectors to loosen cable end connections.
(3) Remove all slack in cables, then tighten U-bolt connectors.
(4) Check that emergency valve will open and close when control handle is operated.
(5) Pull on valve handle to open emergency valve.
(6) Repeat steps (1) through (5) if cables do not function properly.

d. Removal

Tag and disconnect control cables from the emergency valve control. Remove two screws and nuts that secure control to side of cabinet. Remove valve control.

e. Disassembly and Assembly

(1) Remove roll pin (8) securing shaft (9) to bracket (7), fig. P35.
(2) Remove shaft (9). Remove lever (1) and the trip bar assembly (10).

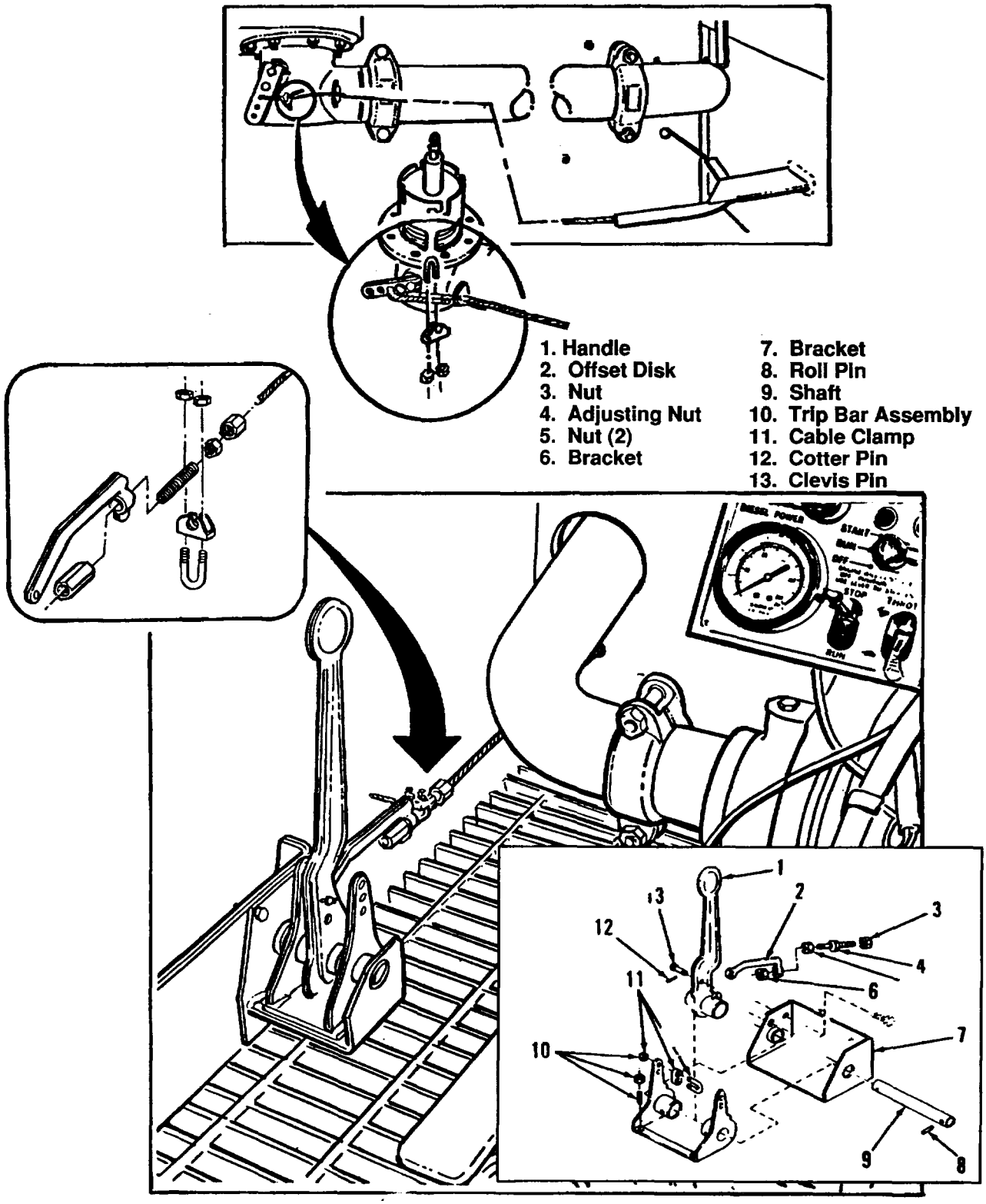


Figure 4-35. Emergency Valve Controls

(3) Remove cotter pin (12) and clevis pin (13) that secures offset link (2) to handle (1). Remove offset link (2).

(4) Disassemble further if needed, fig. 4-35.

(5) Reassemble by reversing steps (1) through (4).

f. Installation

(1) Mount emergency valve control in place using two nuts and screws.

(2) Reconnect the cables and adjust (step c).

4-35. General Instructions for Removal of Pipes and Valves

WARNING

Read and observe all safety precautions listed in the Warning Summary before performing maintenance on dispensing equipment.

(1) Close emergency valve.

(2) Open discharge valve and drain water from path of emergency valve through discharge valve.

(3) Consider the size and weight of the unit to be removed and provide support.

(4) Loosen or remove any item necessary to allow removal of the unit. In some instances when removing valves, piping may have to be loosened at different places to make it easy to remove valve and gaskets.

(5) When replacing O-rings, coat with food grade lubricant to facilitate installation.

(6) Coat all male threaded pipe fittings with antiseize tape (item 27, Appendix E) before installation.

(7) Following the replacement of any unit, test for leaks and correct if leaks are evident.

(8) When installing split couplings and gaskets, follow procedure below. fig. NO TAG

a. Lubricate complete gasket with food-grade sealant.

b. Slide gasket onto one pipe end. Ensure that gasket lip does not overhang pipe end.

c. Align and bring the two pipe ends together and slide gasket into position centered between the grooves on each pipe end.

d. Assemble the coupling, being sure edges of coupling drop securely into grooves. Squeeze housing tight with hands to further center the gasket and seat the housing.

WARNING

Uneven tightening of nuts may cause gasket to pinch.

e. Install coupling bolts and tighten nuts finger tight. Tighten the nuts uniformly until coupling halves are firmly together: metal-to-metal. Tighten nuts to torque specified.

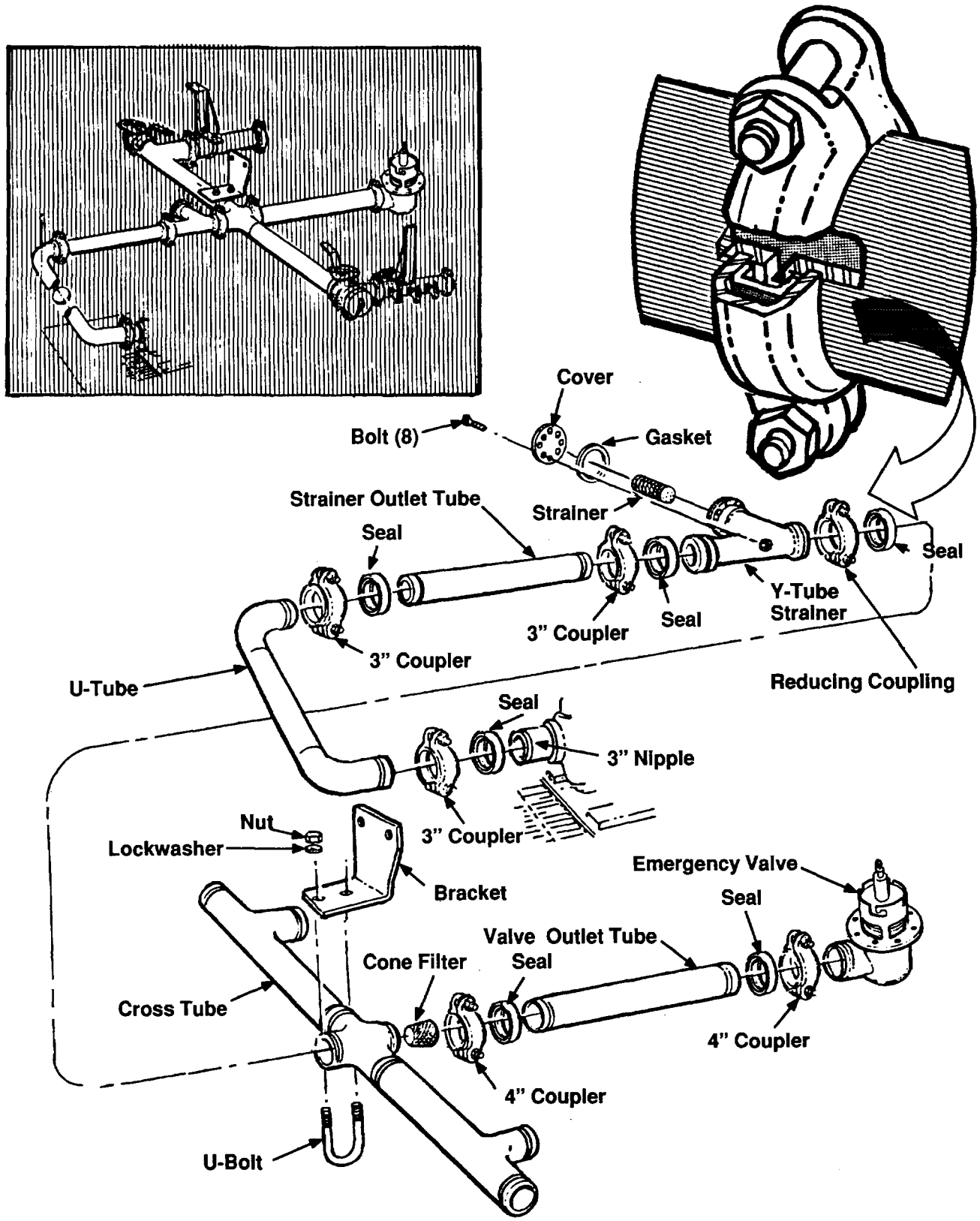


Figure 4-36. Manifold System - Exploded View

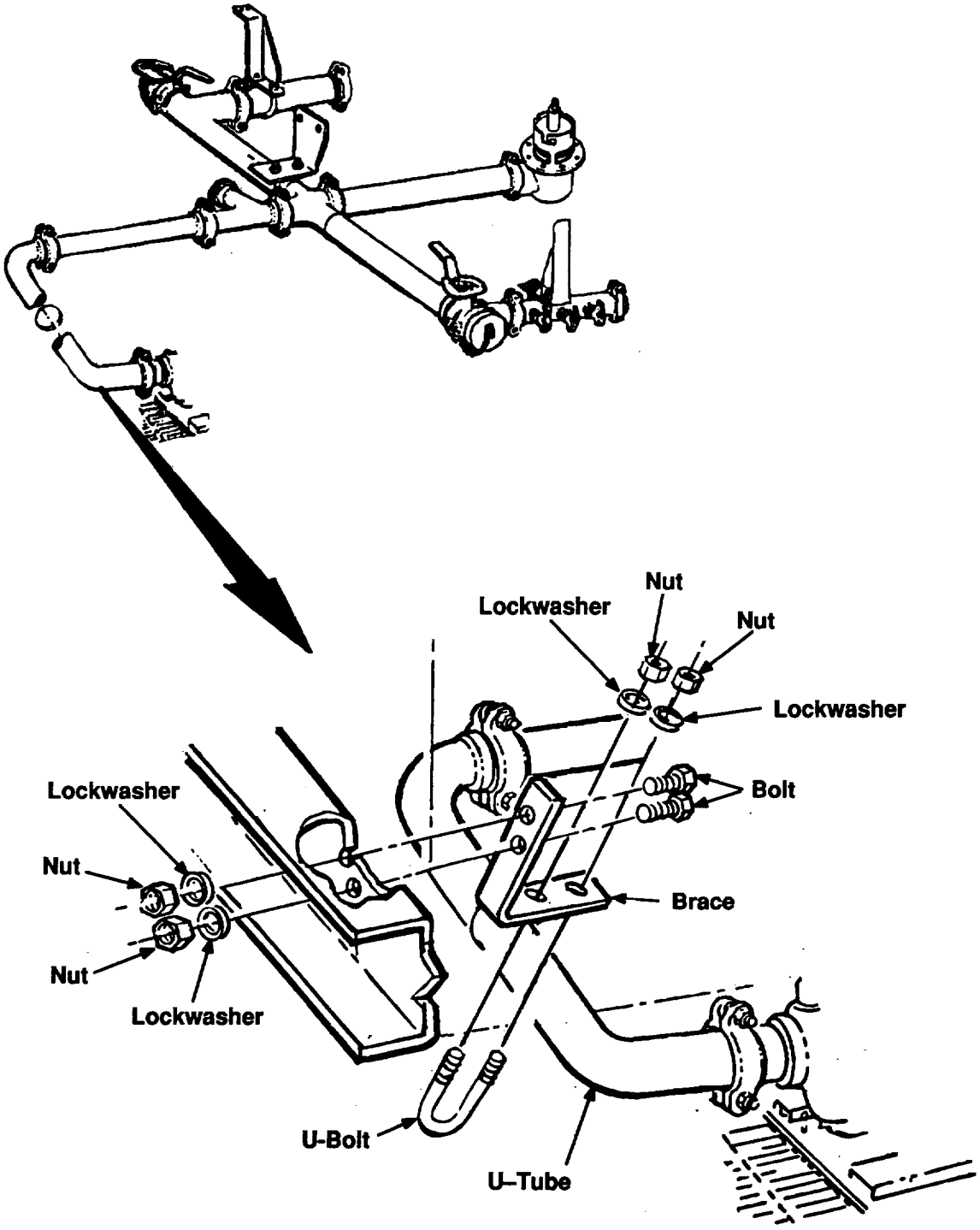


Figure 4-37. Manifold to Pump

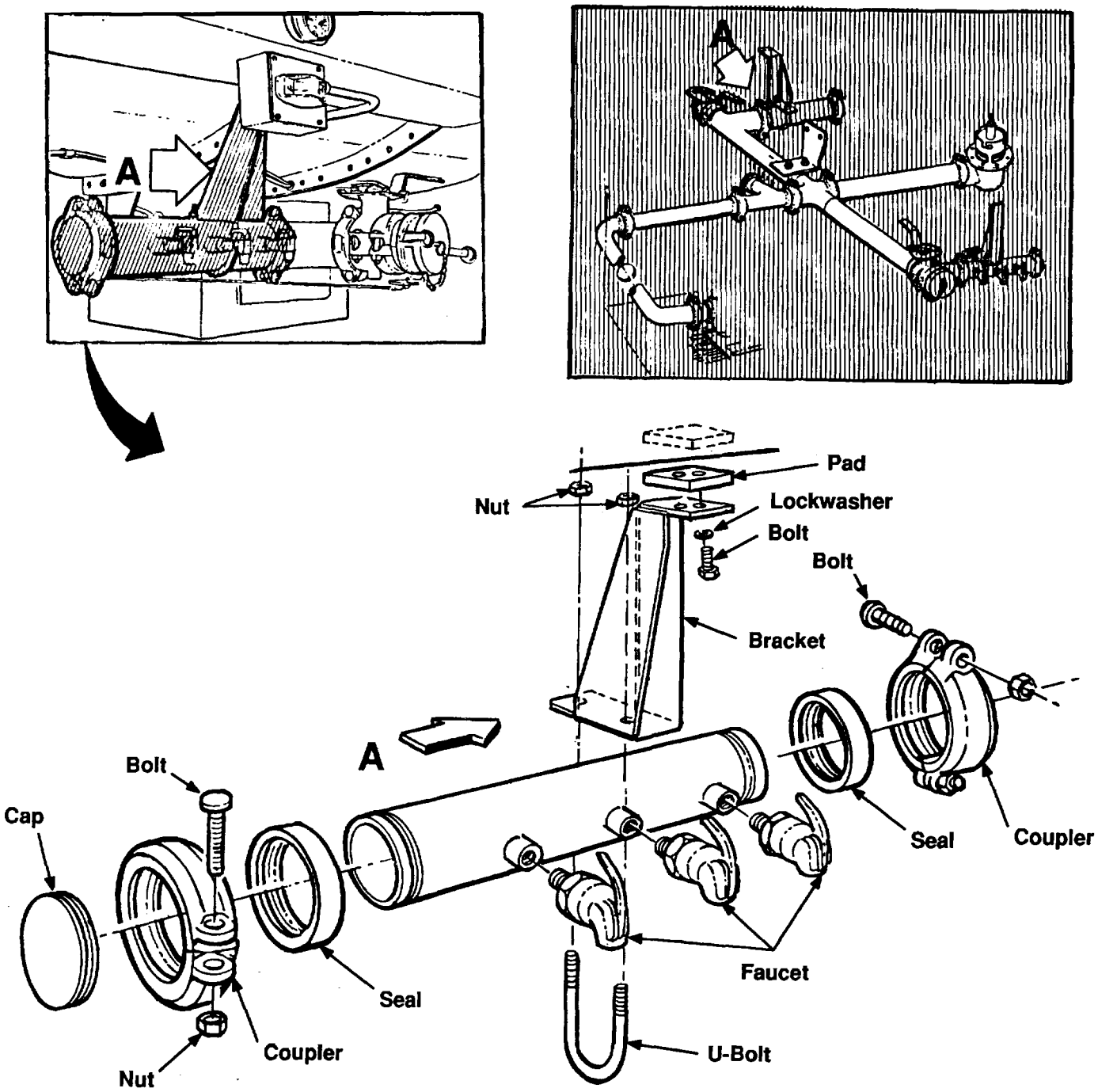


Figure 4-38. Faucet Manifolding - Curbside Rear View

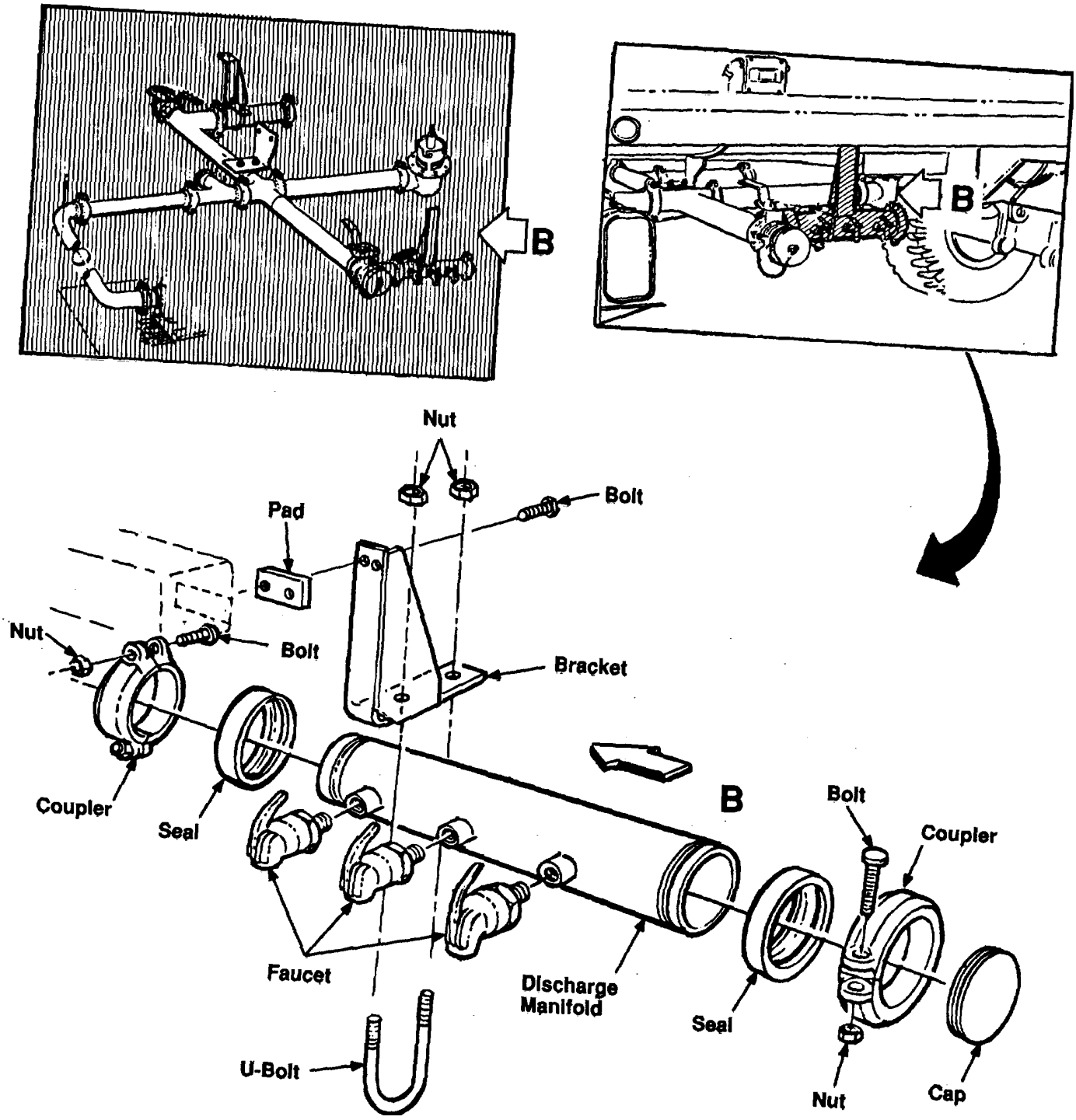


Figure 4-39. Faucet Manifolding - Roadside Rear View

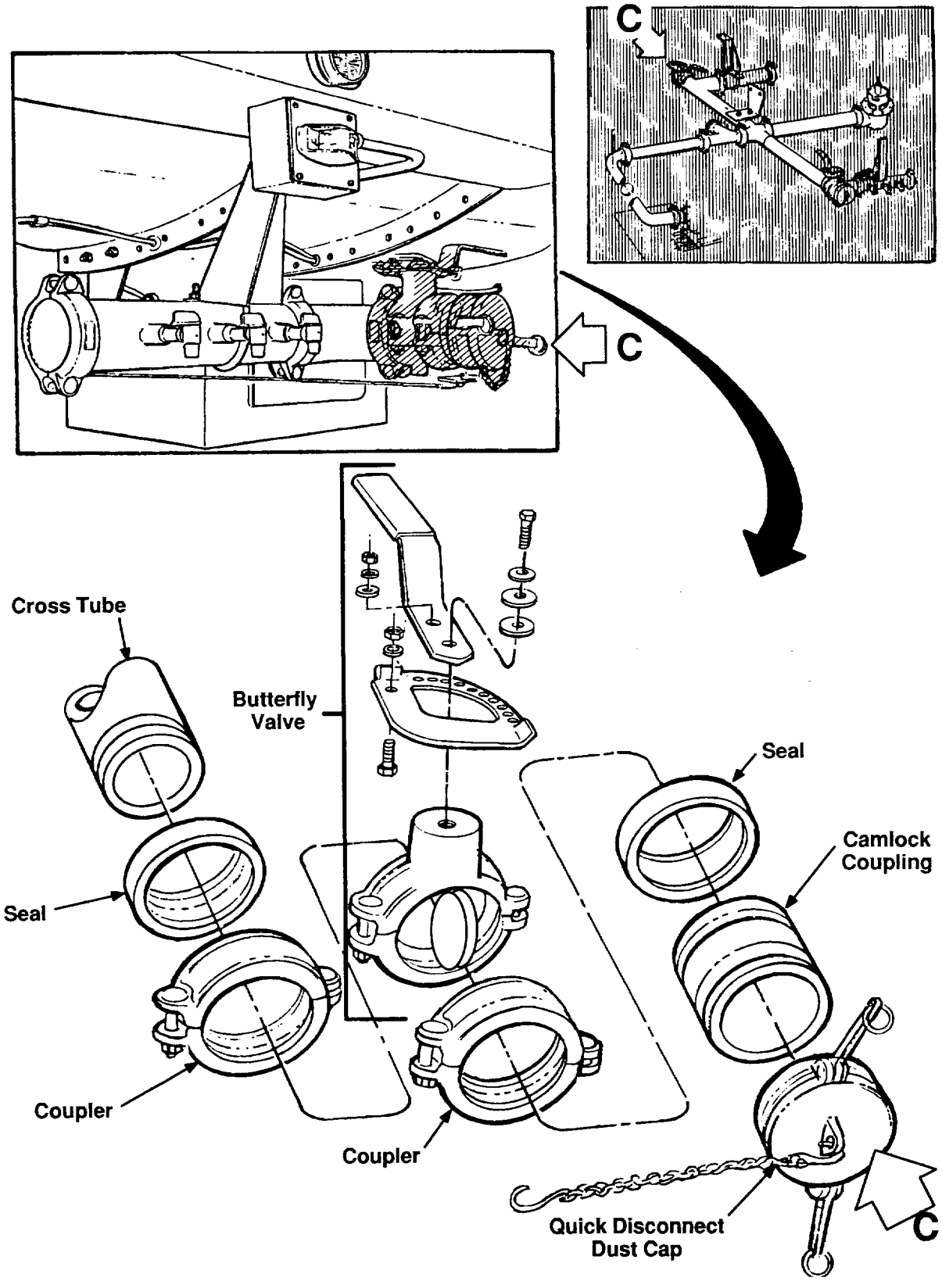


Figure 4-40. Gravity Discharge Valve (Curbside Rear Exploded View)

Section XIII. DRAINING AND PURGING OF TANK INTERIOR - WATER TANKERS ONLY

4-36. Water Tanker Cleaning

NOTE

A THOROUGH READING OF TB MED 577 and FM 21-10 is essential for understanding proper draining, purging and cleaning methods.

a. Preparation

WARNING

DO NOT ENTER the tank unless you are trained In confined space entry and all entry requirements have been met and a permit issued. All maintenance and cleaning operations which require worker entry into the tank should be performed at a facility that has a confined space entry program (i.e., General Support or Depot level). Workers must contact the supporting safety office and comply with confined space entry requirements.

(1) Remove rust from interior surfaces using scour powder and a nonmetallic scouring pad or brush.

(2) Steam clean for at least 30 minutes (if possible).

(3) Thoroughly rinse the interior of the container a discard the contents.

(4) Prepare a soap solution by adding one-third c teen cup of dishwashing compound to 10 gallons (38 liters) of hot water or 3-1/3 canteen cups of dishwashing compound to 100 gallons (380 liters) of hot water.

b. Cleaning procedures

(1) Thoroughly wash the interior surfaces of equipment with the soap solution scrubbing the interior surfaces with a long-handled brush.

(2) Clean the pump, pipes, valves and spigots by drawing soap through them.

(3) Rinse the container and apparatus twice with warm (120°F, 49°C) water to completely remove the soap solution.

(4) Drain the rinse water through the discharge apparatus and discard the rinse water.

(5) After cleaning, sanitize the container with a 100 ppm chlorine solution as discussed below.

4-37. Equipment Sanitizing

a. General

All equipment used to store and distribute potable water will be sanitized with a 100 ppm chlorine solution after the equipment has been cleaned.

b. Preparation

(1) Construct a seepage pit or sump into which the waste chlorine solution and rinse waters will be discharged. Waste chlorine solution should not be discharged into bodies of water or into sanitary sewers. The chlorine can kill aquatic organisms in the water and bacteria in sewage which are necessary for waste degradation.

(2) Prepare a sanitizing solution of 100 ppm chlorine.

(a) Using calcium hypochlorite, add one ampule to one gallon (3.8 liter) of potable water or add five level mess kit spoonfuls to 100 gallons (380 liters) of potable water.

(b) Using liquid bleach, add one mess kit spoonful to two gallon (7.6 liters) of potable water or add one gallon of bleach to 500 gallons (1,900 liters) of potable water.

c. Procedures

(1) When sufficient quantities of water are available, fill the container with the sanitizing solution. Close the manhole covers or ports. Allow the solution to remain in the container for 60 minutes. Briefly operate the water dispensing unit to ensure that the sanitizing solution has circulated through the pump, pipes, hoses and spigots.

(2) If sufficient quantities of water are not available, apply the sanitizing solution by spraying or brushing (use a clean, nonmetallic brush) it on the interior surface to include ports and manholes. Add additional solution to the tank to clean the discharge and pumping apparatus. The solution must remain in contact with the surfaces for 60 minutes and may require

reapplications of the solution every ten minutes to keep surfaces wet.

(3) Rinse the equipment and apparatuses twice with potable water.

(4) Drain the rinse water through the discharge apparatus and appropriate distribution pumps, hoses and nozzles.

(5) If the equipment is not to be used for a long period of time, open all ports and manholes, and allow the equipment to dry.

(6) When dry, store the equipment per guidance, para 4-68.

d. Disposal of Sanitizing Solutions

(1) During peacetime operations, land disposal of waste chlorine solutions used in sanitizing is not consistent with good disposal practices and is illegal in CONUS. These solutions must be discharged in accordance with local, state or host nation regulations. Normally, the waste chlorine solutions can be discharged directly to a waste water collection system. Some facilities may require dechlorination (neutralization of the chlorine solution) prior to discharging. Approval from the waste water treatment facility must be granted prior to any type of discharge. If a sanitary sewer system cannot be used (i.e., wartime or OCONUS deployment) then field expedient measures should be considered to allow the chlorine to dissipate such as soakage pits, trenches, ponds or hardwall storage units.

(2) Two dechlorination methods are available for peacetime use. The first method is through dissipation of chlorine into the air, which may take a long time to occur. Another more efficient method is to dechlorinate with sulfur compounds, such as sodium, thiosulfate, sodium sulfide, or sodium bisulfate. For 400 gallons of 100ppm chlorine sanitizing solution, approximately 1/2 lb of the sulfur compound is required (assuming ideal mixing). Periodic chlorine residual monitoring will be necessary after chemical addition to ensure adequate dechlorination has occurred prior to discharge.

4-38. Equipment Decontamination

a. Level of Decontamination Performance

(1) *Organized decontamination.*

Large-scale NBC decontamination operations are performed by the NBC defense company or detachment as discussed in FM3-87 (HTF).

(2) *Unit Decontamination.*

Unit decontamination will be supervised by the unit NBC officer or noncommissioned officer. Decontamination procedures are discussed in TM 3-220.

WARNING

Procedures for field expedient decontamination of equipment and containers are referenced below. These procedures should only be used when the unit is isolated from the NBC defense company or detachment which is responsible for organized decontamination of equipment and personnel.

b. Field expedient decontamination.

Water purification and supply personnel and unit field sanitation teams regularly work with an effective chemical and biological agent decontaminant, calcium hypochlorite. This chemical can be used for decontamination of equipment surfaces by following the procedures described below.

(1) Preparation.

(a) Construct a soakage pit or sump into which the decontamination waste and rinse water can be discharged or use one of the other alternatives described in part d of para 4-37.

(b) Wear personal protective equipment and prepare a three percent solution of chlorine by adding three canteen cups of calcium hypochlorite to six gallons (23 liters) of water.

(2) Procedures.

(a) Apply the solution to the exterior of the equipment or container using brushes or brooms. One gallon (3.8 liters) of the solution should cover eight square yards (seven square meters). The decontamination solution must remain in contact with the surface for at least 30 minutes and may have to be reapplied occasionally to keep the surface wet.

(b) Thoroughly wash the surface with water.

(c) Test the water stored in the container with the M272 kit to determine if the water was contaminated.

If not, rechlorinate the water to 5 ppm or at a higher level if prescribe by the command surgeon.

(d) If the water is contaminated with a detectable level of chemical agent which exceeds the standards in table 3-1, water purification sections should retreat the water using appropriate methods described in FM 10-52, chapter 6, section m. Units should procure a new supply of potable water from quartermaster supplies.

Table 4-4. Nomenclature for ordering equipment cleaning and sanitizing supplies

NSN Identifier	Item
7920-00-061-0038	Brush, Scrub, Plastic *Item used to scrub the interior surfaces of water purification, storage, and distribution equipment.*
7920-00-753-5242	Pad, scouring, type I, 6 in. by 9 -1/2 in. by 1/4in.
7930-00-205-0442	Scouring Powder, 14 oz can *Item used to clean steel and aluminum surfaces of water purification, storage and distribution equipment*
7930-00-899-9534	Dishwashing Compound, five gal bottle *Item used to prepare a soap solution for cleaning equipment.*
6810-00-242-4770	Calcium Hypochlorite, Technical, 3-3/4 lb bottle
6810-00-255-0471	Calcium Hypochlorite, Technical, 6 oz bottle
6810-00-255-0472	Calcium Hypochlorite, Technical, 100 lb drum
6810-00-598-7316	Sodium Hypochlorite, 5 gal bottle
6850-00-270-6225	Chlorination Kit, Water Purification *Item used to disinfect water and to prepare a sanitizing solution for equipment.*
6810-00-264-5896	Carbon, Activated, Technical, 10 lb pail
6810-00-264-6575	Carbon, Activated, Technical, 50 lb Table 4-9. Unit Troubleshooting drum *Item used to neutralize bad tastes and odors in water.*
6810-00-163-8057	Sodium Thiosulfate, 1 lb can
6750-00-200-2403	Sodium Sulfide, 1 lb can
7930-00-559-9481	Sodium Bisulfate, 1 lb can

Section XIV. MAINTENANCE OF BOGIE ASSEMBLY

4-39. General, M1098

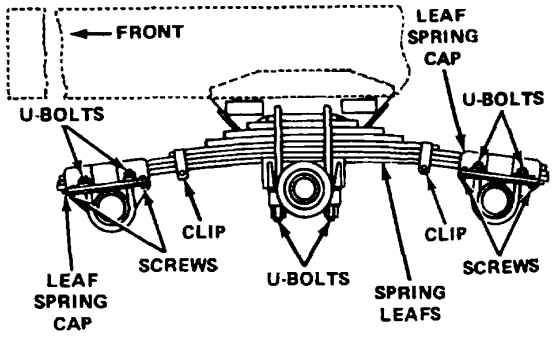


Figure 4-41. Bogie Assembly (M1098)

a. Preliminary. Position semitrailer on hard level surface with front resting on landing gear. Jack and block rear of frame. Remove wheels, para 4-51.

b. Inspection. Clean axle and suspension system with water and fiber brush to allow for careful inspection.

(1) Inspect general condition of trunnion tube, axles, and spring leaves. Look for cracks or damage.

(2) Check tightness of U-bolts, fig. 4-41. Check clips on leaf springs, Table 4-5.

(3) Check tightness of U-bolts and screws, fig. 4-41. They should be tight on leaf spring cap and seat, table 4-5.

(4) Look for cracked brake drum.

Table 4-5. Tabulated Torque Values - Bogie Assembly, M1098

Location/Description	Torque
Spring U-Bolts (Nuts)	200-220 lb-ft
Spring Cap and Seat U-Bolts (Nuts)	200-220 lb-ft
Spring Cap and Seat Screws	240 lb-ft
Hub Cap Retainer Bolts	16-20 lb-ft
Wheel Stud Nuts	450-500 lb-ft

(5) Look for damaged brake camshaft.

(6) Look for worn brake hoses or damaged brake chamber.

(7) Check tightness of bolts which fasten bogie assembly to trailer frame.

c. Repair. Tighten loose bolts. If damage or wear is evident, notify direct support maintenance.

Section XV. MAINTENANCE OF BRAKE SYSTEM

4-40. General, M1098

a. Description. The semitrailer brakes are air-operated cam-type brakes. Two brake camshafts, two slack adjusters, and two brake chambers are assembled to the front and rear axle. The brake chamber movement through the slack adjuster causes the camshaft to, rotate and force the brake shoes against the brake drum, fig. 4-43.

(1) Attached to the slack adjusters are two cam-shafts - one right-hand and one left-hand.

(2) The "S"-shaped part of the camshaft is positioned between the rollers on the brake shoes.

b. Actuation. When ;the brake is actuated, air is applied to the brake chambers, and the diaphragm rod moves the slack adjusters rotating the brake camshaft against the two rollers on the brake shoes. This action forces the brake shoes against the brake drum causing friction to slow or stop the vehicle. When the brake is released, spring action returns the brake shoes to release position.

c. Brake Air System, Fig. 4-44. Compressed air is transmitted from the towing vehicle through the service and emergency air lines. When the engine of the towing vehicle is running, air pressure of 90-120 psi is kept in the system though the emergency air line. Compressed air is routed into the rear reservoir through the emergency relay valve. From the rear reservoir, the air enters the front reservoir.

(1) The front reservoir is for the fail-safe brakes. A pressure protection valve between the two reservoirs maintains approximately 75 psi of air in the front reservoir for release of the fail-safe brakes.

(2) When there is enough reserve air in front reservoir, the spring brakes can be released opening a valve on the roadside of the semitrailer.

d. Service Brake. When the towing vehicle is attached, the foot brake operates the brakes on both the semitrailer and the towing vehicle.

(1) Applying the brake pedal delivers through the service line to the emergency relay valve.

(2) In response to the service signal, the emergency relay valve releases air form the rear reservoir to the brake chambers. Air pressure causes the camshaft in each brake assembly to rotate and force the brake shoes against the brake drum.

(3) Releasing the brake pedal stops the service signal to the emergency relay valve. the emergency relay valve closes the supply from the reservoir and releases air from the brake chambers.

e. Emergency Relay Valve, Fig. 4-42. This valve increases the speed at which brakes apply and release. The relay valve is attached to the rear reservoir above the forward axle.

(1) The emergency relay valve releases air from the rear (primary) reservoir to all brake chambers in response to the service signal from the towing vehicle.

(2) The emergency relay valve will also cause the fail-safe brakes to apply automatically if the semi-trailer breaks away from the towing vehicle.

f. Fail-Safe Units, Fig. 4-43. The fail-safe units are spring chambers which are assembled piggyback on the brake air chambers. One is installed on the air chambers at each of the four corners of the tandem axle assembly. The fail-safe unit provides parking and emergency braking.

(1) Air pressure of approximately 65 psi is needed to release the fail-safe units.

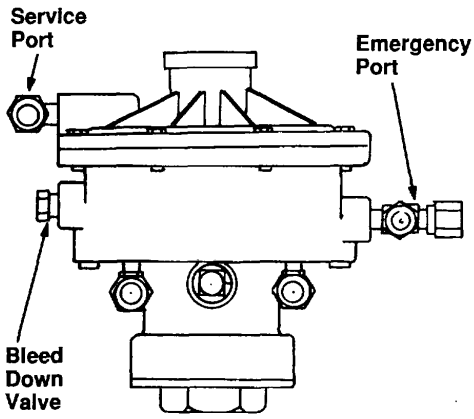


Figure 4-42. Emergency Relay Valve

(2) Loss of air pressure will release the heavy spring and push the piston against the diaphragm plate of the air chamber. This force is applied through the camshaft to the brake shoes.

g. Slack Adjusters. These convert linear motion of the brake chamber to rotating motion of the camshaft.

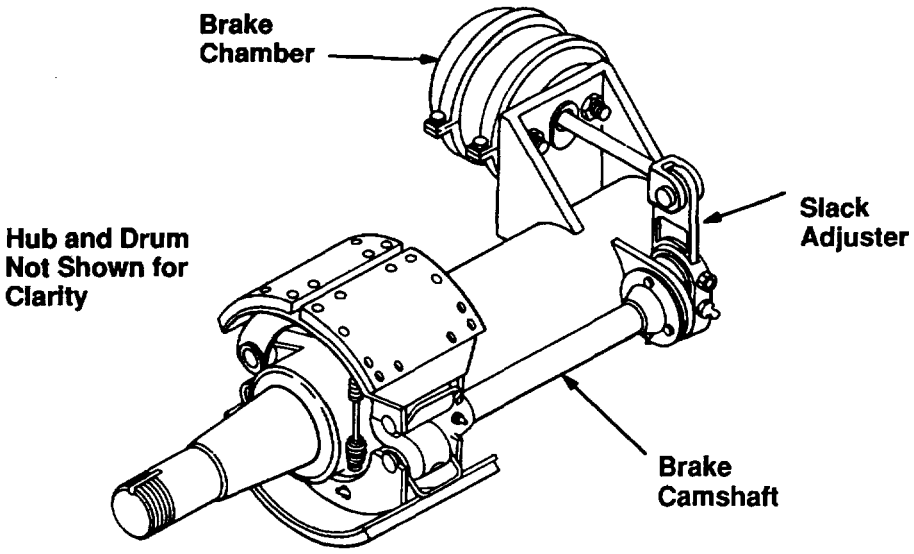


Figure 4-43. Brake Actuator Assembly (M1098)

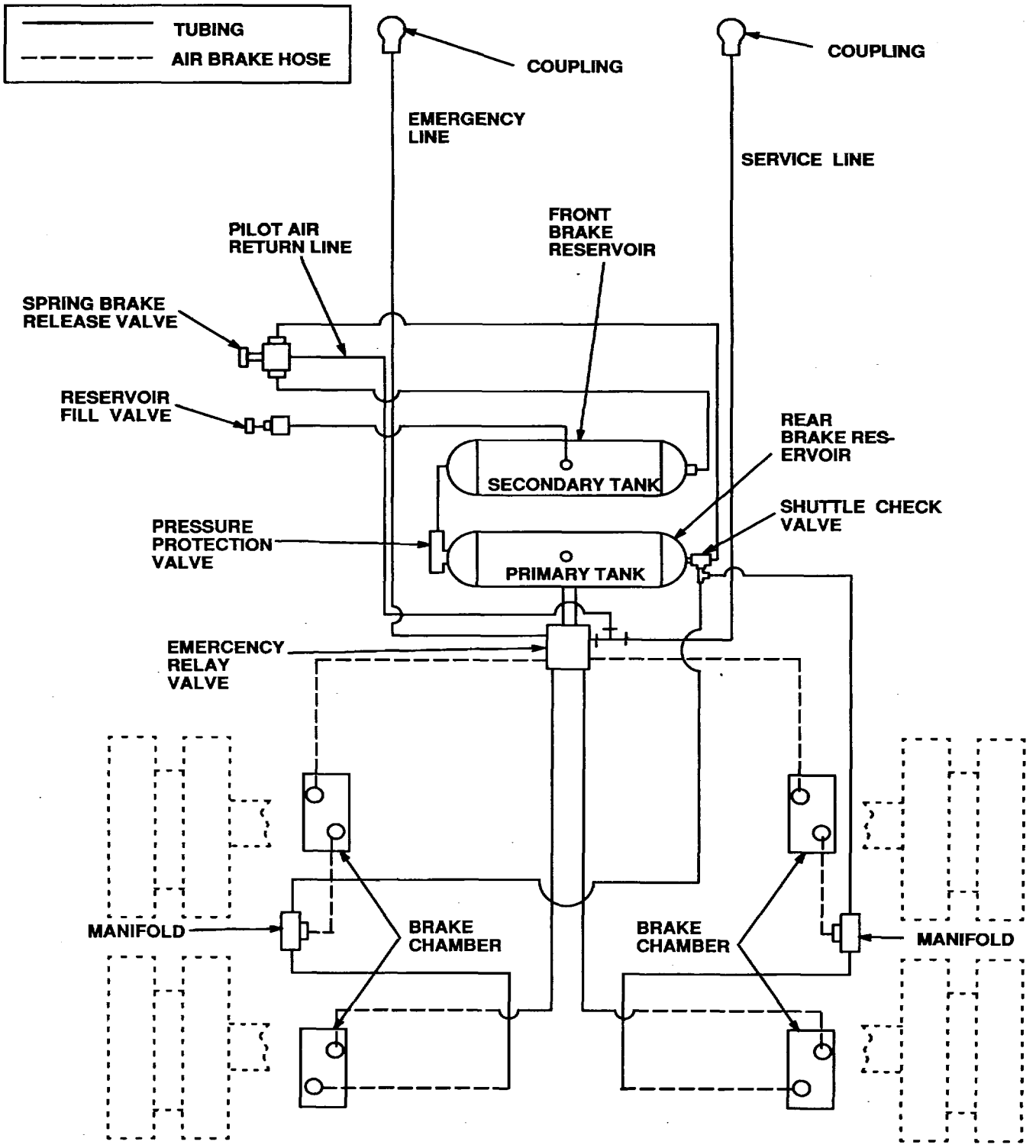


Figure 4-44. Brake Schematic

The slack adjuster consists of a housing, two gears, and two gear covers. Brake adjustments are made through the slack adjuster.

4-41. Service Brake Shoe Assemblies

NOTE

Always perform both parts a and b when doing slack or yoke adjustment.

a. Test and Adjustment, Initial Slack Adjustment.

(1) Lift semitrailer so all wheels off the ground. Block the frame securely.

(2) Release all spring forces from slack adjuster and camshaft by applying air to the air brake chamber.

(3) For the first adjustment, turn the adjusting nut counterclockwise until the brake lining is tight against the drum, Fig. 4-45. Wheel will not rotate freely.

(4) Turn the adjusting nut in the opposite direction for only two or three clicks so that the brake lining just clears the drum. Rotate the drum to check the clearance. It should be between 1.5" and 2". When lining wear causes the air chamber stroke to increase beyond two inches, reset the stroke to 1.5".

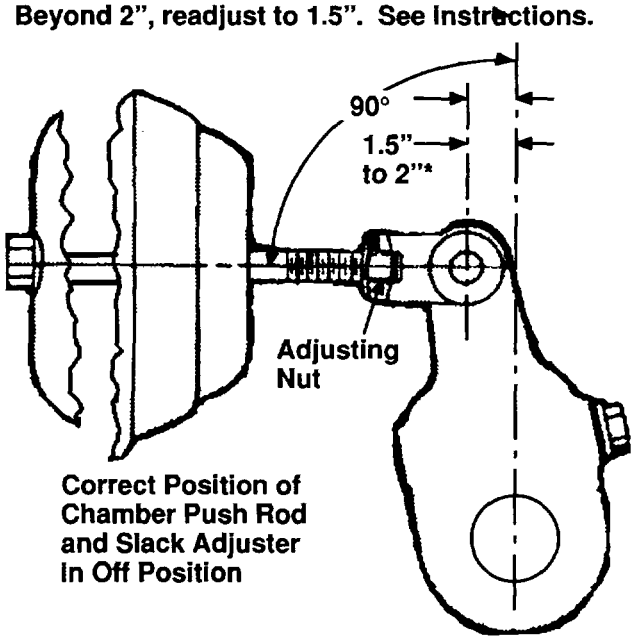


Figure 4-45. First Adjustment, Slack Adjuster

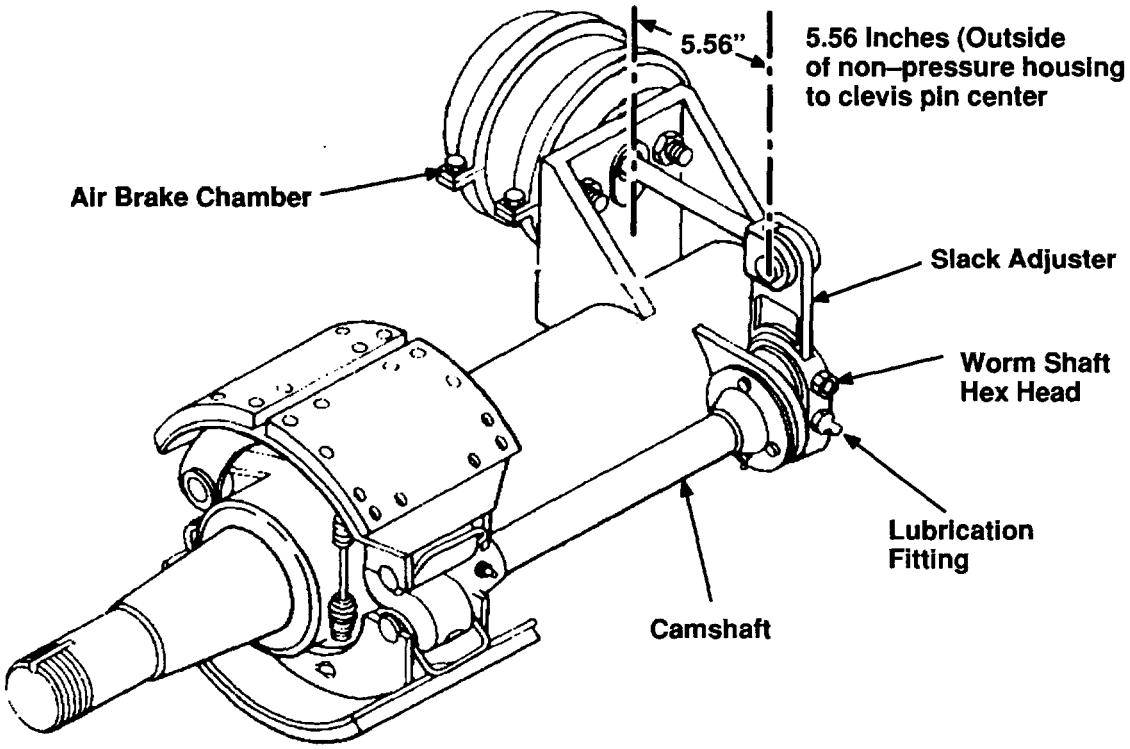


Figure 4-46. Adjustment of Yoke and Slack Adjuster

b. Test and Adjustment, Final Yoke and Slack Adjustment.

(5) Check yoke adjustment.: Dimension from outside of non-pressure housing to center of clevis pin must be 5.56-inches, fig. 4-46.

(6) Apply a 9/16-inch wrench to worm shaft hex head and push in against the slack adjuster to unlock the worm shaft.

(7) Turn the hex head of the worm shaft clockwise on slack adjuster until wheels cannot be turned.

(8) Back off the worm shaft until the wheel turns freely.

Repeat steps (1) through (8) for all four brake assemblies.

c Inspection and Replacement

(1) Remove wheel and drum assembly, para 4-51.

(2) Inspect brake linings for damage and wear. New lining has approximately 1/2-inch of stock above center rivets and approximately 1/4-inch of stock above end rivets. Replace brake shoe if lining is damaged or worn within 1/16-inch of rivet heads. By recording lining wear between scheduled annual brake maintenance periods, expected wear can be calculated. Shoes with linings that will not last until the next scheduled maintenance interval should be replaced.

d. Removal.

(1) Remove wheel and drum assembly, para 4-51.

(2) Using brake spring pliers, remove brake shoe return spring, fig. 4-47.

(3) Remove anchor pin retaining rings and anchor pin washers.

(4) Drive upper and lower anchor Pins from rear of brake shoe.

(5) Remove brake shoes.

(6) Remove roller retainers and rollers from brake shoes.

(7) Remove spring pins from brake shoes.

WARNING

Dry cleaning solvent P - D - 680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F - 138°F (38°C - 59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes with water and get medical aid.

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). Wear protective clothing (goggles and gloves) and use caution to avoid Injury to personnel.

(8) Clean anchor pins, rollers, roller retainers, spring pins, and brake shoe return spring with dry cleaning solvent (item 11, Appendix E). Dry the parts with low pressure compressed air.

(9) Refer replacement of brake linings and refacing of the drums to direct support maintenance.

e. Installation.

(1) Install spring pins on brake shoes. fig. 4-47.

(2) Install rollers and roller retainers on brake shoes.

(3) Place brake shoes into position on brake spider, and install upper and lower anchor pins and anchor pin washers.

(4) Install anchor pin retaining rings on upper and lower anchor pins.

(5) Using brake spring pliers, install brake shoe return spring.

e. Assembly and Adjustment.

(1) Install wheel and drum assembly, para 4-51.

(2) Perform slack and yoke adjustments, parts a and b of this procedure.

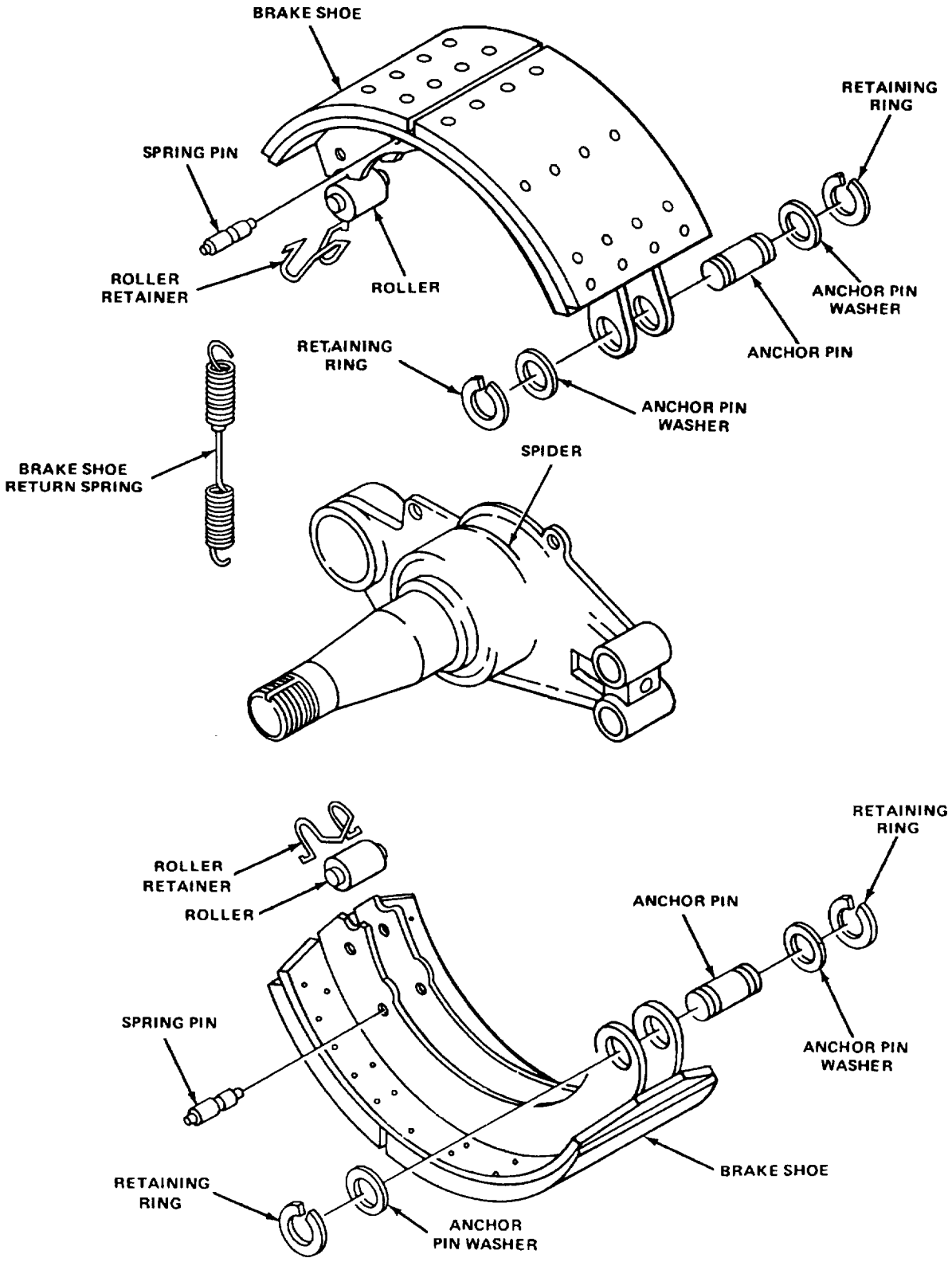


Figure 4-47. Removing and Installing Brake Shoes

4-42. Brake Air Chamber Test and Replacement of Brake Chamber, Fig. 4-48.

a. Test.

(1) With towing vehicle connected and vehicle brakes applied, coat the flanges and connections on the air chamber with soapy water.

(2) Check for leakage indicated by bubbles. No leakage is permissible.

WARNING

DO NOT overtighten clamp on air chamber. Maximum torque should be 20-25 lb-ft Over-tightening will distort the flange and cause more leakage.

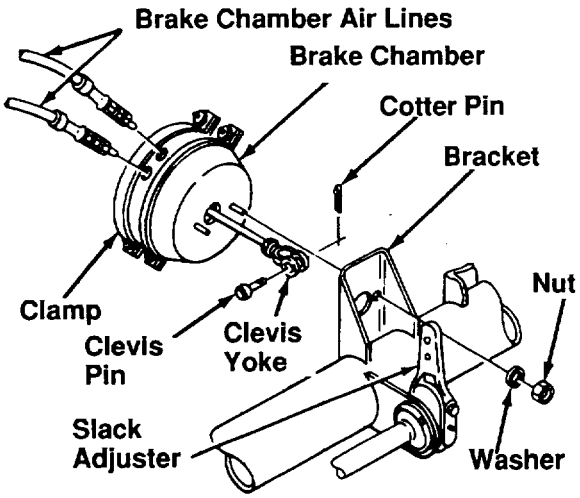


Figure 4-48. Removing and Installing Brake Chamber

(3) If leakage is found at flange, tighten the clamp. If leakage is found at connections, tighten fittings.

(4) After initial brake application forced out a small amount of air, no air should he expelled from the air chamber. If air continued to exhaust, replacement of the brake chamber and fail-safe unit as an assembly is necessary.

b. Removal.

(1) Open drain valves on the air reservoirs and allow air to bleed off, fig. 4-54.

(2) Disconnect two brake hoses from brake chamber, fig. 4-48.

(3) Remove cotter pin and clevis pin securing clevis yoke to slack adjuster.

(4) Remove two nuts, two lockwashers securing brake chamber to bracket. Discard lockwashers.

(5) Remove brake chamber.

d. Installation

(1) Place brake chamber in position on bracket, fig. 4-48.

(2) Install two new lockwashers and two nuts to secure brake chamber to bracket.

(3) Check clevis yoke adjustment, para 4-41.

(4) Install clevis pin and cotter pin to secure yoke to slack adjuster.

(5) Connect two brake hoses to brake chamber.

(6) Close drain valves on air reservoirs, fig. 4-54.

(7) Pressurize air brake system and check for leaks.

WARNING

DO NOT attempt to repair brake chamber fail-safe unit, Fig. 4-49. It is dangerous since the spring Is highly compressed. No repair Is authorized for fail-safe unit.

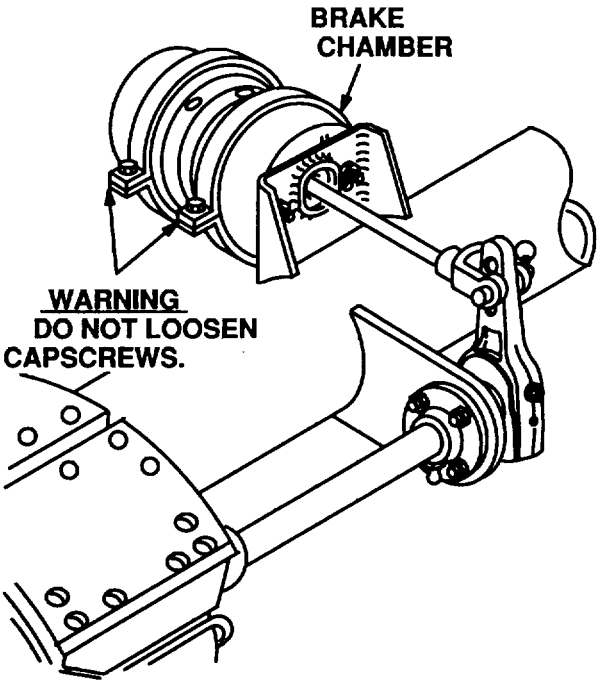


Figure 4-49. Brake Chamber Warning

4-43. Slack Adjuster

a Removal

(1) Remove cotter pin and clevis pin securing yoke to slack adjuster, fig. 4-50.

(2) Remove retaining ring from end of car shaft.

(3) Using a brass hammer, tap on slack adjuster lightly until it comes off the camshaft.

b. Inspection and Repair

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F - 138°F (38°C - 59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and Set medical aid.

(1) Thoroughly clean slack adjuster, splines of camshaft, and other metal parts using dry cleaning solvent (item 11, Appendix E) and a stiff fiber brush. Make sure parts are completely dry.

(2) Inspect slack adjuster for external damage, and the worm shaft hex head for being frozen or binding.

(3) Replace all parts which are not in good condition.

c. Installation

(1) Place slack adjuster into position on camshaft. Use a brass hammer to lightly tap it into place.

(2) Install retaining ring into recess on camshaft.

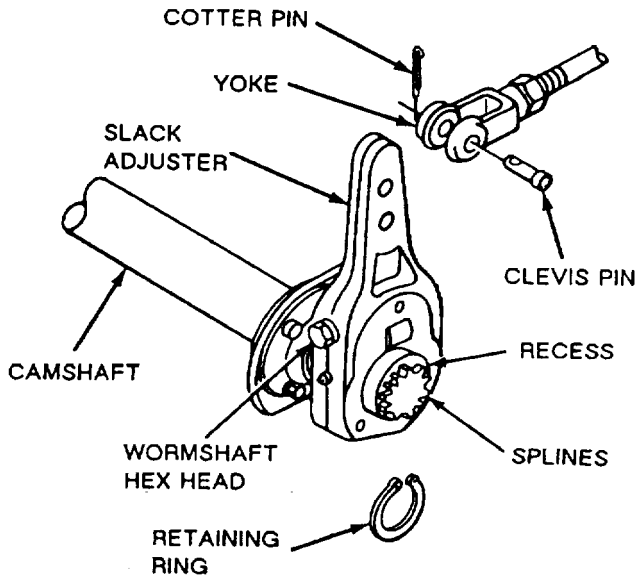


Figure 4-50. Removing and Installing Slack Adjuster

(3) Place yoke into position at slack adjuster and install clevis pin.

(4) Install cotter pin to secure clevis pin.

(5) Adjust slack adjuster, part a of para 4-41.

(6) Lubricate slack adjuster, fig. 3-6.

4-44. Brake Camshaft, Fig. 4-51.

Removal.

(1) Remove wheel and drum assembly.

(2) Remove brake shoes, para 4-41.

(3) Remove slack adjuster, 4-43.

(4) Expand retaining ring and slide camshaft part way out of spider. Remove retaining ring.

(5) Glide camshaft out of spider.

(6) Remove two washers and two seals from camshaft.

(7) Remove spider bushing.

(8) Remove four nuts, four washers, and four screws securing camshaft bushing assembly to bracket.

(9) Remove inner retainer and outer retainer.

(10) Remove camshaft bushing and two preformed packings.

b. Inspection and Repair

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). Wear protective clothing (goggles and gloves) and use caution to avoid injury to personnel.

NOTE

Use a wire brush to clean camshaft and inner and outer retainers, if required, to remove caked-on dirt and corrosion.

(1) Thoroughly clean all metal parts with dry cleaning solvent (item 11, Appendix E). Dry the parts with low pressure compressed air.

(2) Inspect camshaft for twists and bends.

(3) Inspect inner and outer retainers for bends and cracks.

(4) Inspect spider bushing and camshaft bushing for cracks and excessive wear.

(5) Replace all parts which are not in good condition.

c. Installation.

(1) Assemble camshaft bushing, two preformed packings, and inner and outer retainers to bracket in order shown.

(2) Install four screws, four washers, and four nuts to secure camshaft hushing assembly to the bracket. Tighten four nuts.

(3) Install spider bushing.

(4) Install seal and washer, slide camshaft part way through spider, and install second seal and washer on camshaft in order shown.

(5) Expand retaining ring and slide over camshaft. Install camshaft and lock in place with retaining ring.

(6) Install slack adjuster, para 4-43.

(7) Install brake shoes, para 4-41.

(8) Install wheels and drum assembly, 4-51.

(9) Adjust slack adjuster, part a of para 4-41.

(10) Lubricate camshaft, fig. 3-9.

4-45. Service and Emergency Couplings, Air Lines and Fittings

a. Test

(1) Connect air brake hose couplings from towing vehicle to semitrailer, fig. 4-51. Apply brakes and coat hose couplings, connectors, and fittings of emergency and service lines with soap and water solution. No leakage is permissible.

(2) Check air lines and fittings for restriction caused by dents or kinks.

(3) Coupling damage is usually caused 1 worn, damaged, or improperly installed packing ring Install new packing ring to stop leaks.

b. Packing Ring Replacement, fig. 4-52.

(1) Remove packing ring by prying out of coupling with screwdriver or other suitable tool.

(2) Clean groove in body. Partially collapse. packing ring with fingers and put one side of packing ring flange into groove. Use a blunt-ended tool to push ring in place. The packing ring must lie flat with no twists or bulges.

c. Repair

(1) Tighten screws holding air line clips.

(2) Tighten fittings if leaks are found. Replace lines or fittings if leaks cannot be stopped, para 4-50.

4-46. Emergency Relay Valve, Fig. 4-42.

a. Test.

(1) When the brake pedal or trailer hand brake lever of the following vehicle is depressed or applied, air is

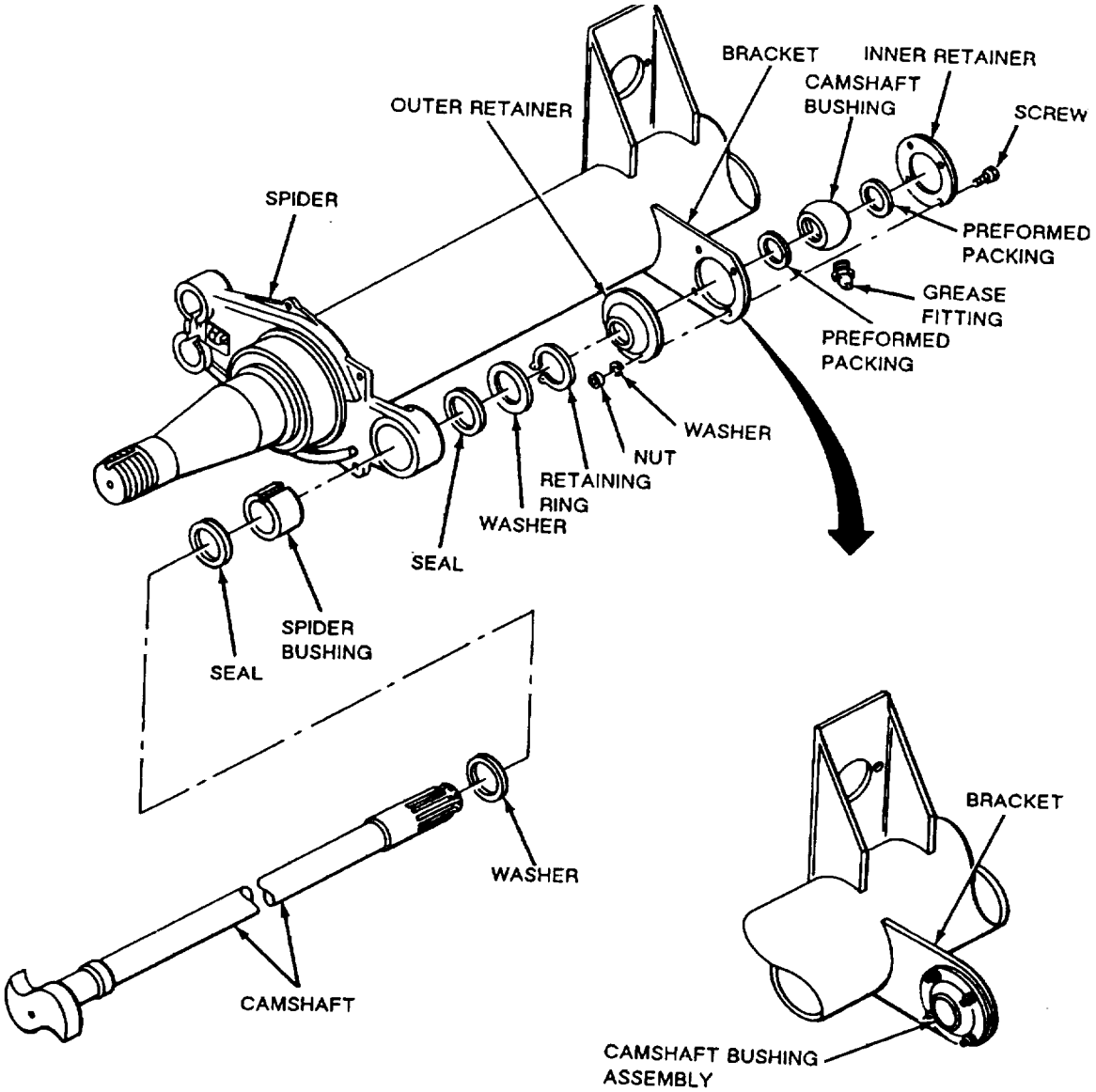


Figure 4-51. Brake Camshaft Removal and Installation

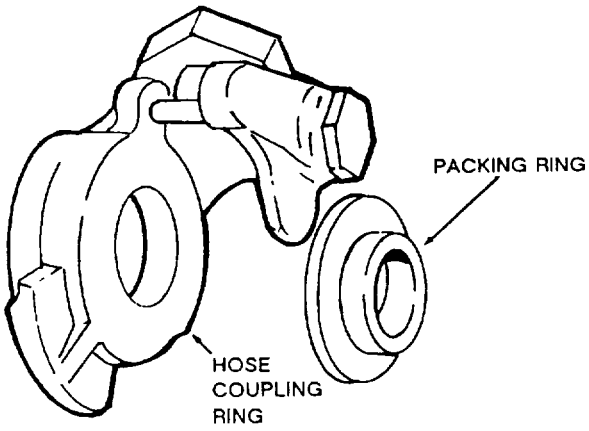


Figure 4-52. Packing Ring Installation.

delivered through the service line to the emergency lay valve.

(2) The emergency relay valve releases air from primary brake reservoir to the brake chambers to set brakes.

(3) Engage the service brake and apply so; water to exhaust port on top of the emergency re valve. If there is leakage, replace the relay valve.

(4) Apply and release the service brake several times. Listen for immediate response from the relay valve. If there is hesitation in brake application and release, replace the relay valve.

b. Replacement.

(1) Block semitrailer wheels to prevent movement.

(2) Disconnect towing vehicle and / or air brake lines and open air drain valves on bottom of both reservoirs, fig. 4-54. Leave open while replacing valve.

(3) Tag air lines for identification at assembly. Disconnect hose and tube fittings from valve. Remove double check valve and unscrew valve from nipple in reservoir.

(4) Screw new valve into nipple. Install double check valve, and reconnect hose and tube fittings.

(5) Close air drain valves in both reservoirs. Connect towing vehicle and fill the reservoir.

(6) Test service brakes and parking brakes as described in part a.

(7) Remove blocking from semitrailer wheels.

4-47. Air Reservoirs, Fig. 4-54.

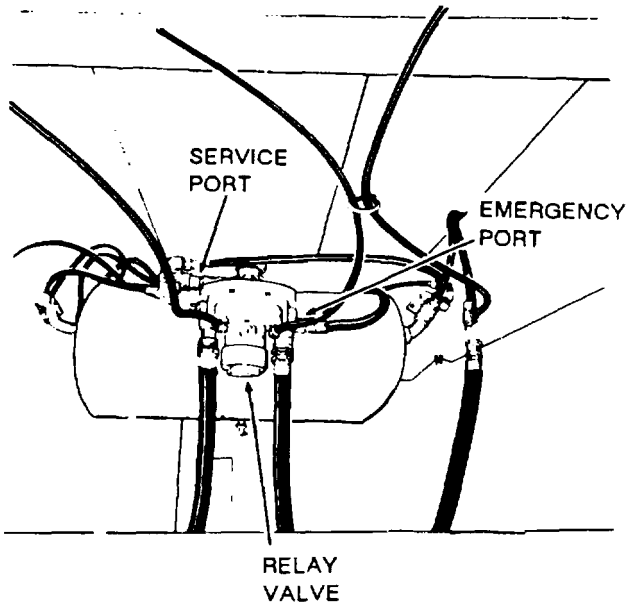


Figure 4-53. Emergency Relay valve Installation

a. Removal.

(1) Block semitrailer wheels to prevent movement.

(2) Drain air from reservoir by opening drain valves on bottom of both air reservoirs.

(3) If air drain valves are to be replaced, unscrew and replace with new ones.

(4) If rear reservoir is to be replaced, disconnect hoses and fittings to emergency relay valve. Relay mounted to a nipple on rear reservoir.

(5) Remove air fittings on each end of reservoir. Remove two mounting bolts on each end of reserve and remove reservoir. If rear reservoir is remove emergency relay valve will be removed with it. Remove relay valve by unscrewing from nipple.

b. Installation

(1) Install new reservoir, bolt in place and reconnect fittings. If rear reservoir was replaced, screw emergency relay valve onto reservoir nipple before

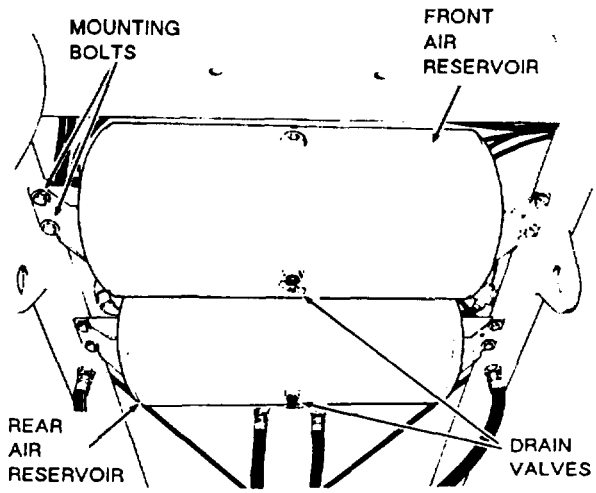


Figure 4-54. Air Reservoirs.

replacing reservoir on frame. Close air drain valves. Refill with air and check reservoir for leaks.

4-48. Pressure Protection Valve (Fig. 4-55.)

a. Test and Adjustment.

(1) Attach air system test gage to trailer "Emergency" gladhand with gage closest to trailer.

(2) Attach air supply line to valve end of test gage. Air supply can be either a tractor or stationary source.

(3) Pressurize system. Close valve on test gage when system is full. Note gage reading. Drain secondary (forward) air reservoir by opening drain valve (in bottom of reservoir. When all air has exhausted from secondary system, gage should read 75 psi. If pressure is not correct, adjust pressure protection valve as follows:

(a) Loosen locknut (4) at base of cap.

(b) Turn cap (5) clockwise to increase pressure setting.

(c) Turn cap counterclockwise to decrease setting.

(4) Repeat step (3) until desired pressure is obtained, then tighten lock nut.

(5) Remove air system test gage.

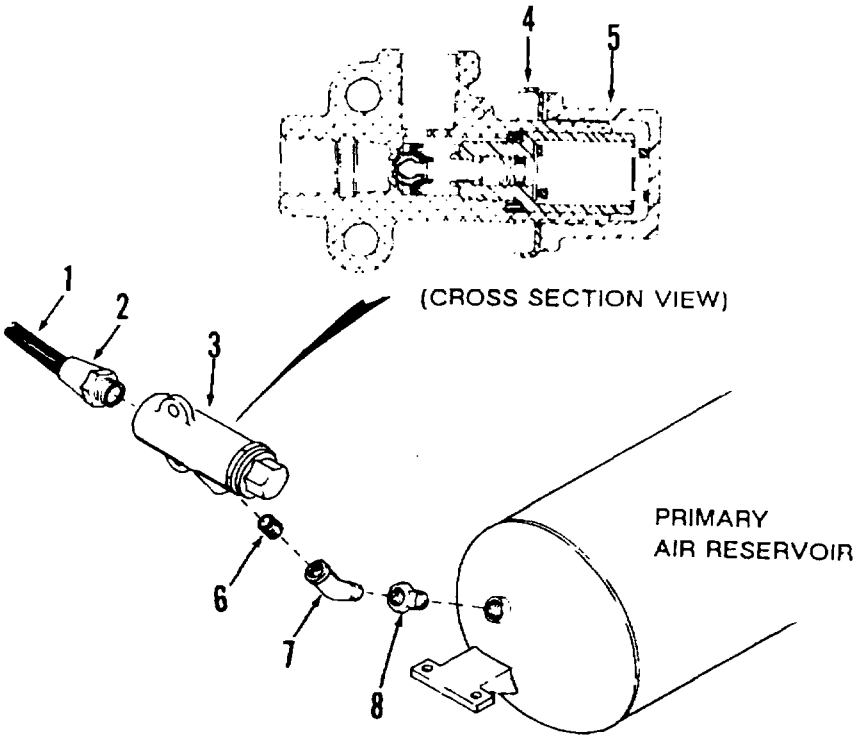


Figure 4-55. Pressure Protection Valve

b. Removal.

(1) Block semitrailer to prevent movement.

(2) Exhaust air from system by opening drain valves on bottom of air reservoirs.

(3) Remove air line (1), fig. 4-55. Also remove adapter (2) from end of valve.

(4) Unscrew valve (3) from nipple (6).

(5) Remove elbow (7) and bushing (6) from air reservoir if replacement is necessary.

c. Repair. No repair is authorized for the pressure protection valve. Replace valve if malfunction occur

d. Installation.

(1) Apply antiseize tape (item 28, Appendix to male threads and install new nipple (6) in side port valve. Turn valve and nipple into elbow (7) on air reservoir.

(2) Install air line (1) and adapter (2) on vale

(3) Test and adjust valve (step a)

(4) Remove blocking from semitrailer wheels.

4-49. Parking Brake Control Valve, Fig. 4-56.

a. General. The parking brake control valve is basically an off-on, push-pull control valve. Its function is to release the fail-safe (spring) brakes for semitrailer movement by other than a towing vehicle.

(1) The valve can only be used when all air has been exhausted from the rear (primary) reservoir.

(2) In the OUT position, the valve is closed, allowing springs in the fail-safe chambers to apply braking pressure.

(3) In the IN position, air is delivered from the front (secondary) reservoir to the fail-safe chamber, compressing the spring and releasing the brakes.

(4) When the trailer is connected to a towing vehicle, air from the emergency line is applied to the pilot port of the valve, maintaining the OUT position. However, air from the emergency line is also directly applied to the fail-safe chamber, compressing the spring during normal towing operation.

b. Test. Internal leakage in the valve is indicated if the spring brakes do not apply when the button is pulled out and the system is at full pressure. External

leakage can be detected by applying soapy water around the valve stem. No leakage is permitted. If the valve leaks, or does not operate, replace valve.

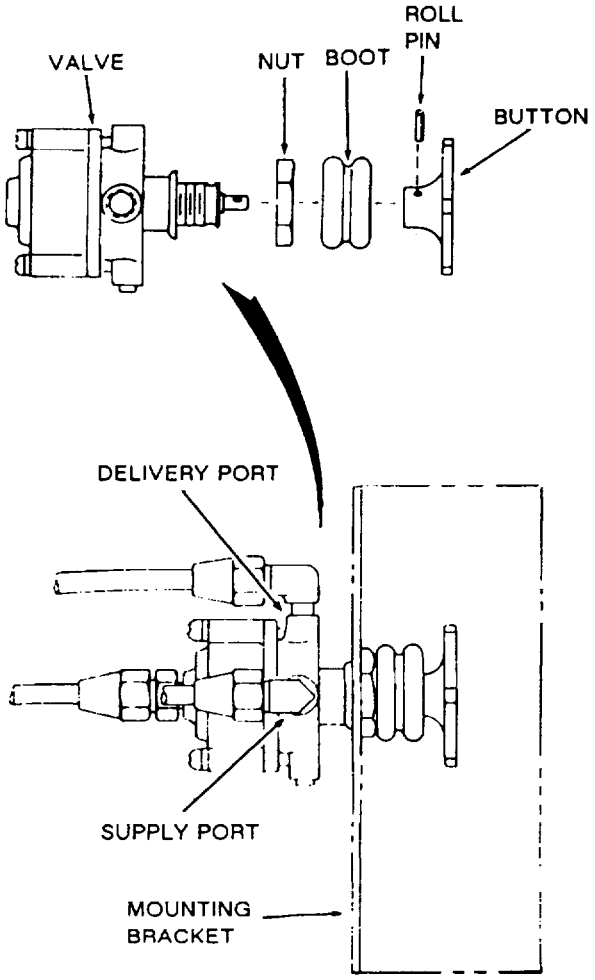


Figure 4-56. Parking Brake Control Valve Installation.

c. Removal

(1) Block semitrailer wheels to prevent movement.

(2) Exhaust air from system by opening drain valves on bottom of air reservoirs.

(3) Tag and disconnect air lines from elbow and adapter on control valve.

(4) With a small drift and hammer, remove roll pin which secures button to stem of control valve. Remove button.

(5) Remove nut (in neck of valve) and pull the control valve from the mounting bracket.

(6) Remove fittings from valve ports.

d. Repair. No repair is authorized for the parking brake control valve. If malfunction or leakage is indicated, replace the complete valve.

e. Installation.

(1) Install fittings on valve ports. Use antiseize tape (item 28, Appendix E) on male pipe threads. Remove button and nut from control valve so that valve can be inserted into mounting bracket.

(2) Position control valve in mounting bracket. Install nut on neck of control valve and tighten securely.

(3) Install button on end of valve stem. Aline hole in button with hole in stem and install roll pin.

(4) Connect air lines to fittings on valve ports and remove tags.

(5) Remove blocking from semitrailer wheels.

4-50. Air Lines, Valves, and Fittings

a. General. The general arrangement of the air brake system on the semitrailers is shown in fig. x4-57. Nylon tubing connects the gladhands on front of semi-trailer to the brake relay valve on rear air reservoir. Clips fasten the tubing to the underside of the tank and to the frame members. Grommets are installed to protect the tubing where it passes through the frame and cross members. Hoses and tubing connect the brake chambers to the reservoirs and relay valve.

b. Maintenance. Visually inspect for damage to air lines, loose clips, or missing grommets. Also check the following:

(1) Brake hoses should he looped in a way that prevents the hoses from hanging below the axle.

(2) Separators on brake hoses should he positioned to prevent brake hoses from rubbing against axles or other brake hoses.

(3) Clips should be bent down securely on tubing.

c. Replacement of Nylon Tubing.

(1) Block semitrailer wheels to prevent movement.

(2) Exhaust air from system by opening drain valves on bottom of air reservoirs.

(3) Disconnect tubing from fitting and remove the insert, compression sleeve and nut on both ends tubing. Release the clips and pull tubing through grommets.

NOTE

Tubing is stocked in bulk lengths. Measure original tubing and cut new tubing to same length.

(4) Install tubing on semitrailer and bend clips down securely to hold tubing in position.

(5) Trim ends of tubing to get a smooth, square cut. Slide tubing nut on end of tube. Slide compression sleeve over end of tubing. Install tubing insert. Connect tubing to adapter fitting and tighten tubing nut securely. Do the same procedure on both ends.

(6) Check replaced tubing for leaks. No leaks are permitted.

(7) Remove blocking from semitrailer wheel.

d. Air Line Fittings. Use antiseize tape (item 28, Appendix E) on all male pipe threads. Take care not to let any of the tape get into the system.

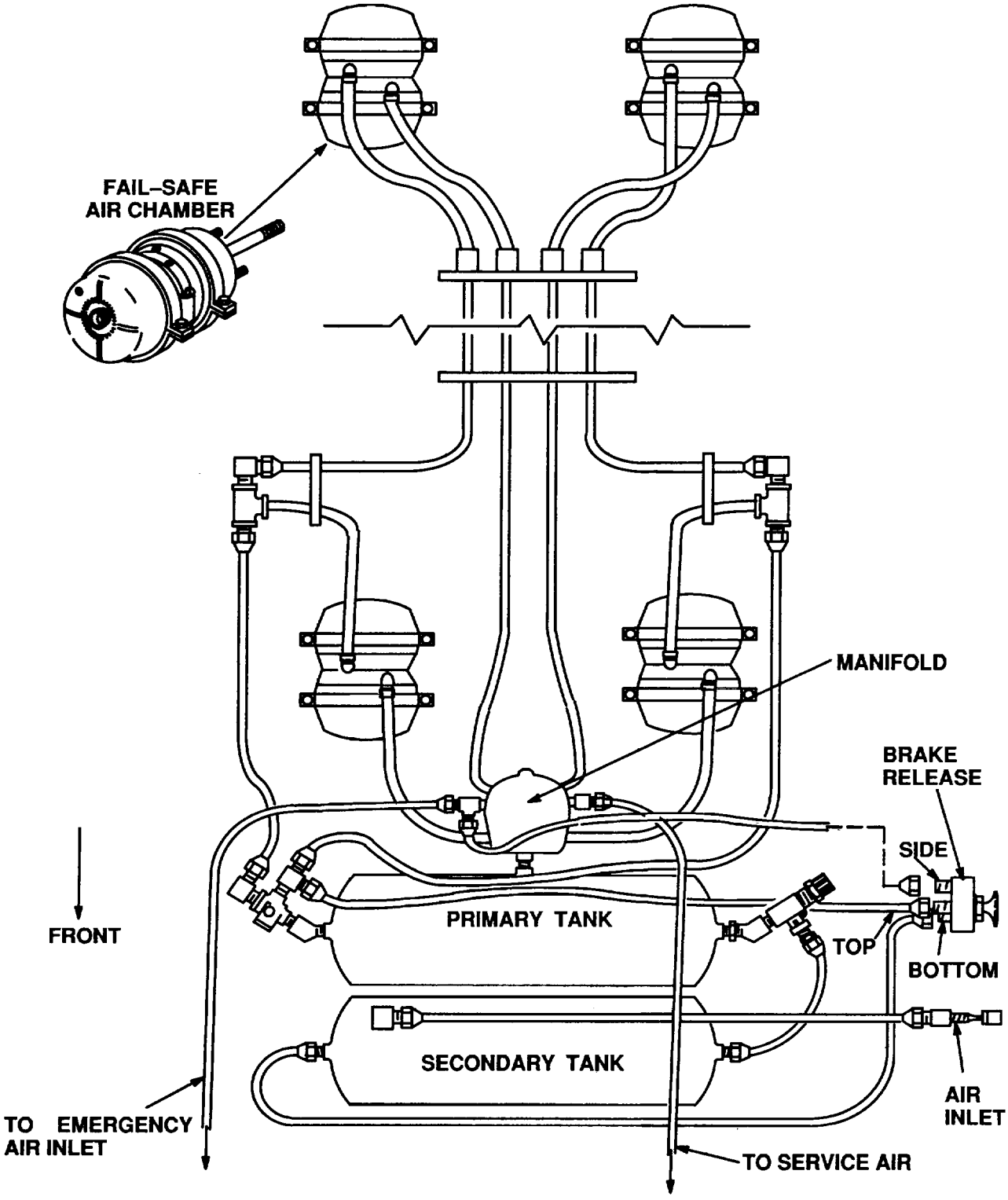


Figure 4-57. Brake Schematic

Section XVI. MAINTENANCE OF WHEELS, HUBS, AND DRUMS

4-51. Wheels, Hubs, and Drums

a. Tire and Wheel Replacement, Fig. 4-58.

(1) *Removal.* Block any of the tires that are no being removed. Jack up axle until tire is clear of ground Support axle with jack stand or blocking. Remove outer stud nuts. Remove tire and wheel assembly. If inner tire must be removed, remove the ten inner stud nuts, and remove inner tire and wheel assembly.

(a) Repair tubes, para 4-52.

(b) Refer to general support maintenance for repair of tires.

(3) *Installation.* Position inner wheel over studs on axle hub. Replace ten inner stud nuts, lower tire to ground, and tighten to 450-500 lb-ft using sequence in figure. Jack up axle and position outer wheel over inner stud nuts. Lower tire to ground, and using sequence in fig. 4-59. Tighten nuts to 450 to 500 lb-ft.

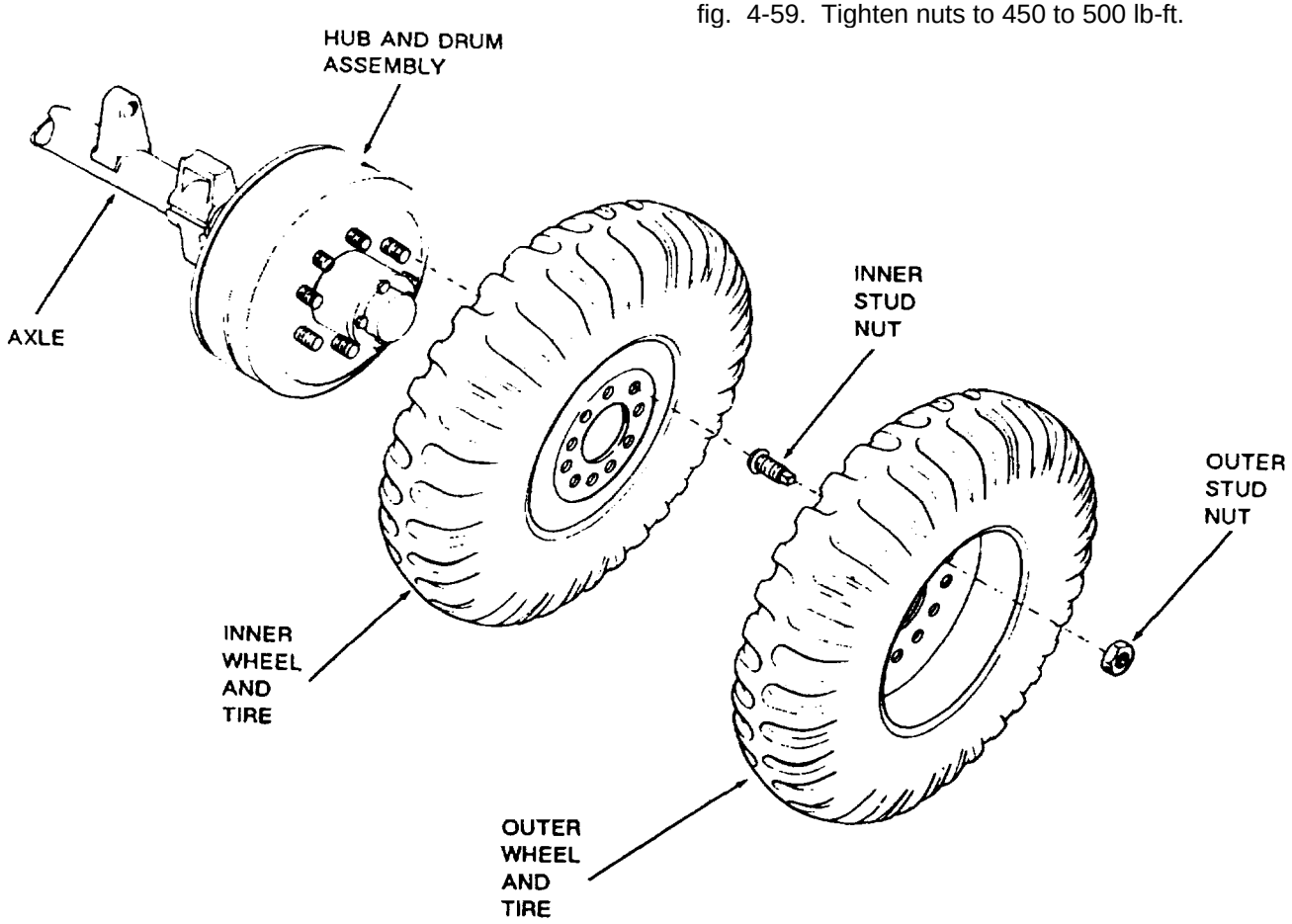


Figure 4-58. Replacement of Tires and Wheels.

b. Removal of Tires, Wheel, Hub. And Drum as an Assembly

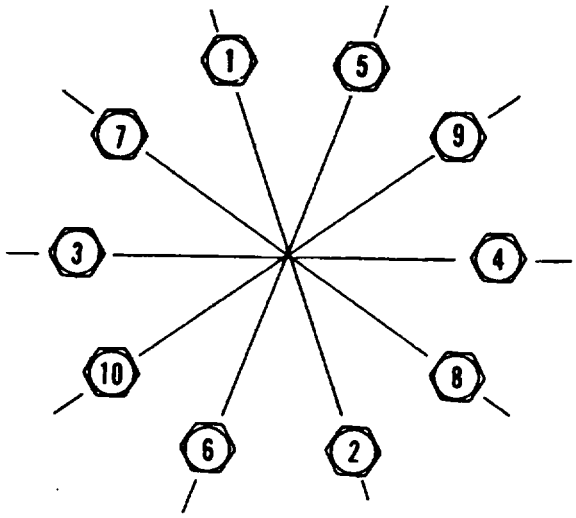


Figure 4-59. Tightening Order for Wheel Stud Nuts.

(1) Block any of the tires that are not being removed.

WARNING

The fail-safe chamber power spring must be manually compressed and the air reservoirs must be vented of pressure before removal of hub and drum assembly.

(2) Manually compress fail-safe chamber power spring, para NO TAG

(3) Release air pressure by opening drain valves on both air reservoirs, fig. 4-54.

(4) Jack up axle until tires are clear of ground. Support axle with jack stand or blocking.

(5) Remove six bolts and lockwashers securing hub cap to hub, fig. 4-60. Remove hub cap and hub cap basket. Discard gasket.

(6) Remove outer wheel bearing nut, wheel bearing washer, lock ring, and inner wheel bearing nut.

(7) Place wheel lift jack under wheel and raise jack until weight is removed from bearing.

(8) Remove outer wheel bearing cone.

(9) Remove tires, wheels, hub and drum as an assembly.

c. Replacement of Wheel Bearings, Fig 4-60.

(1) *Removal.*

(a) Remove tires, wheels, hub, and drum as an assembly *(b* above).

(b) Remove seal with a seal puller and remove inner wheel bearing cone, fig. 4-60.

(2) Inspection and Repair.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

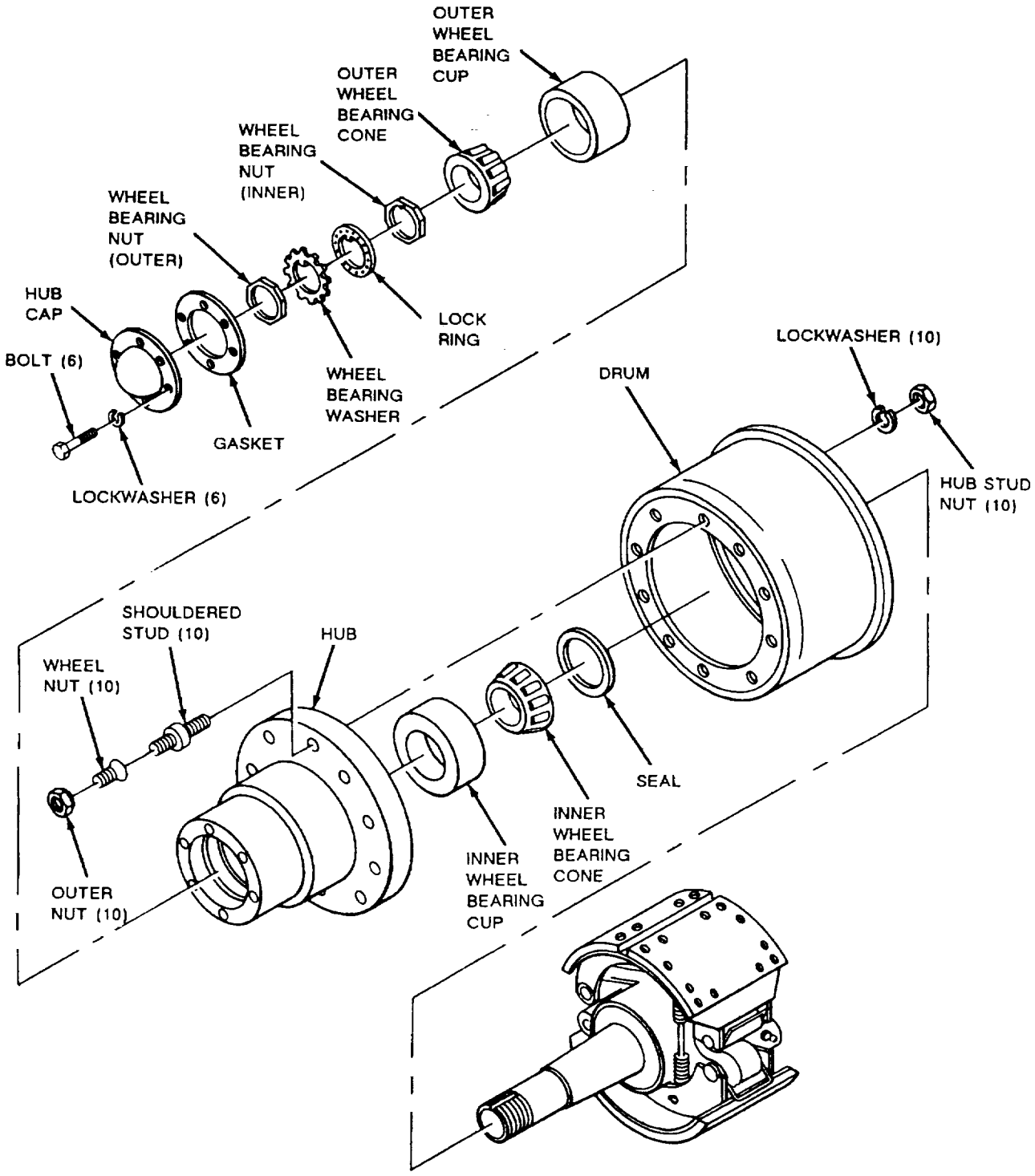


Figure 4-60. Hub, Drum, and Wheel Bearings

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). Wear protective clothing (goggles and gloves) and use caution to avoid injury to personnel.

CAUTION

Do not clean parts with gasoline, In a hot solution tank, or with water and alkaline solutions. Separate wheels and hub before cleaning. Dry cleaning solvent will deteriorate the tires.

Do not spin bearings with compressed air.

(a) Thoroughly clean all parts with d cleaning solvent (item 11, Appendix E) and a stiff fiber brush. Ensure that parts are completely dry. use low pressure compressed air to dry parts, if available.

NOTE

If wheel bearings need replacing, bearing cups must also be replaced (Step d).

(b) Inspect wheel bearings for cracks breaks in bearing cage, etching or pitting on roller surfaces faces, and any evidence of wear. Replace if worn damaged.

(c) Pack bearings from large end of cone with grease (item 17, Appendix E), ensuring that cavities between rollers and cage are filled. Cover beings with a clean, lint-free rag until time to install.

(d) Inspect bearing cups in hub for pit grooves, or flaking. If damaged, use a puller to remove. Drive in new bearing with a suitable driver.

(e) Inspect hub cab for damage to flange that would allow water to leak into wheel bearings. R place if damaged.

(f) Replace hub cab gasket.

(g) Check threads of studs, screws, and nuts for damage.

(h) Inspect brake drum for pitting or scoring. Inspect hub bearing surface for damage. If brake drum is damaged, notify direct support maintenance for repair.

(3) Installation, Fig. 4-60.

(a) Ensure that the spindle is thoroughly clean. Apply light coat of grease.

(b) Install inner seal using seal replacement tool.

(c) Install tire, wheel, hub, and brake drum assembly (step g).

g. Installation and Adjustment of Tires, Wheels, Hub, and Drum as an Assembly

NOTE

Jack may be adjusted to compensate for hub spindle misalinement when Installing hub to spindle.

(1) Position hub and drum assembly on spindle with tires resting on greased plate. If drum binds on brake shoes when partially installed, adjust brake shoes to reduce brake shoe spread. Push hubs fully onto spindle.

(2) Jack wheel completely off ground.

(3) Tighten inner bearing nut to 200 lb-ft while rotating hub and drum assembly.

(4) Back off inner bearing nut approximately 1/4 to 1/3 turn so dowel on nut will aline with hole in lock ring when tab on lock ring is positioned on axle spindle keyway. Install lock ring, wheel bearing washer, and outer wheel bearing nut. Tighten outer wheel bearing nut to 200-225 lb-ft.

(5) Apply a light coat of grease (item 17, Appendix E) to new hub cap gasket and position gasket on hub.

(6) Install hub cap and secure with six bolts and lockwashers. Tighten bolts to 16-20 lb-ft.

(7) Pressurize air system by attaching towing vehicle air lines to semitrailer and starting towing vehicle engine.

(8) Adjust brakes (para 4-34).

(9) Manually release fail-safe chamber power spring (para 2-4).

(10) Remove any blocking from tires.

h. Wheel Studs

(1) Removal, Fig. 4-60.

(a) Remove wheels and tires.

(b) Remove six bolts and lockwashers fasten the hub cap to the hub. Remove hub cap and gasket.

(c) Using wheel bearing nut wrench move outer wheel bearing nut, wheel bearing was lock ring, and inner wheel bearing nut.

(d) Remove outer wheel bearing cone

(e) Remove hub and drum from axle spindle being careful not to damage seal.

(f) Remove nuts, lockwashers, and broken studs from hub and drum.

(2) Installation, Fig. 4-60.

(a) Install studs (short side from shoulder facing out) into hub and drum and secure studs lockwashers and nuts.

(b) Install hub and drum onto axle spindle.

(c) Pack bearing from large end of cone with grease (item 17, Appendix E) making sure all cavities between rollers and cup are filled.

(d) Install outer wheel bearing cone in hub.

(e) Install inner bearing nut, lock ring, wheel bearing washer, and outer wheel bearing nut, but do not tighten.

(f) Install wheels and tires and adjust wheel hearings.

4-52. Tire and Tube

a. Service. Gage tires for correct pressure. For hard surface roads, inflate to 70 psi; for cross-country and sand, inflate to 35 psi.

b. Inspection. Remove objects such as nails or glass. Check for apparent loss of air, unusual wear, or missing valve caps. Replace as required.

c. *Repair.* Refer to TM 9-2610-200-24 for instructions on dismounting, repair, and mounting of tire and tube on rim.

Section XVII. MAINTENANCE OF FRAME AND TOWING ATTACHMENTS

4-53. Upper Coupler/Kingpin Assembly

a. Service.

(1) Remove dust, dirt, and old grease from kingpin.

(2) Grease liberally with clean grease (item 17, Appendix E).

(3) Check tightness of bolts holding plate to frame. If bolts are loose, tighten them to 140 lb-ft.

(4) For replacement of bolt-on upper coupler (kingpin) assembly, refer to direct support maintenance.

4-54. Spare wheel Carrier, Fig. 4-61.

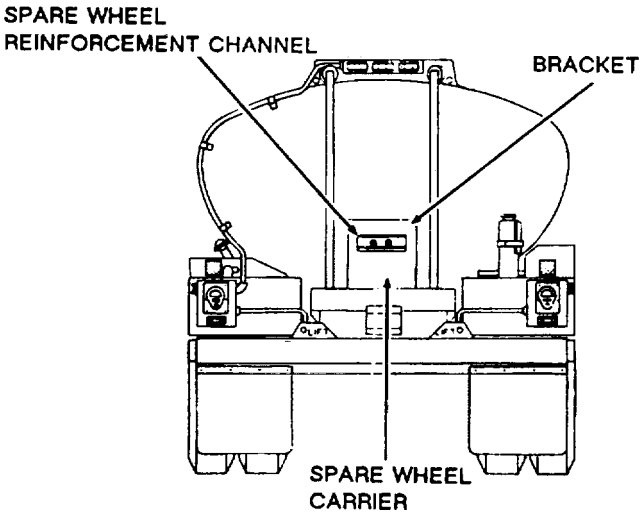


Figure 4-61. Spare Wheel Carrier

WARNING

Type 1 Dry cleaning solvent P-D-680 Is toxic and flammable. The solvent's flash point is 100°F-138°F (38°C-59°C). In a hot, arid environment, type 2 solvent, which has a higher flashpoint, should be used. When using either type, observe the following:

Always wear chemical splash goggles, full face shield, nitrile rubber or polyvinyl alcohol gloves and protective apron. Contact nearest safety office or industrial hygienist for guidance on appropriate respiratory protection.

Adequate ventilation must be provided. Work should be performed out of doors or In a well ventilated area. If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help.

Avoid solvent contacts with skin, eyes and clothes and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. If solvent contacts eyes or skin, immediately wash the effected area. Eyelids should be held open during washing. Seek medical attention Immediately. Continue eye washing during transport to medical treatment facility.

a. Service. Clean with water and stiff brush. Use dry cleaning solvent (item 11, Appendix E) to degrease.

b. Replacement. If bracket needs replacing, notify direct support maintenance.

c. Repair. Repair is limited to straightening bracket.

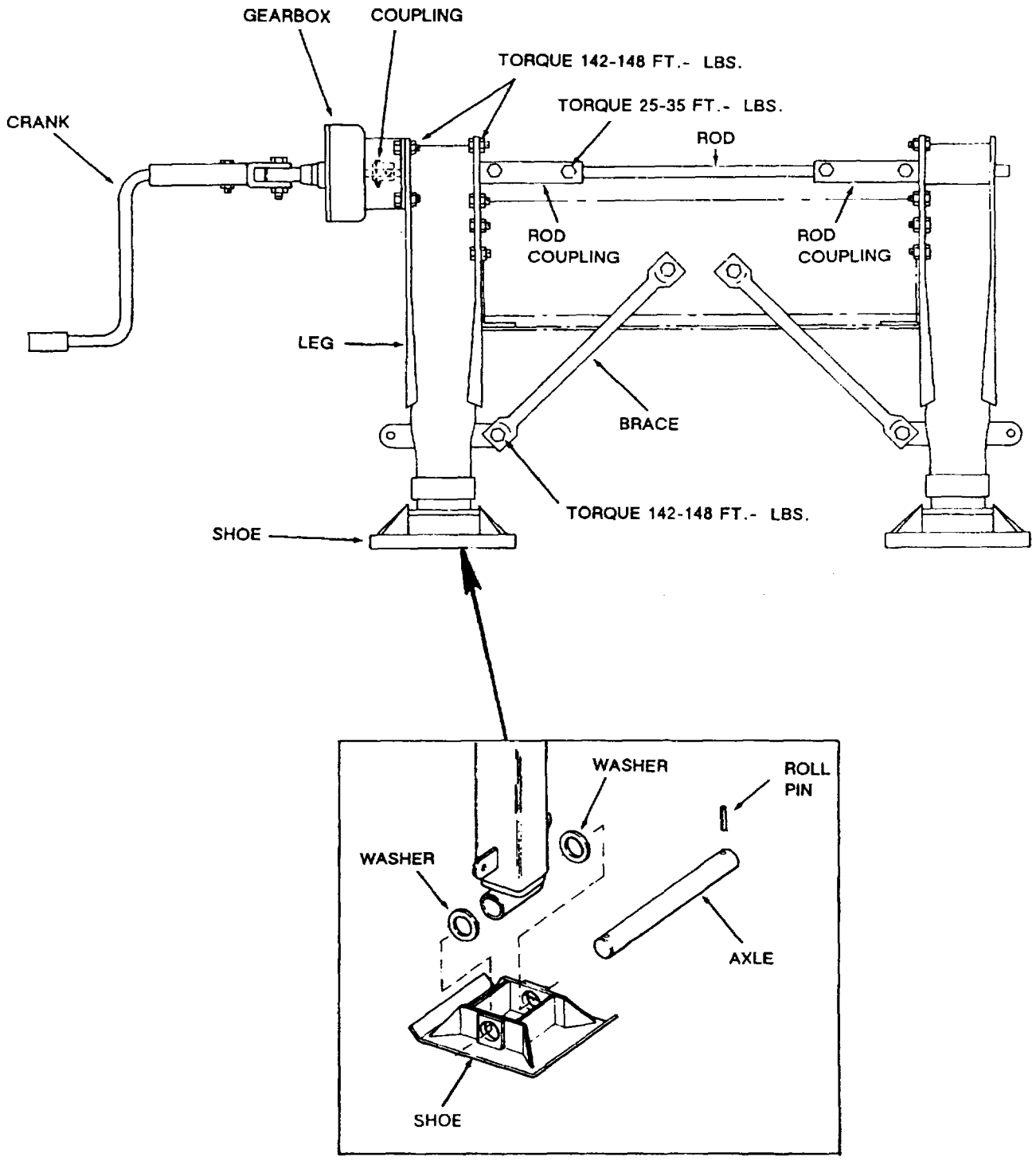


Figure 4-62. Landing Gear Installation

4-55. Landing Gear, Fig. 4-62.

a. Removal of Landing Gear Shoe.

(1) Block wheels to prevent semitrailer movement. Lift front end of semitrailer with jacks, and block securely.

(2) Remove roll pins and outer washer from lower ends of leg assembly and axle.

(3) Pull axle from shoe to be removed. Remove shoe.

b. Installation of Landing Gear Shoe.

(1) Position shoe at end of landing gear leg assembly. Insert axle through one side of shoe, through inner washer, leg, other inner washer, and through other side of shoe.

(2) Reinsert outer washers and roll pins.

(3) Remove jacks and blocking.

c. Removal of Landing Gear Leg Assembly.

(1) Remove shoe of leg to be removed (para *a)*

(2) Remove two capscrews, lockwashers, and nuts which attach braces to the leg assembly. Remove capscrew, lockwasher, and nut attaching rod coupling to leg. If rod and brace cannot be moved out of way loosen nuts on ends of brace attached to semitrailer frame.

(3) If leg with gear box is to be removed, re move capscrew, washer, and nut that attaches coupling to leg. Remove four mounting capscrews, washers, and nuts, and remove gearbox assembly and coupling.

(4) Remove eight capscrews, washers, and nut securing leg to semitrailer frame. Remove leg.

d. Installation of Landing Gear Leg Assembly.

(1) Position leg assembly onto semitrailer frame. Attach with eight capscrews, washers, and nuts

(2) Position gearbox assembly and coupling or landing gear leg. Install two mounting capscrews washers, and nuts.

(3) Fasten coupling to operating shaft with capscrew, washer, and nut.

(4) Attach brace to leg assembly with capscrew, lockwasher, and nut.

NOTE

Ensure that legs are extended equally before holes are alined and screw Inserted in rod coupling.

(5) Attach rod coupling to leg assembly with a capscrew, lockwasher, and nut.

(6) Install shoe on leg assembly (para *b).*

4-56. Board Assembly, Landing Gear, Fig. 4-63.

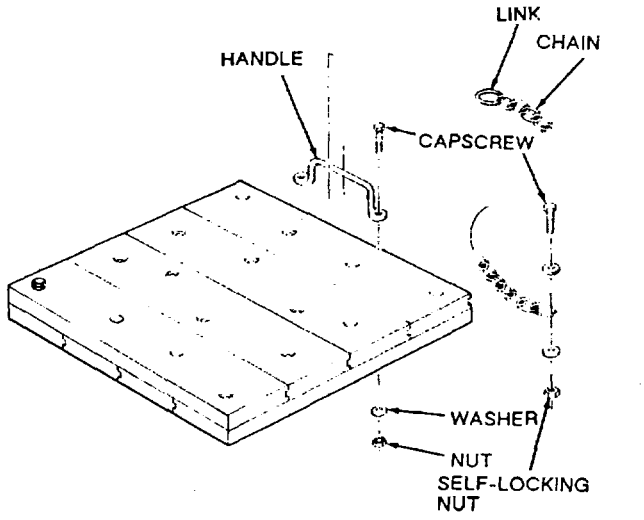


Figure 4-63. Ground Board Assembly.

a. Replace board assembly by removing two screws, washers, nuts, handle, and removing chain from handle. Attach chain to handle and secure handle to board assembly with two screws, washers, and nuts.

b. Replace chain assembly by removing chain from bracket and board handle. Attach chain to bracket and handle.

Section XVIII. MAINTENANCE OF TANK BODY PARTS

4-57. Brackets, Splash plates, and Mudflaps, Fig. 4-64.

a. Removal.

(1) Remove three bolts and nuts holding front splash plate to frame.

(2) Remove four bolts, washers, and nuts from bracket holding mudflaps to rear bumper.

b. Installation.

(1) Position front splash plate and fasten to frame with three bolts and nuts.

(2) New mudflaps are stocked in one size only. Cut and drill the mudflaps using the dimensions shown in figure 4--64.

(3) Put mudflaps in position, place bracket on top side of mudflaps, and fasten to rear bumper with four capscrews, washers, and nuts.

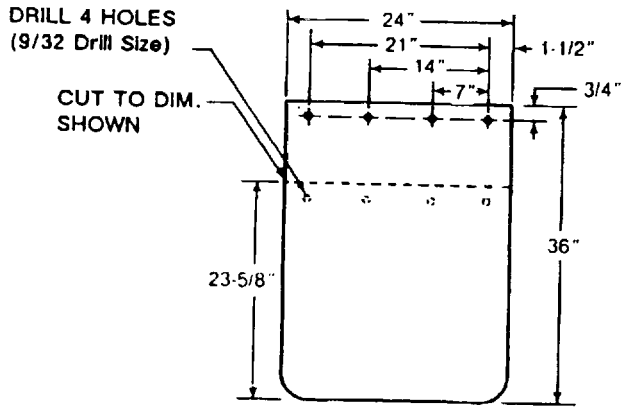


Figure 4-64. Mudflap Modification

4-58. Tank Body, Fig. 4-65.

Damage to the tank body and evidence of leaks and bent or broken metal parts will be reported to the responsible maintenance level for correction.

4-59. Ladder and Drain, Fig. 4-65.

a. Inspection.

(1) Check ladder and drain pipe connections on top of semitrailer to ensure that drain holes are open and free of debris.

(2) Check bolts for tightness at top of semi-trailer and at bottom.

(3) Check welds on bolt flange on both top and bottom to make sure they are not loose or cracked.

b. Service.

(1) Remove any debris from top of semitrailer that may plug drain holes.

(2) Tighten bolts if loose.

(3) If any welds are cracked or loose, notify direct support maintenance for repair.

c. Replacement.

(1) Ladder. Remove eight capscrews and nuts and remove ladder. Install and position new ladder on tank. Secure with eight capscrews and nuts.

(2) *Drain Pipes.* Remove four capscrews and nuts on each drain pipe. Remove drain pipe. Install and position new drain pipe on tank, and secure with four capscrews and nuts.

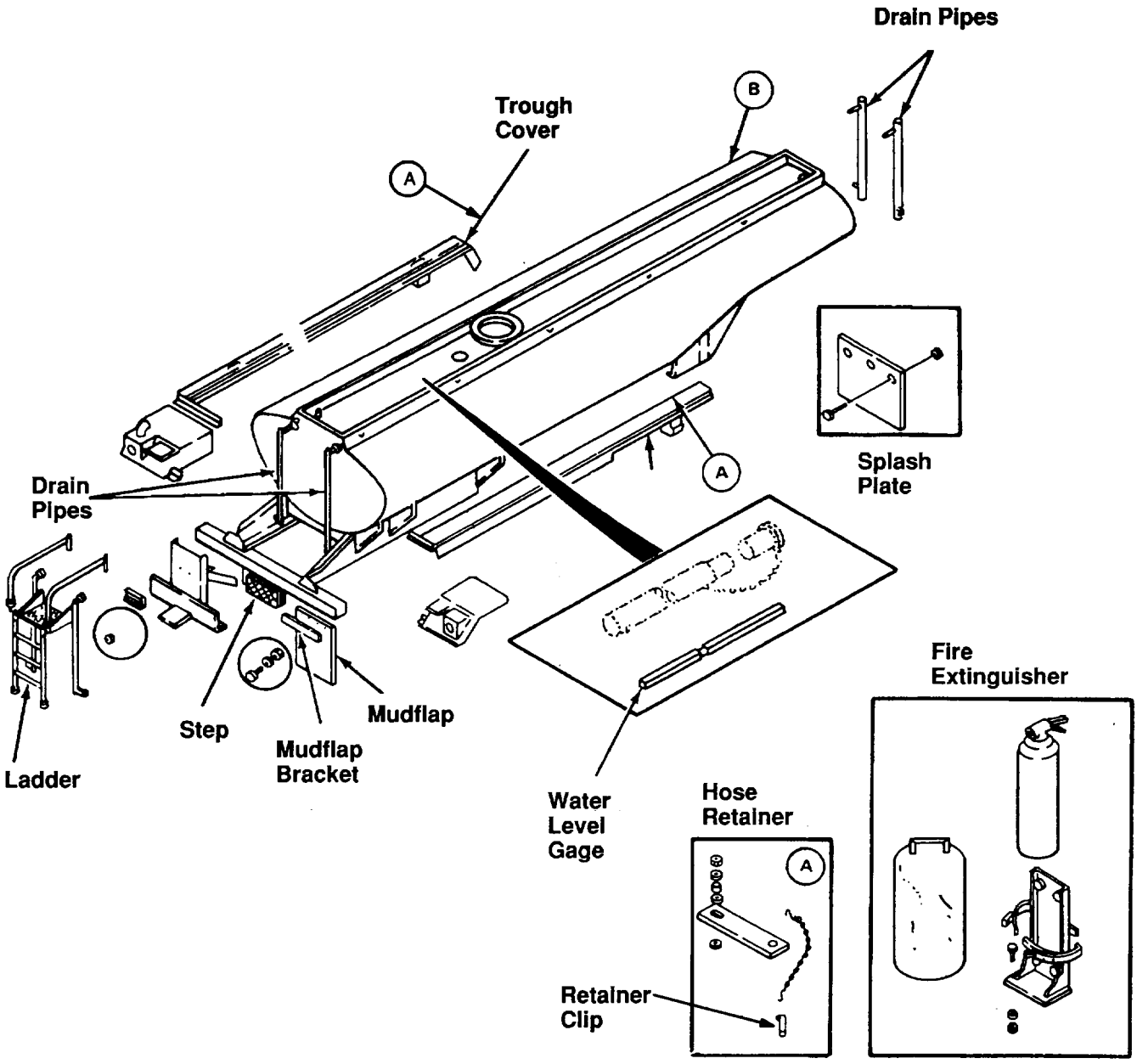


Figure 4-65. Tank Body Parts

4-60. Miscellaneous Body Parts, Fig. 4-66.

a. Vent Caps.

(1) If leakage is evident at vent cap, remove vent cap and gasket. Discard casket.

(2) Apply antiseize tape (item 28, Appendix E) to threads of pipe nipple.

(3) Install new gasket inside vent cap.

(4) Install vent cap and tighten securely using a pipe wrench.

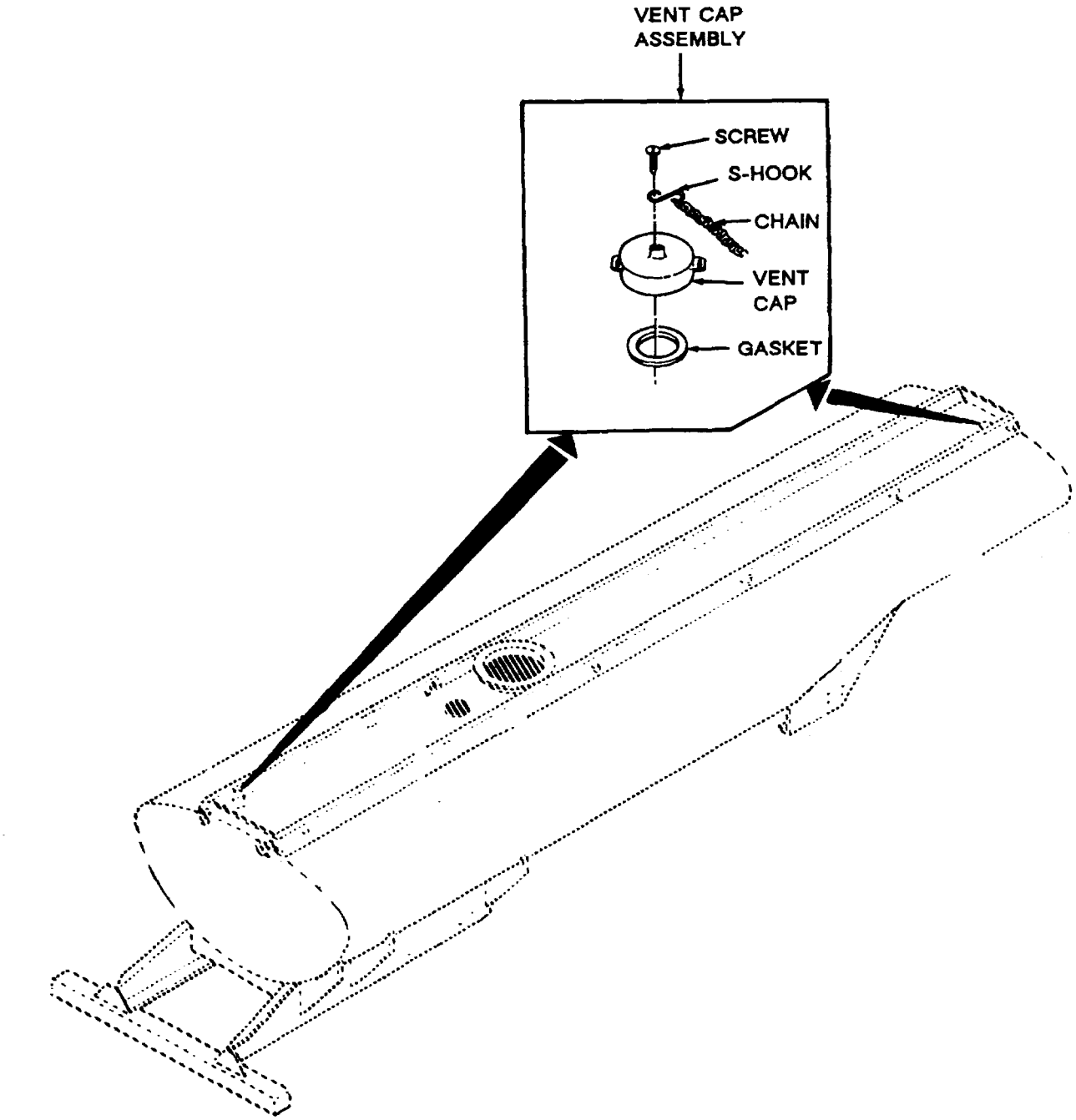


Figure 4-66. Vent Caps.

4-61. Tool Box, Fig. 4-67.

a. Replacement.

NOTE

On some semitrailers, tools box may be tack welded in position. Break weld with a cold chisel to remove tool box. Do not reweld when installing tool box.

(1) Remove tool box contents and set aside.

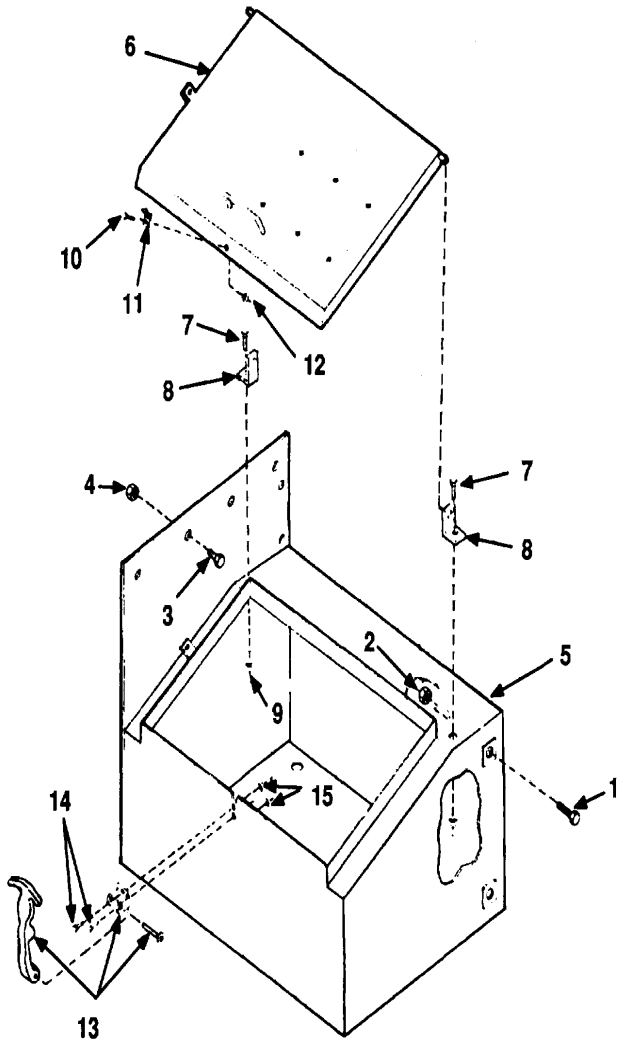
(2) Place a support under tool box to support it when mounting screws are removed.

(4) Remove two capscrews (1) and nuts (2).

(5) Remove four capscrews (3) and nuts (4), and remove tool box (5).

(6) Install tool box by reversing steps (1) through (5).

b. Disassembly and Assembly. Remove and install any items that need replacement, fig. 4-67.



1. Capscrew (2)
2. Nut (2)
3. Capscrew (4)
4. Nut (4)
5. Tool Box
6. Cover
7. Capscrew
8. Angle (2)
9. Nut (2)
10. Screw
11. Catch
12. Nut
13. Rubber Catch
14. Screw (2)
15. Nut (2)

Figure 4-67. Tool Box

4-62. Manhole and Fill Cover, Fig. 4-68.

WARNING

Always relieve pressure In tank shell before opening manhole cover.

a. Adjustment (Fig. 4-65).

(1) Remove padlock, release safety latch (13) and open fill cover (7).

(2) Loosen locknut (5) on underside of fill cover and close fill cover.

(3) Loosen or tighten adjusting bolt (14) in center of strongback until latch just clears the secondary latch on end of strongback.

(4) Open fill cover (7) and tighten locknut (5).

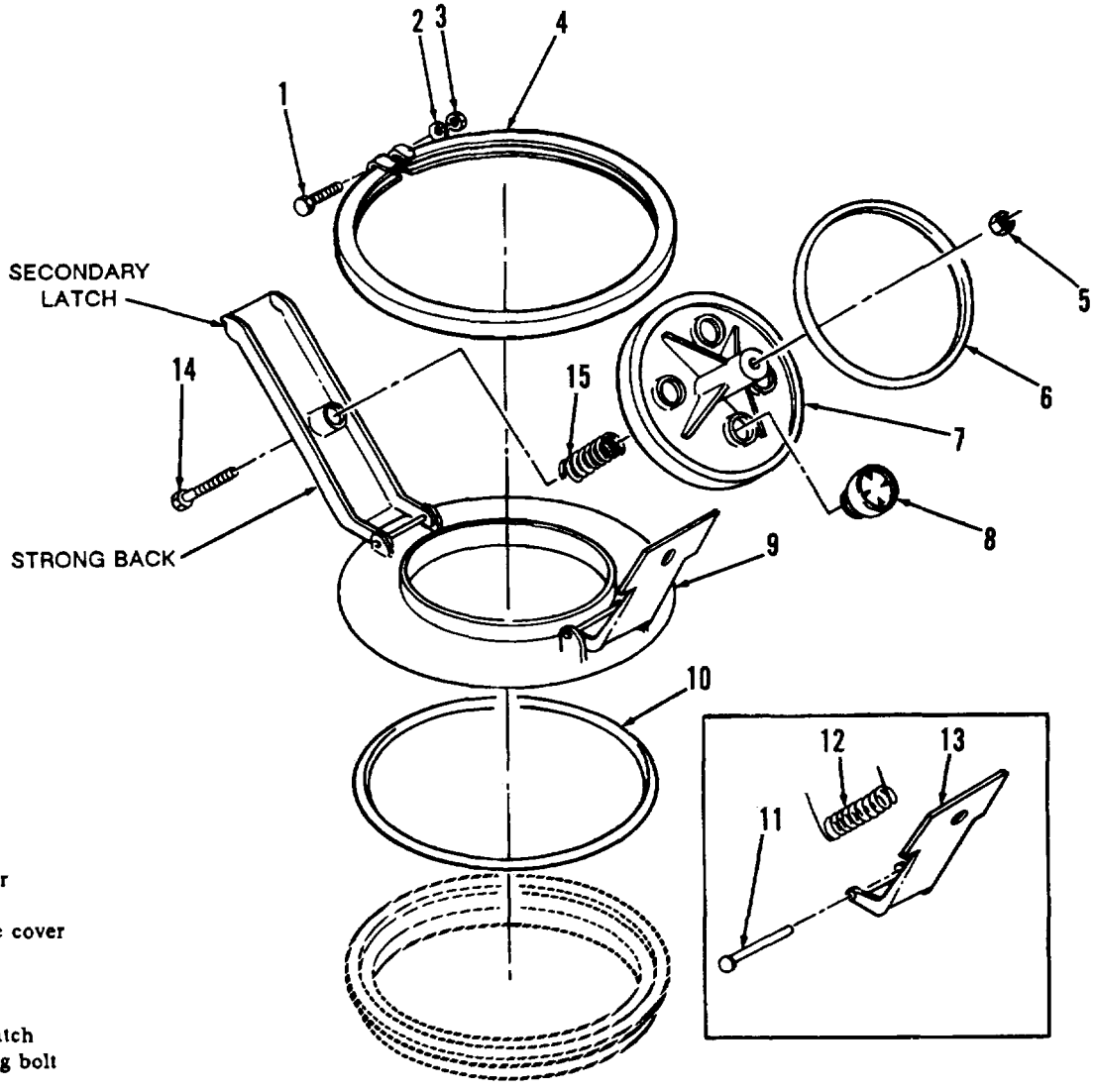
(5) Close cover and recheck clearances of latch and strongback.

b. Removal.

(1) Remove bolt (1), washer (2), and nut (3) that holds manhole clamp (4) to semitrailer.

(2) Remove clamp ring to free manhole cover (9) and gasket (10).

c. Disassembly.



1. Bolt
2. Washer
3. Nut
4. Clamp
5. Locknut
6. Gasket
7. Fill cover
8. Vent
9. Manhole cover
10. Gasket
11. Pin
12. Spring
13. Safety latch
14. Adjusting bolt
15. Spring

Figure 4-68. Manhole and fill Cover.

(1) Remove locknut (5) and remove fill cover (7), adjusting bolt (14), and spring (15).

(2) Remove vent (8) and gasket (6) from cover (7). If gummed up with product, or if there signs of obvious damage, replace vent.

(3) Using a punch and hammer, drive pin (11) from safety latch (13). Remove spring (12).

d. Assembly.

(1) Position safety latch (13) and spring (12) manhole cover (9). Install pin (11). Peen end of pin to cure safety latch to manhole cover.

(2) Install gasket (6) and vent (8) to fill cover (7).

(3) Install assembled fill cover to manhole (9) using adjusting bolt (14), spring (15), and locknut (5).

(4) Adjust (step *a).*

e. Installation.

(1) Position manhole cover gasket (10). Set manhole cover (9) in place and retain with clamp (4).

(2) Secure clamp with bolt (1), washer (2), and nut (3).

Section XIX. MAINTENANCE OF BODY ACCESSORY ITEMS

4-63. Bulk Transfer Hose Assembly

a. Removal. Remove retainer clips from hose retainers, slide bar aside, and remove hose from trout fig. 4-65.

b. Installation. Put hose in trough, move bar into position, and attach retainer clip.

4-64. Water Level Cage

If wooden fuel gage is unreadable or broken, replace. If cap, chain, or storage tube is missing or damaged, replace.

4-65. Reflectors

a. *General.* Reflectors are located on the front, near the marker lights, and on both ends of the hose trough

b. Replacement.

(1) Remove old reflector off semitrailer. Clean surface thoroughly.

(2) Place new reflector in position.

4-66. Identification and Instruction Plates, Para 1-9.

NOTE

Some instruction plates have been mounted with rivets. Drill rivets out and replace with proper machine screw.

a. Removal. Remove screws holding plates to semitrailer.

b. Installation. Fasten new plates to semitrailer with screws.

4-67. Fire Extinguisher Mounting Bracket.

a. Service. Check tightness of mounting bolts and for damage to retainer bracket.

b. Replacement.

(1) Remove protective cover and fire extinguisher.

(2) Remove four self-locking nuts, flatwashers and capscrews. Remove mounting bracket.

(3) Install new mounting bracket and fasten with four capscrews, flatwashers, and self-locking nuts.

(4) Install fire extinguisher and protective cover.

Section XX. PREPARATION FOR STORAGE OR SHIPMENT

4-68. General

a. This section contains requirements and procedures for administrative storage of equipment that issued to and in use by Army activities worldwide.

b. The requirements specified herein are necessary to maintain the equipment in administrative storage in such a way as to achieve the maximum readiness, condition.

c. Equipment that is placed in administrative storage should be capable of being readied to perform its mission within a 24-hour period, or as otherwise prescribed by the approving authority.

d. Report equipment in administrative storage prescribed for all reportable equipment.

e. Perform inspections, maintenance services, and lubrication as specified herein.

f. Records and reports to be maintained for equipment in administrative storage are those prescribed by DA PAM 738-750, for equipment in use.

g. When determining maintenance actions required, 10% variance is acceptable on time, running hours, or mileage.

h. Accomplishment of applicable PMCS, as mentioned throughout this section, will be on a quarterly basis.

4-69. Scope and Criteria of Administrative Storage

a. The placement of equipment in administrative storage can be for short periods of time when a shortage of maintenance effort exists.

b. Items should be ready for use within the time factors determined by the directing authority.

c. During the storage period appropriate maintenance records will be kept.

4-70. Preparation of Equipment for Administrative Storage

a. Storage Site.

(1) Select the best available site for administrative storage. Separate stored equipment from equipment in use. Conspicuously mark the area "Administrative Storage".

(2) Covered space is preferred.

(3) Open sites should be improved hardstand, if available. Unimproved sites should be firm, well drained, and kept free of excessive vegetation.

b. Storage Plan.

(1) Store equipment 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 consideration such environmental conditions 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 firefighting equipment and personnel.

c. Maintenance Services and Inspection.

(1) *Maintenance Services*. Prior to storage, perform the next scheduled unit PMCS.

(2) Inspection. Inspect and approve equipment prior to storage. Do not place equipment in storage in a "Non Mission Capable" condition.

d. Auxiliary Equipment and Basic Issue Items.

(1) Process auxiliary and basic issue items simultaneously with the major item to which they are assigned. If possible, store auxiliary and basic issue items with the major item.

(2) If stored apart from the major item, mark auxiliary and basic issue items with tags indicating the major item, its registration or serial number and locations, and store in protective type closures.

(3) In addition, place a tag or list indicating the location of the removed items in a conspicuous place on the major item.

e. Correction of Shortcomings and Deficiencies. Correct all shortcomings and deficiencies prior to storage, or obtain a deferment from the approving authority.

f. Lubrication. Lubricate the equipment in accordance with Section I of chapter 3.

g. General Cleaning, Painting, and Preservation Non-Water Carrying Surfaces.

CAUTION

Do not direct pressurized water or steam against air cleaners, exhaust outlets, unsealed electrical systems, fire control instruments, or any exterior opening which will damage a component.

(1) *Cleaning.* Clean the equipment of dirt, grease, and other contaminants, but do not use vapor degreasing. Remove foreign objects that are wedged between wheels.

(2) *Painting.* Remove rust and damaged pa by scraping, wire brushing, sanding, or buffing. Sane a smooth finish and spot paint as necessary 43-0209). Correct CARC paint for this applicator identified as 13226-E-7414. If M1098 Water tanker painted with Chemical Agent Resistant Coat (CARC) then specific requirements for respiratory protection, ventilation and surface preparation must met. Contact your supporting safety or industrial hygiene office for guidance prior to working with CA paint.

(3) *Preservation.* After cleaning and drying, immediately coat unpainted non-water carrying me surfaces with an oil or grease, as appropriate. Use lubricants as approved in Section I of Chapter 3.

NOTE

Place a piece of barrier material between desiccant bags and metal surfaces.

NOTE

Air circulation under draped covers reduces deterioration from moisture and heat.

(4) *Weatherproofing.* Sunlight, heat, moisture (humidity), and dirt tend to accelerate deterioration. stall all covers (including vehicle protective closures) authorized for the equipment. Close and secure openings except those required for venting and draining. Seal openings to prevent the entry of rain, snow, or dust. Insert desiccant when complete seal is required. Place equipment and provide blocking or framing to allow for ventilation and water drainage. Support cover away from item surfaces which may rust, rot, or mildew.

4-71. Care of Equipment In Administrative Storage

a. Maintenance Services. After equipment has been in administrative storage, inspect, service, and exercise as specified herein.

b. Inspection. Inspection will usually be visual and must consist of at least a walk-around examination of all equipment to observe any deficiencies that may have occurred. Inspect equipment in open storage weekly and that in covered storage monthly. Immediately after any severe storm or environmental change, inspect all equipment. The following are examples of things to look for during visual inspection:

(1) Low or flat tires.
(2) Condition of preservatives, seals and wraps.
(3) Corrosion or other deterioration.
(4) Missing or damaged parts.
(5) Water in compartments.
(6) Any other readily recognizable short-comings or deficiencies.

c. Repair During Administrative Storage. Keep equipment in an optimum state of readiness. Accomplish required services and repairs as expeditiously as possible. Whenever possible, perform all maintenance "on site".

d. Exercising. Exercise equipment in accordance with table 4-14, Exercise Schedule; and the following instructions:

(1) *Vehicle Major Exercise.* Depreserve equipment by removing only that material restricting exercise. Close all drains, remove blocks, and perform all before-operation checks. Couple semitrailer to towing vehicle and drive for at least 25 miles. Make several right and left 900 turns. Make several hard braking stops without skidding. Do the following during exercising when it is convenient and safe: operate all other functional components and perform all During and After operation checks.

(2) Scheduled Services. Scheduled services will include inspection as described in paragraph b, and be conducted in accordance table 4-14. Lubricate in accordance with section I of Chapter 3.

(3) Corrective Action. Immediately take action to correct shortcomings and deficiencies noted. Record inspection and exercise results on DA Form 2404. Record and report all maintenance actions on DA Form 2407. After exercising, restore the preservation to the original condition. Replenish lubricants used during exercising, and note the amount on DA Form 2409-1.

e. Rotation. To ensure utilization of all assigned material, rotate items in accordance with any rotational plan that will keep the equipment in an operational condition and reduce the maintenance effort.

4-72. Procedures for Common Components and Miscellaneous Items

a. Tires. Visually inspect tires during each walk-around inspection of the semitrailer. This inspection includes checking about 5% of the tires, including spare tire, with a tire gage. Inflate, repair, or replace as necessary, those found to be low, damaged, or excessively worn. With a crayon, mark inflated and repaired tires for checking at the next inspection.

b. Air Lines and Reservoirs. Drain air lines and reservoirs of condensation, and leave the drain cocks open. Attach a caution tag, annotated to provide for closing of drain cocks when equipment is exercised. Place tags in a conspicuous location.

c. Water Tank, Piping and Faucets. Drain and purge with dried compressed air. Do not apply contact preservatives. Leave all drains, valves and faucets open.

d. Seals. Seals may develop leaks during storage, or shortly thereafter. If leaking persists, refer to the applicable maintenance section in this manual for corrective maintenance procedures.

4-73. Removal of Equipment from Administrative Storage

a. Activation. Restore equipment to normal operating condition in accordance with the instructions contained in section I of Chapter 4, Service Upon Receipt of Material.

b. Servicing. Resume the maintenance service schedule in effect at the commencement of storage, or service the equipment before the scheduled dates in order to produce a staggered work load.

4-74. Preparation of Equipment for Shipment

a. Refer to TM 55-200, TM 55-01, and TM 743-200-1 for additional instructions on processing, storage, and shipment of material.

b. Semitrailers that have been removed from storage for shipment do not have to be reprocessed if they reach their destination within the administrative storage period. Reprocess only if inspection reveals any corrosion, or if anticipated in-transit weather conditions make it necessary.

c. When a semitrailer is received and has already been processed for domestic shipment, as indicated on DD Form 2258, the semitrailer does not have to be reprocessed for storage unless corrosion and deterioration are found during the inspection upon receipt. List all discrepancies found because of poor preservation, packaging, packing, marking, handling, loading, storage, or excessive preservation on SF 364. Repairs that cannot be handled by the receiving unit must have tags attached listing the needed repairs. A report of these conditions will be submitted by the unit commander for action by an ordnance maintenance unit.

4-75. Preparation of Vehicles for Intermediate and Long Term Storage

a. Classification.

Processing for shipment and storage shall be in accordance with applicable level protection summarized below, which is derived from MIL-V-2038D.

b. Level of Protection.

Processing of vehicles shall be in accordance with the level of protection, Level A or Level B. specified in procurement document and the requirements of the applicable paragraphs of this specification in the specific vehicle Equipment Preservation Data Sheet (EPDS).

c. Criteria.

Determination of level of protection is based upon the following criteria:

Level A - Long Term Storage for Domestic or Overseas Shipment.

1. Processing for any storage outside building or for open deck loading regardless of length of time.

2. Processing for shipment stored in excess of 90 days from date of processing.

Level B. - Intermediate Term Storage For Domestic or Overseas Shipment.

1. Limited processing for immediate shipment and u excluding open deck loading, and for any storage not exceed 90 days from date of processing.

NOTE

Periodic care and preservation during storage Is required in either long term or short term storage.

d. Unit Instructions.

1. Refer to the Equipment Preservation Data Sheet (EPDS), for the Preparation for Shipment and Storage of M1098 vehicles. The equipment shall be prepared in accordance with the EPDS and the applicable general requirements, and Quality Assurance Provisions of Specification MIL - V - 62038.

2. Semitrailers shall be processed Level A or B as specified IAW the EPDS and MIL-V-62038. While the vehicles are in storage, periodic care, and preservation during storage is required; see SB 740-98-1, titled: Storage Serviceability Standard, Tracked Vehicles, Wheeled Vehicles, and Component Parts.

3. An Equipment Preservation Data Sheet for the M1098, 5,000 gallon semitrailer may be obtained from U.S. Army Tank-Automotive Command, ATTN: AMSTA-GTPD, Warren, MI, 48397-5000.

Table 4-16. Exercise Schedule.

Weeks	2	4	6	8	10	12	14	16	18	20	22	24
PMCS						X						X
Scheduled Services		X		X		X		X		X		
Vehicle Major Exercise												X

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

5-1. Repair Parts

Repair pans required for direct support and gene support maintenance of the M1098 semitrailer are list and illustrated in TM 9-2330-388-24P.

5-2. Special Tools and Equipment

Table 5-1 contains a list of all special tools, components of tool sets, and test and support equipment needed direct support and general support to maintain the semitrailers. Additional information for special tools is contained in TM 9-2330-388-24P.

5-3. Fabricated Tools and Equipment

Table 5-2 contains information on fabricated tube lines required by direct support and general support maintenance. Table 5-3 contains fabrication instructions for all tools which must be made by direct support or general support personnel for maintenance of the semitrailers.

Table 5-1. Special Tools, Test, and Support Equipment.

Item	NSN or Reference No.	Reference		Use
		Fig. No.	Para No.	
Puller, flywheel	5108-00-423-1596 P/N (19207)	7-12.	7-6	Remove flywheel.
Gage, compression tester	4910-00-870-6283 10899180 (19207)	7-13.	7-7.	Testing cylinder compression
Test fixture, delivery valve	4910-00-255-8641 P/N 65-0030	7-1.	7-2.	Testing fuel injection pump delivery valve.

Table 5-2. Fabricated Tube Lines

Part No.	Bulk Part No.	Bulk Tubing Dia.	Length
11670918-1	CPR 104420-1	1/4"	60"
11670918	CPR 104420-2	3/8”	60"
11670918-3	8360440	5/8"	40"

Table 5-3. Fabricated Tools and Equipment

Item	NSN or Reference No.	Fig. No.	Para. No.	Use	Material Required
Engine Run-on Stop Tool		NO TAG	NO TAG	Force engine stoppage in case of run-on	Welding rod
Puller, Flywheel		7-12.	7-6.	Bolts for puller	3/16" Stock Steel 2 of 1-3/4" Steel Flat Washer

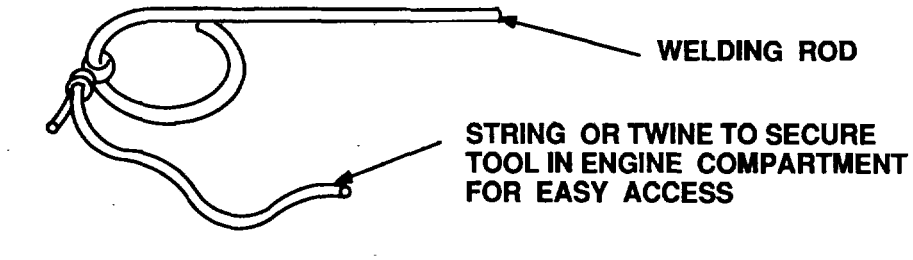


Figure 5-1. Engine Run-on Stop Tool

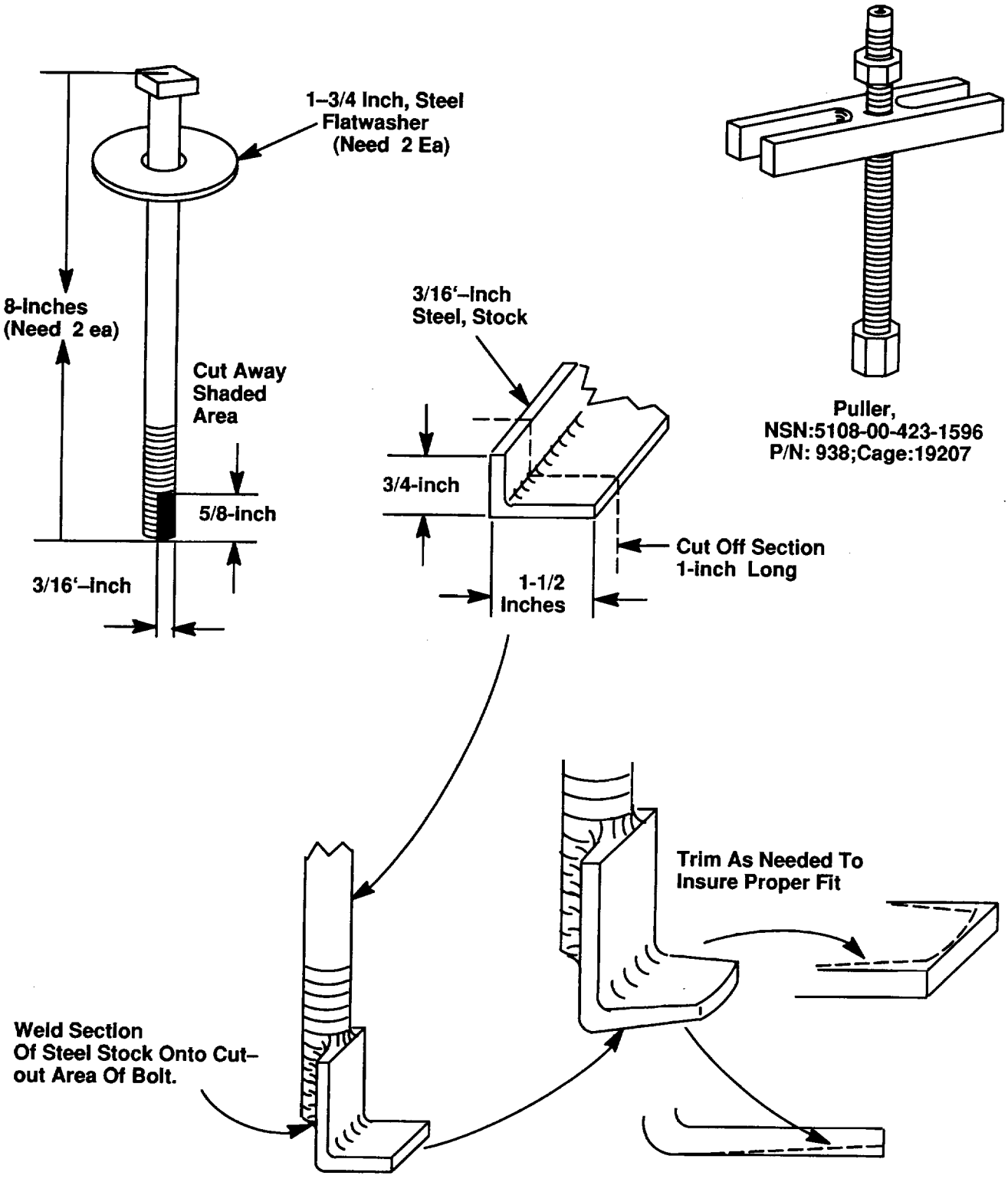


Figure 5-2. Fabrication of Puller Legs

Section II. GENERAL MAINTENANCE

5-4. General Maintenance

a. This section contains general maintenance instructions which are the responsibility of direct support and general support maintenance personnel. These instructions pertain to several components or assemblies and otherwise would need to be repeated several times throughout the chapters. Special information on general repair practices, parts replacements, welding, riveting, and tools arc also included.

b. Ensure that all safety precautions listed in warning Summary are followed while perform maintenance. Pay close attention to all WARNINGS and CAUTIONS.

5-5. General Maintenance Procedures

a. Work Area.

(1) Make sure the work area is clean before you disassemble the pump or engine.

(2) Make sure that materials needed for maintenance task are at hand. These may include cleaning solvents, lubricants, buckets, or other containers cleaning or keeping components separated, cleaning wiping cloths, and the proper tools.

b. Cleaning of Components, Assemblies or Parts.

(3) Clean the exterior of the component or assembly before disassembly to keep foreign matter from bearings, gears, and other machine-surfaced parts which are subject to scoring and other such damage.

WARNING

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). wear protective clothing (goggles and gloves) and use caution to avoid injury to personnel.

(4) If compressed air is used to clean parts you should make sure it is free of dirt and other contaminants.

(5) Protect disassembled parts from dust, blowing sand, and moisture which can cause rapid wear and deterioration of bearings, gears, and other machine parts.

c. General Instructions.

(1) In disassembly, remove only as many parts or components as required for indicated repair. Complete disassembly of a component is not always required to make repairs. Good judgment should be used to keep disassembly operations to a minimum.

(2) During disassembly, tag critical parts to ensure proper reassembly. Mark mating parts by scribe marks or indelible ink to be certain of correct positioning at assembly.

(3) Unserviceable or unrepairable assemblies will be broken down into items of issue, and serviceable parts will be returned to stock. Parts or assemblies which cannot be repaired, selective-fitted, or reclaimed to standards contained in this manual, will be salvaged and replaced with new parts.

(4) If a required new part is not available, reconditioning of the old part is necessary. Such parts should be inspected carefully after reconditioning to determine their suitability and probable service life. Replacement parts should be requisitioned immediately.

(5) Replace seals and gaskets of all components disassembled.

(6) Replace springs if broken, distorted, or cracked, or if they do not conform to specific tensile standards.

(7) Replace screws or nuts with damaged threads or rounded corners. Replace lockwashers.

(8) During assembly, subassemblies should be assembled first. The subassemblies can then be combined into major components and installed to make a complete major assembly.

d. Care of Bearings.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100° F-138° F (38° C-59° C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). Wear protective clothing (goggles and gloves) and use caution to avoid Injury to personnel.

NOTE

Refer to TM 9-214 for further Information on the Inspection, care, and maintenance of bearings.

(1) Clean ball and roller bearings by placing them in a wire basket and immersing in a container of fresh dry cleaning solvent (item 11, Appendix E). Agitate the bearings in the solvent to remove all traces of old lubricant.

(2) After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.

(3) Dip the cleaned bearings in clean engine oil and immediately wrap them in a lint-free cloth (item 24 Appendix E) to protect them from dust and other foreign matter.

5-6. Specific Procedures

a. Welding.

(1) Refer to 9-237 for welding instructions and materials. All welds must reflect good workmanship and approved welding procedures. Welds must be secure, free from cracks, excessive spatter, and obvious defects.

(2) Read and observe all safely precautions in the warning Summary before performing any welding operation.

b. Surface Protection.

(1) Clean and repaint all outer non-water carrying surfaces on which paint has deteriorated or become damaged.

(2) Do not paint or electrical grounds, wiring harnesses or leads.

(3) Paint exterior of vehicle in accordance with 12355846. Correct CARC paint for this application is identified in TM 43-0139. If M1098 Water tanker is painted with Chemical Agent Resistant Coating (CARC) then specific requirements for respiratory protection, ventilation and surface preparation must be met. Contact your supporting safety or industrial hygiene office for guidance prior to working with CARC paint. Rustproof as per part No. 8750251.

c. Repairing Damaged Threads.

(1) When determined feasible by inspection, damaged threads should be repaired by retapping, by use of a thread die or a thread restorer file.

(2) Tapped holes for screw thread inserts that have mutilated threads may be repaired by:

(a) Drilling and tapping holes oversize, then installing larger screws.

(b) Filling tapped hole by welding, then redrilling and tapping hole to original size.

d. Removing Burrs, Scratches, and Raised Metal.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only In a well - ventilated area. Avoid contact with skin, eyes,

and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (38° C-59° C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes with water and get medical aid.

WARNING

Under no circumstances is dry cleaning solvent to be used on an area that is used to store or pass water. No preservatives of any type are to be used on water carrying surfaces.

(1) Use fine mill file, soft stone, or crocus cloth (item 4, Appendix E) dipped in dry cleaning solvent (item 11, Appendix E) to remove burrs, scratches, or raised metal.

(2) When filing aluminum, clean file often with steel file brush to avoid loading file with aluminum particles which will gouge work surface.

e. Cleaning Materials and Methods.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes with water and get medical aid.

WARNING

Under no circumstances is dry cleaning solvent to be used on an area that Is used to store or pass water. No preservatives of any type are to be used on water carrying surfaces.

(1) Refer to TM 9-247 for cleaning materials to be used.

(2) Cleaning is normally done by the dip-tank and/or vapor-degreaser methods, or by cleaning with cloths soaked in dry cleaning solvent (item 11, Appendix E).

f. Cleaning of Material Received From Storage.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F - 138°F (38°C-59°C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes with water and get medical aid.

WARNING

Under no circumstances is dry cleaning solvent to be used on an area that Is used to store or pass water. No preservatives of any type are to be used on water carrying surfaces.

(1) Material received from storage by direct and general support maintenance units will be cleaned by the dip-tank, vapor-degreaser, or steam method; whichever is applicable or available. Descriptions of these methods are as follows:

(*a) Dip-tank Method*. Disassemble as required and place parts in a perforated metal basket. Submerge and agitate the basket in a tank containing dry cleaning solvent (item 11, Appendix E). Repeat, using a second

tank with clean solvent. Extent of treatment in each tank will depend on ease with which Pans are cleaned.

(b) Vapor-degreaser Method. Tanks containing heated solution of trichlorethylene or perchlorethye ((type II) are used for degreasing items that are v greasy or oily and are not readily cleaned by the d: tank method. Place parts in a perforated metal bas and submerge below the vapor in the tank. Keep the basket in this position until all the grease, oil, or c melts and runs off the parts. If necessary, material may be washed with degreasing spray unit.

(c) Steam Method. Place parts in a perforated metal basket and steam treat until clean. This method is less efficient than the vapor-degreaser method, and parts may require additional cleaning to remove final traces of grease, oil or dirt, particularly from recesses.

(2) If some time is to elapse before the start repair or overhaul operations, apply a coat of light grade PE-10 preservative oil to all finished metal surfaces to prevent rusting other than water carrying surfaces.

WARNING

Compressed air used for drying or cleaning purposes must not exceed 30 psi (207 kPa). wear protective clothing (goggles and gloves) and use caution to avoid injury to personnel.

g. Cleaning After Shop Inspection. After in-process shop inspections, dip parts in a tank containing finger-print remover oil (item 9, Appendix E). Remove pans (with rubber gloves), and dry thoroughly with compressed air or by wiping with clean, lint-free cloths (item 24, Appendix E). Apply preservatives as soon possible after cleaning.

h. Lubrication. Refer to Chapter 3, Section I for lubrication instructions.

i. Installation of Split Couplings. When installing couplings and gaskets, use the procedure described para 4-35.

DIRECT SUPPORT TROUBLESHOOTING

Table 5-3. Direct Support Troubleshooting

ENGINE

No. Malfunction

1. ENGINE MISFIRES UNDER HEAVY LOAD

2. ENGINE SPEED IS NOT CONSTANT (HIGH OR LOW SPEED; HUNTING OR LOSS OF CONTROL).

Initial Setup

Tools
General Mechanic's tool kit

Personnel
Two

Equipment Conditions
- Tanker parked on level ground.
- Parking brakes set and wheels chocked.
- Unit troubleshooting, Malfunctions No. 17 or No. 18 completed.
- Approximately 300 - 500 gallons water in tank.
- Hoses and valves set up to pump water (see para. 4-7.)

NOTE
Read paragraph 4–7 before doing any work.

A Check line between fuel filter and injector pump for presence of fuel.

NOTE

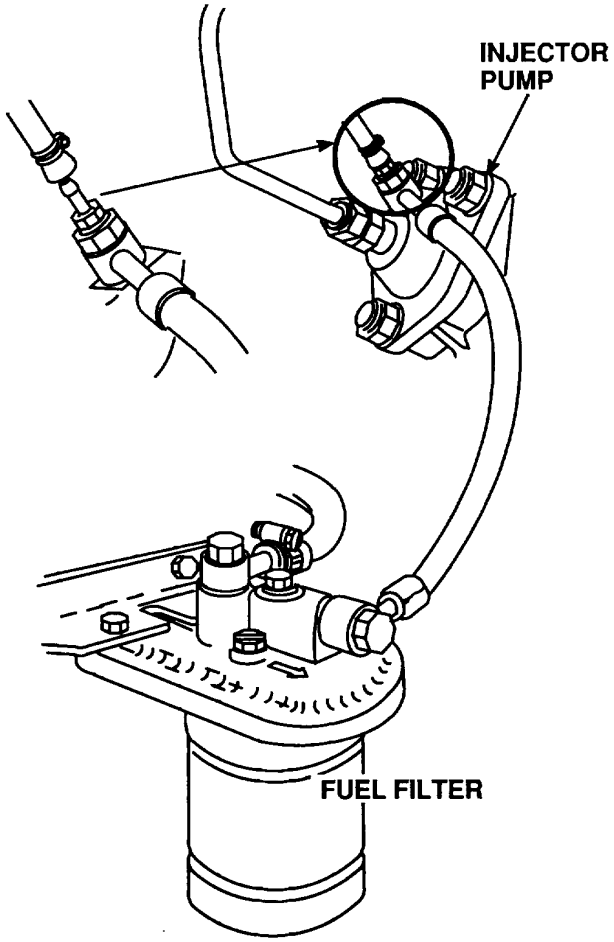
The following procedures have to be performed at the same time.

- Loosen clamp on injector pump fuel return line, but do not remove the line itself. With ignition switch in OFF position, have helper lift compression release lever and manually turn engine crank shaft using manual (rope start) procedure. At same time, very carefully, loosen, but do not remove completely, fuel return line from fitting to determine presence of fuel in line.
- As soon as presence of fuel in line is noted, stop turning engine crank shaft, and quickly retighten fitting.

Was presence of fuel noted at fuel tank connection of injector fuel return line?

YES → Go To Block B

NO → Go To Block C



DIRECT SUPPORT TROUBLESHOOTING

Table 5-3. Direct Support Troubleshooting

ENGINE

No. Malfunction

1. ENGINE MISFIRES UNDER HEAVY LOAD

2. ENGINE SPEED IS NOT CONSTANT (HIGH OR LOW SPEED; HUNTING OR LOSS OF CONTROL). (Continued)

From Block A

B Check fuel injector pump for proper output pressure.

1. Install pressure gage as shown.

NOTE

The following procedures have to be performed at the same time.

2. With ignition switch in OFF position, have helper lift compression release lever and slowly turn engine crank shaft using manual (rope start) procedure until maximum (highest or peak) reading is obtained (compression stroke), and make a note of reading.

- If gage reading is less than 4500 psi, replace fuel injector pump (para. 7–2).
- If gage reading is 4500 psi or above, go to next step.

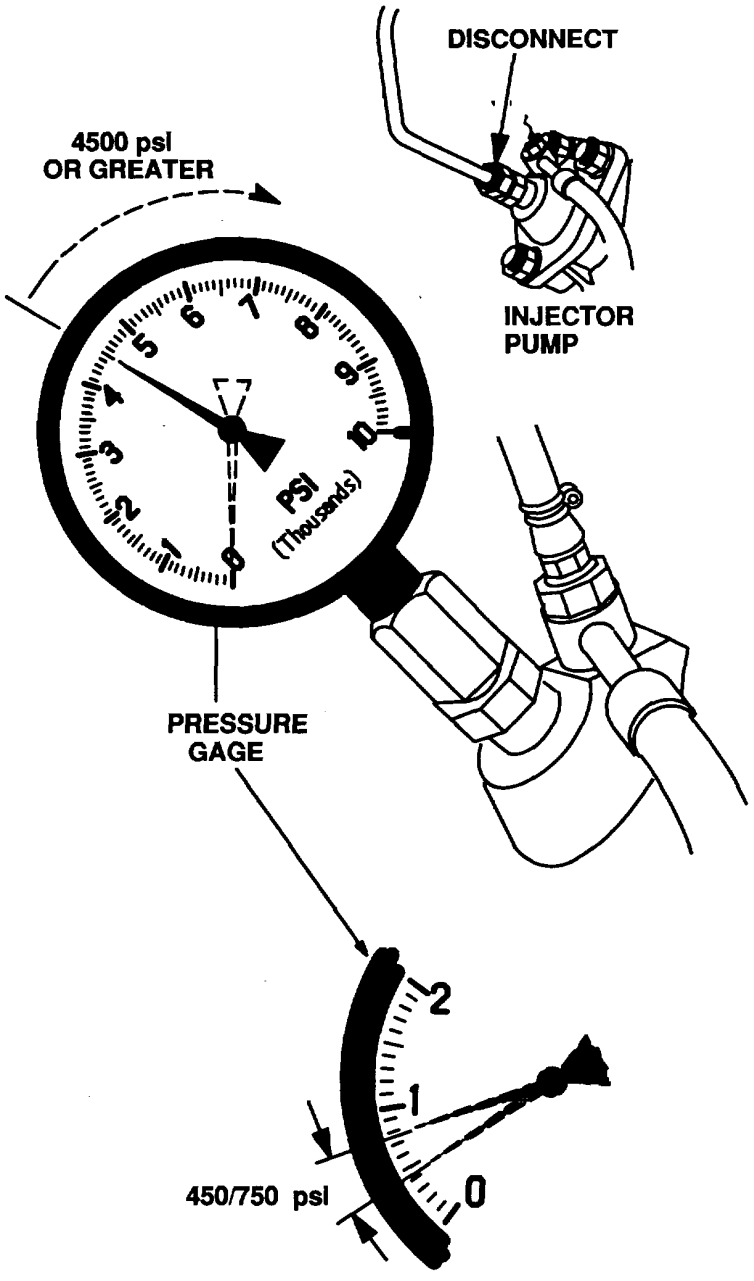
3. With ignition switch in OFF position, have helper lift compression release lever and slowly turn engine crank shaft using manual (rope start) procedure until minimum (lowest or bottom) reading is obtained and stop. Hold crank shaft it a set position for 15 to 30 seconds, and make a note of reading.

- If gage reading is less than 450/750 psi, or if reading is at first higher than required minimum reading, then continues to decrease (that is, if the pressure starts to leak off), replace fuel injector pump (para. 7–2).

Was fuel injector pump OK?

YES → Go To Block D

NO → Go To Block E



DIRECT SUPPORT TROUBLESHOOTING

Table 5-3. Direct Support Troubleshooting

ENGINE

No. Malfunction

1. ENGINE MISFIRES UNDER HEAVY LOAD

2. ENGINE SPEED IS NOT CONSTANT (HIGH OR LOW SPEED; HUNTING OR LOSS OF CONTROL).

From Block B (YES) Path

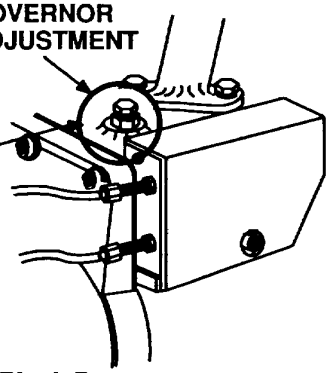
D Check for proper length of pumping stroke.

1. Remove cowling from engine for access.
2. Perform Pump Length of Stroke Check (Adjust Governor) (para. 7–2).
   - ♦ Adjust length of pump stroke. If ok, go to step 3.
   - ♦ If length of pump stroke cannot be adjusted properly, replace engine.
3. Test engine.

Does engine work properly (Has engine misfiring stopped, or is engine speed now constant)?

YES → **F** Problem solved; return trailer to service.

NO → **G** Replace engine



From Block B (NO) Path

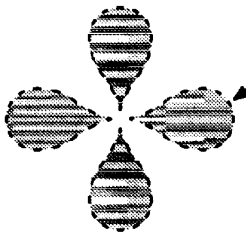
E Check fuel injector works properly.

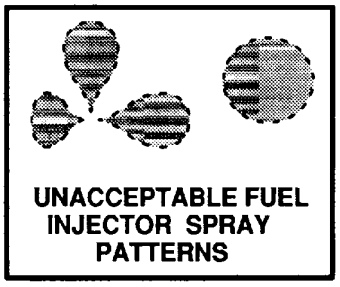
1. Perform fuel injector test (para. 7–2).
   - ♦ Check for breakaway pressure, using injector tester, for approximately 3045 psi. If breakaway pressure is less than 3045 psi, replace injector (para 7–2).
   - ♦ Check for proper spray pattern, as shown in accompaning illustration. If spray pattern differs significantly from illustration, replace injector (para. 7–2).
2. If injector was replaced test engine.

Does engine work properly (Has engine misfiring stopped, or is engine speed now constant)?

YES → **H** Problem solved; return trailer to service.

NO → **J** Replace engine





Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

5-7. Upper Coupler (Kingpin) Plate Replacement, Fig. 5-3.

WARNING

Upper coupling Is heavy and awkward to handle.

a. Removal.

(1) Provide a balanced jack support for upper coupler plate (4).

(2) Remove twelve locknuts (1), bolts (3), and washers (2). Discard locknuts.

(3) Remove upper coupler plate (4) from under semitrailer

b. Installation.

(1) Place upper coupler plate (4) on a suitable support jack.

(2) Lift upper coupler plate (4) into position under semitrailer. Loosely install twelve bolts (3), washers (2), and new locknuts (1)

(3) Ensure that upper coupler plate (4) is flush against semitrailer. Tighten twelve locknuts (1) to 130 - 140 lb - ft.

(4) Lubricate upper coupler plate (4), para 3-1.

c. Rustproofing and Painting Above Plate.

(1) Remove rust and damaged paint by scraping, wire brushing, sanding, or buffing. Sand to a smooth finish and spot paint as necessary (TM 43-0139). If M1098 Water tanker is painted with Chemical Agent Resistant Coating (CARC) then specific requirements for respiratory protection, ventilation and surface preparation must be met. Contact your sup- porting safety or industrial hygiene office for guidance prior to working with CARC paint.

(2) Rustproof as per part No. 8750251.

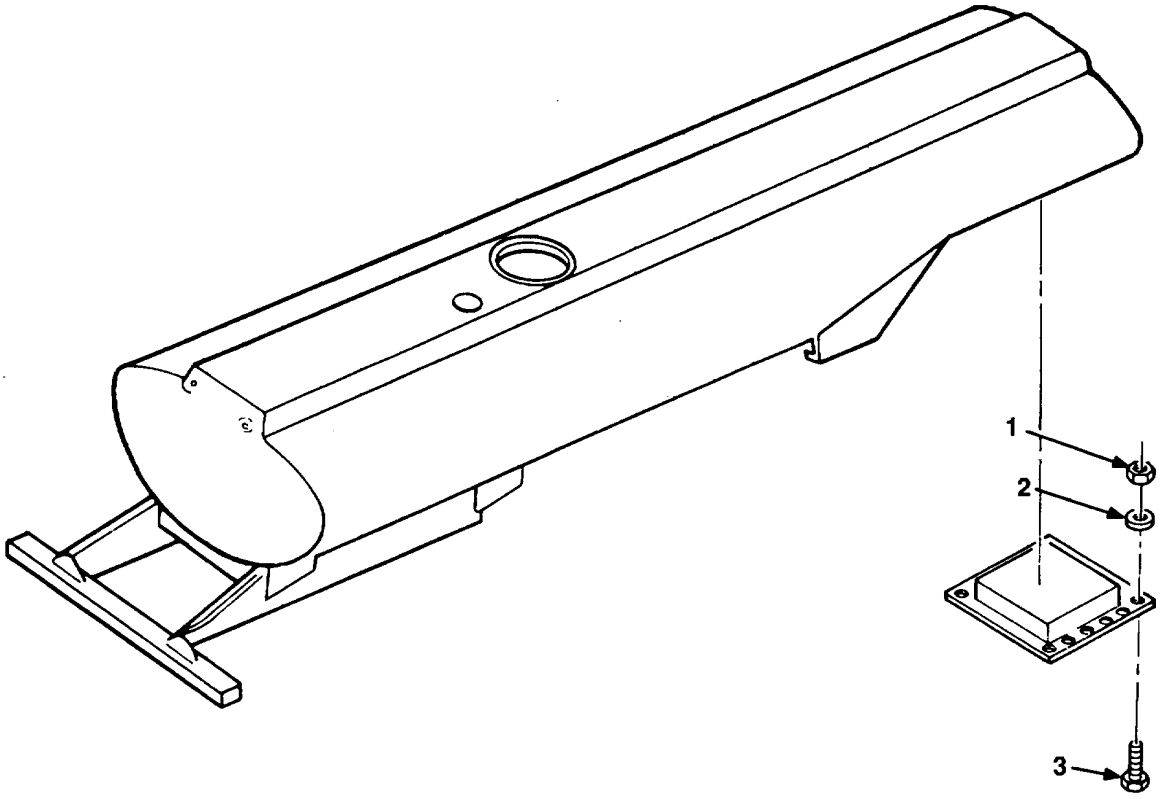


Figure 5-3. Upper Coupler (Kingpin) Plate

5-8. Suspension

a. Removal, Fig. 5-4.

(1) Position semitrailer on hard level surface with front resting on landing gear.

WARNING

Release air pressure from both air reservoirs before doing any work on brake lines or other pressurized air lines.

(2) Release air from both air reservoirs by opening drain cocks on bottom of reservoirs, fig. 4-54.

(3) Loosen wheel lug nuts while wheels are or ground.

(4) Jack up rear of semitrailer and support under frame securely until weight of semitrailer is removed from springs and axles.

(5) Remove wheels from both axles, para 4-51.

(6) Remove both axles, para 5-9.

(7) Position a jack under the trunnion tube close to the inside of each trunnion hanger.

(8) Raise jacks just enough to support trunnion tube.

(9) Remove four nuts, four washers, and four bolts which fasten the trunnion hanger to the mounting bracket. Repeat for opposite side.

(10) Slowly lower suspension and support trunnion tube.

b. Disassembly, Fig. 5-4.

(1) Use lifting device to support spring.

(2) Remove four nuts and four washers from U-bolts.

(3) Remove two U-bolts and wear pale.

(4) Using lifting device, lift spring from upper trunnion hub and remove it from the suspension.

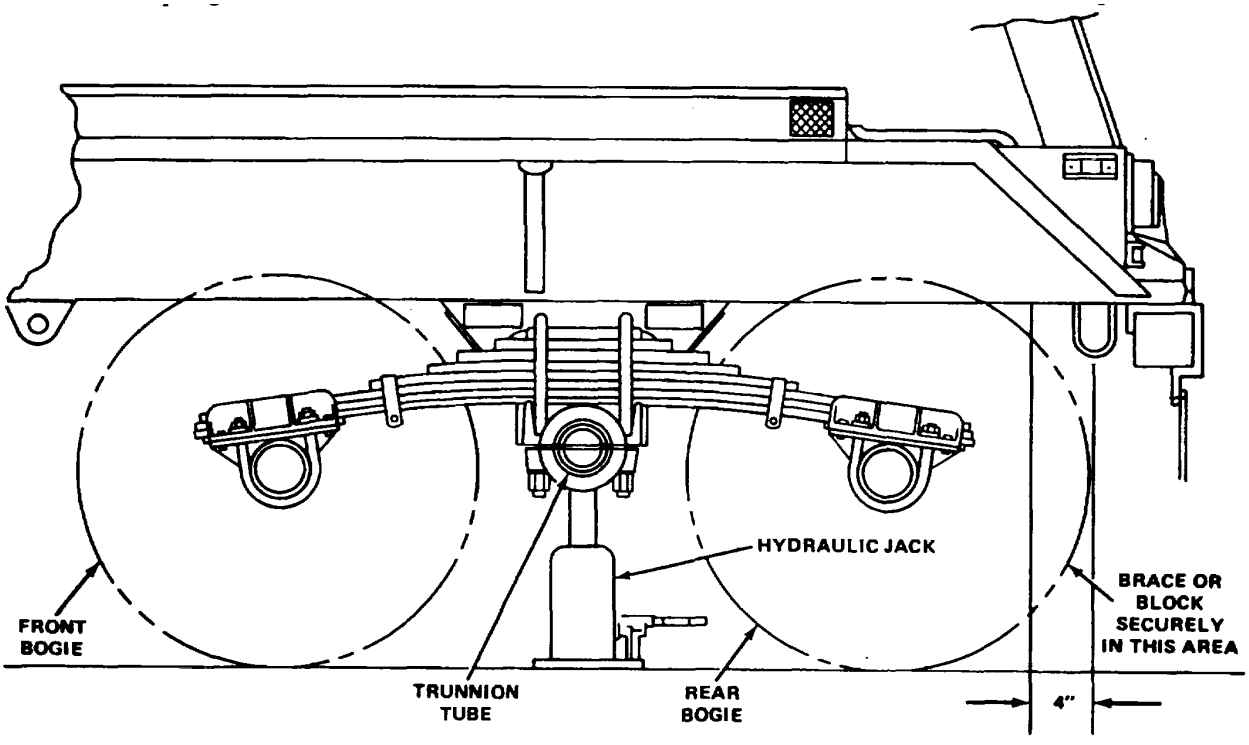


Figure 5-4. Suspension Assembly

(5) Remove upper and lower trunnion hub and trunnion tube.

(6) Remove rubber bushing and trunnion washer from trunnion tube.

(7) Loosen two trunnion hanger capscrews and nuts, and slide hanger off trunnion tube.

(8) Repeat steps (1) through (7) for opposite side.

c. Assembly

(1) Slide trunnion hanger onto trunnion tube. Do not tighten trunnion hanger capscrews and nuts at this time.

(2) Slide trunnion washer and rubber bushing onto trunnion tube.

(3) Install the upper and lower trunnion hub on the trunnion tube.

(4) Using lifting device, position spring on upper trunnion hub so that center bolt of spring is in recess of trunnion hub.

(5) Put wear plate in position on the spring. The nut on the center bolt of the spring fits into hole in the wear plate.

(6) Install two U-bolts over wear plate and through holes in upper and lower trunnion hubs.

(7) Install four washers and four nuts on U-bolts, and tighten evenly to 200-320 lb.-ft.

(8) Repeat steps (1) through (7) for opposite side.

d. Installation.

(1) Place a jack under trunnion tube close to inside of each trunnion hanger, and slowly raise suspension into position under trunnion support brackets.

(2) Aline holes in the trunnion hanger with holes in the mounting bracket.

(3) Install four bolts, four washers, and four nuts. The nuts are tightened, jack up the suspension to seat the trunnion hanger. Tighten nuts evenly to 90 lb ft.

(4) Tighten two trunnion hanger capscrews and nuts.

(5) Repeat steps (2) through (4) for opposite side.

(6) Install both axles, para 5-9.

(7) Install wheels on both axles, para 4-51.

(8) Remove supports and jacks, and lower rear end of semitrailer to ground.

5-9. Axle

a. Removal, Fig. 5-4.

(1) Position semitrailer on hard level surface with front resting on landing gear.

WARNING

Release air pressure from both air reservoirs before doing any work on brake lines or other pressurized air lines.

(2) Release air from both air reservoir by opening drain cocks on bottom of reservoirs, fig. 4-54.

(3) Loosen wheel nuts while wheels are on ground.

(4) Position jacks just inboard of the spring end up on axle. Jack up axle to be removed until wheels clear the ground.

(5) Remove wheels, para 4-51.

(6) Raise rear of semitrailer with an overhead crane or A-frame support until weight of springs has been removed from axle. Block frame securely, fig. 5-4.

(7) Remove brake air chambers, para 4-42.

(8) Remove four nuts, four washers, and four bolts which fasten the spring end cap to spring seat on axle.

(9) Remove four nuts, four washers, and two U-bolts which fasten the spring seat on axle to the spring end cap.

(10) Remove leaf spring seats.

(11) Remove cushioning pads.

(12) Remove adjustment plates.

(13) Repeat steps (8) through (12) for other side.

(14) Slowly lower axle.

b. Installation, Fig. 54.

(1) Move axle into position under semitrailer. Raise and revolve axle into position on ends of suspension springs.

(2) At each end of axle, loosely install spring sets, adjustment plates, cushioning pads, and spring end caps with two U-bolts, four washers, and four nuts.

(3) At each end of axle, loosely install spring end cap to spring seat on axle with four bolts, four washers, and four nuts.

(4) Tighten all nuts evenly to 200-320 lb-ft.

(5) Install brake air chambers, para 4-42.

(6) Install wheels, para 4-51.

(7) Remove supports and jacks.

(8) Tighten wheel nuts to proper torque and proper sequence, fig. 4-59.

5-10. Bogie Assembly

a. Removal

(1) Position semitrailer on hard, level surface with front resting on landing gear.

(2) Jack up rear of semitrailer and support under frame securely until weight of semitrailer is removed from springs and axles, fig. 5-4.

(3) Release air from both air reservoirs by opening drain cocks on bottom of reservoirs, fig. 4-54.

(4) Tag and disconnect eight hoses from brake air chambers on both axles. Manually release the failsafe springs, para NO TAG

(5) Position a jack under the trunnion tube close to the inside of each trunnion hanger to support weight of trunnion tube.

(6) Remove four nuts, four washers, and four bolts which fasten the trunnion hanger to the mounting bracket. Repeat for opposite side.

(7) Remove jacks from under trunnion tube. Raise semitrailer until there is enough clearance to roll the bogie assembly and wheels out from under rear of semitrailer, fig. 5-4.

(8) Lower semitrailer onto supports or cribbing after bogie assembly is removed, fig. 5-4.

b. Installation

(1) Raise rear of semitrailer to allow bogie assembly to roll under frame from rear. With front of bogie assembly toward front of semitrailer, roll bogie assembly into position under mounting brackets for the trunnion hangers.

(2) Position a jack under trunnion tube as close as possible to the inside of each trunnion hanger.

(3) Lower the semitrailer to within one inch of the trunnion hangers.

(4) Aline holes in mounting bracket with holes in hanger.

(5) Install four capscrews, four washers, and four nuts. As the nuts are tightened, jack up trunnion tube to seat the trunnion hanger. Tighten nuts to 90 lb.-ft.

(6) Tighten two trunnion capscrews and nuts.

(7) Repeat steps (4) through (6) for opposite side.

(8) Connect eight hoses to brake air chambers on both axles as tagged. Manually release the failsafe springs, para NO TAG

(9) Remove jacks and supports, and lower semitrailer to ground.

CHAPTER 6

REPAIR OF FRAME AND BODY PARTS

Section I. GENERAL

6-1. Scope

This chapter contains instructions for repair and replacement of frame and body parts, including the bogie assembly, which are beyond the scope of the using organization. These repairs, with the exception of repairs to tank body or main frame, are allocated to direct sport maintenance.

6-2. Reference

a. Safety. Ensure that all safety precautions listed in the Warning Summary are followed while performing maintenance. Pay close attention to all WARNINGs and CAUTIONs.

b. Procedures. Procedures for repairs involving welding, surface preparation, cleaning, and painting are included under General Maintenance Procedures, para NO TAG

Section II. BRAKES And BRAKE SYSTEM COMPONENTS

6-3. Trunnion Cross Tube, Fig. 6-1.

a. Removal. Refer to para 5-8.

b. Installation. Refer to para 5-8.

6-4. Brake Shoes (Fig. 6-3)

a. Disassembly.

WARNING

Due to asbestos hazard, do not grind on rivet heads. Failure to follow this warning may result In injury or death to personnel.

(1) Punch rivets out from back side of shoeing a hammer and a drift or punch.

(2) Remove linings from brake shoes.

b. Inspection and Repair.

(1) Oil or grease saturated linings are not reusable. Saturated linings indicate leakage in the axle shaft seals.

(2) Grooving or uneven wear in brake linings indicates a need for refacing or replacement of brake drum.

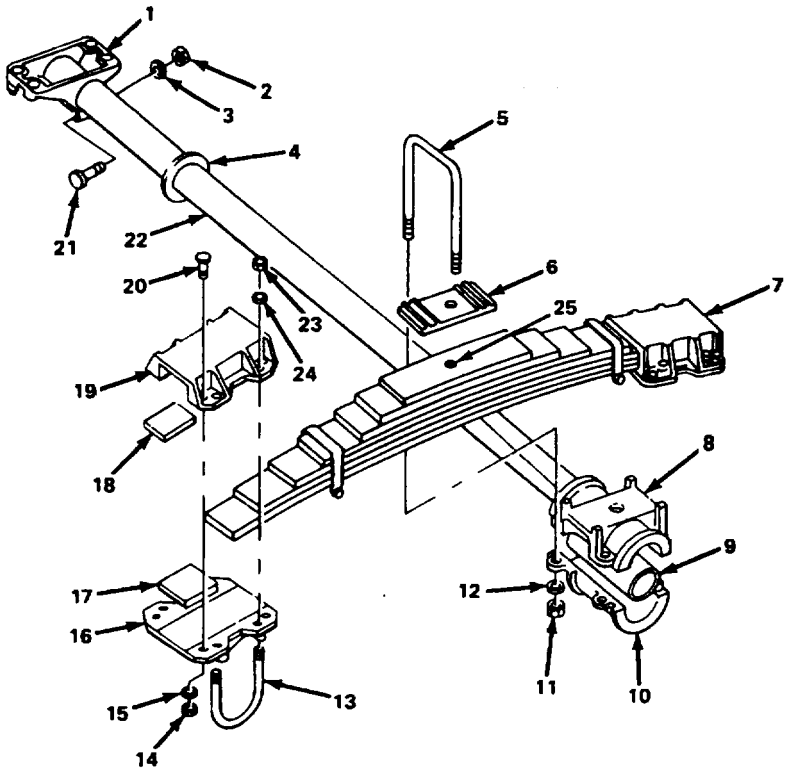
(3) Inspect brake shoe for distortion, cracks or damage. Replace the brake shoe if these conditions are found. Lining and shoe contact surfaces should be clean and smooth.

(4) Use new rivets of the correct body diameter, head size and shape, length, and material. When removing rivets from the brake shoes, be careful to avoid any damage to the holes in the shoe. Do not use a chisel to shear them off as the force will elongate the rivet holes. If holes are burred, they should be filed down flush with the shoe table.

Never shim the brake linings. Brake noise may result because of cracked and/or loose lining, since a tight installation is not possible with shims. The inside surface of the lining is the correct arc to match the shoe table, and the rivet holes in the linings will only line up with holes in the holes in the shoes when they are in direct contact. Prior to riveting be sure the holes in the lining blocks and the shoes are exactly matched.

The correct length rivet must be selected for each application. A variation in shoe thickness may require a different length rivet. The solid portion of the rivet should end just at the inner surface of the shoe. The hollow portion of the rivet should protrude past the inner surface of the shoe.

The riveting machine must be adjusted so that the roll of the rivet is complete, but the rivet should not split.



1. Trunnion spring hanger
2. Trunnion hanger nut
3. Trunnion hanger flatwasher
4. Trunnion hanger flatwasher
5. Spring mounting U-bolt
6. Spring top wear plate
7. Spring leaf assembly
8. Upper spring trunnion hub
9. trunnion hub rubber bushing
10. Lower spring trunnion hub
11. U-bolt nut
12. U-bolt nut
13. Vehicle suspension U-bolt
14. End cap nut
15. End cap flatwasher
16. Vehicle suspension spring seat
17. Spring seat adjustment plate
18. End cap pad
19. Vehicle suspension spring cap
20. End capscrew
21. Trunnion hanger screw
22. Trunnion spring tube
23. U-bolt nut
24. U-bolt flatwasher
25. Center bolt

Figure 6-1. Spring Seat and Trunnion Cross Tube Assembly

Always use a roll set, never a star set, when riveting brake linings. A star set does not compress the rivet and expand it to fill the hole. Consequently, the lining may work loose in service.

c. Assembly.

NOTE
Do not use combination linings.

(1) Make sure lining and shoe contact surfaces are clean.

(2) Clamp lining to brake shoe with C-clamps with rivet holes in both pieces aligned.

(3) Drive the rivets squarely into the holes with a 7/16-inch flat head drift.

(4) Position the C-clamps as close to the rivet holes as possible and make certain the lining is tight against the brake shoe.

(5) Working from heel to toe of brake shoe, form the rivet heads with the correct tubular rivet set. Follow the order shown in figure 6-2.

(6) Check lining installation with a 0.002-inch feeler gage to ensure that lining and shoe contact. Lining to shoe clearance is excessive if gage can be inserted between shoe and lining.

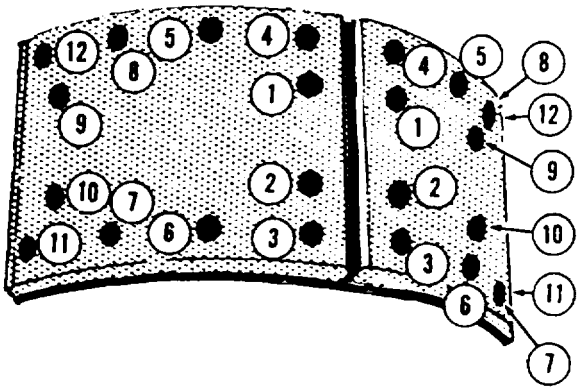


Figure 6-2. Brake Lining Riveting Sequence

6-5. Brake Drums

a. Removal. Refer to para 4-51.

b. Reboring of Brake Drums.

(1) Reboring is not recommended due to reduced strength of refaced drums. If it is necessary to rebore a drum, remove as little metal as necessary to true the friction surface.

(2) If reboring requires removal of more than 1/16-inch of material, replace the drum.

c. Installation. Refer to para 4-51.

CHAPTER 7

REPAIR OF ENGINE ASSEMBLY

Section I. DESCRIPTION

7-1. Scope

a. This chapter contains instructions for direct and general support maintenance of the engine and related parts which are beyond the scope of using organization.

b. The terms right, left, front, and rear used in this technical manual, with reference to the engine and its components, are determined as viewed from the front or flywheel end of engine.

Section II. DIRECT AND GENERAL SUPPORT MAINTENANCE OPERATIONS FOR M1098 ENGINE

7-2. Injector Removal, Test and Installation

a. Removal

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cables.

3. Remove fuel pump-to-injector high pressure line injector by disconnecting fitting.

4. Remove one bolt that holds low-pressure injector line to injector and position line out of the way.

b. Test

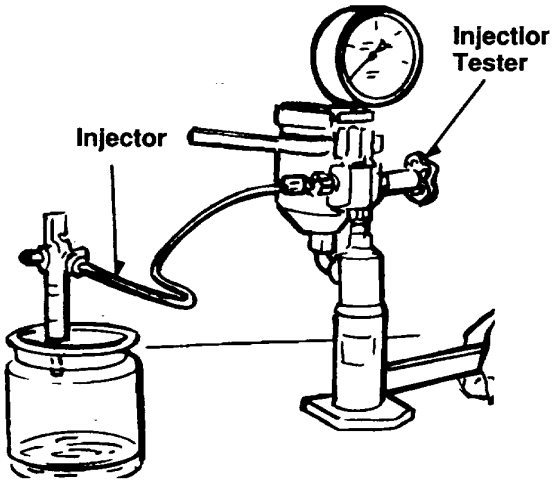


Figure 7-1. Injector Testing

5. Remove two nuts that secure injector to cylinder head and remove injector. End of injector will have .5 mm washer-type shims on end of injector or resting on plane in housing.

1. Test fuel injector for breakaway pressure and pattern using Injection Tester 49100-255-641. Use Adapter G-3.

Test injector following tester instructions, fig. 7-1. Breakaway setting is approximately 2,300 psi.

c. Installation

1. Install injector in cylinder head, make sure the correct number of shims are installed between the injector and cylinder head, fig. 7-2. The number of shims needed are shown by the number of points marked in the cylinder head, fig. 7-3.

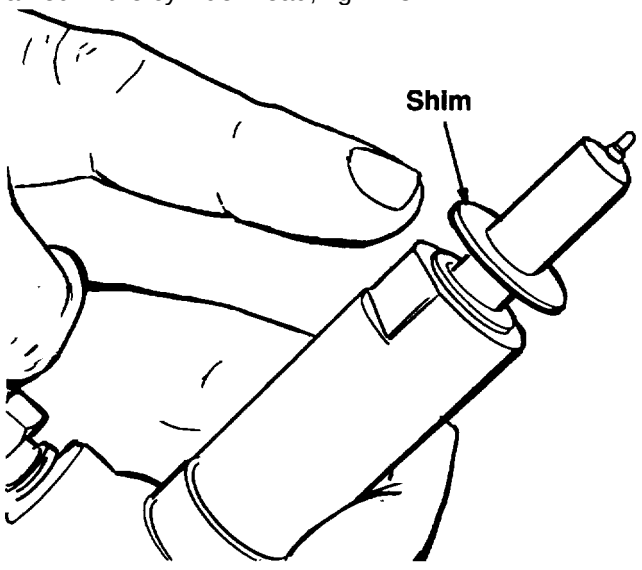


Figure 7-2. Placing Shims on Injector

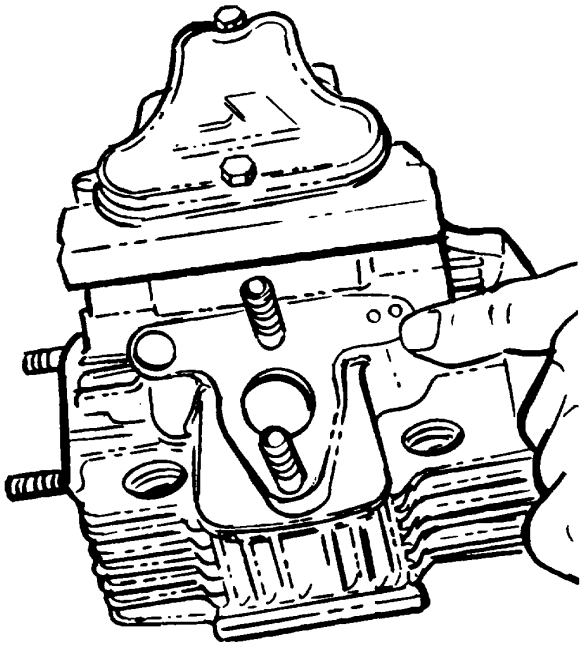


Figure 7-3. Counting Shims

2. Secure injector to cylinder head with two nuts.

3. Position low pressure fuel return hose on injector allow fuel flow. Secure with one bolt.

4. Connect high pressure line to injector.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

5. Connect positive then negative battery cables.

6. Connect red upper stator to regulator wire.

7-3. Fuel Injector Pump Removal and Installation Timing Adjustment

a. Removal

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cables.

3. For access remove muffler extension pipe and muffler.

CAUTION

If stop control is not in stop position, pump will not come out because the fuel rack must be in the middle position.

Do not force the pump when removing or it may be damaged.

4. Put engine stop control in the stop position.

5. Disconnect low pressure fuel supply line and high pressure line at fuel pump.

Remove three (3) nuts holding pump to block. Slowly pull the pump form the block.

b. Timing Adjustment and Installation

NOTE

If injector pump is replaced, it is necessary to check the timing after Installing pump.

1. Install injection pump and adjust timing

a. Install a few advance adjusting shims (gaskets) between the flange of the pump and the engine block.

NOTE

Use shim thickness removed from unit as a starting point.

b. Rotate the flywheel until the injection pump cam is in the rest (lowest) position.

c. Hold the stop lever in, until the governor lever fork is in middle position of the injection pump housing in the engine block.

d. While holding the stop lever in the above position, install the injection pump in the engine block, being careful that the fuel rack pin is correctly set in between the governor lever fork, Fig. 7-4. Install injector pump, Fig. 7-5.

2. Adjust injection advance timing.

a. Hold the stop control lever in to the first point of resistance (about halfway).

b. Put the throttle lever to the maximum speed position.

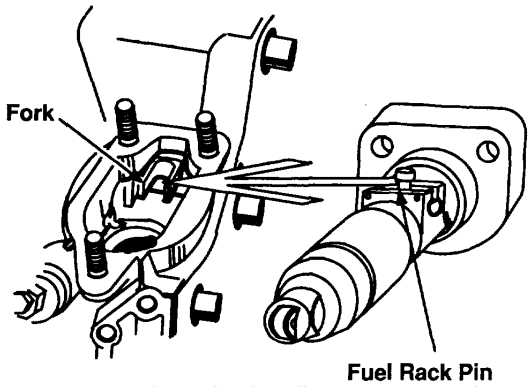


Figure 7-4. Fuel Rack Pin Alignment to Fork.

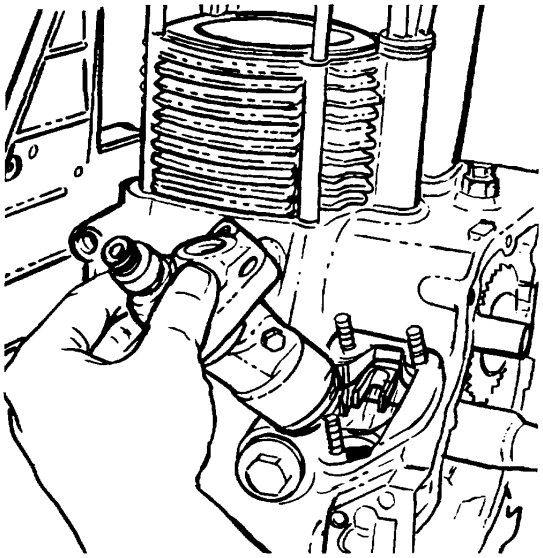


Figure 7-5. Installing Injector Pump

c. Unscrew the delivery connector to the injection pump, remove the delivery needle valve but not it's seat. Install the connector and delivery valve seat back on the injection pump, fig. 7-6.

d. Connect the fuel tank to the injection pump.

e. Rotate the flywheel. At the beginning of the compression stroke, fuel will be ejected from the fuel pump delivery connector.

f. Keep on slowly rotating the flywheel in the compression stroke, until the fuel ceases to come out.

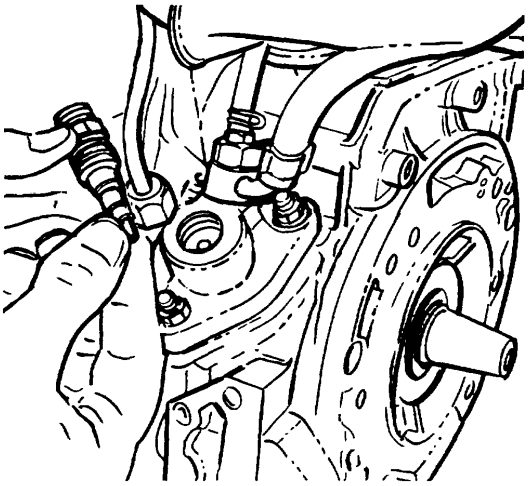


Figure 7-6. Removing Delivery Needle Valve

This is the moment when the pumping action of the injection pump begins, and the reference mark on the crankshaft support (flywheel side) must coincide with the circular mark on the flywheel, fig. 7-7.

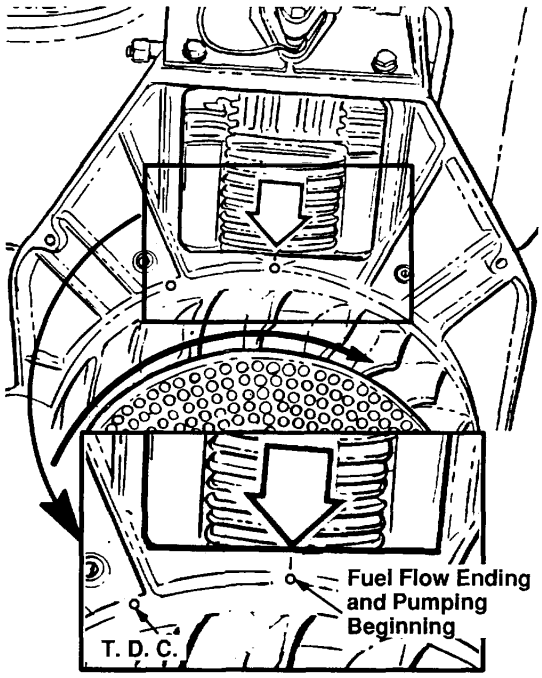


Figure 7-7. Pumping Beginning

g. If the circular reference mark is before the notch on the crankshaft support, the injection is too advanced, so that it is necessary to remove the pump and add shims (gaskets) between the pump flange and the crankcase, fig. 7-8.

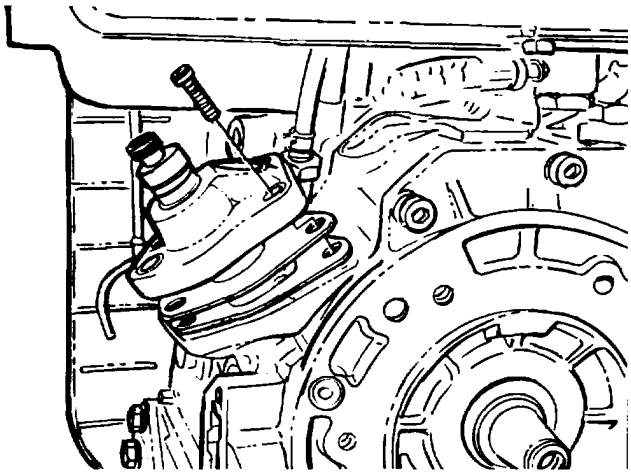


Figure 7-8. Removing Injection Pump for Shimming

h. If the circular reference mark is after the notch on the crankshaft support, the injection is too late and pump shims (gaskets) must be removed.

i. Each 0.1 mm (0.0039 Inches) shim thickness moves the pumping beginning point about one degree on the flywheel.

3. Pump Length of Stroke Check

a. After noting the pumping start with accelerator lever in maximum speed position, proceed as follows: Slowly rotate the flywheel until the fuel begins to come out again from the pump delivery connector. II this moment the pumping action ends, and the distance between the circular mark stamped on the flywheel and the crankshaft support must be 37 mm or 1.457 in., fig 7-9.

b. If the circular mark falls before the specified distance, the fuel delivery is not sufficient. If beyond the specified distance, the fuel delivery is excessive. Rotate the eccentric pin to achieve correct specifications fig. 7-10.

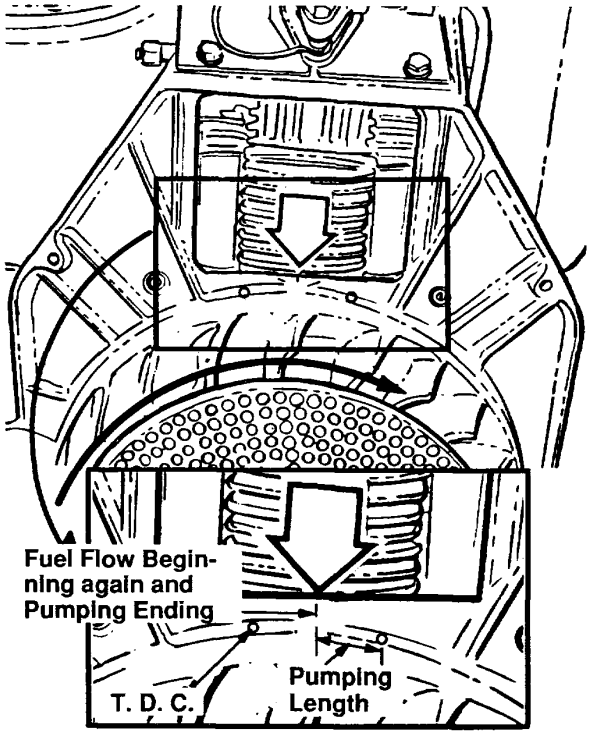


Figure 7-9. Pumping Length

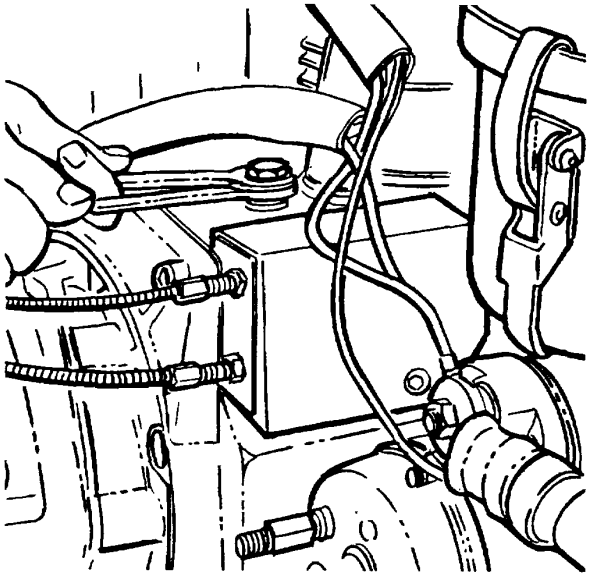


Figure 7-10. Rotating Eccentric Pin

c. At completion of adjustment, unscrew delivery connector of the injection pump, install the delivery needle valve in the injector pump and again stall the connector.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

4. Connect positive then negative battery cables.

5. Connect red upper stator to regulator wire.

7-4. Adjusting Valve Clearance

a. Removal of Valve Cover and Adjustment.

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cable

3. Remove wing nut, washer and air cleaner.

4. Remove two screws and washers from valve cover. Remove cover and gasket.

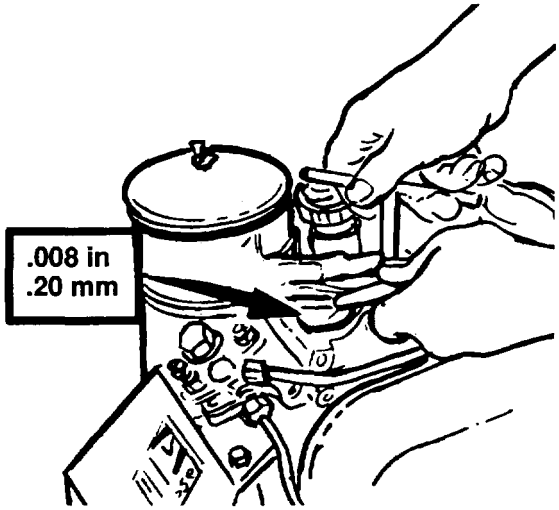


Figure 7-11. Adjusting Valve Clearance

5. Adjust the valve clearance, with the engine cold using a feeler gauge. Adjust the clearance between valves and rocker arms to .008 in or .20 mm, fig. 7-11.

b. Installation

1. Install valve cover, torque to 4.9 Nm or 3.6 lb-ft. Replace with new gasket if needed.

2. Install air cleaner, washer and wing nut.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

3. Connect positive then negative battery cables.

4. Connect red upper stator to regulator wire.

7-5. Starter Removal and Installation

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cables.

3. Remove wing nut, washer and air cleaner.

4. Disconnect two wires at solenoid.

5. Remove two Allen screws holding starter to front cover.

6. Remove strap supporting starter at bracket and remove starter.

b. Installation

1. Position starter to engine front cover and loosely install two Allen Head mounting screws while supporting starter.

2. Torque starter-to-front-cover screws to 33 Nm (25 ft-lbs).

3. Tighten strap securing starter to support bracket.

4. Connect two wires at solenoid.

5. Install air cleaner and secure with washer and wing nut.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

6. Connect positive then negative battery cables.

7. Connect red upper stator to regulator wire.

7-6. Ring Gear Removal and Installation

a. Removal

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cables.

3. Remove four Allen screws and flatwashers that cure protective cover to engine front cover.

4. Remove flywheel nut and washer, rope pulley and guard net.

5. Use puller NSN 5-180{)(023-1596, P/N 938 to move ring gear. Fabricate legs as shown in Fig. NO TAG

6. Remove flywheel using puller, fig. 7-12. Remove key from crankshaft.

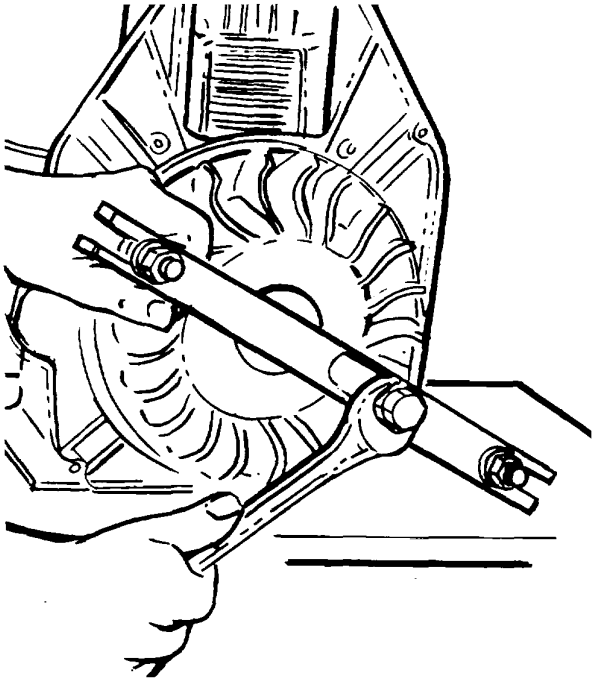


Figure 7-12. Removing Flywheel

7. Remove flywheel ring gear with housing. If necessary, remove ring gear.

b. Installation

1. Install ring gear on flywheel housing, if removed. Secure flywheel to flywheel housing.

2. Push flywheel assembly onto crankshaft and install key.

3. Install guard net, rope pulley, washer and flywheel nut. Tighten flywheel nut to a torque of 275 NM or 203 lb-ft.

4. Position protective cover and secure with four Allen screws and flatwashers.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

5. Connect positive then negative battery cables.

6. Connect red upper stator to regulator wire.

7-7. Compression Testing

If necessary to perform a compression check, utilize Compression Tester \, NSN 10899180.

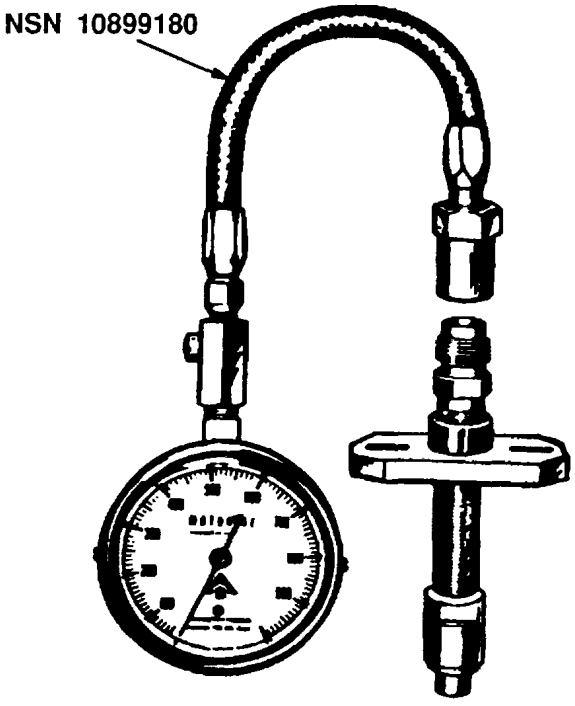


Figure 7-13. Compression Tester

7-8. Charging Circuit Components Removal and Installation

CAUTION

It is Important to observe the following charging circuit precautions to prevent damage to components:

The voltage regulator must be connected to the battery and electrically grounded before the alternator is connected to the voltage regulator. Failure to do so may damage the voltage regulator.

Make sure red wire into the "R" terminal at regulator is disconnected before connecting battery. Then re-connect the red wire after battery is connected and before operating unit.

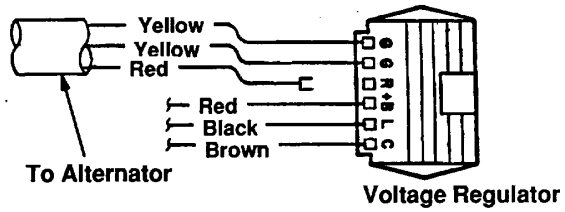


Figure 7-14. Voltage Regulator Harness

A. Disconnect red wire.
B. Connect battery.
C. Connect red wire.

Observe correct polarity when connecting the battery cables: positive cable to positive post and negative to negative. If cables are reversed, even momentarily, the voltage regulator and alternator will be damaged Immediately and must be replaced.

A loose or intermittent ground connection between battery negative terminal and voltage regulator frame will cause a varying charge current and damage to the voltage regulator may occur.

If during operation either yellow wire Is grounded, the rotor is quickly demagnetized and the stator is damaged. Either result will necessitate the replacement of the alternator(stator and magnetized rotor). The battery may also totally discharge.

a. Voltage Regulator Removal

1. Disconnect negative then positive terminals at battery.

2. Disconnect red wire and two yellow wires in loom from voltage regulator.

3. Remove remaining harness connection (red, black, brown wires) at voltage regulator.

4. Remove two screws and voltage regulator.

b. Voltage Regulator Installation

1. Secure voltage regulator with two screws.

2. Connect red, black, brown wires harness connection to voltage regulator

3. Connect two yellow wires in loom at voltage regulator.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

3. Connect positive then negative battery cables.

4. Connect red upper stator to regulator wire.

c. Alternator Stator and Magnet Removal

1. Remove flywheel ring gear with housing as described in part a of para 7-6.

2. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

3. Disconnect negative, then positive battery cables.

4. Disconnect two yellow wires in loom from voltage.

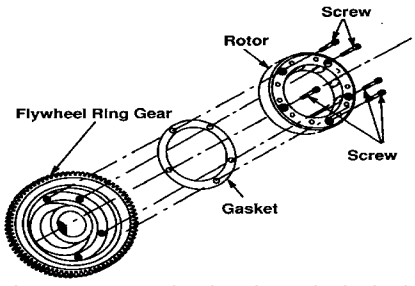


Figure 7-15. Flywheel Exploded View

5. Separate alternator permanent magnet rotor from flywheel housing by removing five Allen screws and gasket, Fig. 7-15.

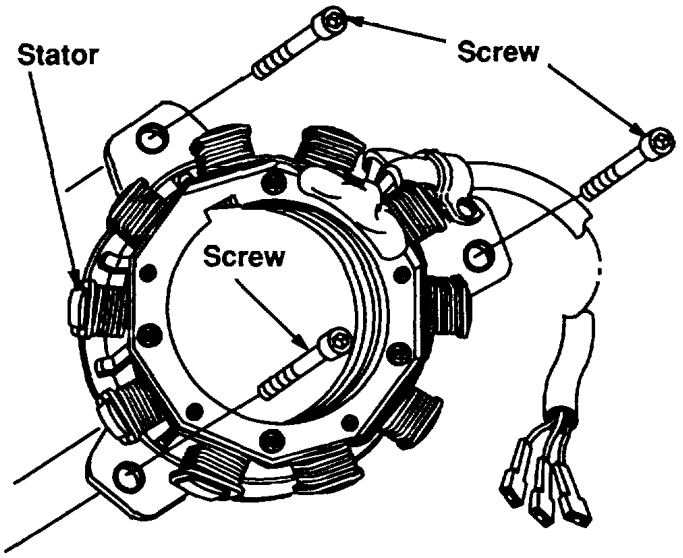


Figure 7-16. Stator Retaining Screws

6. Remove three Allen screws and stator assembly from engine front cover, Fig. 7-16.

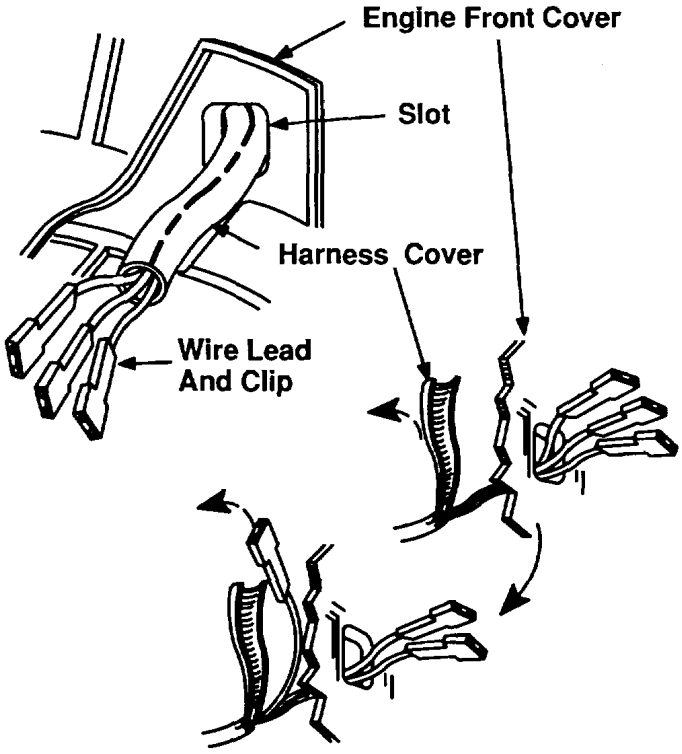


Figure 7-17. Passing Alternator Harness

NOTE

Slot in engine cover plate is too small to allow alternator harness leads to be pulled through the slot without cutting off clips. In order to be able to remove the leads without cutting off the clips, perform the following procedure.

7. Very carefully, slice through the harness cover of the alternator, making sure not to cut insulation of wire leads contained within the insulating cover. Make cut to about 4-inches back from clips, Fig. 7-17.

8. Peel cover back, and pull it through slot in engine cover plate. This will allow enough room to pull leads with attached clips through the slot without cutting off clips. Pull leads with clips attached through the slot, one at a time.

d. Alternator Stator and Rotor Magnet Installation

NOTE

If new stator is installed, steps 5 and 6 of removal procedure must be performed on new harness.

1. Insert leads and insulating harness cover through slot in engine front cover. Once all leads and insulation is through slot, make sure insulation on leads is not damaged. Wrap damaged area with electrician's insulating tape as needed to complete the repair.

2. Install stator assembly on engine front cover and secure with three Allen screws.

3. Install gasket and alternator permanent magnet rotor and secure with five Allen screws.

4. Install flywheel ring gear with housing as described in part b of para 7-12.

5. Connect two yellow wires in loom at voltage regulator.

CAUTION

Do not connect red stator-to-regulator wire until after battery has been connected to engine.

6. Connect positive then negative battery cables.

7. Connect red upper stator to regulator wire.

7-9. Pump Removal and Installation, Food Grade Mechanical Seal Replacement.

WARNING

Remove or disconnect battery before working on engine or pump set.

Wash oil or fuel from skin as soon as possible after contact.

Never disconnect any wire unless the engine Is stopped and all switches are in the "OFF" position.

1. Disconnect upper red alternator-to-voltage regulator wire at voltage regulator.

2. Disconnect negative, then positive battery cables.

3. Close emergency valve and open discharge valve to drain water from pump and water pipes.

4. Remove six screws securing rear panel to cabinet.

5. Disconnect skid from mounting plate by removing four nuts and washers from bolts attaching assembly to engine.

6. Disconnect and remove coupler between "U"-tube water outlet and pump inlet adapter.

7. Remove two bolts and coupler that holds pump outlet and disconnect outlet from pump.

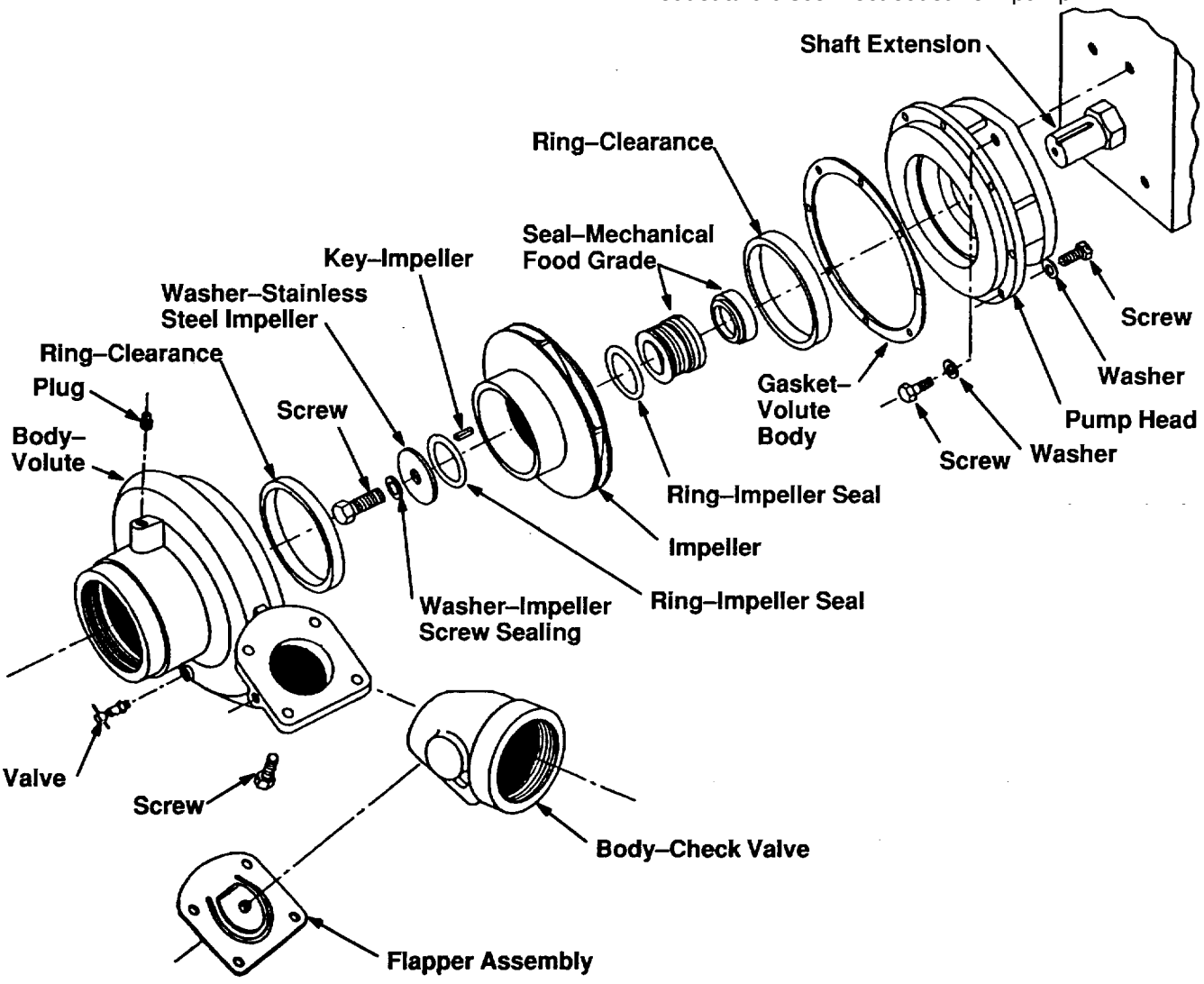


Figure 7-18. Pump Disassembled

8. Remove eight screws that secure pump volute body to pump head. Tap body free with **soft** hammer (rawhide, rubber head, etc.).

9. Remove one screw and washer which fastens impeller to shaft.

NOTE

Place a long 3/8" screw or 3/8" diameter bar through one of the pump head mounting holes and a flat bar In one of the Impeller cavities. This will prevent the engine from rotating when removing screw.

10. Remove impeller by putting hardwood wedges on each side of impeller, between it and pump head. The wedges should bear against impeller disc directly behind impeller vanes to prevent damaging the impeller, Impeller key can be removed after impeller.

11. Remove the spring and carbon section (sealing washer) of food grade pump mechanical seal from shaft. Observe the seal seat and sealing washer. If they are scored or the lip on sealing washer is worn, replace complete seal assembly.

12. Inspect impeller hubs and clearance rings in pump volute and pump head and replace if any of these surfaces are scored or worn excessively.

13. If service other than pump mechanical seal replacement is being performed, remove four screws that cure pump head to engine.

b. Installation

WARNING

Observe correct polarity when connecting the battery cables: positive cable to positive post and negative to negative. If cables are reversed, even momentarily, the voltage regulator and alternator will be damaged immediately and must be replaced.

A loose or intermittent ground connection between battery negative terminal and voltage regulator frame will cause a varying charge current and damage to the voltage regulator may occur.

1. If removed, install pump head to engine with four screws.

2. Apply food grade silicone on outside of pump mechanical seal seat and carefully press into pump head with ceramic surface toward you.

3. Apply food grade silicone on side of sealing washer and turn onto shaft until the lip comes into contact with ceramic surface.

CAUTION

Keep the seal seat (ceramic) and sealing washer surfaces of pump mechanical seal clean, and be careful not to crack or chip ceramic surface or carbon wearing lip.

4. Place "O" rings in grooves of impeller, then line up keyway of shaft, push impeller onto shaft. Insert impeller key.

5. Replace screw, copper washer, and steel washer and tighten to

NOTE

Place a long 3/8" screw or 3/8" diameter bar through one of the pump head mounting holes and a flat bar In one of the Impeller cavities. This will prevent the engine from rotating when securing screw.

6. Clean gasket surfaces on pump head and pump volute body. Then use food grade silicone greased gasket, secure pump volute body to pump head with eight screws.

NOTE

Use new impeller screw, copper washer, gaskets, "O" rings, and nylon locking cap (pump head to pump volute body) screws.

7. Connect coupler that holds "U"-tube water outlet and pump inlet adaptor.

8. Connect pump outlet to pump by securing coupler with two bolts.

9. Connect skid to mounting plate with four bolts and washers.

10. Connect battery cables carefully observing polarity. Positive cable is installed first and goes to connection starter.

11. Connect upper red alternator-to-voltage regulator wire at voltage regulator.

12. Install rear panel on cabinet with six screws.

13. Open emergency valve and discharge valve and unit discharge until stream runs normal.

CAUTION

Water must run normally to avoid a fluid stoppage caused by air pockets. Such an incident while the engine is running could damage the food grade seal in the pump.

14. Test run and check for leaks.

CAUTION

Make sure water is flowing through the pump within two minutes of starting dispensing unit engine, otherwise pump mechanical seal can be damaged. Open discharge valve to check.

15. Prior to placing the pump back into service, it must be cleaned and sanitized. Cleaning is described in para 4-36. Sanitizing is reviewed in para 4-37.

7-10. Torque Setting

Table 4-6. M1098 Engine Torque Setting

APPLICATION	BOLT SIZE	Nm	Lb-Ft.	
Alternator		M6	8	6
Rocker Arm Cover		M6	5	4
Intake Manifold		M8	20	15
Exhaust Manifold		M8	20	15
Engine Front Cover		M8	25	18
Flywheel Nut		M22 X 1.5	275	203
Oil Filter Plug		M 27 X 1.5	25	18
Oil Pump Cover		M5	8	6
Starting Motor		M10	33	25
Engine Mount		M8	20	15
Fuel Pump		M8	25	18
Injection Pump		M8	20	15
Injector		M8	20	15
Cylinder Head		M 10 X 1.25	49	35
Oil Sump Screw		M6	10	7
Valve Clearance Adjustment Screw		M6	10	7
Crankshaft Support (flywheel side) Screw		M 8	23	17
Connecting Rod Cap Screws		M 8 X 1	34	25

APPENDIX A

REFERENCES

A-1. Scope

This appendix lists forms, field manuals, technical manuals, and other publications referenced in this manual and which apply to the operation, organizational maintenance, and direct and general support maintenance of the semitrailers.

A-2. Department of the Army Pamphlets

Consolidated Index of Army Publications and Blank Forms..... DA Pam 25-30
Index and Description of Army Training Devices ..... DA Pam 310-12
Using unit Supply System (Manual Procedures)..... DA Pam 7102-1
The Army Maintenance Management System (TAMMS)..... DA Pam 738-750

A-3. Forms

Recommended Changes to Publications and Blank Forms.....DA Form 2028
Recommended Changes to Equipment Technical Publications ..... DA Form 2028-2
Organizational Control Record for Equipment.....DA Form 2401
Equipment Inspection and Maintenance Worksheet.....DA Form 2404
Maintenance Request. DA Form 2407
Preventive Maintenance Schedule and Record .....DA Form 314
Processing and Deprocessing Record for Shipment, Storage,
and Issue of Vehicles and Spare Engines..... DD Form 1397
Report of Discrepancy (ROD) ..... SF 364
Product Quality Deficiency Report..... SF 368

A-4. Field Manuals

NBC Contamination Avoidance.....FM 3-3
NBC Protection.....FM 3-4
NBC Decontamination.....FM 3-5
Field Behavior of NBC Agents (Including Smoke and Incendiaries) .....FM 3-6
Camouflage .....FM 5-20
Route Reconnaissance and Classification .....FM 5-36
Ammunition Handbook .....FM 9-13
Operation and Maintenance of Ordnance Material in Cold Weather
(0° to -65°F).....FM 9-207
Field Hygiene and Sanitation.....FM 21-10
First Aid for Soldiers .....FM 21-11
Manual for the Wheeled Vehicle Driver.....FM 21-305
Training in units .....FM 25-3
Basic Cold Weather Manual.....FM 31-70
Northern Operations.....FM 31-71
Army Motor Transport Units and Operators .....FM 55-30
Desert Operations (How to Fight).....FM 90-3
Mountain Operations .....FM 90-6
Operational Terms and Symbols..... FM 101-5-1

A-5. Supply Bulletins

Storage Serviceability Standard: Tracked Vehicles,
Wheeled Vehicles, and Component Parts ..... SB 740981

A-6. Technical Bulletins

Hand Portable Fire Extinguishers Approved for Army Users ..... 5-4200200100.
Tactical Wheeled Vehicles: Repair of Frames ..... TB 9-2300-247-40
Air Pollution Control Procedures for Military Vehicles: Construction Equipment and Materials Handling Equipment ..... TB 9-2300-402-10
Equipment Improvement Report and Maintenance Digest (US Army Tank-Automotive Command) Tank and Automotive Equipment ..... T430001-39 Series
Maintenance Expenditure Limits for Tactical Wheeled Vehicles ..... TB 43002-81
Color, Marking and Camouflage Painting of Military Vehicles, Construction Equipment, and Materiels Handling Equipment ..... TB 430209
Corrosion Prevention and Control Including Rustproofing Procedures for Tactical Vehicles and Trailers ..... TB 43-0213
Maintenance in the Desert ..... TB 43-0239
Occupational and Environmental Health: Sanitary Control and Surveillance of Field Water Supplies ..... TB MED 577
Description, Use, Bonding Techniques, and Properties of Adhesives ..... TB ORD 1032

A-7. Technical Manuals

Inspection, Care, and Maintenance of Antifriction Bearings ..... TM 9-214
Operator's Manual for Welding Theory and Application ..... TM 9-237
Deep water Fording of Ordnance Materiel ..... TM 9-238
Materials used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Items Including Chemicals ..... TM 9-247
Organizational, Direct Support, and General Support Care, Maintenance, and Repair of Pneumatic Tires and Inner Tubes ..... TM 9-2610-200-24
Operator's, Organizational, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries ..... TM 9-614200-14
Painting Instructions for Field Use ..... TM 43-0139
Railway Operating and Safety Rules ..... TM 55-200
Rail car Loading Procedures ..... TM 55-601
Storage and Materials Handling ..... TM 743-200-1
Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use ..... TM 750-244-6
Direct Support and General Support Quality Control for Inspector's Inspection Criteria ..... TM 750-245-4

A-8. Other Publications

Army Medical Department Expendable/Durable Items ..... CTA 8-100
Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) ..... CTA 50-970

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

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

b. The maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or components. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets required for each maintenance function as referenced from Section H.

d. Section IV contains supplemental instruction. 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 standard through examination (e.g., by sight, sound, or feel).

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

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

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

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

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

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (components or assembly_ in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the third position of the SMR code.

i. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and 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) prescribed to restore an item to a completely servicable/operation condition as required by maintenance standards in appropriate technical publication (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 materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those gage measurements (hours/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 maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00."

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 the functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, see para B-2.)

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in Column 3. This represents the active time required to perform maintenance function at the indicated level of maintenance. If the number or complexity of the tasks the listed maintenance function vary at different maintenance levels. appropriate work time figures w shown for each level. The work time figure represents the average time required to restore and item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the required to perform the specific tasks identified for maintenance functions authorized in the Maintenance Allocation Chart. The symbol designations for the various maintenance levels are as follows:

C..... Operator or Crew
O..... Unit Maintenance
F ..... Direct Support Maintenance
H..... General Support Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tools 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 alphabetic 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, Tool or Test Equipment 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 Level. The lowest level of maintenance authorized to use the tool or test equipment.

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

d. Column 4, National/NATO Stock Number. The National or NATO Stock Number of the tool or test equipment.

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

B-5. Explanation of Columns in Remarks, Section IV

a. Column 1, Reference 4 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.

Section II. MAINTENANCE ALLOCATION CHART

(1)	(2)	(3)	(4) MAINTENANCE LEVEL					(5)	(6)
			UNIT		DS	GS	Depot		
GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	C	O	F	H	D	TOOLS AND EQUIPMENT	REMARKS
06	**ELECTRICAL SYSTEM**								
0607	*Instrument or Engine Control panel*								
	Wiring, Switches, Decals, Connectors, Conduits, Etc.	Inspect Replace Repair		0.3 0.5 0.5					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0607	*Instrument or Engine Control Panel*								
	Hourmeter	Inspect		0.3					
		Replace		0.5					
0608	*Miscellaneous Items*								
	Box, Triple Marker	Inspect		0.6					
	Rear: Wiring, Connectors, etc.	Repair		1.0					
0609	*Lights*								
	Marker, Composite, Tail, Stop	Inspect		0.6					
		Replace		1.0					
		Repair		1.0					
0610	*Sending Units and Warning Switches*								
	Oil Pressure, Lights, Lamps	Inspect	0.2						
		Replace		0.5					
0612	*Batteries, Storage*								
	Battery, Cover, Box, Terminals, Cables	Service	0.3						
		Test		0.5					
		Replace		0.5					
		Repair		1.0					
0613	*Chassis Wiring Harness*								
	Chassis Wiring, Connectors, Vehicle Coupling	Inspect		0.6					
		Replace		3.0					
		Repair		3.0					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
11	**REAR AXLE**								
1100	*Rear Axle Assembly*								
	Complete Rear Bogie	Service		4.0					
	Attaching Parts:	Replace			6.0				
	Mounting, Gaskets, Seals and Bearings. Tandem Tubes and Spring Seats	Repair			4.0				
12	**BRAKES**								
1202	*Service Brakes*								
	Service Brake Shoe Assemblies and Adjusting Parts	Test		1.5					
		Adjust		1.0					
		Replace		4.0					
		Repair			8.0				
1208	*Air Brake System*								
	Coupling, Air Lines and Fittings, Dummy Couplings	Inspect		0.6					
		Replace		0.5					
		Repair		0.5					
	Chamber, Air, Fail Safe	Inspect and Test		0.2				Pressure Gage 6885-00-387-9654	
		Replace		2.0					
	Valve, Emergency Relay	Inspect		0.6					
		Replace		2.0					
	Reservoir, Air and Drain Cock	Service	0.2						
		Replace		1.0					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
13	**WHEELS**								
1311	*Wheel Assembly*								
	Wheel Assembly, Nuts, Studs, Rings	Replace		0.3					
	Hub and Drum	Replace		1.0					
		Repair			1.0				
	Bearings	Service		0.5					
		Replace		1.0					
	Seals and Wipers			0.5					
				1.0					
1313	*Tires, Tubes*								
	Tubes	Service		1.0					
		Replace		0.5					
		Repair		1.0					
	Tires	Replace		0.5					
		Repair				1.0			
15	**FRAME, TOWING ATTACHMENTS**							1,2,3,4,5	A,B
1501	*Frame Assembly*								
	Frame Bumpers, Brackets	Repair			2.0				
	Control, Emergency Valve, Cables	Service		0.5					
		Adjust		1.0					
		Replace		2.0					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
1503	*Pintles and Towing Attachments*								
	Pintles and Towing Attachments	Service	0.2						
		Inspect		0.3	0.4				
	Upper Coupler (Kingpin) Plate	Inspect		0.3					
		Service		0.3					
		Replace		3.0					
1504	*Spare Wheel Carrier and Tire Lock*								
	Carrier, Spare Wheel	Service		0.3					
		Replace			1.0				
1507	*Landing Gear, Leveling Jacks*								
	Landing Gear, Crank, Jack, Pad and Brackets	Service		0.2					
		Replace		2.0					
		Repair			6.0				
	Board Assembly, Landing Gear	Replace		0.5					
		Repair		0.3					
16	**SPRINGS**							1,2,3	A,B
1601	*Springs*								
	Springs and Attaching Parts	Replace			4.0				
1605	*Torque, Radius, and Stabilizer Rods*								
	Torque, Radius, and Stabilizer Rods	Replace			2.0				
		Repair			2.0				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
18	**BODY**							1,2,3,4	A,B
1801	*Body*								
	Brackets, Splash Plates, Mudflaps	Replace		0.6					
		Repair			2.0				
1808	*Stowage Racks, Boxes, Straps, Carrying Cases, Cable Reels, Hose Reels, Troughs, etc.*								
	Stowage Racks	Service	0.2						
		Repair			1.0				
	Cabinet	Service	0.2						
		Repair			1.0				
		Replace			8.0				
		Inspect	0.1						
	Tool Box	Service	0.1						
		Replace			0.5				
		Repair			1.5				
		Inspect	0.1						
	Cabinet Doors	Service	0.2						
		Repair			1.0				
		Inspect	0.1						
1811	*Tank Bodies*								
	Cover Manhole	Service		0.2					
		Replace		0.5					
		Adjust		0.3					
	Clamp, Gasket, Manhole Cover	Replace		0.5					
				0.2					
	Ladder, Clean Drains, Catwalk	Inspect	0.2						
		Service		0.6					
		Repair			2.0				
	Tank	Inspect	0.4						
		Repair			8.0				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
22	**BODY ACCESSORY ITEMS**							1,2,3	A,B
2202	*Accessory Items*								
	Accessories, Transfer Hoses, Caps, Reflectors, Plugs	Replace Inspect	0.2	0.5					
2210	*Data Plates and Instruction Holders*								
	Plates, Instruction Data Decals, Identification Caution	Replace		0.3					
29	**ENGINE ASSEMBLY**							1,2,3,4, 5,6,7,9	A,B
2910	*Engine Assembly*								
	Engine	Inspect Service Replace Repair	0.2	 0.5 2.0	 4.0				
2913	*Flywheel Assembly*								
	Flywheel and Ring Gear	Inspect Replace		0.5	 1.5				
2915	*Valves and Timing System*								
	Valves and Timing System	Adjust			0.8				

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
2916	*Engine Lubrication System*								
	Engine Lubrication System, Oil Filter, Oil Breather, Gaskets	Inspect		0.2					
		Repair			1.5				
		Replace		0.3					
		Service		0.2					
2932	*Engine Fuel Pump*								
	Engine Fuel Injection Pump	Inspect		0.2					
		Adjust		0.5					
		Replace			1.0				
2933	*Engine Air Cleaner*								
	Air Cleaner Element	Inspect	0.1						
		Service	0.3						
		Replace		0.4					
2935	*Engine Fuel Tank*								
	Engine Fuel Tank, Lines	Inspect	0.2						
		Service		0.5					
		Replace		1.0					
2937	*Engine Fuel Filter*								
	Fuel Filter	Service		0.3					
		Replace		0.5					
2939	*Engine Throttle and Choke Controls*								
	Engine Throttle, Stop Controls, RPM's	Adjust		0.2					
		Replace		0.5					
2941	*Engine Muffler, Exhaust and Tail Pipes*								
	Engine Muffler, Exhaust Gasket	Replace		0.3					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
2952	*Engine Cowling, Deflectors, Air Ducts, and Shrouds*								
	Engine Cowling and Shroud	Replace Repair		1.0 0.6					
2961	*Generator*								
	Regulator	Replace		1.0					
	Alternator, Stator/Rotor Magnet	Replace			1.5				
2963	*Starter, Solenoids, Wiring, and Switches*								
	Starter	Inspect Replace							
	Wiring, Switches, Control Panel	Inspect Replace Repair	0.1	 0.5 0.5					
47	**GAGES (NON-ELECTRICAL), WEIGHING AND MEASURING DEVICES**								
4702	*Gages, Mountings, Lines and Fittings*								
	Water Pump	Inspect Replace Repair	0.1	 0.3 0.4					
72	**DISPENSING AND SERVICING EQUIPMENT COMPONENTS**							1,2,3,4,5	A,B
7202	*Pumps and Meters*								
	Water Pump, Suction and Discharge	Service Replace Repair		0.5 1.5 1.0					

Section II. MAINTENANCE ALLOCATION CHART - Continued

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL UNIT C	UNIT O	DS F	GS H	Depot D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
7203	*Valves, Fittings, Lines*								
	Valves, Fittings, Lines, Piping and Controls, Piping Screens	Service		0.5					
		Replace		1.5					
		Repair		0.5					
7204	*Miscellaneous Parts and Accessories*								
	Faucets	Inspect	0.2						
		Service		0.5					
		Replace		0.3					

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) TOOL OR TEST EQUIPMENT REF CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/NATO STOCK NUMBER	(5) TOOL NUMBER
1	O	Tool Kit, General, Mechanic's Automotive	518-00-177-7033	
2	O	Shop Equipment, Automotive Maintenance and Repair, Organizational Maintenance, Common No. 1	4910-00-7540654	
3	O	Shop Equipment, Automotive Maintenance and Repair Field Maintenance	4190-00-754-0653	
4	F	Shop Equipment, Automotive Maintenance and Repair Field Maintenance	4190-00-754-0705	
5	H	Shop Equipment, Wheeled Field Maintenance Post, Camp and Station	491000-348-7696	
		SPECIAL TOOLS:		
6	F	Driver, Oil Seal Rear Crankshaft	5120-00-125-4411	420-0250
7	F	Gage, Compression Test	4910-00-870-6283	10899180
8		Valve Adjustment Tool		
9	F	Universal Puller	5120-00-61 3-775	11671732
10	O	Universal Injection Tester	5180-01-048-8602	TSE-76226
11	F	Flywheel Tachometer		
12	O	Pressure Gage	6885-00-387-9654	See Table 4-1

Section IV. REMARKS

(1) Reference Code	(2) Remarks
A	Direct Support (F) maintenance includes replacement of repairable assemblies, repair of components or assemblies considered uneconomical to evacuate further. This level performs adjustments of systems for which organizational maintenance does not possess skills or test equipment.
B	General Support (H) maintenance includes repair of most replaceable assemblies. Overhaul of assemblies which require extensive work in terms of man-hours, skills, and testing of overhauled assemblies will be accomplished at depots.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. Scope

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

C-2. General

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

a. Section II. Integral 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 as: it is issued or transferred between 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 semitrailer in operation, to operate it, and to perform emergency repairs. Although shipped separately, packaged BII must be with the semitrailer 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 placement BII, based on TOE/MTOE authorization of the end item.

C-3. Explanation of Columns

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

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

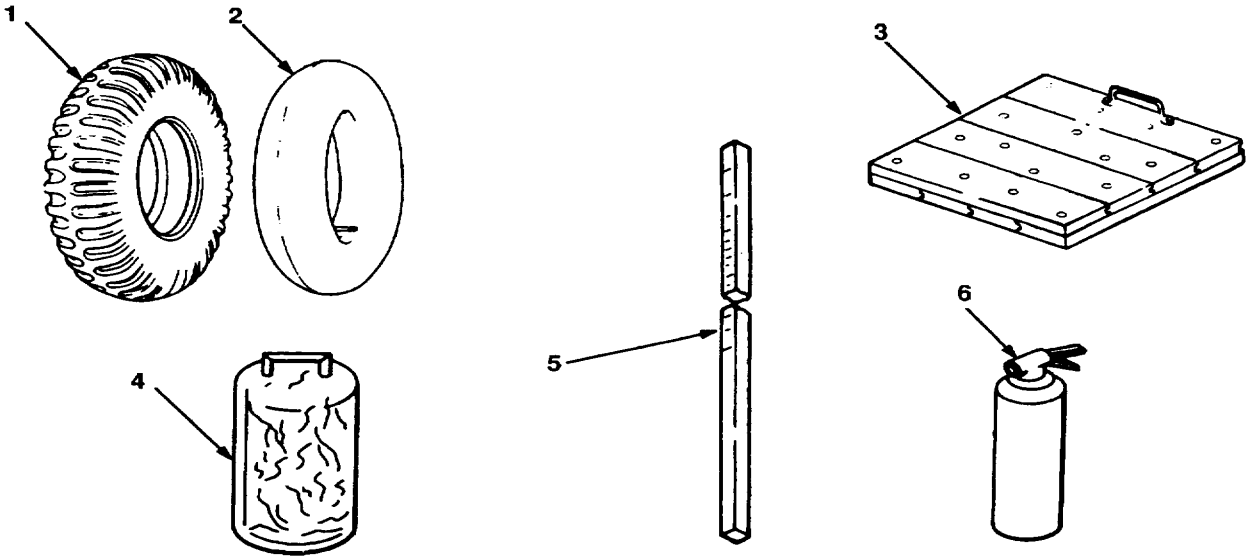
b. Column (2) - National Stock Number. Indicates the National stock number assigned to the item and will he used for requisitioning purposes.

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 parenthesis) followed by the part number. If an item is used on the M1098 Water Tanker, there is but one Usable On Code, WAT, and all parts are assigned to it:

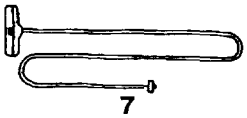
Code	Used On
WAT	M1098

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.



(1)	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, FSCM and Part Number / Usable On Code	(4) U/M	(5) QTY Rqr
1	2610-00-262-8653	TIRE, SPARE (rear bracket) (81349) MIL-T-12459	EA	1
2	2610-00-051-9450	TUBE, INNER, PNEUMATIC (rear bracket) (81348) ZZ-1-550/G2/11.0	EA	1
3	2510-00-741-7585	BOARD, GROUND (at landing legs) (19207) 7417585	EA	2
4	2540-01-080-5597	COVER, FIRE EXTINGUISHER (on extinguishers) (19207) 11668081	EA	2
5	5210-01-054-9934	GAGE, STICK (stowage tube) (19207) 11685988	EA	1
6	4210-00-808-4544	EXTINGUISHER, FIRE (near and side bracket) (03670) IK10E	EA	2



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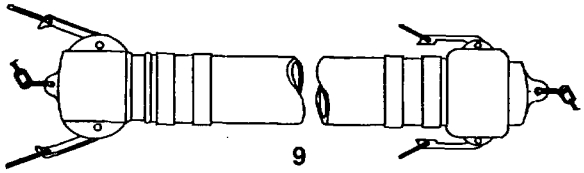

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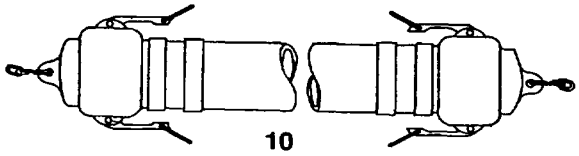

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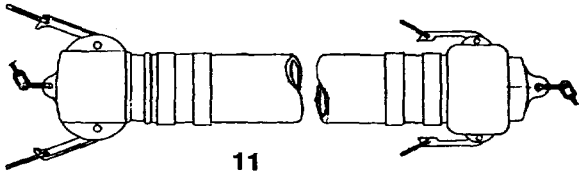

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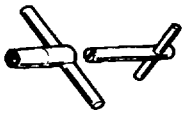
(1)	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, FSCM and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
7		Rope, Starting, M1098		EA	1
8		Acme Tool Kit		EA	1
9		Hose Assy, Water Dispen, 4", M1 098 800-281-38		EA	2
10		Hose Assy, Water Dispen, 4", M1098 800-281-39		EA	1
11		Hose Assy, Water Dispen, 2", M1098 800-281-49		EA	2



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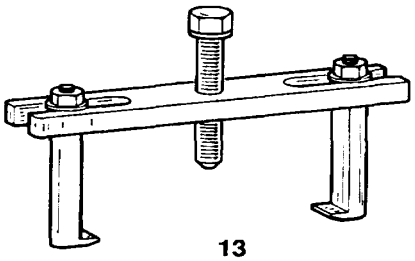

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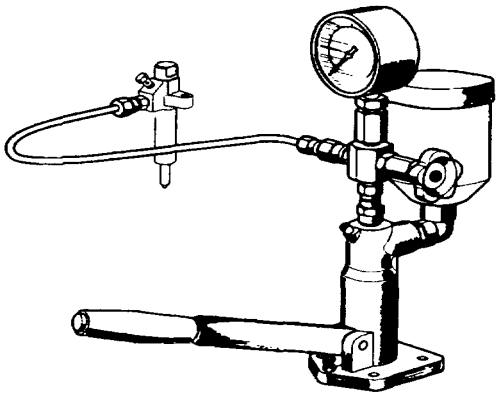

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(1)	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, FSCM and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
12		Valve Adjustment Tool 365.165			
13	5108-00-423-1596	Universal Puller			
14	4910-00-255-8641	Universal Injection Tester 365.043			

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. Scope

a. This appendix lists additional items you are authorized for the support of the M1098 semitrailer.

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

D-2. Explanation of Listing

a. National stock numbers, FSCM and part numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment.

b. If item needed differs for different models of this equipment, the model is shown under the "Usable on Code" heading. The Usable on Code is WAT.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	DESCRIPTION, FSCM and Part Number	(3) QTY U/M	(4) Auth
4930-00-516-0839	ADAPTER ASSY, GRAVITY FILL (96124) 780000-5	EA	1
2590-00-473-6331	BRACKET, WATER CAN (19207) 6566675	EA	1
7240-00-222-3088	CAN, WATER, 5 GAL.	EA	1

APPENDIX E

EXPENDABLE/DURABLE 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 M1098 tank semitrailer. These items are authorized to you by CTA 50-970, Expendable/Durable 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 anti-seize compound, (item 5, Appendix E)".

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

C - Operator/Crew
O- Unit Maintenance
F - Direct 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 Federal Supply Code for Manufacturers (FSCM) in parenthesis followed by the part number.

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

SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C		ADHESIVE; General Purpose (81348) MMM-A-1617	OZ
		8040-00-262-9205	4-Ounce Tube	
2	O		ADHESIVE: Sealant (81349) MIL-A-46106	OZ
		8040-00-225-4548	12 Ounce Tube	OZ
3	C		CLOTH: Abrasive (58536) A-A-I 048	
		5350-00-192-5047	50 Sheets - 80 Grit	EA
		5350-00-192-5049	50 Sheets - 120 Grit	EA
		5350-00-192-5051	50 Sheets - 180 Grit	EA

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
4	C		CLOTH; Abrasive, Crocus (81348) P-C-458	
		5350-00-221-0872	50 Sheets	EA
5	O	8030-00-753-4953	COMPOUND: Anti-seize (81349) MIL- A - 13881	LB
6	O	6030-01-044-5034	COMPOUND: Anti-seize (81349) MIL - T - 5544	LB
7	C	5610-00-782-5555	COMPOUND: Flight Dock (81349) MIL-D-23003	
8	F		COMPOUND: Lapping and Grinding (58536) A- A - 1203	
		5350-00-193-1340	150 Grit - 1 Pound Can	LB
		5350-00-193-1341	220 Grit - 1 Pound Can	LB
		5350-00-193-1348	400 Grit- 1 Pound Can	LB
		5350-00-193-1349	500 Grit- 1 Pound Can	LB
9	F		CORROSION PREVENTIVE: Fingerprint Remover (81349) MIL-C-15074	
		8030-00-664-4017	1 Quart Can	GAL
		8030-00-281-2338	1 Gallon Can	GAL
		8030-00-252-8300	5 Gallon Can	GAL
		8030-00-252-8301	65 Gallon Drum	GAL
10	F		CORROSION PREVENTIVE: Grade 3 (81349) MIL-C-16173	
		8030-00-244-1296	1 Gallon Can	GAL
11	C		DRY CLEANING SOLVENT Type II (81348) P-D-680	
		6850-00-110-4498	1 Pint Can	PT
		6850-00-274-5421	5 Gallon Can	GAL
		6850-00-285-8011	55 Gallon Drum	GAL

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
12	F		DYE: Prussian Blue (81349) MIL-P-30501	
		8010-00-889-9745	1 Ounce Tube	OZ
13	C		FUEL OIL, DIESEL: Arctic, DF-A (81348) W-F-800	
		9140-00-286-5282	5 Gallon Can	GAL
		9140-00-286-5284	55 Gallon Drum	GAL
14	C		FUEL OIL, DIESEL: Regular, DF-2 (81 348) W-F-800	
		9140-00-286-5295	6 Gallon Can	GAL
		9140-00-286-5296	55 Gallon Drum	GAL
15	C		FUEL OIL, DIESEL: Winter, DF-1 (81 348) W-F-800	
		9140-00-286-5287	5 Gallon Can	GAL
		9140-00-286-5288	55 Gallon Drum	GAL
16	F		GREASE: Aircraft (81349) MIL-G-23827	
		9150-00-985-7247	6-1/2 Pound Can	LB
17	C		GREASE: Automotive and Artillery (81349) MIL-G-10924	
		9150-00-935-1017	14 Ounce Cartridge	OZ
		9150-00-190-0904	1-3/4 Pound Can	LB
		9150-00-190-0905	61 /2 Pound Can	LB
18	F		HYDRAULIC FLUID (81349) MIL-H6083	
		9150-00-935-9807	1 Quart Can	QT
19	C	9150-00-889-3523	LUBRICATING OIL: (81349) MIL-P-46002	OZ

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
20	C		LUBRICATING OIL: Internal Combustion Engine, Arctic, OEA (81349) MIL-L-46167	QT
		9150-00-402-4478	1 Quart Can	GAL
		9150-00-402-2372	5 Gallon Can	GAL
		9150-00-491-7197	55 Gallon Drum	
21	C		LUBRICATING OIL: OE/HDO 10w (81349) MIL-L-2104	
		9150-0O-189-6727	1 Quart Can	QT
		9150-00-186-6668	5 Gallon Can	GAL
		9150-00-191-2772	55 Gallon Drum	GAL
22	C		LUBRICATING OIL: OE/HDO 30w (81349) MIL-L-2104	
		9150-00-186-6681	1 Quart Can	QT
		9150-00-188-9858	5 Gallon Can	GAL
		9150-00-189-6729	55 Gallon Drum	GAL
23	O		LUBRICATING OIL: OE/HDO 40W (81349) MIL-L-2104	
		9150-00-189-6730	Quart Can	QT
		9150-00-188-9860	5 Gallon Can	GAL
		9150-00-188-9862	55 Gallon Drum	GAL
24	O		LUBRICATING OIL: OE/HDO 20W/20, 15W/40 (81349) MIL-L-2104	
		9150-01-152-4117	1 Quart Can	QT
		9150-01-152-4118	5 Gallon Can	GAL
		9150-01-152-4119	55 Gallon Drum	GAL
25	O	6505-00-133-8060	PETROLATUM: White	OZ
26	C		RAG: Wiping, Cotton and Cotton Synthetic (58536) A-A-531	
		7920-00-205-1711	50 Pound Bale	LB

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
27	O		SEALANT: Silicone, RTV (11862)1052734	
		8030-01-159-4844	8-1/2 Ounce Tube	
28	O		SEALING COMPOUND: Pipe, Anaerobic, with Teflon (05972) 592-31	
29	O	8030-01-054-0740	50 Milliliter Tube	ML
			TAG: Marker (81349) MIL-T-12755	
			50 Each	EA
30	O		TAPE: Anti-seize, 1/2 inch Width (81349) MIL-T-27730A	
		8030-00-889-3535	260 Inch Roll	
31	0		TAPE: Insulation, Electrical (81 348) HH-I-510	
		5970-00-644-3167	85 Foot Roll	
32	C		Chlorine Test Tablets	
33	C		PH Test Tablets	
34	C		Cleaning Brush	

F-1. Torque Limits

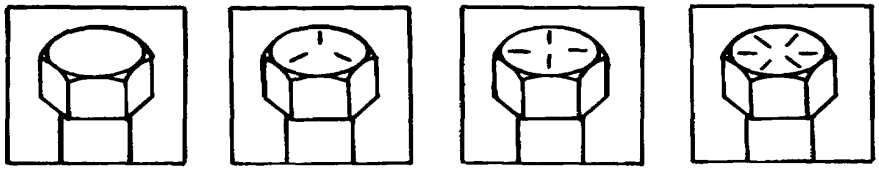
APPENDIX F
TORQUE LIMITS

Table F-1. Standard Torque Specifications,

USAGE	MUCH USED	MUCH USED	USED AT TIMES	USED AT TIMES
CAPSCREW DIAMETER AND MINIMUM TENSILE STRENGTH PSI (KG/SO CM)	To 1/2-69.000 (4850.7000) To 3/4-64,000 (4499.2000) To 1-55,000 (3816.5000)	To 314-120,000 (8436.0000) To 1-115,000 (8084.5000)	To 5/8-140,000 (9842.0000) To 3/4-133,000 (9349.9000)	150,000 (10545.0000)
QUALITY OF MATERIAL	INDETERMINATE	MINIMUM COMMERCIAL	MEDIUM COMMERCIAL	BEST COMMERCIAL
SAE GRADE NUMBER	1 or 2	5	6 or 7	8

CAPSCREW HEAD MARKINGS

Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).



CAPSCREW BODY SIZE (INCHES)- (THREAD)	TORQUE FT-LB (N-M)	TORQUE FT-LB (N.M)	TORQUE FT-LB (N.M)	TORQUE FT-LB (N.M)
1/4-20	5 (7)	8 (11)	10 (14)	12 (16)
-28	6 (8)	10 (14)		14 (19)
5/16-18	11 (15)	17 (23)	19 (26)	24 (33)
-24	13 (18)	19 (26)		27 (37)
3/8-16	18 (24)	31 (42)	34 (46)	44 (60)
-24	20 (27)	35 (47)		49 (66)
7/16-14	28 (38)	49 (66)	55 (75)	70 (95)
-20	30 (41)	55 (75)		78 (106)
1/2-13	39 (53)	75 (102)	85 (115)	105 (142)
-20	41 (56)	85 (115)		120 (163)
9/16-12	51 (69)	110 (149)	120 (163)	155 (210)
-18	55 (75)	120 (163)		170 (231)
5/8-11	83 (113)	150 (203)	167 (226)	210 (285)
-18	95 (129)	170 (231)		240 (325)
3/4-10	105 (142)	270 (366)	280 (380)	375 (509)
-16	115 (156)	295 (400)		420 (570)
7/8-9	160 (217)	395 (536)	440 (597)	605 (820)
-14	175 (237)	435 (590)		675 (915)
1-8	235 (319)	590 (800)	660 (895)	910 (1234)
-14	250 (339)	660 (895)		990 (1342)

CAUTION: Capscrews threaded Into aluminum may require reductions In torque of 30% or more, unless inserts are used.

NOTE: Do not use above values In place of those specified in the engine groups of this manual; special attention should be observed served in case of SAE Grade 6,.7, and 8 capscrews.

1. Always use the torque values listed above when specific specifications are not available.
2. The above is based on use of clean and dry threads.
3. Reduce torque by 10% when engine oil is used as a lubricant.
4. Reduce torque by 20% if new plated capscrews are used.

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LINEAR MEASURE

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

WEIGHTS

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

LIQUID MEASURE

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

SQUARE MEASURE

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

CUBIC MEASURE

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

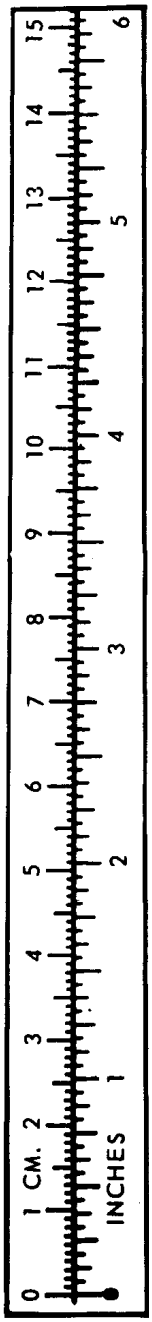
TEMPERATURE

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

APPROXIMATE CONVERSION FACTORS

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

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



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