

TECHNICAL MANUAL

**OPERATOR'S AND UNIT
MAINTENANCE MANUAL**

**TRUCK, FIREFIGHTING,
1000 GPM MULTIPURPOSE,
MODEL 2500L**

NSN 4210-01-193-3621

**This copy is a reprint which includes current pages from
Changes 1 through 8**

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SAFETY WARNINGS**WARNING**

(Compressed Air)

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

WARNING

(Low Voltage)

Death or serious injury could occur under certain conditions by "low voltage." Do not be misled by this term. Treat "low voltage" with the same caution as "high voltage." Be sure that the equipment is unplugged/disconnected and that circuit breakers are set to OFF and batteries are disconnected. Be sure the equipment is properly grounded. Always have another person standing by who is trained in electric shock first aid.

WARNING

(Hoisting)

Death or serious injury could occur if unauthorized or unnecessary personnel are in the hoisting area. Permit only personnel actually engaged in the hoisting operation to be near the vehicle and hoisting equipment. All instructions for the hoisting operations must come from one authorized person.

WARNING

(Hoisting)

injury to personnel or damage to equipment could occur from improper hoisting. Hoist the load slowly to avoid tearing out lifting eye assemblies, slipping slings or load shift. Do not jerk the load or swing it from side-to-side when hoisting. This places additional stress on hoisting components which can cause failure and loss of load. Be sure hoisting equipment is on solid footing and is suitable for the size of the load. Watch boom angle and overhead clearance when hoisting.

WARNING

(Physical Lifting)

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

SAFETY WARNINGS - Continued**WARNING**

(P-D-680)

Dry cleaning solvent P-D-680 is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

WARNING

(Battery Handling)

Serious injury could occur from the careless handling or storage of batteries or battery electrolyte (acid). If acid is splashed on the skin, wash the affected area immediately with plenty of clean water. If acid is splashed in the eyes, wash immediately with plenty of clean water and get medical attention.

WARNING

(Jump-Starting Engines)

Serious injury could occur if dead batteries are not boosted properly. Always wear eye protection. Keep sparks and flames away. Do not smoke. Keep away from dead batteries during starting procedure. Be sure both batteries have the same voltage and grounding and are filled with electrolyte (acid). Do not try to start if the acid is frozen. Connect ends of one cable to the positive (+) terminals of both batteries. Lay a damp cloth over the dead battery to prevent arcing when starting. Connect ends of the other cable to the negative (-) terminal of the good battery and to an engine bracket of dead engine away from dead battery or fuel system components. After dead engine has been started, remove cables in reverse order.

WARNING

(Exhaust Gases)

Carbon Monoxide (exhaust gas) is a colorless, odorless toxic gas. Prolonged inhalation may lead to coma, brain damage, or death. Never operate the main engine or winterization system in an enclosed space without proper ventilation.

For artificial respiration, refer to FM 21-11.

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NO 8

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OPERATOR'S AND UNIT MAINTENANCE MANUAL
TRUCK, FIREFIGHTING, 1000 GPM MULTIPURPOSE,
MODEL 2500L

NSN 4210-01-193-3621

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4-457 and 4-458

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**TRUCK, FIREFIGHTING,
1000 GPM MULTIPURPOSE,
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**TRUCK, RREFIGHTING,
1000 GPM MULTIPURPOSE,
MODEL 2500L**

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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 Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished to you.

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HOW TO USE THIS MANUAL

ARRANGEMENT. This manual is divided into four chapters. The purpose of each chapter is listed below.

Chapter 1 INTRODUCTION. Provides users with information about standard data required in all manuals. It also familiarizes users with the truck and related equipment.

Chapter 2 OPERATING INSTRUCTIONS. Presents instructions needed by the operator and crew to effectively and efficiently operate the trucks.

Chapter 3 OPERATOR MAINTENANCE INSTRUCTIONS. Presents the necessary information for the operator to help keep the truck and its components in good running order.

Chapter 4 UNIT MAINTENANCE. Presents the necessary procedures and instructions including lists of special tools to maintain the truck in good running condition.

An alphabetical subject index, located at the rear of this manual, has been included to improve reader access to required information.

EXPLANATION OF NUMBERING SYSTEM

Text. The information contained in this manual is numbered sequentially for easy access of data.

Example 2-1

First number (2) indicates the chapter

Second number (1) indicates the paragraph numbers within the chapter

The symbols a to z, (1) to (99), and (a) to (zz) indicate subparagraphs.

Page, Figure and Table Numbers. All are numbered sequentially within the chapter.

Example 3-12

First number (3) indicates the chapter

Second number (12) indicates the page number, figure number or table number within that chapter.

LOCATION OF NUMBERS

Text. Appear beside and to the left of related text.

Page. Appear at the bottom right (odd number) or the bottom left (even number) of the page.

Figure. Appear directly below the related illustration.

Table. Appear directly above the related table.

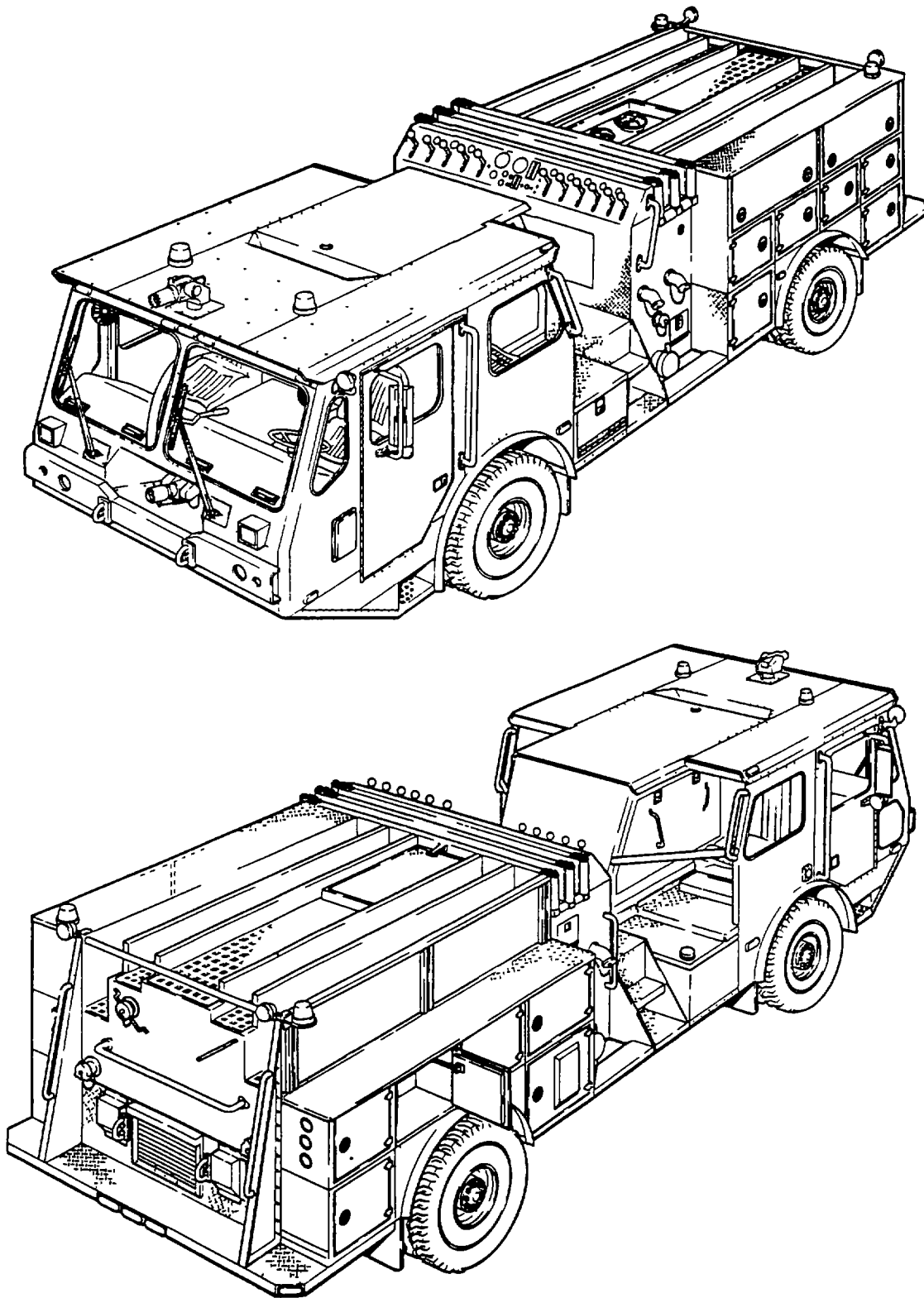


Figure 1-1. Model 2500L Firefighting Truck, NSN 4210-01-193-3621

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

a. This manual provides operator instructions, and operator and unit maintenance instructions for the Model 2500L, 1000 GPM Multipurpose, Firefighting Truck NSN 4210-01-193-3621.

b. The manual includes a detailed description of the truck and its control components as well as detailed information for its operation and maintenance. Although the truck is supplied complete with firefighting equipment, only brief descriptions of this equipment are provided and no attempts are made to explain firefighting techniques.

1-2. MAINTENANCE FORMS, RECORDS AND REPORTS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS. If your Model 2500L Firefighting Truck, needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF368 (Quality Deficiency Report) Mail it to us at Commander, U.S Army Aviation and Troop Command, ATTN: AMSAT-I-MDO, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. We will send you a reply.

1-4. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. The guidelines for destruction of Army materiel to prevent enemy use will be those prescribed in TM 751-244-3.

1-5. PREPARATION FOR STORAGE OR SHIPMENT. The procedures and requirements covering preparation for storage or shipment will be those prescribed in Chapter 4.

1-6. WARRANTY INFORMATION. The Model 2500L, 1000 GPM Multipurpose, Firefighting Trucks, are warranted by Amertek Inc. for 1 year. Warranty starts on date found in block 15, DA Form 2408-9, in the logbook. Report all defects in material or workmanship to your supervisor who will take action through your organizational maintenance shop.

1-7. UST OF ABBREVIATIONS. All abbreviations used in this manual conform to Military Standard MIL-STD-12 and its amendments

Section II. EQUIPMENT DESCRIPTION.**1-8. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES.**

a. Purpose of the Model 2500L Firefighting Truck, NSN 4210-01-193-3621. This firefighting truck is designed for aircraft crash, fire, and rescue operations. The truck is also capable of fighting ground and structural fires.

b. Capabilities. The speed and constant readiness of this truck enables quick response to any emergency situation. The truck is equipped with selective two or four-wheel drive making it suitable for travel both on or off-road. For firefighting, the truck is equipped with on-board water and foam tanks and an engine driven fire pump. In aircraft crash emergencies, water and foam can be deployed with the truck stationary or in pump-and-roll mode from two discharge turrets mounted on the front of the truck. For fighting of structural fires, hose equipment connected to pressure outlets on the sides and rear of the truck may be used.

c. Features. The features characterizing the Model 2500L firefighting truck, comprise:

- (1) Low center of gravity combined with high ground clearance enabling travel on steep grades and through rough terrain.
- (2) Three-piece cab and body design to minimize stress on body components during travel in rough terrain.
- (3) Low overall vehicle height to ensure air transportability.
- (4) Skid plate and belly pan for protection of front and rear axles respectively.
- (5) Fully insulated cab providing protection from low temperatures and radiant heat from fires.
- (6) Single diesel engine providing drive for both vehicle power train and fire pump.
- (7) Automatic transmission and simple drive line system for transfer of tractive power to the drive wheels.
- (8) CFR (Crash, Fire and Rescue) firefighting system fully controlled and operated from the cab.
- (9) Raised central panel location for structural firefighting provides the operator with full 360 degree field of vision.
- (10) Winterization system to allow stand-by duty in freezing weather.
- (11) Easy access to all vital components and equipment.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

a. Frame and Suspension.

(1) The frame consists of two side members and seven cross members bolted together. The frame serves as a mounting base for the engine, drive train, fire pump, cab, pump body, and hose body. The frame is flexible to prevent heavy stress on components during travel in rough terrain.

(2) The front bumper is mounted directly to the side frames together with two eyelets for towing purposes, (see fig. 1-2). Rear towing eyelets are also attached to the frame. The suspension leaf springs are attached to the frame with shackles and spring pins. The axles and springs are assembled with two U-bolts at each location. Spring action is dampened with heavy duty shock absorbers.

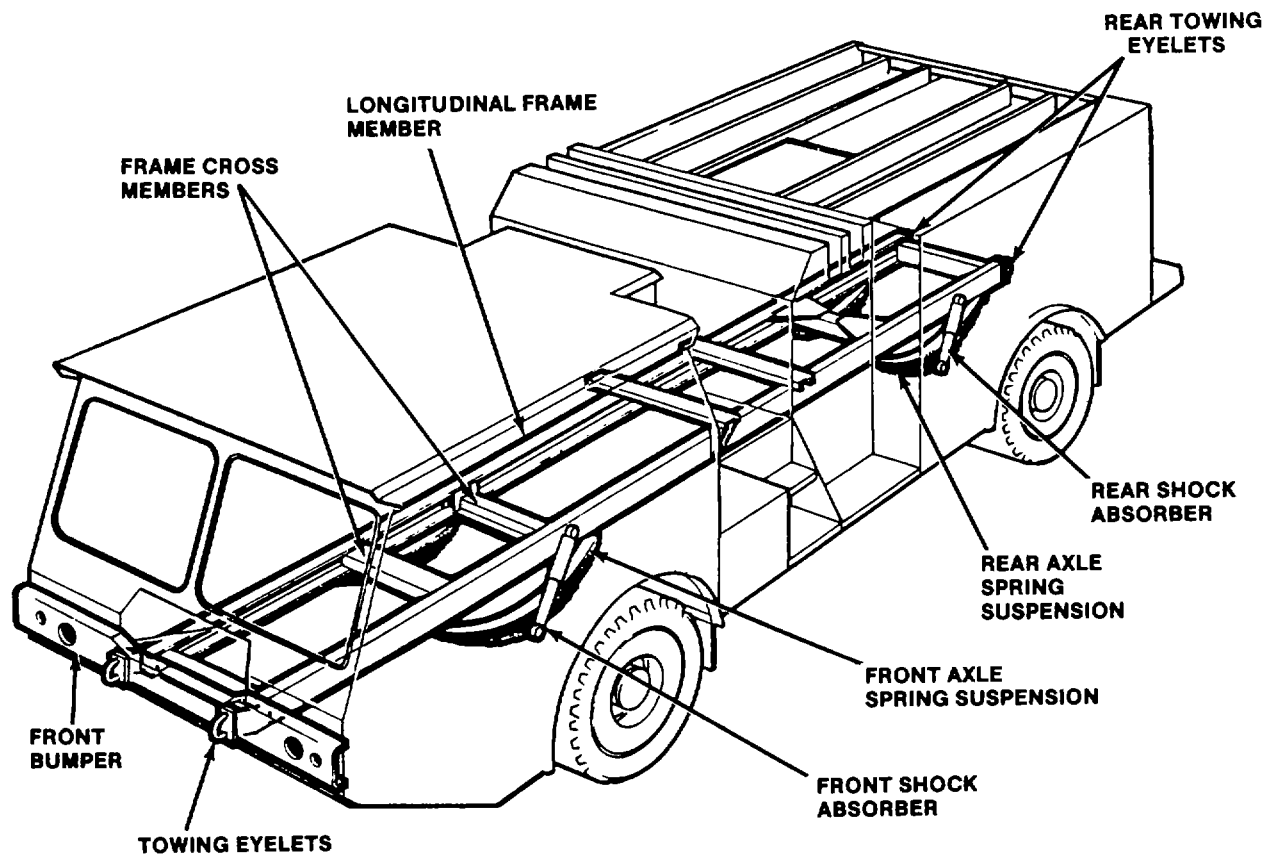


Figure 1-2 Frame and Suspension Components

b. Cab and Body.

(1) The cab and body consists of three separate assemblies each attached to the frame by means of vibration absorbing rubber mounts. The cab, pump body, and hose body (see fig. 1-3) are fabricated of aluminum and insulated against heat and cold. The cab is divided by a fire wall making the front compartment fully enclosed. The front compartment accommodates the driver and one crewmember. The rear semi-enclosed compartment contains two rear facing crew seats. All crew seats are equipped with seat belts.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

b. Cab and Body. - Continued

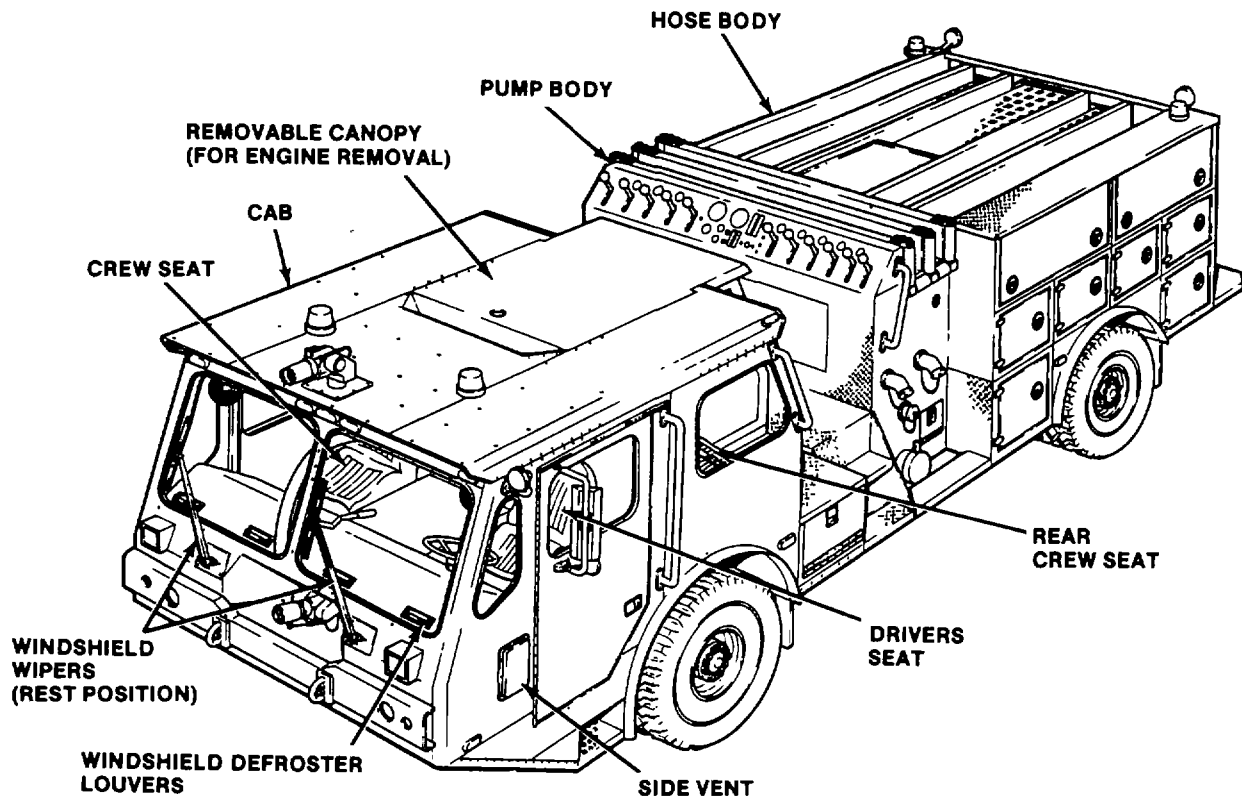


Figure 1-3 Cab and Pump Body Components - Left Side View

(2) The cab is equipped with side windows of tempered safety plate glass and windshields of laminated glass. Each windshield is provided with a pantograph-type wiper and washer assembly capable of maintaining 75% of the glass area clear. To remove grime, cleaning fluid is sprayed into the wiper blade path from washer nozzles located on the wiper arms. Windshield washer fluid is contained in two reservoirs located inside the cab. The wiper motors are air driven with infinite speed control.

(3) The cab is provided with a fluid-to-air heat exchanger mounted on the right hand side floor of the cab. Two fans direct fresh air through the heater and air ducts to the windshield defroster louvers and/or floor outlets. Fluid to the heater core is provided from the engine cooling system. Two fans mounted near the top of the windshield provide air circulation in the cab.

(4) Controls and indicators to operate the truck and firefighting systems are located inside the cab. Their arrangement prevents interference with driver/crewmember entrance or exit from the cab. Refer to Chapter 2 for operating details of the controls and indicators.

(5) The lower left and right rear corners of the cab contain the battery compartment and fuel tank respectively. The fuel tank compartment is equipped with a blower to cool the tank when firefighting in structural mode.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

b. Cab and Body. - Continued

(6) The fire wall dividing the cab also forms part of the engine compartment. The left and right sides of this compartment have large removable panels to provide service access. The top of the compartment is provided with an engine air intake opening. The pump body encloses the fire pump, piping, and control valves for the firefighting system. To access this equipment, the front face of the body is provided with a large removable panel and the side faces with smaller access doors. A control panel for structural firefighting is located at the top front of the body. Refer to Chapter 2 for operating details of the control levers and indicators. The lower front part of the pump body consists of two steps on each side and a catwalk across the truck. The steps and catwalk provide access to the rear crew seats and the structural control panel. The steps and catwalk are clad with non-skid aluminum sheeting.

(7) The rear engine compartment panel is provided with vent holes. During winter operation, warm air from the engine, vented through these holes, keeps the catwalk free of ice.

(8) Draft, hydrant, and water discharge ports are located on both the left and right side of the pump body, (see fig. 1-4). The top of the body contains two cross-lay hose beds. These beds are equipped with vertical and horizontal aluminum hose rollers at both ends to ease hose play-out from either side of the truck. The beds accommodate 1-1/2 inch fire hose. The beds are identified as BED #1 (front bed) and BED #2 (aft bed). A hinged step is attached to each side of the body to provide access to these hose beds.

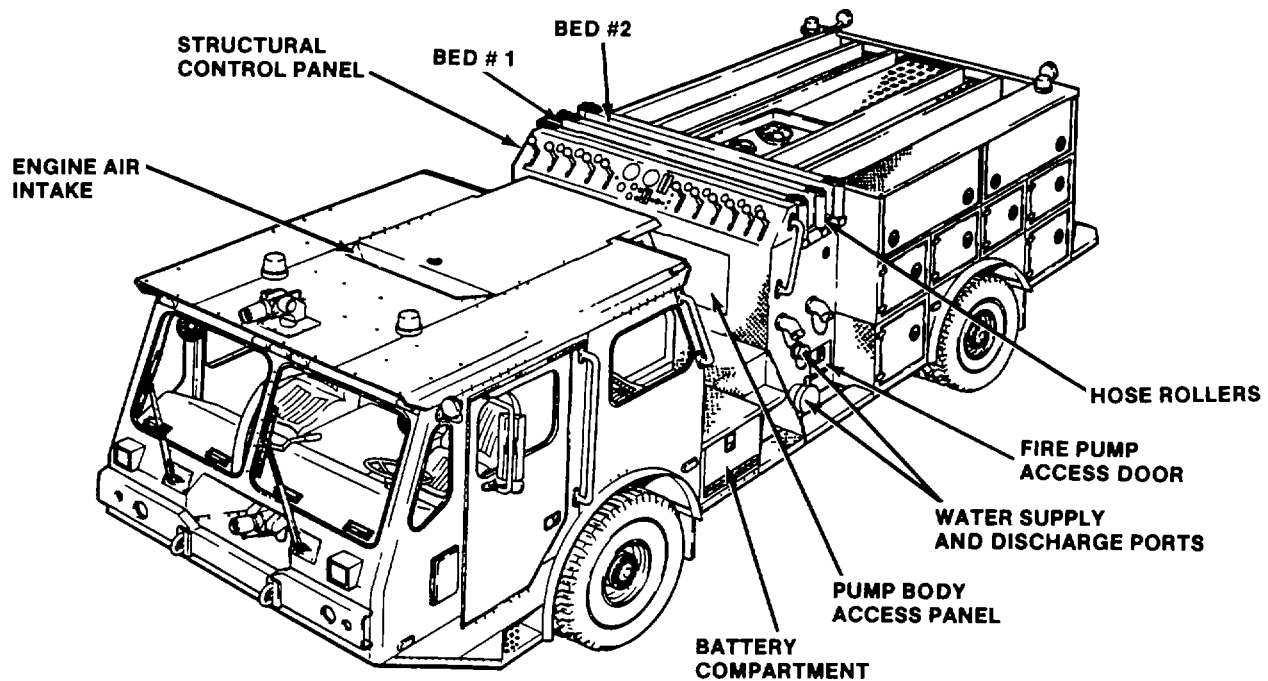


Figure 1-4 Cab and Pump Body Components (Continued)

(9) The hose body houses the water and foam tanks and contains storage compartments for auxiliary equipment, (see fig. 1-5). The body structure, is made of aluminum.

(10) Two large storage compartments are provided on the upper left hand side of the rear body. These compartments are equipped with top hinged doors and collapsible gas cylinders to support the doors in the fully open position. All other doors are fitted with spring-type hatch holders.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

b. Cab and Body. - Continued

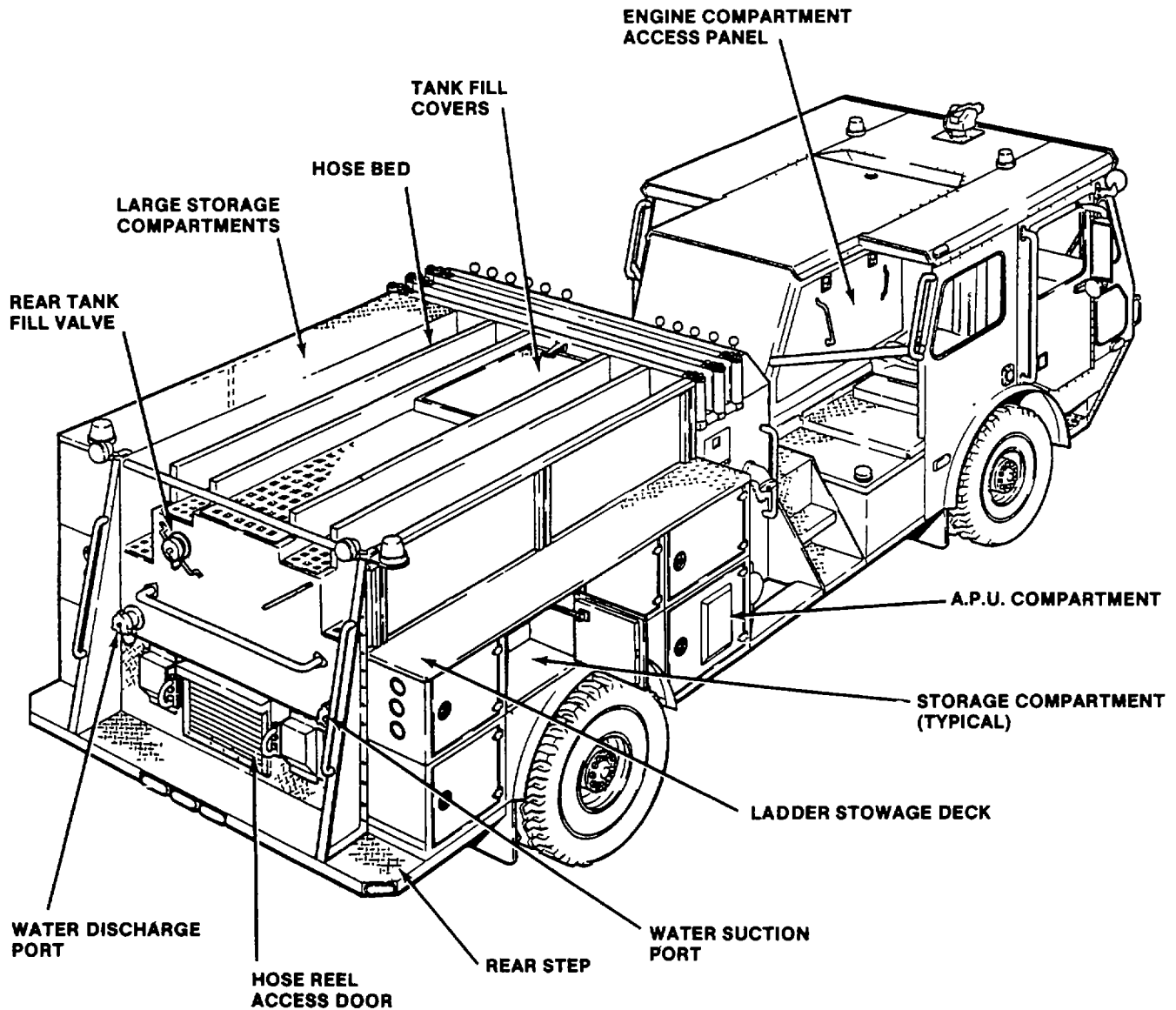


Figure 1-5 Rear Body Components

(11) The two lower storage compartments on each side are provided with drain holes and rubber vacuator valves in the floor plates to ensure positive draining of water. The vacuator valves prevent intrusion of mud and dirt when the truck is traveling in a wet environment. All storage compartments are provided with large D-ring handles to ensure that crewmembers can access the compartments while wearing protective gloves. A large hatch on top of the body provides access to the water and foam tank fill covers. The hose bed will accommodate 1-1/2 inch, 2-1/2 inch, and/or 6 inch size fire hose. Connections for tank fill, pump suction, and water discharge are provided through the rear panel. The rear step provides easy access to the hose bed and also functions as the rear bumper.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

c. Lights and Safety Equipment.

(1) The lights comprise the driving lights, signal lights, warning lights, work lights, and auxiliary lights. The exterior mounted lights are shown in figure 1-6.

(2) The headlights, parking lights, tail lights, marker lights, and license plate lights make up the driving lights group. These lights are controlled and operated by the driver from the dash panel.

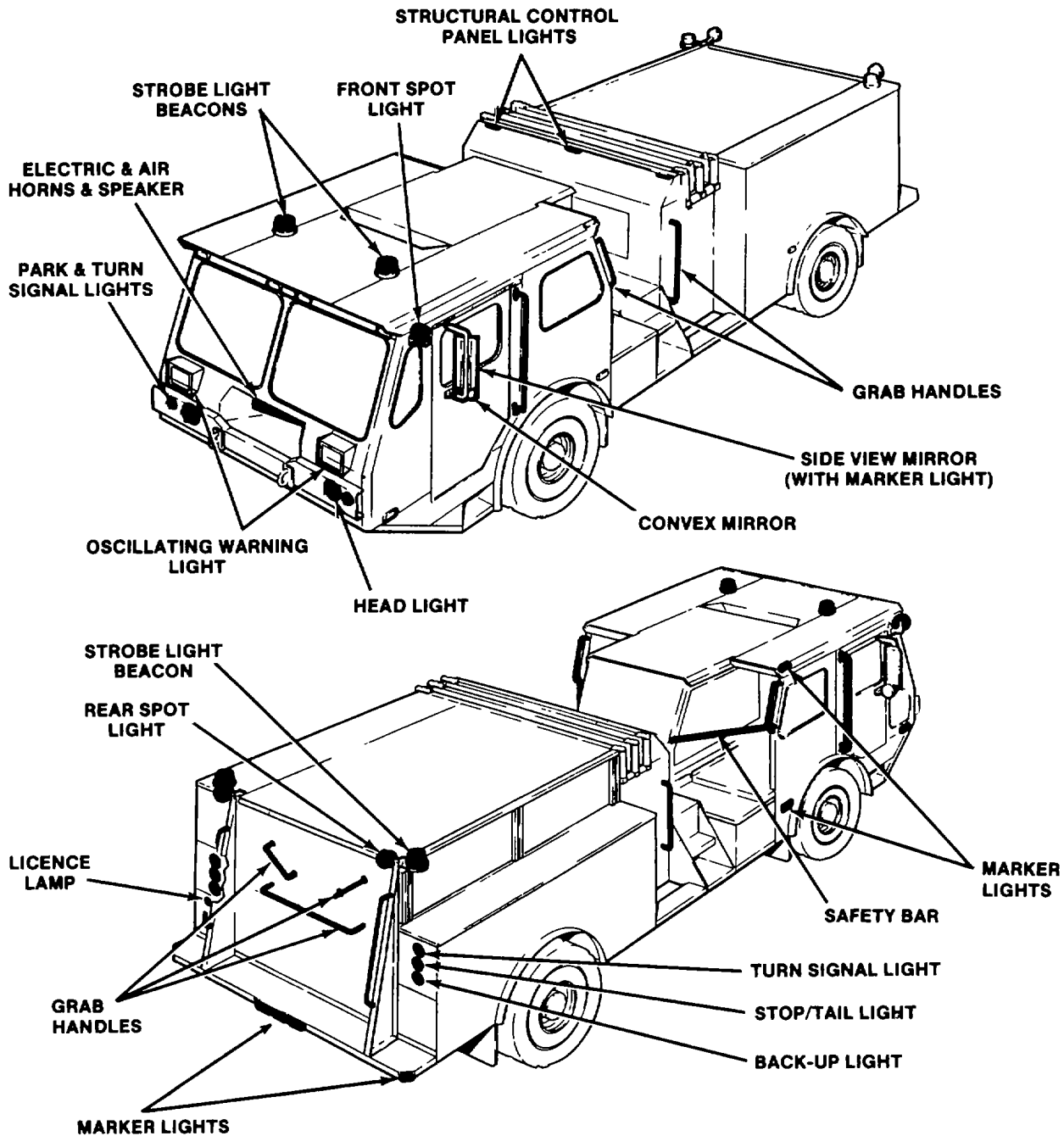


Figure 1-6 Cab Exterior Lights and Safety Devices

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

c. Lights and Safety Equipment. - Continued

(3) The signal lights, consisting of the turn signal lights, stop lights, and back-up lights are used to indicate to other traffic that the truck is about to change direction, slow down, or stop. The turn signal lights are directly controlled by the driver. The stop lights automatically illuminate when the brake pedal is applied. The back-up lights together with a back-up alarm operate when the transmission is selected to reverse gear. In addition to normal turn indication, all the turn signal lights can be selected to flash simultaneously. This feature is used to indicate road hazard conditions.

(4) The warning lights, comprising the strobe light beacons and oscillating warning lights, are used as visual warning signals to other traffic. The beacons are fitted with high intensity flash tubes and the oscillating lights with high intensity halogen bulbs.

(5) The work lights consist of the front and rear spotlights. These high intensity lights are used for illumination of work areas in front and behind the truck respectively. The front lights can be aimed individually from within the cab.

(6) The auxiliary lights consist of the structural control panel lights, cab and canopy lights, a cab map reading light, engine compartment lights, and storage compartment lights. These lights are provided for crew convenience. Two of the cab dome lamps and the storage compartment lights are normally controlled by door actuated switches. The remaining lights are manually controlled.

(7) Rearview mirrors, comprising two rectangular mirrors and two convex mirrors are provided on the cab doors. The rectangular mirrors are heated to prevent fogging or icing in cold weather and are equipped with marker lights. The convex mirrors enable wide angle rear viewing.

(8) Grab handles, located at all crew stations, are provided for safety when climbing on and off the truck. Hinged safety bars are provided at the rear crew seats as additional protection for the rear seated crewmembers.

(9) An electronic siren/PA (Public Address) unit is installed in the cab accessible to both driver and crewmember. The speaker is mounted behind the front bumper together with electric and air horns. The electric horns are operated from the steering wheel. The air horn is operated from pull chains on both sides of the cab.

d. Engine. The truck is provided with a V-configuration, six-cylinder, two-cycle diesel engine equipped with turbocharger and aftercooler (see fig. 1-7). The engine develops 350 horsepower at a governed speed of 2100 rpm.

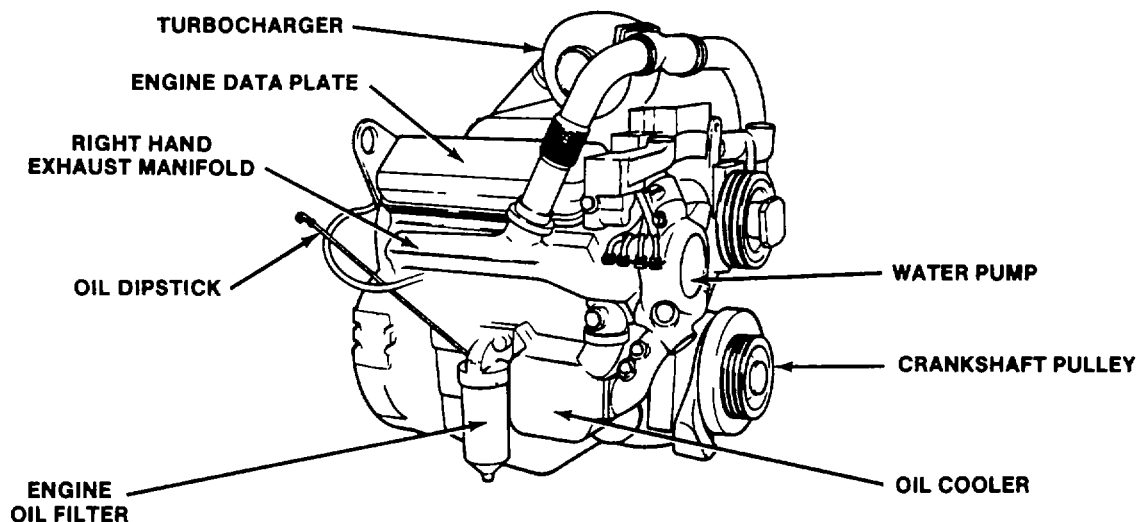


Figure 1-7. Truck Engine

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

e. Fuel, Air Intake, and Exhaust Systems.

(1) The fuel system comprises a 45 gallon fuel tank, 12-volt electric priming pump, fuel/water separator, engine fuel pump, fuel filter, and supply and return lines between tank and engine, (see fig. 1-8). The fuel/water separator is equipped with a heater element for cold weather operation. Both the fuel/water separator and the fuel filter have replaceable filter elements.

(2) The air intake system consists of the air filter, turbocharger compressor, engine blower, and aftercooler. The exhaust system consists of exhaust piping, turbocharger turbine, and muffler. The air cleaner is mounted above the engine and connected with a flexible elbow to the turbocharger. The exhaust pipe is flange mounted to the turbocharger. The muffler is mounted to the frame with rubber bushings and hanger brackets.

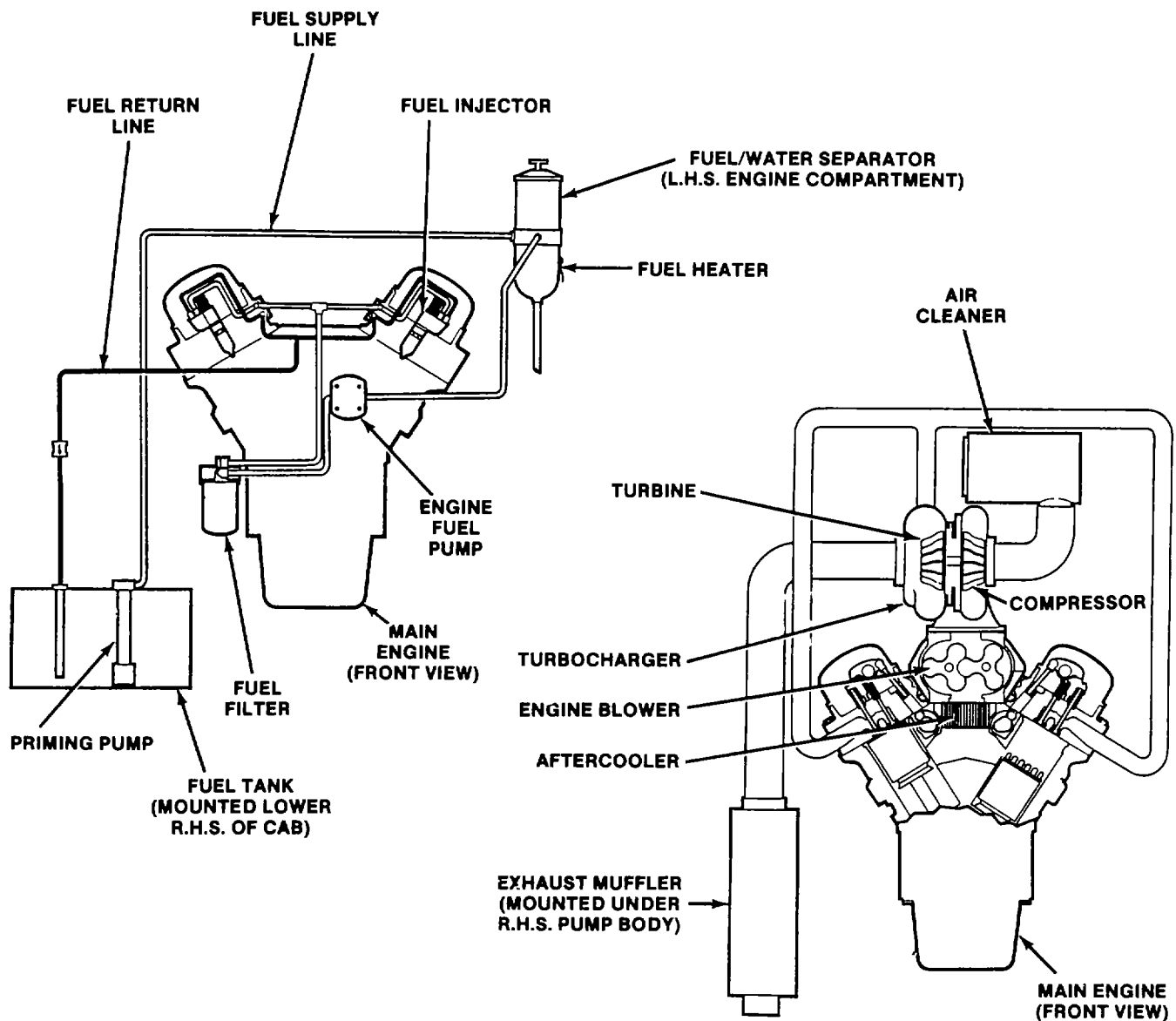


Figure 1-8. Fuel, Air Intake, And Exhaust Systems

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

f. Cooling System.

(1) The engine cooling system consists of the radiator, engine mounted water pump, temperature controlled fan, and hoses connecting the engine and radiator, (see fig. 1-9). Hoses are installed between the transmission and the oil cooler, built into the radiator, for cooling the transmission fluid. Additional hoses connect the engine cooling system to the cab heater unit and to the winterization system.

(2) To control the amount of cooling air flowing through the radiator, a compressed-air-operated radiator shutter and fan are provided. The shutter and fan operation is automatically controlled by a multistat (temperature probe and control valve assembly). The multistat is located in the return coolant line from the radiator to engine.

(3) A liquid-to-liquid type auxiliary cooler is provided for additional cooling of the engine when the truck is stationary and operating in the structural firefighting mode. The auxiliary cooler is located in the pump body and connected with hoses to the engine cooling system. Water derived from the fire pump discharge is used for cooling the engine coolant. The flow of water is controlled with a valve mounted on the structural control panel.

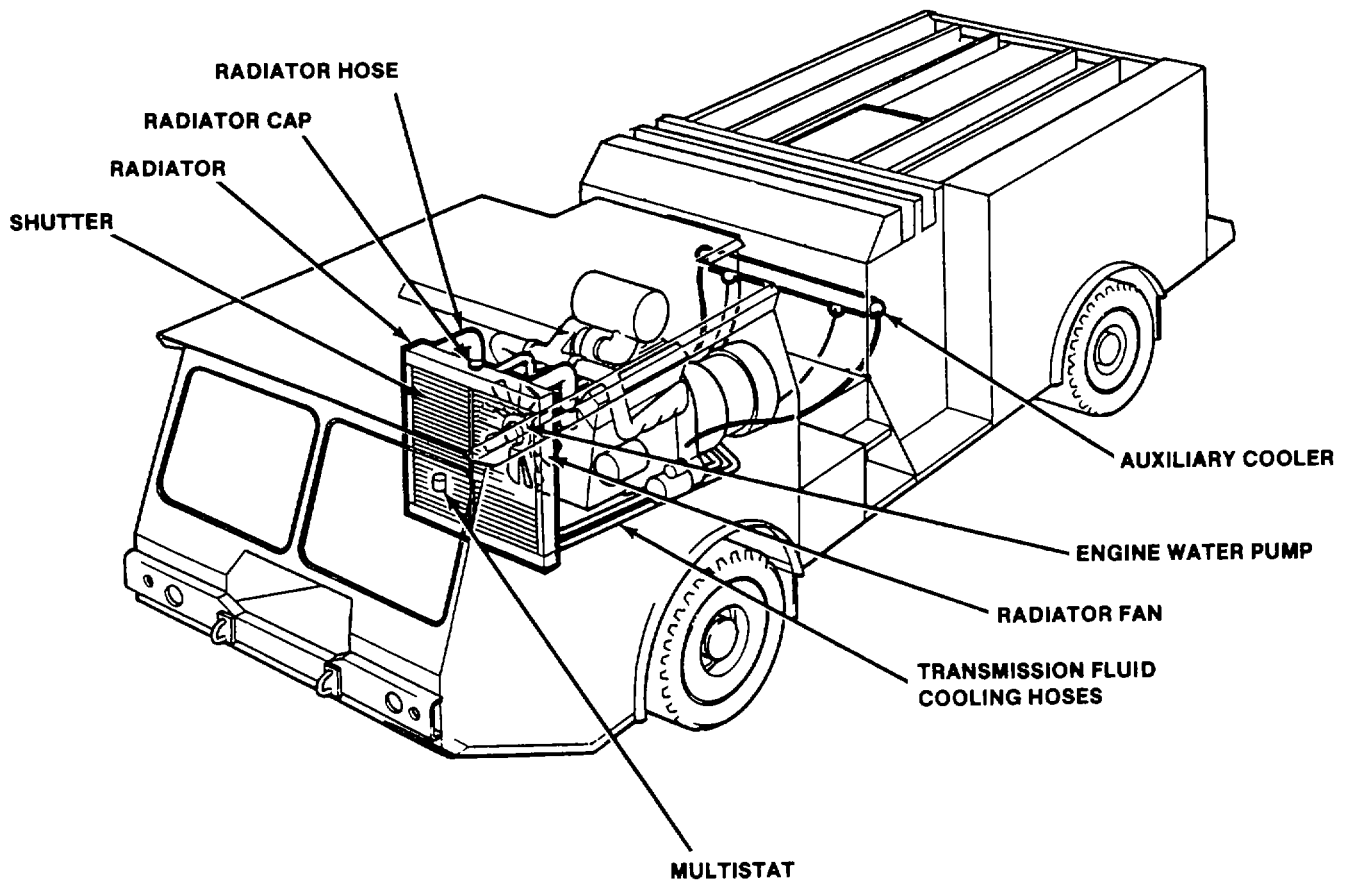


Figure 1-9. Cooling System Components

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

g. Electrical System.

(1) The fire truck is equipped with a 12-volt dc main electrical system and a 110-volt ac auxiliary system. All components and subsystems used to operate and control the truck and firefighting equipment are powered from the 12-volt system. The 110-volt ac system is used to operate auxiliary power tools and accessories.

(2) The 110-volt ac system consists of a 12-Vdc to 110-Vac Inverter connected to the main engine alternator. Four receptacles are mounted on the left and right sides of the hose body, (see fig. 1-10). An additional two 110-Vac receptacles are available on the inverter itself.

(3) The 12-volt system consists of four maintenance-free batteries located in the battery compartment. The batteries are connected to a battery switch in the cab. To maintain the charge of the batteries, two 12-volt, 80-amp alternators, driven by the main engine, are provided. All of the major components and circuits are protected by automatic-reset-type circuit breakers. To provide 24-Vdc to auxiliary radio equipment the truck is equipped with a 12-to 24-Vdc converter. The converter is connected to the truck batteries via the battery switch.

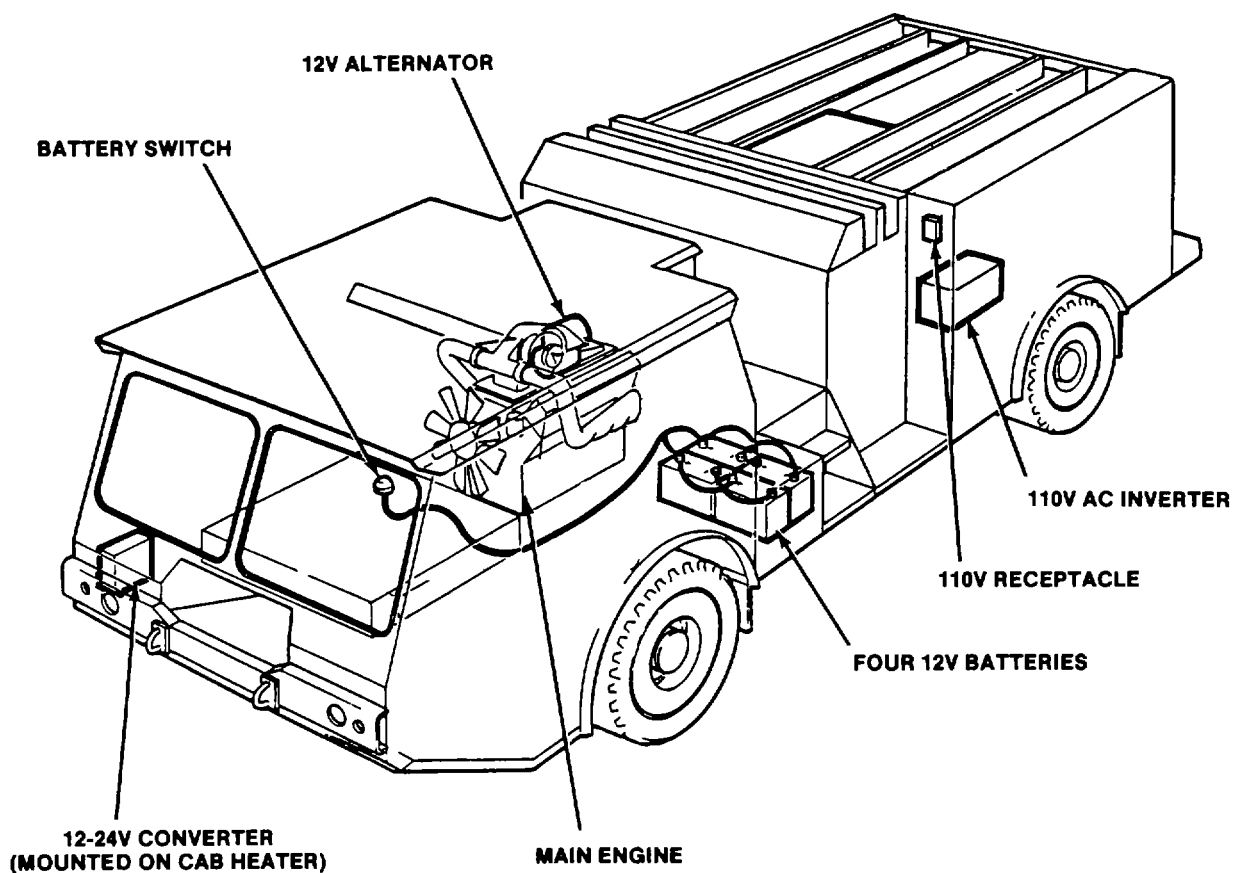


Figure 1-10. Electrical System Components

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued**h. Transmission and Drive Train.**

(1) The truck is equipped with an automatic transmission that provides five-forward and one-reverse gear. . The transmission is connected to the engine via a torque converter that functions both as a fluid coupling and a torque multiplier. A torque converter lock-up clutch provides direct drive between engine and transmission when the vehicle obtains sufficient speed. This lock-up automatically disengages when the speed drops to the downshift limit of the gear range in which the vehicle is traveling. The transmission contains four sets of planetary gears and six hydraulically activated clutch packs. Engagement of the clutches and gears is controlled by means of the gear selector control in the cab and an automatic, governor-controlled shift mechanism in the transmission.

(2) The drive train from the transmission to the wheels consists of two drive shafts, and the rear and front axles, (see fig. 1-11). The rear axle is provided with a power divider gearing and clutch, controlled by the driver, for selection of either 2or 4-wheel drive.

(3) The drive shaft between the front and rear axle is a two-part unit supported by a center bearing. The front and rear axles are both equipped with single reduction, controlled traction (differential lock) differentials to ensure positive traction on all four wheels. The controlled traction mechanism is engaged and disengaged from the cab. The front axle is provided with ball and socket mounted wheel ends.

(4) The wheels consist of four single-unit rims mounted with tubeless, bias-ply tires suitable for both on and off-road use.

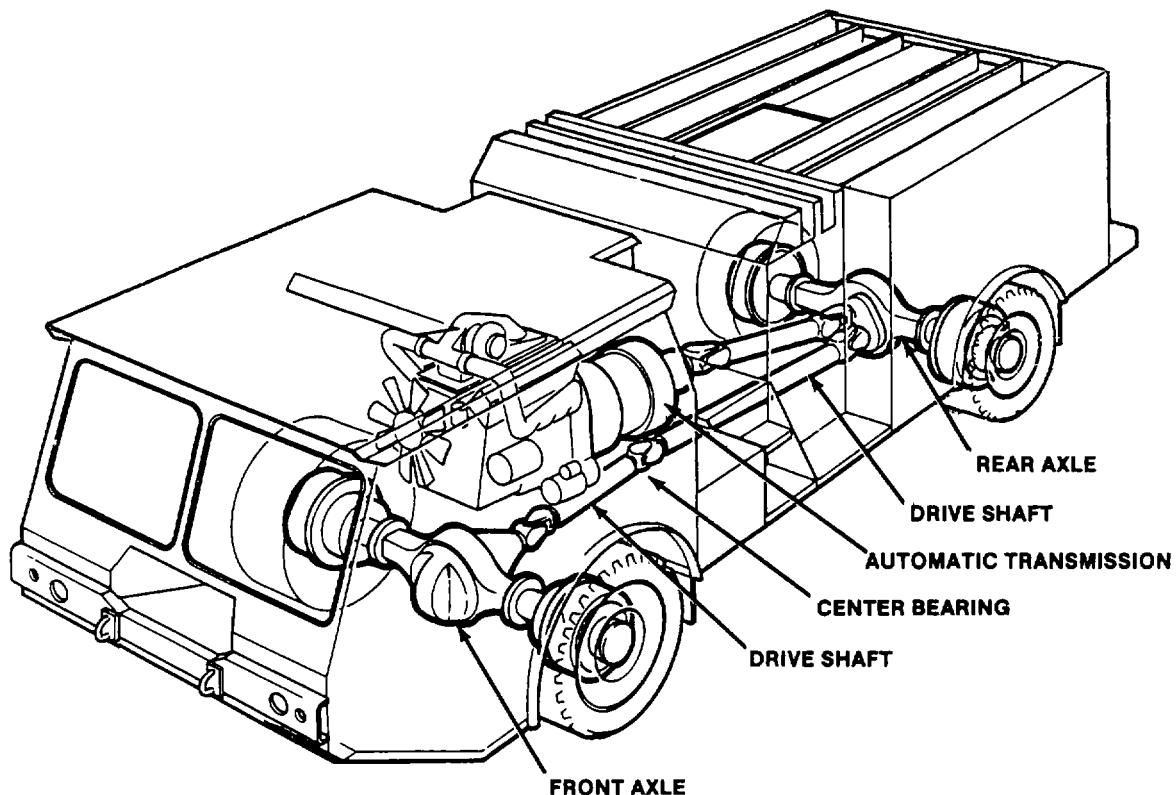


Figure 1-11. Transmission and Drive Train Components

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued

j Steering System. The truck is equipped with a mechanical power-assisted steering system. The system consists of the steering wheel, steering column and shaft assembly, power assisted steering gear, power steering pump, and power steering fluid reservoir, (see fig. 1-12). Steering action (left and right turns) is mechanically transmitted from the steering wheel via the power assisted steering gear to the front wheels in case of failure of the power assist system, the truck can be steered manually.

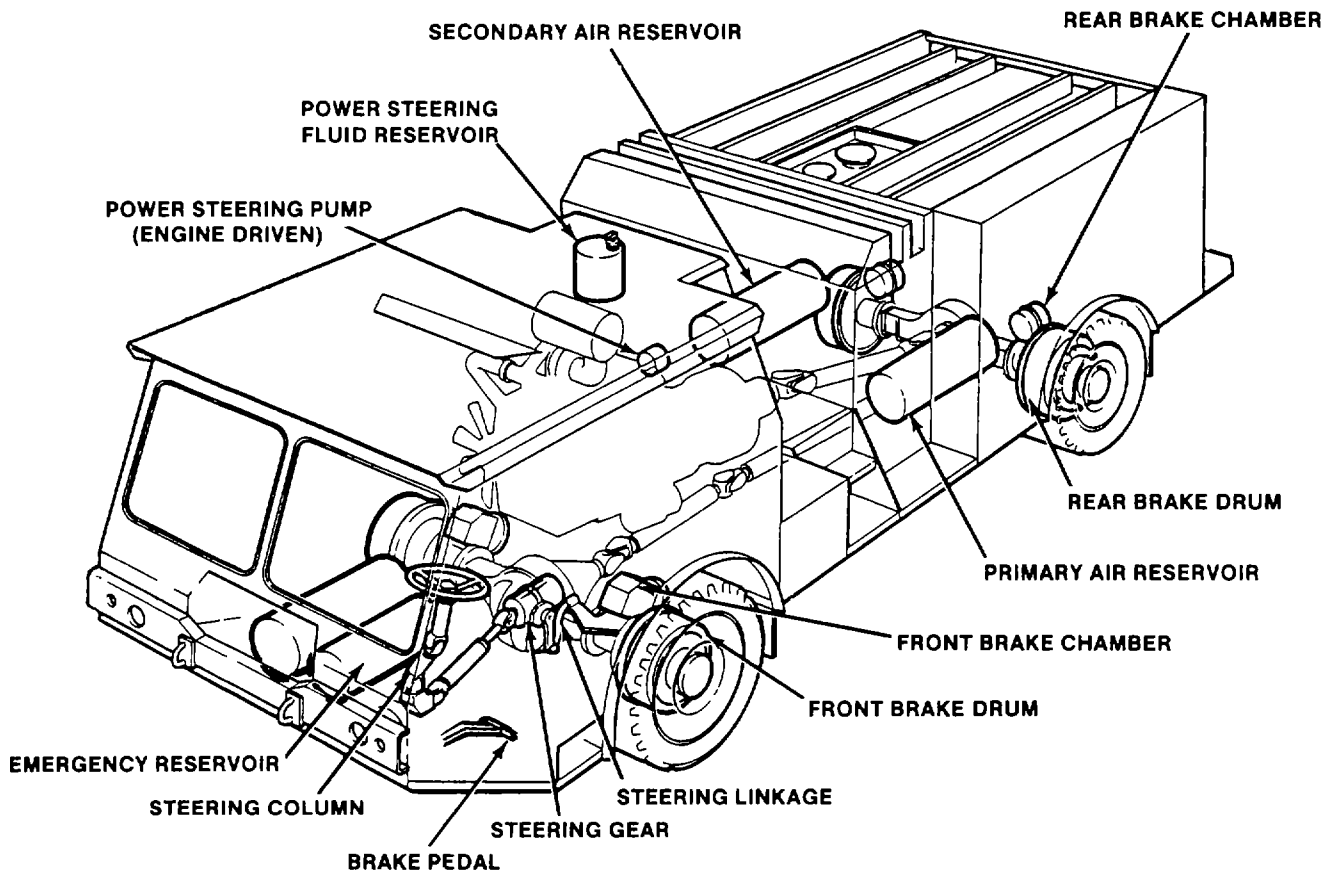


Figure 1-12. Steering and Brake Components

k. Brake System.

(1) The truck is equipped with air-operated service brakes on all four wheels and with mechanical, spring-applied parking brakes on the rear wheels. Compressed air for service brake application is provided from pressurized reservoir tanks. The main brake valve, attached to the brake pedal, and additional pressure operated valves are used to control the application of air pressure to the brake chambers. Mechanical linkages are used to transfer braking power from these chambers to the wheel brakes.

(2) The mechanical-parking-brake activating springs are located in chambers mounted piggyback on the rear air brake chambers. The parking brakes are automatically engaged when air pressure is exhausted from these air chambers. To manually apply the parking brakes, a control valve is provided in the cab. For release of the emergency brakes when normal air pressure is not available, an emergency air reservoir is provided.

1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

m. Air System.

(1) The air system comprises a main-engine-driven compressor, an air drier and four reservoirs in addition, valves and hoses for supply and control of the truck and firefighting equipment are included, (see fig. 1-13). The reservoirs are filled successively. This is achieved with the pressure protection valves.

(2) The primary reservoir supplies air to the rear brakes, engine throttle and firefighting system. The primary reservoir is filled and pressurized before the other reservoirs. The air socket may be used to pressurize the primary air system from a shop supply in the event of system overhaul.

(3) The fast reservoir is used to store air when the engine is shut down. When the ignition is off, the reservoir is totally isolated. When the ignition is switched on, the air starter valve opens, and the primary reservoir is pressurized. This allows the truck to be driven without waiting for the primary tank to be charged by the compressor.

(4) The secondary reservoir is filled after the primary reservoir is pressurized. The secondary circuit supplies air to the front brakes, parking brake release, air horns, wipers, washers, fan, and shutter.

(5) The emergency reservoir is filled after the primary reservoir is pressurized. The emergency reservoir only supplies the emergency parking brake release system.

(6) The primary, secondary, and emergency systems are fitted with pressure gages which are located in the cab. Audiovisual alarm lamps indicate when the pressure is low. Manual draincocks are fitted to each reservoir.

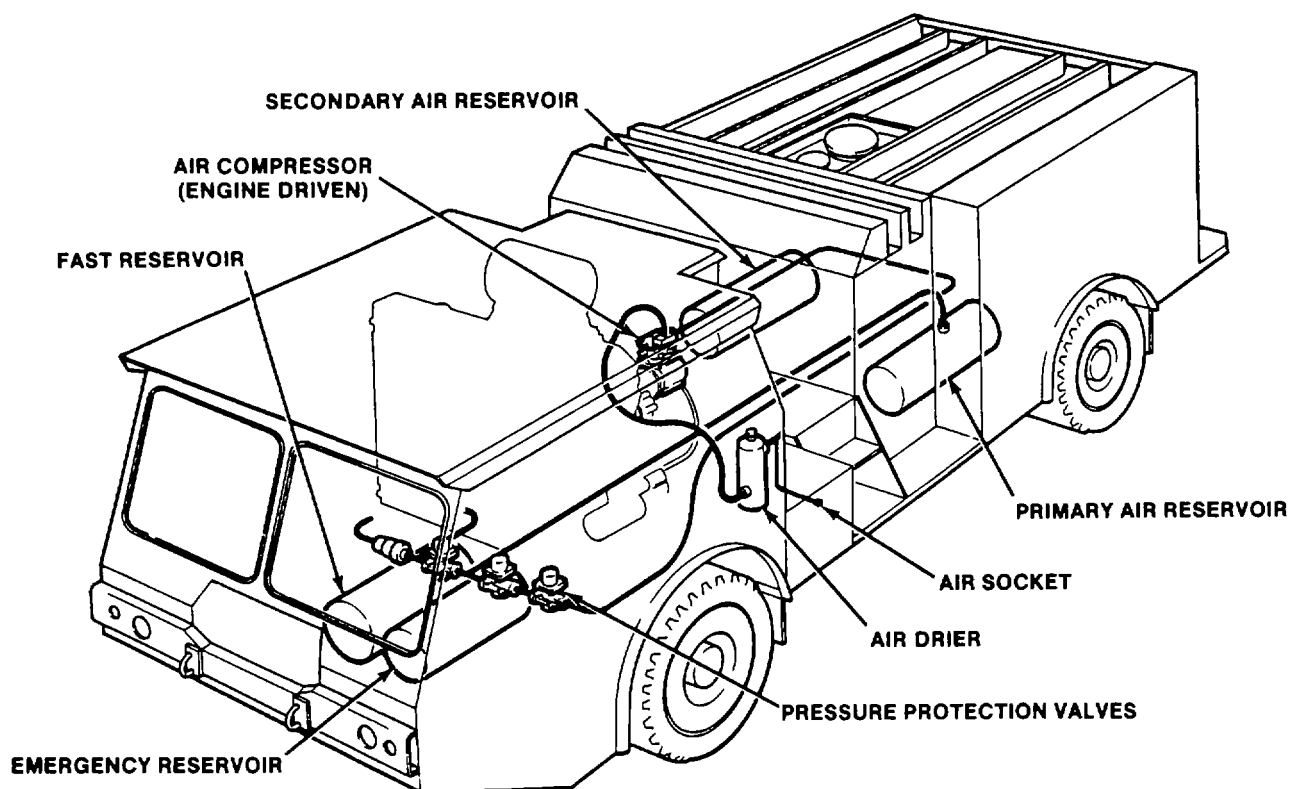


Figure 1-13. Air System Components

1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued

n. Firefighting System.

(1) The firefighting system consists of a foam and water tank, a fire pump, a water pressure regulating system, a foam proportioning system, and a control system including pressure gages, (see fig. 1-14). The water and foam discharge system includes the roof and bumper turrets and handline discharge ports.

(2) The water tank is mounted on the truck frame. The tank is attached by rubber-and-spring-type flexible mounts to relieve twisting forces from frame flexing during travel in rough terrain. The foam tank is bolted directly to the water tank. The water tank is provided with baffles to reduce surging. These baffles have large cut-outs to ensure unrestricted water passage and service access. Both tanks are provided with overflow lines which provide unrestricted tank ventilation. Filling and service access is provided through fill openings in the top of each tank. These openings are equipped with tight fitting covers which are held closed by clamp type locks. The water tank is equipped with an automatic tank fill valve to enable filling by another pumping unit. This valve is located in the tank rear wall. Another inlet near the top of the tank is used for refilling via the fire pump. A sump at the bottom of each tank provides connection to the water and foam piping systems.

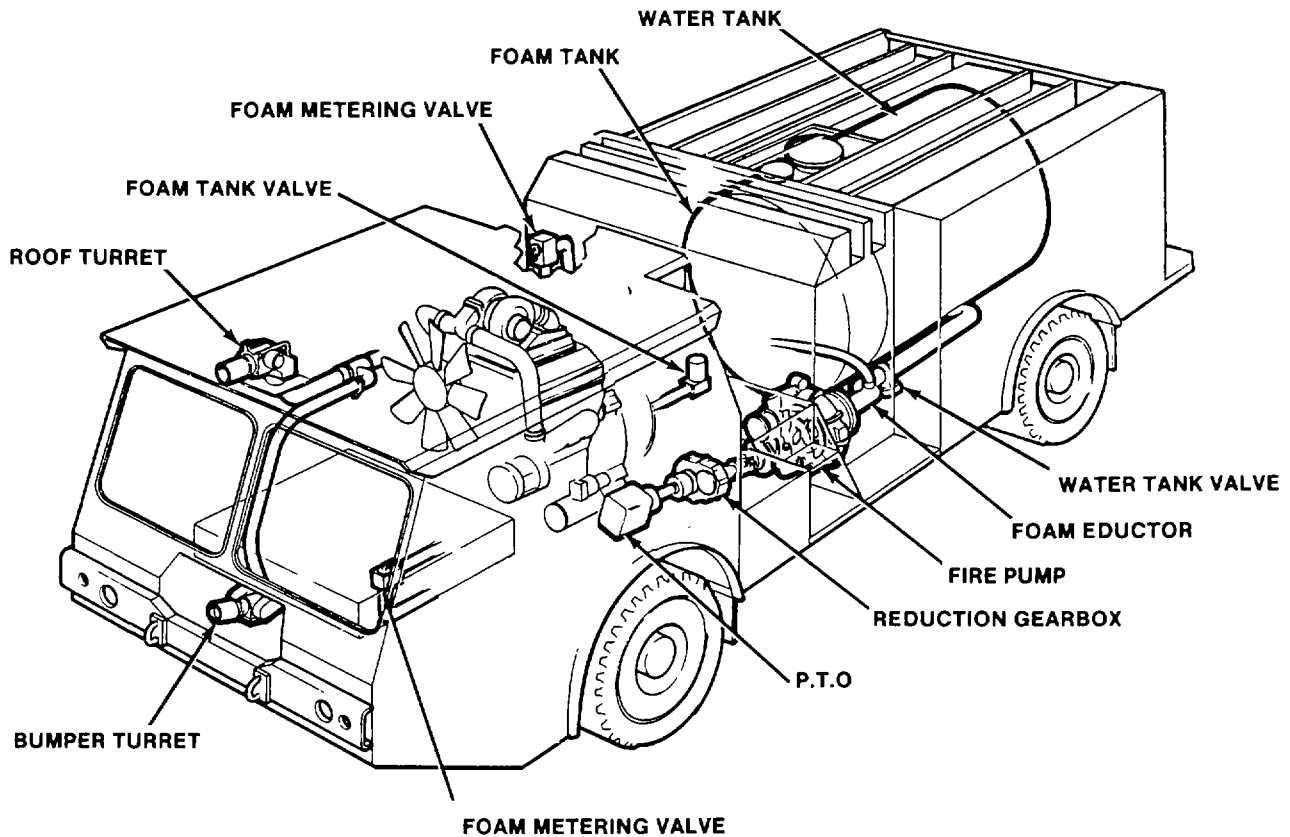


Figure 1-14. Firefighting System Components

1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued**n. Firefighting System - Continued**

(3) The fire pump is a single-stage centrifugal-type pump. It is mounted to the frame on the left side. The pump is driven by the engine via a Power Take Off (PTO) gear and a reverse mounted reduction gearbox. The PTO is equipped with an electrically controlled, hydraulically engaged clutch. A control switch for engaging the clutch and pump drive is located in the cab. Control of the pump flow and pressure is obtained through control of the engine speed. A governor (throttle control) switch for this purpose is located in the cab and a throttle regulator is provided on the structural control panel.

(4) The pump may be used for water or foam mixture. Foam concentrate is drawn into the water flow via an eductor and mixed as it passes through the pump. The pump may also be used to draft water via the 6-in suction ports on the pump body. The pump is fitted with an automatic priming system.

(5) An air-operated tank valve is used to control the delivery of water from the tank to the pump. Discharge of water from the handline ports and turrets is controlled by manually operated ball valves. A relief valve is installed in the pump discharge manifold to relieve excessive pressure. A manually operated drain valve is provided between the tank valve and the tank.

(6) Air-operated valves are used to control delivery of foam from the tank to the water eductor and for flushing of the foam system subsequent to use. Proportioning of foam agent into the water system is controlled either by a metering valve located in the cab or a similar valve located on the right hand side of the pump body front panel. A manually operated drain valve is provided between the foam tank valve and the tank.

(7) The roof and bumper turrets are manually controlled and operated from inside the cab. A direct linkage from each turret to separate control handles provides the operator with side sweep and elevation control. Discharge patterns from each turret are individually controlled by separate control levers.

(8) The fire hoses provided consist of 1-1/2-in and 2-1/2-in hoses equipped with couplings for attachment to outlet ports and separate nozzles. A selection of five nozzles is available to accommodate different flow, pressure, and spray pattern requirements.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

p. **Winterization System.** The winterization system comprises a combustion-type water heater (winterization heater), a water-to-air heat exchanger with blower fan (pump body heater), a water-to-air heat exchanger (battery heater), water and foam tank heat exchanger elements, and pumping connecting all of these components to the engine cooling system and the APU-driven circulation pump, (see fig. 1-5). The water tank to pump suction pipe is also equipped with a water/water heat exchanger. The system is provided to keep the cab and engine coolant warm, without running the main engine. In addition, it maintains the temperature of the firefighting system above freezing when the truck is on emergency stand-by in cold weather. Engine coolant is heated by the winterization heater and circulated through the main engine, cab heater, water and foam tanks, battery heater and the pump body heater. The winterization heater draws its fuel from the main engine fuel tank. Electrical power for operation is provided from the truck batteries.

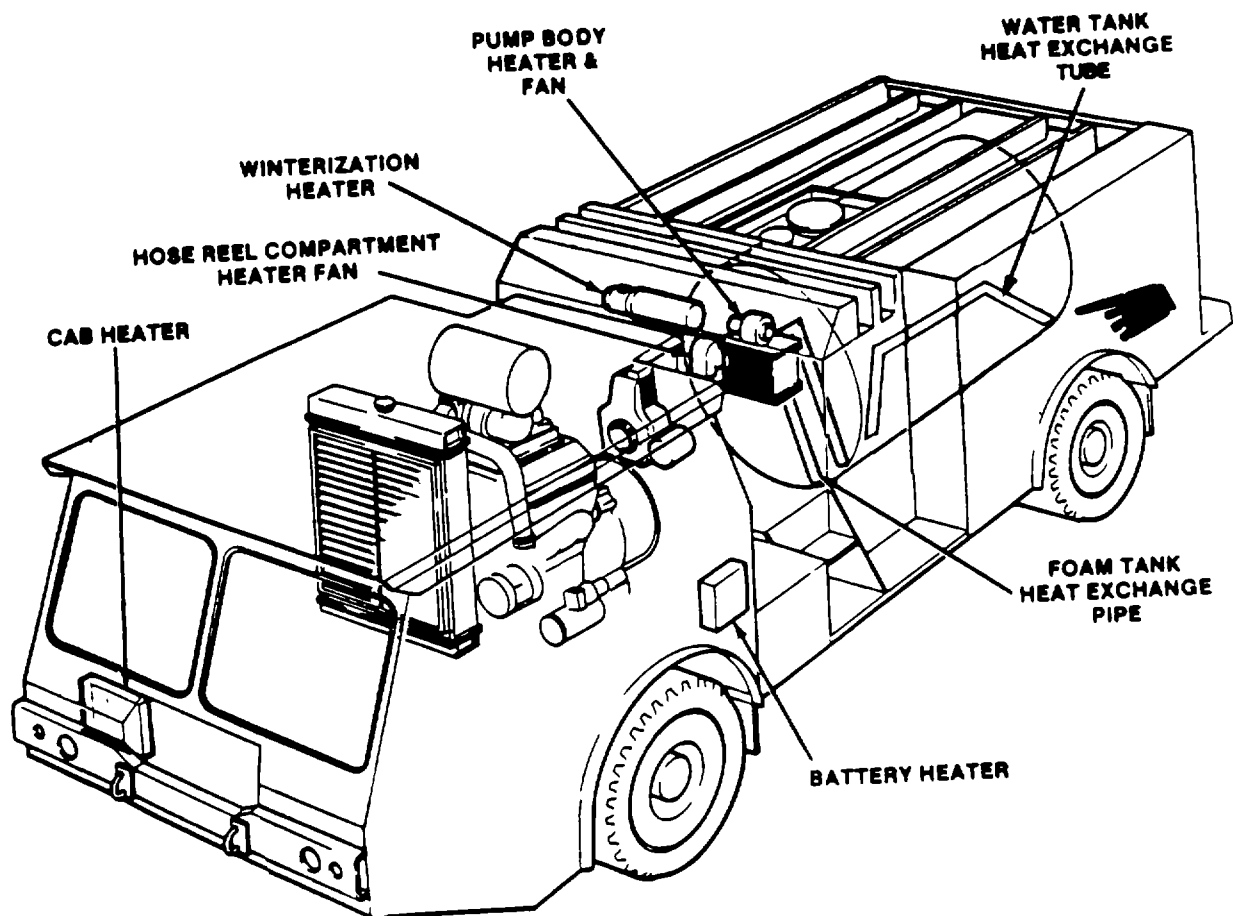


Figure 1-15. Winterization System Components

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. - Continued

q. Auxiliary Power Unit.

(1) The Auxiliary Power Unit (APU) consists of a five horse-power, four cycle, air cooled diesel engine driving a 12-volt 80-amp alternator and the circulation pump needed for operation of the winterization system, (see fig. 1-16). The APU is equipped with an electric starter motor as well as a rope pulley for manual cranking. Fuel for the APU is provided from the main engine fuel tank.

(2) The APU is located in the lower front right compartment of the hose body. The combustion air filter is mounted under the hose body on the back face of the compartment. The engine exhaust is piped out of the compartment toward the rear of the truck. A blower fan in the pump body is connected with ducting to the hose reel compartment to provide warm air to this compartment and thus prevent freeze-up of the hose reel components.

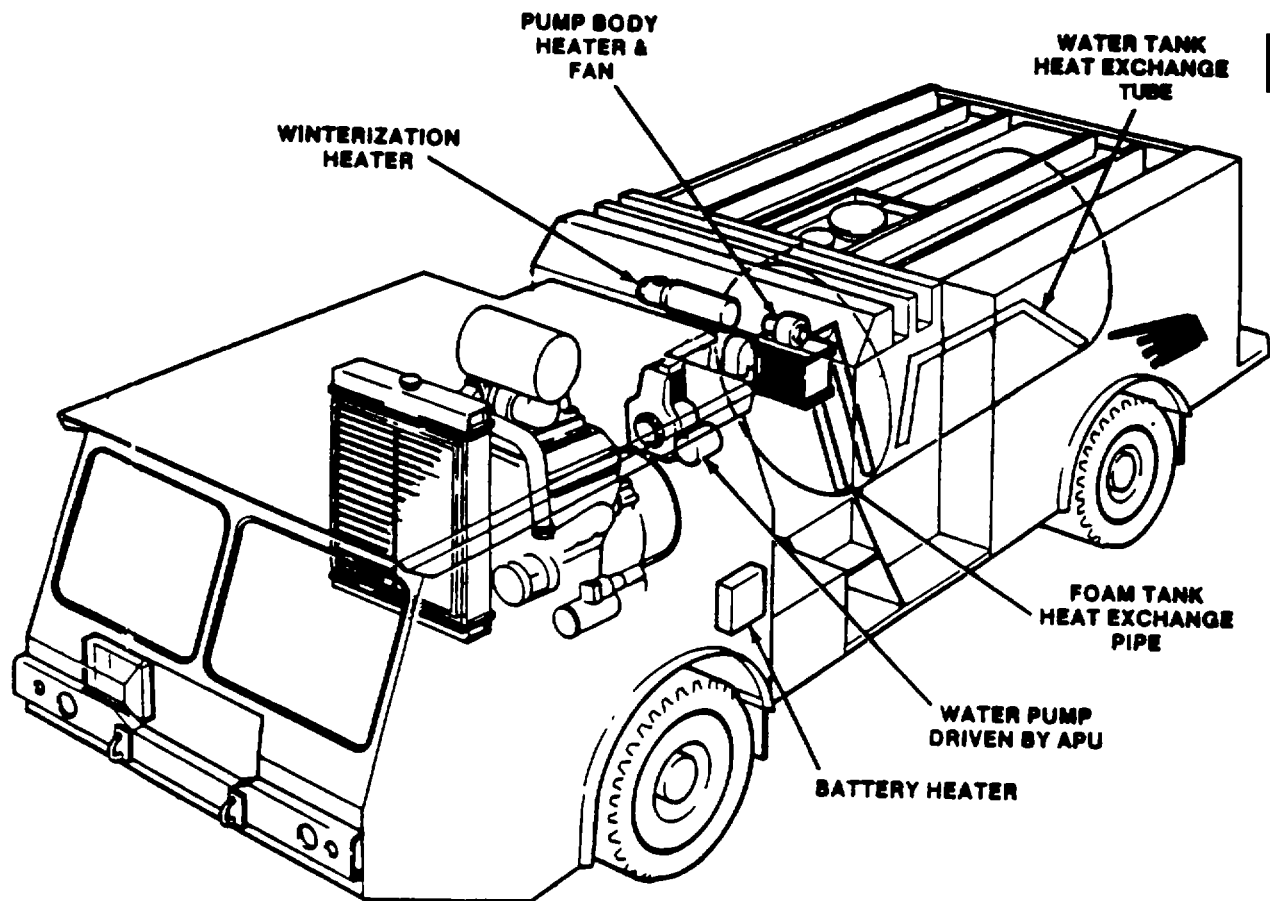


Figure 1-16. Auxiliary Power Unit

1-10. EQUIPMENT DATA.

a. Truck Weights and Dimensions.

Weight Loaded	29,350 lb (13313 kg)
Front	12,010 lb (5448 kg)
Rear	17,340 lb (7865 kg)
Weight Loaded (no Firefighting Equipment Set)	26,867 lb (12187 kg)
Front	10,994 lb (4987 kg)
Rear	15,873 lb (7200 kg)
Weight Loaded (no agents)	22,342 lb (10134 kg)
Front	13,444 lb (6098 kg)
Rear	8,898 lb (4036 kg)
Weight Empty (no agents, or Firefighting Equipment Set)	19,710 lb (8940 kg)
Front	11,860 lb (5379 kg)
Rear	7,850 lb (3561 kg)
Length	302.0 in. (76250 mm)
Height	102.0 in. (25450 mm)
Width	96.0 in. (24380 mm)
Wheel Base	160.0 in. (40640 mm)
Volume	1711.3 cu ft (484 cu m)
Turning Circle.....	75 ft (22 9 m)

b. Chassis and Body.

Manufacturer	Amertek Inc
Body Shell	Aluminum
Frame	Steel

c. Engine.

Make	Detroit Diesel Allison
Model	6V92 TA
Type.....	two-stroke, water cooled
Displacement	552 cu in. (9 L)
Maximum Horsepower (at 2100 rpm)	350 bhp (261 kW)
Engine Idle	600 rpm
Oil Capacity	19.5 qt (18.5 L)
Operating Temperature (coolant).....	170-195 deg. F (75-90 deg. C)
Compression Ratio.....	17:1
Coolant Capacity (Includes radiator)	15.2 gal (57.5L)
Lube Oil Pressure (at 1800-2100 rpm)	50-70 psi (345-485 kPa)
(at 600 rpm idle)	10 psi (70 kPa)
Primary Fuel	DF2
Emergency Alternate Fuels	JP-4, JP-5 or JP-8

1-10. EQUIPMENT DATA. - Continued

d. Transmission.

Make Detroit Diesel Allison
 Model HT 750 DRD
 Type 5-Speed Automatic with Lockup
 Oil Capacity..... 58.0 qt (55.0 L)
 Operating Temperature (Oil Pump) 160-220° F (70-105° C)
 Shifter Remote Cable Control
 Gear Ratios..... 5th - 1.00:1
 4th - 1.38:1
 3rd - 2.02:1
 2nd - 3.19:1
 1st - 7.97:1
 Rev - 4.72:1

PTO Make Chelsea
 Model..... 852 Hot Shift

e. Axles.

Make Eaton
 Ratio. 3.70:1
 Oil Capacity..... 14.7 qt (13.9 L)
 Differential..... Controlled Traction

Front Model..... EDS-18
 Type..... Steer-Drive, Single Reduction

Rear Model..... 220-S4
 Type Single Reduction

f. Drive Shafts.

Make Dana
 Center Bearing Make INA
 Model FY311189

g. Tires and Rims.

Tires. Make..... Michelin
 Model Jumbo Super All Grip
 Size 14.75 (13.00R20PXL-T)
 Pressure..... 75 psig (480 kPa)

Rim. Make..... Canam
 Material Aluminum/Steel
 Size 14.75

1-10. EQUIPMENT DATA. - Continued

h. Suspension

Spring MakeHendrickson
 Model, Front..... 37520
 Model, Rear..... 37521

Shock Absorbers Make Monroe
 TypeHeavy-duty Hydraulic

j. Steering System

Steering Type.....Integral Hydraulic Assist

Steering Gear Make Sheppard
 Model M492-SCC4
 Ratio 18.4:1

Steering Pump MakeVickers
 ModelV20-F
 Type Gear Driven, Vane
 Fluid Capacity 12.0 qt (11.4 L)

k. Brake System.

Service Brakes Type Air/Drum
 Air Chamber Make Bendix-Front
 Anchor Lock-Rear
 Shoe Size 16.5 x 5 in. -Front
 16.5 x 7 in. -Rear

Parking Brake TypeSpring Brake Chamber

m. Air System.

Air Compressor Make Midland Ross
 Model 1600
 Capacity..... 16 cfm (450 L/min)

Air Drier Make Bendix
 Model AD-2

Air Tanks Three Bendix-1791 cu in. (29.3 L)
 One Bendix-2428 cu in. (39.9 L)

n. Fuel System.

Tank Capacity45 gal (170 L)
 Priming Pump TypeIn-tank electric-12 volt
 Fuel/Water Separator..... Racor FG1000/12
 Fuel Filter Detroit Diesel Allison Spin-on

1-10. EQUIPMENT DATA. - Continued

p. Cooling System

Radiator Make Heatex Howden Inc
 Type Fin and Tube (Includes Transmission oil cooler)

Frontal Area 1397.0 sq in. (0.90 sq m.)
 Capacity (Including Engine) 15.2 gal (57.5 L)
 Engine Fan On 195 deg. F, Off 190 deg. F
 (90 deg. C) (88 deg. C)
 Radiator Shutters Open 190 deg. F, Close 185 deg. F
 (88 deg. C) (85 deg. C)

q. Electrical System.

Type 12-volt negative ground
 Protection Automatic thermal reset breakers

Batteries Make Delco
 Model 1150
 Number of Batteries Four

Alternator Make Delco
 Model 27-SI
 Output each 80 amp 12 Vdc
 Number of Units Two

r. Firefighting System

Agent Tanks Construction Stainless Steel
 Water Tank Capacity 660 gal (2500 L)
 Foam Tank Capacity 72 gal (273 L)
 Fill/Inspection Hatches Make Betts Industries

Fire Pump Make Godiva
 Model UFPX 664/1
 Type Single stage Centrifugal
 Oil Capacity 0.7 qt (0.7 L)
 Pumping Rate Structural mode 1000 gpm at 150 psi (3790 L/min)
 CFR mode 600 gpm at 250 psi (2270 L/min)

Foam Proportioners Make Feecon
 Model HCAP 1.5
 Metering Control Multiple Orifice
 Metering Percentage 0.1 to 10%

1-10. EQUIPMENT DATA - Continued

Turrets Make Feecon
 Type Non-aspirating
 Control Manual
 Pattern..... Variable

(1) Roof Turret Model RAFS-500
 Discharge Rate..... 500 gpm (1890 L/min)
 Range (in solid pattern) In excess of 175 ft (53 m)

(2) Bumper Turret Model RAFS-250
 Discharge Rate 250 gpm (946 L/min)
 Range (in solid Pattern) In excess of 150 ft (46 m)

Hose Reel Make Hannay
 Model 7000
 Handline Capacity three-50 ft (15 m) lengths of 1 inch hose

s. Winterization System

Auxiliary Power Unit

(1) Engine Make Lombardini
 Model..... 6LD325
 Type Single-Cylinder, Air-Cooled Diesel
 Displacement 19.8 cu in. (325 cc)
 Horsepower 6.5 bhp (4.8 kW)
 Oil Capacity 1.04 qt (0.98 L)
 Primary Fuel DF2
 Emergency Alternate Fuels JP-4 JP-5 or JP-8

(2) Auxiliary Alternator Make Delco
 Model 27-SI
 Output 80 amp 12 Vdc
 Number of Units One

(3) Circulating Pump Make DURO
 Model Modified 80-SI
 Flow Rate 22 gpm (83 L min)

Winterization Heater Make Webasto
 Model DBW 300
 Heat Output 104,000 Btu/hr (110 MJ/hr)
 Fuel Consumption 1.1 gal/hr (4.2 L/hr)

Section III. TECHNICAL PRINCIPLES OF OPERATION.

1-11. ENGINE AIR INTAKE AND EXHAUST SYSTEMS The flow of engine intake air and exhaust gases is shown in figure 1-17.

a. **Air Filter and Duct.** Air for combustion is drawn through the air filter which removes dust particles harmful to the engine. The filter element and housing are permanently bonded together to prevent by-pass of unfiltered air. From the filter, the air is ducted to the turbocharger. The duct, consisting of a flexible elbow, is clamped to the filter housing and turbocharger. A sensor tube is connected from the elbow duct to a pressure gage located in the cab. As dust and other airborne particles are trapped, restriction to flow through the element increases and results in a lower pressure in the duct. This pressure is registered on the gage and used as a filter condition indicator.

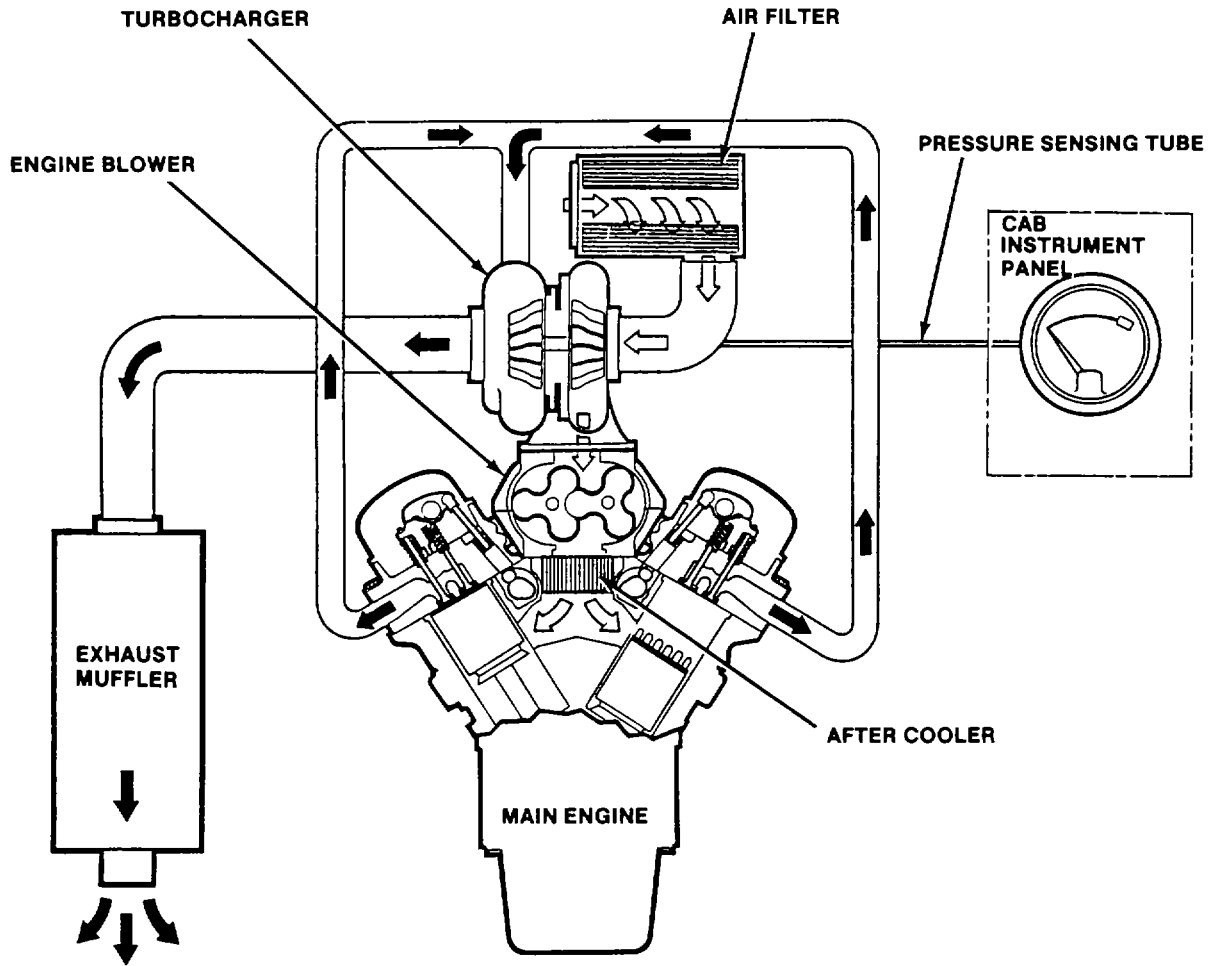


Figure 1-17. Engine Intake Air and Exhaust Gas Flow

1-11. ENGINE AIR INTAKE AND EXHAUST SYSTEMS. - Continued

b. Turbocharger The turbocharger compressor wheel and turbine are mounted on a common shaft but located in isolated housings, (see fig. 1-18). The turbine wheel, driven by the hot exhaust gases, drives the compressor wheel. Air from the filter is drawn into the compressor, pressurized, and discharged to the engine blower.

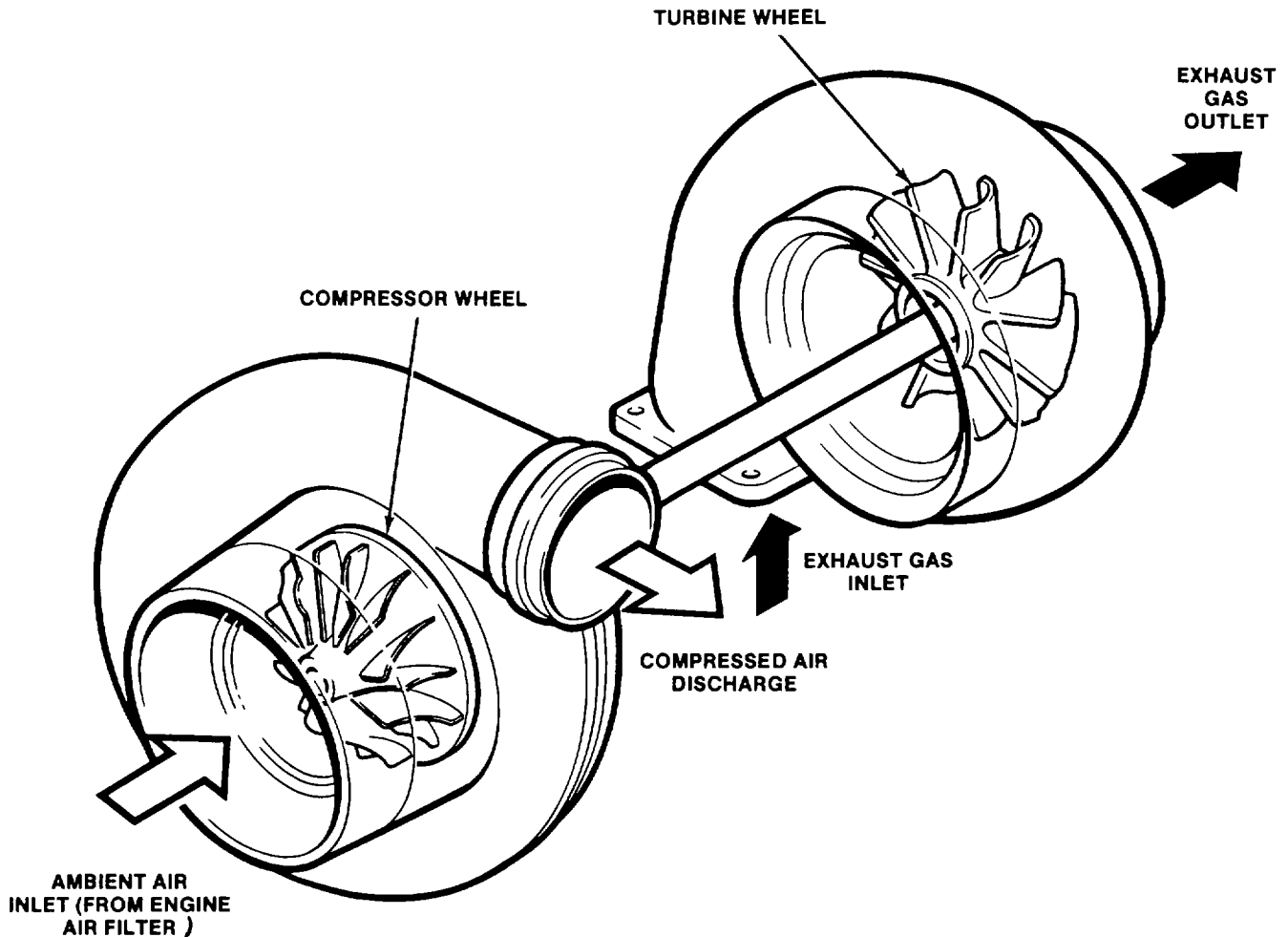


Figure 1-18. Turbocharger

c. Engine Blower. Second stage compression of the intake air is accomplished by an engine blower. This blower and the turbocharger work in conjunction. At low engine speed, little compression takes place in the turbocharger. Therefore, primary pressurization of the intake air takes place in the blower unit. At higher engine speeds, the compression capacity of the turbocharger exceeds that of the engine blower and most of the air from the turbocharger is discharged directly into the aftercooler via a by-pass valve in the blower housing.

d. Exhaust System. After combustion, the hot exhaust gasses flow from the engine through the exhaust manifold and turbocharger. From the turbocharger, the exhaust is vented to atmosphere through the exhaust pipe and muffler.

1-12 ENGINE FUEL SYSTEM. The engine fuel supply system is shown in figure 1-19.

a. Fuel Tank and Priming Pump. The engine diesel fuel is stored in the fuel tank and pumped by the priming pump to the fuel/water separator.

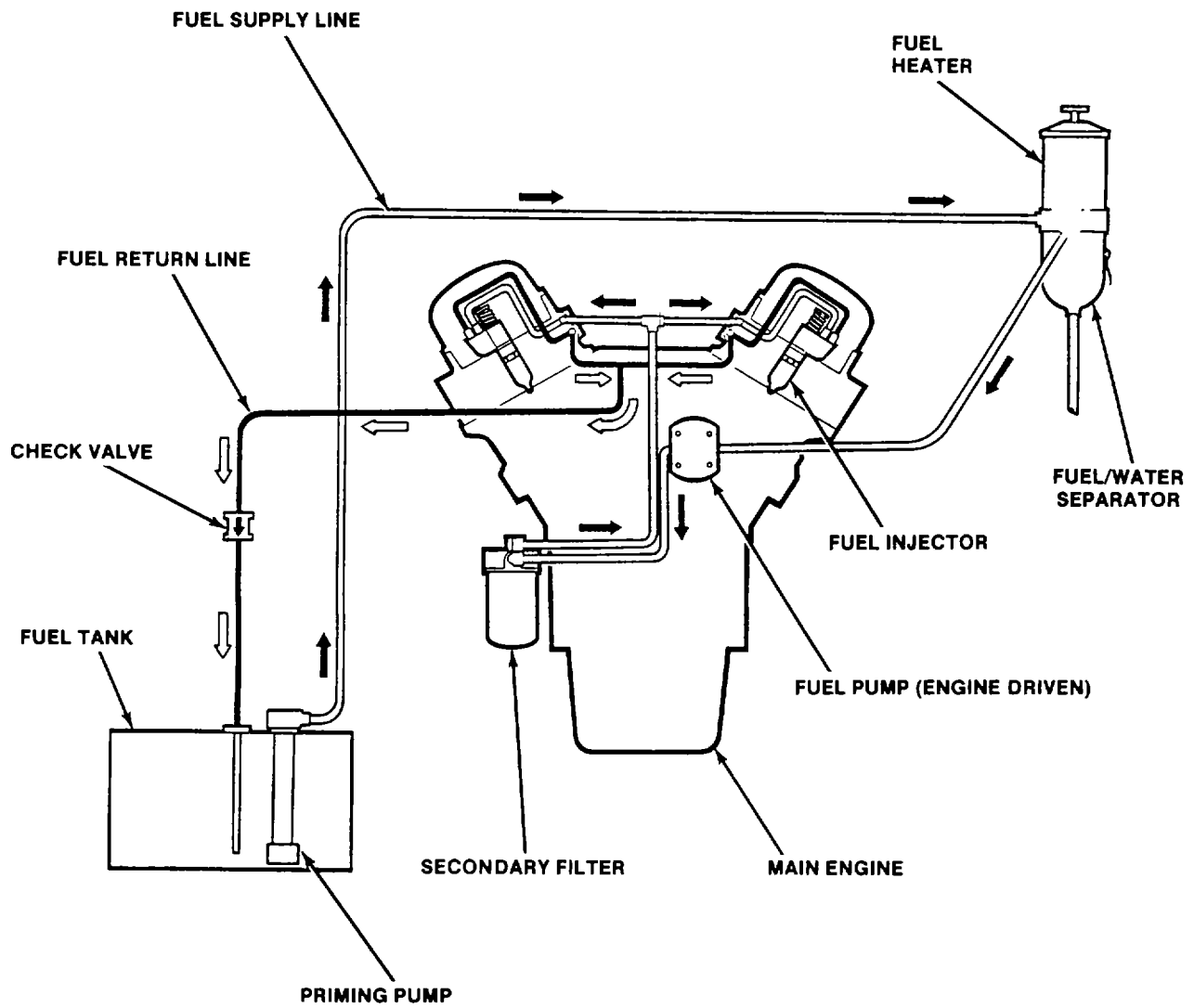


Figure 1-19. Engine Fuel System

1-12. ENGINE FUEL SYSTEM. - Continued

b. Fuel/Water Separator. The fuel entering the fuel/water separator is filtered in three stages. In the first stage, liquid and solid contamination up to 30 microns in size, is removed by centrifugal action in the lower part of the filter unit, (see fig. 1-20). In the second stage, liquid contamination flows with the fuel into the filter separator shell. The liquid contamination collects on the surface of the shell and on the replaceable element and forms drops. As these drops become heavier, they fall to the bottom of the filter separator bowl. In the third stage, the fuel flows through the filter element where minute solid particles are removed. The separator unit is equipped with a thermostat-controlled electric disc heater. This heater is set to switch on when the temperature of the fuel drops below 35 deg. F (2 deg. C). When in operation, the heater prevents formations of wax and thereby ensures a free fuel flow through the filter. The electric circuit to the heater is controlled via the engine ignition switch.

NOTE

When the ambient temperature is below 35 deg. F (2 deg. C), the heater should always be on for a few minutes prior to start-up to ensure that the fuel in the separator is clear.

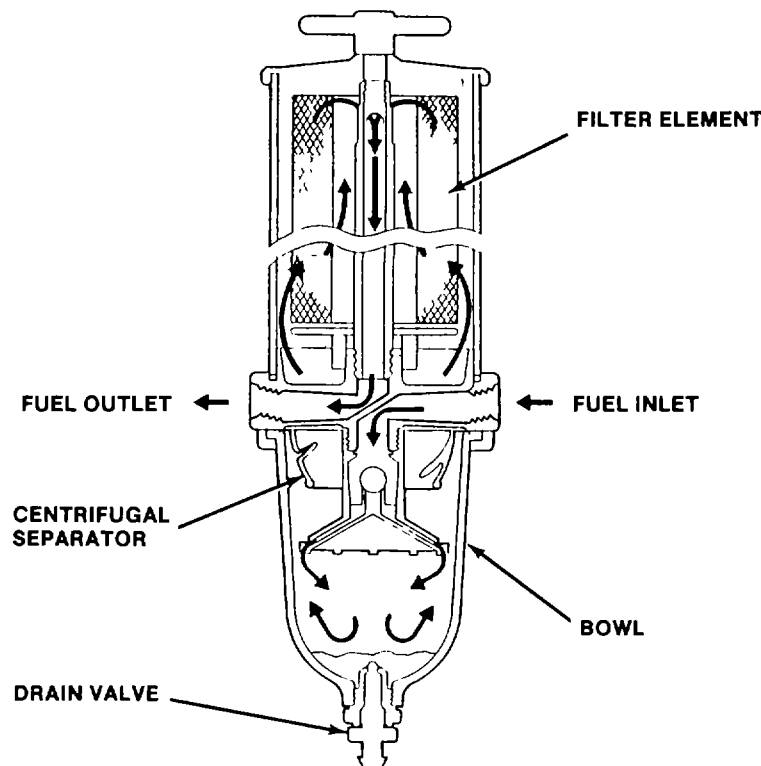


Figure 1-20. Fuel/Water Separator

c. Engine Fuel Pump and Secondary Filter The fuel flowing from the fuel/water separator is delivered to the engine-driven fuel pump. This pump is a gear-type unit which discharges the fuel at higher pressure to the secondary fuel filter. In this filter, impurities that escaped filtration in the fuel/water separator are removed.

d. Fuel Injectors. From the secondary filter, the fuel flows to the engine injectors where it is metered and atomized into the engine cylinders. Excess fuel is circulated around the injectors to cool them and returned to the tank through the fuel return line and check valve. The check valve prevents system draining or back flow when the engine is shut down.

1-13. ENGINE GOVERNOR AND THROTTLE CONTROL. The fuel metering in the injectors is adjusted by the engine governor and throttle control via a mechanical linkage (fuel rack). The governor controls the engine idle and maximum speed. When the engine is shut off, the fuel injectors are automatically positioned to the advanced fuel position for starting. Once started, the governor immediately moves the fuel rack to the idle position. To stop the engine, the governor stop control lever is actuated. This lever pulls the fuel rack back and shuts off the fuel supply. The stop control lever is engaged by the electrically-operated fuel shut-off solenoid which is controlled via the ignition switch. The solenoid is always energized when the engine is running.

a. Throttle Control - Driving Mode To control the engine speed, an air-operated throttle control air chamber is provided. This air chamber is attached to the governor housing and linked via the governor speed control shaft to the injector fuel rack, (see fig. 1-21). Air pressure is provided to the throttle air chamber via the treadle valve/accelerator pedal. By depressing the accelerator pedal, the operator controls the air flow and thus the engine speed. An internal return spring in the control air chamber will retract the linkage and reduce the engine speed to idle when the accelerator pedal is released. An external return spring provides a similar function. It is provided to ensure positive retraction of the linkage should the internal spring fail.

b. Throttle Control - Firefighting Mode.

(1) Variable, stabilized engine speed is required to provide infinite control of the water pump pressure. To achieve this, a pressure-regulated throttle control governor is mechanically linked to the engine speed governor. The throttle control governor consists of two pressure chambers mechanically connected to the governor speed control shaft. The pressure provided in the air chamber will increase the engine speed. This will result in increased water pressure which, via the water pressure chamber, will tend to retard the speed. Stable speed is obtained when the force from the water pressure equalizes the force from the air pressure.

NOTE

The area of the air chamber is three times larger than the area of the water chamber. This feature enables control of water pressures that are three times higher than the controlling air pressures.

(2) When the firefighting equipment is engaged in CFR mode, air pressure, preset at 80 psi (475 kPa), is provided to the air pressure chamber. The counterbalance water pressure, therefore, is 240 psi (1630 kPa). This is obtained at an engine speed of about 1200 rpm.

(3) In the structural firefighting mode, engine speed and thus water pressure is manually controlled. Throttle control air pressure is provided to the air pressure chamber from the hand throttle (air regulator) on the structural control panel.

1-13. ENGINE GOVERNOR AND THROTTLE CONTROL - Continued

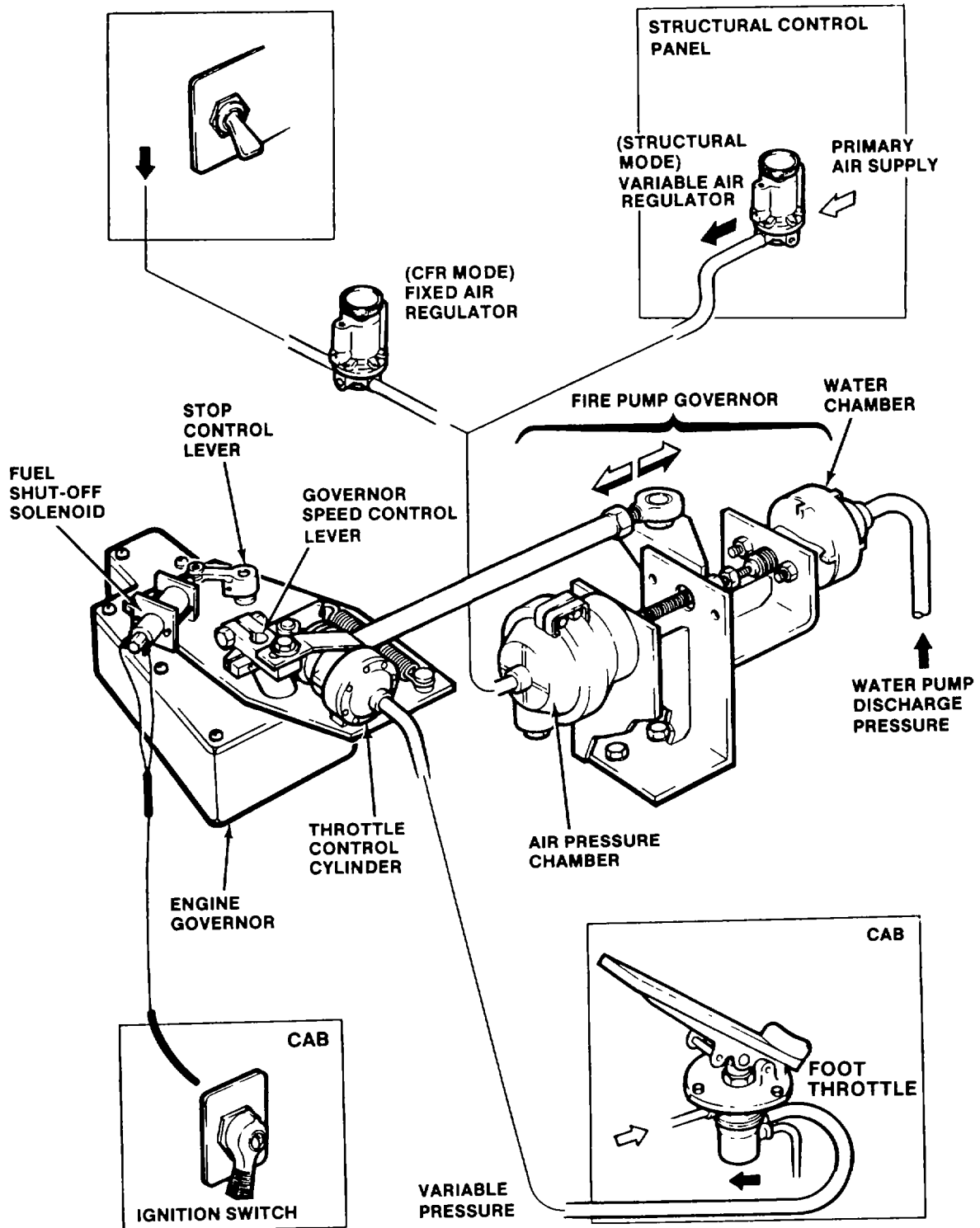


Figure 1-21. Engine Governor and Throttle

1-14. ENGINE COOLING SYSTEM. The flow through the engine cooling system is shown in figure 1-22.

a. Engine and Radiator. The system is a rapid warm-up system with two semi-blocking thermostats. At coolant temperatures below 180 deg. F (82 deg. C), the thermostat valves remain closed and block the main flow path to the radiator. The engine-driven water pump circulates coolant through the oil cooler and engine and through to the radiator top tank via the deaeration line. From the top tank the coolant is returned to the water pump via the fill line. Thus the warm coolant is vented and circulated without heat loss in the radiator core. When the coolant temperature increases to 180 deg. F (82 deg. C), the thermostats start to open and at the same time restrict the by-pass system. The partially open thermostats permit a portion of the coolant to circulate through the radiator. When the coolant temperature reaches approximately 190 deg. F (88 deg. C) the thermostats fully open, the by-pass system is completely blocked off and all of the coolant circulates through the radiator. The engine coolant temperature is registered on temperature gages located in the cab and on the structural control panel.

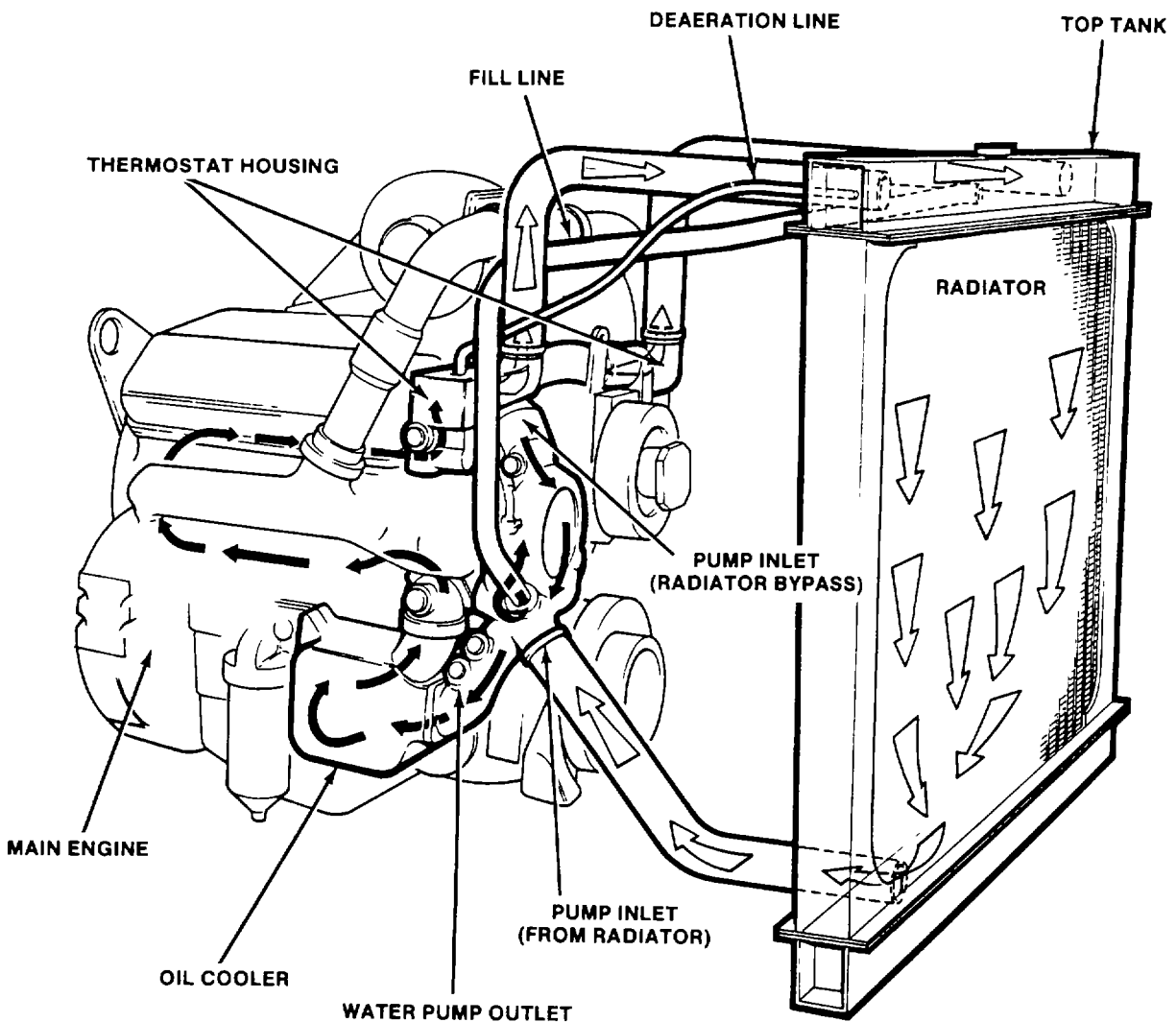


Figure 1-22. Engine Cooling System

1-14. ENGINE COOLING SYSTEM - Continued

b. Fan and Shutters The ambient air flow through the radiator removes heat from the coolant circulated through the core. To maintain optimum engine operating temperature, the air flow is controlled. The shutters and fan providing this control are automatically engaged by the multistat, (see fig. 1-23). When the engine is started, compressed air is provided to close the shutters and to disengage the fan clutch. With the fan not operating and no flow of ambient air through the radiator the cooling system heats up rapidly. When the coolant reaches operating temperature the multistat shuts off air pressure to the shutter cylinder. This causes the shutters to open. When the flow of air through the radiator is insufficient to dissipate the heat, the multistat shuts off air pressure to the fan clutch and it engages. Increased ambient air flow through the radiator thereby reduces the coolant temperature. The system temperature is maintained within a range of 5 to 6 deg. F (2.5 deg. to 3 deg. C). The automatic control of the fan and shutters can be manually disengaged by an override control provided in the cab. When operated, air flow to the multistat is shut off, thus the shutters are open and the fan engaged.

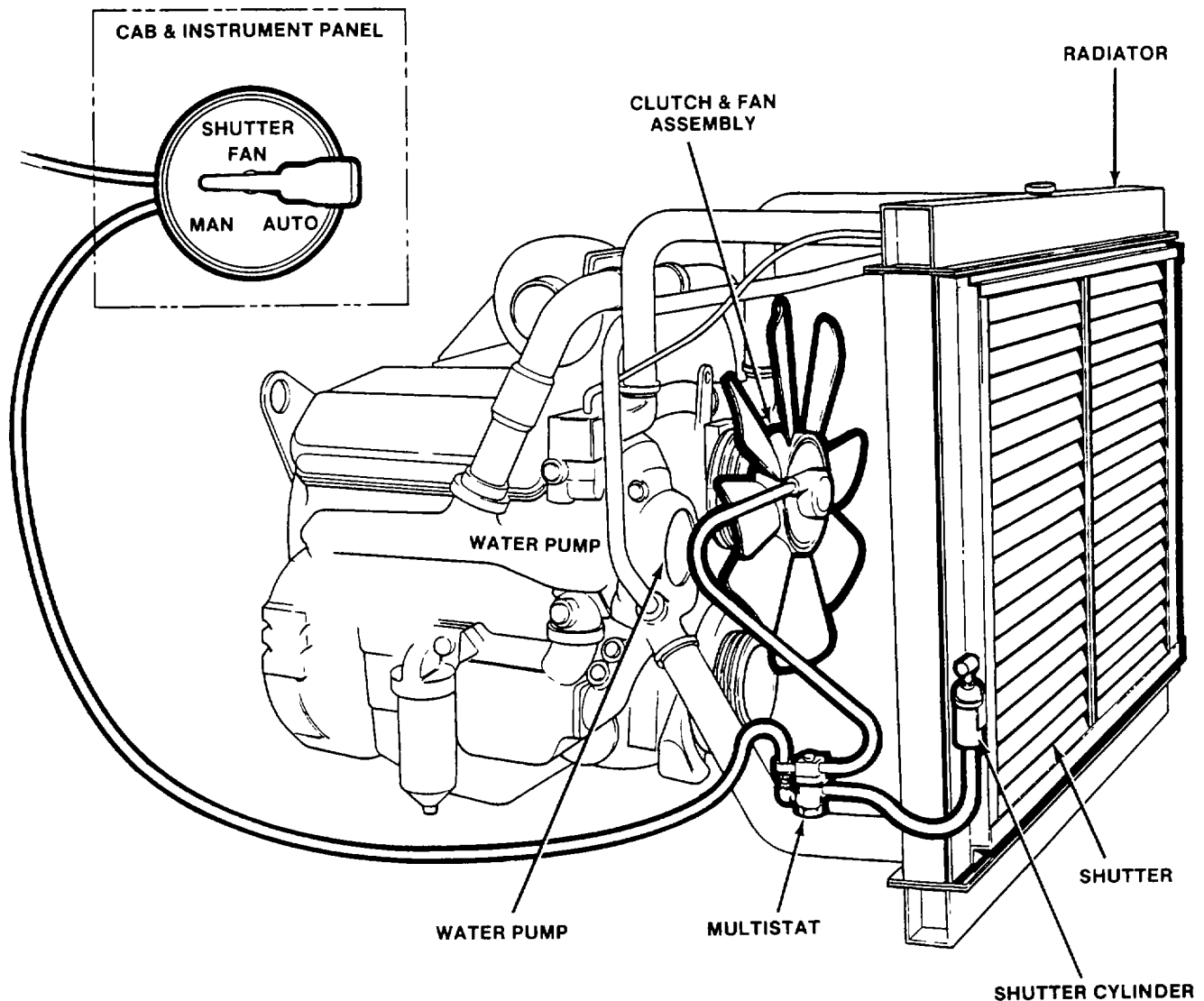


Figure 1-23. Radiator Fan and Shutter System

1-15. DRIVE TRAIN. Tractive power from the engine is transferred via the transmission and main drive line through the power divider and rear differential to the rear wheels, (see fig. 1-24). Power transfer to the front wheels is provided via the power divider and front wheel drive lines.

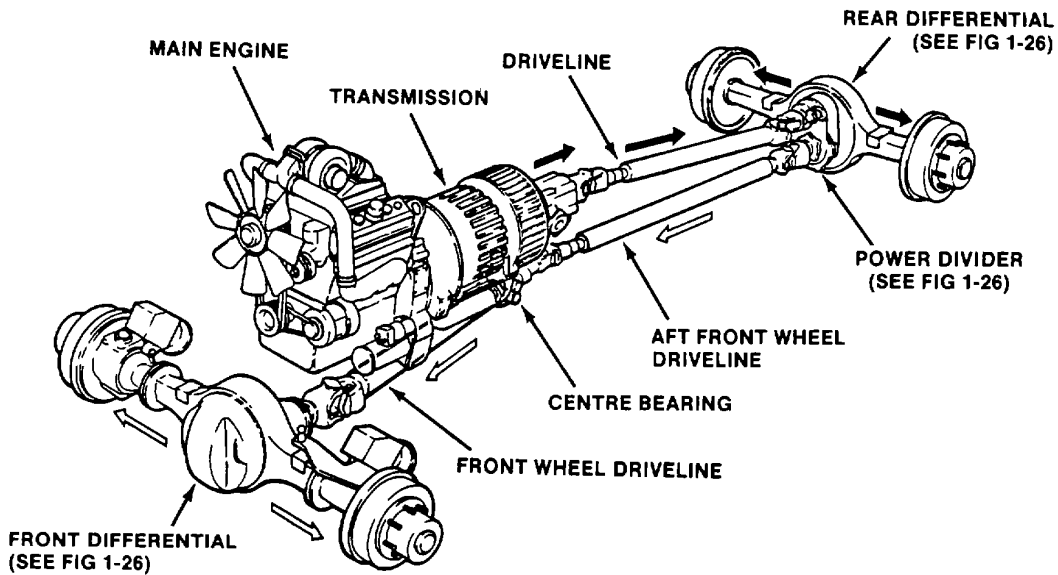


Figure 1-24. Tractive Power transfer

a. Power Divider.

(1) The 4-wheel drive transfer gearing and the power flow through the power divider is illustrated in figure 1-25. The transfer gearing includes a mechanical sliding clutch for engagement and disengagement of the drive line to the front wheels.

(2) In two-wheel operating mode, the sliding clutch is disengaged and power flow is direct to the rear axle. For four-wheel-drive operation, the sliding clutch is engaged and power is distributed through the helical gears to both the front and rear axles.

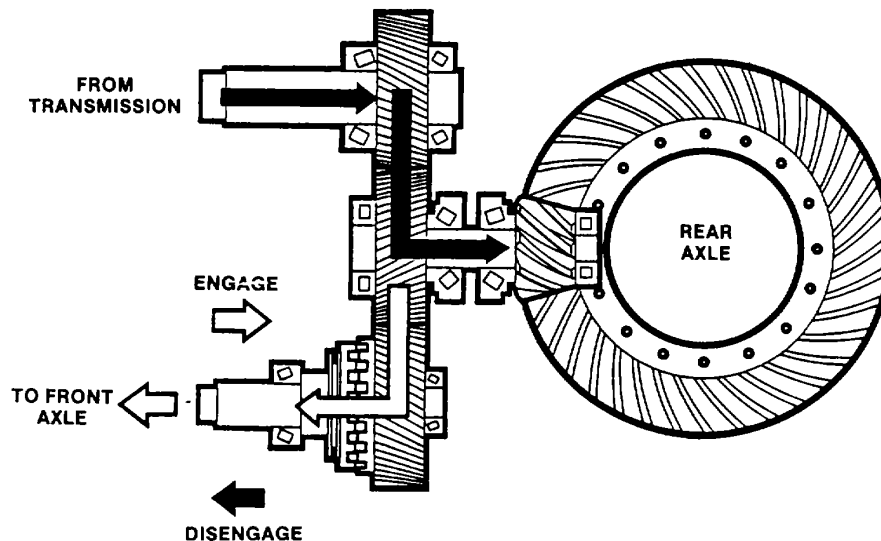


Figure 1-25. Power Divider Operation

1-15. DRIVE TRAIN. - Continued

b. Controlled Traction Differential. The front and rear axles are both provided with Controlled Traction Differentials (differential locks). The differential locks, (see fig. 1-26) incorporate a friction plate assembly (clutch) which is under constant spring pressure. When engaged, the differential lock prevents one wheel from slipping in relation to the other on the same axle. When disengaged, conventional differential action for normal road conditions is restored. When engaged, the differential lock will slip sufficiently for the vehicle to negotiate turns in a normal manner.

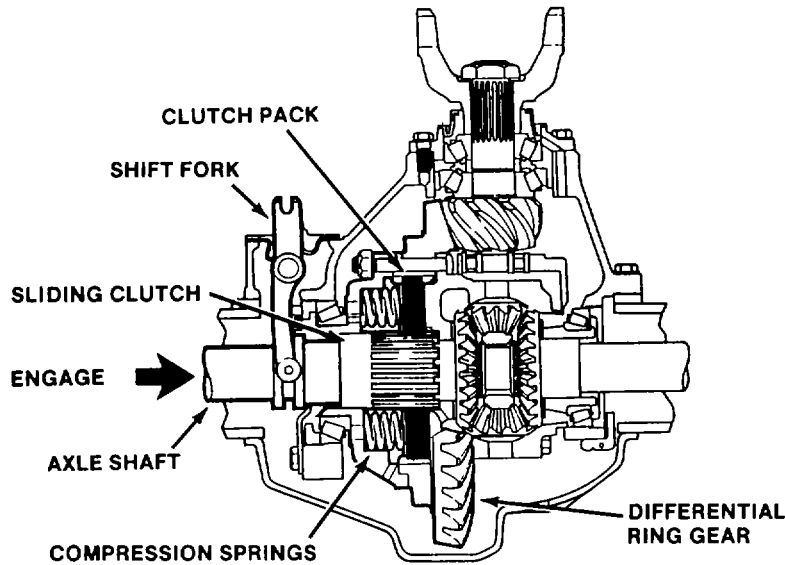


Figure 1-26. Controlled Traction Differential Clutch

c. Power Divider and Differential Lock Control. Four-wheel-drive and the differential locks are engaged and disengaged by air-operated shift units, (see fig. 1-27). Air flow to these units is controlled via two selector valves in the cab. The four wheel drive shift unit should be engaged only when the vehicle is stopped or driven at very low speed. The differential locks can be actuated at any time except when one or more wheels are spinning.

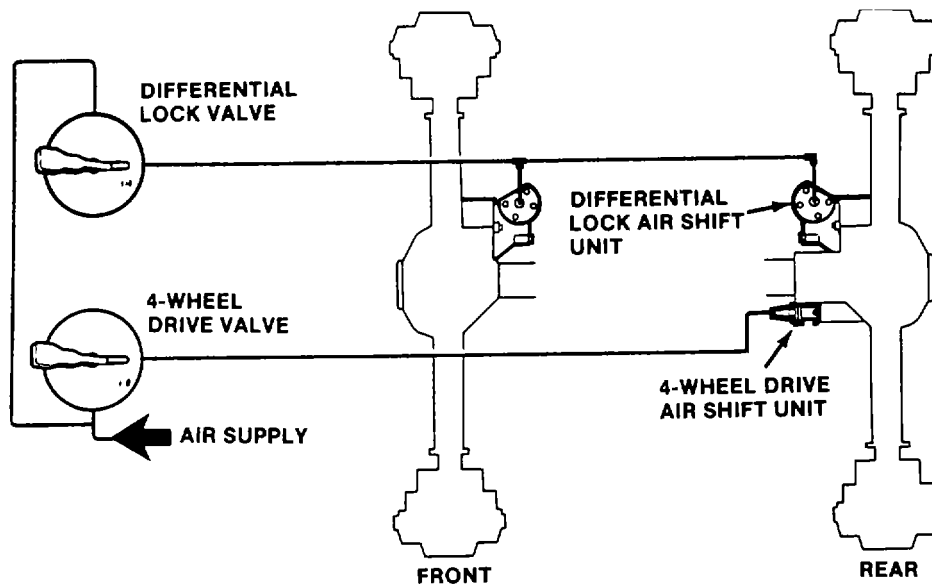


Figure 1-27. Differential Lock And Four Wheel Drive Systems

1-16 STEERING SYSTEM. Turning motion from the steering wheel is mechanically transmitted through the steering column and shaft linkage to the steering gear. In the gear, the motion is transferred via a rack and pinion to the pitman arm. A steering linkage connected to this arm provides the final transfer to the wheel ends.

a. Power Assist System.

(1) To reduce the force required to manually turn the front wheels, the steering system is provided with a hydraulically-operated power assist system, (see fig. 1-28). Hydraulic fluid from the reservoir is pressurized by a vane-type power steering pump. From the pump, this fluid is supplied to the steering gear (line C) where it flows through an internal piston and valve assembly. From the gear, the fluid is returned to the reservoir (line B).

(2) To ensure that the working pressure of the hydraulic flow is maintained below a set limit, the pump is equipped with a pressure relief valve. This valve is connected with a drain line (line A) back to the reservoir.

(3) To remove solid contaminant from the system, the reservoir is provided with a replaceable internal filter.

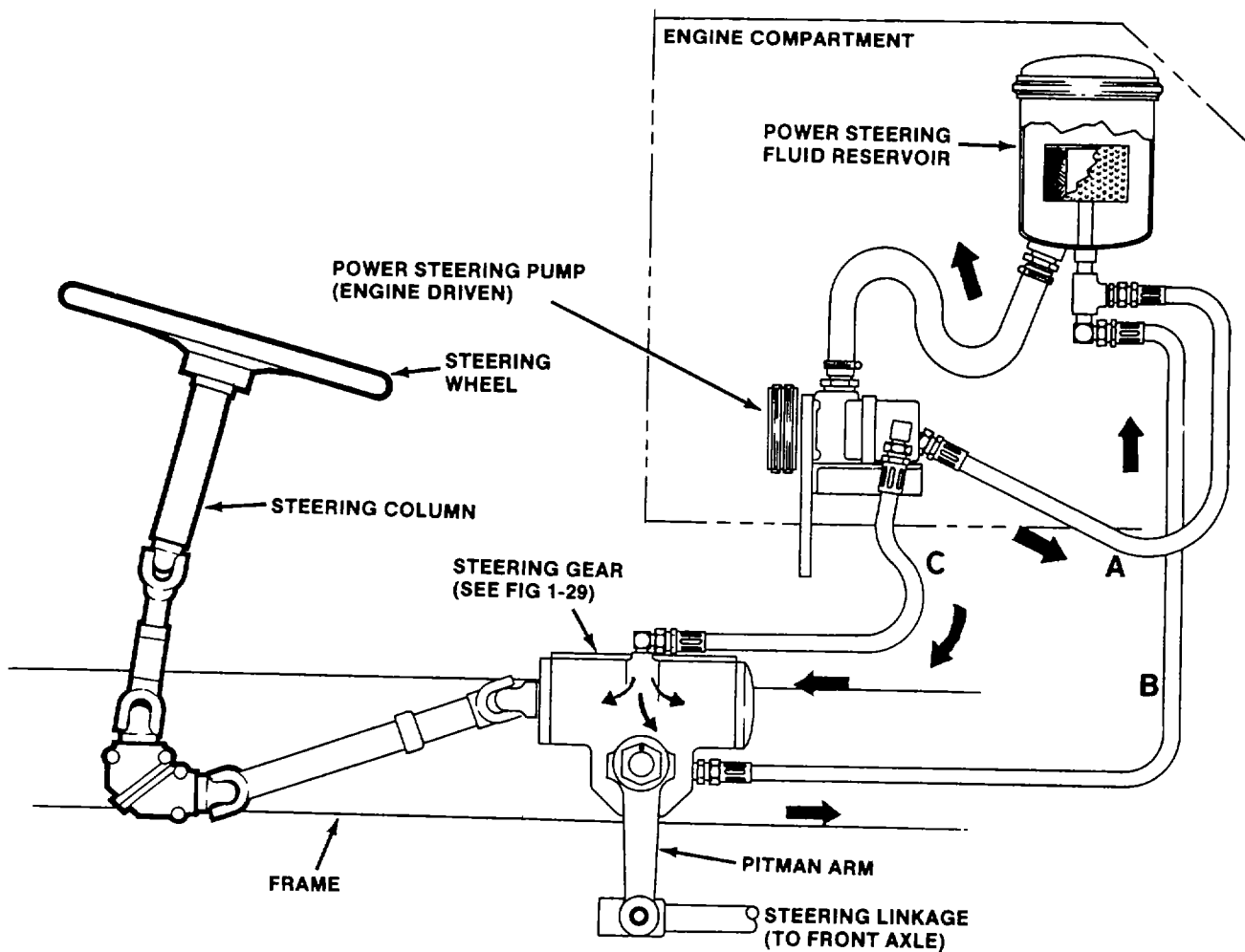


Figure 1-28. Power Steering System

1-16. STEERING SYSTEM. - Continued

b. Steering Gear.

(1) Inside the steering gear, fluid is distributed to both ends of a piston assembly, (see fig. 1-29) and equal pressure is maintained while the steering is neutral. When the steering wheel is turned, the motion will push the valve assembly toward one end of the piston. This action will close off oil flow to that end and increase the flow to the other end. The hydraulic pressure from this flow will assist moving the piston and thereby turn the gear. If the piston is moved to its extreme limit, i e, the front wheels are turned to maximum angle, a plunger operated relief valve will open and relieve the hydraulic pressure. A relief valve is provided at each end of the piston.

(2) When steering action is stopped or returned to neutral, spring action from disc-type springs at both ends of the valve body will center the valve and equalize the oil pressure on both sides of the piston.

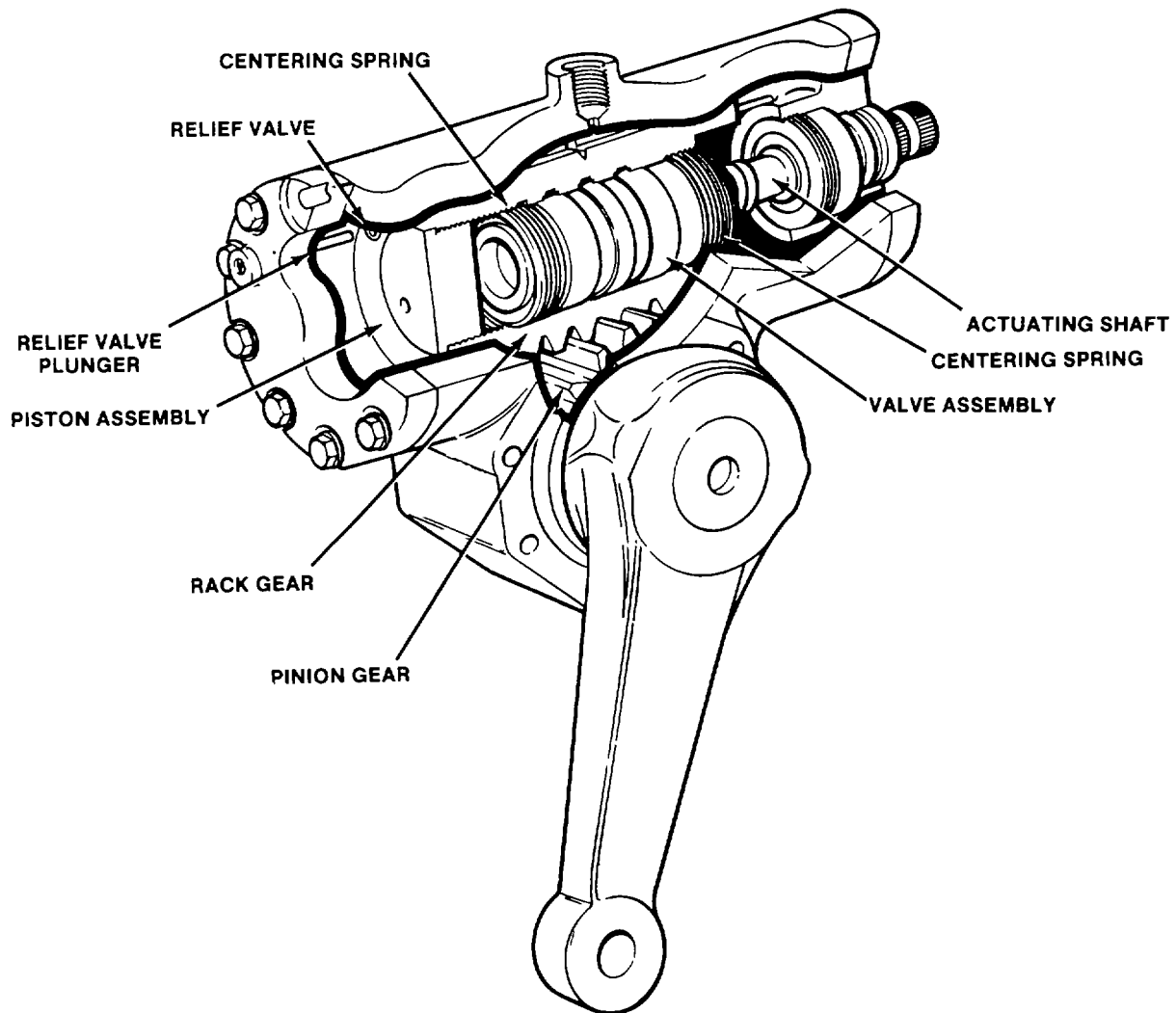


Figure 1-29. Power Steering Gear

1-17. BRAKE SYSTEM. Air pressure to operate the service and emergency brakes is supplied from the primary, secondary, and emergency reservoirs. During normal operation, air in the primary system is used to apply the rear brakes and air in the secondary system is used to apply the front brakes and release the parking brakes.

a. Parking Brakes.

(1) To release the parking brakes, the control (A), (see fig. 1-30) is pushed in. Air from the secondary reservoir flows from the control valve via the spring brake valve, double check valve and quick release valve to the rear brake air chambers. To engage the brakes, the control (A) is pulled OUT to depressurize the parking brake air lines. When these lines lose pressure, the quick release valve opens and vents the brake air chambers to the atmosphere. As the air pressure is relieved, spring pressure from the spring chambers engages the brakes.

(2) If the secondary air supply is depleted, the brakes can be released by pressure from the emergency reservoir. By pushing and holding the control (B) IN, the secondary reservoir is isolated and the emergency reservoir is opened to pressurize the system.

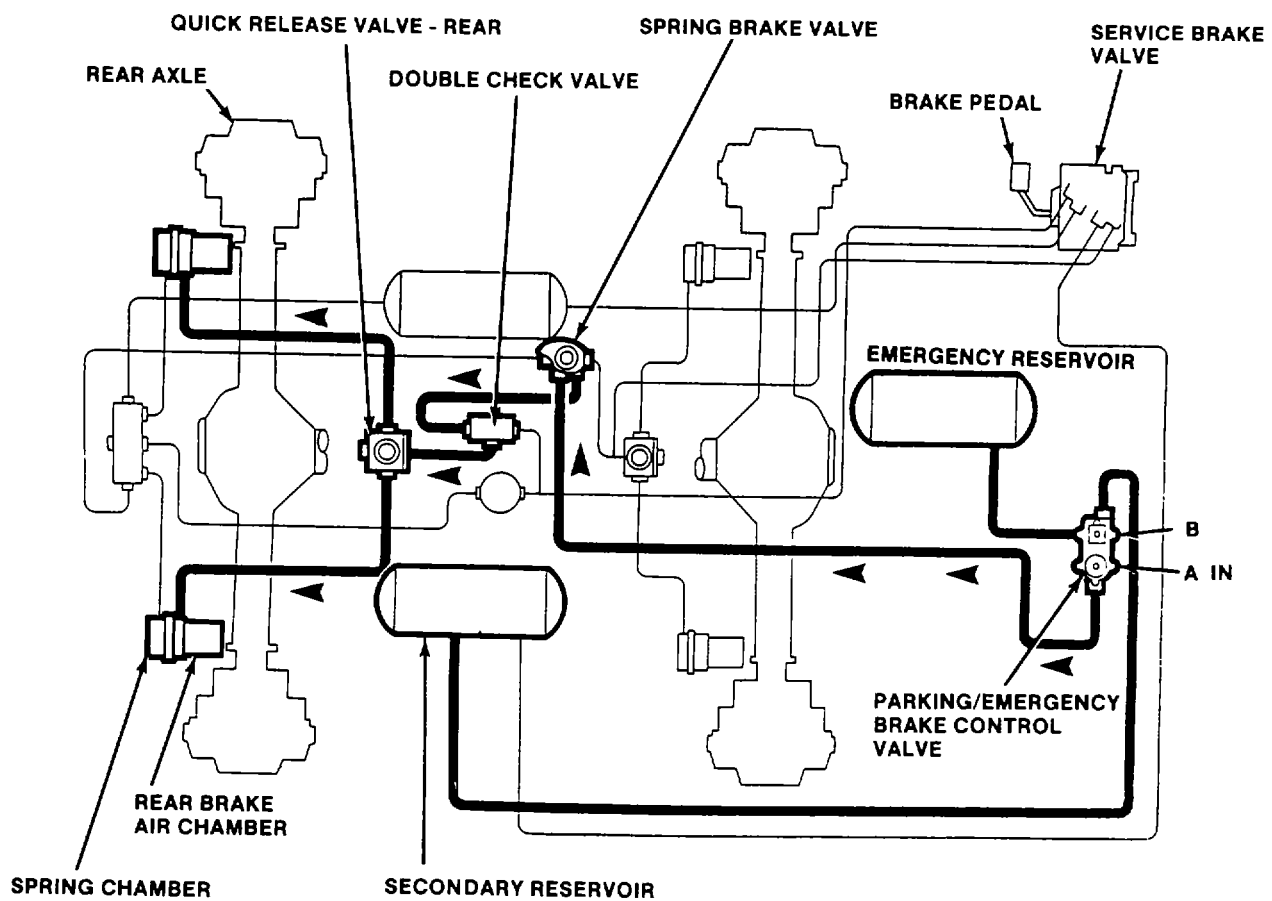


Figure 1-30. Parking Brake System

1-17. BRAKE SYSTEM - Continued

b. Rear Brake System

(1) When the brake pedal is depressed, pilot pressure is supplied from the primary reservoir via the service brake valve and regulator to the relay valve, (see fig. 1-31). The pilot pressure opens the relay valve and allows brake application air from the primary reservoir to enter and pressurize the spring brake chambers. The combined force of air and spring pressure suppresses the parking brake release pressure in the opposing air chambers, (see para. 1-17 a.) and engages the brakes.

(2) To prevent excessive brake force, the continuously balanced pilot and spring chamber air pressures are regulated to a maximum 45 psi (see 310 kPa) Below this limit the pressures are infinitely controlled.

(3) When the brake pedal is released, the pilot pressure is exhausted. The relay valve shuts off the brake application air and vents the spring chambers to atmosphere. The opposing air chambers remain pressurized and thus disengage the brakes.

(4) To prevent jamming of the brakes if the service brakes are applied while the parking brakes are engaged, counteracting pressure is provided to the air chambers. This air pressure is provided via the double check valve and quick release valve simultaneously with the application of air pressure to the spring chambers.

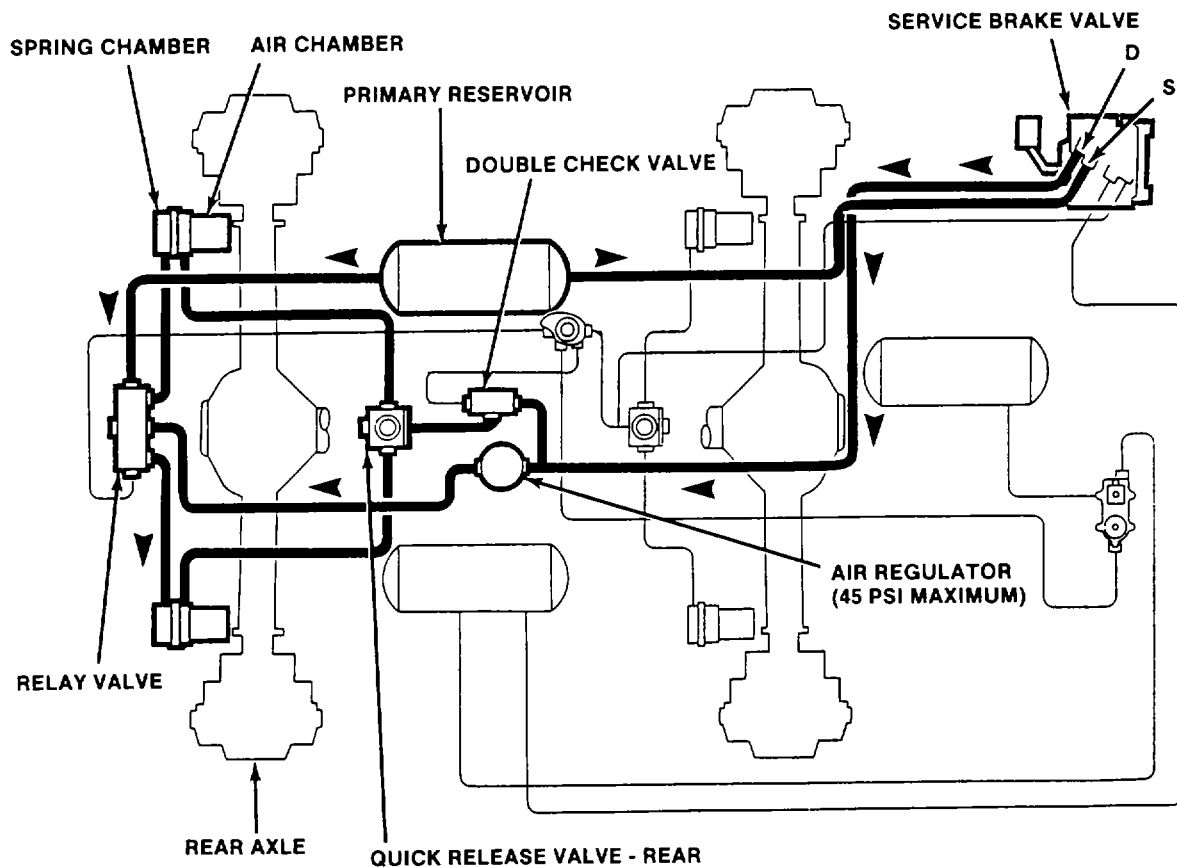


Figure 1-31. Rear Brake System - Normal Operation

1-17. BRAKE SYSTEM. - Continued

(5) If the primary system becomes depleted of air, the secondary system is indirectly used to apply the rear brakes. The shift from primary to secondary air is automatic and carried out in the spring brake valve when the brakes are applied.

(6) Normally, primary air pressure, supplied via the relay valve, keeps the secondary (control) air supply port in the spring brake valve closed. This action keeps the valve function neutral.

(7) With no primary air available, secondary air pressure causes the spring brake to partially close and reduce the air pressure that keeps the parking brakes disengaged, (see fig. 1-32). When this occurs, the quick release valve automatically opens and momentarily vents the air chambers to the atmosphere. The reduction in pressure in the air chambers is proportional to the secondary air pressure applied to the spring brake valve.

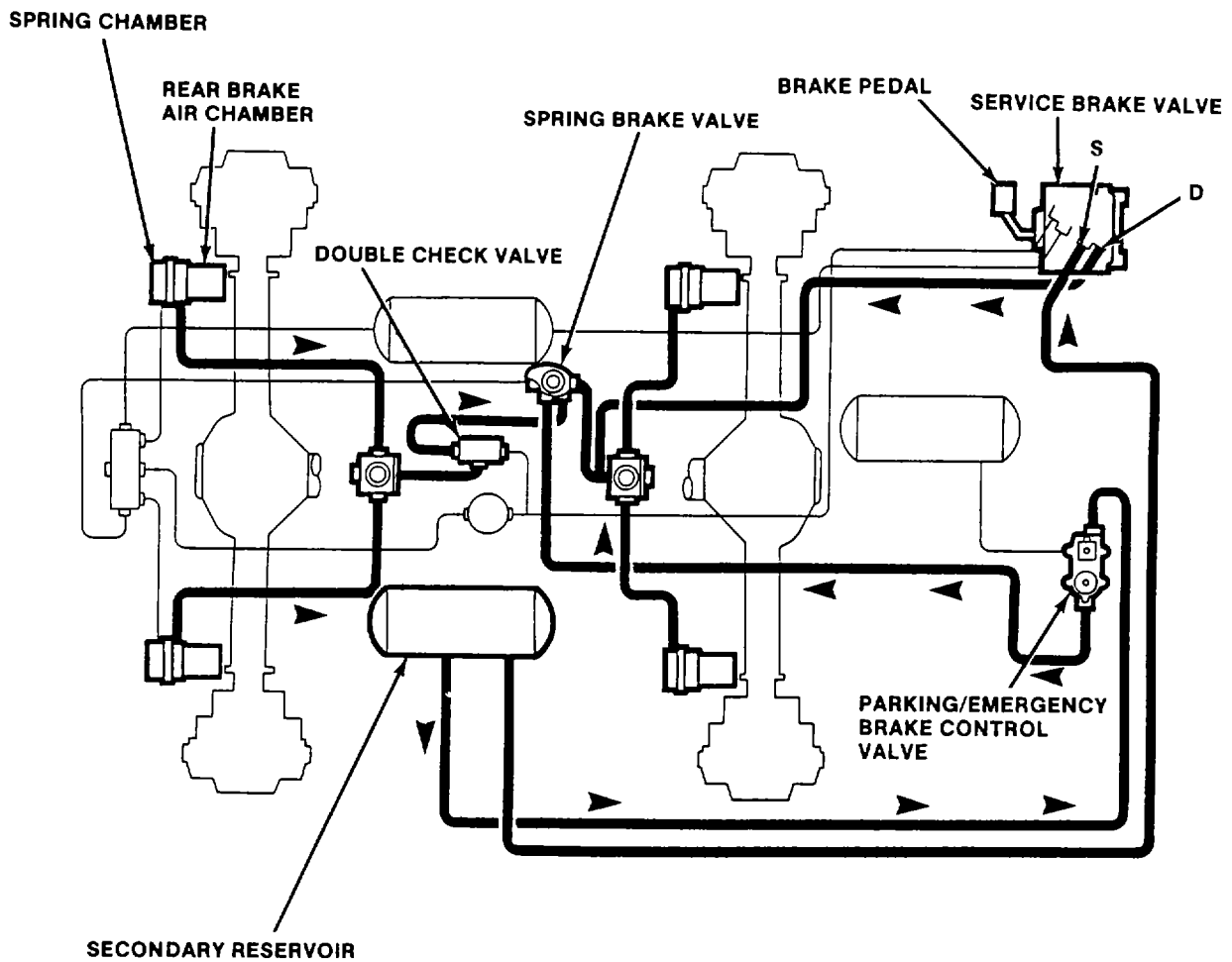


Figure 1-32. Rear Brake System - Secondary Air Only

1-17. BRAKE SYSTEM - Continued

c. Front Brake System.

(1) To engage the front brakes, air pressure is supplied from the secondary reservoir via the service brake valve (front) to the front wheel brake air chambers, (see fig. 1-33). When the brake pedal is released, the air pressure exhausts. Without pressure, the quick release valve opens and vents the air chambers to atmosphere, thereby, releasing the brakes.

(2) The front brake system is operational only when the secondary reservoir is pressurized.

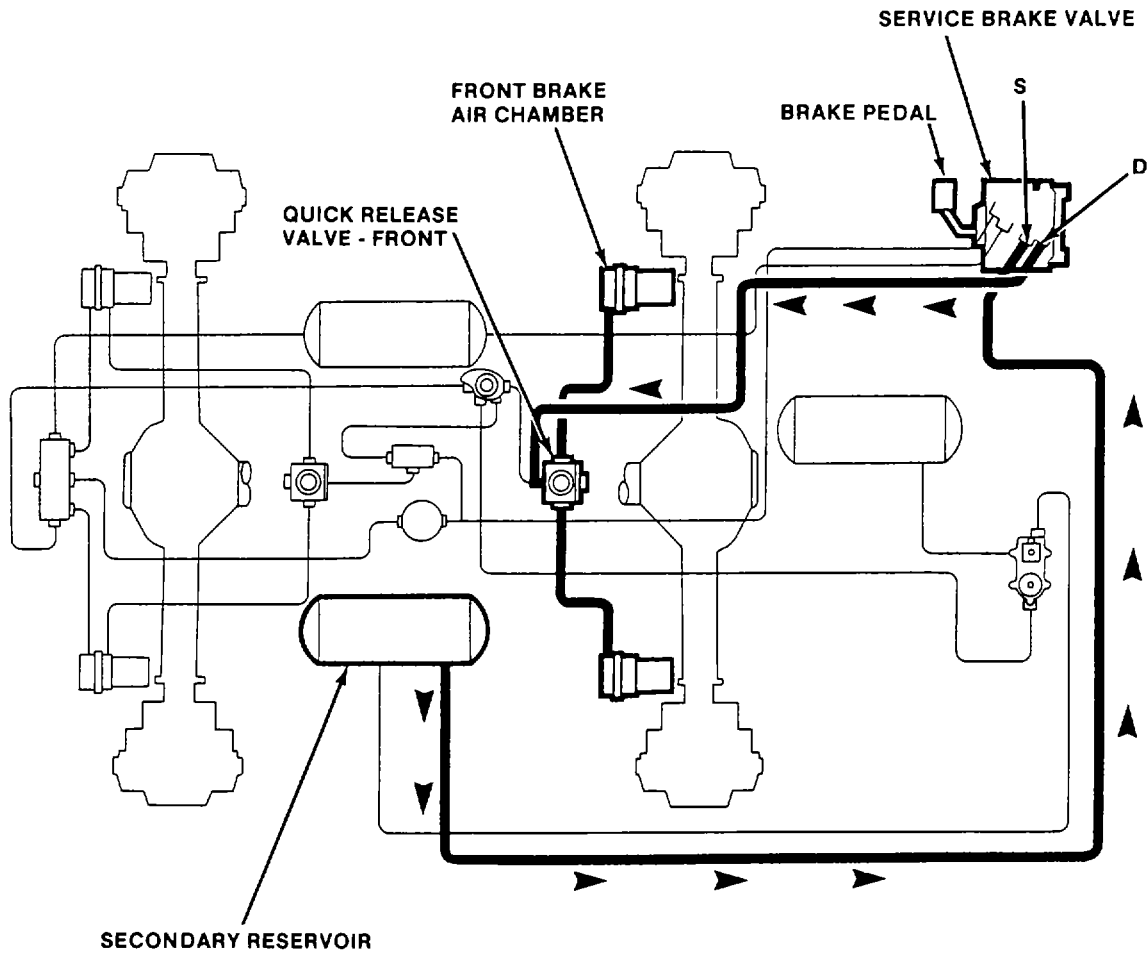


Figure 1-33. Front Brake System

1-18. AIR SYSTEM. In this paragraph, only that part of the air system comprising air supply and storage, and driving accessory operation is covered. Details of the remaining parts of the system are provided in paragraph 1-13, engine governor and throttle control, paragraph 1-14, engine cooling system, paragraph 1-15, drive train, and paragraph 1-19, firefighting system.

a. Air Supply and Storage System.

(1) The air flow through the system is shown in figure 1-34. Filtered air is drawn from the engine turbocharger into the compressor. Here the air is compressed and discharged via the dryer into the primary reservoir.

(2) The air flow from the primary to the secondary, emergency, and fast reservoirs is restricted by pressure protection valves (A). These valves isolate the primary reservoir until sufficient pressure is available to permit vehicle operation. When this pressure is obtained, pressurization of the remaining reservoirs takes place. The check valves (K) prevent backflow from the emergency and fast reservoirs once these are charged.

(3) The fast reservoir is open to the primary reservoir whenever the ignition switch is set to ON. The reservoirs are connected via the air starter valve. This valve is operated by pilot air pressure from the fast reservoir via a solenoid valve.

(4) To provide quick pressurization of the primary tank immediately after start up, the fast reservoir is maintained fully charged and isolated when the ignition is OFF.

(5) During normal operation, the system is charged until maximum pressure is reached in all reservoirs. When this occurs, the system pressure is sensed by the compressor via the (RS) line from the secondary reservoir and the compressor starts to unload. Unloading continues until the system pressure is well below maximum. When this happens, the unloading stops and charging continues.

(6) While the system is charging, the air flowing through the air drier is dehumidified. The moisture is precipitated and collected in the bottom of the drier. When the compressor unloads, the discharge air opens a valve in the bottom of the drier and the accumulated moisture is blown out by a backflow of pressurized air. This air, still hot from compression, also removes residual moisture from the drying element.

(7) Pressure gages for the primary, secondary, and emergency reservoirs are provided in the cab.

1-18. AIR SYSTEM. - Continued

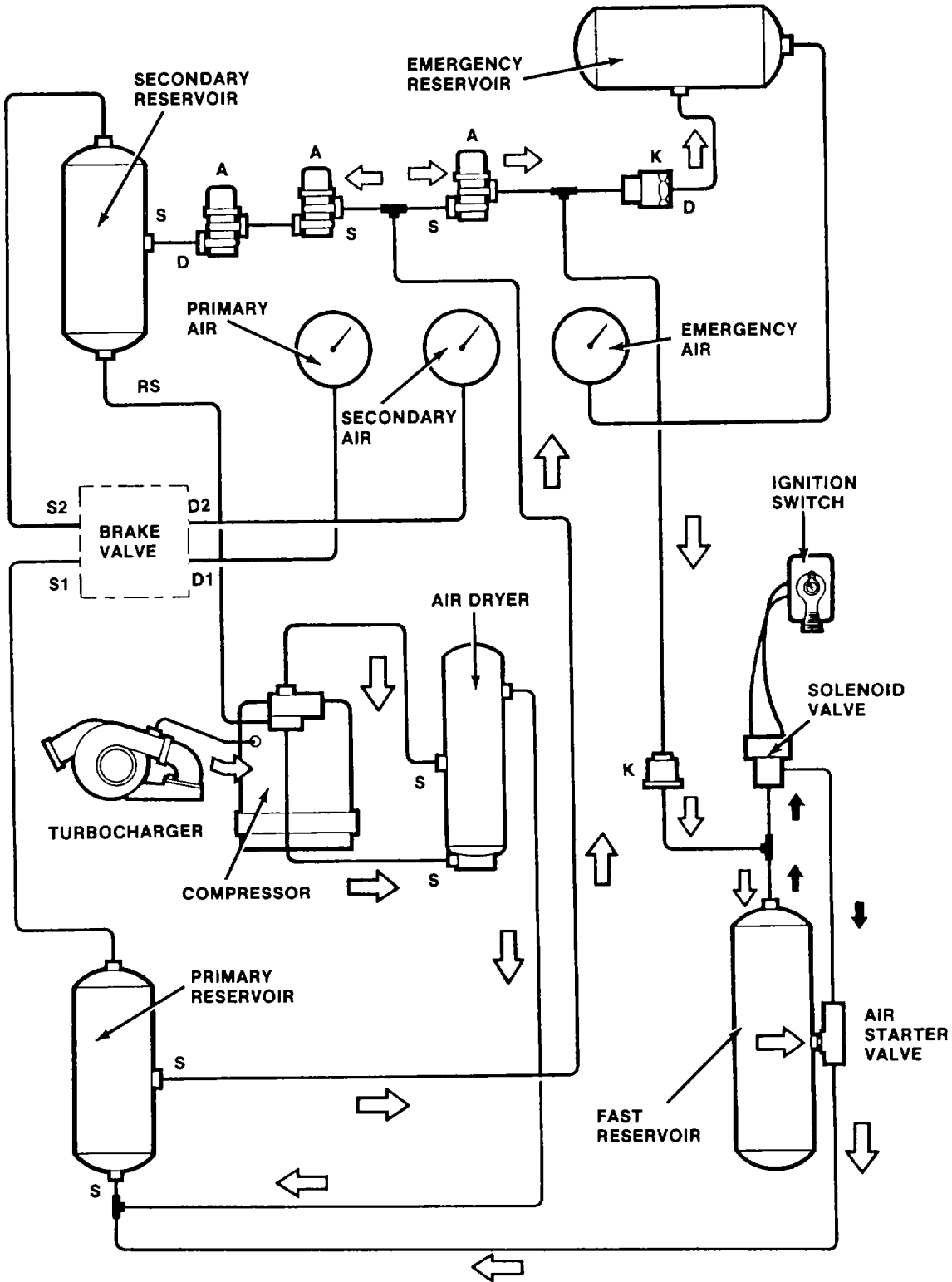


Figure 1-34. Air Supply and Storage System

1-18. AIR SYSTEM - Continued

b. **Driving Accessory Air System.** Air supply for operation of the windshield wipers, washer jets, and air horn is provided from the secondary reservoir via manifold # 1. Air flow to the individual components is shown in figure 1-35.

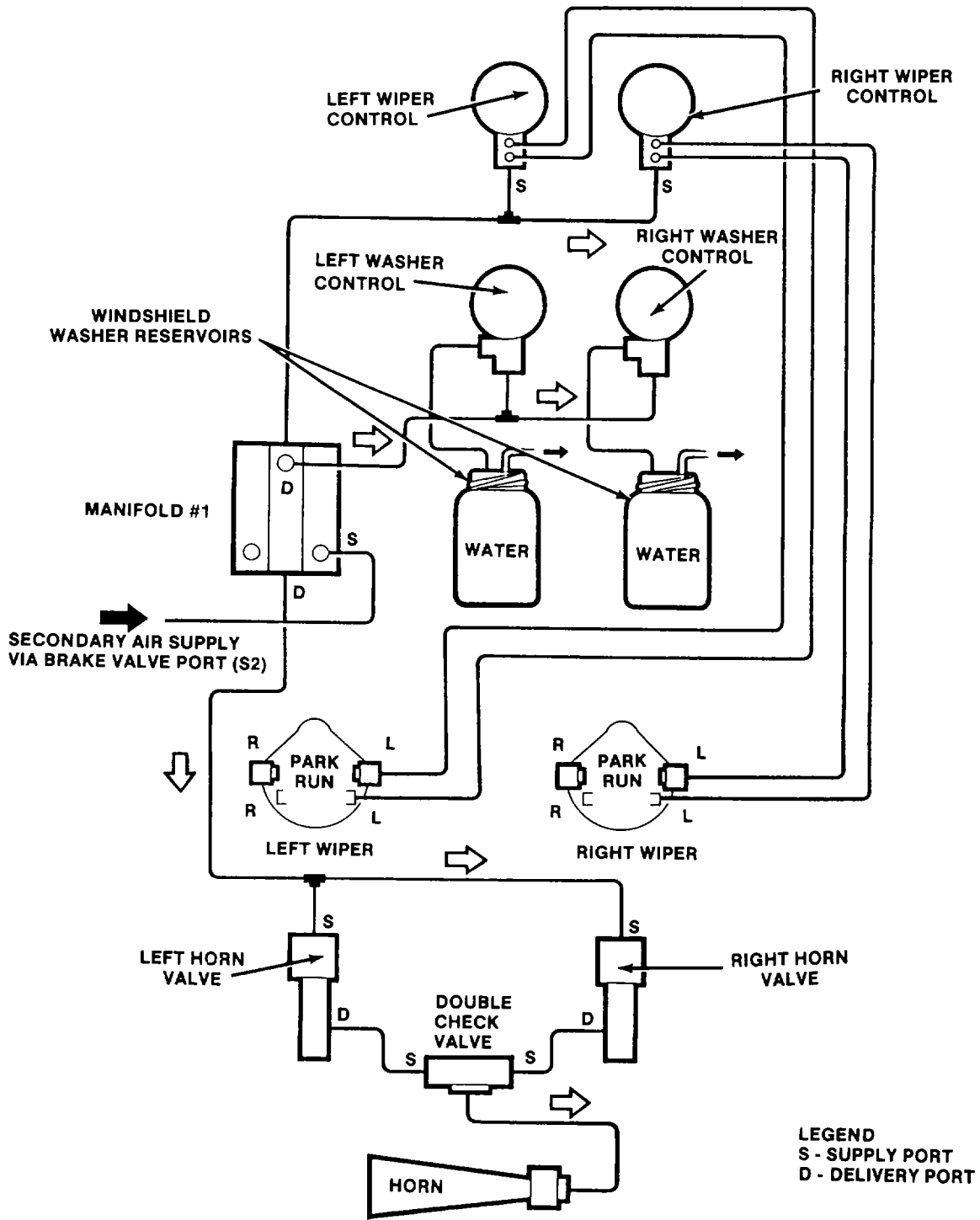


Figure 1-35. Driving Accessory Air System

1-19. FIREFIGHTING SYSTEM. Controls are provided in the cab and on the structural control panel to enable firefighting in CFR or structural mode. The controls are interlocked to ensure single operator control in CFR mode, the system can only be controlled from the cab. In structural mode, the system is controlled from the structural control panel. Pump engagement and disengagement however, is always controlled from the cab.

CAUTION

To prevent inrush surges and engine overspeeding, water must always be available at the pump before it is engaged. While operating, water supply to the pump must be continuous. If discontinued, the pump must be shut down immediately to prevent damage.

In CFR, pump-and-roll mode, the pump must be disengaged immediately when the water tank is emptied. Failure to do this can cause loss of vehicle control due to engine overspeeding.

a. Water Supply and Discharge System.

(1) In CFR mode water to the pump is always supplied from the tank, (see fig. 1-36) in structural mode, the supply can be from the tank or alternative sources via the suction manifold. The alternative sources may be fire hydrants, remote pumping units, or an open reservoir. If water is drawn from the tank for structural firefighting, a continuous supply must be secured via the automatic tank fill valve.

(2) Automatic priming of the fire pump takes place if the pump is void of water when initially engaged. The priming pump, driven by the fire pump, evacuates the fire pump suction. As soon as water pressure is available, the priming pump automatically disengages.

(3) From the pump the water flows via the discharge manifold to the turrets and handline discharge valves (A) and (B).

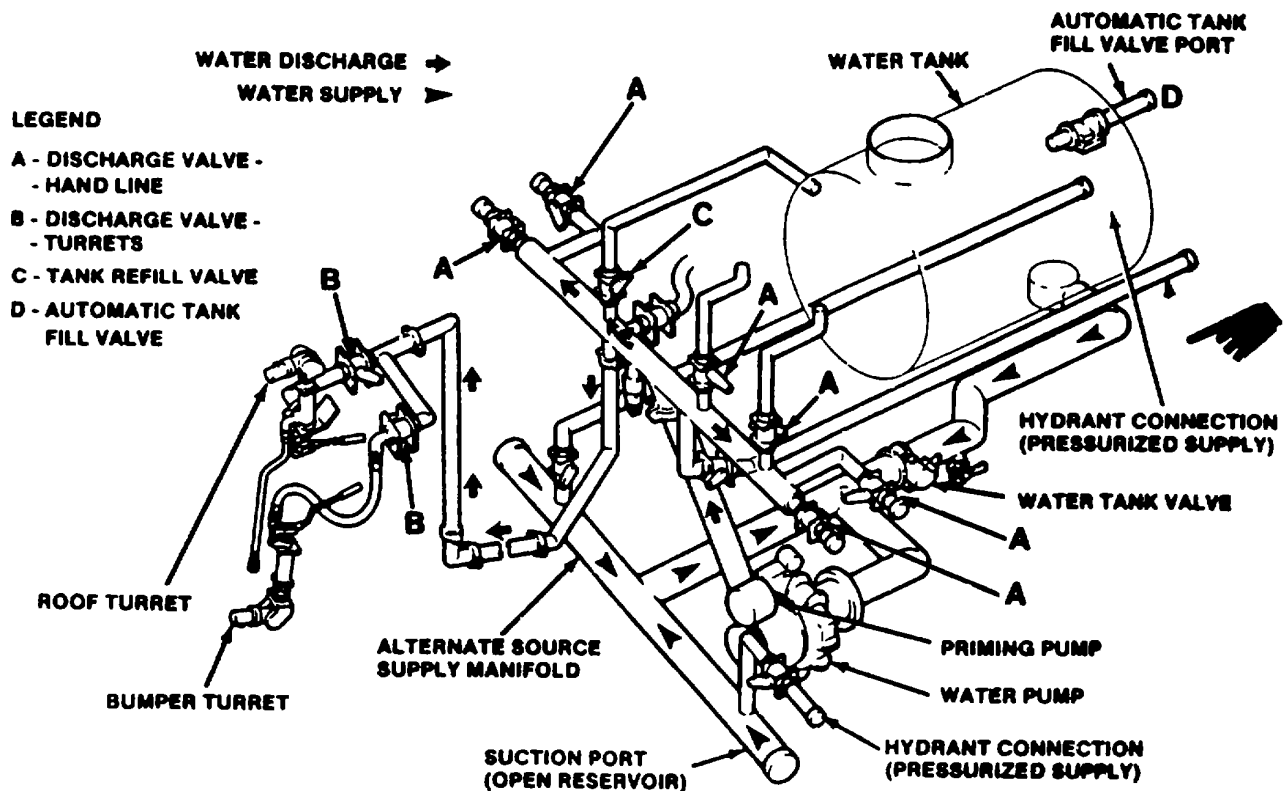


Figure 1-36. Water Supply and Discharge System

1-19. FIREFIGHTING SYSTEM. - Continued

b. Foam Induction System.

(1) Foam concentrate is released from the foam tank and metered into the water flow to the pump, (see fig. 1-37). In CFR mode, the control valves through which the concentrate is released and metered are operated from the cab. In structural mode, these functions are controlled from the structural control panel. To produce foam, water (derived from the pump discharge) is cycled through the eductor into the pump suction. In the eductor, the water draws the foam concentrate into the flow by venturi action.

(2) To remove residual foam from the foam lines after firefighting, the foam tank valve is closed and the flush valve is opened. Water from the pump discharge is then cycled through the metering valves and through the eductor.

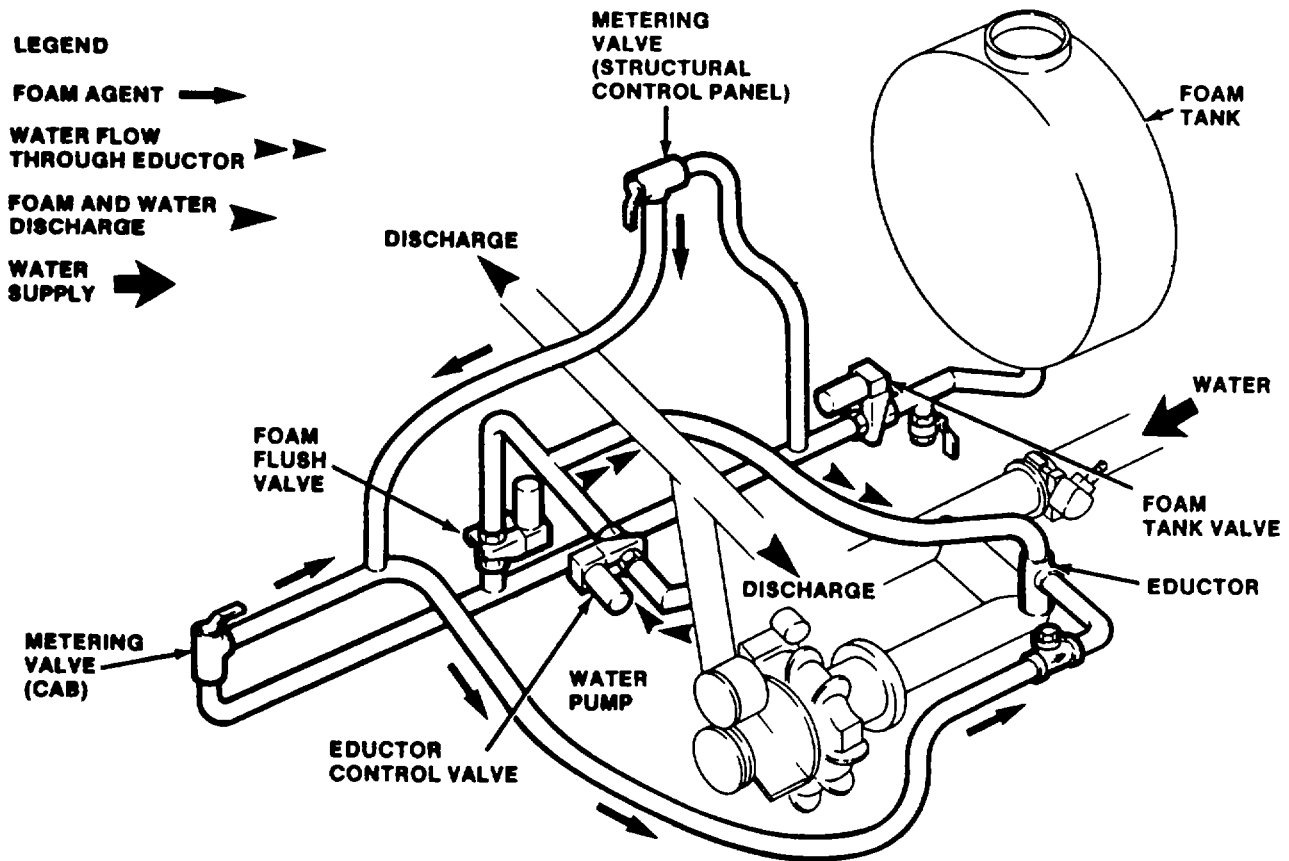


Figure 1-37. Foam Induction System

c. Pump and System Interlock Control - CFR Mode.

(1) When the tank valve is opened in CFR mode, the switch (A), located on the tank valve, closes. This action causes the TANK VALVE OPEN indicator to illuminate and also enables the circuit to the pump switch, (see fig. 1-38).

(2) When the pump is switched ON, the PTO solenoid valve is energized. This allows pressurized oil from the transmission to engage the PTO clutch. The oil pressure also triggers the oil pressure switch causing the PUMP ENGAGED indicator to illuminate and the throttle control solenoid valve (L) to energize. The pressure switch (C) remains closed since no air pressure is applied to manifold # 2 in CFR mode, (see para. 1-19 e.)

1-19. FIREFIGHTING SYSTEM. - Continued

d. System Interlock Control - Structural Mode.

(1) In structural firefighting mode air, manifold # 2 is pressurized, (see fig. 1-40) and the circuit to the pump switch is enabled via the closed contacts of pressure switch (B). The control circuit through valve switch (A) is by-passed thus allowing the water tank valve to be open or closed as required. A diode between the switch (B) and the TANK VALVE OPEN indicator prevents the indicator from being energized when the tank valve is closed.

(2) When the pump is switched ON, the PTO solenoid valve is energized. Pressurized oil from the transmission engages the PTO clutch and triggers the oil pressure switch. This causes the PUMP ENGAGED indicator to illuminate. The pressure switch (C) is open, triggered by air pressure in manifold # 2 (see para. 1-19 f.) and the throttle control solenoid valve (L) is de-energized in this state automatic throttle governor control is locked out.

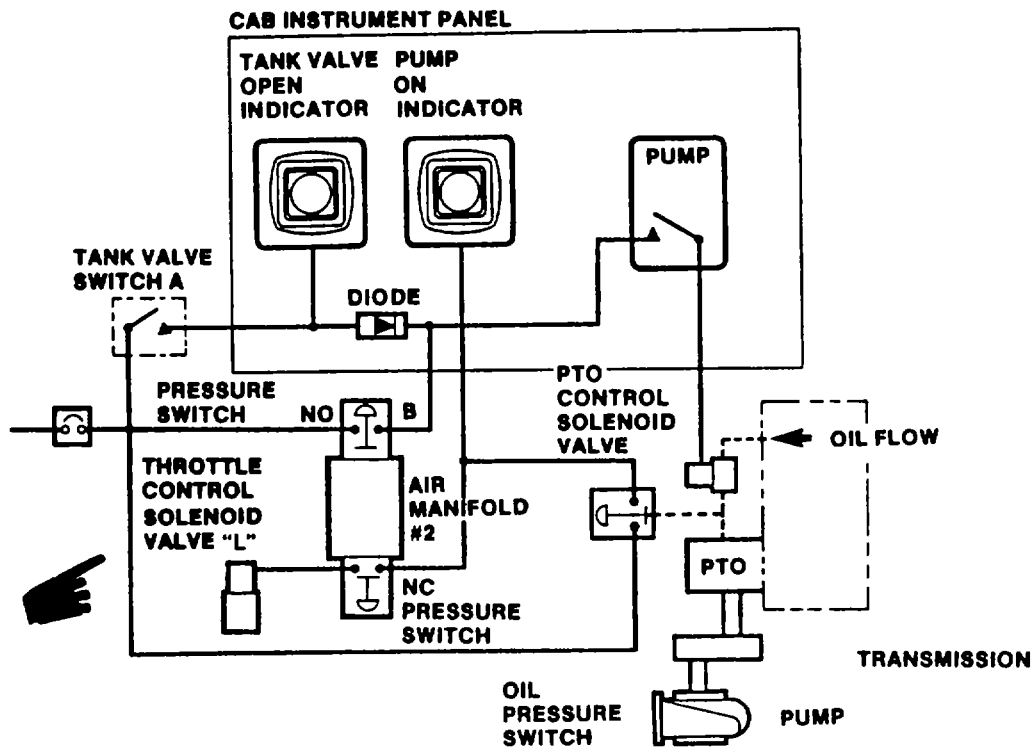


Figure 1-38. System Interlock Control

Change 6 1-45

1-19. FIREFIGHTING SYSTEM. - Continued

e. Water and Form Control - CFR Mode.

(1) With the mode switch selected to CFR, manifold #2 is isolated and air flow is provided to the TANK VALVE switch, (see fig. 1-39). When the TANK VALVE switch is set on OPEN, air pressure is provided to open the tank valve.

(2) When the PUMP switch is set to ON (see para 1-19c.), air flow is also provided via the energized solenoid valve (L) to the GOVERNOR switch. Setting this switch to ON provides air flow to the throttle control governor. The air flow is regulated to 80 psig by the fixed regulator. Refer to paragraph 1-13 for details of throttle operation. Control air flow is also provided to the FOAM VALVE and WATER EDUCTOR switches.

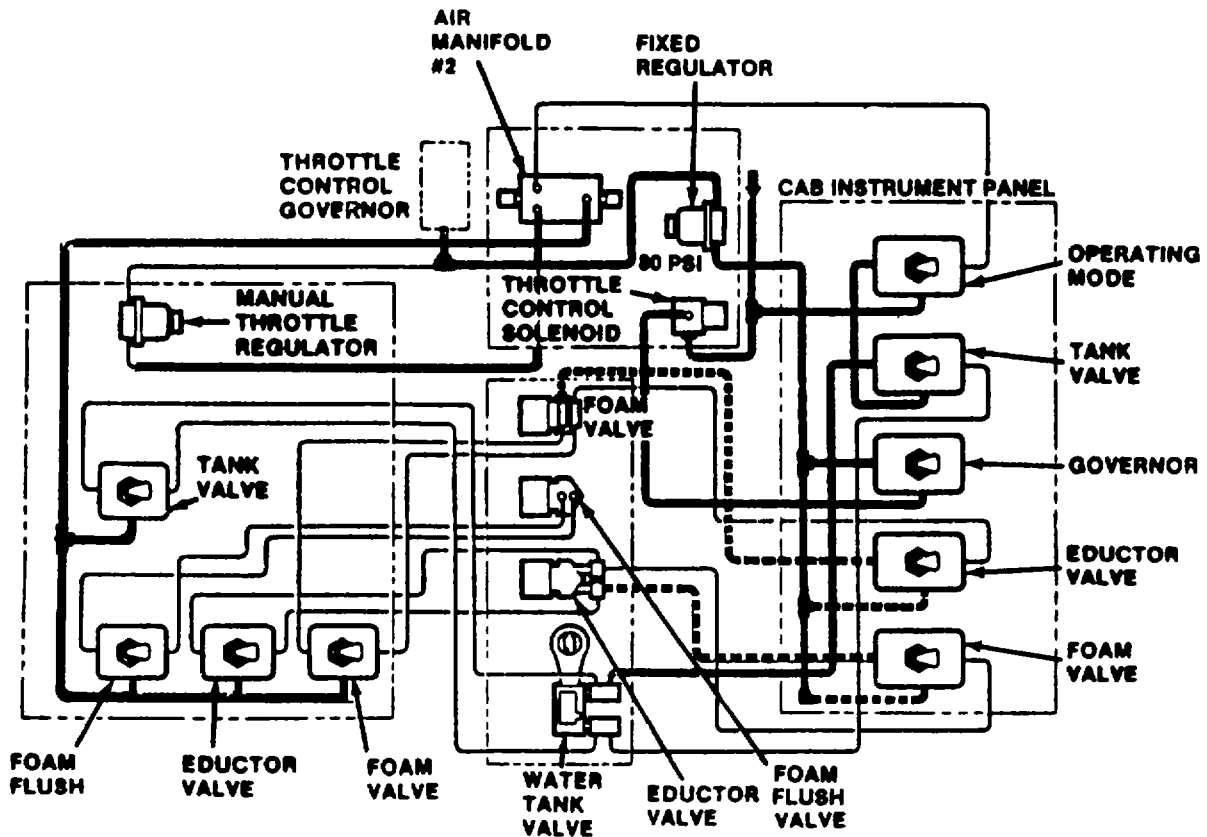


Figure 1-39. Water and Foam Control - CFR Mode.

1-19. FIREFIGHTING SYSTEM. - Continued

f. Water and Foam Control - Structural Mode.

(1) With the mode switch selected to structural firefighting mode (see fig. 1-40), air pressure is provided via manifold #2 to the manual throttle regulator. Air pressure is also provided to the water TANK VALVE switch and the foam control switches on the structural control panel.

(2) The water and foam control switches in the cab are isolated. The water tank valve as well as the foam control valves can only be opened and closed from the structural control panel.

(3) When the pump is switched on (see para. 1-19d.), water flow and pressure is regulated by adjusting the manual THROTTLE regulator. Refer to paragraph 1-13 for details of throttle operation.

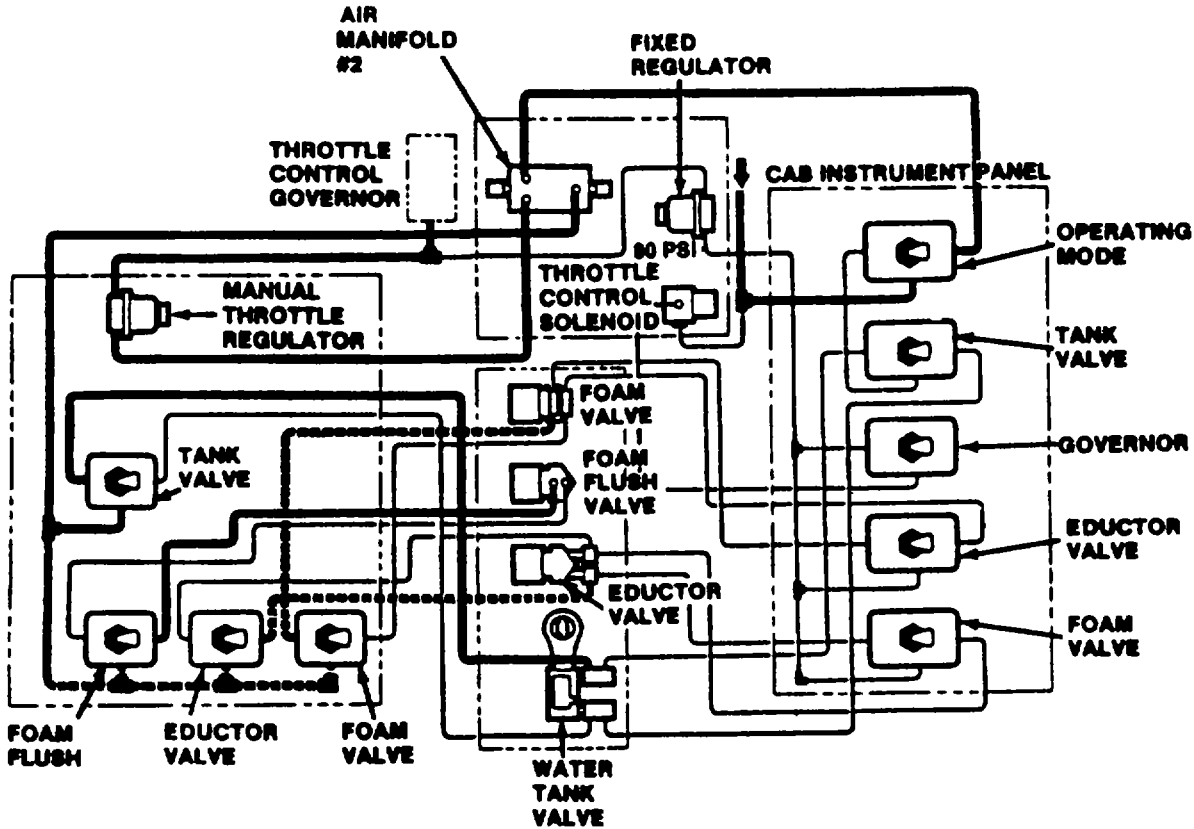


Figure 1-40. Water and Foam Control - Structural Mode

1-19. FIREFIGHTING SYSTEM. - Continued

g. Hose Reel and Automatic Tank Fill Control.

(1) The hose reel is provided with an electric motor drive to rewind the fire hose after use. The motor is energized via a motor relay actuated from a push button switch located externally on the rear body panel, (see fig. 1-41) A drain valve in the hose reel supply line enables draining of residual water after firefighting. Removal of residual water from the fire hose prior to rewinding is accomplished using the air blow-out valve.

(2) The rear tank fill port is equipped with an air-operated automatic tank fill valve. Air pressure to keep this valve closed is provided via a normally-open solenoid-controlled air valve. The solenoid is connected to the water level monitor 3/4 full indicator. It is energized when the switch is set to ON and the water level is below 3/4 full. When energized, air pressure to the automatic tank fill valve is shut off and the valve is open. The tank fill valve is closed whenever the switch is set to OFF or the tank level is at or above 3/4 full provided that air pressure is available.

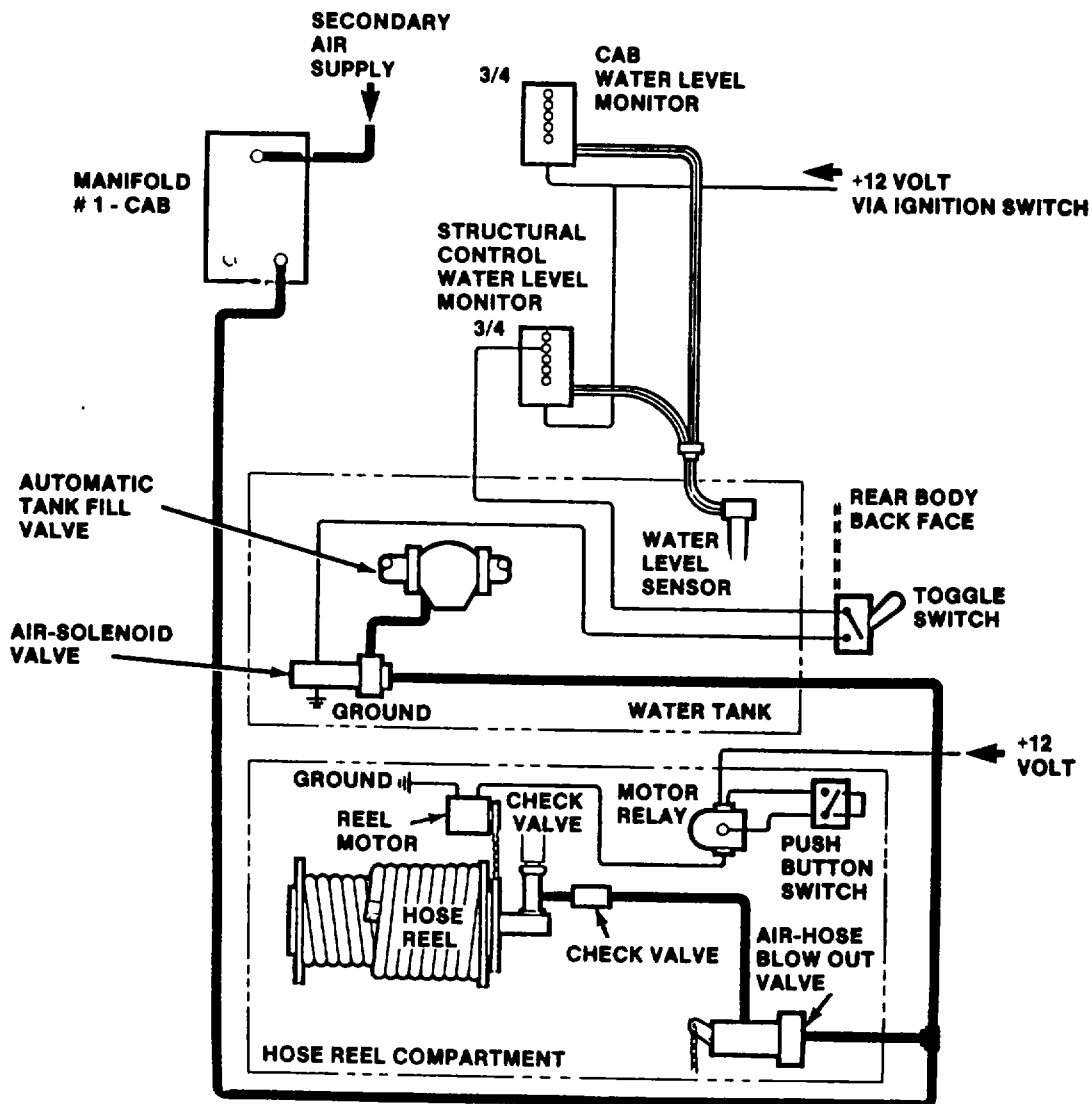


Figure 1-41. Hose Reel and Automatic Tank Fill Control

1-20. WINTERIZATION SYSTEM.

a. When operated, the winterization system heater provides heating of the engine coolant. This coolant is distributed through the winterization system by the APU driven circulation pump, (see fig. 1-42). Individual components of the winterization system may be isolated by main engine-mounted valves. Normally all valves on the engine should be OPEN.

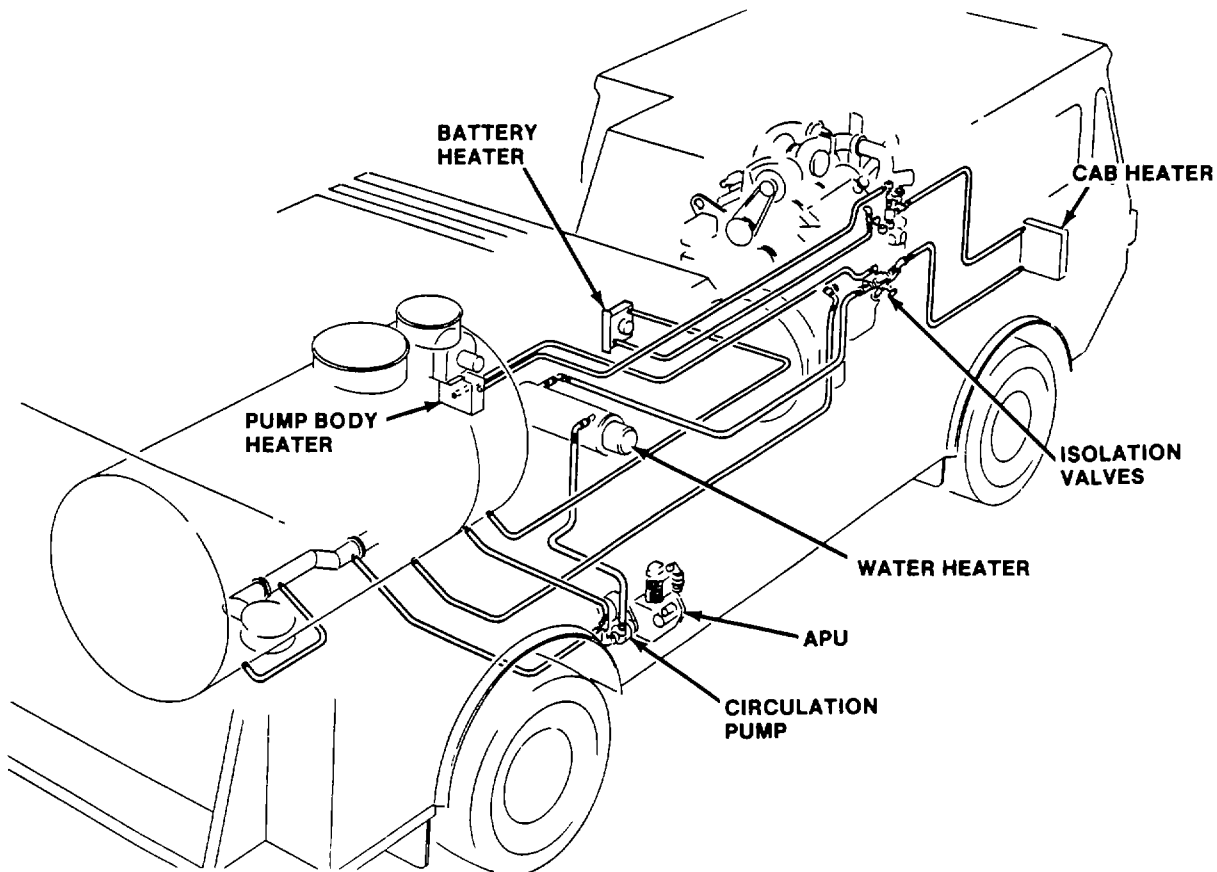


Figure 1-42. Winterization System Coolant Flow

1-20. WINTERIZATION SYSTEM. - Continued

b. The winterization system is dependent on the APU being in operation since circulation of the engine coolant is necessary to maintain the heater in operation. If circulation is stopped (the APU stopped) while the heater is ON, continued heating of the coolant contained in the heater unit, will cause the heater to shutdown. A thermal breaker in the heater must be reset before the heater can be restarted. The APU should always be started before the heater is switched ON and stopped after the heater is switched OFF.

c. The APU also drives an auxiliary alternator which is connected to the truck batteries. The output from this alternator is sufficient to maintain the batteries fully charged while the winterization system is operating.

d. The APU and winterization heater are controlled by separate start and stop controls, however, the fuel supply to both units is delivered by a common fuel pump, (see fig. 1-43). This fuel pump is energized only when the APU key switch is set to Prime or Run. Excess fuel supplied to the heater or APU is returned to the fuel tank.

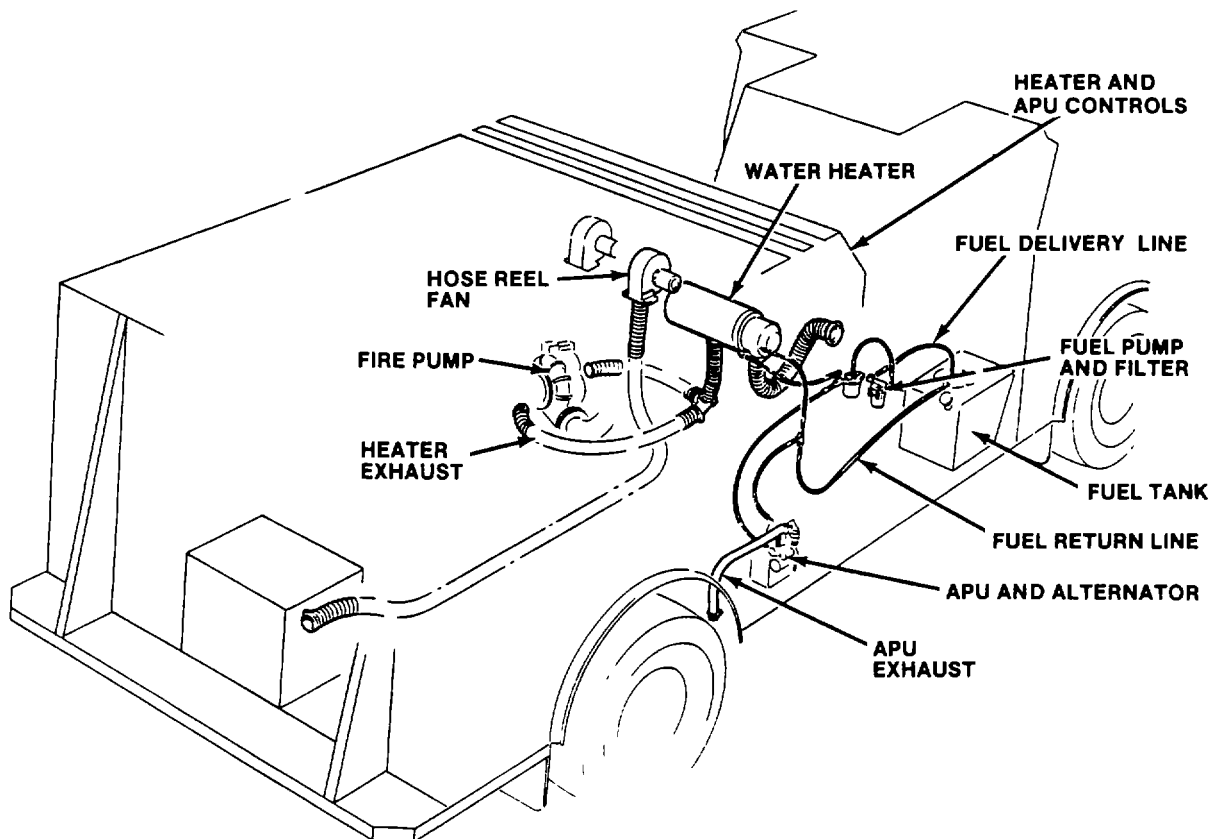


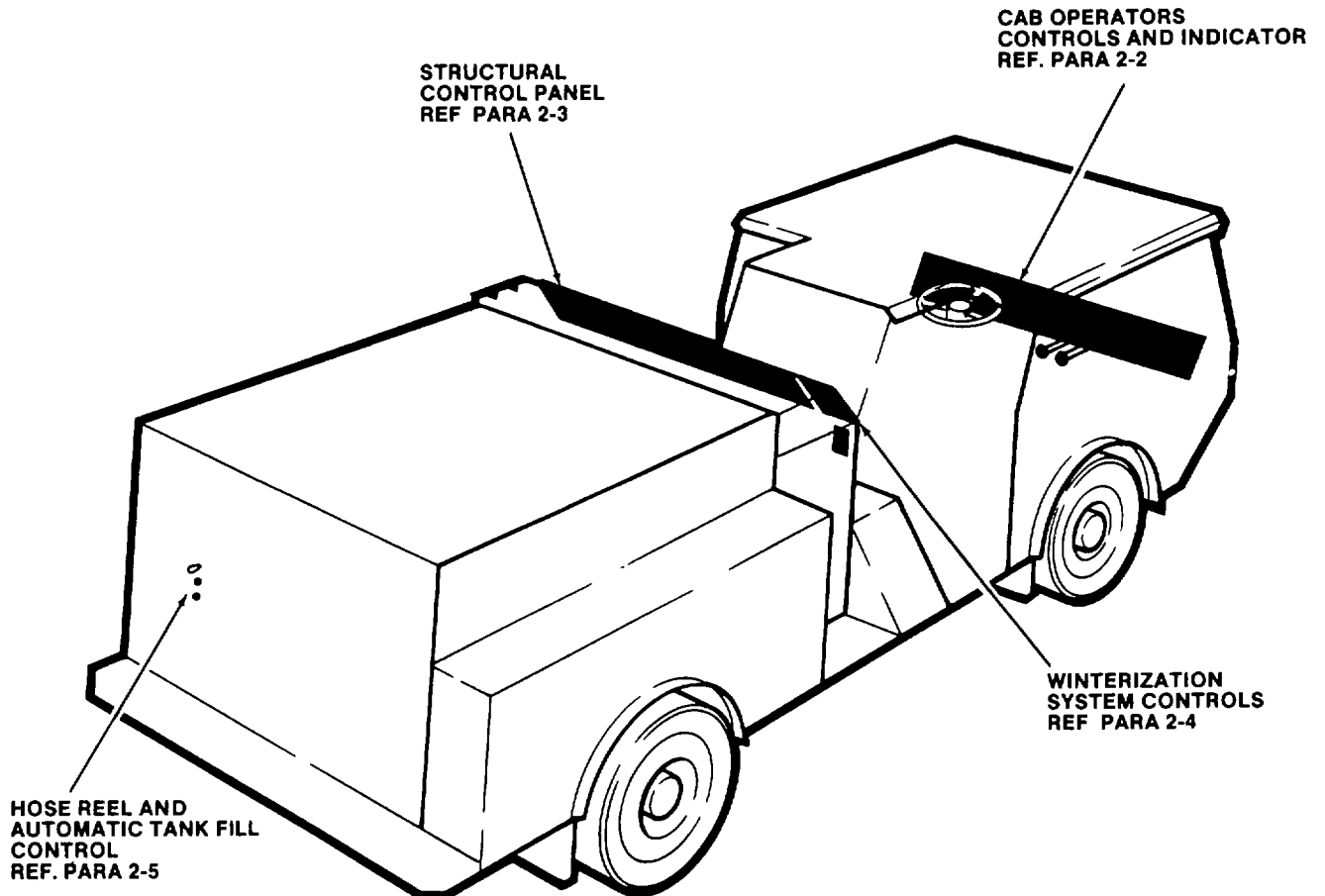
Figure 1-43. Winterization Heater and APU Fuel and Exhaust System.

CHAPTER 2.

OPERATING INSTRUCTIONS.

Section I. DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS.

2-1. **CONTROLS AND INDICATORS OVERVIEW.** Controls and indicators for operation of the truck and for firefighting are located on the truck as shown below.



2-2. CAB OPERATOR CONTROLS AND INDICATORS

SPOT LIGHT CONTROL HANDLE
 - Permits 360 deg horizontal and 120 deg vertical rotation

DEFROSTER FAN CONTROL
 Ref para 2-2 e

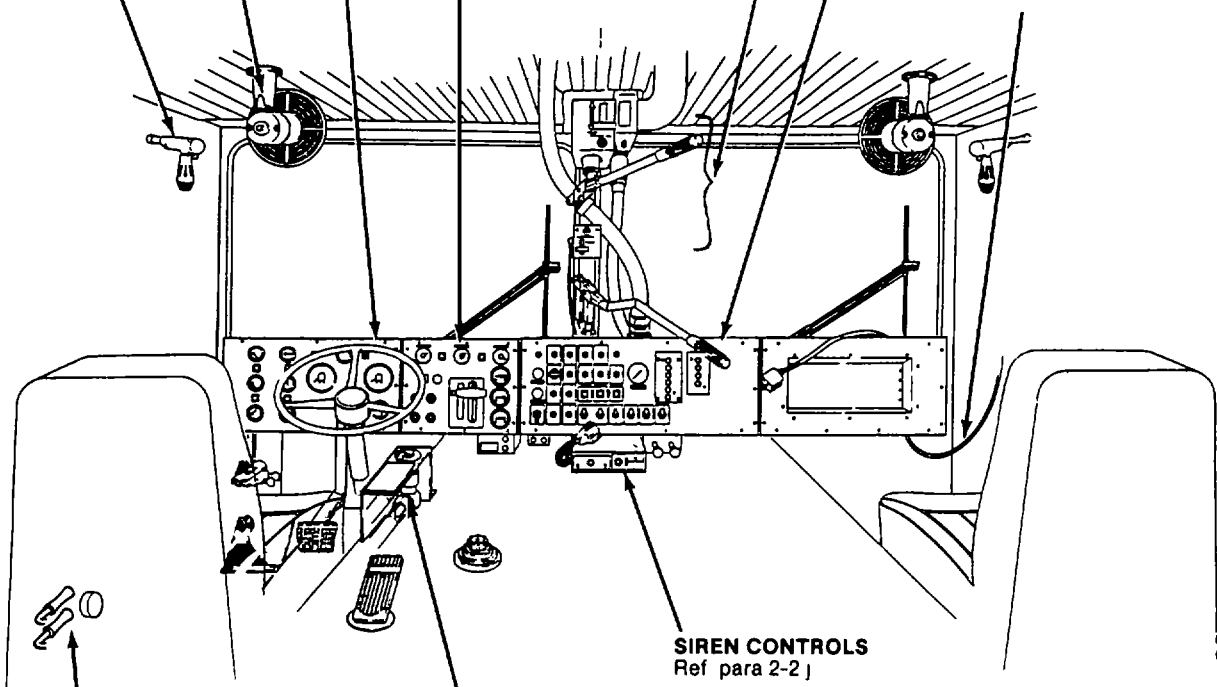
DRIVER PANEL
 Ref para 2-2 a and 2b

AIR PANEL
 Ref para 2-2 c and 2-2 d

TURRET DISCHARGE PANEL
 Ref para 2-2 k

ELECTRICAL PANEL
 - Driving Controls
 Ref para 2-2 e and 2 f
 - CFR Controls
 Ref para 2-2 g and 2 h

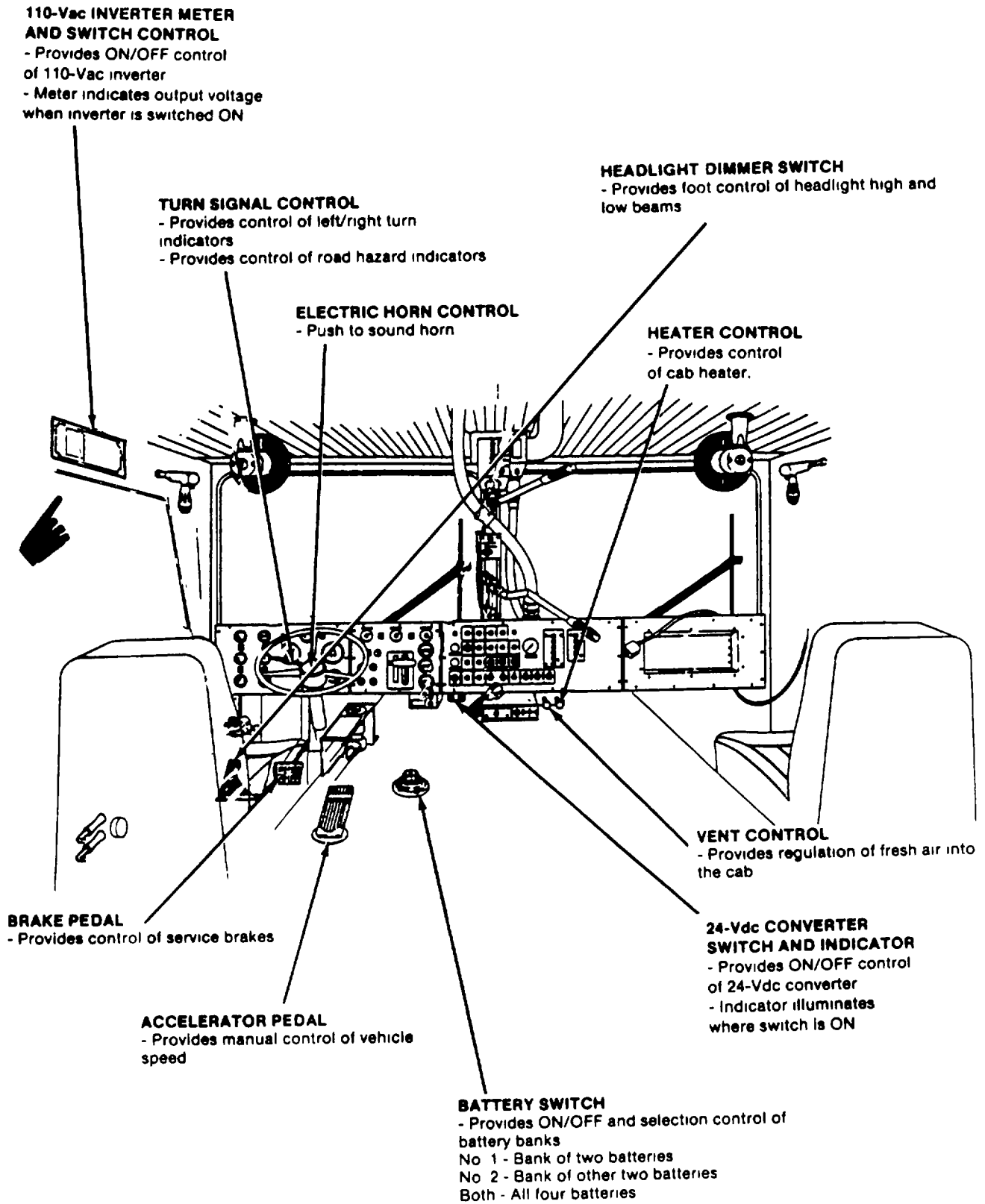
AIR HORN CONTROL CABLE
 - Pull to sound horn



SEAT ADJUSTMENT CONTROLS
 Ref para 2-2 i

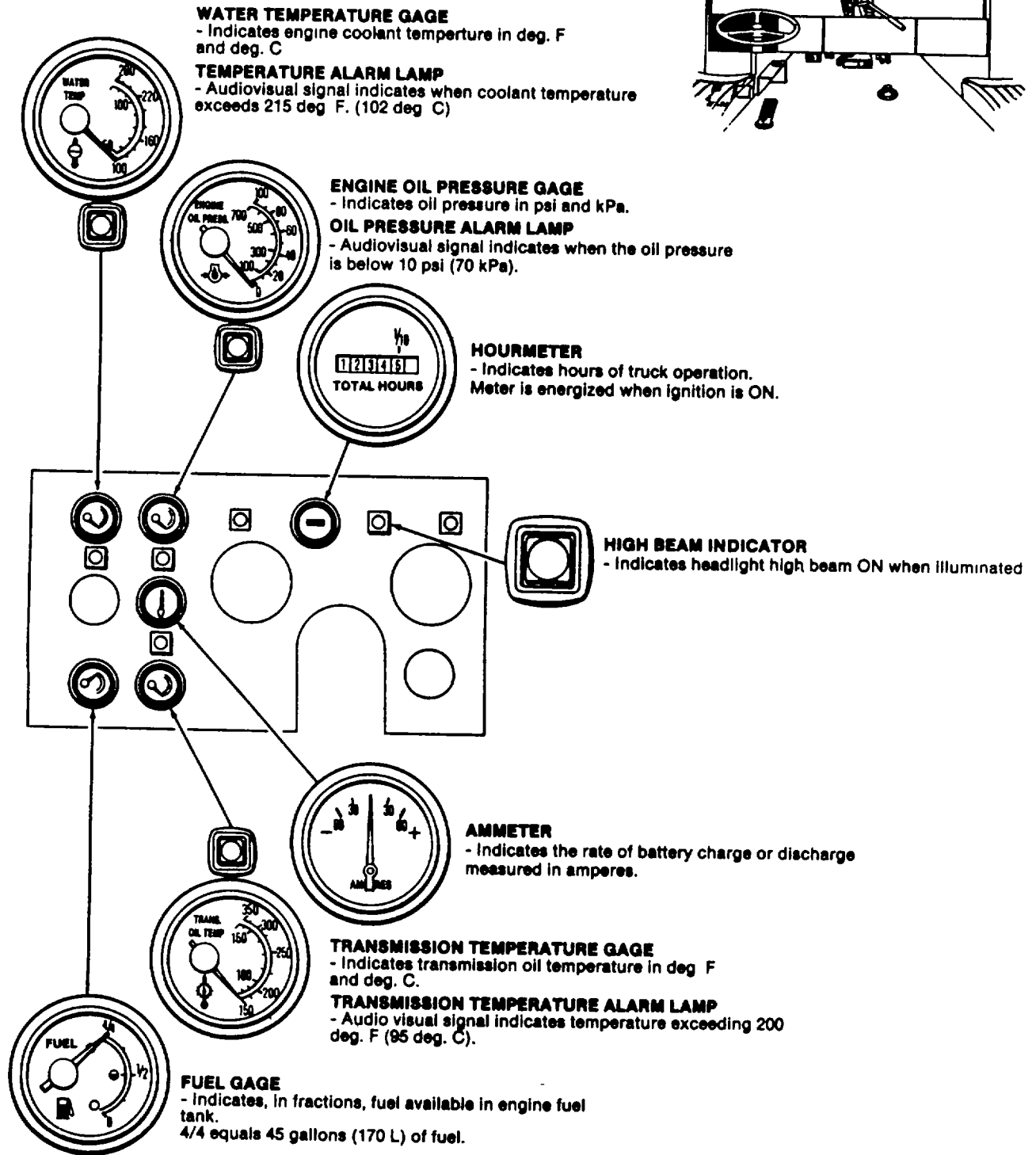
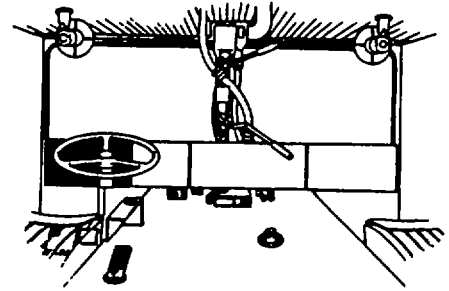
CFR - FOAM PROPORTIONING VALVE
 - Provides manual control of foam metering
 - One to nine percent foam mix in water

2-2. CAB OPERATOR CONTROLS AND INDICATORS. - Continued



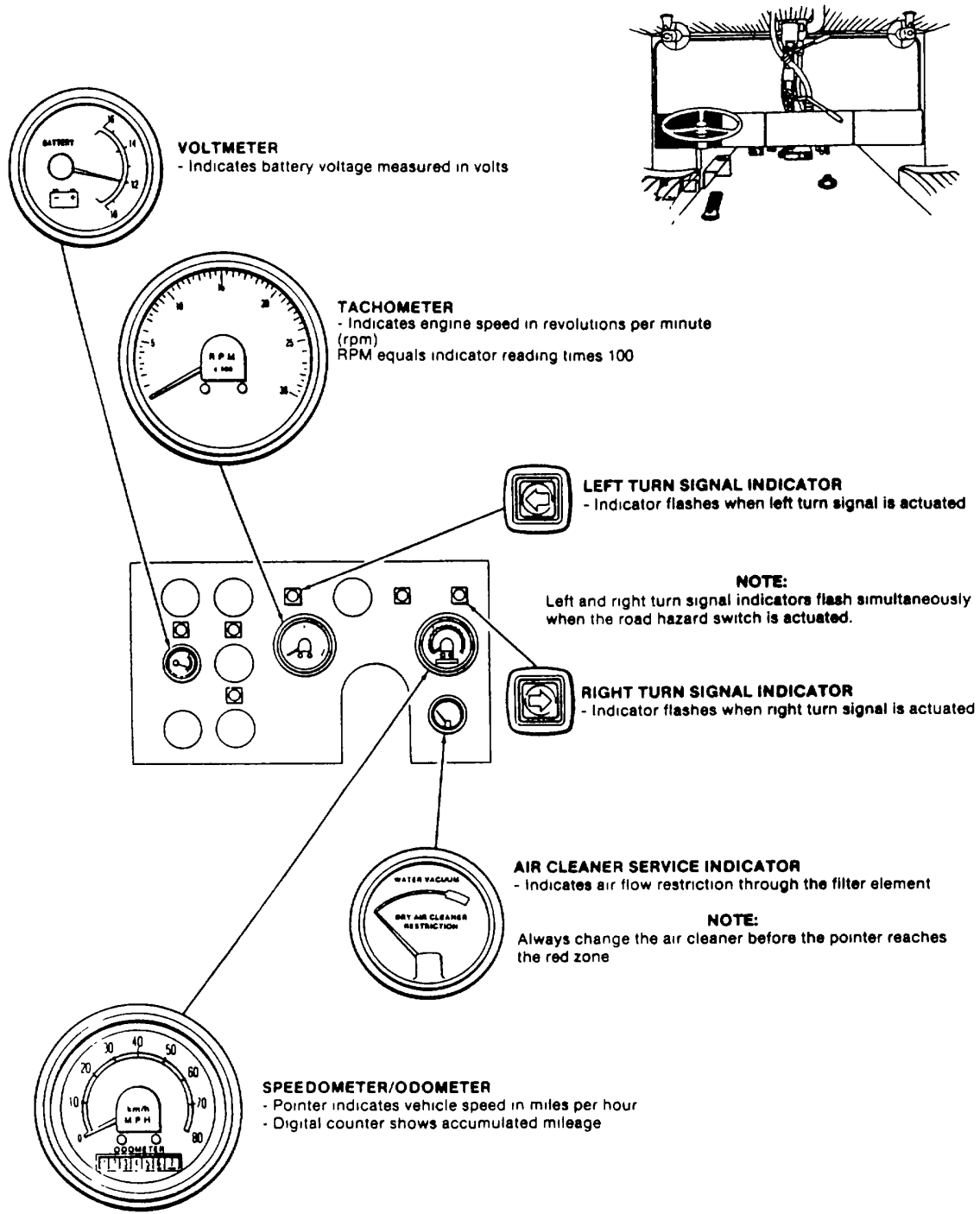
2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

a. Driver Panel - Engine and Transmission Gages



2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

b. Driver Panel - Engine Gages

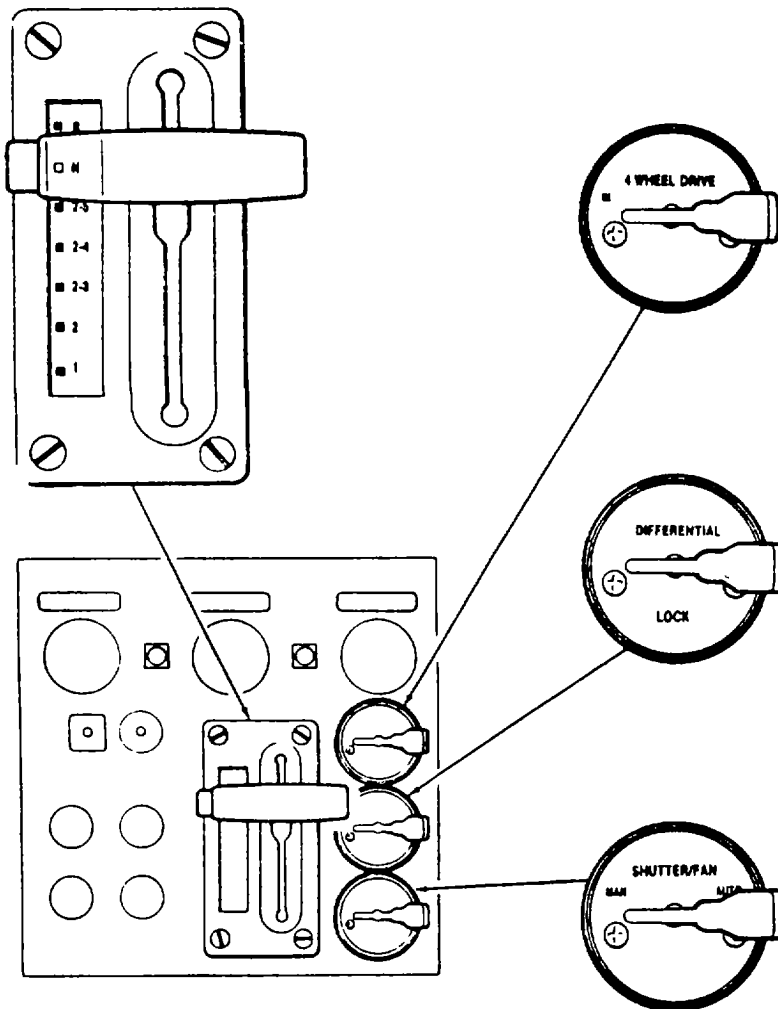
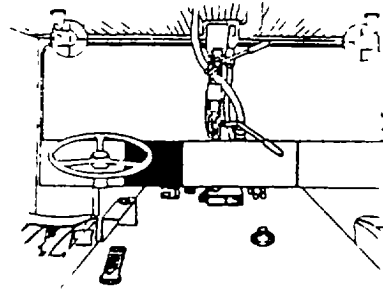


2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

c. Air Panel - Driving Controls

TRANSMISSION SHIFT CONTROL

- R (Reverse) Used when backing up the vehicle
- N (Neutral) Select when parking the vehicle
Must be selected prior to start up and before selecting pump drive ON in CFR mode when vehicle is stopped
- 2-5 Gear Range Select for normal driving
- 2-4 Gear Range Select for normal driving at lower speed
- 2-3 Gear Range Select for poor driving conditions
Provides greater engine braking power than 2-4 and 2-5 gear range
- 2ND Gear Select for travel in rough terrain
Use in CFR, pump and roll mode
Maximum attainable speed less than 30 mph (50 km/hr)
- 1ST Gear Select for travel in very rough terrain
May be used in CFR, pump and roll mode
Maximum attainable speed less than 15 mph (25 km/hr)



CAUTION

To prevent damage to drive train components, select 4-wheel drive IN only, when the vehicle is stopped

4-WHEEL DRIVE CONTROL

- Select IN for 4-wheel drive
- Select OUT for rear wheel drive only

CAUTION

To avoid equipment damage, select differential lock IN only when traction on all 4 wheels has stopped

DIFFERENTIAL LOCK

- Select IN to engage differential lock
- Select OUT to disengage differential lock

NOTE

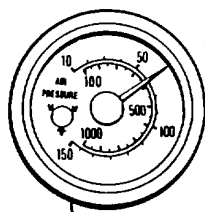
Engage the differential locks only when 4-wheel drive is engaged

SHUTTER/FAN CONTROL

- Select AUTO for automatic fan and shutter operation (automatic engine cooling control)
- Select MAN for manual control (continuously engaged fan and fully opened shutters)

2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

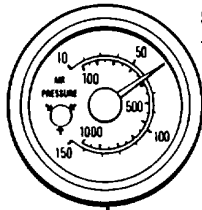
d. Air Panel - Gages and Controls



PRIMARY AIR TANK PRESSURE GAGE
- Indicates tank pressure in psi and kPa



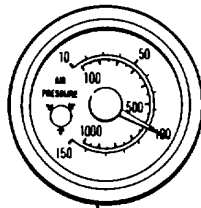
PRIMARY PRESSURE ALARM LAMP
- Audiovisual signal indicates when pressure drops below 60 psi (410 kPa)



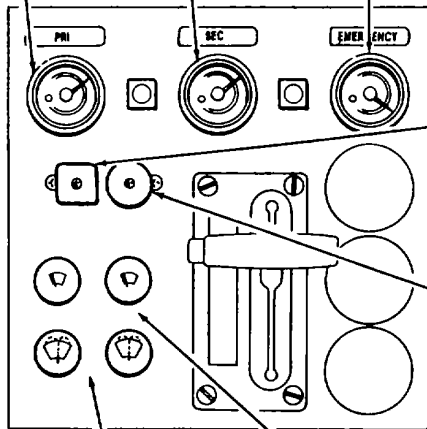
SECONDARY AIR TANK PRESSURE GAGE
- Indicates tank pressure in psi and kPa



SECONDARY PRESSURE ALARM LAMP
- Audiovisual signal indicates when pressure drops below 60 psi (410 kPa)



EMERGENCY AIR TANK PRESSURE GAGE
- Indicates tank pressure in psi and kPa



PARKING BRAKE CONTROL
- Pull knob to apply parking brakes
- Push knob to release brakes



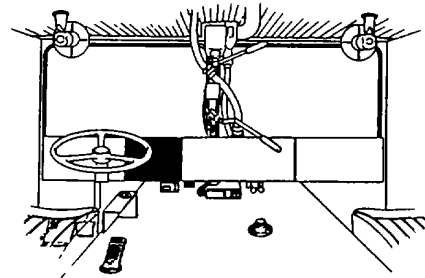
EMERGENCY PARKING BRAKE RELEASE
- Push and hold control knob depressed to release parking brakes



WINDSHIELD WIPER CONTROL - LEFT/RIGHT
- Pull, to switch wiper ON Push, to switch OFF
- Turn knob to select HIGH or LOW speed

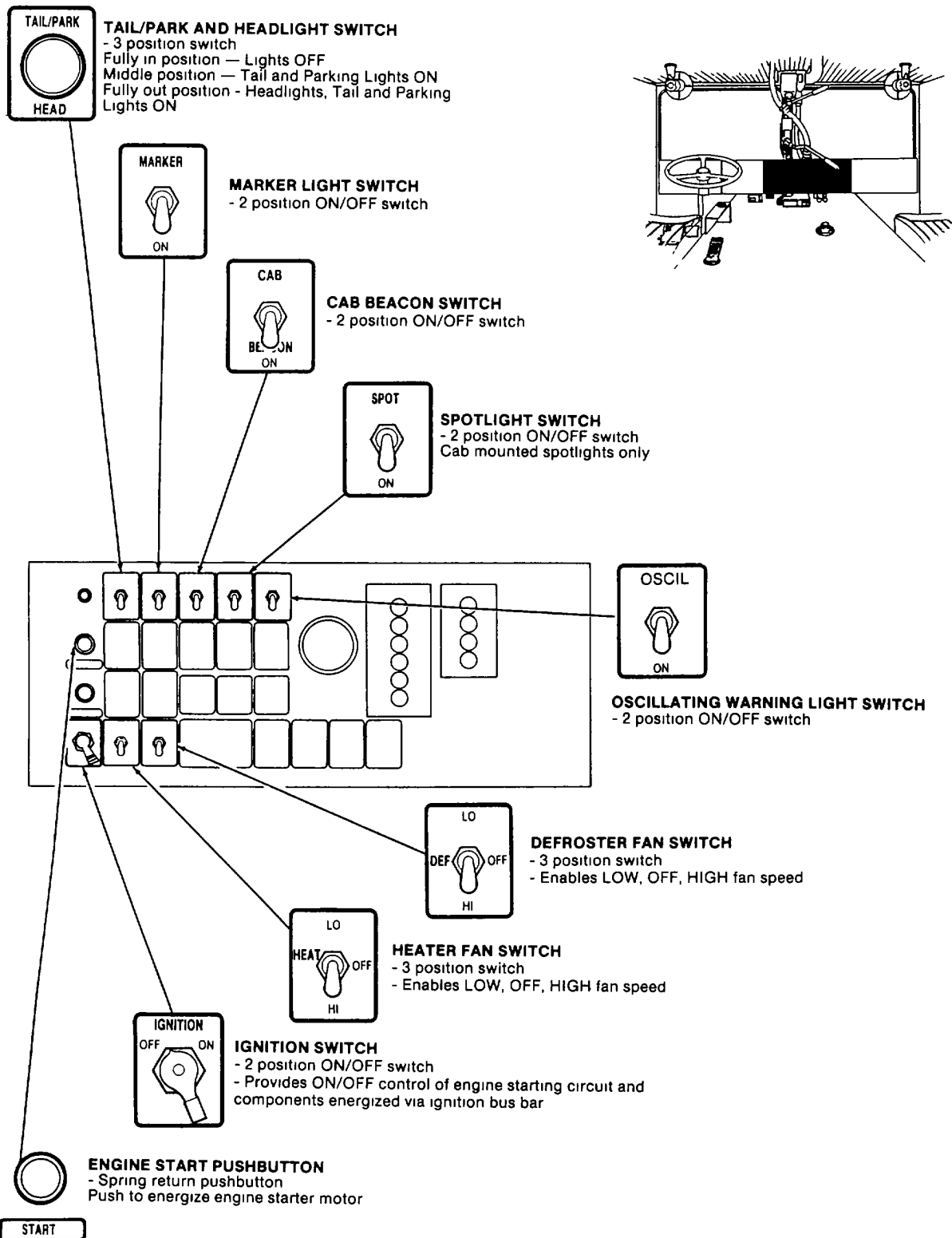


WINDSHIELD WASHER CONTROL - LEFT/RIGHT
- Push knob to energize washer pump
The pump stops when the knob is released



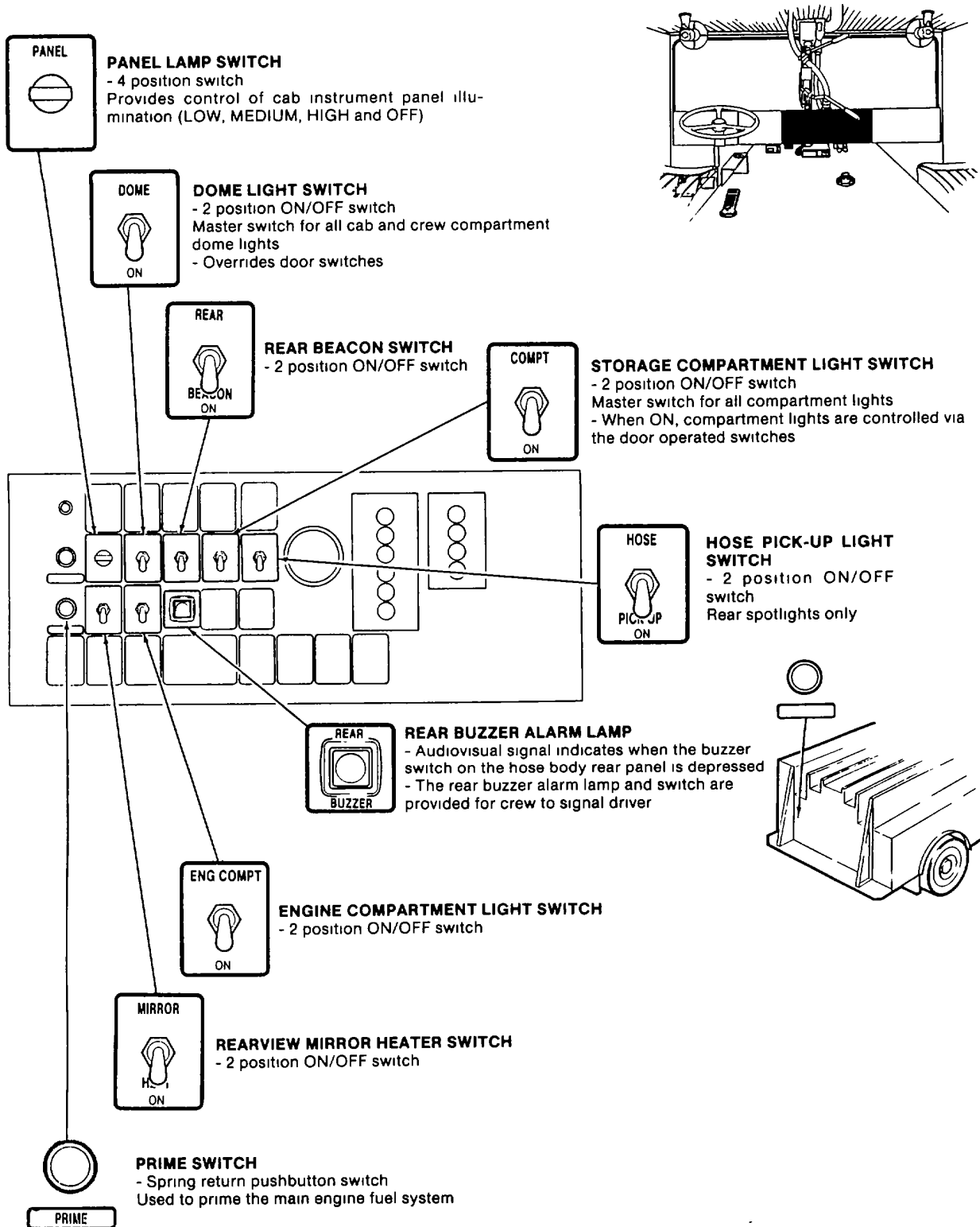
2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

e. Electrical Panel - Ignition and Light Switches



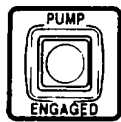
2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

f. Electrical Panel - Accessories Switches

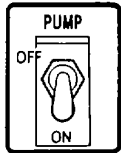


2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

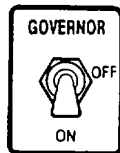
g. Electrical Panel - Firefighting Switches



PUMP ENGAGED INDICATOR
- Indicator flashes when the pump is engaged



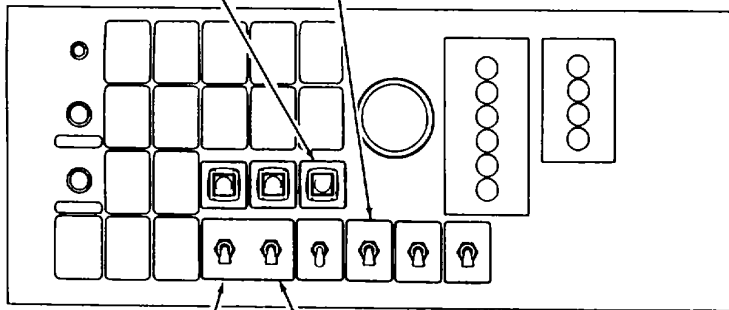
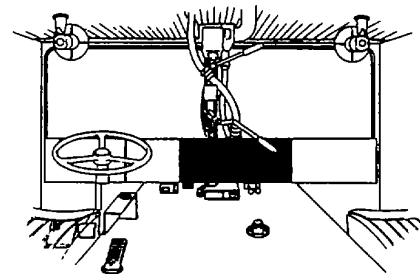
PUMP SWITCH
- 2 position ON/OFF switch
Provides control of pump drive PTO



ENGINE GOVERNOR SWITCH
- 2 position ON/OFF switch
Provides control of the automatic engine governor

NOTE

When a valve air switch is set to **EM** the switch is **OFF**. The valve is left in the last actuated state, i.e., open or closed, and the valve actuator is relieved of all pressure.



NOTE

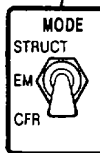
The **CFR** mode, the **TANK**, the **PUMP**, and the **GOVERNOR** switches should be selected **ON** or **OPEN** in this order to ensure a smooth start up of the firefighting system. Disengage the system in reverse order.



TANK VALVE OPEN INDICATOR
- Indicator flashes when the valve is opened in CFR mode
- No indication in structural mode



WATER TANK VALVE SWITCH
- 3 position air switch
Select **OPEN/CLOSE** to open or close the tank valve



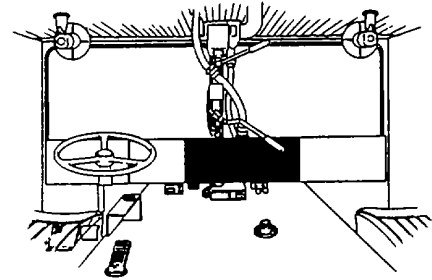
FIREFIGHTING MODE SELECTOR SWITCH
- 3 position air switch
Select **STRUCT** to activate the system in structural mode
Select **CFR** to activate the system in CFR mode
In **EM** position both structural and CFR firefighting modes are deactivated

NOTE

CFR must be selected to enable automatic engine governor and water tank operation in CFR mode. **Structural must be selected** to enable control of the firefighting system from the structural control panel.

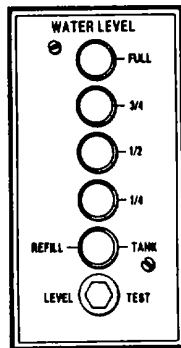
2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

h. Electrical Panel - Firefighting Gages and Switches

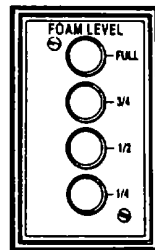


PUMP PRESSURE GAGE
 - Indicates the water pump pressure in psi and kPa
 Pressure is measured close to the discharge turrets

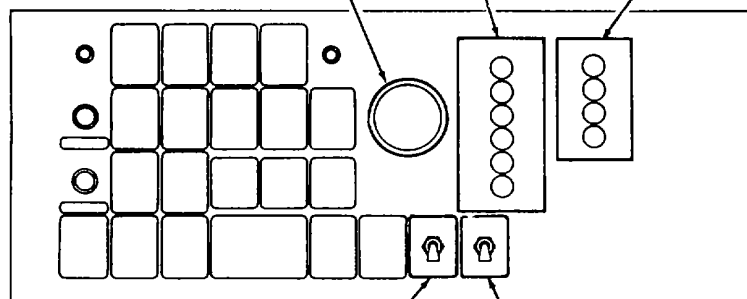
PUMP PRESS



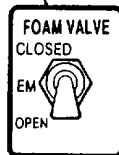
WATER LEVEL GAGE
 - Illuminated lamps indicate water available in the tank
 - Indications are in fractions of full tank level (660 gallons (2500 L))
 - Refill indicator flashes when the water drops below the 1/4 tank level
 - Level test pushbutton permits tank level checks when the ignition is off



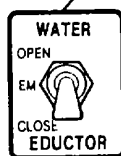
FOAM LEVEL GAGE
 - Illuminated lamps indicate foam agent available in the tank
 - Indications are in fractions of full tank level (72 gallons (275 L))



NOTE:
 When a valve air switch is set to EM the switch is off
 The valve is left in the last actuated state, i.e., open or closed, and the valve actuator is relieved of all pressure



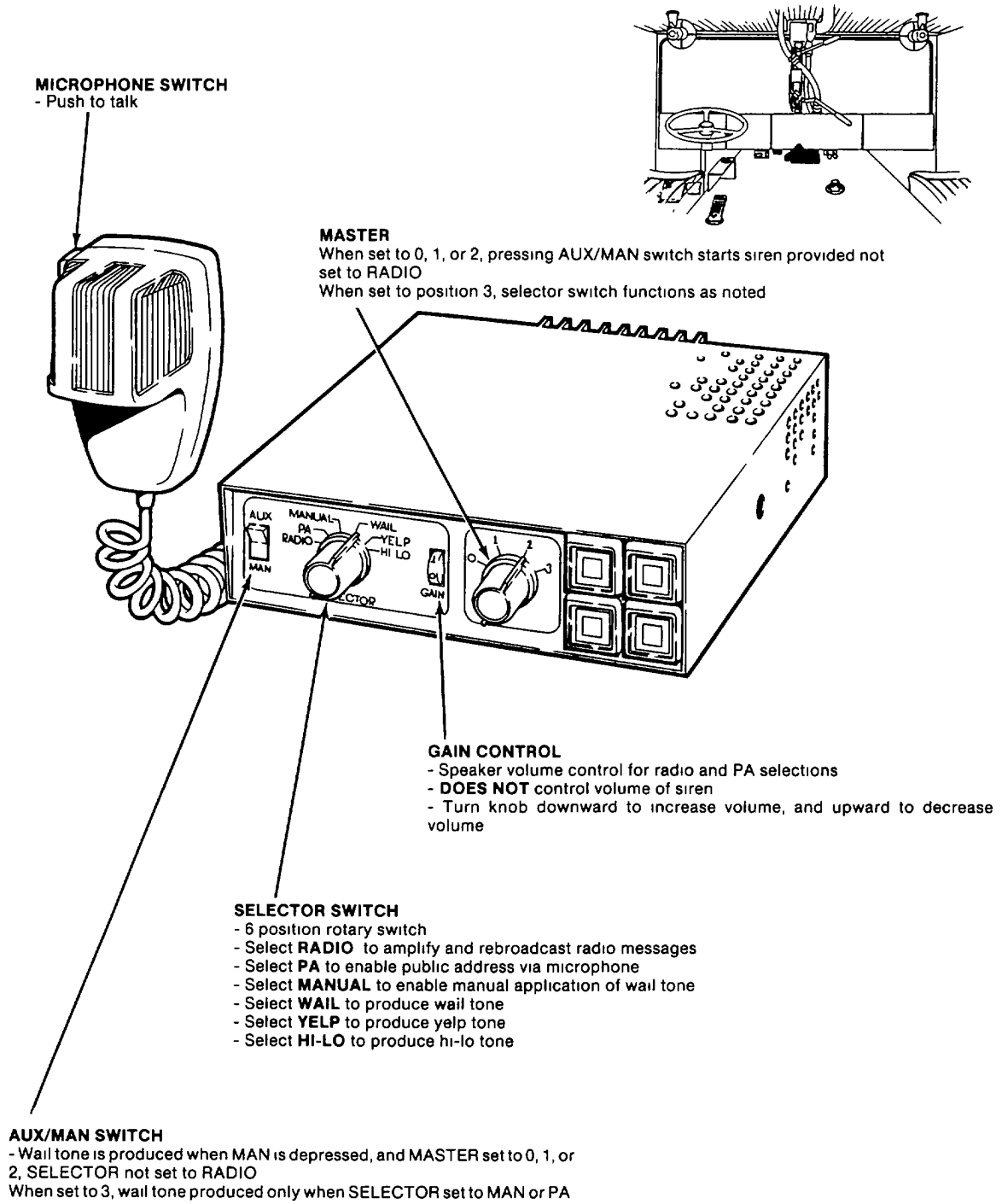
WATER EDUCTOR VALVE SWITCH
 - 3 position air switch
 Select **OPEN** when foam is required
 Select **CLOSE** when water only is required



FOAM VALVE SWITCH
 - 3 position air switch
 Select **OPEN/CLOSE** to open or close the tank valve

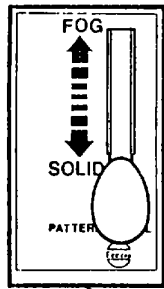
2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

j. Siren



2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

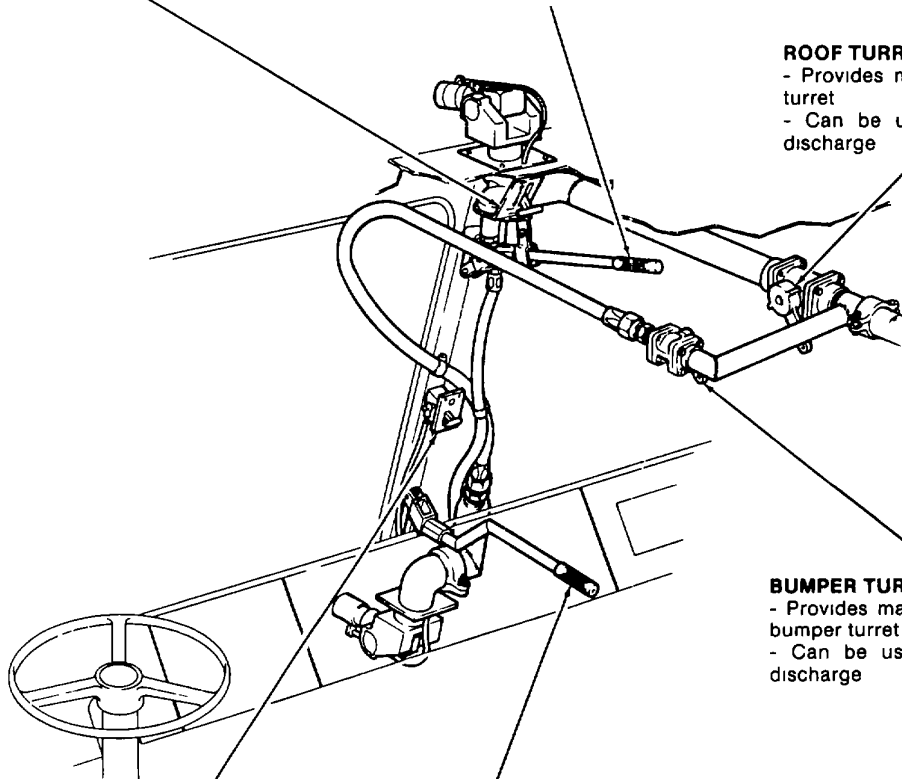
k. Turret Discharge Controls



ROOF TURRET SPRAY PATTERN CONTROL
 - Enables control of spray pattern from fog to solid stream
 - Spray pattern can be changed during discharge

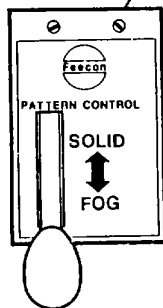
ROOF TURRET ELEVATION AND SWEEP CONTROL
 - Enables aim of roof turret toward fire zone
 Maximum sweep angle 120 deg Left/right from center
 Maximum elevation 60 deg up, 15 deg down from center

ROOF TURRET VALVE
 - Provides manual control of flow to roof turret
 - Can be used to regulate flow during discharge



BUMPER TURRET VALVE
 - Provides manual control of flow through bumper turret
 - Can be used to regulate flow during discharge

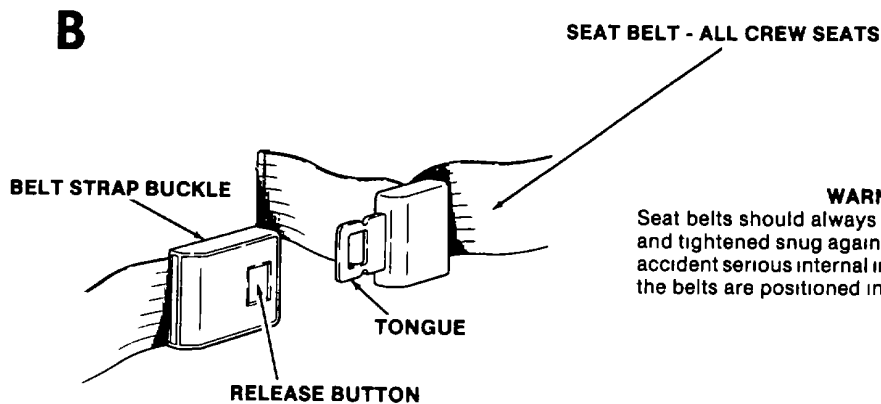
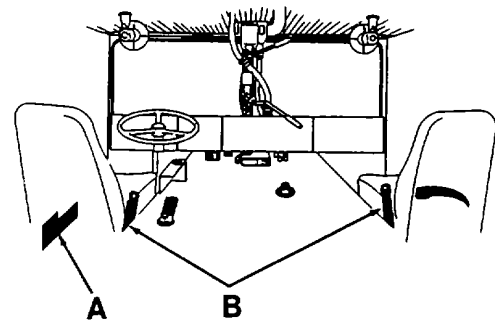
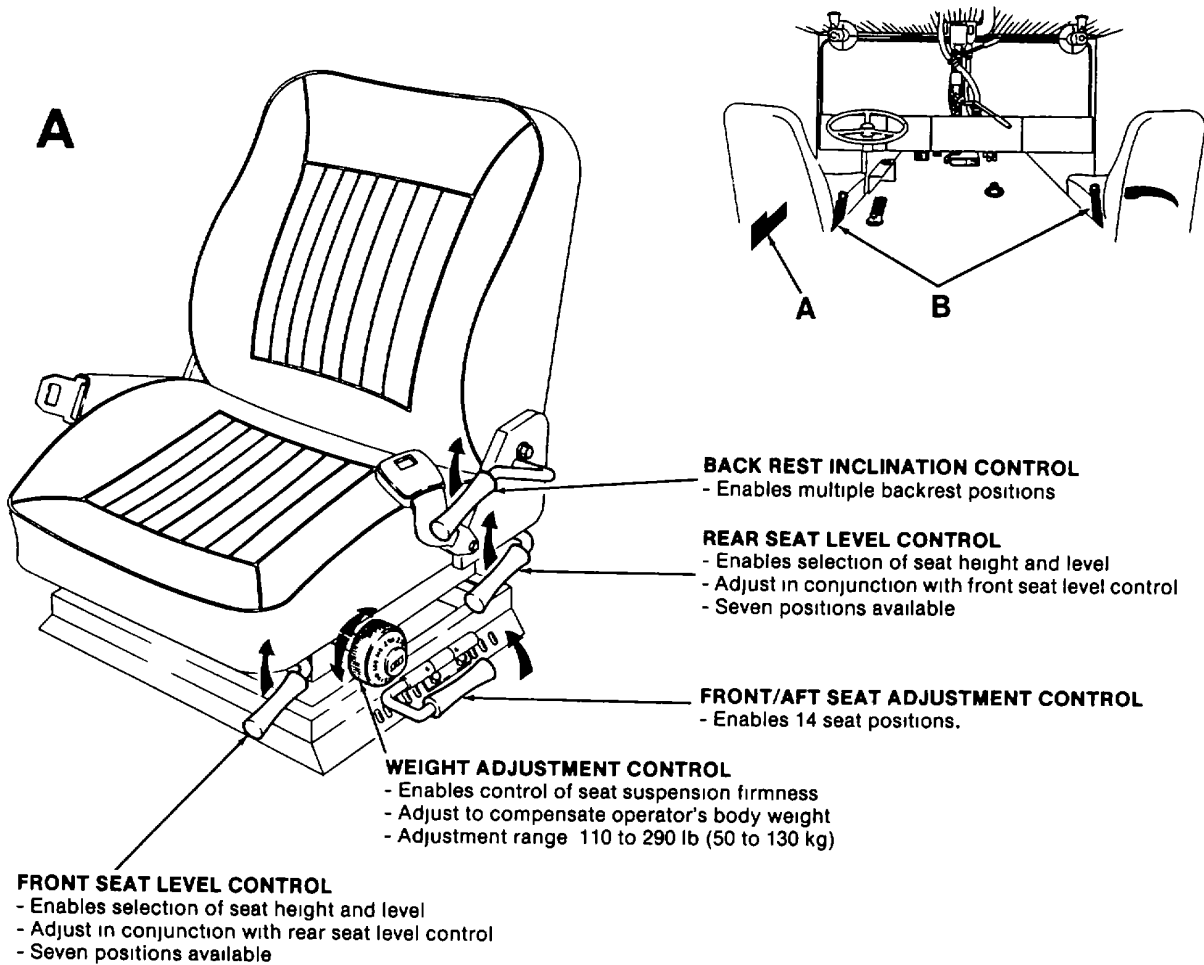
BUMPER TURRET ELEVATION AND SWEEP CONTROL
 - Enables aim of bumper turret toward fire zone
 Maximum sweep angle 80 deg left/right from center
 Maximum elevation 45 deg up, 15 deg down from center



BUMPER TURRET SPRAY PATTERN CONTROL
 - Enables control of spray pattern from cone shaped fog to solid stream
 - Spray pattern can be changed during discharge

2-2. CAB OPERATOR CONTROLS AND INDICATORS - Continued

I. Seat and Seat Belts

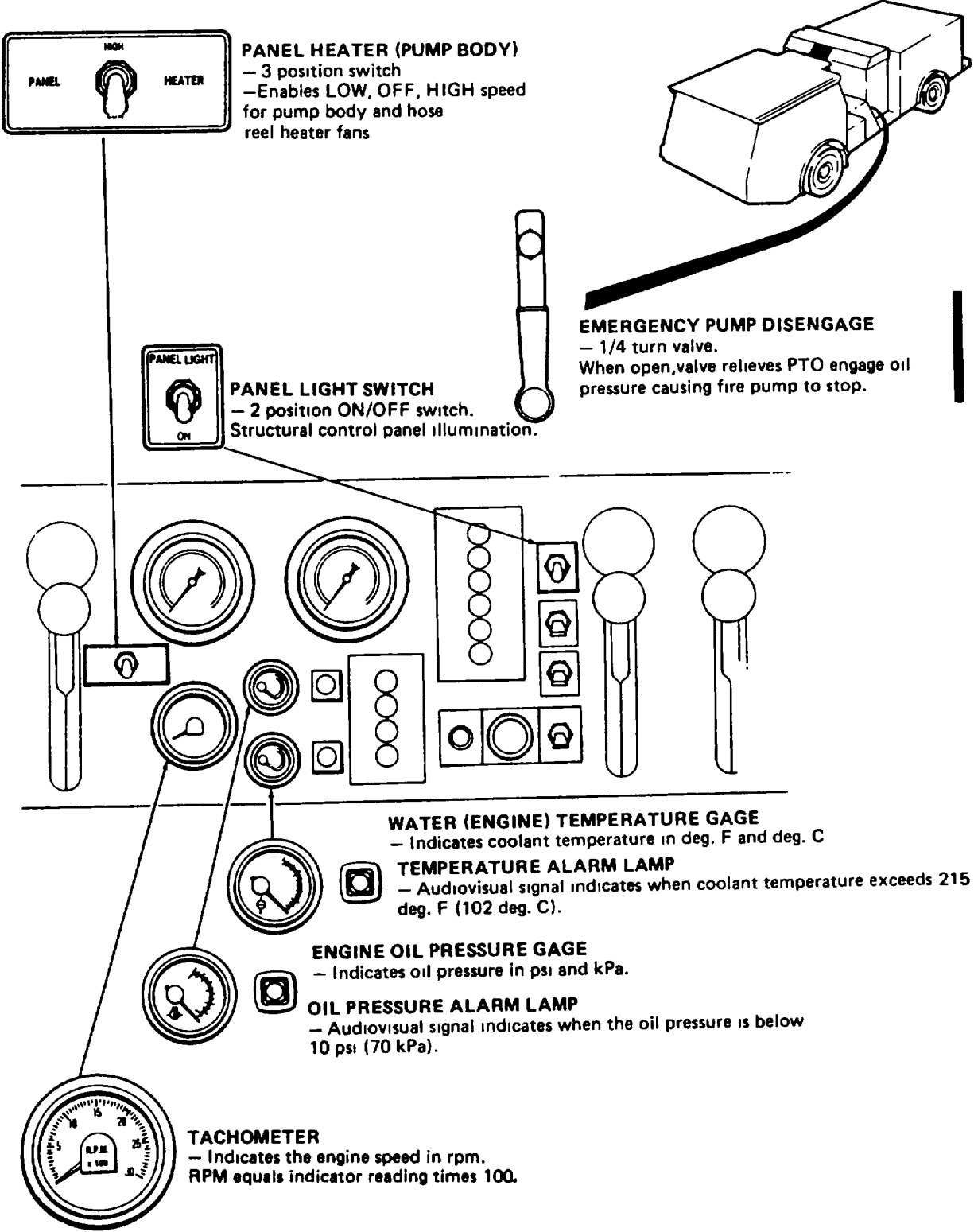


WARNING
Seat belts should always be worn around the hips and tightened snug against the body. In case of an accident serious internal injuries can be sustained if the belts are positioned incorrectly.

When using the belts, make sure the buckle and tongue locks together
Adjust the belts by moving the tongue part to the desired position on the belt strap
Release the belts by depressing the release button on the buckle

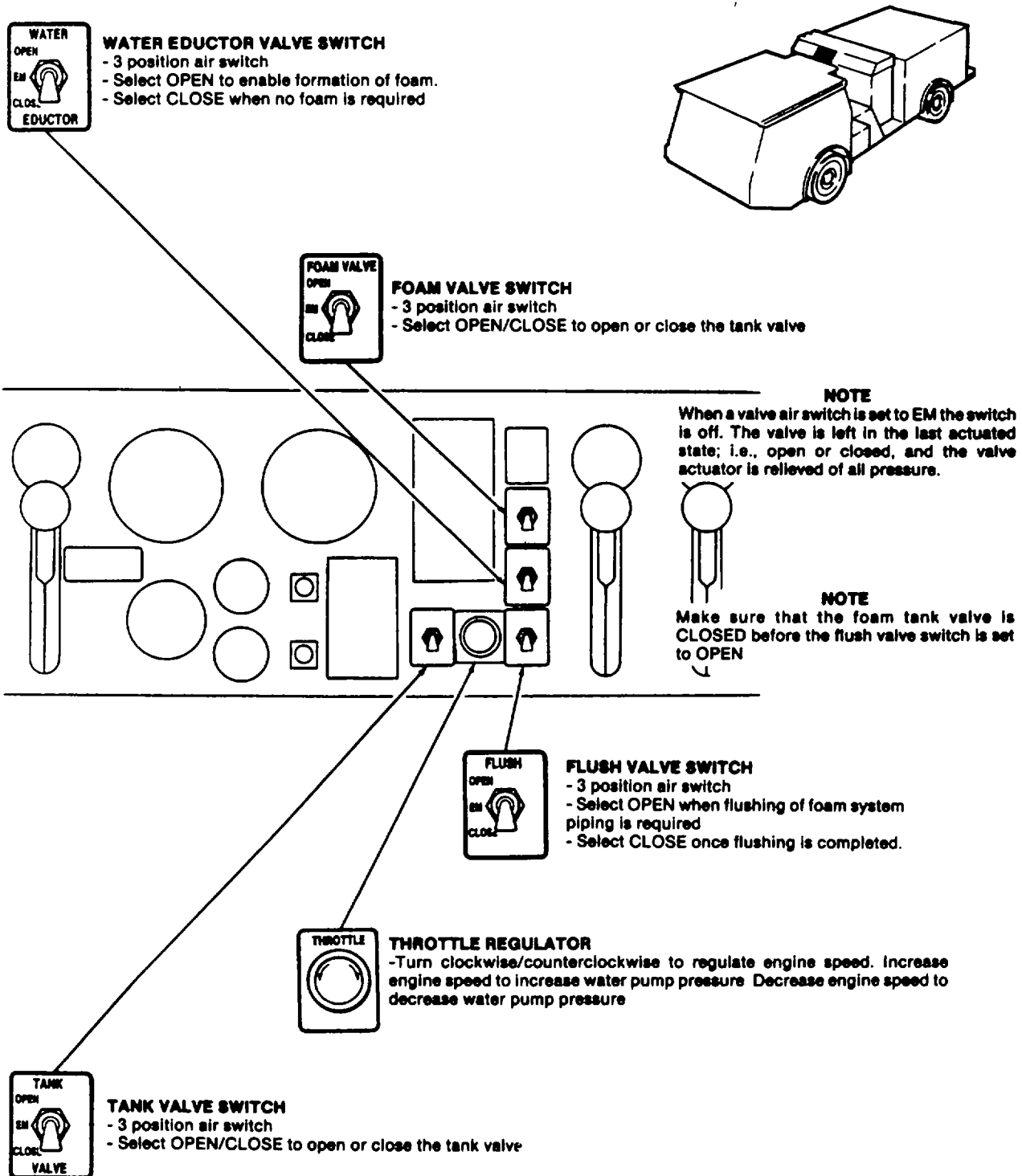
2-3 STRUCTURAL CONTROL PANEL

a. Engine and Pump Body Heater Controls



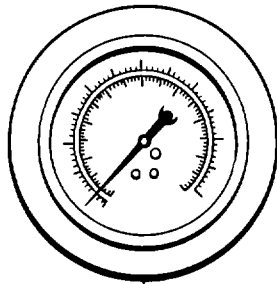
2-3. STRUCTURAL CONTROL PANEL - Continued

b. Water and Foam Controls

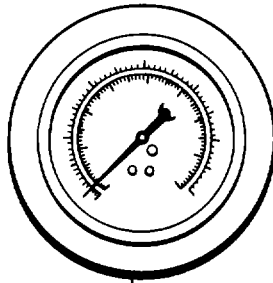
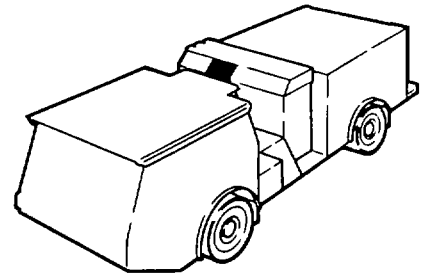


2-3. STRUCTURAL CONTROL PANEL - Continued

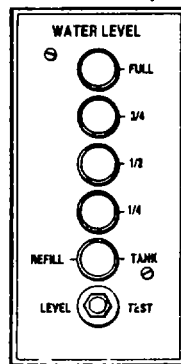
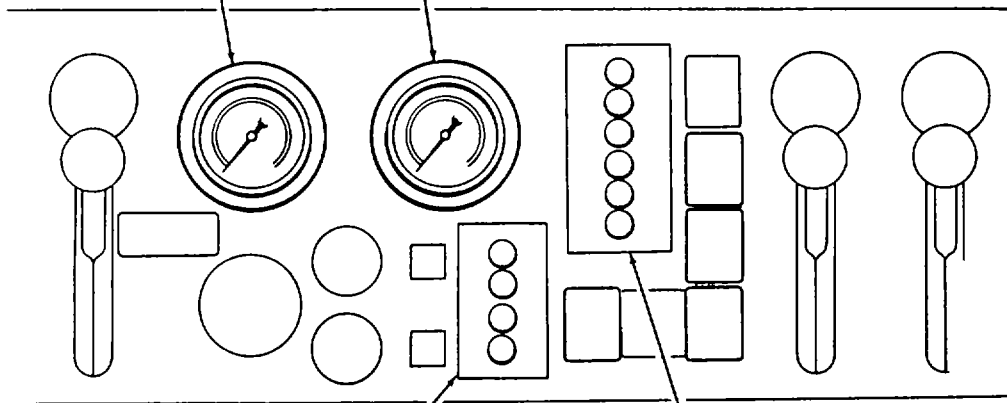
c. Water and Foam Gages



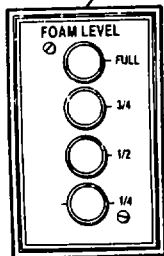
SUCTION PRESSURE GAGE
 - Indicates the water pump suction pressure in in Hg /psi and kPa
 Pressure is measured in the suction manifold near the pump inlet



DISCHARGE PRESSURE GAGE
 - Indicates the water pump discharge pressure in psi and kPa
 Pressure is measured in the discharge manifold close to the pump discharge



WATER LEVEL GAGE
 - Illuminated lamps indicate water available in the tank
 - Indications are in fractions of full tank level (660 gallons (2500 L))
 - Refill indicator flashes when the water drops below the 1/4 tank level
 - Level test pushbutton permits level checks when ignition is OFF



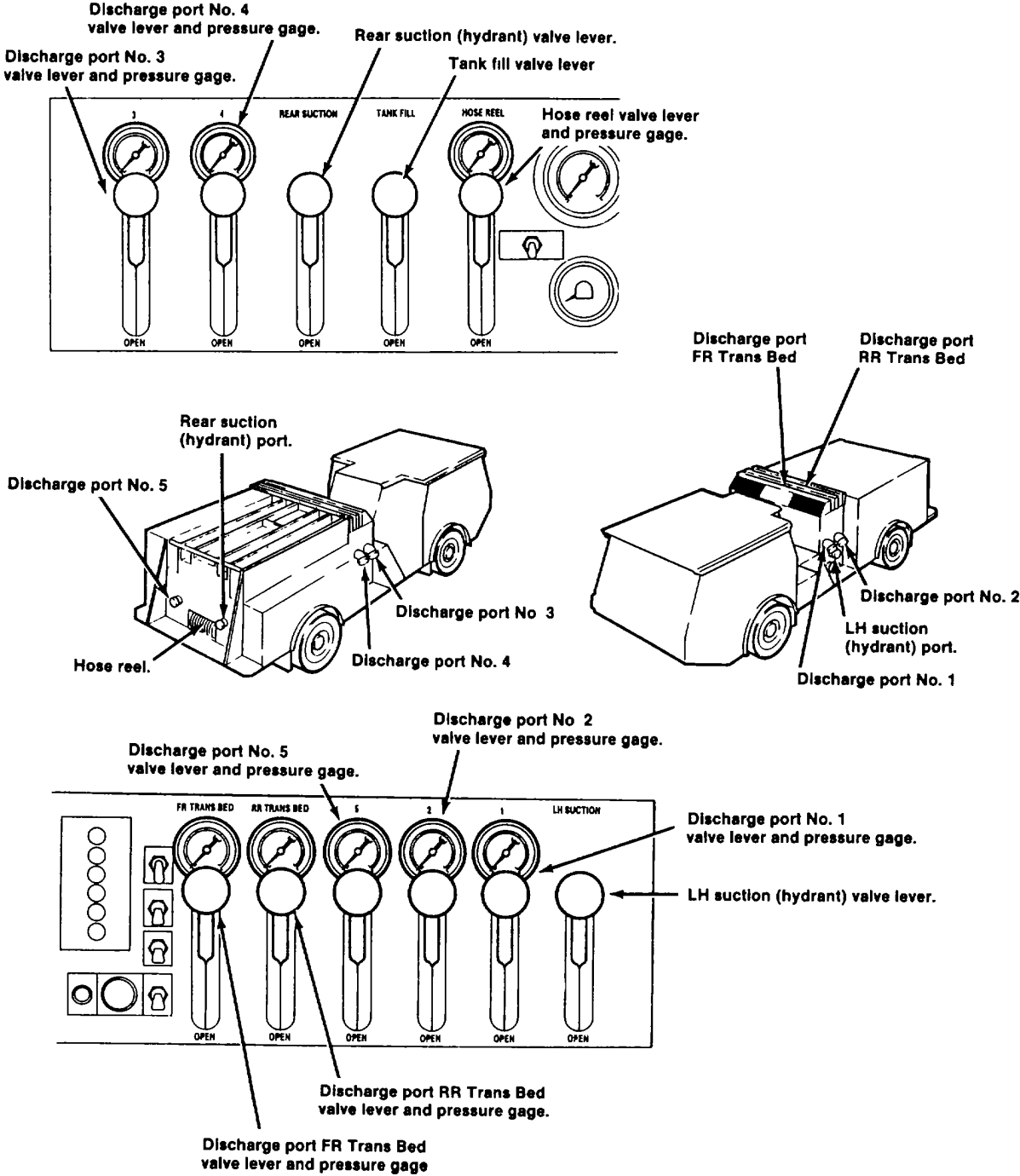
FOAM LEVEL GAGE
 - Illuminated lamps indicate foam agent available in the tank
 - Indications are in fractions of full tank level (72 gallons (275 L))

2-3. STRUCTURAL CONTROL PANEL - Continued

d. Draft and Discharge Control Valves

NOTE

All discharge valve levers can be regulated between fully open and fully closed. The pressure gage above each valve lever indicates the discharge port pressure psi and kPa. The tank fill and the suction (hydrant) valves are normally operated either fully closed or fully open.

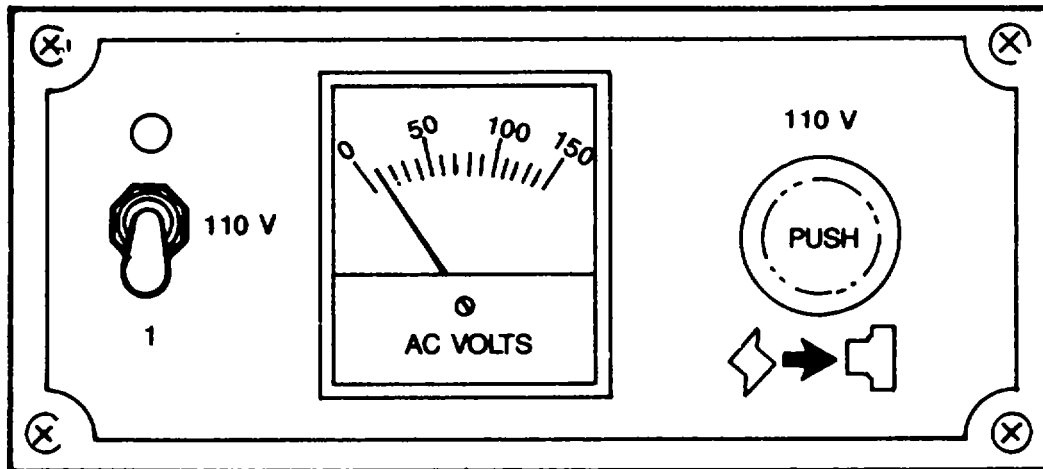
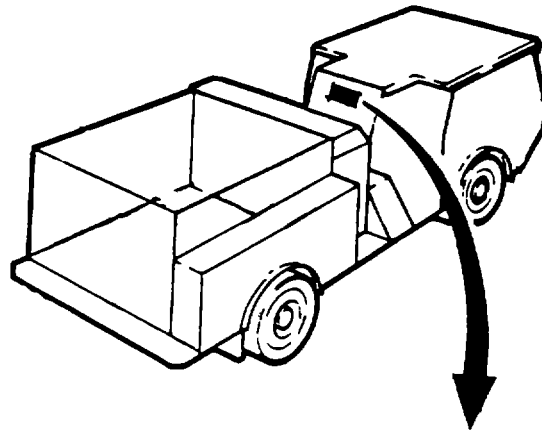


Each of discharge ports No. 1 thru No. 4 are fitted with manual drain valves. Valve handles are mounted beneath each port.

2-3. STRUCTURAL CONTROL PANEL. - Continued

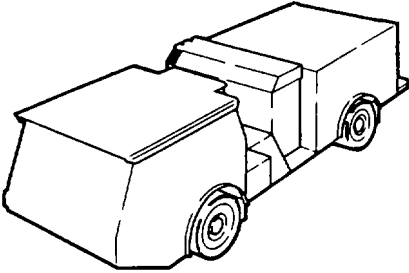
e. 110V Alternator Meter and Switch Control

- (1) Provides ON/OFF control for 110V alternator.
- (2) Meter indicates output voltage when alternator is switched ON.



Change 6 2-18.1/(2-18.2 Blank)

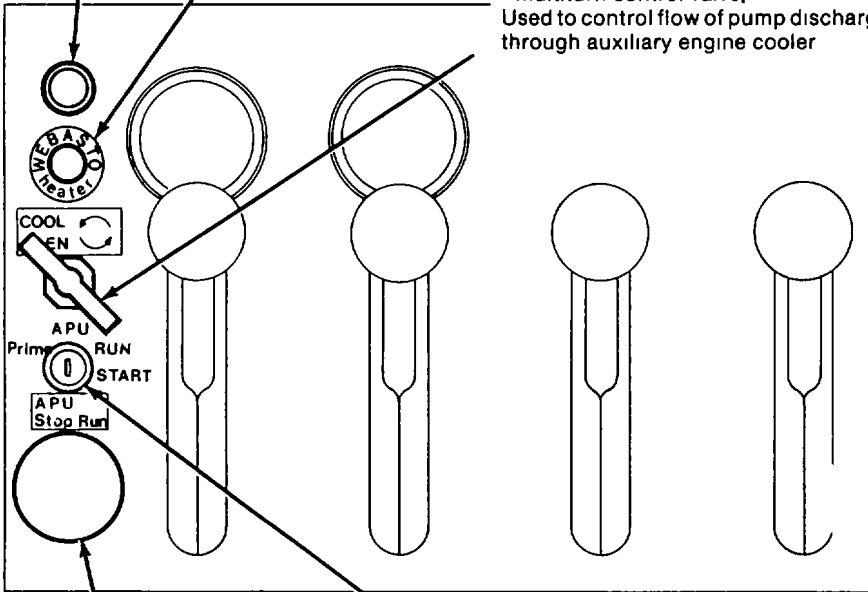
2-4 WINTERIZATION SYSTEM CONTROLS



WINTERIZATION HEATER INDICATOR
- Illuminates when the heater is switched ON

WINTERIZATION HEATER SWITCH
- 2 position ON/OFF switch pull to switch ON - push to switch OFF
Heater ignition and operation is automatically controlled when switch is ON

AUXILIARY ENGINE COOLER CONTROL VALVE
- multiturn control valve,
Used to control flow of pump discharge water through auxiliary engine cooler

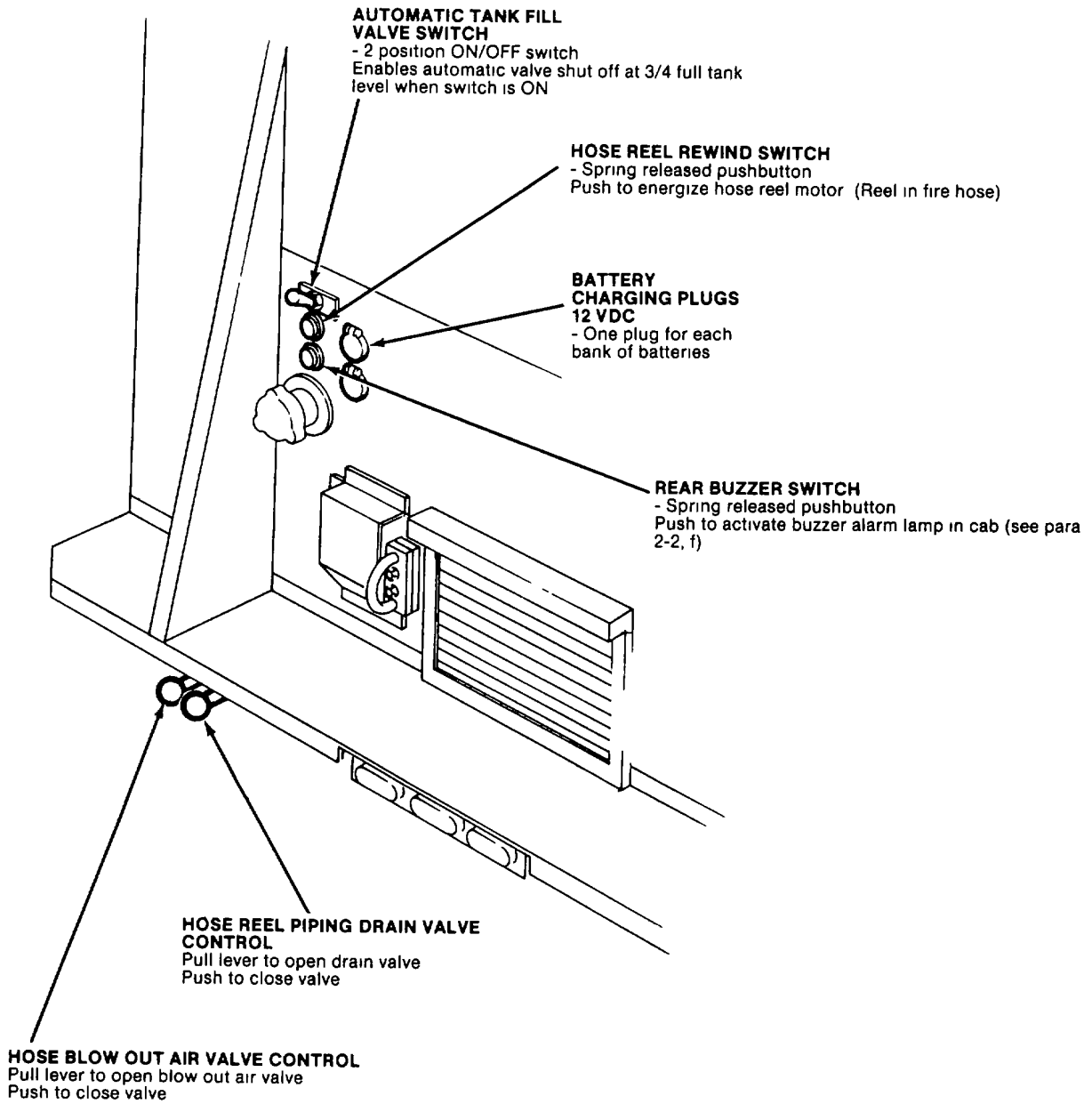


APU STOP CONTROL
- Pull knob out to stop engine

APU OPERATION SWITCH
- 4 position key switch
Vertical position - switch OFF

PRIME - Fuel pump energized to prime fuel system
RUN - Fuel pump and run position
START - APU starter motor energized when key is held in this position
Switch automatically returns to RUN position when key is released

2-5 HOSE REEL AND TANK REAR FILL VALVE



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

2-6. GENERAL.

Operator's Preventive Maintenance Checks and Services (PMCS) are required inspections and care of your fire truck necessary to keep it in good working order. All instructions and intervals are mandatory.

- a. Before you operate equipment. Always keep in mind the CAUTIONS and WARNINGS. Perform your Before (B) PMCS prior to the equipment's leaving its containment area or performing its intended mission.
- b. While you operate equipment. Always keep in mind the CAUTIONS and WARNINGS. Perform your During (D) PMCS when the equipment is being used in its intended mission.
- c. After you operate equipment. Be sure to perform your After (A) PMCS after the equipment has been taken out of its mission mode or returned to its containment area.

2-7. OPERATOR PMCS PROCEDURES.

- a. The purpose of the PMCS table is to indicate the order in which checks are to be done, as well as to indicate when they are to be done.
- b. Routine checks like equipment inventory, cleaning, dusting, washing, stowing items not in use, and checking for loose nuts and bolts are not listed in the PMCS table. They are things you should do anytime you see they must be done if you find a routine check like one of these listed in the PMCS table, it is listed because it is either a very critical component or other operators reported problems with this item.
- c. The first column of the PMCS table provides the item number (order) accomplishments of checks and services.
- d. The interval column of the PMCS table tells you when to do a certain check or service using the following coding:
 - A: After Mission: Checks and services to be carried out after a mission. These services ready the fire truck for the next emergency.
 - D: Daily Checks: These checks are carried out once per day. If you are the first operator to check that truck that day, do your daily checks at the beginning of the shift so you know the fire truck is ready to respond to an emergency
 - W: Weekly Checks: These checks are carried out once a week. You should perform W/PMCS as well as D/PMCS if:
 - (1) You are the assigned operator and these checks have not been carried out for a full week.
 - (2) You are operating the fire truck for the first time.
- e. Explanation of ITEM TO BE INSPECTED/Procedure column. The ITEM TO BE INSPECTED/Procedure column of the PMCS table tells you what item to inspect and tells you how to do the required checks and services. Carefully follow these instructions if you do not have the tools, or if the procedure tells you to, have Unit Maintenance do the work.
- f. Explanation of Equipment is Not Ready/Available If: column. This column tells you when and why your fire truck cannot be used. If your equipment does not perform as required, refer to Chapter 3 under

Troubleshooting for possible problems. Report any malfunctions on the proper DA Form 2404, or refer to DA PAM 738-750.

NOTE

The terms **ready/available** and **mission capable** refer to the same status. **Equipment is on hand and is able to perform its mission.** (See DA PAM 738-750)

CAUTION

Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

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

Class III leaks should be reported to your supervisor or unit maintenance.

Leakage definitions for operator/crew PMCS shall be classified as follows.

- | | |
|-----------|--|
| 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 enough to cause drops to drip from item being checked/inspected. |
| Class III | Leakage of fluid great enough to form drops that fall from the item being checked/inspected. |

Change 5 2-22

Table 2-1. Operator Preventive Maintenance Checks and Services (PMCS)

A - After Mission

D - Daily Checks

W - Weekly

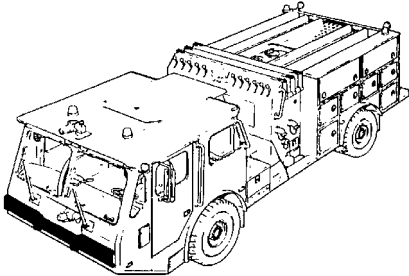
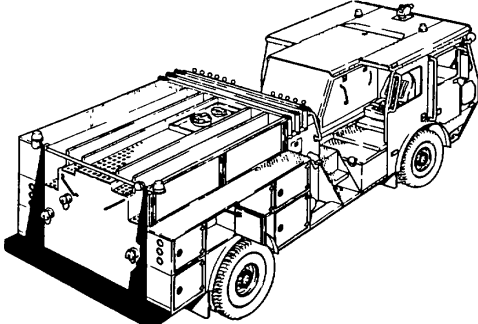
Item No.	Interval			ITEM TO BE INSPECTED/	ProcedureEquipment is not Ready/Available If
	A	D	W		
1	•	•		<p>FRONT BUMPER</p> <p>Be sure bumper is not severely scratched, scored or dented. Clean as required. Be sure all nuts and bolts are tight.</p> <p>Be sure towing eyes are not bent out of shape and welds are secure, look for paint cracks at the weld. Refer to Organizational Maintenance for repair.</p> 	- Attaching hardware totally missing from one end of bumper
2	•	•		<p>REAR STEP</p> <p>Be sure bumper is not severely scratched, scored or dented. Clean as required.</p> <p>Be sure towing eyes are not bent out of shape and welds are secure, look for paint cracks at the weld. Refer to Organizational Maintenance for repair.</p> 	- Attaching hardware missing from rear step.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

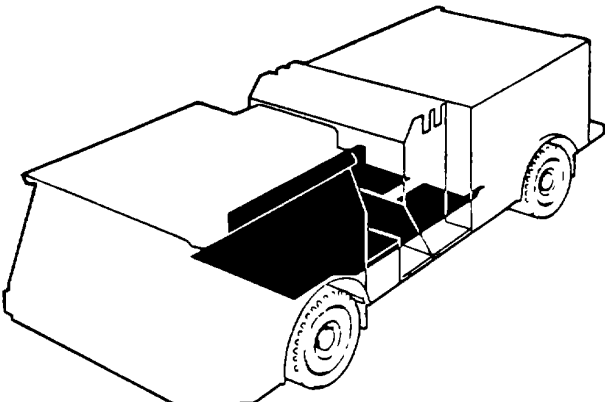
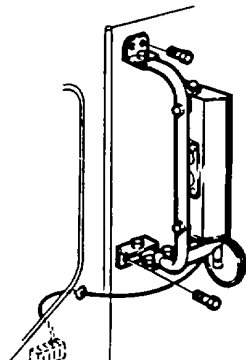
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
3	•	•		<p>HEAT SHIELDS</p> <p>Check that all heat shields are in place and are not severely bent, scratched, or dented. Clean as required.</p> <p>Be sure all fasteners are in place and are tight. Refer to Organizational Maintenance for repair.</p> 	- Heat shields bent to ground level.
			•	<p>CAB DOORS</p> <p>Ensure both cab doors latch. Check inner and outer handles operate. Check window regulator moves window up and down smoothly.</p> <p>Be sure door seal is in place.</p>	
5	•	•		<p>CAB MIRRORS</p> <p>Check mirrors are not cracked and mounting is secure.</p> <p>Check marker lights illuminate when marker light switch in cab is set to ON.</p> 	- Cab mirrors broken or missing.

Table 2-1. Operator Preventive Maintenance Checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

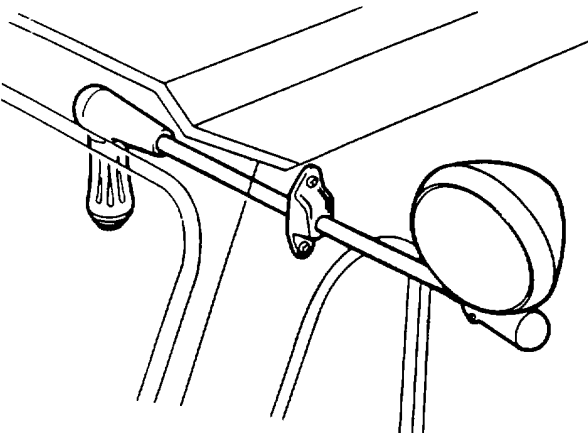
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
6			•	<p>CAB MIRROR HEATERS</p> <p>In winter/cold climates, set MIRROR switch to ON and check condensation/frost on mirror disappears, ie heater is working.</p>	
7	•	•		<p>CAB WINDOWS</p> <p>Be sure rear cab sliding windows operate smoothly and seals are in place. Be sure windshield and cab side windows are unbroken. Ensure all seals are in place.</p>	
8			•	<p>SPOTLIGHT INSPECTION - Front</p> <p>Set SPOT switch to ON in cab.</p> <p>Check both front spotlights. illuminate Swivel handle and check lamp swivels smoothly to the extent of its travel.</p> 	
9			•	<p>SPOTLIGHT INSPECTION - Rear</p> <p>Set HOSE PICK UP switch to ON in cab. Check both rear spotlights illuminate. Check mounting is secure.</p>	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

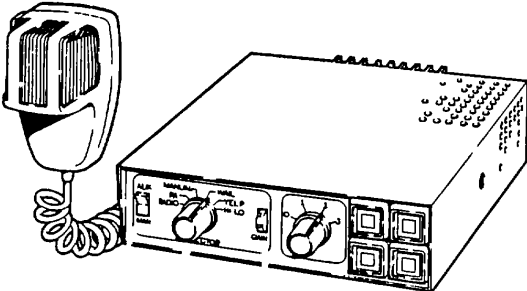
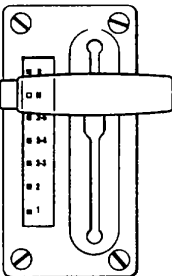
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
10			•	<p>SIREN AND PA</p> <ul style="list-style-type: none"> Check operation of the siren/PA unit mounted in the cab. <p>Check siren, radio rebroadcast and PA functions. Refer to Chapter 2 for operating instructions.</p> 	- SIREN/PA unit does not operate in one or more of its functions.
11	•	•		<p>CAB INSTRUMENT PANEL INDICATING LAMPS</p> <p>Set PANEL switch to HIGH and check all gage back lights illuminate. Check panel lamps also illuminate. Set switch to MED and LOW and be sure lamps dim.</p>	
12			•	<p>GLOVE COMPARTMENT</p> <ul style="list-style-type: none"> Clean glove compartment. 	
13			•	<p>SHIFT CONTROL</p> <ul style="list-style-type: none"> Check operation of shift unit with main engine running. All gear ranges should be selectable and movement of handle should be free and smooth. Be sure truck will not start unless selected to Neutral. Be sure reversing lamps and horn operate when selected to Reverse. 	- Any range is not operable.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

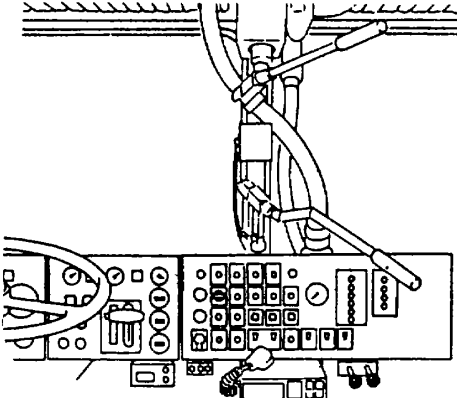
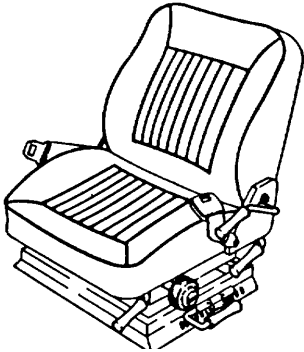
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
14				<p>HEATER CONTROLS</p> <ul style="list-style-type: none"> With main engine running, pull control knob out to HEAT. Set HEATER fan to HIGH and DEFROST fan to HIGH. Pull heat flow knob and check hot air flows out of dash registers. Push in heat flow knob and check hot air flows out of floor registers. 	
15				<p>SEATS</p> <ul style="list-style-type: none"> Check operation of all seat position levers to ensure each seat is fully adjustable. Check operation of seat belts and check belt fabric is not torn or worn. Check all seat and belt fasteners are tight. 	<ul style="list-style-type: none"> - Seat belts missing or severely damaged. - Seats loose, or any seat adjuster falls to lock.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

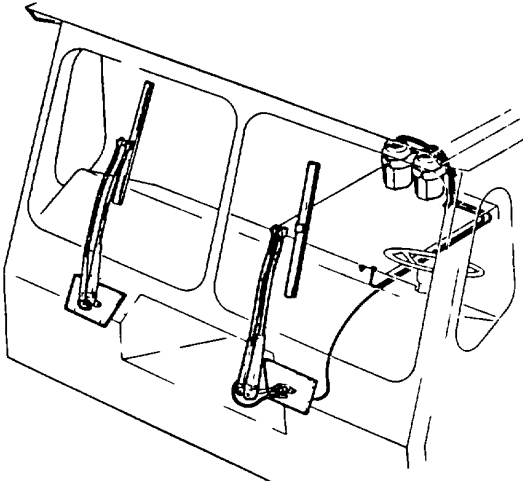
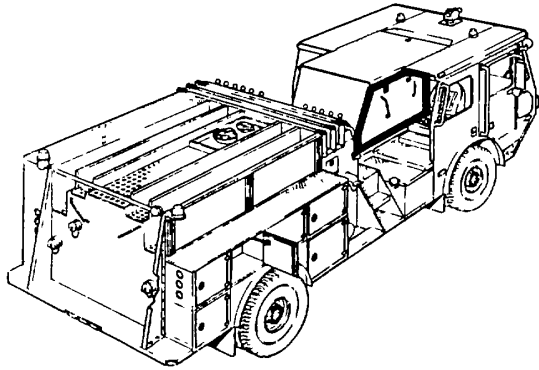
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
16	•	•		<p>WINDSHIELD WASHER/WIPER</p> <p>Check fluid level in wash bottle is up to the full mark Replenish as required.</p> <p>Check wiper and washer controls. Wiper speed should be fully adjustable between slow and fast speed. Washer nozzle should spray fluid into path of wiper. Clean nozzle as required.</p> 	
17	•			<p>ENGINE COVERS</p> <p>Check engine covers on both sides of the engine are in place. Tug on both handles to ensure cover is fastened securely.</p> 	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

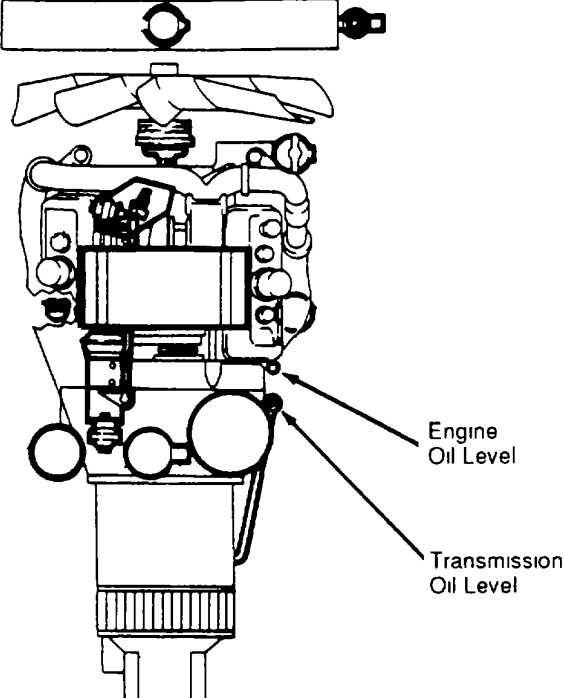
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
17A		•		<p>ENGINE OIL - MAIN ENGINE. Check the engine oil level daily after the engine has stopped. Wait 20 minutes before checking level on the dipstick.</p> <p>See LO 5-4210-220-12 for correct lubricant.</p> 	
17b		•		<p>TRANSMISSION Check the transmission fluid level each day. Allow transmission to reach operating temperature of 160 to 200 °F. With the parking brake applied, shift the engine through all drive ranges prior to the check. Then shift to neutral. If the oil registers in the HOT RUN band marked on the dipstick, the transmission may be operated safely. If it registers on or below the bottom line of the HOT RUN band, do not operate truck. See LO 5-4210-220-12 for correct lubricant.</p> <p>To achieve temperature rise to the normal operating range on the MACI Truck, the vehicle should be run at high idle for approximately 10 minutes (this assumes a normal ambient temperature). The transmission temperature gauge should read between 160°F and 200°F.</p>	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

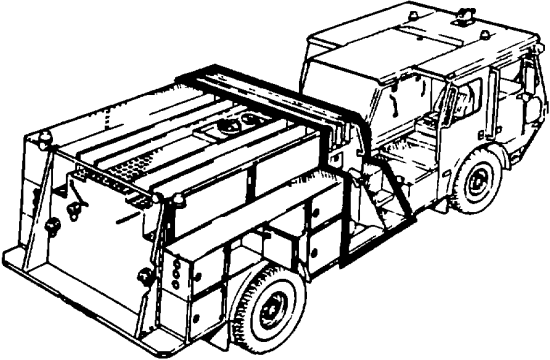
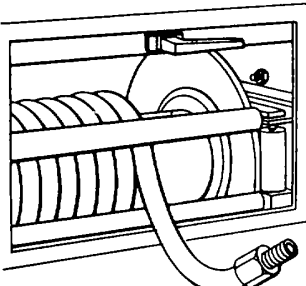
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
18	•	•		<p>PUMP BODY</p> <p>Check pump body for dents and scratches. Clean paint work as required. Be sure all nuts and bolts are tight.</p> <p>Ensure all three access panels are securely latched. Check steps between hose body and pump body are latched.</p> <p>Ensure hoses are correctly stowed in the cross-lay hose beds. Confirm rollers move freely.</p> 	
19	•	•		<p>HOSE REEL</p> <p>Pull out about 5 feet of hose. Operate air purge valve and ensure air bleeds into the hose. If water comes out of hose nozzle leave valve open until water stops. Operate water drain valve. Leave open till water drains out of hose reel supply line. Reclose valve.</p> <p>Press rewind pushbutton and check hose rewinds. Confirm all rollers move freely.</p> 	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

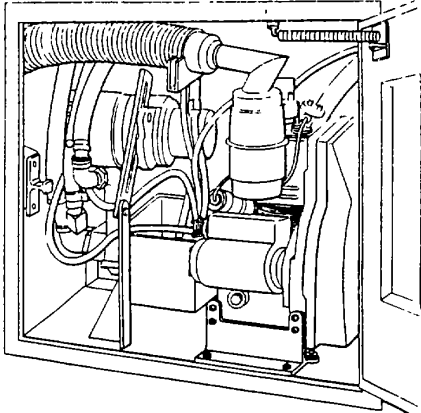
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
20				<p>HOSE INSPECTION</p> <ul style="list-style-type: none"> Pull out hose reel hose to its full length. Inspect hose for kinks, tears or cuts. <p>Report any failed hose to Organizational Maintenance for repair.</p>	- Hose missing or severely cut or kinked.
21				<p>HOSE CONNECTOR INSPECTION</p> <ul style="list-style-type: none"> With hose reel hose pulled out from reel, inspect each connector for damage/looseness. Tighten all connectors as required. Report any damage to Organizational Maintenance for repair. 	- Connector leaking or badly damaged.
22				<p>APU INSPECT</p> <ul style="list-style-type: none"> Open APU compartment door and check for oil leaks and dirty engine cooling fins. Clean up as required. <p>Check all hoses for water/fuel leaks.</p> <p>Check for corrosion/tightness of all electrical connections.</p> <p>Check alternator drive belt tension. Belt movement should be less than 1/2 in (1 cm) midway between he pulleys.</p> <p>Report any oil, fuel, or water leak, corroded electrical connection or loose belt to Organizational Maintenance for repair.</p> 	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

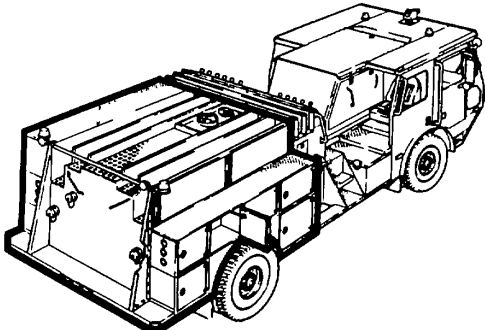
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
23				<p>APU TEST</p> <ul style="list-style-type: none"> Ensure winterization valves on main engine are open. Start APU as detailed in para. 2-11. <p>Let engine run for 15 minutes. Check it runs smoothly and cleanly Exhaust from hose reel area of truck should be clean. Report any deficiencies to Organizational Maintenance.</p>	
24	•	•		<p>HOSE BODY</p> <p>Check hose body for dents and scratches. Clean paint work as required. Be sure all fasteners are tight. Ensure equipment is correctly stowed on the hose bed and ladder deck. Ensure mud flaps are not torn and are fastened securely.</p> 	- Equipment securing hardware broken or severely damaged.
25	•	•		<p>COMPARTMENTS</p> <p>Check each compartment for the following:</p> <ol style="list-style-type: none"> Hatch holder holds door in open position (gas cylinders are installed on upper doors). Lamp illuminates when door is opened (cab COMPT switch must be set to ON). Door latches easily and does not open when tugged. Door seal is intact and securely in place securely. Equipment is stowed correctly and fixtures are in place. In lower compartments only, be sure drain valves are in place. Report any deficiencies to Organizational Maintenance. 	- Door will not latch. - Heavy equipment stowing fixtures missing, or loose

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

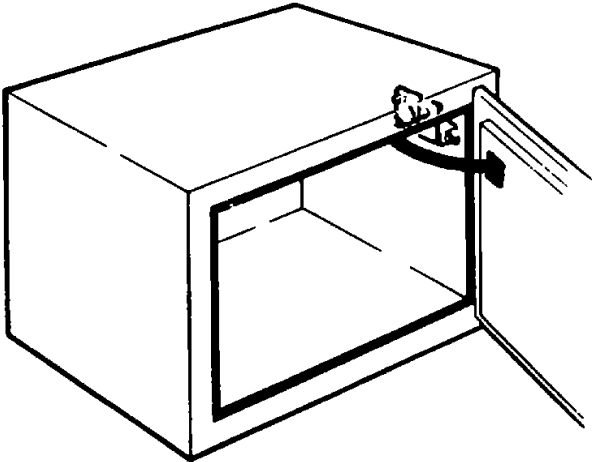
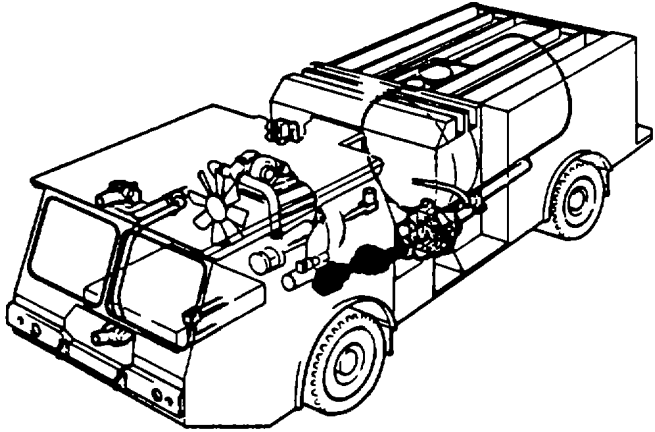
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
26				<p>COMPARTMENTS (cont.)</p> 	
				<p>PUMP DRIVE AND PTO</p> <ul style="list-style-type: none"> Check for lubrication leaks throughout the system, the PTO unit and solenoid, reducer gearbox, pump and both drive shafts. Report any leak to Organizational Maintenance. <p>Grasp each drive shaft and attempt to rotate and move up and down. There should be no slack. Report any movement to Organizational Maintenance.</p> 	

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly


Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
27				<p>Start pump using water from water tank and check operation of pump drive, pump, roof turret and bumper turret, (see para. 2-11).</p> <p>FIRE PUMP INSPECTION</p> <ul style="list-style-type: none"> Examine pump for signs of oil or water leaks. Check clearance between priming pump fiber wheel and the pump drive pulley; of there is no air space, report to Organizational Maintenance. Pulley requires replacement. 	<p>-Pump drive noisy. -Pump will not deliver 250 psi (1700 kPa). -Water from turrets in SOLID will not reach 150 ft (45 m).</p> <p>-Pump pulley worn out.</p>
28				<p>PRIMING TANK INSPECTION</p> <ul style="list-style-type: none"> Check level of fluid in priming tank. Top up with 50/50 water/antifreeze solution as required. 	
29				<p>ROOF TURRET INSPECTION</p> <p>Ensure the roof turret valve is in the slightly cracked position.</p> <ul style="list-style-type: none"> Examine roof turret for any signs of damage. <p>From the cab, remove the locking pin, and check turret for freedom of movement.</p> <p>Move spray control lever from fog to straight stream. Ensure this lever works freely.</p>	<p>-Turret or control lever very stiff.</p>

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

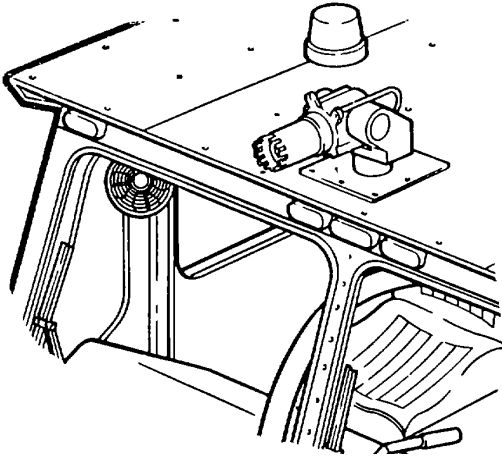
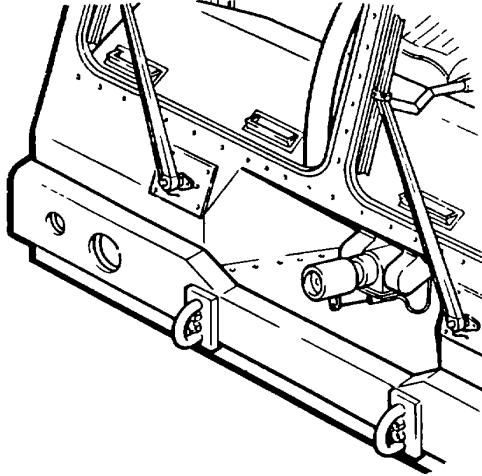
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
30				<p>ROOF TURRET INSPECTION (cont.)</p> 	
	•	•		<p>BUMPER TURRET INSPECTION</p> <p>Examine bumper turret for any signs of damage.</p> <p>From the cab, operate turret and check for freedom of movement.</p> <p>Move spray control lever from fog to straight stream. Ensure lever moves freely.</p> 	- Turret or control lever very stiff.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

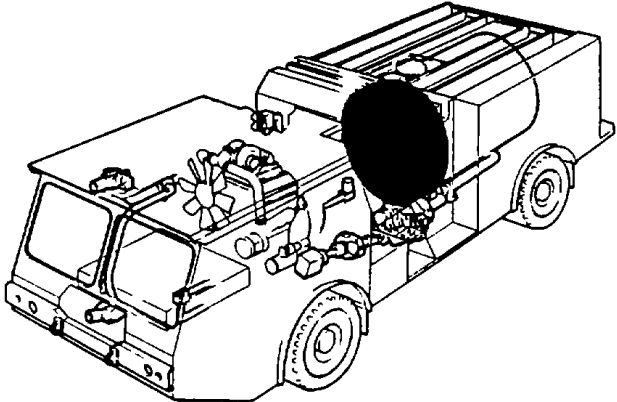
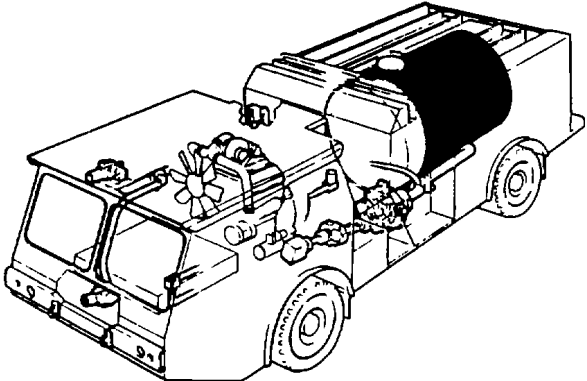
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
31				<p>FOAM TANK INSPECTION</p> <ul style="list-style-type: none"> With foam tank empty, open foam tank inspection hatch Look for any signs of corrosion/leaks. 	- Tank leaks.
32				<p>WATER TANK INSPECTION</p> <ul style="list-style-type: none"> With water tank empty, open water tank inspection hatch. Look for any sign of corrosion or leaks. <p>Start main engine and connect rear fill valve to pressurized water supply.</p> <p>Set control switch to ON and check water tank starts to fill. Set control switch to OFF and check valve closes. Listen for water splashing inside of tank. If valve leaks report to Organizational Maintenance. Close hatch and remove hose connection to tank rear fill valve.</p> 	- Tank leaks.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

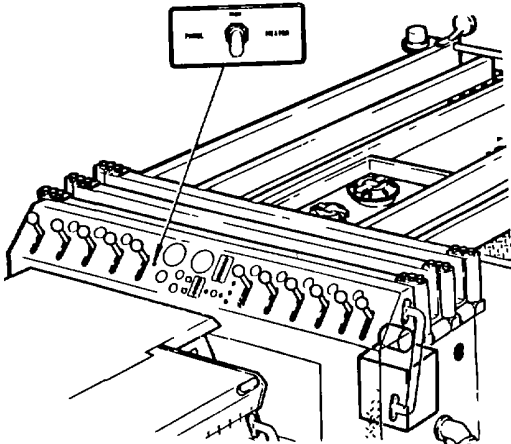
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
33				<p>WINTERIZATION SYSTEM</p> <ul style="list-style-type: none"> Start pump body heater and hose reel blower via switch on structural control panel. Ensure fans start. Listen for any rattles or rumblings in the bearings.  <p>Report any noises to Unit Maintenance. Ensure winterization valves on main engine are OPEN.</p> <p>Start the Auxiliary Power Unit and Winterization Heater, (see para. 2-12).</p> <p>Ensure that hot water is circulated through the cab, battery heater, pump body heater, water and foam tanks. Check that warm air comes out of the cab and pump body heaters. Check all fuel and water lines for signs of leakage, cuts or abrasions. When testing is complete, shut down the Winterization Heater and APU.</p> <p>Report any deficiencies to Unit Maintenance.</p>	
34				<p>COOLING SYSTEM</p> <p><u>WARNING</u></p> <p>When the engine is hot, the coolant can cause serious burns. To prevent injury, allow engine to cool before carrying out the following inspection.</p> <ul style="list-style-type: none"> Examine all hoses and air lines for signs of leakage, cuts, or abrasions. Report any deficiencies to Unit Maintenance. 	<p>- Any water hose is leaking or has serious cuts or abrasions.</p> <p>- Any hose is leaking or has serious cuts or abrasions.</p>

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

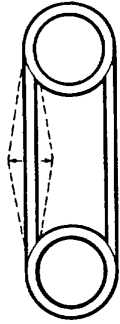
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
				<p>COOLING SYSTEM (cont.)</p> <p>Examine radiator fan belts for signs of wear or damage. Check belt tension. Belt should move less than 1/2 in at midpoint between pulleys.</p>  <p>With the engine shut down, check the radiator fan is locked to the pulley. The fan will not rotate. Check that the shutter on the front of the radiator is open.</p> <p>Start main engine and check shutter closes.</p> <p><u>WARNING</u></p> <p>A rotating fan can cause serious injury. Even when the fan clutch is disengaged the fan will rotate. Do not attempt to stop it rotating.</p> <p>While watching the radiator fan, have second crewman operate FAN OVERRIDE switch in the cab. When set to MANUAL the fan will stop when the engine is stopped.</p> <p>When set to AUTO, and the engine not at working temperature, the fan will run on when the engine is stopped. Check when set to MANUAL, the shutter opens. Report any deficiencies to Organizational Maintenance.</p>	<p>- Fan belts severely worn or missing.</p> <p>- Fan blades missing.</p> <p>- Fan shutter will not operate.</p>

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

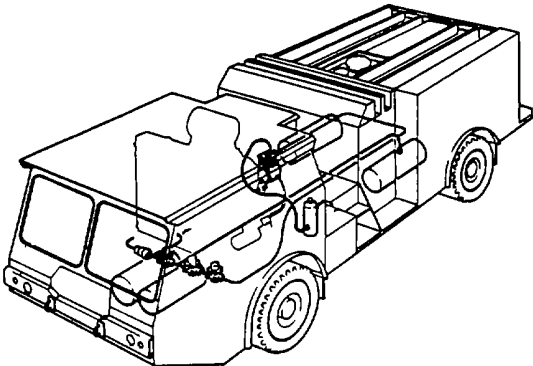
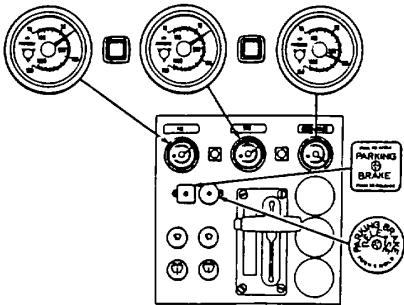
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
35				<p>AIR TANKS</p> <ul style="list-style-type: none"> Open draincock on each air tank and drain any water/oil out of the tank. When the air is free of spray, close draincock. If a stream of water/oil comes out of the draincock, report to Organizational Maintenance.  <p>Check tanks and fittings for any signs of leakage, serious dents or scratches. Report any deficiencies to Organizational Maintenance.</p>	<ul style="list-style-type: none"> - Any air tank contains liquid water or oil. - Any air tank or hose is leaking.
36				<ul style="list-style-type: none"> <p>AIR SYSTEM</p> <p>Check all air hoses, fittings and brake valves for signs of leakage, serious dents, or scratches, cuts or abrasions.</p> <p>With the main engine running, operate the foot brake in the cab and ensure the brakes operate smoothly. Report any uneven or spongy action, dragging, squealing, or chatter to Organizational Maintenance. Check air pressure gages in cab register at least 90 psi (620 kPa).</p>  	<ul style="list-style-type: none"> - Any air line is broken. - Air pressure in any tank is less than 90 psi (620 kPa).

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

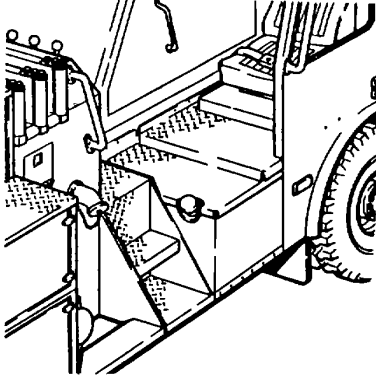
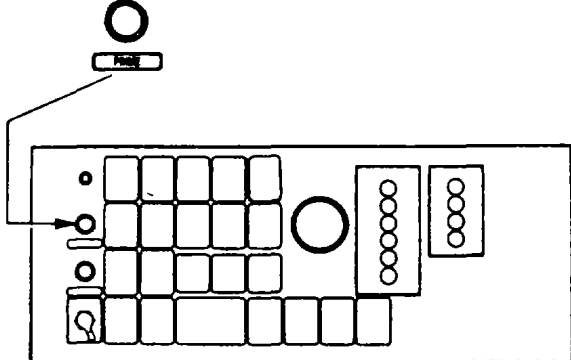
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
37				<p>AIR SYSTEM (cont.)</p> <p>Pull out the parking brake control and ensure the parking brake holds the truck stationary.</p> <p>Check air horns function.</p> <p>FUEL TANK</p> <p>Fill the fuel tank after every mission. Ensure cap is tightened.</p> <p>Check for any signs of fuel leakage. Report any leaks to Organizational Maintenance.</p> 	<p>- Parking brake will not hold the truck.</p> <p>- Fuel tank leaks.</p>
38				<p>FUEL PRIMING PUMP</p> <p>Operate fuel priming pump pushbutton in cab, and listen at fuel tank for pump noise indicates pump is running.</p> 	<p>- Fuel priming pump will not operate.</p>

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

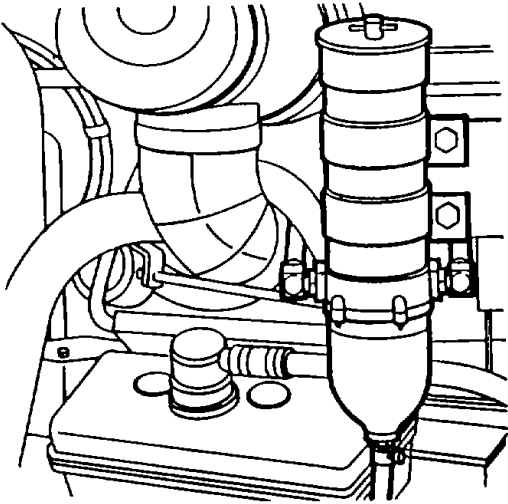
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
39				<p>WATER/FUEL SEPARA. TOR</p> <ul style="list-style-type: none"> Drain any sediment from water/fuel separa. tor. Inspect fuel separa. tor and lines Look for any signs of leakage. Fuel bowl should be full at all times. Report any deficiencies to Organizational Maintenance. 	- Water/fuel separa. tor leaks.
40				<p>FUEL PUMP AND FILTER</p> <ul style="list-style-type: none"> Inspect main engine fuel pump, filter and all fuel lines. Look for any signs of leakage. <p>Check lines for chaffing or nicks. Report any deficiencies to Organizational Maintenance.</p>	- Major fuel leaks.

Table 2-1. Operator Preventive Maintenance checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

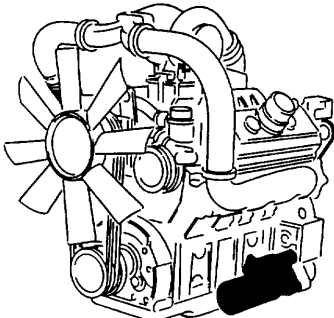
Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
41				<p>STARTER MOTOR</p> <ul style="list-style-type: none"> Check cables for chaffing and/or loose insulation. Follow cables from battery box through to starter motor Check all connections for tightness and corrosion. Report any deficiencies to Organizational Maintenance. 	- Starter motor will not operate.
42				<p>LIGHTS</p> <p>Check all lamps function.</p> <p>FRONT</p> <ul style="list-style-type: none"> Headlights Turn lights Marker lights Emergency beacons Spotlights Oscillating lights <p>REAR</p> <ul style="list-style-type: none"> Stoplights Tail lights Brake lights Licence lamp Marker lights Emergency beacons Spotlights <p>CAB</p> <ul style="list-style-type: none"> Dome lights Instrument panel lights Map lights Gage back lights <p>Structural Control Panel</p> <ul style="list-style-type: none"> Instrument panel lights Gage back lights <p>Report any failed lamps to Organizational Maintenance.</p>	

Table 2-1. Operator Preventive Maintenance Checks and Services (PMCS)-Continued

A - After Mission

D - Daily Checks

W - Weekly

Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
43			•	<p>STEERING SYSTEM</p> <p>Check for oil leaks on all hoses and fittings between reservoir and pump in engine compartment and steering gear (left hand wheel).</p> <p>Check reservoir to maintain appropriate level.</p> <p>Check belt tension on steering pump. There should only be 0.05 in. (1.27 mm) free play in belt.</p> <p>Check steering column and miter box for grease leaks.</p> <p>Check, while operating the vehicle and turning the steering wheel lock-to-lock, that the steering is free turning and even.</p> <p>Check electric horn operates when button is pressed in center of steering wheel.</p>	<p>-Large oil leaks or hose damage.</p> <p>-Steering pump belts worn or broken.</p> <p>-Failed universal joints or stiff steering.</p>
44				<p>DRIVE LINES-POWER TRAIN</p> <p>Check all seals and universal joints. Grease should not be leaking out. Check center bearing similarly.</p> <p>There should be no free play in any drive shaft. Grasp shaft and attempt to rotate to check for movement.</p>	<p>-Looseness in drive lines.</p> <p>-Bent drive lines.</p>
45				<p>ENGINE OIL SYSTEM</p> <p>Check for oil leaks around all gaskets and fittings in the engine compartment</p> <p>Check gaskets around oil pan and oil filter.</p> <p>Check oil reservoir to maintain appropriate level.</p>	<p>-Large oil leaks.</p>
46				<p>TRANSMISSION OIL SYSTEM</p> <p>Check for oil leaks around oil gaskets and fittings.</p> <p>Check gasket around transmission pan and transmission filter.</p> <p>Check transmission reservoir to maintain appropriate level.</p>	<p>-Large oil leaks.</p>

Table 2-1. Operator Preventive Maintenance Checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
45	•	•		<p>WHEELS AND TIRES</p> <p>Check pressure of all tires, 70 psi (480 kPa)</p> <p>Check each tire for large objects in tread, remove</p> <p>Check for deep cuts, uneven wear, or signs of tread separa. tion.</p> <p>Report any deficiencies to Organizational Maintenance.</p>	<ul style="list-style-type: none"> - Pressure low - Deep cuts or tread separa. tion
46		•	•	<p>FRONT AXLE</p> <p>Inspect front axle for signs of oil loss</p> <p>Inspect tie rod ends for grease loss.</p> <p>If, when steering the truck, any noise/grating is generated in the axle steering mechanism, report failure to Organizational Maintenance.</p> <p>Inspect steering balls for signs of deep scoring or severe corrosion. Report any deficiency to Organizational Maintenance.</p>	<ul style="list-style-type: none"> - Severe loss of oil - Noisy steering (failed ball joints) - Noisy bearings or gears

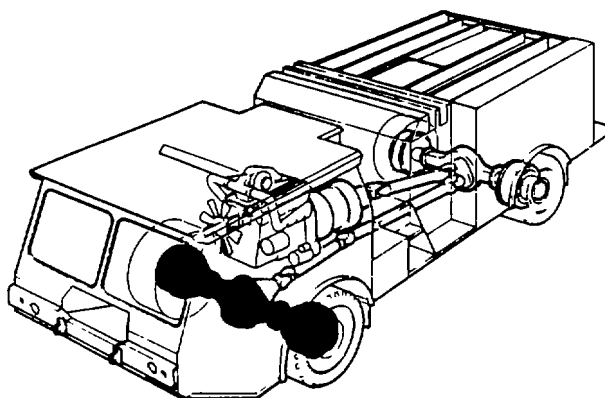
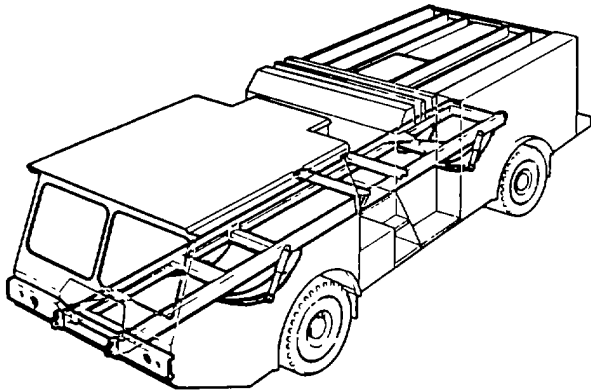


Table 2-1. Operator Preventive Maintenance Checks and Services (PMCS) - Continued

A - After Mission

D - Daily Checks

W - Weekly

Item No.	Interval			ITEM TO BE INSPECTED/Procedure	Equipment is not Ready/Available If
	A	D	W		
47				<p>FRAME</p> <ul style="list-style-type: none"> Inspect all cross members and mounting brackets on the frame. Check all nuts and bolts are tight Check dampers for damage or excessive wear. Check water tank mounting springs are intact. Check all metal is free of cracks. (Check paint for cracks on welds or radially from bolt holes especially) <p>Report any deficiencies to Organizational Maintenance</p>	<ul style="list-style-type: none"> - Cracked cross vibration member(s) or side member(s) - Vibration damper(s) missing - Tank mounting spring(s) missing or broken
					

Section III. OPERATING PROCEDURES.**2-8. ASSEMBLY AND PREPARATION FOR USE.**

Before starting, driving, and testing the truck carry out oil and lubricant inspection as detailed in Lube Order LO 5-4210-220-12, fuel up the truck, and fill water and foam tanks.

2-9. INITIAL ADJUSTMENTS.

All subsystems and components requiring adjustments are pre-set by the manufacturer and no special procedures are, therefore, required. Carry out all routine checks and inspections as detailed in Operator's PMCS Procedures, see para. 2-7.

2-10. OPERATING THE VEHICLE.

a Starting the Engine

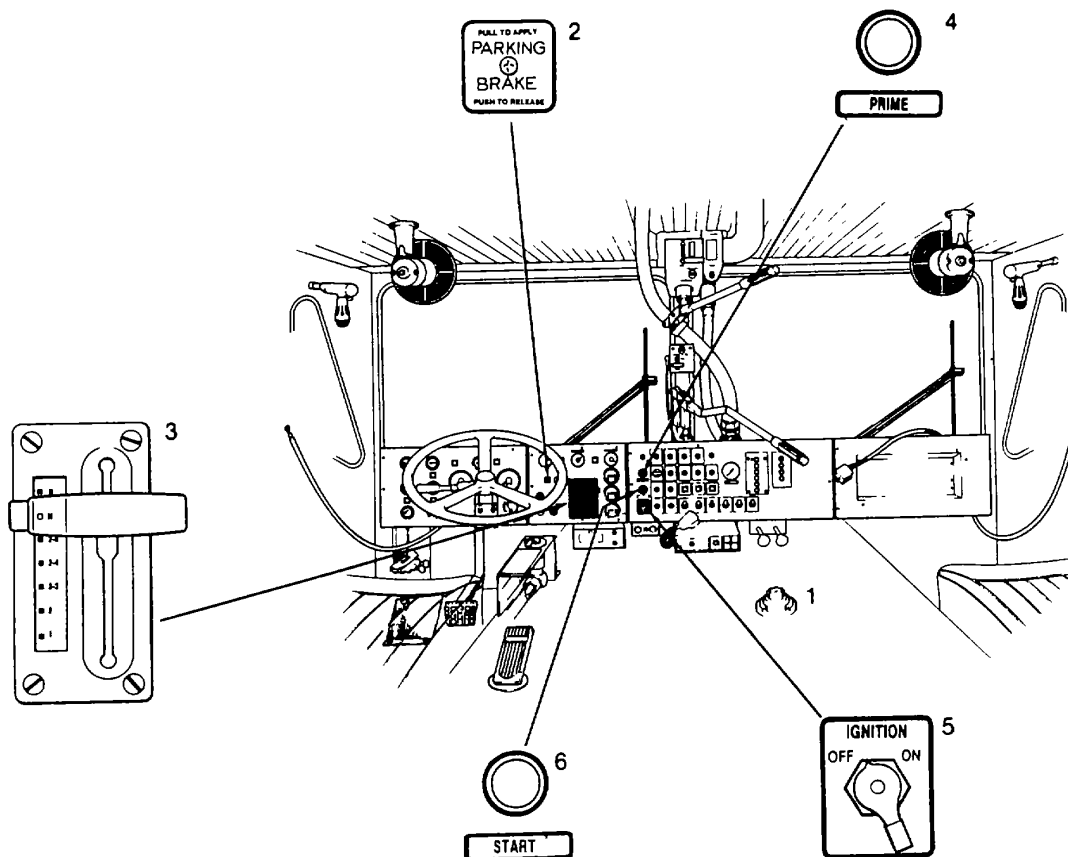
- (1) Set battery switch (1) to BOTH.
- (2) Be sure that the parking brakes are engaged, i e, the brake control button (2) is pulled OUT.
- (3) Be sure that the transmission shift lever (3) is in N (neutral) position. The transmission neutral start switch prevents starting unless the transmission is in neutral.

NOTE

Prime the engine fuel system if the engine falls to start. Depress the prime button (4) for 10 to 20 seconds

If the engine falls to start after priming and several starting attempts, consult the troubleshooting chart in Chapter 3, Section II.

- (4) Turn the ignition switch (5) to ON.
- (5) Depress the start button (6) until the engine starts or a maximum of 30 seconds. If the engine falls to start, wait one to two minutes and repeat the starting attempt. Waiting between starting attempts is necessary to prevent overheating of the starter motor.



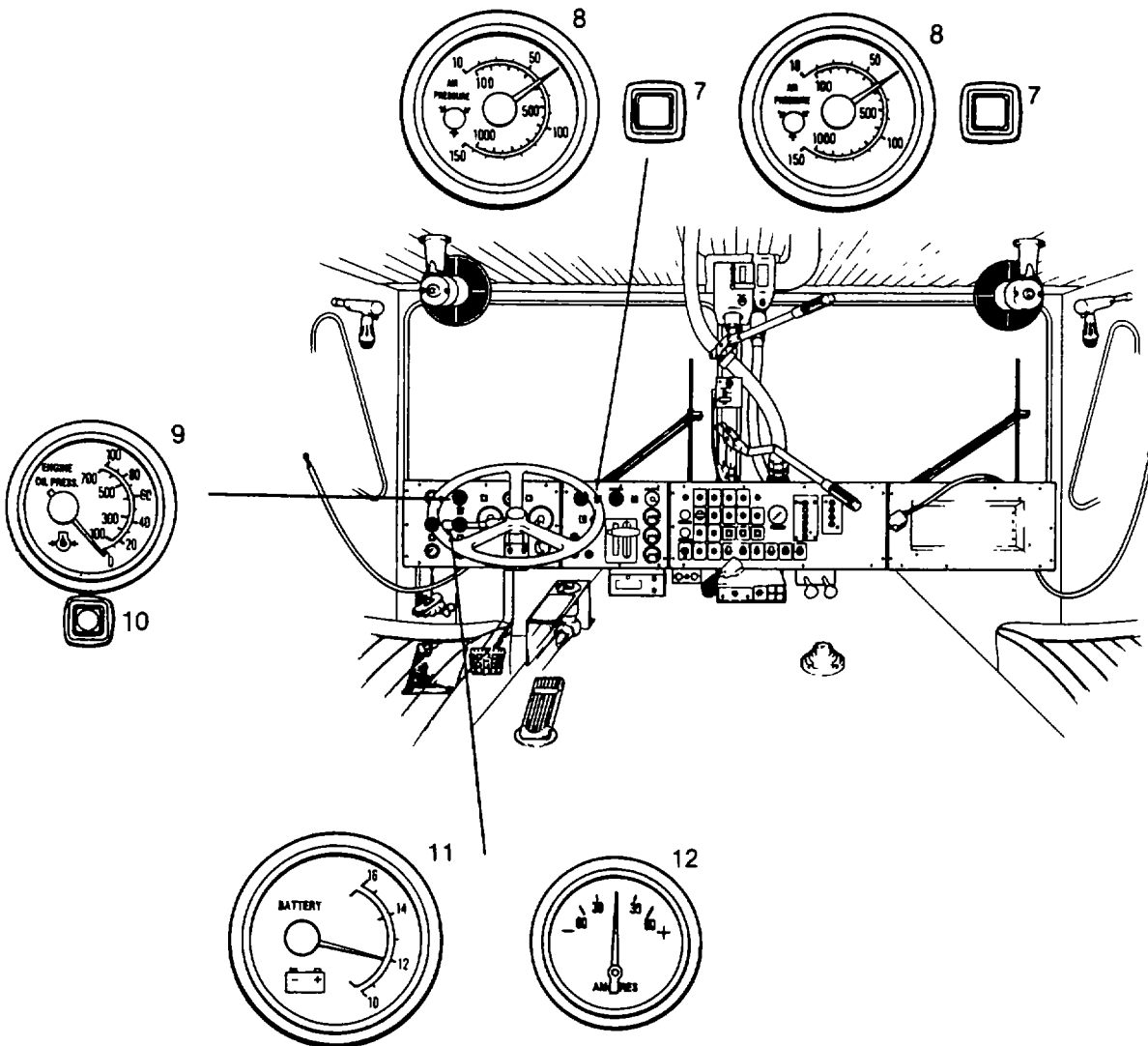
2-10. OPERATING THE VEHICLE. - Continued

NOTE

The alarm lamps (7) will sound and illuminate when the engine is started and the air system pressure is below 65 psi (450 kPa). The audiovisual signals will cease once the air system pressure exceeds 65 psi (450 kPa) as indicated on gages (8).

(6) When the engine is started, observe the oil pressure gage (9). After the first few seconds of operation the oil pressure alarm lamp (10) should cease indicating and the oil pressure remain above 10 psi (70 kPa). If the oil pressure remains below 10 psi (70 kPa), stop the engine and refer to Organizational Maintenance.

(7) Observe the voltmeter (11) and ammeter (12) to ensure that the batteries are being charged.



2-10. OPERATING THE VEHICLE - Continued

b. Driving the Vehicle

WARNING

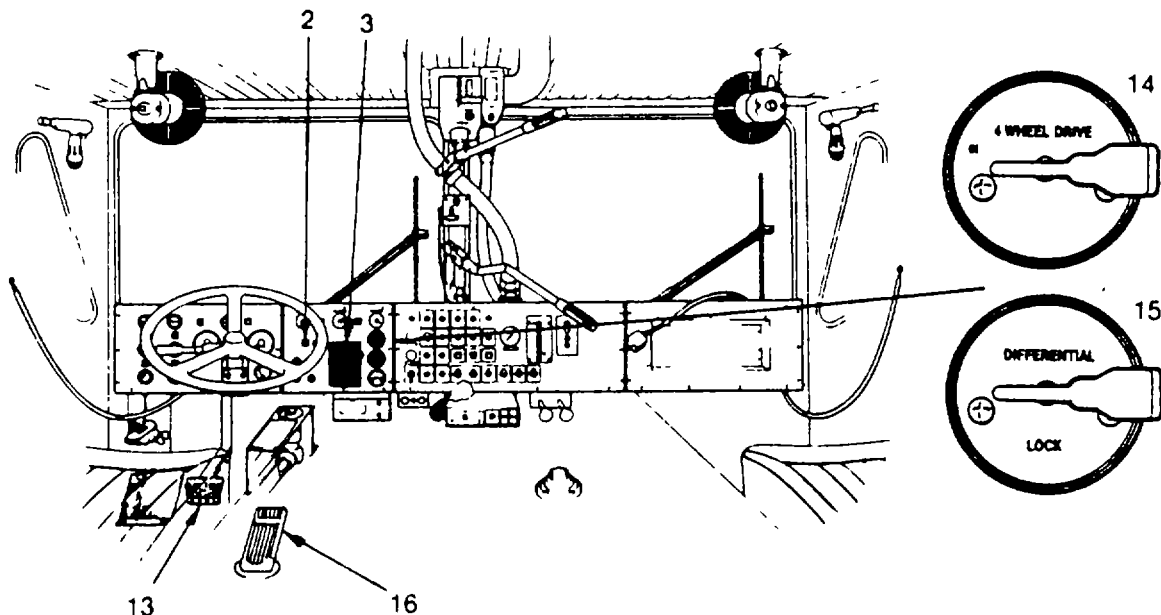
The service brakes are ineffective and driving hazardous when the air system alarm lamps are Indicating. Commence safe driving ONLY when the alarm lamp indication ceases.

- (1) Adjust the drivers seat and rearview mirrors, and switch ON lights, beacons, siren and other accessories as required Fasten your seat belt.
- (2) Depress the brake pedal (13) to engage the service brakes.
- (3) Release the parking brakes by pushing the parking brake button (2) IN.
- (4) Be sure that the 4-wheel drive (14) and differential locks (15) are selected to OUT before you drive.
- (5) Select desired gear or gear range using transmission shift lever (3).
- (6) Release the brake pedal (13) and depress the accelerator pedal (16).

CAUTION

Come to a complete stop before engaging 4-wheel drive mode to prevent damage to the vehicle.

- (7) Select 4-wheel drive (14) to IN when you need to negotiate rough terrain. Remember you MUST come to a complete stop before this mode is selected to prevent damage to the power divider
- (8) Select differential lock (15) IN to maintain traction on all wheels when in 4-wheel drive mode Be sure you come to a complete stop when you select the switch to prevent damage to the differential.



2-10 OPERATING THE VEHICLE - Continued

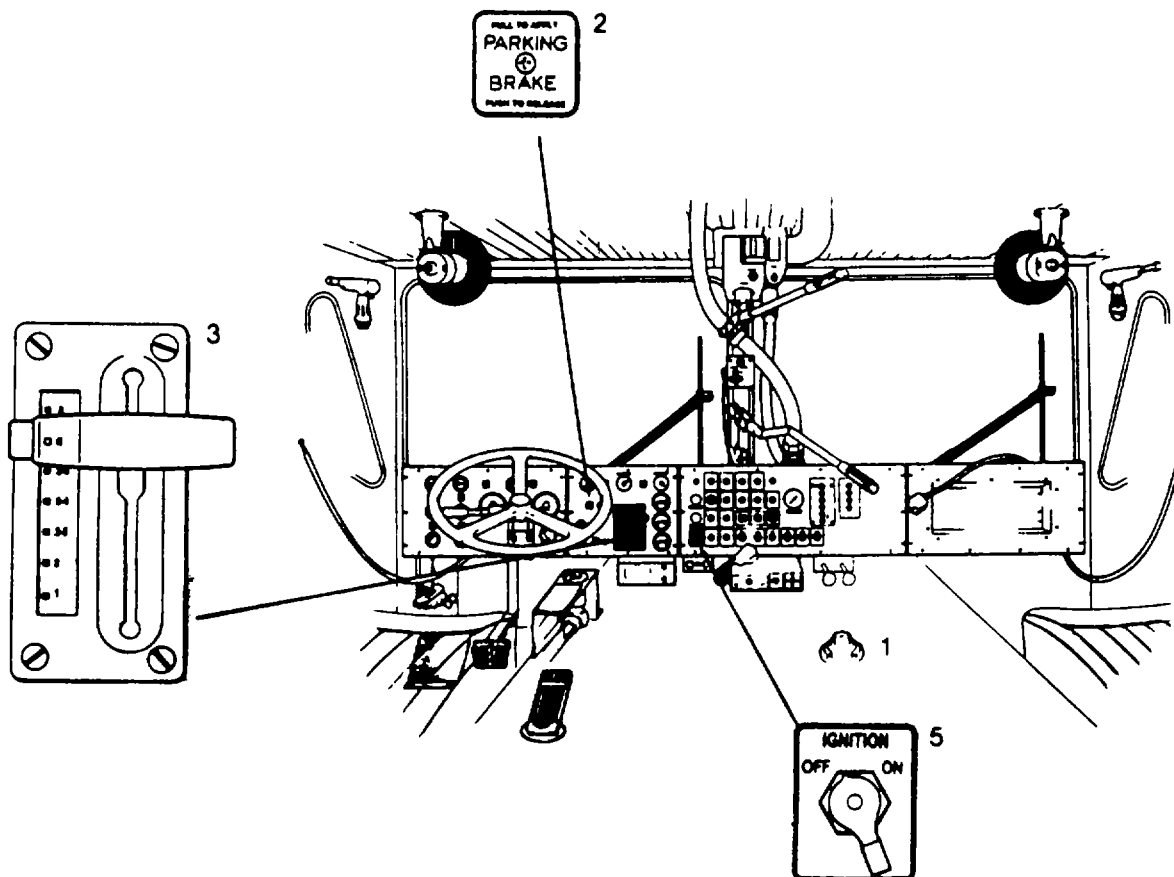
c. Shutting Down the Engine

- (1) After stopping the truck, engage the parking brakes by pulling the parking brake knob (2) OUT.
- (2) Place the transmission shift lever (3) into N (neutral) position.

CAUTION

The turbocharger can be damaged unless the engine is idled for at least 2 minutes. The turbocharger normally operates at 40 to 60,000 rpm and is lubricated by the engine oil pump. Therefore, to prevent lack of lubrication, reduction in speed is necessary before the engine is stopped.

- (3) Idle the engine at least 2 minutes, then turn the ignition switch (5) to OFF.
- (4) Switch OFF all lights and accessory controls.
- (5) Set battery switch (1) to OFF.



2-11. FIREFIGHTING OPERATIONS.

a. CFR Mode.

NOTE

CFR operation may be carried out with the truck stationary or in pump-and-roll mode. Pump-and-roll mode may be selected while the truck is in motion.

(1) Select the transmission shift lever (1) to N (neutral) for stationary operation, or R, 1, 2, or 2-3 for pump-and-roll operation.

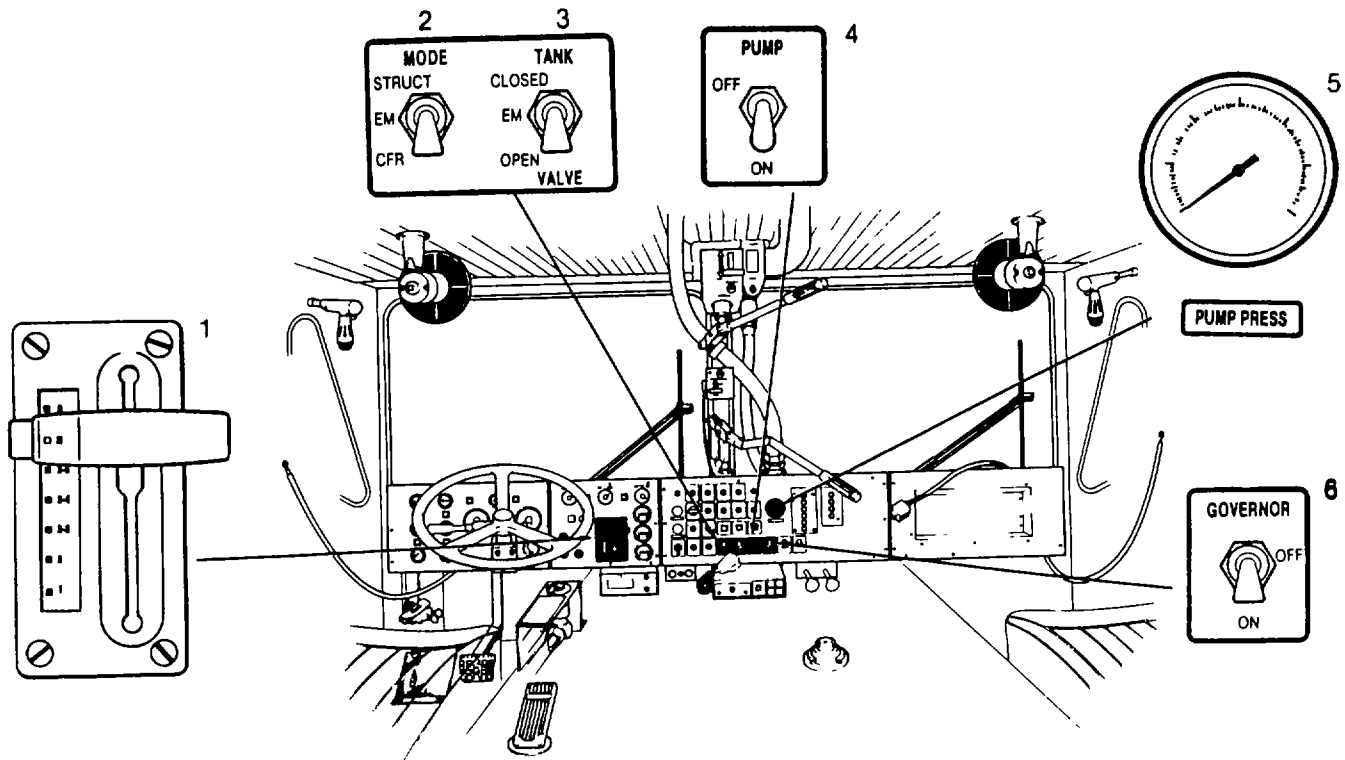
CAUTION

To avoid water hammer, adjust the vehicle speed so that the engine is operating at or below 1200 rpm before you engage the pump.

- (2) Set the mode switch (2) to CFR.
- (3) Set the water tank valve switch (3) to OPEN.
- (4) Set the pump switch (4) to ON.
- (5) Be sure that pressure is registered on the pump pressure gage (5) before you engage the governor.
- (6) Set the governor switch (6) to ON.

NOTE

The CFR, TANK, PUMP and GOVERNOR must be selected in the above order to ensure a smooth start-up of the firefighting system.



2-11. FIREFIGHTING OPERATIONS. - Continued

NOTE

If foam is required, carry out steps 7, 8 and 9.

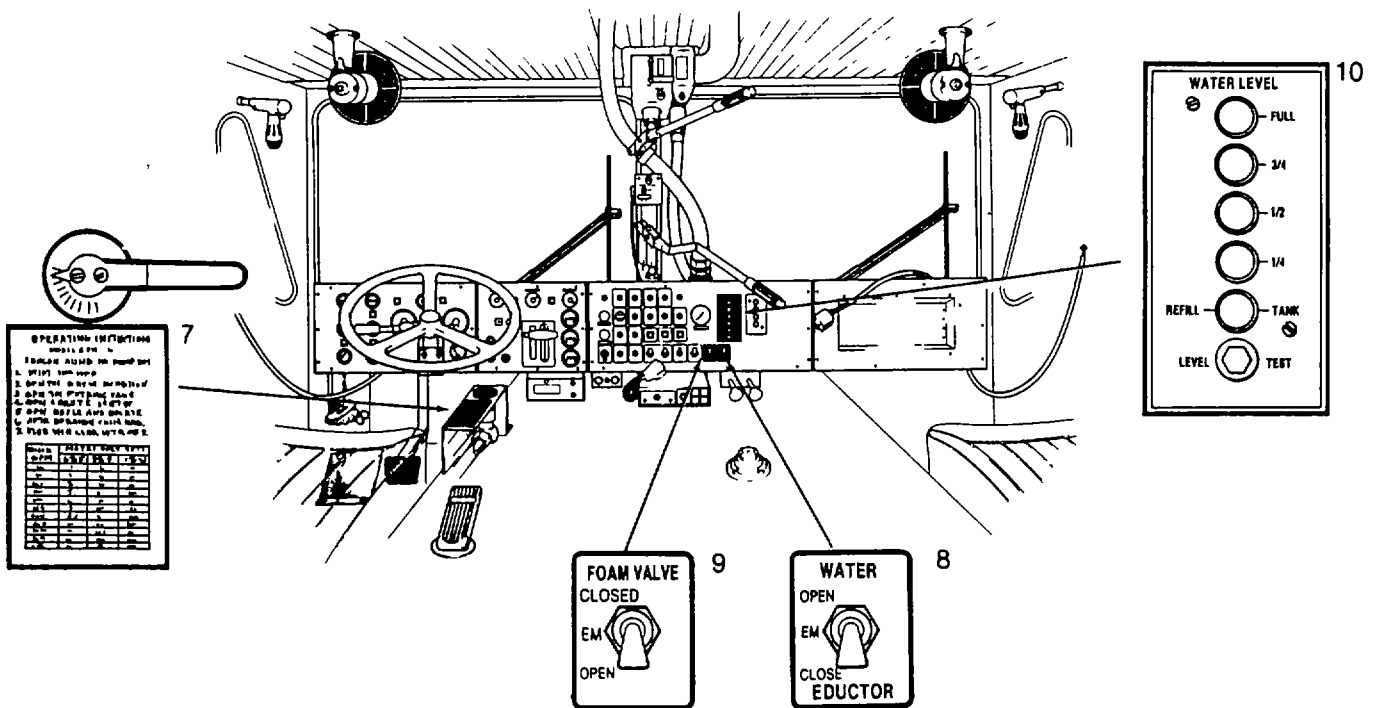
- (7) Turn the foam metering valve (7) to required foam percentage.
- (8) Set the water educator switch (8) to open.
- (9) Set the foam valve switch (9) to open.

WARNING

Engine overspeeding and difficult vehicle control may be experienced in pump-and-roll mode if the water tank is completely emptied. Be prepared to shut off the automatic governor when the tank level indicator (10) shows 1/4 tank and refill required.

NOTE

Use the brake pedal to control the vehicle speed in pump-and-roll mode.



2-11. FIREFIGHTING OPERATIONS-Continued**NOTE**

Operate the roof and/or bumper turret as required.

- (10) Remove the turret handle lock pin (11).
- (11) Open the roof turret valve (12) as required.
- (12) Using the turret handle (13), aim the water or foam discharge flow toward the fire zone.
- (13) Adjust the discharge pattern as required using lever (14).
- (14) Open the bumper turret valve (15) if required.
- (15) Using the turret handle (16) aim the water or foam discharge flow toward the fire zone
- (16) Adjust the discharge pattern as required using lever (17).
- (17) Shut down the firefighting system when the fire is extinguished or the water supply is used up. Make sure the bumper turret valve (15) is fully closed and the roof turret valve (12) is slightly cracked Place roof turret handle (12) in storage position and reinstall the lock pin (11).
- (18) If foam has been used, switch the foam tank and water educator valve switches to CLOSED and set the foam proportioning valve to 0.
- (19) Set fire system control switches to OFF or CLOSED in the following order, GOVERNOR, PUMP, TANK.

Change 2 2-51

2-11. FIREFIGHTING OPERATIONS-Continued

b. Structural Firefighting

(1) Stop the vehicle and idle the engine. Engage the parking brakes by pushing in button (1) and set the transmission shift lever (2) to N (neutral).

(2) Set the mode switch (3) to STRUCT.

(3) Play out the connect suction hoses to water supply insuring that connections are tight and all drains and discharge ports are closed.

NOTE

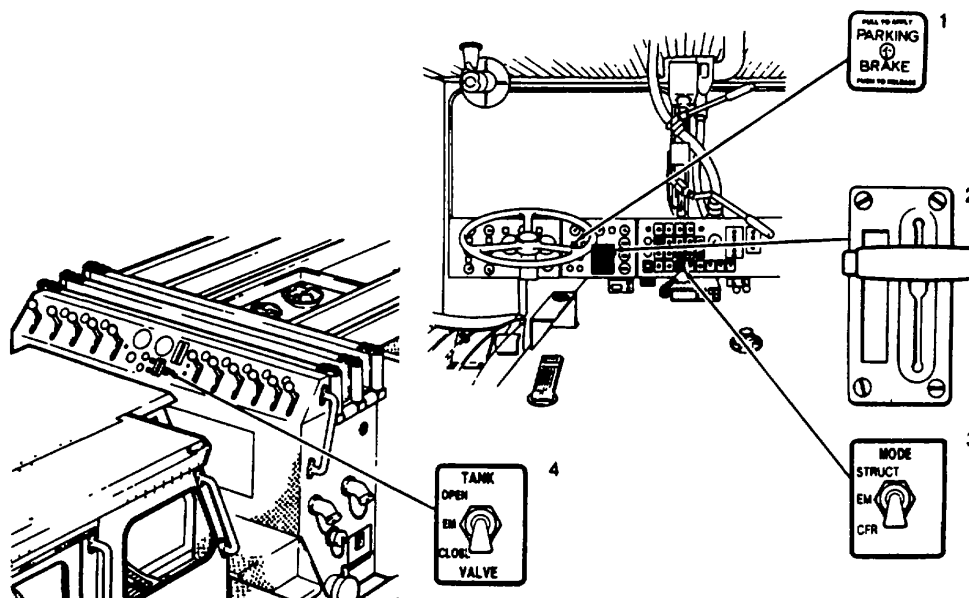
- When water must be supplied via the water tank, connect hoses between the source, (hydrant, pump, tanker) and the rear auto fill valve. Set the rear auto tank fill valve switch to ON (see para. 2-5). Maintain switch OFF when not in use.
- When water must be supplied via drafting, connect hoses between water source (open pond, holding tank) and suction ports on vehicle. Be sure that all internal and external strainers are in place.

(4) If use of the tank supply is required, set the tank valve switch (4) to OPEN.

NOTE

Maintain the switch CLOSED when water is provided via the suction manifold.

(5) Play out and attach hoses to the discharge ports as required.



2-11. FIREFIGHTING OPERATIONS-Continued

(6) Set the pump switch (5) to ON.

(7) When ready to begin firefighting, increase the pump pressure by manually adjusting the throttle regulator (6) in a clockwise direction.

NOTE

Maintain the pump discharge pressure gage (7) at approximately 150 psi (1030 kPa).

(8) Open applicable discharge port(s) and regulate the hose discharge pressure(s) using levers (8).

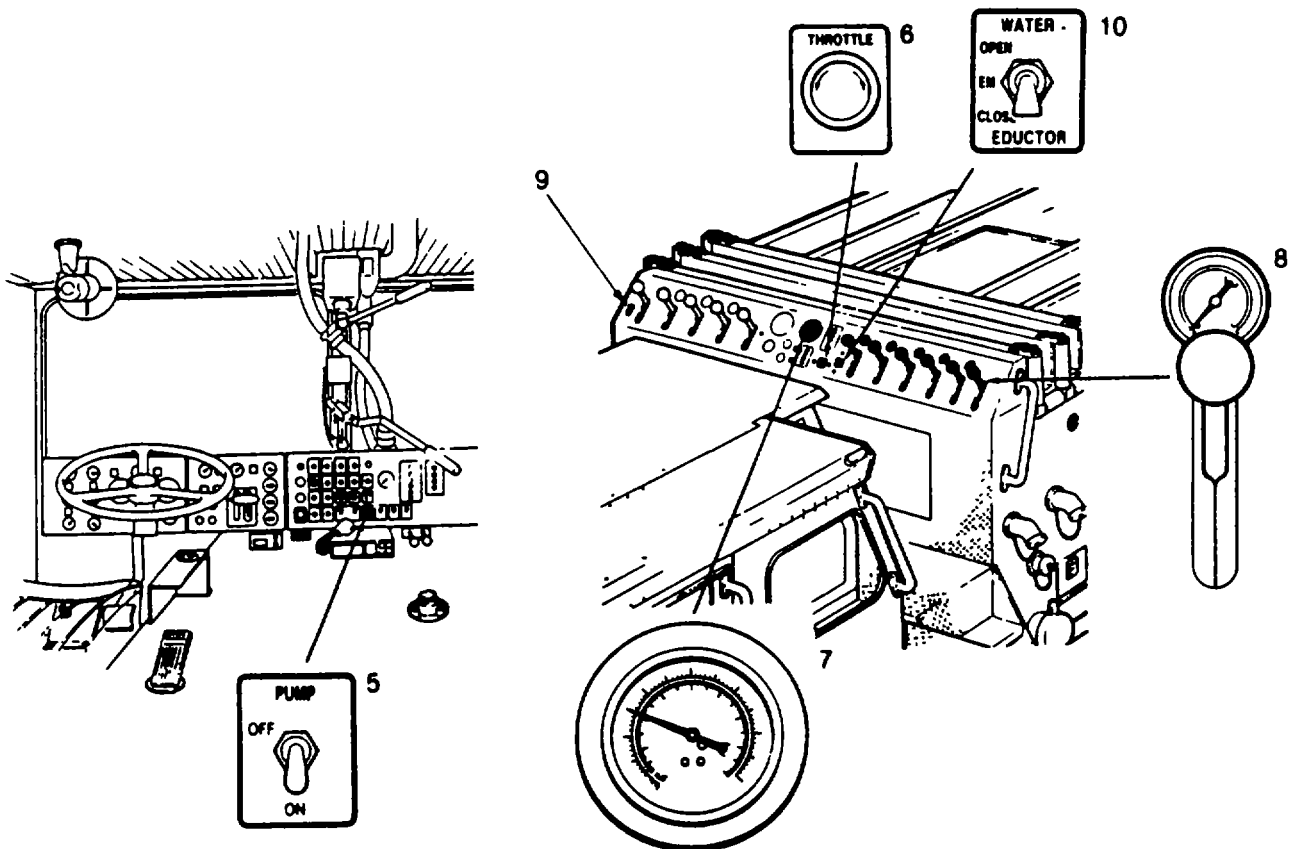
NOTE

Monitor engine coolant temperature. If the temperature exceeds 210 deg. F (99 deg. C), or the alarm sounds, open COOLANT control valve (9) gradually until temperature stabilizes at 200 deg. F (93 deg. C).

NOTE

If foam is required, carry out steps 9 thru 12.

(9) Set the water educator switch (10) to OPEN.



2-11. FIREFIGHTING OPERATIONS-Continued

- (10) Turn the foam metering valve (12) to required foam percentage.
- (11) Set the foam valve switch (13) to OPEN.
- (12) While discharging foam, observe the water and foam tank level gages (14 and 15). Reduce the engine speed to idle before or immediately after the water tank is emptied and shut the pump OFF.

CAUTION

If the engine water temperature exceeds 210 deg. F (100 deg C), open COOLER valve (9) until temperature stabilizes.

NOTE

If the foam tank is emptied, firefighting may be continued using water only. Set the foam valve and water eductor switches to CLOSED and set the foam proportioning valve to 0.

CAUTION

When backing off the throttle bring the engine to an idle, then back the throttle control off an additional three turns. This will prevent the throttle control from interfering with the governor control when in the CFR mode. Failure to adhere to this procedure will cause excessive hydraulic hammering resulting in catastrophic damage to the water delivery system.

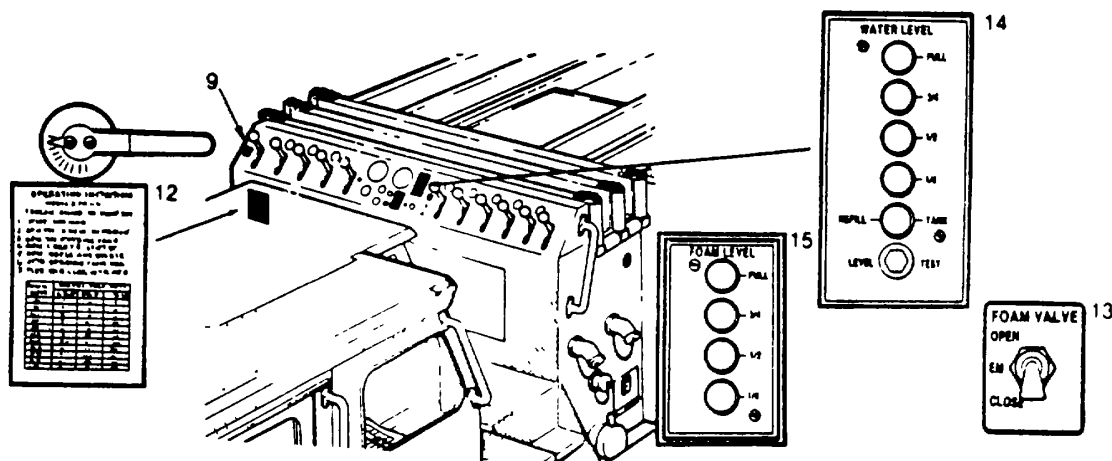
- (13) When the fire is extinguished or the water supply is emptied, throttle the engine back to idle and close all discharge valves.

- (14) Set the pump switch (5) to OFF.

NOTE

If the pump cannot be disengaged with the switch, open the manual pump shutdown valve (16).

- (15) If required, set the water tank valve switch (4) to OFF
- (16) If foam has been used, set the foam valve (13) and water eductor switches (10) to CLOSED and turn the foam metering valve (12) to 0.
- (17) If the hose reel has been used, open the hose nozzle and blow air through the hose to remove residual water. Rewind the hose (see para. 2-5).
- (18) Disconnect and store other hoses as applicable and cap all suction and discharge ports.



2-11. FIREFIGHTING OPERATIONS - Continued

c. Operating 110-Vac Auxiliary Equipment

CAUTION

To prevent damage to the 110-Vac inverter, the inverter must be energized and deenergized and loads connected and disconnected in the sequence detailed in the following steps

(1) Inverter may be operated with the fire pump operating, in this case carry out steps 3 thru 5. If the fire pump is not being operated, carry out, steps 2 thru 5.

(2) Set mode switch (1) to STRUCT in cab Adjust hand throttle (2) on structural control panel until engine is running at a steady 1300 rpm.

(3) Press the ON pushbutton (3) on the control box in the cab, the inverter housing, or the control box located on the structural control panel.

(4) Be sure the inverter (5) voltmeter beside the control switch indicates 110 Vac, then connect the auxiliary equipment to any of the 110-Vac receptacles.

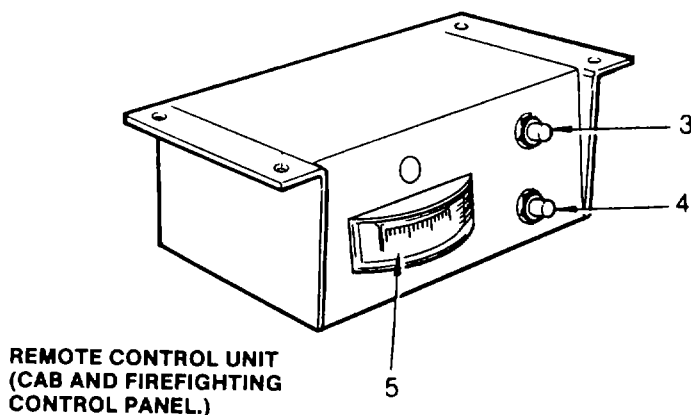
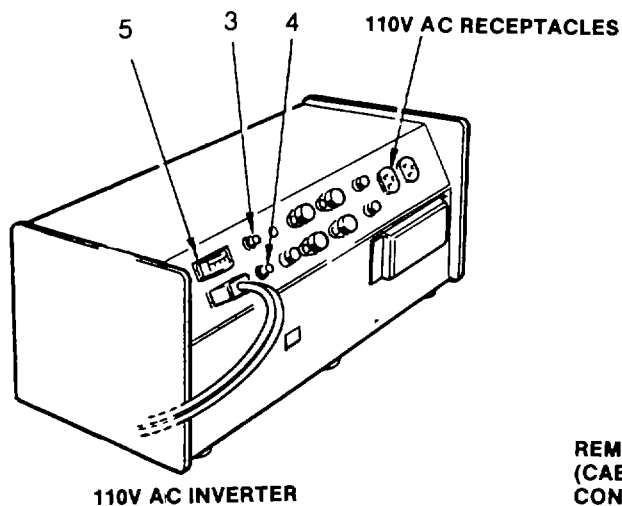
(5) While the auxiliary equipment is operating, monitor and maintain the inverter voltage at 110 Vac. Adjust the engine throttle position, if necessary, to maintain this voltage.

CAUTION

If the fire pump is required to be shut off during 110-Vac system operation, unplug all loads and switch off inverter, shut down pump as detailed in para. 2-11 b preceding, and repeat steps 2 thru 5.

(6) When the use of 110-Vac equipment is no longer required, switch off and unplug the equipment.

(7) Hold OFF pushbutton (4) on any of the 110-Vac controls until voltage indicator reduces to zero. Reduce engine speed to idle by turning throttle (2) fully anticlockwise (unless fire pump is operating).



2-12. OPERATING THE WINTERIZATION SYSTEM

Both the Winterization heater and the APU must be operated to make the system functional.

NOTE

All valves mounted on the engine should be open at all times.

- a. Turn the APU Ignition key switch (1) to RUN.

NOTE

To reduce the load on the starter motor, the engine compression can be released at the initial starting attempt by pulling lever (2).

- b. Momentarily turn the APU switch (1) to START position until the engine fires.

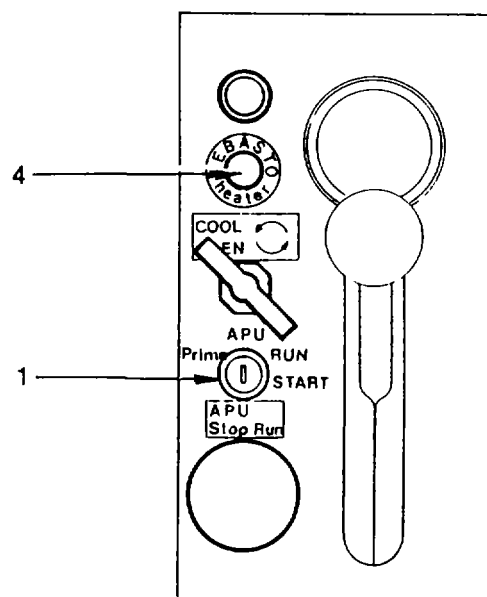
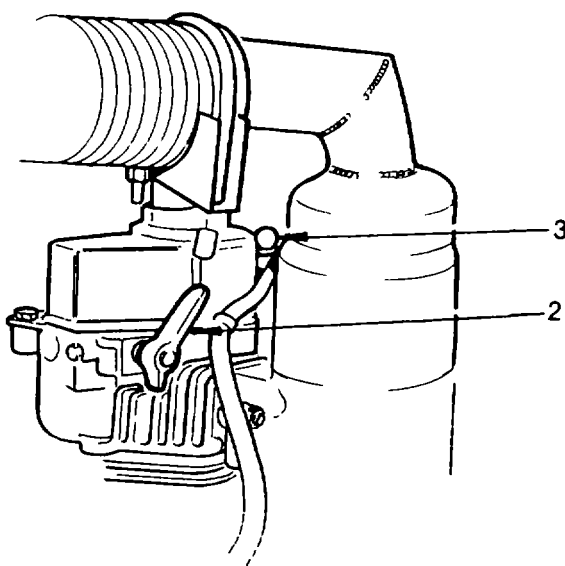
NOTE

If the engine fails to start within 30 seconds, release the switch and allow the starter motor to cool off at least 2 minutes. Prime the APU by turning the ignition key switch (1) to PRIME for about 20 seconds before the next starting attempt.

At low ambient temperatures (below 15 deg F (-10 deg C)) when the air is too cold to promote initial combustion, an ether-type starting aid may be used.

- c. Remove the manifold plug (3) on the engine cylinder head and, using an aerosol, spray directly into the ether port while starting the engine as normal. Confine the spray to 1-2 seconds burst at a time. Replace the plug when the engine starts.

- d. By using a starting rope on the engine pulley, the engine can be started manually. Lift the pulley cover and coil the starting rope on the pulley. Pull the rope to start the engine. Reinstall the pulley cover when the engine has started.



2-12. OPERATING THE WINTERIZATION SYSTEM. - Continued

- e. To start the Winterization Heater, pull the heater switch (4) OUT.

NOTE

The APU should always be running before the winterization heater is switched ON.

- f. Switch the pump body heater and hose reel blower switch (5) to HIGH or LOW to provide circulation of warm air inside the pump body and hose reel compartment.

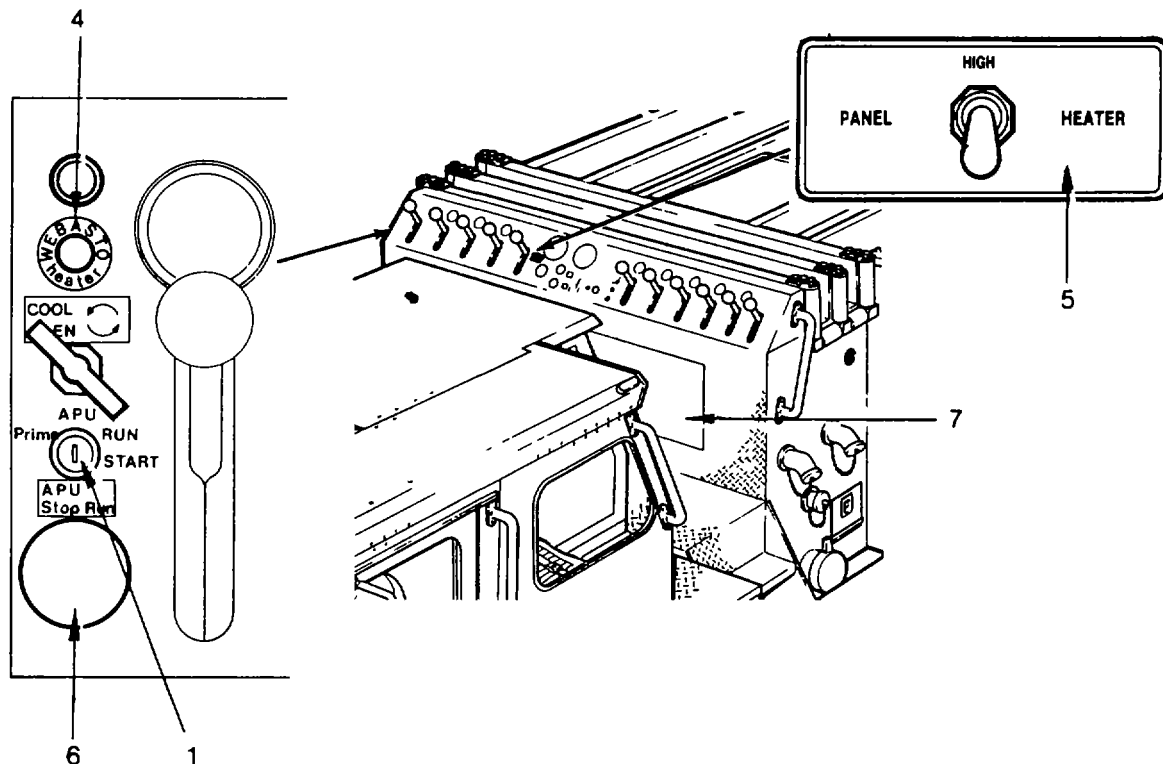
- g. Pull the cab heater control out to allow circulation of coolant through the heater core and set the heater fan switch to HI Set the DEFROST fan switch to HI to ensure circulation of hot air around cab.

- h. To switch the winterization system off, push the winterization heater switch (4) IN.

- j. Wait 3-5 minutes to let the winterization heater cool, then pull the APU stop control (6). Turn the key switch (1) to OFF position.

NOTE

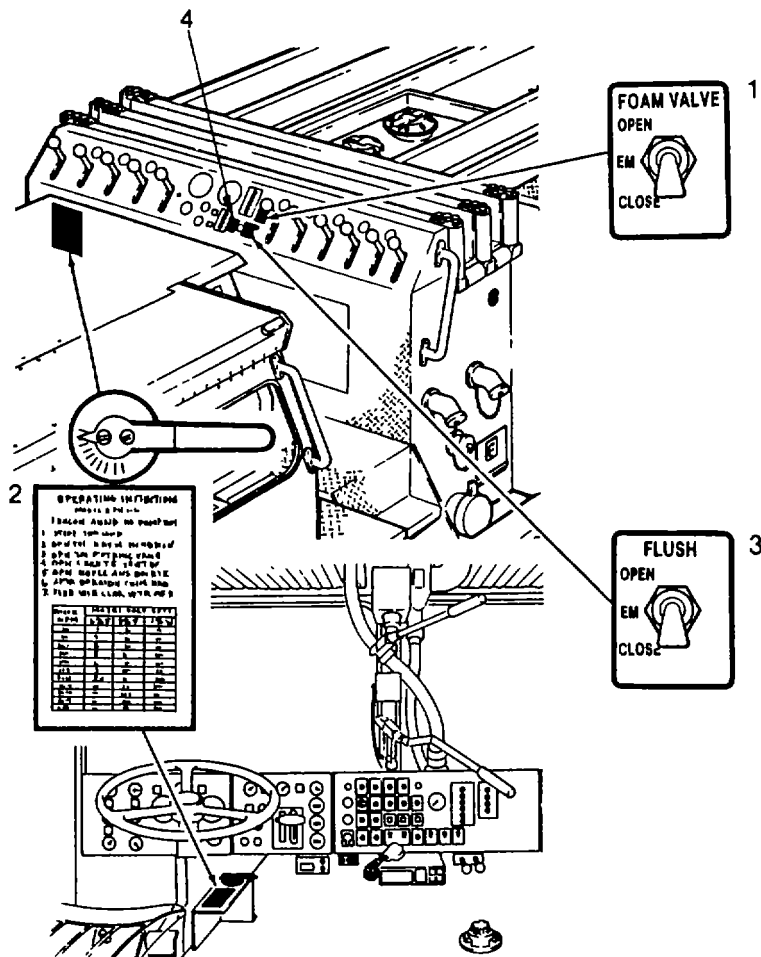
When responding to an emergency, start the main engine and then shut down both the winterization heater and the APU. Continued circulation of coolant through the winterization heater after it is shut down is necessary to cool the heater. If not cooled adequately the thermal breaker may trip and prevent restart until the breaker is manually reset. The reset button is located under the cover on top of the winterization heater. Access to the cover is gained via the pump body door (7).



2-13. AFTER MISSION PROCEDURES.

a. Flushing of Foam Piping and Hoses. After foam has been used, the foam and water pipes including fire hoses and/or turrets must be flushed with clean water. If necessary, drain and fill the water tank as detailed in para. 2-13 b and 2-13 c prior to flushing.

- (1) Be sure the foam tank valve (1) is CLOSED Start the fire pump in structural mode as detailed in para. 2-11b.
- (2) Fully open the foam metering valves (2) in the cab and on the structural panel.
- (3) Set the foam flush valve switch (3) to OPEN and regulate the pump discharge pressure to 150 psi (1030 kPa) using throttle (4).
- (4) Open discharge valves and hose nozzles including the hose reel and turret nozzles in turn until clean water discharges from each nozzle.
- (5) Shut down the firefighting system as detailed in para. 2-11 b steps 13 thru 18.



2-13. AFTER MISSION PROCEDURES. - Continued

NOTE

Steps 6 through 10 are performed only if temperature is less than 32° F (0° C).

- (6) Open hose reel nozzle and hose blow out control (No. 7). Blow out residual water from hose reel.
- (7) Close blow out control (7).

NOTE

Hose does not need to be unwound to drain.

- (8) Open hose reel drain valve and drain hose.
- (9) Dram residual water from the bumper turret piping valve (No. 8) and fire pump valve (No. 6).
- (10) Remove one of the 6 inch suction port caps and open all discharge and suction valves.

NOTE

If the foam tank does not need to be drained, do not open the foam tank valve or foam tank drain valve.

- (11) Open all induction system valves. Allow all residual water to drain.
- (12) Install all fire hose and hose nozzles in storage position on the truck. Close all valves and install all caps.

b. Draining Water and Foam Tanks

- (1) To drain the water tank, pull out the drain valve lever (10) on the left side of the truck. Water may be drained directly onto the ground.

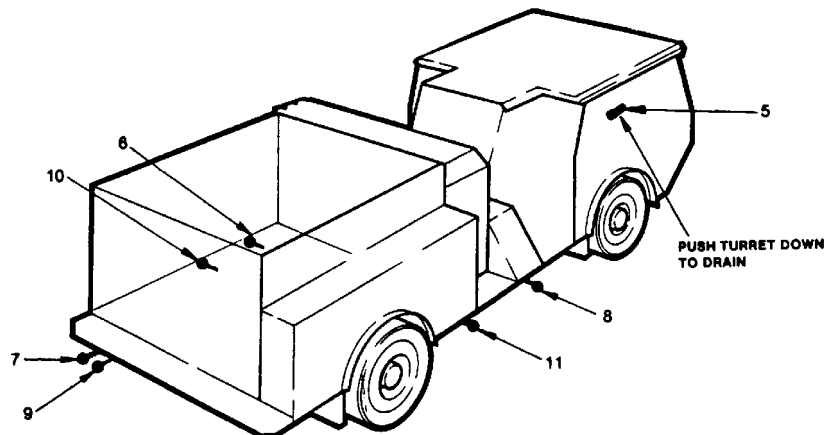
NOTE

Be sure the drain valve is closed, lever pushed in, after draining.

- (2) To dram the foam tank, pull out the foam tank drain valve lever (11) on the right side of the truck. Collect the foam concentrate in clean containers and retain it for subsequent use.

NOTE

Be sure the drain valve is closed, lever pushed in, after draining.



2-13. AFTER MISSION PROCEDURES. - Continued

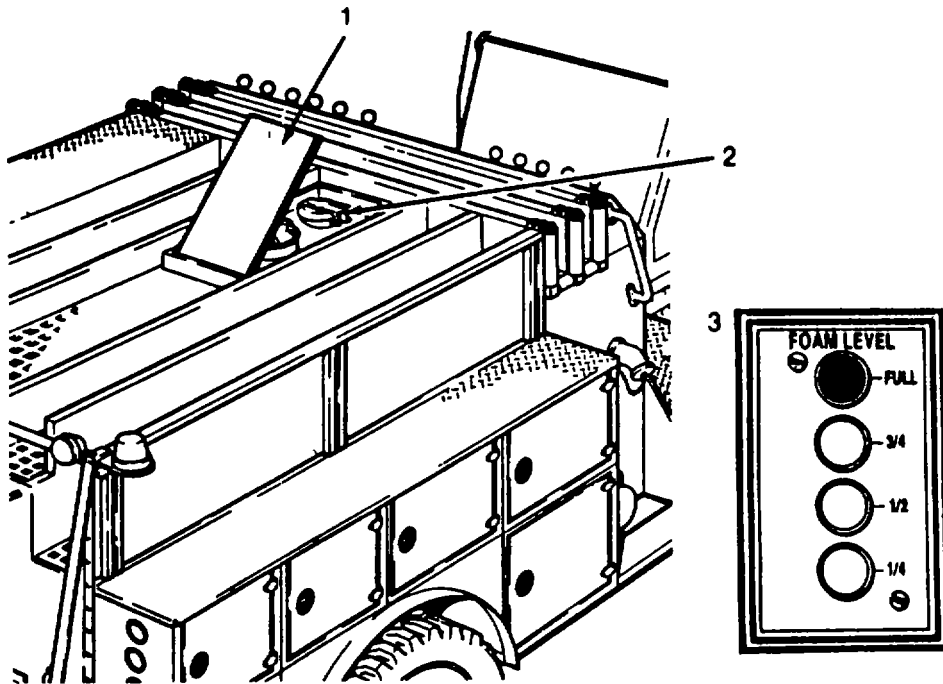
c. Filling the Foam Tank

- (1) Open the tank fill access cover (1).
- (2) Open the foam tank cover (2) and pour foam concentrate into the tank via the installed foam funnel.
- (3) Monitor the foam level gage (3) and stop filling when the gage shows FULL.

NOTE

The truck ignition switch must be ON for the indicator to work. Stop filling when the full indicator illuminates. Any additional fluid will be lost through the tank overflow.

- (4) Close the tank cover (21).
- (5) Close the tank fill access cover (1).



2-13. AFTER MISSION PROCEDURES. - Continued

d. Filling the Water Tank

- (1) Open the tank fill access cover and water tank cover (1 and 4) or remove the tank rear fill valve cap (6).
- (2) If the tank is filled through the top opening, any pressurized water supply can be used.

NOTE

The tank can be filled only 3/4 full via the tank rear fill valve.

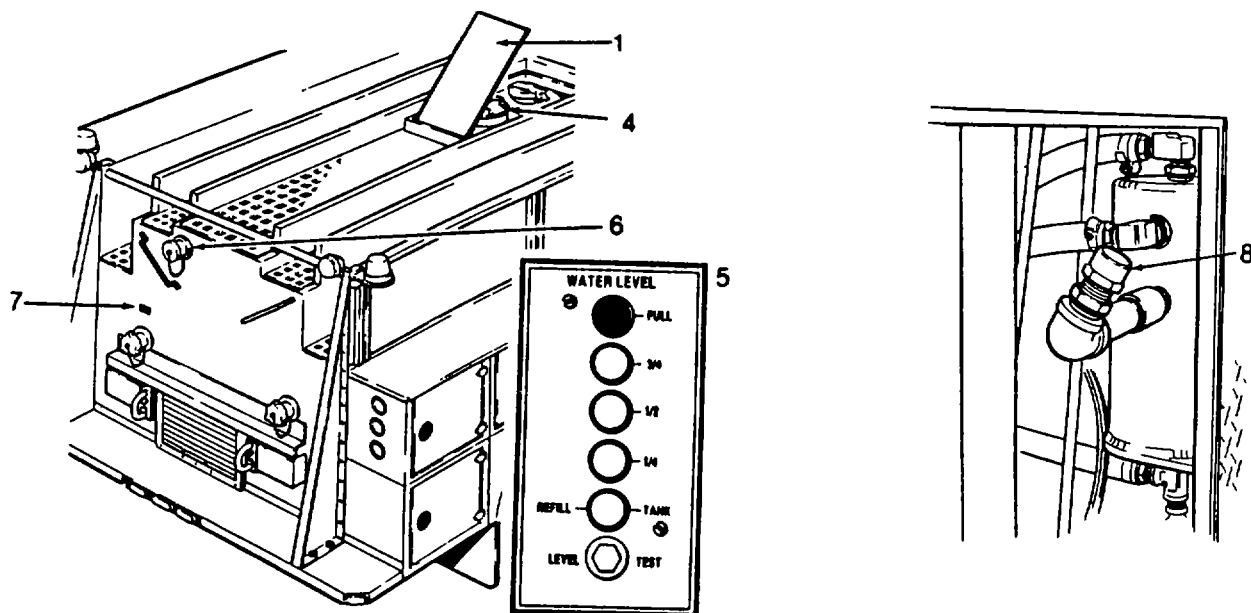
- (3) If the tank is filled via the fill valve, a 2 1/2 in. hose must be connected between the port and the supply source. The truck ignition switch must be set to ON and the tank rear fill valve switch (7) set to ON.
- (4) Monitor the water level gage (5) and stop when the gage shows FULL or the tank rear fill valve closes. The truck ignition must be ON or the level test button depressed for the indicator to work.
- (5) Remove fill hose. Close the tank and access cover (1 and 4) or install the tank rear fill valve cap (6)

NOTE

The tank can also be filled via the suction manifold if the fire pump is running and the tank fill valve is open if from draft, use the 5 in. suction ports. If from pressure supply (eg; hydrant) use the left side, right side, or rear 2 1/2 in. suction ports.

e. Filling the Fire Pump Priming Tank

Check the level of fluid in the priming tank. Remove fill cap (8) and add a 50/50 solution of antifreeze (Item 2, Appendix E) and water until fluid spills from the vent port. Replace the fill cap.



Section IV. OPERATION UNDER UNUSUAL CONDITIONS.**2-14. OPERATION IN EXTREME COLD.****WARNING**

Doors and access panels may freeze shut and walking surfaces become slippery and hazardous from formation of ice in freezing weather. Be sure that all ice is removed as quickly as possible.

- a. No special procedures other than the use of the winterization system are required for operation in cold climates. The winterization system should always be used whenever the truck is on standby where the ambient temperature is below 32°F (0°C).
- b. After firefighting, remember to drain residual water from all piping as detailed in para. 2-13.

NOTE

If the truck cannot build up air pressure to operate the air operated valves, air can be injected into the system using the shop connection air valve mounted on the left side of the truck between the pump body steps.

- c. If the truck is not operated and ambient temperature is below 32°F (0°C), perform steps 1 and 2 paragraph 2-13b; then steps 6 through 12, paragraph 2-13d.
- d. Be sure that all PMCS procedures and lubrication recommendations to maintain the vehicle operational in cold weather are followed.

2-15. OPERATING IN EXTREME HEAT.

- a. When operating in a very hot environment, pay extra attention to the engine and transmission temperature and oil pressure gages. Use auxiliary coolant heat exchanger when pumping in the structural mode.
- b. Be sure that lubricant and coolant recommendations for operation under extreme heat conditions are followed.

2-16. OPERATION IN AREAS WITH SALT AIR AND MIST.

- a. In areas where salt air and sea spray are common, measures must be taken to protect the vehicle from corrosion. Use wax and/or other surface protection agents frequently on painted and chrome plated surfaces. Coat all other exposed metallic surfaces with protective oil as necessary.
- b. If salt water is used for firefighting, the firefighting system, including all hoses used, should be flushed with potable water on return to base.

NOTE

The pump is designed for use with fresh water. Therefore, if salt water is used, the pump must be flushed with fresh water to prevent corrosion of pump components.

2-17. OPERATION IN SNOW.

- a. Operating in areas with heavy snow fall can cause problems unless walkways, hose beds and control equipment are continuously cleared of snow. If not cleared frequently, the equipment including exposed controls may become difficult to operate.
- b. When driving through deep snow or snow banks use the four-wheel-drive and engage the differential locks.

2-18. OPERATION IN MUDDY AND SWAMPY AREAS.

a. When traveling off-road in rough terrain, water holes, ditches, creeks, and swampy areas may be negotiated. This will cause a build-up of dirt and debris on the vehicle. Be sure to thoroughly clean the truck immediately after the mission

b Engage four-wheel-drive and engage the differential locks to maintain traction before negotiating rough terrain.

2-19. OPERATION IN DUST PRONE AREAS.

In areas where dust and sand storms are frequent, extra attention must be paid to lubrication and maintenance of the vehicle. This includes checking or replacing filters and cleaning inside the engine compartment and pump body. Removal of gritty dust from components such as valves and control lever linkages and other moving parts is essential. Unless removed, fine dust may cause excessive component wear.

2-20. OPERATION AT HIGH ALTITUDES.

Normally operation at higher altitudes will cause loss of engine power, however, since the truck is equipped with a turbocharged engine, this loss will not be appreciable.

2-63/(2-64 Blank)

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

Refer to lube order instructions LO 5-4210-220-12 for lubrication details.

Section II. OPERATOR TROUBLESHOOTING PROCEDURES

3-1. GENERAL.

Troubleshooting at the operator level requires you to locate any trouble as quickly as possible. Once the trouble is located, perform the corrective action required.

If the malfunction is not listed or is not corrected by your actions, notify your supervisor.

3-2. SYMPTOM INDEX.

Refer to table 3-1, OPERATOR TROUBLESHOOTING under the number against the system in this index to determine the test and corrective action required.

APU	
FAILS TO CRANK	1a
CRANKS BUT WILL NOT START	1b
RUNNING UNEVEN AND STALLS FREQUENTLY	1c
FIRE PUMP	
WON'T PRIME	2a
WON'T ENGAGE	2b
VALVES	
FAILS TO OPERATE	3a
LEAKING	3b
WATER PIPING	
WON'T DRAIN	4
DISCHARGE HOSE	
WON'T DEPRESSURIZE	5
FOAM DISCHARGE	
NO DISCHARGE	6a
EXCESS FOAM	6b
TURRET	
WON'T DISCHARGE	7
WATER TANK	
FOAM ENTERING	8
FOAM TANK	
WATER ENTERING	9

3-2. SYMPTOM INDEX - Continued

WINTERIZATION HEATER

NOT HEATING 10a
 NOT RESTARTING AUTOMATICALLY 10b

AIR SYSTEM

ALARM 11

LIGHTS

FAIL TO OPERATE 12

MOTORS

FAIL TO OPERATE 13

STEERING

HARD 14a
 ERRATIC 14b

TRANSMISSION

OVERHEATING 15

ENGINE

WON'T CRANK 16a
 WON'T START 16b
 DIFFICULTY IN STARTING 16c
 STOPS 16d
 RUNS UNEVENLY 16e
 WON'T REACH OPERATING TEMPERATURE 16f
 OVERHEATS 16g
 THROTTLE INOPERATIVE 16h
 EXCESSIVE BLACK OR GREY SMOKE 16j

TIRES

EXCESSIVE WEAR 17

BRAKES

BURNING 18a
 GRAB 18b
 SLOW TO OPERATE 18c
 SQUEAL 18d

PARKING BRAKE

WON'T RELEASE 19

Table 3-1. OPERATOR TROUBLESHOOTING.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1a	APU FAILS TO CRANK	<p>Step 1. Battery switch in cab set to OFF.</p> <p style="padding-left: 40px;">Set battery switch to BOTH.</p> <p>Step 2. Batteries low on charge.</p> <p style="padding-left: 40px;">Start engine manually, (see para. 2-12).</p>
1b	APU CRANKS BUT WILL NOT START	<p>Step 1. Fuel tank empty.</p> <p style="padding-left: 40px;">Refuel vehicle.</p> <p>Step 2. Intake air too cold to enable initial combustion.</p> <p style="padding-left: 40px;">Use ether-type starting aid, (see para. 2-12).</p>
1c	APU RUNNING UNEVEN AND STALLS FREQUENTLY	<p>Step 1. Fuel tank empty.</p> <p style="padding-left: 40px;">Refuel vehicle.</p> <p>Step 2. Truck batteries low on charge making alternator hard to drive.</p> <p style="padding-left: 40px;">a. Start main engine, then APU.</p> <p style="padding-left: 40px;">b. If main engine won't start, refer to Organizational Maintenance.</p>

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2a FIRE PUMP WILL NOT PRIME

Step 1. Check all discharge valves are closed.

Close all discharge valves.

Step 2. Check all suction caps fitted to suction ports not being used.

Replace all suction caps.

Step 3. Check fluid level in priming reservoir.

Refill with 50/50% of antifreeze and water as detailed in para. 2-13 e.

Step 4. Check suction hose screen (If pumping from draft) is below water level.

Push screen well below surface.

Step 5. Check condition of suction hose and connection (if pumping from draft).

Tighten connections or replace hose as required.

Step 6. Check tank valve open, if pumping from tank.

Open tank valve.

Step 7. Check water in tank, if pumping from tank.

Refill tank as required.

2b FIRE PUMP WILL NOT ENGAGE

Step 1. Check correct switching sequence has been carried out.

Carry out correct switching sequence, (see para. 2-11).

Step 2. Manual PTO shutoff valve open.

Close valve (on left hand side of pump body).

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3a AIR OPERATED VALVE FAILS TO OPEN OR CLOSE

Step 1. Check correct switching sequence.

Carry out correct switching sequence, (see para. 2-11).

Step 2. Check air leaking from switch or valve connections.

Tighten connection.

3b VALVES LEAKING WATER/AGENT

Valves not closed.

Close valve.

4 WATER/AGENT REMAINS IN PIPING AFTER DRAIN OPENED

Check drain valve outlet.

Clean dirt/blockage from drain hole.

5 DISCHARGE HOSE WON'T DEPRESSURIZE

Check drain valve.

Clean dirt/blockage from drain hole.

6a NO FOAM DISCHARGE AT ANY NOZZLE

Step 1. Check if foam valve set to OPEN.

Set foam valve to OPEN.

Step 2. Check if foam proportioning valve (in cab or on structural panel) closed.

Set foam proportioning valve to required percentage, (see para. 2-11).

Step 3. Check if foam tank empty or content diluted.

Drain tank and/or refill tank as required.

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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6b EXCESS FOAM FROM TURRET OR NOZZLE

More than one foam proportioning valve open.

Close foam proportioning valve on unmanned station.

7 ROOF OR BUMPER TURRET WILL NOT DISCHARGE

Step 1. Check manual valve in cab roof is open.

Open manual valve.

Step 2. Check pump ON lamp is lit.

Carry out correct operating procedure to start pump, (see para. 2-11).

8 FOAM ENTERING WATER TANK

Check water tank valve is closed.

Close valve.

9 WATER ENTERING FOAM TANK

Check foam tank valve is closed.

Close valve.

10a WINTERIZATION HEATER NOT HEATING

Step 1. Check if heater switched ON.

Set heater switch to ON, check indicator illuminates.

Step 2. Check battery switch in cab set to 1, 2, or BOTH.

Set battery switch to 1, 2, or BOTH.

Step 3. Heater thermal breaker tripped by overheating.

Reset thermal breaker, (see para. 2-12).

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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10b WINTERIZATION HEATER FAILS TO RESTART AUTOMATICALLY

Step 1. Check if heater thermal breaker tripped.

Reset thermal breaker Restart winterization heater, (see para. 2-12).

Step 2. Check winterization system shutoff valves on engine are open.

Open shutoff valves and reset heater thermal breaker.

Restart heater, (see para. 2-12).

11 AIR SYSTEM IN ALARM

Step 1. Check all reservoir valves are closed.

Close drain valves.

Step 2. Check engine has been running for at least 5 minutes.

Check pressure after 5 minutes

Step 3. Brakes operated many times.

Allow pressure to recover before proceeding.

12 ANY LIGHT FAILS TO OPERATE

Step 1. Check switch is ON.

Set switch to ON.

Step 2. Check engine starter operates.

Some lights require ignition ON, others require battery switch only ON.
Check operating instructions.

13 ANY MOTOR FAILS TO OPERATE

Step 1. Check switch is ON.

Set switch to ON.

Step 2. Check engine starter operates.

Some motors require ignition ON, others require only battery switch ON.
Check operating instructions.

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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14a WHEEL STEERING HARD IN ONE OR BOTH DIRECTIONS

Check tire pressures.

Inflate tires to correct pressure, 70 psi (480 kPa).

14b ERRATIC STEERING OR NO STEERING AT ALL

Check steering pump drive belt tension.

Refer to Organizational Maintenance.

15 TRANSMISSION OVERHEATING

Step 1. Check if low oil level.

Refer to Organizational Maintenance.

Step 2. Check engine coolant level.

Add coolant as required.

Step 3. Check if gear range selected too high.

Select lower gear

16a STARTER WILL NOT CRANK MAIN ENGINE

Step 1. Check battery switch set to BOTH.

Set battery switch to BOTH.

Step 2. Check ignition switch ON.

Set ignition switch to ON.

16b ENGINE CRANKS BUT WILL NOT START

Step 1. Check fuel gage.

Fill fuel tank as required.

Step 2. Prime fuel system.

Push prime switch for 10-20 seconds.

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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16c ENGINE IS DIFFICULT TO START

Step 1. Check battery switch set to BOTH.

Set battery switch to BOTH.

Step 2. Check air temperature.

Engine will be sluggish if cold.

Step 3. Check battery indicators are green.

If not green, allow engine to boost batteries before switching off engine.

Step 4. Check fuel grade.

Drain and refill tank with correct fuel.

Step 5. Water in fuel.

Check water separator and drain as required.

16d ENGINE STARTS THEN STOPS

Step 1. Check fuel level.

Fill tank as required.

Step 2. Check fuel grade.

Drain fuel tank and refill with correct fuel.

Step 3. Check fuel lines for crimping or leaks.

Refer to Organizational Level for repair.

16e ENGINE RUNS UNEVENLY OR STALLS FREQUENTLY

Step 1. Check coolant temperature.

Allow engine to reach normal operating temperature.

Step 2. Check fuel level.

Refill fuel tank.

Step 3. Check fuel grade.

Drain fuel tank and refill with correct clean fuel.

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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16f ENGINE WILL NOT REACH WORKING TEMPERATURE

Step 1. Check auxiliary engine cooler is closed off.

Close cooler control valve.

Step 2. Check shutter/fan are in AUTO.

Set to AUTO.

16g ENGINE IS OVERHEATING

Step 1. Check if truck is pumping in structural mode.

Open auxiliary engine cooler control valve to reduce engine coolant temperature.

Step 2. Check if shutters are open.

Set SHUTTER/FAN CONTROL to MANUAL in cab.

Check shutters open (fan will engage also).

Step 3. Check engine coolant level in radiator.

Add coolant if level is low.

NOTE

If on a mission and a leak occurs in the winterization circuit, close all valves on right hand side of engine to isolate leak from engine. If engine coolant is continually lost, refer to Organizational Level for repair.

Step 4. Check for debris in front of radiator.

Remove debris.

16h ENGINE FOOT THROTTLE WILL NOT OPERATE

Step 1. Check air pressure is normal.

Wait until secondary air pressure is out of alarm.

Step 2. Check if fire system selected to CFR and pump engaged.

Use brakes to control truck speed.

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

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

16j EXHAUST - EXCESSIVE BLACK OR GREY SMOKE

Step 1. Check fuel grade.

Drain fuel tank and refill with correct fuel.

Step 2. Check if engine is overloaded.

Reduce speed and select lower gear range.

17 EXCESSIVE TIRE WEAR

Step 1. Insufficient tire inflation.

Inflate to correct pressure 70 psi (480 kPa).

Step 2. Prolonged driving with differential locks engaged.

Be sure differential locks are engaged only when on slippery ground or operating off-road.

18a BRAKE SHOES SMELL OF BURNING

Step 1. Truck brakes applied for long period, or harshly due to hill descend, or emergency stop.

a. Change to lower gear range.

b. Avoid harsh braking by careful driving.

Step 2. Check if brake drums have foreign material inside, e.g. sand or mud.

Hose down brake drums when cool to touch. Be sure all material is removed.

18b BRAKES GRAB OR TRUCK PULLS TO ONE SIDE

Step 1. Ride brakes for 100 yards to check if there is water in the hubs.

This will dry shoes and drums.

Step 2. Check linings are clean.

Refer to Organizational Level if covered in oil or grease.

Step 3. Check tire pressures.

Inflate tires to correct pressure, 70 psi (480 kPa).

Table 3-1. OPERATOR TROUBLESHOOTING - Continued

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

18c BRAKES OPERATE SLOWLY OR ERRATICALLY

Step 1. Check air system pressures.

- a. Allow air system to recharge.
- b. Check air lines for leaks.
- c. Check quick release, relay, and spring brake valves for leaks.
- d. Check foot treadle valve for leaks.

Step 2. Check tire pressure.

Inflate tires to correct pressure, 70 psi (480 kPa).

Step 3. Ride brakes for 100 yards to check whether there is water in the hubs.

This will dry the shoes and drums.

19 PARKING BRAKES WILL NOT RELEASE

Secondary air pressure is low.

Release parking brakes by pushing emergency release button and holding in until secondary air reaches 65 psi (450 kPa).

CHAPTER 4

UNIT MAINTENANCE

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

4-1. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

Nomenclature	National/NATO Stock Number
Tool Kit, General Mechanic, Automotive	5180-00-177-7033
Tool Kit, Master Mechanic	5180-00-699-5273
Shop Equipment, Automotive Maintenance and Repair	4910-00-754-0650
Shop Equipment, General Purpose Repair	4940-00-287-4894
Shop Equipment, Automotive Maintenance and Repair	4910-00-754-0705

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

For special tools and support equipment for repair at the Unit level of maintenance, refer to TM 5-4210-220-20P. Individual equipment requirements are covered in the specific equipment maintenance tasks.

4-3. REPAIR PARTS.

Repair parts for this equipment are listed in TM 5-4210-220-20P, Repair Parts and Special Tools List (RPSTL), covering Unit Maintenance for this equipment.

Section II. SERVICE UPON RECEIPT**4-4. INTRODUCTION.**

This paragraph provides instructions for preparing a new, reconditioned, or recently transported truck for operation.

CAUTION

Due to the critical nature of the service for which this vehicle is intended, no vehicle should be placed in service if there is any doubt or evidence of improper function of any of the components or systems.

a. Pump Body, Hose Body

(1) Inspect body for shipping damage; minor damage (e.g. scratches, small dents) should not effect truck function. Major damage should be repaired prior to use and all items adjacent to the damage should be thoroughly checked for correct operation.

(2) Check all doors, latches, and hinges operate correctly, replace any which are defective.

(3) Check all glass screens and windows for cracks and proper seating within weather stripping, replace or repair as required.

(4) Check all lamps and beacons for dirty or broken lenses. Clean or replace as required.

(5) Check seats and belts are properly installed and are adjustable. Replace seats if fabric is damaged or seat is not adjustable. Replace seat belt if belt fabric is damaged (cuts or abrasions greater than 1/4 in long) (6 mm), or belt is not adjustable, or fastener is broken.

b. Cab

(1) Inspect cab body for shipping damage as per a (1) preceding.

(2) Check all doors, latches, and hinges operate correctly, replace any which are defective.

(3) Check all glass screens and windows for cracks and proper seating within weather stripping, replace or repair as required.

(4) Check all lamps and beacons for dirty or broken lenses. Clean or replace as required.

(5) Check seats and belts are properly installed and are adjustable. Replace seats if fabric is damaged or seat is not adjustable. Replace seat belt if belt fabric is damaged (cuts or abrasions greater than 1/4 in. (6 mm) long), or belt is not adjustable, or fastener is broken.

(6) Check level of solvent in windshield washer reservoirs. Refill as required.

(7) Check that all switches and controls are set to OFF or in NEUTRAL, see Chapter 2.

4-4. INTRODUCTION - Continued**c. Chassis, Axle, Wheels**

- (1) Check tire pressure 70 psi (480 kPa) Inflate as required.
- (2) Inspect each tire for serious cuts, separated tread, or lumps. Remove all foreign objects lodged in tread.
- (3) Check axle vents to ensure freedom from obstruction.
- (4) Check lubricant level in front and rear differentials. Add oil as required. Check for any leaks.
- (5) Check front and rear suspension for loose bolts, broken springs or damaged parts. Replace as required.
- (6) Check all wheel mounting nuts for proper torque, 450 ft lb (730 Nm) (dry).
- (7) Check steering reservoir for proper fluid level.
- (8) Examine steering linkages and steering gear for shipping damage.

d. Fuel System

- (1) Check fuel tank level and fill as necessary.
- (2) Drain sediment from water/fuel separator.
- (3) Inspect fuel line connections for evidence of leakage. Tighten or remake joints, as required.

e. Engine

- (1) Remove any seals, plugs, or tape used to seal any air inlets and ports during shipping.
- (2) Check crankcase oil level and inspect oil on dipstick for cleanliness. Take an oil sample for analysis. Top up, or drain and refill the crankcase as required.
- (3) Inspect engine and all piping connections for evidence of leakage. Repair as required.
- (4) Check tension of fan, alternator and power steering drive belts. Belts should be tight enough to allow 1/2 in. (12 mm) deflection midway between the pulleys. Adjust as required.

f. Cooling System

- (1) Clear away any debris blocking air flow to radiator.
- (2) Check level of coolant in radiator, not more than 3 in. (80 mm) air space between coolant and top of radiator.
- (3) Sample the coolant and ensure there is sufficient antifreeze for the environment in which the truck is to be operated.
- (4) Check all cooling system hoses for evidence of leakage. Refit or tighten connections as required.

4-4. INTRODUCTION - Continued**g. Transmission**

- (1) Check transmission oil level. Take an oil sample for analysis. Top up, or drain and refill as required.
- (2) Check all external hydraulic lines for evidence of leakage. Tighten or replace all defective fittings.

h. Fire Pump

- (1) Check pump oil level. Take an oil sample for analysis. Top up, or drain and refill the pump casing as required.
- (2) Check the pump primer gear is riding in drive pulley.
- (3) Drain water and foam tanks. Inspect interior of both tanks for foreign objects.
- (4) Close all drains.
- (5) Fill water, foam, and priming tank via top mount fills. Check there are no leaks.
- (6) Check reduction gear box oil level. Take an oil sample for analysis. Top up, or drain and refill as required.
- (7) Check all external suction and discharge connection caps are in place and secure. (Three on right hand side of truck, four on left hand side and two at rear of truck).
- (8) Reel out both cross lay hoses, and hose reel fully and inspect for damage and correct installation. Reel up all hoses.

j. Electrical System

- (1) Check engine, starter motor, and instrumentation wiring for proper connections and condition of wiring insulation. Pay particular attention to the wiring harnesses as they pass through bulkheads or holes in the frame. Ensure all rubber grommets are in place.
- (2) Check battery compartment and battery connection. Clean away any corrosion, neutralizing the acid with baking soda solution. Paint any bare or rusty steel. Coat all battery connections with a petroleum jelly (Item 21, Appendix E). Check tightness of battery connections.

k. Auxiliary Power Unit

- (1) Inspect auxiliary power unit, removing any seals plugs or tape used to seal air inlets and ports during shipping.
- (2) Check crankcase oil level and inspect oil on dipstick for cleanliness. Take an oil sample for analysis. Top up, or drain and refill the crankcase as required.
- (3) Examine air cleaner element for dirty or restricted condition. Replace as required.
- (4) Inspect engine and all piping connections for evidence of leakage. Repair as required.
- (5) Check tension of all belt drives. Belts should be tight enough to allow 1/2 in. (12 mm) deflection midway between the pulleys.

4-4. INTRODUCTION - Continued**k. Auxiliary Power Unit Continued**

- (6) Inspect fuel line connections for evidence of leakage. Tighten, or remake joints as required.

m. Auxiliary Power Unit Test

- (1) Start auxiliary power unit (Refer to para. 2-12). (If unit falls to start due to discharged main batteries, start manually).
- (2) Start winterization system and check operation of the circulating pump, compartment heaters and winterization heater.
- (3) Allow to run for 20 minutes and then stop winterization heater.
- (4) Check for any leaks in the winterization system and repair as required. Stop APU when inspection complete.

n. Main Engine Test

- (1) Start main engine (Refer to para. 2-10).
- (2) When engine is running, check.
- oil pressure builds up to at least 20 psi (140 kPa), warning lamp extinguishes.
 - air pressure warning lamps extinguish (primary and secondary).
 - engine air filter gage remains in safety zone.
 - engine water temperature warning lamp extinguishes.
 - battery voltage and current (amps) remain in safety zone.
 - transmission oil temperature lamp extinguishes.
- (3) Check operation of all lamps, beacons.
- tall park and head lights (high beam and low beam)
 - marker lights
 - spotlights
 - panel lights
 - dome lights
 - rear beacon lights
 - compartment lights
 - hose pick-up lights
 - engine compartment lights
 - dash lights

Replace any lamps that have failed.

- (4) Check operation of rear buzzer, main siren, and PA system.
- (5) Check operation of radiator shutter manual override. When engine is not running, shutter is closed. When engine is started, shutter closes and fan freewheels. When engine warms up, fan lock ups and shutter opens automatically.
- (6) Allow engine to warm up to 170-195 deg. F (75-90 deg. C).

4-4. INTRODUCTION - Continued**n. Main Engine Test Continued**

- panel.
- (7) Set Mode switch in cab to STRUCTURAL. Adjust engine speed to 1200 rpm via throttle on the structural panel.
 - (8) Check receptacles on both sides of hose body (110V, 60 Hz) and lower engine speed to low idle.
 - (9) Visually inspect engine and transmission for signs of leakage (coolant, fuel, or oil).
 - (10) Open drain valves on all air reservoirs and drain all condensate.

p. Truck Test

- (1) Set transmission shift to "1", release parking brake and drive vehicle at low speed, checking operation of brakes, steering, and throttle.
- (2) Check operation of 4-wheel drive and differential lock selectors.
- (3) Check operation of all transmission gear ranges.

q. Fire Pump and Turret Test

- (1) Set mode switch to CFR.
- (2) Engage transmission in range 2.
- (3) Start fire pump and check pump discharge pressure exceeds 250 psi. Refer to para. 2-11.
- (4) Check operation of bumper turret in the stationary, and pump-and-role-mode. (Ten second bursts are sufficient) Maximum truck speed is 30 mph (50 kph).
- (5) Check operation of roof turret in the stationary, and pump-and-role-mode. (Ten second bursts are sufficient). Maximum truck speed is 30 mph.
- (6) Repeat 5 and 6 with foam by setting tank valve open and foam control valve to a setting between 0 and 9.
- (7) Leave engine running, but vehicle stationary and parking brake applied.
- (8) Flush the foaming system (Refer to para. 2-13).

r. Structural Firefighting Test

- (1) Set Mode switch to Structural.
- (2) Control discharge pressure of pump using hand throttle on the Structural Control Panel. Refer to para. 2-11.
- (3) Check operation of both cross-lay hoses and hose reel.
- (4) Check operation of all structural hoses and other fire equipment .

4-4. INTRODUCTION - Continued**r. Structural Firefighting Test Continued**

- (5) Connect rear or side suction to a hydrant.
- (6) With pump running, open hydrant valve and tank fill valve and check tank fills.
- (7) Ensure that with two cross-lay hoses operational and roof turret operating, that pump maintains level of tank at greater than 75%.
- (8) Close all hose and turret valves and refill tank to 100%. Close tank fill valve.
- (9) Disengage pump and remove suction hose from truck and hydrant.
- (10) Replace all hoses in their storage position.

s. Vehicle Standby

- (1) Allow main engine to run for 2 minutes in neutral after coming to rest and applying parking brake.
- (2) Switch off engine and all lights.
- (3) Top up fuel tank.
- (4) Top up foam tank.
- (5) Vehicle is now on standby and may be used in the event of an emergency.
- (6) If air temperature is ever less than 32 deg. F (0 deg. C), set up winterization system as detailed in para. 2-

12.

Section III. UNIT PMCS**4-5. GENERAL.**

a The purpose of scheduled preventive maintenance checks and services (PMCS) is to prevent trouble, reduce down time, and ensure that the fire truck is ready for operation at all times.

b Records and reports of preventive maintenance checks and services must be made in accordance with requirements set forth in DA PAM 738-750. The Army Maintenance Management System (TAMMS). Use the PMCS Table item No. column to get the number of the TM ITEM NO. column of DA Form 2404, Equipment Inspection and Maintenance Worksheet.

c Explanation Of Table

(1) Item Number Column. The Item No column of the PMCS table is used to get the number for the TM ITEM NO column of DA FORM 2404 (Equipment Inspection and Maintenance Worksheet).

(2) Interval Column. The interval column of the PMCS table tells you when to do a certain check or service.

NOTE

Always keep in mind all CAUTIONS and WARNINGS when performing PMCS.

The following coding is used

- W: Weekly Checks: These checks are carried out once a week.
- M: Monthly Checks: These checks are carried out monthly.
- S: Semi-Annual Checks: These checks are carried out twice per year.
- A: Annual: These checks are carried out annually.
- B: Bi-Annual Checks: These checks and services are carried out once every two years.

(3) Explanation of ITEM TO BE INSPECTED/Procedure column. The ITEM TO BE INSPECTED/Procedure column of the PMCS table tells you what item to inspect and tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedures tells you to, have Direct Support Maintenance do the work.

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
1		•				<p>CAB WARNING LAMPS:</p> <p>Perform test of all warning functions. Inspect all items for physical damage. Check all electrical connections are tight.</p>
2			•			<p>CAB SIGNALLING LAMPS:</p> <p>Perform operational test of all signalling lamps. Inspect all items for physical damage. Check all electrical connections are tight.</p>
3		•				<p>CAB SWITCHES:</p> <p>Perform operational test of all switches. Inspect all switches for physical damage. Check all electrical connections are tight.</p>
4		•				<p>CAB AIR COMPONENTS:</p> <p>Inspect all air lines and piping for evidence of leaks or cracks. Replace individual fittings and hoses as necessary. Perform operational test of all air switches.</p>
5		•				<p>WIPER BLADES:</p> <p>Check operation of wiper blades. Replace as required. Refer to paragraph 4-12.</p>
6		•				<p>BATTERIES:</p> <p>Inspect battery retainer to make sure battery tray is latched. Check tightness of battery hold down plate. Tighten as required. Inspect terminals and leads for corrosion. Clean corrosion from terminals. Inspect leads for loose terminals and broken insulation. Replace as required. Refer to paragraph 4-24.</p>
7			•			<p>PUMP BODY WARNING LAMPS:</p> <p>Perform test of all warning functions. Inspect for defective alarm lamps or sender units. Inspect all items for physical damage. Check all electrical connections</p>
8			•			<p>PUMP BODY SIGNALLING LAMPS:</p> <p>Perform operational test of all signalling lamps. Inspect for failed bulbs or sender units. Inspect all items for physical damage. Check all electrical connections are tight.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
9	•					<p>PUMP BODY SWITCHES: Perform operational test of all switches. Inspect all switches for physical damage. Check all electrical connections are tight.</p>
10	•					<p>PUMP BODY AIR COMPONENTS: Inspect all air lines and piping for evidence of leaks or cracks. Replace individual fittings and hoses as necessary. Perform operational test of all air switches.</p>
11		•				<p>VALVE LEVERS: Operate valve levers. Check for smooth operation. Check each lever locks with less than 1 full turn of knob. Check valve is fully open when knob is set to full open and valve is fully closed when knob is set to full closed.</p>
12		•				<p>GAGES: Check that the bubble in each gage is less than 25% of the total area of the glass. Replace gage as required. Check all gages read similar pressures when subject to the same pump pressure. Check all water lines to the gages for leaks. Replace/tighten as required. Refer to paragraph 4-13.</p>
13	•					<p>CAB AND PUMP BODY SAFETY BARS: Check all safety bars for tightness. Replace as required. Refer to paragraph 4-12</p>
14	•					<p>SUCTION AND DISCHARGE CONNECTIONS: Check all cap retaining chains are in place. Remove each cap and check threads for severe damage. Replace connection/cap as required. Check all suction strainers are in place and are clean.</p>
15	•					<p>FLIP-UP STEP: Check both flip-up steps between pump body and hose body are securely hinged to hose body. Be sure they clip safely to hose body in the up position. Straighten/replace as required.</p>
16		•				<p>FIRE PUMP: Perform operational test from draft supply with 20 feet of hard suction hose. Check pump primes in less than 30 seconds. While pumping check for water or oil leaks through the hole in the bottom of housing between the pump volute body and gear housing.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
17						<p>Inspect water pump body for cracks or excessive wear. Check priming hoses for leaks or wear. Refer to Direct Support if any are found. Check fuel tank cooling fan operates while pump is operating in structural mode.</p> <p>FOAM SYSTEM:</p> <p>Operate foam system with known flow of agent through nozzle and foam meter set for 3% solution. Check foam mix is 3% by discharging tank of water (660 gallons) and measuring amount of foam used. Should be 20 gallons. May use a dye solution to check calibration rather than foam concentrate. With foam tank empty, set up foam system for flushing but open foam tank valve. Ensure no water backfeeds to foam tank. Replace check valve if it does not seat.</p>
18						<p>Check all pipe/hoses for leaks while fire pump is operating. Set up structural flow of 500 gallons/minute at 250 psi. Close discharge valves slowly. Ensure engine speed decreases quickly and pump pressure does not exceed 280 psi before levelling out at 250 psi. Open discharge valves quickly and check pump pressure recovers to 250 psi within 5 seconds.</p>
19						<p>AUTOMATIC PRESSURE RELIEF VALVE:</p> <p>With pump operating, close discharge valves quickly. Be sure pressure relief valve on discharge manifold in pump body opens at 275 psi and pump pressure does not exceed 280 psi. Replace relief valve as required. Refer to paragraph 4-18.</p>
20						<p>TURRETS:</p> <p>Set truck in pump-and-roll mode and check discharge pressure is 250 psi when secondary air pressure is in excess of 85 psi. Adjust air regulator on brake pedal plate as required to obtain 250 psi pump pressure. While discharging, check operation of turrets and inspect housings for leaks.</p>
21						<p>WATER PIPE DRAIN VALVES:</p> <p>When discharge stops, check turret heads drain automatically, replace automatic drain valves as required.</p> <p>Check operation of all pipe and pump manual drain valves.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
22			•			<p>FOAM TANK:</p> <p>With foam tank full, inspect tank for leaks. Remove hatch, and check funnel is in place and undamaged. With foam tank empty, engine or APU running, and winterization valves open, check foam tank heat exchanger and hose connections for leaks. If exchanger is leaking, refer to Direct Support for tank replacement.</p>
23			•			<p>WATER TANK:</p> <p>With water tank full, check for water leaks. Remove hatch and mesh screen. Inspect interior of tank for debris, sand, algae etc. Clean tank as required. Connect rear tank fill valve to a hydrant supply and check water tank fills to 3/4 level and valve closes. Check seat does not leak. With water tank empty, engine or APU running, and winterization valves open, check water tank copper heat exchanger and hoses for leaks. If exchanger is leaking, refer to Direct Support level for repair.</p>
24		•				<p>WINTERIZATION WATER HEATER:</p> <p>During winter months only, inspect heater for water or fuel leaks. Repair as required (See tests under WINTERIZATION also).</p>
25		•				<p>WINTERIZATION AIR BLOWERS:</p> <p>During winter months only, inspect air blowers and heater cores. Check air blowers spin without catching the frame. Replace as required.</p>
26			•			<p>ENGINE COOLER HEAT EXCHANGER:</p> <p>Inspect heat exchanger for leaks. Start main engine and fire system in structural mode. When engine is at operating temperature, open emergency heat exchanger via control valve and check engine temperature falls.</p>
27				•		<p>HOSE REEL:</p> <p>Check manual drain and air blowout of the hose reel. Inspect all fittings for damage. Replace as required.</p>
28				•		<p>HOSE BED ROLLERS:</p> <p>Inspect pump body, hose body, and hose reel rollers for free rotation. Replace as required.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
29		•				<p>AUXILIARY POWER UNIT: During winter months only, open compartment and inspect for oil, fuel, or water leaks. Repair as required. Clean cylinder head cooling fins with soft bristle brush.</p> <p>Start APU and check all controls function. Refer to WINTERIZATION test following. Inspect Fuel Filter.</p>
30	•					<p>WINTERIZATION: During winter months only, with APU operating, start winterization heater. Check all main engine valves are open for total winterization circulation. Start cab, battery box, and pump body heater fans.</p> <p>Loosen top water connection on pump body heater core and vent any air trapped in the system. Ensure all heaters operate. Check all hoses for leaks. Replace as required.</p>
31		•				<p>ENGINE COOLING: Start main engine and check all hoses for leaks. Replace/repair hoses/tubes as required. Check temperature of engine remains less than 200 deg. F as observed on the cab and pump body engine water temperature gages.</p>
32				•		<p>STEERING WHEEL AND COLUMN: Inspect the steering wheel for cracks or damage. Check electric horn, signal indicator and 4-way flasher work.</p>
33				•		<p>STEERING ARM DRAG LINK: Inspect steering arm and drag link for any scoring, corrosion, bends, or other damage. Carry out operational test to ensure steering geometry.</p>
34				•		<p>STEERING GEAR: Inspect steering gear for signs of wear, leakage, or other damage. Operate gear and check relief valve in gear operates before wheels reach left or right hand stops. Adjust gear as required.</p>
35		•				<p>FRONT AND REAR SUSPENSION: Inspect U-bolts, shock absorbers, leaf springs, hangers, and shackles for any major damage. Replace parts as required.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
36		•				<p>TIE ROD AND TIE ROD ENDS:</p> <p>Inspect tie rod end seals for indication of damage and ensure seals are properly seated. Inspect tie rod for bends, or serious dents. Check turning torque between ball stud and ball cavity, should be greater than 5 in. lbs (0.5 Nm). When wheels are turned, the tie rod should move smoothly. Replace any parts found defective. (If tie rod is suspected of being bent, check front wheel alinement.)</p>
37		•				<p>AXLES:</p> <p>Check front and rear axles for obvious signs of oil leakage. Check vent lines are firmly fixed and vent is open. Check operation of the 4-wheel drive and differential lock system.</p>
38	•					<p>BRAKES:</p> <p>Check operation of service and parking brakes. Inspect all brake shoes for wear. Shoe lining should be at least 1/4 in. (6 mm) thick. Check and adjust slack adjusters as required.</p> <p>Check all hoses for leaks or chaffing. Replace as required.</p>
39		•				<p>AIR DRIER:</p> <p>Check air reservoirs for moisture. A teaspoonful or less is normal. Check air drier is securely mounted. Inspect hoses/fittings for leaks.</p>
40			•			<p>AIR DRIER:</p> <p>Check operation of purge valve in bottom of air drier. Check for proper operation of the check valve mounted in the air drier supply port.</p>
41					•	<p>AIR DRIER:</p> <p>Replace air drier dessicant and oil filter. Refer to paragraph 4-22.</p>
42		•				<p>BRAKE VALVE:</p> <p>Lubricate all pedal moving parts with light engine oil (item 17, Appendix E). Apply 2 drops of oil between plunger and mounting plate. DO NOT OVER OIL.</p>

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
43						<p>BRAKE VALVE:</p> <ul style="list-style-type: none"> Disassemble brake valve and clean all parts. Replace all rubber O-rings and any part found worn or damaged. <p>Replace all rubber parts and any parts found worn or damaged. Set pump-and-roll regulator to 75 psi and service brake regulator to 45 psi.</p>
44						<p>AIR SWITCHES:</p> <ul style="list-style-type: none"> Check operation of stop lamp pressure switches and alarm pressure switches mounted on the brake pedal plate.
45						<p>PRESSURE PROTECTION VALVES:</p> <ul style="list-style-type: none"> Check operation of pressure protection valves. Ensure set points are adjusted correctly. Replace any valve which leaks or is not adjusted correctly. Refer to paragraph 4-22.
46						<p>AIR COMPRESSOR:</p> <ul style="list-style-type: none"> Check operation of air compressor and governor. With no leaks and all tanks empty, all air tanks should reach maximum pressure in less than 5 minutes. Maintain governor and compressor as required. Replace filters in governor.
47						<p>ELECTRICAL ALARM SYSTEMS:</p> <ul style="list-style-type: none"> Test all electrical alarm/indication systems (e g engine oil pressure, engine over temperature). Replace senders and/or alarm units as required.
48						<p>ELECTRICAL LAMP:</p> <ul style="list-style-type: none"> Check all truck lamps both interior and exterior and replace bulbs or lenses as required.
49						<p>ENGINE COMPARTMENT:</p> <ul style="list-style-type: none"> Inspect engine compartment. Look for signs of wear or leaks or, deterioration of wiring harnesses, air lines, drive belts or hoses. Tighten/replace components as required.
50						<p>ENGINE THROTTLE:</p> <ul style="list-style-type: none"> Check operation of engine throttle and shut down system. Check for air leaks or loose hardware. Replace components as required.

Table 4-1. Unit PMCS - Continued

W - Weekly

M - Monthly

S - Semi-Annually

M - Monthly

B - Bi-Annual

ITEM NO.	Interval					ITEM TO BE INSPECTED/PROCEDURE
	W	M	S	A	B	
51			•			<p>ENGINE STARTER:</p> <p>Remove oil caps and add 8 drops of engine oil, (item 17, Appendix E) to the oil wicks.</p>
52			•			<p>EXHAUST SYSTEM:</p> <p>Check the exhaust system manifold retaining nuts, and clamps for tightness. Remake/tighten any leaking connections. Replace exhaust components if manifold, muffler, or pipes have holes.</p>
53				•		<p>AIR BOX DRAINS:</p> <p>With the engine running check there is a flow of air in the air box drain tubes. Clean tubes as required.</p>
54				•		<p>GOVERNOR:</p> <p>Check and record the engine idle speed and the maximum engine no-load speed.</p>
55				•		<p>ENGINE AND TRANSMISSION MOUNTS:</p> <p>Check the engine and transmission mounts, and mounting bolts. Tighten bolts as required.</p>
56				•		<p>TRANSMISSION SHIFT LINKAGE:</p> <p>Inspect transmission shift linkage cable. Adjust as required. Apply a few drops of engine oil to both ends of the cable.</p>
57				•		<p>TRANSMISSION BREATHER:</p> <p>Inspect the breather mounted on top of the torque converter housing Clean as required.</p>
58				•		<p>TRANSMISSION SHIFT CHANGE:</p> <p>Subtract 100 rpm from the maximum engine no-load speed. While accelerating in the 2-5 range, at full throttle check upshift occurs when engine speed equals the speed noted above.</p>

Section IV. UNIT TROUBLESHOOTING PROCEDURES

4-6. GENERAL.

Troubleshooting at the Unit Maintenance level requires you to locate any trouble as quickly as possible. Once the trouble is located, repair or replace the part if you are authorized to do so or determine if a higher category of maintenance is required.

4-7 PROCEDURES.

Repair by Unit Maintenance are limited by tools, test equipment, and replacement parts allocated to that level. Before using the troubleshooting table, check your work order and talk to the operator, if possible, for a description of symptoms if trouble occurred while equipment was in operation.

4-8. SYMPTOM INDEX.

Refer to table 4-2, TROUBLESHOOTING, under the number against the symptom in this index to determine the tests and corrective action required.

CAB

DOOR WON'T OPEN	1a
HEATER LEAK	1b
NO HEAT	1c
NO DEFROST	1d
FAN INOPERATIVE	1e
WASHER INOPERATIVE	1f
WIPER WON'T RUN	1g
WIPER WON'T CLEAR WINDSHIELD	1h
WINDOWS INOPERATIVE	1j

PUMP BODY

GRATING WON'T LATCH	2a
HOSE ROLLER WON'T ROLL	2b
VALVE HANDLE INOPERATIVE	2c
VALVE HANDLE WON'T LOCK	2d
LEVEL GAGE NOT FUNCTIONING	2e
DISCHARGE GAGE INOPERATIVE	2f
PUMP GAGE INOPERATIVE	2g
ENGINE GAGE INOPERATIVE	2h

AUXILIARY POWER UNIT

WON'T CRANK	3a
WON'T START	3b
CRANK SLOWLY	3c
STOPS	3d
ERRATIC OPERATION	3e
LOW POWER	3f

4-8. SYMPTOM INDEX - Continued

HOSE BODY

COMPARTMENT DOOR WON'T LATCH 4

FIRE SYSTEM

WON'T ENGAGE 5a
 INSUFFICIENT PRESSURE 5b
 WON'T PRIME 5c
 PRIMING TANK OVERFLOWS 5d
 PUMP LEAKS 5e
 VALVE FAILS TO OPEN OR CLOSE 5f
 VALVE LEAKS 5g
 FOAM IN WATER TANK 5h
 WATER IN FOAM TANK 5j
 INCORRECT FOAM CONCENTRATION 5k
 TURRET LEAKING 5m
 TURRET DISCHARGE UNEVEN 5n
 REAR TANK FILL INOPERATIVE 5p
 HOSE REEL WON'T PLAY OUT 5q
 HOSE REEL WON'T REWIND 5r

WINTERIZATION HEATER

WON'T START 6a
 STOPS 6b
 LOW POWER 6c
 EXCESS SMOKE 6d
 TRIPS 6e

RADIATOR

COOLANT LOSS 7a
 OILY COOLANT 7b
 SHUTTER WON'T OPERATE 7c

AIR SYSTEM/BRAKES

INSUFFICIENT PRESSURE 8a
 COMPRESSOR NOISY 8b
 HIGH RESERVOIR PRESSURE 8c
 EXCESS OIL IN PURGE 8d
 EXCESS LOSS OF AIR 8e
 SERVICE BRAKES WON'T HOLD PRESSURE 8f
 ENGINE FOOT THROTTLE WON'T OPERATE 8g
 BRAKES BURNING 8h
 BRAKES GRAB 8j
 BRAKES SLOW TO OPERATE 8k
 PARK BRAKE WON'T RELEASE 8m
 PRIMARY AIR BUILDUP SLOW 8n
 RESERVOIR LOW PRESSURE 8p

4-8. SYMPTOM INDEX - Continued

ELECTRICAL

LIGHT WON'T OPERATE	9a
GAGE WON'T INDICATE	9b
MOTOR WON'T OPERATE	9c

STEERING

HARD	10a
LIGHT	10b
ERRATIC	10c
OVERSTEER.....	10d
PUMP NOISY	10e
PUMP OIL LEAK	10f
GEAR OIL LEAK, OUTPUT SHAFT	10g
GEAR OIL LEAK, INPUT SHAFT	10h
BACKLASH	10j
WHEELS WON'T GO STRAIGHT AHEAD	10k
TURNING RESTRICTED.....	10l

DRIVE LINES

TRUCK VIBRATION, NOISE	11a
SQUEAL, CENTER BEARING	11b

TRANSMISSION

LOW STALL SPEED.....	12a
OIL OUT OF FILLER TUBE	12b
OIL DIRTY	12c
OIL PRESSURE LOW	12d
OVERHEATING	12e
ROUGH SHIFTS.....	12f
NO SHIFTS	12g
TRUCK MOVE IN NEUTRAL	12h
HIGH STALL SPEED.....	12j

ENGINE

WON'T CRANK	13a
WON'T START	13b
DIFFICULT TO START	13c
ERRATIC OR STOPS.....	13d
LOW POWER	13e
LOW OIL PRESSURE	13f
FUMES FROM ROAD DRAFT TUBE	13g
EXHAUST BLACK	13h
HIGH OIL CONSUMPTION	13j
OVERHEATS	13k

4-8. SYMPTOM INDEX - Continued

AXLES

NOISY	14a
WHEELS WON'T DRIVE	14b
AXLE SHAFT LUBE LEAK	14c
PINION SHAFT OIL LEAK	14d
NO DIFFERENTIAL LOCK-UP	14e

Table 4-2. UNIT TROUBLESHOOTING - Continued

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

1a CAB HEATER LEAKS

Determine location of leak.

Remake connections or replace components as required, (see para. 4-12).

1b CAB HEATER FAILS TO HEAT

Step 1. Core or fan blocked by dirt or litter.

Clean fan housing or heater.

Step 2. Coolant lines blocked.

Replace damaged hose.

Step 3. Heater valve closed.

a. Open heater valve.

b. Replace heater valve or heater valve operating cable, (see para. 4-12).

Step 4. Air lock in heater.

Loosen outlet connection and vent air.

Step 5. Engine not at working temperature.

a. Wait until engine at temperature.

b. Engine thermostat failed, replace thermostat, (see para. 4-28).

Step 6. Blower fan not working.

a. Replace defective switch, wire or circuit breaker.

b. Replace fan motor, or tighten fan blower to motor shaft, (see para. 4-12).

1c CAB DEFROSTER LOUVERS NOT BLOWING

Defroster damper not opening.

Check cable and damper, (see para. 4-12).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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1d CAB CIRCULATING FAN NOT OPERATING

Step 1. Failed motor.

Replace motor.

Step 2. Failed switch, wires, or circuit breaker.

Replace failed component.

1e WINDSHIELD WASHER INOPERATIVE

Step 1. Wash reservoir empty.

Refill reservoir.

Step 2. Leaking air line/no air pressure.

a. Check and tighten air lines.

b. Wait until secondary air at 85 psi (590 kPa).

Step 3. Leaking water line.

Check and tighten water lines.

Step 4. Plugged nozzles on wiper arm.

Clean or replace nozzles.

Step 5. Faulty control valve.

Replace control valve, (see para. 4-24).

1f WINDSHIELD WIPERS WILL NOT RUN

Step 1. Leaking air lines/no air pressure.

a. Check and tighten air lines.

b. Wait until secondary air at 85 psi (590 kPa).

Step 2. Motor failed.

Replace motor, (see para. 4-12).

Step 3. Linkages tight, bent, or corroded.

Replace wiper arm, or free up as required, (see para. 4-12).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1g WIPERS NOT CLEAR WINDSHIELD EVENLY	Step 1 Wiper blade worn out.	Replace wiper blade, (see para. 4-12).
	Step 2 Linkages tight, or bent.	Replace wiper arm, or free up as required, (see para. 4-12).
1h CAB DOOR WINDOW WILL NOT OPERATE	Window regulator broken.	Replace window regulator.
1j CAB DOOR WILL NOT OPEN	Step 1 Failed door latch.	Replace door latch, (see para. 4-12).
	Step 2 Failed door handle.	Replace door handle, (see para. 4-12).
	Step 3 Inner door handle rod broken or displaced.	<ul style="list-style-type: none"> a Latch back into position. b Replace rod, (see para. 4-12).
2a SAFETY GRATING WON'T LATCH UP OR DOWN	Bent hinge.	Replace hinge.
2b HOSE ROLLER WILL NOT ROTATE	Step 1 Bent shaft.	Replace shaft.
	Step 2 Failed nylon bearing.	Replace bearing.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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2c VALVE HANDLE WILL NOT OPERATE

Visually inspect rod valve linkage and valve to determine which component is causing the stiffness.

Replace component(s) that have failed, (see para. 4-13).

2d VALVE HANDLE WILL NOT LOCK IN POSITION

Step 1 Threads stripped on rod or block.

Replace rod and/or block.

Step 2 Rod out of adjustment.

Remove spring pin in lower end, turn handle one half turn and replace spring pin.

2e WATER OR FOAM GAGE NOT FUNCTIONING

Step 1 Check cab level gage.

a If cab gage working, replace pump body level gage.

b If cab gage behaving same as pump body, check wiring to sensor.

c If wiring is OK, check/clean level sensor.

Step 2 Bulbs failed/missing.

Replace bulbs.

Step 3 Failed wire, harness plug, or circuit breaker.

Replace failed component.

2f AGENT DISCHARGE GAGE NOT OPERATING

Step 1 Gage failed.

Replace gage, (see para. 4-24).

Step 2 Water pressure line blocked or disconnected at either end.

Replace/tighten hose or connections as required.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2g PUMP SUCTION OR DISCHARGE GAGE NOT OPERATING	Step 1 Gage failed.	Replace gage, (see para. 4-24).
	Step 2 Water pressure line blocked or disconnected either end.	Replace/tighten hose or connections as required.
2h ENGINE MONITORING GAGE NOT OPERATING	Gage, sender unit, harness plug, or wire failed.	Replace failed component, (see para. 4-24).
3a STARTER WILL NOT CRANK APU ENGINE	Step 1 Battery switch set to OFF.	Set battery switch to BOTH.
	Step 2 Batteries low in charge.	<ul style="list-style-type: none"> a Start with hand crank. b Charge batteries.
	Step 3 Engine starter switch faulty.	Replace starter switch.
	Step 4 Starter, or starter solenoid failed.	Replace starter.
3b APU ENGINE CRANKS NORMALLY BUT WILL NOT START	Step 1 Check fuel level.	Add fuel and prime system.
	Step 2 Air in fuel system.	Remove connection to injector, turn start switch and prime until fuel appears out of injector connection.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3b APU ENGINE CRANKS NORMALLY BUT WILL NOT START - Continued

- Step 3 Broken fuel line or blocked fuel filter.
Check for leakage/blockage. Replace/repair as required.
- Step 4 Failed fuel pump.
Replace fuel pump.
- Step 5 Air filter blocked.
Replace air filter element, (see para. 4-15).
- Step 6 Engine very cold.
Use starting aid.
- Step 7 Low engine compression.
- a Exhaust valves sticking or burned - replace, (see para. 4-15).
 - b Compression wings burned or broken - replace, (see para. 4-15).
 - c Cylinder head gasket leaking - replace, (see para. 4-15).

3c APU ENGINE CRANKS SLOWLY

- Step 1 Sample lubricating oil.
Change lubricating oil to correct viscosity.
- Step 2 Loose or corroded starter motor or battery terminals.
Tighten, clean, or replace terminals.
- Step 3 Batteries not fully charged.
Charge or replace batteries.
- Step 4 Low ambient temperature.
Operate ether start system.
- Step 5 Starter/starter solenoid failed.
Replace starter, (see para. 4-15).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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3d APU ENGINE STARTS BUT STOPS

- Step 1 Water in fuel system or fuel contamination, check fuel.
Drain fuel tank replace filter, add new fuel and prime.
- Step 2 Air in system.
Air leak between tank and fuel pump check all hoses/connections.
- Step 3 Sample fuel.
Drain tank, replace fuel filter and refill with proper/clean fuel.
- Step 4 Engine timing wrong, check timing.
Adjust timing, (see para. 4-15).
- Step 5 Fuel filter blocked.
Replace fuel filter.

3e ERRATIC APU ENGINE OPERATION

- Step 1 Sample fuel.
Drain tank, replace fuel filter and refill with proper/clean fuel.
- Step 2 Check fuel filter.
Replace filter if blocked.
- Step 3 Remove fuel tank cap. If engine runs normally, vent is blocked.
Unblock vent.
- Step 4 Low cylinder compression pressure, check with gage.
Overhaul engine, (see para. 4-15).
- Step 5 Governor out of adjustment.
Overhaul governor, (see para. 4-15).
- Step 6 Check truck battery charge.
Recharge batteries if very low

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3f APU ENGINE LOW POWER	Step 1 Sample fuel.	Drain tank, change filter and refill with correct fuel.
Step 2 Check air cleaner.	Replace filter and clean housing, (see para. 4-15).	
Step 3 Check fuel filter and hoses.	Replace filter if dirty. Replace hoses if blocked or kinked.	
Step 4 Check throttle linkage.	Repair/replace faulty part.	
Step 5 Check engine adjustments.	Adjust and if necessary, overhaul engine, (see para. 4-15).	
4 COMPARTMENT DOOR WILL NOT LATCH	Step 1 Check latch and handle.	Replace failed component.
Step 2 Check hatch holder.	Replace as required.	
5a PUMP WILL NOT ENGAGE	Step 1 Check correct sequence of switching has been carried out	Use proper switching sequence.
Step 2 Check manual shutdown valve is closed.	Close manual shutdown valve.	
Step 3 Check PTO solenoid clicks when pump switch operated.	If no click, check electrical connections and solenoid. Replace solenoid or wire/connections as required	

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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5a PUMP WILL NOT ENGAGE - Continued

- Step 4 If solenoid operates, fault is due to.
- a Failed pump, replace pump, (see para. 4-18).
 - b Failed reducer gearbox, replace gearbox, (see para. 4-17).
 - c Failed PTO, replace PTO, (see para. 4-17).
 - d Leaking oil pressure lines, replace oil lines, (see para. 4-17).
 - e Failed transmission, refer to Direct Support.

5b PUMP ENGAGES BUT WILL NOT ACHIEVE DESIRED WATER PRESSURES

- Step 1 Check pressure relief valve is not blowing off.
Replace valve as required, (see para. 4-18).
- Step 2 Check air pressure to air regulator.
Secondary air pressure must be greater than 85 psi (590 kPa).
- Step 3 Check air pressure out of regulator.
Pump-and-roll regulator should be at least 75 psi (520 kPa), structural regulator should have variable air pressure up to 100 psi (690 kPa).
- Step 4 Check pump speed
- a Binding in pump, replace pump, (see para. 4-18).
 - b Binding in reducer gearbox, replace gearbox, (see para. 4-17).
 - c PTO clutch worn out - replace PTO, (see para. 4-17).

5c PUMP WILL NOT PRIME.

- Step 1 Check fiber wheel clearance.
Refer to Direct Support if wheel worn.
- Step 2 Check hose connections between suction and priming pump for leaks.
Replace hoses/tighten connections as required.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
5c PUMP WILL NOT PRIME - Continued	Step 3 Check seals on all suction and discharge piping.	Replace victaulic couplings and/or seals in discharge/suction cap as required.
Step 4 Priming pump failed.	Refer to Direct Support Level for repair.	
5d PRIMING TANK OVERFLOWS DURING NORMAL PUMP OPERATION	Stop and start pump a few times while pumping from draft.	If condition does not correct itself, this is due to failed pump priming valve. Refer to Direct Support Level for repair.
5e PUMP CASING LEAKS WATER WHILE PUMPING	Check location of leak	Refer to Direct Support for repair.
5f AIR OPERATED VALVE FAILS TO OPEN OR CLOSE	Step 1 Check air connections or hose for leaks.	Tighten connections or replace hose.
Step 2 Check shuttle valve for leaks and correct operation.	Replace shuttle valve, (see para. 4-18).	
Step 3 Check air cylinder for ease of operation - with no air valve may be operated manually.	Replace valve or air cylinder, (see para. 4-18).	
5g VALVES LEAKING WATER/AGENT	Step 1 Check actuator linkage.	Adjust actuator linkage.
Step 2 Valve dirty or worn.	Clean or replace valve, (see para. 4-18).	

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
5h FOAM ENTERING WATER TANK	Step 1 Check air connection, hoses, shuttle valve on water tank valve.	Tighten/remake joints or replace hose or shuttle valve.
	Step 2 Operate tank valve manually.	If valve operates full 1/4 turn, seal is faulty. Replace valve.
5j WATER ENTERING FOAM TANK	Step 1 Check air connection, hoses, shuttle valve on foam tank valve.	Tighten/remake joints or replace hose or shuttle valve.
	Step 2 Check whether valve in foam line has failed.	Replace foam check valve, (see para. 4-18).
	Step 3 Foam tank valve has failed.	Replace foam tank valve or actuator, (see para. 4-18).
5k FOAM PERCENTAGE DOES NOT MEET SPECIFICATION	Step 1 Check correct water flow used for calculation.	Repeat test with meter valve set according to new flow rate.
	Step 2 Check foam metering valve for cleanliness and correct operation.	Replace metering valve, (see para. 4-18).
	Step 3 Foam tank valve not opening fully.	Replace foam tank valve or actuator, (see para. 4-18).
	Step 4 Foam check valve has restriction.	Replace foam tank check valve, (see para. 4-18).
	Step 5 Check venturi for cleanliness.	Remove and clean venturi, (see para. 4-18).
	Step 6 Check foam concentrate for contamination.	Drain tank and fill with proper solution.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
5m ROOF OR BUMPER TURRET LEAKING WATER	Check for worn or missing seal ring in turret base, worn seals or O-rings within turret.	Repair turret, (see para. 4-18).
5n ROOF OR BUMPER TURRET DISCHARGE PATTERN UNEVEN	Step 1 Check for damaged or dirty nozzle.	Repair or replace nozzle, (see para. 4-18).
	Step 2 Pattern control cable out of adjustment.	Adjust cable as required, (see para. 4-18).
5p TANK REAR FILL VALVE WILL NOT OPERATE	Step 1 Check water tank to make sure it is less than 3/4 full.	Empty tank to 3/4 mark. Select valve to ON and check if valve opens.
	Step 2 Check power to solenoid from pump body level monitor.	a Check power at level monitor and solenoid.
		b Replace failed components or wire.
	Step 3 Check air to solenoid and air out of solenoid.	a Replace solenoid if it has failed.
		b If no air to solenoid, check secondary air. It must be at 65 psi (450 kPa) or above.
		c Check tank valve diaphragm Replace if leaking.
		d Check hoses for leaks.
5q HOSE WILL NOT PLAY OUT	Step 1 Foreign object jammed between cover and reel.	Remove object.
	Step 2 Hose reel bearing seized.	Replace hose reel bearing.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
5r HOSE WILL NOT REWIND	Step 1. Motor failed.	Replace motor, (see para. 4-14).
	Step 2 Switch, relay, wire, harness plug or circuit breaker failed.	Replace failed component, (see para. 4-14).
	Step 3 Motor chain broken.	Replace chain, (see para. 4-14).
6a WINTERIZATION HEATER WILL NOT START	Step 1 Check if overheat fuse is blown.	Replace fuse as required.
	Step 2 Check fuel tank level.	Fill fuel tank as required.
	Step 3 Remove fuel line and check for fuel flow.	<ul style="list-style-type: none"> a Clean fuel pump filter. b Replace fuel pump, (see para. 4-19). c Repair fuel hoses.
	Step 4 Check fuel lines are connected right.	Connect fuel lines correctly.
	Step 5 Check fuel nozzle for clogging.	Clean or replace nozzle, (see para. 4-19).
	Step 6 Check for voltage on fuel solenoid.	If no voltage, replace control unit, (see para. 4-19).
	Step 7 Listen or feel for click on solenoid when plugged and unplugged.	If no sound, or click replace solenoid, (see para. 4-19).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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6a WINTERIZATION HEATER WILL NOT START - Continued

Step 8 Remove cables from solenoid valve and cover photoresistor with tape. Start heater and look for spark after 15 seconds.

Replace ignition unit if no spark, (see para. 4-19).

Step 9 Using voltmeter check for a minimum of 9 volts at connector B, terminals 1 and 2.

NOTE

Refer to marking on control unit for terminal identification.

If voltage, replace wiring. If no voltage, replace unit, (see para. 4-19).

Step 10 Check electrode gap.

Adjust gap as required, (see para. 4-19).

Step 11 Photoresistor faulty.

Replace photoresistor, (see para. 4-19).

6b COMBUSTION STARTS BUT GOES OUT AFTER 15 SECONDS

Photoresistor faulty.

Replace photoresistor, (see para. 4-19)

6c NO OR LOW POWER TO HEATER

Step 1 Check circuit breaker.

Replace circuit breaker if open circuit.

Step 2 Check truck batteries discharged.

Recharge or replace batteries.

Step 3 Check wire from circuit breaker to winterization heater.

Replace if broken.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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6d EXHAUST SMOKES EXCESSIVELY

Step 1 Check blower wheel is tight on shaft

Tighten setscrew, (see para. 4-19)

Step 2 Check blower motor

Replace as required, (see para. 4-19)

6e BOOSTER HEATER OVERHEATS AND TRIPS

Step 1 APU shutdown too quickly

Allow APU or main engine to run for at least 2 minutes after heater shutdown. Reset
overheat relay.

Step 2 Water temperature thermostat faulty

Replace thermostat and reset overheat relay

7a LOSS OF COOLANT FROM RADIATOR SYSTEM

Step 1 Check all hoses when engine at working temperature

Replace hose/fittings if any are leaking, (see para. 4-20)

NOTE

Hoses are also connected to winterization components

Step 2 Check radiator for leakage

Repair or replace radiator, (see para. 4-20)

Step 3 Check cab heater for leak

Repair or replace cab heater or components, (see para. 4-12)

Step 4 Check pump body heater for leaks

Repair or replace heater, (see para. 4-20)

Step 5 Check winterization heater for leaks

Repair or replace heater, (see para. 4-15)

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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7a LOSS OF COOLANT FROM RADIATOR SYSTEM - Continued

- Step 6 Check winterization pump seal for leaks
Replace pump, (see para. 4-20)
- Step 7 Check battery heater for leaks
Repair or replace heater, (see para. 4-20)
- Step 8 With tanks empty, check water and foam tank heat exchangers for leaks.
Repair or replace heat exchanger (water tank) or whole tank (foam tank), (see para. 4-20)
- Step 9 Check for water in engine oil. Tank a sample with engine running.
Refer to Direct Support
- Step 10 Check for water in transmission oil
Refer to Direct Support

7b OIL IN RADIATOR COOLANT

- Sample radiator coolant and determine whether oil is from transmission or engine
Refer to Direct Support

7c FAN AND SHUTTER WILL NOT OPERATE IN AUTO

- Step 1 Check engine at working temperature (190 deg. F)
Allow engine to reach normal temperature
- Step 2 Check air lines to multistat and to shutter and fan
Replace/repair connectors or hoses as required, (see para. 4-22)
- Step 3 Check multistat for operation
Replace as required, (see para. 4-22)

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
8a AIR COMPRESSOR FAILS TO MAINTAIN PRESSURE OR ADEQUATE AIR SUPPLY	Step 1 Check engine air cleaner gage in cab	Replace engine air cleaner if blocked, (see para. 4-23)
Step 2 Check hose between engine and compressor is not kinked or leaking	Replace hose, (see para. 4-9)	
Step 3 Check for excessive system leakage	Replace broken hose, leaking air tank etc, or close air drain valve	
Step 4 Check governor/governor setting	Adjust or repair governor as required, (see para. 4-22)	
8b AIR COMPRESSOR NOISY	Step 1 Check for restriction in discharge line to air drier	a Replace hose, (see para. 4-9)
		b Remove restriction
Step 2 Check oil flow to compressor	Replace hose or fittings, (see para. 4-28)	
Step 3 Compressor bearings worn or excessive wear in compressor	Repair compressor, (see para. 4-28)	
8c AIR RESERVOIRS AT 110 PSI (760 kPa) OR GREATER	Step 1 Check for restriction or leak in control hose between air drier and governor	Replace hose or fittings, (see para. 4-9)
Step 2 Check governor/governor setting	Adjust or repair governor as required, (see para. 4-22)	
Step 3 Compressor unloader pins or seals sticking	Repair compressor, (see para. 4-22)	

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
8d EXCESSIVE OIL IN PURGE WHEN COMPRESSOR UNLOADS OR OIL IN AIR RESERVOIR	Step 1 Check engine air cleaner gage in cab	Replace air cleaner, (see para. 4-23)
	Step 2 Check hose between engine and compressor for kinks or other obstruction	Replace hose, (see para. 4-9)
	Step 3 Check oil return line from compressor to engine	Replace hose if kinked or obstructed, (see para. 4-28).
	Step 4 Check operation of compressor	Overhaul compressor, (see para. 4-28)
8e RESERVOIR PRESSURE FALLS MORE THAN 2 PSI/MIN (14 kPa/MIN) WHEN ENGINE STOPPED	Step 1 Check reservoir draincocks	Close/repair draincocks
	Step 2 Check all valves for leaks	Replace valves, (see para. 4-22)
	Step 3 Check all pressure switches on brake pedal plate for leaks	Replace switches, (see para. 4-22)
	Step 4 Check purge valve on bottom of air drier	If leaking, replace purge assembly, (see para. 4-22)
	Step 5 Listen for loss of air on all air lines and fittings. Check with bubble test.	Replace/remake connections or replace hose, (see para. 4-9)
8f SERVICE BRAKES WILL NOT HOLD PRESSURE	Step 1 Check chambers for leakage	Replace as required, (see para. 4-30 or 4-32)

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2	Check all air lines and connections for leaks. Check with bubble test Replace/remake connections or replace hose, (see para. 4-9)
	Step 3	Check quick release valve exhaust for leaks Repair valve as required, (see para. 4-22)
	Step 4	Check brake treadle valve for leaks Repair as required, (see para. 4-22)
8g	ENGINE FOOT THROTTLE WILL NOT OPERATE	
	Step 1	Check all air lines from foot throttle to throttle air chamber Repair/replace as required, (see para. 4-9)
	Step 2	Check for air leaks from throttle air chamber Replace air chamber, (see para. 4-28)
	Step 3	Check air chamber rod is connected to engine governor shaft Reconnect or replace air chamber as required
	Step 4	Foot throttle valve damaged Repair foot throttle valve, (see para. 4-22)
8h	BRAKE SHOES SMELL OF BURNING	
	Step 1	Check if brake shoes are dragging a Adjust shoes, (see para. 4-30 or 4-32) b If rear only, parking brake air pressure is low or parking brake diaphragm has leak Replace air chamber or check for leaks in parking brake circuit
	Step 2	Check if brake drums are full of sand/mud Clean drums when cool to touch
	Step 3	Clean brake shoe return springs Replace if broken, (see para. 4-30 or 4-32)

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
8j	BRAKES GRAB OR PULL TO ONE SIDE	
	Step 1 Check brake linings	Replace if coated with oil or grease, (see para. 4-30 or 4-32)
	Step 2 Check brake adjustment	Adjust, (see para. 4-30 or 4-32)
	Step 3 Check brake chamber diaphragms for leaks	Replace chamber, (see para. 4-30 or 4-32)
8k	BRAKES SLOW TO OPERATE OR ARE ERRATIC	
	Step 1 Check air lines for leaks	Repair, (see para. 4-9)
	Step 2 Check quick release, relay and spring brake valves for leaks	Repair, (see para. 4-22)
	Step 3 Check foot treadle valve for leaks	Repair, (see para. 4-22)
	Step 4 Check brake linings are clean	Replace shoes if coated with oil or grease, (see para. 4-30 or 4-32).
	Step 5 Check brake adjustment	Adjust brakes, (see para. 4-30 or 4-32)
8m	PARKING BRAKE WILL NOT RELEASE	
	Step 1 Check for leaks in secondary or emergency release circuits	Replace hoses/fittings
	Step 2 Check release valve for leaks	Repair brake release valve, (see para. 4-22)
	Step 3 Check parking brake chambers for leaks	Replace brake chambers, (see para. 4-30)

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
8n FAST AIR NOT TRANSFERRING TO PRIMARY AIR WHEN IGNITION TURNED ON. PRIMARY AIR IN ALARM FOR MORE THAN 5 SECONDS AFTER IGNITION ON	Step 1 Check air starter valve on fast air tank	Repair as required, (see para. 4-22)
	Step 2 Check for leaks on fast air reservoir	Repair hoses/ connectors, replace tank or close drain valve
	Step 3 Solenoid valve operation on fast air tank	Starter solenoid valve should be open when ignition on
8p ANY AIR RESERVOIR PRESSURE LOW	Step 1 Check reservoir drain valve closed	Close drain valve
	Step 2 Check for leaks from reservoir	Repair hoses/connectors, replace tank
	Step 3 Check pressure protection valves for correct operation	If one is not opening at set pressure of 85 psi (590 kPa), the tank it serves will not be charged. Replace, (see para. 4-22)
	Step 4 Check pressure gage or pressure switch	Replace as required, (see para. 4-22)
9a ANY LIGHT FAILS TO OPERATE	Step 1 Check bulb	Replace bulb
	Step 2 Check bulb connector	<ul style="list-style-type: none"> a Clean b Replace connector and bulb if severely corroded

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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9a ANY LIGHT FAILS TO OPERATE - Continued

- Step 3 Check harness connections to bulb
- a Replace if broken or severely corroded
 - b Tighten connections
- Step 4 Trace wire back to switch. Check 12 Vdc on output from switch
- a Replace wire if 12 Vdc at switch but not at lamp end of wire
 - b Replace switch if 12 Vdc on input to switch but not on output when switch is ON
- Step 5 Trace wire back to circuit breaker
- a Replace wire if breaker output is 12 Vdc but no voltage on switch end of wire
 - b Replace breaker if no output from breaker
- Step 6 Check ignition or battery bus bar is at 12 Vdc
- a Set ignition switch ON
 - b Set battery switch to BOTH
 - c Check wiring between batteries and bus bars
 - d Recharge batteries

9b ANY ELECTRICAL GAGE FAILS TO INDICATE

- Step 1 Check gage
- Replace gage
- Step 2 Check sender
- Replace sender
- Step 3 Check wire between sender and gage for continuity especially at harness plugs
- Replace plug or wire

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 4. Check wire between breaker and sender.	Replace wire.
	Step 5. Check circuit breaker.	Replace circuit breaker.
9c ANY MOTOR FAILS TO OPERATE		
	Step 1. Check voltage on wires to motor.	Replace motor if wires at 12 Vdc.
	Step 2. Check wire between switch or relay and motor.	Replace wire if voltage on switch end but none at motor.
	Step 3. Check relay.	Replace relay.
	Step 4. Check wire between breaker and switch/relay.	Replace wire if voltage on breaker but none at switch/relay.
	Step 5. Check breaker.	Replace breaker if voltage in bus bar but none at breaker output.
10a STEERING HARD IN ONE OR BOTH DIRECTIONS.		
	Step 1. Check ambient air temperature.	Run engine for few minutes. Steering will be stiff at very low temperatures.
	Step 2. Check oil level.	<ul style="list-style-type: none"> <li>a. Fill reservoir as required, (see LO 5-4210-220-12). <li>b. Check for leaks.
	Step 3. Check oil viscosity and/or oil cleanliness.	Drain system and refill with correct oil, (see LO 5-4210-220-12).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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10a STEERING HARD IN ONE OR BOTH DIRECTIONS - Continued

Step 4. Check for low oil pressure.

- a. Pump losing efficiency, replace or repair pump (see para. 4-25).
- b. Hoses crimped, replace, (see para. 4-25).
- c. Hoses leaking excessively, replace, (see para. 4-25).
- d. Replace pump relief valve, (see para. 4-25).

Step 5. Air in system.

Replace pump or suction hose if leaking air to suction side, (see para. 4-25).

Step 6. Drive belts loose.

Tighten/replace belts, (see para. 4-25).

Step 7. Check for binding in steering column or shaft.

Replace steering column or shaft U-joints, (see para. 4-25).

Step 8. Check wheel alinement.

Adjust tie rod ends, (see para. 4-32).

Step 9. Check axle king pins.

Refer to Direct Support.

Step 10. Check steering gear actuating valve.

Replace steering gear actuating valve and piston, (see para. 4-25).

Step 11. Check reversing springs in steering gear.

Replace reversing springs, (see para. 4-25).

Step 12. Check for metal or dirt in relief valve of steering pump.

Clean relief valves and seats, (see para. 4-25).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10b STEERING EXTREMELY LIGHT IN ONE OR BOTH DIRECTIONS		
	Check for bent or damaged reversing springs in steering gear.	Replace reversing springs, (see para. 4-25).
10c STEERING ERRATIC		
	Step 1. Check engine idle speed.	Adjust to 600 rpm.
	Step 2. Check steering pump drive belts.	Tighten belts, (see para. 4-25).
	Step 3. Check for worn universal joint in steering shafts.	Replace universal joint, (see para. 4-25).
	Step 4. Check pump vanes for wear.	Replace vanes, (see para. 4-25).
	Step 5. Check suction hose and fittings for blockage.	Replace hoses or fittings, (see para. 4-25).
10d DARTING, WANDERING (OVER)STEERING		
	Step 1 Check tire pressure.	Inflate tires to correct pressure, 70 psi (480 kPa).
	Step 2. Check tread wear.	Change tire if tread is bulging or warped due to broken plys.
	Step 3. Check wheel alinement.	Adjust tie rod ends, (see para. 4-32).
	Step 4. Check for air in oil circuit.	Bleed power steering oil system.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10d DARTING, WANDERING (OVER)STEERING - Continued		
	Step 5. Check for looseness or worn axle steer Joints.	Refer to Direct Support.
	Step 6. Check for excessive wear or damage in steering gear.	Replace or repair as required, (see para. 4-25).
10e STEERING PUMP NOISY		
	Step 1. Check suction hose to pump for blockage.	Replace hose as required, (see para. 4-25).
	Step 2. Check if reservoir oil is foamy.	Check hose and pump for leaks.
10f OIL LEAKING AT STEERING PUMP DRIVE SHAFT		
	Oil seal or shaft worn.	Replace steering pump, (see para. 4-25).
10g OIL LEAKING AT OUTPUT SHAFT OF STEERING GEAR		
	Step 1 Check oil filter in reservoir (high back pressure).	Replace filter if dirty, (see LO 5-4210-220-12).
	Step 2. Check oil return hose.	Replace hose if pinched or restricted, (see para. 4-25).
	Step 3. Check steering gear.	<ul style="list-style-type: none"> a. Replace quad ring seal, (see para. 4-25). b. Replace damaged bronze bearings, (see para. 4-25).
10h OIL LEAKING AT INPUT SHAFT OF STEERING GEAR		
	Step 1. Check oil seal.	Replace all seals, (see para. 4-25).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Check actuating shaft seal surface for wear.	Replace/polish as required, (see para. 4-25).
10j STEERING WHEEL HAS EXCESSIVE BACKLASH		
	Step 1. Check steering shaft universal joints for wear.	Replace universal joints, (see para. 4-25).
	Step 2. Check backlash in miter box.	Replace miter box, (see para. 4-25).
	Step 3. Check for loose steering shaft or worn splines.	Replace steering shaft, (see para. 4-25).
	Step 4. Check pitman arm and steering axle balls.	Replace pitman arm or axle balls, (see para. 4-25).
	Step 5. Check adjustment of drag link.	Adjust as required, (see para. 4-25).
	Step 6. Check tightness of steering column, miter box and steering gear mounting hardware.	Tighten.
	Step 7. Check steering gear.	Repair steering gear, (see para. 4-25).
10k WHEELS WILL NOT ATTEMPT TO RETURN TO STRAIGHT AHEAD POSITION FROM TURNS		
	Step 1. Check steering column and steering shafts for binding.	Replace column or universal joints, (see para. 4-25).
	Step 2. Check mounting of steering gear.	Tighten mounting hardware.
	Step 3. Check drag link ends for seizing.	Regrease or adjust drag link ends.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10k WHEELS WILL NOT ATTEMPT TO RETURN TO STRAIGHT AHEAD POSITION FROM TURNS - Continued		
	Step 4. Check axle king pins.	Refer to Direct Support.
	Step 5. Check steering pump oil flow.	<ul style="list-style-type: none"> a. Check belts are tight. b. Check for vane seizure in pump and replace as required, (see para. 4-25).
10l WHEEL TURN ANGLE RESTRICTED		
	Check steering gear relief plungers.	Adjust as required.
11a EXCESSIVE TRUCK VIBRATION OR NOISE		
	Step 1 Check all drive line yokes are alined.	Disassemble and reassemble correctly, (see para. 4-26).
	Step 2. Drive line out of balance.	Replace defective drive line. Look for missing balance weights, (see para. 4-26).
	Step 3. Drive line bent.	Replace drive line, (see para. 4-26).
	Step 4. Check universal joints.	Replace universal joint, (see para. 4-26).
11b HIGH PITCHED SQUEAL FROM CENTER BEARING AREA, OR GRINDING SOUND		
	Check center bearing wear.	Replace drive shaft center bearing.
12a TRANSMISSION HAS LOW STALL SPEED		
	Step 1 Engine not performing efficiently.	Refer to Engine Troubleshooting.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Torque converter has broken parts.	Refer to Direct Support.
12b OIL THROWN FROM FILLER TUBE		
	Step 1. Dipstick loose.	Install correctly.
	Step 2. Oil level too high.	Drain to proper level.
	Step 3. Breather clogged.	Clean/replace breather.
	Step 4. Dipstick gasket worn.	Replace gasket, (see para. 4-27).
	Step 5. Wrong dipstick being used.	Replace dipstick.
12c TRANSMISSION OIL DIRTY		
	Step 1. Failure to change oil at proper interval.	Change oil and filter, (see LO 5-4210-220-12).
	Step 2. Damaged oil filter.	Change oil and filter, (see LO 5-4210-220-12).
	Step 3. Transmission operating at high temperature.	<ul style="list-style-type: none"> <li>a. Check radiator transmission oil cooler for blockage. <li>b. Check cooling hoses are not crimped or blocked, replace, (see para. 4-27).
	Step 4. Clutch failure.	Refer to Direct Support.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
12d TRANSMISSION OIL PRESSURE LOW.		
	Step 1. Check oil level.	Add oil as required.
	Step 2. Check cooler hoses for restriction or kinks.	Replace hoses, (see para. 4-27).
12e TRANSMISSION OVERHEATING		
	Step 1. Check oil level.	Adjust to correct level.
	Step 2. Check oil is Dexron II.	Drain and flush transmission if wrong oil used. Refill.
	Step 3. Check oil cooler lines between transmission and radiator.	a. Replace kinked or restricted hose, (see para. 4-27). b. Replace radiator if oil cooler is blocked, (see para. 4-20).
12f TRANSMISSION SHIFTS ROUGHLY		
	Step 1. Check shift linkage adjustment.	Adjust as required, (see para. 4-12).
	Step 2. Check modulator air line is not kinked or restricted.	Replace air line.
12g NO RESPONSE TO SHIFT LEVER MOVEMENT		
	Step 1. Check shift linkage.	Reconnect as required, (see para. 4-12).
	Step 2. Main pressure low.	a. Add oil if low. b. Change oil filter, (see LO 5-4210-220-12).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
12h TRUCK MOVES IN NEUTRAL	Check shift linkage adjustment.	Adjust as required, (see para. 4-12).
12j TRANSMISSION HAS HIGH STALL SPEED	Check for low oil level.	Add oil.
13a STARTER WILL NOT CRANK MAIN ENGINE	Step 1. Check battery indicators are green.	<ul style="list-style-type: none"> a. If not green, charge batteries. b. If green, check all connections between battery and starter for tightness and corrosion. Clean/tighten as required.
	Step 2. Connect jumper between B and S terminal on motor.	<ul style="list-style-type: none"> a. If starter motor starts, fault is in ignition circuit, (see para. 4-24). b. If starter motor will not start, check solenoid and motor windings, (see para. 4-24).
	Step 3. Check ignition circuit.	Replace components as required, (see para. 4-24).
13b ENGINE CRANKS BUT WILL NOT START	Step 1. Air in fuel system.	Remove fuel inlet to fuel rack on cylinder head and prime fuel system.
	Step 2. Check for blocked or broken fuel line.	Replace, (see para. 4-23).
	Step 3. Check for choked fuel filter.	Replace both fuel filters, (see para. 4-23).
	Step 4. Remove fuel tank fill cap if engine runs smoothly, tank vent is blocked.	Clean/replace vent

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
13b ENGINE CRANKS BUT WILL NOT START - Continued		
	Step 5. Check fuel priming pump operates.	Repair fuel priming pump, (see para. 4-23).
13c ENGINE HAS DIFFICULTY IN STARTING		
	Step 1. Check battery and starting motor connections.	Tighten and remove corrosion products.
	Step 2. Check lubricating oil.	Fill engine with correct lubricating oil, (see LO 5-4210-220-12).
	Step 3. Check starter motor current draw.	Repair motor as required, (see para. 4-24).
13d ENGINE STARTS BUT STOPS OR RUNS ERRATICALLY		
	Step 1. Check for fuel leaks.	<ul style="list-style-type: none"> a. Tighten/remake connections, (see para. 4-23). b. Replace fuel lines, (see para. 4-23).
	Step 2. Check for crimped or blocked fuel lines.	Replace fuel lines, (see para. 4-23).
	Step 3. Check for dirty fuel filters.	Replace both fuel filters, (see para. 4-23).
	Step 4. Air in system due to foaming in fuel tank.	Replace fuel tank, (see para. 4-23).
	Step 5. Remove fuel tank fill cap. If engine runs smoothly, vent in tank is blocked.	Clean/replace vent.
	Step 6. Check coolant temperature.	a. Replace thermostats if engine will not heat up, (see para. 4-28).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	b. Check air hoses to multistat, engine fan and engine shutter for crimps	Replace if required.
	c. Check operation of multistat and replace if required, (see para. 4-22).	
13e ENGINE HAS LOW POWER		
	Step 1. Check engine air cleaner.	Replace as required, (see para. 4-23).
	Step 2. Check engine fuel filters.	Replace fuel filters, (see para. 4-23).
	Step 3. Check engine oil.	Drain and refill if oil is very dirty.
	Step 4. Check brakes are not dragging.	Check for slow air leak in brake system and adjust or repair brakes.
13f ENGINE LOW OIL PRESSURE AT WORKING TEMPERATURE		
	Step 1. Check oil level.	Top up as required.
	Step 2. Wrong oil viscosity.	Drain and refill with correct oil.
	Step 3. Oil bypassing oil cooler.	Clean or replace oil cooler, (see para. 4-28).
	Step 4. Check gage.	Replace as required, (see para. 4-24).
	Step 5. Check sender.	Replace as required, (see para. 4-24).
	Step 6. Oil cooler bypass valve not operating correctly.	Replace bypass valve, (see para. 4-28).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
13g OIL OR FUMES SEEN AT ROAD DRAFT TUBE		
	Step 1. Check engine breather.	Clean or replace breather.
	Step 2. Check exhaust and muffler.	Remove blockage or replace system, (see para. 4-21).
13h EXHAUST SMOKE - BLACK		
	Step 1. Recheck engine when at operating temperature.	Allow engine to reach operating temperature.
	Step 2. Check fuel grade.	Drain and refill tank with correct fuel.
	Step 3. Check exhaust for restriction.	Remove restriction or replace exhaust, (see para. 4-21).
	Step 4. Check air filter.	Replace if clogged, (see para. 4-23).
13j HIGH LUBRICATING OIL CONSUMPTION		
	Step 1. Check external oil lines or connections for leaks.	Tighten/remake connections or replace hoses, (air compressor, turbocharger).
	Step 2. Check crankcase oil level.	Drain oil from crankcase if overfilled.
	Step 3. Check crankcase breathers.	Clean/replace as required, (see para. 4-21).
	Step 4. Check air cleaner.	Replace if blocked, (see para. 4-28).

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
13k ENGINE OVERHEATING		
	Step 1. Check shutter is open.	Set shutter to MAN in cab.
	Step 2. Check coolant level.	Find leak and repair. Top up as required.
	Step 3. Check radiator core.	Remove foreign material externally or internally.
	Step 4. Remove coolant filler cap and operate engine, checking for combustion gases in the system.	Refer to Direct Support level.
	Step 5. Check fan belts for wear.	Replace fan belts, (see para. 4-20).
14a CONSTANT NOISE FROM AXLES		
	Step 1. Sample lubricant.	Drain and refill with correct lubricant.
	Step 2. Check lubricant level.	Top up as required.
	Step 3. Excessive pinion or drive gear wear, or bearings worn.	Refer to Direct Support.
14b REAR OR FRONT WHEELS DO NOT DRIVE (DRIVE SHAFT ROTATING)		
	Step 1. Broken axle shaft.	Replace, (see para. 4-26).
	Step 2. Broken pinion.	Replace - refer to Direct Support.
	Step 3. Drive teeth stripped.	Replace drive gear, refer to Direct Support.

Table 4-2 UNIT TROUBLESHOOTING - Continued

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
14c LUBRICANT LEAKS THROUGH AXLE SHAFTS		
Step 1. Check axle housing vent system for restrictions.	Inspect and correct, (see para. 4-30 or 4-32).	
Step 2. Sample lubricant.	Drain and fill with correct lubricant.	
Step 3. Check lubricant level.	Drain as required.	
Step 4. Worn or incorrectly installed axle shaft oil seal.	Replace oil seal, (see para. 4-30 or 4-32).	
14d LUBRICANT LEAKS AT AXLE PINION SHAFTS		
Step 1. Sample lubricant.	Drain and fill with correct lubricant.	
Step 2. Check lubricant level.	Drain as required.	
Step 3. Check axle vent system for restrictions.	Inspect and correct.	
Step 4. Check if drive yoke loose on pinion shaft.	Tighten yoke, (see para. 4-30 or 4-32).	
14e AXLE DOES NOT ENGAGE DIFFERENTIAL LOCK-UP		
Step 1. Check for broken or pinched air line.	Check and replace.	
Step 2. Check if lock-up air chamber diaphragm is broken or chamber has internal damage.	Replace air chamber, (see para. 4-30 or 4-32).	
Step 3. Air switch defective.	Replace switch, (see para. 4-24).	

Section V UNIT MAINTENANCE PROCEDURES

4-9 GENERAL MAINTENANCE PROCEDURES.

This section describes general procedures that apply to all maintenance tasks detailed in this manual. To avoid repetition, these general procedures will not be repeated elsewhere in the manual.

4-9.1 General Removal and Disassembly Instructions.

a. Troubleshooting

Before removing any item, refer to the troubleshooting table. This ensures that faults are isolated to a particular component.

b. Cleanliness

Work areas must be kept clean. This avoids contamination of internal parts. This is especially true for areas where control valves, cylinders, or other hydraulic or air system parts are disassembled.

c. De-energize and Depressurize

Before removing any part of electrical, hydraulic, pneumatic, or foam systems ensure the system is not energized or pressurized (e.g. disconnect batteries or relieve all pressure from air system by opening drain valves). Ensure that all controls are in the OFF position before starting any removal procedure.

d. Preparation

Study the task description before disassembling or removing any item. This reduces job time as all tools and equipment will be available and procedures will have been noted.

e. Work Space

Ensure there is sufficient clearance to remove or disassemble a particular part. Disassemble adjacent parts as necessary to provide reasonable working clearance.

f. Lifting

Use a hoist, jack, or other aid when lifting heavy parts. Lifting devices should be positioned and attached to the part to remove all strain from mounting hardware before part is removed. Never work under a part which is supported only by a lifting device. Always support that part on maintenance trestles or other supports before starting work.

g. Lifting Truck

In certain cases it will be necessary to raise the truck so that all tires clear the ground. The following procedure describes a safe method of lifting the truck.

- (1) Drain water tank to reduce truck weight.
- (2) Park truck on level, hard surface. Position gear selector to N (neutral) and apply parking brakes.
- (3) Chock wheels of opposite axle.

4-9. GENERAL MAINTENANCE PROCEDURES - Continued

4-9.1 General Removal and Disassembly Instructions - Continued

g. Lifting Truck - Continued

(4) Place 10 ton hydraulic jack beneath differential. Raise the jack until tires clear the ground.

(5) Place maintenance trestles beneath axle, one on each side of differential. If truck is to be supported by frame, and tires still need to clear the ground, raise the truck high enough to compensate for leaf spring sag.

(6) Carefully lower truck onto maintenance trestles. Be sure maintenance trestles are adjusted to the same height and are of sufficient capacity to carry truck weight.

(7) Repeat steps 4 thru 6 to raise other axle.

h. Lowering The Truck

(1) Place 10 ton hydraulic jack beneath differential. Raise the jack until all weight is off maintenance trestles.

(2) Remove maintenance trestles from beneath axle (one on each side of differential).

(3) Carefully and slowly, lower jack until all weight is removed from jack immediately after truck is grounded, chock the wheels.

(4) Repeat step 1 thru 3 to lower other axle as necessary.

(5) Ensure gear selector is positioned to N (neutral) and parking brakes are applied, then remove all wheel chocks.

j. Identification

Identify all parts of similar shape with tags. This will make proper reassembly easier. Be sure to identify ends of electric, hydraulic, and air lines as they are disconnected.

k. Salvage

Some assemblies that are removed, even though defective, shall be treated as valuable items. They may be rebuilt for future use.

l. Expendable Parts

Whenever possible, all gaskets, packings, and seals shall be discarded during removal or disassembly. Similarly, lock wire, lockwashers, cotter pins, and like items shall be discarded during disassembly. All should be replaced during assembly. When removing seals, gaskets, or packings, take care not to damage (e.g. scratch) the sealing surfaces if surfaces are damaged they must be repolished to give a good sealing surface.

m. Parts Protection

To prevent moisture and dirt from entering housings, lines, and other openings, apply protective covers after disassembly. Wrap all parts in clean paper or dip parts in rust preventive oil.

4-9 GENERAL MAINTENANCE PROCEDURES - Continued**4-9.2 General Cleaning Instructions.****CAUTION**

Do not use scrapers, wire brushes, abrasive wheels, or compounds when cleaning parts unless called for in detailed instructions. These procedures may alter size of machined surface and may weaken a stressed part.

- a. Dry Cleaning Solvent

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

Whenever dry cleaning solvent is recommended for cleaning, use item 10, Appendix E.

- b. Mineral Spirits

WARNING

Mineral spirits are toxic to skin, eyes, and lungs. Skin and eye protection is required. Avoid prolonged or repeated contact. Good, general ventilation is normally adequate.

- c. Gasoline, Diesel Fuel

WARNING

Never use gasoline or diesel fuel to clean parts.

- d. Freon 113

WARNING

All freons are asphyxiants and are toxic to skin and eyes. Skin and eye protection is required. Use only in a well ventilated area.

Freons are used to clean any parts that normally come in direct contact with hydraulic fluid.

4-9. GENERAL MAINTENANCE PROCEDURES - Continued**4-9.2 General Cleaning Instructions - Continued**

e. Degreasing Machine

WARNING

1,1,1 Trichloroethane is toxic to skin, eyes and lungs. Skin and eye protection is required. Avoid prolonged or repeated contact. Good, general ventilation is normally adequate.

Heavy oil and grease may be removed with a degreasing machine filled with 1,1,1 Trichloroethane. All parts shall be dipped in rust preventive oil after removal from machine.

f. Baking Soda Solution

Truck battery exterior surfaces, terminals, and cable clamps should be cleaned with a weak solution of baking soda (item 5, Appendix E) and water. A bristle brush soaked in the solution may be used to remove caked dirt or corrosion products.

g. Solvent Spray Gun

WARNING

Spray gun must be used in spray booth with filter and face shield for personnel since dry cleaning solvent (item 10, Appendix E) is toxic to skin, eyes and lungs. Avoid prolonged or repeated contact.

h. Hot Water/Steam

Radiator cores should be cleaned with steam or hot water. If sediment within the core cannot be completely removed in this way, core will have to be boiled in a chemical bath. This bath is a strong solution of caustic soda and is available in a radiator repair shop.

j. Pressure Wash

Painted surfaces (e g truck body) shall be cleaned with a detergent solution and a pressure washer. Always rinse surface with clean water.

Although the truck body paint is very durable, certain solvents may damage the paint. Keep solvents away from painted surfaces. A pressure washer should be used to remove excessive road dirt, oil, and grease from exterior parts prior to dismantling.

k. Steam Cleaning

Oil and fuel tanks should be flushed with steam for at least 24 hours before welding or maintaining such tanks

l. Ball and Roller Bearings

When cleaning ball or roller bearings, place them in a basket. Suspend the basket in a dry cleaning solvent, (item 10, Appendix E) preferably, overnight. If needed, use a brush to remove caked grease or chips. Avoid rotating the bearings until all solid particles are removed. When bearings are clean, spin them in a light lubricating oil to remove solvent, (item 17, Appendix E).

4-9. GENERAL MAINTENANCE PROCEDURES - Continued

m. Rubber Parts

Do not clean preformed packings or other rubber parts in solvent. These parts should be wiped with a clean, dry, lint-free cloth.

n. Electrical Components

Electrical components (e g coils, switches) which use insulating materials shall not be soaked or sprayed with cleaning solutions. Remove dirt with a clean, dry, lint-free cloth. If necessary, moisten cloth with dry cleaning solvent (item 10, Appendix E).

p. Complex Components

Components that consist of a fabrication with passages and cavities should be checked thoroughly after cleaning. A thin flexible wire should be run through all passages to ensure they are not blocked individual passages may be cleaned using a pressure spray gun and dry cleaning solvent (item 10, Appendix E).

4-9.3 General Inspection Instructions.

a. Sealing Surfaces

Check all contact surfaces of gaskets, packings, or seals. Ensure there are no nicks, burrs, or scratches. These might damage new seals during assembly if any defect is found, correct it as outlined in para. 4-9.4 following.

b. Ball and Roller Bearings

Check bearings for pitted balls, races, or separator. Bearings shall be rejected if any of the following are seen in the race load area.

- (1) Cuts or grooves parallel to ball or roller rotation
- (2) Fatigue pits (not minor machine marks or scratches)
- (3) Cracks found during magnetic particle inspection
- (4) Serious abrasion of balls or rollers
- (5) Serious discoloration of any part of the bearing

c. Drain Plug

When removing drain plugs from transmission, engine, or axles, inspect the plug. A build-up of grit and/or fine metal particles may indicate part failure. A few fine particles are normal.

d. Tubing and Hoses

Check all hose surfaces for broken or frayed fabric. Check for breaks or weak points due to kinking or rubbing inspect metal tube lines for kinks or excessive corrosion. Inspect fitting threads or clamps for damage. Replace any faulty part. After assembly, check all disturbed joints for leaks.

4-9. GENERAL MAINTENANCE PROCEDURES - Continued**4-9 3 General Inspection Instructions - Continued**

e. Splines

Inspect shaft splines for wear. This will include pitting, peening or fatigue cracks. Perform magnetic particle inspection if needed.

f. Electrical Parts

Inspect all wiring for chaffed or burned insulation. Check all terminals for tightness. Check all lamps for failure. Check for burns, or broken fittings or components.

g. Gears

The following steps should be used to make a general visual inspection of all gears. Specific tests for particular gears, outlined in the text, should also be carried out if any gear looks faulty, perform a surface temper and/or magnetic particle inspection.

(1) Normal Wear. Loss of metal from surface of teeth. Wear must not prevent gears from meshing or performing properly.

(2) Initial Pitting. This may occur when gears are first put into service it may continue until high spots have been reduced it will not affect contact surfaces. This pitting is not necessarily serious.

(3) Destructive Pitting. This pitting occurs after initial pitting, often at an increasing rate. This type will destroy the contact area and reduce the load capacity of the gear. Rapid destruction will occur with use.

(4) Abrasive Wear. This damage is caused by fine particles carried in the lubricant or embedded in gear tooth. This material may come from:

- Bearing or gear tooth material
- Abrasives not removed during assembly
- Sand or scale from castings
- Impurities from oil or the environment

(5) Scoring. Slight scoring, galling or other surface damage is seen as tears or scratches in the direction of sliding. It starts in areas of highest stress and speed. This is usually at tip of teeth.

(6) Burning. Burning is seen as discoloration, and causes loss of hardness of the metal. Burning is caused by any of the following:

- Gear Overload
- Overspeed
- Lack of Backlash
- Too Little Lubrication
- Wrong Lubrication

4-9. GENERAL MAINTENANCE PROCEDURES - Continued

If discoloration can be wiped off, such marks can usually be traced to oil-burn stains which are not serious.

(7) Rolling. This damage usually occurs only on plastic gears. Rolling is when material is pushed out of shape but does not break off. It is usually caused by heavy, even loads and overheating.

h. Metal Parts

Visually inspect all castings and weldments for cracks. Parts that carry a great load should be inspected by the magnetic particle method. Non-ferrous parts may be inspected by the fluorescent penetrant method.

j. Magnetic Particle Inspection

This type of inspection can only be carried out on metals that can be magnetized. If in doubt check whether a magnet sticks to the surface. It should only be carried out if parts are not easily replaceable (cost or special order), or parts have been reworked or reground, or parts are subject to high stress. Magnetizing current depends on parts being magnetized for solid section parts, current shall be 1000 amps per diameter inch for variable diameter thickness, current shall be adjusted for diameter inspected. .

Parts shall be rejected if:

(1) Indications of non-metallic inclusions are present (foreign body - solid, liquid, or gaseous) and these are longer than one inch, or indications are closer than 1/8 in. apart.

(2) Any evidence of cracks are seen

(3) Scattered short sharp bursts are seen. Bursts are caused by metals working at temperatures that weaken and break the material. Bursts are not usually seen until the metal is cut through to the burst area.

(4) Separate short wavy lines in the same general direction are seen. Flakes are caused by improper cooling. They are not usually seen until the metal is cut through to the flake area.

(5) Fine, sharp, tightly packed lines are seen (grinding cracks). These are usually caused by a glazed grinding wheel. The wheel, instead of cutting the material, rubs and overheats the material. The lines are thermal cracks similar to heat treat and hardening cracks.

k. Fluorescent Penetrant Inspection

This type of inspection can be carried on any metal but is usually reserved for non-magnetic material (e.g. aluminum, stainless steel). The parts shall be warm prior to applying penetrant. The penetrant may be applied by dipping, painting or spraying. All surfaces to be examined shall be completely covered. Penetrant time for various metals is as follows:

Aluminum Alloy - no less than 20 minutes

Magnesium Alloy - no less than 20 minutes

Brass or Bronze - no less than 30 minutes

Ferrous Alloys - no less than 30 minutes

4-9. GENERAL MAINTENANCE PROCEDURES - Continued

4-9.3 General Inspection Instructions - Continued

k Fluorescent Penetrant Inspection - Continued

After applying penetrant, the surfaces will be cleaned with lukewarm water less than 120 deg. F. (Cool water may be used, but cleaning time will be longer). Pressurized water spray may be used to shorten the washing cycle. The following methods may be used to develop the parts:

(1) Wet Developer Method

Parts shall be completely covered in developer by spraying or dipping. Parts shall be dried and developed in a recirculating hot air drier for one half the penetration time.

(2) Dry Developer Method

Parts must first be dried. They dry developer shall be spread on all surfaces by dusting or by dipping the part. Parts shall be developed for one half the penetration time.

(3) No Developer Method

When no developer is used, drying and developing time shall be at least equal to penetration time to allow sufficient bleeding of penetrant from defects. If additional clarity is required during inspection dry developer may be applied by a hand powder bulb.

Following development, the part shall be inspected under black light. Any evidence of cracks is cause for rejection. After inspection the parts shall be cleaned with dry cleaning solvent (Item 10, Appendix E) and covered with rust preventive oil.

m. Lapping Procedures

(1) Clean the part with dry cleaning solvent (item 10, Appendix E) and dry with compressed air. Clean the lapping blocks with compressed air. Do not use a cloth or any other material for this purpose.

(2) Spread a good quality 600 grit dry lapping powder on one of the lapping blocks. Place the part to be lapped flat on the block and, using a figure eight motion, move it back and forth across the block. Do not press on the part, but use just enough pressure to keep the part flat on the block. It is important that the part be kept flat on the block at all times.

(3) After each four or five passes, clean the lapping powder from the part by drawing it across a clean piece of tissue placed on a flat surface and inspect the part. DO NOT LAP EXCESSIVELY.

(4) When the part is flat, wash it in dry cleaning solvent (item 10, Appendix E) and dry it with compressed air.

(5) Place the dry part on the second block. After applying lapping powder, move the part lightly across the block in a figure eight motion several times to give it a smooth finish. DO NOT LAP EXCESSIVELY. Wash the part in dry cleaning solvent (item 10, Appendix E) again, and dry it with compressed air.

(6) Place the dry part on the third block. Do not use lapping powder on this block. Keep the part flat and move it across the block several times, using the figure eight motion. Lapping the dry part in this manner gives it the "mirror" finish required for perfect sealing.

4-9 GENERAL MAINTENANCE PROCEDURES - Continued

(7) Wash the lapped part in dry cleaning solvent (item 10, Appendix E) and dry with compressed air.

4-9.4 General Repair/Assembly Instructions.

a. Truck body

Chassis and exterior painted parts may be resurfaced where paint is damaged or parts have been repaired. Before resurfacing, scrape off loose and blistered paint. Clean area to be painted by sanding or buffing. Remove dust. During repair operations, protect bare steel surfaces from rusting with protective oil. Minor body dents may be removed by bumping with a soft-faced hammer while using a wooden block backing.

b. Welding

Welding and brazing may be used to repair cracks in steel parts (e g brackets, panels and light framework) . Aluminum body panels may also be welded. They should only be welded when replacement parts are not available. Do not weld or braze castings, moving parts, or parts under great stress, except in emergencies. Refer to TM 9-237 for welding practices.

c. Hoses

Replace all broken, frayed, crimped or soft flexible hoses. Replace stripped or damaged fittings. When replacing hose clamps ensure hoses are not crimped.

d. Hose Assemblies

There are two different styles of hose assemblies. Described below are procedures for hose replacement

NOTE

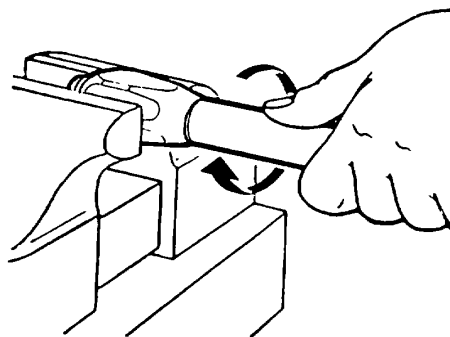
If original hose route cannot be followed at time of replacement, find alternative route and measure for new hose length

GENERAL PURPOSE - High Temperature, Hydraulic, Air and Fuel Application

(1) Carefully examine both hose end fittings. Discard hose end fittings if any signs of damage are evident. Proceed to step 4 following to assemble new hose assembly using new hose end fittings.

(2) If hose end fittings are to be reused, remove from old hose. Clamp socket in a vise. Remove nipple from hose and socket by unscrewing in a counterclockwise direction.

(3) Once nipple is removed, invert hose and reclamp socket in vise. Unscrew hose from socket by turning hose in a clockwise direction. If hose is excessively long, socket removal is possible by clamping hose in vise and unscrewing socket from hose in clockwise direction.



4-9 GENERAL MAINTENANCE PROCEDURES - Continued

4-9.4 General Repair/Assembly Instructions Continued

(4) Using a cut-off saw or a fine tooth hacksaw cut new hose square to length.

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

(5) Using compressed air, blow out shavings from hose bore.

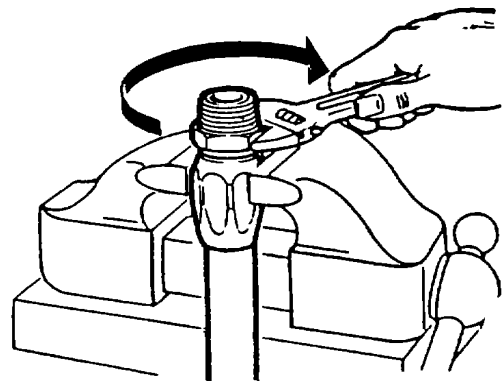
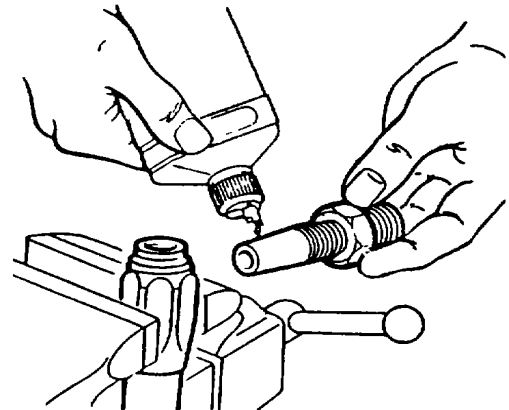
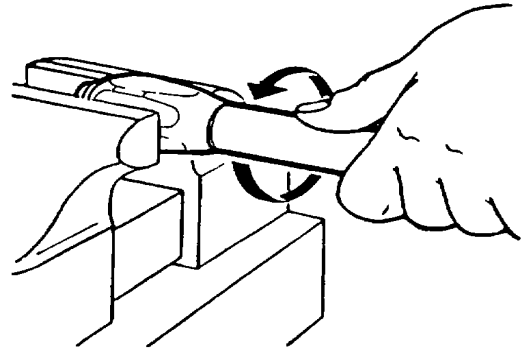
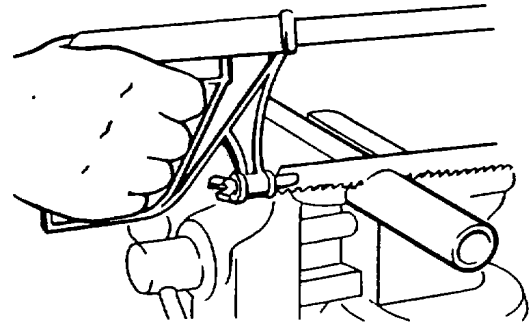
(6) Clamp socket in vise. Thread new hose into socket in a counterclockwise direction until it bottoms out, then back out hose 1/4 turn.

(7) Using hydraulic oil (item 9, Appendix E), liberally lubricate nipple threads and inside of hose.

(8) Insert nipple into hose and socket and tighten in a clockwise direction. Leave 1/32 in. (1 mm) between nipple hex and socket.

(9) To prevent any contamination from new hose assembly, blow out hose assembly using compressed air. Rinse inside of hose with hot water. Do not allow water temperature to exceed 180 deg. F (82 deg. C). Using compressed air, blow out all water from hose assembly.

(10) If hose assembly is not going to be installed immediately after installing fittings, cap both ends to keep hose clean.



4-9 GENERAL MAINTENANCE PROCEDURES - Continued.

TEFLON HOSE - Medium Pressure (with Vacuum Service)

(1) Carefully examine both hose end fittings. Discard hose end fittings if any sign of damage is evident. Proceed to step 3 following, to assemble new hose assembly using new hose end fittings.

(2) If hose end fittings are to be reused, remove from old hose. Clamp socket in vise. Unscrew nipple (in a counterclockwise direction) and remove. Slide the socket away from the hose end by tapping on flat surface. Using pliers, pull the sleeve from hose

NOTE

It is recommended that new sleeves be used when old fitting is reused.

(3) Wrap teflon hose with masking tape (item 18, Appendix E) at cut-off area. Using a cut-off saw or a fine-tooth hacksaw, cut hose square to length. Remove all tape. Trim any extending wires flush with hose end, then remove hose material burrs.

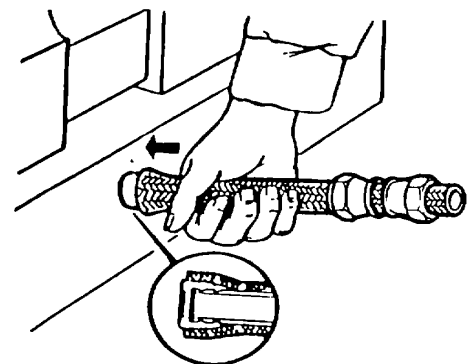
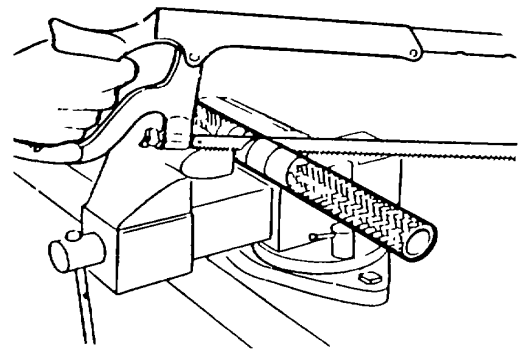
WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

(4) Using compressed air, blow out shavings from hose bore.

(5) Slip two sockets onto new hose. Ensure the sockets are back to back.

(6) Push a sleeve over the end of the tube and under the wire braid by hand. Position sleeve in hose by pushing the hose against a flat surface. Ensure the tube stock butts against the inside shoulder of the sleeve.



4-9. GENERAL MAINTENANCE PROCEDURES - Continued

4-9 4 General Repair/Assembly Instructions - Continued

d Hose Assemblies - Continued

(7) Set the sleeve barbs into the Teflon tube by installing the end of the sleeve and tube over the nipple and then work the hose bore over the nipple as shown.

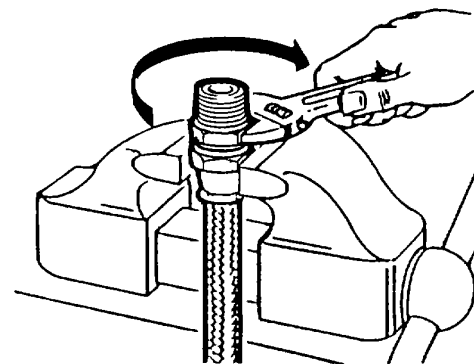
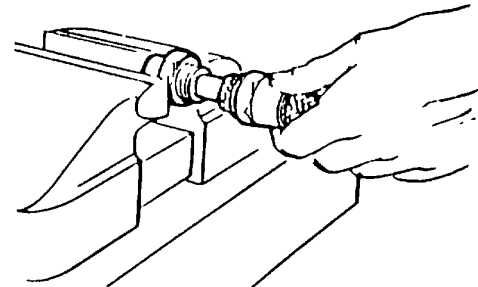
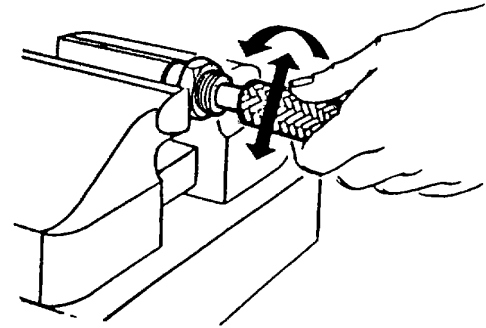
(8) Lubricate the nipple and socket threads with hydraulic fluid (item 9, Appendix E).

(9) Clamp the nipple hex in a vise. Push the hose over the nipple using a twisting action until seated against nipple clamber. Push socket forward and thread onto nipple handtight.

(10) Invert hose assembly and clamp socket in vise. Tighten nipple in a clockwise direction until $1/32$ in. (1 mm) clearance between nipple and socket is achieved. Further tightening is acceptable if socket and nipple hexes are to be aligned.

(11) To prevent any contamination from new hose assembly, blow out hose assembly using compressed air. Rinse inside of hose with hot water. Do not allow water temperature to exceed 180 deg. F (82 deg. C). Using compressed air, blow out all water from hose assembly.

(12) If new hose assembly is not going to be installed immediately after installing fittings, cap both ends to keep hose clean.



4-9 GENERAL MAINTENANCE PROCEDURES - Continued

e Fasteners

Replace any bolt, screw, nut, or fitting that has damaged threads. Inspect tapped holes for damage. If fitting cannot be retapped with next oversize screw or stud, chasing the threads with proper size tap or die may cure the problem.

f Gaskets

Never reuse old gaskets except in an absolute emergency. Always ensure correct gasket is being used as replacement by fitting dry.

g Oil Seals

Install oil seals with lip seal facing the source of oil. Install by carefully applying an even force on the outer edge of the seal. If oil seals are to be installed over a keyed or splined shaft, use a guide. This will prevent the sharp edges of the shaft damaging the lip seal. Make a guide by cutting and shaping very thin gage sheet metal over the splines. Make sure the edges are bent slightly inward to prevent these damaging the seal.

h Bearing Installation

CAUTION

To prevent personal injury or premature bearing failure when removing or installing bearing races, always exert force on the tight ring of the bearing.

To assist in bearing installation procedures it is acceptable to heat or cool bearing races. Outer bearing races can be cooled to reduce the race diameter. Place bearing in a deep freeze for about two hours prior to assembly. It is acceptable to leave bearing in deep freeze for a longer period of time.

CAUTION

To avoid bearing failure, never heat a bearing using an open flame.

Inner bearing races can be heated to increase the race diameter. An electrically-heated-type oil bath is recommended. Do not allow oil temperature to exceed 275 deg. F (135 deg. C). The preceding procedure can also be used to help during installation of gears on shafts. If accessible, shafts may be cooled to reduce outer diameter, and gears may be heated to increase inner diameter.

j. Lubrication

Lubricate bearings with the type of lubricant normally used before assembly (e.g. gear lube in gear box bearing). This will provide lubrication during first run-in until system lubrication can reach bearings.

k Electrical Items

Replace broken, worn or burned electrical wiring with wire of the same carrying capacity. Always refer to tags and sketches made at removal.

m Testing

Test operation of any system after installation or repair. Inspect for leaks, vibration, noise, misalignment or other problems. Recheck after a few hours of normal operation.

4-10. FRONT BUMPER.

This task covers

- a Removal
- b Installation
- c Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

20, Appendix E Penetrating Oil
310591 Locknut

EQUIPMENT CONDITION

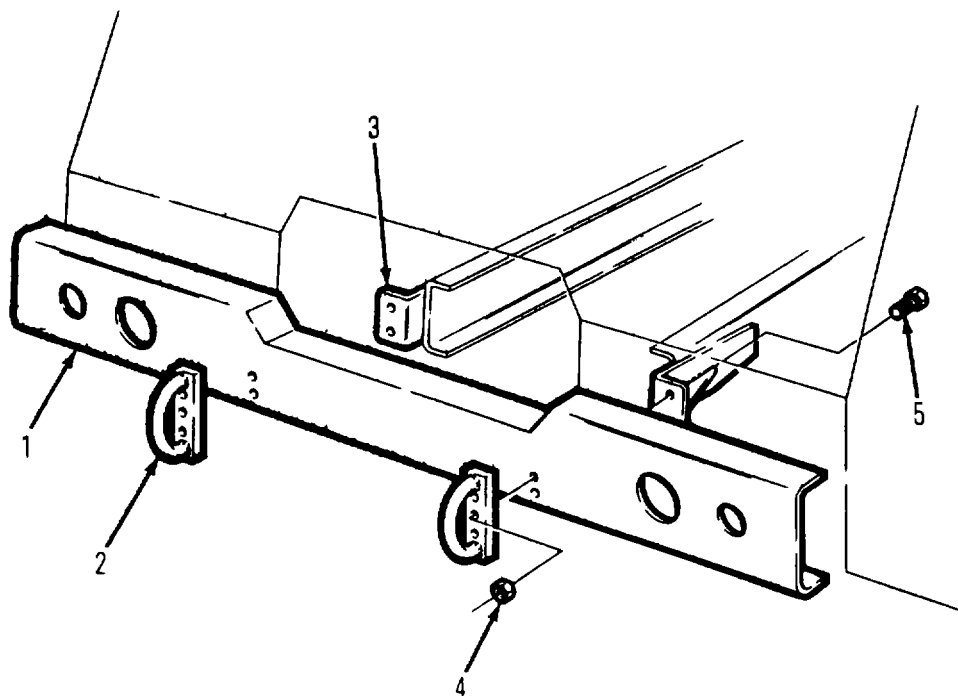
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

PERSONNEL REQUIRED - 2**WARNING**

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

NOTE

If the bumper fasteners are excessively corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.



4-10. FRONT BUMPER. Continued

REMOVAL

- (1) Remove the four locknuts (4) and capscrews (5) attaching the bumper (1) and tow rings (2) to the bumper mounting brackets. Discard the locknuts.
- (2) Remove the bumper and set it aside.

INSTALLATION

- (1) Raise the bumper (1) onto the bumper mounting brackets (3) and aline the mounting holes.
- (2) Install the capscrews (5) and new locknuts (4) attaching the tow ring (2) and the bumper (1) to the bumper mounting bracket (3).
- (3) Tighten the capscrews and locknuts to 150 ft lb (205 Nm).

REPAIR**a Front Bumper Repair.**

- (1) Inspect front bumper for bends, large dents or cracked welds.
- (2) Straighten the front bumper.

NOTE

Disconnect the batteries if performing welding procedures with bumper mounted on the truck.

- (3) Repair broken welds following procedures described in TM 9-237.
- (4) Clean bumper and paint following procedures described in para. 4-9.

b Tow Ring Repair

- (1) Inspect tow rings for oversized mounting holes or cracked welds.
- (2) Replace tow ring if any damage is found. Do not attempt to weld.
- (3) Clean tow rings and paint following procedures described in para. 4-9.

c Front Bumper Mounting Brackets Repair.

- (1) Inspect front bumper mounting brackets (3) for loose ends, bends or cracked welds.
- (2) Repair front bumper mounting brackets as detailed in para. 4-33.

4-11 HEAT SHIELDS

4-11.1 Front Heat Shield.

This task covers

- a Removal
- b Installation
- c Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

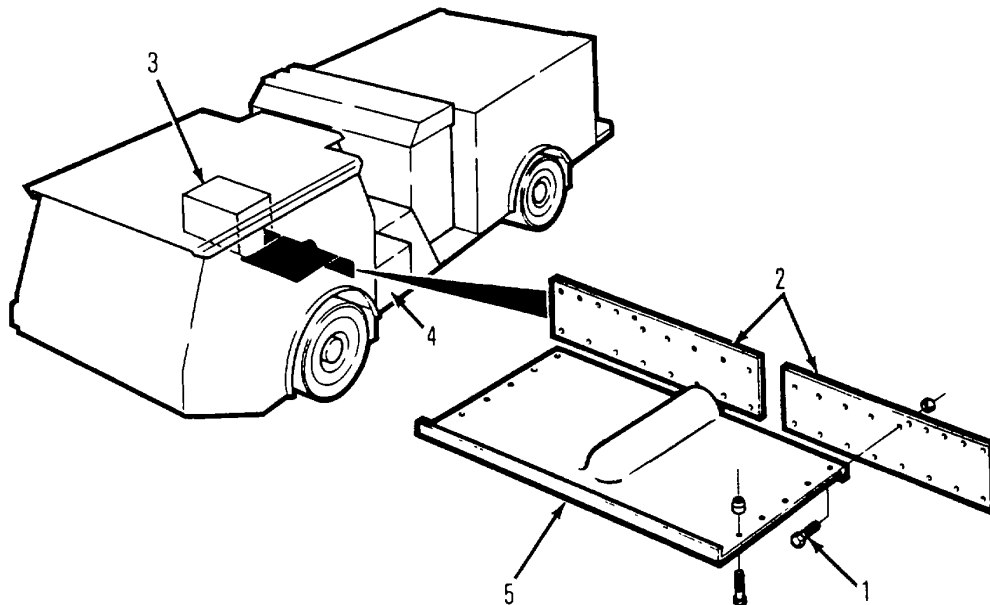
MATERIALS/PARTS

25, Appendix E Sealant
310700-07 Locknut
85-0-8731701 Sheet Rubber
102428 Front Heat Shield

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Wheels Blocked
Pump Body Heat Shield Removed (see para. 4-11)

PERSONNEL REQUIRED - 2



REMOVAL

a Front Heat Shield Removal

- (1) Remove the capscrews (1) that attach the rubber deflectors (2) to the fuel tank housing (3), and battery box (4), and front heat shield (5).

4-11. HEAT SHIELDS - Continued

- (2) Loosen the capscrews retaining the front heat shield (5) to the fuel tank housing (3) and battery box (4).
- (3) Leave the four corner capscrews fingertight and completely remove the rest.
- (4) While supporting the front heat shield (5), remove the four corner capscrews and lower heat shield to the ground.

INSTALLATION

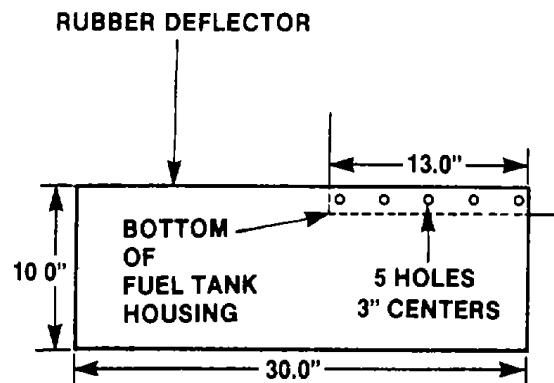
CAUTION

If drilling mounting holes in the fuel tank housing (3) or battery box (4) make sure the drill bit does not penetrate the fuel tank or one of the batteries.

NOTE

New heat shields are supplied with the mounting holes punched. The heat shields are used as templates to drill holes if new fuel tank housing (3) or new battery box (4) are also installed.

- (1) Apply sealant (Item 25, Appendix B) to each mating surface during assembly.
- (2) Slide the front heat shield under the truck. Raise the heat shield into place.
- (3) Install capscrews attaching the front heat shield (5) and tighten to 8 ft lb (11 Nm).
- (4) Cut and drill the rubber deflector as shown.
- (5) Lift the rubber deflector into place and align the holes with the insert fasteners in the fuel tank housing.
- (6) Mark on the rubber deflector the position of the mounting holes in the pump body and front heat shield and where the drive shaft opening starts.
- (7) Cut and drill the rubber deflector where marked.
- (8) Install all capscrews and new locknuts and tighten to 8 ft lb (11 Nm).
- (9) Install the left hand side rubber deflector similarly to steps 1 thru 8 preceding.
- (10) Install pump body heat shield. Measure and drill holes to mount lower end of rubber deflector to pump body heat shield.



4-11. HEAT SHIELDS - Continued

4-11 1 Front Heat Shields - Continued

REPAIR

- (1) Oversized or cracked mounting holes can be repaired by installing oversized washers over them. If patches are needed, report to Direct Support Level for repair.
- (2) Dents can be straightened by bumping them with a soft plastic hammer while using a block of wood as backing.
- (3) Make sure the pump body heat shield drain hole is not plugged.
- (4) Replace heat shields that cannot be repaired.
- (5) Clean and paint repaired area or new heat shield as detailed in para. 4-9.

4-74 /(4-75 Blank)

4-11 HEAT SHIELDS - Continued

4-11.2 Pump Body Heat Shield.

This task covers

- a Removal
- b Installation
- c Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN-5180-00-177-7033

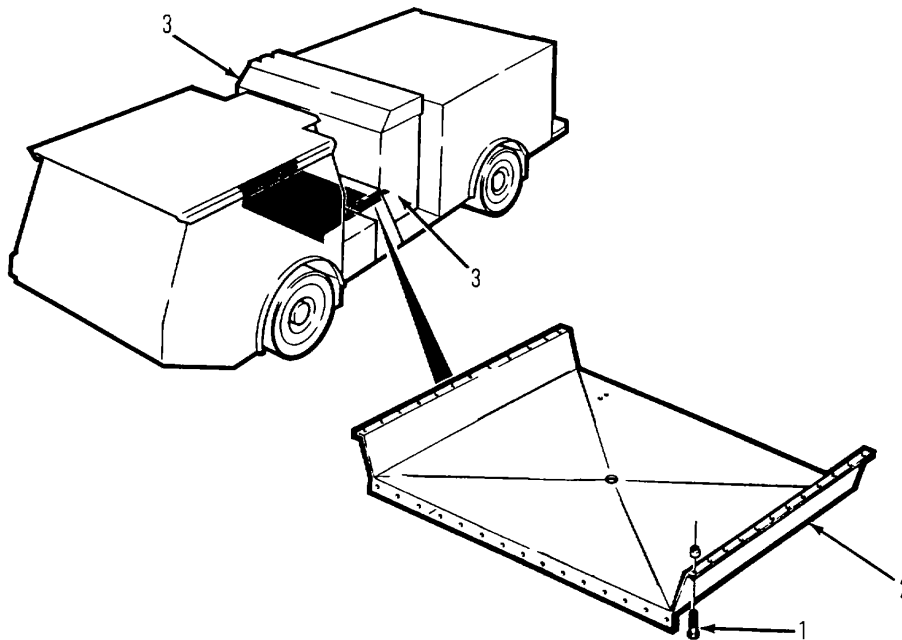
MATERIALS/PARTS

25, Appendix E Sealant
102429 Pump Body Heat Shield

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Wheels Blocked

PERSONNEL REQUIRED - 2

**REMOVAL**

- (1) Loosen the capscrews (1) retaining the pump body heat shield (2) to the pump body side sheets (3).
- (2) Leave the four corner capscrews fingertight, and completely remove the rest.
- (3) Remove the capscrews that retain the pump body heat shield to the hose body heat shield.

4-11 HEAT SHIELDS - Continued

- (4) Remove the capscrews that retain the pump body heat shield to the front heat deflector.
- (5) While supporting the pump body heat shield (2), remove the four corner capscrews (1) and lower pump body heat shield to the ground.

INSTALLATION

- (1) Apply sealant (item 25, Appendix B) to the perimeter of each mating surface during assembly.
- (2) Slide the pump body heat shield (2) under the truck. Raise the heat shield into place and support it.
- (3) Install capscrews (1) attaching the pump body heat shield (2) to the pump body side sheet (3) and tighten to 8 ft lb (11 Nm).
- (4) Install the capscrews that retain the pump body heat shield to the hose body heat shield.
- (5) Install the capscrews that retain the front heat deflector to the pump body heat shield.

REPAIR**NOTE**

Repair pump body heat shield as detailed in para. 4-11.1 REPAIR.

4-11 HEAT SHIELDS - Continued

4-11.3 Hose Body Heat Shield.

This task covers

- a Removal
- b Installation
- c Repair

TOOLS

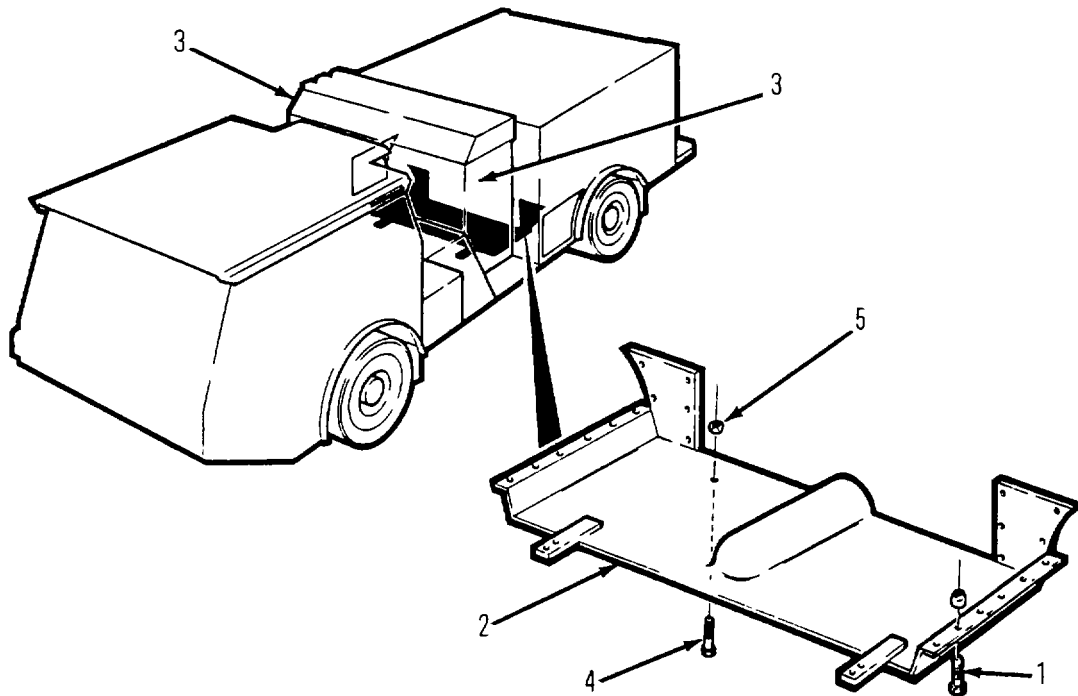
Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

25, Appendix E Sealant
102433 Hose Body Heat Shield

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Wheels Blocked
Pump Body Heat Shield Removed (see para. 4-11)

PERSONNEL REQUIRED - 2

REMOVAL

- (1) Loosen the capscrews (1) retaining the hose body heat shield (2) to the lower compartment boxes (3).
- (2) Remove the capscrews that retain the hose body heat shield to the inside of the wheel wells.

4-11 HEAT SHIELDS - Continued

- (3) Remove the capscrew (4) and nut (5) that retains the heat shield to the support.
- (4) Leave the four corner capscrews fingertight, and completely remove the rest.
- (5) While supporting the heat shield remove the four corner capscrews and lower hose body heat shield to the ground.

INSTALLATION

- (1) Apply sealant (item 25, Appendix B) to the perimeter of each mating surface during assembly.
- (2) Slide the hose body heat shield under the truck. Raise and support the heat shield.
- (3) Install capscrews (1) attaching the hose body heat shield (2) to the hose body compartments (3) and tighten to 8 ft lb (11 Nm).
- (4) Install the capscrew (4) and nut (5) that retains the heat shield to the support.
- (5) Install the capscrews that retain the hose body heat shield to the inside of the wheel well.

REPAIR**NOTE**

Repair hose body heat shield as detailed in para. 4-11.1 REPAIR.

4-12. CAB.**4-12.1 Cab Mirror.**

This task covers

- a Removal
- b. Inspection
- c Installation
- d Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

2118 Grommet
MS51922-13 Locknut
42-0067-00 Lamp Bulb

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Disconnected (see para. 4-24)

NOTE

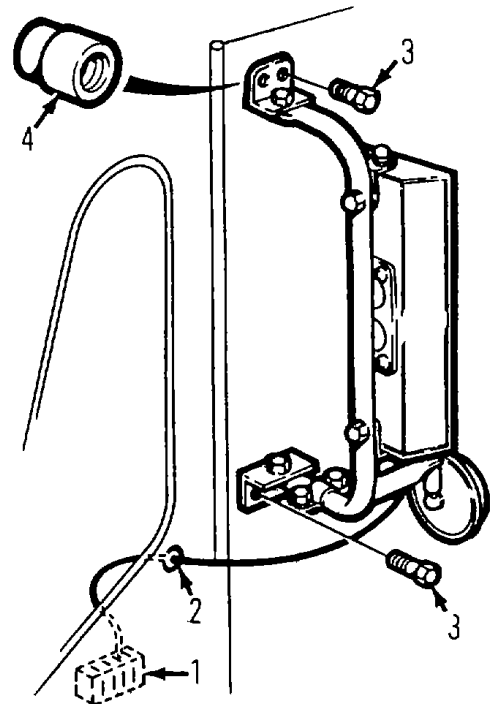
Removal and installation of the left hand mirror is detailed. The procedure for removal and installation of the right hand mirror is similar.

REMOVAL

- (1) Disconnect the three mirror cable leads from terminal block (1) inside cab.
- (2) Pull mirror cable through grommet (2).
- (3) Remove five screws (3) Retain screws and mirror assembly.

INSPECTION

- (1) Check mirror assembly for superficial damage. Be sure that both mirrors and the marker light lens are free of cracks. Be sure that the mirror cable is in good condition.
- (2) Check grommet (2) and replace if it shows signs of deterioration.
- (3) Inspect door insert fasteners (4). If loose or damaged, notify Direct Support level for repair.



4-12. CAB - Continued

INSTALLATION

- (1) Attach mirror assembly to cab door using screws (3).
- (2) Install new grommet (2), if required, and route mirror cable through grommet.
- (3) Connect mirror cable leads to terminal block inside cab as per following table.

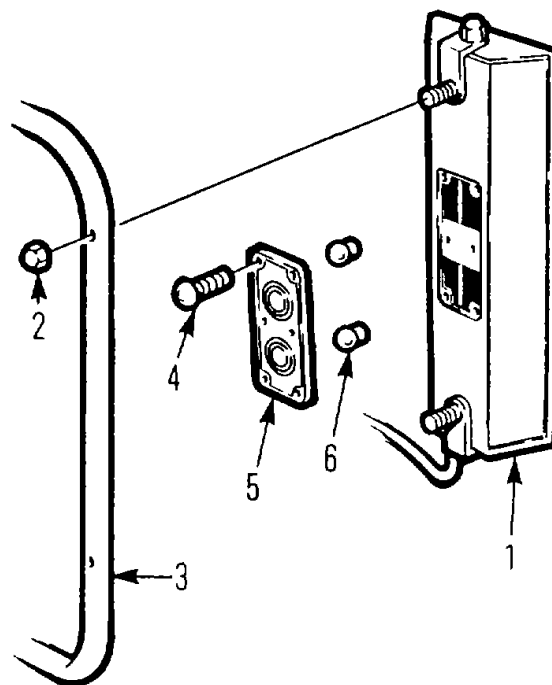
LEAD	TERMINAL
GREEN	G
BLACK	67
WHITE	88

REPAIR**a Heated Mirror Repair**

- (1) Carry out steps 1 and 2 of mirror assembly REMOVAL preceding.
- (2) Disassemble the mirror (1) from the mirror arm (3) by removing two locknuts (2).
- (3) Install new mirror to mirror arm and attach using new locknuts (2).
- (4) Install mirror cable as detailed in mirror assembly INSTALLATION Instruction steps 2 and 3 preceding.

b Marker Light Lens and Bulb Repair.

- (1) Remove two locknuts (2) and disassemble mirror (1) from mirror arm (3).
- (2) Remove six screws (4) attaching lens (5) Discard lens if it is cracked or broken.
- (3) Replace burned-out or damaged bulbs (6).
- (4) Install marker light lens using screws (4).
- (5) Install mirror to mirror arm using two new locknuts (2).



4-12. CAB - Continued

4-12.1 Cab Mirror - Continued

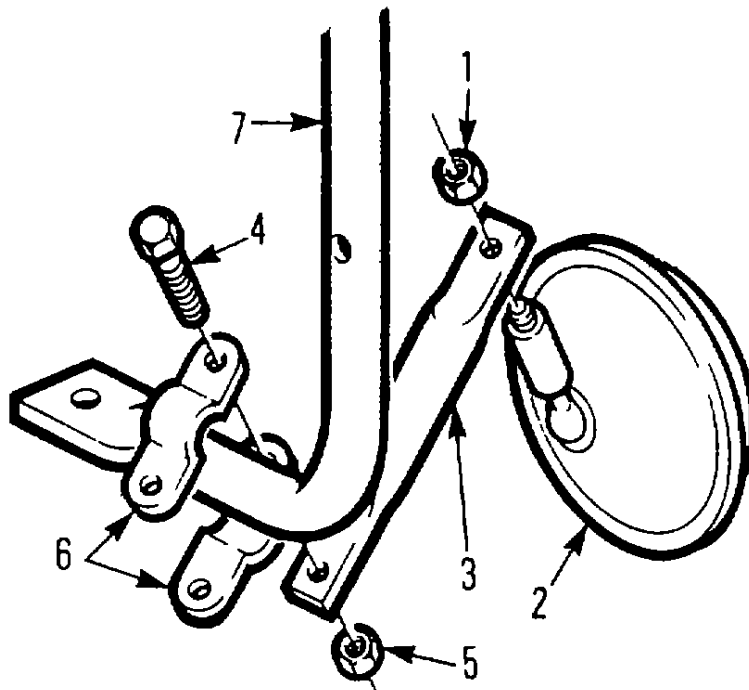
c Convex Mirror And Clamp Repair

- (1) Remove nut (1) attaching mirror (2) to clamp arm (3).
- (2) Install new mirror (2) to clamp arm using new locknut (1).

NOTE

If both mirror and clamp arm are to be replaced, carry out steps 3, 4, and 2 in this order.

- (3) Remove screws (4) and nuts (5) and discard components (1) thru (6).
- (4) Assemble new clamps (6) and clamp arm (3) to mirror arm (7) using new screws (4) and nuts (5).



4-82 / (4-83 Blank)

4-12. CAB - Continued**4-12.2 Cab Door.**

- This task covers**
- a. Removal
 - b. Inspection
 - c. Installation
 - d. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS / PARTS

34, Appendix E White Grease
310342-03 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF
Mirror Removed From Door (see para. 4-12.1)

PERSONNEL REQUIRED - 2**NOTE**

Removal and installation of the left hand door is detailed. The procedure for removal and installation of the right hand door is similar.

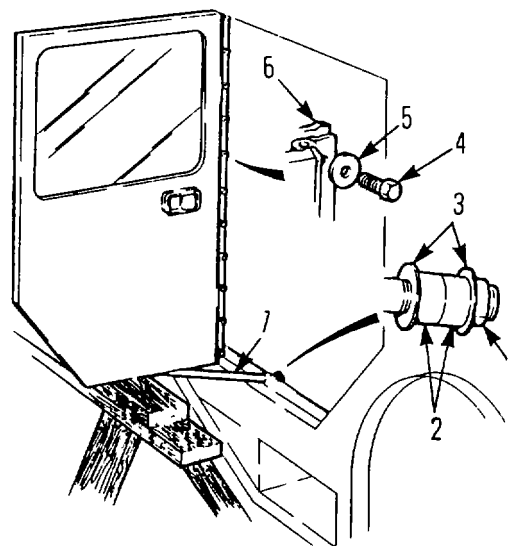
REMOVAL

- (1) Place support under the fully open door.
- (2) Remove locknut (1), rubber bumpers (2) and flat washers (3) Access these parts from underneath the cab.

CAUTION

Door is heavy, be sure second person supports it.

- (3) Remove screws (4), flat washers (5), and shim (6), if used, from cab panel.
- (4) Lift and remove door.

**INSPECTION**

- (1) Check door hinge for damage and corrosion. Be sure hinge moves freely if movement is stiff, clean and lubricate hinge with white grease (item 34, Appendix E).
- (2) Inspect cab door, door frame, and shim (6). Dents and other damage, including paint work, should be repaired before the door is installed.
- (3) Inspect door check components. Be sure rubber bumpers (2) are in a good condition and the check rod (7) is undamaged.

4-12. CAB - Continued

INSTALLATION

- (1) Place door on support and align with door frame. Be sure rod (7) protrudes through door frame.
- (2) Orientate shim (6) so that edge closest to mounting holes faces outward when installed.
- (3) Lubricate screws with white grease (item 34, Appendix E). Position shim between door hinge and door frame. Attach both hinge and shim to door frame using screws (4) and flat washers (5).
- (4) Check that door is aligned with door frame. Loosen screws and realign if necessary.
- (5) Tighten screws to 50 ft lb (65 Nm).
- (6) Install washers (3) and rubber bumpers (2) Install new locknut (1).

REPAIR

a. Door Hinge Repair

NOTE

Door hinge cannot be repaired. Replace if damaged.

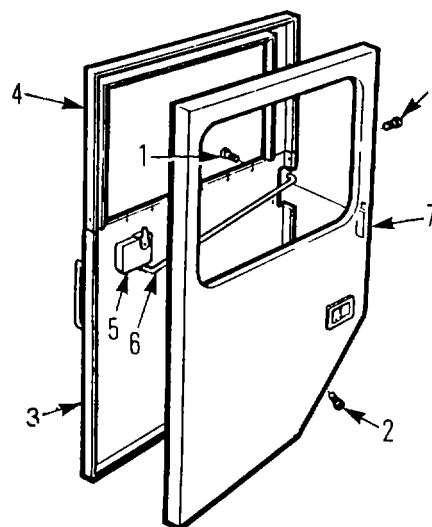
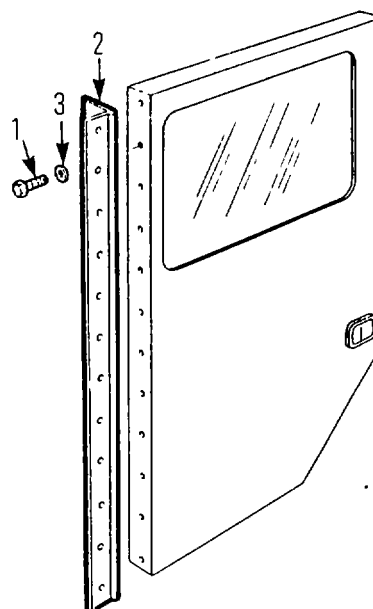
- (1) Remove 12 screws (1) and flat washers (3).
- (2) Clean hinge area on door and, if necessary, repair paint (see para. 4-9).
- (3) Lubricate screws (1) with white grease (item 34, Appendix E). Attach hinge (2) to door using screws (1) and washers (3).

b. Window Repair

NOTE

Window cannot be repaired. Replace if damaged.

- (1) Remove upper door panel (4) by removing screws (2).
- (2) Remove lower door panel (3) by removing screws (2 and 1).
- (3) Disconnect inside handle rod (6) from latch (7) and handle (5).
- (4) Remove screws (8) attaching angle piece (9).



4-12. CAB - Continued

4-12.2 Cab Door - Continued

CAUTION

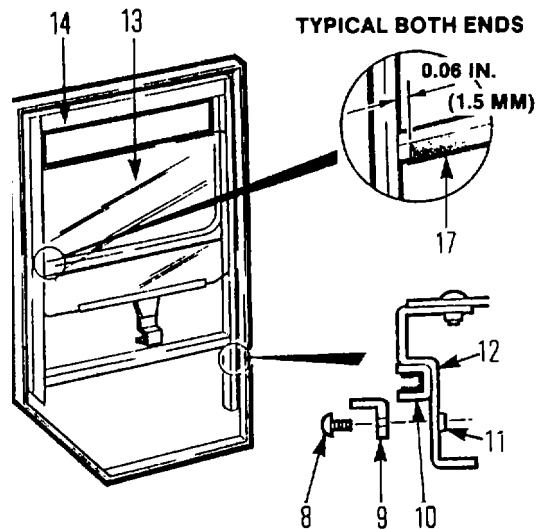
Prevent breaking the glass. Move window (13) clear of glass run channel (14) before carrying out step 5.

- (5) Carefully pry glass run (10) loose from bond with window support (12) and remove both glass run and window.

NOTE

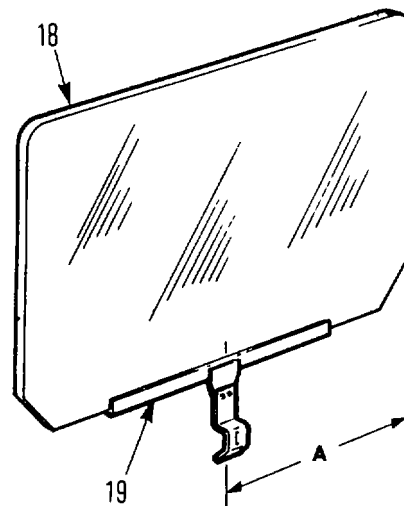
If clearance between vertical window supports is insufficient to allow removal of window remove angle piece (15) and glass run (16) also. Follow procedure detailed in steps 4 and 5.

- (6) Remove old adhesive from window support (12) and reuseable glass run channel.
- (7) Inspect weatherstrip (17) and insert fasteners (11) Worn or deteriorated weatherstrip and loose or damaged inserts must be replaced. Notify Direct Support Level for repair of inserts. Use contact adhesive (item 6, Appendix E) when replacing weatherstrip (17).
- (8) Inspect components for wear and damage and replace if faulty or deteriorated.
- (9) When replacing window (13), bond new window pane (18) and glass channel assembly (19) together using contact adhesive (item 6, Appendix E) maintaining dimension A as shown.



Right door window A = 12.8 in. (326 mm)
 Left door window A = 15.4 in. (391 mm)

- (10) Apply contact adhesive (Item 6, Appendix E) to glass arm channel. Apply adhesive very sparingly. Too much adhesive will make future removal difficult.
- (11) Fit window and glass arm channel together and install in door. Be sure glass arm butts against upper glass arm channel (14) and seats firmly against window support.
- (12) Install angle piece (9) and attach using screws. (8) Check that window slides up and down easily.



4-12. CAB - Continued

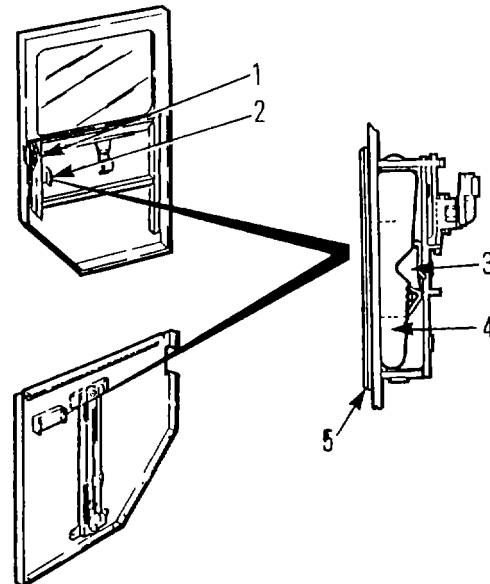
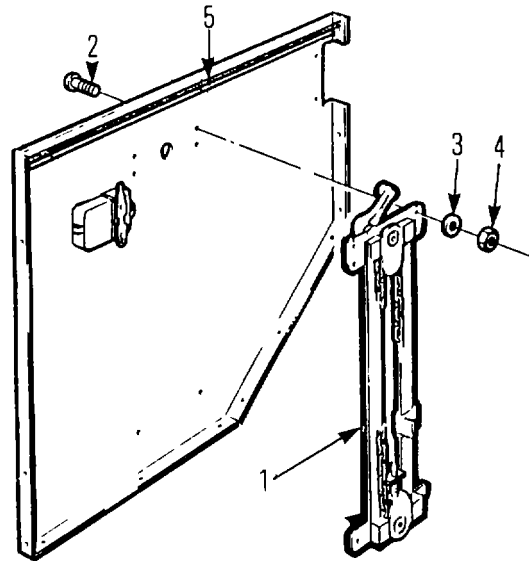
- (13) Install inside upper door panel (2) using screws (1).
- (14) Install inside handle rod (6) to door latch (7) and inside door handle (5) and line window regulator crank with hole in window glass channel bracket .
- (15) Attach lower inside panel (3) using screws (1 and 2).

c. Window Regulator Repair

NOTE

Window regulator cannot be repaired. Replace if damaged.

- (1) Remove inside lower door panel as detailed in steps 2 and 3 of Window Repair procedure (b. preceding).
- (2) Remove window regulator attaching screw (2), flat washers (3) and nuts (4) and remove window regulator (1).
- (3) Inspect weatherstrip (5) and other accessible door components. Replace any found damaged or deteriorated. When replacing weatherstrip, bond new weatherstrip in place with contact adhesive (item 6, Appendix E). Be sure to maintain 1/16 in. (1.5 mm) clearance between ends of weatherstrip and vertical glass runs.
- (4) Install window regulator (1) using screws (2), flat washers (3) and locknuts (4).
- (5) Install inside lower door panel to outer door panel as detailed in steps 14 and 15 of Window Repair procedure.



d. Outside/Inside Door Handle Repair.

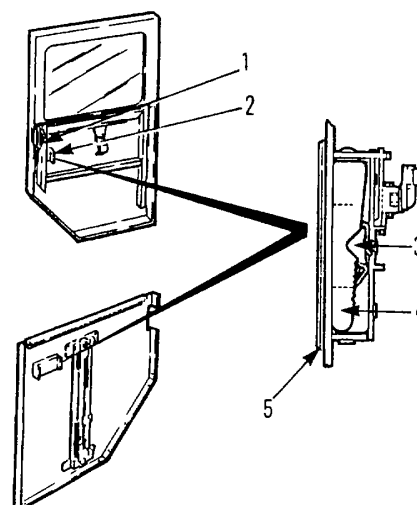
NOTE

Door handle cannot be repaired. Replace if damaged.

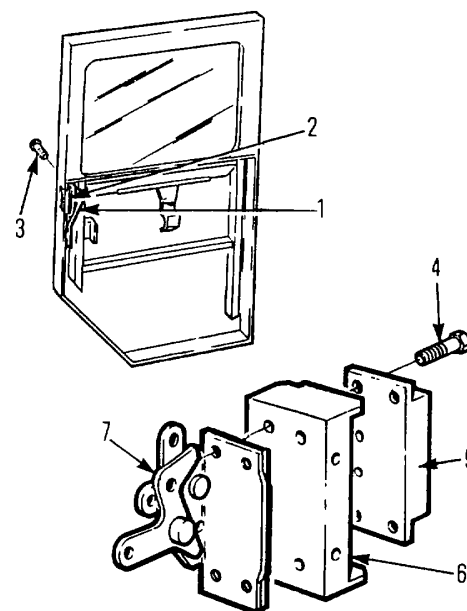
- (1). Remove inside lower door panel as detailed in steps 2 and 3 of Window Repair procedure, b preceding.
- (2). When replacing outside door handle, disconnect rod (1) from handle (2).
- (3). Lift up spring clips (3) and remove keys (4).

4-12. CAB - Continued**4-12.2 Cab Door - Continued**

- (4) Pull door handle free of door panel.
- (5) Inspect handle gasket (5) and replace if damaged or deteriorated.
- (6) Inspect weatherstrip and other accessible door components. Replace any found damaged or deteriorated. When replacing weatherstrip, bond in place with contact adhesive (item 6, Appendix E). Be sure to maintain 1/16 in. (1.5 mm) clearance between ends of weatherstrip and vertical glass runs.
- (7) Install door handle in door panel and attach using keys (4). Push keys down firmly to secure handle. Ensure spring clips engage on keys.
- (8). Attach rod (1) to outside door handle
- (9) Install inside lower door panel to outer door panel as detailed in steps 14 and 15 of Window Repair procedure (b. preceding).

**e. Door Latch Repair**

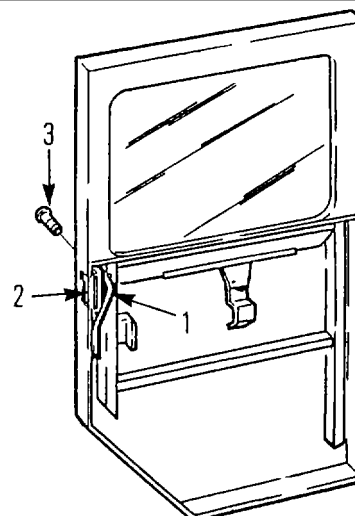
- (1) Remove inside lower door panel as detailed in steps 2 and 3 of Window Repair procedure (b. preceding).
- (2) Disconnect rod (1) from door latch (2).
- (3) Remove screws (3) and remove latch from door panel.
- (4) Disassemble door latch (5), latch support (6), and latch mounting plate (7) by removing screws (4).
- (5) Inspect door latch components. Replace faulty parts. Lubricate pivot points and moving parts with white grease (Item 34, Appendix E).
- (6) Assemble latch components as shown. Tighten capscrews (4) to 8 ft lb (11 Nm).



- (7) Inspect weatherstrip and other accessible door components. Replace any found damaged or deteriorated. When replacing weatherstrip, bond in place with contact adhesive (Item 6, Appendix E.) Be sure to maintain 1/16 in. (1.5 mm) clearance between ends of weatherstrip and vertical glass runs.

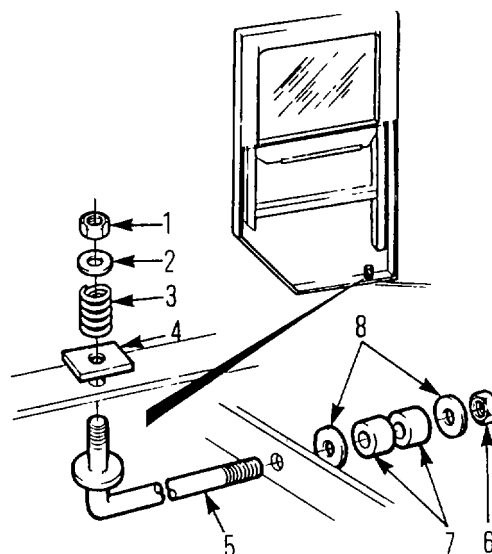
4-12. CAB - Continued

- (8) Install door latch (2) in door panel and attach using screws (3).
- (9) Attach rod (1) to door latch.
- (10) Install inside lower door panel to outer door panel as detailed in steps 14 and 15 of Window Repair procedure, b. preceding.



f. Door Check Repair

- (1) Remove rubber bumpers (7), nut (6), and washers (8) from stop rod. Access these parts from underneath the cab.
- (2) Remove inside lower door panel as detailed in steps 2 and 3 of Window Repair procedure, b. preceding.
- (3) Remove door check components from the outer door panel in the order shown. Replace any broken or worn components.
- (4) Before reassembly apply five drops of threadlock liquid (item 29, Appendix E) to the nut (1).
- (5) Install door check components in reverse order shown. Turn nut (1) down only 2 to 3 turns after spring (3) starts to compress, or until rod protrudes top of nut.
- (6) Install inside lower door panel to outer door as detailed in steps 14 and 15 of Window Repair procedure, b. preceding.
- (7) Ensure door check rod protrudes through door frame. Install bumpers (7), washer (8), and new locknut (6) on check rod as shown.



4-12. CAB - Continued

4-12.3 Spotlight.

- This task covers**
- Removal
 - Inspection
 - Installation
 - Repair

TOOLS

Shop Equipment Automotive
Maintenance and repair
NSN 4910-00-754-0650

MATERIALS / PARTS

320562 Butt Splice
MS51922-1 Locknut

EQUIPMENT CONDITION

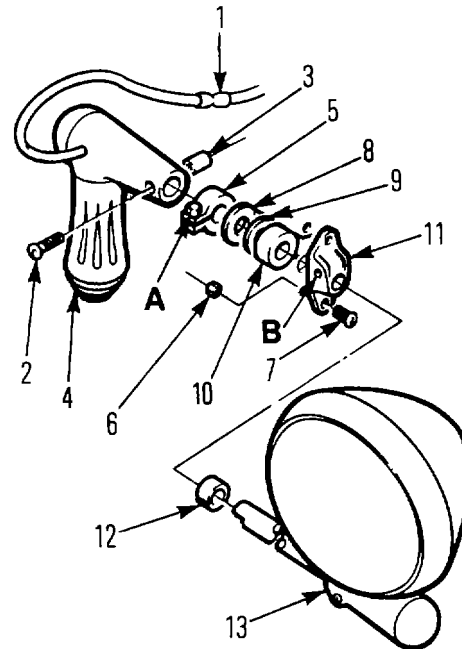
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

NOTE

Removal, installation, and repair of the left hand spotlight is detailed. The procedures for the right hand spotlight are similar.

REMOVAL

- Cutout wire butt splice (1) and discard. Be sure to cut as close as possible to splice on both sides. If splice is not accessible, cut wire at least 2 in. (50 mm) away from spotlight.
- Remove handle assembly wedge screw (2) and wedge (3). Pull handle assembly (4) free of lamp assembly shaft.
- Loosen screw (A) and remove collar (5). Remove screw (7) and nut (6) attaching arm (8). Remove arm (8), wire clip (9), and rubber bushing (10).
- Loosen screw (B) and pull lamp assembly (13) out of bracket (11). Be sure to retain split sleeve (12).
- Remove two screws (7) and nuts (6), and remove bracket (11).

**INSPECTION**

- Inspect all components for superficial damage. Be sure the bulb lens is free of cracks.
- Check that components making up the handle and lamp assemblies are firmly attached.

4-12. CAB - Continued

INSTALLATION

- (1) Install bracket (11) using two screws (7) and nuts (6) Tighten nuts firmly.
- (2) Be sure split sleeve (12) is placed on the lamp shaft and push the shaft through bracket (11) until sleeve is seated and lamp base butts against bracket. Secure sleeve by tightening screw (B).
- (3) Install rubber bushing (10), wire clip (9), and arm (8) over shaft. Attach arm to cab wall using screw (7) and nut (6).
- (4) Install collar (5) over shaft and be sure it engages with the arm (8) While pulling on lamp shaft, push collar, arm (8), and wire clip (9) snug against rubber bushing (10) and tighten screw (A).

NOTE

The lamp assembly shaft consists of an inner shaft and shaft tube, and an outer shaft tube. The inner shaft and a driven gear inside the handle assembly are keyed together. The outer shaft tube is notched to permit attachment to the handle by wedge and screw.

- (5) While holding the lamp and pushing the handle assembly onto the lamp shaft, rotate the handle until the internal gear and shaft slip together.
- (6) Be sure the notch in outer shaft aligns with wedge mounting hole in handle and install wedge (3) and screw (2).
- (7) Connect lamp wiring by installing new butt splice (1) Attach wire to wire clip (9).

REPAIR

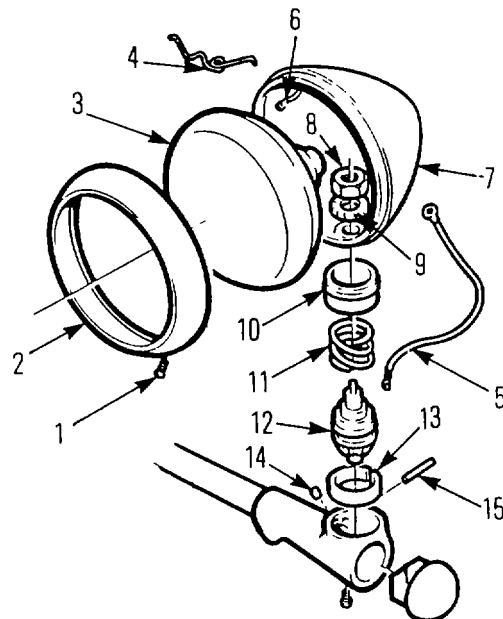
- a. Lamp Head Repair.

NOTE

Spotlight may remain installed on truck.

To replace lamp bulb, carry out steps (1), (9), and (10) only.

- (1) Remove screw (1) and lamp ring (2)
Disconnect wires (5) and (6) from bulb (3)
Remove retaining springs (4) attaching bulb to lamp ring and remove bulb.
- (2) Remove wire (5), nut (8), and washer (9)
Remove lamp shell (7) from lamp housing.
- (3) Remove screw (14), pin (15), bushing (10), and spring (11).



4-12. CAB - Continued

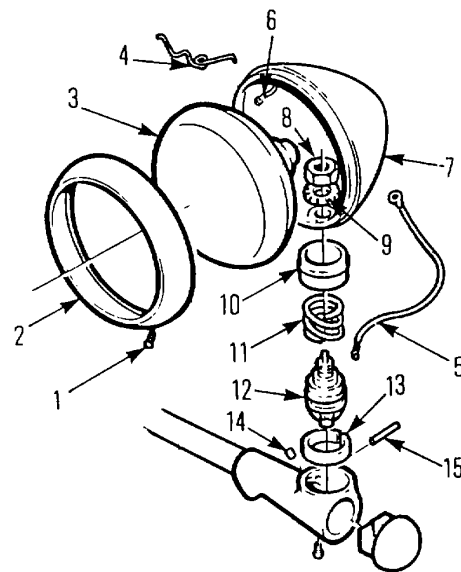
4-12.3 Spotlight - Continued

- (4) Remove headpost (12) from lamp housing and remove nylon ring (13) from headpost.
- (5) Inspect parts for wear and corrosion. Replace defective parts.
- (6) Install nylon ring (13) on headpost (12) Lubricate headpost gear and nylon ring with white grease (Item 34, Appendix E) and insert headpost in lamp housing.

NOTE

Hardened steel washers form protective barriers between spring (11), bushing (10) and headpost (12) Be sure these washers remain in place when assembling lamp head.

- (7) Install spring (11) and bushing (10) Secure bushing with pin (15).
- (8) Install screw (14) Tighten it firmly to prevent nylon ring (13) from rotating inside the lamp housing.
- (9) Install lamp shell (7) to headpost using washer (9) and nut (8).
- (10) Assemble lamp ring (2) and bulb (3) using springs (4) Attach wires (5 and 6) to bulb, and wire (5) to headpost.
- (11) Install lamp ring to lamp shell and secure with screw (1).

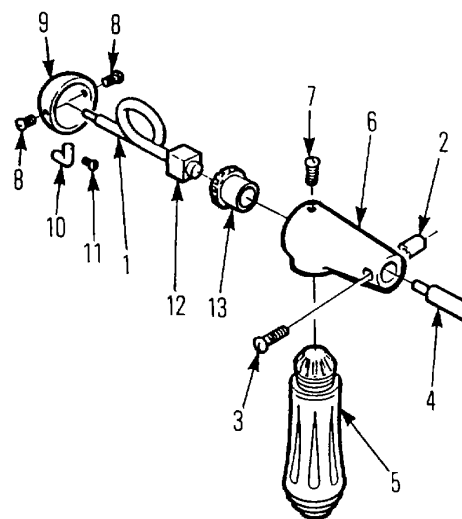


- b. Handle Housing, Handle, and Lamp Switch Repair.

NOTE

To replace handle and handle housing assembly, carry out steps 1, 2 and 11
To replace switch and wire assembly carry out steps 1, 4, 5, 7, 8, 9, and 11.

- (1) Cut wire butt splice out of wire (1) and discard. Be sure to cut as close to splice as possible.
- (2) Remove screw (3) and wedge (2) Pull handle and housing assembly off shaft (4).
- (3) Pull handle (5) from housing (6).
- (4) Remove screw (7), screws (8), switch cap (9) and switch assembly (12).
- (5) Remove screw (11) and toggle (10).



4-12. CAB - Continued

(6) Inspect all parts for wear and corrosion. Clean corroded parts. Replace if defective.

NOTE

If the gear on handle (5) or the gear (13) has defective teeth, replace complete handle and housing assembly.

- (7) Install toggle (10) and screw (11) in switch (12).
- (8) Be sure gear (13) is properly located in housing (6) and install switch (11) and switch cap (9) Attach switch cap using screws (8).
- (9) Install screw (7).
- (10) Lubricate gear on handle (5) using white grease (Item 34, Appendix E.) Install handle to housing (6) using wedge (2) and screw (3).
- (11) Install handle assembly to shaft (4) and connect wiring as detailed in steps 5 thru 7 of INSTALLATION preceding.

4-12. CAB - Continued**4-12.4 Siren / PA Unit.**

This task covers a. **Removal**
b. **Installation**

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

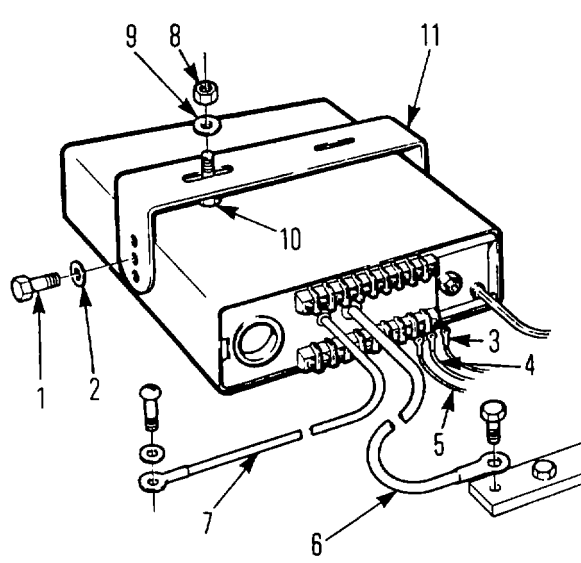
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

REMOVAL

- (1) Remove two screws (1) and washers (2).
- (2) From the backside of siren, tag and disconnect wires (3), (4), and (5).
- (3) Disconnect cable (6) at battery bus bar, terminal 125. Disconnect ground wire (7) and remove siren (Battery bus bar is behind hinged panel on dash).
- (4) Remove two nuts (8), washers (9), and screws (10) and retain bracket (11).

INSTALLATION

- (1) Install bracket (11) using two screws (10), washers (9), and nuts (8). Tighten nuts firmly.
- (2) Connect wires (3), (4), and (5) to terminal strip on the rear of siren as shown. Be sure wires are hooked up correctly as identified.
- (3) Connect cable (6) to battery bus bar, terminal 125, and attach wire (7) to ground.
- (4) Install siren on bracket (11) using screws (1) and lockwashers (2). Finger tighten screws only.
- (5) Adjust siren position in bracket for operator convenience and tighten screws (1) firmly.
- (6) Fold back hinged panel and secure.



4-12. CAB - Continued**4-12.5 Glove Compartment.**

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

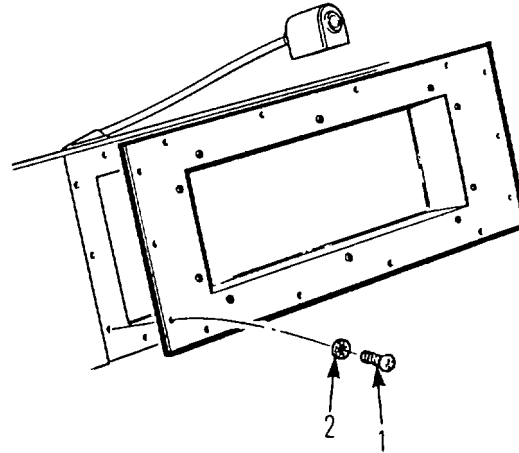
Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

REMOVAL

- (1) Lift glove compartment box out of instrument panel frame.
- (2) Lift glove compartment box out of instrument panel frame.

**INSPECTION**

- (1) Inspect glove compartment box for damage. Minor dents and surface damage may be straightened and the paint repaired, see para 4-9.
- (2) Replace compartment box if damage is substantial.

INSTALLATION

- (1) Place glove compartment box in instrument panel frame.
- (2) Attach box using screws (1) and lockwashers. Tighten screws firmly.

4-12. CAB - Continued

4-12.6 Transmission Shift Control.

- This task covers**
- a. Removal
 - b. Installation
 - c. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS / PARTS

DZ982-1 Bulb

EQUIPMENT CONDITION

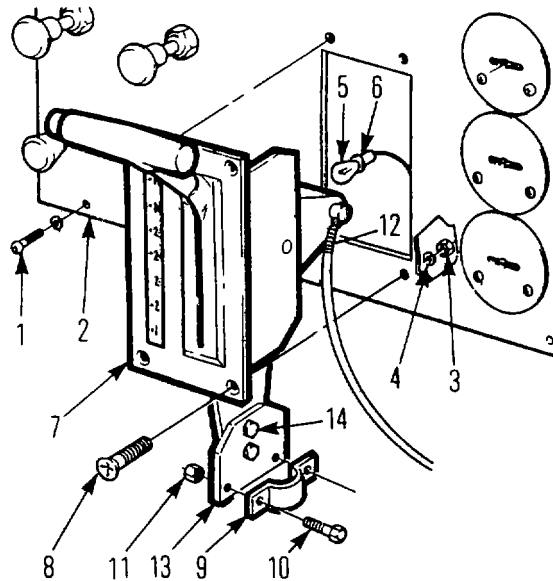
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF
Transmission Shift Control in N (neutral)

NOTE

To replace bulb carry out steps 1 and 2 of removal procedure and steps 3 and 4 of installation procedure.

REMOVAL

- (1) Remove screws (1) attaching instrument panel (2).
- (2) Pull instrument panel free of dashboard frame to access nuts (3) and lamp socket (6) Pull lamp socket out of shift control (7) and replace bulb (5).
- (3) Be sure shift lever is selected to NEUTRAL and remove nuts (11) and screws (10) attaching clamp (9).
- (4) Unscrew cable ferrule (12) from shift control swivel.
- (5) Remove screws (8), nuts (3), and washer (4) Remove shift control (7).



INSTALLATION

- (1) Check transmission is in NEUTRAL and the selector is positioned to NEUTRAL before proceeding with installation.
- (2) Install shift control (7) in panel (2) using screws (8), lockwashers (4), and nuts (3) Tighten nuts firmly.
- (3) Screw ferrule (12) into shift control cable swivel. Adjust ferrule position to accurately line up cable sheathing clamp point with bracket (13).

4-12. CAB - Continued

NOTE

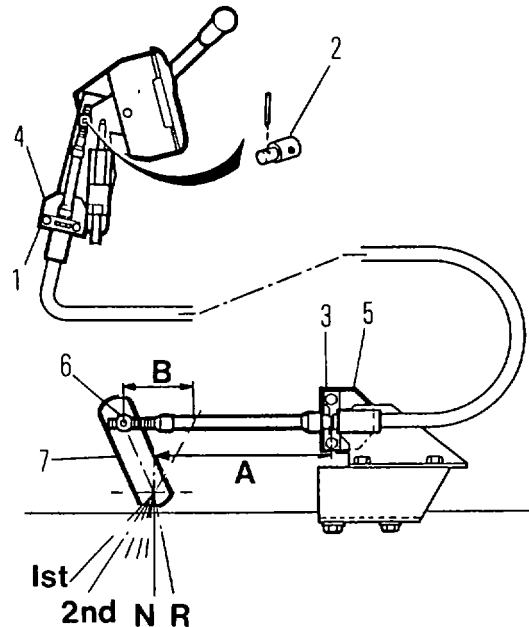
If adjustment of ferrule (12) is not enough to properly aline cable sheathing clamp point with bracket (13), bracket location may be adjusted. To do this, loosen nuts (14) and slide bracket (13) to new position. Be sure to tighten nuts firmly after adjustment.

- (4) Install lamp socket (6) in shift control.
- (5) Check that adjustment of transmission shift cable is accurate. Refer to steps 13 and 14 of Transmission Cable Repair following.
- (6) Install instrument panel to dashboard frame using screws (1) Tighten screws firmly.

REPAIR

a. Transmission Cable Repair

- (1) Remove instrument panel containing transmission shift control as detailed in REMOVAL preceding.
- (2) Remove cable clamp (1) attaching cable sheathing to shift control bracket (4).
- (3) Remove cotter pin and swivel fitting (2) attaching cable end to shift control. Unscrew swivel fitting from cable end.
- (4) Remove cable clamp (3) attaching cable sheathing to transmission bracket (5).
- (5) Remove cotter pin and swivel fitting (6) attaching cable end to transmission shift arm (7). Unscrew fitting from cable end.



- (6) Remove transmission shift cable from truck and route new cable in place.
- (7) Screw cable end into swivel fitting (2) until fitting is located half-way in on the threaded portion of the cable end fitting.
- (8) Attach cable sheathing to shift control bracket (4) using clamp (1).
- (9) Screw cable end into swivel fitting (6) and attach cable to bracket (5) in the same manner as detailed in steps (7 and 8).
- (10) Be sure that the shift control is placed in NEUTRAL and the transmission selected in neutral before proceeding with the cable installation. The illustration shows Reverse, Neutral and the forward gears. Move shift over by hand, if necessary, to locate NEUTRAL position.

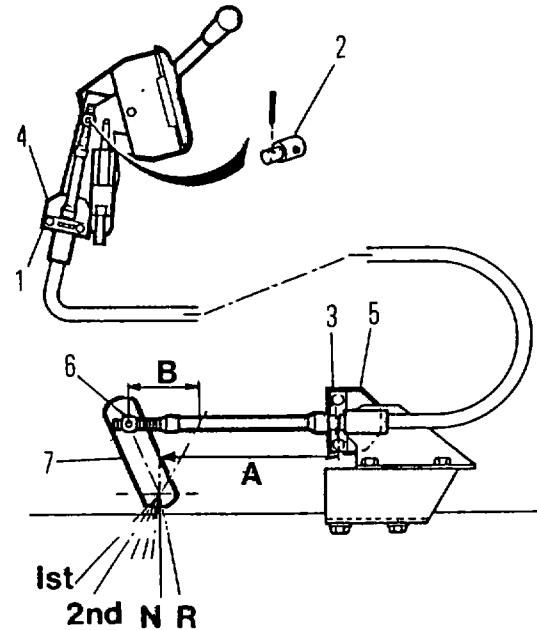
4-12. CAB - Continued

4-12.6 Transmission Shift Control - Continued

NOTE

Cable brackets (4) and (5) do not normally require adjustment. They may be repositioned if the length of new cable sheathing differs from the old. Typically the length (A) is adjusted to 6.8 in. (173 mm).

- (11) Line up fittings (2 and 6) with mounting holes in shift control and transmission shift arm respectively. Move swivel fittings further in or out on the threaded cable buds to achieve this.
- (12) Install swivel fittings to shift control and transmission shift arm and secure with cotter pins.
- (13) Select in turn, 1st and reverse gears using the shift control lever. The transmission shift shaft has detents in all gear positions. Be sure that the detents in the two extreme positions fully engage.
- (14) Be sure that when either 1st or reverse gear is selected, no undue stress is exerted on swivel fittings (2 and 6). If necessary remove fitting from transmission arm of shift control and readjust position on cable. Reinstall after adjustment.
- (15) Install control panel containing transmission shift control as detailed in INSTALLATION preceding.



4-12. CAB - Continued

4-12.7 Heater Control.

This task covers a. Removal
 b. Inspection
 c. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
 NSN 5180-00-177-7033

MATERIALS / PARTS

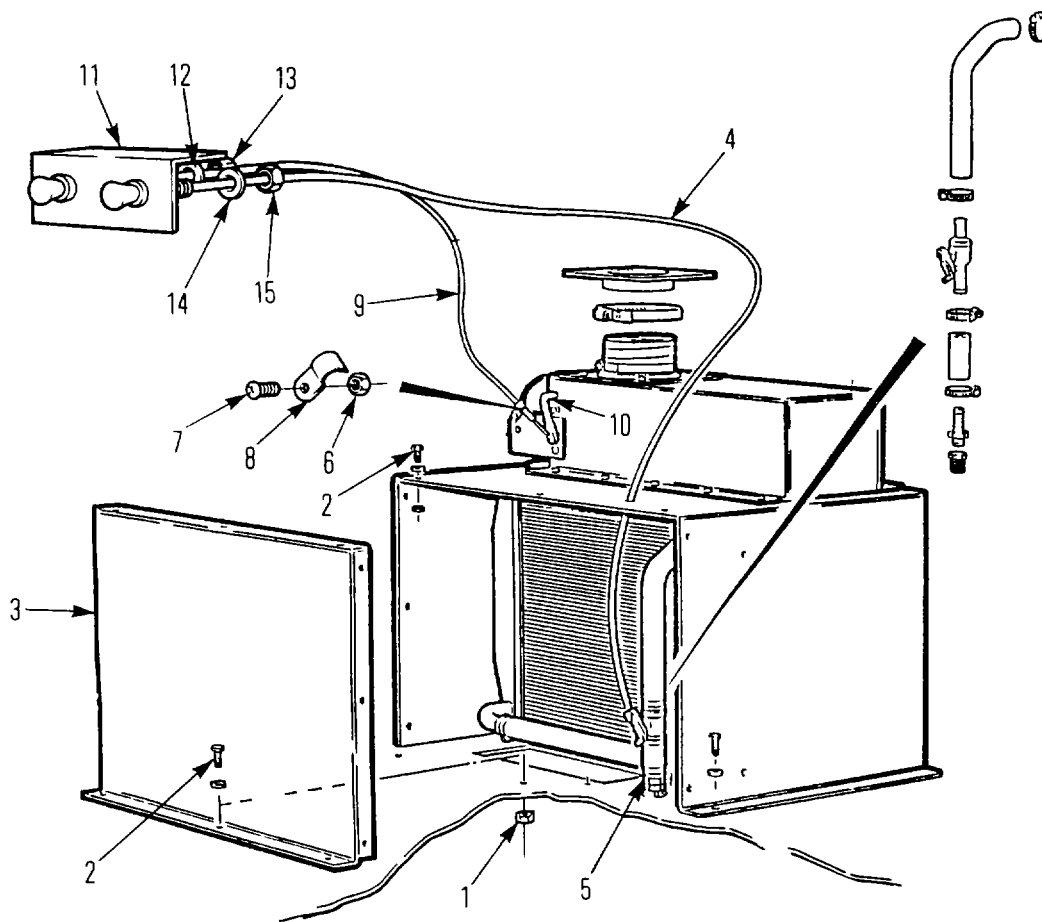
310342-01 Locknut
 310700-07 Locknut
 33070-48-3008811 Defrost Cable
 33070-72-3008811 Heater Cable

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Battery Switch OFF

NOTE

Repair of the heater control is limited to replacement of the heater and defroster cables



4-12. CAB - Continued**REMOVAL**

a. Heater Cable Removal

- (1) Remove screws (2) and nuts (1) attaching heater box cover (3) Remove cover.
- (2) Disconnect cable (4) from valve (5) and pull cable out of heater box.
- (3) Loosen nut (13) and pull cable (4) through bracket (11) Collect nut (13) and washer (12) when cable is fully withdrawn from bracket.

b. Defroster Cable Removal.

- (1) Remove nut (6), screw (7) and cable clip (8) Remove cable (9) from diverter arm (10).
- (2) Loosen nut (15) and pull cable through bracket. Collect nut (15) and washer (14) when cable is fully withdrawn from bracket.

INSPECTION**NOTE**

Inspect cables for kinks, damaged knobs, stripped thread and damage to sheathing. Cables not in a good condition should be replaced.

INSTALLATION

a. Heater Cable Installation

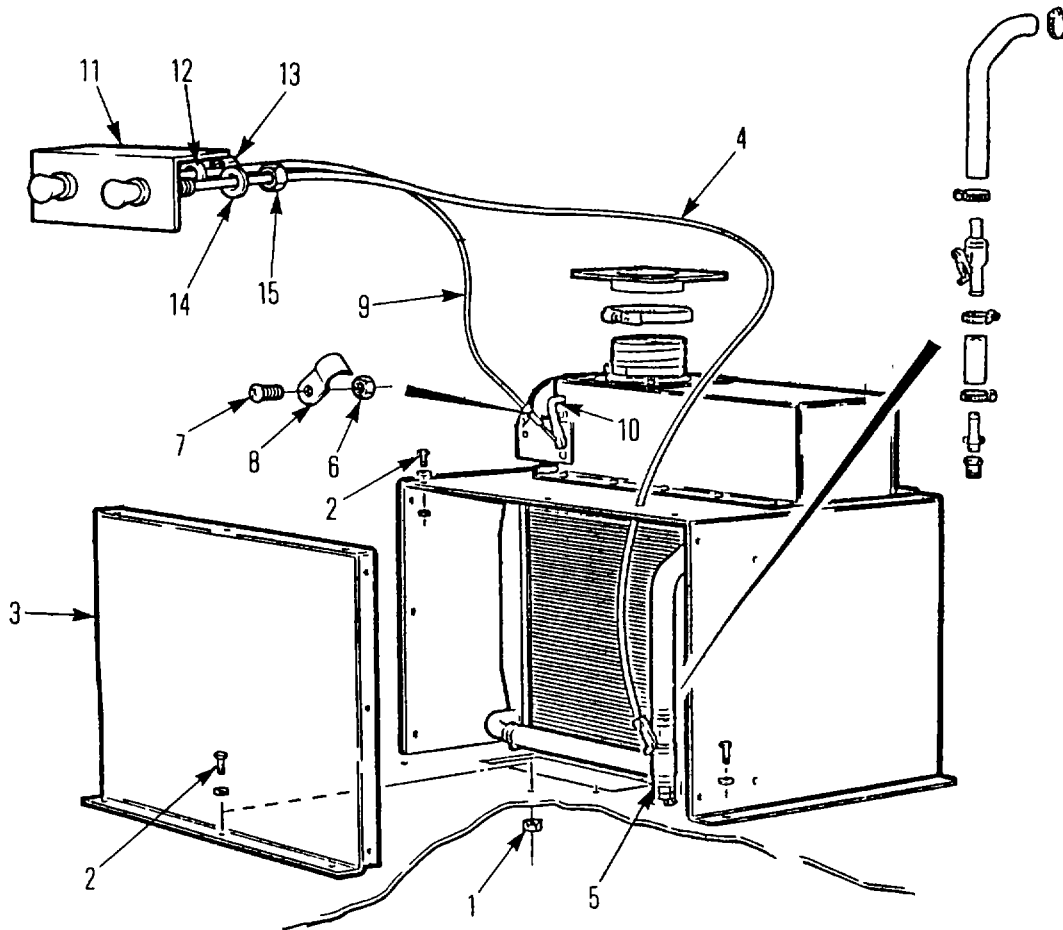
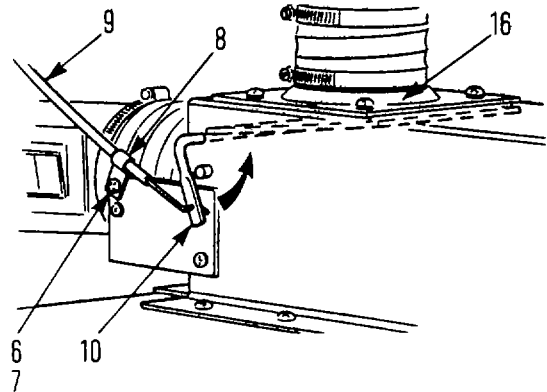
- (1) Remove nut (13) and washer (12) from cable.
- (2) Feed cable (4) through heater control bracket.
- (3) Feed washer (12) and nut (13) up cable and thread onto cable conduit until conduit is tight against bracket.
- (4) Feed cable (4) through hole in heater box as shown. Check and make sure that valve (5) is fully closed and cable knob (5) is fully pushed IN. Attach cable wire to valve actuator and secure cable sheathing to valve bracket.
- (5) Install cover (3) using screws (2) and nuts (1).

4-12. CAB - Continued

4-12.7 Heater Control - Continued

b. Defrost Cable Installation

- (1) Remove nut (15) and washer (14) from cable. Feed cable through heater control bracket. Feed washer (14) and nut (15) up cable and thread onto cable conduit until conduit is tight against bracket.
- (2) Attach cable (9) to diverter arm (10). Be sure that when knob is pushed IN, diverter fully closes defroster opening (16).
- (3) Secure cable to heater box using clip (8), screw (7), and nut (6).



4-12. CAB - Continued

4-12.8 Heater Unit.

- This task covers
- a Removal
 - b Inspection
 - c Installation
 - d Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

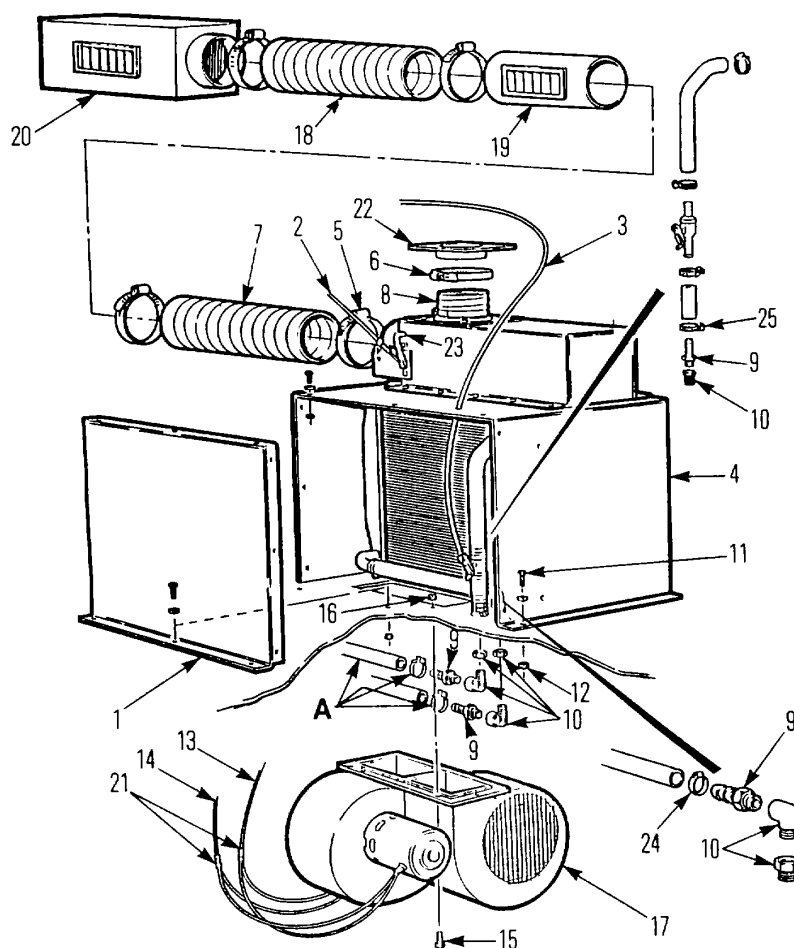
MATERIALS/PARTS

320562 Butt Splice
MS51922-1 Locknut
310342-01 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Disconnected (see para. 4-24)
24-Vdc Converter Removed (see para. 4-24)
Heater Control Cables Removed (see para. 4-12.7)

PERSONNEL REQUIRED - 2



4-12. CAB - Continued**REMOVAL**

- (1) Crimp heater hoses using suitable pliers to prevent loss of engine coolant. Remove inlet and outlet winterization hoses and clamps (A) (below cab floor).
- (2) Loosen hose clamps (5 and 6) and disconnect flex hoses (7 and 8).
- (3) Loosen hose clamps (24 and 25) and pull heater hoses from barbed nipples.
- (4) Remove screws (11) and nuts (12) and pull heater unit out of cab.
- (5) Tag and cut the wires (13 and 14) as well as the colored blower motor wires. Cut the wires as close as possible to the butt splices (21).
- (6) Remove screws (15) and nuts (16) and remove blower unit.

INSPECTION

- (1) Inspect heater box components for superficial damage and defects. A trace of crystal deposit left by evaporated coolant often indicates a potential leak or a weak joint. If any traces or deposits are noticed, test the components as detailed under Heater Core and Plumbing Repair following.
- (2) Check that the movement of diverter arm (23) is smooth and unobstructed and that the heater core is solidly attached to the heater box. Tighten the attaching screws if necessary.
- (3) Inspect flexible hoses (8, 7, and 18) as well as the air diffusers (19 and 20). Replace damaged hoses if the air diffusers (19 or 20) are damaged, notify Direct Support Level for repair.

NOTE

Use flexible hose (64 - 2920X) and cut to appropriate length when replacing items (7, 8, and 18).

- (4) Inspect the blower unit. Check that blower wheels and housings do not rub against one another. Rubbing caused by minor damage to the housing may be eliminated by straightening dents or bends in housing walls.
- (5) Inspect bulkhead fittings (10) and barbed hose fittings (9). Fittings with stripped thread or surface damage that could cause leaks must be replaced.

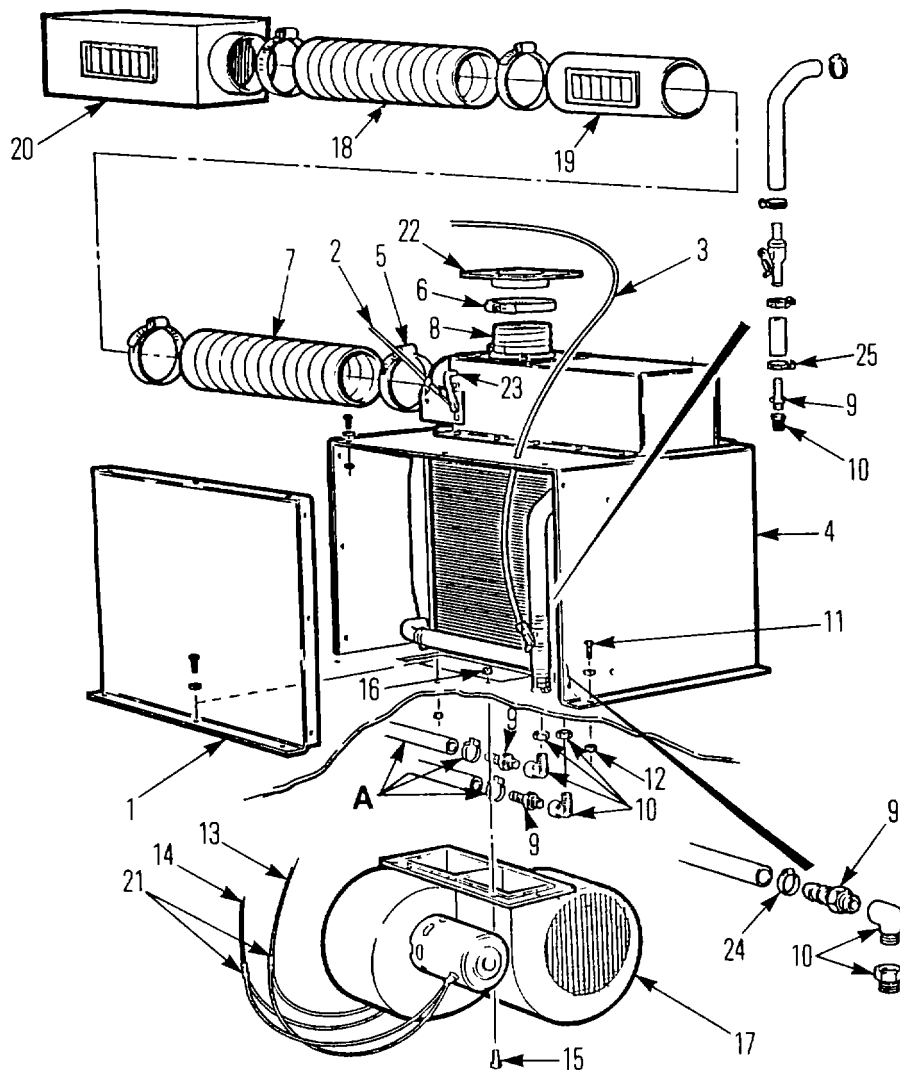
INSTALLATION

- (1) Install blower unit (17) to cab floor using six screws (15) and nuts (16). Tighten nuts firmly.
- (2) Install heater box (4) complete with heater core. Attach box using six screws (11) and nuts (12).
- (3) Attach heater hoses to barbed nipples on floor of cab. Tighten clamps (24 and 25).

4-12. CAB - Continued

4-12.8 Heater Unit - Continued

- (4) Connect wires (13 and 14) and blower motor wires as tagged using new butt splices.
- (5) Attach flex hose (8) to defroster flange (22) and attach flex hose (7) to heater box (4). Secure hoses using hose clamps (5) and (6).
- (6) Install inlet and outlet hoses and clamps (A) to barbed nipples (9). Tighten clamps sufficiently to provide leak proof joints. Remove crimp pliers from hoses.
- (7) Install heater control cables (2 and 3) and front cover (1) as detailed in para. 4-12.



REPAIR

- a. Heater Control Valve and Hoses Repair

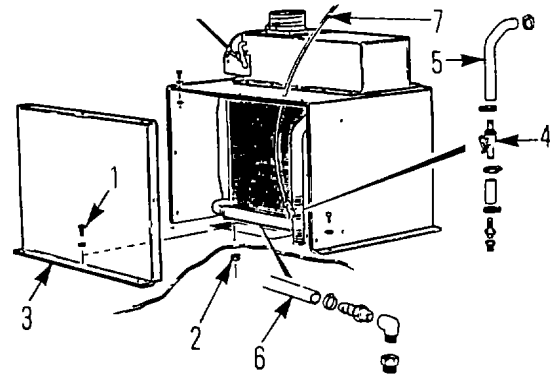
NOTE

Heater unit may remain in truck.

- (1) Remove screws (1), nuts (2), and panel (3).

4-12 CAB - Continued

- (2) Inspect heater control valve (4). Replace valve if:
 - valve shows signs of leakage.
 - valve operation is sloppy, i e to much play between stem and body.
 - valve is excessively hard to open or close.
 - valve cannot be fully opened or fully closed.



- (3) Inspect hoses (5 and 6) Replace if leaking or signs of swelling, cracks or brittleness are present.
- (4) Use illustration as guide to replace components.
- (5) Apply sealant (item 22, Appendix E) to thread of fittings replaced.
- (6) If removed, reinstall heater control cable (7) as detailed in para. 4-12.4 INSTALLATION.
- (7) Install cover (3) and attach using screws (1) and nuts (3).

b. Heater Core Repair

NOTE

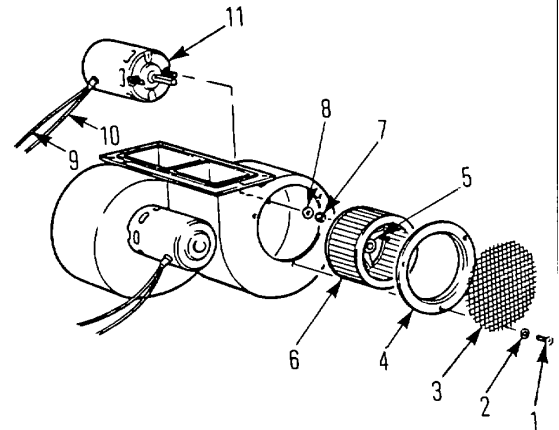
Heater core cannot be repaired. If leaking, replace heater unit as detailed in REMOVAL and INSTALLATION preceding.

c. Blower Wheel Repair

NOTE

Blower unit may remain in truck. This instruction details repair of either blower wheel.

- (1) Remove screws (1), washers (2), screen (3), and ring (4).
- (2) Loosen socket head set screw (5) and pull blower wheel (6) off motor shaft.
- (3) Inspect removed parts. Damage such as minor dents or bends in the screen, ring, or blower wheel may be straightened. Parts with major defects must be replaced.
- (4) Install blower wheel on motor shaft. Tighten screw (5) against flat on shaft. Be sure blower wheel can spin without interference with housing or ring (4). If necessary, loosen screw (5) and adjust wheel position.
- (5) Install ring (4) and screen (3) using washers (2) and self-tapping screws (1).



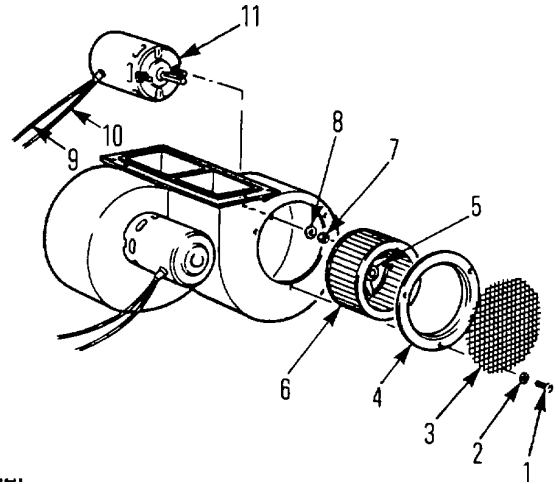
4-12. CAB - Continued**4-12.8 Heater Unit - Continued**

d. Blower Motor Repair

NOTE

Blower unit may remain in truck. The blower motor is a non-repairable item and must be replaced if defective. This instruction details repair of either motor.

- (1) Remove screen (3), ring (4), and blower wheel (6) as detailed in steps 1 and 2 of Blower Wheel Repair (c. preceding).
- (2) Tag and cut wires (9 and 10) as well as the colored blower motor wires. Cut the wires as close as possible to the butt splices.
- (3) Remove nuts (7), washers (8), and motor (11).
- (4) Install new motor (11) and attach to housing using washers (8) and nuts (7). Tighten nuts securely being careful not to overtighten.
- (5) Connect wires (9 and 10) as tagged, using new butt splices.
- (6) Install blower wheel (6), ring (4), and screen (3) as detailed in steps 4 and 5 of Blower Wheel Repair (c. preceding).



4-12. CAB - Continued**4-12.9 Seat.**

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

34, Appendix E White Grease
310700-05 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

PERSONNEL REQUIRED - 2**NOTE**

Although the front crew seat and the drivers seat are different, the mounting of the seats is identical.

REMOVAL

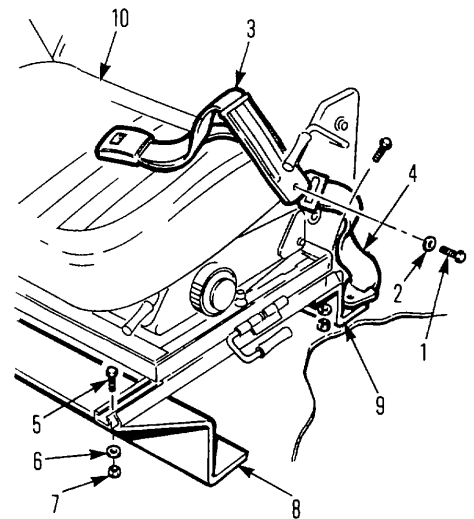
a. Front Seat Removal

- (1) Remove screws (1) and washers (2) attaching seat belts (3) and tether straps (4) to seat (10).

NOTE

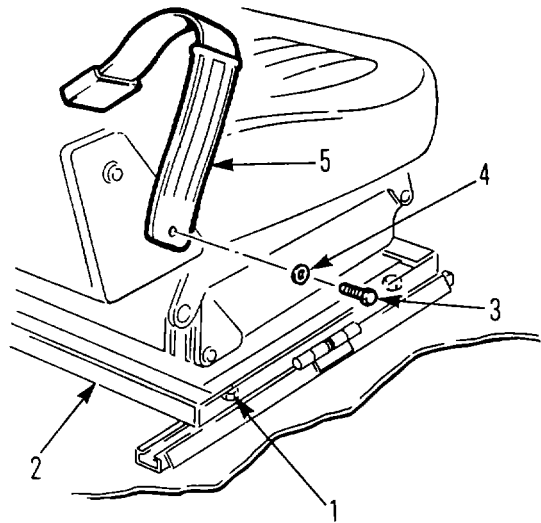
Only the drivers seat is equipped with tether straps.

- (2) Remove screws (5), nuts (7), and washers (6) attaching seat to front and rear seat risers (8) and (9) and remove seat from cab.

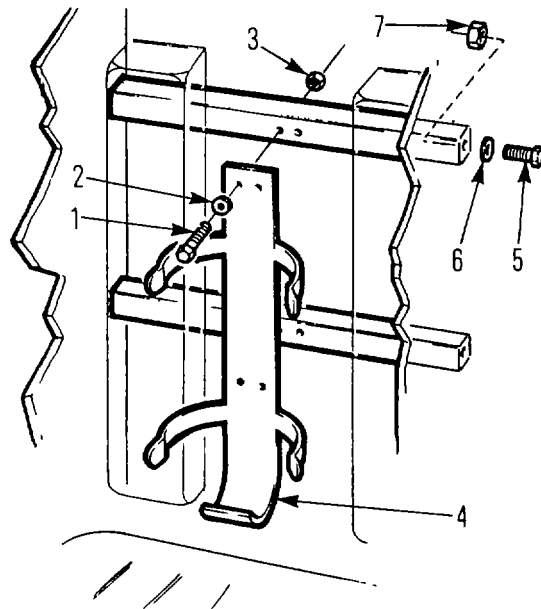


4-12. CAB - Continued**b. Rear Seat Base Removal**

- (1) Remove nuts (1), and remove seat base (2).
- (2) Remove screws (3), washers (4) and remove seat belt (5).

**c. Rear Seat Back Removal**

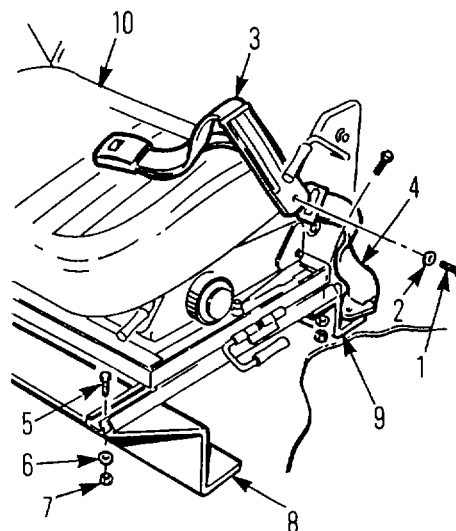
- (1) Lift off breathing air set.
- (2) Remove breathing air bracket (4) by removing screws (1) washers (2) and nuts (3).
- (3) Remove screws (5), washers (6), and nuts (7) and lift out seat back.

**INSPECTION**

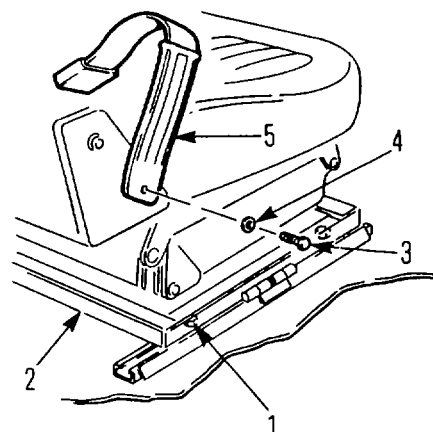
- (1) Inspect seat for damaged or broken components. Clean corroded or rusted parts and lubricate pivot joints and sliding surfaces with white grease (item 34, Appendix E).
- (2) Seat components with exception of the complete seat and seat belt are not replaceable. Minor rips and tears in the vinyl upholstery may be repaired using a commercially available vinyl repair kit.

4-12. CAB - Continued**4-12 9 Seat - Continued****INSTALLATION****a. Front Seat Installation**

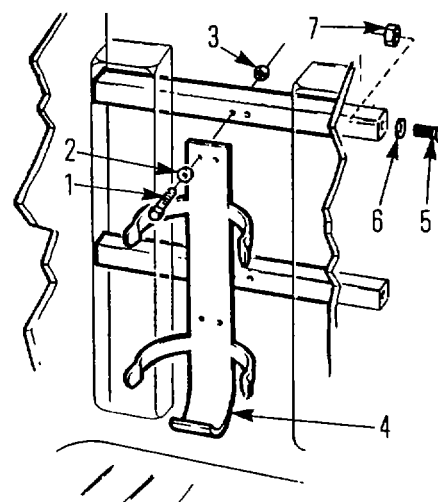
- (1) Install seat on seat risers using screws (5), washers (6), and locknuts (7). Tighten to 22 ft lb (29 Nm).
- (2) Install seat belts (3) and, on drivers seat only, tether straps (4) using screws (1) and lockwashers (2). Tighten screws to 22 ft lb (29 Nm).

**b. Rear Seat Base Installation**

- (1) Install seat (2) using nuts (1). Tighten to 22 ft lb (29 Nm).
- (2) Install seat belt (5) using screws (3) and lockwashers (4). Tighten to 22 ft lb (29 Nm).

**c. Rear Seat Back Installation**

- (1) Align seat back with cab side and engine compartment mounting holes.
- (2) Install screws (5), washers (6) and nuts (7). Tighten securely.
- (3) Align breathing air set bracket (4) and retain with screws (1), washers (2), and nuts (3).
- (4) Install breathing air set.



4-12. CAB - Continued**4-12 10 Windshield Wiper and Washer.**

This task covers Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

MATERIALS/PARTS

25, Appendix E Sealant
22, Appendix E Pipe Sealant
M-874-21TM Wiper Blade
96126-227TM Wiper Arm
APMS-683 Wiper Motor
88171-74&-68 Nozzle

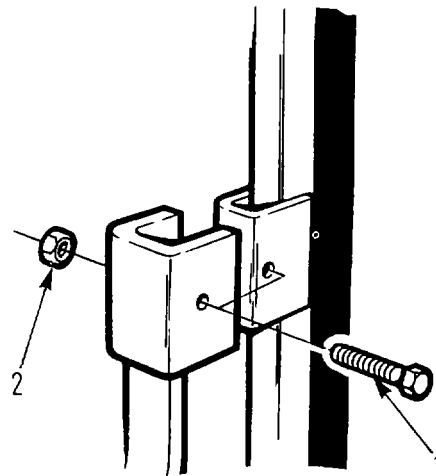
NOTE

No parts can be repaired. Replace components as detailed in the following.

REPLACEMENT

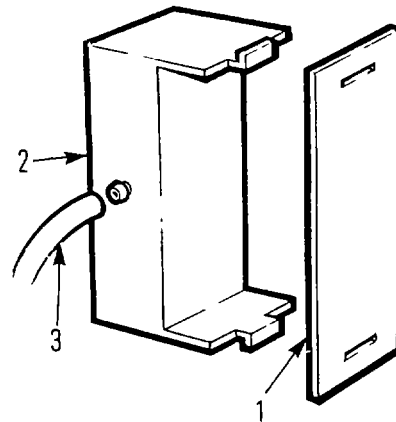
a. Wiper Blade Replacement

- (1) Remove screw (1) and nut (2).
- (2) Remove wiper blade.
- (3) Install new wiper blade and secure with screw (1) and nut (2).



b. Washer Nozzle Replacement

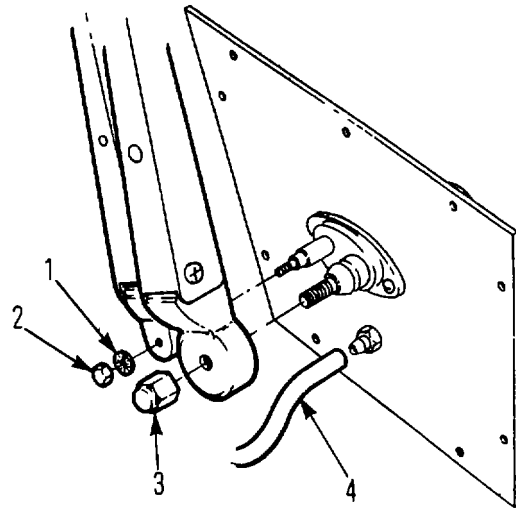
- (1) Pry off locking clip (1).
- (2) Pull delivery tube (3) off nozzle.
- (3) Install delivery tube (3) new nozzle (2).
- (4) Retain on wiper arm with clip (1).



4-12. CAB - Continued

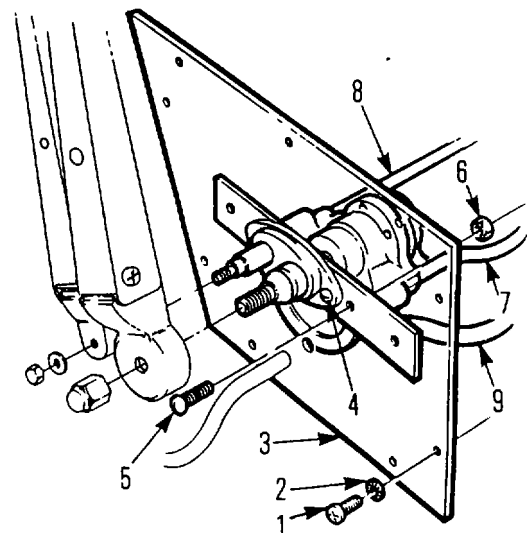
c. Wiper Arm Replacement

- (1) Remove wiper blade as detailed in a preceding.
- (2) Remove washer nozzle as detailed in b preceding.
- (3) Remove cap nut (2), washer (1) and cap nut (3).
- (4) Pull washer hose (4) off bulkhead fitting.
- (5) Carefully pry both wiper arms of the master shaft. The larger arm is located on a tapered spline.
- (6) Pry washer hose plastic retainer off smaller arm and remove hose.
- (7) Install hose and retainer on new arm. Ensure there is 2 in. (5 cm) free hose at top of arm.
- (8) Install blade on new arm.
- (9) Locate arm on motor splines. Check that arm is vertical and approximately 4 in. (10 cm) away from left hand post (looking at front of truck).
- (10) Install cap nut (3), washer (1), and cap nut (2). Tighten securely.
- (11) Install washer nozzle as detailed in b preceding.
- (12) Push washer hose (4) onto bulkhead fitting.



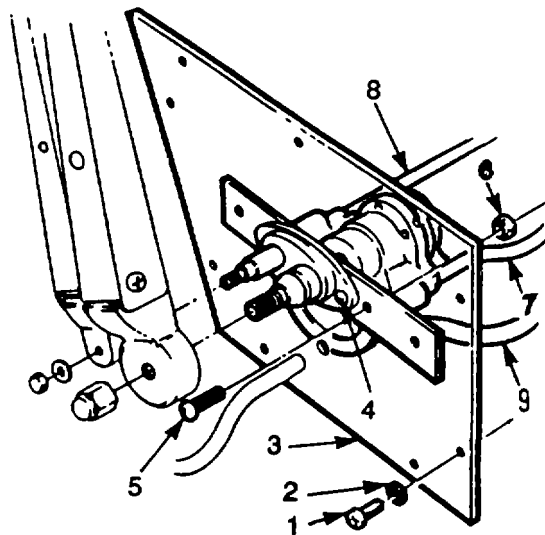
d. Wiper Motor Replacement

- (1) Remove wiper arm as detailed in c preceding. The nozzle and washer hose need not be removed from the arm.
- (2) Remove screws (1) and washers (2).
- (3) Pry off motor plate (3).
- (4) Tag and remove the air hoses (7, 8) and water hose (9).
- (5) Remove screws (4) and lift off driver unit.
- (6) Remove screws (5) and nuts (6) and pull off the motor. Remove hose fittings.
- (7) Install hose fittings on new motor. Coat threads with pipe sealant (item 22, Appendix E).



4-12. CAB - Continued**4-12.10 Windshield Wiper and Washer - Continued**

- (8) Install new motor or motor plate using screws (5) and nuts (6).
- (9) Install drive unit and secure with screws (4).
- (10) Install air hose (7,8) and water hose (9) (red air hose attaches to rear of the motor).
- (11) Coat mating area of motor plate (3) with fresh sealant (item 25, Appendix E). Align motor plate with cab panel and secure with screws (1) and washers (2).
- (12) Install wiper air as detailed in c preceding.



4-12. CAB- Continued

4-12.10.1 Windshield

This task covers: a. Removal
 b. Replacement

TOOLS

Tool Kit, General
 Mechanic, Automotive
 NSN 5180-177-7033
 Shop Equipment, Automotive
 Maintenance and Repair
 NSN 491 0-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see Para. 2-10)
 APU Shutdown (see Para. 2-12)
 Battery Switch OFF
 Transmission Shift Control in Neutral

MATERIALS/PARTS

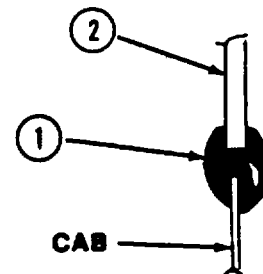
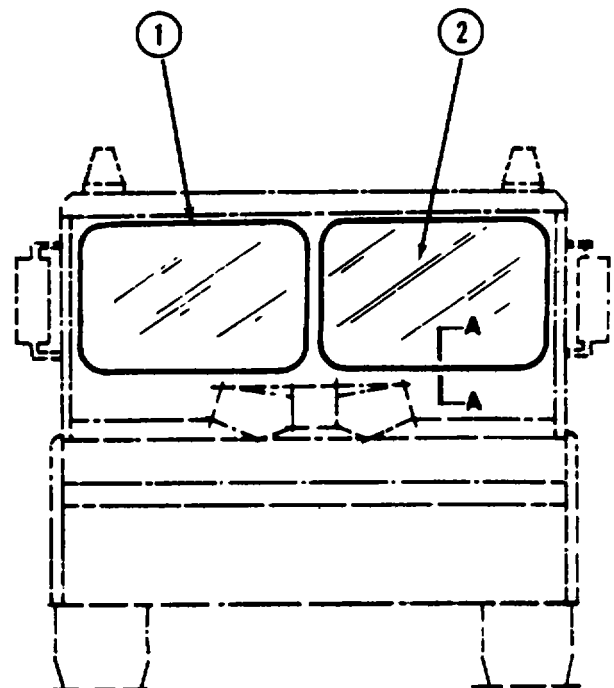
1-310934, Windshield Front Cab
 1-102464-01, Rubber Glass Set

REMOVAL

WARNING

Remove glass carefully to avoid injury.

- (1) Unlock lip of rubber molding (1) using glass insertion tool.
- (2) Remove windshield (2) leaving rubber molding (1) intact.



SECTION A - A

4-12. CAB - Continued

REPLACEMENT

- (1) Lubricate rubber molding (1) completely with soapy water solution.
- (2) Install new windshield into rubber molding (1), tapping gently with glass insertion tool.
- (3) Hold windshield (2) in place. Carefully force locking lip of rubber molding (1) to seal windshield.
- (4) Move insertion tool slowly around windshield (2) pressing in lip of rubber molding (1) to secure windshield.

4-12. CAB - Continued**4-12 11 Engine Compartment Covers and Canopy**

- This task covers
- a. Removal
 - b. Inspection
 - c. Installation
 - d. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

310342-02 Locknut

EQUIPMENT CONDITION

Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

NOTE

The procedures for left and right engine cover removal, installation, and repair are identical.

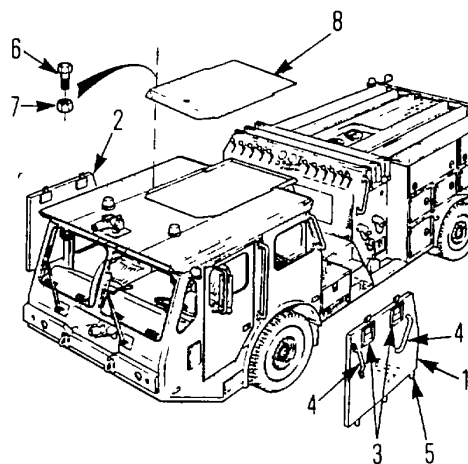
REMOVAL

a. Engine Compartment Cover Removal

- (1) Remove left/right cover (1)/(2). Lift door lock handles (3) and pull upper edge of cover free of frame.
- (2) Grasp grab handles (4) and lift cover location pins (5) free of engagement with frame.

b. Engine Canopy Removal

- (1) Remove engine air cleaner as detailed in para. 4-23.8.
- (2) Remove screws (6) and locknuts (7) attaching canopy panel (8).
- (3) Remove canopy panel by lifting it free of roof structure.

**INSPECTION**

- (1) Inspect each compartment cover for damage and defective components. Refer to appropriate repair procedure if handles, lock, or locating pins are damaged.
- (2) Minor dents in the cover panels may be straightened using a hammer and dolly, see para. 4-9. More extensive damage must be referred to Direct Support Level.

4-12. CAB - Continued**INSTALLATION**

a. Engine Compartment Cover Installation

- (1) Place left/right cover so that pins (5) protrude locating holes in compartment frame.
- (2) Lift door lock handles (3) and push upper edge of cover into place in frame. Release handles and be sure both door locks engage.

b. Engine Canopy Installation

- (1) Place canopy panel (8) in assembly position on roof structure.
- (2) Attach panel using screws (6) and new locknuts (7). Tighten firmly.
- (3) Install engine air cleaner as detailed in para. 4-23.8.

REPAIR

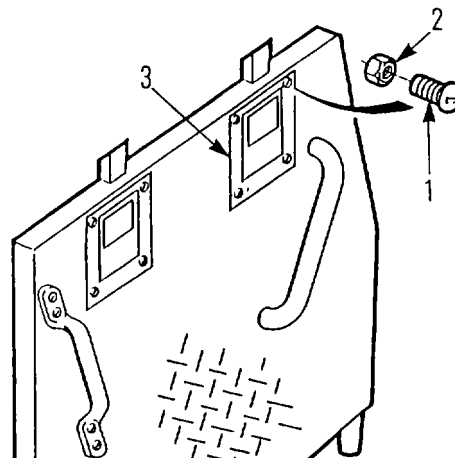
a. Door Lock Handle Repair

NOTE

Compartment cover removed from truck.

Door lock handle is non-repairable. If defective, it must be replaced

- (1) Remove four screws (1) and locknuts (2) and remove handle (3).
- (2) Clean residual sealant from edge of cover panel.
- (3) Apply a 1/8 in. (3 mm) bead of sealant (Item 25, Appendix E) to contact surface of new door lock handle (3).
- (4) Install lock handle using screws (1) and new locknuts (2). Tighten nuts firmly.



4-12. CAB - Continued

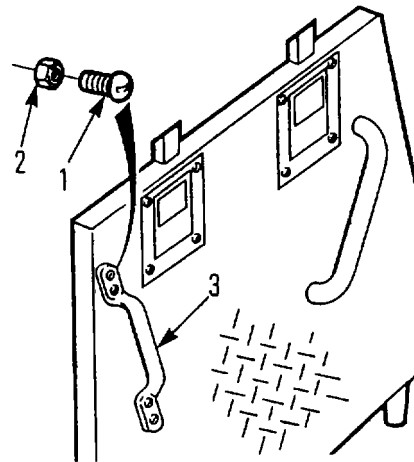
4-12.11 Engine Compartment Covers and Canopy - Continued

b. Small Grab Handle Repair

NOTE

Compartment cover removed from truck.

- (1) Remove four screws (1) and locknuts (2) and remove grab handle (3).
- (2) Inspect grab handle. Replace handle if damage is major.
- (3) Install handle (3) using four screws (1) and new locknuts (2). Tighten nuts firmly.

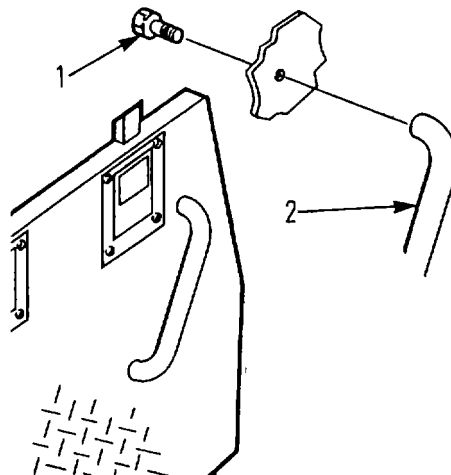


c. Large Grab Handle Repair

NOTE

Compartment cover removed from truck.

- (1) Remove two capscrews (1) and remove handle (2).
- (2) Inspect grab handle. Replace handle if damage is major.
- (3) Apply threadlock liquid (item 29, Appendix E) to thread of screws (1) and install handle (2). Tighten screws firmly.

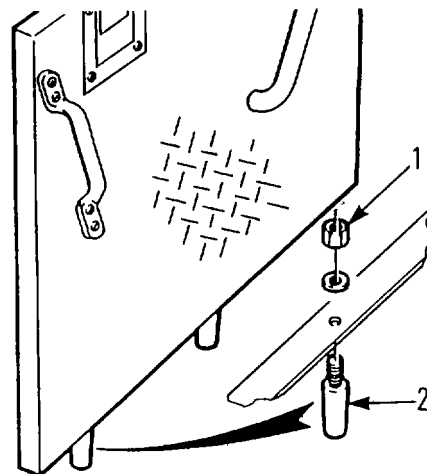


d. Location Pin Repair

NOTE

Compartment cover removed from truck.

- (1) Remove locknut (1) and pin (2).
- (2) Inspect pin. Replace, if thread is damaged or stripped.
- (3) Install pin (2) using new locknut (1). Tighten nut firmly.



4-13. PUMP BODY.**4-13.1 Structural Control Panel**

- This task covers
- a. Removal
 - b. Inspection
 - c. Installation
 - d. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

25, Appendix E Sealant
101991 Gage Panel Assembly

EQUIPMENT CONDITION

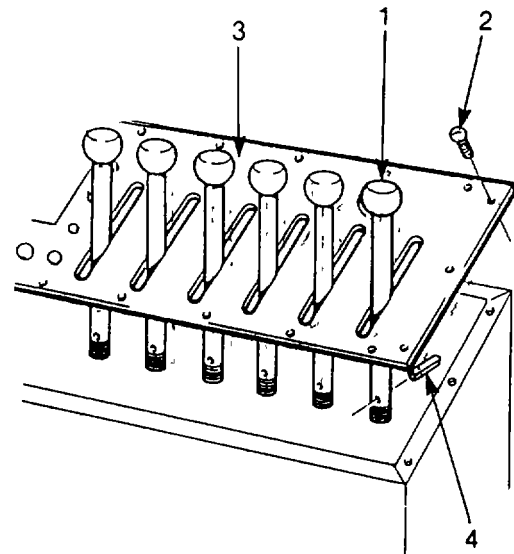
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF
All Air Tanks Drained

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the structural control panel.

REMOVAL

- (1) Remove throttle and stop control cables from APU (see Winterization System Controls Repair following).
- (2) Remove spring pin (4) from bottom of control rod(s) (1). Unscrew all rods.
- (3) Remove screws (2) and lift control panel (3) free of console and control levers.
- (4) Support panel so that wires and hoses leading to controls and gages are accessible.
- (5) Tag and remove wires from electrical gages and switches.
- (6) Tag and remove hoses from water gages and air controls.
- (7) Remove control panel from truck.

**INSPECTION**

- (1) Inspect control panel components. Be sure that all controls and indicators are in good condition. Replace any failing inspection as detailed in REPAIR following.

4-13 PUMP BODY - Continued

- (2) Inspect insert fasteners in console. Damaged or loose fasteners must be replaced. Notify Direct Support Level for repair.
- (3) Inspect valve control levers and control rod linkages. If any are bent or have seized ends, repair as detailed under Valve Lever Repair and Tie Rod Linkage. Repair following.

INSTALLATION

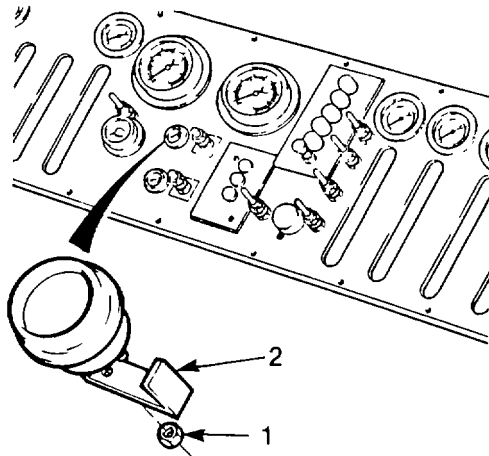
- (1) Place structural control panel on console and support it so that the underside of the panel is accessible.
- (2) Connect all wires to electrical gages and switches. Be sure they are connected as noted under REMOVAL step 5.
- (3) Connect hoses to air controls and water gages. Be sure they are connected as noted under REMOVAL step 6.
- (4) Connect throttle and stop control cables to APU (see Winterization System Controls Repair following).
- (5) Apply a 1/8 in. (3 mm) bead of sealant (item 25, Appendix E) to mating surface of console.
- (6) Install control panel and tighten screws (2) firmly.
- (7) Screw control rods (1) into lever boss until rod just bears on shaft. Install spring pin (4).
- (8) Be sure that when rod is rotated clockwise, rod locks to shaft. When rotated fully anticlockwise, rod is free from shaft and valve operates smoothly.

REPAIR

- a. Electric Gage Repair (Tachometer, engine oil pressure, and water temperature gages)

NOTE

Control panel may remain installed. Gages are non-repairable and must be replaced if faulty.



- (1) Tag and remove wires from gage.
- (2) Remove nuts (1) and clamp (2) Remove gage from control panel and discard.
- (3) Install new gage using clamp (2) and nuts (1) provided with the new gage.
- (4) Connect wires to gage as tagged.
- (5) Set battery switch to BOTH and start engine. Check function of new gage. If the engine temperature gage is replaced, keep the engine running for at least five minutes to allow the cooling system to heat up.

4-13 PUMP BODY - Continued

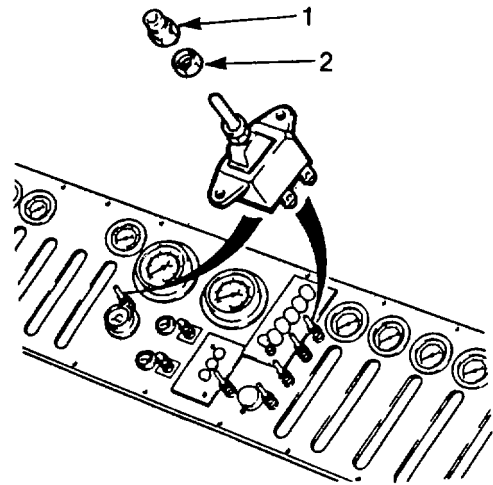
4-13.1 Structural Control Panel - Continued

- b. Electric Switch Repair (Heater and panel light switches).

NOTE

**Control panel may remain installed.
Switches are non-repairable.
Replace if faulty.**

- (1) Tag and remove wires from switch.
- (2) Remove protective boot (1) and nut (2) Remove switch and discard.
- (3) Install new switch using nut (2) provided with switch.
- (4) Install protective boot (1).
- (5) Connect wires to switch as tagged.
- (6) Set battery switch to BOTH. Check function of new switch.

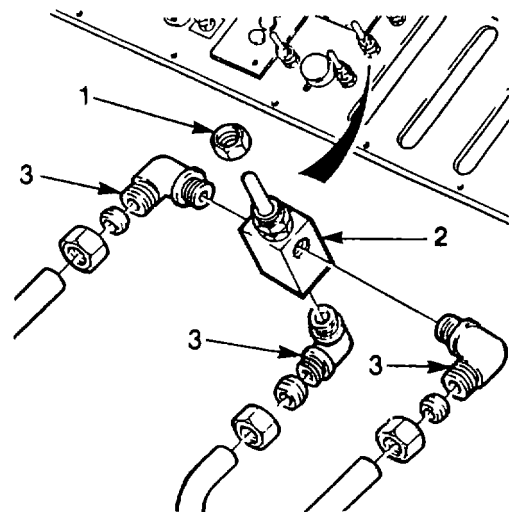


- c. Air Switch Repair (tank, foam, eductor and flush switch).

NOTE

**Control panel may remain installed.
Air switches are non-repairable.
Replace if faulty.**

- (1) Tag and remove air lines from switch.
- (2) Remove nut (1) and switch body (2) and discard.
- (3) Install new air switch (2) using nut (1) provided with switch.
- (4) Apply pipe sealant (item 22, Appendix E) to elbow fittings (3) and install in switch body.
- (5) Connect air lines to switch as tagged.
- (6) Close air tank drain valves, set battery switch to BOTH and start main engine. Start and operate the structural fire system as detailed in para. 2-11. Be sure the air switch operates correctly.



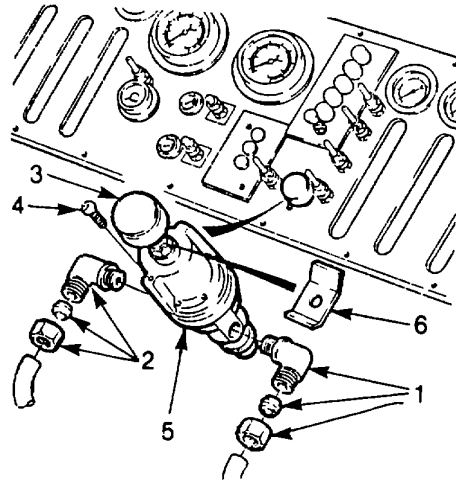
4-13 PUMP BODY - Continued

d. Throttle Regulator Repair.

NOTE

Control panel may remain installed on console.

- (1) Tag and remove air lines and fittings (1 and 2).
- (2) Remove knob (3) and screws (4). If replacing regulator, unscrew locking device (6) and install on new regulator.
- (3) Remove throttle regulator (5) from control panel.



NOTE

The throttle regulator (5) is identical to the air regulator used in the primary brake system.

- (4) Repair regulator as detailed in para. 4-22.6
- (5) Apply threadlock liquid (Item 29, Appendix E) to screws (4).
- (6) Install regulator (5) to control panel using screws (4). Tighten screws firmly.
- (7) Install knob (3).
- (8) Connect air lines and fittings (1 and 2) to regulator as tagged. Coat all threads with pipe sealant (Item 22, Appendix E) prior to installation.
- (9) Set battery switch to BOTH and start main engine. Set cab MODE switch to STRUCT and check engine speed can be controlled with the regulator.

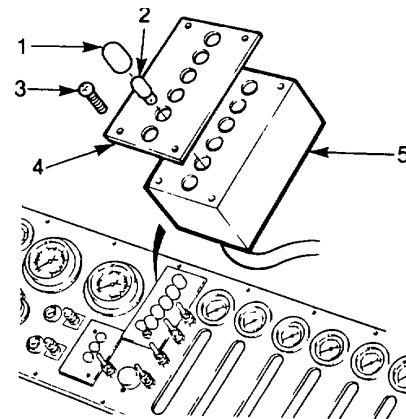
e. Level Monitor Repair.

NOTE

This procedure is applicable to both foam and water level monitors. The water level monitor only is illustrated. Control panel may remain installed on console. Neither foam or water level monitor box, (5) is repairable. Replace if defective. To replace light bulbs or lenses, carry out steps 1 and 2 only. (1) Unscrew applicable lens

- (1) and remove bulb (2).
- (2) Replace bulb and/or lens as required. Insert bulb in holder and install lens.

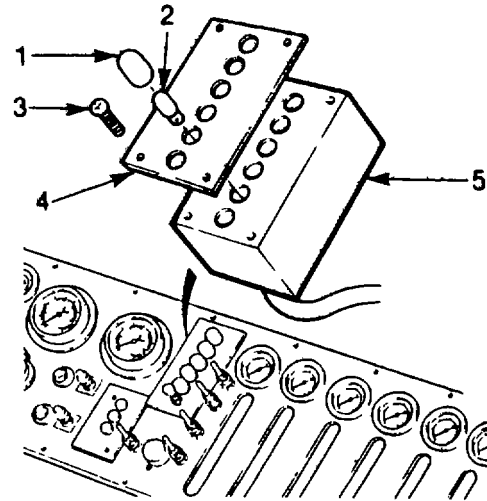
- (3) To remove monitor box (5), disconnect plugs leading to box and tag as necessary.



4-13 PUMP BODY - Continued

4-13.1 Structural Control Panel - Continued

- (4) Remove two screws (3) attaching bezel plate (4) and monitor box (5) to control panel.
- (5) Remove level monitor from pump body.
- (6) Apply threadlock liquid (item 29, Appendix E) to screws (3).
- (7) Install new monitor box (5) and bezel plate to control panel using screws (3). Tighten screws firmly.
- (8) Connect plugs to monitor.

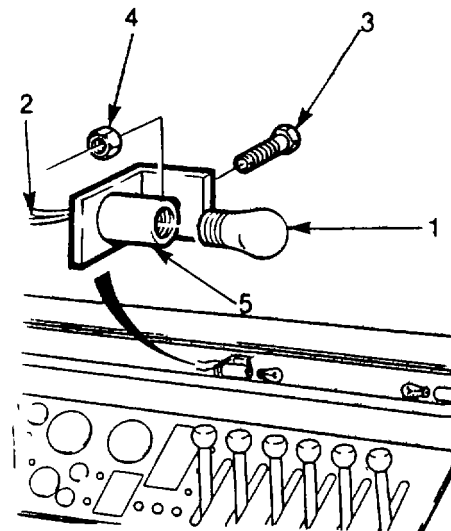


f. Panel Lamp Repair.

NOTE

Control panel may remain installed on console. To replace light bulb, carry out step 1 only.

- (1) Remove bulb (1) Replace if broken or burned out.
- (2) Disconnect wires (2) inside console.
- (3) Remove screw (3) and nut (4) attaching lamp socket (5).
- (4) Remove and replace lamp socket.
- (5) Install new lamp socket. Route wires (2) through panel into console.
- (6) Attach lamp socket to light bar using screw (3) and nut (4). Tighten screw firmly.
- (7) Connect lamp wires inside console.
- (8) Install bulb (1).



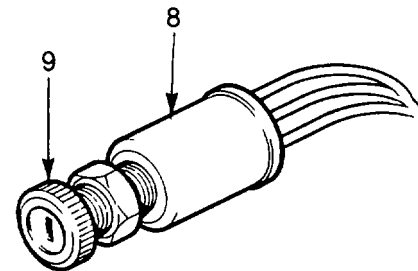
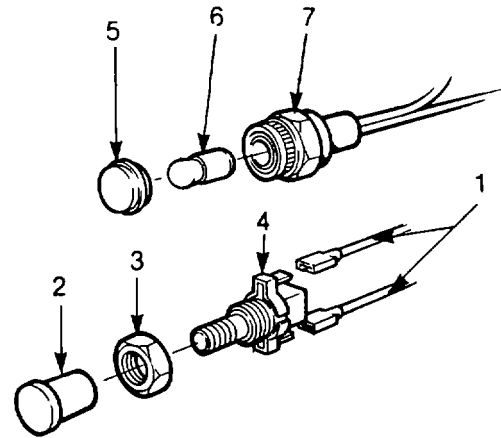
4-13 PUMP BODY - Continued

g. Winterization System Controls Repair

NOTE

Control panel may remain installed on console. None of the winterization system control components are repairable. Faulty components must be replaced. Refer to applicable steps below for replacement of individual components.

- (1) Tag and disconnect winterization heater switch wires (1).
- (2) Remove knob (2), nut (3), and switch body (4).
- (3) Install new switch using nut (3) and knob (2) supplied with switch.
- (4) Connect wires to switch as tagged in step 1.
- (5) Remove indicator lens (5) and bulb (6).
- (6) Replace bulb and reinstall indicator lens.
- (7) To replace complete indicator, tag and disconnect wires and remove. Indicator bezel nut (7). Remove indicator from control panel.
- (8) Install new indicator and connect wires as tagged in step 7.
- (9) Tag and remove wires from APU switch (8).
- (10) Remove bezel nut (9) and remove switch body from control panel.
- (11) Install new switch using bezel nut supplied with switch.
- (12) Connect wires to APU switch as tagged in step 9.

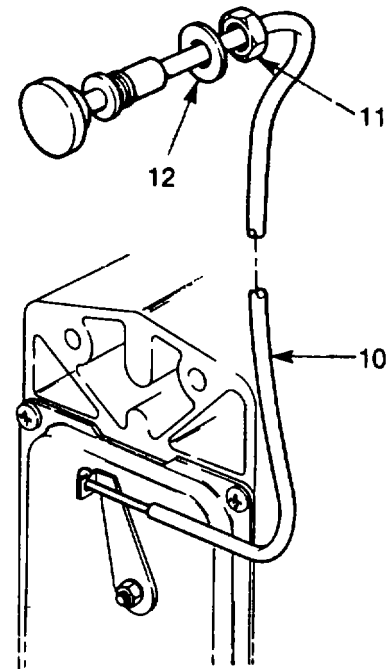
**NOTE**

To access the APU stop control cable, the complete engine must be pulled out of the APU compartment and reinstalled after the cable is replaced. See para. 4-15.1 for details.

- (13) Disconnect the stop control cable (10) at the APU as required.

4-13 PUMP BODY - Continued**4-13.1 Structural Control Panel - Continued**

- (14) Pull cable free of APU compartment.
- (15) Unscrew nut (11) and pull cable out of control panel.
- (16) Install new control cable (10) and attach to panel using new nut (11) and washer (12). Tighten nut firmly.
- (17) Route cable into the APU compartment.
- (18) Attach cable to APU fuel shut off lever.
- (19) Install APU as detailed in para. 4-15.1.
- (20) Start APU, see para. 2-12 and be sure engine operates correctly.

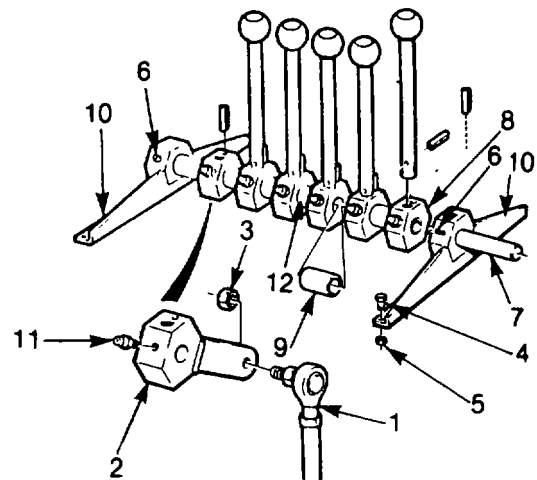


h. Valve Lever Repair.

NOTE

Control panel removed from console. See REMOVAL procedure preceding. The valve control levers are assembled in two banks which are identical except for the number of levers. The repair procedure is the same for both banks.

- (1) Disassemble tie rod linkages and lever locks. For each linkage, remove nut (3) and pull tie rod end (1) free of lever lock (2).
- (2) Remove four screws (4) and nuts (5) attaching lever bank to pump body console.
- (3) Remove lever bank from console.
- (4) Loosen two setscrews (6) and remove shaft (7).



- (5) Inspect lever locks (8). The bore in each lock should be smooth and well lubricated.
- (6) Inspect shaft (7). It must be straight and the surface smooth. Minor surface damage and scratches may be removed using emery cloth (Item 12 or 13, Appendix E).
- (7) Install shaft locks (8) and spacers (12) on shaft (7) using new and/or old parts as required.
- (8) Install control brackets (13) to shaft and tighten setscrews (6).

4-13 PUMP BODY - Continued

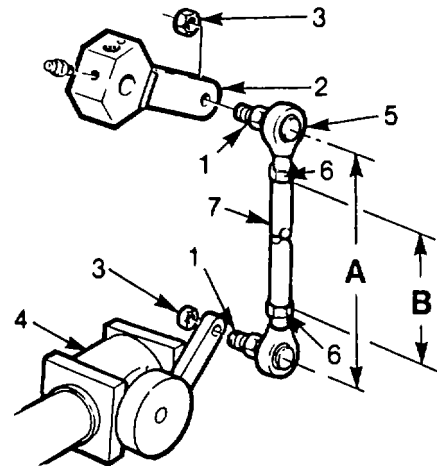
- (9) Install grease nipple(s) (11).
- (10) Install control lever bank in pump body console using four screws (4) and nuts (5). Tighten nuts to 8 ft lb (11 Nm).
- (11) Attach tie rod linkages (1) to lever locks (2) and secure with nuts (3).
- (12) Lubricate all lever locks with white grease (item 34, Appendix E).
- (13) Install structural control panel and control rod knobs as detailed in INSTALLATION preceding.

j. Tie Rod Linkage Repair.

NOTE

Control panel may remain installed on console.

- (1) Remove nuts (3) and pull tie rod linkage (1) free from lever lock (2) and valve (4).
- (2) Before disassembling tie rod linkage, measure rod end center to center distance (A). Note this measurement.
- (3) Loosen locknut (6) and unscrew tie rod end from linkage rod.



- (4) Inspect rod (7). Minor bends may be straightened without affecting rod function. Replace rod if it is severely damaged or either threaded end is stripped. Be sure to replace rod with one of equal length (B).
- (5) Inspect tie rod ends. Check for damage to thread, wear and corrosion. If wear or damage is excessive, replace rod.
- (6) Install tie rod ends (5) evenly to control rod (7). If measurement (A) is available go to steps 7 and 9 if (A) is not available go to steps 8 and 9.
- (7) Adjust position of tie rod ends to obtain dimension (A). Secure tie rod ends by tightening nuts (6) against rod.
- (8) Adjust position of tie rod ends until linkage can be inserted into valve handle and valve lever lock. Be sure the valve is fully closed and the lever is in the closed position. Tighten nuts (6) against rod when correct length is obtained. Operate lever a few times ensuring valve opens and closes. Readjust tie rods end if required.
- (9) Install linkage to lever lock (2) and valve (4) and secure with nuts (3). Tighten nuts firmly.
- (10) Lubricate all lever locks with white grease (Item 34, Appendix E).

4-13 PUMP BODY - Continued**4-13 2 Pump Body Doors.****This task covers**

- a. Replacement
- b. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

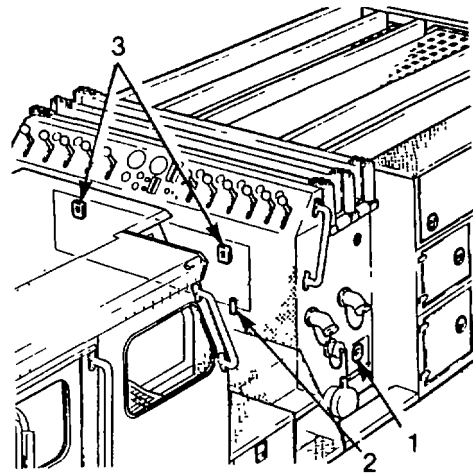
MATERIALS/PARTS

101833 Pump Panel Door
102622 Pump Compartment Door

REPLACEMENT

a. Pump Panel Door Replacement.

- (1) Remove door by pulling lock handles (3) up and lifting door out and up until free of frame.
- (2) Install new door. Line up location pins (2) at the bottom of door with holes in the bottom door frame. Push door into place and be sure door locks engage.



b. Side Panel Door Replacement.

NOTE

The left and right side panel doors are identical.

- (1) Remove door by pulling lock handle (1) up and lifting door up and out until free of panel.
- (2) Install new door. Line up channel section at the bottom of door with support strip at the bottom of door opening and push door into place. Be sure door lock engages.

4-13 PUMP BODY - Continued

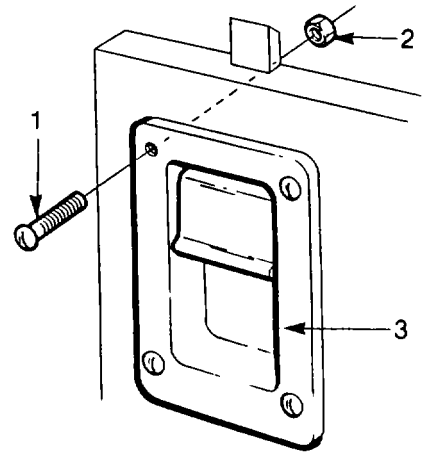
REPAIR

a. Door Lock Handle Repair

NOTE

Identical door lock handles are used on all three pump body doors. The following repair procedure applies to any door. Door lock handle is non-repairable. If defective it must be replaced.

- (1) Remove four screws (1) and locknuts (2) and remove handle (3).
- (2) Clean residual sealant from edge of door panel.
- (3) Apply a 1/8 in. (3 mm) bead of sealant (item 25, Appendix E) to contact surface of new door lock handle (3).
- (4) Install lock handle using screws (1) and new locknuts (2). Tighten nuts firmly.

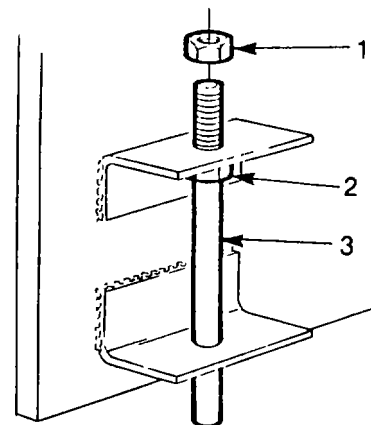


b. Location Pin Repair.

NOTE

This procedure is only applicable to the pump panel door.

- (1) Remove locknuts (1 and 2) and pin (3).
- (2) Inspect pin. Replace if thread is damaged or stripped.
- (3) Install pin (3) using new locknuts (1 and 2).
- (4) Adjust nuts until pin extends 1/4 in. (6 mm) below edge of door panel as shown. Tighten nuts firmly.



4-13 PUMP BODY - Continued**4-13.3 Hose Bed Rollers****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

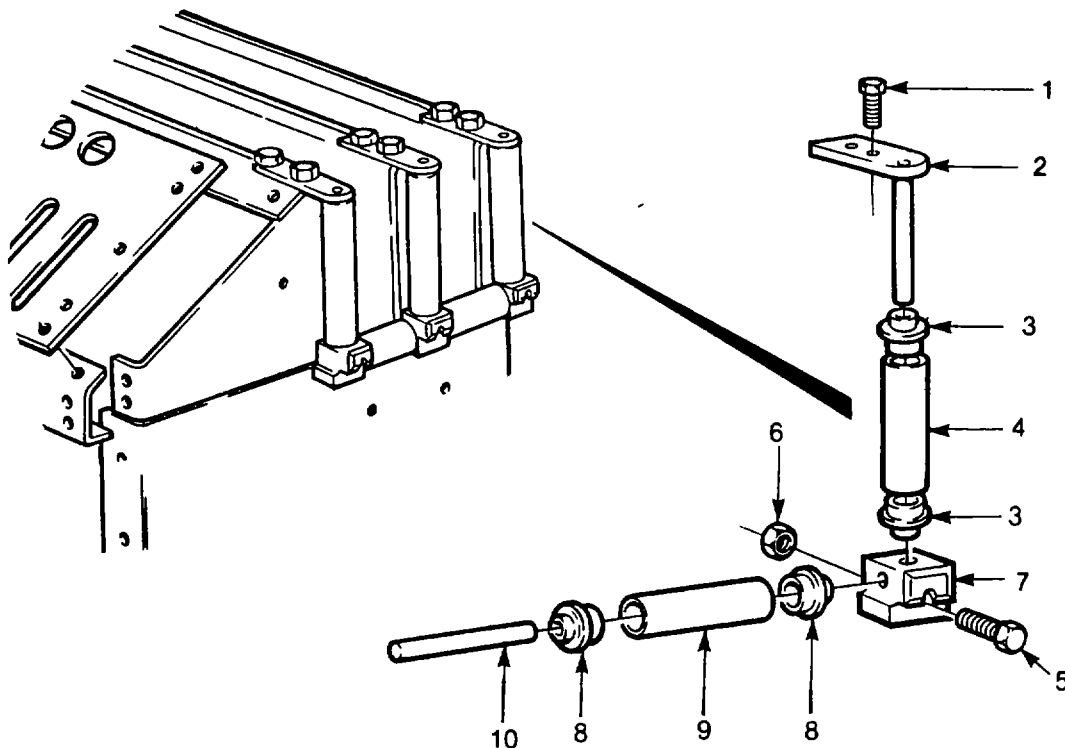
12, Appendix E Emery Cloth
MS51922-17 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

REMOVAL

- (1) Remove screws (1), rod weldment (2), nylon bearings (3), and roller (4)
- (2) Repeat step 1 for the second and third vertical roller
- (3) Remove screw (5), nut (6), and roller mounting block (7)
- (4) Remove horizontal nylon bearings (8), rollers (9), and shaft (10).
- (5) Repeat steps 3 and 4 to remove remaining roller and mounting blocks



4-13 PUMP BODY - Continued**INSPECTION**

- (1) Inspect all nylon bearings for wear and damage. Replace if bearing is excessively loose or shaft bore is too enlarged by wear.
- (2) Inspect hose rollers. Roller surface must be smooth with no surface damage. Minor scratches may be removed using emery cloth (item 12, Appendix E.) Replace dented or seriously damaged rollers.

INSTALLATION

- (1) Install one roller mounting block (7) using screw (5) and nut (6). Tighten nut firmly.
- (2) Pre-assemble one horizontal roller (9), two nylon bearings (8), and shaft (10). Install roller assembly to mounting block installed in step 1.
- (3) Install second roller mounting block to secure roller assembly.
- (4) Repeat steps 2 and 3 for remaining roller and mounting block.
- (5) Pr-assemble vertical rollers (4), nylon bearings (3), and rod weldments (2).
- (6) Apply threadlock liquid (item 29, Appendix E) to screws (1).
- (7) Install vertical roller assemblies to hose bed using screws (1). Tighten screws firmly.
- (8) Check rollers operate freely.,

4-14. HOSE REEL ASSEMBLY.

4-14.1 Hose Bed Covers

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

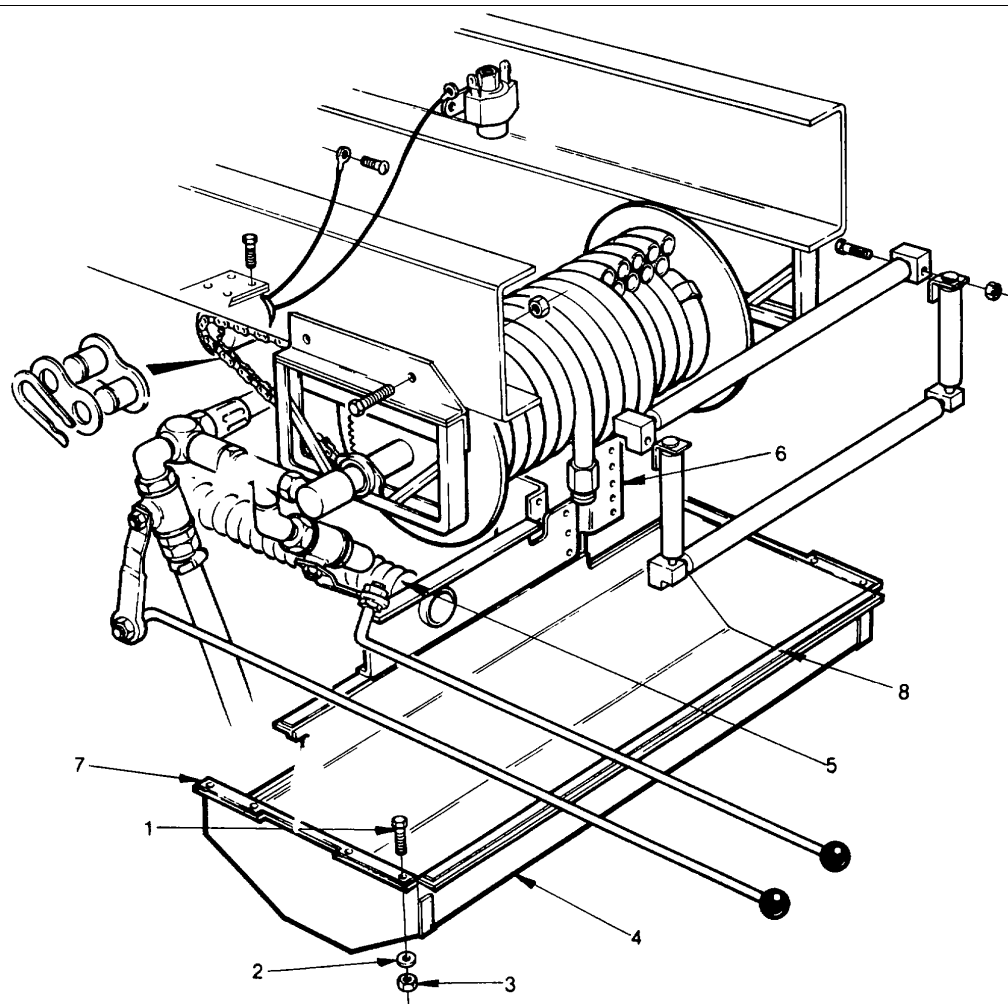
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

MATERIALS/PARTS

310703 Locknut
623 2142 Weatherstripping

PERSONNEL REQUIRED - 2



4-14. HOSE REEL ASSEMBLY - Continued**REMOVAL**

- (1) Remove screws (1), washers (2) and nuts (3) attaching cover (4) to hose body compartments.
- (2) Lower cover (4) and disconnect heater hose (5).

INSPECTION

- (1) Inspect rubber deflector, item (6). If a deflector is damaged or has deteriorated from prolonged use it should be replaced.
- (2) Inspect reel cover (4) Be sure it is in good condition before reusing. Minor damage may be repaired, see REPAIR following.
- (3) Inspect weather stripping (8) on upper edges of cover. Repair or replace as necessary to provide good sealing when cover is reinstalled.

INSTALLATION

- (1) Attach heater hose (5) to cover and install cover (4) using screws (1), washers (2), and new locknuts (3).
- (2) Tighten nuts to 50 in. lb (5.6 Nm).

4-14. HOSE REEL ASSEMBLY.

4-14.2 Hose Reel

This task covers

a. Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

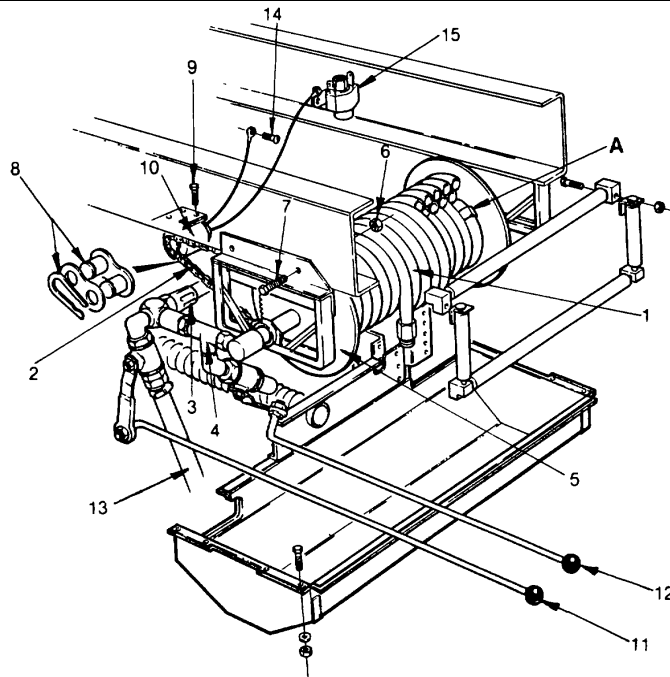
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Hose Reel Cover Removed (see para. 4-14.1)

MATERIAL/PARTS

- 22, Appendix E Pipe Sealant
- GH406 Hose Reel
- 310591 Locknut, 5/8 - 11
- 310700-05 Locknut, 5/16 - 18
- 310960-02 Electric Motor, 12 Vdc
- Chain, #35
- Chain Master Link, #35
- FC-300-24 Hose, 1/2 In.
- 411-2YS Hose Swivel Connector
- 102226 Elbow
- Drain valve 3/4 in.
- 1630 Air Blow Down Valve
- 102342 Manifold

PERSONNEL REQUIRED - 2



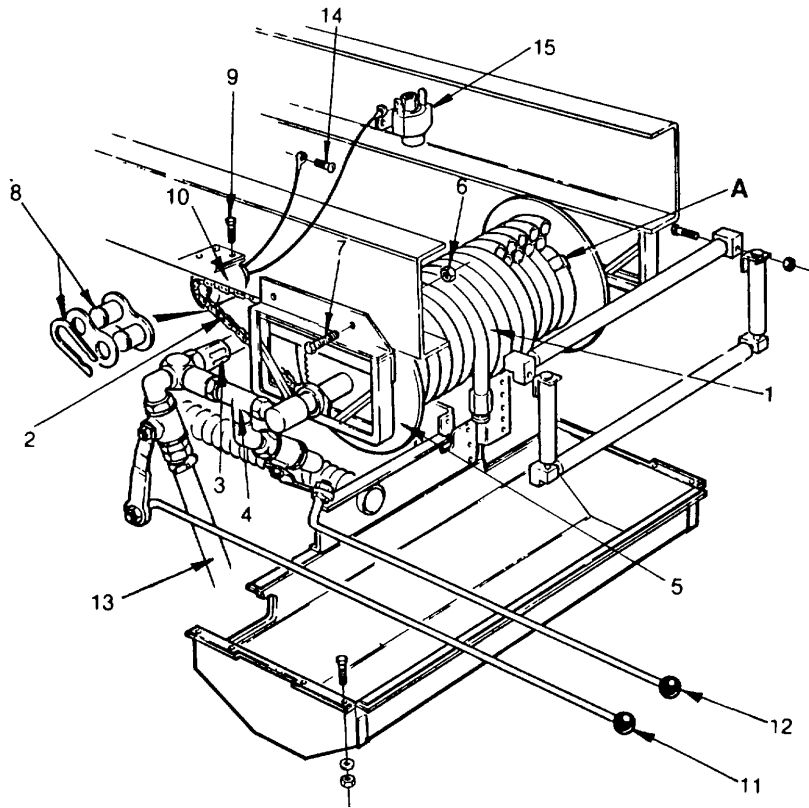
4-14. HOSE REEL ASSEMBLY - Continued**REPLACEMENT**

a. Reel Assembly Replacement.

- (1) Unreel hose (1) and disconnect from hose reel fitting (A).
- (2) Disconnect chain linkage (8) and remove chain (2) from reel sprocket.
- (3) Disconnect air blow out and water drain valve linkages (11) and (12) and disconnect air hose (13).
- (4) Disconnect hose (3) from elbow-valve-and-pipe assembly (4) Remove the valve-and-pipe assembly (4) from hose reel (5).
- (5) Place wooden blocks or other suitable support underneath hose reel frame and remove locknuts (6) and bolts (7).
- (6) Remove support placed under hose reel and pull reel away from truck.
- (7) Inspect new hose reel to ensure it is undamaged.
- (8) Place and support new hose reel (5) in assembly position with truck frame, i e, mounting holes alined.
- (9) Install bolts (7) and locknuts (6), and remove reel support. Tighten locknuts to 160 ft lb (2.5 Nm).
- (10) Apply pipe sealant (Item 22, Appendix E) to elbow-valve-and-pipe assembly (4) and install on hose reel.
- (11) Connect hose (3) to the assembly (4).
- (12) Connect valve linkages (11) and (12) to blow out valve lever and drain valve lever. Install air hose (13).
- (13) Loosen motor mounting bolts and locknuts (9) and slide motor (10) toward the rear of the truck. Wrap chain (2) around reel sprocket and install linkage (8).
- (14) Slide motor (10) forward until chain is properly tensioned (1/2 in. (13 mm) deflection midway between reel and motor sprockets). Tighten bolts and locknuts (9) to 20 ft lb (25 Nm).
- (15) Attach fire hose (1) to reel connector and rewind hose. Observe the chain drive. If chain jumps on motor sprocket, it is too loose if motor is slow and noisy, chain is too tight. Readjust chain tension if necessary.

4-14. HOSE REEL ASSEMBLY - Continued

4-14.2 Hose Reel - Continued



b. Reel Motor Replacement.

- (1) Remove ground screw (14) attaching motor lead (-) to frame. Remove motor lead (+) from solenoid (15). Remove ties attaching leads to frame member.
- (2) Remove chain connecting link (8) and remove chain (2) from motor (10).
- (3) Remove locknuts and capscrews (9), and motor (10).
- (4) Inspect new motor to be sure it is not damaged from handling and shipping.
- (5) Install a new motor (10) using capscrews and locknuts (9). Do not tighten bolt.
- (6) Wrap chain (2) around motor sprocket and assemble using connecting link (8).
- (7) Slide motor forward until chain is properly tensioned (1/2 in. (13 mm) deflection midway between reel and motor sprockets). Tighten capscrews and locknuts (9) to 20 ft lb (25 Nm).

4-14. HOSE REEL ASSEMBLY - Continued

- (8) Ground motor lead marked (-) to frame using screw and nut (14).
- (9) Install motor lead marked (+) to solenoid (15). Be sure both motor leads are securely attached.
- (10) Partially reel out the hose. Press rewind button and observe the chain drive if chain jumps on motor sprocket it is too loose. If the motor is slow and noisy the chain is too tight. Readjust tension is necessary.

c. Reel Drive Chain Replacement.

- (1) Loosen reel motor mounting bolts and nuts (9), and disconnect chain connecting link (8).
- (2) Remove old chain (2) from motor and hose reel sprockets and install new chain.
- (3) Push motor toward hose reel as necessary and install new chain connecting link (8).
- (4) Move motor forward until chain is properly tensioned (1/2 in. (13 mm) deflection midway between reel and motor sprockets) Tighten bolts and locknuts (9) to 20 ft lb (25 Nm).
- (5) Partially reel out the hose. Press rewind button and observe the chain drive. If chain jumps on motor sprocket chain is too loose. If the motor is slow and noisy the chain is too tight. Readjust tension is necessary.

d. Hose Reel Piping Replacement.**NOTE**

To replace hose (3), between discharge manifold and hose reel, the hose body heat shield must be removed, see para. 4-11.3.

- (1) To replace hose (3), disconnect it from elbow assembly (4) and valve on pump body discharge manifold. Pull hose past water tank and remove it from truck.

NOTE

Hose (16) is manufactured from one piece of hose, and two swivel fittings. P/n 4110245.

- (2) Route new hose (3) alongside water tank and connect it to valve on discharge manifold and elbow assembly (4) at hose reel.
- (3) Other hose reel piping components may be replaced individually as required. Apply pipe sealant (Item 22, Appendix E) to all pipe thread connections before assembly.

4-14. HOSE REEL ASSEMBLY.**4-14.3 Hose Rollers****This task covers****a. Replacement****TOOLS**

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

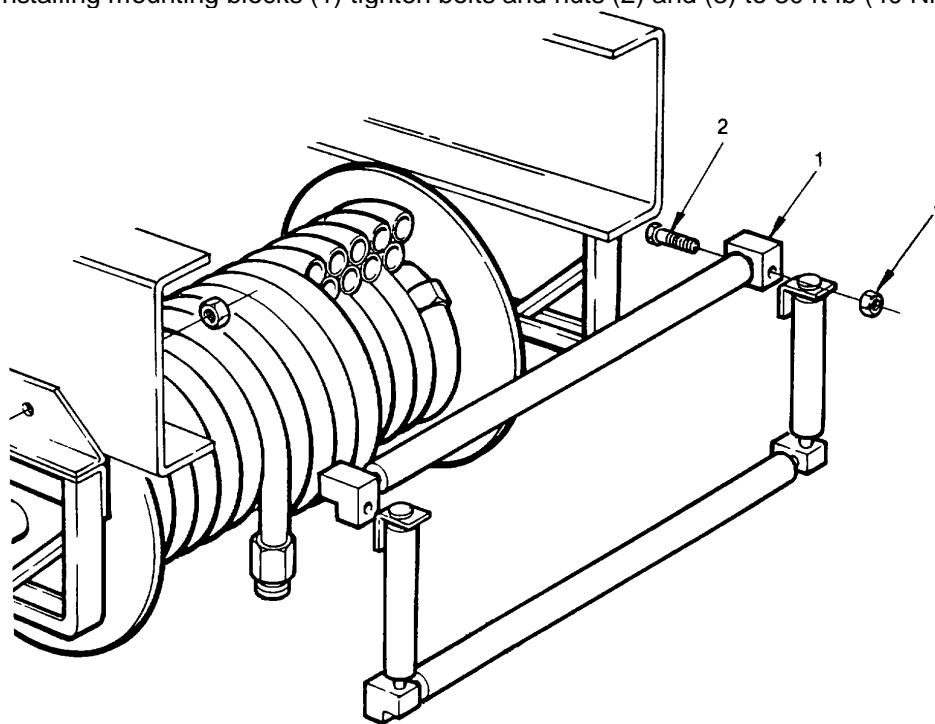
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

MATERIAL/PARTS

EH650 Mounting Block
310718-01 Roller Tubing, Short
101563-01 Roller Rod, Short
FH303-15 Bearing
310718-03 Roller Tubing, Long
101563-03 Roller Rod, Long
MS51922-17 Locknut, 3/8-16
MS27183-13 Lockwasher
MS90725-66 Capscrew, 3/8-16 X 2

REPLACEMENT

- (1) Replace individual hose roller components as required. Use illustration as guide for disassembly and assembly.
- (2) When installing mounting blocks (1) tighten bolts and nuts (2) and (3) to 30 ft lb (40 Nm).



4-14. HOSE REEL ASSEMBLY.**4-14.4 Hose And Hose Couplings.****This task covers****a. Replacement****TOOLS**

Shop Equipment, Automotive Maintenance And Repair,
NSN 4910-00-754-0705

MATERIAL/PARTS

1" - 3227 X 50 ft Hose
1916 Hose Coupling

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

CAUTION

Do not use oil or any other forms of lubricant to ease coupling and hose assembly as this may damage the hose material or weaken the hose and coupling joint.

REPLACEMENT**a. Hose Replacement**

- (1) Remove hose from hose reel
- (2) Install new hose on hose reel

b. Hose Coupling Replacement

- (1) To replace a damaged hose coupling, cut the hose as close as possible to the coupling but be sure the new hose end will be undamaged and cut square.
- (2) Replace the hose end as detailed in para. 4-9.

4-15. AUXILIARY POWER UNIT.

4-15.1 Auxiliary Power Unit Assembly

This task covers

- a. Removal
- b. Disassembly
- c. Assembly
- d. Inspection
- e. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

29, Appendix E Threadlock Liquid
6LD325/AMERTEK Engine
MS51922-17 Locknut
310592 Locknut
MS51922-1 Locknut

WARNING

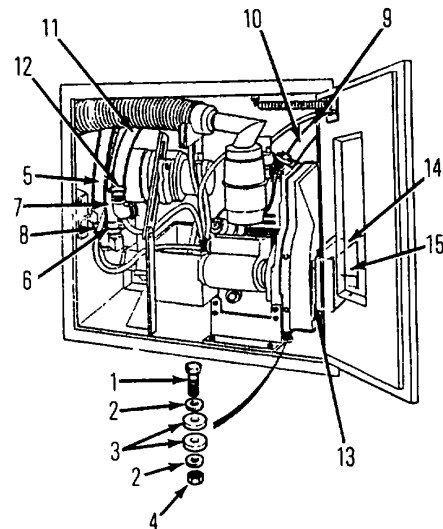
Exhaust systems can be hot enough to cause serious burns. Allow exhaust system to cool before maintaining the APU.

Engine coolant can be hot enough to cause serious burns. Allow engine to cool before maintaining the APU.

REMOVAL

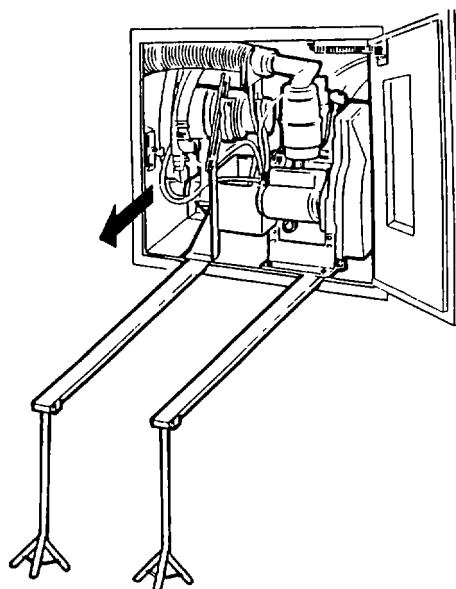
- (1) Disconnect APU engine exhaust as detailed in para. 4-19 1.
- (2) Clamp inlet and outlet water hoses (5, 7, and 11) with hose crimp retaining pliers.
- (3) Loosen hose clamps (6, 8 and 12) and pull hoses of water pump.
- (4) Tag and disconnect electrical wires to engine starter motor and alternator.
- (5) Loosen hose clamps (9) on air intake hose (10) Pull air intake hose from engine.
- (6) Disconnect fuel delivery and return hose at engine.
- (7) Loosen both cover holding capscrews (13) and lift cover (14) up.

- (8) Unscrew and remove pulley cover (15) from compartment.



4-15 AUXILIARY POWER UNIT - Continued

- (9) Remove four capscrews (1) and nuts (4) Remove eight washers (2) and rubber washers (3)



- (10) Pry up APU assembly and install two skid planks (2 x 4) under mounting plate. Skid plates should extend out of hose body at least 2 ft (60 cm) and be securely supported on their outer ends at hose bed level.

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

- (11) Slide the APU assembly part way out of the hose body compartment (A small hydraulic floor crane may be used instead of skid plates if available).
- (12) When access is available to the stop control, disconnect the cable. Slide APU assembly completely out of the compartment.

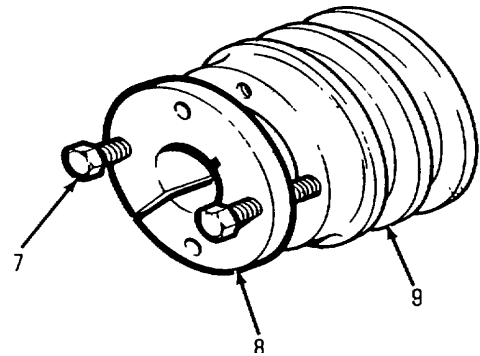
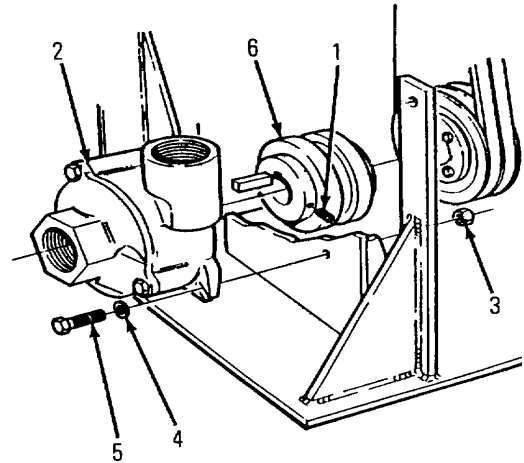
4-15. AUXILIARY POWER UNIT - Continued

4-15.1 Auxiliary Power Unit Assembly - Continued

DISASSEMBLY**NOTE**

In general, the APU assembly will only be removed from the hose body compartment so that the engine can be replaced, or repaired. The alternators and pump can be repaired or replaced with the APU assembly in the truck. The following details the procedures to replace the engine.

- (1) Remove alternator and alternator tensioning bracket. Discard all locknuts
- (2) Loosen set screws (1)
- (3) Remove two capscrews (5), washers and locknuts (3) Discard locknuts (4)
- (4) Carefully pull circulating pump (2) to separate engine and pump drive couplings
- (5) Remove key and drive coupling (6) from engine shaft
- (6) Remove alternator drive belts
- (7) Remove the two capscrews (7) on the alternator drive bushing. Thread capscrews into threaded holes of bushing
- (8) Tighten capscrews into bushing (8) to force pulley (9) off bushing
- (9) Remove bushing, pulley, and drive shaft key from engine
- (10) Remove four capscrews from pump mounting bracket
- (11) Remove four capscrews and locknuts securing engine to APU base plate. Discard locknuts

**ASSEMBLY****NOTE**

This procedure details the method of rebuilding the APU assembly.

- (1) Install capscrews and locknuts to secure APU engine to the base plate.

4-15 AUXILIARY POWER UNIT - Continued

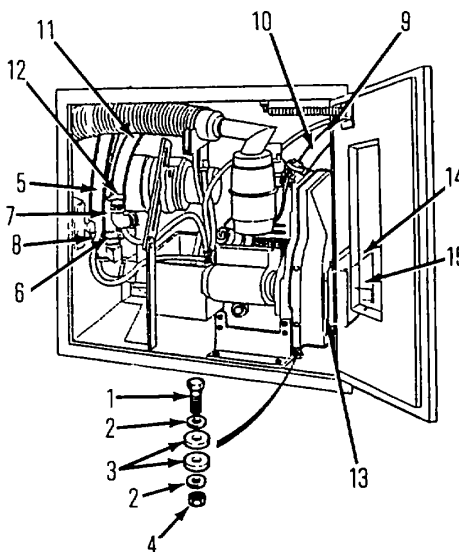
- (2) Install the pump mounting bracket on engine end plate using capscrews. Apply thread lock liquid (Item 29, Appendix E) to each capscrew before installing.
- (3) Install drive shaft key in key way and place sheave and bushing on engine drive shaft. Install capscrews through bushing into sheave but do not tighten.
- (4) Mount alternator on base plate together with the belt tensioning bracket but do not tighten mounting bolts.
- (5) Install both alternator drive belts over the drive sheave and the alternator pulley.
- (6) Aline the drive sheave and drive pulley so that the belt is in the same plane.
- (7) Tighten the bushing capscrews on the engine pulley.
- (8) Pull up on alternator until drive belts are tight (less than 1/2 in. (1.2 cm) movement midway between the pulleys) Tighten the alternator brackets, capscrews and nuts.
- (9) Install the pump drive coupling on the engine drive shaft.
- (10) Aline the pump drive coupling with the pump.
- (11) Install the capscrews, washers and nuts to attach the pump to the pump bracket.
- (12) Tighten the pump drive coupling set screws.

INSPECTION

- (1) Before installing new APU assembly in hose body ensure all shipping blanks and packaging are removed.
- (2) Check alternator belt tension and adjust as required (Half in. (1.2 cm) movement of belt midway between pulleys).

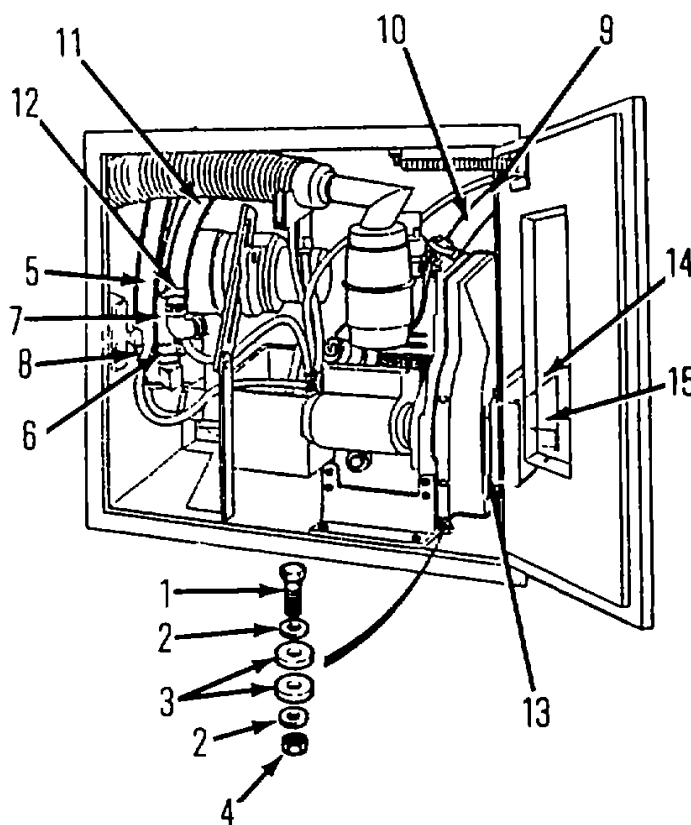
INSTALLATION

- (1) Using a small hydraulic floor crane or skid planks as in REMOVAL, slide APU assembly into hose body APU compartment. Do not push all the way in.
- (2) Connect the stop control cable to engine throttle plate. Slide APU assembly into compartment completely.
- (3) Using a pry bar, lift each corner of the base plate in turn and insert rubber washer between plate and bottom of box.. Ensure they are alined with the hold down capscrew holes.



4-15. AUXILIARY POWER UNIT - Continued**4-15.1 Auxiliary Power Unit Assembly - Continued**

- (4) Insert capscrews (1) through plate, rubber washer (3) and bottom of box. Place rubber washer on end of each capscrew followed by washer (2) and locknut (4).
- (5) Torque locknuts to 30 ft lb (41 Nm).
- (6) Install pulley cover (15) in compartment. Lower manual start cover (14) over pulley and tighten capscrews (13).
- (7) Reconnect fuel delivery and return hoses.
- (8) Reconnect air intake hose (10) between engine and back of box. Tighten hose clamps (9).
- (9) Reconnect electrical wires to engine starter and alternator.
- (10) Push water hoses (5, 7 and 11) over pump barbed nipples and tighten hose clamps (6, 8 and 12).
- (11) Remove hose crimp retaining pliers from water hoses.
- (12) Fill engine with oil as detailed in the Lube Order (LO 5-4210-220-12).
- (13) Start APU and run for 15 minutes checking fuel and water connections. This also will remove all air out of the Winterization System.
- (14) Loosen top hose on pump body heater and bleed all air from the heater.
- (15) Check level of coolant in main engine radiator and top up as required.



4-15. AUXILIARY POWER UNIT - Continued**4-15.2 Circulation Pump.**

This task covers a Removal
 b Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

MS51922-1 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

APU Shutdown (see para. 2-12)

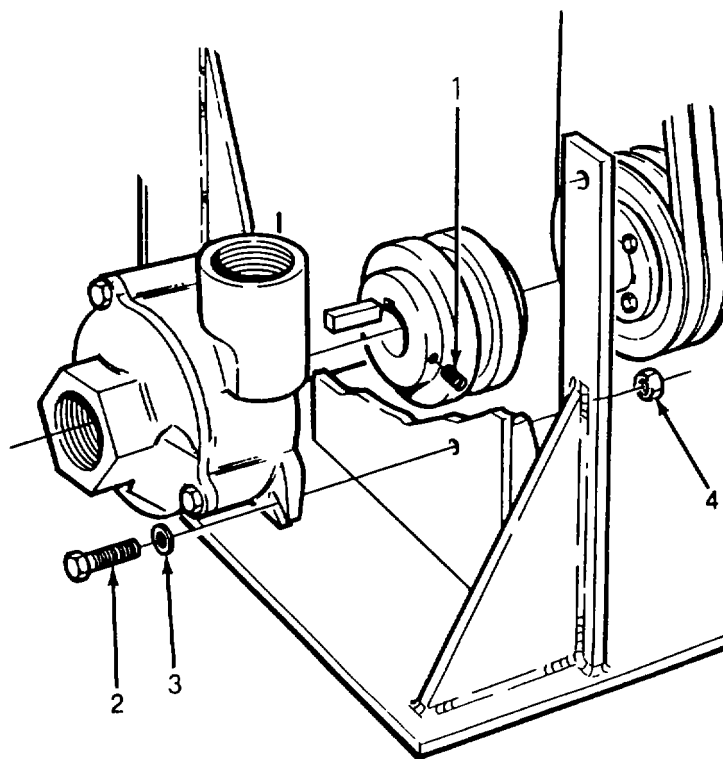
Batteries Disconnected (see para. 4-24)

WARNING

Engine coolant can be hot enough to cause serious burns. Allow engine to cool before removing the circulation pump.

NOTE

The circulation pump can be removed and repaired with the APU assembly mounted in the truck.



4-15. AUXILIARY POWER UNIT - Continued**REMOVAL**

- (1) Clamp inlet and outlet water hoses with hose crimp retaining pliers.
- (2) Loosen hose clamps and pull hoses of water pump barbed fittings.
- (3) Loosen set screws (1).
- (4) Remove two capscrews (2), washers (3) and locknuts (4) Discard locknuts.
- (5) Withdraw water pump from pump support bracket and separate the drive couplings.
- (6) Remove fittings from pump suction and discharge.
- (7) Remove pump drive coupling.

INSTALLATION

- (1) Install pump drive coupling on end of pump shaft.
- (2) Install fittings on pump suction and discharge.
- (3) Install two capscrews (2), washers (3) and locknuts (4) and tighten to 8 ft lb (11 Nm).
- (4) Install set screws (1) to lock pump drive coupling.
- (5) Push water hoses onto pump and tighten hose clamps.
- (6) Remove hose crimp retaining pliers from inlet and outlet hoses.
- (7) Start APU and run for 15 minutes checking for fuel and water leaks. This will also remove all air out of the Winterization System.
- (8) Check level of coolant in main engine radiator and top up as required.

4-15. AUXILIARY POWER UNIT - Continued**4-15.3 Alternator.**

This task covers

- a Replacement
- b Repair

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

1105465 Alternator
A26 Belt

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

NOTE

The alternator can be removed with the APU assembly mounted in the truck.

REPLACEMENT

- a. Drive Belt Replacement

NOTE

The drive belts can only be replaced if the pump is removed from the APU. This can be done with the APU in the truck. Always replace drive belts as a matched pair.

- (1) Disassemble APU as detailed in para. 4-15.1 DISASSEMBLY, steps 2 thru 6
- (2) Install new drive belts and assemble APU as detailed in para. 4-15.1, ASSEMBLY, steps 5 thru 12.
- b. Alternator Replacement.
 - (1) Tag and disconnect electrical wiring to alternator.
 - (2) Remove alternator tensioning bracket.
 - (3) Remove alternator capscrew holding alternator to pump frame.
 - (4) Install new alternator in compartment and attach to pump frame with capscrew.
 - (5) Install drive belts over alternator fan pulley.
 - (6) Install alternator tensioning bracket Push on alternator and tighten tensioning bracket capscrews such that the drive belts can be pressed approximately 1/2 in. (2 mm) midway between the pulleys.

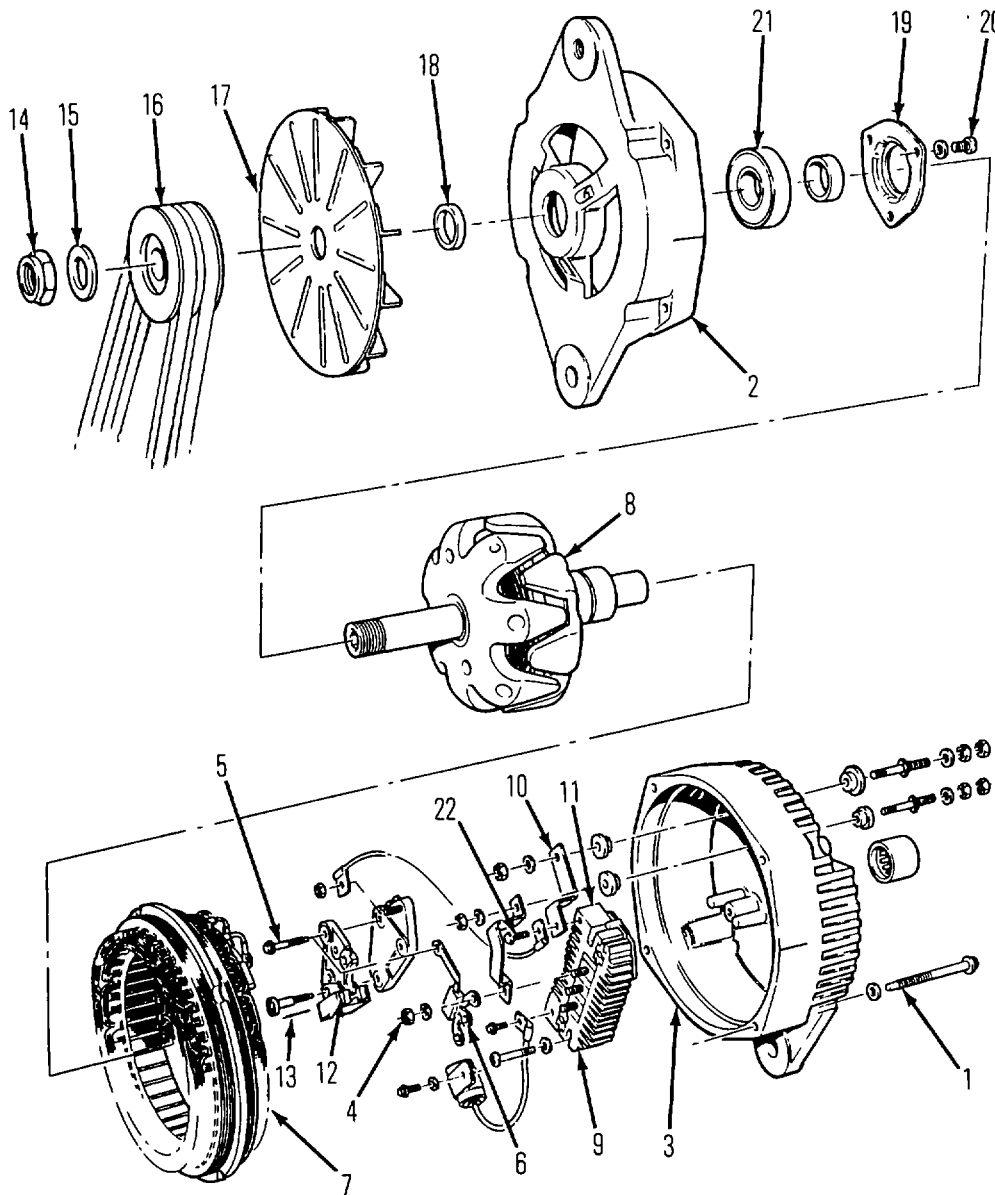
4-15 AUXILIARY POWER UNIT - Continued

REPAIR

NOTE

Alternator must be removed from truck for repair.

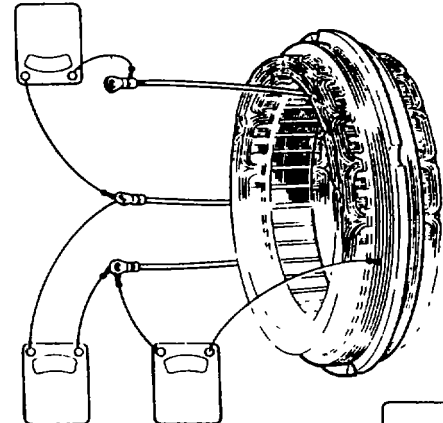
- (1) Make scribe marks on end frames to facilitate reassembly.
- (2) Remove four bolts (1) and separate drive end frame assembly (2) from slip ring end frame assembly (3).
- (3) Remove three nuts (4) and screw (5) Be careful not to loose insulator on screw.
- (4) Remove diode trio (6).
- (5) Separate stator (7) from end frame.



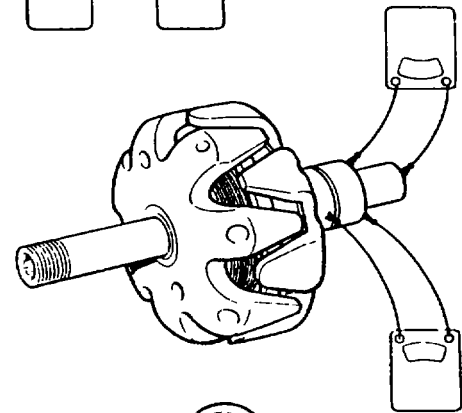
4-15. AUXILIARY POWER UNIT - Continued

4-15.3 Alternator - Continued

(6) Connect ohmmeter between each stator lead and stator frame. If reading is low, stator is grounded and requires replacement.



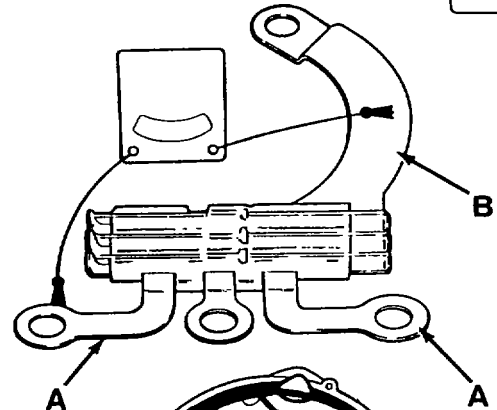
(7) Check rotor for grounds using ohmmeter between each slip ring and the rotor shaft. Reading should be very high, otherwise replace rotor.



(8) Check rotor for resistance between slip rings. Reading should be 2.4 - 3.5 ohms. If not, replace rotor.

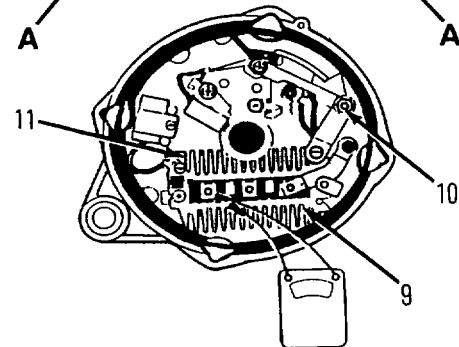
(9) Clean slip rings with emery cloth (item 13, Appendix E) while rotating rotor.

(10) Check diode trio by connecting ohmmeter between each short lead (A) and single long lead (B).



(11) Current should flow from short lead (A) to long lead (B), but not in reverse. Check all short leads. Replace diode trio if any lead is faulty.

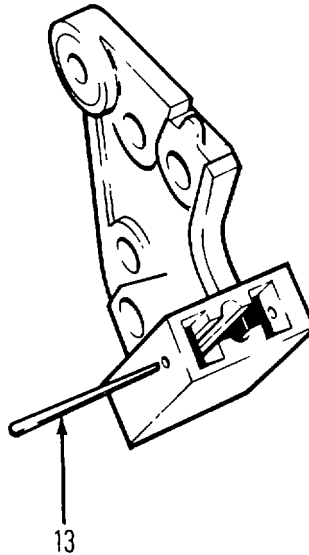
(12) Check rectifier bridge with ohmmeter connected from grounded heat sink (9) to flat metal (10) on terminal. Reverse leads. If both readings are the same, replace the rectifier bridge.



(13) Repeat test between grounded heat sink (9) and the other two flat metal strips (10).

4-15. AUXILIARY POWER UNIT - Continued

- (14) Repeat test between insulated heat sink (11) and all three flat metal strips.
- (15) Disconnect black lead between regulator and rectifier bridge by removing screws (2).
- (16) Remove brush/brush holder by removing two remaining screws.

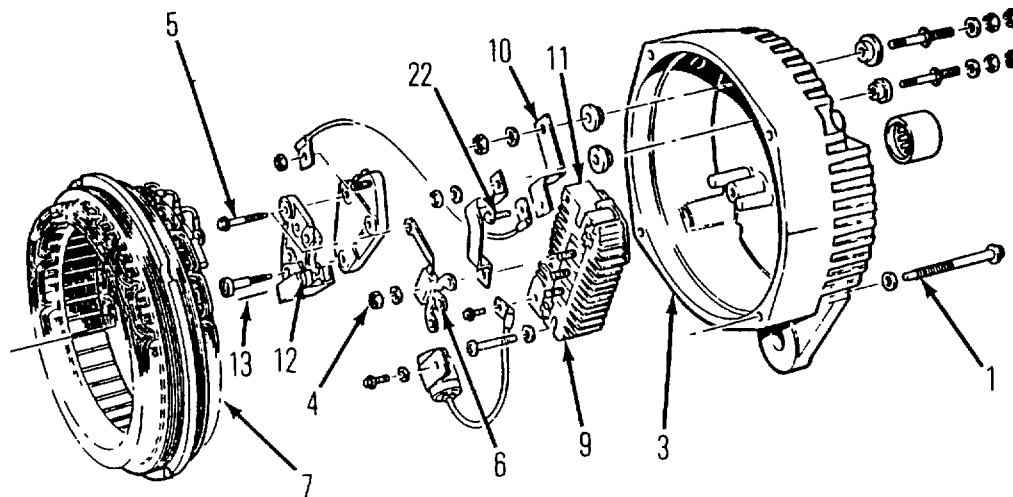
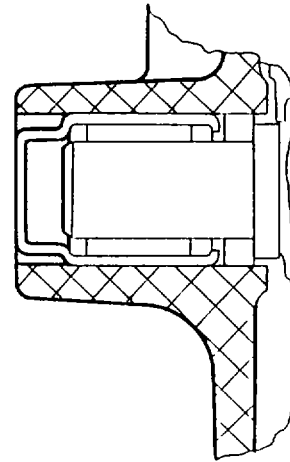


- (17) Clean brushes (12) with soft dry cloth. Replace brushes if carbon brush is less than 3/16 in. (5 mm) long.
- (18) Put brushes in holder and hold with brush retainer wire (13) or toothpick as shown.
- (19) To remove rotor, hold shaft with allen key and remove nut (14), washer (15), pulley (16), fan (17) and collar (18).
- (20) Push rotor (8) from housing.
- (21) Remove retainer plate (19) by removing screws (20).
- (22) Pushing bearing (21) out and clean all parts with a soft cloth.
- (23) Replace bearing if loose in housing or on shaft or bearing itself is worn. This is a sealed bearing, it cannot be regreased.
- (24) When replacing press into frame with tube that presses on the outer race only.
- (25) Install retainer plate (19) using screws (20).
- (26) Push rotor (8) into end frame and assemble collar (18), fan (17), pulley (16), washer (15), and nut (14). Tighten nut to 60 ft lb (82 Nm).

4-15. AUXILIARY POWER UNIT - Continued

4-15.3 Alternator - Continued

- (27) Check movement of rotor in slip ring end bearing. If loose replace bearing by pushing bearing from outside to inside of end frame.
- (28) Place new bearing on outside and with flat plate, push into housing until top of bearing grease cup is flush with outside of slip ring end frame.
- (29) Install brush/brush holder in end frame. Be sure toothpick sticks through outside of end frame.
- (30) Connect black wire from regulator to rectifier and secure with screw (22).
- (31) Install stator and diode and tighten nuts on rectifier.
- (32) Guide slip ring end frame over drive end frame. Ensure scribe marks aline.
- (33) Install four bolts between both frames and tighten securely.



4-15. AUXILIARY POWER UNIT - Continued**4-15.4 Engine Air Cleaner.**

This task covers Replacement

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

530-2175-050 Filter Element

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump and Hose Body Heat Shields Removed
(see para. 4-11)

REPLACEMENT

- (1) Air filter is mounted on the back face of the APU compartment. Access filter from underneath truck.
- (2) Unscrew cap from filter housing.
- (3) Remove filter cartridge and discard.
- (4) Install new filter cartridge. Carefully align filter cartridge and lid.
- (5) Tighten lid to filter housing.

4-15. AUXILIARY POWER UNIT - Continued**4-15.5 Engine Starter Motor.**

This task covers Repair

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

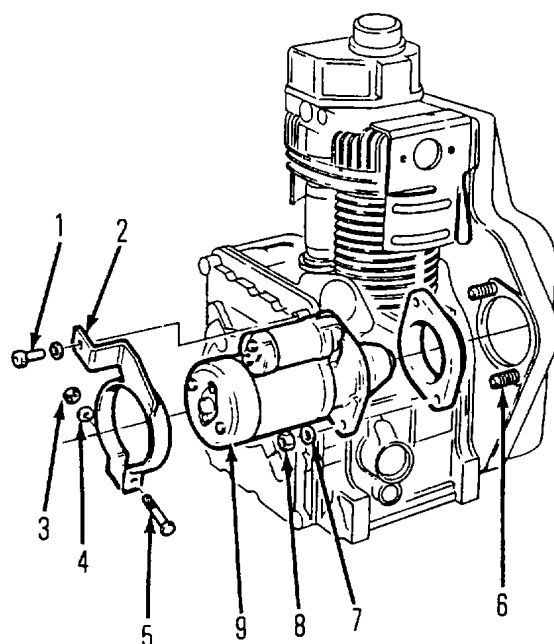
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

REPAIR**NOTE**

May be repaired with APU in truck if the starter motor or solenoid has failed, the starter assembly must be replaced.

- (1) Tag and disconnect electrical connections between wiring harness and starter motor.
- (2) Remove machine screw (1) attaching starter mounting bracket (2) to engine crankcase cover plate.
- (3) Loosen clamp bolt (5), nut (4) and washer (3) securing mounting bracket to starter. Remove starter bracket.
- (4) Remove two nuts (8) and washers (7) securing starter to mounting studs (6).
- (5) Remove starter assembly (9).
- (6) Replace faulty starter with new or remanufactured unit.
- (7) Install two washers (7) and nuts (8) to secure starter assembly to block.
- (8) Install starter mounting clamp (2) with machine screw (1).
- (9) Tighten clamping bolt (5).



4-15. AUXILIARY POWER UNIT - Continued**4-15.6 Engine Injector Pump.**

This task covers

a	Adjustment
b	Test
c	Removal
d	Installation
e	Repair

TOOLS

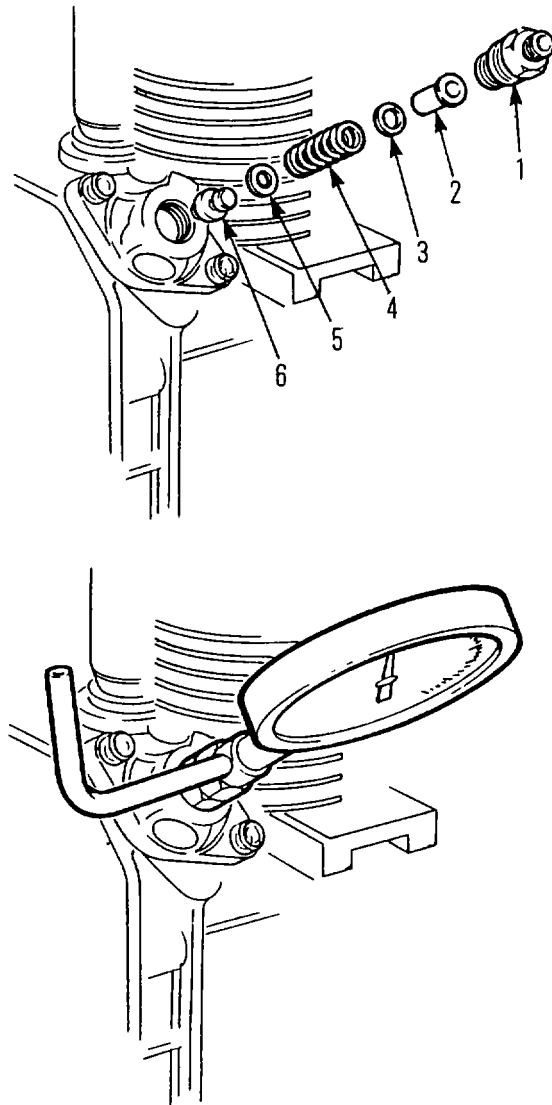
Tool Kit, Master Mechanic,
NSN 5180-00-699-5273
7270-2003-08 Injector Pump Tester

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Engine need NOT be removed from truck.

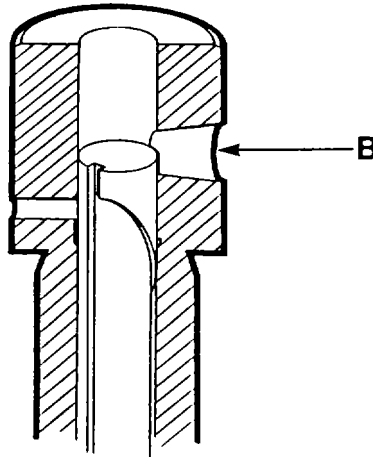
ADJUSTMENT

- (1) Remove pressure line between injection pump and injector.
- (2) Remove delivery union (1), filler (2), filler shim (3), delivery valve spring (4), gasket (5), and delivery valve (6).
- (3) Install tester (7270-2003-08) in pump body and install dial gage. (If special tester is not available, injector timing can be checked by comparing flywheel timing marks with fuel being ejected from injector pump (ie, only carry out instruction 1 and follow with instruction 4 following).
- (4) Place fuel rack to maximum fuel delivery, (throttle at maximum).
- (5) Set compression release lever to start position and set APU key switch to ON. Check fuel pump starts.
- (6) Using rope on engine start pulley, slowly rotate flywheel until engine is in compression stroke. Stop when fuel spills out from tester tube (method 1) or from delivery union (method 2) Adjust dial gage reading to zero.

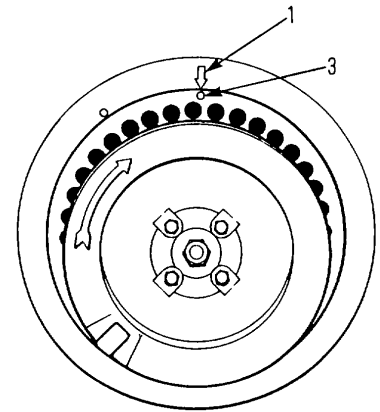


4-15. AUXILIARY POWER UNIT - Continued

- (7) Continue to rotate until fuel stops spilling. This is the start of the pumping stroke. Injector pump plunger is covering barrel feed orifice B.
- (8) Note position of dial injector (method 1) Dial gage must indicate a prestroke of 0.084 - 0.092 in. (2.10 - 2.30 mm).



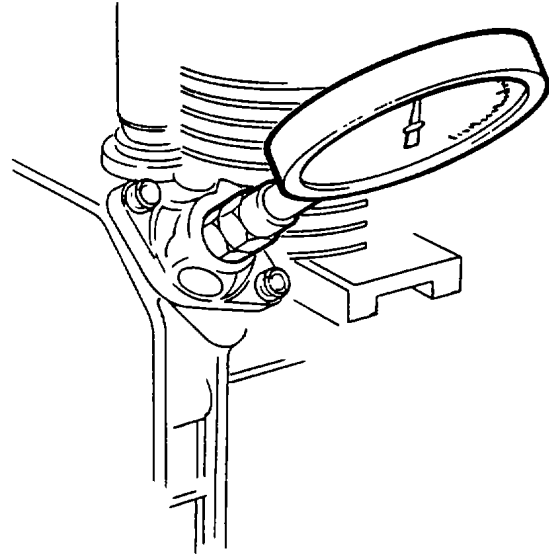
- (9) Note position of flywheel timing marks (both methods). Mark 3 on flywheel must be aligned with mark 1 on shroud. If fuel spilling stops earlier (timing advanced) add shims under the pump, if later (timing retarded) remove shims.
- (10) To add or remove shims under the pump, remove pump machine screws and carefully withdraw pump.
- (11) Add or withdraw shims and replace pump in crank cover. Tighten capscrews to 20 ft lb (25 Nm).
- (12) Repeat steps 3 thru 11 as required.
- (13) If by adjusting shims, the prestroke is out of range, check camshaft (see para. 4-15.12) or repair injector pump (see REPAIR following).
- (14) When complete, remove tester (if installed) Replace delivery valve gasket, delivery valve spring, filler shim, delivery union and pressure line.
- (15) Set APU keyswitch OFF.



4-15. AUXILIARY POWER UNIT- Continued**4-15.6 Engine Injector Pump - Continued****TEST****NOTE**

May be tested with APU in truck.

- (1) Remove pressure line between injection pump and injector.
- (2) Connect a 0 - 10,000 psi (0 - 70,000 kPa) pressure gage to delivery union.
- (3) Set APU keyswitch to ON Check fuel pump starts.
- (4) Set control rack to mid-position, APU throttle to mid position.
- (5) Rotate engine through several revolutions, using starter motor (keyswitch set to START), This will purge all air from the fuel system.
- (6) While watching pressure gage, rotate engine through a complete injection cycle.
- (7) Note maximum pressure on gage.
- (8) Repeat test with control rack in fully open position, APU throttle in maximum position.
- (9) If first test pressure is less than 4000 psi (28,000 kPa) or second test pressure is less than 5500 psi (38,000 kPa) replace injector pump assembly or replace plunger and barrel (see REPAIR following).
- (10) Repeat the test and note the pressure drop that immediately follows the peak pressure reading. Pressure drop should be between 400 - 700 psi (2800 - 4800 kPa).
- (11) If test pressure is not reached, replace pump assembly (see REMOVAL following) or replace delivery valve (see REPAIR following).

**REMOVAL**

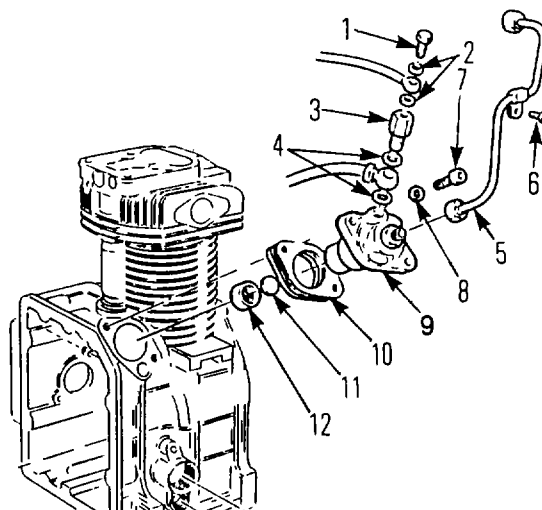
- (1) Remove banjo bolt (1), both washers (2), banjo bolt (3), and both washers (4).
- (2) Remove high pressure injector feed line (5) and clamp retaining bolt (6).
- (3) Remove both machine screws (7) and washers (8).
- (4) Carefully withdraw injector pump (9) from block. Take care to ensure gaskets (10), spacer (11), and tappet (12) are removed from the block.

4-15. AUXILIARY POWER UNIT - Continued

- (5) Repair pump as detailed in REPAIR following.

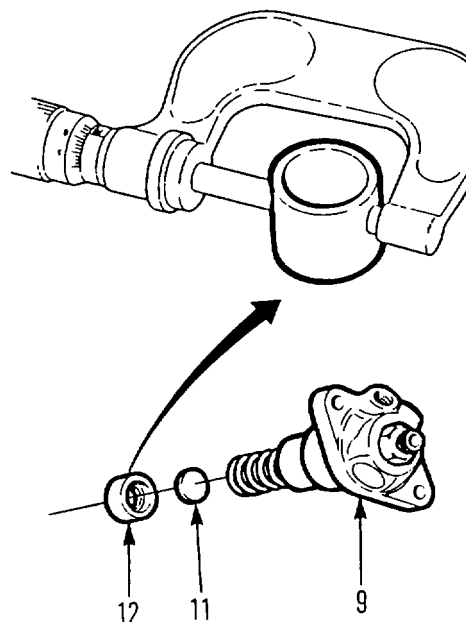
INSTALLATION

- (1) Install spacer (11) in tappet (12) and slide over end of injector pump.
- (2) Install machine screws (7) and washers (8) through pump flange.
- (3) Install spacer gaskets (10) over machine screws.
- (4) Aline pump rack pin with rack slot in block and install injector pump in block.
- (5) Tighten machine screws to 22 ft lb (30 Nm).
- (6) Adjust timing and test pump as detailed in ADJUSTMENT and TEST preceding.

**REPAIR****NOTE**

Injector pump must be removed from block. See REMOVAL preceding

- (1) Measure tappet (12) external diameter. It must be between 1.1016 -1.1024 in. (27.98 mm). If less or tappet to guide clearance exceeds 0.004 in. (0.01 mm) replace tappet.
- (2) If original tappet is to be reused, remove any light marks or grooves with fine emery cloth (Item 13, Appendix E).
- (3) Measure thickness of spacer (11). Thickness of spacer must be between 0.138 - 0.142 in. (3.45 - 3.55 mm). Measure several positions. If error between measurements is greater than 0.004 in. (0.001 mm), replace spacer.
- (4) Any other fault found during testing cannot be repaired. Replace whole injector pump.



4-15. AUXILIARY POWER UNIT - Continued**4-15.7 Engine Injector.**

This task covers

- a. Removal
- b. Installation
- c. Repair

TOOLS

Tool Kit, Master Mechanic,
NSN 5780-00-699-5273

EQUIPMENT CONDITION

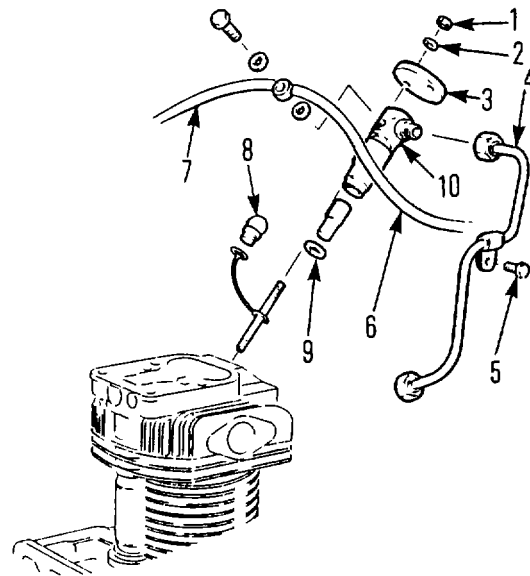
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)

NOTE

The injector can be replaced with APU in truck.

REMOVAL

- (1) Remove high pressure injector feed line (4) and clamp retaining bolt (5).
- (2) Pull fuel return hoses (6, 7) off barbed couplings on fuel injector.
- (3) Remove both nuts (1) and washers (2).
- (4) Remove plate (3) and starting aid plug (8).
- (5) Pull injector out of cylinder head.

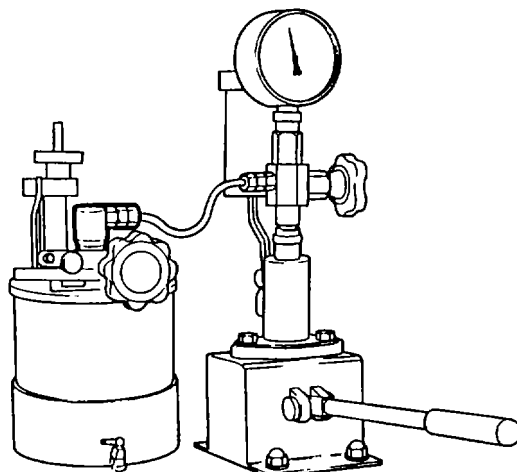
**INSTALLATION****NOTE**

If a new injector is being installed remove cylinder head, see para. 4-158.

- (1) Install injector in cylinder head. For new injector, check nozzle tip protrudes but of head by 0.10 - 0.12 in. (2.5 - 3.0 mm). Adjust with shims between injector and head.
- (2) Slide starting aid plug retaining clip (8) over left hand stud.
- (3) Install injector retaining plate (3), washers (2), and nuts (1).
- (4) Tighten nuts to 9 ft lb (12 Nm).
- (5) Install high pressure injector feed line (4) and clamp retaining bolt (5).
- (6) Install fuel return lines (6 and 7).
- (7) Start engine and check for fuel leaks. Tighten or replace hoses as required.

4-15. AUXILIARY POWER UNIT - Continued**REPAIR**

- (1) Connect the injector to a diesel fuel injection nozzle tester.
- (2) Operate hand pump and be sure injection pressure is 2800 - 3100 psi (19,500 - 21,500 kPa). Check spray angle is 155 deg.
- (3) Operate hand pump slowly building pressure to 2550 psi (17,500 kPa)
- (4) If injection pressure is low, replace injector. If injector drips, dismantle injector and lap needle and seat together. If still drips, replace nozzle.
- (5) If nozzle is dirty on outside, clean carefully with wooden stick. Clean four nozzles with a 0.006 in. (0.15 mm) wire.
- (6) Install injector in engine as detailed in INSTALLATION preceding.



4-15. AUXILIARY POWER UNIT - Continued**4-15.8 Engine Intake and Exhaust Valves.**

This task covers

- a. Removal
- b. Inspection
- c. Installation
- d. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

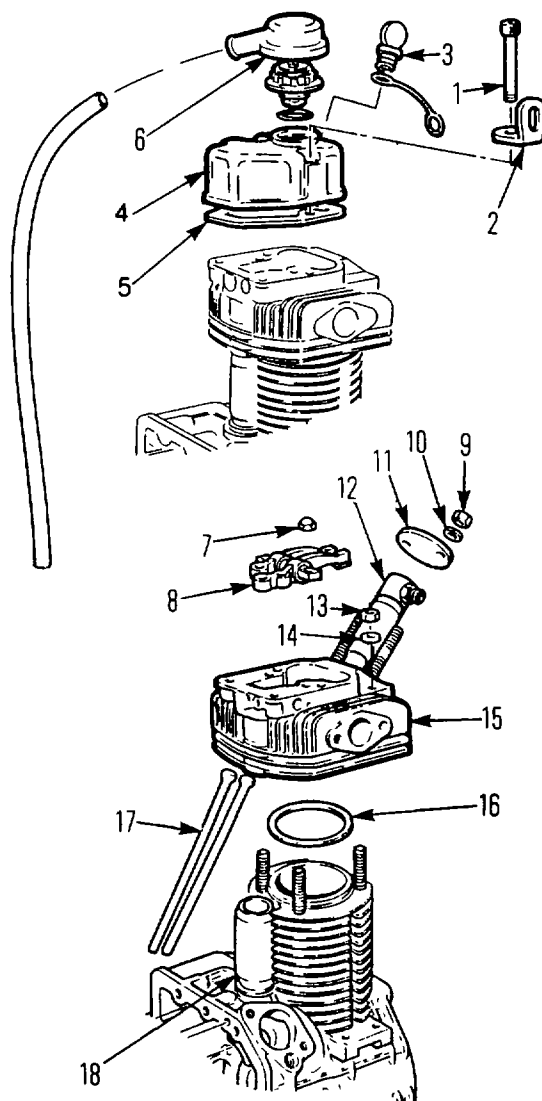
APU Shutdown (see para. 2-12)
Engine Dismounted from Base
(see para. 4-15.1)

MATERIALS/PARTS

31, Appendix E Grinding Compound
500.4400.015 Valve Cover Gasket
520.4730.030 Cylinder Head Gasket
520.4730.031 Cylinder Head Gasket
520.4730.032 Cylinder Head Gasket
520.4730.033 Cylinder Head Gasket
500.4740.018 Push Rod Cover Seal
500.4740.025 Push Rod Cover Seal

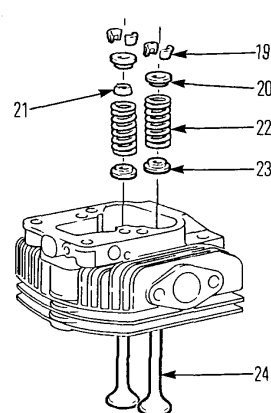
REMOVAL

- (1) Remove left hand and right hand shrouds as detailed in para. 4-15.9 REMOVAL, steps 1 thru 4.
- (2) Lift off oil breather cover (6) and lay aside.
- (3) Lift off ether start plug (3) and lay aside.
- (4) Remove machine screws (1) together with engine lift bracket (2).
- (5) Remove valve cover (4) together with gasket (5).
- (6) Remove both acorn nuts (7) from head studs.
- (7) Remove rocker arm assembly (8).
- (8) Remove injector retaining nuts (9) and washers (10).
- (9) Lift off injector holding plate (11) and ether plug (3) Pull injector (12) out of cylinder head.
- (10) Remove remaining head nuts (13) and washers (14).
- (11) Lift head assembly (15) from studs Remove cylinder head gasket (16).
- (12) Lift out push rods (17) from push rod tube (18) on drive side of cylinder.



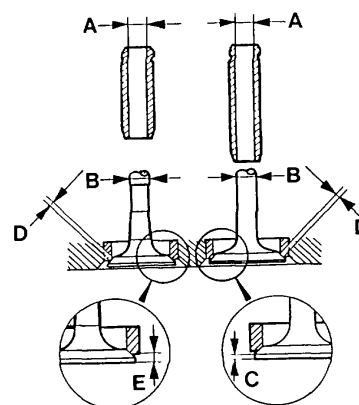
4-15. AUXILIARY POWER UNIT - Continued

- (13) Compress each valve spring (22) in turn to remove valve half cones (19), spring seats (20, 23) springs (22), oil seal (21) (intake only) and valve (24).



INSPECTION

- (1) Remove all scale from cylinder head and valves using a wire brush and scraper.
- (2) Inspect each rocker arm, if badly worn, scored or damaged, replace.
- (3) Inspect rocker arm pivot, diameter must be (0.370 - 0.378 in.) (9.4 - 9.6 mm). Clearance between pivot and rocker arms(s) bore should be less than 0.004 in. (0.1 mm).
- (4) Replace rocker arm(s) or pivot as required.
- (5) Check rocker arm lube holes are clear. Clean out with stiff wire as required.
- (6) Inspect push rods and protecting tube. Push rods should be straight with end tips smooth. The protecting tube must be undamaged.
- (7) Discard upper and lower push rod cover seals.



- (8) Inspect valves if valve heads are distorted, cracked, mushroomed or seat surface are worn excessively replace, (see table). If valves are only slightly worn regrind seat surface to 45 deg. on valve grinder.

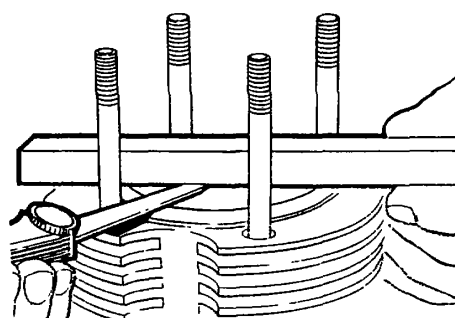
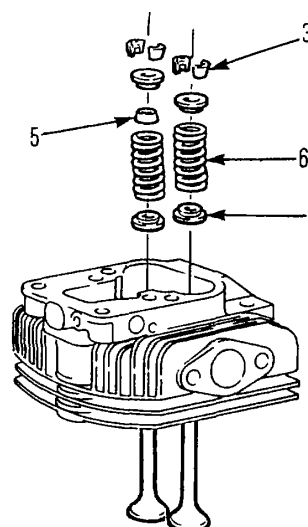
B in. (mm)	A-B In. (mm)	C In. (mm)	D In. (mm)	E In. (mm)
0.275-0.276 (6.98-7.00)	0.001-0.003 (0.03-0.08)	0.028-0.035 (0.70-0.90)	0.055-0.063 (1.40-0.60)	0.063-0.071 (1.60-1.80)

4-15. AUXILIARY POWER UNIT - Continued**4-15.8 Engine Intake and Exhaust Valves - Continued**

- (9) Inspect valve guides. If guides are excessively worn (see table), are grooved or have carbon deposits, replace valve guide. (See REPAIR following).
- (10) Inspect valve seats if badly scored or they have an irregular wear pattern resurface seat. If seat diameter is greater than 1.06 in. (27 mm) (intake) 0.91 in. (23 mm) (exhaust) replace seat. See REPAIR following.
- (11) Lap valves and seats with valve grinding compound (item 31, Appendix E) even if neither is replaced.
- (12) Inspect valve springs. Replace if broken, cracked or chipped. Check free length equals 1.65 in. (42 mm).. With load of 51 lb (23 kg) spring length must be 1.26 in. (32 mm). Replace if spring will not meet these specifications.

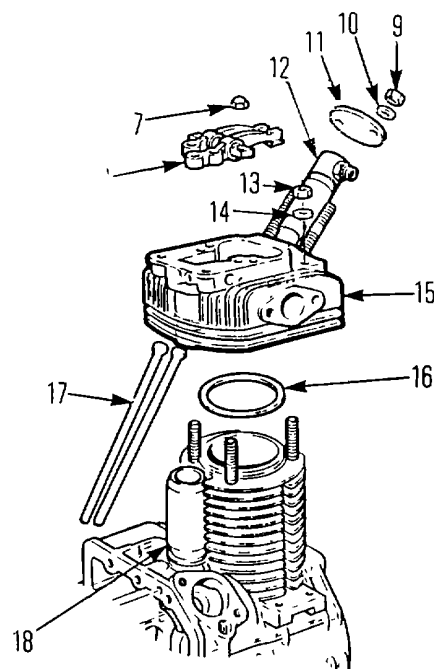
INSTALLATION

- (1) Install valves in cylinder head.
- (2) Install valve spring retainers (7) valve springs (6) valve seal (5, intake only), upper retainer over valve shafts.
- (3) Compress each spring in turn and install spring retainer (3) over valve shaft.
- (4) Install injector into cylinder head, see para. 4-15.7 INSTALLATION.
- (5) Replace push rod cover upper and lower seals on cover. Install cover in engine block.
- (6) Rotate flywheel until piston is at top dead center. Measure piston crown face to cylinder edge clearance.
- (7) Crown face of piston must be between 0.008 in. (0.20 mm) higher and 0.006 in. (0.15 mm) lower than cylinder edge.
- (8) Adjust clearance by selecting one of the following cylinder head gaskets.

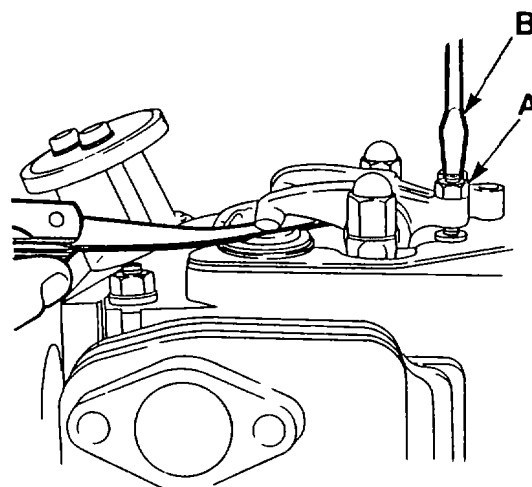


4-15. AUXILIARY POWER UNIT - Continued

SIZE	PART NO.
0.020 in. (0.50 mm)	520.4730.030
0.024 in. (0.60 mm)	520.4730.031
0.028 in. (0.70 mm)	520.4730.032
0.032 in. (0.80 mm)	520.4730.033

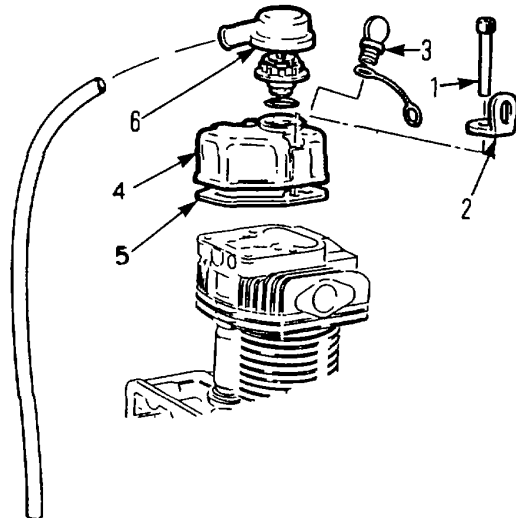


- (9) Install new head gasket (16) onto cylinder block.
- (10) Install push rods (11) in cover, ensuring the tips seat in the tappets.
- (11) Install cylinder head (15) over studs, ensuring push rod cover seal fits into head recess.
- (12) Install rocker arm assembly (8) over studs. Exhaust rocker has two adjusting screws and mounts on the exhaust side of the engine.
- (13) Guide the push rods into correct rocker arm. Push rod next to cylinder is inlet push rod. (Push rods will be crossed over in tube if correctly installed).
- (14) When rocker arm and push rods are engaged, install both acorn nuts (7) and jam nuts (13) onto cylinder head studs.
- (15) Tighten to 29 ft lb (39 Nm), working crosswise.
- (16) Adjust valve tappet clearance to 0.006 in. (0.15 mm) with piston at top dead center of compression stroke. (Flywheel mark 3 aligned with shroud mark 2).
- (17) When adjusted, tighten rocker arm locking nuts (A) ensuring adjuster screw (B) does not rotate.
- (18) With piston at top dead center of compression stroke, operate decompression lever. Check exhaust valve lowering starts when lever has traveled halfway between "ON" and "OFF" positions.
- (19) Adjust by altering set screw at rear of exhaust rocker arm. Adjust until clearance between decompression spindle and bottom of screw is 0.036 - 0.044 in. (0.9 - 1.1 mm) with lever in the "OFF" position.
- (20) Set compression release and rotate flywheel. Ensure decompression lever resets within 1 full rotation of the engine.
- (21) Install valve cover (4) with new gasket (5) on cylinder head.



4-15. AUXILIARY POWER UNIT - Continued**4-15.8 Engine Intake and Exhaust Valves - Continued**

- (22) Install machine screws (1) together with engine lift bracket(s) and tighten to 25 ft lb (34 Nm).
- (23) Install oil breather cover (6) and ether start plug (3).
- (24) Install left hand and right hand shrouds as detailed in para. 4-15.9 INSTALLATION steps 7 thru 11.
- (25) Install engine on base, see para. 4-15.1 ASSEMBLY (26) Install engine in truck, see para. 4-15.1 INSTALLATION.

**REPAIR a. Valve Guide Repair.**

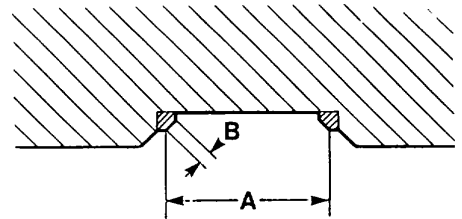
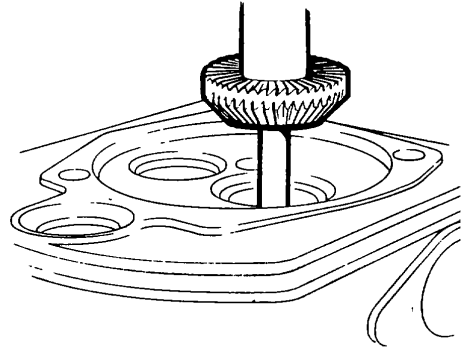
- (1) Remove cylinder head from engine and disassemble as detail
- (2) If guides are worn they must be replaced with oversize guides.
- (3) Remove valve guide retaining rings.
- (4) Press guides out of cylinder head with a punch or using a suitable arbor and press.
- (5) Ream guide bores. Do not use reamers more than 0.020 in. (0.5 mm) oversize.
- (6) When bore is true, measure bore and machine replacement oversize guide to an outside diameter of 0.0020 - 0.0024 in. (0.05 - 0.06 mm) in excess of bore.
- (7) Press in replacement guides and install retaining rings (8) Install valves in guides and ensure valve movement is not restricted. Ream internal diameter of guides as necessary.
- (9) Install cylinder head on engine as detailed in INSTALLATION preceding.

b. Valve Seat Repair.

- (1) Remove cylinder head from engine and disassemble as detailed in REMOVAL preceding.
- (2) If valve seats are severely worn they must be replaced.
- (3) Drill three or four 0.082 - 0.12 in. (2-3 mm) holes through valve seat.
- (4) Cut seat with chisel avoiding damage to seat housing.

4-15. AUXILIARY POWER UNIT - Continued

- (5) Extract seat and clean out seat housing.
- (6) Press new seat in head using discarded valve as arbor or using a pilot drift. Heat the head if necessary in an oil bath to 320 - 360 deg. F (160 - 180 deg. C).
- (7) Cut valve seat using a 35 mm cutter for either inlet or exhaust valves. Finished seat diameter (A) should be 1.06 in. (27 mm) for inlet valve, 0.91 in. (23 mm) for exhaust valve. Seat width (B) should be between 0.055 - 0.063 in. (1.40 - 1.60 mm).
- (8) Lap valve and seat with valve grinding compound (item 31, Appendix E).
- (9) Install cylinder head on engine as detailed in INSTALLATION preceding.



4-15. AUXILIARY POWER UNIT - Continued

4-15.9 Engine Flywheel and Ring Gear.

This task covers: a. Removal
 b. Installation
 c. Repair

TOOLS

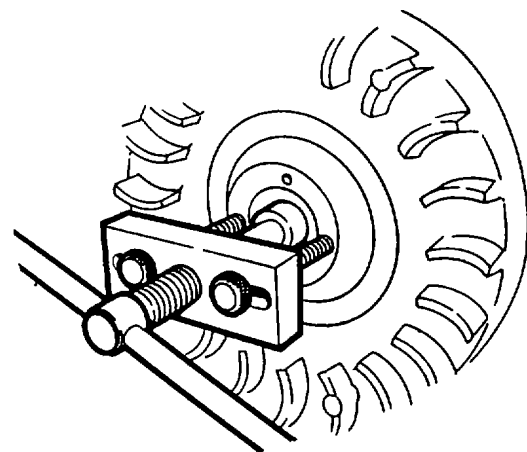
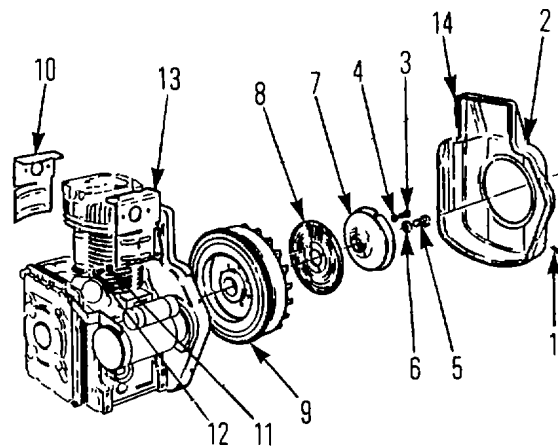
Shop Equipment, Automotive
 Maintenance and Repair,
 NSN 4910-00-754-0705

EQUIPMENT CONDITION

APU Shutdown (see para. 2-12)
 Engine Dismounted from Base
 (see para. 4-15.1)

REMOVAL

- (1) Remove injector feed line and clamp retaining bolt.
- (2) Remove muffler and air intake couplings from engine.
- (3) Remove machine screws (12) and washers (11) from both left hand and right hand air shrouds.
- (4) Remove left hand and right hand air shrouds (10 and 13).
- (5) Remove six machine screws (1) and lift front cowling (2) from engine.
- (6) Remove four machine screws (3) and washers (4) and lift rope pulley (7) and screen (8) from engine.
- (7) Loosen capscrew (6) and washer (5). Do not remove capscrew. To prevent crank turning, clamp drive end. Do not use flywheel cooling fans or ring gear to jam the flywheel.
- (8) Thread two capscrews into rope pulley mounting holes. Insert puller slotted yoke between capscrews. Pull flywheel against center retaining capscrew.
- (9) When flywheel is loose, detach puller, and remove capscrew (6) and washer (5). Remove flywheel (9).

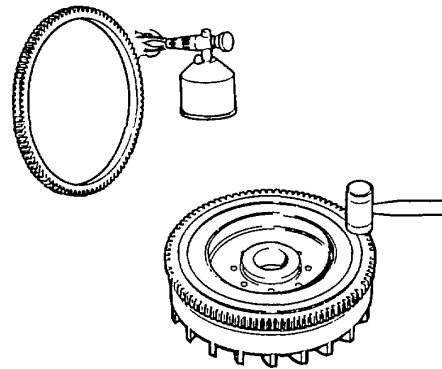


4-15. AUXILIARY POWER UNIT - Continued**INSTALLATION**

- (1) Ease flywheel (9) onto end of crankshaft taking care key and socket are alined.
- (2) Install washer (5) and capscrew (6) and tighten to 100 ft lb (135 Nm).
- (3) Install screen (8) and rope pulley (7) on flywheel.
- (4) Install and tighten washers (4) and capscrews (3) to 9 ft lb (12 Nm).
- (5) Be sure gasket (14) is fitted to engine cowling (2).
- (6) Install cowling (2) with six machine screws (1).
- (7) Be sure intake and exhaust gaskets are installed on head studs.
- (8) Install left hand (10) and right hand (13) shrouds over intake and exhaust studs.
- (9) Install washers (11) and capscrews (12).
- (10) Install injector feed line on injector and injector pump Install clamp retaining bolt.
- (11) Install muffler and air intake couplings ensuring intake and exhaust gaskets are fitted between left hand and right hand shrouds and the couplings.
- (12) Install engine on base, see para. 4-15.1 ASSEMBLY.
- (13) Install APU in truck, see para. 4-15.1 INSTALLATION.

REPAIR

- (1) To replace ring gear, remove flywheel as detailed in REMOVAL preceding.
- (2) Inspect keyway and tapered socket. Replace flywheel and ring gear if damaged.
- (3) Inspect ring gear if teeth are worn or damaged, replace ring gear. See following.
- (4) Place flywheel on wooden block so ring gear is clear of support base.
- (5) Using a large punch and hammer, drive ring gear clear of flywheel. If it will not break away, carefully heat ring with gas torch and drive off when warm.
- (6) Heat new ring with gas torch. Do not allow any part to become more than blue hot. When evenly warm, place over flywheel and drive it onto its seat quickly and evenly using a hammer and punch.
- (7) Install flywheel on engine as detailed in INSTALLATION preceding.



4-15. AUXILIARY POWER UNIT - Continued

4-15.10 Engine Piston and Piston Rod.

This task covers a. Removal
 b. Inspection
 c. Installation

TOOLS

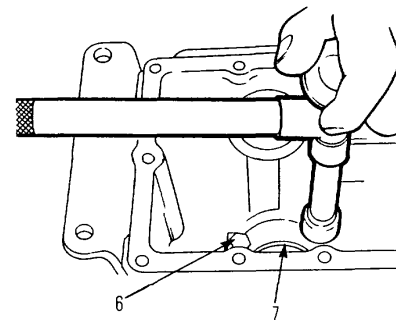
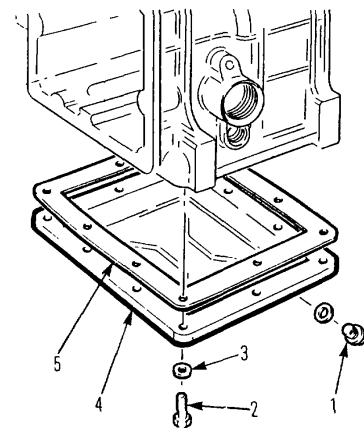
Shop Equipment, Automotive
 Maintenance and Repair,
 NSN 4910-00-754-0705
 EQUIPMENT CONDITION
 APU Shutdown (see para. 2-12)
 Engine Dismounted from Base
 (see para. 4-15.1)
 Cylinder Head Removed (see para. 4-15.9)

MATERIALS/PARTS

12, Appendix E Emery Cloth
 17, Appendix E Lubricating Oil
 500.4601.003 011 Pan Gasket
 520.4730.030 Cylinder Head Gasket
 520.4730.031 Cylinder Head Gasket
 520.4730.032 Cylinder Head Gasket
 520.4730.033 Cylinder Head Gasket
 500.4400.015 Valve Cover Gasket
 500.4740.018 Push Rod Cover Seal
 500.4740.025 Push Rod Cover Seal

REMOVAL

- (1) Remove oil pan plug (1) and drain oil from engine.
- (2) Remove oil pan capscrews (2) and washers (3).
- (3) Remove oil pan (4) and discard gasket (5).
- (4) Rotate flywheel until piston is at bottom dead center of its stroke.
- (5) Bend back retaining washer plate tabs and remove capscrews (6) and washer plate (7).
- (6) Remove bottom cap of piston rod together with bearing half.
- (7) Tap piston and piston rod upwards out of block.
- (8) Remove bearing half from lower end of piston rod.
- (9) Remove piston pin retaining ring and push piston pin out of piston and piston rod. Separate piston and piston rod.



4-15. AUXILIARY POWER UNIT - Continued

INSPECTION

- (1) Check cylinder wall out of round and taper with dial gage at two diameters a and b perpendicular to each other. Check at three different heights as illustrated.
- (2) If cylinder diameter is more than 0.004 in. (0.10 mm) nominal (see below), or is out of round by more than 0.002 in. (0.05 mm), or is tapered more than 0.004 in. (0.10 mm), cylinder block must either be replaced or rebored to accept an oversize piston.

Nominal 3.0732 - 3.0740 in. (78.00 - 78.02 mm)
 First oversize 3.0929 - 3.0937 in. (78.50 - 78.52 mm)
 Second oversize 3.1126 - 3.1134 in. (79.00 - 79.02 mm)

Oversize piston and rings must also be installed.

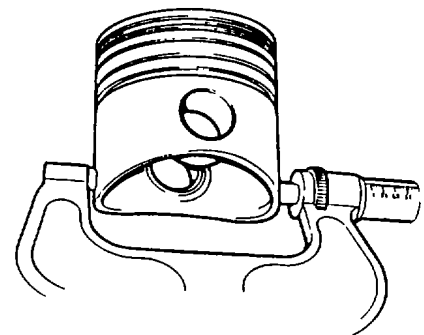
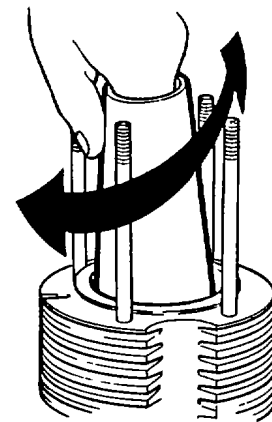
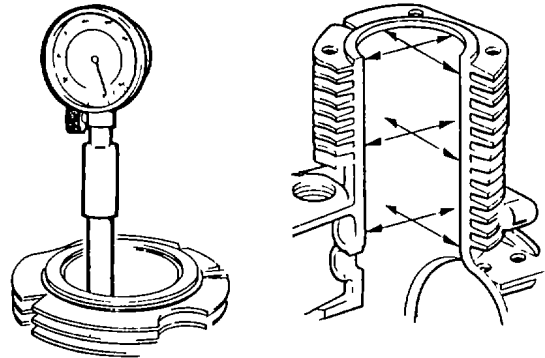
- (3) If cylinder diameter is less than 0.004 in. (0.10 mm) nominal (see step 2 preceding), or is out of round by less than 0.002 in. (0.05 mm), or is tapered less than 0.004 in. (0.10 mm), piston rings should be replaced on original piston, if piston is not damaged. (See step 5 following).
- (4) Restore roughness to cylinder by honing with emery cloth (item 12, Appendix E) soaked in diesel fuel, or with honing tool. Work in helical movement to obtain a cross hatch surface pattern.
- (5) Inspect piston, removing any scale, or carbon deposits on head. Measure piston skirt diameter perpendicular to wrist pin bore as illustrated.

- (6) Maximum skirt wear must not exceed 0.002 in. (0.05 mm)

Nominal 3.0693 - 3.0697 in. (77.90 - 77.91 mm)
 1st oversize 3.0890 - 3.0894 in. (78.40 - 78.41 mm)
 2nd oversize 3.1087 - 3.1091 in. (78.90 - 78.91 mm)

Replace piston as required.

- (7) Measure wrist pin bore for out-of-roundness. Replace piston and wrist pin if out-of-roundness exceeds 0.004 in. (0.10 mm).
- (8) Inspect wrist pin for scoring or seizure marks. Replace piston and piston pin if any found.
- (9) Measure wrist pin diameter and wrist pin bushing in piston rod. Replace both if clearance exceeds 0.0025 in. (0.07 mm).



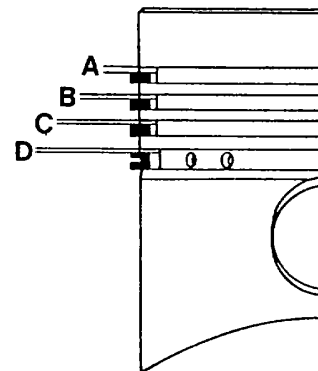
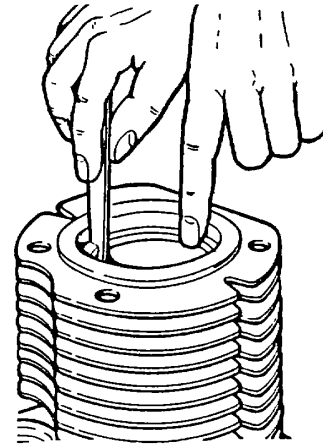
4-15. AUXILIARY POWER UNIT - Continued

4-15.10 Engine Piston and Piston Rod - Continued

- (10) Remove rings with expander and scrape away all carbon deposits from ring grooves (Use discarded ring if required).
- (11) Install new rings in cylinder and check for perfect mating between ring and cylinder wall. Measure ring end gap. File ring ends as required.

End gap for compression ring should be 0.010 - 0.016 in. (0.25 - 0.40 mm), for oil control ring, 0.008 - 0.014 in. (0.20 - 0.30 mm).

- (12) Install rings on piston and measure ring to groove clearance. Top ring is chromium plated. Replace piston and/or rings if wear limit exceeds that shown.

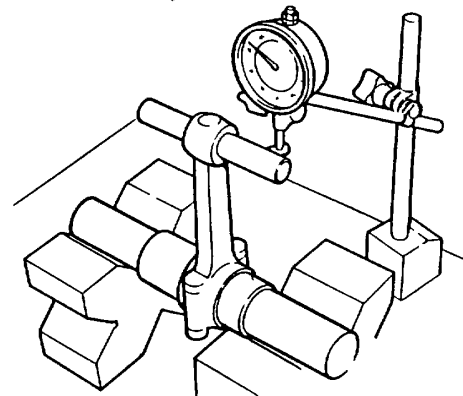


WEAR LIMITS

- A 0.009 in. (0.22 mm)
- B 0.007 in. (0.17 mm)
- C 0.007 in. (0.17 mm)
- D 0.005 in. (0.12 mm)

- (13) Check alignment of piston rod bores as illustrated. Replace if bending or twist exceeds 0.002 in. (0.05 mm). Bend or twist may be straightened in press if less than this figure.
- (14) Measure crankshaft journal for wear. If wear exceeds 0.004 in. (0.10 mm), regrind crankshaft and fit undersize bearings, see para. 4-15.12.

Crank pin diameter is nominally 1.5756 - 1.5760 in. (39.9 - 40.00 mm), 1st undersize is 1.5658 - 1.5662 in. (39.74 - 39.75 mm), 2nd undersize is 1.5560 - 1.5563 in. (39.745 - 39.755 mm)

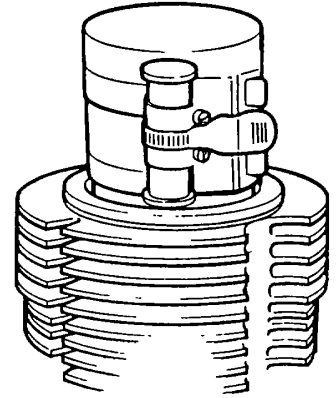


INSTALLATION

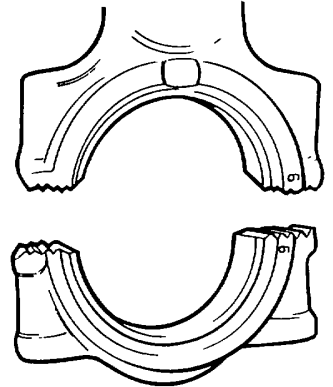
- (1) Ensure piston ring gaps are 180 deg. apart.
- (2) Swab cylinder and piston with lubricating oil (item 17, Appendix E).
- (3) Install piston rod in piston, slide piston pin into piston and secure with retaining ring.

4-15. AUXILIARY POWER UNIT - Continued

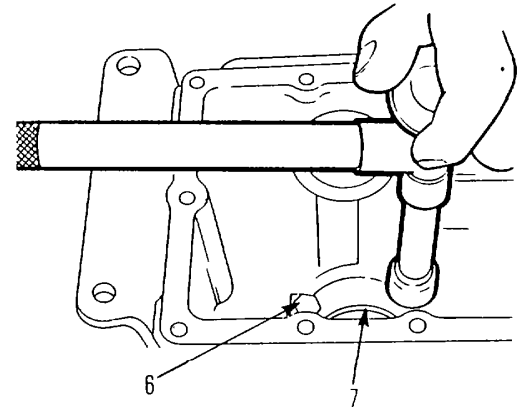
- (4) Install ring compressor on piston.
- (5) With crank at bottom dead center install piston in cylinder head. Be sure arrow head on piston crown points to, (or crown dimple is on), the flywheel side of the engine.
- (6) Mount new bearing cap in crank end of piston rod and push home onto crank.



- (7) Install new bearing cap into piston rod cap. Install cap on piston rod ensuring reference marks on rod and cap are aligned.

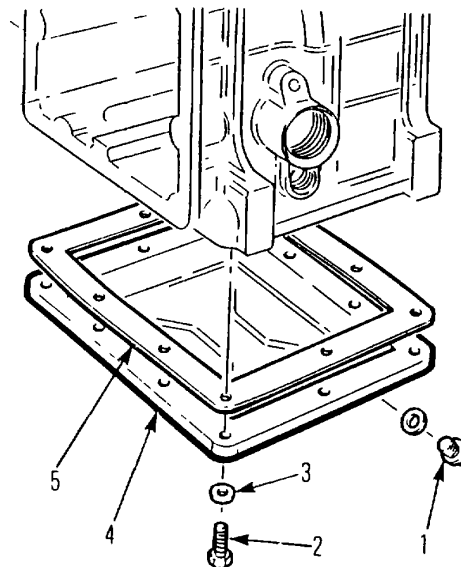


- (8) Install lock plate and capscrews. Tighten to 25 ft lb (34 Nm).
- (9) Bend up locking tabs on the lock plate.



4-15. AUXILIARY POWER UNIT - Continued**4-15.10 Engine Piston and Piston Rod - Continued**

- (10) Install oil pan (4) with new gasket (5).
- (11) Install capscrew (2) and washers (3). Tighten to 25 ft lb (35 Nm).
- (12) Install cylinder head, see para. 4-15.8.
- (13) Install engine on base, see para. 4-15.1 ASSEMBLY.
- (14) Install engine in truck, see para. 4-15.1 INSTALLATION.



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4-15. AUXILIARY POWER UNIT - Continued**4-15.11 Engine Crankshaft and Camshaft**

This task covers:

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
7070.3595.46 Puller

EQUIPMENT CONDITION

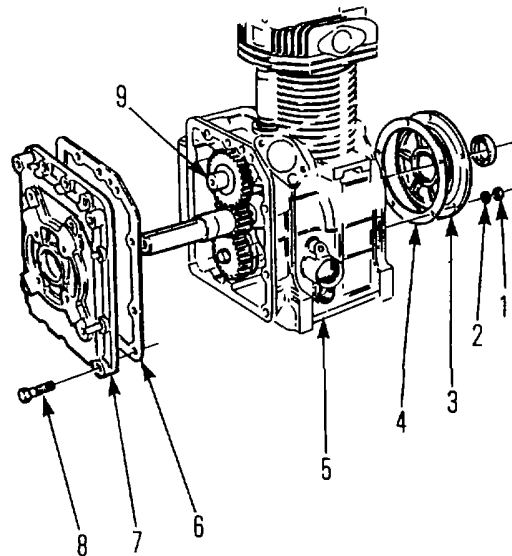
Engine Dismounted from Base (see para. 4-15.1)
Flywheel Removed (see para. 4-15.10)
Cylinder Head Removed (see para. 4-15.9)
Piston and Piston Rod Removed (see para. 4-15.11)

MATERIALS/PARTS

13, Appendix E Emery Cloth
17, Appendix E Lubricating Oil
34, Appendix E White Grease
500.4701.015 Bearing End Plate Gasket (0.10 mm)
500.4701.003 Bearing End Plate Gasket (0.20 mm)
500.4701.094 Bearing End Plate Gasket (0.30 mm)
500.4701.017 Bearing End Plate Gasket (0.40 mm)
500.4601.020 Crankcase Cover Gasket (0.20 mm)
500.4601.002 Crankcase Cover Gasket (0.30 mm)
9.1213.056 Crankcase Cover Oil Seal
9.1210.092 Bearing End Plate Oil Seal

REMOVAL

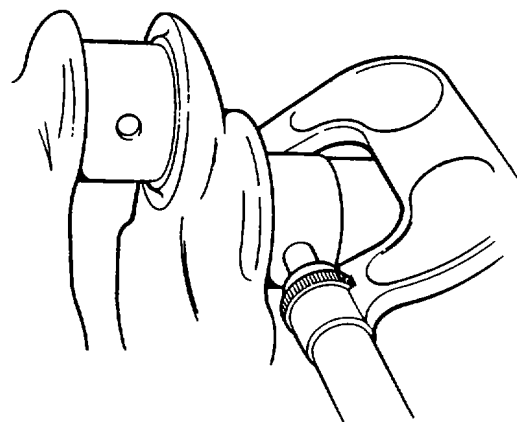
- (1) Remove any burrs from crank, drive end.
- (2) Remove crankcase cover machine screws (8). (Old breather tube will be removed from engine. Lay aside.)
- (3) Lift off cover (7) and gasket (6).
- (4) Inspect camshaft (9). Rotate crankshaft and check mark on tooth of crankshaft gear aligns with similar mark on camshaft gear.
- (5) If there is no mark on camshaft, mark camshaft tooth that is adjacent to crankshaft tooth with center punch.
- (6) Withdraw camshaft from housing.
- (7) Remove nuts (1) and washers (2) and remove bearing end plate. Remove and discard gasket (4).
- (8) Withdraw crankshaft from block through flywheel side taking care not to touch bearing surface with crankshaft driving gear.
- (9) Remove thrust washers from either end of crankshaft.
- (10) Remove oil seal in both crankcase cover and bearing end plate.



4-15. AUXILIARY POWER UNIT - Continued

INSPECTION

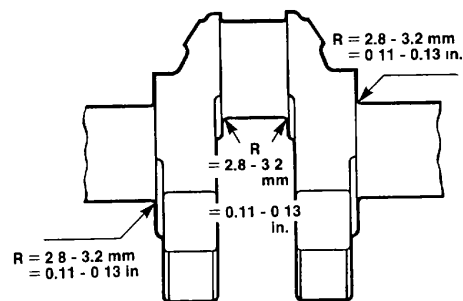
- (1) Check crankshaft and camshafts for cracks using the Magnaflux method, or similar, see para. 4-9. Replace components if cracks are detected.
- (2) Examine shaft gears for wear, replace shaft if teeth are cracked or pitted.
- (3) Examine crankshaft main journals and crank pin journal for seizure marks or grooves. Light grooves can be removed with emery cloth (Item 13, Appendix E). Replace crankshaft if marks are severe.
- (4) Measure crankshaft journal to crankcase cover bearing in two directions at 90 deg. to each other. Journal must be between 1.1028 - 1.1032 in. (27.90 - 28.00 mm). Replace crankshaft if overworn. Journal cannot be reground.
- (5) Measure main crankshaft journals in two directions at 90 deg. to each other.
- (6) If any journal is more than 0.004 in. (0.10 mm) out of round, or total wear exceeds 0.004 in. (0.10 mm) replace or regrind crankshaft to next undersize.



Crankshaft Journals Diameter	Nominal 1.5756 - 1.5760 in. (39.99 - 40.00 mm)
	1st undersize 1.5658 - 1.5662 in. (39.74 - 39.75 mm)
	2nd undersize 1.5559 - 1.5563 in. (39.49 - 39.50)
Crankshaft Journal Bearings Diameter	Nominal 1.5772 - 1.5780 in. (40.03 - 40.05 mm)
	1st undersize 1.5673 - 1.5681 in. (39.78 - 39.80 mm)
	2nd undersize 1.5575 - 1.5586 in. (39.53 - 39.55 mm)

Bearing to journal clearance at assembly should be 0.0012 - 0.0024 in. (0.003 - 0.006 mm), bearings are worn out if clearance exceeds 0.007 in. (0.17 mm).

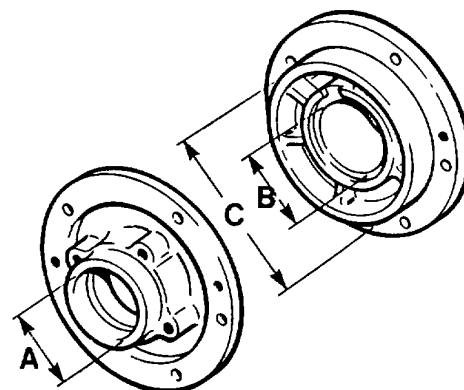
- (7) Restore journal fillet radius as illustrated. Do not remove any material from journal flanges facing side thrust washers.
- (8) Remove expansion plugs from crankshaft and clean out oil ways with wire



4-15. AUXILIARY POWER UNIT - Continued

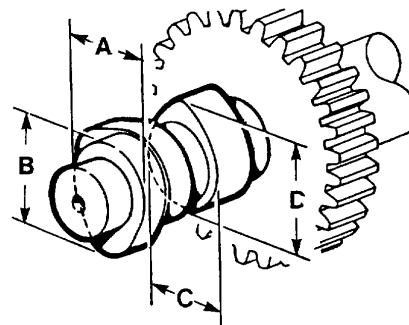
4-15.11 Engine Crankshaft and Camshaft - Continued

- (9) Install expansion plugs in crankshaft.
- (10) Inspect main crankshaft bearings. If crankshaft has to be reground or replaced, replace bearings using puller 7070.3595.46.
- (11) If original crankshaft is to be installed, measure inner diameter of journal bearings and compare with crankshaft journals (See table for specifications).
- (12) Inspect bearing end plate. Measure seal ring housing diameter A, bearing housing diameter B, and centering ring housing C. In each case measure at least 3 different diameters.



A	Seal Housing	2.0472 - 2.0488 (51.96 - 52.00 mm)
B	Bearing Housing	1.7320 - 1.7336 (43.96 - 44.00 mm)
C	Centering Housing	4.8860 - 4.8872 (124.01 - 124.04 mm)

- (13) Replace bearing end plate if any housing is worn beyond specification (see table) or any housing is out of round by more than 0.004 in. (0.010 mm).
- (14) Remove oil plug from end of camshaft. Clean oil way with wire. Replace oil plug.
- (15) Measure camshaft lobe diameters (Valve lobes are furthest away from gear and are narrower than injector pump lobe). Replace if below tolerance or lobes are severely grooved.



	Inlet & Exhaust Valve		Injector Pump	
	A	B	C	D
in.	1.095 - 1.103	1.3057 - 1.3061	1.095 - 1.103	1.375 - 1.379
mm	27.80 - 28.00	33.14 - 33.15	27.80 - 28.00	34.90 - 35.00

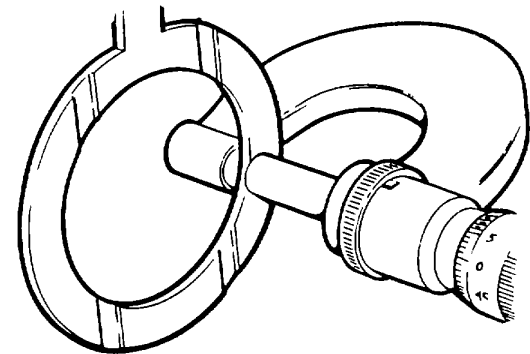
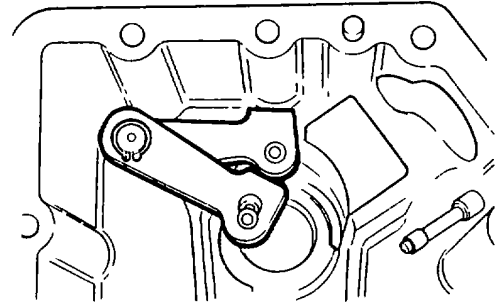
- (16) Measure camshaft journal diameters. They should be 0.7864 - 0.7868 in. (19.96 - 19.97 mm) and 1.0220 - 1.0224 in. (25.94 - 25.95 mm). Replace if below tolerance. They cannot be reground.
- (17) Measure camshaft bearing diameters in crankcase and crankcase cover.

4-15. AUXILIARY POWER UNIT - Continued

NOTE

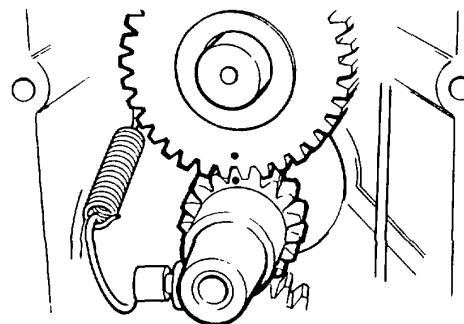
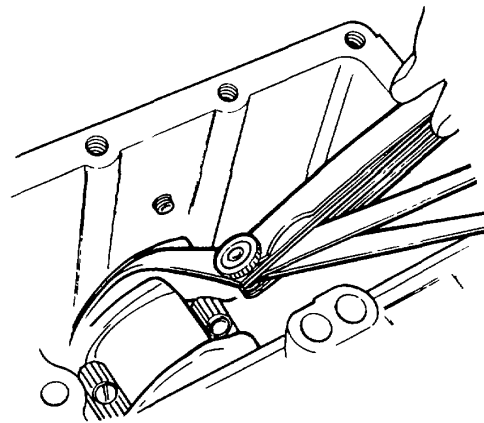
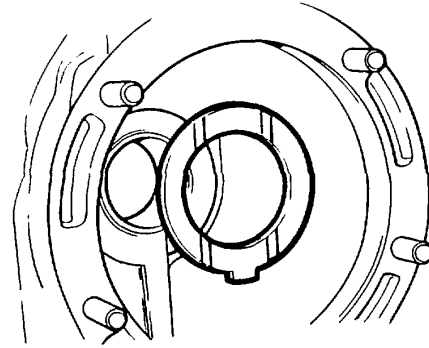
Difference between these measurements and those in step 16 must be less than 0.004 in. (0.10 mm). Replace camshaft or crankcase, or crankcase cover as required.

- (18) Insert crank into crankcase cover. Check for radial movement between needle bearing and journal. Replace bearing if movement is excessive using puller 7070.3595.46. Replace bearing from crank side of cover. Engraved side of bearing must be on crank side of cover.
- (19) Check flange area of cover. Clean away all gasket material. Remove any burrs or sharp edges with emery cloth (item 13, Appendix E).
- (20) Remove valve tappet circlip and lift out both tappets.
- (21) Inspect valve tappets. Diameter of pivot must be between 0.370 - 0.378 in. (9.4 - 9.6 mm). Replace as required.
- (22) Measure diameter of pivot hole in both tappets. Hole must not be greater than (pivot diameter + 0.004 in. (0.1 mm)). Replace pivot or tappets as required.
- (23) Check gap between tappet rollers and shaft. Gap must be greater than 0.008 in. (0.2 mm). Replace hinged tappet if necessary. Roller must roll freely and not bind.
- (24) Install both tappets on pivot and replace circlip.
- (25) Inspect both crankshaft thrust washers for wear. Replace if badly scored or if any measurement indicates a thickness of less than 0.090 in. (2.31 mm)



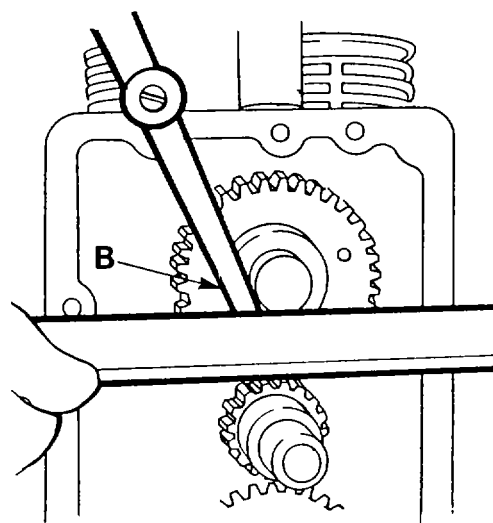
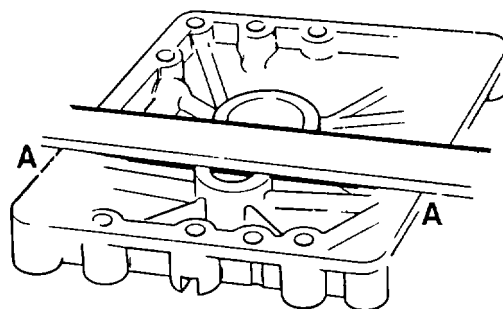
4-15. AUXILIARY POWER UNIT - Continued**4-15.11 Engine Crankshaft and Camshaft - Continued****INSTALLATION**

- (1) Install new oil seals in crankcase cover and bearing end plate.
- (2) Install crankcase thrust washer on inner wall of block. If necessary hold in place with white grease (item 34, Appendix E).
- (3) Smear lubricating oil (Item 17, Appendix E) on central bushing.
- (4) Carefully install crankshaft through bushing. Do not damage bushing with crankshaft gear.
- (5) Smear lubricating oil (item 17, Appendix E) on bearing end plate bushing.
- (6) Install second thrust washer over crank and push bearing end plate over crankshaft. Ensure thrust washer keys with end plate. Be sure oil seal is not forced and therefore damaged.
- (7) Install two bolts in threaded holes of end plate.
- (8) Adjust crankshaft end float by tightening/loosening two bolts in end plate. End float should be 0.004 - 0.008 in. (0.10 - 0.20 mm).
- (9) When end float is correct, measure end plate/crankcase clearance. Select gasket(s) of suitable thickness (Gaskets are available in thickness of 0.004, 0.008, 0.0124, 0.016 in. (0.10, 0.20, 0.30, 0.40 mm).
- (10) Remove bearing end plate and bolts. Place selected gasket over end plate and install on crankcase as detailed in step 6 preceding. Tighten nuts to 22 ft lb (29 Nm). Check crankshaft end play and readjust as required.
- (11) Lift hinged tappets and install camshaft into block bore. Match timing mark on crankshaft gear to mark on camshaft gear.
- (12) If timing marks are not marked on gears proceed as in steps 13 and 14 following. Otherwise proceed to step 15.



4-15. AUXILIARY POWER UNIT - Continued

- (13) Place piston at top dead center..
- (14) Insert the camshaft with cams on overlapping position (inlet starts to open-exhaust just about to close). Check that tappets are at the same height, otherwise shift gear one tooth back or forward until alinement of tappets is obtained.
- (15) Lay straight edge across inside of crankcase cover. The gasket surface of housing should be on same plain as the cover thrust surface for the crankshaft. There should be no clearance at A. Check with feeler gage. If there is clearance, measure with feeler gage.
- (16) Support engine on workbench so crankshaft and camshaft are positioned in upright position.
- (17) Measure clearance B between straight edge placed across block and thrust surface of camshaft. Clearance B should not be greater than 0.004 in. (0.10 mm). (If necessary combine clearance measurements A and B).
- (18) Select gasket(s) to give camshaft end play of 0.004 - 0.012 in. (0.10 - 0.30 mm). Gaskets are available in. 0.008, 0.012 in. (0.20, 0.30 mm) sizes.
- (19) Coat crankshaft cover camshaft journal, crankshaft needle bearing, and oil seal with lubricating oil (item 17, Appendix E).
- (20) Install crankshaft cover using machine screws. Be sure engine breather tube clamp is installed with bottom left hand screw.



4-15. AUXILIARY POWER UNIT - Continued

4-15 11 Engine Crankshaft and Camshaft - Continued

- (21) Install piston and piston rod as detailed in para. 4-15.10
- (22) Install cylinder head as detailed in para. 4-15.8
- (23) Install flywheel as detailed in para. 4-15.9
- (24) Replace engine on base as detailed in para. 4-15.1 ASSEMBLY
- (25) Replace APU in truck as detailed in para. 4-15.1 INSTALLATION

4-182/(4-183 Blank)

4-15. AUXILIARY POWER UNIT - Continued**4-15 12 Engine Lubrication System****This task covers**

- a. Test
- b. Repair

TOOLS

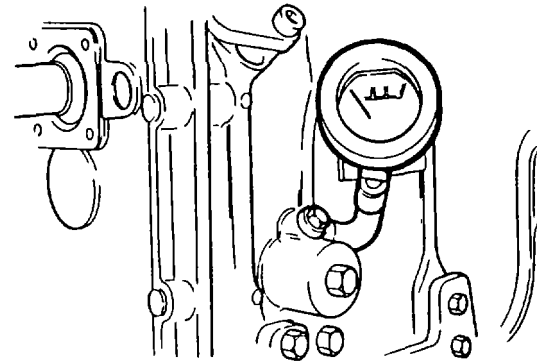
Shop Equipment, Automotive
Maintenance Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

APU Shutdown (see para. 2-12)
APU may be mounted in truck
except where indicated

TEST

- (1) Remove pipe plug directly above oil filter element cap.
- (2) Connect 0 - 100 psi (0 - 1000 kPa) gage to oil pressure port.
- (3) Start engine and note oil pressure. Low idle 20-30 psi (140 - 200 kPa) High Idle 50-65 psi (340 - 450 kPa).
- (4) If pressure is low, replace filter, or relief valve, or oil pump. If pressure is high, remove and inspect relief valve.
- (5) When repair is complete, remove test gage and install pipe plug.

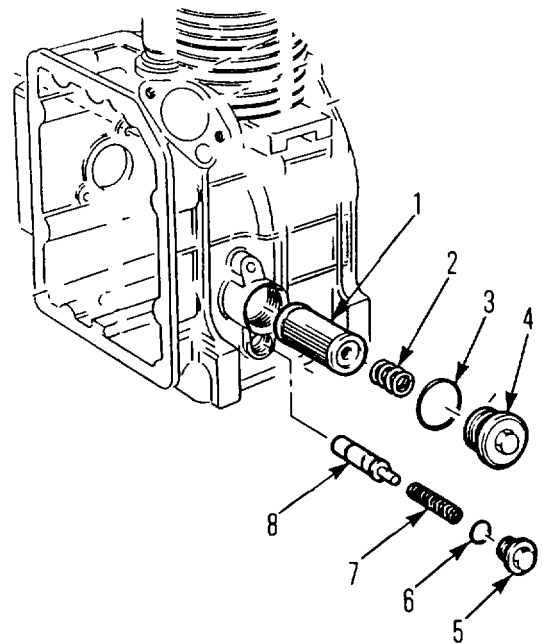
**REPAIR.**

- a. Engine Oil Filter Repair.

NOTE

The engine oil filter can be cleaned or replaced.

- (1) Remove oil filter plug (4).
- (2) Extract spring (2) and filter element (1) from block.
- (3) Clean, and if necessary replace oil filter.
- (4) Slide filter (1) into block followed by spring (2).
- (5) Check seal ring (3) on plug (4). If damaged, replace.
- (6) Install plug in engine block and tighten



4-15. AUXILIARY POWER UNIT - Continued

- (7) Start engine and check for oil leaks
- (8) Repeat TEST preceding

b. Oil Pressure Relief Valve Repair

NOTE

No repair of parts is possible. Replace components as required.

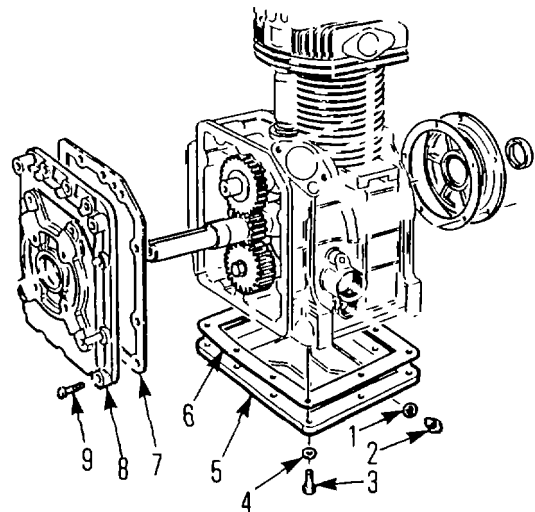
- (1) Remove plug (5).
- (2) Extract spring (7) and valve body (8).
- (3) Check valve and housing bore for scours or sticking marks. Remove any marks with emery cloth (item 13, Appendix E).
- (4) Measure valve diameter. Should be between 0.465 - 0.472 in. (11.80 - 11.975 mm). If less than this, replace valve.
- (5) Measure spring free length. If less than 1.46 in. (37 mm), replace.
- (6) Install valve body (8) and spring (7) in engine block.
- (7) Inspect seal ring (6) on plug (5). If damaged, replace.
- (8) Install plug in engine block and tighten.
- (9) Start engine and check for oil leaks.
- (10) Repeat TEST preceding.

c. Oil Pump Repair

NOTE

This can only be carried out with engine removed from truck, and engine dismantled from base. No repair of parts is possible. Replace components as required.

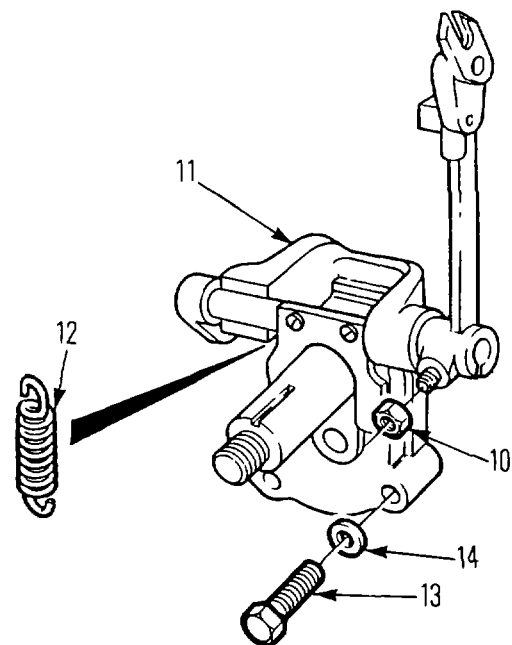
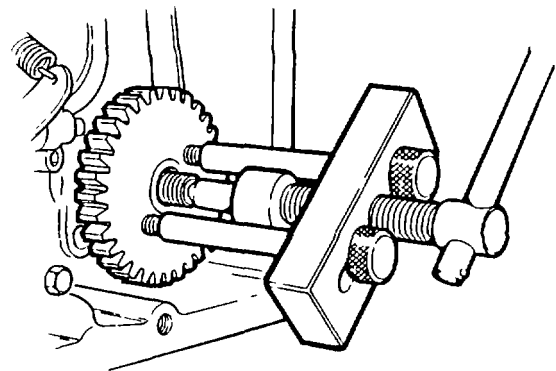
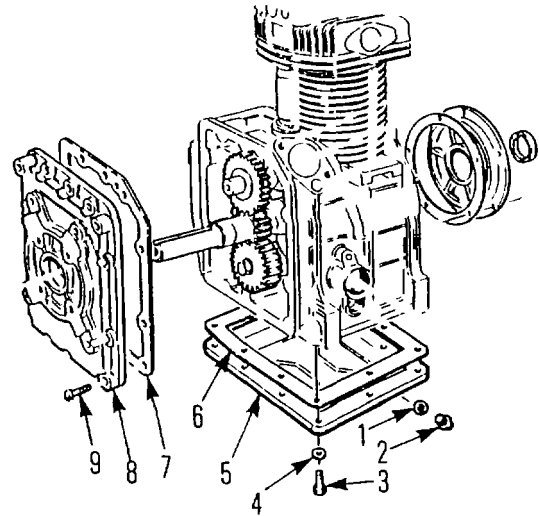
- (1) Remove APU from truck, see para. 4-15.1 REMOVAL.
- (2) Remove engine from APU base, see para. 4-15.1 DISASSEMBLY.
- (3) Drain oil from engine by removing oil pan plug (2).
- (4) Remove any burrs from crank, drive end



4-15. AUXILIARY POWER UNIT - Continued

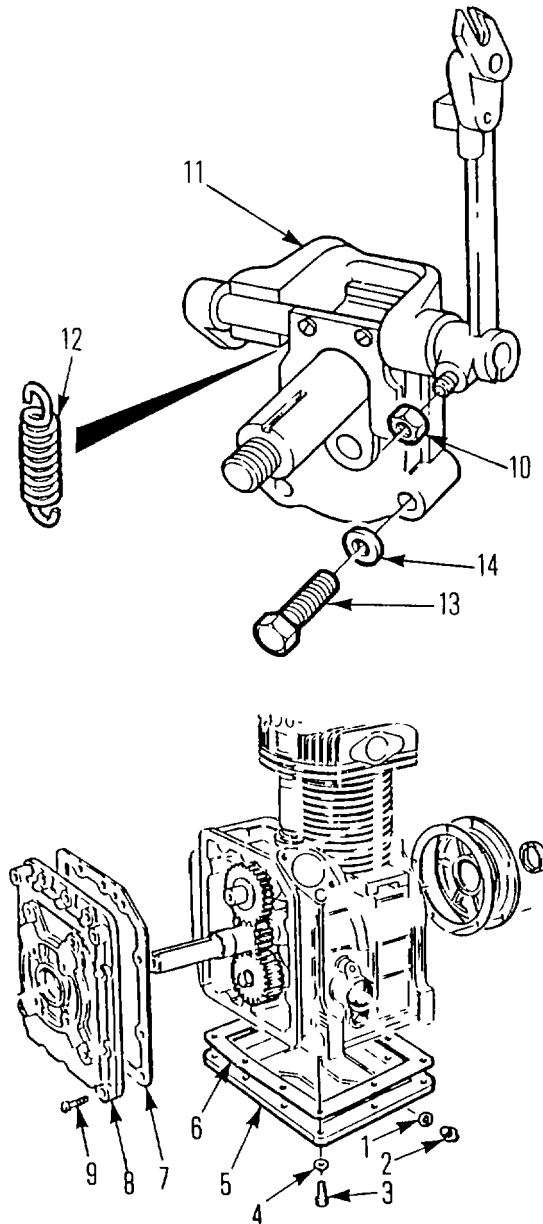
4-15.12 Engine Lubrication System - Continued

- (5) Remove crankcase cover machine screws (9) (Oil breather tube will be removed from engine Lay aside).
- (6) Lift off cover (8) and gasket (7).
- (7) Remove oil pan screws (3) and washers (4).
- (8) Lift off oil pan (5) and gasket (6).
- (9) Remove oil pump/governor drive gear nut and washer.
- (10)) Using puller, remove gear from spindle as shown Retain gear and drive key.
- (11) Loosen nut (10) retaining injector pump fuel rack actuator to governor Slip shaft off governor and remove.
- (12) Remove spring (12) from governor shaft to pump anchor.
- (13) Remove screws (13) and washers (14) attaching oil pump/governor assembly to crankcase.
- (14) Lift out assembly (11) from crankcase.
- (15) Inspect oil pump by removing back plate (Back plate may remain in crankcase. If so remove from crankcase).
- (16) Measure oil pump gear/housing gap. Gap must not exceed 0.006 in. (0.15 mm) Check side play does not exceed 0.006 in. (0.15 mm), Replace assembly if gap or play is excessive.
- (17) Check diameter of spindles and diameter of spindle bushing in back plate and in housing. Spindle to bushing clearance must be less than 0.006 in. (0.15 mm) for each (of four) spindles. Replace assembly if any spindle is out of tolerance.
- (18) Inspect gear teeth and side faces for damage. Replace if required.



4-15. AUXILIARY POWER UNIT - Continued

- (19) Install pump assembly in block ensuring back plate is alined with spindles.
- (20) Secure assembly with four screws (13) and washers (14).
- (21) Attach spring (12) to governor input shaft.
- (22) Install injector pump fuel rack actuator to cover and to fuel rack mechanism.
- (23) Install drive key in governor drive shaft and push drive gear on shaft.
- (24) Install gear nut and washer and torque to 25 ft lb (34 Nm).
- (25) Set up governor as detailed in para. 4-15. 14.
- (26) Install crankcase cover (8) using new gasket(s) (7). Ensure it is the same thickness as the one removed. Be careful not to damage oil seal as it is pushed along crankshaft.
- (27) Fasten crankcase cover using machine screws (9) Ensure oil breather tube is connected with bottom left hand screw.
- (28) Install oil drain plug (2) and washer (1) in pan and install pan (5) on crankcase with new gasket (6) Tighten capscrews to 25 ft lb (35 Nm).
- (29) Install engine on base as detailed in para. 4-15.1 ASSEMBLY.
- (30) Install engine in truck as detailed in para. 4-15.1 INSTALLATION



4-15 AUXILIARY POWER UNIT - Continued**4-15.13 Engine Governor****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

APU Shutdown (see para. 2-12)

Engine Removed from Base (see para. 4-15.1)

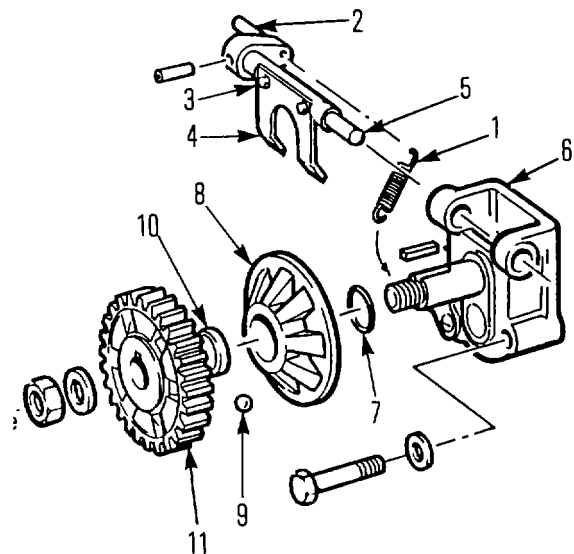
MATERIALS/PARTS

500.4601.020 Crankcase cover gasket (0.20 mm)

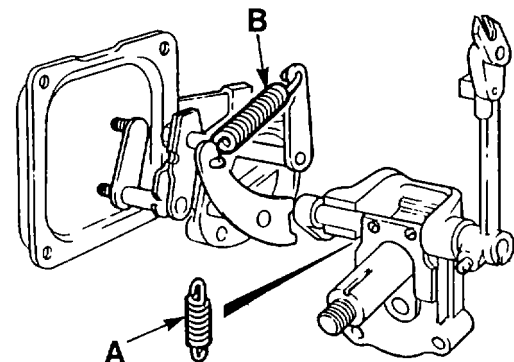
500.4601.002 Crankcase cover gasket (0.30 mm)

REMOVAL

- (1) Remove governor/oil pump assembly from engine as detailed in 4-15.13, Oil Pump Replace, steps 1 thru 14.
- (2) Remove injector pump, see para. 4-15.6 REMOVAL.
- (3) Remove circlip (7) from governor drive gear.
- (4) Remove moving bell (8), slotted collar (10) and six balls (9) from the drive gear (11).
- (5) Disconnect spring (1) from pin (2) and remove screws (3) from governor actuating plate (4).
- (6) Slide governor shaft (5) out of oil pump housing (6).

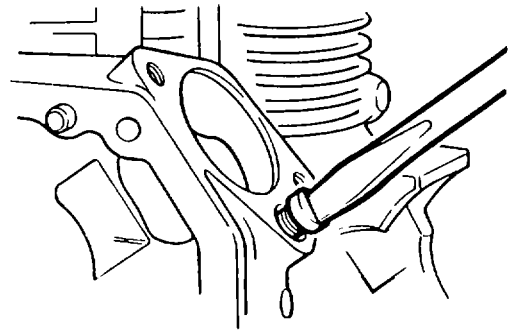
**INSPECTION**

- (1) Remove spring B and check free length is 2.25 in. (57.0 mm). Spring length should be 2.84 in. (72.0 mm) with a load of 3.3 lb (1.5 kg). Replace/install spring as required.
- (2) Check free length of governor spring (A) is 1.18 in. (30 mm). Replace/install spring as required.
- (3) Remove cotter pin and bushing from fuel rack and remove fuel rack from fuel control lever pin

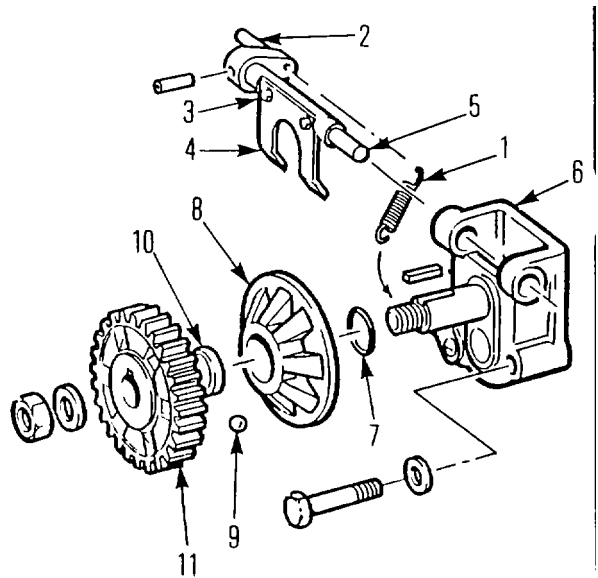


4-15. AUXILIARY POWER UNIT - Continued

- (4) Remove fuel control lever pin. Check diameter of pin is 0.193 - 0.197 in. (4.90 - 5.00 mm).
- (5) Check internal diameter of fuel rack and check clearance between it and fuel control lever pin is less than 0.006 in. (0.15 mm) Replace/install fuel control lever pin and fuel rack as required.
- (6) Inspect governor shaft (5) for wear Clearance between shaft and housing should be less than 0.006 in. (0.15 mm) Replace components as required.
- (7) Inspect governor actuating plate (4) Replace if tabs are worn or bent.

**INSTALLATION.**

- (1) Slide governor shaft (5) into housing (6) and install governor actuating plate (4) with screws (3).
- (2) Install six balls (9), slotted collar (10), and moving bell (8) in governor gear (11).
- (3) Lock governor assembly to gear using circlip (7).
- (4) Install injector pump into crankcase ensuring pin of pump locates in the fuel rack slot.
- (5) Install governor/oil pump assembly in engine as detailed in para. 4-15.12, Oil Pump Replace, steps 19 thru 24.
- (6) Tune engine as detailed in para. 4-15.14.
- (7) Install engine on base, see para. 4-15.1 ASSEMBLY.
- (8) Install APU in truck, see para. 4-15.1 INSTALLATION



4-15. AUXILIARY POWER UNIT - Continued

4-15.14 Engine Adjustment

**This task covers
Adjustment**

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

500.4601.020 Crankcase Cover Gasket (0.20 mm)
500.4601.002 Crankcase Cover Gasket (0.30 mm)

EQUIPMENT CONDITION

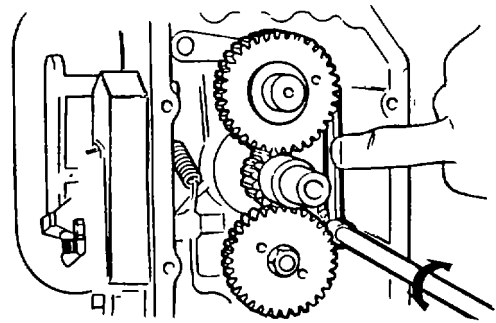
APU Shutdown (see para. 2-12)
Engine Removed from Base

NOTE

Engine turning is usually carried out after repair of the engine. In this case the crank cover will be removed from engine (instruction 1-3 below).

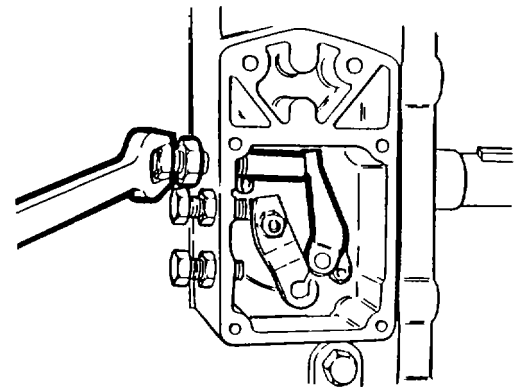
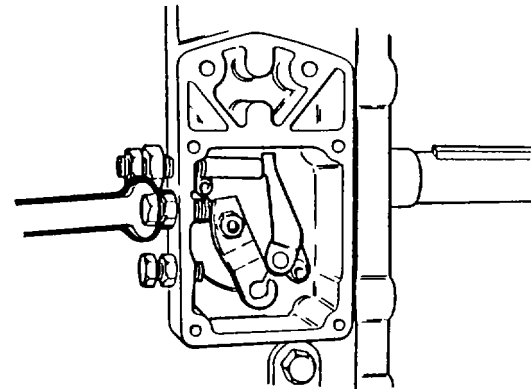
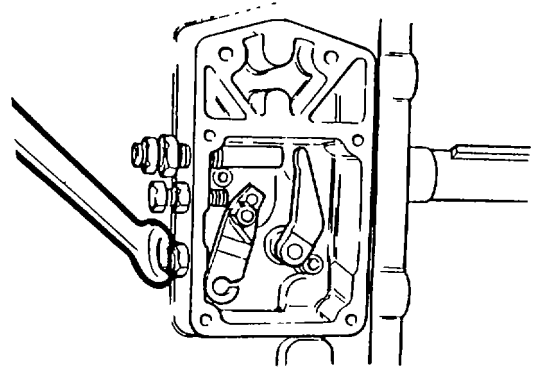
ADJUSTMENT.

- (1) Drain oil from engine by removing oil pan plug.
- (2) Remove any burrs from crank, drive end.
- (3) Remove crankcase cover screws. Lift off cover and gasket.
- (4) Loosen screw on control lever and push control lever to maximum fuel position. Ensure throttle lever is at maximum position. Tighten screw on control lever.
- (5) Replace crankcase cover, if necessary checking camshaft end play (See para. 4-15.12 INSTALLATION steps 14 thru 18).
- (6) The engine can only be properly adjusted if mounted on a dynamometer. If this is not possible, mount engine to bench with temporary fuel and power supply (For a better test, mount engine on base, connect water pump and alternator. Connect water to pump and alternator to a set of discharged batteries).
- (7) Start engine and run it at low idle for 15 minutes or until it reaches normal operating temperature



4-15. AUXILIARY POWER UNIT - Continued

- (8) With no load, adjust minimum idle speed to 1300 rpm (Use mechanical tachometer).
- (9) With no load, adjust maximum idle speed to 3780 rpm.
- (10) With engine running at full load, adjust gap between lever B and plunger C to 0.002 in. (0.05 mm).
- (11) If dynamometer is not available, adjust by quick accelerations of engine. If engine is sluggish and makes no smoke, turn plunger C outwards. If engine smokes heavily, turn plunger C inwards.
- (12) If on dynamometer, check fuel consumption. Should be 6.1 cu in. (100 ml) in 190-200 sec with engine running at 3600 rpm delivering 6.5 hp (4.78 kW) (If engine has been completely rebuilt, do not carry out this test until engine has operated at various low loads for at least 10 hours).
- (13) When adjustment is complete, Install engine on base as detailed in para. 4-15.1 ASSEMBLY.
- (14) Install APU in truck as detailed in para. 4-15.1, INSTALLATION



4-16. HOSE BODY

4-16.1 Hatch Holder.

This task covers

- a. Removal
 - b. Inspection
 - c. Installation
-

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

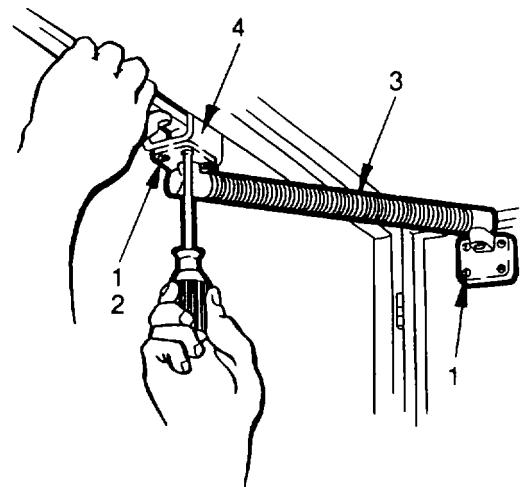
0115-3 Hatch Holder

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

REMOVAL

- (1) Remove the four capscrews (1) and nuts (2) that retain the hatch holder (3) to the hatch holder stiffener (4).
- (2) Remove the four capscrews (1) that retain the opposite end of the hatch holder (3) to the compartment door. These capscrews fasten into insert fasteners



INSPECTION

- (1) Check hatch holder spring for any distortion or damage that may prevent the spring from locking. Replace as necessary.
- (2) Each hatch holder has a cable inside the spring which limits its extending range. Clamp one hatch holder bracket in the jaws of a vise. Grasp the other bracket and pull against spring pressure. If the spring expands more than 1 in. (2.5 cm) the cable is broken or disconnected. Replace the hatch holder.
- (3) Check mounting holes for oversize and check brackets for cracks.
- (4) Check hatch holder stiffener is securely attached to compartment box. Report loose hatch holder stiffeners to Direct Support Level for lock bolt replacement.
- (5) Check insert fasteners in compartment door are not loose or stripped. Report damage to Direct Support Level for insert fastener replacement

4-16. HOSE BODY - Continued

INSTALLATION

- (1) Lift the hatch holder into position and align with the holes in the compartment door
- (2) Install four capscrews and tighten firmly
- (3) Install the four capscrews (1) and nuts (2) that retain the hatch holder to the hatch holder stiffener. Tighten the capscrews and nuts

4-16. HOSE BODY - Continued**4-16 2 Gas Cylinder****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

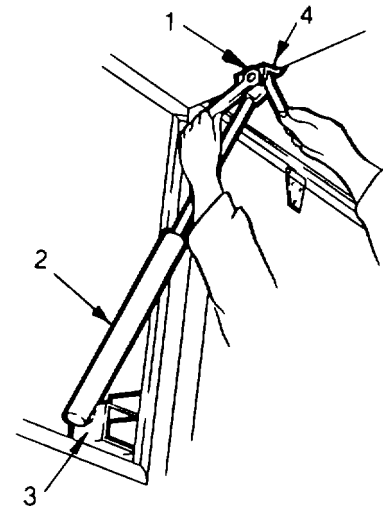
777-7741 Gas Cylinder
310700-05 Locknut

EQUIPMENT CONDITION

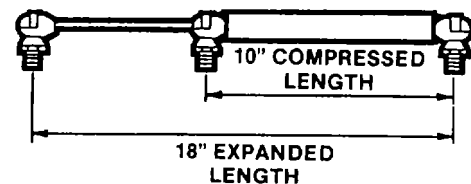
Main Engine Shutdown (see para. 2-10)

REMOVAL

- (1) Remove the locknuts (1) that retain the gas cylinder (2) to the gas cylinder stiffener (3) and the gas cylinder bracket (4). Discard the locknuts.
- (2) While supporting the door, pull gas cylinder ball studs out of the box and door bracket.
- (3) Remove the second gas cylinder similarly to steps 1 and 2 preceding.

**INSPECTION.**

- (1) Collapse the cylinder until fully compressed, then release. The gas cylinder should expand by itself to the fully expanded position. Replace the gas cylinder if it does not extend to at least 18 in. (400 mm).
- (2) Check ball studs on each end of the gas cylinder for looseness.
- (3) Check condition of gas cylinder rod. If pitted, replace gas cylinder.
- (4) Check condition of gas cylinder seal. If worn or cracked, replace gas cylinder.
- (5) Ensure gas cylinder brackets are secure on the compartment door. Report loose gas cylinder brackets to Direct Support Level for rivet replacement.



4-16. HOSE BODY - Continued

INSTALLATION

- (1) Raise the gas cylinder into position, and insert the ball studs into the gas cylinder bracket and gas cylinder stiffener mounting holes. Install new locknuts and tighten to 17 ft lb (23 Nm).
- (2) Install the second gas cylinder similarly to step 1 preceding.

4-16. HOSE BODY - Continued

4-16.3 Compartment Door.

This task covers

- a. Removal
- b. Installation
- c. Repair

TOOLS

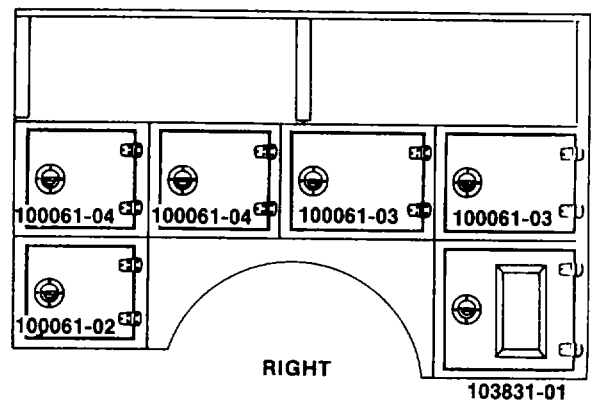
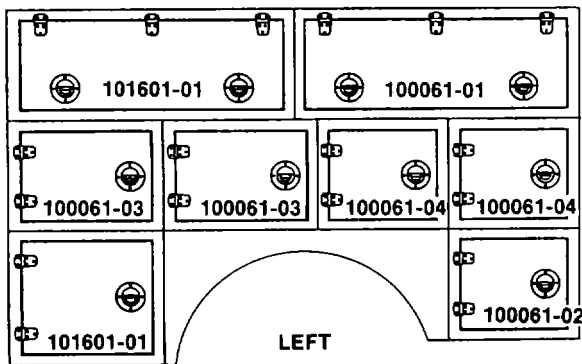
Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
Hatch Holder Removed From Door (see para. 4-16.1)
Gas Cylinder Removed From Door (see para. 4-16.2)

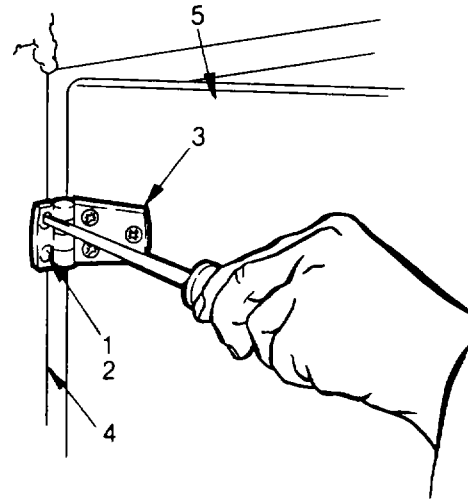
MATERIALS/PARTS

100061-01 Compartment Door Assembly
100061-02 Compartment Door Assembly
100061-03 Compartment Door Assembly
100061-04 Compartment Door Assembly
101601-01 Compartment Door Assembly
103831-01 Compartment Door Assembly
101688 Gas Cylinder Bracket
79-L Handle SST
3-206U Latch and Striker
310258-03 Machine Screw
310314-01 Locknut
310629-03 Machine Screw
MS90725-10 Capscrew
MS51922-1 Locknut
310385 Hinge
MS15795-710 Flat Washer



4-16. HOSE BODY - Continued**REMOVAL**

- (1) Support the compartment door (5) and remove the two machine screws (1) and locknuts (2) that retain the hinge (3) to the compartment box (4).
- (2) Remove the remaining hinges similarly to step 1 preceding. Lift the compartment door (5) away from the compartment box and place on a workbench to begin disassembly.
- (3) If required, remove hinges and install on new door following procedures described in Hinge Repair following.
- (4) If required, remove handles and install on new door following procedures described in Handle Repair following.

**INSTALLATION I**

- (1) Lift the compartment door (5) into position. Align the holes in the hinges (3) with the holes in the compartment box (4) and install the capscrews (1) and new locknuts (2). Tighten the capscrews and locknuts. The left hand upper compartment doors have three hinges.
- (2) Carry out the striker and striker bracket adjustment procedures described in para. 4-16.4.

REPAIR

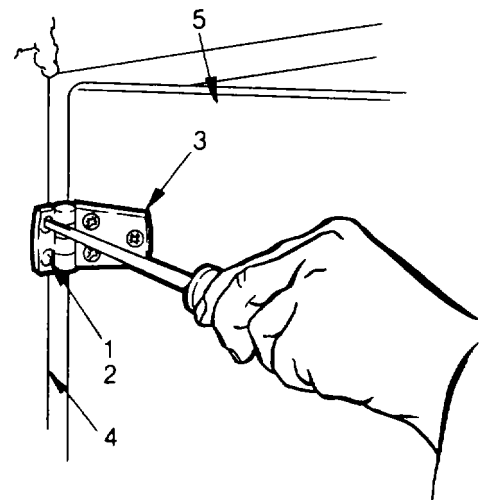
a. Hinge Repair.

NOTE

If only one hinge requires replacing, support door during the following procedure. If all hinges have to be replaced carry out instructions 1 for all hinges. Place door on workbench before starting instruction 2.

- (1) Remove the two capscrews (1) and locknuts (2) that retain the hinge (3) to the compartment box (4) Discard locknuts.
- (2) Remove the three capscrews (1) and locknuts (2) that retain the hinge (3) to the compartment doors (5) One capscrew tightens into an insert fastener, two capscrews use locknuts. Discard locknuts.

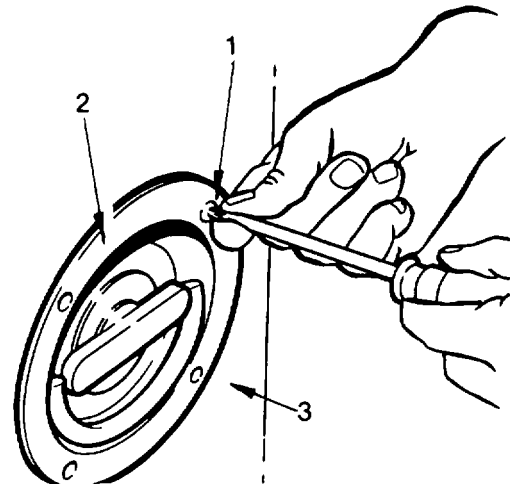
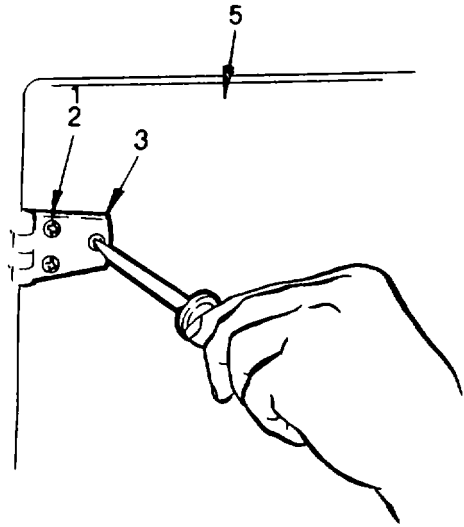
- (3) Remove remaining hinges similarly to steps 1 and 2 preceding



4-16. HOSE BODY - Continued

4-16 3 Compartment Door - Continued

- (4) Inspect hinges for cracks, oversized mounting holes, or for excessive hinge pin movement.
- (5) If any damage is evident replace the hinge.
- (6) Install hinge into position on the compartment door and align the mounting holes. Install one capscrew through the hinge and fingertighten into the insert fastener.
- (7) Install capscrews and locknuts that fasten the hinge to the compartment door. Tighten locknuts securely.
- (8) Install remaining hinges similarly to steps 6 and 7 preceding.
- (9) Lift the compartment door (5) into position. Align the holes in the hinges (3) with the holes in the compartment box (4) and install the capscrews (1) and new locknuts (2). The left hand upper compartment doors have three hinges.
- (10) Adjust compartment door striker as described in Striker and Bracket Repair following.
- (11) Apply white grease (Item 34, Appendix E) to lubricate the hinge.

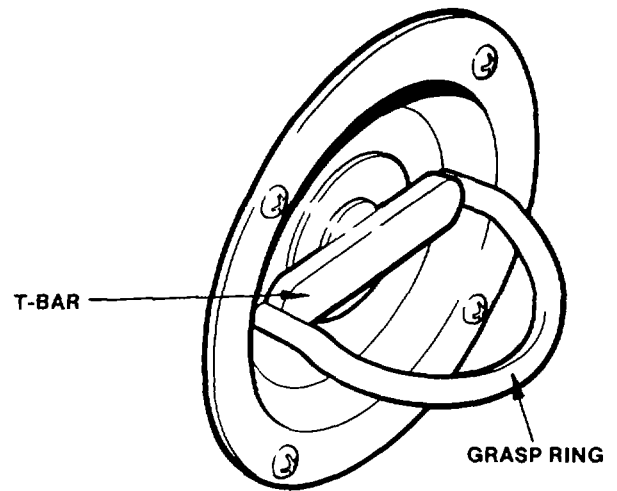

b Handle Repair.
NOTE

The handle cannot be repaired, replace if damaged.

- (1) Remove the four capscrews (1) that retain the handle (2) to the compartment door (3).
- (2) Using a flat screwdriver, pry handle free of seal bond with door. Left hand upper compartment doors have two handles.

4-16. HOSE BODY - Continued

- (3) Check handle function. The grasp ring should pivot in the 'T' shaped bar without any binding. The 'T' shaped actuator bar should also rotate freely. Replace as necessary.
- (4) On a new handle, shorten actuator bar (4) as shown.
- (5) Apply sealant (Item 25, Appendix E) to the handle mating surface. Install the handle on the door and attaching using four capscrews (1).
- (6) Apply white grease (item 34, Appendix E) to the pivot points of the handle.

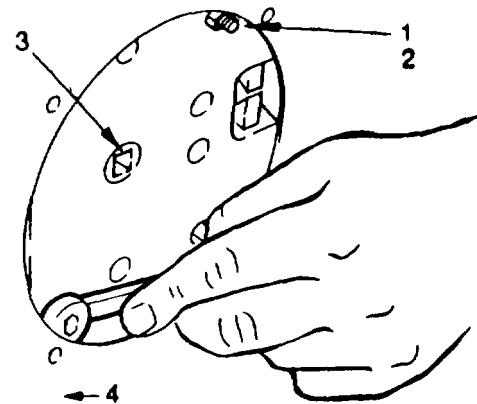
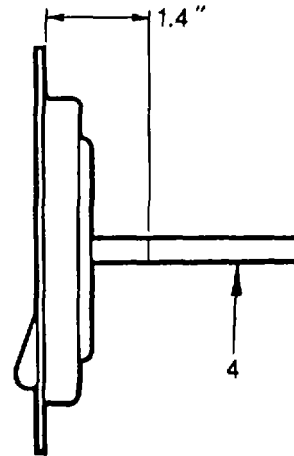


c. Latch Repair.

NOTE

The latch cannot be repaired, replace if damaged.

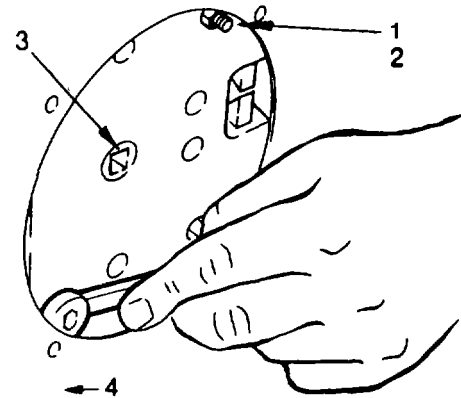
- (1) Remove compartment handle as detailed in Handle Repair.
- (2) Remove the capscrews (1) and locknuts (2) that retain the latch (3) to the compartment door (4). Discard the locknuts.
- (3) Remove the latch from the compartment door through the opening left by the compartment handle. Left hand upper compartment doors have two latches that are removed similarly



4-16 HOSE BODY - Continued

4-16.3 Compartment Door - Continued

- (4) Check the latch jaws for wear and ensure the latch halves are intact. Replace as necessary. When ordering, the latch and striker are ordered together.
- (5) Apply sealant (item 25, Appendix E) to the latch mating surface.
- (6) Install the latch (3) into the compartment door (4) and align the mounting holes. Install the capscrews (1) from the inside side of the door and attach the new locknuts (2) through the compartment handle opening. Torque the locknuts to 8 ft lb (11 Nm).
- (7) Lubricate latch jaws using white grease (item 34, Appendix E).

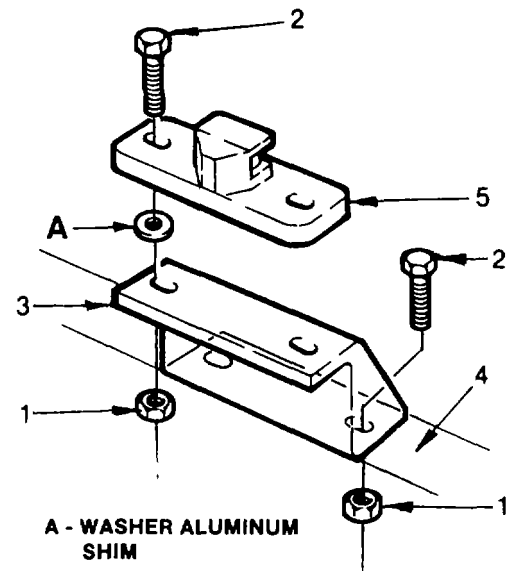


d. Striker and Bracket Repair.

NOTE

The striker and bracket cannot be repaired, replace/adjust as required.

- (1) Remove locknuts (1) and capscrews (2) that retain the striker bracket (3) to the compartment box (4). Discard the locknuts. Access striker bracket locknuts from inside adjacent compartment.
- (2) Remove locknuts (1) and capscrews (2) that retain the striker (5) to the striker bracket (3). Discard the locknuts.



4-16. HOSE BODY - Continued

- (3) Inspect striker and striker bracket for damage such as worn or cracked striker, or cracked bracket. Replace as necessary. The latch and striker are ordered as a pair, they should be replaced as a pair.
- (4) Assemble striker and bracket. Install the capscrews and new locknuts fingertight. Ensure to install the same number of washers as removed.
- (5) Install the striker bracket into the compartment box and align the mounting holes. Install the capscrews and new locknuts fingertight.
- (6) Adjust the striker and bracket until the compartment door closes properly and is flush with the compartment box. The striker and striker bracket have slotted mounting holes allowing adjustment in any direction.
- (7) Adjust compartment door striker by adding or deleting aluminum shim washers between the striker and striker bracket. This will raise or lower the striker in relation to the compartment latch.
- (8) Tighten the capscrews to 8 ft lb (11 Nm) when the striker and bracket are properly adjusted.
- (9) Operate the compartment door a few times to ensure proper operation.

e. Compartment Door Repair.

- (1) Remove compartment door as described in REMOVAL preceding.
- (2) Using a hammer and a dolly block, remove small dents in perimeter of the door. Large dents in the center of the door cannot be removed because of the double wall construction. Replace compartment door if damage does not allow proper closing.
- (3) Clean and paint repaired area as described in para. 4-9.
- (4) Install compartment door as detailed in INSTALLATION preceding.

4-17. PUMP DRIVE AND PTO.

4-17.1 Power Take Off Unit.

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

MATERIALS/PARTS

9, Appendix E Dexron 852-XGAKP-B6XV PTO Assembly

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Pump Body Heat Shield Removed (see para. 4-11.2)
 PTO to Reducer Gear Drive Shaft Removed (see para. 4-17.2)

PERSONNEL REQUIRED - 2

WARNING

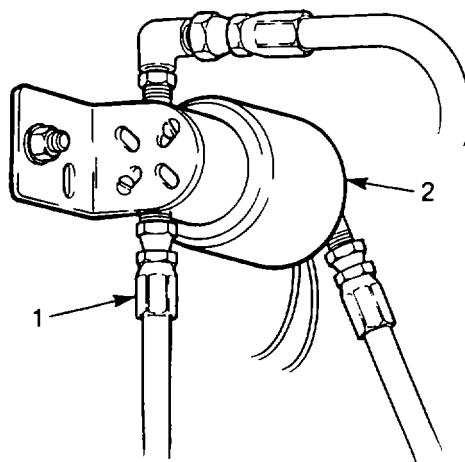
Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

CAUTION

Damage to the transmission and the PTO assembly can result from Insufficient or excessive backlash.

REMOVAL

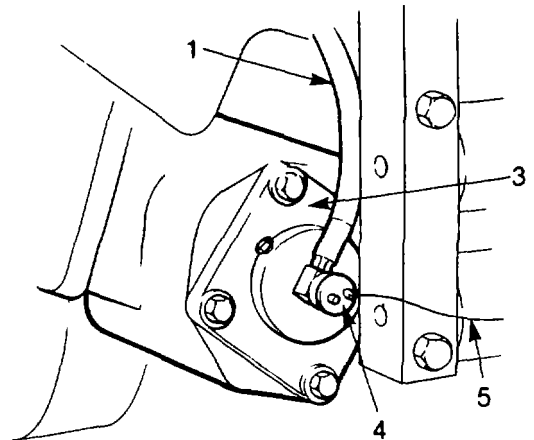
- (1) Remove the transmission drain plug and drain transmission fluid into a clean pan. Transmission fluid should be warm.
- (2) Disconnect the solenoid valve to PTO high pressure line (1) at the solenoid valve (2). Plug line and fitting.



4-17. PUMP DRIVE AND PTO - Continued

- (3) Disconnect the solenoid valve to PTO high pressure line (1) at the PTO (3) Plug line and fitting

- (4) Tag and disconnect wiring (5) to pressure switch (4)



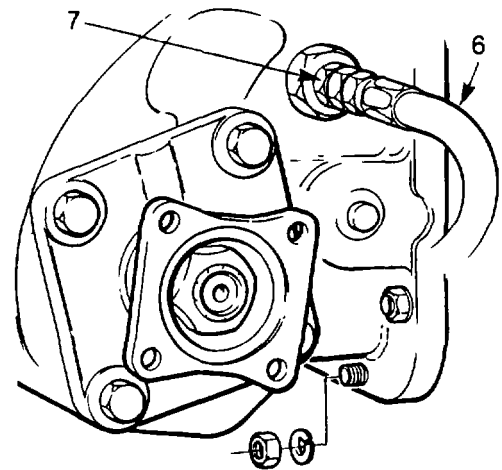
- (5) Remove the lubrication line (6) from the PTO Inspection plug (7) Plug line and fitting

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

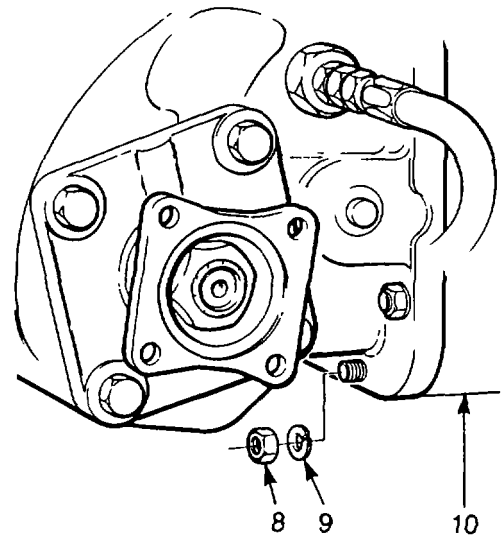
NOTE

The PTO is mounted on the torque converter housing. A large amount of fluid will be trapped in both housings. During PTO removal use care to drain trapped fluid into a clean pan.



- (6) Remove the nuts (8) and lockwashers (9) that retain the PTO (3) to the torque converter housing (10).

- (7) Remove the PTO (3) from the torque converter housing (10). It may be necessary to break the seal between the PTO housing and the torque converter housing using a soft hammer.



INSPECTION

- (1) Inspect mounting studs for damage as described in para. 4-9 Replace damaged studs using a stud extractor.

4-17. PUMP DRIVE AND PTO - Continued

4-17.1 Power Take Off Unit - Continued

- (2) Remove old gasket material using a putty knife and wire brush. Extra care should be taken to eliminate the possibility of gasket material entering the torque converter housing.

INSTALLATION

CAUTION

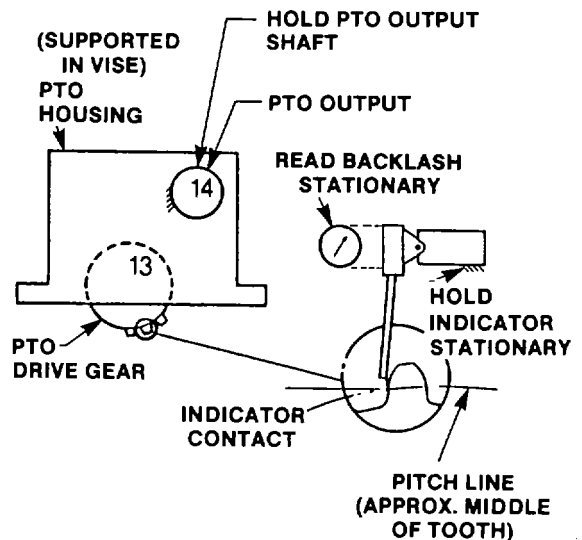
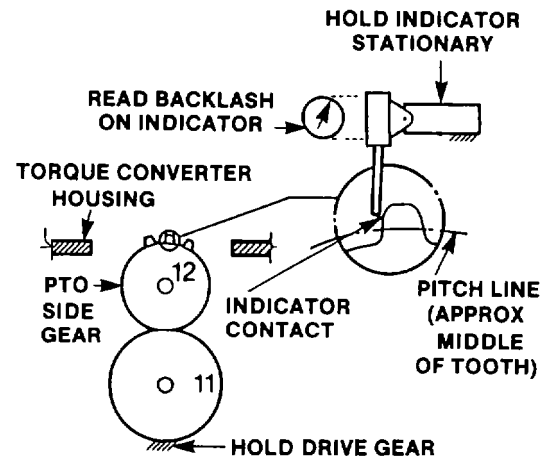
Damage to the transmission and the PTO assembly can result from insufficient or excessive backlash. Carefully check and adjust PTO drive-to-driven-gear backlash.

- (1) Hold drive gear (11) stationary. If transmission is mounted on the truck, the drive gear is held stationary by the engine crankshaft.
- (2) Attach dial indicator to torque converter housing in a position allowing PTO side-gear backlash to be measured.
- (3) Move PTO side gear (12) in both directions. Observe backlash and record as measurement 'A'.
- (4) Support PTO housing in a vise.
- (5) Attach dial indicator to PTO housing allowing PTO drive-gear backlash to be measured.
- (6) Hold PTO output shaft (14) while moving PTO drive-gear (13) in both directions. Observe backlash and record as measurement 'B'.
- (7) Make sure both dowel pins are in position in the torque converter housing.
- (8) Install a 0.010 in. (0.25 mm) gasket on the dowel pins.

CAUTION

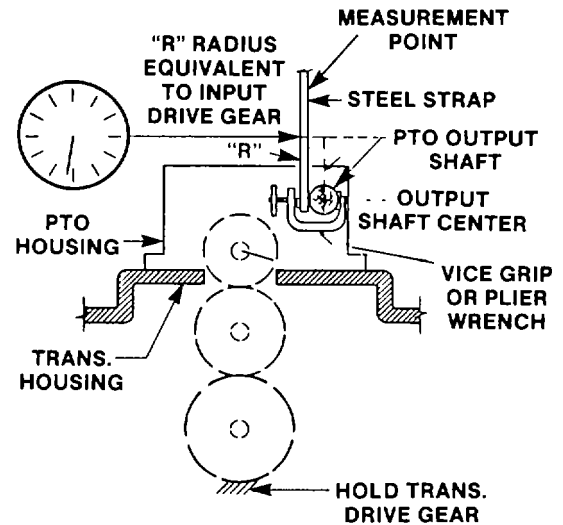
The PTO is heavy and if dropped could result in personal injury. Be sure to provide proper support during installation of the PTO.

- (9) Lift PTO into position and install onto torque converter housing.



4-17. PUMP DRIVE AND PTO - Continued

- (10) Install lockwashers and nuts retaining PTO to torque converter housing. While rotating the output shaft to and fro, tighten nuts until either the nuts are torqued to 50 ft lb (67 Nm), or the output shaft seizes (no gear backlash).
- (11) Attach a steel strap to the PTO output shaft (14) with a 'C'-clamp.
- (12) Mark off 2.66 in. (67.7 cm) on the steel strap, from the center of the output shaft (14). This distance represents the radius of the PTO drive gear (13).
- (13) Attach dial indicator to the transmission housing allowing combined backlash to be measured. Measurement point is dimension marked on steel strap.

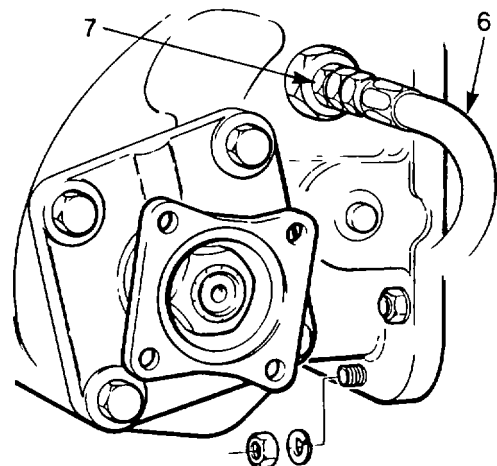


- (14) Move the output shaft in both directions. Measure the combined backlash and record as measurement 'C'.
- (15) Determine the backlash (D) between the PTO side gear and the PTO drive gear using the following formula.

$$D = C - (A + B)$$

For safe PTO operation, backlash should be between 0.006 to 0.029 in. (0.15 to 0.73 mm).

- (16) Adjust PTO side gear to PTO drive gear backlash by adding or deleting gaskets until correct backlash is achieved. A 0.010 in. (0.25 mm) gasket will change backlash about 0.006 in. (0.15 mm) A 0.020 in. (0.50 mm) gasket will change backlash about 0.012 in. (0.30 mm). Do not stack more than 3 gaskets together. Ensure that at least one gasket remains between components.
- (17) Install and tighten the lubrication line (6) into the inspection plug (7).



4-17. PUMP DRIVE AND PTO - Continued**4-17.1 Power Take Off Unit - Continued**

(18) Install the solenoid valve to PTO high pressure line (1) into the PTO (3).

(19) Install wiring (5) to pressure switch (4).

(20) Install and tighten the solenoid valve to PTO high pressure line (1) at the solenoid valve (2).

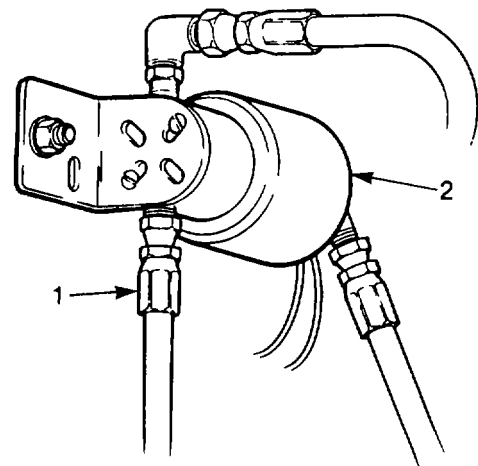
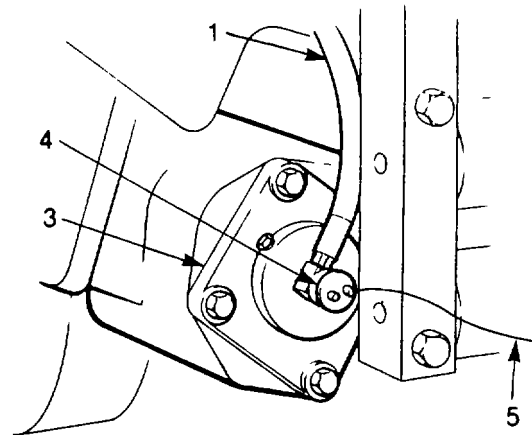
(21) Install and torque the transmission drain plug to 20 ft lb (27 Nm).

(22) Install pump drive shaft, see para. 4-17.2.

(23) Remove dipstick from transmission filler tube and install transmission fluid (Item 9, Appendix E) as per lube order LO 5-4210-220-12.

(24) Prior to final transmission fluid level check, engage PTO to fill high pressure line and clutch cavity (see para. 2-11). Also select all transmission ranges.

(25) Allow transmission to reach operating temperature. Check transmission oil level is in the HOT BAND Top up as required.



4-17. PUMP DRIVE AND PTO - Continued

4-17.2 PTO to Reducer Gear Drive Shaft.

This task covers **a. Removal**
 b. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
 NSN 5810-00-177-7033

MATERIALS/PARTS

14, Appendix E Gasket Eliminator
 16, Appendix E Grease
 20, Appendix E Penetrating Oil
 102603 Drive Shaft

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Pump Body Heat Shield Removed (see para. 4-11.2)

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

CAUTION

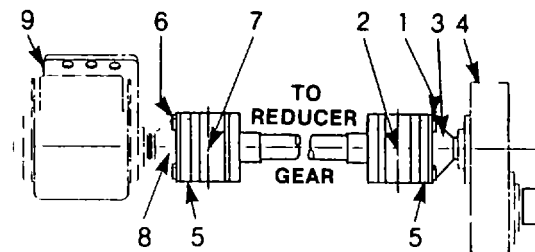
Constant velocity joint damage could result if drive shaft is hung from one end. Always support one end of the drive shaft using mechanics wire, until the other end is also removed.

NOTE

If the drive shaft fasteners are excessively corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.

REMOVAL

- (1) Remove the four capscrews (1) that retain the constant velocity joint (2) to the companion flange (3) of the reducer gear (4).
- (2) Using a hammer, lightly tap spacer plate (5) until the constant velocity. Joint (2) separates from the companion flange (3).
- (3) Using mechanics wire, support the reducer gear end of the drive shaft.
- (4) Remove the four capscrews (6) that retain the constant velocity joint (7) to the companion flange (8) of the PTO (9).

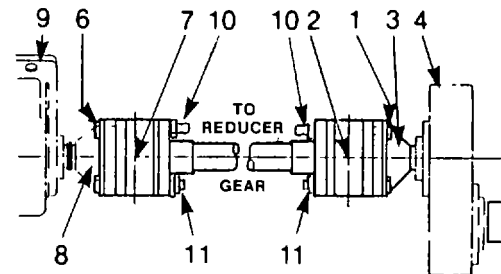


4-17. PUMP DRIVE AND PTO - Continued

- (5) Using a soft hammer, lightly tap spacer plate (5) until the constant velocity joint (7) separates from the companion flange (8).
- (6) Carefully maneuver the PTO to reducer gearbox drive shaft out from between the PTO (9) and the reducer gear (4).

INSTALLATION

- (1) Apply gasket eliminator (item 14, Appendix E) to the mating surfaces to the PTO and reducer gear companion flanges (3, 8).
- (2) Raise the PTO to reducer gear drive shaft into position.
- (3) Support PTO end of drive shaft using mechanics wire.
- (4) Align mounting holes of the constant velocity joint (2) with the holes in the companion flange (3). Install capscrews (1) fingertight.
- (5) Align mounting holes of the constant velocity joint (7) with the holes in the companion flange (8). Install capscrews (6) fingertight.
- (6) Torque all drive shaft capscrews (1 and 6) to 63 ft lb (85 Nm).
- (7) Remove mechanics wire used as a support.
- (8) Lubricate both constant velocity joints. Remove plug (11) from the inboard side of the constant velocity joint. Cover this hole with your finger. Lubricate constant velocity joint through grease fitting (10) until grease (item 16, Appendix E) is expelled from hole. Reinstall plug (11) into hole and tighten.



4-17. PUMP DRIVE AND PTO.**4-17.3 Reducer Gear to Pump Drive Shaft Replace.**

- This task covers**
- a. Removal
 - b. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5810-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body and Hose Body Heat Shield Removed
(see para. 4-11)

MATERIALS/PARTS

16, Appendix E Grease
20, Appendix E Penetrating Oil
29, Appendix E Threadlock Liquid
915173-1 Drive Shaft

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

CAUTION

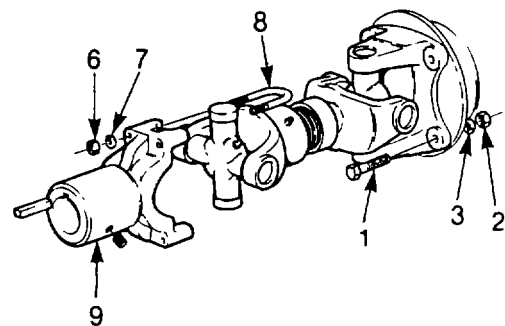
Universal joint damage could result if drive shaft is hung by one end. Always support one end of the drive shaft using mechanics wire, until the other end is also removed.

NOTE

If the drive shaft fasteners are excessively corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.

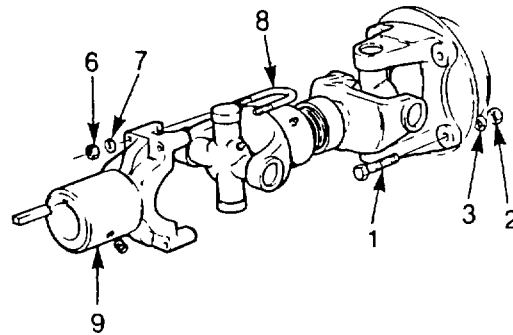
REMOVAL

- (1) Remove the four capscrews (1), nuts (2), and lockwashers (3).
- (2) Support the drive shaft using mechanics wire.
- (3) Remove the nuts (6) and lockwashers (7) from the U-bolts (8).
- (4) Using a hammer and a punch, lightly tap on U-bolts (8) until they are removed from the end yoke (9). Stagger the taps so the U-bolts will not bind up in the end yoke.
- (5) Carefully maneuver the drive shaft out from between the reducer gearbox and the pump.



4-17. PUMP DRIVE AND PTO - Continued**INSTALLATION**

- (1) Compress the reducer gear to pump drive shaft to the shortest possible length.
- (2) Raise the reducer gear to pump drive shaft into position and support using mechanics wire.
- (3) Ensure the bearing caps (11) of the universal joint are fully seated into the end yoke (9) of the reducer gear.
- (4) Install the U-bolts (8). Using a hammer, lightly tap U-bolts until they contact the bearing cap.
- (5) Apply threadlock liquid (item 29, Appendix E) to U-bolt threads. Install the lockwashers (7) and nuts (6). Tighten nuts to 32 ft lb (43 Nm).
- (6) Align the holes of the flanged yoke (4) with the holes in the pump drive flange (5).
- (7) Install the capscrews (1), lockwashers (3), and nuts (2). Apply threadlock liquid (item 29, Appendix E) to capscrews (1). Tighten nuts to 110 ft lb (150 Nm).
- (8) Remove mechanics wire used as a support
- (9) Lubricate both universal joints, until grease (Item 16, Appendix E) is expelled from all bearing cap seals
- (10) Lubricate slip joint until grease (item 16, Appendix E) is expelled from welch plug. Cover welch plug with finger and continue lubricating until grease is expelled from dust cap.



4-17. PUMP DRIVE AND PTO.

4-17.4 Reducer Gearbox Replace.

- This task covers**
- a. Removal
 - b. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5810-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body and Hose Body Heat Shield Removed
(see para. 4-11)
PTO to Reducer Gear Drive Shaft Removed
(see para. 4-17.2)
Reducer Gear to Pump Drive Shaft Removed
(see para. 4-17.3)

MATERIALS/PARTS

3, Appendix E Antiseize Compound
15, Appendix E Gear Oil
20, Appendix E Penetrating Oil
200-A-2:1 Reducer Gearbox
MS51922-17 3/8 in. Locknut
MS51922-9 5/16 in. Locknut

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

CAUTION

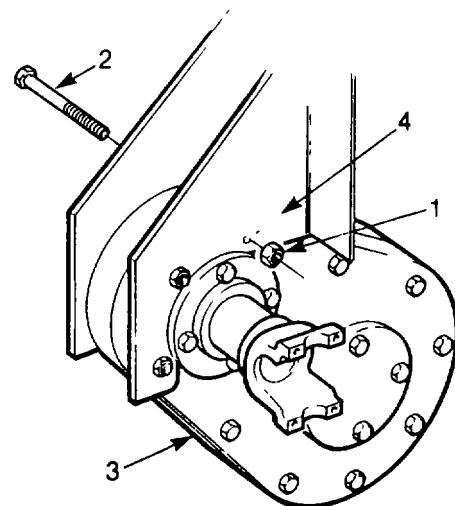
Damage to reducer gearbox bearings may occur if the companion flange or end yoke are forced onto the shafts. Ensure that the bores and shafts are free from dirt, paint, or corrosion. Clean or repair as necessary.

NOTE

If the reducer gearbox fasteners are excessively corroded, apply penetrating oil (Item 20, Appendix E) to ease disassembly.

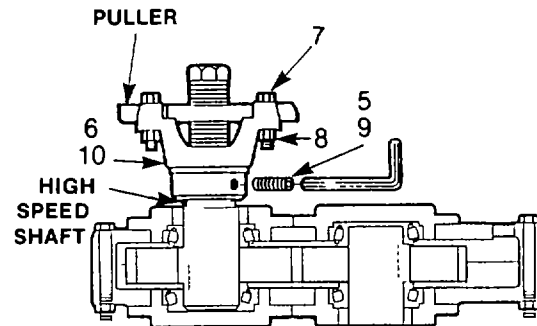
REMOVAL

- (1) Remove the drain plug and drain reducer gearbox lubricant into clean drain pan. Reducer gearbox lubricant should be warm prior to draining. Inspect sediment on drain plug. This may help determine component condition before disassembly.
- (2) Remove the locknuts (1) and capscrews (2) that retain the reducer gearbox (3) to the mounting brackets (4).



4-17. PUMP DRIVE AND PTO - Continued

- (3) Carefully lower the reducer gearbox (3) from its mounting brackets (4).
- (4) Remove the end yoke set screws (5 and 9).
- (5) Using a mechanical puller remove the end yokes (6 and 10).



- (6) Remove the keys from the shaft keyways and inspect for damage.
- (7) Remove drain, fill tube and vent from reducer gearbox housing.

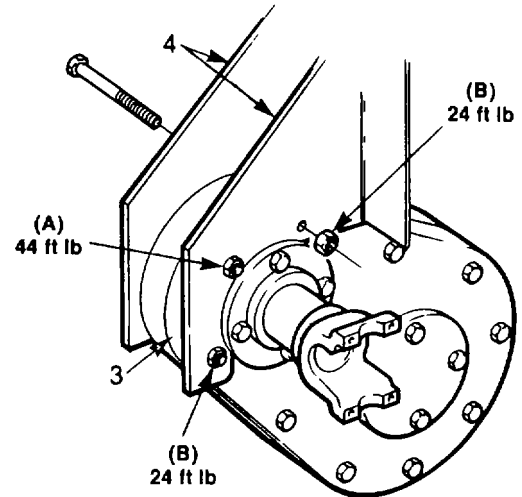
INSTALLATION**CAUTION**

Damage to reducer gearbox bearings may occur if the companion flange or end yoke are forced onto the shafts. Ensure that the bores and shafts are free from dirt, paint, or corrosion. Clean or repair as necessary.

- (1) Install the keys into both shaft keyways.
- (2) Apply antiseize compound (item 3, Appendix E) to both shafts of the reducer gearbox.
- (3) Slide the end yoke (6) onto the high speed shaft. Ensure that end yoke is at least 1/8 in. (3 mm) away from seal.
- (4) Tighten the end yoke set screw (5) firmly.
- (5) Slide the companion flange (10) onto the low speed shaft. Ensure that the companion flange is at least 1/8 in. (3 mm) away from seal.
- (6) Tighten the companion flange set screw (9) firmly.

4-17. PUMP DRIVE AND PTO - Continued**4-17.4 Reducer Gearbox Replace - Continued**

- (7) Remove the three capscrews and locknuts that are used to retain the reducer gearbox to the mounting brackets. Discard the locknuts.
- (8) Check the mounting brackets are fastened to the frame member.
- (9) Raise the reducer gearbox (3) into position between the mounting brackets (4). Align the holes and install the capscrews (2) and new locknuts (1). Make sure the low speed shaft (large gear) is facing the PTO.
- (10) Tighten capscrew and locknut (A) to 44 ft lb (60 Nm).



- (11) Tighten capscrews and locknuts (B) to 24 ft lb (33 Nm).
- (12) Install the fill tube and vent securely. Be sure they are vertical.
- (13) Fill the reducer gearbox with gear oil (item 15, Appendix E) as described in Lube Order LO 5-4210-220-12.
- (14) Install reducer gear to pump drive shaft as described in para. 4-17.3.
- (15) Install PTO to reducer gear drive shaft as described in para. 4-17.2.
- (16) Start truck and check reducer gear operation, see Chapter 2.

4-18. PUMP, PIPING, AND VALVES.

4-18.1 Fire Pump.

This task covers

- a. Removal
- b. Installation

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

EQUIPMENT CONDITION

Water Tank Drained (see para. 2-13)
 All Piping Drained
 Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Pump Body and Hose Body Heat Shields Removed (see para. 4-11)
 Reducer Gear To Pump Drive Shaft Removed (see para. 4-17.3)
 Winterization Heater Exhaust Removed (see para. 4-19.1)

MATERIALS/PARTS

2, Appendix E Antifreeze
 14, Appendix E Gasket Eliminator
 20, Appendix E Penetrating Oil
 310591 Locknut
 310594 Locknut
 51095 Pump

PERSONNEL REQUIRED - 2

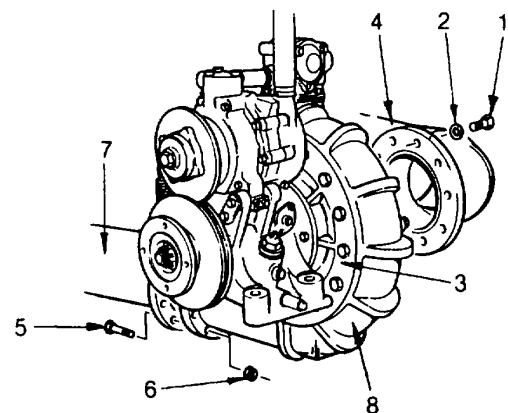
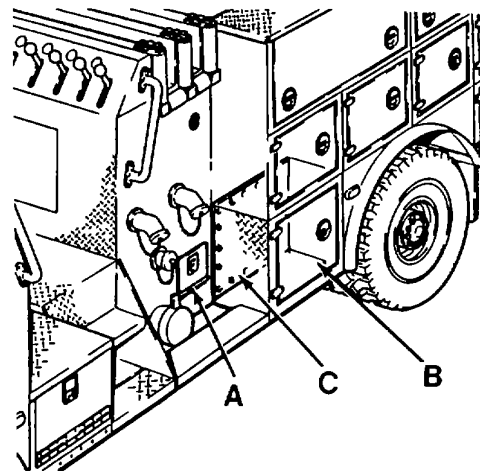
REMOVAL

- (1) Remove pump compartment door (A).
- (2) Open compartment door (B) and remove all equipment.
- (3) Remove rear plate (C).
- (4) Drain the primer reservoir. Open the draincock (9) on the primer housing and allow the antifreeze to drain into a clean drain pan.

NOTE

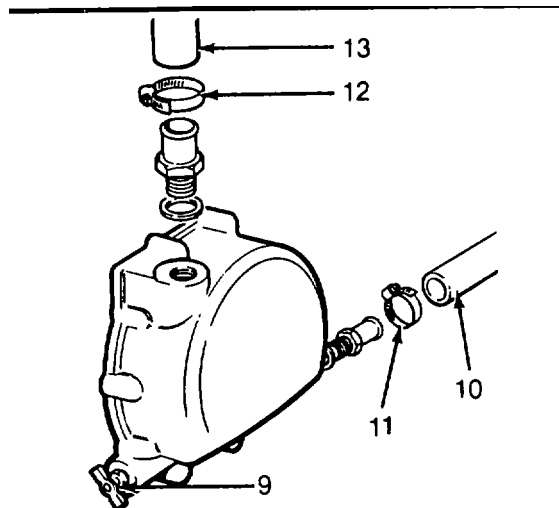
If the piping fasteners are excessively corroded, apply penetrating oil (Item 20, Appendix E) to ease disassembly.

- (5) Remove the capscrews (1) and washers (2) that retain the suction tee (4) to the pump (3). Discard the washers.
- (6) Remove the eight capscrews (5) and locknuts (6) that retain the pump discharge elbow (7) to the pump volute body (8). Discard the locknuts.



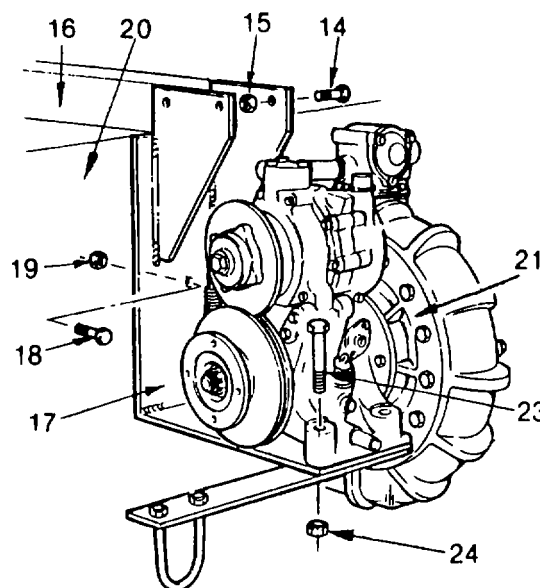
4-18. PUMP, PIPING, AND VALVES - Continued

- (7) Remove the gear clamps (11, 12) and the primer hoses (10, 13).
- (8) Disconnect the tachometer cable from the pump.

**WARNING**

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

- (9) Using a dolly type hydraulic jack, support the pump mounting bracket (17) at its installed height.
- (10) Insert a block of wood between the frame side member and the mounting channel.
- (11) Remove the four capscrews (14) and locknuts (15) that retain the mounting channel (16) to the pump mounting bracket (17). Discard the locknuts.
- (12) Remove the four capscrews (18) and locknuts (19) that retain the pump mounting bracket (17) to the frame side member (20). Discard the locknuts.
- (13) Remove the two outermost capscrews retaining the pump to the mounting bracket. Remove the pipe clamp from the suction pipe support bracket and remove the support bracket.
- (14) Carefully maneuver the pump (21) while lowering the dolly type hydraulic jack to the ground it may be necessary to turn the pump on the jack saddle during lowering to provide enough clearance to remove the pump.
- (15) Lift the pump (21) and pump bracket (17) onto a clean workbench.
- (16) Remove the two capscrews (23) and locknuts (24) that retain the pump (21) to the pump mounting bracket (17). Discard the locknuts.



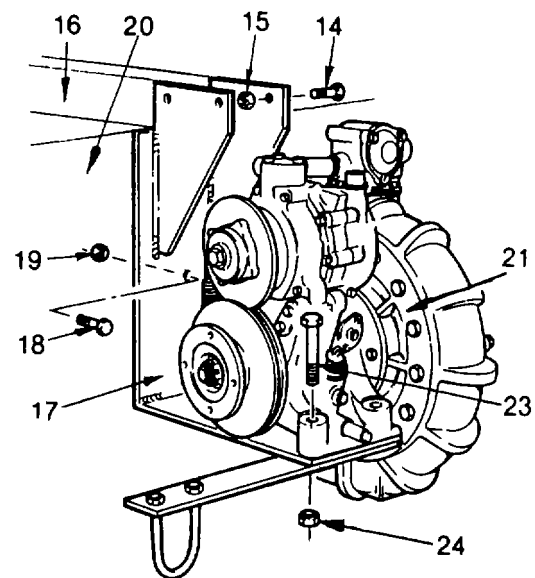
4-18. PUMP, PIPING, AND VALVES - Continued

4-18.1 Fire Pump - Continued

INSTALLATION**WARNING**

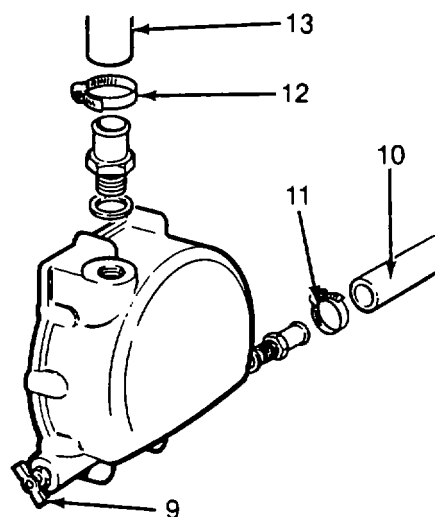
Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing.

- (1) Be sure the suction tube, the volute body and their mating surfaces are clean prior to re-gasketing.
- (2) Set the pump (21) on the pump mounting bracket (17) and align the mounting holes.
- (3) Install the two innermost capscrews (23) and new locknuts (24) and tighten to 270 ft lb (266 Nm).
- (4) Lift the pump and bracket assembly off the workbench and set it on the saddle of a dolly type hydraulic jack.
- (5) Apply gasket eliminator (Item 14, Appendix E) to the volute body and suction tube flanges.
- (6) Carefully raise the dolly type hydraulic jack until the mounting holes in the pump mounting bracket (17) align with the holes in the mounting channel (16). Align the suction tube and volute body flanges with their respective piping and install capscrews and locknuts fingertight.
- (7) Install the four capscrews (14) and new locknuts (15) used to fasten the pump mounting bracket (17) to the mounting channel (16). Tighten the locknuts to 160 ft lb (217 Nm).
- (8) Align the mounting holes in the pump mounting bracket (17) with the holes in the frame side member (20).
- (9) Install the four capscrews (18) and new locknuts (19) used to fasten the pump bracket (17) to the frame side member (20). Tighten the locknuts to 160 ft lb (217 Nm).
- (10) Remove the block of wood used to support the mounting channel during pump removal.

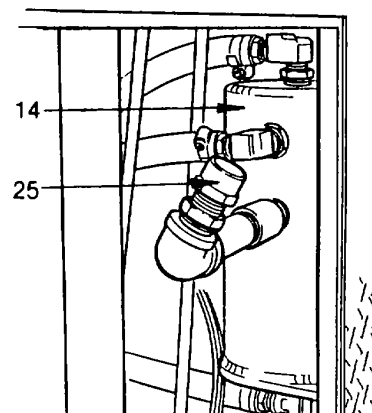


4-18. PUMP, PIPING, AND VALVES - Continued

- (11) Install the primer inlet hose (10) onto the primer inlet connection and tighten the gear clamp (11).
- (12) Install the primer return hose (13) onto the primer inlet connection and tighten the gear clamp (12).



- (13) Tighten the suction tee capscrews (1) to 270 ft lb (365 Nm).
- (14) Tighten the pump discharge elbow locknuts (6) to 150 ft lb (205 Nm).
- (15) Wipe off excess gasket eliminator (Item 2, Appendix E) from pipe flanges.
- (16) Raise the pump suction bracket into position and attach pipe clamp to suction pipe. Install outermost capscrews through pump, pump bracket and suction pipe bracket. Tighten capscrews and nuts to 270 ft lb (266 Nm). Tighten pipe clamp securely.
- (17) Allow gasket eliminator to cure for at least one hour prior to testing for leaks.
- (18) Ensure the drain valve (9) on the priming pump housing is closed. Fill the pump primer reservoir (14) with antifreeze (item 2, Appendix E) through the reservoir fill tube (25).
- (19) Check the fire pump oil level (see Lube Order LO 5-4210-220-12)
- (20) Install box rear plate (C).
- (21) Install all equipment in compartment box.
- (22) Install reducer gear to pump drive shaft as detailed in para. 4-17.3.
- (23) Fill tank and start fire pump as detailed in para. 2-11 and check for any leaks. Tighten/remake joints as required.
- (24) Replace heat shields as detailed in para. 4-11.2 and para. 4-11.3.



4-18. PUMP, PIPING, AND VALVES - Continued**4-18.2 Water Piping.**

This task covers	Replacement
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TOOLS

Tool Kit, Master Mechanic,
NSN 4910-00-699-5273

EQUIPMENT CONDITION

Water Tank Drained (see para. 2-13)
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
All Piping Drained
Heat Shields Removed (see para. 4-11)

MATERIALS/PARTS

14, Appendix E Gasket Eliminator
22, Appendix E Pipe Sealant
29, Appendix E Threadlock Liquid

PERSONNEL REQUIRED - 2**REPLACEMENT****NOTE**

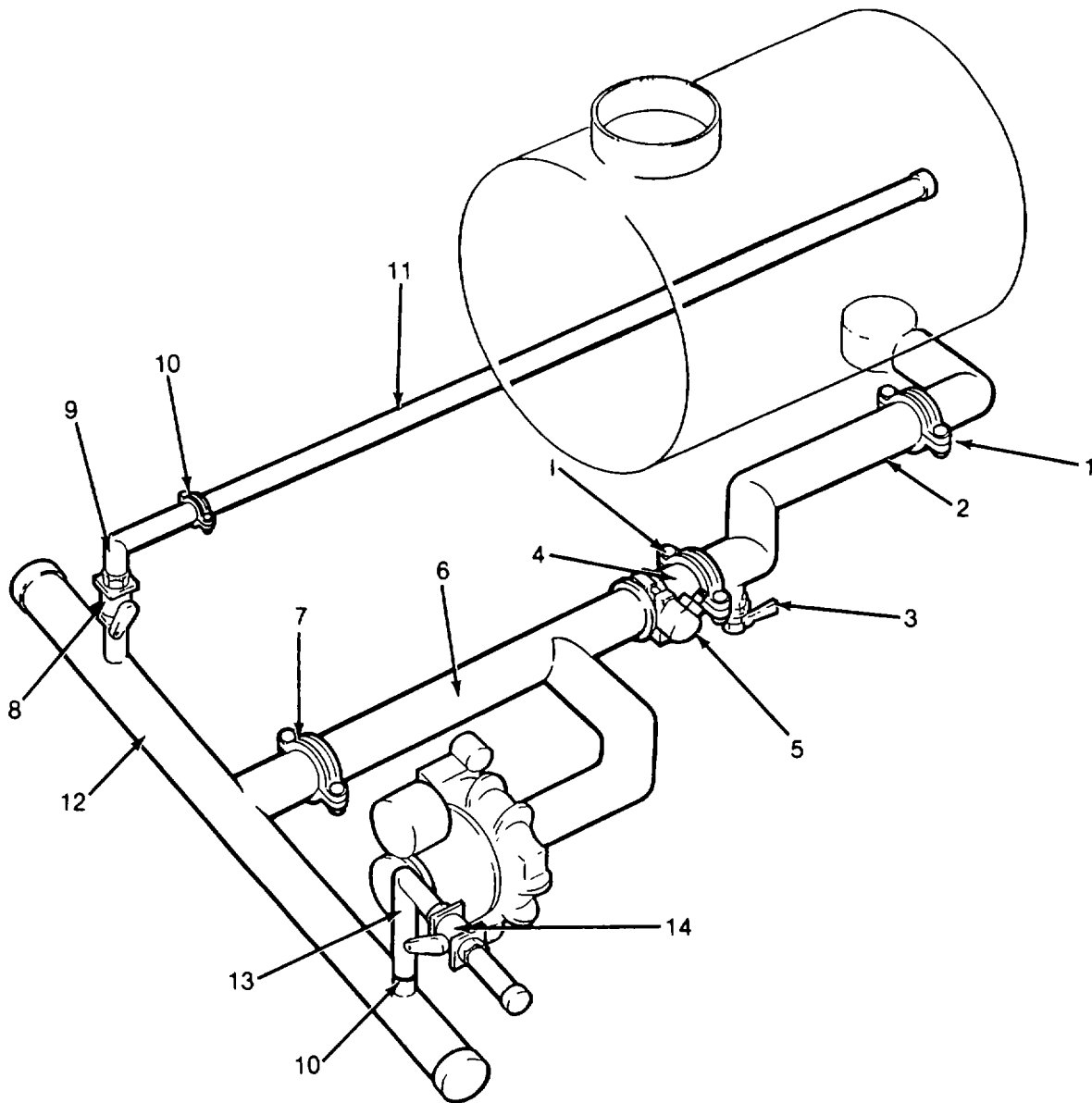
This section does not cover replacement of:

- a. Automatic Tank Fill - Rear (Item #49)
- b. Hose Reel Hose (Item #24)
- c. Tank Fill Hose (Item #30)

Report to Direct Support Level for replacement or repair of these items.

- (1) Replace damaged suction piping, hoses or valves using the illustration and legend as a guide.
- (2) Replacement procedures for the different components are covered in the paragraphs listed below.
- (3) Apply pipe sealant (item 22, Appendix E) to all pipe threads prior to installation. When connecting pump suction use gasket elimination (item 14, Appendix E) prior to installation. Coat all fastener threads on flanges with threadlock liquid (item 29, Appendix E) prior to installation.
 - a. Victaulic Coupling (see para. 4-18.3).
 - b. 2 1/2" Drop-out Valve (see para. 4-18.4).
 - c. Water Tank Valve (see para. 4-18.5).
 - d. Tank Drain Valve (see para. 4-18.6).

4-18. PUMP, PIPING, AND VALVES - Continued



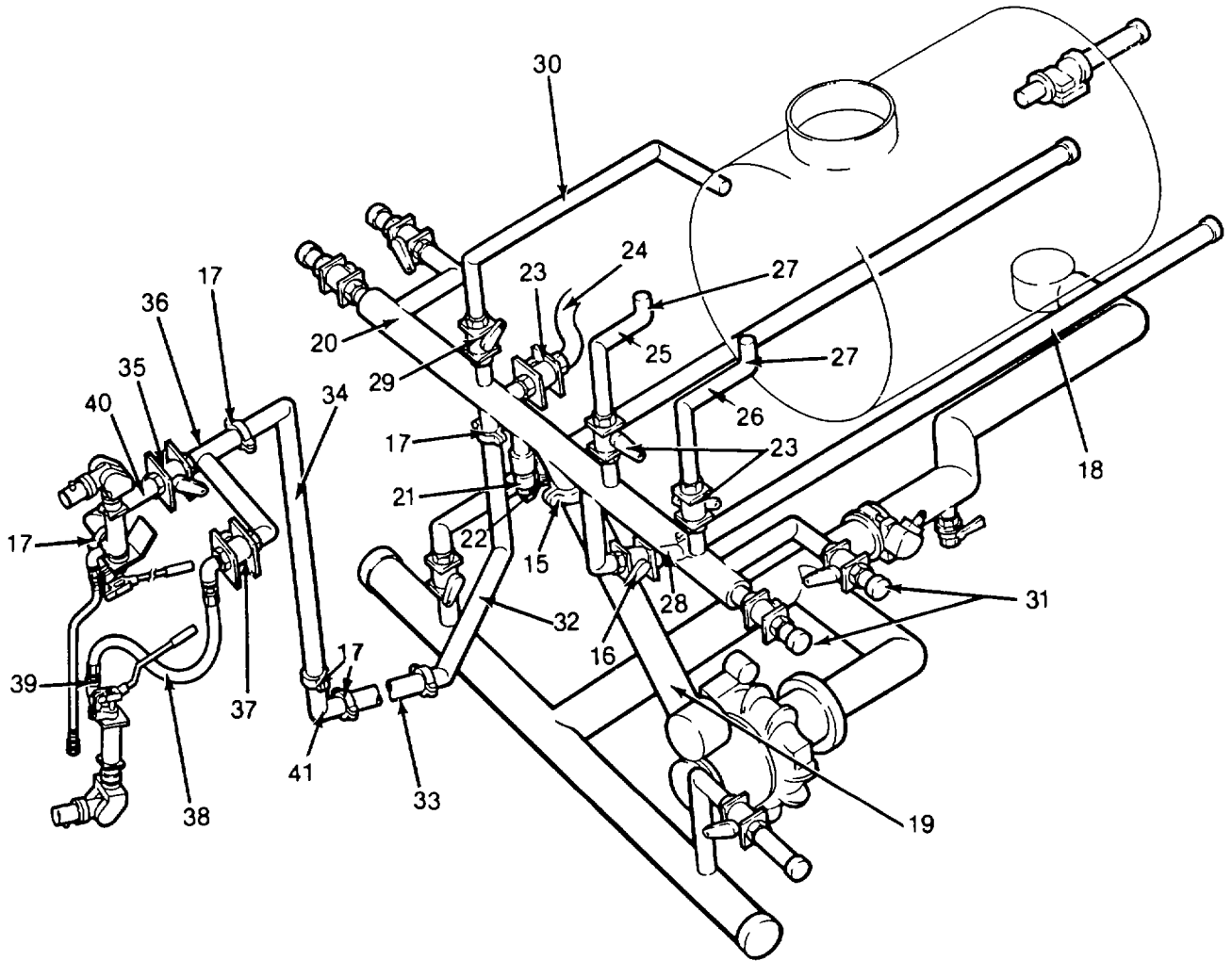
ITEM PART NO	DESCRIPTION	ITEM PART NO.	DESCRIPTION
1	Style 75-4 4" Victaulic Coupling	8	896-01-01-D 2 1/2" Ball Valve
2	102241 Tank Outlet Pipe	9	101698-01 90 Deg. Elbow 2 1/2"
3	1.5-21-1136-TT-0 Tank Drain Valve	10	Style 75-2 5 2 1/2" Victaulic Coupling
4	100205 Tank to Suction Pipe	11	101700-01 2 1/2" Pipe Rear Suction
5	102212 Tank Valve	12	100218 Suction Manifold
6	101701 Suction Tee	13	101698-02 90 Deg. Elbow 2 1/2"
7	Style 75-5 5" Victaulic Coupling	14	896-13-01-D 2 1/2" Ball Valve

4-18 PUMP, PIPING, AND VALVES - Continued**4-18.2 Water Piping - Continued**

ITEM PART NO	DESCRIPTION	ITEM PART NO.	DESCRIPTION
15 Style 75-4	4" Victaulic Coupling	31 896-01-37-D	2 1/2" Ball Valve
16 896-01-01SP-D	2 1/2" Ball Valve	32 101754	Double Elbow 2 1/2"
17 Style 75-2.5	2 1/2" Victaulic Coupling	33 101758	2 1/2" Pipe
18 101700-01	2 1/2" Pipe Rear Discharge	34 101761	78 Deg. Elbow 2 1/2"
19 101556	Discharge Elbow	35 896-01-01 -E	2 1/2" Ball Valve
20 100237	Discharge Manifold	36 101763	Tee-Roof to Bumper Turret
21 20-1	Pressure Relief Valve	37 891-01-01-E	1 1/2" Ball Valve
22 102226	Pressure Relief Valve Elbow	38 101638-055	Hose Bumper Turret
23 891-01-03-D	1 1/2" Ball Valve	39 102248	Reducing Elbow
24 101638-144	Rear Hose Reel Hose	40 101765	90 Deg. Elbow
25 102229	Elbow, Front Transverse Bed	41 101759	74 Deg. Elbow
26 102228	Elbow, Rear Transverse Bed	42 112-B-06	3/8" Nipple
27 348-L-1 1/2	90 Deg. Swivel Elbow	43 116-B-12	3/8" Street Elbow
28 101695	30 Deg. Elbow	44 110-B-08x06	1/2"-3/8" Bushing
29 891-01-01-D	1 1/2" Ball Valve	45 00053720	Automatic Drain Valve
30 101638-048	Tank Fill Hose	46 KF12-08PS	Adapter 3/4" Hose x 1/2 NPT
		47 101984-10	3/4" Hose x 36" Long
		48 129-B-08x24	1/2" Bulkhead

- (1) Replace damaged discharge piping, hoses or valves using the illustration and legend as a guide.
- (2) Replacement procedures for the different components are covered in the paragraphs listed below.
 - a Victaulic Coupling (see para. 4-18.3)
 - b 2 1/2" Drop-out Ball Valve (see para. 4-18.4)
 - c Pressure Relief Valve (see para. 4-18.7)
 - d Automatic Drain Valve (see para. 4-18.8)
 - e 1-1/2" Drop-out Ball Valve (see para. 4-18.9)
- (3) Apply pipe sealant (item 22, Appendix E) to all pipe threads prior to installation. When connecting pump discharge use gasket elimination (item 14, Appendix E) prior to installation. Coat all fastener threads on flanges with threadlock liquid (item 29, Appendix E) prior to installation.

4-18 PUMP, PIPING, AND VALVES - Continued



NOTE
 Items 42 to 48 not shown for clarity

4-18. PUMP, PIPING, AND VALVES - Continued**4-18.3 Victaulic Couplings.****This task covers Replacement****TOOLS**

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
All Piping Drained

MATERIALS/PARTS

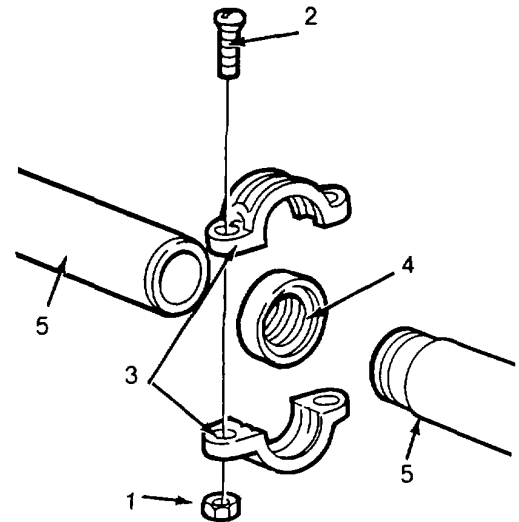
21, Appendix E Petroleum Jelly
75-E-1.5" Victaulic Seal
75-E-2.5" Victaulic Seal
75-E-4.0" Victaulic Seal
75-E-5.0" Victaulic Seal

NOTE

To replace some couplings, it may be necessary to remove the heat shields (see para. 4-11) or to drain the water tank (see Chapter 2).

REPLACEMENT

- (1) Remove the nuts (1) and capscrews (2) retaining the clamp halves (3) together.
- (2) Separate the clamp halves (3) and remove. It may be necessary to break the seal between the gasket (4) and the clamp halves (3) using a small hammer.
- (3) Remove gasket (4) from pipe and discard.
- (4) Clean the pipe ends (5) and inspect for damage such as indentations, roll marks or projections that might cause the gasket (4) to leak. Replace defective piping as required.
- (5) Inspect clamp halves (3) for cracks or dents.
- (6) Using petroleum jelly (item 21, Appendix E), uniformly lubricate the entire gasket (4) and the pipe ends (5).
- (7) Install new gasket (4) onto one pipe.
- (8) Maneuver the second pipe and slide the gasket (4) onto it. Center the gasket over both pipes (5).
- (9) Position the clamp halves (3) over the pipes (5) and gasket (4). Ensure the clamp lips lay in the rolled grooves.
- (10) Install the capscrews (2) and nuts (11) and tighten as indicated.



4-18 PUMP, PIPING, AND VALVES - Continued

TABLE OF RECOMMENDED TORQUE VALUES				
CLAMP STYLE	HEAD SIZE	BOLT SIZE	TORQUE	
			ft lb	(Nm)
75 - 2.5"	11/16"	7/16"	25	(34)
75 - 4.0"	7/8"	9/16"	55	(75)
75 - 5.0"	15/16"	5/8"	75	(101)
75 - 1.5"	11/16"	7/16"	25	(34)

4-18 PUMP, PIPING, AND VALVES - Continued**4-18.4 2 1/2 Inch Drop-out Ball Valve.**

This task covers a. Removal b. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
4, Appendix G Retainer Removing Tool

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Heat Shields Removed (see para. 4-11) (as required)
All Piping Drained

MATERIAL/PARTS

22, Appendix E Pipe Sealant
27, Appendix E Silicone Grease
29, Appendix E Threadlock Liquid
57295 O-Ring (Actuator Shaft)
57321 O-Ring (Pivot Bolt)
57378 O-Ring (Body)
63820 Seat
57414 O-Ring (Seat)
57313 O-Ring (Retainer)

NOTE

The following valves are 2 1/2 in. drop-out ball valves

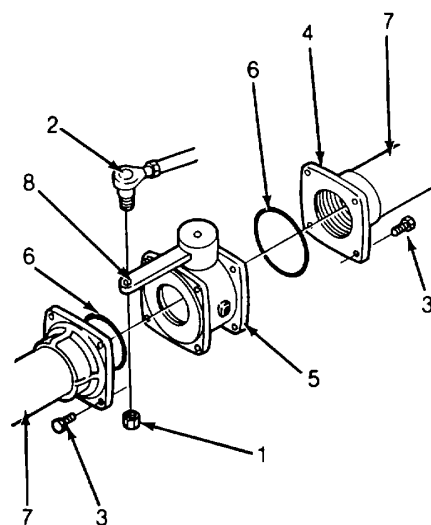
- (1) Rear suction
- (2) Side suction
- (3) Rear discharge
- (4) Side discharge (4 off)
- (5) Roof turret manual

NOTE

This removal procedure is used for all 2 1/2 in. ball valves regardless of their location on the firefighting system.

REMOVAL

- (1) Remove nut (1) and separate the control rod linkage (2) from the control handle (8).
- (2) Set control handle (8) to the open position to eliminate damage to the ball during removal of the valve body (5).
- (3) Remove capscrews (3) that retain the end caps (4) to the valve body (5) Some valve bodies are connected to piping on one end only.
- (4) Slide valve body (5) from between end caps (4).
- (5) Remove O-rings (6) from valve body (5) grooves and discard.



4-18 PUMP, PIPING, AND VALVES - Continued

- (6) If pipe replacement is necessary, remove the end cap (4) from the pipe (7).
- (7) Apply pipe sealant (item 22, Appendix E) to the threads of the new pipe and install the end cap (4) hand tight. Continue to tighten end cap an additional 1-2 turns. Be sure to install the end cap so that it will line up with the valve body and opposite end cap.

INSTALLATION

- (1) Lubricate the O-rings (6) using silicone grease (item 27, Appendix E) and install into the valve body (5) grooves.
- (2) Set the control handle (8) to the open position to eliminate damage to the ball during installation of the valve body (5).
- (3) Carefully install the valve body (5) between the end caps (4). Be sure the O-rings (6) are not damaged during installation.
- (4) Apply threadlock liquid (item 29, Appendix E) to the capscrews (3) and install capscrews (3) through end caps (4) into valve body (5). Tighten until snug. Do not overtighten.
- (5) Attach the control rod linkage to the control handle (8). Install the nut (1) onto ball joint and tighten firmly.
- (6) Test valve operation by actuating lever on structural control panel a few times.

4-18. PUMP, PIPING, AND VALVES - Continued

4-18.5 Water Tank Valve.

This task covers

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

MATERIALS/PARTS

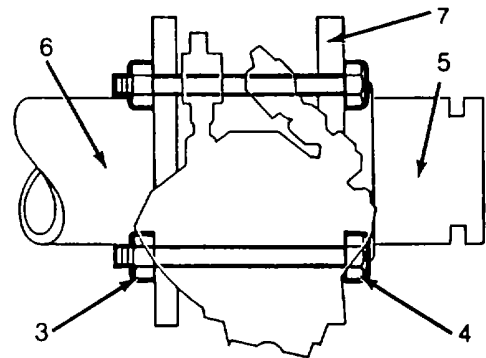
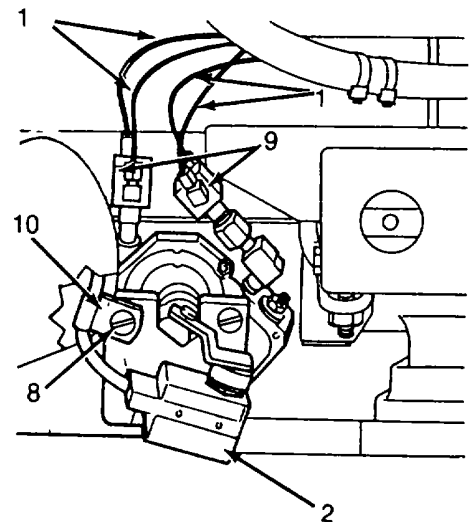
14, Appendix E Gasket Eliminator
 22, Appendix E Pipe Sealant
 29, Appendix E Threadlock Liquid
 310591 Locknuts
 112-B-02 Close Nipple
 BZE6-ZRN Microswitch
 S125 Shuttle Valve
 V60B Actuator
 1512WM-5S Check Valve

EQUIPMENT CONDITION

Water Tank Drained (see para. 2-11)
 All Piping Drained
 Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Pump Body and Hose Body Heat Shield Removed (see para. 4-11)

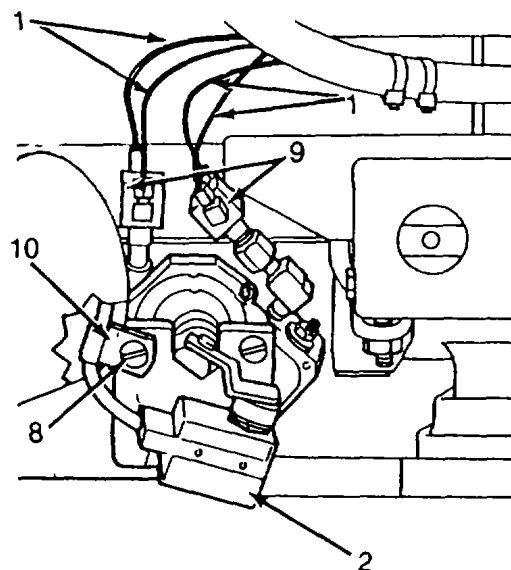
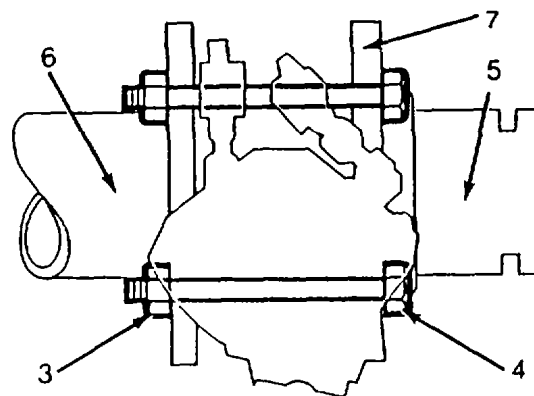
REMOVAL

- (1) Make sure the cab OPERATING MODE switch and TANK VALVE switch are set to mid-position.
- (2) Make sure the structural panel TANK VALVE switch is set to mid-position.
- (3) Tag and remove the four air lines (1) from the shuttle valves (9).
- (4) Remove the wiring cover from the microswitch (2) Tag and remove wires from terminals.
- (5) Remove microswitch wiring support clamp (10) by removing microswitch mounting bracket screw (8).
- (6) Remove the four locknuts (3) and capscrews (4) Discard locknuts.
- (7) Separate pipe flanges (5 and 6) and lower the tank valve assembly (7).
- (8) If a new valve is to be installed, make a sketch of all the valve fittings and their location. Remove from the old valve.



4-18 PUMP, PIPING, AND VALVES - Continued**INSTALLATION**

- (1) If required, install the pipe fittings removed during REMOVAL on the new valve. Coat all threads with pipe sealant (item 22, Appendix E) prior to installation.
- (2) Clean all flanges and inspect flanges for corrosion, nicks, scratches. Replace tank valve or piping as necessary.
- (3) Apply gasket eliminator (item 14, Appendix E) to the tank to suction pipe flange (6) and the tank outlet pipe flange (5).
- (4) Separate the two flanges (5 and 6) to allow the tank valve assembly (7) to be installed without disturbing the gasket eliminator.
- (5) Insert the tank valve assembly (7) between the two flanges (5 and 6) Make sure the flow arrow on the body points away from the tank.
- (6) Apply threadlock liquid (item 29, Appendix E) to all four capscrews (4).
- (7) Install the capscrews (4) and new locknuts (3) and tighten to 150 ft lb (203 Nm).
- (8) Install the wiring to the microswitch (2).
- (9) Install the microswitch wiring support clamp (10) using the micro switch mounting bracket screw (8).
- (10) Install and tighten the air lines (1) into their proper location on shuttle valves (9) as shown.
- (11) Wipe off excess gasket eliminator from pipe flanges (5 and 6).
- (12) Allow gasket eliminator to cure for at least one hour prior to testing for leaks.
- (13) Replace heat shields (see para. 4-11.3).
- (14) Be sure valve operates. Operate from cab (MODE switch set to CFR) and from structural control panel (MODE switch set to STRUCT). Tighten/remake connections as required.
- (15) Be sure cab lamp illuminates when valve is open. Adjust microswitch as required.



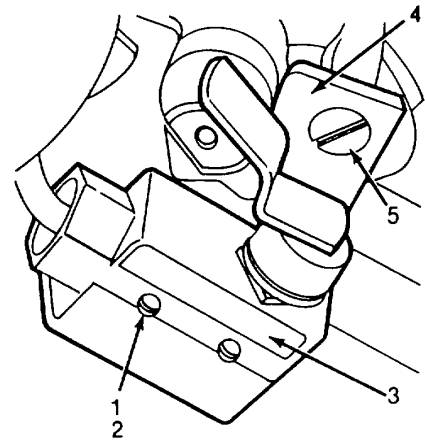
4-18 PUMP, PIPING, AND VALVES - Continued**4-18.5 Water Tank Valve - Continued****REPAIR**

Repair of the water tank valve consists of replacement of the major components

These repairs may be carried out with the water tank valve mounted in the truck except as noted

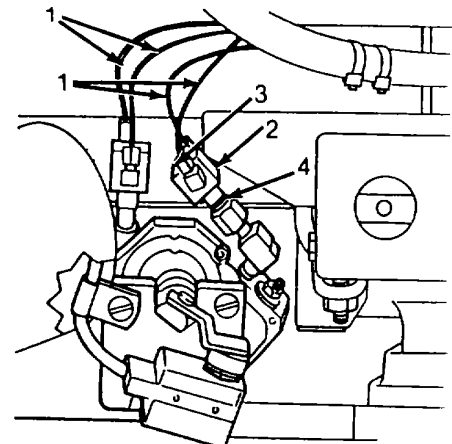
a. Microswitch Repair

- (1) Tag and remove wiring to microswitch.
- (2) Remove nuts (1) and machine screws (2) that retain the microswitch (3) to the microswitch bracket (4).
- (3) If microswitch bracket (4) is bent, or distorted remove the one remaining screw (5). Remove bracket and straighten or replace.
- (4) Attach new microswitch bracket (4) using screw (5). Leave the other hole vacant for installation of the support clamp.
- (5) Aline new microswitch (3) with mounting bracket (4).
- (6) Install both machine screws (2) and nuts (1) and tighten firmly.
- (7) Install wiring to the microswitch (3).
- (8) Be sure cab lamp illuminates when valve is open. Adjust microswitch if required.



b. Shuttle Valve Repair

- (1) Tag and remove air lines (1) from shuttle valve (2) being replaced.
- (2) Remove both fittings (3) from shuttle valve (2).
- (3) Remove shuttle valve (2) from close nipple (4).
- (4) Inspect air lines (1) for crimps, or wear that may cause air leaks. Repair or replace as necessary.
- (5) Inspect fittings (3 and 4) for stripped threads or distortion that may cause air leaks. Replace if necessary.
- (6) Apply pipe sealant (item 22, Appendix E) to threads and install shuttle valve (2) onto close nipple (4). Position valve in orientation shown.

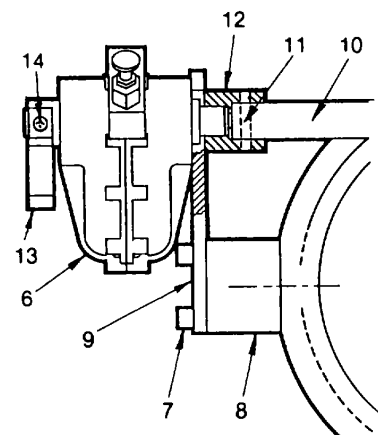
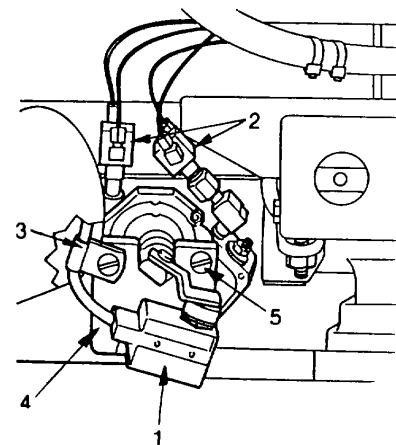


4-18 PUMP, PIPING, AND VALVES - Continued

- (7) Apply pipe sealant (item 22, Appendix E) to threads and install (3) into shuttle valve ports in orientation shown.
- (8) Install and tighten air lines (1) to their proper location on shuttle valve (2) as shown.
- (9) Test valve and connections by operating the valve a few times from both the cab and the structural control panel. (For cab operation, mode switch must be set to CFR, for structural panel operation, mode switch must be set to STRUCT). Tighten and/or remake connections as required.
- (10) Be sure cab lamp illuminates when valve is open (Batteries connected and Ignition ON). Adjust microswitch as required.

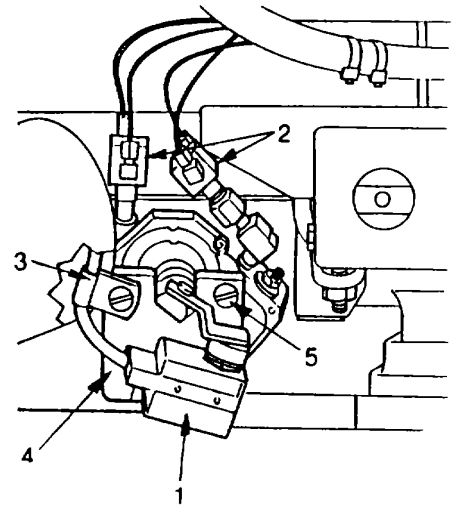
c. Actuator Repair

- (1) Remove microswitch (1) as detailed in Microswitch Repair preceding.
- (2) Remove both shuttle valves (2) as detailed in Shuttle Valve Repair preceding.
- (3) Remove the microswitch wiring support clamp (3) and microswitch bracket (4) by removing screws (5).
- (4) Remove the remaining shuttle valve fittings from the actuator (6).
- (5) Remove the microswitch cam (13) from the actuator shaft.
- (6) While supporting the actuator (6), remove the four machine screws (7).
- (7) Separate the actuator (6) from the check valve extended hinge pin (10).
- (8) Inspect all fittings for stripped threads, or cracks that may cause an air leak.
- (9) Drill through and tap (#10-32) the actuator shaft in order to attach cam (13) to shaft.
- (10) Lift new actuator (6) into position.
- (11) Aline actuator coupling (12) with roll pin (11).
- (12) Aline actuator mounting holes to valve and install machine screws (7).
- (13) Apply pipe sealant (item 22, Appendix E) to threads and install shuttle valve fittings in the orientation shown.

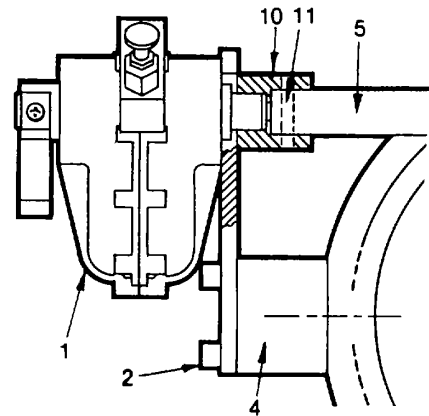


4-18 PUMP, PIPING, AND VALVES - Continued**4-18.5 Water Tank Valve - Continued**

- (14) Install the microswitch bracket (4) and microswitch wiring support clamp (3) using screws (5).
- (15) Install both shuttle valves (2) as detailed in Shuttle Valve Repair preceding.
- (16) Install microswitch (1) as detailed in Microswitch Repair preceding.
- (17) Attach microswitch cam (13) to actuator shaft using screw (14).
- (18) Be sure valve operates. Operate from cab (mode switch set to CFR) and from structural control panel (mode switch set to STRUCT). Tighten/remake connections as required.
- (19) Be sure cab lamp illuminates when valve is open. Adjust microswitch as required.

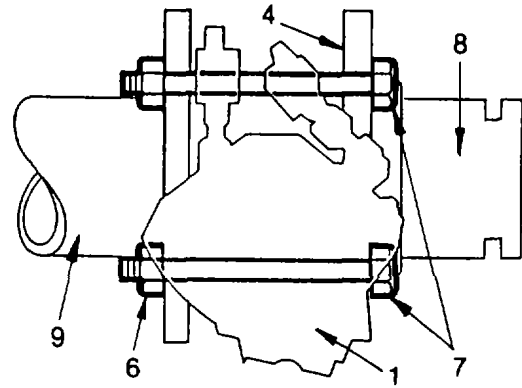
**d. Valve Repair**

- (1) While supporting the actuator assembly (1), remove the four machine screws (2).
- (2) Separate the actuator assembly (1) from the valve extended hinge pin (5).
- (3) Using mechanics wire support actuator assembly (1) from frame side member.
- (4) Remove four locknuts (6) and capscrews (7). Discard locknuts.
- (5) Separate the pipe flanges (8 and 9) and lower valve (4).
- (6) Clean pipe flanges (8 and 9) and inspect for cracks or corrosion. Replace pipes as necessary.
- (7) Apply gasket eliminator (item 14, Appendix E) to pipe flanges (8 and 9).
- (8) Separate the two pipe flanges (8 and 9), allowing enough room to install the valve (4) without disturbing the gasket eliminator.
- (9) Install valve (4) between the two pipe flanges (8 and 9) with flow arrow pointing away from the tank.
- (10) Apply threadlock liquid (item 29, Appendix E) to capscrews (7).



4-18. PUMP, PIPING, AND VALVES - Continued

- (11) Install capscrews (7) and new locknuts (6) and tighten to 150 ft lb (203 Nm).
- (12) Lower actuator assembly (1) from frame side member. Discard mechanics wire .
- (13) Lift the actuator assembly into position and align the actuator coupling (10) with the roll pin (11).
- (14) Aline actuator assembly mounting holes with valve and install machine screws.
- (15) Wipe off excess gasket eliminator from pipe flanges (8 and 9).
- (16) Allow gasket eliminator to cure for at least one hour prior to testing for leaks.
- (17) Be sure valve operates. Operate from cab (MODE switch set to CFR) and from structural control panel (MODE switch set to STRUCT). Tighten/remake connections as required.
- (18) Be sure cab lamp illuminates when valve is open. Adjust microswitch as required.



4-18. PUMP, PIPING, AND VALVES - Continued**4-18.6 Tank Drain Valve (Manually Operated).****This task covers**

- a. Removal
- b. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

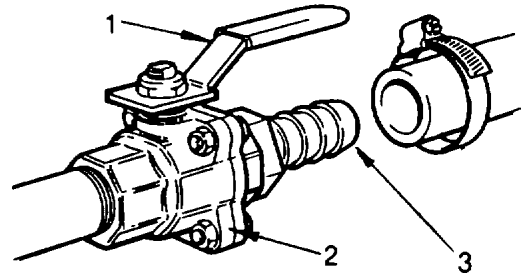
22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Water (foam) Tank Drained (see para. 2-13)
All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body and Hose Body Heat Shield Removed
(see para. 4-11)

REMOVAL

- (1) Disconnect the remote handle from the drain valve.
- (2) Remove the gear clamp and drain hose from the valve.
- (3) Set the tank drain valve handle (1) in the open position (down).
- (4) Remove the ball valve (2) from the tank outlet pipe nipple (3).

**INSTALLATION**

- (1) Clean the threads of the nipple and the ball valve.
- (2) Inspect tank outlet pipe nipple (3) and ball valve (2) for stripped or corroded threads. Replace defective parts.
- (3) Apply pipe sealant (item 22, Appendix E) to the tank outlet pipe nipple (3).
- (4) Install the ball valve (2) onto the tank outlet pipe nipple (3) Make sure the ball valve handle is in an easily accessible position.
- (5) Close the tank drain valve before filling the water (foam) tank.
- (6) Install drain hose onto the nipple and tighten gear clamp.
- (7) Install the remote handle on the drain valve.

4-18. PUMP, PIPING, AND VALVES - Continued**4-18.7. Pressure Relief Valve****This task covers**

- a. Removal
- b. Installation
- c. Test

TOOLS

Tool Kit, Master Mechanic,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant
20-1 Relief Valve

EQUIPMENT CONDITION

All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

NOTE

Access to the pressure relief valve can be gained via the removable pump body access panel.

REMOVAL

- (1) Remove the pressure relief valve (1) from the discharge manifold coupling (2).
- (2) Clamp the body of the pressure relief valve (1) in a vise.
- (3) Using a pipe wrench, remove the 90 deg. elbow (3) from the body of the pressure relief valve (1).

INSTALLATION

- (1) Clean and inspect all threads on pressure relief valve (1), discharge manifold coupling (2) and 90 deg. elbow (3) Replace components if threads are stripped or corroded.
- (2) Apply pipe sealant (item 22, Appendix E) to the threads of the 90 deg. elbow (3).
- (3) With the pressure relief valve (1) clamped in a vise, install 90 deg. elbow (3). Ensure the elbow drain is facing down as shown.
- (4) Apply pipe sealant (item 22, Appendix E) to the threads of the pressure relief valve (1) and install into the discharge manifold coupling (2). Ensure the 90 deg. elbow (3) faces the rear of the truck.

4-18. PUMP, PIPING, AND VALVES - Continued**TEST**

- (1) With the valve installed in the truck, start the fire pump in the structural mode, see para. 2-11.
- (2) With no hoses open, screw in engine throttle until pump outlet pressure approaches 270 psi (1860 kPa).
- (3) While watching the pressure relief valve discharge, continue to increase pump speed up to a maximum of 275 psi (1900 kPa).
- (4) Reduce throttle and shutdown the pump, see para. 2-11.
- (5) Replace valve if valve does not relieve at set pressure.

4-18. PUMP, PIPING, AND VALVES - Continued

4-18 8 Automatic and Manual Drain Valves.

This task covers a. Replacement

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

MATERIALS/PARTS

22, Appendix E Pipe Sealant
00053720 Auto Drain Valve
311467-02 Manual Drain Valve

EQUIPMENT CONDITION

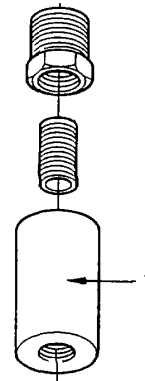
All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

An automatic drain valve is installed on roof turret and bumper turret. Manual drain valves are installed on each discharge valve, the pump discharge pipe, and the turret water line beneath the engine. Pump body heat shield must be removed to access the pump. A similar valve is also installed on the hose reel. Remove hose reel cover to access.

REPLACEMENT

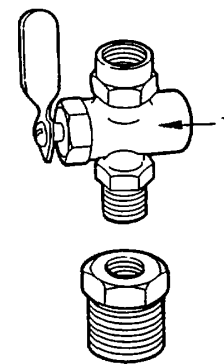
a Automatic Drain Valve Replacement

- (1) Remove the automatic drain valve (1) and discard.
- (2) Inspect new valve and fitting threads for stripped threads or other damage. Replace any component failing inspection.
- (3) Apply pipe sealant (item 22, Appendix E) to the threads and install automatic drain valve.



b. Manual Drain Valves Replacement (1). Remove remote handle from drain valve.

- (2) Remove manual drain valve (1) and discard.
- (3) Inspect new valve and fitting threads for stripped threads or other damage.
- (4) Apply pipe sealant (item 22, Appendix E) to the threads and install manual drain valve (1). Be sure the handle is easily accessible and not interfering with any other components.
- (5) Install remote handle on drain valve.



4-18. PUMP, PIPING, AND VALVES Continued

4-18.9 1 1/2 Inch Drop-Out Ball Valve.

This task covers

- a. Removal
- b. Installation

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

EQUIPMENT CONDITION

All Piping Drained
 Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Heat Shields Removed (see para. 4-11) (as required)

MATERIALS/PARTS

14, Appendix E Silicone Grease
 22, Appendix E Pipe Sealant
 29, Appendix E Threadlock Liquid
 57395 O-ring Spacer
 57321 O-ring Actuator Shaft
 57348 O-ring Pivot Bolt
 57338 O-ring Body
 63821 Seat
 57421 O-ring Seat
 57318 O-ring Retainer

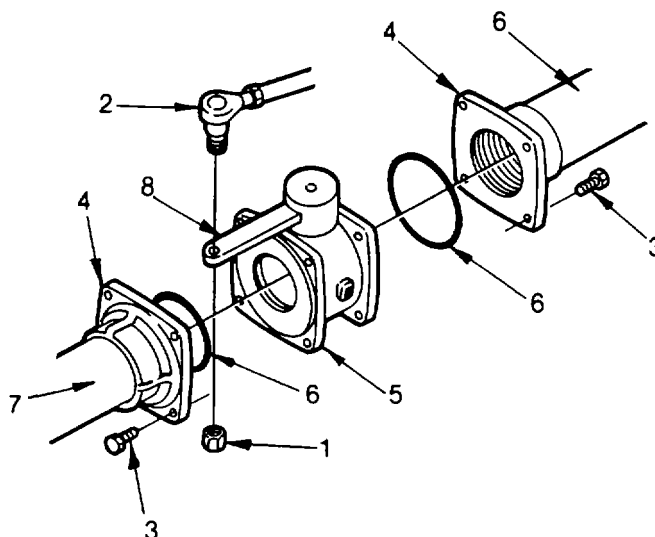
NOTE

The following valves are 1 1/2 in. drop-out ball valves.

- a. Tank fill (from discharge manifold)
- b. Bumper Turret Manual
- c. Cross-lay hose bed (2 off)

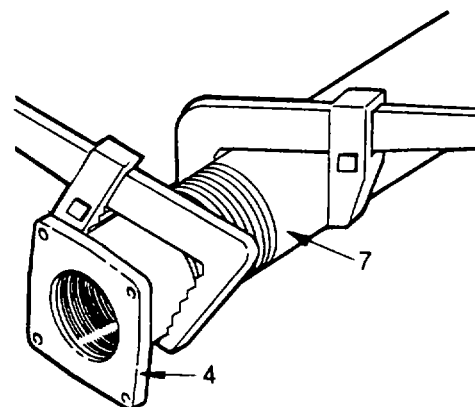
NOTE

This removal procedure is used for all 1 1/2 in. ball valves regardless of their location on the firefighting system.



4-18. PUMP, PIPING, AND VALVES - Continued**REMOVAL**

- (1) Remove nut (1) and separate the control rod linkage (2) control handle (8).
- (2) Set control handle (8) to the open position to eliminate damage to the ball during removal of the valve body (5).
- (3) Remove the capscrews (3) that retain the end caps (4) to the valve body (5). Some valve bodies are connected to piping on one end only.
- (4) Slide valve body (5) from between end caps (4).
- (5) Remove O-rings (6) from valve body (5) grooves and discard.
- (6) If pipe replacement is necessary, remove the end cap (4) from the pipe (7) using two pipe wrenches
- (7) Apply pipe sealant (item 22, Appendix E) to the threads of the new pipe and install the end caps (4). Be sure to install the end cap so that it will line up with the valve body and opposite end cap.

**INSTALLATION**

- (1) Lubricate the O-rings (6) using silicone grease (item 27, Appendix E) and install into the valve body (5) grooves.
- (2) Set the control handle (8) to the open position to eliminate damage to the ball during installation of the valve body (5).
- (3) Carefully install the valve body (5) between the end caps (4). Ensure the O-rings (6) are not damaged during installation.
- (4) Apply threadlock liquid (item 29, Appendix E) to the capscrew (3) and install the capscrews (3) through end caps (4) into valve body (5). Tighten until snug. Do not overtighten.
- (5) Attach the control rod linkage to the control handle (8). Install the nut (1) onto ball joint and tighten firmly.
- (6) Test valve operation by actuating lever on structural control panel a few times.

4-18. PUMP, PIPING, AND VALVES-Continued

4-18.10 Foam Piping, Couplings, and Valves

This task covers Replacement

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

LEGEND

- 22, Appendix E,
- 1. 102190
- 2. Style 75-1.5
- 3. 102189
- 4. 102187
- 5. 102176
- 6. 102183
- 7. 102202
- 8. 101638-084
- 9. 101638-156
- 10. Fig 1105-1.5
- 11. 101638-036
- 12. 253530
- 13. 2024-24-24S
- 14. 101638-060
- 15. 102272
- 16. 2021T-24-24S
- 17. 92-105"
- 18. 102256
- 19. 2565-23
- 20. 102247
- 21. 101638-180
- 22. 1.5-21-1136-TTO
- 23. 101830-01
- 24. HS 40
- 25. DCH 2250

MATERIALS/PARTS

- Pipe Sealant
- Elbow Assembly
- Victaulic Coupling
- Elbow Assembly
- Tee Assembly
- Actuator Valve
- Pipe Weldment
- Pipe Weldment
- Hose x 84.0" L
- Hose x 156.0" L
- Tee Fitting
- Hose x 36.0" L
- Meter Valve
- Elbow Fitting
- Hose x 60.0 in. L
- Mounting Bracket - Meter Valve
- Adaptor Fitting
- Check Valve
- Elbow Assembly
- Eductor
- Reducer Weldment 2" 1.5" NPT
- Hose x 180.0" L
- Ball Valve
- Nipple 1 1/2 NPT x 2.38 LG
- Hose Clamp 2 1/2"
- Silicone Hose

EQUIPMENT CONDITION

- All Piping Drained
- Pump Access Panels Removed (as required)
- Main Engine Shutdown (see para. 2-10)
- APU Shutdown (see para. 2-12)
- Batteries Disconnected (see para. 4-24)
- Heat Shields Removed (see para. 4-11) (as required)
- Foam Tank Drained (see para. 2-13) (as required)

PERSONNEL REQUIRED - 2

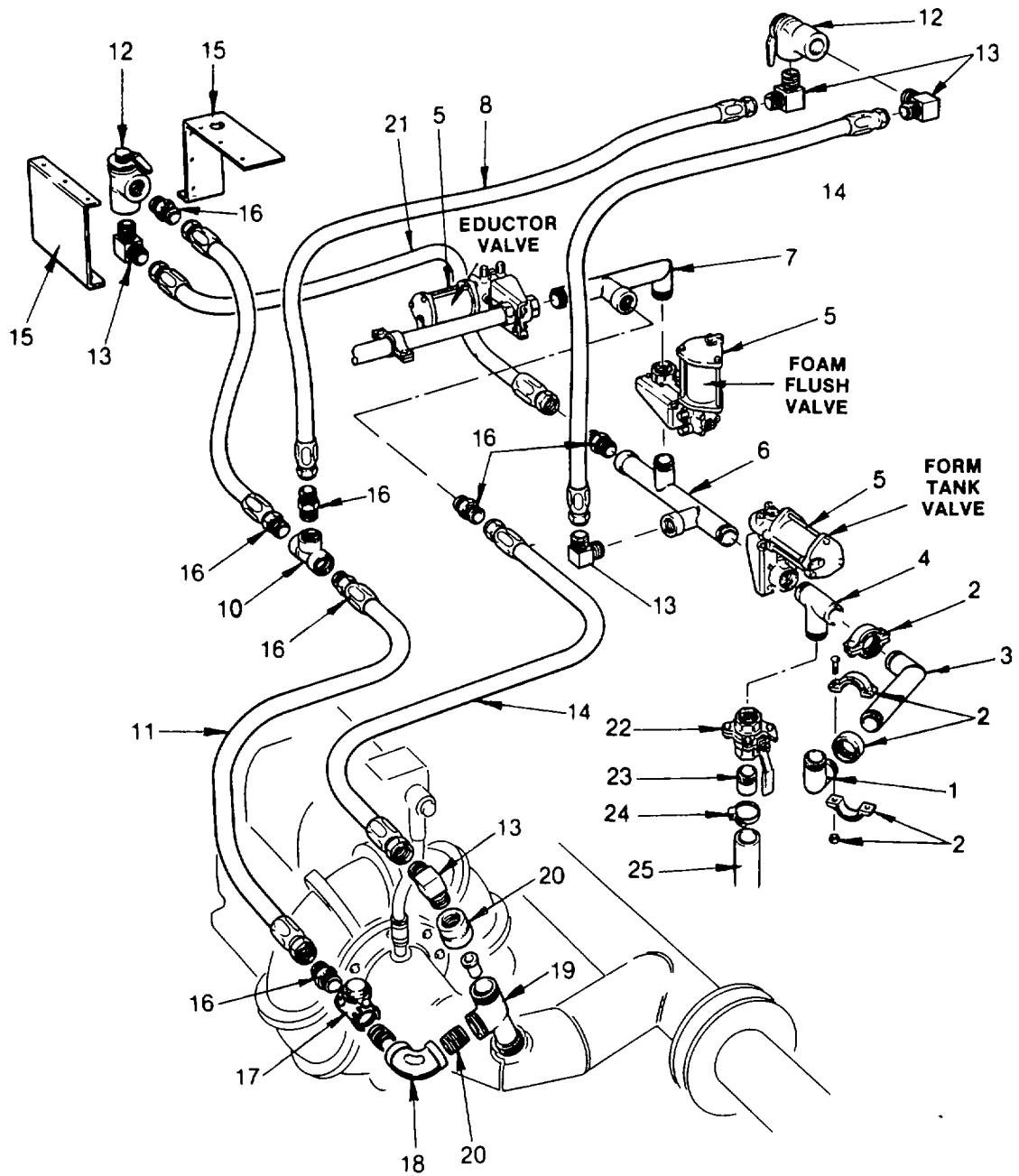
REPLACEMENT

Replace damaged piping, hoses, or valves using the illustration and MATERIALS/PARTS legend as a guide.

Replace the couplings and valves using the following procedures

- Victaulic Coupling see para. 4-18.3
- Drain Valve see para. 4-18.6
- Air Actuated Ball Valve see para. 4-18.11
- Air Actuator Repair see para. 4-18.12
- Foam Metering Valve see para. 4-18.13
- Foam Eductor Check Valve see para. 4-18.14
- Foam Eductor see para. 4-18.15

4-18. PUMP, PIPING, AND VALVES-Continued



4-18. PUMP, PIPING, AND VALVES-Continued

4-18.11 Air Actuated Ball Valves.

This task covers

- a. Removal
- b. Installation
- c. Adjustment

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

EQUIPMENT CONDITION

All Piping Drained
 Foam Tank Drained (see para. 2-13)
 Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Pump Body Heat Shield Removed (see para. 4-11.2)

MATERIALS/PARTS

11, Appendix E Electrical Tape
 22, Appendix E Pipe Sealant

NOTE

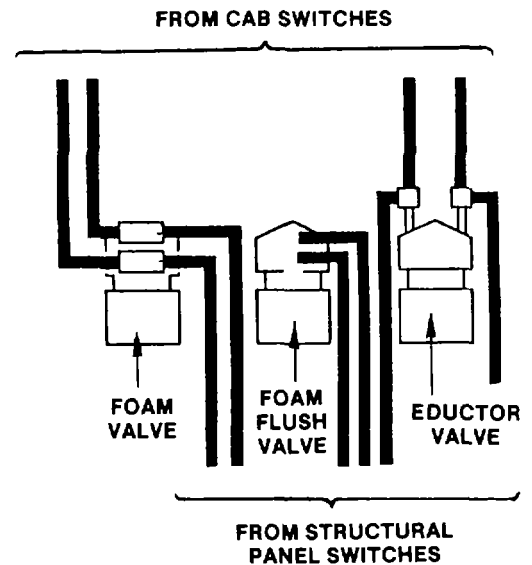
The following is a general remove/install procedure. To remove/install a specific air actuating ball valve use the following illustration as a guide. It may be necessary to remove the actuator prior to ball valve removal.

REMOVAL

- (1) Disable the switching system by setting the cab MODE switch to mid-position. Tag this switch identifying 'Repairs in Progress'.
- (2) Bleed the air from the actuator by setting the cab WATER EDUCTOR and FOAM VALVE switch to mid-position.
- (3) Bleed the structural panel air lines by setting the FOAM VALVE, WATER EDUCTOR and FLUSH switches to mid-position.
- (4) Tag and remove the air lines from the air actuated ball valve being removed. Tagging will ensure proper assembly.

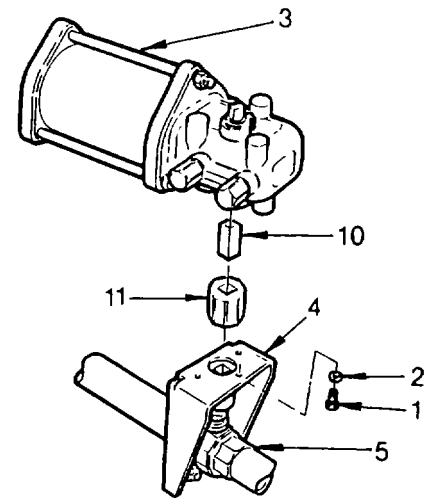
NOTE

If only the ball valve is being removed it is acceptable to leave air lines connected and to suspend the actuator from the frame using mechanics wire.



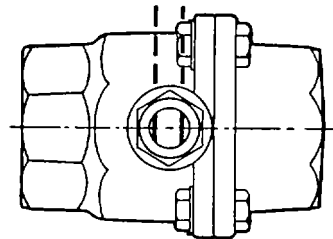
4-18. PUMP, PIPING, AND VALVES-Continued

- (5) If the actuator has to be separated from valve to allow removal of valve, remove the three capscrews (1) and lockwashers (2) that retain the actuator (3) to the bracket (4).
- (6) Separate the actuator (3) from the bracket (4). Remove the reducer (10) and coupling (11) and retain for installation.



- (7) Mark the position of the ball valve prior to removal.
- (8) Using two pipe wrenches, unscrew the ball valve (5) from the piping system.
- (9) Inspect the foam piping and ball valves for stripped or corroded threads. Replace defective parts.
- (10) Repair air actuator following procedures outlined in para. 4-18.12.

**VALVE CLOSED
VALVE STEMS FLATS
ARE PERPENDICULAR
TO WATER FLOW**

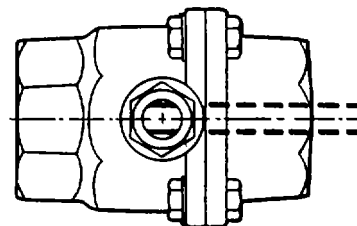


INSTALLATION

- (1) Apply pipe sealant (item 22, Appendix E) to the threads and install the ball valve onto one pipe end. Be sure the valve is positioned the same as noted in REMOVAL preceding.
- (2) Install the second pipe into the ball valve. Be sure the piping is in the same position as prior to removal.

NOTE

Actuator should be remounted on the ball valve from which it was removed. Adjust actuator stops each time valve is remounted.

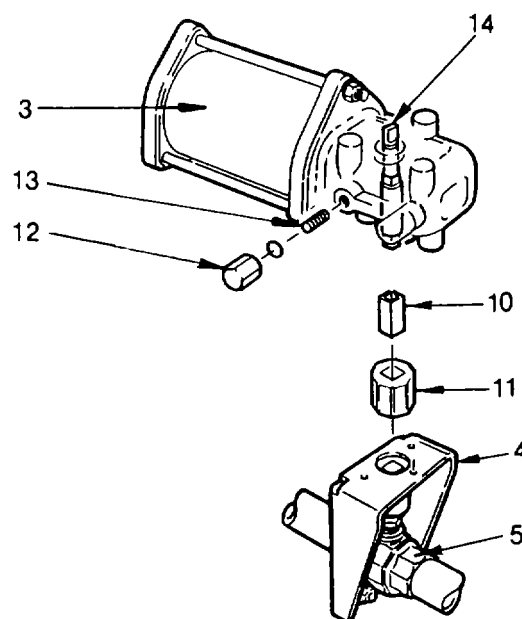
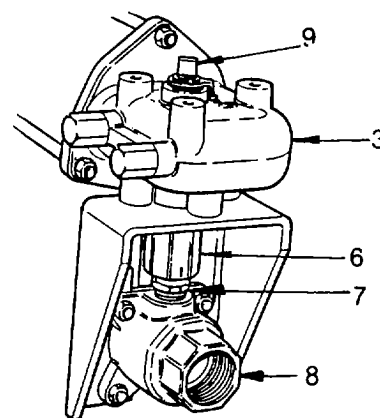


**VALVE OPENED
VALVE STEMS FLATS
IN LINE WITH
WATER FLOW**

- (3) Before installing actuator, it is necessary to know the open and closed position of the valve.
- (4) Install the coupling onto the valve stem. It will be necessary to apply a small piece of electrical tape (item 11, Appendix E) to obtain a tight fit between the valve stem and coupling. This will hold the coupling in place while adjustments are made.

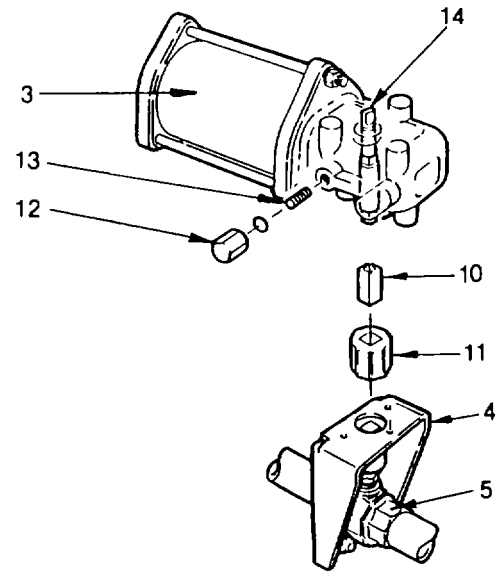
4-18. PUMP, PIPING, AND VALVES-Continued**4-18.11 Air Actuated Ball Valves-Continued**

- (5) Turn the valve stem so the ball is in the fully open position. Scribe one mark on the coupling (6) and one mark on the stem nut (7) or body (8). Be sure the scribe marks will be visible once the actuator is installed.
- (6) Turn the valve stem counterclockwise until the ball is in the fully closed position.
- (7) Scribe another mark on the coupling (6) to match up with the mark on the stem nut (7) or body (8).
- (8) Ensure the actuator (3) is in the fully open or closed position. Using plier wrench clamped on driver (9) turn it until the driver arm contacts a stop setscrew.
- (9) Using a plier wrench turn the ball valve to the position indicated by the actuator indicator.
- (10) Install the reducer (10) into the coupling (11).
- (11) Install actuator (3) onto mounting bracket (4). Aline driver (14) with the reducer (10), and aline the mounting holes. Install capscrews (1) and washers (2) and tighten until snug.
- (12) Connect air lines as tagged in REMOVAL preceding.



4-18. PUMP, PIPING, AND VALVES-Continued

- (13) Remove acorn nuts (12) from the stop set-screws (13) of the actuator (3).
- (14) Change position of relevant structural panel FOAM VALVE, WATER EDUCTOR and FLUSH switches to 'CLOSED'.
- (15) Change the position of the cab WATER EDUCTOR and FOAM VALVE switch to 'CLOSED'.
- (16) Pressurize the structural panel switches by setting the MODE switch to 'STRUCT'.
- (17) Set the relevant structural panel switch to OPEN to check the adjustment of the fully open stop setscrew.
- (18) Check scribe marks for proper alinement. If alined go to step 24.
- (19) If adjustment is necessary, release pressure from actuator by setting relevant structural panel switch to 'EM'.
- (20) Adjust the fully open stop setscrew in or out 1/2 turn at a time.
- (21) Repeat step 19 thru 22 until the scribe mark on the coupling alines with the scribe mark on the stem nut or body.
- (22) Install and tighten acorn nut while the actuator is pressurized in the fully open position.
- (23) Set the relevant structural panel switch to CLOSED to check the adjustment of the fully closed stop setscrew.
- (24) Check scribe marks for proper alinement. If alined go to step 28.
- (25) If adjustment is necessary repeat steps 19 thru 22, but for the CLOSED position.
- (26) Install and tighten acorn nut while the actuator is pressurized in the fully closed position.



4-18. PUMP, PIPING, AND VALVES-Continued

4-18.12 Actuator Repair.

This task covers

- a. Disassembly
- b. Inspection
- c. Assembly

TOOLS

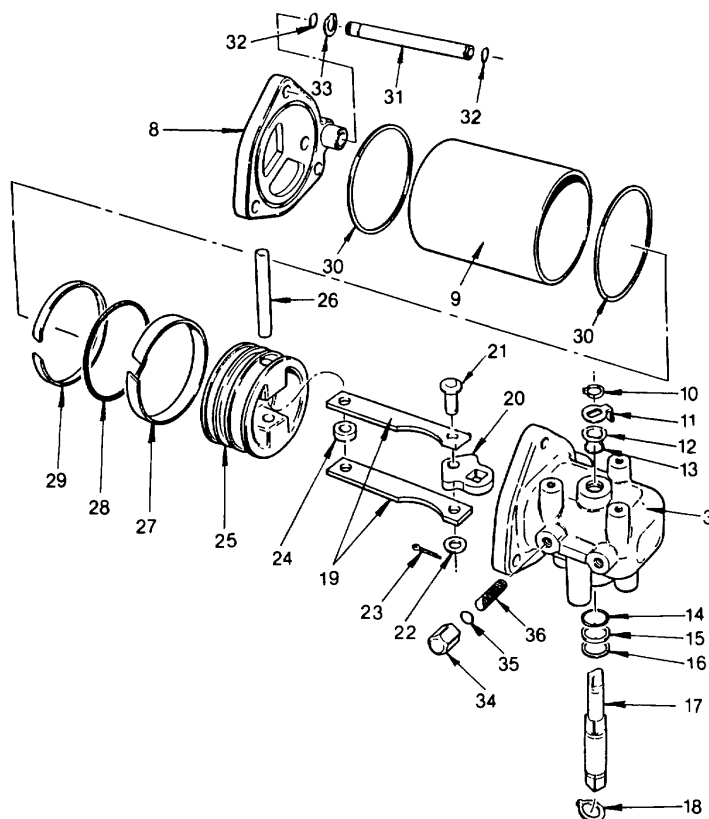
Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Air Actuated Ball Valve Removed From Truck
(see para. 4-18.11)

MATERIALS/PARTS

- 27, Appendix E Silicone Grease
- 005-0006-51 Upper Drive Seal
- 006-0376-63 Piston Bearing (Wide)
- 006-0377-63 Piston Bearing
- 005-0236-51 Piston Seal
- 036-0411-98 Gasket
- 005-0066-51 Stop Screw Seal
- 005-0067-51 Tube Seal
- 005-0030-51 Lower Drive Seal

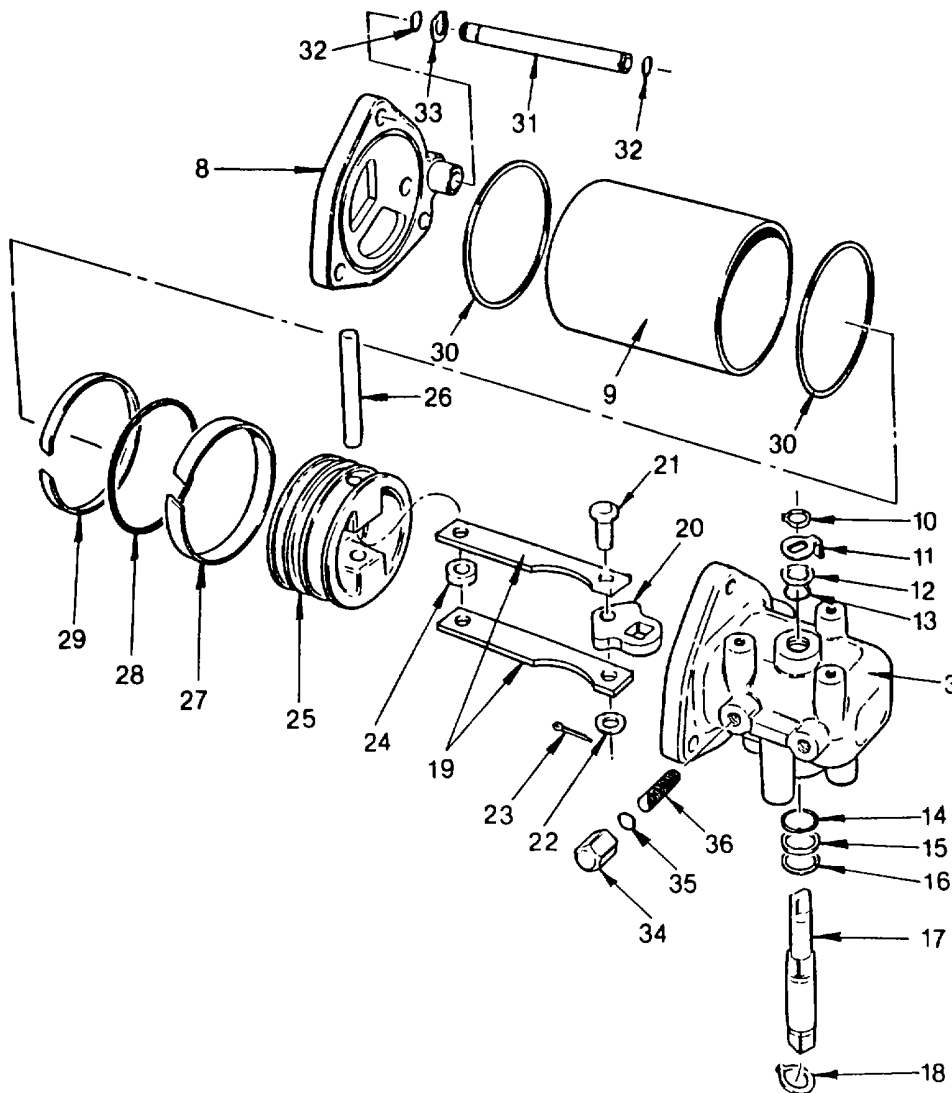


4-18. PUMP, PIPING, AND VALVES-Continued**DISASSEMBLY**

- (1) Remove the three capscrews (1) and lockwashers (2) that retain the actuator cylinder body (3) to the bracket (4).
- (2) Separate the actuator from the bracket. Retain the coupling and reducer which are linkage components between the ball valve and actuator.
- (3) Remove three nuts (5), lockwashers (6) and pull tie rods (7) from end cap (8).
- (4) Separate the end cap (8) from the cylinder (9) and remove the transfer tube assembly (31).
- (5) Pull the cylinder (9) away from the cylinder body (3) until it separates from the piston (25).
- (6) Remove two gaskets (30), one on each side of the cylinder (9).
- (7) Lightly clamp cylinder body (3) in a vise.
- (8) Remove the retaining ring (10), indicator pointer (11), and the pointer bearing (12)/
- (9) Support the piston end of connector plates and, lightly tap the top of the driver (17) until it drops through the cylinder body (3).
- (10) Remove the acorn nuts (34), stop screw seals (35), and stop screws (36) from the cylinder body (3).
- (11) Remove retaining ring (18) from driver (17).
- (12) Remove the back up washer (16), driver seal retainer (15), and lower drive seal (14) from the driver (17).
- (13) Remove upper driver seal (13) from the cylinder body (3).
- (14) Remove cylinder body (3) from the vise.
- (15) Remove piston bearings (27 and 29) from the piston (25).
- (16) Remove piston seal (28) from the piston (25).
- (17) Remove pivot pin retainer (23) and pivot pin washer (22) from the pivot pin (21). Pull the pivot pin from the connector plates (19) and remove the driver arm (20).
- (18) Remove piston pin (26) from piston (25). Then remove the connector plates (19) and the connector plate spacer (24) from the piston.

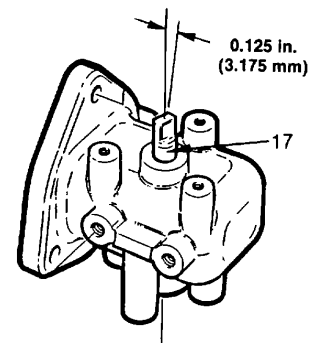
4-18. PUMP, PIPING, AND VALVES-Continued

4-18.12 Actuator Repair-Continued



INSPECTION

- (1) Discard all O-rings, seals and gaskets.
- (2) Inspect all sealing and mating surfaces for nicks, burrs, or scratches that may damage new seals during assembly.
- (3) Inspect cylinder (9) inner bore and piston (25) for scoring, pitting, dents, or cracks. Replace both components if one is found to be defective.
- (4) Install driver (17) into cylinder body driver hole and check for out-of-round or looseness between the two components. Replace cylinder body and driver if play exceeds 0.125 in. (3.175 mm).



4-18. PUMP, PIPING, AND VALVES-Continued

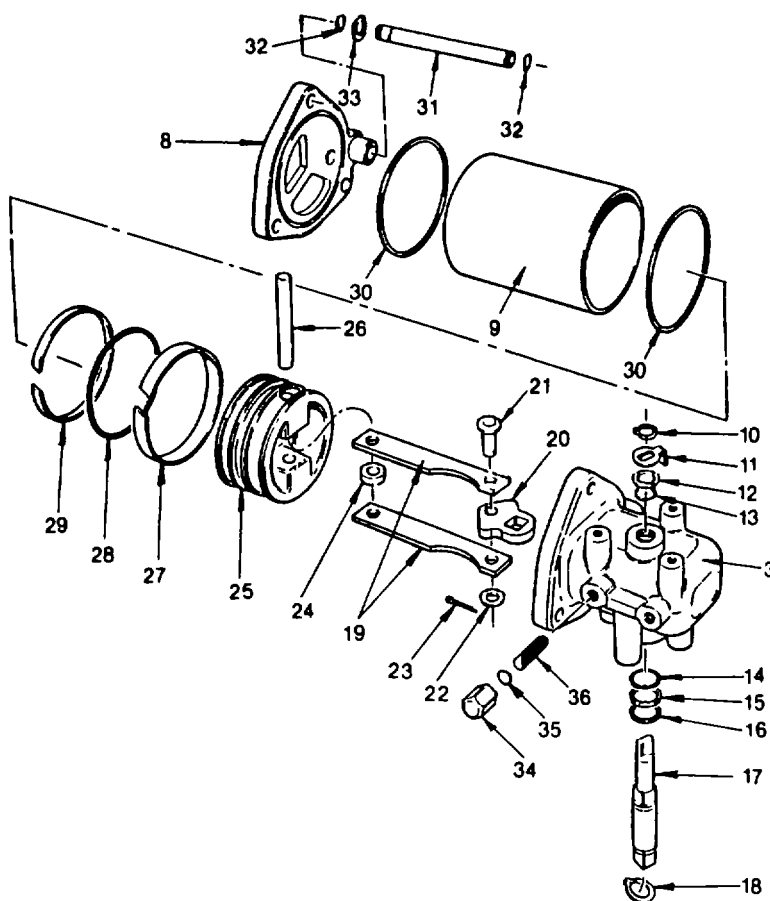
- (5) Inspect piston (25), connector plates (19), and driver arm (20) pivot holes for being out-of-round. Replace as necessary
- (6) Inspect piston pin (26) and pivot pin (21) for grooves, bends, or damage that will not allow the valve to operate properly.
- (7) Install driver arm (20) onto driver (17). Apply an opposing to and fro twisting action to the driver arm while holding the driver. If the driver arm twists more than 0.125 in. (3.175 mm) replace both components.
- (8) Inspect transfer tube (31) for corrosion, dents, or for being out-of-round. Replace transfer tube if any damage is found.

ASSEMBLY

- (1) Lubricate the upper drive seal (13) with silicone grease (item 27, Appendix E) and insert the seal into the driver hole of the cylinder body (3).
- (2) Lubricate the pivot pin (21) with silicone grease (item 27, Appendix E). Install one connector plate (19), driver arm (20), the second connector plate (19), and the pivot pin washer (22) on pivot pin (21). Install the pivot pin retainer (23) into the pivot pin (21) and spread the prongs apart.
- (3) Lubricate the driver (17) and seals using silicone grease (item 27, Appendix E). Install the lower drive seal (14), drive seal retainer (15) and back-up washer (16) onto the driver (17).
- (4) Install retaining ring (18) onto driver (17).
- (5) Insert the driver arm/connector plate assembly into the cylinder body (3) opening and center it with the driver hole in the cylinder body. Be sure recess on connection plates faces the stop screw side of the body as shown.
- (6) Install the driver (17) into the cylinder body (3). Engage the square drive of the driver (17) with the square hole in the driver arm (20).
- (7) Install the pointer bearing (12) and indicator pointer (11).
- (8) Install the retainer ring (10) onto the driver (17).
- (9) Lubricate gasket (30) and install into cylinder body (3) groove.
- (10) Assemble piston end of connecting plates insert the connector plate spacer (24) between the connector plates (19).
- (11) Carefully slide piston (25) onto connector plates (19). Aline the holes and install the piston pin (26). Lubricate the piston bearings (27 and 29) and seal (28) with silicone grease (item 27, Appendix E) and install on the piston.
- (12) Lubricate the cylinder (9) inner bore with silicone grease (item 27, Appendix E) and install the piston assembly. Slide the cylinder until it contacts the cylinder body (3).

4-18. PUMP, PIPING, AND VALVES-Continued

4-18.12 Actuator Repair-Continued



- (13) Lubricate seals (32) with silicone grease (item 27, Appendix E) and install one on each end of the transfer tube (31).
- (14) Insert snap ring end of transfer tube (31) into the end cap (8).
- (15) Lubricate gasket (30) with silicone grease (item 27, Appendix E) and install into the groove of the end cap (8).
- (16) Aline the transfer tube (31) with the hole in the cylinder body (3) and aline the end cap (8) with the cylinder (9), then push into place.
- (17) Install three tie rods (7) through the end cap (8) and through the cylinder body (3) holes. Install three lockwashers (6) and nuts (5) and torque to 15 ft lb (22 Nm).
- (18) Install stop screws (36) and stop screw seals (35) into cylinder body (3). Leave the acorn nuts (34) off until actuator stops have been adjusted.
- (19) Install the air actuator assembly as detailed in para. 4-18.11 INSTALLATION.

4-18. PUMP, PIPING, AND VALVES-Continued**4-18.13 Foam Metering Valve.****This task covers**

- a. Removal
- b. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Foam Tank Valve Closed (see para. 2-11)

MATERIALS/PARTS

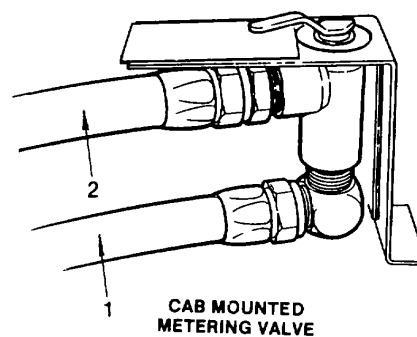
22, Appendix E Pipe Sealant
27, Appendix E Silicone Grease
00253530 Foam Metering Valve

NOTE

There are two metering valves used on the truck. One is mounted in the cab, and the other is mounted on the structural control panel.

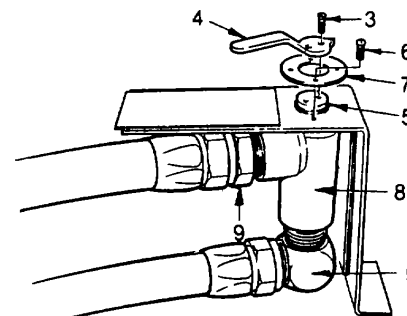
REMOVAL

- (1) Tag and remove the inlet (1) and the outlet hoses (2) from the metering valve.
- (2) Remove two machine screws (3) that retain the handle (4) to the extension plug (5).
- (3) Remove the two machine screws (6) that retain the body (8) and dial (7) to the mounting bracket.
- (4) Remove the metering valve from the mounting bracket and clamp in a vise.



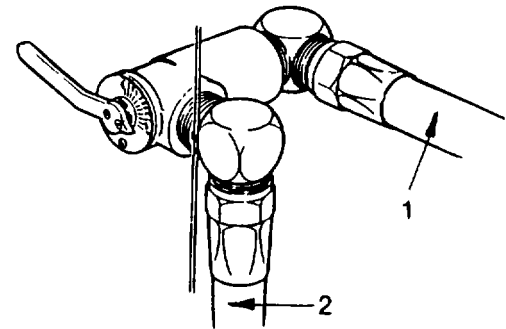
NOTE
Mark the position of the fittings prior to removal to ensure proper assembly.

- (5) Remove the fittings (9) from the body (8).



4-18. PUMP, PIPING, AND VALVES-Continued**INSTALLATION**

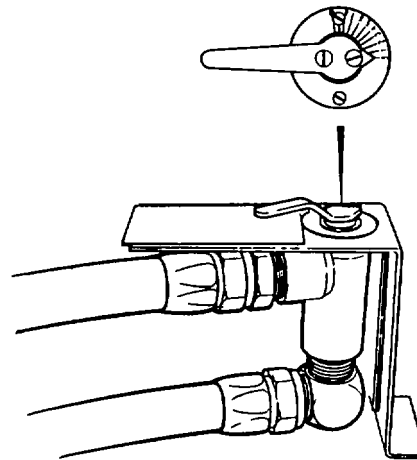
- (1) Clean the fitting and body threads and inspect threads for corrosion, stripped threads or cracks.
- (2) Inspect hoses and hose end fittings. Replace as required.
- (3) Clamp the body (8) in a vise. Do not overtighten. This could damage the valve body.
- (4) Apply pipe sealant (item 22, Appendix E) to the threads and install fittings (9) into body (8). Be sure orientation of fittings is same as noted in REMOVAL preceding. Remove body from vise.



**STRUCTURAL
PANEL MOUNTED
METERING VALVE**

NOTE

Dial and handle can be positioned in any of the four quadrants. Be sure to position valve and handle in the same orientation as shown.



- (5) Position metering valve beside the mounting bracket and aline the mounting holes of the body (8), mounting bracket, and dial (7).
- (6) Install two machine screws (6) and tighten firmly.
- (7) Position the handle (4) over the extension plug (5). Install two capscrews (3) and tighten firmly. Be sure the handle indicates the plug position in relation to the body.
- (8) Install inlet and outlet hoses (1 and 2).
- (9) Start firefighting system as detailed in para. 2-11. Tighten/remake any leaking connections.

4-18. PUMP, PIPING, AND VALVES-Continued**4-18.14 Foam Check Valve.****This task covers**

- a. Removal
- b. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

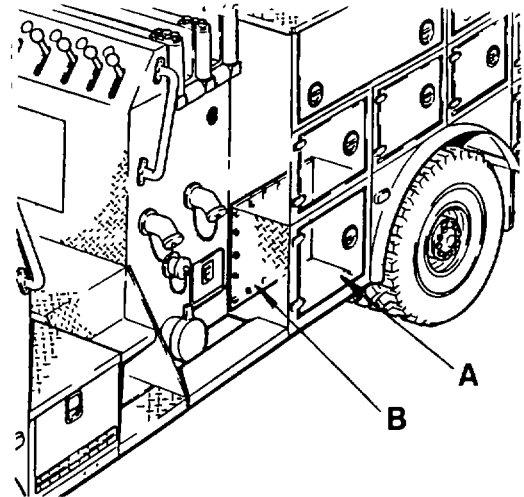
All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body Heat Shield Removed (see para. 4-11.2)

MATERIALS/PARTS

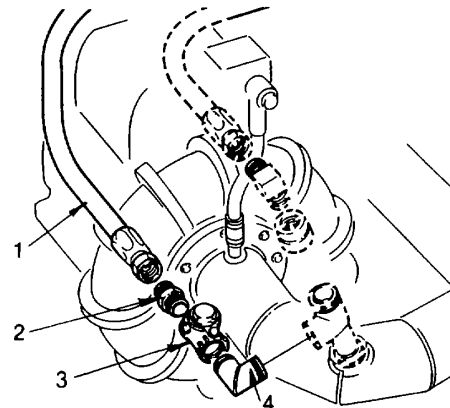
22, Appendix E Pipe Sealant
92-105" Check Valve

REMOVAL

- (1) Open compartment door (A) and remove all equipment.
- (2) Remove the box rear plate (B).
- (3) Remove the foam supply hose (1) and nipple (2).
- (4) Remove the check valve (3) from the elbow (4).

**INSTALLATION**

- (1) Apply pipe sealant (item 22, Appendix E) to threads and install check valve (3) onto elbow (4). Ensure the check valve is installed so the flap is vertical and the flap pivot is uppermost.
- (2) Apply pipe sealant (item 22, Appendix E) to the threads and install nipple (2).
- (3) Install and tighten foam supply hose (1) to the nipple (2).
- (4) Replace box rear plate (B).
- (5) Install equipment in compartment box.
- (6) Start firefighting foam system as detailed in para. 2-11. Tighten/remake any leaking connections.



4-18. PUMP, PIPING, AND VALVES-Continued**4-18.15 Foam Eductor.****This task covers**

- a. Removal
- b. Installation

TOOLS

Shop Equipment, Automotive
Maintenance And Repair,
NSN 4910-00-754-0650

EQUIPMENT CONDITION

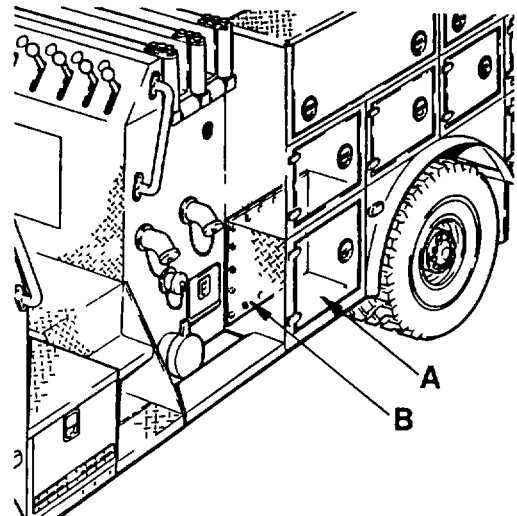
All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

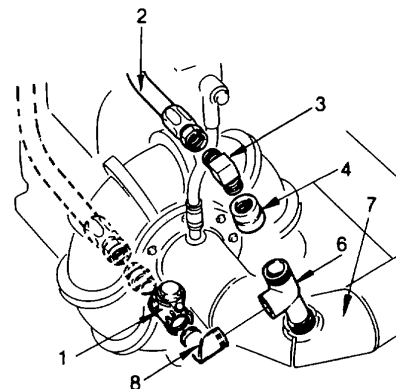
22, Appendix E Pipe Sealant
2565-23 Foam Eductor

REMOVAL

- (1) Open compartment door (A) and remove all equipment.
- (2) Remove the box rear plate (B).
- (3) Remove check valve (1) as detailed in para. 4-18.14.
- (4) Remove hose (2) and elbow (3).
- (5) Remove elbow (8) from eductor (6).
- (6) Remove the eductor (6) from the suction tee fitting (7).
- (7) Clamp eductor in a vise. Do not overtighten, this could damage the body.
- (8) Remove reducer (4) from eductor.

**INSTALLATION**

- (1) Make sure all fitting and valve threads are clean and undamaged. Apply pipe sealant (item 22, Appendix E) to threads.
- (2) Clamp eductor in a vise. Do not overtighten, this could damage the body.
- (3) Install reducer (4) onto eductor (6).



4-18. PUMP, PIPING, AND VALVES-Continued

- (4) Install elbow (3) into reducer (4). Be sure elbow orientation is as shown.
- (5) Remove eductor (6) from vise and install into suction tee fitting (7) in orientation shown.
- (6) Install elbow assembly (8) into eductor (6) in orientation shown.
- (7) Install hose end (2) onto elbow (3) and tighten firmly.
- (8) Install check valve as detailed in para. 4-18.14.
- (9) Replace box rear plate (C).
- (10) Install equipment into compartment box.
- (11) Start firefighting foam system as detailed in para. 2-11. Tighten/remake any leaking connections

4-18. PUMP, PIPING, AND VALVES-Continued

4-18.16 Roof Turret.

This task covers

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

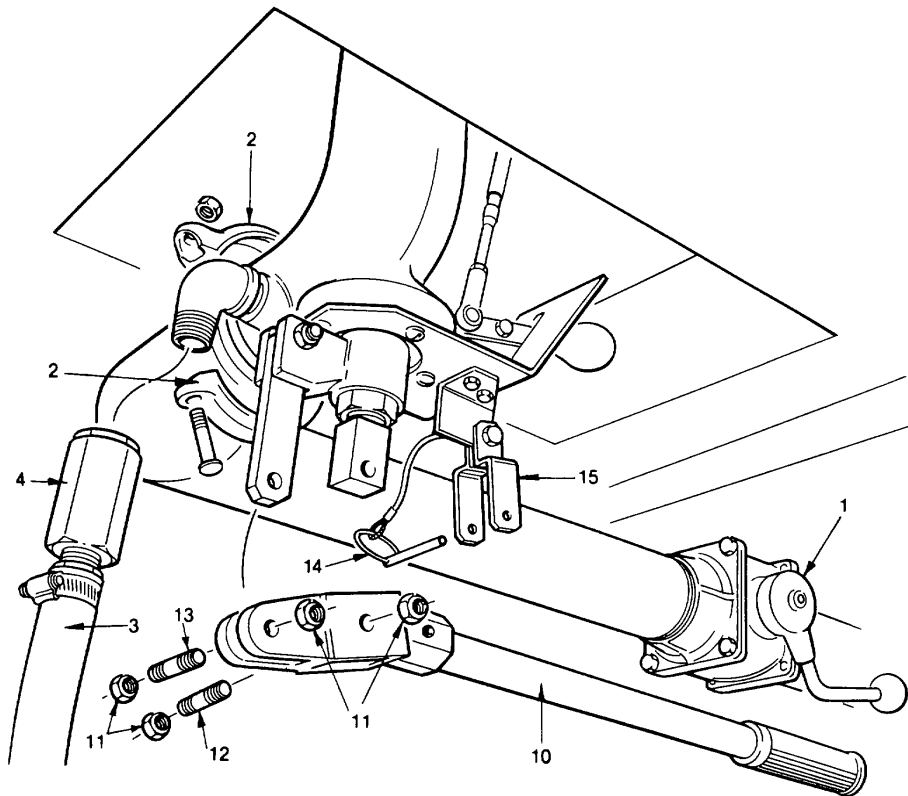
EQUIPMENT CONDITION

All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

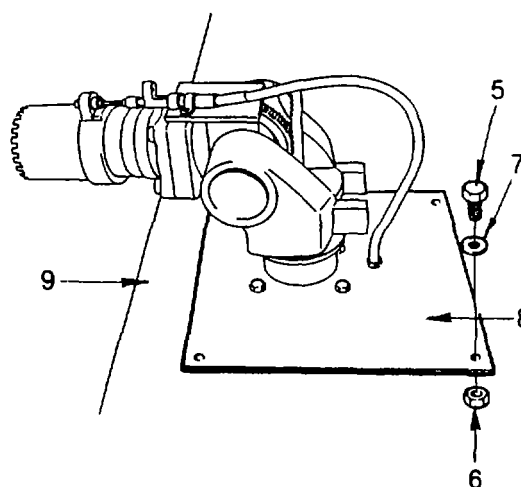
23, Appendix E Pipe Sealant
25, Appendix E Sealant
MS51922-17 Locknut 3/8-16
MS51922-13 Locknut 5/16-24
01229040 Roof Turret

PERSONNEL REQUIRED-2



4-18. PUMP, PIPING, AND VALVES - Continued**REMOVAL**

- (1) Close roof turret ball valve (1).
- (2) Remove victaulic coupling (2), see para. 4-18.3.
- (3) Remove the four locknuts (11) and two studs (12, 13) that retain the handle assembly (10) to the turret. Discard locknuts.
- (4) Pull fast pin (14) from handle lock (15) and remove handle assembly (10).
- (5) Loosen gear clamp and remove hose (3) from automatic drain valve (4).
- (6) Remove automatic drain valve (4), fittings, and street elbow from base of roof turret.
- (7) Remove the four capscrews (5), washers (7), and locknuts (6) that retain the turret mounting plate (8) to the cab roof (9).
- (8) Using a screwdriver, break the sealant bond between the roof (9) and the mounting plate (8).
- (9) Carefully maneuver the roof turret and mounting plate assembly out of truck. It may be necessary to turn roof turret to allow the control handle and bracket to clear the roof turret hole.

**INSTALLATION**

- (1) Clean old sealant from the roof (9) and the mounting plate (8).
- (2) Apply a continuous bead of sealant (item 25, Appendix E) to the perimeter of roof turret hole.
- (3) Lift roof turret assembly onto truck roof and carefully lower it into plate. It will be necessary to turn roof turret to allow the control handle and bracket to clear the roof turret hole.
- (4) Align mounting holes with minimum lateral movement. Apply sealant (item 25, Appendix E) to capscrew shoulders (5), washers (7) and install them into the mounting holes. Install locknuts (6) and tighten to 28 ft lb (38 Nm).
- (5) Apply pipe sealant (item 22, Appendix E) to threads of fittings and assemble as shown.
- (6) Install drain hose (3) onto barbed nipple. Install gear clamp and tighten firmly.
- (7) Install victaulic coupling (2), see para. 4-18.3.
- (8) Lift the handle assembly (10) up to turret and align the mounting holes.
- (9) Install studs (12, 13) and locknuts (11) and tighten to 17 ft lb (23 Nm).

4-18 PUMP, PIPING, AND VALVES - Continued**4-18.16 Roof Turret - Continued**

(10) Lift handle assembly into handle lock (15) and insert fast pin (14).

(11) Operate roof turret to ensure that all controls are functioning properly, see Chapter 2.

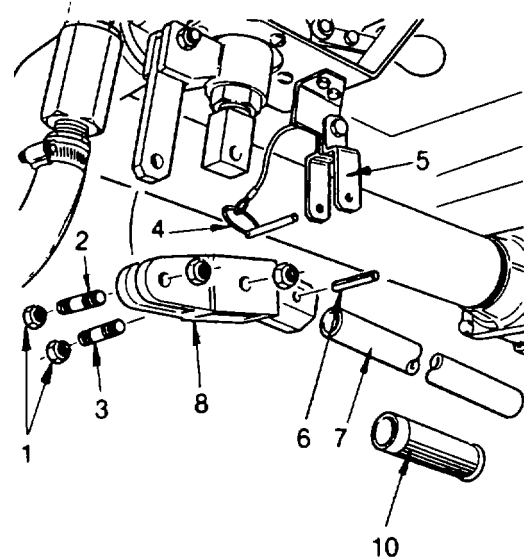
REPAIR

a. Handle Repair

NOTE

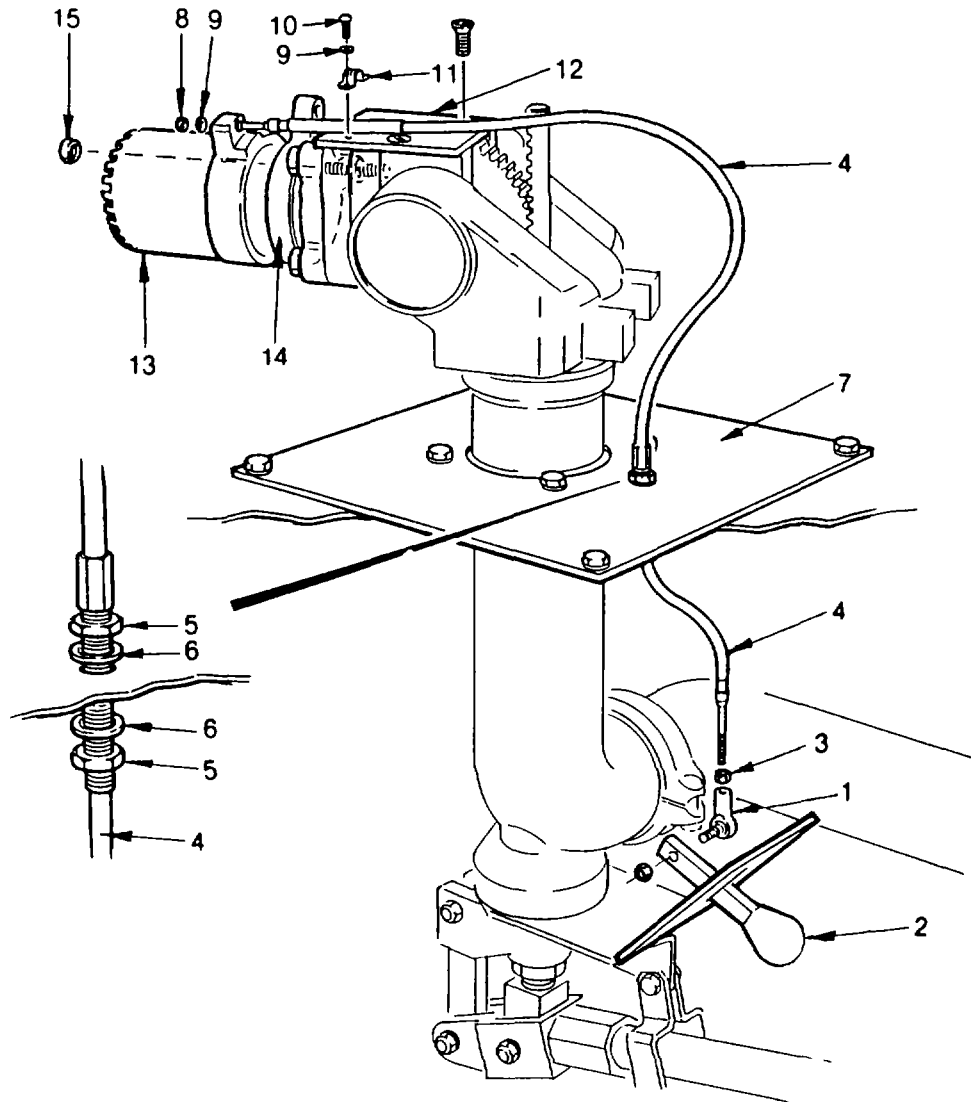
This task can be completed with the turret mounted on the truck.

- (1) Remove the four locknuts (1) and two studs (2 and 3) that retain the handle assembly to the turret. Discard locknuts (1).
- (2) Pull the fast pin (4) from the handle lock (5) and lower handle assembly.
- (3) Remove roll pin (6) and pull handle (7) out of handle holder (8).
- (4) Inspect handle grip (9) for cuts, or deterioration.
- (5) Inspect handle (7) for bends, or oversize roll pin hole.
- (6) Inspect roll pin (6) for wear.
- (7) Inspect handle holder (8) for cracks, oversize stud and roll pin holes or oversize handle hole.
- (8) Evidence of damage of any kind is cause for rejection. Replace parts as necessary.
- (9) Install handle (7) into handle holder (8). Align roll pin holes and insert roll pin (6).
- (10) Raise handle into position. Align handle holder holes with the holes in the column link (10) and swivel block (11) Install studs (2 and 3).
- (11) Install new locknuts (1) onto studs (2 and 3) and tighten to 17 ft lb (23 Nm).
- (12) Raise handle (7) into handle lock (5) and insert fast pin (4).



4-18. PUMP, PIPING, AND VALVES - Continued**4-18.16 Roof Turret - Continued**

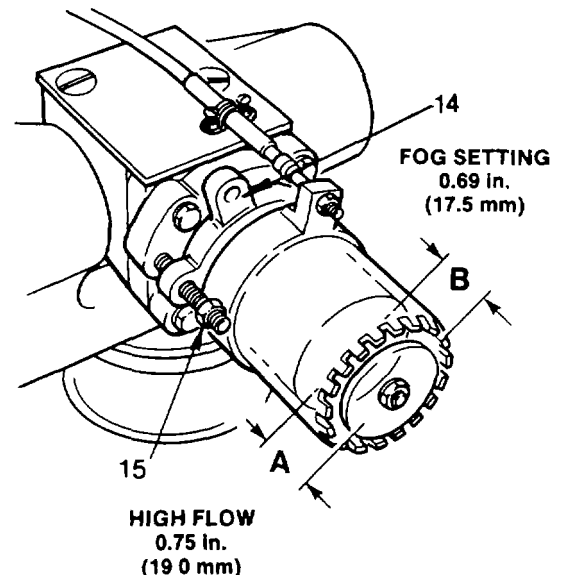
b. Control Cable Repair - Continued



- (5) Loosen the nut (5) clamping the cable conduit to base plate (7).
- (6) Remove nut (5) and seal washer (6) from cable conduit (4).
- (7) Remove nut (8) and lockwasher (9) from nozzle end of cable (4).
- (8) Remove two machine screws (10) and two lockwashers (9) that retain the conduit clamp (11) to the cable mount plate (12). Pull cable (4) out of sleeve boss.
- (9) Pull cable (4) through base plate (7). Remove seal washer (6) and nut (5) from cable conduit (4).

4-18. PUMP, PIPING, AND VALVES - Continued

- (10) Inspect seal washers for deterioration. Replace parts as necessary.
- (11) Prepare new cable for installation as shown. Install upper nut (5) and upper seal washer (6) onto new cable conduit (4). Ensure that only one nut is on the nozzle end of the cable. Remove all hardware and fasteners from control handle end of cable.
- (12) Install nozzle end of cable into the sleeve boss and install lockwasher (9) and nut (8). Tighten nut firmly.
- (13) Attach cable (4) to cable mounting plate (12) using conduit clamp (11), machine screw (10), and lockwasher (9) as shown. Do not tighten screws.
- (14) Install control handle end of cable through opening in base plate (7).
- (15) Install lower seal washer (6) and lower nut (5) onto cable conduit as shown. Tighten lower nut (5) firmly.
- (16) Install jam nut (3) onto control handle end of cable (4).
- (17) Thread end rod ball joint (1) onto cable the same number of turns as recorded in step 3 preceding.
- (18) Install rod end ball joint (1) into control handle (2). Install ball joint attaching nut and tighten firmly to control handle.
- (19) Tighten jam nut (3) against rod end ball joint (1) to lock it in position.
- (20) Set control handle to 'FOG' position.
- (21) Check housing adjustment for proper clearance (A) as shown. This adjustment determines flow rate.
- (22) If adjustment is necessary loosen jam nuts (15). Position housing (14) to obtain 0.75 in. (19.0 mm). Tighten jam nuts firmly.
- (23) Be sure control handle is set to 'FOG' position.
- (24) Check sleeve adjustment for proper clearance (B) as shown. This adjustment determines water pattern.
- (25) If adjustment is necessary loosen conduit clamp machine screws (10). Slide cable (4) in the direction of water flow until sleeve (13) to housing (14) clearance is 0.69 in. (17.5 mm).
- (26) Tighten machine screws (10) immediately after adjustment.



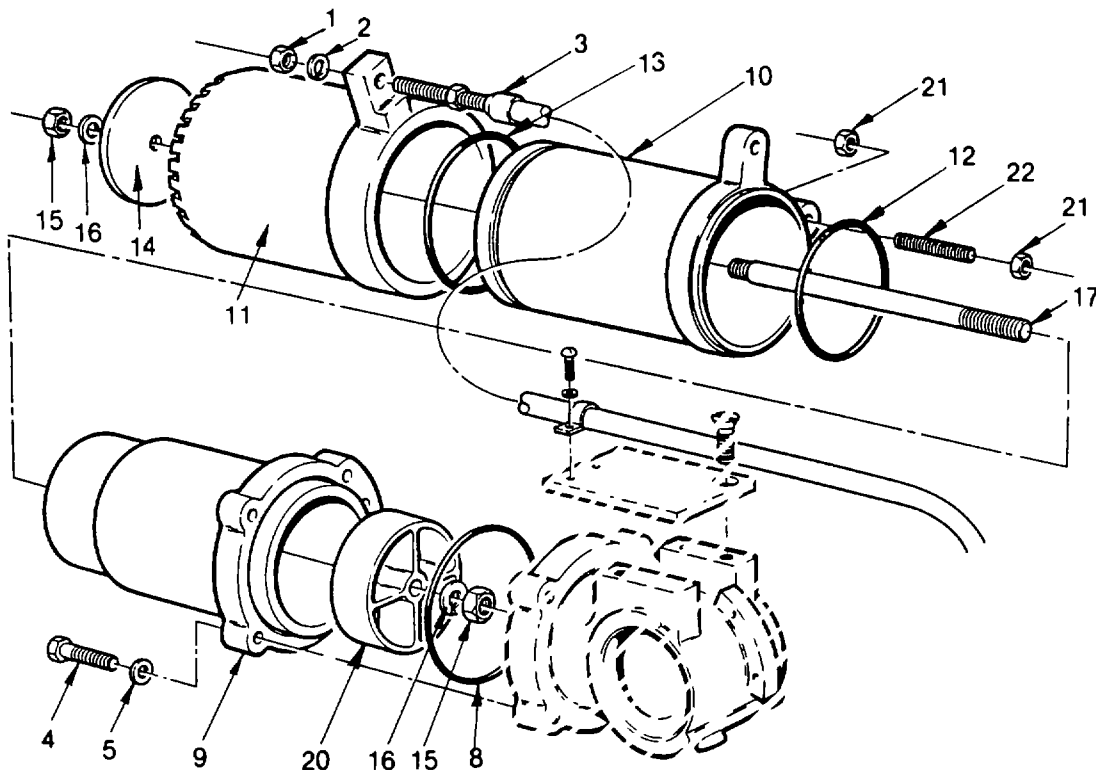
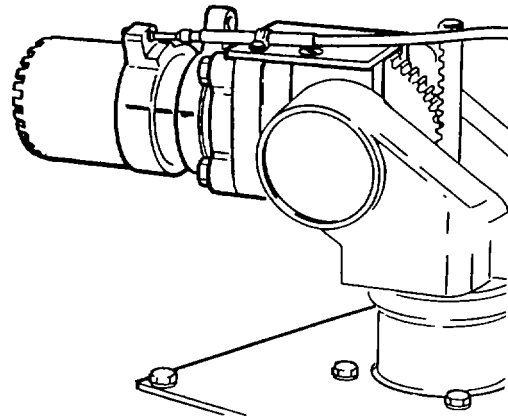
4-18. PUMP, PIPING, AND VALVES - Continued**4-18 16 Roof Turret - Continued**

c. Nozzle Repair

NOTE

This task can be completed with the turret mounted on the truck. Scribe a mark down the side of the nozzle/head assembly to make assembly easier.

- (1) Remove nut (1) and lockwasher (2) from the nozzle end of cable (3).
- (2) Remove four capscrews (4) and lockwashers (5) that retain the nozzle assembly (6) to the head (7).
- (3) Separate the nozzle assembly (6) from the head (7). Remove O-ring (8) and discard.
- (4) Clamp the tip mounting boss (9) in a vise. Be sure to use vise jaw caps to eliminate tip damage. Do not overtighten vise.
- (5) Pull sleeve (11) off the housing (10) and remove O-ring (13) and discard.
- (6) Remove jam nut (15), lockwasher (16), and button (14) from button shaft (17).



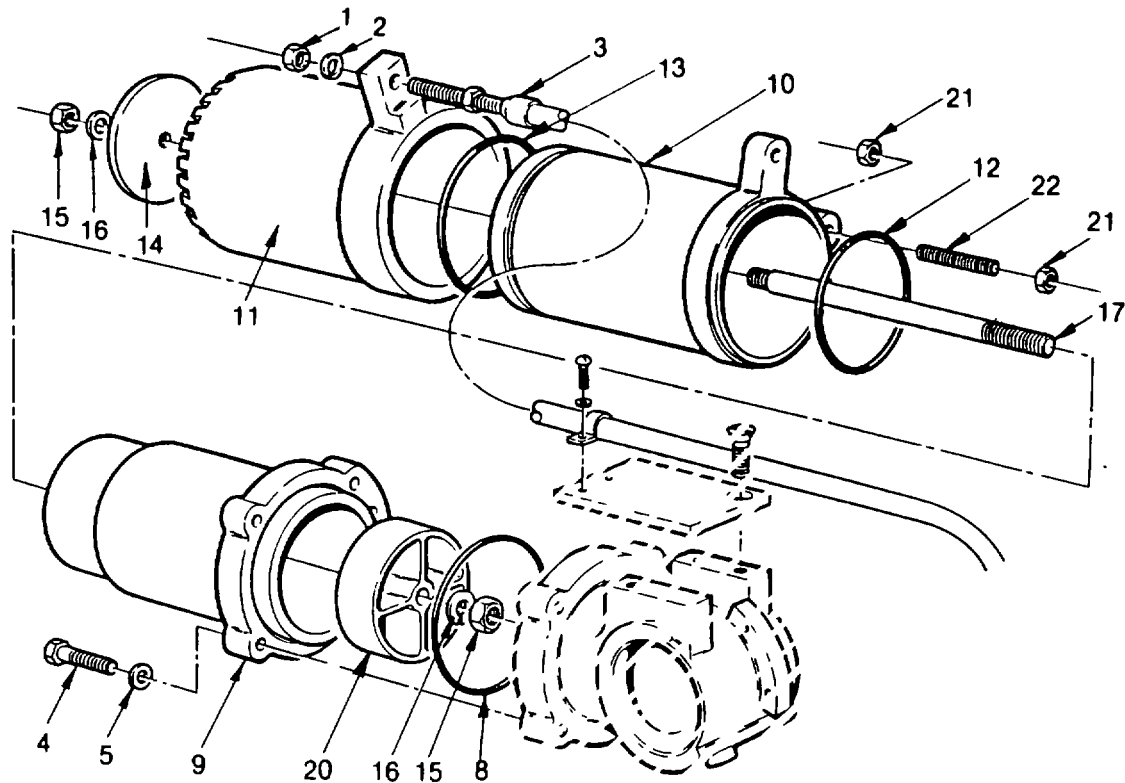
4-18. PUMP, PIPING, AND VALVES - Continued

- (7) Visually inspect web (20), and if damaged, press it out of the tip (9) using an arbor press. If not damaged proceed to step 10.
- (8) Clamp button shaft (17) in a vise and remove jam nut (18).
- (9) Unscrew web (20) from button shaft (17). Discard web.
- (10) Remove nut (21) from setscrew (22).
- (11) Pull the housing (10) off the tip and remove O-ring (12). Discard O-ring.
- (12) Remove setscrew (22) from the tip (9).

NOTE

Small lime deposits can be dissolved by soaking parts in acetic acid (item 1, Appendix E) and rubbing them gently with a brass bristle brush.

- (13) Remove lime deposits, corrosion from all components using a brass bristle brush.
- (14) Wipe all components using a soft, dry, lint free cloth.
- (15) Inspect components for corrosion, cracks, or stripped or worn threads.
- (16) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.
- (17) If web (20) has been removed, press new web into tip (9) through inlet end. Be sure the machined face of the web is installed first.
- (18) Apply threadlock liquid (item 29, Appendix E) to the threads of the setscrew (22) and install into tip (9). Tighten firmly.
- (19) Wipe excess threadlock liquid (item 29, Appendix E) from hexagon socket setscrew (22) and install one nut (21). Tighten until nut reaches tip boss (9).
- (20) Lubricate O-ring (12) using silicone grease (item 27, Appendix E) and install into groove on tip (9).
- (21) Align housing (10) with tip (9) and setscrew (22) and slide into place.
- (22) Install the second nut (21) onto the setscrew (22).
- (23) Position nuts (21) to allow housing (10) to be completely retracted on the tip (9). Tighten nuts (21) firmly.
- (24) Attach button (14) to button shaft (17) using lockwasher (16) and jam nut (15). Tighten jam nut to 7 ft lb (10 Nm).
- (25) Apply threadlock liquid (item 29, Appendix E) to threads of button shaft (17). Install into web (20) until button measures 0.75 in. (19 mm) from the housing tip as shown.

4-18. PUMP, PIPING, AND VALVES - Continued**4-18 16 Roof Turret - Continued****c. Nozzle Repair - Continued**

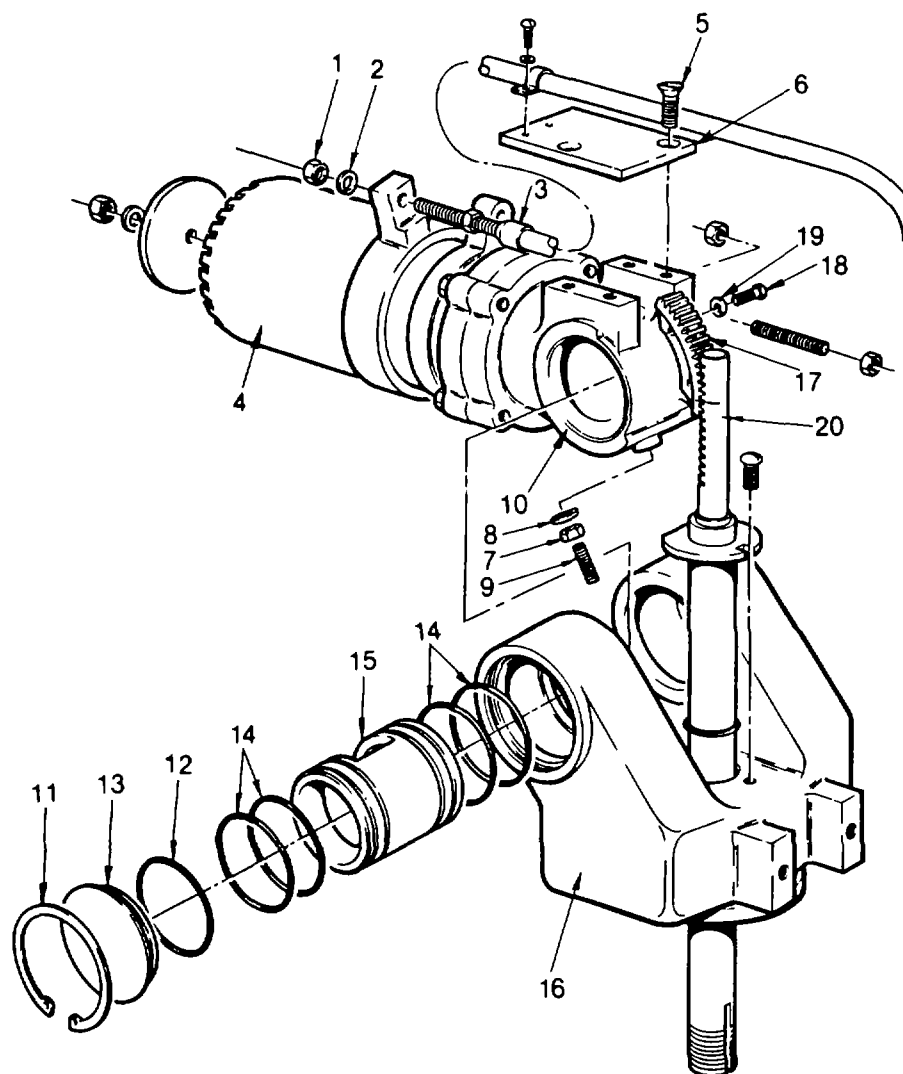
- (26) Apply threadlock liquid (item 29, Appendix E) to the button shaft threads (17) and install lockwasher (19) and jam nut (18). Tighten jam nut firmly.
- (27) Lubricate O-ring (13) with silicone grease (item 27, Appendix E) and install into groove on housing (10).
- (28) Slide the sleeve (11) onto the housing (10) until it contacts the shoulder. Be sure to align scribe marks.
- (29) Lubricate O-ring (8) using silicone grease (item 27, Appendix E) and install into groove on tip flange (9).
- (30) Lift nozzle assembly (7) up to head (6). Be sure to install the cable end (3) into the sleeve boss. Install lockwasher (2) and nut (1) and tighten firmly.
- (31) Attach the nozzle assembly (7) to the head (6) using lockwashers (5) and capscrews (4). Tighten to 15 ft lb (22 Nm).
- (32) Adjust control cable following steps 20 thru 26 of Control Cable Repair preceding.

4-18. PUMP, PIPING, AND VALVES - Continued

d. Head Repair

NOTE

This task can be completed with the turret mounted on the truck.

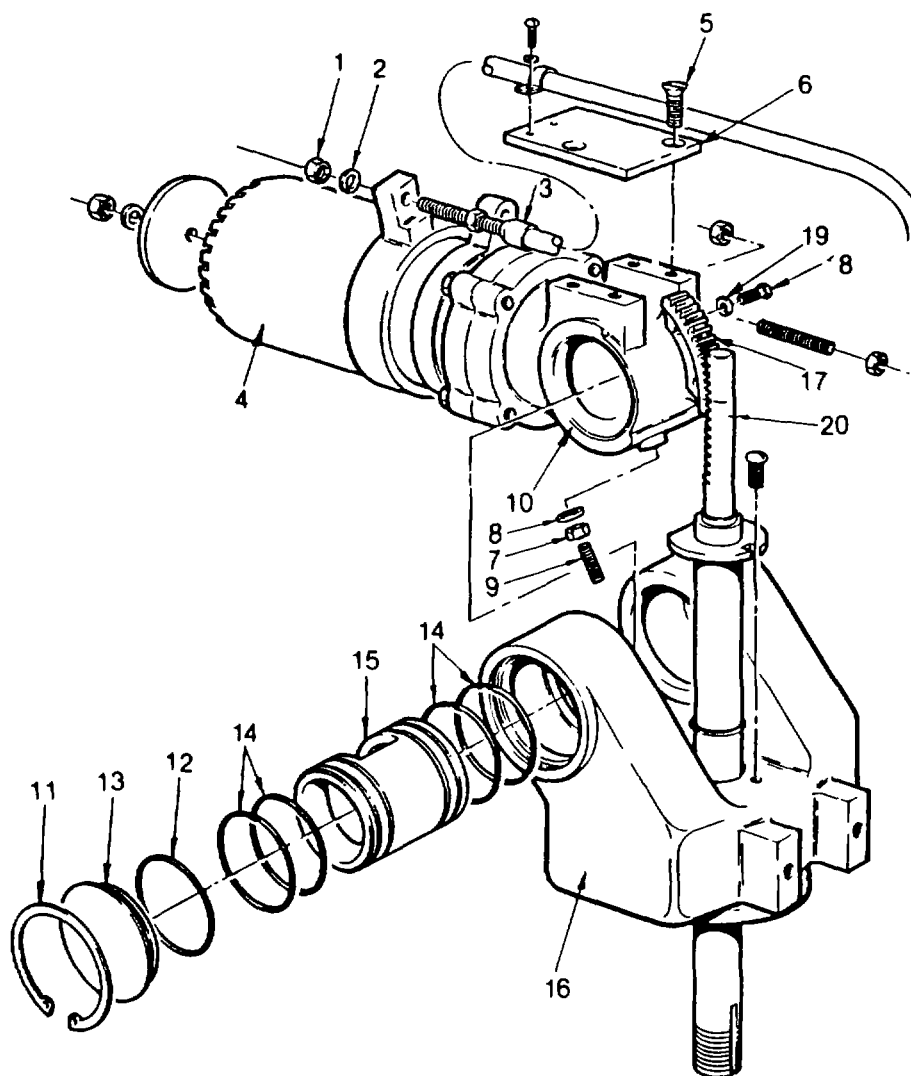


- (1) Remove nut (1) and lockwasher (2) that retain the cable end rod (3) to the sleeve (4).
- (2) Remove capscrews (5) and pull cable mounting plate (6) away from turret.
- (3) Remove jam nut (7), seal washer (8), and setscrew (9) from head (10).
- (4) With the head pointed straight ahead, scribe a mark on both the gear segment (17) and the elevation shaft (20) to ease alignment during assembly.
- (5) Remove the retaining ring (11) from the side of the body (19).

4-18. PUMP, PIPING, AND VALVES - Continued

4-18.16 Roof Turret - Continued

d. Head Repair - Continued



- (6) Remove cap (13) and O-ring (12) from the side of the body (16).
- (7) Carefully pull elevation bearing (15) from head (10). Use extreme care when removing the elevation bearing so as not to damage the four O-rings (14).
- (8) Separate the head (10) from the body (16).
- (9) Remove the two setscrews (18) and washers (19) that retain the gear segment (17) to the head (10).
- (10) Clean all parts using a brass bristle brush, then wipe off using a clean, dry, lint-free cloth.

4-18. PUMP, PIPING, AND VALVES - Continued

- (11) Inspect head (10) and body (16) sealing surfaces for scratches, corrosion or dirt that may cause a leak.
- (12) Inspect elevation bearing (15) for being worn or out of round. Check O-ring grooves for being free from indentations or projections.
- (13) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.
- (14) Attach the gear segment (17) to the head (10) using two washers (19) and two setscrews (18). Tighten setscrews firmly.
- (15) Lubricate O-rings (14) using silicone grease (item 27, Appendix E) and install into elevation bearing grooves (15).
- (16) Lightly lubricate the elevation bearing (15) outside diameter and the head (10) and body (16) inside diameters using silicone grease (item 27, Appendix E).
- (17) Lift the head (10) and align the scribe mark on the gear segment (17) with the scribe mark on the elevation shaft (20). Align the head (10) and body (16) inside diameters.
- (18) Carefully slide elevation bearing (15) into body (16) and through head (10). Be sure to align the hole in the head with the hole in the elevation bearing.
- (19) Install the setscrew into the head (10). Be sure the point of the setscrew protrudes through the elevation bearing. Tighten until snug.
- (20) Install seal washer (8) and jam nut (7) onto setscrew (9) and tighten firmly.
- (21) Lubricate O-ring (12) using silicone grease (item 27, Appendix E) and install into groove of end cap (13).
- (22) Install end cap (13) into body (16) and lock in place using retaining ring (11).
- (23) Lift cable mounting plate assembly (6) and position on turret head (10). Insert cable end (3) into sleeve boss (4).
- (24) Install cable mounting plate capscrews (5) and tighten firmly.
- (25) Install lockwasher (2) and nut (1) onto cable end rod (3) and tighten firmly.
- (26) Check control cable adjustment following steps 20 thru 26 of Control Cable Repair preceding.

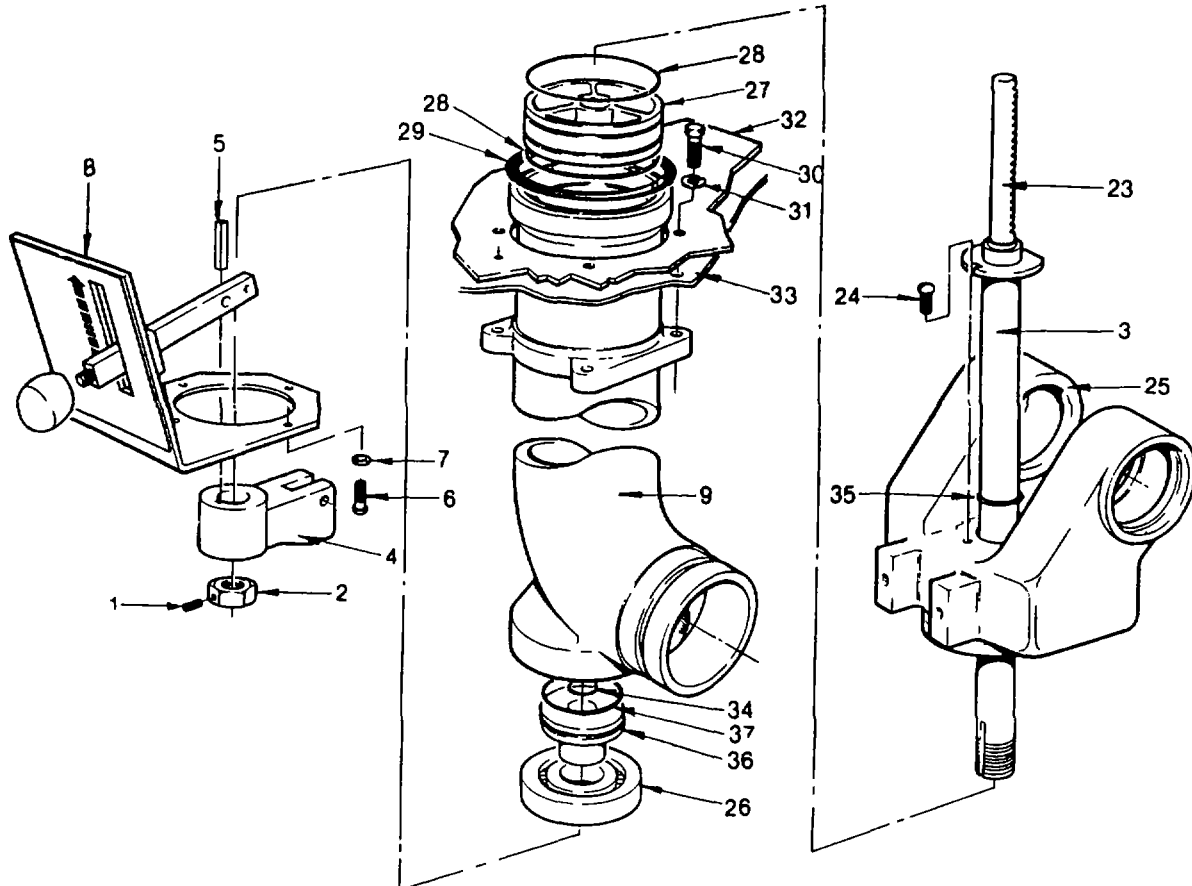
4-18. PUMP, PIPING, AND VALVES - Continued

4-18.16 Roof Turret - Continued

e. Base and Body Repair

NOTE

This task can only be completed with the turret removed from the truck.



- (1) Remove roof turret assembly as detailed in REMOVAL preceding.
- (2) Remove control cable as detailed in steps 1 thru 9 of Control Cable Repair preceding.
- (3) Remove the head as detailed in steps 1 thru 7 of Head Repair preceding.
- (4) Remove the setscrew (1) from the rotation nut (2).
- (5) Remove rotation nut (2) from rotation tube (3).

4-18. PUMP, PIPING, AND VALVES - Continued

- (6) Pry the link mount (4) and key (5) from the rotation tube (3).
- (7) Remove four screws (6) and lockwashers (7) and slide pattern control bracket off elevation shaft (23). Pull the elevation shaft (23) out through the bottom of the base (9). Use extreme care so as not to damage the bushing in the top of the rotation tube (3).
- (8) Remove screw (24) that retains the rotation tube (3) to the body (25).
- (9) Pull the rotation tube assembly (3) out through the top of the body (25).
- (10) Remove O-rings (34 and 35) from rotation tube assembly (3).
- (11) Separate the body (25) from the base (9).
- (12) Remove rotation bearing (27) and O-rings (28, 29) from the base (9).
- (13) Remove capscrews (30) and washers (31) that retain the base (9) to the plate (32).
- (14) Remove the base gasket (33).
- (15) Remove the ball bearing (26) from the base (9).
- (16) Remove the bearing seal (36) and O-ring (37) from the base (9).

NOTE

Small lime deposits can be dissolved by soaking components in acetic acid (item 1, Appendix E) and then rub them with a brass bristle brush.

- (17) Remove lime deposits, scale, or corrosion from the base, body head, rotation tube, and shaft using a brass bristle brush.
- (18) Inspect base (9), body (25), and head for corrosion, cracks or any other damage that may cause water leaks.
- (19) Inspect bearings following procedures in para. 4-9.
- (20) Inspect elevation shaft, segment gear, rotation tube and mounting link for damage.
- (21) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.

CAUTION

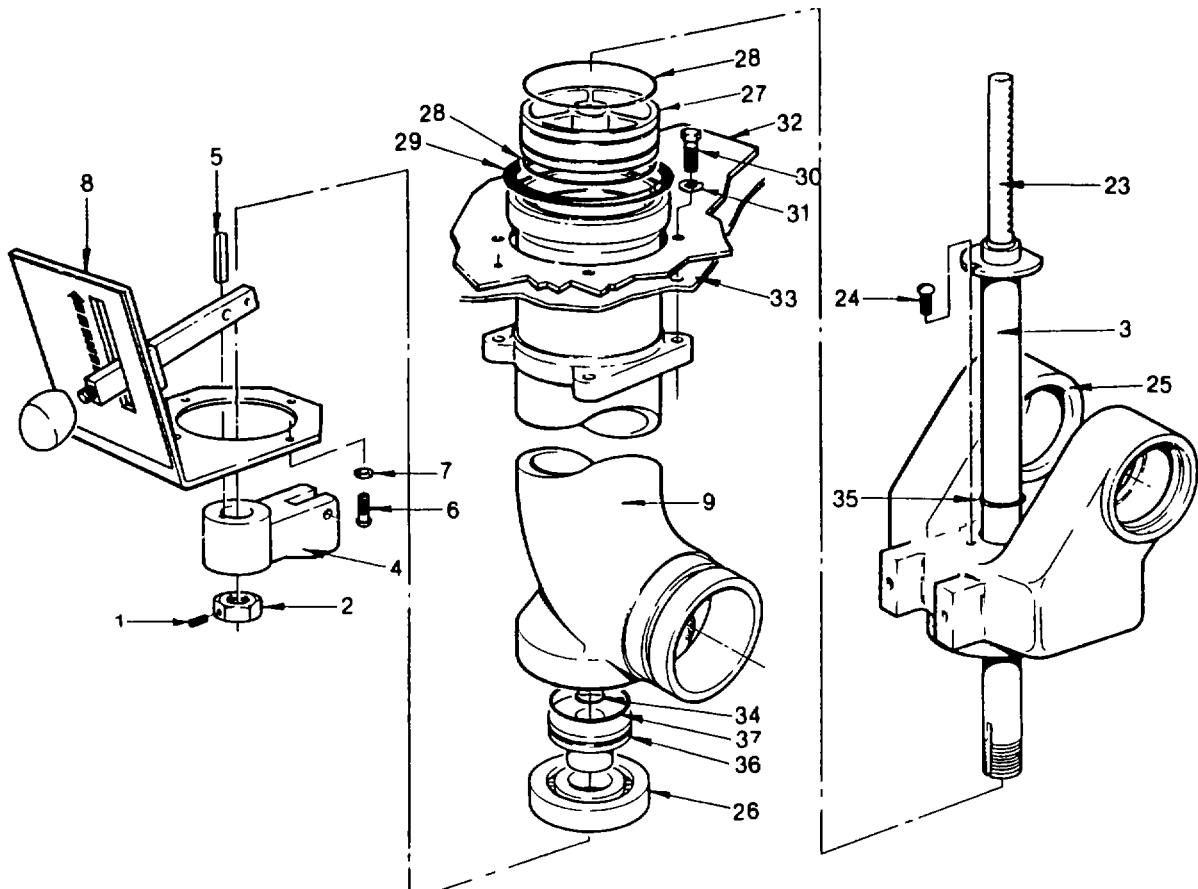
To reduce the possibility of O-ring damage, apply silicone grease (item 27, Appendix E) to all O-rings and their sealing surfaces prior to installation.

- (22) Install base gasket (33) onto turret base (9).
- (23) Install base plate (32) and align mounting holes.

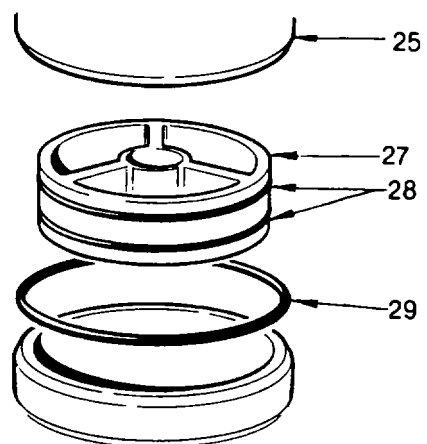
4-18. PUMP, PIPING, AND VALVES - Continued

4-18 16 Roof Turret - Continued

e. Base and Body Repair - Continued



- (24) Install capscrews (30) and washers (31) and tighten to 15 ft lb (22 Nm).
- (25) Install both O-rings (28) in the grooves of the rotation bearing (27).
- (26) Lower rotation bearing (27) into the base (9) and push in until it contacts bearing shoulder.
- (27) Locate O-ring (29) on the chamfered edge of the base (9).
- (28) Lower the body (25) onto the base. Be sure O-ring (29) is not disturbed when the body is installed.



4-18 PUMP, PIPING, AND VALVES - Continued

- (29) Install O-ring (35) onto rotation tube (3).
- (30) Install rotation tube (3) into the body hole and through the base hole. Install screw (24) and tighten firmly.
- (31) Temporarily invert the turret and balance on body (25).
- (32) Install O-ring (34) into the rotation tube groove. Install from the threaded end of the rotation tube.
- (33) Install O-ring (37) into groove of bearing seal (36).
- (34) Install bearing seal (36) and ball bearing (26) into the base.
- (35) Install pattern control bracket (8) and fasten to base (9) with screws (6) and lockwasher (7). Tighten screws firmly.
- (36) Set the key (5) into the keyway of the rotation tube.
- (37) Align keyways and slide link mount (4) onto the rotation tube (3).
- (38) Install rotation nut (2) and tighten until body (25) can not be turned. Unscrew rotation nut about 1/4 turn or until body can be rotated freely. Tighten setscrew (1) firmly.
- (39) Apply white grease (item 34, Appendix E) to the entire length of the elevation shaft (23) and install into the rotation tube (3) from the base end (9). Use care not to damage the bushing in the body end of the rotation tube.
- (40) Install the head as detailed in steps 15 thru 23 of Head Repair preceding.
- (41) Install control cable and adjust as detailed in steps 10 thru 26 of Control Cable Repair preceding.
- (42) Install roof turret into truck as detailed in INSTALLATION preceding.

4-18. PUMP, PIPING, AND VALVES - Continued**4-18.17 Bumper Turret.**

This task covers

- Removal
- Installation
- Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

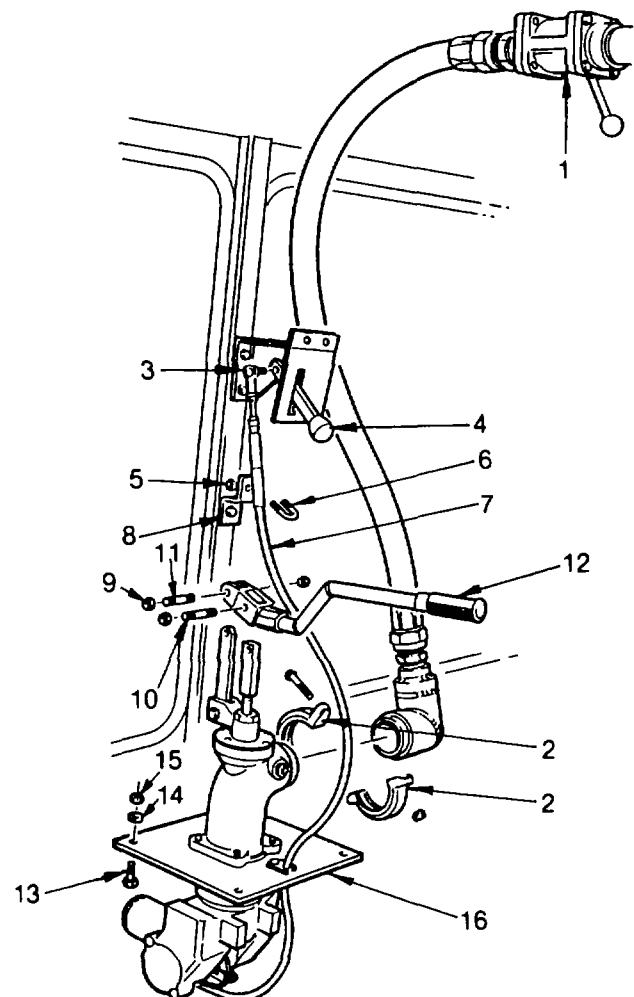
All Piping Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

25, Appendix E Sealant
MS51922-1 Locknut 1/4"-20
MS51922-13 Locknut 5/16"-24
1227540 Bumper Turret

PERSONNEL REQUIRED - 2**REMOVAL**

- Close the bumper turret ball valve (1).
- Remove victaulic coupling (2), see para. 4-18.3.
- Remove cable end rod ball joint (3) from control handle (4).
- Remove locknuts (5) and clamp (6) that retain the cable (7) to the Z-bracket (8). Discard locknuts.
- Remove the four locknuts (9) and two studs (10, 11) that retain the handle assembly (12) to the turret. Discard locknuts.
- Remove four locknuts (15), flatwashers (14), and capscrews (13) that retain the mounting plate (16) to the cab turret enclosure.
- While supporting the turret assembly, break sealant bond between mounting plate and the cab turret enclosure using a flat screwdriver.
- Carefully lower bumper turret from cab turret enclosure. It may be necessary to turn bumper turret to allow the base to clear the bumper turret hole.



4-18. PUMP, PIPING, AND VALVES - Continued**INSTALLATION**

- (1) Clean old sealant from the cab turret enclosure and the mounting plate (16).
- (2) Apply a continuous bead of sealant (item 25, Appendix E) to the perimeter of the cab turret enclosure.
- (3) Raise bumper turret into the cab turret enclosure. It may be necessary to turn the bumper turret to allow the base to clear the bumper turret hole.
- (4) Align the mounting holes and install the capscrews (13) flat washers (14), and locknuts (15). Tighten locknuts to 28 ft lb (38 Nm).
- (5) Attach handle assembly (12) using two studs (10, 11) and four locknuts (9). Tighten locknuts to 17 ft lb (23 Nm).
- (6) Attach cable end rod ball joint (3) to the control handle (4).
- (7) Install victaulic coupling (2), see para. 4-18.3.
- (8) Attach cable (7) to Z-bracket (8) using clamp (6) and locknuts (5). Tighten locknuts firmly.
- (9) Check control cable adjustment. See REPAIR following.
- (10) Operate bumper turret to ensure that all controls are functioning properly, see Chapter 2.

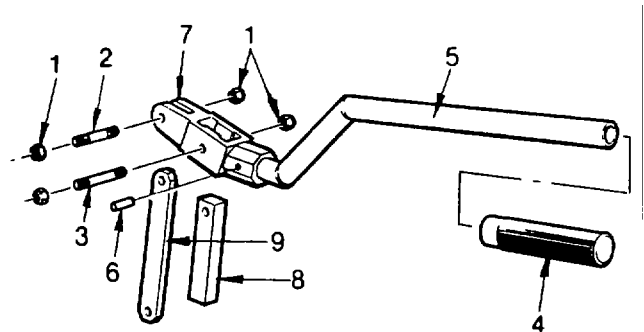
REPAIR

a. Handle Repair

NOTE

This task can be completed with the turret mounted on the truck.

- (1) Remove the four locknuts (1) and two studs (2 and 3) that retain the handle assembly to the turret. Discard locknuts (1) and remove handle assembly.
- (2) Remove roll pin (6) from handle holder (7).
- (3) Pull handle (5) from handle holder (7).
- (4) Inspect handle grip (4) for cuts or deterioration.
- (5) Inspect handle (5) for bends, or oversize roll pin hole.
- (6) Inspect roll pin (6) for wear.
- (7) Inspect handle holder (7) for cracks, oversize stud or roll pin holes, or oversized handle hole.



4-18. PUMP, PIPING, AND VALVES - Continued

4-18 17 Bumper Turret - Continued

a. Handle Repair - Continued

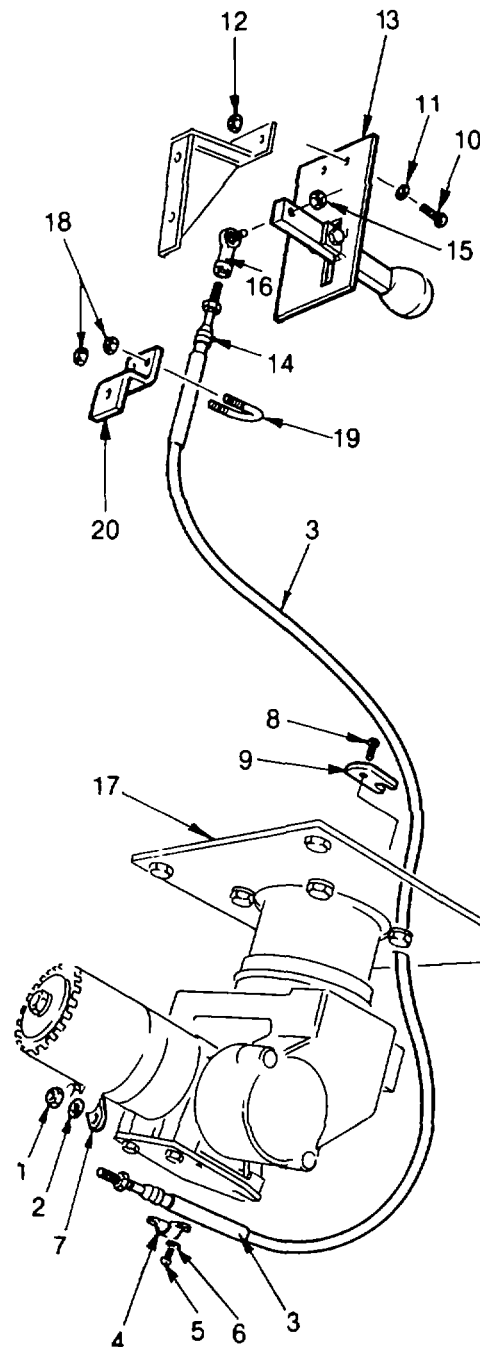
- (8) Evidence of damage of any kind is cause for rejection. Replace parts as necessary.
- (9) Install handle (5) into handle holder (7). Align roll pin holes and insert roll pin (6).
- (10) Raise handle into position. Align handle holder holes with the holes in the column link (9) and swivel block (8) and install studs (2 and 3).
- (11) Install new locknuts (1) onto studs (2 and 3) and tighten to 17 ft lb (23 Nm).

b. Control Cable Repair

NOTE

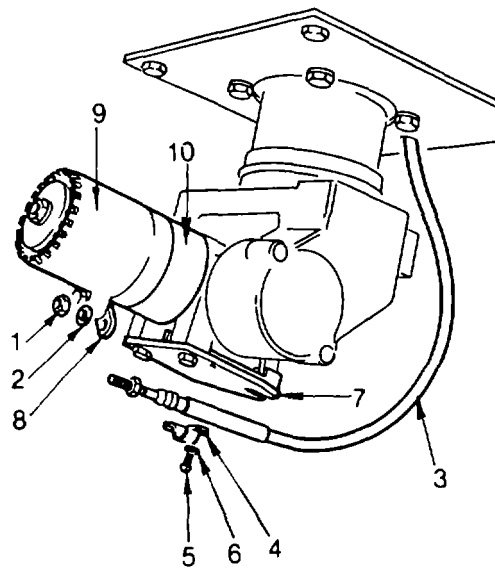
This task can be completed with the turret mounted on the truck. Control cable repair consists of cable replacement if cable does not function freely.

- (1) Remove nut (1) and lockwasher (2) from nozzle end of cable (3).
- (2) Remove conduit clamp (4) that holds cable (3) to the mounting plate (7) by removing screws (5) and lockwasher (6).
- (3) Pull cable (3) out of water sleeve link (8).
- (4) Remove capscrew (9) and lockwasher that retains clamp (10) Pull clamp off cable (3).
- (5) Remove screws (11), lockwashers (12), and nuts (13) that retain the handle bracket (14) to the pattern control bracket.
- (6) Loosen jam nut (16) and unscrew the ball joint (17) from the cable end rod (15). Count the number of turns it takes to remove ball joint and record.
- (7) Remove locknuts (20) from U-bolt (21) and remove cable (3) from Z-plate (22).
- (8) Pull cable (3) through base plate (18) to remove.



4-18. PUMP, PIPING, AND VALVES - Continued

- (9) Slide new cable (3) through base plate (18) from inside the truck. Lock into position using clamp (10), lockwasher and screw (9). Tighten screw firmly.
- (10) Thread ball joint (17) onto the cable end rod (15) the same number of turns as recorded in step 6 preceding. Tighten jam nut (16) firmly.
- (11) Attach pattern control handle bracket (14) using screws (11), lockwashers (12), and nuts (13).
- (12) Attach cable (3) to Z-plate (22) using U-bolt (21) and locknuts (20). Tighten locknuts firmly.
- (13) Install nozzle end of cable (3) into water sleeve link (8) and attach using washer (2) and nut (1). Tighten nut firmly.
- (14) Set control handle to 'FOG' position. Ensure water sleeve (18) is fully retracted on the water tip (19).
- (15) Attach cable (3) to mounting plate (7) using conduit clamp (4) screws (5) and lockwashers (6).
- (16) Cycle control handle from 'FOG' to 'SOLID' a couple of times.
- (17) Set control handle to 'FOG'. Cable adjustment is satisfactory if zero clearance is measured between water sleeve (18) and tip assembly (19). If adjustment is necessary repeat steps 15 thru 18 preceding.

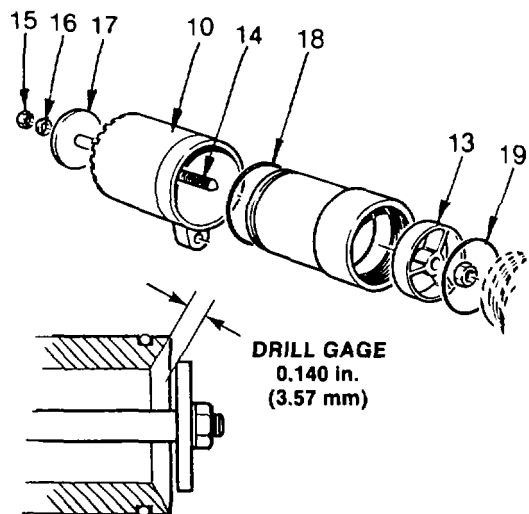


c. Nozzle Repair

NOTE

This task can be completed with the turret mounted on the truck.

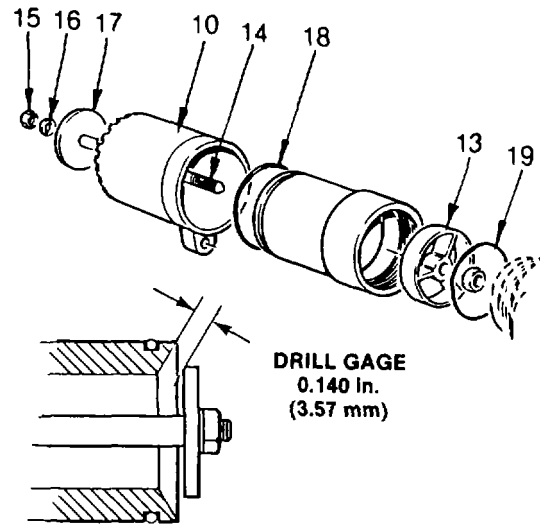
- (1) Remove nut (1) and lockwasher (2) from nozzle end of cable (3).
- (2) Remove conduit clamp (4) that holds cable (3) to the mounting plate (7) by removing screws (5) and lockwashers (6).
- (3) Pull cable (3) out of water sleeve link (8).
- (4) Carefully pull on water sleeve (9) until it separates from the water tip (10).
- (5) Unscrew the water tip (10) from the turret head.



4-18 PUMP, PIPING, AND VALVES - Continued**4-18.17 Bumper Turret - Continued**

c. Nozzle Repair - Continued

- (6) Remove jam nut (15) and lockwasher (16) that retains the button (17) to the button shaft (14).
- (7) If web (13) is damaged and needs to be replaced, press it out of the tip assembly (10) using an arbor press.
- (8) Clamp the button shaft (14) in a vise and remove jam nut (12).
- (9) Unscrew web (13) from button shaft (14). Discard web.
- (10) Remove button shaft (14) from vise and inspect for damage such as stripped threads, corrosion or bends.
- (11) Remove O-rings (18, 19) from tip assembly (10). Discard O-rings.

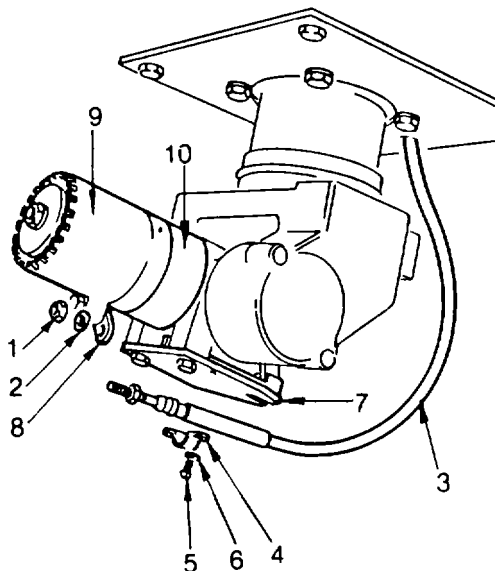
**NOTE**

Small lime deposits can be dissolved by soaking parts in acetic acid (item 1, Appendix E) and rubbing them with a brass bristle brush.

- (12) Remove lime deposits, or corrosion using a brass bristle brush.
- (13) Wipe all components using a soft, dry, lint-free cloth.
- (14) Inspect all components for corrosion, cracks, or stripped or worn threads.
- (15) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.
- (16) If web was removed, press new web (13) into the tip (10) through the inlet end. Ensure the machined face of the web is installed first.
- (17) Attach button (17) to the button shaft (14), using lockwasher (16) and jam nut (15). Tighten jam nut to 9 ft lb (12 Nm).
- (18) Apply threadlock liquid (item 29, Appendix E) to the button shaft (14) following manufacturer's recommendations.
- (19) Screw button shaft (14) into web until clearance between button (17) and tip assembly (10) is 0.14 in. (3.6 mm) as shown.
- (20) Install jam nut (12) onto button shaft (14) and tighten to 17 ft lb (23 Nm).

4-18. PUMP, PIPING, AND VALVES - Continued

- (21) Lubricate O-ring (19) with silicone grease (28, Appendix E) and install into inner bore of tip assembly (10).
- (22) Screw water tip (10) onto the turret head (11) and tighten firmly.
- (23) Lubricate O-ring (18) with silicone grease (item 27, Appendix E) and install into the outer bore groove on the water tip (10).
- (24) Attach cable (3) to mounting plate (7) using conduit clamp (4) screws (5) and lockwashers (6) Do not tighten screws (5).
- (25) Carefully slide water sleeve (9) onto water tip (10) Make sure the cable (3) end rod protrudes through the water sleeve link (8).
- (26) Install lockwasher (2) and nut (1) onto the cable (3) end rod and tighten firmly.
- (27) Set the control handle to 'FOG' position Ensure water sleeve (9) is fully retracted on the water tip (10).
- (28) Tighten conduit clamp screws (5) firmly.
- (29) Cycle control handle from 'FOG' to 'SOLID' a couple of times.
- (30) Set control handle to 'FOG' Cable adjustment is satisfactory if water sleeve (9) is seated against water tip shoulder (10). If clearance is noticeable readjust by loosening screws (5) and repeating steps 27 thru 30.



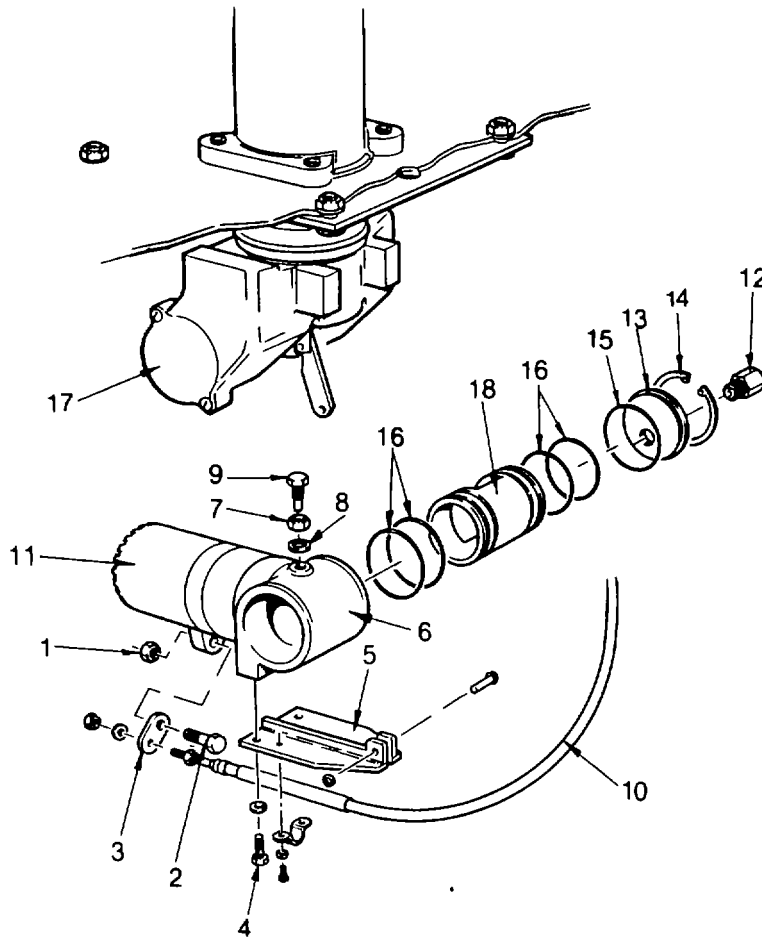
4-18. PUMP, PIPING, AND VALVES - Continued

4-18.17 Bumper Turret - Continued

a. Head Repair.

NOTE

This task can be completed with the turret mounted on the truck.



- (1) Remove nut (1) and capscrew (2) that retains the water sleeve link (3) to the water sleeve (11).
- (2) Remove capscrews (4), and lower cable (10) and cable mounting plate (5) from head (6).
- (3) Remove jam nut (7), seal washer (8), and the bearing screw (9) from the head (6).
- (4) Remove drain valve (12) from end cap (13).
- (5) Remove end cap retaining ring (14) and pull end cap (13) and O-ring (15) from body (17). Remove O-ring and discard.

4-18. PUMP, PIPING, AND VALVES - Continued

- (6) While supporting the head assembly, carefully pull elevation bearing (18) out of head (6). Use extreme care so as not to damage four O-rings (16) during removal of elevation bearing.
- (7) Separate head (6) from body (17).
- (8) Remove O-rings (16) from elevation bearing (18).
- (9) Discard all O-rings.
- (10) Clean all parts using a brass bristle brush and wipe off using a clean, dry, lint-free cloth.
- (11) Inspect head (6) and body (17) sealing surfaces for scratches, corrosion or dirt that may cause a leak.
- (12) Inspect elevation bearing, for being worn or out of round. Check O-ring grooves are free of indentations or projection.
- (13) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.
- (14) Lubricate four O-rings (16) using silicone grease (item 27, Appendix E) and install into elevation bearing grooves (18).
- (15) Lightly lubricate the elevation bearing (18) outside diameter, and the head (6) and body (17) inside diameters using silicone grease (item 27, Appendix E).
- (16) Lift the head (6) and position between the lugs of the body (17).
- (17) Carefully slide elevation bearing into body (17) and through the head (6). Be sure to align the hole in the head with the hole in the elevation bearing.
- (18) Install jam nut (7) and seal washer (8) onto bearing screw (9).
- (19) Install bearing screw (9) into head (6) until it seats. Tighten jam nut (7) onto seal washer (8) until snug.
- (20) Lubricate O-ring (15) using silicone grease (item 27, Appendix E) and install into end cap groove (13).
- (21) Install end cap (13) into body (17) and lock in place using retaining ring (14).
- (22) Raise cable mounting plate (5) into position. Align the mounting holes and install capscrews (4). Tighten firmly.
- (23) Attach water sleeve link (3) to water sleeve (11) using capscrew (2) and nut (1). Tighten nut firmly.
- (24) Set control handle of bumper turret to 'FOG' Cable adjustment is satisfactory. If water sleeve (11) is fully retracted on the water tip (19).
- (25) Adjust control cable as detailed in steps 15 thru 18 of Control Cable Repair preceding.

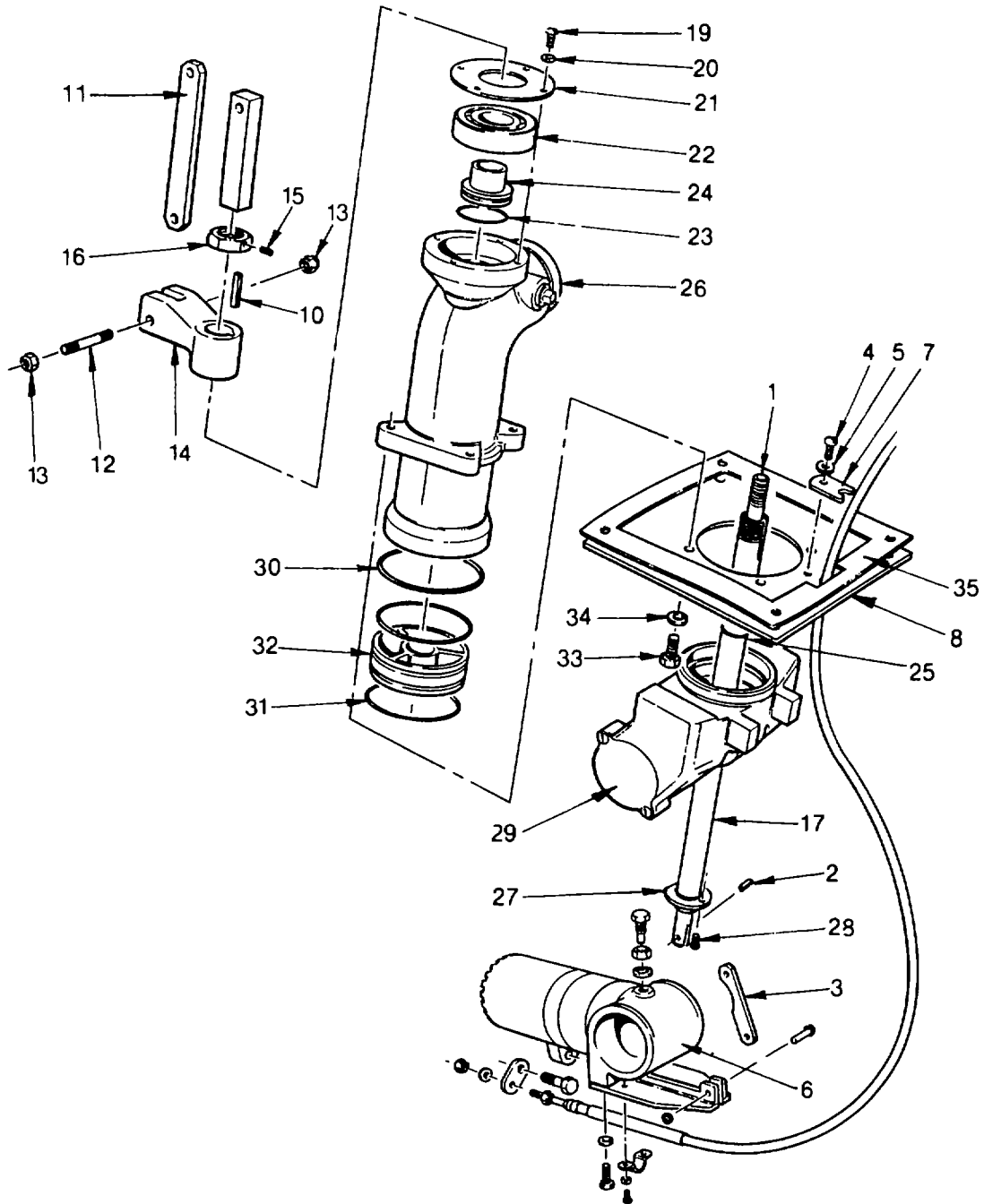
4-18. PUMP, PIPING, AND VALVES - Continued

4-18.17 Bumper Turret - Continued

e Base and Body Repair

NOTE

This task can only be completed with the turret removed from the truck.



4-18. PUMP, PIPING, AND VALVES - Continued

- (1) Remove bumper turret as detailed in REMOVAL preceding.
- (2) Remove roll pin (2) and pull elevation link (3) from elevation shaft (1).
- (3) Remove head (6) as detailed in step 1 thru 8 of Head Repair preceding.
- (4) Remove capscrew (4) and lockwasher (5) that retains conduit clamp (7) to the mounting plate (8) and pull control cable through mounting plate.
- (5) Remove column link (11) from link mount (14) by removing stud (12) and locknuts (13).
- (6) Loosen setscrew (15) and remove rotation nut (16) from rotation tube (17).
- (7) Pry the link mount (14) and key (10) from rotation tube (17).
- (8) Remove four screws (19) and lockwashers (20) and slide bearing retainer (21) off shaft (1).
- (9) Pull elevation shaft (1) out through the top of the base (26). Use extreme care so as not to damage the bushing in the top of the rotation tube.
- (10) Remove screw (28) that retains the rotation tube (17) to the body (29).
- (11) Pull the rotation tube assembly (17) out through the bottom of the body (29).
- (12) Remove O-rings (25 and 27) from rotation tube assembly (17).
- (13) Separate the body (29) from the base (26).
- (14) Remove the rotation bearing (32) and O-rings (30, 31) from the base (26).
- (15) Remove the ball bearing (22) and bearing seal (24) from the base (26). Remove O-ring (23) and discard.
- (16) Remove capscrews (33) and lockwashers (34). Remove mounting plate (8), and gasket (35) from the base (26).

NOTE

Small lime deposits can be dissolved by soaking components in acetic acid (item 1, Appendix E) and gently rubbing them with a brass bristle brush.

- (17) Remove lime deposits, scale or corrosion from the body, base, head, rotation tube, and shaft using a brass bristle brush.
- (18) Wipe all components using a clean, dry, lint free cloth.
- (19) Inspect all components for excessive corrosion at sealing surfaces, cracks, or wear that may cause leaks.
- (20) Evidence of damage of any kind is cause for rejection. Replace components or assembly as required.

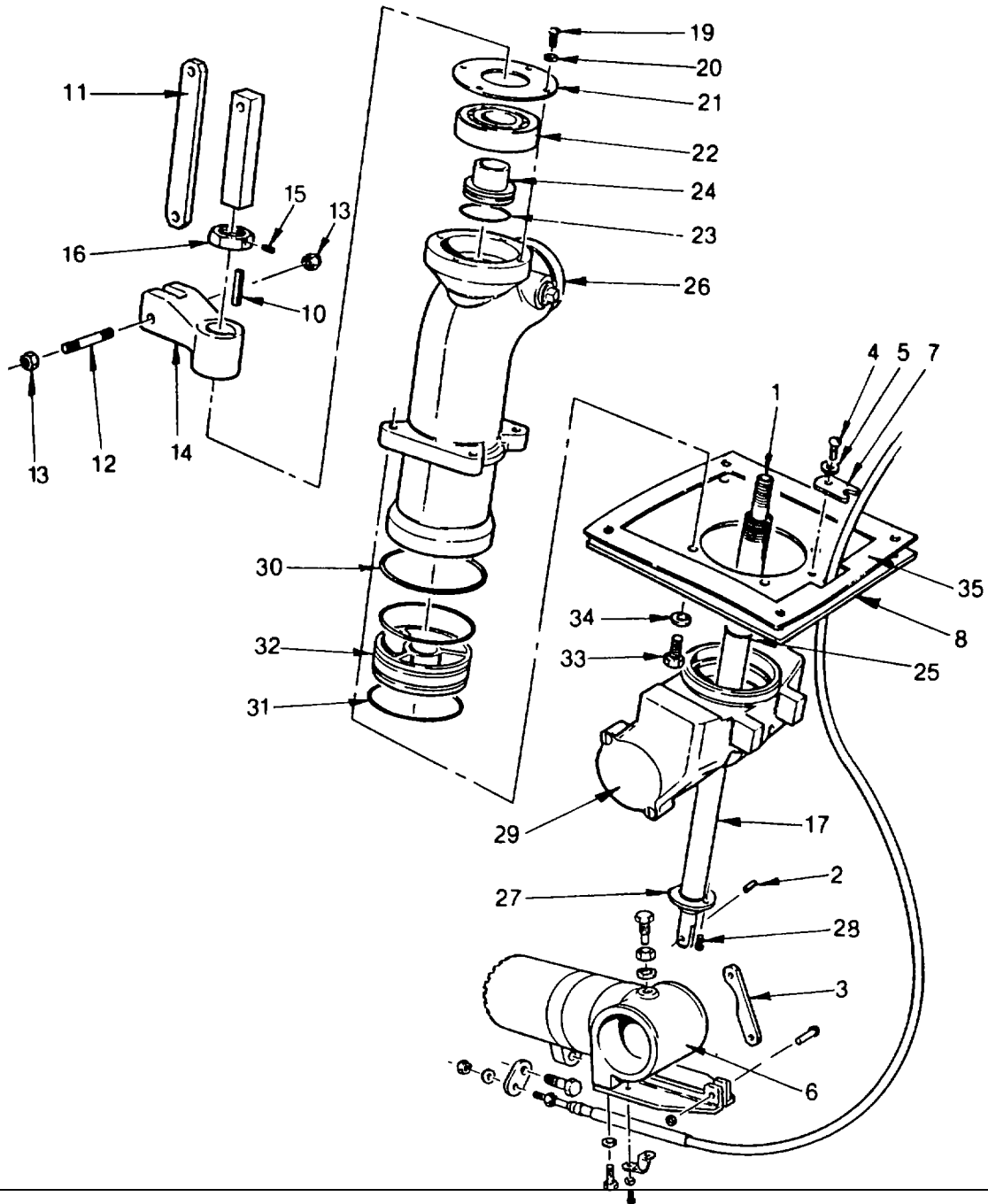
4-18. PUMP, PIPING, AND VALVES - Continued

4-18.17 Bumper Turret - Continued

e.. Base and Body Repair - Continued.

CAUTION

To reduce the possibility of O-ring damage, apply silicone grease (item 27, Appendix E) to all O-rings and their sealing surfaces prior to installation.



4-18. PUMP, PIPING, AND VALVES - Continued

- (21) Attach gasket (35) and mounting plate (8) to base using capscrews (33) and lockwashers (34). Tighten capscrews to 14 ft lb (19 Nm).
- (22) Install O-rings (30) into grooves of the rotation bearing (32).
- (23) Install rotation bearing (32) into base (26) and push in until it contacts the bearing shoulder.
- (24) Install O-ring (31) on chamfered edge of base (26).
- (25) Assemble the base (26) and body (29) together. Be sure O-ring (31) is in place.
- (26) Slide O-ring (27) onto threaded end of rotation tube (17), past first O-ring groove and up to the collar.
- (27) Install rotation tube (17) through body hole (29), rotation bearing, and the base hole (26). Align rotation tube collar to mounting hole and install screw (28).
- (28) Invert the turret and balance on body end of rotation tube (17).
- (29) Install O-ring (25) into the rotation tube groove from the threaded end of the rotation tube.
- (30) Install O-ring in seal bearing groove (24).
- (31) Install seal bearing (24) and ball bearing (22) into base (26).
- (32) Install bearing retainer (21) using four screws (19) and lockwashers (20). Tighten screws firmly.
- (33) Set key (10) into keyway on rotation tube (17). Align keyways and slide link mount (14) onto rotation tube.
- (34) Install rotation nut (16) and tighten until body cannot be turned. Unscrew rotation nut about 1/4 turn or until body can be rotated freely. Tighten setscrew (15) firmly.
- (35) Apply white grease (item 34, Appendix E) to the entire length of the elevation shaft (1) and install it into the rotation tube (17) from the base end. Use care not to damage the bushing in the body end of the rotation tube.
- (36) Install column link (11) into link mount (14) using stud (12) and new locknuts (13).
- (37) Install cable (9) through mounting plate (8) and retain using conduit clamp (7), capscrew (4), and lockwasher (5).
- (38) Install head (6) as detailed in Head Repair, steps 10 thru 26.
- (39) Attach elevation link (3) to elevation shaft (1) using roll pin (2).
- (40) Install bumper turret as detailed in INSTALLATION preceding.

4-19. WINTERIZATION SYSTEM.**4-19 1 Winterization Exhaust System.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

MATERIALS/PARTS

89711-K Tubing Flexible
89556-K Flatband Clamp
103954 Wye

WARNING

Exhaust parts may cause severe burns if touched while hot. Exhaust system must be cool before working on system.

NOTE

The following procedures can be used to replace either the APU or the winterization heater exhaust pipe.

REMOVAL

- (1) Remove clamp nuts. If nuts are corroded cut band with hacksaw.
- (2) Remove clamp.
- (3) Remove exhaust tubing.

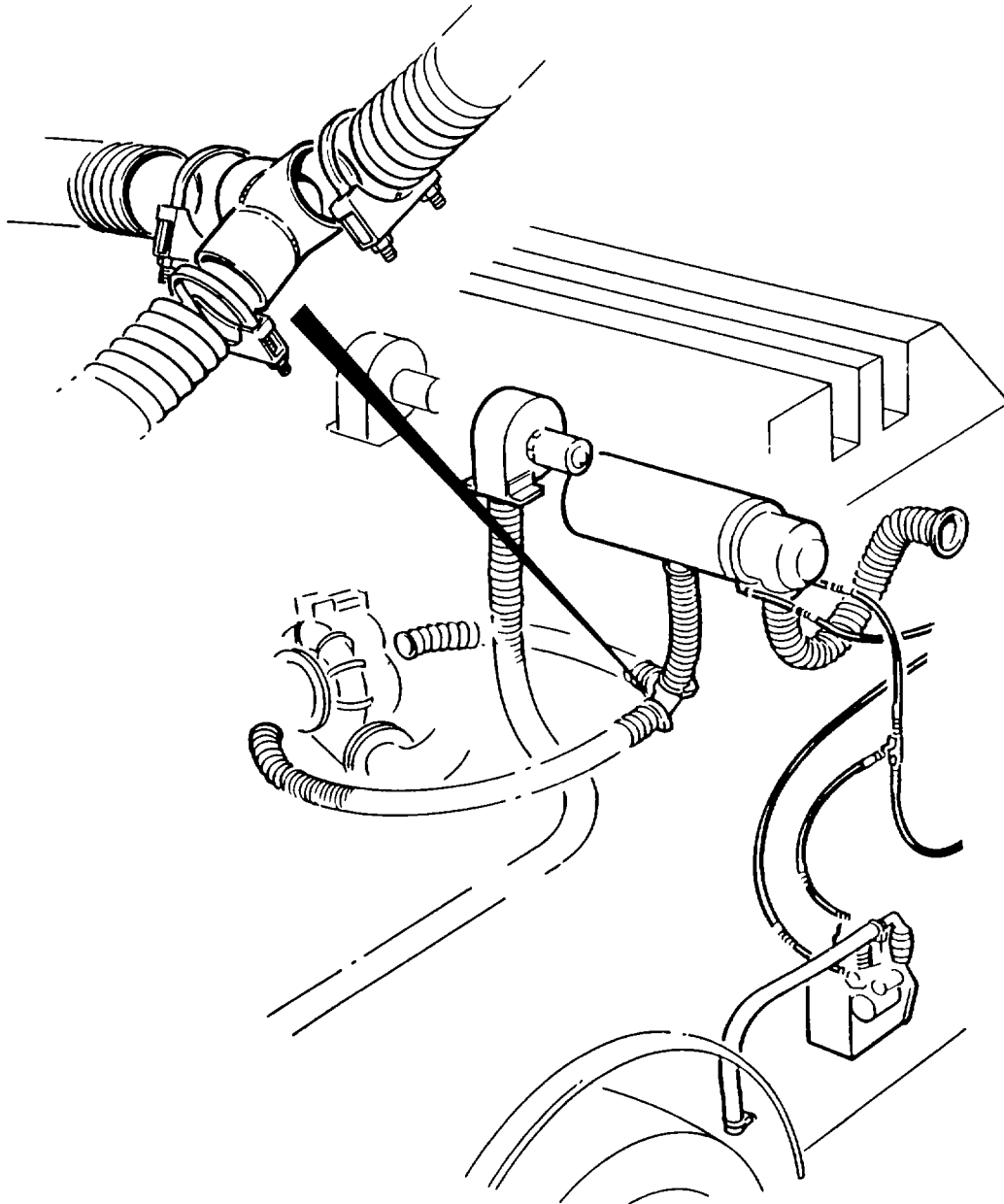
INSPECTION

- (1) Inspect tubing and clamps for corrosion.
- (2) Check tubing for excessive dents or separation.
- (3) Replace parts as required.

INSTALLATION

- (1) Install pre-cut tubing on winterization heater exhaust outlet or on APU exhaust outlet.
- (2) Install new clamps and nuts.
- (3) Tighten clamp nuts to 30 ft lb (41 Nm).

4-19. WINTERIZATION SYSTEM - Continued



4-19. WINTERIZATION SYSTEM.**4-19.2 Winterization Fuel System.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

900729-21 Clamp Support

MS51922-17 Locknut

MS90725-60 Capscrew

101634-044 Assembly Hose

101634-028 Assembly Hose

101634-015 Assembly Hose

101634-024 Assembly Hose

101634-058 Assembly Hose

48-F-06X06 Connector

101-B-06 Tee

HS12 Hose Clamp

TUBENE02512 Tubing

KFO406MS Connector

3730-036 Fuel Filter Element

1-9982-044 Fuel Filter

116-B-04 Elbow Street

113-B-04X24 Nipple

116-B-02 Elbow Street

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

APU Shutdown (see para. 2-12)

Batteries Disconnected (see para. 4-24.12)

MATERIALS/PARTS

22, Appendix E Pipe Sealant

235A Fuel Pump

127-B-02 Tee

48-F-06X04 Connector

112-B-02 Nipple

110-B-04X02 Bushing Reducer

103-B-04 Coupling

2600 Valve Check

48-F-06X02 Connector

REMOVAL

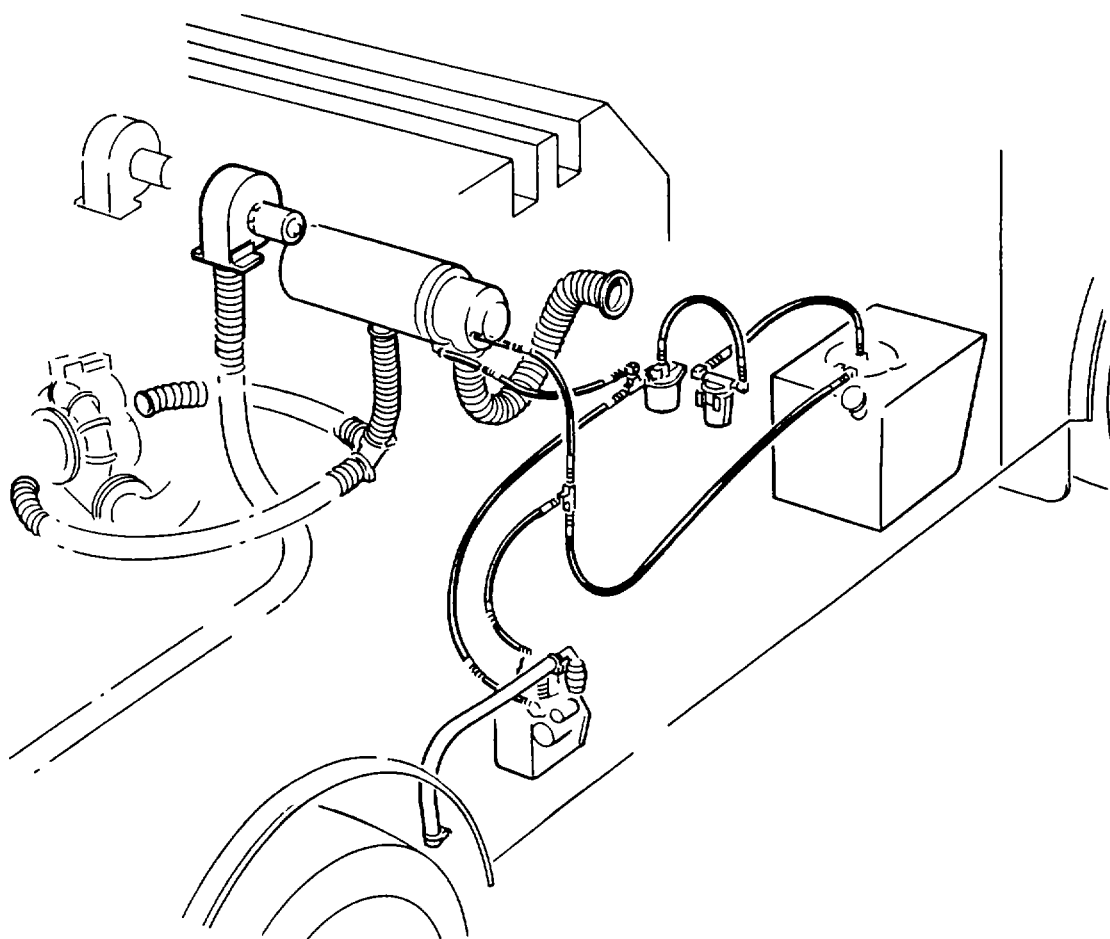
- (1) Remove top cover from fuel tank compartment.
- (2) Remove pump body inspection door.
- (3) Remove support clamps from hose(s) which require replacement.
- (4) All hoses and fittings may be removed individually. Remove components as required.

INSPECTION

- (1) Inspect hoses for cracks, kinks or excessive deterioration. If inspection reveals problem areas within hose assemblies, replace hose. Manufacture hoses as detailed in para. 4-9.
- (2) Inspect fittings for damaged threads. Replace fittings found to be damaged.
- (3) Inspect the seat and poppet of check valve for deep scratch marks or pitting. Check for weak or broken spring. If any damage is detected replace check valve assembly.
- (4) Inspect inlet screen of electric fuel pump for contamination. Screen may be cleaned with compressed air. Pump unit is not repairable.
- (5) Remove fuel filter element and discard. Replace with new element.

4-19 WINTERIZATION SYSTEM - Continued**INSTALLATION**

- (1) All threads must be sealed with pipe sealant (item 22, Appendix E) prior to installation.
- (2) Install pump body inspection door.
- (3) Install top cover on fuel tank compartment.



4-19. WINTERIZATION SYSTEM.**4-19.3 Winterization Water Circulation System.****This task covers**

- a Removal**
- b Inspection**
- c. Installation**

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

KF12-12PS Nipple Barbed
186101-20-16S Nipple Barbed
FIG1103,1 1/4NPT Elbow Street
FC-300-24 Hose, MDM Press
KF12-08PS Nipple Barbed
FIG 300,1/2" Valve Gate
FIG343x4 00x1/2 Nipple Pipe
116-B-08 Elbow Street
FIG92-04 Check Valve
186101-12-16S Nipple, Barbed
FIG 300,3/4 Valve, Gate
3326X12 Nipple, Close
116-B-12 Elbow, Street
110-B-12X08 Bushing, Reducing
112-B-08 Nipple, Close
3220X16X12 Bushing Reducing

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

MATERIALS/PARTS

22, Appendix E Pipe Sealant
DHH750 Hose, Silicone
HS12 Clamp, Hose
DHH1000 Hose, Silicone
HS24 Clamp, Hose
3700X12 Tee

WARNING

Engine coolant can be hot enough to cause severe burns. Allow engine to cool before maintaining the water circulation system.

REMOVAL

- (1) Drain radiator by opening valve on right hand side. Collect coolant in suitable container. Total volume is approximately 15 gal (57 L).

NOTE

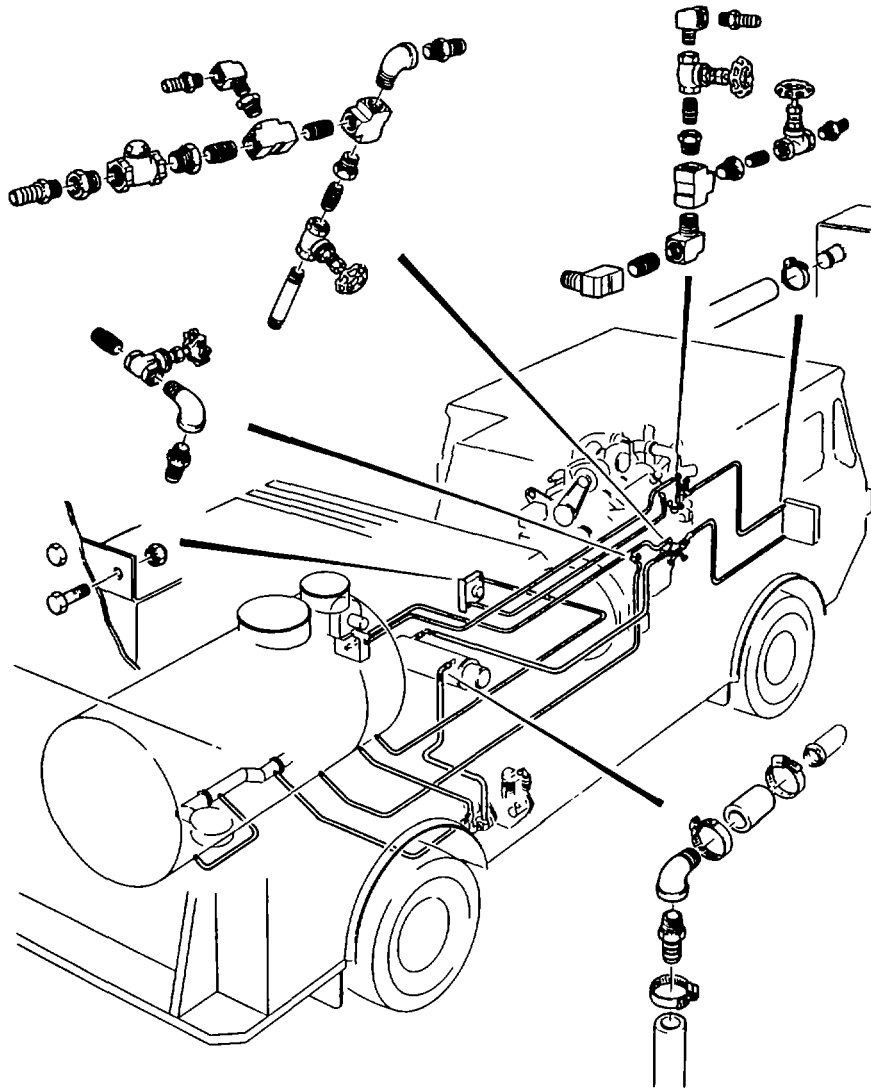
If hose/fitting to be replaced can be isolated by clamping adjacent hose, use a pair of hose crimp retaining pliers on each side. This saves draining the whole system. Be sure the pliers are not overtightened as this will damage the hose

- (2) Determine which end of hose that is to be removed is the lowest. Place container beneath connection.
- (3) Undo connector and collect coolant in container.
- (4) Individual components that are leaking may be removed as required.

INSPECTION

- (1) Inspect hose for cracks or brittleness. Replace hose if either condition is present.

4-19. WINTERIZATION SYSTEM - Continued



- (2) Inspect hose for damaged hose ends at hose clamp areas. If cracking or swelling of hose end is present cut end off hose to gain access to a new seal and clamp area, providing hose is long enough. Check complete hose length for twisted or crushed areas due to improper installation or operation of unit. Replace as required.

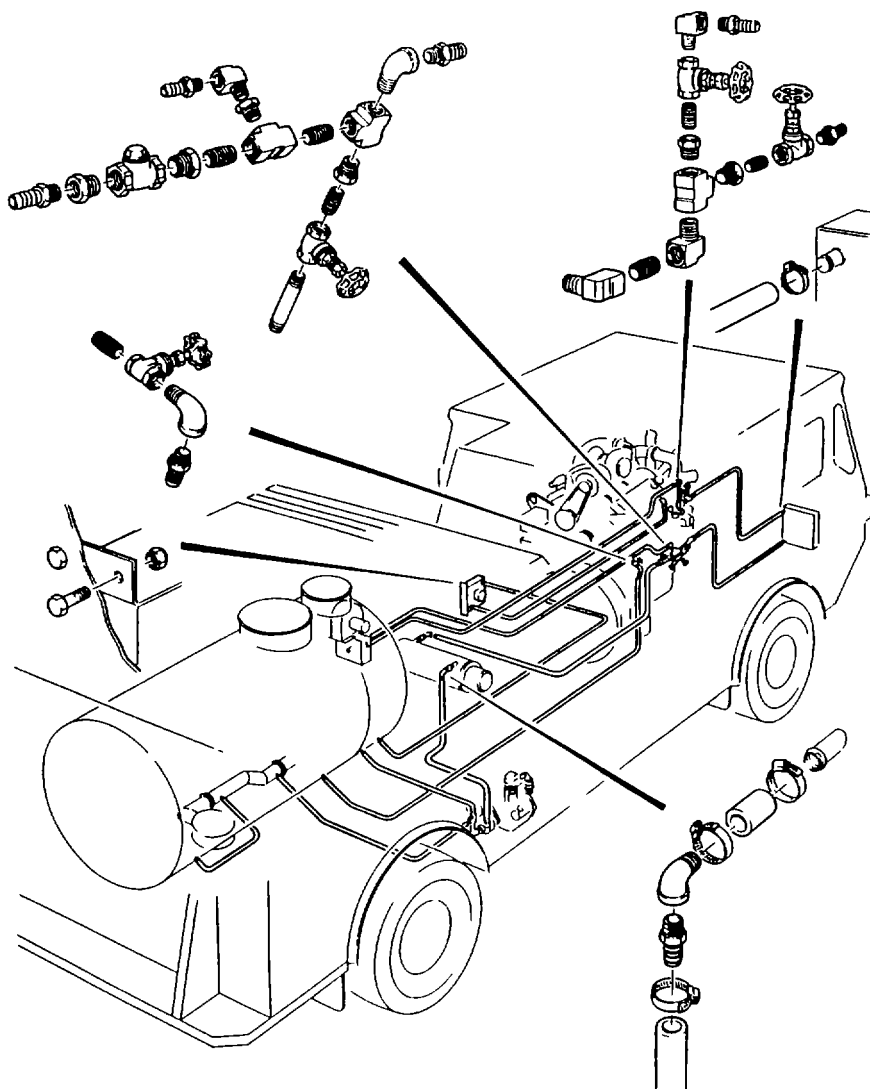
NOTE

Hose splicing causes a restriction in flow and should only be used as a temporary repair. If hose damage is present the entire length of hose should be replaced.

- (3) Inspect barbed nipples for damage. Nicks, scratches or marks could cause improper sealing of hose. If damage is present, replace nipple.
- (4) Inspect other fittings and adaptors for damaged threads or bodies. Replace fittings as required.

4-19. WINTERIZATION SYSTEM.

4-19.3 Winterization Water Circulation System.



INSTALLATION

- (1) Use pipe sealant (item 22, Appendix E) on all pipe thread connections prior to installation.
- (2) Ensure all hoses are routed to avoid kinking, interference with rotating objects or touching hot objects (eg, exhaust pipe).
- (3) Clamp all hoses so they are secure.
- (4) Ensure all connections are tight and radiator valve is closed. If fitted, remove hose crimp retaining pliers used to isolate the hose/connector being replaced.

4-19. WINTERIZATION SYSTEM - Continued

- (5) Refill radiator. Ensure winterization valves are open on main engine.
- (6) Start APU only (not winterization heater) and leave running for at least 15 minutes. Top up radiator as required during this time. Check system for leaks. Tighten/remake connections as required.
- (7) While APU is running, loosen connection on winterization heater outlet and bleed air from top of heater . Retighten hose clamp.
- (8) Stop APU and start main engine. Run engine until normal operating temperature is reached.
- (9) Check system for leaks. Tighten/remake connections as required.
- (10) Shut down engine and allow radiator to cool for 1 hour.
- (11) Check level of radiator. Top up as required.

4-19. WINTERIZATION SYSTEM.**4-19.4 Pump Body Heater.****This task covers**

- a Removal
- b Inspection
- c. Installation
- d Repair

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

MATERIALS/PARTS

HS72 Hose Clamp
64-2920X Tubing
MS90725-6 Capscrew
102200 Assy, Pump Body Heater

WARNING

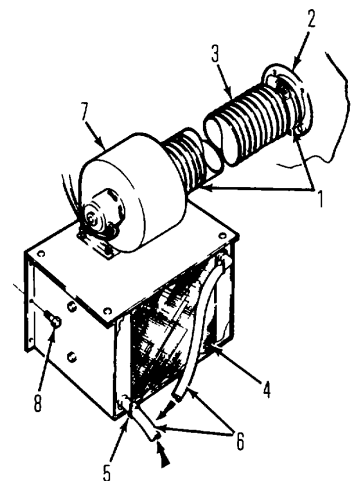
Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the pump body heater.

NOTE

The fuel tank cooling fan and hose reel fan are identical to the pump body heater fan. Replacement of these fans and motors is similar to pump body fan as detailed in repair following:

REMOVAL

- (1) Remove pump body door.
- (2) The heater can be isolated by using two pairs of hose crimp retaining pliers, one on the heater inlet and one on the heater outlet hose. Otherwise, place container beneath radiator drain hose. Open valve and drain all coolant.
- (3) Remove hose clamps (5) from both inlet and outlet water hoses (6) to heater.
- (4) Remove hose clamps (1) from air intake nipple (2) and heater (4).
- (5) Remove air intake hose (3)..
- (6) Tag and disconnect electrical connections to motor (7).



4-19. WINTERIZATION SYSTEM - Continued

- (7) While supporting the pump body heater, remove capscrews (8) attaching heater to hose body.
- (8) Remove heater from pump body via the pump body door.

INSPECTION

- (1) Remove fan and fan mounting plate from the heater housing by removing the four screws.
- (2) Pressure test heater core with compressed air. Blank outlet connection. Connect air pressure hose to inlet connection.
- (3) Place assembly in water bath and ensure it remains under water.
- (4) Slowly pressurize the core up to a maximum pressure of 20 psi (140 kPa). Check for air bubbles (5). Repair or replace heater core as required.
- (6) Replace fan and fan mounting plate on heater housing and replace four retaining screws.
- (7) Spin fan wheel with finger and check the fan and housing do not rub together.

INSTALLATION

- (1) Insert pump body heater through pump body door and align with holes on hose body front panel.
- (2) Tighten capscrews (8) attaching heater to hose body.
- (3) Reconnect electrical connections to motor.
- (4) Slip air intake hose (3) over air intake nipple (2) and heater (4), tighten hose clamps (1). If hose crimp retaining pliers were used to isolate the heater, remove the pliers.
- (5) Close radiator drain valve. Top up radiator.
- (6) Ensure winterization circulation valves on engine are open.
- (7) Start APU and allow water to circulate. Check all connections for leaks. Tighten/remake as required.
- (8) While APU is running, loosen connection on pump body heater outlet and bleed air from top of heater. Retighten hose clamp.
- (9) Top up radiator as required and replace radiator cap.
- (10) Stop APU and start main engine. Allow engine to reach normal operating temperature and shutdown.
- (11) When engine is cool remove radiator cap and top up radiator as required.

4-19. WINTERIZATION SYSTEM.**4-19 1 .4 Pump Body Heater - Continued****This task covers**

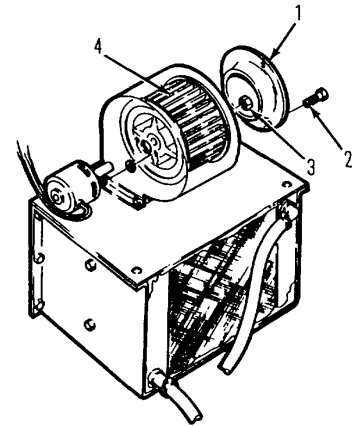
- a Removal
- b Inspection
- c. Installation

REPAIR**NOTE**

To repair pump body heater, the heater must be removed from the pump body as detailed in REMOVAL preceding.

a. Fan Wheel Repair.

- (1) If fan wheel rubs, attempt to straighten housing or ring assembly to prevent rubbing.
- (2) If fan wheel is bent and requires replacing, remove three screws (2) attaching ring assembly (1) to fan wheel housing (4).
- (3) Remove setscrew attaching fan wheel to motor shaft.
- (4) Remove fan wheel from housing.
- (5) Place new fan wheel in housing and slip over motor shaft.
- (6) Tighten setscrew on fan wheel hub, and spin fan to ensure it does not rub.
- (7) Align ring assembly (1) on fan wheel housing and attach with screws (2).
- (8) Spin fan wheel to check it does not rub. Re-align as required.
- (9) Replace heater in pump body as detailed in INSTALLATION preceding.



b. Fan Motor Repair.

NOTE

Motor cannot be repaired, replace as required.

- (1) Remove fan wheel as detailed in a preceding.
- (2) Insert 3/8 In socket in fan wheel housing and remove nuts (3). Pull fan motor out of housing.
- (3) The motor cannot be repaired. Replace motor.
- (4) Insert motor holding bolts through housing and tighten nuts (3).
- (5) Replace fan wheel as detailed above.

4-19. WINTERIZATION SYSTEM - Continued

c. Heater Core Repair.

NOTE

Heater cannot be repaired; if it leaks, replace heater assembly.

4-19. WINTERIZATION SYSTEM.**4-19 1 5 Winterization Heater.****This task covers**

- a Removal
- b Installation
- c. Repair

TOOLS

Tool Kit, Master Mechanic,
NSN 5180-00-699-5273
2, Appendix G Electrode Alignment Gage (For
Repair Only)

MATERIALS/PARTS

DBW300-21 Winterization Heater
MS51922-17 Locknut

PERSONNEL REQUIRED - 2**EQUIPMENT CONDITION**

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

WARNING

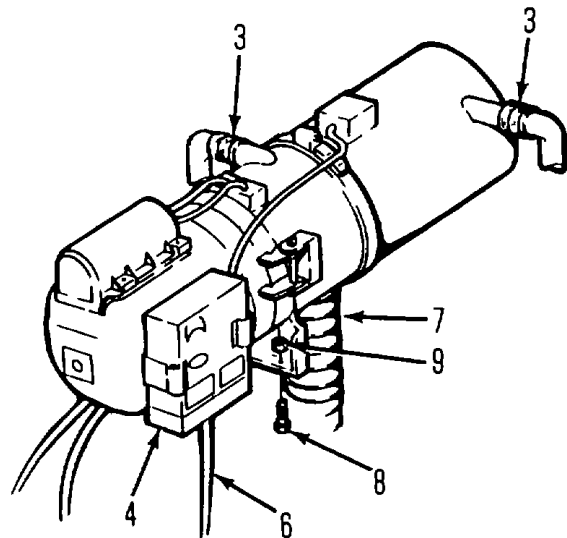
Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the winterization heater.

NOTE

System should be checked only when temperature is between 35 - 45 deg. F (2 - 7 deg. C).

REMOVAL

- (1) Remove pump body access door.
- (2) The heater can be isolated by using two pairs of hose crimp retaining pliers, one on the heater inlet, and one on the heater outlet hose. Otherwise, place container beneath radiator drain hose. Open radiator valve and drain all coolant.
- (3) Disconnect electrical plugs (6) to heater.
- (4) Loosen hose clamps (3) on inlet and outlet water hoses and pull hoses of heater fittings. Tag water pipes.
- (5) Loosen hose clamps and fuel lines and pull hoses off connectors. Plug and tag fuel lines.
- (6) Detach exhaust pipe (7) from heater by removing hose clamp.
- (7) Remove capscrews (8) and locknuts (9) attaching heater to mounting brackets. Discard locknuts.
- (8) Carefully supporting heater, pull heater out of pump body via the pump body access door.



4-19. WINTERIZATION SYSTEM - Continued**INSTALLATION**

- (1) Carefully lift heater through pump body access door and place in position on the support brackets.
- (2) Aline heater on brackets and tighten capscrews (8) and locknuts (7).
- (3) Attach exhaust pipe (7) to heater and tighten clamps.
- (4) Push fuel lines on to connectors and tighten hose clamps. Fuel inlet line is on left hand side of heater looking at motor end.
- (5) Push water hoses and connectors and tighten hose clamps. Water inlet line is on left hand side and is nearest port to motor.
- (6) Reconnect electrical plugs (6) to heater.
- (7) Close valve on radiator and fill radiator. If hose crimp retaining pliers were used to isolate the heater, remove the pliers.
- (8) Start APU and circulate water through winterization system topping up radiator as required. Check all connections for leaks. Tighten/remake as required.
- (9) While APU is running, loosen connection on pump body heater outlet and bleed air from top of heater. Retighten hose clamp.
- (10) Top up radiator as required and replace radiator cap.
- (11) Start winterization heater (see para. 2-12). Check heater fires up and brings temperature of coolant up to a steady 50 deg. F (10 deg. C).
- (12) Stop winterization system (see para. 2-12).
- (13) Replace pump body panel.

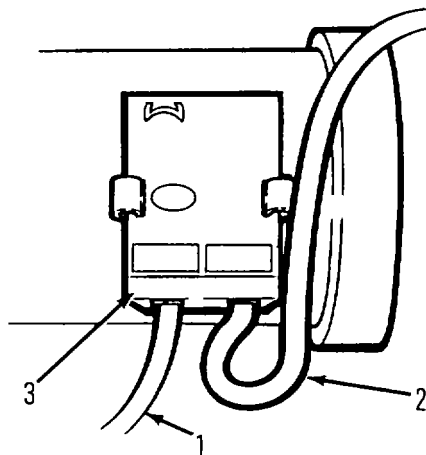
REPAIR

a. Electronic Control Unit Repair

NOTE

This can be replaced without removing heater from truck.

- (1) Disconnect wiring harness plugs (1, 2) from control unit.
- (2) Unclip control unit from side of motor (3) and replace. The electronic control unit cannot be repaired.
- (3) Refit all plugs into electronic control unit.



4-19. WINTERIZATION SYSTEM-Continued

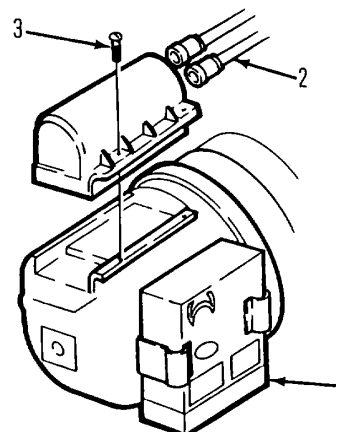
4-19.5 Winterization Heater-Continued

b. Ignition Spark Coil Repair

NOTE

This can be replaced without removing heater from truck.

- (1) Unplug connections between electronic control unit and ignition spark coil.
- (2) Remove ignition leads (2) from ignition spark coil.
- (3) Remove four screws (3) mounting coil to top of motor and replace the ignition spark coil. The ignition spark coil cannot be repaired.
- (4) Connect ignition leads and fasten new ignition coil with four screws (3).

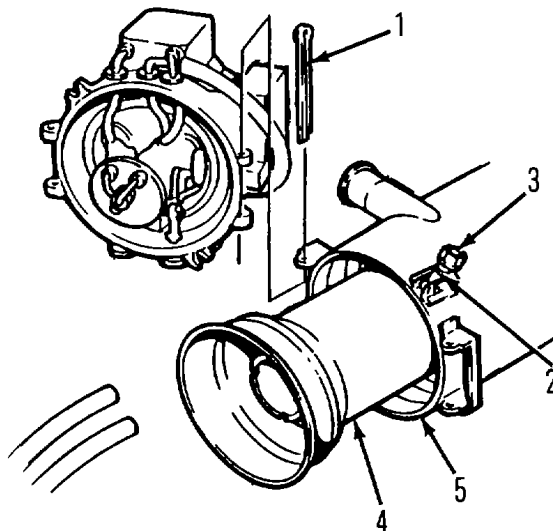


c. Combustion Chamber Repair

NOTE

Unit must be removed from truck for repair.

- (1) Loosen nuts (3) and swing aside eyebolts (2).
- (2) Straighten cotter pin (1) and, while supporting motor/fan assembly, remove pin from hinge.
- (3) Set motor fan assembly to one side.
- (4) Gently tap on rim of combustion chamber (4) and pull out of heat exchanger (5).
- (5) Clean inside and outside of chamber with water and a brush. If combustion chamber is severely corroded replace.
- (6) To install, push combustion chamber (4) into heat exchanger (5) until rims are seated. Tap with soft faced hammer is necessary.
- (7) While supporting motor/fan assembly, align holes in hinge between motor/fan assembly and heat exchanger. Slide cotter pin into hinge and bend ends.
- (8) Swing motor/fan assembly to closed position and tighten nuts (3) on eyebolts (2).
- (9) Replace heater assembly in truck. See INSTALLATION preceding.



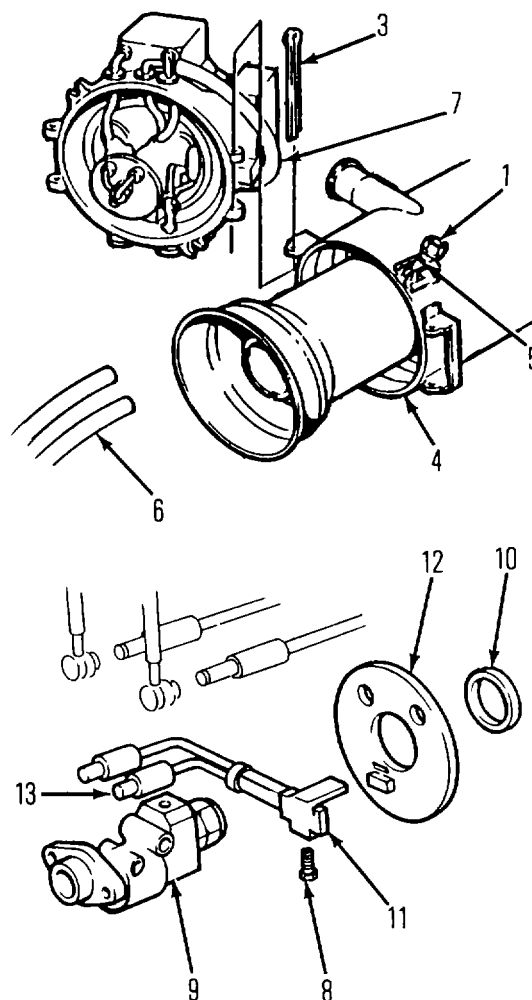
4-19. WINTERIZATION SYSTEM - Continued

d. Flame Detector Repair

NOTE

This can be replaced without removing complete unit from truck.

- (1) Disconnect fuel lines (6).
- (2) Disconnect wiring harness (7).
- (3) Loosen nuts (1) and swing eyebolts (5) clear.
- (4) Support burner assembly (4) and remove cotter pin (3). Place burner assembly on clean workbench area.
- (5) Remove fuel nozzle circlip (10).
- (6) Pull disc (12) containing flame detector (11) outwards. Disconnect electrical plugs (13). Remove disc and detector from nozzle holder.
- (7) Remove screw (8) to separate disc (12) and detector (11). Discard detector; it cannot be repaired.
- (8) Install new detector (11) on disc (12) using original screw (8).
- (9) Push disc (12) onto nozzle holder (9) and install circlip (10).
- (10) Plug detector wires (13) into electronic control unit.
- (11) Aline burner assembly with heater base in the truck. Replace cotter pin (3).
- (12) Swing burner assembly onto heater, and swing eyebolts (5) into holder. Tighten nuts.
- (13) Reconnect wiring harness to heater.
- (14) Reconnect fuel lines to heater.



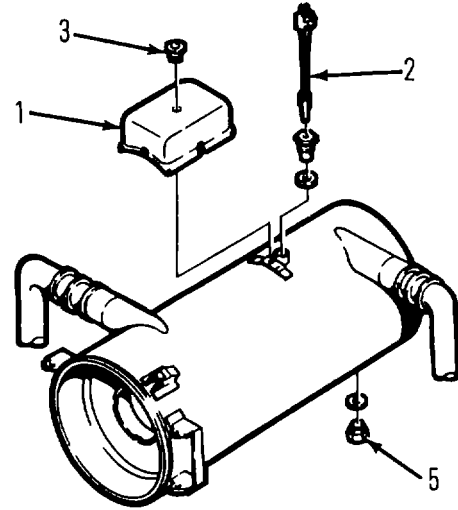
4-19. WINTERIZATION SYSTEM-Continued**4-19.5 Winterization Heater-Continued**

e. Over Heat Fuse Repair

NOTE

This can be replaced without removing unit from truck.

- (1) Remove knurled nut (3) and protection cap (1) to gain access to over heat fuse (2).
- (2) Tag and disconnect electrical connections to overheat fuse.
- (3) Clamp inlet and outlet coolant hoses to stop coolant flow.
- (4) Remove drain plug (5) and catch coolant in drain pan.
- (5) Remove overheat fuse (2) and discard.
- (6) Install new overheat fuse, reconnect electrical connections as tagged. Replace protection cap (1).
- (7) Remove installed clamps on coolant hoses.
- (8) Start APU and circulate water through winterization system topping up radiator as required.



f. Overheat Thermostat Repair

NOTE

This can be replaced without removing unit from truck.

- (1) Remove knurled nut (3) and protection cap (1) to gain access to overheat thermostat (2).
- (2) Tag and disconnect electrical connections.
- (3) Remove overheat thermostat (2) and discard. Thermostat is not repairable.
- (4) Install new overheat thermostat.
- (5) Reconnect electrical connections. Be sure they are connected the same as the original unit.
- (6) Replace protection cap (1) and tighten knurled nut (3).

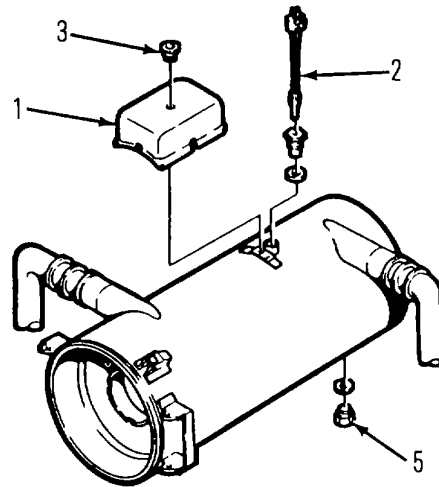
4-19. WINTERIZATION SYSTEM - Continued

g. Heater Control Thermostat Repair

NOTE

This can be replaced without removing unit from truck.

- (1) Remove knurled nut (3) and protection cover (1) to gain access to thermostat (2).
- (2) Tag and disconnect electrical connections.
- (3) Remove heater control thermostat (2) and discard. Thermostat is not repairable.
- (4) Install new control thermostat.
- (5) Reconnect electrical connections. Be sure they are connected the same as the original unit.
- (6) Replace protection cap (1) and secure with knurled nut (3).

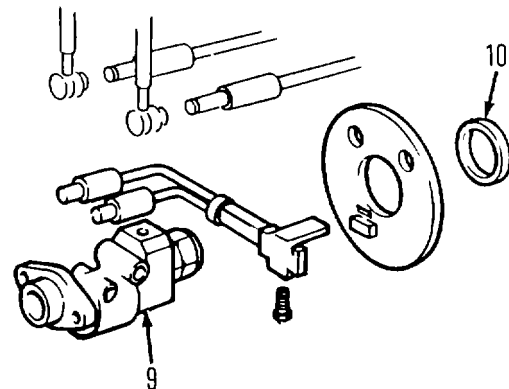


h. Fuel Nozzle Assembly Repair.

NOTE

This can be replaced without removing complete unit from truck.

- (1) Disconnect fuel lines (6).
- (2) Disconnect wiring harness (7).
- (3) Loosen nuts (1) and swing eyebolts (5) clear.
- (4) Support burner assembly remove cotter pin (3). Place burner assembly on clean workbench area.
- (5) Remove circlip (10) and loosen fuel nozzle (9) with a wrench.
- (6) Remove nozzle.

**CAUTION**

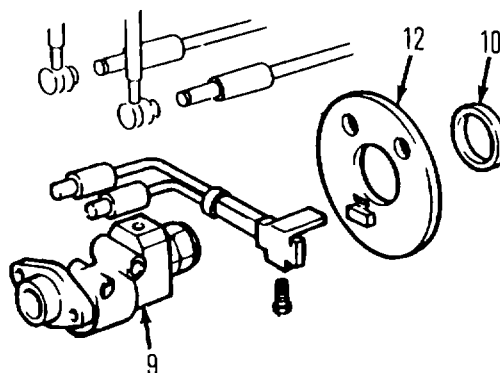
Do not clean the nozzle bore hole or the tip with solid objects or wire.

Do not use compressed air, use clean flowing fuel to clean nozzle and strainer.

The nozzle should not be cleaned and re-used except in an emergency. It should be replaced.

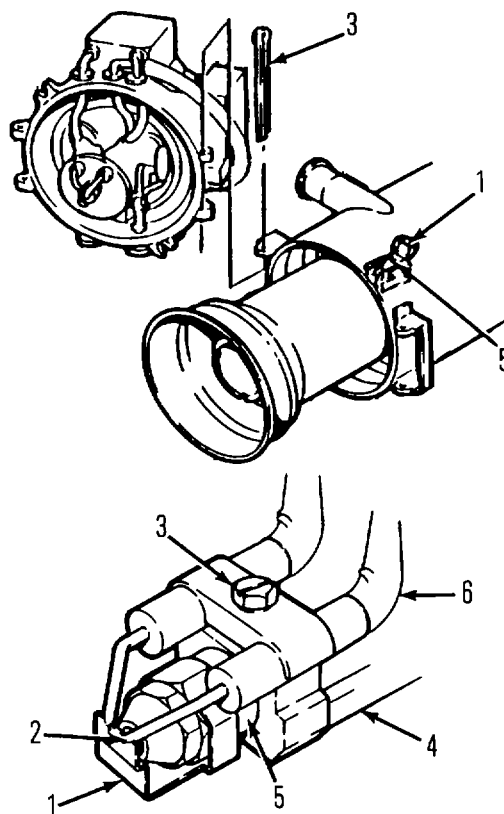
4-19. WINTERIZATION SYSTEM-Continued**4-19.5 Winterization Heater-Continued****h. Fuel Nozzle Assembly Repair - Continued**

- (7) Install nozzle (9) in nozzle holder, making sure circlip (10) is in position to hold disc (12) in place when nozzle is tightened.
- (8) Reinstall burner assembly onto heater base in the truck. Replace cotter pin (3).
- (9) Swing burner assembly onto heater, and swing eyebolts (5) onto holder. Tighten nuts (1).
- (10) Reconnect wiring harness to heater.
- (11) Reconnect fuel lines to heater.

**j. Ignition Electrodes Repair****NOTE**

These can be replaced without removing complete unit from truck.

- (1) Remove burner unit described in section h. 1 to 4.
- (2) To adjust the ignition electrodes no further disassembly of unit is necessary.
- (3) Using the electrode adjust gage, (item 2, Appendix G), align the front edge of the gage with the fuel nozzle (5). Adjust the points of the ignition electrodes (2) so they lay in the two grooves. Slight adjustment may be made by bending electrodes (2). For major adjustment loosen screw (3) and adjust electrodes. Retighten screw (3).
- (4) To replace ignition electrodes, remove screw (3) and unplug electrodes from ignition leads (6). Remove and replace electrodes through disc assembly. Adjust setting as described in step 3 preceding.
- (5) Reinstall burner assembly onto heater in the truck. Replace cotter pin.
- (6) Swing burner assembly onto heater and swing eyebolts onto holder. Tighten nuts.
- (7) Reconnect wiring harness to heater.
- (8) Reconnect fuel lines to heater.



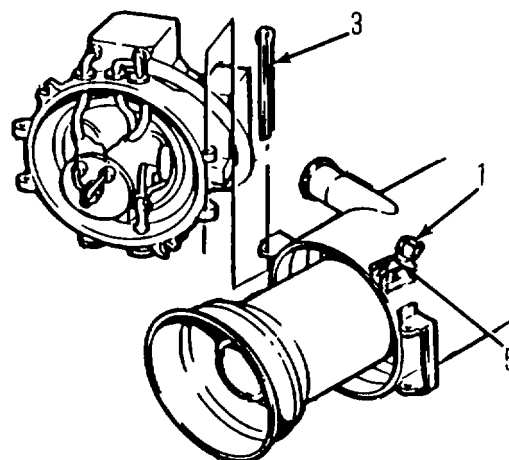
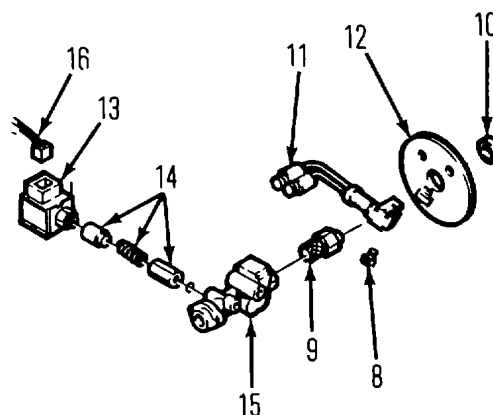
4-19. WINTERIZATION SYSTEM - Continued

k. Fuel Solenoid Valve Repair

NOTE

This can be replaced without removing complete unit from truck.

- (1) Remove flame detector (11) as described in d. Preceding.
- (2) Unplug connector (16) from solenoid valve (13).
- (3) Using a 12-Vdc test lead, dab the terminals of the solenoid valve. If the valve clicks, the coils is working but the poppet valve is leaking. Replace poppet valve assembly as in step 4 following. If the solenoid does not click, replace whole solenoid valve as in step 5 following.
- (4) Unscrew solenoid valve (13) from nozzle holder assembly (15). Slide out poppet valve and spring (14) and replace new parts in coil. Go to step 6.
- (5) Unscrew solenoid valve (13) from nozzle holder assembly (15). Discard solenoid valve and replace.
- (6) Screw solenoid valve carefully into nozzle holder assembly (15).
- (7) Test as in step 3 preceding.
- (8) Plug connector (16) into solenoid valve (13).
- (9) Attach flame detector (11) to disc (12) using screw (8).
- (10) Place disc over fuel nozzle (9) and replace circlip (10).
- (11) Plug detector wires into electronic control unit.
- (12) Reinstall burner assembly onto heater base in the truck. Replace cotter pin (3).
- (13) Swing burner assembly onto heater and swing eyebolts (5) onto holder. Tighten nuts (1).
- (14) Reconnect wiring harness to heater.
- (15) Reconnect fuel lines to heater.



4-19. WINTERIZATION SYSTEM-Continued

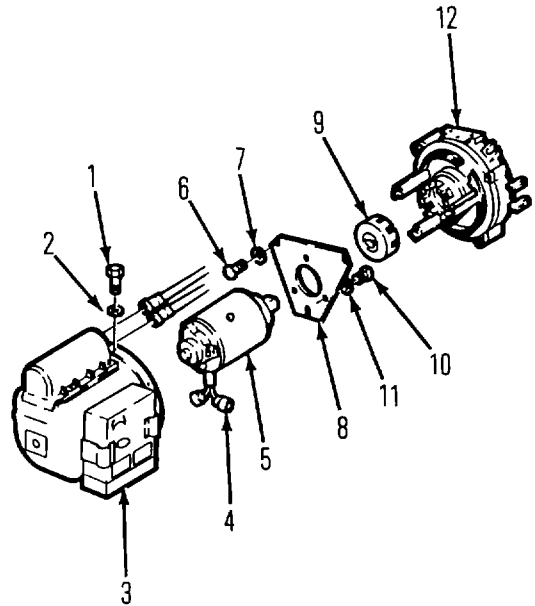
4-19.5 Winterization Heater-Continued

m. Electric Motor Repair

NOTE

This can be replaced without removing complete unit from truck.

- (1) Remove burner unit as described in section h, steps 1 thru 4 preceding.
- (2) Unplug ignition leads and solenoid wires from motor protection cover assembly (3).
- (3) Remove four screws (1) and washers (2). Remove protection cover (3) from burner unit and disconnect motor connections (4) from cover assembly.
- (4) Remove three screws (6) and washers (7) attaching motor mounting flange (8) to blower housing (12).
- (5) Remove half clutch (9) from motor shaft.
- (6) Remove three screws (10) and washers (11) attaching motor mounting flange (8) to motor (5).
- (7) Replace motor (5).
- (8) Place new motor (5) in motor mounting flange (8) and secure using screws (10) and washers (11).
- (9) Install half clutch (9) on motor shaft.
- (10) Place mounting flange assembly on fan housing (12). Install three screws (6) and washers (7) using screws and washers.
- (11) Inspect engagement of two half clutches (9). If positioning of motor half clutch has to be adjusted remove motor and mounting flange assembly. Reposition motor half clutch. Recheck engagement when re-installed.
- (12) Tighten screws (6) and washers (7).
- (13) While holding protection cover, reconnect motor connections.
- (14) Install protection cover (3) with four screws (1) and washers (2).
- (15) Install burner assembly in truck as described in h. preceding.



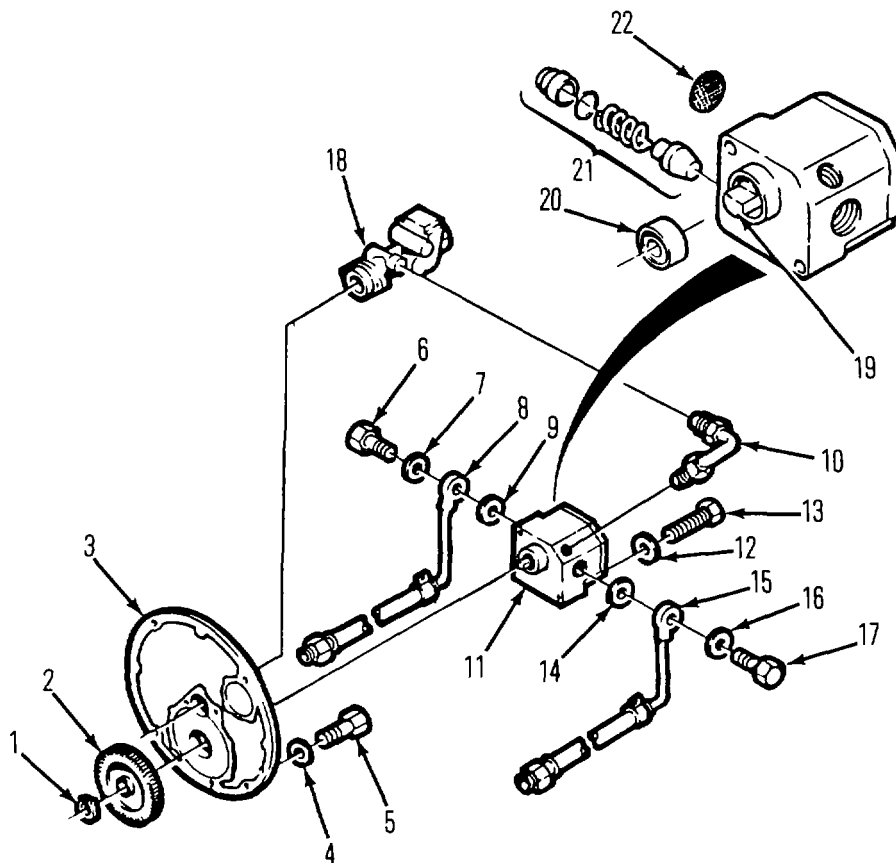
4-19. WINTERIZATION SYSTEM - Continued

n. Fuel Pump Repair

NOTE

This can be replaced without removing complete unit from truck.

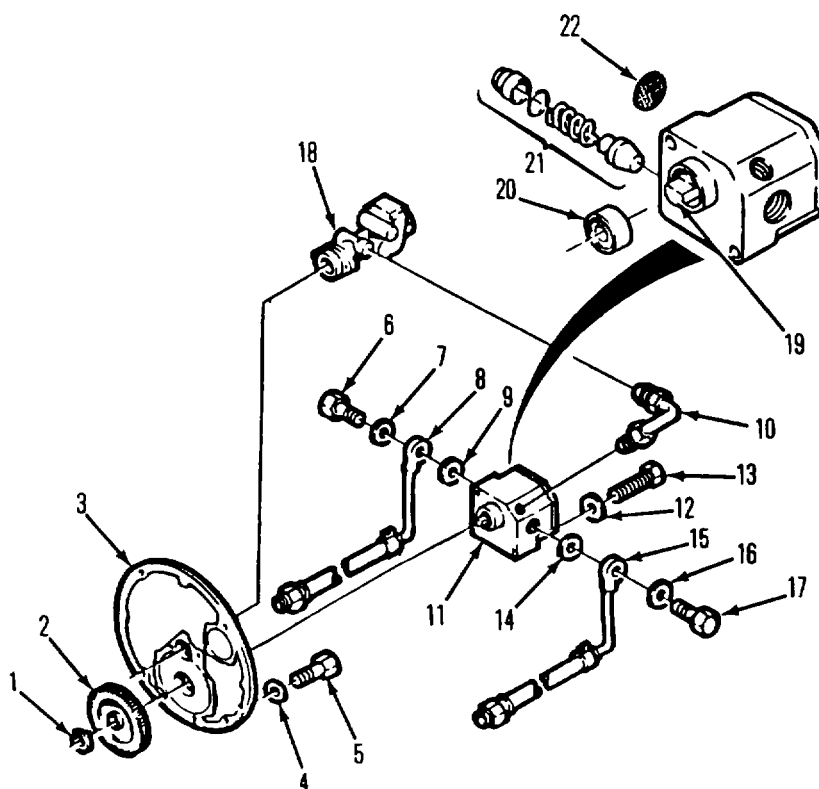
- (1) Remove flame detector as described in d. preceding.
- (2) Unplug electrodes from ignition leads.
- (3) Disconnect plug to fuel solenoid valve.
- (4) Remove fuel supply line (10) from fuel pump (11) and nozzle holder (18).
- (5) Remove banjo bolt (6). Remove fuel inlet line (8), and seals (7) and (9).
- (6) Remove banjo bolt (17). Remove fuel return line (15) and seals (14 and 16).
- (7) Remove four capscrews (5) and washers (4) and lift plate (3) away from blower assembly.
- (8) Remove circlip (1). Remove drive gear (2) from pump shaft (19).
- (9) Remove two capscrews (12) and washers (13). Lift fuel pump off plate (3).
- (10) Check fuel pump filter (22) for contamination. Clean with clean fuel.



4-19. WINTERIZATION SYSTEM-Continued

4-19.5 Winterization Heater-Continued

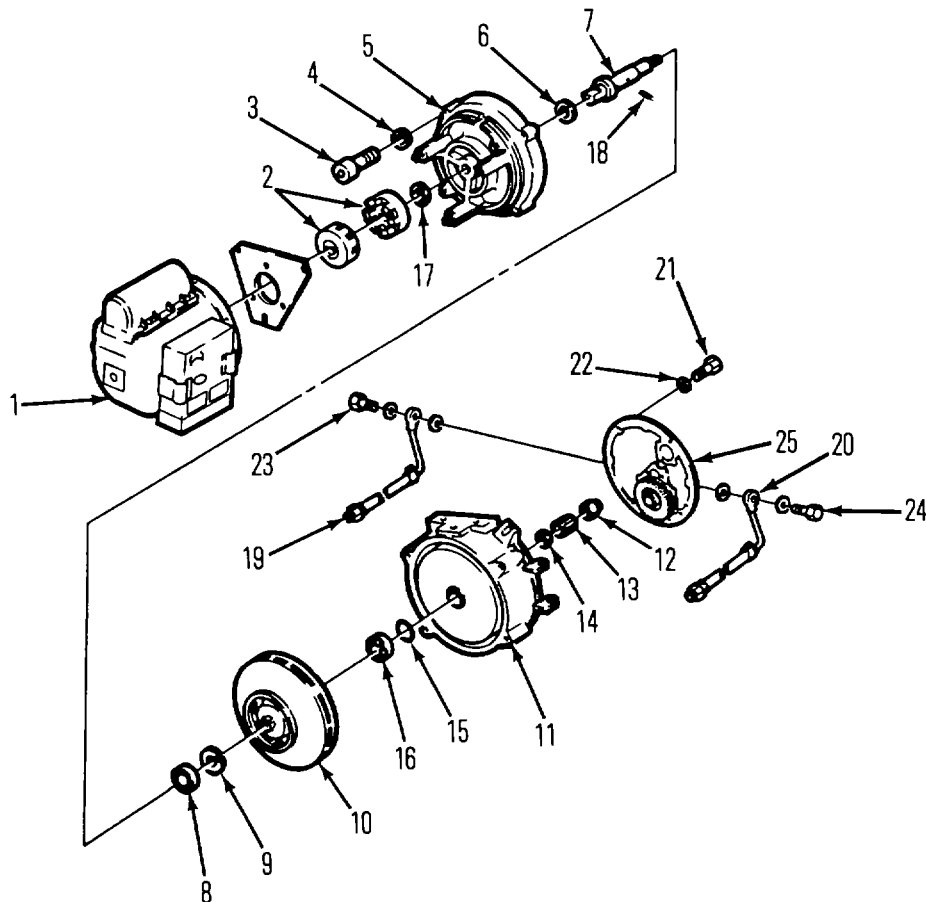
n. Fuel Pump Repair-Continued



- (11) Check pressure control valve (21) for broken spring. Replace control valve assembly if any damage is detected.
- (12) Replace fuel pump complete if gears or body show any damage, or there is excessive gear to body clearance.
- (13) Install new pump through nozzle holder plate (3) and attach with two capscrew (12) and washers (13).
- (14) Install drive gear (2) and circlip (1) on fuel pump shaft (19).
- (15) Install fuel pressure line (10) between fuel pump (11) and nozzle holder (18).
- (16) Install plate (3) on blower assembly using four capscrews (5) and washers (4).
- (17) Reconnect fuel inlet (8) and return lines (15) using new sealing washers (7, 9, 14, 16) on banjo bolts (6, 17).
- (18) Plug ignition leads into electrodes.
- (19) Connect plug to fuel solenoid valve.
- (20) Replace flame detector and install assembly in truck as described in d. preceding.

4-19. WINTERIZATION SYSTEM - Continued

p. Heater Fan and Fan Bearings Repair

**NOTE**

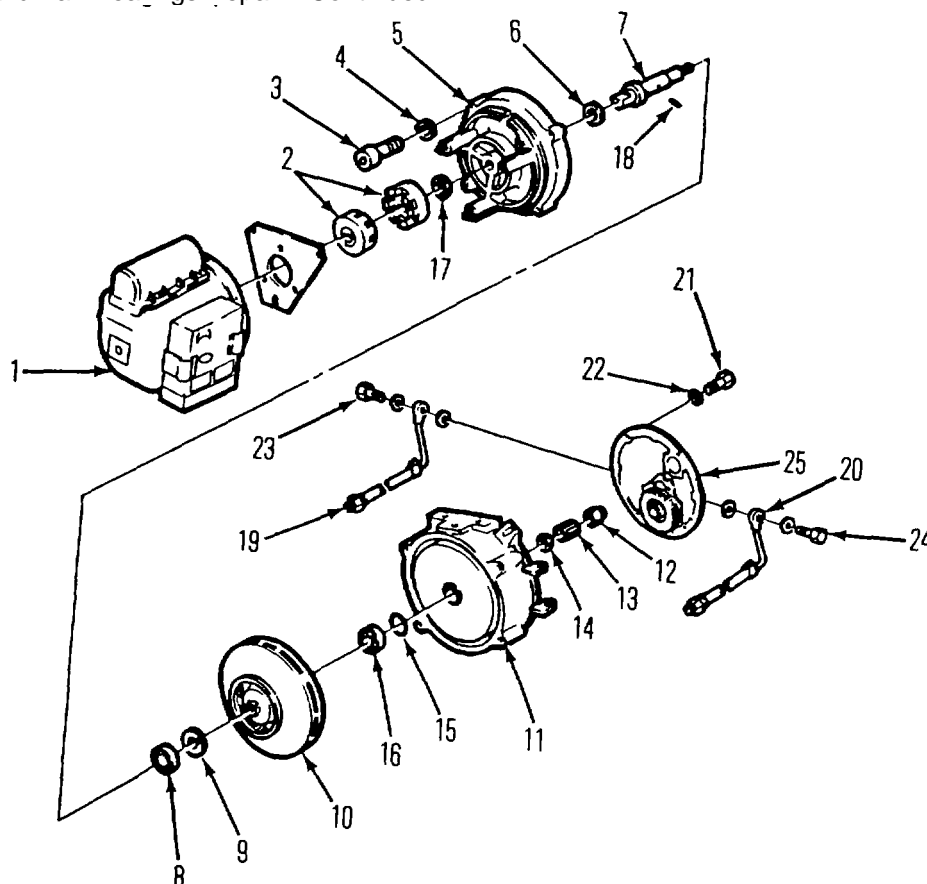
This can be replaced without removing complete unit from truck.

- (1) Remove motor as detailed in m. preceding.
- (2) Remove flame detector and support disc as detailed in d. preceding.
- (3) Remove fuel inlet and outlet lines (19 and 20) to fuel pump by removing banjo bolts (23 and 24) and associated seal washers.
- (4) Remove four cap screws (21) and washers (22). Lift off plate assembly (25) from fan housing (11).
- (5) Support fan assembly in vise.
- (6) Remove nut (12) fuel pump drive gear (13) and washer (14) from fan shaft. Stop fan rotating by holding wrench on clutch flat.
- (7) Remove four cap screws (3) and washers (4).
- (8) Pull blower housing (11) from motor support (5), If very tight use a puller between blower housing and end of shaft.

4-19. WINTERIZATION SYSTEM-Continued

4-19.5 Winterization Heater-Continued

p. Heater Fan and Fan Bearings Repair - Continued



- (9) Remove fan (10) from shaft (7), if necessary using puller.
- (10) Remove circlip (9) and remove housing from vise.
- (11) Tap motor drive end of shaft with soft faced hammer. Bearing (8), drive shaft (7) will fall away from housing (5).
- (12) Using drift remove bearing (16) from housing (11).
- (13) Remove and discard both seals, (15 and 6).
- (14) Inspect bearings, fan drive shaft, circlips and drive pin (18) for wear. Replace all components failing inspection.
- (15) Inspect blower housing (11) and motor support housing (5) for cracks or warps. Replace as required.
- (16) Check fan for wear in drive pin area or destruction of vanes. Clean all debris from fan. Replace as required.

4-19. WINTERIZATION SYSTEM - Continued

- (17) Replace O-ring seal (15) and bearing (16) in housing (11).
- (18) Fit circlip (17) into motor support housing (5). Press new seal against circlip (fan side).
- (19) Press bearing (8) onto drive shaft (7) (fan end) until it rests on the shoulder of the shaft.
- (20) Press drive pin (18) into hole in drive shaft.
- (21) Press drive shaft into motor support housing until outer race of bearing (8) rests on circlip (17).
- (22) Fit circlip (9) into motor support housing.
- (23) Push fan (10) onto drive shaft (7) ensuring it keys onto drive pin (18).
- (24) Press blower housing (11) onto drive shaft.
- (26) Install capscrews (3) and washers (4) and tighten.
- (27) Install washer (14) and gear (13) onto drive shaft and secure with locknut (12).
- (28) Install motor as detailed in m. preceding, but do not replace blower housing on heater in truck.
- (29) Install flame detector as detailed in d. preceding.

4-20. RADIATOR AND COOLING SYSTEM.**4-20.1 Radiator and Shutter Assembly.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
104065 Radiator Lifting Beam

MATERIALS/PARTS

22, Appendix E Pipe Sealant
25, Appendix E Sealant

PERSONNEL REQUIRED - 3**EQUIPMENT CONDITION**

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Engine Compartment Covers Removed (see para.
4-12.11)
Roof Canopy Removed (see para. 4-12.11)
(Including Air Filter)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the radiator.

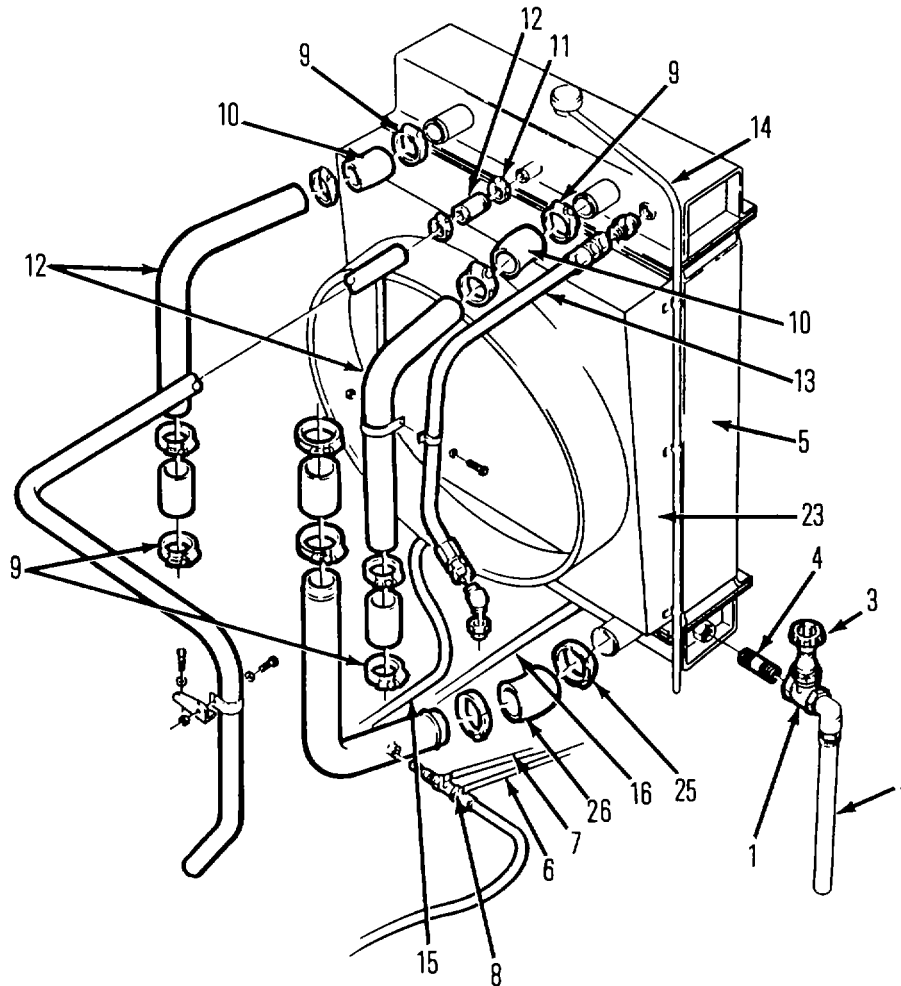
NOTE

The radiator can only be removed through roof canopy. The workshop should be equipped with an overhead crane with a ground clearance of at least 16 ft (4.9 m). The radiator weighs 300 lb (135 kg).

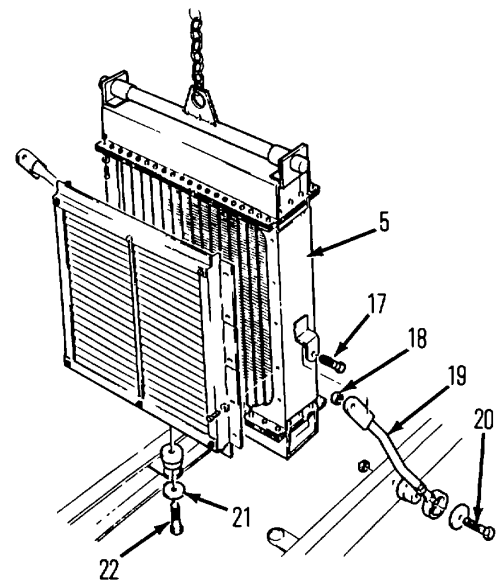
REMOVAL

- (1) Drain the radiator via the valve (1) on the right-hand side of the radiator. Cooling system capacity is about 16 gal (60 L).
- (2) Remove drain hose (2) and handle (3). Then unscrew drain valve (1) and nipple (4) from radiator (5).
- (3) Tag and disconnect air line (6) between multistat and fan clutch, and air line (7) between multistat and radiator shutter. Disconnect hoses at multistat (8).
- (4) Loosen four gear clamps (9). Pull upper hoses (10) from radiator connection. Remove clamp (11) and pull hose (12) from radiator connection. Twist upper tubes (12) 1/4 turn inward.
- (5) Loosen radiator connection on hose (13) and remove radiator overflow hose (14). Position hoses so they do not interfere with removal.

4-20. RADIATOR AND COOLING SYSTEM - Continued



- (6) Tag and disconnect transmission cooling hoses (15 and 16) from bottom of radiator (5). Install a No. 16 (1 in.) plug in the end of each hose to prevent oil loss or contamination of transmission oil.
- (7) Plug transmission cooling hose nipples using No. 16 (1 in.) plugs.
- (8) Disconnect air line (6) at fan clutch end. Be careful not to damage radiator core.
- (9) Loosen and remove capscrews (17) and nuts (18) from the left and right stabilizers (19). Loosen capscrews (20) and position stabilizers so they do not interfere with removal.

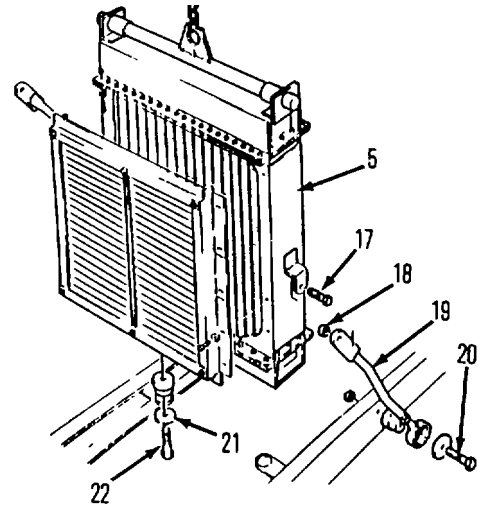


4-20. RADIATOR AND COOLING SYSTEM - Continued**4-10.1 Radiator and Shutter Assembly - Continued**

- (10) Loosen hose clamp (25) and pull lower hose (26) from radiator connection.
- (11) Attach radiator lifting tool to the top of the radiator upper tank.

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device. Wear safety shoes, gloves and other suitable protective clothing.



- (12) Attach overhead crane to radiator lifting tool eye, then take up crane slack DO NOT LIFT TRUCK..
- (13) From underneath the truck, remove both capscrews (21) and washers (22).
- (14) Lift radiator assembly (5) until it just clears rubber isolators, then carefully slide radiator assembly forward enough until the fan clears shroud (23).
- (15) Carefully continue to lift radiator assembly straight up through the top of the truck. Ensure air hoses connected to shutter control (24) do not interfere during radiator removal. Once removed, lower radiator to the ground.

INSTALLATION

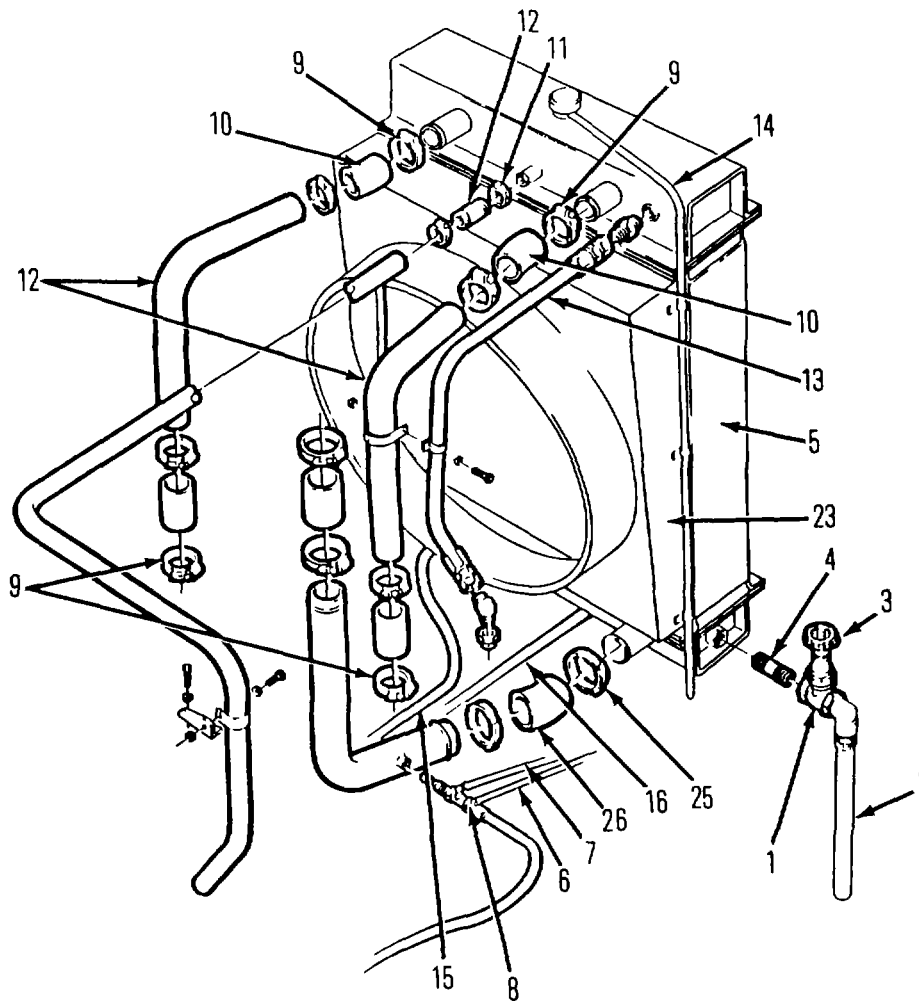
- (1) Attach radiator lifting tool to the radiator (5) being installed in the truck.

WARNING

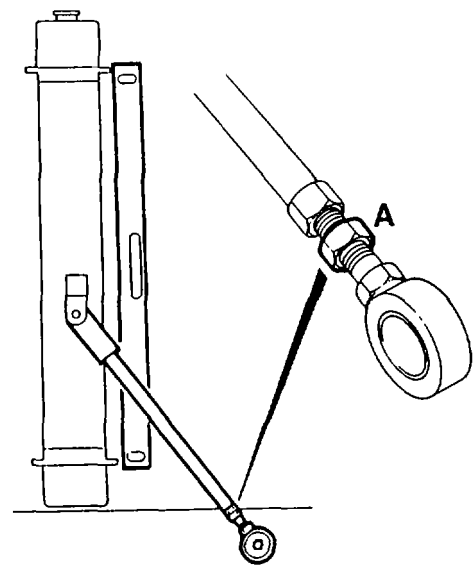
Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device. Wear safety shoes, gloves and other suitable protective clothing.

- (2) Raise radiator assembly until it clears truck roof. Position radiator over engine compartment slightly forward off the radiator isolators.
- (3) Carefully lower radiator assembly (5) straight down into the engine compartment. Make sure the fan clears the shroud (23) and the air lines attached to the shutter control do not interfere during installation.
- (4) Stop lowering the radiator assembly (5) just as it contacts the isolators.
- (5) Aline mounting holes in radiator with holes in isolators. Install capscrews (21) and washers (22).

4-20 RADIATOR AND COOLING SYSTEM - Continued

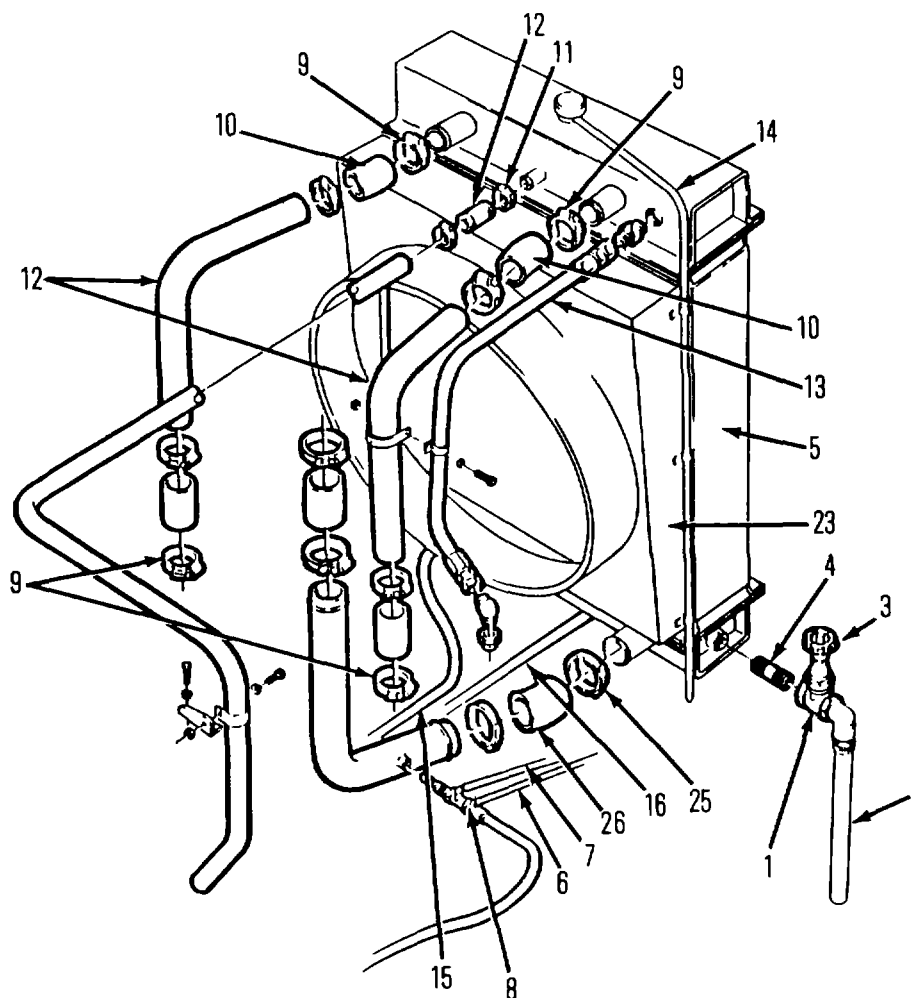


- (6) Completely lower radiator and attach the upper ends of the left and right stabilizers (19) to the radiator using capscrew (17) and nut (18).
- (7) Tighten capscrews (21) to 150 ft lb (205 Nm).
- (8) Attach hose (26) to radiator connection and secure using clamp (25).
- (9) Check radiator is perpendicular to the frame by using a level on the frame and comparing it to the radiator back face. Adjust by removing stabilizer bar upper end, slackening locknut (A) and rotating bar either 1 full turn clockwise or anticlockwise. Tighten fasteners (17, and 20) to 150 ft lb (205 Nm).



4-20. RADIATOR AND COOLING SYSTEM - Continued

4-20.1 Radiator and Shutter Assembly - Continued



- (10) Disconnect overhead crane and remove radiator lifting tool from radiator.
- (11) Attach air line (6) to fan clutch.
- (12) Remove plugs from transmission hoses (15 and 16) and plugs from radiator. Attach hoses (15 and 16) to radiator and tighten fittings firmly.
- (13) Attach hose (13) to radiator connection and tighten firmly.
- (14) Attach overflow hose to radiator fill neck.
- (15) Twist upper tubes (12) so that hoses (10) can be connected to radiator connections.

4-20. RADIATOR AND COOLING SYSTEM - Continued

- (16) Push hoses (10) onto radiator connections. Tighten four clamps (9) firmly.
- (17) Attach hose (12) to radiator connection and tighten clamp (11) firmly.
- (18) Attach air line (6) and air line (7) to the correct port on multistat (8).
- (19) Apply pipe sealant (item 22, Appendix E) to the threads of close nipple (4). Attach drain valve (1) to radiator (5) using close nipple.
- (20) Attach hose (2) to drain valve (1) and secure using clamp.
- (21) Fill radiator with a water and antifreeze solution (see LO 5-4210-220-12).
- (22) Check for leaks and repair as required.
- (23) Start APU and circulate water through winterization/engine cooling system for fifteen minutes. Top up radiator as required. Bleed any air from the inlet connection to the winterization heater in the pump body.
- (24) Install radiator cap and start main engine. Check for leaks as engine warms up. Run until at working temperature and be sure radiator fan and shroud operate.
- (25) Check transmission hose connections for leaks. Tighten or replace as required.
- (26) Stop main engine and, when cool, check radiator level. Top up as required. Check transmission oil level and top up as required.

REPAIR**NOTE**

For radiator core leak, refer problem to Direct Support.

- a. Radiator Pressure Cap Repair

WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the radiator.

NOTE

The radiator pressure cap cannot be repaired. It must be replaced. The cap can be replaced without removing the radiator from the truck.

- (1) Remove pressure cap from radiator via hole in roof canopy.
- (2) Inspect radiator cap seating area for dirt, score marks etc.

4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20 1 Radiator and Shutter Assembly - Continued**

a. Radiator Pressure Cap Repair - Continued

- (3) Install radiator cap. Start engine and check temperature of coolant when at working temperature. Be sure no fluid is dripping from radiator overflow hose.

b. Radiator Overflow Hose Repair

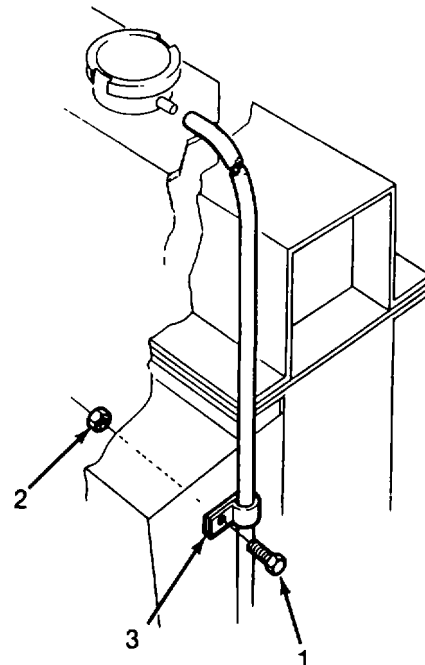
WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the radiator.

NOTE

The radiator overflow hose cannot be repaired. Replace if it has cracks or tears. The overflow hose can be replaced without removing the radiator from the truck.

- (1) Remove screws (1), nuts (2), and clamps (3).
- (2) Pull radiator overflow hose off radiator.
- (3) Cut length of radiator hose to fit.
- (4) Install radiator hose on filler neck.
- (5) Clamp in place using screw (1), nuts (2) and clamps (3).



c. Radiator Drain Valve Repair

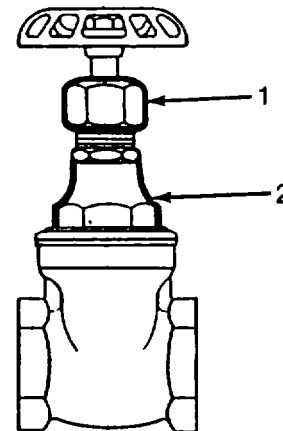
WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the radiator.

NOTE

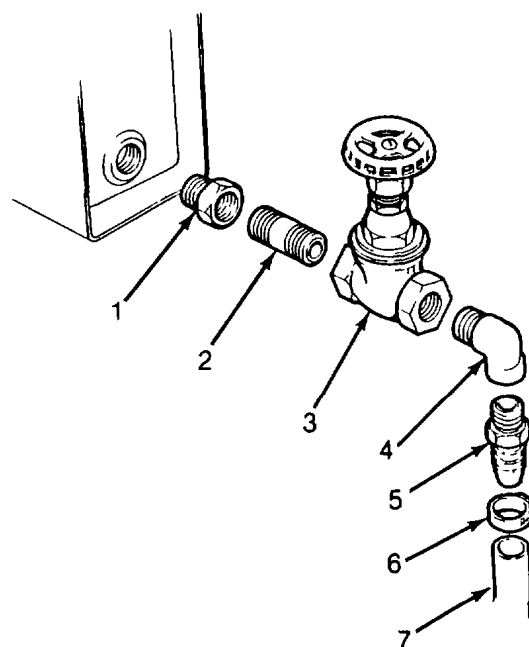
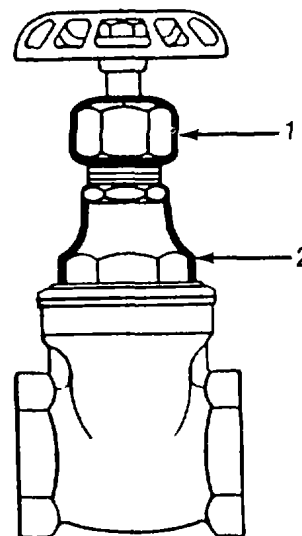
The drain valve can be repaired without removing radiator from the truck.

- (1) If the valve stem leaks when under pressure, tighten gland nut (1) until leak stops.
- (2) If leak does not stop replace the valve, see below.



4-20. RADIATOR AND COOLING SYSTEM - Continued

- (3) If the valve body seal leaks, tighten body nut (2) until leak stops.
- (4) If leak does not stop, drain the radiator and either.
 - (a) remove valve body by unscrewing body nut (2) and replace the body seal, or
 - (b) replace the valve, see below.
- (5) If tightening does not stop leaks or the valve seat leaks, replace the valve. Drain radiator via the valve. The cooling capacity is about 16 gal (60 L).
- (6) Remove pipe clamp (6) and drain hose (7).
- (7) Holding the valve body, unscrew the street elbow (4) from the valve.
- (8) Remove valve handle and holding the reducer bushing (7) unscrew valve (3). If nipple (2) is removed with valve, remove nipple from valve.
- (9) Install nipple (2) and new valve (3) on reducer bushing (1.) Coat threads with pipe sealant (item 22, Appendix E) before installation.
- (10) Install elbow/barbed nipple assembly on valve using pipe sealant (item 22, Appendix E) on threads.
- (11) Install hose (7) and hose clamp (6) on barbed nipple.
- (12) Refill radiator and start engine, top up radiator as required. Be sure winterization valves on engine are open.
- (13) Bleed air from the winterization heater inlet hose (In the pump body). Top up radiator as required.
- (14) Replace radiator cap and allow engine to reach working temperature. Inspect fittings for leaks. Tighten fittings as required.



4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20.1 Radiator and Shutter Assembly - Continued**

d. Radiator Shroud Repair

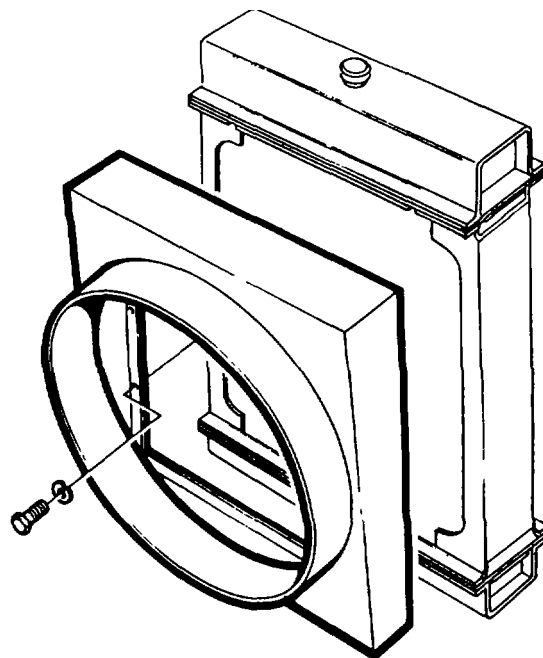
WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the radiator.

NOTE

The shroud can be repaired without removing radiator from the truck.

- (1) If the shroud is bent or dented such that it interferes with the fan, bend shroud away from fan. Always test clearance by rotating fan by hand before starting engine. To disengage fan clutch, set fan switch to AUTO.
- (2) If shroud is very badly damaged, replace as detailed below.
- (3) Remove engine compartment canopy, see para. 4-12.11.
- (4) Remove fan hub nuts and nut retaining the fan clutch piston. Remove the piston. Place fan against radiator, within the shroud.
- (5) Disconnect air hose from fan clutch piston and pull out of shroud.
- (6) Remove the hoses and tubes connected to the upper tank on the radiator, see para. 4-20.3.
- (7) Remove the radiator overflow hose from shroud.
- (8) Undo capscrews attaching shroud to radiator.
- (9) Pull shroud and fan up through the roof canopy.
- (10) Replace shroud and fan and reattach to radiator with screws.
- (11) Replace hoses and tubes connected to the upper tank on the radiator, see para. 4-20.3.
- (12) Thread air hose through fan shroud and attach to fan clutch piston.
- (13) Install fan and fan clutch piston on fan hub. Tighten fan retaining nuts to 75 ft lb (100 Nm).



4-20. RADIATOR AND COOLING SYSTEM - Continued

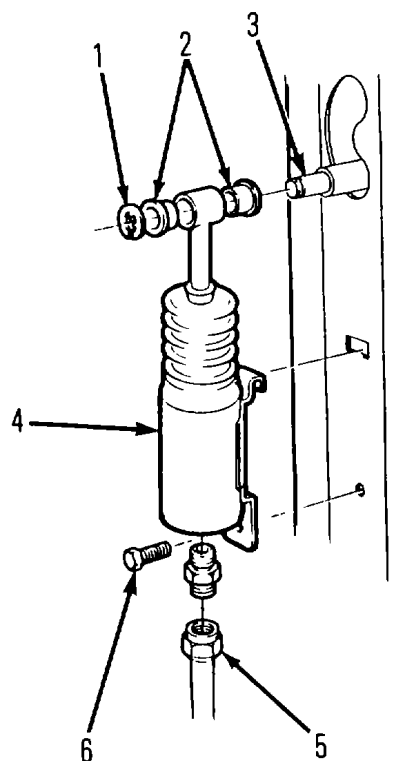
- (14) Install radiator overflow hose on fan shroud.
- (15) Test fan/shroud installation as detailed in step 1 preceding.
- (16) Replace the engine compartment canopy.

e. Radiator Shutter Cylinder Repair.

NOTE

Radiator does not have to be removed from truck, but it must be dismantled and moved back towards the engine about 4 in. (10 cm). Shutter cylinder cannot be repaired. It must be replaced if faulty. Ensure air tanks are drained.

- (1) Move radiator back toward engine about 4 in. (10 cm) as detailed in para. 4-20.1 REMOVAL preceding. Rotate right hand side back further than left hand side until shutter cylinder is accessible.
- (2) When accessible, disconnect air line (5) to radiator shutter cylinder.
- (3) Remove retaining screw (6).
- (4) Remove circlip (1) from end of shutter arm (3) and ease cylinder push rod off shutter arm. Remove both bushings (2) from shutter arm.
- (5) Remove fitting from old cylinder and install on new using pipe sealant (item 22, Appendix E) on the threads.
- (6) Install new cylinder (4) on shutter arm. Be sure bushings are correctly installed.
- (7) Retain cylinder on shutter arm (3) using circlip (1).
- (8) Install cylinder body into side of shutter and attach using screw (6).
- (9) Connect air line to radiator shutter cylinder using pipe sealant (item 22, Appendix E) on threads.
- (10) Install radiator as detailed in INSTALLATION preceding.
- (11) Start engine and fill air tanks to full pressure. Set shutter switch in cab to AUTO, in AUTO, shutter should be CLOSED. Set shutter switch to MANUAL, shutter should be OPEN.



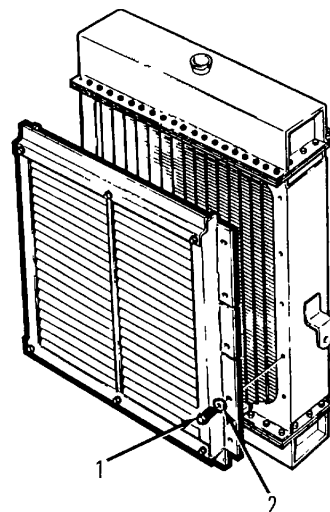
4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20 1 Radiator and Shutter Assembly - Continued**

f. Radiator Shutter Repair.

NOTE

The shutter cannot be repaired. Replace if faulty. Radiator must be removed from truck to enable shutter replacement. Ensure air tanks are drained.

- (1) Remove radiator from truck as detailed in REMOVAL preceding.
- (2) Remove shutter and shutter cylinder together by removing retaining screws (1) and washers (2).
- (3) Remove air line from shutter cylinder.
- (4) Prior to installation of new shutter, coat the flange areas of the radiator with sealant (item 18, Appendix E).
- (5) Install shutter on radiator using screws (1) and washers (2) Tighten to 7 ft lb (10 Nm).
- (6) Test assembly by connecting a 100 psi air supply to the shutter cylinder. Ensure shutter operates freely.
- (7) Coat threads with pipe sealant (item 22, Appendix B) and connect air line to shutter cylinder. Wrap in a pigtail and tape to side of radiator.
- (8) Install radiator/shutter assembly as detailed in INSTALLATION preceding.



4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20.2 Fan Assembly**

This task covers **Replacement**

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 4-12)
Batteries Disconnected (see para. 4-24)
Engine Compartment Covers Removed (see para
4-12.11)
Truck Wheels Blocked
All Air Tanks Drained

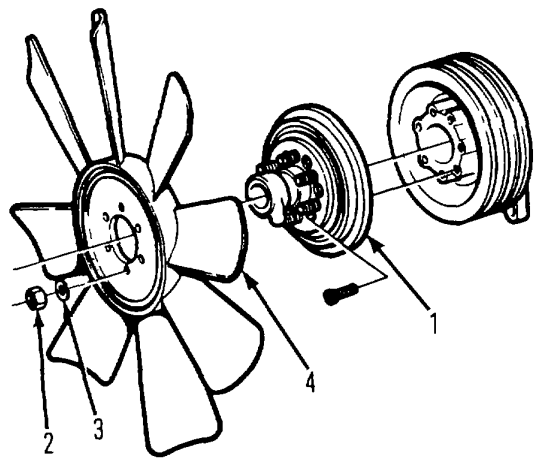
MATERIALS/PARTS

16, Appendix E Grease
4035-37494-07 Fan
1090-06060-02 Fan Clutch
1077-05827-02 Fan Hub

REPLACEMENT

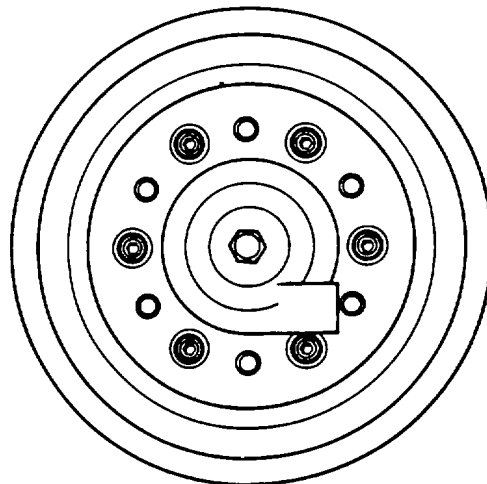
a. Fan Replacement.

- (1) Disconnect air line from fan clutch piston.
- (2) Remove nut from end of fan clutch (1) and remove fan clutch piston.
- (3) Remove nuts (2) and lockwashers (3) retaining fan to fan hub. Fan clutch is locked on because no power is on truck. However, fan will still slip so hold blades when loosening nuts.
- (4) Remove fan (4) and rest against radiator.
- (5) Remove fan clutch and pulley assembly as detailed in b. following, steps 2 thru 6.
- (6) Remove fan through space between engine and radiator shroud.
- (7) Place new fan against radiator, install through space between engine and radiator shroud.
- (8) Install fan clutch and pulley assembly as detailed in b following, steps 12 thru 17.
- (9) Place new fan over fan clutch and tighten nuts to 75 ft lb (100 Nm).
- (10) Install fan clutch piston and secure with nut. Reconnect air line to clutch.
- (11) Rotate fan by hand to test clearance between fan and shroud. To disengage fan clutch, set fan switch to AUTO. Fan clearance should be at least 1 in. (2.5 cm).



4-20. RADIATOR AND COOLING SYSTEM - Continued**b. Fan Clutch Replacement.**

- (1) Carry out steps 1 thru 4 in a. preceding.
- (2) Loosen fan pulley support block capscrews.
- (3) Loosen belt adjusting screw on top of fan pulley support block until fan belts can be removed from crankshaft pulley
- (4) Remove fan belts from both pulleys. Slip them over the fan clutch and remove from engine compartment.
- (5) While supporting clutch and pulley assembly, remove capscrews retaining fan pulley support block to engine
- (6) Lower fan pulley support block and remove from truck via left hand engine compartment.
- (7) Install fan pulley assembly in a vise. Connect an air line to the fan clutch and charge clutch to 100 psi (690 kPa).
- (8) Rotate fan clutch until the machine screws attaching fan clutch to fan pulley are visible. Remove air supply
- (9) Remove machine screws attaching clutch to pulley. Remove clutch but retain spacer between clutch and pulley.
- (10) Install new fan clutch on pulley ensuring spacer is fitted between pulley and clutch. If necessary connect air line to clutch assembly to allow alinement of screw heads with holes in clutch hub.
- (11) Attach using machine screws removed above. Tighten screws to 75 ft lb (100 Nm)
- (12). Install fan assembly in truck against engine support bracket. Install four retaining capscrews fingertight.
- (13) Slip fan belts over fan clutch pulley and crankshaft pulley.
- (14) Tighten adjusting screw until there is 1/2 in. (1.2 cm) play in fan belt midway between the pulleys.
- (15) Tighten support bracket retaining capscrews to 75 ft lb (100 Nm).
- (16) Install fan on fan clutch and tighten nuts to 75 ft lb (100 Nm).
- (17) Coat threads of elbow with pipe sealant (item 22, Appendix E) and install in fan clutch. Reconnect air line to clutch.



4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20.2 Fan Assembly - Continued**

c. Fan Pulley Replacement.

- (1) Carry out steps 1 thru 9 of b. preceding.
- (2) Lubricate new fan pulley using grease (item 16, Appendix E).

NOTE

Some fan hubs are fitted with grease nipple on rear of pulley and a pressure relief valve on rear of support block. Lubricate until grease comes out of the pressure relief valve. Other fan hubs are fitted with pipe plugs. Remove the plugs and install a grease nipple, (1/8 in. NPT) in one port and a relief valve (1/8 in. NPT, 1-5 psi) in the other port. Lubricate until grease comes out of pressure relief valve. Then remove fittings and refit pipe plugs.

- (3) Carry out steps 10 thru 17 of b. preceding but install new fan pulley to original fan clutch.

4-20. RADIATOR AND COOLING SYSTEM - Continued**4-20.3 Radiator Tubes and Pipes**

This task covers	Replacement
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TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Engine Compartment Covers Removed
(see para. 4-12.11)
Truck Wheels Blocked
All Air Tanks Drained

MATERIALS/PARTS

22, Appendix E Pipe Sealant
102138 Radiator Upper Tube
DCH 2250 Hose, Cut 5 in.
HS40 Hose Clamp
DHH1000 Hose, cut 4 in.
ET 24 Hose Clamp
48-F-06X04 Connector
101634-028 Hose Assembly
54-F-06X04 Elbow, 45 deg.
110-B-06X04 Reducer Bushing
HS52 Hose Clamp
DCH 3000 Hose, Cut 5 in.
1056-05683 Multistat
102137 Radiator Lower tube
116-B-12 Street Elbow
186101-12-16S Barbed Nipple
102139 Radiator Suction Tube

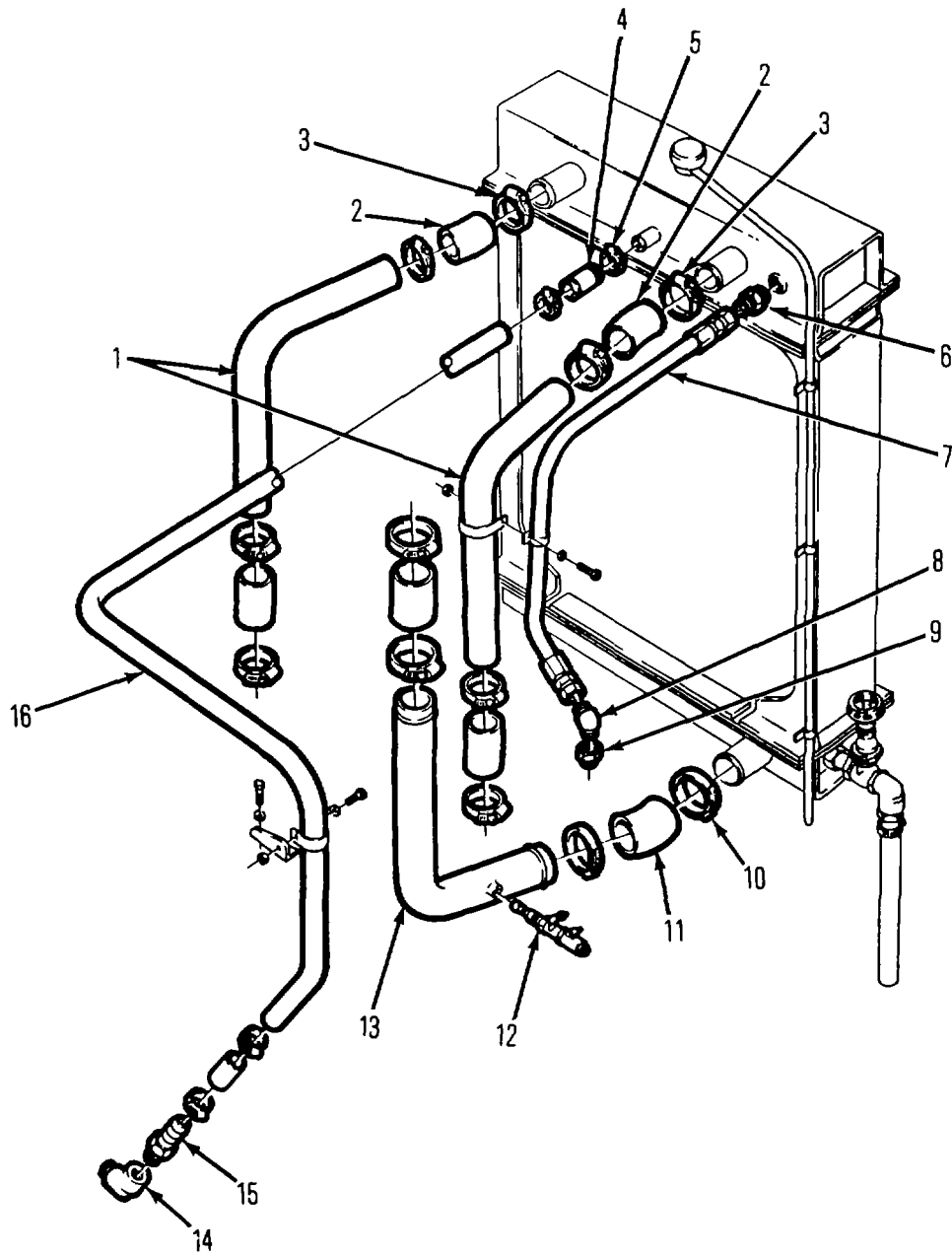
WARNING

Engine coolant can cause severe burns. Allow engine to cool before attempting to remove any tube or pipe.

REPLACEMENT

- (1) Components may be replaced individually. Drain radiator as detailed in para. 4-20.1 REMOVAL prior to replacing any component.
- (2) For replacement of hose assembly (7) refer to para. 4-9 for new hose manufacture.
- (3) Prior to replacement of lower radiator tube (13), tag and remove air hoses from multistat (12).
- (4) Prior to installation of any fitting, coat pipe threads with pipe sealant (item 22, Appendix E).
- (5) After installation always ensure there is at least 1 in. (2.5 cm) clearance between any tube or pipe and any moving part (e.g., fan belt). Ensure original securing hardware is reattached to replacement tube or pipe.
- (6) Fill radiator with coolant as detailed in LO 5-4210-220-12.
- (7) Check for leaks and repair as required.
- (8) Install radiator cap and start main engine. Check for leaks as engine warms up. Run until at working temperature and be sure radiator fan and shroud operate.
- (9) Stop main engine and, when cool, check radiator level. Top up as required.

4-20. RADIATOR AND COOLING SYSTEM - Continued



4-20. RADIATOR AND COOLING SYSTEM - Continued

4-20.4 Radiator Fan Belt.

This task covers **Replacement**

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

MATERIALS/PARTS

5133770 Belt Set, Matched

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Engine Compartment Covers Removed
(see para. 4-12.11)

WARNING

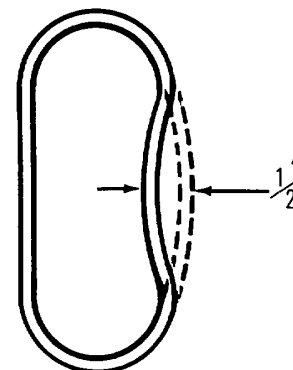
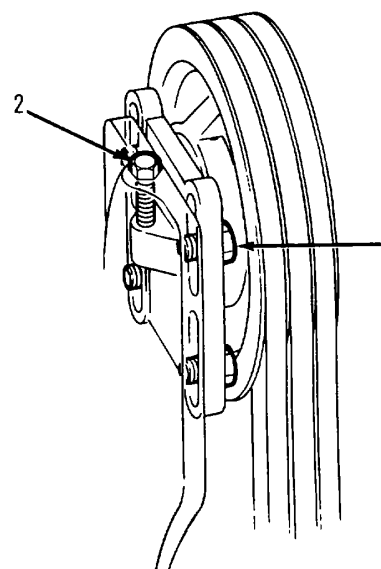
Engine coolant can cause severe burns. Allow engine to cool before attempting to maintain the fan belts.

CAUTION

Damage to truck could occur in the event belts are not equally tensioned. Always replace the belts as a set.

REPLACEMENT

- (1) Loosen all four fan belt pulley locking bolts (1).
- (2) Rotate bolt (2) anticlockwise until belts are loose enough to be pulled over pulley.
- (3) Pull belts over fan and discard.
- (4) Check new belts are a matched set and are in good condition.
- (5) Push belts over the fan and loop them over the top and bottom fan belt pulleys. Ensure they are not crossed.
- (6) Rotate bolt (2) clockwise until belts are tight. There should be 1/2 in. (1.2 cm) movement of belts midway between the pulleys.
- (7) Tighten four fan belt pulley locking bolts to 68 ft lb (92 Nm).



4-21. EXHAUST SYSTEM.**4-21.1 Muffler and Tail Pipe.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

MATERIALS/PARTS

86147 Muffler
891564 Tall Pipe

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body, and Hose Body Heat Shields Removed
(see para. 4-11)

WARNING

Exhaust parts can be hot enough to cause severe burns. Allow exhaust system to cool before servicing.

The muffler is heavy. To prevent personal injury, use a floor jack to support muffler during removal or installation.

REMOVAL

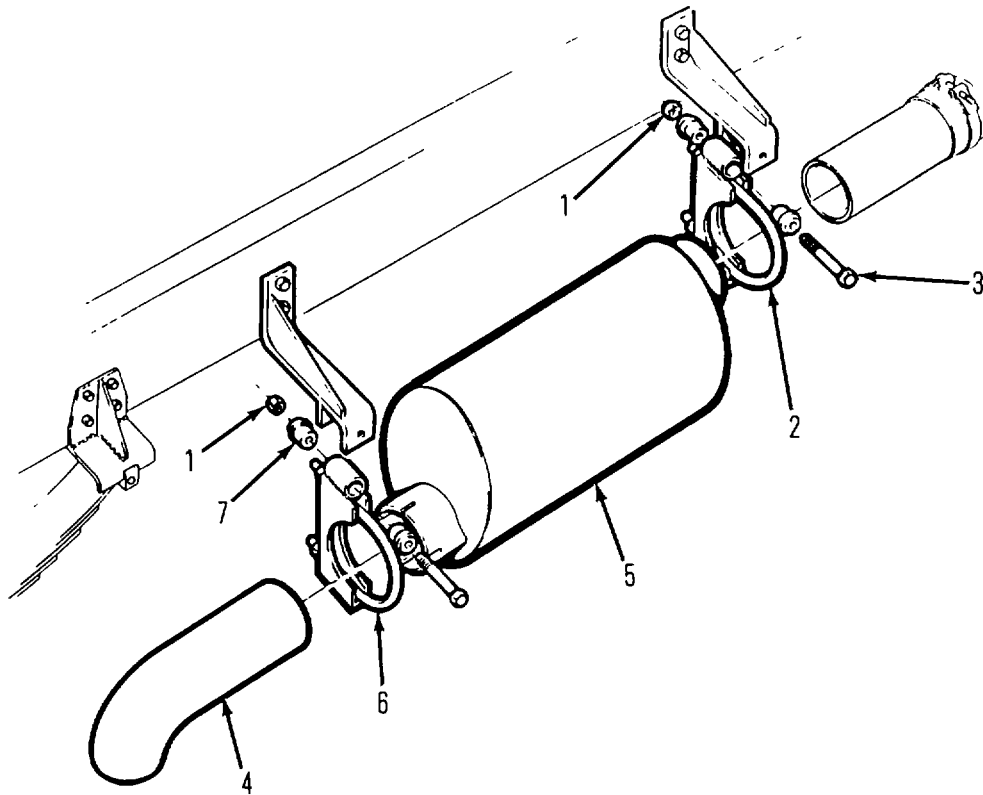
- (1) Remove remote handles from foam tank drain valve and turret pipe drain valve. Pull them clear of the underside of the truck.
- (2) Remove nuts and washers (1).
- (3) Loosen pipe clamp (2) on front of muffler. Do not remove clamp U-bolt.
- (4) While supporting the muffler, tap out the bolts (3). Twist muffler and tall pipe until it is free of exhaust pipe. Lower to the floor.
- (5) When on the floor, remove both pipe clamps (2 and 6), and remove tall pipe (4) from muffler.

INSPECTION

- (1) Inspect all parts for corrosion. Excessive corrosion resulting in holes or flaking is cause for rejection.
- (2) Inspect rubber shocks (7). They should not be brittle or cracked. Replace as required.
- (3) Replace any part failing inspection.

4-21. EXHAUST SYSTEM - Continued**INSTALLATION**

- (1) Slide tall pipe (4) onto dished end of muffler.
- (2) Connect pipe clamps (2 and 6) into position but do not tighten.
- (3) Push muffler assembly into exhaust pipe and align pipe clamps with the support brackets.
- (4) Push bolts through supports and pipe clamps and replace nut and washer (1).
- (5) Align tall pipe, by rotating, until it is pointing toward the ground.
- (6) Tighten both pipe clamps and the support bracket bolts to 30 ft lb (41 Nm).
- (7) Install remove handles to foam tank drain valve and turret pipe drain valve.



4-21. EXHAUST SYSTEM - Continued**4-21.2 Exhaust Pipe Assembly****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Pump Body and Hose Body Heat Shields Removed
(see para. 4-11)
Muffler Removed (see para. 4-21.1)

MATERIALS/PARTS

89528-K Clamp, Seal
89559-K Clamp
89510-K Clamp-V
89688-K Tube
89781-K Elbow
101851 Tube
89613-K Tube, Flexible
101623 Elbow, Weldment

WARNING

Exhaust parts can be hot enough to cause severe burns. Allow exhaust system to cool before servicing.

REMOVAL

- (1) Remove remote drain handle from turret pipe drain valve. Pull rod clear of underside of truck.
- (2) Remove seal clamp (3) from upper end of flex tube (4).
- (3) Remove clamp (1) and elbow weldment (2) from turbocharger.
- (4) Separate elbow weldment from flex tube.
- (5) Remove the remaining exhaust pipe by slipping it down through the frame.
- (6) Remove seal clamp (3) from lower end of flex tube and four flat-band clamps (7) between elbows and tubes. Break or twist apart remaining exhaust pipe.

INSPECTION

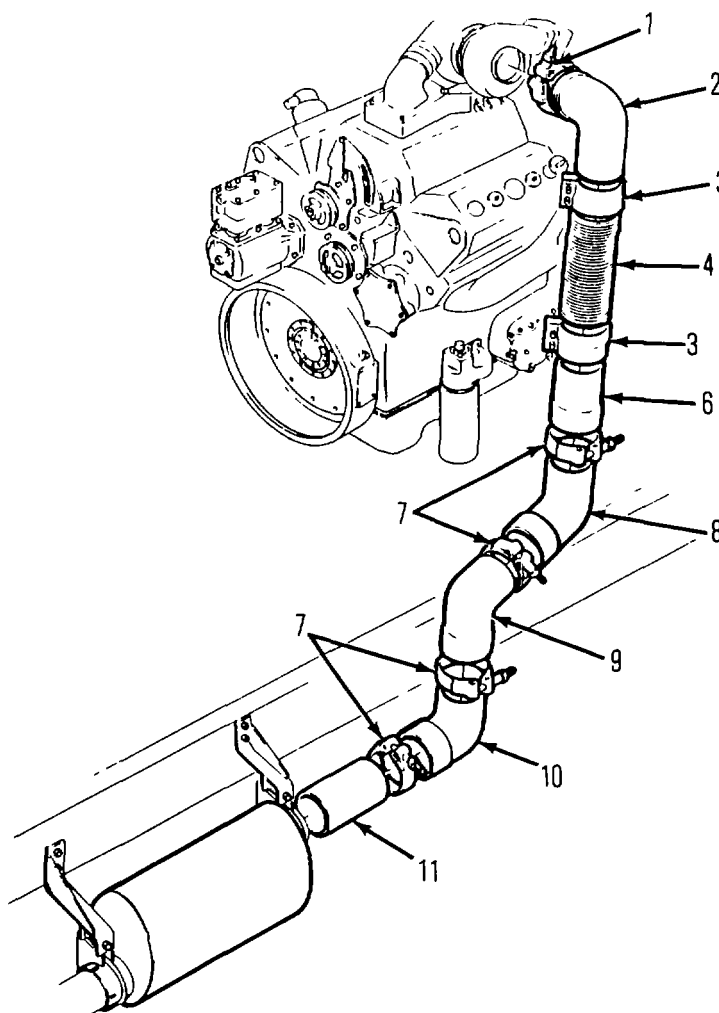
- (1) Inspect all parts for corrosion. Excessive corrosion resulting in holes or flaking is cause for rejection.
- (2) Replace any part failing inspection.

INSTALLATION

- (1) Install elbow weldment (2) on turbocharger with clamp (1) Do not tighten.
- (2) Fit together the flex tube (4), tube (6), three elbows (8, 9 and 10) and tube (11).

4-21. EXHAUST SYSTEM - Continued

- (3) Attach both seal clamps (3) and four flat-band clamps (7) but do not tighten.
- (4) Push exhaust pipe up through the frame and attach flex tube to elbow weldment (2) with seal clamp (3). Do not tighten.
- (5) Install muffler and tail pipe as detailed in para. 4-21.1.
- (6) Aline muffler pipe so that tube (11) fits into the muffler (12).
- (7) When alined, tighten four flat-band clamps (7) and two seal clamps (3) and turbocharger clamp (1) to 30 ft lb (41 Nm).
- (8) Tighten muffler clamps and support brackets to 30 ft lb (41 Nm).
- (9) Start engine and check for leaks. Tighten or remake joints as required.
- (10) Install remote handle on turret pipe drain valve.



4-21. EXHAUST SYSTEM - Continued**4-21.3 Clamps and Hangers**

This task covers	Replacement
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TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Pump Body Heat Shields Removed
(see para. 4-11.2)

MATERIALS/PARTS

21, Appendix E Petroleum Jelly
89528-K Seal Clamp
89559-K Clamp
89510-K V Clamp
101625 Clamp, Weldment
2206923 Rubber Shock
101777 Bracket Support Rear
101778 Bracket Support Front
MS51922-17 Locknut
MS90725-60 Capscrew
MS90725-72 Capscrew

WARNING

Exhaust parts can be hot enough to cause severe burns. Allow exhaust system to cool before servicing.

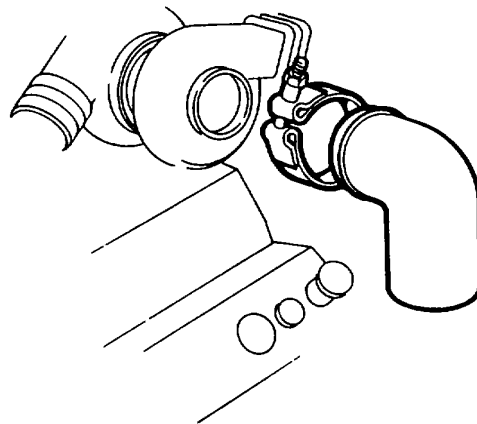
REPLACEMENT

- a. V Clamp or Clamp Replacement.

NOTE

Similar procedures are used for the tube - tube clamp and the turbocharger clamp.

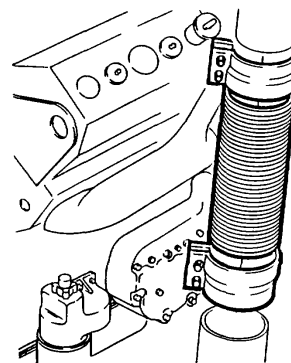
- (1) Remove clamp from turbocharger end of elbow weldment. If nut is severely corroded cut band using a hacksaw.
- (2) Separate elbow from turbocharger and insert new clamp over turbocharger and elbow flange.
- (3) Tighten clamp nut to 30 ft lb (41 Nm).



4-21. EXHAUST SYSTEM - Continued

b. Seal Clamp Replacement.

- (1) Remove clamp from either end of flexpipe. If nuts are severely corroded, cut band using a hacksaw.
- (2) Separate flexpipe from tube and insert new clamp over flexpipe. Push flexpipe onto tube.
- (3) Tighten clamp nuts to 30 ft lb (41 Nm).

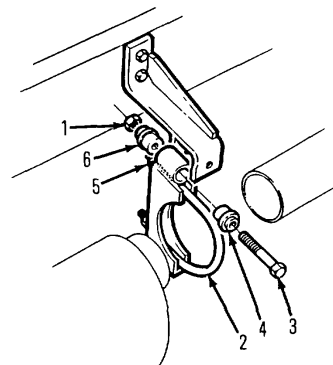


c. Support Bracket and Clamp Replacement.

NOTE

The hanger assembly on each end of the muffler are similar. Use following procedure to remove either hanger.

- (1) Remove hose body, heat shield, see para. 4-11.3.
- (2) Support weight of muffler on a floor jack.
- (3) Remove nut (1) and capscrew (3).
- (4) Remove nuts (5) from clamp. If nuts are severely corroded cut clamp U-bolt.
- (5) Tap bolt (3) out of support bracket.
- (6) If support bracket is damaged, undo nuts and bolts attaching support bracket to frame. Replace support bracket and tighten new nuts and bolts to 30 ft lb (41 Nm).
- (7) Fit shock rubbers (6) in new clamp weldment.
- (8) Tap bolt through support bracket and clamp weldment. Smear petroleum jelly (item 21, Appendix E) onto bolt to ease assembly.
- (9) Push U-bolt part of clamp through weldment. Install and tighten nuts to 30 ft lb (41 Nm).
- (10) Tighten nut (1) on support bolt to 30 ft lb (41 Nm).
- (11) Remove floor jack.



4-22. AIR SYSTEM**4-22.1 Air Tanks****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

PERSONNEL REQUIRED - 2**WARNING**

Death or serious injury could occur if compressed air is directed against the skin. Always drain the air tanks via the draincocks prior to removal.

NOTE

This is a generalized procedure for removal of any (of four) air tanks.

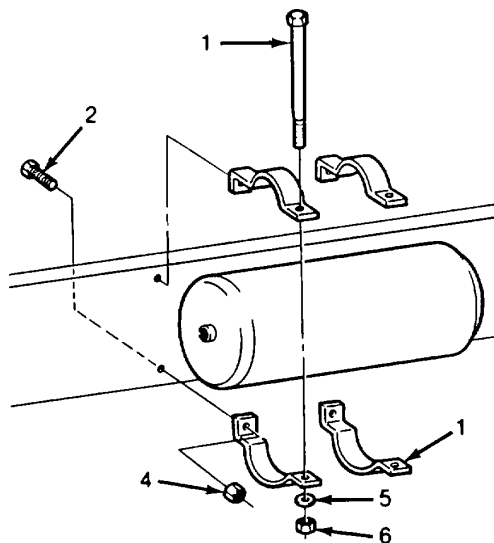
To access the PRIMARY tank remove left rear wheel (see para. 4-29.1) and pump access panel in lower left hose body compartment.

To access the SECONDARY tank remove pump body and hose body heat shield (see para. 4-11.) and right rear wheel (see para. 4-29.1).

To access the EMERGENCY or FAST air tank remove the small skid plate in front of the front axle.

REMOVAL

- (1) Tag and remove all hoses connected to the air tank being removed. Do not remove any fittings or valves while tank is installed on the truck.
- (2) Remove both capscrews (1), washers (5), and nuts (6).
- (3) Where possible loosen capscrew (2) and nut (4) on at least one of the support clamps (3) on each end of the tank.
- (4) Slide the tank, if necessary bending the support clamps, and remove from the truck.



4-22. AIR SYSTEM - Continued

- (5) Note position of all fittings and valves and remove from tank

INSPECTION

- (1) Check air tank for dents or cracks. Replace as required. Air tanks cannot be repaired by welding except in emergencies
- (2) Using a shop supply, pressurize the tank with air, submerge in water and check for any leaks. Replace fittings as required.

INSTALLATION

- (1) Coat all pipe threads with pipe sealant (item 22, Appendix E) and refit valves and fitting as noted in REMOVAL preceding
- (2) Raise air tank into position against clamps. Be sure air tank draincock is at the lowest point.
- (3) Install clamps (3) that were removed, or loosened on frame using capscrews (2) and nuts (4)
- (4) Install capscrews (1), washers (5), and nuts (6) Tighten securely
- (5) Coat all pipe threads with pipe sealant (item 22, Appendix E) and install air lines removed in step 2 of REMOVAL preceding
- (6) Reconnect batteries and start truck. When relevant air reservoir is charged, brush all air connections with soap solution. Remake or replace all leaking joints.

4-22. AIR SYSTEM - Continued**4-22.2 Pressure Protection Valves and Manifold.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained
Emergency and Fast Air Reservoirs Removed
(see para. 4-22.1)

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the pressure protection valves.

NOTE

This is a generalized instruction for any (of the three) pressure protection valves installed on the truck. The pressure protection valves are located on a cross member beneath the cab.

REMOVAL

- (1) Tag and remove all air lines (A thru H) connected to the pressure protection valve manifold
- (2) Remove the capscrews and locknuts attaching the manifold to the cab cross member
- (3) Dismantle the manifold as required using the illustration as a guide

INSTALLATION

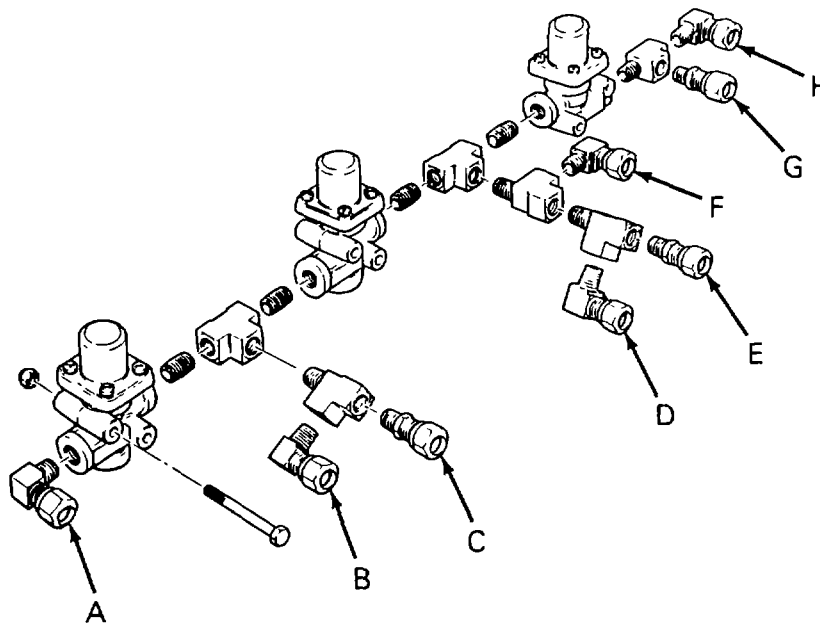
- (1) Assemble the pressure protection valves using the illustration as a guide. Be sure all pipe threads are coated with pipe sealant (item 22, Appendix E) during assembly. Use the illustration to orientate both the pressure protection valves.
- (2) Connect temporary pressure gages and drain valves to ports A, C, and H
- (3) Connect a blank to ports B, E, F, and G
- (4) Connect a temporary air line from shop supply together with a pressure gage to port D

4-22 AIR SYSTEM - Continued

- (5) Slowly build up the pressure in line D to 90 psi (620 kPa) maximum
- (6) Brush all connections with soap solution. Tighten or remake connections as required.
- (7) When all leaks are repaired, release all pressure by venting ports A, C, and H
- (8) Refill line D very slowly with air to a maximum of 90 psi (620 kPa)
- (9) Monitor the pressure gages and note the pressure at port D when the other gages start to show an increase in pressure. (Port A will only show pressure when the space between the two pressure protection valves is at pressure.)
- (10) All valves should have a pressure setting of 85 psi (500 kPa) Adjust the pressure setting by loosening the locknut (1) and tightening or loosening the adjusting cap (2) as required
- (11) When all valves are set, remove pressure gages, drain valves, blanks, and temporary air lines
- (12) Mount manifold on cab cross member using the six machine screws and locknuts
- (13) Connect the truck air lines to the manifold. Be sure they are in the same location as noted in step 1 of REMOVAL preceding

REPAIR**NOTE**

The pressure protection valves cannot be repaired. If faulty, replace



4-22 AIR SYSTEM - Continued**4-22.3 Spring Brake Valve.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

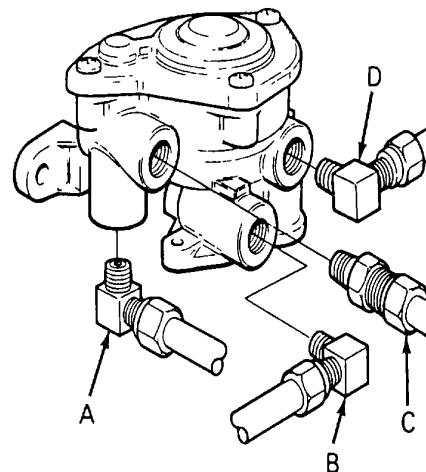
Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the spring brake valve.

NOTE

This valve is installed on the frame cross member above the rear axle.

REMOVAL

- (1) Tag and disconnect air lines A, B, C and D from spring brake valve
- (2) Remove capscrews and locknuts and remove spring brake valve from truck
- (3) Remove the elbow connectors from each port. Make a sketch to indicate which elbows fit which ports.

**INSTALLATION**

- (1) Coat elbows with pipe sealant (item 22, Appendix E) and install on new valve
- (2) Install the spring brake valve in the truck using the capscrews and locknuts
- (3) Install a pressure gage in a tee to port C. Connect all air lines as noted in step 1 of REMOVAL preceding. Coat all pipe threads with pipe sealant (item 22, Appendix E) prior to installation.

4-22. AIR SYSTEM - Continued

- (4) Connect truck batteries and start main engine. When air system is pressurized, release the parking brakes
- (5) Check all connections for leaks using a brush and soap solution. Tighten as required.
- (6) When brakes are released, pressure gage on inlet port should read at least 65 psi (450 kPa)
- (7) Place parking brake in the PARK position. Be sure the spring brakes on the rear wheels apply promptly and pressure reading drops quickly to zero. When set to RELEASE, be sure brakes release promptly.
- (8) Open the primary reservoir draincock and allow it to drain. Apply the foot brake several times and note the gage pressure reading. Check that the pressure drops continuously and the parking brakes do not release after some more attempts.
- (9) Shut down main engine and drain all air tanks
- (10) Remove gage and tee from spring brake valve. Replace with the original elbow.
- (11) Repressurize all air tanks with main engine and check brakes on moving vehicle

REPAIR

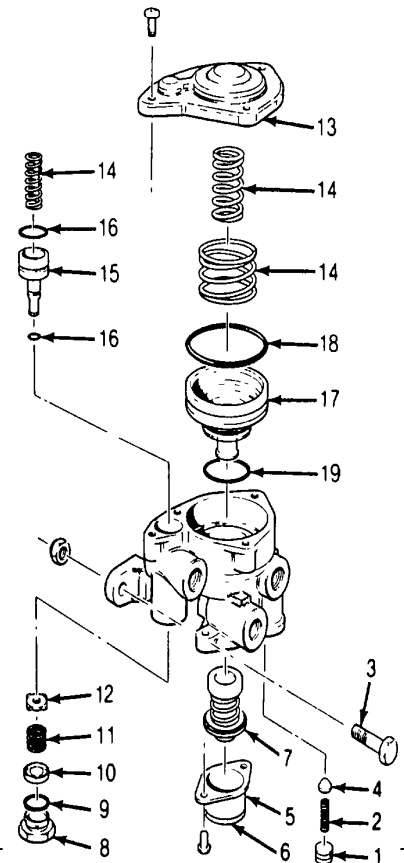
NOTE

The spring brake valve can only be repaired if it is removed from the truck. See REMOVAL preceding.

- (1) Remove the socket head pipe plug (1)
- (2) Remove the check valve spring (2) and the check valve (4)
- (3) Remove the two screws and exhaust cover (5)
- (4) Separate the exhaust diaphragm (6) from the cover
- (5) Remove the inlet and exhaust valve assembly (7)
- (6) Remove the inlet and exhaust valve cap nut (8) and separate the cap nut O-ring (9)
- (7) Remove the valve stop (10), valve spring (11), and inlet and exhaust valve (12)

CAUTION

The cover is under a spring load, and should be held while removing the screws.



4-22 AIR SYSTEM - Continued

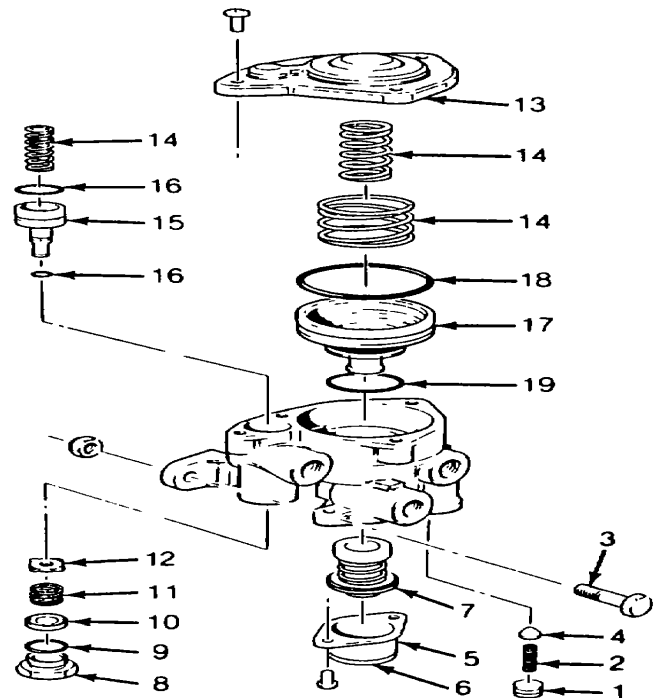
4-22.3 Spring Brake Valve - Continued

- (8) Remove the four screws and lockwashers that secure the cover to the body
- (9) Remove the cover (13) and the three piston springs (14)

NOTE

Some spring brake valves have only two piston springs.

- (10) Remove the small piston (15) and the small and large O-rings (16)
- (11) Remove the large piston (17) Remove piston O-rings (18) and (19)
- (12) Discard all parts except cover (13), piston (17), pipe plug (1), exhaust cover (5), cap nut (8), piston (15), machine screws and body
- (13) Clean all remaining parts and inspect for excessive wear, scrub marks or deterioration. Inspect the valve seats for nicks or burrs. Replace any parts failing inspection.



- (14) Lubricate all new O-rings, O-ring grooves, and piston bores with petroleum jelly (item 21, Appendix E)
- (15) Assemble the check valve (4), and valve spring (2) and install in body
- (16) Apply pipe sealant (item 22, Appendix E) to the socket head pipe plug (1) and install in the body. Tighten to 130 - 170 in. lb (14.6 - 19.3 Nm)
- (17) Install inlet and exhaust valve assembly (7) in valve body
- (18) Secure the exhaust cover (5) with the two screws and lockwashers. Tighten to 20 - 30 in. lb (2.25 - 3.38 Nm)
- (19) Install exhaust diaphragm (6) into the exhaust cover
- (20) Place inlet exhaust valve (12) in the body. Install the valve spring (11) and valve stop (10)
- (21) Install O-ring (9) on cap nut and install cap nut (8) in body. Tighten to 100 - 125 in. lb (11.3 - 14.1 Nm)
- (22) Install the small and large O-rings (16) on the small diameter piston (15) and install piston in the body

4-22. AIR SYSTEM - Continued

- (23) Install large O-ring (18) and small O-ring (19) on the large diameter piston and install piston in the body
- (24) Install the piston springs (14) In their respective pistons
- (25) Secure the cover to body using the four screws and lockwashers. Tighten to 50 - 80 in. lb (5.64 - 9.03 Nm)
- (26) Install and test the spring brake valve in the truck as detailed in INSTALLATION preceding

4-22 AIR SYSTEM - Continued**4-22.4 Relay Valve.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
All Air Tanks Drained

WARNING

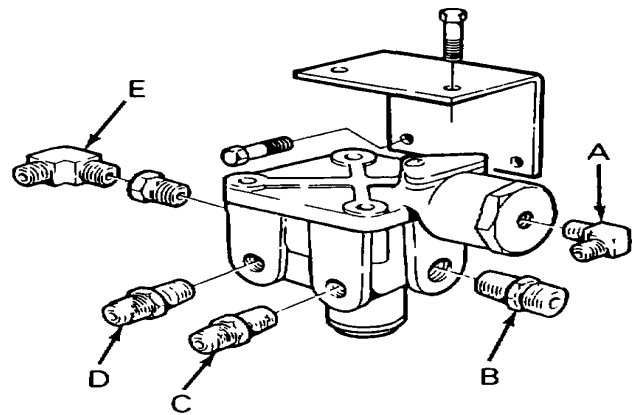
Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the relay valve.

NOTE

This valve is installed on the frame cross member above the rear axle.

REMOVAL

- (1) Tag and disconnect air lines A, B, C, D and E from relay valve
- (2) Remove locknuts and remove relay valve from truck
- (3) Remove all pipe fittings from relay valve ports. Make a sketch that indicates which fittings fit which ports

**INSTALLATION**

- (1) Install pipe fittings in relay valve ports using sketch as a guide. Coat all threads with pipe sealant (item 22, Appendix E) prior to installation.
- (2) Install relay valve on truck using locknuts
- (3) Install air lines to valve ports. Be sure the air lines are connected the same as noted in step 1 of REMOVAL preceding
- (4) Reconnect the batteries and start the truck main engine

4-22. AIR SYSTEM - Continued

- (5) When all air tanks are at pressure, make several brake applications and check for prompt application and release of the rear brakes
- (6) With the service brakes released, brush the exhaust port and area around the retaining ring with soap solution A 1 in. (2.5 cm) bubble in 3 seconds leakage is permitted
- (7) With the service brakes applied, brush the exhaust port with soap solution. A 1 in. (2.5 cm) bubble in 3 seconds leakage is permitted.
- (8) With the service brakes applied, brush the outside of the valve, where the cover joins the body, and each hose connector with soap solution. No leakage is permitted.
- (9) If the body or a connector leaks, tighten or remake connections as required. If the exhaust port leaks, repair the valve as detailed in REPAIR following.

REPAIR

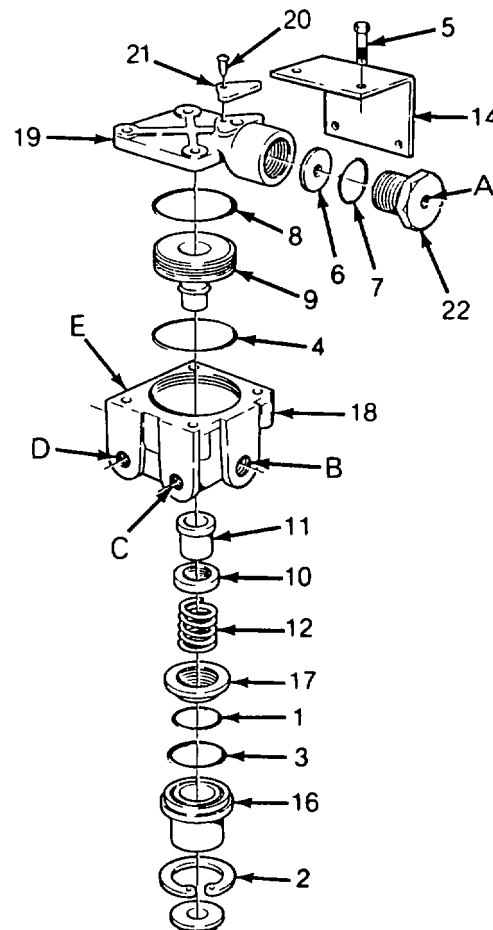
NOTE

The relay valve can only be repaired if it is removed from the truck. See REMOVAL preceding.

Prior to disassembly, mark the location of the mounting bracket to the cover and the cover to the body.

- (8) Remove the valve retainer (10) from the inlet/exhaust valve

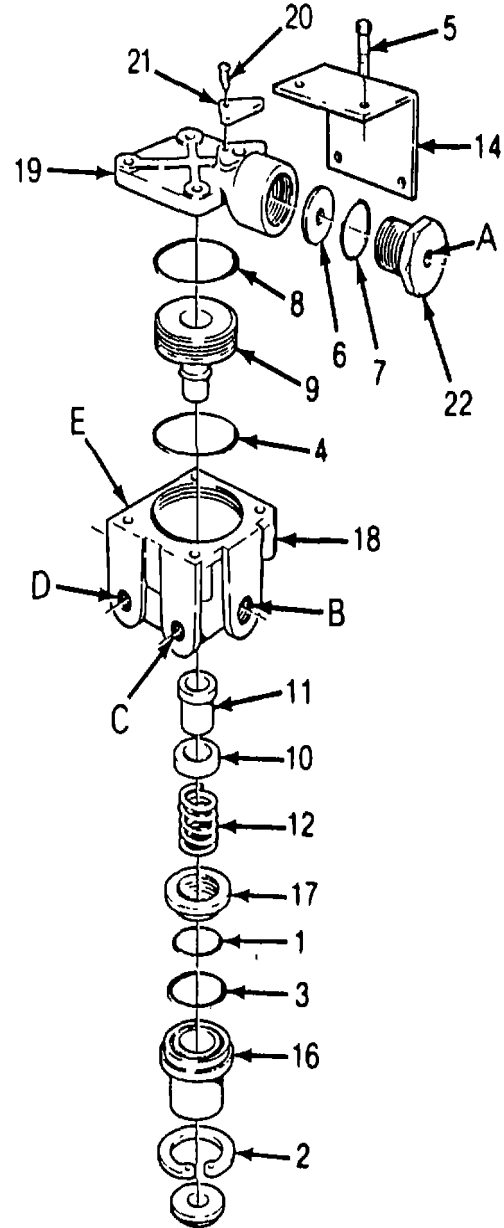
- (1) Remove the four capscrews (5) and lockwashers securing the cover (19) to the body
- (2) Remove the cover (19), ring (8), and mounting bracket (14)
- (3) Remove the piston (9) and O-ring (4) from the body (18)
- (4) While depressing the exhaust cover (16), remove the retaining ring (2, 8) and slowly relax the spring (12) beneath the exhaust cover
- (5) Remove the exhaust cover assembly. Remove O-ring retainer (17) from exhaust cover and remove O-rings (1 and 3)
- (6) Remove the inlet/exhaust valve return spring (12) from the body
- (7) Remove the inlet/exhaust valve (11) from the body



4-22. AIR SYSTEM - Continued

4-22.4. Relay Valve - Continued

- (9) Remove the screw (20) and exhaust cover (21) from the cover
- (10) Remove the service port cap nut (22) and O-ring (7) from the cover
- (11) Remove the diaphragm (6) from the cover
- (12) Discard all parts except body (18), cover (19), cap nut (22) mounting bracket, relay piston (9), and capscrews
- (13) Clean all remaining parts and inspect for excessive wear, scrub marks or deterioration. Inspect the valve seat for nicks or burrs. Replace any parts failing inspection.
- (14) Lubricate all new O-rings, O-ring grooves, and piston bores with petroleum jelly (item 21, Appendix E).
- (15) Install large piston O-ring (4) on piston (9)
- (16) Install inner (1) and outer (3) O-rings in the exhaust cover assembly and install retainer (17)
- (17) Install the O-ring (8) on the cover
- (18) Install piston in body, taking care not to damage the piston O-ring.
- (19) Noting the reference marks made during disassembly, install the cover on the valve body and the mounting bracket on the cover.
- (20) Secure the mounting bracket and cover to the body using the four capscrews (5) and lockwashers. Torque to 80 - 120 in. lb (9 03 - 13 55 Nm)
- (21) Install the valve retainer (10) in the inlet/exhaust valve (11) and install in the body.
- (22) Install the inlet/exhaust valve return spring (12) in the body
- (23) Install the exhaust cover assembly in the body taking care not to damage the O-ring
- (24) While depressing the exhaust cover, install retaining ring (2) Make sure the retaining ring is completely seated in its groove in the body.



4-22. AIR SYSTEM - Continued

- (25) Install the service port cap nut O-ring (7) on the cap nut (22)
- (26) Install the diaphragm in the cover making certain it is positioned between the guide ribs in the cover
- (27) Install the service port cap nut and torque to 150 in. lb (16.75 Nm)
- (28) Install the exhaust cover (21) using the screw. Torque to 15 - 21 in. lb (1.68 - 2.78 Nm)
- (29) Install and test the relay valve in the truck as detailed in INSTALLATION preceding

4-22. AIR SYSTEM - Continued**4-22.5 Quick Release Valve****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

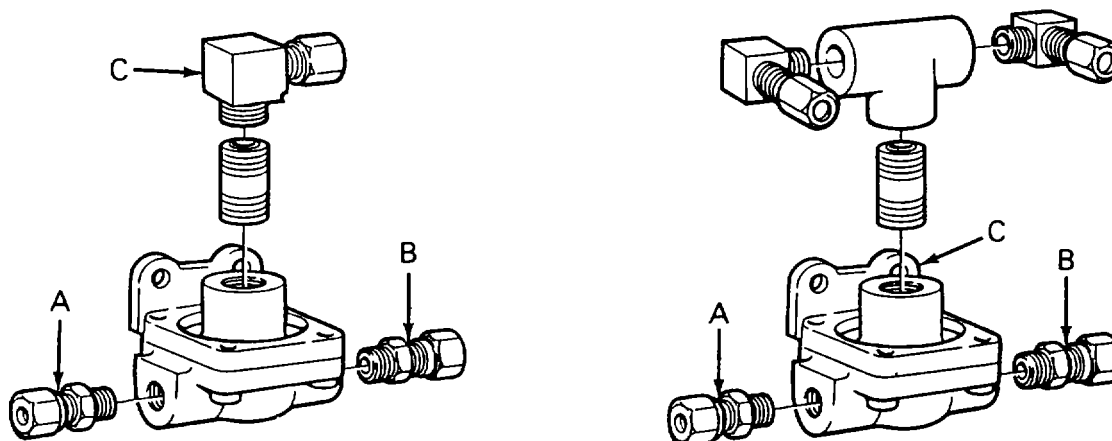
Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the quick release valves.

NOTE

The rear brake quick release valve is installed on the cross member above the rear axle. The front brake valve is mounted similarly but above the front axle.

REMOVAL

- (1) Tag and remove air lines A, B, and C from the quick release valve
- (2) Remove the capscrews and locknuts securing the valve to the cross member
- (3) Remove relay valve from truck and remove all connectors from valve using illustration as a



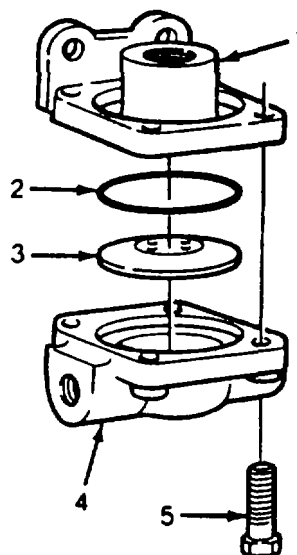
4-22. AIR SYSTEM - Continued**INSTALLATION**

- (1) Using illustration as a guide, install connectors in valve ports. Coat all threads with pipe sealant (item 22, Appendix E) prior to installation.
- (2) Install relay valve on truck using capscrews and locknuts
- (3) Install air line A, B, and C. Be sure they are installed in the same ports as noted in step 2 of REMOVAL preceding.
- (4) While applying foot brake, brush exhaust port with soap solution. A 1 in. (2.5 cm) bubble in 3 seconds leakage is permitted.
- (5) While applying foot brake, brush body and connectors with soap solution. No leakage is permitted.
- (6) Make several brake applications and check for prompt application and release of the relevant (front or rear) brakes.

REPAIR**NOTE**

The quick release valve can only be repaired if it is removed from the truck, see REMOVAL preceding.

- (1) Remove four screws (5) from body (4)
- (2) Lift off cover (1) and diaphragm (3)
- (3) Remove O-ring (2) from cover
- (4) Discard the O-ring (2) and diaphragm (3)
- (5) Install new O-ring (2) in cover (1) Install diaphragm (3) in body (4) Lay cover carefully over diaphragm
- (6) Install screws (5) and tighten to 30 - 60 in. lb (3.39 - 6.78 Nm)
- (7) Install and test in truck as detailed in INSTALLATION preceding



4-22. AIR SYSTEM - Continued**4-22.6 Air Regulators.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E, Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
All Air Tanks Drained

WARNING

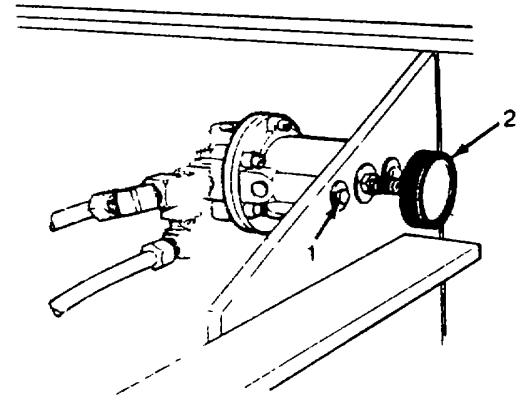
Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the air regulators.

NOTE

One of these valves is installed in the hose reel compartment on the frame cross member above the rear axle. It is located on the compartment back wall at the upper right side. This valve is identical to the throttle regulator on the structural control panel.

REMOVAL

- (1) Tag and disconnect air lines from air regulator
- (2) Remove valve knob (2).
- (3) Remove capscrews (1) from valve and remove valve from truck.
- (4) Remove the connectors from each port

**INSTALLATION**

- (1) Install a pressure gage and draincock on the delivery port of the valve
- (2) Install a temporary air line and pressure gage on the supply side of the valve
- (3) Close the delivery side draincock
- (4) Slowly raise the air pressure on the supply side in 5 psi (35 kPa) steps. At each step, be sure both gages read the same pressure until the set pressure of the gage is reached.

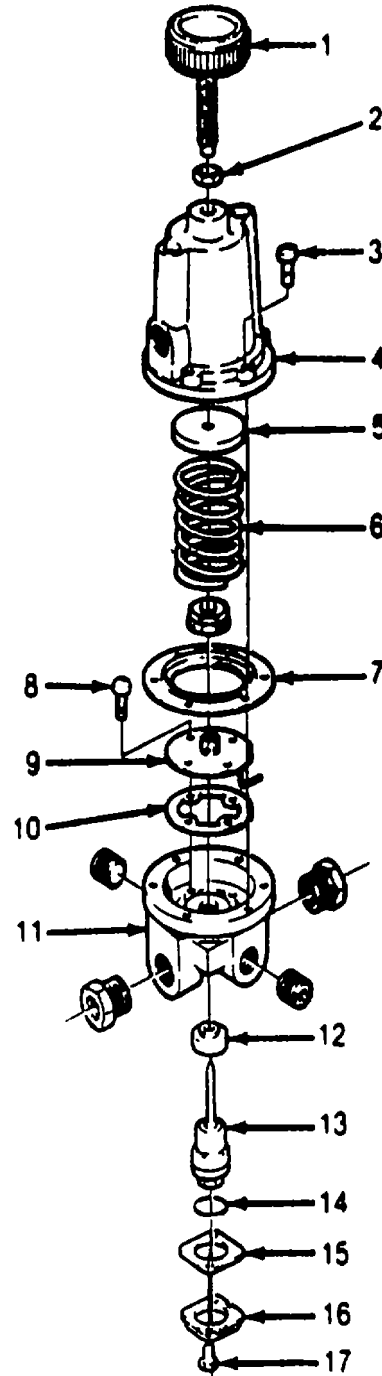
4-22. AIR SYSTEM - Continued

Rear brake air regulator setting 45 psig (379 kPa)

CFR water pressure/air regulator setting:75 psig (517 kPa).

Throttle Regulator setting: None; Pressure should increase gradually as valve handle is turned.

- (5) When the set pressure is reached, pressurize supply side to(set pressure +10 psig (70 kPa)) and hold this pressure for 10 minutes. Ensure delivery side pressure does not increase more than 2 psig (14 kPa) during this time
- (6) Depressurize both sides of the valve and remove the gages, draincock and temporary air supply
- (7) Install regulator in truck using capscrews. Install air lines and fittings as removed In step 1 of REMOVAL preceding. Coat all threads with pipe sealant (item 22, Appendix E) prior to installation.
- (8) For each brake regulator truck test, start main engine and with truck fully loaded with all normal auxiliary equipment, water and foam, drive truck on test truck to 30 mph (50 kph). Brake hard and ensure neither front wheels nor rear wheels lock up preferentially. If rear wheels lock first, reduce pressure through regulator If front wheels lock first, increase pressure through regulator. Repeat the test until both axles lock up simultaneously.
- (9) For the CFR water pressure/air regulator, start the CFR fire system as detailed in para. 2-11
- (10) With water discharging through the roof turret, adjust the air regulator until the pump discharge pressure is 225 psig (1550 kPa). When the air regulator is set up correctly shut down the fire pump as detailed in para. 2-11
- (11) For the throttle regulator, start the fire pump in the structural mode as detailed in para.2-11. Operate the throttle and check engine speed Increases gradually from 800 rpm to 2250 rpm. While adjusting be sure pump pressure does not exceed 250 psig (1700 kPa).
- (12) When throttle has been checked shut down the fire system as detailed In para. 2-11.



4-22. AIR SYSTEM - Continued

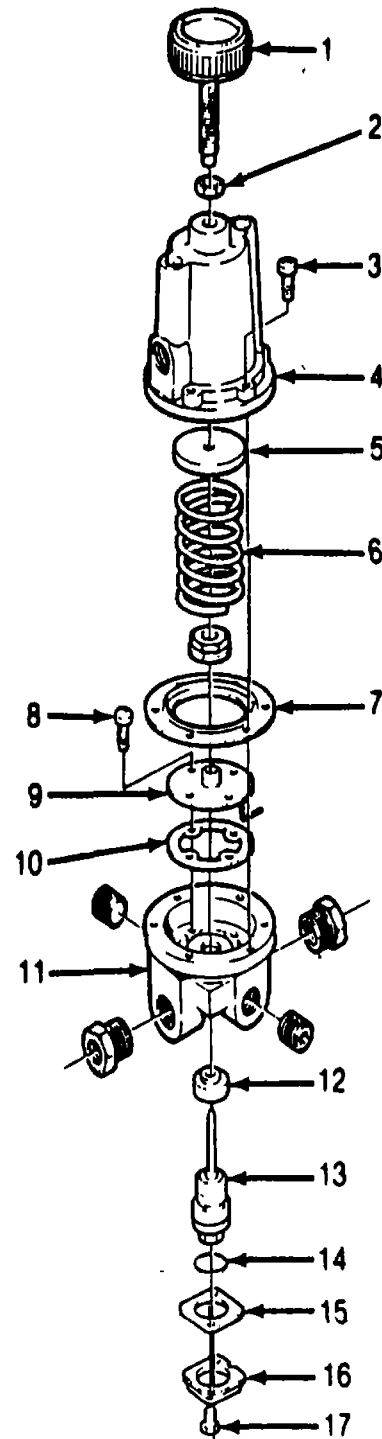
4-22.6 Air Regulators - Continued

REPAIR

NOT

Valve must be removed from truck for repair. See REMOVAL preceding.

- (1) Remove screws (17) from base of valve. Lift off retaining cap (16) and plate (15).
- (2) Pull exposed hexagon brass portion out of valve. Whole inner valve assembly is attached to this piece.
- (3) Remove six screws (3) and lift bonnet assembly from valve.
- (4) Remove screws (8). Lift out jet tube assembly (9). Be careful not to bend the jet tube.
- (5) Remove cork gasket (10).
- (6) Push downwards on the seat ring (12). Force should be applied to the brass portion of the seat ring visible from the top of the regulator. Force ring out of bottom of regulator.
- (7) Discard seat ring (12) seal ring (14), cork gasket (10), inner valve assembly (13) and diaphragm (7).
- (8) Clean all remaining components. Be sure all foreign matter is removed.
- (9) Coat the outside of the new seat ring (12) with petroleum jelly (item 21 Appendix E). Place in body, brass side first. Press into place being careful not to damage rubber seal.
- (10) Place cork gasket (10) into body (11).
- (11) Install jet tube assembly over gasket, align sides and install screws (8). Tighten firmly. Be sure jet tube is positioned into outlet port of regulator.
- (12) Insert new inner valve assembly (13) into valve body. Be sure screen is centrally located in the groove on the topside of the valve body.



4-22. AIR SYSTEM - Continued

- (13) Install seal ring (14), retaining plate (15), and cap (16) and retain with screws (17)
- (14) Place the new diaphragm (7) over the valve stem. Aline screw holes in diaphragm with those in the body (11)
- (15) Place main spring (6) and spring cap (5) in position on top of the diaphragm
- (16) Place bonnet (4) in position over the spring and retain with screws (3). Tighten securely.
- (17) Install and test valve as detailed in INSTALLATION preceding

4-22 AIR SYSTEM - Continued**4-22 7 Air Starter Valve****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the air starter valve.

NOTE

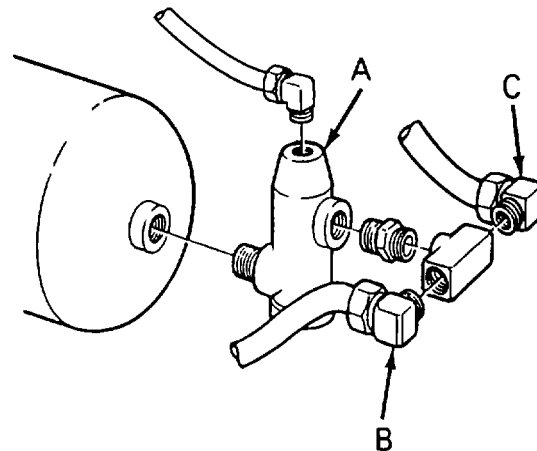
The air starter valve is installed on the fast air tank which is mounted to the frame beneath the cab. To access the fast air tank, the cab skid plate may be removed for easier access. (Refer to Direct Support.)

REMOVAL

- (1) Tag and remove air lines A, B, and C from the air starter valve
- (2) Unscrew the air starter valve from the fast air tank
- (3) Remove all fittings from the valve. Make a sketch to indicate which fittings are installed in each port.

INSTALLATION

- (1) Using your sketch as a guide connect all fittings to the air starter valve. Be sure all threads are coated with pipe sealant (item 22, Appendix E) prior to installation.
- (2) Install air starter valve on the fast air tank



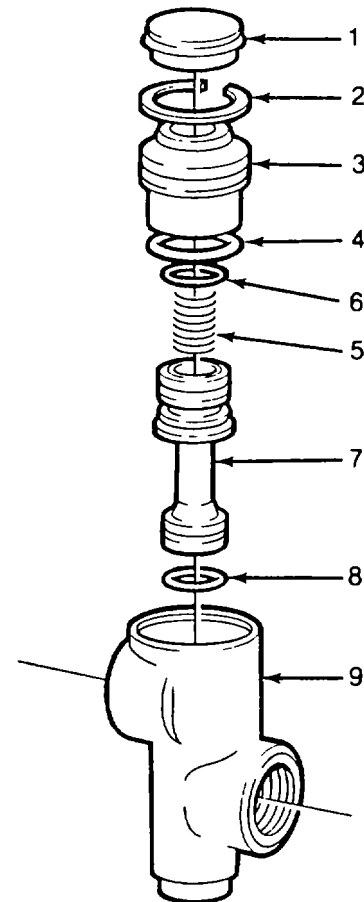
4-22 AIR SYSTEM - Continued

- (3) Install air lines A, B, and C
- (4) Start main engine and allow all air tanks to fill with air
- (5) Brush valve body and connectors with soap solution. No leakage is permitted. Tighten/replace connectors as required.
- (6) Shut down main engine and drain primary air tank (left rear wheel well)
- (7) Restart main engine while monitoring cab primary air pressure gage. Check that as soon as ignition switch is operated and prior to engine start, the primary air tank is pressurized to at least 50 psi (340 kPa) as a result of the air starter valve operating.
- (8) Replace front wheel and cab skid plate if required

REPAIR**NOTE**

The air starter valve can only be repaired if it is removed from the truck. See REMOVAL preceding.

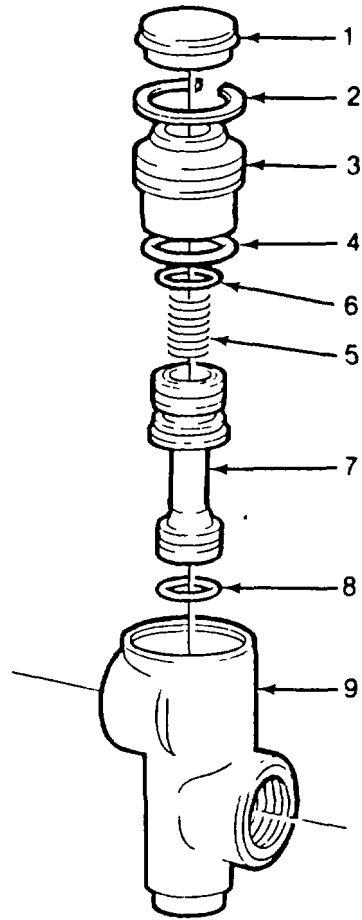
- (1) Pull off boot (1)
- (2) Push down on valve guide (3) and remove retaining ring (2) Be aware that valve guide is spring loaded
- (3) Remove valve guide (3) and push out supply valve (7) and spring (5) from body (9)
- (4) Remove and discard O-ring (4), supply valve (7), retaining ring (2), and boot (1)
- (5) Clean and Inspect all remaining components. Check for burrs, scuff marks or other deterioration. Replace any components failing inspection.
- (6) Coat all O-rings and sliding surfaces with petroleum jelly (item 21, Appendix E).
- (7) Slide new supply valve (7) carefully into body. Be sure lower O-ring (8) is not scuffed as it passes the delivery port.
- (8) Install spring (5)
- (9) Install new O-ring (4) on valve guide (3) and push carefully over supply valve and into body. Retain with ring (2).



4-22. AIR SYSTEM - Continued

4-22 7 Air Starter Valve - Continued

- (10) Install boot (1) over valve guide. Be sure it seats snugly over the valve guide.
- (11) Install and test valve in truck as detailed in INSTALLATION preceding



4-22. AIR SYSTEM - Continued**4-22.8 Service Brake Valve.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the service brake valve.

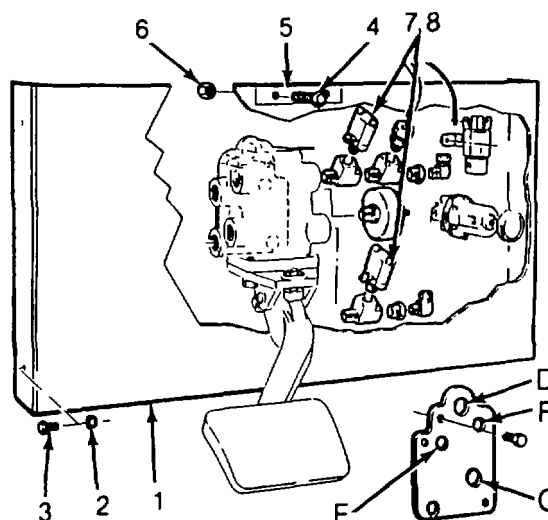
NOTE

The service brake valve is installed on the air manifold plate located beneath the dash on the drivers side of the cab.

To remove whole brake pedal assembly, refer to REMOVAL, steps 1 thru 6. To remove just the internal parts of the valve, refer to REMOVAL, steps 7 thru 11. Similarly, to install just the internal parts of the valve, refer to INSTALLATION, steps 4 thru 18. The internal parts of the brake valve can be removed and repaired with the valve body remaining in the truck.

REMOVAL

- (1) Tag and remove wires from the four pressure switches (7, 8) mounted on the brake valve.
- (2) Tag and disconnect the three air lines (A, B, C) connected to the front of the brake valve.
- (3) Remove bolts (4) and nuts (6) to disconnect steering support brackets (5) from plate.
- (4) While supporting the plate (1), remove the six screws (3) and locknuts (2).
- (5) Tag and remove the four hoses (D, E, F, G) connected to the back of the brake valve.

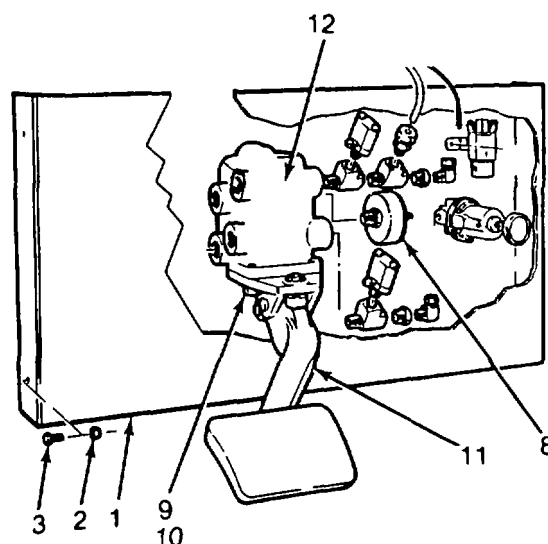


4-22. AIR SYSTEM - Continued

- (6) While supporting the brake valve, remove the three capscrews (12) attaching brake pedal to plate.
- (7) Remove all fittings and pressure switches attached to the valve.
- (8) To remove the valve internals carry out the following instructions.
- (9) Remove capscrews (9) and washers (10) Remove brake pedal assembly (11).
- (10) Pry off retainer plate mounted beneath valve block. This plate may come off as brake pedal assembly is removed.
- (11) Pull out the lower static piston assembly from the body (12).
- (12) Make a hook using a piece of wire and insert wire into body. Hook remaining valve assembly and pull firmly to remove assembly from body (12).

INSTALLATION

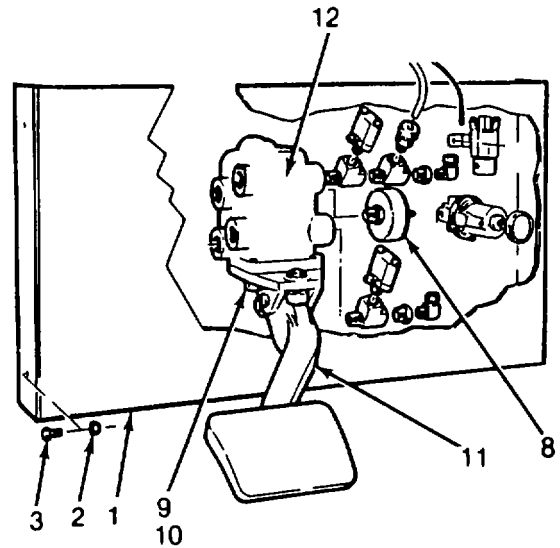
- (1) Push upper static piston into valve body.
- (2) Push lower static piston into valve body and retainer. Ensure locking tabs of retainer plate engage valve body.
- (3) Install pedal assembly (11) using three capscrews (9) and washers (10).
- (4) Install all fittings and pressure switches in valve body using illustration as a guide. Do not install stop light switches (8). Coat all pipe threads with pipe sealant (item 22, Appendix E) prior to installation.



- (5) Support the valve and attach the brake valve to the plate (1) using capscrews (7).
- (6) Replace hoses (D, E, F, and G) to the back of the brake valve. Be sure they are connected exactly as noted in REMOVAL, step 4.
- (7) While supporting the plate (1) Install the six screws (3) and locknuts (2).
- (8) Install bolts (4) and nuts (6) to reattach steering support brackets (5) to brake pedal plate (1).
- (9) Reconnect hoses (A, B, and C) to the front of the brake valve. Be sure they are connected exactly as noted in REMOVAL, step 2.
- (10) Connect a temporary 0 - 150 psi (0 - 1000 kPa) gage to each of the brake stop switch ports.
- (11) Start main engine and allow all air tanks to reach full pressure.

4-22. AIR SYSTEM - Continued**4-22.8 Service Brake Valve - Continued**

- (12) Brush the brake pedal and connectors with a soap solution while applying the brake. No leakage is permitted. Tighten/remake joints as required.
- (13) Release brake pedal and then slowly apply. Check that both pressure gages have similar readings and both show a reading proportional to the movement of the brake pedal (Primary valve should be approximately 2 psi (14 kPa) greater than secondary valve).
- (14) From full application, release pedal and check pressure falls to zero promptly.
- (15) Stop main engine, set battery switch to OFF.
- (16) Drain pressure from all air tanks via the draincocks.



- (17) Disconnect the temporary pressure gages and install the stop light switches (8).
- (18) Connect wires to all pressure switches mounted on the foot brake. Be sure they are connected exactly as noted in REMOVAL step 1.
- (19) Restart main engine and ensure stop lights illuminate when brake is applied and low air alarms cease when air tanks are at full pressure.

REPAIR**CAUTION**

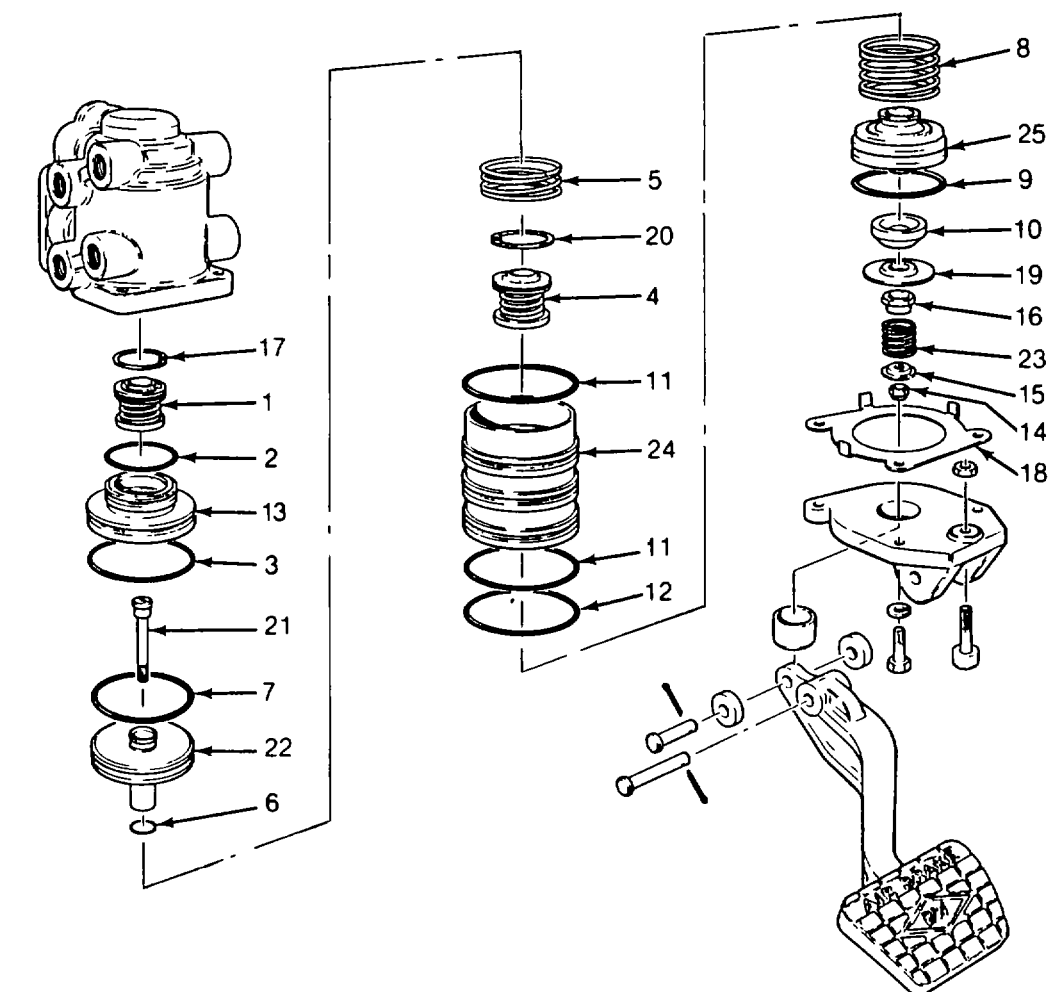
Normal procedure is to replace the brake valve assembly if malfunctioning. In an emergency, it may be repaired as per the following procedures.

NOTE

The brake valve does not have to be removed from the truck to repair the internal mechanism (see REMOVAL steps 7. thru 11. only).

- (1) Remove O-rings (2 and 3).
- (2) Remove retaining ring (17), and remove No 2 circuit inlet exhaust assembly (1).
- (3) Apply firm pressure on spring seat (19), which will compress piston return spring. Locking groove in piston (25) is now accessible through rectangular opening in lower static piston body (24) Insert wire or screwdriver into locking groove, thus holding static piston spring in compressed position.

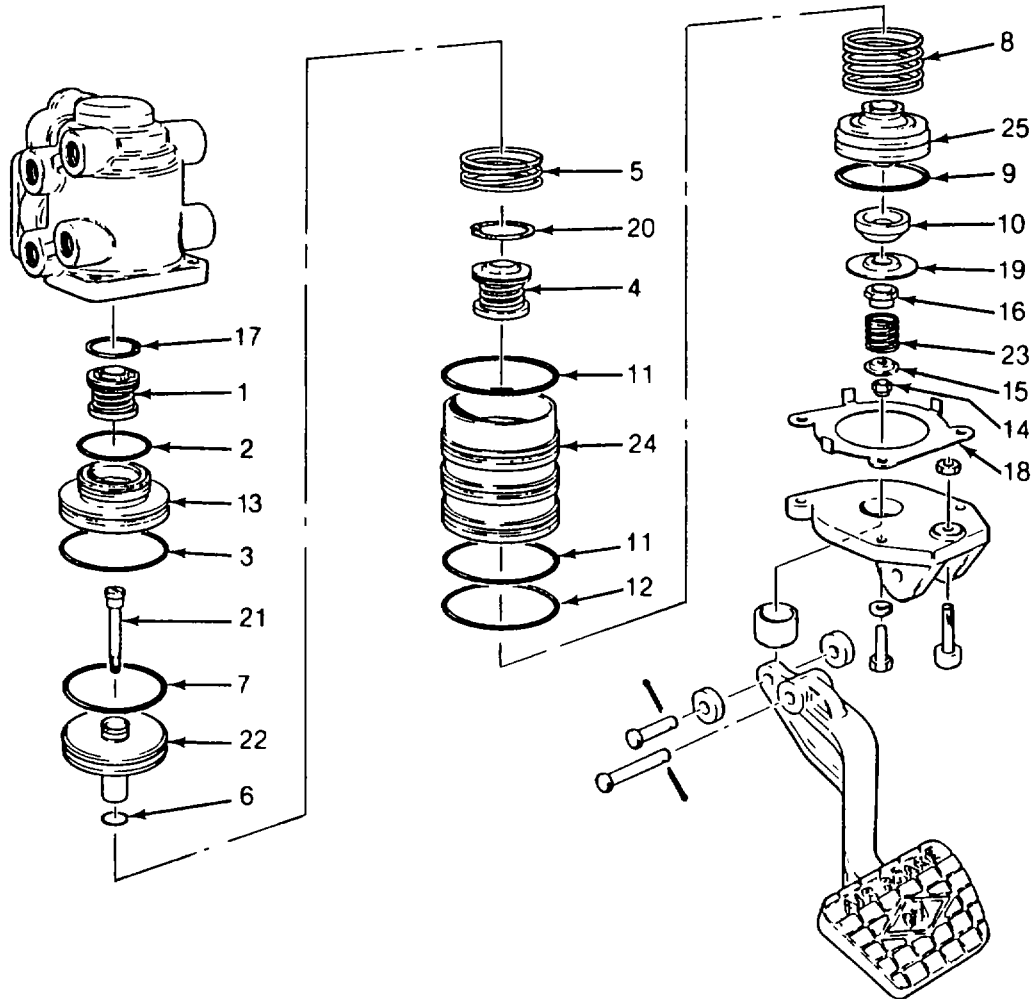
4-22. AIR SYSTEM - Continued



- (4) Insert blade of screwdriver through relay piston exhaust passage into slot of stem (21), and remove locknut (14) being careful not to nick the exhaust seat of the relay piston.
- (5) Remove locknut, spring seat (15), stem spring (23), spring seat nut (16), rubber spring seat (19), and rubber spring (10).
- (6) Relay piston (22), relay spring (5), and stem bolt (21) may now be removed.
- (7) Removal of screwdriver or wire from locking groove will permit spring load to push the No. 1 circuit piston (25) from the lower static piston (24). Care should be used when removing tool from locking ring because of spring load.
- (8) Remove O-rings (6 and 7) from relay piston and O-ring (9) from No 1 circuit piston (25).
- (9) Remove O-rings (11 and 12) from lower static piston.
- (10) Remove large retaining ring (20) from lower static piston and remove No. 1 circuit inlet/exhaust valve assembly (4).

4-22. AIR SYSTEM - Continued

4-22.8 Service Brake Valve - Continued



- (11) Two maintenance kits are available for the valve. If the valve pistons and other sliding parts show major wear, replace whole internal assembly using the major repair kit. If parts are not badly worn, replace only those parts in the minor repair kit. Instructions below are for the minor repair kit.
- (12) Before assembly lubricate all O-rings, bores, and mating surfaces with petroleum jelly (item 21, Appendix E).
- (13) Install new No 2 circuit inlet/exhaust assembly (1) in upper static piston (13), making certain retaining ring (17) is engaged in groove of upper static piston bore.
- (14) Install new O-rings (2 and 3) on upper static piston (13).
- (15) Install new No 1 circuit inlet/exhaust assembly (4) in lower static piston (24) making certain retaining ring (20) is engaged in groove of lower static piston bore.

4-22 AIR SYSTEM - Continued

- (16) Install three new O-rings (2 of 11) and (12) in grooves of lower static piston assembly (24).

NOTE

The larger diameter O-ring is installed in groove nearest to bottom of piston assembly.

- (17) Install new O-rings (6) and (7) on relay piston (22) and new O-ring (9) on No 1 circuit piston (25).
- (18) Carefully clamp No 1 circuit piston (25) in a soft-jawed vise taking care not to damage the exhaust seat or the outside diameter. Assemble the new rubber spring (10) over the center stem of the center of the piston, then the spring seat (19), and the new spring seat nut (16).
- (19) Tighten the spring seat nut until the end of the piston stem and the spring seat nut are flush.
- (20) Insert relay piston spring (5), and relay piston (22) in top end of lower static piston (24). Install No 1 circuit piston spring (8) and No 1 circuit piston assembly (25) in the bottom of lower static piston (24).
- (21) Install stem bolt (21) through bore of relay piston (22). Invert entire lower static piston assembly and position over a screwdriver mounted in a vise. Engage screwdriver blade in slot in head of stem.
- (22) Depress No 1 circuit piston assembly (25) against spring until locking groove is accessible through rectangular hole in side of lower static piston (24). Engage a screwdriver or wire in locking groove and release pressure on piston.
- (23) Install stem spring (23), spring seat (15), and stem nut (14) Torque to 20 - 30 in. lb (2.3 - 3.4 Nm).
- (24) Install upper static piston assembly (13) in valve body
- (25) Install lower static piston assembly (24) In valve body Install retainer (18), making certain locking tabs engage boss on valve body.
- (26) Install and test the valve assembly as detailed in INSTALLATION preceding.

4-22. AIR SYSTEM - Continued**4-22.9 Emergency Brake Valve.****This task covers**

- a. Removal
- b. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

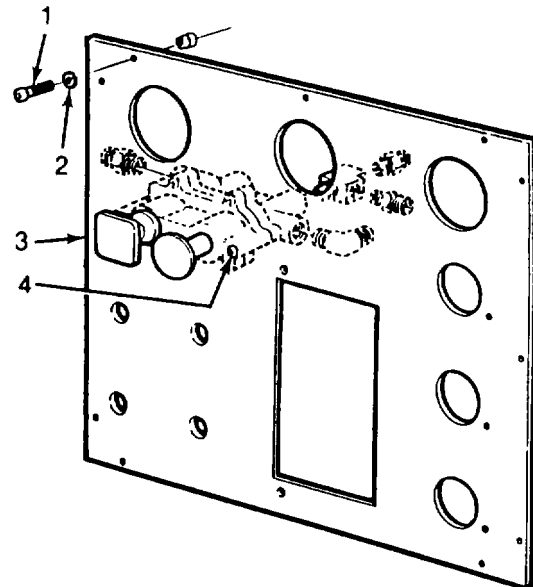
Death or serious injury could occur if compressed air is directed against the skin. Always drain air tanks via the draincocks prior to maintaining the emergency brake valve.

NOTE

The emergency brake valve is mounted on the cab dash.

REMOVAL

- (1) Remove screws attaching both knobs to emergency brake valve (One is yellow, the other green).
- (2) Remove 12 screws (1) and washers (2) retaining air panel (3) to dash.
- (3) Lift up air panel and tag/disconnect air hoses from brake valve.
- (4) Remove two screws (4) and remove emergency brake valve from air panel.
- (5) Remove all pipe fittings from emergency brake valve.

**INSTALLATION**

- (1) Install 3/8 X 1/4 connector in all ports except exhaust using pipe sealant (item 22, Appendix E) on the threads.
- (2) Install emergency brake valve on air panel using screws (4).

4-22 AIR SYSTEM - Continued

- (3) Connect air lines to brake valve. Be sure lines are connected as noted in REMOVAL preceding.
- (4) Install both knobs on emergency brake valve.
- (5) Start main engine and allow all air tanks to reach full pressure.
- (6) Push PARKING BRAKE square knob and check parking brakes release.
- (7) Brush valve body and connectors with soap solution. No leakage is permitted. Tighten/remake joints as required.
- (8) Pull PARKING BRAKE square knob and check parking brakes engage.
- (9) Push PARKING BRAKE RELEASE knob and hold in. Check parking brake releases.
- (10) Release PARKING BRAKE RELEASE knob and shutdown main engine.
- (11) Install air panel in dash using screws (1) and washers (2).

4-22. AIR SYSTEM - Continued**4-22.10 Foot Throttle Valve.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant
25, Appendix E Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

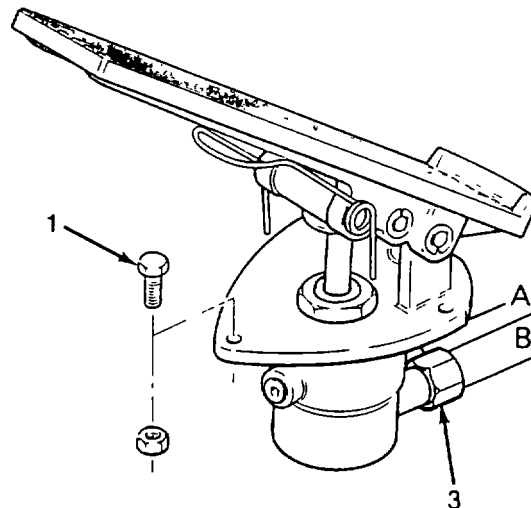
Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the foot throttle valve.

NOTE

The foot throttle is mounted in the cab adjacent to the drivers feet. The valve mechanism is mounted beneath the cab floor. It may be easier to remove the front left hand wheel and access the valve from beneath the truck rather than from the cab (as outlined below). This will depend on the amount of corrosion and dirt on the fittings and mounting hardware.

REMOVAL

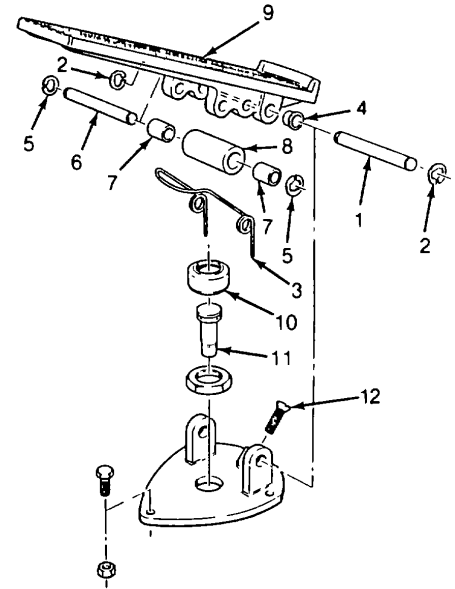
- (1) Remove the three capscrews (1) and ease the foot throttle up through the cab floor.
- (2) Tag and disconnect the air hoses A and B.
- (3) Lift valve assembly up into cab and remove connectors (2).

**INSTALLATION**

- (1) Coat threads of connectors (2) with pipe sealant (item 22, Appendix E) and install in valve body.
- (2) Pull hoses up through cab floor and connect to valve assembly. Be sure they are connected to same ports as noted in step 2 of REMOVAL preceding.

4-22 AIR SYSTEM - Continued**4-22.10 Foot Throttle Valve - Continued****a. Treadle Repair - Continued**

- (10) Align pedal housing holes, valve housing holes and spring (3) and push pin (1) through all three components. Ensure spring tends to push pedal up.
- (11) Retain pin (1) with clips (2).
- (12) Ensure roller just contacts the push rod when pedal is released. Repair stop screw (12) as required, see b. following.

**b. Stop Screw Repair****NOTE**

The stop screw is held in position with threadlock liquid. Replace screw if position of stop requires adjustment.

- (1) Remove screw (12).
- (2) Clean the threads in the mounting plate. Use a tap if necessary.

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm² [?]) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

- (3) Clean the mounting plate and new screw threads with dry cleaning solvent (item 10, Appendix E) and dry with compressed air.
- (4) Pressurize the throttle valve with at least 65 psi (450 kPa) air pressure either from the truck or from a temporary air supply.
- (5) Apply a liberal coating of threadlock liquid (item 29, Appendix E) to both the screw and mounting plate. Install the screw and adjust until the roller (8) just contacts the push rod (11).

4-22 AIR SYSTEM - Continued

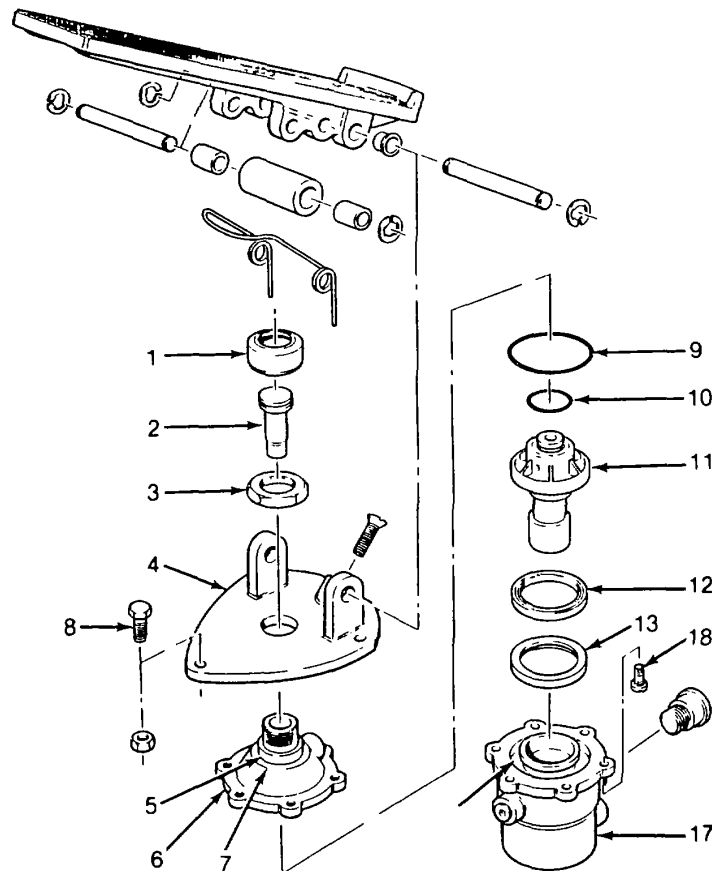
c. Valve Repair

NOTE

The foot throttle valve subassembly can be repaired with the valve removed from the truck. See REMOVAL preceding.

Two repair kits are available, one to overhaul the valve subassembly and the pedal, and one to overhaul just the valve subassembly.

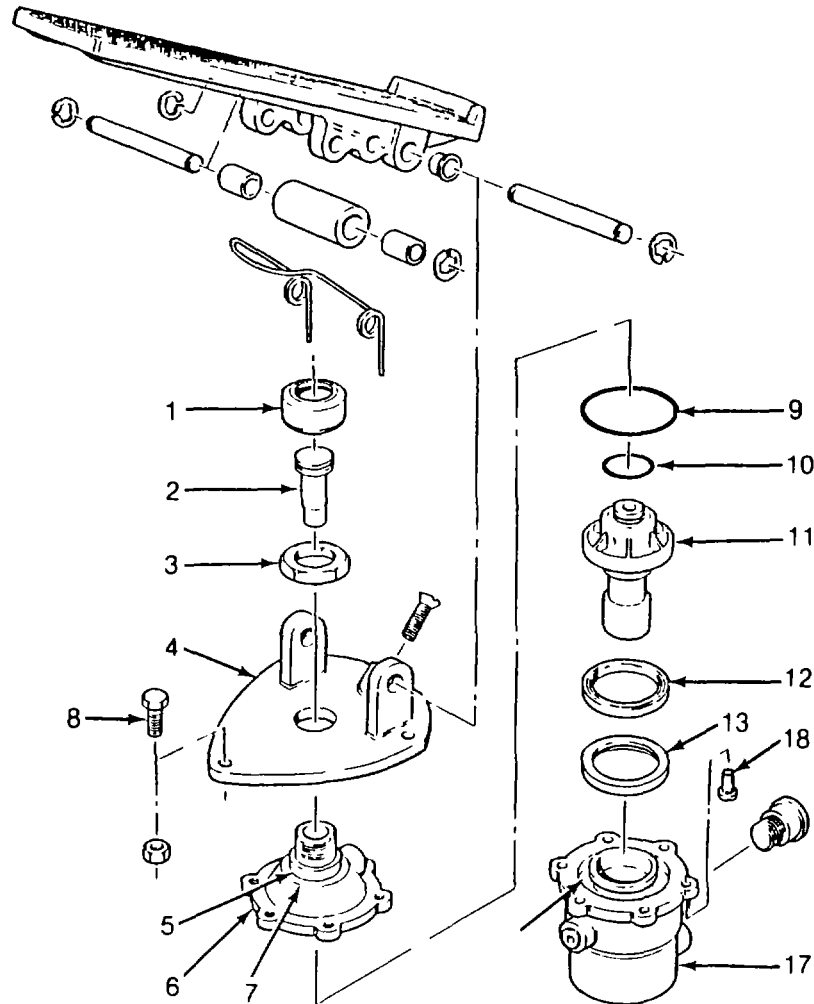
- (1) Remove screws (18) and separate body (17) from cover (6).
- (2) Remove piston (14), spring (15), and shims (16).
- (3) Remove seal (12) and thrust ring (13) from piston.
- (4) Pull the barrier plate assembly (11) out of the upper assembly.
- (5) Remove the treadle as detailed in b. preceding.



4-22. AIR SYSTEM - Continued

4-22 10 Foot Throttle Valve - Continued

c. Valve Repair - Continued



(6) Remove push rod (2) and boot (1).

(7) Unscrew locking nut (3) and screws (8) Separate cover (6) and guide (5) from treadle plate (4).

(8) Discard screws (8), seal (12), barrier plate (11), O-rings (9, 10), push rod (2), and boot (1).

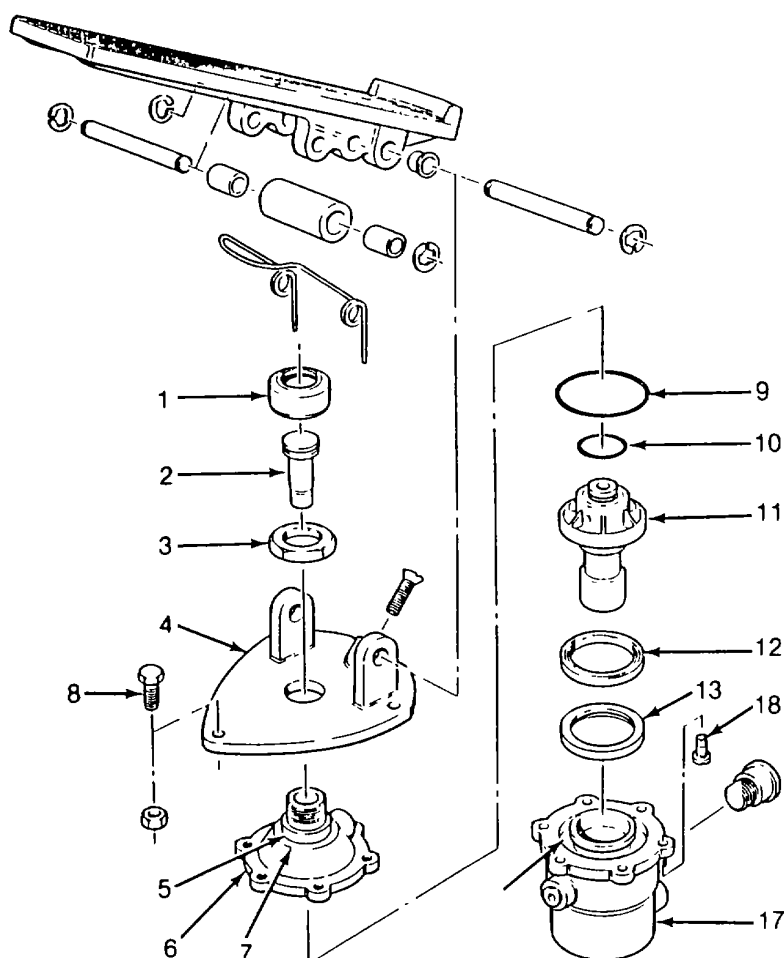
(9) Inspect remaining parts for wear, scuff marks, or other deterioration. Replace any parts failing inspection.

(10) Install guide (5) in cover (6) using screws (8) and washers (7). Install cover in treadle plate and retain with nut (3).

(11) Lubricate inside of body (17) with petroleum jelly (item 21, Appendix E).

4-22. AIR SYSTEM - Continued

- (12) Install shim (16) and spring (15) in body (1).
- (13) Install new seal (12) and thrust ring (13) on piston (14). Lubricate seal with petroleum jelly (item 21, Appendix E) prior to installation. Be sure seal opening faces upwards.
- (14) Insert piston (14) carefully in body (17). Be sure seals are not torn on insertion. Check piston moves freely up and down in body.
- (15) Install push rod (2) and boot (1) into upper body assembly.
- (16) Install O-ring (10) on barrier plate (11) and install O-ring (9) on cover. Install barrier plate in cover assembly.
- (17) Aline lower assembly with cover assembly. Be sure inlet and outlet ports point away from the pointed end of the treadle plate. Install screws (18) and tighten to 24 in. lb (2.7 Nm).
- (18) Install treadle as detailed in b preceding.
- (19) Install and test foot throttle valve assembly in truck as detailed in INSTALLATION preceding.



4-22. AIR SYSTEM - Continued**4-22.11 Air Compressor Governor****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

236577 Gasket

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained
LH Engine Cover Removed (see para. 4-12.11)

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the air compressor governor.

NOTE

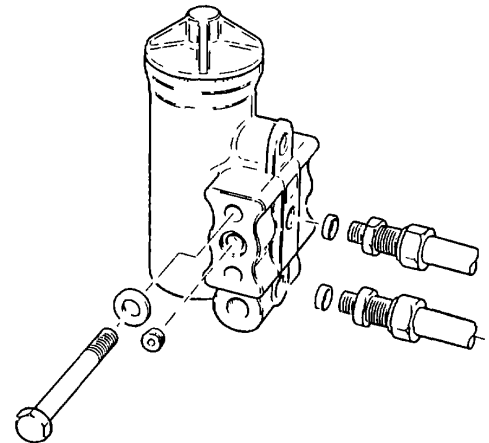
The governor is mounted on the compressor at the left rear of the engine.

REMOVAL

- (1) Tag and remove both air lines from the governor.
- (2) Remove both governor mounting bolts and remove governor from compressor. Discard gasket and be sure all gasket material is removed from both governor and compressor flange.

INSTALLATION

- (1) Install new gasket on governor and hold in place with screws through governor body.
- (2) Install governor on compressor and tighten bolts to 24 ft lb (33 Nm).
- (3) Install air lines. Be sure they are connected exactly as tagged in step 1 REMOVAL preceding.
- (4) Ensure all other ports are blanked with pipe plugs.



4-22. AIR SYSTEM - Continued

- (5) Start the main engine and allow air tanks to fill. Check pressure on primary and secondary air pressure gages in cab when governor cuts out.
- (6) Cut out pressure should be 105 - 115 psi (700 - 800 kPa).
- (7) With the engine still running, make a series of brake applications to reduce the air pressure and observe at what pressure the governor cuts in.
- (8) Cut-in pressure should be 90 - 100 psi (600 - 700 kPa).
- (9) If pressure settings are too low, remove governor cap, loosen the locking nut and turn adjusting screw counterclockwise. If pressure is too high, turn screw clockwise.

NOTE

Be careful not to over adjust. Each 1/4 turn of the adjusting screw raises or lowers the pressure setting approximately 4 psi (27 kPa).

- (10) When proper adjustment is obtained, tighten the adjusting screw locknut and replace the cover.
- (11) With the air pressure less than cut-out pressure, brush soap solution around the cover and exhaust port. Slight leakage is permitted. Excessive leakage indicates a faulty inlet valve or lower piston O-ring.
- (12) With the air pressure above cut-out pressure, brush soap solution around the cover and exhaust port. Slight leakage is permitted. Excessive leakage indicates a faulty exhaust valve seal, exhaust stem O-ring, or O-ring at the top of the piston.
- (13) Leakage on all pipe fittings should be zero. Tighten and/or remake connections as required.

4-22. AIR SYSTEM - Continued

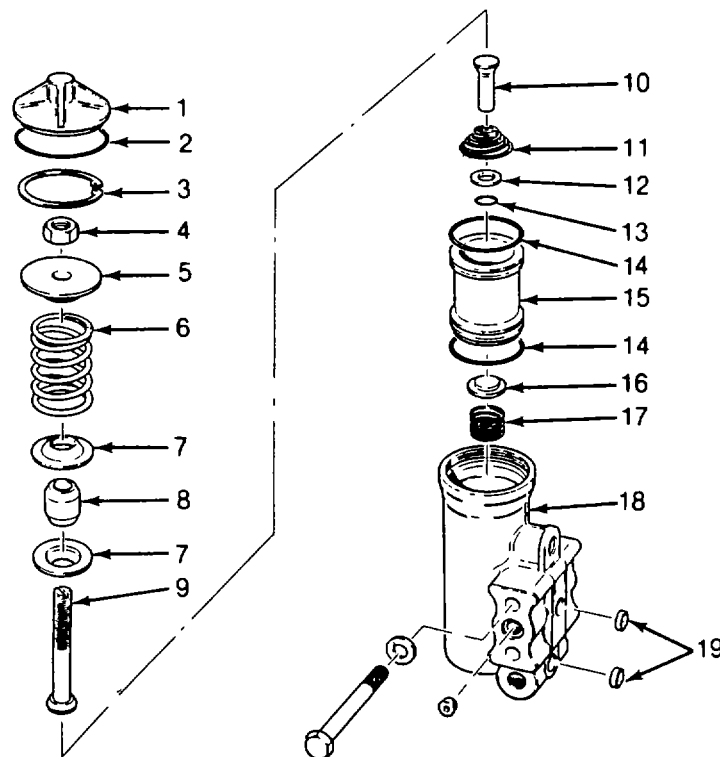
4-22 11 Air Compressor Governor - Continued

REPAIR

NOTE

Governor must be removed from truck for repair . See REMOVAL preceding.

- (1) Unscrew and remove cover (1) with O-ring (2).
- (2) Remove the retaining ring (3).
- (3) Pull the adjusting screw (9) and spring assembly out of the body (18).



- (4) The spring assembly need not be disassembled unless the valve spring is broken or has lost tension. To dismantle, the following instructions apply, otherwise proceed to step 7.
- (5) Remove the locknut (4) and the upper spring seat (5).
- (6) Remove spring (6), spring seat (7), spring guide (8), and second spring seat (7) from the adjusting screw (9).
- (7) Gently tap open end of valve body on flat surface to remove exhaust stem (10), exhaust stem spring (11), washer (12) and piston assembly (15).
- (8) Remove and discard the two O-rings (14) from the piston (15).

4-22. AIR SYSTEM - Continued

- (9) Using a hooked wire remove and discard O-ring (13) from the inside of the piston.
- (10) Disengage inlet/exhaust valve spring (17) from recess in bottom of piston. Remove spring (17) and the inlet/exhaust valve (16).
- (11) Remove filters (19) from unloader and reservoir ports.
- (12) Discard cover (1), inlet/exhaust valve (16), spring (17), both filters (19), exhaust stem O-rings (13), and piston O-ring (14).
- (13) Clean and inspect remaining parts for wear, score marks, or other deterioration. Replace any parts failing inspection.
- (14) Lubricate body bores, new O-rings, and O-ring grooves with petroleum jelly (item 21, Appendix E).
- (15) Install O-ring (13) in piston (15).
- (16) Drop the new inlet/exhaust valve (16) into the piston and position the spring (17), small end against the valve, in the piston. Press the spring down until the larger coiled end snaps into the recess inside the piston (15).
- (17) Install O-rings (14) on outside of piston (15)
- (18) Install the washer (12) and the exhaust stem spring (11) into the piston with the large coil end next to the piston.
- (19) Install the exhaust stem (10) through spring (11) and into piston (15).
- (20) Install assembled piston into the governor body (18).
- (21) If the spring assembly was not disassembled proceed to step 25.
- (22) Install lower spring seat (7), spring guide (8), spring seat (7), pressure setting spring (6), and upper spring seat (5) onto adjusting screw (9). Be sure they are installed in the above order.
- (23) Screw down the upper spring seat (5) until distance from top of seat to bottom of adjusting screw is 1 7/8 in. (48 mm).
- (24) Install the locknut (4).
- (25) Install the adjusting screw and spring assembly into the governor body (18).
- (26) Install retaining ring (3) making sure it seats completely into the groove in body (18).
- (27) Install cover O-ring (2) in cover (1) and screw onto adjusting screw. Tighten until cover bottoms onto governor body.
- (28) Install filters (19) In governor body.
- (29) Install and test governor on compressor as detailed in INSTALLATION preceding.

4-22. AIR SYSTEM - Continued**4-22 12 Air Drier.****This task covers**

- a. Removal
- b. Installation
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to maintaining the air drier.

NOTE

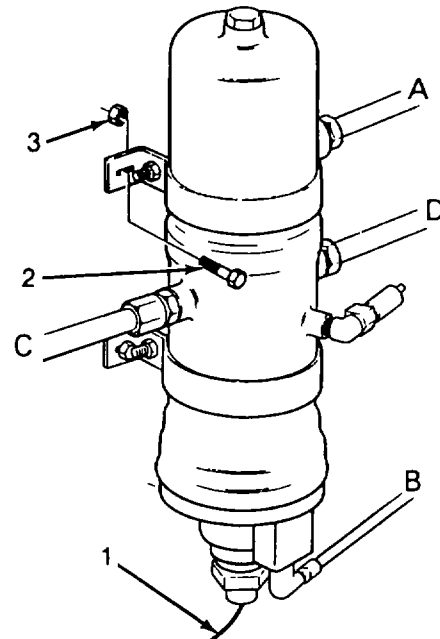
The air drier is mounted on left hand side of the frame beneath the pump body step.

REMOVAL

- (1) Tag and disconnect the air lines (A, B, C, and D) to the drier.
- (2) Tag and disconnect wire (1) from drier heater.
- (3) While supporting the drier, remove the four bolts (2) and nuts (3).
- (4) Lower drier to floor and remove from truck.
- (5) Remove all pipe fittings from inlet, outlet, and compressor control ports and making a sketch of the location of the fittings.

INSTALLATION

- (1) Coat all threads with pipe sealant (item 22, Appendix E) and install pipe fittings in air drier using your sketch as a guide.



4-22. AIR SYSTEM - Continued

- (2) Raise drier and install on frame using capscrews (2) and locknuts (3).
- (3) Connect air lines to drier. Be sure they are connected as noted in REMOVAL preceding.
- (4) Connect wire (1) to terminal of heater.
- (5) Connect the batteries and start the main engine. Allow pressure to build up to governor cut-out. Shut main engine down.
- (6) Wait two minutes and observe the primary air pressure gage in the cab if this pressure continues to drop, check for air leakage from the drier purge valve. If air is leaking, this indicates a failed check valve in the outlet port of the air drier. Replace check valve as detailed in REPAIR following.
- (7) Restart main engine and drain air from the primary air tank until the compressor restarts compressing.
- (8) Check for excessive leakage from the purge valve by brushing the purge valve with soap solution. Brush all fittings similarly.
- (9) Replace/tighten fittings as required or replace purge valve as detailed in REPAIR following.
- (10) Check operation of the drier safety valve by pulling on exposed stem. Air must exhaust while the stem is held and should reseat when released. Replace as detailed in REPAIR following if test is unsatisfactory.
- (11) Check that, when ignition is on, the heater terminal is at 12 volts with respect to the drier shell. If not, check breaker behind hinged dash panel and wire between breaker and drier.
- (12) Turn the ignition switch off and cool the end cover assembly to less than 40 deg. F (4 deg. C). With an ohmmeter check resistance between electrical terminal and the aluminum of the end cover. Resistance should be 2.0 - 4.0 ohms.
- (13) Warm the end cover to over 90 deg. F (32 deg. C) and check resistance as above. Resistance should exceed 1000 ohms.
- (14) If the resistance is outside these limits, carry out test 15, 16, and 17.
- (15) With the ignition switch off, remove the thermostat cover by removing screws.
- (16) Check resistance between aluminum of the end cover and heater post. If not between 2.0 - 2.8 ohms replace the end cover assembly as detailed in REPAIR following (the heater has failed but cannot be replaced alone). If the heater resistance is within these limits, the thermostat has failed. See REPAIR following.
- (17) Run the truck as normal and check for moisture build up in the tanks daily. Replace desiccant if there is evidence of moisture in the air tanks.

4-22. AIR SYSTEM - Continued

4-22.12 Air Drier - Continued

REPAIR

a. Safety Valve Repair

NOTE

Safety valve cannot be repaired, it must be replaced. It may be replaced with the drier mounted on the truck. Ensure all air tanks are drained prior to safety valve repair.

- (1) Unscrew safety valve from elbow on side of drier and discard.
- (2) Coat new safety valve threads with pipe sealant (item 22, Appendix B) and screw onto elbow.
- (3) Test air drier as detailed in INSTALLATION, steps 5 thru 17, preceding.

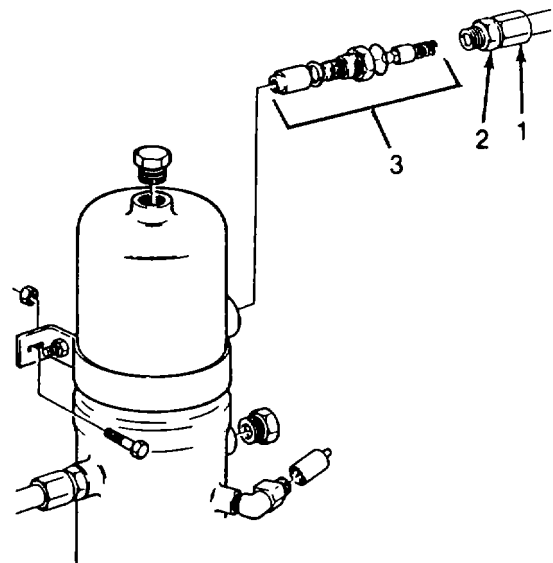
b. Check Valve Repair

NOTE

Check valve cannot be repaired, it must be replaced. It may be replaced with drier on truck.

Ensure all air tanks are drained prior to check valve repair

- (1) Remove outlet air line (1) from air drier and remove outlet fitting (2).
- (2) Unscrew check valve (3) from air drier.
- (3) Coat threads of new check valve and air line fitting with pipe sealant (item 23, Appendix B). Be sure O-ring is on external threaded portion of check valve.
- (4) Reinstall the check valve in the outlet port and reconnect the air line.
- (5) Test air drier as detailed in INSTALLATION, steps 5 thru 17, preceding.



c. End Cover Repair

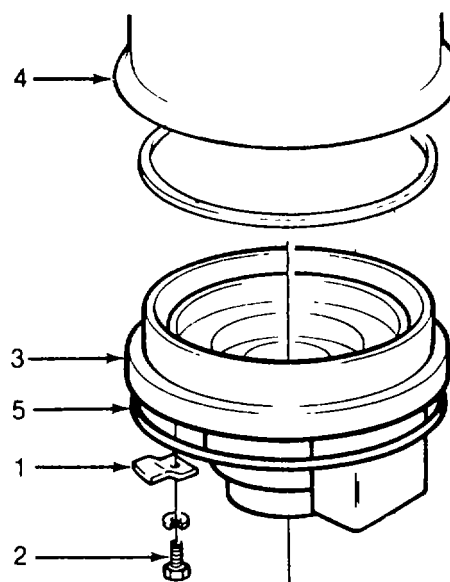
NOTE

This may be repaired with drier on truck. Ensure all air tanks are drained prior to end cover repair.

- (1) Tag and disconnect the air line from the end cover and mark location of this port on the drier.

4-22. AIR SYSTEM - Continued

- (2) Tag and disconnect the heater wire.
- (3) Loosen the three capscrews (2) on the end cover and turn the retaining clamps (1) aside (capscrews may be left fingertight).
- (4) Locate the notch in the dryer shell (4). While pushing the end cover (3) up into the drier, insert the blade of a screwdriver in the notch and slowly pry out the retainer ring (6). Remove the end cover assembly.
- (5) Remove and discard the large O-ring (5) around the end cover assembly.
- (6) If the heater element has failed, the whole end cover assembly should be replaced. For purge valve repair see d following.
- (7) Lubricate and install the new O-ring (5) around the end cover assembly.
- (8) Push the end cover up into the body and install the retaining ring (6). Be sure the gap in the ring is within 1 in. (2.5 cm) of the notch in the body.
- (9) Locate retaining clamps (1) and tighten capscrews (2).
- (10) Test air drier as detailed in INSTALLATION, steps 5 thru 17, preceding.



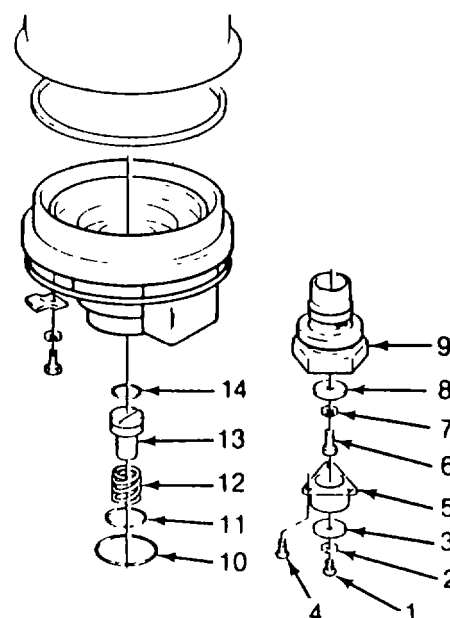
d. Purge Valve and Exhaust Diaphragm Repair

NOTE

These may be repaired with drier on truck.

Ensure air tanks are drained prior to repair.

- (1) Remove end cover as detailed in End Cover Repair, steps 1 thru 5, preceding.
- (2) Remove the single screw (1) securing the exhaust diaphragm and separate the diaphragm (3), washer (2), and screw (1). Discard the diaphragm.
- (3) Remove the three screws (4) securing the exhaust cover and remove the exhaust cover (5).
- (4) Remove the purge valve assembly and the large hex cap nut (9) from the end cover. Discard both O-rings (10 and 11) around the cap nut.

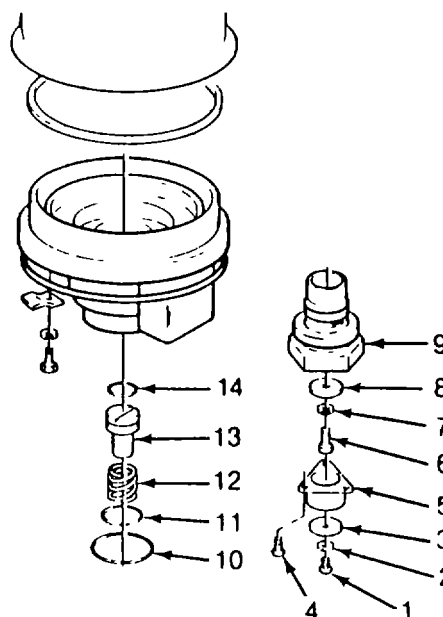


4-22. AIR SYSTEM - Continued

4-22.12 Air Drier - Continued

d. Purge Valve and Exhaust Diaphragm Repair - Continued

- (5) Remove the capscrew (6) which holds the assembly together.
- (6) Separate capscrew (6), purge valve (8), purge valve piston (13), and the piston return spring (12).
- (7) Discard the piston O-ring (14), the purge valve (8), and the piston return spring (12).
- (8) Inspect all remaining parts. Be sure all surfaces, bores, parts, and passages are clean and dry.
- (9) Lubricate all new O-rings and piston bore in hex cap nut (9) with petroleum jelly (item 21, Appendix E).



- (10) Install O-ring (14) on piston (13).
- (11) Install the purge piston return spring (12) and piston (13) in hex cap nut (9).
- (12) Install the purge valve (8) in the cap nut so that the rubber portion rests on the metal seat of the cap nut.
- (13) Secure the valve to the piston using the screw (6) and lockwasher (7) and torque to 50 in. lb (5.6 Nm).
- (14) Install the two O-rings (10 and 11) on the hex cap nut (9).
- (15) Lubricate the cap nut threads and the cap nut bore of the end cover with petroleum jelly (item 21, Appendix E). Install the cap nut, torquing it to 240 in. lb (27 Nm).
- (16) Secure the exhaust diaphragm (3) to the exhaust cover (5) using screw (1) and washer (2).
- (17) Secure the exhaust cover (5) to the hex cap nut (9) using screw (4).
- (18) Install end cover in drier as detailed in End Cover Repair, steps 7 thru 10, preceding.

e. Thermostat and Heater Repair

NOTE

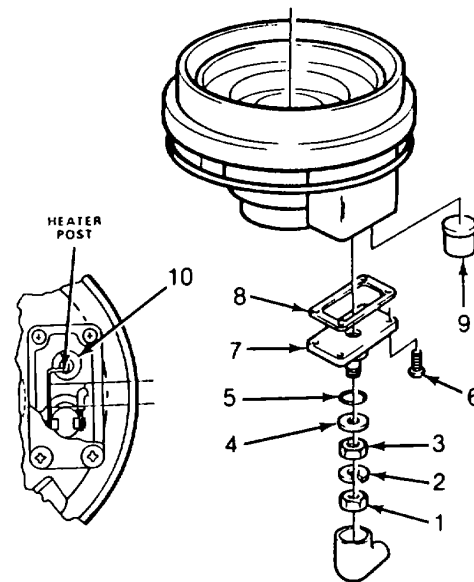
These may be repaired with drier on truck.

Ensure air tanks are drained prior to repair.

- (1) Remove end cover as detailed in End Cover Repair, steps 1 thru 5, preceding.

4-22. AIR SYSTEM - Continued

- (2) Remove nut 1), lockwasher (2), nut (3), flatwasher (4), and O-ring (5). Discard O-ring.
- (3) Remove four screws (6) and cover (7).
- (4) Remove and discard gasket (8).
- (5) Remove and retain spacer (9).
- (6) Cut uninsulated thermostat wire at Point B. Remove and discard thermostat and terminal assembly (10).
- (7) Clean remaining wire attached to heater terminal.
- (8) Clean thermostat "pocket" in end cover.
- (9) Cut uninsulated lead of new thermostat (10) at point A.



- (10) Install thermostat in end cover "pocket" and position uninsulated leads next to each other.
- (11) Using a soldering heat sink, clamp uninsulated leads at Point B and solder leads with straight rosin core solder. DO NOT USE ACID CORE SOLDER. Clean excess solder off end cover.
- (12) Install thermostat terminal in cover (7).
- (13) Install O-ring (5), washer (4), nut (3), lockwasher (2), and nut (1). Torque nuts to 24 in. lb (2.7 Nm).
- (14) Install spacer (9) over thermostat (10).
- (15) Install gasket (8) and cover (7) Secure cover to end cover using screws (6). Torque to 36 in. lb (4.1 Nm)
- (16) Test thermostat as follows.
 - (a) At a temperature above 85 deg. F (29 deg. C) check resistance between thermostat terminal (1) and end cover (10). Resistance should be 200,000 ohms or greater, if not, check for solder "path" short.
 - (b) Chill entire end cover assembly to 35 deg. F (1.5 deg. C) or below and check resistance again. Resistance should be 2 - 15 ohms.
- (17) Install end cover in drier as detailed in End Cover Repair, steps 7 thru 10, preceding.
- (18) Install and test air drier as detailed in INSTALLATION preceding.

4-22. AIR SYSTEM - Continued

4-22.12 Air Drier - Continued

f. Desiccant Filter Repair

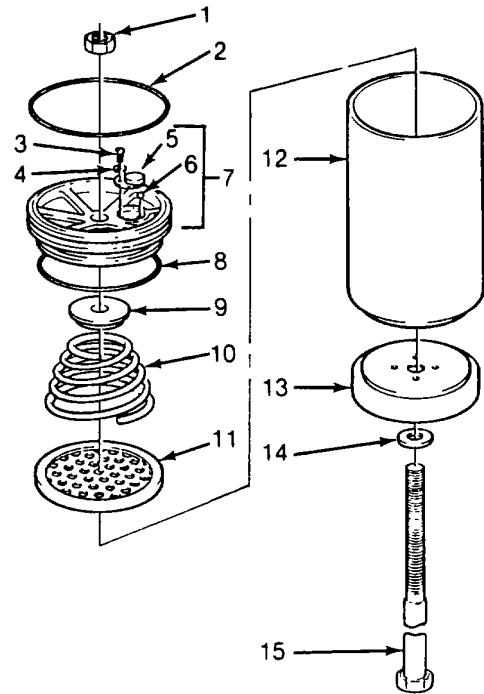
NOTE

This task consists of replacing the desiccant in the air drier.

This task may be accomplished with the drier on the truck.

Ensure air tanks are drained prior to repair.

- (1) Remove end cover as detailed in End Cover Repair, steps 1 thru 5, preceding.
- (2) Remove the cartridge and desiccant sealing plate assembly by unscrewing the hex bolt seen inside the main shell of the drier.
- (3) Remove locknut (1) from assembly, assembly is spring loaded. Hold assembly firmly while removing nut the last few turns.
- (4) Lift off the desiccant plate assembly (7).
- (5) Remove the two O-rings (2 and 8) from the desiccant plate (7) and discard them.
- (6) Remove the ball check valve retaining clip (5) and remove and discard the rubber ball valve (6).
- (7) Clean the desiccant plate thoroughly. Be sure the purge orifice and check valve seat are clean.
- (8) Install a new ball check valve (6) and replace the retaining clip (5), screw (3), and washer (4).
- (9) Lubricate the two new O-rings (2 and 8) with petroleum jelly (item 21, Appendix E) and install them in their respective grooves in the desiccant plate (7).
- (10) Remove the spring (10), spring seat (9), bolt (15), and cartridge shell (12). Discard the oil separator filter (13), the two perforated plates (11), and desiccant material.
- (11) Insert a new perforated plate into the cartridge, cloth side up, and tap it firmly to the bottom (Cloth always faces desiccant material).
- (12) Slide washer (14) and oil separator filter (13) over the cartridge bolt with the gasket surface next to the shell (12).
- (13) Install the bolt with the oil separator into the bottom of the shell (12) and through center hole of the perforated plate in the bottom of the shell.



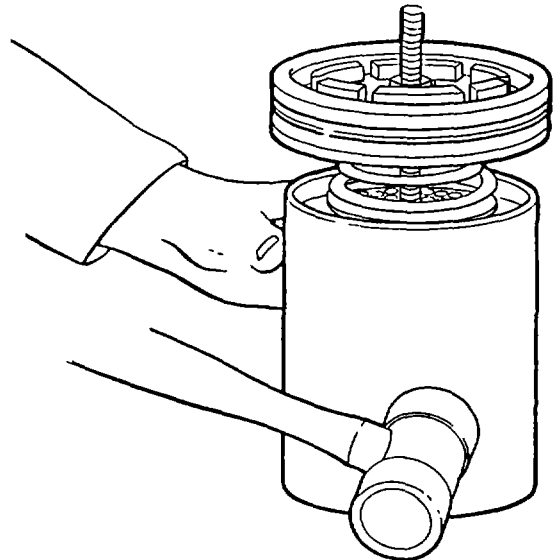
4-22. AIR SYSTEM - Continued

- (14) Pour the entire package of desiccant material into the shell, making sure none is lost. Handle carefully so that the bolt does not fall out.
- (15) Level the desiccant material and install second perforated plate cloth side down. (Make sure the shoulder of the bolt is centered, and extends slightly above the top of the perforated plate).

NOTE

If the shoulder of the bolt does not extend above the perforated plate tap the side of the desiccant container

- (16) Set the conical spring (10) on top of the perforated plate (large diameter down - small diameter up).
- (17) Place the spring retainer (9) on top of the spring.
- (18) Install the previously rebuilt desiccant plate (7) on the cartridge bolt so that the ball check retaining clip is in view.
- (19) Using the locknut, (1) draw the assembly together to approximately half of the spring's free height. While slowly turning the cartridge, tap the side of the shell with a plastic mallet. This allows the desiccant material to settle properly into place.
- (20) Continue to tighten the nut, making sure all items are properly aligned.
- (21) Install desiccant cartridge assembly in air drier housing and turn bolt head until assembly is screwed tight into the housing.
- (22) Install end cover in drier as detailed in End Cover Repair, steps 7 thru 10, preceding.
- (23) Install and test air drier as detailed in INSTALLATION preceding.



4-22. AIR SYSTEM - Continued**4-22.13 Air Lines and Piping****This task covers****Replacement****TOOLS**

Shop Equipment, Automotive
Maintenance and Repair.
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E, Pipe Sealant

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Blocked
All Air Tanks Drained

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Always drain all air tanks via the draincocks prior to replacing any air line or pipe.

REPLACEMENT

- (1) Disconnect both ends of air line that has failed. Use the air schematics in Appendix H as a guide to determine location of both ends.
- (2) For tubes with compression fittings, thread a new piece of brake tubing between the two connectors. Be sure the tubing follows the same routing as the failed tube.
- (3) Cut tube from roll and fit new nut and sleeve on both ends of the tube. Coat threads of connector with pipe sealant (item 22, Appendix E), and tighten nut onto connector.
- (4) All connectors should be tightened approximately two turns beyond hand tight.
- (5) Lay new tube in harness and if necessary strap in place with tie wraps. Be sure tube is supported at least every 2 - 3 ft (0.6 - 0.9 m).
- (6) Be sure tube does not come any closer than 1 in. (25 mm) to any moving or hot part.
- (7) When tube is installed, reconnect truck batteries and start main engine. When air line is pressurized brush both connectors with soap solution to check for leaks. Tighten/remake connections as required.
- (8) For hoses with flared connectors, lay out and cut new hose as above. Remove hose and fit new connectors to each end as detailed in para. 4-9. Be sure same type of connectors are used.
- (9) Install hose assembly in truck and carry out instructions 4 thru 7 preceding.
- (10) Remove old air line or pipe from truck, or, if in a harness, cut back to the harness from both ends so that failed line or pipe will not be used subsequently.

4-23. FUEL SYSTEM AND AIR INTAKE

4-23. Fuel Tank

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

19, Appendix E White Grease
22, Appendix E Pipe Sealant
25, Appendix E Sealant
311424 Fuel Tank

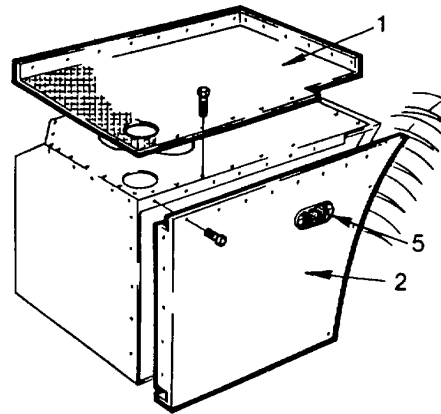
PERSONNEL REQUIRED -2

WARNING

JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

REMOVAL

- (1) Place suitable container underneath fuel tank drain. Fuel tank, when full, contains 45 gal (170 L) of fuel.
- (2) Remove fuel tank drain plug and filler cap and drain all fuel from the tank.
- (3) Remove 3 screws securing fuel tank cover to outer cab.
- (4) Remove 3 screws and lockwashers securing fan to inner cab. Tag and cut wire adjacent to butt connector.
- (5) Remove aluminum decking (1) from top of fuel tank compartment.
- (6) Loosen front fender where it attaches to fuel tank front face (2).



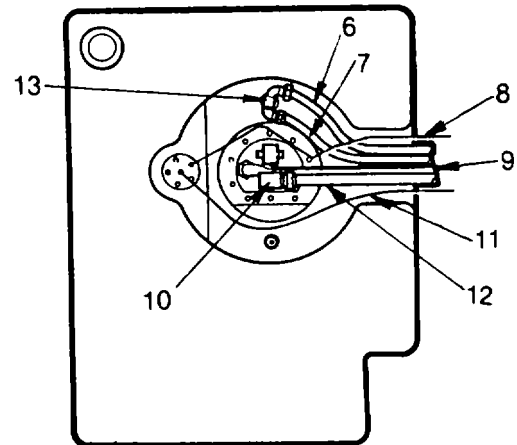
NOTE

To remove screw A, drill a 3/8 In (9.5 mm) hole to access screw head.

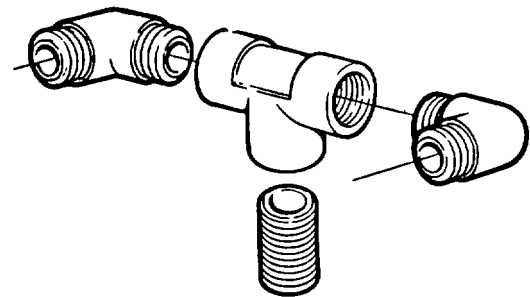
- (7) Remove front face (2) of fuel tank compartment, support front face carefully to prevent breaking wires to lamp (5).
- (8) Support front face and cut wire to lamp about 6 in. (150 mm) from front face.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (9) Remove winterization and main engine fuel return lines (6 and 7) and cap the ends.
- (10) Tag and remove winterization fuel delivery line (9) and cap the end.
- (11) Tag and remove main engine fuel delivery line (11) and cap the end.
- (12) Tag and remove grounding wire (8), fuel priming pump wire (10) and fuel level sender unit wire (12).
- (13) Remove pipe fittings (13) from fuel return opening on tank (Includes close nipple, tee and two elbows).
- (14) Remove four capscrews, flatwashers and lockwashers attaching tank to bottom of compartment.
- (15) Slide fuel tank out of side of fuel tank compartment.

**INSPECTION**

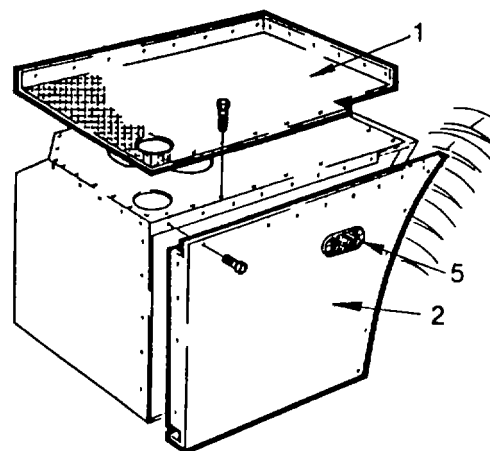
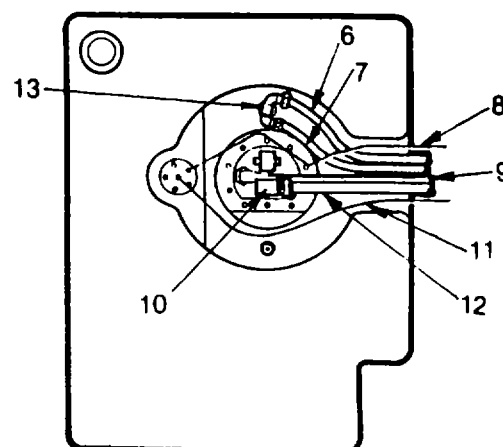
- (1) Check fuel tank for signs of cracking or leaks. Check inserts in bottom of tank are undamaged and threads are clean. If fuel tank is damaged, refer to Direct Support Level for repair.
- (2) Check fuel return insert is undamaged and threads are clean.
- (3) Inspect all fittings for damaged threads, or cracked bodies. Replace as required.
- (4) Clean and inspect all electrical connections. Coat all connectors with white grease (item 34, Appendix E).

**INSTALLATION**

- (1) Slide fuel tank through side of fuel tank compartment until mounting fasteners in tank line up with holes in bottom of compartment.
- (2) Install four capscrews, flatwashers, and lockwashers and torque to 30 ft lbs (41 Nm).
- (3) Coat all pipe threads with pipe sealant (item 22, Appendix E) and rebuild the return assembly on the tank. The arms of the elbows should be horizontal and point towards the hose duct on the engine side of the tank.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.1 Fuel Tank - Continued**

- (4) Connect grounding wire (8) to fuel priming pump and level sender. Connect positive wires (10 and 12) to fuel priming pump and to fuel level sender.
- (5) Reconnect main engine fuel delivery line (11) to priming pump.
- (6) Reconnect winterization fuel delivery line (9) to fuel tank.
- (7) Reconnect winterization and main engine fuel return lines (6 and 7) to return assembly (13). It does not matter which hose is attached to either elbow.
- (8) Fill fuel tank with 10 gal of fuel. Connect main batteries temporarily and check fuel level indicator. In cab indicates approximately 1/4 full. Replace sender unit or gage as required, see para. 4-24.
- (9) Set fuel priming switch to MANUAL in cab and check fuel priming pump starts (hum in fuel tank) Repair pump as required, see para. 4-23.2.
- (10) Disconnect main batteries.
- (11) Strip insulation on end of lamp wire and harness wire sufficient for a butt connector.
- (12) While holding fuel tank compartment side, connect butt connector between lamp and harness wire.
- (13) Coat mating surfaces of front face with sealant (item 25, Appendix E) and install front face.
- (14) Install fuel tank top.
- (15) Attach front fender to fuel tank front face.
- (16) Install tank cooling fan and guard. Reconnect wires with new butt connector.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued

4-23.2 Fuel Priming Pump

This task covers

- a. Removal
- b. Inspection
- c. Installation
- d- Repair

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

MATERIALS/PARTS

1-218019 Fuel Pump Gasket

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

WARNING

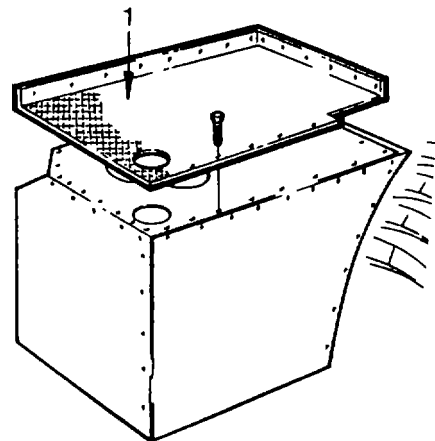
JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

NOTE

The fuel priming pump may be removed/installed either with the fuel tank removed or installed in the truck. The instruction is written assuming the fuel tank is mounted in the truck.

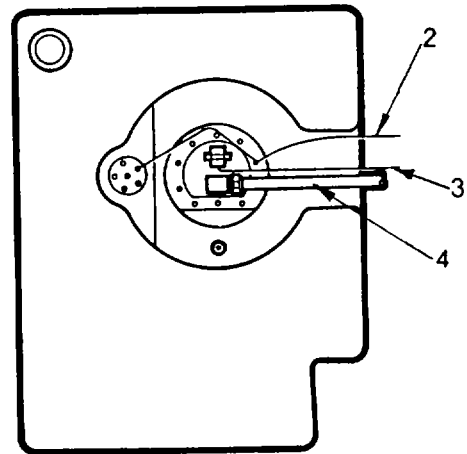
REMOVAL

- (1) Place suitable container underneath fuel tank, drain fuel tank. Fuel tank when full, contains 45 gal (170 L) of fuel.
- (2) Remove fuel tank drain plug and filler cap and drain all fuel from the tank.
- (3) Remove aluminum decking (1) from top of fuel tank.



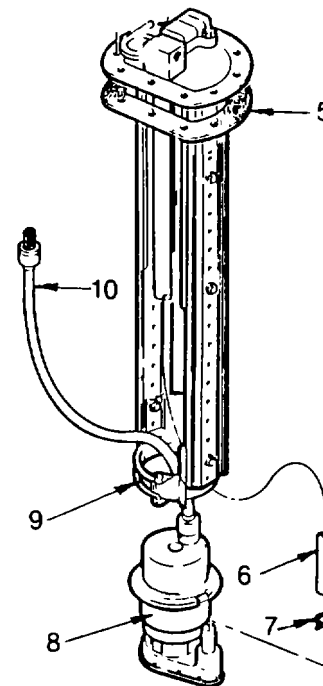
4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (4) Tag and disconnect grounding wire (2) from priming pump and fuel tank level sender.
- (5) Tag and disconnect positive wire (3) from priming pump.
- (6) Remove main engine fuel delivery line (4).
- (7) Using a flat screwdriver, remove the 10 screws and washers clamping pump upper flange to fuel tank.
- (8) Withdraw pump from fuel tank, allowing fuel to drain out of pump into tank.
- (9) While holding pump over suitable receptacle, remove hose clip (7) from pump discharge. Pull hose (6) off nipple and drain fuel from hose and pump.



INSPECTION

- (1) Remove gasket (5) from pump flange and discard.
- (2) Disconnect electrical lead (10) from underneath top plate.
- (3) Unclamp the clamp ring (9) holding pump to hanger.
- (4) Connect 0 - 20 psi (0 - 150 kPa) gage to pump outlet.
- (5) Immerse pump (8) in an open container of diesel fuel for at least 5 minutes.
- (6) Connect pump to a 12 volt battery via an ammeter, voltmeter, fuse and switch as shown.
- (7) Start pump and check the following readings.
 - (a) Pump pressure exceeds 7 psi (48 kPa)
 - (b) Battery voltage exceeds 13.2V
 - (c) Pump current less than 5.0A



- (8) If pump is not better than specification, leave it soaking for a further 10 minutes and try again. If pump will not rotate at all check electrical connections, see REPAIR following. If it still will not meet specification the pump is faulty and must be replaced.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued

4-23.2 Fuel Pump - Continued

- (9) Remount pump in clamp ring and reconnect electrical lead.
- (10) Check pump discharge hose is free of any cracks or kinks. Replace as required.
- (11) Check all hanger assembly bolts are tight.
- (12) Remove any old gasket material from pump and tank flange.
- (13) Carefully place new gasket over hanger assembly and onto pump flange.

INSTALLATION

- (1) Carefully slide assembled pump and hanger into fuel tank.
- (2) Using a flat screwdriver, install the 10 screws and washers securing flange to tank.
- (3) Reconnect main engine fuel delivery line.
- (4) Reconnect pump ground wire and electrical lead. Be sure tank level sender ground wire is also reconnected.
- (5) Test pump by pressing PUMP PRIME pushbutton in the cab. Ensure pump hums.
- (6) Replace aluminum decking over fuel tank compartment.

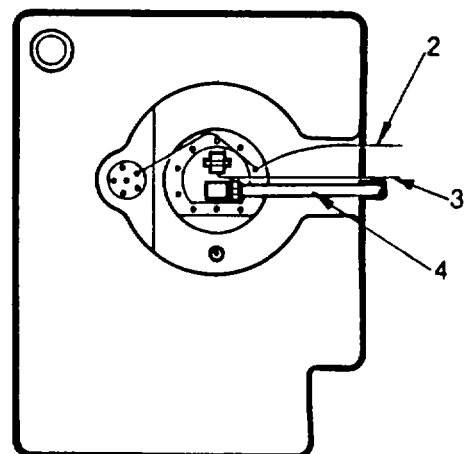
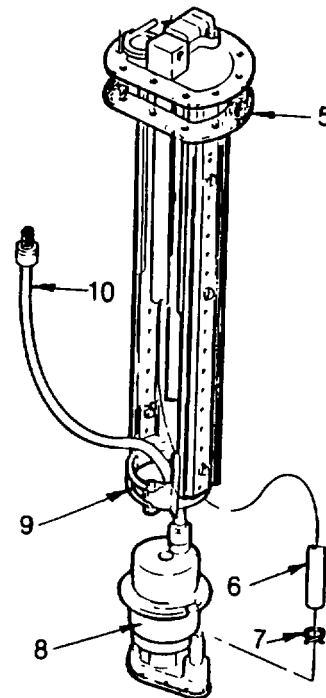
REPAIR

NOTE

All repairs require priming pump to be removed from fuel tank. See REMOVAL preceding.

a. Discharge Hose Repair

- (1) Remove hose clips from both ends of the discharge hose.
- (2) Pull discharge hose off pump and flange fittings.
- (3) Replace hose with piece of similar length and internal diameter. Ensure it is compatible with diesel fuel.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (4) Replace hose clips.
- (5) Carry out the INSPECTION preceding to ensure pump is up to specification.

b. Pump Repair

- (1) The pump and motor are not repairable. If the tests carried out as detailed in INSPECTION preceding indicate the pump has failed, replace the pump as detailed in INSPECTION.
- (2) Always soak a new pump and check the specification before installing in the hanger.

c. Electrical Connection Repair

- (1) When carrying out the INSPECTION tests and the pump will not run, carry out the following.
- (2) Disconnect electrical lead from pump.
- (3) Connect ohmmeter (continuity tester) between the plug terminal on one end of the electrical lead and the corresponding terminal on the other end.
- (4) If either wire is open circuit, replace lead.
- (5) Connect ohmmeter (continuity tester) between both terminals in the plug on one end.
- (6) Replace electrical lead if a short circuit exists. Check both plugs.
- (7) Check electrical plug on pump hanger flange similar to 3 thru 6 preceding. Replace electrical plug on flange if it has failed.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued

4-23.3 Water/Fuel Separator Filter

This task covers

Replacement

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

MATERIALS/PARTS

2020SM Filter
11007 Gasket
11350 O-Ring

EQUIPMENT CONDITION

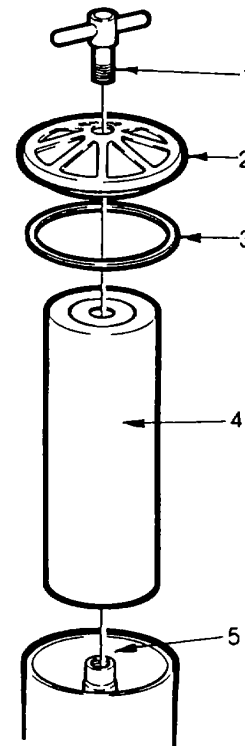
Main Engine Shutdown (see para. 2-10)
LH Engine Cover Removed (see para. 4-12.11)

WARNING

JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

REPLACEMENT

- (1) Open drain valve on water/fuel separator and drain all fuel into a receptacle. Dispose of fuel.
- (2) Unscrew T-handle (1) completely. Remove lid (2) Remove gasket (3) and discard.
- (3) Lift out filter element (4) and discard.
- (4) With receptacle beneath water/fuel separator drain, flush body and bowl with clean fuel. Dispose of this fuel.
- (5) Close drain valve.
- (6) Install new filter element (4) over rod in water/fuel separator body. Fill water/fuel separator with clean fuel.
- (7) Fit new gasket (3) to lid (2). Place lid on body. Ensure rim of body mates in lid recess.
- (8) Inspect T-handle O-ring. Replace as required.
- (9) Screw T-handle (1) into body (5) through hole in lid. Hand tighten only.
- (10) Start engine and ensure there are no air or fuel leaks. Tighten connections as required (Allow engine to run for 10 minutes. Then check fuel bowl for bubbles).
- (11) Stop engine and check fuel does not drain back to tank, ie check valve seats. Refit check valve if required, see para. 4-23.4.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.4 Water/Fuel Separator****This task covers**

- a. Removal
- b. Installation

TOOLS

Tool Kit, General Mechanic,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
LH Engine Cover Removed (see para. 4-12.11)

MATERIALS/PARTS

22, Appendix E Pipe Sealant
2020SM Filter
11007 Gasket
11350 O-Ring

WARNING

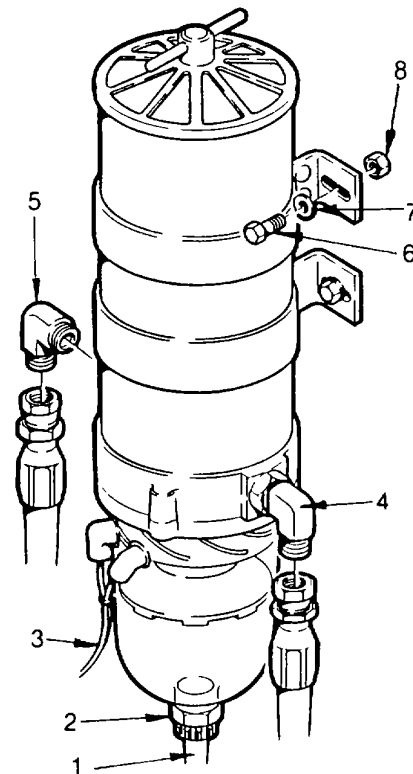
JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

REMOVAL

- (1) Remove filter element as detailed in para. 4-23.3, steps 1 thru 5.
- (2) Unplug heater wires (3), label, and set aside.
- (3) Tag and disconnect inlet and outlet fuel lines at the elbows (4 and 5).
- (4) While supporting separator, remove capscrews (6), nuts (8), and washers (7) attaching support clamps to cab-wall (four places).

INSTALLATION

- (1) While supporting filter, install capscrews (6) nuts (8) and washers (7) to attach support clamps to wall.
- (2) Ensure drain valve is closed.
- (3) Coat threads with pipe sealant (item 22, Appendix E) and connect inlet lines to elbows (5) (4 and 5) as tagged.
- (4) Connect heater wires (3) to heater socket on filter/separator bowl.
- (5) Install filter element as detailed in 4-23.3, steps 6 thru 10.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.5 Fuel Pump****This task covers**

- a. Removal
- b. Inspection
- c. Installation
- d. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
J1508-D Fuel Pump Repair Tool Set

MATERIALS/PARTS

10, Appendix E Dry Cleaning Solvent
20, Appendix E Penetrating Oil
28, Appendix E Silicone Sealant
32, Appendix E Vegetable Shortening
5150193 Gasket

EQUIPMENT CONDITION

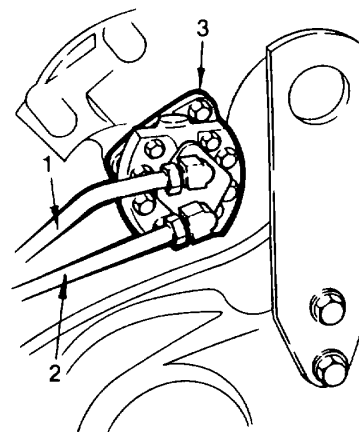
Main Engine Shutdown (see para. 2-10)
RH Engine Cover Removed (see para. 4-12.11)

WARNING

JP-4 is a highly volatile fuel. Extraordinary care must be taken where servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

REMOVAL

- (1) Tag and disconnect fuel lines (1 and 2) from inlet and outlet openings of the fuel pump.
- (2) Remove the three pump attaching bolts (3) and withdraw the pump from the governor housing.
- (3) Remove drive coupling fork from pump or governor housing.

**INSPECTION**

- (1) Discard gasket and clean surface of mating flanges. Check for scores or scratches.

WARNING

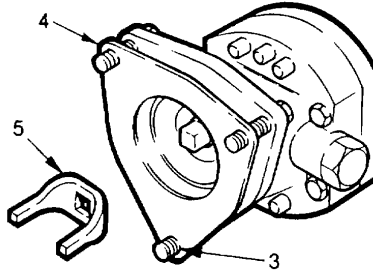
Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (2) Clean pump body with dry cleaning solvent (item 10, Appendix E)
- (2) Spin driveshaft and check it operates freely and smoothly
- (3) If the pump is damaged or has failed in service, refer to REPAIR procedures following

INSTALLATION**NOTE**

The pump must be installed with the inlet opening (marked "LH IN") next to the balance weight cover. The inlet and outlet openings must be vertical, the inlet being the lower opening.



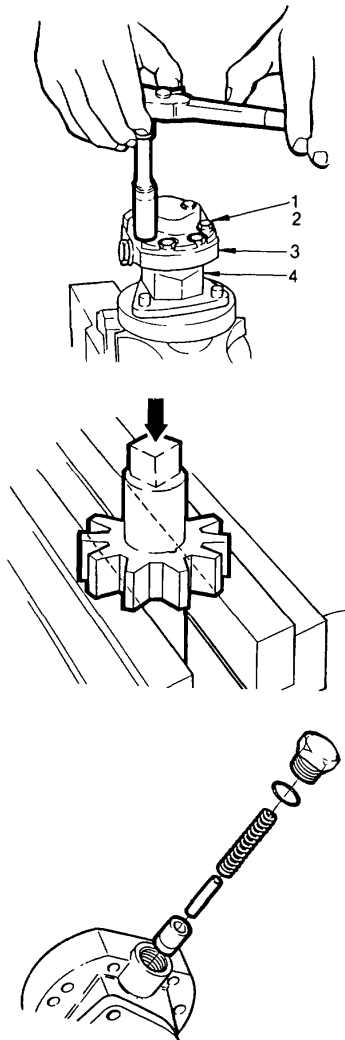
- (1) Place a new pump gasket (4) against the mounting flange and hold in place with the protruding ends of the three mounting bolts (3).
- (2) Place the drive coupling fork (5) on the square end of the shaft.
- (3) Place the fuel pump against the governor housing. Ensure the drive coupling fork registers with the slots in the drive disc.
- (4) Secure the pump to the governor housing with the three bolts and tighten to 10 ft lb (14 Nm).
- (5) Connect the fuel inlet line to the inlet elbow.
- (6) From the cab, press the fuel priming switch. This starts the priming pump. Continue priming until fuel spills from the engine fuel pump outlet elbow.
- (7) Connect the fuel outlet line to the outlet elbow.
- (8) Run the engine and check fuel pump for leaks. If any leaks occur, tighten the connections only enough to stop the leak.

REPAIR

- (1) The pump can only be repaired if it is removed from the truck.
- (2) Drain all fuel from pump by rotating and shaking.
- (3) Mount fuel pump in holding fixture J1508-10. The fixture should be mounted in a vise.
- (4) Remove fuel inlet and outlet elbows from the pump cover.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.5 Fuel Pump - Continued**

- (5) Remove eight cover bolts (1) and lockwashers (2). Withdraw pump cover (3) from pump body (4). Take care not to damage machined faces of either component.
- (6) Pull up drive shaft and withdraw shaft with attached gear from fuel pump body.
- (7) Insert drive shaft, non-square end, into vise jaws. Vise jaws should not bear on shaft. Press square end, if necessary tapping with soft hammer, until the gear is pressed beyond the gear retaining ball detent.
- (8) Remove ball.
- (9) Invert drive shaft in vise jaws and press gear from drive shaft. Gear must be withdrawn from non-squared end of shaft.
- (10) Pull out the driven shaft and gear from the pump body. The gear cannot be withdrawn from the driven shaft.
- (11) Remove relief valve plug and copper gasket. (Take care not to allow spring to jump out of assembly. Remove plug slowly with socket wrench so spring cannot escape).
- (12) Lift/shake out valve spring, pin and relief valve from cavity in pump body.

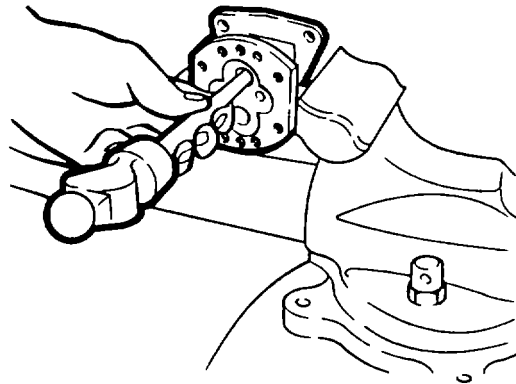


4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (13) Remove oil seals using tool J1508-13.

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

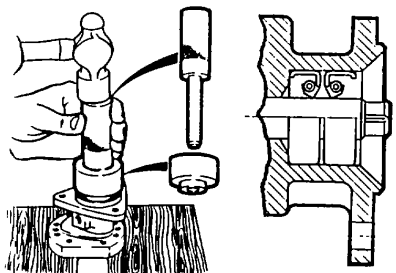
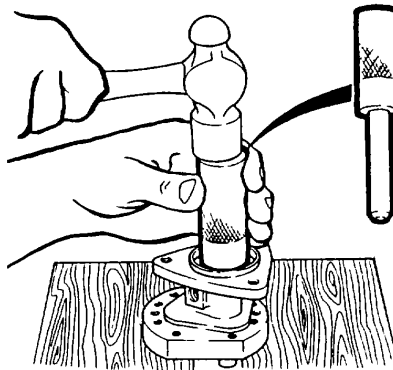


Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

- (14) Clean all parts with dry cleaning solvent (item 10, Appendix E). Dry with compressed air.
- (15) Discard oil seals, they cannot be replaced when removed from body.
- (16) Check pump gear teeth for scoring, chipping, or wear.
- (17) Check ball slot in drive gear for wear.
- (18) Check drive and drive shafts for scoring or wear. Replace the shafts if necessary. They should be a close fit in both pump body and pump cover.
- (19) Check both pump body and pump cover mating surfaces are flat and smooth and fit tightly together. Any scratches or slight damage may result in fuel leaks.
- (20) Check for wear in the gear contact area of both cover and body. Replace as required.
- (21) Check all body drilled passages are clean and unblocked. (Remove plugs from body for access, as required).
- (22) Lubricate the lips of two new oil seals with a light coat of vegetable shortening (item 32, Appendix E). Both seals are identical.
- (23) Place one of the seals on the pilot of the installer handle J1508-8. The spring side of the seal away from the handle.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.5 Fuel Pump - Continued**

- (24) Support the body on wooden blocks. Insert the pilot of the installer in the pump body, so the seal starts straight into the pump flange.
- (25) Drive the seal into the body until it bottoms.
- (26) Remove installer, slide the adaptor J1508-9 over the pilot. The shorter snout should be towards the handle.
- (27) Slide the second seal onto the pilot with the spring side toward the handle.
- (28) Insert the pilot into the pump body and drive the seal until the shoulder of the adaptor just contacts the pump body.
- (29) Clamp pump body, flange to flange, between the soft jaws of a bench vise. Pump valve cavity must be up.
- (30) Lubricate the outside of the relief valve. Place it in the valve cavity, hollow end up. Insert the spring inside of the valve seat, and pin inside the spring.
- (31) Fit a new gasket over the valve plug. Place plug over the spring and thread it into the pump body. Tighten to 18 ft lb (24 Nm).
- (32) Push the fuel pump drive gear over the end of the non-squared end of the drive shaft. The slot in the gear must face the non-squared end of the shaft. (Do not push on from squared end, otherwise lip seal area of shaft will be damaged).
- (33) Press the drive gear beyond the gear retaining ball detent. Place the gear retaining ball in the detent and press gear back until the ball contacts the end of the slot in the gear.
- (34) Mount fuel pump in holding fixture J1508-10. Lubricate the pump shaft with engine oil and insert the square end of the shaft into the opening on the gear side of the pump body. Push the shaft through the oil seals carefully until the gear is in the pump cavity.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (35) Lubricate the driven shaft and gear with engine oil. Place in the pump body if the driven gear has chamfered teeth, this side must face the pump body, if the gear has a slot, this side must face the pump cover. Ensure driven and drive gear mesh.
- (36) Apply a thin coat of silicone sealant (item 28, Appendix E) on the face of the pump cover outside of the gear pocket area. The coating must be very thin since the pump clearances are set up on the basis of metal-to-metal contact. Ensure no sealant is squeezed into the gear compartment.
- (37) Place the cover over the pump body. Ensure bolt holes line up. The cover can only be installed in one position over the shafts. The two dowel pins should locate into the pump body.
- (38) Secure the cover (3) in place with the eight bolts (1) and lockwashers (2). Tighten bolts alternately and evenly to 9 ft lb (12 Nm).
- (39) Rotate the pump drive shaft by hand to ensure parts rotate freely. If the shaft does not rotate, tap pump gently while trying to move shaft.
- (40) Install fuel pump inlet and outlet elbow in pump cover. Do not tighten.
- (41) If fuel pump is to be installed in truck refer to INSTALLATION procedure preceding. If it is to be stored, blank inlet and outlet connections with shipping caps. Coat pump with penetrating oil (item 20, Appendix E).

4-23 FUEL SYSTEM AND AIR INTAKE - Continued**4-23.6 Main Engine Fuel Filter****This task covers**

- a. Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0650

MATERIALS/PARTS

25010778 Filter Cartridge

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
RH Engine Cover Removed (see para. 4-12.11)

CAUTION

JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

NOTE

The main engine fuel filter is mounted on the front right hand of the engine.

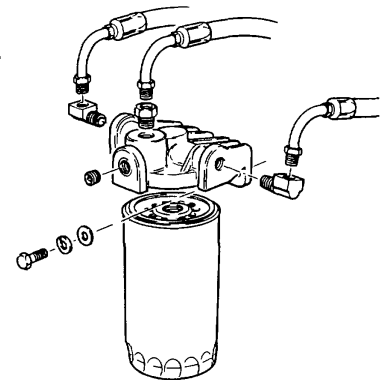
REPLACEMENT

- a. Filter Cartridge Replacement

- (1) Unscrew the filter using a filter removal tool.
- (2) Remove from the engine and discard in a combustible waste area.
- (3) Fill a replacement filter cartridge about two-thirds full with clean fuel oil.
- (4) Coat the seal gasket lightly with clean fuel oil.
- (5) Install the cartridge and tighten it to one-half turn beyond gasket contact.
- (6) Start the engine and check for leaks. Tighten the filter as required.

- b. Filter Cover Replacement

- (1) Carry out Filter Cartridge Replace steps 1 and 2.
- (2) Tag and remove fuel filter inlet and outlet hoses.
- (3) Remove both capscrews securing filter cover to engine block.



4-23. FUEL SYSTEM AND AIR INTAKE - Continued

- (4) Line up new cover with engine block mounting holes.
- (5) Install two capscrews lockwashers and flatwashers to attach filter cover to engine block.
- (6) Replace fuel filter inlet and outlet hoses. Be sure all unused ports are fitted with 1/4 in. pipe plugs.
- (7) Install new filter as detailed in Filter Cartridge Replacement preceding (steps 3 thru 6).

4-23. FUEL SYSTEM AND AIR INTAKE - Continued**4-23.7 Fuel Line, Hoses and Piping.****This task covers**

- a. Replacement
- b. Repair

TOOLS

Tool Kit, General Mechanic,
NSN 5810-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
RH and LH Engine Cover Removed
(see para. 4-12.11)

MATERIALS/PARTS

22, Appendix E, Pipe Sealant
112-B-06 Nipple
49-F-06X06 Elbow
101-B-06 Tee

101634-048 Hose Assembly
101635-068 Hose Assembly
2062T-8-10S Elbow
54-F-08X06 Elbow, 45 deg
2-5110/1615 Hose Assembly
8924154 Elbow
2-5160/1615 Hose Assembly
14338 Elbow 45 deg
193004 Elbow
25202/1615 Hose Assembly
116332 Bushing
5129184 Tee
8924171 Connector
2.5215/1615 Hose Assembly
5128927 Elbow

WARNING

JP-4 is a highly volatile fuel. Extraordinary care must be taken when servicing components that use this fuel. The truck shall be grounded to an approved grounding point if it contains JP-4 fuel.

NOTE

All hoses, pipes and fittings are accessible without removing any equipment except that if a connection has to be removed from the fuel tank, the fuel tank aluminum decking must be removed, see para. 4-23.1.

REPLACEMENT

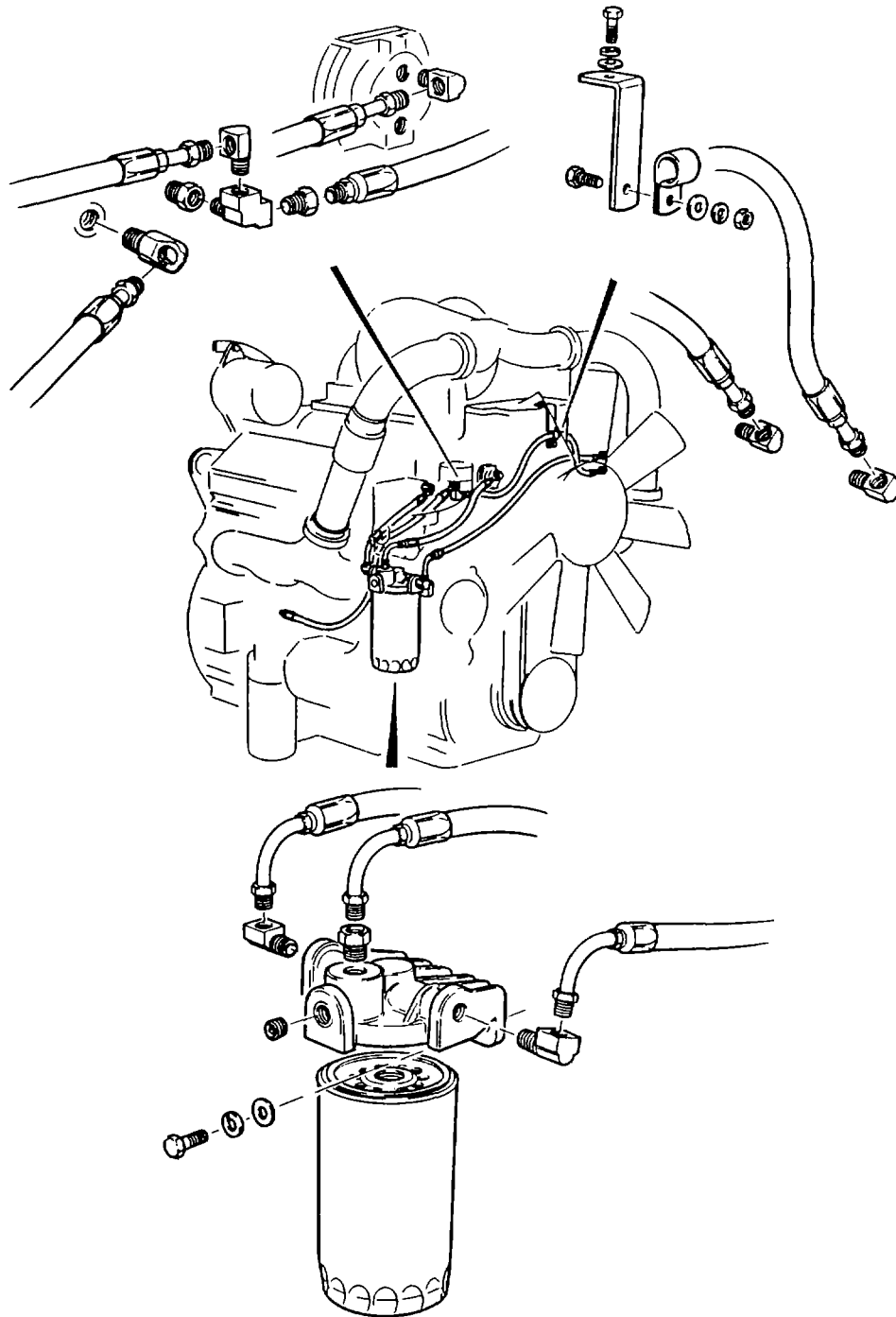
- (1) Hoses and fittings may be replaced individually. When removing any component, always place a receptacle beneath the disconnect on point. Be sure to catch all the fuel. Mop up the spills and dispose of the fuel.
- (2) Prior to installation, coat all threads with pipe sealant (item 22 Appendix E).
- (3) Always prime the main engine and APU after replacing any components to be sure there is no air trapped in the fuel system.

REPAIR

- (1) Any cracked, misthreaded or broken fittings must be replaced.
- (2) If hose shows signs of deterioration, replace as detailed in para. 4-9.

4-23. FUEL SYSTEM AND AIR INTAKE - Continued

4-23.7 Fuel Line, Hoses and Piping.



4-23 FUEL SYSTEM AND AIR INTAKE - Continued**4-23.8 Air Filter.****This task covers****a. Replacement****TOOLS**

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

62891-002 Air Filter

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
RH And LH Cover Removed (see para. 4-12.11)

REPLACEMENT

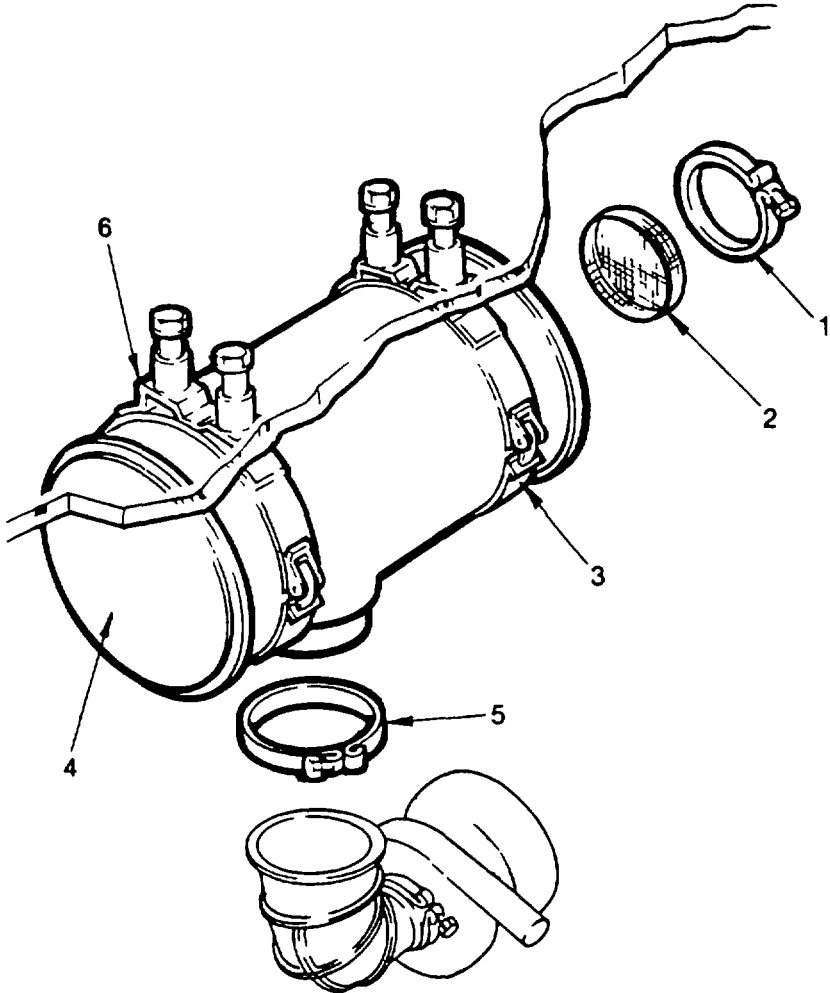
- (1) Loosen clamp (5).
- (2) While supporting air filter, undo clamps (3 and 6).
- (3) Remove air filter from engine compartment.

NOTE

If air cleaner is being removed for access only, go to step 11 for installation instructions.

- (4) Remove clamp (1) and air inlet screen (2).
- (5) Discard air filter (4). It cannot be cleaned or reused.
- (6) Clean and inspect air inlet screen. Make up a new screen if any wires are missing.
- (7) Inspect turbocharger inlet elbow. Clean interior taking care not to damage inlet pressure sensor.
- (8) Be sure all clamps are serviceable. Replace as required.
- (9) Install clamp (5) over turbocharger inlet elbow, if removed.
- (10) Install screen (2) over new filter and clamp securely in place.
- (11) Carefully maneuver air filter (4) into support clamps ensuring rubber elbow fits over filter outlet port.
- (12) Secure both clamps (3 and 6).
- (13) Tighten clamp (5) ensuring it grips both the elbow and the filter outlet port.
- (14) Start engine and check cab air filter gage registers no restriction. (Gage needle not in the red).

4-23. FUEL SYSTEM AND AIR INTAKE - Continued



4-24. ELECTRICAL SYSTEM**4-24.1 Alternator****This task covers**

- a. Test
- b. Replacement
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0650

MATERIALS/PARTS

1105465 Alternator

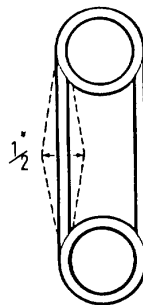
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF
110 Volt Inverter OFF
LHS and RHS Engine Cover Removed
(see para. 4-12.11)

TEST**NOTE**

If the batteries are undercharged carry out tests 1 thru 11. If the batteries are overcharged, or showing low electrolyte level, carry out test 12 thru 14.

- (1) Be sure undercharging is not a result of accessories being left on. With all accessories off and battery switch set to BOTH and batteries charged, connect a voltmeter between the terminals of the current shunt. The reading should be zero even in the millivolt range. If there is a reading, check for a broken accessory switch or an accessory circuit connected directly to the battery bus bar. The current shunt is mounted on the left hand engine lifting bracket.
- (2) Be sure alternator drive belts are tight. There should be a maximum 1/2 in. (12 mm) play in drive belt at the mid-position between the pulleys.
- (3) Be sure all battery, starter motor, alternator, and ground connections are tight and clean. Be sure battery posts are not coated with corrosion products.
- (4) Switch ignition on and note dash-mounted voltmeter reading. A zero reading indicates wire 22 or 21 or the wires between the batteries and battery switch are broken. It may also indicate a fault with the battery switch or the ignition switch. Check all wire and switches and replace failed components.

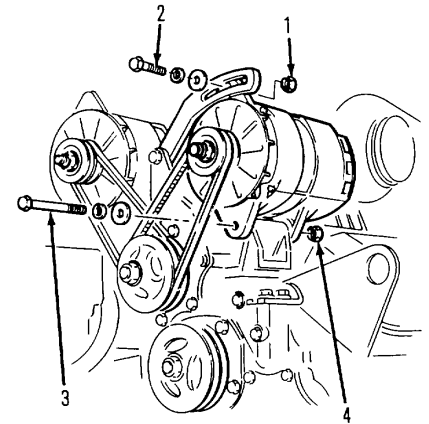


4-24. ELECTRICAL SYSTEM - Continued

- (5) Disconnect battery cables at negative pole of both pairs of batteries.
- (6) Connect a carbon pile across the positive and negative terminals of one battery.
- (7) Reconnect the battery cables, and start the main engine (see Chapter 2). Turn on all accessories.
- (8) Operate engine at 1200 rpm or more and adjust carbon pile as required to obtain maximum current output from the alternators. Read current on dash-mounted ammeter.
- (9) Check output is greater than 40 amps. If above this figure, the alternators are performing satisfactorily.
- (10) If current is less than 40 amps, loosen belt on one alternator and retest. Repeat procedures for second alternator. Determine which alternator has failed and replace (see REPLACEMENT following).
- (11) Remove battery negative cables and disconnect carbon pile. Reconnect battery negative cables.
- (12) If battery is overcharging, ie, is hot or is using water, carry out the following tests.
- (13) Start main engine. With all accessories set to OFF, increase engine speed to obtain the maximum voltage reading.
- (14) If voltage exceeds 15 volts, alternator is faulty. Replace alternators, see REPLACEMENT following.

REPLACEMENT

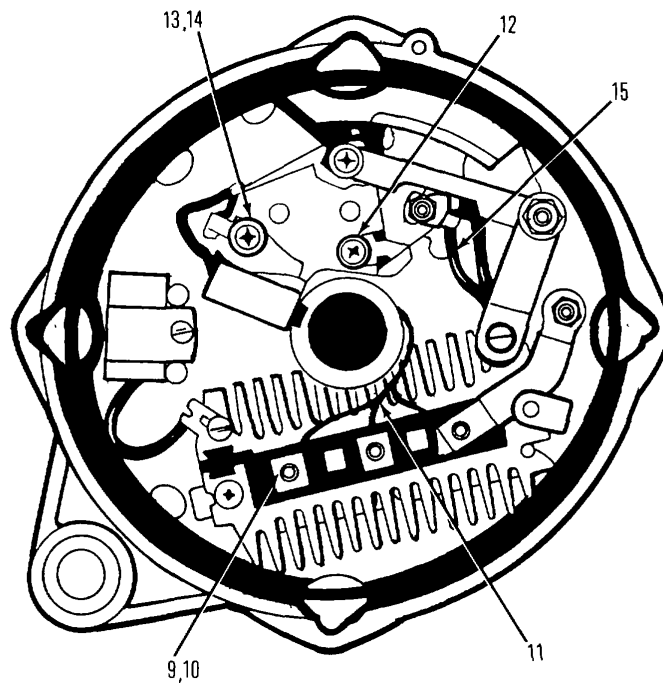
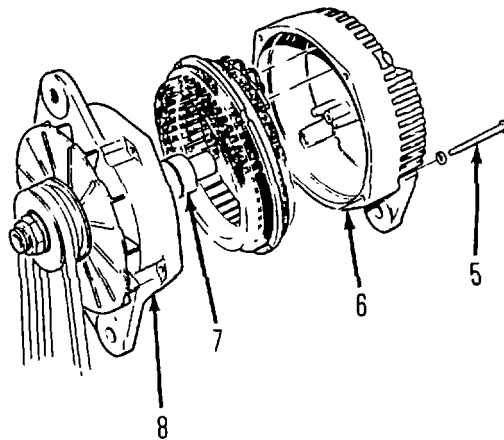
- (1) Disconnect batteries as detailed in para. 4-24.12.
- (2) Tag and disconnect all wires and plugs to failed alternators.
- (3) Loosen belt tightening nut (1) and bolt (2) and fulcrum bolt (3) from failed alternator.
- (4) Remove belts and remove nut (1) and bolt (2) completely.
- (5) Remove fulcrum bolt (3) and nut (4) and lift alternator from engine.
- (6) Deleted
- (7) Remove four bolts (5) from alternator.
- (8) Separate slip ring end frame (6) and stator (7) from drive end frame and rotor assembly (8).



4-24 ELECTRICAL SYSTEM - Continued

4-24. 1 Alternator - Continued

- (9) Remove nuts (9) and washers (10) and remove stator (7) from slip ring end frame (6).
- (10) Remove diode trio (11) by removing insulated screw (12).
- (11) Remove screw (13) and insulated washer (14).
- (12) Connect a 12 in. piece of # 16 white wire, with suitable ring terminal, to negative brush using screw (13) and washer (14). Wire terminal must be under the insulated washer to ensure good electrical contact with brush terminal.
- (13) Remove and discard the black regulator jump lead (15) between the voltage regulator and the positive (BAT) terminal of the alternator.



4-24. ELECTRICAL SYSTEM - Continued

- (14) Thread the other end of the lead from step 12 through the rear of the alternator using convenient ventilating holes. Make sure the lead is routed and secured so it does not interfere with rotor.
- (15) Assemble stator (7) to end frame (6) using three sets of nuts and washers (9 and 10).
- (16) Assemble rotor and drive end frame assembly (8) and slip ring end frame (6) using bolts (5).
- (17) Install alternator on engine with fulcrum bolt.
- (18) Slip drive belt over engine and alternator pulley.
- (19) Install belt tightening bolt and nut. Lever on alternator until there is approximately 1/2 in. (12 mm) belt movement midway between the pulley.
- (20) Tighten belt tightening nut and bolt securely.
- (21) Connect leads to alternator as tagged in step 2. (New white lead is connected to alternator ground, blue lead from inverter is connected to positive terminal of regulator plug.
- (22) Start main engine and check current generated on cab amp gage.

REPAIR**NOTE**

The main engine alternators are the same model as installed on the APU. The main engine alternator regulators and tri-diodes are not used; the 110 Vac inverter is used to regulate alternator output. For repair of main engine alternator refer to para. 4-15.3.

4-24. ELECTRICALSYSTEM-(Continued)**4-24.2 STARTING MOTOR****This task covers**

- a. Replacement
- b. Installation
- c. Repair

TOOLS

Shop Equipment, General Purpose Repair,
FSN 4940-287-4894

MATERIALS/PARTS

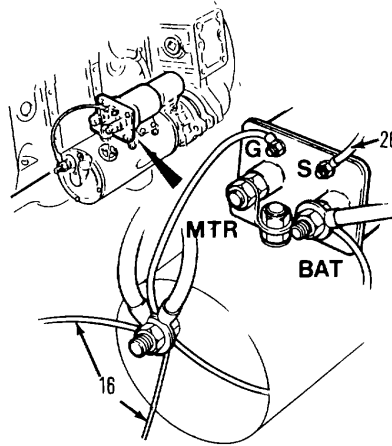
14, Appendix E Gasket Eliminator

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
RHS Engine Cover Removed (see para. 4-12.11)
LH Suspension Shock Absorber Top Nut Removed
(see para. 4-31.1)

REMOVAL

- (1) Tag and disconnect all wires from the main ground connection on the back of the motor. There are 5 wires plus one to the starter solenoid. Do not remove this last wire.
- (2) Tag and disconnect all wires from BAT connection on the starter motor. There are 2 wires.
- (3) Tag and disconnect wire 26 on the S (solenoid) connection of the starter motor.
- (4) Remove mounting bolts from starter motor/engine flange and lift out starter motor.

**INSTALLATION**

- (1) Clean starter motor flange. Recoat starter motor and engine flange with gasket eliminator (item 14, Appendix E).
- (2) Install starter motor in flywheel hole. Be sure that when mounting holes are aligned, the nose of the motor is clear of the starter ring on the flywheel. Install and tighten bolts to 15 ft lb (22 Nm).

NOTE

If necessary, remove nose housing bolts and rotate housing to desired position.

- (3) Connect all wires to the connector posts. Be sure they are connected exactly as noted in steps 1 thru 3 of REMOVAL preceding.

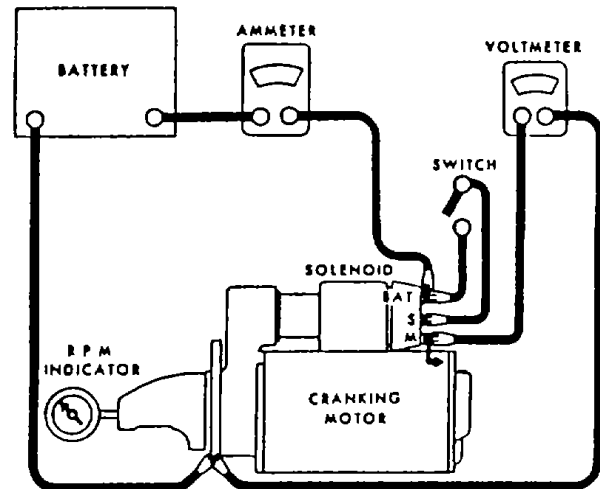
4-24. ELECTRICAL SYSTEM - Continued

- (4) Reconnect batteries.
- (5) Press cab START button, with ignition ON. Be sure main engine cranks at good speed and when button is released, starter motor disengages. A distinct pull-in of the solenoid will be heard just prior to the motor starting.

REPAIR**NOTE**

Starting motor must be removed from truck prior to repair. When repairing, only disassemble motor so far as is necessary to make repair or replace defective parts.

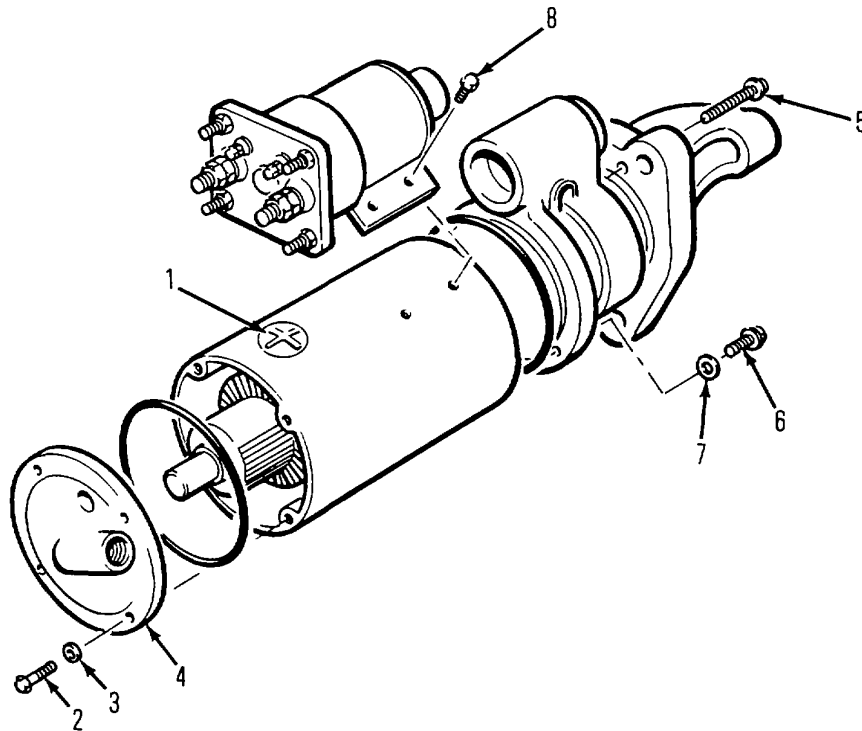
- (1) Check armature rotates freely by prying pinion with a screwdriver. If the armature does not turn freely, disassemble starter to find cause (see step 9 following). Otherwise proceed with tests 2-8.
- (2) Connect starter motor to test gear as shown. Be sure battery is fully charged.
- (3) Close switch and note the reading on the voltmeter, ammeter and rpm indicator. At a voltage of between 10 and 13 volts, a healthy motor will have a current draw of between 140 - 215A at a speed of 4000 - 7000 rpm.
- (4) Low speed and high current indicates:
 - (a) tight, dirty, or worn bearings
 - (b) loose pole shoes
 - (c) bent armature shaft
 - (d) shorted armature
 - (e) grounded armature or field
- (5) No speed and high current indicates:
 - (a) direct ground in terminal or fields
 - (b) seized bearings
- (6) No speed and no current draw indicates:
 - (a) open field circuit
 - (b) open armature coils
 - (c) broken brush springs, worn brushes, high insulation between commutator bars or other causes preventing good contact between brushes and commutator



4-24. ELECTRICAL SYSTEM - Continued

4-24.2 Starting Motor - Continued

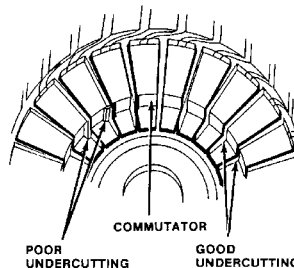
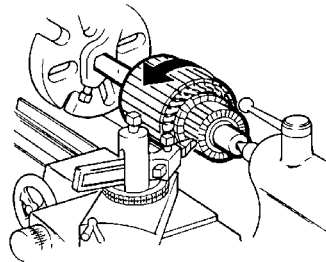
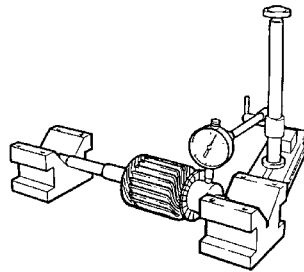
- (7) Low speed and low current indicates:
- (a) high internal resistance due to poor connection, defective leads, or dirty commutator
 - (b) same faults as step 6 preceding.
- (8) High speed and high current indicate shorted fields.
- (9) To disassemble the motor, note the relative positions of the solenoid, lever housing, and nose housing. Mark pieces with chalk to ensure motor is assembled in the same manner.



- (10) Disconnect motor from test gear (if necessary) and disconnect field coil connector from solenoid MTR terminal.
- (11) Disconnect lead between solenoid and motor ground terminals. Remove screws (8) from solenoid. Remove brush inspection plugs (1) and the brush lead screws.
- (12) Remove bolts (2) and washers (3) and separate end frame (4) from field frame.
- (13) Remove bolts (5) and separate nose housing from lever housing.
- (14) Remove bolts (6) and washers (7) and remove lever housing from field frame.

4-24. ELECTRICAL SYSTEM - Continued

- (15) Separate lever housing and field frame. Pull armature out of lever housing.
- (16) Separate solenoid from lever housing by pulling apart.
- (17) Clean armature, field coils and other components with a clean, lint-free cloth and/or a soft bristle brush.
- (18) Clean commutator with No. 00 sandpaper (item 24, Appendix E).
- (19) Inspect brushes and springs. Replace if worn, broken or chipped. Be sure springs have some springiness and show no signs of overheating. Replace whole brush assembly rather than individual components.
- (20) Be sure brushes do not bind to the brush holders. Clean as required.
- (21) Inspect armature commutator. If it is worn, out of round by more than 0.003 in. (0.08 mm), or insulation between strips is high, place armature in a lathe. Turn down the commutator until there are no more high or worn spots.
- (22) Undercut the insulation so that it is 1/32 in. (0.8 mm) wide and the same dimension below the surface of the commutator. Lightly sand complete unit, and with a soft brush and cloth, remove all traces of dirt and copper filings from commutator slots.
- (23) Check electrical continuity of the armature.

**NOTE**

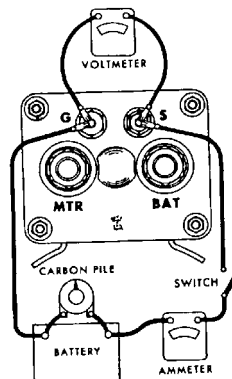
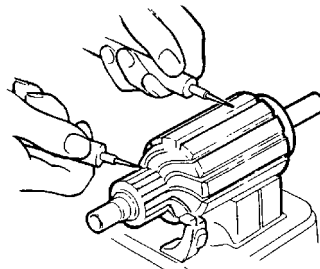
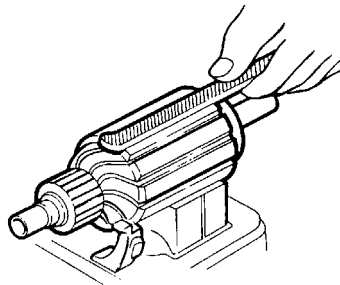
Open circuits most likely occur at the commutator to winding connection. Poor contact causes burning and arcing on the commutator bars. If the burning is not excessive, repair can be effected by resoldering the leads to the riser bars using a rosin flux. Replace armature if open circuit cannot be repaired.

4-24. ELECTRICAL SYSTEM - Continued**4-24.2 Starting Motor - Continued**

Short circuits are located by use of a growler. When the armature is revolved in the growler, a metal strip, such as a hacksaw blade, held above it will vibrate above the area of the armature core in which the short circuit is located. Shorts between commutator bars are sometimes produced by brush dust or copper between the bars. These shorts can be eliminated by cleaning out the slots. Replace armature if short cannot be removed.

Ground circuits are located by placing one test point of a 110-volt test lamp on the commutator bar with the other point on the core or shaft. Replace the armature if a winding is grounded.

- (24) Check electrical continuity of the field coils. Connect a 110- volt test lamp between the field coil connector and the field frame. If the lamp illuminates, at least one field coil is grounded.
- (25) Remove all coils and separately test each coil. Replace any failing inspection.
- (26) Connect test lamp leads to each field coil and check for an open circuit field coil. If lamp does not illuminate field coils are open circuit.



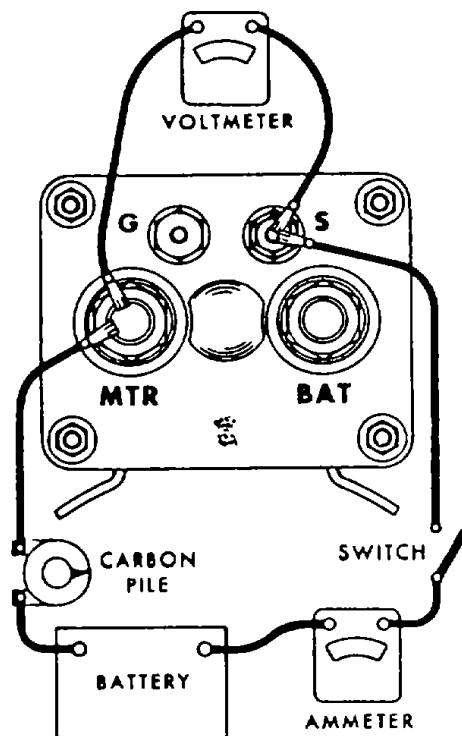
- (27) Connect the solenoid circuit as shown. If the current reading is very high this indicates a shorted or grounded hold-in winding. A very low reading indicates poor connections. Replace the solenoid if any faults are indicated.

CAUTION

To prevent overheating of the winding, connect pull-in winding for 15 seconds only.

4-24. ELECTRICAL SYSTEM - Continued

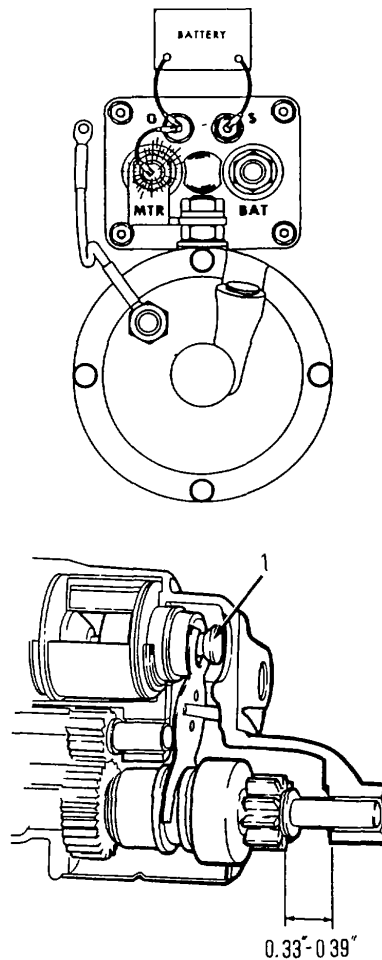
- (28) Repeat test with connections shown. This tests the pull-in winding of the solenoid. Replace solenoid if any faults are indicated
- (29) Install armature into the nose housing bearing and check play between armature and bushing. If play is excessive replace bushing. Dip bushing into lubricating oil (item 17, Appendix E) prior to installation. (Use SAE No. 20 oil).
- (30) Repeat above for the commutator end plate bushing.
- (31) Repeat above for the drive housing bushing.
- (32) Inspect lever and lever housing. Ensure fork moves freely on its fulcrum pin. Be sure tabs on fork are not worn. Replace any components failing inspection.
- (33) Install new O-ring on lever housing, field frame end.
- (34) Install armature in lever housing. Install brake washer over protruding armature shaft.
- (35) Slide drive assembly onto armature shaft. Withdraw shaft until drive assembly locates on fork
- (36) Install and tighten lever housing retaining screws.
- (37) With brush assembly attached to end frame, pull armature out of the field frame just far enough to permit the brushes to be placed over the commutator.
- (38) Install new O-ring on end frame and install end frame over field frame.
- (39) Install and tighten end frame screws and lockwashers.
- (40) Install new gasket in lever housing and install nose housing onto lever housing. Be sure the housings are alined as noted during disassembly.



4-24 ELECTRICAL SYSTEM - Continued

4-24.2 Starting Motor - Continued

- (41) Slide solenoid into lever housing until mounting holes are aligned. Install and tighten solenoid retaining screws.
- (42) Install field terminal to MTR metal jumper and tighten connector nuts.
- (43) Remove plug from drive end of lever shaft.
- (44) Connect a battery to the G and S terminals of the solenoid. Flash a jumper between G and MTR terminal. This will activate the solenoid and hold motor in cranking position until battery is disconnected.
- (45) Press on drive assembly and measure end play between pinion and housing.
- (46) Adjust shaft nut (1) until clearance is 0.33 - 0.39 in. (8.3 - 9.9 mm).
- (47) Remove battery and connect frame to solenoid (G) ground wire.
- (48) Replace lever shaft plug and brush inspection plugs.
- (49) Install motor in truck as detailed in INSTALLATION preceding.



4-422

4-24. ELECTRICAL SYSTEM - Continued**4-24.3 Wiring Harness**

This task covers	a	Test
	b	Replacement
	c	Repair

TOOLS

Shop Equipment, General Purpose Repair,
FSN 4940-287-4894

EQUIPMENT CONDITION

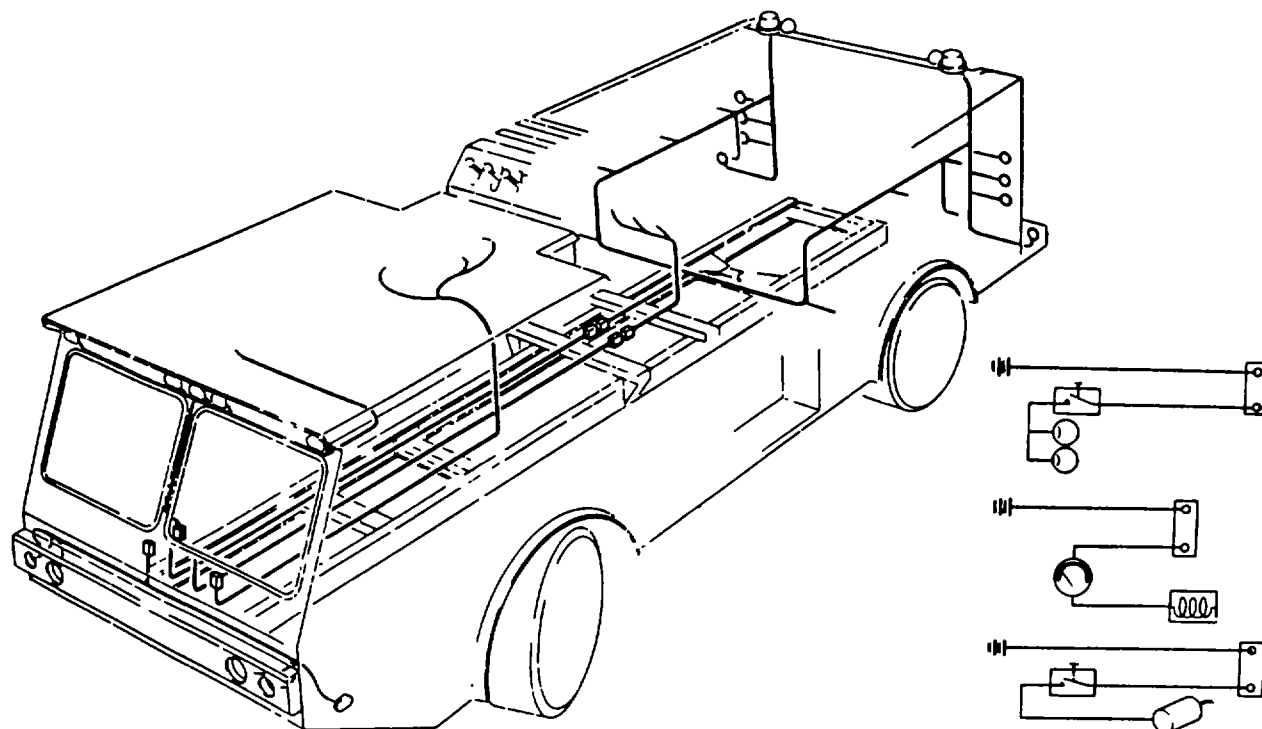
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

NOTE

A full electrical schematic is included in FO-1. This should be used to aid troubleshooting test and repair.

TEST

(1) If a circuit or number of circuits fail. ie lamp(s) does not work, first test the lamp or gage or sender unit as detailed in the relevant section of 4-24.



- (2) All circuits have a schematic diagram similar to the one shown.
- (3) All circuits have unique wire numbers. The wire number between the terminals of hardware (e. g. switch, lamp) is identical even if the wire feeds 10 lamps in parallel or passes through a junction box or terminal strip. This allows easier testing of wires. If one end is at 12 Vdc. then all terminals with that same wire number should be at 12 Vdc.

4-24. ELECTRICAL SYSTEM - Continued

- (4) To test the wire, either use an ohmmeter connected between the two ends of the wire or connect one end to a known 12 Vdc source and test the other end with a voltmeter.
- (5) If one wire is not conducting in a harness. lay a new wire the same size as the one that has failed, alongside the harness. Follow the same route as the harness. Tape the new wire to the harness at least every 12 in. (30 cm).
- (6) Remove the number sleeves from the end of the old wire and insert on new wire, or number new wire with new sleeves.
- (7) Attach the same terminals to the new wire as are on the old wire.
- (8) Connect new wire to the terminals and check circuit functions correctly.
- (9) Cut failed wire ends out of harness so the wire cannot be reused.

REPLACEMENT

- (1) If harness has suffered severe damage due to road obstruction or other such accidents and more than 4 or 5 wires are cut through, the whole harness should be replaced.
- (2) Refer to illustration for harness routes and location of plug and sockets.
- (3) Tag and disconnect all terminals from which harness is removed to aid replacement; all new harnesses are numbered the same as the old one and should be connected identically.
- (4) Be sure that when new harness is installed, all holes through bulkheads are protected with suitable rubber grommets.
- (5) Be sure harness is installed with similar supports as old harness.
- (6) Be sure that no part of the harness is closer than 1 in. to moving or hot surfaces.

REPAIR

a. Harness Repair

- (1) Badly damaged harnesses should not be repaired except in emergencies. Use butt connectors to join cut wire ends together
- (2) A harness must be replaced if more than 5 wires are cut through.

4-24. ELECTRICAL SYSTEM - Continued**4-24.3 Wiring Harness - Continued**

b. Wire Repair

NOTE

If only a single wire has failed, replace that wire as detailed in test preceding.

c. Terminal Repair

- (1) All harness terminals are of the crimp type. If one or more has broken off, replace with an identical connector.
- (2) Always use correct crimping tool when installing crimp connectors. No wires should be soldered for any reason as this can lead to premature failure of the connection since all flexibility is taken out of the wire at the point of solder.

4-24. ELECTRICAL SYSTEM - Continued**4-24.4 Instrument Control Panel Instruments.**

This task covers Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

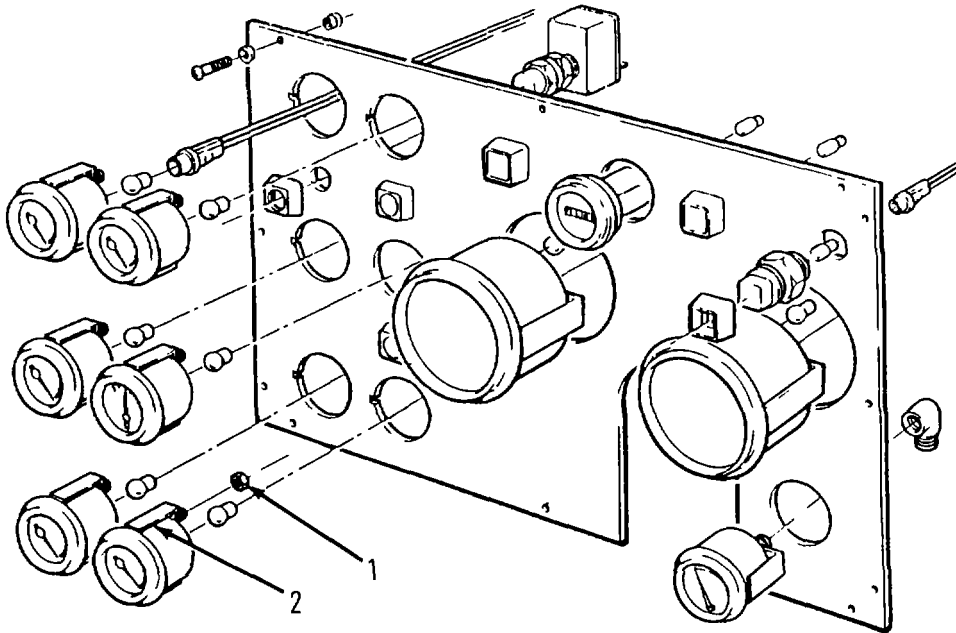
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

530C0/46668 Tachometer
512S2-47510 Speedometer
Model Z-30 Air Filter Gage
15002-3 Hourmeter
82707 Trans Temperature Gage
82712 Fuel Level Gage
284AD Ammeter
82709 Voltmeter
82705 Engine Oil Pressure Gage
82702 Engine Water Temp Gage
82710 Air Pressure Gage
AM-2 Water Tank Level Monitor
A4-2 Foam Tank Level Monitor
J726.4P Pump Discharge Pressure Gage

NOTE

Some cab instruments are similar to each other. Similar instruments are grouped together in the following instruction to simplify the manual.



4-24 ELECTRICAL SYSTEM - Continued

REPLACEMENT

a. Dash Panel Gages Replacement

NOTE

This instruction is used to replace the following meters, fuel level, transmission oil temperature, voltmeter, ammeter, engine water temperature, engine oil pressure, engine hourmeter, air filter monitor, tachometer, and speedometer.

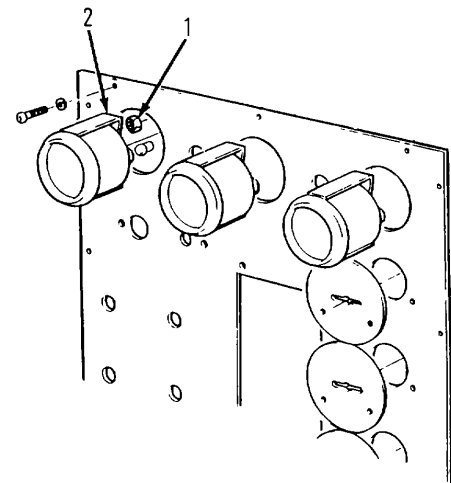
- (1) Remove steering wheel as detailed in para. 4-25.1. Remove 12 machine screws retaining dash panel to instrument panel frame.
- (2) Lift dash panel.
- (3) Tag and remove wires from the failed gage (For air filter gage, remove air line). Loosen turn signal switch on steering column if required.
- (4) Remove nuts (1) and clamp (2) and lift gage from panel.
- (5) Install new gage in panel. Ensure bezel fits snugly against plate.
- (6) Install new nuts (1) and clamp (2). Tighten nuts.
- (7) Connect wires to gage as tagged (For air filter gage, install air line).
- (8) Aline dash panel on instrument panel frame and install 12 machine screws.
- (9) Install steering wheel as detailed in para. 4-25.1.
- (10) Connect batteries and start main engine. Check function of new gage.

b. Cab Air Panel Gages Replacement.

NOTE

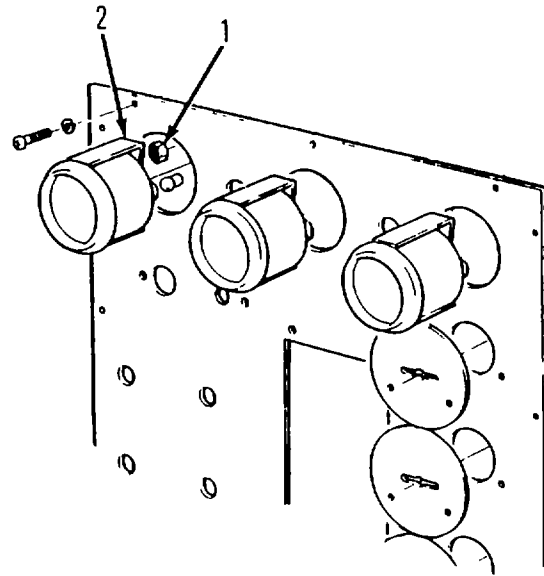
This instruction is used to replace the primary, secondary, and emergency air gages

- (1) Drain all air tanks via draincocks before proceeding.
- (2) Remove 12 machine screws retaining air panel to instrument panel frame.
- (3) Lift up air panel.
- (4) Tag and disconnect air hose from failed gage.
- (5) Remove nuts (1) and clamp (2) and lift gage from panel.



4-24. ELECTRICAL SYSTEM - Continued**4-24.4 Instrument Control Panel Instruments - Continued.****b. Cab Air Panel Gages Replacement - Continued**

- (6) Remove fittings from gage.
- (7) Install fitting on new gage. Coat pipe threads with pipe sealant (item 22, Appendix B) prior to installation.
- (8) Install new gage in panel. Ensure bezel fits snugly against plate.
- (9) Install new nuts (1) and clamp (2). Tighten nuts.
- (10) Connect air line to gage as tagged.
- (11) Align dash panel on instrument panel frame and install 12 machine screws.

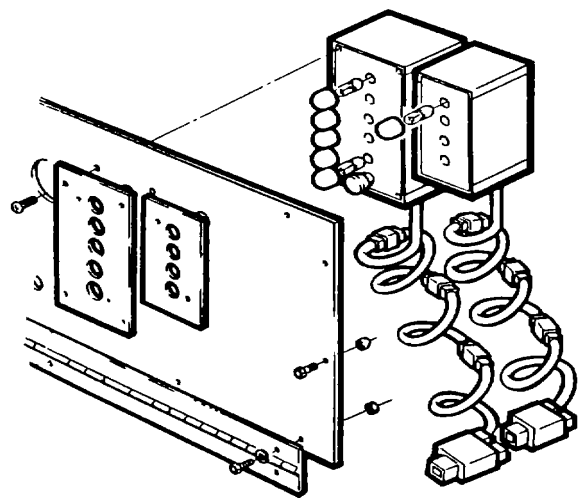


- (12) Connect batteries and start main engine. Check pressure gages for correct readings as air system is charged. When fully charged, all gages should indicate 105 - 110 psi (720 - 760 kPa).

c. Cab Fold-down Panel Gages Replacement**NOTE**

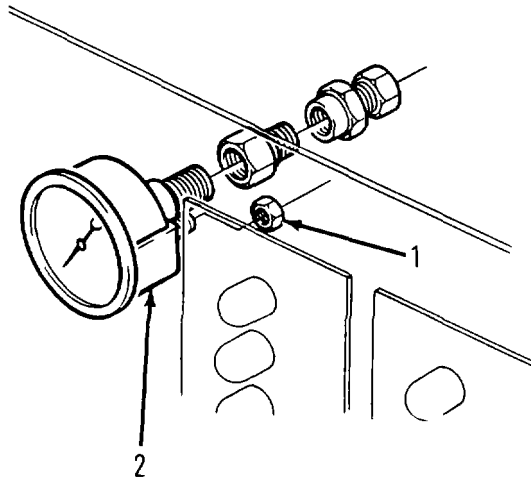
This instruction details replacement of the level monitors and pressure gages on the cab fold-down panel.

- (1) Remove 10 machine screws from top and sides of fold-down panel and pull panel upwards from top.
- (2) To replace either level monitor, tag and remove wires from monitor and remove 2 screws from bezel plate.
- (3) Lift off bezel and remove monitor.
- (4) Align new monitor and bezel plate with holes on panel. Install 2 screws to attach level monitor to panel.
- (5) Connect wires to monitor as tagged in step 2 preceding. For test, see step 13 following.
- (6) To replace pump discharge pressure gage, tag and disconnect water line from back of gage.



4-24 ELECTRICAL SYSTEM - Continued

- (7) Remove nuts (1) and clamp (2) and lift gage from panel.
- (8) Remove fitting from gage.
- (9) Install fitting on new gage. Coat threads with pipe sealant (item 22, Appendix B) prior to installation.
- (10) Install new gage in panel. Ensure bezel fits snugly against plate.
- (11) Install new nuts (1) and clamp (2). Tighten nuts.
- (12) Connect water line to gage as tagged.
- (13) Fold back instrument panel and retain with 12 machine screws.
- (14) Start main engine and fire pump as detailed in. Chapter 2 (CFR or structural mode).
- (15) Check pressure gage or level monitor function correctly.



4-429

4-24. ELECTRICAL SYSTEM - Continued**4-24.5 Instrument Control Panel Lights.**

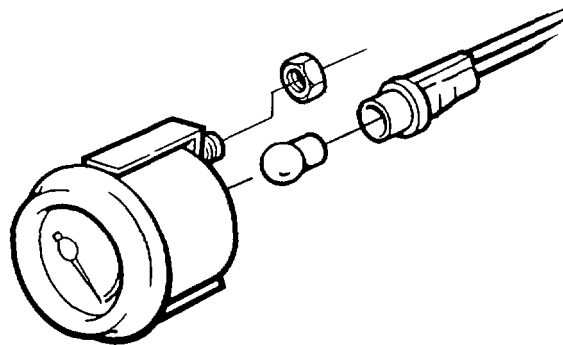
This task covers Replacement

TOOLSTool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033**EQUIPMENT CONDITION**Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)**MATERIALS/PARTS**#1816 Bulb
#1893 Bulb
DWG 114-FF Lens Hi Beam
DWG 114-BE Lens Indicator
G 3-1/2 Bulb
AA23 Lens Level Monitor Green
AA31 Lens Level Monitor Red
AA32 Lens Level Monitor Amber
#1889 Bulb
#255 Bulb Flashing**NOTE**

Some cab instrument control panel lights are similar. Similar lights are grouped together in the following instructions to simplify the manual.

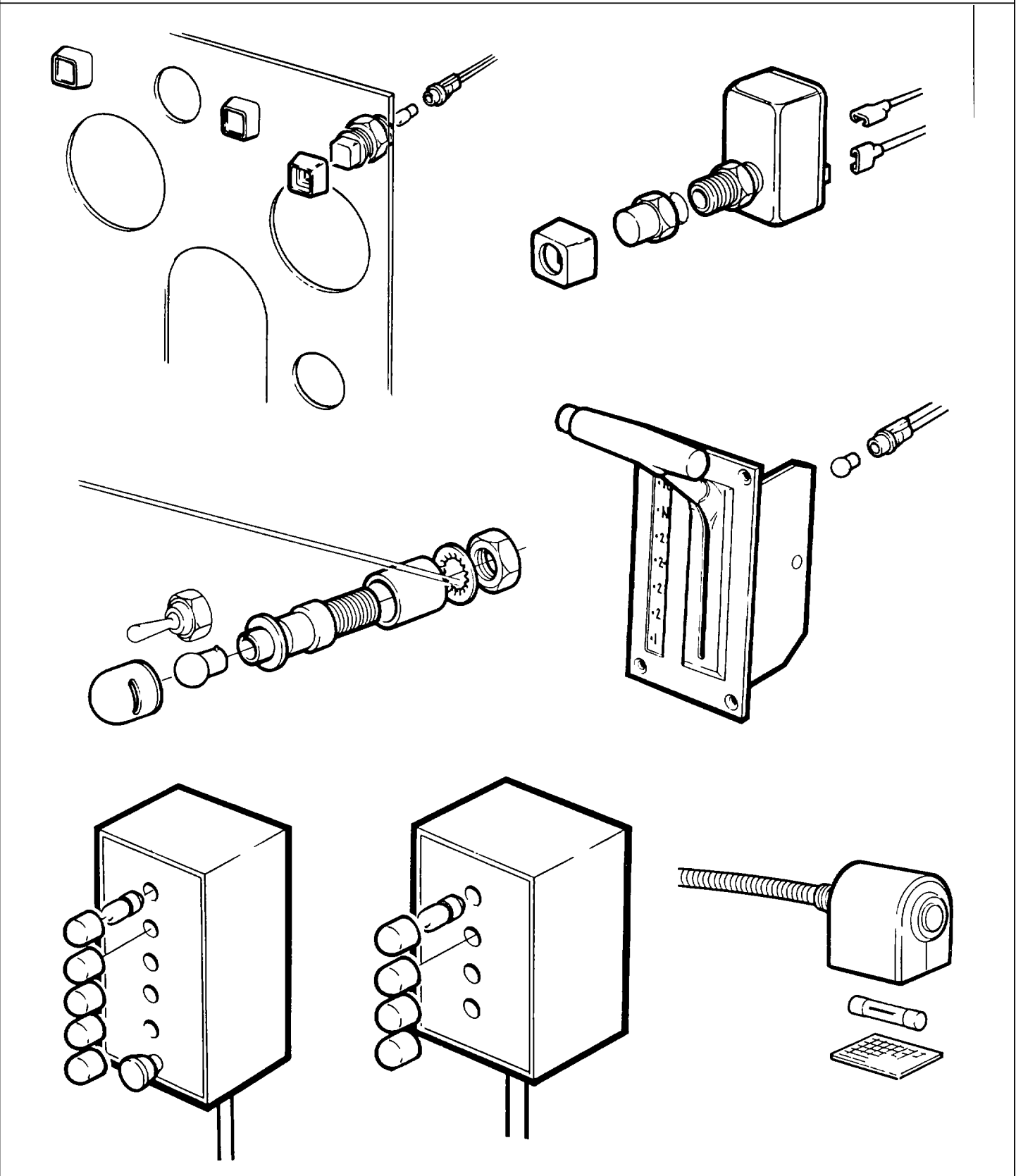
REPLACEMENT

- (1) If the bulb that has failed is a gage backlight, refer to para. 4-24.4 to gain access to the back of the gage. Replace bulb as shown in the illustration
- (2) For all other bulbs used on instrument panel, replace lights as shown in following illustrations



4-430

4-24 ELECTRICAL SYSTEM - Continued



4-24 ELECTRICAL SYSTEM - Continued**4-24.6 Instrument Control Panel Switches.**

This task covers Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

7769 Dimmer Switch
551840 Switch SPST
551842 Switch SPDT
551846 Switch DPDT
68362 Panel Lamp Switch
2484-16 Ignition Switch
90030 Start Pushbutton
229635TW-N Air Switch, Air Panel
41T-D3 Air Switch, Fold-down panel
8201K6 Pump Switch
8499K1 Pump Switch Guard
7124 Headlight Switch

NOTE

All cab switches are similar. Similar switches are grouped together in the following instructions to simplify the manual.

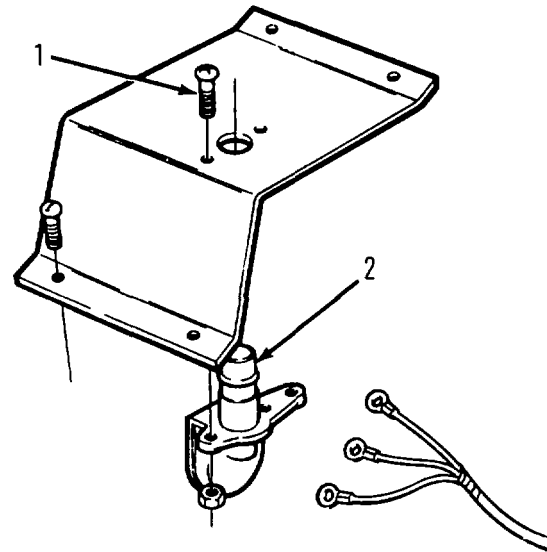
REPLACEMENT

- a. Dimmer Switch Replacement
 - (1) Remove screws (1).
 - (2) Tag and remove wires 62, 63, and 64.
 - (3) Remove switch (2) and discard.
 - (4) Connect wires as marked to new switch.
 - (5) Install switch in plate, align mounting holes. Tighten screws (1) firmly.
- b. Air Switch (Air Panel) Replacement.

NOTE

These switches are used to operate the 4-Wheel Drive, Differential Lock, and Fan.

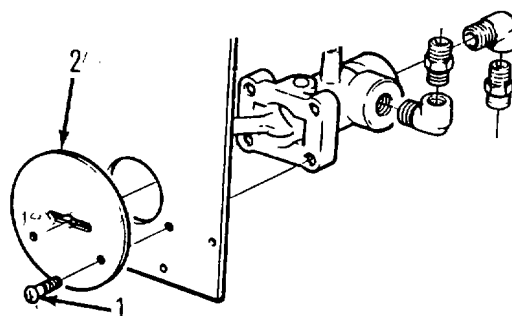
- (1) Drain all four truck air tanks.
- (2) Remove air panel as detailed in para. 4-24.4 paragraph b.
- (3) Tag and disconnect both air lines from valve.



4-24. ELECTRICAL SYSTEM - Continued

- (4) Remove screws (1) and face plate (2).
- (5) Lift switch from back of panel.
- (6) Install fittings in switch. Coat thread with pipe sealant, (item 22, Appendix E) prior to installation.
- (7) Install switch in panel. Retain with screws (1) and face plate (2).
- (8) Install air lines as tagged in step 2 preceding.
- (9) Install air panel on instrument panel frame.

c. Toggle Switch (Fold-Down Panel) Replacement

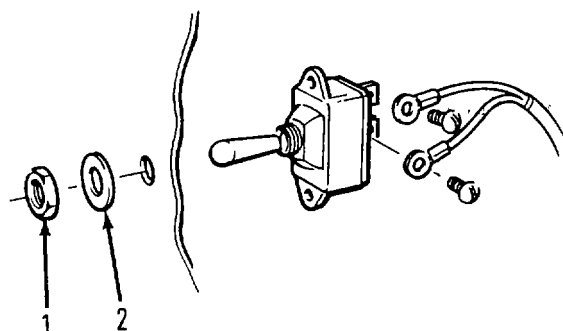


NOTE

These switches are Single-Pole-Single-Throw (SPST), Single-Pole-Double-Throw (SDT) or Double-Pole-Double-Throw (DPDT). They are installed similarly. These switches are used to operate all the truck lights (except panel lamp), the heated mirrors, the heater and defroster fans and the fire pump.

The fire pump switch 8201K6 has a guard (8499K1) over the top to prevent inadvertent operation. The guard and switch are mounted using two screws rather than the toggle nut outlined in the following. Otherwise replacement is the same as detailed following. The headlamp switch is a push-pull. Remove knob prior to remove, otherwise replacement is the same as detailed following.

- (1) Hinge up the fold-down panel as detailed in para. 4-24.4 paragraph c.
- (2) Tag and disconnect wires from failed switch.
- (3) Unscrew nut (1) from front face of panel. Remove nut (1) and lockwasher (2).
- (4) Pull switch from rear of panel and discard.
- (5) Install new switch in panel hole. Be sure terminal mounted in middle of switch block has screw head pointing to the right. Check pump switch has open contacts when switch is pointing upwards).
- (6) Install washer (2) and nut (1). Tighten firmly.
- (7) Reconnect wires as tagged in step 2 preceding.
- (8) Fold back panel and install retaining screws.

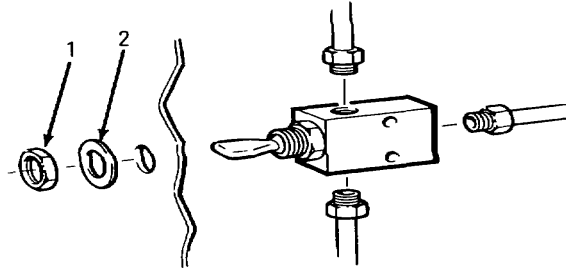


4-24. ELECTRICAL SYSTEM - Continued**4-24.6 Instrument Control Panel Seitches - Continued**

d. Air Switches (Fold-Down Panel) Replacement

NOTE

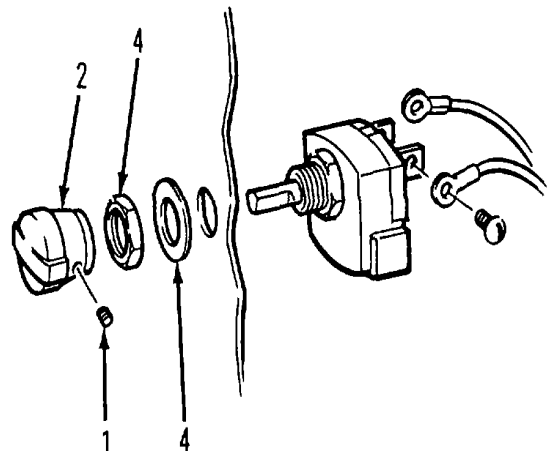
These small air switches are used to set the truck mode and to operate the tank valve, CFR governor, water educator, and foam valve.



- (1) Drain all four truck air tanks.
- (2) Hinge up the fold-down panel as detailed in para. 4-24.4 paragraph c.
- (3) Tag and disconnect the air line from all three ports on the valve.
- (4) Unscrew nut (1) from front face of panel. Remove nut (1) and lockwasher (2).
- (5) Pull switch from rear of panel.
- (6) Remove fittings from valve ports and discard switch.
- (7) Install fittings in new air switch. Coat threads with pipe sealant (item 22, Appendix E) prior to installation.
- (8) Install new switch in panel hole. Orientation of switch does not matter provided toggle operates up and down.
- (9) Install washer (2) and nut (1). Tighten firmly.
- (10) Reconnect air lines as tagged in step 3 preceding.
- (11) Fold back panel and install retaining screws.

e. Panel Lam Switch Replacement

- (1) Hinge up the fold-down panel as detailed
In para. 4-24.4 paragraph c.
- (2) Tag and disconnect wires from failed switch.
- (3) Loosen screw (1) and pull knob (2) off switch.
- (4) Remove nut (3) and washer (4).
- (5) Pull switch from rear of panel and discard.
- (6) Install new switch in panel hole. Be sure it is
in same rotation as removed switch.



4-24. ELECTRICAL SYSTEM - Continued

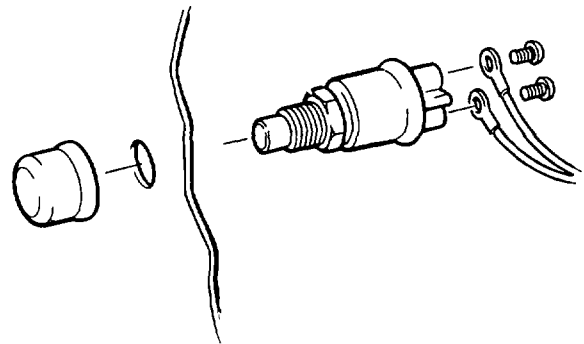
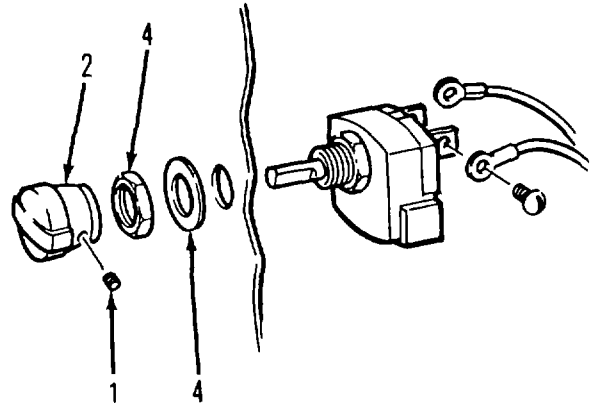
- (7) Install washer (4) and nut (3). Tighten securely.
- (8) Install new knob (2) and tighten screw (1) securely.
- (9) Reconnect wires as noted in step 2 preceding.
- (10) Fold back panel and install retaining screws.

f. Ignition Switch Replacement.

- (1) This switch is similar to panel lamp switch in construction except activating knob is secured with an axial screw.
- (2) To replace, carry out procedures detailed in e preceding

g. Start Push button Replacement.

- (1) Hinge up the fold-down panel as detailed in para. 4-24.4 paragraph c.
- (2) Tag and disconnect wires from the failed switch.
- (3) From back of panel, loosen clamping nut (3).
- (4) Unscrew pushbutton (1) from front of panel. Remove and discard the switch.
- (5) Install new switch through hole in panel. Screw on the pushbutton (1).
- (6) Tighten clamping nut (3) securely.
- (7) Reconnect wires as tagged in step 2 preceding.



4-24 ELECTRICAL SYSTEM - Continued**4-24 7 Instrument Control Panel Flashers and Relays.**

This task covers Replacement

TOOLSTool Kit, General Mechanic, Automotive,
NSN 5780-00-1777-7033**EQUIPMENT CONDITION**

Main Engine Shutdown (see para. 2-10)

APU Shutdown (see para. 2-12)

Batteries Disconnected (see para. 4-24)

Fold-Down Panel Lifted Up (see para. 4-24.4)

MATERIALS/PARTS

1115834 Relay

115858 Relay

1114534 Magnetic Switch

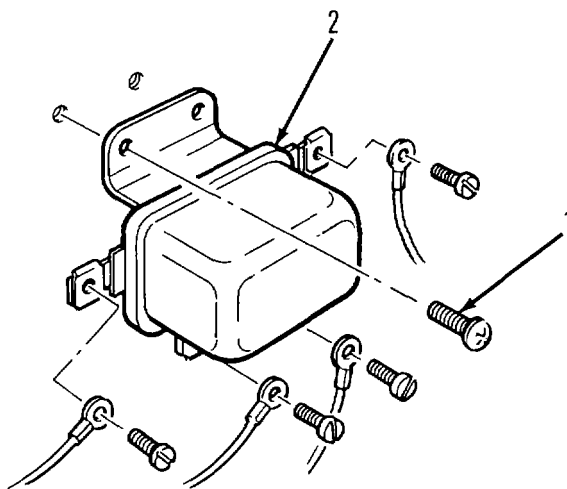
1039-06823-01 Flasher

NOTE

All flashers and relays are mounted similarly and are located behind the fold down panel of the instrument panel.

REPLACEMENT

- (1) Tag and disconnect wires from unit that has failed.
- (2) Remove mounting screw (1).
- (3) Lift out flasher/relay (2) and discard.
- (4) Install new flasher/relay in panel using screws (1). Tighten securely.
- (5) Reconnect wires as noted in step 1. preceding.
- (6) Replace fold-down panel.



4-436/(4-437 Blank)

4-24 ELECTRICAL SYSTEM - Continued

4-24.8 Truck Lights.

This task covers a. Replacement
 b. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

MATERIALS/PARTS

W1893 Bulb, Clearance Lamp
94092-3 Clearance Lamp Lens, Yellow
94093-3 Clearance Lamp Lens, Red
46643 Clearance Lamp, Yellow
46642 Clearance Lamp, Red
AG+7039 Rear Deck Light
GE4435 Sealed Beam Rear Deck Light
61031-3 Dome Lamp

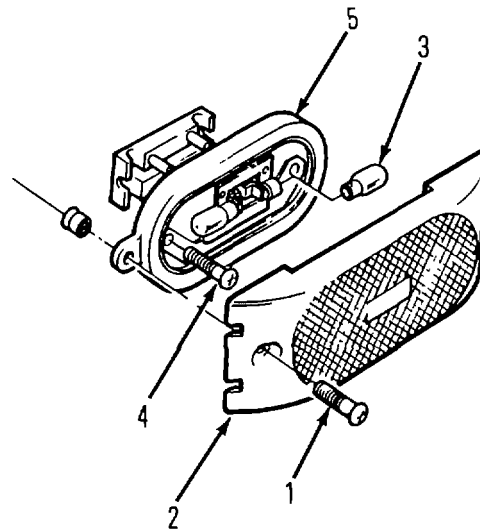
90401 Lens, Dome Lamp
S93 Bulb, Dome Lamp
60121-3 Licence Lamp
19-2005-01 Lens, Licence Lamp
B-67 Bulb, Licence Lamp
52773 Indicating Lamp
62171 Reversing Lamp
52770 Brake Lamp
60191 Compartment Lamp
45821 Lamp Hood
77122 Emergency Lamp, Front
44661 Flashtube
92042 Lens, Red
77102 Emergency Lamp Rear
92032 Lens, Red
103540 Oscillating Light
H1600 Oscillating Light, Bulb

NOTE

For replacement of mirror marker lights and front spotlight, see para. 4-12. For replacement of headlights, see para. 4-24.9.

REPLACEMENT

- a. Clearance Lamp Replacement
 - (1) For bulb or lens replacement, remove screws (1) and lens (2).
 - (2) Replace bulbs in holders or replace lens as required. Install lens (2) using screws (1). Tighten securely.
 - (3) For lamp replacement, remove screws (1), lens (2), screws (4) and backing plate (5).
 - (4) Install new backing plate over the no-splice wire holder, ensuring backing plate spikes break the wire insulation in the same position as previous plate.
 - (5) Secure backing plate (5) with screws (4).



4-24. ELECTRICAL SYSTEM - Continued

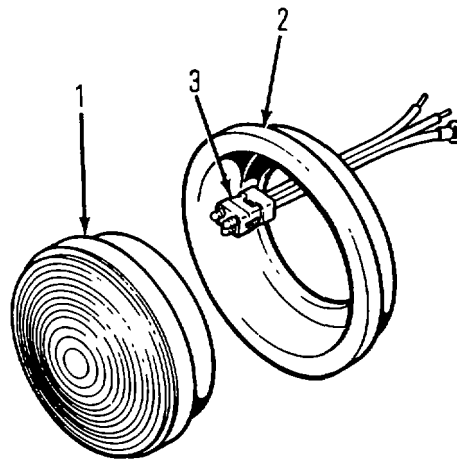
- (6) Install bulbs (3).
- (7) Install lens using screws (1), tighten securely.

b. Signal, Brake, and Reversing Lamp Replacement

NOTE

No bulbs are installed in these lamps, they are "sealed beam" type units.

- (1) To replace front signal lamp, remove front bumper, see para. 4-10.1
- (2) To remove rear signal, brake, or reversing lamp, remove lamp protection plate from inside of hose body compartment.
- (3) Unplug pigtail (3) from lamp being replaced.

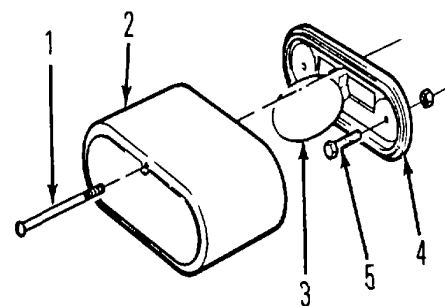


- (4) Using a screwdriver under the lip of the rubber grommet (2), ease the grommet and lamp out of the panel.
- (5) Replace lamp (1) in rubber grommet (2).
- (6) Push lamp and grommet into body work. A light smear of petroleum jelly (item 21, Appendix E) on the rubber will ease installation.

- (7) Install plug in rear of lamp. Check lamp operates.
- (8) Replace front bumper or lamp protection plate as required.

c. Licence Lamp Replacement.

- (1) For bulb or lens replacement, remove screw (1) and lens (2).
- (2) Replace bulb in holder, or replace lens as required.
- (3) Install lens (2) using screw (1), tighten securely.
- (4) For lamp replacement, unplug pigtail from wiring harness (in hose body compartment).
- (5) Remove screw (1) and lens (2).
- (6) Remove screw (4) and backing plate (5). Carefully withdraw wire connection through hole in body.

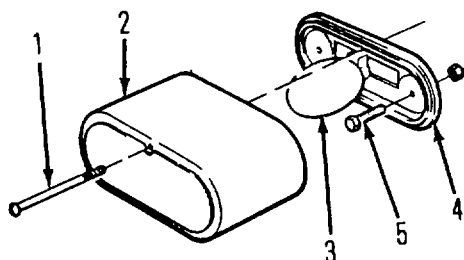


4-24. ELECTRICAL SYSTEM - Continued

4-24.8 Truck Lights - Continued

c. Licence Lamp Replacement - Continued

- (7) Install new lamp wire through body panel and connect to harness. Aline mounting holes and install backing plate using screws (5).
- (8) Install new bulb (3).
- (9) Install lens (2) and retain with screw (1).
- (10) Check lamp operates.

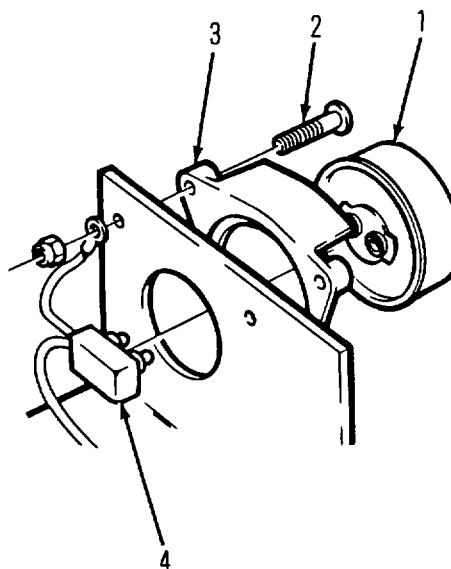


d. Engine and Hose Body Compartment Lamp Replacement.

NOTE

No. bulbs are installed in these lamps, they are "sealed beam" type unit.

- (1) For lamp hood replacement, twist lamp while pushing in. Pull out lamp, unplug pigtail, and replace lamp.
- (2) For lamp base replacement remove screws (2) and lift lamp base from support.
- (3) Unplug pigtail (4).
- (4) Remove lamp from new base. Secure base to support using screws (2). Do not overtighten. Be sure to attach pigtail ground wire to one of the mounting screws.
- (5) Plug pigtail into new lamp and install lamp in base with a twist.



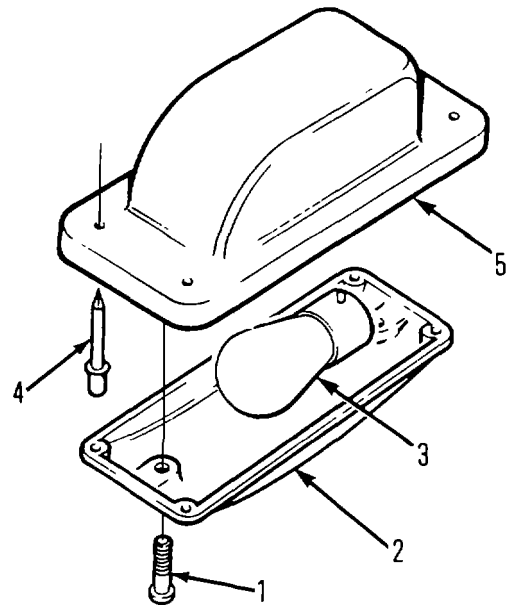
4-24 ELECTRICAL SYSTEM - Continued

e. Dome Lamp Replacement

NOTE

Six dome lamps are installed in truck, one above each seat and one in each enclosed cab footwell.

- (1) To replace lens or bulb, remove screws (1).
- (2) Remove lens (2) and bulb (3) and replace as required.
- (3) Install lens with screws (1). Do not overtighten.
- (4) To remove base (5), remove fasteners (4) and carefully pull lamp from mount.
- (5) Cut wire at butt connector.
- (6) Install new lamp wire to harness with new butt connector.
- (7) Install lamp base using fasteners (4).
- (8) Replace bulb and lamp as detailed in steps 2 and 3.

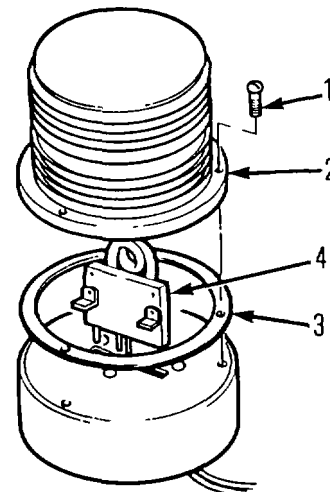


f. Front Emergency Lamp Replacement.

NOTE

The flashtube and lens may be replaced.

- (1) Remove screws (1) and lift off lens (2). Take care not to damage gasket (3).
- (2) Pull out flashtube (4).
- (3) Replace flashtube and/or lens as required. Install lens (2) with screws (1).



4-24. ELECTRICAL SYSTEM - Continued

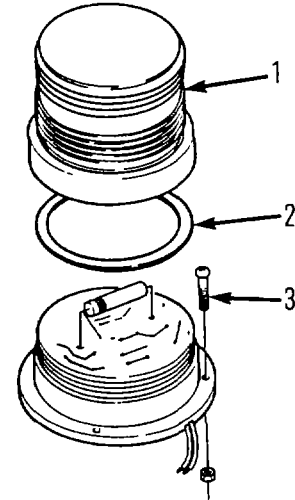
4-24.8 Truck Lights - Continued

g. Rear Emergency Lamp Replacement

NOTE

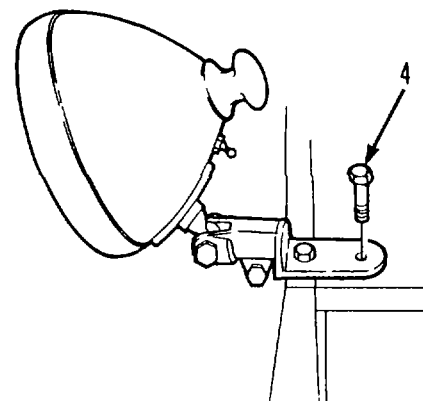
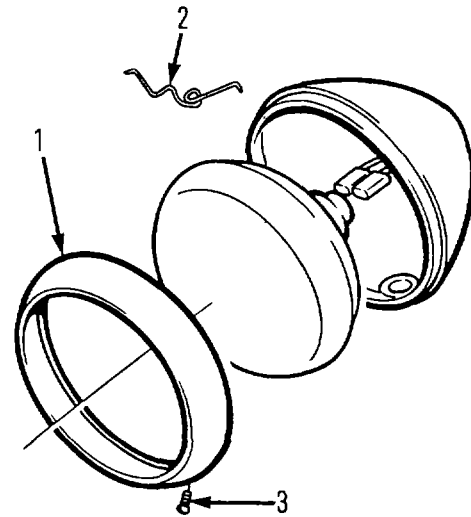
Only the lens is replaceable.

- (1) To remove lens (1), unscrew lens. Replace with new gasket (2).
- (2) To replace lamp, remove screws (3).
- (3) Lift lamp from base and cut wires at butt connector.
- (4) Join new lamp wires to harness with butt connector.
- (5) Install new lamp using screws (3). Do not overtighten.



h. Rear Deck Lights Replacement

- (1) To replace sealed beam, remove ring mounting screw (3).
- (2) Pull ring (1) forward, sealed beam is held in ring with springs (2).
- (3) Pull wire connectors from back of sealed beam.
- (4) Remove springs (2) and replace lamp.
- (5) Install springs (2) to secure lamp to ring (1).
- (6) Offer up ring assembly to lamphead. Install connectors on to terminals of lamp.
- (7) Push ring into lamphead, ensure lower lip on ring aligns with lamphead indent.
- (8) Secure ring with screw (3).
- (9) To replace rear deck light, remove screws (4) securing lamp to hose body.
- (10) Cut wire to lamp adjacent to butt connector. Cut butt converter from harness.



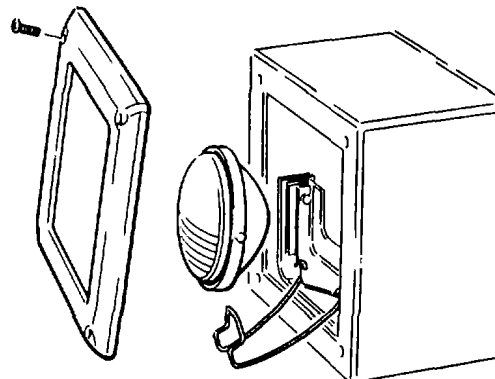
4-24. ELECTRICAL SYSTEM - Continued

(11) Attach wire of new lamp to new butt connector
Install screws (4) to install new lamp.

(12) Crimp butt connector onto wire harness.

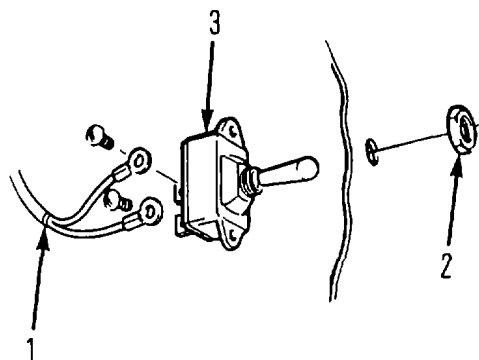
i Oscillating Lamp Replacement.

- (1) To replace sealed beam, remove lens mounting screws (1) and lift off lens.
- (2) Pull bulb retaining spring forward from the top while holding sealed beam.
- (3) Remove sealed beam from housing and unscrew positive and negative terminals.
- (4) Replace bulb, connect positive and negative leads and clamp bulb in position with spring.
- (5) Install lens and tighten screws (1) securely.
- (6) To replace oscillating lamp assembly, the lamp base retaining rivets have to be drilled out. Refer to Direct Support Level for installation of rivets.

**REPAIR**

Rear Deck Light Switch Repair.

- (1) To replace switch, remove sealed beam as detailed in Rear Deck Light Replacement preceding.
- (2) Tag and disconnect wire (1) from switch.
- (3) Unscrew locking nut (2) from switch toggle and pull switch (3) out of housing.
- (4) Replace switch and secure with locking nut.
- (5) Attach wires to switch as tagged in step 2.
- (6) Install sealed beam as detailed in Rear Deck Light Replacement preceding.



4-24. ELECTRICAL SYSTEM - Continued**4-24.9 Headlight****This task covers**

- a. Replacement
- b. Alinement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

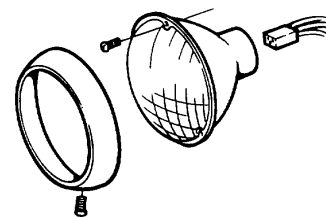
920-3347 Headlamp
H 6014(2D1) Sealed Beam

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Front Bumper Removed (see para. 4-10.1)

REPLACEMENT

- a Sealed Beam Replacement.
 - (1) Remove screw from bottom of bezel.
 - (2) Pull up on bezel and remove.
 - (3) Remove three small screws that mount sealed beam to lamp adjusting plate. Do not disturb headlight adjuster screws.
 - (4) Pull out sealed beam and remove plug from back.
 - (5) Install plug on new sealed beam.
 - (6) Install new sealed beam in fixture. Be sure lettering on lamp lens is not upside down.
 - (7) Install three retaining screws and tighten firmly.
 - (8) Replace bezel ring and secure with small screw.
 - (9) Check headlamp illuminates.
 - (10) Replace front bumper, see para. 4-10.1.
- b Lamp Replacement.
 - (1) Remove sealed beam as detailed in a preceding.
 - (2) Remove eight screws securing lamp pot to cab.
 - (3) Pry lamp pot from cab. Scrape all sealing compound from cab panel.



4-24 ELECTRICAL SYSTEM - Continued

- (4) While holding pot, unscrew wires to lamp from terminal block. Note which color wire is attached to which terminal.
- (5) Attach wires of new lamp to terminal block as noted in step 4.
- (6) Apply a 1/8 in. (3 mm) bead of sealant (item 25, Appendix E) around the edge of the cab panel hole.
- (7) Offer up new lamp pot to cab and secure with eight screws. Tighten securely.

NOTE

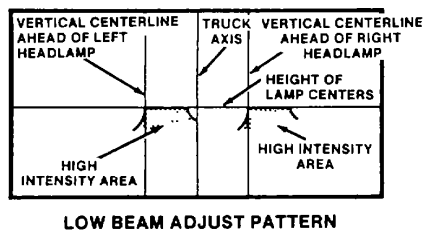
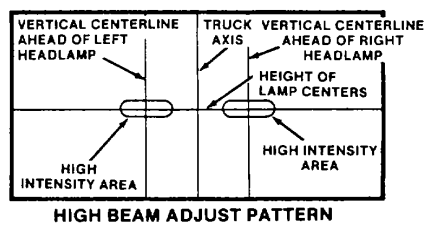
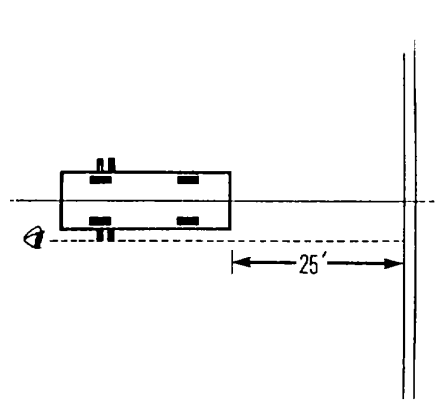
The lamp pot and its flange form part of the cab envelope. Be sure sealant is spread all round flange to prevent entry of water to cab (8). Install sealed beam as detailed in a. preceding. Before installing cab bumper align new lamp as detailed in ALINEMENT.

ALINEMENT

NOTE

Two people will be required to carry out this alinement. To ensure correct alinement front bumper should be removed, see para. 4-10.1.

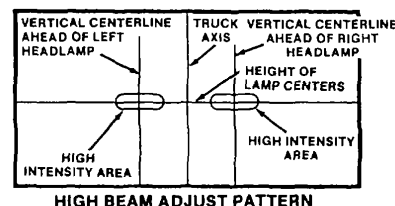
- (1) Park truck on a level floor 25 feet (7.6 m) away from a light colored vertical screen or wall.
- (2) Open both rear doors on the middle row of the hose body compartments.
- (3) Sight down both doors on one side of the truck and mark this point on the screen. Repeat for the other side of the truck.
- (4) Draw a vertical line on the screen at the midpoint between the two sight marks.
- (5) Measure the distance, center to center, between the two head lamps. Divide this distance by two and draw two vertical lines, at this distance from the vertical center line, one each side.
- (6) Measure the vertical height between the floor and the center line between the headlamps. Mark a horizontal line on the screen at this same height.



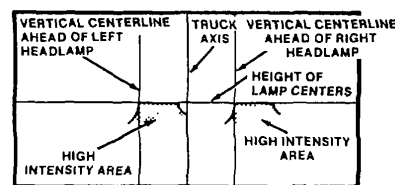
4-24. ELECTRICAL SYSTEM - Continued

4-24.9 Headlight - Continued

- (7) Switch on the headlamps on full beam. The shaded area as shown indicates the high intensity zone of the high beam.
- (8) Turn top adjusting screw on headlamp for vertical adjustment, side screw for horizontal adjustment.
- (9) Switch headlamps to low beam. The shaded area indicates the high intensity zone of the low beam.
- (10) Make further adjustments as required, but be aware any further adjustment will alter high beam pattern. Also low beam should never be above the height of the lamp centers and should always be to the right of the center line of the lamp.



HIGH BEAM ADJUST PATTERN



LOW BEAM ADJUST PATTERN

NOTE

If the truck is to be operated on the left hand side of the road, e.g. England, the low beam should be offset to the left of the lamp center line.

4-24. ELECTRICAL SYSTEM - Continued**4-24.10 Sending Units and Warning Switches.****This task covers**

- a. Test
- b. Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

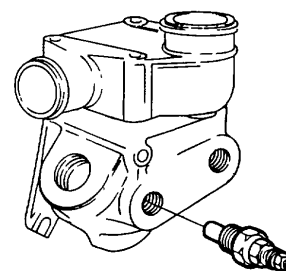
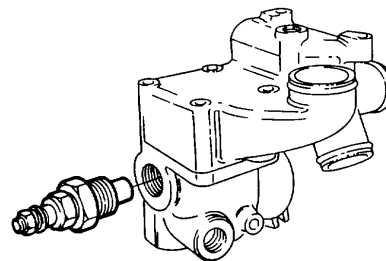
Main Engine Shutdown (see para. 2-10)
LHS and RHS Engine Covers Removed
(see para. 4-12.11)

MATERIALS/PARTS

279B Oil Pressure Sender
1042-33110-06 Oil Pressure Switch
334AD Water Temp Sender
1002-05511-34 Water Temp Switch
3345 Oil Temp Sender
1002-05511-52 Oil Temp Switch
2337439 Speedometer Drive Sleeve
SG201A/46253 Speedometer Generator
703386 Speedometer Drive Gear
SM305-47062 Tachometer Sensor

TEST

- a Engine Water Temperature Gage Test
 - (1) Run main engine and monitor temperatures on pump panel and cab dash panel gages. Each gage is supplied from different senders.
 - (2) If no temperature is recorded on one gage, ground the S terminal on gage. If gage does not register, replace gage.
 - (3) If gage registers, either sender or wire is at fault. For pump panel, wire number is 114. Wire runs from pump body through plug on frame into engine compartment. For cab, wire number is 46. Wire runs from gage through plug to fold-down panel terminal strip to engine compartment.
 - (4) Check wire for continuity. If good, replace sender (See illustration).
- b Engine Water Temperature Alarm Test.
 - (1) Alarm lamps in cab and on pump panel are energized by different senders.
 - (2) To test operation of alarm system, connect a jumper between terminal on relevant sender and brass nut of sender. (See illustration for sender location). Check relevant alarm sounds.

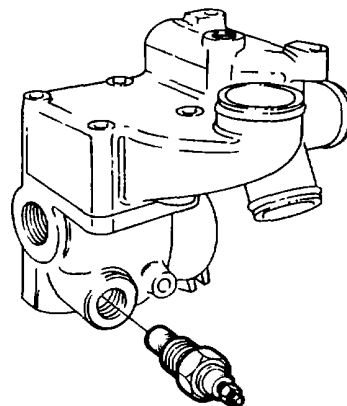


4-24. ELECTRICAL SYSTEM - Continued

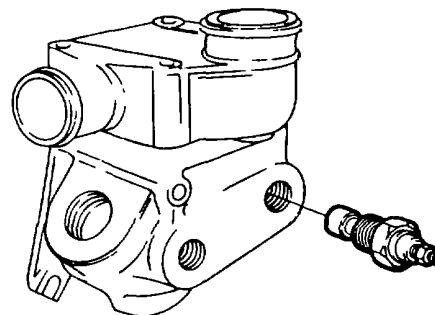
- (3) If no alarm, check wire for continuity. Wire number for pump panel is 115 and for cab is 47. Both wires run in same harness as gage circuits in a preceding (see step 3).
- (4) If wire is good, replace alarm lamp and retest as in 2 preceding.
- (5) To test sender, remove from engine and with continuity tester connected between terminal and body, immerse sender in boiling water. Sender contacts should close at 210 deg. F (98.9 deg. C).

c Engine Oil Pressure Gage Test

- (1) Run main engine and monitor oil pressure gages on pump panel and in cab. Each gage is supplied from a different sender.
- (2) If pressure is not recorded on any one gage, ground the S terminal on gage. If gage does not register, replace gage.
- (3) If gage registers, either sender or wire is at fault. Check wire for continuity. Wire number for pump panel is 112 and for cab is 41. Both wires run in same harness as gage circuits in a preceding, see step 3.
- (4) If wire is continuous, replace sender (see Illustration for sender location).

**d Engine Oil Pressure Alarm Test.**

- (1) Alarm lamps in cab and on pump panel are energized by the same sender.
- (2) To test operation of the alarm, turn ignition ON, but do not start engine. Check both alarms sound.
- (3) If no alarm, check wire for continuity. Wire number for pump panel is 113 and for cab is 42. Both wires run in same harness as gage circuits in a preceding (see step 3).
- (4) If wire is continuous, ground the wire from sender. If alarm does not sound, replace alarm lamp.
- (5) If alarm lamp sounds in step 4, sender is faulty. Replace sender (see Illustration for sender location).



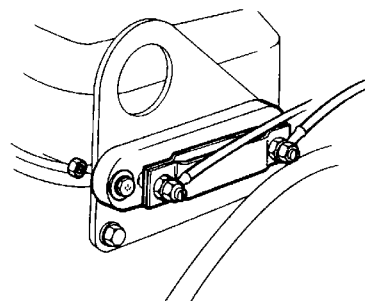
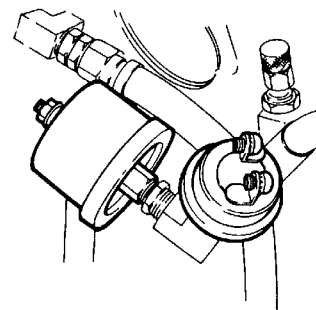
4.24. ELECTRICAL SYSTEM - Continued**4-24.10 Sending Units and Warning Switches - Continued**

- e. Engine Oil Pressure (Fuel Pump Shutdown) Test.

NOTE

This oil pressure switch will cause fuel priming pump to stop if no oil pressure is registered when engine is running.

- (1) Connect a voltmeter between priming pump relay terminal 35 and ground. The relay is the middle one of three relays installed behind cab fold-down panel. Voltmeter should read 12V.
- (2) Start main engine and check voltmeter reads at 0 volts.
- (3) Stop main engine and remove voltmeter.
- (4) If oil sender does not operate, replace oil sender.
- (5) If wire is broken replace wire 35 from sender to terminal 35 of the priming pump relay.
- (6) To check relay coil, connect voltmeter between terminal of relay and ground. Voltmeter will read 12 volt. When cab PRIME pushbutton is pressed, voltmeter should read 0 volts. Replace relay if no voltage is read.



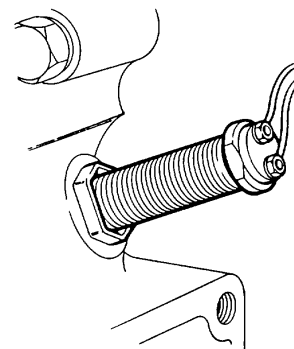
- f. Ammeter Shunt Test.

- (1) Connect a voltmeter across terminals of the ammeter. Shunt is mounted on the rear engine lifting bracket.
- (2) With engine ignition ON, crank main engine. Voltmeter should read approximately 1 volt.
- (3) Replace shunt if no reading is obtained.

4-24. ELECTRICAL SYSTEM - Continued

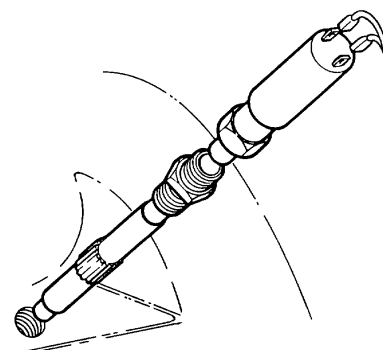
g Tachometer Test

- (1) Start main engine and monitor the engine tachometer in the cab and on the pump body. The engine should idle at 800 rpm. A single sensor on the engine drives both the cab and pump panel tachometers.
- (2) If neither meter is indicating, replace sensor unit and retest as in 1 preceding.
- (3) If only one tachometer has no reading, tag and remove wires from tachometer and sensor unit (see illustration for sensor location). Tachometer wires 48 and 49 run from cab meter through plug to terminal strip in cab fold-down panel to engine compartment. Tachometer wires from pump panel run from meter through plug to engine compartment.
- (4) If wires are continuous replace failed meter and retest as in 1 preceding



h Speedometer Test

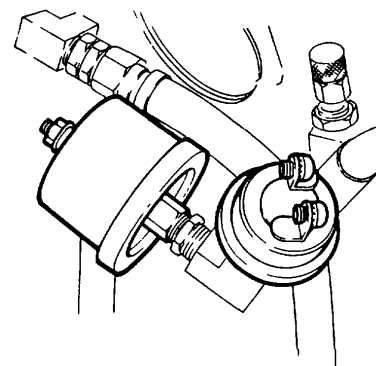
- (1) Start main engine and monitor the speedometer when vehicle is being driven. A single sensor on the transmission drives the cab speedometer.
- (2) If the speedometer registers no reading, tag and disconnect wires from the sensor and the meter
- (3) Test wires for continuity if these wires are continuous replace meter and test as in 1 preceding
- (4) If meter still does not register, replace the sensor unit.



4-24. ELECTRICAL SYSTEM - Continued**4-24.10 Sending Units and Warning Switches - Continued****REPLACEMENT**

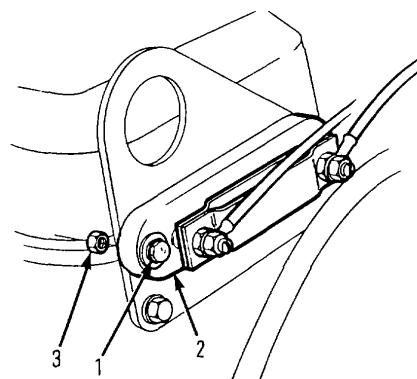
- a Engine Water Temperature, Gage and Alarm Sensor, Engine Transmission Oil Pressure, Gage and Alarm Sensor, Engine Oil Pressure (including fuel pump shutdown) sensors. All these sensors are similar. The general procedure outlined below should be used to replace any of these sensors.

- (1) Check APU is shutdown (see Chapter 2) and disconnect batteries as detailed in para. 4-24.12 prior to replacing any sender unit.
- (2) Tag and remove wires connected to the sensor terminals.
- (3) Using wrench, carefully remove sensor from engine or transmission block. If sensors are extremely tight, soak visible threads with penetrating oil (item 20, Appendix E) prior to removal.
- (4) Replace sensor and tighten securely. Do not overtighten. Do not seal with pipe sealant or other material.
- (5) Connect wires as noted in step 1. Test sensor as detailed in TEST preceding.



- b Ammeter Shunt Replacement.

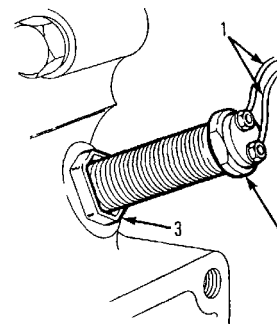
- (1) Disconnect batteries, see para. 4-24.12.
- (2) Tag and remove wires from both terminals of the shunt.
- (3) Removing mounting capscrews (1) and nuts (3) and discard shunt (2).
- (4) Attach new shunt using capscrews (1) and nuts (3).
- (5) Reconnect wires to both terminals of shunt as noted in step 2 preceding.
- (6) Test shunt as detailed in TEST preceding.



4-24. ELECTRICAL SYSTEM - Continued

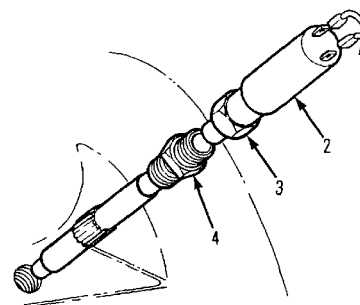
c. Tachometer Sensor Replacement.

- (1) Check APU is shutdown (see Chapter 2) and disconnect batteries as detailed in para. 4-24.12 prior to replacing any sender unit.
- (2) Tag and remove wires (1) from tachometer sensor.
- (3) Loosen locknut (3) and unscrew sensor (2) from flywheel housing.
- (4) Install new sensor in housing. Screw in until tip of sensor just touches the starter ring gear.
- (5) Back out 1 full turn and tighten locknut securely.
- (6) Reconnect wires to both terminals as noted in step 1 preceding.
- (7) Test tachometer as detailed in TEST preceding.



d. Speedometer Sensor Replacement.

- (1) Check APU is shutdown (see Chapter 2) and disconnect batteries as detailed in para. 4-24.12 prior to replacing Sensor.
- (2) Tag and remove wires (1) from speedometer sensor which is located in the rear housing of the transmission.
- (3) Loosen nut (3) and remove sender (2).
- (4) Check drive tang in transmission housing cannot be turned. If it does turn, the gear drive is faulty. Replace as in steps 8 thru 10.
- (5) Replace sender. Be sure drive tang from gear drive aligns with slot in sender.
- (6) Tighten nut (3) securely.
- (7) Replace wires (1). Drive truck and ensure speedometer indicates truck speed.
- (8) If there is still no signal remove sender again and remove sleeve (4).
- (9) Lift out gear drive and check for signs of damage Gear teeth may be stripped or lock between gear and shaft may have broken. Replace gear drive if any fault is evident.
- (10) If gear is missing or teeth are badly damaged, transmission may require overhaul. Refer to General Support Level.



4-24. ELECTRICAL SYSTEM - Continued**4-24.11 Electric Horn System.****This task covers**

- a. **Adjustment**
- b. **Replacement**
- c. **Repair**

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

MATERIALS/PARTS

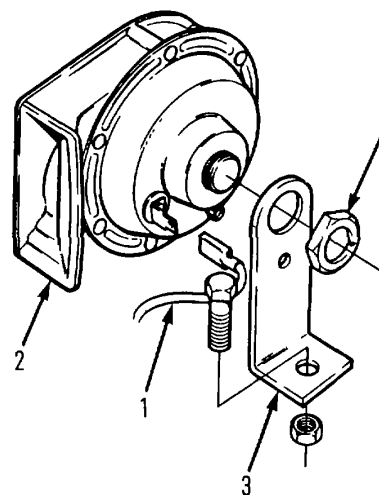
9000 130 Horn F Tone
9000 131 Horn A Tone
1965 698 Horn Nut
1967 209 Horn Bracket

PERSONNEL REQUIRED - 2**ADJUSTMENT**

- (1) Each horn has an adjusting screw mounted on the nut side of the horn. This screw may be adjusted to alter the tone of the horn.
- (2) Disconnect wire from other horn and adjust screw until desired tone is heard.
- (3) Reconnect other horn. Repeat step 2 for the second horn. One note should be high and the other low in pitch.
- (4) If a horn does not work at all, replace horn. Adjusting the tone screw will rarely result in a reliably working horn.

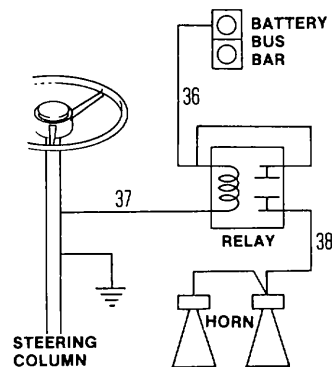
REPLACEMENT

- (1) Tag and disconnect wire (1) from horn.
- (2) Unscrew mounting nut (4) and remove horn (2) from truck.
- (3) Inspect mounting bracket. If severely corroded, replace.
- (4) Replace horn and mounting nut. Tighten nut securely.
- (5) Reconnect wire as noted in step 1.



4-24. ELECTRICAL SYSTEM - Continued**REPAIR**

- (1) If one or both horns fail to operate, remove wire from horn and connect a 12-volt bulb between ground and the wire.
- (2) Press horn button and check lamp lights. If lamp does not light, check continuity of wire 38 between horns and horn relay in cab fold-down instrument panel.
- (3) If relay does not operate, check wire 36 on relay terminals 3 and 4 is at 12 volts. Check continuity of wire 37 between relay and steering column.
- (4) If all wires and voltages are satisfactory, fault is either at horn button, in horns or is the relay. For horn button replacement, see para. 4-25.1. For horn replacement, refer to REPLACEMENT preceding. For relay replacement, see para. 4-24.7.



4-24. ELECTRICAL SYSTEM - Continued**4-24.12 Battery.****This task covers**

- a. Test
- b. Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0650

MATERIALS/PARTS

1980514 Battery

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)

NOTE

Truck batteries are of the no-maintenance type. Do not attempt to add water to the battery cells.

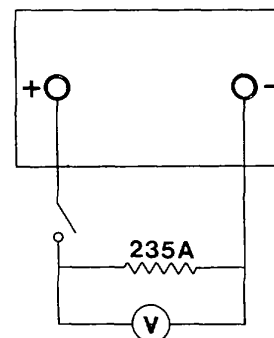
TEST

- (1) Be sure battery is fully charged, cell Indicator should be green. If cell indicator is a light or yellow color, electrolyte level is low and battery should be replaced. If indicator is dark, battery needs charging.
- (2) If battery needs charging connect 12 volt, 10 amp source to plugs in rear hose body and charge for at least 24 hours.

CAUTION

Using an alligator clamp to connect loads to battery will damage battery terminals. Connect leads to battery with bolted cable ends and use switch to connect/disconnect loads.

- (3) Connect a 290 amp load across the battery terminals for 15 seconds to remove surface charge (This is equivalent to a 0.041 ohm, 4 kw rated resistor or carbon pile).
- (4) Wait 15 seconds after above test. Then connect a voltmeter across the battery terminals. Switch the 290 amp load across the battery terminals again. Read the voltage after 15 seconds.
- (5) Disconnect load.



4-24. ELECTRICAL SYSTEM - Continued

(6) The battery voltage should be as follows.

Ambient Temp	70 F 21 C	60 F 16C	50 F 10C	40 F 4C	30 F -1 C	20 F -7 C	10 F -12C	0 -18 C
Battery Voltage	9.6	9.5	9.4	9.3	9.1	8.9	8.7	8.5

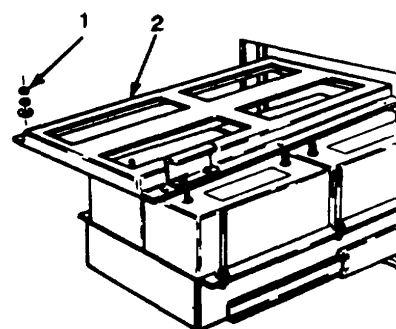
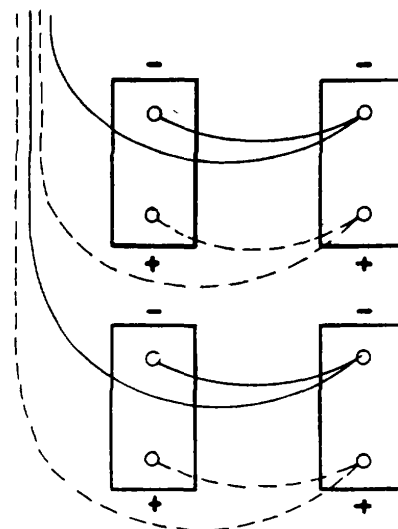
(7) If battery falls the load test, it should be replaced.

REPLACEMENT

NOTE

The procedure for disconnecting the truck batteries is outlined in steps 1 thru 7. This procedure must be used whenever the batteries are required to be disconnected for truck maintenance.

- (1) Set battery switch in cab to OFF
- (2) Open battery compartment; battery compartment is located on left hand side of truck to the rear of the drivers door.
- (3) Hold back latch on right hand side of battery rack and pull rack forward
- (4) Remove all positive leads from the positive terminals of the batteries
- (5) Remove all negative leads from the negative terminals of the batteries.
- (6) If batteries are not being replaced, just disconnected, lift up all leads and slide a suitable piece of plywood, hard board, or plastic sheet between the top of the batteries and the leads. If necessary the rack can be pushed in and the compartment door closed
- (7) Tie a label to the door handle to explain why the batteries are disconnected and who is working on the truck.

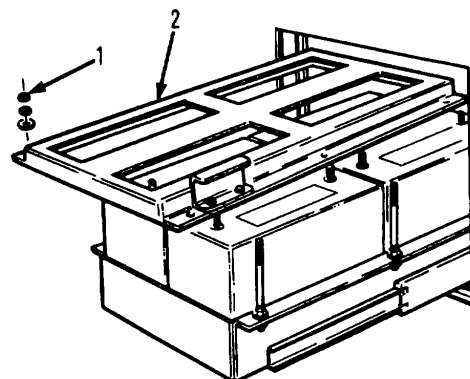


4-24. ELECTRICAL SYSTEM - Continued**4-24.12 Battery - Continued**

- (8) To remove the batteries, remove the battery hold down plate retaining nuts (1).
- (9) With two people, one holding the left hand side and one the right, lift up the retaining plate (2) and pull out of the drawer.

WARNING

Serious injury could occur if heavy equipment is moved/lifted without sufficient personnel to do the job. Use proper physical lifting procedures or use a suitable lifting device or dolly. Wear safety shoes, gloves and other suitable protective clothing. All batteries contain a strong acid solution. Splashing in the eye can cause blindness. Splashing on the skin can cause severe burns. Do not drop or tilt batteries. If liquid from the batteries is splashed, wash the affected area with copious quantities of water. Consult a doctor if splashed in the eye or taken internally. Always wear gloves, apron and eye protection when handling batteries.



- (10) Remove batteries one at a time being careful not to tip the batteries. Each battery weights 60 lb (27 kg).
- (11) Install new batteries one at a time into the battery tray. Be careful not to trap the battery leads.
- (12) With two people, one holding the left hand side and one the right hand side, slide the battery retaining plate into the drawer. Be sure all battery leads are above the retaining plate
- (13) Lower retaining plate onto batteries and secure in place with the nuts. Tighten to 30 ft lb (41 Nm).
- (14) Connect battery leads to batteries as illustrated. Be sure red coded leads are connected to the positive terminals.
- (15) Tighten post nuts to 30 ft lb (41 Nm).
- (16) Push battery rack into compartment. Be sure latch catches. Close door.

4-24. ELECTRICAL SYSTEM - Continued

4-24.13 Volt Radio converter.

This task covers

- a. Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIAL PARTS

12T2 4RA Converter

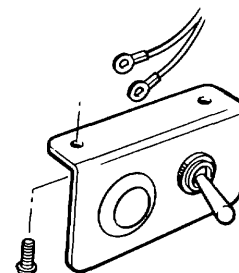
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected

REPLACEMENT

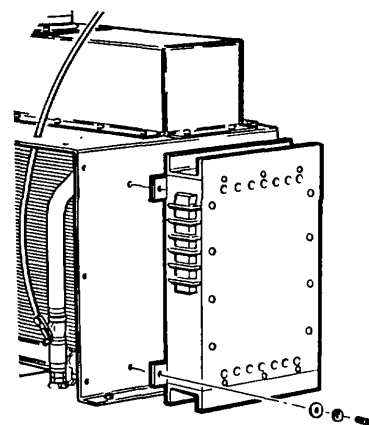
a Switch Unit Replacement

- (1) Tag and disconnect wires to switch and lamp module.
- (2) Remove switch module by removing screws.
- (3) Remove and replace switch or lamp holder depending which has failed.
- (4) Reconnect switch module to instrument panel.
- (5) Connect wires as noted in step 1 preceding.



B Converter Module Replacement.

- (1) Tag and disconnect 24-volt wires to radio.
- (2) Tag and disconnect 12-volt and ground wires.
- (3) Remove four screws attaching module to heater assembly.
- (4) Remove converter module from truck
- (5) Replace converter module and attach using four screws.
- (6) Reconnect wires as noted in steps 1 and 2 preceding.



4.24 ELECTRICAL SYSTEM - Continued**4-24.14 AC Electrical System.****This task covers**

- a. Test
- b. Replacement
- c. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0650

MATERIALS/PARTS

A40-12 Inverter

PERSONNEL REQUIRED - 2**EQUIPMENT CONDITION**

Main Engine Shutdown

TEST**NOTE**

The ac electrical system is designed to operate when the engine is running at speed of 1200 rpm or greater.

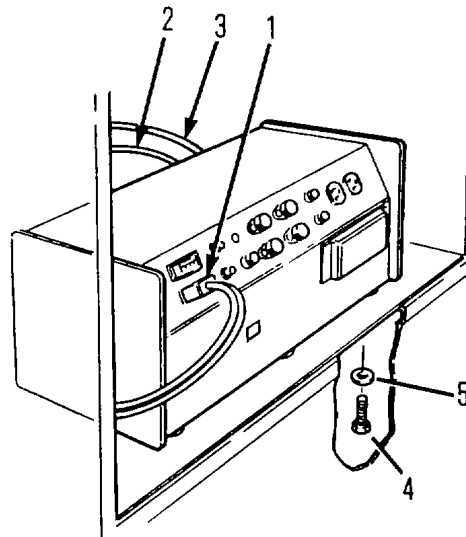
The inverter is located in one of the left hand hose body compartments.

- (1) Start main engine and set cab mode switch to STRUCT. Control engine speed with hand throttle on structural panel.
- (2) Adjust throttle control on structural panel until engine speed on cab tachometer indicates 1200 rpm.
- (3) Switch on inverter from cab or structural panel, or on unit itself.
- (4) Connect loads not in excess of 5 kW to the outlets.
- (5) Check all 110-Vac loads function correctly and check meter on cab or structural panel indicates approximately 110 Vac.
- (6) Switch off all loads and unplug all loads from the 110-Vac receptacles.
- (7) Switch off inverter.
- (8) Bring engine speed back to idle and shutdown main engine as detailed in para. 2-10.

4-24. ELECTRICAL SYSTEM - Continued**REPLACEMENT**

a. Inverter Replacement

- (1) Ensure truck batteries are disconnected.
- (2) Unplug control lead (1) from front of inverter.
- (3) Remove capscrews (4) and washers (5). These are accessed from the rear wheel arch.
- (4) Pull inverter forward and twist until rear of unit can be accessed.
- (5) Tag and disconnect ac lead (2) from back of inverter.
- (6) Unplug dc leads (3) from back of inverter.
- (7) Replace inverter unit in compartment.
- (8) Reconnect dc leads (3) to back of inverter.
- (9) Reconnect ac leads (2) to back of inverter.
- (10) Align inverter feet with holes in panel. Secure with capscrews (4) and lockwashers (5).
- (11) Reconnect remote control lead (1) to inverter.

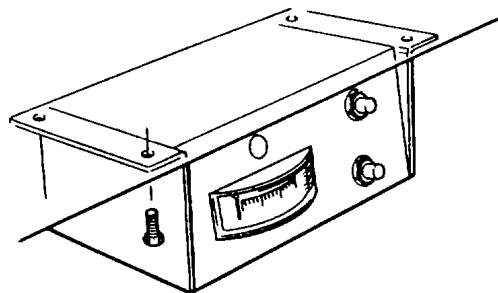


b. Remote Control Unit Replacement

NOTE

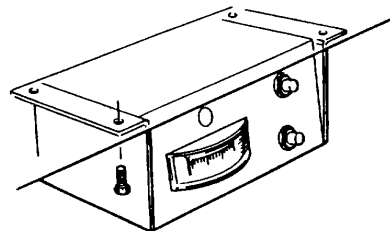
Two units are installed, one in the cab and one on the structural control panel.

- (1) Be sure truck batteries are disconnected.
- (2) Remove pump body heat shield, see para. 4-11.2
- (3) Unplug remote control plug from inverter in hose body compartment.
- (4) Thread wire harness back through hose body and chassis to cab (or pump body).
- (5) Remove screws that retain remote control unit to cab dash panel (or to pump body panel).



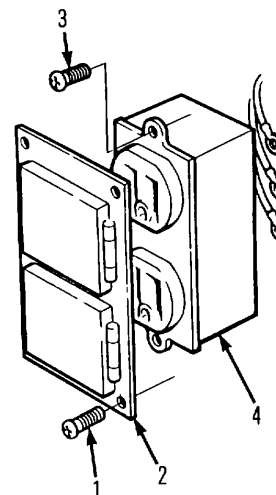
4-24. ELECTRICAL SYSTEM - Continued**4-24.14 AC Electrical System - Continued****b Remote Control Unit Replacement - Continued**

- (6) Replace remote control unit in cab (or pump body panel).
- (7) Thread wire harness through cab (or pump body panel), and along frame to hose body. Be sure it follows same routing as original wires. Tie and wrap in position approximately every 2 ft (600 mm).
- (8) When in position, plug into inverter

**c Receptacle Replacement**

Two receptacles are installed on the truck, one on each side of the hose body. This instruction may be used to replace either receptacle.

- (1) Be sure truck batteries are disconnected.
- (2) Remove screws (1) and remove face plate (2).
- (3) Remove screws (3) and gently ease receptacle (4) from panel.
- (4) Loosen screws on back of receptacle and tag and disconnect all three wires.
- (5) Attach new receptacle to wires as tagged in step 4.
- (6) Install receptacle on cab using screws (3).
- (7) Install face plate (2) to receptacle using screws (1). Be careful to ensure face plate gasket is flat and is pulled tight against cab.
- (8) Reconnect main batteries, start main engine and fire pump and test receptacle as in TEST preceding.



4-24. ELECTRICAL SYSTEM - Continued

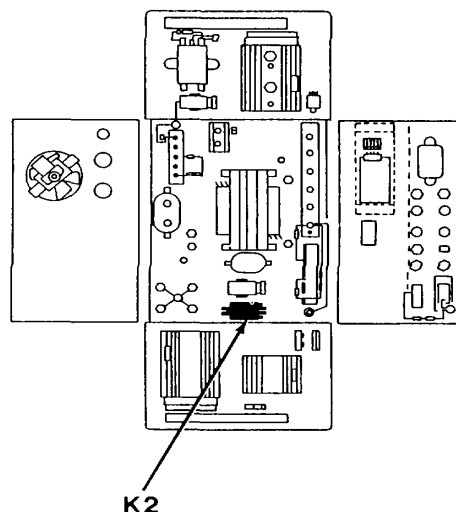
REPAIR

NOTE

Check out of the inverter requires a 4-2700 test strip to be plugged into the "Dynamic Inverter" plug on front panel of inverter.

a. K2 Relay Repair

- (1) Be sure battery switch is set to BOTH, engine not running
- (2) Connect a voltmeter between brown and green on the test strip
- (3) Press the inverter start button. Voltage should be 10 Vdc or higher.
- (4) If voltage is less than 10 Vdc replace relay K2, this is located inside the inverter as shown
- (5) Set battery switch to OFF
- (6) To open inverter, unscrew mounting bolts securing inverter to bottom of compartment
- (7) Pull inverter forward and remove front, top, and back panel fasteners
- (8) Carefully lay the front and back panels down and remove the top panel
- (9) Pull relay K2 from its base and replace
- (10) Set battery switch to BOTH and connect voltmeter between blue and green on test strip. With the start button depressed, voltage should be 10 Vdc or higher. If it is zero, the replaced K2 relay has failed. Replace.
- (11) If voltage is 10 Vdc or higher, but the voltage between brown and green is still zero, check out the K1 relay as detailed in K1 Relay Repair following.
- (12) If voltage is 10 Vdc between blue and green and between brown and green, K2 relay is satisfactory
- (13) Set battery switch to OFF and replace front, back, and top panels and install fasteners
- (14) Carefully slide unit back into compartment and replace feet retaining bolts



4-24. ELECTRICAL SYSTEM - Continued

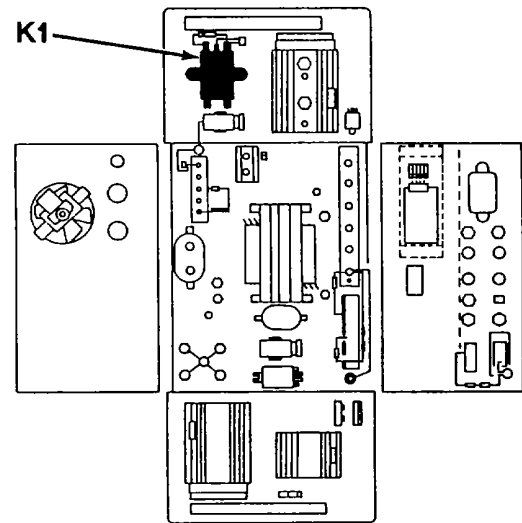
4-24.14 AC Electrical System - Continued

b. K1 Relay Repair

NOTE

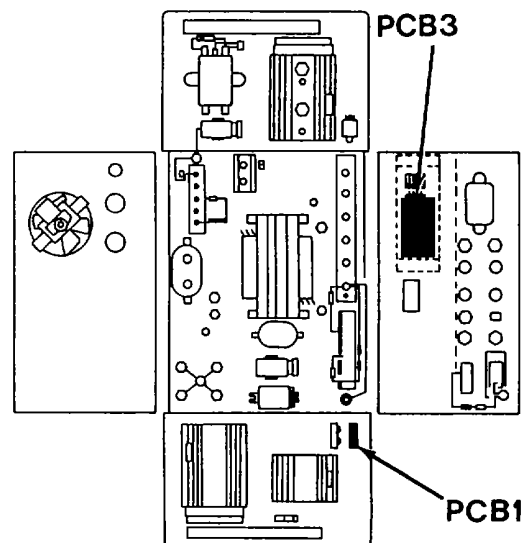
Always check out K2 relay before checking out K1 relay. This is detailed in a preceding.

- (1) Open the inverter as detailed in a preceding, steps 5 thru 8.
- (2) Locate K1 relay and with battery switch set to BOTH but Ignition off, connect a voltmeter between the two small terminals on top of the relay (the coil).
- (3) Without depressing the start button, voltage should be 0 Vdc. With start button depressed, voltage should be 10 Vdc or higher.
- (4) If it is zero with start button depressed recheck K2 relay as detailed in a preceding.
- (5) Check the resistance across the two large terminals at the top of the relay with an ohmmeter
- (6) Without depressing start button, resistance should be greater than 100 kOhms
- (7) With start button depressed, resistance should be less than 5 ohms
- (8) Replace relay K1 if either of these readings is not obtained
- (9) Replace inverter as detailed in steps 13 and 14 of K2 Relay Repair preceding



c. Voltage Regulator PCB1 and PCB3 Repair

- (1) Connect the 4-2400 Test Strip to the Dynamic Inverter plug on front panel of inverter
- (2) Set battery switch to BOTH and the ignition switch to ON, but the engine not running
- (3) Measure voltage between blue and green on test strip
- (4) Without depressing the start button, the voltage should be 10 Vdc or higher. If not, replace the regulator, PCB3, see 6 following
- (5) With the start button depressed, the voltage should be 10 Vdc or higher. If not, replace the regulator PCB1, as detailed following

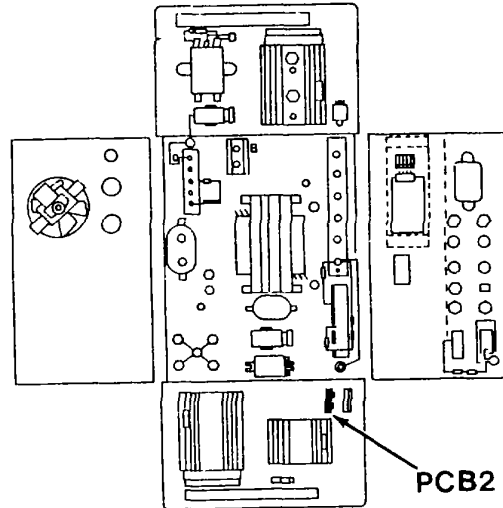


4-24. ELECTRICAL SYSTEM - Continued

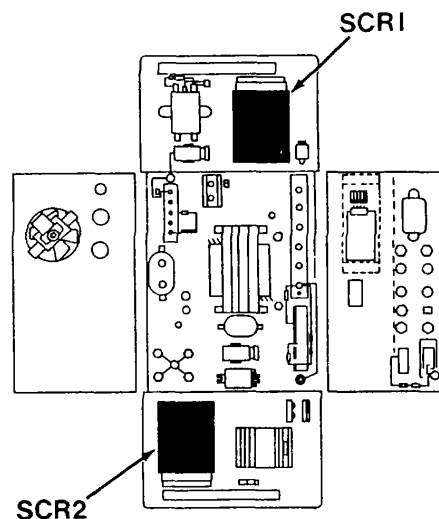
- (6) Open the inverter as detailed in a preceding, steps 5 thru 8.
- (7) Unplug PCB1 or PCB3 as required and replace.
- (8) Replace inverter as detailed in steps 13 and 14 of K2 Relay Repair preceding.

d. Oscillator Circuit Board PCB2 Repair

- (1) Open the inverter as detailed in a preceding, steps 5 thru 8.
- (2) Set battery switch to ON, and ignition switch OFF.
- (3) Locate the SCR gate leads, the small white leads to the SCR's which have a plastic connector in the lead.
- (4) Tag and separate the leads from the plastic connector.
- (5) With the start button depressed, read the voltage between the oscillator case (ground) and the part of the gate lead connected to the oscillator circuit board PCB2.
- (6) Replace the oscillator board PCB2 if the voltage is not between 2 Vdc and 7 Vdc and the voltage is not equal on both leads from each SCR (± 0.3 Vdc)
- (7) Replace inverter as detailed in steps 13 and 14 of a preceding

**e. SCR Repair**

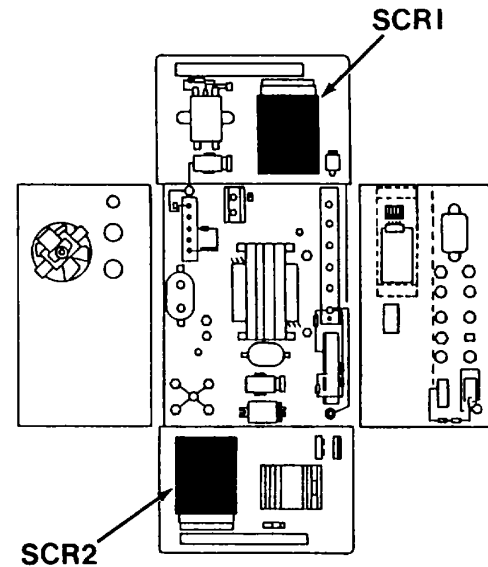
- (1) Be sure all commutation fuses are not blown. These four fuses are mounted on the front of the inverter.
- (2) Open the inverter as detailed in a preceding steps 5 thru 8.
- (3) Leave battery switch OFF.
- (4) Remove SCR cathode (ground) wires from their ground connection. These are red # 8 wires which are attached to the bottom of the inverter with a nut and screw.
- (5) Connect an ohmmeter with positive lead (+) on heat sink and negative lead (-) on the cathode removed from ground stud.



4-24. ELECTRICAL SYSTEM - Continued**4-24.14 AC Electrical System - Continued**

e. SCR Repair - Continued

- (6) If resistance reading is less than 1000 ohms, replace SCR. Resistance should be greater than 100 kohms.
- (7) To replace the SCR, pop the plastic plugs out of the 1 in. (25 mm) holes in the slotted area behind the heat sink from the inside with a screwdriver.
- (8) Disconnect the small connector to the SCR gate lead
- (9) Remove the SCR using a 3/4 in. socket
- (10) Install new SCR. Be sure there is thermal grease between the SCR case and the heat sink. Tighten nut securely.
- (11) Reconnect the cathode (ground) lead.
- (12) Reconnect the gate lead.
- (13) Replace inverter as detailed in steps 13 and 14 of a preceding.



f. Diode Repair

NOTE

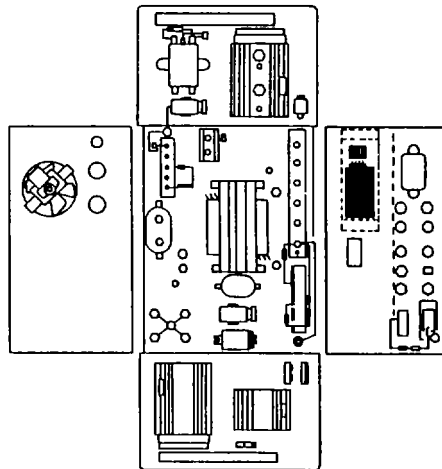
These are 14 diodes in the inverter, and there are 3 basic different types.

- (1) Open the inverter as detailed in a preceding steps 5 thru 8.
- (2) All diodes should conduct anode to cathode and block cathode to anode.
- (3) Remove diodes from heat sink or chassis before testing.
- (4) Connect an ohmmeter between cathode and anode. Resistance should be very high, greater than 100 kohms.
- (5) Connect an ohmmeter between anode and cathode. Resistance should be very low.
- (6) Replace any fuses failing the test.
- (7) Replace inverter as detailed in steps 13 and 14 of a preceding.

4-24. ELECTRICAL SYSTEM - Continued

g. Voltage Regulator Adjustment

- (1) Set battery switches to BOTH and start main engine as detailed in Chapter 2.
- (2) Run the engine at approximately 1500 rpm and switch on the headlights. Because of the short duration of this test, adjust engine speed with the foot throttle. Keep at steady 1500 rpm.
- (3) Connect the 4-2700 test strip to the front of the inverter and measure the voltage black to green.
- (4) Voltage should be between 13.8 to 14.2 Vdc as controlled by voltage regulator PCB3.
- (5) Press alternator start switch.
- (6) Voltage should be between 13.8 to 14.2 Vdc as controlled by voltage regulator PCB1.
- (7) If out of these limits, adjust PCB1 and/or PCB3 by turning the gray potentiometer screw on the regulator holes that are drilled in the sides of the inverter in the respective positions.
- (8) If voltage cannot be adjusted in either case to 14.2 Vdc, replace failed regulator as detailed in c. preceding.



4-25. STEERING SYSTEM - Continued.

4-25.1 Steering Wheel, Steering Column, Horn and Turn Signal.

This task covers

- a. Replacement
- b. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)

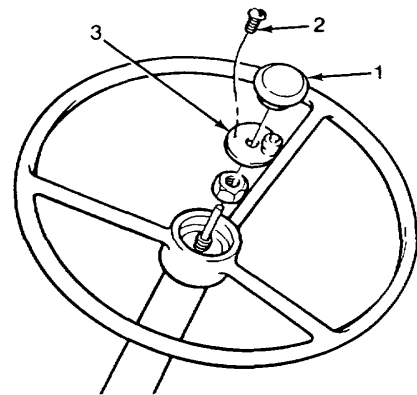
MATERIALS/PARTS

3, Appendix E Antiseize Compound
29, Appendix E Threadlock Liquid
465611 Horn Button Assembly
81-581 Steering Wheel
032149 Horn Contact
034059 Horn Contact Insulation
HS52 Hose Clamp
1030-10-6 Turn Switch
89541-K Pipe Clamp
UC 32214 Steering Column
60619-1 Socket

REPLACEMENT

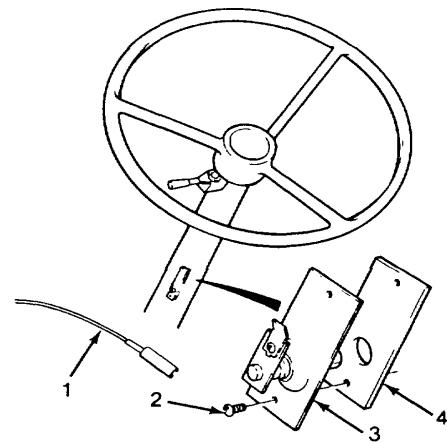
a. Horn Button Assembly Replacement

- (1) Firmly push the horn button (1) down and turn it counterclockwise. Remove horn button from steering wheel.
- (2) Remove screws (2) attaching horn contact ring (3) to steering wheel. Remove horn contact ring.
- (3) Install new horn contact ring (3) using screw (2). Tighten screws firmly.
- (4) Push the new horn button (1) down over the horn contact ring and twist it clockwise until seated.
- (5) Select battery switch to BOTH and check that horn operates.



b. Horn Contact Assembly Replacement

- (1) Disconnect wire (1).
- (2) Remove screws (2), connector assembly (3), and insulator (4).
- (3) Install new switch and insulator using screws (2).
- (4) Connect horn wire (1).
- (5) Select battery switch to BOTH and check horn operates .



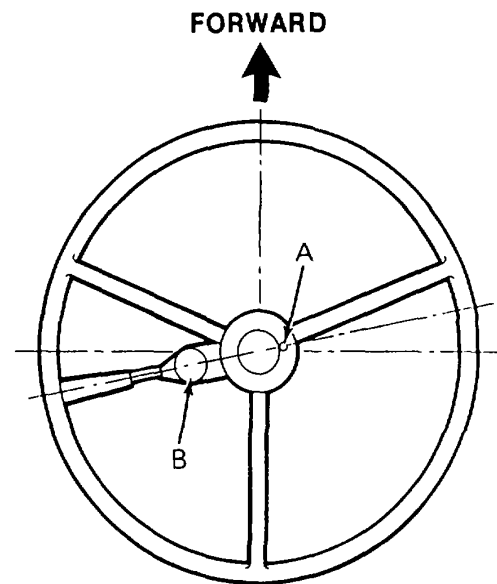
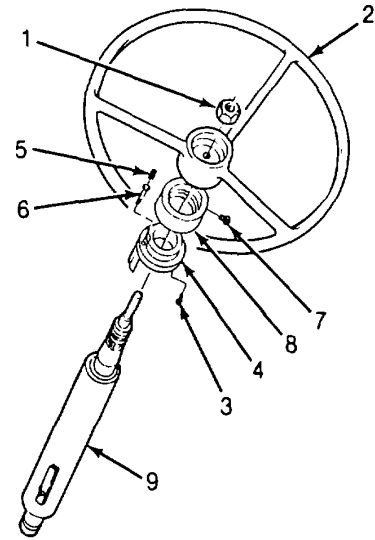
4-25. STEERING SYSTEM - Continued.**c. Steering Wheel Replacement**

- (1) Place a piece of tape on the steering wheel rim and align a piece of tape on the instrument panel.
- (2) Remove horn button assembly. See steps 1 and 2 of a preceding.
- (3) Remove steering wheel nut (1) and steering wheel (2). Removal of steering wheel may require use of a puller.

NOTE

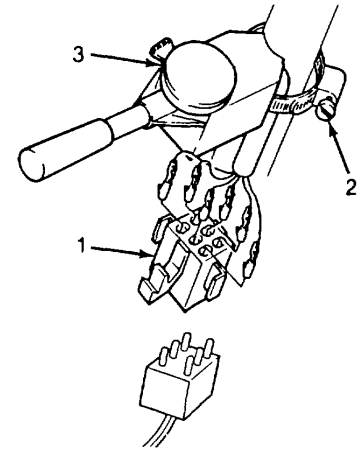
If new steering wheel is to be installed, carry out steps 4 thru 9. Otherwise proceed to step 10 to install original steering wheel.

- (4) Remove screws (3) and turn signal ring (4). Retain spring (5) and plunger (6).
- (5) Loosen setscrew (7) and remove self-canceling ring (8).
- (6) Inspect turn signal ring and self-canceling ring. Replace if damaged or defective.
- (7) Install self-canceling ring on new steering wheel and tighten setscrew (7) securely.
- (8) Preassemble spring (5), plunger (6), and turn signal ring (4).
- (9) Install turn signal ring assembly (4) on self-canceling ring (8) using screws (3).
- (10) Position steering wheel on column as shown. Be sure the cancel arm (A) is positioned 180 deg. opposite the turn signal switch (B). If necessary, loosen setscrew (7) and reposition self-canceling ring (8). Be sure tape on wheel rim and instrument panel are aligned.
- (11) Apply threadlock liquid (item 29, Appendix E) to steering wheel nut (1). Install nut and tighten to 70 ft lb (310 Nm).
- (12) Install horn button assembly. See Horn Button Assembly Replacement preceding (steps 3, 4, and 5).



4-25. STEERING SYSTEM - Continued.**4-25.1 Steering Wheel, Steering Column, Horn and Turn Signal - Continued****d. Turn Signal Switch Replacement**

- (1) Unplug connector (1) from steering column harness.
- (2) Unscrew hose clamp (2) until fully open and remove turn signal switch (3).

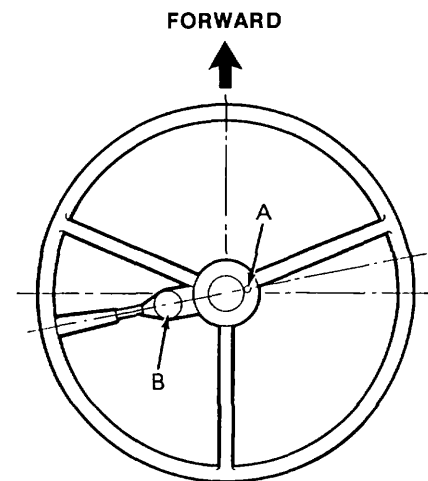
**NOTE**

**If a new switch is to be installed, carry out steps 3 thru 6
Otherwise proceed to step 7 to install original turn switch.**

- (3) Install new sockets on each wire of the new turn signal switch.
- (4) Using a small screwdriver, push on locating tabs in socket housing on failed turn signal switch.
- (5) Pull each wire and socket out of housing. Note position of each colored wire.
- (6) Push sockets from new switch into housing. Be sure the socket locating tags lock in socket housing.
- (7) Install turn signal switch using hose clamp (2).
- (8) Adjust switch position to ensure proper interaction of switch canceling button (B) and arm (A). Be sure the switch is situated opposite the cancel arm (A) as shown. Tighten hose clamp.
- (9) Plug connector (1) into steering column harness connector.

e. Upper Column Assembly Replacement

- (1) Remove horn button assembly, horn contact assembly, steering wheel, and turn signal switch (see a, b, c, and d preceding).
- (2) Remove machine screws from dash panel and lift up panel, resting it on top of dash. Unplug harnesses as required.
- (3) Remove bolt (1) and nut (2).
- (4) Remove clamp nuts (4). Pull column (4) free of universal joint (5), support brackets (6) and clamps (7).

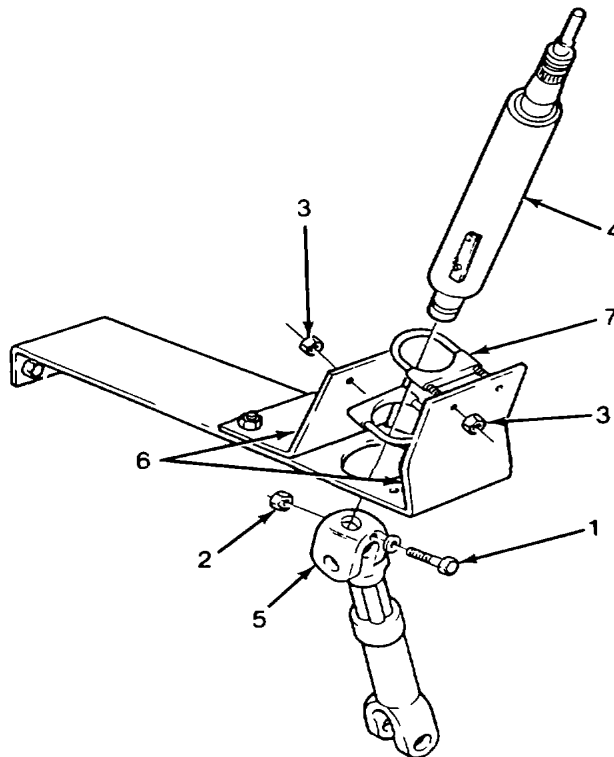


4-25. STEERING SYSTEM - Continued.

- (5) Inspect all reusable parts removed from column. Inspect support brackets (6) and clamps (7). Replace damaged or faulty components.
- (6) Coat upper and lower splines of column with antiseize compound (item 3, Appendix E).
- (7) Slide end of new column assembly through clamps (7) and into universal joint (5).
- (8) Install bolt (1) and nut (2) and tighten to 35 ft lb (48 Nm).
- (9) Tighten clamp nuts (3) to 35 ft lb (48 Nm).
- (10) Install harness plugs on dash panel and install dash panel.
- (11) Install turn signal switch, steering wheel, horn contact assembly, and horn button assembly as detailed in a, b, c, and d preceding .

REPAIR**NOTE**

Repair is limited to replacement of components as detailed under the relevant replacement paragraph.



4-25. STEERING SYSTEM - Continued.

4-25.2 Steering Shaft

This task covers

- a. Replacement
- b. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

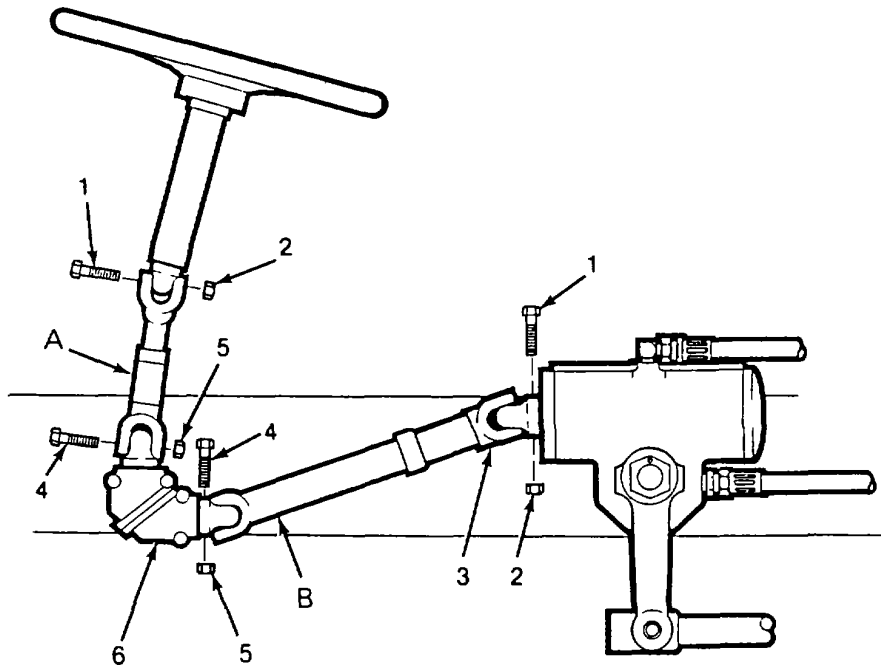
3, Appendix E Antiseize Compound
904860-141 Steering Shaft
904860-144 Steering Shaft
S-103X Cross and Bearing Kit
MS90728-66 Capscrew
MS51922-17 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Battery Switch OFF

NOTE

The two steering shafts (A and B) have different lengths. The procedure below outlines the replacement of steering shaft A. To replace shaft B, the shaft cover must be removed. The same procedure may be used to replace shaft B.



4-25. STEERING SYSTEM - Continued**REPLACEMENT**

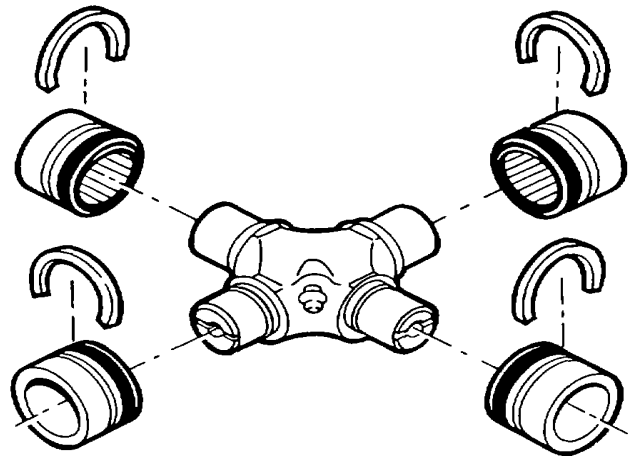
- (1) Place a piece of tape on the steering wheel rim and align another piece of tape on the instrument panel.
- (2) Remove screw (1) and nut (2).
- (3) Collapse shaft A to release yoke (3) from steering column. (For shaft B, this releases yoke from steering gear).
- (4) Remove screw (4) and nut (5) and pull shaft free of miter box (6).
- (5) Coat splines of steering shaft with antiseize compound (item 3, Appendix E).
- (6) Be sure steering shafts are phased as shown and install new shaft on miter box using screw (4) and nut (5). Tighten nut to 35 ft lb (48 Nm).
- (7) Be sure tape on wheel rim and instrument panel are aligned and push yoke (3) onto shaft of steering column. Install screw (1) and nut (2). Tighten nut to 35 ft lb (48 Nm). (For shaft B, install yoke onto steering gear).

REPAIR**NOTE**

Repair of the steering shafts is limited to replacement of the universal joint. Both universal joints should be replaced at the same time.

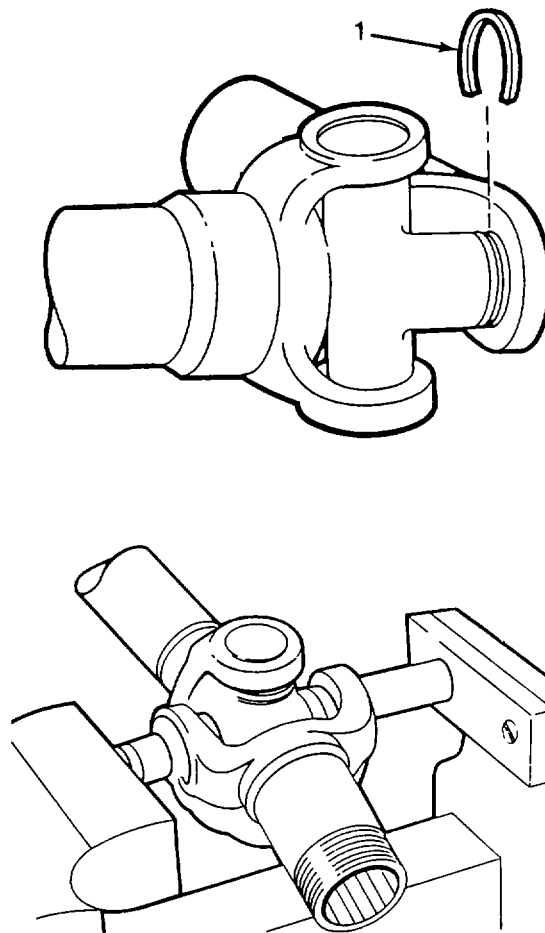
Steering shaft must be removed from truck for repair.

- (1) Remove retaining rings (1) from all four bearing caps.
- (2) Set the universal joint up in a vise as shown. Use a small socket (2) as a punch and a large socket (3) as a receiver.
- (3) Tighten vise and press bearing out of yoke lug.
- (4) Remove shaft from vise and rotate one-half turn. Repeat pressing procedure to remove second bearing cap from cross.
- (5) Carefully maneuver cross out of shaft yoke.
- (6) Repeat procedure 2 thru 5 to remove cross from end yoke.
- (7) Repeat procedures 2 thru 6 to remove cross from other end of shaft.



4-25. STEERING SYSTEM - Continued**4-25.2 Steering Shaft - Continued**

- (8) Maneuver new cross into shaft yoke. Push new bearing caps into yoke.
- (9) Install assembly into vise as shown. While rotating cross with one hand, tighten vise until bearing caps are pushed into cross.
- (10) Repeat procedures 8 and 9 for end yoke.
- (11) Repeat procedures 8 thru 10 for second universal joint.
- (12) Be sure all bearing caps are pushed fully home. Install bearing cap retaining rings.



4-474/(4-475 Blank)

4-25. STEERING SYSTEM - Continued**4-25.3 Power Steering Pump.****This task covers**

- a. Removal
- b. Inspection
- c. Installation
- d. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Battery Switch OFF
Power Steering Drained of Fluid

MATERIALS/PARTS

17, Appendix E Lubricating Oil
22, Appendix E Pipe Sealant
29, Appendix E Threadlock Liquid
V20F 1P8P 1A6H11 Steering Pump

WARNING

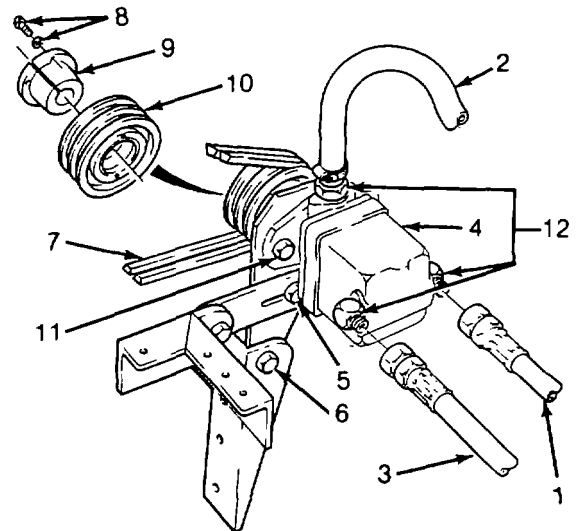
To prevent fire hazards, collect residual fluid and clean any spills immediately when disassembling power steering components.

CAUTION

Pump or steering gear failure due to contamination may occur unless strict cleanliness and protective measures are taken when disassembling and assembling power steering components. Power steering fluid is engine oil, 10W/40 (except under Arctic conditions). Refer to LO 5-4210-220-12.

REMOVAL

- (1) Remove hoses (1, 2 and 3) from power steering pump (4). Plug or cover hose ends immediately.
- (2) Loosen screws (5 and 6). Push pump toward engine pulley and remove drive belt (7).
- (3) Remove screws and washers (8).
- (4) Install same screws into the blind holes of the bushing (9) and tighten evenly. The bushing (9) and pulley (10) will separate.
- (5) Remove bushing (9) and pulley (10) from pump drive shaft. Retain drive key.



4-25. STEERING SYSTEM - Continued

- (6) Remove capscrews (11) and remove pump from engine bracket.
- (7) Remove fittings (12) from pump if new pump is to be installed. Plug or cover the ports to prevent contamination of the pump.

INSPECTION

- (1) Inspect hoses, belts, and pump body. Damaged or deteriorating parts must be replaced.
- (2) Inspect reusable hardware items with stripped or damaged threads must be replaced.
- (3) Clean pump fittings (12) thoroughly and inspect for damage including stripped threads. Replace as required.

INSTALLATION

- (1) Apply pipe sealant (item 22, Appendix E) to fittings (12). Remove protective plugs from pump ports and install fittings.
- (2) Apply threadlock liquid (item 29, Appendix E) to capscrews (11) and install new pump (4). Tighten to 35 ft lb (48 Nm).
- (3) Install hoses (1, 2 and 3).
- (4) Install pulley (10) and bushing (9) on pump shaft. Be sure drive key is installed on pump shaft. Install screws and washers (8). Tighten evenly to 35 ft lb (48 Nm).
- (5) Install belts (7) and, while levering pump, tighten screws (5 and 6).
- (6) Check belt tension approximately midway between the two pulleys. A firm push with the thumb should deflect each belt about 0.5 in. (13 mm). Adjust position of pump as necessary.

CAUTION

To prevent damage to pump vanes, be sure power steering reservoir is refilled before starting engine.

- (7) Refill power steering reservoir with 10W/40 oil, (item 17, Appendix E). (see LO 5-4210-220-12).
- (8) Start main engine and check hose connections for leaks and, if necessary, tighten fittings.
- (9) Turn the steering wheel fully left and fully right and make sure the response to turning is smooth and easy.
- (10) Stop engine and recheck belt tension. Readjust pump position if necessary to maintain belt tension as detailed in step 6.

4-25. STEERING SYSTEM - Continued

4-25.3 Power Steering Pump-Continued

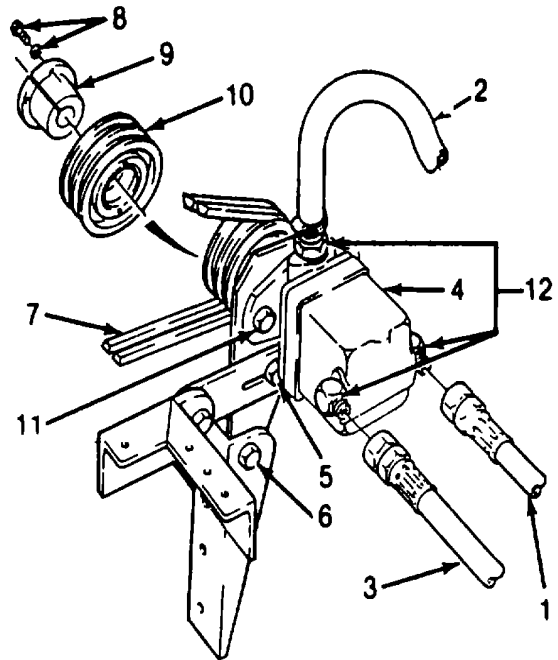
REPAIR

a. Drive Belt Repair

NOTE

Replace drive belts in matched pairs only. Uneven belt wear and short service life will result if belts are replaced individually or in unmatched pairs.

- (1) Loosen screws (5 and 6). Push pump (4) toward engine pulley and remove old belts (7).
- (2) Install new belts and tension by levering pump (4) away from engine pulley. Tighten screws (5 and 6).
- (3) Check belt tension. A firm push with the thumb midway between engine and pump pulley should deflect each belt approximately 0.05 inches (1.27 mm). Adjust pump position as necessary.



b. Pressure Relief Valve Repair

CAUTION

Do not repair relief valve (5). If faulty, the relief valve must be replaced. Valve malfunction and potential pump destruction may occur if disassembly is attempted.

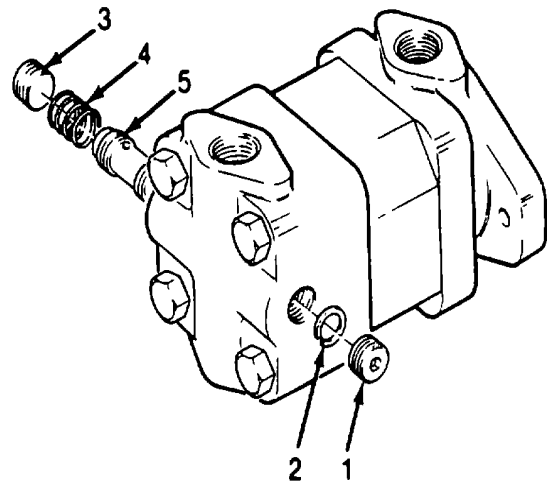
NOTE

Pressure relief valve may be replaced without removing steering pump from truck.

- (1) Remove plug (1), plug (3), and spring (4).
- (2) Insert a suitable tool through the bore where plug (1) is removed and push relief valve (5) out of valve cover

NOTE

Retaining ring (2) can remain in valve cover unless it is damaged. If removed, be careful not to scratch valve bore.



4-25. STEERING SYSTEM - Continued

- (3) Inspect valve cover bore. If scratched or otherwise damaged, replace the valve cover. Do not attempt to repair.

NOTE

During handling and shipping of new relief valve, burrs may be raised on sharp edges. Be sure to remove these burrs before installing relief valve.

- (4) Coat the new relief valve with lubricating oil (item 17, Appendix E) and install it in the valve cover, small land first.
- (5) Check the valve slides smoothly in the valve bore and install spring (4).
- (6) Apply pipe sealant (item 22, Appendix E) to plugs (1) and (3) and install in valve cover.

c. Pump Cartridge Repair

NOTE

Pump must be removed from truck. See REMOVAL preceding.

- (1) Remove cover screws (1). Note position of cover ports with respect to body port and lift off cover (2) and O-ring (6).
- (2) Remove pressure plate (4) and spring (3).
- (3) Note position of ring (7) with respect to body (12). Also note the direction of the arrow on the ring. Lift ring free of pump body (12). Remove and discard gasket (10).
- (4) Remove vanes (9) from rotor and pull rotor (8) off pump shaft.
- (5) Remove pressure relief valve from valve cover (see b. preceding).

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air, always use chip guards, eye protection, and other personal protective equipment.

- (6) Using dry cleaning solvent (item 10 Appendix E), wash all parts thoroughly and blow dry using compressed air.
- (7) Inspect rotor (8) and vanes (9). Replace both if excessive play is noticed between vanes and slots in rotor.

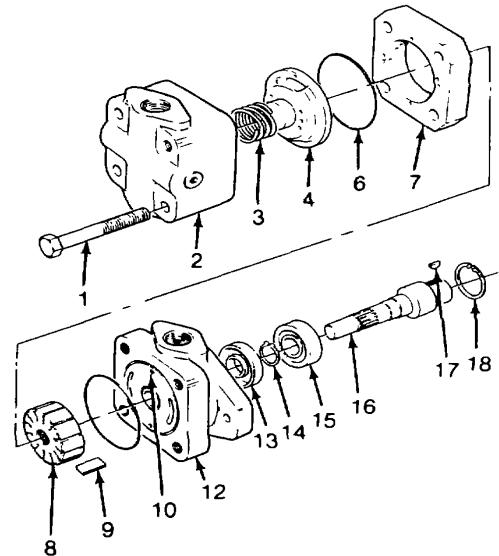
4-25. STEERING SYSTEM - Continued**4-25.3 Power Steering Pump - Continued**

c. Pump Cartridge Repair - Continued

- (8) Check wearing surfaces of body (12), pressure plate (4), ring (7), and rotor (8) for scoring and excessive wear. Light scoring marks may be removed by lapping. Deeply scored or worn parts warrant replacement of the pump.
- (9) Spin shaft and rock shaft end to end and fro. Replace pump if bearing is noisy or excessive play is noted when shaft is rocked.
- (10) Push cover (2) onto pump shaft. Rock cover on shaft. If excessive play is noted between shaft and cover journal, replace pump.

NOTE

During handling and shipping of new cartridge parts, burrs may be raised on sharp edges. Be sure to remove these burrs before installing new parts in pump.



- (11) Install new O-rings (6 and 10) in the body and cover. Install ring (7) so that the arrow on the perimeter points in direction of rotation as noted in step 3.
- (12) Install rotor (8) on shaft and insert vanes (9) in rotor slots. Be sure the rounded vane edges are toward the cover ring.
- (13) Place pressure plate (4) on locating pins and flat against the ring. Position spring (3) on pressure plate and install cover (2). Be sure cover ports are orientated as noted in step 1.
- (14) Install and tighten cover screws (1) to 75 ft lb (100 Nm).
- (15) Rotate the shaft by hand to ensure that there is no internal binding in the pump. Install shaft key (11).
- (16) Install and test pump on truck as detailed in INSTALLATION preceding.

4-25. STEERING SYSTEM - Continued**4-25.4 Power Steering Filter Reservoir.**

This task covers a. Replacement

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Battery Switch OFF

MATERIALS/PARTS

17, Appendix E Lubricating 011
22, Appendix E Pipe Sealant
91417A Power Steering Filter Reservoir

WARNING

To prevent fire hazards, collect residual fluid and clean up any spills. Immediately when disassembling power steering components.

CAUTION

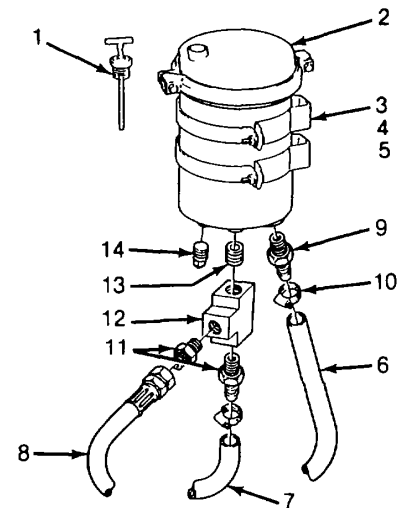
Pump or steering gear failure due to contamination may occur unless strict cleanliness and protective measures are taken when disassembling and assembling power steering components.

CAUTION

Power steering fluid is engine oil 10W/40 (except under Arctic conditions). Refer to LO 5-4210-220-12.

REPLACEMENT

- (1) Remove dipstick (1). Remove drain plug (14) and drain steering fluid into a suitable container and funnel. Reservoir contains about 9 qt (10 L) of oil.
- (2) Remove hoses (6, 7, and 8).
- (3) Remove screws (3) and locknuts (4) attaching reservoir (2) to brackets (5).
- (4) Remove fittings (10) thru (13)
- (5) Inspect new reservoir. Be sure it is clean and install filter element as detailed in Lube Order LO 05-4210-220-12. Reassemble reservoir. (If new reservoir has new brackets (5), remove and discard).
- (6) Apply pipe sealant (item 22, Appendix E) to fitting threads and install fittings (10 thru 13) to reservoir.



4-25. STEERING SYSTEM - Continued

- (7) Attach reservoir to brackets (5) using screws (3) and locknuts (4). Tighten nuts to 35 ft lb (48 Nm).
- (8) Install hoses (6, 7, and 8). Tighten clamp (9) only enough to secure hose and prevent leaks.
- (9) Install drain plug (14) and tighten securely.
- (10) Refill reservoir as detailed in Lube Order LO 5-4210-220-12.
- (11) Start engine and check hose connections for leaks. Tighten fittings as necessary.
- (12) Turn steering wheel fully right and fully left. After a couple of turns the steering motion should become smooth.
- (13) Stop the engine and check the reservoir dipstick. Top up the reservoir as required.

4-25. STEERING SYSTEM - Continued

4-25.5 Drag Link

This task covers

- a. Adjustment
- b. Replacement
- c. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Battery Switch OFF
Steering Shaft Covers Removed

MATERIALS/PARTS

16, Appendix E Grease
HL-25709-H Drag Link
1/4 x 3 Cotter Pin
221589 Dust Shield

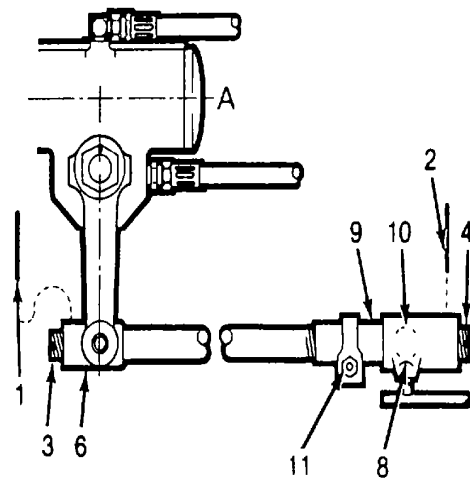
PERSONNEL REQUIRED - 2

ADJUSTMENT

NOTE

Front wheel alignment must be checked and adjusted prior to adjusting drag link, see para. 4-32.2.

- (1) Position truck front wheels straight ahead.
- (2) Be sure there is no noticeable play between link end (6) and pitman arm ball. If excessive play is observed, remove cotter pin (1) and tighten plug (3) until it bottoms against ball, then back off until cotter pin (1) can be installed install and secure cotter pin.
- (3) Note position of pitman arm relative to steering gear to determine if adjustment of drag link is necessary, i.e., whether to increase or decrease length of drag link. When drag link is correctly adjusted the pitman arm should be at right angles to the steering gear axis (A) when the wheels are straight ahead.
- (4) Remove cotter pin (2), plug (4) and loosen dust shield (8). Remove link end (9) from axle linkage ball (10).
- (5) Loosen nut (11) and turn link end (9) clockwise or counterclockwise (full turns) to adjust length of drag link.

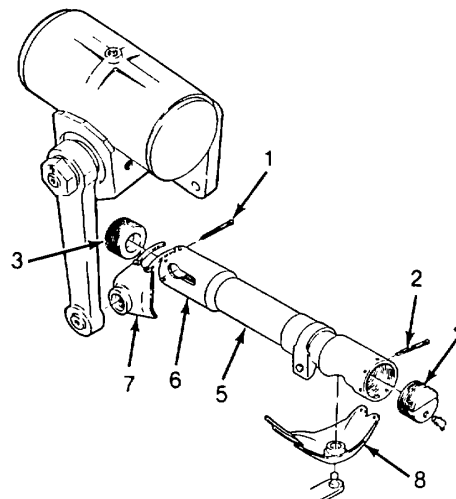


NOTE

One full turn of link end (9) changes the length of the link approximately 3/32 in. (2 mm).
Three full turns changes the length 1/4 in. (6.4 mm).

4-25 STEERING SYSTEM - Continued

- (6) Install link end (9) to ball (10) and turn steering wheel until drag link just pushes on ball without moving front wheels.
- (7) Hold steering wheel so that contact of ball and drag link is maintained and check position of pitman arm. The arm should be at right angles to the steering gear axis (A).
- (8) Repeat steps 5 and 6 until condition in step 7 is satisfied.
- (9) Replace dust shield (8) over axle ball (10) and install plug (4) to link end (9). Install link end on ball (10).
- (10) Tighten plug (4) until it bottoms against ball, then back off until cotter pin (2) can be installed. Install and secure cotter pin.
- (11) Tighten nut (11) securely.
- (12) Tie dust shield around the link end.
- (13) Lubricate both ends of the drag link with grease (item 16, Appendix E).

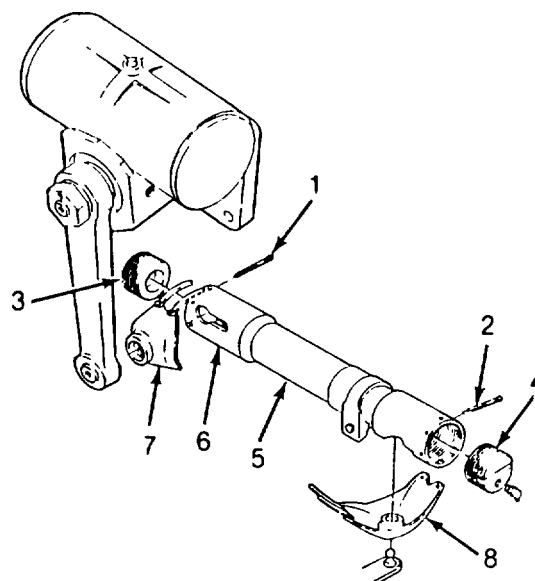
**REPLACEMENT.**

- (1) Remove cotter pin (1) and plug (3). Pull link end (6) off pitman arm ball. Turn steering wheel slightly if necessary, to aid the removal. Remove dust shield (7).
- (2) Remove cotter pin (2) and plug (4) and remove complete drag link (5) from truck.
- (3) Inspect new drag link and preadjust it to same length as the one removed.

NOTE

Nominal center-to-center distance between pitman arm and steering linkage balls is 22 7/8 in. (581 mm).

- (4) Install a new dust shield (7) and link end (6) on pitman arm. Screw plug (3) into link until it bottoms against ball, then back off until cotter pin (1) can be installed. Install and secure cotter pin.
- (5) Adjust and complete drag link installation as detailed in ADJUSTMENT preceding



4-25. STEERING SYSTEM - Continued**4-25.5 Drag Link - Continued****REPAIR****NOTE**

Drag link may remain installed in truck.

Repair of the drag link is limited to replacement of grease nipples (12), cotter pins (1 and 2), plugs (3 and 4), and dust shields (7 and 8). Always carry out ADJUSTMENT whenever drag link end is removed from pitman arm or axle linkage ball.

4-25. STEERING SYSTEM - Continued

4-25.6 Power Steering Gear.

This task covers

- a. Removal
- b. Inspection
- c. Installation
- d. Adjustment
- e. Repair

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

MATERIALS/PARTS

3, Appendix E Antiseize Compound
 492XSCC4 Steering Gear
 310591 Locknut
 310631 Locknut

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Battery Switch OFF
 Power Steering Filter Drained of Fluid

WARNING

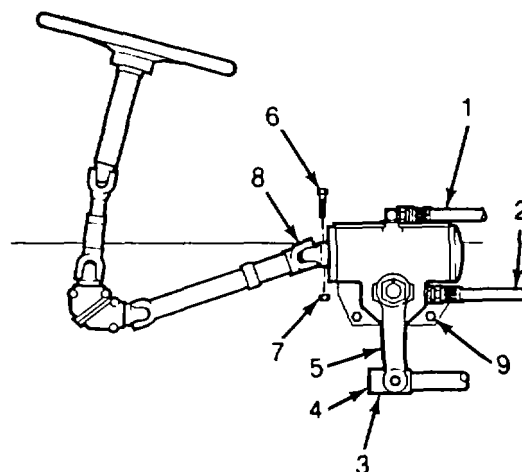
To prevent fire hazards collect residual fluid and clean up spills immediately when disassembling power steering components.

CAUTION

Pump or steering gear failure due to contamination may occur unless strict cleanliness and protective measures are taken when disassembling and assembling power steering components.

REMOVAL

- (1) From inside the cab remove steering shaft covers.
- (2) Tag and disconnect hoses (1 and 2) at the steering gear and drain residual oil. Cap hoses and steering gear ports when drained to protect components against contamination.
- (3) Remove cotter pin (3) and unscrew drag link plug (4).
- (4) Remove drag link from pitman arm (5).
- (5) Remove screw (6) and locknut (7) and pull yoke (8) off steering gear.



CAUTION

Steering gear assembly and rear cab cross member are attached to frame using capscrews (9). Support must be placed under cross member before steering gear is removed

4-25 STEERING SYSTEM - Continued

- (5) Use a hydraulic jack to support the rear cab cross member. Place a maintenance trestle underneath the cross member to support it.
- (6) Remove capscrew and locknuts (9) and remove steering gear.
- (7) If steering gear is not replaced immediately, Install capscrews and locknuts into frame and handtighten only. This will prevent inadvertent damage to cab if trestle is removed.

INSPECTION .

- (1) Inspect steering gear and pitman arm for wear and damage. A bent or damaged input shaft, output shaft, or pitman arm must be replaced.
- (2) Inspect steering gear fittings and hose end fittings for damage. Replace defective components.

INSTALLATION .

- (1) Install steering gear to truck frame using capscrews and locknuts (9). Tighten nuts to 180 ft lb (245 Nm).
- (2) Jack up cab cross member and remove maintenance trestle. Lower and remove jack.
- (3) Apply antiseize compound (item 3, Appendix E) to steering gear input shaft splines. Install yoke (8) using screw (6) and new locknut (7). Tighten nut to 40 ft lb (55 Nm).
- (4) Install hoses (1 and 2) in steering gear port fittings.
- (5) Refill power steering reservoir with oil as detailed in Lube Order LO 5-4210-220-12.
- (6) Install and adjust drag link to pitman arm as detailed in para. 4-25.5.
- (7) Start engine and check hose connections for leaks. Tighten fittings if necessary.
- (8) Turn steering wheel fully right and fully left. After a couple of turns the steering motion should become smooth.
- (9) Stop the engine and refill the reservoir to FULL on the dipstick.

ADJUSTMENT.**NOTE**

Steering gear adjustment consists of adjusting the relief valve plungers. These are used to relieve power steering pressure at full left and right turns.

- (1) With the engine running, turn the steering wheel in one direction until a high-pressure hiss is heard or until the axle stops contact each other.

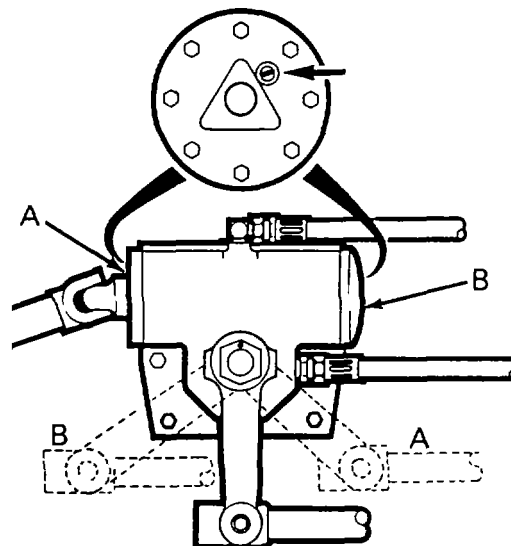
4-25. STEERING SYSTEM - Continued**4-25.6 Power Steering Gear - Continued**

- (2) Turn the relief valve plunger (A) or (B) in or out until the high-pressure hiss starts when a clearance of approximately 3/16 in. (4.5 mm) can be measured between axle stops (1).

NOTE

Turning the plunger in will increase the space between the axle stops. Turning the plunger out will decrease the clearance. Do not turn the plungers out beyond flush with plunger boss or leakage will occur.

- (3) Repeat steps 1 and 2 at other steering limit.

**REPAIR**

- a. Pitman Arm Repair.

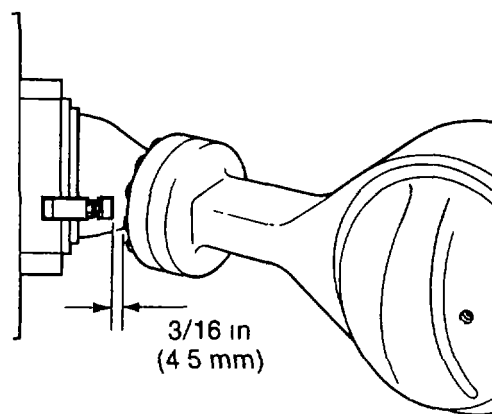
NOTE

Steering gear removed from truck.

WARNING

To prevent a serious accident, do not weld or apply excessive heat to pitman arm or output shaft. Welding or excessive heating may lead to component failure and loss of steering control.

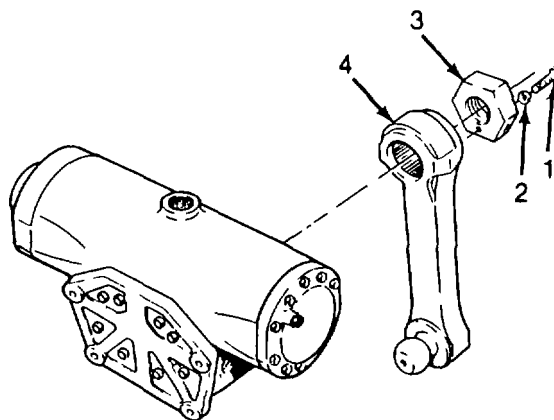
- (1) Remove capscrew (1), lockwasher (2), and split nut (3).
- (2) Using a puller, remove pitman arm (4) from output shaft.
- (3) Clean and inspect splines on output shaft. If these are seriously worn or damaged the output shaft must be replaced. See b. following.
- (4) Line up timing arrow on new pitman arm with arrow on output shaft. Install pitman arm and apply antiseize compound (item 3, Appendix E) to output shaft thread and mating surfaces of pitman arm and nut (3).



4-25 STEERING SYSTEM - Continued

WARNING

The pitman arm can work loose and result in loss of vehicle steering control unless the arm is installed and secured as detailed in steps 5 thru 8.



- (5) Install and tighten nut (3) to approximately 450 ft lb (610 Nm).
- (6) Remove nut (3). Measure distance A between pitman arm and shaft shoulder as shown. Distance A should be 1/8 to 3/32 in. (3 to 4 mm). If less than 1/8 in. (3 mm), replace output shaft as detailed in b. following.
- (7) Install nut (3) and tighten to 675 ft lb (915 Nm).
- (8) Install lockwasher (2) and capscrew (1). Tighten capscrew to 15 ft lb (20 Nm).

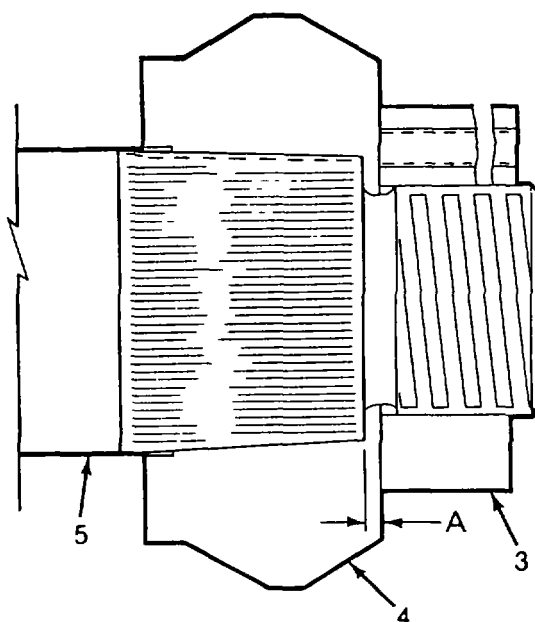
b. Output Shaft Repair.

NOTE

Steering gear removed from truck.

WARNING

To prevent a serious accident, do not weld or apply excessive heat to pitman arm or output shaft. Welding or excessive heat may lead to component failure and loss of steering control.



- (1) Remove pitman arm as detailed in a preceding.
- (2) Remove screws (1) and washers (2) attaching cover (3).
- (3) Using a soft hammer, tap on end of output shaft to loosen cover.
- (4) Carefully slide output shaft, pinion gear, and cover through housing. Pull output shaft (4) out of cover (3) and discard O-ring (5).
- (5) Inspect bearings (6 and 10) while these are still installed in gear housing (12) and cover (3). The bearings should remain installed unless damaged or defective.
- (6) If replacement of either bearing is required, use a suitable internal bearing puller to remove the defective bearing.

4-25. STEERING SYSTEM - Continued

4-25.6 Power Steering Gear - Continued

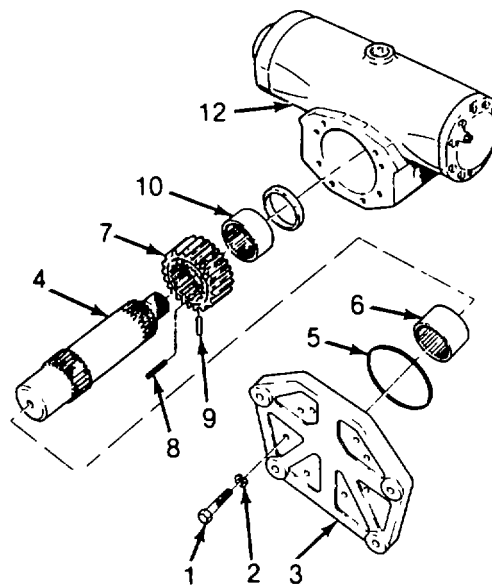
b. Output Shaft Repair - Continued

- (7) Remove quad ring (11) and discard.
- (8) Remove roll pin (8) and drill out pin (9). Press gear (7) off shaft (4).

NOTE

If pin (9) cannot be drilled out, it can be sheared off using a press capable of providing approximately 10 tons of pressure. After pin is sheared and gear and shaft are taken apart, drill remaining pin half out of shaft and drive other half out of gear.

- (9) Clean inside of gear housing using a clean, dry, lint-free cloth. Do not use liquid cleaning agents.

**WARNING**

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air, always use chip guards, eye protection, and other personal protective equipment.

- (10) Clean all reusable parts removed from steering gear using cleaning solvent (item 10, Appendix E) and blow dry using compressed air.
- (11) Inspect shaft (4) and pinion gear (7). Replace either part if damaged.
- (12) Coat new and reusable parts with lubricating oil (item 17, Appendix E) in preparation for assembly.
- (13) Press new bearings (6 and 10) in place in cover (3) and housing (12). Be sure bearings are flush with internal cover and housing surface (faces toward pinion gear).
- (14) Install new quad ring (11) in groove in housing (12). The ring may appear to be too large but will fit.
- (15) Align timing arrow on output shaft (4) with arrow on pinion gear (7) and press gear onto shaft.
- (16) Install retaining pin (9) and secure it using roll pin (8).

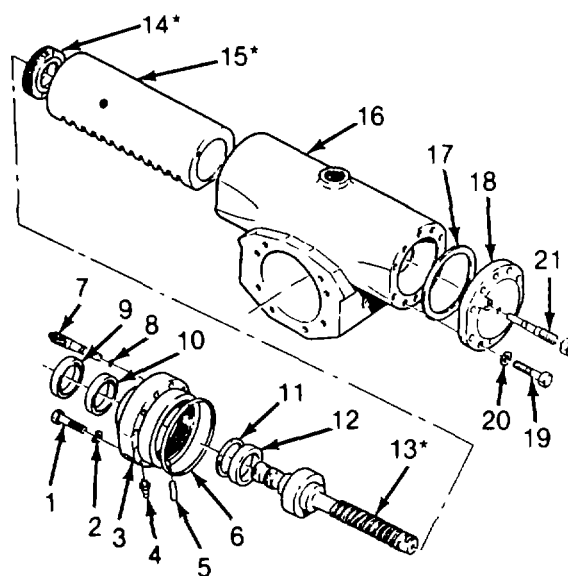
4-25 STEERING SYSTEM - Continued

- (17) Line up timing marks on pinion gear with timing mark on piston assembly in gear housing. Install output shaft and pinion gear in gear housing.
- (18) Install new O-ring (5) in groove in cover (3).
- (19) Install cover (3) on gear housing. Be careful not to damage O-ring (5). Use a soft hammer to fully seat cover against housing.
- (20) Install screws (1) and lockwashers (2). Tighten screws to 125 ft lb (170 Nm).
- (21) Install pitman arm to output shaft as detailed in a preceding.

c. Input Shaft Repair.

NOTE**Steering gear removed from truck.**

- (1) Remove pitman arm and output shaft, see a and b preceding.
- (2) Remove both relief plungers (7 and 8).
- (3) Make reference marks on bearing cap (3), cylinder head (18), and housing (16) so that steering gear can be reassembled in same configuration.
- (4) Remove screws and washers (1 and 2). Turn input shaft (13) to free bearing cap from housing (16) (5). Support bearing cap when free of housing and continue to turn shaft (13) until it is free of piston (15). Discard O-ring (6).
- (6) Remove screws and washers (19 and 20). Remove cylinder head (18) and discard seal ring (17).
- (7) Carefully slide piston (15) free of housing bore.
- (8) Using a 5/64 in. drill, drill pin (5) out of bearing cap (3) and retaining nut (14).
- (9) Using a spanner wrench, remove retaining nut (14) from bearing cap (3).
- (10) Press shaft and bearing (13) out of bearing cap. Be careful not to damage shaft or bearing if these parts are to be reused.
- (11) Remove seals (9, 10, and 12) from bearing cap and discard. Retain back-up washer (11) for reuse with new seals.



* Items not separately replaceable

4-25. STEERING SYSTEM - Continued

4-25.6 Power Steering Gear - Continued

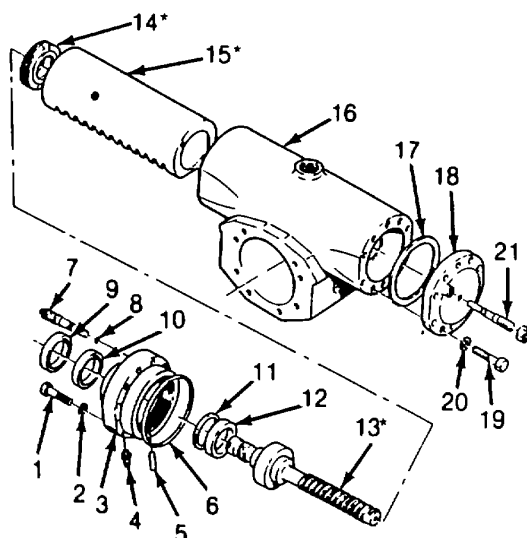
c. Input Shaft Repair - Continued

(12) Remove grease nipple (4)

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C)

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air, always use chip guards, eye protection, and other personal protective equipment.



* Items not separately replaceable

(13) Clean all parts except piston assembly (15) using cleaning solvent (item 10, Appendix E). Blow parts dry using compressed air. Clean piston assembly (15) using clean, dry, lint-free cloths or tissue paper.

(14) Inspect parts for wear and damage. If replacement of piston assembly (15), shaft and bearing assembly (13), or shaft retaining nut (14) is required, all three components must be replaced. For this purpose use Mated Kit, part no 5521921. Replace other parts individually as necessary.

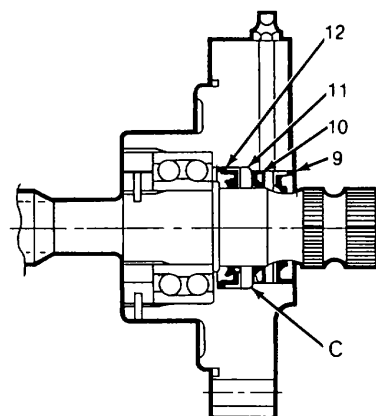
(15) Coat all components with lubricating oil (item 17, Appendix E).

(16) Install grease nipple (4) in bearing cap.

(17) Install seals (9, 10, and 12) and backing washer (11) in bearing cap. Be sure back-up washer is positioned with undercut C toward shoulder in bore. Be sure seals are positioned and oriented as shown.

NOTE

If high pressure oil seal (11), part No. 235041, is replaced with a high pressure seal, part No. 2370461, the back-up washer (11) must be discarded as the new high pressure teflon seal kit 2370461 has the back-up washer built in.



4-25 STEERING SYSTEM - Continued

- (18) Lubricate all three seals with grease (item 16, Appendix E).
- (19) Carefully install shaft and bearing assembly (13) in bearing cap and install retaining nut (14).
- (20) Tighten retaining nut until all end play between bearing and bearing cap is removed. Install new lock pin (5).
- (21) Carefully slide piston assembly (15) into gear housing.
- (22) Place a new O-ring (6) on bearing cap (3) and carefully screw shaft (13) into piston assembly.
- (23) Push bearing cap (3) into gear housing and attach using screws and washers (1 and 2). Tighten screws to 40 ft lb (55 Nm).
- (24) Place new seal ring (17) on cylinder head (18). Install head using screws and washers (19 and 20). Tighten screws to 40 ft lb (55 Nm).
- (25) Center piston assembly in housing by turning shaft. Install relief plungers (7 and 8).
- (26) Install output shaft components and pitman arm as detailed in a and b preceding.
- (27) Lubricate nipple (4) with grease (item 16, Appendix E) until grease is squeezed out between seal (9) and shaft (13).

4-25 STEERING SYSTEM - Continued.**4-25.7 Miter Box****This task covers****a. Replacement****TOOLS**

Tool Kit, General Mechanic, Automotive,
NSN 5180-00-177-7033

MATERIALS/PARTS

7524553 Miter Box
MS51922-17 Locknut

EQUIPMENT CONDITION

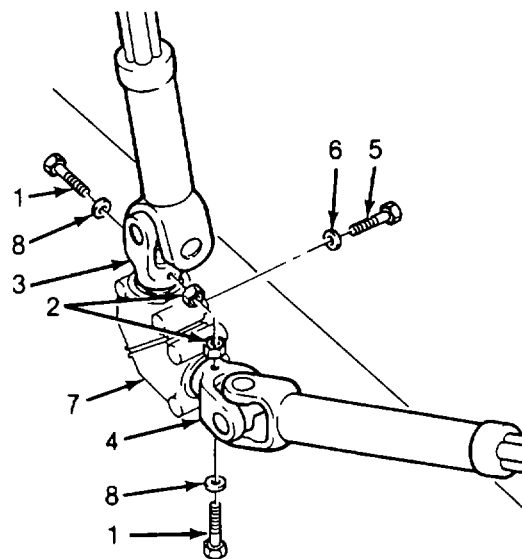
Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Battery Switch OFF

NOTE

The miter box cannot be repaired. Replace if damaged.

REPLACEMENT

- (1) Remove steering shaft cover.
- (2) Remove screws and nuts (1 and 2) and pull steering shaft yokes (3 and 4) off miter box shafts.
- (3) From underneath the truck, remove screws (5) and washers (6) attaching miter box (7) to cab. Remove miter box.
- (4) Inspect new miter box. Check that backlash in gears are barely noticeable when attempting to turn shafts counter to each other.
- (5) Install miter box using screws (5) and washers (6). Tighten screws securely.
- (6) Be sure steering shafts are phased as shown and slide yokes (3) and (4) onto miter box shaft splines. Secure using screws, washers and nuts (1, 8, and 2).
- (7) Check that steering wheel is centered when the front wheels are positioned straight ahead and pitman arm is square to steering gear axis.
- (8) Change position of yoke on steering gear shaft, if necessary, to accurately center steering wheel.
- (9) Tighten nuts (2) to 40 ft lb (55 Nm).



4-26 DRIVE LINES, POWER TRAIN**4-26.1 Front Axle to Center Bearing Drive Shaft Yoke.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
2, Appendix G Alinement Bar

MATERIALS/PARTS

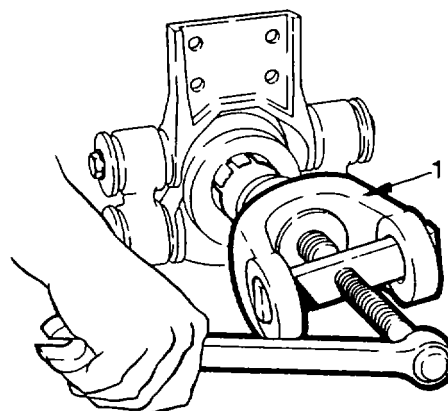
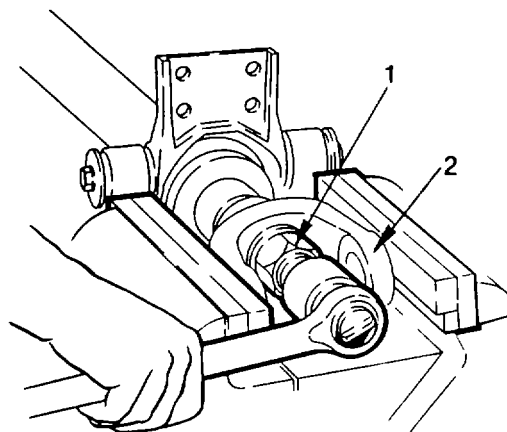
10, Appendix E Dry Cleaning Solvent
13, Appendix E Emery Cloth
6-4-4601 Yoke
231502 Shaft Locknut

EQUIPMENT CONDITION

Front Axle to Center Bearing Drive Shaft Removed
(see para. 4-26.3)

REMOVAL

- (1) Using a vise, clamp center bearing end yoke (2) allowing access to the self-locking nut (1).
- (2) Remove self-locking nut (1) and discard.
- (3) Remove the end yoke from the vise.
- (4) Support the drive shaft by lightly clamping the tube at the center bearing end of the shaft in the vise.
- (5) Using a mechanical puller, remove end yoke (2) from splined shaft. When using puller, follow tool manufacturer's recommendations.



4-26. DRIVE LINES, POWER TRAIN - Continued**INSPECTION****WARNING**

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Using dry cleaning solvent (item 10, Appendix E), clean the yokes.

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

- (2) After washing, dry the components using compressed air.
- (3) Inspect the yokes for damage Replace yoke if any damage is found.
- (4) Qualify cross hole alinement using an alinement bar (2, Appendix G)
 - Small imperfections can be removed using a hand file or emery cloth (item 13, Appendix E)
 - If the alinement bar will not pass through the cross holes, replace the yoke
 - Raised metal or a distorted yoke lug is a cause of premature universal joint failure.

INSTALLATION.

- (1) Ensure the splined shaft and the splined hole are free of dirt, corrosion or paint. Clean parts if necessary.
- (2) Install end yoke onto splined shaft. Ensure that both yokes are in matched position and install a new locknut (1).
- (3) Support end yoke (2) in a vise and tighten locknut (1) to 450 ft lb (610 Nm).

4-26. DRIVE LINES, POWER TRAIN - Continued**4-26.2 Slip Joint Yoke.****This task covers**

- a. Disassembly
- b. Inspection
- c. Assembly

TOOLS

Shop Equipment, General
 Purpose Equipment,
 FSN 4940-287-4894
 2, Appendix G Alinement Bar

MATERIALS/PARTS

10, Appendix E Dry Cleaning Solvent
 16, Appendix E Grease EP1
 20, Appendix E Penetrating Oil
 6-3-2651 KX Slip Yoke

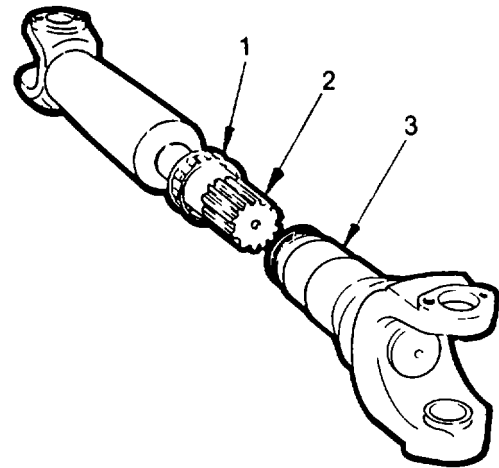
EQUIPMENT CONDITION

Appropriate Drive Shaft Removed (see para. 4-26.3)

DISASSEMBLY**NOTE**

The two slip joints used on this truck are the same. The steps described below refer to either slip joint. If components are excessively corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.

- (1) Mark slip joint before removal, this will ensure alinement of components during installation.
- (2) Use pliers to remove dust cap (1).
- (3) Separate the two shafts (2 and 3).

**INSPECTION.****WARNING**

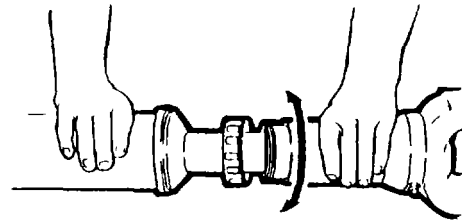
Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Using dry cleaning solvent (item 10, Appendix E), wash splined stub shaft (2), slip yoke assembly (3) and dust cap (1).

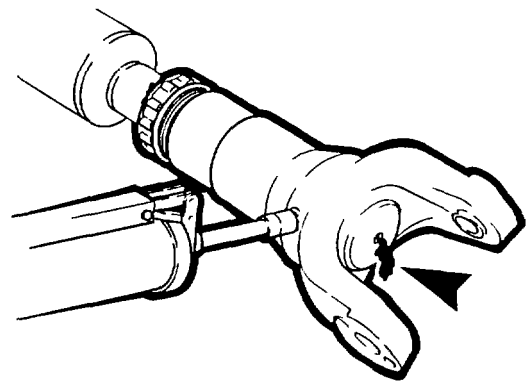
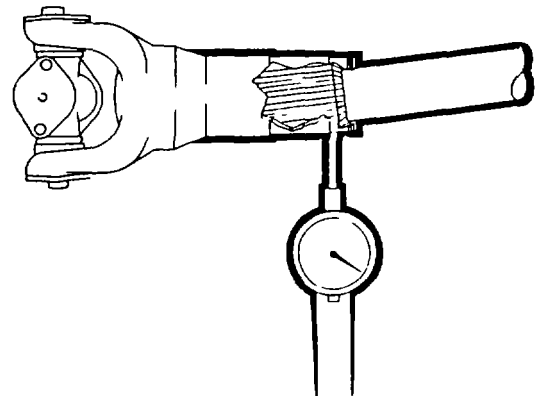
4-26. DRIVE LINES, POWER TRAIN - Continued

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.



- (2) After washing, dry the components using compressed air.
- (3) Inspect splines and threads for damage such as wear, pitting, flaking, rolling, peening and fatigue cracks.
- (4) Install slip yoke assembly on to splined stub shaft.
- (5) Using an opposing to and fro twisting motion visually check the movement between the two shafts. If play seems to be excessive, use a dial gauge to measure the movement. The movement must not exceed 0.007 in. (0.18 mm).
- (6) Inspect dust cap. If it is severely bent, or threads are stripped, replace it.
- (7) Qualify cross hole alinement, see para. 4-26.1.
- (8) Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.

**ASSEMBLY.**

- (1) Install splined stub shaft into slip yoke assembly.
- (2) Ensure that both yokes are in matched position.
- (3) Using pliers, Install and tighten dust cap.
- (4) Once assembled, lubricate the slip joint assembly until grease (item 16, Appendix E) is expelled from pressure relief hole in welch plug. Cover pressure relief hole and continue lubricating until grease appears at slip yoke dust cap (1).

4-26 DRIVE LINES, POWER TRAIN - Continued

4-26.3 Drive Shafts.

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

16, Appendix E Grease
20, Appendix E Penetrating Oil
230-323 Lockstrap
310592 Locknut

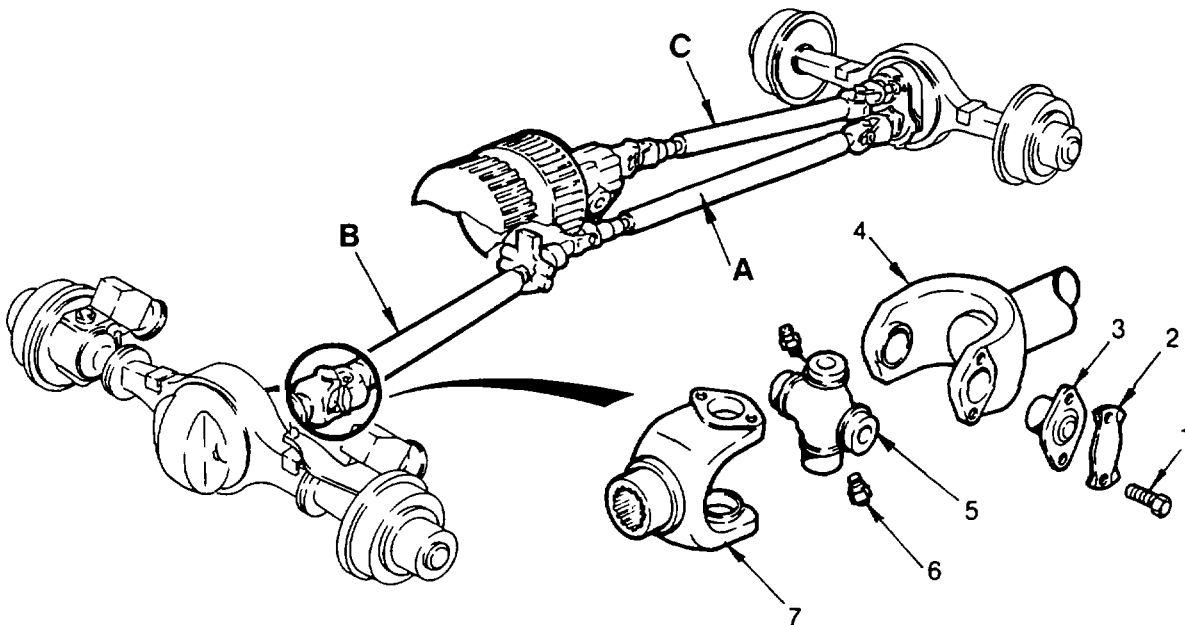
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Wheels Blocked
Heat Shields Removed (see para. 4-11)

PERSONNEL REQUIRED - 2

NOTE

During removal and installation of the drive shafts it may be necessary to raise the front or rear axle and rotate the yokes in order to access attaching hardware.



4-26. DRIVE LINES, POWER TRAIN - Continued

REMOVAL**NOTE**

Disconnect rear drive shafts and differential end of front drive shaft with the universal joint crosses attached to shaft. Disconnect front drive shaft with U-joint cross to rear drive shaft remaining attached to rear shaft.

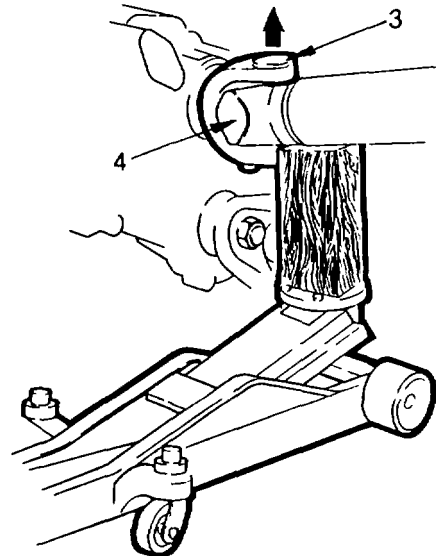
a. Drive Shaft Removal.

- (1) If the drive shaft universal joint locking screws and straps are corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.
- (2) Mark all yokes and slip joints before removal. This will ensure alignment of components during installation.
- (3) Using a hammer and chisel bend down the ears on the two lockstraps (2) attached to the yoke opposite the drive shaft to be removed (e g (7) in illustration).
- (4) Remove capscrews (1) and lockstraps (2).

CAUTION

Do not use jack method to disassemble U-joint between front and rear drive as this may cause damage to the center bearing. Unless special puller (Kent Moore J36138) is available, disconnect front and rear drive shafts at differentials and detach center bearing from frame. Disassemble drive shafts on floor where shafts, yokes, and center bearing can be supported.

- (5) Turn the yoke until the bearing plates (3) are vertically aligned. If necessary, raise the front or rear axle as detailed in para. 4-9.
- (6) Using a floor jack and a block of wood, jack the wooden block up until it contacts the drive shaft end yoke (4) as shown.
- (7) Continue to jack the block up until it forces the upper bearing plate (3) out of the yoke.
- (8) Once the upper bearing plate has been removed, lower the jack and rotate the shaft a half turn. Remove the second bearing plate similar to steps 5, 6, and 7.

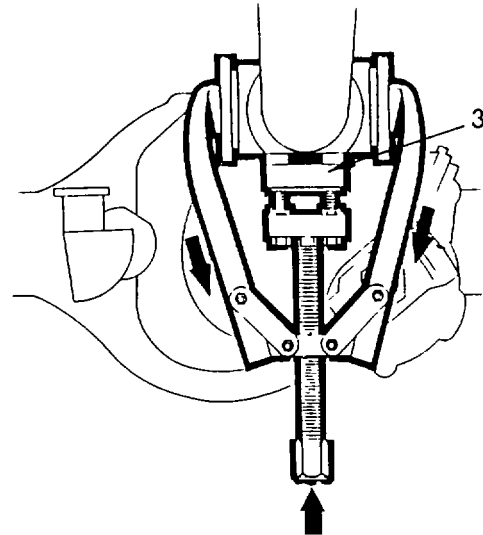


4-26. DRIVE LINES, POWER TRAIN - Continued

4-26.3 Drive Shafts - Continued

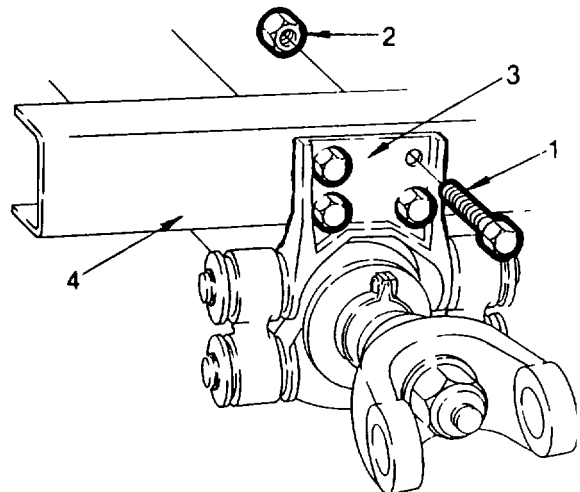
a. Drive Shaft Removal - Continued

- (9) If the bearing plates cannot be removed using the jack method, use special puller (Kent Moore J36138) to pull the bearing plates (3). Attach the puller as shown.
- (10) Support removed end of drive shaft using mechanics wire.
- (11) Remove the bearing plates from the opposite end of the drive shaft similar to steps 5 thru 9 preceding.
- (12) Carefully maneuver universal joint cross out of the end yokes. Do not use force as this can damage the bearing surfaces.



b. Center Bearing Removal.

- (1) If the center bearing fasteners are corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.
- (2) Remove four capscrews (1) and nuts (2) that retain center bearing (3) to frame cross member (4).



INSPECTION

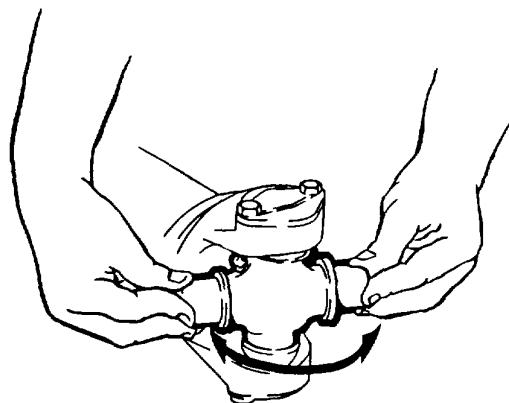
SHAFT	UNIVERSAL JOINT	SHAFT	SLIP JOINT	CENTER BEARING	TRANSMISSION MOUNTED YOKE	AXLE MOUNTED YOKE
A	X(2)	X	X			X
B	X(1)	X		X		X
C	X(2)	X	X		X	X

a. Universal Joint Inspection

- (1) Using a clean, dry, lint free cloth wipe exposed universal joint cross journals.

4-26 DRIVE LINES, POWER TRAIN - Continued

(2) Visually inspect exposed universal joint cross journals and needle bearings in bearing plates. Look for defects caused by lack of lubrication and physical damage. If corrosion, pitting, unusual wear or missing bearing needles is evident, the universal joint must be replaced. See para. 4-26.4.

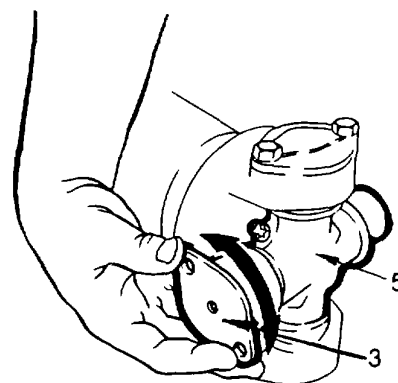


(3) Check the remaining two universal joint bearings. Grasp the universal joint cross as shown, and oscillate the cross. Binding or looseness indicates a defective bearing. If damage is evident, the universal joint must be replaced. See para. 4-26.4.

(4) Apply a small amount of grease (item 16, Appendix E) to needle bearings of removed bearing plates.

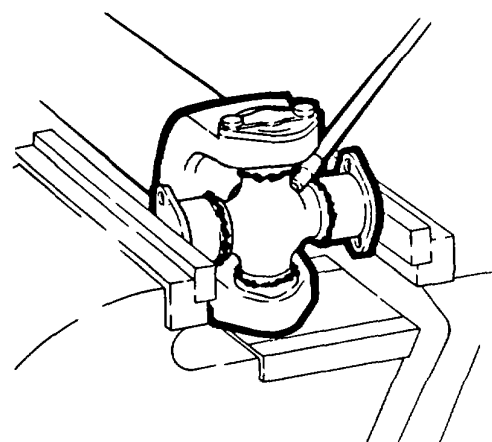
(5) Install the bearing plates (3) to the universal joint cross (5).

(6) Turn and test each bearing plate on the cross journals as shown. The movement must be smooth and resistance free.



(7) Install universal joint in a vise so the loose bearing plates are clamped to the cross. Using a grease gun, lubricate the universal joint until grease (item 16, Appendix E) is expelled from all four bearing plates. If grease nipple is blocked, remove and replace.

(8) Remove universal joint from vise and temporarily tape or wire bearing plates to cross.



b. Shaft inspection (1). Visually inspect drive shafts for dents, excessive corrosion, cracked welds, or missing balance weights.

(2) Inspect yokes, see para. 4-26.1.

(3) If a drive shaft is damaged it should be replaced along with the universal joints.

4-26 DRIVE LINES, POWER TRAIN - Continued**4-26.3 Drive Shafts - Continued**

c. Slip Joint Inspection

NOTE

The slip joint can be inspected with the drive shafts mounted in the truck.

- (1) Using an opposing to and fro twisting motion, look for excessive movement between the two shaft halves. If play appears excessive use a dial gage to measure the movement. Movement must not exceed 0.007 in. (0.18 mm). Evidence of damage of any kind is cause for rejection. Replace component or assembly as required.
- (2) Using a hand grease gun, lubricate the slip joint until grease (item 16, Appendix E) is expelled from pressure relief hole in welch plug. Cover pressure relief hole and continue lubricating until grease appears at slip yoke dust cap.

d. Center Bearing Inspection

- (1) Remove the front axle to center bearing drive shaft as described in para. 4-26.3.
- (2) Support drive shaft tube in a vise.
- (3) Rotate center bearing bracket. If binding or grinding is observed refer to Center Bearing Repair, see para. 4-26.5.

e. Axle and Transmission Yoke Inspection

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Using dry cleaning solvent (item 10, Appendix E), clean the yokes.

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

- (2) After washing, dry the yokes using compressed air.
- (3) Inspect yokes see para. 4-26.1.

4-26. DRIVE LINES, POWER TRAIN - Continued

- (4) Check attachment of yokes to shafts. No play or wobble must be evident.
- (5) Report any damage to Direct Support Level for repairs.

INSTALLATION

a. Drive Shaft Installation

CAUTION

Ensure that the universal joint bearings stay clean. Contamination induced in bearings will severely cut the service life of the universal joints.

During installation, damage to universal joint may occur if cross binds on needle bearings. When tightening the bearing plates, oscillate the universal joint cross and stop tightening capscrews at the first sign of resistance.

NOTE

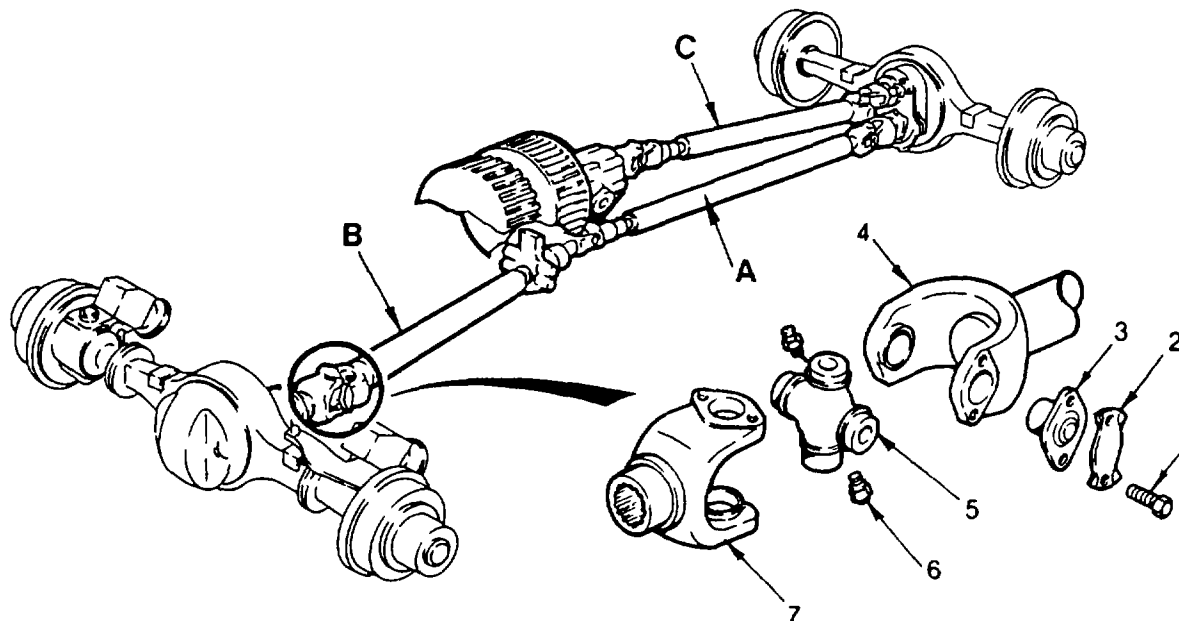
The front drive shaft (B) and center bearing must always be fully installed before rear drive shaft (A) is installed.

- (1) Remove tape or wire retaining bearing plates and remove these from cross that is to be installed.
- (2) Support end of the drive shaft being installed using mechanics wire.

4-26. DRIVE LINES, POWER TRAIN - Continued

4-26.3 Drive Shafts - Continued

a. Drive Shaft Installation - Continued.

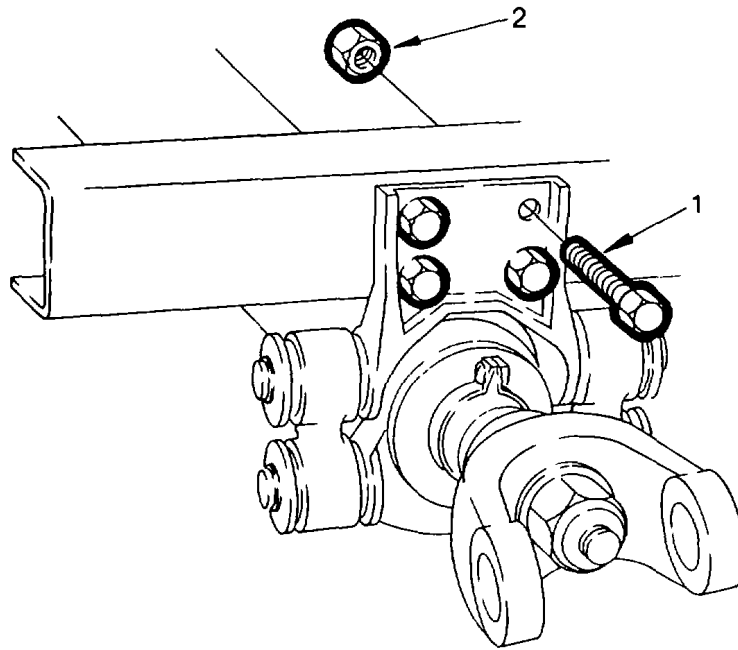


- (3) Maneuver the universal joint (5) into yoke so that cross journals are positioned in yoke lugs (6).
- (4) Install bearing plate (3). Push journal of cross (5) through the yoke lugs (6) and into needle bearing in bearing plate.
- (5) While supporting the cross, to prevent separation of cross and bearing, use a hammer, and with the cross aligned, lightly tap bearing plate (3) until it is completely installed.
- (6) Install lockstrap and finger tighten both cap screws.
- (7) Rotate drive shaft and yoke one half turn to facilitate installation of the second bearing plate.
- (8) Carefully install bearing plate onto the opposite arm of the cross.
- (9) Install lockstrap and finger tighten both cap screws.
- (10) Repeat step 1 at other end of drive shaft.
- (11) Install the second universal joint. Repeat procedure detailed in step 3 thru 9.
- (12) Tighten all cap screws (1) to 40 ft lb (54 Nm).
- (13) Secure cap screws by bending up jockstrap tabs.

4-26. DRIVE LINES, POWER TRAIN - Continued

b. Center Bearing Installation

- (1) Raise center bearing end of drive shaft and align bearing with mounting holes in frame cross member
- (2) Install capscrews (1) and nuts (2). Tighten nuts finger tight. With all four screws and nuts in place, tighten nuts to 85 ft lb (115 Nm)



4-26 DRIVE LINES, POWER TRAIN - Continued**4-26.4 Universal Joint.****This task covers**

- a. Disassembly
- b. Inspection
- c. Assembly

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

20, Appendix E Penetrating Oil
5-280X Cross and Kit

EQUIPMENT CONDITION

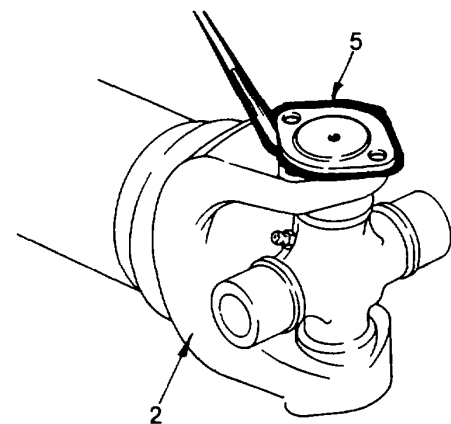
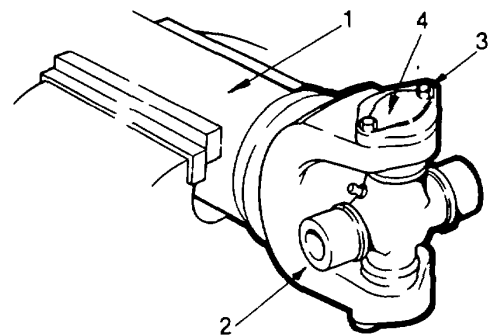
Drive Shaft Removed From Truck (see para. 4-26.3)

DISASSEMBLY**NOTE**

The universal joints used in the truck drive line are all the same. The steps below describing the disassembly, inspection, and assembly procedures are common to all joints.

If the drive shaft fasteners are corroded, apply penetrating oil (item 20, Appendix E) to ease disassembly.

- (1) Support the drive shaft (1) in a vise.
- (2) Using a hammer and chisel bend down the ears on lockstrap (4).
- (3) Remove capscrews (3), and remove the lockstrap (4).
- (4) Rotate bearing plate (5) about 1/4 turn and, using a hammer and chisel, partially separate bearing plate (5) from yoke (2) as shown.
- (5) Using a pry bar on each side of the bearing plate.
- (5) pry on the plate until it is removed from the yoke (2).
- (6) Repeat steps 3, 4 and 5 on the opposite bearing plate. If the bearing cannot be removed by this method, use special puller (Kent Moore J36138) to pull the bearing plate, see para. 4-26.3. When using pullers, follow tool manufacturer's recommendations.
- (7) Carefully maneuver the cross out of the yoke.



4-26. DRIVE LINES, POWER TRAIN - Continued**INSPECTION**

- (1) Visually inspect exposed universal joint cross journals and needle bearings in bearing plates. Look for defects caused by lack of lubrication and physical damage. If corrosion, pitting, universal wear or missing bearing needles is evident, the universal joint must be replaced.

WARNING

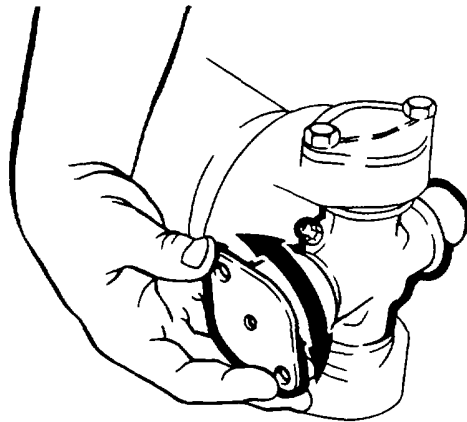
Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (2) Using dry cleaning solvent (item 10, Appendix E) and a brush, wash universal joint crosses and yokes. Do not attempt to disassemble or wash bearing plates.

WARNING

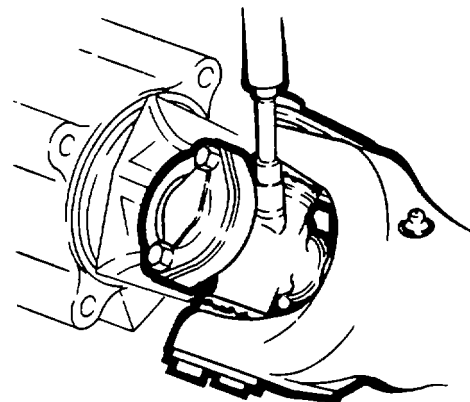
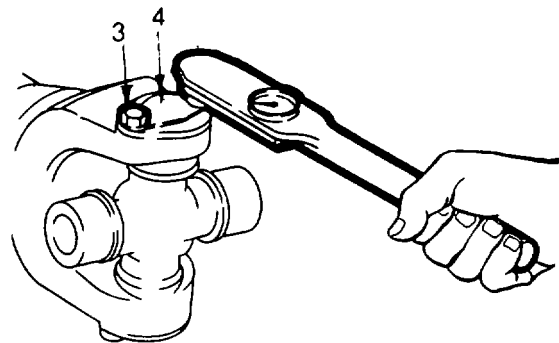
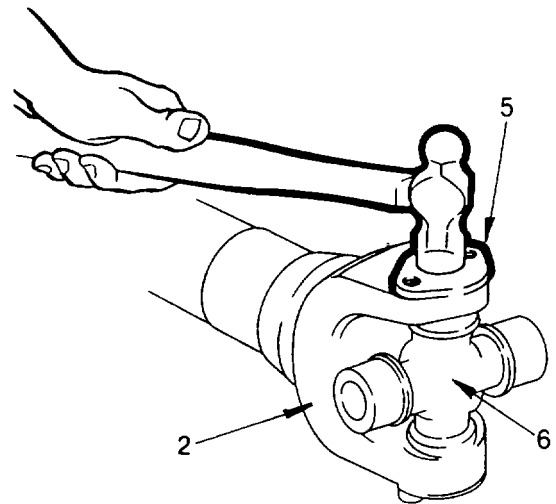
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- (3) After washing, dry the components using compressed air.
- (4) Apply a small amount of grease (16, Appendix E) to each bearing plate needle bearing.
- (5) Install and test needle bearings on cross journals as shown. The movement must be smooth and resistance free.
- (6) If any component is failing, the complete universal joint must be replaced.
- (7) Inspect yoke as described in para. 4-26.1.



4-26. DRIVE LINES, POWER TRAIN - Continued**4-26.4 Universal Joint - Continued****ASSEMBLY**

- (1) Install the cross in yoke so that cross journals are positioned in yoke lugs. Grease fitting in cross must be towards shaft.
- (2) Install the bearing plate (5). Push journal of cross (6) through the yoke lugs and into needle bearing in bearing plate.
- (3) While supporting the cross to prevent separation of cross and bearing, use a hammer to lightly tap bearing plate (5) into place in the yoke (2).
- (4) Install lockstrap (4) and capscrews (3). Fingertighten capscrews.
- (5) Rotate drive shaft yoke to facilitate installation of the second bearing plate.
- (6) Carefully install bearing plate onto opposite side of the cross similar to procedure in steps 2 thru 4.
- (7) Tighten capscrews to 40 ft lb (54 Nm). While tightening, move cross back and forth to ensure that it does not bind in the needle bearings.
- (8) Using a hammer and chisel, bend up the lockstrap ears to secure capscrews.
- (9) Install drive shaft see para. 4-26.3.
- (10) When all bearing plates are installed and drive shaft is in place, lubricate the universal joints until grease (item 16, Appendix E) is expelled from all four bearing plate seals.



4-26. DRIVE LINES, POWER TRAIN - Continued

4-26.5 Center Bearing.

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

10, Appendix E Dry Cleaning Solvent
13, Appendix E Emery Cloth
231502 Locknut
310592 Locknut

EQUIPMENT CONDITION

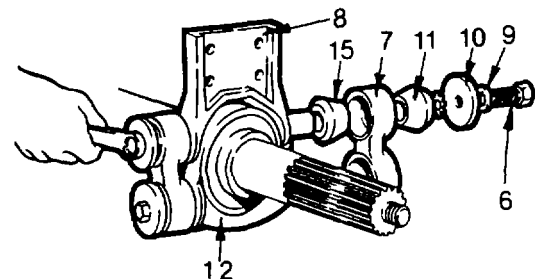
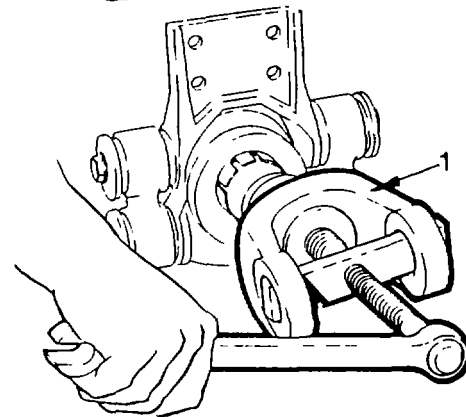
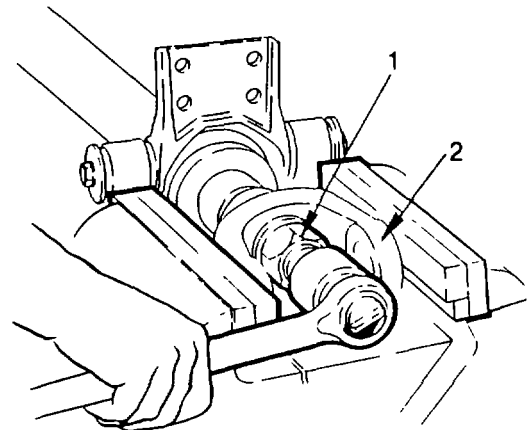
Front Drive Shaft Removed (see para. 4-26.3)

REMOVAL

NOTE

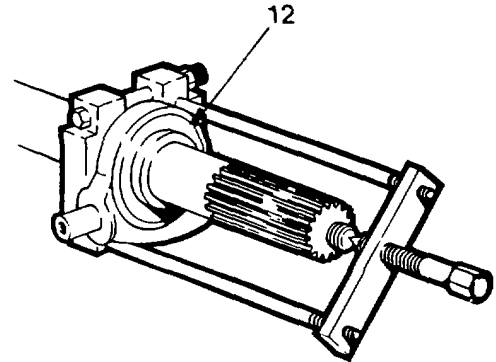
This truck uses one center bearing for support of the drive shafts between the front and rear axles.

- (1) Using a vise, clamp center bearing end yoke (2) allowing access to the self-locking nut (1).
- (2) Remove the self-locking nut (1) and discard.
- (3) Remove center bearing end yoke from the vise.
- (4) Using a mechanical puller, as required, remove end yoke (2) from drive shaft.
- (5) Pull whole bearing assembly (3) off shaft. If assembly is tight disassemble bearing on shaft as detailed following. Otherwise disassemble with bearing off shaft.
- (6) Remove the snap rings (4) retaining the outer covers (5) in place. Slide outer cover from end of shaft. Slide the inner cover away from bearing.
- (7) Remove the four capscrews (6), internal tooth washers (9), flat washers (10), and external tooth washers (11).
- (8) Holding the bracket (8), remove the four bushings (14). Carefully remove the connecting links (7) that attach the bracket (8) to the housing (12).
- (9) Remove the bushings (15) from the bracket (8) and the housing (12).



4-26 DRIVE LINES, POWER TRAIN - Continued

- (10) Using a mechanical puller and bearing separator, as required, remove the center bearing and housing assembly (12) from the shaft. Slide inner cover off shaft.
- (11) Place bearing and assembly housing (12) in a vise.
- (12) Wipe grease from bearing to access snap rings retaining bearing.
- (13) Using two screwdrivers or suitable tools remove the bearing retaining snap rings from the housing.
- (14) Set bearing and housing assembly up in a press if required, and remove the bearing from the housing (12). Discard the bearing.



INSPECTION

WARNING

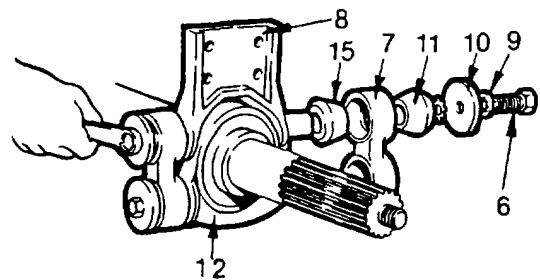
Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Using dry cleaning solvent (item 10, Appendix E), wash all components of center bearing except for the rubber bushings (14 and 15).

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personnel protective equipment.

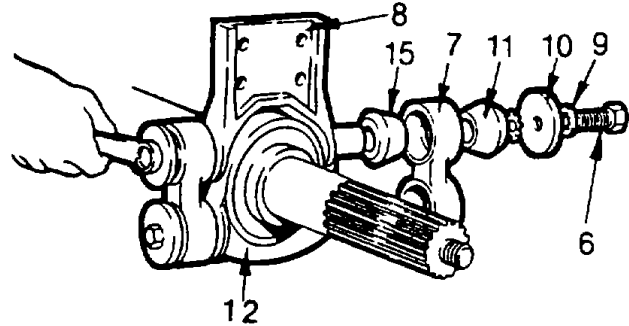
- (2) After washing, dry the components using compressed air.



4-26 DRIVE LINES, POWER TRAIN - Continued**4-26.5 Center Bearing - Continued**

(3) Wipe bushings (14 and 15) with a clean and dry lint free cloth.

(4) Check splined shaft journal area, splined section, and threaded section for damage and defects. Remove small burrs using emery cloth (item 13, Appendix E). Use a new bearing to check shaft. Bearing must slide onto shaft easily.



(5) Inspect the housing (12) and bracket (8) for cracks, oversized mounting holes, damaged threads or abnormal wear.

(6) Using a new bearing (16), check bore in housing. If the outer race can spin freely when installed in the housing, the housing should be replaced. If the bearing is too tight the housing may have burrs or irregularities. Remove with emery cloth (item 13, Appendix E).

(7) Inspect connecting links (7) for cracks, or wear.

(8) Inspect connecting link bushings (14 and 15) for cracking, wearing or deterioration.

(9) Inspect connecting link fasteners for damaged threads, and inspect washer (9, 10, and 11) for rust or cracks.

(10) Inspect bearing covers for rust, dents, or cracks.

(11) Evidence of damage of any kind is cause for rejection. Replace assembly as required.

INSTALLATION

(1) If a new bearing assembly is being installed proceed to step 15. If a new bearing is being used, rebuild bearing prior to installation as detailed following.

(2) Install one inner snap ring (13) into housing (12).

(3) Apply grease (item 16, Appendix E) to outer race of bearing.

(4) Press bearing (16) into the housing (12) until it contacts the snap ring.

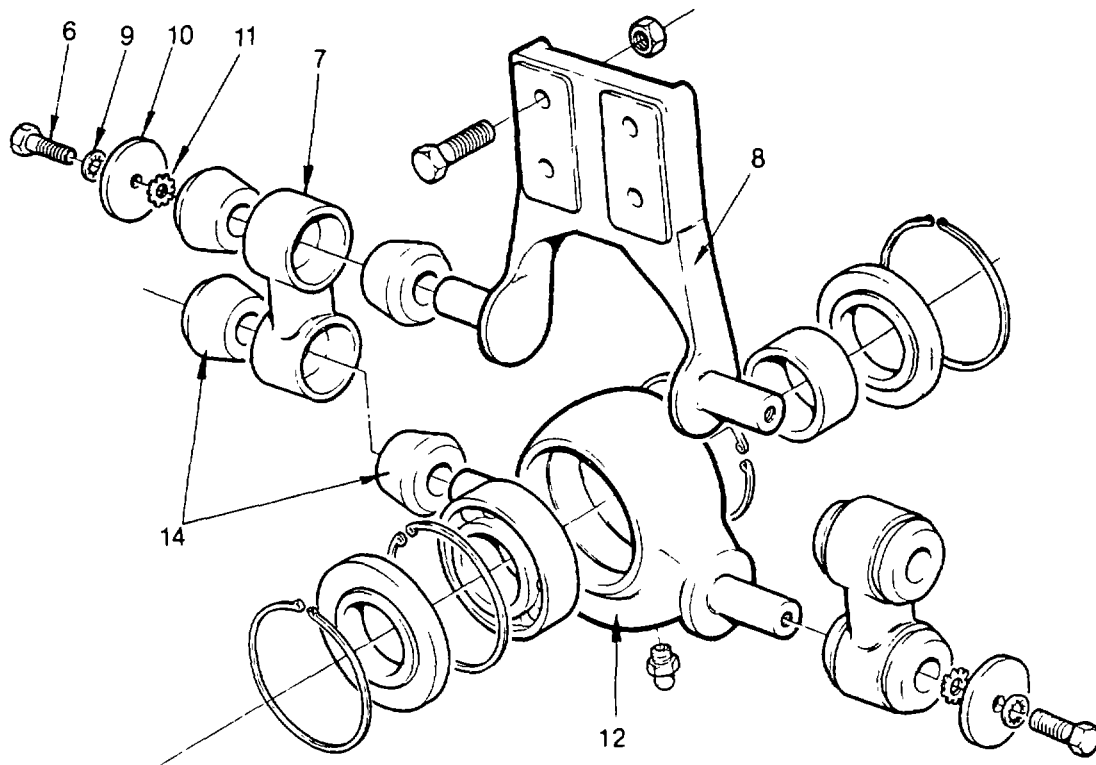
(5) Install the remaining inner snap ring (13) in housing (12).

(6) Install the bearing covers (17) into the housing and retain with the outer snap ring (13).

(7) Install the bushings (15) on the bracket (8) and on the housing (12).

(8) Grasp bracket (8) and support over the housing (12).

4-26. DRIVE LINES, POWER TRAIN - Continued



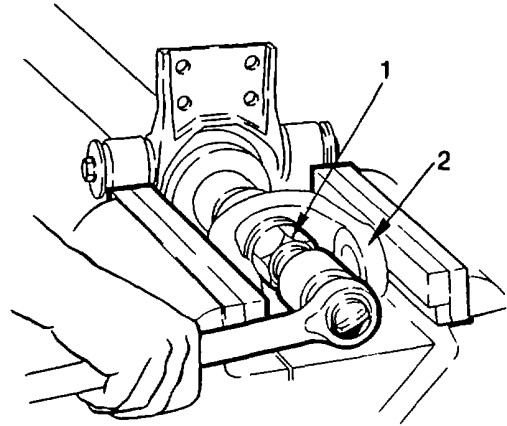
- (9) Install one connecting link (7) joining the housing (12) and the bracket (8) together.
- (10) Install the bushings (14) into the connecting link (7).
- (11) Install external tooth washers (11), flatwashers (10), internal tooth washers (9) and capscrews (6). Fingertighten capscrews (6).
- (12) Install second connecting link (7) similar to steps 10 and 11 preceding.
- (13) Support drive shaft tube in a vise. Tighten the housing capscrews to 70 ft lb (95 Nm).
- (14) Remove the drive shaft tube from the vise and reclamp the vise on the bracket (8). Tighten bracket capscrews to 70 ft lb (95 Nm).
- (15) Coat the splined area of the shaft back to the bearing shoulder with antiseize compound (item 3, Appendix E).
- (16) Supporting the drive shaft in a vise, slide the bearing assembly onto the shaft with the machined surface of the bracket facing away from the splined section of the drive shaft.

NOTE

Shaft and bearing tolerances are close, ensure bearing is square to the shaft during installation. A soft faced hammer may be used to tap the bearing into position. If bearing will not slide easily, remove any burrs from shaft or bearing.

4-26 DRIVE LINES, POWER TRAIN - Continued**4-26.5 Center Bearing - Continued**

- (17) Install end yoke onto the splined shaft so that the yokes are in matched position.
- (18) Install a new locknut (1) onto the splined shaft.
- (19) Supporting end yoke (2) in a vise, torque locknut to 450 ft lb (610 Nm).
- (20) Once assembled, lubricate the center bearing until grease (item 16, Appendix E) is expelled from covers.
- (21) Install drive shafts, see para. 4-26.3.



4-27. TRANSMISSION**4-27.1 Transmission Cooling and Filtration System**

This task covers Replacement

TOOLS

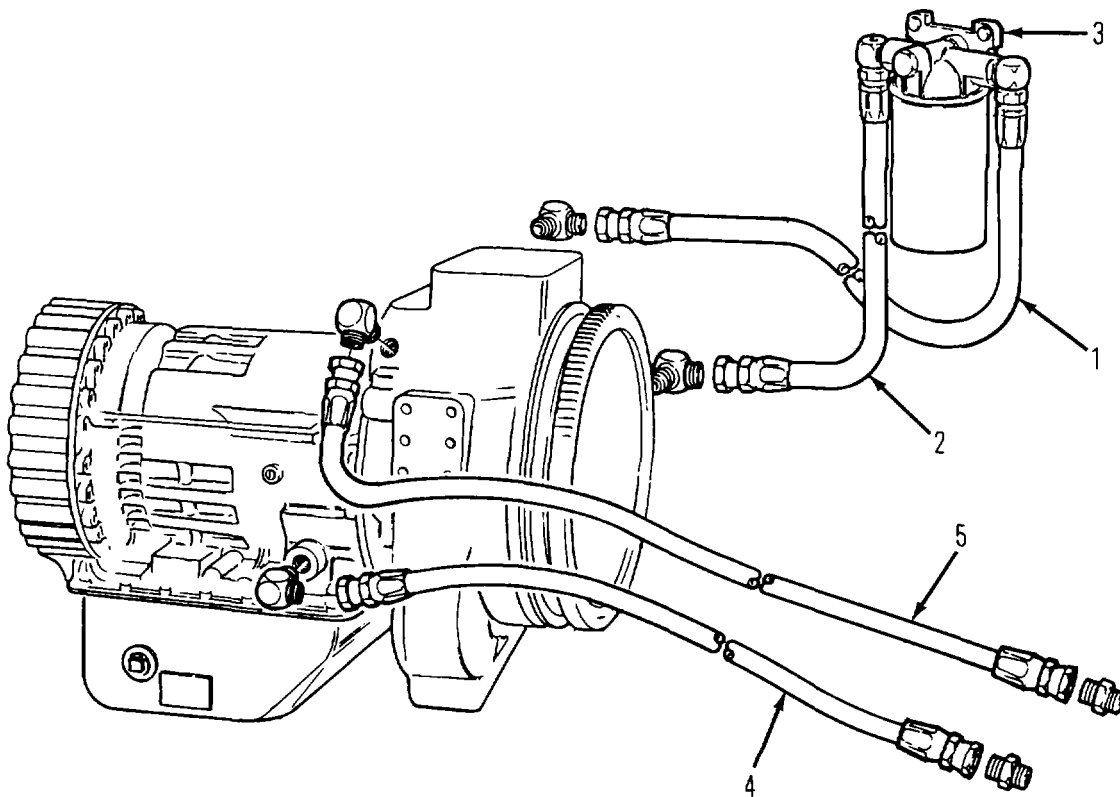
Tool Kit, Master Mechanic,
NSN 5180-00-699-5273

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
A.P.U Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Cab and Pump Body Heat Shields Removed
(see para. 4-11)

MATERIALS/PARTS

9, Appendix E Dexron II
25, Appendix E Pipe Sealant
FC-300-16 Hose
190261-16S Elbow Swivel
411-165 Connector Swivel
2021T-16-12S Connector, Hose-NPT
2062T-16-16S Elbow, O-ring
102293 Elbow, O-ring
102294 Elbow, O-ring
25010643 Filter

**REPLACEMENT**

- (1) Place suitable containers underneath transmission to drain oil from hoses and transmission. If complete oil change is necessary, remove transmission pan and torque converter plug.
- (2) Tag and remove oil filter hoses (1 and 2) from filter base (3) and transmission. Place on clean workbench area for complete cleaning and inspection.

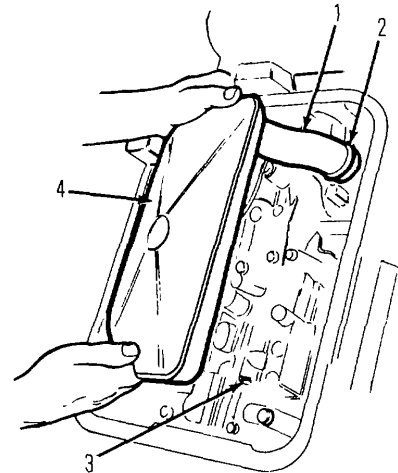
4-27. TRANSMISSION - Continued

- (3) Remove filter cartridge and discard.
- (4) Remove elbow fittings on filter base or transmission if fittings or O-rings are damaged.
- (5) Tag and remove hoses (4 and 5) to and from radiator cooler exchanger.
- (6) Place hoses on clean workbench area for complete cleaning and inspection.
- (7) If any hose was leaking or is found to be faulty during inspection refer to para. 4-9 to manufacture new hose.

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (8) If original hoses are to be reused, flush hoses thoroughly with dry cleaning solvent (item 10, Appendix E) before installing.
- (9) Install filter and cooling hoses. Ensure there are no kinks or twists in hose assemblies. Be sure they are at least 1 in. (2.5 cm) away from any moving or hot parts.
- (10) Lubricate filter seal ring with transmission oil (item 9, Appendix E) and install new filter cartridge. Tighten filter 3/4 turn after filter seal contacts its seat.
- (11) If transmission internal suction screen is to be inspected and cleaned, remove 23 bolts that retain oil pan to transmission housing. Discard pan gasket.
- (12) Remove suction screen retaining bolt, washer, and spacer. Inspect screen (4) for damage. Replace or wash filter screen assembly.
- (13) Install new seal ring (2) on intake pipe (1). Secure filter assembly. Remove, clean, and reinstall governor feed line screen (3) in valve body.
- (14) A sealer or cement (item 6, Appendix E) may be applied to the pan flange area that is outside the raised bead of the flange. Place new oil pan gasket onto the oil pan.
- (15) Install oil pan and gasket to transmission. Tighten screws to 13 ft lb (18 Nm).
- (16) Pour in approximately 55 qt (52 L) of new Dexron II (item 9, Appendix E). If during oil level check procedure, inconsistent dipstick readings occur, look for improper venting of transmission breather. Always check oil level on dipstick at least twice.



4-27. TRANSMISSION - Continued**4-27.1 Transmission Cooling and Filtration System - Continued**

- (17) Add required oil to bring oil level to full COLD RUN band on dipstick. Do not overfill transmission. Excessive oil causes overheating.
- (18) Check oil while the vehicle is on level ground and the parking brake applied. Start engine and shift the transmission through all drive ranges to fill the clutch cavities and oil passages. Shift to neutral. Allow oil to reach normal operating temperature.
- (19) Check transmission oil level is in the HOT RUN band. Top up as required.

4-522/(4-523 Blank)

4-27. TRANSMISSION - Continued

4-27.2 Transmission and Flexplate.

This task covers Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705
J22582 Engine Barring Tool
4, Appendix G Engine Support Plate

Wires Disconnected (see para. 4-17.10)
PTO Drive Gearbox and Drive Shaft Removed
(see para. 4-17.1)
Starter Motor Removed (see para. 4-24.2)
Transmission Cooler and Filtration Hoses Removed
(see para. 4-27.1)
Engine Air Compressor Removed (see para. 4-28.3)

EQUIPMENT CONDITION

All Truck Auxiliary Equipment Removed
Water Tank Drained
Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
All Heat Shields Removed (see para. 4-11)
Transmission Shift Disconnected (see para. 4-12.6)
All Drive lines Removed (see para. 4-26.3)
Speedometer and Other Sender

MATERIALS/PARTS

4, Appendix E Antiseize Compound
14, Appendix E Gasket Eliminator
310591 Locknut
310592 Locknut
6885601 Transmission
6882610 Flexplate Assembly

PERSONNEL REQUIRED - 2

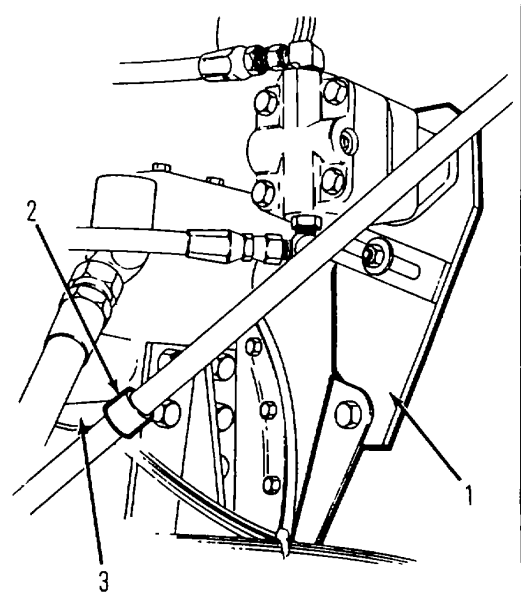
NOTE

To allow transmission to be rolled out from under truck, clearance between pump body and floor must be 32 in. (810 mm) plus the collapsed height of the transmission lifting stand being used. Calculate height necessary to raise truck to enable transmission removal and installation. Approximate weight of vehicle could be in excess of 22,000 lb (10,000 kg).

If appropriate truck hoist is available, use as required. If truck hoist is not available, truck can be driven up on ramps of necessary height or truck may be jacked up front and rear and safety stands of adequate height and strength placed under front and rear axles.

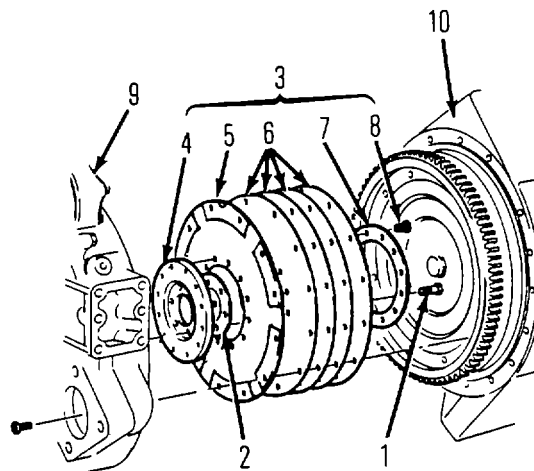
REPLACEMENT

- (1) Remove center bearing cross member frame assembly
- (2) Be sure transmission and torque converter are drained of oil
- (3) Remove oil level dipstick upper support (2) and bracket (3) from transmission housing
- (4) Disconnect lower end of dipstick from transmission pan. Slide dipstick assembly out from underneath truck
- (5) Using floor jack support rear of transmission, remove mounting bolts attaching transmission mounting brackets to frame brackets.



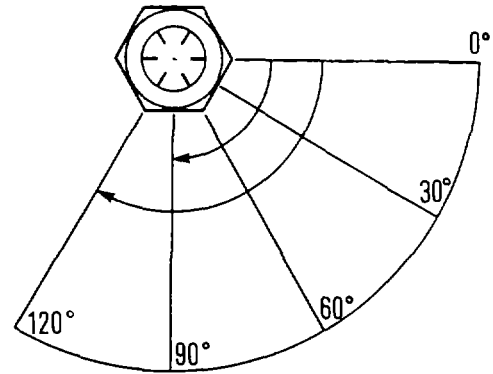
4-27. TRANSMISSION - Continued

- (6) Remove mounting bracket from transmission and mounting brackets from frame.
- (7) Remove steering pump support bracket (1) from right side of the engine. Lift steering pump and bracket out of the way and secure with mechanics wire.
- (8) Install engine support brackets (4, Appendix G) to rear side of engine pads on engine flywheel housing. Attach brackets with 5/8 - 11 X 1 1/2 in. bolts, 6 each side. Adjust bracket adjusting bolts until rear of engine is supported by frame.
- (9) Remove floor jack from transmission.
- (10) Position transmission lifting stand under transmission. Attach support brackets and safety chains. Adjust height and angle to properly support transmission.
- (11) Using removed starter mounting hole as an access hole, remove 12 bolts attaching flexplate to transmission flywheel. Barr engine with J22582 to remove flexplate bolts.
- (12) Remove inspection plate from top left hand of torque converter housing. Remove 24 bolts attaching transmission housing to engine flywheel housing, three bolts are accessed through the torque converter housing inspection plate.
- (13) Pry transmission rearward from engine flywheel housing. Continue to move transmission rearward until it can be lowered clear of engine.
- (14) Remove transmission and lifting stand from underneath truck.
- (15) Remove flexplate assembly from engine crankshaft by removing six bolts (1) and retaining plate (2). Remove flexplate assembly (3).
- (16) Remove retaining bolts (8) from hub (4).
- (17) Separate drive discs (5 and 6). Check for cracked centers or damaged exterior mounting holes. Replace any damaged plates.
- (18) Assemble flexplate hub (4), drive disc (5 and 6), retainer (7), and retaining bolts (8). Do not tighten bolts.
- (19) Apply antiseize (item 4, Appendix E) to bolts (1). Align flexplate assembly and retaining plate (2) on crankshaft and install bolts (1). Do not tighten bolts.
- (20) Align flex discs by installing two 1/2 in. nuts and bolts on outer circumference of disc assembly 180 deg. apart. Tighten to hold in position.



4-27. TRANSMISSION - Continued**4-27.2 Transmission and Flexplate**

- (21) Tighten retaining bolts (1) to 50 ft lb (68 Nm). Turn the bolts an additional 90 - 120 deg. to obtain required clamping force.
- (22) Tighten flexplate assembly bolts (8) to 115 ft lb (156 Nm).
- (23) Remove bolts installed to align flexplates.
- (24) Position transmission on transmission lift stand and push stand and transmission under truck.
- (25) Apply gasket eliminator (item 14, Appendix E) to transmission/engine flange. Raise and align transmission to engine.

**NOTE**

Installing two alignment dowels in engine flywheel housing will help during installation of transmission to engine. Dowels should be 7/16 in. - 20 X 6 in. long.

CAUTION

Do not pull transmission and engine together with flywheel housing bolts. Damage to flywheel pilot and crankshaft could result. Transmission and engine must be pushed completely together before tightening bolts.

- (26) With transmission flush and square with engine flywheel housing, install 24 bolts attaching transmission to engine.
- (27) Tighten bolts to 65 ft lb (88 Nm).
- (28) Install 12 bolts through starter hole opening, to attach flexplate to flywheel. Use engine barring tool J22582 to rotate engine and transmission to install all bolts. Tighten to 115 ft lb (156 Nm). When all bolts have been tightened remove barring tool.
- (29) Check isolators are in place and undamaged on frame brackets. Install transmission support brackets to frame. Install mounting brackets to transmission. Align transmission and frame mounting brackets using mounting bolts as guides and by raising/lowering the engine support bracket (4, Appendix G) adjusting bolts. Install snubbing washers and new locknuts and tighten to 170 ft lb (231 Nm).
- (30) Remove engine support brackets (4, Appendix G).
- (31) Install transmission dipstick to transmission pan.
- (32) Install transmission dipstick upper support and bracket to transmission.

4-27 TRANSMISSION - Continued

- (33) Install center bearing cross member assembly to frame. Install new locknuts on all bolts. Tighten 1/2 in. bolts to 90 ft lb (122 Nm), 5/8 in. bolts to 170 ft lb (231 Nm).
- (34) Install transmission hoses as detailed in para. 4-27.1.

4-527

4-28. ENGINE.**4-28.1 Old Filter**

This task covers a. Replacement
 b. Repair

TOOLS

Tool Kit, General Mechanic, Automotive,
 NSN 5180-00-177-7033

MATERIALS/PARTS

17, Appendix E Lubricating Oil
 25010495 Oil Filter
 8924896 Gasket

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 RH Engine Cover Removed (see para. 4-12.11)
 Pump Body and Front Heat Shield Removed
 (see para. 4-11)
 Turret Water Discharge Pipe Removed (see para.
 4-18.2)

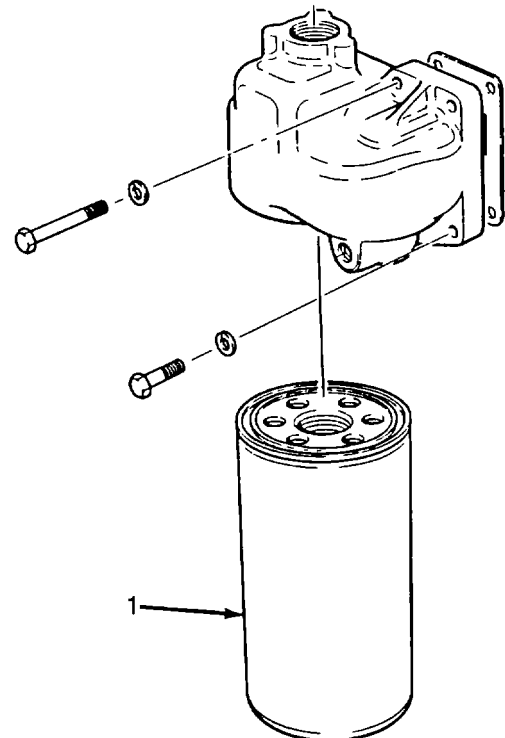
NOTE

The main engine oil filter is mounted on the front right hand of the engine.

REPLACEMENT

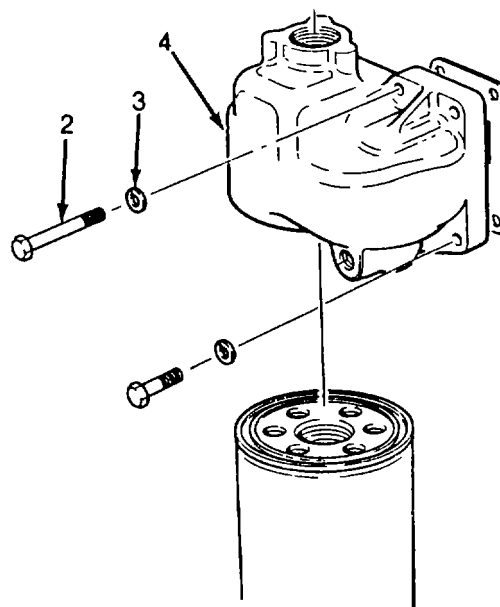
a. Filter Cartridge Replacement

- (1) Unscrew the filter (1) using a filter removal tool.
- (2) Remove from the engine and discard in a combustible waste area.
- (3) Coat the seal gasket of a new filter cartridge lightly with clean oil (item 17, Appendix E).
- (4) Install the cartridge and tighten it to one-half turn beyond gasket contact.
- (5) Check main engine oil level. Top up/replace oil as required.
- (6) Start the engine and check for leaks. Tighten the filter as required. Recheck engine oil level.



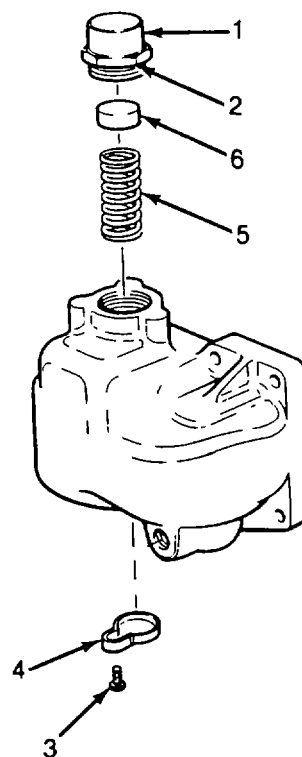
4-28 ENGINE - Continued**b. Filter Cover Replacement**

- (1) Carry out Filter Cartridge Replacement steps 1 and 2.
- (2) Remove capscrews (2) and washers (3) securing filter cover (4) to engine block.
- (3) Remove and discard old gasket (5). Be sure to remove all material from engine block.
- (4) Line up new cover and gasket with engine block mounting holes.
- (5) Attach to engine using capscrews (2) and washers (3).

**REPAIR****NOTE**

Repair to the mounting block consists of replacing the pressure relief valve.

- (1) Remove the plug (1) and gasket (2), or the screw (3) and retainer (4) and withdraw the spring (5) and bypass valve (6).
- (2) Clean and inspect the parts for wear. If necessary, install new parts.
- (3) Reassemble and install the bypass valve. Tighten the bypass valve plug to 105 ft lb (143 Nm).



4-28. ENGINE - Continued

4.28.2 Oil Cooler.

- This task covers
- a. Removal
 - b. Inspection
 - c. Installation

TOOLS

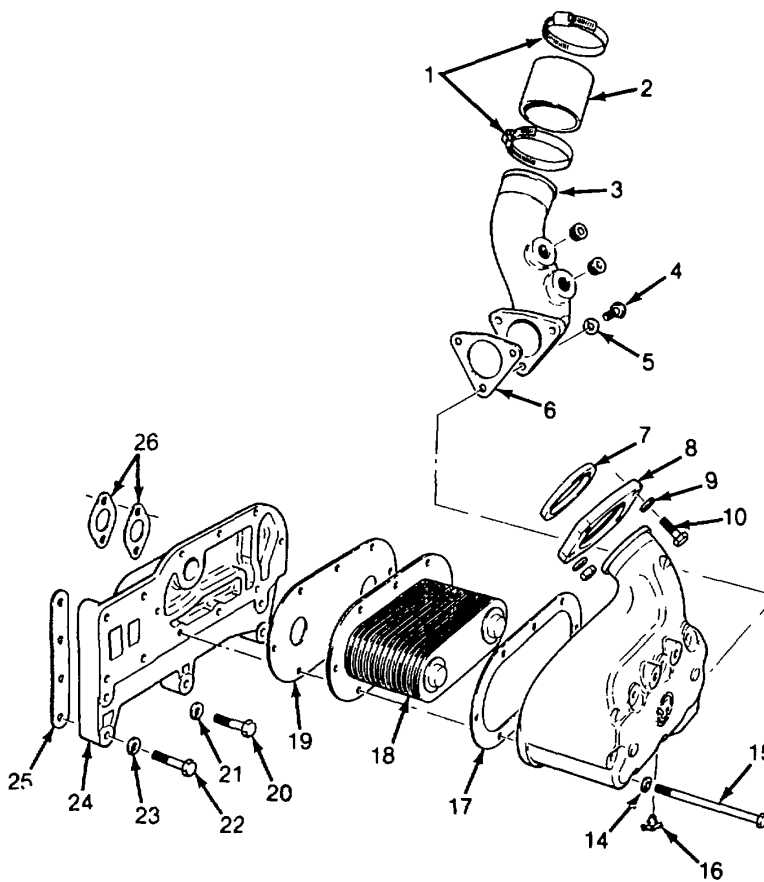
Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0650

MATERIALS/PARTS

- 5117476 Gasket
- 5125599 Seal
- 5117535 Gasket
- 89233223 Gasket
- 5150155 Gasket

EQUIPMENT CONDITION

- Main Engine Shutdown (see para. 2-10)
- APU Shutdown (see para. 2-12)
- Batteries Disconnected (see para. 4-24)
- RH Engine Cover Removed (see para. 4-12.11)
- Pump Body And Front Heat Shield Removed
(see para. 4-11)
- Turret Water Discharge Pipe Removed
(see para. 4-18.2)



4-28. ENGINE - Continued**REMOVAL**

- (1) Drain the engine cooling system by opening the draincock (16) on the bottom of the oil cooler housing.
- (2) Loosen clamps (1) and slide hose (2) down on the water inlet elbow.
- (3) Remove capscrews (4), and lockwashers (5). Remove elbow (3) and gasket (6). Discard gasket.
- (4) Remove capscrews (10), washers (9), nuts (12) and washers (11) and withdraw the water outlet flange (8) and seal (7). Discard gasket.
- (5) Remove bolts (15) and washers (14) and remove oil cooler housing (13) and core (18) as an assembly from the engine.
- (6) Remove and discard gaskets (17 and 19).
- (7) If the adapter plate (24) is to be removed, remove oil filter and mounting cover as detailed in para. 4-28.1.
- (8) Remove capscrews and lockwashers attaching plate (24) to engine.
- (9) Remove and discard gaskets (26).

INSPECTION

- (1) Clean the oil passages in the oil cooler core using either a solvent or caustic solution.
- (2) Clean the water side of the oil cooler with an acid solution. Remove from the acid as soon as the bubbling stops. Flush cooler in clean water.
- (3) Dip cooler in oil when cleaning is complete.

INSTALLATION

- (1) If the oil cooler adapter (24) was removed, use new gaskets (26) and attach the adapter to the cylinder block with bolts and lockwashers.
- (2) Affix new gaskets (17, 19) to the inner and outer faces of the cooler flange (18) and insert the oil cooler core in the oil cooler housing (13). The inlet and outlet openings in the oil cooler core are marked "IN" and "OUT". Make sure the oil cooler core is reinstalled in its original position.
- (3) Place the housing (13) and oil cooler core (18) against the adapter plate (24) and secure with bolts (15) and lockwashers (14).
- (4) Install a water outlet flange (8) and new seal (7). Secure the flange to the cylinder block with bolts (10), nuts (12) and lockwashers (9, 11).
- (5) Affix a new gasket (6) to the oil cooler housing and secure the water inlet elbow to the housing with capscrews (4) and lockwashers (5).

4-28. ENGINE - Continued**4-28.2 Oil Cooler - Continued**

- (6) Slide the water inlet elbow hose (2) in position and tighten the clamps (1).
- (7) Install oil filter and mounting cover as detailed in para. 4-28.1.
- (8) Close the draincock in oil cooler housing and fill the cooling system to the proper level.
- (9) Add sufficient oil to the crankcase to bring the oil level to the proper level on the dipstick.

(10) Start and run the engine for a short period and check for oil and water leaks. After any leaks have been corrected and the engine has been stopped long enough (approximately twenty minutes) for the oil from various parts of the engine to drain back to the crankcase, bring the oil level up to the proper level on the dipstick.

4-532/(4-533 Blank)

4-28. ENGINE - Continued

4-28.3 Air Compressor

This task covers

- a. Removal
- b. Installation
- c. Repair

TOOLS

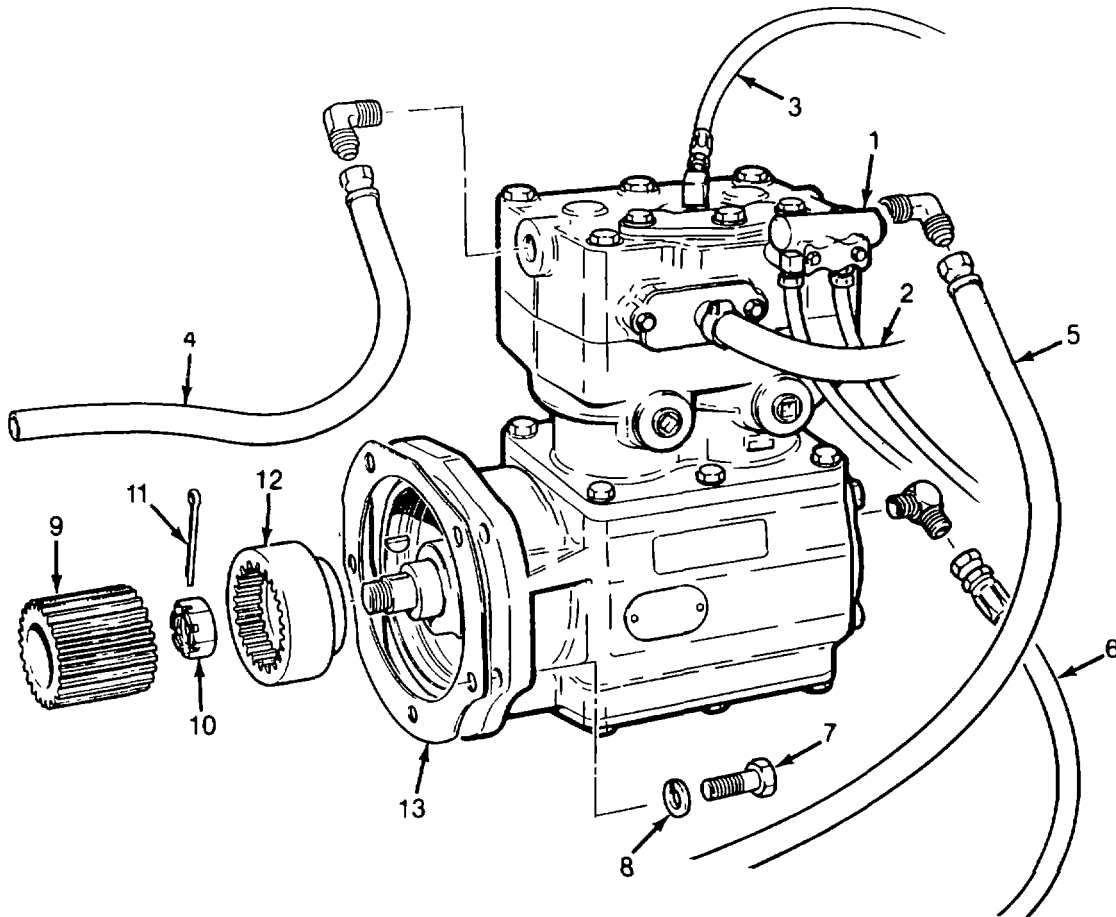
Tool Kit, Master Mechanic,
 NSN 5180-00-699-5273
 J25447A Compressor Valve Inlet Tool

MATERIALS/PARTS

16, Appendix E Grease
 17, Appendix E Engine Oil
 27, Appendix E Silicone Grease
 236577 Governor Gasket

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24.12)
 Both Engine Compartment Covers Removed
 (see para. 4-12.11)
 Engine Coolant Drained
 Wheels Blocked
 Air Tanks Drained



4-28. ENGINE - Continued**REMOVAL****NOTE**

Cap all hoses and fittings after removal to prevent contamination.

- (1) Tag and remove both air lines from the air compressor governor (1).
- (2) Tag and remove the air inlet hose (2) and high pressure hose (3) at the air compressor.
- (3) Tag and remove the air compressor coolant hoses (4 and 5).
- (4) Remove the oil pressure feed hose (6) from the air compressor crankshaft bearing cap fitting.
- (5) Loosen and remove the two capscrews that retain the fire pump governor assembly to the main engine. Tag and disconnect the water line at the fire pump governor water pressure diaphragm. This will allow temporary repositioning of the fire pump governor during air compressor removal.
- (6) Remove the capscrews (7) and lockwashers (8) that retain the air compressor to the main engine.
- (7) Carefully maneuver the air compressor from the engine compartment. Make sure not to drop the drive coupling (9). Remove the drive coupling from the drive hub (12).
- (8) Remove and discard gasket (13).

NOTE

If the air compressor is to be replaced or overhauled carry out steps 9 thru 12.

- (9) Remove the cotter pin (11).
- (10) Remove the nut (10).
- (11) Pull the air compressor drive hub (12) from the crankshaft (15). Retain the key (14) for inspection prior to assembly.
- (12) Make a sketch and remove all fittings from the compressor.

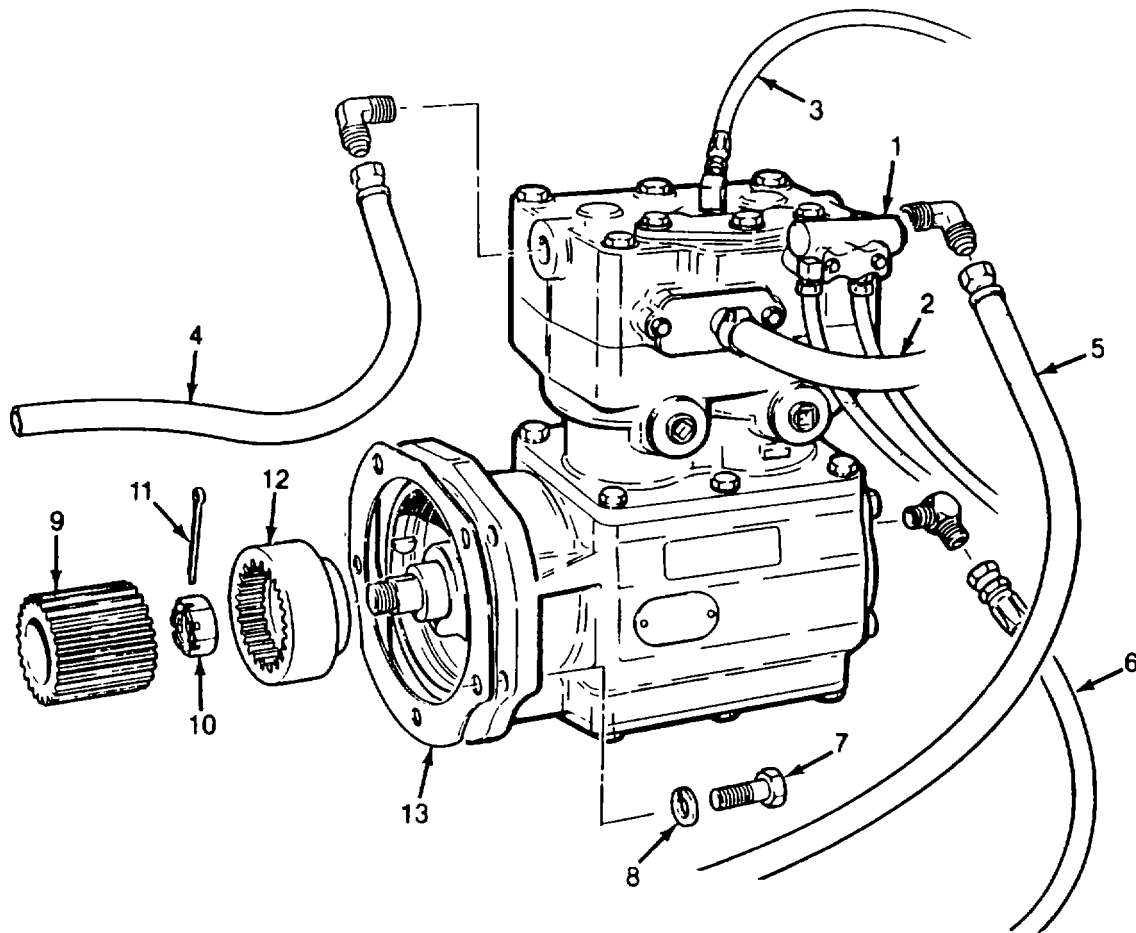
INSTALLATION**NOTE**

If air compressor has been overhauled carry out steps 1 thru 3.

- (1) Examine the key (14) for damage and replace as necessary. Install key into keyway on crankshaft (15).
- (2) Install compressor drive hub (12) onto crankshaft (15) and secure with nut (10). Torque nut to 150 ft lb (203 Nm). Install cotter pin (11) to secure nut (10).

4-28 ENGINE - Continued

4-28.3 Air Compressor - Continued



- (3) Using sketch made during removal install all pipe fittings in compressor. Coat all threads with pipe sealant, (item 23 Appendix E) prior to installation.
- (4) Coat the air compressor drive coupling (9) with grease (item 16, Appendix E) and install into compressor hub (12). The grease will help retain drive coupling during installation.
- (5) Lift the air compressor into the engine compartment.
- (6) Install gasket (13) onto compressor mounting flange.
- (7) Install air compressor onto engine and secure using lockwashers (8) and capscrews (7). Tighten capscrews to 115 ft lb (155 Nm).
- (8) Reposition the fire pump governor and secure to main engine using capscrews. Tighten capscrews to 115 ft lb (155 Nm).
- (9) Reattach water line to fire pump governor water pressure diaphragm and tighten securely.

4-28 ENGINE - Continued

- (10) Attach the oil pressure feed hose (6) to the air compressor crankshaft bearing cap fitting.
- (11) Attach the coolant hoses (4 and 5) and clamp securely.
- (12) Refill cooling system and bleed out all air.
- (13) Reconnect the truck batteries.

NOTE

If the air compressor has been overhauled inject about 5 cc of engine oil (item 17, Appendix E) into air compressor intake while the engine is running. Stop the engine when fog appears at compressor exhaust.

- (14) Install air inlet hose (2) and high pressure hose (3) to the air compressor.
- (15) Install the air lines to the air compressor governor (1).
- (16) Check the operation of the air compressor and governor. With no leaks and all tanks empty, all air tanks should reach maximum pressure of 105 - 125 psi (724 - 862 kPa) in less than 5 minutes.
- (17) During initial operation check for coolant leaks, oil leaks, noise, or overheating.
- (18) After air pressure has reached maximum, shutdown engine and check for air leaks.

REPAIR**NOTE**

Minor air compressor repairs can be completed with the unit mounted to the truck engine. Major overhaul or repairs require removal of air compressor from truck engine. Disassemble air compressor using the following procedures. The repair procedures described below refers to an air compressor that has been removed from the truck engine.

- a. Initial Cleaning

WARNING

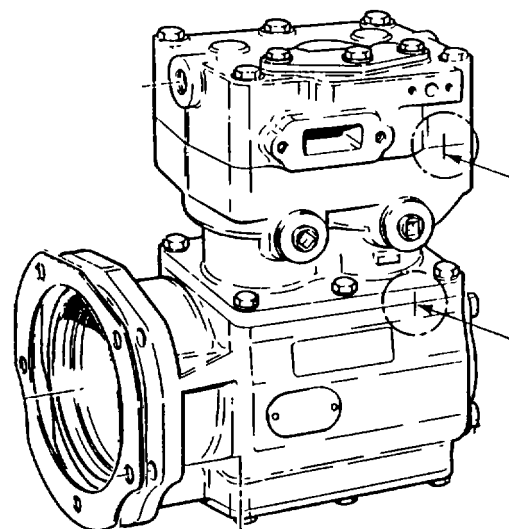
Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Prior to disassembly, clean the air compressor exterior using dry cleaning solvent (item 10, Appendix E).

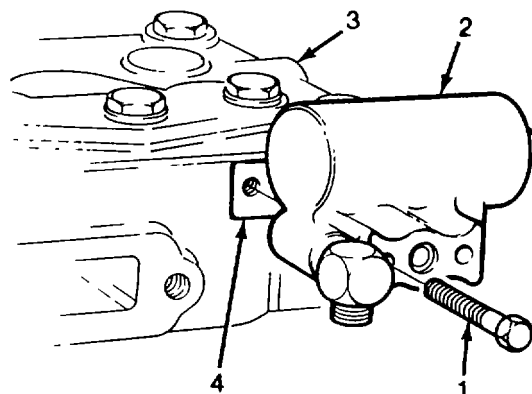
4-28 ENGINE - Continued**4-28.3 Air Compressor - Continued****WARNING**

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air, always use chip guards eye protection and other personal protection equipment.

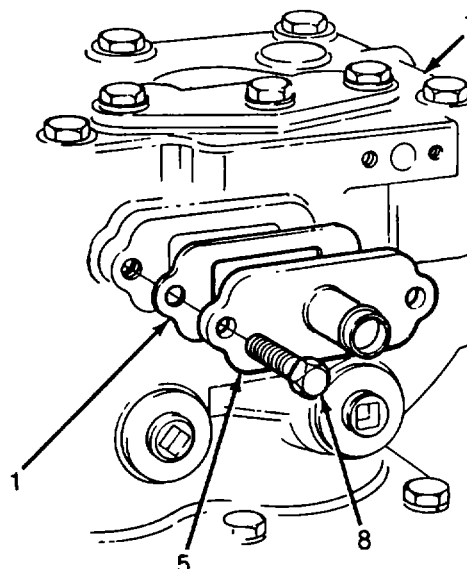
- (2) Dry the compressor exterior using compressed air.
- (3) If the compressor is going to be disassembled, mark the compressor body as shown. Aligning chalk marks will ensure proper assembly.

**b. Governor Removal**

- (1) Remove the two capscrews (1) that retain the governor (2) to the air compressor cylinder head (3).
- (2) Remove and discard governor gasket (4).

**c. Air Inlet Connection Removal**

- (1) Remove the two capscrews (8) that retain the air intake flange (5) to the air compressor cylinder head (7).
- (2) Remove and discard air intake gasket (1).



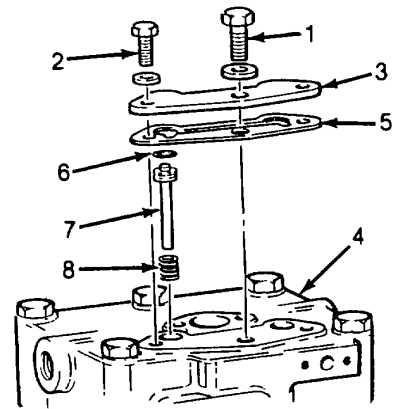
4-28. ENGINE - Continued

d. Unloader Removal

WARNING

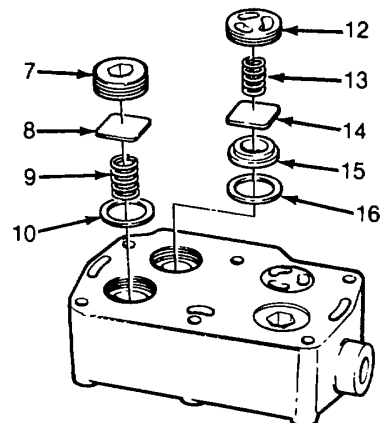
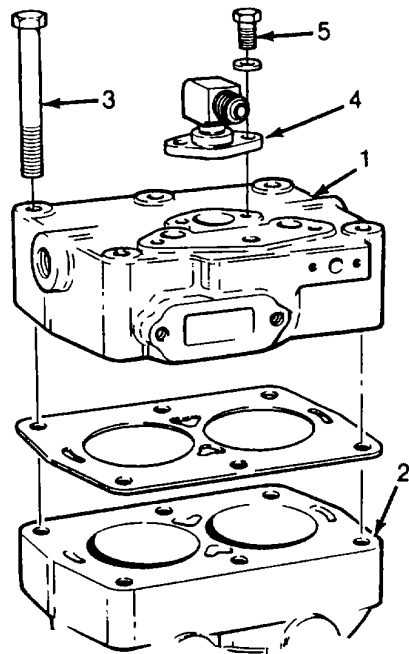
If unloader service is required with the air compressor mounted to the truck engine, drain the air tanks.

- (1) Remove two unloader cover bolts (2) and one cylinder head bolt (1), then lift the unloader cover (3) from the cylinder head (4).
- (2) Remove and discard gasket (5).
- (3) Remove unloader pins (7) and springs (8) from cylinder head (4). Remove O-rings (6) from pins (7) and discard.



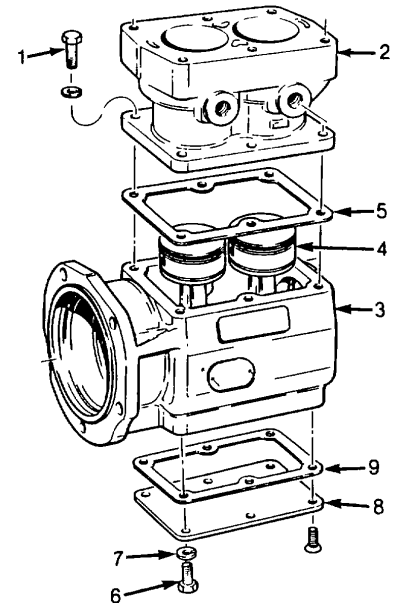
e. Cylinder Head Removal and Disassembly

- (1) With the cylinder head still mounted, remove the air pressure outlet fitting (4) from the top of the cylinder head (1), by removing capscrews (5).
- (2) To remove the cylinder head (1) from the block (2), remove the five remaining capscrews (3).
- (3) Using a soft faced hammer, gently tap the cylinder head (1) to loosen it from the block (2).
- (4) Lift cylinder head (1) from block (2).
- (5) Remove and discard the cylinder head gasket (6).
- (6) To disassemble cylinder head (1), remove unloader as detailed in d. preceding, then proceed to step 7.
- (7) Place cylinder head (1) on workbench, with bottom side up.
- (8) Using a 9/16 in. allen wrench remove the exhaust valve seat (7). Remove the exhaust valve (8), exhaust valve spring (9) and washer (10) from both exhaust valve ports.
- (9) Using a spanner wrench (or Kent Moore J25447 A) remove the inlet valve cages (12), inlet valve springs (13), inlet valves (14), inlet valve seats (15), and washers (16).



4-28. ENGINE - Continued**4-28.3 Air Compressor - Continued****f. Cylinder Block Removal**

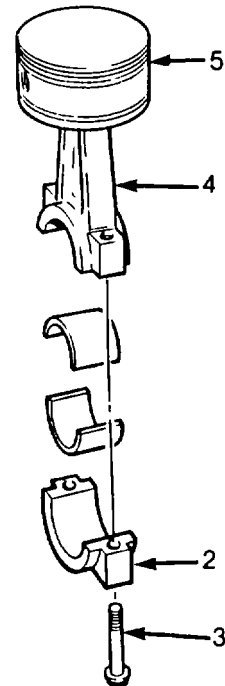
- (1) Remove the six capscrews (1) that retain the cylinder block (2) to the crankcase (3).
- (2) Using a soft faced hammer, gently tap the cylinder block (2) to loosen it from the crankcase (3).
- (3) Carefully lift cylinder block from crankcase. Take care not to damage the pistons (4).
- (4) Remove and discard cylinder block gasket (5).

**g. Cover Plate Removal**

- (1) Remove the six capscrews (6) and lockwashers (7) that retain the cover plate (8) to the crankcase (3).
- (2) Remove gasket (9) and discard.

h. Pistons and Connecting Rods Removal

- (1) Position crankcase on its side to expose connecting rod bolts.
- (2) Mark the connecting rod caps to ensure that they are returned to the same connecting rods from which they are removed.
- (3) Rotate crankshaft so that one connecting rod is at the bottom of its stroke. Using a 12 point socket, remove the connecting rod capscrews (3).
- (4) Lift the piston and connecting rod through the top of the crankcase. Install connecting rod cap (2) onto connecting rod (4) and install connecting rod capscrews (3) fingertight.
- (5) Repeat steps 3, and 4 on the remaining connecting rod assemblies.

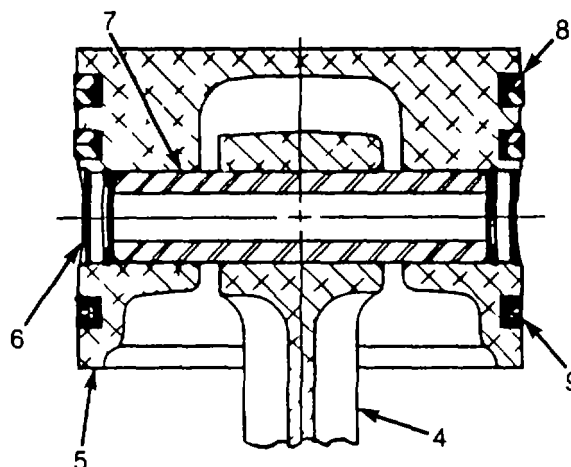
**NOTE**

To disassemble piston/connecting rod assemblies carry out steps 6 thru 10.

- (6) Remove snap rings (6) from piston (5).

4-28. ENGINE - Continued

- (7) Using an arbor press, carefully press piston pin (7) from piston (5).
- (8) Separate the connecting rod (4) from the piston (5).
- (9) Using a piston ring expander, remove the compression rings (8) and oil rail (9) from the piston (5).
- (10) Repeat step 6 thru 9 for the other piston assembly.

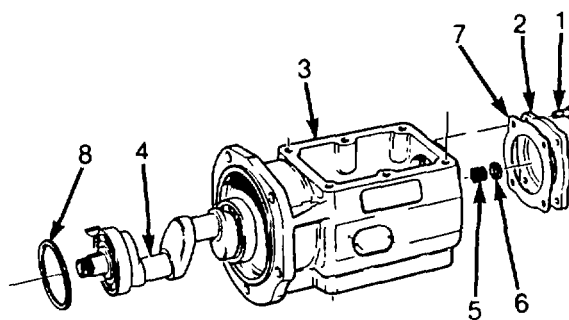
**j. Crankshaft Removal****CAUTION**

Removal of crankshaft may cause main bearing damage. It is recommended to inspect crankshaft and crankcase prior to crankshaft removal.

NOTE

If visual inspection shows that the crankcase or crankshaft is damaged, the compressor should be replaced with a new unit.

- (1) Remove the four capscrews (1) securing the end cap (2) to the crankcase (3).
- (2) Using a soft faced hammer, gently tap end cap (2) until it becomes loose.
- (3) Carefully remove end cap (2) from crankcase (3). Remove spring (5) and seal ring (6).
- (4) Remove and discard end cap gasket (7).
- (5) Remove snap ring (8) from crankcase (3).
- (6) Carefully maneuver crankshaft (4) from crankcase (3).



4-28.3 Air Compressor - Continued

k. Inspection

WARNING

Dry cleaning solvent P-D-680 (safety or Stoddard's solvent) is potentially dangerous. Avoid repeated and prolonged breathing of vapors and skin contact with the liquid. Do not use near open flame, arcing equipment or other ignition sources. Always wear eye protection and protective clothing. The flash point of P-D-680 is 100 to 138 deg. F (30 to 59 deg. C).

- (1) Wash all compressor components using dry cleaning solvent (item 10, Appendix E).

WARNING

Death or serious injury could occur if compressed air is directed against the skin. Do not use compressed air for cleaning or drying unless the pressure is/has been reduced to 30 psi (2.11 kg/cm²) or less. When working with compressed air always use chip guards, eye protection and other personal protective equipment.

- (2) Dry all components using compressed air.
- (3) Using extreme care not to scratch machined surfaces, remove carbon deposits from the cylinder head interior surface. Clean all interior air and water passages.
- (4) Using extreme care not to scratch machined surfaces, remove carbon from piston crown and ring grooves.
- (5) Using compressed air, blow out all drilled passages to ensure they are clear.
- (6) Using extreme care not to scratch machined surfaces, remove all gasket material from gasketed surfaces.
- (7) Inspect all cylinder head components as detailed below.
 - (a) Examine cylinder head for cracks and damaged threads. The head gasket surface must be free of nicks and gouges. Replace the head if damaged.
 - (b) Inspect the inlet and exhaust valve discs for wear. Replace the valves if cracked, pitted or grooved on either side.
 - (c) Check the inlet and exhaust valve springs for loads at specified heights.

Inlet Valve Spring
 Load at 0.287 Inch0.62/0.36 lb (0.28/0.16 kg)

Exhaust Valve Spring
 Load at 0.73 inch3.70/3.30 lb (1.68/1.50 kg)

4-28. ENGINE - Continued

- (d) Examine the inlet valve cages for damage and wear. Measure the valve guide diameter and the distance from the top of the cage to the valve stop. Examine the inlet valve seat for damage. Measure from the valve seating surface to the surface that contacts.

Inlet Valve Cage

Valve Guide Diameter.0.920/0.916 in. (23.37/23.27 mm)

Top of Cage of Valve Stop 0.137/0.131 in. (3.48 - 3.33 mm)

Inlet Valve Seat

Valve Seating Surface to Valve Cage

Contact Surfaces0.0265/0.0235 in. (0.673/0.597 mm)

- (e) Examine the exhaust valve seat for damage and wear. Measure the valve guide diameter and the distance from the top of the valve seat to the valve seating surface.

Exhaust Valve Seat

Valve Guide Diameter 1.151/1.145 in. (29.24-29.08 mm)

Top of Valve Seat To Seating Surface..... 0.128/0.125 in. (3.25-3.18 mm)

- (f) Examine the exhaust valve stop for damage, looseness or wear. Measure the distance from the valve end of the stop to the surface on which the spring sets. If the exhaust valve stop is loose, worn, damaged or does not meet specifications measurement from the valve stop surface to the spring seating surface, the head assembly must be replaced.

Exhaust Valve Stop

Valve Stop Surface to Spring Seat Surface 0.74/0.72 in. (18.80/18.30 mm)

- (g) Examine the unloader seal bore diameters for scoring or pitting. Check unloader pins for damage. Measure the length of the unloader pins.

Unloader Pin Length1.854/1.850 in. (47.09/46.99 mm)

- (h) Check the unloader springs for loads at specified heights.

Unloader Spring Load at 0.3954.18/3.38 lb (1.90/1.53 kg)

- (8) Inspect pistons, connecting rods and bearings as detailed below.

- (a) Examine pistons for scoring, cracks or other damage. Replace as needed.

- (b) Measure the outside diameter of the piston at a 90 deg. angle to the piston pin bore. Compare this measurement with the diameter of the cylinder bore. Piston to bore clearance should not exceed 0.008 in. (0.20 mm) replace the pistons. The block must be replaced or bored oversize to 0.020 in. (0.51 mm). Oversize pistons at 0.020 in. (0.51 mm) are available for the EL 1600 air compressor.

Piston Diameter Below2.7450/2.7440 in. (69.723/69.698 mm)

4-28. ENGINE - Continued

4-28.3 Air Compressor - Continued

- (c) Check piston pins for wear. Piston pins that have a variation in diameter of more than 0.003 in. must be replaced.

Rod Pin Diameter0.5620/0.5618 in. (14.275/14.270 mm)

- (d) There are two styles of piston pin fit, both methods of checking are detailed below.

Interference fit piston and pin.

Check the fit of the piston pins in the piston and connected rod. Pin must have a light interference fit in piston and slip fit rod. If any parts are worn, the complete piston and rod assembly must be replaced.

Slip fit piston and pin (new models)

Check the fit of the piston pin and connecting rod. Pin should be a slip fit in the piston and rod. Visually check for worn or damaged areas. Replace parts as required or replace with a complete piston and rod assembly. The connecting rod and the rod bearing cap must be replaced as a unit.

Piston Pin Hole0.5618/0.5615 in. (14.270/14.262 mm)

Connecting Rod Pin Hole0.5624/0.5622 in. (14.285/14.280 mm)

Rod Pin Diameter0.5620/0.5618 in. (14.275/14.27 mm)

- (e) Check the fit of compression and oil rings in the piston ring grooves. Place rings in piston ring grooves and measure side clearance. Place rings in the cylinder bores and measure gap.

Groove Clearance Compression Rings0.0015/0.0045 in. (0.038/0.114 mm)

Oil Rings.....0.0005/0.0045 in. (0.013/0.114 mm)

Piston Rings Compression 0.007/0.017 in
 Gap in 2.7500 in. Bore..... (0.18/0.43 mm)

Oil Ring Gap in..... 0.015/0.55 in
 2 7500 in. Bore (0.38/1.40 mm)

Clearance between ring and ring groove, or ring cap must be within limits. If clearance or gaps are not within these limits, new rings must be installed.

NOTE

Whenever a complete compressor teardown is accomplished, new rings are recommended.

4-28. ENGINE - Continued

- (f) Examine connecting rod bearing inserts for scoring, pitting or visible wear. Check fit of rod bearings on crankshaft journals. Clearance between bearing and crankshaft journals must be between 0.005 and 0.0021 in. (0.127 and 0.053 mm). If damage is evident or clearance does not meet the specified dimensions new inserts must be installed.
- (g) Check clearance between side of connected rod bearing cap and crankshaft if clearance exceeds 0.010 in. (0.25 mm) new rod and bearing cap must be installed.

Connecting Rod Journal Width..... 1.3670/1.2650 in. (34.722/32.131 mm).

NOTE

The connecting rod and rod bearing cap must be replaced as a unit.

- (9) Inspect cylinder block as detailed below.

- (a) Examine cylinder block for cracks. Replace if damaged.
- (b) Examine cylinder bores for scratches, scoring and pitting. Check bores for out-of-round or taper. If out-of-round more than 0.0005 in. (0.013 mm) or tapered more than 0.001 in. (0.03 mm) from top to bottom of bore, the block must be rebored or honed oversize, or replaced with a new cylinder block.

Cylinder Bore..... 2.7500/2.7495 in. (69.850/69.837 mm).

- (10) Check crankshaft and bearings as detailed below.

- (a) A bent or twisted crankshaft cannot be repaired if connecting rod journals are scored beyond repair or worn beyond the specifications, replace with a new crankshaft or regrind journals. Service insert bearings are available at 0010 and 0020 in. (0.25 mm and 0.51 mm) undersize.

Connecting Rod Journal Diameter .. 1.1855/1.1850 in. (30.112/30.099 mm)
 Main Bearing Journal Diameters 1.3784/1.3779 in. (35.011/34.999 mm)

- (b) Thread, keyway, and all ground and machined surfaces must not be mutilated or worn.
- (c) Examine ball bearings for worn or damaged balls, rotate bearing by hand to detect roughness. If wear, roughness or damage is evident, bearing must be replaced. See para. 2-7 bearing replacement.

Ball Bearing Outside Diameter 2.8341/2.8346 in. (71.986/71.999 mm).
 Inside Diameter..... 1.3775/1.3780 in. (34.989/35.001 mm).

- (11) Check the crankshaft bearing cap as detailed below.

- (a) Examine crankshaft rear bearing cap and replace if worn or cracked.

Bearing Cap Seal Diameter 0.636/0.635 in. (16.15/16.13 mm).

4-28. ENGINE - Continued**4-28.3 Air Compressor - Continued**

- (b) Compressors with a ball-type rear bearing have a seal and spring or bowed washer in the rear bearing cap.

Check the wear of the seal where it contacts the crankshaft. The seal must be replaced if grooved more than 0.005 in. (0.31 mm). Measure outside diameter of seal ring. If diameter is not within specifications, the seal ring must be replaced.

Check the oil seal spring for loads at assembled heights. Spring must conform to specifications.

Some compressors have bowed washers rather than oil seal springs. Examine bowed washer for wear. If worn, replace.

Seal Ring Outside Diameter..... 0.633/0.632 in. (16.08/16.05 mm).

- (12) Check the crankcase as described below.

- (a) Examine crankcase for cracks and damage to gasket surfaces. Replace if necessary.
 (b) Inspect studs in crankcase. Replace any bent or damaged studs. Check all threaded holes for damaged threads. If threads are damaged install hell-coil (thread insert).
 (c) Measure the crankcase bearing bore diameter and if not within specifications, replace the crankcase.

Bearing Bore Diameters..... 2.8350/2.8344 in. (72.009/71.993 mm)

- (13) To repair the air compressor governor refer to para. 4-22.11.

NOTE

To reassemble the air compressor carry out steps m. thru v. Do not attempt to force parts into position during assembly, as this could cause damage. Coat the crankshaft, bearings, connecting rod bearings, pistons, pin, and cylinder block bore with engine oil (item 17, Appendix E) before reassembly.

m. Crankshaft and Bearing Installation.

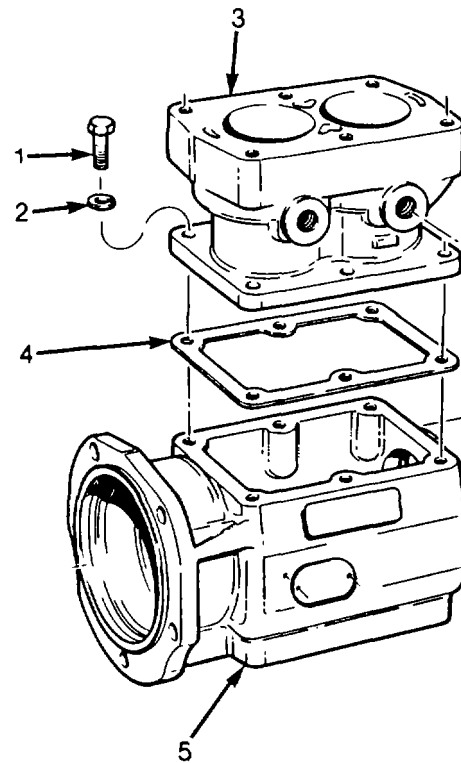
- (1) The crankshaft should be installed in the crankcase before rear end cap is installed. Bearings should already be pressed on the crankshaft. Maneuver crankshaft and bearing assembly into crankcase. Be sure that the front bearing is recessed enough to allow installation of lock ring into end of crankcase housing.
 (2) Install lock ring used to retain the front bearing.
 (3) On compressors with rear ball bearings, place a new gasket on the cap mating surface install the spring or bowed washer in the end cap. Outer diameter of washer must contact the bottom of the hole, in the end cap. Install the seal in the end cap. Lubricate seal with oil install end cap making sure the seal and spring or bowed washer does not fall out.

4-28. ENGINE - Continued

- (4) Pull bearing cap into position be alternately tightening the four attaching bolts. Torque to 120 in. lb (14 Nm).

n. Cylinder Block Installation.

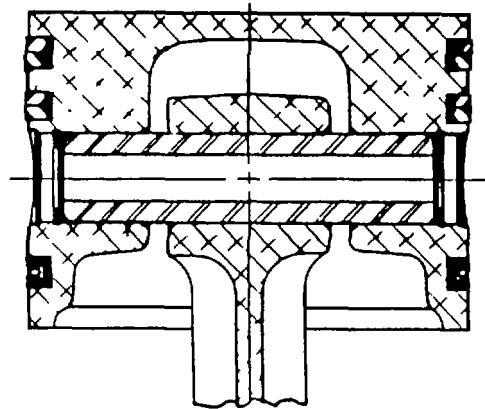
- (1) Place a new cylinder block to crankcase gasket (4) on the crankcase (5). Place the cylinder block (3) on the crankcase in the same orientation as it was removed.
- (2) Assemble the six bolts (1) and lockwashers (2) torquing the two center bolts to 8 ft lb (11 Nm), then the four end bolts. Increase the bolt torque to 30 ft lb (41 Nm), torquing the center two bolts and then the four end bolts.

**p. Piston and Connecting Rod Assembly**

- (1) Position connecting rod in piston and press piston pin into place. This may be a slip fit or light press fit.
- (2) Install snap rings into piston at the ends of the piston pin.

NOTE

Compression rings must be installed with surface marked "TOP" facing top of the piston. Some compression rings may have dots indicating the top of the ring.

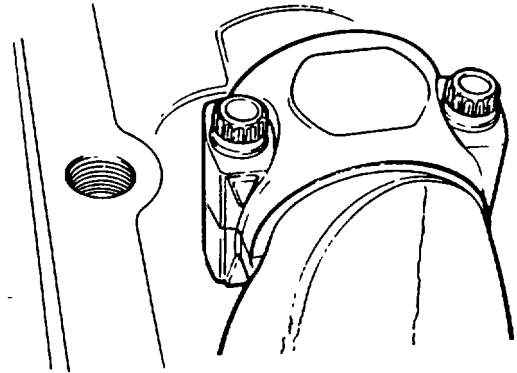


- (3) Install compression and oil rails and expander rings on pistons. Seven rings are used in each piston, two compression rings in each of the top two grooves, and two oil rails and an expander ring at the bottom.
- (4) Stagger ring gaps by 120 deg.
- (5) Press the connecting rod bearing inserts into the connecting rod and bearing cap. Make sure the locating tangs on the inserts engage the locating notches in the rod and cap. Aline arrows on the cap and rod as shown. Make sure each rod cap is installed on the rod from which it was removed.
- (6) Coat rod bearings with engine oil (item 17, Appendix E).

4-28. ENGINE - Continued**4-28.3 Air Compressor - Continued**

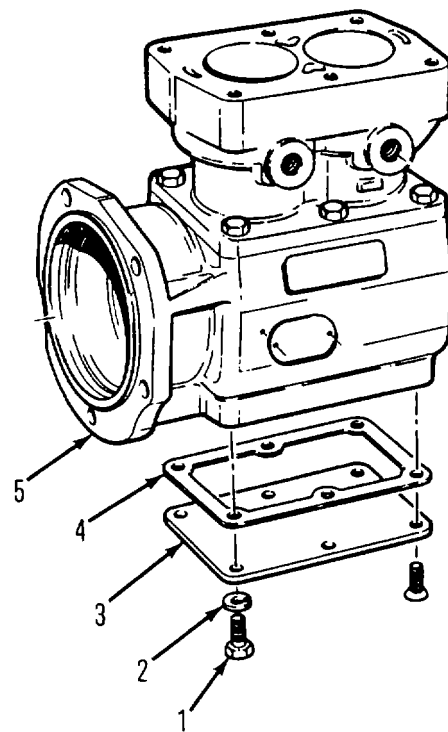
q. Piston And Connecting Rod Installation.

- (1) Lubricate the cylinder walls and pistons with engine oil (item 17, Appendix E).
- (2) Remove the rod cap and bearing from the connecting rod. Stagger ring gaps by 120 deg. Using a ring compressor, insert the piston so that the top of the piston is flush with the top of the block.
- (3) Turn the assembly over and position the connecting rod on the crankshaft journal making sure bearing inserts are in place. Lubricate the rod journal with engine oil (item 17, Appendix E).
- (4) Install connecting rod bearing caps and inserts aligning the arrows on the bearing caps and rod as shown. Install connecting rod bolts, tighten the bolts with 5/16-12 point heads to 185 in. lb (21 Nm), tighten the bolts with 1/4-12 point heads to 105 in. lb (12 Nm).
- (5) Repeat steps 1 thru 4 to install the second connecting rod/piston assembly.



r. Cover Plate Installation.

- (1) Position cover plate gasket (4) and cover plate (3) on crankcase (5).
- (2) Install the six capscrews (1) and lockwashers (2).
- (3) Tighten the six capscrews (1) evenly to 130 in. lb (15 Nm).



4-28. ENGINE - Continued

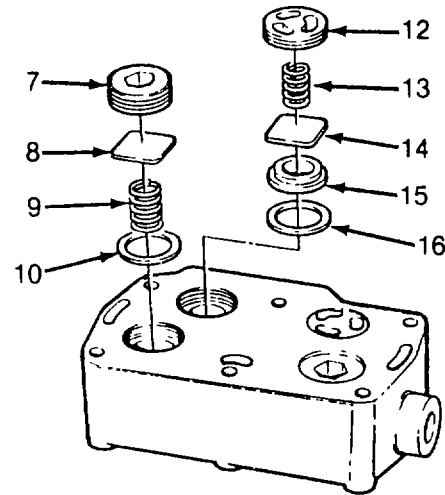
s. Cylinder Head Reassembly.

- (1) Invert cylinder head (1) and insert new copper washers (10, 16) into all four ports.
- (2) Insert exhaust valves (9), springs (8) and exhaust valve seat (7). Using a 9/16 in. allen wrench, tighten valve seats to 70 ft lb (95 Nm).
- (3) Insert inlet valve seats (15), inlet valves (14), inlet valve springs (13), and inlet valve cages (12).

NOTE

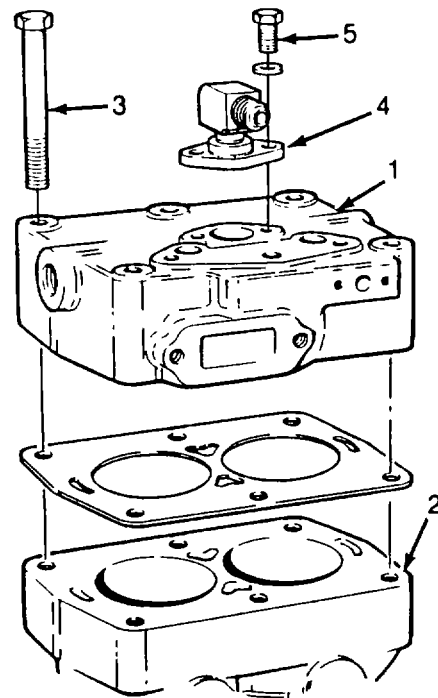
The inlet valve and inlet valve springs must be centered to insure the valve is not torqued between the valve seat and the valve cages to 75 ft lb (100 Nm) using special tool J25447A.

- (4) Turn the head over to insert the new unloader springs (6).
- (5) Install new O-rings (4) onto unloader pins (5).
- (6) Apply silicone grease (item 27, Appendix E) to the O-ring, forming a ball around it.
- (7) Insert the unloader pins (5) into the cylinder head.
- (8) Place the unloader gasket (3) on the unloader cover (2). Assemble these two items to the head as a unit compressing the unloader springs and hold firmly until the unloader cover bolts (1) and lockwashers or hardened plain washers are installed. Tighten these bolts to approximately 10 in. lb (1.2 Nm) torque. These bolts will be tightened to a final torque after the head bolts are torqued.



t. Cylinder Head Installation.

- (1) Place a new head to block gasket on the cylinder block. Place the head on the gasket and install the six head bolts. The one long head bolt is to be inserted through the unloader cover plate. Tighten the head bolts to 20 ft lb (27 Nm) following the order as shown. Retighten the head bolts to 30 ft lb (41 Nm) in the same order.
- (2) Tighten the unloader cover bolts to 125 in. lb (14 Nm) torque after torquing the head bolts.
- (3) Install air outlet connection (4) using screws (5). Coat flange area with gasket eliminator (item 14, Appendix E).



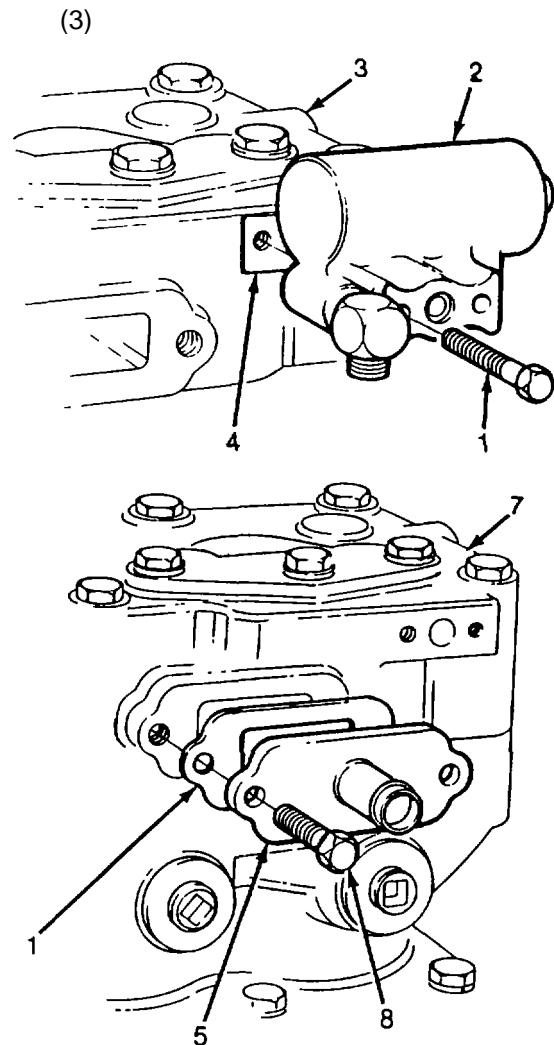
4-28. ENGINE - Continued**4-28.3 Air Compressor - Continued**

u. Air Inlet Connection Installation

- (1) Using a new gasket (6), attach the air cleaner inlet flange (5) to the cylinder head (7) using two capscrews (8).
- (2) Tighten capscrews (4) to 130 in. lb (15 Nm).

v. Governor Installation.

- (1) Using a new gasket (4), attach the governor (2) to the cylinder head (3) using two capscrews (1).
- (2) Tighten the capscrews (1) to 130 in. lb (15 Nm).



4-28. ENGINE - Continued

4.28.4 Thermostat

This task covers

- a. Replacement

TOOLS

Tool Kit, General Mechanic Automotive,
 NSN 5180-00-177-7033
 J8550 Thermostat Seal Installer
 J7079-2 Drive Handle

MATERIALS/PARTS

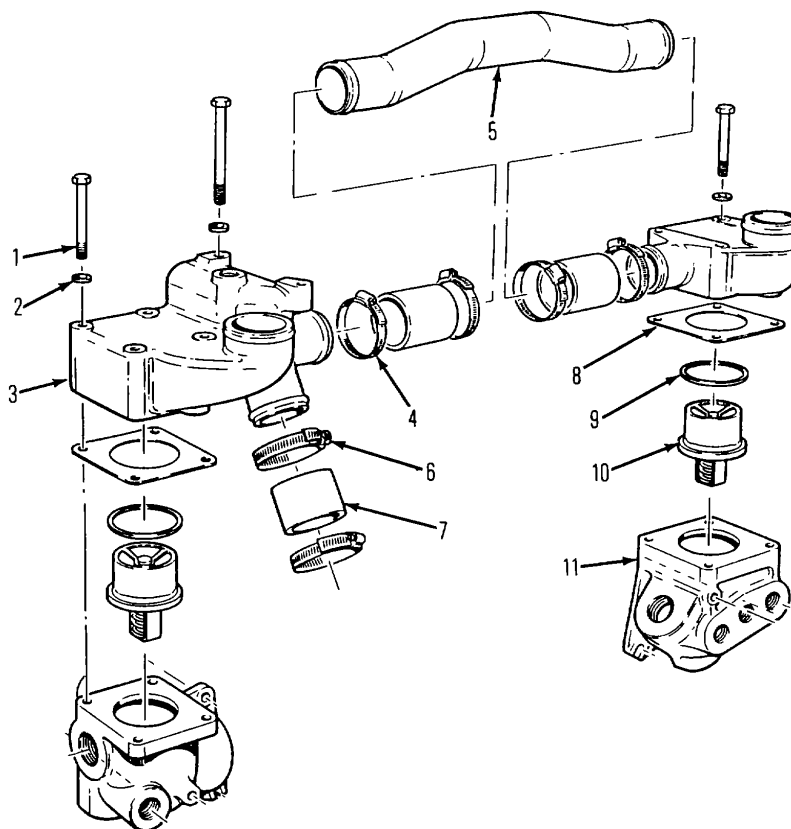
5117786 Gasket
 5102651 Thermostat
 5132155 Seal
 5100860 Gasket

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24)
 Both Engine Covers Removed (see para. 4-12.11)

WARNING

Engine coolant can cause severe burns or scalds. Allow engine to cool before attempting to maintain the thermostats.



4-28. ENGINE - Continued**REPLACEMENT**

- (1) Drain the cooling system by opening the radiator draincock. The engine cooling system capacity is approximately 16 gal (60 L).
- (2) Loosen hose clamps (4) and remove the crossover tube (5).
- (3) Loosen hose clamp (6) and disconnect hose (7) from water pump.
- (4) Remove the bolts (1) and lockwashers (2) securing the covers (3) to the thermostat housings.
- (5) Remove the thermostat covers (3) and gaskets (8). Remove the thermostats (10) and discard.
- (6) Clean the thermostat sealing surfaces in the thermostat housing (11) and covers (3).
- (7) Remove the seals (9) from the thermostat covers and discard the seals.
- (8) Position the new seals (9) so the lip of the seal faces away from the thermostat when installed. Install with installer J8550 and driver handle J7079-2 (9). Place a new gasket (8) on each thermostat housing (11).
- (10) Place new thermostats (10) in the thermostat housings.
- (11) Attach the covers (3) to the housings with bolts (1) and washers (2). Tighten bolts to 35 ft. lb (47 Nm).
- (12) Slide the hose (7) between the water pump and right hand housing over the housing and tighten clamp (6).
- (13) Install the bypass tube (5) on both covers and tighten clamps (4).
- (14) Refill the cooling system as detailed in LO 5-4210-220-12.
- (15) Start the main engine and check for leaks. When engine cools recheck radiator level. Top up as required.

4-29. WHEELS AND TIRES**4-29.1 Wheels****This task covers**

- a. Replacement
- b. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)

PERSONNEL REQUIRED - 2**WARNING**

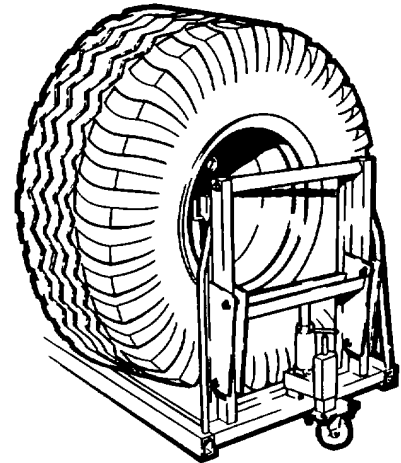
Wheel and tire are heavy 300 lb (140 kg). To avoid personal injury, use care when removing.

NOTE

Left-hand wheels have left-hand nuts, right-hand wheels have right-hand nuts. Do not intermix nuts when removing wheels.

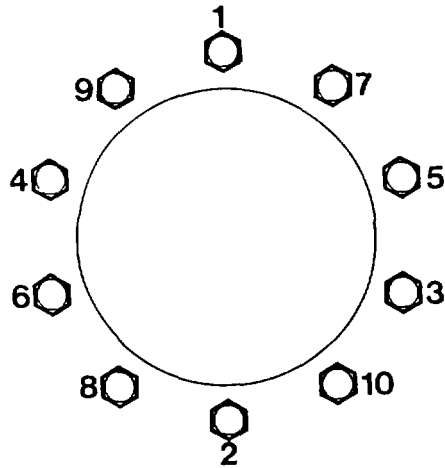
REMOVAL

- (1) Locate 10 ton hydraulic jack beneath axle just inboard of that wheel that is to be removed.
- (2) Apply truck parking brake and chock both wheels of other axle.
- (3) Raise jack until tire clears the ground.
- (4) Put maintenance trestle beneath axle and lower jack until trestle takes the weight of the truck. Ensure tire is clear of the ground. (If not repeat 3 and 4 raising trestle by one notch).
- (5) Locate wheel lift truck beneath wheel and attach safety chain.
- (6) Using wheel brace or air operated wrench, remove wheel nuts completely and pull wheel off axle studs. Take care not to damage stud threads.



4-29 WHEELS AND TIRES - Continued**INSTALLATION**

- (1) Install wheel over axle studs. Adjust height of wheel lift truck, so as not to damage the stud threads.
- (2) Draw wheel onto axle by snuging bolts in sequence.
- (3) When all nuts are seated tighten to 450 ft lb (730 Nm) in same sequence.
- (4) Raise truck on axle jack and remove maintenance trestles. Lower jack until truck is supported on its tires. Remove jack and chocks.



4-555

4-29. WHEELS AND TIRES**4-29.2 Tires****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

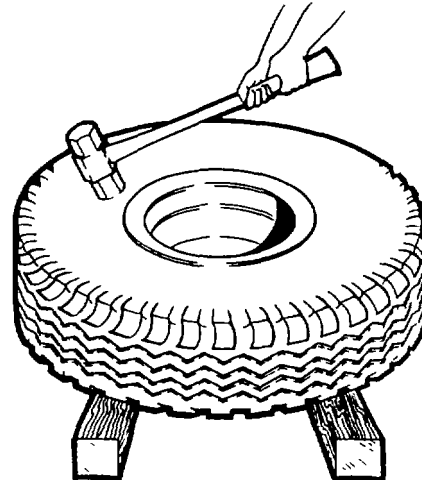
30, Appendix E Tire Bead Lubricant
215388 Tire

PERSONNEL REQUIRED - 2**EQUIPMENT CONDITION**

Wheel Removed from Truck (see para. 4-29.1)

REMOVAL

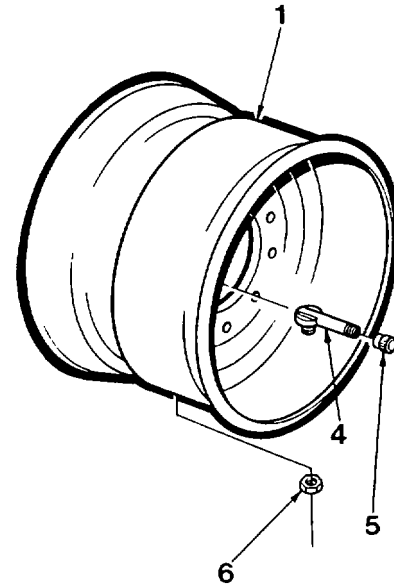
- (1) Remove valve core slowly and allow all air to escape.
- (2) Place wheel and tire assembly on wooden blocks.
- (3) Beat side of tire with hammer to break tire to rim seal.
- (4) Insert curved end of two tire irons between rim and tire bead about 5 in. (12 cm) apart.
- (5) Force both tools down and out to lift bead over wheel rim.
- (6) Leave one tool in place and put second 5 in. (12 cm) away from first position. Repeat steps 5 and 6 until side of tire is removed from rim.
- (7) Turn tire over, and repeat steps 3 thru 6 driving other edge of tire over same side of rim as the first.
- (8) Remove valve stem from rim.

**INSPECTION**

- (1) Use wire brush to remove all dirt and corrosion from rim.
- (2) Inspect rim for cracks, deep pitting or dents.
- (3) Replace rim if any significant damage is found (e.g. cracked weld, bent rim).
- (4) Repaint rim as required.

4-29 WHEELS AND TIRES - Continued**INSTALLATION**

- (1) Install valve stem (2) in rim (1) and tighten nut (4) securely.
- (2) Place rim on wooden blocks.
- (3) Lubricate bead and rim with tire bead lubricant (item 30, Appendix E).
- (4) Place tire on top of rim. Move tire until part of lower bead is resting between rims of wheel.
- (5) Insert tire iron between wheel rim and lower tire bead. Lever bead over rim.
- (6) Force part of top tire bead over edge of rim. Insert tire iron between wheel rim and top tire bead. Lever the bead over rim.

**WARNING**

To avoid personal injury, never stand close to tire while inflating, install in safety cage.

- (7) Inflate tire to a maximum pressure of 90 psi (620 kPa) and ensure tire bead is seated on the rim.
- (8) Adjust to the operating pressure of 70 psi (480 kPa) and fit valve cap (3).
- (9) Install wheel on truck as detailed in para. 4-29.1.

4-557

4-30. REAR AXLE.**4-30.1 Axle Assembly.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair
NSN 4910-00-754-0705

MATERIALS/PARTS

22, Appendix E Pipe Sealant
29, Appendix E Threadlock Liquid
100031-04 U-Bolt
100031-05 U-Bolt
MS27183-23 Washer
310424 Nut

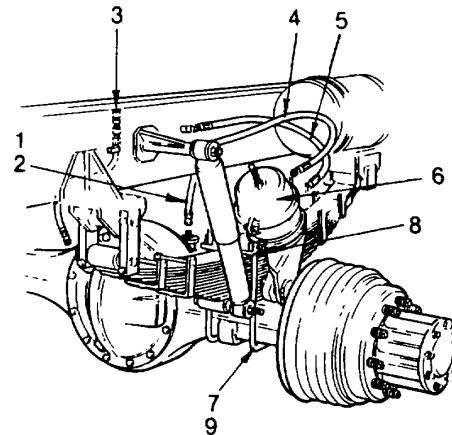
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Wheels Blocked
Pump Body and Hose Body Heat Shields
Removed (see para. 4-11)
Rear Wheels Removed (see para. 4-23.1)
Rear Axle Drive Lines Removed (see para. 4-26.3)
Hose Reel Cover Removed (see para. 4-14.1)
Air Tanks Drained

PERSONNEL REQUIRED - 2**REMOVAL****WARNING**

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

- (1) Tag and disconnect air lines (1 and 2) from rear axle air shift units (differential lock and 4X4 drive).
- (2) Remove capscrew attaching axle breather (3) to frame and temporarily attach breather to axle with masking tape.



- (3) Tag and disconnect air hoses (4 and 5) from both left and right brake chambers (6).
- (4) Scribe spring plates (8) with alignment marks.
- (5) With trolley jack supporting differential housing, remove nuts (7) and U-bolts (9). If nuts and threaded sections of -bolts are too corroded to permit disassembly, flame cut the U-bolts (6). Lower jack and remove axle from beneath truck.
- (7) Disconnect vent line from axle housing if new axle is being installed.

4-30 REAR AXLE - Continued**INSPECTION**

- (1) Visually inspect axle assembly for damage and oil leaks paying particular attention to power divider input and output shaft seal areas.
- (2) Inspect attached components such as brake drums, spring brake chambers, and breather hose components. Replace components showing signs of excessive wear or damage.

INSTALLATION

- (1) Connect vent line to axle, if required.
- (2) Remove vent plug from differential lock unit and replace with 1/4 in. setscrew on a new axle. Apply threadlock liquid (item 11, Appendix E) to setscrew.
- (3) Support axle with trolley jack on differential housing and maneuver the axle under the truck.
- (4) Lift axle and align with springs.
- (5) Apply threadlock liquid (item 29, Appendix E) to nuts (7).
- (6) Install U-bolts (9) through spring plate (8), and secure with nuts (9). Be sure axle and springs are properly aligned. Be sure spring plate scribe marks are aligned. Three U-bolts are 15 in. long and one is 15 1/2 in. long. Three longer U-bolt fits inboard of the right hand spring.
- (7) Tighten nuts (7) to 300 ft lb (410 Nm).
- (8) Install air lines (1 and 2) to rear axle air shift units. Coat threads with pipe sealant (item 22, Appendix E).
- (9) Install air lines (4 and 5) to spring brake chambers (6) on both sides of truck. Coat threads with pipe sealant (item 22, Appendix E).
- (10) Using capscrew, install axle breather (3) to frame.

4-30. REAR AXLE - Continued**4-30.2 Axle Shaft****This task covers**

- a. Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

28, Appendix E Silicone Sealant
113503 Axle Shaft
13886 Gasket
13885 Dowel

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Wheels Blocked
Axle Oil Drained (see LO 5-4210-220-12)

REPLACEMENT**WARNING**

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

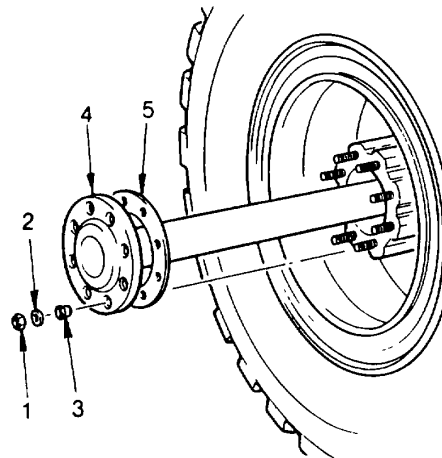
CAUTION

Metal particles and debris from a failed component may cause failure of other components. To reduce the chance of additional axle failures, drain and clean axle housing cavities as necessary and replace the lube oil.

NOTE

This procedure is common to both left and right wheel ends. Unless removal and installation of axle shaft is required for removal of hub or brake components, the rear wheel(s) may remain installed.

- (1) Jack affected wheel end until wheel is clear of the ground. Support raised wheel end on a maintenance trestle.
- (2) Remove nuts (1), washers (2), and taper dowels.
- (3) Using a brass drift and hammer, strike axle shaft flange in the center, if necessary, to loosen dowels.



4-30. REAR AXLE - Continued

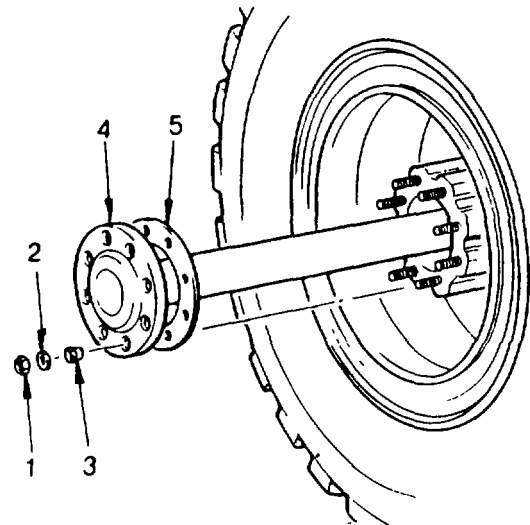
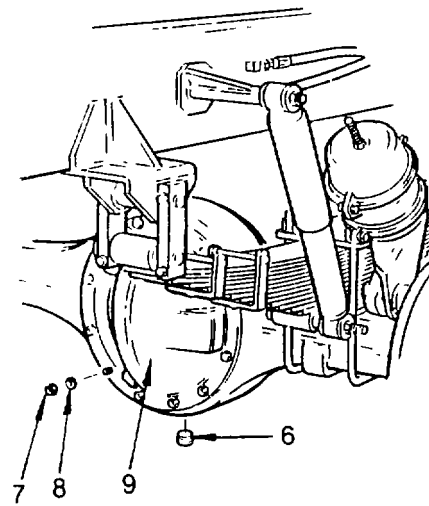
- (3) Remove axle shaft (4) and gasket (5). Discard gasket.
- (4) If axle shaft is broken, remove nuts and lockwashers (7 and 8) attaching differential cover (9). Remove cover.
- (5) Through the open differential housing, remove the broken axle shaft piece.

NOTE

If damage to differential is noticed or a broken axle shaft piece cannot be removed, notify Direct Support Level for assistance.

- (6) Clean differential housing and remove any debris.
- (7) Clean housing and differential cover flanges of old sealant and apply a thin coat of silicone sealant (item 28, Appendix E) to cover flange.
- (8) Install housing cover (9) using lockwasher (8) and nuts (7). Tighten nuts to 135 ft lb (180 Nm).
- (9) Relieve parking brake pressure, see para. 4-30.4, so that wheel is free to turn.
- (10) Install new gasket (5) and axle shaft (4). Turn wheel as necessary to enable shaft spline to mate with differential, and holes in shaft flange to align with hub studs.
- (11) Install taper dowels (3), washers (2), and nuts (1). Hand tighten nuts.
- (12) Reapply parking brake spring pressure, see para. 4-30.4 and tighten nuts (1) to 120 ft lb (160 Nm).
- (13) Raise wheel and remove maintenance trestle Lower and remove jack.

- (14) Install drain plug (6) and fill axle with fresh oil, see lube order LO 5-4210-220-12.



4-30. REAR AXLE - Continued**4-30.3 Hub Assembly.****This task covers**

- a. Adjustment
- b. Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

3, Appendix E Antiseize Compound
16, Appendix E Grease
89126-F Hub
592-A Bearing Cup Inner
572 Bearing Cup, Outer
86797 Wheel Bolt
99906 Bearing Cone, Inner
34368 Bearing Cone, Outer
88319 Oil Seal
86478 Stud, 5/8 - 18

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Wheels Blocked
Air Tanks Drained
Relevant Rear Wheel Removed (see para. 4-23.1)
Axle Oil Drained (see LO 5-4210-220-12)
Relevant Axle Shaft Removed (see para. 4-20 2)

WARNING

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support

CAUTION

Metal particles and debris from a failed component may cause failure of other components. To reduce the chance of additional axle failures, drain and clean axle housing cavities as necessary and replace lube oil.

NOTE

Hub repair is limited to replacement of components. When removing hub, inspect components, and replace as required. These procedures are common for both left and right wheel ends

ADJUSTMENT

- (1) Remove axle shafts as detailed in para. 4-30.2.
- (2) Release parking brake as detailed in para. 4-30.4, ADJUSTMENT, step 3.
- (3) Remove outer adjusting nut (3) and lockwasher (4).
- (4) Using a torque wrench, tighten inner locknut (5) to a torque of 50 ft lb (68 Nm) while rotating the wheel in both forward and reverse directions. The wheel should turn easily. Back off inner locknut 1/4 to 1/3 turn.
- (5) Install lockwasher (4) snug against inner locknut.

4-30. REAR AXLE - Continued

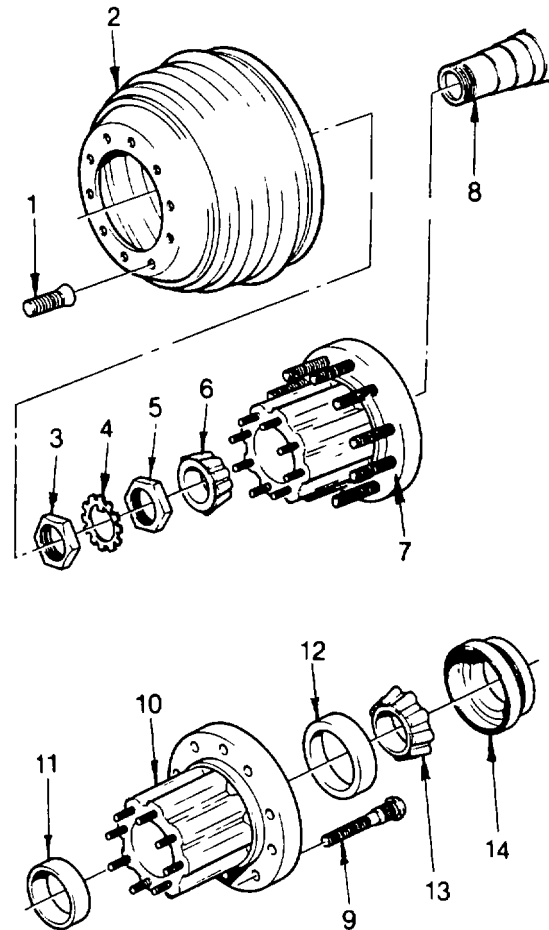
- (6) Install outer locknut (3) and tighten to a torque of 260 ft lb (350 Nm).
- (7) Repeat wheel rotation in both directions. Rotation should be free with an end play of 0.001 to 0.010 in. (0.03 to 0.25 mm).
- (8) When adjustment is complete, secure locknuts by bending a tab on lockwasher (4) over a flat on each locknut (3 and 5).
- (9) Install axle shaft as detailed in para. 4-30.2.

REPLACEMENT

- (1) Relieve parking brake pressure and adjust slack adjuster to provide clearance between brake shoes and brake drum, see para. 4-30.4, ADJUSTMENT, step 3.
- (2) Remove inner wheel nuts (1) and remove brake drum (2).
- (3) Straighten locking tabs on lockwasher (4) and remove outer locknut (3), lockwasher (4), and inner lock nut (5).
- (4) Remove outer bearing (6) from spindle (8) and remove complete hub assembly (7).
- (5) Remove oil seal (14) from inner bearing in hub assembly.
- (6) Inspect spindle (8) for damage. Minor nicks and burrs may be removed but otherwise no repair should be done. If spindle is seriously damaged, the complete axle housing must be replaced.
- (7) Inspect hub assembly. If badly damaged or cracked or bearing cups cannot be removed (see step 8) replace hub assembly.
- (8) If bearings require replacement, replace bearing and bearing cups. Remove cups from hub using a suitable press.
- (9) If new hub is used, press bolts (9) in hub (10).

NOTE

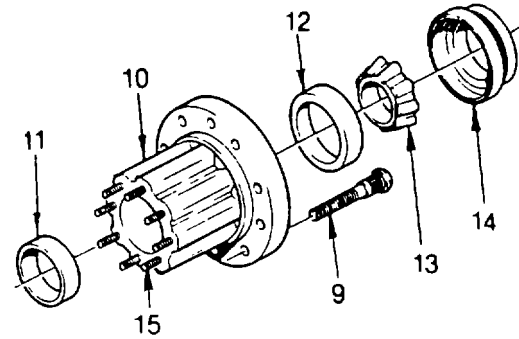
Use left hand threaded bolts (9) in left hub and right hand threaded bolts in right hub.



4-30 REAR AXLE - Continued

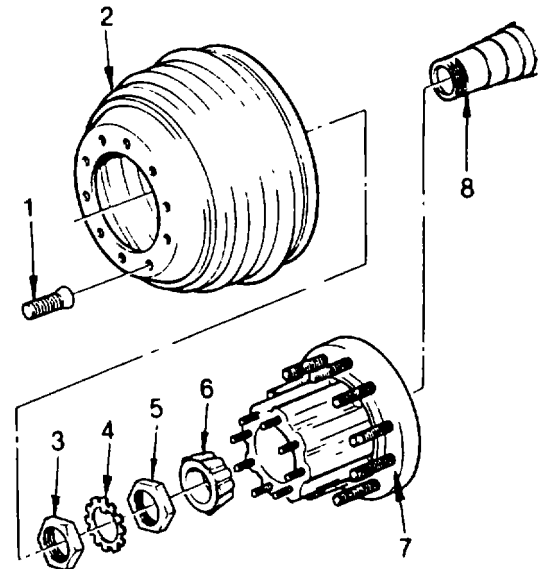
4-30.3 Hub Assembly - Continued

- (10) If required, install new bearing cups (11 and 12) using a press. Be sure bearing cups are fully seated.
- (11) Apply antiseize compound (item 3, Appendix E) to thread of new studs (15) and install in hub, if required.
- (12) Pack bearing (13) with grease (item 16, Appendix E). Install it in bearing cup (12) and install new seal (14) in hub.

**CAUTION**

Be careful not to damage oil seal when installing hub on spindle.

- (13) Pack new bearing cone (6) with grease (item 16, Appendix E). Install hub on spindle and install bearing cone (6).
- (14) Install inner bearing nut (5) with machined shoulder surface against bearing cone (6).
- (15) Install brake drum (2) and inner wheel nut (1) and tighten to 120 ft lb (160 Nm). Install wheel, as detailed in para. 4-29.1.
- (16) Adjust wheel bearings as detailed in ADJUSTMENT preceding.
- (17) Raise wheel end and remove maintenance trestle. Lower and remove jack.
- (18) Install drain plug in differential housing and fill axle with fresh oil (see lube order LO 5-4210-220-12).



4-30 REAR AXLE - Continued

4-30.4 Brake Assembly

This task covers

- a. Adjustment
- b. Removal
- c. Inspection
- d. Installation

TOOLS

Shop Equipment, Automotive Maintenance And Repair, NSN 4910-00-754-0705

3 78500 Air Chamber Bracket Overhaul Kit

4 70326 Retaining Spring

5 78580 Return Spring

6 805448 Brake Shoe and Lining

7 804017 Lock Ring

8 23570 Shim Washer, 030 in. Thick

9 35428 Shim Washer, 0 60 in. Thick

10 70525 Slack Adjuster

11 43943 Inner Washer, Slack Adjuster

12 100087 Camshaft LH

13 100088 Camshaft RH

14 60600 Brake Chamber Nut - 5/8 - 18

15 104482 Brake Chamber

16 38540 Capscrew

17 ---- Air Chamber Bracket*

18 ---- Air Chamber Bracket*

19 79903 Seal

20 1000035 Bushing

21 39074 Cam Roller

22 39075 Pin Cam Roller

23 088374 Bolt

24 79935 Brake Spider

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)

APU Engine Shutdown (see para. 2-12)

Batteries Disconnected (see para. 4-24.12)

Wheels Blocked

Air Tanks Drained (see para. 4- 22.1)

Rear Wheel Removed (see para. 4- 29.1)

Axle Housing Drained Of Oil

Axle Shaft Removed (see para. 4-30.2)

Hub And Brake Drum Removed (see para. 4-30.5)

MATERIAL/PARTS

16, Appendix E Grease

22, Appendix E Pipe Sealant

29, Appendix E Threadlock Liquid

1 1005015 Major Overhaul Kit

2 1001238 Minor Overhaul Kit

Major Overhaul Kit consists of items 2, 5, and 6 - one kit covers one brake assembly (wheel end)

Minor Overhaul Kit consists of items 4, 5, 21, and 22 - one kit covers one brake assembly (wheel end)

Air Chamber Bracket Kit consists of items 7, 19, and 20 - One kit covers two air chamber brackets (one axle)

* Only available as part of Air Chamber Bracket Kit

WARNING

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

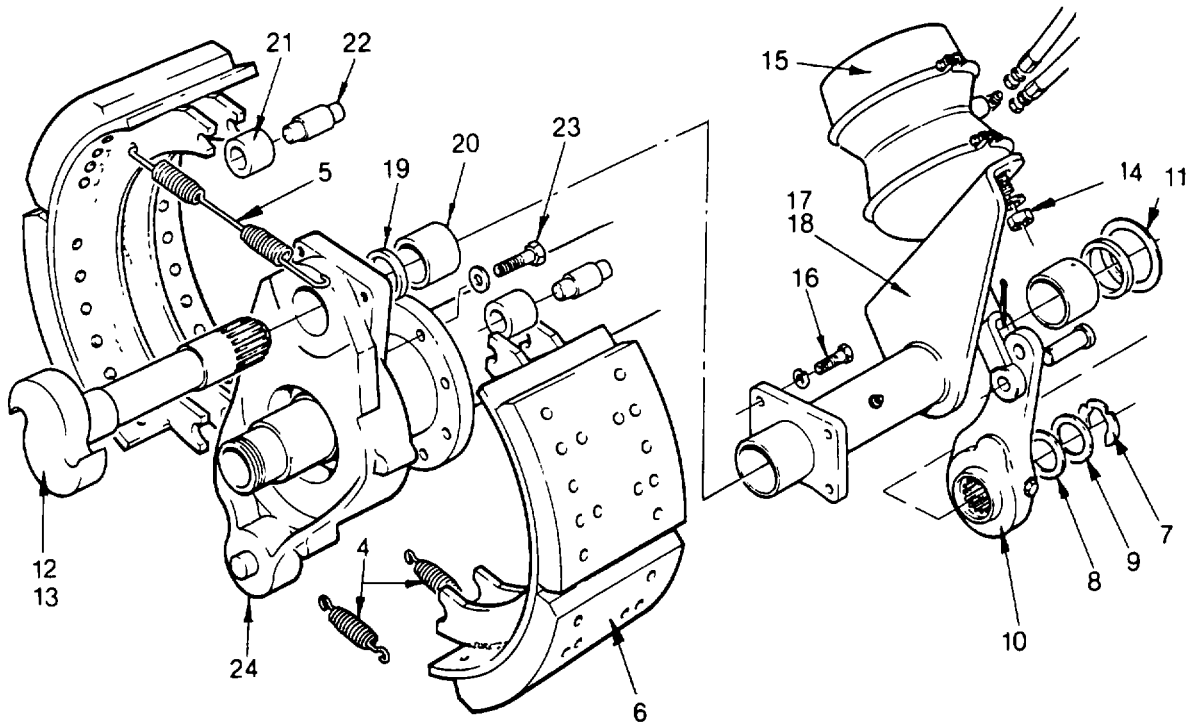
CAUTION

To prevent serious accidents, always service both left hand and right hand brakes together.

4-30. REAR AXLE - Continued

NOTE

These procedures are common for both left and right brake assemblies. Assemblies or components that can only be used on left hand or right hand wheel are so marked. They are not interchangeable.



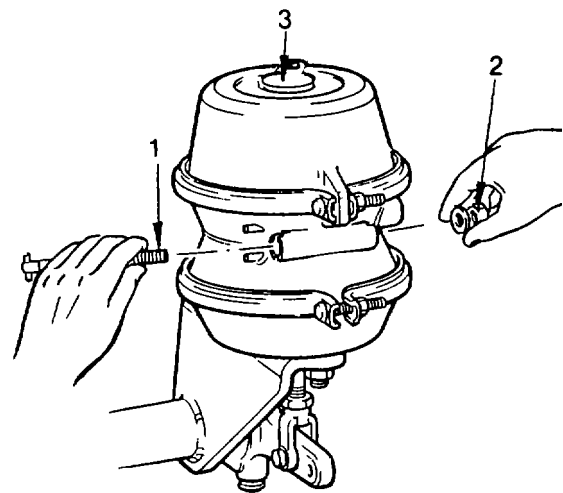
ADJUSTMENT

- (1) Block the front wheels to prevent the truck from moving while working on the rear axle
- (2) Jack affected wheel end up until wheel is off the ground Support raised wheel end on maintenance trestle

NOTE

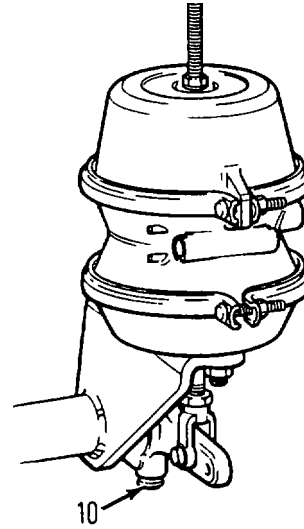
Brake adjustment may be carried out with rear wheel either removed or installed.

- (3) From its storage position on the side of the brake air chamber remove stud (1) and nut (2).
- (4) Remove plastic cap (3) from top of brake chamber.
- (5) Insert stud (1) into brake chamber. Twist stud into engagement with spring retainer inside brake chamber.
- (6) Install and tighten nut until parking brake spring is completely retracted and the brake fully released.



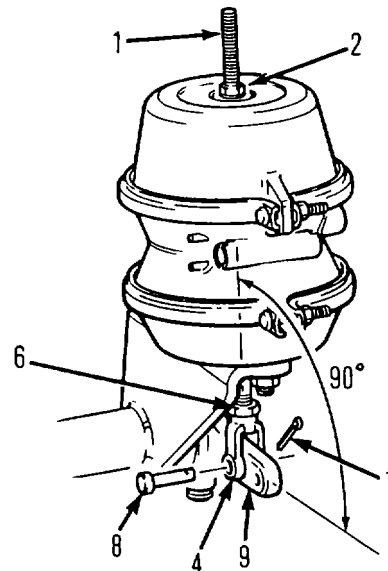
4-30. REAR AXLE - Continued**4-30.4 Brake Assembly - Continued**

- (7) If disconnected, connect truck batteries and start engine. Run engine until air system is at normal pressure.
- (8) Stop the engine and disconnect truck batteries.
- (9) Push locking sleeve on slack adjuster down and turn adjustment screw (10) clockwise until brake shoes are tight against brake drum.
- (10) Back screw (10) off approximately two turns, 10-12 flats on the screw head, until there is no brake drag.
- (11) Be sure locking sleeve engages adjuster screw (10) when adjustment is completed.



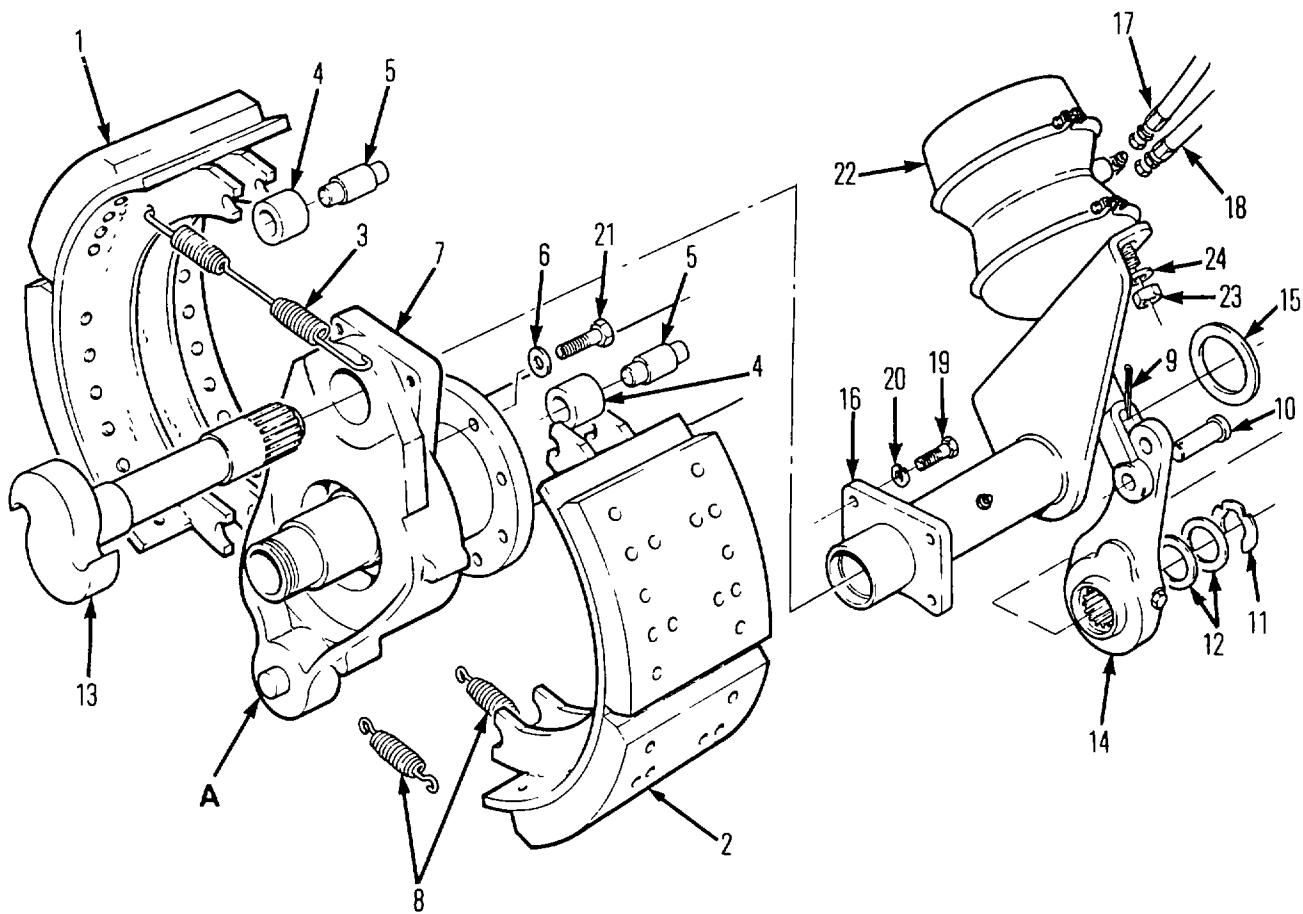
- (12) To be sure brakes are free and without drag, tap brake drum with a hammer and listen for a clear ringing sound, or turn the wheel in forward and reverse directions and check brake shoes do not rub against brake drum.
- (13) Apply the rear brakes using the brake pedal in the cab. Check the angle between air chamber push rod and slack adjuster as shown. The angle should be 90 deg. If the angle is less, or more than a few degrees larger than this, adjust position of clevis (4) on push rod (5).

- (14) To adjust position of clevis loosen jam nut (6).
- (15) Remove clevis pin (8) and disconnect clevis (4) from slack adjuster (9).
- (16) Turn clevis (4) as required to increase or decrease overall length of push rod.
- (17) Secure clevis pin using cotter pin (7) and tighten jam nut (6) against clevis.
- (18) Recheck angle between slack adjuster and push rod as detailed in step 10 above.
- (19) Apply parking brake by removing nut (2), and twisting stud (1) out of engagement with spring retainer. Remove stud from brake chamber.



- (20) Install stud and nut in storage position on side of brake chamber. Tighten nut securely.
- (21) Install protection plug in brake chamber opening.
- (22) Repeat steps 2 thru 21 for second rear brake. When complete, lift axle with jack and remove maintenance trestles.

4-30. REAR AXLE - Continued



REMOVAL

- (1) Using a lever, lift brake shoe (1) to stretch return spring (3).
- (2) Remove cam roller (4) and pin (5).
- (3) Lift brake shoe (2) as in step 1 and remove other roller and pin (4 and 5).
- (4) Push both brake shoes toward camshaft (13) and remove return spring (3).
- (5) Rotate brake shoes around anchor pin (A) and remove them from the axle.

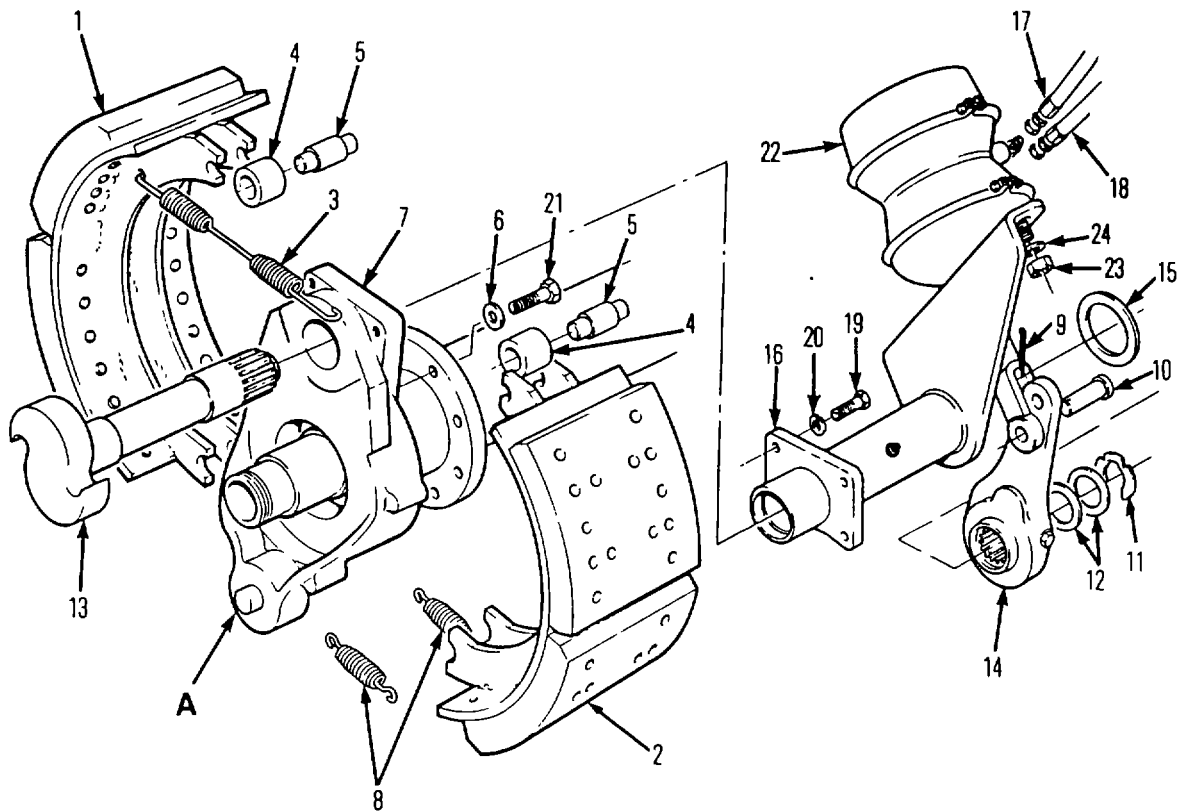
NOTE

Replace cam rollers and pins (4 and 5), shoe return spring (3), and shoe retainer springs (8) every time the brake shoes are replaced.

- (6) Remove cotter pin (9) and clevis pin (10) from air chamber push rod clevis.

4-30. REAR AXLE - Continued

4-30.4 Brake Assembly - Continued



- (7) Remove snap ring (11) and washers (12) from camshaft (13)
- (8) Remove slack adjuster (14) using a suitable puller

CAUTION

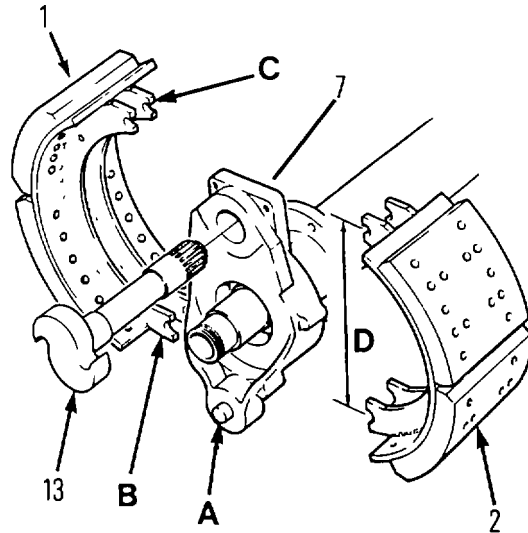
Do not hammer on slack adjuster to remove. Damage to slack adjuster and/or camshaft (13) splines may result.

- (9) Remove washer (15) and pull camshaft (13) out of air chamber bracket (16)
- (10) Tag and disconnect brake chamber air lines (17 and 18)
- (11) Remove capscrews (19) and washers (20) attaching air chamber bracket (16) to brake spider (7) and remove air chamber bracket
- (12) Inspect brake spider (7) for cracks at bolt hole, cam area or around anchor pin. Remove capscrews (21) and washers (6) if replacement is required.
- (13) Inspect air chamber bracket for cracks or bends. Inspect air chamber for leaks, bent push rod, loose clamp rings, clogged vent holes or housing damage. Replace either component by removing nuts (23) and washers (24).

4-30. REAR AXLE - Continued

INSPECTION

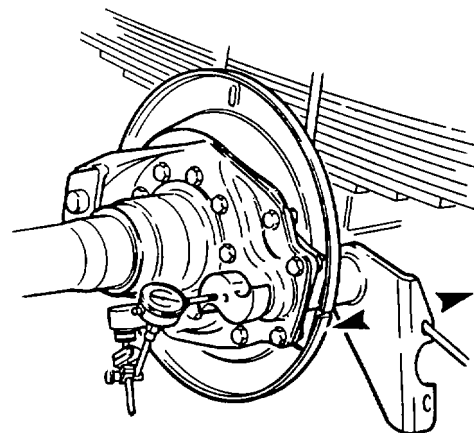
- (1) Inspect anchor pin (A) If pin is loose or grooved more than 0.03 in. (0.8 mm) below original surface, replace the spider.
- (2) Inspect brake shoes (1 and 2) and replace if lining is contaminated, cracked or worn to less than 1/4 in. (6.4 mm) thickness at any point, or if rivets are closer to surface than 1/16 in. (1.6 mm) in any location.
- (3) Check brake shoes for bent or cracked webs or table. Check also for broken weld seams, loose rivets or elongated rivet holes. Replace shoes if any of these conditions are found.
- (4) Check shoe span by measuring the distance D between centerlines of anchor pin and camshaft roller recesses. If D is less than 12 5/16 in. (312.7 mm) or more than 12 9/16 in. (319.1 mm) replace brake shoes.
- (5) Check anchor pin and camshaft roller recesses (B and C) for elongation or visible wear. Replace brake shoes. If diameter of roller recesses (C) have been enlarged to 7/8 in. (22.43 mm) or greater use a piece of 7/8 in. bar stock as a gage.
- (6) Inspect camshaft (13). Check for damaged or worn splines, corroded or worn bearing journals, and brinelling, cracks or flat spots on camshaft head. Replace camshaft if worn or defective.



NOTE

To carry out the following inspection procedure the camshaft, brake spider, air chamber bracket, and slack adjuster including normally used shim washers must be assembled as shown.

- (7) Check camshaft end play as detailed in steps 8 thru 11 following
- (8) Mount a suitable dial indicator with the plunger referencing the cam head at 90 deg. from cam face.
- (9) Pull camshaft inward, ie., cam head toward spider, to take up any end play and set dial indicator to zero.
- (10) Push camshaft outward and note maximum dial indication. The end play measured should be 0.005 - 0.045 in. (0.13 - 1.14 mm).



4-30 REAR AXLE - Continued

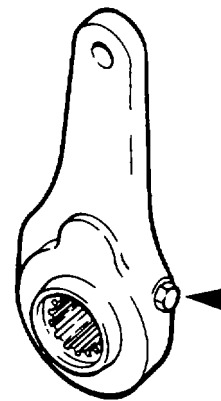
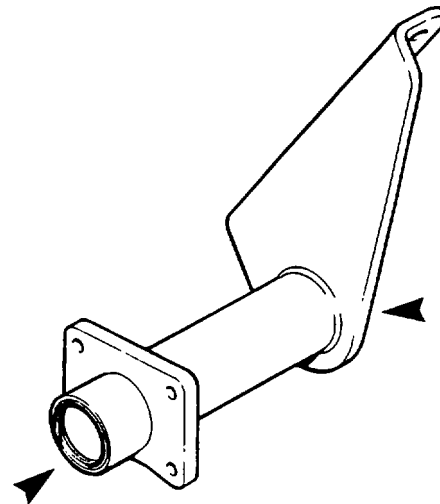
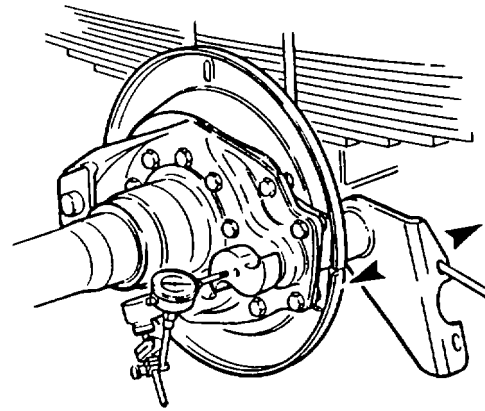
4-30.4 Brake Assembly - Continued

- (11) If end play is outside these limits adjust by removing/installing shim washers between slack adjuster and lock ring.

NOTE

Shim washers are available in two thicknesses, 0.030 in. (0.76 mm) and 0.060 in. (1.52 mm).

- (12) Check bushing surfaces are smooth. If rough, replace bushings and oils seals. Bushings can be removed with a suitable puller. For installation see INSTALLATION step 1 following.
- (13) Mount a suitable dial indicator with the plunger referencing the cam face at 90 deg. to cam bearing journal.
- (14) Set indicator dial to zero and move cam head radially up and down. Note maximum dial reading.
- (15) Mount dial indicator at slack adjuster end of camshaft and repeat step 14.
- (16) If measured play exceeds 0.020 in. (0.51 mm) at either end of camshaft, replace bushings in air chamber bracket.
- (17) With new bushings installed in air chamber bracket, recheck radial play as above. If radial play still exceeds 0.020 in. (0.51 mm), replace camshaft. Replace oil seals.
- (18) Check camshaft oil seals for wear and damage. If oil seal lips are distorted or damaged, replace oil seals.
- (19) Inspect slack adjuster for damage to body, splines, and clevis pin bushings. If any serious defects are noticed, replace slack adjuster.
- (20) Depress slack adjuster locking sleeve and turn adjuster nut E with a wrench at least one turn clockwise and counterclockwise. If binding is observed, replace slack adjuster.



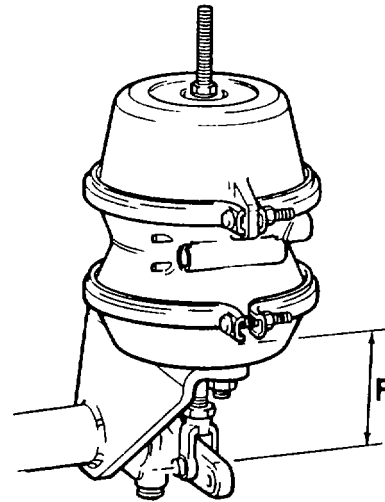
4-30 REAR AXLE - Continued

- (21) If brake air chamber is replaced, adjust clevis position and push rod so that distance F from chamber to center of clevis pin holes equals $2 \frac{5}{8} \pm 1/16$ in. (66.7 ± 1.6 mm).

CAUTION

Do not reuse a brake drum if the diameter of the bore exceeds the manufacturers recommended maximum or the total indicated runout exceeds 0.020 in. (0.51 mm).

- (22) Inspect brake drum for cracks, heat-checks, glazing, grooving, runout and out-of-round. If brake drum is cracked it must be replaced. If drum is glazed, grooved, out-of-round, etc, it may be turned in a lathe and reused provided the maximum diameter of the bore, stamped inside the drum, is not exceeded.

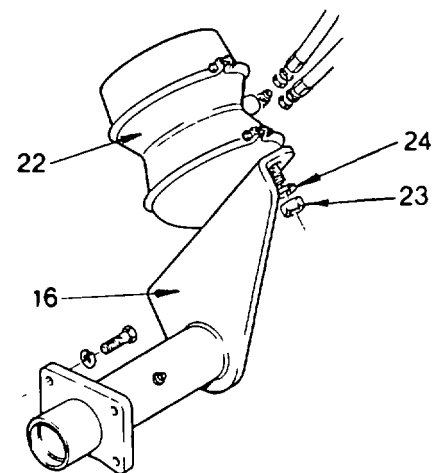
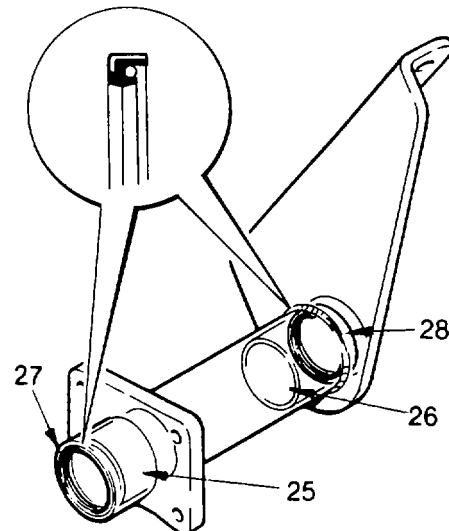
**INSTALLATION**

- (1) If bushings (25 and 26) are replaced, use a suitable piloted punch to drive new bushings in place. When correctly seated bushing (25) should be in $1/4$ in. (6.4 mm) from end of tube and bushing (26) $21/32$ in. (16.7 mm) from other end of tube.

CAUTION

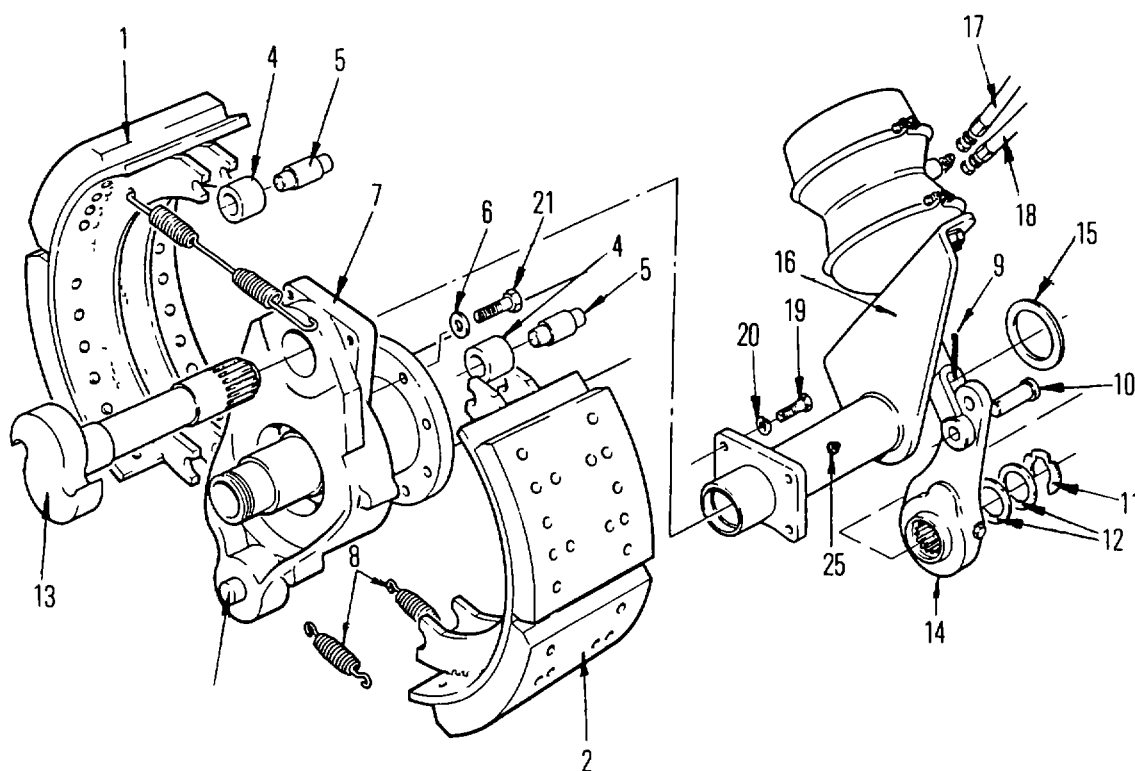
Improperly orientated seals may allow grease to leak out of camshaft head and contaminate brake drum and brake shoe lining

- (2) Install seals (27 and 28) using a suitable pilot. Be sure seal springs are facing in the same direction, toward air chamber end of bracket.
- (3) If disassembled, assemble brake air chamber (22) and air chamber bracket (16) using washers and nuts (23 and 24). Be sure air hose ports in brake chamber face away from bracket. Tighten nuts to 170 lb (230 Nm).



4-30. REAR AXLE - Continued

4-30.4 Brake Assembly - Continued



- (4) If replaced, install new brake spider (7) using hardened washer (6) and bolts (21). Apply threadlock liquid (item 29, Appendix E) to bolt thread. Install and tighten bolts to 115 ft lb (155 Nm).
- (5) Install air chamber bracket (16) to spider (7) using bolts (19) and washer (20) Tighten bolts to 85 ft lb (115 Nm)
- (6) Apply a light coat of pipe sealant (Item 22, Appendix E) to thread of fittings and install brake chamber hoses (17 and 18) to brake chamber. Tighten fittings firmly to provide leak proof connections.
- (7) Apply a light coat of grease (Item 16, Appendix E) to journals and splines on camshaft (13), and slide it through spider (7) and brake chamber bracket (16). Be careful not to damage seals inside bracket tube. Be sure that no grease had been left on camshaft head.
- (8) Connect brake shoes (1 and 2) together using retaining springs (8). Place brake shoes around axle spindle so that lower end is riding on anchor pin (A).
- (9) Install return spring (3).
- (10) Lever each brake shoe in turn and install cam rollers and pins (4 and 5) between brake shoes and camshaft head.

4-30. REAR AXLE - Continued**NOTE**

Shim washers (15) and (12) are identical except for the thickness. Normally washer (15) should be the thickest.

- (11) Install shim washer (15) and slack adjuster (14). Be sure adjustment screw on side of slack adjuster is facing away from air chamber.
- (12) Install appropriate shim washers (12) (refer to INSPECTION step 7, if necessary, to determine shim requirement). Install lock ring (11).
- (13) Attach slack adjuster to brake chamber clevis using clevis pin (10) and cotter pin (9). If advanced too far depress locking sleeve on side of slack adjuster and turn slack adjuster toward brake chamber clevis to line up clevis pin holes.
- (14) Lubricate camshaft via grease nipple (25) with grease (item 16, Appendix E). Do not over-lubricate as this will damage the seals
- (15) Install wheel hub and brake drum, as detailed in para. 4-30.3, and axle shaft, as detailed in para. 4-30.2. Adjust brake as outlined in ADJUSTMENT procedures following.
- (16) Be sure axle is refilled with oil, see lube order LO 5-4210-220-12, and parking brake is reapplied, see ADJUSTMENT step 16, when installation and adjustment of the brake is complete.

4-30 REAR AXLE - Continued

4-30.5 Air Shift Units.

This task covers

- a. Replacement
- b. Repair

TOOLS

Shop Equipment, Automotive Maintenance and Repair, NSN 4910-00-754-0705

MATERIALS/PARTS

9, Appendix E Dexron
 21, Appendix E Petroleum Jelly
 22, Appendix E Pipe Sealant
 28, Appendix E Silicone Sealant
 113581 Lock Up Shift Unit
 73507 CTD Air Shift Unit
 119855 Shift Fork Seal

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24.12)
 All Wheels Blocked
 All Air Tanks Drained

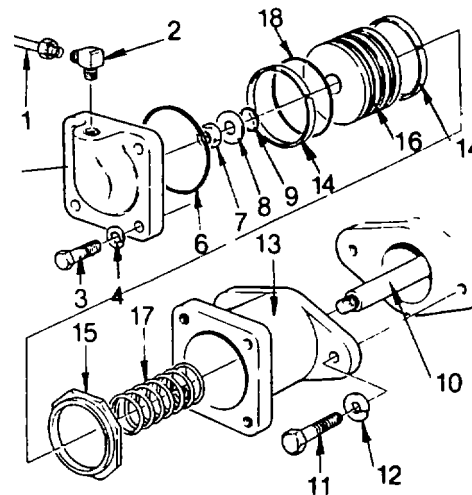
REPLACEMENT

- a 4-Wheel Drive Air Shift Unit Replacement

NOTE

Parts for the air shift unit can be bought separately or as a total unit. The shift unit, including the shift fork (10), is included in the replacement unit. If shift fork must be replaced, request assistance from Direct Support Level.

- (1) Remove control air line (1) and fitting (2) from shift unit cover (5).
- (2) Remove capscrews (3) and lockwasher (4) attaching cover (5) Remove cover and O-ring (6).
- (3) Remove nut (7), flatwasher (8), and O-ring (9) from shift fork push rod (10).
- (4) Remove capscrew (11) and lock washer (12) attaching body (13) to power divider housing. Remove body (13) and piston (16) assembled.
- (5) Remove spring (17) from shift fork (10).
- (6) Clean old sealant from power divider mounting flange.



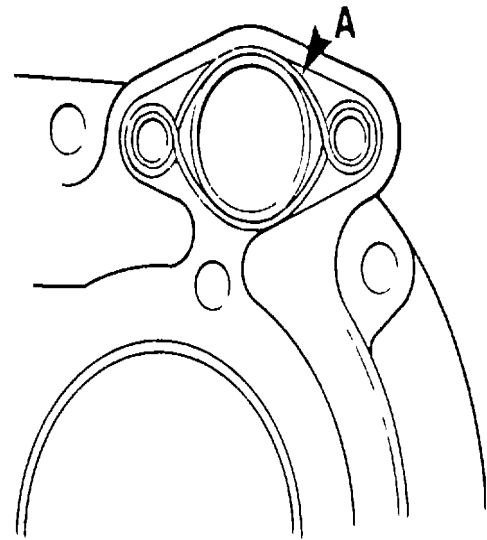
NOTE

If air shift unit is repaired, remove piston (16) from body (13). Remove piston stop (15). Discard all O-rings and felt oilers. Inspect all other components for damage. Replace as required.

- (7) Inspect new components for nicks, scratches, and other defects before starting installation.

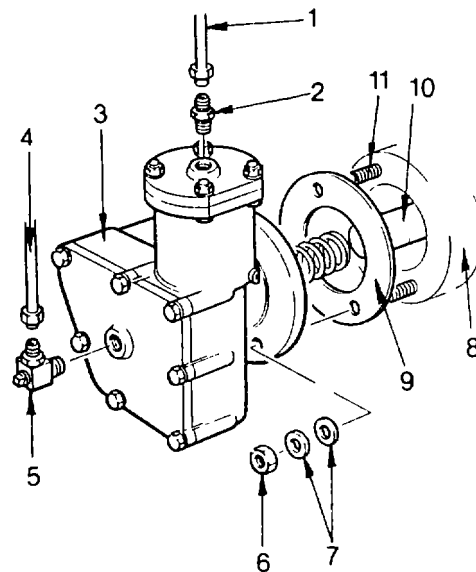
4-30. REAR AXLE - Continued

- (8) Soak new felt oilers (14) in Dexron (item 9, Appendix E) and lubricate O-rings (18) and (9) with petroleum jelly (item 21, Appendix E).
- (9) Apply a 1/8 in. (6.5 mm) bead of silicone sealant (A) (item 28, Appendix E) to mounting flange of power divider housing as shown.
- (10) Install new shift unit body (13) to power divider housing using capscrews (11) and lockwashers (12) Tighten capscrews to 50 ft lb (70 Nm).
- (11) Place spring (17) over push rod (10) and insert piston stop (15) in body (13).
- (12) Install felt oilers (14) and O-ring (18) on piston (16).
- (13) Install piston in shift unit body (13) Attach piston to shift fork (10) using O-ring (9), flatwasher (8), and nut (7). Tighten nut to 25 ft lb (35 Nm).
- (14) To hold O-ring (6), apply petroleum jelly (item 21, Appendix E) to mounting surface of cover (15) . Place O-ring on cover and install both items to body (13) using capscrews (3) and washers (4). Be sure air inlet cover is facing upward as illustrated. Tighten capscrews (3) to 100 in. lb (11 Nm).
- (15) Apply pipe sealant (item 22, Appendix E) to fitting (2) and install in cover (5) Tighten fitting firmly.
- (16) Install control air line (1) to fitting (2).



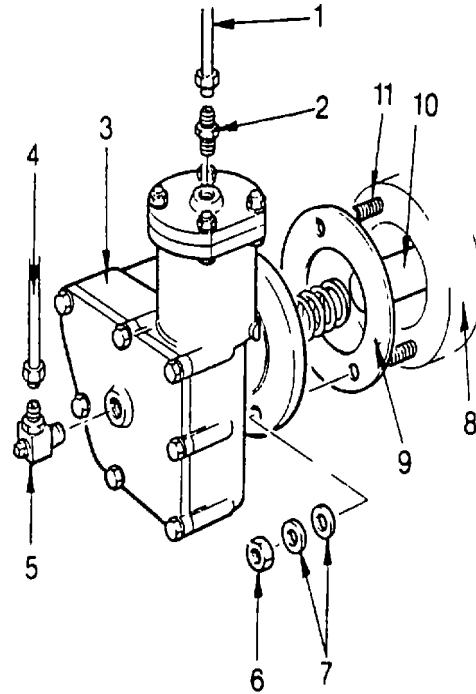
b Differential Lock Air Shift Unit Replacement

- (1) Remove control air line (1) and fitting (2) from top cover of air shift unit (3).
- (2) Remove vent line (4) and tee (5) from air shift unit.
- (3) Remove nuts (6) and washers (7), and pull air shift unit free of studs (11).
- (4) Pull spring from seal and remove seal (9) from shift fork (10) and housing studs (11).
- (5) Inspect new air shift unit to be sure it is undamaged and remove shipping plugs from top and end covers.
- (6) Inspect seal and spring (9). Replace if either part is damaged or deteriorated.



4-30. REAR AXLE - Continued**4-30.5 Air Shift Units - Continued****b. Differential Lock Air Shift Unit Replacement Continued**

- (7) Inspect fittings (2 and 5). Replace if damaged or faulty.
- (8) Remove vent plug (12) and replace with 1/4 in. setscrew. Coat threads of setscrew with threadlock liquid (item 29, Appendix E) prior to installation. Screw flush with housing.
- (9) Lubricate shift fork (10) and studs (11) with Dexron (item 22, Appendix E). Push shift unit onto housing (8) making sure shift fork (10) and actuating lever in shift unit engage.
- (10) Secure air shift unit using nuts (6) and washers (7). Tighten nuts to 60 ft lb (80 Nm).
- (11) Fill shift unit housing with Dexron (item 22, Appendix E) as detailed in lube order LO 5-4210-220-12.
- (12) Apply pipe sealant (Item 22, Appendix E) to pipe thread of fittings (2 and 5) Install fittings to shift unit and install control air and vent lines (1 and 4).

**REPAIR****a. 4-Wheel Drive Air Shift Unit Repair****NOTE**

All components in the 4-Wheel drive air shift unit are individually replaceable. Refer to **REPLACEMENT** preceding for details of removal and installation. Whenever the shift unit is repaired, all O-rings and felt oilers on piston should be replaced.

4-30. REAR AXLE - Continued

b. Differential Lock Air Shift Unit Repair

NOTE

Air shift unit removed from truck

NOTE

Replacement of gasket (4) or O-ring (5) may be done without removing air shift unit from truck. Whenever the air shift unit is disassembled for repair, all O-rings and piston felt oilers should be replaced.

- (1) Remove capscrews (1), lockwashers (2), cover (3), and gasket (4) from shift unit housing (6). Drain housing.
- (2) Remove locknuts (10), capscrews (9), top cover (11), and O-ring (12). Discard locknuts and O-ring.

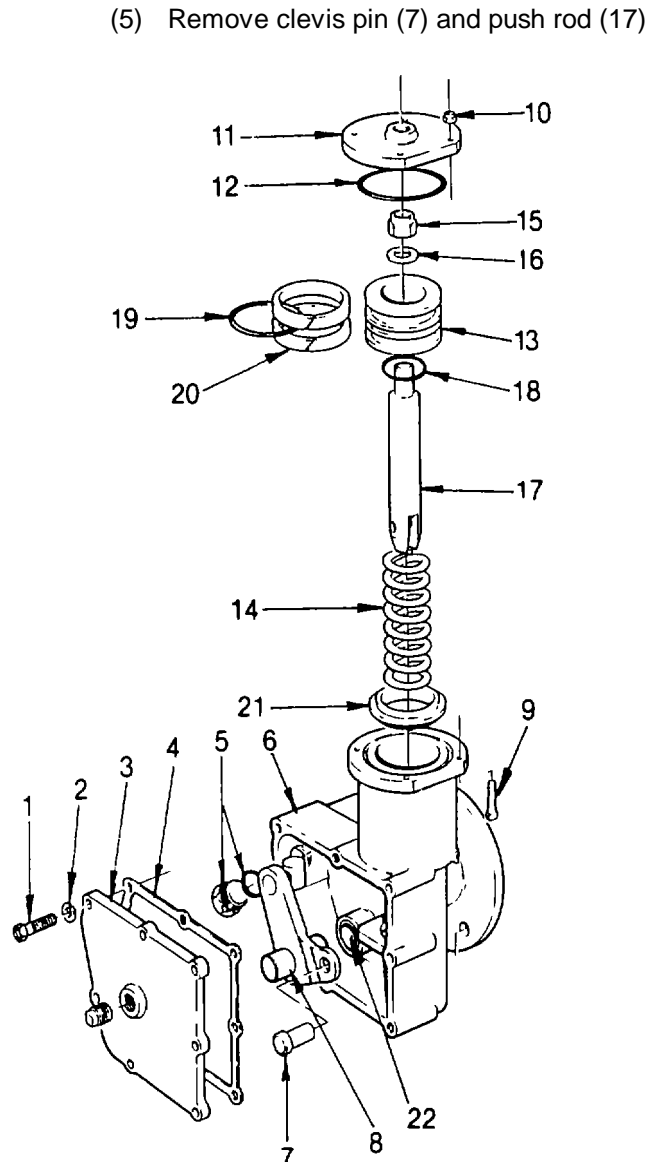
WARNING

During the following procedure the piston (13) will pop out of the housing by action of the spring (14) when nut (15) is removed. Take precautions to prevent injury to your hands and face.

- (3) Remove locknut (15), flat washer (16), and piston (13) from push rod (17). Remove and discard O-rings (18 and 19), and felt oilers (20).
- (4) Remove compression spring (14) and piston stop (21).
- (6) Remove actuating lever and pivot pin assembly (8). Do not disassemble actuating lever.
- (7) Inspect housing (6) for damage and defects. Replace complete air shift unit if excessive wear or damage, including deep scoring of piston bore, is noticed.
- (8) Inspect actuating lever and pin (8) for wear and deterioration. Replace both parts if either are defective.

NOTE

If replacement of actuating lever and pin (8) as well as bushings (22) is required, replace complete air shift unit.

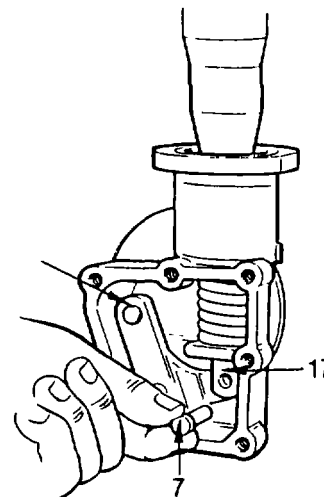
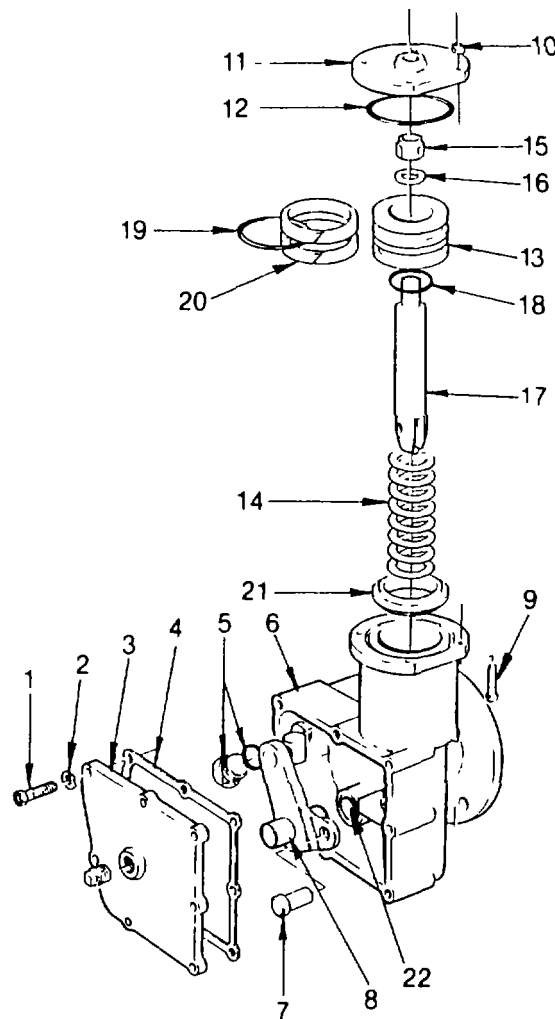


4-30. REAR AXLE - Continued

4-30.5 Air Shift Units - Continued

b. Differential Lock Air Shift Unit Repair Continued

- (9) Inspect housing and cover bearing bushings (22). Replace bushings if these are heavily worn or scored.
- (10) Inspect piston (13). Replace if friction surface shows excessive wear, deep scoring, or other damage.
- (11) Inspect push rod (17) and replace if thread is stripped, clevis pin holes are elongated, or rod otherwise damaged.
- (12) In preparation for installation, soak new felt oilers (20) in Dexron (item 9, Appendix E) and lubricate O-rings (5, 12, and 19) with petroleum jelly (item 27, Appendix E).
- (13) Lubricate bearing bushings (22) with Dexron (item 9, Appendix E) and install actuating lever and pin (8), assembled as shown, in shift unit housing.
- (14) Install piston (13) and O-ring (18) on push rod (17) and secure with washer (16) and locknut (15). Tighten locknut to 150 in. lb (17 Nm).
- (15) Install felt oilers (20) and O-ring (19) on piston (13).
- (16) Insert piston stop (21), compression spring (14) and the assembled piston and push rod in shift unit housing. Be sure clevis end of push rod (17) lines up with actuating lever (8).
- (17) Using a press, carefully push piston into housing bore. As the push rod (17) protrudes the spring stop bracket, make sure push rod clevis straddles actuating lever arm (8).
- (18) Aline clevis pin holes in push rod and actuating lever and install clevis pin (7).
- (19) Apply gasket eliminator (item 14, Appendix E) to capscrews (1).



4-30. REAR AXLE - Continued

- (20) Install gasket (4) and cover (3) to shift unit housing using capscrews (1) and lockwashers (2). Tighten capscrews to 100 in. lb (11 Nm).
- (21) Place O-ring (12) in groove housing (6) and install cover (11) using capscrews (9) and locknuts (10) Tighten locknuts to 130 in. lb (15 Nm).
- (22) Be sure to refill air shift unit with Dexron (item 9, Appendix E) as detailed in lube order LO 5-4210-220-12, when the unit is installed on truck.

4-31 FRONT AND REAR SUSPENSION

4-31 1 Shock Absorbers

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

15, Appendix E Gear Oil
29, Appendix E Threadlock Liquid
74003 Shock Absorber
310594 Locknut

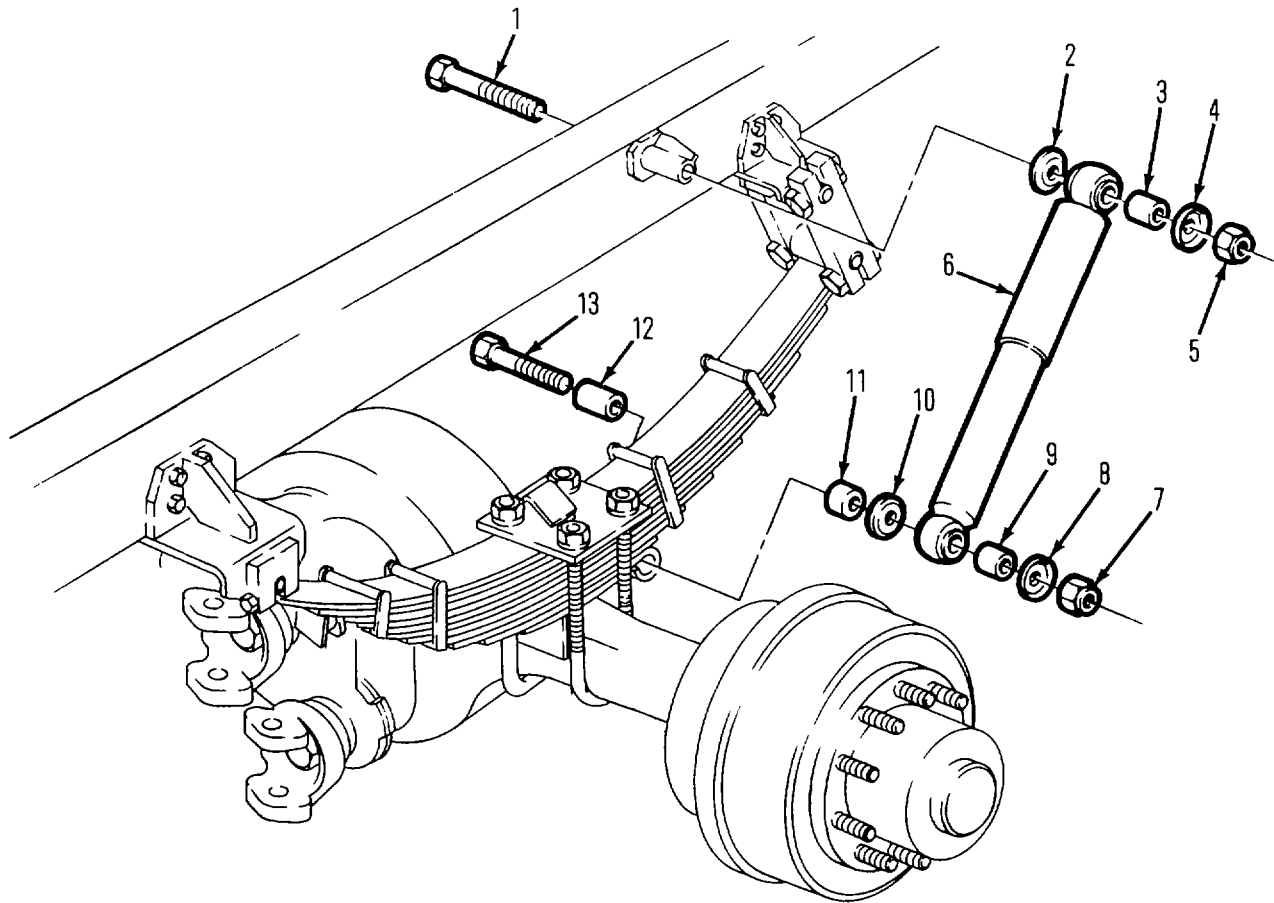
EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheels Removed (see para. 4- 29.1)

PERSONNEL REQUIRED - 2

NOTE

The front shock absorbers are mounted inboard of the frame, whereas the rear shock absorbers are mounted outboard of the frame.



4-31. FRONT AND REAR SUSPENSION - Continued**REMOVAL**

- (1) To gain access to the shock absorbers, the truck wheel(s) have to be removed. To make replacement easier, the weight of the truck should be on the spring. The truck can:
 - (a) be jacked and supported on maintenance trestles under the front (or rear) axle, (see para. 4- 29.1), or:
 - (b) be supported on maintenance trestles under the frame, and then jacked under the axle until nearly all the truck weight is on the front (or rear) spring(s).
- (2) With the truck supported as above, remove wheel(s) from axles, depending which shock absorber is to be replaced. It is easier to replace one shock absorber at a time. If both shocks on a single axle are to be removed, repeat the following for each shock absorber.
- (3) Remove nut (7) and washer (8) from lower end of shock absorber. Discard locknut.
- (4) Drive out lower bolt (13) ensuring drift does not damage bolt threads or score inner bushing (11).
- (5) When bolt is free of shock absorber remove washer (10), spacer (12), shock absorber bushing (9), and spring bushing (11). The spring bushing may require use of puller to remove. Use puller with land diameter of 1 in. (2.5 cm) to push spring bushing out of spring.
- (6) Repeat (3, 4, and 5), for upper end of shock absorber (There is no removable spacer or spring bushing in upper end).

INSPECTION

- (1) Inspect shock absorber for signs of corrosion and leaks. The skirt should not be severely corroded, any holes are cause for rejection.
- (2) Check the connecting rod. It should be bright and clean and should have no score marks.
- (3) Generally, shock absorbers should be replaced if they are ever removed from the truck unless they have been in service less than 1 year.
- (4) Check shock absorber upper and lower bushings for corrosion and wear. Both inner and outer surfaces should not be scored.
- (5) Check spring bushing for corrosion and wear. Outer surface should not be heavily corroded. Inner surface should not be scored or corroded.

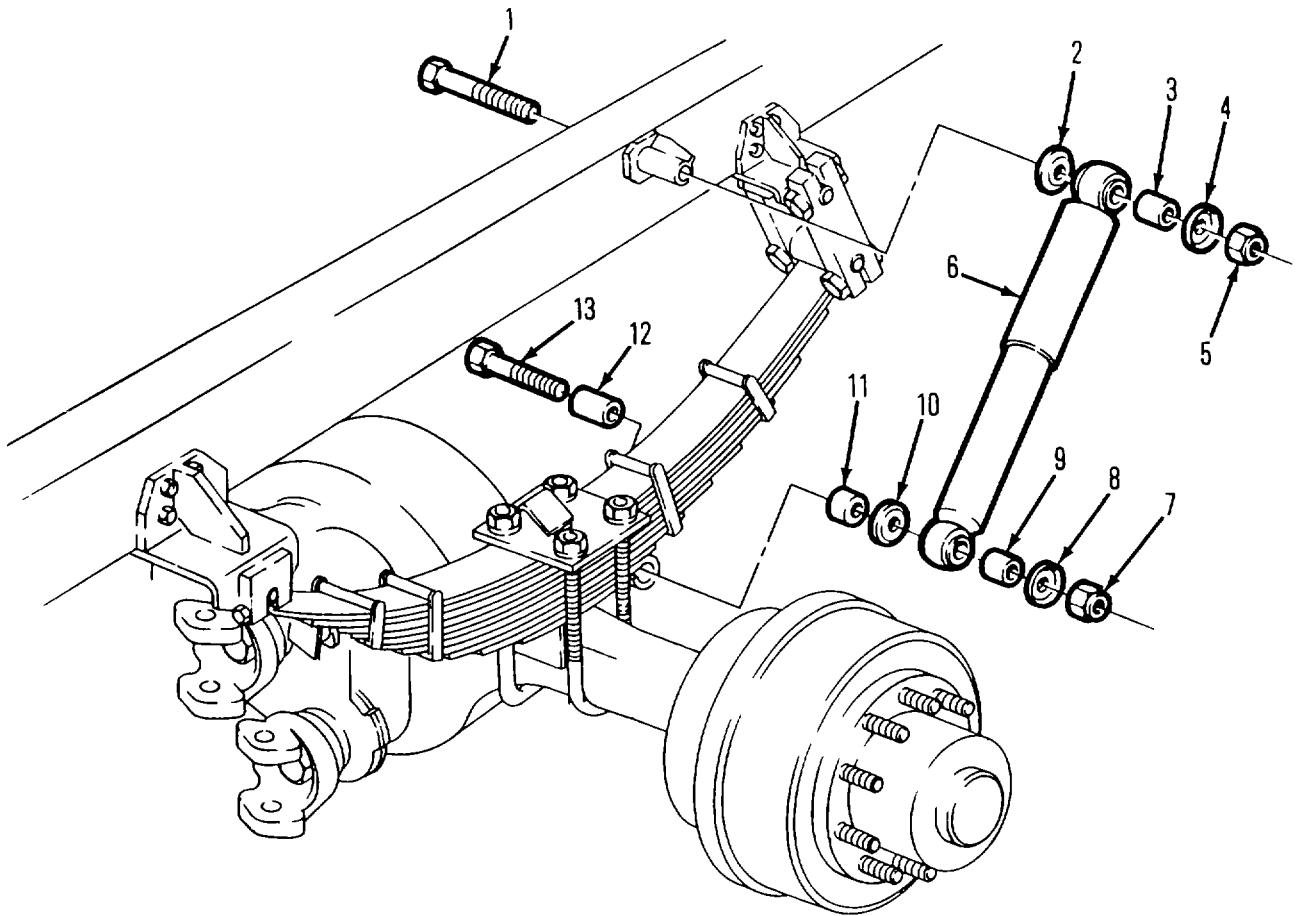
INSTALLATION

- (1) Install lightly oiled bushing (3) in upper end of shock absorber (6) (This is the large end of shock absorber) Use gear oil (Item 15, Appendix E).
- (2) Install upper retaining bolt (1) into frame. (Head outboard on front axle, head inboard on rear axle).

4-31. FRONT AND REAR SUSPENSION - Continued**12-4-31.1 Shock Absorbers - Continued**

- (3) Slide shock washer (2) onto bolt, cup face away from bolt head. Slide shock absorber (6) onto bolt followed by second shock washer (4), cup face toward bolt head.
- (4) Apply five drops of threadlock liquid (item 29, Appendix E) to locknut and install locknut fingertight.
- (5) If truck is supported by maintenance trestles under the frame, raise jack under axle until spring takes almost all weight of vehicle.
- (6) Insert lightly oiled spring bushing (12) into the spring. Use gear oil (item 15, Appendix E). A puller may be required to install. Use puller with land diameter of 1 in. (2.5 cm) to push spring bushing into spring.
- (7) Install lower retaining bolt (15) into spring bushing (Head outboard on front axle, head inboard on rear axle).
- (8) Slide shock spacer (11) followed by shock washer (10) onto bolt (Washer to have cup face away from bolt head).
- (9) Install lightly oiled bushing (9) in lower end of shock absorber.
- (10) Pull down lower end of shock absorber and slide bolt (13) through shock absorber lower bushing (9).
- (11) Slide shock washer (8) onto bolt, cup face toward bolt head. Apply five drops of threadlock liquid (item 29, Appendix E) to locknut and Install locknut.
- (12) Tighten both upper and lower shock-absorber locknuts to 150 ft lb (205 Nm).
- (13) Replace wheel(s) on axle and lower vehicle, see para. 4- 29.1.

4-31. FRONT AND REAR SUSPENSION - Continued



4-31. FRONT AND REAR SUSPENSION - Continued**4-31.2 Springs.****This task covers**

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24)
Truck Wheel Removed (see para. 4-29.1)
Shock Absorber Removed (see para. 4-31.1)

MATERIALS/PARTS

17, Appendix E Engine Oil
29, Appendix E Threadlock liquid
16, Appendix E Grease
37520 Front Spring Assembly
37521 Rear Spring Assembly
100031-01 U-bolt
100031-03 U-bolt
100031-04 U-bolt
100031-05 U-bolt
310424 Locknut
310592 Locknut

PERSONNEL REQUIRED - 2**WARNING**

Leaf spring weighs about 200 lb (90 kg). Use suitable equipment or assistance to avoid injury.

NOTE

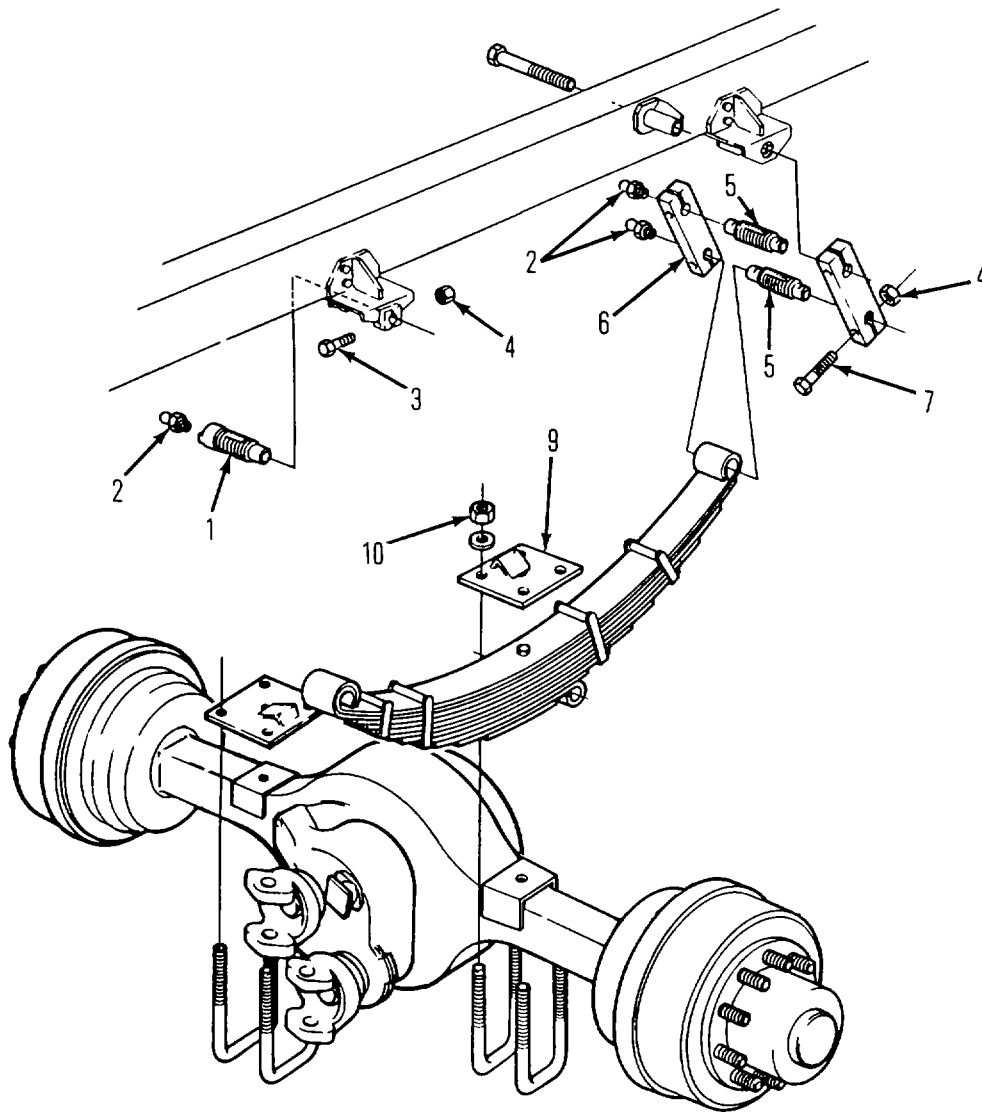
The front and rear springs are mounted similarly except that the rear springs are mounted outboard of the frame and the front are mounted directly beneath the frame. The rear springs have 15 leafs, whereas the front only have 11. Only replace one spring at a time.

REMOVAL**NOTE**

For rear spring, remove hose reel cover, see para. 4-14.1. For front springs, remove front and pump body heat shield, see para. 4-11.

- (1) Ensure wheel and shock absorber on that end of the axle which is to have spring replaced are removed. Ensure front or rear of truck (depending which spring is to be replaced) is supported on maintenance trestles on the frame.
- (2) Support axle on jack. Raise jack until it just touches the axle.
- (3) Remove both suspension U-bolts by undoing nuts (10). If nuts and threads are corroded burn through U-bolts.
- (4) Mark spring top plate (9) forward edge and top face. Remove spring top plate.
- (5) Raise jack under axle until there is a small gap between axle and spring.

4-31. FRONT AND REAR SUSPENSION - Continued



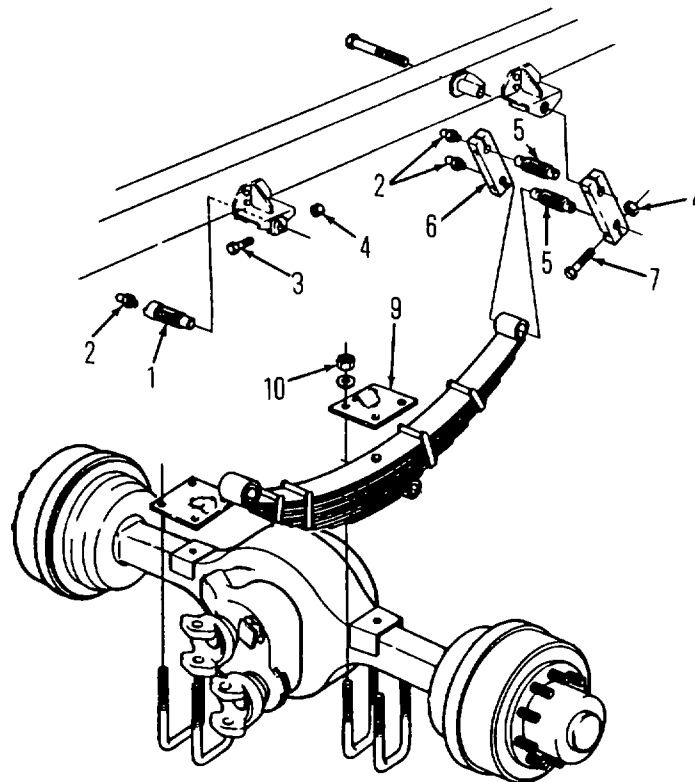
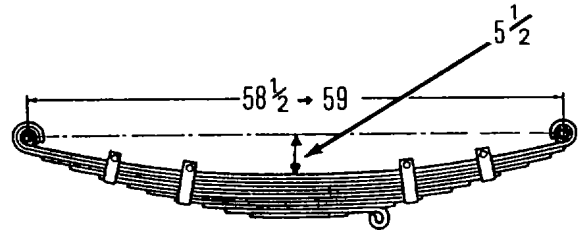
- (6) Remove grease fittings (2) from all three spring pins (1 and 5).
- (7) Remove locknuts (4) from all six shackle locking bolts (3 and 7). Drive out locking bolts with a drift. Take care not to damage threads.
- (8) Remove both shackles (6) from rear of spring by pulling them off the spring pins (5).
- (9) While supporting rear end of spring, remove spring front pin (1). It has to be pushed inboard. Remove spring from where it rests on axle.
- (10) Remove spring pin (5) from rear of spring. Remove spring pin (5) from frame.

4-31. FRONT AND REAR SUSPENSION - Continued

4-31.2 Springs - Continued

INSPECTION

- (1) Wipe all parts clean. Use pressure washer as required. Use wire brush to remove rust and scale.
- (2) Inspect spring pins and shackles for excessive wear or corrosion. Spring pins should fit snugly into bushings and shackles.
- (3) Inspect spring bushings for excessive wear.
- (4) Inspect spring leaves for cracks and deformities. Check spring dimensions as shown. Check the spring dimensions whether it is an old spring or a new one being replaced. The dimensions shown are the same for a rear or front spring.
- (5) Check all bolts and nuts for excessive corrosion.
- (6) Replace all parts failing inspection. Discard all U-bolts and locknuts. These must always be replaced whenever they are removed.

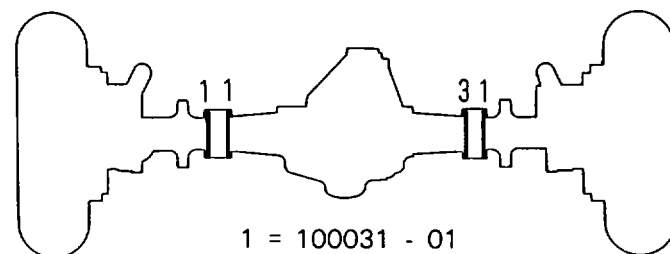
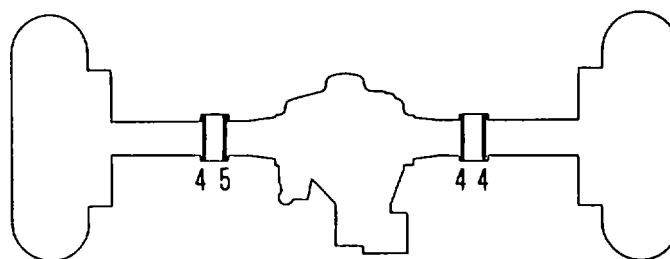


4-31. FRONT AND REAR SUSPENSION - Continued**INSTALLATION**

- (1) Ensure eye bushings are in both ends of the spring.
- (2) Place spring (8) in position with double leaf wrap toward front end of truck. Ensure middle of spring rests on top of axle.
- (3) Coat front spring pin (1) with engine oil (item 17, Appendix E). Align spring bushing with frame holes and push pin in, with one locking slot down and grease fitting outboard. Do not drive pin with hammer as this may damage grease fitting threads. If properly aligned the spring pin may be pushed in by hand.
- (4) Coat spring pin (5) with engine oil (item 17, Appendix E) and insert into frame bushing. (Grease-fitting hole inboard of frame).
- (5) Coat second spring pin (5) with engine oil (item 17, Appendix E). Insert pin into spring rear bushing. (Grease-fitting hole inboard of frame).
- (6) Raise or lower jack beneath axle on which the spring is resting until the two rear spring pins line up with the holes in the outboard shackles (6).
- (7) Align spring pin locking slots so they are facing each other. Push outboard shackle (6) onto the spring pins. If the shackle is a tight fit, hold a soft-headed hammer against the other end of one pin and tap the shackle on that end. Repeat with the hammer against the other spring pin. Repeat until shackle is against lip of both pins.
- (8) Fit both locking bolts (7) to the shackle. Do not drive the locking bolts as this will damage the threads. If they do not slide home, the pin locking slots are not aligned. Twist the pin from the other end until is aligned. Locking bolt heads must be to front of shackle.
- (9) Apply five drops of threadlock liquid (item 29, Appendix E) to locknuts (4) and install (5) fingertight on both shackle locking bolts.
- (10) Install inboard shackle, if necessary re-aligning the spring via the jack.
- (11) Install both locking bolts (7) in inboard shackle. Apply five drops of threadlock liquid (Item 29, Appendix E) to locknuts (4) and tighten to 75 ft lb (100 Nm). Locking bolt heads must be to front of shackle.
- (12) Tighten locknuts (4) on rear outboard shackle to 75 ft lb (100 Nm).
- (13) Install both locking bolts (3) in front spring pin (1) It may be necessary to re-align the spring via the jack. Locking bolt heads must be to front of shackle.
- (14) Apply five drops of threadlock liquid (Item 29, Appendix E) to locknuts (4) and tighten to 75 ft lb (100 Nm).
- (15) Install grease fittings (2) on all three spring pins (1 and 5). Apply grease (Item 16, Appendix E) to each shackle until it can be seen at the ends of that shackle.

4-31. FRONT AND REAR SUSPENSION - Continued**4-31.2 Springs - Continued**

- (16) Install U-bolts (13, 14) over axle and spring, and hold in position with spring top plate (9). Check marked edge is forward and marked face is top. Three different U-bolts are used. Be sure correct U-bolts are fitted. Ensure spring center rivet is aligned with center hole of spring top plate and center hole of axle spring weldment.
- (17) Install washer (11) on each U-bolt thread. Apply five drops of threadlock liquid (item 29, Appendix E) to each nut (10) and tighten each nut on each U-bolt in turn to gradually pull up the U-bolt. Tighten each nut to 300 ft lb (410 Nm).
- (18) Install shock absorber as detailed in para. 4-31.1. Replace wheel on axle as detailed in para.4-29.1.



- 1 = 100031 - 01
3 = 100031 - 03
4 = 100031 - 04
5 = 100031 - 05

4-32. FRONT AXLE.

4-32.1 Axle Assembly.

This task covers

- a. Removal
- b. Inspection
- c. Installation

TOOLS

Tool Kit, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Pump Body & Front Heat Shield Removed
(see para. 4-11)
Front Drive Line Removed (see para. 4-26.3)
Wheels Blocked
Wheels Removed (see para. 4- 29.1)
Drag Link Removed (see para. 4-25.6)
Air Tanks Drained

MATERIALS/PARTS

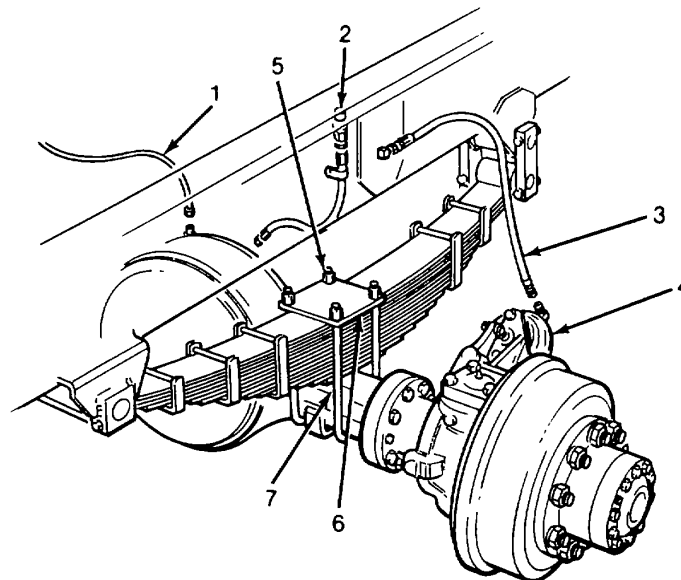
22, Appendix E Pipe Sealant
29, Appendix E Threadlock Liquid
100031-01 U-Bolt
100031-03 U-Bolt
310424 Nut
MS27183-23 Washer

PERSONNEL REQUIRED - 2

REMOVAL

WARNING

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.



4-32. FRONT AXLE - Continued

- (1) Disconnect air line (1) from front axle differential lock air shift unit.
- (2) Remove and retain capscrew and clamp attaching breather (2) to frame. Tape vent hose to axle temporarily.
- (3) Disconnect air hoses (3) from both left and right brake chambers (4).
- (4) With trolley jack placed underneath differential housing, support front axle and remove nuts (5) and U-bolts (7). If nuts and U-bolts are too corroded, flame cut the U-bolts.
- (5) Scribe spring plates (6) with alignment marks and remove from top of spring.
- (6) Lower trolley jack and maneuver the front axle out from underneath the truck.
- (7) Disconnect vent line from axle housing if new axle is to be installed.

INSPECTION

- (1) Visually inspect axle assembly for damage, and oil and grease leaks. Pay particular attention to pinion seal area and wheel end ball seals.
- (2) Inspect tie rod and tie rod ends, brake drums, brake air chambers, and vent hose components. Replace components showing signs of excessive wear or damage.

INSTALLATION

- (1) Install vent hose on front axle, if required.
- (2) If new axle, remove plug from differential lock air shift unit and replace with 1/4 in. setscrew. Apply threadlock liquid (item 29, Appendix E) prior to installation.
- (3) Support axle with trolley jack under the differential and maneuver the axle under the truck
- (4) Align axle with springs. Apply threadlock liquid (item 29, Appendix E) to nuts (5). Install U-bolts (7) through spring plate (6) and secure with nuts (5). Note that two different U-bolts are used. The wider U-bolts must be installed inboard of the springs.
- (5) Be sure axle and springs are properly aligned and spring plate scribe marks are aligned before firming up nuts (5). Tighten nuts to 300 ft lb (410 Nm).
- (6) Coat threads with pipe sealant (item 22, Appendix E) and install air line (1) on differential lock air shift unit.
- (7) Coat threads with pipe sealant (Item 22, Appendix E), and install air hoses (2) on both left and right brake air chambers (4)
- (8) Install axle breather (2) on frame using capscrew and nut as shown.
- (9) If a new axle is installed, be sure to carry out tie rod adjustment as detailed in para. 4-32.2, and steering gear and drag link adjustment as detailed in para. 4-25.6.

4-32. FRONT AXLE.

4-32.2 Tie Rod and Tie Rod Ends.

This task covers

- a. Adjustment
- b. Replacement

TOOLS

Tool Kit, General Mechanic, Automotive, NSN 5180-00-177-7033

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
 APU Engine Shutdown (see para. 2-12)
 Batteries Disconnected (see para. 4-24.12)
 Rear Wheels Blocked (see para. 4-9)
 Truck Front End Raised (see para. 4-9)

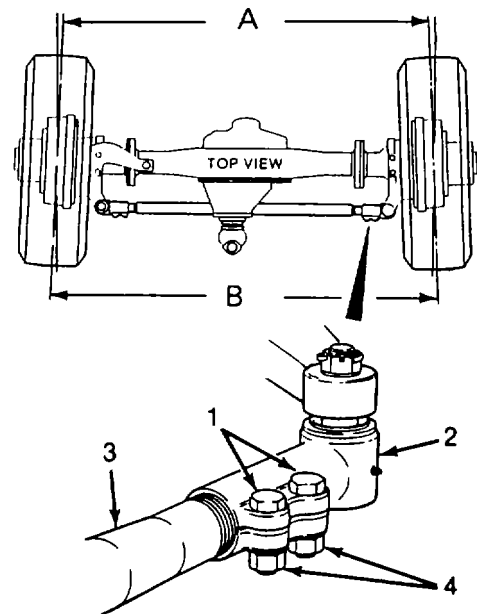
MATERIALS/PARTS

16, Appendix E Grease
 302439 Tie Rod End LH
 302438 Tie Rod End RH
 302440 Tie Rod
 36400 Capscrew
 90422 Lockwasher
 56286 Hex Nut
 MS15003-1 Grease Fitting
 302447 Washer
 302365 Castle Nut
 90871 Cotter Pin

ADJUSTMENT

- (1) Scribe a line around the center of each front tire by holding a chalk against the tire tread while rotating the wheel.
- (2) Measure distance (A and B) at front and rear of wheels as shown and compare the measurements (A) should be 0 to 1/8 in. (0 to 3.2 mm) shorter than (B). If the difference between (A) and (B) is not within this range, adjust tie rod as detailed in steps 3 thru 5.
- (3) Loosen capscrews (1) and nuts (4) securing left and right tie rod ends (2).
- (4) Adjust tie rod length and thus front wheel toe-in by turning tie rod (3) clockwise or counterclockwise. Adjust until toe-in is within range detailed in step 2.

- (5) Tighten tie rod clamping capscrews (1) and nuts (4) to 175 ft lb (235 Nm) when rod adjustment is final.



NOTE

Be sure tie rod is sufficiently screwed into both tie rod ends to provide effective clamping when capscrews (1) are tightened.

4-32. FRONT AXLE - Continued**REPLACEMENT****NOTE**

Tie rod and tie rod ends should be replaced as individual components, ie., replacement of one component does not demand replacement of any other components.

Left tie rod end has left-hand thread and right tie rod end has right-hand thread.

The following instructions are applicable to replacement of either left or right end.

- (1) Remove cotter pin (1), castellated nut (2) and washer (3).
- (2) Separate tie rod end (4) from wheel end arm.
- (3) Loosen capscrews(5) Unscrew and remove tie rod end from tie rod (6).
- (4) To replace the tie rod, remove both tie rod ends as detailed in steps 1 thru 3 above.
- (5) When replacing either tie rod end, also replace clamping hardware, (5, 7, and 8), and grease nipple (9).
- (6) When assembling tie rod be sure to screw tie rod ends into each tie rod approximately the same number of turns.
- (7) Install tie rod ends (4) on wheel end arm using washer (3) and castellated nut (2). Tighten nut to 450 ft lb (615 Nm). Install and secure cotter pin (1).
- (8) Lubricate tie rod ends using grease (item 16, Appendix E).
- (9) Whenever tie rod or tie rod ends are replaced or their relationship is disturbed, adjust front wheel toe-in as detailed in ADJUSTMENT preceding.

4-32. FRONT AXLE - Continued

4-32.3 Hub Assembly.

This task covers

- a. Replacement
- b. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Rear Wheels Blocked
Applicable Front Wheel Removed (see para. 4-23.1)
Axle Drained of Oil (see LO 5-4210-220-12)
Air Tanks Drained

MATERIALS/PARTS

3, Appendix E Antiseize Compound
16, Appendix E Grease

- 302411 Hub Oil Seal
- 302410 Oil Seal Spacer
- 302328 Bearing Cone
- 302329 Bearing Cup
- 302407 Brake Drum
- 302417 Stud RH
- 302408 Stud LH
- 302406 Wheel Hub
- 302414 Wheel Nut RH
- 302334 Wheel Nut LH
- 302330 Wheel Bearing Nut
- 302332 Capscrew
- 90859 Lockwasher
- 3023321 Bearing Nut Lock
- 302335 Hub Cap
- 302434 Capscrew
- 30422 Lockwasher

REPLACEMENT

WARNING

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

NOTE

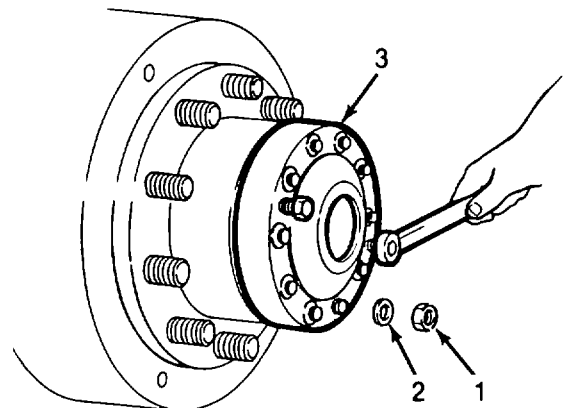
Hub repair is limited to replacement of components. When removing hub, inspect components, and replace as required. This procedure is applicable to left or right hub assembly. To carry out bearing adjustment only, carry out steps 1 thru 3 and 15 thru 18.

- (1) Back off slack adjuster brake adjustment, see para. 4-32.5 to provide sufficient lining clearance so that brake drums can be easily removed.

- (2) Remove nuts (1), lockwashers (2), and hub cap (3).

NOTE

Puller screw holes are provided if difficulty is experienced in removing hub cap.



4-32. FRONT AXLE - Continued

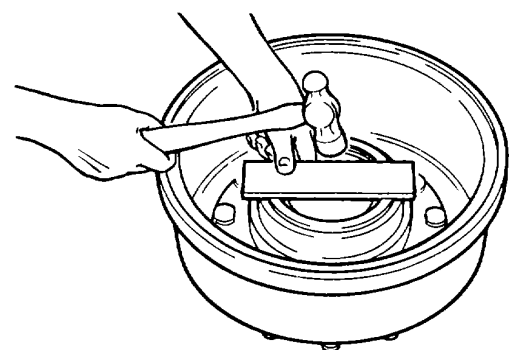
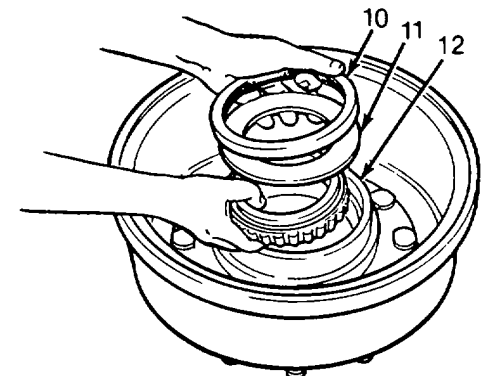
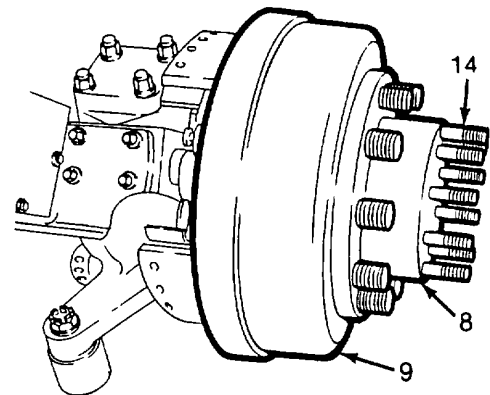
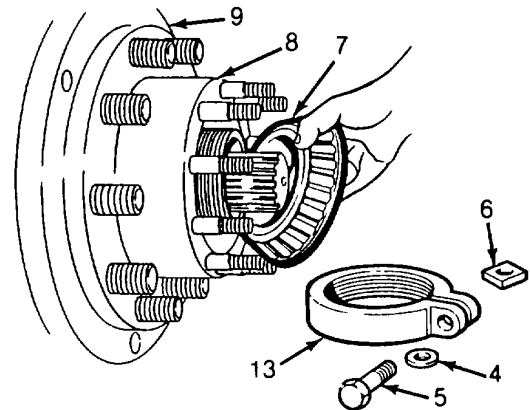
- (3) Remove clamp screw (5) and lockwasher (4) from wheel bearing adjusting nut (6). This will release the nut lock. Remove lock (13) then unscrew and remove bearing adjusting nut.
- (4) Remove wheel outer bearing cone (7).

NOTE

If bearing cone is not to be replaced identify its location so it can be returned to its original position.

Generally brake drum and hub may be left assembled.

- (5) Remove wheel hub (8), and drum (9) assembled. To disassemble hub, remove oil seal (10) and spacer (11) then lift out inner bearing cone (12).
- (6) Inspect bearing cones and cups for pitting, wear or other faulty condition. If bearing replacement is necessary, remove cup from hub using suitable puller. Replace bearings in sets (cup and cone).
- (7) Inspect brake drum (9) for cracks, discoloration due to hard spots, heat checking, glazing, grooving or severe out-of-round condition. Replace cracked drums.
- (8) Inspect hub (8) for damage. Replace hub if faulty.
- (9) If new hub is required, install new studs (14) in hub. Apply antiseize compound (Item 3, Appendix E) to studs before installation.
- (10) If bearing cups were removed from hub, install with suitable driver. Install cups until they seat firmly against shoulder inside hub.
- (11) Line entire wall of hub with grease (Item 16, Appendix E). Fill hub with grease leaving only an opening large enough for the spindle to pass through.
- (12) Pack bearing cones with grease (Item 16, Appendix E). Install inner bearing cone (12) in hub. Install bearing spacer (11) on cone with chamber (at inner diameter) facing out.
- (13) Install oil seal (10) in hub using suitable driver or press. Press seal in until it is flush with face of hub.



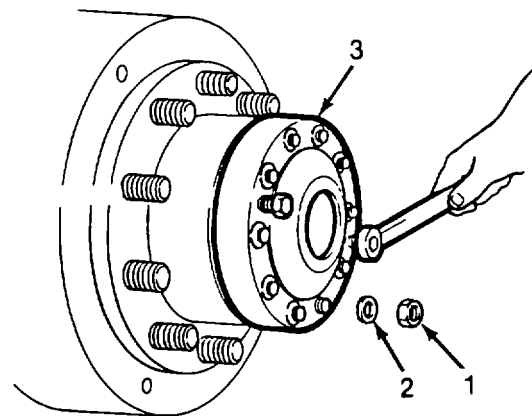
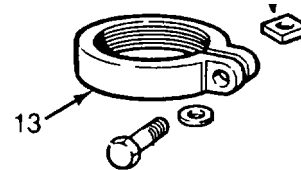
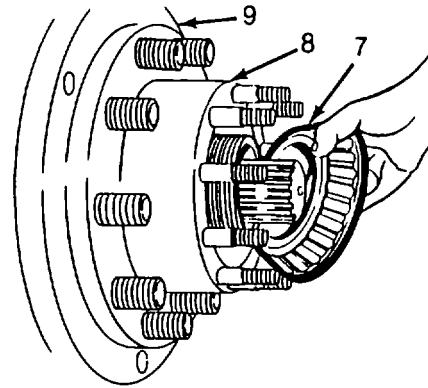
4-32. FRONT AXLE - Continued**4-32.3 Hub Assembly - Continued**

- (14) Install assembled hub (8) and drum (9) on spindle. Install outer bearing cone (7).
- (15) Install wheel bearing adjusting nut (6). Tighten nut to seat the bearings. Rotate drum while tightening nut. After nut is seated firmly against bearing cone, back off until the slot in the adjusting nut aligns with slot (or groove) in axle spindle.

NOTE

Bearing adjustment is important. The nut should be tight enough to eliminate hub end play and create a slight drag. This drag should produce at least a 5 lb (22 Nm) pull at wheel mounting studs. If drag is incorrect, reset adjusting nut.

- (16) After bearing adjustment is correct, install lock nut (13) in the adjusting nut slot. Install capscrew and lockwasher in the nut to hold lock and adjusting nut in position.
- (17) Pack groove in hub cap with grease (Item 16, Appendix E) (1/2 in. thick layer).
- (18) Using a soft-nosed hammer, install hub cap (3). Apply antiseize compound (Item 23, Appendix E) to thread of hub studs and secure hub cap with nuts (1) and lockwashers (2). Tighten nuts to 220 ft lb (300 Nm).

**REPAIR****NOTE**

Disassemble and replace worn or broken parts as detailed in REPLACEMENT preceding.

4-32. FRONT AXLE.

4-32.4 Axle Shaft Assembly.

This task covers

- a. Adjustment
- b. Replacement

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

MATERIALS/PARTS

16, Appendix E Grease
302423 Axle Shaft RH
302324 Axle Shaft LH

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Rear Wheels Blocked
Air Tanks Drained
Wheel Removed (see para. 4-29.1)
Axle Drained of Oil (see LO 5-4210-220-12)
Hub and Brake Drum Removed (see para. 4-32.3)
Brake Components Removed (see para. 4-32.5)

REPLACEMENT

WARNING

Accidents causing serious or fatal injuries may occur unless the truck is supported by maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

NOTE

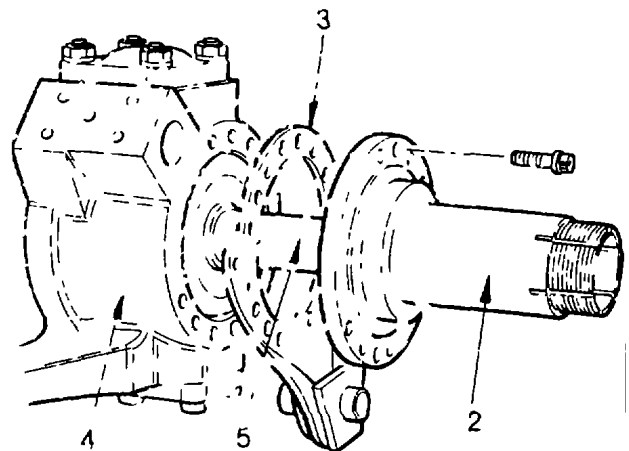
The following procedures are common to both left and right axle shafts.

- (1) Remove capscrews attaching spindle and spider (2 and 3) to ball socket (4).
- (2) Before removing spindle and spider, place a container under ball socket to catch falling grease.

CAUTION

Be careful when hammering on the spindle. If struck too hard the spindle may crack.

- (3) Remove spindle and spider. If spindle binds, loosen it with light taps using a soft-faced hammer.
- (4) Turn ball socket to the straight ahead position and remove axle shaft assembly (5).

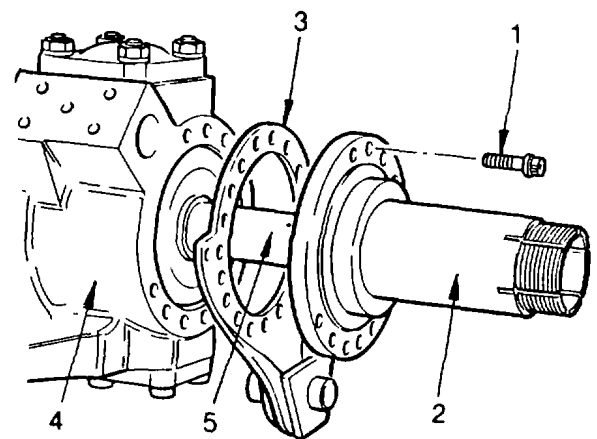
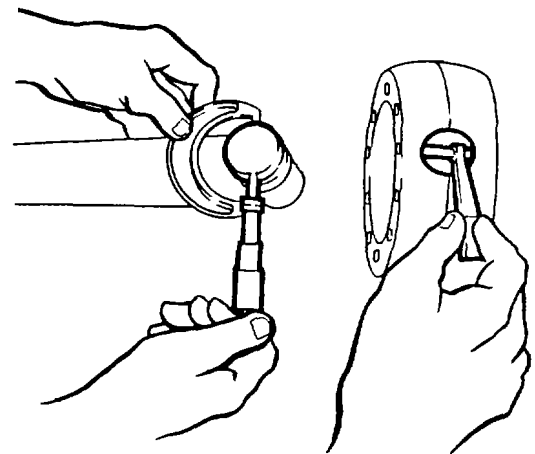
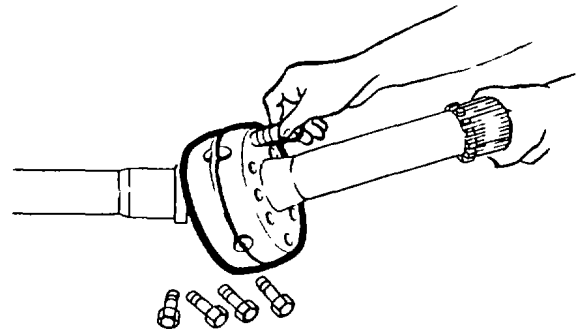


4-32. FRONT AXLE - Continued

NOTE

If axle shaft assembly is removed for any reason other than replacement, it should be thoroughly inspected before reuse.

- (5) Check shaft splines for damage, cracks, or wear. Check shaft journal for scoring or excessive grooving. Check that yoke trunnions are not excessively loose in cage rings. Replace axle shaft assembly if faulty or damaged.
- (6) To measure exact clearance between axle yoke trunnions and cage ring holes, the axle shaft may be disassembled and the components checked as detailed in steps 7 thru 10 following.
- (7) Punch mark trunnions and cage rings as shown. To ensure correct operation of axle shaft, the trunnions must be replaced in the original cage ring holes.
- (8) Measure yoke trunnions and cage ring holes as shown. If the clearance between corresponding ring holes and yoke trunnions exceeds 0.050 in. (1.25 mm) replace axle shaft assembly.
- (9) If axle shaft assembly is reuseable, lubricate journals with grease (item 16, Appendix E) and reassemble components in exactly same positions as before disassembly.
- (10) Rotate the shaft and be sure the trunnions move freely during a full revolution with the axle shafts forming an angle of 30 deg.
- (11) Be sure ball socket (4) is in straight ahead position and grease axle shaft bushing. Pack inner walls of axle ball with 3/4 in. (75 mm) layer of grease (Item 16, Appendix E).
- (12) Inspect axle shaft (5) and remove any nicks and burrs to prevent damaging oil seal inside axle ball.
- (13) Carefully install axle shaft assembly. Be sure cage rings are completely coated with grease when the shaft is inserted in housing.
- (14) Install brake spider (3) and spindle (2) using capscrews (1). Tighten capscrews to 220 ft lb (300 Nm).



4-32. FRONT AXLE.

4-32.5 Brake Assembly.

This task covers

- | | |
|----------------------|------------------------|
| a. Adjustment | b. Removal |
| c. Inspection | d. Installation |

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para. 2-10)
APU Engine Shutdown (see para. 2-12)
Batteries Disconnected (see para. 4-24.12)
Rear Wheels Blocked
Air Tanks Drained
Front Wheels Removed (see para. 4-29.1)
Axle Housing Drained of Oil
(see LO 5-4210-220-12)
Hub and Brake Drum Removed
(see para. 4-32.3)

MATERIALS/PARTS

- 16, Appendix E Grease
- 22, Appendix E Pipe Sealant
- 1. 302340 Brake Shoe and Lining
- 2. 302370 Brake Spider
- 3. 99708 Spider Capscrew
- 4. 302373 Anchor Pin
- 5. 302374 Snap Ring
- 6. 302400 Brake Chamber Assembly Kit
- 7 * Brake Shoe Return Spring
- 8 * Brake Shoe Retaining Spring

- 9. 302428 Pin and Cam Roller Assembly
- 10. 302397 Bracket Assembly LH
302431 Bracket Assembly RH
- 11. 302435 Bracket Capscrew
- 12. 90424 Bracket Lockwasher
- 13. 302353 Nut
- 14. 302446 Lockwasher
- 15. MS15003-1 Grease Fitting
- 16. Clevis Pin
- 17. Cotter Pin
- 18. 302424 Guard LH
302433 Guard RH
- 19. 79363 Guard Capscrew
- 20. 73453 Guard Lockwasher
- 21. 47495 Guard Washer
- 22. 302393 Slack Adjuster
- 23. 302391 Camshaft Bushing
- 24. 302390 Seal
- 25. 302389 Camshaft Spacer
- 26. 302392 Washer
- 27. 302388 Camshaft LH
302416 Camshaft RH
- 28. 302395 Shim 0.030 in. thick
302394 Shim 0.060 in. thick
- 29. 302396 Snap Ring

*Not supplied as individual components. Supplied in
Kit No. 302400 sufficient for one wheel end.

WARNING

Fatal or serious accidents can occur as a result of uneven brake performance. To reduce this risk, always service both front brake assemblies together.

Accidents causing serious or fatal injuries may occur unless the truck is supported on maintenance trestles. Never rely on hydraulic jacks or mechanical lifting devices for support.

NOTE

The following procedures are common to both left and right wheel ends.

4-32. FRONT AXLE - Continued

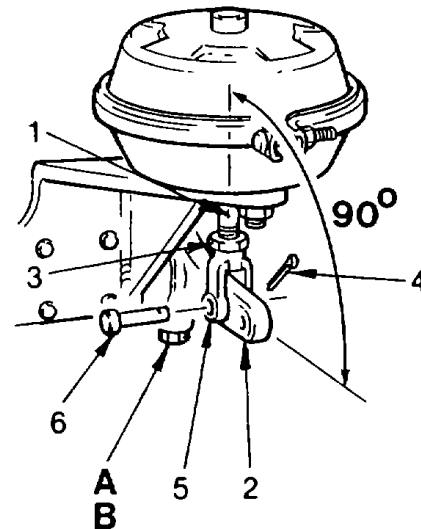
ADJUSTMENT

- (1) Block the rear wheels to prevent the truck from moving while working on the front axle.
- (2) Jack affected wheel end up as detailed in para. 4-9. Support raised wheel end on maintenance trestle.

NOTE

Brake adjustment may be carried out with front wheel either removed or installed.

- (3) Connect truck batteries and start engine. Run engine until air system is at normal pressure.
- (4) Stop the engine and disconnect truck batteries.
- (5) Push locking sleeve (B) on slack adjuster down and turn adjustment screw (A) clockwise until brake shoes are tight against brake drum.
- (6) Back off screw (A) approximately two turns, 10-12 flats on the screw head, until there is no brake drag.
- (7) Be sure locking sleeve (B) engages adjuster screw (A) when adjustment is completed.
- (8) To be sure brakes are free and without drag, tap brake drum with a hammer and listen for a clear ringing sound, or turn the wheel in forward and reverse direction and check that brake shoes do not rub against brake drum.
- (9) Apply the brakes using the brake pedal in the cab. Check the angle between air chamber push rod (1) and slack adjuster (2) as shown. The angle should be 90 deg.

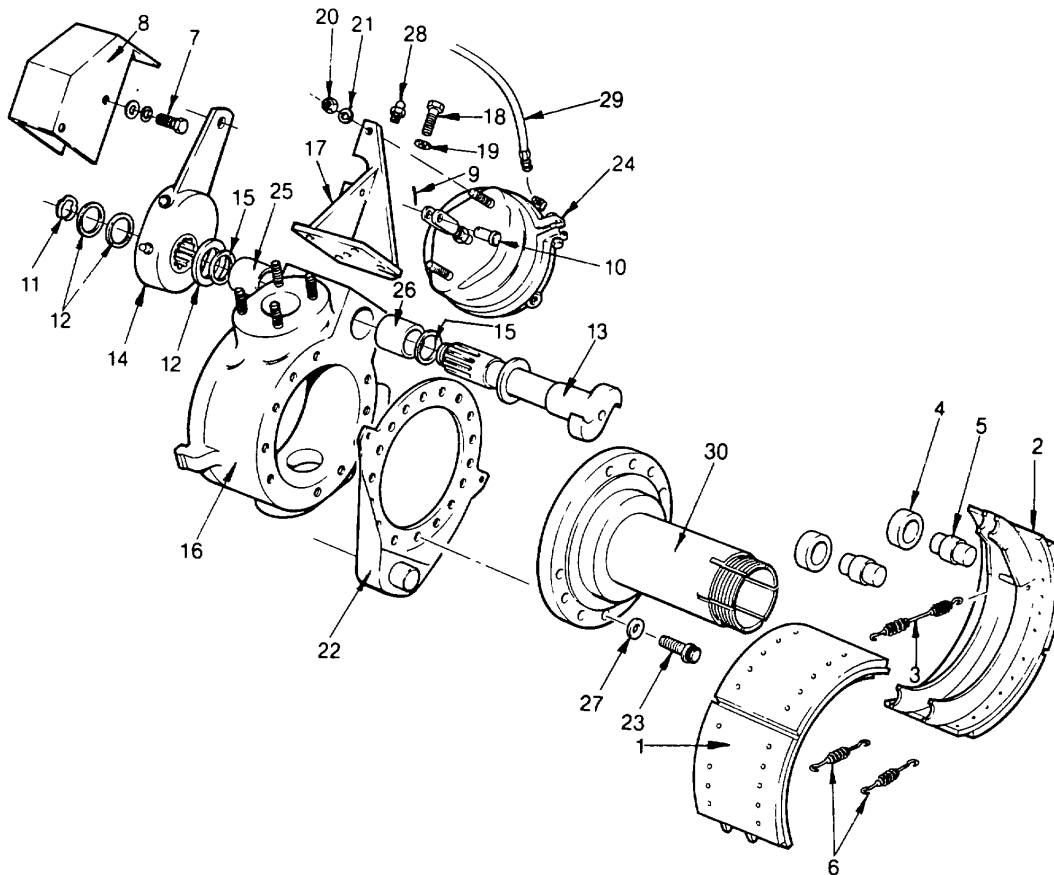


- (10) To adjust position of clevis, loosen jam nut (3).
- (11) Remove cotter pin (4) and disconnect clevis (5) from slack adjuster by removing pin (6).
- (12) Turn clevis (5) as required to increase or decrease overall length of push rod.
- (13) Connect clevis (5) to slack adjuster (2) and install clevis pin (6). Secure clevis pin using cotter pin (4).
- (14) Tighten jam nut (3) against clevis.
- (15) Recheck angle between slack adjuster and push rod as detailed in step 9 above.
- (16) Repeat steps 2 thru 15 on second front brake.

4-32. FRONT AXLE - Continued

4-32.5 Brake Assembly - Continued

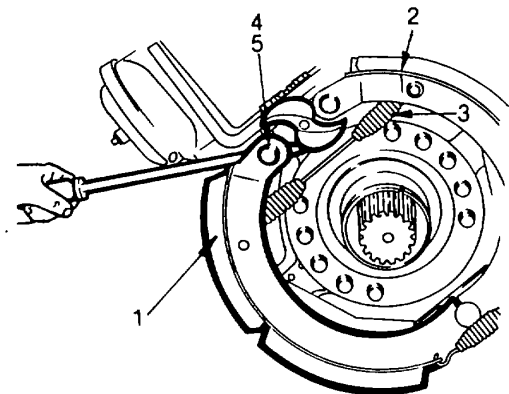
REMOVAL



NOTE

This instruction may be used when brake shoes require replacement or when brake assembly is removed to allow replacement of the ball socket.

- (1) Using a lever, lift brake shoe (1) to stretch return spring (3).
- (2) Remove cam roller (4) and pin (5).
- (3) Lift brake shoe (2) as in step 1 and remove other roller and pin (4 and 5).
- (4) Push both brake shoes toward camshaft and remove return spring (3).



4-32. FRONT AXLE-Continued

- (5) Rotate brake shoes around anchor pin (A) and remove from axle.

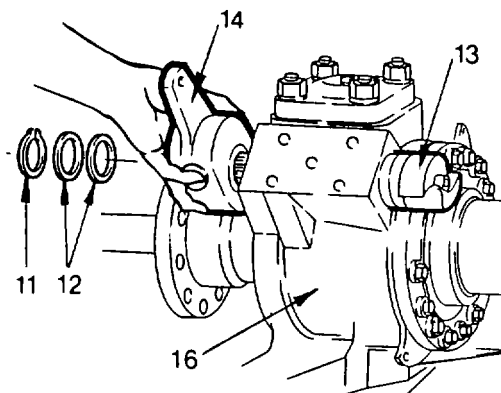
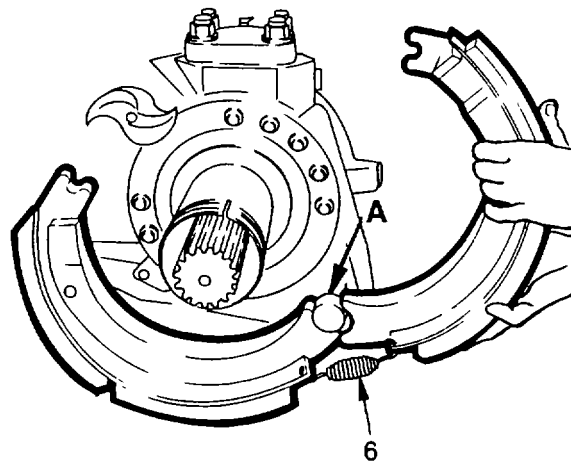
NOTE

Replace cam rollers and pins (4 and 5), shoe return spring (3), and shoe retainer springs (6) every time the brake shoes are replaced.

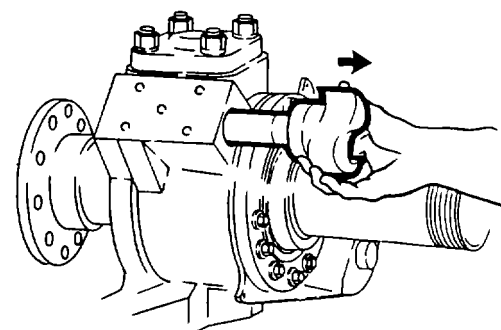
- (6) Remove capscrew (7) and cover (8).
 (7) Remove cotter pin (9) and clevis pin (10) from air chamber push rod clevis.
 (8) Remove snap ring (11) and washers (12) from camshaft (13).

CAUTION

Do not hammer on slack adjuster to remove. Damage to slack adjuster and/or camshaft splines may result.



- (9) Remove slack adjuster (14) using a suitable puller if necessary.
 (10) Remove washer (12) and pull camshaft (13) out of bore in ball socket (16).

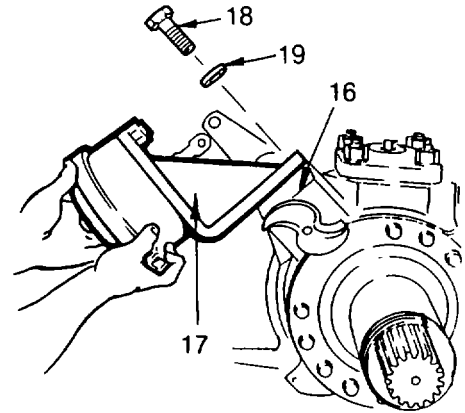


4-32. FRONT AXLE-Continued

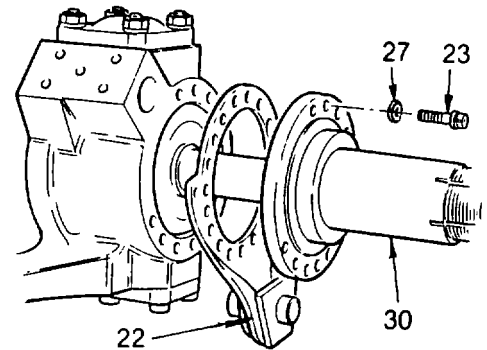
4-32.5 Brake Assembly-Continued

INSPECTION

- (1) Inspect air chamber bracket (17) for cracks or bends. Inspect air chamber (24) for leaks, bent push rod, loose clamp ring, clogged vent, or housing damage. If air chamber is damaged remove nuts (20) and washers (21) and disconnect brake chamber air line (29). If bracket (17) is damaged or ball socket assembly is being replaced, remove capscrews (18), washers (19) and disconnect brake air line (29).



- (2) Inspect brake spider (22) for cracks at bolt holes, cam area, or around anchor pin. If replacement of the spider or ball socket assembly is required remove capscrews (23) and washers (27) and remove both wheel spindle (30) and spider (22).



- (3) Inspect anchor pin (A). If pin is loose or grooved more than 0.03 in. (0.8 mm) below original surface, replace the spider.
- (4) Inspect brake shoes (1 and 2) and replace if lining is contaminated, cracked, or worn to 3/16 in. (4.5 mm) thick at any point, or if rivets are less than 1/16 in. (1.6 mm) below surface of lining.
- (5) Check brake shoes for bent or cracked webs or table. Check also for broken weld seams, loose rivets, or elongated rivet holes. Replace shoes if any of these conditions are found.
- (6) Inspect camshaft (13). Check for damaged or worn splines, corroded or worn bearing journals, brinelling, cracks, or flat spots on camshaft head. Replace camshaft if worn or defective.

NOTE

To carry out the following inspection procedure, the camshaft, brake spider, and slack adjuster including normally used shim washers must be assembled as shown.

- (7) Mount a suitable dial indicator with the plunger referencing the cam head at 90 deg.. from cam face.
- (8) Pull camshaft inward, i.e., cam head toward spider, to take up any end play and set dial indicator to zero.

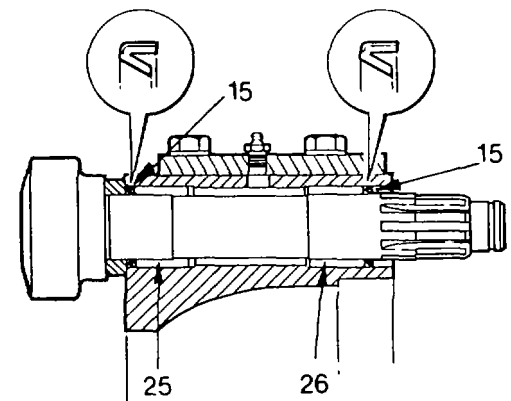
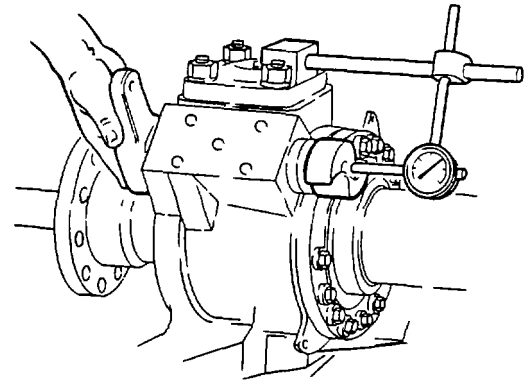
4-32. FRONT AXLE-Continued

- (9) Push camshaft outward and note maximum dial indication. The end play measured should be 0.005 - 0.045 in. (0.13 - 1.14 mm).
- (10) If end play is outside these limits adjust by removing/installing shim washers (12) between slack adjuster and lock ring.

NOTE

Shim washers are available in two thicknesses, 0.030 in. (0.76 mm) and 0.060 in. (1.52 mm).

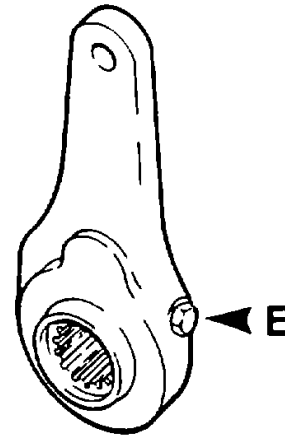
- (11) Check that inside surfaces of bushings (25 and 26) are smooth. If rough, replace bushings and oils seals. Bushings can be removed with a suitable puller.
- (12) Mount a suitable dial indicator with the plunger referencing the cam face at 90 deg. to cam bearing journal.
- (13) Set indicator dial to zero and move cam head radially up and down. Note maximum dial reading.
- (14) Mount dial indicator at slack adjuster end of camshaft and repeat step 13.



- (15) If measured play exceeds 0.02 in. (0.51 mm) at either end of camshaft, replace bushings (25 and 26).
- (16) Recheck radial play, as above, when new bushings are installed in ball socket bore. If play still exceeds 0.020 in. (0.51 mm), replace camshaft
- (17) Check camshaft oil seals (15) for wear and damage. If oil seal lips are distorted or damaged, or new bushings (25 and 26) have been installed in ball socket, replace oil seals. Be sure seal springs are facing in the same direction, away from the brake spider.
- (18) Inspect slack adjuster (14) for damage to body, splines, and clevis pin bushings. If any serious defects are noticed, replace slack adjuster.

4-32. FRONT AXLE-Continued**4-32.5 Brake Assembly-Continued**

- (19) Depress slack adjuster locking sleeve and turn adjuster nut (E) with a wrench at least one turn clockwise and counterclockwise. If binding is observed, replace slack adjuster.

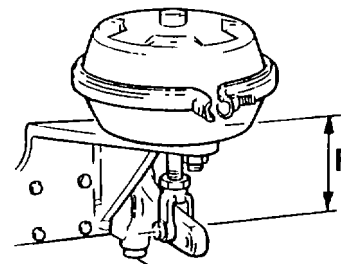


- (20) If brake chamber (24) is replaced, adjust clevis position on push rod so that distance (F) from chamber to center of clevis pin holes equals 2 5/8 - 1/16 in. (66.7 - 1.6 mm).

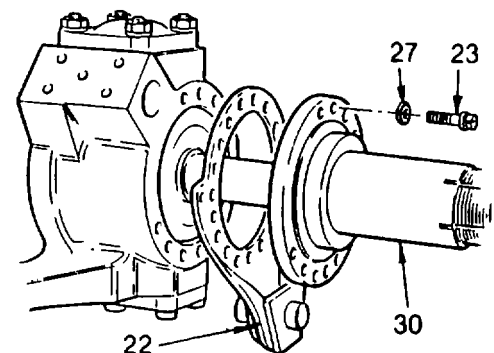
CAUTION

Do not reuse a brake drum if the diameter of the bore exceeds the manufacturers recommended maximum or the total indicated runout exceeds 0.020 in. (0.51 mm).

- (21) Inspect brake drum for cracks, heat-checks, glazing, grooving, runout and out-of-round. If brake drum is cracked it must be replaced. If drum is glazed, grooved, out-of-round, etc., it may be turned in a lathe and reused provided the maximum diameter of the bore is less than the figure stamped inside the drum.

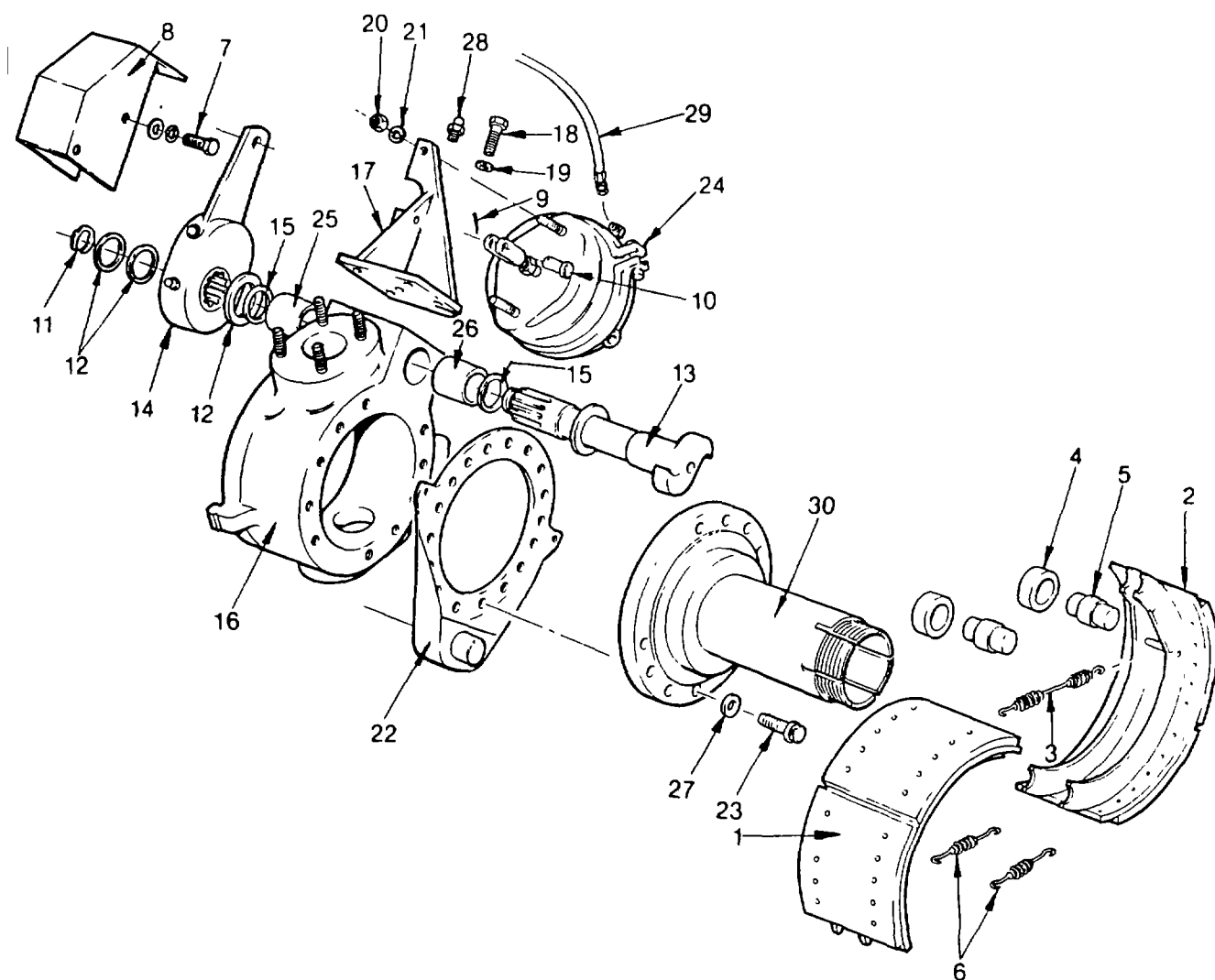
**INSTALLATION**

- (1) If disassembled, assemble air chamber (24) and bracket (17) using washers and nuts (20 and 21). Be sure air hose port in brake chamber faces away from ball socket. Tighten nuts to 170 ft lb (230 Nm).
- (2) If replaced, install new brake spider (22) and wheel spindle (30) using hardened washer (27) and bolts (23). Apply threadlock liquid (Item 29, Appendix E) to bolt threads. Install and tighten bolts to 200 ft lb (270 Nm).



4-32. FRONT AXLE-Continued

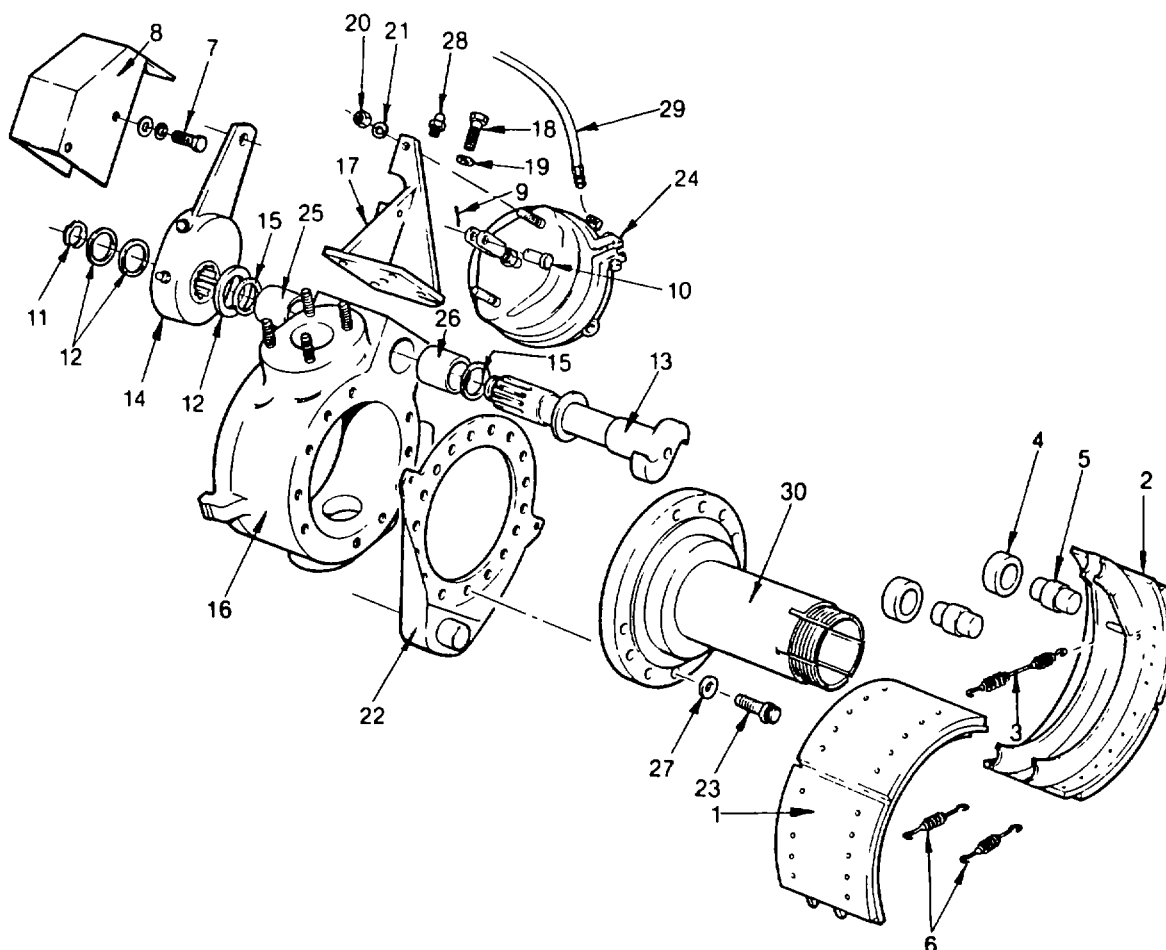
- (3) Install air chamber bracket (17) to ball socket (16) using bolts (18) and washers (19). Tighten bolts to 85 ft lb (115 Nm).
- (4) Apply pipe sealant (item 22, Appendix E) to fitting threads and install brake chamber hoses (29) to brake chamber (24). Tighten fittings firmly.
- (5) Apply a light coat of grease (item 16, Appendix E) to journals and spines on camshaft (13), and slide it through bore in ball socket. Be careful not to damage seals inside bore. Remove excess grease from area around camshaft bore and make sure that the camshaft head is clean and grease free.
- (6) Connect brake shoes (1 and 2) together using retaining springs (6). Place brake shoes around axle spindle so that lower ends ride on anchor pin (A).
- (7) Install return spring (3).
- (8) Lever each brake shoe in turn and install cam rollers and pins (4 and 5) between brake shoes and camshaft head.



4-32. FRONT AXLE

4-32.5 Brake Assembly-Continued

- (9) Install shim washer (15) and slack adjuster (14). Be sure adjustment screw on side of slack adjuster is facing away from air chamber.
- (10) Install appropriate shim washers (12) (refer to INSPECTION step 7, if necessary, to determine shim requirement). Install lock ring (11).
- (11) Attach slack adjuster to brake chamber clevis using clevis pin (10) and cotter pin (9). If advanced too far, depress locking sleeve on side of slack adjuster and turn slack adjuster toward brake chamber clevis to line up clevis pin holes.
- (12) Lubricate camshaft via grease nipple (28) with grease (item 16, Appendix E). Do not over lubricate as this will damage the seals.
- (13) Install wheel hub and brake drum as detailed in para. 4-32.3. Adjust brake as outlined in ADJUSTMENT procedure preceding.
- (14) Be sure axle is refilled with oil, see lube order LO 5-4210-220-12, when installation and adjustment of the brake is complete.



4-32. FRONT AXLE-Continued**4-32.6 Air Shift Unit.****This task covers**

- a. Replacement
- b. Repair

TOOLS

Shop Equipment, Automotive
Maintenance and Repair,
NSN 4910-00-754-0705

EQUIPMENT CONDITION

Main Engine Shutdown (see para.. 2-10)
APU Shutdown (see para.. 2-12)
Batteries Disconnected (see para.. 4-24.12)
All Wheels Blocked
All Air Tanks Drained

MATERIALS/PARTS

9, Appendix E Dexron
22, Appendix E Pipe Sealant
27, Appendix E Silicone Grease
38, Appendix E Silicone Sealant
73507 Differential Lock Air Shift Unit
119855 Shift Fork Seal

NOTE

The front and rear axle differential lock air shift units are identical. Refer to para. 4-30.5 for replacement and repair procedures.

4-33. FRAME ASSEMBLY**This task covers**

- a. Replacement**
- b. Repair**

If the frame or any of its components requires repair or replacement, return truck to manufacturer or call a manufacturers representative to site, to oversee frame repair.

Section VI. Preparation For Storage Or Shipment

4-34. Introduction

The truck may be transported by rail, low bed trailer, aircraft, or by driving it to the new location. The truck does not require any components to be removed before transporting. The truck mirrors should be folded in to the truck side if transporting other than by driving the vehicle.

Refer to paragraph 1-10, for truck weights and dimensions when determining the size of the transporting vehicle.

4-35. Preparation For Transport

- a. Drain water and foam tanks.
- b. Secure all compartment and cab doors.
- c. If moving other than by driving, fold in cab mirrors, and separately package all auxiliary equipment.

NOTE

The fuel tank may have to be drained prior to transportation. Check with Federal, State or local authorities.

APPENDIX A**REFERENCES****A-1. SCOPE.**

This appendix lists all forms, field manuals, technical manuals and miscellaneous publications referenced in this manual

A-2. FORMS.

Equipment Inspection And Maintenance Worksheet	DA Form 2404
Discrepancy In Shipment Report	SF361
Report Of Discrepancy	SF364
Recommended Changes To DA Publications	DA Form 2028-2

A-3. TECHNICAL MANUALS.

Intermediate Direct Support And Intermediate General Support Maintenance Manual	TM 5-4210-220-34
Unit Maintenance Repair Parts And Special Tools List	TM 5-4210-220-20P
Intermediate Direct Support And Intermediate General Support Maintenance Repair Parts And Special Tools List	TM 5-4210-220-34P
Lubrication Order	LO 5-4210-220-12
The Army Maintenance Management System	DA PAM 738-750
Destruction Of Army Materiel To Prevent Enemy Use	TM 750-244-3
Welding Manual	TM 9-237

A-4. MISCELLANEOUS PUBLICATIONS

Fuels, Lubricants, Oil And Waxes	C910011
Consolidated Index Of Army Publications And Blank Forms	DA PAM 310-1

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

- a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.
- b. The Maintenance Allocation Chart (MAC) in section II designates overall authority and responsibility of the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.
- c. Section III lists the tools and test equipment (both special tools and common tools sets) required for each maintenance function as referenced from section II.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows.

- a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound or feel).
- b. **Test.** To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.
- c. **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.
- d. **Adjust.** To maintain, or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.
- e. **Aline.** To adjust specified variable elements of an item to bring about an optimum or desired performances.
- f. **Calibrate.** To compare an instrument (measurement standard or item of test, measurement and diagnostic equipment) of unverified accuracy with an instrument of known and greater accuracy to detect and correct any discrepancy in the accuracy of the unverified instrument.
- 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 replacing, setting, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of the equipment or system.
- h. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC as shown in the 3rd position code of the SMR code.
- i. **Repair.** The application of maintenance services (inspect, test, service, adjust, aline, calibrate, replace), including fault location/troubleshooting (the process of investigating and detecting the cause of equipment malfunctioning, the act of isolating a fault within a system or unit under test (UUT), and disassembly/assembly (encompasses the step-by-step taking apart (or breakdown of a spare/functional

group coded item to the level of its least component identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration) procedures, and maintenance actions (welding, grinding, riveting, straightening, facing remachining, and/or resurfacing) 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. To restore an item to a complete serviceable condition as prescribed by maintenance serviceable standards.
- k. Rebuild. To restore an item, to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and specifications and subsequent reassembly of the item.

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

- a. Column 1, Group Number. Column 1 lists functional group 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 Functions. Column 3 lists the functions to be performed on the item listed in column 2 (For detailed explanation of these functions, see paragraph B-2).
- d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, (including any necessary disassembly/subassembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various categories are as follows:

- C Operator/Crew
- O Unit Maintenance
- F Intermediate Direct Support Maintenance
- H Intermediate General Support Maintenance
- D Depot 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 in Section IV.

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

- a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.
- b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.
- c. Column 3, Nomenclature. Name or Identification of the tool or test equipment.
- d. Column 4, National Stock Number. The National stock number of the specific tool or test equipment.
- e. Column 5, Tool Number. The manufacturer's part number.

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEM:
TRUCK FIREFIGHTING, MULTI-PURPOSE NSN 4210-193-3621

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
00	TRUCK, FIRE, MULTI- PURPOSE								
01	FRONT BUMPER								
	FRONT BUMPER ASSY	INSPECT REPAIR REMOVE	0.15	2.0 1.5				T5 T1	
02	REAR STEP								
	REAR STEP ASSY	INSPECT REPLACE REPAIR	0.15		2.00 1.50			T5 T5	
03	HEAT SHIELDS								
	HEAT SHIELD ASSY	INSPECT REPAIR REPLACE	0.15	2.00 2.00				T1 T5	
04	CAB								
	DOORS	INSPECT REPAIR INSTALL	0.15	2.00 1.50				T1 T1	
	MIRRORS	INSPECT REPAIR INSTALL	0.10	0.30 0.30				T1 T1	
	SPOTLIGHT	INSPECT REPAIR INSTALL	0.10	1.00 0.30				T1 T1	

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
	SIREN & P A SYSTEM	INSPECT REPAIR INSTALL	0.15	0.35	2.00			T5 T1	
	GLOVE COM- PARTMENT	INSPECT INSTALL	0.10	1.00				T1	
	SHIFT CONTROL	INSPECT REPAIR INSTALL	0.15	1.50 1.00				T1 T1	
	HEATER CONTROLS	INSPECT REPAIR INSTALL	0.10	1.00 1.50				T1 T1	
	HEATER/ DEFROSTER	INSPECT REPAIR INSTALL	0.10	2.00 2.00				T1 T1	
	DRIVERS SEAT	INSPECT REPAIR INSTALL	0.15	1.50 1.00				T1 T1	
	PASSENGER SEAT	INSPECT REPAIR INSTALL	0.10	1.50 1.00				T1 T1	
	JUMP SEAT	INSPECT REPAIR INSTALL	0.10	1.50 1.00				T1 T1	
	WINDSHIELD WASHER ASSY	INSPECT REPAIR INSTALL	0.15	1.00 1.00				T1 T1	
	WINDSHIELD	REPLACE		1.00				T1,T5	
	ENGINE COVERS	INSPECT REPAIR INSTALL	0.10	2.00 0.30				T1	

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
05	PUMP BODY								
	PUMP BODY ASSY	INSPECT REPLACE REPAIR	0.25		30.0 10.0			T5 T5	
	CONSOLE ASSY & HOSE BODY	REPAIR REPLACE			10.0 15.0			T5 T5	
	GAGE PANEL	REPLACE		1.0				T1	
	GAGES	REPLACE		0.30				T1	
	PUMP PANEL DOOR ASSY	REPAIR REPLACE		0.30 0.30				T1 T1	
06	HOSE REEL ASSY								
	HOSE REEL	INSPECT REPAIR REPLACE	0.15	0.30 0.45				T1 T1	
	HOSE	INSPECT REPLACE	0.10	0.30				T1	
	CONNECTORS	INSPECT REPLACE	0.10	0.30				T1	
07	AUXILIARY POWER UNIT ASSY								
	AUXILIARY POWER UNIT	INSPECT TEST REPLACE REPAIR	0.15 0.15	1.00 1.50				T2 T6	

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
08	HOSE BODY ASSEMBLY								
	HOSE BODY	INSPECT REPLACE REPAIR	0.20	30.00 2.00				T5 T5	
	HATCH HOLDER- MAIN BODY	INSPECT REPLACE	0.15	0.30				T2	
	COMPART- MENT DOORS	INSPECT REPAIR REPLACE	0.15	0.30 0.30				T3 T2	
	PANEL, MANHOLE, SIDES	INSPECT REPLACE	0.15		.45			T5	
	COMPART- MENT HOSE BODY	INSPECT REPLACE REPAIR	0.15		2.0 1.0			T5 T5	
09	PUMP DRIVE & P.T.O.	INSPECT	0.15						
	P T O ASSY	REPLACE REPAIR OVERHAUL		1.50	2.00 3.50			T5 T5 T5	
	PUMP DRIVE ASSY & DRIVESHAFT	REPLACE REPAIR		1.00	2.00			T1 T5	
	REDUCER GEAR BOX	REPLACE REPAIR OVERHAUL		1.00	2.00 3.00			T1 T5 T5	

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
010	PUMP PIPING & VALVES								
	PUMP	INSPECT REPLACE REPAIR	0.15	1.00	3.00			T5 T5	
	WATER TANK VALVE	REPAIR REPLACE						T5 T2	
	VALVES	REPLACE		0.30				T2	
	PIPING	REPLACE		0.40				T1	
	COUPLINGS & SEALS	REPLACE		0.30				T1	
	FOAM METERING VALVE	INSPECT REPLACE	0.15	0.30				T3	
	ROOF TURRET	INSPECT REPLACE REPAIR	0.15	2.00 1.00				T2 T5	
	NOZZLE ASSY	REPLACE REPAIR		0.30 0.40				T2 T5	
	BUMPER TURRET	INSPECT REPLACE REPAIR	0.15	2.00 1.00				T2 T5	
	NOZZLE ASSY	REPLACE REPAIR		0.30 0.40				T2 T5	
	011	FOAM TANK ASSEMBLY							
		TANK	INSPECT REPLACE REPAIR	0.15		6.0 3.0			T5 T5
		PIPING	REPLACE			1.0			T5

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
012	WATER TANK ASSEMBLY								
	TANK	INSPECT REPLACE REPAIR	0.15		6.0 3.00			T5 T5	
	PIPING	REPLACE			3.00			T5	
013	WINTER-IZATION								
	WINTER-IZATION SYSTEM	INSPECT REPAIR REPLACE	0.15	0.45 1.50				T2 T2	
	HOSES	REPLACE		0.30				T2	
014	RADIATOR & COOLING SYSTEM								
	RADIATOR	SERVICE REMOVE REPAIR	0.25	2.00 1.00				T8 T1	
	RADIATOR CORE	REPLACE REPAIR			2.00 1.00			T5 T5	
	SHUTTER ASSY	REPAIR REPLACE		0.30 1.00				T5 T8	
	FAN ASSY	REPLACE		1.00				T1	
	TUBING	REPLACE		1.00				T1	
	BELTS	REPLACE		1.00				T1	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
0.15	EXHAUST SYSTEM								
	MUFFLER	REPLACE		1.00				T1	
	PIPES	REPLACE		1.00				T1	
	CLAMPS & HANGERS	REPLACE		1.00				T1	
016	AIR SYSTEM								
	AIR TANKS	INSPECT INSTALL	0.15	1.00				T1	
	VALVES	INSPECT REPAIR INSTALL	0.15	0.30 1.00				T5 T5	
	AIR LINES & PIPING	INSPECT REPLACE	0.10	0.30				T1	
017	FUEL SYSTEM & AIR INTAKE								
	FUELTANK	INSPECT REPAIR INSTALL	0.15	0.40	1.0			T5 T1	
	PRIMING PUMP	REMOVE REPAIR		0.30 0.30				T1 T5	
	WATER/FUEL SEPARATOR	INSPECT INSTALL	0.15	0.30				T1	
	FUEL PUMP	INSPECT REPAIR INSTALL	0.15	0.30 0.30				T7 T1	
	FUEL FILTER	REPLACE		0.30				T3	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
018	FUEL LINE, HOSES & PIPING	INSPECT REPAIR INSTAL	0.15	0.30 0.30				T5 T1	
	AIR INTAKE SYSTEM	INSPECT	0.15						
	AIR FILTER	REPLACE		0.30				T1	
	ELECTRICAL SYSTEM								
	ALTERNATOR	TEST REPLACE REPAIR		0.30 0.40 1.00				T3 T1 T3	
	STARTER	INSPECT REPAIR INSTALL	0.15	2.00 2.00				T4 T2	
	ELECT SYSTEM D C	TEST REPAIR REPLACE		0.30 0.40 1.00				T2 T2 T2	
	INSTRUMENT CONTROL PANEL								
	INSTRU- MENTS	REPLACE		0.30				T1	
	LIGHTS	REPLACE		0.30				T1	
	SWITCHES	REPLACE		0.30				T1	
	FLASHERS	REPLACE		0.30				T1	
	LIGHTS	ALINE REPAIR REPLACE		0.30 0.30 0.30				T1 T1 T1	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
019	SENDING UNITS & WARNING SWITCHES	TEST REPLACE		0.30 1.00				T1 T1	
	HORN ASSEMBLY	ADJUST REPAIR REPLACE		0.20 0.40 1.00				T1 T1 T1	
	BATTERY	TEST REPLACE		0.30 0.30				T3 T1	
	RADIO-D C	REPLACE		0.50				T1	
	ELECT SYSTEM A C	TEST INSPECT REPAIR REPLACE		0.30 0.30 0.50 0.50				T3 T3 T3 T3	
	INVERTER & RECEP- TACLE	TEST REPLACE REPAIR		0.20 1.00 1.00				T1 T5	
	STEERING SYSTEM ASSEMBLY								
	STEERING COLUMN	INSPECT REPAIR REPLACE	0.15	1.00 2.00				T5 T1	
	STEERING PUMP & RESERVOIR	REPAIR REPLACE		1.00 2.00				T1 T1	
	DRAG LINK	ADJUST REPLACE REPAIR		0.40 2.00 2.00				T1 T1 T1	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
020	STEERING GEAR	ADJUST REPLACE REPAIR		0.30 1.00 1.50				T1 T5 T5	
	SHAFT & MITER BOX	REPLACE		2.00				T1	
	DRIVELINES POWER TRAIN								
021	YOKE DRIVELINE	REPLACE INSPECT REPAIR INSTALL	0.15	2.00 1.00 1.50				T4 T5 T5	
	TRANSMISSION								
	TRANSMISSION ASSY	SERVICE INSTALL REPAIR OVERHAUL		0.30 3.00	10.00	15.00		T9 T11 T12	
022	ENGINE ASSEMBLY								
	DIESEL ENGINE	SERVICE REPLACE REPAIR OVERHAUL	0.15	3.00		8.00 60.00		T5 T5 T5	
	FRONT ENGINE SUPPORT	REPLACE			1.00			T5	
	OIL COOLER & FILTER	REPAIR INSTALL		3.00 2.00				T3 T3	
	AIR COMPRESSOR	INSPECT REPAIR INSTALL		0.30 2.00 2.00				T10 T2	
	EXHAUST MANIFOLD	REPLACE		1.50				T2	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
	THERMOSTAT	REPLACE		0.50				T10	
	ACCESSORY DRIVE	INSPECT		1.00					
		REPAIR			2.00			T19	
		INSTALL			2.00			T19	
	ROCKER COVER	REPLACE			0.50			T1	
	PUSH RODS, ROCKER LEVERS & HOUSING	INSPECT			0.30			T1	
		REPAIR			2.00			T18	
		INSTALL			2.00			T18	
	INJECTORS	INSPECT			0.30			T18	
		ADJUST			0.30			T18	
		REPAIR			2.00			T18	
		INSTALL			2.00			T18	
	CYLINDER HEADS- VALVES & SPRINGS	INSPECT			1.50			T18	
		REPAIR			2.00			T18	
		INSTALL			2.00			T18	
		ADJUST			0.50			T18	
	WATER PUMP	INSPECT			0.30				
		REPAIR			1.50	T19			
		INSTALL			1.50			T5	
	OIL PUMP	INSPECT			0.30				
		REPAIR			1.00			T20	
		INSTALL			1.00			T2	
	OIL PAN				0.50		T2		
	TURBO- CHARGER	REPLACE				1.00		T5	
		REPAIR					1.50	T13	
	BLOWER	REPLACE				1.00		T13	
		REPAIR					3.00	T13	
	AFTER- COOLER	REPLACE				1.00		T5	
		REPAIR					0.50	T5	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
023	FLYWHEEL HOUSING	REPLACE REPAIR				2.00 1.00	T14 T14		
	GEAR TRAIN	REPLACE REPAIR				3.00 1.50	T14 T14		
	CAMSHAFT	REPLACE REPAIR				3.00 3.00	T15 T15		
	PISTON CONNECTING RODS	REPLACE REPAIR				1.00 1.00	T16 T16		
	CRANKSHAFT PULLEY	REPLACE REPAIR				2.00 1.50	T14 T14		
	CRANKSHAFT & MAIN BEARING	REPLACE REPAIR				3.00 4.00	T14 T14		
	CYLINDER BLOCK AND LINERS	INSPECT REPAIR INSTALL				0.30 1.00 2.00	T17 T17		
	WHEELS & TIRES	SERVICE REMOVE REPLACE	0.20	0.30 1.00			T5 T5		
	024	REAR AXLE							
		AXLE ASSEMBLY	REMOVE		2.00			T5	
AXLE SHAFT LH & RH		REPLACE		0.40			T5		
HUB ASSY LH & RH		REPLACE REPAIR		1.00 0.50			T5 T5		

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
025	BRAKE ASSY LH & RH	INSPECT		0.30					
		ADJUST		0.50				T5	
		REPLACE		4.00				T5	
	4-WH TRANSFER UNIT	REPAIR				2.00			T5
		REPLACE				4.00			T5
	AIR SHIFT	REPLACE		2.00					
		REPAIR		1.00					
	DIFFEREN- TIAL CARRIER	SERVICE		0.30					
		REPAIR REPLACE			4.00 3.00			T5 T5	
	026	REAR SUSPENSION	SHOCKS		1.50				
SPRINGS				4.00					T5
FRONT AXLE									
026	AXLE ASSEMBLY SHAFT LH & RH.	REMOVE		4.00					
		REPLACE		4.00					
	TIE RODS & ENDS	INSPECT	0.15						
		SERVICE		0.30					
		ADJUST REPLACE		0.30 2.00				T1 T1	
	HUB ASSY LH & RH	REPLACE		2.00					T5
		REPAIR		1.00					T5
	BRAKE ASSY LH. & RH	INSPECT		0.30					
		ADJUST		0.50					T5
		REPLACE		4.00					T5
AIR SHIFT UNIT	REPAIR		2.00					T5	
	REPLACE		1.00					T5	

(1) GROUP NO.	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
027	BALLSOCKET ASSY LH & RH	INSPECT SERVICE REPLACE		0.30 0.30	4.00			T5	
	DIFFEREN- TIAL CARRIER	SERVICE REPAIR REPLACE		0.30	4.00 3.00			T5 T5	
	FRONT SUSPENSION								
	SHOCK ABSORBERS	REPLACE		1.00				T5	
	SPRINGS	REPLACE		4.00				T5	
028	FRAME ASSY								
	FRAME	INSPECT REPLACE REPAIR	0.15	3.00 3.00				T5 T5	

Section III TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL/NATO STOCK NUMBER	(5) TOOL NUMBER
T1	0	Tool Kit, General Mechanic Automotive	5180-00-177-7033	
T2	0	Tool Kit, Master	5180-00-699-5273	
T3	0	Shop Equipment, Automotive Maintenance and Repair	4910-00-754-0650	
T4	0	Shop Equipment, Automotive General Purpose Repair	4910-287-4894	
T5	0	Shop Equipment, Automotive Maintenance and Repair	4910-00-754-0705	
T6	0	T5 plus MACI Set 13		
T7	0	T5 plus MACI Set 14		
T8	0	T5 plus MACI Set 15		
T9	0	T5 plus MACI Set 1		
T10	0	T5 plus MACI Set 2		
T11	F	T5 plus MACI Set 3		
T12	H	T5 plus MACI Set 12		
T13	H	T5 plus MACI Set 7		
T14	H	T5 plus MACI Sets 8 and 7		
T15	H	T5 plus MACI Sets 9 and 7		
T16	H	T5 plus MACI Set 10		
T17	H	T5 plus MACI Sets 7 and 11		
T18	F	T5 plus MACI Sets 1 and 5		
T19	F	T5 plus MACI Set 4		
T20	F	T5 plus MACI Sets 4 and 6		

APPENDIX C**COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST****Section I. INTRODUCTION****C-1. SCOPE.**

This appendix lists components of end item and Basic Issue Items (BII) for the Fire Truck to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

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

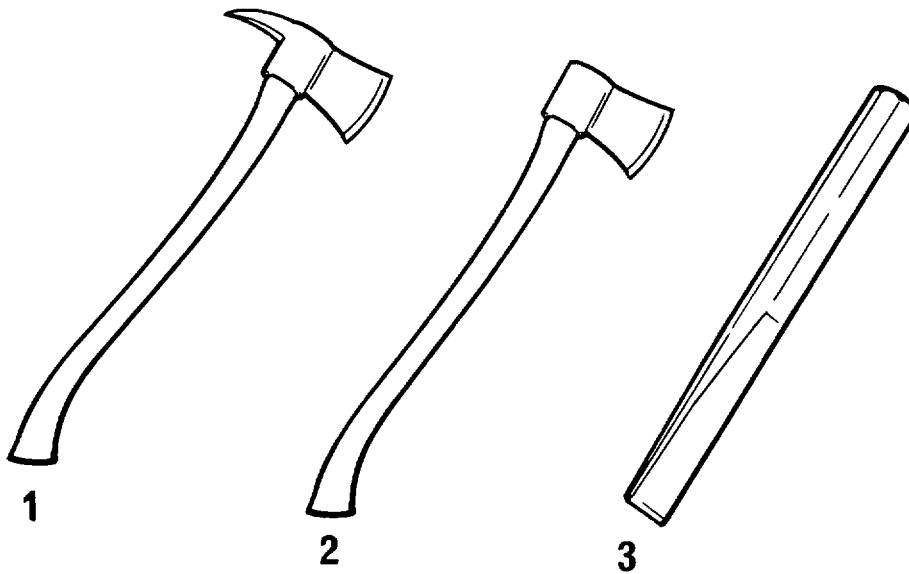
- a. Section II. Components of End Item. This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred property accounts.
- b. Section III. Basic Issue Items. These are the minimum essential items required to place the Fire Truck in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the Fire Truck during operation and whenever it is transferred between property accounts. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

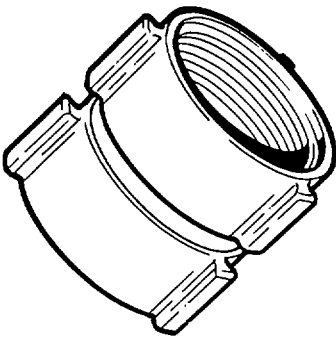
The following provides an explanation of columns found in the tabular listings:

- 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 be used for requisitioning purposes.
- c. Column (3) -Description indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.
- d. Column (4) -Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e g, ea, in, pr).
- e. Column (5) -Quantity Required (Qty Rqr). Indicates the quantity of the item authorized to be used with/on the equipment.

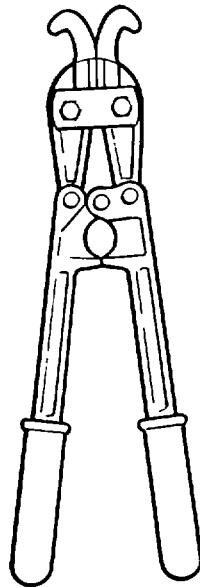
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
1	4210-00-142-4949	AX, PICK HEAD: 6 LB: 5 IN.CUTTING EDGE;12 IN. LG	EA	1
2	5110-00-293-2336	AX,SINGLE BIT: 4 LB HEAD WT,4 3/4 IN. W CUTTING EDGE (81348) GCGA 926 TYPE 1 CLASS1 STYLE1	EA	1
*	4210-00-243-9664	BLANKET,FIRE: ASBESTOS,71 IN. W 72 IN. LONG,W/2 HAND	EA	1
*	4240-00-919-2864	BREATHING APPARATUS,SELF/CONTAINED: PRESSURE (81348) GGG-B-675	EA	4
*	3750-00-240-3085	BUSH HOOK, HAND: STRAP-EYE TYPE: 1 CUTTING EDGE: (81348) GGG-B-800	EA	4
*	6130-01-160-5624	CHARGER,BATTERY: (12183) K552	EA	1
3	5110-00-236-3272	CHISEL,COLD,HAND: 3/4 IN. W OF CUT,6 1/2 IN. LG (81348) GGG-C-313 TYPE IV CLASS 1	EA	1



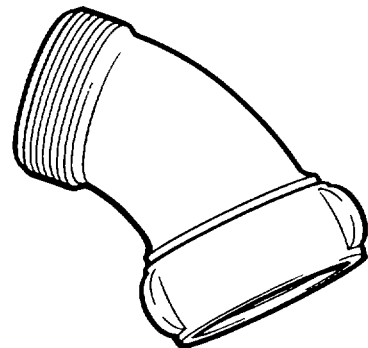
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	4210-00-127-9234	CLAMP,FIRE HOSE, SHUTOFF: RED, DIE CAST ALU. FRAME (00912) 590	EA	1
*	4210-01-160-8043	COUPLING HOSE SWIVEL,INTERNAL, 1 1/2 IN. -9NH (36473) 310874	EA	2
1	4210-00-288-8816	COUPLING,HOSE.BRASS SWIVEL: ROCKER LUG WRECKING (36473) 310875	EA	2
*	5120-00-224-1344	CROWBAR: 35 TO 37 IN. LG (81348) GGGB101 TYPE 2 SIZE 1	EA	1
2	5110-00-541-6730	CUTTER,CABLE,HAND OPERATED RIGID HEAD CENTER CUT: (36473) 310877	EA	1
*	6665-01-038-3006	DETECTOR SET,COMBUSTIBLE GAS SNIFFING PORTABLE: (40912) 464284	EA	1
3	4210-00-288-7864	ELBOW,HOSE: BRASS: 45 DEG:SWIVEL BODY: 1ST END, ROCKER (36473) 310879	EA	2



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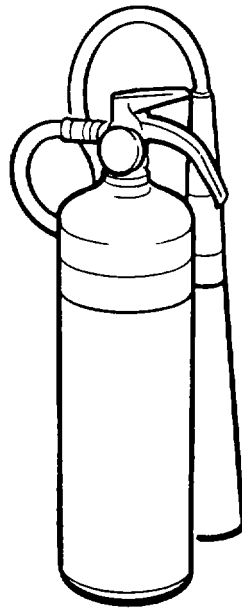


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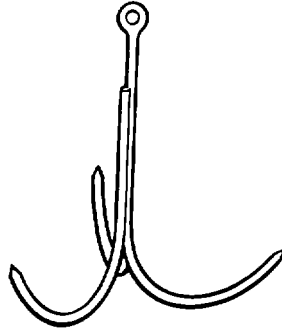
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
1	4210-00-202-7858	EXTINGUISHER,FIRE,CARBON DIOXIDE: STD CHARGED: HAND (12183) CO-150	EA	1
*	4210-00-251-5343	EXTINGUISHER,FIRE,DRY CHEMICAL: HAND OP,20 LBS (81348) OE915	EA	1
*	4210-01-160-5632	EXTINGUISHER,FIRE,WATER: VEST TANK, ADJU SPRAY, (12183) FVT8	EA	4
*	4140-01-160-5628	FAN,VENTILATING	EA	1



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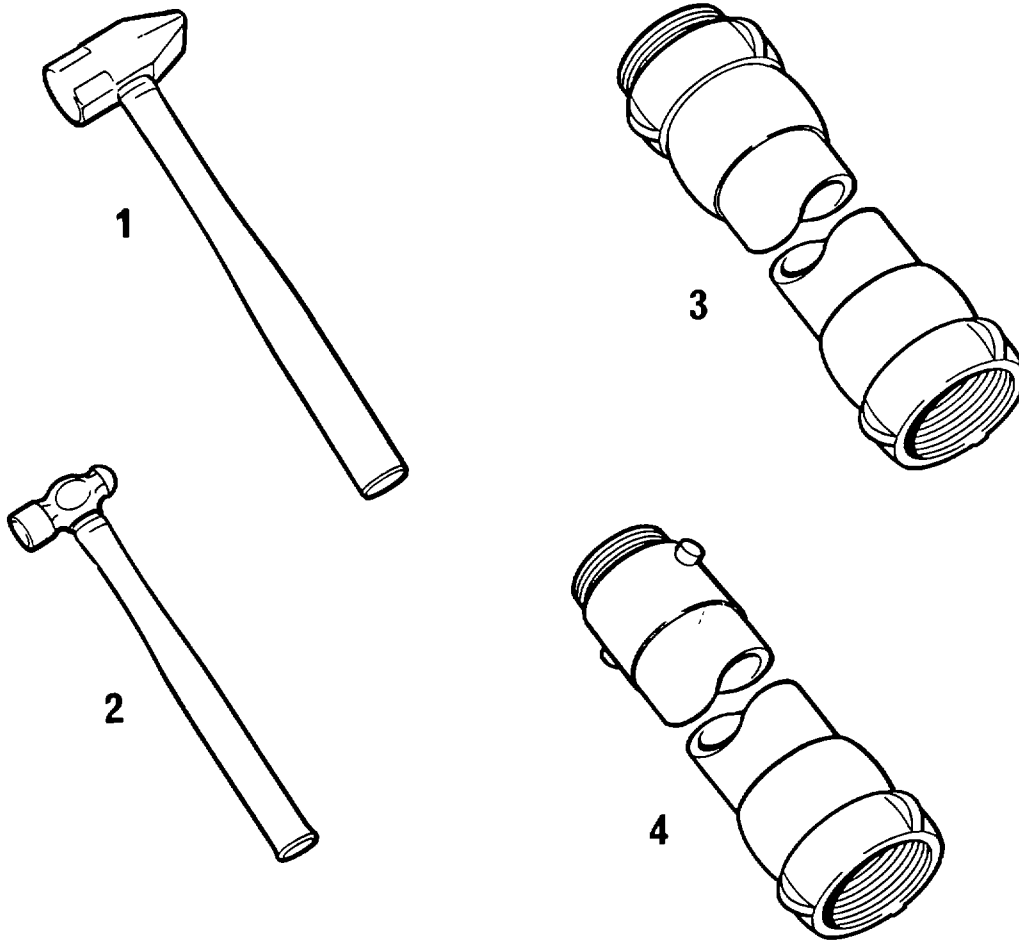
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	4210-01-056-8343	FOAM LIQUID,FIRE EXTINGUISHING 5 GAL (81349) MIL-F-24385	EA	13
*	5330-00-202-4637	GASKET,SYNTHETIC RUBBER 1 7/16 IN. OD (00912) STYLE 234	EA	5
*	5330-00-202-4645	GASKET,SYNTHETIC RUBBER 2 1/16 IN. OD (81349) MIL-R-3065	EA	10
*	5330-00-202-4659	GASKET,SYNTHETIC RUBBER 3 3/16 OD (81349) MIL-R-3065	EA	5
1	2040-00-828-3831	GRAPNEL MARINE,FORGED STEEL,11 LB, 3 PRONG (81349) MIL-G-613	EA	1



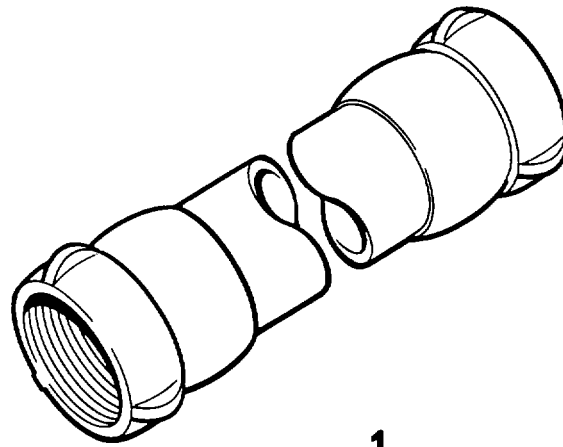
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ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
1	5120-00-224-4130	HAMMER, BLACKSMITH SLEDGE, CROSS PEEN, 12 LB (81348) GGG-H-86TY10CL2	EA	2
2	5120-00-061-8543	HAMMER, MACHINISTS, BALL PEEN 1 LB (81348) GGG-H-86 TY2STBCL1	EA	2
*	4940-00-595-8359	HEATING TORCH, FUEL OIL BURNING, HAND PUMP 5 GAL (81349) MIL-H-20206 TYPE 1	EA	2
*	4210-01-108-8716	HOOLIGAN TOOL, FORCIBLE ENTRY (12183) TP30	EA	1
3	4210-00-202-6712	HOSE ASSY, NON-METALLIC, SYN. RUBBER, 1 IN. (81348) ZZ-H421 TY1CLA	EA	3
4	4210-00-202-6713	HOSE ASSY, NON-METALLIC, SYN. RUBBER, 2 1/2 IN. (81348) ZZ-H561 TY1CLB	EA	2



ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	4210-01-160-8103	HOSE ASSY, NON-METALLIC 4 1/2 IN. (12183) 12HSD7-SYT19CSHAB	EA	1
*	4210-00-078-9169	HOSE ASSY, TEXTILE FIBER 2 1/2 IN. (81348) ZZ-H-451, SIZE 2 1/2, TY3CLB	EA	24
1	4210-00-078-9170	HOSE ASSY, TEXTILE FIBER, 1 1/2 IN. (81348) ZZ-H-451, SIZE 1 1/2, TY3CLB	EA	16
*	4210-00-900-8557	KIT, FIREFIGHTING, W/CANVAS TOOL BAG (12183) CRKS	EA	2



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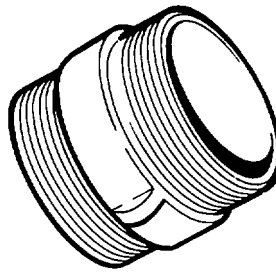
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	4210-00-289-3638	LADDER,FIRE,EXTENSION: 3 SECT,36 FT LG EXT, (81349) MIL-L-12197	EA	1
*	4210-00-160-5622	LADDER,LATERAL FOLDING:ATTIC TYPE,10 FEET LG, (12183) 585 A-10	EA	1
*	4210-01-160-5626	LADDER,ROOF,SINGLE: AL SIDE RAILS,3 IN. W (12183) 575B-14	EA	1
*	6230-01-160-5625	LANTERN,ELECTRIC: BATTERY OP,ADJU SPOT OR FLOOD (12183) K130	EA	2
*	6530-01-066-0452	LITTER,RIGID,STOKES: STEEL FRAME AND WOOD SLATSAND (5M658) RRL-A97	EA	1
1	5120-00-243-2395	MATTOCK: PICK HANDLED: 5 LB HEAD WEIGHT (81348) GGG-H-506	EA	2



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ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	5120-00-293-3467	MATTOCK:3 3/4 LB HEAD,36 IN. LG WOOD HANDLE, (81348) GGG-A-926	EA	2
1	4210-00-288-8827	NIPPLE,HOSE: COPPER ALLOY:2 1/2 IN.DIA. HOSE.500 PSI (96906) MS39113-2	EA	2
*	4210-01-160-8049	NIPPLE HOSE: 1 I IN. DIA. HOSE,ROCKER LUG, (12183) B10 PB	EA	2
*	4210-01-134-3713	NOZZLE,FIRE HOSE,WATER: THROW HNDL BALL (00912) STYLE 1708	EA	1
*	4210-01-160-8045	NOZZLE,FIRE HOSE,WATER:THROW HNDL SHUTOFF (Th-NN) (00912) 5028	EA	1
*	4210-01-160-8046	NOZZLE,FIRE HOSE,WATER:THROW HNDL BALL (00912) 1715P	EA	1



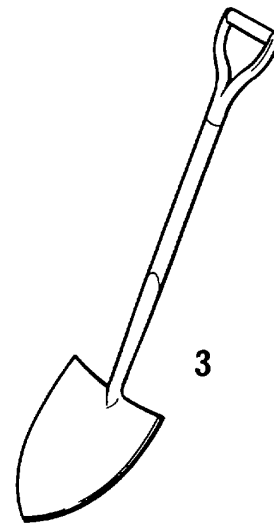
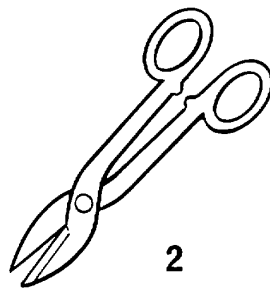
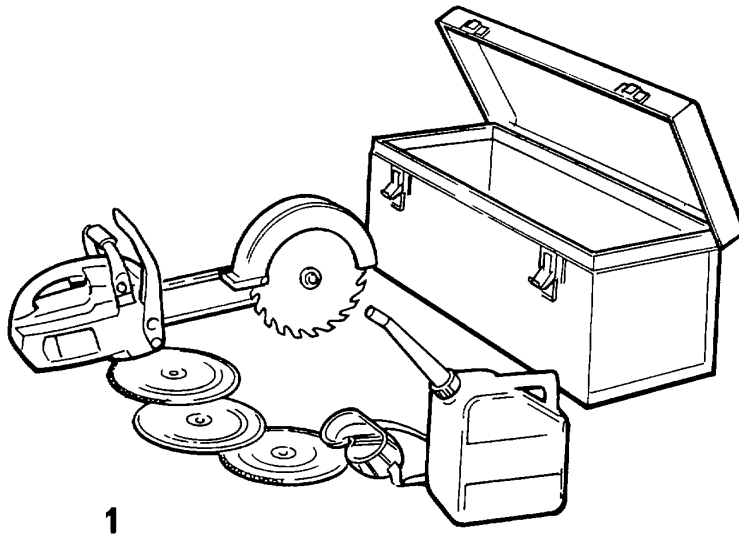
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C-9

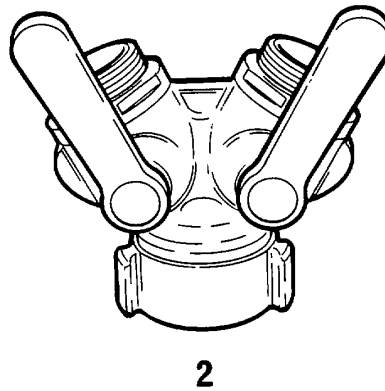
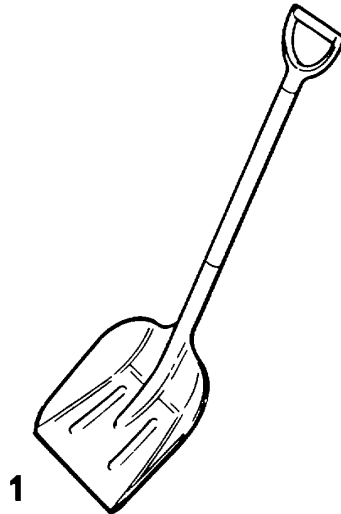
ILLUS NO.	NATIONAL STOCK NO.	DESCRIPTION	U/M RQD	QTY
*	4210-01-160-8047	NOZZLE,FIRE HOSE,WATER: THROW HNDL BALL (00912) 1725P	EA	2
*	5120-01-160-5630	PIKE POLE:STRAIGHT,PLAIN PI,W/HOOK,6 FEET (12183) T127FG	EA	1
*	5120-01-160-5631	PIKE POLE:STRAIGHT,PLAIN PT,W/HOOK,10 FEET (12183) T125FG	EA	1
*	5120-01-160-8062	PIKE POLE:STRAIGHT,PLAIN PT,W/HOOK,35 IN. LG (51010) CH32FG	EA	1
*	4210-00-200-0346	PLAY PIPE,NOZZLE,FIRE HOSE:ONE/PC BRASS CASTING (81349) MIL-P-12164	EA	2
*	4210-00-203-3512	RAKE,FOREST FIRE:10 7/8 IN. HEAD W,6 BLANKS (12183) TMC1	EA	2
*	4210-01-160-5635	REDUCER,COUPLING HOSE:RIGID,2 1/2 -7 1/2 NH (12183) B423	EA	4

ILLUS NUMBER	NATIONAL STOCK NUMBER	DESCRIPTION	U/M RQD	QTY
	4210-01-160-5634	REDUCER,HOSE COUPLING: COPPER ALLOY CONCENTRIC (12183) B64	EA	1

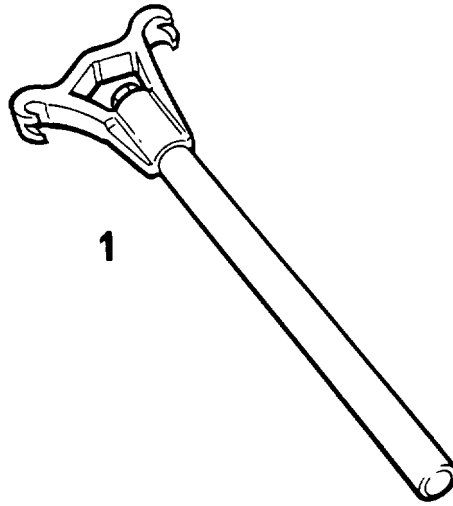
ILLUS NUMBER	NATIONAL STOCK NUMBER	DESCRIPTION	U/M RQD	QTY
*	4020-00-689-5690	ROPE FIBROUS,3 STRAND,150 FT,2 1/4 IN. CIRC (81348) TR605	CL	2
1	5130-00-134-1207	SAW,CIRCULAR BLADE,TWO CYCLE,FAN COOLED	EA	1
2	5110-00-293-0089	SHEARS,METAL CUTTING,STRAIGHT 12 1/2 IN.	EA	1
3	5120-00-293-3336	SHOVEL,HAND,D-HANDLE,OPEN BACK (81348) GGG-S-326	EA	2



ILLUS NUMBER	NATIONAL STOCK NUMBER	DESCRIPTION	U/M RQD	QTY
1	5120-00-224-9326	SHOVEL,HAND,D-HANDLE,SQ PT (81348) GGG-S-326	EA	2
2	4210-00-288-7861	SIAMESE CONNECTION,BRASS,GATED VALVE,2 1/2 IN. (81349) MIL-C-52404	EA	1
	4210-00-081-0622	SPANNER & HOLDER ASSY (00912) 448	EA	3
*	4210-00-203-3228	STRAINER SUCTION, 2 1/2 IN. (00912) STYLE 340 SIZE 6 IN.	EA	1
*	4210-00-252-3378	STRAP,HOSE AND LADDER (81349) MIL-S-11086	EA	4
*	8640-00-841-6456	TARPAULIN,COTTON DUCK,OLIVE DRAB 17 X 12 FT (81348) KP146	EA	2



ILLUS NUMBER	NATIONAL STOCK NUMBER	DESCRIPTION	U/M RQD	QTY
1	5120-00-288-8849	WRENCH, SPANNER, ADJUSTABLE (81348) GGG-W-665	EA	2
*	6240-00-865-6739	BULB (34141) 1584	EA	1
*	6140-01-032-9979	BATTERY 34141 5000-G5	EA	1



APPENDIX D

ADDITIONAL AUTHORIZATION LIST

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the Fire Truck.

D-2. GENERAL.

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

D-3. EXPLANATION OF LISTING.

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

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 Model 2500L Firefighting Truck. This listing is for information purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100 Army Medical Department Expendable/Durable Items.

E-2. EXPLANATION OF COLUMNS.

- a. Column(1) Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., Use cleaning compound (item 5, Appendix E)).
- b. Column(2) Level. This column identifies the lowest level of maintenance that requires the listed item.
 - C - Operator/Crew
 - O - Organizational 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 Manufacturer (FSCM) in parentheses followed by the part number.
- e. Column(5) Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e g, ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

ITEM NO.	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
1	O		Acetic Acid (Vinegar)	Ea
2	O		Antifreeze	Ea
3	O		Antiseize Compound	Ea
4	O		Antiseize Compound (International Compound # 2)	Ea
5	O		Baking Soda	Ea
6	O		Contact Adhesive	Ea
7	O		Crocus Cloth	Ea
8	O		Cutting Oil	Ea
9	O		Dexron II	Ea
10	O		Dry Cleaning Solvent	Ea
11	O		Electrical Tape	Ea
12	O		Emery Cloth (80-100 Grit)	Ea
13	O		Emery Cloth (400 Grit)	Ea
14	O		Gasket Eliminator	Ea
15	O		Gear Oil	Ea
16	O		Grease	Ea
17	O		Lubricating Oil (or engine oil)	Ea
18	O		Masking Tape	Ea
19	F		Methyl Ethyl Ketone	
20	O		Penetrating Oil	Ea
21	O		Pipe Sealant	Ea
22	O		Retaining Compound	Ea
23	O		Sandpaper (OO Grit)	Ea
24	O		Sealant	Ea
25	O		Seal Retainer	Ea
26	O		Silicone Grease	Ea
27	O		Silicone Sealant	Ea
28	O		Threadlock Liquid	Ea
29	O		Tire Bead Lubricant	Ea
31	O		Petroleum Jelly	Ea
32	O		Vegetable Shortening	Ea
33	O		Vulcanizer	Ea
34	O		White Grease	Ea

APPENDIX F
STORAGE AND SIGN GUIDE.

F-1. SCOPE.

This appendix lists all the decalcomanias and plates on the truck and shows their location.

1. Power Take Off-Caution
2. Battery Ground Identification
3. Battery Positive Identification
4. Battery Boosting Instructions
5. Vehicle Identification Number Plate
6. Transportation Data Plate
7. Daily Service Instruction - Air Tanks
8. Air Reservoir Identification - Emergency
9. Air Reservoir Identification - Fast Air
10. Foam System Instruction Plate
11. Heat Treated Frame - Caution
12. Power Outlet Caution
13. Air Reservoir Identification - Secondary
14. Air Reservoir Identification - Primary
15. Diesel Fuel Only - Caution

APPENDIX G

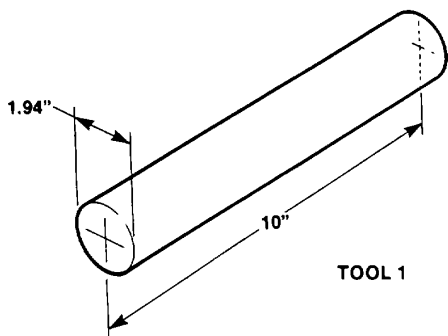
ILLUSTRATED LIST OF MANUFACTURED ITEMS

This appendix includes instructions for making items authorized to be manufactured or fabricated at organizational maintenance. All parts and bulk materials needed for manufacture on the items are listed by part number or specification number in a tabular list on the illustration.

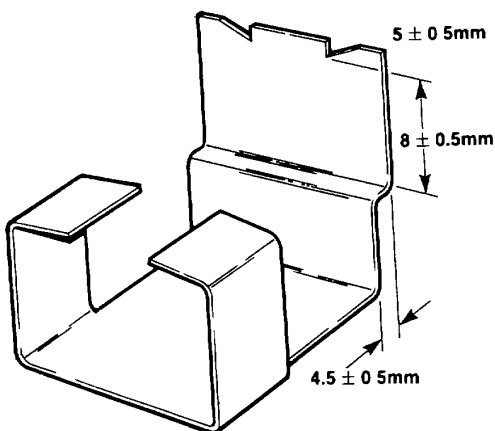
Tool 1 Drive Line Alinement Bar Material
 Mild Steel Bar Stock
 (2 in.) ASTMA 36 Cold Rolled

Tool 2 Electrode Alinement Gage Material
 Mild Steel Plate (1/16 in.)
 ASTM A36

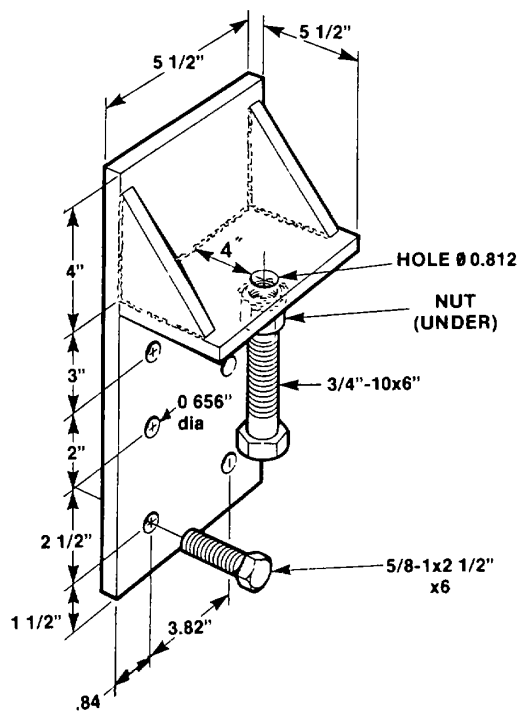
Tool 3 Engine Support Plate Material
 1.Mild Steel Plate 1/2 in. ASTM A36
 2.Bolt MS90725-201 (threaded up to head)
 3.Bolt MS90725-162
 4.Nut MS5197-23



TOOL 1



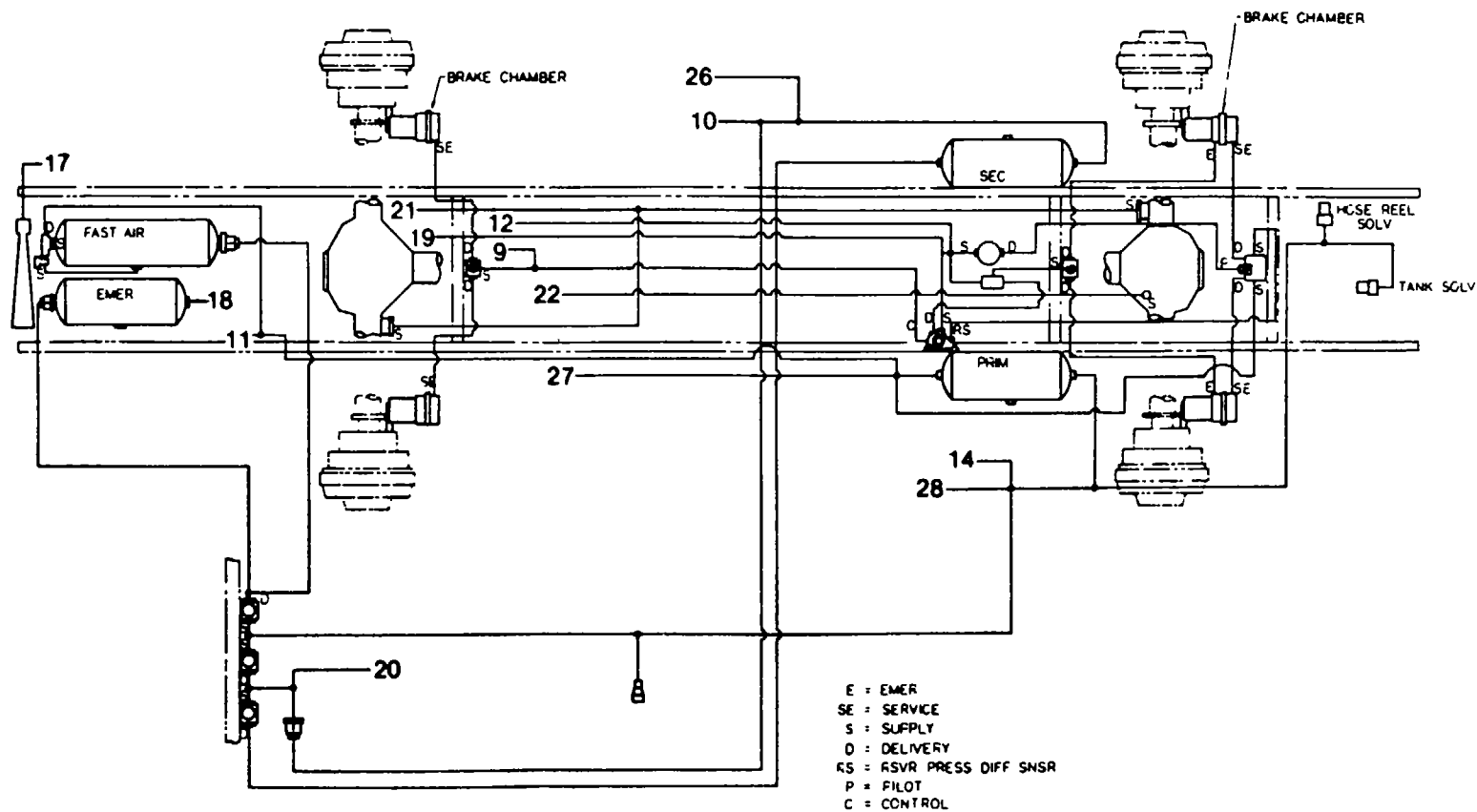
TOOL 2



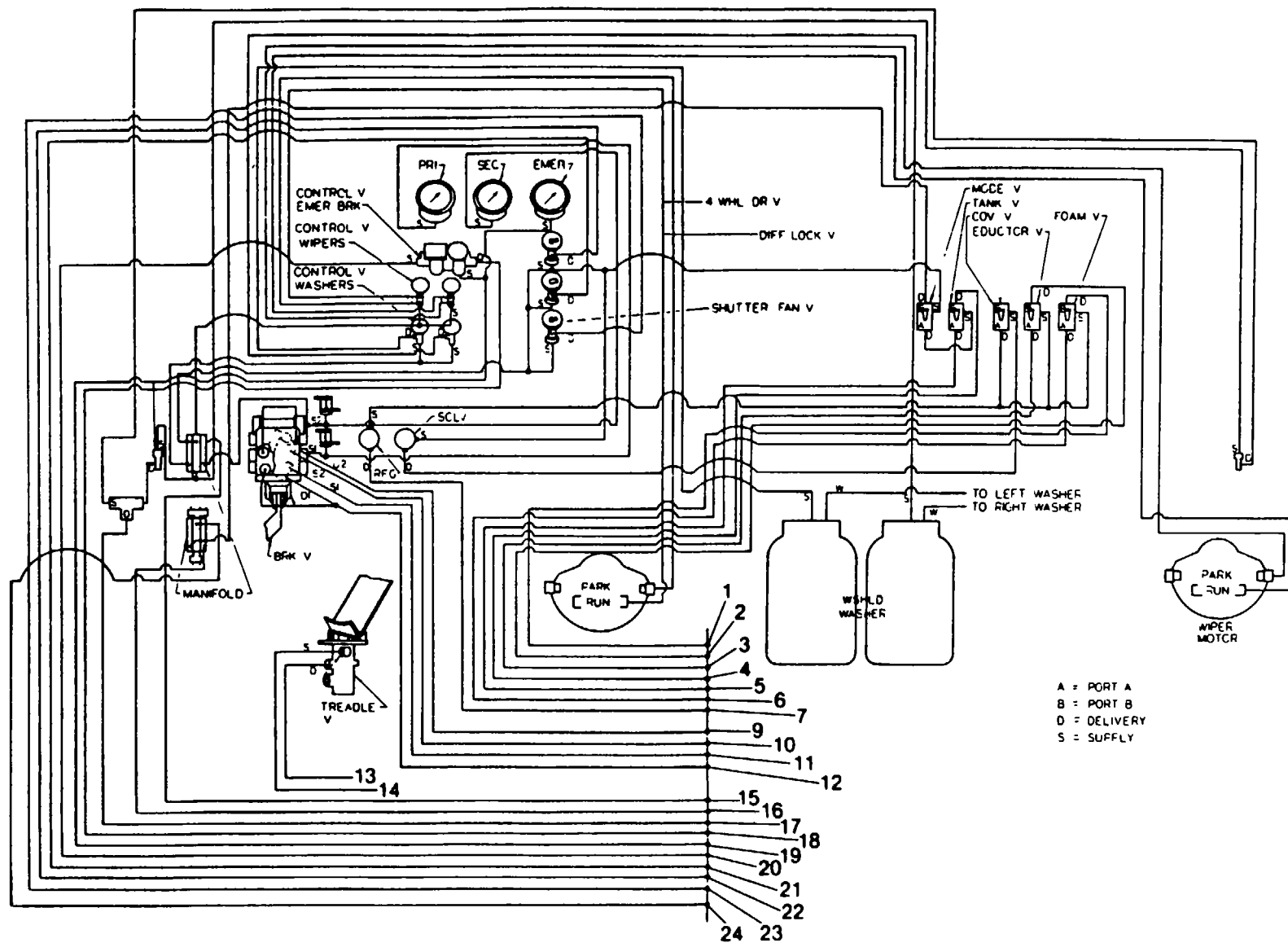
TOOL 3

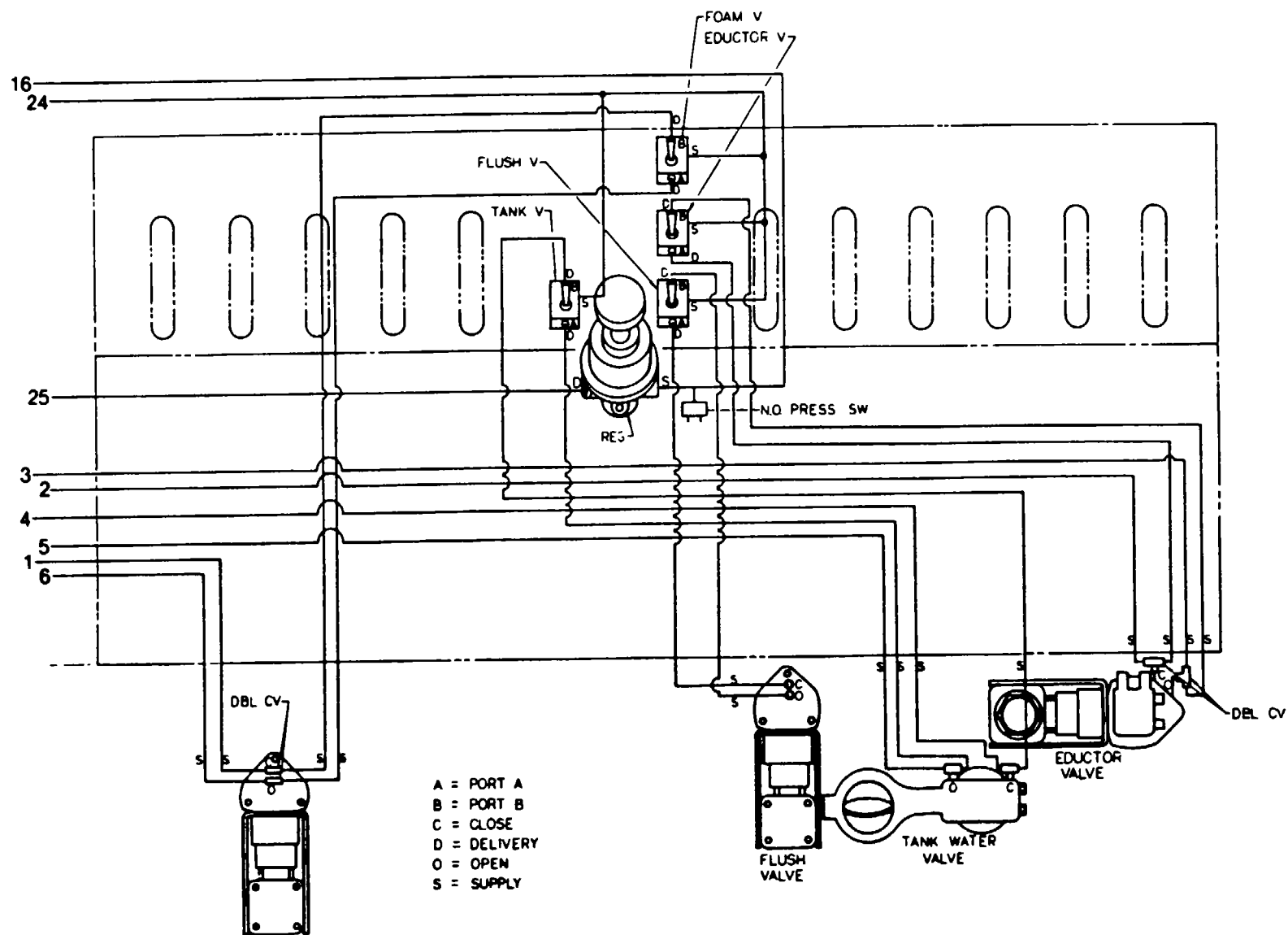
G-1/G-2 Blank)

APPENDIX H
AIR SCHEMATICS

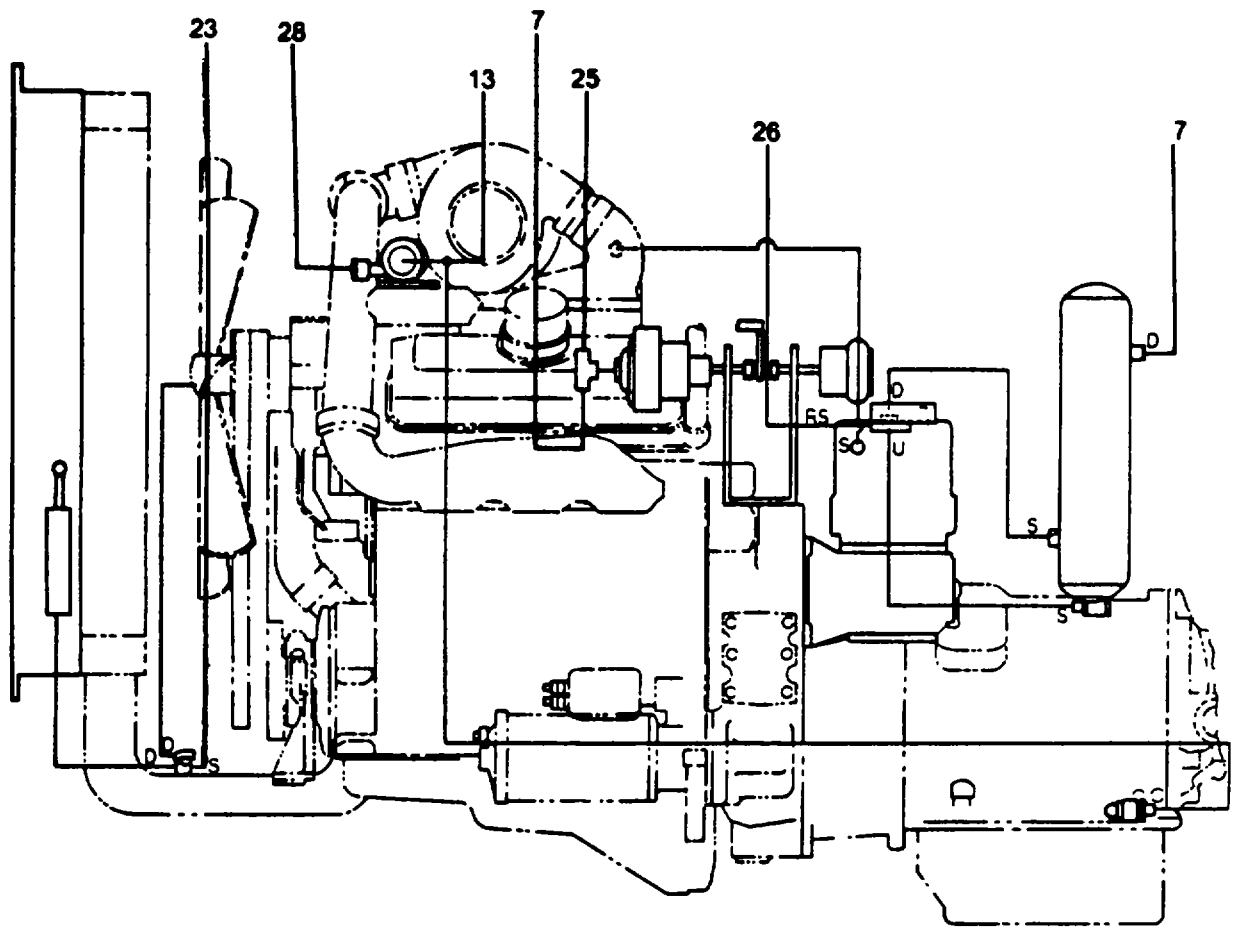


Change 3 H-1





Change 3 H-3

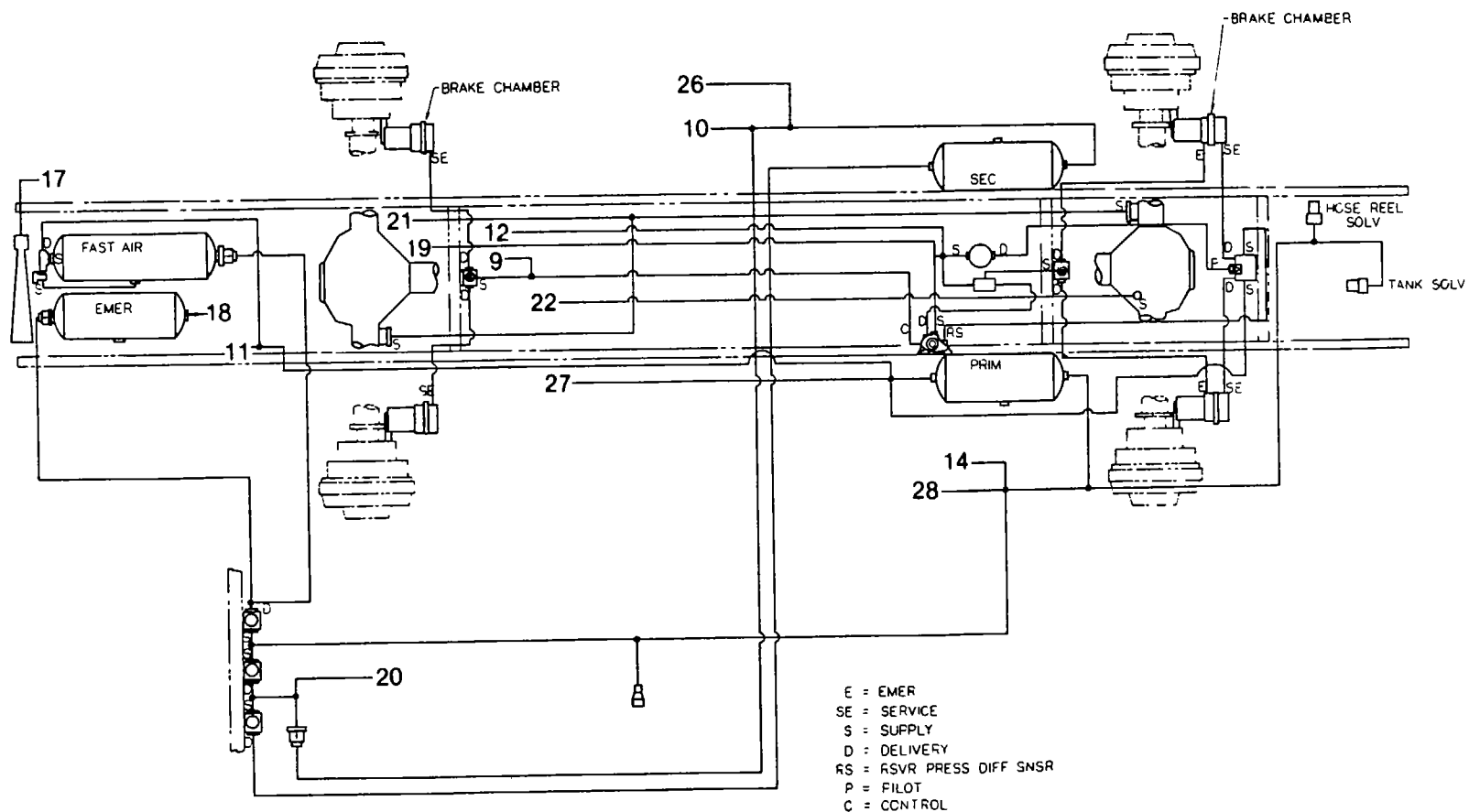


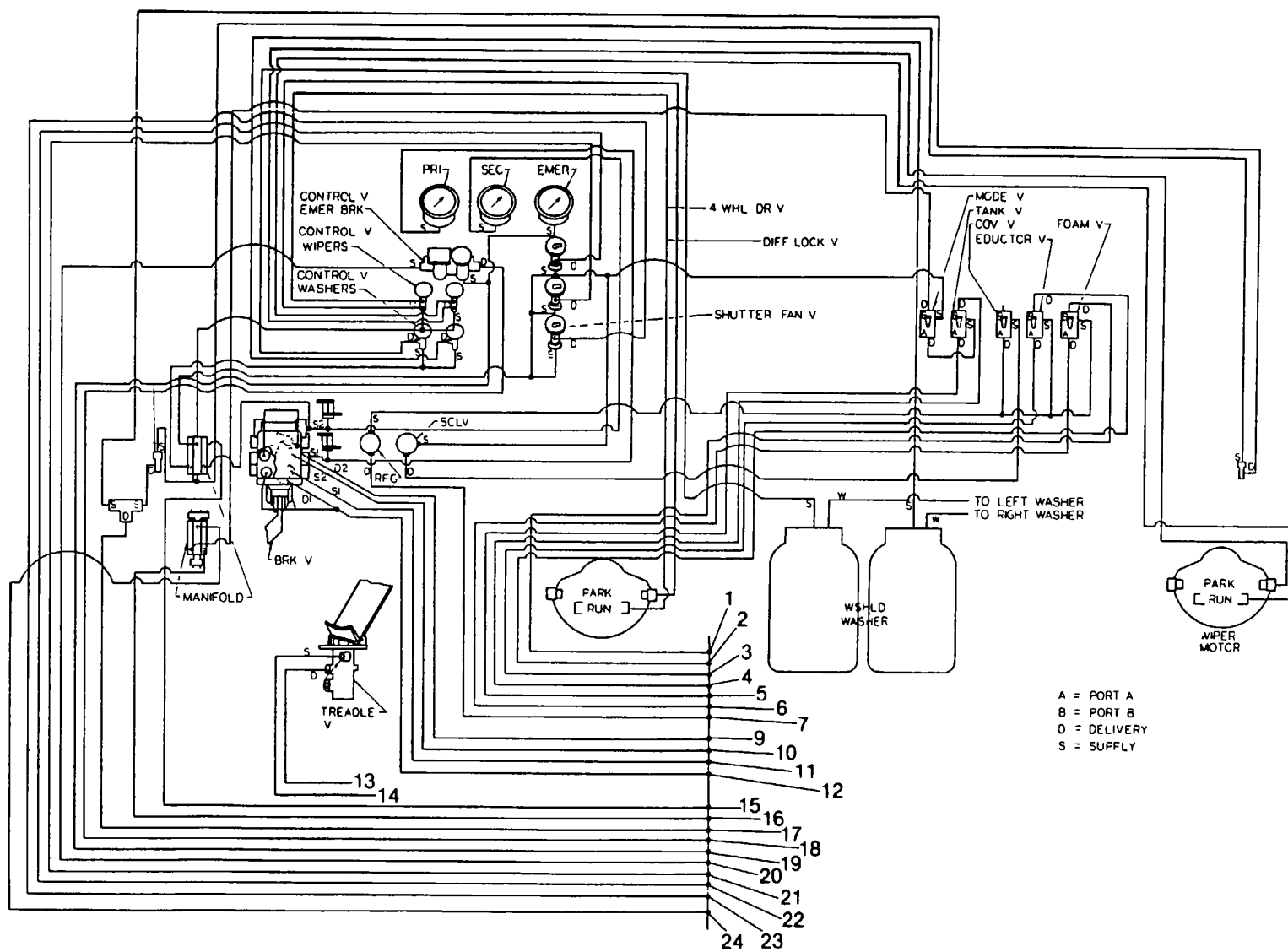
D = DELIVERY
RS = RSVR PRESS DIFF SNSR
S = SUPPLY
U = UNLOADER

Change 3 H-4



APPENDIX J
AIR SCHEMATIC





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By Order of the Secretary of the Army:

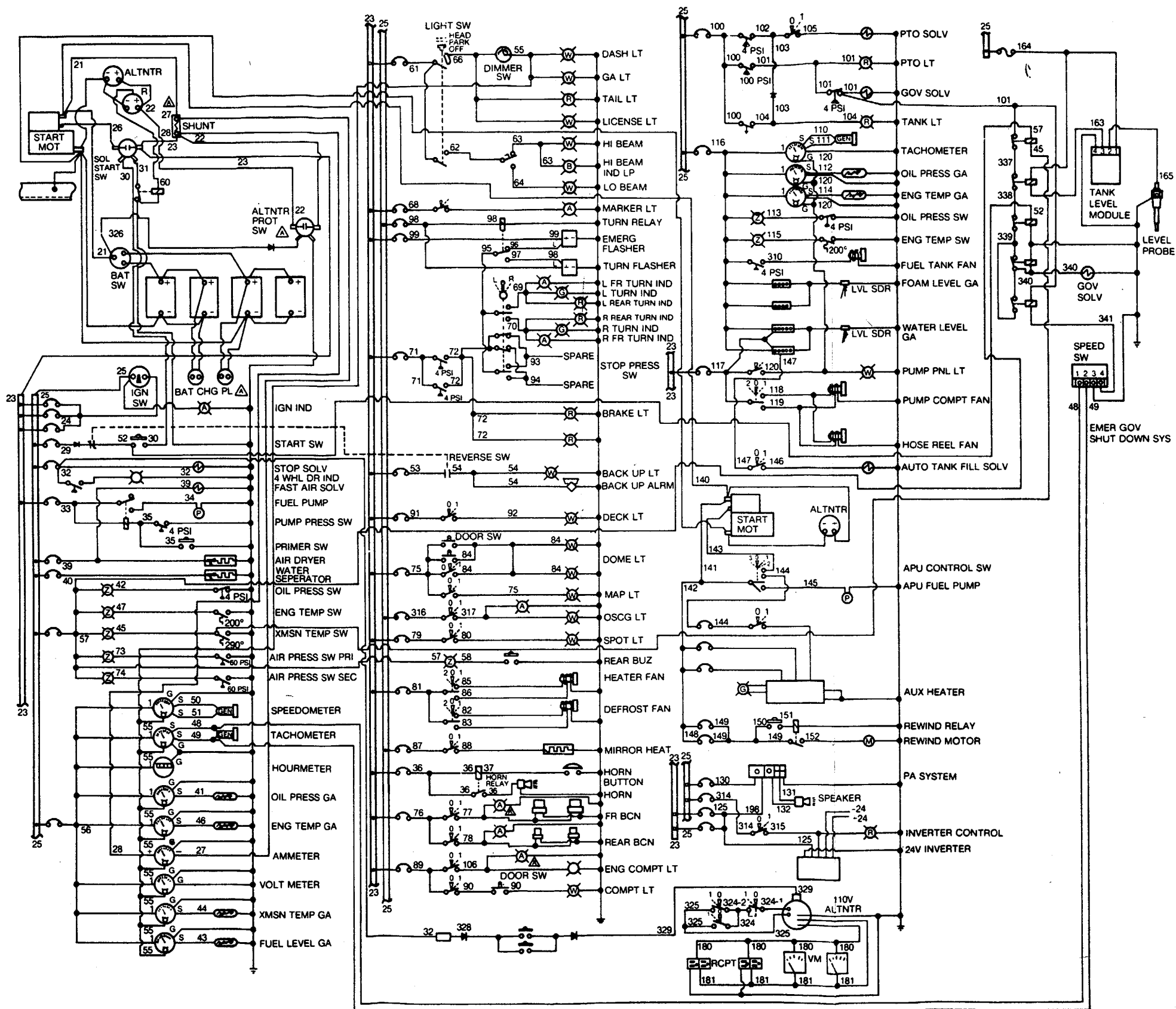
Official:

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FO-1 ELECTRICAL SCHEMATICS
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 <div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 10px;"> <p style="margin: 0;"><i>THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</i></p> </div>		SOMETHING WRONG WITH PUBLICATION		
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The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

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

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

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

Temperature (Exact)

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