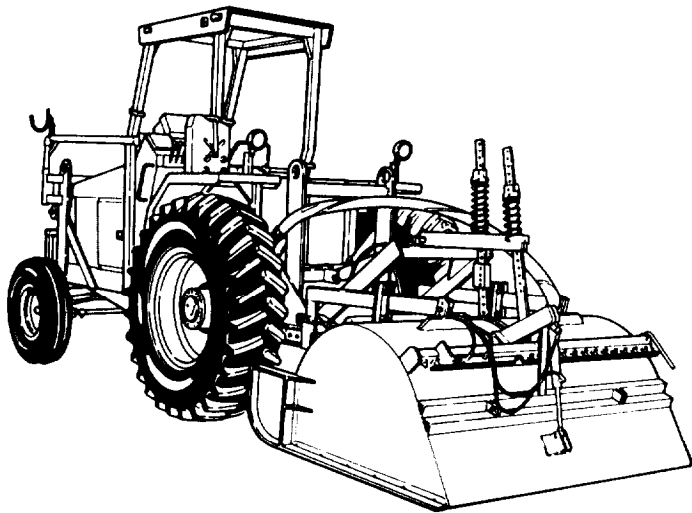


TECHNICAL MANUAL

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



MIXER, ROTARY TILLER

SEAMAN-MAXON, INC.

MODEL TO730H-KEG

NSN

3895-01-331-8560

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is unlimited.

This copy is a reprint which includes current
pages from Change 1.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

14 AUGUST 1992

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

WARNING

- Wear safety glasses or goggles when checking batteries. Always check electrolyte level with engine stopped. Do not smoke or use exposed flame when checking battery; explosive gases are present and severe injury to personnel can result.
- Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and do not smoke when performing maintenance on batteries. Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

WARNING

The brake system may contain asbestos material. Parts of the brake assembly may be coated with asbestos dust; breathing this dust can harm personnel.

- Use a filter mask approved for use against asbestos dust.
- Never use compressed air or dry brush to clean these assemblies.
- Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust.
- Use water and a soft bristle brush or cloth to remove dirt or mud.

WARNING

Hearing protection required when the equipment is in operation. When it is necessary to have the equipment running, hearing protection is required by personnel within the area of this equipment.

WARNING

CARBON MONOXIDE (EXHAUST GAS) CAN KILL YOU

Carbon monoxide is a colorless, odorless, DEADLY POISONOUS gas and when breathed deprives body of oxygen and causes SUFFOCATION. Breathing air with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, a sleepy feeling, and coma. Permanent BRAIN DAMAGE or DEATH can result from severe exposure.

The following precautions MUST be followed to ensure personnel are safe whenever personal heater or main or auxiliary engine is operated for any purpose.

- DO NOT operate personnel heater or engine of vehicle in enclosed area without adequate ventilation.
- DO NOT idle engine for long periods without ventilator blower operation. If tactical situation permits, open hatches.
- DO NOT **drive** any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
- NEVER sleep in a vehicle when the heater is operating or the engine is idling.
- BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either are present, IMMEDIATELY EVACUATE AND VENTILATE the area. Affected personnel treatment shall be: expose to fresh air; keep warm, DO NOT PERMIT PHYSICAL EXERCISE; if necessary, give artificial respiration as described in FM 12-11 and get medical attention.
- BE AWARE; neither the gas particulate filter unit nor field protection mask for nuclear-biological-chemical protection will protect you from carbon monoxide poisoning.

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS GOOD VENTILATION

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

WARNING

- Do not remove the radiator cap when the engine is hot; steam and hot coolant can escape and burn personnel.
- Use extreme care when removing the radiator pressure cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After use securely tighten cap.
- Use a clean, thick waste cloth or like material to remove the cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.
- Clean fuel tank to purge any flammable liquid or vapors before welding, grinding or using any heat producing device near the fuel tank.
- Post signs that read “NO SMOKING WITHIN 50 FEET (15 m)” when working with open fuel, fuel lines or fuel tanks.
- When refueling, stop vehicle, shut down engine, and apply parking brake. Ensure no open flame in or near area. Never smoke. Never add fuel with engine running. Do not have driver seated when adding fuel. After fuel is added, securely close reservoir cap; a loose cap can cause a fuel leak or be a fire hazard. Before starting vehicle, check that no fuel has spilled on or around vehicle.

WARNING

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

WARNING

Prussian Blue Dye is poisonous and can burn skin on contact. Over exposure to dye can cause heart and skin problems, dizziness, and unconsciousness.

WARNING

Ensure your seatbelt is fastened before operating vehicle. Avoid sudden stops and operate at a safe speed.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 138°F (50°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

Change

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 8 September 1992

No. 1

OPERATORS, UNIT
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL
FOR
MIXER, ROTARY TILLER,
SEAMAN-MAXON, INC.,
MODEL T0730H-KEG,
NSN 3895-01-331-8560

TM 5-3895-369-14, dated August 14 1992, is changed as follows:

1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page.

Remove Pages

Insert Pages

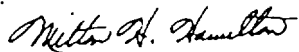
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3. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

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*General, United States Army
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TECHNICAL MANUAL

No. 5-3895-369-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 August 1992

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

FOR

**MIXER, ROTARY TILLER
SEAMAN-MAXON, INC.
T0730H-KEG
NSN 3895-01-331-8560**

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

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HOW TO USE THIS MANUAL

This manual is designed to help operate and maintain the Mixer, Rotary Tiller NSN 3895-01-331-8560. Listed below are some of the special features that have been included to help locate and use the needed information.

A front cover Table of Contents is provided for quick reference to chapters and sections that will be used often.

Warning, caution and note headings, subject headings, and certain other essential information are printed in bold type to make them easier to see.

The maintenance tasks describe what must be done to the mixer before starting the task, and what must be done to return the mixer to operating condition after the task is finished.

The appendixes are located at the end of the manual. They contain a reference guide to other manuals, guidelines to reading the Maintenance Allocation Chart (MAC), a list of expendable supplies and materials, and other material for maintaining the mixer.

In addition to text, there are exploded-view illustrations showing you how to take the part off and put it on. Cleaning and inspection procedures are also included, when required.

Chapters 1 and 2 of this manual are directed at the crew/operator of the mixer. These chapters include an overall description of the mixer and discuss the controls and indicators, their location and use, and the instructions for operation of the mixer under different circumstances.

Chapter 3 of this manual covers crew/operator lubrication, preventive maintenance checks and services, and basic troubleshooting. Crew/operator maintenance is also covered in this chapter.

Chapter 4 of this manual covers unit maintenance including troubleshooting and maintenance procedures.

Chapter 5 of this manual covers direct support and general support maintenance including troubleshooting and maintenance procedures.

FOLLOW THESE GUIDELINES WHEN USING THIS MANUAL

The operator must read through this manual and become familiar with the contents before attempting to operate the mixer.

Read all WARNINGS and CAUTIONS before performing any procedure.

The equipment conditions found in the maintenance procedures are of a general nature and the mechanic may be able to perform only certain tasks within a procedure to accomplish the equipment condition.

CHAPTER 1

INTRODUCTION

Para	Contents	Page
1-1	Scope	1-1
1-2	Maintenance Forms and Records	1-1
1-3	Destruction of Army Materiel to Prevent Enemy Use	1-1
1-4	Warranty Information	1-2
1-5	Reporting Equipment Improvement Recommendations (EIR)	1-2
1-6	List of Abbreviations	1-3
1-7	Preparation for Storage or Shipment	1-3
1-8	Location and Description of Major Components	1-4
1-9	Safety, Care, and Handling	1-6
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1-12	Electrical System	1-11
1-13	Hydraulic System	1-13
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Section I. GENERAL INFORMATION

1-1. SCOPE.

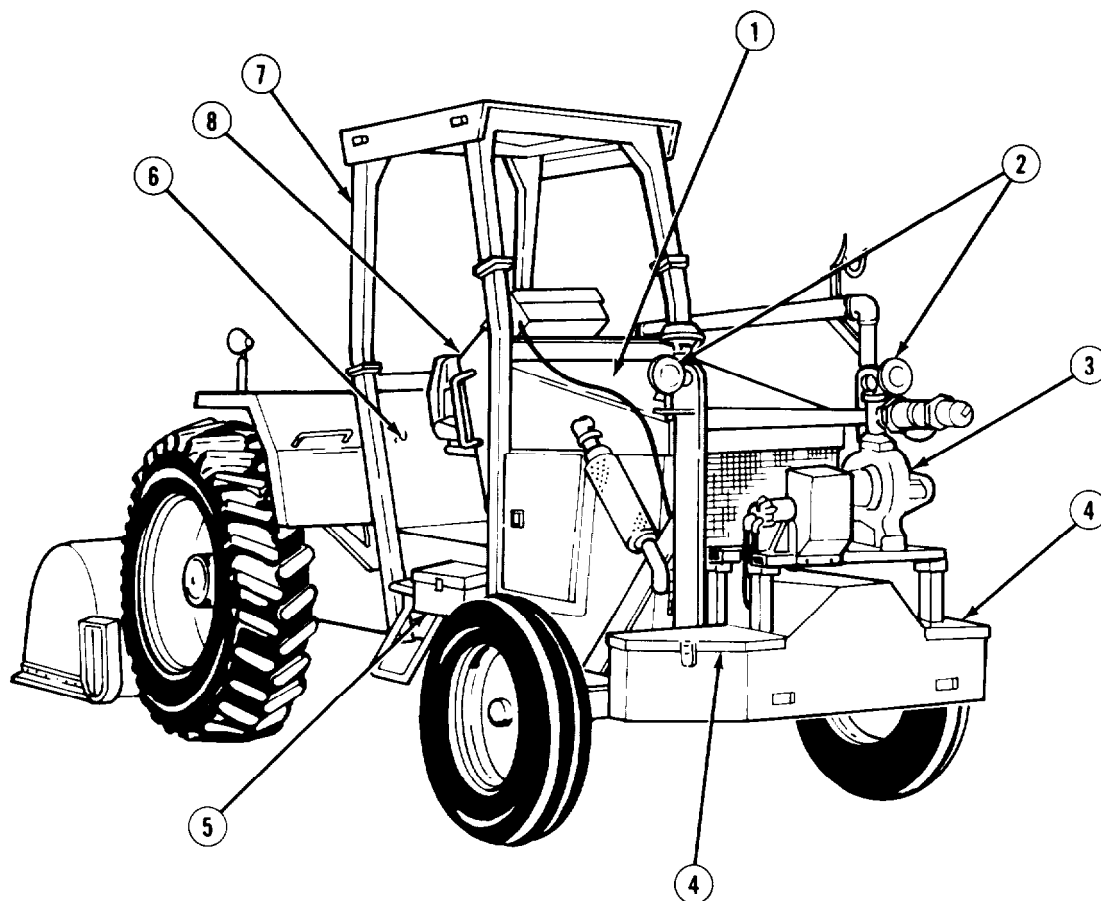
- a. Type of Manual.* This manual is used for operation and maintenance of the Mixer, Rotary Tiller.
- b. Model Number and Equipment Name.* Mixer, Rotary Tiller, NSN 3895-01-331-8560, produced by Seaman-Maxon Company of Wisconsin, Model TO730H-KEG. (See Figures 1-1 and 1-2).
- c. Purpose of Equipment.* The Mixer, Rotary Tiller, hereinafter referred to as the vehicle, is designed to stabilize soil in preparation for the application of pavement material.

1-2. MAINTENANCE FORMS AND RECORDS.

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

1-3. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE.

Command decision, according to the tactical situation, will determine when the destruction of the vehicle will be accomplished. A destruction plan will be prepared by the using organization unless one has been prepared by a higher authority. For general destruction procedures for this equipment, refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use (U.S. Army Tank-Automotive Command).



- | | |
|-----------------------|----------------------------------|
| 1. Engine Compartment | 5. Auxiliary Battery |
| 2. Front Floodlights | 6. Fuel/Hydraulic Tank |
| 3. Additive Pump | 7. Rollover Protective Structure |
| 4. Tool Boxes | 8. Operator's Area |

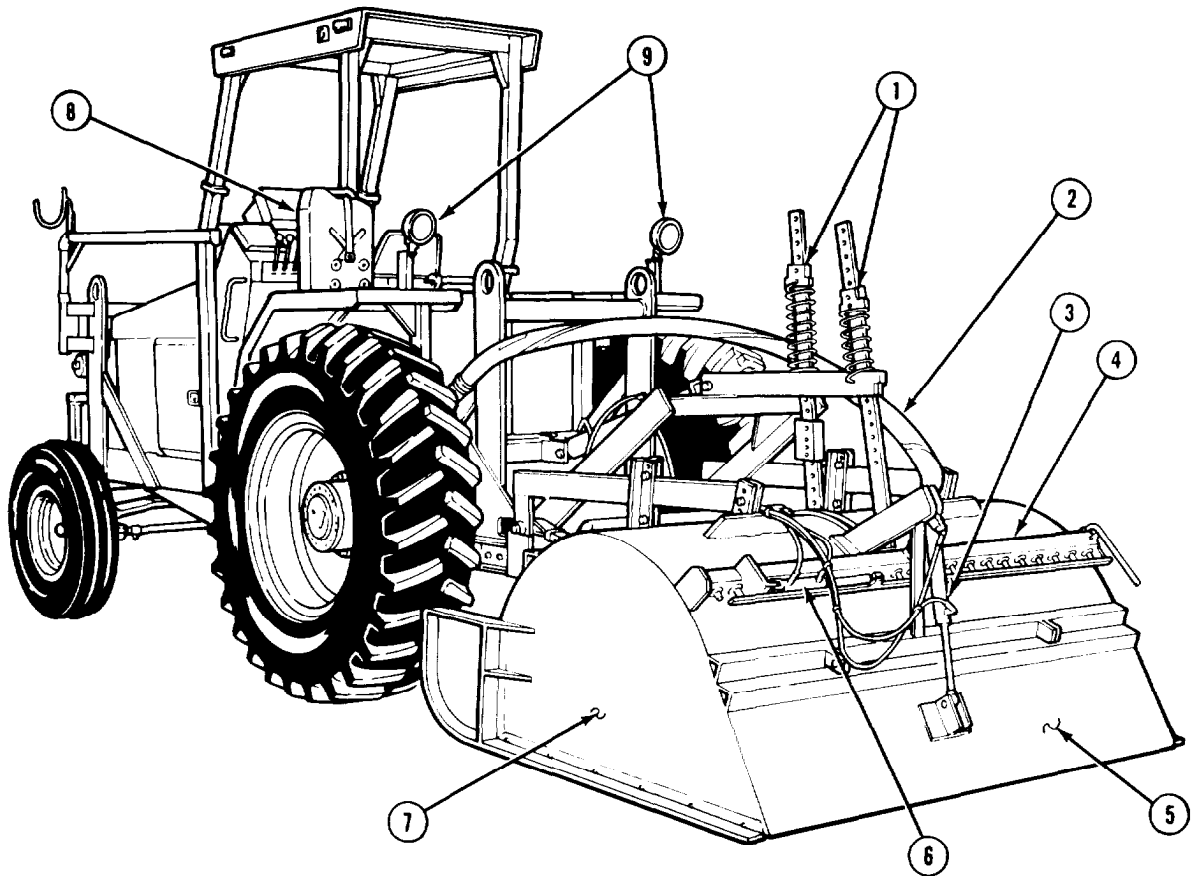
Figure 1-1. Mixer, Rotary Tiller - Right Front View

1-4. WARRANTY INFORMATION.

For warranty information see commercial manufacturers warranty.

1-5. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your vehicle 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 SF 368 (Quality Deficiency Report). Mail it to us at Commander, U. S. Army Tank-Automotive Command, ATTN: AMSTA-QRD, Warren, Michigan 48397-5000. A reply will be furnished to you.



- | | |
|-------------------------|-----------------------|
| 1. Rotor Depth Controls | 6. Spray Bar Cylinder |
| 2. Additive System Hose | 7. Rotor Assembly |
| 3. Tailboard Cylinder | 8. Fuel Can |
| 4. Spray Bar | 9. Rear Floodlights |
| 5. Tailboard | |

Figure 1-2. Mixer, Rotary Tiller - Left Rear View

1-6. LIST OF ABBREVIATIONS.

All abbreviations used in this manual conform to MIL-STD-12 and its amendments.

1-7. PREPARATION FOR STORAGE OR SHIPMENT.

Refer to Chapter 4, Section VI for unit preparation for storage or shipment.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-8. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

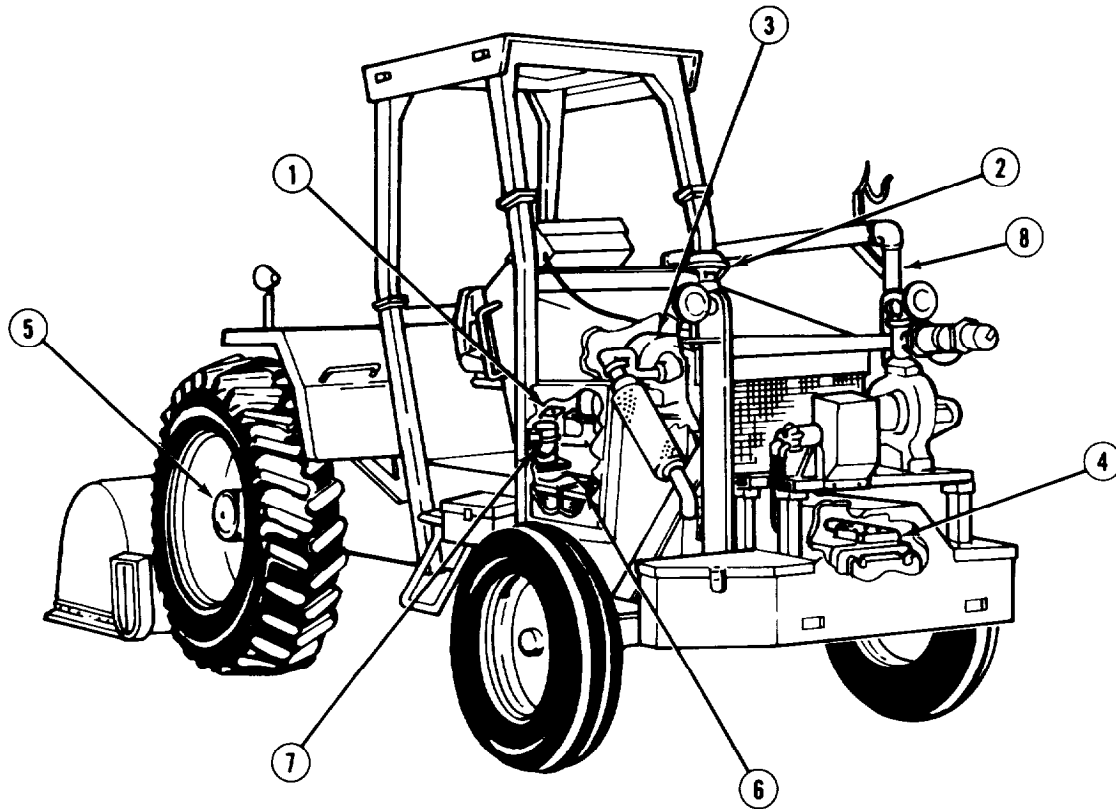


Figure 1-3. Mixer, Rotary Tiller - Major Components (Sheet 1 of 2)

Engine. Diesel engine (1) provides 152 hp (113 kilowatt) to drive the hydrostatic transmission, rotor, and accessories.

Air Cleaner. Air cleaner (2) filters out dust and debris from the air induction system.

Turbocharger. Turbocharger (3) provides increased horsepower by forced air induction.

Hydrostatic Pump. Half of hydrostatic transmission, the hydrostatic pump (4) hydraulically powers the hydrostatic motor.

Wheel Ends (Planetary). Wheel ends (5) increase the power ratio at the rear wheels.

Batteries. Batteries (6) provide cranking power to start the engine.

Emergency Steering Motor. Emergency steering motor (7) provides steering capabilities if the engine becomes inoperative.

Swing Boom. Swing boom (8) supports additive system feed host from support vehicle.

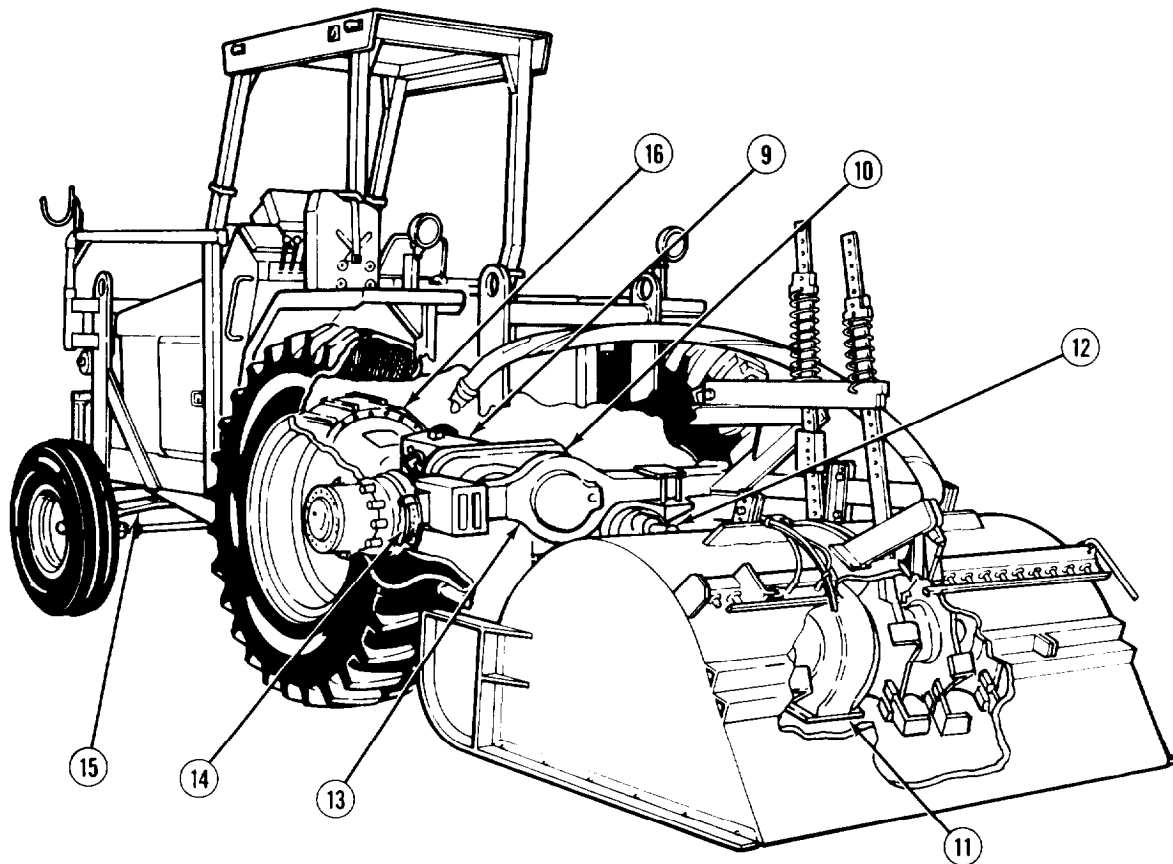


Figure 1-3. Mixer, Rotary Tiller - Major Components (Sheet 2)

Hydrostatic Motor. Half of the hydrostatic transmission, the hydrostatic motor (9) powers the 2-speed range box and rear axle.

2-Speed Range Box. 2-speed range box (10) allows operation at speeds from 0-6 mph (0-9 kph) in LOW range and 0-17 mph (0-27 kph) in HIGH.

Rotor Drive Assembly. Rotor drive assembly (11) drives the rotor in preparing ground surface for paving.

Pillow Block. Pillow block (12) transmits power from clutch assembly to rotor drive assembly (11).

Rear Axle. Rear axle (13) powers the rear wheels to drive the vehicle.

Rear Brakes. Rear brakes (14) stop the vehicle from travelling.

Front Axle. Front axle (15) provides vehicle steering capabilities.

Clutch Assembly. Clutch assembly (16) transmits power from the engine to the rotor drive assembly (11) through drive shafts.

1-9. SAFETY, CARE, AND HANDLING.

The following are significant hazards and safety recommendations.

a. Refueling vehicle. Refueling vehicle is a normal operating condition. Shut off engine and do not smoke when filling tank

b. Debris thrown from rotor assembly when tailboard is raised. This is a normal operating condition. Do not go behind vehicle until rotor assembly has been shut off.

1-10. EQUIPMENT DATA.

Table 1-1 contains the equipment data that applies to the vehicle.

Table 1-1. Equipment Data

General Specifications

Type	Mixer, Rotary Tiller
Model	TO730HXEG
Length	265 in. (72.4 m)
Height	121 in. (33 m)
Width	96 in. (26.24 m)
Weight	14,980 lb (6800.92 kg)
Fuel:	Diesel
Tires:	
Size	
Front	9.50 x 20 - 8 ply
Rear	18.4 x 34 - 8 ply
Pressure	
Front	40 psi
Rear	20 psi
Speed Range	
LOW	0-6 mph (0-9 kph)
HIGH	0-17 mph (0-27 kph)
Maximum Mixing Speed	8 mph (12 kph)

Engine Specifications

Type	Diesel
Rating	152 hp (113 kilowatt)
Manufacturer	Cummins
Model	6BT5.9
Number of Cylinders	6
Total Displacement	359 cu.in. (5.9 l)
Operating rpm range	1800-2000 rpm
Idle Speed	1100-1150 rpm
Bore	4.02 in. (102 mm)
Stroke	4.72 in. (120 mm)
Compression Ratio	17.5:1
Firing Order	1-5-3-6-2-4
Air Cleaner	Dry paper element, replaceable.

Table 1-1. Equipment Data - CONT.

Engine Specifications - Continued

Cylinder Block

Number of Compression Rings (per piston)	2
Number of Oil Rings (per piston)	1
Crankcase Capacity with Filter Change	15 qt (14.2 l)
Cylinder Bore Diameter	4.0157 to 4.0203 in. (102 to 102.116 mm)
Out-of-Roundness	0.00015 in. (0.038 mm)
Taper	0.003 in. (0.76 mm)
Deck Surface Variance Between Cylinders	0.002 in. (0.050 mm)
Camshaft Bore Diameter (2-5 only)	2.1324 in. (54.164 mm)
Camshaft Bushing Bore Diameter (1 only)	2.1317 in. (54.146 mm)
Tappet Bore Diameter	0.630 to 0.632 in. (16.000 to 16.055 mm)
Main Journal Diameters	3.2662 to 3.2682 in. (82.962 to 83.013 mm)
Out-of-Roundness	0.002 in. (0.050 mm)
Taper	0.0005 in. (0.013 mm)
Rod Journal Diameters	2.7150 to 2.7170 in. (68.962 to 69.013 mm)
Out-of-Roundness	0.002 in. (0.050 mm)
Taper	0.0005 in. (0.013 mm)
Bearing Clearance	0.0035 in. (0.089 mm)
Piston Skirt Diameter	4.0088 to 4.0117 in. (101.823 to 101.896 mm)
Piston Ring Clearance	
Intermediate	0.003 to 0.0059 in. (0.075 to 0.150 mm)
Oil Control	0.0016 to 0.0051 in. (0.040 to 0.130 mm)
Ring Gap	
TOP	0.0160 to 0.0270 in. (0.40 to 0.70 mm)
Intermediate	0.0100 to 0.0215 in. (0.25 to 0.55 mm)
Oil Control	0.0100 to 0.0215 in. (0.25 to 0.55 mm)
Piston Pin Bore	1.5750 to 1.5758 in. (40.006 to 40.025 mm)
Piston Pin Diameter	1.5744 to 1.5749 in. (39.990 to 40.0032 mm)
Connecting Rod Pin Bore	1.5769 to 1.5784 in. (40.053 to 40.092 mm)
Piston to Cylinder Bore Limits	0.0023 to 0.0039 in. (0.06 to 0.10 mm)
Main Bearing Bore Diameter	2.2720 in. (83.106 mm)

Crankshaft

End Play	0.005 to 0.010 in. (0.13 to 0.25 mm)
Connecting Rod Side Clearance	0.004 to 0.012 (0.1 to 0.3 mm)

Cylinder Head

Valve Stem to Rocker Clearance	
Intake	0.010 in (0.25 mm)
Exhaust	0.020 in (0.50 mm)
Valve Guide Bore Diameters	0.3157 to 0.3185 in. (8.019 to 8.089 mm)
Deck Surface Variance	
End-to-End	0.003 in. (0.075 mm)
Within a 2 in. (50.8 mm) diameter area	0.0039 in. (0.010 mm)
Valve Stem Diameter	0.3126 to 0.3142 in. (7.94 to 7.98 mm)
Valve Seat Angle	
Intake	30°
Exhaust	45°
Valve Rim Thickness - minimum	0.031 in. (0.79 mm)
Valve Depth	0.039 to 0.060 in. (0.99 to 1.52 mm)
Valve Scat Width	0.060 to 0.080 in. (1.5 to 2.0 mm)

Table 7-1. Equipment Data - CONT.

Engine Specifications - Continued

Cylinder Head - cont.

Valve Springs

Free Length	2.190 in. (55.63 mm)
Inclination - maximum	0.039 in. (1.0 mm)
Spring Tension - minimum	65.0 to 72.2 lb (289.32 N) compress to a height of 1.94 in. (49.25 mm)

Rocker Lever Bore 0.7480 to 0.7500 in. (19.000 to 19.051 mm)

Rocker Shaft Diameter 0.7456 to 0.7470 in. (18.938 to 18.975 mm)

Camshaft

Diameter at Peak of Lobe

Intake - minimum 1.852 in. (47.040 mm)

Exhaust - minimum 1.841 in. (46.770 mm)

Lift Pump - minimum 1.398 in. (35.5 mm)

Journal - minimum 2.1245 in. (53.962 mm)

End Play 0.007 to 0.011 in. (0.17 to 0.29 mm)

Tappet Stem Diameter 0.627 to 0.629 in. (15.936 to 15.977 mm)

Lube Pump

Gerotor Tip Clearance - maximum 0.007 in. (0.1778 mm)

Port Plate Clearance - maximum 0.005 in. (0.127 mm)

Body Bore Clearance . maximum 0.015 in. (0.381 mm)

Turbocharger

Shaft Bearing Diameter - minimum 0.432 in. (10.97 mm)

Shaft End Play 0.001 to 0.003 in. (0.03 to 0.08 mm)

Radial Clearance 0.012 to 0.018 in. (0.30 to 0.46 mm)

Injection Pump Gear Backlash 0.003 to 0.013 in. (0.08 to 0.33 mm)

Camshaft Gear Backlash 0.003 to 0.013 in. (0.08 to 0.33 mm)

Lube Pump Gear Backlash 0.003 to 0.013 in. (0.08 to 0.33 mm)

Cooling System

Capacity 6 gallons (23 l)

Fuel System:

Fuel Tank Capacity 55 gal. (208.2 l)

Fuel Injector Pump Mechanical, external

Governor Mechanical, internal

Fuel Injectors Mechanical, pressure activated

Hydraulic System

Hydraulic Tank Capacity 42 gal. (159.9 l)

Hydrostatic Pump Capability 17.5 gpm (66.23 lpm)

Hydrostatic Motor Capability 10.0 gpm (37.85 lpm)

Electrical

Batteries Two - 12.volt

Starter 24 volt (solenoid attached).

Alternator 24 volt/45 amp.

Lighting 24 volt

Additive Instrumentation/Horn 12 volt

Additive System

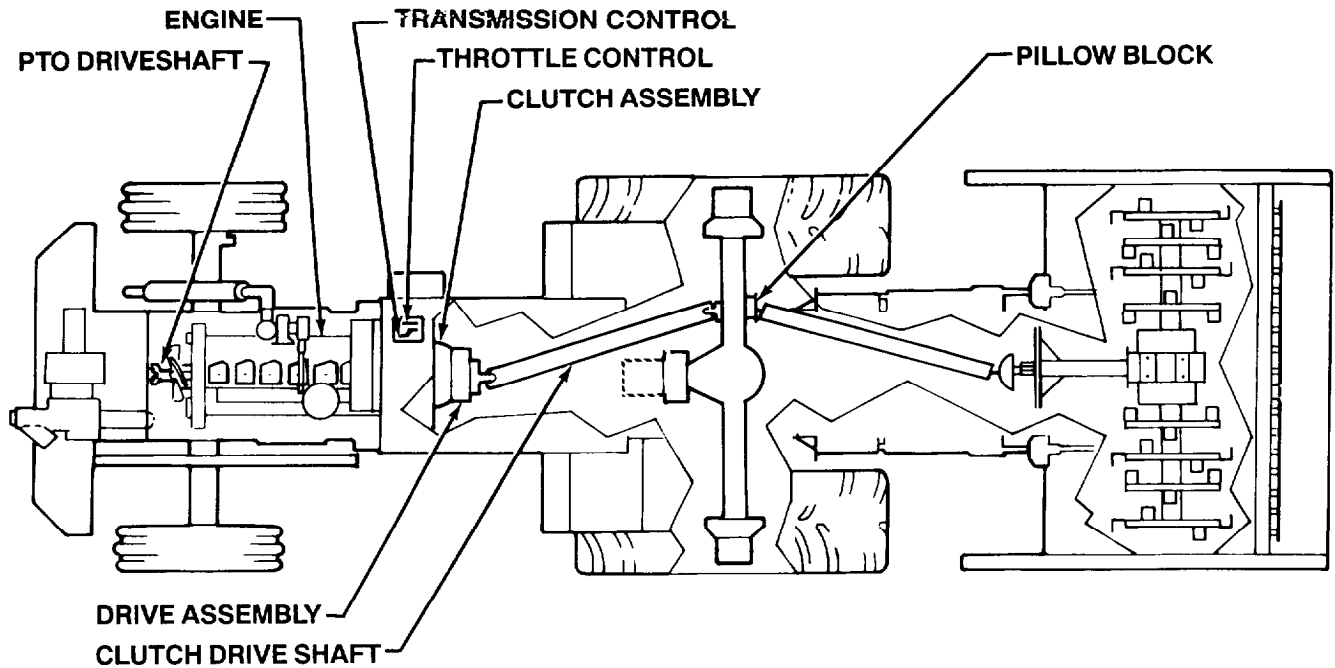
Pump Capability 210 gpm at 605 rpm (maximum)

Motor Hydraulic, variable speed

Spray Bar External, rotor hood mounted, 21 valve

Section III. TECHNICAL PRINCIPLES OF OPERATION

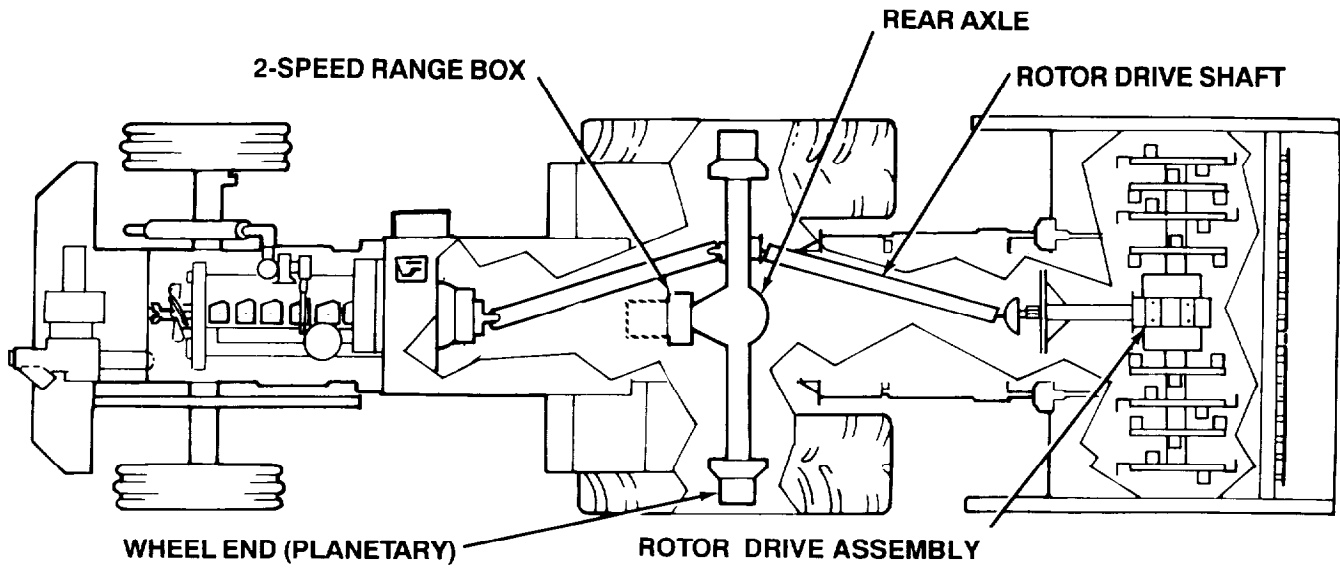
1-11. MECHANICAL SYSTEM.



MECHANICAL SYSTEM

Item	Description
Engine	Engine is a 6-cylinder diesel that provides power for all systems.
Throttle Control	Throttle control sets engine rpm.
Transmission Control	Transmission control determines direction of vehicle travel; forward, reverse, or neutral.
PTO Drive Shaft	PTO drive shaft runs off of the engine damper and drives the hydrostatic pump.
Clutch Assembly	Clutch assembly engages or disengages engine power to the rotor drive assembly.
Drive Assembly	Drive assembly powers the clutch drive shaft when the clutch assembly is engaged.
Clutch Drive Shaft	Clutch drive shaft conveys power to the rotor drive assembly.
Pillow Block	Pillow block transmits power from the clutch drive shaft to the rotor drive shaft.

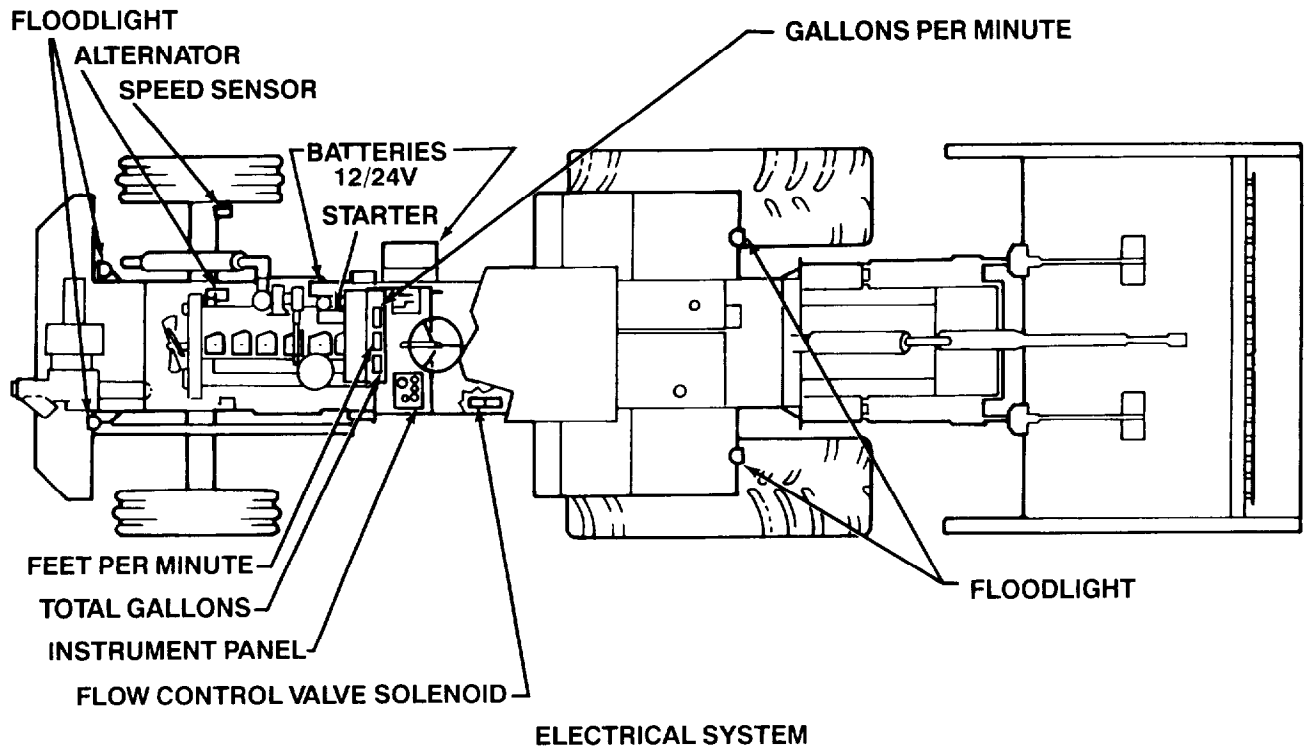
1-11. MECHANICAL SYSTEM (CONT).



MECHANICAL SYSTEM

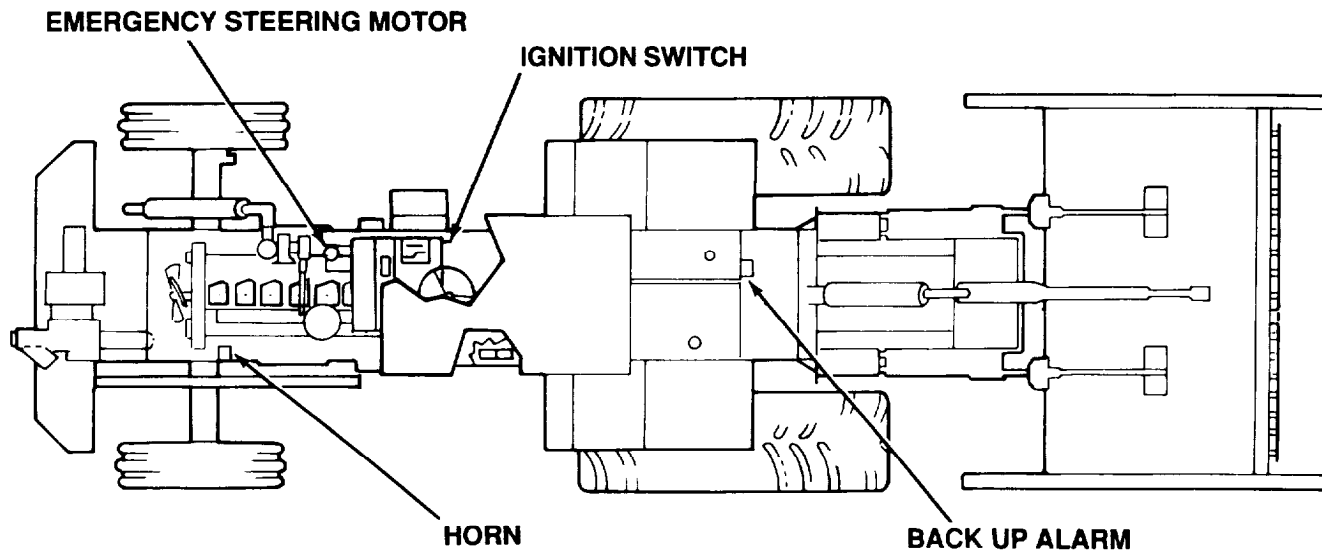
Item	Description
Rotor Drive Shaft	Rotor drive shaft transmits power to the rotor drive assembly from the drive and clutch assemblies.
Rotor Drive Assembly	Rotor drive assembly drives the rotor when the clutch assembly is engaged.
2-Speed Range Box	2-speed range box is driven by the hydrostatic transmission. It transmits engine power to the rear axle in either HIGH or LOW range.
Rear Axle	Rear axle drives the rear wheels propelling the vehicle.
Wheel Ends (Planetary)	Wheel ends increase torque at wheels by a ratio of 35:1.

1-12. ELECTRICAL SYSTEM.



Item	Description
Batteries	Batteries are two 12-volt units.
Alternator	Alternator is a 24-volt unit that maintains the battery charge.
Starter	Starter is a 24-volt unit that starts the engine by engaging the flywheel.
Instrument Panel	Instrument panel contains gauges that indicate engine rpm, electrical charge on system, water temperature, oil pressure, and hours of usage.
Total Gallons	Indicates total number of gallons pumped through additive system within one work period.
Feet Per Minute	Indicates travel speed of vehicle from speed sensor.
Gallons Per Minute	Records flow rate of additive system in gallons per minute (gpm).
Speed Sensor	Senses vehicle travel speed.
Flow Control Valve Solenoid	Flow control valve solenoid regulates the flow of hydraulic fluid to the additive system hydraulic motor.
Floodlights (Front/Rear)	Floodlights provide lighting to work safely under low light conditions.

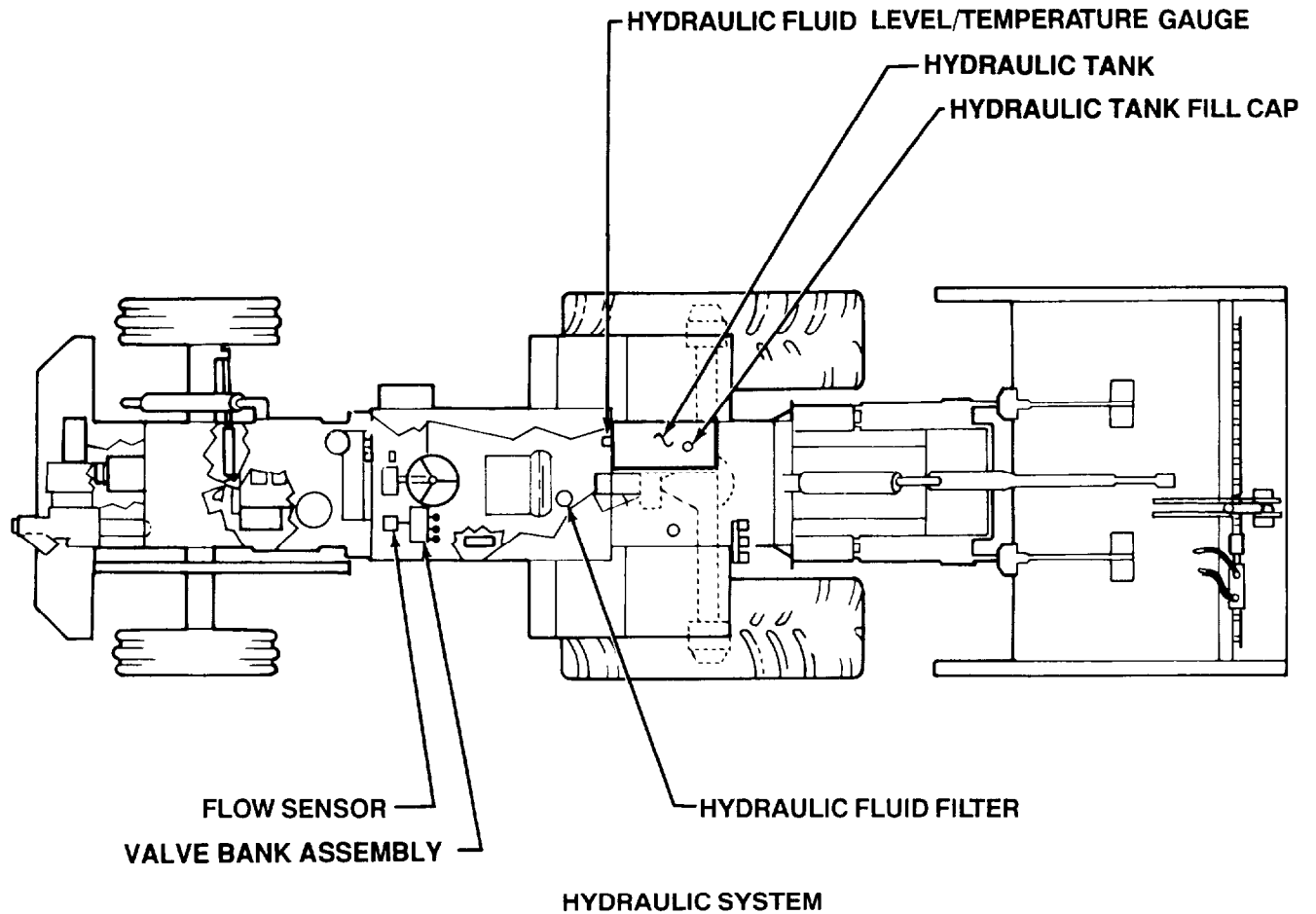
1-12. ELECTRICAL SYSTEM (CONT).



ELECTRICAL SYSTEM

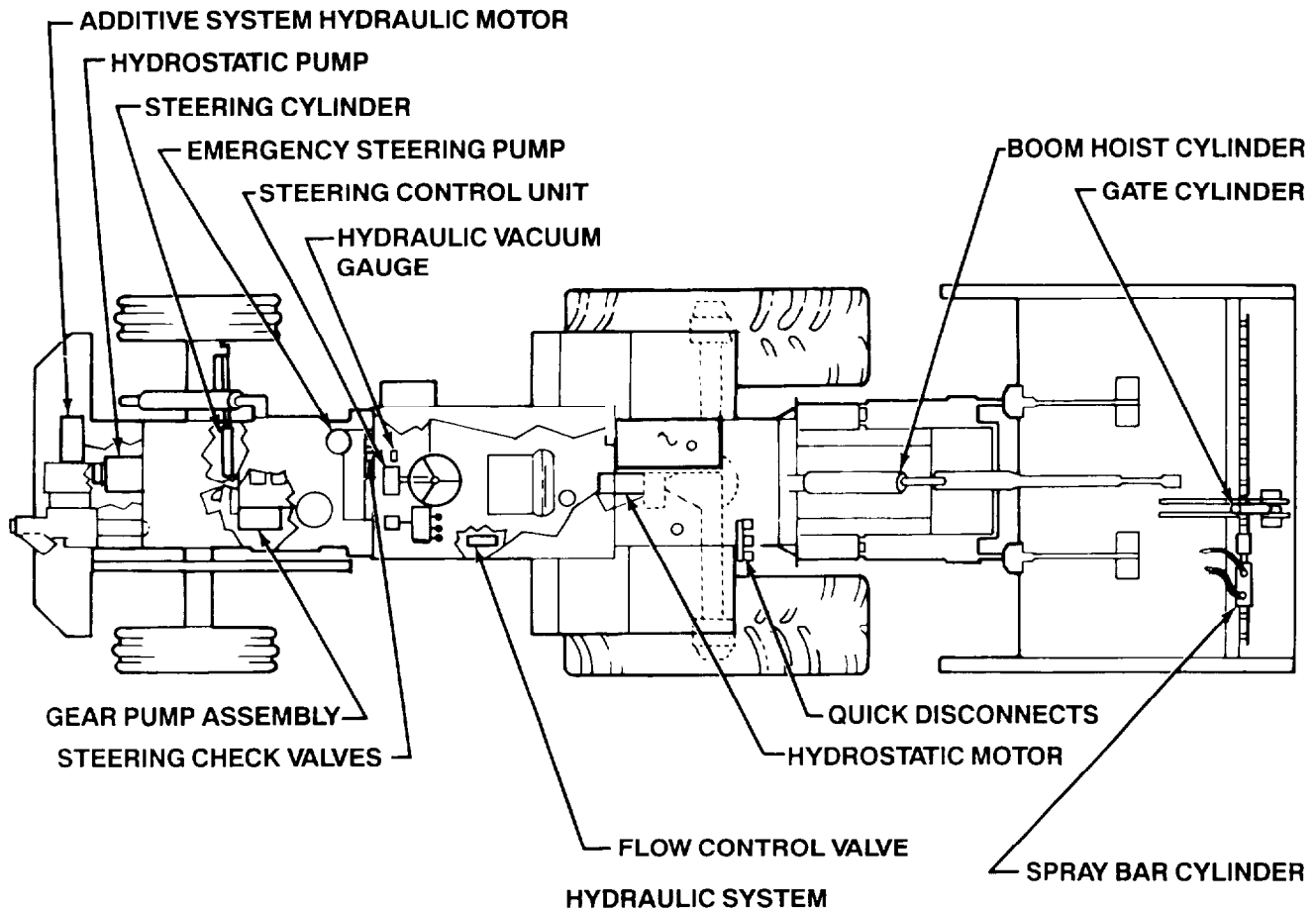
Item	Description
Emergency Steering Motor	Motor provides power to emergency steering pump to provide steering capabilities during engine failure.
Horn	Horn provides an audible alarm.
Back Up Alarm	Alarm provides an audible signal to alert personnel that vehicle is backing up.
Ignition Switch	Switch provides means of starting and stopping vehicle systems.

1-13. HYDRAULIC SYSTEM.



Item	Description
Hydraulic Tank	Hydraulic tank is attached to the fuel tank as one unit. Tank holds 42 gallons (159.9 l) of hydraulic fluid.
Hydraulic Tank Fill Cap	Hydraulic tank fill cap provides a safe way of filling and sealing the hydraulic tank.
Hydraulic Fluid Level/ Temperature Gauge	Hydraulic fluid level/temperature gauge indicates the level and temperature of fluid in the tank by use of a thermometer encased in a flow-through sight gauge.
Hydraulic Fluid Filter	Hydraulic fluid filter removes impurities from hydraulic fluid.
Valve Bank Assembly	Valve bank assembly controls the fluid flow to raise and lower the rotor and tailboard and to open and close the spray bar valves.
Flow Sensor	Flow sensor measures hydraulic fluid flow to operate hydraulic control unit levers. Flow sensor lights indicator lamp on additive instrument panel when spray bar cylinder is activated.

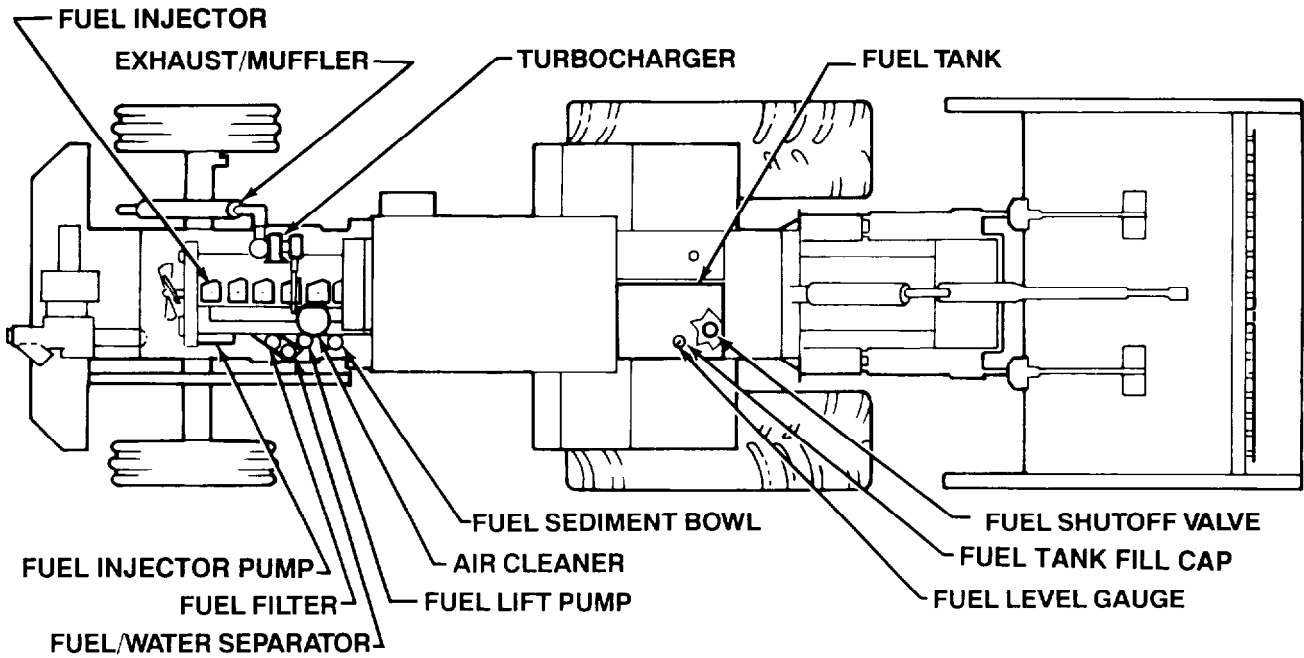
1-13. HYDRAULIC SYSTEM (CONT).



Item	Description
Additive System Hydraulic Motor	Hydraulic motor drives the additive system pump.
Hydrostatic Pump	Variable pitch hydrostatic pump provides hydraulic power to the hydrostatic motor.
Hydrostatic Motor	Hydrostatic motor drives the rear axle.
Gear Pump Assembly	Gear pump assembly is a double-pump unit that converts mechanical power to hydraulic power to drive the steering and the additive systems.
Steering Control Unit	Steering control unit controls the steering cylinder according to the direction steering wheel is turned.
Steering Cylinder	Steering cylinder turns the front wheels according to the directional flow dictated by the steering control unit.

Item	Description
Steering Check Valves	Steering check valves provide directional flow of hydraulic fluid from either the gear pump assembly or the emergency steering motor/pump.
Emergency Steering Pump	Emergency steering pump provides steering capabilities for vehicle during engine failure.
Boom Hoist Cylinder	Boom hoist cylinder raises and lowers rotor assembly.
Gate Cylinder	Gate cylinder opens and closes tailboard.
Spray Bar Cylinder	Spray bar cylinder opens and closes valves on spray bar.
Hydraulic Vacuum Gauge	Hydraulic vacuum gauge measures vacuum/pressure in hydraulic system.
Quick Disconnects	Quick disconnects provide for quick and easy couplings of hydraulic lines to the rotor assembly.
Flow Control Valve	Control valve diverts hydraulic fluid to operate additive motor.

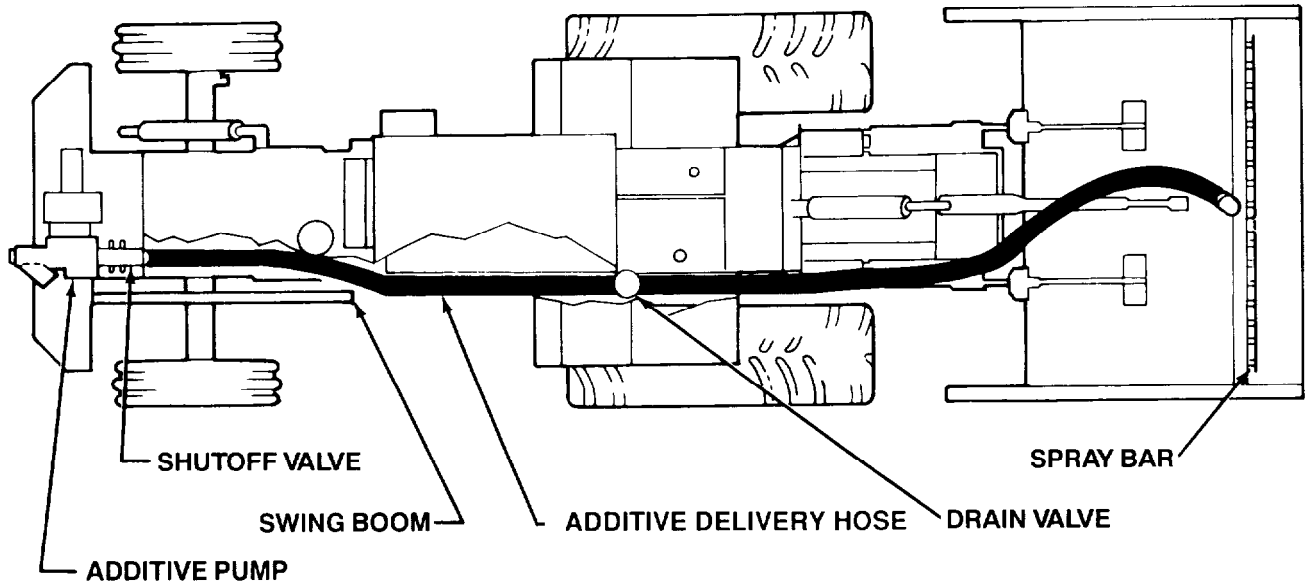
1-14. FUEL SYSTEM.



FUEL SYSTEM

Item	Description
Fuel Injectors	Fuel Injectors provide a measured amount of fuel to each cylinder.
Fuel Injector Pump	Fuel injection pump provides pressurized fuel to the fuel injectors.
Fuel Filter	Fuel filter removes particulates from the fuel.
Fuel Sediment Bowl	Fuel sediment bowl traps sediment from fuel before fuel reaches engine.
Fuel Lift Pump	Fuel lift pump pulls fuel from the fuel tank to the engine.
Fuel Tank	Fuel tank provides an on-board fuel capacity of 55 gallons (208.2 l).
Fuel Level Gauge	Fuel level gauge, located on the fuel cap, indicates fuel level.
Fuel Tank Fill Cap	Fuel tank fill cap provides a safe way of sealing the fuel tank and taking on fuel.
Fuel Shutoff Valve	Fuel shutoff valve provides a way to safely shut off the fuel at the fuel tank.
Fuel/Water Separator	Fuel/water separator separates water, caused by moisture, from fuel.
Air Cleaner	Air cleaner removes particulates from engine intake air.
Turbocharger	Turbocharger, driven by the exhaust, forces clean air into intake manifold.
Exhaust/Muffler	Engine exhaust is released through muffler assembly.

1-15. ADDITIVE SYSTEM.



ADDITIVE SYSTEM

Item	Description
Additive Pump	Additive pump provides emulsion under pressure to the spray bar.
Spray Bar	Spray bar spreads emulsion evenly over the spray surface.
Shutoff Valve	Shutoff valve provides a way to shut flow of emulsion off at the tank.
Drain Valve	Drain Valve provides a way to drain additive piping system after purging.
Additive Delivery Hose	Additive delivery hose is high pressure, heavy duty, rubber hose that carries additive emulsion to the spray bar.
Swing Boom	Swing boom supports additive system feed hose from support vehicle.

CHAPTER 2

OPERATIONS INSTRUCTIONS

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2-3	Location of Instructional Data Plates and Decals	2-6
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Section I. DESCRIPTION AND USE OF OPERATORS CONTROLS AND INDICATORS.

2-1. INTRODUCTION .

This section provides descriptions and locations of the various controls and indicators on the vehicle. Table 2-1 lists each control and indicator and the functions performed.

2-2. LOCATION AND USE OF CONTROLS AND INDICATORS.

Know the location and proper use of each control and indicator before operating the vehicle. Use this section to learn the proper use of each control and indicator. Separate illustrations, with keys, are provided in this section.

NOTE

The vandal instrument cover has been removed from illustrations to show all controls and indicators.

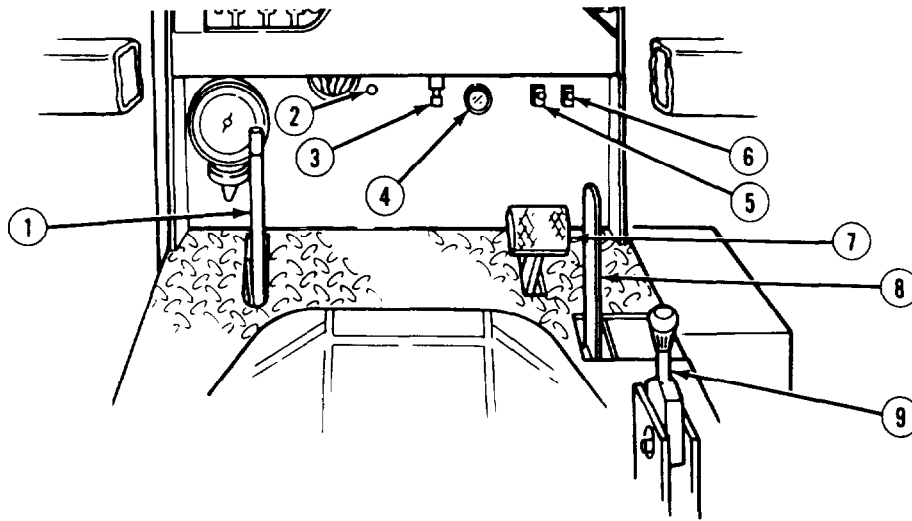


Table 2-1. Controls and Indicators.

Key	Control/Indicator	Function
1	Rotor Control Lever	Engages clutch drive rotor assembly. This lever has two positions; ROTOR ON and ROTOR OFF. ROTOR ON engages rotor and ROTOR OFF disengages rotor.
2	Emergency Steering Switch	Activates emergency steering system. Allows steering of vehicle in the event of engine failure.
3	Air Cleaner Restriction Indicator	Indicates restriction of air intake system. When restriction indicator button pops up, air intake filter should be serviced or obstruction removed.
4	Hydraulic Fluid Vacuum Gauge	Indicates restriction of hydraulic filter. When gauge reads 10 to 30 in. Hg (254 - 762 mm Hg), filter should be changed
5	FRONT Floodlight Switch	Turns front floodlights ON and OFF.
6	REAR Floodlight Switch	Turns rear floodlights ON and OFF.
7	Brake Pedal	Stops forward and reverse movement of vehicle.
8	2-Speed Lever	Controls speed of vehicle. Lever has three positions: full forward (LOW) provides low gear, center position (NEUTRAL) provides neutral gear, and full backward (HIGH) provides high gear.
9	Parking Brake	Manually controls brakes. The full up (vertical) position sets brakes and full down (horizontal) position releases brake. Brake is released by pulling lever up then pushing forward and down.

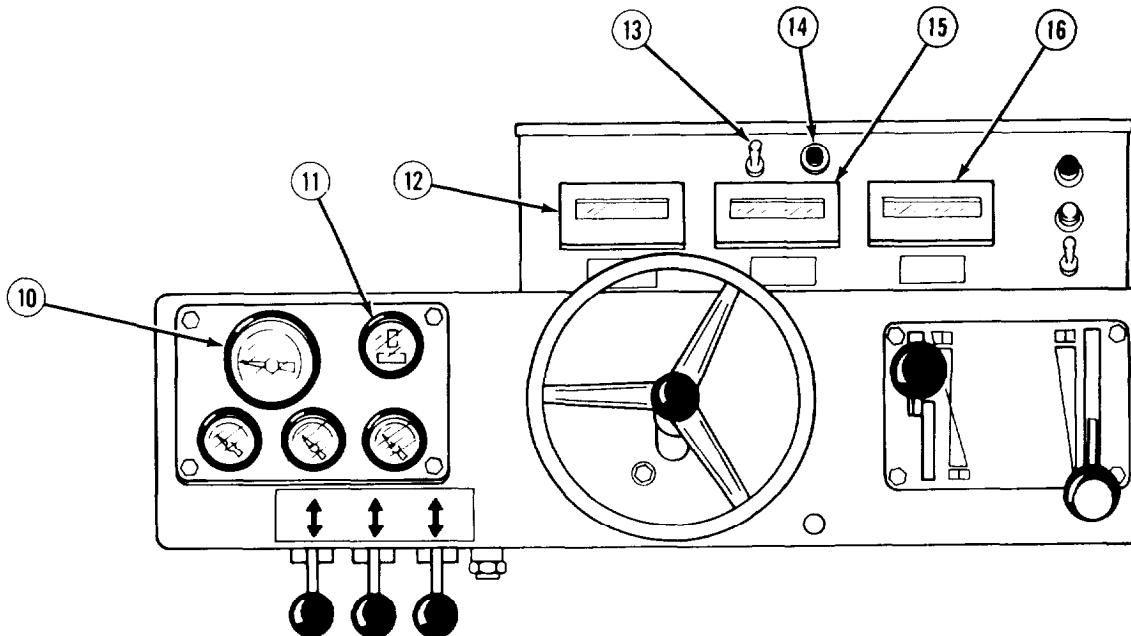


Table 2-7. Controls and Indicators - CONT.

Key	Control/Indicator	Function
10	Tachometer	Indicates engine speed in revolutions per minute (rpm).
11	Hour Meter	Indicates hours of elapsed operation time.
12	TOTAL GALLONS PUMPED (TGP) Meter	Indicates total gallons pumped during operation of additive system. Meter contains reset button to zero meter.
13	GROUND SPEED (FPM) Meter Switch	Turns GROUND SPEED meter ON and OFF.
14	GROUND SPEED Switch Indicator Light	Illuminates to indicate GROUND SPEED meter switch is in ON position.
15	GROUND SPEED (FPM) Meter	Indicates ground speed of vehicle in feet per minute (FPM).
16	PUMP OUTPUT GRM Meter	Indicates rate of additive system pump output in gallons per minute (GPM).

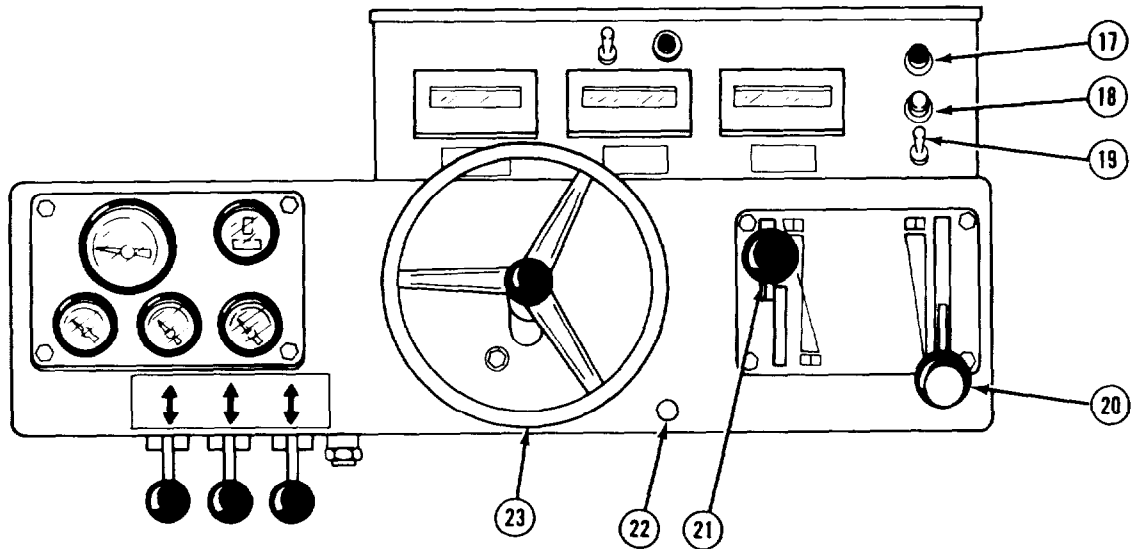


Table 2-1. Controls and Indicators - CONT.

Key	Control/Indicator	Function
17	Pump Speed Control	Controls pumping rate of additive system pump. As pump speed control knob is adjusted, changes in pumping rate can be observed on PUMP OUTPUT meter. Turning control knob to the right increases pumping rate and to the left decreases rate.
18	Pump Speed Control Switch Indicator Light	Illuminates to indicate pump speed control switch is in SPRAY ON position.
19	Pump Speed Control Switch	Applies power to pump speed control and additive system pump meters. Up position (SPRAY ON) applies power; down position (SPRAY OFF) activates pump speed control and meters.
20	THROTTLE Control Lever	Controls engine speed. Push lever fully forward (FULL) for increase engine power. Pull lever fully backward (IDLE) to decrease engine power.
21	TRANSMISSION Control Lever	Controls forward and reverse movement of vehicle. Control lever has three positions: full forward (FWD) places vehicle in forward gear, center position places vehicle in neutral, and full backward (REV) position places vehicle in reverse.
22	HORN Switch	Press to sound horn.
23	Steering Wheel	Controls left and right movement of vehicle during operation.

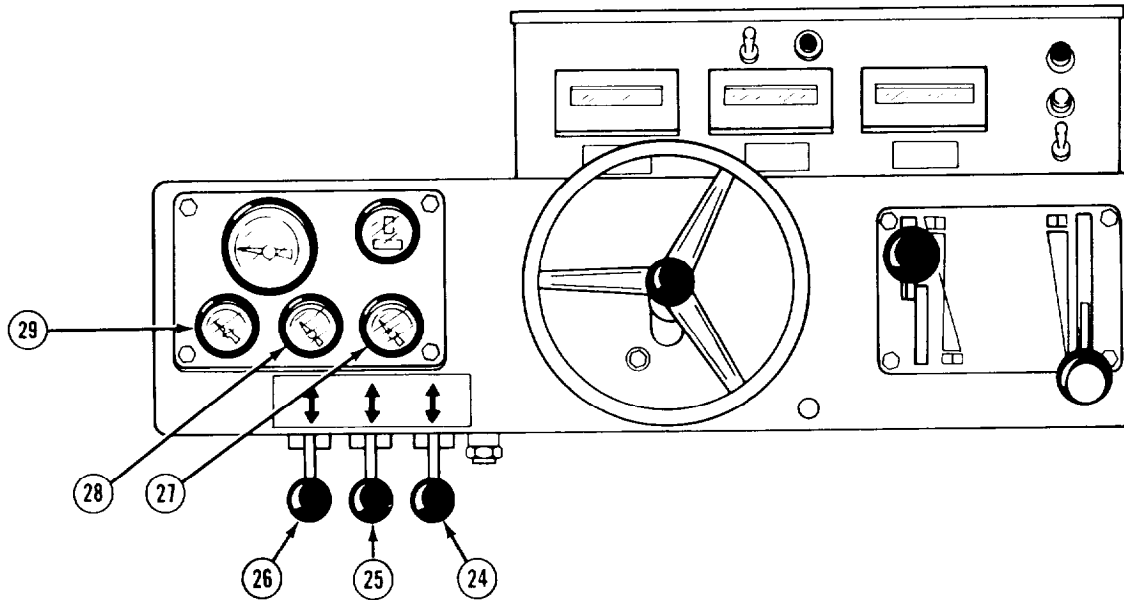


Table 2-1. Controls and Indicators - CONT.

Key	Control/Indicator	Function
24	Rotor Boom Control Lever	Controls raising and lowering of rotor assembly. Push lever forward (RAISE ROTOR) to raise rotor assembly. Pull lever backward (LOWER ROTOR) to lower rotor assembly.
25	Tailboard Control Lever	Controls raising and lowering of tailboard. Push lever forward (RAISE TAILBOARD) to raise tailboard. Pull lever backward (LOWER TAILBOARD) to lower tailboard.
26	Spray Bar Control Lever	Controls operation of additive system pump and spray bar. Push lever forward (PUMP ON/SPRAY ON) to operate pump, open spray bar, and apply additive solution. Pull lever backward (PUMP OFF/SPRAY OFF) to turn pump off, close spray bar, and stop application of additive solution.
27	Voltmeter Gauge	Measures charge on electrical system during operation. Charge should not fall below 24 volts.
28	Water Temperature Gauge	Measures engine coolant temperature in degrees Fahrenheit and Celsius. Coolant temperature should not exceed 180°F (82°C).
29	Oil Pressure Gauge	Measures engine oil pressure in pounds per square inch (psi) and kilopascals (kPa). Normal operating range should be 35 to 60 psi (241- 414 kPa).

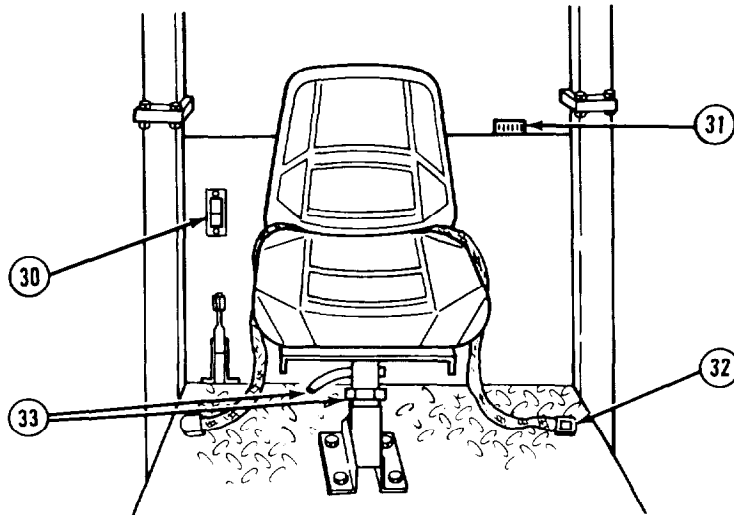


Table 2-7. Controls and Indicators - CONT.

Key	Control/Indicator	Function
30	Hydraulic Fluid Tank Gauge	Measures level and temperature of hydraulic fluid in tank. Fluid temperature is indicated in degrees Fahrenheit from 20°F to 180°F (-10°C to 80°C).
31	Fuel Tank Gauge	Measures level of fuel in fuel tank.
32	Seat Belt	Provides for operator safety during operation of vehicle.
33	Seat Adjustment	Adjusts height of operators seat. To adjust seat, loosen adjustment knob. While pulling outward on pin, raise or lower seat to desired position and release pin. Tighten adjustment knob.

2-3. LOCATION OF INSTRUCTIONAL DATA PLATES AND DECALS.

Figures 2-1 and 2-2 show the locations of the vehicle’s data plates and decals.

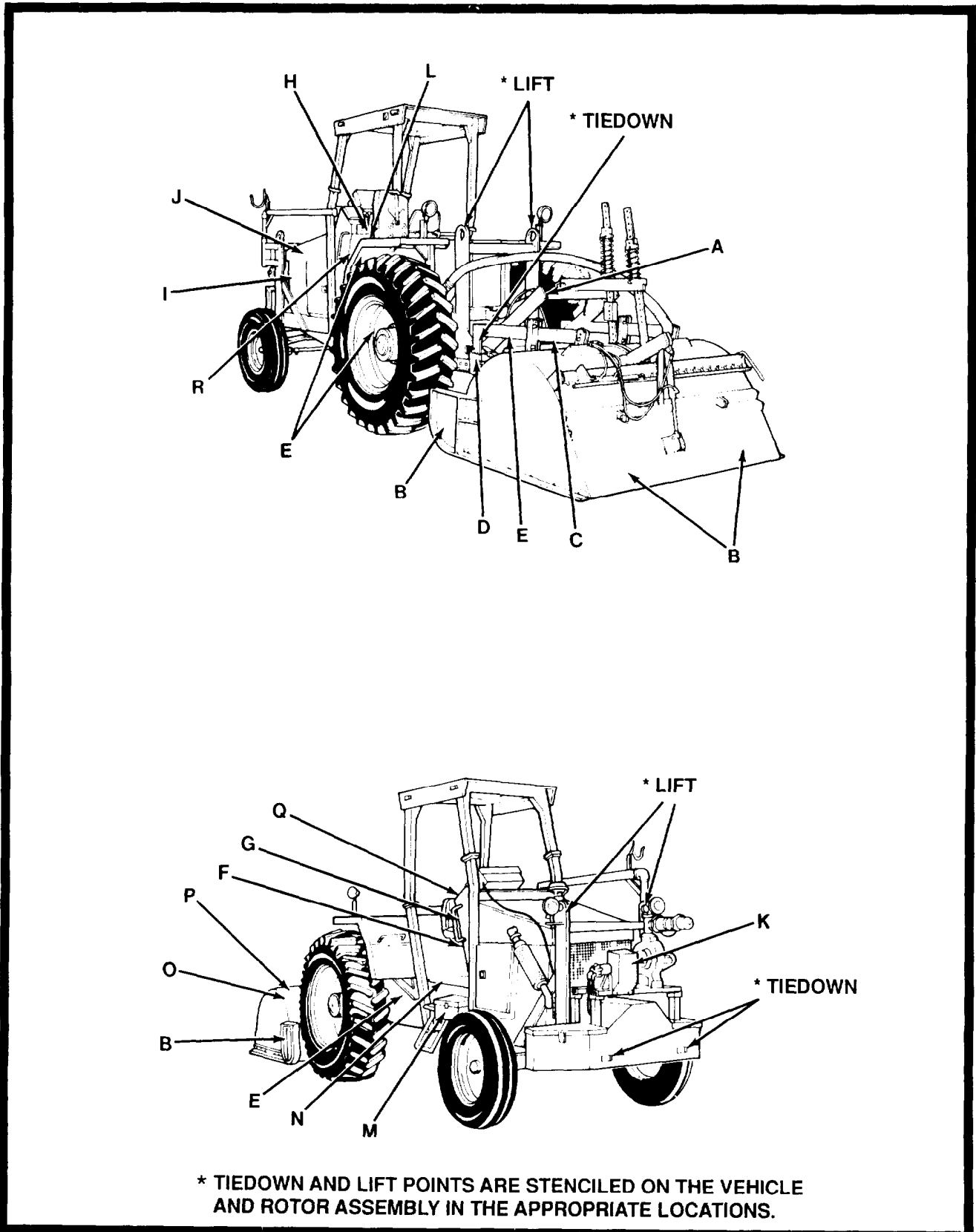


Figure 2-1. Data Plate Location (Sheet 7 of 9)

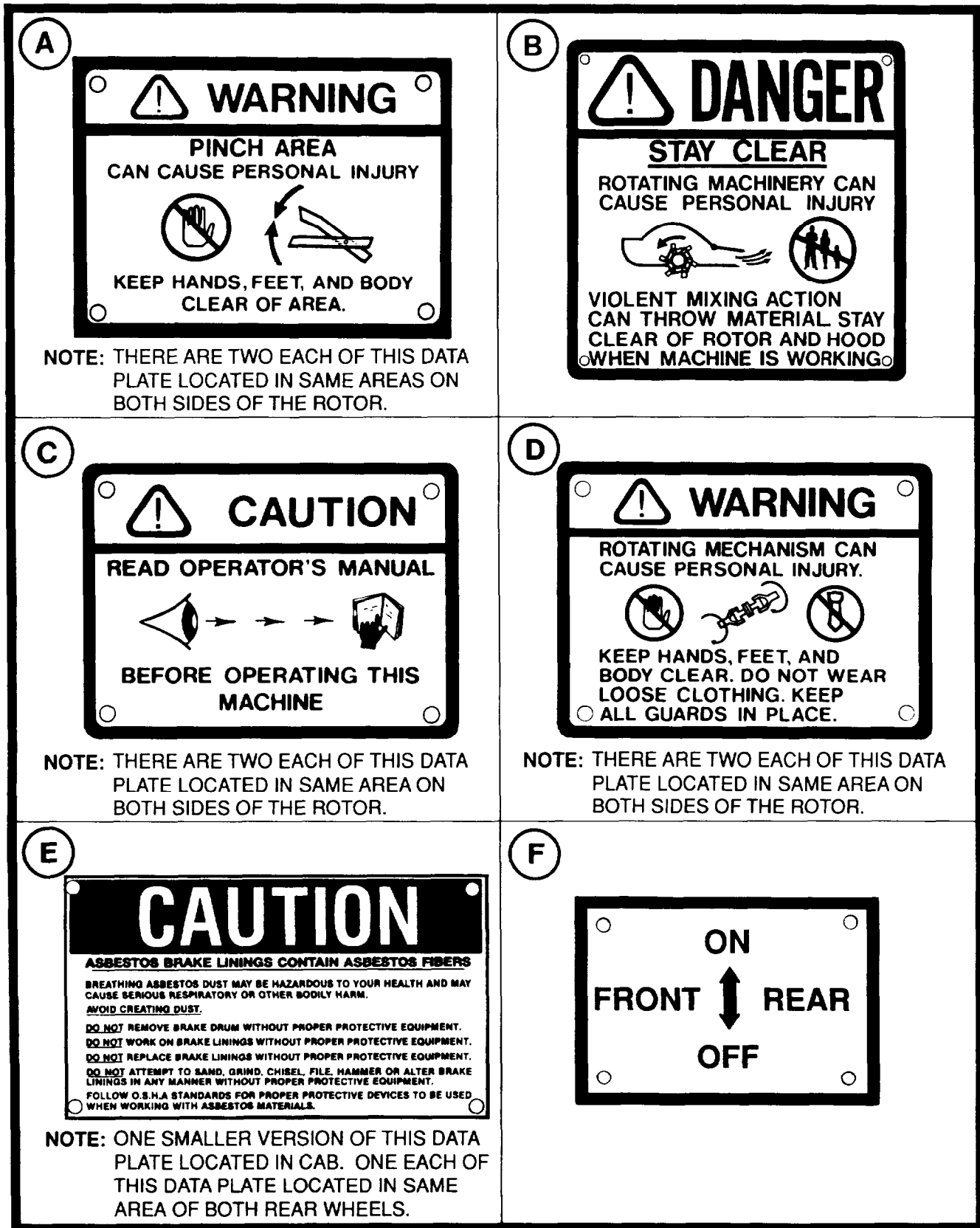


Figure 2-7. Data Plate Location (Sheet 2)

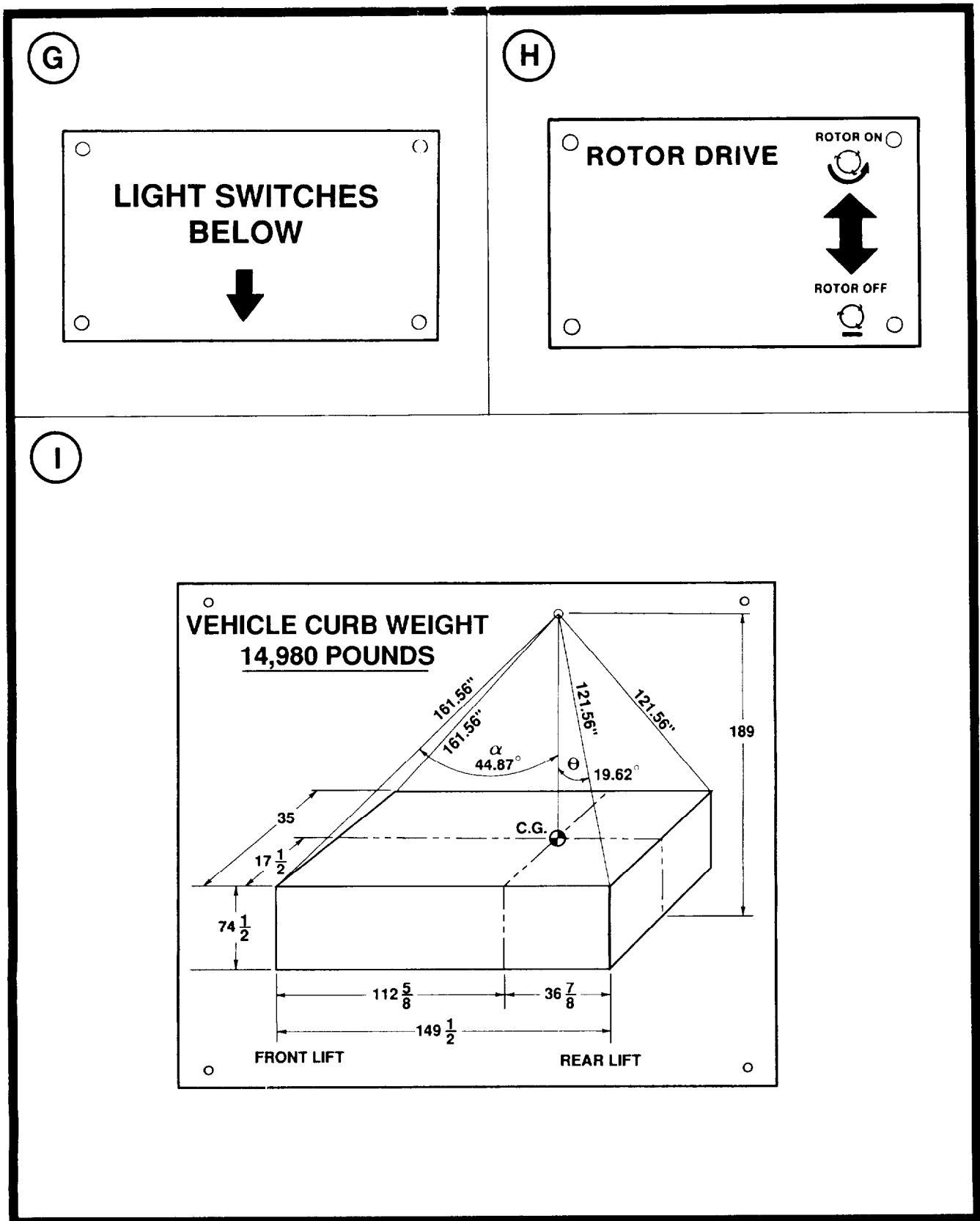
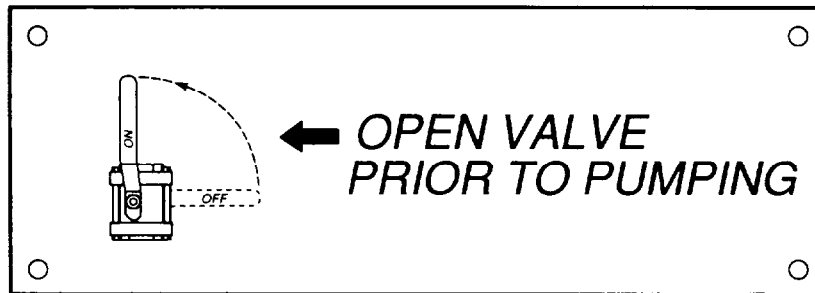


Figure 2-1. Data Plate Location (Sheet 3)

J



K

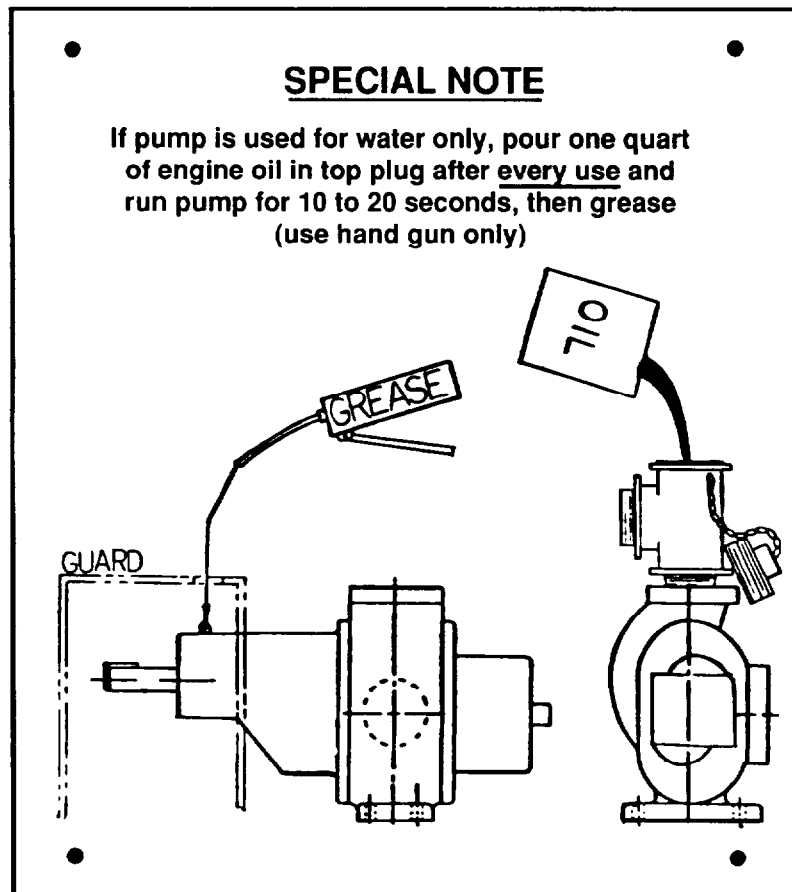
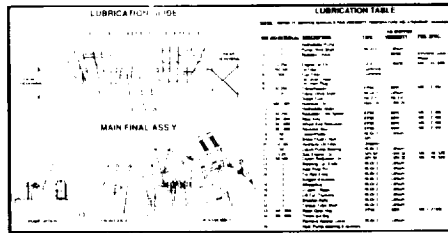


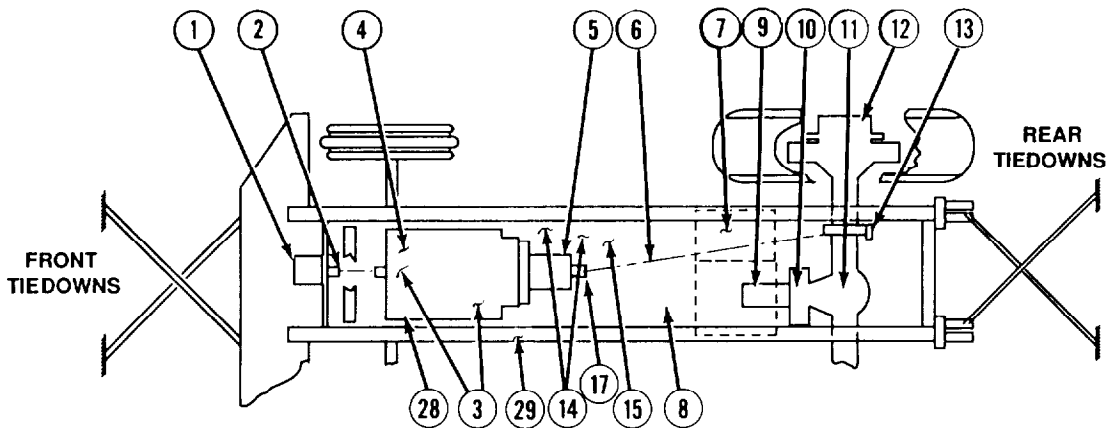
Figure 2-7. Data Plate Location (Sheet 4)

L¹

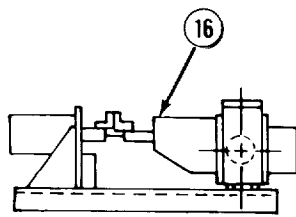
NOTE: THE VEHICLE LUBRICATION DATA PLATE (VIEW L) IS DIVIDED INTO TWO PARTS (L1 AND L2) FOR THE PURPOSE OF ILLUSTRATION. REFER TO L2 FOR EXPLODE OF LUBRICATION TABLE.



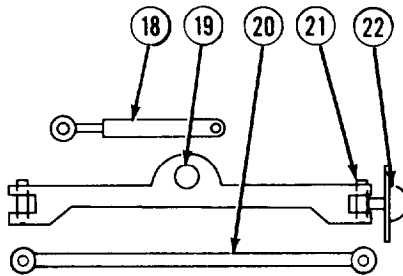
LUBRICATION GUIDE



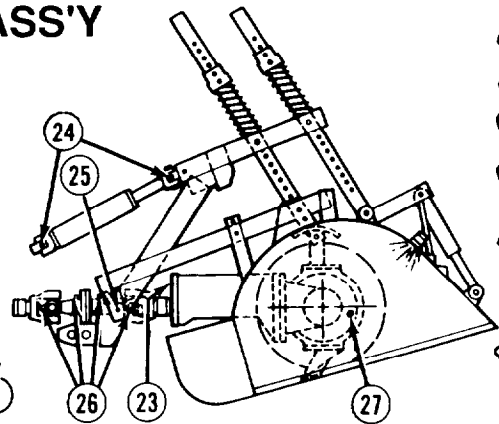
MAIN FINAL ASS'Y



PUMP OPTION



FRONT AXLE

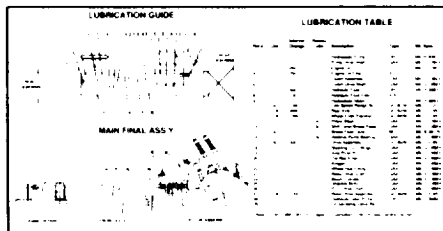


ROTOR ASSEMBLY

Figure 2-1. Data Plate Location (Sheet 5)

L²

NOTE: THE VEHICLE LUBRICATION DATA PLATE (VIEW L) IS DIVIDED INTO TWO PARTS (L1 AND L2) FOR THE PURPOSE OF ILLUSTRATION. REFER TO L1 FOR EXPLODE OF LUBRICATION GUIDE OF MAIN FINAL ASSEMBLY.



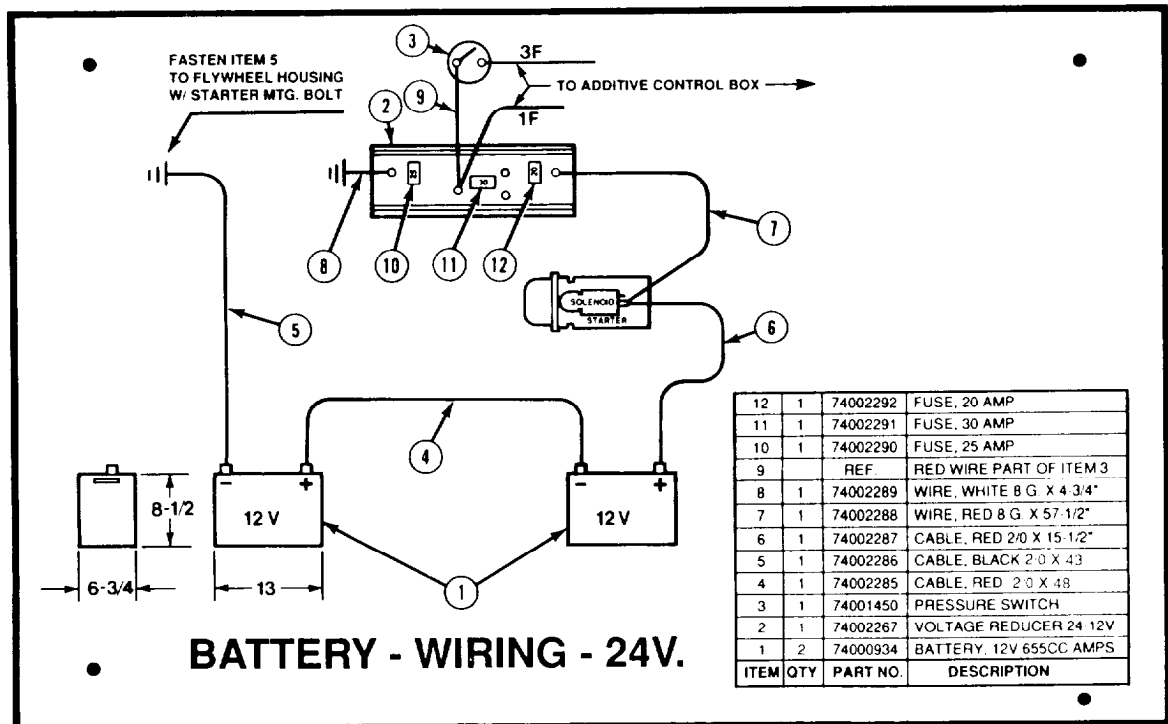
LUBRICATION TABLE

Ref.#	Chk	Interval Change	(Hours) Lube	Description	Type	Mil. Spec
1	-	-	-	Hydrostatic Pump	OHT	MIL-H-6083
2	-	-	10	Pump Drive Shaft	GAA	MIL-G-10924
3	10	250	-	Engine Oil	-	MIL-L-2104
4	-	250	-	Engine Oil Filter	A.R.	--
5	-	-	10	Clutch Assembly	GAA	MIL-G-10924
6	-	-	10	Clutch Drive Shaft	GAA	MIL-G-10924
7	10	500	-	Hydraulic Fluid	OHT	MIL-H-6083
8	-	100	-	Hydraulic Fluid Filter	A.R.	--
9	-	-	-	Hydrostatic Motor	OHT	MIL-H-6083
10	50	1000	-	Two-Speed Range Box	GO 80/90	MIL-L-2105
11	100	4000	-	Rear Axle	GO 80/90	MIL-L-2105
12	100	1000	-	Wheel Ends-Planetary	GO 80/90	MIL-L-2105
13	-	-	50	Pillow Block	GAA	MIL-G-10924
14	-	-	50	Shift Lever/Brake Pedal	GAA	MIL-G-10924
15	50	-	-	Brake Fluid Level	BFS	MIL-B-46176
16	-	-	50	Additive Pump Bearing	GAA	MIL-G-10924
17	50	500	-	Drive Assembly	GO 80/90	MIL-L-2105
18	-	-	10	Steering Cyl Fittings	GAA	MIL-G-10924
19	-	-	10	Axle Pivot Pin	GAA	MIL-G-10924
20	-	-	10	Tie Rod Ends	GAA	MIL-G-10924
21	-	-	10	Kingpin	GAA	MIL-G-10924
22	-	-	10	Wheel Hub Fittings	GAA	MIL-G-10924
23	-	-	10	Rotor Drive Shaft	GAA	MIL-G-10924
24	-	-	10	Boom Cylinder	GAA	MIL-G-10924
25	-	-	10	Shackle Bolts	GAA	MIL-G-10924
26	-	-	10	PTO Drive Shaft	GAA	MIL-G-10924
27	100	1000	-	Rotor Drive Assembly	GO 80/90	MIL-L-2105
28	-	-	-	Hydraulic Gear Pump	OHT	MIL-H-6083
29	-	-	-	Oil Sampling Valve Ref.		

*Refer to TM 5-3895-369-14, Chapter 3, Lubrication Chart, for appropriate viscosity.

Figure 2-1. Data Plate Location (Sheet 6)

M



N

CLUTCH LUBRICATION

Apply small amount of lubricant to clutch throwout collar once a day.

CLUTCH ADJUSTMENT (OVERCENTER TYPE ONLY)

IMPORTANT - If clutch does not pull, heats, or operating lever jumps out, adjustment is required. To adjust clutch, remove hand hole plate, turn clutch until adjusting lock pin can be reached. Pull adjusting pin out and turn adjusting yoke to right or clockwise until operating lever requires a distinct pressure to engage. A new clutch requires several adjustments until friction discs are worn in.

Figure 2-1. Data Plate Location (Sheet 7)

○

SEAMAN-MAXON, INC.

MODEL NO. SERIAL NO.

THIS EQUIPMENT WAS
MANUFACTURED BY SEAMAN MAXON, INC.
3204 W. MILL RD. MILWAUKEE, WI. 53209

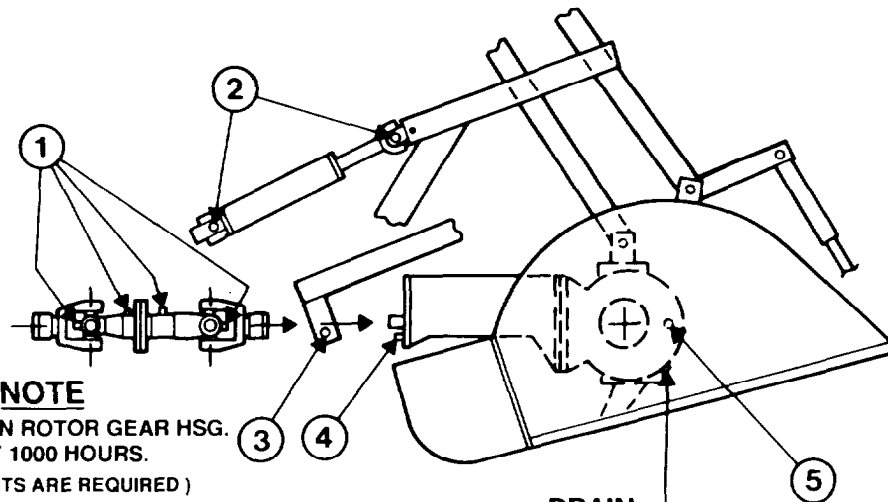
CAUTION
READ OPERATOR'S MANUAL

BEFORE OPERATING THIS MACHINE

○

MIXER LUBRICATION





REF.#	Chk	Interval Change	(Hours) Lube	Description	Type	Mil. Spec
1	-	-	10	PTO Drive Shaft	GAA	MIL-G-10924
2	-	-	10	Boom Cylinder	GAA	MIL-G-10924
3	-	-	10	Shackle Bolts	GAA	MIL-G-10924
4	-	-	10	Rotor Drive Shaft	GAA	MIL-G-10924
5	100	1000	-	Rotor Drive Assembly	GO 80/90	MIL-L-2105



NOTE
CHANGE OIL IN ROTOR GEAR HSG.
EVERY 1000 HOURS.
(FIVE QUARTS ARE REQUIRED)
CHECK OIL LEVEL EVERY 100 HOURS

Figure 2-1. Data Plate Location (Sheet 8)

Q

 CAUTION ENGAGE ROTOR ONLY IN RAISED POSITION LOWER ROTOR INTO WORK AREA WHILE MOVING FORWARD SLOWLY	 CAUTION READ OPERATOR'S MANUAL  BEFORE OPERATING THIS MACHINE	HYDROSTATIC GROUND DRIVE  LO N HI
--	---	--

R

SERIAL NO.: <input type="text"/>		
CONTRACT: DAAE07-90-C-1445		
MO76, MIXER, ROTARY TILLER, SOIL STABILIZATION, SELF PROPELLED		
24 VOLT ELECTRICAL SYSTEM		
MAXIMUM ALLOWABLE SPEED:		
HIGHWAY: 15 MPH	MAXIMUM EQUIPMENT CAPACITY:	
OFF-ROAD: 15 MPH	HIGHWAY: 16,840 LBS.	
	OFF-ROAD: 16,840 LBS.	
TIRE INFLATION PRESSURE:		
FRONT: 44PSI	PUBLICATIONS:	
REAR: 20 PSI	OPERATIONS MANUAL:	
	TM5-3895-369-14	
	RPSTL: TM5-3895-369-24P	
SHIPPING DATA:		
OVERALL LENGTH: 274"	DES. ACT. 64559	MFR: 64559
OVERALL WIDTH: 94.5"	PART NO.: 74001778	
OVERALL HEIGHT: 122"	MODEL NO.: T0730H-KEG	
HEIGHT WITH ROPS/FOPS REMOVED: 93"	NSN: 3895-01-331-8560	
SHIPPING CUBAGE: 1,828 CU FT	REGISTRATION NO.: <input type="text"/>	
SHIPPING WEIGHT: 14,980 LBS		

Figure 2-1. Data Plate Location (Sheet 9)

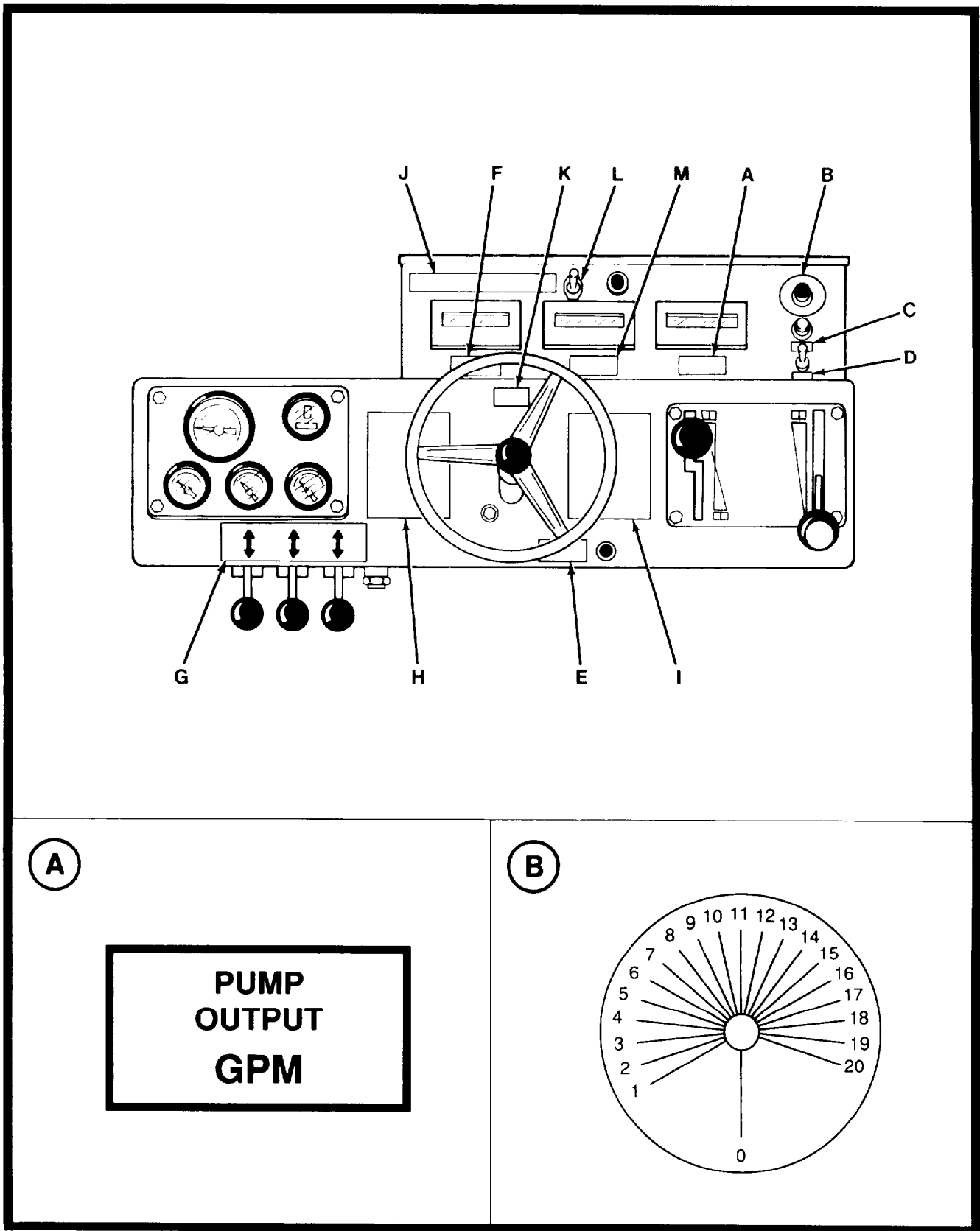


Figure 2-2. Instrument Panel Data Plates and Decals(Sheet 7 of 5)

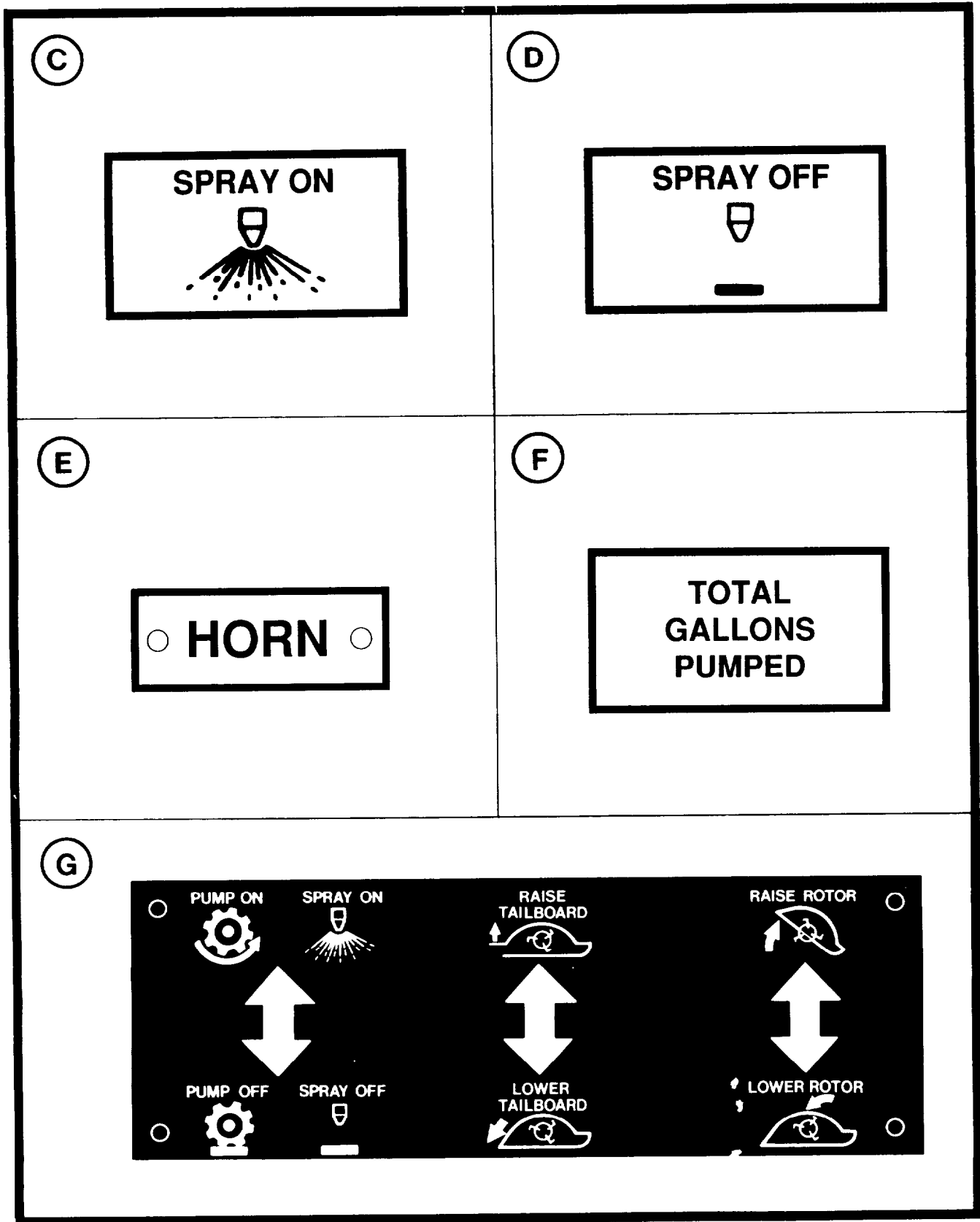


Figure 2-2. Instrument Panel Data Plates and Decals (Sheet 2)

H

ADDITIVE SYSTEMS BASED ON 2000 ENGINE RPM APPLICATION GUIDE NO. 91-2 .5 THROUGH 2.2 GALLONS					
GALLONS PER SQ. YD.	GALLONS PER LINEAR FT.	PUMP OUTPUT GPM	TRAVEL SPEED FPM	PUMP OUTPUT GPM	TRAVEL SPEED FPM
0.5	0.4	40	100	60	150
		45	112	80	200
		50	125	95	237
0.75	0.6	40	67	100	166
		50	83	120	200
		60	100	132	220
1.0	0.8	40	50	100	125
		64	80	150	187
		80	100	200	250
1.2	0.9	45	50	100	111
		72	80	150	67
		117	130	200	222
1.4	1.1	55	50	100	91
		88	80	150	136
		121	110	200	181
1.6	1.2	60	50	100	83
		120	100	150	125
		168	140	200	167
1.8	1.4	56	40	100	71
		112	80	150	107
		217	155	200	143
2.0	1.6	72	63	100	45
		120	75	150	94
		160	100	200	125
2.2	1.7	68	40	100	59
		127	75	150	88
		212	125	200	118

Figure 2-2. Instrument Panel Data Plates and Decals (Sheet 3)

I

**ADDITIVE SYSTEMS BASED ON 2000 ENGINE RPM
APPLICATION GUIDE NO. 91-2
2.4 THROUGH 4.0 GALLONS**

GALLONS PER SQ. YD.	GALLONS PER LINEAR FT.	PUMP OUTPUT GPM	TRAVEL SPEED FPM	PUMP OUTPUT GPM	TRAVEL SPEED FPM
2.4	1.8	72	40	100	55
		135	75	150	83
		216	120	200	111
2.6	2.0	80	40	100	50
		170	85	150	75
		220	110	200	100
2.8	2.2	121	55	100	45
		165	75	150	68
		220	100	200	91
3.0	2.3	126	55	100	43
		172	75	150	65
		218	95	200	87
3.2	2.5	125	50	100	40
		187	75	150	60
		212	85	200	80
3.4	2.6	117	45	100	38
		169	65	150	58
		221	85	200	77
3.6	2.8	126	45	100	36
		182	65	150	54
		218	78	200	71
3.8	3.0	120	40	100	33
		171	50	150	50
		216	72	200	67
4.0	3.1	124	40	100	32
		170	55	150	48
		217	70	200	64

Figure 2-2. Instrument Panel Data Plates and Decals (Sheet 4)

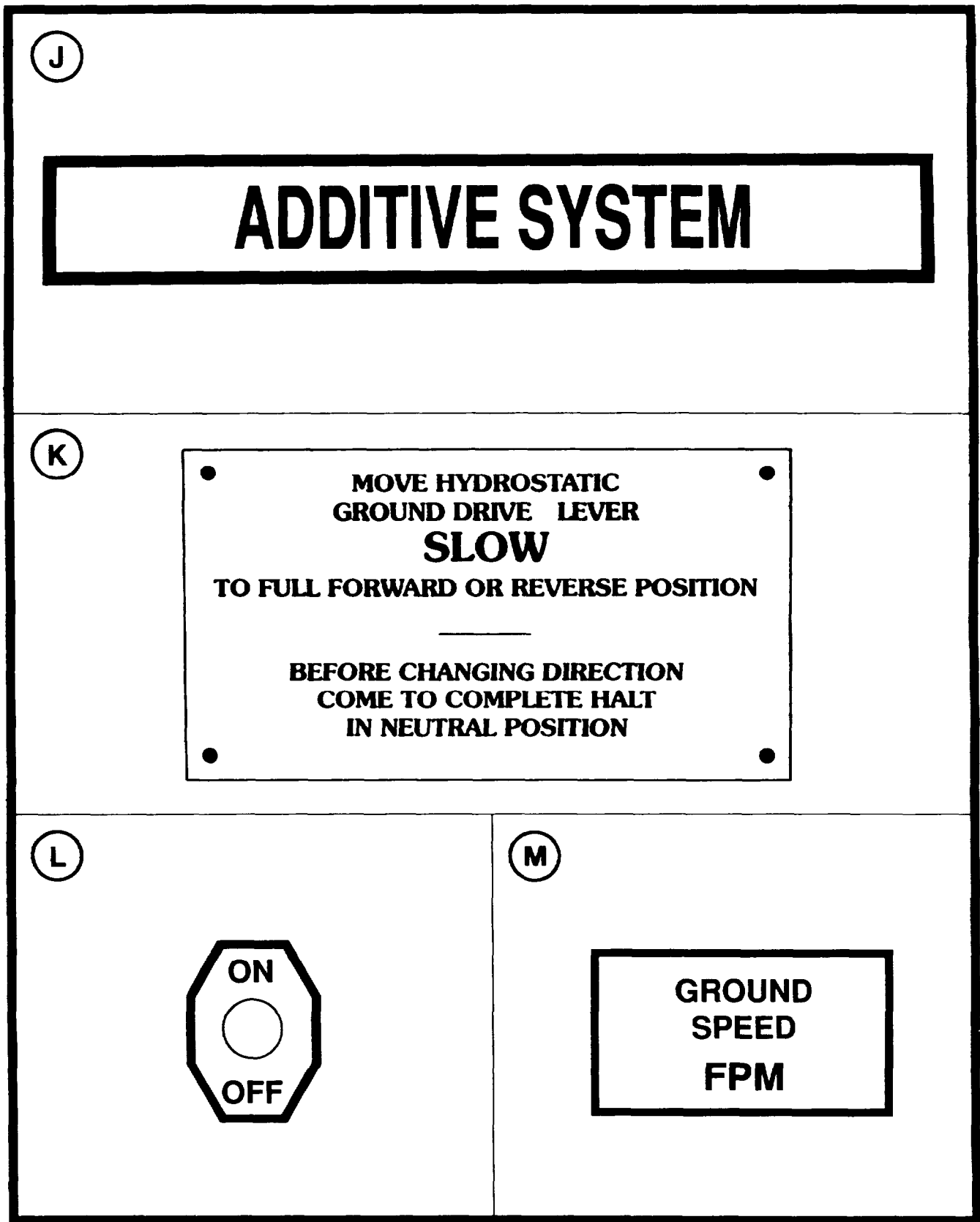


Figure 2-2. Instrument Panel Data Plates and Decals (Sheet 5)

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-4. PMCS INTRODUCTORY MATERIAL.

This section contains PMCS instructions for the Mixer, Rotary Tiller. The PMCS table contains checks and services necessary to ensure that the vehicle is ready for operation. Operator PMCS is limited to inspection and service tasks as they are listed in the Maintenance Allocation Chart (MAC). Operator maintenance is performed at the specified intervals listed on the PMCS table (Table 2-2). The operator performs these tasks before operating the vehicle, during the operation of the vehicle, and after it is shut down.

- a. **Before PMCS Procedures.** Before PMCS is performed just before operating the vehicle. Pay attention to WARNINGS, CAUTIONS, and NOES.
- b. **During PMCS Procedures.** During PMCS is performed while the vehicle is in operation. Pay attention to WARNINGS, CAUTIONS, and NOTES.
- c. **After PMCS Procedures.** After PMCS is performed immediately after operating the vehicle. Pay attention to WARNINGS, CAUTIONS, and NOES.
- d. **Weekly PMCS Procedures.** Weekly PMCS is performed once a week. Pay attention to WARNINGS, CAUTIONS, and NOTES.
- e. **Equipment Failure.** If the vehicle or any of its components fail to operate, do not operate correctly, or if damage is observed, refer to troubleshooting instructions in Section III. Any equipment failures or operation problems should be recorded on the proper forms. These forms are a permanent record of services, repairs, and modifications made on the vehicle. They are a checklist to know what was wrong with the vehicle after its last use and whether those faults have been checked. Refer to DA Pam 738-750 for information on forms and records.
- f. Always perform PMCS in the same order until it becomes a habit. Once practiced in the same order, problems will be spotted in a hurry.
- g. If something looks wrong and cannot be repaired immediately, enter it on the DA 2404 form. If something seems seriously wrong, report it immediately to unit maintenance.
- h. When performing PMCS, take the tools and rags needed to make the checks.

2-5. GENERAL PMCS PROCEDURES AND CONDITIONS.

The following paragraph describes general procedures and conditions that should be observed when performing PMCS. If any of the components being inspected during the PMCS procedures show any of the conditions described in this paragraph, report it on a DA 2404 form and inform unit maintenance.

2-5. GENERAL PMCS PROCEDURES AND CONDITIONS (CONT).

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

a. Cleanliness. Dirt, grease, oil, and debris can cover and hide serious problems. Use drycleaning solvent (item 54, appendix E) on all metal surfaces.

b. Bolts, Nuts, and Screws. Check bolts, nuts, and screws for obvious looseness, missing, bent, or broken condition. Look for chipped paint, bare metal, or rust around bolt heads. If any part seems loose, notify unit maintenance.

c. Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If bad welds are found, notify unit maintenance.

d. Electric Wires and Connectors. Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure wires are in good shape. If bad wires or connectors are found, notify unit maintenance.

e. Hydraulic Lines and Fittings. Look for wear, damage, leaks, and make sure clamps and fittings are tight. Wet spots show leaks, and a stain around a connector or fitting can mean a leak. If a loose fitting or connector causes a leak, tighten it.

f. Damage is defined as: any conditions that affect safety or render the vehicle unusable for mission requirements.

g. Rust and Corrosion. Check vehicle body and frame for rust and corrosion. If any bare metal or corrosion exists, clean, and apply a thin coat of oil. Report it to your supervisor.

2-6. FLUID LEAKAGE DEFINITION.

The following paragraphs describe the different types/classes of leaks and how they affect the status of the vehicle. Become familiar with them and remember - WHEN IN DOUBT NOTIFY UNIT MAINTENANCE. Class I and II leaks are considered minor leaks and operations can continue under these conditions. When operating with these types of leaks, fluid levels must be checked regularly as required in the PMCS. Class III leaks must be reported to unit maintenance for corrective action. If there is any doubt about the type of leak, notify unit maintenance.

a. Class / Leaks. Class I leaks are identified by a wetness or discoloration not great enough to form drops. It is more of a seepage than a leak.

b. Class II Leaks. Class II leaks are identified by a flow of fluid great enough to form drops but not great enough to cause the drops to fall from the leak point.

c. Class III Leaks. Class III leaks are identified by a flow of fluid great enough to form drops that fall from the leak point.

(1) If a Class III leak is discovered before operating the vehicle, the vehicle can be operated as long as the fluid level is between the maximum and minimum points on the dipstick or sight glass. If the fluid level is below the minimum point on the dipstick or sight glass, do not operate the vehicle and notify unit maintenance.

(2) If a Class III leak is discovered during operation of the vehicle, the operation can be completed as long as the leak is drops only and not a steady stream of fluid. The fluid level must also be within its operating range. If the leak is a steady stream and/or fluid level falls below minimum point on dipstick or sight glass, turn off the vehicle and notify unit maintenance.

(3) If a Class III leak is discovered after an operation is complete and the fluid level is below minimum on the dipstick or sight glass, the vehicle cannot be operated until the leak is repaired.

2-7. PMCS TABLE DESCRIPTION.

The PMCS table is arranged in columns that inform the operator which item is being inspected/serviced, when a vehicle assembly or component should be inspected/serviced, where the item is located, the procedures necessary to accomplish the task, and the conditions that will prevent operation of the vehicle.

a. Item No. The Item No. column provides a logical sequence for performing the PMCS tasks. The items being inspected can be visible, inside, or under the vehicle.

b. Interval. The Interval column provides the appropriate time interval for performing each task. This column lists all the tasks according to the interval: **Before** tasks first, **During** second and, **After** tasks last.

c. Location. This column lists the name of the assembly or component to be inspected/serviced and its location on the vehicle.

d. Procedure. The Procedure column provides the instructions necessary to accomplish the inspection/service. It also lists important Warnings, Cautions and Notes related to each task. If a task is covered elsewhere in the manual, it is referenced by paragraph number rather than being repeated in this column.

e. Not Fully Mission Capable. This column lists the conditions that will cause the vehicle to be inoperable. If any of these conditions exist, the vehicle shall not be operated until they are corrected.

Table 2-2. Operator Preventive Maintenance Checks and Services

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
1	Before	<u>GENERAL</u>	<p style="text-align: center;">NOTE</p> <ul style="list-style-type: none"> • If the equipment must be kept in continuous operation, do only the procedures that can be done without disturbing operation. Make complete checks and services when the equipment is shut down. • Ensure that all daily/weekly lubrication requirements are performed on the vehicle as directed in Chapter 3, Lubrication Instructions. • Perform WEEKLY, as well as BEFORE, PMCS if <ol style="list-style-type: none"> a. You are the assigned operator but have not operated the equipment since the last WEEKLY. b. You are operating the equipment for the first time. • Levers, pins, linkage, etc., not equipped with lubrication fittings, should operate freely and be clear of rust. When checking oil/fuel levels, ensure vehicle is on level surface for accurate reading. 	Class III leaks or any fuel leaks.
		<u>EXTERIOR</u>	<div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;">WARNING</div> <p>Read and understand all of the safety precautions and warnings before performing any checks and services or personal injury can result.</p> <p>Perform walk-around inspection of vehicle. Check for leaks or obvious damage that would require more detailed inspection.</p>	
2	Before	Safety decals, data plates, etc.	Check for damage and legibility.	Safety decals or safety data plates are missing or damaged beyond legibility

Table 2-3. Operator Preventive Maintenance Checks and Services - CONT.

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
3	Before	<u>ENGINE</u> Engine coolant	<div style="text-align: center; border: 2px solid black; padding: 5px; margin-bottom: 10px;">WARNING</div> <p>Check coolant level only when the engine is stopped. Wait until the temperature is below 160°F (70°C) before removing the radiator pressure cap. Failure to do so can cause personal injury from heated coolant spray.</p> <p>Check coolant level. Maintain coolant level at not more than one inch below bottom of radiator neck.</p>	Class III leaks exist. Overheating condition exists (above 212°F [100°C]).
4	Before	<u>INTERIOR</u> Brakes	Test air brakes before operating vehicle.	Brakes do not function properly.
5	During	Instrument panel	Inspect panel for damage, unserviceable instruments, and broken glass. Monitor instrumentation regularly for proper function of air systems.	A malfunction/deficiency is observed during operation which would damage the equipment if operation were continued.
5	During	Instrument panel	<p>a. Engine Oil Pressure: 10 PSI at idle (min. allowable). 30 PSI to 60 PSI at rated rpm.</p> <div style="text-align: center; border: 2px dashed black; padding: 5px; margin-bottom: 10px;">CAUTION</div> <p>Continuous operation with coolant temperature above 212°F (100°C) can damage the engine.</p> <p>b. Engine Coolant Temperature: 180°F Min. 190°F Max.</p>	Oil pressure gauge is inoperable. Coolant temperature gauge is inoperative.

Table 2-3. Operator Preventive Maintenance Checks and Services - CONT.

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
5	During	<u>INTERIOR - CONT.</u> Instrument panel - continued	c. Tachometer: Needle moves when throttle is actuated. 1100 rpm at idle. 2000 rpm at rated. d. Voltmeter: Normal operating range is between 24 volts and 28.5 volts. e. Vacuum Indicator, Hydraulic Oil Filter: Check position of indicator needle. If it enters the Red Danger Zone, the filter element should be cleaned or replaced. f. TGP, FPM, and GPM Digital Meters: Activate toggle switches. Check meters for digital ON display.	
6	During	Backup alarm, horn, lights, etc. <u>EXTERIOR</u>	Check for proper operation. <div style="border: 2px solid black; padding: 5px; text-align: center; width: fit-content; margin: 10px auto;">WARNING</div> Read and understand all of the safety precautions and warnings before performing any checks and services or personal injury can result.	
7	After	Additive System	Close valve at the supply tank and with spray bar ON, loosen feed hose fitting at the supply tank. Continue pumping until only air comes out of the spray nozzles. Flush additive system with an appropriate cleaner before shutting down.	Additive system is plugged with additive material.
8	After	Tines, Mixing	Check for cracks, dents, distortion, and insecure mounting.	Tines are unserviceable.

Table 2-3. Operator Preventive Maintenance Checks and Services - CONT.

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
9	After	<u>INTERIOR</u> Air cleaner element	<div style="border: 2px solid black; padding: 5px; text-align: center; margin-bottom: 10px;">WARNING</div> <p>If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal procedures.</p> <p>Check air cleaner service indicator. If red flag is raised, filter element requires servicing.</p>	When red flag is in raised position. If air cleaner is missing.
10	After	<u>EXTERIOR</u> Wheels	Check for defects.	Rim is bent, lugnuts are loose or missing.
11	After	Tires	Check tires for defects and correct air pressure: front tires - 40psi rear tires - 20psi	Tires are missing pieces of rubber, heavily cracked, or separating.
12	After	<u>ENGINE</u> crankcase	<p>Reference: TM 9-2610-200-24</p> <div style="border: 2px dashed black; padding: 5px; text-align: center; margin-bottom: 10px;">CAUTION</div> <p>Wait at least 5 minutes after shutting off the engine to allow oil to drain to oil pan before checking.</p> <p>With engine shut off, check dipstick for oil level. Never operate the engine oil level below the L (low) mark or above the H (high) mark.</p>	Class III leaks exist.
13	After	Valve cover gaskets	Check for leaks at all valve cover gaskets.	Class III leaks.

Table 2-3. Operator Preventive Maintenance Checks and Services - CONT.

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
<div style="border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;">WARNING</div>				
<u>EXTERIOR</u>				
14	Weekly	Spray bar	Check spray bar assembly for bends, dents, and for improperly operating nozzles.	Spray bar assembly is unserviceable.
15	Weekly	PTO shaft guard	Check for presence and condition of shaft guard.	Shaft guard is missing or damaged.
<u>ENGINE</u>				
16	Weekly	Fuel/water separator	Open the valve on the bottom of the fuel filter to allow water to drain. Close the valve when clean fuel is visible. If fuel in sediment bowl is contaminated, drain.	Any fuel leaks.
17	Weekly	Fan	Check the fan for cracks, loose rivets, and bent or loose blades.	Fan is loose or damaged.
18	Weekly	Drive belt	Visually inspect the belt. Check the belt for cracks or fraying.	Belt missing, cracked or frayed.
<u>EXTERIOR</u>				
19	Weekly	Exhaust system	Check muffler and exhaust pipe for corrosion, damage, loose fasteners, etc. Check for presence and condition of muffler guard.	Muffler or exhaust pipe leaks. Muffler guard is missing.

Table 2-3. Operator Preventive Maintenance Checks and Services - CONT.

Item No.	Interval	<u>Location</u> Item to Check/Service	Procedure	Not Fully Mission Capable If:
20	Weekly	<u>ENGINE</u> Engine battery and cables	<div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;">WARNING</div> <p>Do not smoke or allow flame or spark in the vicinity while checking or filling the batteries. The batteries generate hydrogen - a highly explosive gas. Wear safety goggles when adding distilled water.</p> <div style="text-align: center; border: 1px dashed black; padding: 5px; width: fit-content; margin: 0 auto;">CAUTION</div> <p>In cold operation charge batteries immediately after water has been added to prevent freezing and damage to batteries; run engine for one hour at 1500 RPM.</p> <p>Check the level of electrolyte. Electrolyte level should be above the plates and below the fill hole. Check for broken, loose, or corroded terminals and cables.</p>	Batteries will not crank engine. Cables are broken loose, or heavily corroded.
21	Weekly	<u>EXTERIOR</u> Auxiliary battery and cables, and battery box.	Check the level of electrolyte. Electrolyte level should be above the plates and below the fill hole. Check for broken, loose, or corroded terminals and cables.	Batteries will not crank engine. Cables are broken loose, or heavily corroded.
22	Weekly	<u>INTERIOR</u> Grab-handles and anti-skid steps.	Check for damage, rust, and corrosion.	Grab-handles and/or anti-skid steps are damaged, rusted, or corroded.
23	Weekly	ROPS/FOPS	Check for cracks in weldments or metal on structure, loose or lost bolts, worn or damaged rubber mounting pads, and rust or corrosion.	ROPS/FOPS damaged or missing.
24	Weekly	Operator's seat and seat belt.	Check seat for wear and tear. Check seat belt for damage to webbing, buckle, and adjustment hardware. Check attachment hardware and anchorage of the restraint system.	Personal safety of operator during normal operation is impaired.

Section III. OPERATION UNDER USUAL CONDITIONS.

This section contains all instructions necessary to operate the Mixer, Rotary Tiller, under usual (normal) conditions. These instructions include preparing the vehicle for operation, start-up instructions, vehicle operation, additive system operation and shutdown procedures.

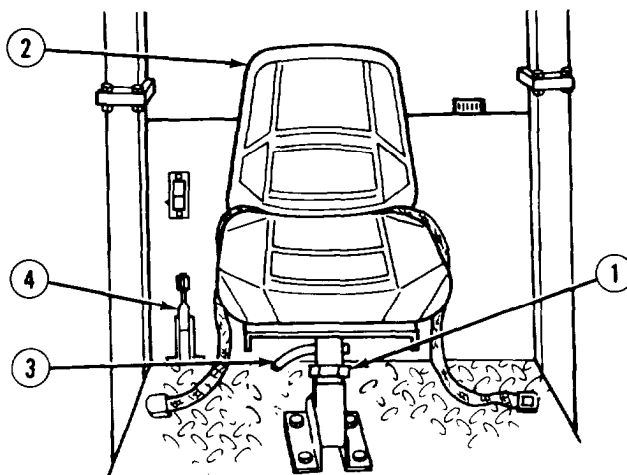
2-8. PREPARATION FOR OPERATION.

a. Introduction. The following paragraphs cover the preparation of the vehicle for normal operation. Initial preparation for use after shipment should have already been performed by unit maintenance personnel. Descriptions of controls called out in these procedures can be found in Controls and Indicators table (Table 2-1).

b. Operator Checks and Services. Operator checks and services are restricted to those tasks outlined and listed in Section II Operator Preventive Maintenance Checks and Services table (Table 2-2). These checks and services are divided into those tasks that are performed before operating the vehicle, tasks performed during operation of the vehicle, and those tasks that are performed as part of shutting down the vehicle.

c. Pre-Start Adjustments.

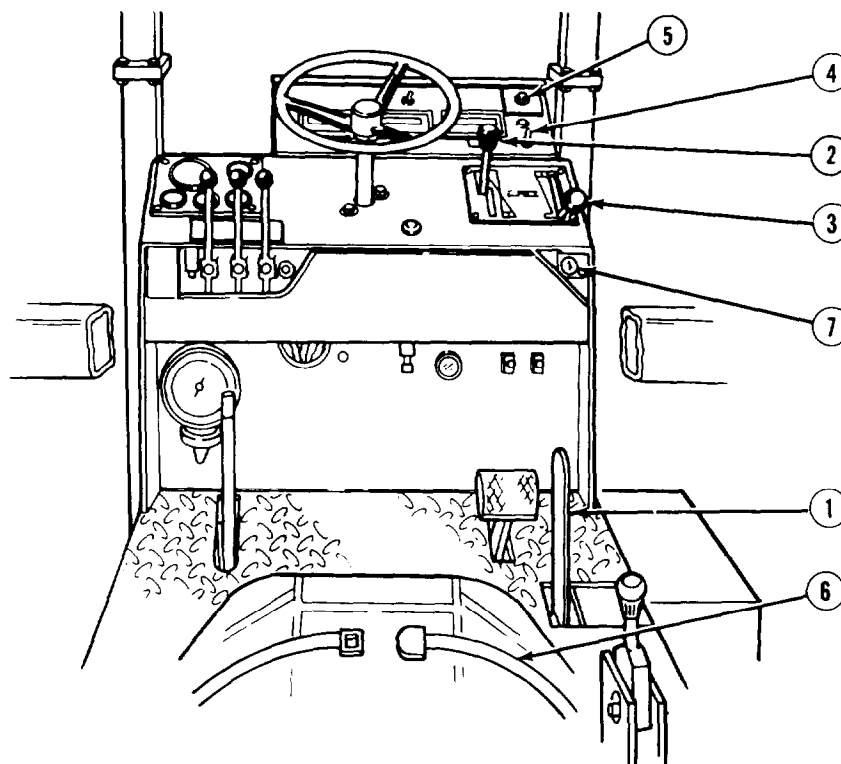
- (1) Loosen adjustment knob (1).
- (2) Hold seat (2) up and pull pin (3) outward.
- (3) Raise or lower seat (2) to desired height.
- (4) Tighten adjustment knob (1).
- (5) Set and lock parking brake (4).



2-9. START-UP PROCEDURES.

a. Introduction. The following paragraphs describe the positions that the controls must be in before starting the vehicle. Descriptions of controls called out in these procedures can be found in Table 2-1, Controls and Indicators.

b. Pre-Start Positions of Controls.



- (1) Place 2-speed lever (1) and TRANSMISSION control lever (2) in neutral position.
- (2) Place THROTTLE control (3) in IDLE position.
- (3) Set pump speed control switch (4) to **SPRAY OFF**.
- (4) Turn pump speed control (5) fully counterclockwise.
- (5) Fasten seat belt (6) and adjust belt snug.
- (6) Insert key into ignition switch (7) and turn it to right to start engine.

WARNING

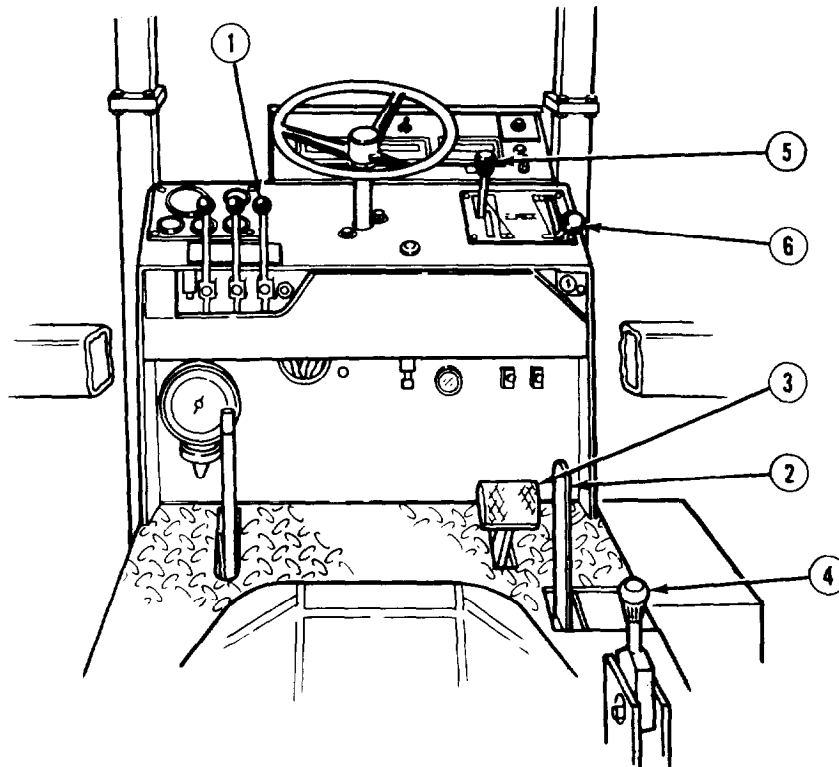
Hearing protection is required for operator and also for all personnel working in and around this vehicle while vehicle is operating.

- (7) Allow engine to warm-up for a few minutes; three to five minutes if engine is cold.
- (8) Perform operator PMCS procedures designated **During** in the Interval column (Table 2-2).

2-10. DRIVING INSTRUCTIONS.

a. Introduction. The following procedures provide instructions for moving the vehicle around a work site without the rotor being engaged. Descriptions of controls called out in these procedures can be found in Table 2-1, Controls and Indicators.

b. Vehicle Driving Procedures.



WARNING

Hearing protection is required for operator and also for all personnel working in and around this vehicle while vehicle is operating.

- (1) Push rotor boom control (1) forward to RAISE ROTOR position to raise rotor assembly above ground.
- (2) Set 2-speed lever (2) in HIGH or LOW position as desired.
- (3) Press brake pedal (3) and hold it in braking position.
- (4) Release parking brake (4).
- (5) Place TRANSMISSION control lever (5) in forward (FWD) or reverse (REV) position as desired.

2-10. DRIVING INSTRUCTIONS (CONT).

Engaging 2-speed lever while THROTTLE control lever is out of the IDLE position will cause vehicle to jump and jerk. Sudden movement of the THROTTLE control lever will also cause vehicle to jump and jerk. Ensure that seat belt is securely fastened. Jumping and jerking movement of the vehicle can throw the operator from the vehicle and into its path. Vehicle THROTTLE control lever is very sensitive and must be moved carefully and gradually.

CAUTION

Never operate the vehicle over 2400 rpm or serious damage may occur.

NOTE

1800-2000 rpm is the most efficient engine speed range for vehicle operation.

- (6) Slowly release brake pedal (3) while gradually pushing THROTTLE control lever (6) forward toward FULL position until reaching desired speed.

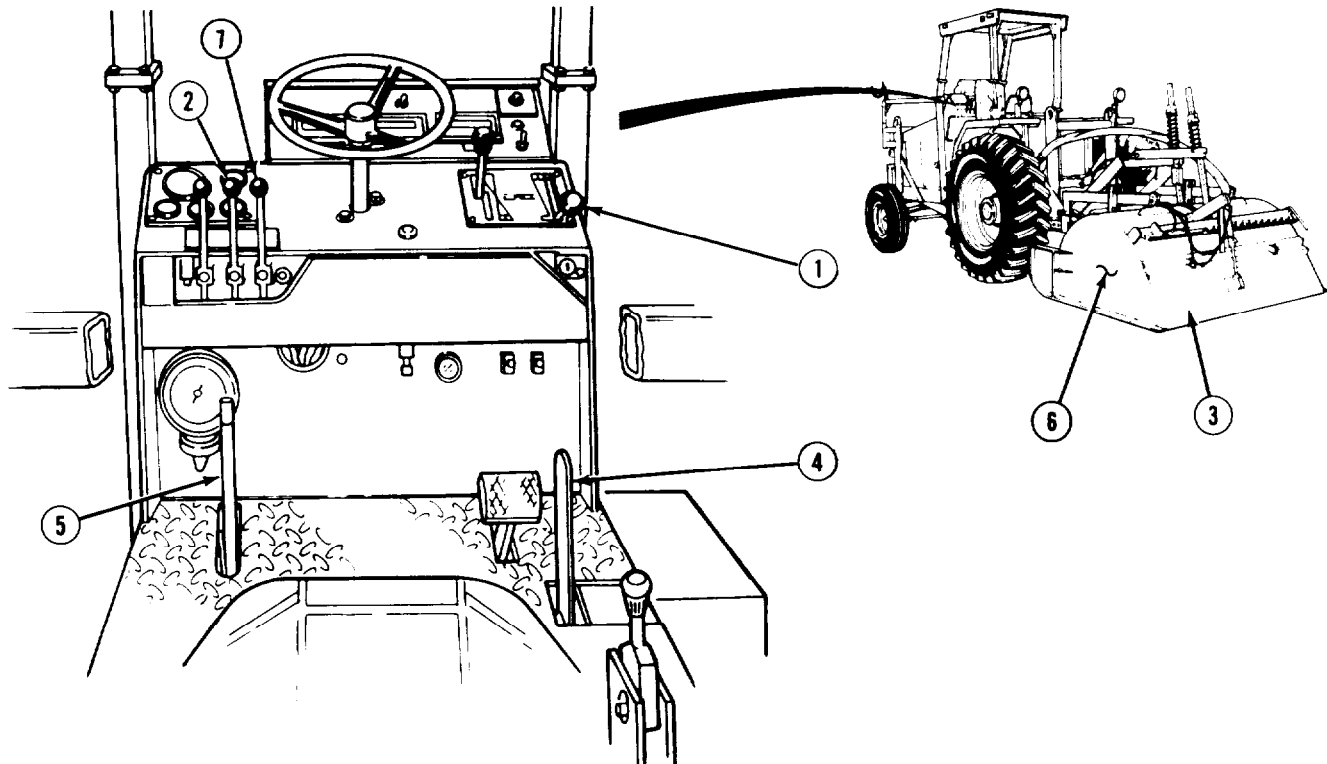
c. Vehicle Stopping Procedures.

- (1) Gradually pull THROTTLE control lever (6) to IDLE position and apply brake (3).
- (2) Set 2-speed lever (2) in neutral position.
- (3) Pull parking brake lever (4) up to locked position.
- (4) If vehicle is going to **be** shut down, continue with following steps:
 - (a) Lower rotor assembly by pulling lever (1).
 - (b) Shut down additive system as necessary (para 2-12[c]).
 - (c) Turn ignition key to OFF position.

2-11. ROTOR OPERATING PROCEDURES.

a. **Introduction.** The following paragraphs provide instructions for operating the rotor assembly and preparing soil road construction. Descriptions of controls called out in these procedures can be found in Table 2-1, Controls and Indicators.

b. Mixing Operation Procedures.



WARNING

Hearing protection is required for operator and also for all personnel working in and around this vehicle while vehicle is operating.

- (1) Start vehicle (para 2-9).
- (2) Drive vehicle to job site (para 2-10).
- (3) Stop vehicle (para 2-10[c]).
- (4) Pull THROTTLE control lever (1) to IDLE position.
- (5) Push tailboard control lever (2) forward to RAISE TAILBOARD position until tailboard (3) is fully raised.
- (6) Set 2-speed lever (4) in LOW range position.

CAUTION

Engaging rotor assembly while it is in the down position can cause extensive damage to rotor drive assembly, drive train and engine. Rotor assembly should always be raised above the ground before it is engaged.

- (7) Push rotor control lever (5) to ROTOR ON to engage clutch and start rotor assembly (6).
- (8) Push THROTTLE control lever (1) forward toward FULL position until engine speed is 2000 rpm.

WARNING

To avoid injury during rotor operation, personnel should remain well clear of the rear of the rotor assembly. When the rotor is being operated at a high velocity, it will throw rocks and materials out from under the tailboard.

- (9) Pull rotor boom control lever (7) back to LOWER ROTOR position until rotor assembly is completely down.
- (10) Adjust THROTTLE control lever (1) to desired mixing speed according to Table 2-3.
- (11) Pull tailboard control lever (2) back to LOWER TAILBOARD position until tailboard (3) lowers enough to slow down engine.

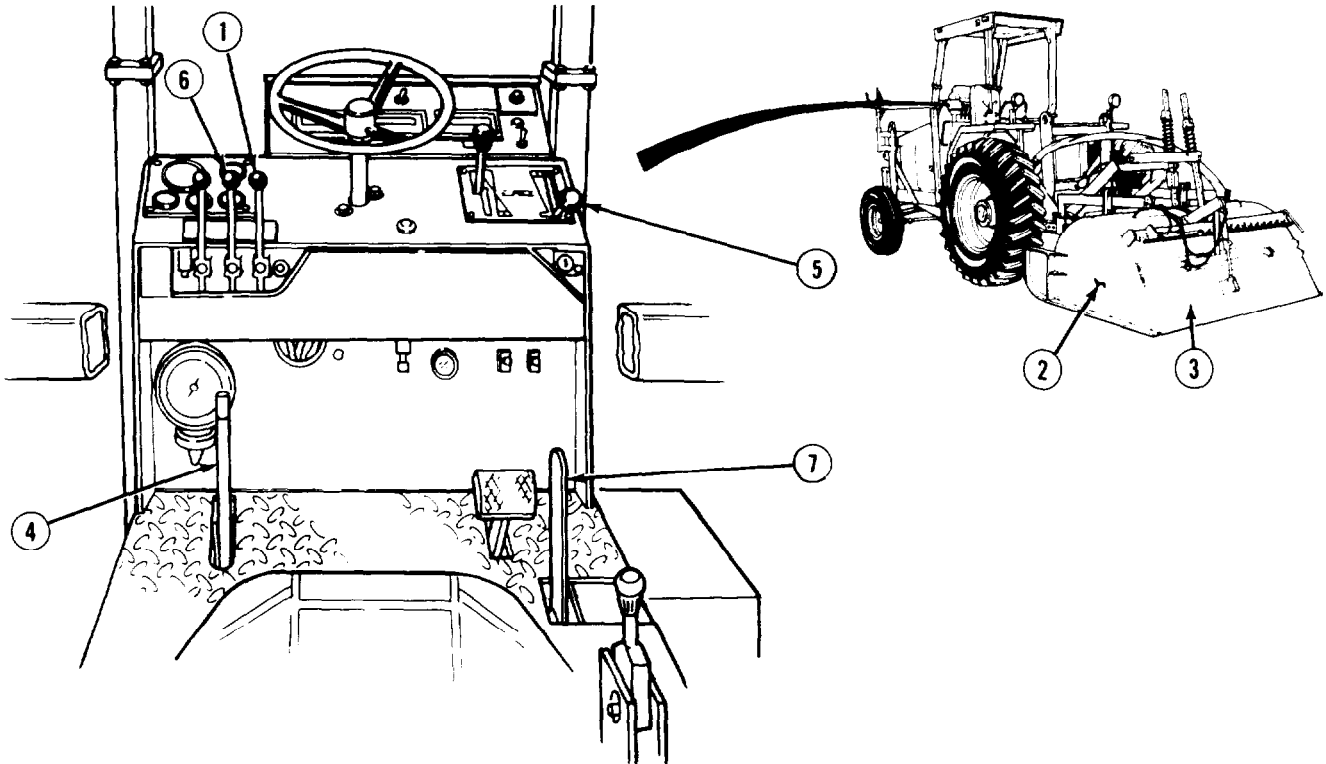
NOTE

Before starting mixing operation, the operator should make a trial run to ensure mixing speeds and pump settings are correct.

- (12) Start moving forward (para 2-10[b]).
- (13) Evaluate efficiency of vehicle settings.
- (14) Stop vehicle (para 2-10[c]).
- (15) Readjust mixing speed and tailboard height according to soil conditions.
- (16) Continue mixing operation.

2-11. ROTOR OPERATING PROCEDURES (CONT).

c. Turn Around Procedures. The following instructions provide procedures for turning the vehicle around during mixing operations.



WARNING

Raising rotor too high above ground while it is operating can cause personal injury. When the rotor is being operated at a high velocity, it will throw rocks and materials out from under the tailboard. To avoid injury during rotor operation, personnel should remain well clear of the rear of the rotor assembly.

NOTE

If a trench is required at the end of each mixing pass, skip steps (1) and (2) and come to a complete stop before continuing on with step (3).

- (1) As vehicle reaches end of mixing pass, push rotor boom control lever (1) forward to RAISE ROTOR position until rotor assembly (2) begins to raise above ground.
- (2) Continue to move forward until no more material is being mixed and forced from back of tailboard (3).
- (3) Pull rotor control lever (4) to ROTOR OFF to disengage clutch and stop rotor assembly (2).

- (4) Push rotor boom control lever (1) forward to RAISE ROTOR position until rotor assembly (2) is fully raised.
- (5) Turn vehicle around and line it up for next mixing pass.
- (6) Push rotor control lever (4) to ROTOR ON to engage rotor assembly (2).
- (7) Pull rotor boom control lever (1) back to LOWER ROTOR position until rotor assembly (2) is fully down.
- (8) Move vehicle forward to continue mixing operation.

d. Mixing Operation Shut-down Procedures.

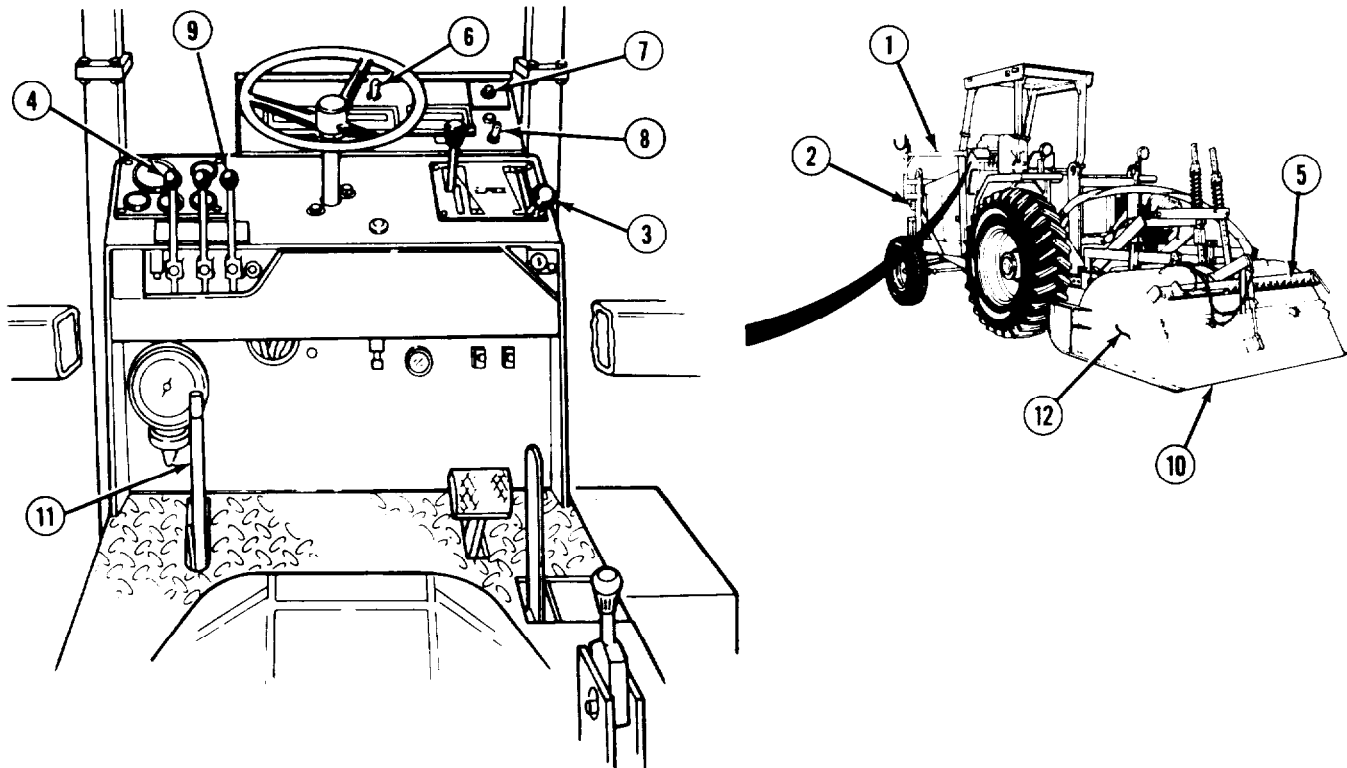
WARNING

Raising rotor too high above ground while it is operating can cause personal injury. When the rotor is being operated at a high velocity, it will throw rocks and materials out from under the tailboard. To avoid injury during rotor operation, personnel should remain well clear of the rear of the rotor assembly.

- (1) As vehicle moves forward, push rotor boom control lever (1) forward to RAISE ROTOR position until rotor assembly (2) just begins to raise from ground.
- (2) Continue to move forward until all material is passed out of tailboard (3).
- (3) Pull rotor control lever (4) to ROTOR OFF to disengage rotor assembly (2).
- (4) Stop vehicle (para 2-10[c]).
- (5) Push rotor boom control lever (1) fully forward to RAISE ROTOR position to raise rotor assembly (2) above ground.
- (6) Pull THROTTLE control lever (5) down to IDLE position.
- (7) Pull tailboard control lever (6) down to LOWER TAILBOARD position to lower tailboard.(3) completely.
- (8) Set 2-speed lever (7) in neutral position.
- (9) Perform operator PMCS procedures designated **After** in the **Interval** column (Table 2-3).

2-12. ADDITIVE SYSTEM OPERATING PROCEDURES.

The additive system provides the capability of adding several types of additive solutions to soil during mixing operations. The following procedures provide instructions for operating and shutting down the additive system. Descriptions of controls called out in these procedures can be found in Table 2-1, Controls and Indicators.



a. Additive System Operation.

- (1) Swing additive boom (1) to front of vehicle.
- (2) Connect additive supply hose from remote vehicle to additive pump (2).
- (3) Push THROTTLE control lever (3) forward toward PULL position until the required engine speed is reached (Table 2-3).
- (4) Push spray bar control lever (4) forward to PUMP ON/SPRAY ON position and hold for 5 seconds to open spray bar (5), then release lever.
- (5) Place GROUND SPEED (FPM) meter switch (6) in ON position.
- (6) Set pump speed control (7) to position 8.
- (7) Start mixing operation (para 2-211).
- (8) Place pump speed control switch (8) in SPRAY ON position.

NOTE

When adjusting additive pumping system, pump output (GPM) should be adjusted rather than the vehicle's ground speed (FPM).

- (9) Adjust additive pump speed as required (Table 2-3).
- (10) Push spray bar control lever (3) forward to PUMP ON/SPRAY ON position and hold lever in this position to apply additive solution.

b. Turn Around Procedures. The following instructions provide procedures for turning the vehicle around during mixing operations when the additive system is operating.

- (1) Release spray bar control lever (3) to stop application of additive solution.
- (2) Pull spray bar control lever (4) back to PUMP OFF/SPRAY OFF and hold in until spray bar (5) is closed.

Raising rotor too high above ground while it is operating can cause personal injury. When the rotor is being operated at a high velocity, it will throw rocks and materials out from under the tailboard. To avoid injury during rotor operation, personnel should remain well clear of the rear of the rotor assembly.

NOTE

If a trench is required at the end of each mixing pass, skip steps (2) and (3) and come to a complete stop before continuing on with step (4).

- (3) As vehicle reaches end of mixing pass, push rotor boom control lever (9) forward to RAISE ROTOR position until rotor assembly (2) begins to raise above ground.
- (4) Continue to move forward until no more material is being mixed and forced from back of tailboard (10).
- (5) Pull rotor control lever (11) to ROTOR OFF to disengage clutch and stop rotor assembly (12).
- (6) Push rotor boom control lever (9) forward to RAISE ROTOR position until rotor assembly (12) is fully raised.
- (7) Turn vehicle around and line it up for next mixing pass.
- (8) Pull rotor control lever (11) to ROTOR ON to engage rotor assembly (12).
- (9) Pull rotor boom control lever (9) back to LOWER ROTOR position until rotor assembly (12) is fully down.
- (10) Move forward to continue mixing operation.
- (11) Push spray bar control lever (4) forward to PUMP ON/SPRAY ON position and hold in position to open spray bar (5) and apply additive solution.

2-12. ADDITIVE SYSTEM OPERATING PROCEDURES (CONT).

Table 2-3. Additive System Operation Settings

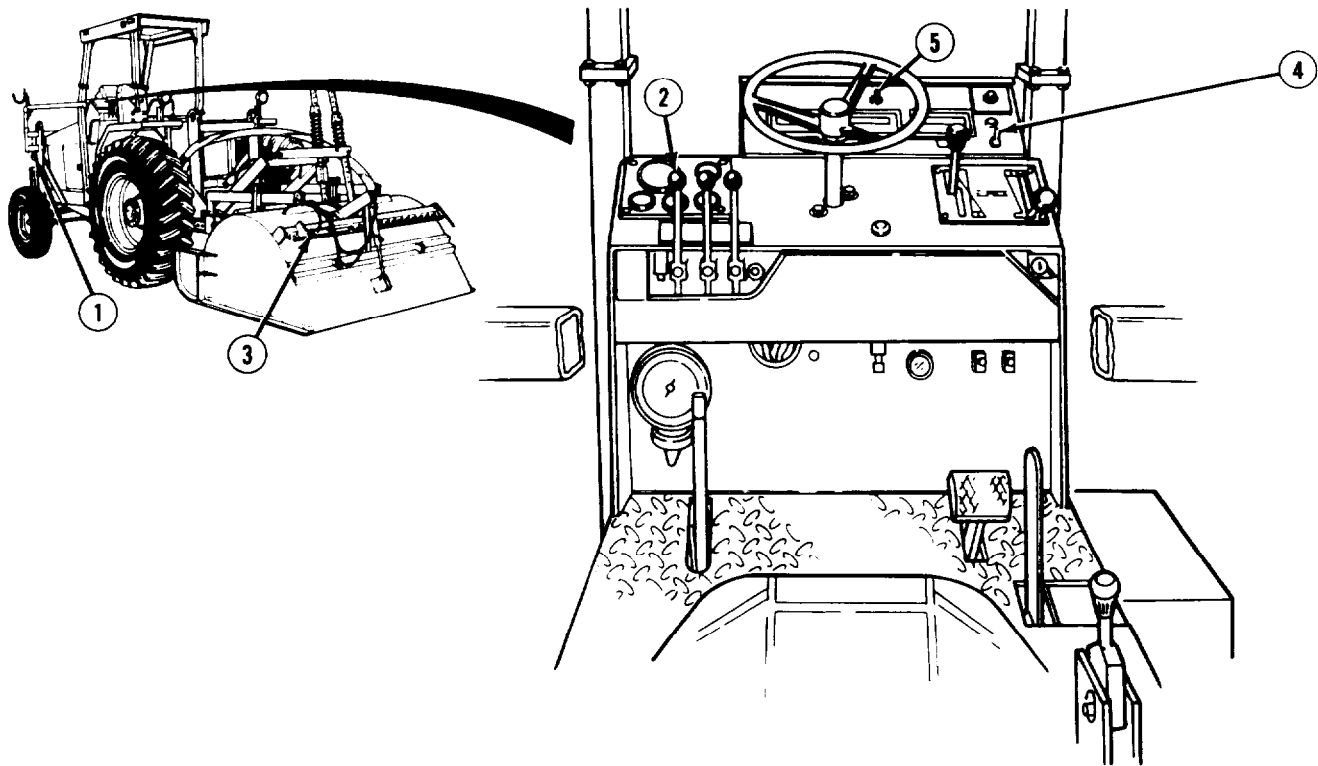
GALLONS PER SQ. YD.	PER LINEAR FT.	PUMP OUTPUT GPM	TRAVEL SPEED FPM	PUMP OUTPUT GPM	TRAVEL SPEED FPM
0.50	0.40	40	100	60	150
		45	112	80	200
		50	125	95	237
0.75	0.60	40	67	100	166
		50	83	120	200
		60	100	132	220
1.00	0.80	40	50	100	125
		64	80	150	187
		80	100	200	250
1.20	0.90	45	50	100	111
		72	80	150	187
		117	130	200	222
1.40	1.10	55	50	100	91
		88	80	150	136
		121	110	200	181
1.60	1.20	60	50	100	83
		120	100	150	125
		168	140	200	167
1.80	1.40	56	40	100	71
		112	80	150	107
		217	255	200	143
2.00	1.60	72	63	100	71
		120	75	150	94
		160	100	200	143
2.20	1.70	68	40	100	59
		127	75	150	88
		212	125	200	118

Table 2-3. Additive System Operation Settings - CONT.

GALLONS PER SQ. YD.	PER LINEAR FT.	PUMP OUTPUT GPM	TRAVEL SPEED FPM	PUMP OUTPUT GPM	TRAVEL SPEED FPM
2.40	1.80	72	40	100	55
		135	75	150	83
		216	120	200	111
2.60	2.00	80	40	100	50
		170	85	150	75
		220	110	200	100
2.80	2.20	121	55	100	45
	165	75	150	68	
	220	100	200	91	
3.00	2.30	126	55	100	45
	172	75	150	65	
	218	95	200	87	
3.20	2.50	125	50	100	40
	187	75	150	60	
	212	85	200	80	
3.40	2.60	117	45	100	38
	169	65	150	58	
	221	85	200	77	
3.60	2.80	126	45	100	36
	182	65	150	54	
	218	78	200	71	
3.60	2.80	126	45	100	36
	182	65	150	54	
	218	78	200	71	
3.80	3.00	120	40	100	33
	171	50	150	50	
	216	72	200	67	
4.00	124	40	100	32	
	3.10	170	55	150	48
	217	70	200	64	

2-12. ADDITIVE SYSTEM OPERATING PROCEDURES (CONT).

c. Additive System Shut-down Procedures.



- (1) Stop vehicle (para2-10[c]).
- (2) Close supply valve on remote additive supply tank.
- (3) Disconnect feed hose from additive supply valve.
- (4) Allow additive system pump (1) to continue pumping until only air is coming from spray bar nozzles.

WARNING

Cleaning compound can cause skin rash and can give off harmful vapors. To avoid injury, use in well-ventilated area. Wash immediately with soap and water if compound contacts skin or clothes.

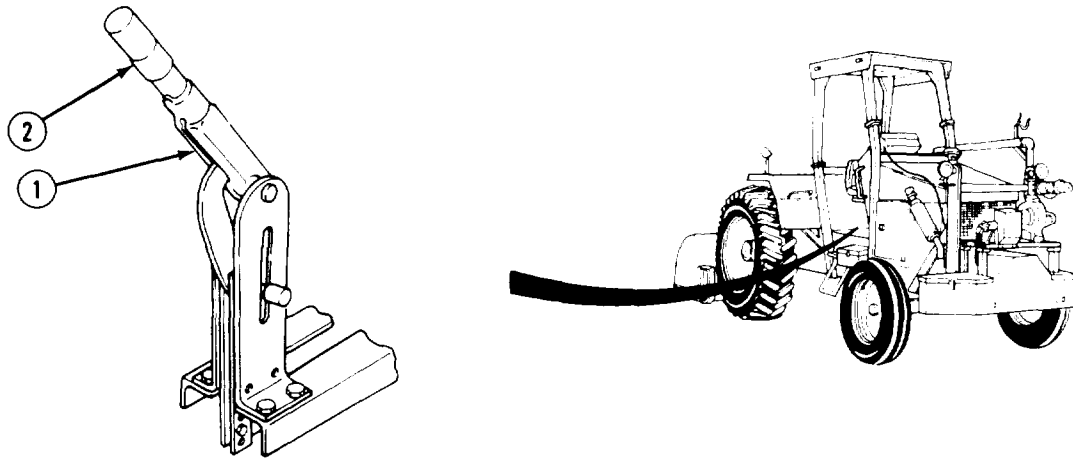
- (5) Place end of additive feed hose into cleaning solution (item 9, appendix E).
- (6) Pump cleaning solution through additive system to flush it out.
- (7) Remove additive feed hose from cleaning solution.
- (8) Pull spray bar control lever (2) back to PUMP OFF/SPRAY OFF position until spray bar (3) is closed.
- (9) Place pump speed control switch in SPRAY OFF position and GROUND SPEED (FPM) meter switch in OFF position.
- (10) Disconnect feed hose from additive system pump (1).
- (11) Shut down vehicle (para 2-10[c]).

2-13. PARKING BRAKE OPERATION AND ADJUSTMENT.

WARNING

If the parking brake does not set correctly, the vehicle can roll into personnel and/or equipment and cause serious injury and damage. When the brake lever is pulled up and back, it should feel tight.

a. Brake Operation. This procedure covers setting and releasing the parking brake. In the set position, the parking brake lever is perpendicular to the vehicle floor and pointing to roof. In the released position, the brake lever is parallel to the floor and pointing forward.



- (1) Pull up and back on brake lever (1) to set brake.
- (2) Pull back slightly on brake lever (1) to release brake.

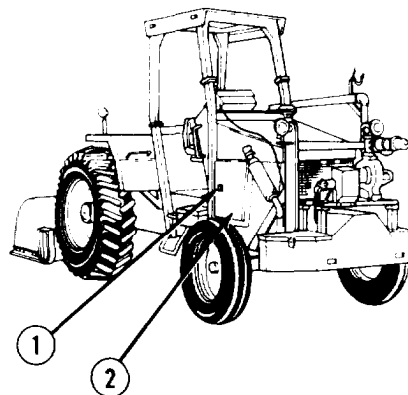
b. Brake Adjustment.

- (1) Pull back slightly on brake lever (1) to release brake.
- (2) Turn adjusting knob (2) to the right to tighten brake cable tension or to the left to release tension.
- (3) Pull up and back on brake lever (1) to set brake and check cable tension. Repeat steps (1) and (2) as necessary until brake cable tension is correct.
- (4) Ensure parking brake is set before leaving vehicle.

2-14. ENGINE ACCESS DOOR OPERATION.

The vehicle is equipped with an access door on each side of the engine compartment. The following procedure applies to opening and closing either door.

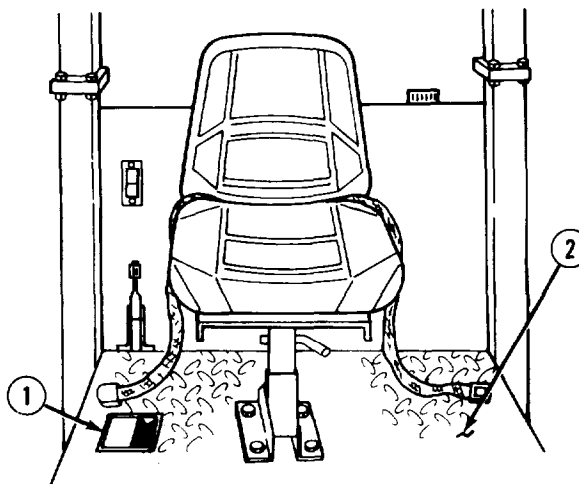
- a. Open door by grasping handle (1) and pulling door (2) open.
- b. Close door (2) and make sure handle (1) secures door.



2-15. AFT FLOOR DECK OPERATION.

a. **Raise Aft Floor Deck.** The aft floor deck must be raised and supported in position to perform some PMCS procedures.

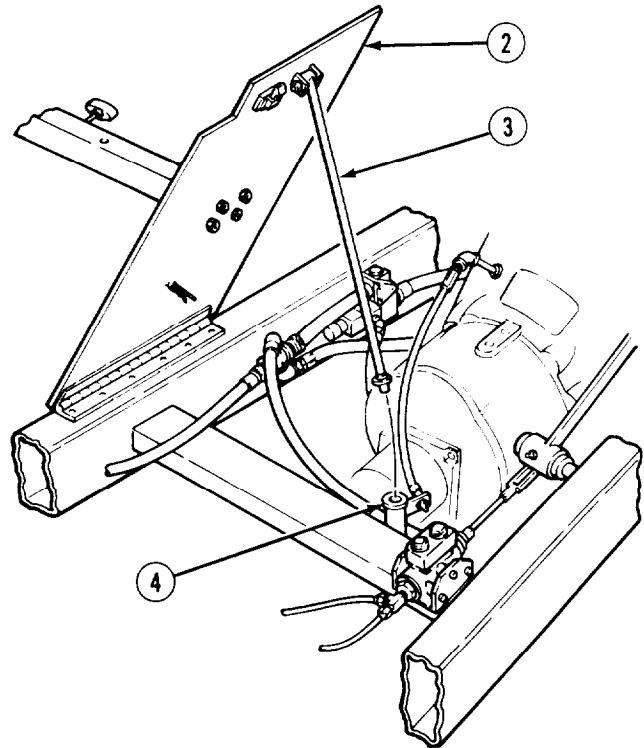
- (1) Unlatch floor deck handle (1) and lift up floor deck (2).



- (2) Swing prop rod (3) down and inert end in support (4).
- (3) Lower floor deck (2) until supported by prop rod (3).

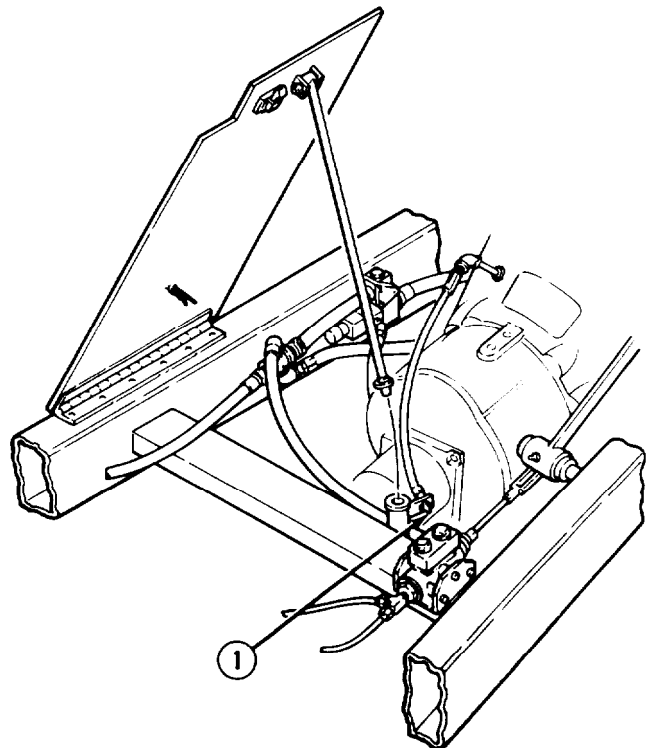
b. Lower Aft Floor Deck.

- (1) Lift floor deck (2) up and remove prop rod (3) from support (4).
- (2) Secure prop rod (3) to bottom of floor deck (2).
- (3) Lower floor deck (2) and latch with handle (1).



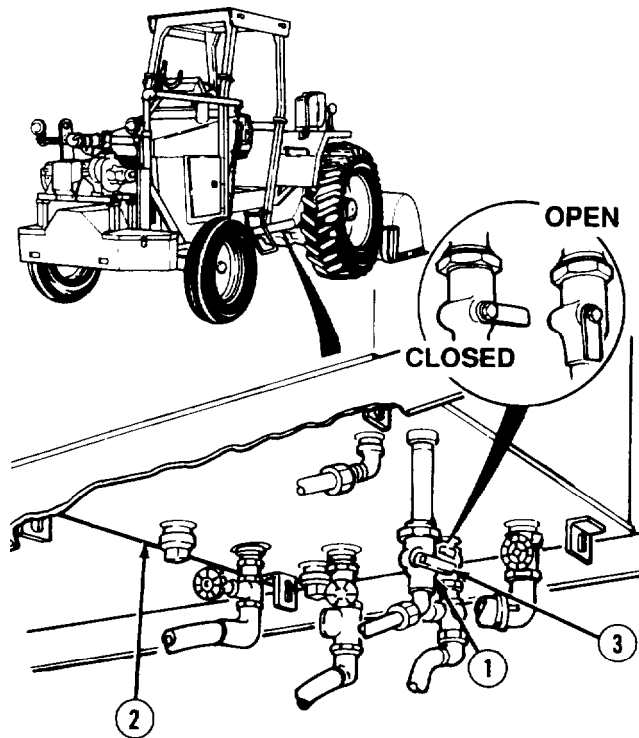
2-16. CLUTCH SERVICE.

- (1) Raise and support aft floor deck (para 2-15).
- (2) Add grease to clutch fitting (1) (Figure 3-1).
- (3) Lower aft floor deck (para 2-15).



2-17. FUEL SHUTOFF VALVE OPERATION.

The fuel shut off valve must be closed to perform certain maintenance procedures.

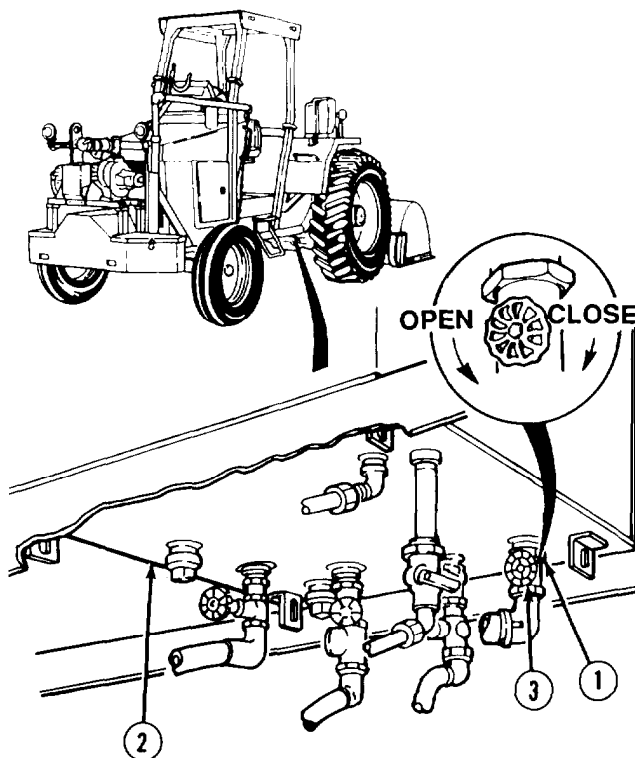


a. Close fuel shutoff valve (1), located beneath fuel/hydraulic tank (2), by rotating handle (3) until handle is perpendicular to body of valve.

b. Open fuel shutoff valve (1) by rotating handle (3) until handle is in-line with the body of valve.

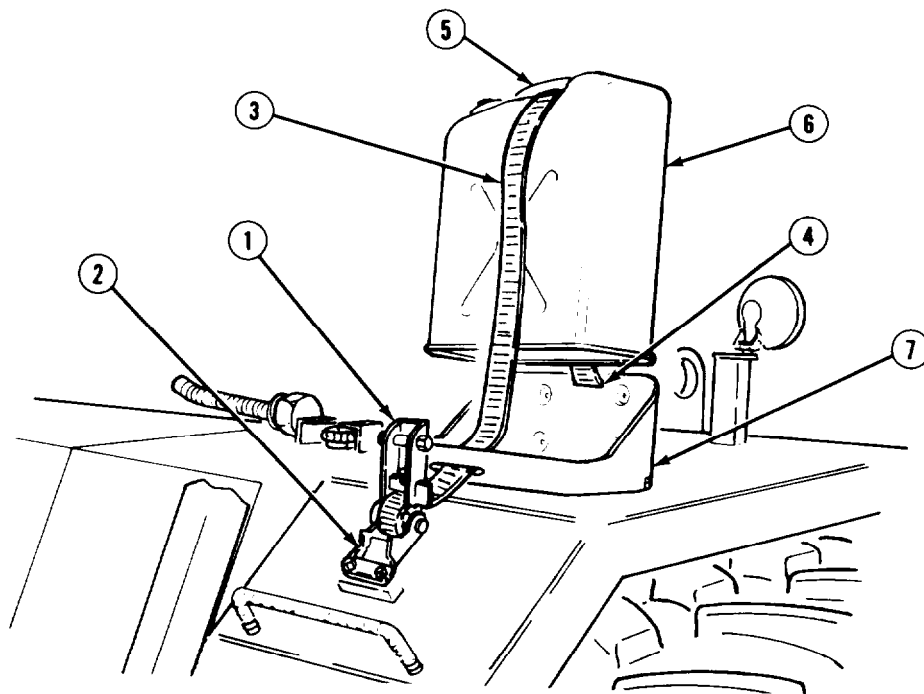
2-18. HYDRAULIC SHUTOFF VALVE OPERATION.

All four hydraulic shutoff valves operate in the same manner.



- a.* Close hydraulic valve (1), located beneath fuel/hydraulic tank (2) by turning handle (3) fully to the right.
- b.* Open hydraulic valve (1) by turning handle (3) to the left.

2-19. FUEL CAN REMOVAL AND INSTALLATION.



a. Fuel Can Removal.

- (1) Lift up buckle lever (1).
- (2) Pull ratchet release (2) down to release tension on strap (3).
- (3) Pull enough of strap (3) from buckle lever (1) to remove clip (4) from holder (7).
- (4) Disconnect clip (4) and pull strap (3) through fuel can handle (5).
- (5) Remove fuel can (6).

b. Fuel Can Installation.

- (1) Set fuel can (6) in holder (7).
- (2) Feed strap (3) through fuel can handle (5) and install clip (4) in holder (7).
- (3) Move buckle lever (1) back and forth until strap (3) is tight enough to secure fuel can (6) in place.
- (4) Push buckle lever (1) down until it locks in place.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-20. OPERATION IN UNUSUAL WEATHER.

The Mixer, Rotary Tiller usually operates under conditions that are generally UNUSUAL for other vehicles. Operator PMCS instructions are designed to cover these conditions. However, operation in extreme heat or cold requires additional checks and services. The following paragraphs cover these conditions.

2-21. OPERATION IN EXTREME HEAT.

CAUTION

- Operating during periods of extreme heat [ambient temperatures above 100°F (38°C)] can cause the vehicle engine and hydraulic systems to overheat. Engine temperatures above 230°F (110°C) and hydraulic fluid temperatures above 250°F (121°C) can cause damage to engine and hydraulic system components. Coolant and hydraulic fluid temperatures should be checked often during periods of extreme heat to prevent damage to engine and hydraulic system components.
 - Gaskets and seals are more likely to leak when engine and hydraulic system operating temperatures are high. Engine and hydraulic fluid levels should be checked more often during periods of extreme heat to prevent damage to engine and hydraulic system components. Checks for leaks around gaskets, seals, and fittings should also be made more often.
- a. Check engine oil level (para 3-6) and operating temperature often for system temperature above 230°F (110°C).
 - b. Check hydraulic fluid level (para 3-11) and operating temperature for system temperature above 250°F (121°C).
 - c. Check cooling system often.
 - (1) Check coolant temperature gauge for engine operating temperature above 230°F (110°C).
 - (2) Check that coolant level is not below minimum (para 3-7).
 - (3) If conditions described in steps (1) and (2) exist, set transmission control lever to IDLE position and 2-speed lever to NEUTRAL position.
 - (4) Allow engine to run at idle for a few minutes to cool down.
 - (5) When system temperatures have returned to a safe range, resume operation as necessary.
 - d. Extreme heat will cause tire pressure to increase. Check tire pressure often.

2-21. OPERATION IN EXTREME HEAT (CONT).

- e. Perform operator PMCS more often than normal (Table 2-2).
- f. When adding coolant to radiator, ensure water source is soft. Local desert water sources can have high mineral deposits that will clog radiator.
- g. Ensure that water/antifreeze mix is at least 50:50. This mixture raises the coolant boiling point to help prevent overheating.

2-22. OPERATION IN EXTREME DUST.

The vehicle normally operates in dusty conditions and PMCS instructions are designed to handle these conditions. However, in deserts, dust conditions are more extreme and certain checks and services must be made more often than normal.

- a. Check air restriction indicator more often than normal to ensure air cleaner is not becoming clogged.
- b. Check fuel/water separator frequently and drain it as necessary.
- c. Watch all gauges in instrument panel more closely to ensure vehicle is not affected by dusty conditions.
- d. Park vehicle so it does not face into wind.



Blowing dust and sand can scratch glass surfaces. When the vehicle is not being operated, glass surfaces must be covered for protection.

- e. Cover instrument panel, vacuum gauge, air restriction indicator, hydraulic fluid oil level indicator, fuel tank fill cap, and spotlights when vehicle is parked for extended periods of time in extremely dusty conditions.
- f. Cover open space in fuel tank fill hole when adding fuel to tank.
- g. Do not fill fuel tank completely. Extreme heat will cause fuel to expand in tank and overflow.
- h. High temperatures can damage hoses. Check radiator and lubricant hoses for leaks around fittings and replace damaged hoses as necessary.

2-23. OPERATION IN EXTREME COLD.

The vehicle cannot be operated during periods when temperatures are below -25°F (-32°C). In situations when temperatures are above -25°F (-32°C) and below 32°F (0°C), the following instructions must be observed.

a. Start-Up and Operation.

- (1) Remove all snow and ice from vehicle as soon as possible.
- (2) Prepare vehicle for operation in severe cold temperatures according to FM 9-207, FM 31-70, FM 31-71, and FM 21-305 as necessary.
- (3) Decrease tire pressure if pressure was increased for long stand-by periods when temperatures were below -50°F (-46°C).
- (4) Drain fuel filter and fuel/water separator before filling fuel tank to prevent any water in fuel from freezing. This will also prevent fuel filter from clogging.
- (5) Keep fuel tank as full as possible during cold operations.
- (6) Start engine (para 2-9) and allow it to warm up to normal operating temperature.
- (7) Watch gauges closely. If there are any unusual readings, stop vehicle (para 2-10[c]), turn engine off, and refer to operator troubleshooting procedures (Table 3-2).
- (8) Slowly raise and lower rotor assembly, tailboard, and spray bar (para 2-11) to allow hydraulic fluid to warm-up.

WARNING

Icy roads and surfaces are common during periods of severe cold. Care should be exercised when operating on icy surfaces. Sudden movements or lack of attention can cause accidents, injury and possibly death.

- (9) Drive vehicle on icy surfaces as follows:
 - (a) Drive vehicle forward (para 2-10) and allow hydraulic fluid in drive system to warm-up.
 - (b) Turn vehicle right and left to allow hydraulic fluid in steering system to warm-up
 - (c) Avoid making sudden turns and stops.
 - (d) When slowing or stopping, pump brake pedal to avoid slipping and sliding.
 - (e) Begin stopping sooner than normal to avoid slipping and sliding.

2-23. OPERATION IN EXTREME COLD (CONT).

- (f) Steer away from ruts and snow banks.
- (g) Steer vehicle straight up and down hills when possible.

b. ShutDown.

NOTE

Freezing water in additive system or fuel lines can cause damage to pump, hose and fuel lines. Water must be removed from these areas before storing the vehicle when temperatures are forecast to drop below freezing; 32°F (0°C).

- (1) If water was pumped through additive system, flush out pump, hoses, and spray bar with fuel oil (item 30, appendix E).
- (2) Ensure that no water remains in pump or hoses.
- (3) Open additive elbow drain valve behind left rear wheel.

CAUTION

During periods of extreme cold, damage will occur if tires are allowed to freeze to the ground. If a sheltered area is not available when temperatures are forecast to be below 32°F (0°C), the vehicle should be parked in a high, dry area. If a high, dry area is not available, the vehicle should be raised off the ground and parked on wooden planks to prevent tires from freezing to the ground.

- (4) Park vehicle in sheltered area out of wind. If a sheltered area is not available, park vehicle so it does not face into wind.
- (5) Drain water from fuel/water separator.
- (6) If temperatures are forecast to reach -50°F (-46°C), increase tire pressure by approximately 10 psi (69 kPa).

2-24. FORDING OR SWIMMING.

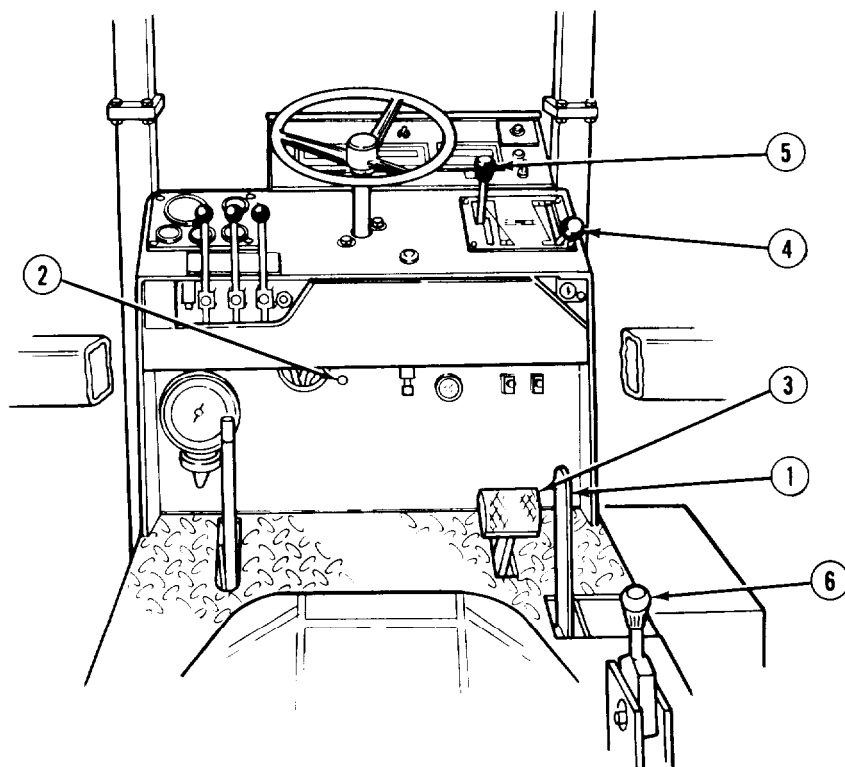
a. Introduction. This paragraph provides instructions for driving the vehicle through water and across streams.

b. Forging Instructions.

WARNING

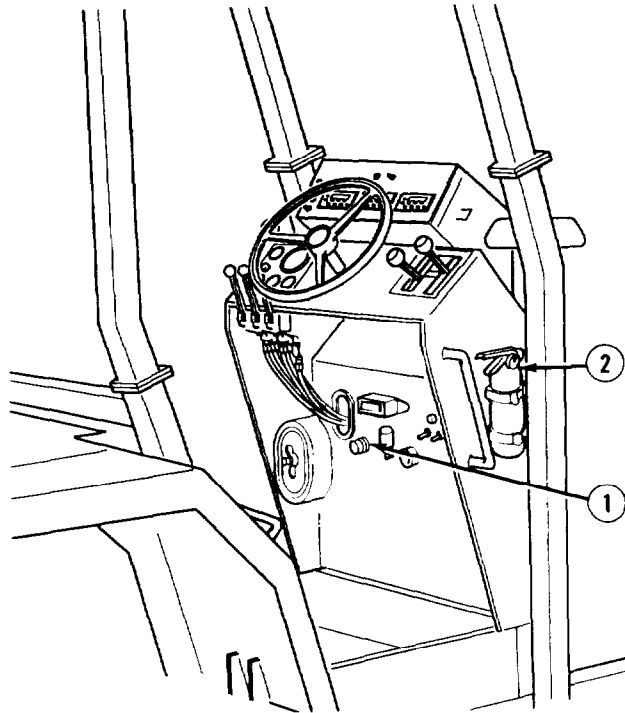
Water depth greater than 3.0 ft (0.9 m) can cause personal injury and/or damage to the vehicle. The vehicle should not enter water deeper than 3.0 ft (0.9 m).

- (1) Make sure depth of water at fording site is not more than 3.0 ft (0.9 m).
- (2) Make sure that bottom of fording site is firm enough that 3.0 ft (0.9 m) maximum fording depth will not be exceeded and vehicle will not become stuck.
- (3) Stop vehicle at edge of water.



- (4) Make sure engine has been operating properly before entering water.
- (5) Set 2-speed lever (1) in LOW range.
- (6) Slowly drive vehicle into water.
- (7) Drive vehicle slowly through water.
- (8) If engine stops, immediately attempt to restart it.
- (9) If engine will not start, press emergency steer switch (2) and tow vehicle from water.
- (10) If vehicle enters water deeper than 3.0 ft (0.9 m), do the following:
 - (a) Press brake pedal (3) and hold it down.
 - (b) Pull THROTTLE control lever (4) back to IDLE position.
 - (c) Push TRANSMISSION control lever (5) to reverse (REV) position.
 - (d) Gradually release brake pedal (3) and push THROTTLE control lever (4) forward.
 - (e) Slowly back vehicle out of water.
- (11) After exiting water, stop vehicle.
- (12) Apply and release parking brake (6) several times to remove water from parking brake components.
- (13) Lightly press brake pedal (3) while driving to dry brake shoes and drums.

2-25. EMERGENCY PROCEDURES.



a. Emergency Steering. The Mixer, Rotary Tiller is equipped with an emergency steering system. The emergency steering system is used to provide steering control in the event of engine failure when steering capabilities are required. Emergency steering is activated by a switch (1) on the firewall (Table 2-1).

b. Fire Extinguisher Location. The recommended location of the fire extinguisher (2) (Appendix D) is on the right side of the vehicle firewall just rearward of the right engine access door.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Para	Contents	Page
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3-2	Troubleshooting Introduction	3-12
3-3	Troubleshooting Symptoms	3-12
3-4	Troubleshooting Procedures	3-13
3-5	Operator Maintenance Introduction	3-19
3-6	Engine Oil Level Check and Service	3-19
3-7	Engine Coolant Check and Service	3-20
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3-9	Electrical System Fuses Inspection and Replacement	3-22
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Section I. LUBRICATION INSTRUCTIONS

3-1. GENERAL LUBRICATION INSTRUCTIONS.

This section contains a lubrication chart that shows the locations of all Mixer, Rotary Tiller lubrication points. Figure 3-1 illustrates the vehicle and the locations of lubrication points. The following paragraphs describe the lubrication chart and how it is used.

Do not start engine or move vehicle when anyone is under vehicle. Severe injury or death could result.

a. Intervals. Intervals (on-condition or hard time) and the related man-hour times are based on normal operation. The man-hour time specified is the time needed to do all the services prescribed for a particular interval. On-condition (OC) oil sample intervals shall be applied unless changed by the Army Oil Analysis Program (AOAP) laboratory. Change the hard time interval if lubricants are contaminated or if operating the equipment under adverse operating conditions, including longer-than-usual operating hours. The calendar interval may be extended during periods of low activity. If extended, adequate preservation precautions must be taken. Hard time intervals will be applied in the event AOAP laboratory support is not available. Hard time intervals must be applied during the warranty period. Intervals shown in this lubrication section are based on calendar and hourly times or calendar times and mileage. An example of a calendar and hourly lubrication is: M/60 H, in which M stands for monthly and 60 H stands for 60 hours of vehicle operation. The lubrication is to be performed, at whichever interval occurs first for the vehicle. Special lubrication intervals and services are shown by the use of an asterisk (*) symbol.

b. Determination of Operating Hours. The reading on the hour meter is the basis of all lubrication intervals that are based on hours of operation.

3-1. GENERAL LUBRICATION INSTRUCTIONS (CONT).

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- c. Clean Fitting Before Lubricating.* Clean parts with cleaning solvent (item 41, appendix E). Dry before lubricating. Dotted arrow points indicate lubrication on both sides of the vehicle.
- d. Lubrication After Fording.* If fording occurs, lubricate all fittings below fording depth. Fording is not recommended.
- e. Lubrication after High-Pressure Washing.* After washing, lubricate all grease fittings and oil can points outside and underneath vehicle.
- f. Level of Maintenance.* The lowest level of maintenance authorized to lubricate a point is indicated by either Operator/Crew (C) or unit maintenance (0). Operator can lubricate points authorized for unit maintenance when authorized by unit maintenance.
- g. Localized Views.* A reference to the appropriate localized view is given after most lubrication entries.
- h. Oil Filter Statement.* Oil filters shall be changed as applicable, when:
- (1) They are known to be contaminated or clogged.
 - (2) Service is recommended by AOAP laboratory analysis.
 - (3) At prescribed hard time intervals.
- i. AOAP Sampling Interval Statement.* Engine oil must be sampled at 50 hours of operation or 90 days, whichever occurs first, for Active Army Units. Reserve and National Guard activities will use 50 hours or 180 days, whichever **occurs** first, as the prescribed interval. Hydraulic fluid will be sampled once-a-year. Sampling will be performed as prescribed by DA Pam 738-750.
- j. Warranty Hard Time Statement.* For equipment under manufacturer's warranty, hard time oil service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or if operation is under adverse conditions such as longer-than-usual operating hours, extended idling periods, or extreme dust.
- k. Lubrication Interval Symbols.* The following lubrication interval symbol is used:

H - Hours (operated)

I. General/ Engine Oil Checks and Services.

- (1) Oil grade requirements are listed on the Lubrication Chart (Figure 3-1).

WARNING

Hot engine oil can cause severe burns and personal injury. Care should be exercised when changing oil filter and draining hot oil.

- (2) Park vehicle on level ground and allow it to sit about ten minutes before checking oil level. Parking on level ground provides the most accurate level reading on the dipstick. Waiting ten minutes, before checking oil level, allows all oil to drain into crankcase.
- (3) Before changing the engine oil, the engine should run for a few minutes to heat the oil. Warm oil will flow more easily and help to drain all oil sludge from the crankcase.

CAUTION

Do not overfill crankcase with engine oil or serious damage may occur to engine.

- (4) Do not overfill crankcase.
- (5) Ensure oil level is correct before operating the vehicle.

LUBRICATION CHART

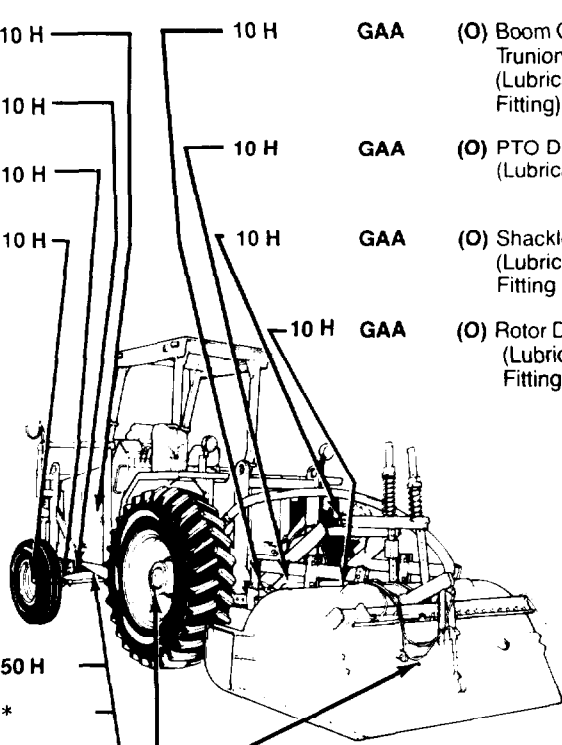
MIXER, ROTARY TILLER

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 138°F (60%). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions or contaminated lubricants. During inactive periods, intervals may be extended provided adequate preservation precautions are taken. Relubricate after washing or fording.

Clean fittings before lubricating. Clean parts with drycleaning solvent. Dry before lubricating.

LUBRICANT	INTERVAL	INTERVAL	LUBRICANT
VIEW H → Check Oil Level at Dipstick (C)	OE/HDO	10 H	(O) Boom Cylinder Trunions (Lubricate 1 Fitting) ← VIEW A
VIEW G → Tie Rod End (Lubricate 1 Fitting) (O)	GAA	10 H	(O) PTO Drive Shaft (Lubricate 2 Fittings) ← VIEW B
VIEW G → Kingpin (Lubricate 2 Fittings) (O)	GAA	10 H	(O) Shackle Bolts (Lubricate 1 Fitting Each Bolt) ← VIEW C
VIEW F → Wheel Hub (Lubricate 1 Fitting) (O)	GAA	10 H	(O) Rotor Drive Shaft (Lubricate 1 Fitting) ← VIEW D
			
Drive Assembly			
VIEW T → Check at Fill Plug (O)	GO 80/90	50 H	
VIEW T → Fill at Fill Plug (O)	GO 80/90	*	
VIEW T → Drain at Drain Plug (O)	GO 80/90	500 H	
Wheel End Reduction Gear			
VIEW E → Check Oil Level at Level Plug (O)	GO 80/90	100 H	
VIEW E → Fill at Level Plug (O)	GO 80/90	*	
VIEW E → Drain at Drain Plug (O)	GO 80/90	1000 H	
Rotor Drive Assembly			
	GO 80/90	100 H	(O) Check Oil Level at Fill Plug ← VIEW D
	GO 80/90	*	(O) Fill at Fill Plug ← VIEW D
	GO 80/90	1000 H	(O) Drain at Drain Plug ← VIEW D

* FILL AS REQUIRED

Figure 3-1. Lubrication Chart (Sheet 1 of 8)

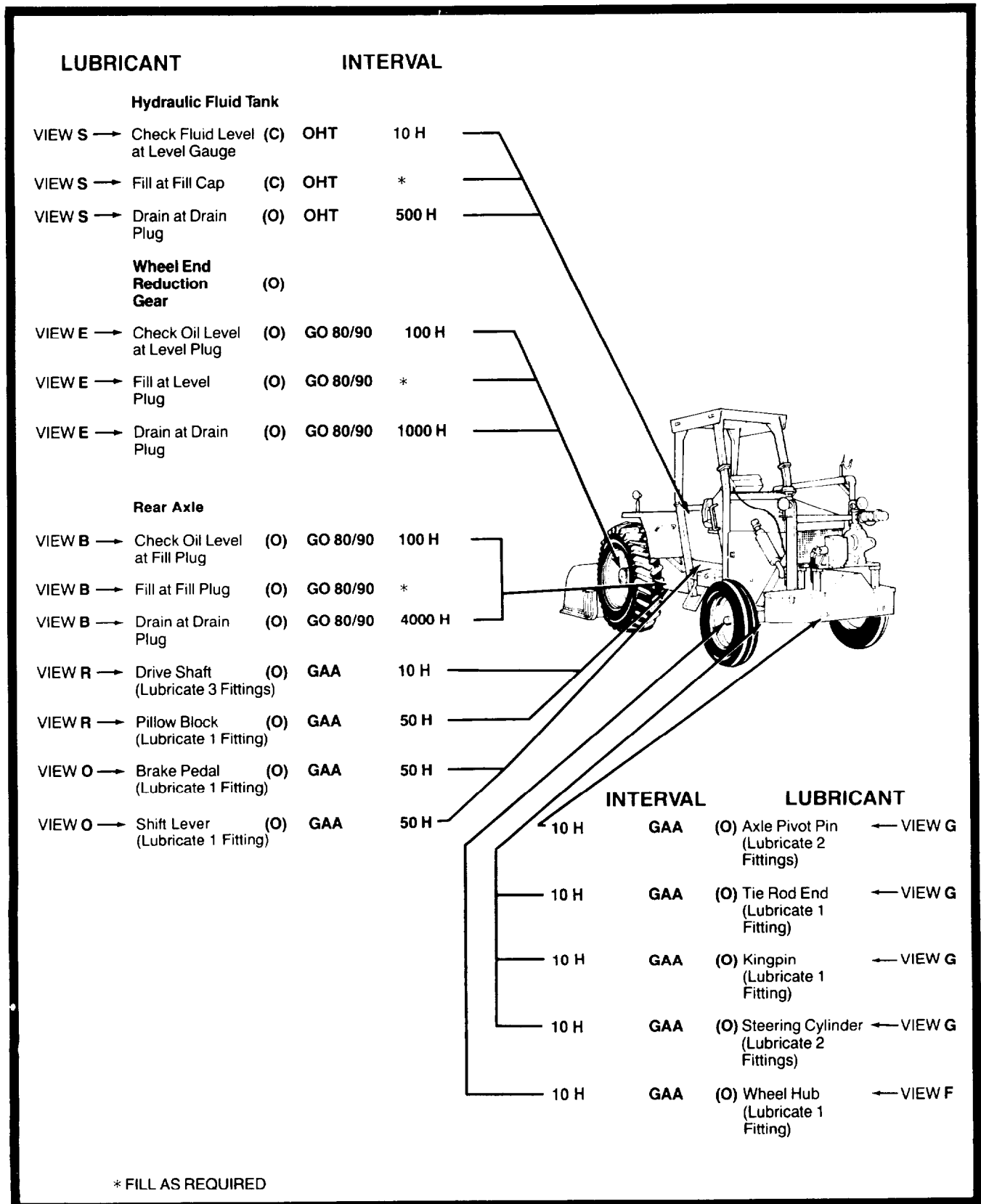


Figure 3-1. Lubrication Chart (Sheet 2)

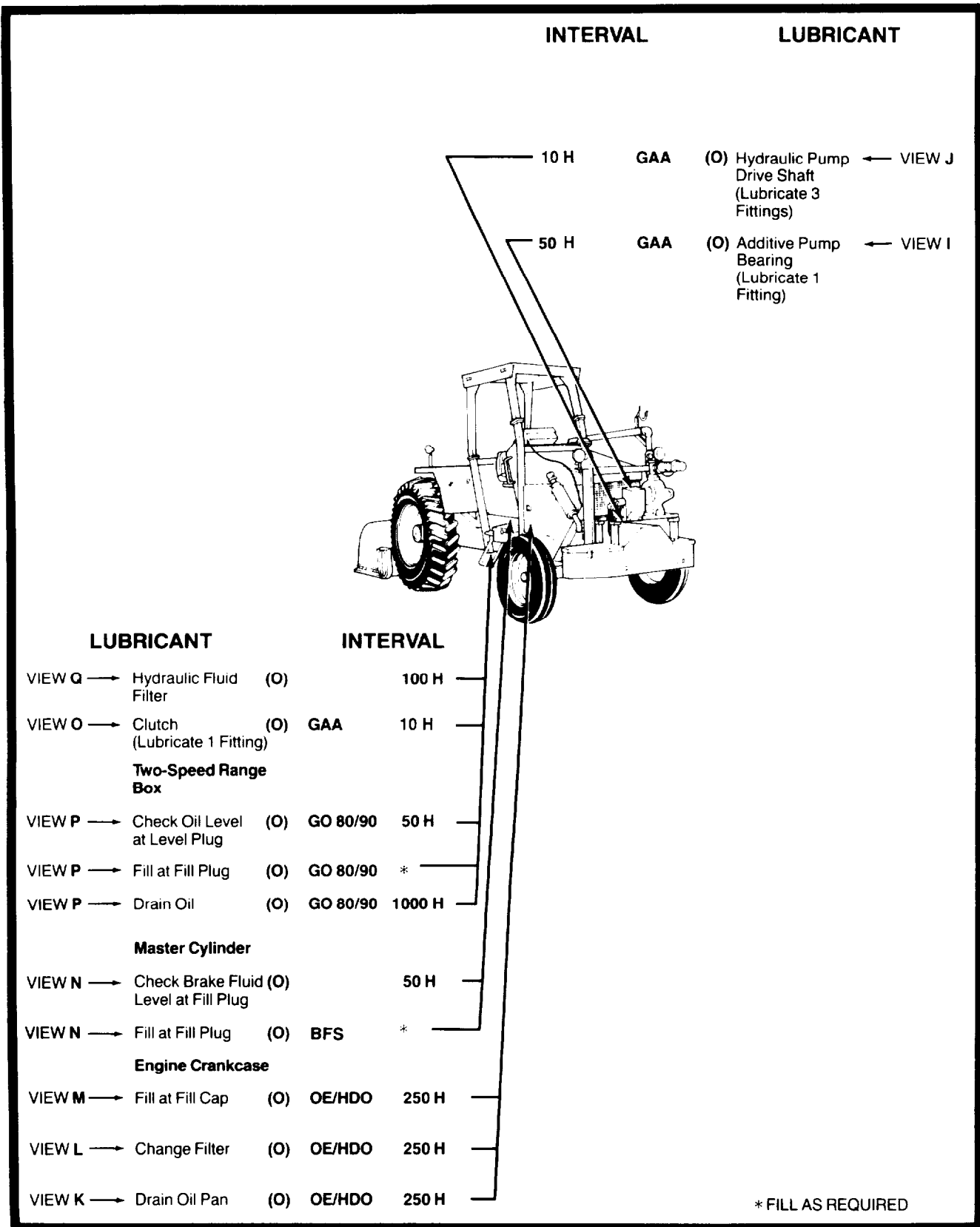


Figure 3-1. Lubrication Chart (Sheet 3)

- KEY -				
LUBRICATION POINT	CAPACITIES	EXPECTED TEMPERATURE		INTERVALS
		- 25°F to + 14°F (- 32°C to - 10°C)	+ 14°F to + 120°F (- 10°C to + 48°C)	
Engine Crankcase	15 qt (14.22 l)	OE/HDO-10 LUBRICATING OIL, TACTICAL (MIL-L-2104)	OE/HDO-15/40 LUBRICATING OIL, TACTICAL (MIL-L-2104) (SEE NOTE 5)	
Boom Cylinder	As Req.	GAA GREASE AUTOMOTIVE AND ARTILLERY (MIL-G-10924) ALL TEMPERATURES		
Shackle Bolts	As Req.			
Rotor Drive Shaft	As Req.			
Tie Rod Ends	As Req.			
Kingpins	As Req.			
Wheel Hub	As Req.			
Pump Bearing	As Req.			
Axle Pivot Pin	As Req.			
Pump Drive Shaft	As Req.			
Steering Cylinder	As Req.			
Clutch	As Req.			
Drive Shaft	As Req.			
Pillow Block	As Req.			
Brake Pedal	As Req.			
Rotor Drive Assembly	5 qt (4.73 l)	GO 80/90 LUBRICATING OIL (MIL-L-2105C) ALL TEMPERATURES		
Wheel End Reduction Gears	As Req.			
Two-Speed Range Box	As Req.			
Differential	As Req.			
Hydraulic Oil Tank	42 gal (159.0 l)	OHT HYDRAULIC FLUID PETROLEUM BASE (MIL-H-6083) ALL TEMPERATURES		
Master Cylinder	.75 qt (.7 l)	BFS SILICONE BRAKE FLUID (MIL-B-46176)		

Figure 3-1. Lubrication Chart (Sheet 4)

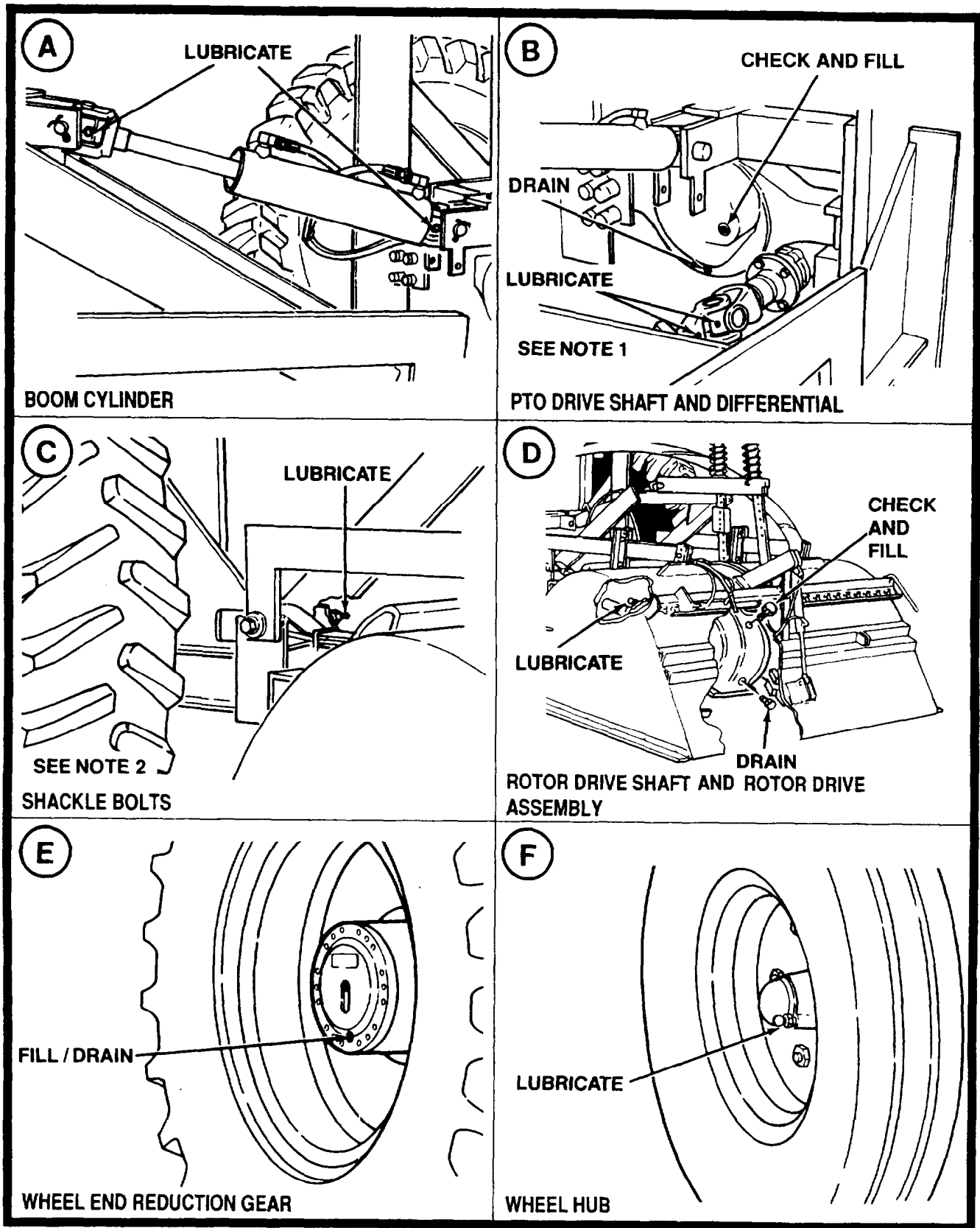


Figure 3-1. Lubrication Chart (Sheet 5)

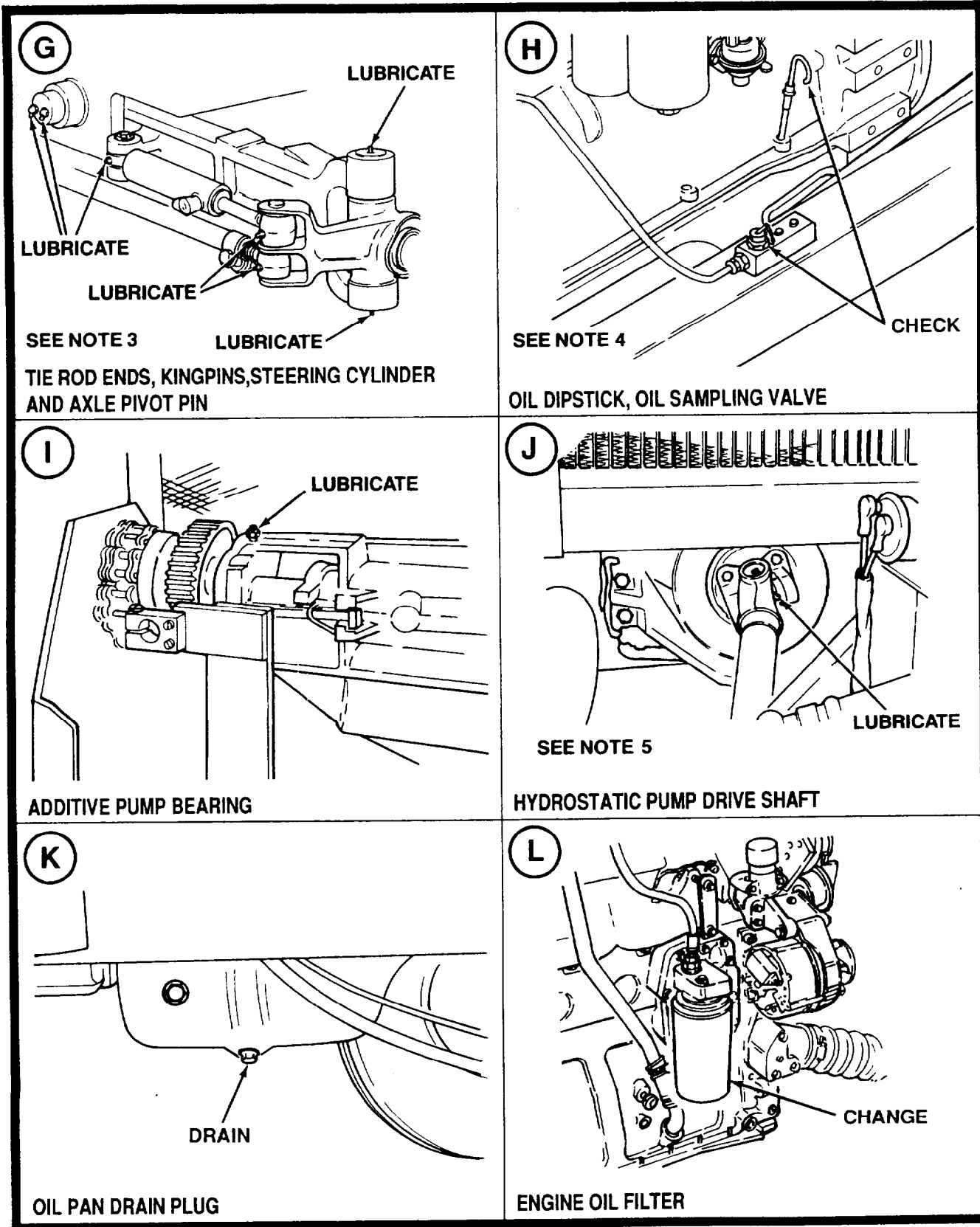


Figure 3-1. Lubrication Chart (Sheet 6)

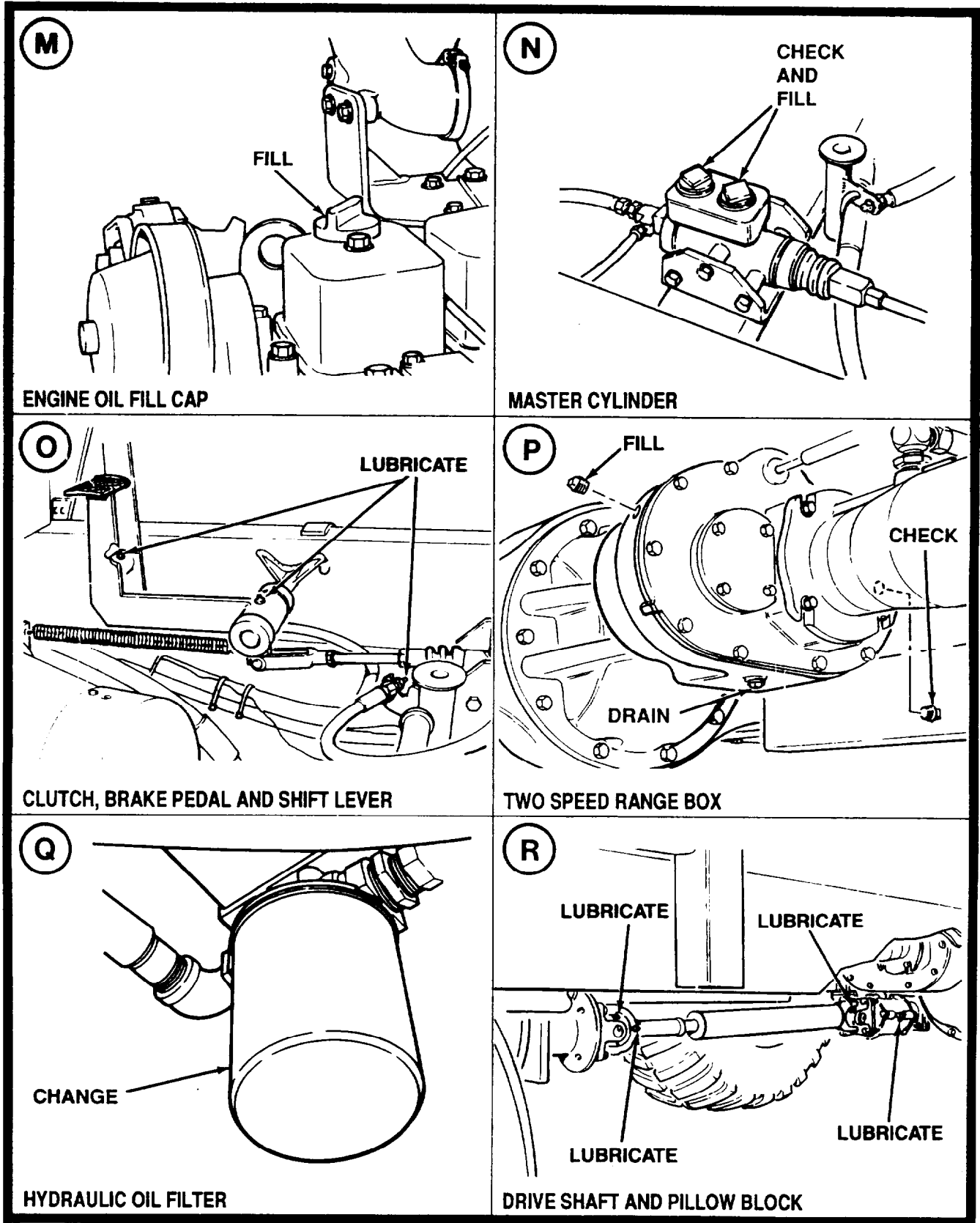


Figure 3-1. Lubrication Chart (Sheet 7)

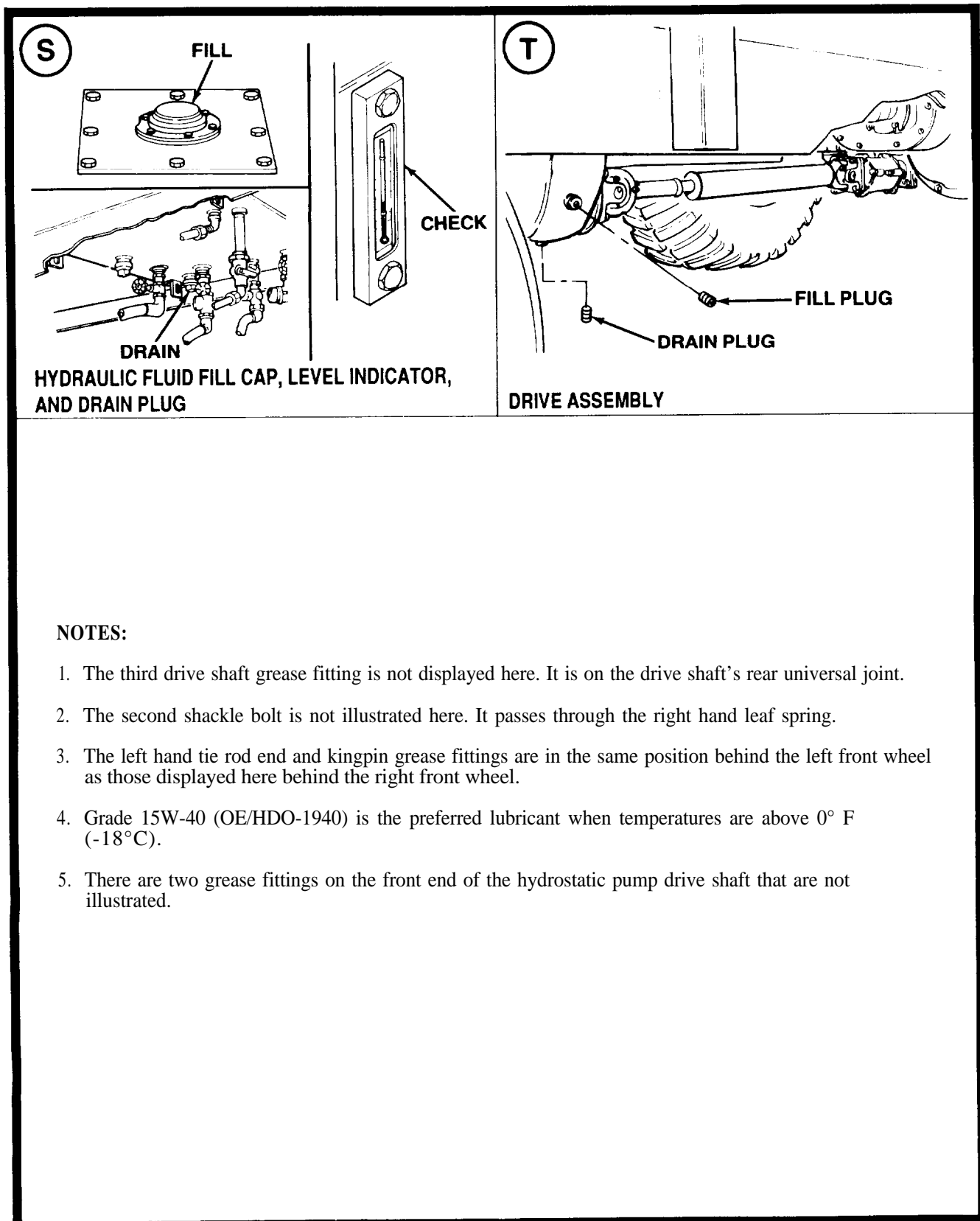


Figure 3-1. Lubrication Chart (Sheet 8)

SECTION II. OPERATOR TROUBLESHOOTING

3-2. TROUBLESHOOTING INTRODUCTION.

This section contains step by step procedures for identifying, locating, and isolating equipment malfunctions.

3-3. TROUBLESHOOTING SYMPTOMS.

Table 3-1 lists the most common malfunctions found during operation of the vehicle. Tests or inspections and corrective actions should be performed in the order listed. This symptom index lists corrective actions that can be performed by the operator. If a malfunction is not listed or a corrective action fails to correct a problem, notify unit maintenance.

Table 3-1. Operator Troubleshooting Symptom Index

Troubleshooting Procedure	Page
ENGINE	
1. Engine cranks but will not start	3-13
2. Engine does not develop full power	3-13
3. Engine hard to start or will not start - no smoke from exhaust	3-14
4. Engine starts but will not keep running	3-14
5. Engine idles rough	3-14
6. Engine will not reach rated speed	3-15
7. Engine fails to develop full power	3-15
8. Engine exhaust smokes excessively	3-15
9. Engine will not stop running	3-15
10. Engine operating temperature too high	3-15
ELECTRICAL SYSTEM	
1. Instrument panel lights do not operate	3-16
2. Gauges do not operate	3-16
3. Forward and/or rear floodlights do not operate	3-16
FUEL SYSTEM	
Engine starts and stops	3-16
ADDITIVE SYSTEM	
Additive pump fails to pump solution	3-17
ROTOR ASSEMBLY	
1. Boom cylinder stutters or will not raise and lower rotor assembly	3-18
2. Gate cylinder stutters or will not raise and lower railboard	3-18
3. Spray bar cylinder stutters or will not open and close spray bar	3-18

3-4. TROUBLESHOOTING PROCEDURES.

Table 3-2 contains the malfunctions listed in Troubleshooting Symptom Index (Table 3-1), test and inspection instructions required to determine cause of malfunction, and corrective actions for repairing the faulty equipment.

Table 3-2. Operator Troubleshooting Procedures

Malfunction	Test or Inspection	Corrective Action
ENGINE		
1. ENGINE CRANKS BUT WILL NOT START.		
	Step 1. Check indication on fuel gauge (para 3-10).	<p>If fuel gauge reads empty, refill tank (para 3-10).</p> <p>If fuel gauge indicates there is fuel in the tank, go to step 2.</p>
	Step 2. Check that fuel shutoff valve is open (para 2-17).	<p>If valve is closed, open valve (para 2-17).</p> <p>If valve is open, go to step 3.</p>
	Step 3. Turn fuel/water separator petcock to drain water from separator.	<p>If engine still does not start, go to step 4.</p>
	Step 4. Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
2. ENGINE DOES NOT DEVELOP FULL POWER.		
	Step 1. Check that the fuel shutoff valve is completely open.	<p>If valve is partially closed, open valve completely.</p> <p>If the valve is open, go to step 2.</p>

Table 3-2. Operator Troubleshooting Procedures - CONT.

Malfunction	Test or Inspection	Corrective Action
ENGINE (CONT)		
2. ENGINE DOES NOT DEVELOP FULL POWER (CONT).	Step 2 Check fuel level indicator (para 3-10).	<p>If level indicator shows fuel tank empty, fill fuel tank (para 3-10).</p> <p>If level indicator shows fuel in tank, go to step 3.</p>
	Step 3. Remove fuel tank fill cap and visually check fuel level (para 3-10).	<p>If tank is empty, refill and notify unit maintenance that fuel gauge does not work.</p> <p>If tank is not empty, go to step 4.</p>
	Step 4. Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
3. ENGINE HARD TO START OR WILL NOT START - NO SMOKE FROM EXHAUST.	Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
4. ENGINE STARTS BUT WILL NOT KEEP RUNNING.	Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
5. ENGINE IDLES ROUGH.	Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>

Table 3-2. Operator Troubleshooting Procedures - CONT.

Malfunction	Test or Inspection	Corrective Action
ENGINE (CONT)		
6. ENGINE WILL NOT REACH RATED SPEED.	Check fuel supply valve (para 2-17).	<p>If valve is fully or partially closed, open valve completely (para 2-17).</p> <p>If valve is fully open, notify unit maintenance.</p>
7. ENGINE FAILS TO DEVELOP FULL POWER.	Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
8. ENGINE EXHAUST SMOKES EXCESSIVELY.	Check air filter (para 3-8).	<p>If air filter is clogged, replace filter (para 3-8).</p> <p>If air filter is clean, notify unit maintenance.</p>
9. ENGINE WILL NOT STOP RUNNING.	Shut fuel valve under fuel tank and notify unit maintenance.	
10. ENGINE OPERATING TEMPERATURE TOO HIGH.	Step 1. Check radiator coolant level (para 3-7).	<p>If coolant level is low, add coolant (para 3-7).</p> <p>If coolant level is normal, go to step 2.</p>
	Step 2. Check crankcase oil level (para 3-6).	<p>If oil level is below low mark, add oil (para 3-6).</p> <p>If oil level is normal, notify unit maintenance.</p>

Table 3-2. Operator Troubleshooting Procedures - CONT.

Malfunction	Test or Inspection	Corrective Action
ELECTRICAL SYSTEM		
1. INSTRUMENT PANEL LIGHTS DO NOT OPERATE.		
	Step 1. Ensure that ignition key switch turned ON.	If lights do not turn on, go to step 2.
	Step 2. Check instrument panel fuse (para 3-9).	If fuse is bad, replace fuse (para 3-9). If fuse is good, notify unit maintenance.
2. GAUGES DO NOT OPERATE.		
	Check instrument panel fuse (para 3-9).	If fuse is bad, replace fuse (para 3-9). If fuse is good, notify unit maintenance.
3. FORWARD AND/OR REAR FLOODLIGHTS DO NOT OPERATE.		
	Step 1. Ensure light switch is turned ON.	If light switch is turned ON, go to step 2.
	Step 2. Check floodlight fuse (para 3-9).	If fuse is bad, replace (para 3-9). If fuse is good, notify unit maintenance.
FUEL SYSTEM		
ENGINE STARTS AND STOPS.		
	Step 1. Check fuel level (para 3-10).	If fuel tank is empty, fill tank (para 3-10). If there is fuel in tank, go to step 2.

Table 3-2. Operator Troubleshooting Procedures - CONT.

Malfunction	Test or Inspection	Corrective Action
FUEL SYSTEM (CONT)		
ENGINE STARTS AND STOPS (CONT).		
Step 2.	Check fuel shutoff valve (para 2-17).	If shutoff valve is not fully open, open valve completely (para 2-17).
		If shutoff valve is fully open, notify unit maintenance.
ADDITIVE SYSTEM		
ADDITIVE PUMP FAILS TO PUMP SOLUTION.		
Step 1.	Ensure that end of feed hose is submerged in additive solution in supply tank.	If feed hose is not submerged in additive solution, submerge end of hose in solution.
		If feed hose is submerged in additive solution, go to step 2.
Step 2.	Check feed hose and camlock fittings for cuts and damage that break additive pump suction.	If feed hose has cuts and breaks that break additive pump suction, disconnect feed hose (para 2-12[c]) and replace.
		If feed hose is not defective, go to step 3.
Step 3.	Check gasket on pump camlock fitting.	If gasket is damaged or missing, disconnect feed hose (para 2-12[c]) and replace gasket.
		If gasket is not defective, go to step 4.
Step 4.	Check hydraulic fluid level (para 3-11).	If level is low, add hydraulic fluid as necessary (para 3-11).
		If level is normal, go to step 5.
Step 5.	Check hydrostatic gear pump supply valve (para 2-18).	If valve is not fully open, open valve completely (para 2-18).
		If valve is fully open, notify unit maintenance.

Table 3-2. Operator Troubleshooting Procedures - CONT.

Malfunction	Test or Inspection	Corrective Action
ROTOR ASSEMBLY		
1. BOOM CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER ROTOR ASSEMBLY.	Step 1. Check hydraulic fluid level (para 3-11).	If level is low, add hydraulic fluid as necessary (para 3-11). If level is normal, go to step 2.
	Step 2. Check hydrostatic gear pump supply valve (para 2-18).	If valve is not fully open, open valve completely (para 2-18). If valve is fully open, notify unit maintenance.
2. GATE CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER TAILBOARD.	Step 1. Check hydraulic fluid level (para 3-11).	If level is low, add hydraulic fluid as necessary (para 3-11). If level is normal, go to step 2.
	Step 2. Check hydrostatic gear pump supply valve (para 2-18).	If valve is not fully open, open valve completely (para 2-18). If valve is fully open, notify unit maintenance.
3. SPRAY BAR CYLINDER STUTTERS OR WILL NOT OPEN AND CLOSE SPRAY BAR.	Step 1. Check hydraulic fluid level (para 3-1 1).	If level is low, add hydraulic fluid as necessary (para 3-11). If level is normal, go to step 2.
	Step 2. Check hydrostatic gear pump supply valve (para 2-18).	If valve is not fully open, open valve completely (para 2-18). If valve is fully open, notify unit maintenance.

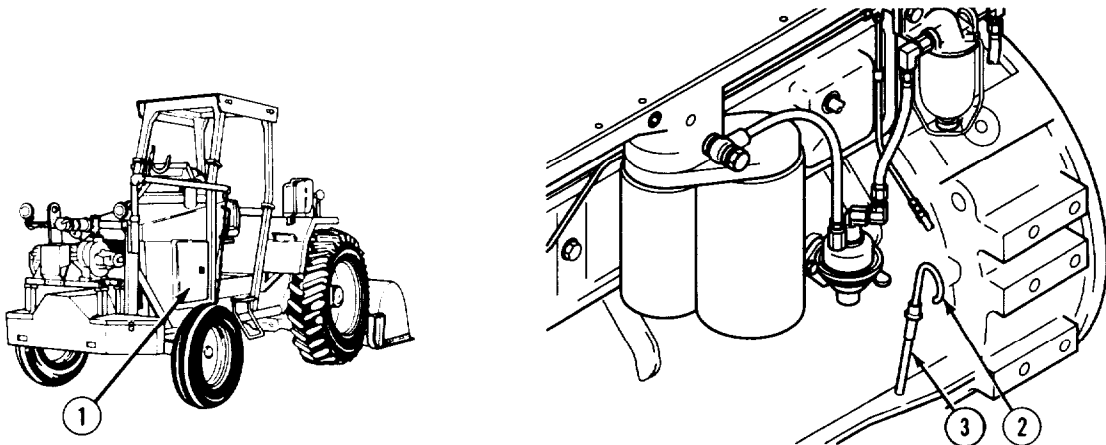
Section III. OPERATOR MAINTENANCE PROCEDURES

3-5. OPERATOR MAINTENANCE INTRODUCTION.

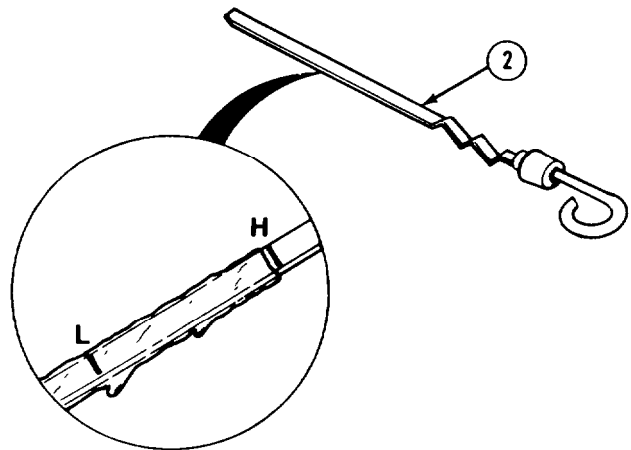
This section covers authorized operator maintenance tasks. The tasks covered in this section are defined in the MAC and limited to the inspection and servicing of vehicle components.

3-6. ENGINE OIL LEVEL CHECK AND SERVICE.

a. Oil Level Check.



- (1) Open engine access door (1).
- (2) Remove oil dipstick (2).
- (3) Wipe oil from dipstick (2).
- (4) Insert dipstick (2) in dipstick tube (3).
- (5) Remove dipstick (2).
- (6) Check oil level. Oil level should be between H and L marks on dipstick (2).
- (7) Add oil as necessary (para 3-5).
- (8) Install dipstick (2).



3-6. ENGINE OIL LEVEL CHECK AND SERVICE (CONT).

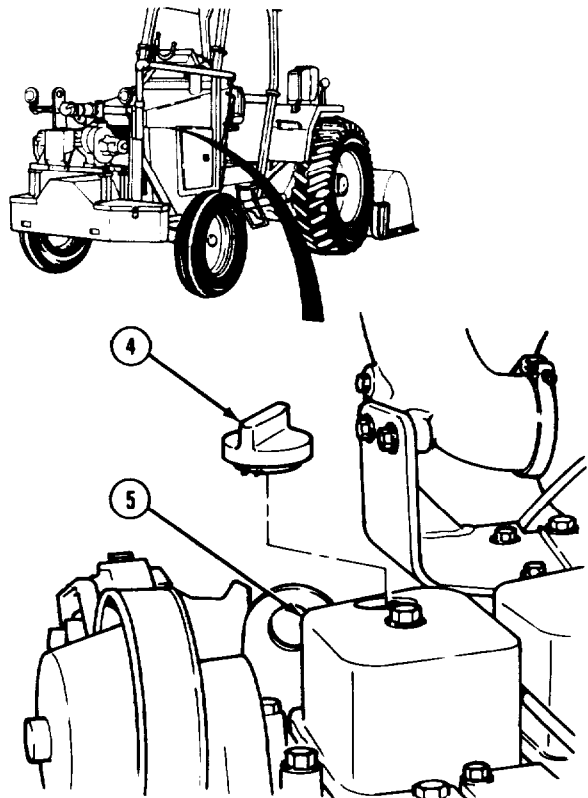
b. Oil Level Service.

- (1) Remove oil fill cap (4) from valve cover (5).

CAUTION

Do not overfill crankcase with engine oil or serious damage will occur to engine.

- (2) Add oil according to lubrication chart (Figure 3-1).
- (3) Install oil filler cap (4) on valve cover (5).
- (4) Check crankcase oil level (para 3-6[a]).

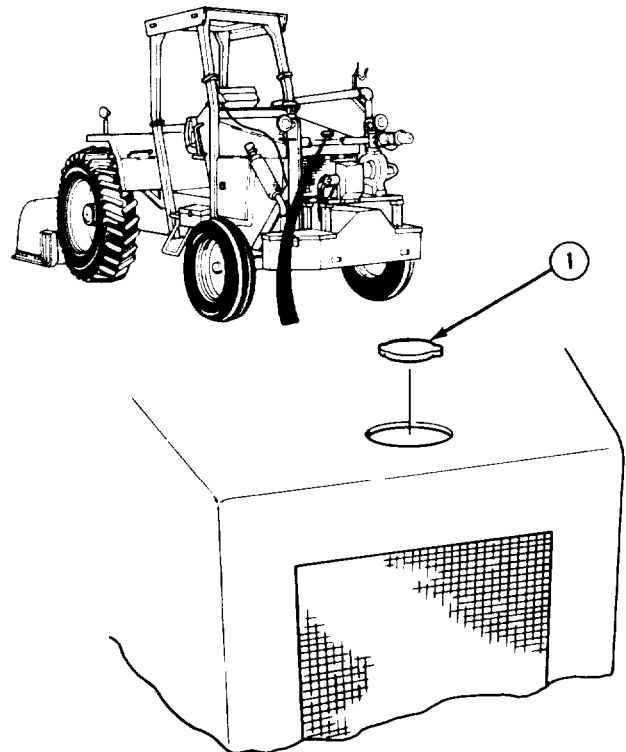


3-7. ENGINE COOLANT CHECK AND SERVICE.

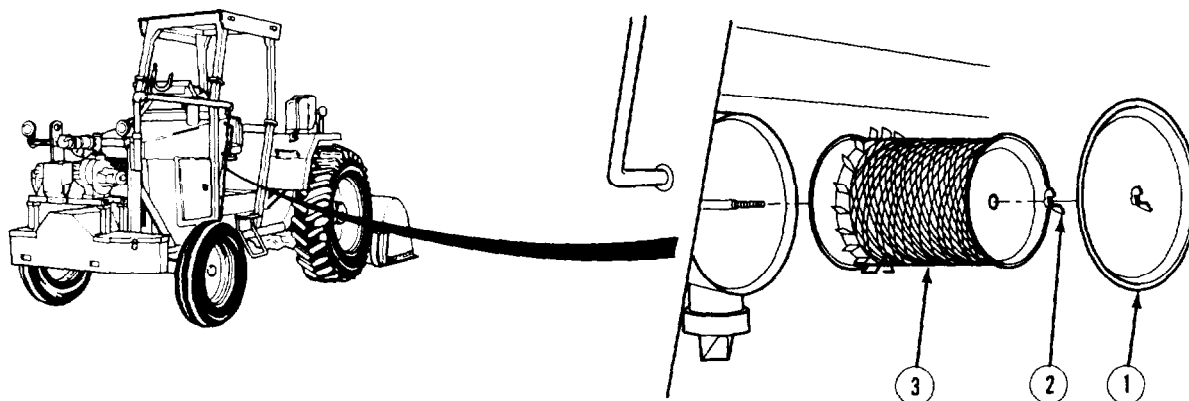
WARNING

Use extreme care when removing the radiator pressure cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel.

- a. Place clean, thick waste cloth over radiator cap (1).
- b. Slowly loosen cap (1) to first stop.
- c. Allow pressure to dissipate completely.
- d. Remove cap (1).
- e. If necessary, add coolant/antifreeze at 50/50 concentration of coolant/antifreeze to water.



3-8. AIR FILTER INSPECTION AND SERVICE.



WARNING

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

a. Removal.

NOTE

Nut used to secure air cleaner cover in place is a captive nut and remains with cover during removal.

- (1) Remove cover (1).
- (2) Remove wing nut (2) and air filter (3).

b. Cleaning/Inspection.

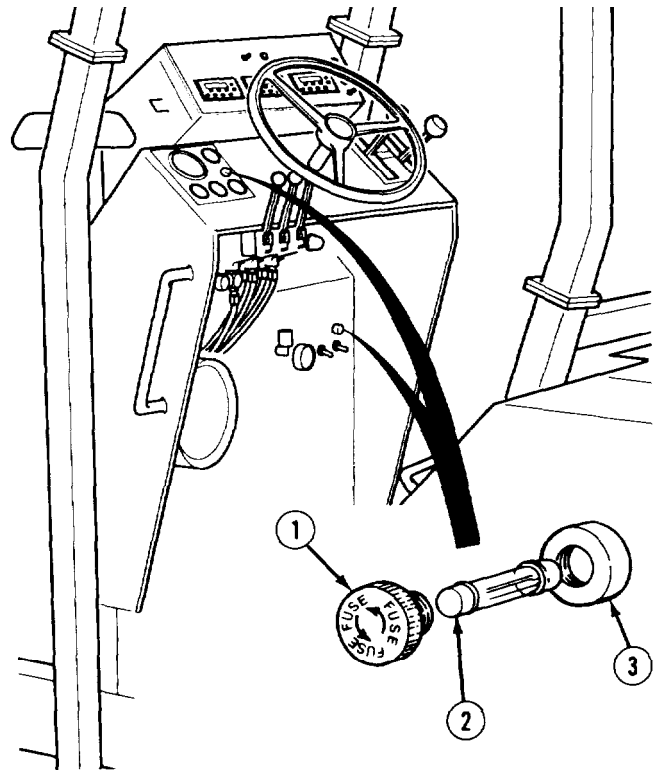
- (1) Hold air filter (3) up to light.
- (2) If light dims or cannot be seen through filter (3), replace filter.
- (3) If light can be seen through filter (3), install filter.

c. Installation.

- (1) Install air filter (3) and wingnut (2).
- (2) Install cover (1).

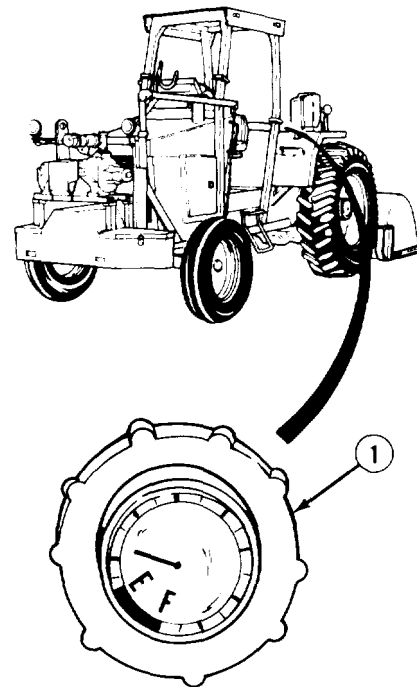
3-9. ELECTRICAL SYSTEM FUSES INSPECTION AND REPLACEMENT:

- a. Remove fuse cap (1).
- b. Remove and inspect fuse (2).
- c. If fuse element is broken, replace fuse (2).
- d. Insert fuse (2) in receptacle (3).
- e. Install fuse cap (1).



3-10. FUEL TANK CHECK AND SERVICE.

- a. **Fuel Tank Check and Service.**
 - (1) Stop vehicle (para 2- 10).
 - (2) Check fuel cap (1) level gauge.
 - (3) Add fuel as necessary (para 3-10[b]).

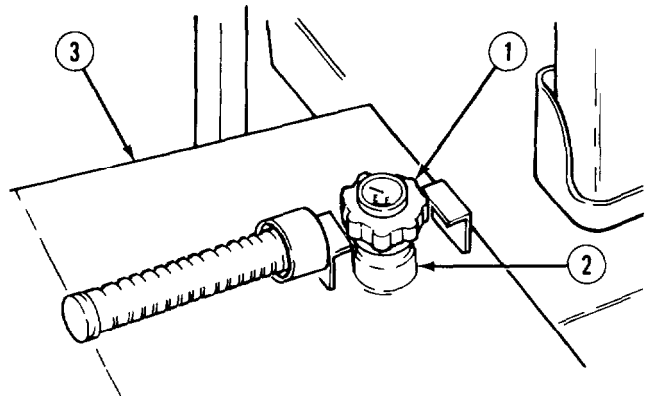


b. Refueling Procedures**WARNING**

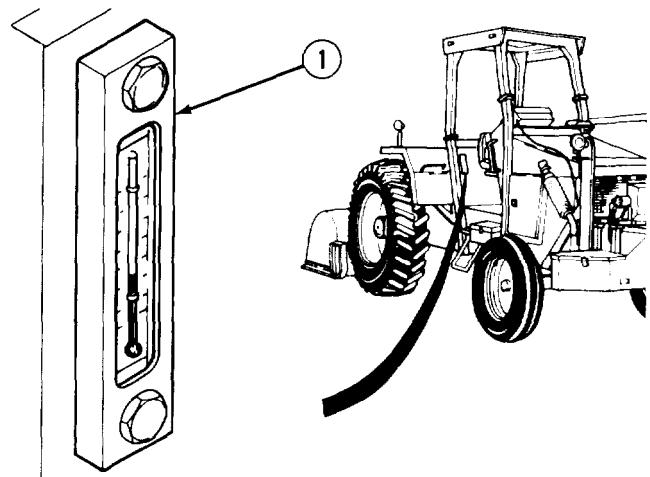
Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep at least a B-C fire extinguisher within easy reach when working with fuel or fuel system.
- When refueling, stop engine, and apply parking brake. Ensure no open flame is near area. Never smoke. Never add fuel when engine is running. Do not have a driver seated when adding fuel.
- Ground fuel funnel or nozzle against filler neck to prevent sparks and be sure to replace fuel tank cap. After fuel is added, securely close fuel cap; a loose cap can cause a fuel leak or be a fire hazard.
- Never overfill the tank or spill fuel. If fuel is spilled, clean it up immediately. Before starting vehicle, check that no fuel is spilled on or around vehicle.

- (1) Stop vehicle (para 2-10).
- (2) Turn ignition to off position (Table 2-1).
- (3) Set parking brake (para 2-13).
- (4) Remove fuel tank cap (1).
- (5) Ground funnel or nozzle against mouth of filler hole (2).
- (6) Fill fuel tank (3).
- (7) Close cap (1) securely.

**3-11. HYDRAULIC FLUID TANK CHECK AND SERVICE.**

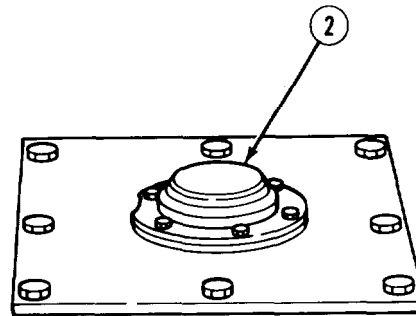
- a. Check hydraulic fluid level indicator (1).
- b. If fluid is required, remove cap (2).



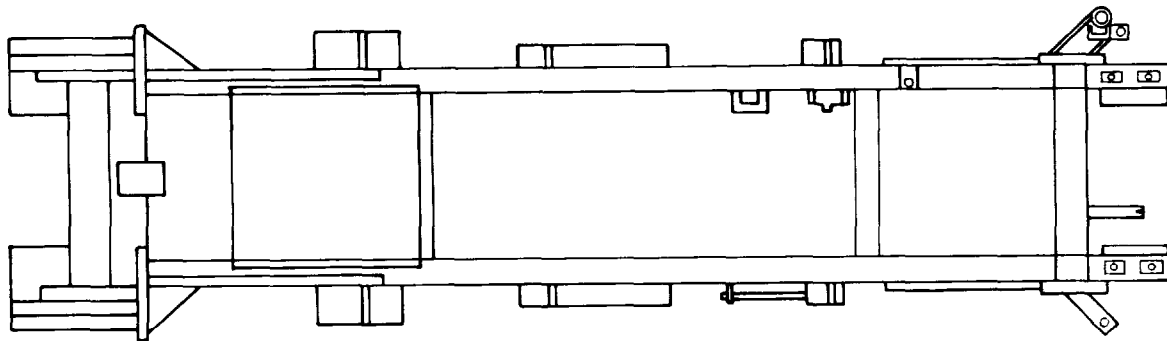
3-11. HYDRAULIC FLUID TANK CHECK AND SERVICE (CONT).

c. Add hydraulic fluid according to lubrication instructions (Figure 3-1) as necessary.

d. Install cap (2) securely.



3-12. MAIN FRAME INSPECTION.



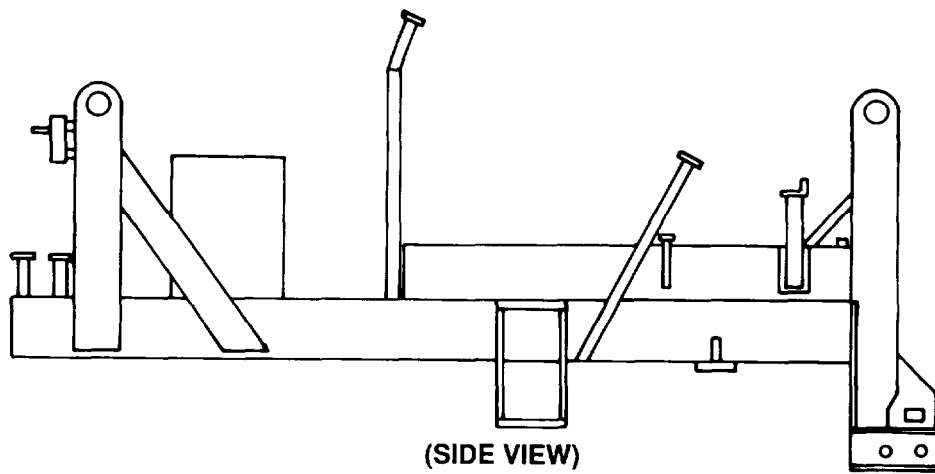
**VEHICLE ATTACHMENT DETAILS
REMOVED FOR CLARITY**

(TOP VIEW)

NOTE

It is only necessary to remove those items which would prevent an accurate inspection of frame assembly. To save time on removal and installation, inspect frame in sections. Remember, much of frame can be inspected from beneath vehicle.

- a. Check for dents or cracks in metal.
- b. Check welds for cracks and inconsistency.
- c. Check screws and screw holes for irregular size and shape.



- d. Check for excessive corrosion and wear on frame.
- e. Check for chipped paint.
- f. If faults are discovered that will impair safe operation, notify unit maintenance.

CHAPTER 4

UNIT MAINTENANCE INSTRUCTIONS

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Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT 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), CTA 50-970 or CTA 8-100, as applicable to your unit. Table 4-1 lists tool kits required and authorized for use at unit maintenance. Reference code numbers listed in column one correspond to those listed in the same column on the MAC.

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

The Maintenance and Allocation Chart (MAC) identifies the authority and responsibility for maintenance tasks listed in this manual. Tool kits, test equipment, and diagnostic equipment required for performing unit maintenance tasks are also identified in the MAC. The Mixer, Rotary Tiller Repair Parts and Special Tools List (RPSTL), TM 5-3895-369-24P lists special tools, TMDE, and support equipment required to perform unit support maintenance procedures contained in this manual.

4-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-3895-369-24P, covering unit maintenance for the vehicle.

Table 4-1. Authorized Unit Support Tool Kits

Tool or Test Equipment Ref Code	Maintenance Level	Nomenclature	Tool Kit Stock Number
1	O, F, H	Tool kit, general mechanic's: automotive	5180-00-177-7033
	O, F, H	Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power	4910-00-754-0653
	O, F, H	Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power	4910-00-754-0654
	O, F, H	Shop equipment, organizational repair: light truck mounted	4910-01-236-0166
	O, F, H	Test set, battery: AN/PSM-13	6625-00-868-8344
	O, F, H	Analyzer set, engine: portable solid state (ST-E/ICE-PM)	4910-01-222-6589

Section II. SERVICE UPON RECEIPT

Level A or level C methods are used to prepare the vehicle for shipment. The following procedures provide instructions for unpacking and preparing the vehicle for use. These instructions will apply to both levels of preparation. Service Upon Receipt instructions are divided into three areas: unpacking, inspection, and servicing.

4-4. UNPACKING UPON RECEIPT INSTRUCTIONS.

Components with unpainted and exposed surfaces are wrapped and taped to protect them during shipment. Packing materials and tape must be removed from the following components before inspecting them:

- Gate cylinder piston rod
- Spray bar cylinder piston rod
- Rotor boom cylinder piston rod
- Seat back and cushion
- Throttle control lever
- Transmission control lever
- Three valve bank assembly levers
- Hydraulic fluid vacuum gauge
- Air restriction indicator
- Instrument panel covers
- Front and rear floodlights
- Hose boom
- Radiator

4-5. INSPECTION UPON RECEIPT INSTRUCTIONS.

- a. Make a visual inspection to ensure all basic issue items, publications, accessories, and attachments are present.
- b. Check all gauges and instruments for damage that may have occurred during transport. Refer to Table 2-1 for locations of control and instruments (gauges).
- c. Check for loose attaching hardware and tighten as necessary.
- d. Check all electrical connections and tighten as necessary.
- e. Check additive system hoses for damage and/or loose connections. Repair any damaged components.

4.6 SERVICE UPON RECEIPT INSTRUCTIONS.

- a. Clean all preservative from vehicle.
- b. Remove all preservative barrier material from vehicle components.
- c. Install front and rear floodlights (para 4-81).
- d. Install batteries and cables (paras 4-87,4-88 and 4-90).

NOTE

Crankcase is filled with preservation oil, MIL-P-21260. This preservation oil can remain in crankcase until the first scheduled oil change.

- e. Drain preservation oil from crankcase oil (para 4-24) and add oil as necessary; refer to Lubrication Chart (Figure 3-1).

- f. Install oil filler cap (para 3-6).
- g. Install dipstick (para 4-33).
- h. Install engine breather tube (para 4-32).
- i. Check hydraulic fluid level (para 3-11) and add hydraulic fluid as necessary; refer to Lubrication Chart (Figure 3-1).
- j. Purge fuel tank of preservation oil according to depreservation guides shipped with vehicle.
- k. Fill fuel tank (para 3-10).
- l. Ensure tire pressure is 40 psi (276 kPa) for front and 20 psi (138 kPa) for rear.
- m. Purge preservation oil from fuel system according to depreservation guides shipped with vehicle.
- n. Remove vandal covers.
- o. Perform Preventive Maintenance Checks and Services in Section III.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-7. PMCS INTRODUCTORY MATERIAL.

This section contains PMCS instructions for the vehicle. The PMCS Table contains checks and services necessary to ensure that the vehicle is ready for operation. Unit PMCS procedures are defined by the MAC. Unit PMCS is performed at the intervals specified in Table 4-2. Preventive Maintenance Checks and Services in Chapter 2 should be completed before performing unit PMCS.

4-8. MAINTENANCE FORMS AND RECORDS.

Maintenance forms and records provide permanent records of maintenance services, repairs, and modifications made on the vehicle. They provide reports to organizational maintenance and the commander, and they serve as a checklist to find out what was wrong with the vehicle after its last use and whether those faults have been fixed. For information needed on forms and records, see DA Pam 738-750.

4-9. GENERAL PMCS PROCEDURES AND CONDITIONS.

The following paragraph describes general procedures and conditions that should be observed when performing PMCS.

a. General/ Guidelines.

- (1) Limit repairs to those actions necessary to ensure mission reliability, safety of personnel, and prevention of further damage or deterioration. Repairs, replacements, or services for cosmetic purposes are forbidden.
- (2) Lube oil sampling. Engine oil must be sampled at 50 hours of operation or 90 days, whichever occurs first, for Active Army Units. Reserve and National Guard Activities will use 50 hours or 180 days, whichever occurs first, as the prescribed interval. Hydraulic fluid will be sampled once-a-year. Sampling will be performed as prescribed by DA Pam 738-750.

4-9. GENERAL PMCS PROCEDURES AND CONDITIONS (CONT).

(3) Lube oil filters. Oil filters shall be serviced/cleaned/changed as applicable when they are known to be contaminated, or clogged; service is recommended by AOAP laboratory analysis; or at prescribed hard time intervals.

(4) Hydraulic systems (other than brake systems) may have class III leakage and not be cause for deadlining. Components, such as actuating cylinders, are designed to allow a certain amount of fluid to pass by the ram seal to lubricate the seal and ram. This could be interpreted as a class III leak. The decision as to whether or not the vehicle should be deadlined is based upon good mechanical knowledge and common sense.

(5) Corrosion prevention and control (CPC). It is important that any corrosion problem with this vehicle be reported so that the problem can be corrected and improvements can be made to prevent the problem in other vehicles. Corrosion should be reported using Standard Form 368, Product Quality Deficiency Report (QDR). Use keywords such as **corrosion, rust, deterioration, or cracking** to ensure that the information is identified as a CPC problem. Send Std Form 368 to Commander, U.S. Army TACOM, Attn: AMSTA-QRD, Warren, MI 48397-5000.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

b. Cleanliness. Dirt, grease, oil, and debris can cover and hide serious problems. Use drycleaning solvent (item 54, appendix E) on all metal surfaces.

c. Bolts, Nuts, and Screws. Check bolts, nuts and, screws for obvious looseness, missing, bent, or broken condition. Look for chipped paint, bare metal, or rust around bolt heads. If any part seems loose, tighten.

d. Welds. Look for loose or chipped paint, rust, or gaps where parts are welded together. If bad welds are found, notify direct support maintenance.

e. Electric Wires and Connectors. Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure wires are in good shape. If bad wires or connectors are found, replace as necessary.

f. Hydraulic Lines and Fittings. Look for wear, damage, and leaks and make sure clamps and fittings are tight. Wet spots show leaks, and a stain around a connector or fitting can mean a leak. If a loose fitting or connector causes a leak, tighten it.

g. Damage is defined as: any conditions that affect safety or render the vehicle unusable for mission requirements.

h. Always perform PMCS in the same order until it becomes a habit. Once practiced, it will be easy to spot anything wrong.

i. If something does not work, refer to troubleshooting instructions in Chapter 3 and this chapter.

- j. If anything looks wrong and is too difficult to fix, write it on DA Form 2404 and notify your supervisor.
- k. When doing PMCS, take tools and supplies needed to perform all tasks.

4-10. FLUID LEAKAGE DEFINITION.

The following paragraphs describe the different types/classes of leaks and how they affect the status of the vehicle. Class I and II leaks are considered minor leaks and operations can continue under these conditions. When operating with these types of leaks, fluid levels must be checked regularly as required in the PMCS.

- a. **Class I Leaks.** Class I leaks are identified by a wetness or discoloration not great enough to form drops. It is more of a seepage than a leak.
- b. **Class II Leaks.** Class II leaks are identified by a flow of fluid great enough to form drops but not great enough to cause the drops to fall from the leak point.
- c. **Class III Leaks.** Class III leaks are identified by a flow of fluid great enough to form drops that fall from the leak point.

(1) If a Class III leak is discovered before operating the vehicle, the vehicle can be operated as long as the fluid level is between the maximum and minimum points on the dipstick or sight glass. If the fluid level is below the minimum point on the dipstick or sight glass, do not operate the vehicle until refilled.

(2) If a Class III leak is discovered during operation of the vehicle, the operation can be completed as long as the leak is drops only and not a steady stream of fluid. The fluid level must also be within its operating range. If the leak is a steady stream and/or fluid level falls below minimum point on dipstick or sight glass, turn off the vehicle.

(3) If a Class III leak is discovered after operation is complete and the vehicle fluid level is below minimum on dipstick or sight glass, the vehicle cannot be operated until the leak is repaired.

4-11. PMCS TABLE DESCRIPTION.

The PMCS Table is arranged in columns which inform unit maintenance which item is being inspected/serviced, when a vehicle assembly or component should be inspected/serviced, where the item is located, and the procedures necessary to accomplish the task.

a. **Item No. The Item No.** column provides a logical sequence for performing the PMCS tasks. The items being inspected can be visible, inside, or under the vehicle.

b. **Interval.** The Interval column provides the appropriate time interval for performing each task. This column lists the time intervals within which the tasks should be performed. Intervals are broken into two groups: months of operation and hours of operation. In all cases, checks of items in the PMCS table should be performed under whichever interval occurs first.

c. **Location.** This column lists the name of the assembly or component to be inspected/serviced and its location on the vehicle.

d. **Procedure.** The Procedure column provides instructions necessary to accomplish the inspection/service. It also lists important Warnings, Cautions, and Notes related to each task. If a task is covered elsewhere in manual, it is referenced instead by paragraph number rather than being repeated in this column.

Table 4-2. Unit Preventive Maintenance Checks and Services

Item No.	Interval		Item to Be Inspected	Procedure
	Mo	Hr		
			<u>ENGINE</u>	
1	3	250	Engine crankcase	Change the lube oil and filter (paras 4-24 and 4-35). Refer to Chapter 3, Section I.
2	6	500	Fuel filters	Change fuel filters (para 4-52). Bleed fuel system if required (para 4-54).
3	12	1000	Valves	Adjust valve lash clearance (para 4-30): Intake - 0.010 in. (0.254 mm) Exhaust - 0.020 in. (0.508 mm)
4	6	500	Radiator	Check the anti-freeze concentration. Add enough anti-freeze to protect the engine to -24°F (-31°C) (para 3-7).
5	12	1000	Cooling system	Drain the cooling system (para 4-66). Check for damaged hoses, and loose or damaged hose clamps. Replace as required (para 4-62). Check radiator for leaks, damage, and build-up of dirt. Clean and repair as required (para 4-60). Flush the system until the water is clean. Use a mixture of 50% water and 50% anti-freeze. System capacity is 6 gal. (23 l).
6	12	1000	Drive belt, tensioner bearing, and fan hub	Check the belt deflection at the longest span of belt. Maximum deflection is 5/8 to 1/2 in. (9.5 - 12.7 mm). Replace belt if required (4-68). Check the tensioner and fan hub bearings. Should spin freely with no rough spots, wobble, or end play. Replace tensioner or fan hub if required (paras 4-69 and 4-67).
7	24	2000	Vibration damper	Check the index lines on the damper hub and the inertia member. If the lines are more than 1/16 in. (1.59 mm) out of alignment, notify direct support maintenance.
				<div style="border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;">WARNING</div> <p>If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal procedures.</p>
8	3	250	Air cleaner/intake system	Check/inspect air cleaner element (para 3-8). Tighten or replace parts as necessary to make sure air intake system does not leak (i.e. cracked hoses, loose clamps, punctures, etc.).

Table 4-2. Unit Preventive Maintenance Checks and Services - CONT.

Mo - Months

Hr - Hours

Item No.	Interval		Item to Be Inspected	Procedure
	Mo	Hr		
9	3	250	BRAKES	
			Parking	Check for damaged parts and proper operation (para 2-13).
10	6	500	Service brakes	Check service brakes operation, Adjust as necessary.
11	6	500	CLUTCH DRIVE ASSEMBLY	
			Clutch assembly	Inspect clutch play. Adjust clutch as necessary (para 4-38).
12	6	500	Drive assembly	Drain and fill with gear oil (para 4-39). Refer to Chapter 3, Section I.
13	12	1000	HYDRAULIC SYSTEM	
			Hydrostatic transmission	Check pump, motor, control valve and control linkage for proper operation. Adjust pump control linkage if required (para 4-55). If neutral position is difficult or impossible to find, notify direct support maintenance. Check charge pressure in neutral (190 to 210 psi minimum [1310 - 1448 kPa]). Check case drain pressure (40 psi [276 k P a]) .
14	1 2	500	Hydraulic tank	Change hydraulic fluid and filter (paras 4-29 and 4-140).
15	12	1000	Additive system hydraulics	Check motor, control valve, and control linkage for proper operation (para 2-12). Check the system for quiet operation, vibration, localized heating, and excessive seal or packing leakage. If improper operation, unusual noise, vibration or leaking is found, notify direct support maintenance.
16	12	1000	ADDITIVE SYSTEM	
			Pump assembly	Check for proper operation (para 2-12). If improper operation is found, notify direct support maintenance. Check relief valve pressure (75 psi [524-kPa]).
17	12	75	TGP/FPM/GPM digital meters	Check for proper operation. Check for presence and condition of vandal cover.
18	12	2 0 0 0	MIXER	
			Rotor hood	Check tailboard for damaged parts and proper operation (para 2-11). Check the hood adjusting bar stop block for proper adjustment.

Table 4-2. Unit Preventive Maintenance Checks and Services - CONT.

Item No.	Interval		Item to Be Inspected	Procedure
	MO	Hr		
19	12	2000	<u>MIXER-CONT</u> Tines, mixing	Check rotor tines for wear. Check attaching locknuts for tightness (para 4-173).
20	6	1000	Rotor drive assembly	Drain and change lube oil in drive assembly housing (para 4-27). Refer to Chapter 3, Section I.
21	12	1000	<u>REAR AXLE</u> Two-speed range box	Drain and fill with gear oil (para 4-25). Refer to Chapter 3, Section I. Check that operating temperature of the range box is between 100° to 180°F (38°C - 82°C).
22	12	1000	Wheel ends/planetary gears	Drain and fill with gear oil. Refer to Chapter 3, Section I..
23	12	4000	Axle assembly	Check for leaking oil seals. Check for damaged axle housing. Drain and fill with gear oil (para 4-26). Refer to Chapter 3, Section I..

Section IV. UNIT TROUBLESHOOTING.

4-12. TROUBLESHOOTING INTRODUCTION.

This section contains step by step procedures for identifying, locating, and isolating equipment malfunctions.

4-13. TROUBLESHOOTING SYMPTOMS.

Table 4-3 lists the most common malfunctions found during operation of the vehicle. Tests or inspections and corrective actions should be performed in the order listed. This symptom index lists corrective actions that can be performed by unit maintenance. If a malfunction is not listed, or corrective action fails to correct a problem, notify direct support maintenance.

4-14. UNIT TROUBLESHOOTING PROCEDURES.

Pages 4-14 through 4-153 contain the malfunctions listed in Troubleshooting Symptom Index (Table 4-3), test or inspection instructions required to determine cause of malfunction, and corrective actions for repairing the faulty equipment. Operator Troubleshooting Procedures (Table 3-2) should be completed before performing Unit Troubleshooting Procedures.

Table 4-3. Troubleshooting Symptom index**Engine Fault Index**

Fault	Description	Page
1.	Engine fails to crank or cranks slowly with clutch disengaged	4-14
2.	Engine cranks but will not start - no smoke from exhaust	4-22
3.	Engine hard to start or will not start - smoke from exhaust	4-26
4.	Engine starts but will not keep running	4-30
5.	Engine surges (speed changes)	4-34
6.	Engine idles rough	4-36
7.	Engine runs rough or misfires	4-44
8.	Engine rpm will not reach rated operating speed	4-50
9.	Engine fails to develop full power	4-54
10.	Engine exhaust smokes excessively	4-62
11.	Engine operating temperature too high	4-66
12.	Engine operating temperature too low	4-74
13.	Engine oil pressure too high	4-78
14.	Engine oil pressure too low	4-82
15.	Engine losing oil	4-88
16.	Fuel or oil leaking from exhaust manifold	4-92
17.	Compression knocks	4-94
18.	Excessive fuel consumption	4-96
19.	Excessive vibration	4-98
20.	Unusual engine noise	4-102
21.	Battery dead and will not hold a charge	4-110
22.	Alternator does not charge batteries	4-114

Additive System Fault Index

Fault	Description	Page
23.	Additive pump turns but will not pump additive solution	4-118
24.	Additive pump will not operate (will not turn)	4-126

Rotor Tiller Fault Index

Fault	Description	Page
25.	Boom cylinder stutters or will not raise and lower rotor assembly	4-132
26.	Gate cylinder stutters or will not raise and lower tailboard	4-136
27.	Spray bar cylinder stutters or will not open and close spray bar	4-140

Vehicle Fault Index

Fault	Description	Page
28.	Vehicle does not move forward or in reverse correctly	4-144
29.	Steering is difficult	4-148

1. ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED.

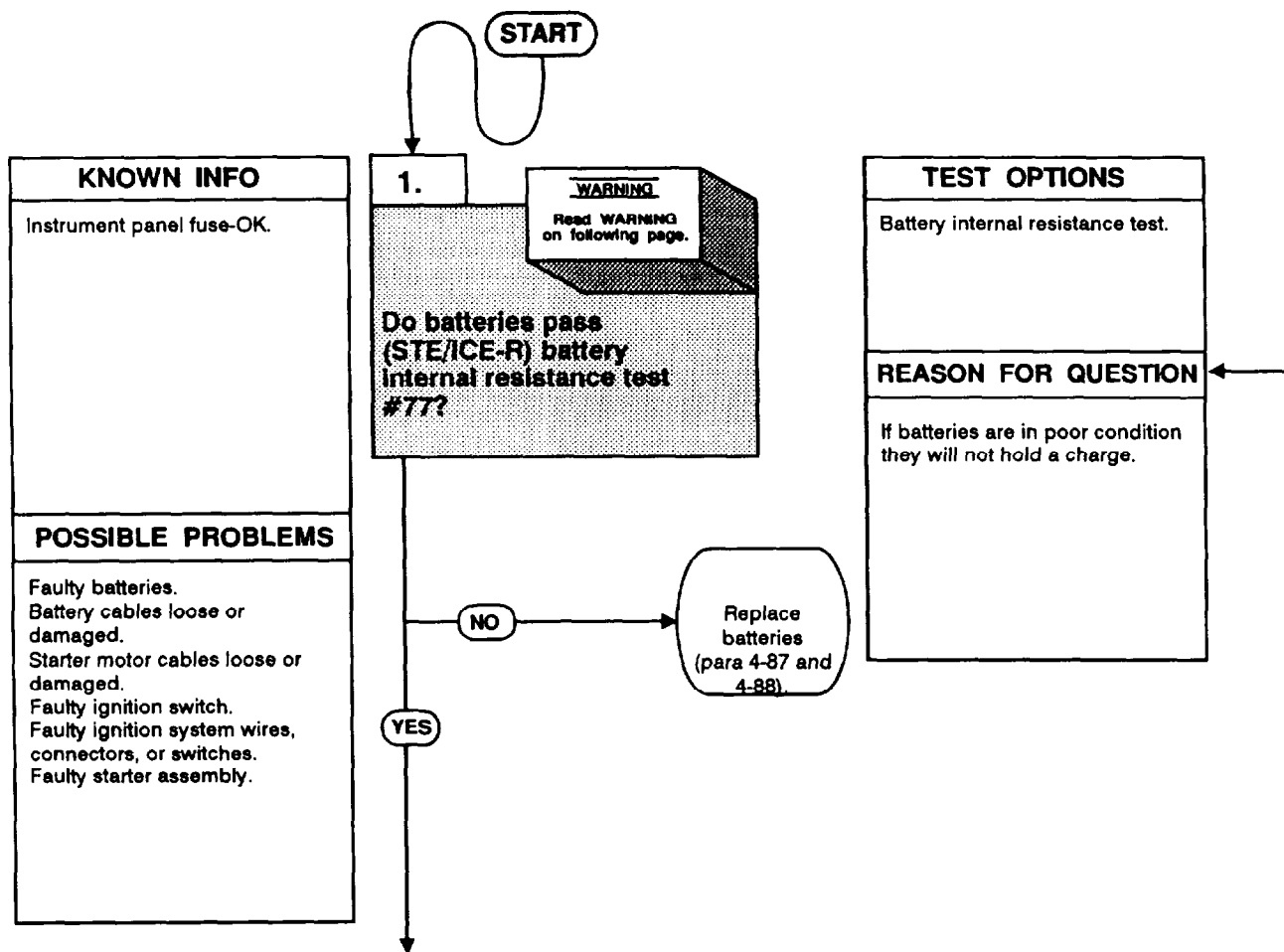
INITIAL SETUP

Equipment Conditions

- Engine shut off,(para 2-10[c]).
- Parking brake set,(para 2-13).
- Right engine door opened, (para 2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).

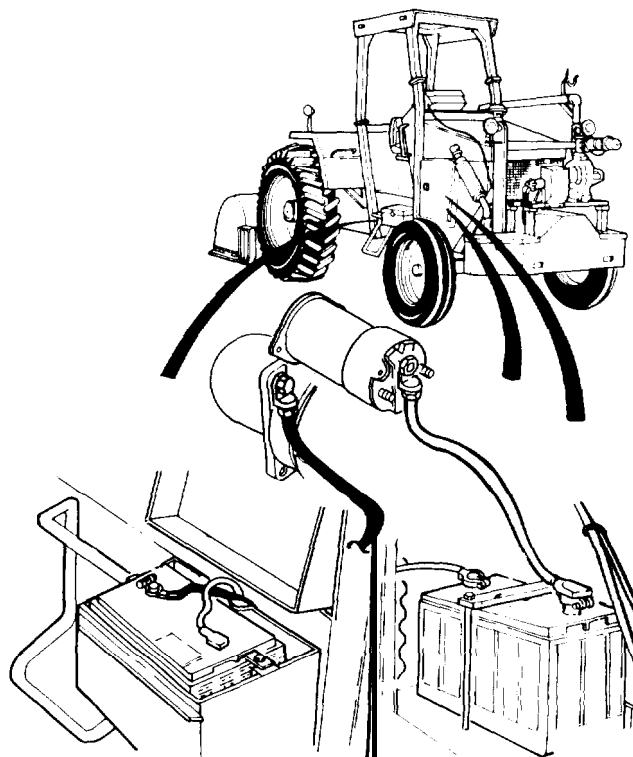


WARNING

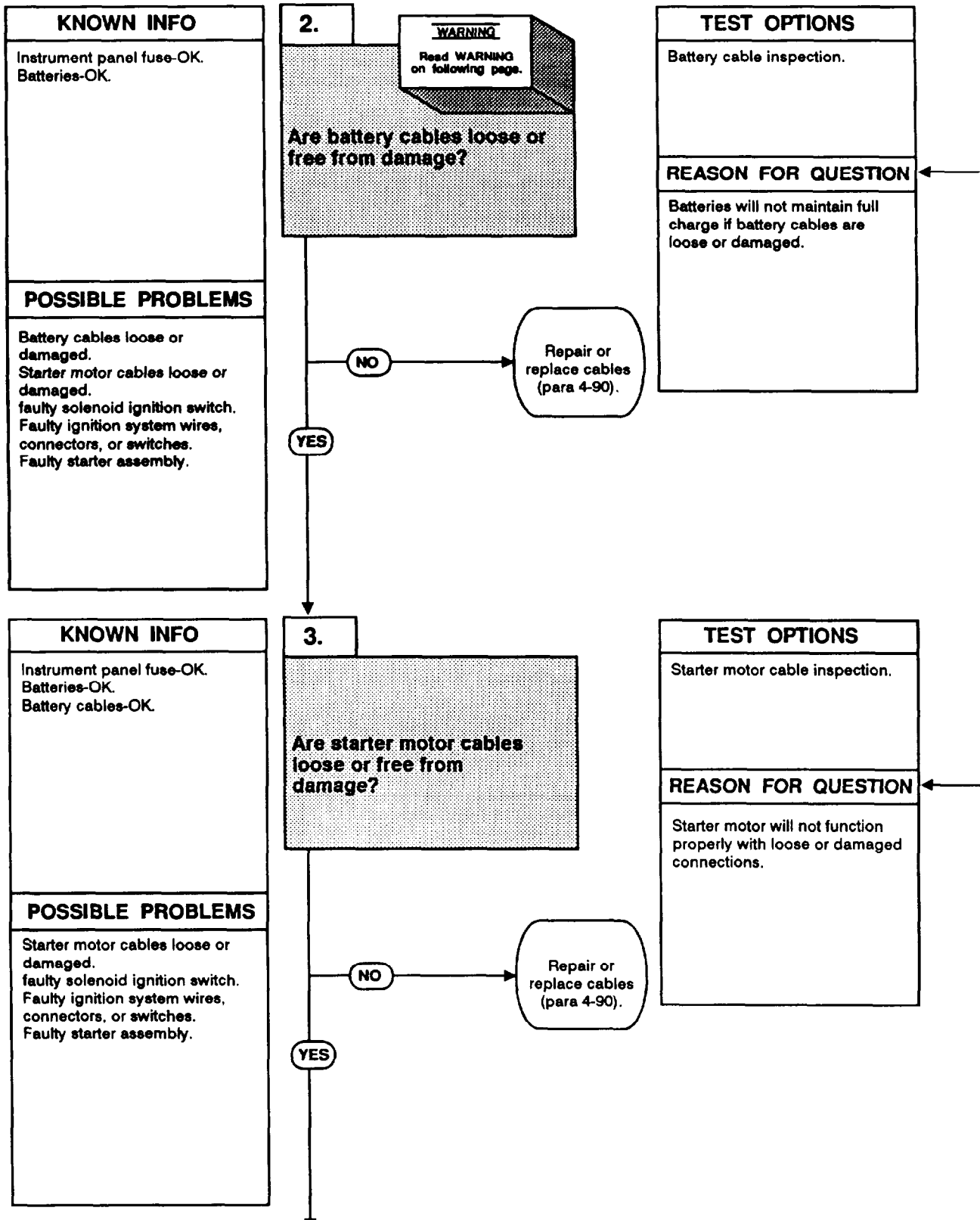
Remove all jewelry such as rings, dog tags, bracelets, etc. if jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel

**BATTERY INTERNAL
RESISTANCE TEST**

- (1) Open right engine door (para 2-14).
- (2) Prevent vehicle from starting.
- (3) Power up STE/ICR to a known good battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run battery internal resistance test #77.
 - (a) Maximum acceptance to pass this test is 13 milliohms. If this is exceeded, check battery cables and connections then retest.
 - (b) If battery internal resistance is still above maximum, replace batteries (para 4-87 and 4-88).
 - (c) if no more than 13 milliohms are detected and batteries are OK, indicates faulty battery cables and connectors.



ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED (CONT).

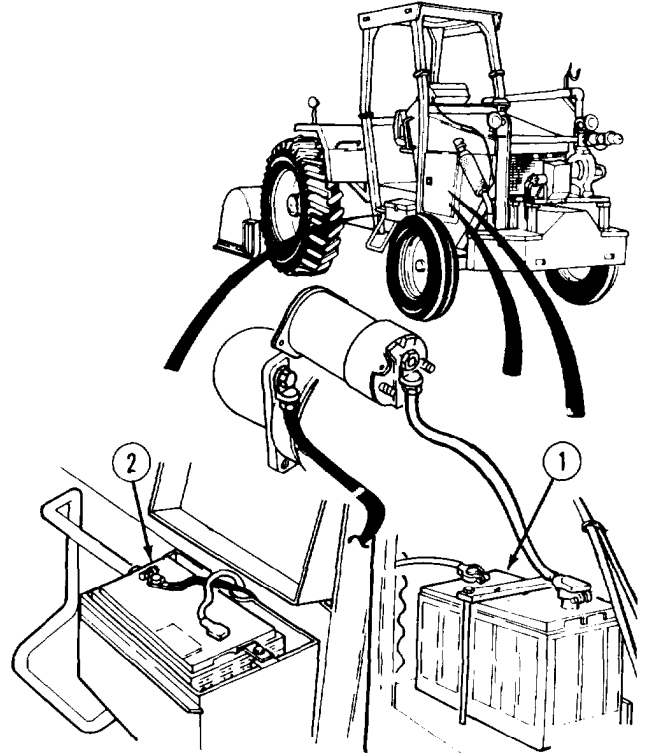


WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

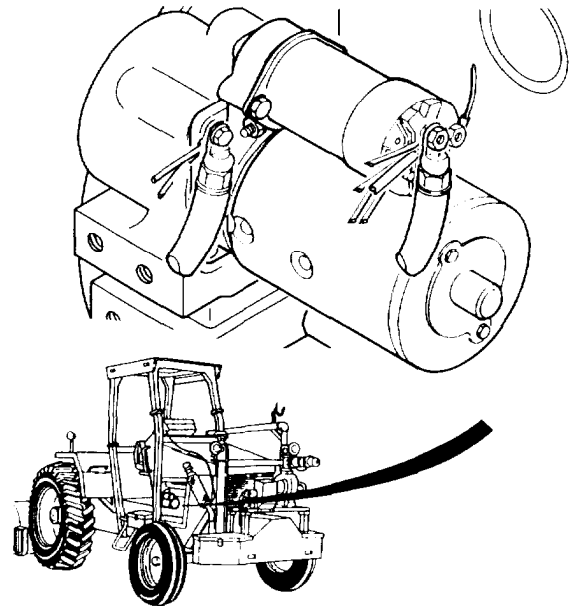
BATTERY CABLE INSPECTION

- (1) Open right engine door (para 2-14).
- (2) Check for loose, dirty, or damaged connections and battery cables (para 4-90).
 - (a) if cables and/or connections are faulty, batteries will not maintain proper voltage.
 - (b) if cables and/or connections are ok, indicates faulty starter motor cables and/or connections.

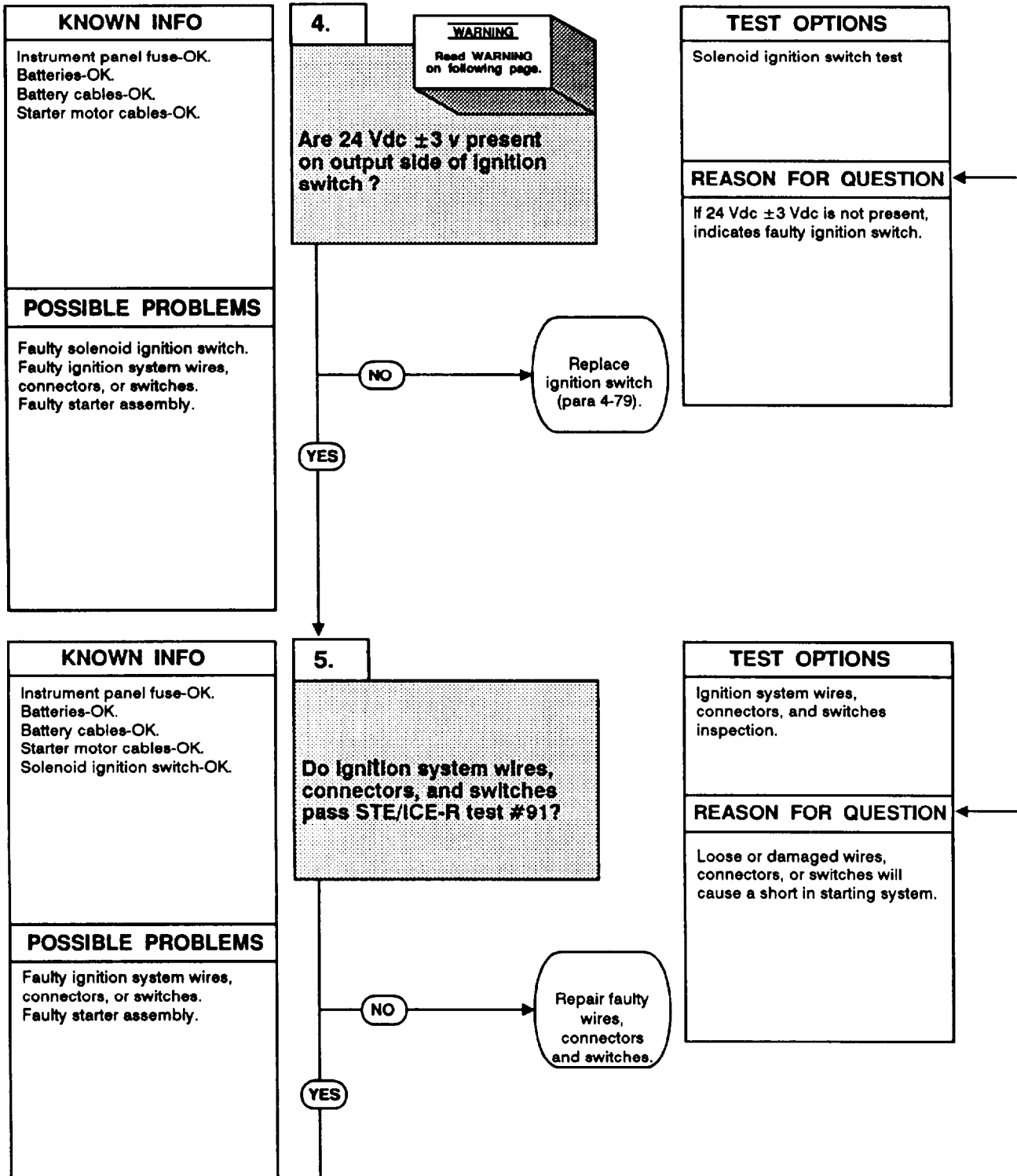


STARTER MOTOR CABLE INSPECTION

- (1) Open right engine door (para 2-14).
- (2) Check for loose, dirty, or damaged connections and starter cables (para 4-71).
 - (a) if cables and/or connections are faulty, repair/replace (para 4-72).
 - (b) If cables and/or connections are ok, indicates faulty solenoid ignition switch.



ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED (CONT).

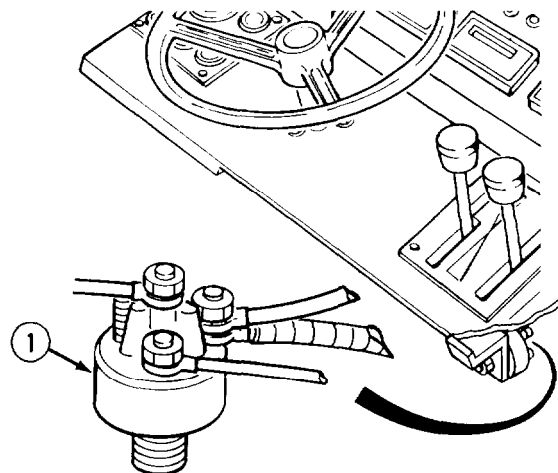


WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

SOLENOID IGNITION SWITCH TEST

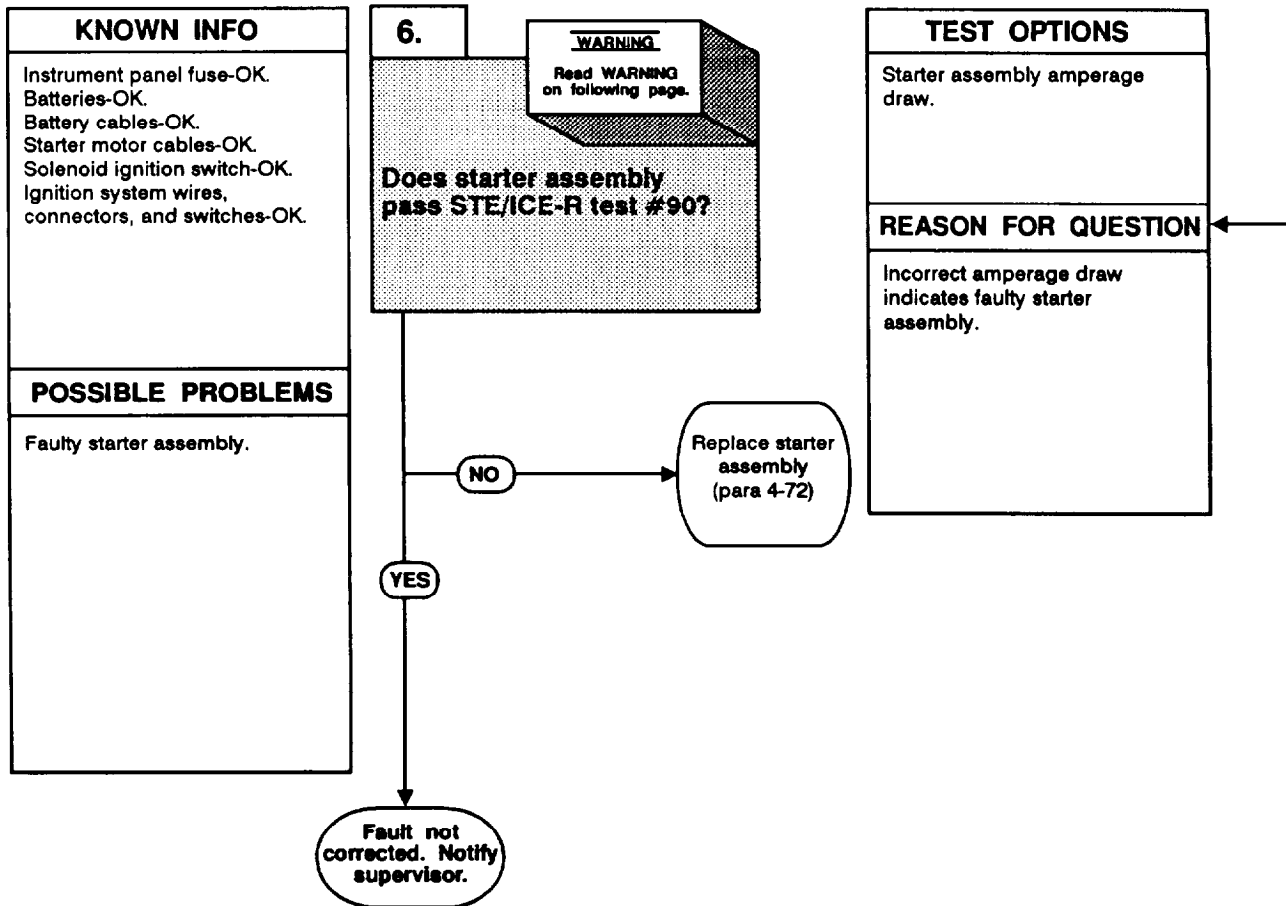
- (1) Open right engine door (para 2-14).
- (2) Power up STE/ICE-R to a known good battery source (TM 9-4910-571-1 2&P, in TK mode).
- (3) Run voltage test #67 at output side of ignition switch (1) in ON position.
 - (a) if 24 ± 3 Vdc is not present, replace ignition switch (para 4-79).
 - (b) If 24 ± 3 Vdc is present, indicates faulty ignition system wires, connectors, or switches.



IGNITION SYSTEM INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove dash panel (para 4-126).
- (3) Power up STE/ICE-R to a known good battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run continuity test #91.
- (5) Refer to electrical schematic (Appendix H) and check ignition system wires, connectors, and switches.
 - (a) If wires, connectors, and switches are loose or damaged, tighten or replace as necessary.
 - (b) If wires, connectors, and switches are ok, indicates faulty fuel injector pump solenoid.

ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED (CONT)

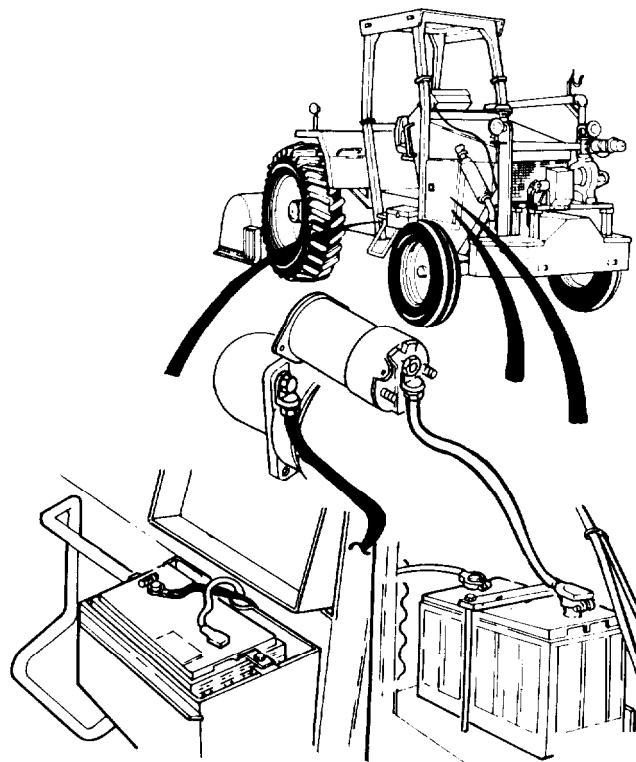


WARNING

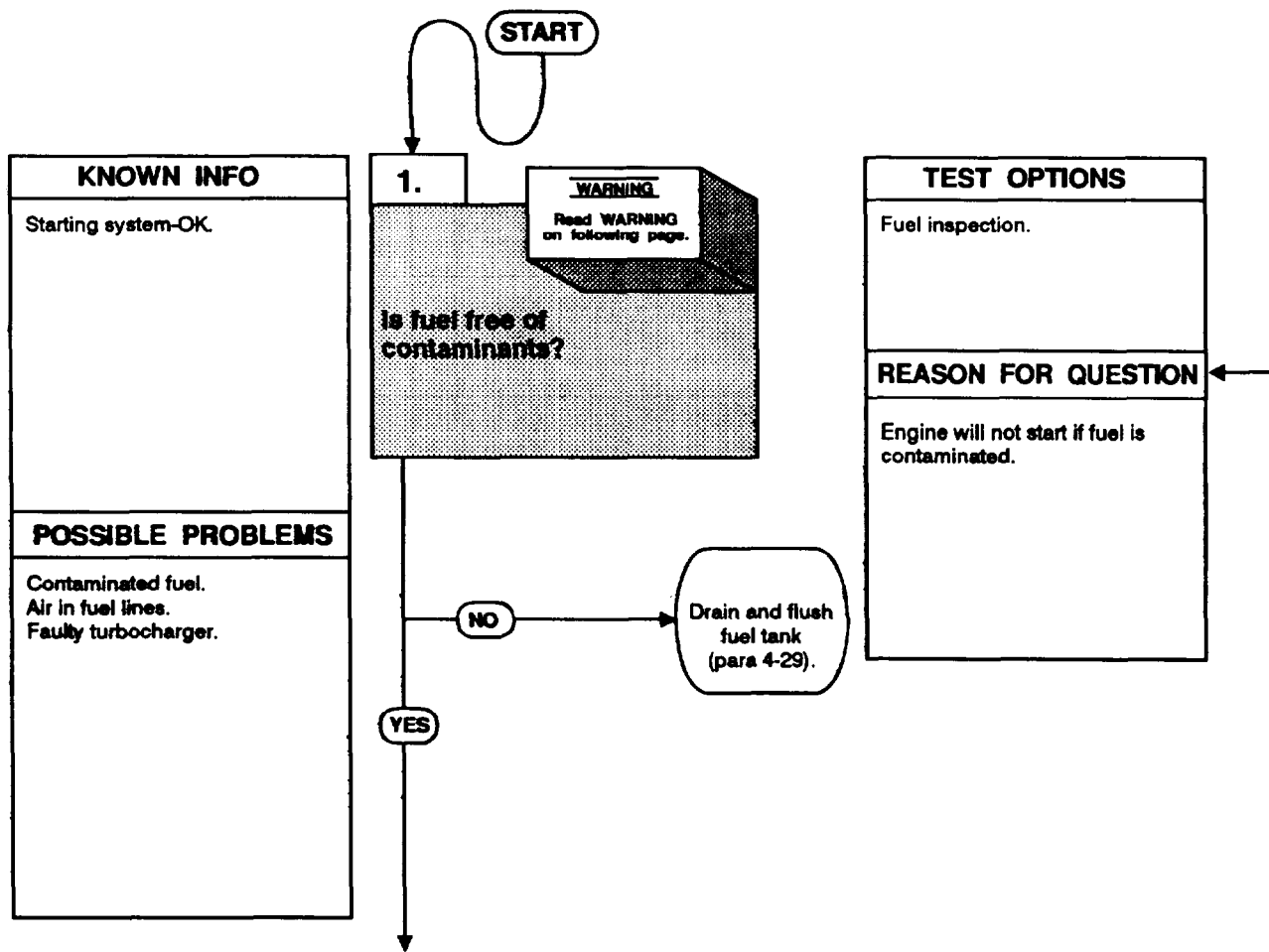
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

**STARTER ASSEMBLY
AMPERAGE TEST**

- (1) Open right engine door (pare 2-14).
- (2) Prevent vehicle from starting.
- (3) Power up STE/ICE-R to known power source (TM 9-4910-571-12&P, in TK mode).
- (4) Run amperage test #90.
 - (a) If starter amperage is not within 225-300 amps, indicates faulty starter assembly.
 - (b) If starter amperage draw is within 225-300 amps, notify supervisor.



2. ENGINE CRANKS BUT WILL NOT START - NO SMOKE FROM EXHAUST.			
<p>INITIAL SETUP</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; padding-right: 20px;"> <p>Equipment Conditions</p> <ul style="list-style-type: none"> Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13). Left/right engine doors open (para 2-14). </td> <td style="width: 50%; vertical-align: top;"> <p>Tools and Special Tools</p> <ul style="list-style-type: none"> Tool kit, general mechanic's: automotive Torque wrench </td> </tr> </table>		<p>Equipment Conditions</p> <ul style="list-style-type: none"> Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13). Left/right engine doors open (para 2-14). 	<p>Tools and Special Tools</p> <ul style="list-style-type: none"> Tool kit, general mechanic's: automotive Torque wrench
<p>Equipment Conditions</p> <ul style="list-style-type: none"> Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13). Left/right engine doors open (para 2-14). 	<p>Tools and Special Tools</p> <ul style="list-style-type: none"> Tool kit, general mechanic's: automotive Torque wrench 		

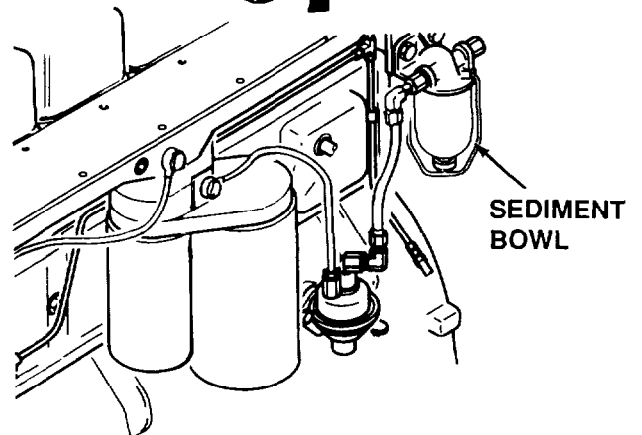
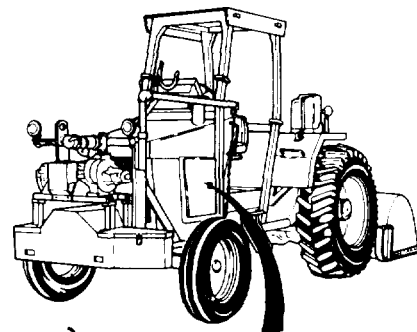


WARNING

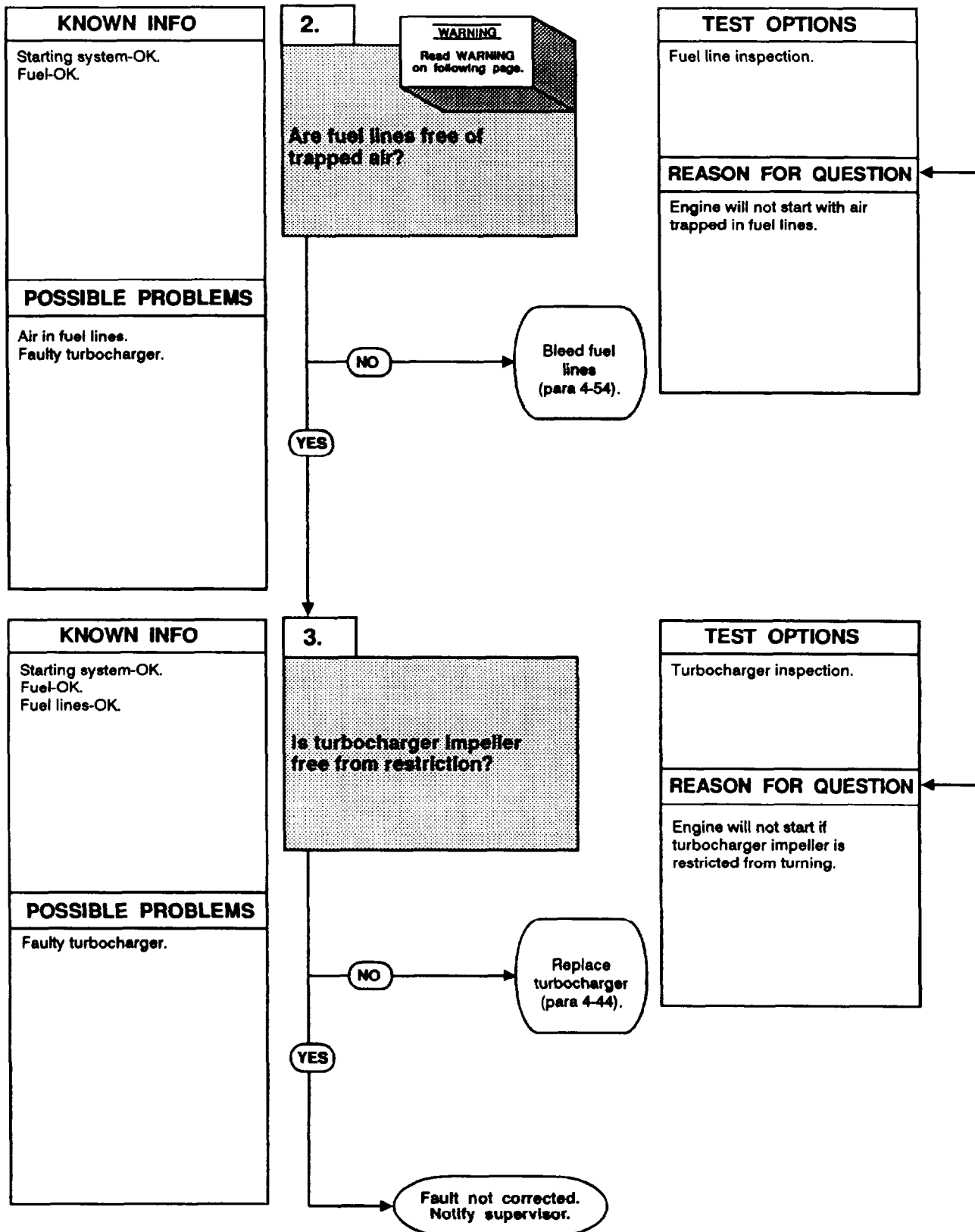
- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

FUEL INSPECTION

- (1) Disconnect negative battery cable (para 4-99).
- (2) Set parking brake (2-13).
- (3) Check sediment bowl for contaminated fuel.
 - (a) If fuel is contaminated, drain and flush fuel tank (para 4-29).
 - (b) If fuel is OK, notify supervisor.
- (4) Connect negative battery cable (para 4-90).



ENGINE CRANKS BUT WILL NOT START - NO SMOKE FROM EXHAUST (CONT)

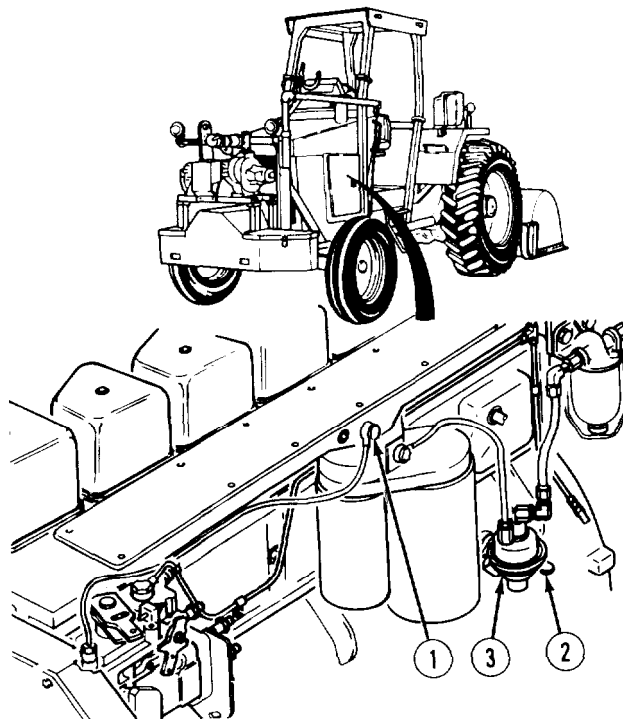


WARNING

- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

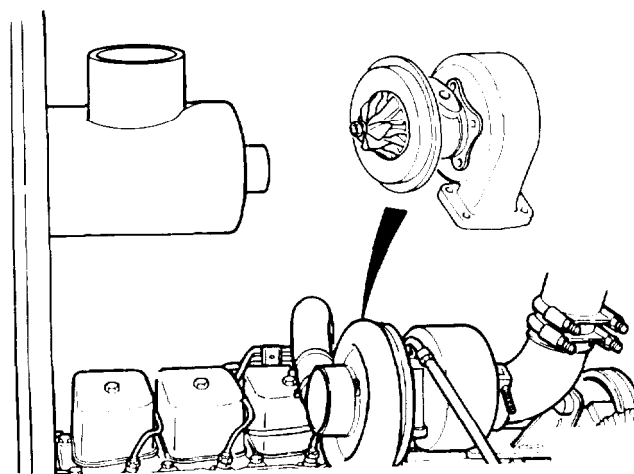
FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is free from air.
- (3) Tighten bleed screw (1) 72 lb-in (8 N•m).
- (4) Start engine (para 2-9).
 - (a) If engine starts, perform steps 5 and 6.
 - (b) If engine does not start, indicates faulty turbocharger.
- (5) Loosen six fuel line fittings on injectors one at a time until engine runs smoothly. Tighten securely.
- (6) Turn engine off (para 2-10(c)).



TURBOCHARGER INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove turbocharger air inlet hose from turbocharger inlet (para 4-43).
- (3) Inspect turbocharger impeller operation.
 - (a) If impeller is damaged or restricted from turning properly, replace turbocharger (para 4-44).
 - (b) If impeller is not damaged or operates properly, notify supervisor.



3. ENGINE HARD TO START OR WILL NOT START - SMOKE FROM EXHAUST.

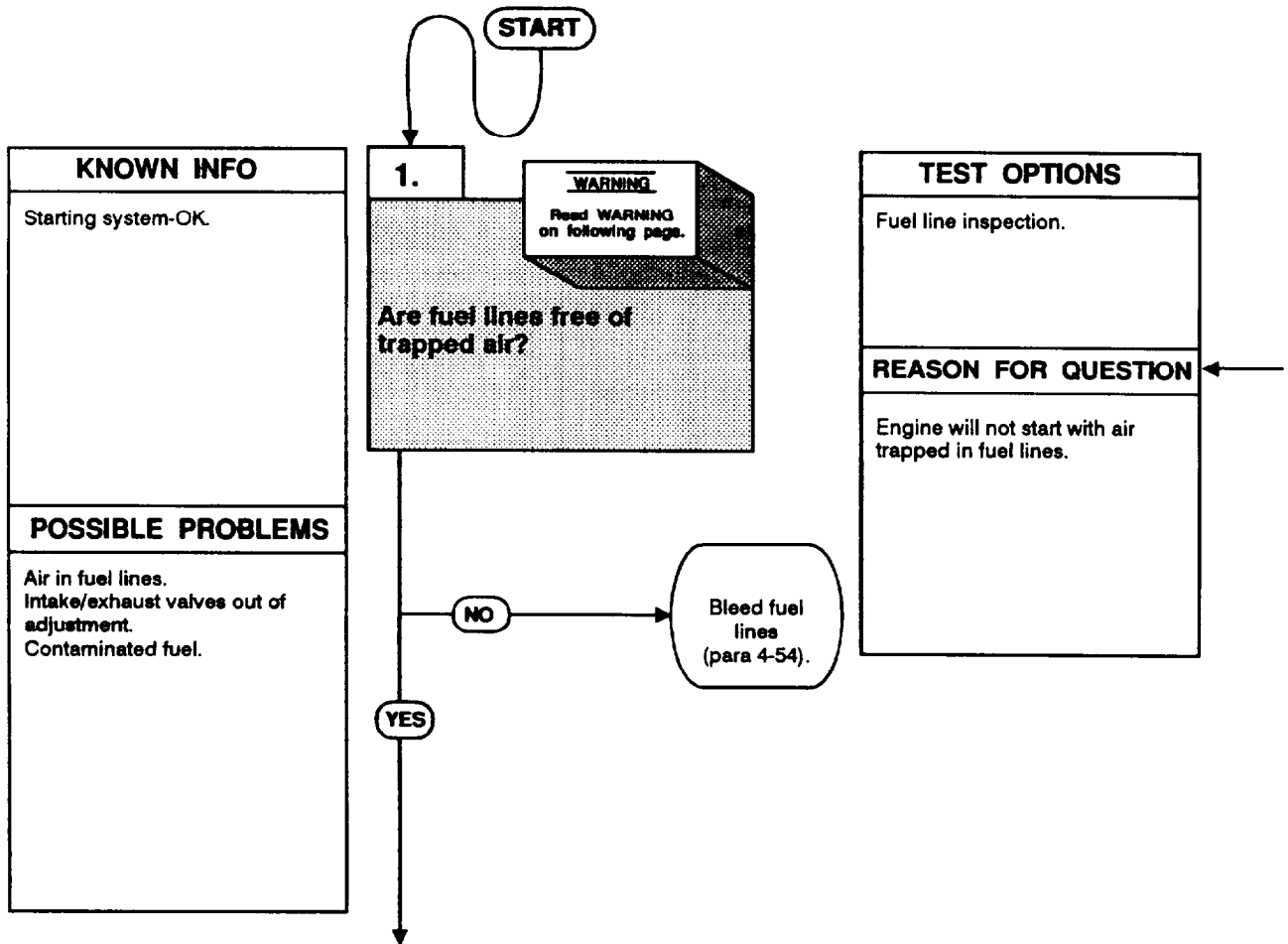
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Left/right engine doors open (para 2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Torque wrench

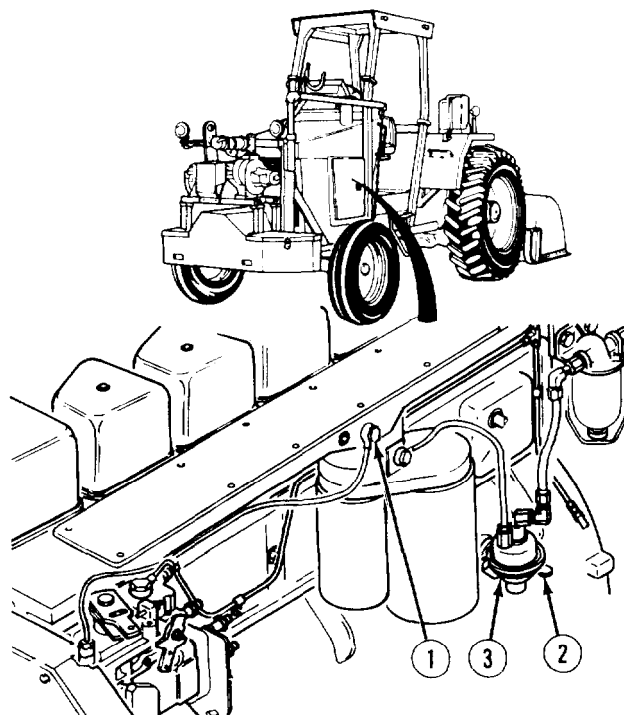


WARNING

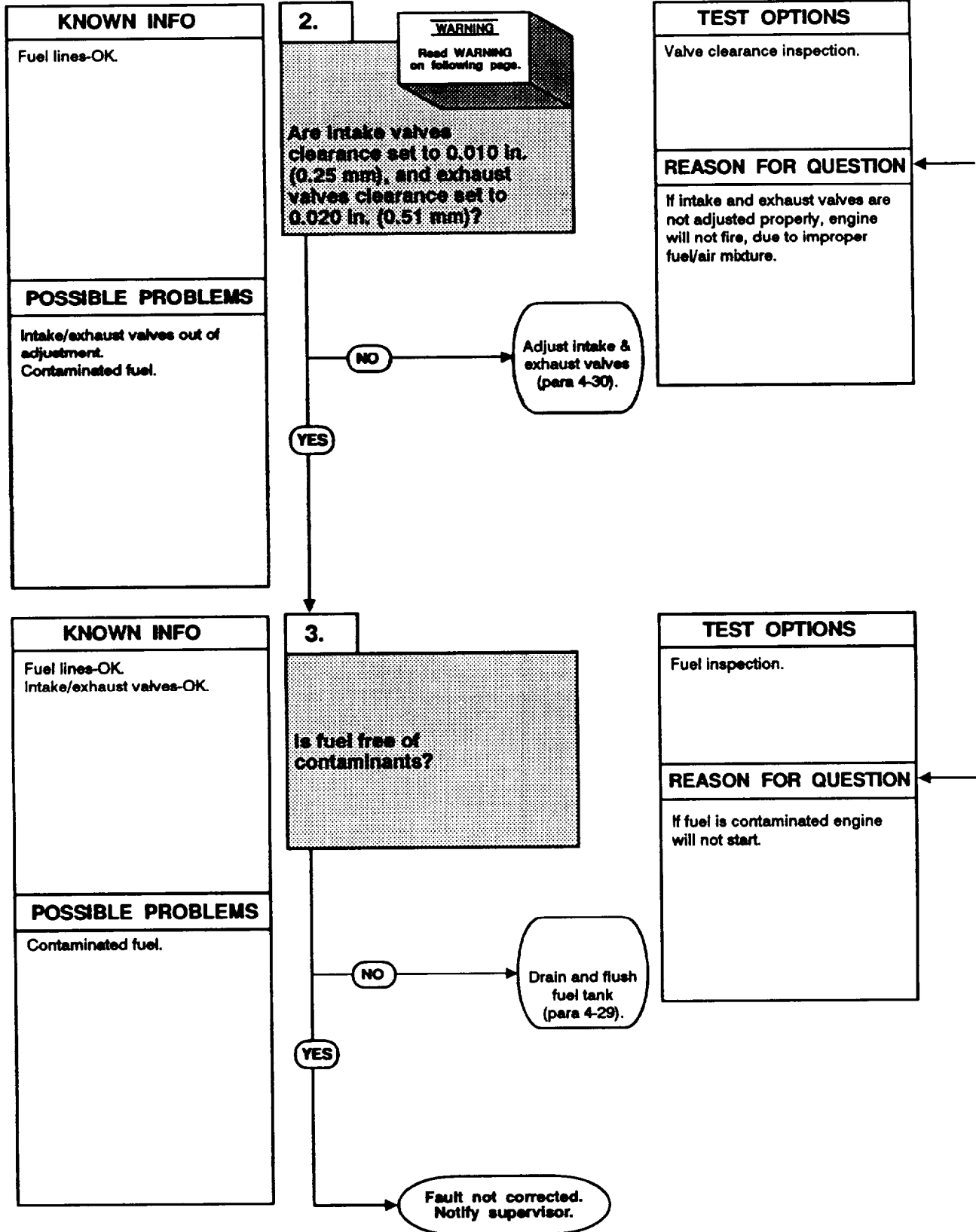
- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is airfree.
- (3) Tighten bleed screw (1) 72 lb-in (8 N^om).
- (4) Start engine (pare 2-9).
 - (a) If engine starts perform steps 5 and 6.
 - (b) If engine does not start indicates faulty valve clearance adjustment.
- (5) Loosen six fuel line fittings on injectors one at a time until engine runs smoothly. Tighten securely.
- (6) Turn engine off (pare 2-10[c]).



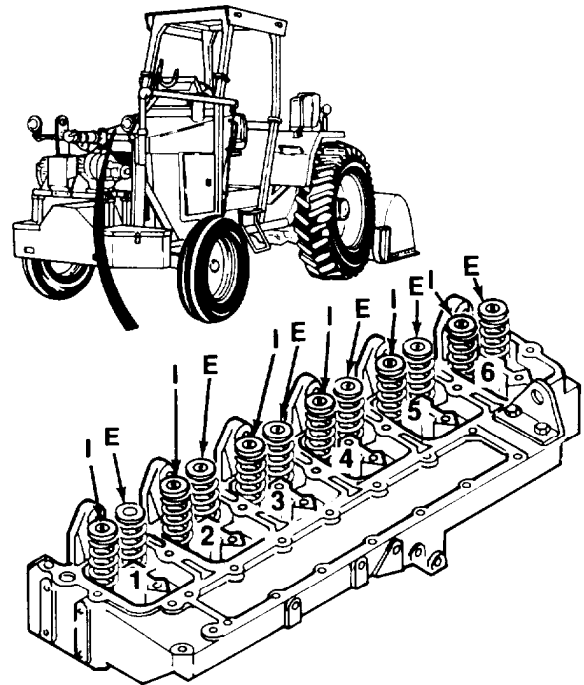
EXHAUST (CONT).



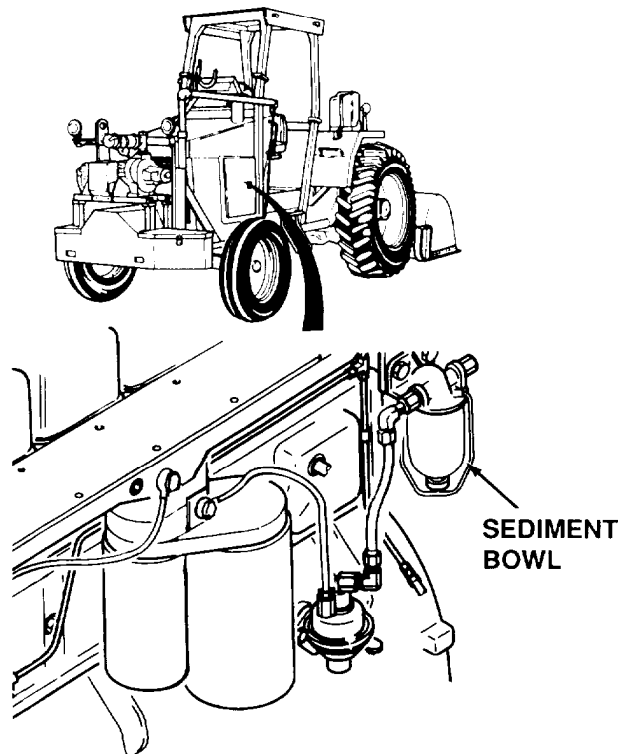
WARNING

- Post signs that read *NO SMOKING WITHIN 50 FEET (15 m)· when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

VALVE CLEARANCE INSPECTION
<ol style="list-style-type: none"> (1) Disconnect negative battery cable (para 4-90). (2) Remove valve covers (para 4-31). (3) Check valve clearance, (para 4-30). <ol style="list-style-type: none"> (a) Intake valves clearance must be 0.010 in. (0.25 mm). (b) Exhaust valves clearance must be 0.020 in. (0.51 mm) (4) Install valve covers (para 4-31). (5) Connect negative battery cable (pare 4-90).



FUEL INSPECTION
<ol style="list-style-type: none"> (1) Disconnect negative battery cable (pare 4-90). (2) Set parking brake (para 2-13). (3) Check sediment bowl for contaminated fuel. <ol style="list-style-type: none"> (a) If fuel is contaminated, drain and flush fuel tank (para 4-29). (b) If fuel is OK, notify supervisor. (4) Connect negative battery cable (para 4-90),



4. ENGINE STARTS BUT WILL NOT KEEP RUNNING.

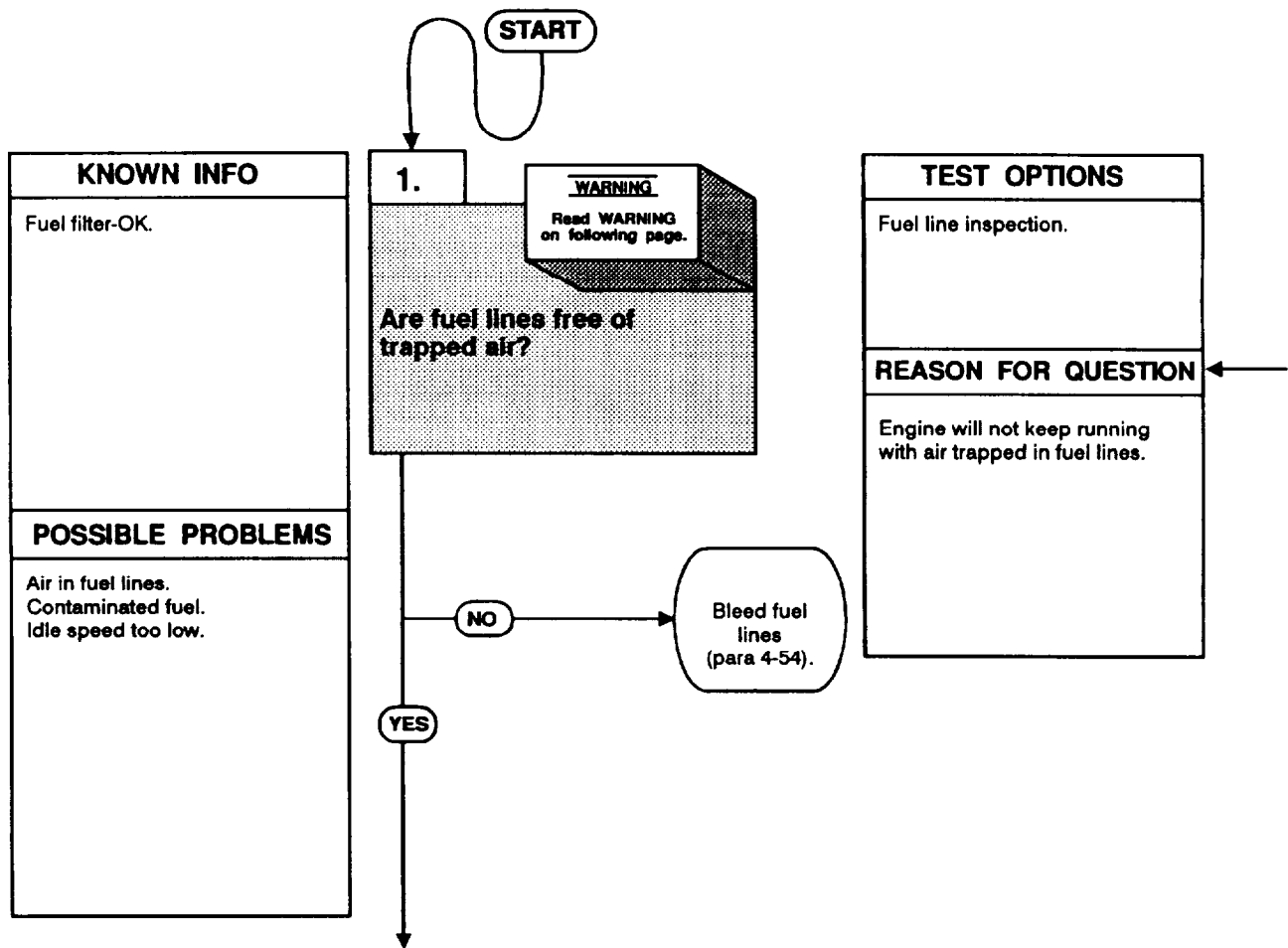
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).
 Left/right engine doors open (para 2-14).

Tools and Special Tools

Tool kit, general mechanic's: automotive
 Torque wrench

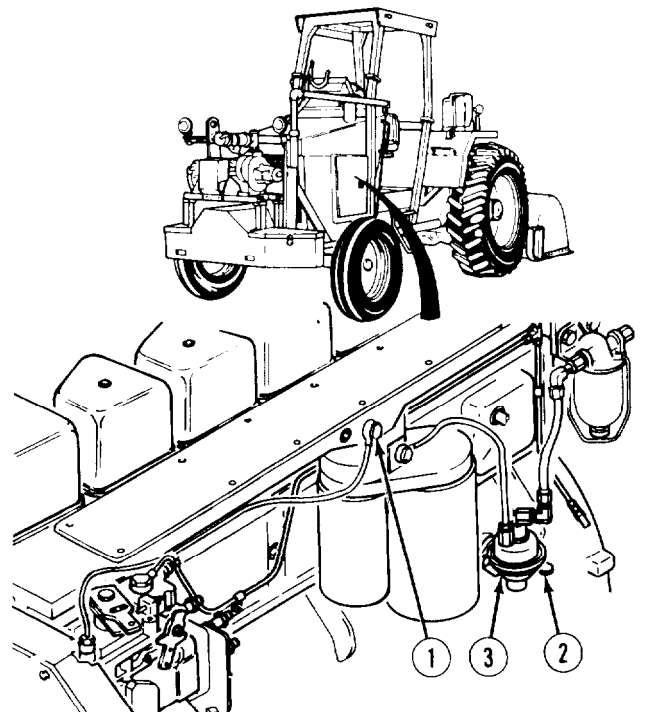


WARNING

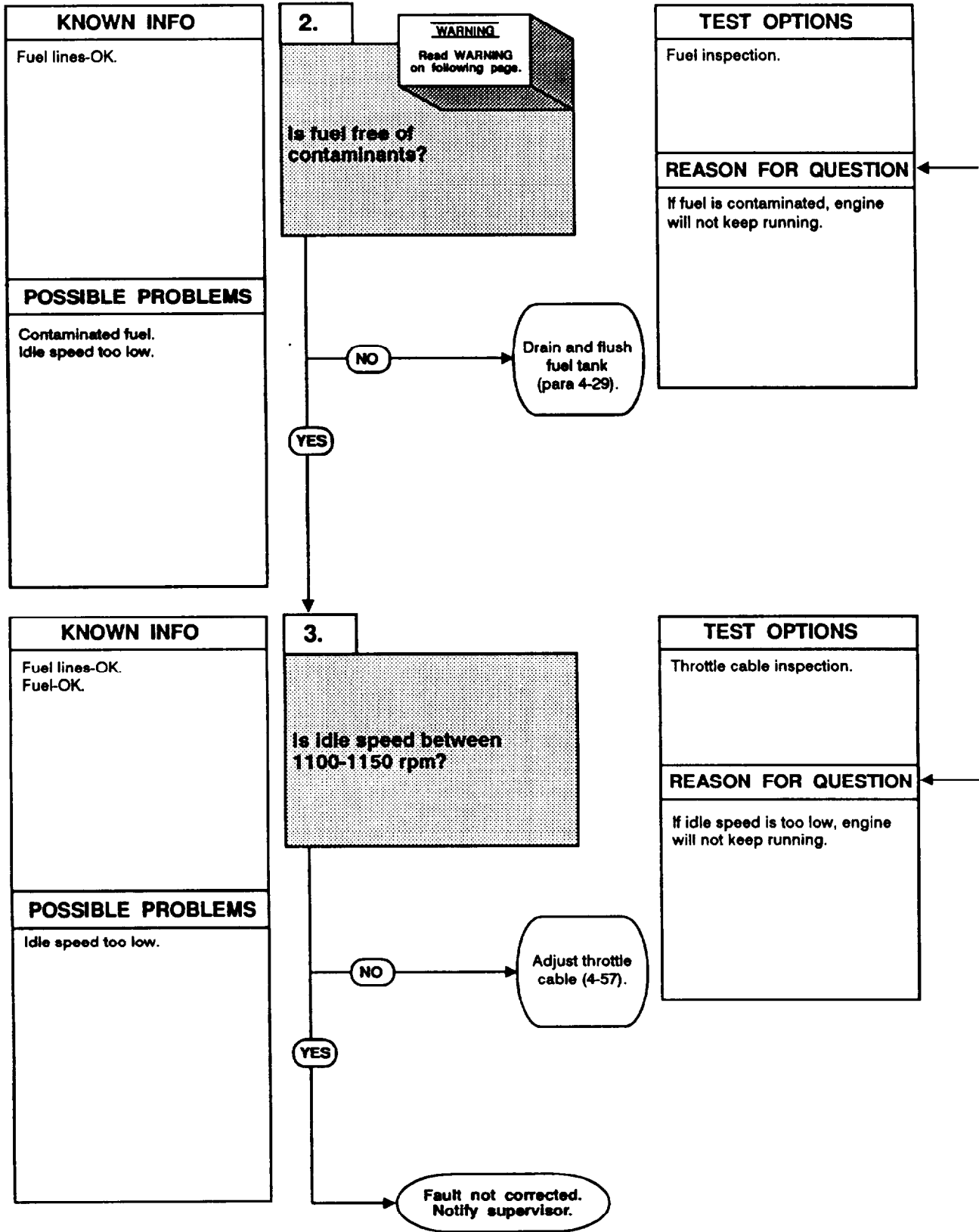
- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks,
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is air-free.
- (3) Tighten bleed screw (1) 72 lb-in (8 N^om).
- (4) Start engine (para 2-9).
 - (a) If engine starts perform steps 5 and 6.
 - (b) If engine does not start indicates contaminated fuel.
- (5) Loosen six fuel line fittings on injectors one at a time until engine runs smoothly. Tighten securely.
- (6) Turn engine off (para 2-10[c]).



ENGINE STARTS BUT WILL NOT KEEP RUNNING (CONT).

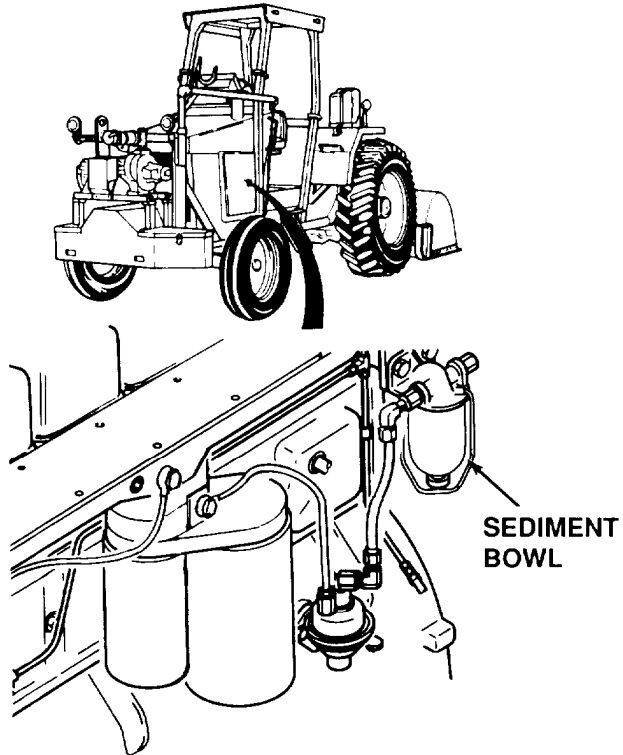


WARNING

- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

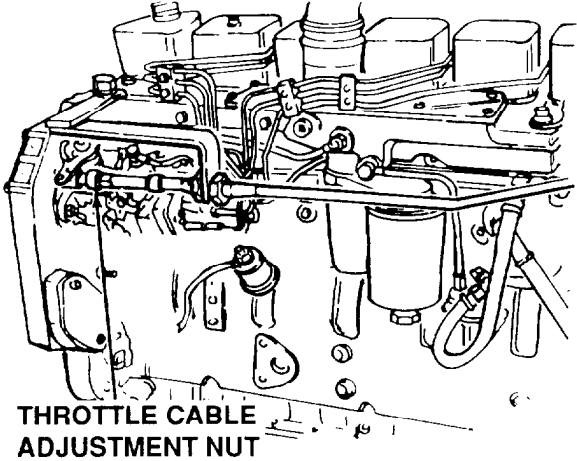
FUEL INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Set parking brake (para 2-13).
- (3) Check sediment bowl for contaminated fuel.
 - (a) If fuel is contaminated, drain and flush fuel tank (para 4-29).
 - (b) If fuel is OK, indicates throttle speed too low.
- (4) Connect negative battery cable (para 4-90).



THROTTLE CABLE INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check throttle cable for loose or damaged connections.
 - (a) if throttle cable is damaged, replace, (para 4-56).
 - (b) If throttle cable is out of adjustment, adjust (para 4-57).
 - (c) If throttle cable is OK, notify supervisor.



5. ENGINE SURGES (SPEED CHANGES).

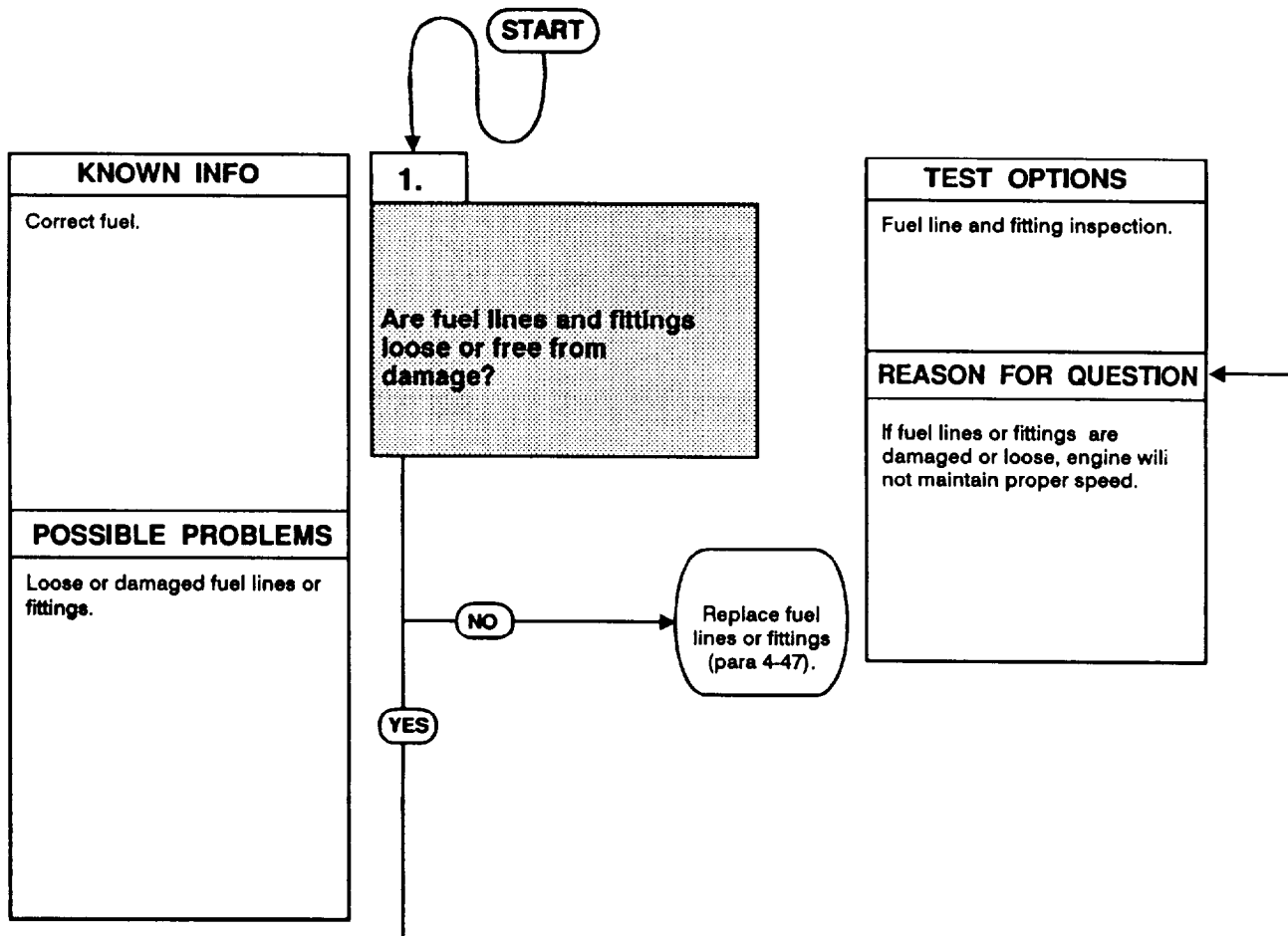
INITIAL SETUP

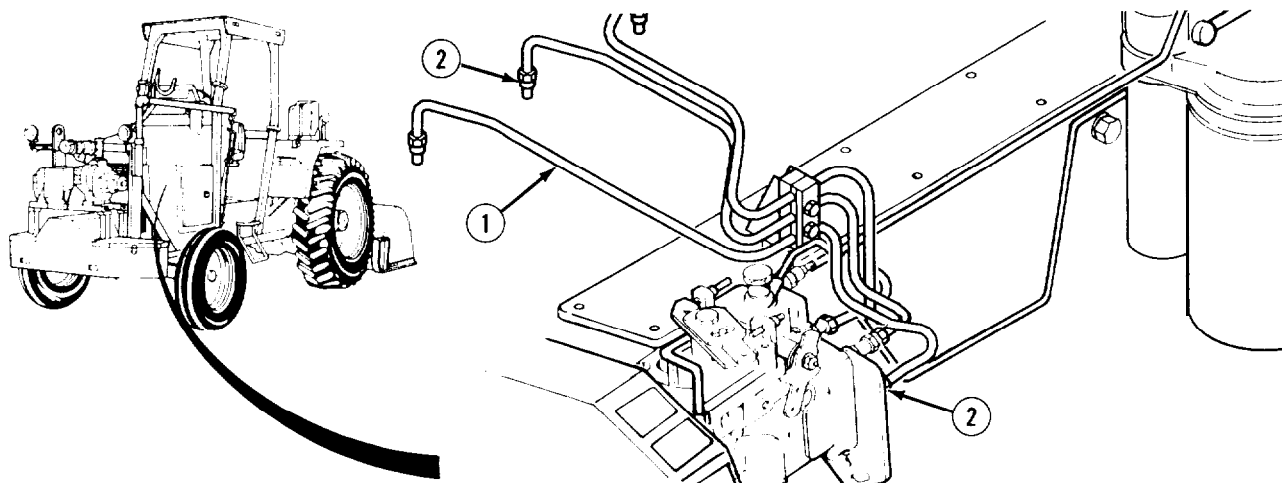
Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Left/right engine doors open (para 2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Torque wrench





WARNING

- Post signs that read ‘NO SMOKING WITHIN 50 FEET (15 m)’ when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FULE LINES AND FITTINGS INSPECTION.
<p>(1) Disconnect negative battery cable (para 4-90).</p> <p>(2) Open left and right engine doors, (para 2-14).</p> <p>(3) Check six fuel lines (1) and fittings (2) for leaks.</p> <p style="padding-left: 20px;">(a) If any fuel lines or fittings leak, tighten or replace as necessary (para 4-47).</p> <p style="padding-left: 20px;">(b) Bleed fuel lines (para 4-54).</p> <p style="padding-left: 20px;">(c) If fuel lines and fittings do not leak, notify supervisor.</p>

6. ENGINE IDLES ROUGH.

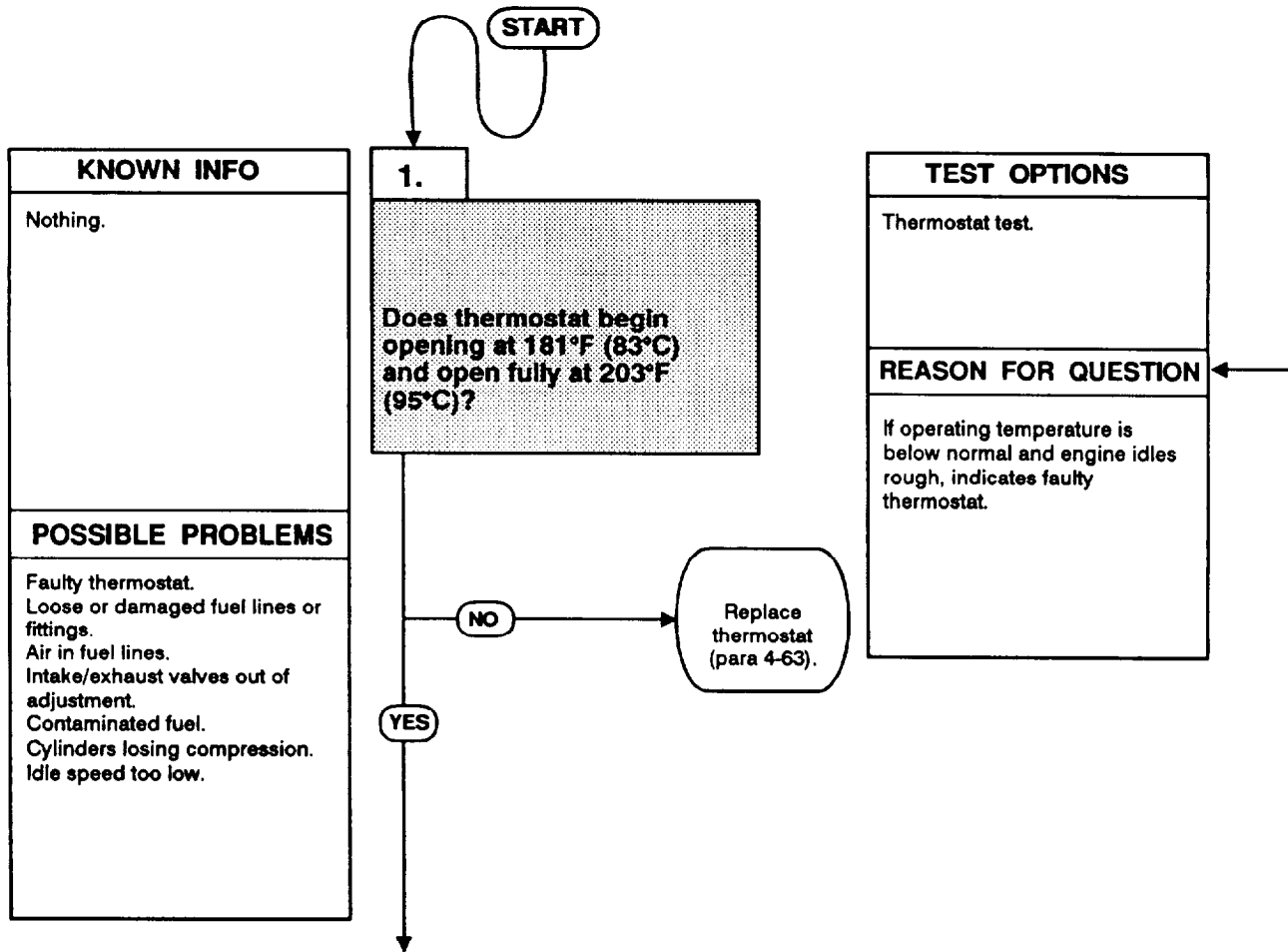
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Left/right engine doors open (para 2-14).

Tools and Special Tools

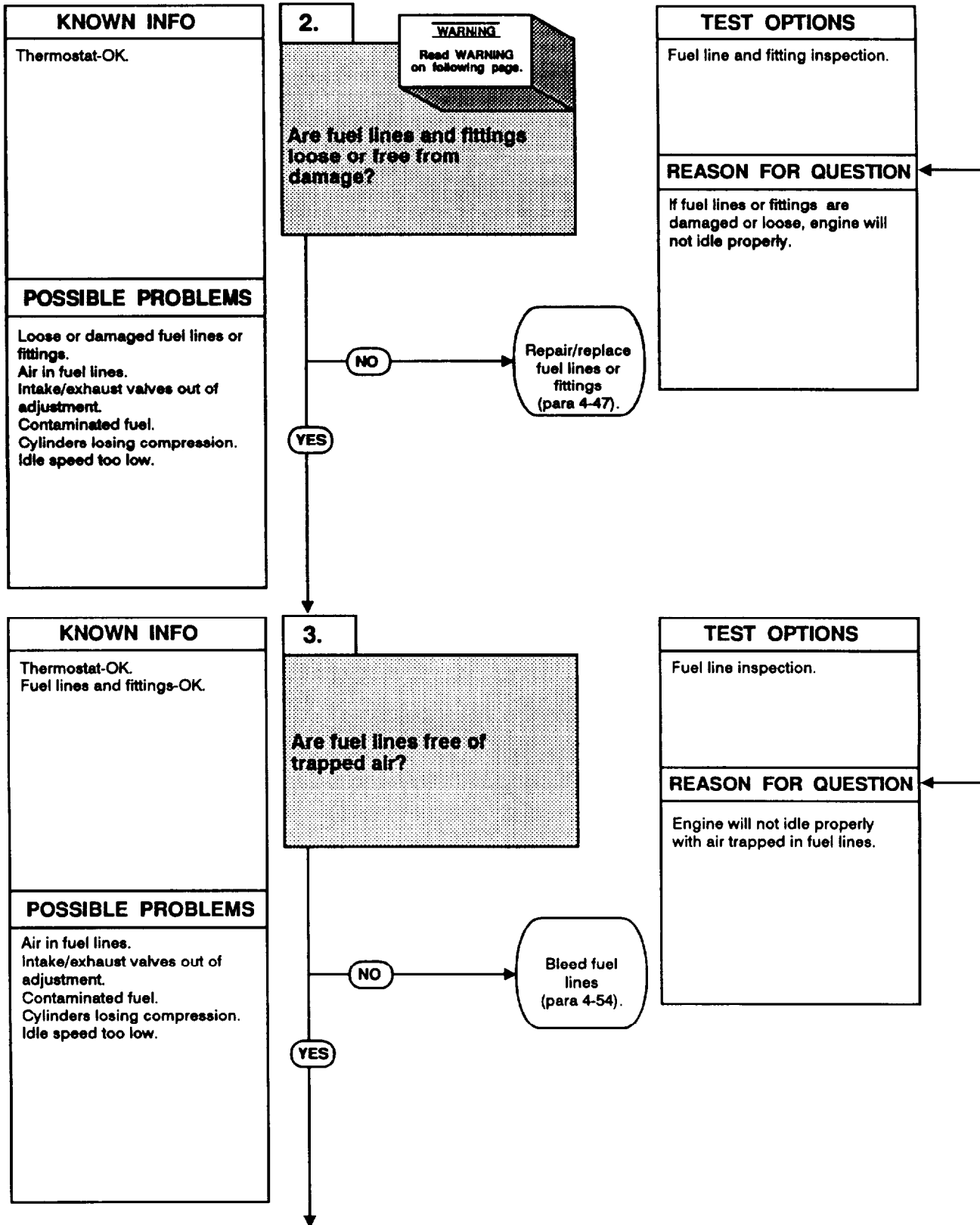
- Tool kit, general mechanic's: automotive
- Torque wrench





Remove thermostat (para 4-63) and test according to TM 750-254; replace thermostat as necessary.

ENGINE IDLES ROUGH (CONT).

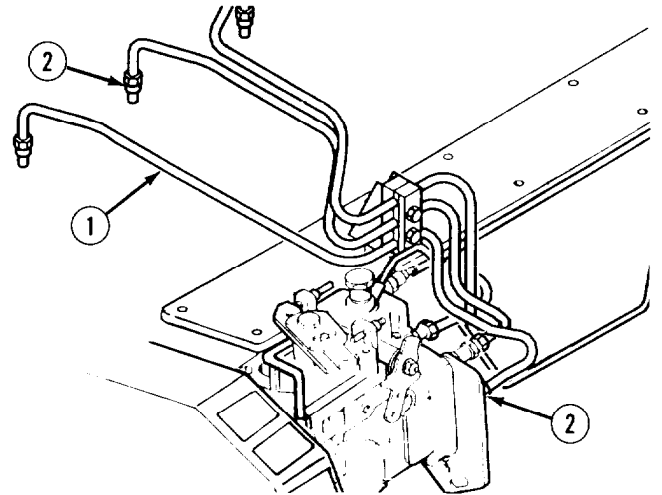


WARNING

- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel liner or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

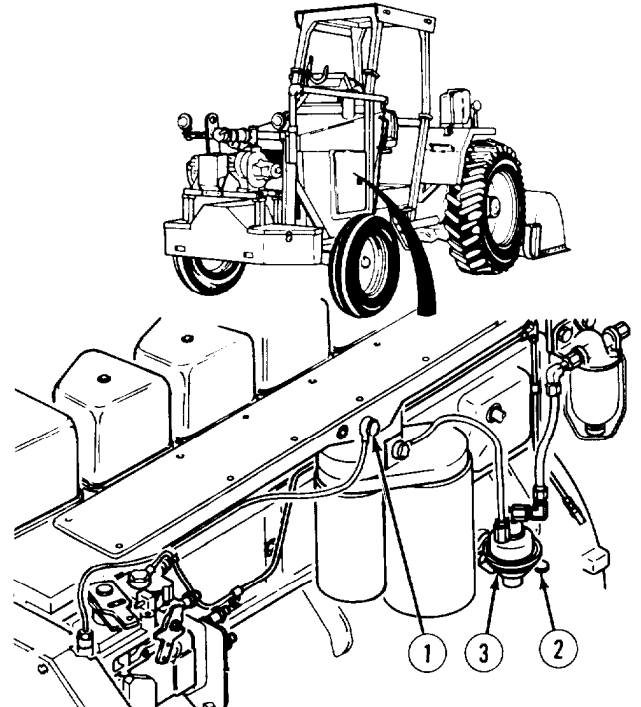
FUEL LINES AND FITTINGS INSPECTION.

- (1) Open left and right engine doors, (para 2-14).
- (2) Check fuel lines and fittings for leaks.
 - (a) If any fuel lines or fittings leak, tighten or replace as necessary (pare 447).
 - (b) If fuel lines and fittings do not leak, indicates air in fuel lines.

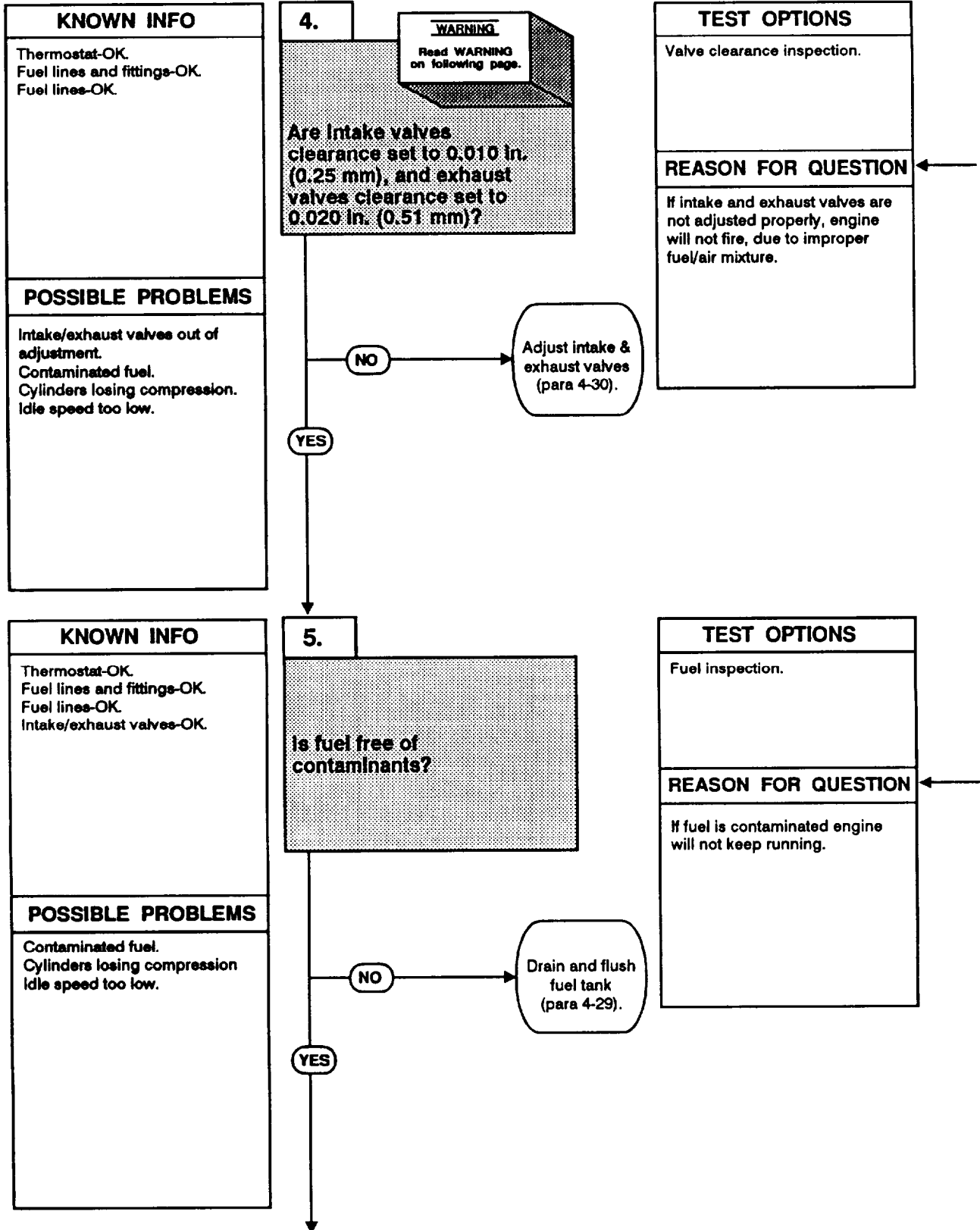


FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is airfree.
- (3) Tighten bleed screw (1) 72 lb-in (6 N^om).
- (4) Start engine (para 2-9).
 - (a) if engine starts perform steps 5 and 6.
 - (b) If engine does not start indicates faulty valve clearance adjustment
- (5) Loosen six fuel line fittings (5) on injectors (6) one at a time and tighten securely until engine runs smoothly.
- (6) Turn engine off (para 2-10[c]).

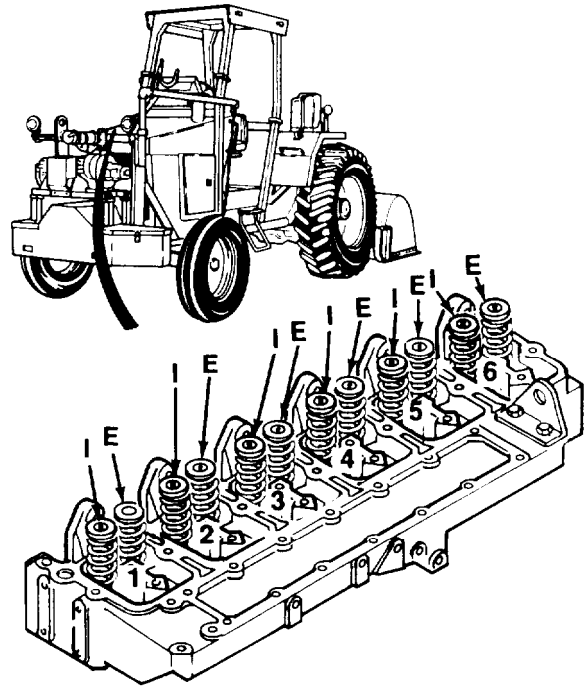


ENGINE IDLES ROUGH (CONT).



VALVE CLEARANCE INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove valve covers (para 4-31).
- (3) Check valve clearance, (para 4-30).
 - (a) Intake valves clearance must be 0.010 in. (0.25 mm).
 - (b) Exhaust valves clearance must be 0.020 in. (0.51 mm)
- (4) Install valve covers (para 4-31).
- (5) Connect negative battery cable (para 4-90).

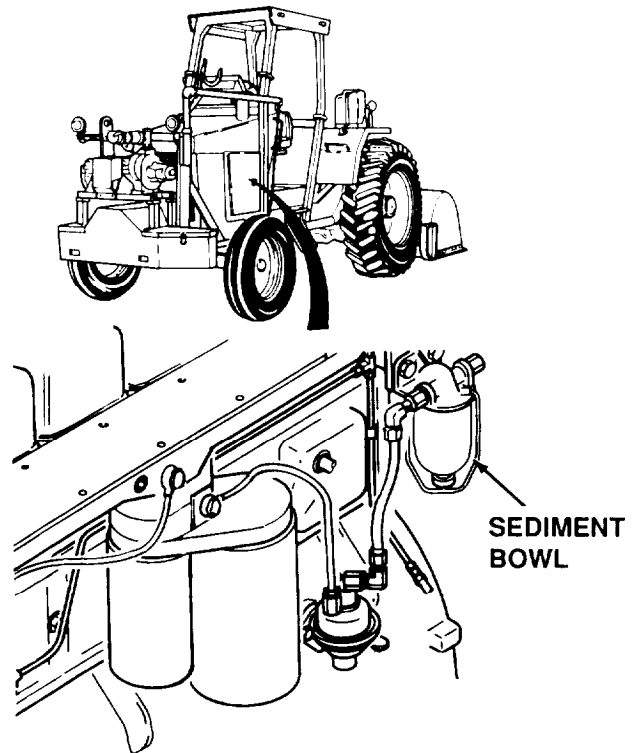


WARNING

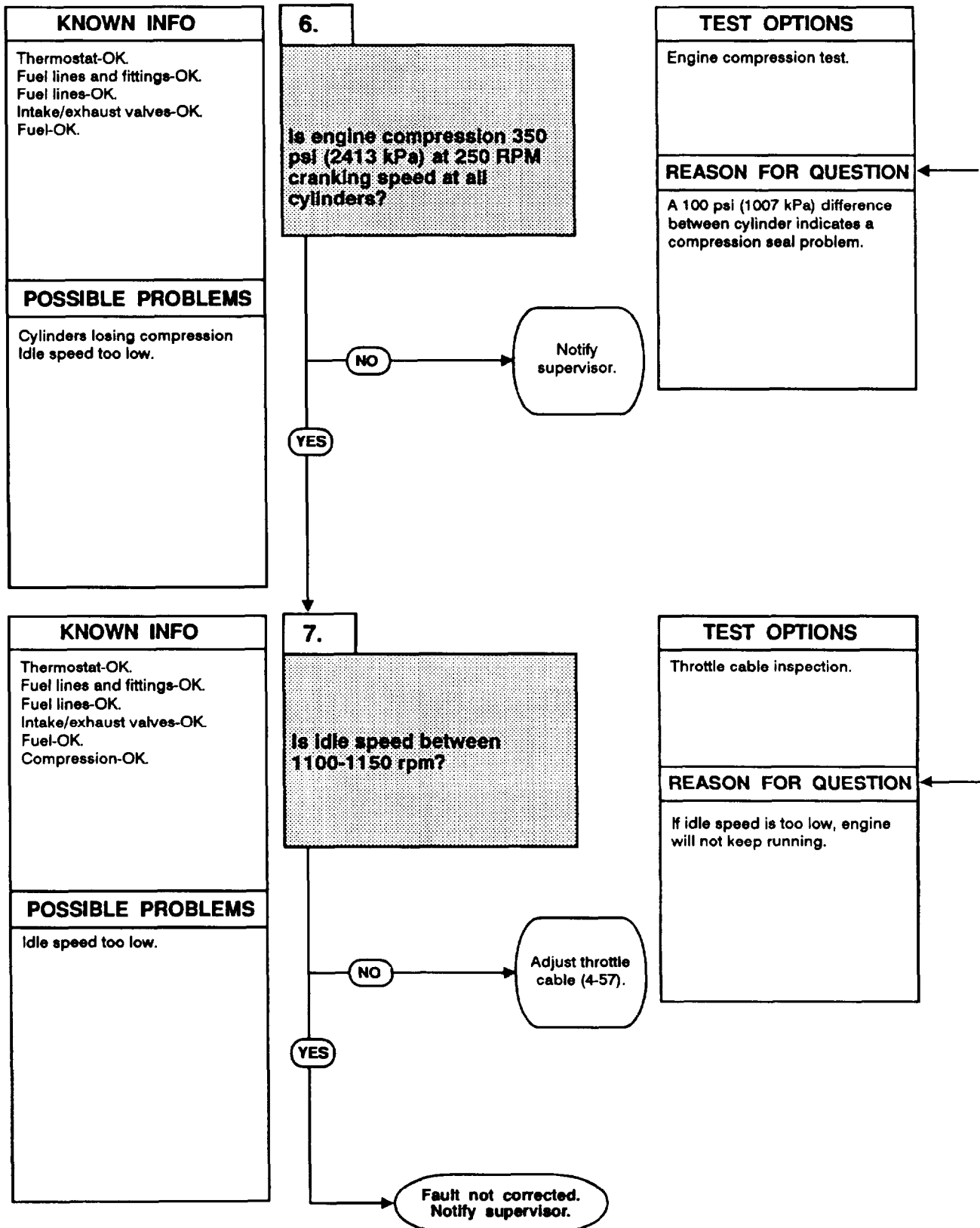
- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

FUEL INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Set parking brake (para 2-13).
- (3) Check sediment bowl for contaminated fuel.
 - (a) If fuel is contaminated, drain and flush fuel tank (para 4-29).
 - (b) If fuel is OK, indicates low compression.
- (4) Connect negative battery cable (para 4-90).



ENGINE IDLES ROUGH (CONT).

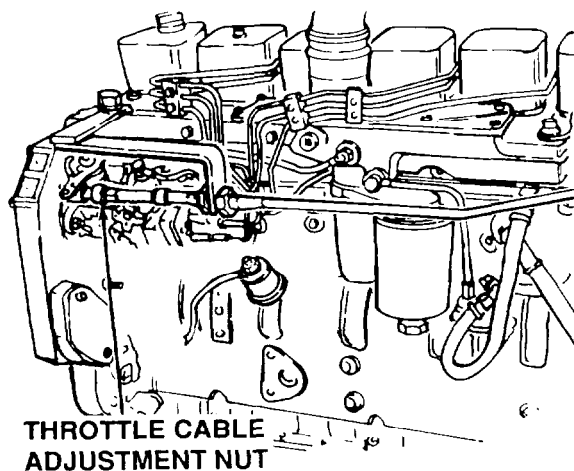


ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-A pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem, notify supervisor.
 - (b) If engine passes compression test indicates that camshaft is not aligned properly.

THROTTLE CABLE INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check throttle cable for loose or damaged connections.
 - (a) If throttle cable is damaged, replace, (para 4-56).
 - (b) If throttle cable is out of adjustment, adjust (para 4-57)
 - (c) If throttle cable is OK, notify supervisor.



7. ENGINE RUNS ROUGH OR MISFIRES.

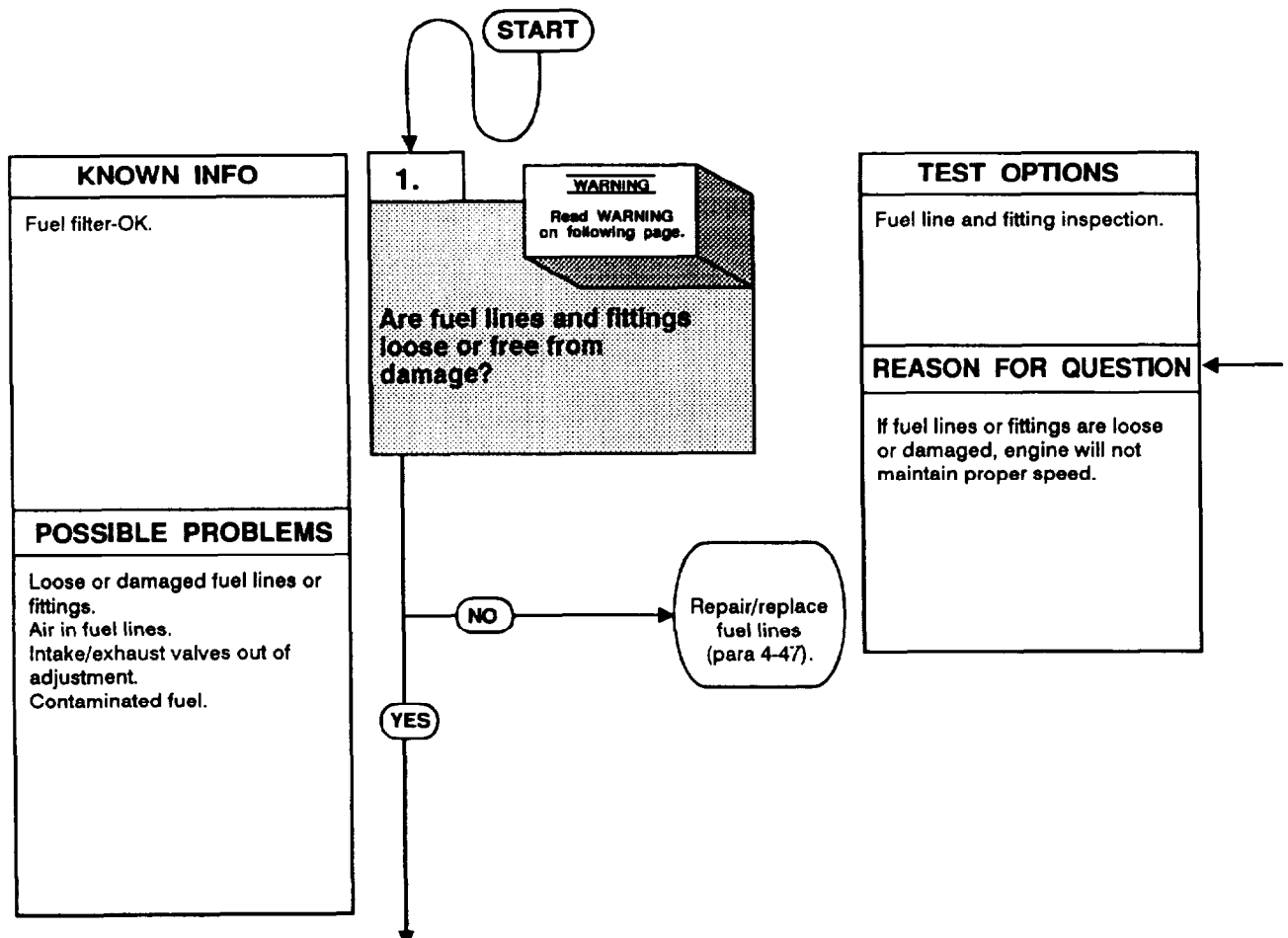
INITIAL SETUP

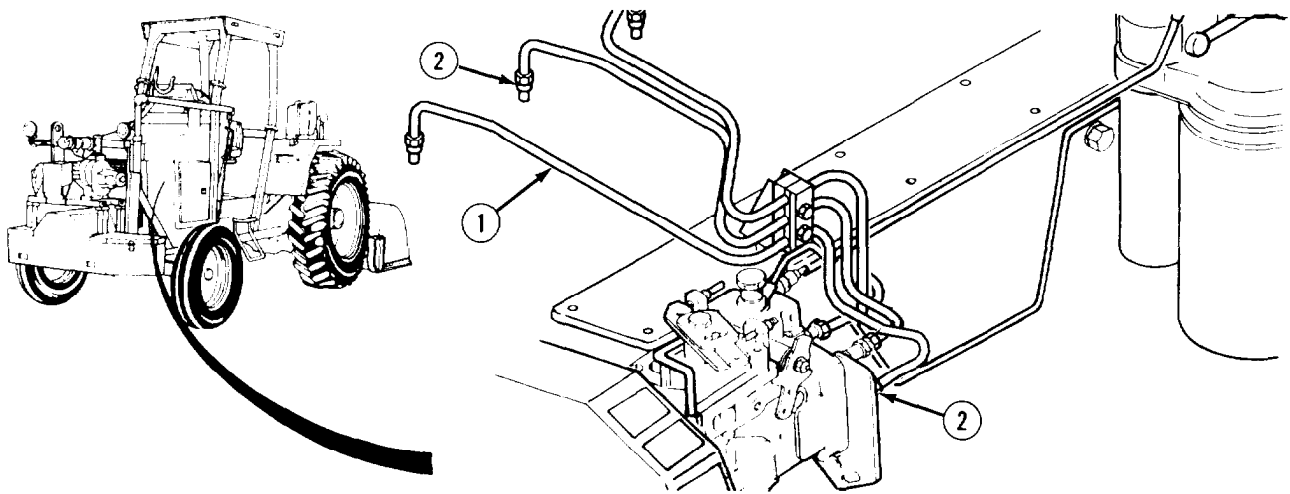
Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Left/right engine doors open (para 2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Torque wrench





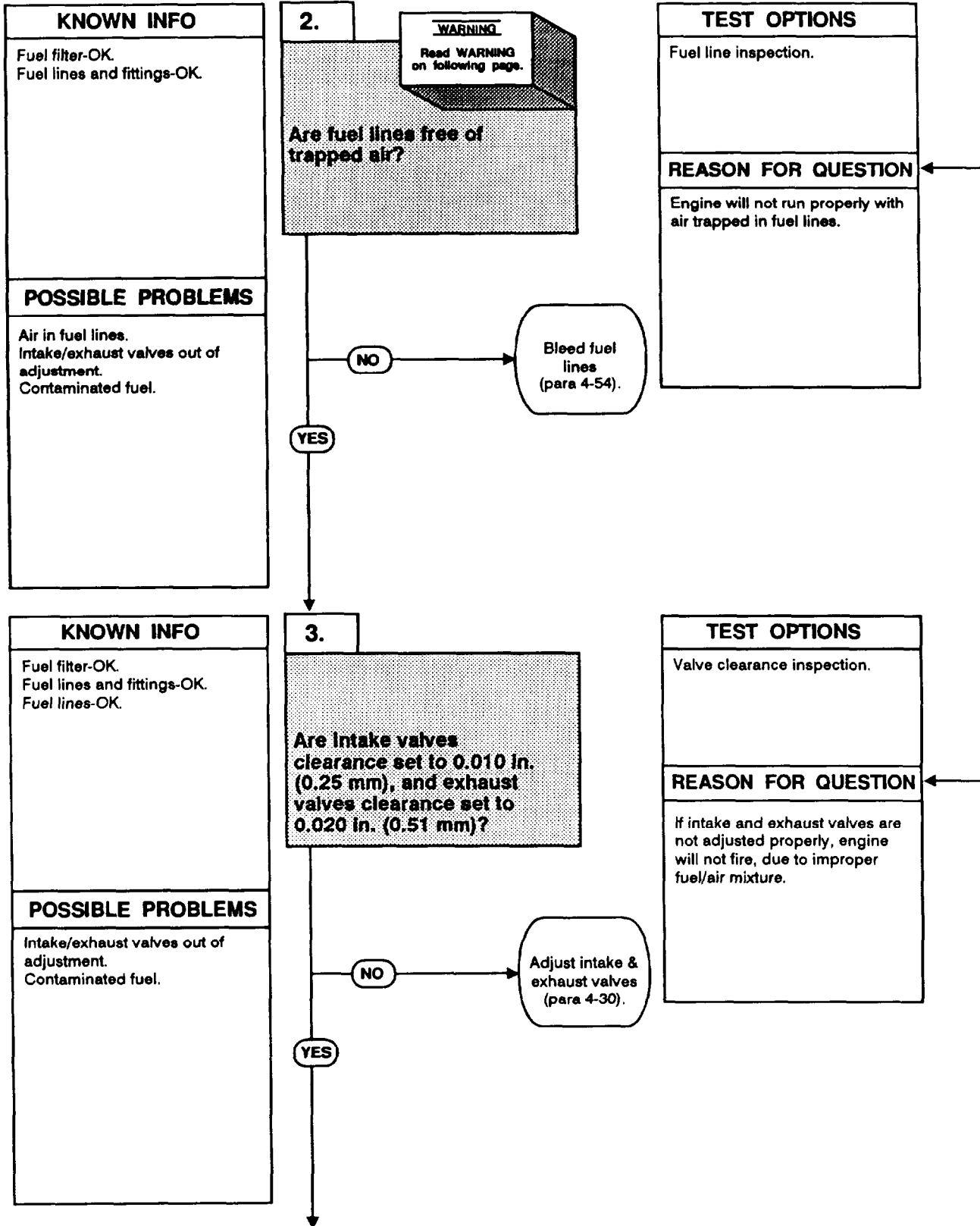
WARNING

- Post signs that read **NO SMOKING WITHIN 50 FEET (15 m)** when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

**FUEL LINES AND FITTINGS
INSPECTION.**

- (1) Open left and right engine doors, (para 2-14).
- (2) Check fuel lines (1) and fittings (2) for leaks.
 - (a) If any fuel lines or fittings leak, tighten or replace as necessary (para 4-47).
 - (b) If fuel lines and fittings do not leak, indicates air in fuel lines.

ENGINE RUNS ROUGH OR MISFIRES (CONT).

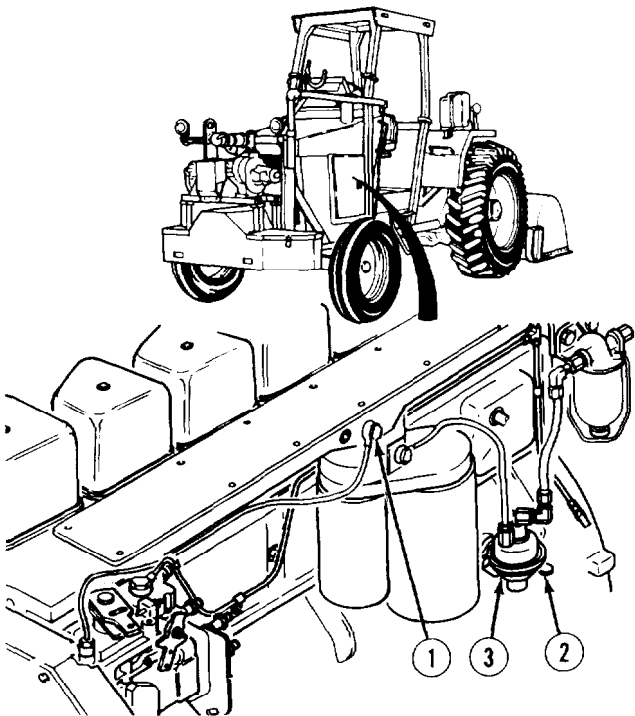


WARNING

- Post signs that read NO SMOKING WITHIN 50 FEET (15 m)"when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

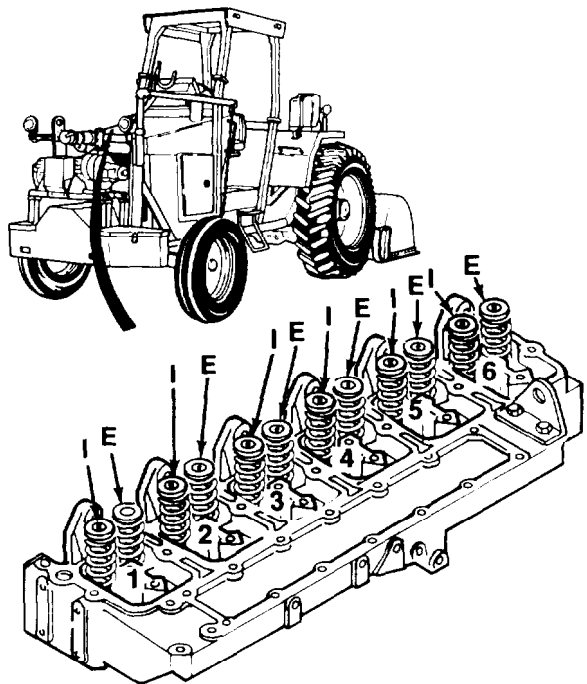
FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is airfree.
- (3) Tighten bleed screw (1) 72 lb-in (8 Nm).
- (4) Start engine (para 2-9).
- (5) Loosen six fuel line fittings on injectors one at a time until engine runs smoothly. Tighten securely.
- (6) Turn engine off (para 2-10[c]).
- (7) If engine still runs rough, indicates faulty valve clearance adjustment.

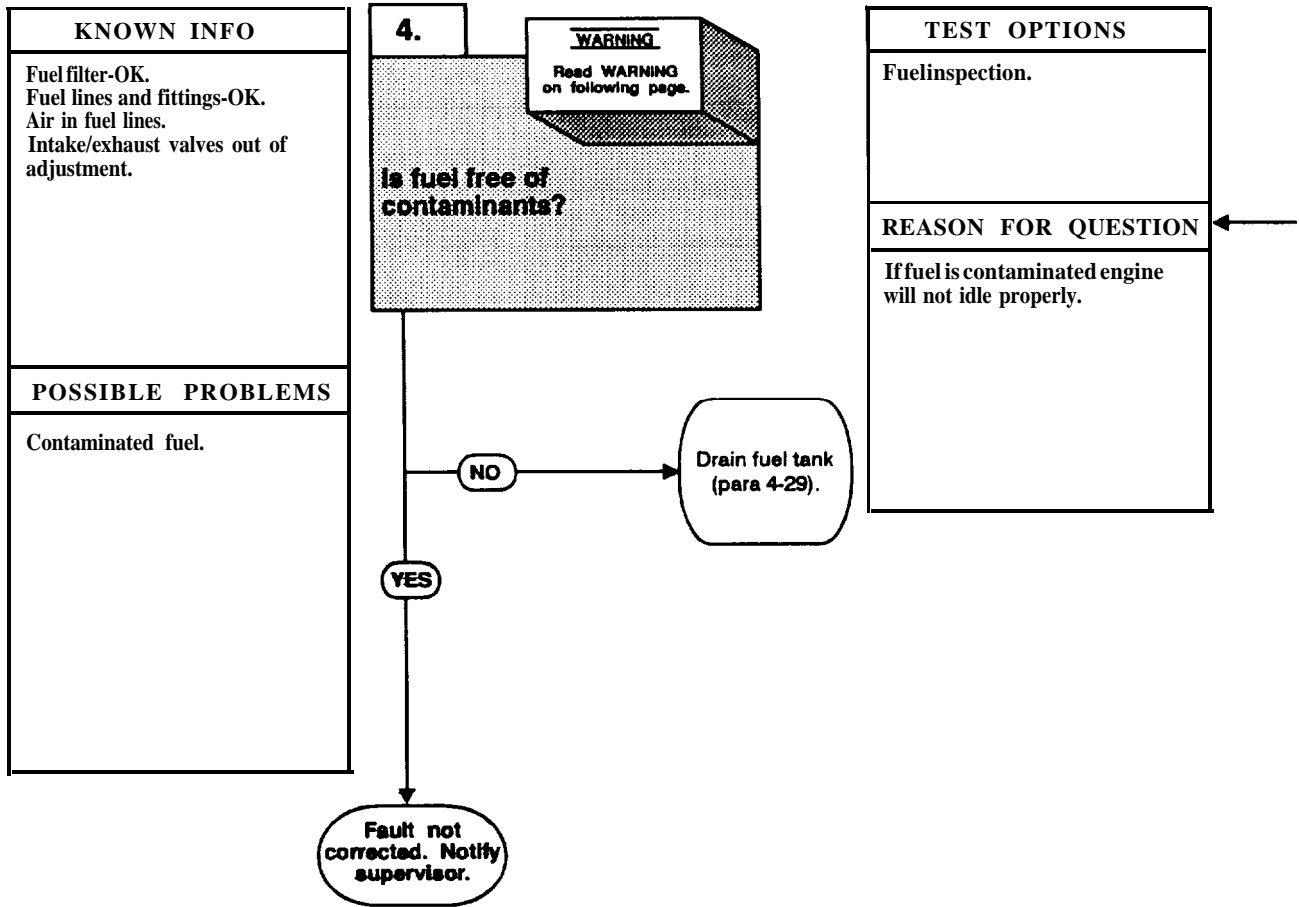


VALVE CLEARANCE INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove valve covers (para 4-31).
- (3) Check valve clearance, (para 4-30).
 - (a) Intake valves clearance must be 0.010 in. (0.25 mm).
 - (b) Exhaust valves clearance must be 0.020 in. (0.51 mm).
- (4) Install valve covers (para 4-31).
- (5) Connect negative battery cable (para 4-90).



ENGINE RUNS ROUGH OR MISFIRES (CONT).

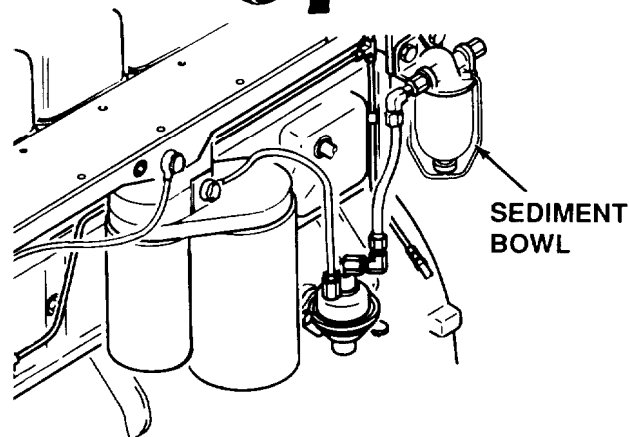
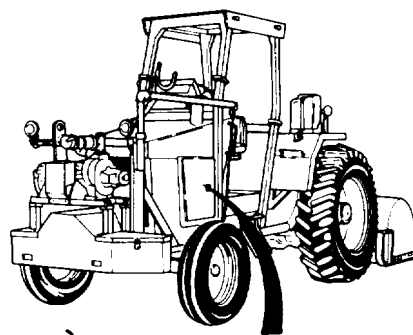


WARNING

- Post signs that read NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Set parking brake (para 2-13).
- (3) Check sediment bowl for contaminated fuel.
 - (a) If fuel is contaminated, drain fuel tank (para 4-29).
 - (b) If fuel is OK, notify supervisor.
- (4) Connect negative battery cable (para 4-90).



8. ENGINE RPM WILL NOT REACH RATED OPERATING SPEED.

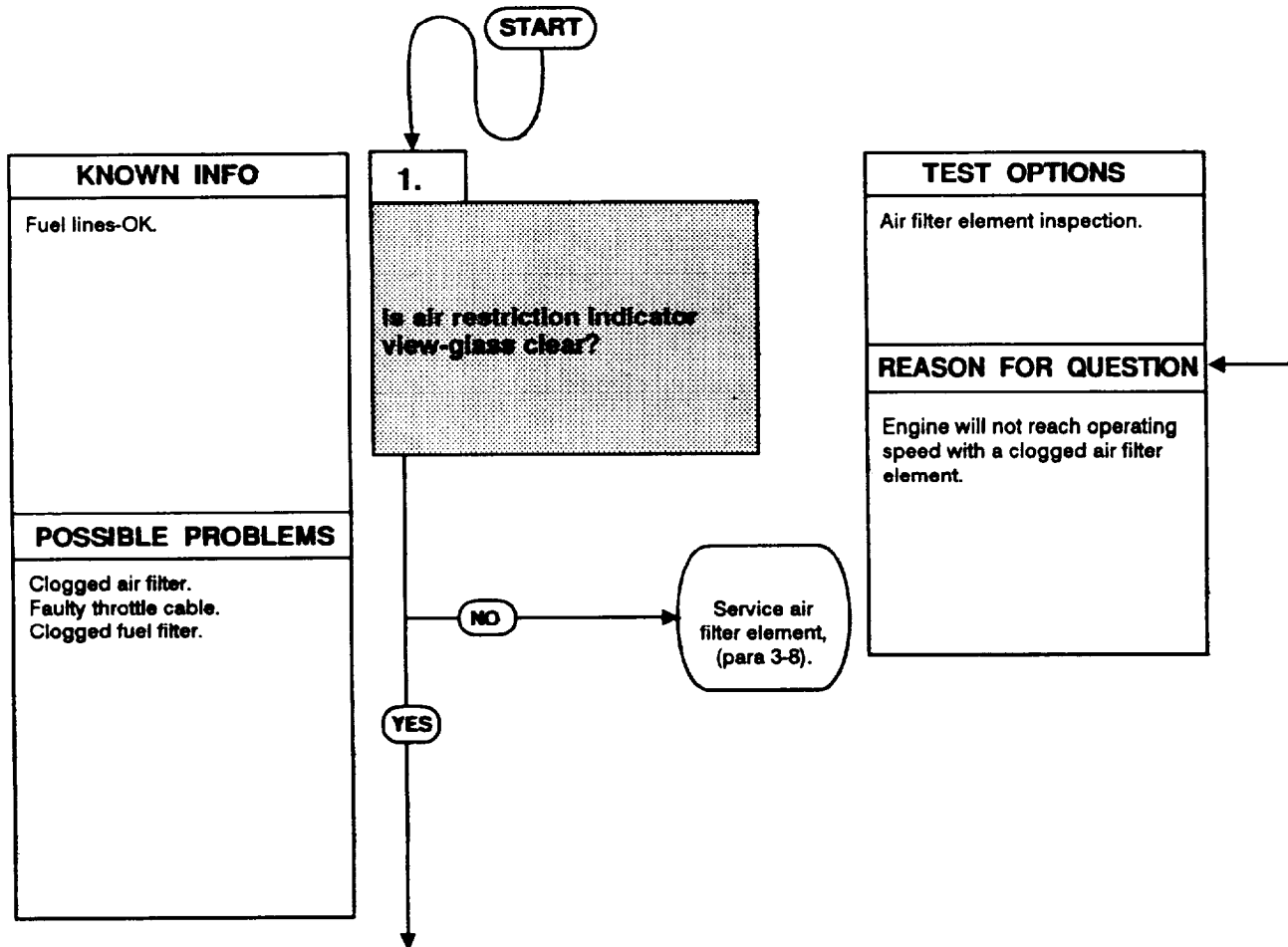
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

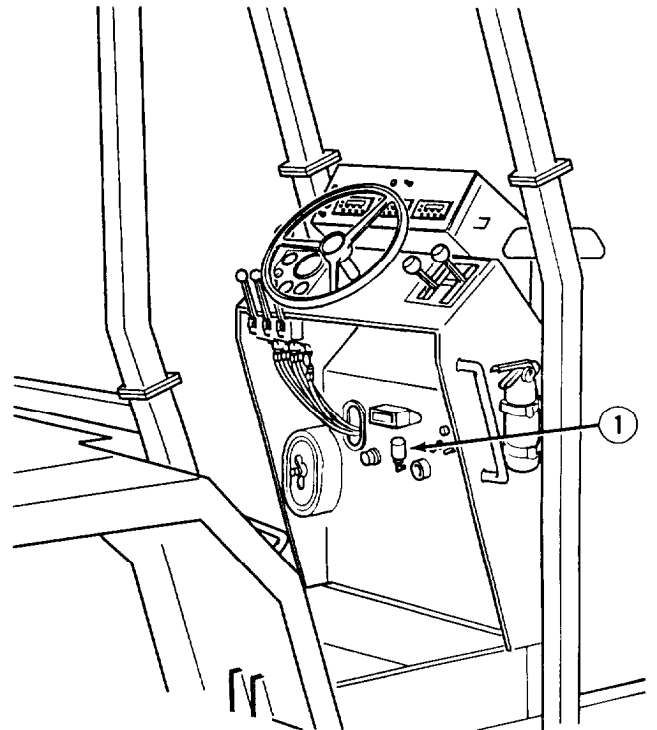
Tools and Special Tools

Tool kit, general mechanics: automotive

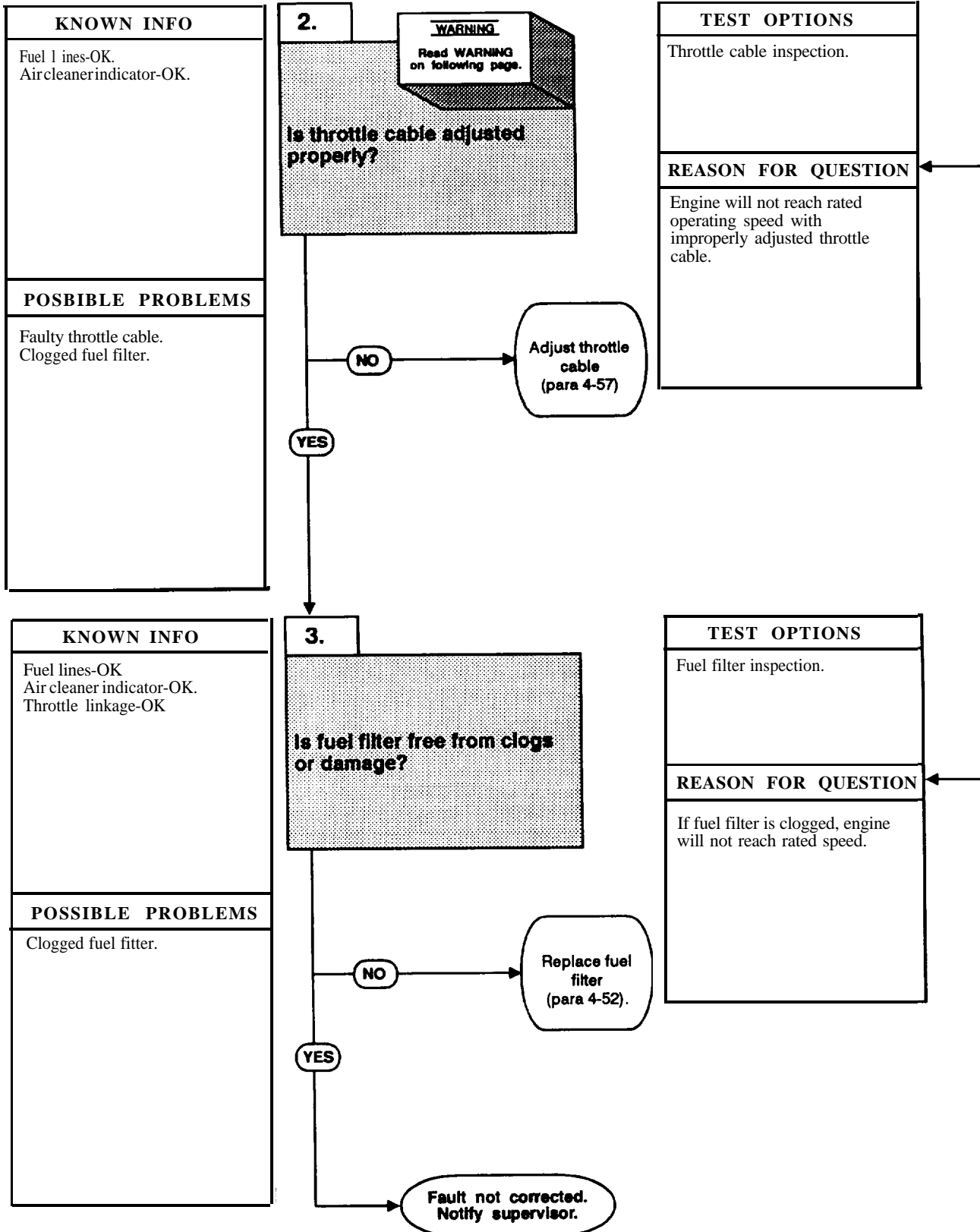


**AIR CLEANER RESTRICTION
INDICATOR INSPECTION**

- (1) Check air restriction indicator (1).
 - (a) If restriction indicator (1) shows red, check air cleaner element (para 3-8).
 - (b) If air restriction indicator (1) is clear, indicates faulty throttle linkage or controls.



ENGINE RPM WILL NOT REACH RATED OPERATING SPEED (CONT).

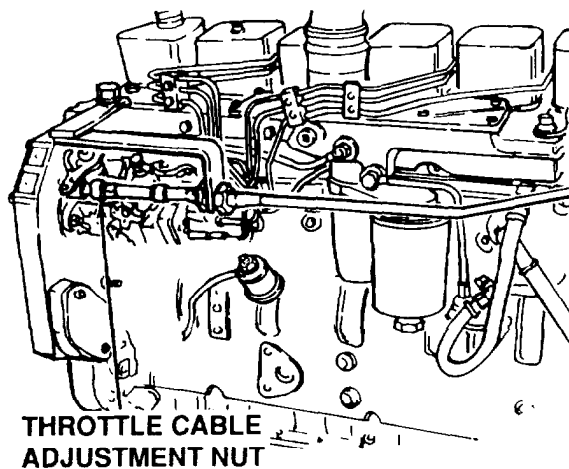


WARNING

- Post signs that read NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

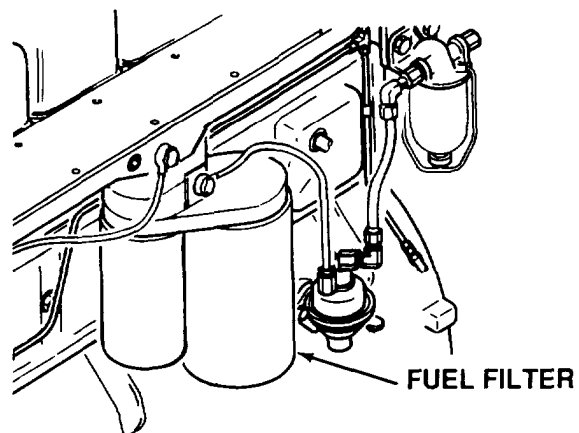
THROTTLE CABLE INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check throttle cable adjustment.
 - (a) If throttle cable is misadjusted, adjust cable (para 4-57).
 - (b) If throttle cable is adjusted properly, indicates clogged fuel filter.



FUEL FILTER INSPECTION

- (1) Open left engine door, (para 2-14).
- (2) Check fuel filter for clogging or damage.
 - (a) If fuel filter is clogged or damaged, replace (pare 4-52).
 - (b) If fuel filter is OK, notify supervisor.



9. ENGINE FAILS TO DEVELOP FULL POWER.

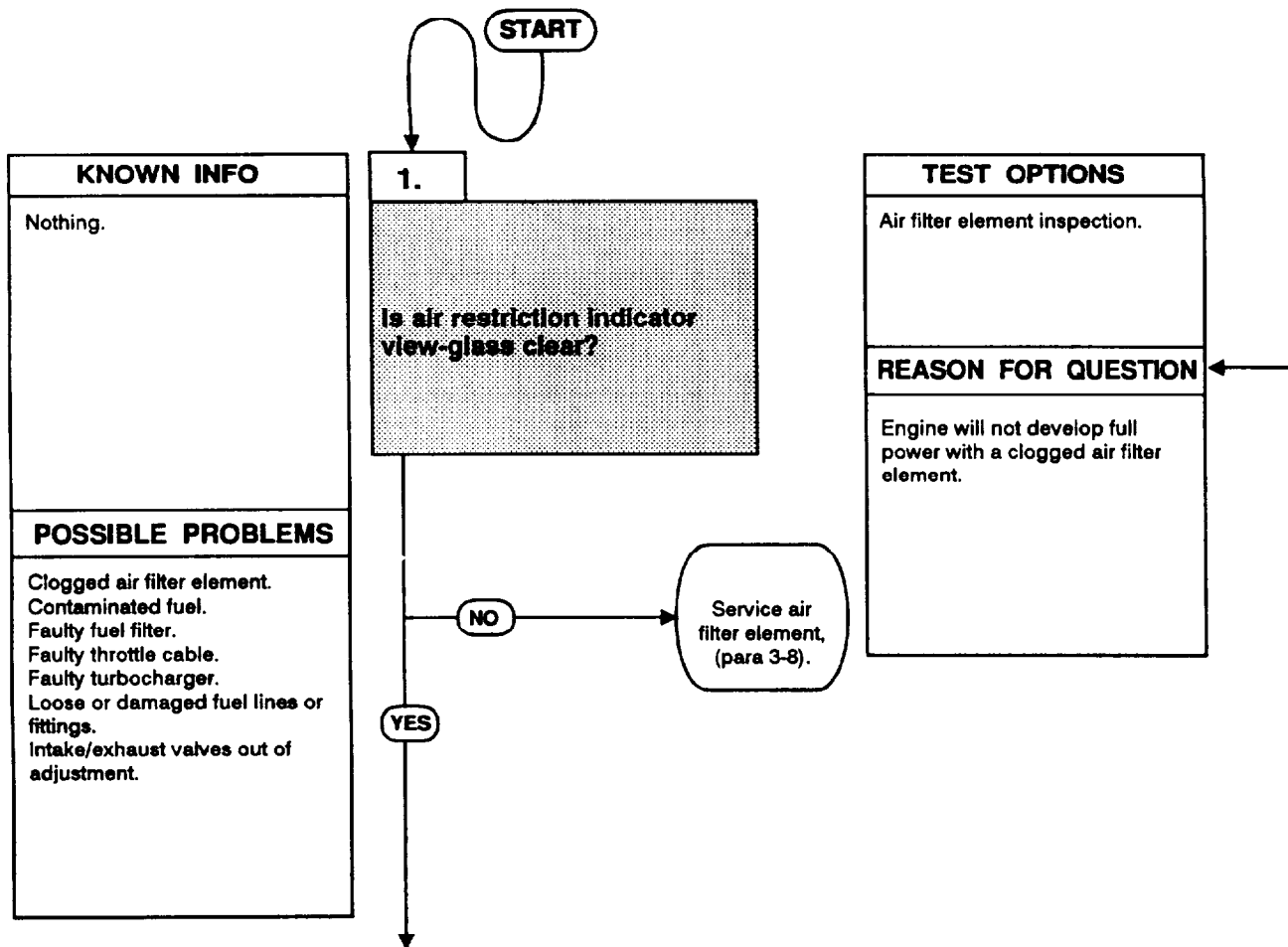
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

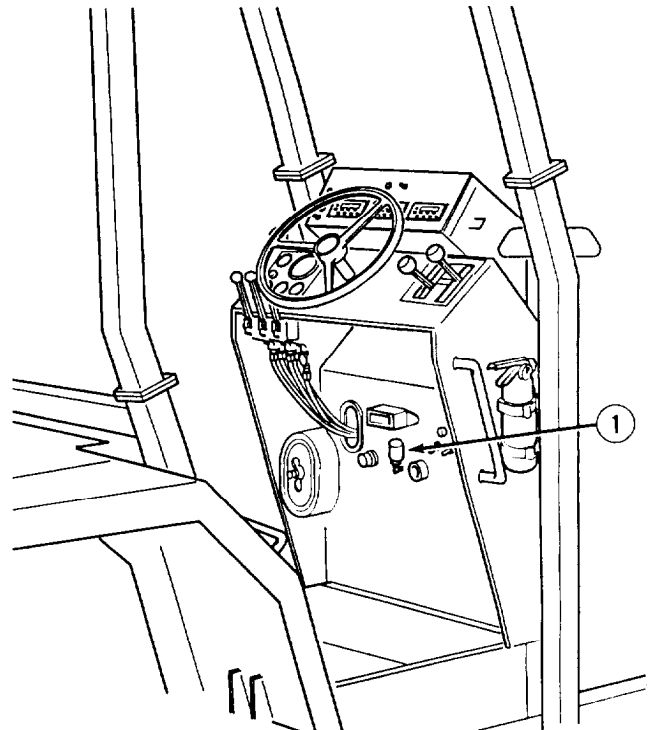
Tools and Special Tools

Tool kit, general mechanic's: automotive

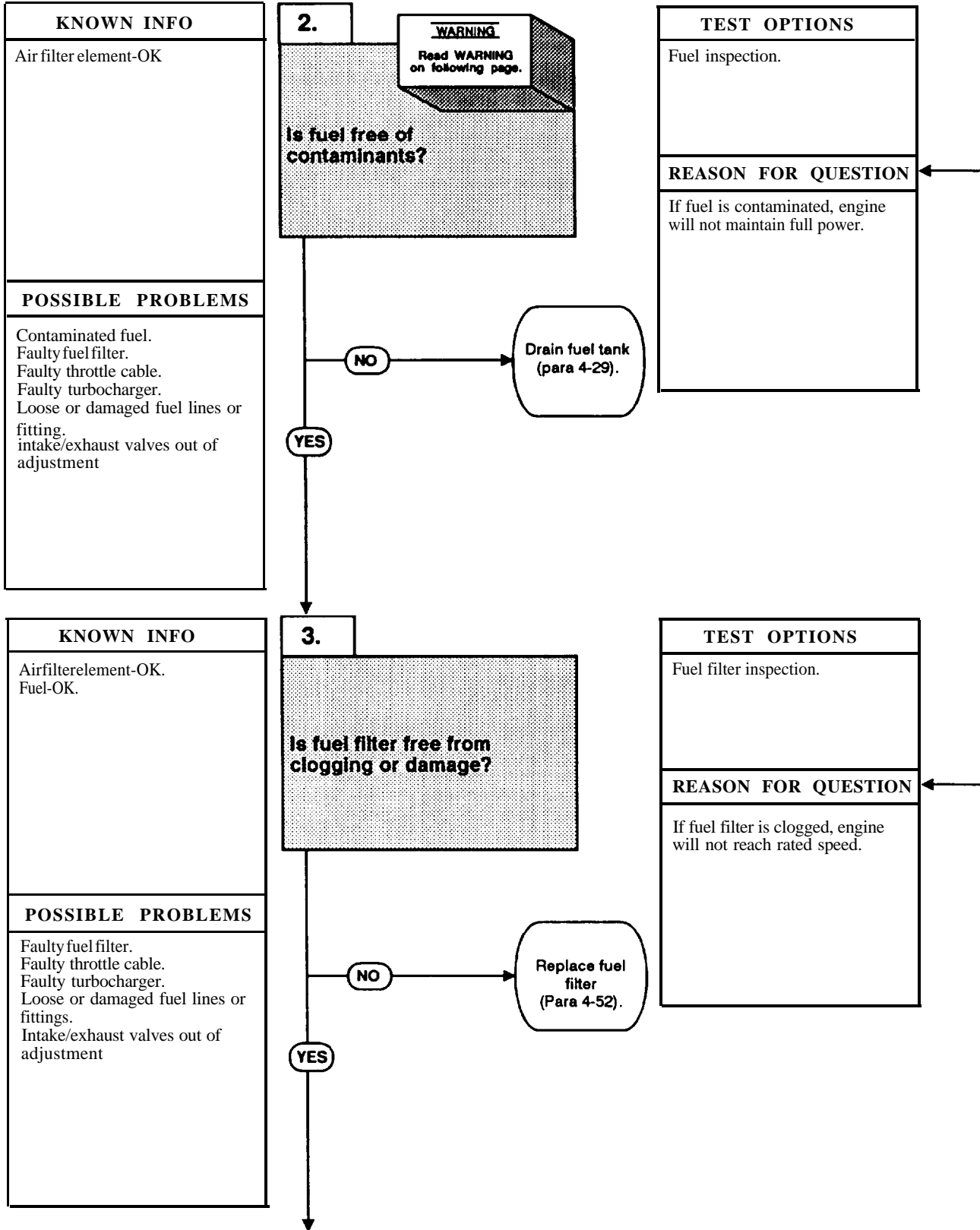


**AIR CLEANER RESTRICTION
INDICATOR INSPECTION**

- (1) Check air restriction indicator (1).
 - (a) If restriction indicator (1) shows red, check air cleaner element (para 3-8).
 - (b) If restriction indicator (1) is clear, indicates contaminated fuel.



ENGINE FAILS TO DEVELOP FULL POWER (CONT).

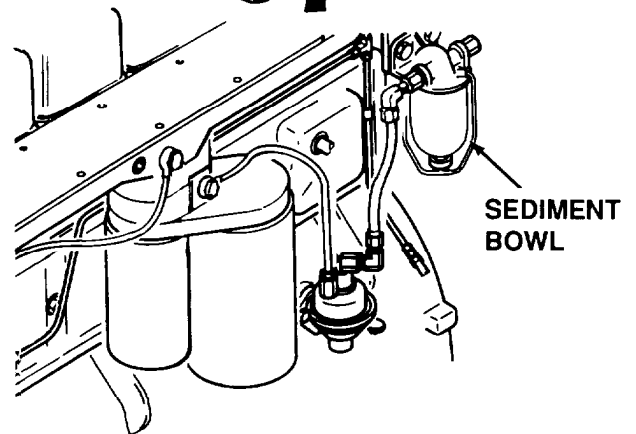
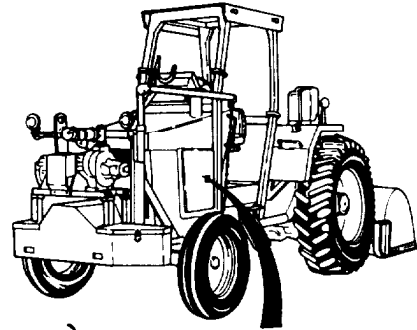


WARNING

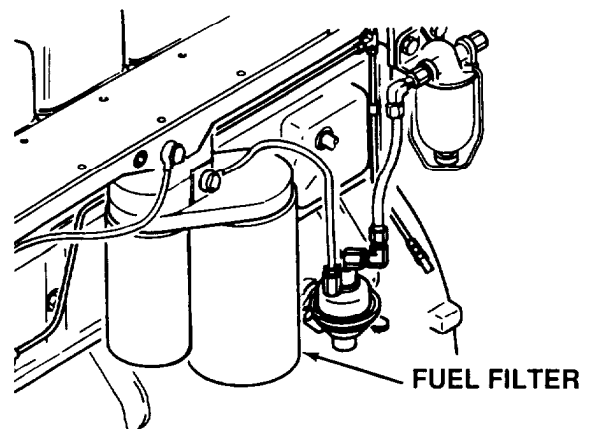
- Post signs that read NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel liner or fuel tanks.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INSPECTION

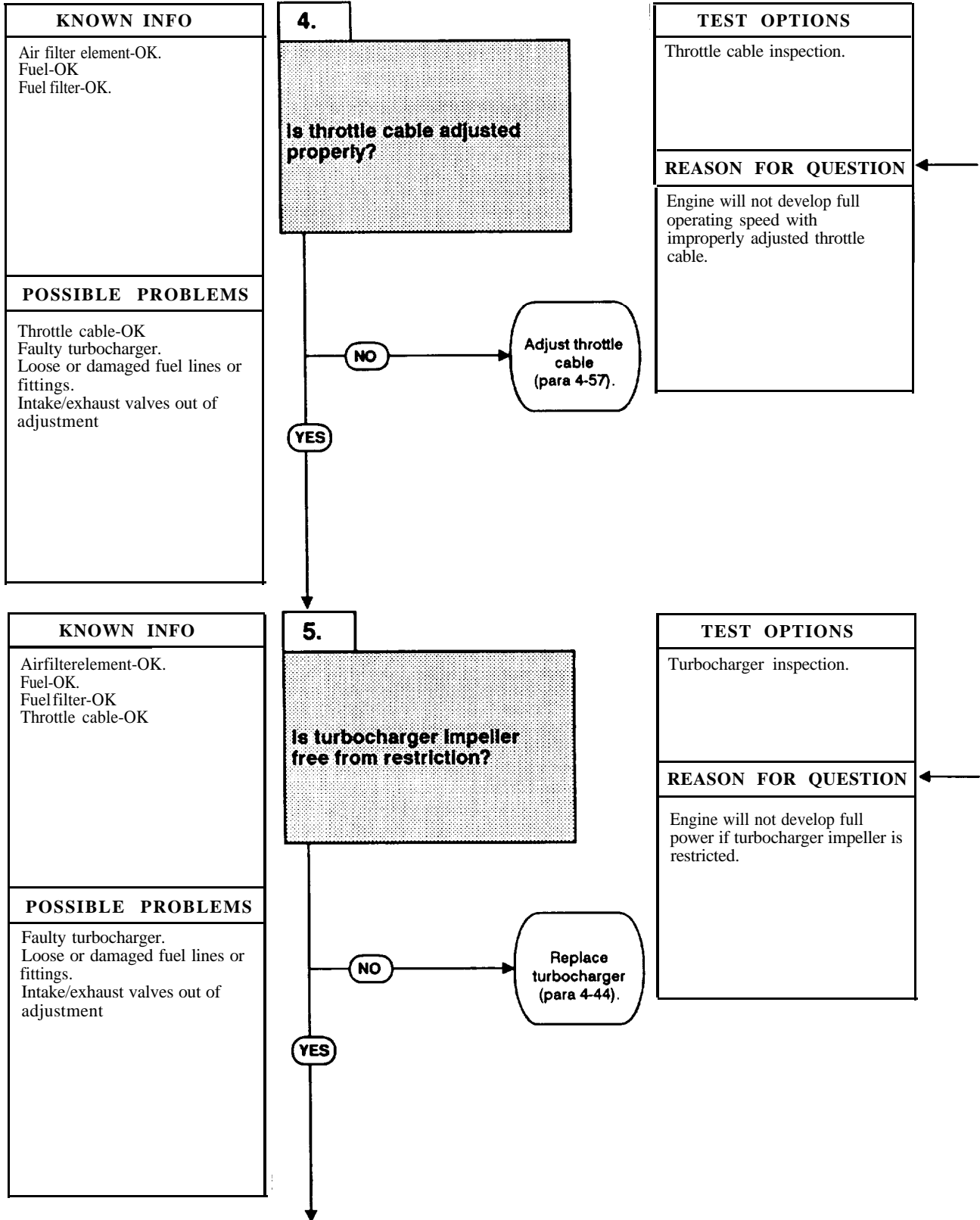
- (1) Disconnect negative battery cable (para 4-90).
- (2) Set parking brake (para 2-13).
- (3) Check sediment bowl for contaminated fuel.
 - (a) If fuel is contaminated, drain fuel tank (para 4-29).
 - (b) if fuel is OK, indicates faulty fuel filter.
- (4) Connect negative battery cable (para 4-90).

**FUEL FILTER INSPECTION**

- (1) Open left engine door, (para 2-14).
- (2) Check fuel filter for clogging or damage.
 - (a) If fuel filter is clogged or damaged, replace (para 4-52).
 - (b) If fuel filter is OK, indicates improper throttle cable adjustment.

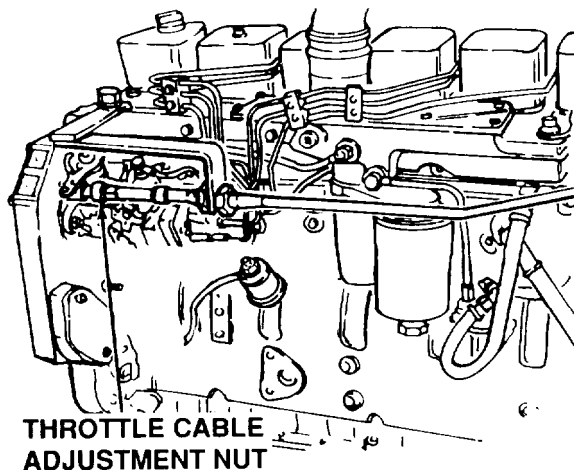


ENGINE FAILS TO DEVELOP FULL POWER (CONT).



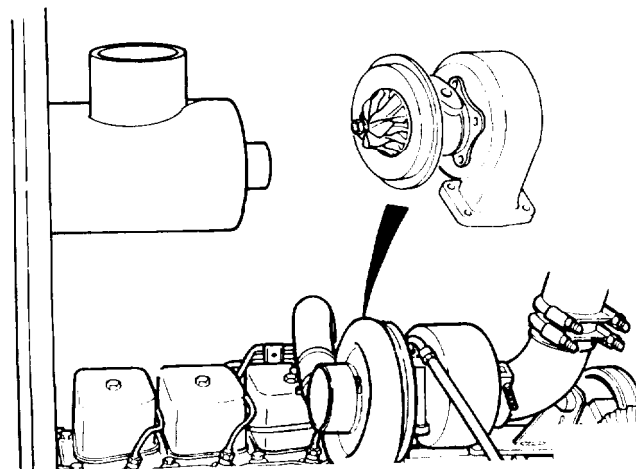
**THROTTLE CABLE
INSPECTION**

- (1) Open left engine door (para 2-14).
- (2) Inspect throttle cable (1) for damage or misadjustment.
 - (a) If throttle cable is damaged, replace (para 4-56).
 - (b) If throttle cable is misadjusted, adjust cable (para 4-57).
 - (c) If throttle cable operates properly, indicates faulty turbocharger.

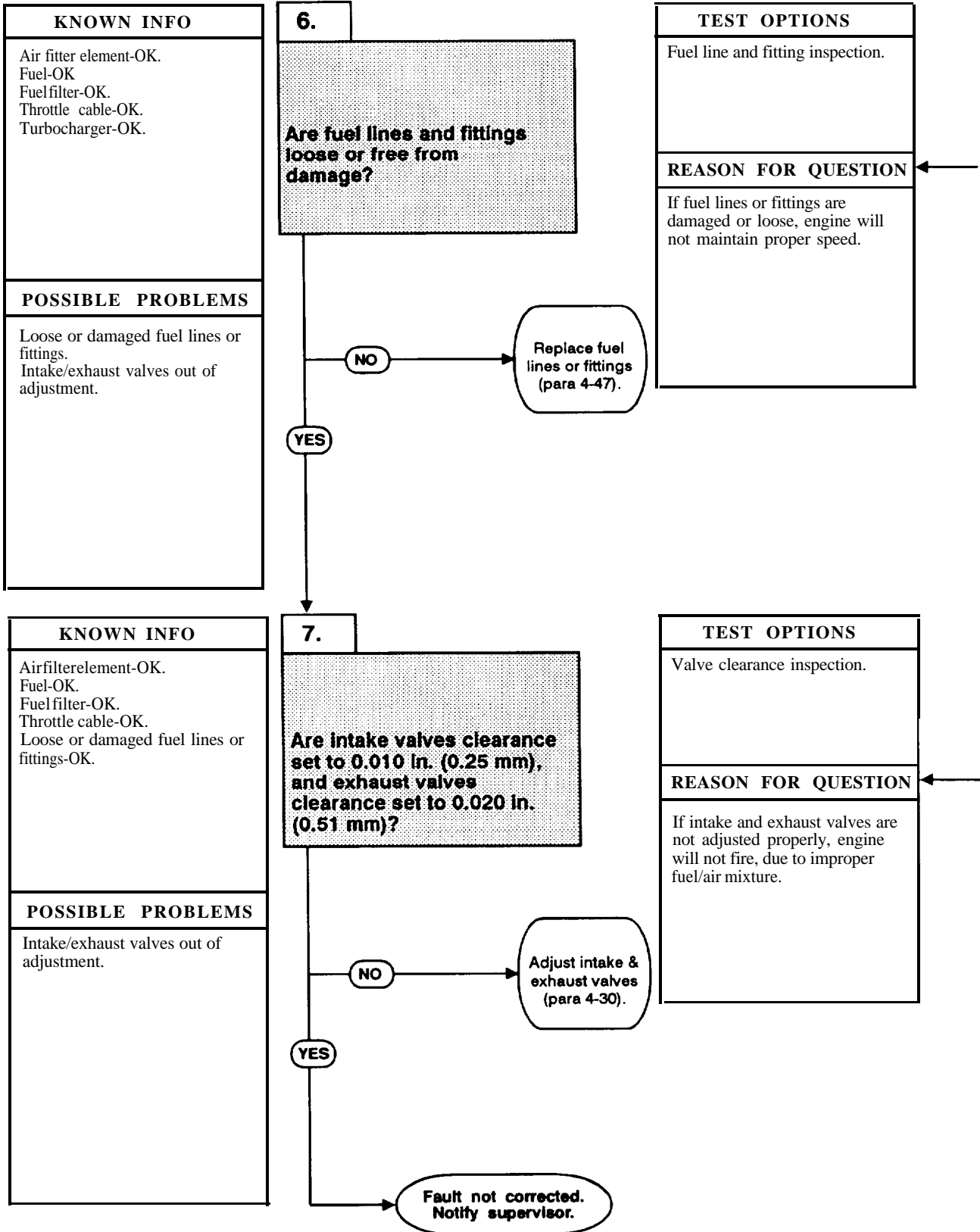


TURBOCHARGER INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove turbocharger air inlet hose from turbocharger inlet (para 4-43).
- (3) Inspect turbocharger impeller operation.
 - (a) If impeller is damaged or restricted from turning properly, replace turbocharger (para 4-44).
 - (b) If impeller is not damaged or operates properly, notify supervisor.



ENGINE FAILS TO DEVELOP FULL POWER (CONT).

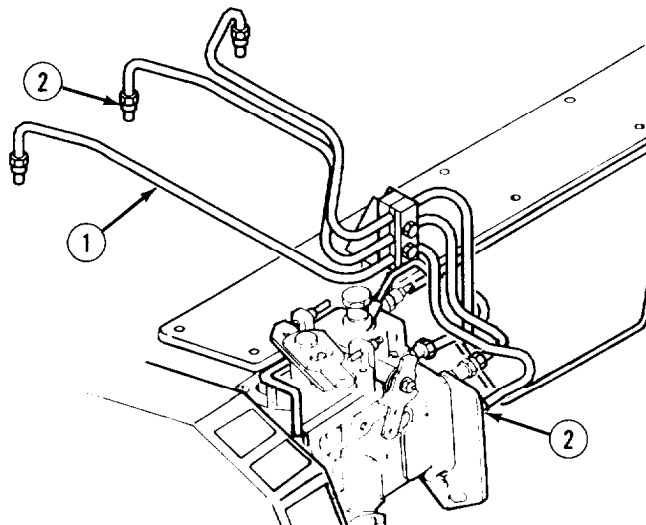


WARNING

- Post signs that read NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.
- Do not work on fuel system when engine is hot: fuel can be ignited by a hot engine.

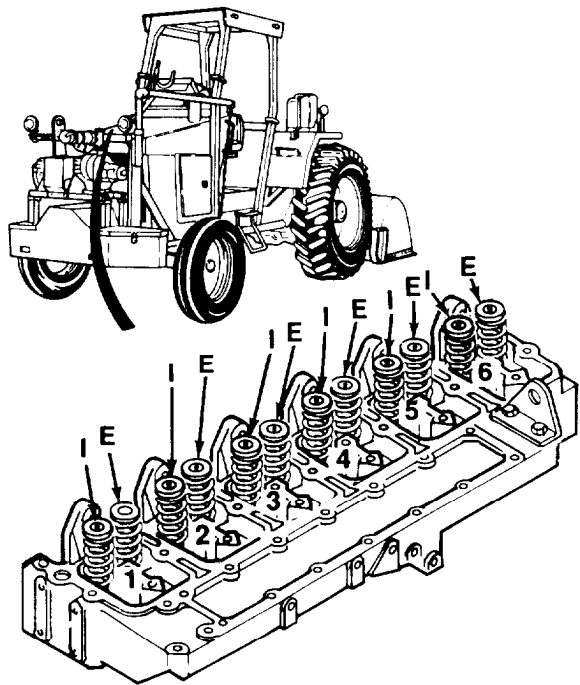
FUEL LINES AND FITTINGS INSPECTION.

- (1) Open left and right engine doors, (para 2-14).
- (2) Check fuel lines (1) and fittings (2) for leaks.
 - (a) If any fuel lines or fittings leak, tighten or replace as necessary (pare 4-47).
 - (b) If fuel lines and fittings do not leak, indicates air in fuel lines.



VALVE CLEARANCE INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove valve covers (para 4-31).
- (3) Check valve clearance, (pare 4-30).
 - (a) Intake valves clearance must be 0.010 in. (0.25 mm).
 - (b) Exhaust valves clearance must be 0.020 in. (0.51 mm)
- (4) Install valve covers (para 4-31).
- (5) Connect negative battery cable (para 4-90).



10. ENGINE EXHAUST SMOKES EXCESSIVELY.

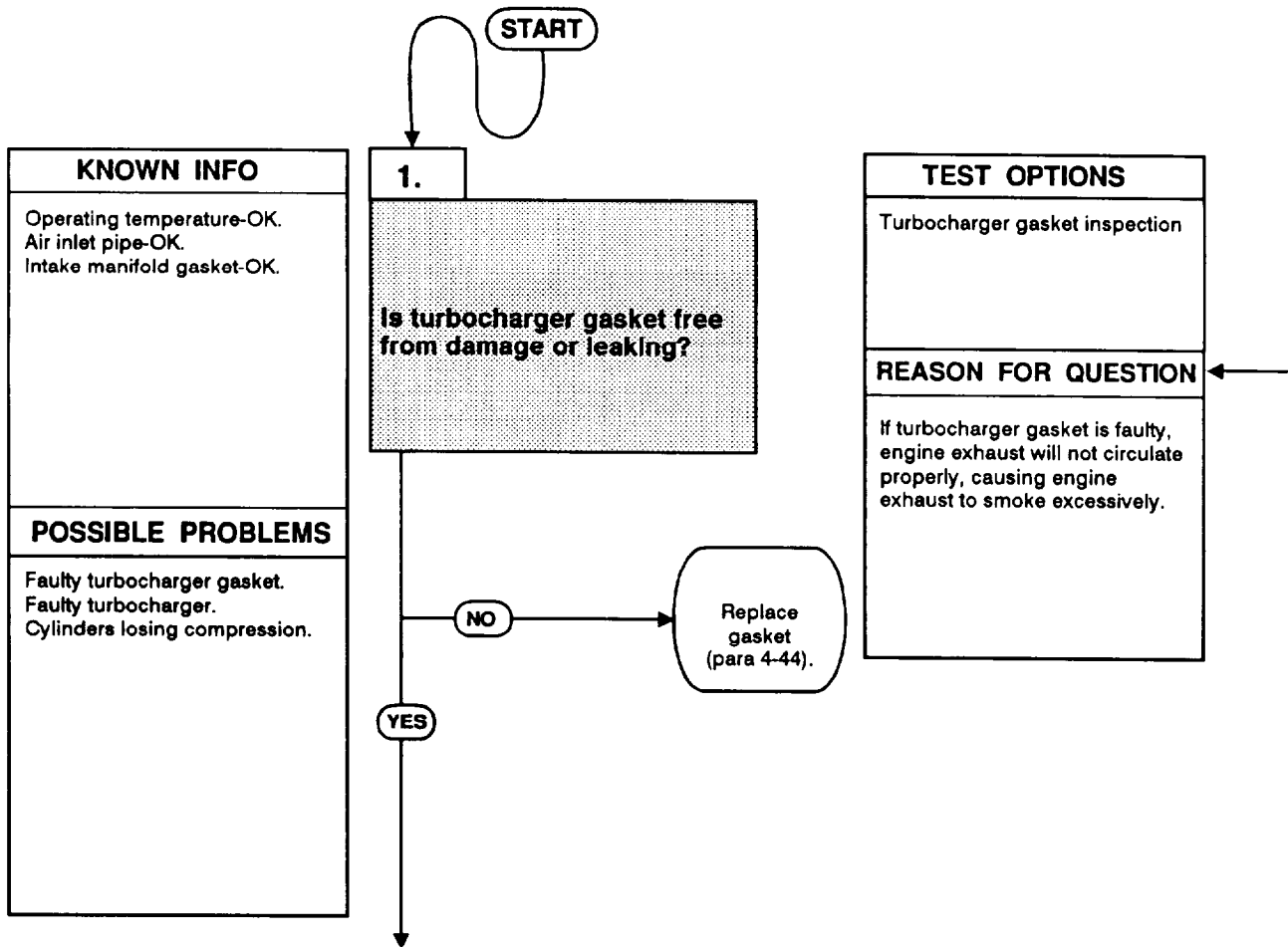
INITIAL SETUP

Equipment Conditions

Engine shut off, (para2-10[c]).
 Parking brake set, (para2-13).

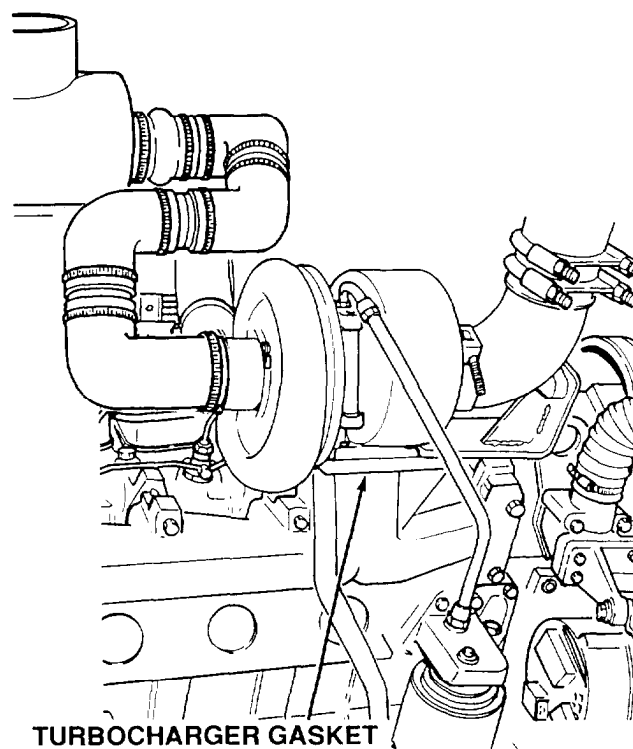
Tools and Special Tools

Tool kit, general mechanic's: automotive

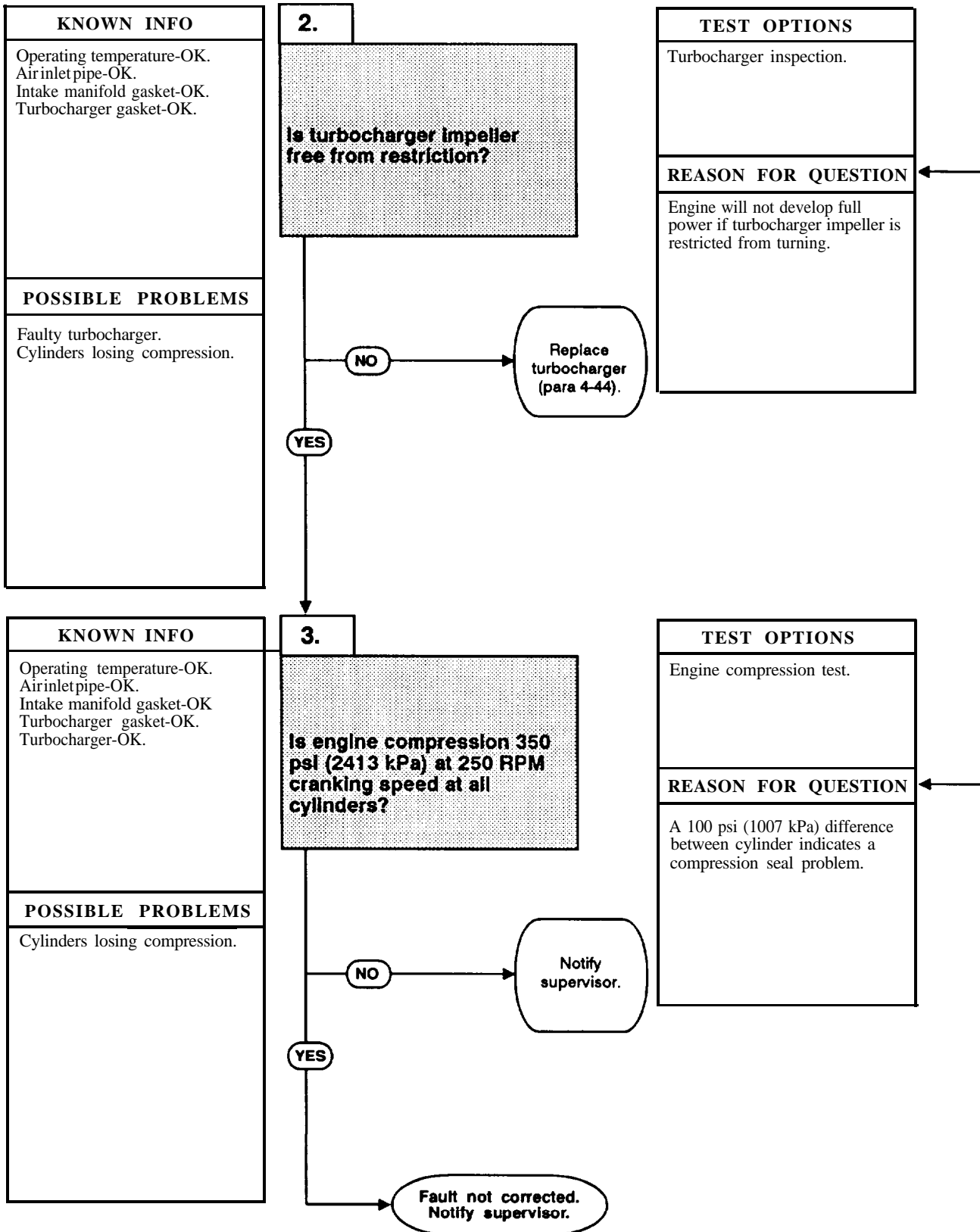


**TURBOCHARGER GASKET
INSPECTION**

- (1) Check for leaks between turbocharger and exhaust manifold.
 - (a) If leaks or damage are present, replace as necessary (para 4-44).
 - (b) If no leaks or damage are present, indicates faulty turbocharger.

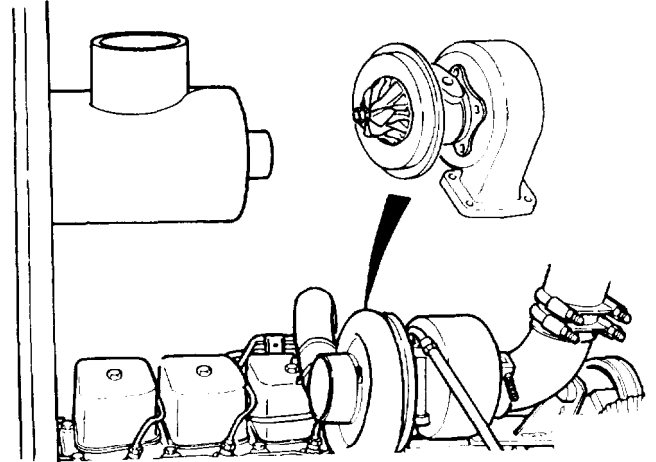


ENGINE EXHAUST SMOKES EXCESSIVELY (CONT).



TURBOCHARGER INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove turbocharger air inlet hose from turbocharger inlet (para 4-43).
- (3) Inspect turbocharger impeller operation.
 - (a) If impeller is damaged or restricted from turning properly, replace turbocharger (para 4-44).
 - (b) If impeller is not damaged or operates properly, indicates low compression supervisor.



ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem, notify supervisor.
 - (b) If engine passes compression test, notify supervisor.

11. ENGINE OPERATING TEMPERATURE TOO HIGH.

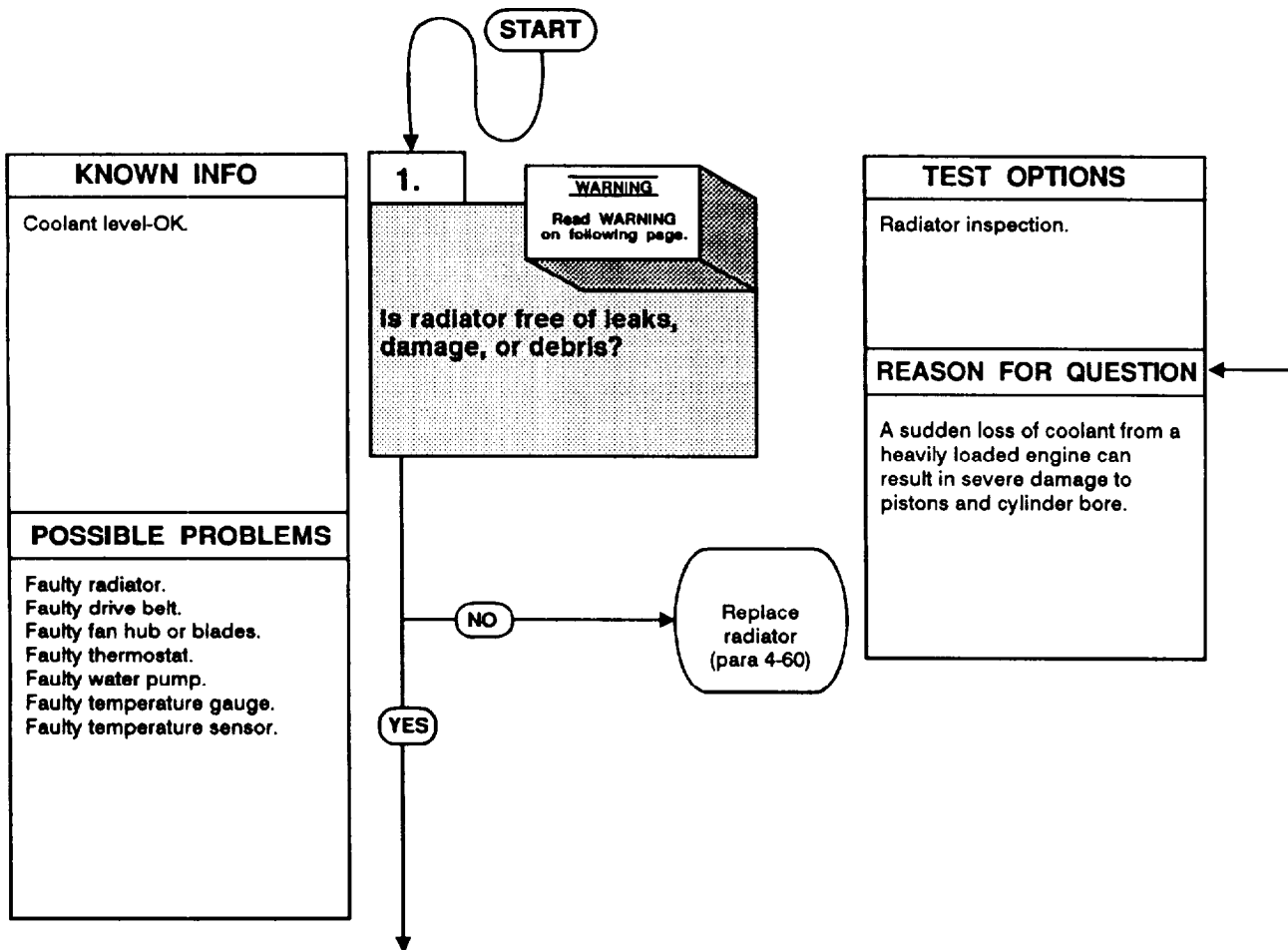
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para2-10[c]).
- Parking brake set, (para2-13).
- Right engine door opened, (para2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).

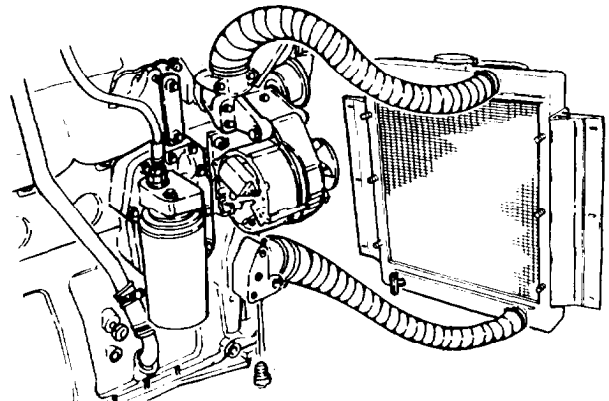
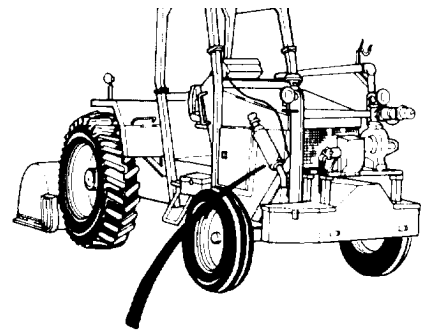


WARNING

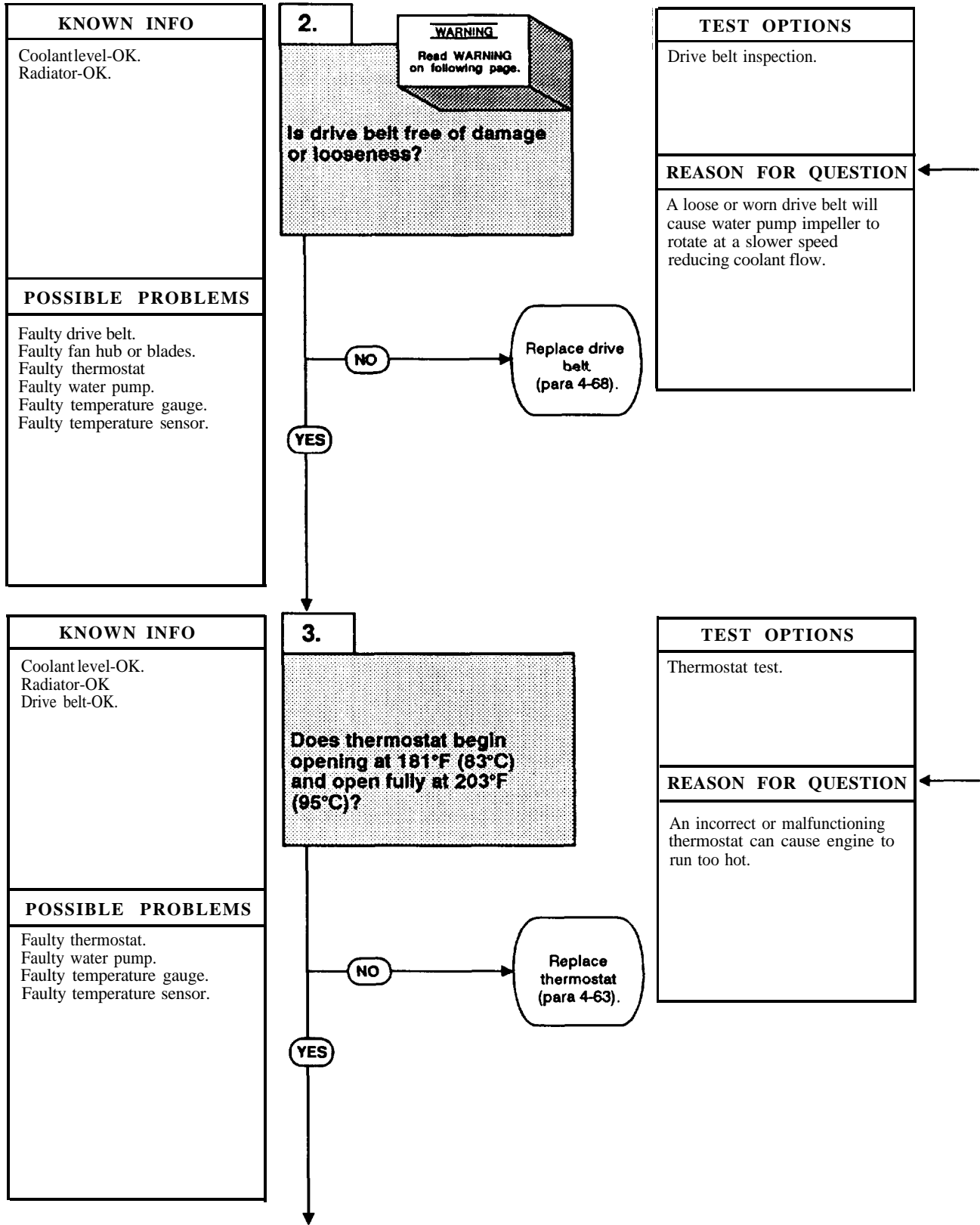
Do not remove radiator cap when the engine is hot; steam and hot coolant can escape and burn personnel. Use extreme care when removing radiator pressure cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After use securely tighten cap. Use a clean, thick waste cloth or like material to remove cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

RADIATOR INSPECTION

- (1) Open left and right engine doors (para 2-14).
- (2) Inspect radiator for obvious damage, or leaks.
 - (a) If radiator is faulty, replace (para 4-60).
 - (b) If radiator is OK, indicates faulty drive belt.



ENGINE OPERATING TEMPERATURE TOO HIGH (CONT.).

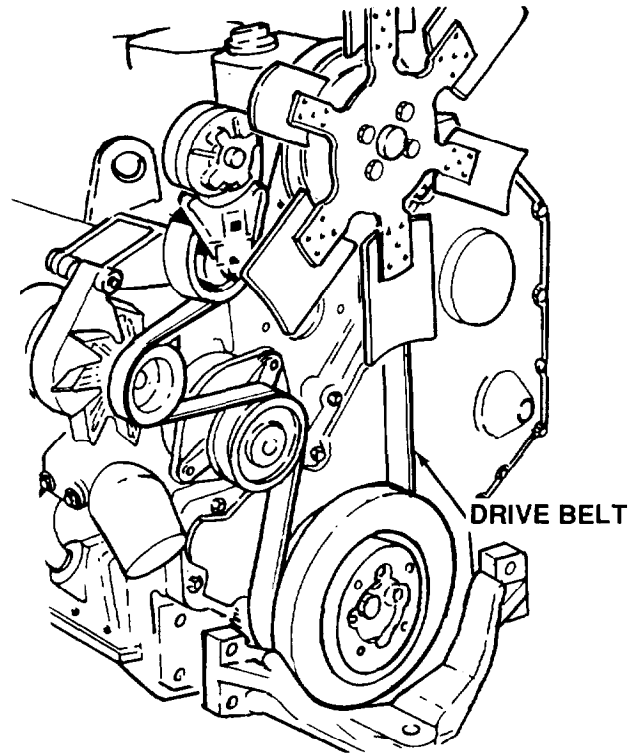


WARNING

Do not remove the radiator cap when engine is hot; steam and hot coolant can escape and burn personnel. Use extreme care when removing radiator pressure cap. Sudden release or pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After use securely tighten cap. Use a clean, thick waste cloth or like material to remove cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

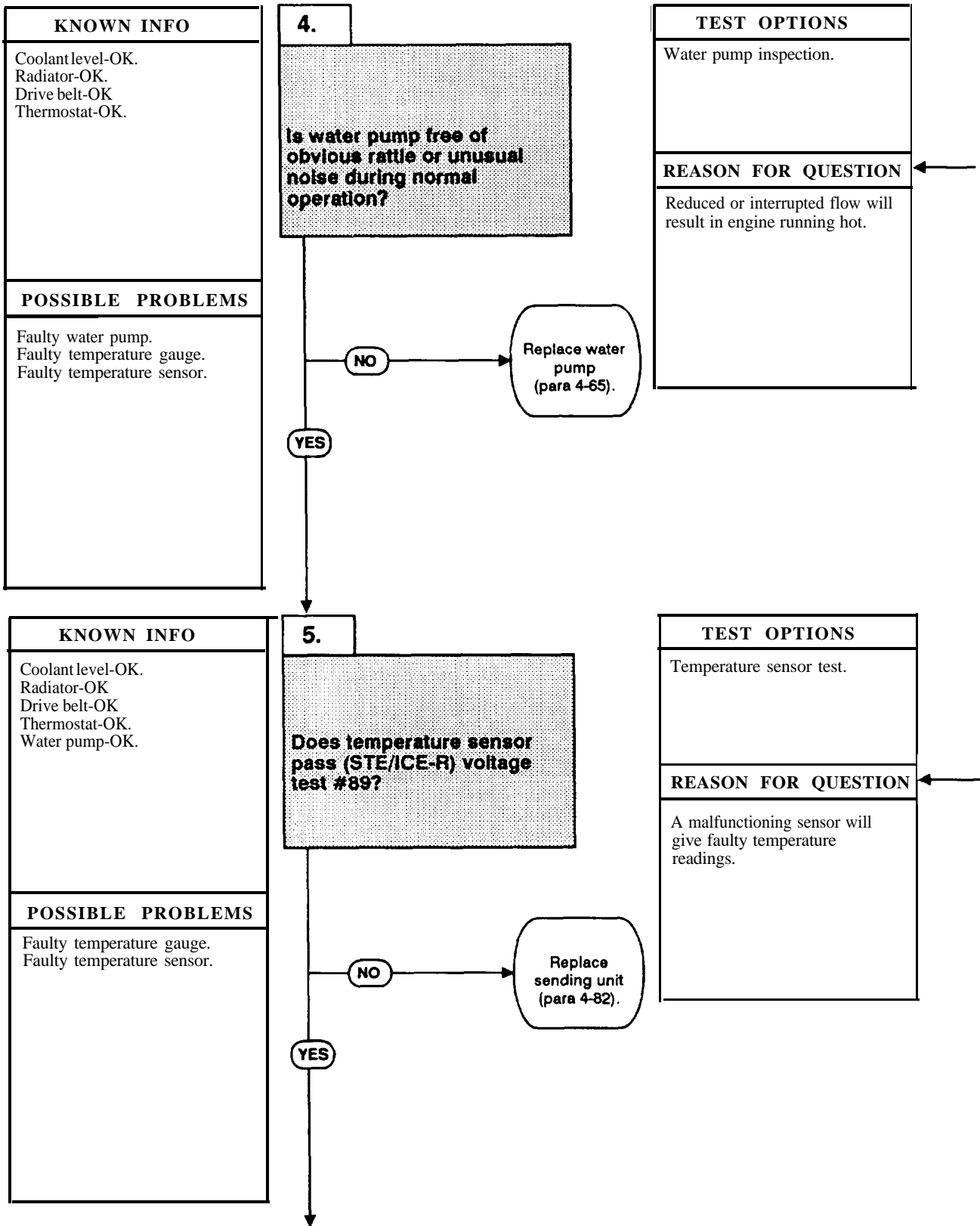
DRIVE BELT INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check drive belt for obvious damage.
 - (a) If damaged, replace drive belt (para 4-58).
 - (b) If drive belt is OK, check drive belt deflection.
- (3) Measure drive belt deflection at longest span of belt. Maximum deflection is 3/8 to 1/2 inch (9.5 to 12.7 mm).
 - (a) If drive belt is not within limits, replace drive belt tensioner (para 4-69).
 - (b) If drive belt is within limits, indicates faulty thermostat.



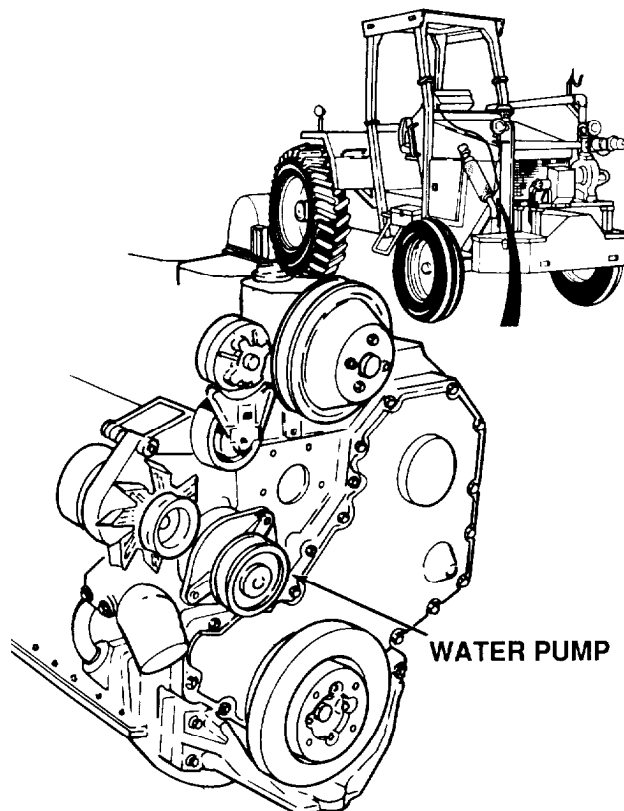
Remove thermostat (para 4-63) and test according to TM 750-254; replace thermostat as necessary.

ENGINE OPERATING TEMPERATURE TOO HIGH (CONT).



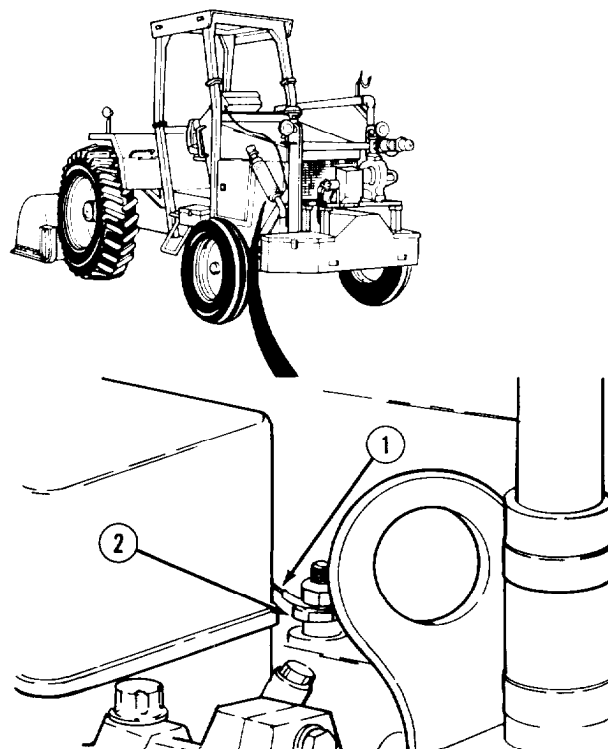
WATER PUMP INSPECTION

- (1) Open left and right engine doors (para 2-14).
- (2) Set parking brake (para 2-13).
- (3) Start engine (para 2-9) and bring to operating temperature.
 - (a) Listen for rattle or unusual noise coming from water pump. If faulty, replace water pump (para 4-65).
 - (b) If water pump is OK, indicates faulty temperature sensor.

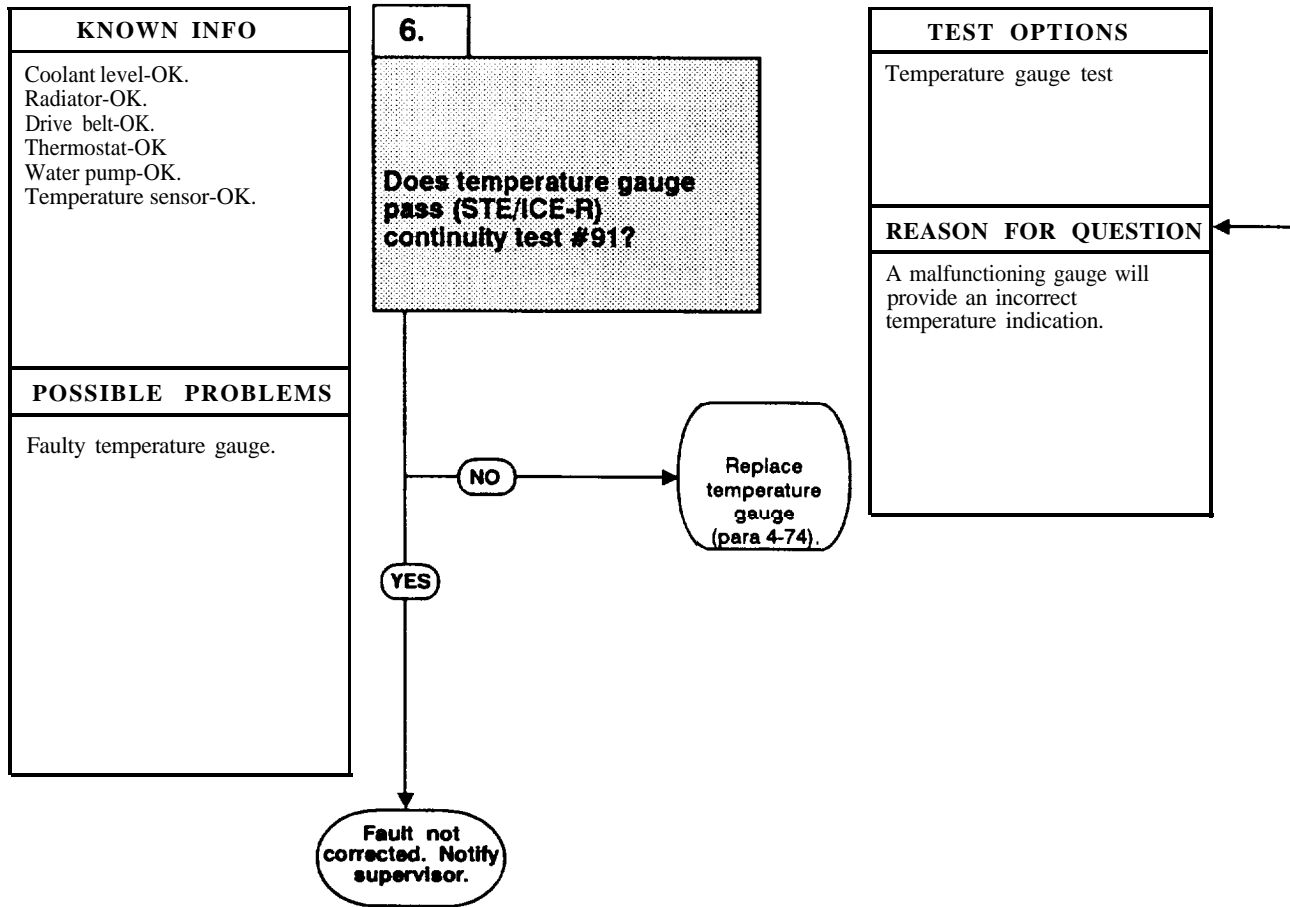


TEMPERATURE SENSOR TEST

- (1) Open left engine door (para 2-14).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Remove wire (1) from temperature sensor unit (2) on vehicle.
- (3) Connect red clip lead from W2 to wire (1) removed from sensor unit (2).
- (4) Connect black clip lead to chassis ground.
- (5) Turn engine switch on (para 2-9).
- (6) Run DC voltage test #89.
 - (a) If VTM indicates 12 ± 3 Vdc, replace temperature sensor (para 4-82).
 - (b) If sensor passes voltage test, indicates faulty temperature gauge.

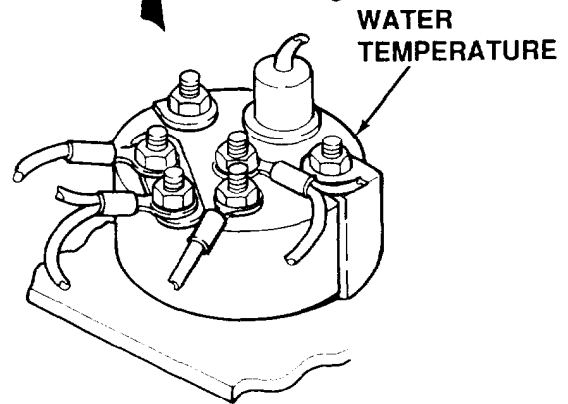
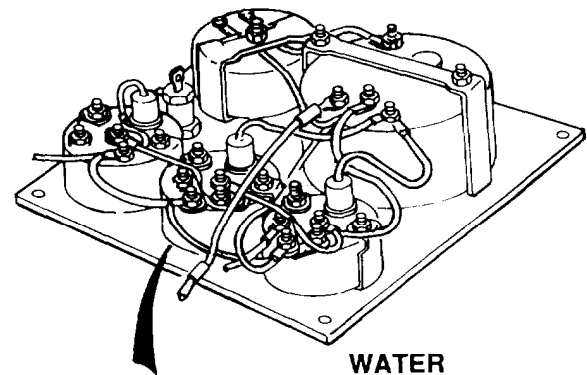


ENGINE OPERATING TEMPERATURE TOO HIGH (CONT).



**TEMPERATURE GAUGE
INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Remove instrument panel (para 4-73).
- (3) Power up STE/ICE-R to a known good battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run continuity test #91.
 - (a) If temperature gauge fails continuity test, replace gauge (para 4-74).
 - (b) If temperature gauge has continuity, notify supervisor.



12. ENGINE OPERATING TEMPERATURE TOO LOW.

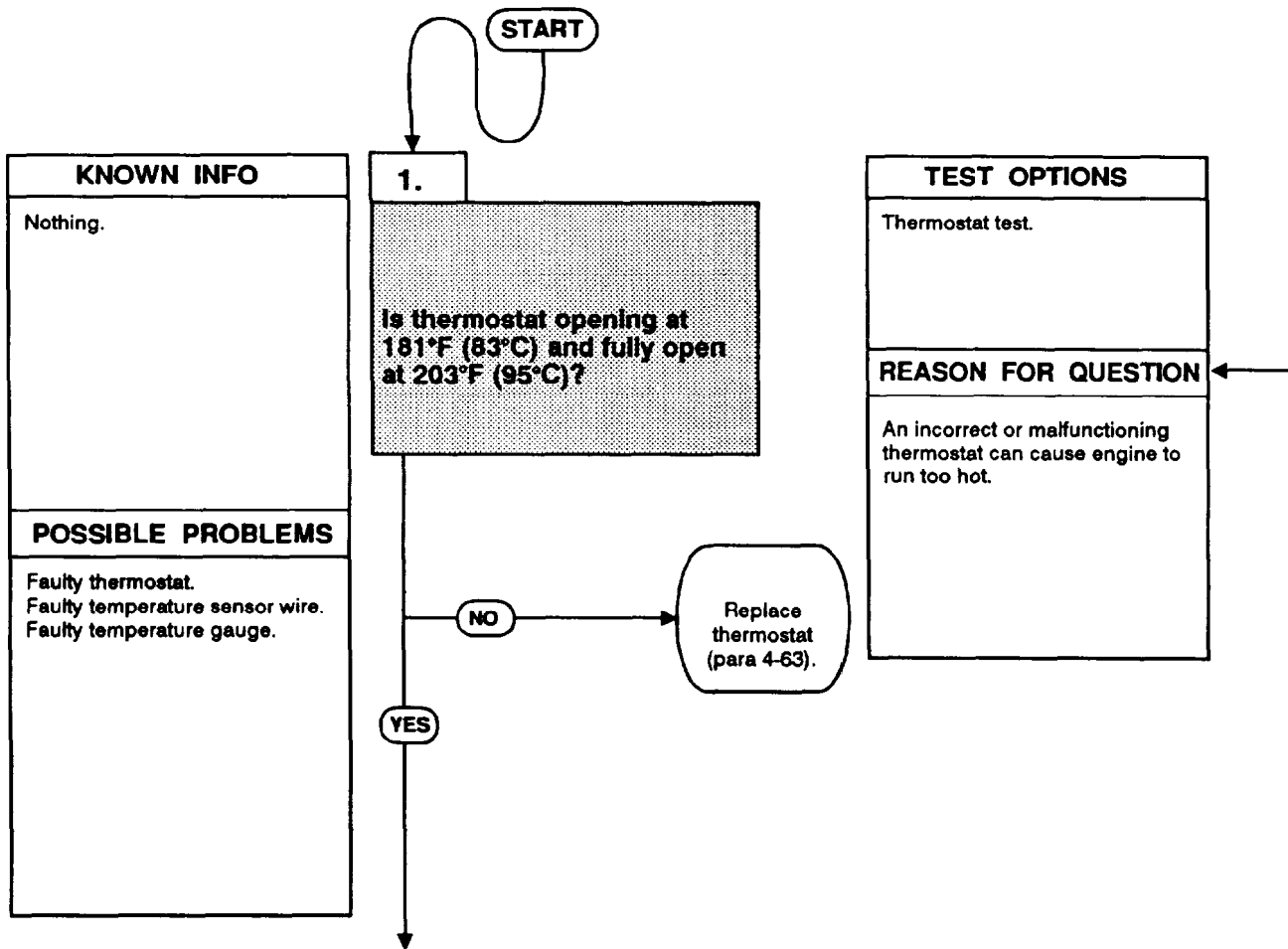
INITIAL SETUP

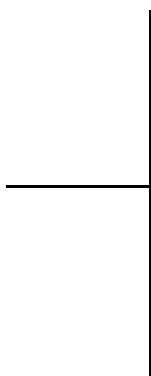
Equipment Conditions

- Engine shut off, (para2-10[c]).
- Parking brake set, (para2-13).
- Right engine door opened, (para2-14).

Tools and Special Tools

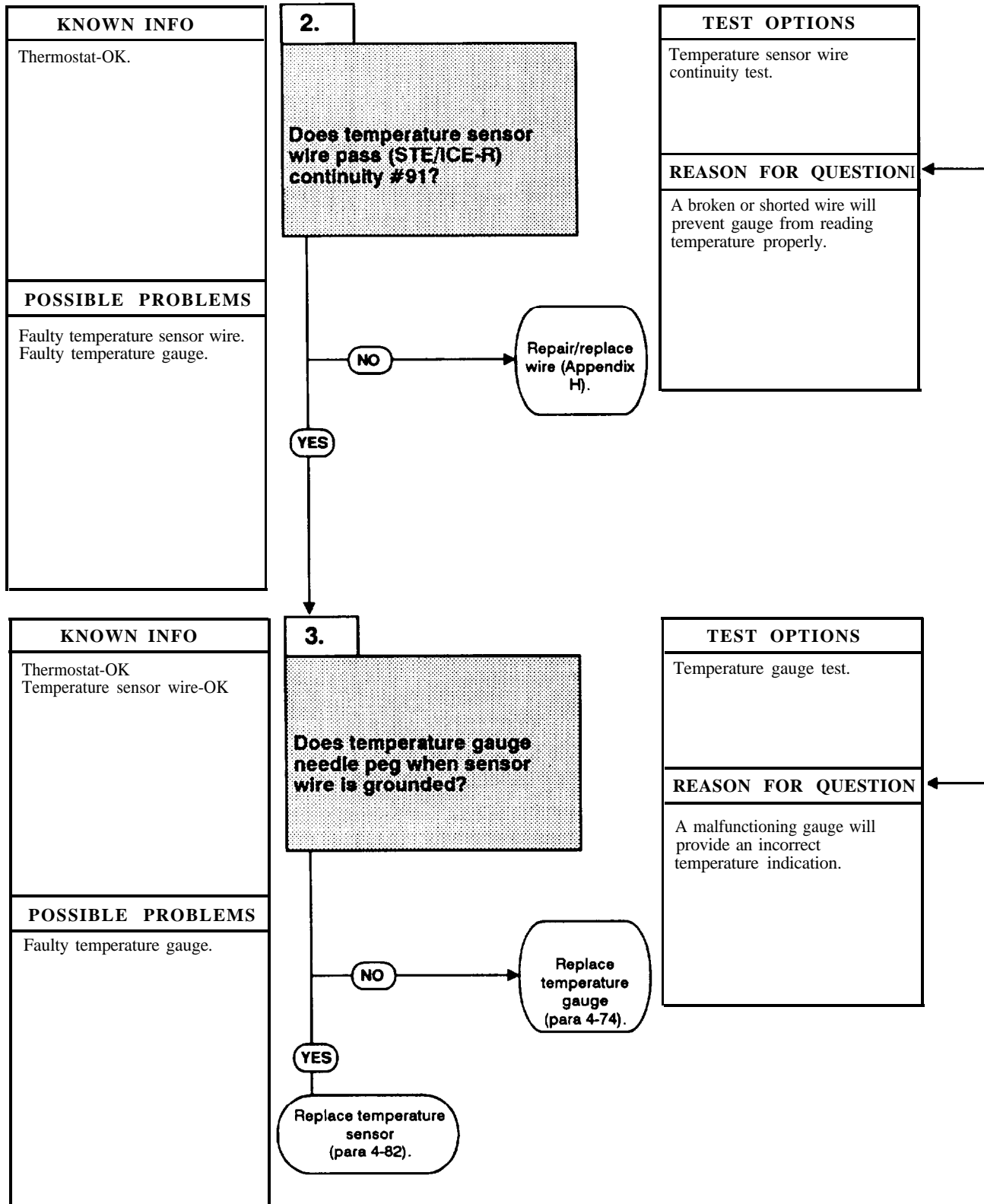
- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).





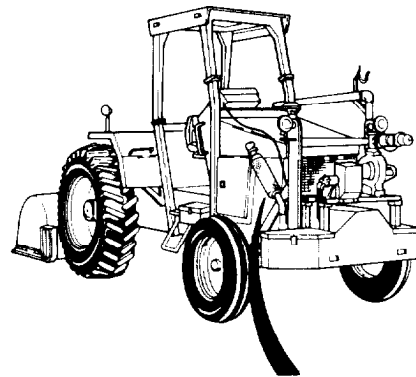
Remove thermostat (para 4-63) and test according to TM 750-254; replace thermostat as necessary.

ENGINE OPERATING TEMPERATURE TOO LOW (CONT).



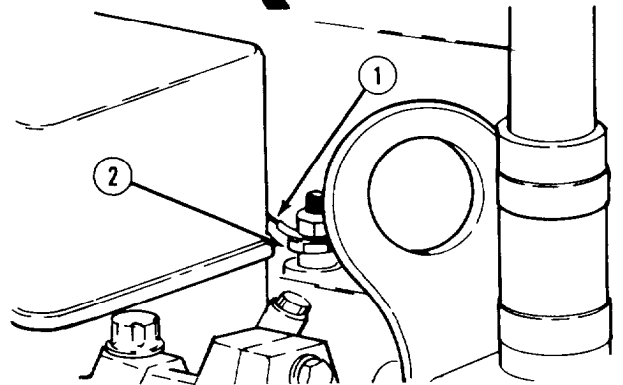
TEMPERATURE SENSOR WIRE CONTINUITY TEST

- (1) Open left engine door (pare 2-14).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Remove wire 21B (1) from temperature sensor (2) on vehicle.
- (4) Remove instrument panel (para 4-73).
- (5) Remove wire 21 A (3) from temperature gauge (4).
- (6) Connect red clip lead to 21 B.
- (7) Connect black clip lead to 21A.
- (6) Run continuity test # 91.
 - (a) If sensor wire fails continuity test, replace/repair wire (Appendix H).
 - (b) If sensor wire passes continuity test, indicates faulty temperature gauge.



TEMPERATURE GAUGE TEST

- (1) Open left engine door (pare 2-14).
- (2) Remove wire 21B (1) from temperature sensor (2) on vehicle.
- (3) Turn engine switch on (para 2-9) and ground wire 21B (1) against cylinder head.
 - (a) If temperature gauge needle does not peg, replace gauge (pare 4-74).
 - (b) If temperature gauge needle pegs, replace temperature sensor (4-62).



13. ENGINE OIL PRESSURE TOO HIGH.

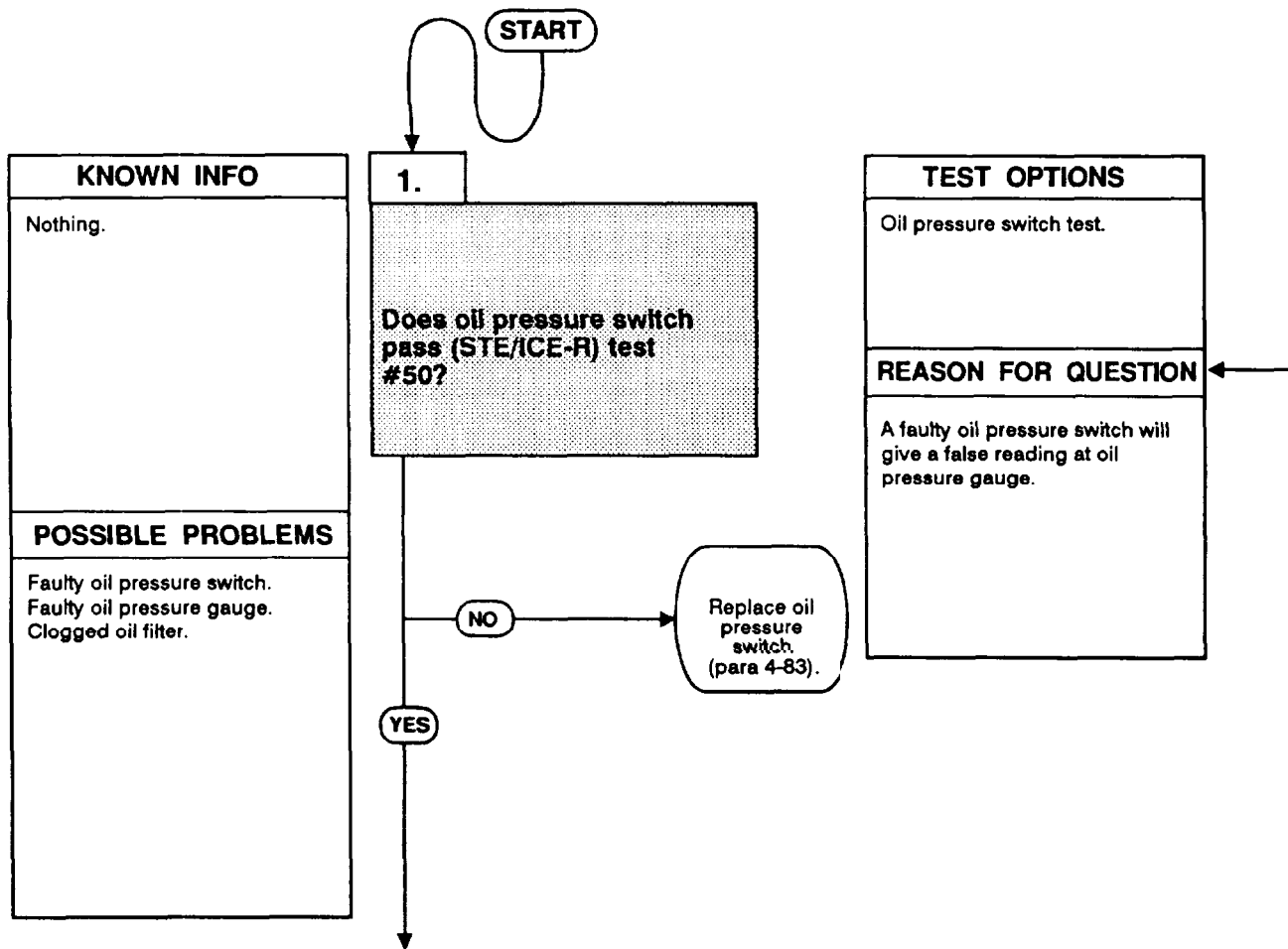
INITIAL SETUP

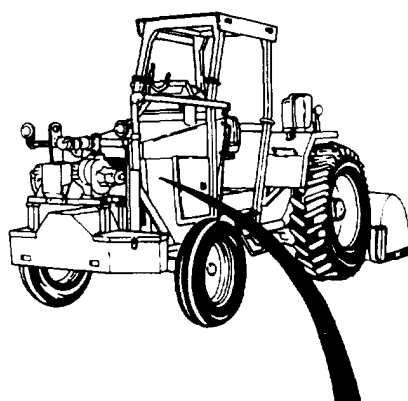
Equipment Conditions

- Engine shut off, (para2-10[c]).
- Parking brake set, (para2-13).
- Left and Right engine doors opened, (para2-14).

Tools and Special Tools

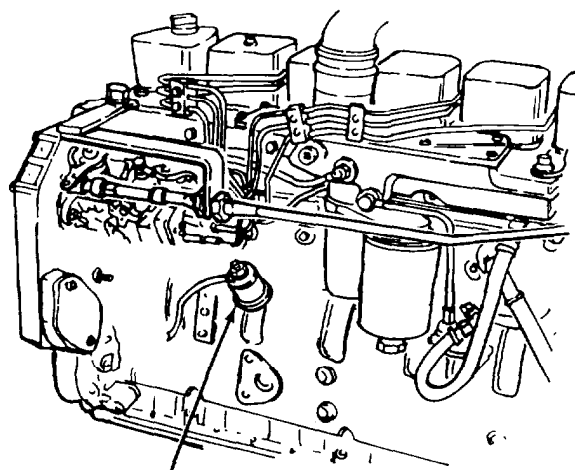
- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).





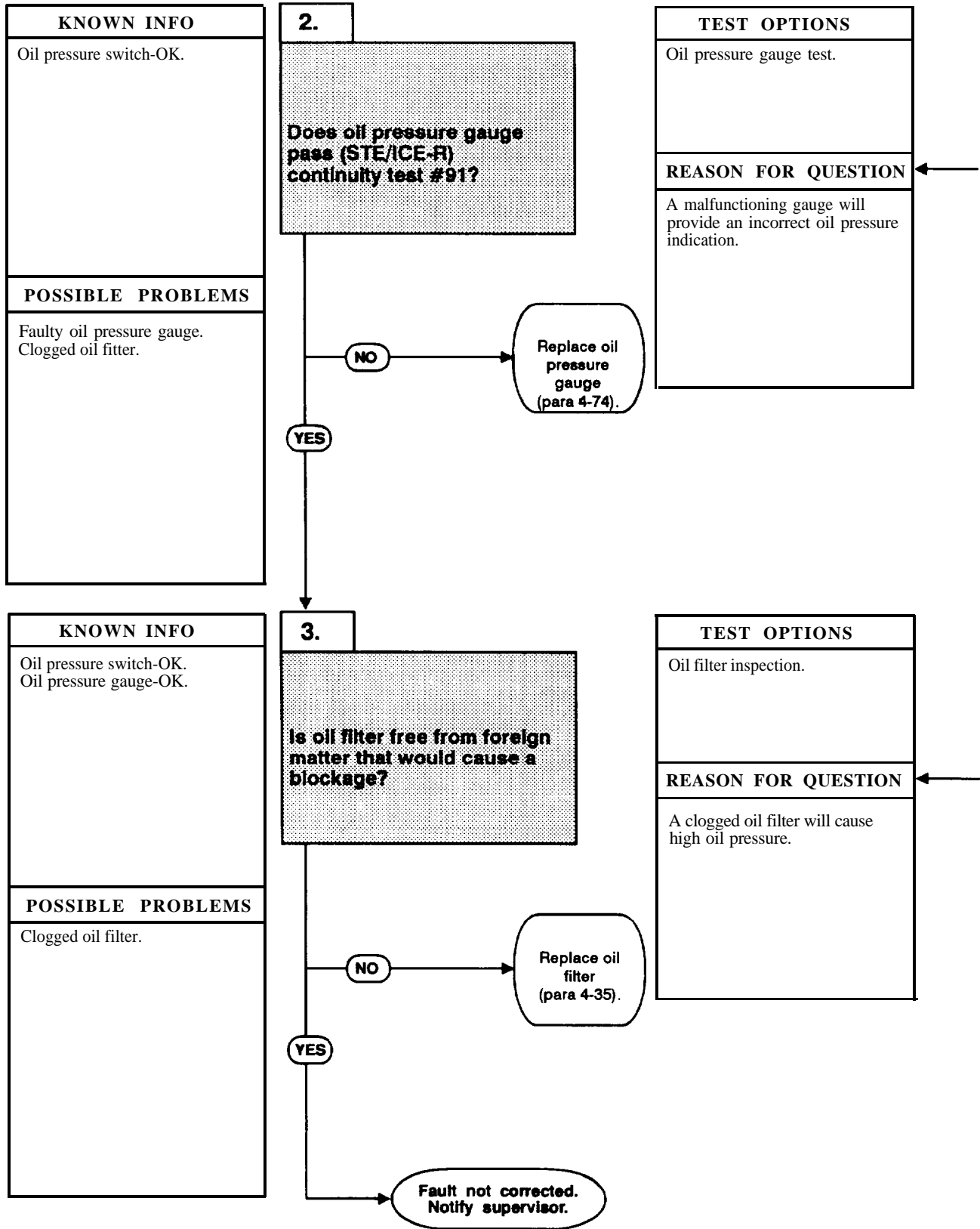
OIL PRESSURE SWITCH TEST

- (1) Open left engine door (para 2-14).
- (2) Remove wire (1) from oil pressure switch (2).
- (3) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run pressure test #50.
 - (a) Minimum oil pressure at idle should read 10 psi (69 kPa), at full speed minimum oil pressure should read 30 psi (207 kPa). If faulty, replace switch (para 4-83).
 - (b) If oil pressure switch is OK, indicates faulty oil pressure gauge.



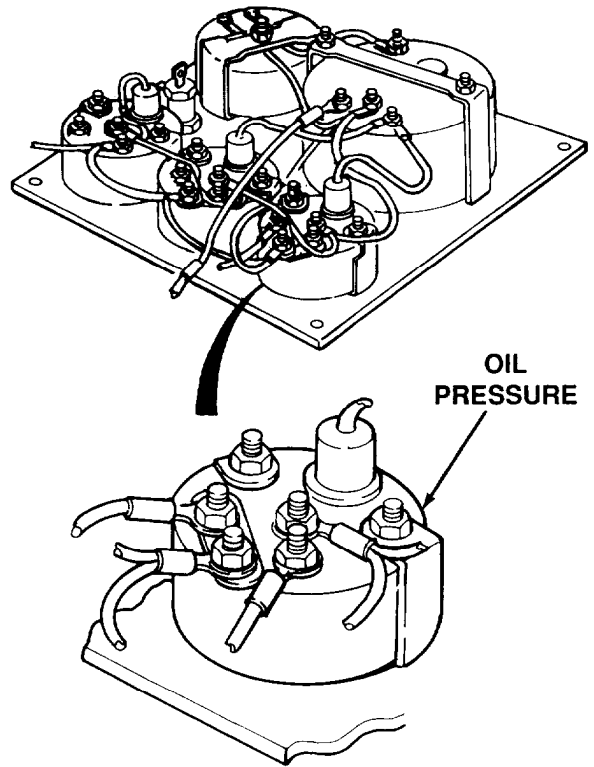
OIL PRESSURE SWITCH

ENGINE OIL PRESSURE TOO HIGH (CONT).



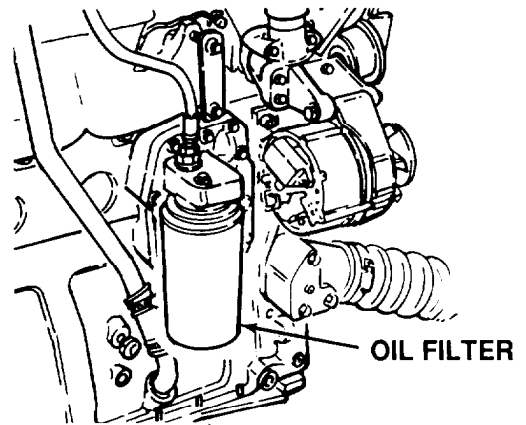
OIL PRESSURE GAUGE TEST

- (1) Remove negative battery cable (para 4-90).
- (2) Remove instrument panel (para 4-73).
- (3) Power up STE/ICE-R to a known good battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run continuity Test # 91.
 - (a) If oil pressure gauge fails continuity test, replace gauge (para 4-74).
 - (b) If oil pressure gauge has continuity indicates clogged oil filter.



OIL FILTER INSPECTION

- (1) Open right engine door (para 2-14).
- (2) Remove oil filter (para 4-35).
 - (a) Check for obvious foreign matter in oil filter that would cause blockage or restriction.
 - (b) If oil filter is OK, notify supervisor.



14. ENGINE OIL PRESSURE TOO LOW.

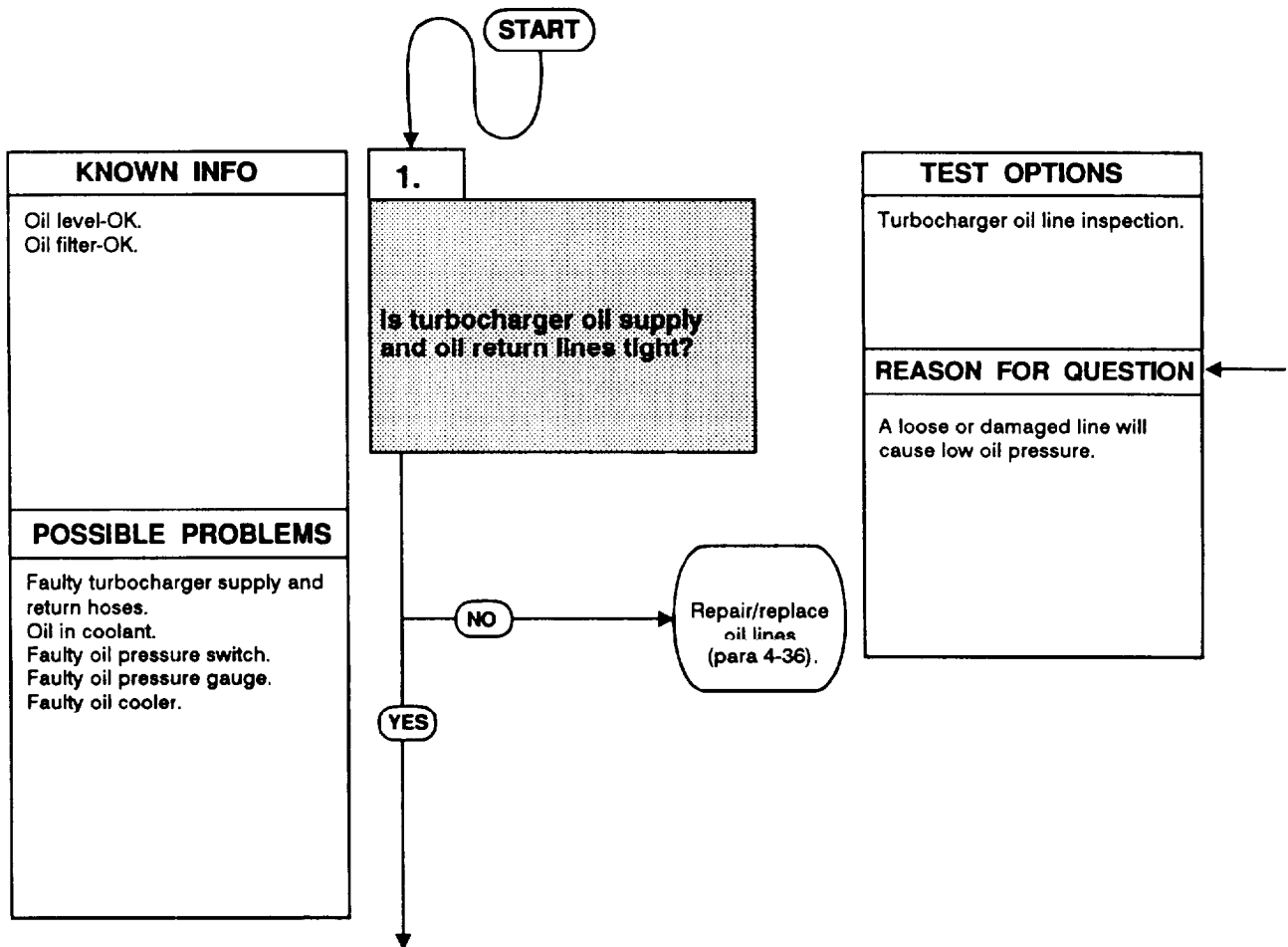
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para2-10[c]).
- Parking brake set, (para2-13).
- Left and Right engine doors opened, (para2-14).

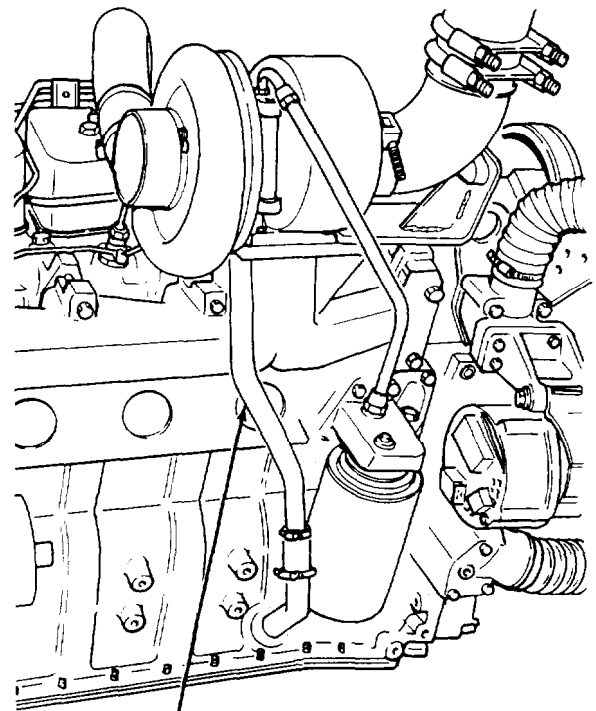
Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).



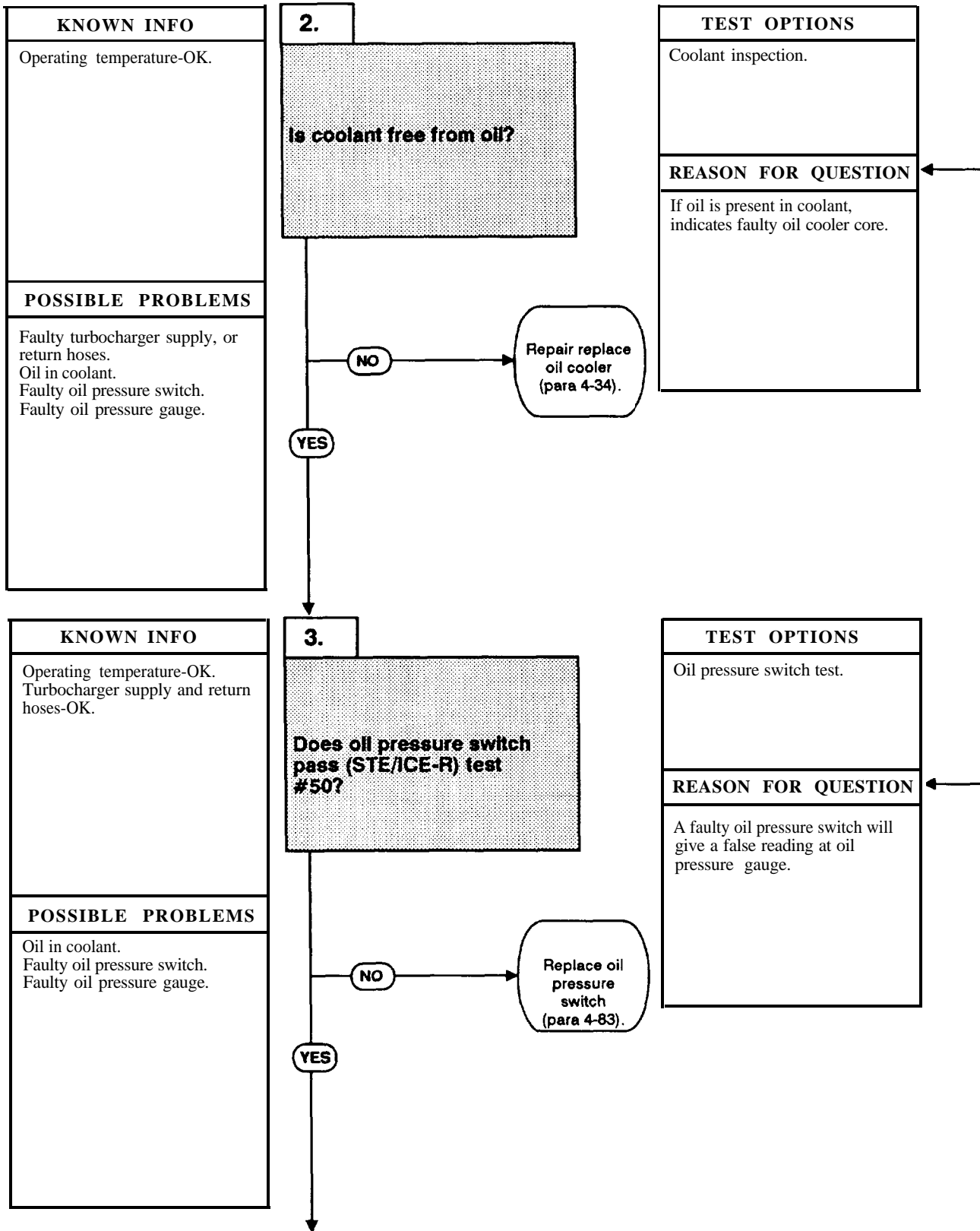
**TURBOCHARGER OIL LINE
INSPECTION**

- (1) Open Left Engine door
(para 2-14).
- (2) Check tightness of turbocharger oil
supply line (1) from oil filter head (4)
to top of turbocharger (3).
- (3) Check tightness of oil drain tube (2)
from bottom of turbocharger (3) to
engine block.
 - (a) Repair/replace oil lines if faulty
(para 4-36).
 - (b) If oil lines are OK, indicates
faulty oil cooler core.



OIL RETURN LINE

ENGINE OIL PRESSURE TOO LOW (CONT).

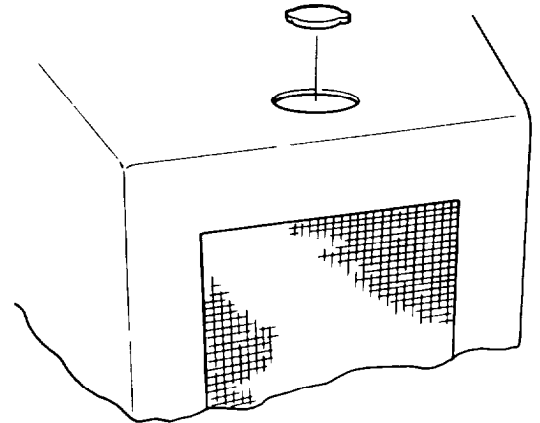
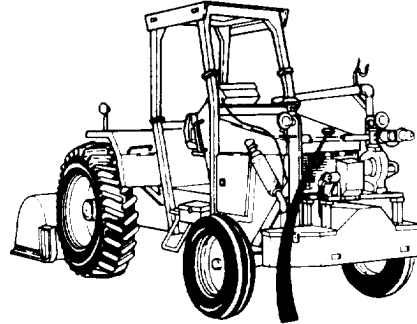


WARNING

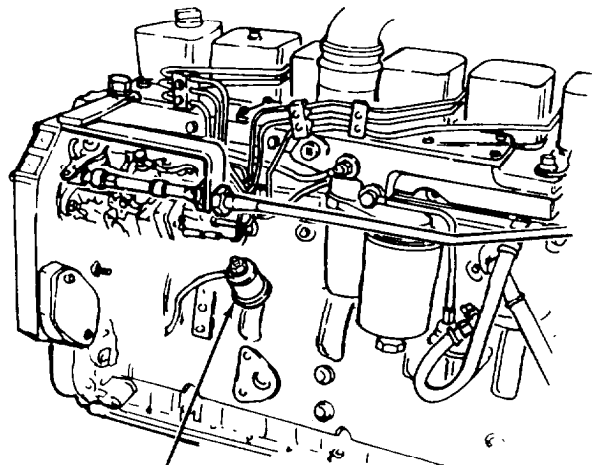
Do not remove the radiator cap when engine is hot; steam and hot coolant can escape and burn personnel. Use extreme care when removing radiator pressure cap. Sudden release or pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After use securely tighten cap. Use a clean, thick waste cloth or like material to remove cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

COOLANT INSPECTION

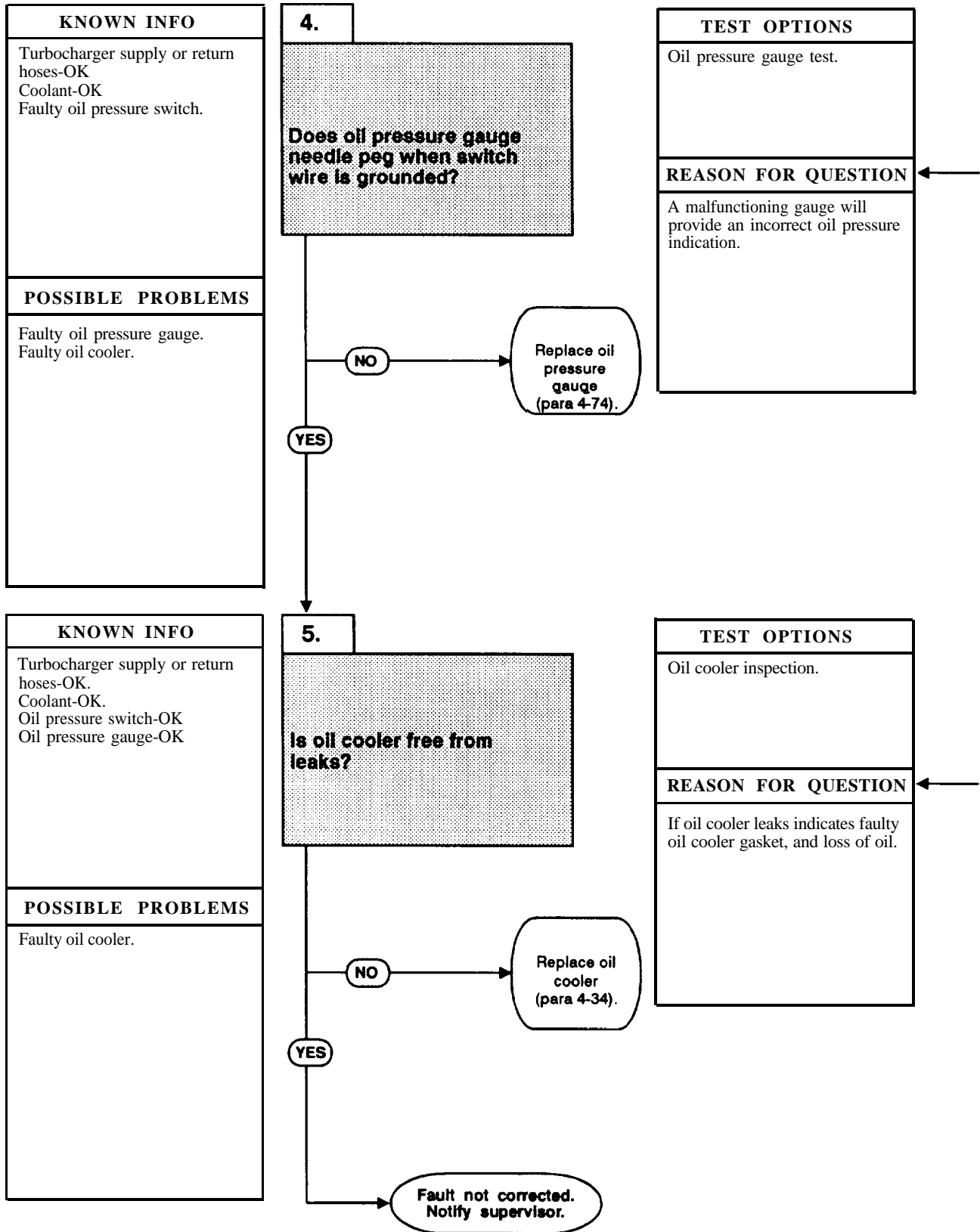
- (1) Remove radiator cap.
 - (a) Inspect coolant in radiator for oil floating on top. If oil is present, indicates faulty oil cooler core. Repair or replace oil cooler core (para 4-34).
 - (b) If oil is not present in coolant, indicates faulty engine oil pressure switch.

**OIL PRESSURE SWITCH TEST**

- (1) Open left engine door (para 2-14).
- (2) Remove oil pressure switch (para 4-83).
- (3) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run pressure test #50
 - (a) Minimum oil pressure at idle should read 10 psi (69 kPa), at full speed minimum oil pressure should read 30 psi (207 kPa). If faulty, replace switch (para 4-83).
 - (b) If oil pressure switch is OK, indicates faulty oil pressure gauge.

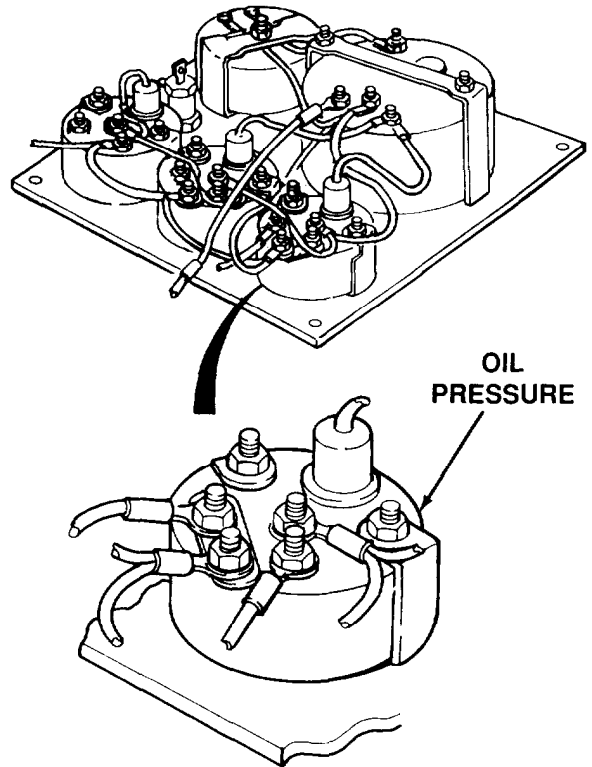
**OIL PRESSURE SWITCH**

ENGINE OIL PRESSURE TOO LOW (CONT).



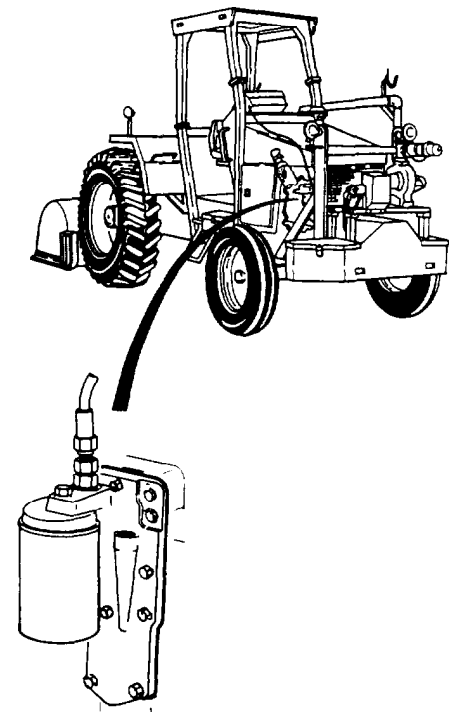
OIL PRESSURE GAUGE TEST

- (1) Open left engine door (para 2-14).
- (2) Remove wire 23B (1) from oil pressure switch (2) on vehicle.
- (3) Turn engine switch on (para 2-9) and ground wire 23B (1) against chassis ground.
 - (a) If oil pressure gauge needle does not peg, replace gauge (para 4-74).
 - (b) If oil pressure gauge needle pegs, replace oil cooler (4-34).



OIL COOLER INSPECTION

- (1) Right engine door open (para 2-14).
- (2) Start engine (para 2-9).
- (3) Check oil cooler for obvious leakage.
 - (a) If leaks are present, replace oil cooler (para 4-34).
 - (b) If oil cooler is not faulty, notify supervisor.



15. ENGINE LOSING OIL.

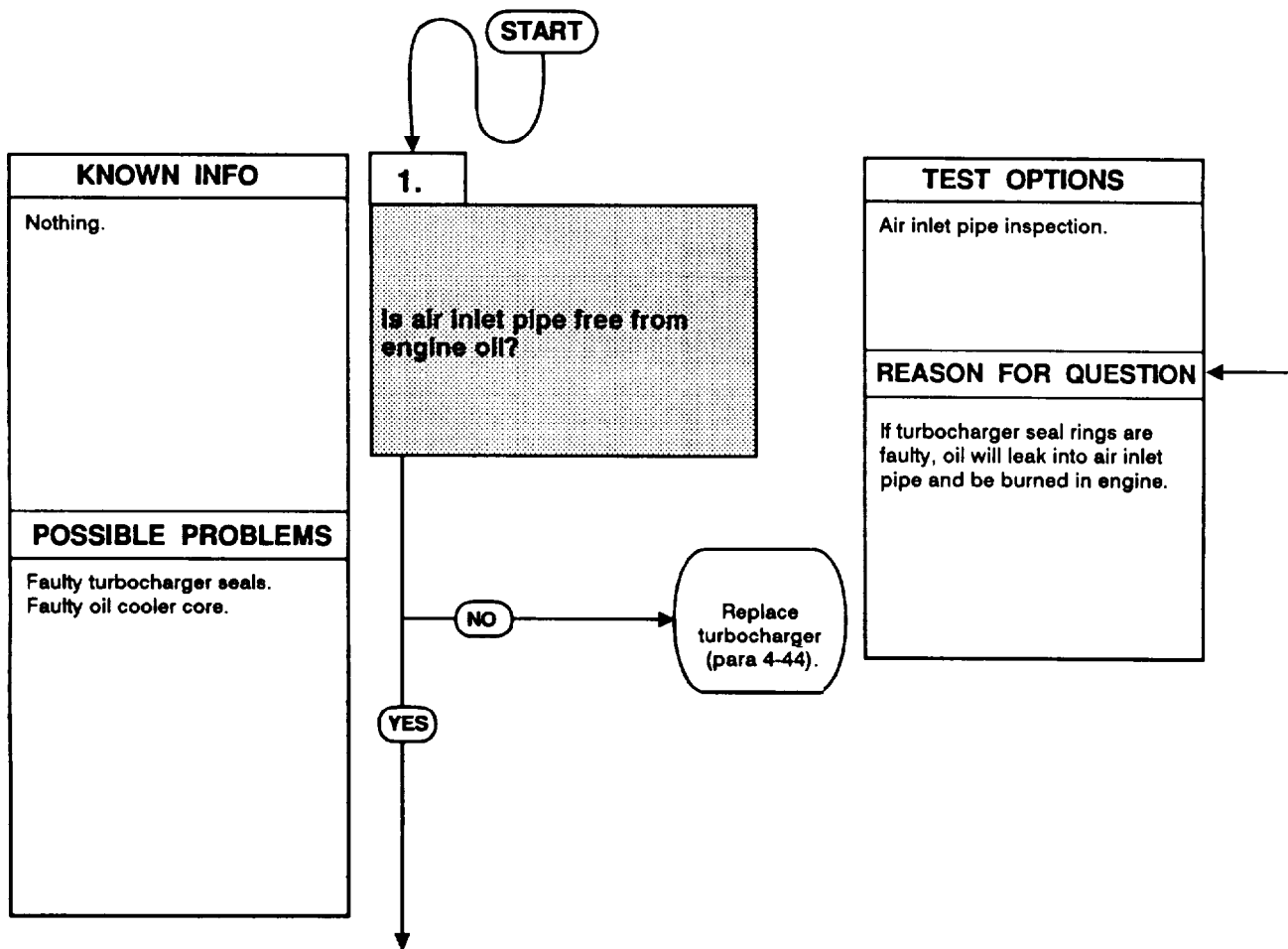
INITIAL SETUP

Equipment Conditions

Engine shut off, (para2-10[c]).
 Parking brake set, (para2-13).

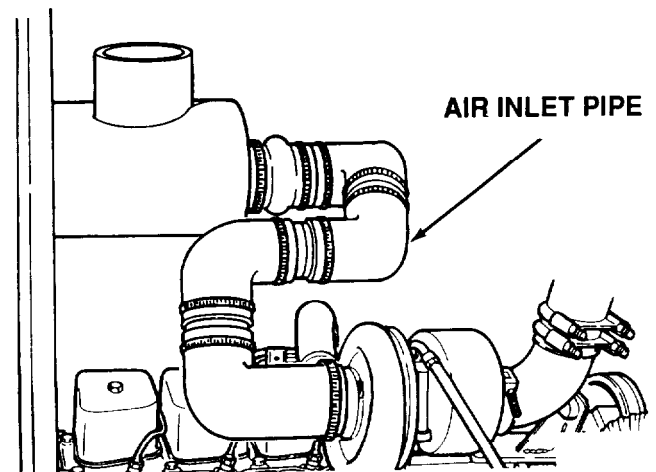
Tools and Special Tools

Tool kit, general mechanic's: automotive

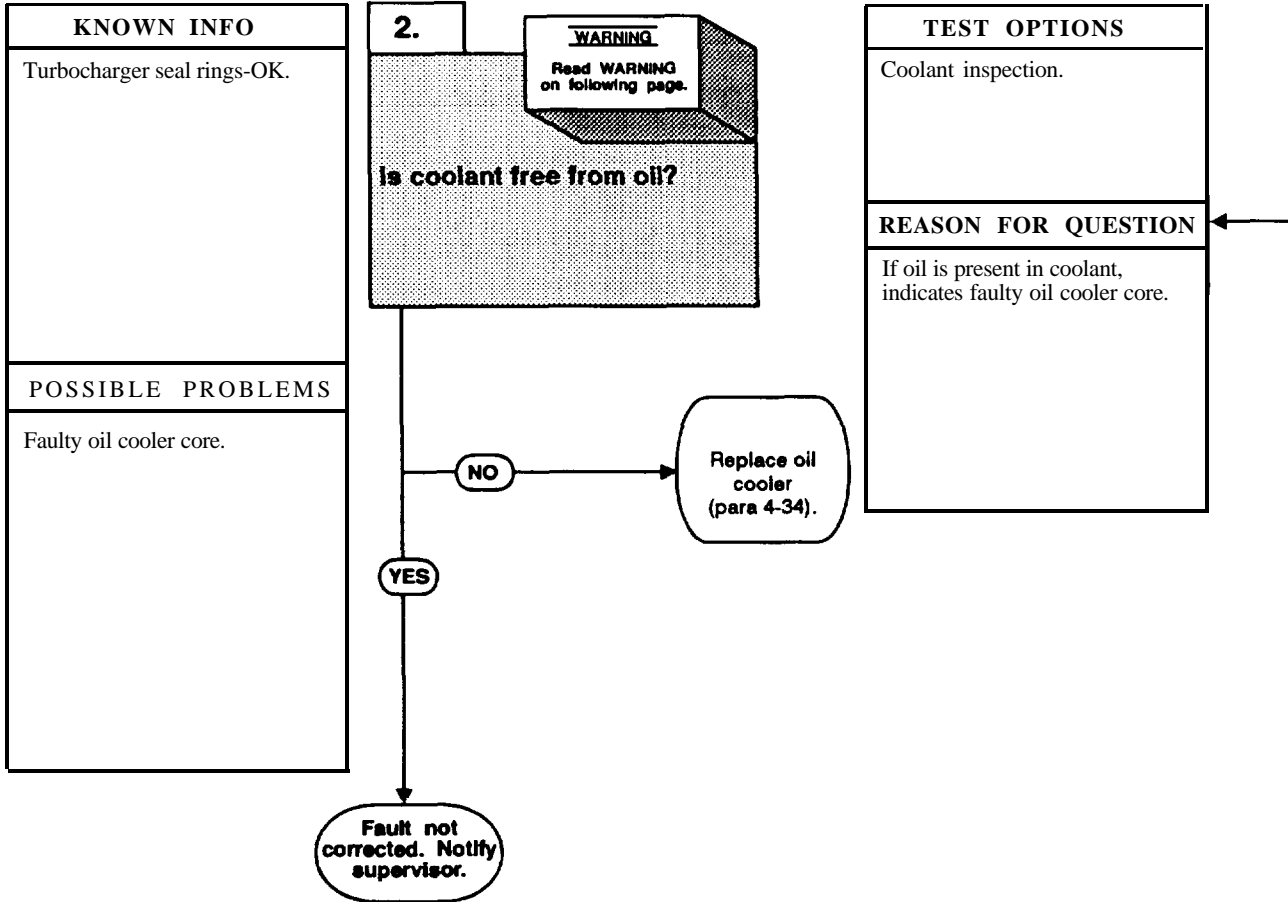


AIR INLET PIPE INSPECTION

- (1) Remove air inlet pipe (para 4-45).
 - (a) If engine oil is present, indicates faulty turbocharger, replace (para 4-44).
 - (b) If no engine oil is present, indicates faulty oil cooler core.



ENGINE LOSING OIL (CONT).

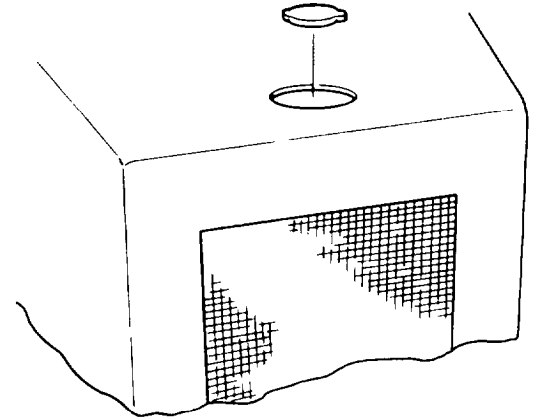
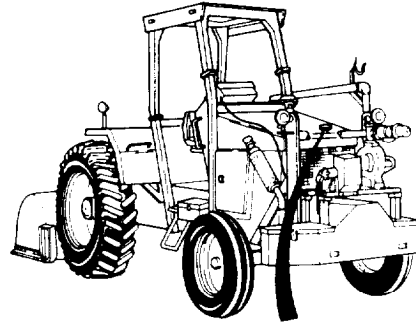


WARNING

Do not remove radiator cap when engine is hot; steam and hot coolant can escape and burn personnel. Use extreme care when removing the radiator pressure cap. Sudden release or pressure can cause a steam flash which could seriously injure personnel. Slowly loosen cap to the first stop to relieve pressure before removing cap completely. After use securely tighten cap. Use a clean, thick waste cloth or like material to remove cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.

**RADIATOR COOLANT
INSPECTION**

- (1) Remove radiator cap.
 - (a) Inspect coolant in radiator for oil floating on top. If oil is present, indicates faulty oil cooler core. Repair or replace oil cooler core (para 4-34).
 - (b) If oil is not present in radiator coolant, notify supervisor.



16. FUEL OR OIL LEAKING FROM EXHAUST MANIFOLD.

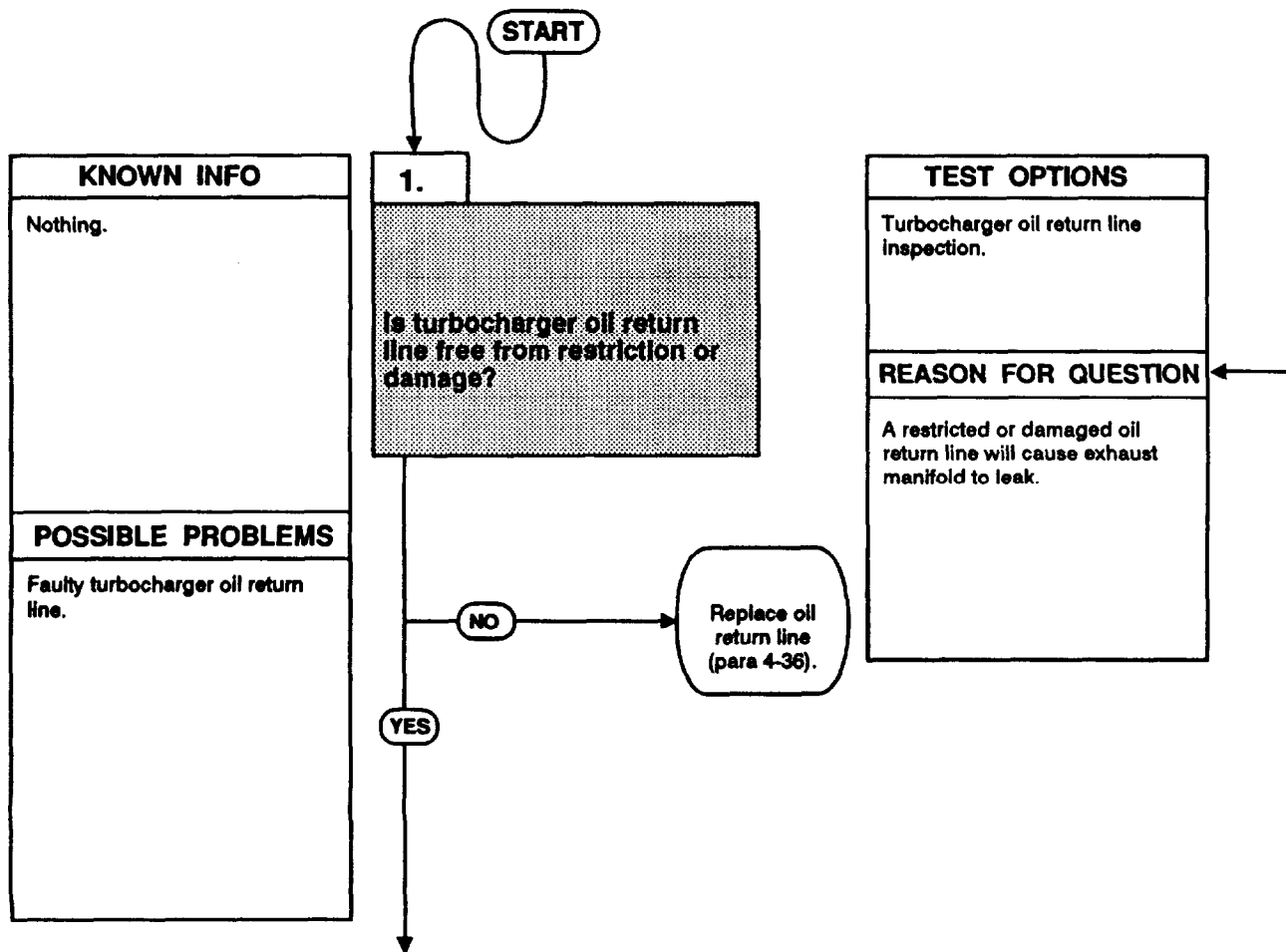
INITIAL SETUP

Equipment Conditions

Engine shut off, (para2-10[c]).
 Parking brake set, (para2-13).

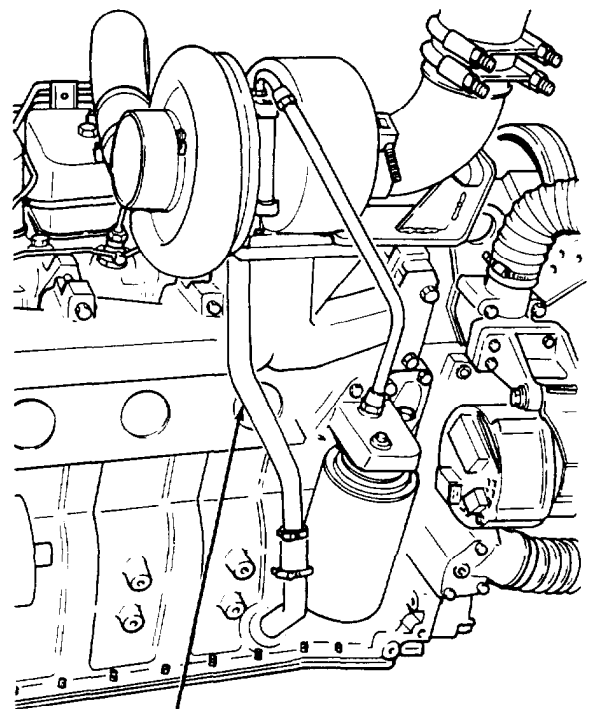
Tool and Special Tools

Tool kit, general mechanic's: automotive



**TURBOCHARGER OIL RETURN
LINE INSPECTION**

- (1) Open right engine door (para 2-14)
- (2) Remove and inspect turbocharger oil return line (para 4-36)
 - (a) If turbocharger oil return line is restricted or damaged, replace as necessary (para 4-36).
 - (b) If turbocharger oil return line is OK, notify supervisor.



OIL RETURN LINE

17. COMPRESSION KNOCKS.

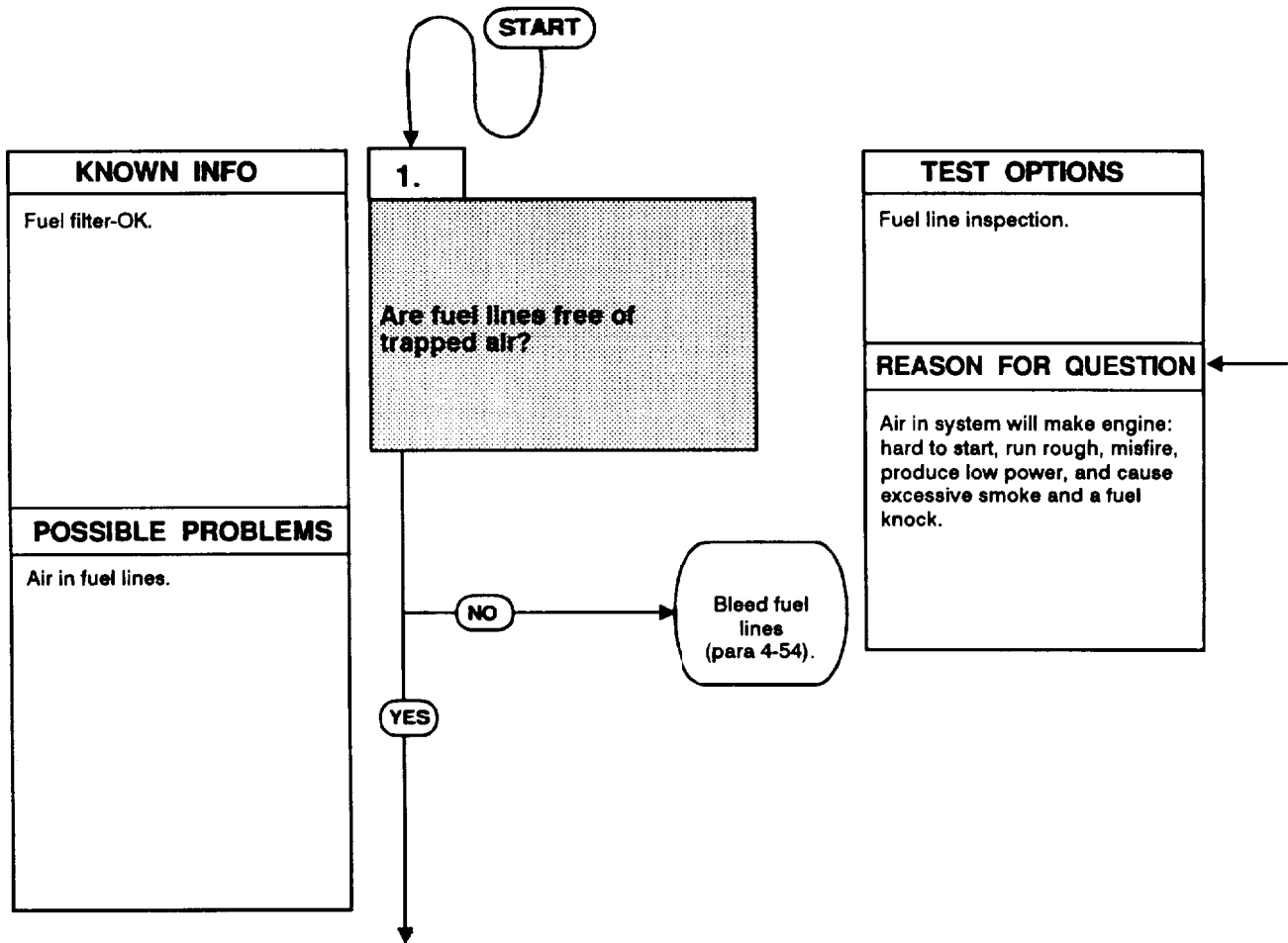
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para2-10[c]).
- Parking brake set, (para2-13).
- Left/right Engine doors open (para2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Torque wrench

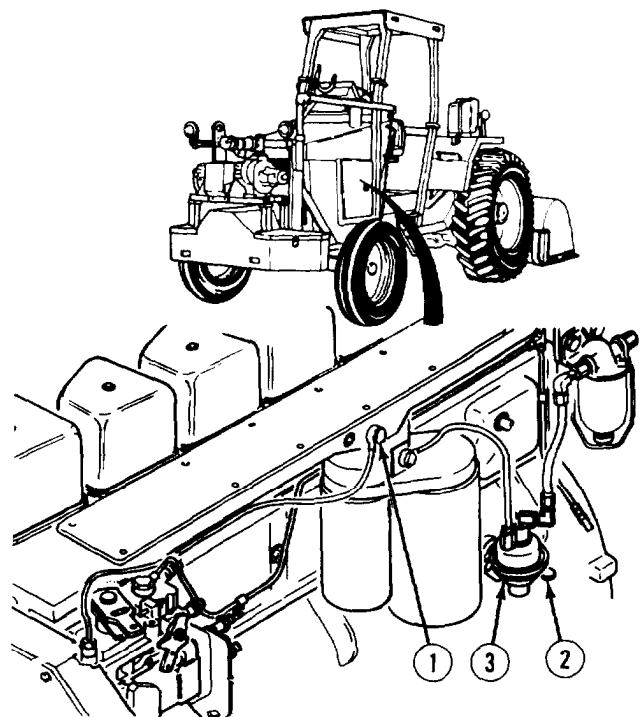


WARNING

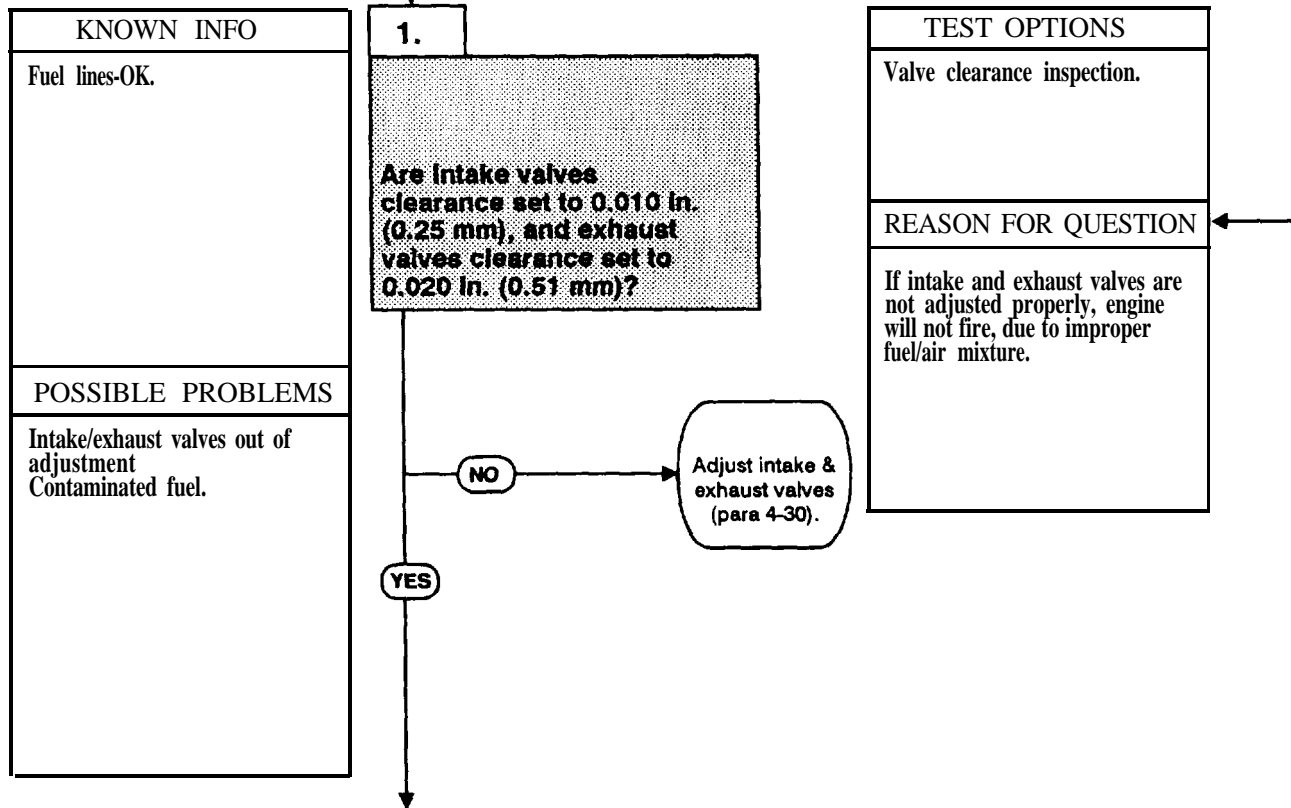
- Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel, fuel lines or fuel tanks.
- Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury.

FUEL LINE INSPECTION

- (1) Loosen bleed screw (1).
- (2) Operate lever (2) on lift pump (3) until fuel is airfree.
- (3) Tighten bleed screw (1) 72 lb-in (6 N•m).
- (4) Start engine (para 2-9).
- (5) Loosen six fuel line fittings on injectors one at a time until engine runs smoothly. Tighten securely.
 - (a) If engine compression knock continues, notify supervisor.
- (6) Turn engine off (para 2-10(c)).

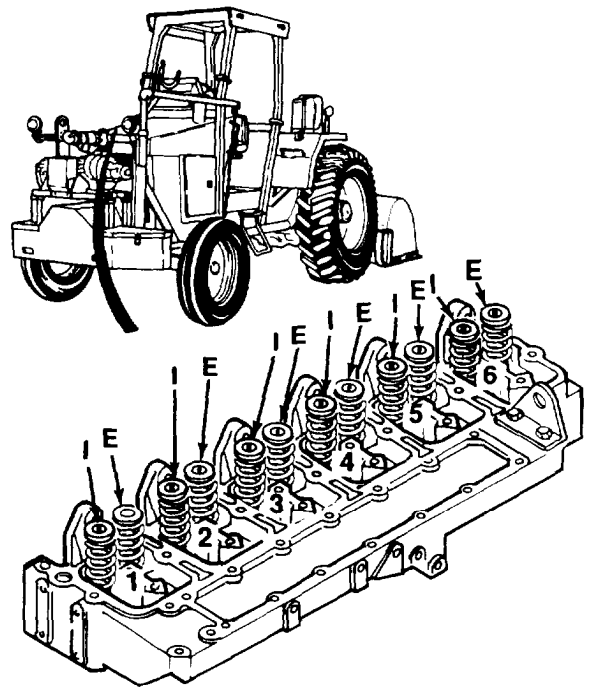


18. EXCESSIVE FUEL CONSUMPTION.	
INITIAL SETUP	
<p><i>Equipment Conditions</i></p> <p>Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13). Left/right Engine doors open (para 2-14).</p>	<p><i>Tools and Special Tools</i></p> <p>Tool kit, general mechanic's: automotive Torque wrench</p>



VALVE CLEARANCE
INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove valve covers (para 4-31).
- (3) Check valve clearance, (para 4-30).
 - (a) Intake valves clearance must be 0.010 in. (0.25 mm).
 - (b) Exhaust valves clearance must be 0.020 in. (0.51 mm).
- (4) Install valve covers (para 4-31).
- (5) Connect negative battery cable (para 4-90).



19. EXCESSIVE VIBRATION.

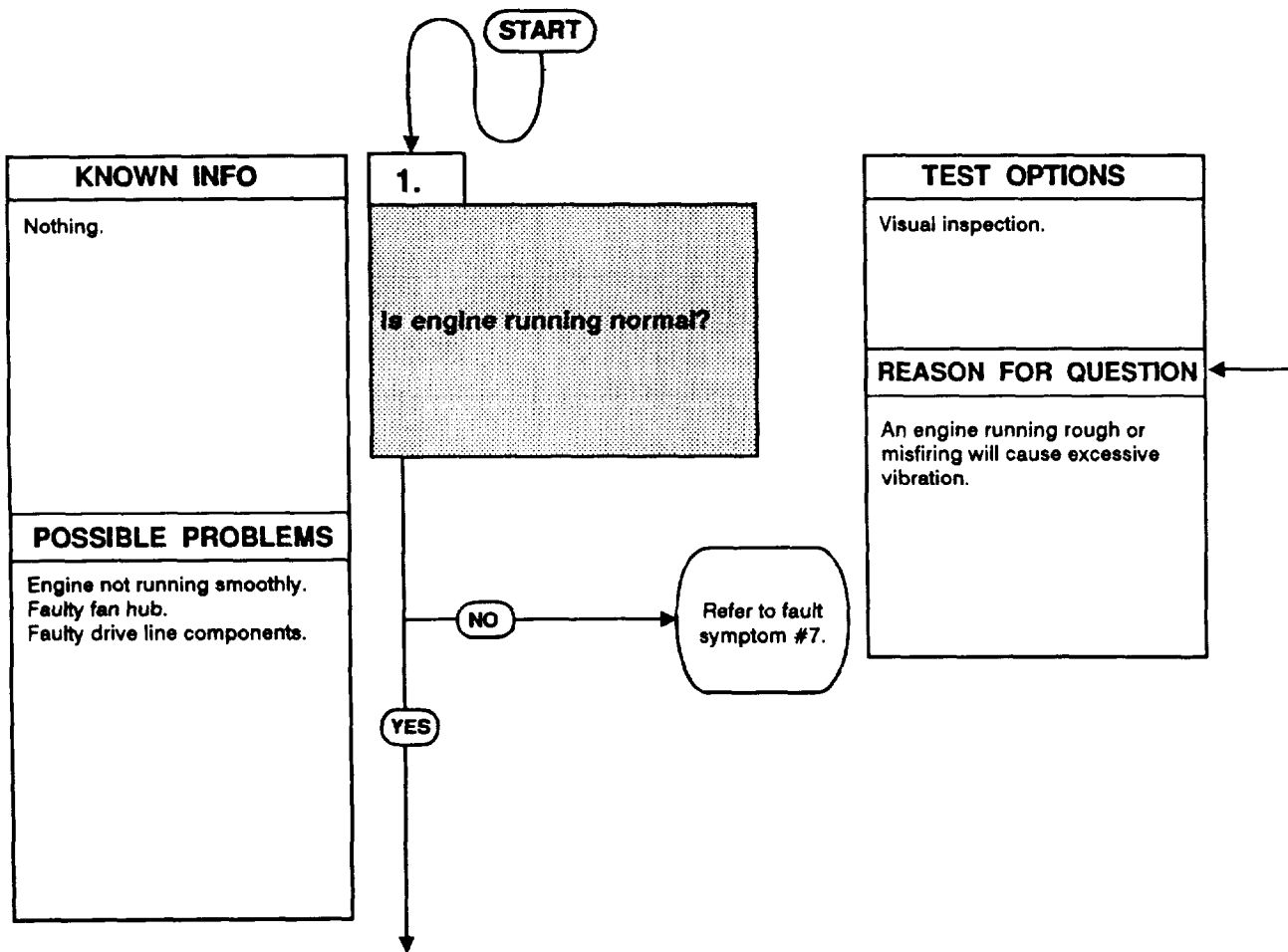
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Left/right Engine doors open (para 2-14).

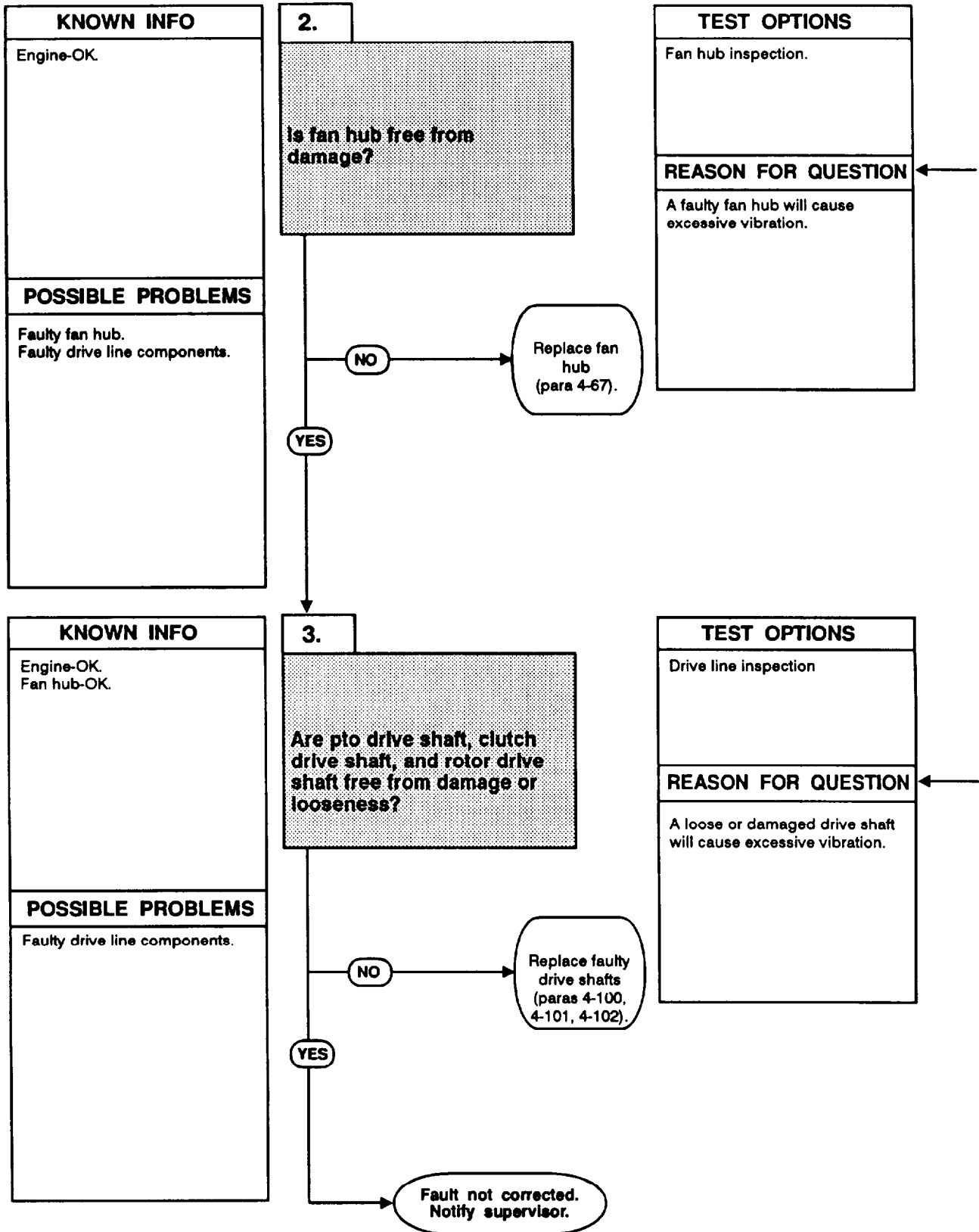
Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Torque wrench



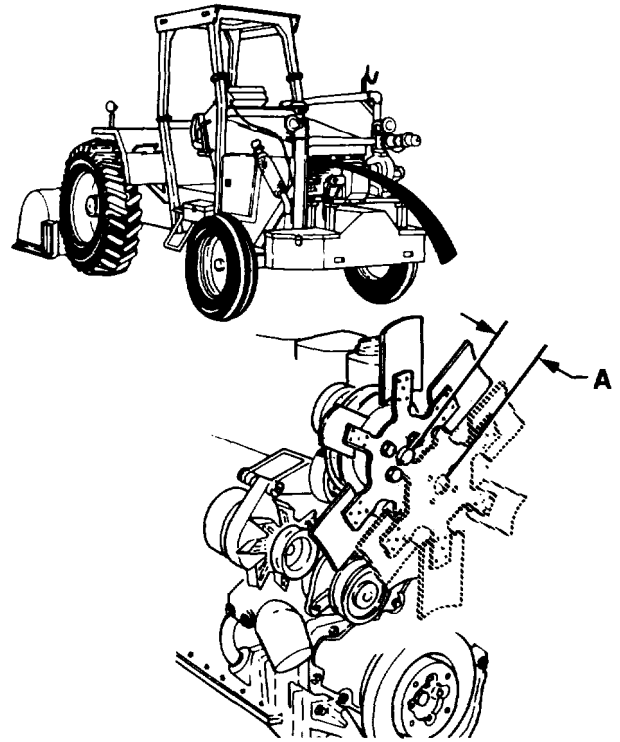
VISUAL INSPECTION
<ol style="list-style-type: none">(1) Start engine (pare 2-9).(2) Inspect engine visually for running rough or misfiring.<ol style="list-style-type: none">(a) If engine is running rough or misfiring, refer to fault symptom #7 for corrective action.(b) if engine is running normal, indicates faulty fan hub.

EXCESSIVE VIBRATION (CONT).



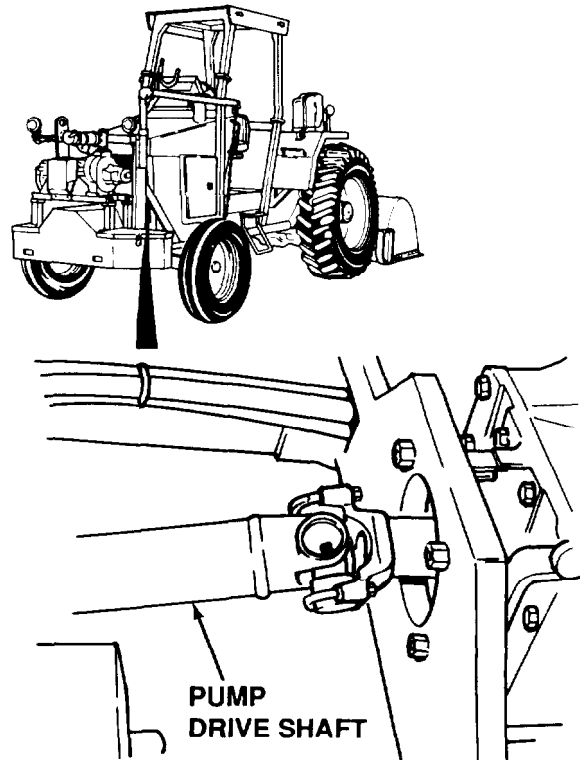
FAN HUB INSPECTION

- (1) Remove drive belt (para 4-68).
- (2) Measure fan end play at position A.
 - (a) If measurement is greater than 0.006 inch (0.15 mm), replace fan support.
 - (b) If fan hub is OK, indicates faulty drive line components.

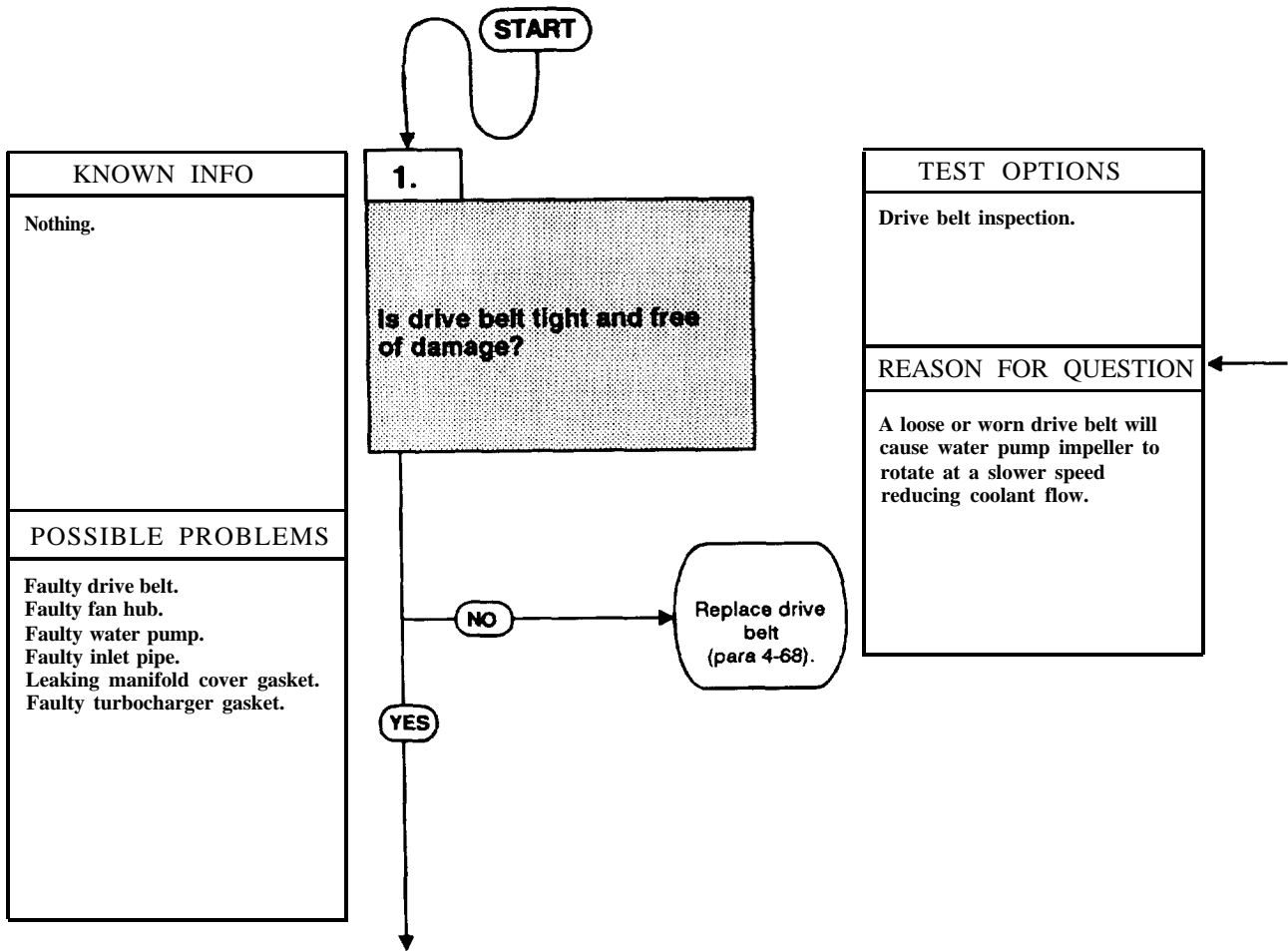


DRIVE LINE INSPECTION

- (1) Start engine (para 2-9).
- (2) Engage pump drive shaft and clutch drive shaft (para 2-10).
 - (a) Check for excessive vibration at drive shafts, replace/repair as necessary (para 4-100, 4-101, and 4-102).
 - (b) If no obvious damage or looseness, notify supervisor.

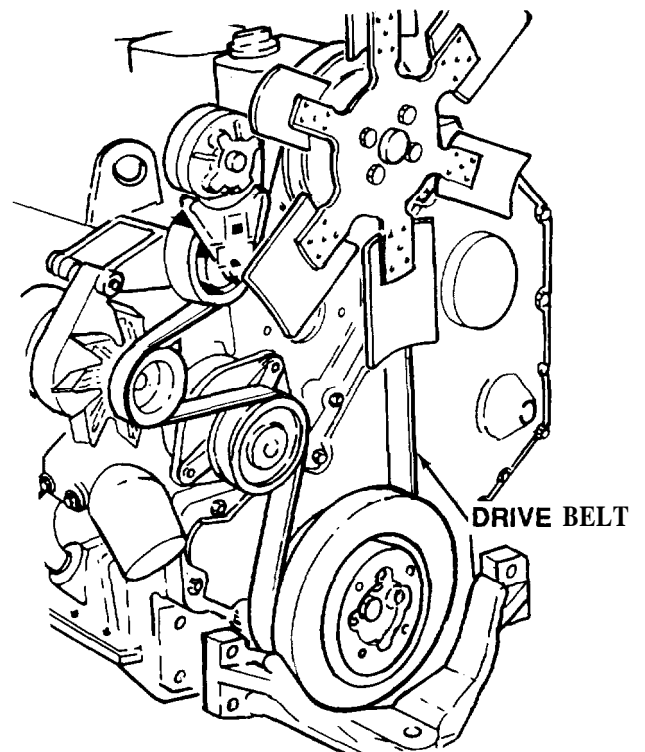


20. UNUSUAL ENGINE NOISE.	
INITIAL SETUP	
<p><i>Equipment Conditions</i></p> <ul style="list-style-type: none"> Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13). Left/right engine doors open (para 2-14). 	<p><i>Tools and Special Tools</i></p> <ul style="list-style-type: none"> Tool kit, general mechanic's: automotive Torque wrench

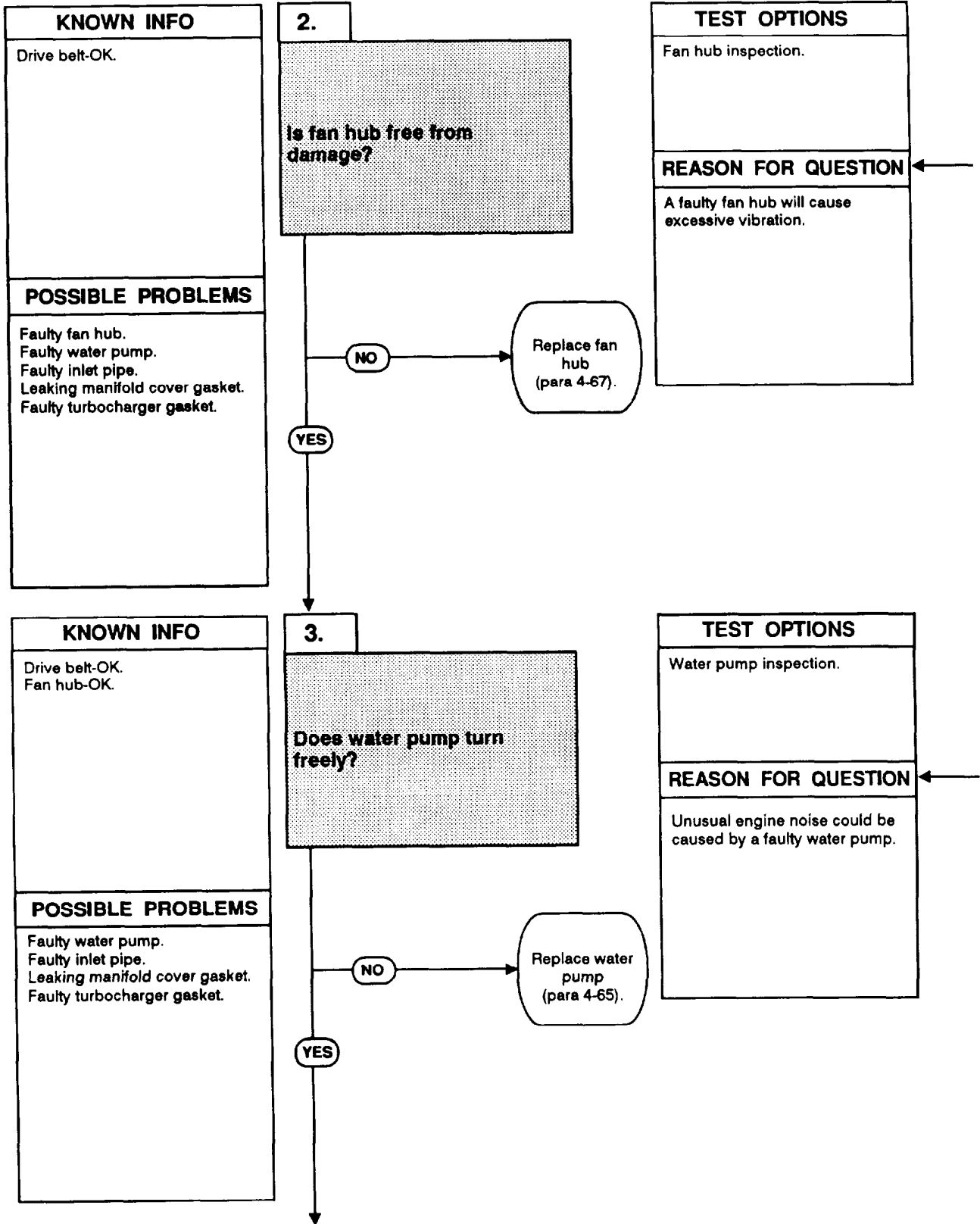


DRIVE BELT INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check drive belt for obvious damage.
 - (a) If damaged, replace drive belt (para 4-68).
 - (b) If drive belt is OK, check drive belt deflection.
- (3) Measure drive belt deflection at longest span of belt. Maximum deflection is 3/8 to 1/2 inch (9.5 to 12.7 mm).
 - (a) If drive belt is not within limits, replace drive belt tensioner (para 4-69).
 - (b) If drive belt is within limits indicates faulty fan hub.

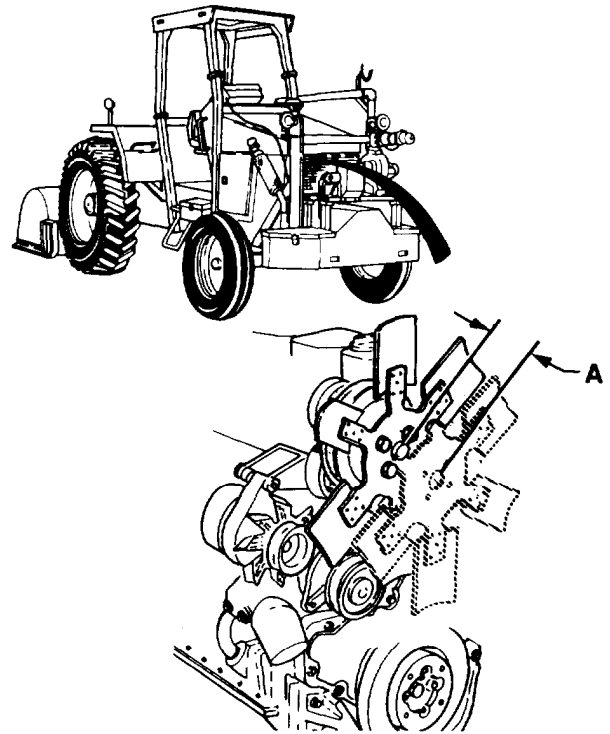


UNUSUAL ENGINE NOISE (CONT).



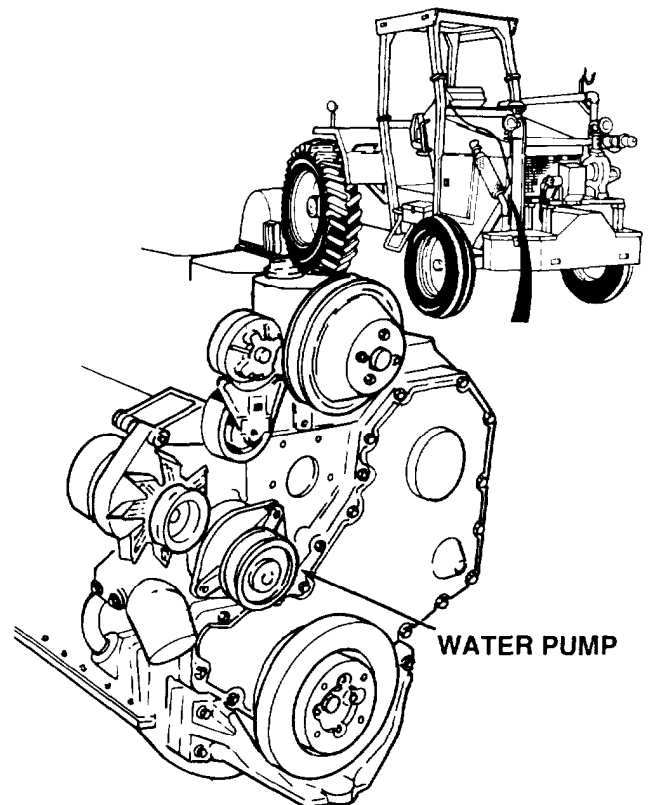
FAN HUB INSPECTION

- (1) Remove drive belt (para 466).
- (2) Measure fan end-play at position A.
 - (a) If measurement is greater than 0.006 inch (0.15 mm), replace fan support
 - (b) If fan hub is OK indicates faulty drive line components.

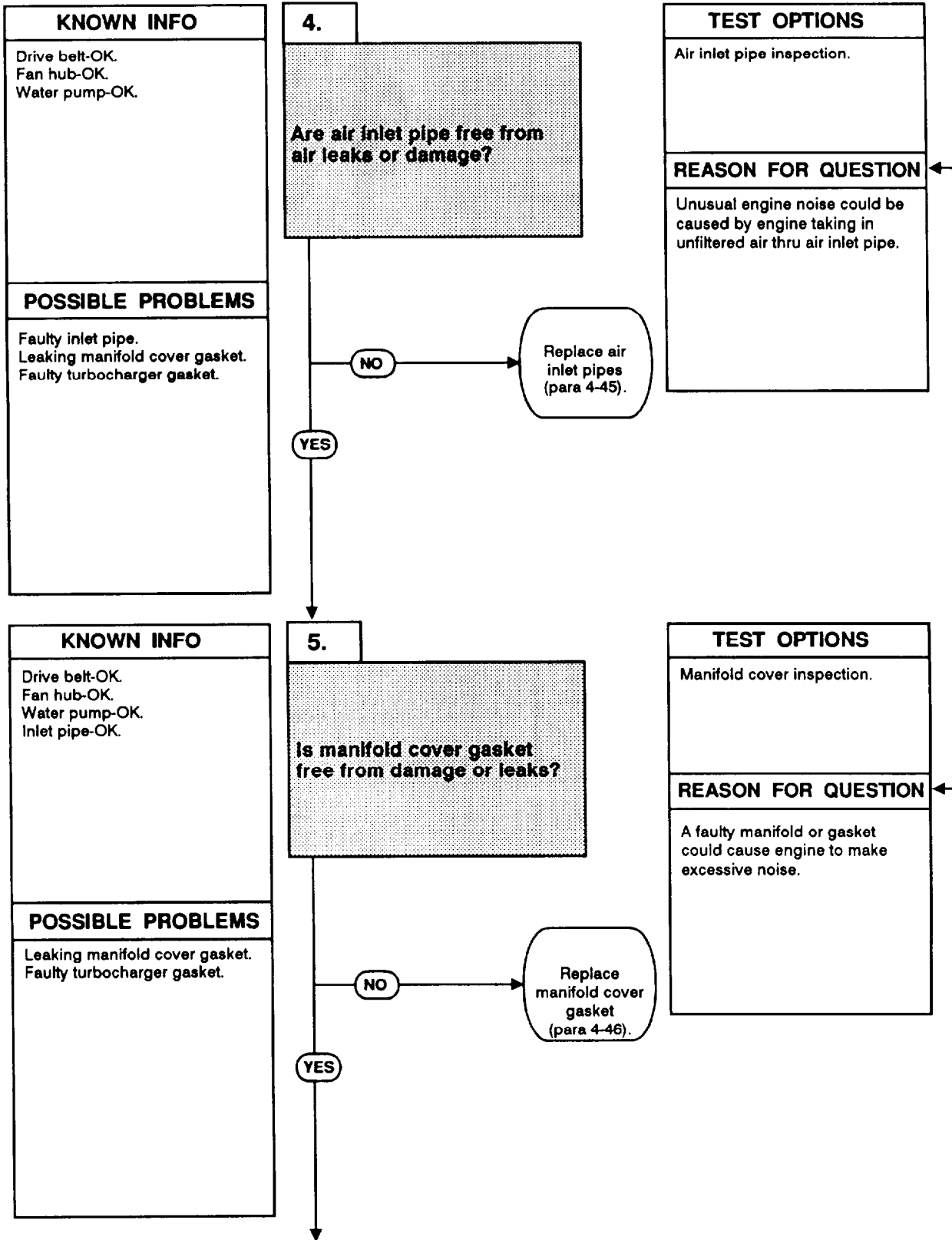


WATER PUMP INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Remove drive belt (para 4-66).
- (3) Check water pump for free rotation.
 - (a) If water pump does not turn freely or rattles, replace (4-65).
 - (b) If water pump is OK, indicates faulty air inlet pipe.

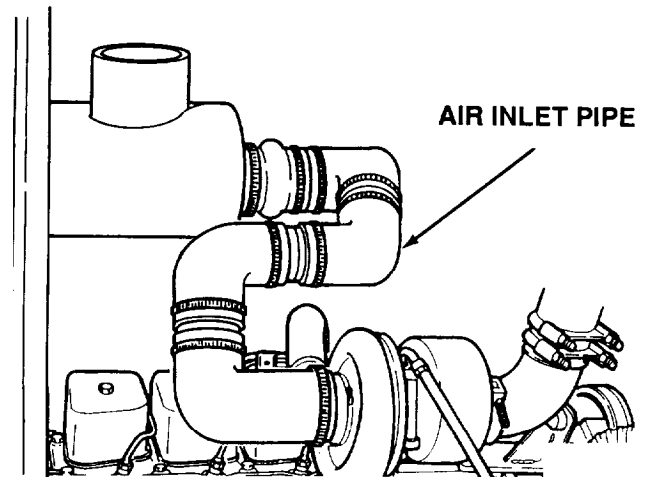


UNUSUAL ENGINE NOISE (CONT).



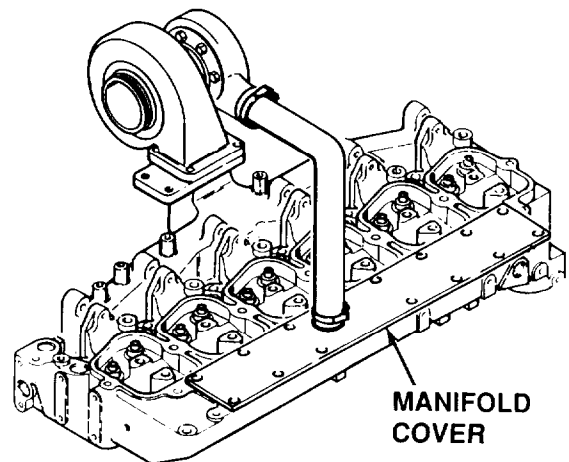
AIR INLET PIPE INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check for air leaks in pipes between turbocharger and manifold cover.
 - (a) If there are leaks in air inlet pipe, repair or replace them as necessary (para 4-45).
 - (b) If air inlet pipes are OK, indicates faulty air access cover or gasket.

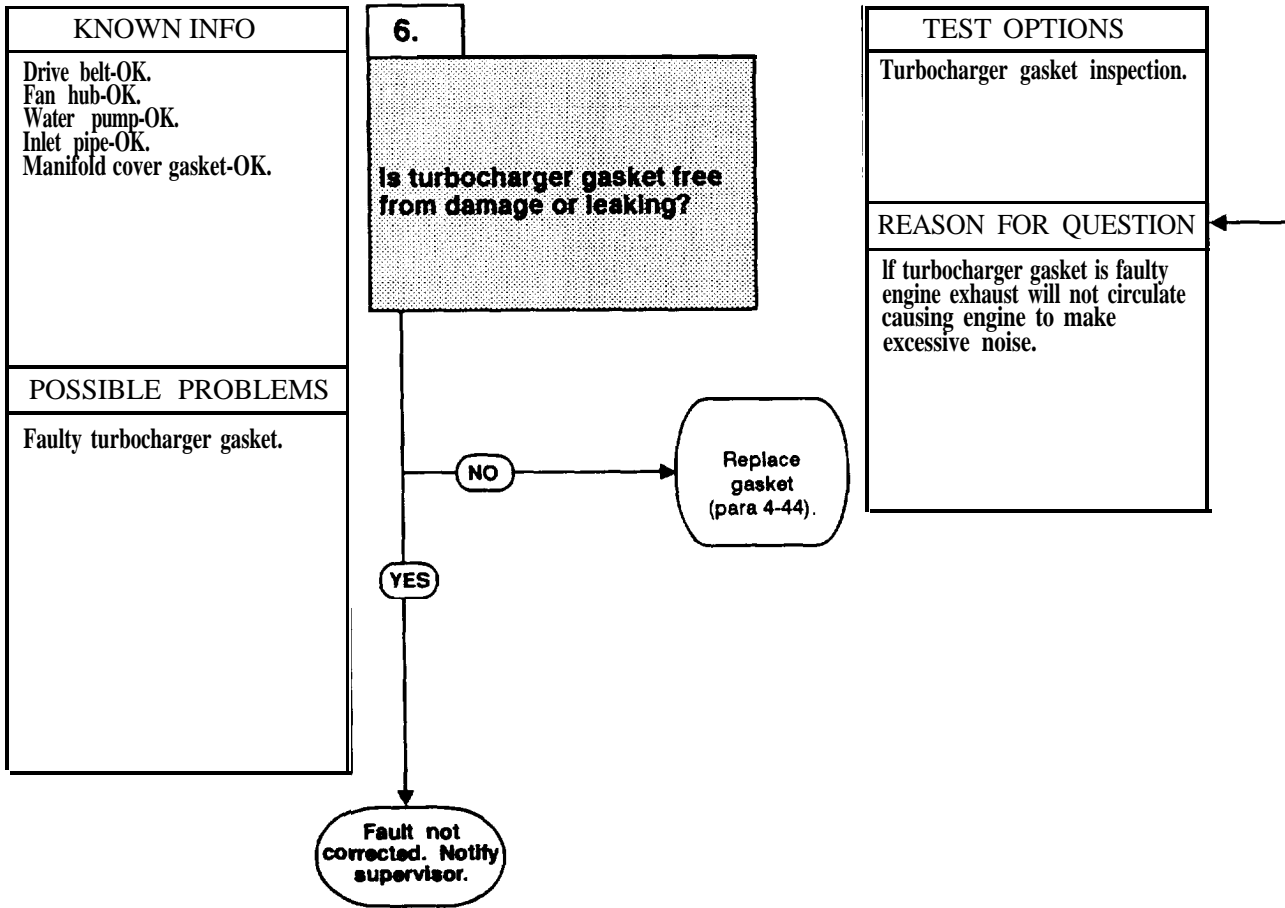


MANIFOLD COVER INSPECTION

- (1) Disconnect negative battery cable (para 4-90).
- (2) Inspect manifold cover for obvious damage that would cause a leak.
 - (a) If gasket is damaged, replace (para 4-46).
 - (b) If gasket is not damaged, indicates faulty turbocharger gasket.

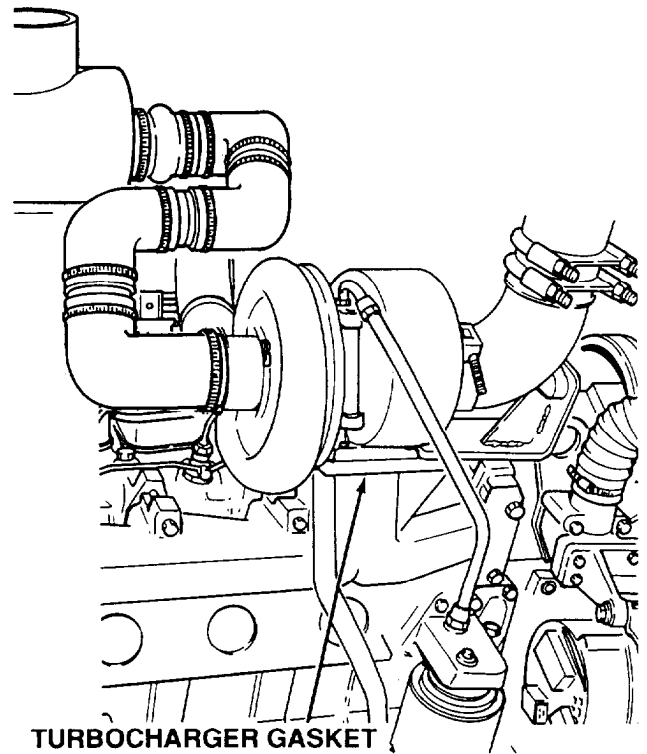


UNUSUAL ENGINE NOISE (CONT).



**TURBOCHARGER GASKET
INSPECTION**

- (1) Check for leaks between turbocharger and exhaust manifold.
 - (a) If leaks or damage are present, replace as necessary (para 4-44).
 - (b) If no leaks or damage are present, notify supervisor.



21. BATTERY DEAD AND WILL NOT HOLD A CHARGE.

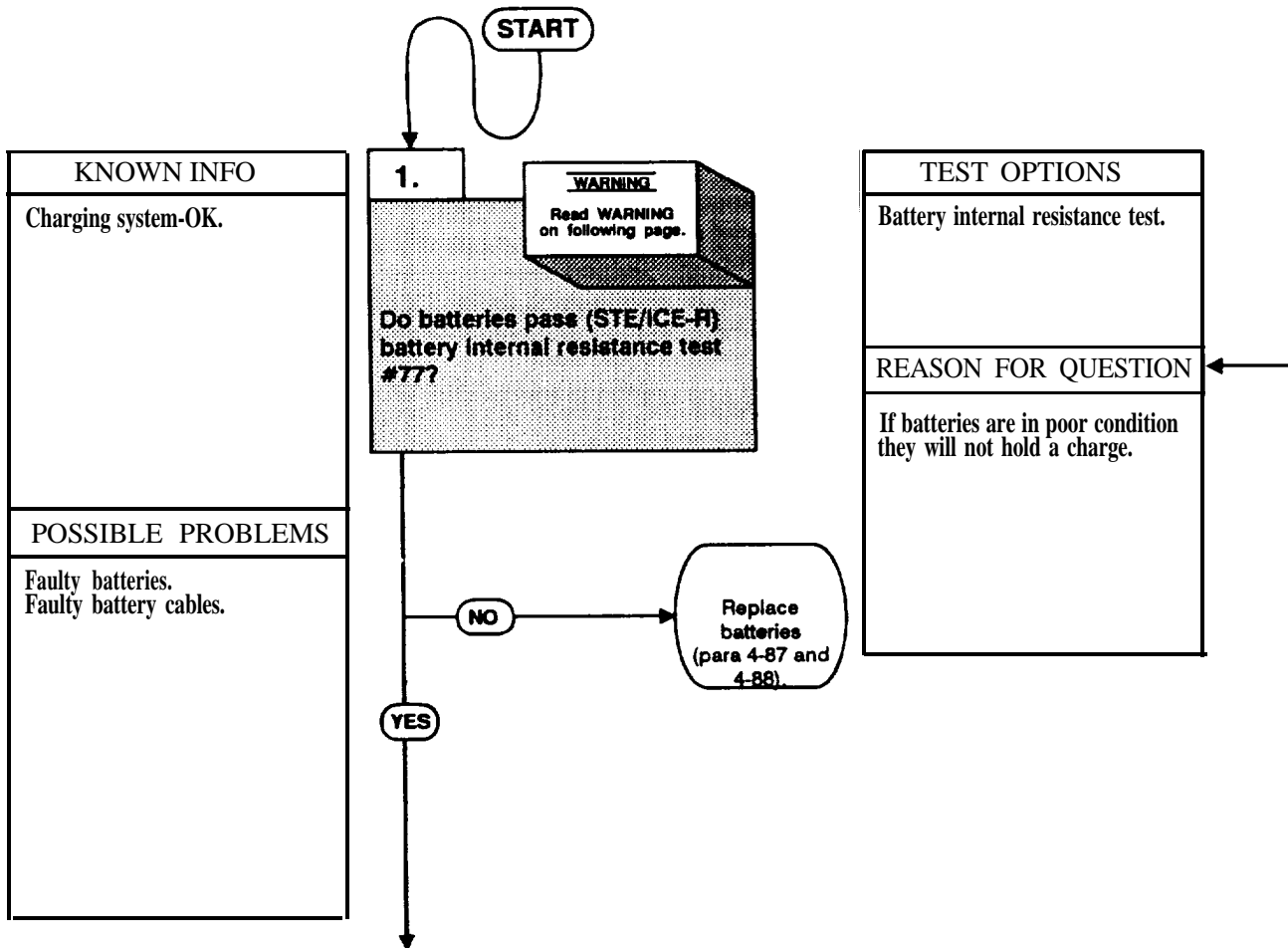
INITIAL SETUP

Equipment Conditions

- Engine shut off,(para 2-10[c]).
- Parking brake set,(para 2-13).
- Right engine door opened, (para 2-14).

Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).

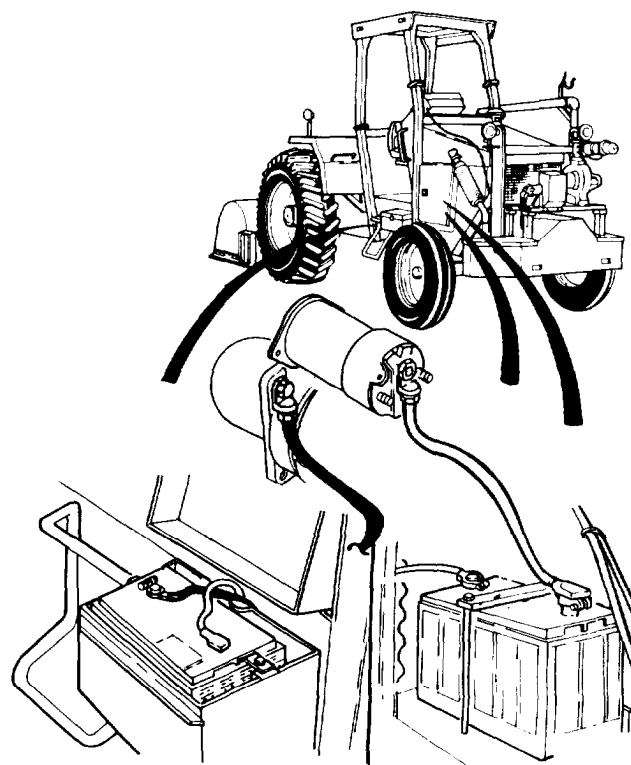


WARNING

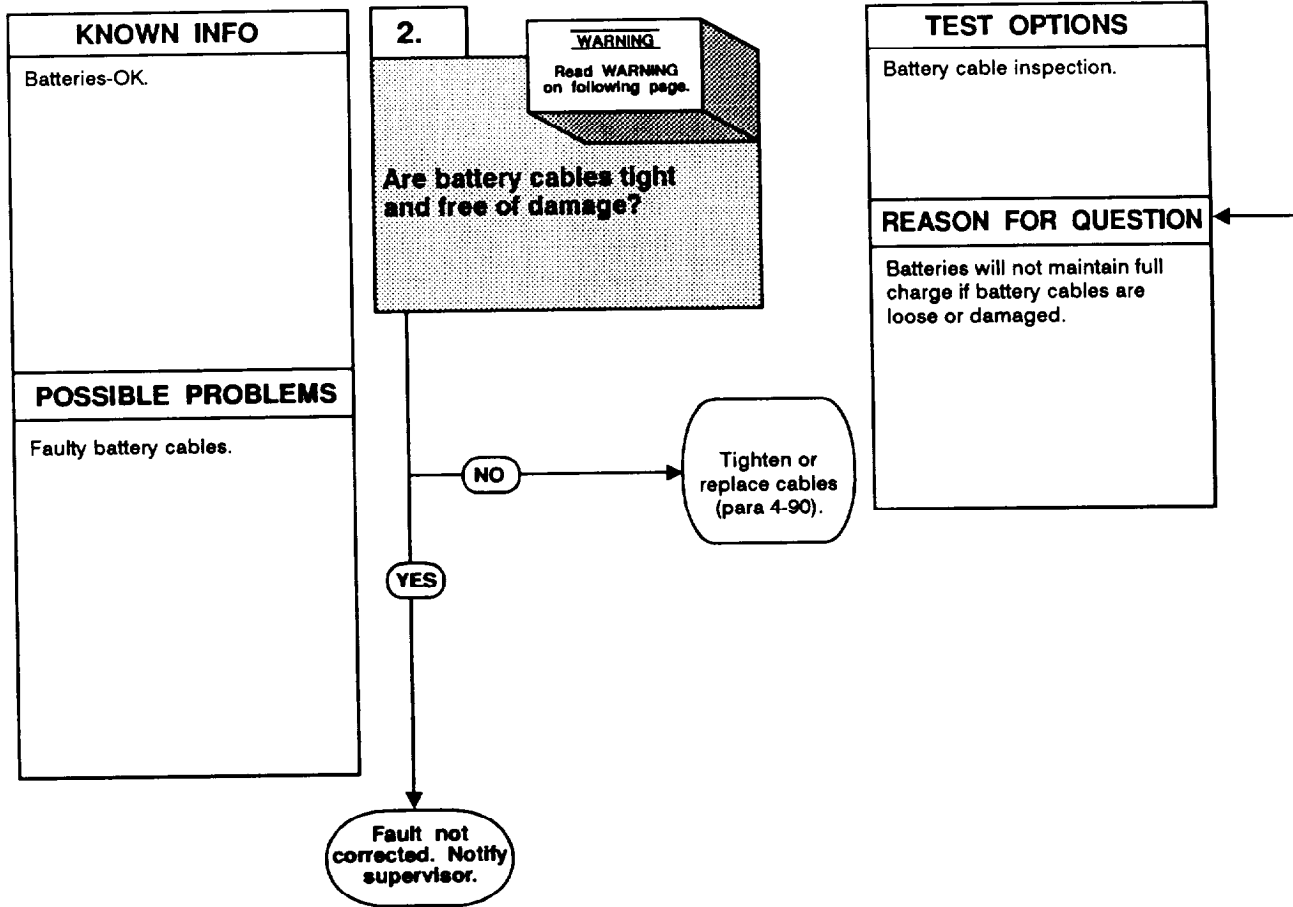
Remove all jewelry such as rings, dog tags, bracelets, a direct short result in heating of tools, damage to equipment, and injury or death to personnel.

**BATTERY INTERNAL
RESISTANCE TEST**

- (1) Open right engine door (para 2-14).
- (2) Prevent vehicle from starting.
- (3) Power up STE/ICE-R to a known good battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Run battery internal resistance test #77.
 - (a) Maximum acceptance to pass this test is 13 milliohms. If this is exceeded, check battery cables and connections then retest.
 - (b) If battery internal resistance is still above maximum, replace batteries (para 4-87 and 4-88).
 - (c) If no more than 13 milliohms are detected and batteries are OK, indicates faulty battery cables and connectors.



BATTERY DEAD AND WILL NOT HOLD A CHARGE (CONT).

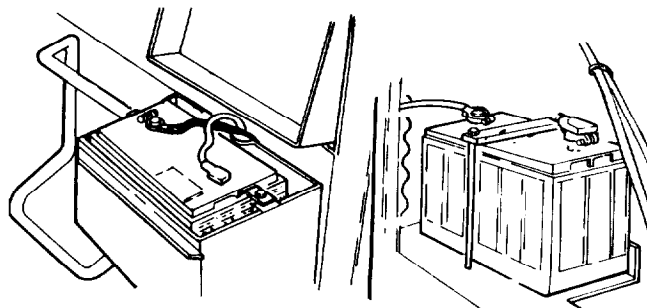


WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

BATTERY CABLE INSPECTION

- (1) Open right engine door (para 2-14).
- (2) Check for loose, dirty, or damaged connections and battery cables.
 - (a) If cables and/or connections are faulty, replace cables (para 4-90).
 - (b) If cables and/or connections are OK, notify supervisor.



22. ALTERNATOR DOES NOT CHARGE BATTERIES.

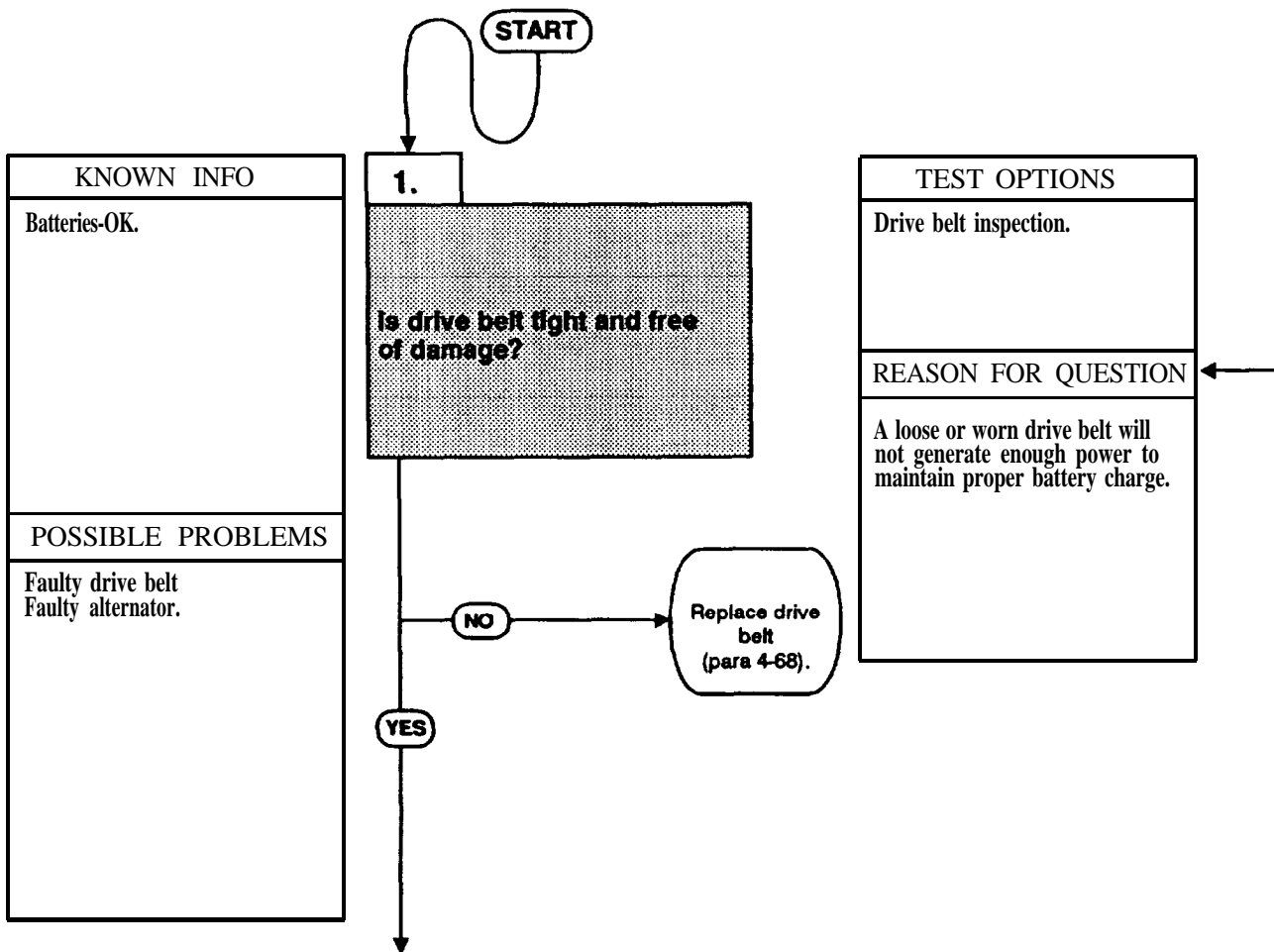
INITIAL SETUP

Equipment Conditions

- Engine shut off, (para 2-10[c]).
- Parking brake set, (para 2-13).
- Right engine door opened, (para 2-14).

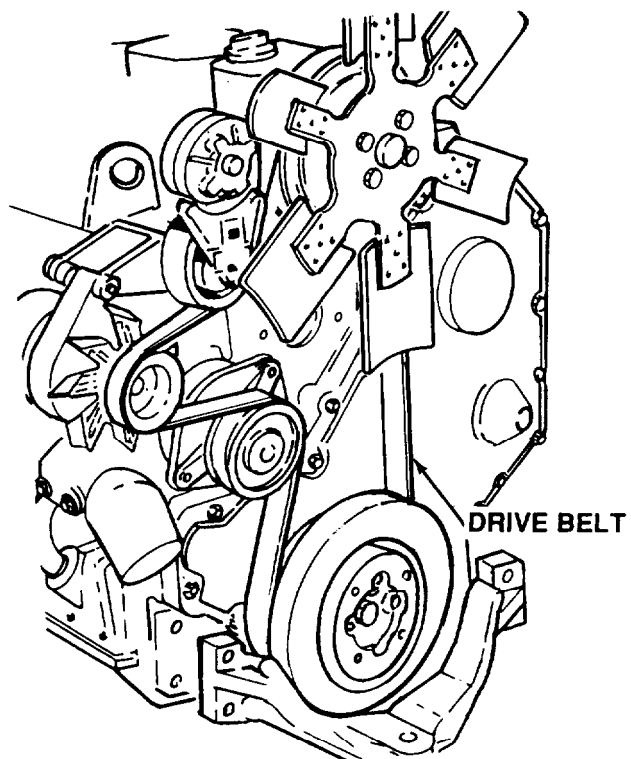
Tools and Special Tools

- Tool kit, general mechanic's: automotive
- Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).

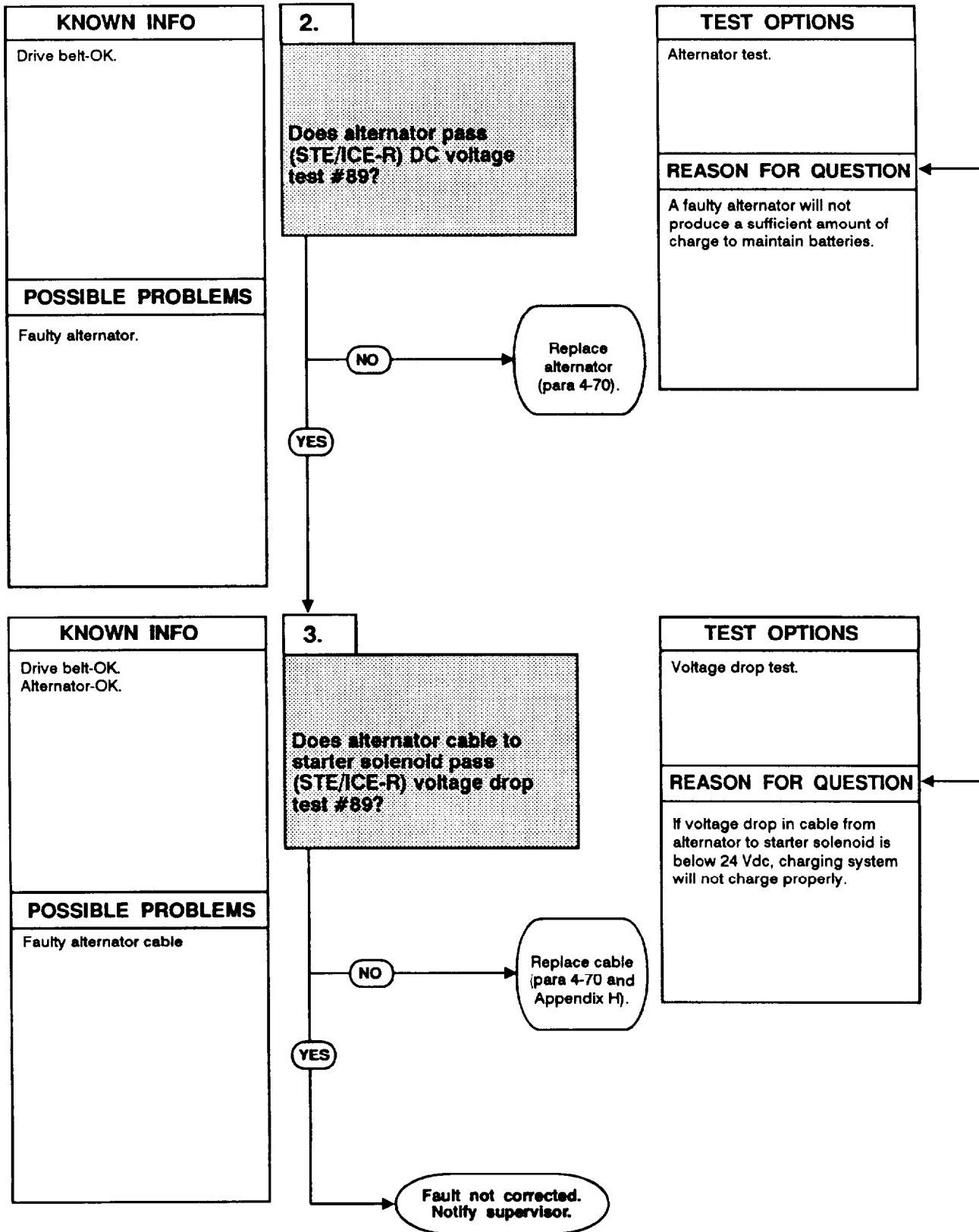


DRIVE BELT INSPECTION

- (1) Open left engine door (para 2-14).
- (2) Check drive belt for obvious damage.
 - (a) Replace drive belt if damaged (para 4-68).
 - (b) If drive belt is not damaged, check drive belt deflection.
- (3) Measure drive belt deflection at longest span of belt. Maximum deflection is 3/8 to 1/2 inch (9.5 to 12.7mm).
 - (a) If drive belt is not within limits, replace drive belt tensioner (para 4-69).
 - (b) If drive belt is within limits indicates faulty alternator.

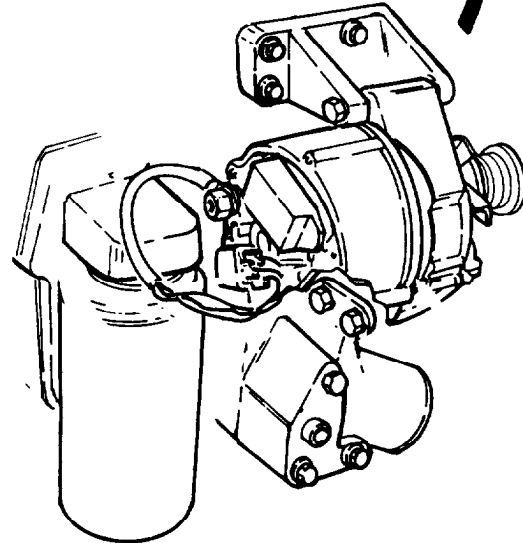
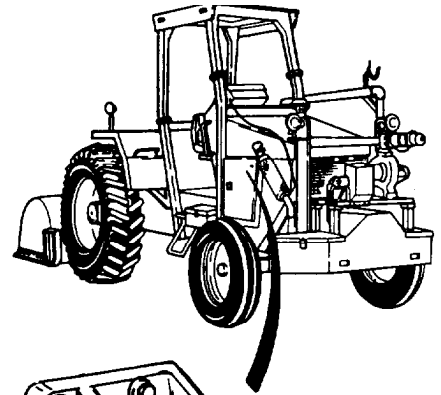


ALTERNATOR DOES NOT CHARGE BATTERIES (CONT).



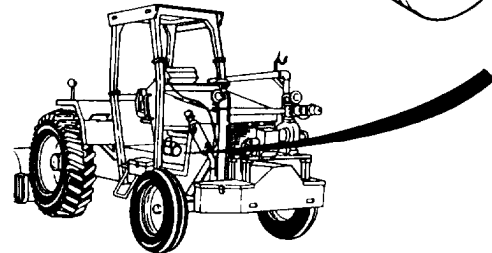
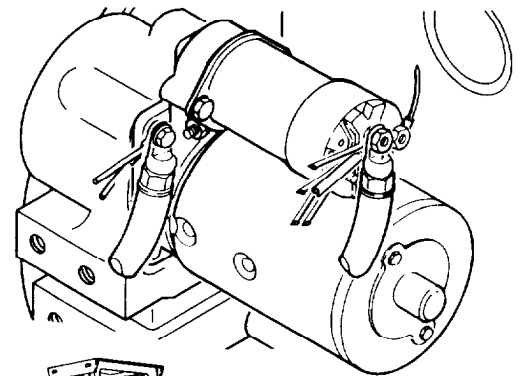
ALTERNATOR TEST

- (1) Open right engine door (para 2-14).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Perform DC voltage test # 89 to evaluate alternator output.
 - (a) Alternator output should be 25 to 28 Vdc. If correct voltage is not present, replace alternator (para 4-70).
 - (b) If alternator is OK, check alternator negative drop.



ALTERNATOR CABLE VOLTAGE DROP TEST

- (1) Open right engine door (para 2-14).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Perform DC voltage test # 89 to check alternator negative cable drop for 24 Vdc at cable end to starter solenoid from alternator (Appendix H).
 - (a) If minimum 25 Vdc is not present, replace cable (Appendix H).
 - (b) If cable is OK, notify supervisor.



23. ADDITIVE PUMP TURNS BUT WILL NOT PUMP ADDITIVE SOLUTION.

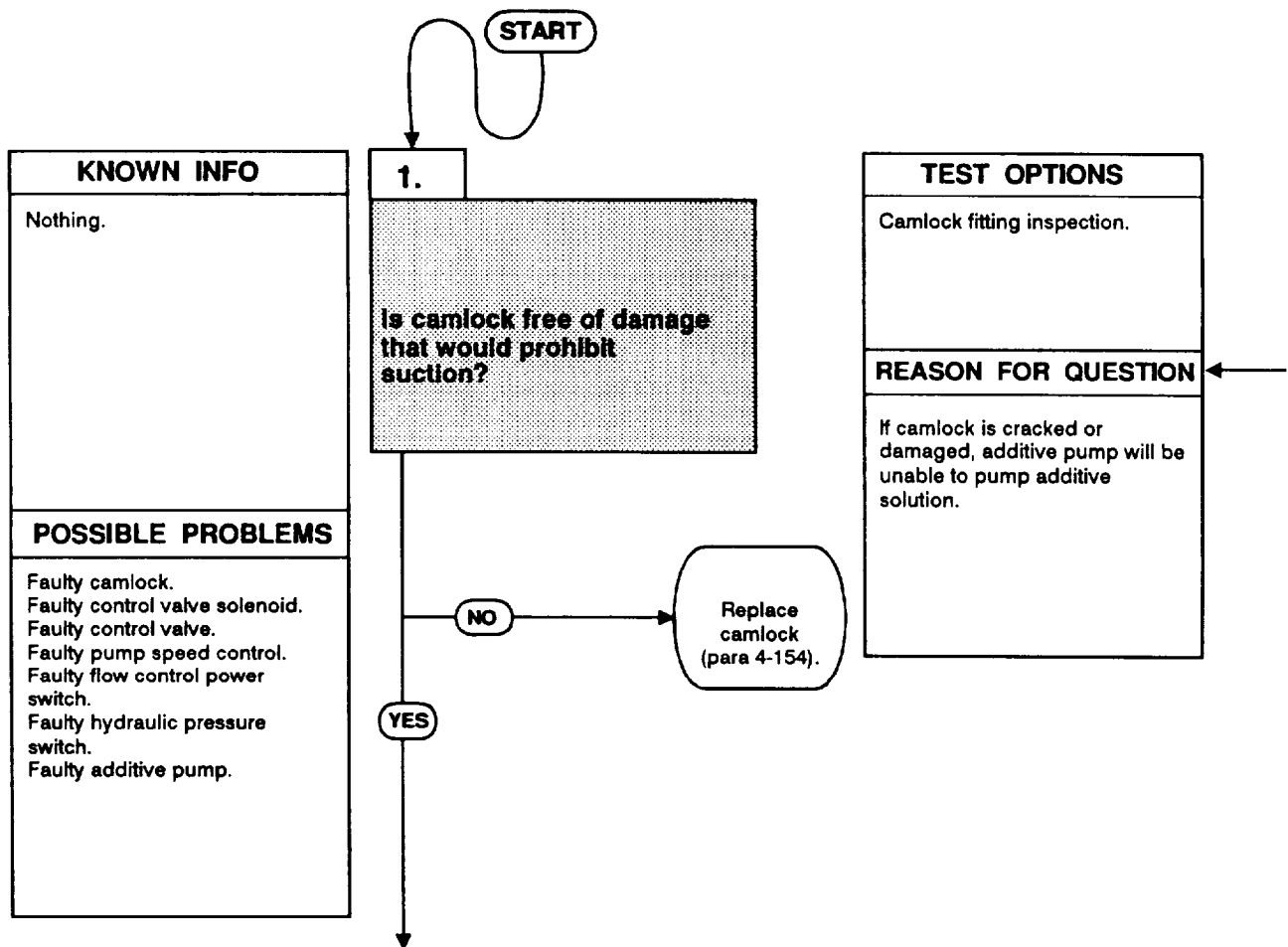
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

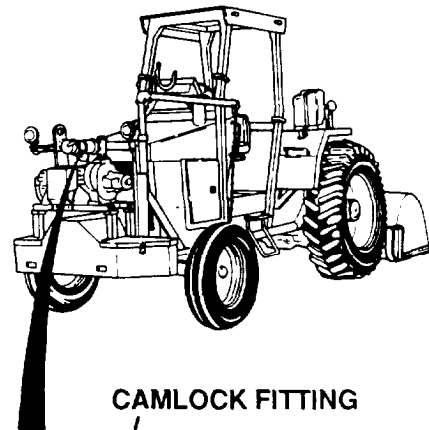
Tools and Special Tools

Tool kit, general mechanic's: automotive
 Test set, Simplified Test Equipment for
 Internal Combustion Engines
 reprogrammable, (STE/ICE-R).

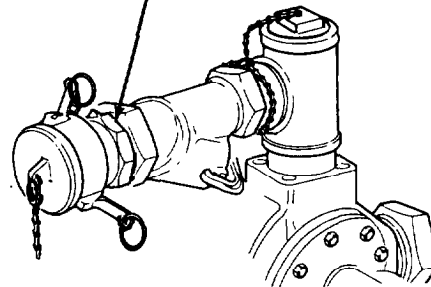


CAMLOCK INSPECTION

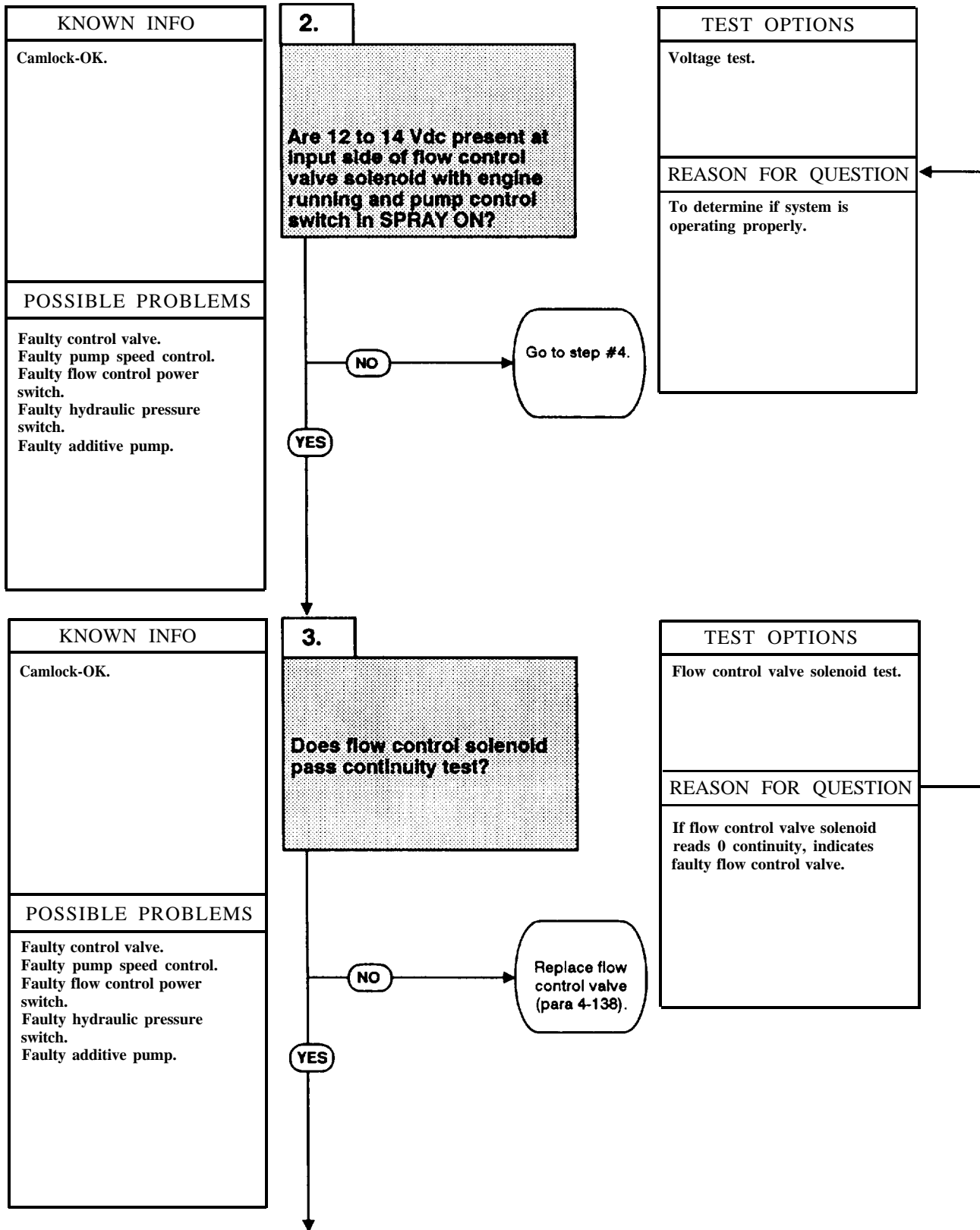
- (1) Check pump camlock fitting for damage that would prohibit additive pump suction.
 - (a) If pump camlock is faulty, replace (para 4-154).
 - (b) If pump camlock is OK, indicates faulty control valve solenoid.



CAMLOCK FITTING

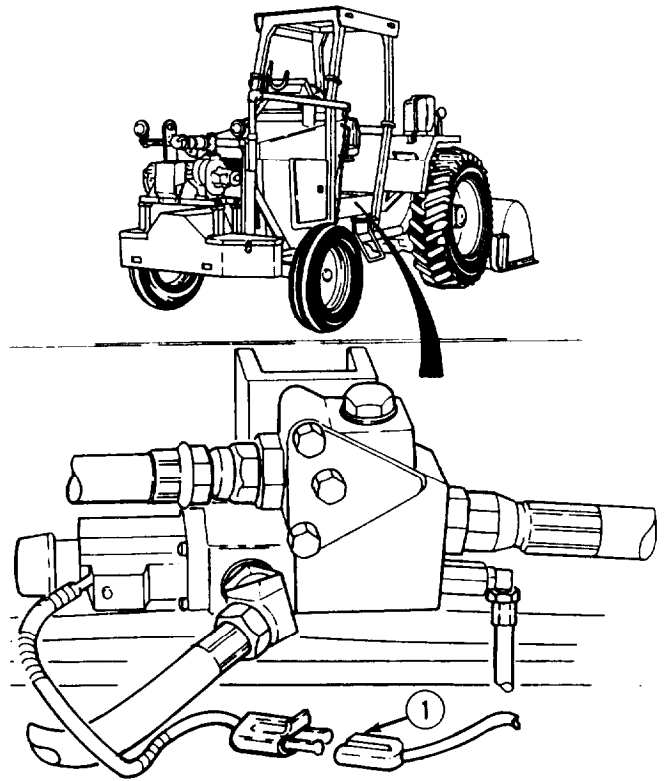


ADDITIVE PUMP TURNS BUT WILL NOT PUMP ADDITIVE SOLUTION (CONT).



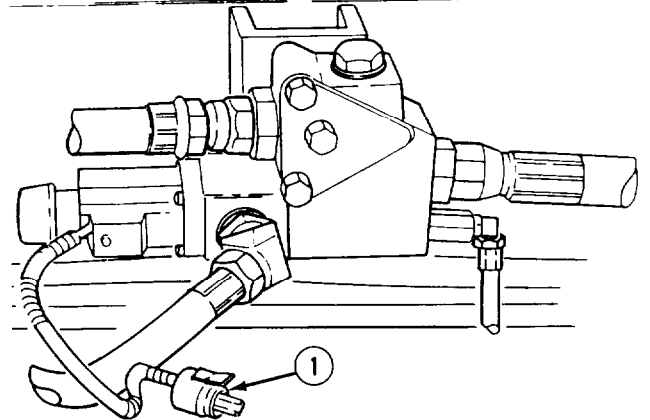
SOLENOID VOLTAGE TEST

- (1) Remove forward floor plate (para 4-132).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of flow control valve solenoid.
 - (a) If 12 to 14 Vdc is present at input side of solenoid, perform continuity test.
 - (b) If 12 to 14 Vdc is not present at input side of solenoid, go to step # 4.



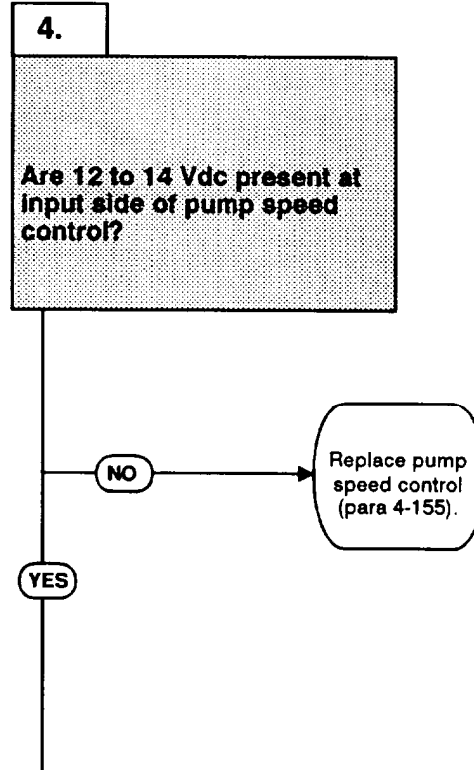
SOLENOID CONTINUITY TEST

- (1) Remove forward floor plate (para 4-132).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Perform continuity test # 91 across flow control valve solenoid wire connector (1).
 - (a) If continuity test is 0, replace flow control valve (para 4-138).
 - (b) If continuity is greater than 0, indicates faulty pressure sensor.



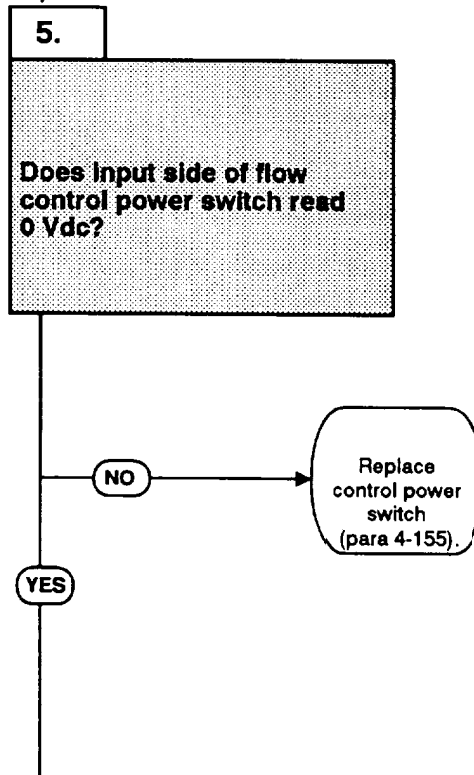
ADDITIVE PUMP TURNS BUT WILL NOT PUMP ADDITIVE SOLUTION (CONT).

KNOWN INFO
Camlock-OK. Control valve-OK.
POSSIBLE PROBLEMS
Faulty pump speed control. Faulty flow control power switch. Faulty hydraulic pressure switch. Faulty additive pump.



TEST OPTIONS
Voltage test.
REASON FOR QUESTION
If 12 to 14 Vdc is not present at input side of pump speed control, indicates faulty pump speed control.

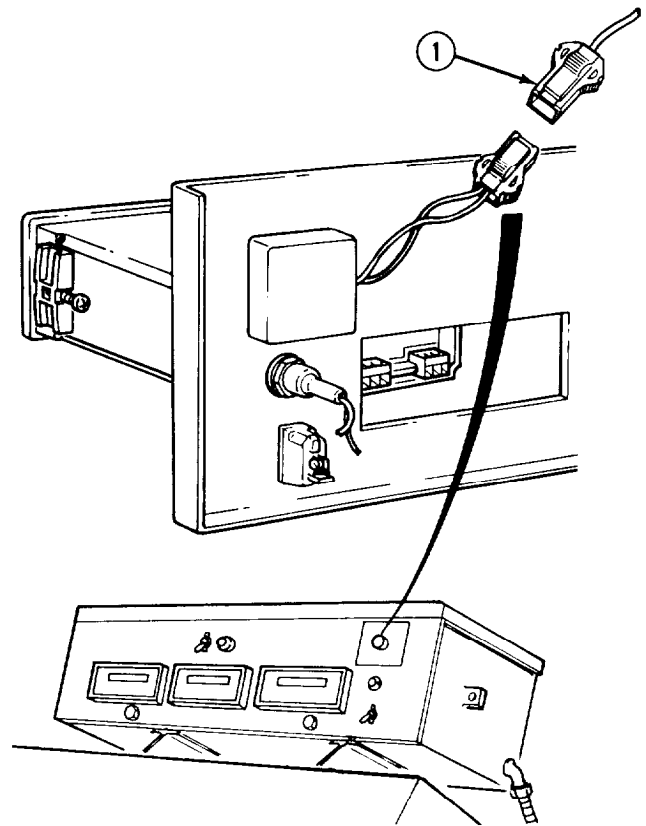
KNOWN INFO
Camlock-OK. Control valve-OK. Pump speed control-OK
POSSIBLE PROBLEMS
Faulty flow control power switch. Faulty hydraulic pressure switch. Faulty additive pump.



TEST OPTIONS
Voltage test.
REASON FOR QUESTION
If flow control power switch reads voltage greater than 0, indicates faulty switch.

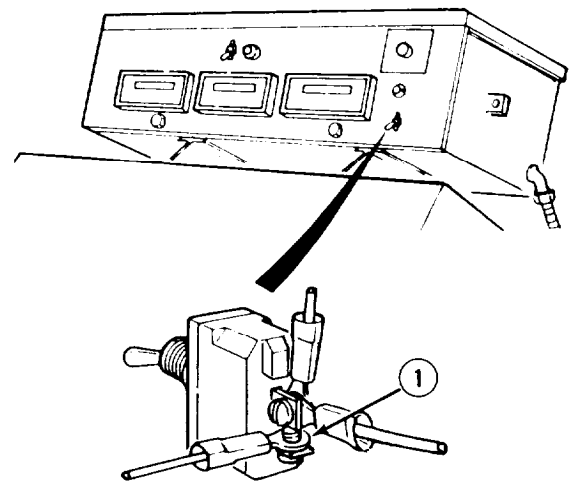
VOLTAGE TEST

- (1) Remove additive instrument panel (para 4-155).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of speed pump control.
 - (a) If 12 to 14 Vdc are present at input (1), replace pump speed control (para 4-155).
 - (b) If 12 to 14 Vdc are not present at input (1), indicates faulty flow control power switch.

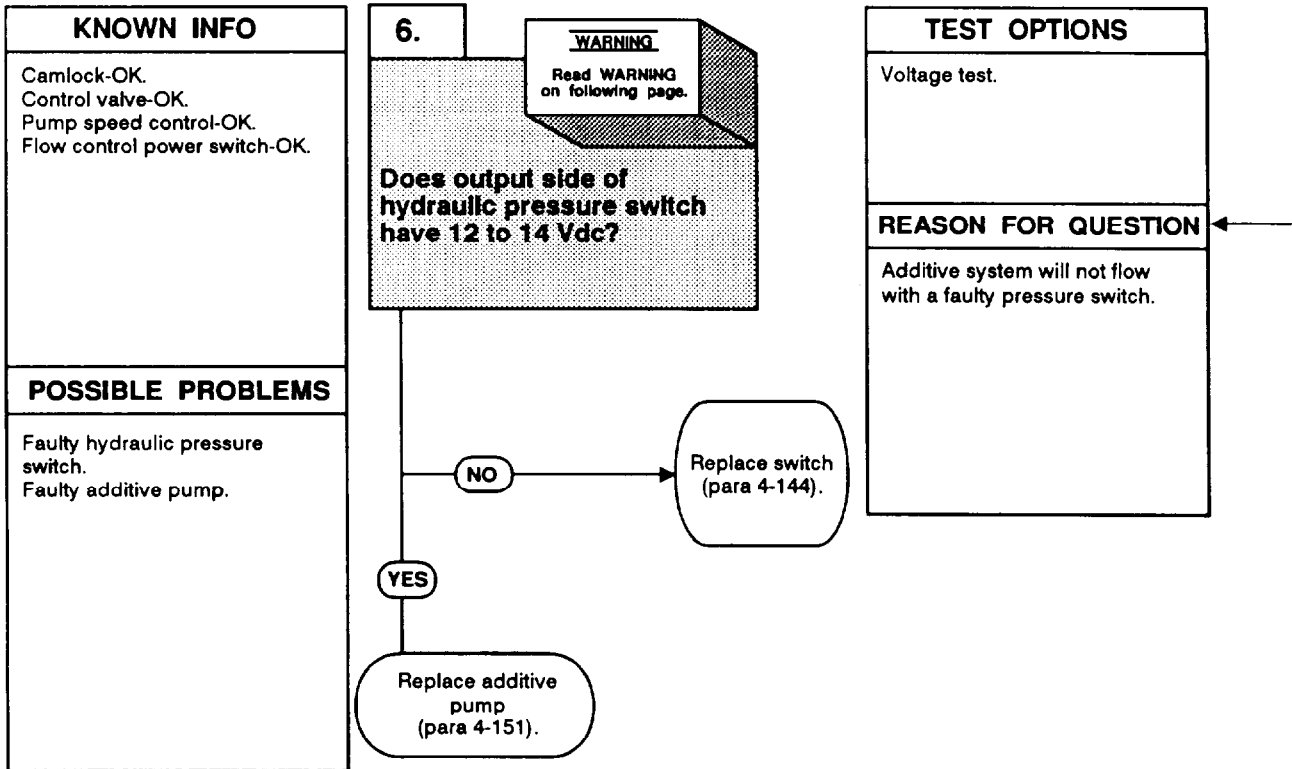


VOLTAGE TEST

- (1) Remove additive instrument panel (para 4-155).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of flow control power switch.
 - (a) If 12 to 14 Vdc are present, replace flow control power switch (para 4-155).
 - (b) If 12 to 14 Vdc are not present, indicates faulty hydraulic pressure switch.

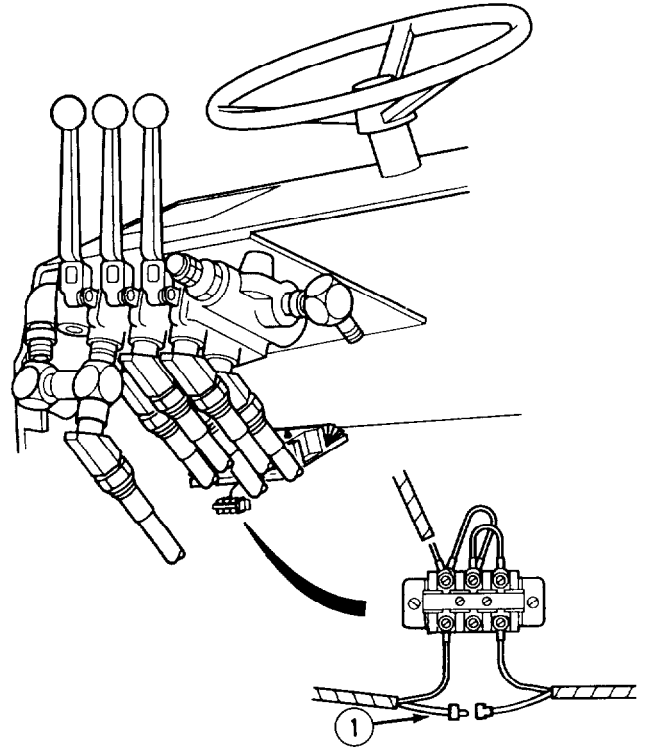


ADDITIVE PUMP TURNS BUT WILL NOT PUMP ADDITIVE SOLUTION (CONT).

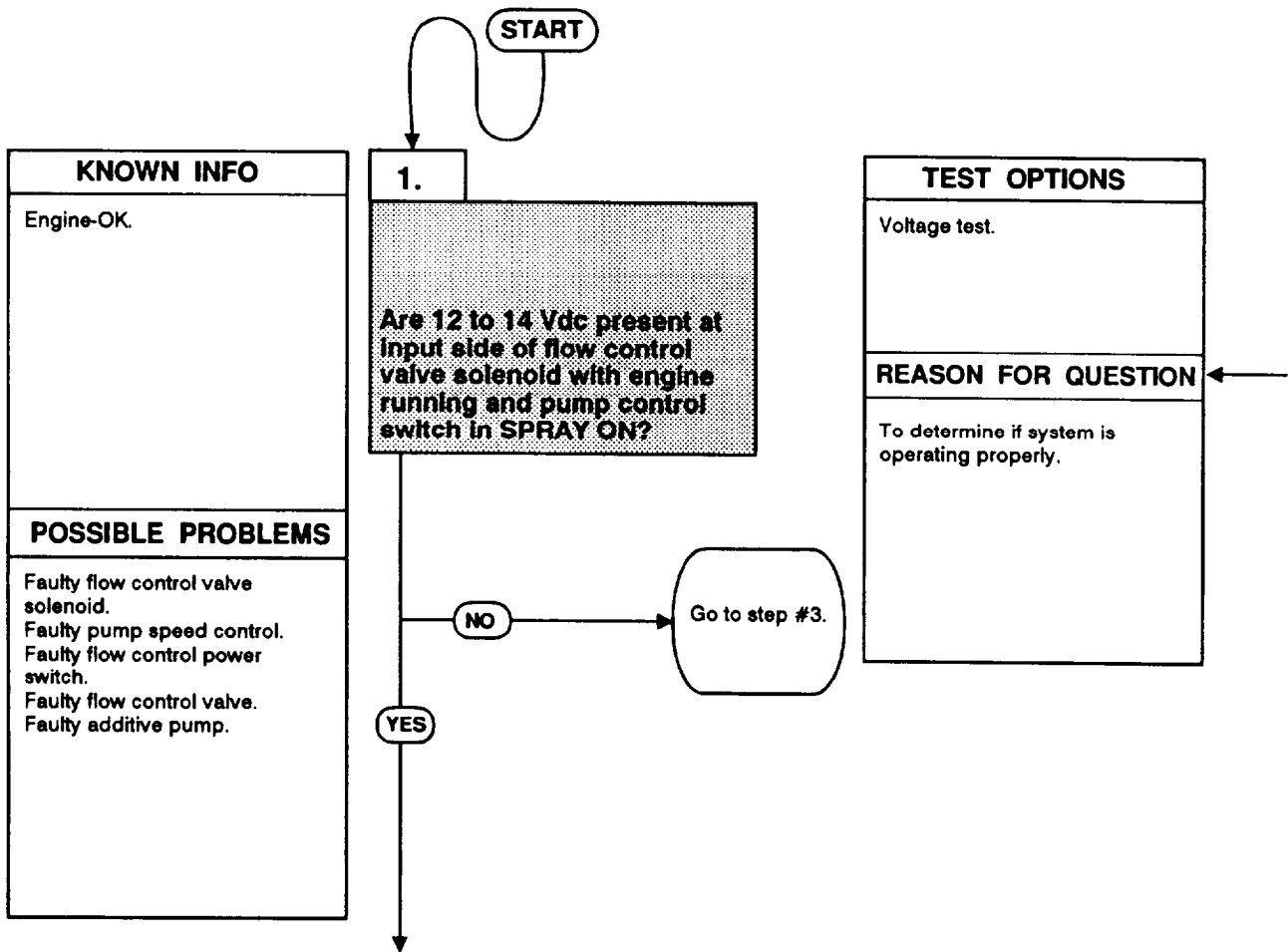


VOLTAGE TEST

- (1) Remove dash panel (para 4-128).
- (2) Disconnect wire (1).
- (3) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (4) Start engine (para 2-9).
- (5) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (6) Perform voltage test #89 at wire (1).
 - (a) If 12 to 14 Vdc is not present, replace, pressure switch (para 4-144).
 - (b) If 12 to 14 Vdc is present, replace additive pump (para 151).

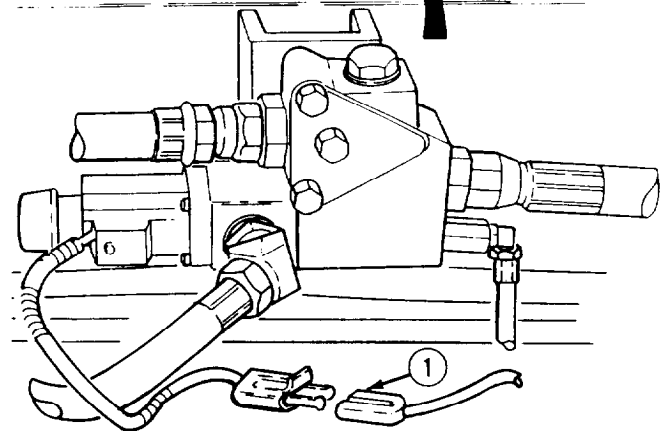
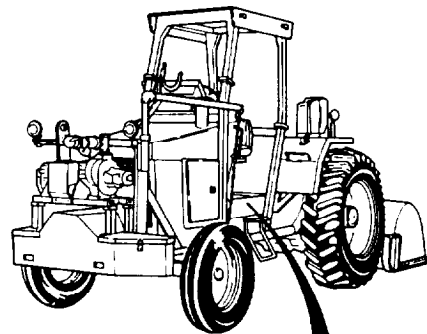


24. ADDITIVE PUMP WILL NOT OPERATE (WILL NOT TURN).	
<p>INITIAL SETUP</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><i>Equipment Conditions</i></p> <p>Engine shut off,(para 2-10[c]). Parking brake set,(para 2-13).</p> </div> <div style="width: 45%;"> <p><i>Tools and Special Tools</i></p> <p>Tool kit, general mechanic's: automotive Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R).</p> </div> </div>	

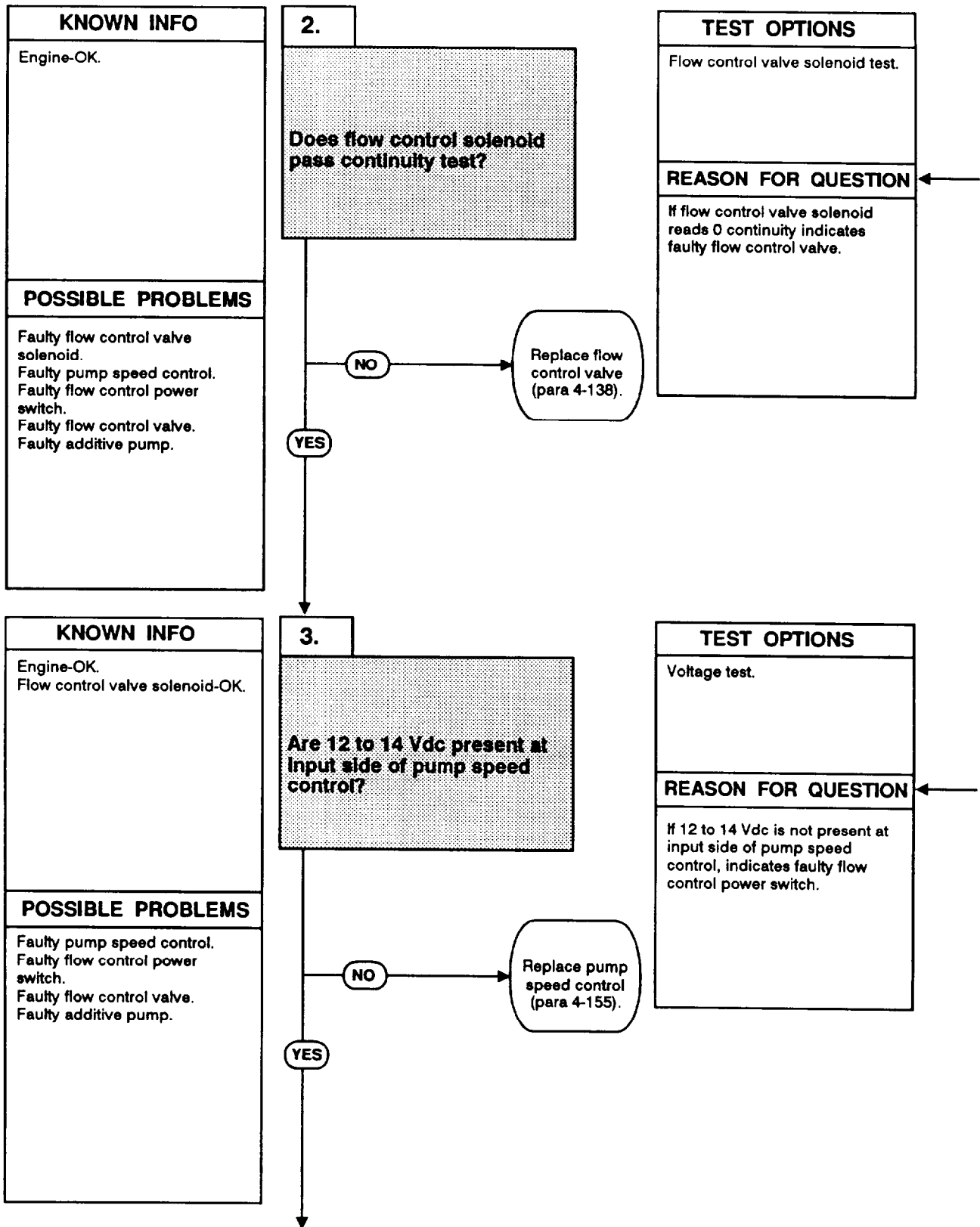


SOLENOID VOLTAGE TEST

- (1) Remove forward floor plate (para 4-132).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of flow control valve solenoid.
 - (a) If 12 to 14 Vdc is present at input side of solenoid, perform continuity test.
 - (b) If 12 to 14 Vdc is not present at input side of solenoid, go to step # 4.

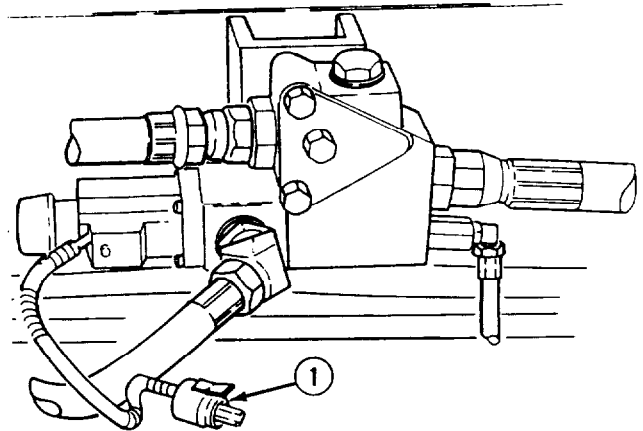


ADDITIVE PUMP WILL NOT OPERATE (WILL NOT TURN) (CONT).



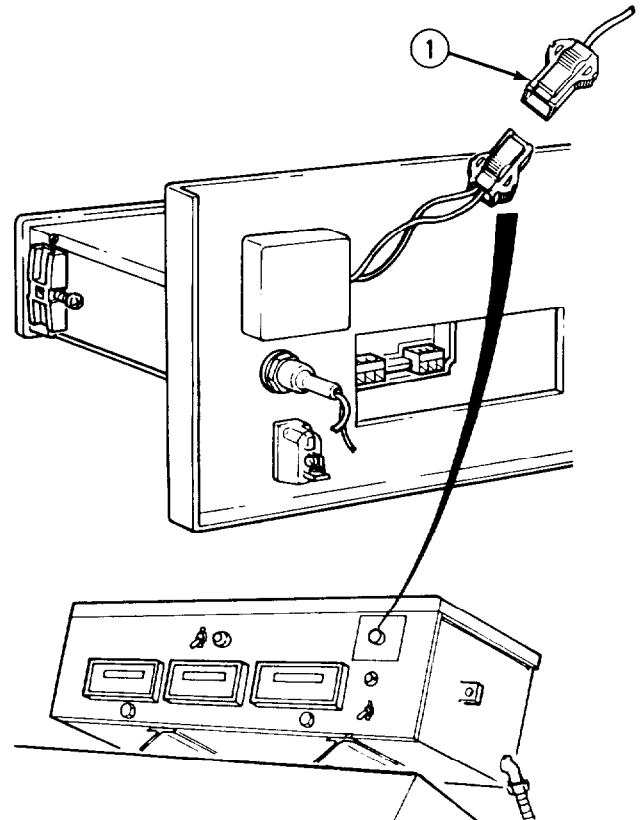
SOLENOID CONTINUITY TEST

- (1) Remove forward floor plate (para 4-132).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Perform continuity test # 91 across flow control valve solenoid wire connector (1).
 - (a) If continuity test is 0, replace flow control valve (para 4-138).
 - (b) If continuity is greater than 0, indicates faulty pressure switch.



VOLTAGE TEST

- (1) Remove additive instrument panel (para 4-155).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of speed pump control.
 - (a) If 12 to 14 Vdc is present at input (1), replace speed pump control (para 4-155).
 - (b) If 12 to 14 Vdc is not present at input (1), indicates faulty flow control power switch.



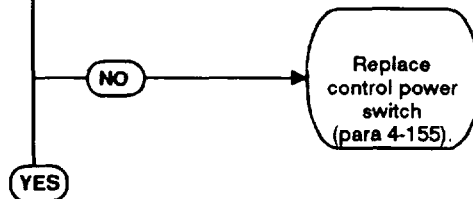
ADDITIVE PUMP WILL NOT OPERATE (WILL NOT TURN) (CONT).

KNOWN INFO
Engine-OK. Flow control valve solenoid-OK. Pump speed control-OK. Flow control power switch-OK.
POSSIBLE PROBLEMS
Faulty flow control valve. Faulty additive pump.

4.

Does input side of flow control power switch read 0 Vdc?

TEST OPTIONS
Voltage test.
REASON FOR QUESTION
If flow control power switch reads voltage greater than 0 indicates faulty switch.

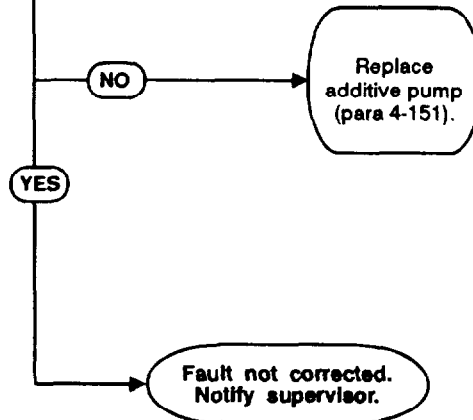


KNOWN INFO
Engine-OK. Flow control valve solenoid-OK. Pump speed control-OK. Flow control power switch-OK. Flow control valve-OK.
POSSIBLE PROBLEMS
Faulty additive pump.

5.

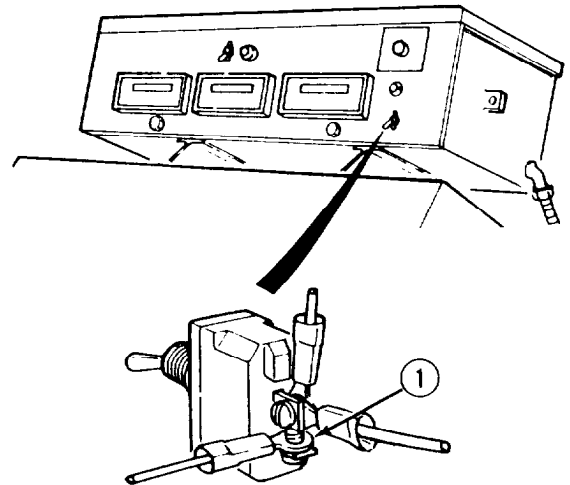
Does additive system motor operate incorrectly with additive pump disconnected?

TEST OPTIONS
Hydraulic motor test.
REASON FOR QUESTION
With flow control power switch in SPRAY ON position and hydraulic motor operates correctly (turns) indicates an internal malfunction within additive pump.



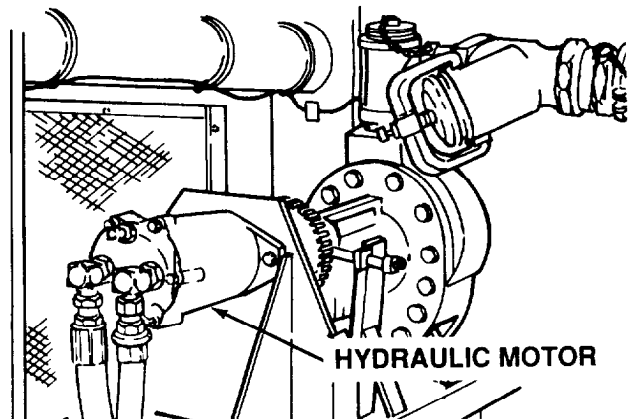
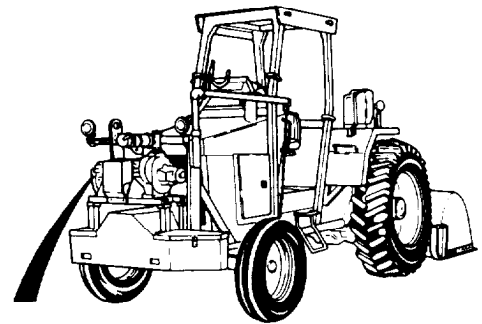
VOLTAGE TEST

- (1) Remove additive instrument panel (para 4-155).
- (2) Power up STE/ICE-R to engine battery (TM 9-4910-571-12&P, in TK mode).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
- (5) Perform voltage test # 89 at input side (1) of flow control power switch.
 - (a) If 12 to 14 Vdc are present at input (1), replace flow control power switch (para 4-155).
 - (b) If 12 to 14 Vdc are not present, faulty additive system motor.



HYDRAULIC MOTOR TEST

- (1) Set parking brake (para 2-13).
- (2) Remove additive chain assembly (para 4-152).
- (3) Start engine (para 2-9).
- (4) Follow Additive System Operating Procedures (para 2-12[a]) steps 3-6.
 - (a) If hydraulic motor operates correctly (turns), replace additive pump (para 4-151).
 - (b) If hydraulic motor does not operate, notify supervisor.



25. BOOM CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER ROTOR ASSEMBLY.

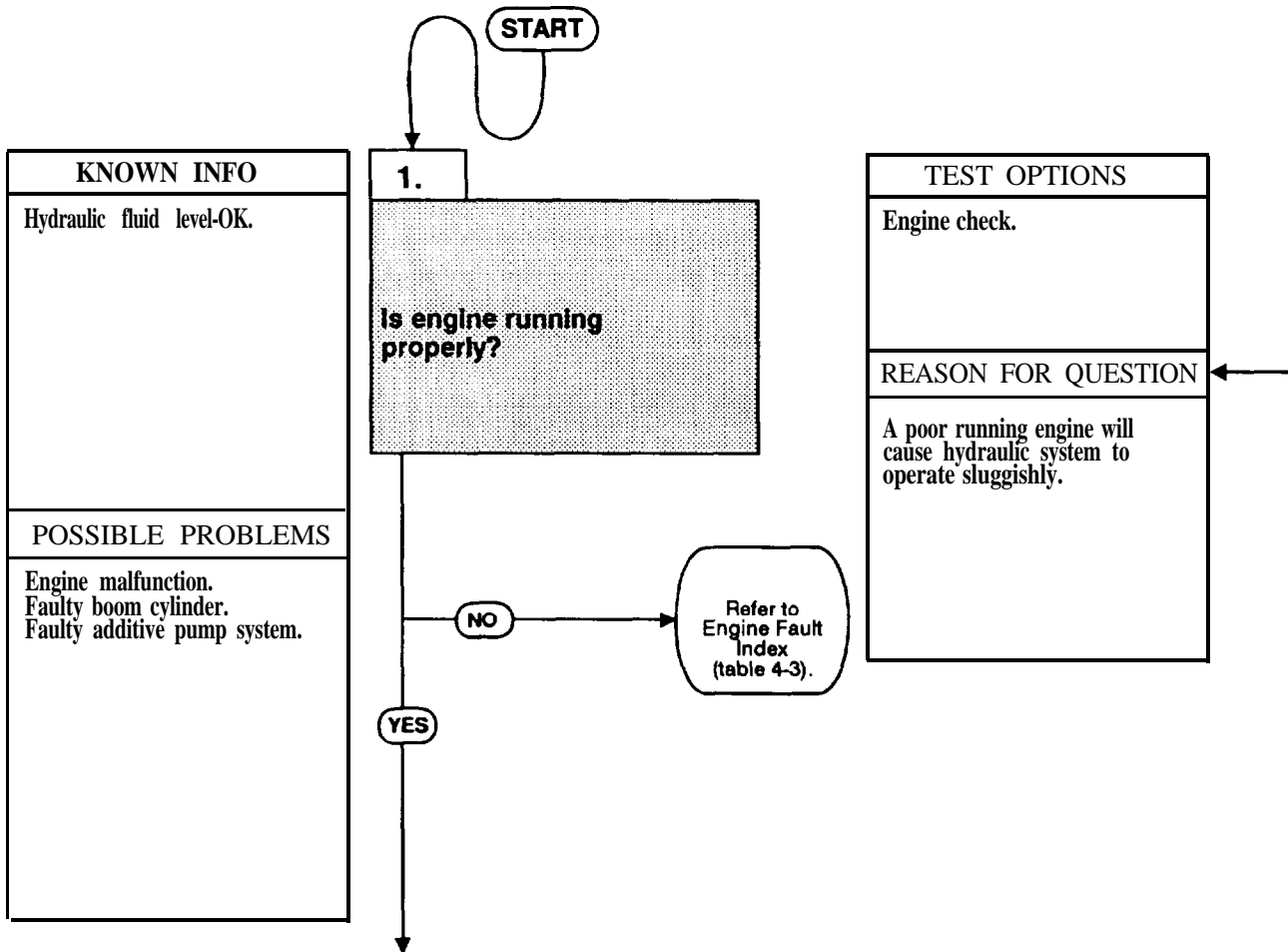
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

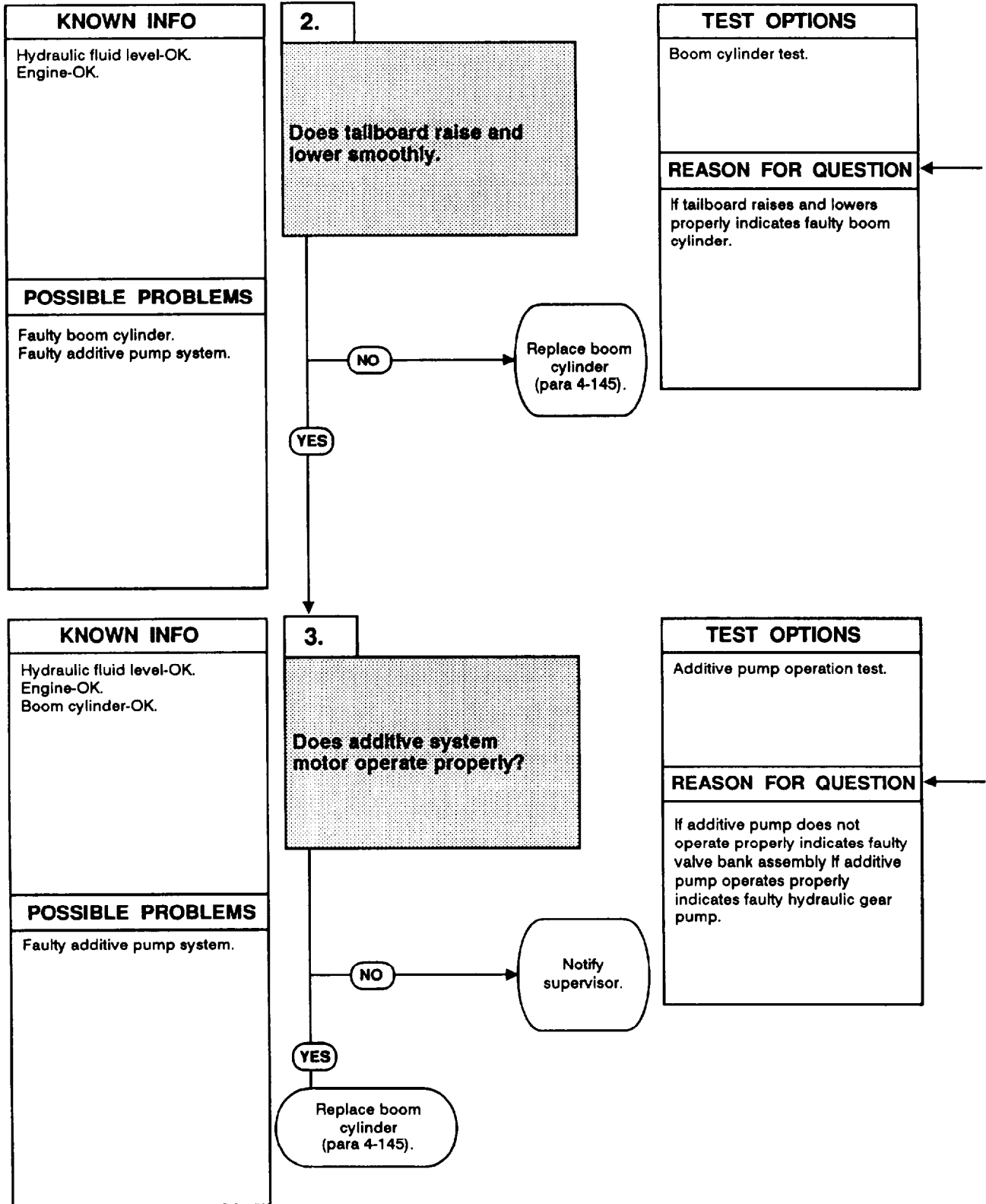
Tool kit, general mechanic's: automotive



ENGINE CHECK

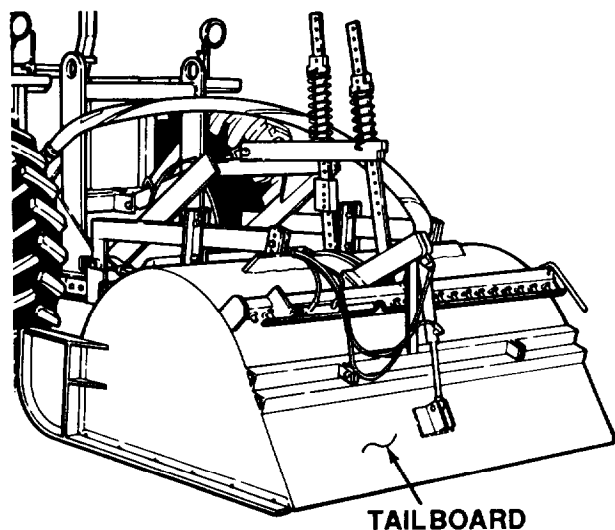
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
 - (a) Listen for unusual engine noise that might cause a malfunction with hydraulic system.
 - (b) If engine operates properly, indicates faulty boom cylinder.

BOOM CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER ROTOR ASSEMBLY (CONT).



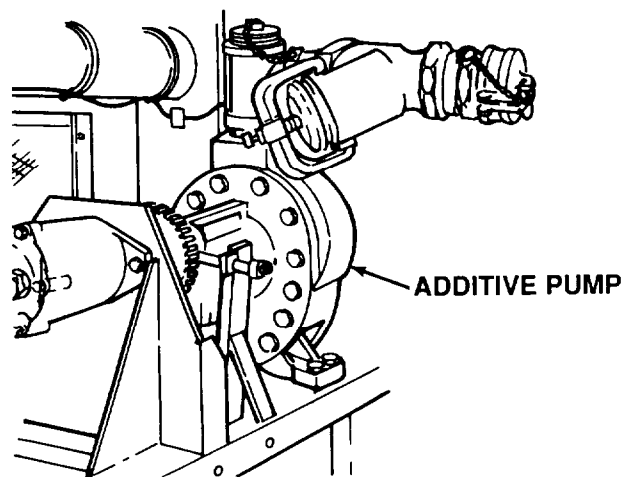
BOOM CYLINDER TEST

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Raise and lower tailboard (para 2-11).
 - (a) If tailboard raises and lowers smoothly replace boom cylinder (para 4-145).
 - (b) If tailboard stutters or will not raise indicates faulty valve bank assembly.



ADDITIVE SYSTEM MOTOR OPERATION TEST

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Operate additive pump (para 2-12).
 - (a) If additive system motor operates properly, replace boom cylinder (para 4-145)
 - (b) If additive system motor does not operate properly indicates faulty hydraulic gear pump notify supervisor.



26. GATE CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER TAILBOARD.

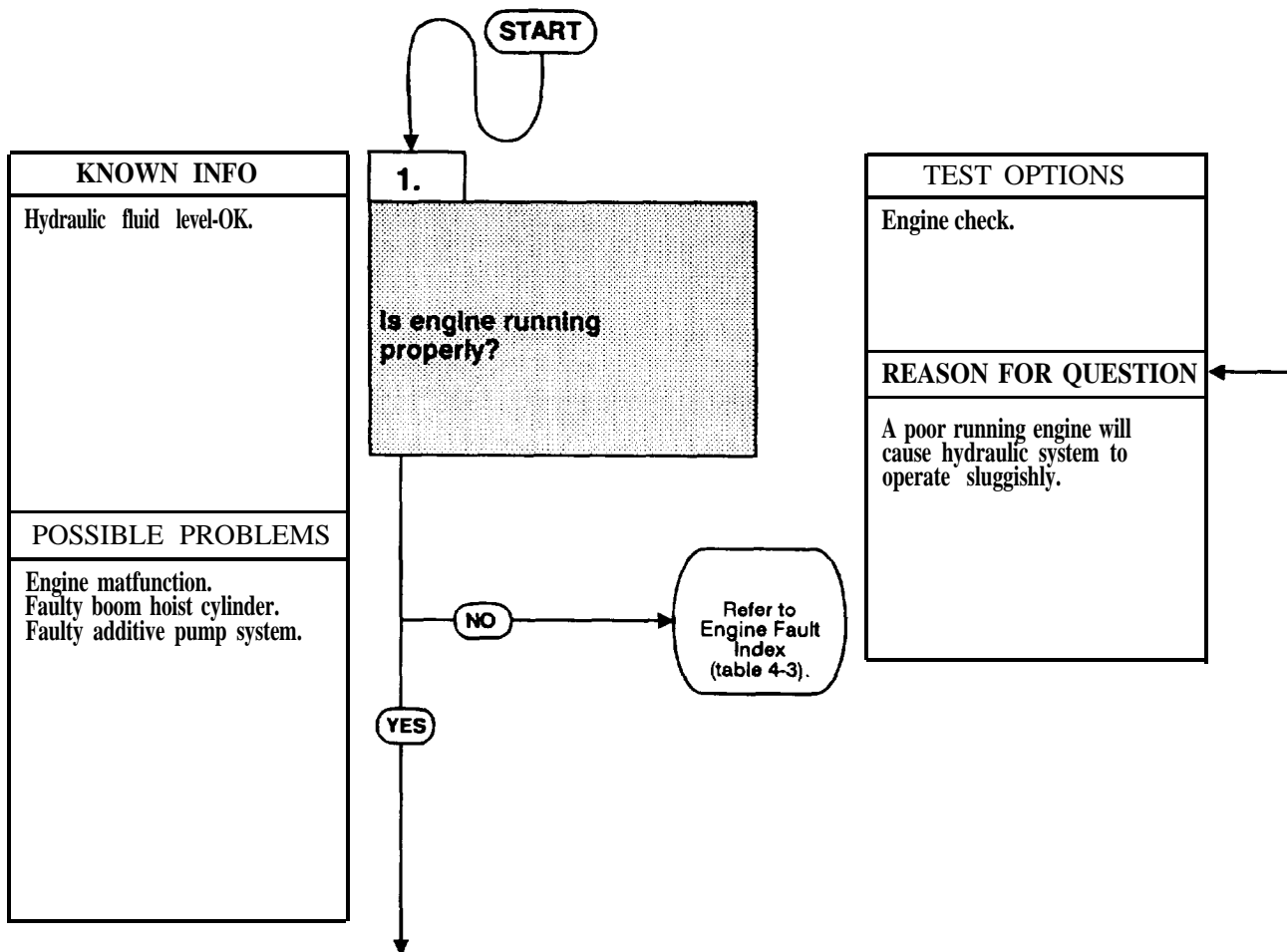
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-20[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

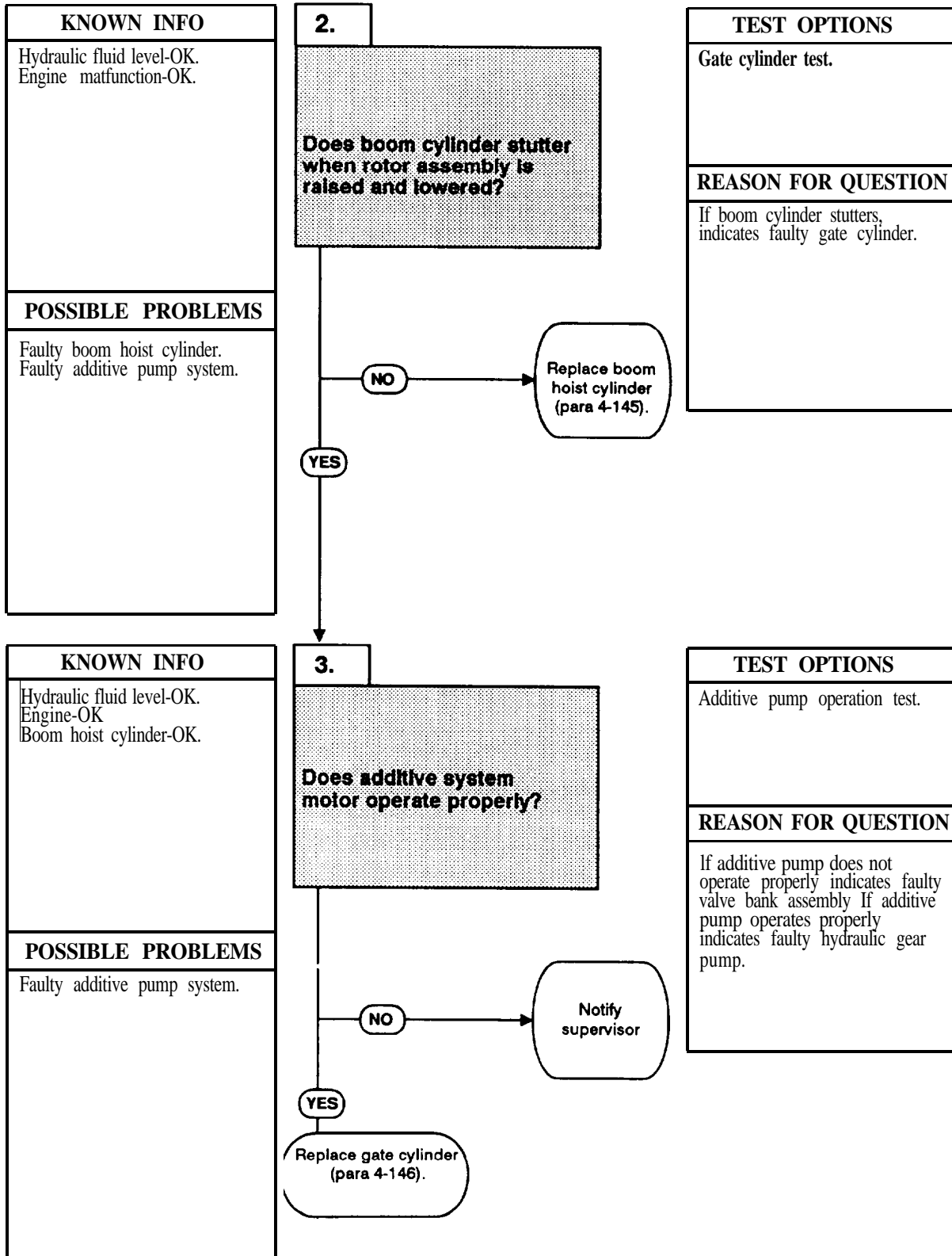
Tool kit, general mechanic's: automotive



ENGINE CHECK

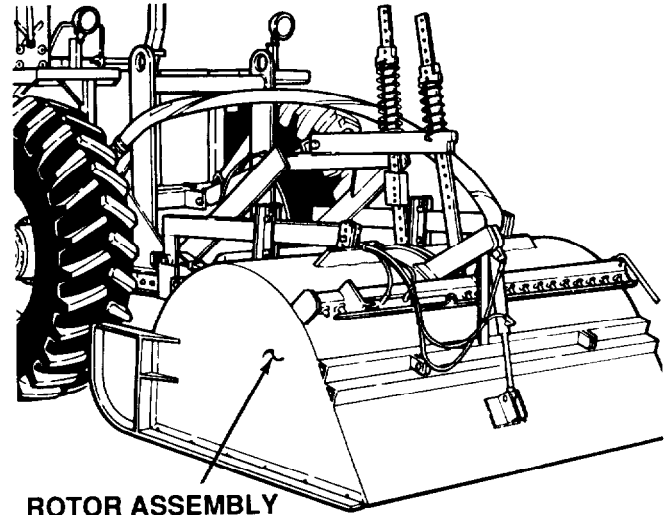
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
 - (a) Listen for unusual engine noise that might cause hydraulic system malfunction.
 - (b) If engine operates properly, indicates faulty gate cylinder.

GATE CYLINDER STUTTERS OR WILL NOT RAISE AND LOWER TAILBOARD (CONT).



BOOM HOIST CYLINDER TEST

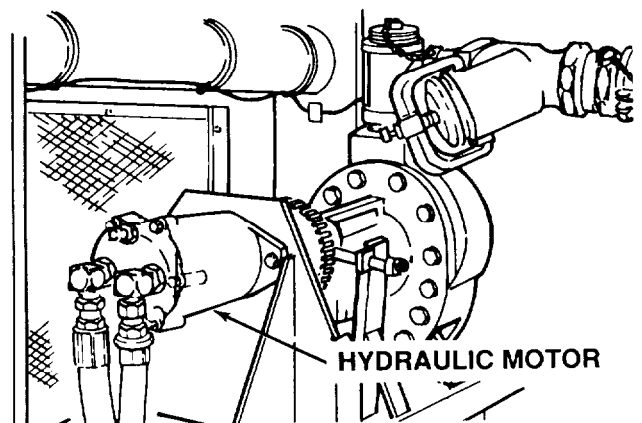
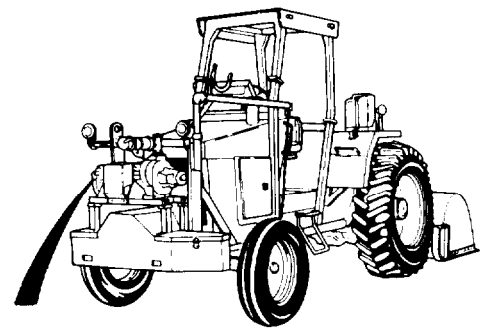
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Raise and lower rotor assembly (para 2-11).
 - (a) If rotor assembly raises and lowers smoothly, replace boom hoist cylinder (para 4-145).
 - (b) If boom cylinder stutters or will not raise indicates faulty valve bank assembly.



ROTOR ASSEMBLY

ADDITIVE SYSTEM MOTOR OPERATION TEST

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Operate additive pump (para 2-12).
 - (a) If additive system motor operates properly replace gate cylinder (para 4-146)
 - (b) If additive system motor does not operate properly indicates faulty hydraulic gear pump notify supervisor.



HYDRAULIC MOTOR

27. SPRAY BAR CYLINDER STUTTERS OR WILL NOT OPEN AND CLOSE SPRAY BAR.

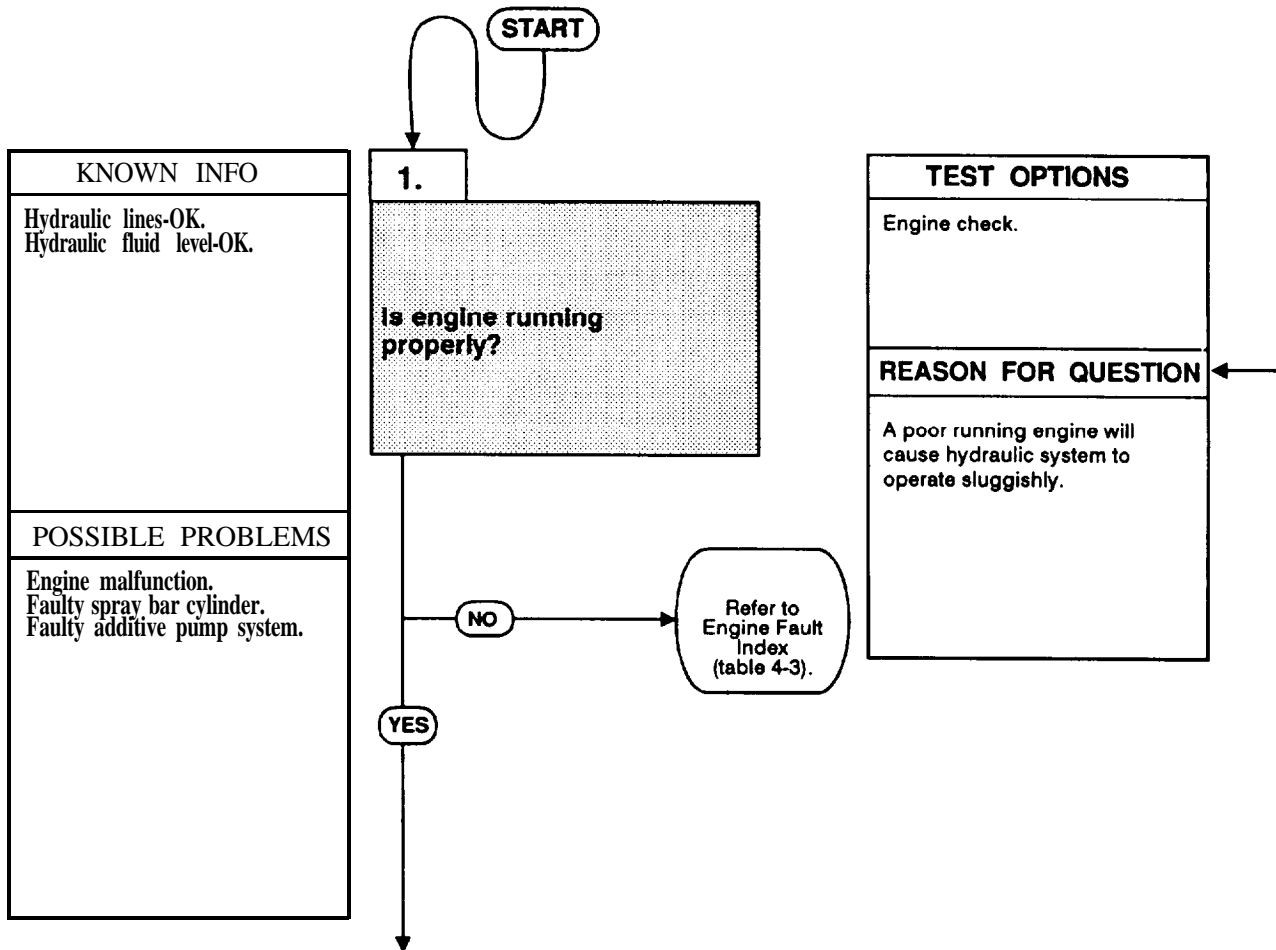
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

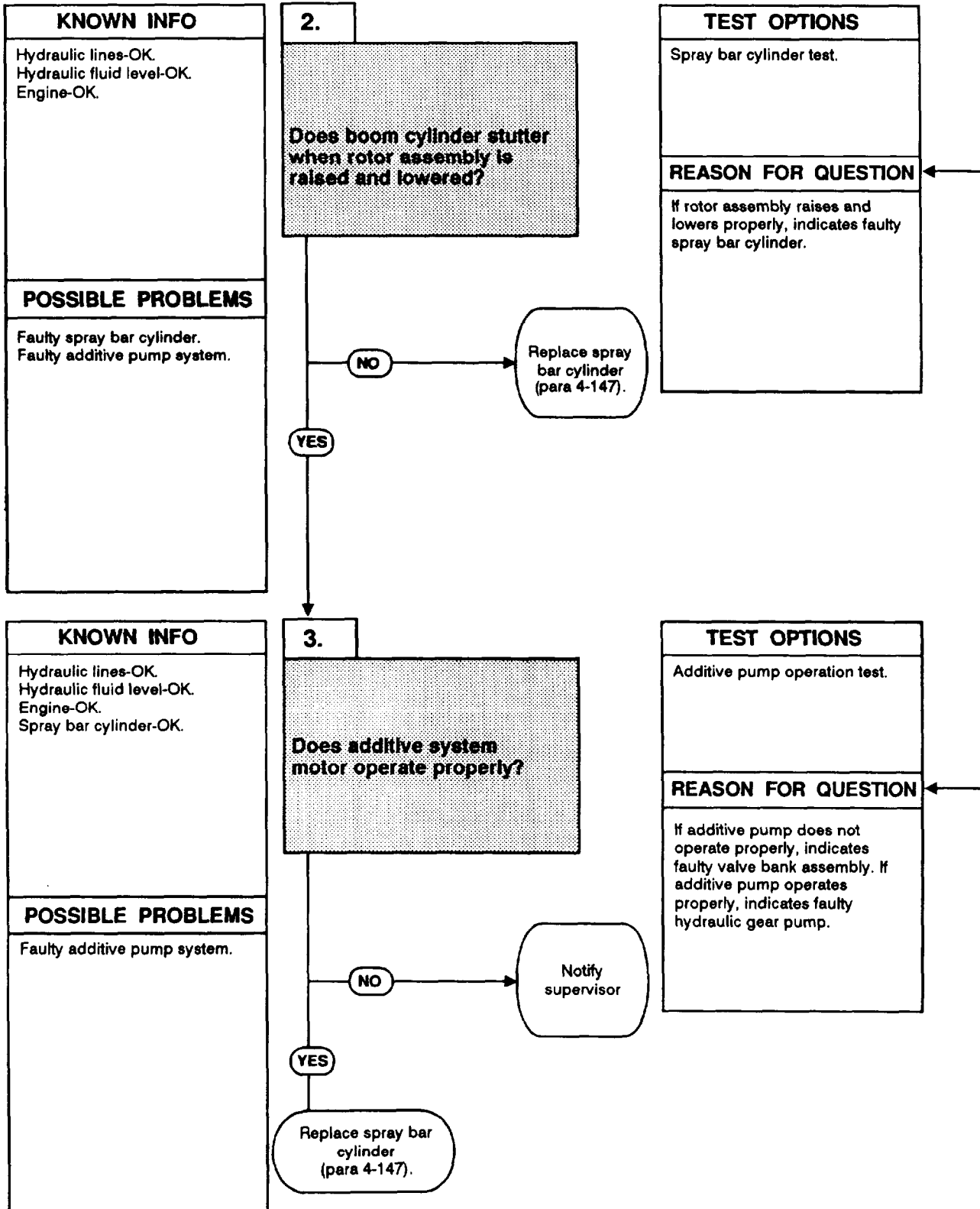
Tool kit, general mechanic's: automotive



ENGINE CHECK

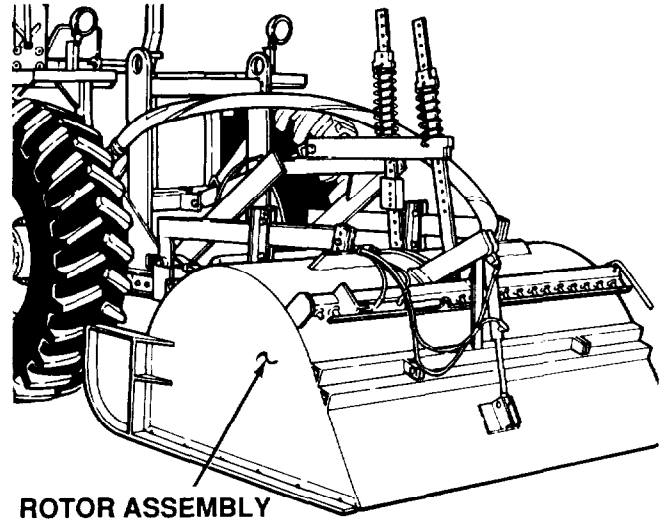
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
 - (a) Listen for unusual engine noise that might cause a malfunction with hydraulic system.
 - (b) If engine operates properly, indicates faulty gate cylinder.

SPRAY BAR CYLINDER STUTTERS OR WILL NOT OPEN AND CLOSE SPRAY BAR



SPRAY BAR CYLINDER TEST

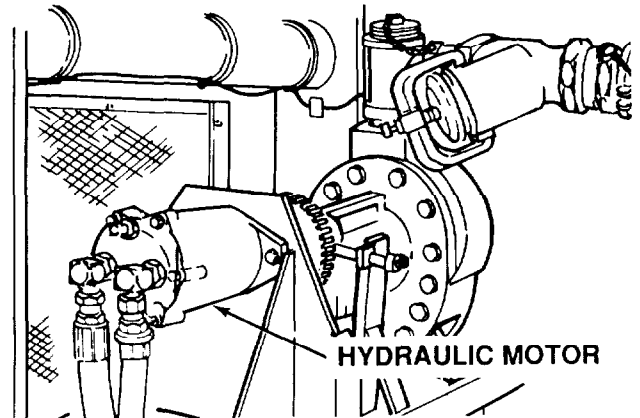
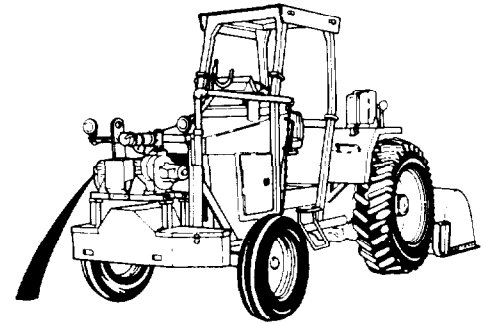
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Raise and lower rotor assembly (para 2-11).
 - (a) If rotor assembly raises and lowers smoothly, replace spray bar cylinder assembly (para 4-147).
 - (b) If boom cylinder stutters or will not raise, indicates faulty valve bank assembly; notify supervisor.



ROTOR ASSEMBLY

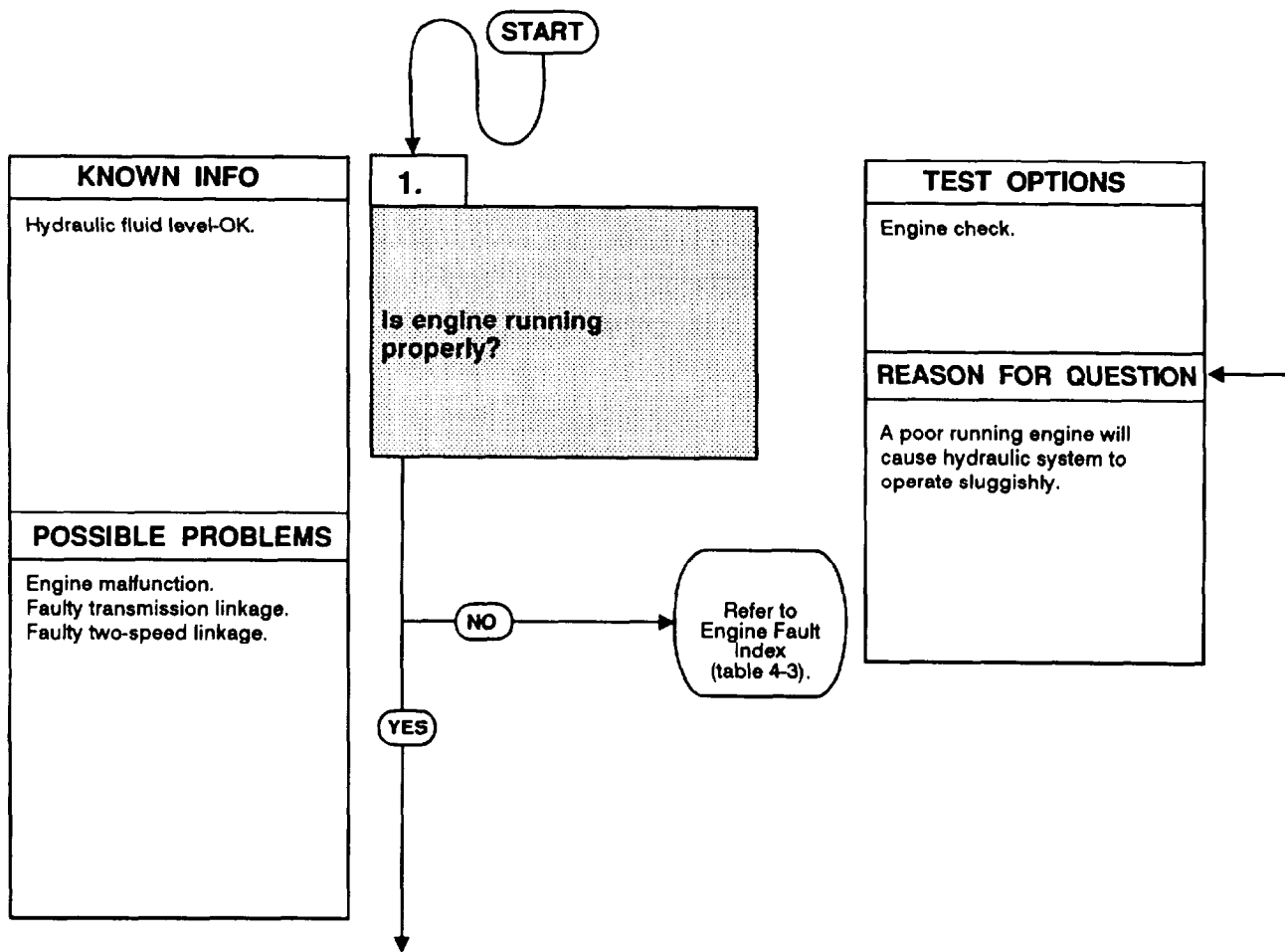
ADDITIVE PUMP OPERATION TEST

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Operate additive pump (para 2-12).
 - (a) If additive system motor operates properly, replace spray bar cylinder (para 4-147).
 - (b) If additive system motor does not operate properly, indicates faulty hydraulic gear pump. Notify supervisor.



HYDRAULIC MOTOR

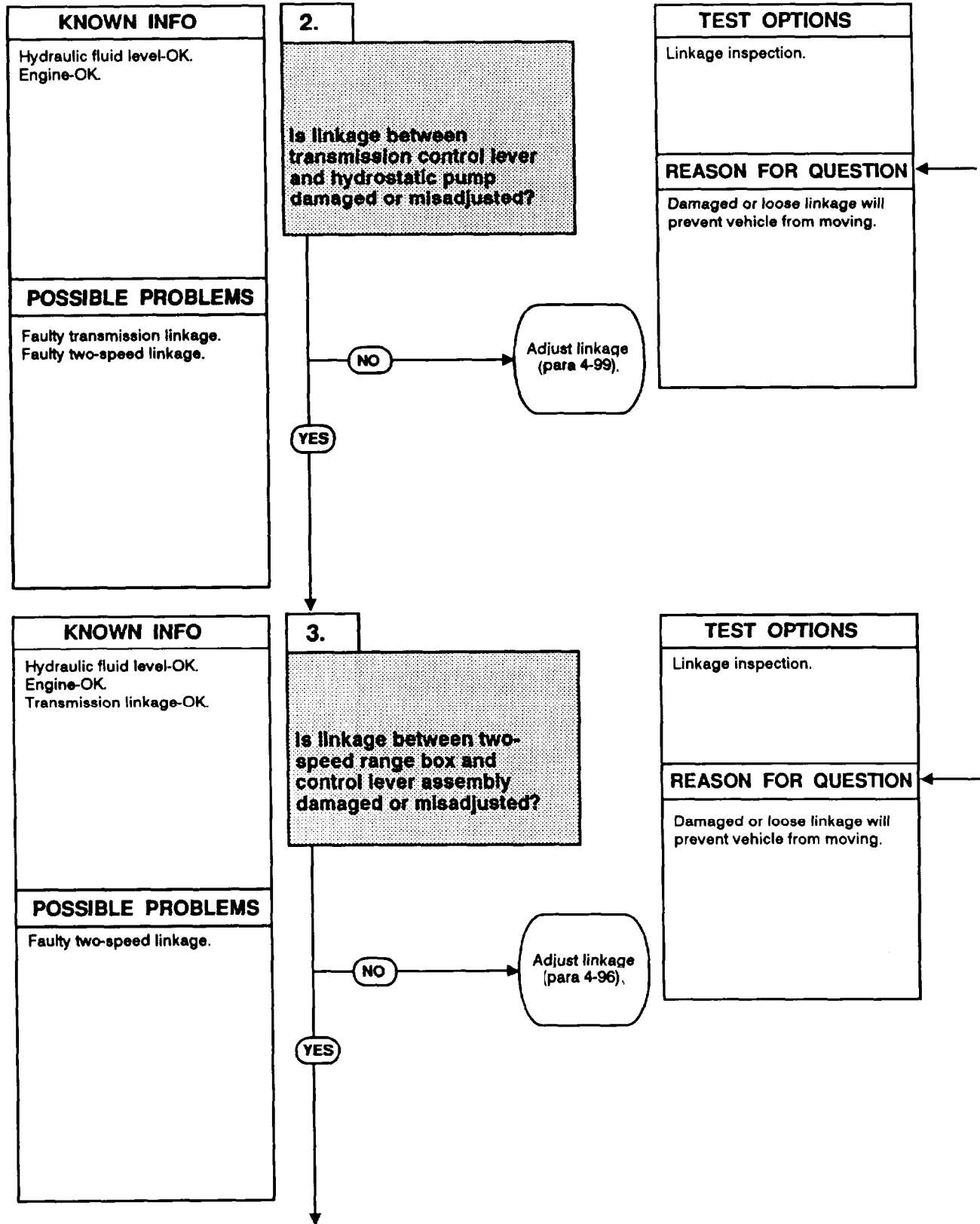
28. VEHICLE DOES NOT MOVE FORWARD OR IN REVERSE CORRECTLY.	
INITIAL SETUP	
<p><i>Equipment Conditions</i></p> <p>Engine shut off, (para 2-10[c]). Parking brake set, (para 2-13).</p>	<p><i>Tools and Special Tools</i></p> <p>Tool kit, general mechanic's: automotive</p>



ENGINE CHECK

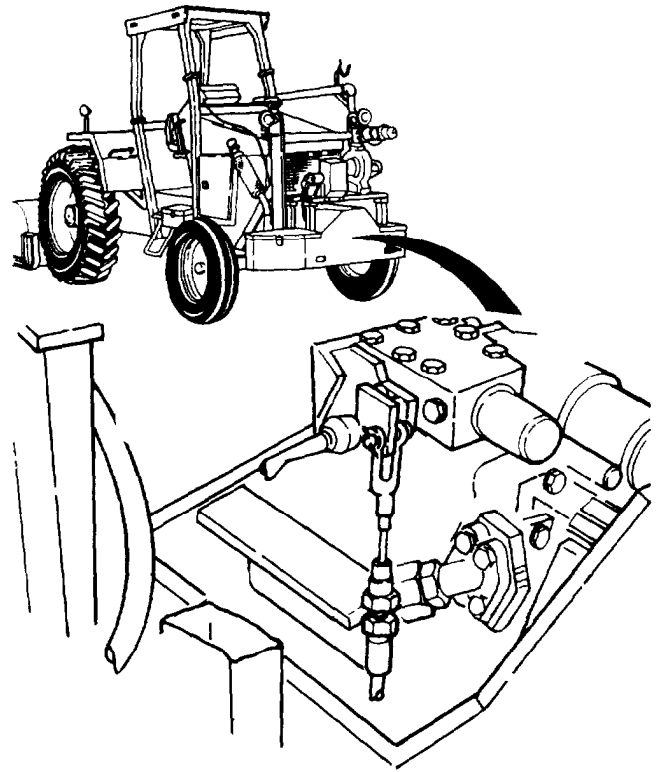
- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
 - (a) Listen for unusual engine noise that might cause a malfunction with hydraulic system.
 - (b) if engine operates properly, indicates faulty gate cylinder.

VEHICLE DOES NOT MOVE FORWARD OR IN REVERSE CORRECTLY (CONT.).



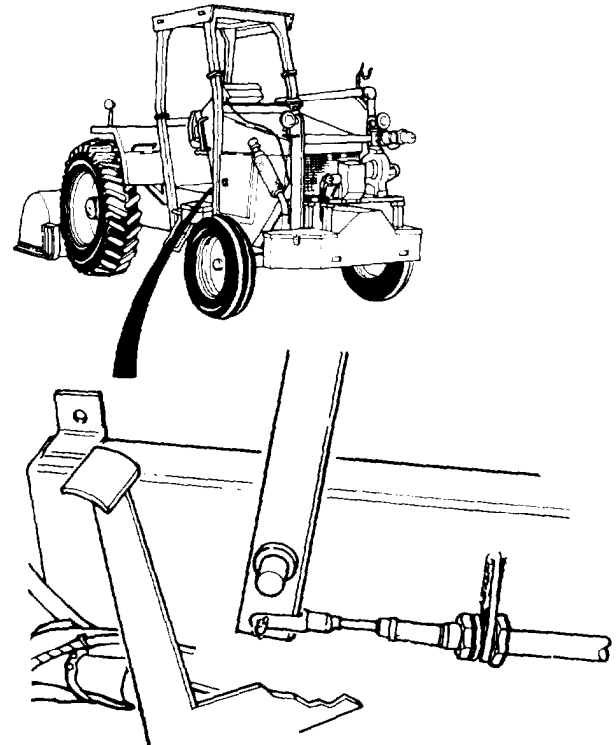
TRANSMISSION LINKAGE INSPECTION

- (1) Remove dash panel (para 4-128).
- (2) Disconnect negative battery cable (para 4-90).
- (3) Remove hydrostatic pump cover (para 4-97).
- (4) Inspect linkage for damage or misadjustment.
 - (a) If linkage is damaged, or mis-adjusted, replace/adjust as necessary (para 4-99 and 4-99).
 - (b) If linkage is OK indicates faulty linkage between two-speed range box and control lever assembly.



TWO-SPEED LINKAGE INSPECTION

- (1) Remove forward floor plate (par 4-132).
- (2) Raise aft floor deck (pare 2-15).
- (3) Remove dash panel (para 4-128).
- (4) Inspect linkage for damage or misadjustment.
 - (a) If linkage is damaged or mis-adjusted, replace/adjust as necessary (para 4-95 and 4-96).
 - (b) If linkage is OK, notify supervisor.



29. STEERING IS DIFFICULT.

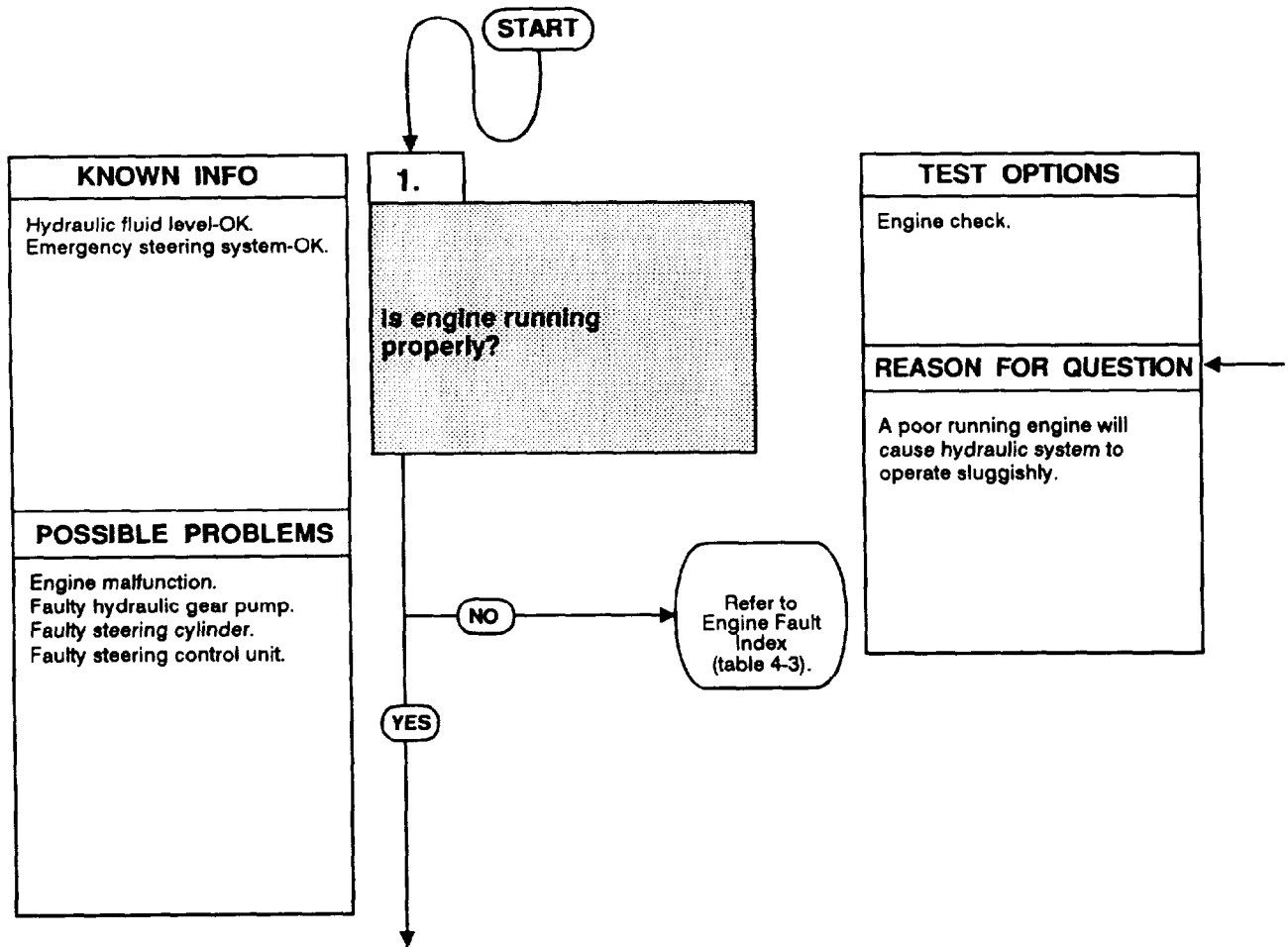
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

Tool kit, general mechanic's: automotive



ENGINE CHECK

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
 - (a) Listen for unusual engine noise that might cause a malfunction with hydraulic system.
 - (b) If engine operates properly, indicates faulty gate cylinder.

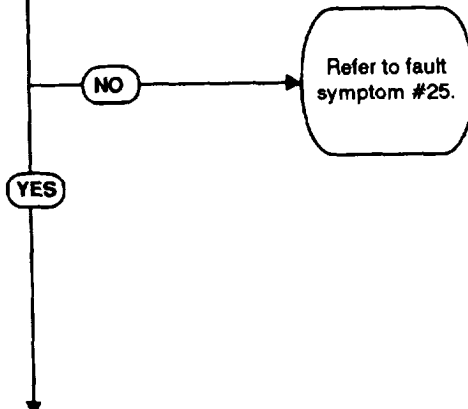
STEERING IS DIFFICULT (CONT).

KNOWN INFO
Hydraulic fluid level-OK. Emergency steering system-OK. Engine-OK.
POSSIBLE PROBLEMS
Faulty hydraulic gear pump. Faulty steering cylinder. Faulty steering control unit.

2.

Does rotor assembly raise and lower without stuttering from boom cylinder?

TEST OPTIONS
Hydraulic gear pump inspection.
REASON FOR QUESTION
If rotor assembly will not raise or lower properly, or if boom cylinder stutters, indicates faulty hydraulic gear pump.

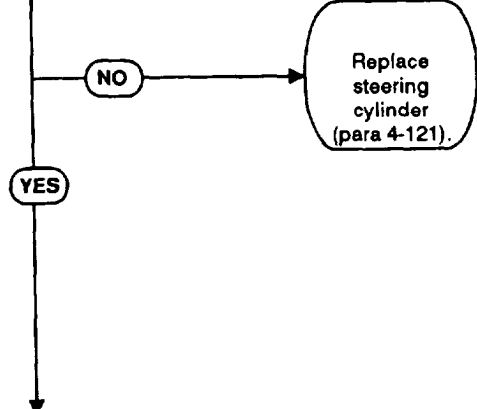


KNOWN INFO
Hydraulic fluid level-OK. Emergency steering system-OK. Engine-OK. Hydraulic gear pump-OK.
POSSIBLE PROBLEMS
Faulty steering cylinder. Faulty steering control unit.

3.

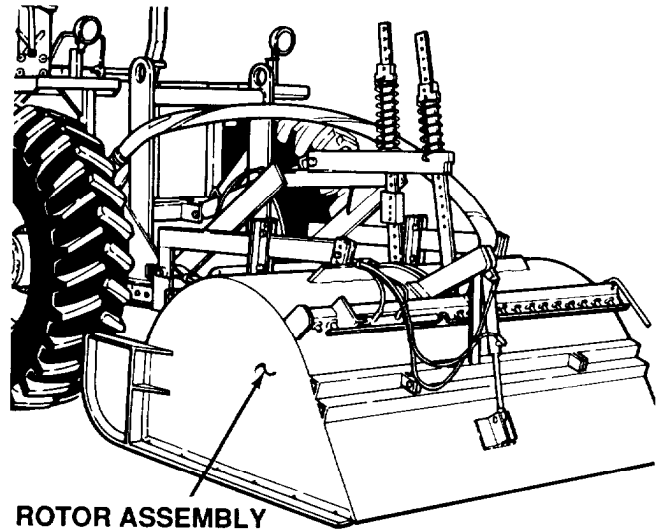
Is steering cylinder free of obvious damage that would restrict steering?

TEST OPTIONS
Steering cylinder inspection.
REASON FOR QUESTION
If steering cylinder is damaged or leaking, steering may be difficult.



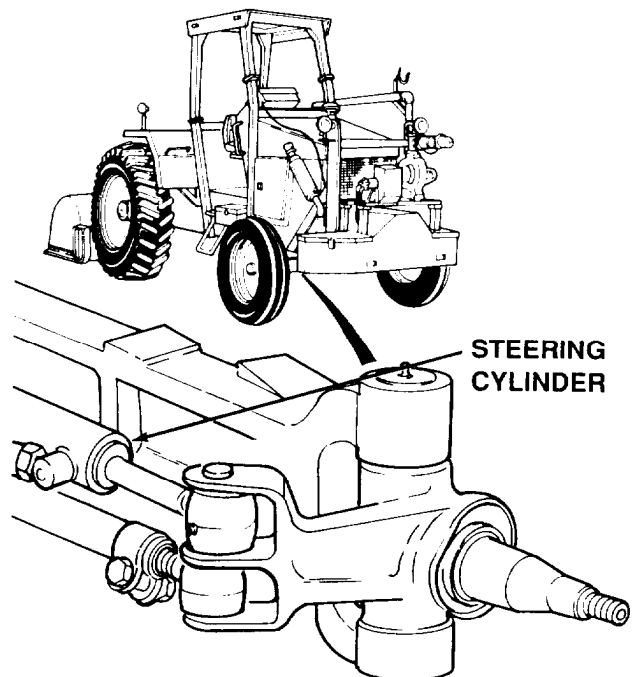
**HYDRAULIC GEAR PUMP
INSPECTION**

- (1) Set parking brake (para 2-13).
- (2) Start engine (para 2-9).
- (3) Raise and lower rotor assembly (para 2-11),
 - (a) If rotor assembly will not raise and lower smoothly, or if boom cylinder stutters, refer to fault symptom #25.
 - (b) If rotor assembly raises and lowers smoothly, indicates faulty steering cylinder.

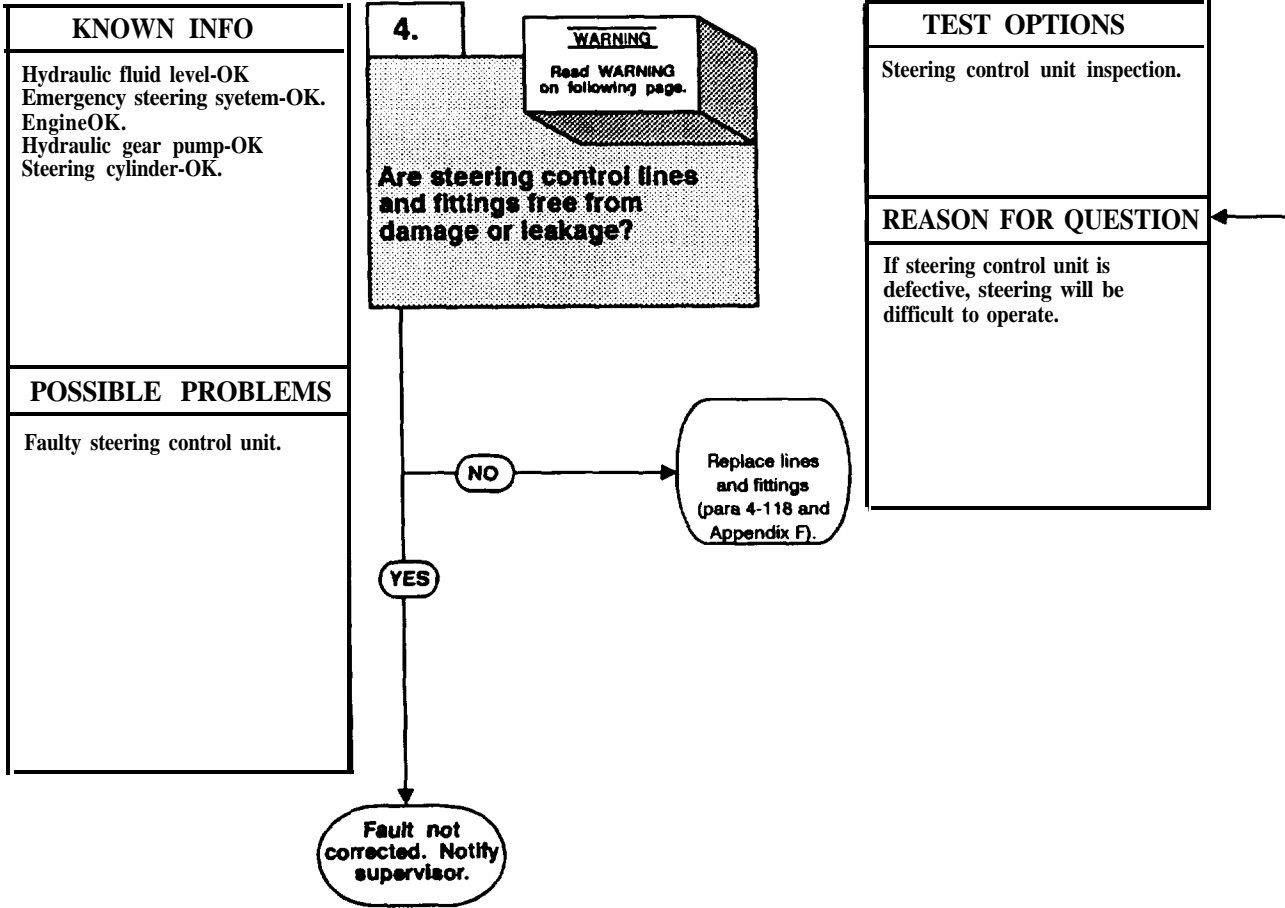


**STEERING CYLINDER
INSPECTION**

- (1) Set parking brake (para 2-13).
- (2) Check steering cylinder for obvious damage or leaks that would cause difficult steering,
 - (a) If steering cylinder is defective, replace steering cylinder (para 4-121).
 - (b) If steering cylinder is OK, indicates faulty steering control unit.

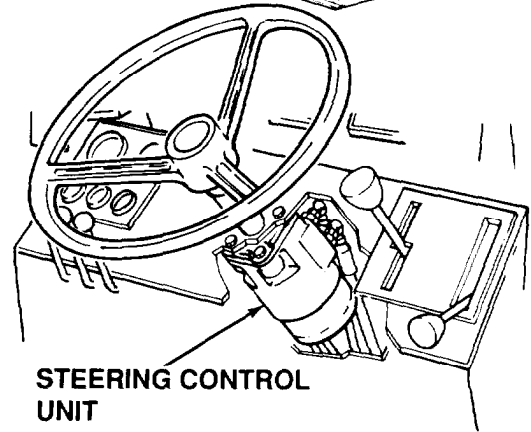
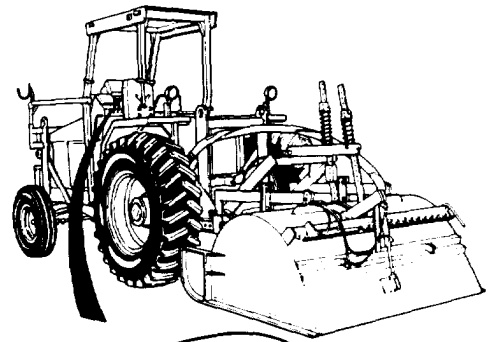


STEERING IS DIFFICULT (CONT).



**STEERING CONTROL UNIT
INSPECTION**

- (1) Set parking brake (para 2-13).
- (2) Remove dash panel (para 4-128).
- (3) Start engine (para 2-9)
- (4) Check steering control unit for obvious damage or leaks that would cause difficult steering.
 - (a) If steering control unit is defective, replace steering control unit (para 4-118).
 - (b) If steering control unit is OK, notify supervisor.



**STEERING CONTROL
UNIT**

Section V. MAINTENANCE PROCEDURES

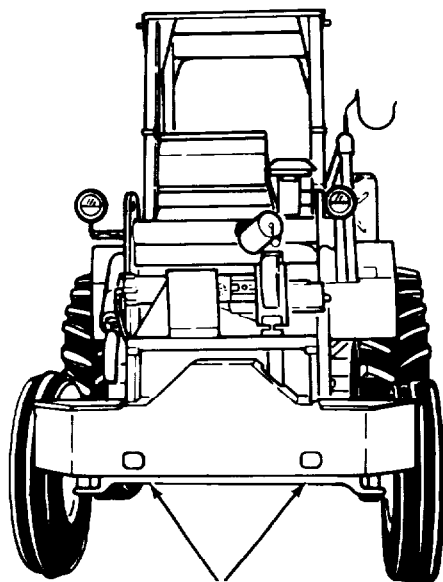
4-15. UNIT MAINTENANCE INTRODUCTION.

Instructions in this section provide general procedures to be followed for inspection, removal, cleaning, repair, replacement, or installation of components and testing authorized at the unit level as specified by the MAC.

4-16. SERVICING EQUIPMENT.

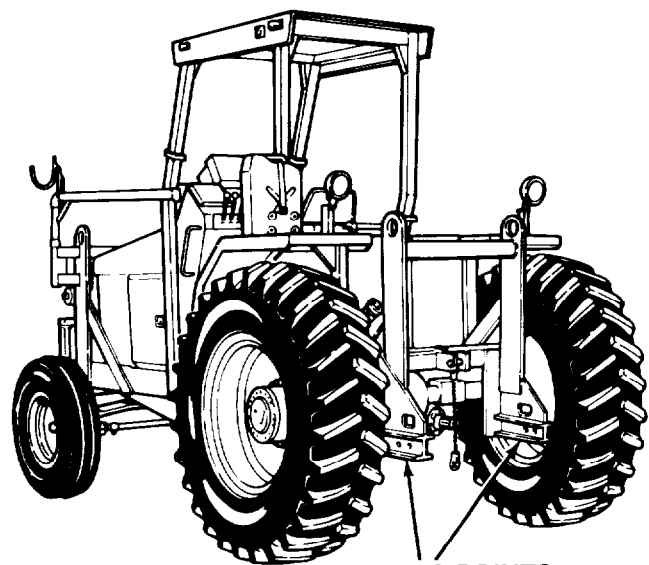
- a. Perform the PMCS contained in Tables 2-2 and 4-2.
- b. Lubricate all points as shown in the Lubrication Chart, Figure 3-1.
- c. Schedule the next preventive maintenance checks and services on DD Form 314, Preventive Maintenance Schedule and Record.

4-17. JACKING LIFT POINTS.



JACKING POINTS

FRONT



JACKING POINTS

REAR

WARNING

Gross vehicle weight is 14,980 lbs (6801 kg). To support vehicle, jackstands must have a 10,000 lb (4537 kg) capacity.

Jacking of vehicle must be done with wheels blocked, hand brakes set, and rotor assembly fully raised. Select jack points only on front axle and rear hitching frame. Jacks shall not be used to support vehicle during maintenance procedures. Personnel must be careful to keep body parts out from under vehicle while it is in raised position. Jacks and jack stands must be able to support 10,000 lb (4537 kg).

4-18. OPERATIONAL CHECKS.

All operational checks included in the maintenance procedures shall include the techniques and methods required to assure the satisfactory performance of the vehicle. Reference the operator's instructions for starting, run-up, and shutdown procedures (para 2-9).

4-19. INSPECTION OF COMPONENTS.

a. Clean all parts before inspection. Examine bearings for rusted or pitted rollers, balls, races, or separator. Examine balls and races for abrasion and/or serious discoloration. The following are conditions for bearing rejection:

- (1) Cuts or grooves parallel to ball or roller rotation.

NOTE

Nicks and gouges outside race load areas are not cause for rejection unless deep enough to cause bearing binding or misalignment.

- (2) Fatigue pits (as opposed to minor machine marks or scratches).
- (3) Cracks or serious discoloration.

b. Check all hose surfaces for broken or frayed fabric and breaks caused by sharp kinks or chafing against other parts of the unit. Inspect metal tubing lines for kinks. Inspect fitting threads for damage. Replace any defective part. Check for leaks after assembly and during initial operation period.

c. Visually inspect all castings and weldments for cracks.

d. Inspect all wiring for chafed or burned insulation. Inspect all connectors for loose connections and broken parts.

e. Inspect gears and splines for cracks, pitting, and discoloration.

4-20. UNIT CLEANING PROCEDURES.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

a When cleaning ball or roller bearings, place in a basket and suspend in a container of drycleaning solvent, (item 54, appendix E). If necessary, use a brush (item 6, appendix E) to remove caked grease or chips. Avoid rotating bearings before solid particles are removed to prevent damaging races and balls.

4-20. UNIT CLEANING PROCEDURES (CONT).

- b.* Do not clean preformed packings or other rubber parts in drycleaning solvent. Wipe with a clean, dry, lint-free cloth (item 12, appendix E).
- c.* Electrical parts such as coils, connectors, switches, and insulated wiring should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean, dry cloth moistened with drycleaning solvent (item 54, appendix E).
- d.* For exterior cleaning of frame and structural components, use detergent (item 19, appendix E) in a solution as recommended on the container. Leave application on items surface for approximately 10 minutes before rinsing. Rinse with hot or cold water under pressure. If available, use hot water under 80 to 120 psi (36 - 54 kPa) pressure. An ordinary garden hose may be used if no other equipment is available. If pressurized water supply is not available, wash painted surfaces with a solution of 1/4 cup soap chips (item 10, appendix E) to one gallon of water.

CAUTION

Do not use gasoline, diesel fuel, or other petroleum base products to clean or preserve hydraulic components. Use of petroleum based products can change the lubricating quality of hydraulic fluid and cause failure or damage to equipment.

- e.* When cleaning hydraulic system components, use petroleum-free solvents. Clean and dry parts thoroughly to make sure no residue remains. If preservative is required before reassembly, apply a light film of hydraulic fluid (item 23, appendix E).

4-21. REMOVAL AND DISASSEMBLY OF COMPONENTS.

- a.* Before removal of any electrical component, disconnect battery ground cables.
- b.* Ensure that adequate clearance is available for removal of the component. Disassemble the vehicle to the extent necessary to provide adequate working clearance.

WARNING

All personnel must stand clear during lifting operations. A swinging or shifting load may cause injury or death to personnel.

- c.* Use a chain hoist, jack or other aid when lifting heavier components. Lifting device should be positioned and attached to components to remove all strain from mounting hardware, before last supporting piece of hardware is removed.
- d.* Discard preformed packings, gaskets, seals and similar material when removed. Be sure that all traces of oil, gaskets, and sealants are removed. When possible, use wood or plastic probes and scrapers to prevent damage to machined surfaces.
- e.* Cotter pins, lockwashers, lockwire, self-locking nuts and similar devices should be discarded when removed. Self-locking fasteners that loosen up must be replaced, not tightened.

f. To prevent moisture and foreign matter from entering open housings, lines, and other openings, use protective coverings as soon as possible after disassembly. Wrap all parts in clean paper or dip parts in the fluid in which they normally operate.

g. Remove parts only if repair or replacement is required. Do not disassemble a component any further than necessary to accomplish needed repairs.

4-22. PAINTING.

Instructions for preparation of material to paint, how to paint, and material to be used are in TM 43-0139. Instructions for camouflage painting are contained in FM 5-20. Stenciling and marking military vehicles are listed in TB 43-0209. Data plate location and description is listed in Chapter 2.

4-23. LUBRICATION INSTRUCTIONS.

Refer to Lubrication Chart (Figure 3-1) for unit maintenance lubrications.

4-24. ENGINE OIL CHANGE/SERVICE.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic’s: automotive

Suitable container (capacity 15 qt.s. [14.2 liters])

Wrench, Torque

Materials/Parts

Packing, preformed

Oil, engine lubricating,(item 35,appendix E)

Equipment Condition

TM or Para

Para 2-14

Para 2-13

Condition Description

Right engine door opened.

Parking brake lever set.

General Safety Instructions

Avoid prolonged skin contact with oil.

Work in a well ventilated area.

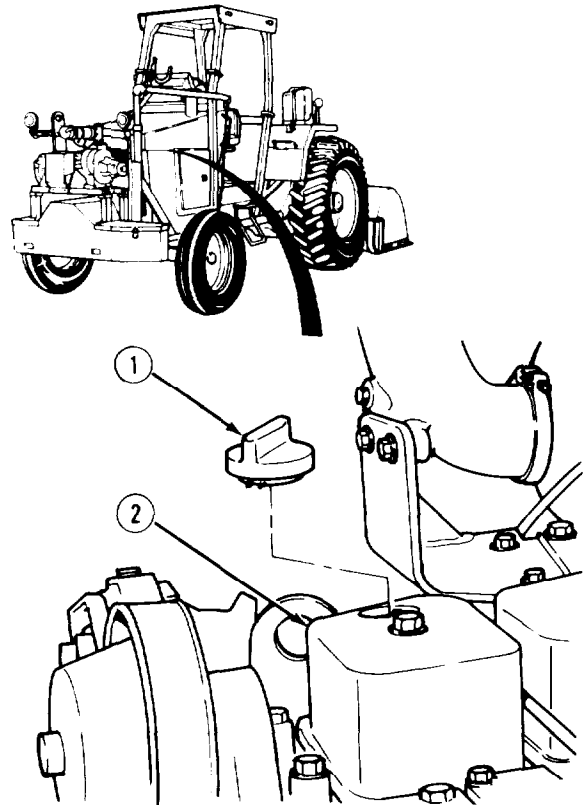
a. Removal.

WARNING

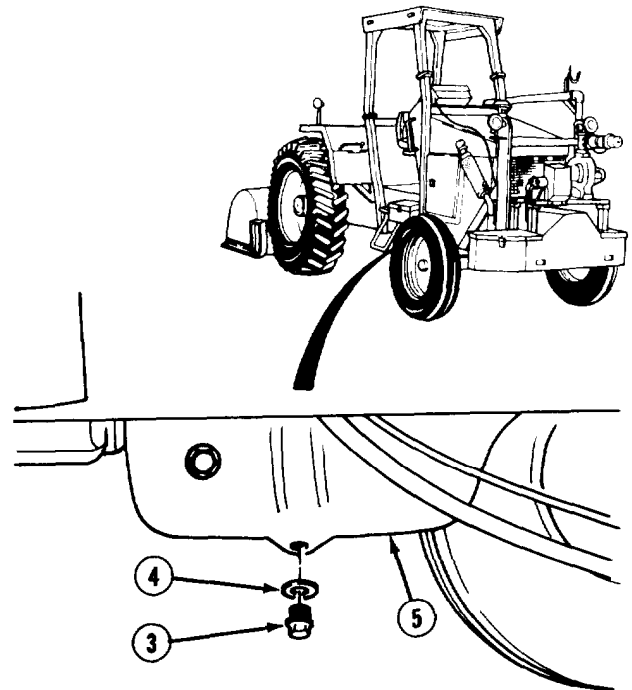
Prolonged contact with lubricating oil, MIL-L-2105, may cause a skin rash. Skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Saturated clothing should be removed immediately. Areas in which lubricating oil is used should be well ventilated to keep fumes to a minimum.

NOTE

- Place suitable container with a 15 qt. (14.2 liters) capacity under drain plug prior to start of procedure.
 - Engine oil filter should be changed with engine oil. This will reduce engine wear and tear and service time.
 - Warm oil before starting procedure. Let engine idle for 5 minutes;
- (1) Remove fill cap (1) from valve cover (2).



- (2) Remove engine oil drain plug (3) and washer (4) from oil pan (5). Discard preformed packing.
- (3) Drain engine oil into suitable container.

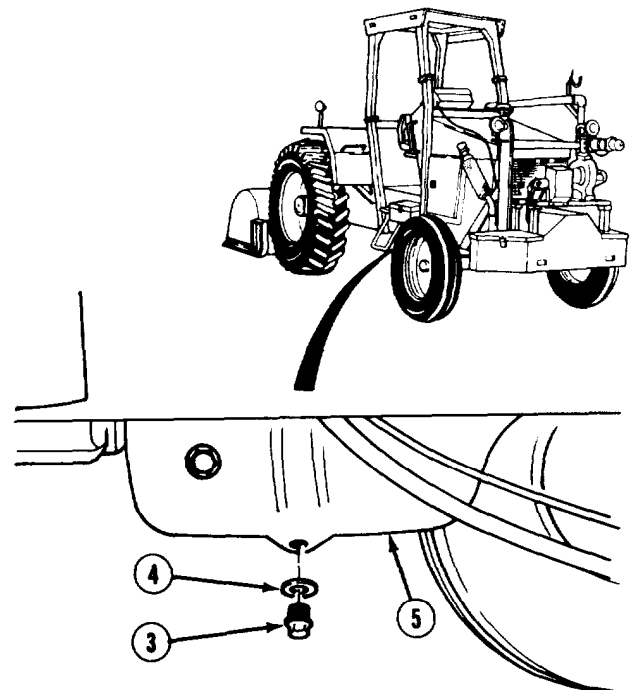


b. Cleaning/Inspection.

CAUTION

Dirt, grit, and metallic particles can cause damage to engine. Drain plug and hole should be clean before plug is installed.

- (1) Clean threads of magnetic oil drain plug and inspect for damage.
- (2) Clean oil pan drain hole and inspect for damaged threads.

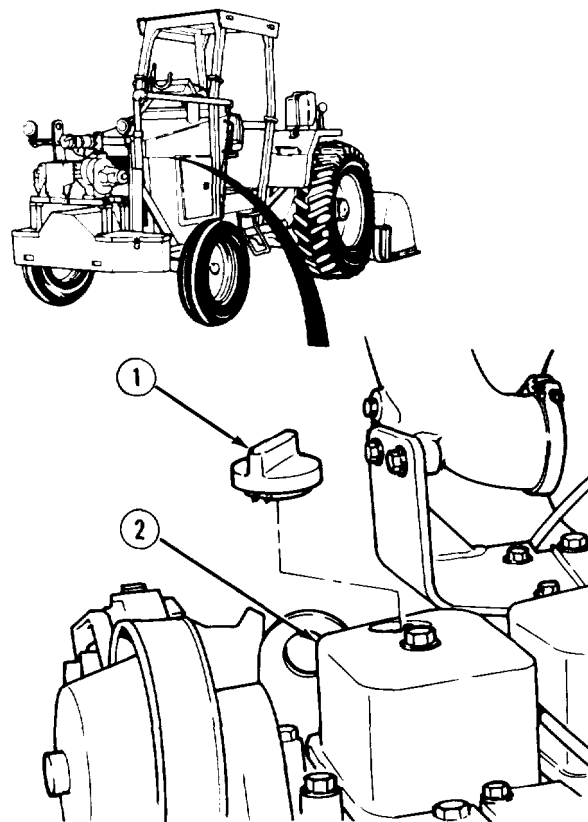


c. Installation.

- (1) Install washer (4) and drain plug (3) in oil pan (5). Tighten drain plug 30 lb-ft (41 N•m).
- (2) Fill engine with 15 qt.s. (14.2 liters) of engine oil.

4-24. ENGINE OIL CHANGE/SERVICE (CONT).

- (3) Install fill cap (1) on valve cover (2).



NOTE

Follow-on Maintenance:

- Inspect for leakage after filling.
- Close right engine door (para 2-14).

END OF TASK

4-25. TWO-SPEED RANGE BOX SERVICE

a. Draining

b. Cleaning/Inspection

c. Filling

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Suitable container (capacity 2 gal. [7.6 liters])

Materials/Parts

Oil, lubricating, gear (item 32, appendix E)

Equipment Condition

TM or Para

Para 2-13

Condition Description

Parking brake set.

General Safety Instructions

Gear oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

a. Draining.

WARNING

Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

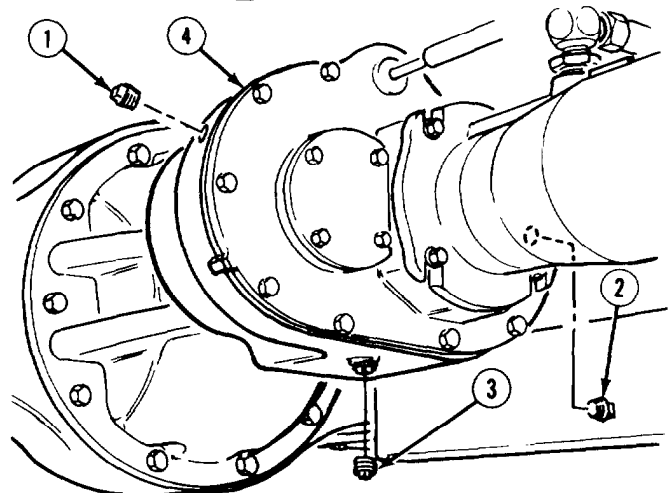
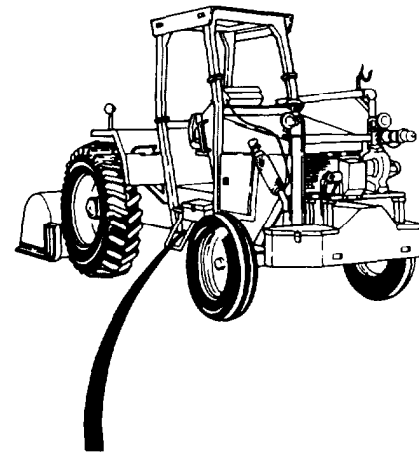
NOTE

Place suitable container with a 2 gallon (7.6 liters) capacity under range box to catch spilling oil.

- (1) Remove fill plug (1), level check plug (2), and drain plug (3) from 2-speed range box (4).
- (2) Allow oil to drain completely from range box (4).

b. Cleaning/Inspection.

- (1) Clean plugs and around drain holes.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plugs.
- (4) Dispose of drained fluids according to local regulations.

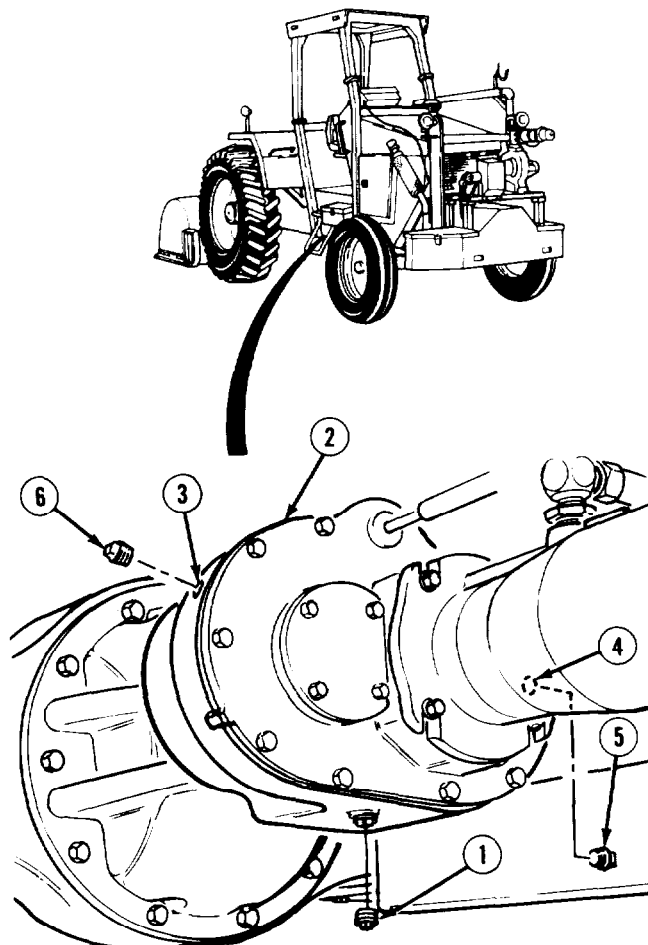


**4-25. TWO-SPEED RANGE BOX SERVICE
(CONT).**

c. Filling.

- (1) Install drain plug (1) in range box (2).
- (2) Fill range box (2) with gear oil, as specified by MIL-L-2105C, through fill hole (3).
- (3) Range box (2) is full when oil level is just below level check hole (4).
- (4) When range box is full, install level check plug (5) and fill plug (6) in range box (2).

END OF TASK



4-26. REAR AXLE SERVICE.

This task covers:

- a. Draining b. Cleaning/Inspection c. Filling

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

Oil, lubricating, gear (item 32, appendix E)

*Equipment Condition**TM or Para*

Para 2-13

Condition Description

Parking brake set.

General Safety Instructions

Gear oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

a. Draining.**WARNING**

Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

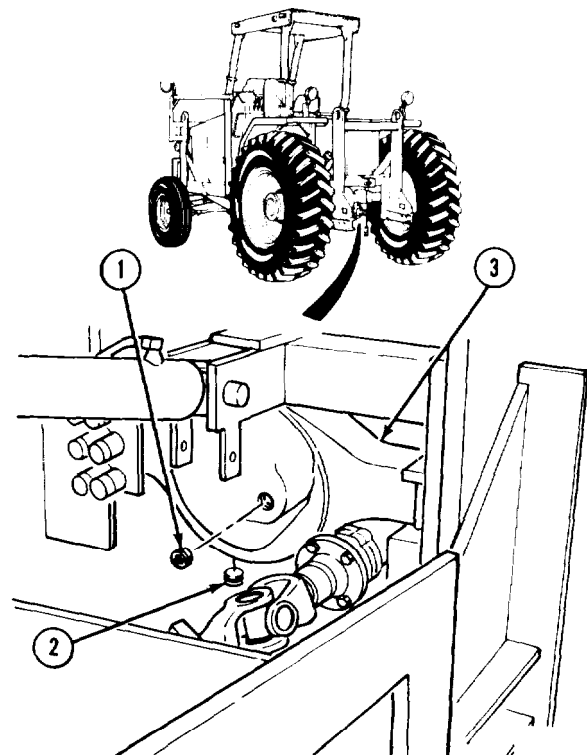
NOTE

Place suitable container with a 5 gallon (19 liters) capacity under rear axle to catch spilling oil.

- (1) Remove till plug (1) and drain plug (2) from rear axle housing (3).
- (2) Allow oil to drain completely from rear axle housing (3).

b. Cleaning/inspection.

- (1) Clean plugs and around drain holes.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plugs.
- (4) Dispose of drained fluids according to local regulations.

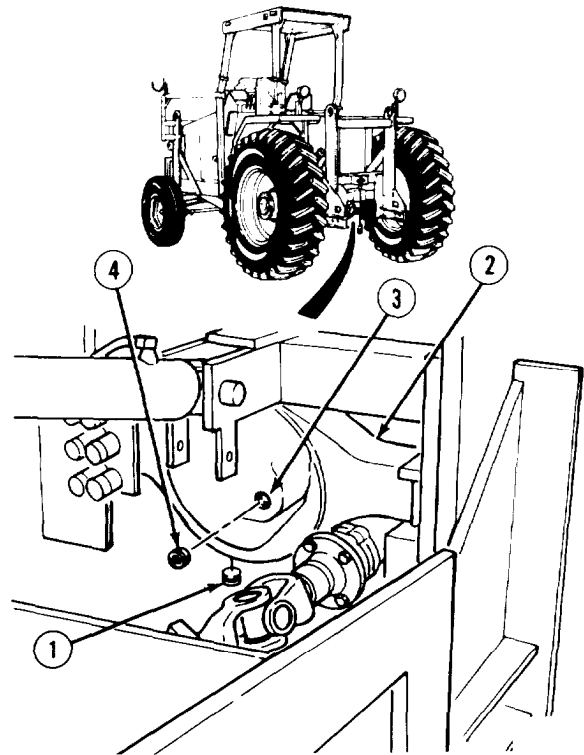


4-26. REAR AXLE SERVICE (CONT).

c. Filling.

- (1) Install drain plug (1) in rear axle housing (2).
- (2) Fill rear axle housing (2) with gear oil, as specified by MIL-L-2105C, through fill hole (3).
- (3) Rear axle housing (2) is full when oil level is just below fill hole (3).
- (4) When rear axle housing is full, install fill plug (4) in rear axle housing (2).

END OF TASK



4-27. ROTOR DRIVE ASSEMBLY SERVICE.

This task covers:

- a. Draining b. Cleaning/Inspection c. Filling

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

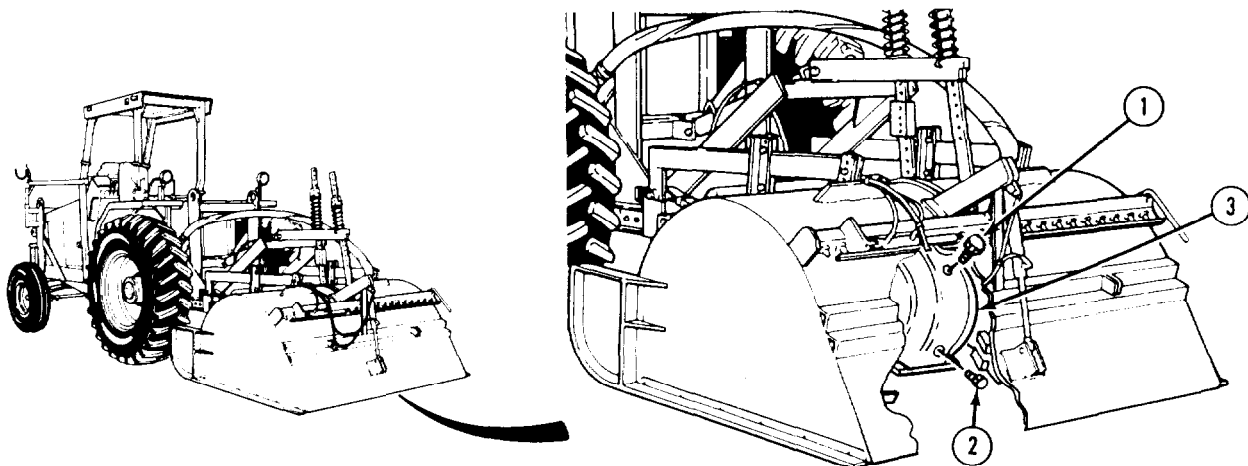
- Oil, lubricating, gear (item 32, appendix E)

Equipment Condition

- TM or Para* *Condition Description*
- Para 2-13 Parking brake set.

General Safety Instructions

- Gear oil is slippery. Clean up spilled oil immediately or injury to personnel may result.



a. Draining.

WARNING

Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

NOTE

Place suitable container with a 5 gallon (19 liters) capacity under rotor drive to catch spilling oil.

- (1) Remove fill plug (1) and drain plug (2) from rotor drive assembly (3).
- (2) Allow oil to drain completely from drive assembly (3).

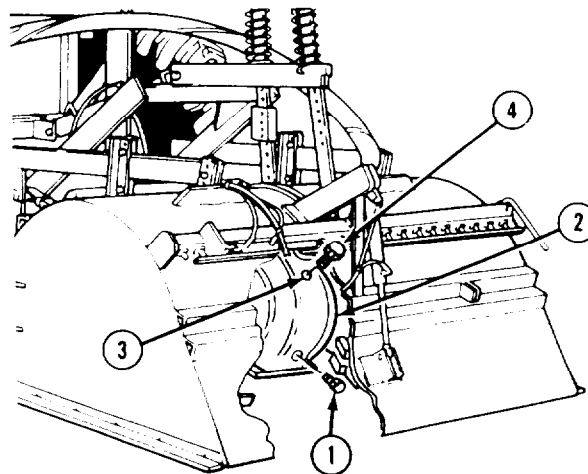
4-27. ROTOR DRIVE ASSEMBLY SERVICE (CONT).

b. Cleaning/Inspection.

- (1) Clean plugs and around drain holes.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plugs.
- (4) Dispose of drained fluids according to local regulations.

c. Filling.

- (1) Install drain plug (1) in drive assembly (2).
- (2) Fill drive assembly (2) with gear oil, as specified by MIL-L-2105C, through fill hole (3).
- (3) Drive assembly (2) is full when oil level is just below fill hole (3).
- (4) When drive assembly is full, install fill plug (4) in drive assembly (2).



END OF TASK

4-28. MASTER CYLINDER SERVICE.

This task covers:

- a. Level Check
- b. Filling

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

BFS, brake fluid, silicone (item 21, appendix E)

Equipment Condition

TM or Para

Para 2-13

Para

Condition Description

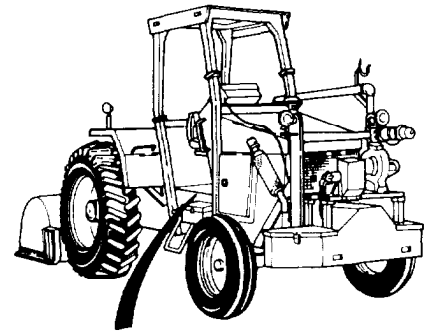
Parking brake set.

Aft floor deck raised.

Wheels chocked.

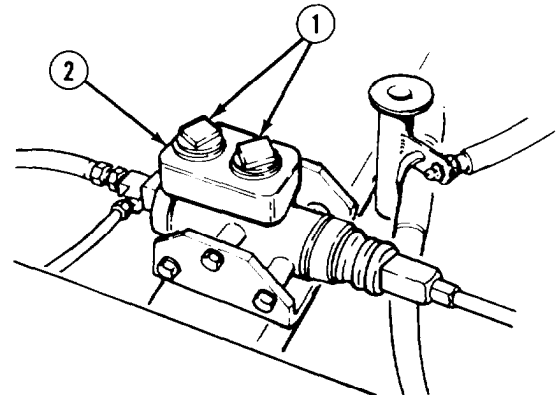
a. Level Check

- (1) Remove two fill caps (1) from master cylinder (2).
- (2) Check brake fluid level. Brake fluid level should be to the bottom threads of fill holes.



b. Filling.

- (1) Fill master cylinder (2) with silicone brake fluid (item 21 , apendix E) to the bottom threads of fill holes.
- (2) Install two fill caps (1) on master cylinder (2). Tighten caps securely.



NOTE

Follow-on Maintenance:

- Lower aft floor deck (para 2-64).
- Remove wheel chocks.

END OF TASK

4-29. FUEL/HYDRAULIC TANK DRAINING.

This task covers:

- a. Draining b. Cleaning/Inspection c. Filling

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Suitable container (capacity 55 gal. [208 liters])

Materials/Parts

Compound, sealing, pipe thread (item 17, appendix E)

Equipment Condition

TM or Para *Condition Description*
Para 2-13 Parking brake set.

General Safety Instructions

Fuel is very flammable and can explode easily.

a. *Draining.*



Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark.
- Post signs that read "NO SMOKING WITHIN 50 FEET" when working with open fuel, fuel lines, or fuel tanks.

NOTE

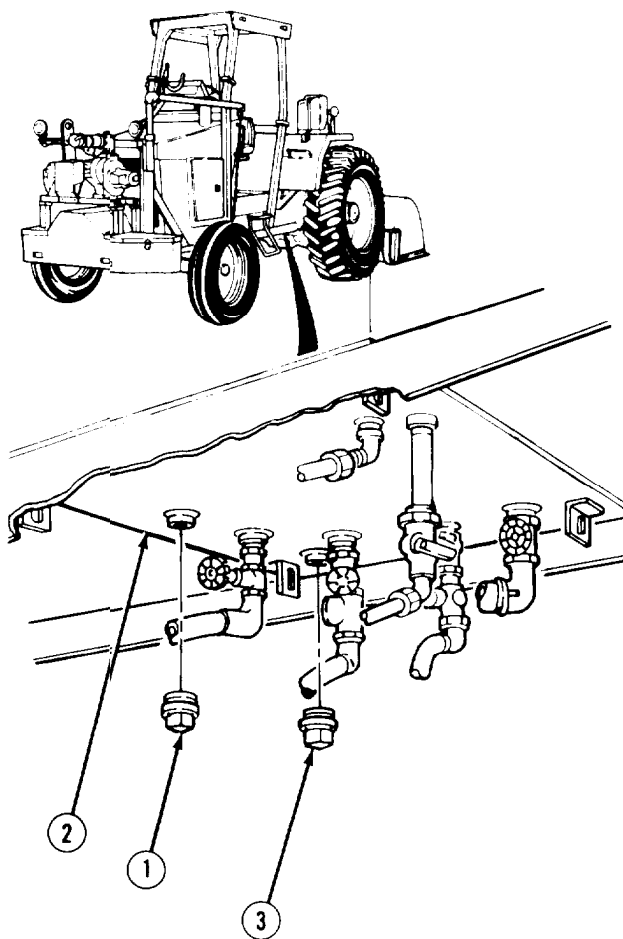
Use suitable container with a 55 gallon (208 liters) capacity.

- (1) To drain fuel tank:
 - (a) Remove drain plug (1) from fuel/hydraulic tank (2).
 - (b) Allow fuel to drain completely from tank (2).

NOTE

Use suitable container with a 42 gallon (159 liters) capacity.

- (2) To drain hydraulic tank:
 - (a) Remove drain plug (3) from fuel/hydraulic tank (2).
 - (b) Allow hydraulic oil to drain completely from tank (2).



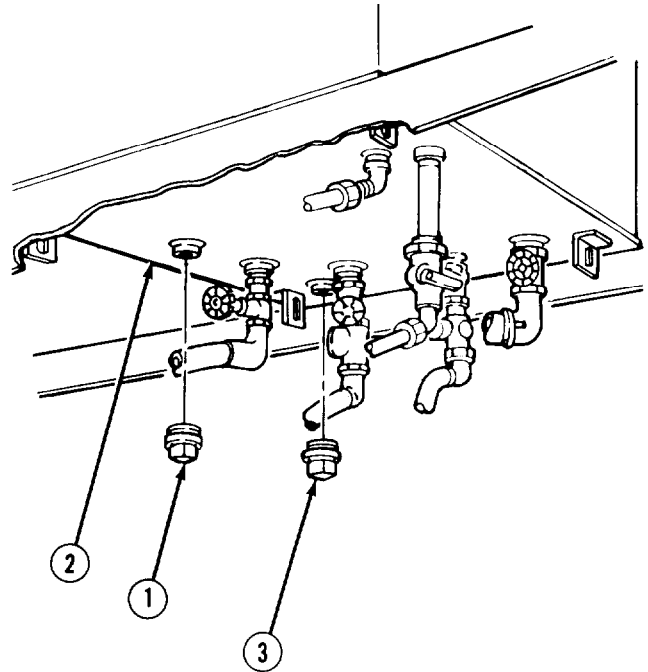
b. Cleaning/Inspection.

- (1) Clean plugs and around drain holes on tank.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plugs.
- (4) Dispose of drained fluids according to local regulations.

c. Filling.**WARNING**

Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) After draining fuel tank:
 - (a) Apply pipe thread sealing compound to plug (1) and install in fuel/hydraulic tank (2).
 - (b) Fill fuel tank (2) according to paragraph 3-10.
- (2) After draining hydraulic tank:
 - (a) Apply pipe thread sealing compound to plug (3), and install in fuel/hydraulic tank (2).
 - (b) Fill hydraulic tank (2) according to paragraph 3-11.



END OF TASK

4-30. VALVE AND ROCKER ARM ADJUSTMENTS.

This task covers:

Adjustments

INITIAL SETUP

Tools

Tool kit, general mechanics: Automotive

Shop equipment, automotive maintenance and repair: organizational maintenance, common no. 1, less power

Holder, vibration damper (para F-7, appendix F)

Equipment Condition

TM or Para

Para 4-31

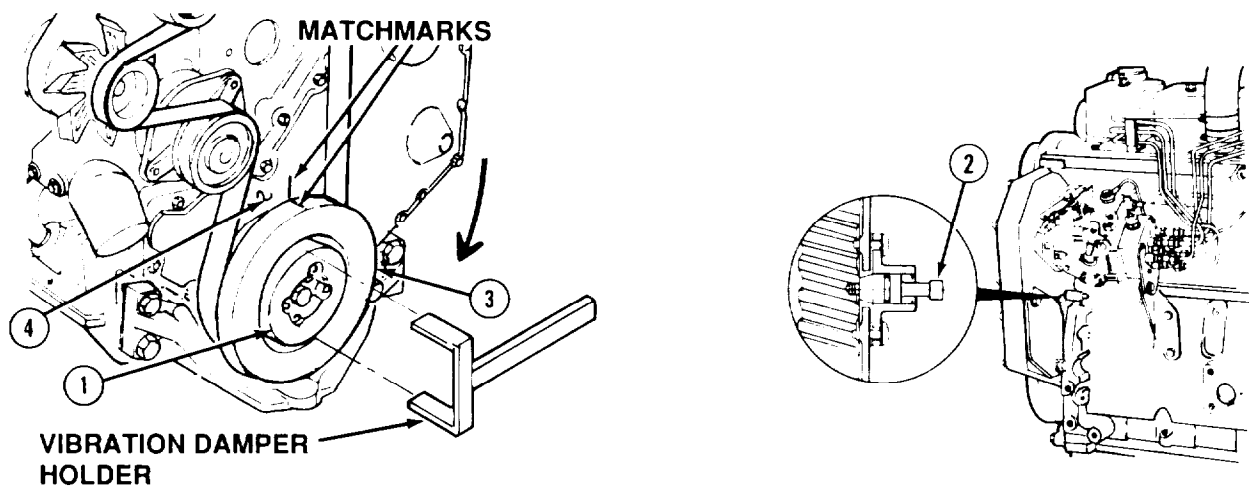
Condition Description

Valve covers removed.

General Safety Instructions

Engine block retains extreme heat during operation. Allow time for cooling before performing procedure.

Adjustments.

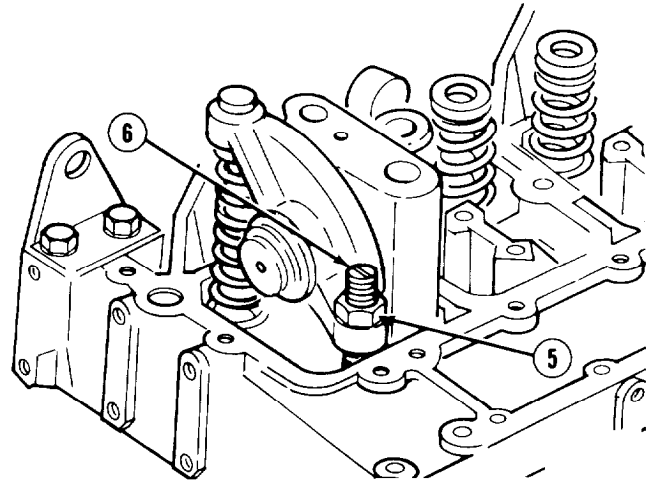


- (1) Locate top dead center (TDC) as follows:

NOTE

- A vibration damper holder is required for this task and must be fabricated (para F-7, appendix F).
- Timing pin will lock when TDC is located.
 - (a) Place vibration damper holder in crankshaft adapter (1). Turn vibration damper holder clockwise while pushing in timing pin (2).
 - (b) Disengage timing pin (2).
 - (d) Matchmark vibration damper (3) and timing cover (4).

- (2) Set valves by holding nut (5) and turning setscrew (6). Adjustment clearance for intake rocker lever must be 0.010 in. (0.25 mm). Adjustment clearance for exhaust rocker lever must be 0.020 in. (0.51 mm).

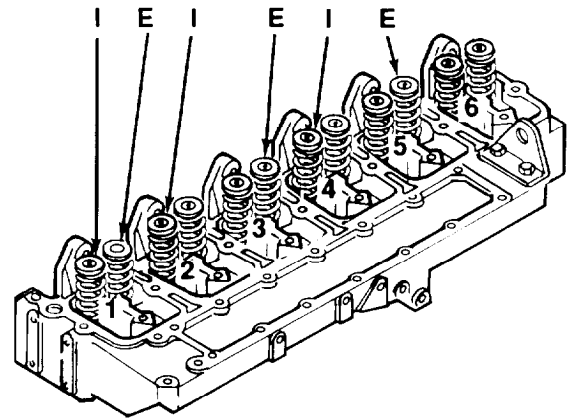


NOTE

- Cylinder 1 is nearest to front of engine.
- Illustrations shown with rocker arms removed for clarity.

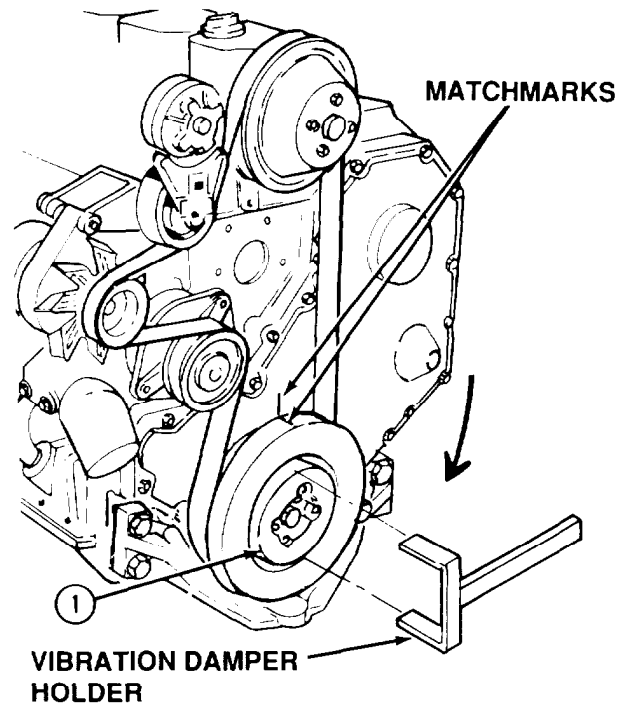
- (3) Set valves on following cylinders:

1. Set intake and exhaust valve.
2. Set intake valve.
3. Set exhaust valve.
4. Set intake valve.
5. Set exhaust valve.
6. Do not set valves.



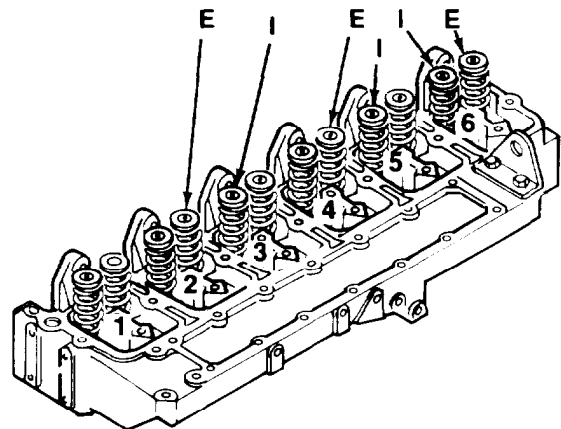
4-30. VALVE AND ROCKER ARM ADJUSTMENTS (CONT.)

- (4) Turn crankshaft adapter (1) with vibration damper holder an additional 360° (full turn) until matchmarks realign.



- (5) Set valves on following cylinders:

1. Do not set valves.
2. Set exhaust valve.
3. Set intake valve.
4. Set exhaust valve.
5. Set intake valve.
6. Set intake and exhaust valve.



NOTE

Follow-on maintenance: Install valve covers (para 4-31).

END OF TASK

4-31. VALVE COVER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Materials/Parts

Packings, preformed (6)

Gaskets, valve cover (6)

Equipment Condition

TM or Para

Para 4-125

Para 4-45

Para 4-43

Condition Description

Hood removed.

Air inlet pipe removed.

Turbocharger air inlet hose removed.

General Safety Instructions

If engine has recently been in operation, allow time to cool before performing procedure.

a. Removal.

- (1) Remove filler cap (1) and six screws (2).
- (2) Remove six preformed packings (3) from screws (2). Discard packings.

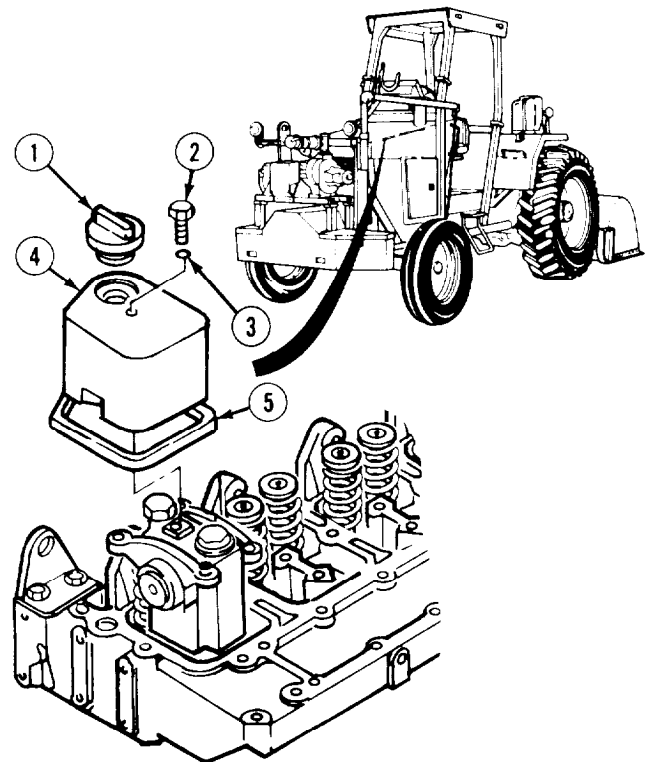


Make sure no contaminants fall into valves when removing covers or damage to equipment may result.

- (3) Remove six valve covers (4) and valve cover gaskets (5). Discard gaskets.

b. Installation.

- (1) Install six valve cover gaskets (5) and valve covers (4).
- (2) Install six preformed packings (3) on screws (2).
- (3) Install six valve covers (4) with screws (2). Tighten screws 216 lb-in (24 N •m).
- (4) Install filler cap (1).



4-31. VALVE COVER REPLACEMENT (CONT).

NOTE

Follow-on Maintenance:

- Install turbocharger air inlet hose (para 4-43).
- Install air inlet pipe (para 4-45).
- Install hood (para 4-125).

END OF TASK

4-32. ENGINE BREATHER TUBE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Equipment Condition

TM or Para
Para 2-14

Condition Description

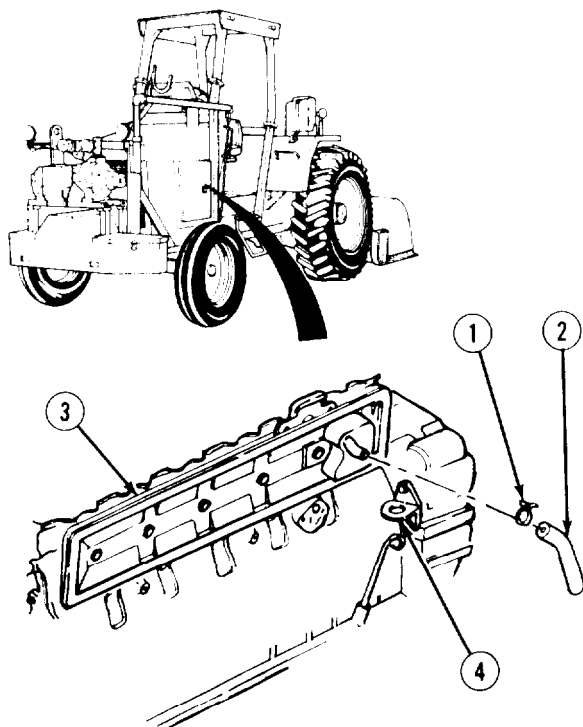
Left engine door opened.

a. Removal.

- (1) Remove clamp (1) from tube (2).
- (2) Remove tube (2) from tappet cover (3) and loop clamp (4).

b. Installation.

- (1) Install tube (2) in loop clamp (4).
- (2) Install tube (2) on tappet cover (3) with clamp (1).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

4-33. OIL DIPSTICK REPLACEMENT/REPAIR.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Tools</i> Tool kit, general mechanic's: automotive	<i>Equipment Condition</i> TM or Para Para 2-14	<i>Condition Description</i> Left engine door opened.
<i>Material/Parts</i> Compound, sealing (item 16, appendix E)		

a. Removal.

- (1) Remove dipstick (1) from gauge tube (2).

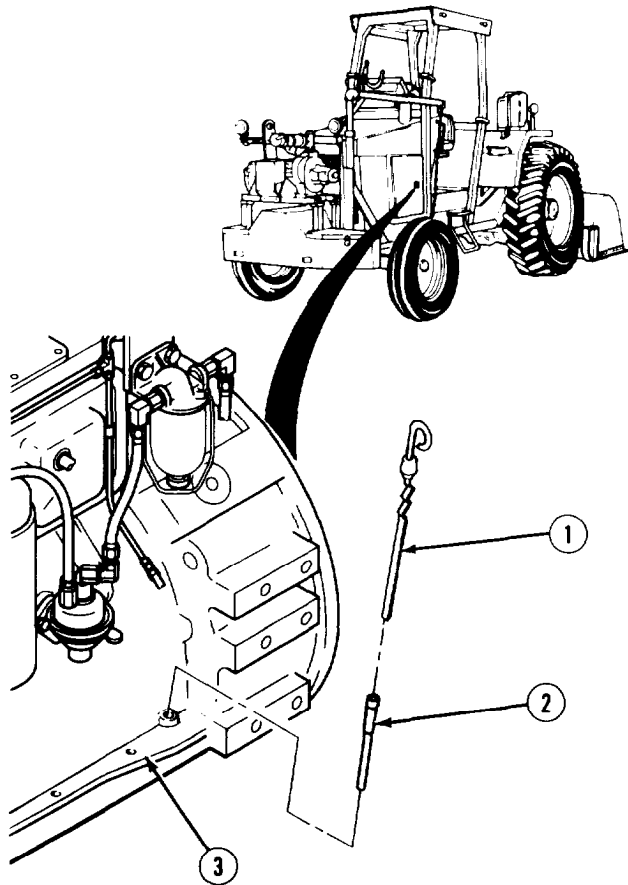


Carefully remove gauge tube or damage to tube may result.

- (2) If damaged, remove gauge tube (2) from engine block (3).

b. Cleaning/Inspection.

- (1) Wipe all parts off with clean cloth and inspect for rust and holes.
- (2) Replace all damaged parts.

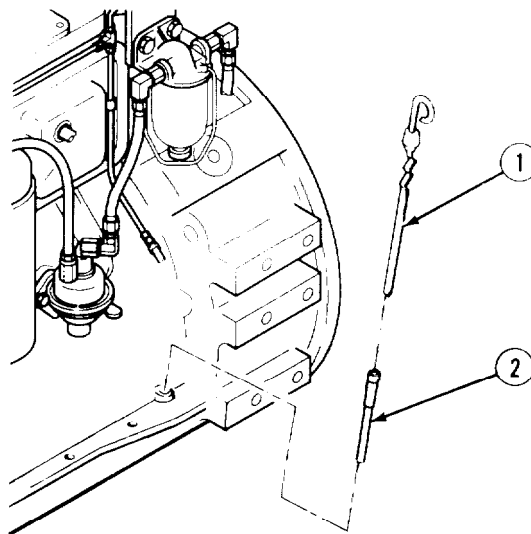


c. *Installation.*

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply sealing compound and install gauge lube (2) in engine block (3).
- (2) Install dipstick (1).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

4-34. ENGINE OIL COOLER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, Torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)
 Gasket, cooler
 Gasket, filter head

Equipment Condition

TM or Para	Condition Description
Para 4-35	Oil filter removed.
Para 4-70	Alternator removed.

General Safety Instructions

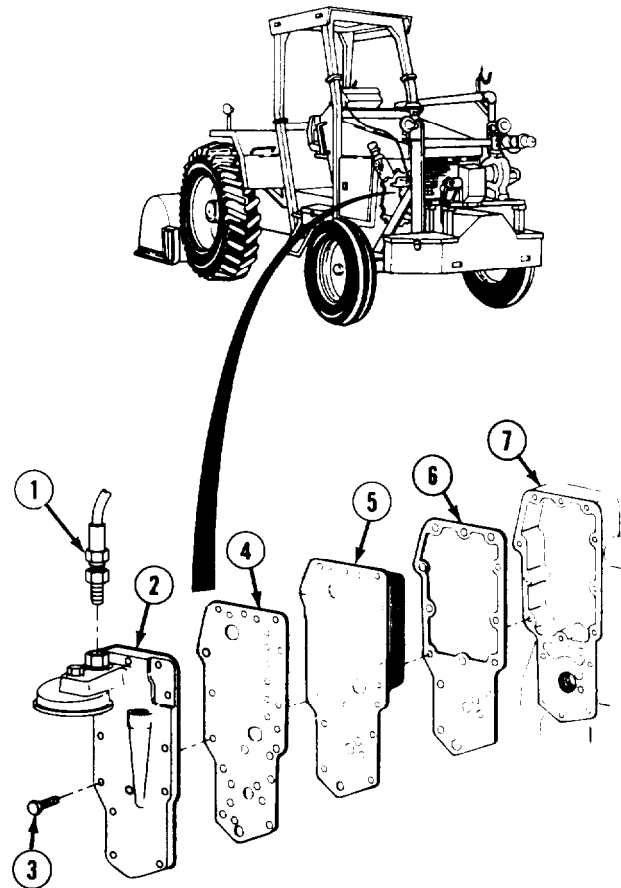
If engine has recently been in operation, allow oil time to cool before performing procedure.

a. Removal.

NOTE

Cap hoses and plug fittings upon removal.

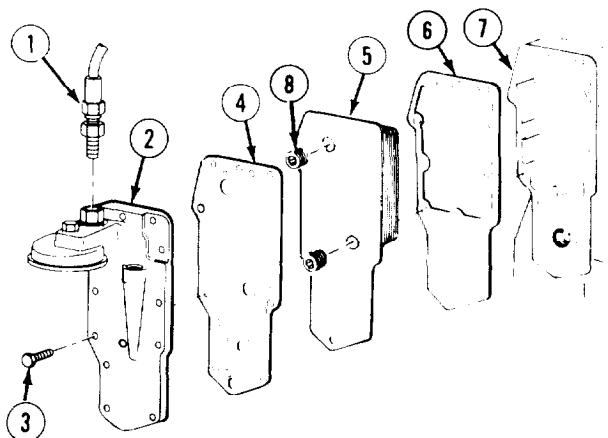
- (1) Remove oil supply tube (1) from filter head (2).
- (2) Remove 14 screws (3) and filter head (2).
- (3) Remove filter head gasket (4), cooler core (5), and cooler core gasket (6) from engine block (7). Discard gaskets.



b. Installation.

Remove protective plugs from new cooler core before installation or damage to engine will result.

- (1) Remove protective plugs (8) from new cooler core (5).
- (2) Install filter head gasket (4), cooler core (5) and cooler core gasket (6) on filter head (2). Align screw holes.
- (3) Install two screws (2), one in center and one at top of filter head.
- (4) Install filter head (2) and assembly on engine block with remaining 12 screws (2). Tighten screws 216 lb-in (24 N •m).
- (5) Install oil tube (1) on filter head (2).

**NOTE**

Follow-on Maintenance:

- Install alternator (para 4-70).
- Install oil filter (para 4-35).

END OF TASK

4-35. ENGINE OIL FILTER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive
 Suitable container (capacity 5 qt.s. [4.7 liters])

Equipment Condition

TM or Para	<i>Condition Description</i>
Para 2-14	Right engine door opened.

Materials/Parts

Oil, engine lubricating, (item 35, appendix E)
 Filter, oil

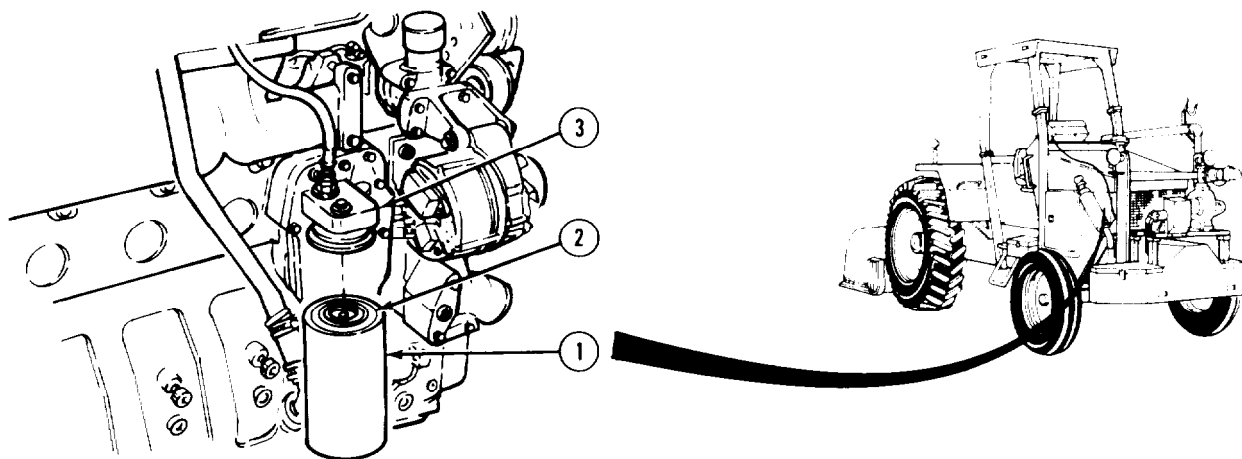
General Safety Instructions

If engine has recently been in operation, allow oil time to cool before performing procedure.

NOTE

Place suitable container with a 5 qt. (4.7 liters) capacity under filter to catch spilling oil.

- a. **Removal.** Remove oil filter (1) and gasket (2) from filter head (3). Discard oil filter.



- b. **Installation.**

- (1) Fill oil filter (1) with engine oil.
- (2) Apply light film of engine oil on gasket (2). Ensure that old gasket is not in filter head (3).
- (3) Install oil filter (1). After oil filter makes contact with filter head (3), turn oil filter 3/4 of full turn more.

NOTE

Follow-on maintenance:

- Check engine oil level and fill if necessary (para 3-6).
- Close right engine door (para 2-14).

END OF TASK

4-36. TURBOCHARGER OIL LINES REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Suitable container (capacity 1 qt.. (.9 liter)

Wrench, torque

Equipment Condition

TM or Para

Para 2-14

Condition Description

Left engine door opened.

Materials/Parts

Cloth, lint-free (item 12, appendix E)

Compound, sealing, pipe thread (item 17, appendix E)

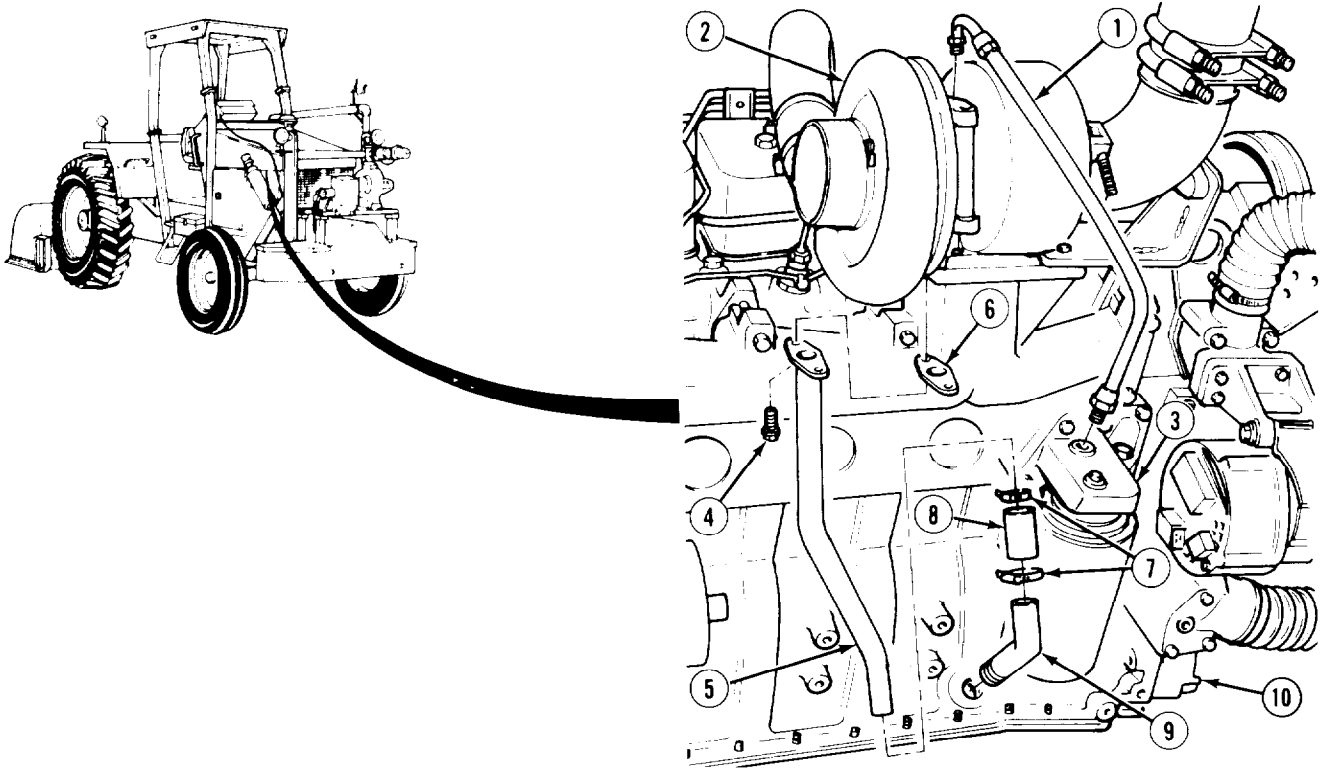
Oil, engine lubricating, (item 35, appendix E)

Solvent, drycleaning (item 54, appendix E)

Gasket, oil drain

4-36. TURBOCHARGER OIL LINES REPLACEMENT (CONT).

a. Removal.



WARNING

Use caution when draining oil. Oil in turbocharger may be hot after operation and could cause serious burns.

NOTE

Place suitable container with a 1 qt. (.9 liter) capacity under supply lines to catch spilling oil.

- (1) Remove supply hose (1) from turbocharger (2) and oil filter head (3).
- (2) Remove two screws (4) and drain tube (5)
- (3) Remove and discard gasket (6).
- (4) Loosen two clamps (7) and remove drain tube (5) from drain tube (8).
- (5) Remove two clamps (7) and hose (8) from drain tube (9).

CAUTION

Removing drain tube may damage tube.

- (6) If damaged, remove drain tube (9) from engine block (10).

b. Cleaning/inspection.

WARNING

Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.

If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

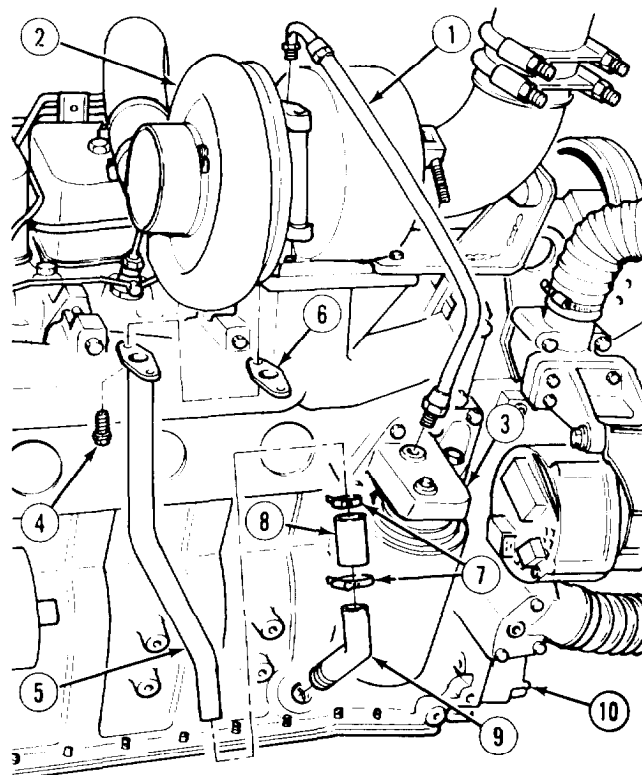
- (1) Flush drain connection and supply line with drycleaning solvent.
- (2) Wipe off oil, debris, and gasket material from drain connection, drain tube, supply line, and turbocharger.
- (3) Inspect oil supply line, oil drain tube and connection, and hose for holes, cracks, and deterioration.
- (4) Replace all damaged parts.

c. Installation.

WARNING

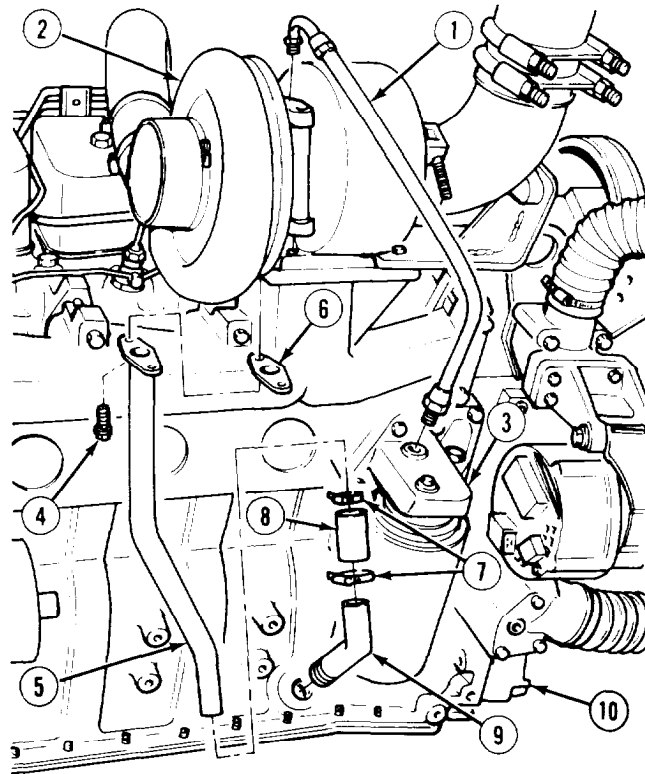
Adhesive sealant MIL-S-46163 can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) If removed, apply sealant and install drain tube (9) in engine block (10). Ensure tube is aligned correctly.
- (2) Install hose (8), two clamps (7), and drain tube (5) on drain tube (9). Do not tighten clamps completely.
- (3) Install gasket (6) and drain tube (5) with two screws (4). Tighten screws 216 lb-in (32 N•m).
- (4) Tighten two clamps (7).



4-36. TURBOCHARGER OIL LINES REPLACEMENT (CONT)

- (5) Fill turbocharger (2) with 2 to 3 ounces (50 to 60 cc) of engine oil in top of oil supply inlet. Turn turbine shaft to coat evenly with oil.
- (6) Install supply hose (1) in oil filter head (3) and turbocharger (2). Tighten supply hose 26 lb-ft (35 N•m).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

4-37. EXHAUST MANIFOLD REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, Torque

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
- Compound, anti-seize (item 13, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Gaskets, manifold (6)

Equipment Condition

TM or Para
Para 4-44

Condition Description
Turbocharger removed.

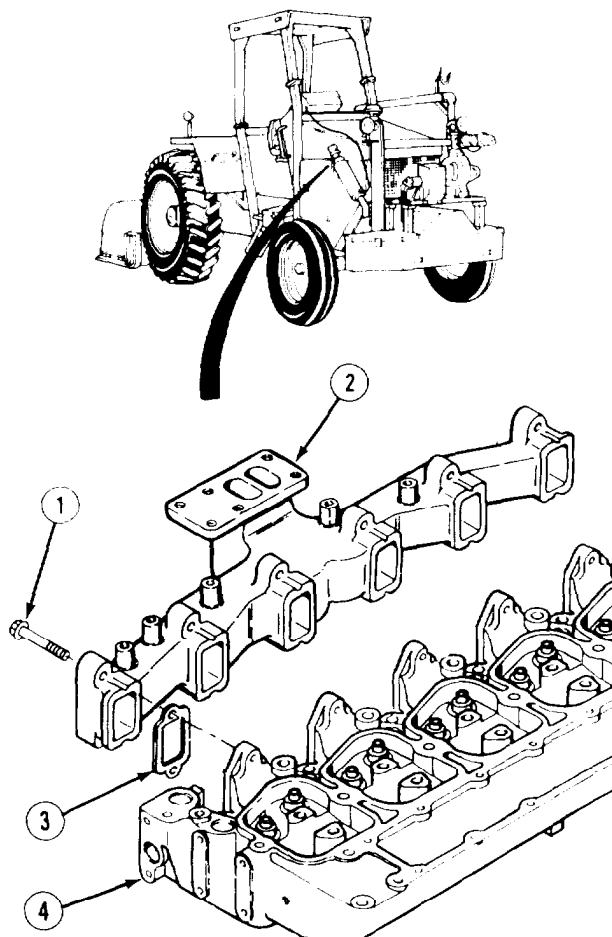
General Safety Instructions

If engine has recently been in operation, allow time for cooling before performing procedure.

NOTE

Valve covers removed for clarity.

- a. **Removal.** Remove 12 screws (1), exhaust manifold (2), and six gaskets (3) from cylinder head (4). Discard gaskets.

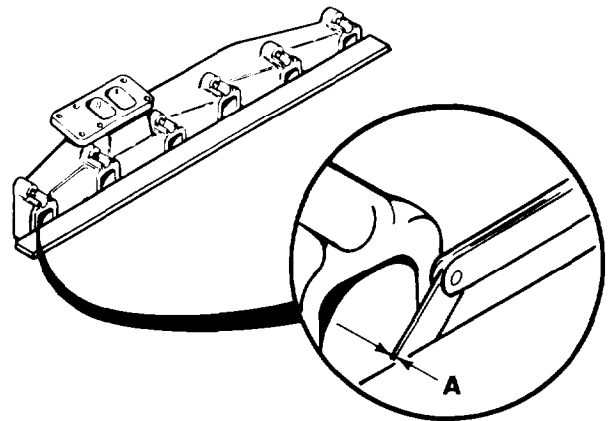


4-37. EXHAUST MANIFOLD REPLACEMENT (CONT).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean exhaust manifold with lint-free cloth and drycleaning solvent.
 - (2) Measure exhaust ports with a straight edge (position A). Clearance must be no greater than 0.004 in. (0.10 mm).
 - (3) Inspect gasket surfaces for scratches, burnout, and other damage.
 - (4) Replace manifold if damaged.

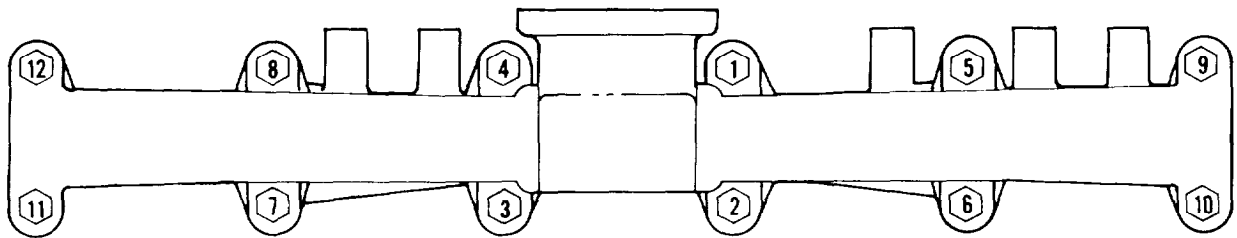
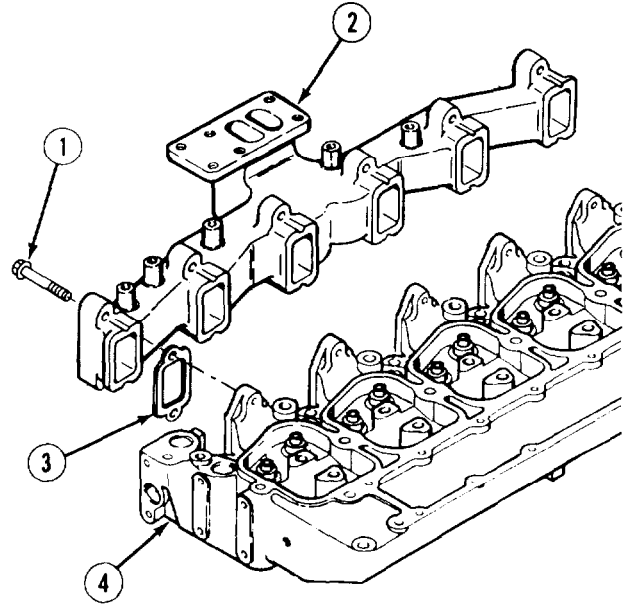


c. *Installation.*

NOTE

Valve covers removed for clarity.

- (1) Apply anti-seize compound to threads of 12 screws (1).
- (2) Install six gaskets (3) and exhaust manifold (2) on cylinder head (4) with 12 screws (1).
- (3) Tighten 12 screws (1) 32 lb-ft (43 N•m) according to pattern shown.



NOTE

Follow-on Maintenance: Install turbocharger (para 4-44).

END OF TASK

4-38. CLUTCH ADJUSTMENT.

This task covers:

Adjustment

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 2-8

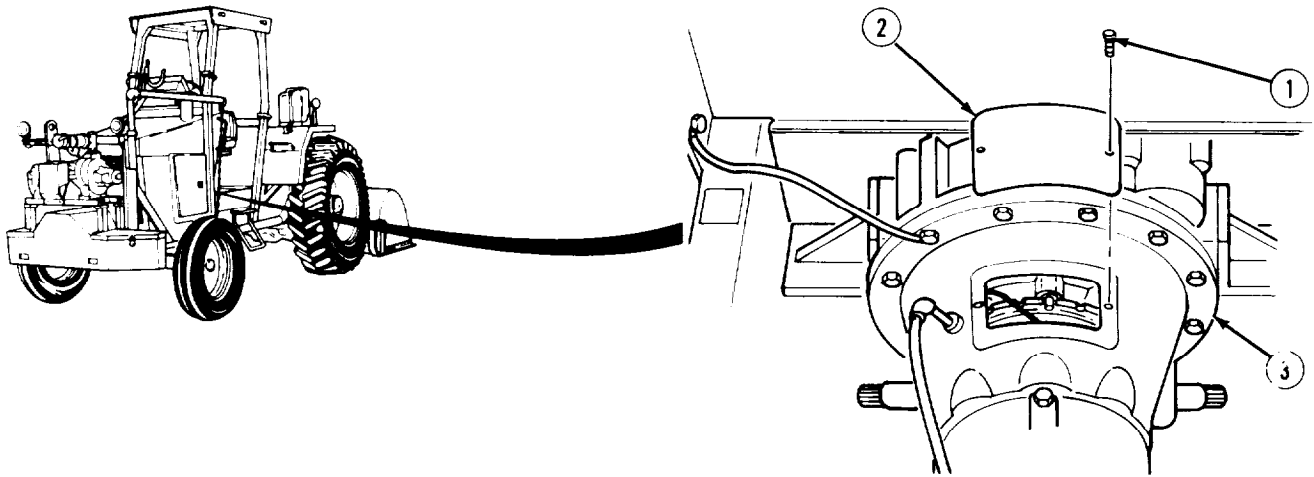
Para 4-132

Condition Description

Clutch disengaged.

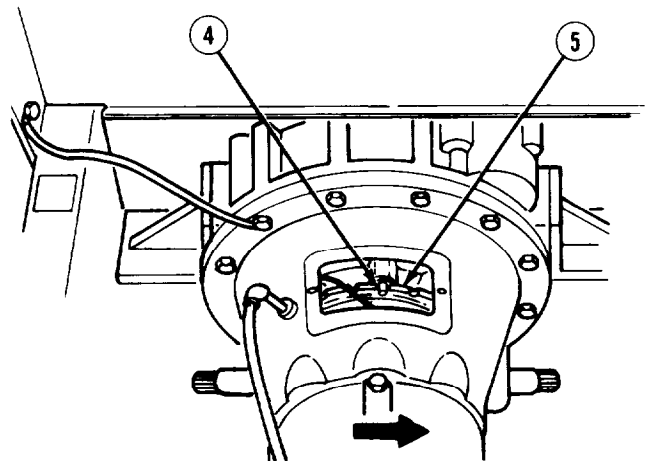
Forward floor plate removed.

Adjustment.

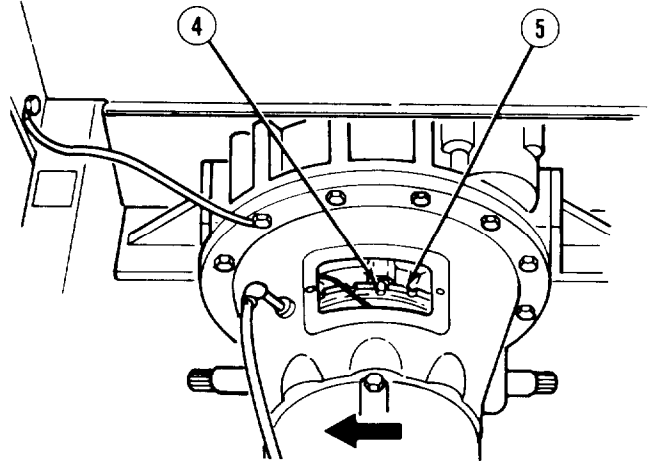


(1) Remove two screws (1) and cover plate (2) from clutch housing (3).

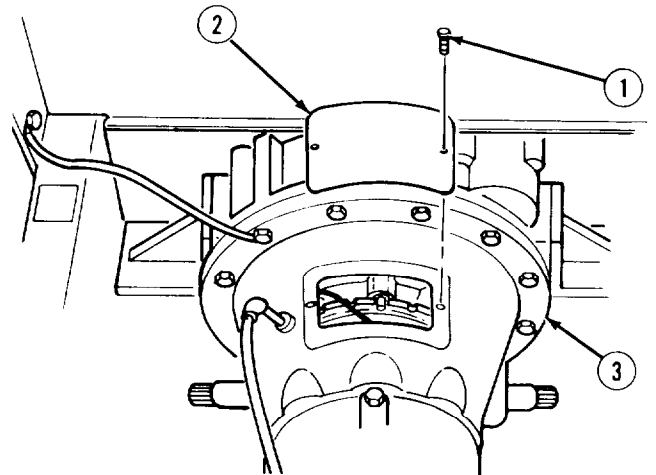
(2) If clutch is slipping, push in locking pin (4) and turn adjusting ring (5) clockwise one notch at a time until clutch no longer slips.



- (3) If clutch is too tight and grabs, push locking pin in (4) and turn adjusting ring (5) counterclockwise one notch at a time until clutch no longer grabs.



- (4) Install cover plate (2) on clutch housing (3) with two screws (1).



NOTE

Follow-on Maintenance: Install forward floor plate (para 4-132).

END OF TASK

4-39. DRIVE ASSEMBLY SERVICE.

This task covers:

a. Draining

b. Cleaning/Inspection

c. Filling

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

Oil, lubricating, gear (item 32, appendix E)

Equipment Condition

TM or Para
Para 2-13

Condition Description
Parking brake set.

General Safety Instructions

Gear oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

a. Draining.

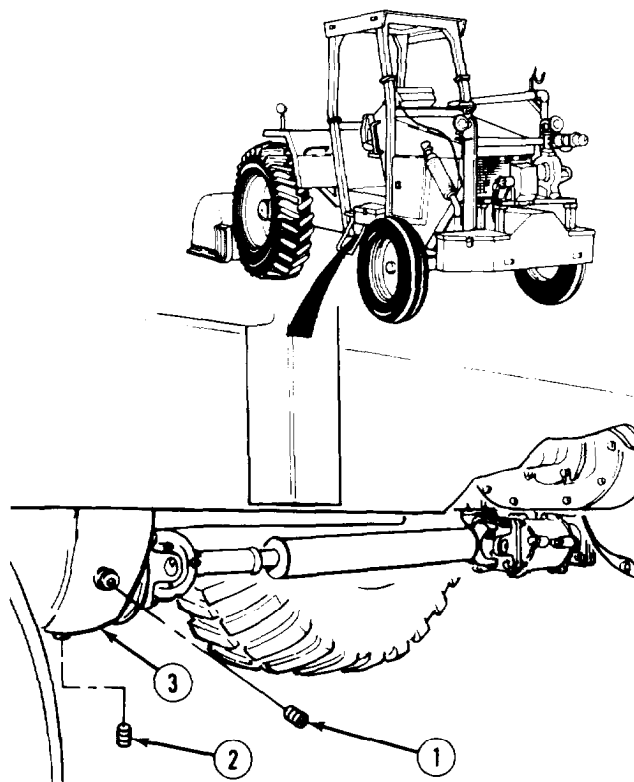
WARNING

Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

NOTE

Place suitable container with a 5 gallon (19 liter) capacity under rotor drive to catch spilling oil.

- (1) Remove fill plug (1) and drain plug (2) from drive assembly (3).
- (2) Allow oil to drain completely from drive assembly (3).

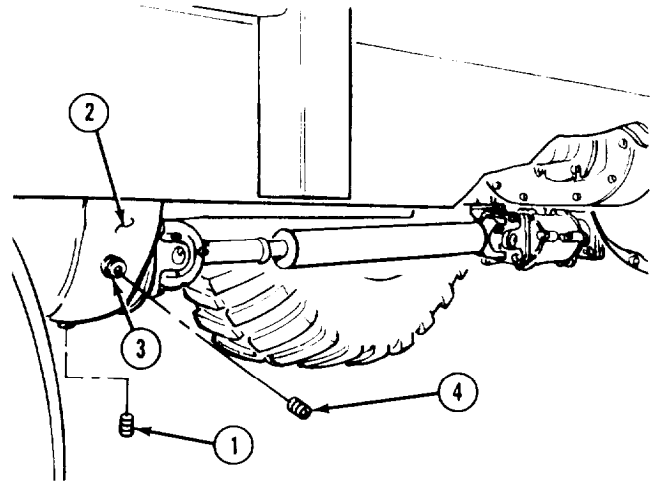


b. Cleaning/Inspection.

- (1) Clean plugs and around holes.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plugs.
- (4) Dispose of drained fluids according to local regulations.

c. Filling.

- (1) Install drain plug (1) in drive assembly (2).
- (2) Fill drive assembly (2) with gear oil, as specified by MIL-L-2105C, through fill hole (3).
- (3) Drive assembly (2) is full when oil level is just below fill hole (3).
- (4) When drive assembly is full, install fill plug (4) in drive assembly (2).

**END OF TASK**

4-40. FUEL LIFT PUMP REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

- Compound, thread locking (item 15, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Gasket

General Safety Instructions

If engine has previously been in operation, allow engine time to cool before performing procedure.

Equipment Condition

TM or Para
Para 2-14

Condition Description
Left engine door opened.

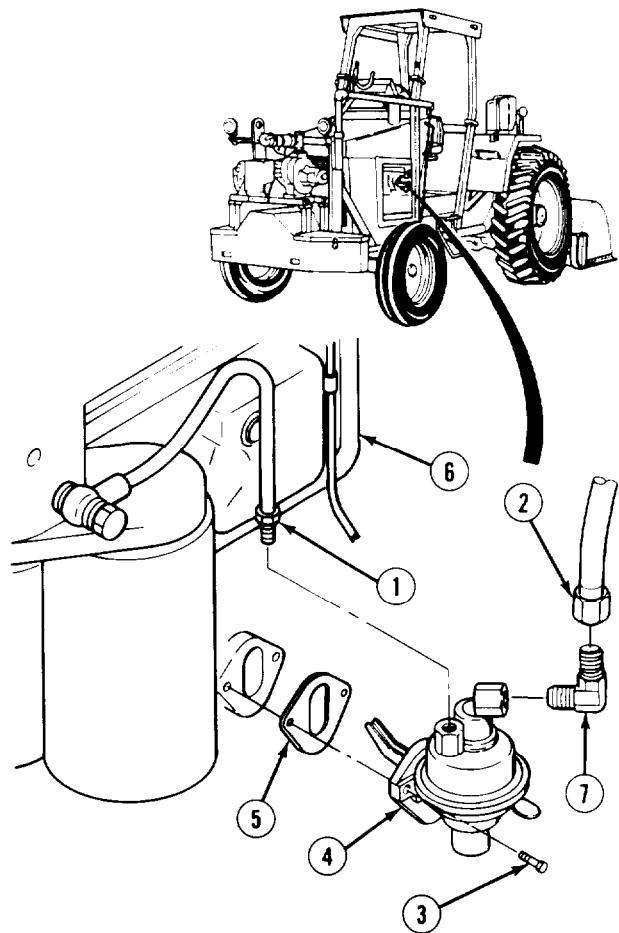
WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.
- Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.

a. Removal.

- (1) Disconnect fuel tube (1) and fuel hose (2).
- (2) Remove two screws (3) lift pump (4), and gasket (5) from cylinder block (6). Discard gasket.
- (3) Remove elbow (7).

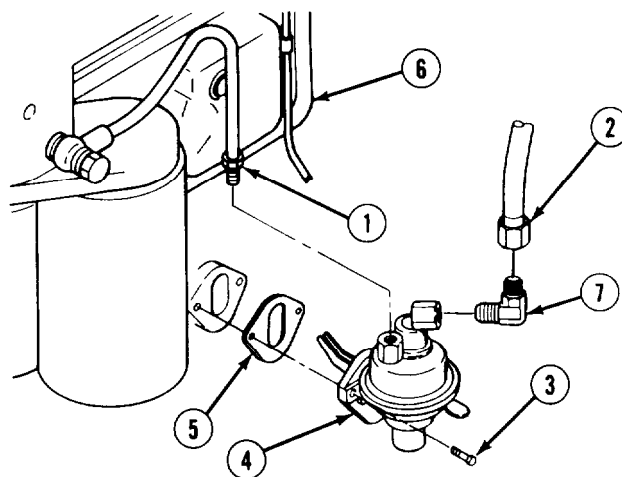


b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean lift pump in drycleaning solvent. Dry with compressed air.
 - (2) Check camshaft lever and return spring for obviously excessive wear. If damaged, replace lift pump (para 4-40).
 - (3) Check diaphragm by blocking fuel inlet and pressing lever. If lifting pump bleeds down, replace lift pump (para 4-40).

c. Installation.

- (1) Install gasket (5) and lift pump (4) on cylinder block (6) with two screws (3). Tighten screws 216 lb-in (24 N•m).
- (2) Coat threads of elbow (7) with pipe thread sealant and install in lift pump (4).
- (3) Connect fuel line (1). Tighten fuel line 216 lb-in (24 N•m).
- (4) Connect fuel hose (2).

**NOTE**

Follow-on maintenance:

- Bleed fuel system (para 4-54).
- Close left engine door (para 2-14).

END OF TASK

4-41. SHUTDOWN SOLENOID REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Packing, preformed

Equipment Condition

TM or Para

Para 2-14

Condition Description

Left engine door open.

General Safety Instructions

If engine has recently been in operation, use caution in performing procedure.

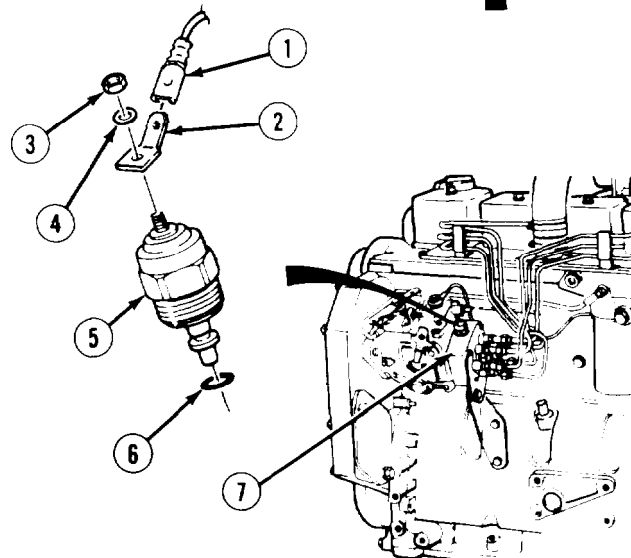
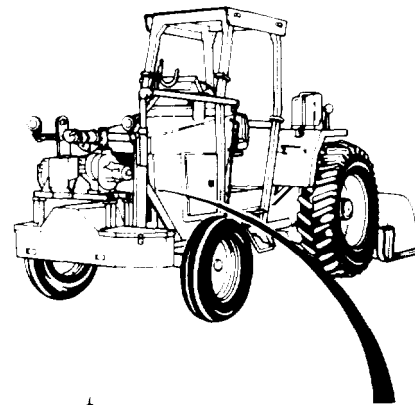
a. Removal.

- (1) Tag, mark, and disconnect positive wire (1) from terminal lug (2).
- (2) Remove nut (3), washer (4) and terminal lug (2).

NOTE

Use caution when removing solenoid. Plunger and spring at solenoid end can fall off into pump.

- (3) Remove shutdown solenoid (5) and preformed packing (6) from fuel injection pump (7). Discard preformed packing.



b. Installation.

- (1) Install preformed packing (6) and shutdown solenoid (5) on injection pump (7). Tighten solenoid 32 lb-ft (43 N•m).
- (2) Install terminal lug (2) with washer (4) and nut (3).
- (3) Connect positive wire (1) on terminal lug (2).

NOTE

Follow-on Maintenance: Close left engine door (para 2-14).

END OF TASK

4-42. AIR CLEANER ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 2-14

Condition Description
Left/right engine doors opened.

Personnel Required

MOS62B, Construction equipment repairer (2)

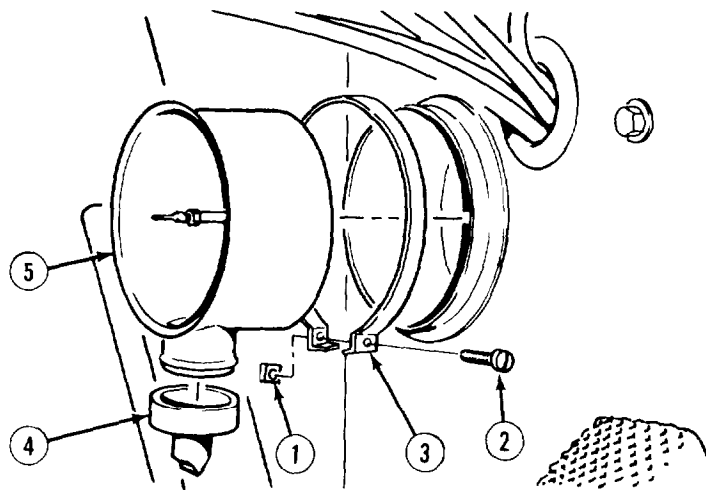
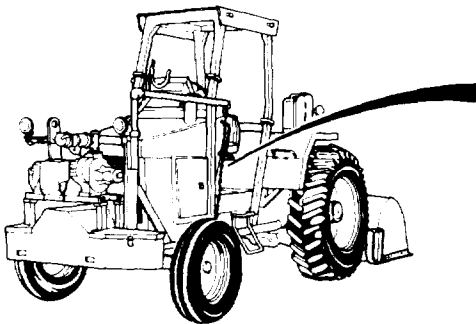
Para 3-8
Para 4-43

Air filter removed.
Turbocharger air inlet hose removed.

Para 4-128

Dash panel removed.

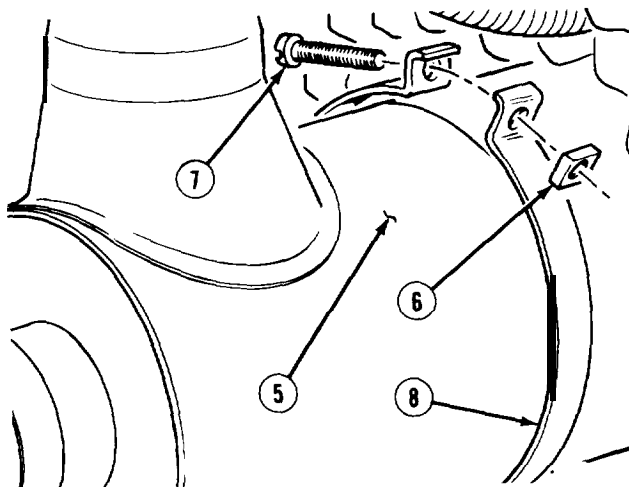
a. Removal.



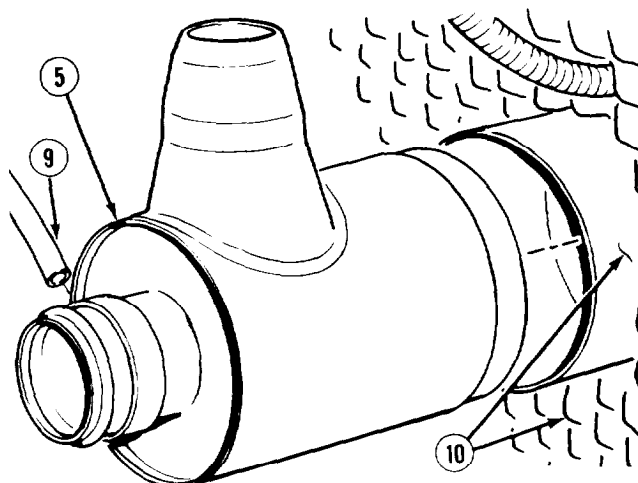
- (1) Remove nut (1) and screw (2) from clamp (3) inside cab.
- (2) Remove rubber boot (4) from housing (5).

4-42. AIR CLEANER ASSEMBLY REPLACEMENT (CONT).

- (3) Remove nut (6) and screw (7) from clamp (8) on engine side.
- (4) Remove clamp (8) from housing (5).



- (5) Remove hose (9) from housing (5).
- (6) Remove housing (5) from firewall (10) from engine side.

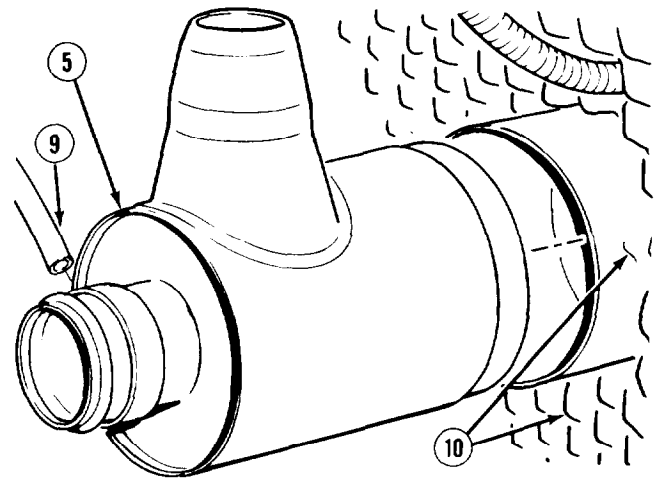


b. Cleaning/Inspection.

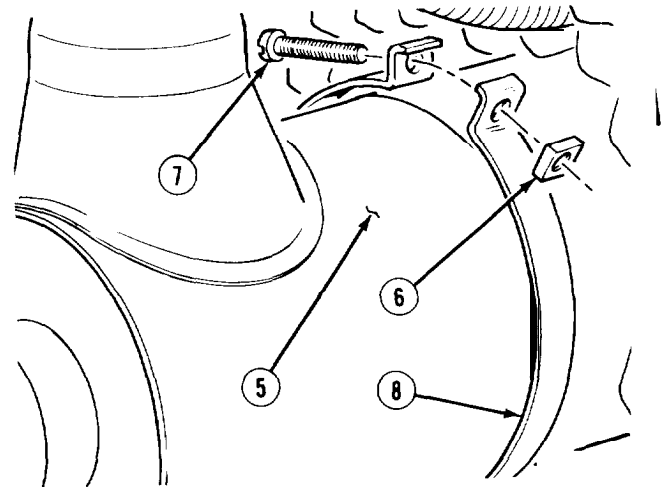
- (1) Wipe metal parts clean.
- (2) Inspect for rust, holes, cracks, or other damage.
- (3) Replace all damaged parts.

c. Installation.

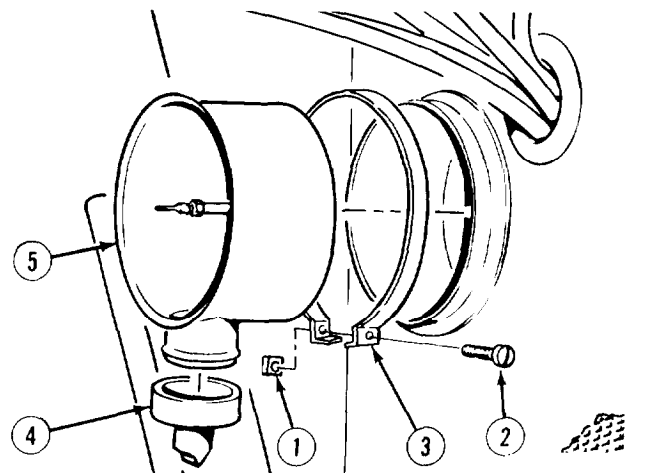
- (1) Install housing (5) in firewall (10) from engine side.
- (2) Connect hose (9) to housing (5).



- (3) Position clamp (8) on housing (5) and install screw (7) and nut (6).



- (4) Install rubber boot (4) on housing (5).
- (5) Install screw (2) and nut (1) in clamp (3) inside cab.



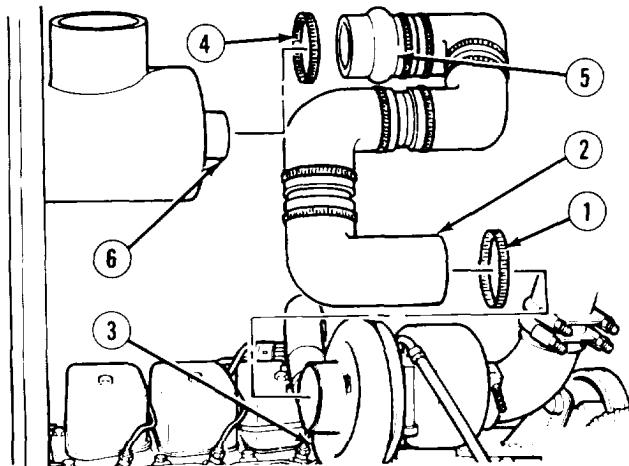
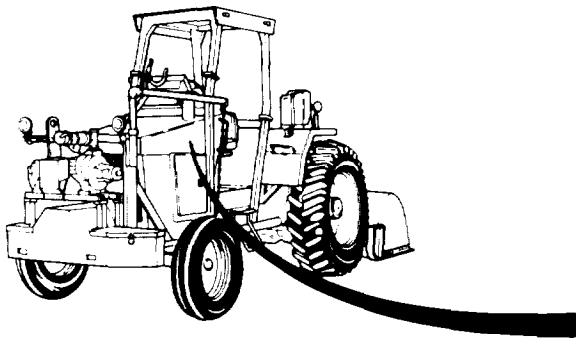
NOTE

Follow-on Maintenance:

- Install panel (para 4-128).
- Install turbocharger air inlet hose (para 4-43).
- Install air filter (para 3-8).
- Close engine doors (para 2-14).

END OF TASK

4-43. TURBOCHARGER AIR INLET HOSE REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Tools</i> Tool kit, general mechanics: automotive Wrench, torque		<i>General Safety Instructions</i> If engine has recently been in operation, allow time for cooling before performing procedure.
<i>Equipment Condition</i> TM or Para Para 4-90 Para 4-125	<i>Condition Description</i> Negative battery cable disconnected. Hood removed.	



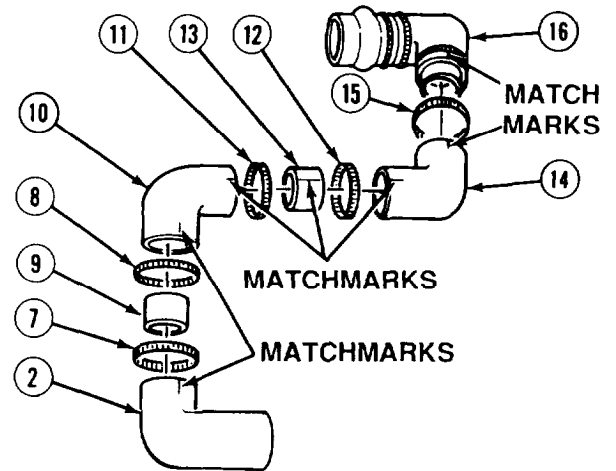
a. Removal.

NOTE

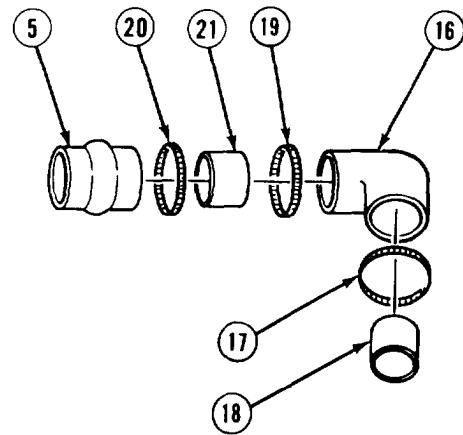
To remove air inlet hose as an assembly, perform steps (1) through (3) only.

- (1) Loosen clamp (1) and remove elbow hose (2) from turbocharger (3).
- (2) Loosen clamp (4) and remove hump hose (5) from air cleaner housing (6).
- (3) Remove air inlet hose as an assembly.
- (4) Remove two clamps (1 and 4).

- (5) Loosen two clamps (7 and 8).
- (6) Matchmark and remove elbow hose (2), two clamps (7 and 8), and pipe (9) from elbow hose (10).
- (7) Loosen two clamps (11 and 12).
- (8) Matchmark and remove elbow hose (10), two clamps (11 and 12), and pipe (13) from elbow hose (14).
- (9) Loosen clamp (15), matchmark and remove elbow hose (14) and clamp from elbow hose (16).



- (10) Loosen clamp (17) and remove pipe (18) and clamp from elbow hose (16).
- (11) Loosen two clamps (19 and 20).
- (12) Remove elbow hose (16), two clamps (19 and 20), and pipe (21) from hump hose (5).



b. Cleaning/Inspection.

- (1) Inspect hoses and pipes for deterioration and holes.
- (2) Inspect clamps for rust, wear, and breaks in bands.
- (3) Replace all damaged parts.

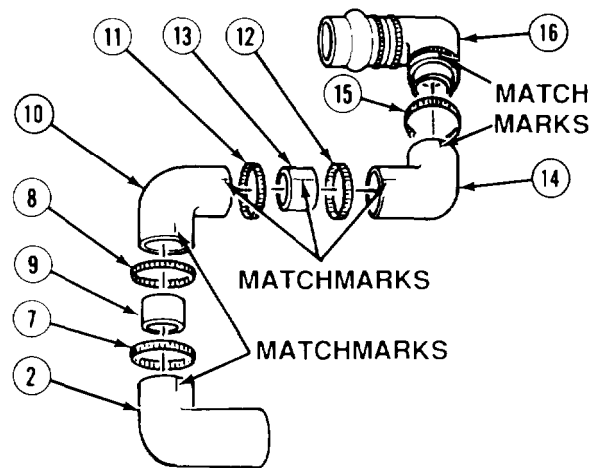
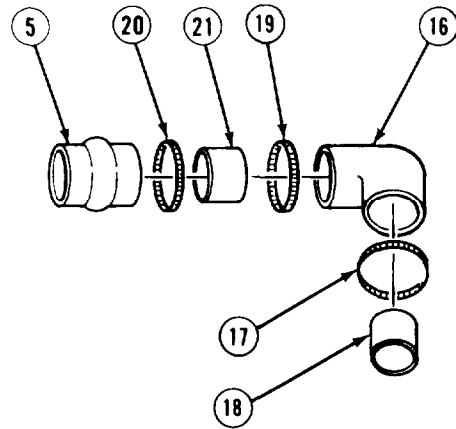
4-43. TURBOCHARGER AIR INLET HOSE REPLACEMENT (CONT).

c. Installation.

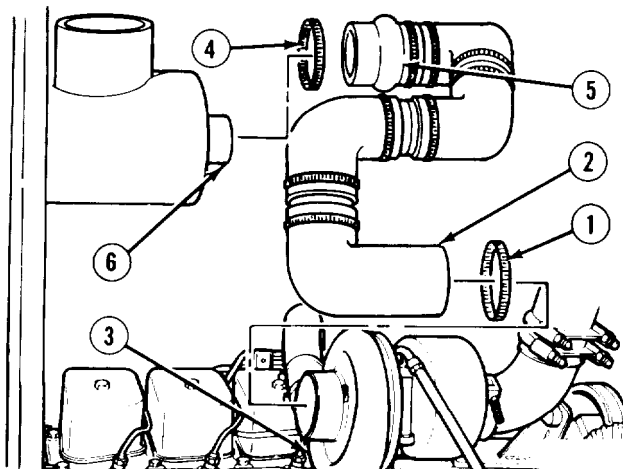
NOTE

To install air inlet hose as an assembly, perform steps (14) and (16).

- (1) Position clamp (20) on hump hose (5).
- (2) Install pipe (21) halfway in hump hose (5).
- (3) Position two clamps (19 and 17) on elbow hose (16).
- (4) Align matchmarks and install pipe (18) halfway in elbow hose (16).
- (5) Install elbow hose (16) on pipe (21).
- (6) Position two clamps (15 and 12) on elbow hose (14).
- (7) Align matchmarks and install pipe (13) in elbow hose (14).
- (8) Align matchmarks and install elbow hose (14) on elbow (16).
- (9) Position two clamps (11 and 8) on elbow hose (10).
- (10) Align matchmarks and install pipe (9) in elbow hose (10).
- (11) Align matchmarks and install elbow hose (10) on elbow hose (14).
- (12) Install clamp (7) on elbow hose (2).
- (13) Align matchmarks and install elbow hose (2) on pipe (9).



- (14) Install clamp (4) on hump hose (5).
- (15) Install hump hose (5) on air cleaner housing (6). Tighten clamp (4) 72 lb-in (8 N•m).
- (16) Install clamp (1) on elbow hose (2).
- (17) Install elbow hose (2) on turbocharger (3). Tighten clamp (1) 72 lb-in (8 N•m).
- (18) Tighten remaining clamps 72 lb-in (8 N•m).

**NOTE**

Follow-on maintenance: Install hood (para 4-125).

END OF TASK

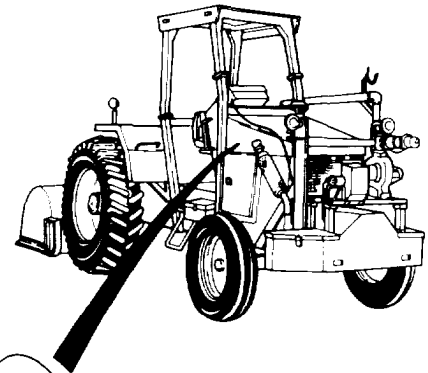
4-44. TURBOCHARGER REPLACEMENT.		
his task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanics: automotive	TM or Para Para 4-36	Turbocharger oil line and drain connection removed.
Wrench, torque		Turbocharger air inlet hose removed.
<i>Materials/Parts</i>	Para 4-43	Air inlet pipe removed.
Compound, anti-seize (item 13, appendix E)	Para 4-45	Exhaust outlet pipe removed.
Gasket, turbocharger	Para 4-58	
Studs (4)		

a. Removal.

NOTE

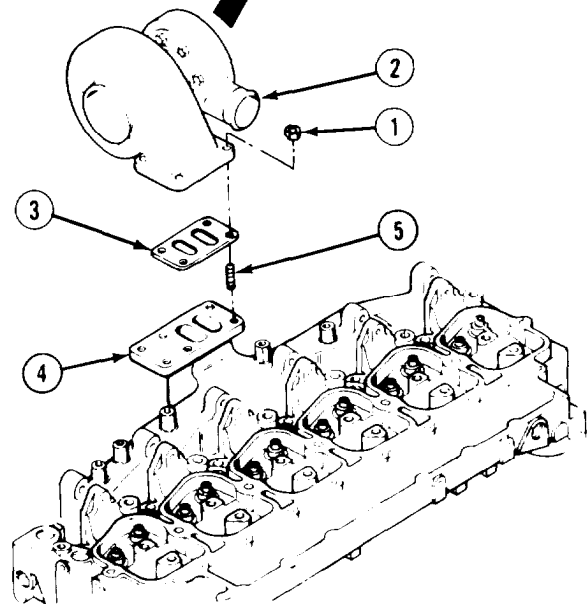
Studs may come out with nuts.

- (1) Remove four nuts (1), turbocharger (2), and gasket (3) from manifold (4). Discard gasket.
- (2) If damaged, remove and discard four studs (5).



b. Installation.

- (1) If removed, apply anti-seize compound to threads and install studs (5) in manifold (4).
- (2) Install gasket (3) and turbocharger (2) on manifold (4) with four nuts (1). Tighten nuts 24 lb-ft (32 N•m).



NOTE

Follow-on Maintenance:

- Install exhaust outlet pipe (para 4-58).
- Install air inlet pipe (para 4-45).
- Install turbocharger air inlet hose (para 4-43).
- Install turbocharger oil line and drain connection (para 4-36).

END OF TASK

4-45. AIR INLET PIPE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Equipment Condition

TM or Para

Para 2-14

Condition Description

Left and right engine door opened.

General Safety Instructions

If engine has previously been in operation, use caution in performing procedure. Engine block retains extreme heat in operation.

a. Removal.

- (1) Loosen four clamps (1) and remove intake pipe assembly (2) from manifold cover (3) and turbocharger (4).
- (2) Remove two hoses (5 and 6) from pipe (2).

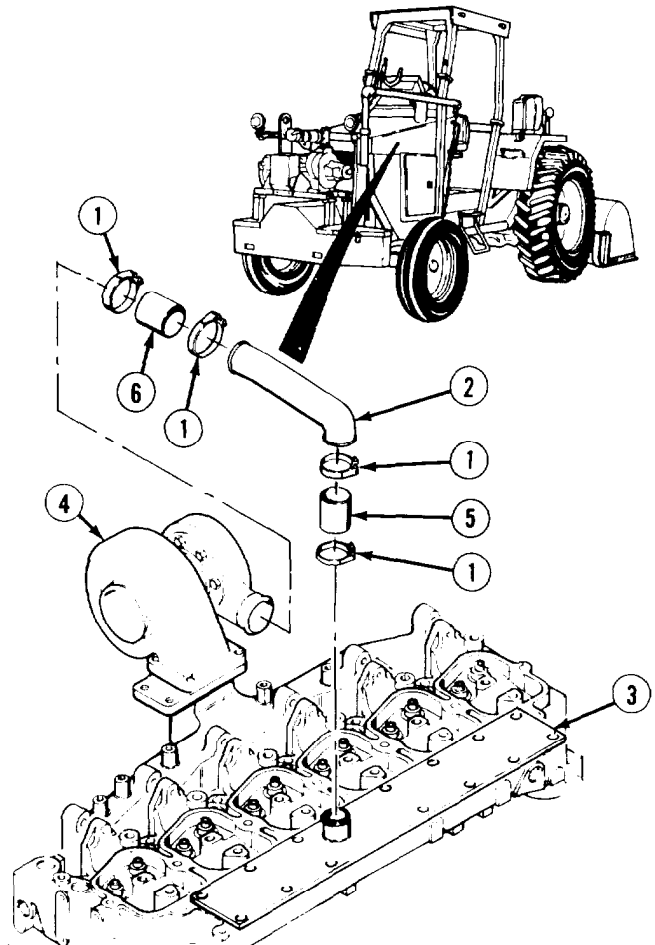
b. Installation.

- (1) Connect two hoses (6 and 5) on pipe (2).
- (2) Install two clamps (1) on hose (6) and connect hose to turbocharger (4).
- (3) Install two clamps (1) on hose (5) and connect hose to manifold cover (3). Tighten four clamps 72 lb-in (8 N•m).

NOTE

Follow-on maintenance: Close left and right engine doors (para 2-14).

END OF TASK



4-46. MANIFOLD COVER REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

Cloth, lint-free (item 12, appendix E)
Compound, sealing, pipe thread (item 17, appendix E)
Solvent, drycleaning (item 54, appendix E)
Gasket, manifold

Equipment Condition

TM or Para
Para 4-43

Para 4-47

Condition Description
Turbocharger air inlet hose removed.
Injector fuel lines removed.

General Safety Instructions

If engine has recently been in operation, allow time for cooling before performing procedure.

a. Removal.

NOTE

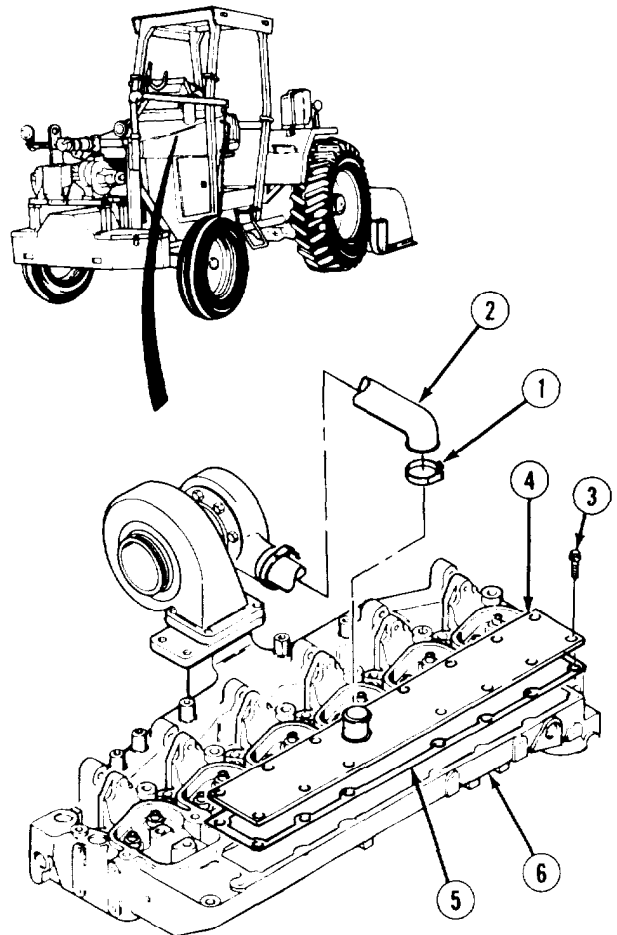
Valve covers removed for clarity.

- (1) Loosen clamp (1) and remove inlet connection (2).

NOTE

Three of 14 screws were removed with fuel line support bracket.

- (2) Remove 11 screws (3), manifold cover (4) and gasket (5) from cylinder head (6). Discard gasket.



b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean gasket and sealant material from manifold cover and cylinder head using scraper, cloth, and drycleaning solvent.
 - (2) Inspect manifold cover for cracks and wear.
 - (3) Replace cover if damaged.

c. Installation.

- (1) Install gasket (5) and manifold cover (4) on cylinder head (6).

WARNING

Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives harmful vapors. Wear protective goggles and use in well-ventilated area. If sealant gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

NOTE

- Three screws will be installed with fuel line brackets.
 - Valve covers removed for clarity.
- (2) Coat threads of 11 screws (3) with pipe thread sealing compound and install screws. Tighten screws 216 lb-in (24 N•m).
 - (3) Install inlet connection (2) on manifold cover (4). Tighten clamp (1) 72 lb-in (8 N•m).

NOTE

Follow-on Maintenance:

- Install injector fuel lines (para 4-47).
- Install turbocharger air inlet hose (para 4-43).

END OF TASK

4-47. FUEL LINES AND FITTINGS REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power
- Wrench, torque

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-17	Fuel shutoff valve closed.
Para 4-44	Turbocharger removed.

General Safety Instructions

If engine has recently been in operation, allow engine time to cool before performing procedure

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Tags, identification (item 55, appendix E)
- Compound, sealing, pipe thread (item 17, appendix E)
- Washers, sealing (6)
- Seals, grommet (2)
- Lockwashers (6)
- Seals, connector (8)

Fuel vapors are flammable.
Do not smoke within 50 ft. (15 m).

WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

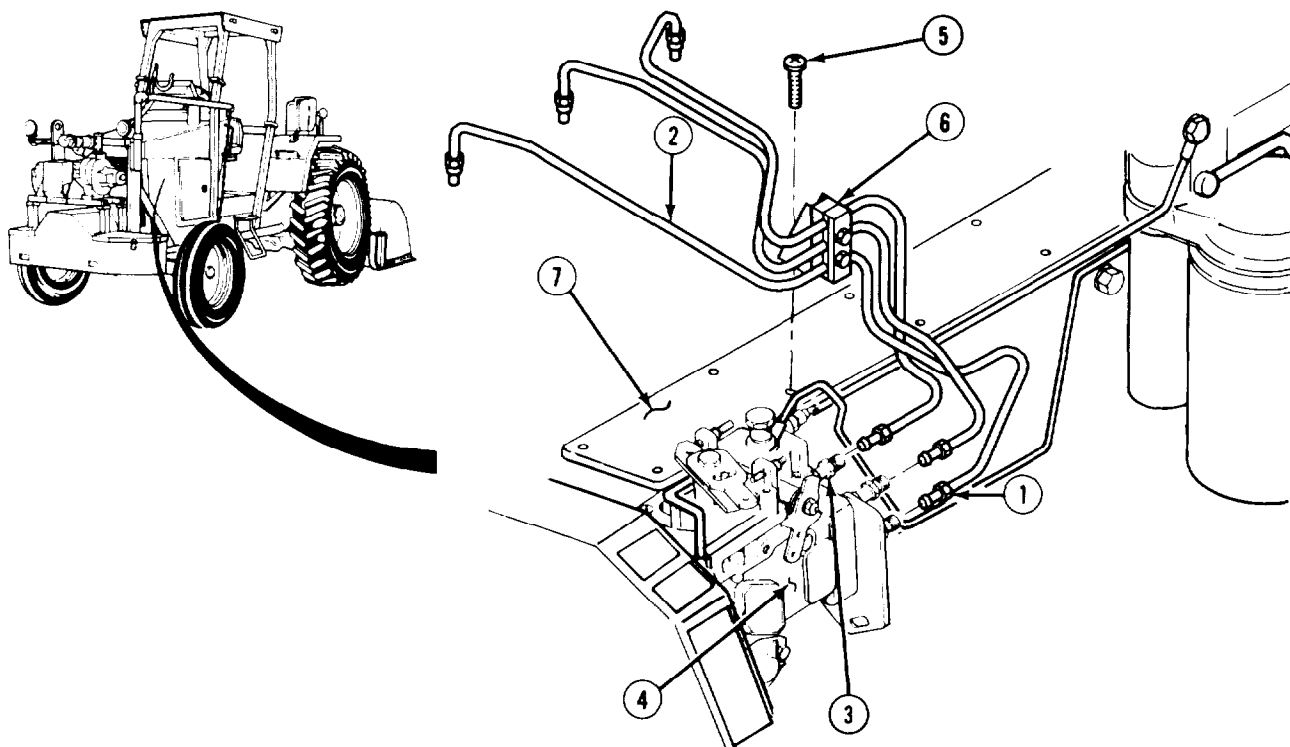
Keep fuel away from open flame or any spark (ignition source).

Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.

Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines, or fuel tanks.

Fuel is slippery and can cause falls. To avoid injury, wipe up spilled fuel with rags.

a. *Removal.*



NOTE

Tag and mark all fuel tubes and hoses before removal.

- (1) Tag, mark, and remove fuel tubes from injection pump to injectors as follows:

CAUTION

Hold fuel injection valves securely when removing fuel tubes. Failure to do so will result in damaging tubes and valves.

- (a) Loosen six connectors (1) and remove fuel tubes (2) from fittings (3) on injection pump (4).

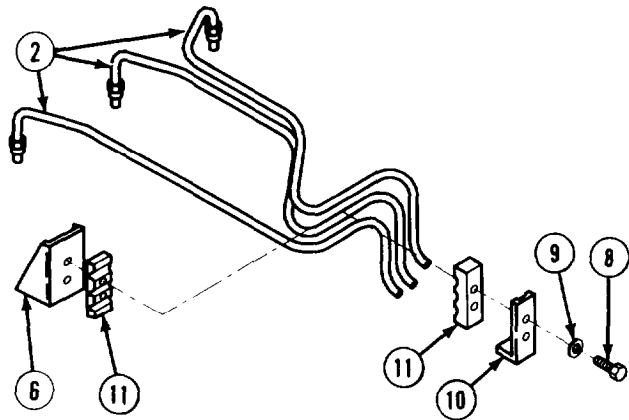
NOTE

Do not separate tubes from braces unless damaged.

- (b) Remove three screws (5) and braces (6) from manifold cover (7).

4-47. FUEL LINES AND FITTINGS REPLACEMENT (CONT).

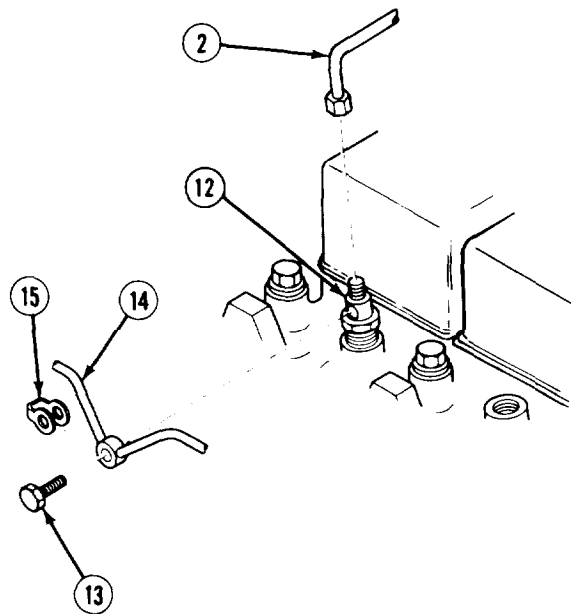
- (c) Remove six screws (8), lockwashers (9), three back-up plates (10), and six isolators (11) from three braces (6) and fuel tubes (2). Discard lockwashers.



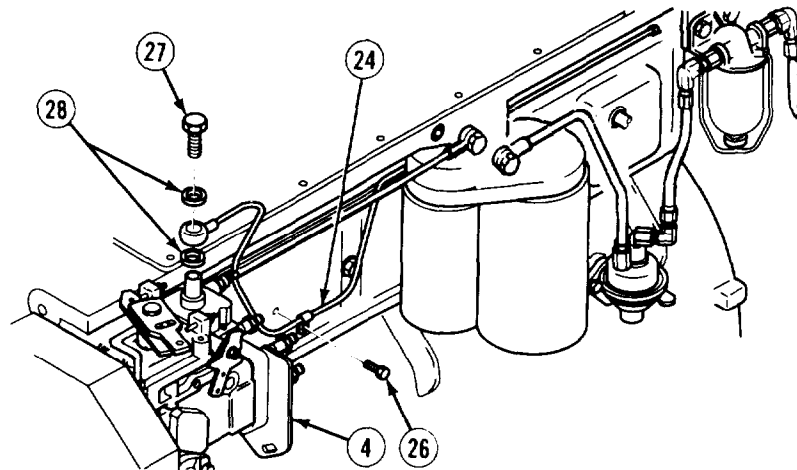
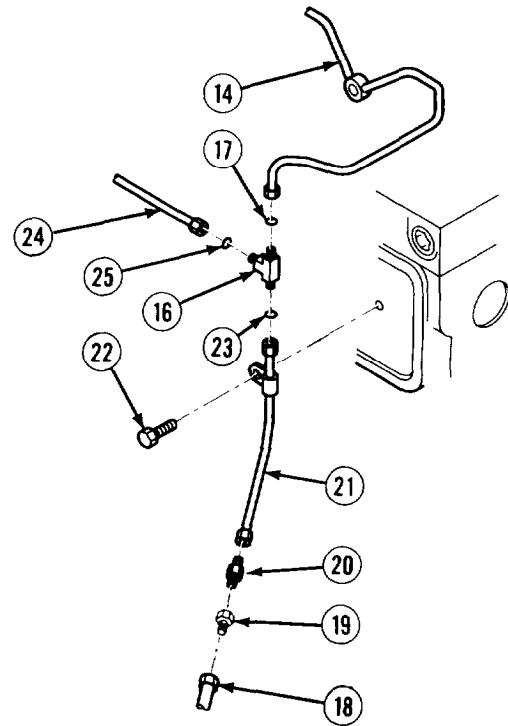
NOTE

Cap injectors after removing tubes.

- (d) Remove six fuel tubes (2) from injectors (12).
- (2) Tag, mark, and remove fuel injector return tube as follows:
 - (a) Remove six banjo screws (13), injector return (14), and six connector seals (15) from injectors (12). Discard connector seals.

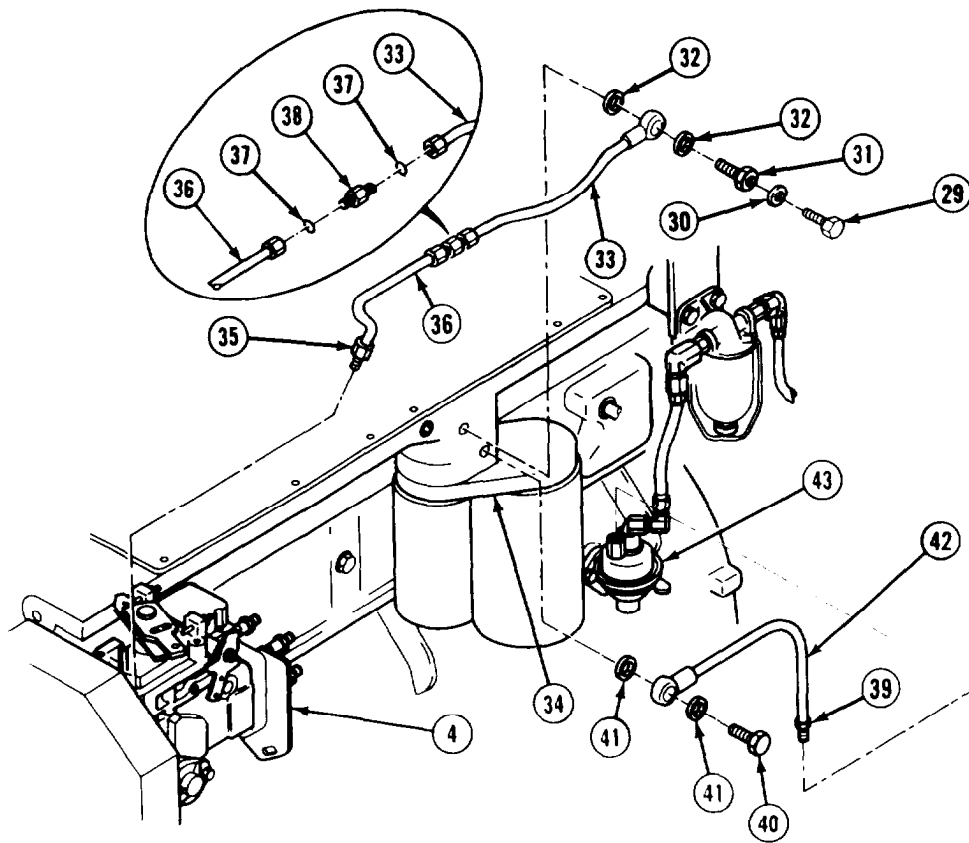


- (b) Remove injector return tube (14) from pipe tee (16).
 - (c) Remove and discard grommet seal (17) from injector return tube (14).
- (3) Tag, mark, and remove fuel return tubes and hose as follows:
- (a) Remove fuel return hose (18), nipple (19), and adaptor (20) from fuel return tube (21).
 - (b) Remove fuel return tube (21) from tee (16).
 - (c) Remove screws (22) and grommet seal (23). Discard grommet seal.
 - (d) Remove fuel return tube (24) and grommet (25) from tee (16). Discard grommet.



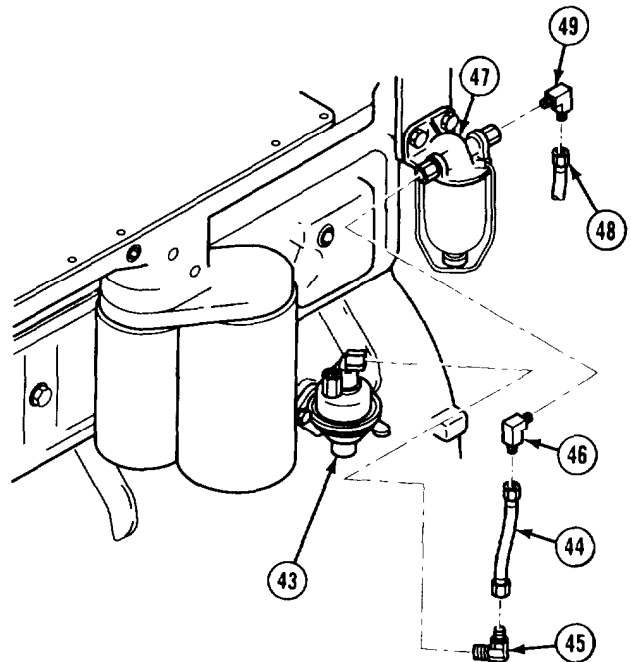
- (e) Remove screw (26).
- (f) Remove banjo screw (27), two sealing washers (28) and fuel return tube (24) from injection pump (4). Discard sealing washers.

4-47. FUEL LINES AND FITTINGS REPLACEMENT (CONT).



- (4) Tag, mark, and remove fuel tubes from filter head as follows:
 - (a) Remove screw (29) and sealing washer (30). Discard sealing washer.
 - (b) Remove banjo screw (31), two sealing washers (32), and fuel tube (33) from filter head (34). Discard sealing washers.
 - (c) Loosen connector (35) and remove fuel tube (36) from injection pump (4).
 - (d) Remove fuel tube (33), two grommet seals (37), and adaptor (38) from fuel tube (36). Discard grommet seals.
 - (e) Loosen connector (39) and remove banjo screw (40), two sealing washers (41), and fuel tube (42) from filter head (34) and lift pump (43). Discard sealing washer.

- (5) Tag, mark and remove fuel hose (44) and elbow (45) from lift pump (43).
- (6) Tag and remove fuel hoses from sediment bowl as follows:
 - (a) Remove fuel hose (44) and elbow (46) from sediment bowl (47).
 - (b) If necessary, perform step 7(b).
 - (c) If necessary, remove fuel hose (48). Remove adaptor (49).

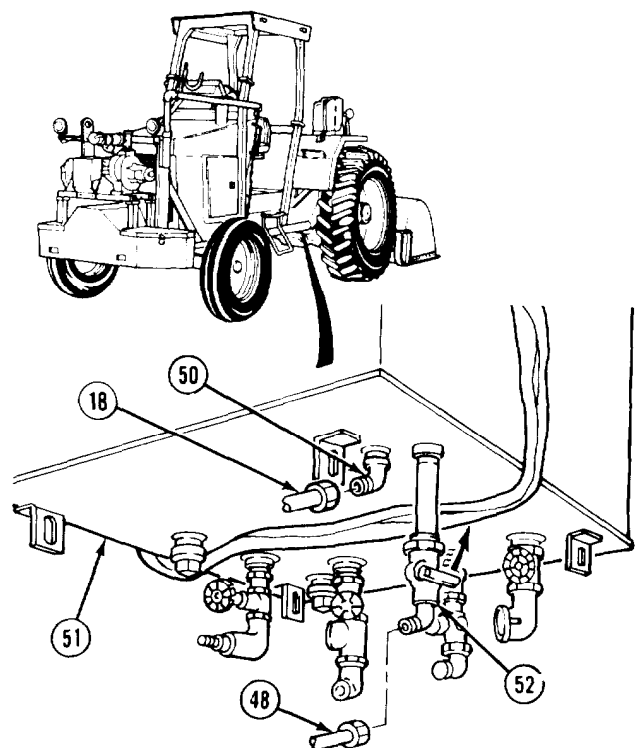


- (7) Tag, mark, and remove fuel hoses from fuel tank as follows:

NOTE

Fuel return hose is removed from engine in step 3(a). Fuel hose is removed from sediment bowl in step 6(a).

- (a) Remove fuel return hose (18) from fitting (50) on fuel tank (51).
- (b) If shutoff valve (52) is not turned off, turn off valve as indicated.
- (c) Remove fuel hose (48) from shutoff valve (52).



4-47. FUEL LINES AND FITTINGS REPLACEMENT (CONT).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using drycleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean banjo screws with drycleaning solvent. Dry with compressed air.
 - (2) Flush fuel tubes with drycleaning solvent. Dry with compressed air.
 - (3) Wipe off fuel tubes with lint-free cloth and inspect tubes for holes, dents, and other damage.
 - (4) Inspect tee, adaptors, and screws for thread bareness.
 - (5) Replace all damaged parts.

c. Installation.

NOTE

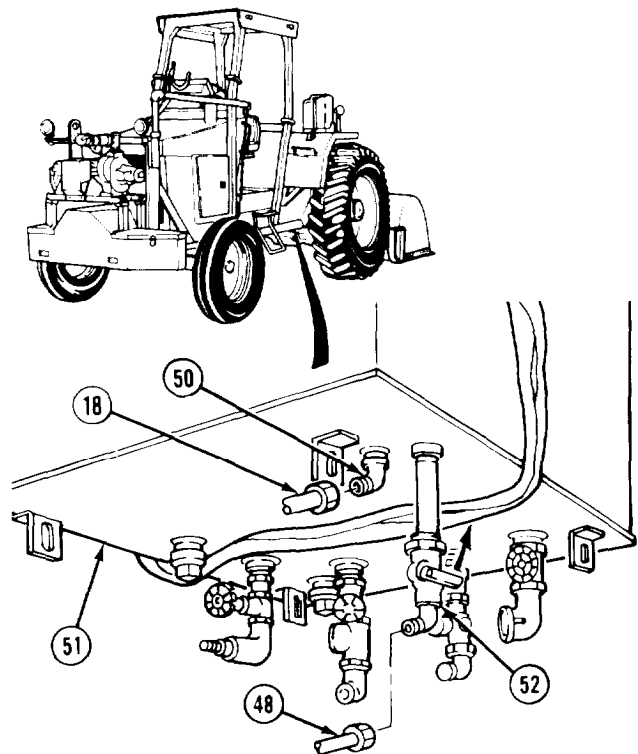
Fuel hose to sediment bowl is installed in step (2). Fuel return hose is installed in step 5(g).

- (1) Install fuel hoses on fuel tank as follows:
 - (a) Install fuel hose (48) on shutoff valve (52).
 - (b) Install fuel return hose (18) on fitting (50).

NOTE

Do not perform step l(c) until procedure is completed.

- (c) Turn shutoff valve (52) on fuel tank (51) in opposite direction to turn fuel on.



WARNING

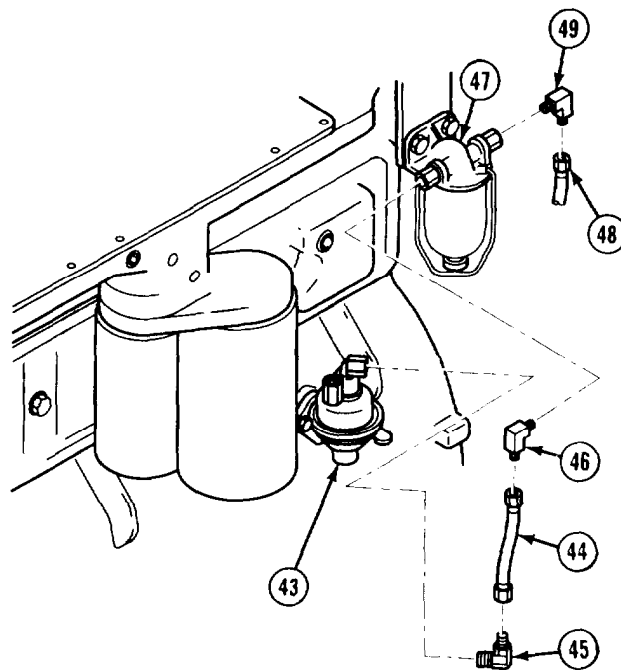
Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated areas. If sealant gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Install fuel hoses on sediment bowl as follows:

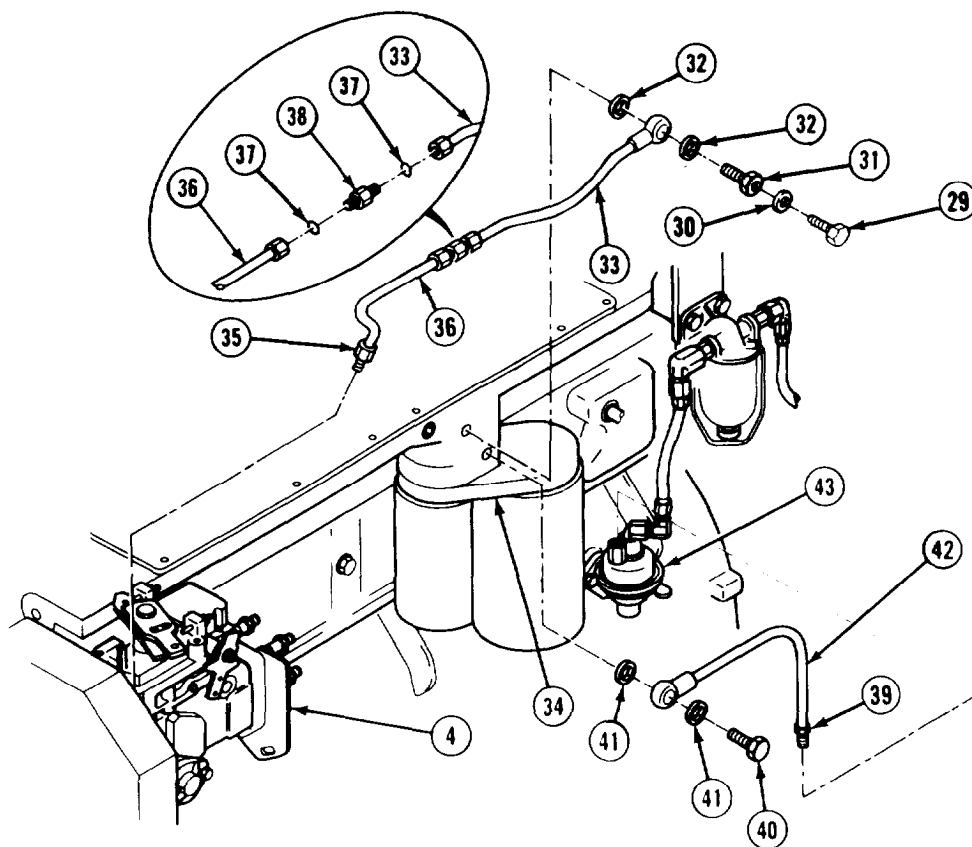
WARNING

Adhesive sealant can damage your eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

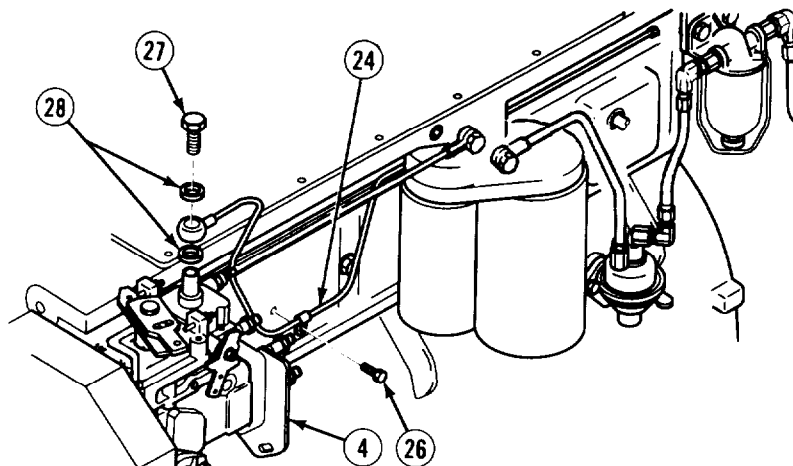
- (a) Coat threads of two elbows (49 and 46) with pipe thread sealing compound and install on sediment bowl (47).
 - (b) Install two hoses (48 and 44).
- (3) Coat threads of elbow (45) with pipe thread sealing compound and install elbow and fuel hose (44) on lift pump (43).



4-47. FUEL LINES AND FITTINGS REPLACEMENT (CONT).

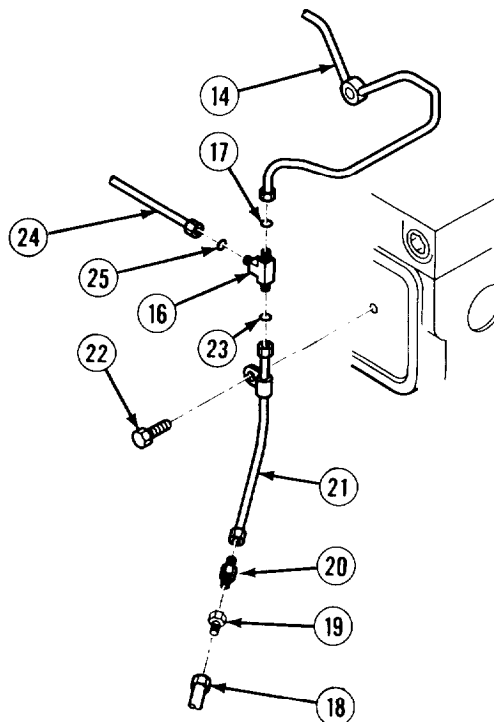


- (4) Install fuel tubes on filter head as follows:
 - (a) Install two sealing washers (41), fuel tube (42) and banjo screw (40) on filter head (34) and lift pump (43).
 - (b) Install fuel tube (36) and fuel tube (33) with two grommets (37) and adaptor (38).
 - (c) Install fuel tube (36) on injection pump (4) and tighten connector (35) securely.
 - (d) Install two sealing washers (32), fuel tube (33), and banjo screw (31) on filter head (34). Tighten screw 78 lb-in (9 N•m).
 - (e) Install sealing washer (30) and screw (29).



(5) Install fuel return tubes and hose as follows:

- (a) Install two sealing washers (28), fuel return tube (24), and banjo screw (27) on injection pump (4). Tighten screw 78 lb-in (9 N•m).
- (b) Install fuel return tube (24) with screw (26). Tighten screw 216 lb-in (24 N•m).
- (c) Install grommet seal (25) and tee (16) on fuel return tube (24).
- (d) Install grommet seal (23) in fuel return tube (21).
- (e) Install fuel return tube (21) on tee (16).
- (f) Install tube (21) with screw (22).
- (g) Install nipple (19) and fuel return hose (18).

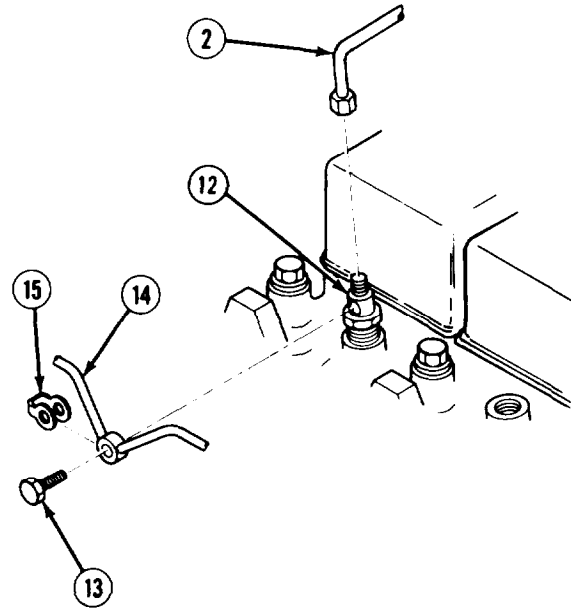


(6) Install fuel injector return tube as follows:

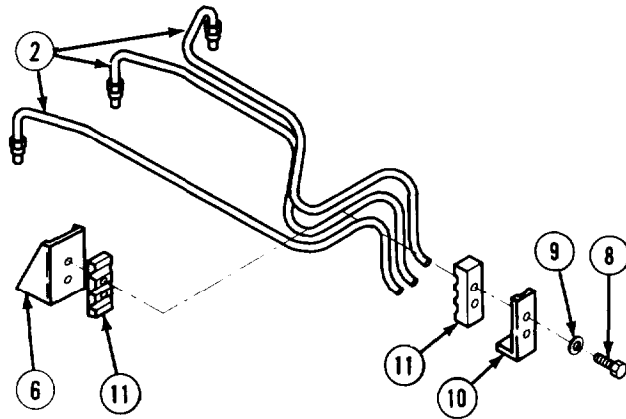
- (a) Install grommet seal (17) on fuel injector return tube (14).
- (b) Install fuel injector return tube (14) on tee (16).

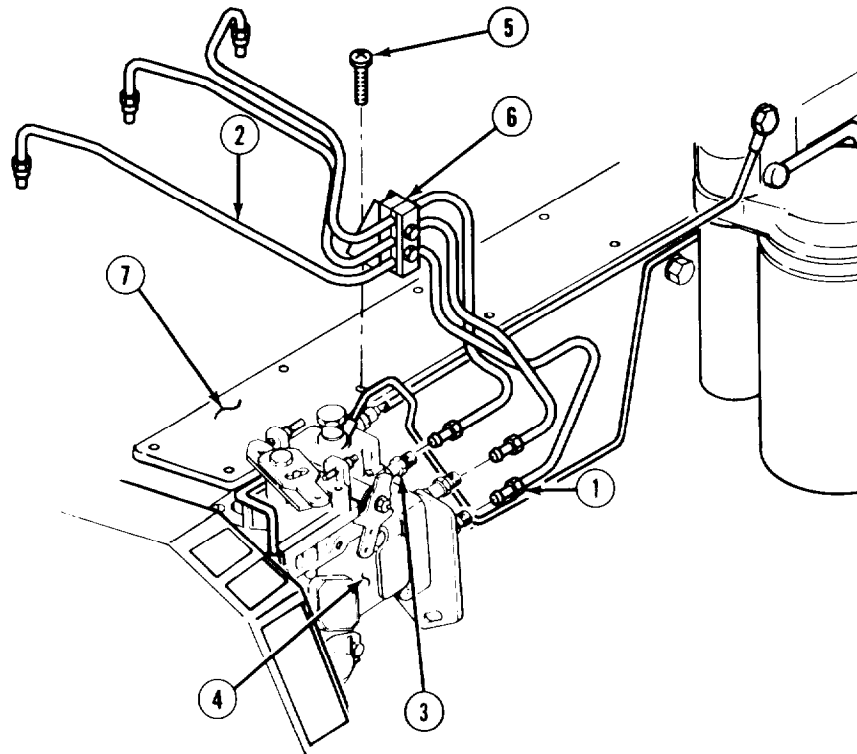
4-47. FUEL LINES AND FITTINGS REPLACEMENT (CONT).

- (c) Install six connector seals (15) and fuel injector return tube (14) with six banjo screws (13). Tighten screws 78 lb-in (9 N•m).
- (7) Install fuel tubes from injectors to injection pump as follows:
 - (a) Install six fuel tubes (2) on injectors (12).



- (b) If removed, install three braces (6), six isolators (11), and three back-up plates (10) on fuel tubes (2) with six lockwashers (9) and screws (8).





- (c) Install three braces (6) with screws (5). Tighten screws 216 lb-in (24 N·m).

CAUTION

Hold fuel injection valves securely when installing fuel tubes. Failure to do so will result in damaging tubes and valves.

- (d) Connect six fuel tubes (2) to fittings (3) on injection pump (4) and tighten connectors (1).

NOTE

Follow-on Maintenance:

- Install turbocharger (para 4-44).
- Bleed fuel system (para 4-54).

END OF TASK

4-48. FUEL SHUTOFF VALVE AND SCREEN REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Sealant, hydraulic (item 52, appendix E)

Equipment Condition

TM or Para
Para 4-49

Condition Description
Fuel/hydraulic tank
removed.

Para 2-17

Fuel shutoff valve closed.

Special Environmental Conditions

Work in well ventilated area.

Fuel vapors are flammable.

Do not smoke within 50 ft. (15 m).

a. Removal.

- (1) Remove fuel valve assembly (1) from tank (2).
- (2) Remove fuel valve screen (3) from fuel valve assembly (1).

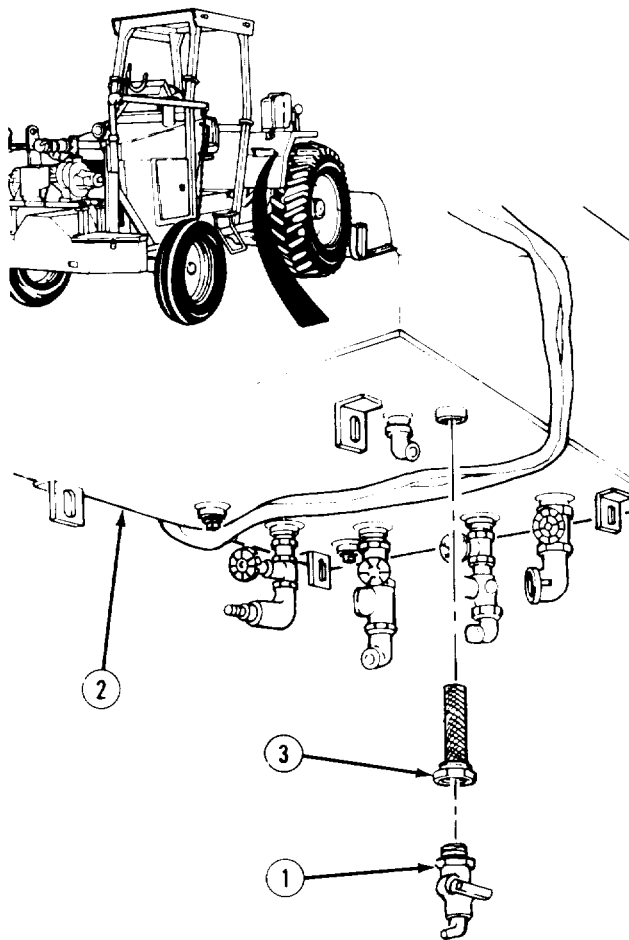
b. Installation.

- (1) Install fuel valve screen (3) to fuel valve assembly (1).
- (2) Apply thread locking sealant to threads of valve assembly (1) and install in tank (2).

NOTE

Follow-on Maintenance: Install fuel/hydraulic tank (para 4-49).

END OF TASK



4-49. FUEL/HYDRAULIC TANK REPLACEMENT/REPAIR.		
This task covers:		
a. Removal	c. Assembly	
b. Disassembly	d. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 4-29	Drain fuel tank.
Shop equipment, organizational repair: light truck mounted	Para 4-29 Para 4-47	Drain hydraulic reservoir Remove fuel lines to tank.
Lifting device (capacity 500 lb [227 kg])	Para 4-86	Back-up horn removed.
<i>Materials/Parts</i>	<i>Special Environmental Conditions</i>	
Sealant, hydraulic (item 52, appendix E)	Work in well ventilated area.	
Gaskets (6)		
Lockwashers (8)	<i>General Safety Instructions</i>	
Locknuts (4)	Fuel vapors are flammable.	
Tags, identification (item 55, appendix E)	Do not smoke within 50 ft. (15 m).	
<i>Personnel Required</i>		
MOS62B, Construction equipment repairer (2)		

4-49. FUEL/HYDRAULIC TANK REPLACEMENT/REPAIR (CONT).

WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

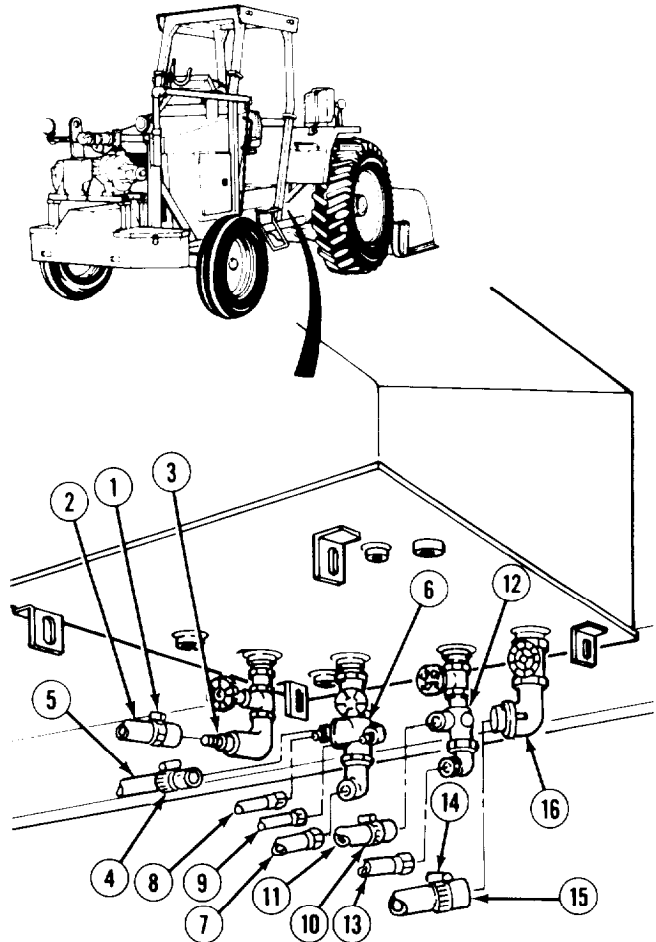
- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C tire extinguisher within easy reach when working with fuel or on a fuel system.
- Post signs that read “NO SMOKING WITHIN 50 FEET (15 m)” when working with open fuel, fuel lines or fuel tanks.
- Fuel is slippery and can cause falls. To avoid injury, wipe up spilled fuel with rags.

a. Removal.

NOTE

Tag and mark hydraulic hoses before removal.

- (1) Loosen clamp (1) and remove hose (2) from valve (3).
- (2) Loosen clamp (4) and remove hose (5) from valve (6).
- (3) Remove three hoses (7, 8, and 9) from valve (6).
- (4) Loosen clamp (10) and remove hose (11) from valve (12).
- (5) Remove hose (13) from valve (12).
- (6) Loosen clamp (14) and remove hose (15) from valve (16).

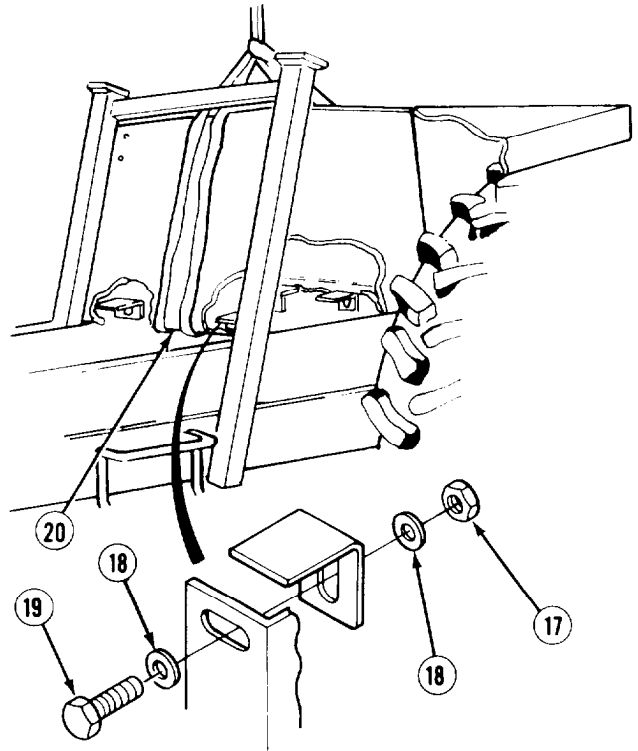


- (7) Remove four locknuts (17), eight washers (18), and four screws (19) from tank assembly (20).

WARNING

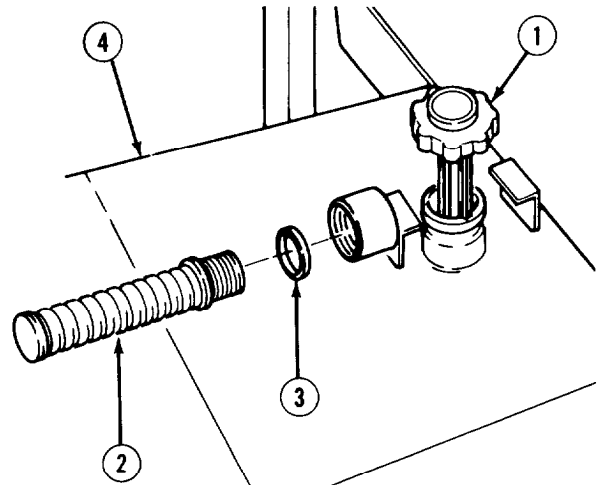
Fuel/hydraulic tank weighs 261 lbs (118 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (8) While mechanic operates suitable lifting device, assistant guides and removes tank assembly (20) from vehicle.



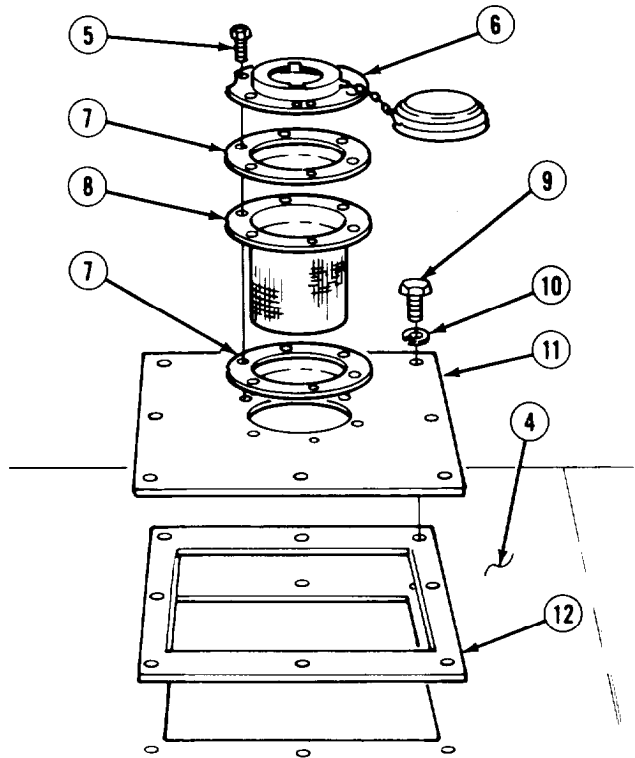
b. Disassembly.

- (1) Remove fill cap (1), spout (2), and gasket (3) from tank (4). Discard gasket.

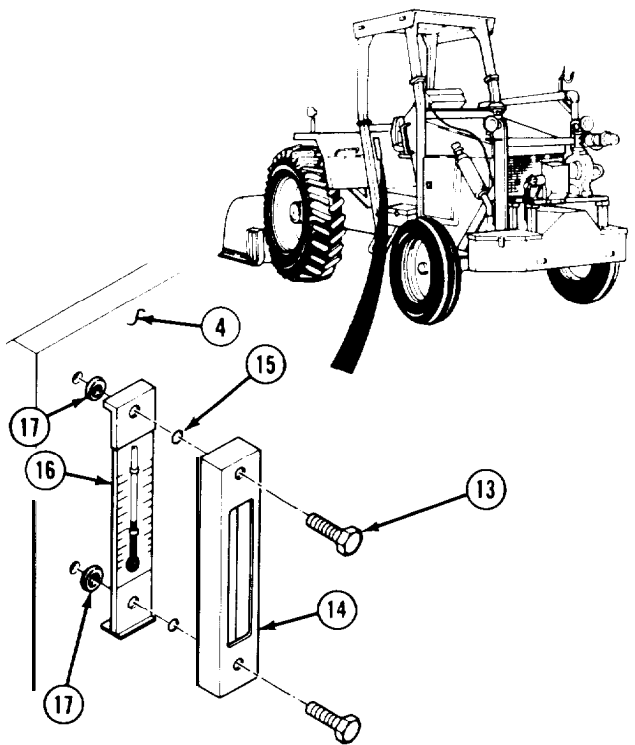


4-49. FUEL/HYDRAULIC TANK REPLACEMENT/REPAIR (CONT).

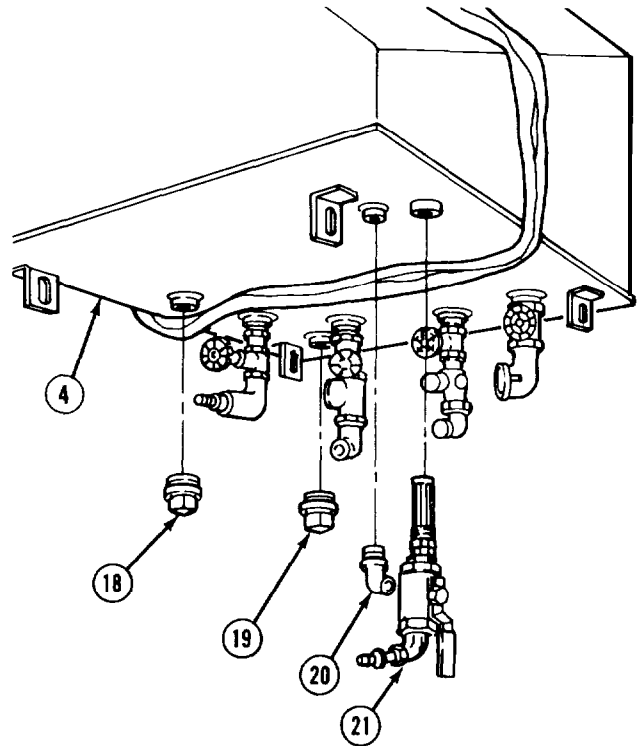
- (2) Remove six screws (5), cap plate (6), two gaskets (7), and fuel filter (8) from tank (4). Discard gaskets.
- (3) Remove eight screws (9), lockwashers (10), plate (11), and gasket (12) from tank (4). Discard lockwashers and gasket.



- (4) Remove two screws (13), cover plate (14), two preformed packings (15), hydraulic meter gauge (16) and gaskets (17) from tank (4). Discard preformed packings and gaskets.



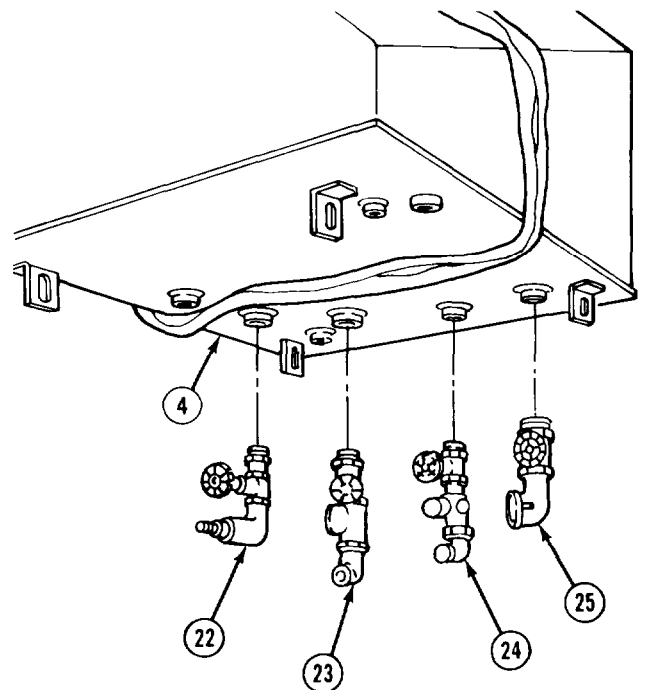
- (5) Remove drain plugs (18 and 19), fuel return fitting (20) and fuel shut off valve (21) from tank (4).



- (6) Remove fittings (22, 23, 24, and 25) from tank (4).

c. Cleaning/Inspection.

- (1) Wipe tank dry.
- (2) Inspect tank for rust, cracks, dents, and holes.
- (3) Repair or replace according to TM-9-237.



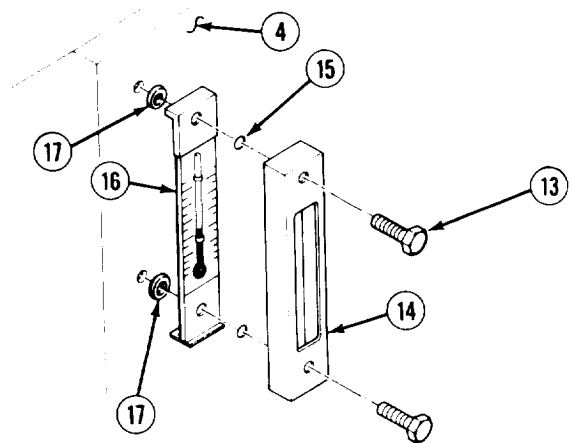
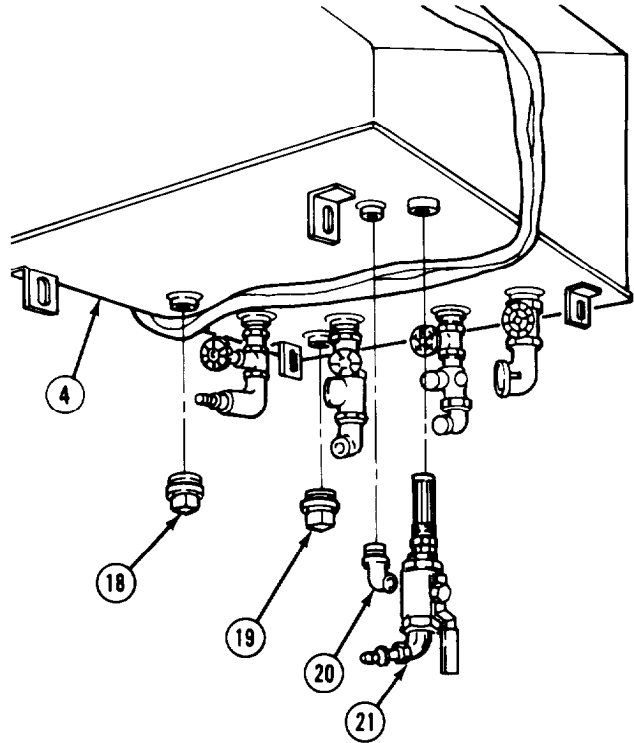
4-49. FUEL/HYDRAULIC TANK REPLACEMENT/REPAIR (CONT).

d. Assembly.

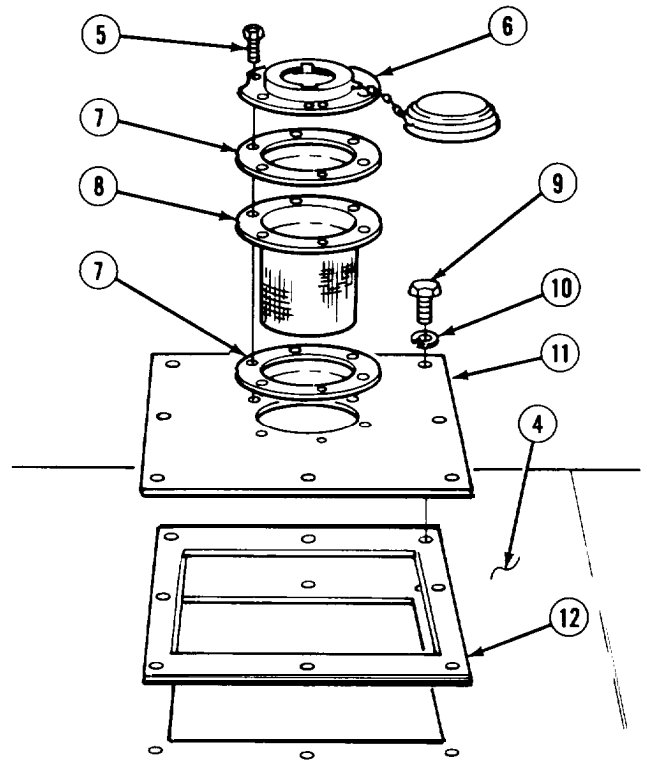
WARNING

Adhesive sealant can damage your eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

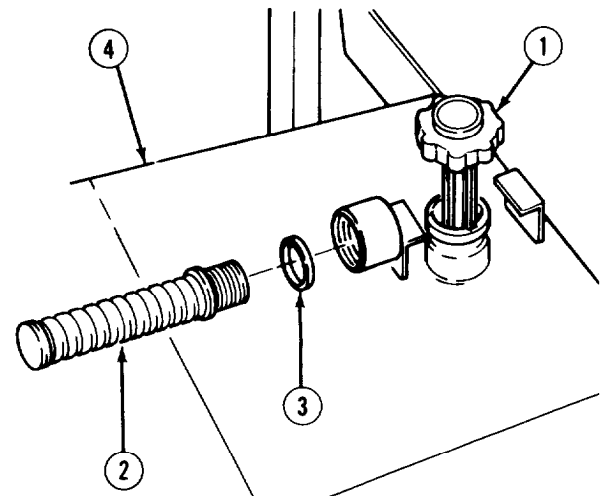
- (1) Coat threads of fittings (22, 23, 24 and 25) with pipe thread sealant compound and install in tank (4).
- (2) Coat threads of threads of fittings with pipe thread sealant compound and install fuel shutoff valve (21), fuel return fitting (20), and drain plugs (19 and 18).
- (3) Install two gaskets (17), hydraulic meter gauge (16), two preformed packings (15), and cover plate (14) on tank (4) with two screws (13).



- (4) Install gasket (12), and plate (11) with eight lockwashers (10), and screws (9) on tank (4).
- (5) Install fuel filter (8), two gaskets (7), cap plate (6), and six screws (5) on tank (4).



- (6) Install gasket (3), spout (2), and fill cap (1) on tank (4).

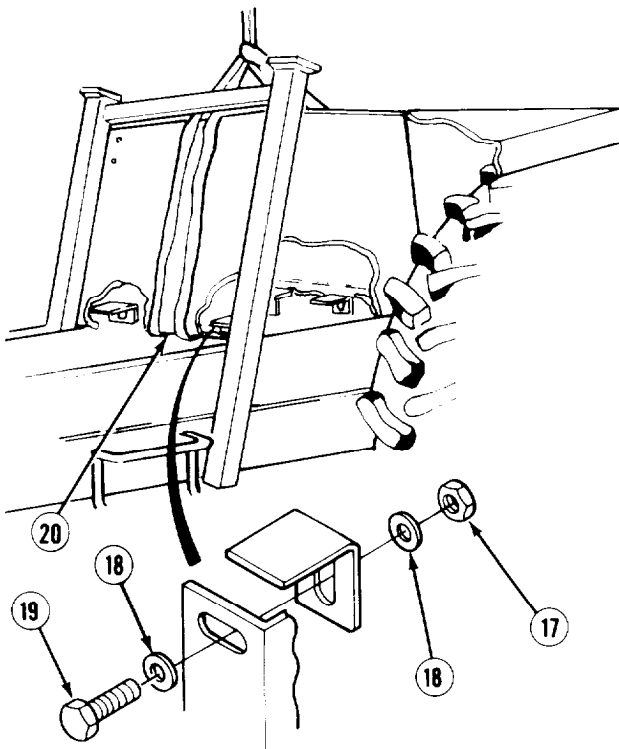


4-49. FUEL/HYDRAULIC TANK REPLACEMENT/REPAIR (CONT).

e. Installation.

Fuel/hydraulic tank weighs 261 lbs (118 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

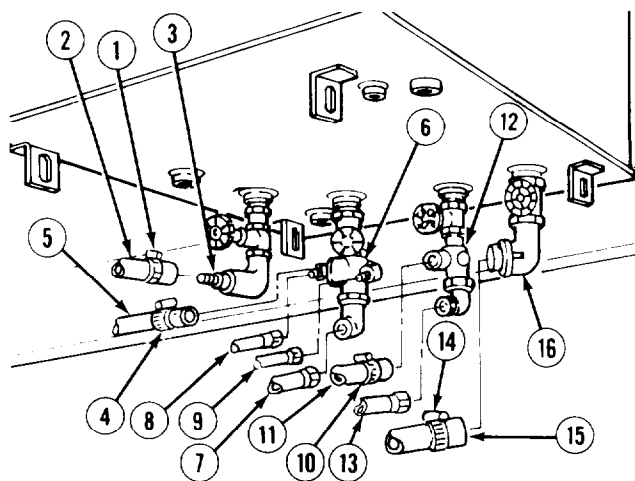
- (1) Mechanic operates suitable lifting device while assistant guides and installs fuel tank/hydraulic tank (20) on vehicle.
- (2) Install tank (20) with four screws (19), eight washers (18), and four nuts (17).



WARNING

Adhesive sealant can damage your eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (3) Coat threaded fittings on valves (16, 12, 6, and 3) with pipe thread sealant compound.
- (4) Install hose (15) on valve (16) and tighten clamp (14).
- (5) Install two hoses (13 and 11) on valve (12). Tighten clamp (10).
- (6) Install four hoses (9, 8, 7, and 5) on valve (6). Tighten clamp (4).
- (7) Install hose (2) on valve (3) and tighten clamp (1).



NOTE

Follow-on Maintenance:

- Install fuel lines (para 4-47).
- Install back-up horn (para 4-86).
- Fill hydraulic tank (para 3-11).
- Fill fuel tank (para 3-10).

END OF TASK

4-50. FUEL CAN ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 2-19

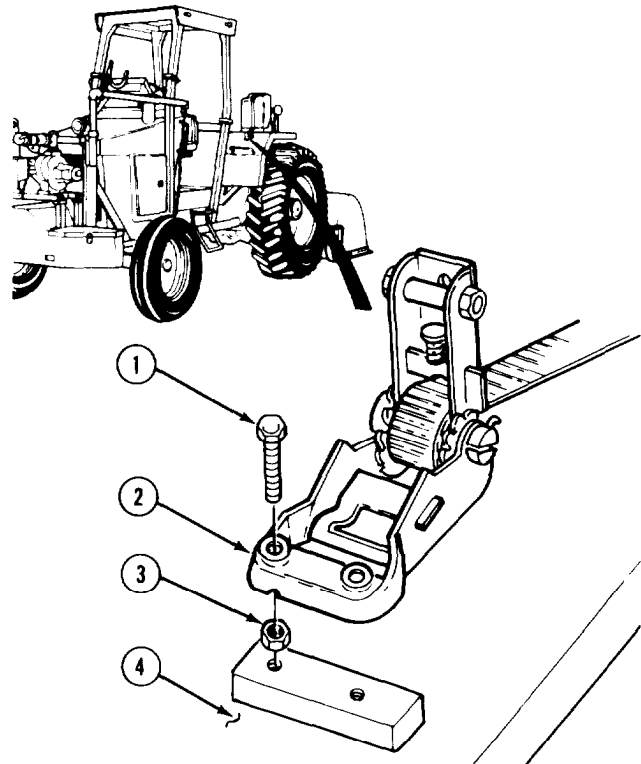
Condition Description
Fuel can removed.

Materials/Parts

Locknuts (4)

a. Removal.

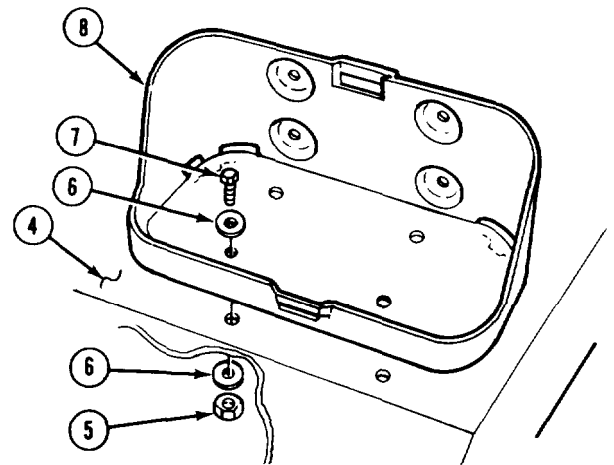
- (1) Remove two screws (1), tie down (2), and two nuts (3) from fender (4).



- (2) Remove four locknuts (5), eight washers (6), four screws (7), and holder (8) from fender (4). Discard locknuts.

b. Installation.

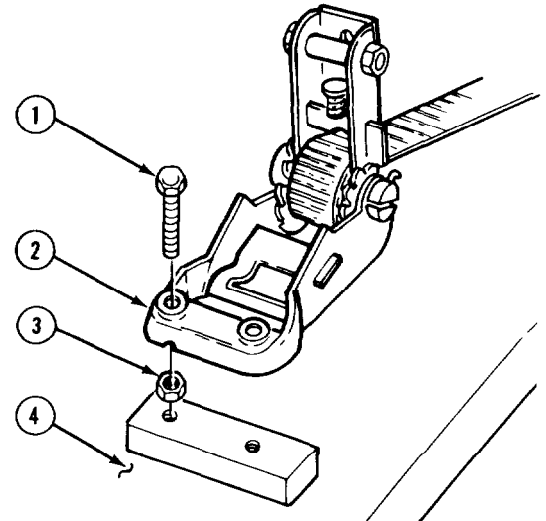
- (1) Install holder (8) on fender (4) with four screws (7), eight washers (6), and four locknuts (5).



NOTE

Nuts go between tie down and fender.

- (2) Install tie down (2) on fender (4) with two screws (1) and nuts (3).



NOTE

Follow-on Maintenance: Install fuel can (para 2-19).

END OF TASK

4-51. FUEL FILTER HEAD REPLACEMENT/REPAIR.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
- Oil, engine lubricating, (item 35, appendix E)
- Packing, preformed (2)

Equipment Condition

TM or Para

Para 4-52

Para 4-90

Condition Description

Fuel filter and water separator removed.
Negative battery cables disconnected.

General Safety Instructions

If engine has previously been in operation, allow engine time to cool before performing procedure.

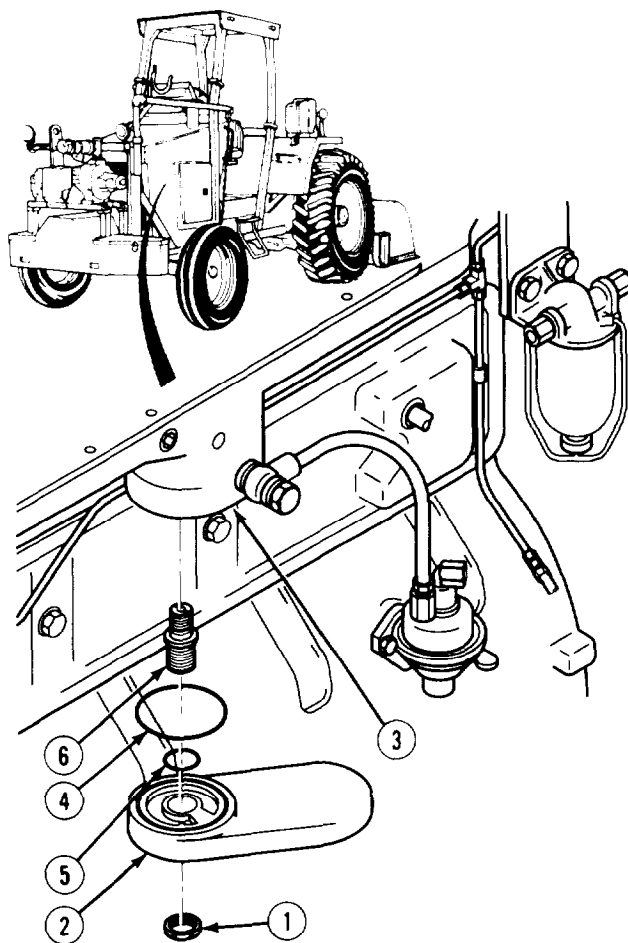
WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.

a. Removal.

- (1) Remove nut (1) and filter head (2) from manifold cover (3).
- (2) Remove and discard preformed packing (4) from filter head (2).
- (3) Remove preformed packing (5) and adapter (6). Discard preformed packing.



b. Cleaning/Inspection.

- (1) Wipe off all parts with lint-free cloth. Inspect filter head for cracks or other damage. If damage is found, replace filter head.
- (2) Inspect nut, plug, and adapter threads for wear. Replace all damaged parts.

c. Installation.

- (1) Install adapter (6) in manifold cover (3). Tighten adapter 24 lb-ft (32 N•m).
- (2) Install preformed packing (5) on adapter (6).
- (3) Install preformed packing (4).
- (4) Lubricate preformed packing (4) and center hole in filter head (2) with engine oil.
- (5) Install filter head (2) with nut (1). Tighten nut 24 lb-ft (32 N•m).

NOTE

Follow-on maintenance: Install fuel filter and water separator (para 4-52).

END OF TASK

4-52. FUEL FILTER AND WATER SEPARATOR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Materials/Parts

Cloth, lint-free (item 12, appendix E)

Filter, fuel

Filter/separator, fuel

Seals (2)

Fuel, diesel (item 30, appendix E)

Equipment Condition

TM or Para

Para 2-14

Condition Description

Left engine door opened.

Equipment Condition

TM or Para

Para 4-90

Condition Description

Negative battery cables disconnected.

General Safety Instructions

If engine has previously been operating, allow engine to cool before performing procedure.

Fuel vapors are flammable.

Do not smoke within 50 ft. (15 m).

a. Removal.



Fuel is very flammable and can explode easily. To avoid serious injury or death:

Keep fuel away from open flame or any spark (ignition source).

Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.

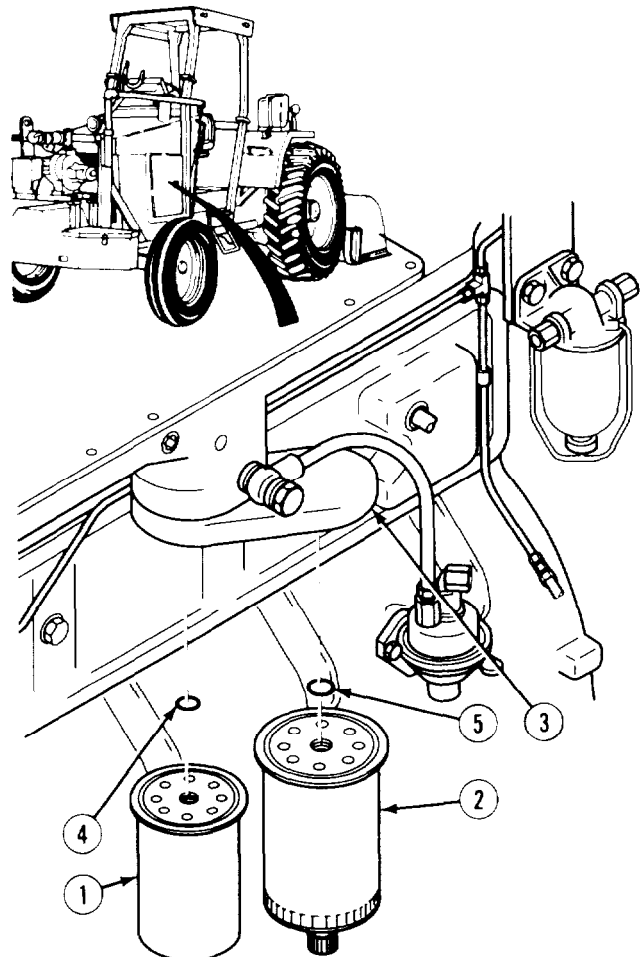
Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel, fuel lines or fuel tanks.

- (1) Remove and discard filter (1) and water separator (2) from filter head (3).

NOTE

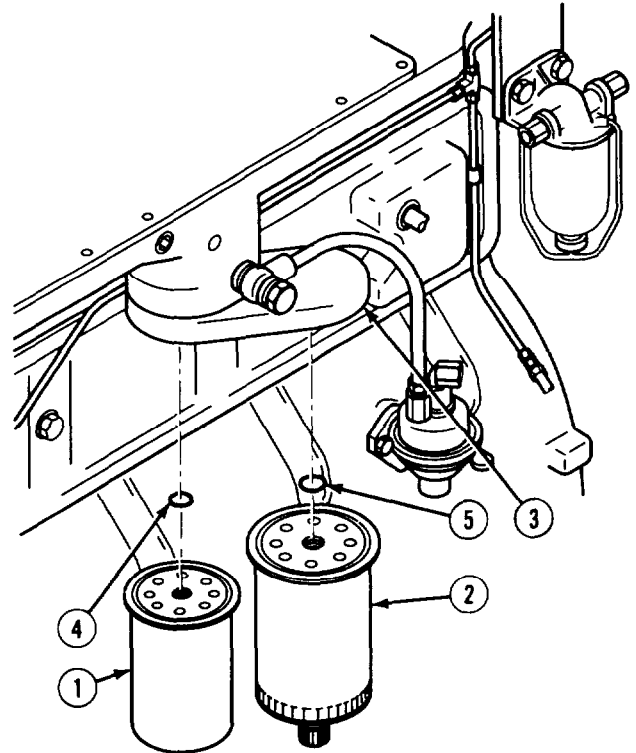
Seals come with filter and water separator when ordered.

- (2) Remove and discard two seals (4 and 5).



b. Installation.

- (1) Fill filter (1) and water separator (2) with diesel fuel.
- (2) Lubricate two seals (4 and 5) and gasket surface on filter (1) and water separator (2) with diesel fuel. Install two seals (4 and 5) in filter head (3).
- (3) Install filter (1) and water separator (2). Tighten filter 1/2 turn after contact.

**NOTE**

Follow-on Maintenance: Bleed fuel system (para 4-54).

END OF TASK

4-53. FUEL SEDIMENT BOWL REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Lockwashers (2)

Preformed packings (2)

Cloth, lint-free (item 12, appendix E)

Equipment Condition

TM or Para

Para 2-14

Condition Description

Left engine door opened.

Equipment Condition

TM or Para

Para 4-47

Condition Description

Fuel lines and fittings removed.

General Safety Instructions

If engine has previously been in operation, allow engine time to cool before performing procedure.

Fuel vapors are flammable.

Do not smoke within 50 ft. (15 m).

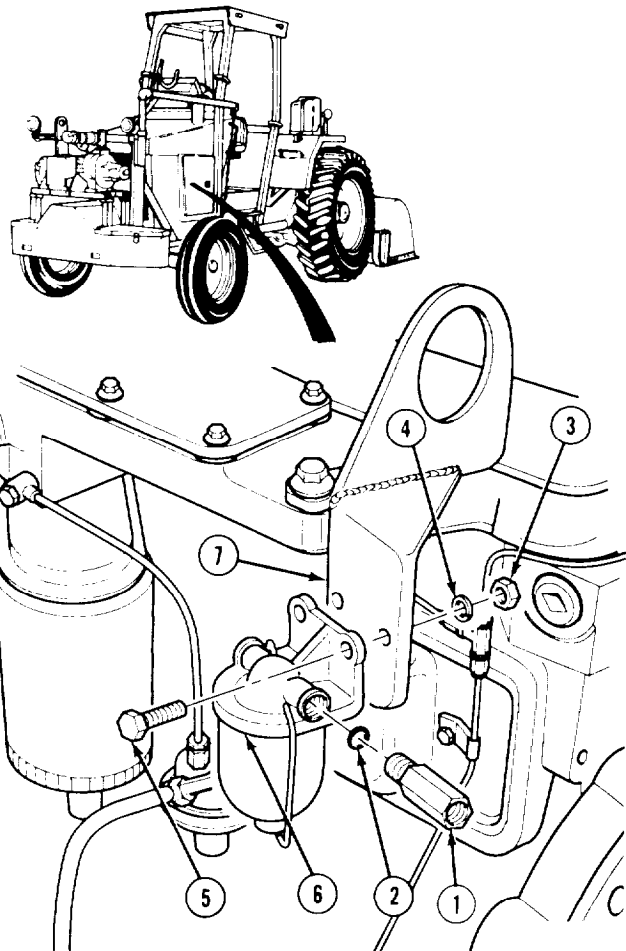
WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Post signs that read "NO SMOKING WITHIN 50 FEET (15.24 METERS)" when working with open fuel, fuel lines or fuel tanks.

a. Removal.

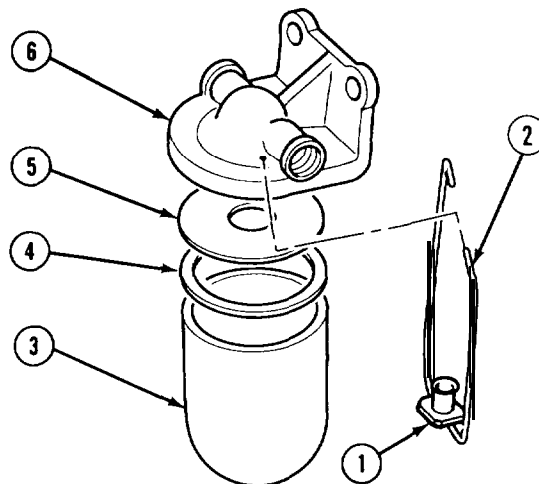
- (1) Remove two reducers (1) and preformed packings (2). Discard preformed packings.
- (2) Remove two nuts (3), lockwashers (4) screws (5), and sediment bowl assembly (6) from rear lifting bracket (7). Discard lockwasher.



b. Disassembly.**NOTE**

Fuel sediment bowl is replaced as an assembly. Do not lose any components when disassembling the fuel sediment bowl.

- (1) Loosen thumb wheel (1), unlatch wire holder (2), and remove bowl (3).
- (2) Remove wire holder (2).
- (3) Remove seal (4) and sediment filter (5) from sediment head (6).

**c. Cleaning/Inspection.****WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Flush sediment head with drycleaning solvent and dry with compressed air.
 - (2) Clean inside bowl with drycleaning solvent and dry with lint-free cloth.
 - (3) Inspect bowl for cracks and chips.
 - (4) Inspect sediment head for cracks and rust.

WARNING

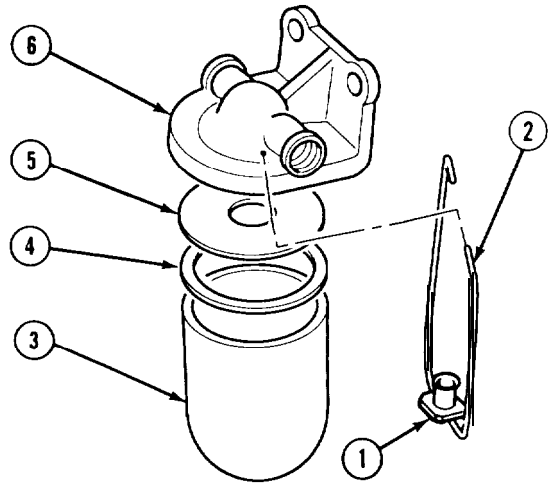
Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

- (5) Rinse seal and sediment filter with diesel fuel.
- (6) Replace all damaged parts.

4-53. FUEL SEDIMENT BOWL REPLACEMENT/REPAIR (CONT).

d. Assembly.

- (1) Install sediment filter (5) and preformed packing (4) in sediment head (6).
- (2) Position wire holder (2) and install bowl (3) (filled with new fuel to aid fuel system bleeding) on sediment head (6) and tighten thumb wheel (1) securely.



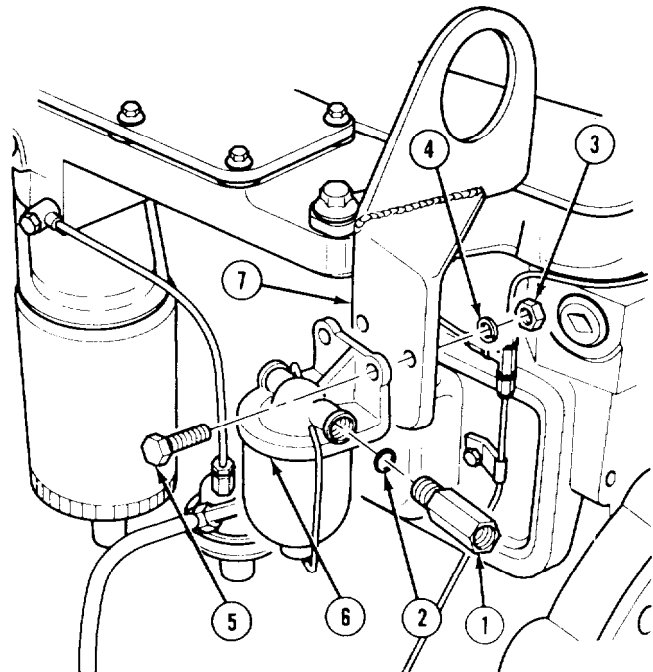
e. Installation.

- (1) Install sediment bowl assembly (6) on rear lifting bracket (7) with two screws (5), lockwashers (4), and nuts (3). Tighten nuts 216 lb-in (24 N•m).
- (2) Install two preformed packings (2) and reducers (1).

NOTE

Follow-on maintenance:

- Install fuel lines and fittings (para 4-47).
- Bleed fuel system (para 4-54).
- Close left engine door (para 2-14).



END OF TASK

4-54. FUEL SYSTEM BLEEDING.

This task covers:

Bleeding

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Suitable container (capacity 1 qt. [.9 liter])

Wrench, torque

General Safety Instructions

If engine has recently been operating, allow engine to cool before performing procedure.

Fuel vapors are flammable.
Do not smoke within 50 ft. (15 m).

Equipment Condition

TM or Para

Condition Description

Para 2-14

Left/right engine doors opened.

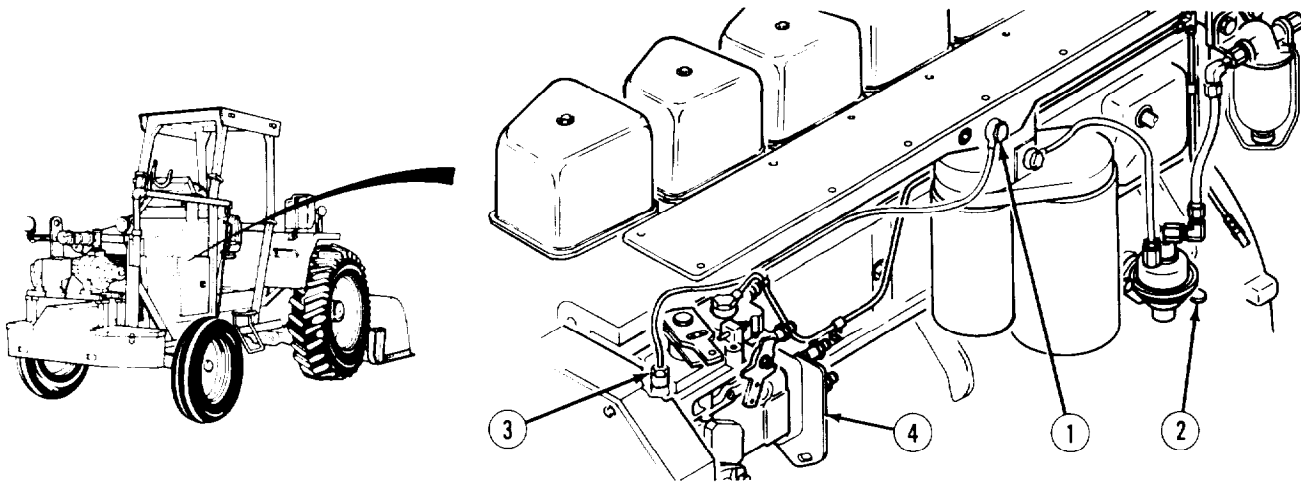
4-54. FUEL SYSTEM BLEEDING (CONT).

WARNING

Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.
- Post signs that read “NO SMOKING WITHIN 50 FEET (15 m)” when working with open fuel, fuel lines or fuel tanks.

Bleeding.



NOTE

Place suitable container with a 1 qt. (.9 liter) capacity under bleed screw to catch spilling fuel.

- (1) Loosen bleed screw (1).
- (2) Pump lever on lift pump (2) until fuel flowing is free from air.
- (3) Tighten bleed screw (1) 72 lb-in (8 N·m).

NOTE

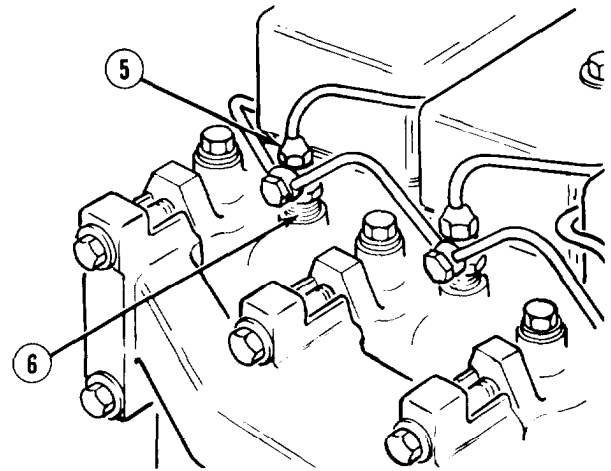
- Place suitable container with a 1 qt. (.9 liter) capacity under injection pump to catch spilling fuel.
 - Only bleed injection pump when injection pump or fuel lines have been replaced.
- (4) Loosen fuel pipe (3) on injection pump (4).
 - (5) Repeat step (2).
 - (6) Tighten fuel pipe (3) securely.

- (7) Start engine (para 2-9).

WARNING

Use caution when loosening intake fuel tubes. Pressure of fuel in tubes is sufficient to penetrate skin and cause severe injury.

- (8) Loosen six fuel tubes (5) on injectors (6) one at a time and tighten each securely until engine runs smoothly.
- (9) Turn off engine (para 2-10[c]).

**NOTE**

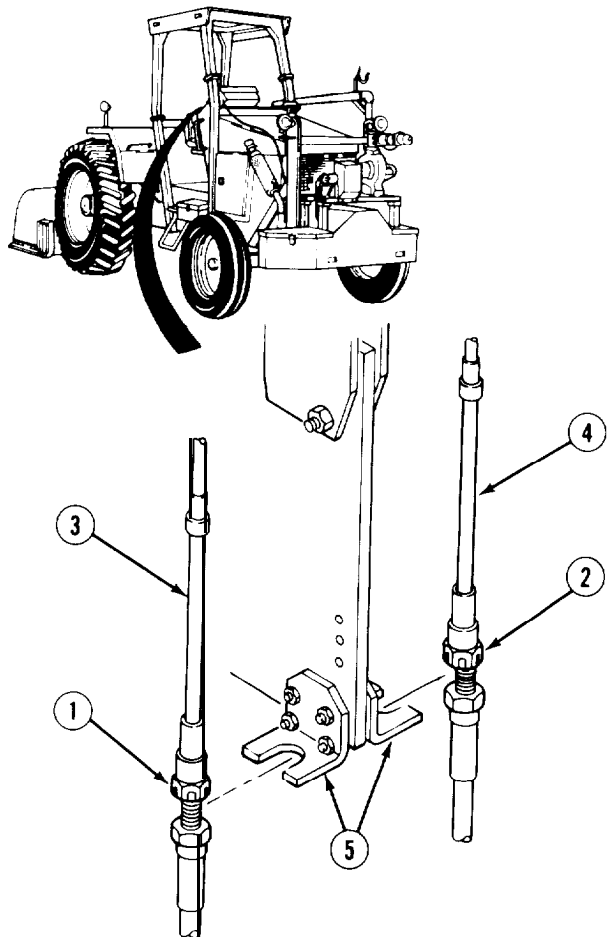
Follow-on Maintenance: Close left/right engine doors (para 2-14).

END OF TASK

4-55. THROTTLE AND PUMP CONTROL LEVERS REPLACEMENT/ADJUSTMENT.		
This task covers:		
a. Removal	b. Installation	c. Adjust
INITIAL SETUP		
<i>Tools</i> Tool kit, general mechanic's: automotive.	<i>Equipment Condition</i> TM or Para Para 4-128 Para 4-90	<i>Condition Description</i> Dash panel removed. Negative battery cables disconnected.
<i>Materials/Parts</i> Tags, identification (item 55, appendix E) Lockwashers (5)		

a. Removal.

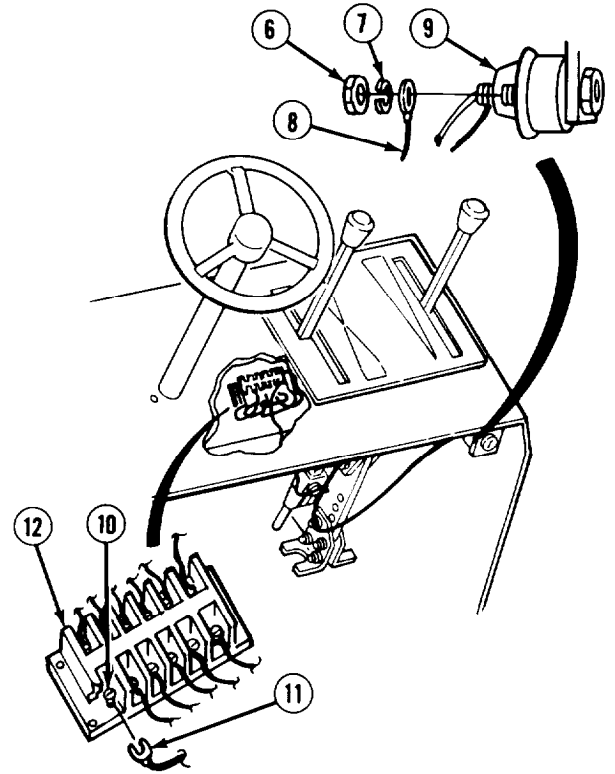
- (1) Loosen two jamnuts (1 and 2) and remove linkages (3 and 4) from bracket (5).



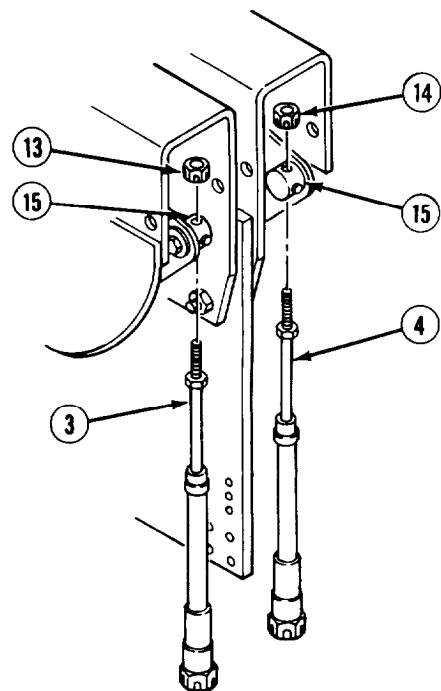
NOTE

Tag and mark all wires before removal.

- (2) Remove nut (6), lockwasher (7) and wire (8) from ignition switch (9). Discard lockwasher.
- (3) Loosen screw (10) and remove wire (11) from terminal block (12).



- (4) Remove two jamnuts (13 and 14) and linkages (3 and 4) from sleeves (15).

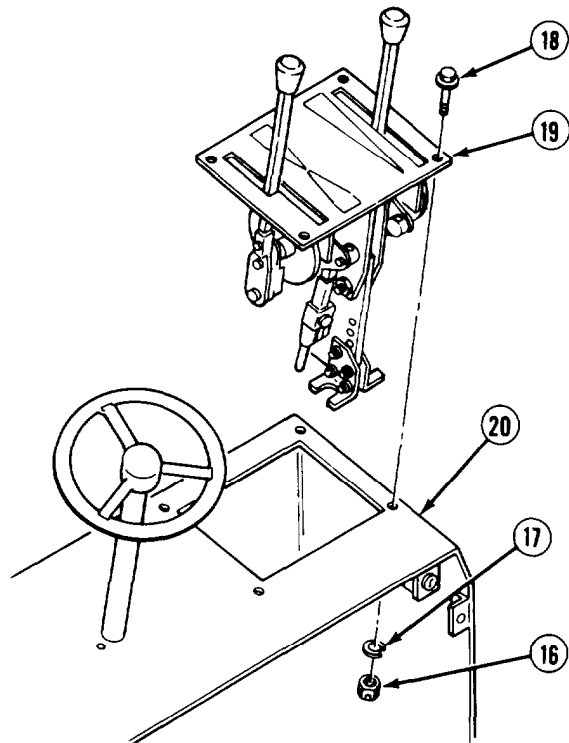


4-55. THROTTLE AND PUMP CONTROL LEVERS REPLACEMENT (CONT).

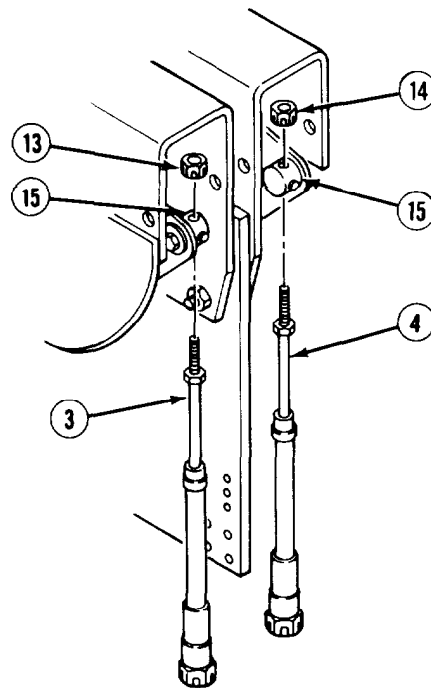
- (5) Remove four nuts (16), lockwashers (17), and screws (18) from throttle/pump control panel (19). Discard lockwashers.
- (6) Remove lift throttle/pump control panel (19) from dash (20).

b. Installation.

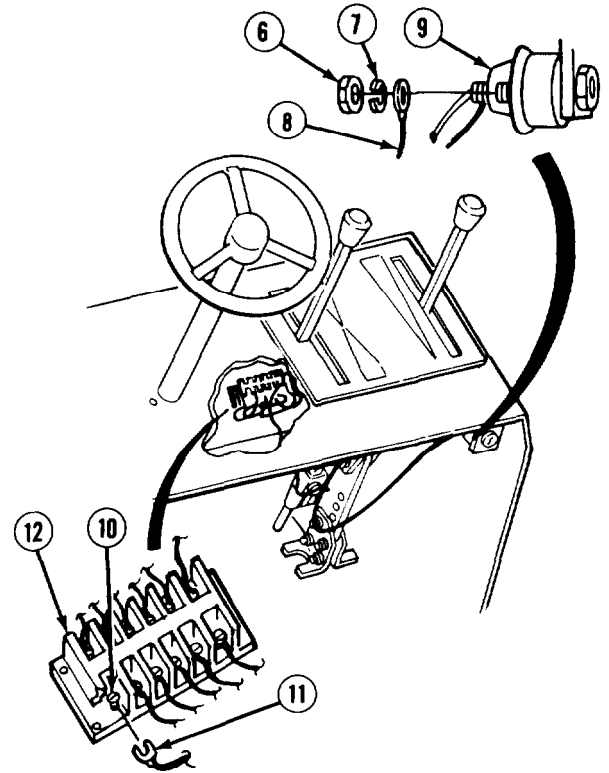
- (1) Position throttle/pump control panel (19) in dash (20).
- (2) Install four screws (18), lockwashers (17), and nuts (16).



- (3) Install linkages (3 and 4) in sleeves (15) with two jamnuts (14 and 13).



- (4) Install wire (11) in terminal block (12) and tighten screw (10) securely.
- (5) Install back-up horn lead (8) in ignition switch (9) with lockwasher (7) and nut (6).



- (6) Install linkage (3 and 4) in brackets (5) with jamnuts (1 and 2).

c. Adjustment.

NOTE

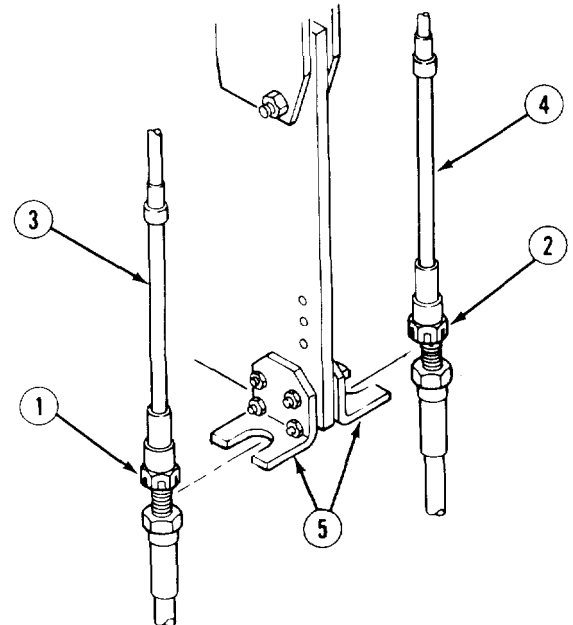
Adjust throttle control cable for full stop-to-stop movement.

- (1) To tighten throttle/pump cables: Turn top and bottom jamnuts to the right (clockwise).
- (2) To loosen throttle/pump control cable: Turn top and bottom jamnuts to the left (counterclockwise).

NOTE

Follow-on Maintenance:

- Install dash panel (para 4-128).
- Connect negative battery cables (para 4-90).



END OF TASK

4-56. THROTTLE CABLE AND BRACKET REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

Lockwashers (2)

Equipment Condition

TM or Para
Para 4-56

Condition Description

Fuel throttle cable removed from control lever.

a. Removal.

- (1) Loosen nut (1), pull back on spring capture (2), and remove fuel throttle cable (3).
- (2) Remove two screws (4), lockwashers (5) and throttle bracket (6) from engine access cover (7). Discard lockwashers.

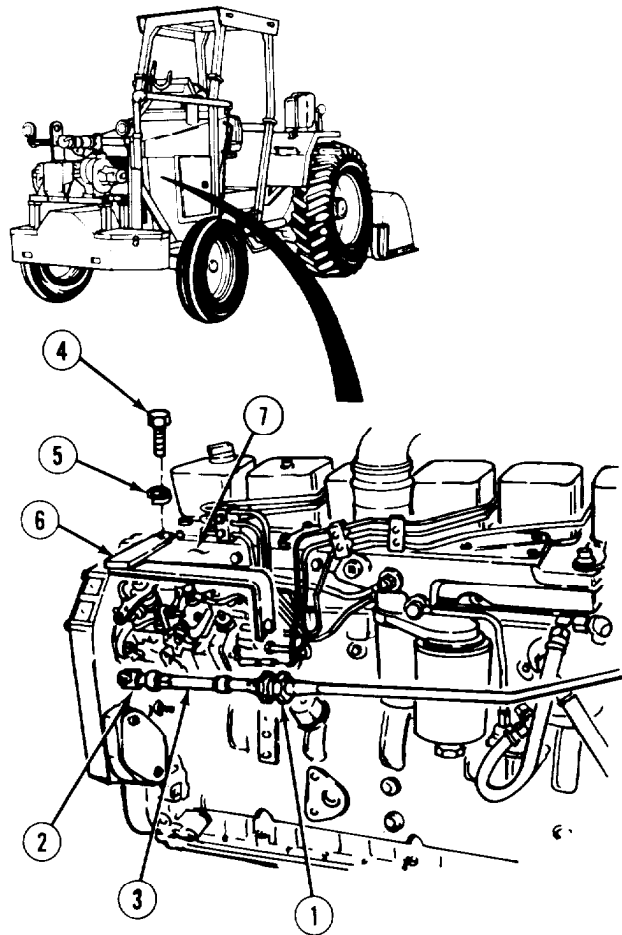
b. Installation.

- (1) Install throttle bracket (6) on engine access cover (7) with two lockwashers (5) and screws (4). Tighten screws 216 lb-in (24 N•m).
- (2) Pull back on spring capture (2), install fuel throttle cable (3) and tighten nut (1) securely.

NOTE

Follow-on Maintenance: Install fuel throttle cable (para 4-56).

END OF TASK



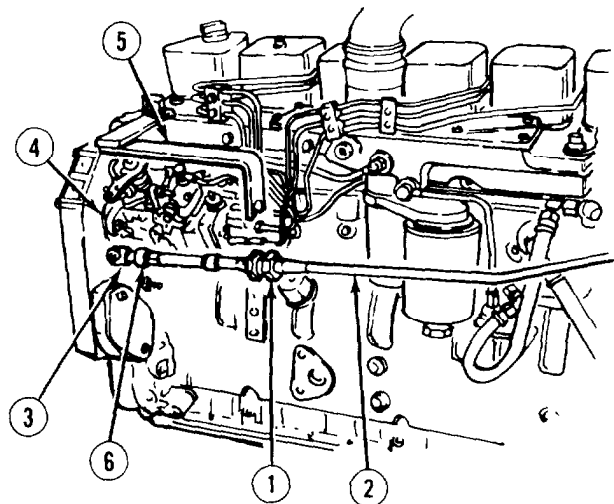
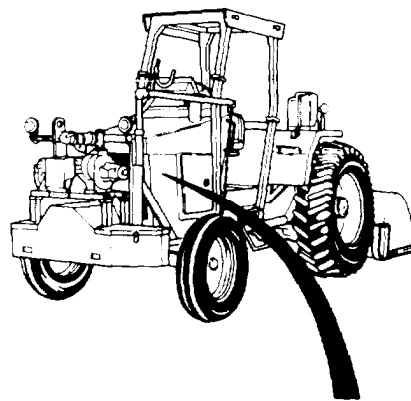
4-57. THROTTLE CABLE ADJUSTMENT.		
This task covers:		
Adjustment		
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 2-13 Para 2-14	Parking brake set. Left engine door opened

Adjustment.

- (1) Loosen jamnut (1) on throttle cable (2).
- (2) Remove spring capture (3) from fuel injection pump (4) and cable (2) from bracket (5).

NOTE

- Loosening or tightening spring capture will lengthen or shorten throttle linkage.
 - When the control lever on the fuel injection pump is flush against setscrew in both high and low settings, the fuel throttle cable setting is correct.
- (3) Loosen nut (6) and adjust spring capture (3) to correct length. Tighten nut securely behind spring capture.
 - (4) Install spring capture (3) on fuel injection pump (4).
 - (5) Install throttle cable (2) in bracket (5) and tighten nut (1).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

4-58. EXHAUST OUTLET PIPE REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools
 Tool kit, general mechanic's: automotive

 Wrench, torque

Equipment Condition
 TM or Para
 Para 4-58
 Condition Description
 Exhaust outlet pipe removed.

Materials/Parts
 Compound, anti-seize (item 13, appendix E)

General Safety Instructions
 If engine has recently been in operation, allow time for cooling before performing procedure.

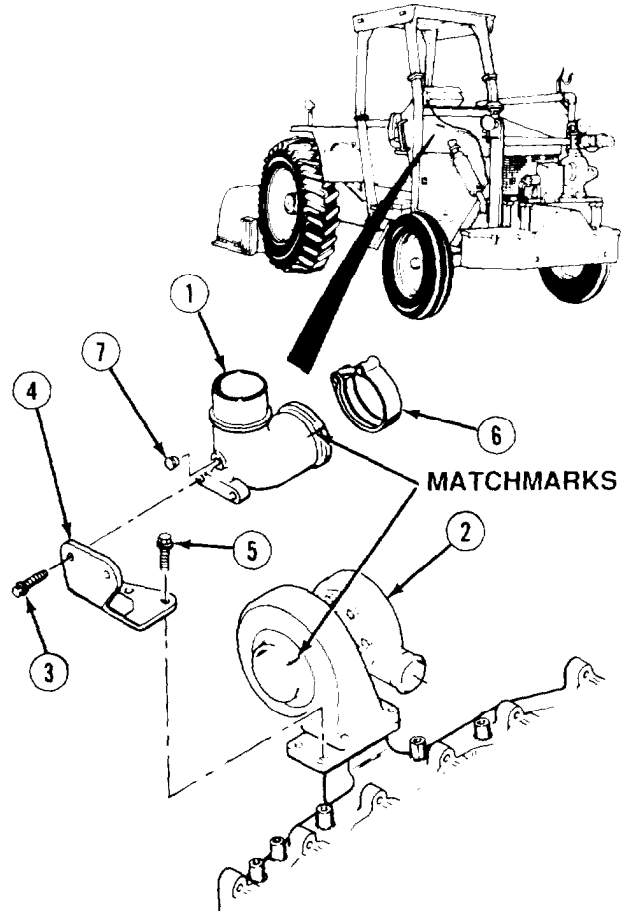
a. Removal.

- (1) Matchmark exhaust connector (1) and turbocharger (2).
- (2) Remove two screws (3) from brace (4).
- (3) Remove two screws (5) and brace (4).
- (4) Loosen clamp (6) and remove clamp and exhaust connection (1) from turbocharger (2).

NOTE

Only remove pipe plug if replacement is necessary.

- (5) If damaged, remove pipe plug (7) from exhaust connection (1).

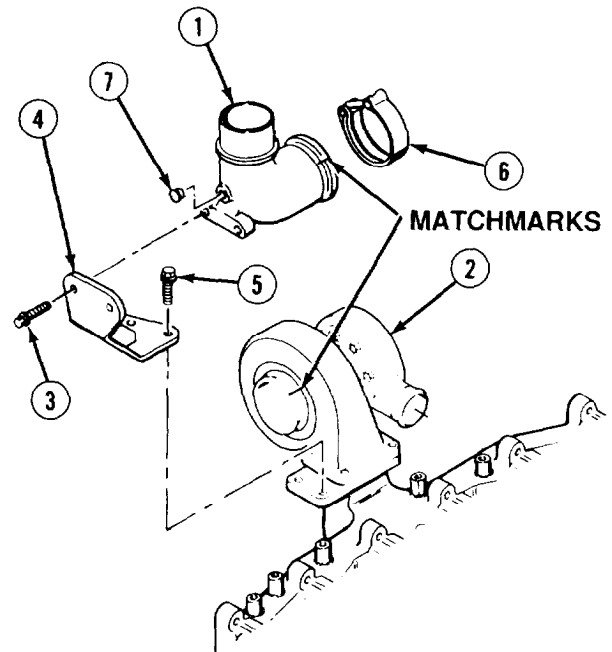


b. Cleaning/Inspection.

- (1) Remove any debris from exhaust connection and manifold.
- (2) Inspect exhaust connection for holes and burnout.
- (3) Replace corroded or damaged parts.

c. Installation.

- (1) If removed, install pipe plug (7). Tighten plug 204 lb-in (23 N·m).
- (2) Apply anti-seize compound to threads of four screws (3 and 5).
- (3) Install brace (4) on exhaust connection (1) with two screws (3). Tighten screws 32 lb-ft (43 N·m).

**NOTE**

Align holes in brace and exhaust manifold before tightening clamp.

- (4) Install exhaust connection (1) on turbocharger with clamp (6). Tighten clamp 72 lb-in (8 N·m).
- (5) Install two screws (5). Tighten screws 32 lb-ft (43 N·m).

NOTE

Follow-on Maintenance: Install exhaust pipe (para 4-58).

END OF TASK

4-59. MUFFLER AND EXHAUST PIPES REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

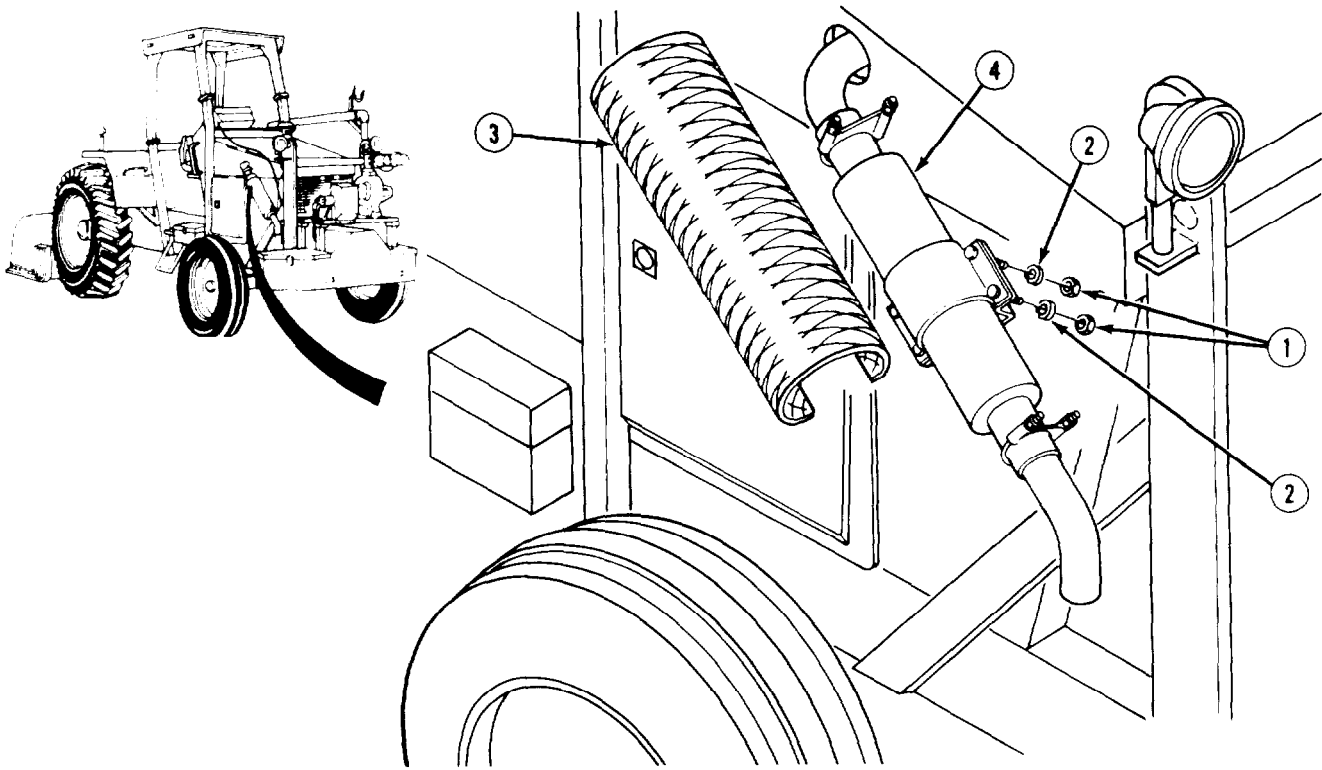
General Safety Instructions

Muffler must be cool before removal.

Materials/Parts

Lockwashers (6)

a. Removal

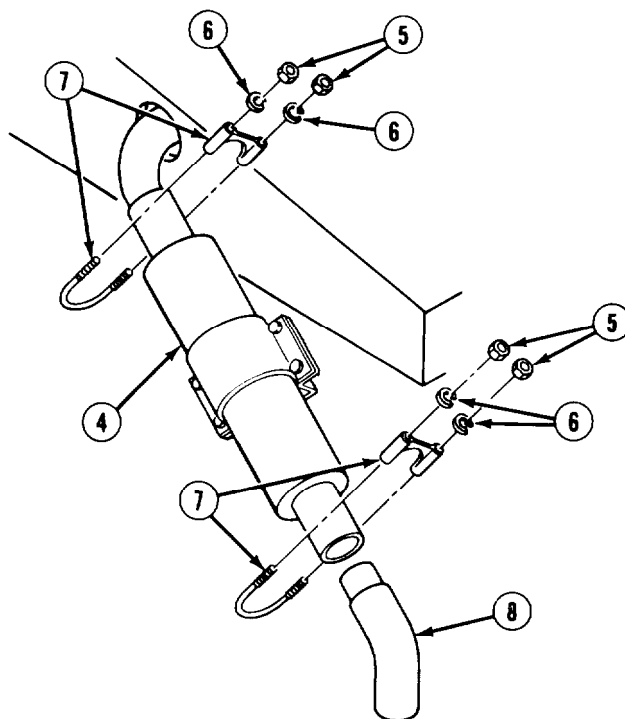


WARNING

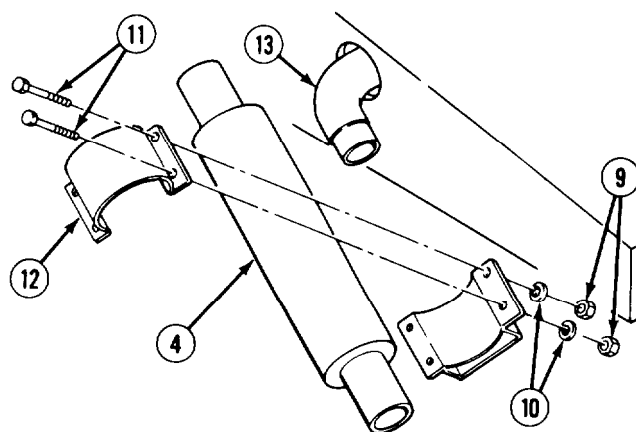
Do not touch hot exhaust system with bare hands; injury to personnel will result.

- (1) Remove four nuts (1), lockwashers (2), and heat guard (3), from muffler (4). Discard lockwashers.

- (2) Remove four nuts (5), lockwashers (6), two u-bolt assemblies (7), and exhaust pipe (8) from muffler (4). Discard lockwashers.

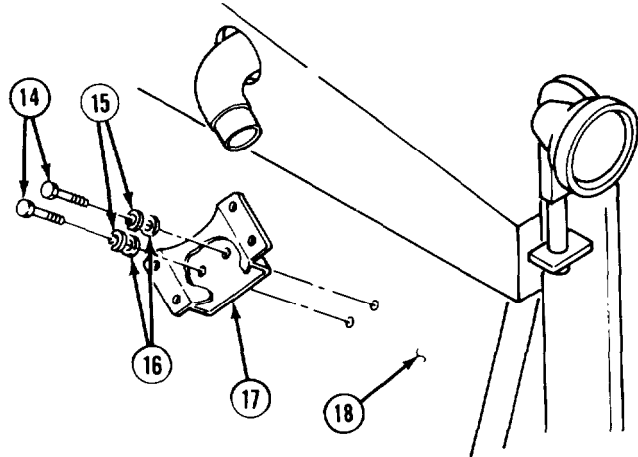


- (3) Remove four nuts (9), lockwashers (10), screws (11), muffler retainer (12), and muffler (4) from pipe (13). Discard lockwashers.



4-59. MUFFLER AND EXHAUST PIPES REPLACEMENT (CONT).

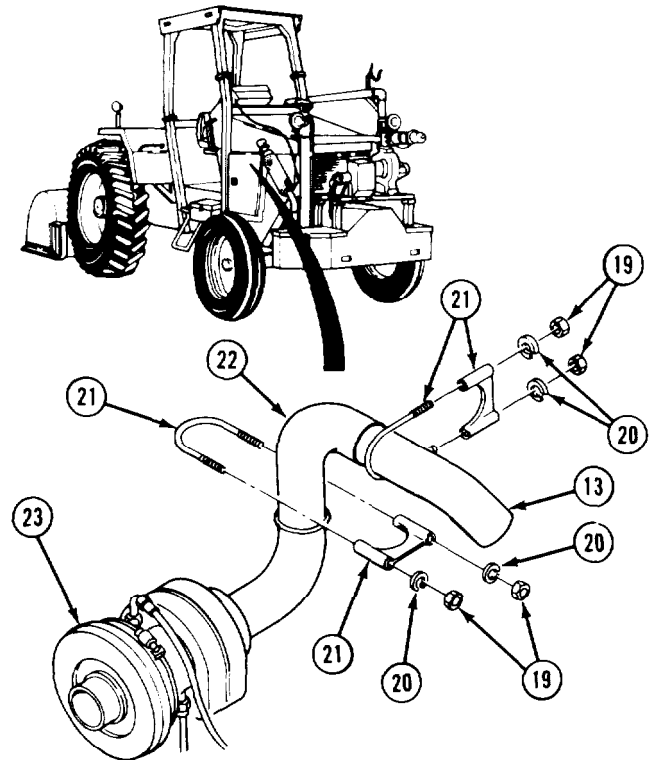
- (4) Remove two screws (14), lockwashers (15), washers (16), and muffler bracket (17) from engine panel (18). Discard lockwashers.



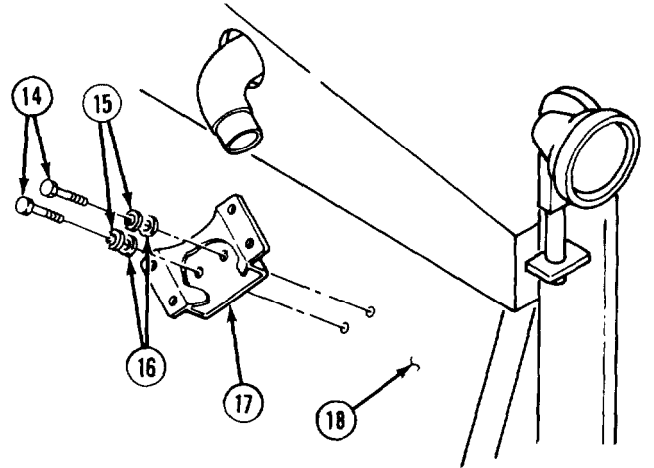
- (5) Open right side engine door and remove four nuts (19), lockwashers (20), two u-bolt assemblies (21), and exhaust pipes (13 and 22) from turbocharger (23). Discard lockwashers.

b. Installation.

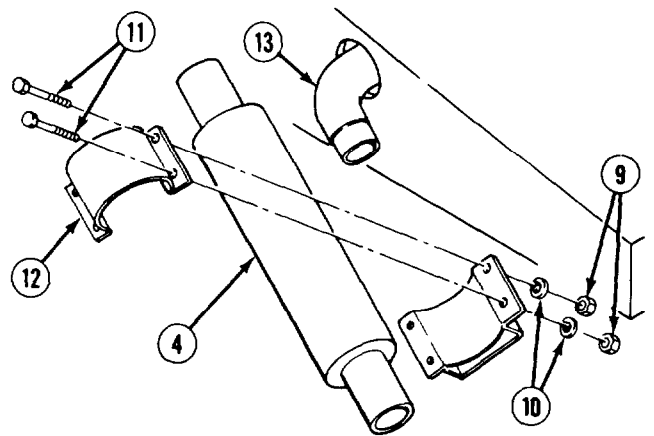
- (1) Install exhaust pipes (13 and 22) and two u-bolt assemblies (21) on turbocharger (23) with four washers (20) and nuts (19). Close right engine door.



- (2) Install muffler bracket (17) on engine panel (18) with two washers (16) lockwashers (15), and screws (14). Do not tighten.

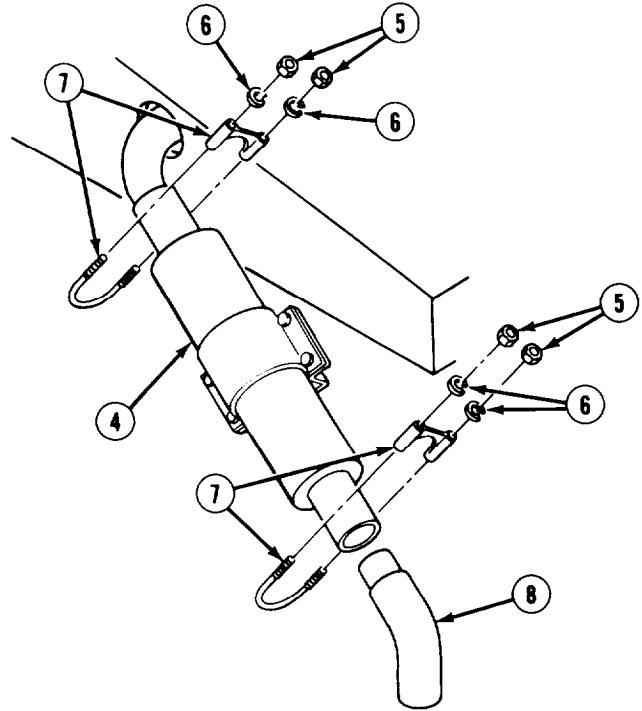


- (3) Install muffler (4) on pipe (13) with muffler retainer (12) and secure with four screws (11), lockwashers (10), and nuts (9). Tighten screws (11 and 14) securely.

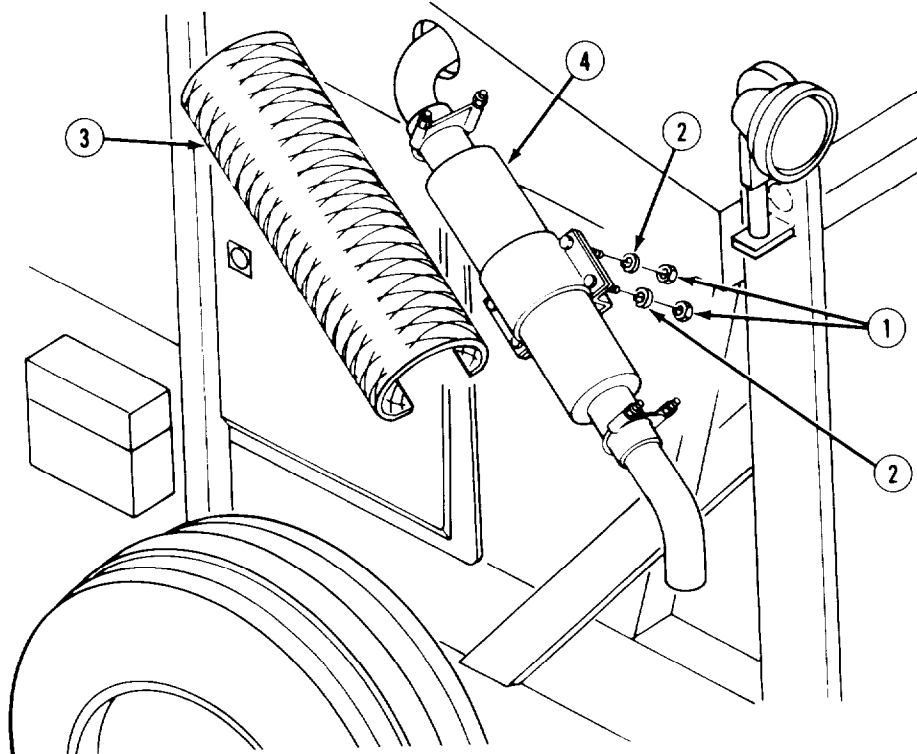


4-59. MUFFLER AND EXHAUST PIPES REPLACEMENT (CONT).

- (4) Install exhaust pipe (8), muffler (4) and two u-bolt assemblies (7) with four lockwashers (6) and nuts (5).



- (5) Install heat guard (3) on muffler (4) with four lockwashers (2) and nuts (1).



END OF TASK

4-60. RADIATOR ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting device (80 lb (36 kg) capacity)

Materials/Parts

Lockwashers (6)

Personnel Required

MOS62B. Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 4-62

Para 4-61

Condition Description

Coolant hoses disconnected.

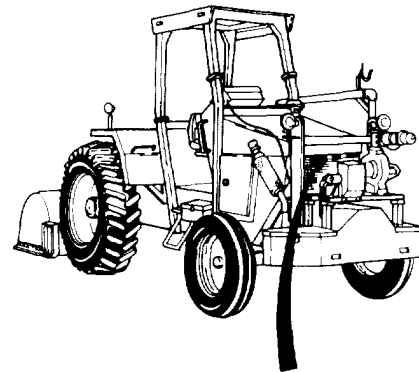
Radiator grille removed.

General Safety Instructions

Radiator must be cool before start of work.

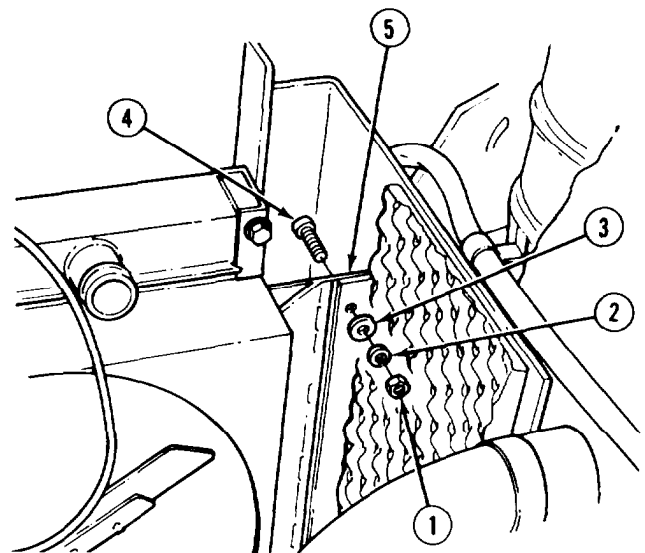
WARNING

- Extreme care should be taken when removing radiator from vehicle. Radiator should not be removed if engine temperature is above 180°F (82°C). Injury to personnel may result.
- Left over radiator fluid may still be present in the radiator. Care should be taken not to come in contact with hot fluid or injury could result.



a. Removal.

- (1) Remove six nuts (1), lockwashers (2), five washers (3), and six screws (4) from radiator brackets (5). Discard lockwashers.

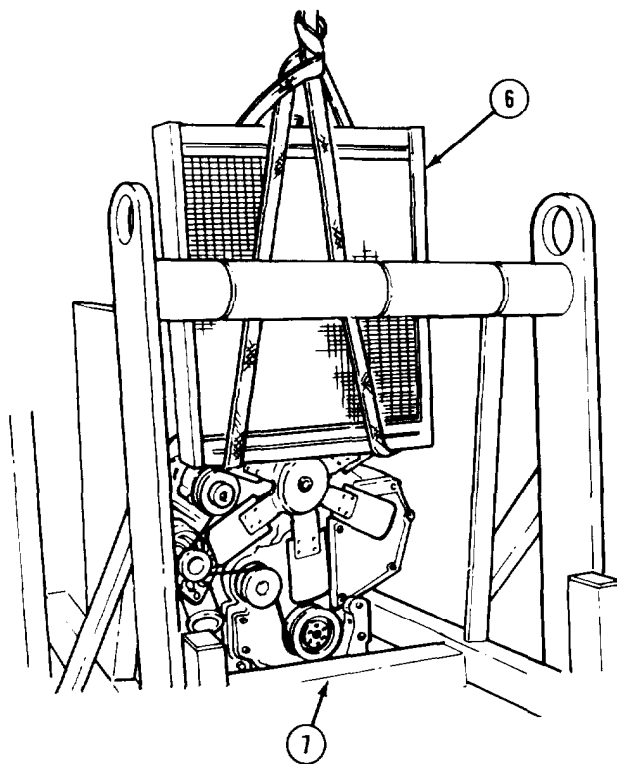


4-60. RADIATOR ASSEMBLY REPLACEMENT (CONT).

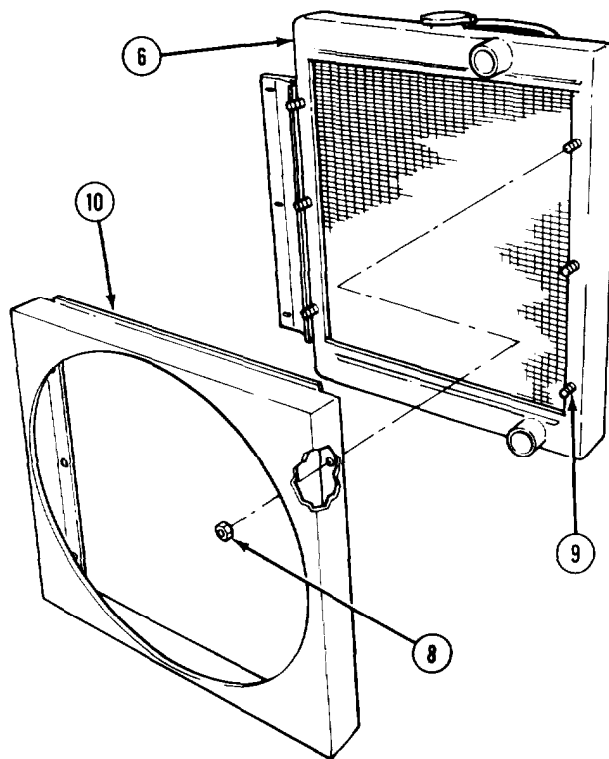
WARNING

Radiator weighs 80 lbs (36 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (2) Mechanic operates suitable lifting device while assistant guides and removes radiator (6) from frame (7).



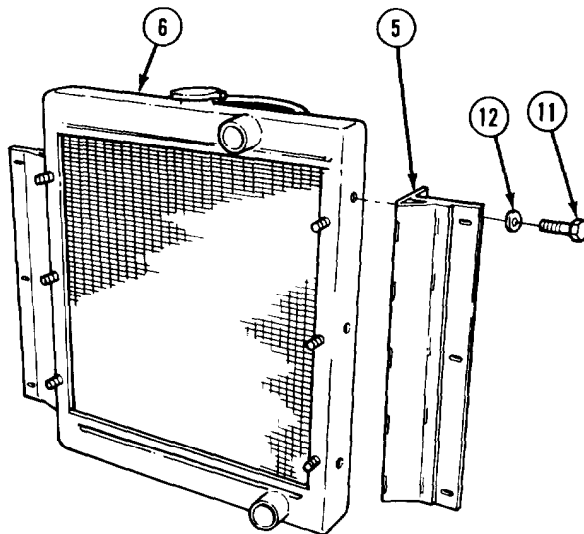
- (3) Remove six nuts (8) from shroud studs (9).
- (4) Remove radiator shroud (10) from radiator (6).



- (5) Remove six screws (11), washers (12) and radiator brackets (5) from side of radiator (6).

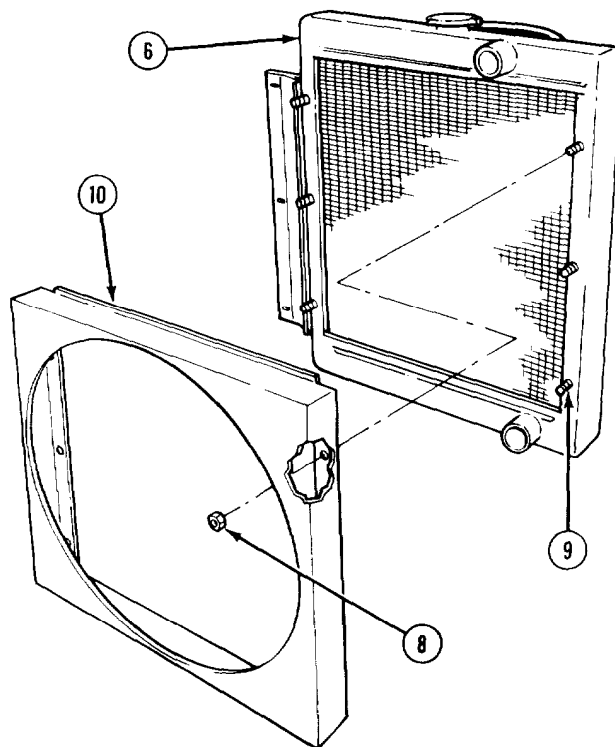
b. Installation.

- (1) Position brackets (5) on side of radiator (6) and install six lockwashers (12) and screws (11).



D-1114-SM

- (2) Position radiator shroud (10) on radiator (6) install six nuts (8) on shroud studs (9). Do not tighten nuts.

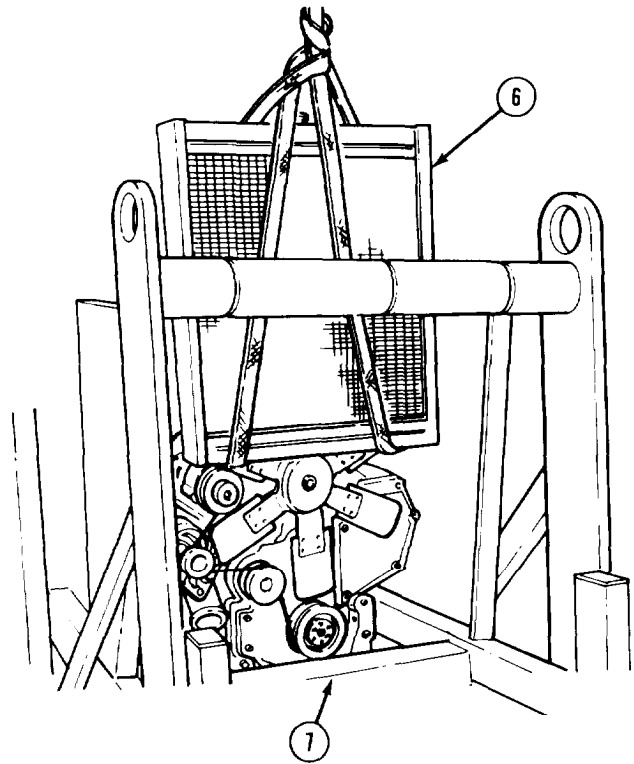


4-60. RADIATOR ASSEMBLY REPLACEMENT (CONT).

WARNING

Radiator weighs 80 lbs (36 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

- (3) Mechanic operates lifting device while assistant guides and installs radiator (6) on frame (7).



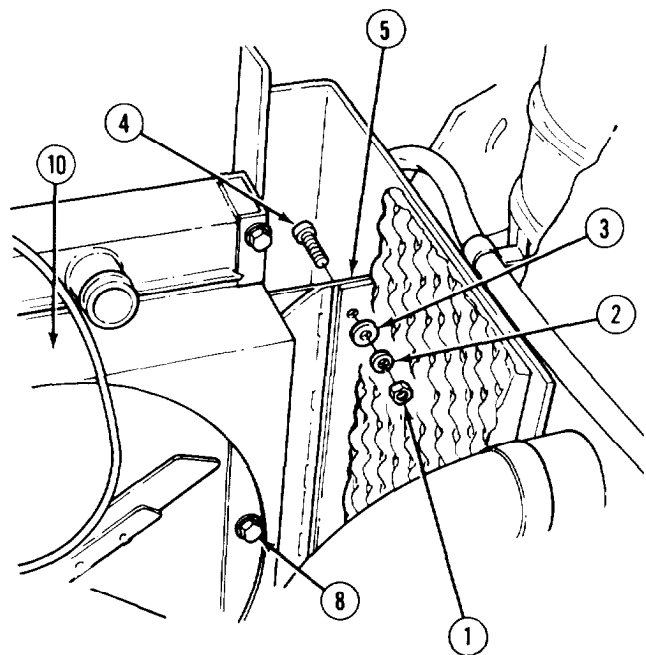
- (4) Install six screws (4), five washers (3), six lockwashers (2), and nuts (1) in radiator brackets (5).
- (5) Center shroud (10) around fan and tighten six nuts (8).

NOTE

Follow-on Maintenance:

- Connect coolant hoses (para 4-62).
- Install radiator grille (para 4-61).

END OF TASK



4-61. RADIATOR GRILLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Personnel Required

MOS62B, Construction equipment repairer (2)

Materials/Parts

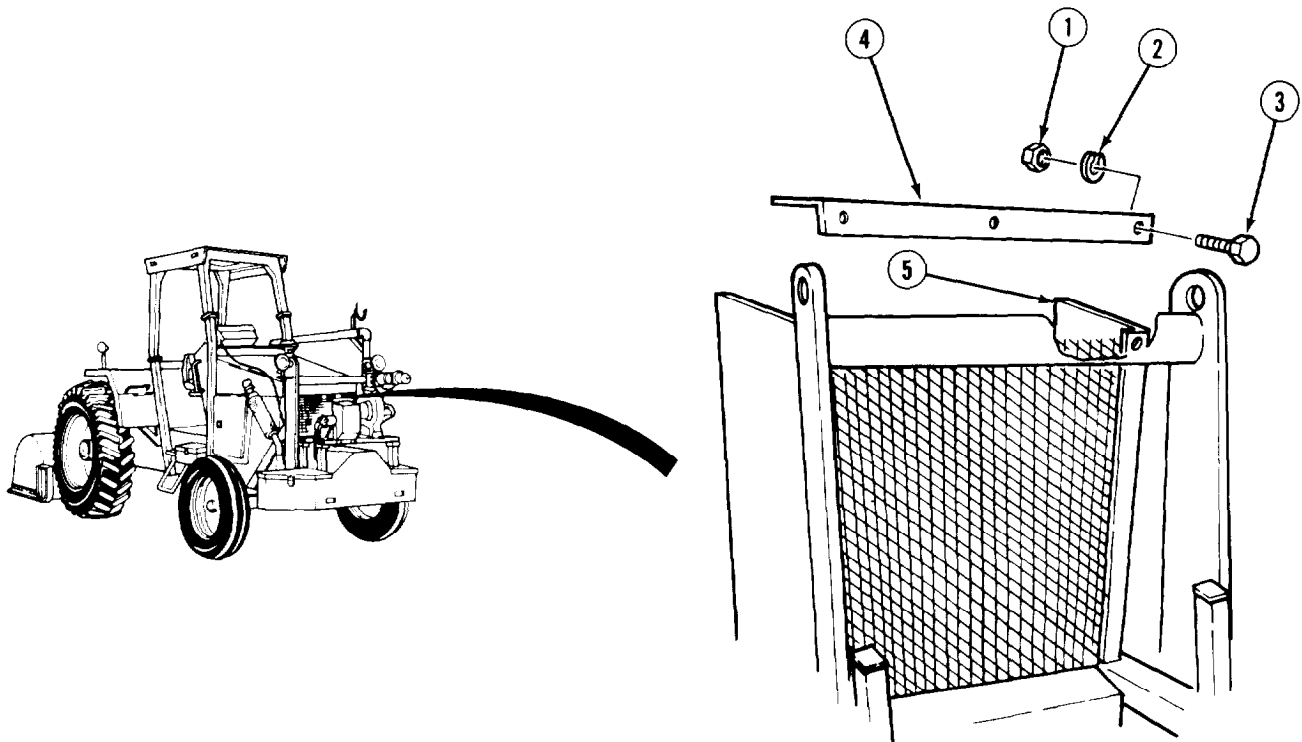
Lockwashers (11)

Equipment Condition

TM or Para
Para 4-125

Condition Description
Hood removed.

a. Removal.



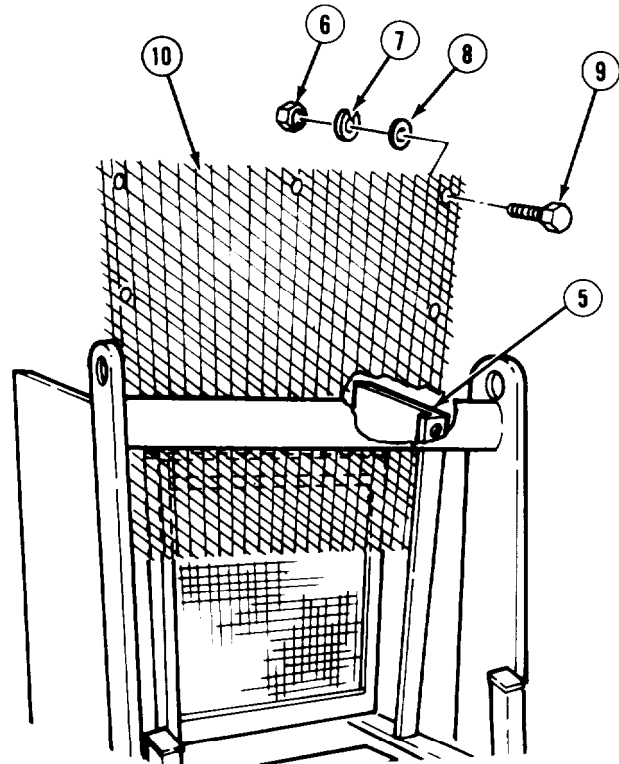
- (1) Remove three nuts (1), lockwashers (2), screws (3), and grille support (4) from frame (5). Discard lockwashers.

4-61. RADIATOR GRILLE REPLACEMENT (CONT).

- (2) Remove eight nuts (6), lockwashers (7), washers (8), and screws (9). Discard lockwashers.
- (3) Remove grille (10) from frame (5).

b. Installation.

- (1) Install front grille (10) in frame (5) with eight screws (9), washers (8), lockwashers (7), and nuts (6).

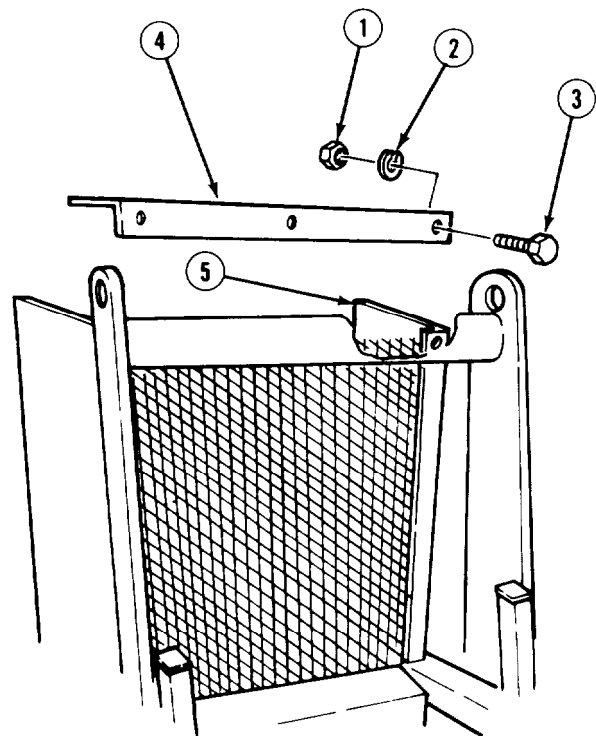


- (2) Install frame support (4) on frame (5) with three screws (3), lockwashers (2), and nuts (1).

NOTE

Follow-on Maintenance: Install hood (para 4-125).

END OF TASK



4-62. COOLANT HOSES REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Equipment Condition

TM or Para
Para 4-66
Para 4-125

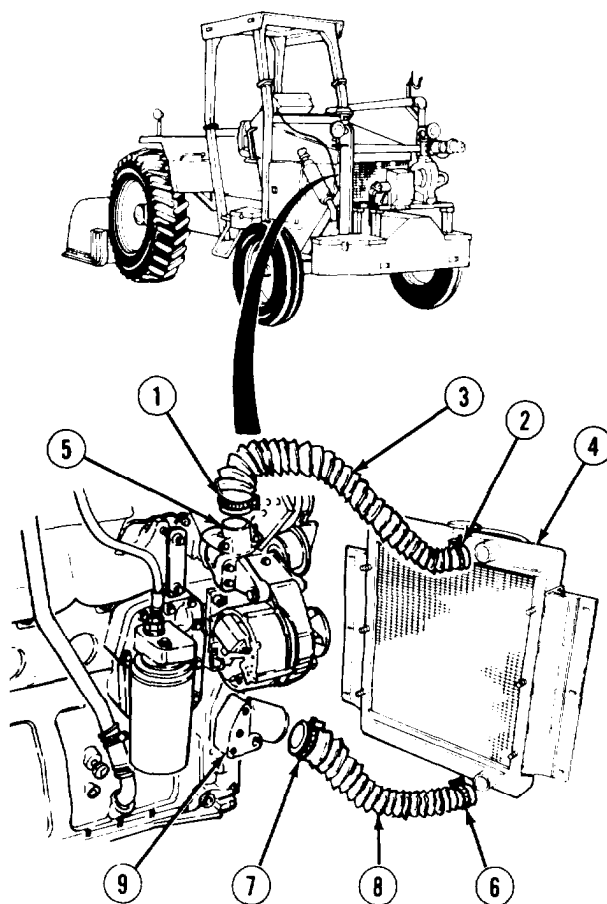
Condition Description
Coolant system drained.
Hood removed.

a. Removal.

- (1) Loosen two clamps (1 and 2).
- (2) Remove hose (3) from radiator (4) and thermostat housing (5).
- (3) Remove two clamps (1 and 2) from hose (3).
- (4) Loosen two clamps (6 and 7).
- (5) Remove hose (8) from radiator (4) and water inlet connection (9).
- (6) Remove two clamps (6 and 7) from hose (8).

b. Installation.

- (1) Position two clamps (6 and 7) on hose (8).
- (2) Install hose (8) on radiator (4) and water inlet connection (9), and tighten clamps (6 and 7).
- (3) Position two clamps (1 and 2) on hose (3).
- (4) Install hose (3) on radiator (4) and thermostat housing (5), and tighten clamps (1 and 2).



NOTE

Follow-on Maintenance:

- Install hood (para 4-125).
- Fill coolant system (para 4-66).

END OF TASK

4-63. THERMOSTAT REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Cloth, lint-free (item 12, appendix E)

Compound, sealing (item 16, appendix E)

Gasket, housing

Equipment Condition

TM or Para

Para 4-66

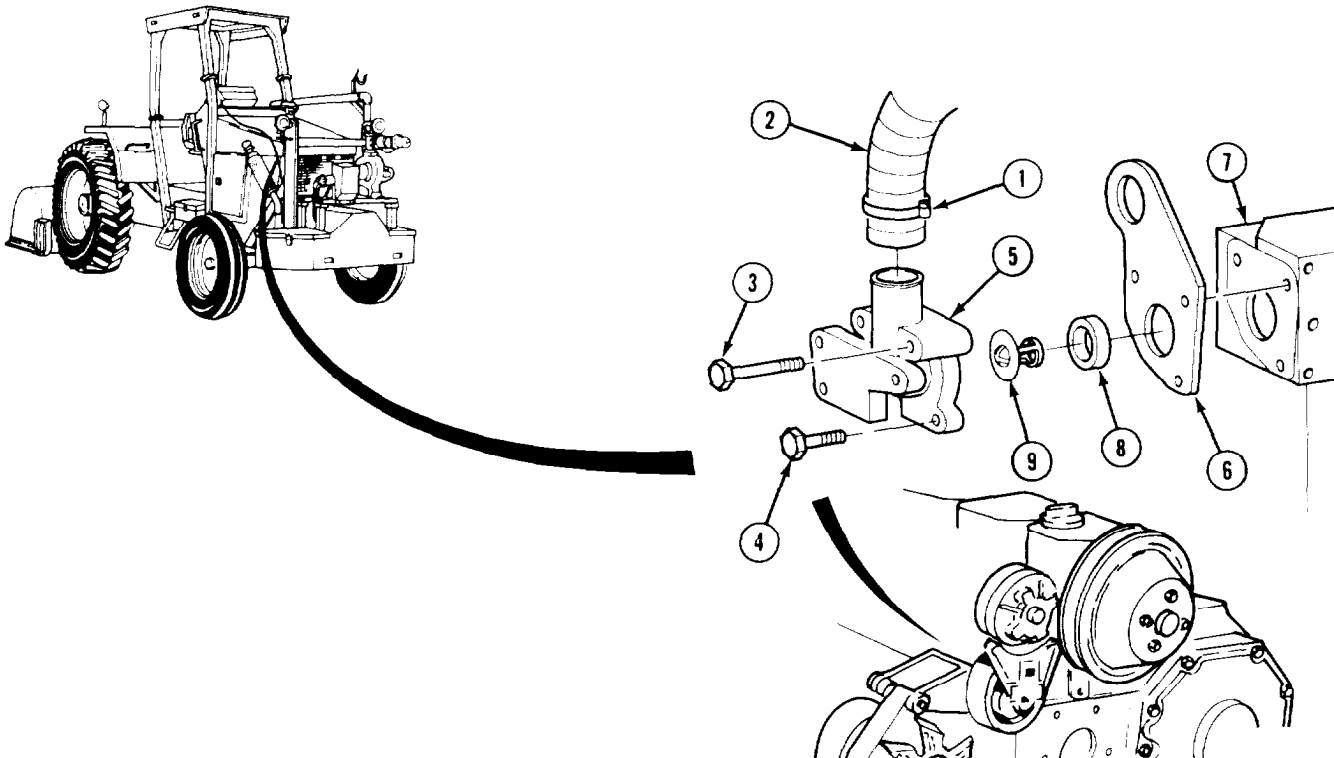
Para 4-71

Condition Description

Coolant system drained.

Alternator bracket removed.

a. Removal.



- (1) Loosen clamp (1) and remove hose (2).
- (2) Remove three screws (3 and 4) housing (5) and lifting bracket (6) from cylinder head (7).
- (3) Remove and discard gasket (8) from cylinder head (7).
- (4) Remove thermostat (9) from housing (5).

b. Cleaning/Inspection.

- (1) Clean housing and thermostat by flushing with water. Dry with cloth.
- (2) Inspect vent notch on the lip of thermostat for rust and corrosion. If notch is not open or damaged, replace thermostat.
- (3) Inspect housing for corrosion and cracks. Replace if damaged.
- (4) Inspect operation by placing thermostat in container of water on temperature controlled heater. Thermostat should open at 181°F (83°C) and fully open at 203°F (95°C). If thermostat fails inspection, replace thermostat.

c. Installation.

- (1) Install thermostat (9) in housing (5).
- (2) Install gasket (8) in cylinder head (7) with recess toward housing (5).



Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

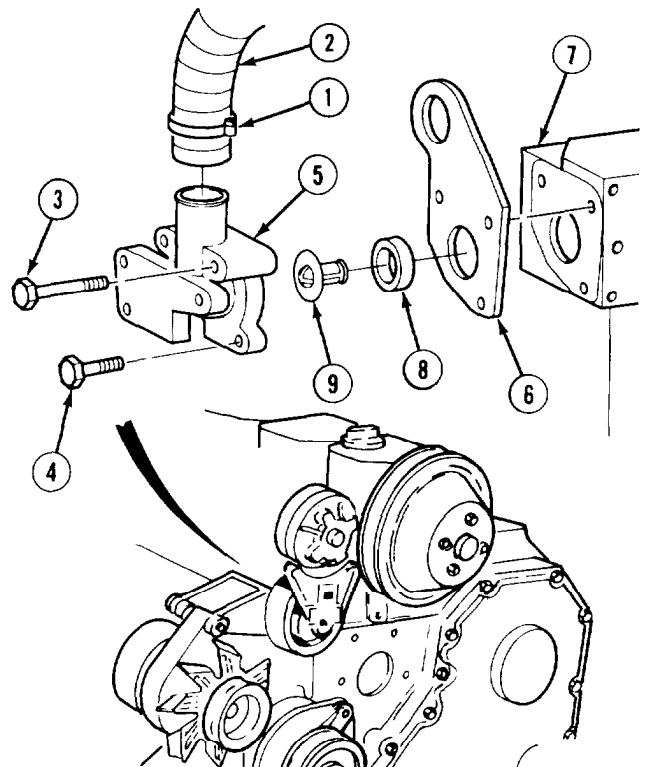
- (3) Apply sealant to cylinder head (7) and housing (5).
- (4) Install lifting bracket (6) and housing (5) with three screws (3 and 4). Tighten screws 216 lb-in (24 N.m).
- (5) Install hose (2) and clamp (1).

NOTE

Follow-on maintenance:

- Install alternator bracket (para 4-71).
- Fill coolant system (para 4-66).

END OF TASK



4-64. WATER INLET REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Cloth, lint-free (item 12, appendix E)

Ring, seal

Equipment Condition

TM or Para

Para 4-66

Para 4-90

Condition Description

Coolant system drained.

Negative battery cables disconnected.

a. Removal.

- (1) Loosen clamp (1) and remove hose (2).
- (2) Remove three screws (3) and water inlet (4) from engine block (5).
- (3) If damaged, remove two pipe plugs (6) from water inlet (4).

NOTE

Seal ring may stay with water inlet.

- (4) Remove and discard seal ring (7) from engine block (5).

b. Installation.

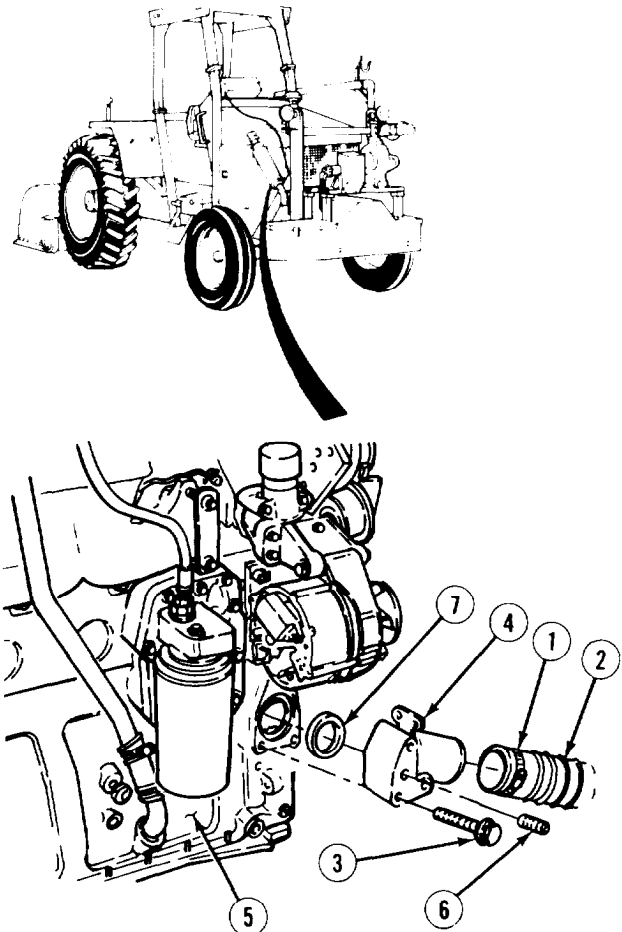
- (1) Install seal ring (7) in engine block (5).
- (2) If removed, install two pipe plugs (6) in water inlet (4).
- (3) Install water inlet (4) with three screws (3). Tighten screws 32 lb-ft (44 N-m).
- (4) Install hose (2) and tighten clamp (1).

NOTE

Follow-on Maintenance:

- Fill coolant system (para 4-66).
- Connect negative battery cables (para 4-90).

END OF TASK



4-65. WATER PUMP ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
- Compound, sealing (item 16, appendix E)
- Gasket, preformed

Equipment Condition

TM or Para

Para 4-60

Para 4-67

Para 4-68

Condition Description

Radiator removed.

Fan assembly removed.

Drive belt removed.

a. Removal.

- (1) Remove two screws (1) and water pump (2) from engine block (3).
- (2) Remove and discard gasket (4).

b. Installation.

- (1) Install gasket (4) in engine block (3).

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, keep eyes open; flush eyes with water for 15 minutes; get immediate medical aid.

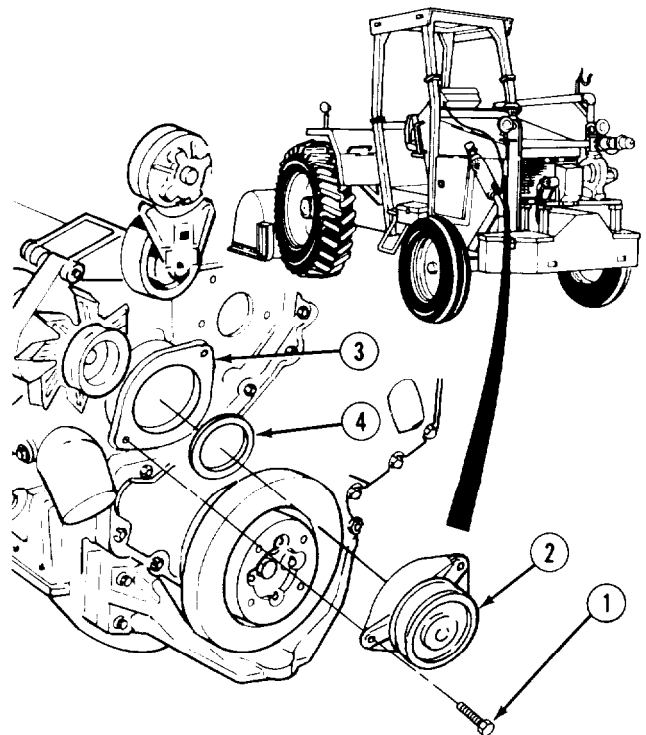
- (2) Apply sealant to water pump (2) and install on engine block (3) with two screws (1). Tighten screws 216 lb-in (24 N-m).

NOTE

Follow-on Maintenance:

- Install drive belt (para 4-68).
- Install fan assembly (para 4-67).
- Install radiator (para 4-60).

END OF TASK



4-66. COOLANT SYSTEM FLUID REPLACEMENT.

This task covers:

- a. Draining
- b. Filling

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Materials/Parts

Antifreeze (item 2, appendix E)
Sodium Carbonate (item 53, appendix E)

Equipment Condition

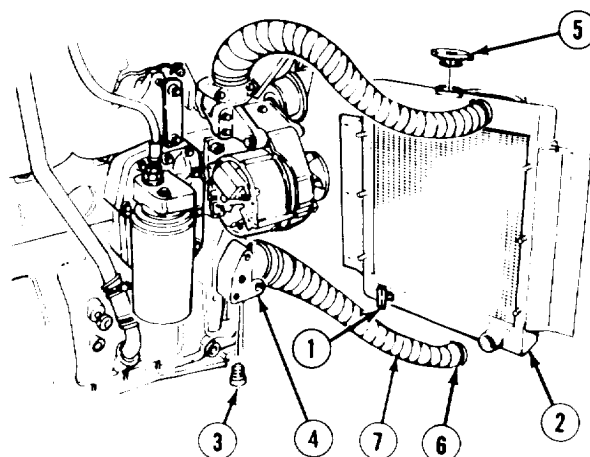
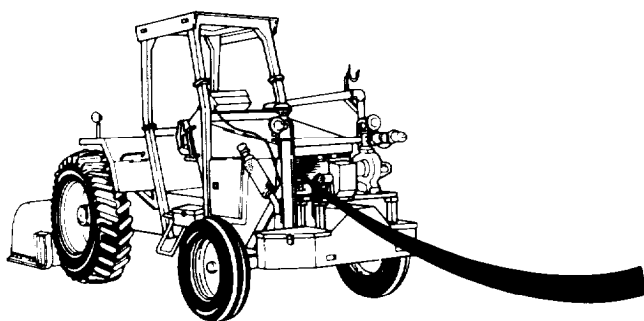
TM or Para
Para 2-14

Condition Description
Right engine door
opened.

General Safety Instructions

If engine has previously been in operation, allow time for cooling before performing procedure.

a. Draining.



WARNING

- Do not drain coolant if water temperature gauge reads above 180°F (82°C). Contact with steam or hot coolant will result in serious injury to personnel.
- Wear goggles/safety glasses when flushing radiator. Alkali based corrosion inhibitor is in coolant system. Contact with skin can cause injury to personnel.

NOTE

Place a suitable container with a 6 gallon (22.7 liters) capacity under radiator to catch spilling coolant.

- (1) Open petcock (1) on radiator (2) and drain radiator.
- (2) Remove plug (3) from water inlet (4) and drain remaining coolant.
- (3) Close petcock (1) and install plug (3).

- (4) Remove cap (5) and fill radiator (2) with 5 gallons (19 liters) clean water and .75 lb (.4 kg) sodium carbonate.
- (5) Run engine five minutes after coolant temperature reaches 180°F (82°C).
- (6) Repeat steps (1) through (3).

NOTE

Place a suitable container with a 6 gallon (22.7 liters) capacity under radiator to catch spilling coolant.

- (7) Loosen clamp (6) and remove hose (7). Drain remaining water.
- (8) Install hose (7) and tighten clamp (6).
- (9) Repeat steps (4) through (8), adding clean water only to flush coolant system. Do not add sodium carbonate.
- (10) If water drained still appears dirty, repeat step (9) until water appears clean.

b. Filling.

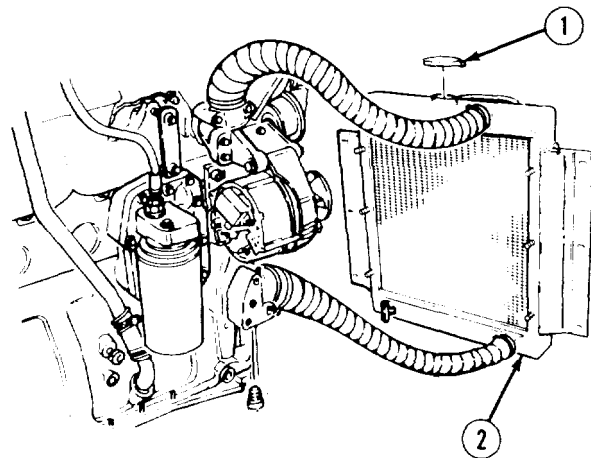
WARNING

Corrosion inhibitor contains alkali. Do not get in eyes; wear goggles/safety glasses when using. Avoid contact with skin. In case of contact, immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention.

CAUTION

Do not fill coolant system with water only. Use ethylene glycol mixture with water. Failure to do so will result in damage to engine.

- (1) Remove cap (1) and fill radiator (2) with a 50 percent mixture of water and antifreeze. Coolant capacity is 6 gallons (22.7 liters).
- (2) Install cap (1).

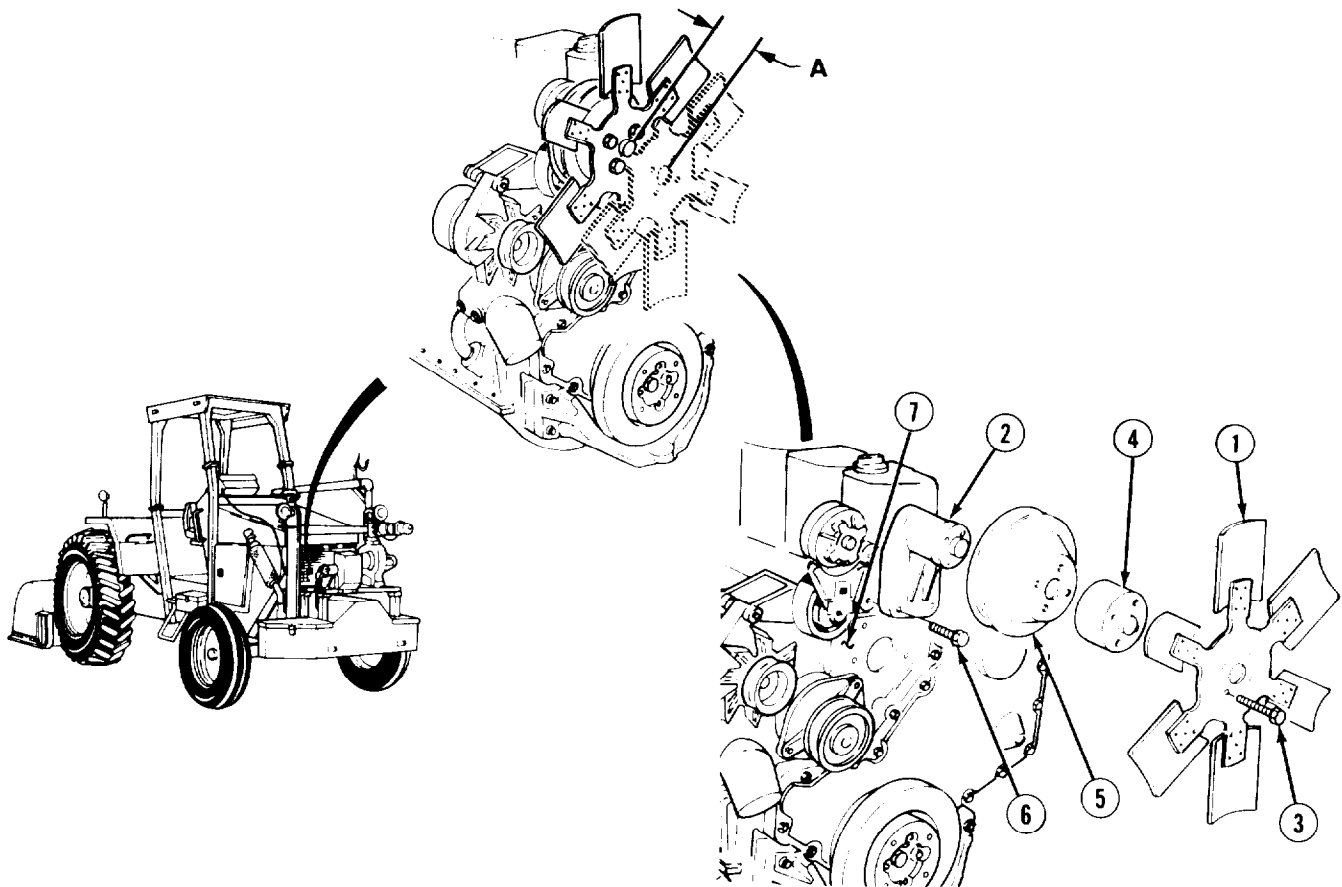


NOTE

Follow-on Maintenance: Close right engine door (para 2-14).

END OF TASK

4-67. FAN ASSEMBLY REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 4-68	Drive belt removed.
Wrench, torque		



a. Removal.

- (1) Measure fan (1) end play at position A. If measurement is greater than 0.006 in. (0.15 mm), replace fan support (2).
- (2) Note direction of fan blades and remove four screws (3), fan (1), and fan spacer (4), and pulley (5).

- (3) Remove four screws (6) and fan support (2) from cylinder head (7).

b. Installation.

- (1) Install fan support (2) on cylinder head (7) with four screws (6). Tighten screws 216 lb-in (24 N-m).
- (2) Install pulley (5), fan spacer (4) and fan (12) with four screws (3). Tighten screws 216 lb-in (24 N.m).

NOTE

Follow-on Maintenance: Install drive belt (para 4-68).

END OF TASK

4-68. DRIVE BELT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Equipment Condition

TM or Para
Para 4-90

Condition Description
Negative battery cables
disconnected.

Material/Parts

Drive belt

Para 4-125

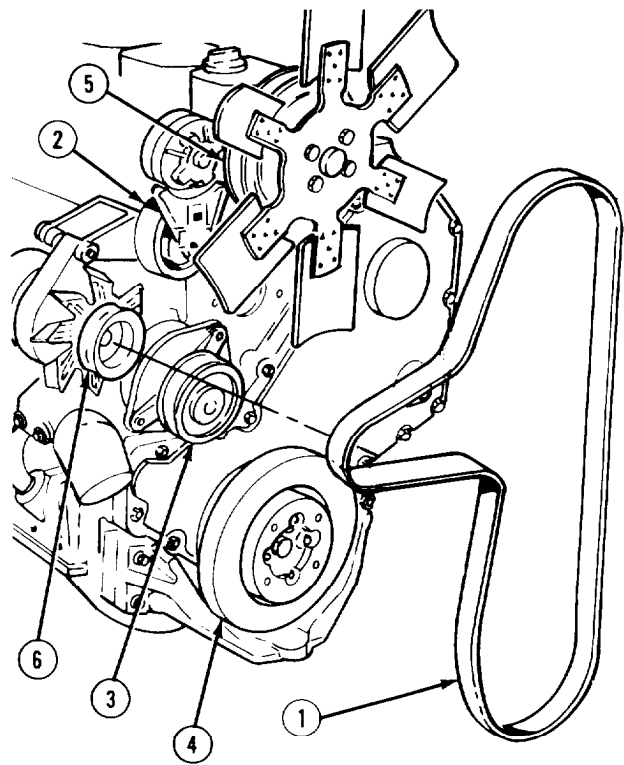
Hood removed.

a. Removal.



Use caution when removing drive belt. Belt tensioner is extremely rigid and can injure personnel.

- (1) Unload belt tensioner (2) and remove drive belt (1) from belt tensioner. Slowly release belt tensioner.
- (2) Remove drive belt (1) from pump pulley (3) crankshaft pulley (4), fan pulley (5), and alternator pulley (6).



b. Installation.

- (1) Position drive belt (1) on alternator pulley (6), fan pulley (5), crankshaft pulley (4), and pump pulley (3), and load belt tensioner (2).
- (2) Install drive belt (1) on belt tensioner (2) and slowly release belt tensioner.
- (3) Measure belt (1) deflection at longest point using tension gauge at 80 to 110 lbs (36 - 49 kgs). Deflection limit is 1/2 to 3/8 in. (9.5 - 12.7 mm). If measurement is not within limits, replace belt.

NOTE

Follow-on Maintenance:

- Connect negative battery cables (para 4-90).
- Install hood (para 4-125).

END OF TASK

4-69. BELT TENSIONER REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanics: automotive
- Wrench, torque

Materials/Parts

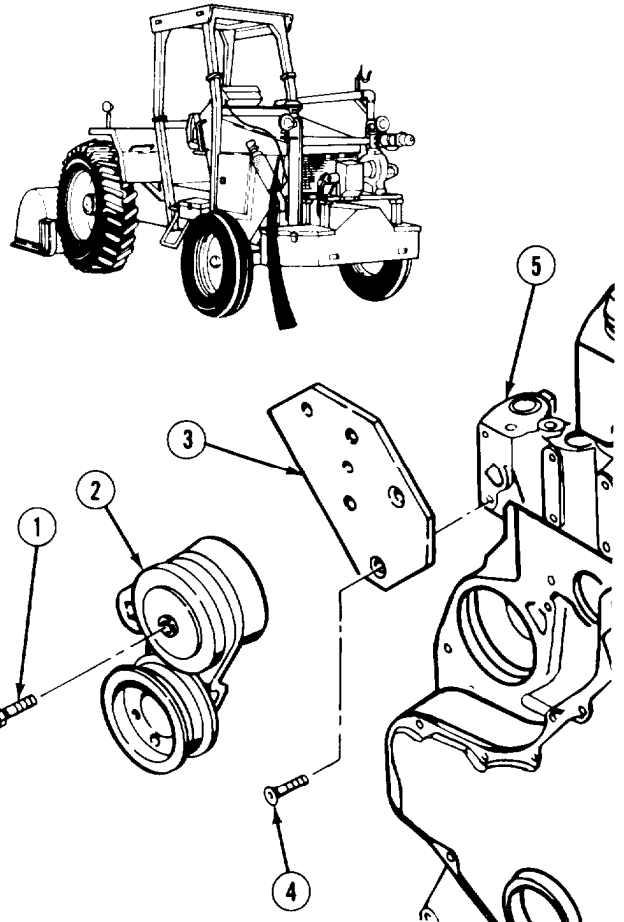
- Cloth, lint-free (item 12, appendix E)
- Paper, abrasive (item 49, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-90	Negative battery cables disconnected.
Para 4-68	Drive belt removed.

a. Removal.

- (1) Remove screw (1) and belt tensioner (2) from bracket (3).
- (2) Remove two screws (4) and bracket (3) from cylinder head (5).
- (3) Inspect belt tensioner (2) bearing. If belt tensioner rotates freely with no rough spots, do not replace.



b. Installation.

- (1) Install bracket (3) on cylinder head (5) with two screws (4). Tighten screws 216 lb-in (24 N.m).
- (3) Install belt tensioner (2) on bracket (3) with screw (1). Tighten screw 32 lb-ft (43 N.m).

NOTE

Follow-on Maintenance:

- Install drive belt (para 4-68).
- Connect negative battery cables (para 4-90).

END OF TASK

4-70. ALTERNATOR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive
 Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power
 Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power
 Wrench, torque

Material/Parts

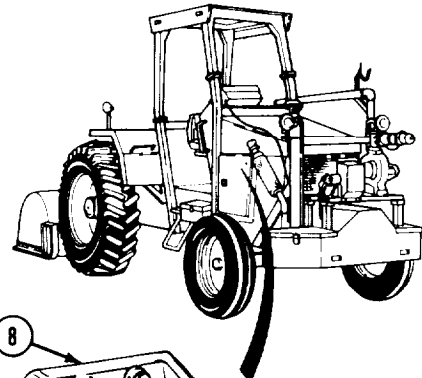
Tag, identification (item 55, appendix E)
 Lockwasher

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-68	Drive belt removed.
Para 4-90	Negative battery cable disconnected.

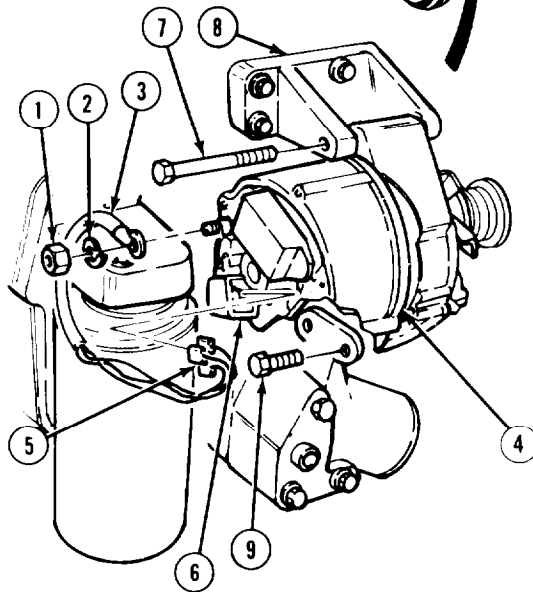
a. Removal.

- (1) Remove nut (1) and lockwasher (2). Tag, mark, and remove wire (3) from alternator (4). Discard lockwasher.
- (2) Tag, mark, and disconnect three connectors (5) from plug (6).
- (3) Remove screw (7) from mount (8).
- (4) Remove screw (9) and alternator (4).



b. Installation.

- (1) Install alternator (4) with screw (9). Do not tighten.
- (2) Install screw (7). Tighten screw (7) 32 lb-ft (43 N.m) and screw (9) 216 lb-in (24 N.m).
- (3) Connect three connectors (5) in plug (6).
- (4) Install wire (3) with lockwasher (2) and nut (1).



NOTE

Follow-on Maintenance:

- Install drive belt (para 4-68).
- Connect negative battery cables (para 4-90).

END OF TASK

4-71. ALTERNATOR BRACKET REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Equipment Condition

TM or Para

Para 4-70

Condition Description

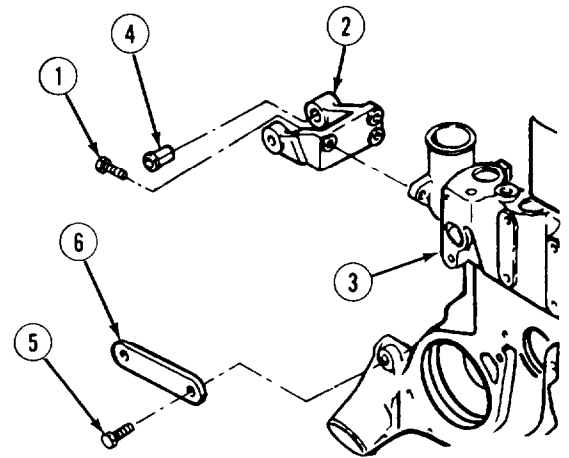
Alternator removed.

a. Removal.

- (1) Remove three screws (1) and alternator bracket (2) from cylinder head (3).
- (2) If damaged, remove bushing (4).
- (3) Note position and remove screw (5) and alternator brace (6).

b. Installation.

- (1) Install alternator brace (6) with screw (5). Tighten screw 216 lb-in (24 N·m).
- (2) Install bushing (4) in alternator bracket (2).
- (3) Install alternator bracket (2) on cylinder head (3) with three screws (1). Tighten screws 216 lb-in (24 N·m).



NOTE

Follow-on maintenance: Install alternator (para 4-70).

END OF TASK

4-72. STARTER REPLACEMENT.

This task covers:

- | | |
|------------------------|-----------------|
| a. Removal | c. Testing |
| b. Cleaning/Inspection | d. Installation |

INITIAL SETUP

Test Equipment

Voltmeter
Ammeter

Materials/Parts

Cloth, lint-free (item 12, appendix E)
Tags, identification (item 55, appendix E)

Tools

Tool kit, general mechanics: automotive

Equipment Condition

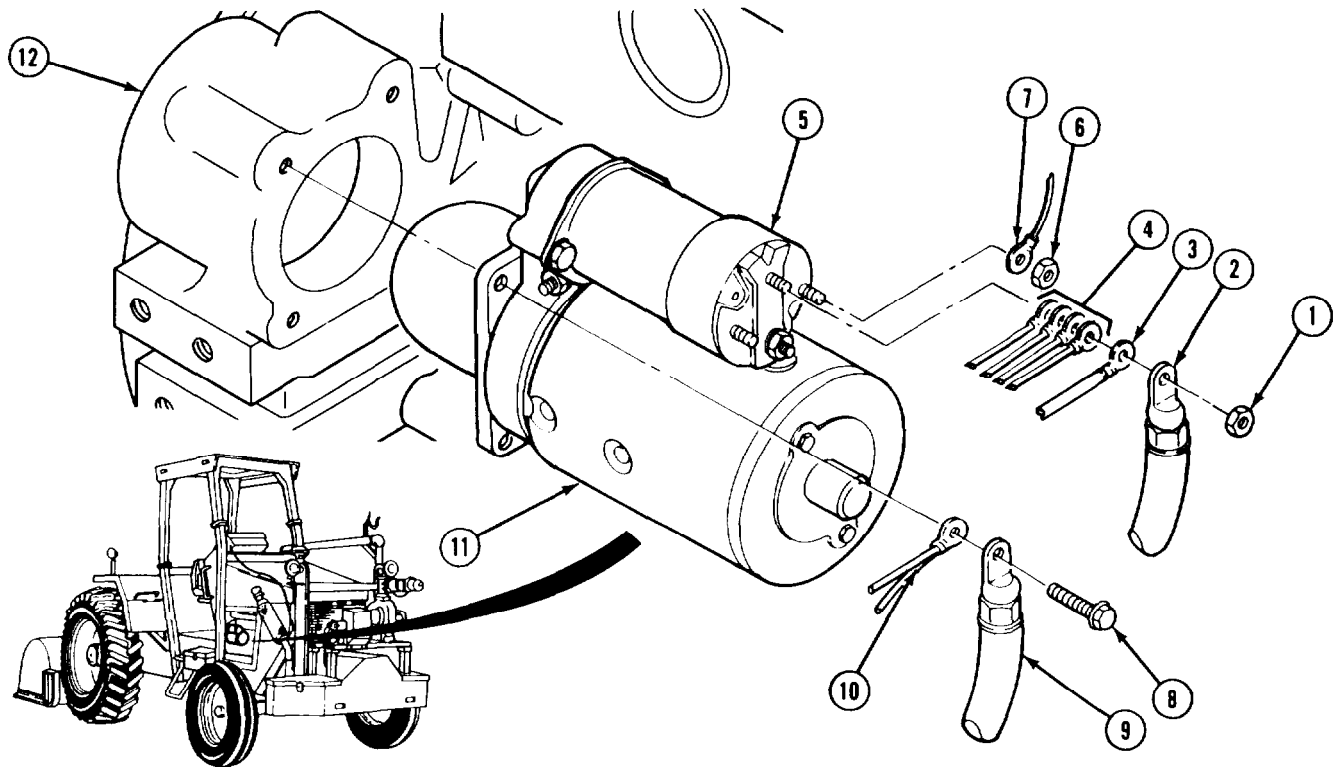
TM or Para
Para 4-87

Condition Description
Engine battery removed.

Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque



a. Removal.

NOTE

Tag and mark all wires before removal.

- (1) Remove nut (1). Tag, mark, and remove positive battery cable (2), and five wires (3 and 4) from solenoid (5).
- (2) Remove nut (6). Tag, mark, and remove wire (7).
- (3) Remove three screws (8). Tag, mark, and remove negative battery cable (9) and two wires (10) from starter (11).
- (4) Remove starter (11) and solenoid (5) from flywheel housing (12).

b. Cleaning/Inspection.

- (1) Wipe off dirt and debris from casing of starter assembly.
- (2) Check wires for cracks, fraying and other damage. Replace wires failing inspection.
- (3) Check posts for thread damage.
- (4) Measure pinion clearance between pinion and retainer. Normal clearance is between 0.10 to 0.140 in. (0.254 to 3.556 mm). If above or below normal clearance, send to direct support maintenance for repair.

4-72. STARTER REPLACEMENT (CONT).

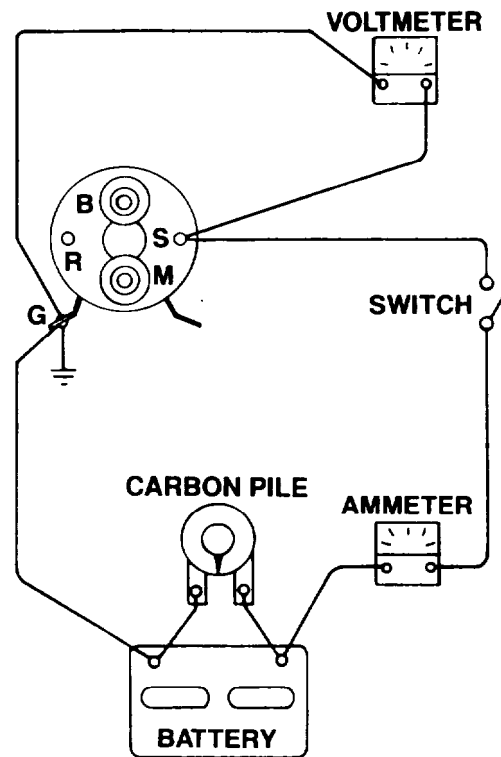
c. Testing.

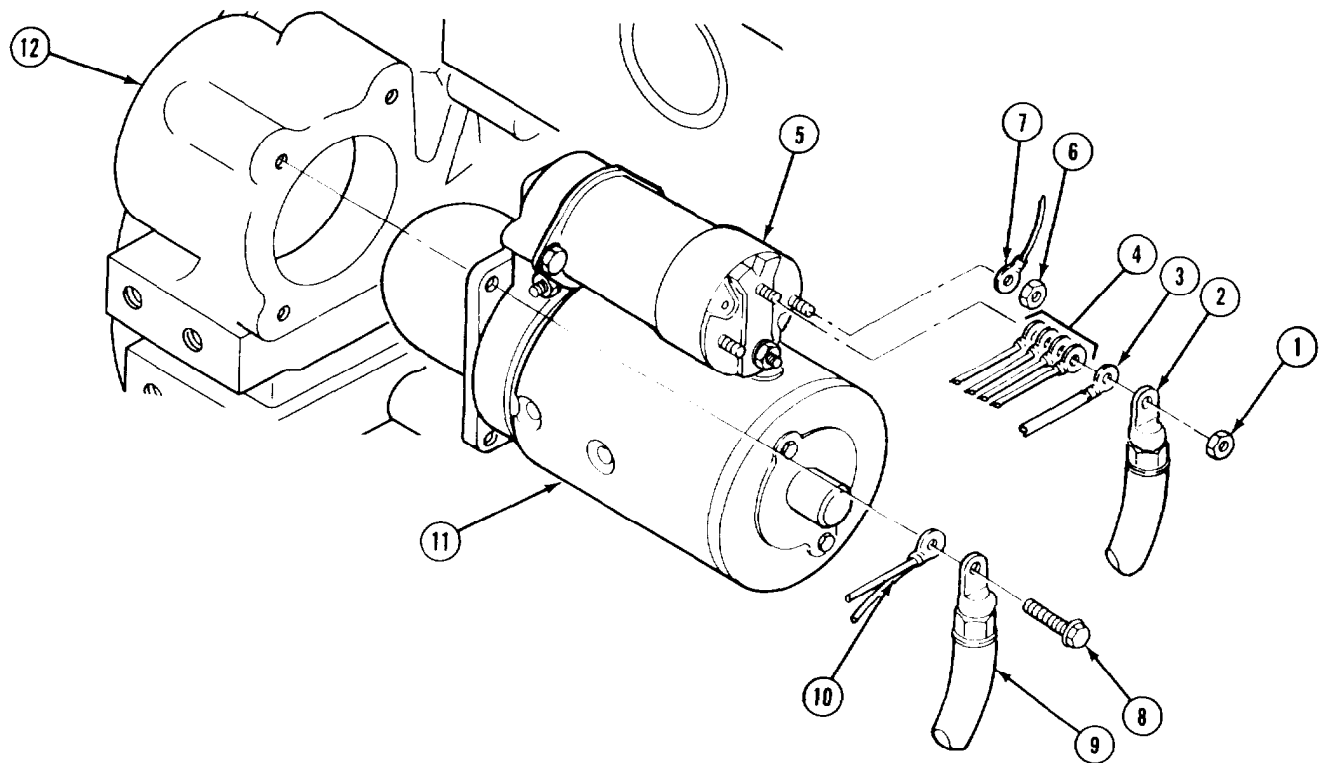
- (1) Test wires and cables for continuity.
Replace wires or cables failing test.
- (2) Perform starter solenoid test as follows:
 - (a) Connect positive battery cable to positive side of ammeter and negative battery cable to solenoid ground.

WARNING

Ensure switch is open prior to connecting to starter solenoid. Electrical shock may result if solenoid is energized while making final battery connection.

- (b) Connect switch leads to ammeter and starter solenoid switch terminal (S).
- (c) Connect voltmeter leads to solenoid ground and solenoid switch terminal (G).
- (d) Connect carbon pile across positive and negative battery terminals.
- (e) Close switch and adjust carbon pile until voltmeter indicates 18 Vdc.
- (f) Observe ammeter reading. Normal reading is 105 to 115 amps. If above or below normal reading, send to direct support maintenance for repair.





d. Installation.

NOTE

Ensure that starter gear engages flywheel.

- (1) Position starter (11) and solenoid (5) on flywheel housing (12).
- (2) Install two wires (10), negative battery cable (9), and three screws (8). Tighten screws 32 lb-ft (43 N.m).
- (3) Install wire (7) and nut (6).
- (4) Install five wires (3 and 4), positive battery cable (2) and nut (1).

NOTE

Follow-on Maintenance: Install engine battery (para 4-87).

END OF TASK

4-73. INSTRUMENT PANEL REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Cloth, lint-free (item 12, appendix E)
 Tags, identification (item 55, appendix E)
 Lockwashers (5)

Equipment Condition

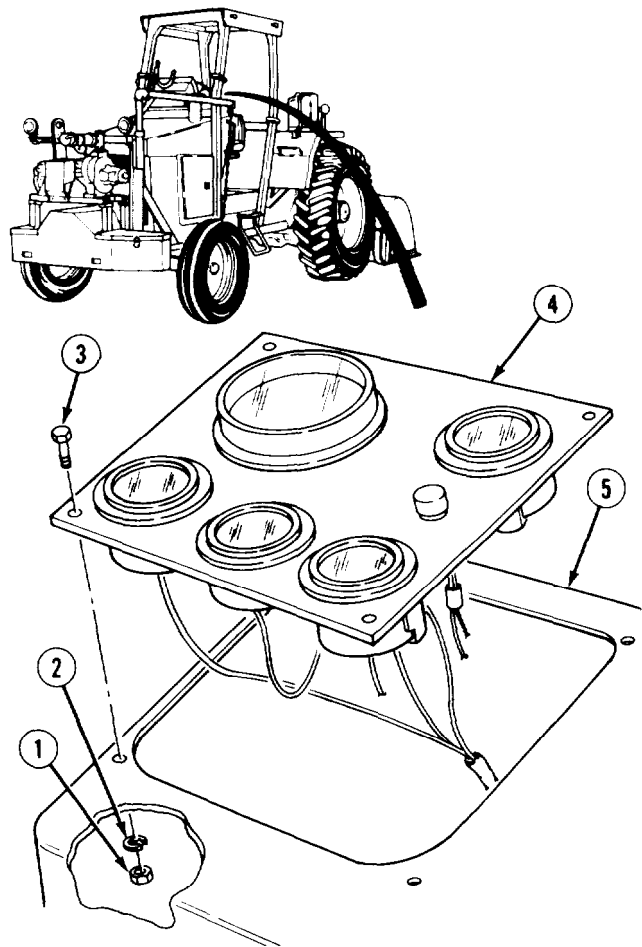
TM or Para
 Para 4-90

Para 4-128
 Para 4-130

Condition Description
 Negative battery cables disconnected.
 Dash panel removed.
 Additive access cover removed.

a. Removal.

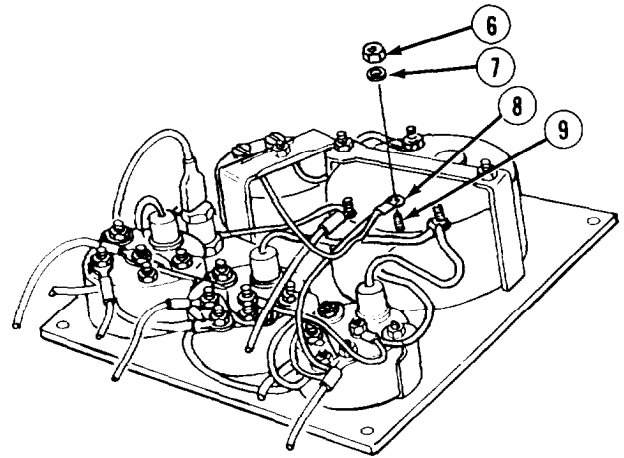
- (1) Remove four nuts (1), lockwashers (2), and screws (3) from instrument panel (4). Discard lockwashers.
- (2) Remove and turn instrument panel (4) over onto dash (5).



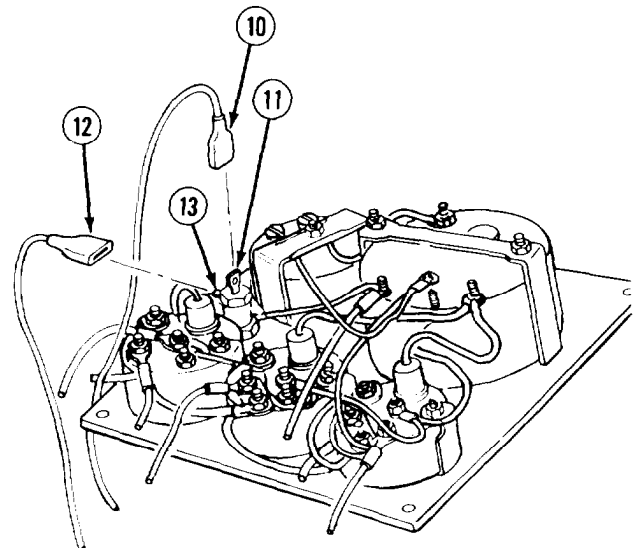
NOTE

Tag and mark wires before removal.

- (3) Remove nut (6) and lo&washer (7). Tag, mark, and remove wire (8) from tachometer post (9). Discard lockwasher.



- (4) Tag, mark, and disconnect wire (10) from fuse post (11).
- (5) Tag, mark, and disconnect wire (12) from fuse post (13).

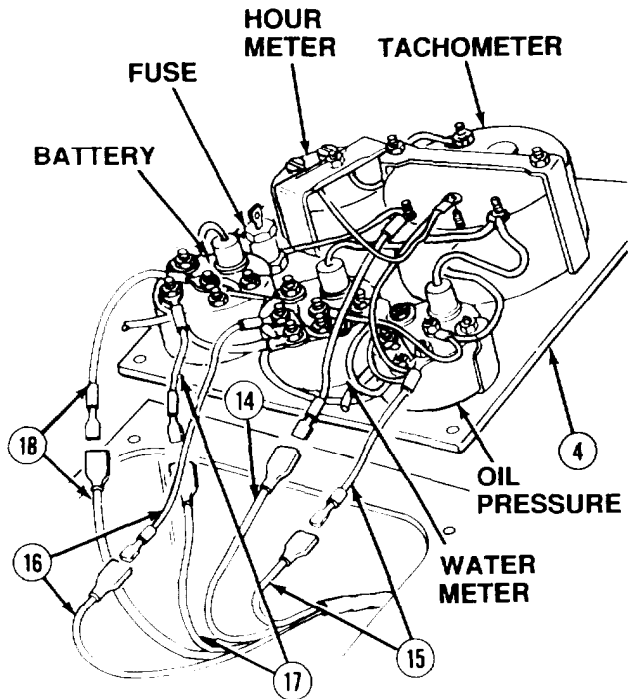


4-73. INSTRUMENT PANEL REPLACEMENT (CONT).

- (6) Tag, mark and disconnect wires (14,15, and 16).
- (7) Tag, mark and disconnect two wires (17 and 18) from voltmeter and separate instrument panel (4).

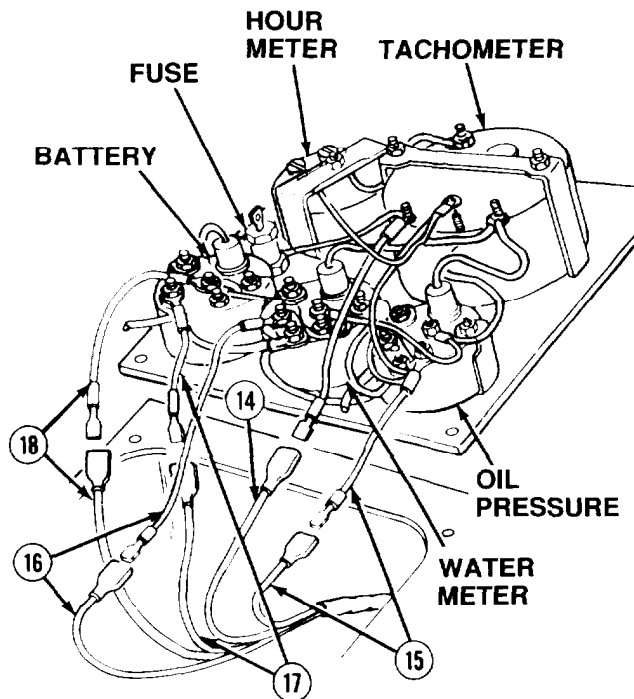
b. Cleaning/Inspection.

- (1) Use a lint-free cloth clean gauge lens.
- (2) Check to see that connectors are not damaged.
- (3) Check wires for tears or fraying.
- (4) Check insulation for wear.



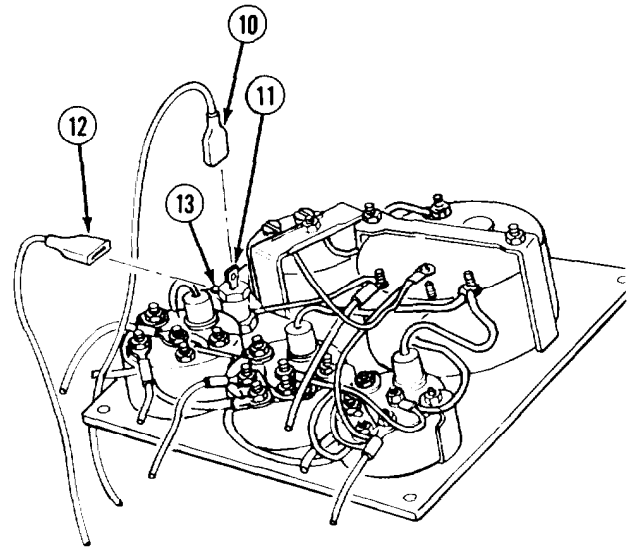
c. Installation.

- (1) Connect two wires (17 and 18) on voltmeter.
- (2) Connect three wires (14,15, and 16).

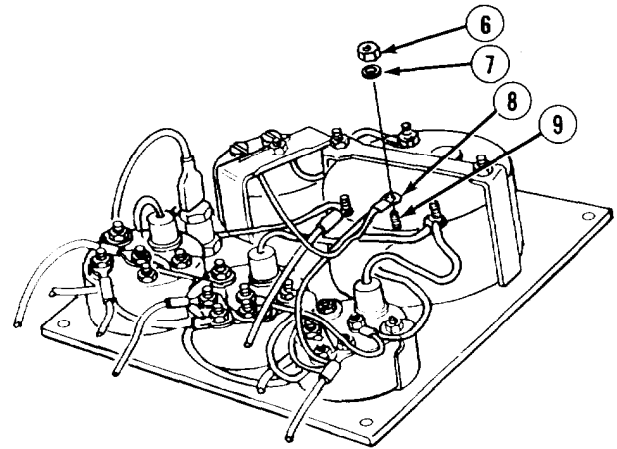


(3) Connect wire (12) on fuse post (13).

(4) Install lead (10) to fuse post (11).

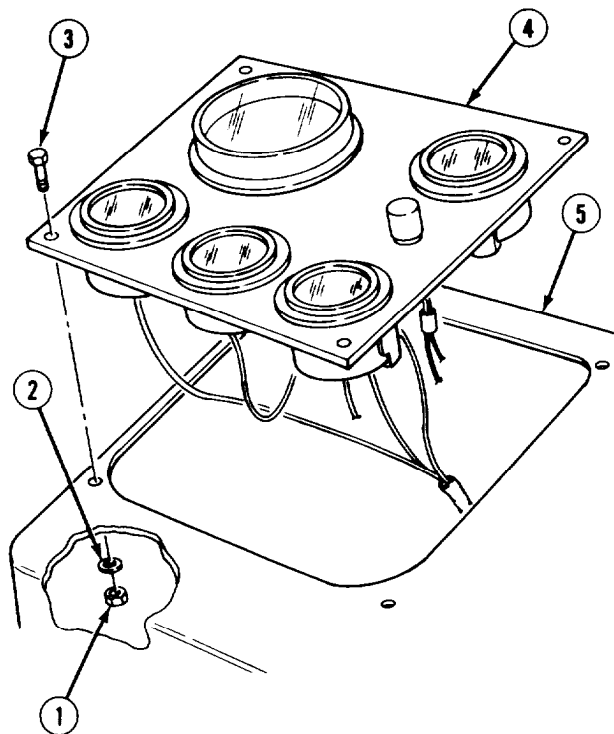


(5) Install wire (8) on tachometer post (9) with lockwasher (7), and nut (6).



4-73. INSTRUMENT PANEL REPLACEMENT (CONT).

- (6) Position instrument panel (4) in dash (5) and install four screws (3), washers (2), and nuts (1).



NOTE

Follow-on Maintenance:

- Install additive access cover (para 4-130).
- Install dash panel (para 4-128).
- Connect negative battery cable (para 4-90).

END OF TASK

4-74. INSTRUMENT PANEL GAUGE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-73

Condition Description
Instrument panel
removed.

Materials/Parts

Adhesive sealant, silicone (item 1, appendix E)
Tags, identification (item 55, appendix E)
Lo&washers (15)

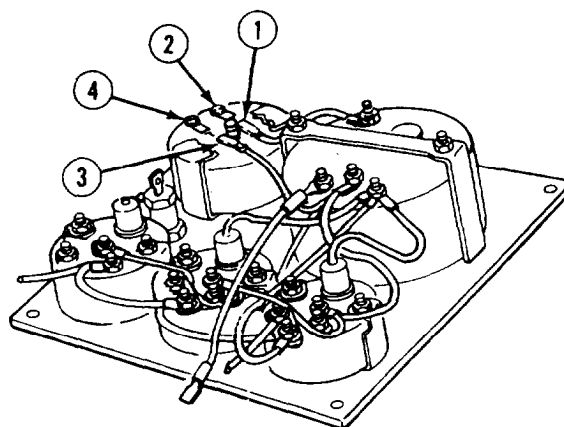
a. Removal.

NOTE

Tag and mark all wires prior to removal.

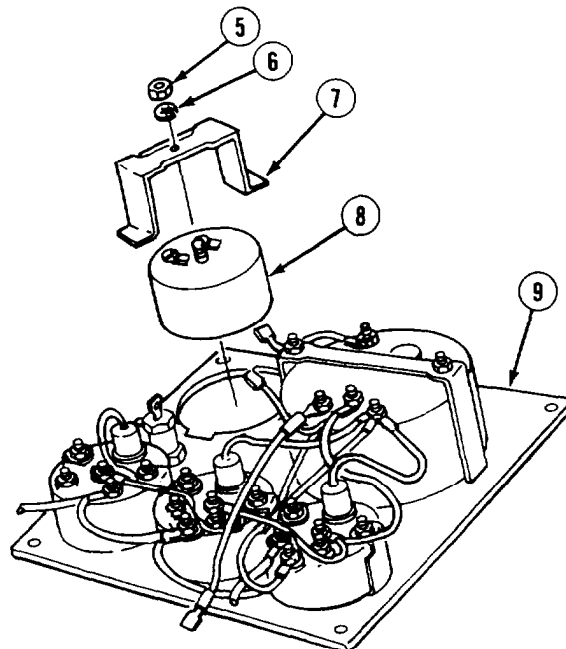
(1) To remove hour meter, proceed as follows:

- (a) Remove wire (1) from terminal (2).
- (b) Remove wire (3) from terminal (4).



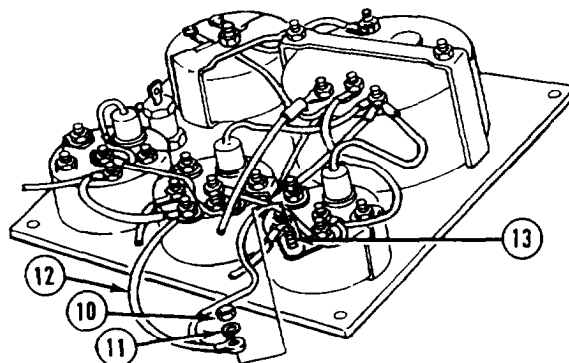
4-74. INSTRUMENT PANEL GAUGE REPLACEMENT (CONT).

- (c) Remove nut (5), lockwasher (6), bracket (7), and hour meter (8) from instrument panel (9). Discard lockwasher.

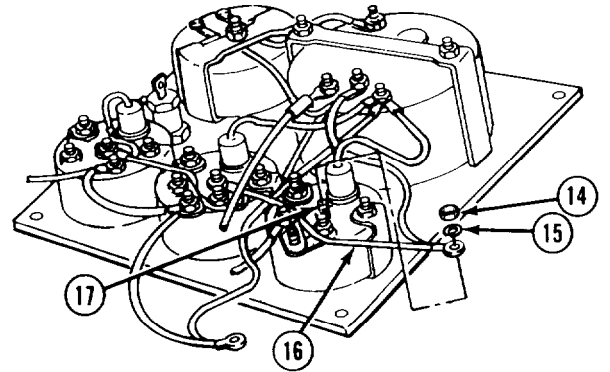


- (2) To remove oil pressure gauge, proceed as follows:

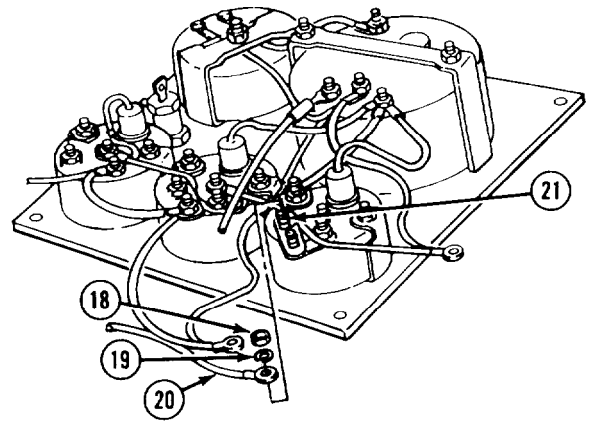
- (a) Remove nut (10), lockwasher (11), and wire (12) from terminal (13). Discard lockwasher.



- (b) Remove nut (14), lockwasher (15), and wire (16) from terminal (17). Discard lockwasher.

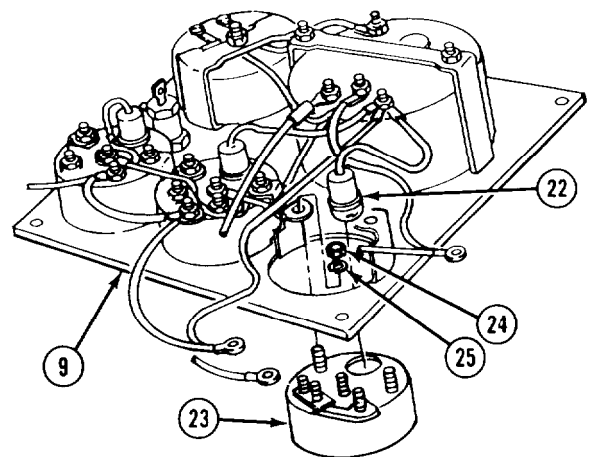


- (c) Remove nut (18), lockwasher (19), and wire (20) from terminal (21). Discard lockwasher.



- (d) Remove gauge lamp (22) from oil pressure gauge (23).

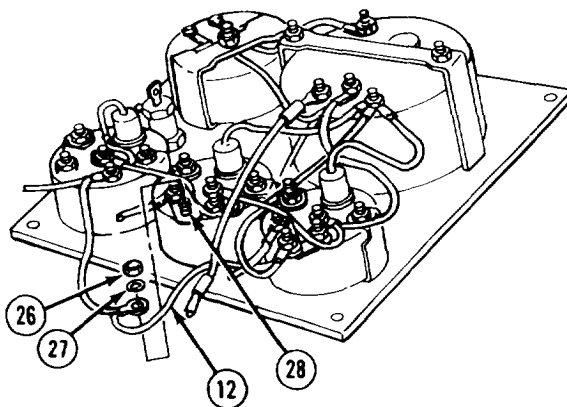
- (e) Remove two nuts (24), lockwashers (25) and oil pressure gauge (23) from instrument panel (9). Discard lockwashers.



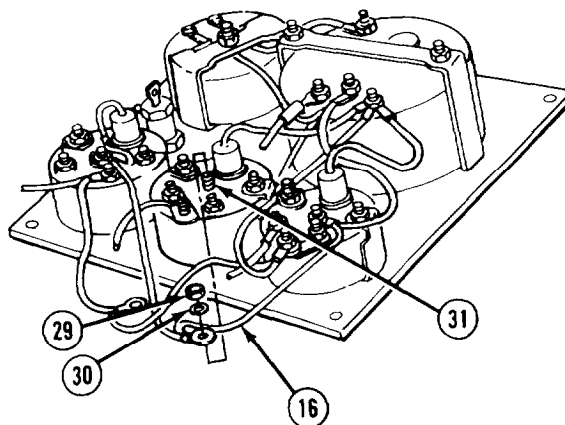
4-74. INSTRUMENT PANEL GAUGE REPLACEMENT (CONT).

(3) To remove water temperature gauge, proceed as follows:

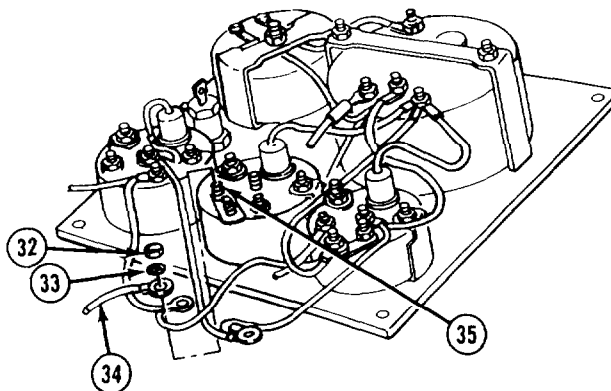
(a) Remove nut (26), lockwasher (27), and wire (12) from terminal (28). Discard lockwasher.



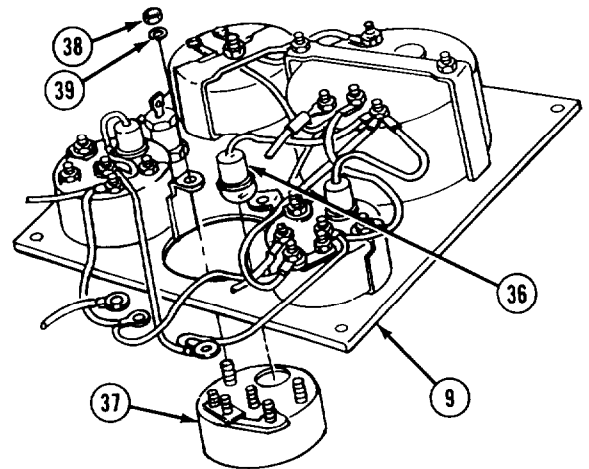
(b) Remove nut (29), lockwasher (30), and wire (16) from terminal (31). Discard lockwasher.



(c) Remove nut (32), lockwasher (33), and wire (34) from terminal (35). Discard lockwasher.

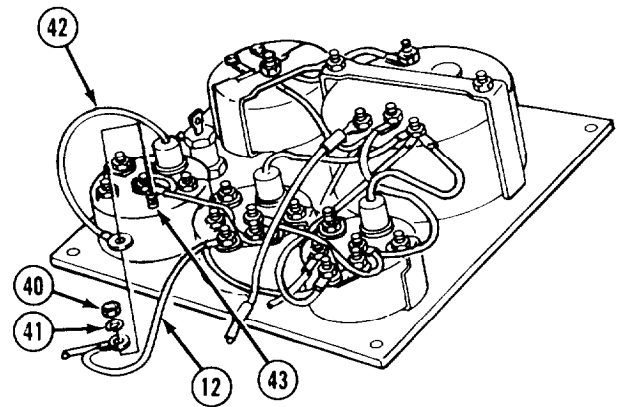


- (d) Remove gauge lamp (36) from water temperature gauge (37).
- (e) Remove two nuts (38), lockwashers (39), and water temperature gauge (37) from instrument panel (9). Discard lockwashers.

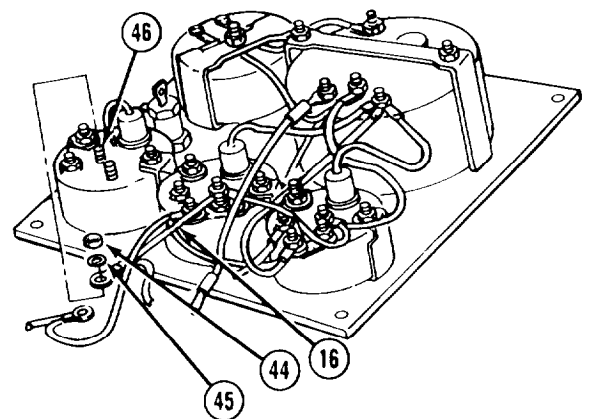


(4) To remove voltmeter, proceed as follows:

- (a) Remove nut (40), lockwasher (41), wire (12), and gauge lamp wire (42) from terminal (43). Discard lockwasher.

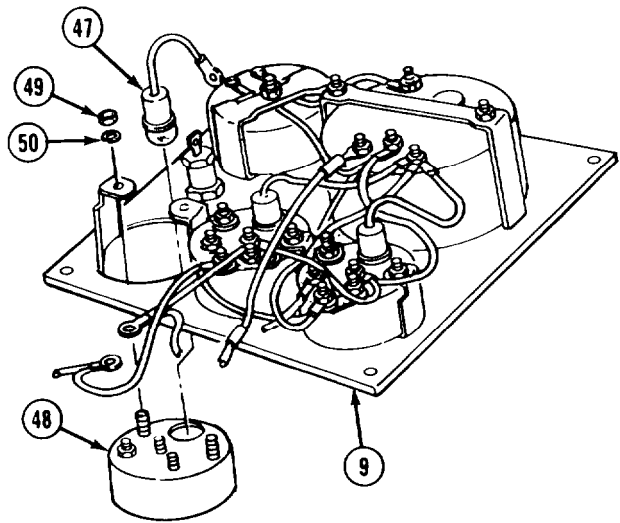


- (b) Remove nut (44), lockwasher (45), and wire (16) from terminal (46). Discard lockwasher.



4-74. INSTRUMENT PANEL GAUGE REPLACEMENT (CONT).

- (c) Remove gauge lamp (47) from voltmeter (48).
- (d) Remove two nuts (49), lockwashers (50), and voltmeter (48) from instrument panel (9). Discard lockwashers.



(5) To remove fuse holder, proceed as follows:

- (a) Remove two wires (50 and 51) from fuse holder (52).
- (b) Remove cap (53), fuse (54), jamnut (55), and fuse holder (52) from instrument panel (9).

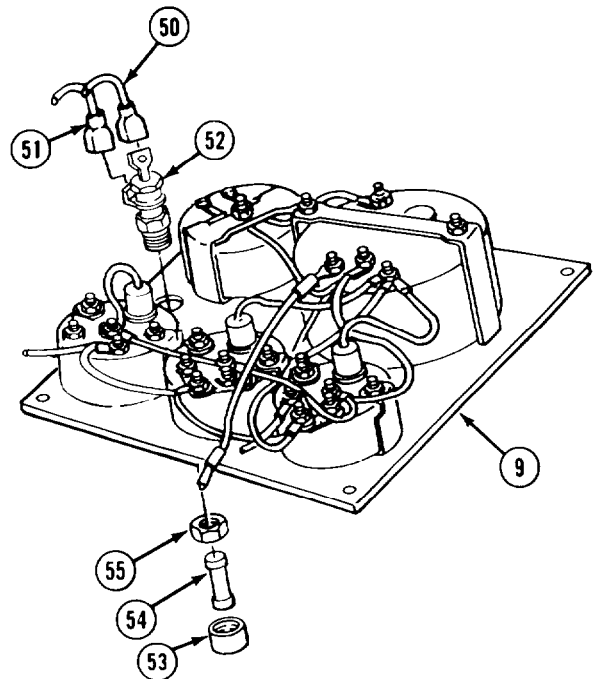
b. Installation.

(1) To install fuse holder, proceed as follows:

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (a) Apply silicone sealant around fuse holder (52).
- (b) Install fuse holder (52) in instrument panel (9) with jamnut (55).
- (c) Install fuse (54) and cap (53) on fuse holder (52).



(2) To install voltmeter, proceed as follows:

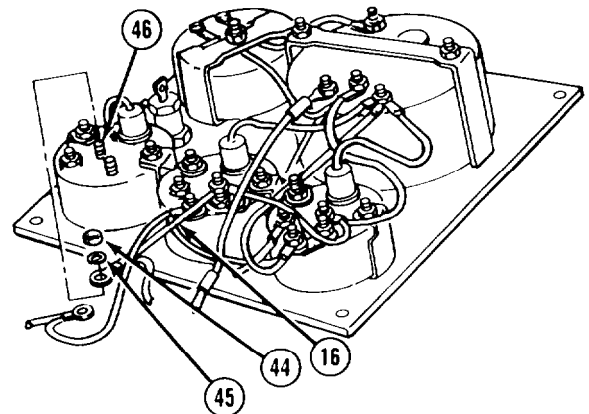
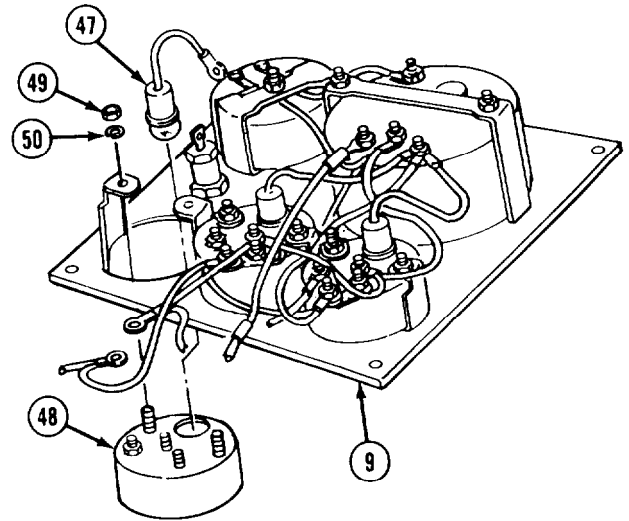
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

Apply silicone sealant around voltmeter (48).

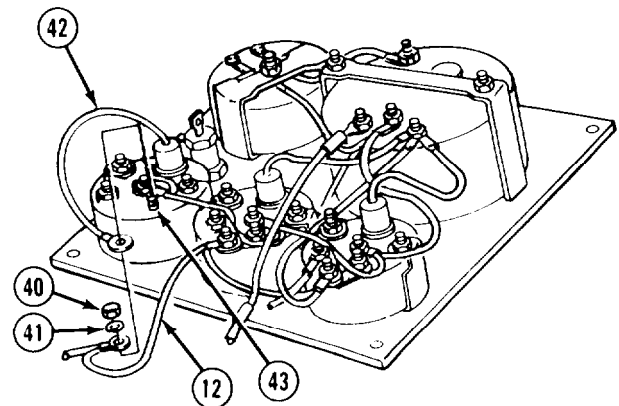
Install voltmeter (48) in instrument panel (9) with two lockwashers (50) and nuts (49).

Install gauge lamp (47) in voltmeter (48).

Connect wire (16) to terminal (46) with lockwasher (45) and nut (44).



(e) Connect wire (12) and gauge lamp wire (42) to terminal (43) with lockwasher (41) and nut (42).



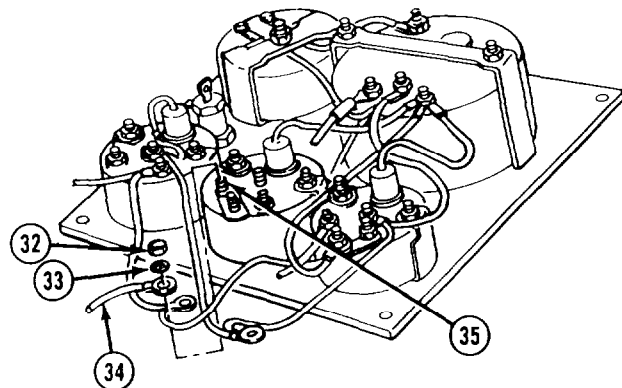
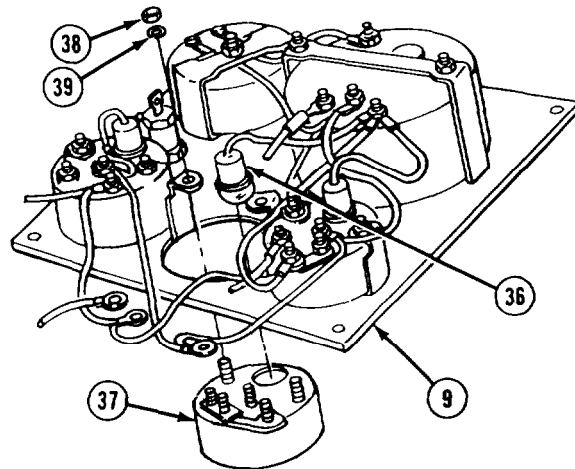
4-74. INSTRUMENT PANEL GAUGE REPLACEMENT (CONT).

- (3) To install water temperature gauge, proceed as follows:

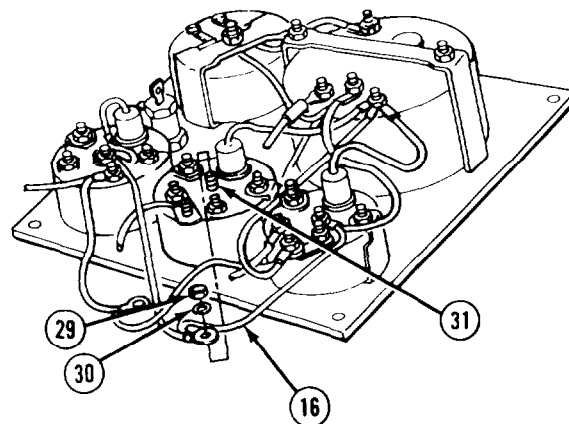
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

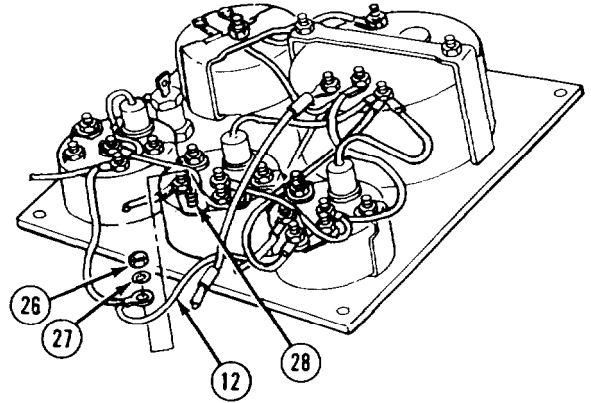
- (a) Apply silicone sealant around water temperature gauge (37).
- (b) Install water temperature gauge (37) in instrument panel (9) with two lockwashers (39) and nuts (38).
- (c) Install gauge lamp (36) in water temperature gauge (37).
- (d) Connect wire (34) to terminal (35) with lockwasher (33) and nut (32).



- (e) Connect wire (16) to terminal (31) with lockwasher (30) and nut (29).



- (f) Connect wire (12) to terminal (28) with lockwasher (27) and nut (26).

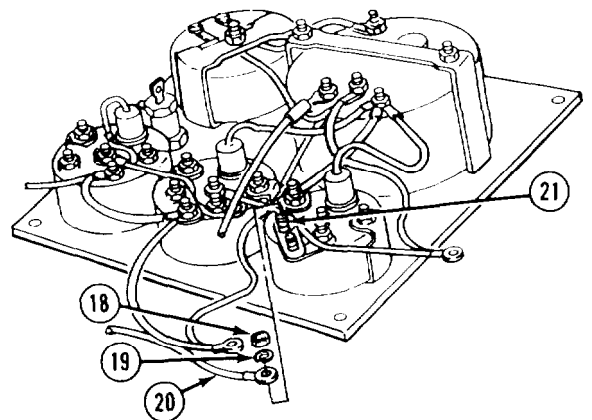
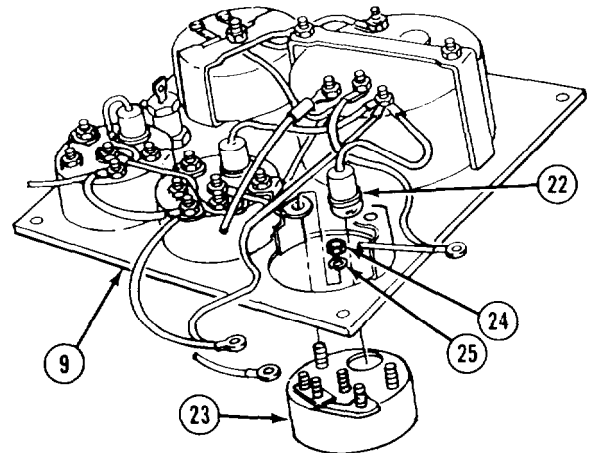


- (4) To install oil pressure gauge, proceed as follows:

WARNING

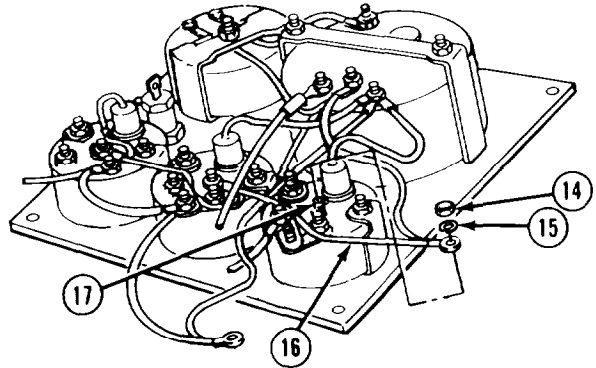
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (a) Apply silicone sealant around oil pressure gauge (23).
- (b) Install oil pressure gauge (23) in instrument panel (9) with two lockwashers (25) and nuts (24).
- (c) Install gauge lamp (22) in oil pressure gauge (23).
- (d) Connect wire (20) to terminal (21) with lockwasher (19) and nut (18).

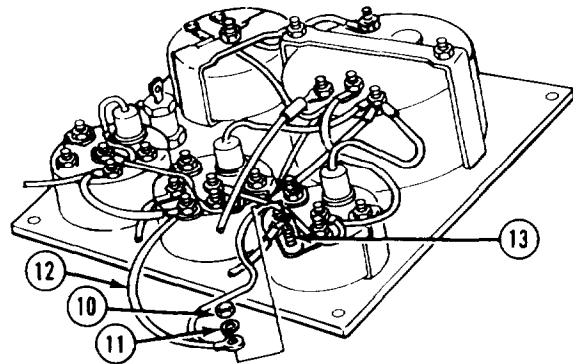


4-74. INSTRUMENT PANEL GAUGE REPLACEMENT (CONT).

- (e) Connect wire (16) to terminal (17) with lockwasher (15) and nut (14).



- (f) Connect wire (12) to terminal (13) with lockwasher (11) and nut (10).

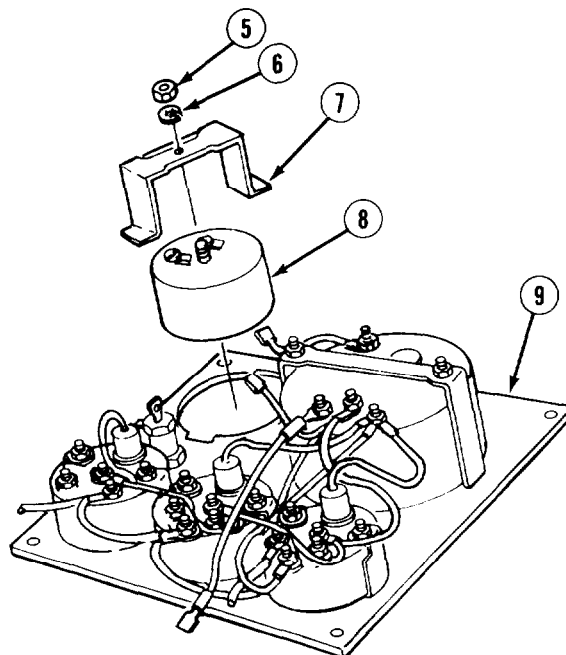


(5) To install hour meter, proceed as follows:

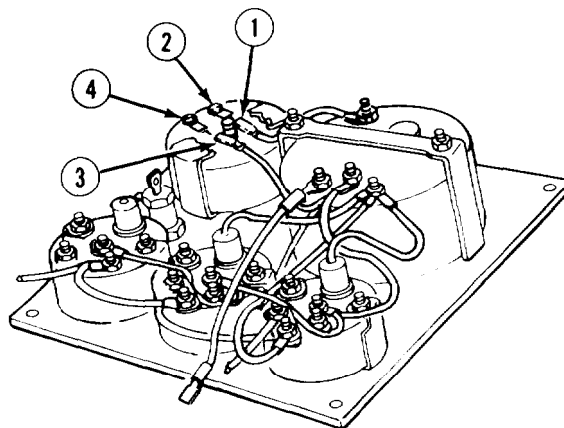
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (a) Apply silicone sealant around hour meter (8).
- (b) Install hour meter (8) in instrument panel (9) with bracket (7), lockwasher (6), and nut (5).



- (c) Connect wire (3) to terminal (4).
- (d) Connect wire (1) to terminal (2).



NOTE

Follow-on Maintenance: Install instrument panel (para 4-73).

END OF TASK

4-75. TACHOMETER REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materias/Parts

Adhesive sealant, silicone (item 1, appendix E)
 Tags, identification (item 55, appendix E)
 Lockwashers (6)

Equipment Condition

TM or Para
 Para 4-90

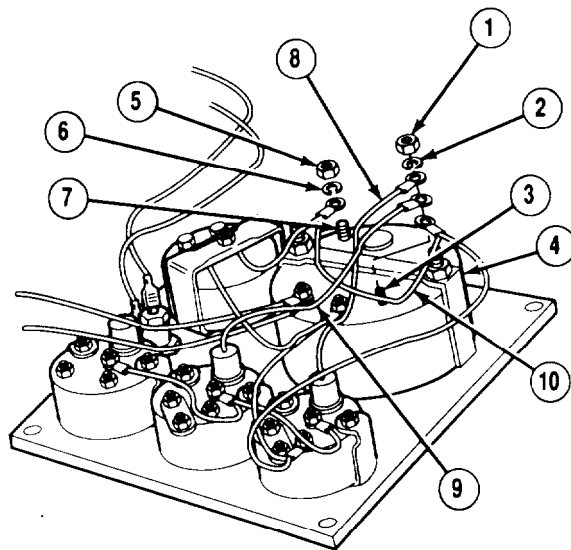
Condition Description
 Negative battery cables disconnected.
 Instrument panel assembly removed.

NOTE

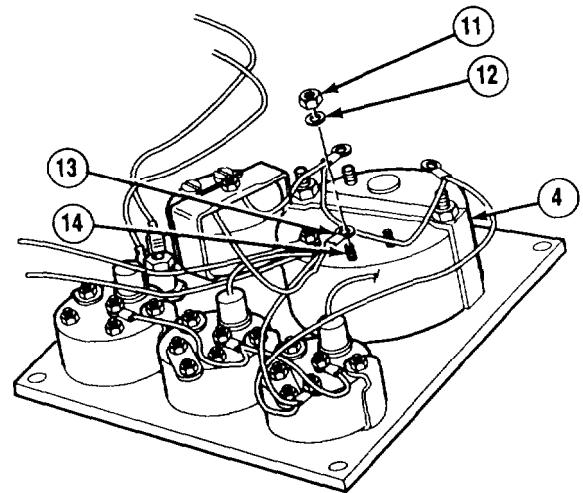
Tag and mark all wires before removal.

a. Removal.

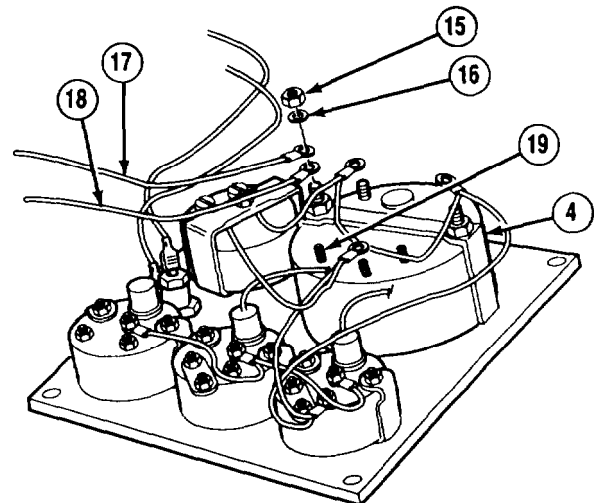
- (1) Remove nut (1) and lockwasher (2) from terminal (3) on tachometer (4). Discard lockwasher.
- (2) Remove nut (5) and lo&washer (6) from terminal (7) on tachometer (4). Discard lockwasher.
- (3) Tag and remove three wires (8, 9, and 10) from terminal (3).
- (4) Tag and remove wire (10) from terminal (7).



- (5) Remove nut (11) and lockwasher (12), tag and remove wire (13) from terminal (14) on tachometer (4). Discard lockwasher.



- (6) Remove nut (15) and lockwasher (16), tag and remove two wires (17 and 18) from terminal (19) on tachometer (4). Discard lockwasher.



4-75. TACHOMETER REPLACEMENT (CONT).

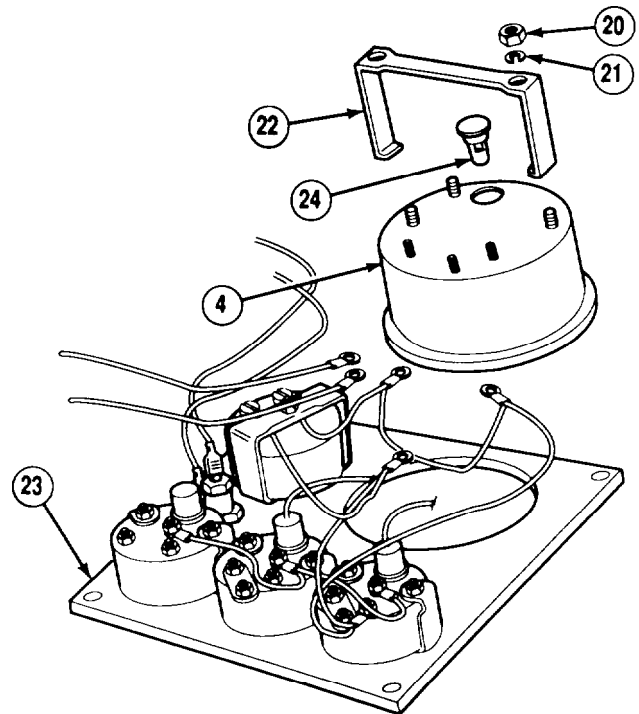
- (7) Remove two nuts (20), lockwashers (21), bracket (22), and tachometer (4) from instrument panel (23).
- (8) Remove gauge lamp (24) from tachometer (4).

b. Cleaning/Inspection.

- (1) Clean any remaining sealant from tachometer and instrument panel.
- (2) Inspect wiring for excessive heat indicated by brown or blackening of wire insulation. Replace as necessary.
- (3) Inspect for broken, striped or cracked insulation allowing wiring to show through. Replace as necessary.

c. Installation.

- (1) Install gauge lamp (24) in tachometer (4).

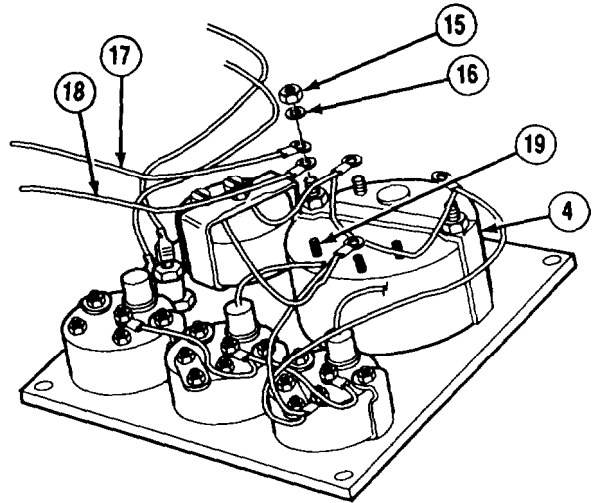


WARNING

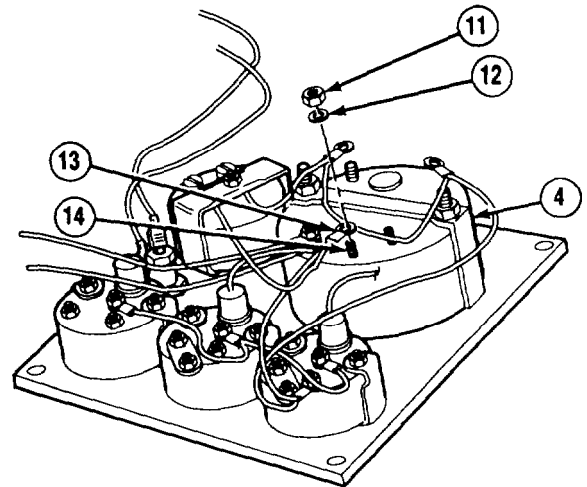
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Apply silicone sealant around tachometer (4) and install in instrument panel (23) with bracket (22), two lockwashers (21), and nuts (20).

- (3) Install wires (18 and 17) on tachometer (4) terminal (19) with lockwasher (16) and nut (15).



- (4) Install wire (13) on tachometer (4) terminal (14) with lockwasher (12) and nut (11).



4-75. TACHOMETER REPLACEMENT (CONT).

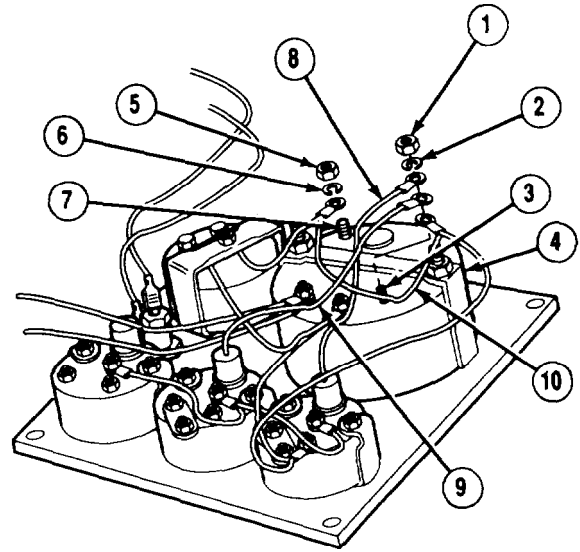
- (5) Install wire (10) on tachometer (4) terminal (7) with lockwasher (6) and nut (5).
- (6) Install wires (10,9, and 8) on tachometer (4) terminal (3) with lockwasher (2) and nut (1).

NOTE

Follow-on Maintenance:

- Install instrument panel assembly (para 4-73).
- Connect negative battery cables (para 4-90).

END OF TASK



4-76. INSTRUMENT GAUGE LAMP REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-130

Condition Description
Additive access cover
removed.

Materials/Parts

Lamp (5)

Para 4-73

Instrument panel
removed (steps 1-2).

a. Removal.

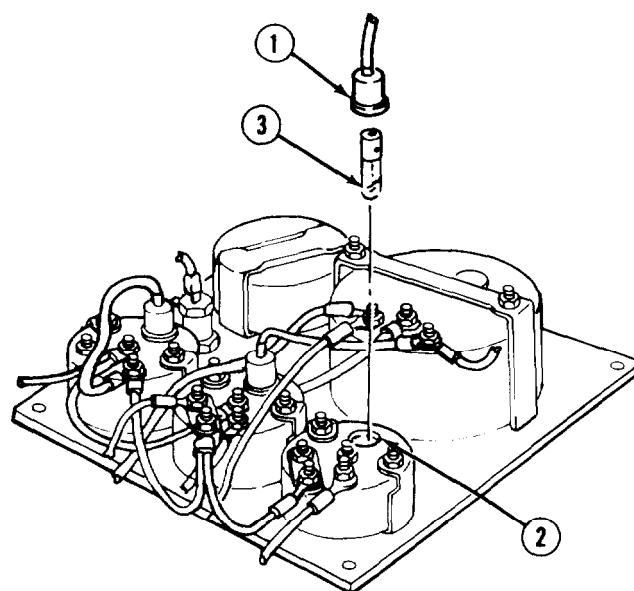
NOTE

All five lamps are removed the same way.

- (1) Remove housing (1) from socket (2).
- (2) Remove lamp (3) from lamp housing (1).
Discard lamp.

b. Installation.

- (1) Install lamp (3) in lamp housing (1).
- (2) Install lamp housing (1) in lamp socket (2).



NOTE

Follow-on Maintenance:

- Install instrument panel (para 4-73).
- Install additive access cover
(para 4-130).

END OF TASK

4-77. ADDITIVE CONTROL BOX REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

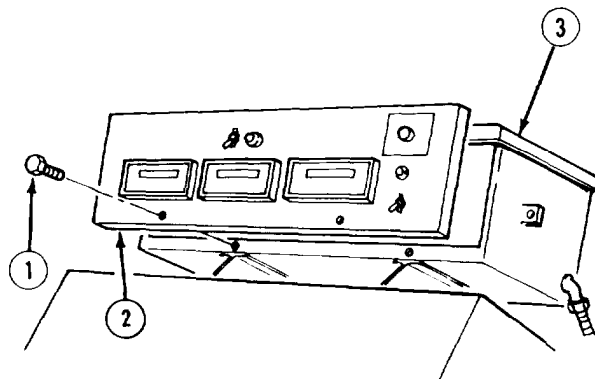
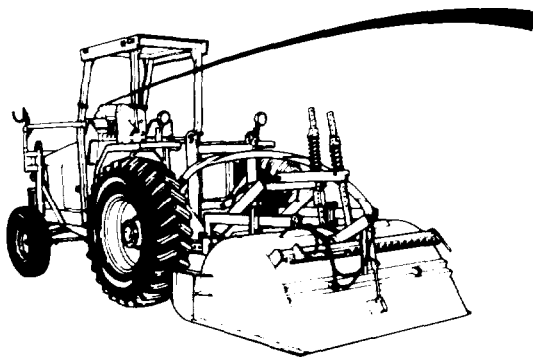
Materials/Parts

Tags, identification (item 55, appendix E)
 Lockwashers (12)
 Preformed packings (2)

Equipment Condition

TM or Para
 Para 4-130

Condition Description
 Additive access cover removed.
 Negative battery cable disconnected.



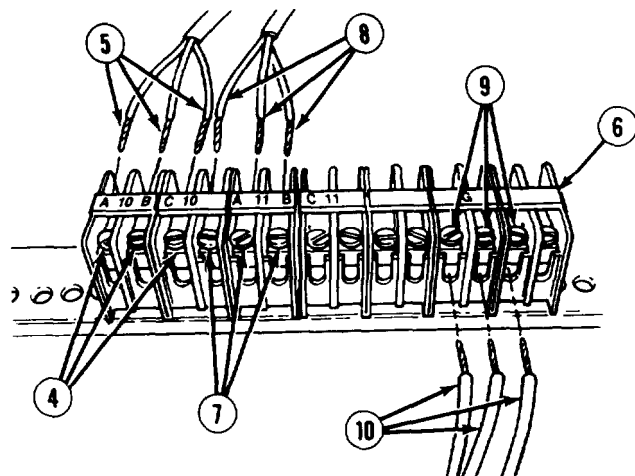
a. Removal.

- (1) Remove two screws (1) and panel (2) from additive control box (3).

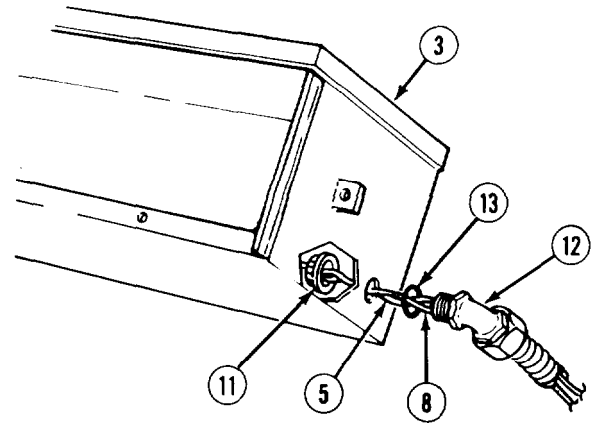
NOTE

Tag and mark all wires before removal.

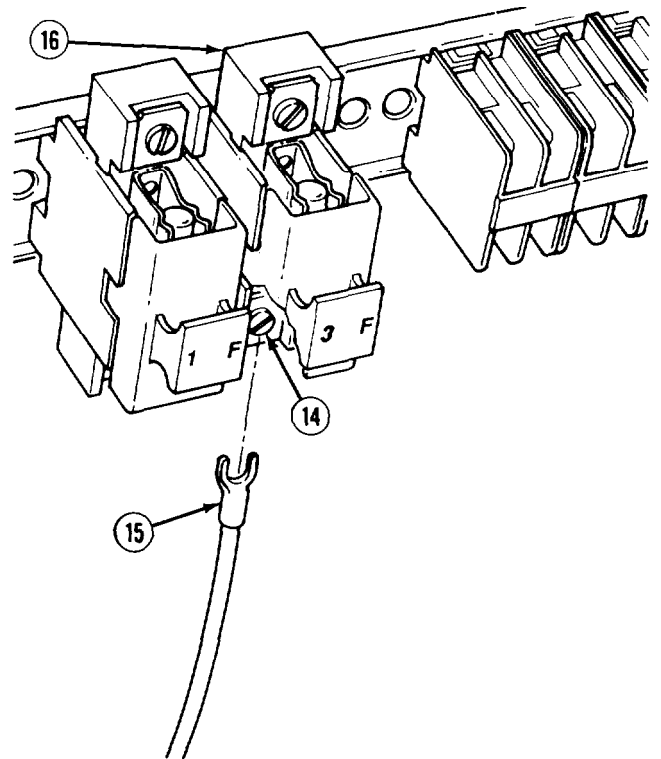
- (2) Loosen three screws (4) and remove wires (5) from terminal block (6).
- (3) Loosen three screws (7) and remove wires (8).
- (4) Loosen three screws (9) and remove wires (10).



- (5) Remove nut (11), elbow (12), and six wires (5 and 8) from additive control box (3).
- (6) If damaged, remove and discard preformed packing (13) from elbow (12).

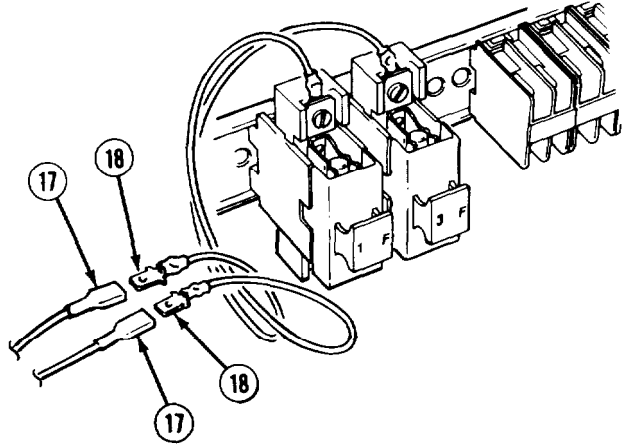


- (7) Loosen two screws (14) and remove four wires (15) from two terminals (16).

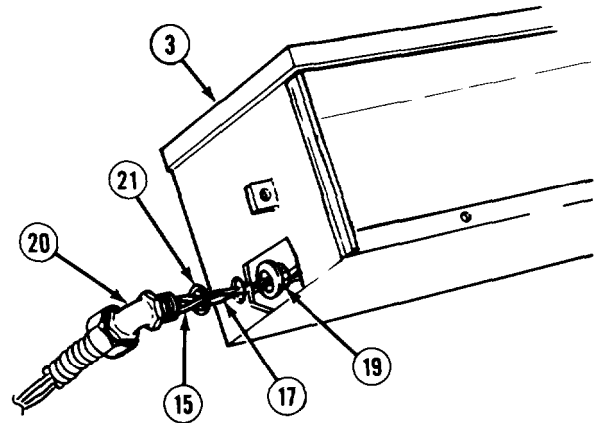


4-77. ADDITIVE CONTROL BOX REPLACEMENT (CONT).

- (8) Disconnect two wires (17) from quick disconnects (18).



- (9) Remove nut (19), elbow (20), and six wires (15 and 17) from additive control box (3).
- (10) If damaged, remove and discard preformed packing (21) from elbow (20).



- (11) Remove eight nuts (22), lockwashers (23), and screws (24) from two mounts (25).
- (12) Remove additive control box (3) from firewall (26).

NOTE

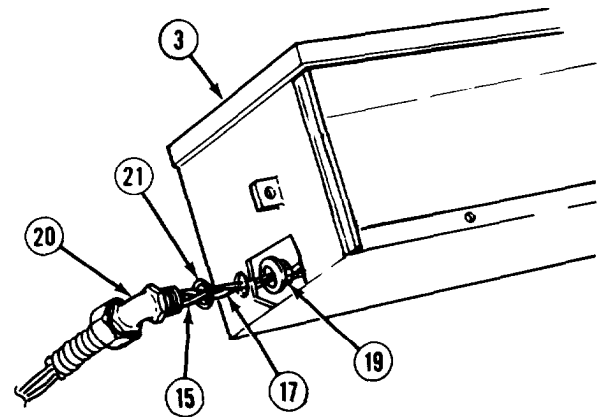
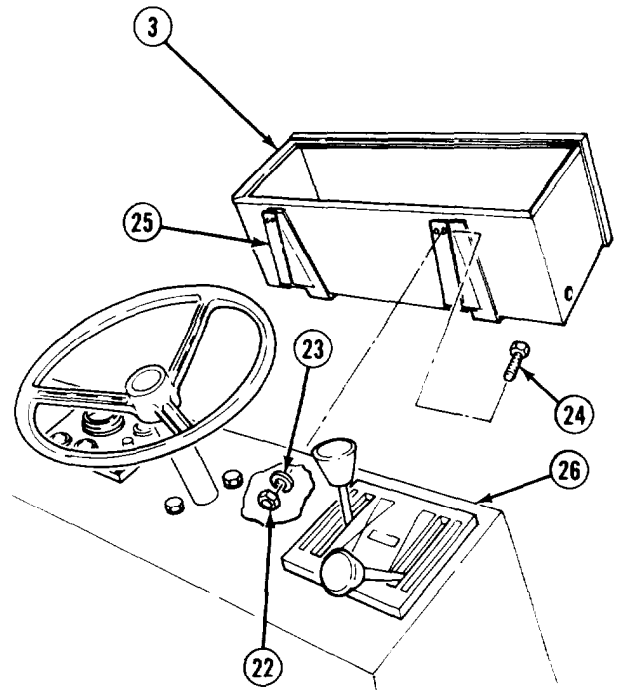
If panel is to be stored, install cover on panel with screws.

b. Installation.

NOTE

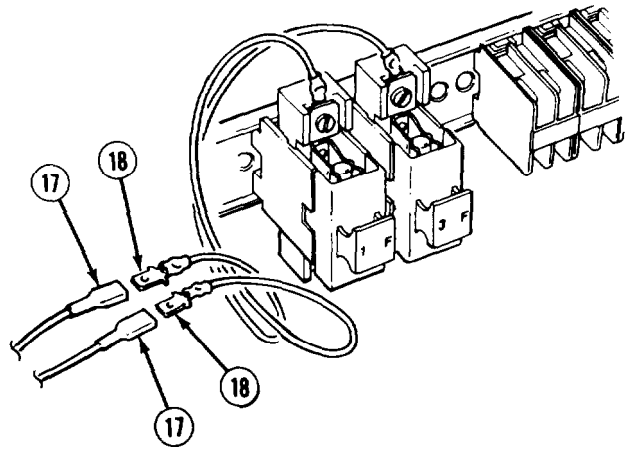
If cover was installed for storage, remove screws and cover from panel.

- (1) Position additive control box (3) on firewall (26).
- (2) Install eight screws (24), lockwashers (23), and nuts (22) through two brackets (25).
- (3) If removed, install preformed packing (21) on elbow (20).
- (4) Install six wires (15 and 17), elbow (20), and nut (19) in additive control box (3).

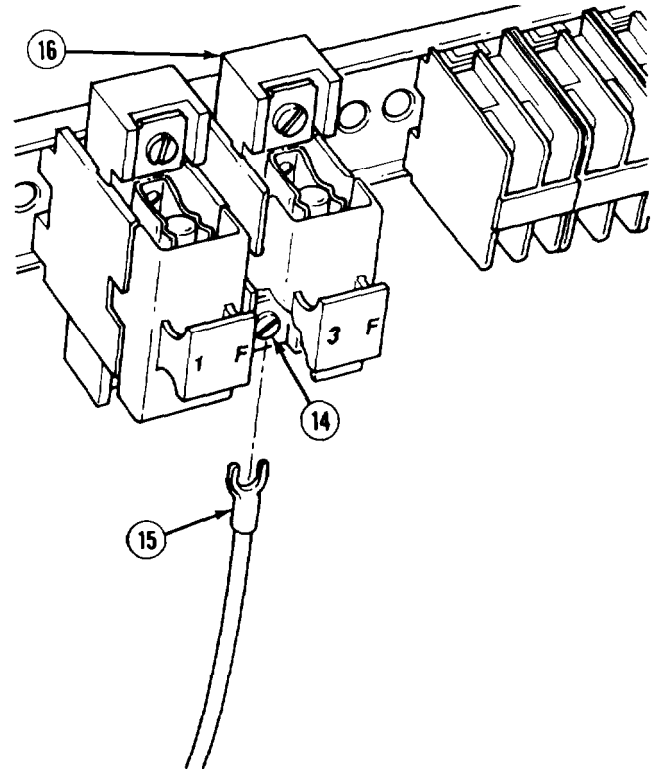


4-77. ADDITIVE CONTROL BOX REPLACEMENT (CONT).

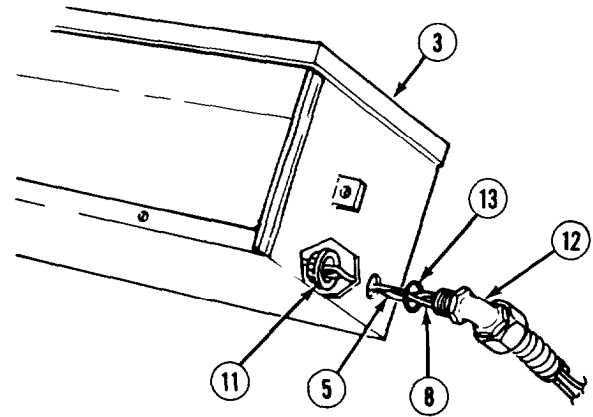
- (5) Connect two wires (17) to quick disconnects (18).



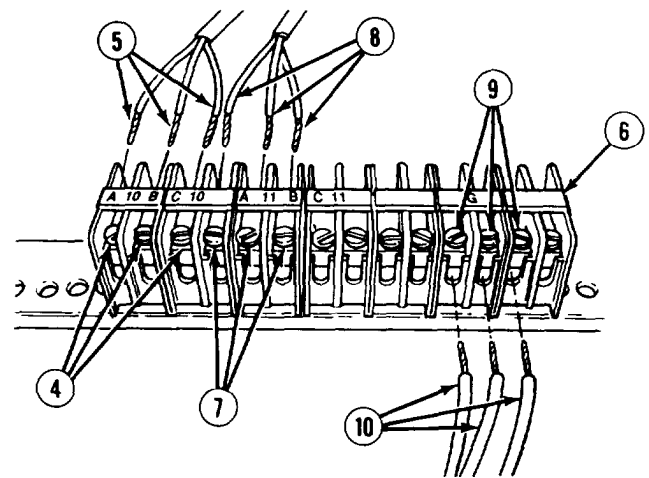
- (6) Install four wires (15) on two terminals (16) and tighten two screws (14).



- (7) If removed, install preformed packing (13) on elbow (12).
- (8) Install six wires (5 and 8), elbow (12), and nut (11) on additive control box (3).



- (9) Install three wires (10) on terminal block (6). Tighten three screws (9).
- (10) Install six wires (5 and 8) on terminal block (6). Tighten six screws (4 and 7).



4-77. ADDITIVE CONTROL BOX REPLACEMENT (CONT).

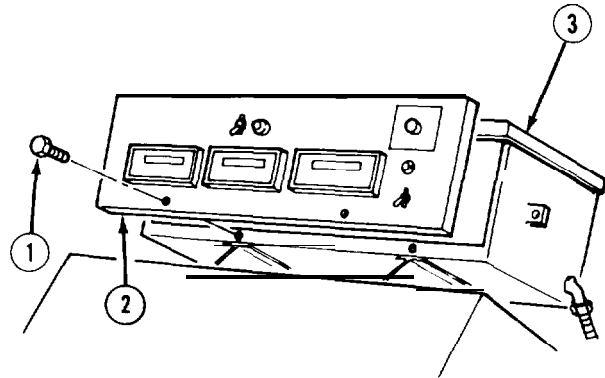
- (11) Install panel (2) on additive control box (3) with two screws (1).

NOTE

Follow-on Maintenance:

- . Install additive access cover (para 4-130).
- . Connect negative battery cable (para 4-90).

END OF TASK



4-78. FIREWALL INSTRUMENT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-90

Condition Description
Negative battery cable disconnected.

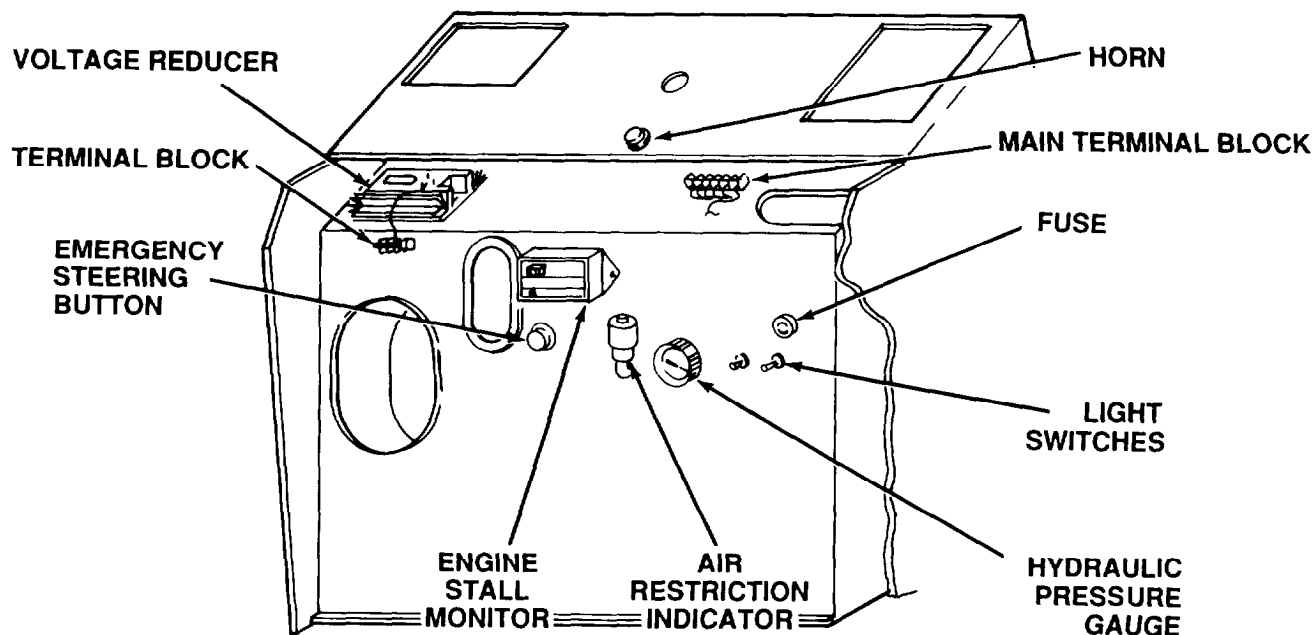
Material/Parts

Sealant, hydraulic (item 52, appendix E)
Tag, identification (item 55, appendix E)
Lockwashers (11)
Washer, star (4)

Para 2-14

Left/right engine doors opened.

THIS TASK WILL REMOVE THE FOLLOWING COMPONENTS



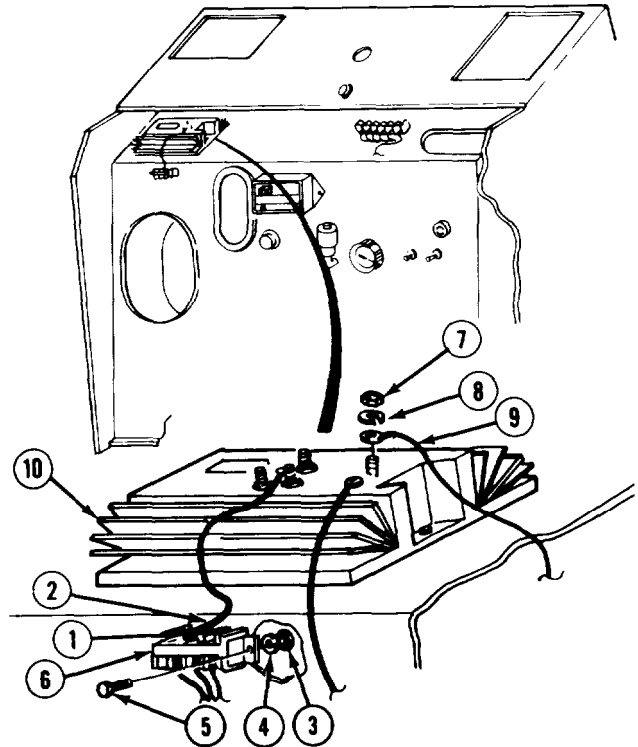
4-78. FIREWALL INSTRUMENT REPLACEMENT (CONT).

a. Removal.

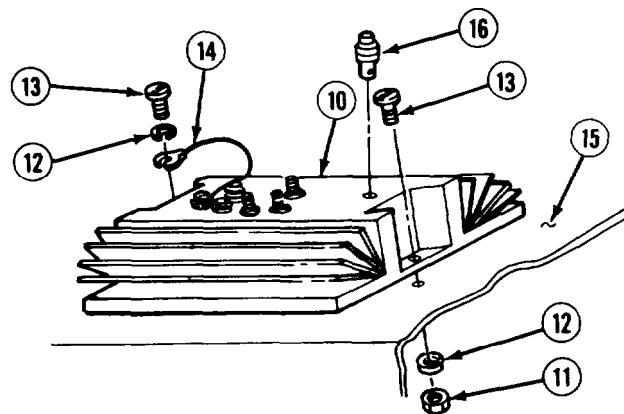
NOTE

Tag and mark all wires before removal.

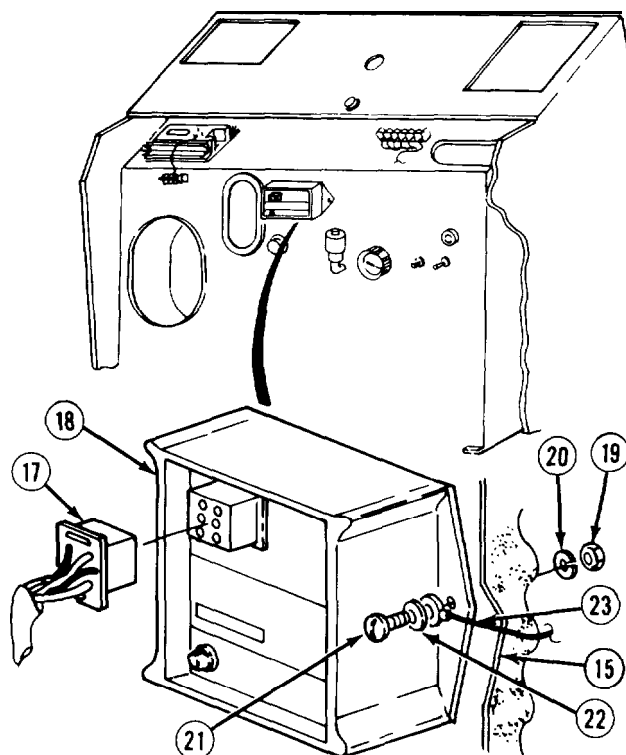
- (1) Loosen four screws (1) tag, mark and remove four wires (2).
- (2) Remove two nuts (3), lockwashers (4), screws (5), and terminal block (6) from firewall. Discard lockwashers.
- (3) Remove three nuts (7), lockwashers (8), and wires (9) from voltage reducer (10). Discard lockwashers.



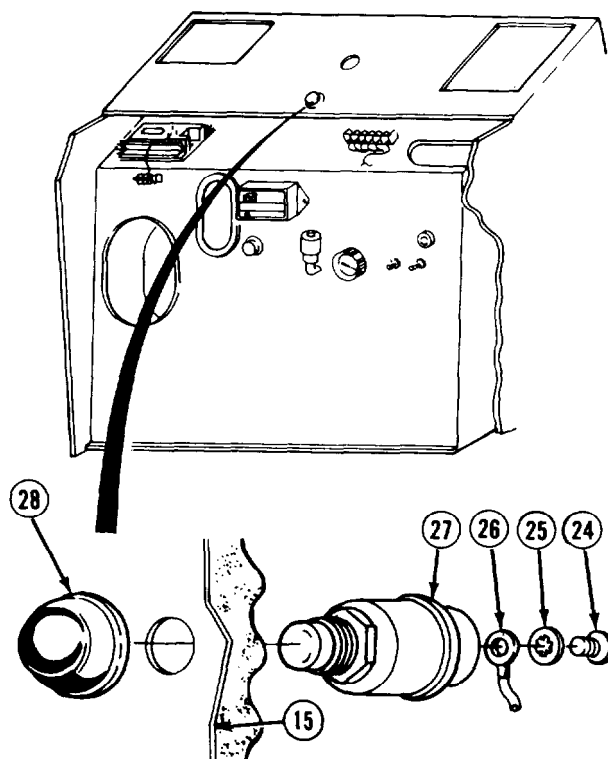
- (4) Remove two nuts (11), lockwashers (12), screws (13), and ground wire (14). Discard lockwashers.
- (5) Remove voltage reducer (10) from firewall (15).
- (6) Remove three fuses (16) from voltage reducer (10).



- (7) Remove plug (17) from engine stall monitor (18).
- (8) Remove two nuts (19), lockwashers (20), screws (21), washers (22), and two ground wires (23). Discard lockwashers.
- (9) Remove engine stall monitor (18) from firewall (15).

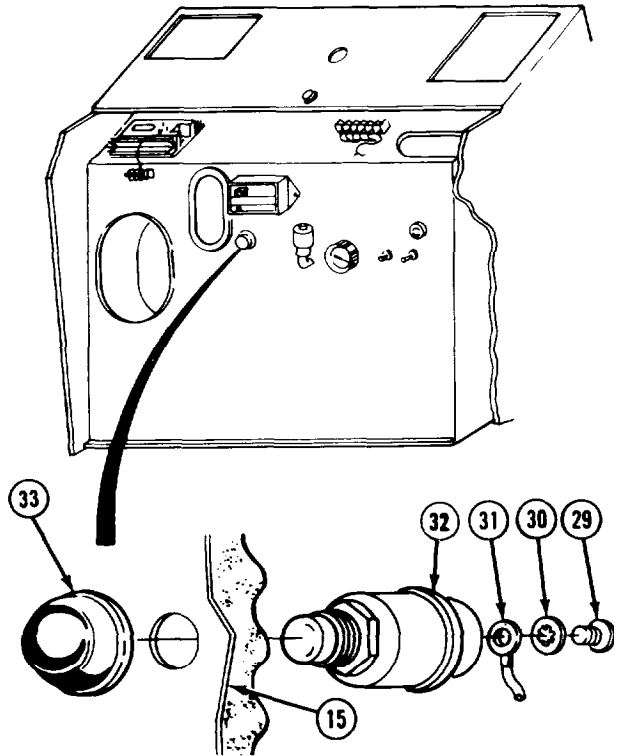


- (10) Remove two screws (24), star washers (25) and leads (26) from horn button (27). Discard star washers.
- (11) Unscrew rubber boot (28) and horn button (27) will release from firewall (15).

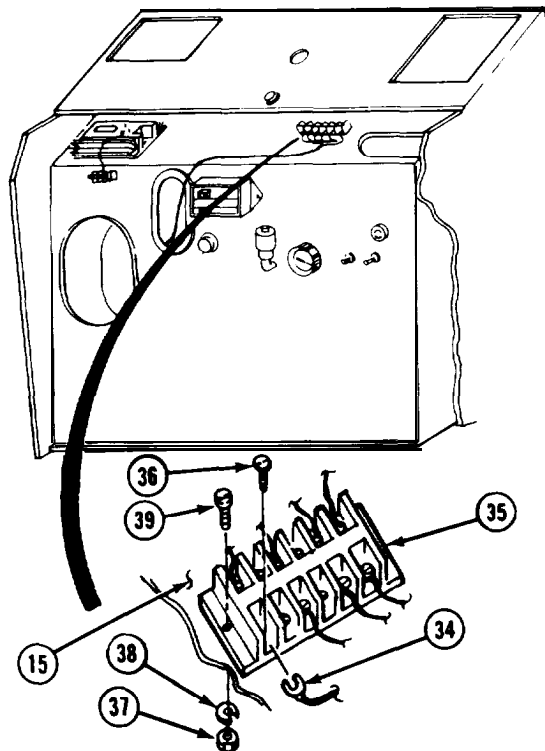


4-78. FIREWALL INSTRUMENT REPLACEMENT (CONT).

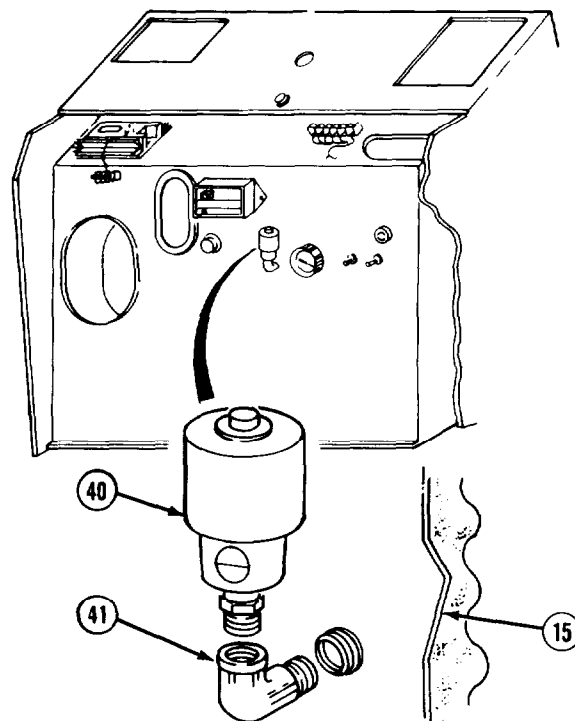
- (12) Remove two screws (29), star washers (30), and leads (31) from emergency steering button (32). Discard star washers.
- (13) Unscrew rubber boot (33) and emergency steering button (32) will release from firewall (15).



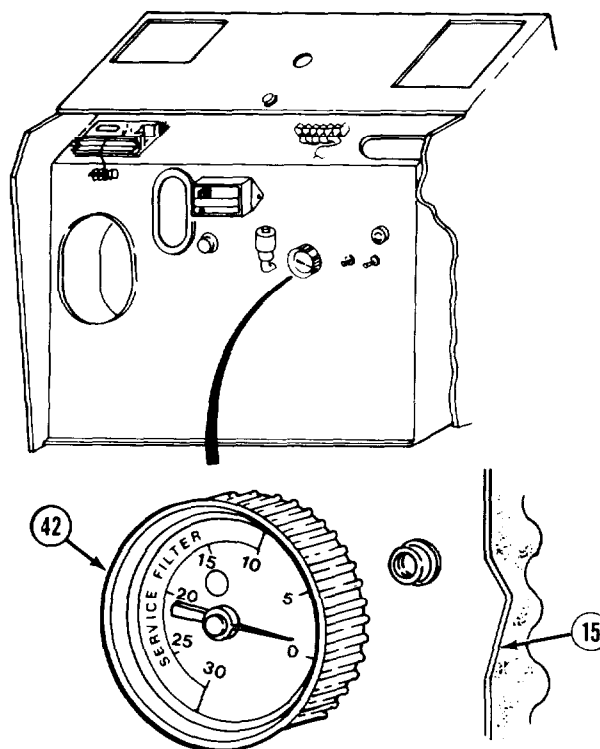
- (14) Remove eight leads (34) from main terminal block (35) by loosening screws (36).
- (15) Remove two nuts (37), lockwashers (38), screws, (39), and main terminal block (35) from firewall (15). Discard lockwashers.



- (16) Remove air restriction indicator (40) and elbow fitting (41) from firewall (15).

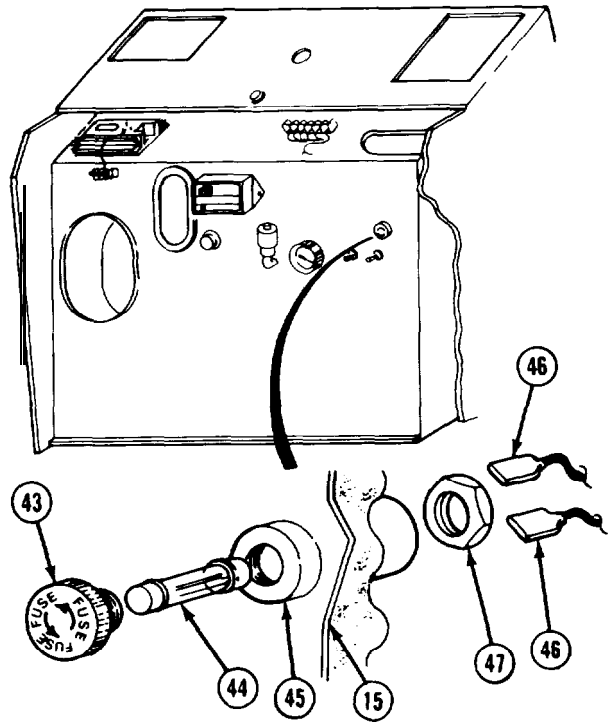


- (17) Remove hydraulic pressure gauge (42) from firewall (15).



4-78. FIREWALL INSTRUMENT REPLACEMENT (CONT).

- (18) Remove fuse cover (43) and fuse (44) from fuse port (45).
- (19) Remove two leads (46) at rear of fuse port (45).
- (20) Remove jamnut (47) and fuse port (45) from firewall (15).



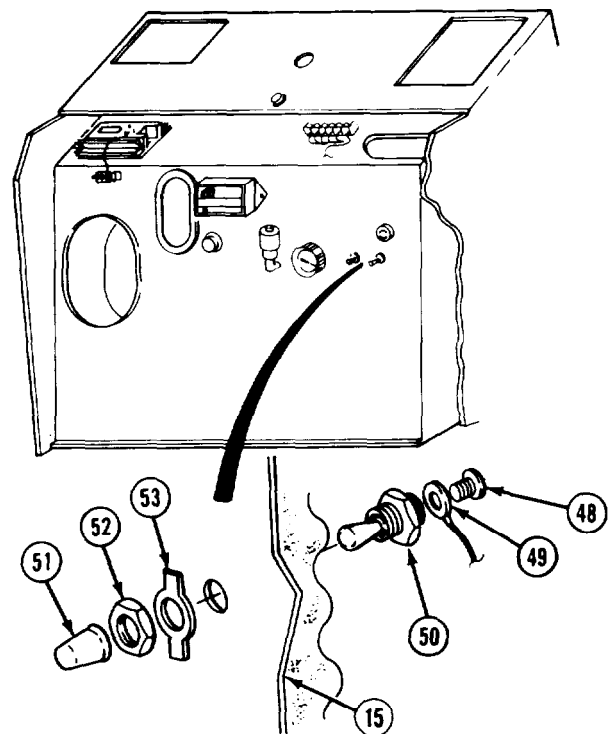
- (21) Remove three screws (48) and leads (49) from switches (50).
- (22) Remove two rubber boots (51), jamnuts (52), and washers (53) from switches (50).
- (23) Remove switches (50) from firewall (15).

b. Cleaning/Inspection.

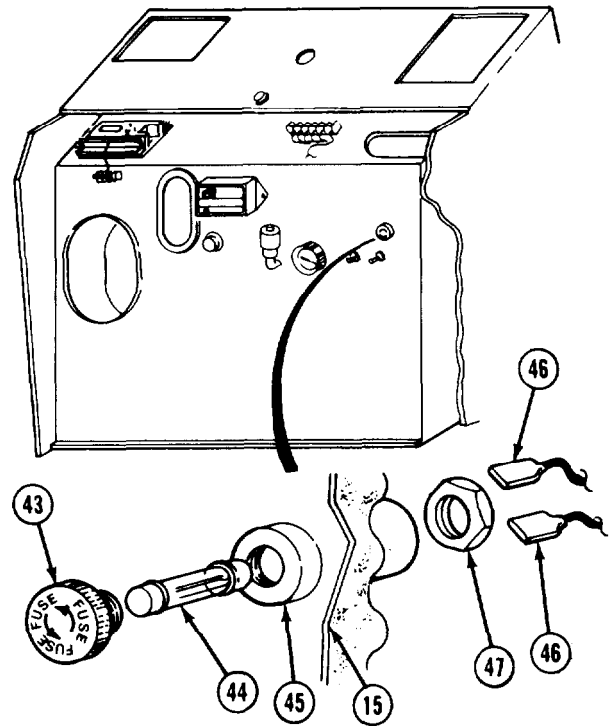
- (1) Check all gauges, leads, and switches for proper connections.
- (2) Check for damaged parts.
- (3) Replace all damaged parts.

c. Installation.

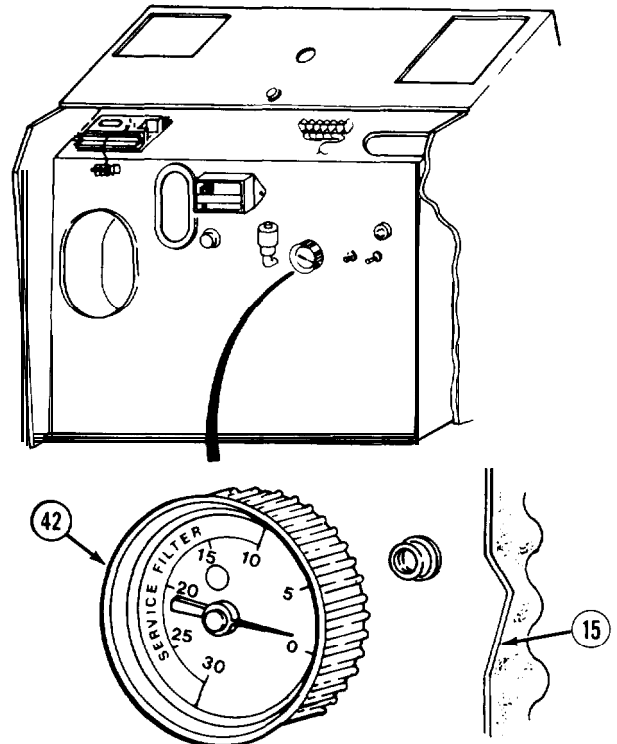
- (1) Install switch (50) to firewall (15).
- (2) Install washers (53), jamnuts (52), and two rubber boots (51) to switches (50).
- (3) Install three leads (49) with screws (48) to switches (50).



- (4) Install fuse port (45) to firewall (15) and secure it with jamnut (47).
- (5) Install two leads (46) to rear of fuse port (45).
- (6) Install fuse (44) and fuse cover (43) to fuse port (45).

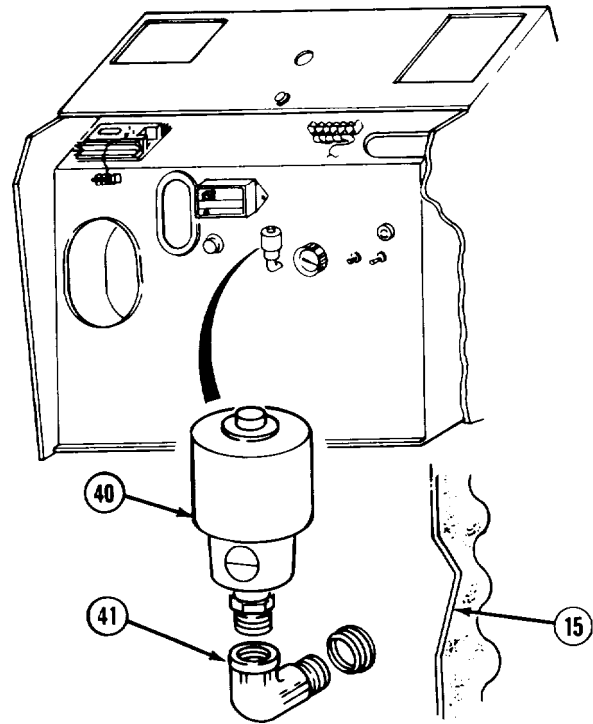


- (7) Apply hydraulic sealant to threads and install hydraulic pressure gauge (42) to firewall (15).

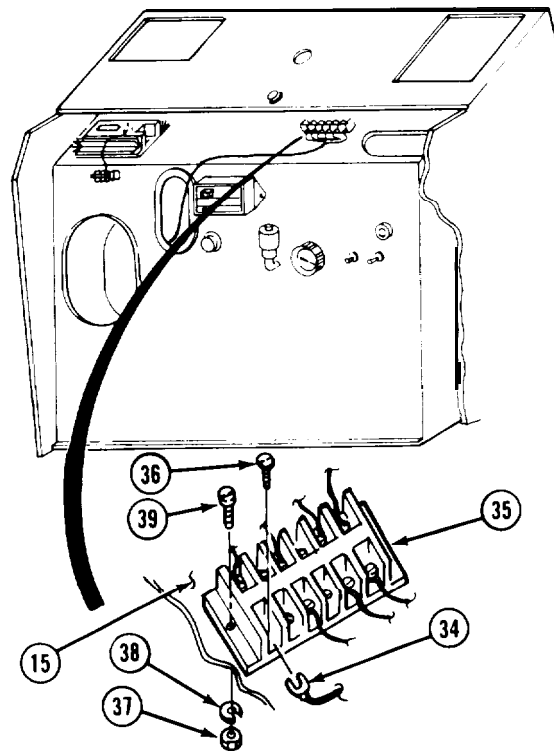


4-78. FIREWALL INSTRUMENT REPLACEMENT (CONT).

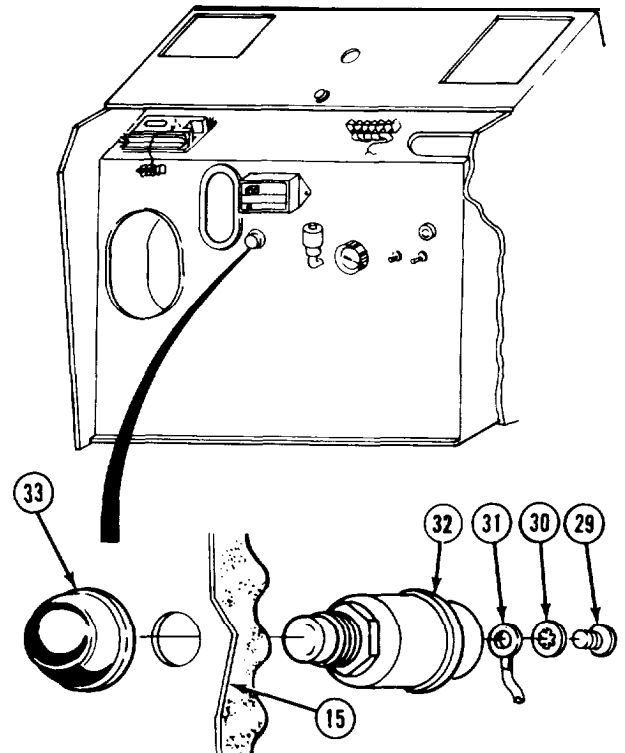
- (8) Apply hydraulic sealant to threads and install elbow fitting (41) and air restriction indicator (40) to firewall (15).



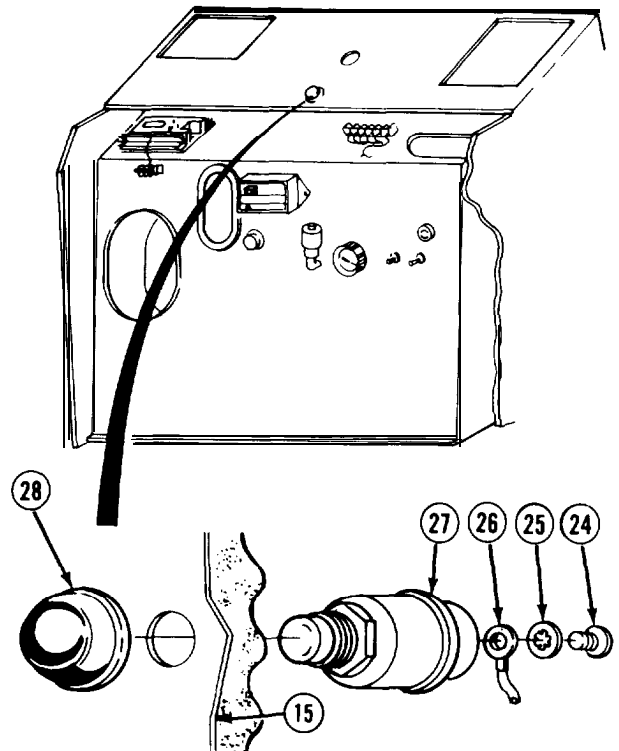
- (9) Install main terminal block (35) on firewall (15) using two screws (39), lockwashers (38), and nuts (37).
- (10) Install eight leads (34) to main terminal block (35) and tighten screws (36).



- (11) Install emergency steering button (32) and rubber boot (33) on firewall (15).
- (12) Install leads (31), star washers (30), and screws (29) to emergency steering button (32).

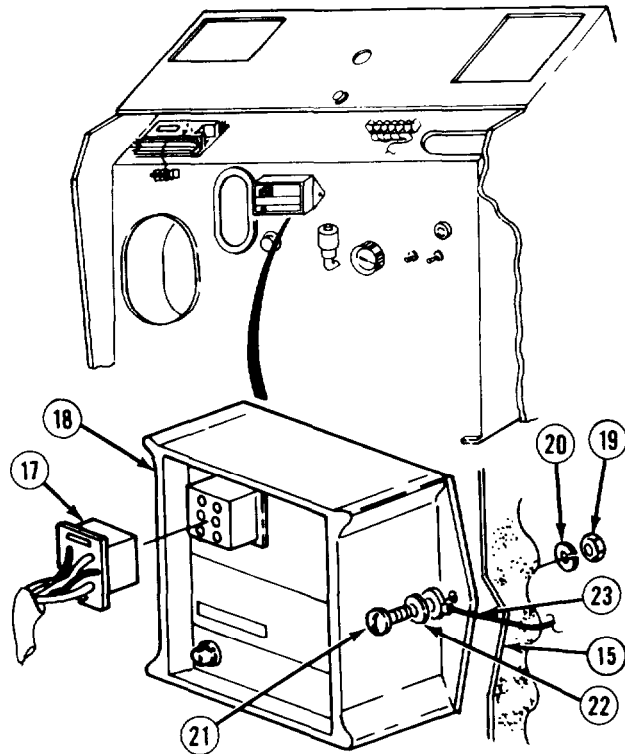


- (13) Install horn button (27) and rubber boot (28) on firewall (15).
- (14) Install two leads (26), star washers (25), and screws (24) on horn button (27).

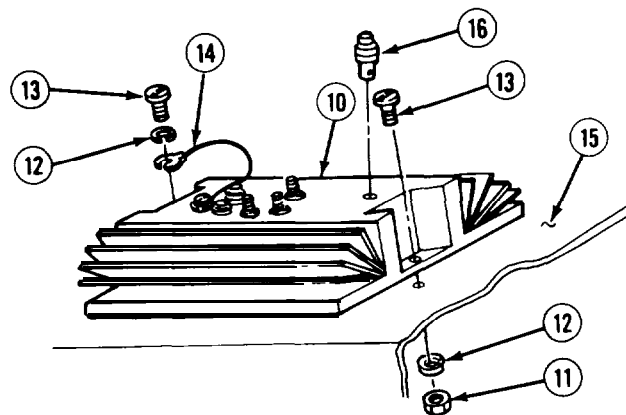


4-78. FIREWALL INSTRUMENT REPLACEMENT (CONT).

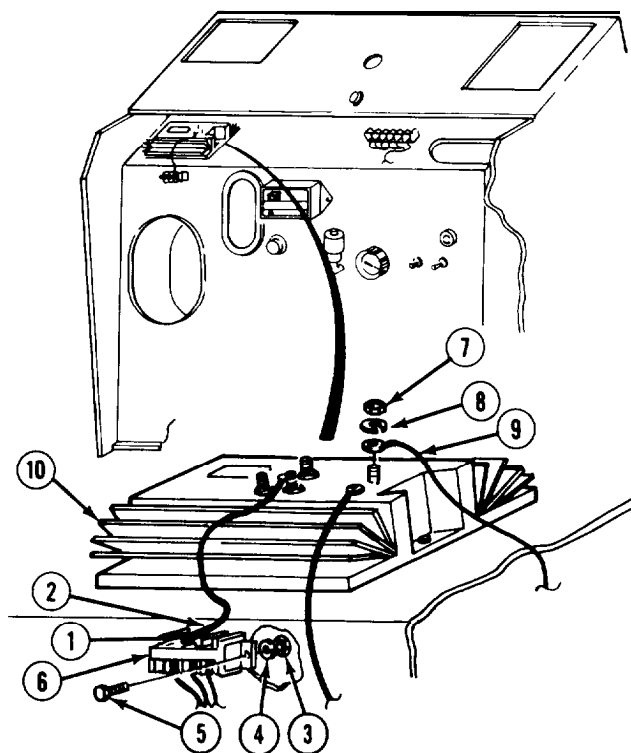
- (15) Install engine stall monitor (18) to firewall (15).
- (16) Install two ground leads (23), washers (22), screws (21), lockwashers (20), and nuts (19) on engine stall monitor (18).
- (17) Install plug (17) to engine stall monitor (18).



- (18) Install three fuses (16) on transducer (10).
- (19) Install transducer (10) to firewall (15).
- (20) Install ground wire (14), screws (13), lockwashers (12), and two nuts (11) on transducer (10).



- (21) Install three leads (9), lockwashers (8), and nuts (7) to transducer (10).
- (22) Install two screws (3), lockwashers (4), and nuts (5) to terminal block (6).
- (23) Install four leads (2) and screws (1) to terminal block (6).



NOTE

Follow-on Maintenance:

- . Connect negative battery cable (para 4-90).
- . Close left/right engine doors (para 2-14).

END OF TASK

4-79. IGNITION SWITCH REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Tags, identification (item 55, appendix E)
Washers, star (3)

Equipment Condition

TM or Para
Para 4-90

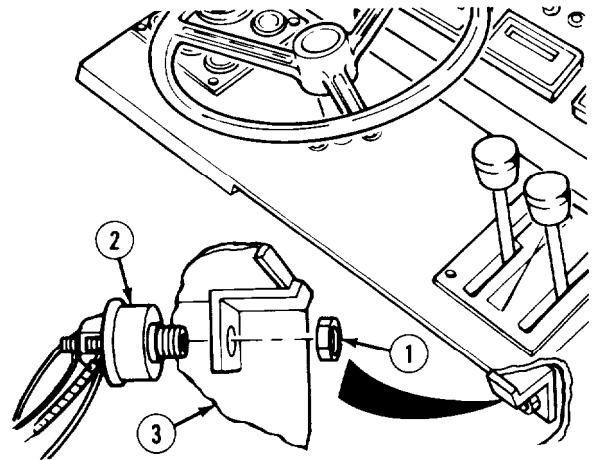
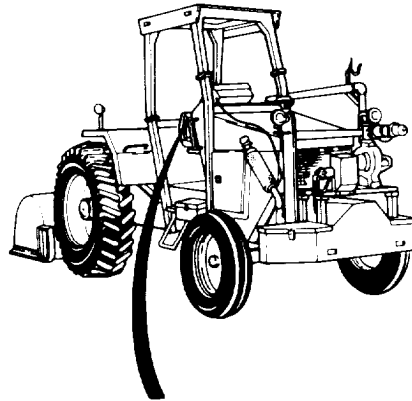
Condition Description
Negative battery cable disconnected.

Para 4-128

Dash panel removed.

a. Removal.

- (1) Remove nut (1) and ignition switch (2) from firewall (3).



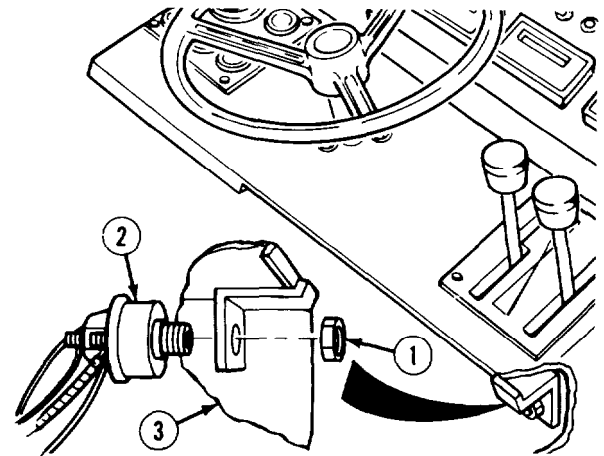
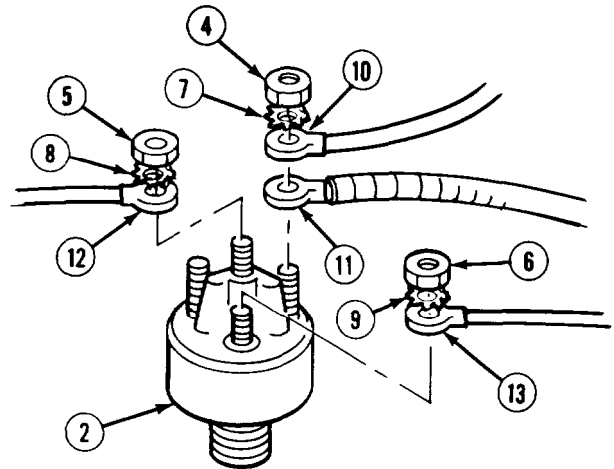
NOTE

Tag and mark all wires before removal.

- (2) Tag, mark and remove three nuts (4, 5, and 6), star washers (7, 8, and 9) and wires (10, 11, 12, and 13) from ignition switch (2). Discard star washers.

b. Installation.

- (1) Install wires (13, 12, 11, and 10), star washers (9, 8, and 7), and nuts (6, 5, and 4) on ignition switch (2).
- (2) Install ignition switch (2) on firewall (3) with nut (1).

**NOTE**

Follow-on Maintenance:

- . Install dash panel (para 4-128).
- . Connect negative battery cable (para 4-90).

END OF TASK

4-80. ELECTRIC SOLENOID REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Tags, identification (item 55, appendix E)

Lockwashers (6)

Bushings (2)

Equipment Condition

TM or Para

Para 2-14

Para 4-90

Condition Description

Right engine door opened.

Negative battery cable removed.

General Safety Instructions

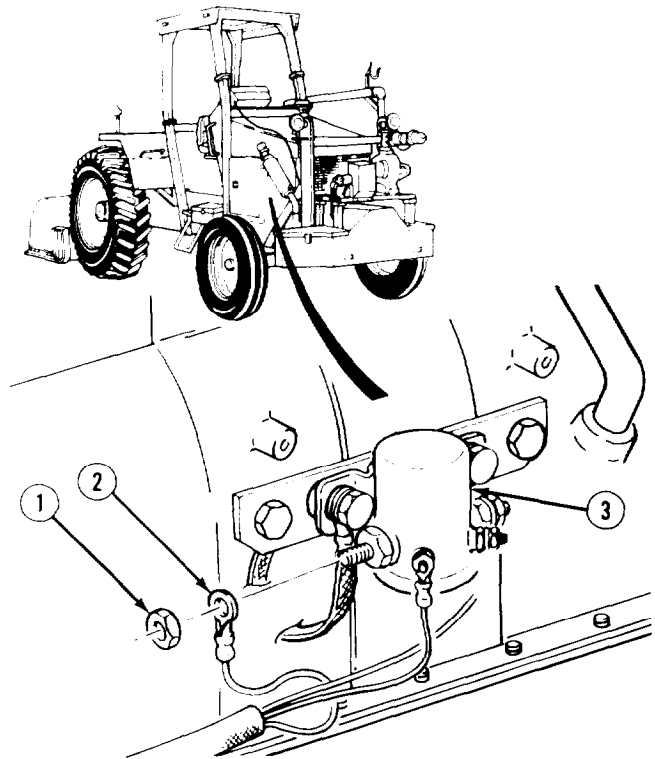
If engine has previously been in operation, use caution when performing procedure.

a. Removal.

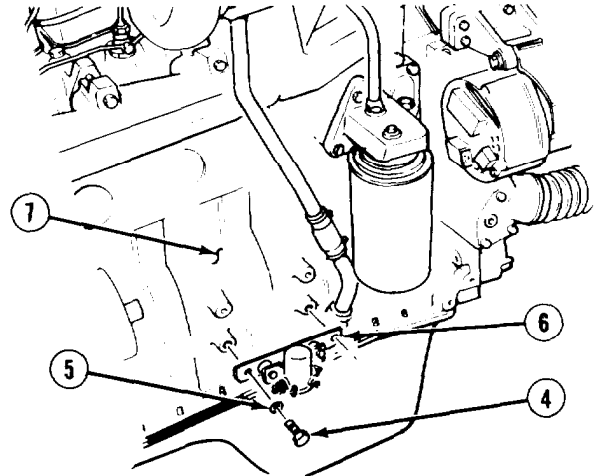
NOTE

Tag and mark all wires before removal.

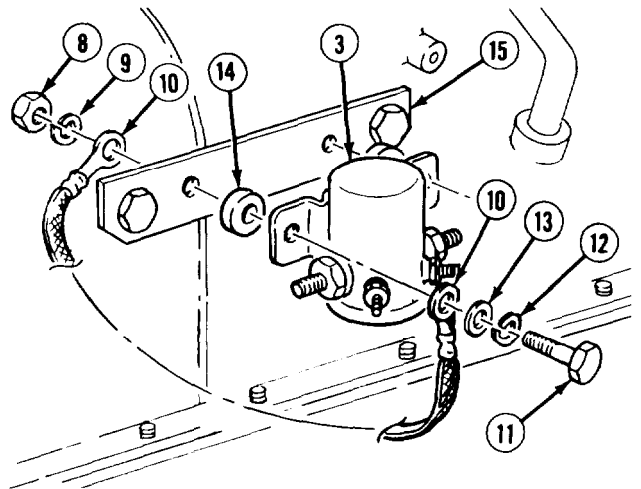
- (1) Tag, mark, and remove four nuts (1) and wires (2) from solenoid (3).



- (2) Remove two screws (4), lockwashers (5), and solenoid (3) from engine block (6). Discard lockwashers.

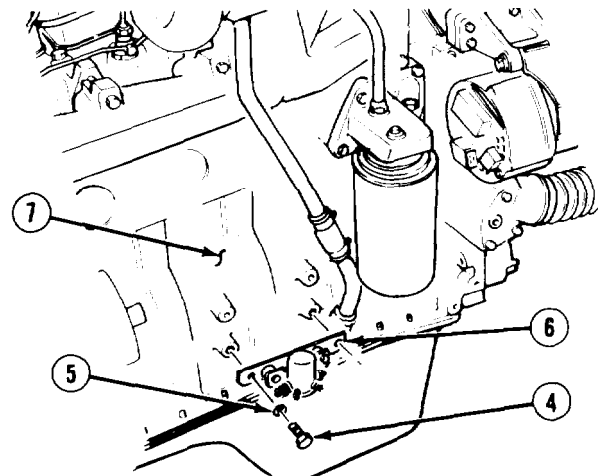


- (3) Remove two nuts (7), lockwashers (8) and ground strap (9). Discard lockwashers.
- (4) Remove two screws (10), lockwashers (11), washers (12) ground strap (9), solenoid (3), and two bushings (13) from bracket (14). Discard lockwashers and bushings.



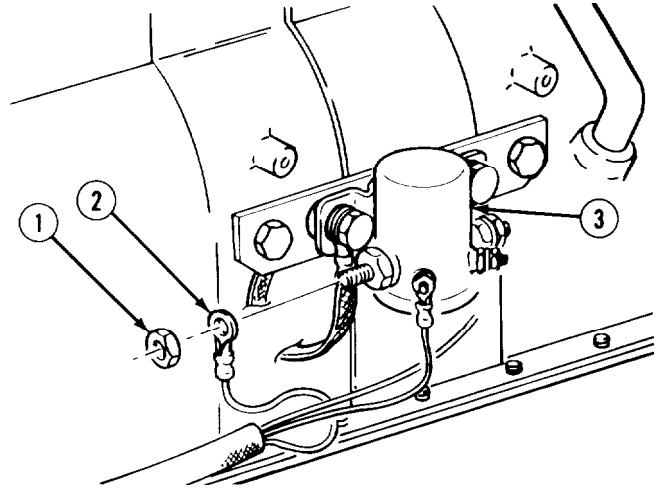
b. Installation.

- (1) Install two bushings (13) solenoid (3), ground strap (9), two washers (12), lockwashers (11), and two screws (10).
- (2) Install ground strap (9), two lockwashers (8), and nuts (7).
- (3) Install solenoid assembly (3) on engine block (6) with two lockwashers (5) and screws (4). Tighten screws 216 lb-in (24 N•m).



4-80. ELECTRIC SOLENOID REPLACEMENT (CONT).

- (4) Install four wires (2) and nuts (1) on solenoid (3).



NOTE

Follow-on Maintenance:

- . Install negative battery cable (para 4-90).
- . Close right engine door (para 2-14).

END OF TASK

4-81. FLOODLIGHT ASSEMBLY REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

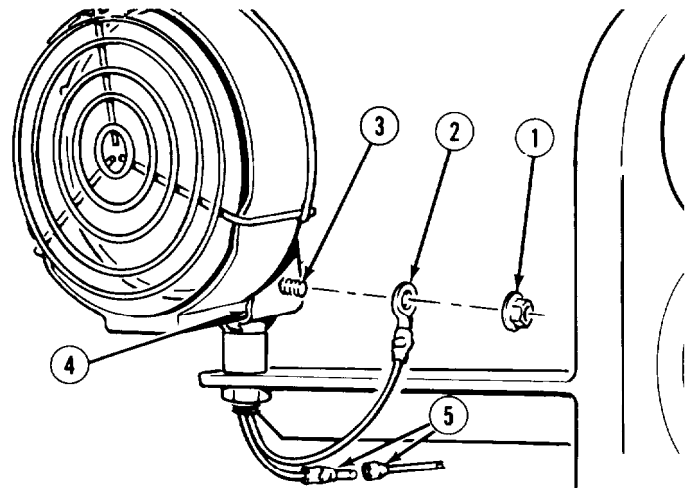
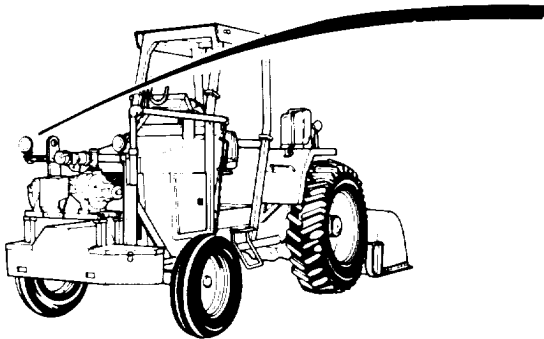
TM or Para
Para 4-90

Condition Description
Negative battery cable disconnect.

Materials/Parts

Cloth, lint-free (item 12, appendix E)
Tags, identification (item 55, appendix E)
Lockwasher
Locknut

a. Removal.

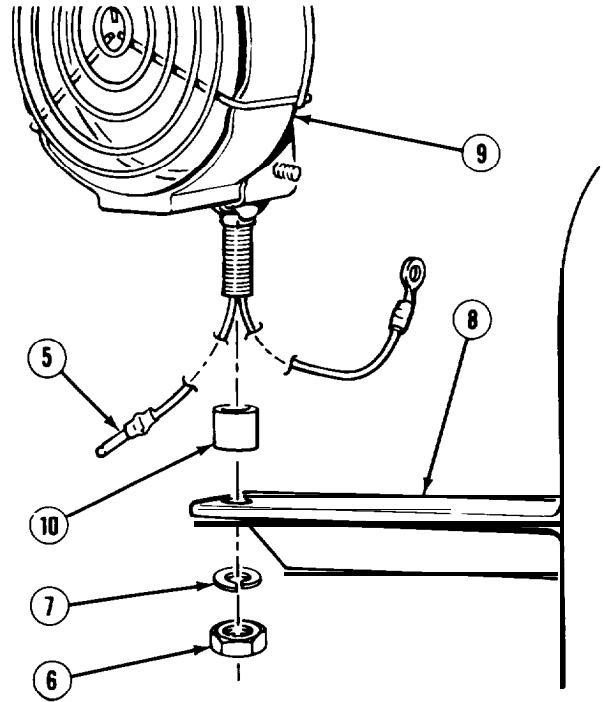


NOTE

- . This procedure is the same for all floodlights.
- . Tag and mark all wires before removal.
- (1) Remove locknut (1) wire (2), from screw (3) in floodlight mount (4). Discard locknut.
- (2) Tag, mark, and disconnect connector (5)

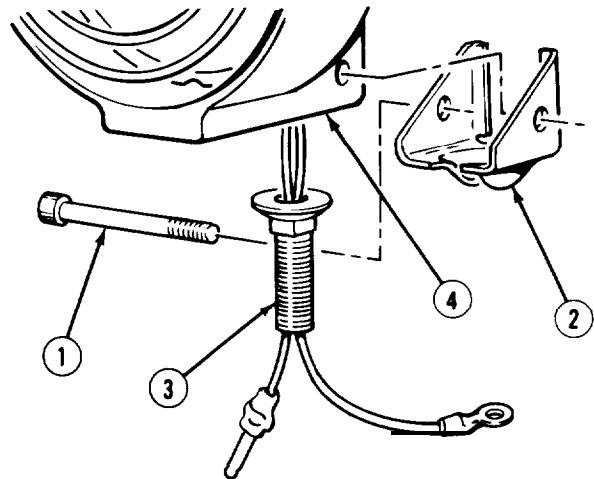
4-81. FLOODLIGHT ASSEMBLY REPLACEMENT/REPAIR (CONT).

- (3) Remove nut (6) and lockwasher (7) from bracket (8). Discard lockwasher.
- (4) Remove floodlight assembly (9), and spacer (10) from bracket (8).



b. Disassembly.

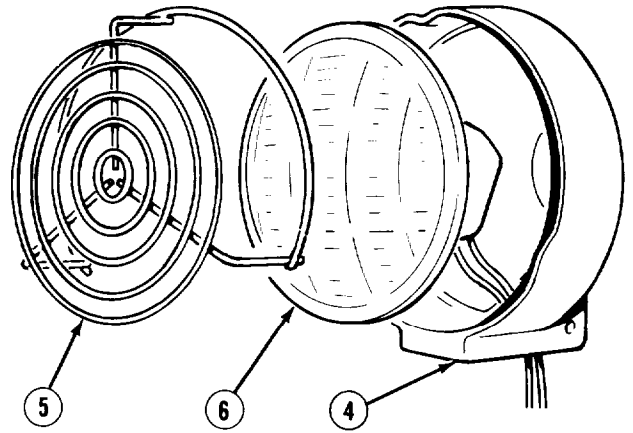
- (1) Remove screw (1), floodlight mount (2) and mounting screw (3) from floodlight base (4).



- (2) Remove grille (5) from base (4).
- (3) Remove lamp (6) from base (4).

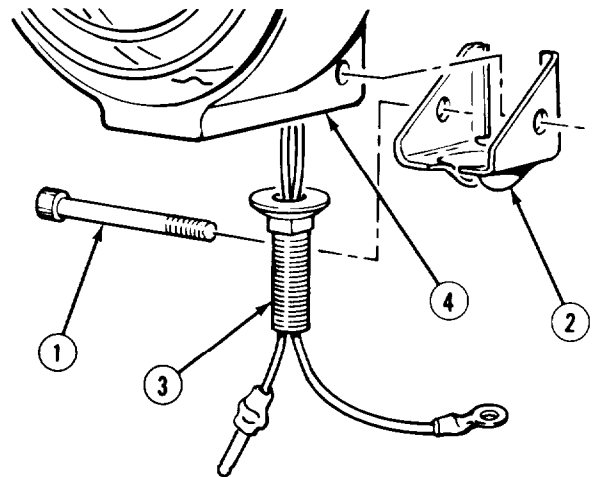
c. Cleaning/Inspection.

- (1) Wipe parts clean with lint-free cloth.
- (2) Check for frayed or broken wires.
- (3) Check for cracks, rust, holes or other damage.
- (4) Replace damaged parts.



d. Assembly.

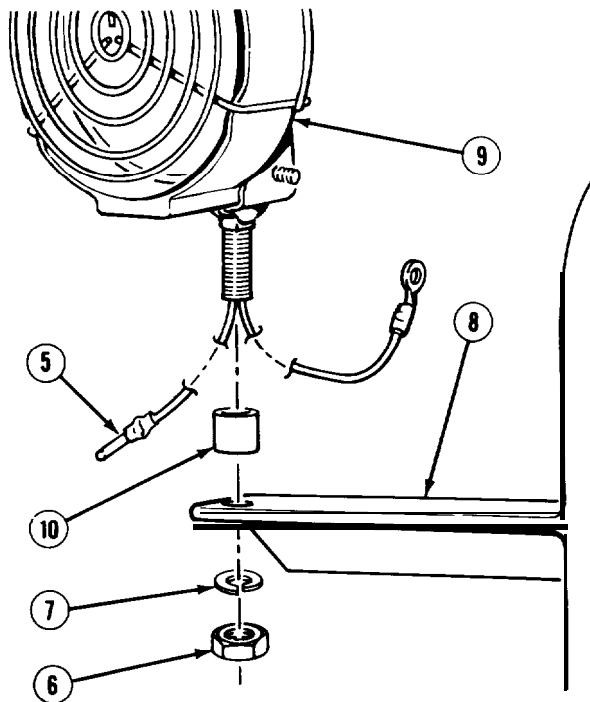
- (1) Install lamp (6) in base (4).
- (2) Install grille (5) on base (4).
- (3) Install mounting screw (3) on base (4).
- (4) Install floodlight mount (2) and screw (3) on base (4).



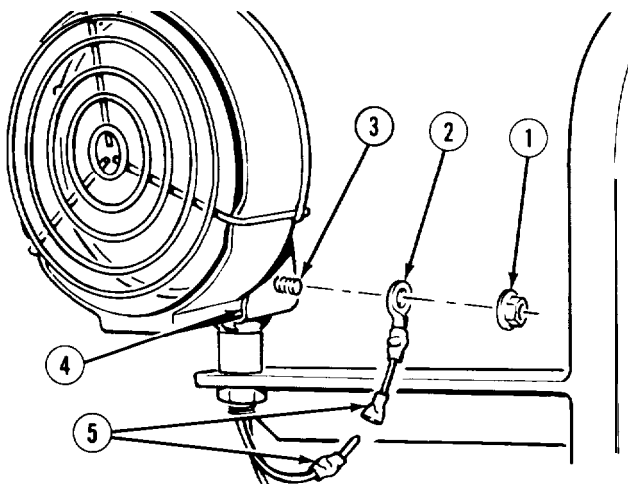
4-81. FLOODLIGHT ASSEMBLY REPLACEMENT/REPAIR (CONT).

e. Installation.

- (1) Install spacer (10) and floodlight assembly (9) in bracket (8) with lockwasher (7) and nut (6).



- (2) Connect connector (5).
- (3) Install wire (2) and locknut (1) on screw (3). Tighten locknut securely against floodlight mount (4).



NOTE

Follow-on Maintenance: Connect negative battery cable (para 4-90).

END OF TASK

4-82. WATER TEMPERATURE SENSOR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Compound, thread locking (item 15, appendix E)

Lockwasher

Equipment Condition

TM or Para

Para 2-14

Para 4-125

Condition Description

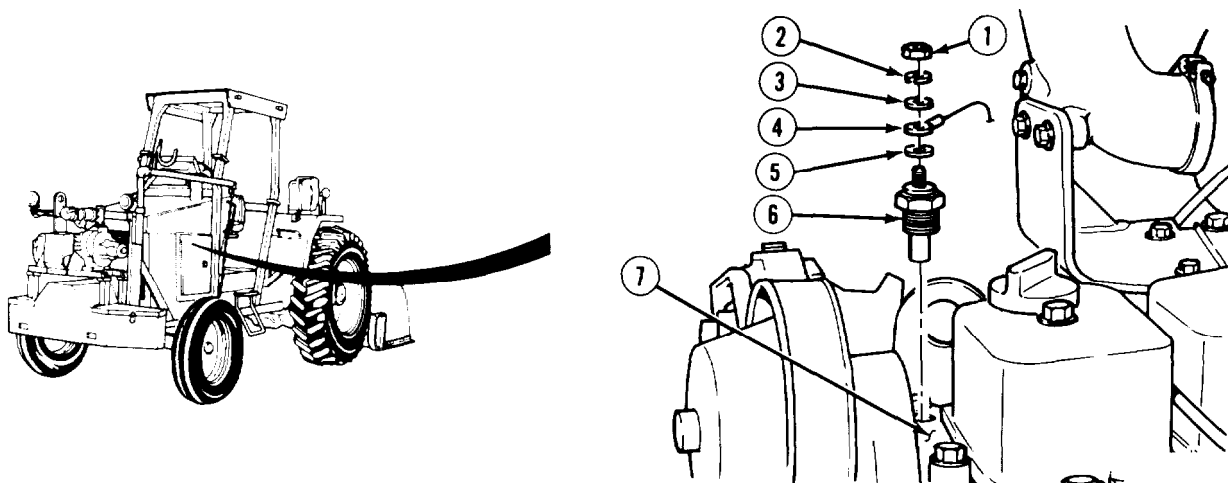
Left engine door opened.

Hood removed.

General Safety Instructions

If engine has previously been in operation, allow time for cooling before performing procedure.

a. Removal.



WARNING

Do not remove temperature sensor if engine is hot. Contact from steam or hot coolant will result in serious injury to personnel.

- (1) Remove nut (1), lockwasher (2), washer (3), wire (4), and washer (5) from temperature sensor (6). Discard lockwasher.
- (2) Remove temperature sensor (6) from cylinder head (7).

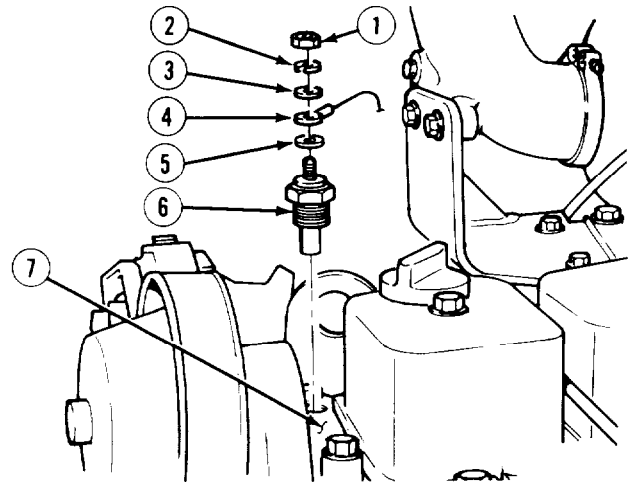
4-82. WATER TEMPERATURE SENSOR REPLACEMENT (CONT).

b. Installation.

WARNING

Adhesive sealant MIL-S-45163 can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) Coat threads of temperature sensor (6) with thread locking compound and install in cylinder head (7). Tighten sensor 144 lb-in (16 N•m).
- (2) Install washer (5), wire (4), washer (3) lockwasher (2), and nut (1) on temperature sensor (6).



NOTE

Follow-on maintenance:

- . Install hood (para 4-125).
- . Close left engine door (para 2-14).

END OF TASK

4-83. ENGINE OIL PRESSURE SWITCH REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, torque

Materials/Parts

Compound, thread locking (item 15, appendix E)

Lockwasher

Equipment Condition

TM or Para

Para 2-14

Condition Description

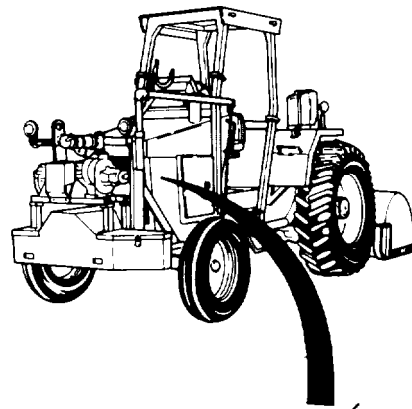
Left engine door open.

General Safety Instructions

If engine has recently been in operation, allow time for cooling before performing procedure.

a. Removal.

- (1) Remove nut (1), lockwasher (2), washer (3), wire (4), and oil pressure switch (5) from elbow pipe (6). Discard lockwasher.
- (2) If damaged, remove elbow pipe (6) from engine block (7).

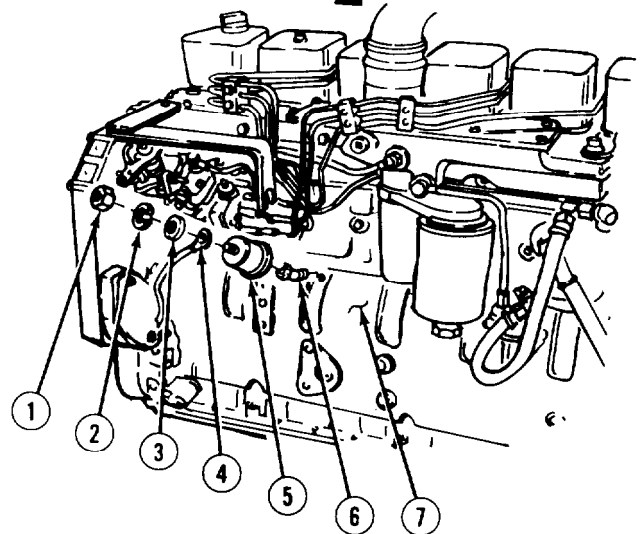


b. Installation.

WARNING

Adhesive sealant MIL-S-45163 can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) If removed, apply thread locking compound to threads of elbow pipe (6) and install elbow pipe on engine block (7).
- (2) Install oil pressure switch (5) on elbow pipe (6). Tighten switch 144 lb-in (16 N•m).
- (3) Install wire (4) washer (3), lockwasher (2), and nut (1) on oil pressure switch (5).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

4-84. HORN REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 2-14

Condition Description
Left engine door opened.

Materials/Parts

Cloth, lint-free (item 12, appendix E)
Tags, identification (item 55, appendix E)
Lo&washer

a. Removal.

NOTE

Tag and mark all wires before removal.

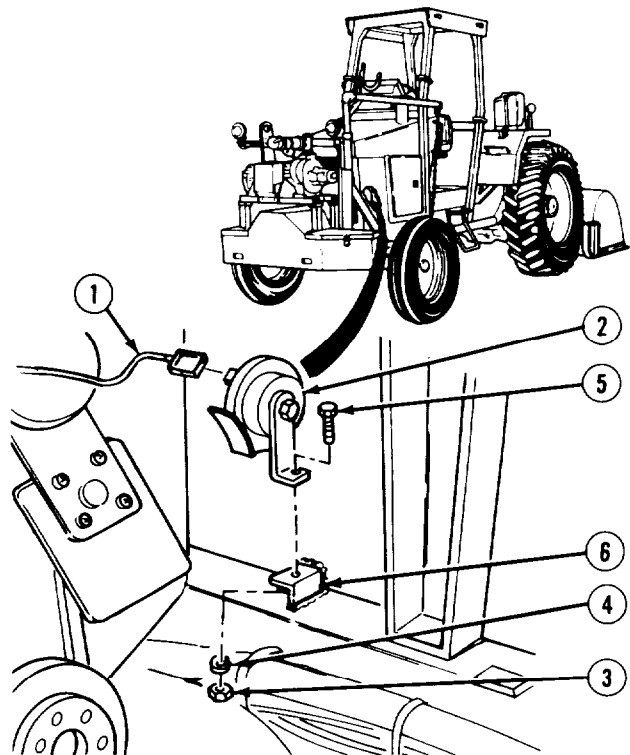
- (1) Tag, mark, and remove wire (1) from horn (2).
- (2) Remove nut (3), lockwasher (4), screw (5) and horn (2) from horn bracket (6). Discard lo&washer.

b. Cleaning/Inspection.

- (1) Wipe parts clean with lint-free cloth.
- (2) Check wires for fraying or cracks.
- (3) Check metal parts for cracks, rust, holes or other damage.
- (4) Replace damaged parts.

c. Installation.

- (1) Position horn (2) on horn bracket (6) and install with screw (5), lockwasher (4), and nut (3).
- (2) Connect wire (1) on horn (2).



NOTE

Follow-on Maintenance: Close Left engine door (para 2-14).

END OF TASK

4-85. BACK-UP HORN ALARM SWITCH REPLACEMENT.

This task covers:

- | | | |
|------------|------------------------|-----------------|
| a. Removal | b. Cleaning/Inspection | c. Installation |
|------------|------------------------|-----------------|

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Materials/Parts

Cloth, lint-free (item 12, appendix E)
 Tag, identification (item 55, appendix E)
 Lockwasher (2)

Equipment Condition

TM or Para
 Para 4-97

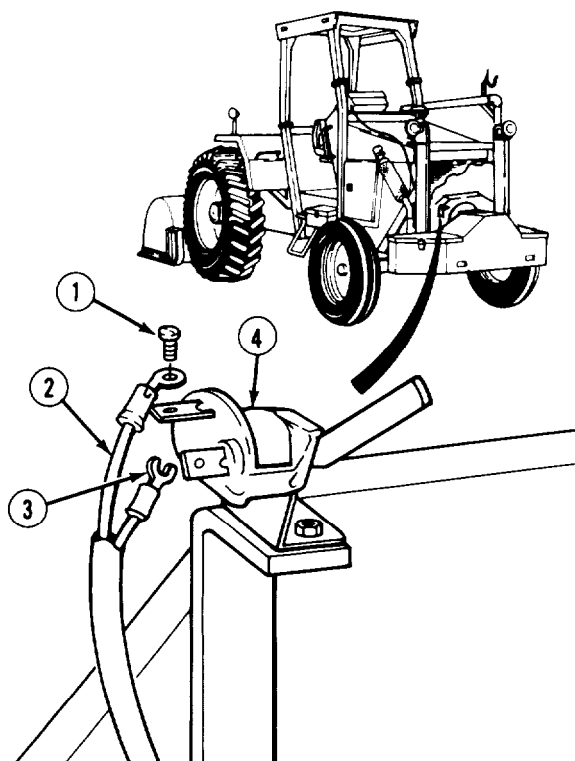
Para 4-90

Condition Description
 Hydrostatic pump cover removed.
 Negative battery cables disconnected.

a. Removal.**NOTE**

Tag and mark all wires before removal.

- (1) Remove two screws (1). Tag, mark and remove wires (2 and 3) from switch (4).



4-85. BACK-UP HORN ALARM SWITCH REPLACEMENT (CONT).

NOTE

Note position of back-up switch arm for installation.

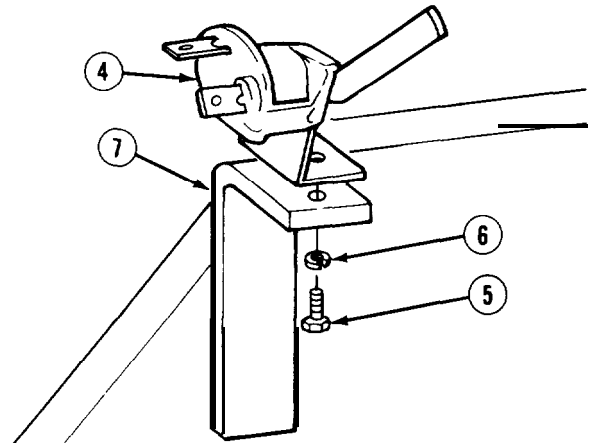
- (2) Remove two screws (5), lockwashers (6), and back-up horn switch (4) from bracket (7). Discard lockwashers.

b. Cleaning/Inspection.

- (1) Wipe parts clean with lint-free cloth.
- (2) Check wires for cracks or fraying.
- (3) Check metal parts for cracks, **rust**, holes, or other damage.
- (4) Replace damaged parts.

c. Installation.

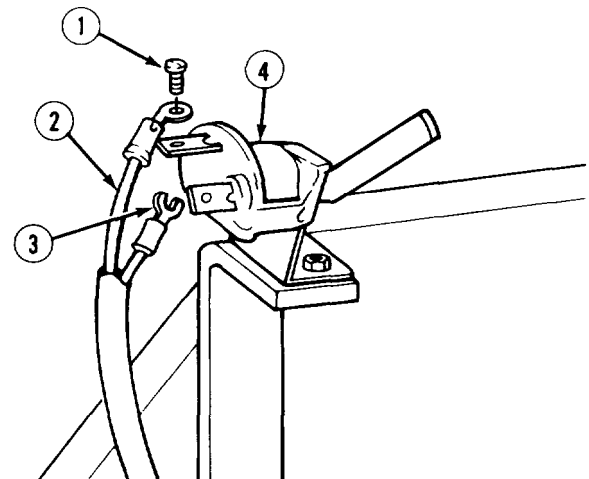
- (1) Install back-up horn switch (4) on bracket (7) with two screws (5) and lockwashers (6).
- (2) Install two wires (2 and 3) on switch (4) with two screws (1).



NOTE

Follow-on Maintenance:

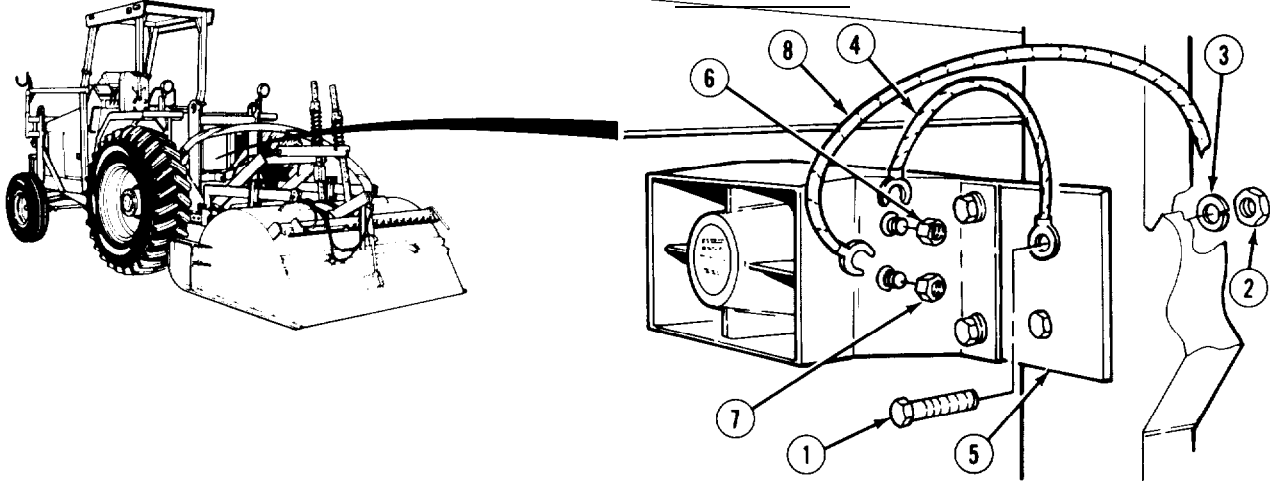
- . Install hydrostatic pump cover (para 4-96).
- . Connect negative battery cable (para 4-90).



END OF TASK

4-86. BACK-UP HORN REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 4-90	Negative battery cables disconnected.
<i>Materials/Parts</i>		
Cloth, lint-free (item 12, appendix E)		
Tag, identification (item 55, appendix E)		
Lockwashers (2)		
Locknut (4)		

a. Removal.



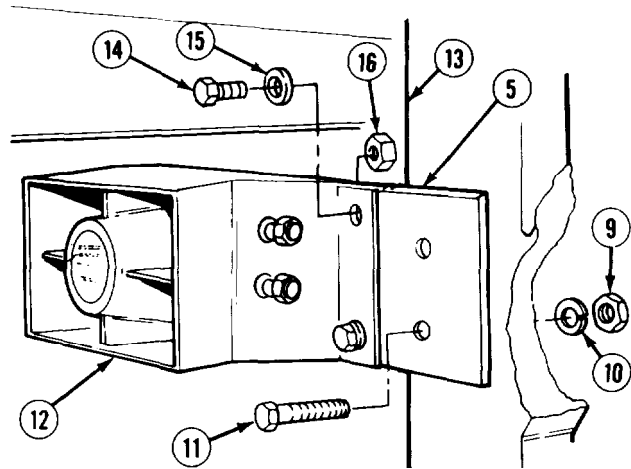
NOTE

Tag and mark all wires before removal.

- (1) Remove screw (1), nut (2), lockwasher (3), and one end of wire (4) from back-up horn bracket (5). Discard lockwasher.
- (2) Loosen nut (6) and remove wire (4).
- (3) Loosen nut (7) and remove wire (8).

4-86. BACK-UP HORN REPLACEMENT (CONT).

- (4) Remove nut (9), lockwasher (10), and screw (11) from bracket (5). Discard lockwasher
- (5) Remove back-up horn (12) from frame (13).
- (6) Remove four screws (14), washers (15), and locknuts (16) from back-up horn (12). Separate bracket (5) from horn. Discard locknuts.



b. Cleaning/Inspection.

- (1) Wipe parts clean with lint-free cloth.
- (2) Check wires for cracks and fraying.
- (3) Check metal parts for cracks, rust, holes, or other damage.
- (4) Replace damaged parts.

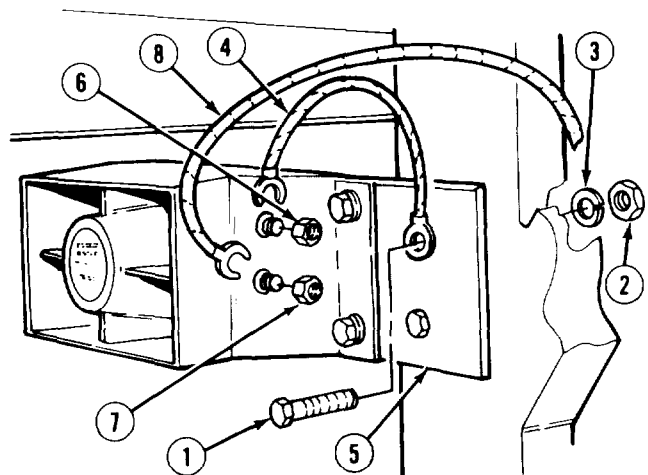
c. Installation.

- (1) Install bracket (5) on horn (12) with four screws (14), washers (15), and locknuts (16).
- (2) Install back-up horn (12) on frame (13) with screw (9), washer (11), and nut (10).
- (3) Install wire (8) and tighten nut (7).
- (4) Install wire (4) and tighten nut (6).
- (5) Install wire (4) on bracket (5) with screw (1), washer (3) and nut (2).

NOTE

Follow-on Maintenance: Connect negative battery cables (para 4-90).

END OF TASK



4-87. ENGINE BATTERY REPLACEMENT (CONT).

b. Installation.

- (1) Position engine battery (4) on engine mounting plate (5).

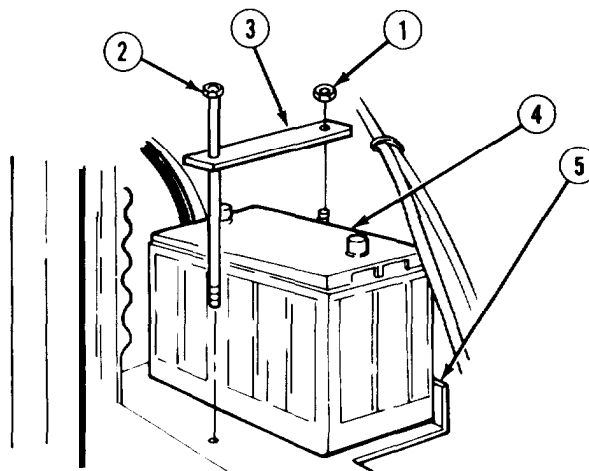
CAUTION

Do not overtighten screw and nut or damage to battery may result.

- (2) Install battery support bar (3) between battery cells with screw (2) and nut (1).

NOTE

Follow-on maintenance: Connect battery cables (para 4-90).



END OF TASK

4-88. AUXILIARY BATTERY REPLACEMENT.

This task covers:

a. Removal

b. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

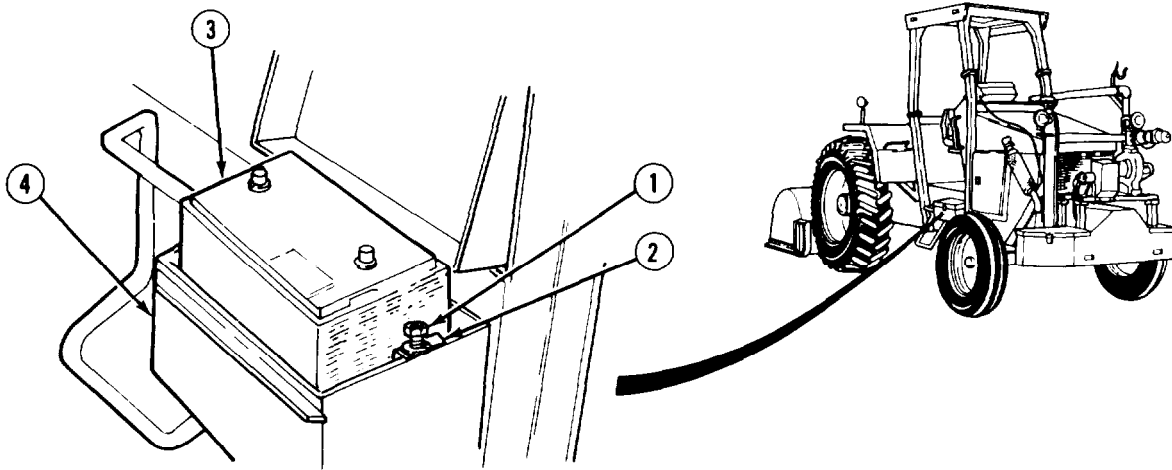
Equipment Condition

TM or Para

Para 4-90

Condition Description

Battery cables disconnected.

**WARNING**

- Remove or disconnect batteries and turn master battery switch off prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.
- Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and do not smoke when performing maintenance on batteries. Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

a. Removal.

- (1) Loosen two nuts (1) and rotate two battery hold-downs (2) away from auxiliary battery (3).
- (2) Remove auxiliary battery (3) from battery box (4).

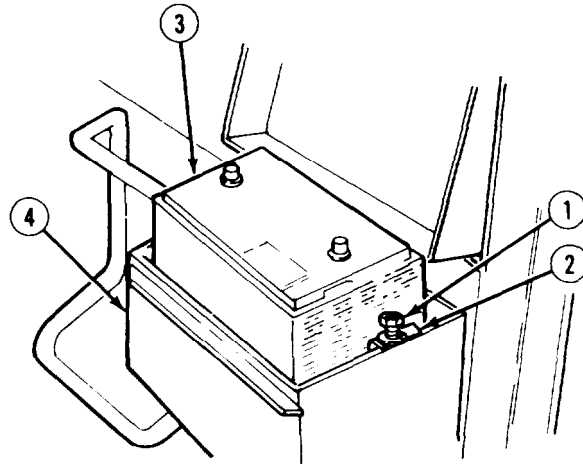
4-88. AUXILIARY BATTERY REPLACEMENT (CONT).

b. Installation.

- (1) Position auxiliary battery (3) in battery box (4).
- (2) Rotate two battery hold-downs (2) onto auxiliary battery (3) and tighten screws (1).

NOTE

Follow-on Maintenance: Connect battery cables (para 4-90).



END OF TASK

4-89. BATTERY BOX REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Equipment Condition

TM or Para
Para 4-88

Condition Description
Auxiliary battery removed.

Materials/Parts

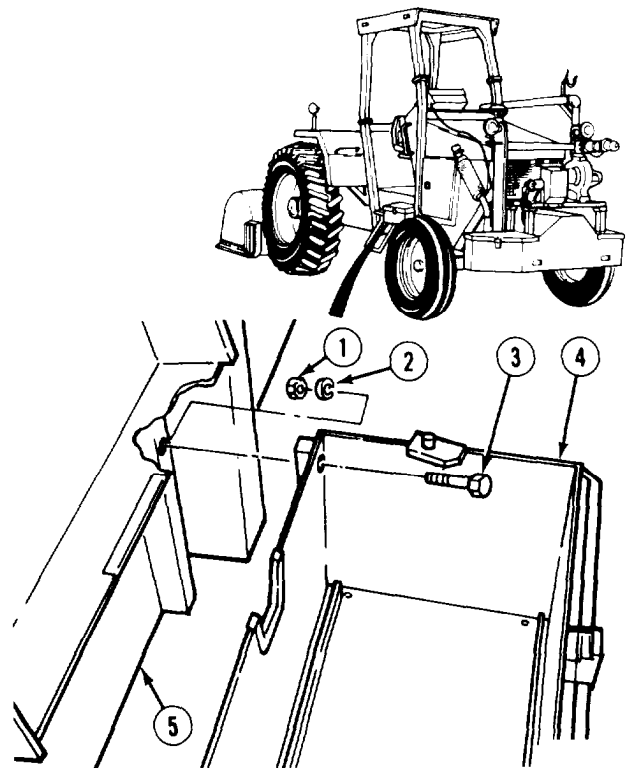
Solvent, drycleaning (item 54, appendix E)

Lockwashers (13)

Locknut

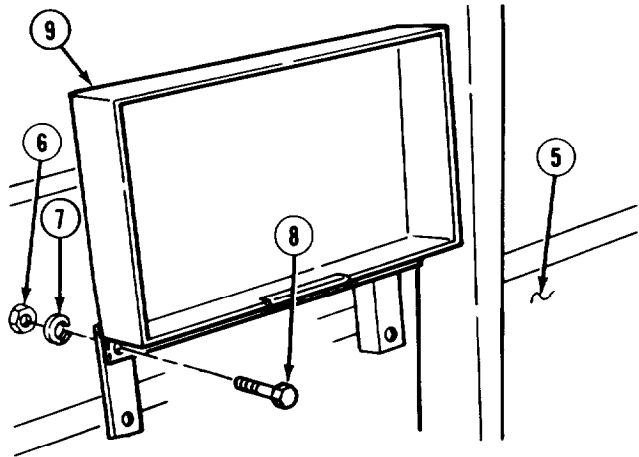
a. Removal.

- (1) Remove four nuts (1), lockwashers (2), screws (3), and battery box (4) from frame (5). Discard lo&washers.



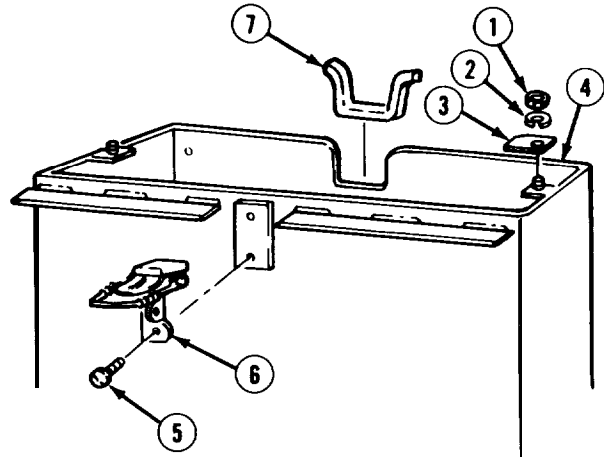
4-89. BATTERY BOX REPLACEMENT/REPAIR (CONT).

- (2) Remove seven nuts (6), lockwashers (7), screws (8), and battery box lid (9) from frame (5). Discard lo&washers.

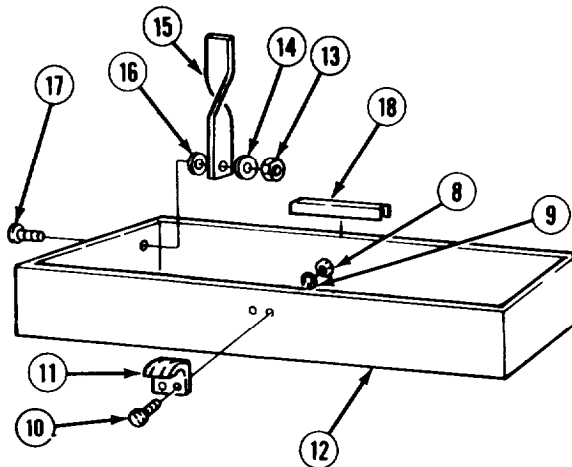


b. Disassembly.

- (1) Remove two nuts (1), lockwashers (2), and battery hold-downs (3) from battery box (4). Discard lockwashers.
- (2) Remove two screws (5) and latch (6).
- (3) Remove edging (7) from box (4).



- (4) Remove two nuts (8), lockwashers (9), screws (10), and latch (11) from cover (12).
- (5) Remove locknut (13), washer (14), cover prop (15), washer (16), and screw (17). Discard locknut.
- (6) Remove edging (18) from cover (12).



c. *Cleaning/Inspection.*

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Wash all parts in drycleaning solvent.

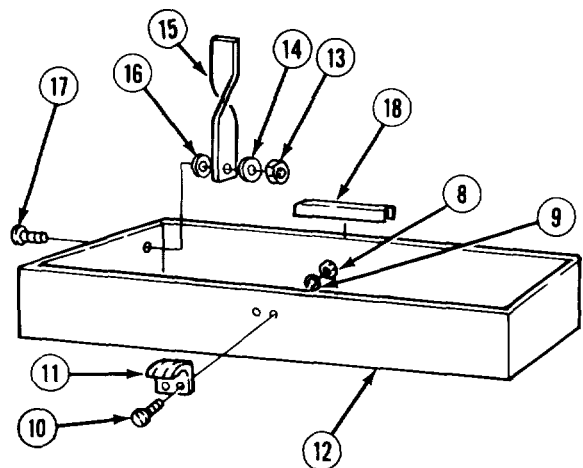
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Dry all parts with compressed air.
- (3) Inspect all parts for damage.
- (4) Replace damaged parts.

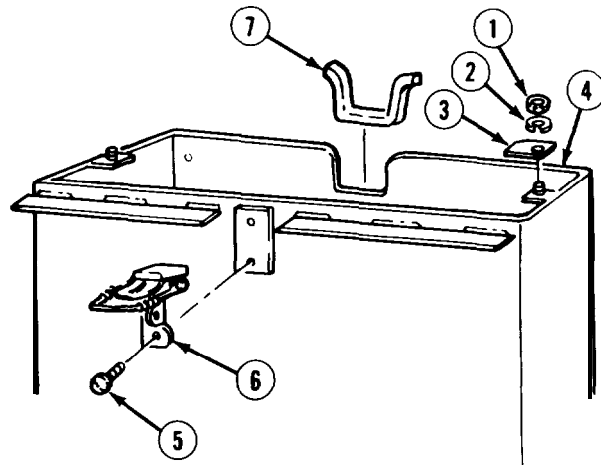
d. *Assembly.*

- (1) Install edging (18) on cover (12).
- (2) Install screw (17), washer (16), cover prop (15), washer (14), and locknut (13). Tighten locknuts so prop can be moved.
- (3) Install hook (11) on cover (12) with two screws (10), lockwashers (9), and nuts (8).



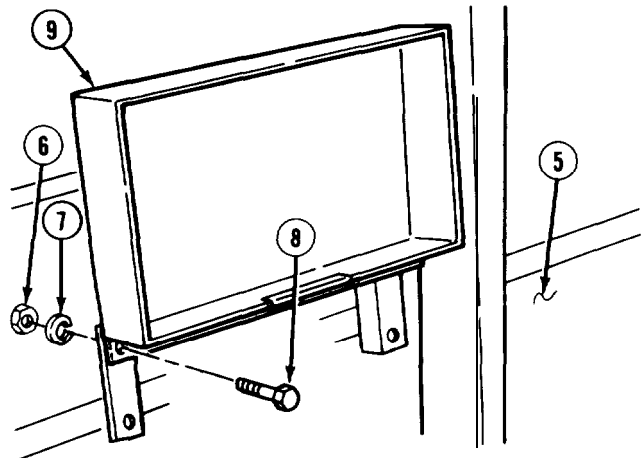
4-89. BATTERY BOX REPLACEMENT/REPAIR (CONT).

- (4) Install edging (7) on box (4).
- (5) Install latch (6) on box (4) with two screws (5).
- (6) Loosely install two hold-downs (3) with lockwashers (2) and nuts (1).

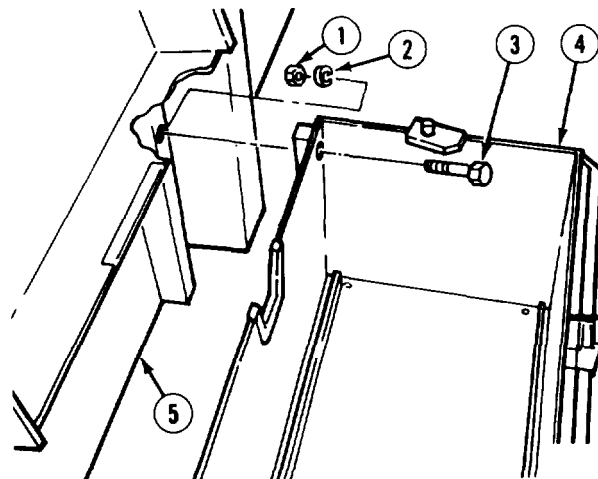


e. Installation.

- (1) Install battery box lid (9) on frame (5) with seven screws (8), lockwashers (7), and nuts (6). Tighten nuts 96 lb-in (10.8 N•m).



- (2) Install battery box (4) on frame (5) with four screws (3), lockwashers (2) and nuts (1). Tighten nuts 204 lb-in (23 N•m).



NOTE

Follow-on Maintenance: Install auxiliary battery (para 4-88).

END OF TASK

4-90. BATTERY CABLE REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

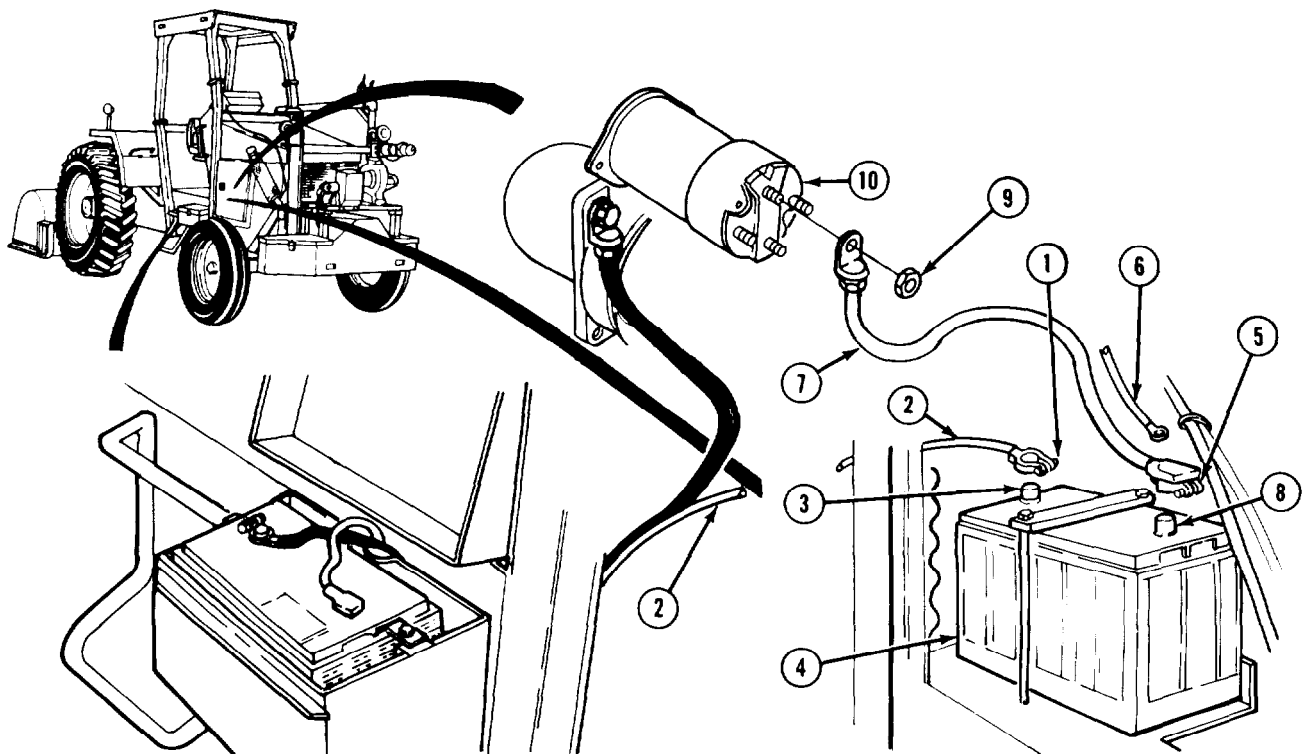
c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

*Equipment Condition*TM or Para
Para 2-14*Condition Description*
Right engine door
opened.*References*

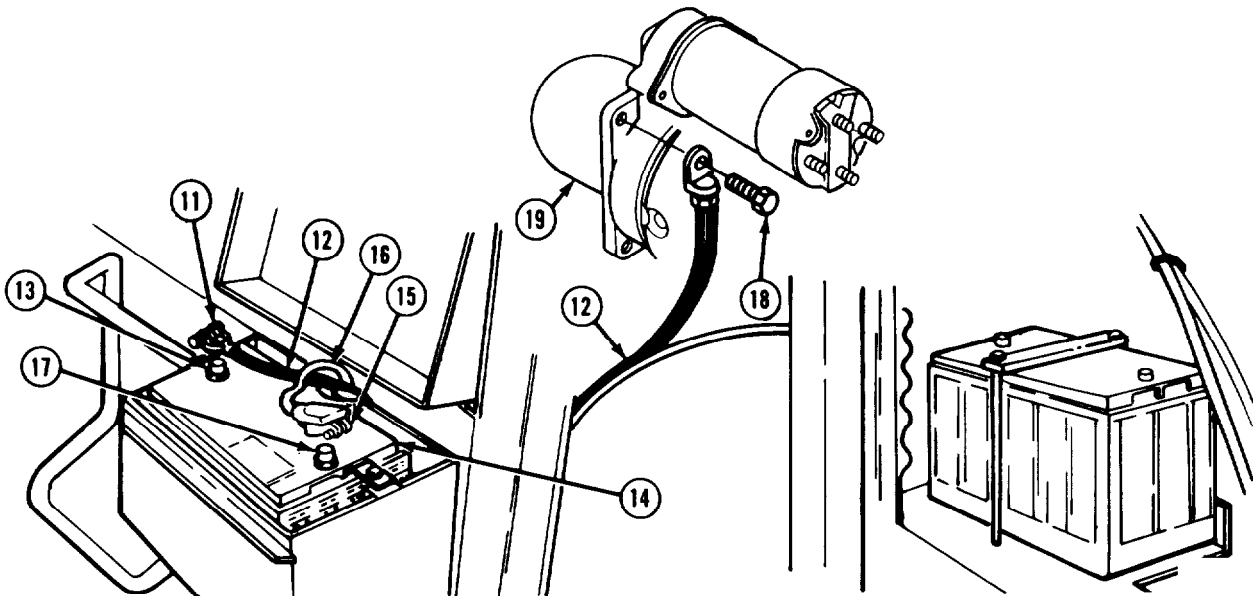
TM 9-6140-200-14

a. Removal.**WARNING**

Be sure to disconnect the negative (-) battery terminal first. Injury or death could result from electrocution.

- (1) Loosen nut (1) and remove cable (2) from negative (-) terminal (3) on engine battery (4).
- (2) Remove nut (5), wire (6), and cable (7) from positive (+) terminal (8) on engine battery (4).
- (3) Remove nut (9) and cable (7) from solenoid (10).

4-90. BATTERY CABLE REPLACEMENT (CONT).



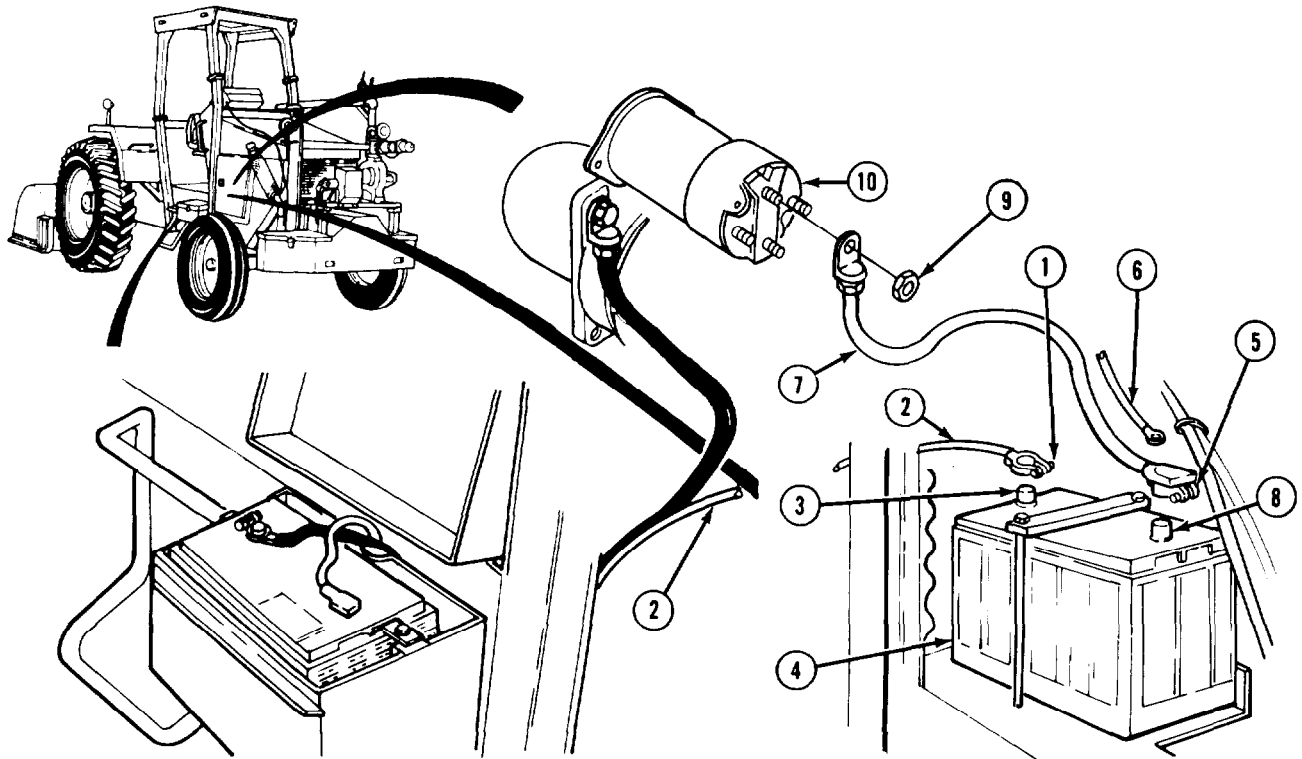
- (4) Loosen nut (11) and remove cable (12) from negative (-) terminal (13) on auxiliary battery (14).
- (5) Loosen nut (15) and remove cable (16) from positive (+) terminal (17) on auxiliary battery (14).
- (6) Remove starter mounting screw (18) and cable (12) from starter (19).

b. Cleaning/Inspection.

- (1) Inspect batteries for cracks or other damage.
- (2) Clean battery terminals.

c. Installation.

- (1) Install cable (12) to starter (19) with starter mounting screw (18).
- (2) Install cable (16) to positive (+) terminal (17) on auxiliary battery (14) and tighten nut (15).
- (3) Install cable (12) to negative (-) terminal (13) on auxiliary battery (14) and tighten nut (11).



- (4) Install cable (7) on solenoid (10) with nut (9).
- (5) Install cable (7) and wire (6) on positive (+) terminal (8) on engine battery (4) with nut (5).
- (6) Install cable (2) on negative (-) terminal (3) on engine battery (4) and tighten nut (1).

NOTE

Follow-on Maintenance: Close right engine door (para 2-14).

END OF TASK

4-91. BATTERY LEVEL INSPECTION.

This task covers:

Inspection

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 2-14

Condition Description
Right engine door
opened.

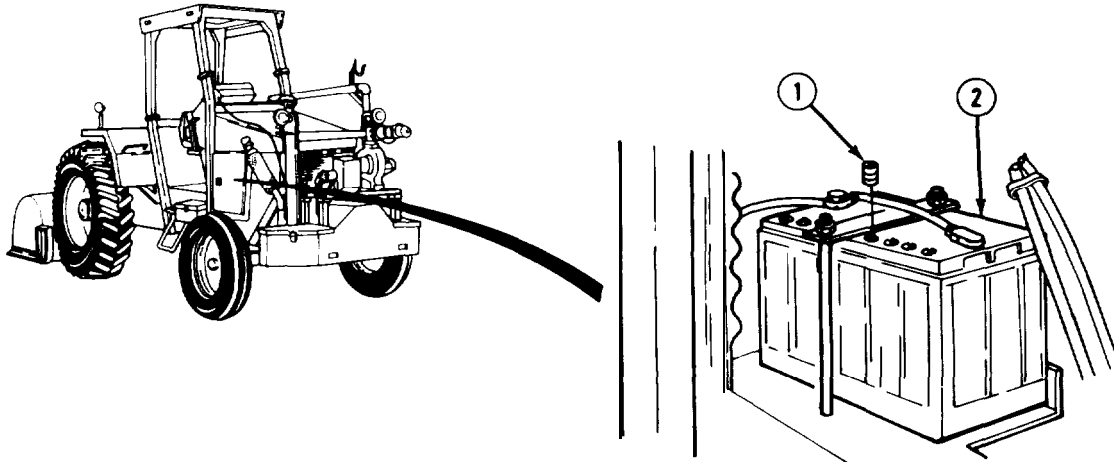
References

TM 9-6140-200-14

Inspection.

WARNING

- Wear safety glasses or goggles when checking batteries. Always check electrolyte level with engine stopped. Do not smoke or use exposed flame when checking battery; explosive gases are present and severe injury to personnel can result.
- Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and do not smoke when performing maintenance on batteries. Injury will result if acid contacts skin or eyes. Wear rubber apron to prevent clothing being damaged.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

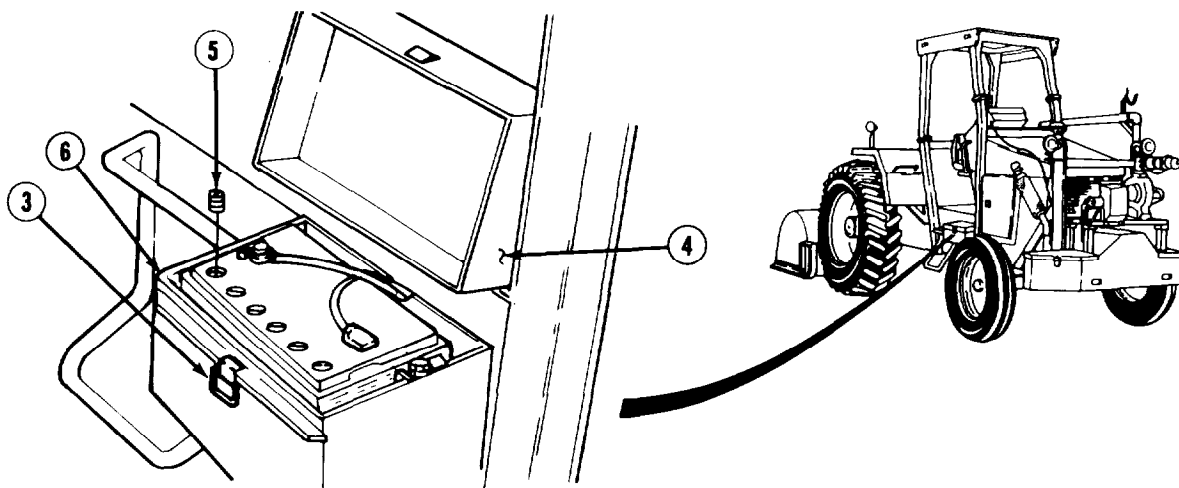
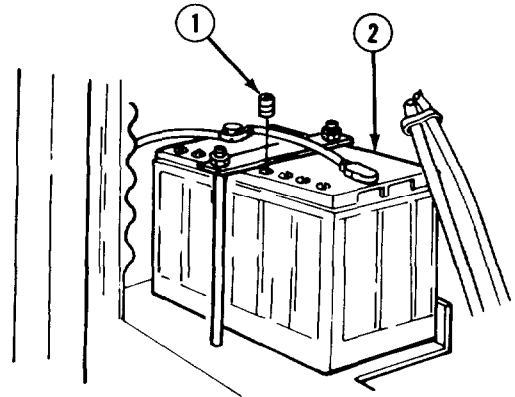


NOTE

This procedure is the same for auxiliary and engine batteries.

- (1) Remove six plugs (1) from engine battery (2).

- (2) Inspect electrolyte level. If level in battery is below split ring level in filler vent, fill to level with distilled water using a funnel. Ensure not to overfill filler vent.
- (3) Install six plugs (1) in engine battery (2).



- (4) Unlock latch (3) and open access door (4).
- (5) Remove six plugs (5) from auxiliary battery (6).
- (6) Repeat step (2).
- (7) Install six plugs (5) in auxiliary battery (6).

NOTE

Follow-on maintenance: Close right engine door (para 2-14).

END OF TASK

4-92. BATTERY TESTING.

Reference TM 9-6140-200-14, Operator's Organizational, Direct Support, and General Support Maintenance Manual for Lead Acid Storage Batteries.

4-93. GROUND WIRE REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-132

Condition Description
Forward floor plate
removed.

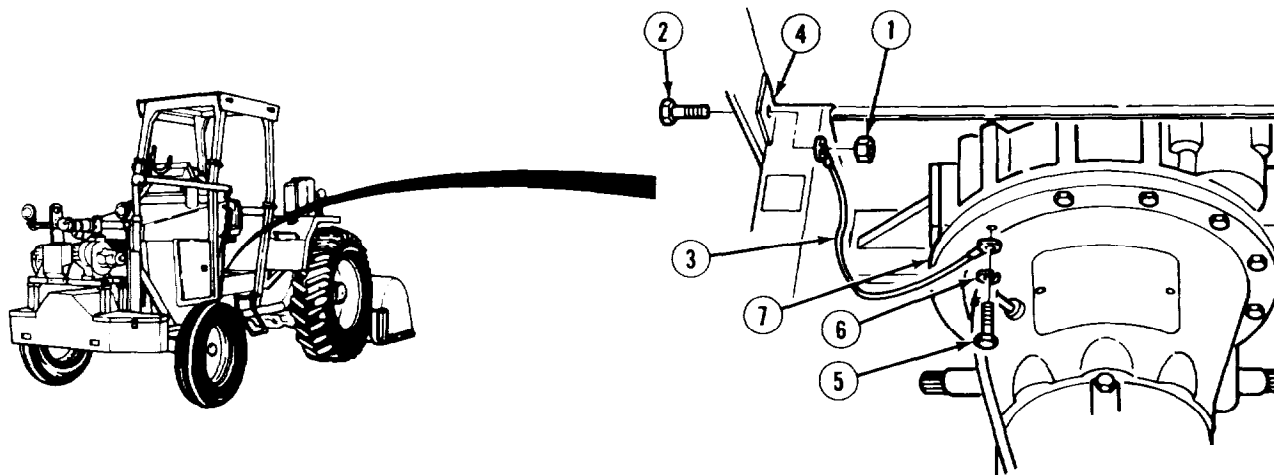
Materials/Parts

Lockwasher
Locknut

Para 4-90

Negative battery cable
disconnected.

a. Removal.



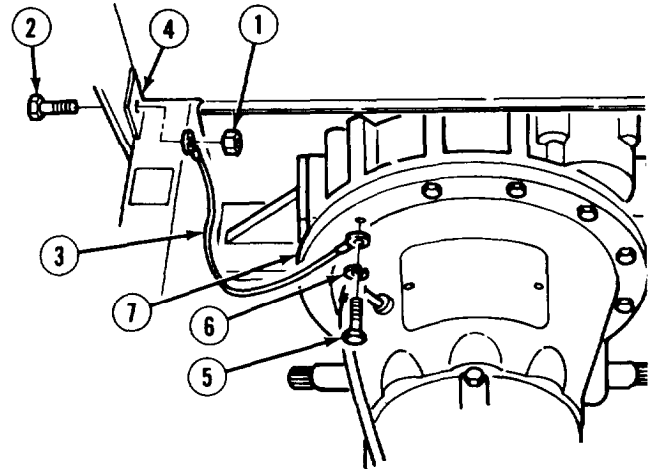
- (1) Remove locknut (1), screw (2) and ground wire (3) from firewall mount (4). Discard locknut.
- (2) Remove screw (5), lockwasher (6), and ground cable (3) from clutch housing (7). Discard lockwasher.

b. Cleaning/Inspection.

- (1) Check for torn or frayed wire.
- (2) Check for continuity.
- (3) Check contact points of firewall and clutch. Clean contacts as necessary.
- (4) Replace all damaged parts.

c. Installation.

- (1) Install ground cable (3) on clutch (7) with lockwasher (6) and screw (5).
- (2) Install ground cable (3) to firewall mount (4) with screw (2) and locknut (1).

**NOTE**

Follow-on Maintenance:

- Install forward floor plate (para 4-132).
- Connect negative battery cable (para 4-90).

END OF TASK

4-94. TWO-SPEED SHIFT LEVER REPLACEMENT.

task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 4-132

Condition Description

Forward floor plate removed.

Materials/Parts

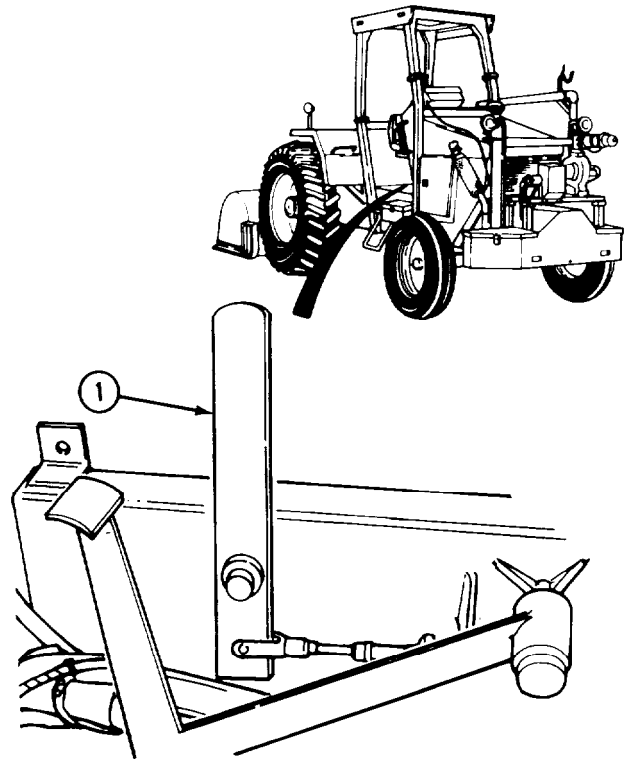
Grease, general purpose (item 25, appendix E)

Solvent, drycleaning (item 54, appendix E)

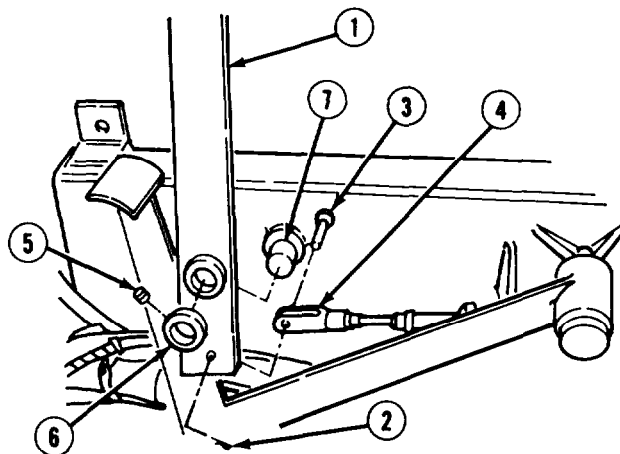
Pin, cotter

a. Removal.

- (1) Place shift lever (1) for 2-speed range box in NEUTRAL (upright position).



- (2) Remove cotter pin (2) and pin (3). Separate clevis (4) from shift lever (1). Discard cotter pin.
- (3) Remove setscrew (5), collar (6), and shift lever (1) from trunnion (7).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Wash parts in drycleaning solvent.

WARNING

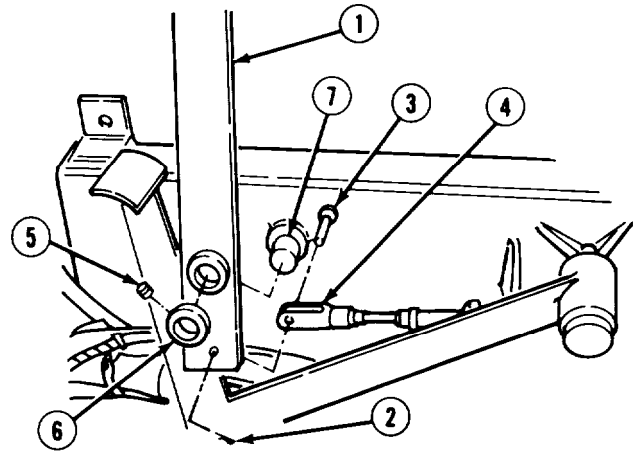
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Dry with compressed air.
- (3) Check parts for damage.
- (4) Replace damaged parts.

4-94. TWO-SPEED SHIFT LEVER REPLACEMENT (CONT).

c. Installation.

- (1) Lubricate trunnion (7).
- (2) Install shift lever (1), collar (6), and setscrew (5). Do not tighten setscrew.
- (3) Attach clevis (4) to shift lever (1) with pin (3) and cotter pin (2).
- (4) Position shift lever (1) on trunnion (7) so that lever can be operated without contacting the inside of clevis (4).
- (5) Tighten setscrew (5).



NOTE

Follow-on Maintenance: Install forward floor plate (para 4-132).

END OF TASK

4-95. TWO-SPEED LINKAGE REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Solvent, drycleaning (item 54, appendix E)
 Pin, Cotter
 Locknut

Equipment Condition

TM or Para
 Para 4-132

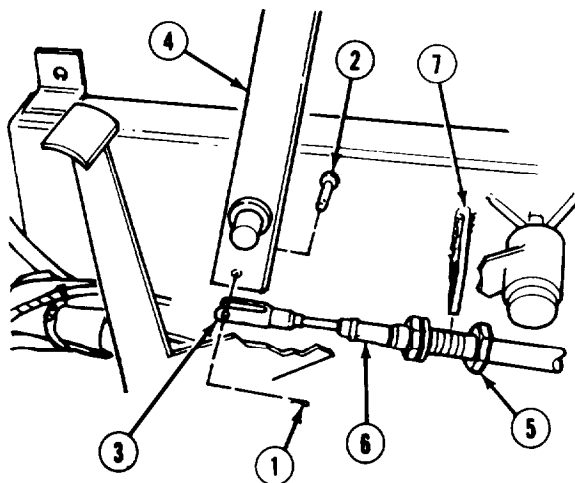
Condition Description
 Forward floor plate removed.

Para 2-15
 Para 4-94

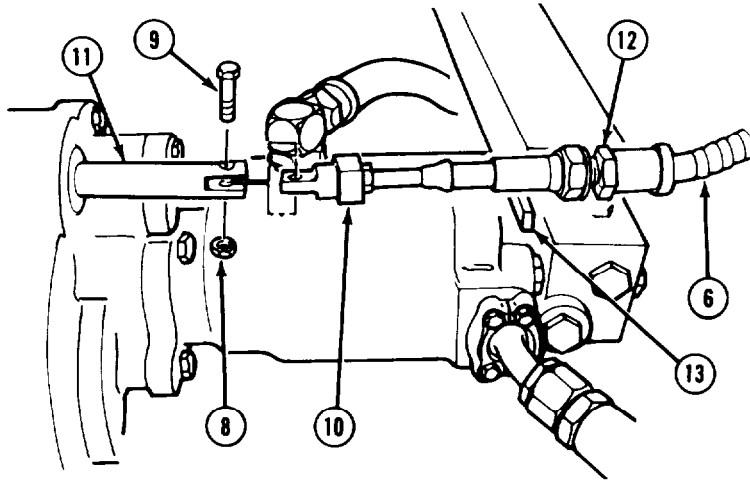
Aft floor deck raised.
 Two-speed shift lever removed.

a. Removal.

- (1) Remove cotter pin (1) and pin (2) from clevis (3) on two-speed control lever (4) and separate clevis from lever. Discard cotter pin.
- (2) Loosen nut (5) and remove cable assembly (6) from mounting bracket (7).



4-95. TWO-SPEED LINKAGE REPLACEMENT/REPAIR (CONT).



- (3) Remove locknut (8), screw (9), and cable end (10) from shifting shaft (11). Discard locknut.
- (4) Loosen jamnut (12) and remove cable assembly (6) from mounting bracket (13).

b. Disassembly.

- (1) Remove clevis (1), jamnut (2), washer (3), and jamnut (4) from cable (5).
- (2) Remove cable end (6), jamnuts (7 and 8), washer (9) and jamnut (10) from cable (5).

c. Cleaning/Inspection.

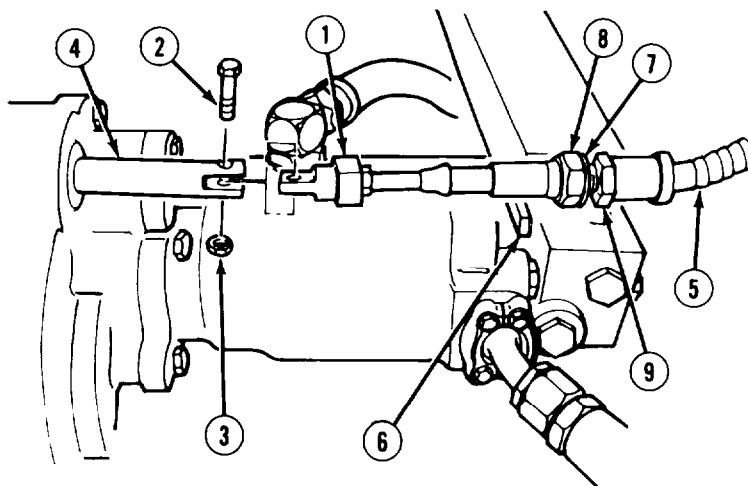
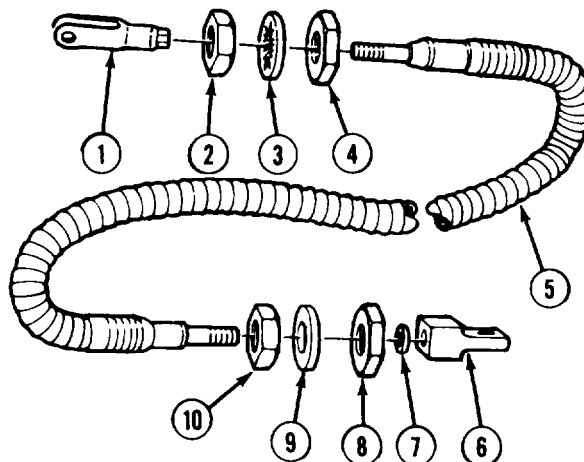
WARNING

Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.

- (1) Clean all metal parts with drycleaning solvent.
- (2) Check all nuts for crossed or peeled threads.

d. Assembly.

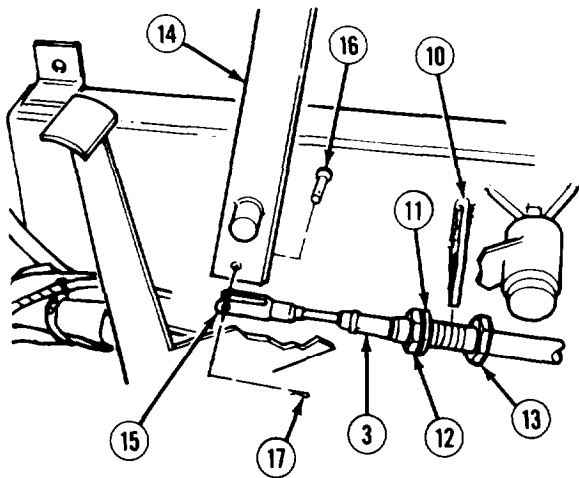
- (1) Install jamnut (10), washer (9), jamnuts (8 and 7), and cable end (6) on cable (5). Tighten jamnut against cable end.
- (2) Install jamnut (4), washer (3), jamnut (2) and clevis (1) on cable (5).

*c. Installation.*

- (1) Install cable end (1) in shifting shaft (4) with screw (2) and locknut (3).
- (2) Install cable assembly (5) on mounting bracket (6) so that bracket is mounted between washer (7) and jamnut (8) on one side and jamnut (9) on the other side. Tighten nuts evenly to eliminate slack on cable assembly between shifting shaft (4) and mounting bracket.

4-95. TWO-SPEED LINKAGE REPLACEMENT/REPAIR (CONT).

- (3) Install cable assembly (3) in mounting bracket (10) so that bracket mounts between washer (11) and jamnut (12) on one side and jamnut (13) on other side.
- (4) Install clevis (14) on two-speed control lever (15) with pin (16) and cotter pin (17).



NOTE

Follow-on Maintenance:

- Adjust cable (para 4-96).
- Install two-speed shift lever (para 4-94).
- Install forward floor plate (para 4-132).

END OF TASK

4-96. TWO-SPEED LINKAGE ADJUSTMENT.

This task covers:

Adjustment

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-132

Condition Description
Forward floor plate
removed.

Materials/Parts

Pin, Cotter
Locknut

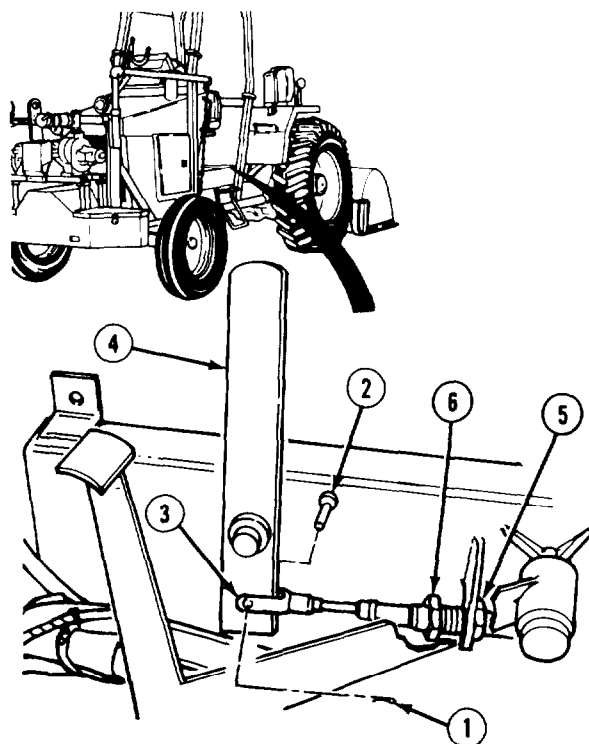
Para 2-15

Aft floor deck raised.

Adjustment.**NOTE**

Make sure 2-speed control lever is in NEUTRAL position.

- (1) Remove cotter pin (1), and pin (2) from clevis (3) on 2-speed control lever (4). Discard cotter pin.
- (2) Loosen jamnuts (5 and 6).



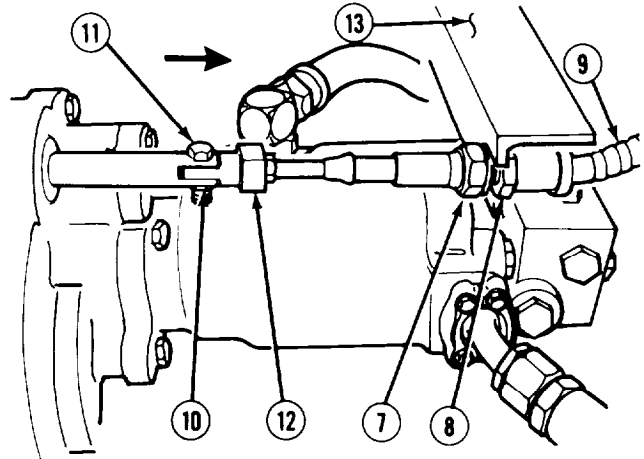
4-96. TWO-SPEED LINKAGE ADJUSTMENT (CONT).

- (3) Loosen jamnuts (7 and 8) on other end of cable (9).
- (4) Remove locknut (10) and screw (11) from cable end (12). Discard locknut.

CAUTION

Do not overtighten nuts as damage may result to cable and/or two-speed range box.

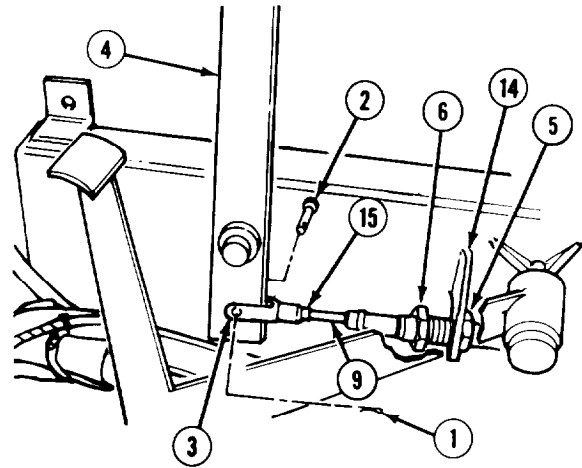
- (5) Tighten jamnut (8) against mounting bracket (13) until cable (9) is snug. Tighten jamnut (7) against mounting bracket.



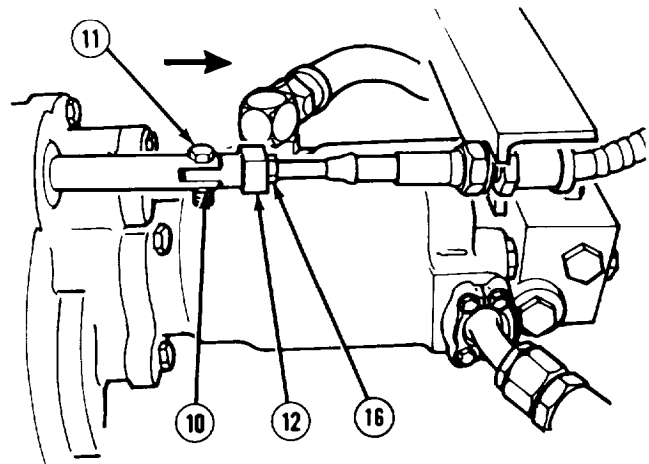
- (6) Tighten jamnut (5) against bracket (14). Tighten jamnut (6) against bracket.

- (7) Check cable (9) for equal travel on both ends.

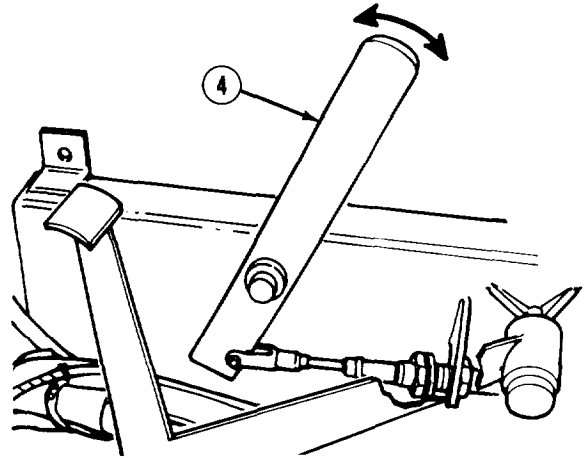
- (8) Position lever, adjust clevis (3) as necessary, and tighten jamnut (15). Reinstall pin (2) and cotter pin (1).



- (9) Adjust cable end (12) as necessary and tighten jamnut (16). Reinstall screw (11) and locknut (10).



- (10) Operate shift lever (4) to check for smooth operation. If lever does not shift smoothly from HI to LO, repeat steps (1) thru (9).



NOTE

Follow-on Maintenance:

- Install forward floor plate (para 4-132).
- Lower aft floor deck (para 2-15).

END OF TASK

4-97. HYDROSTATIC PUMP COVER REPLACEMENT.

a. Removal

b. Installation

INITIAL SETUP

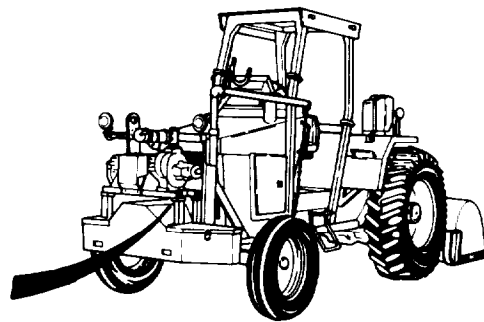
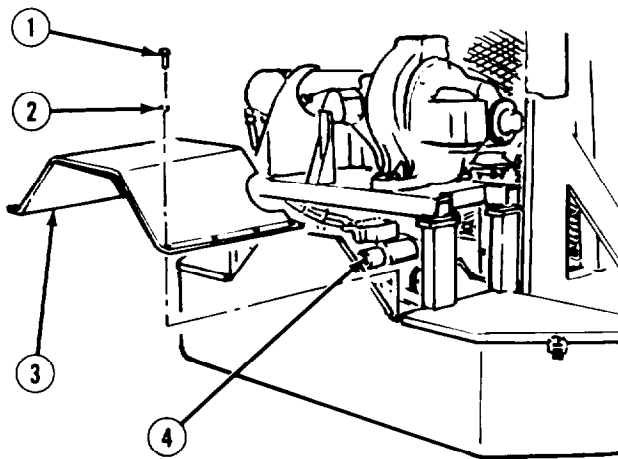
Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Lockwashers (8)

a. Removal.



(1) Remove eight screws (1) and lockwashers (2). Discard lo&washers.

(2) Remove hydrostatic cover (3) from pump (4).

b. Installation.

(1) Position hydrostatic cover (3) over pump (4).

(2) Install eight lo&washers (2) and screws (1).

END OF TASK

4-98. HYDROSTATIC PUMP CABLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 4-98

Condition Description
Hydrostatic pump cable removed from pump control lever.

Materials/Parts

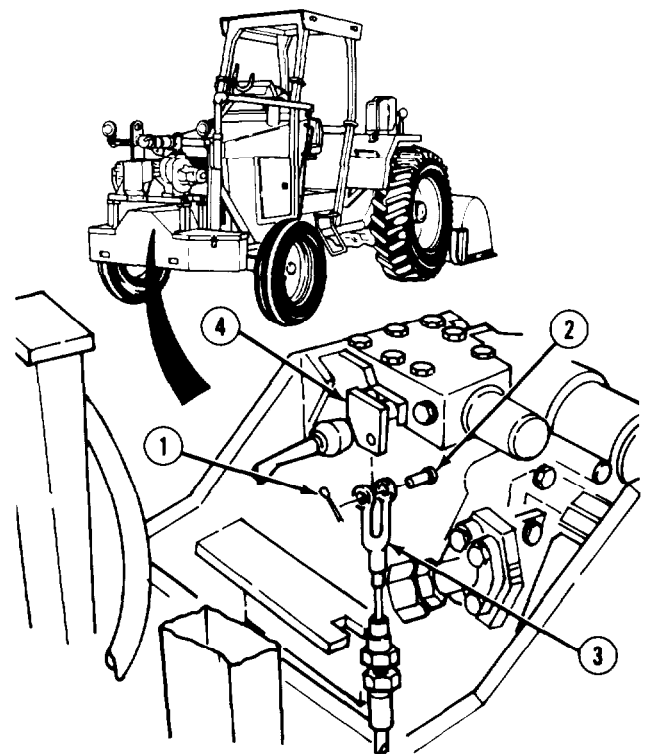
Pin, cotter

Para 4-97

Hydrostatic pump cover removed.

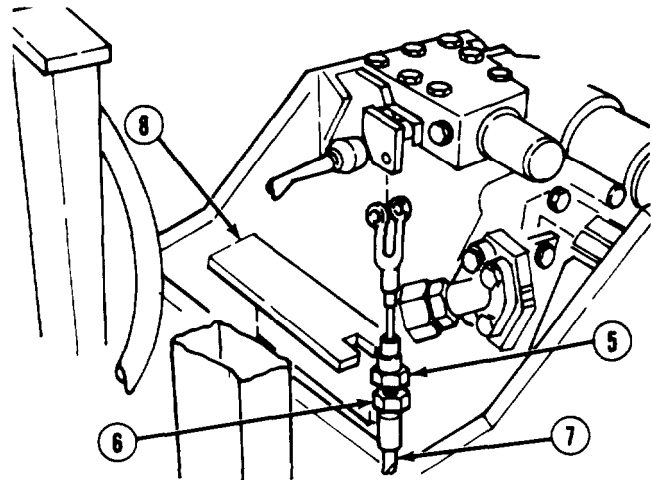
a. Removal.

- (1) Remove cotter pin (1), pin (2), and clevis (3) from lever (4). Discard cotter pin.



4-98. HYDROSTATIC PUMP CABLE REPLACEMENT (CONT).

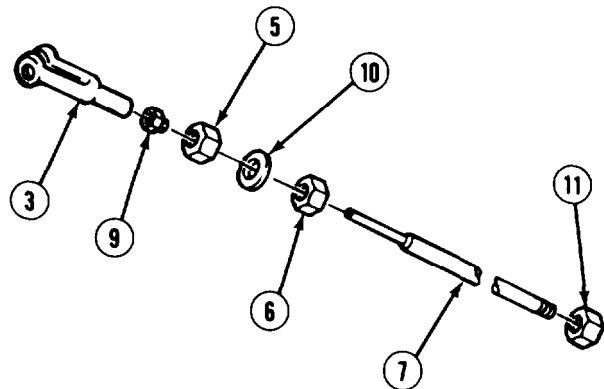
- (2) Loosen two nuts (5 and 6) and remove cable (7) from bracket (8).



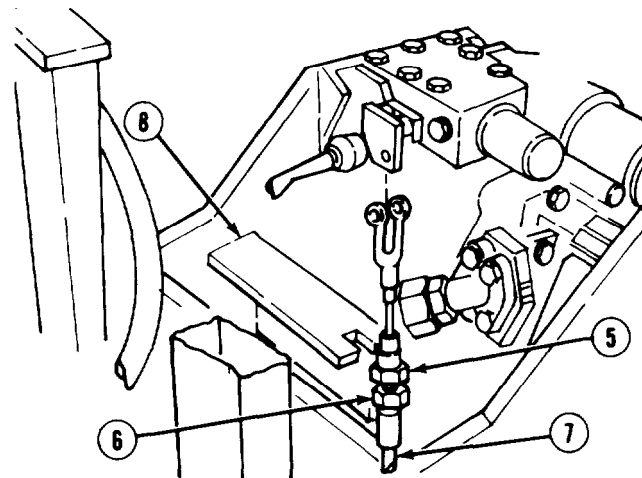
- (3) Remove clevis (3), jamnut (9), nut (5), washer (10), nut (6), and nut (11) from cable (7).

b. Installation.

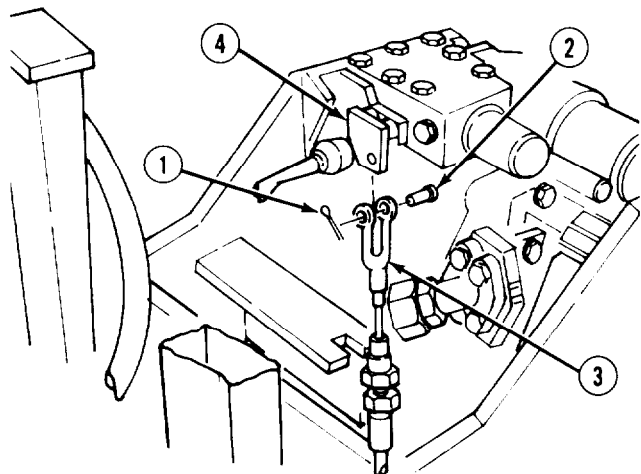
- (1) Install nut (11), nut (6), washer (10), nut (5), jamnut (9), and clevis (3) on cable (7).



- (2) Install cable (7) in bracket (8).
- (3) Tighten two nuts (5 and 6) against bracket (8).



- (4) Install clevis (3) on lever (4) with pin (2) and cotter pin (1).



NOTE

Follow-on Maintenance:

- Install hydrostatic pump cable to control lever (para 4-98).
- Adjust hydrostatic pump cable (para 4-99).
- Install hydrostatic pump cover (para 4-97).

END OF TASK

4-99. HYDROSTATIC PUMP CABLE ADJUSTMENT.

This task covers:

Adjustment

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 2-2

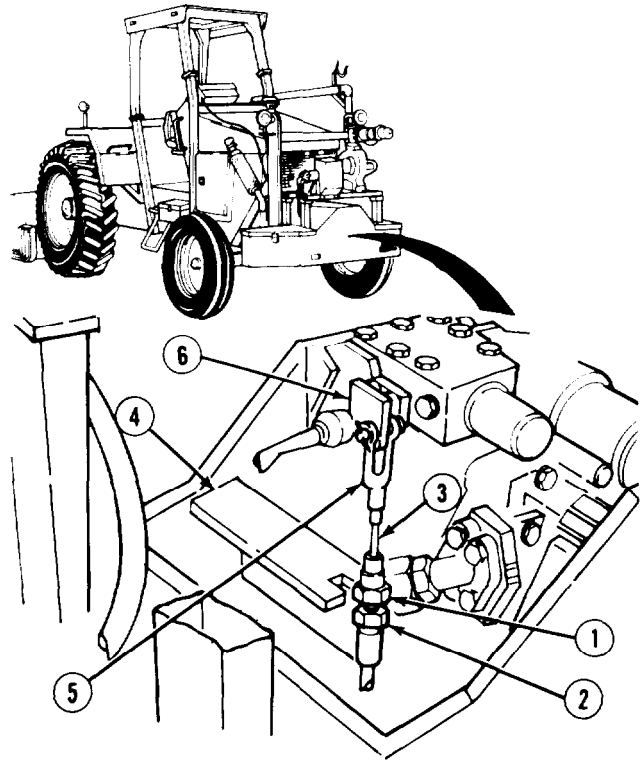
Para 4-97

Condition Description

Pump control lever in neutral position.
Hydrostatic pump cover removed.
Chock wheels.

Adjustment.

- (1) Loosen two nuts (1 and 2) and remove cable (3) from bracket (4).
- (2) Turn clevis (5) until it holds pump lever (6) in detent position.
- (3) Install cable (3) on bracket (4) and tighten two nuts (2 and 1).



NOTE

Follow-on Maintenance: Install hydrostatic pump cover (para 4-97).

END OF TASK

4-100. PUMP DRIVE SHAFT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

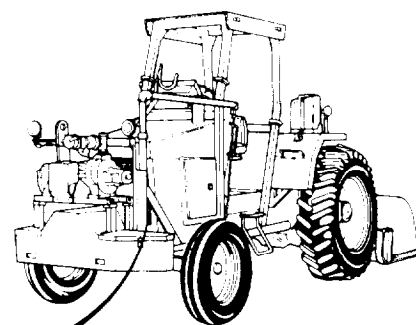
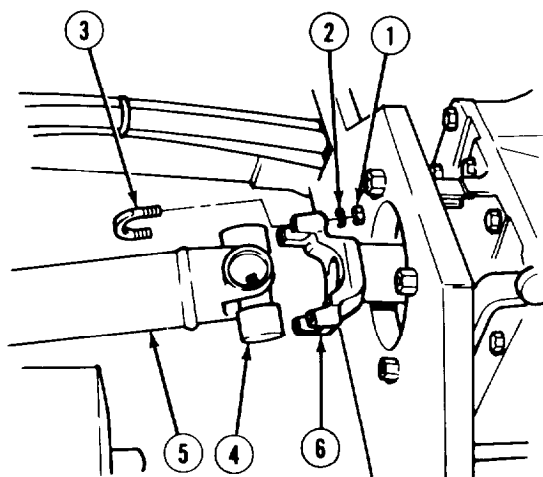
Lockwashers (8)
Pin, cotter

Equipment Condition

TM or Para
Para 2-13
Para 2-2

Condition Description
Parking brake set.
Clutch in neutral.

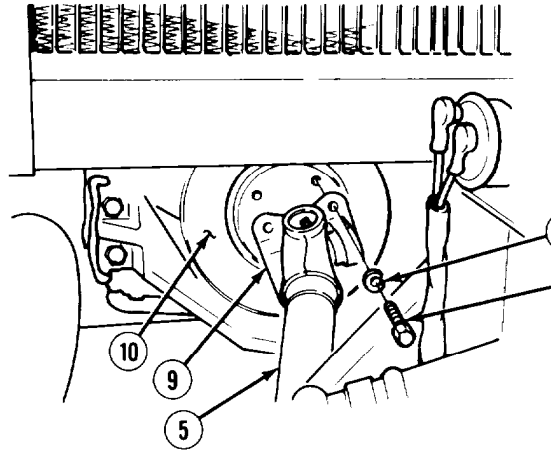
a. Removal.



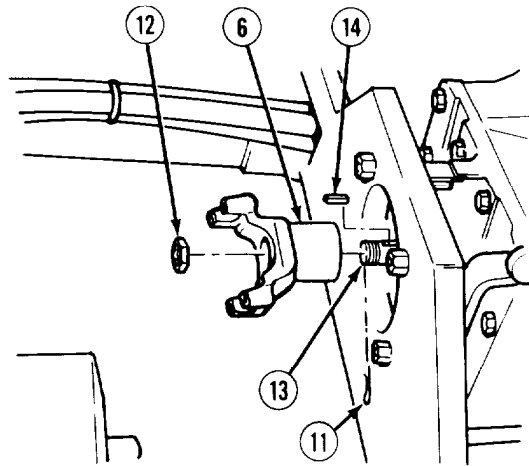
- (1) Remove four nuts (1) lockwashers (2), two u-bolts (3), and universal joint (4), on drive shaft (5) from yoke (6). Discard lockwashers.

4-100. PUMP DRIVE SHAFT REPLACEMENT (CONT).

- (2) Remove four screws (7), lockwashers (8), and flange (9) on drive shaft (5) from damper (10). Discard lockwashers.

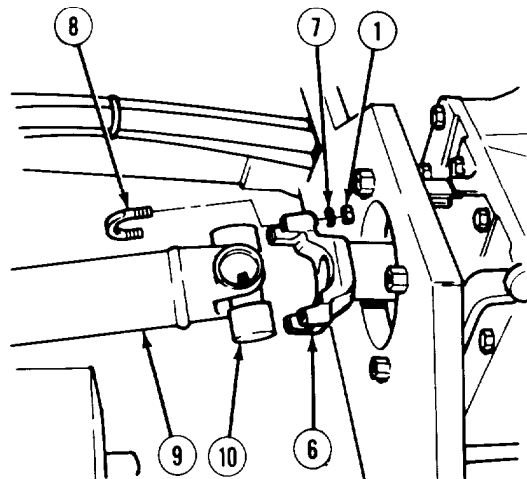


- (3) Remove cotter pin (11), nut (12), and yoke (6) from pump (13). Discard cotter pin.
- (4) Remove key (14) from pump shaft (12).

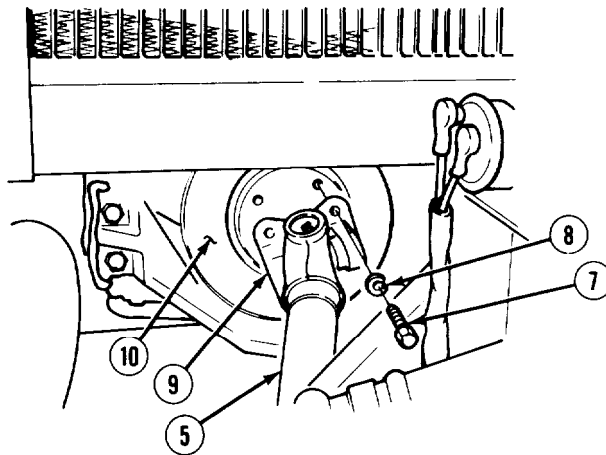


b. Installation.

- (1) Install key (14) in pump shaft (13).
- (2) Install yoke (12) on keyed pump shaft (13) with nut (11) and cotter pin (10).
- (3) Install universal joint (9), on drive shaft (8), on yoke (12) with two u-bolts (7), four lockwashers (6), and nuts (5).



- (4) Install flange (4), on drive shaft (8), on damper (3) with four lockwashers (2) and screws (1). Tighten screws 60 to 70 lb-ft (81-95 N•m).



END OF TASK

4-101. PTO DRIVE SHAFT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

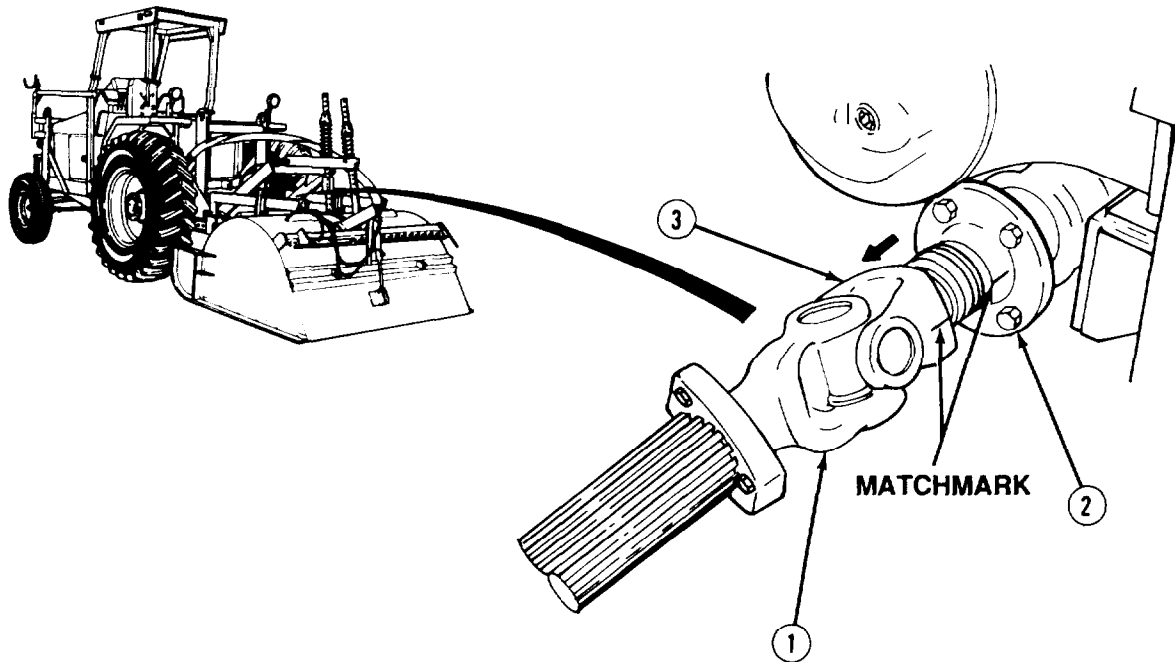
Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Equipment Condition

TM or Para
 Para 2-13
 Para 2-2
 Para 4-103

Condition Description
 Parking brake set.
 Clutch in neutral.
 PTO drive shaft guard removed.

a. Removal.



NOTE

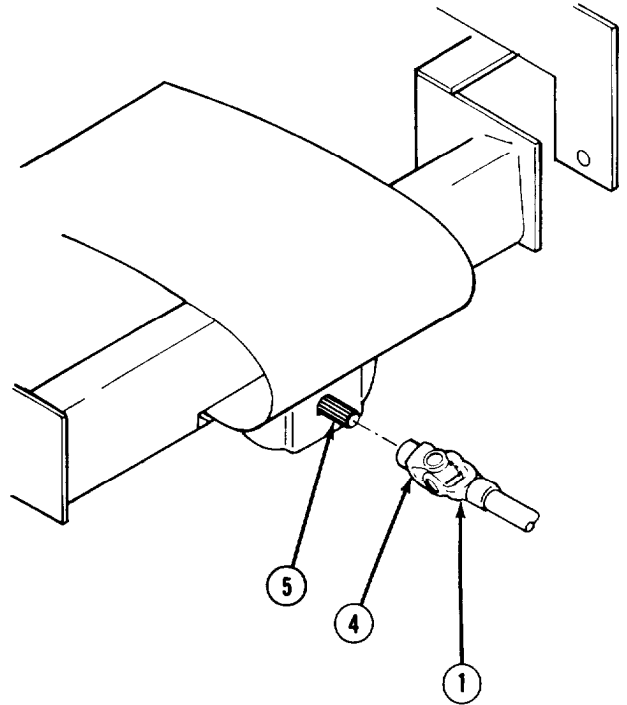
Matchmark shaft for correct installation.

- (1) Matchmark drive shaft (1) and pillow block (2).
- (2) Slide quick-disconnect collar (3) on drive shaft (1), toward rear of vehicle and remove from pillow block (2).

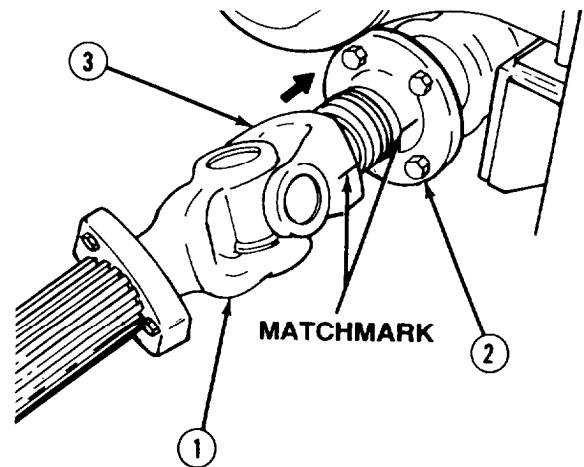
- (3) Slide quick-disconnect collar (4), on drive shaft (1), toward front of vehicle and remove from rotor shaft (5).

b. Installation.

- (1) Slide quick-disconnect collar (5), on drive shaft (1), toward front of vehicle, and install on rotor shaft (4).



- (2) Align matchmarks on drive shaft (1) and pillow block (2).
- (3) Slide quick-disconnect collar (3), on drive shaft (1), toward rear of vehicle and install on pillow block (2).



NOTE

Follow-on Maintenance: Install PTO drive shaft guard (para 4-103).

END OF TASK

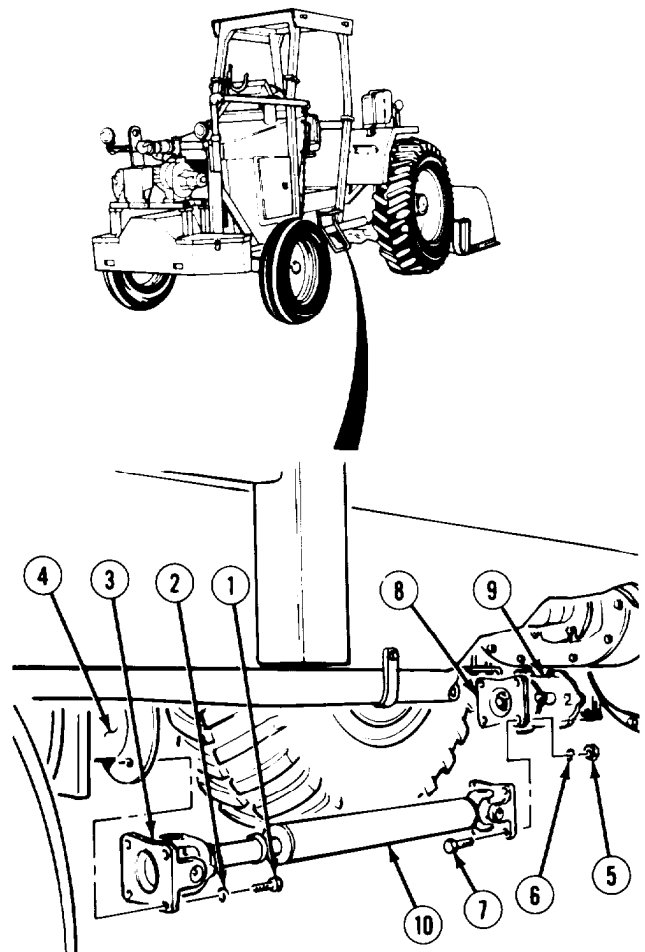
4-102. CLUTCH DRIVE SHAFT REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 2-13	Parking brake set.
Wrench, torque	Para 2-2	Clutch in neutral.
<i>Materials/Parts</i>		
Lockwashers (8)		

a. Removal.

- (1) Remove four screws (1) lockwashers (2) and flange yoke (3) from output flange (4). Discard lockwashers.
- (2) Remove four nuts (5), lockwashers (6), screws (7) and flange yoke (8) from pillow block (9). Discard lockwashers.
- (3) Remove drive shaft (10) from vehicle.

b. Installation.

- (1) Position drive shaft (10) on vehicle.
- (2) Install flange yoke (8) on pillow block (9) with four screws (7), lockwashers (6), and nuts (5). Tighten nuts 75 to 85 lb-ft (101.68 - 115.24 N•m).
- (3) Install flange yoke (3) on output flange (4) with four lockwashers (2) and screws (1). Tighten screws 75 to 85 lb-ft (101.68 - 115.24 N•m).



END OF TASK

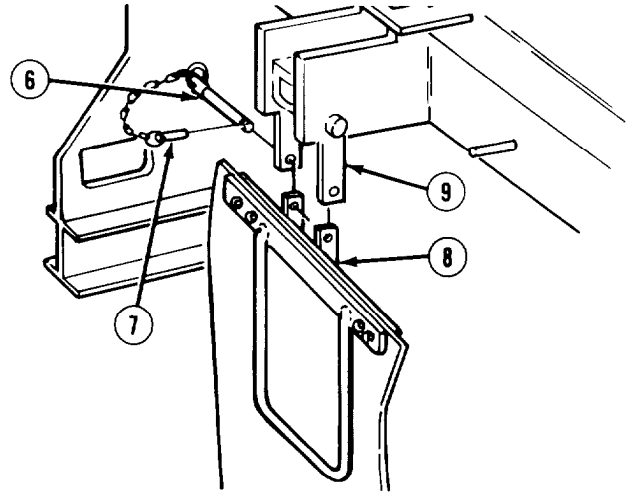
4-103. PTO DRIVE SHAFT GUARD REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	<i>TM or Para</i>	Parking brake set.
<i>Materials/Parts</i>	Para 2-13	
Lockwashers (10)		

a. Removal.

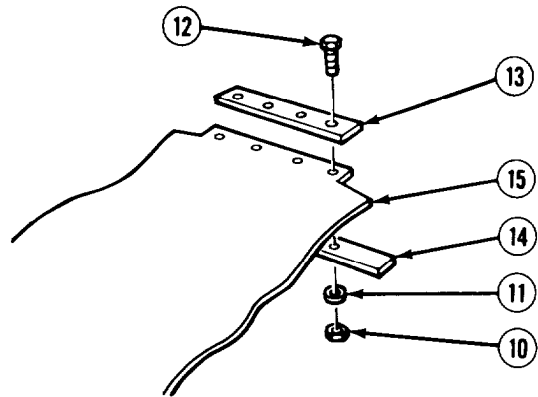
- (1) Remove two nuts (1), lockwashers (2), screws (3), and flap assembly (4) from rotor mounting bracket (5). Discard lockwashers.

4-103. PTO DRIVE SHAFT GUARD REPLACEMENT (CONT).

- (2) Remove retaining pin (6), anchor pin (7), and flap assembly (8) from mounting bracket (9).



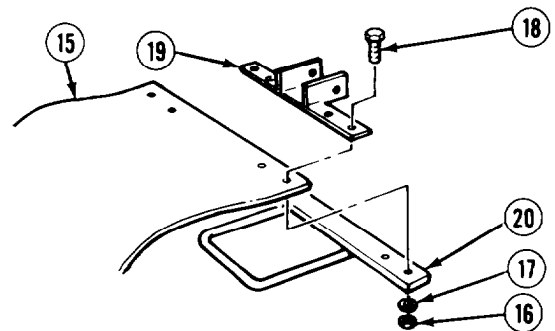
- (3) Remove four nuts (10), lockwashers (11), screws (12), retaining plate (13), and backing plate (14) from flap (15). Discard lockwashers.



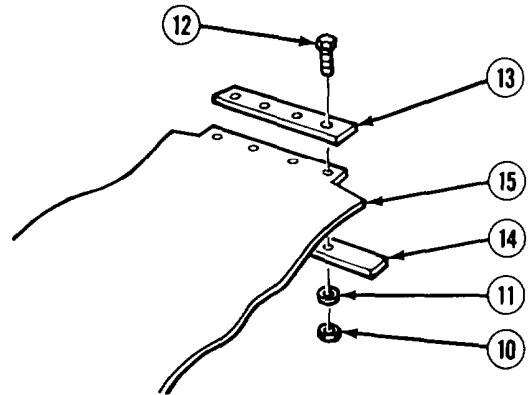
- (4) Remove four nuts (16), lockwashers (17), screws (18), bracket plate (19), backing plate (20), and flap (15).

b. Installation.

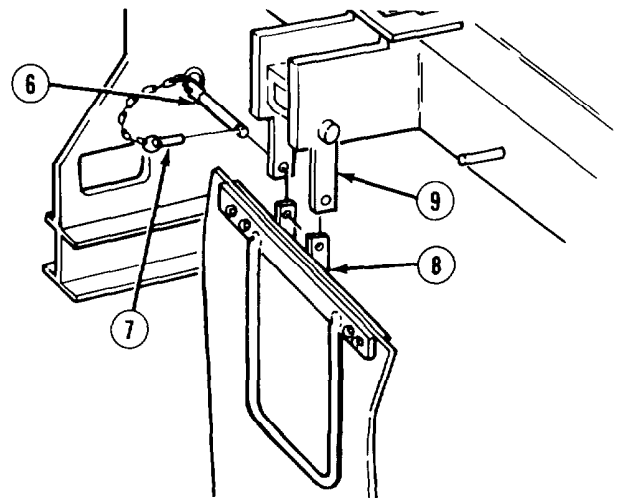
- (1) Install backing plate (20) and bracket plate (19) on flap (15) with four screws (18), lockwashers (17), and nuts (16).



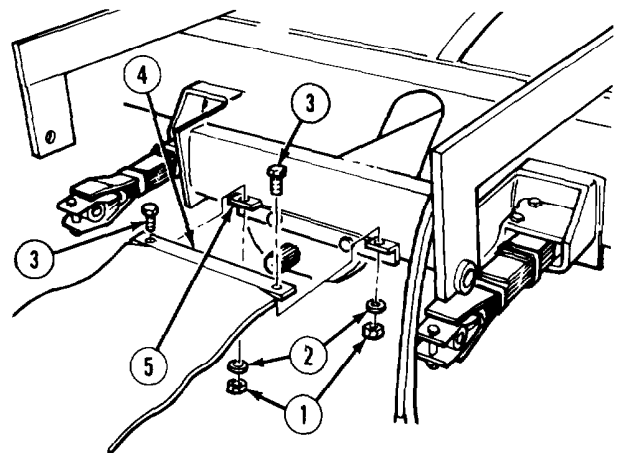
- (2) Install retaining plate (13) and backing plate (14) on flap (15) with four screws (12), lockwashers (11), and nuts (10).



- (3) Install flap assembly (8) on bracket (9) with anchor pin (7) and retaining pin (6).



- (4) Install flap assembly (4) on rotor mounting bracket (5) with two screws (3), lockwashers (2), and nuts (1).



END OF TASK

4-104. PILLOW BLOCK REPLACEMENT.

This task covers:

- a. Removal
- b. Assembly

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

Lockwashers (12)

Equipment Condition

TM or Para

Para 4-101

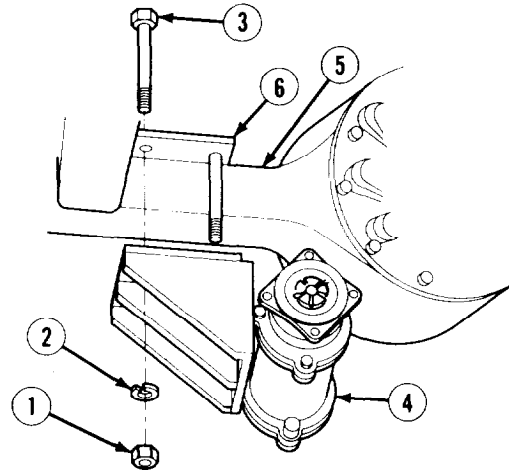
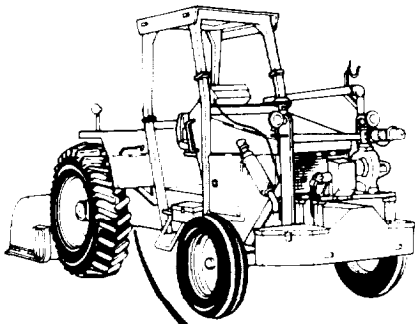
Para 4-102

Condition Description

PTO drive shaft removed

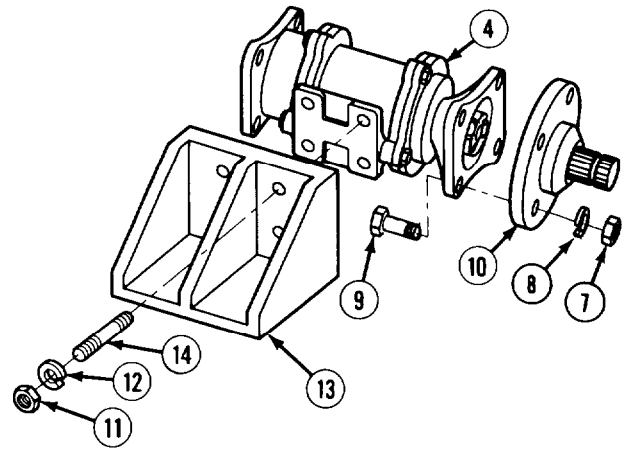
Clutch drive shaft removed.

a. Removal.



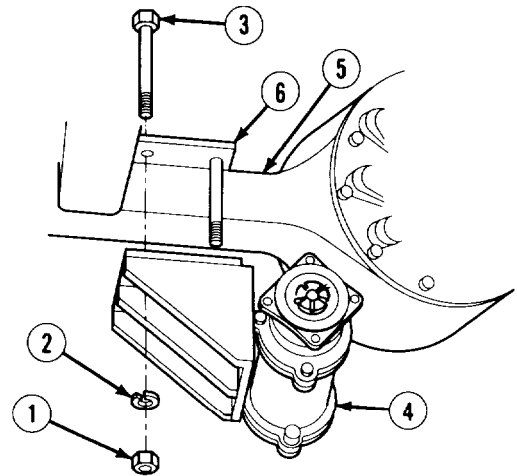
- (1) Remove four nuts (1), lockwashers (2), screws (3), and pillow block assembly (4) from rear axle (5). Discard lockwashers.
- (2) Remove plate (6) from axle (5).

- (3) Remove four nuts (7), lockwashers (8), screws (9), and adapter (10) from pillow block assembly (4). Discard lockwashers.
- (4) Remove four nuts (11), lockwashers (12), and mounting bracket (13) from pillow block assembly (4). Discard lockwashers.
- (5) If damaged, remove four studs (14).



b. Installation.

- (1) If removed, install four studs (14).
- (2) Install mounting bracket (14) over studs (13) on pillow block assembly (4) with lockwashers (12) and nuts (11). Tighten nuts 75 to 85 lb-ft (102 - 115 N•m).
- (3) Install adapter (10) on pillow block assembly (4) with four screws (9), lockwashers (8), and nuts (7). Tighten nuts 75 to 85 lb-ft (102 - 115 N•m).
- (4) Position plate (6) on top of axle (5).
- (5) Install pillow block assembly (4) on axle (5) with four screws (3), lockwashers (2), and nuts (1). Tighten nuts 150 to 160 lb-ft (203 - 217 N•m).



NOTE

Follow-on Maintenance:

Install PTO drive shaft (para 4-101).

Install clutch drive shaft (para 4-102).

END OF TASK

4-105. PARKING BRAKE CABLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 4-106

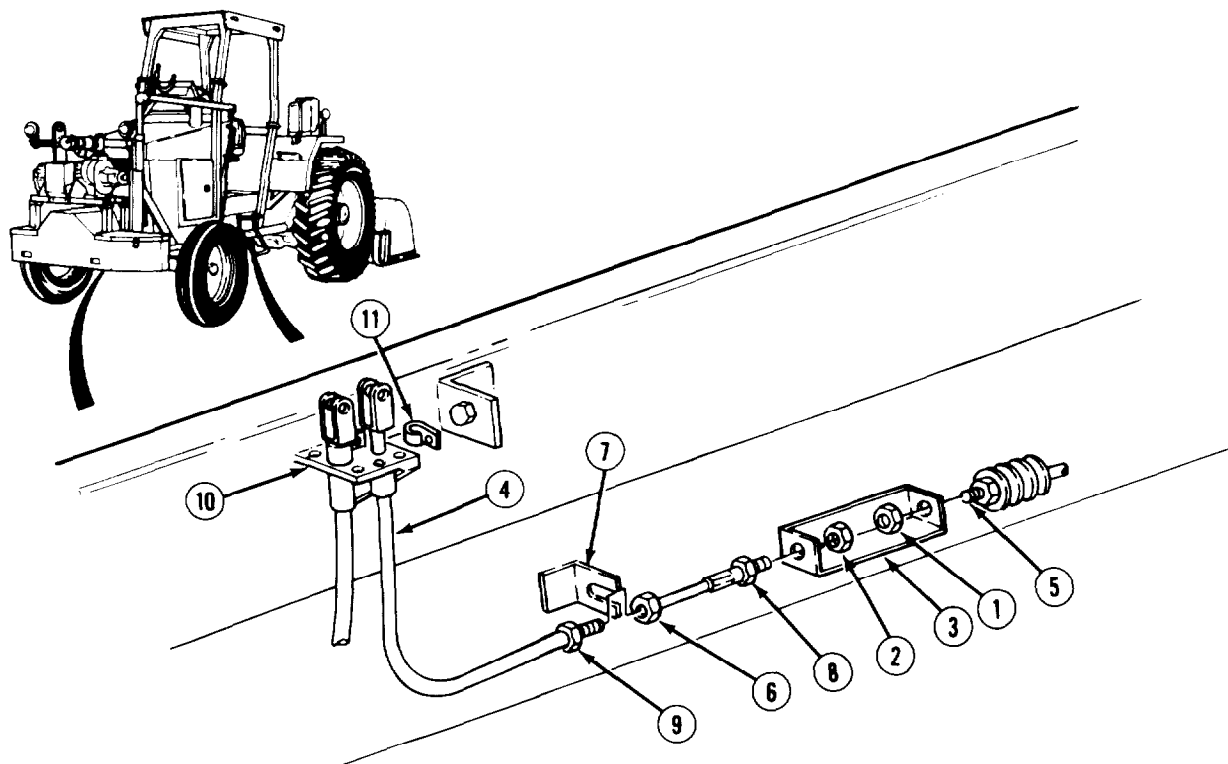
Para 2-15

Condition Description

Parking brake lever and linkage removed.

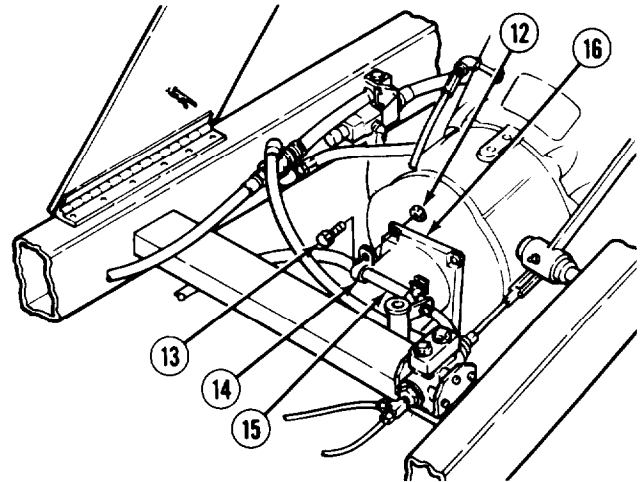
Aft floor deck raised.

a. Removal.

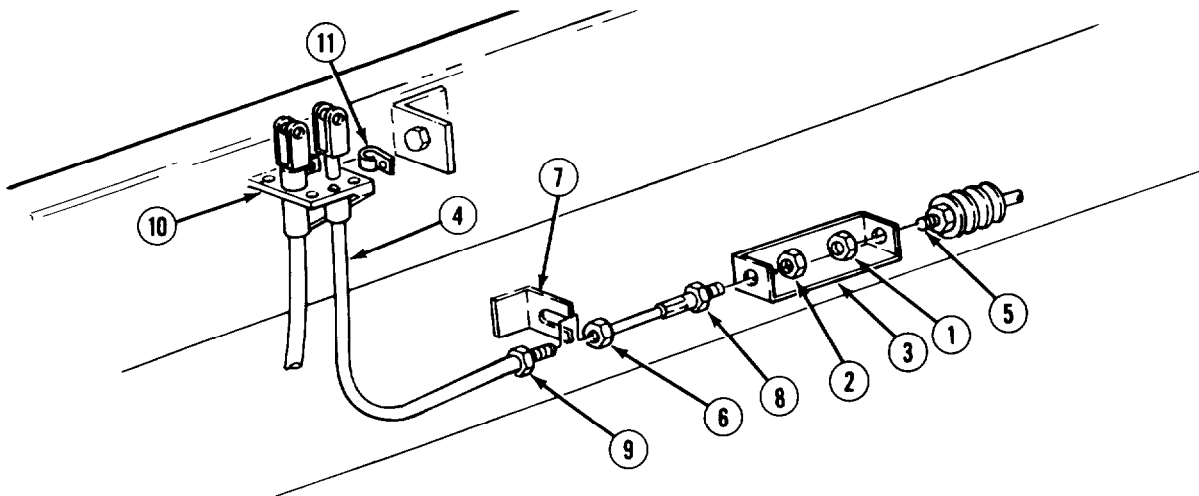


- (1) Remove two jamnuts (1 and 2) and coupling (3) from two cables (4 and 5).
- (2) Remove nut (6) and cable (4) from bracket (7).
- (3) Remove two nuts (8 and 9) from cable (4).
- (4) Remove cable (4) from bracket (10).
- (5) Remove clamp (11) from cable (4).

- (6) Remove two nuts (12), screws (13), clips (14) and cable (15) from clutch brackets (16). Remove clips from cable.
- (7) Repeat steps (1) through (5) to remove cable (15) from other side of vehicle.



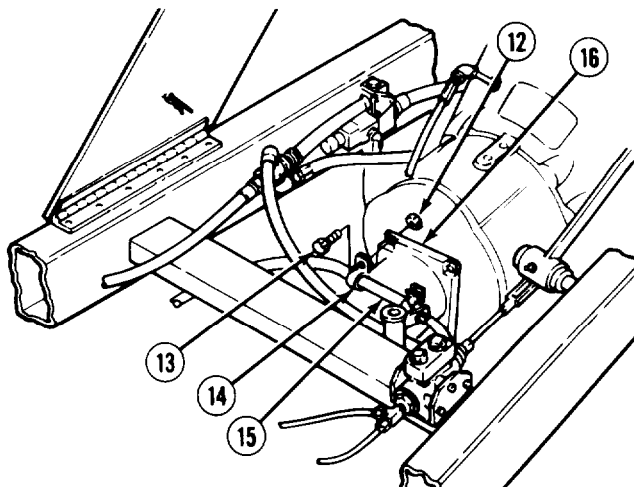
b. Installation.



- (1) Install clamps (11) on cable (4) and position cable in bracket (10).
- (2) Install two nuts (9 and 6) on cable (4), centered on threads.
- (3) Install cable (4) in bracket (7) and tighten nut (6).
- (4) Install nut (8) 1¼ in. (31.8 mm) from end of threads on cable (4).
- (5) Install two cables (5 and 4) in coupling (3) with two jamnuts (1 and 2).

4-105. PARKING BRAKE CABLE REPLACEMENT (CONT).

- (6) Install two clips (14) on cable (15) and cable brackets (16) with two screws (13) and nuts (12).
- (7) Repeat steps (1) through (5) to install cable on other side of vehicle.



NOTE

Follow-on Maintenance:

- Lower aft floor deck (para 2-15).
- Install parking brake lever and linkage (para 4-106).

END OF TASK

4-106. PARKING BRAKE LEVER AND LINKAGE REPLACEMENT.

This task covers:

a. Removal

b. Installation

c. Adjustment

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Condition Description

Wheels chocked.

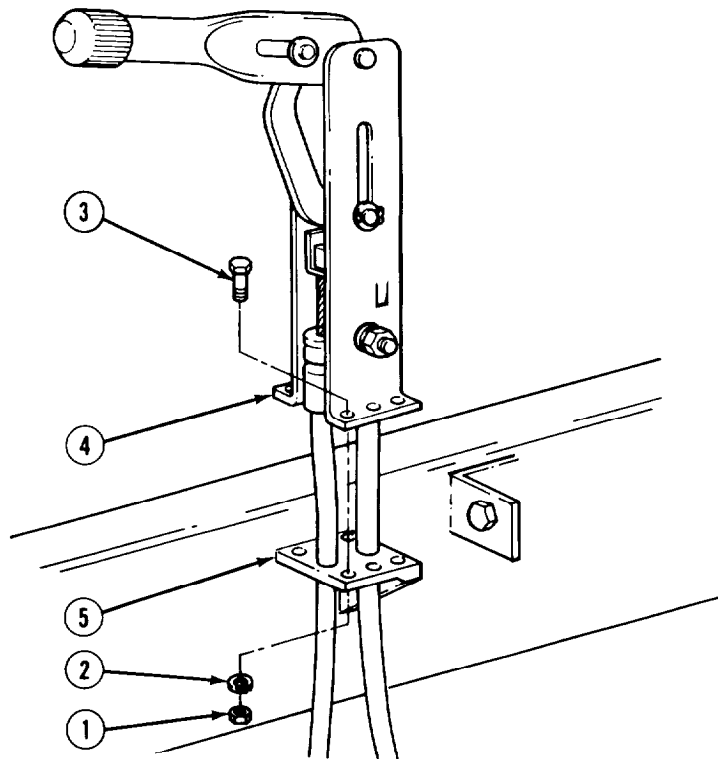
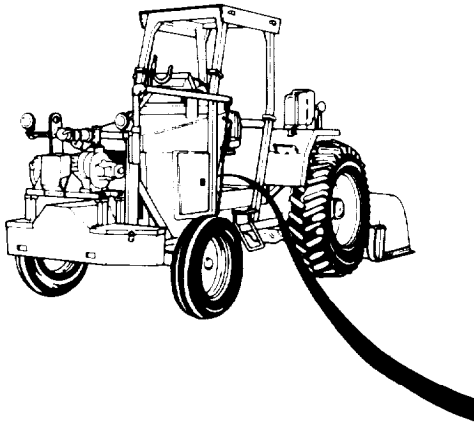
Materials/Parts

Locknut

Lockwashers (4)

Pins, cotter (3)

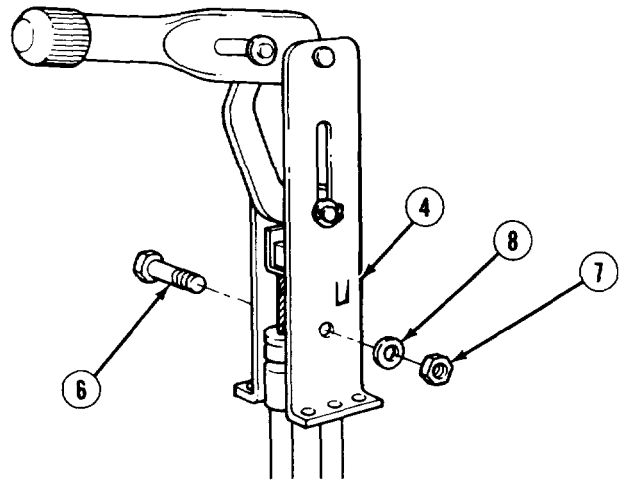
a. Removal.



- (1) Remove four nuts (1), lockwashers (2), and screws (3) from parking brake housing (4) and bracket (5). Discard lockwashers.

4-106. PARKING BRAKE LEVER AND LINKAGE REPLACEMENT (CONT).

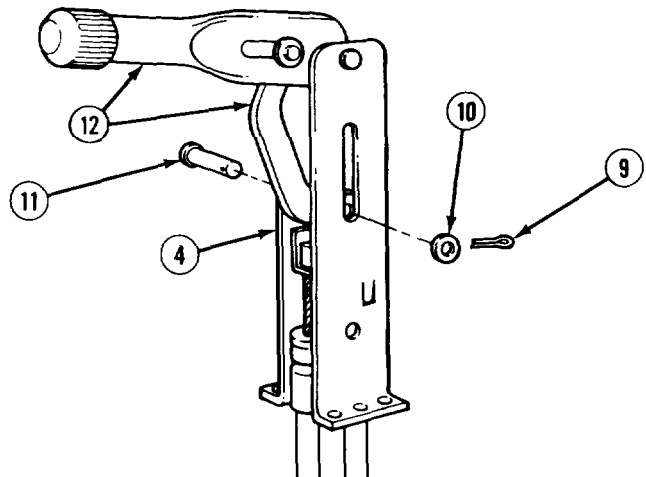
- (2) Remove locknut (7), washer (8), and screw (6) from parking brake housing (4). Discard locknut.



NOTE

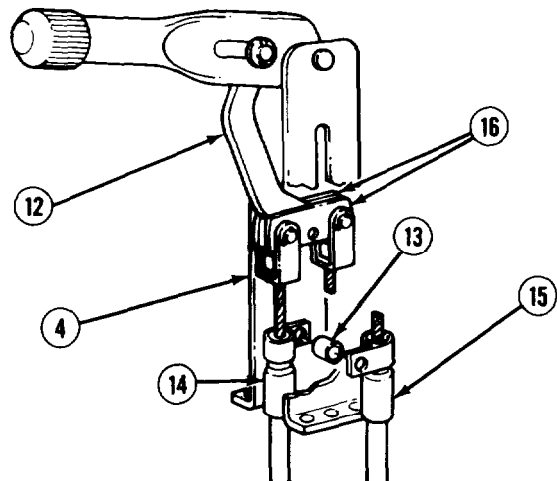
- Note how cables go inside housing. Brake will not work properly if assembled incorrectly.
- Loose parts inside housing will fall if care is not taken. Parking brake housing is removed as an assembly. Do not lose any parts removed in the following steps.

- (3) Remove cotter pin (9) washer (10), and pin (11) from housing (4) and parking brake handle lever (12).

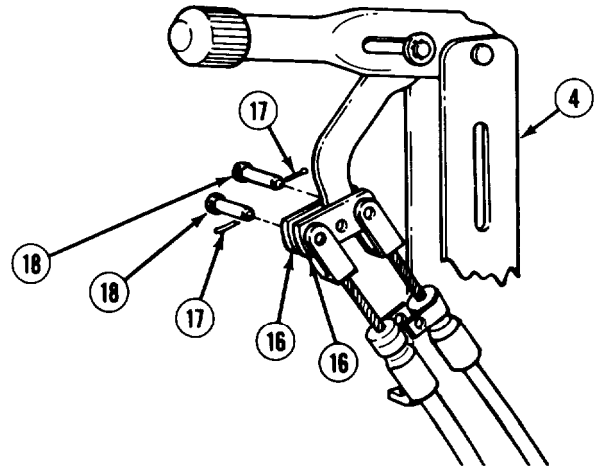


- (4) Move half of housing (4) aside and remove spacer (13) and cables (14 and 15).

- (5) Pull brake handle lever (12) from between two cable holders (16).



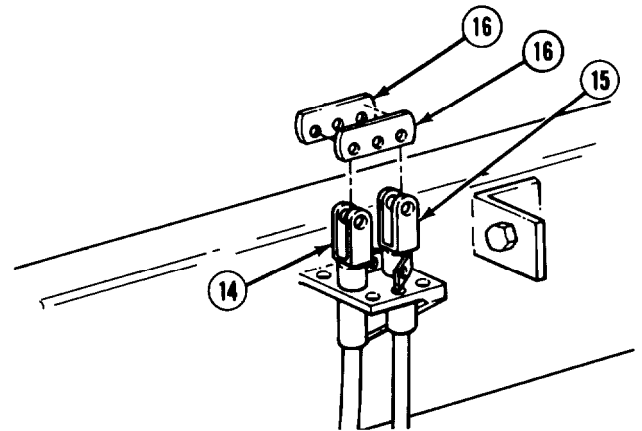
- (6) Remove two cotter pins (17) and pins (18) from cable holders (16).
- (7) Remove parking brake (4) from vehicle.



- (8) Note position and remove two cable holders (16) from cable (14 and 15).

b. Installation.

- (1) Position two cable holders (16) with cables (14 and 15).

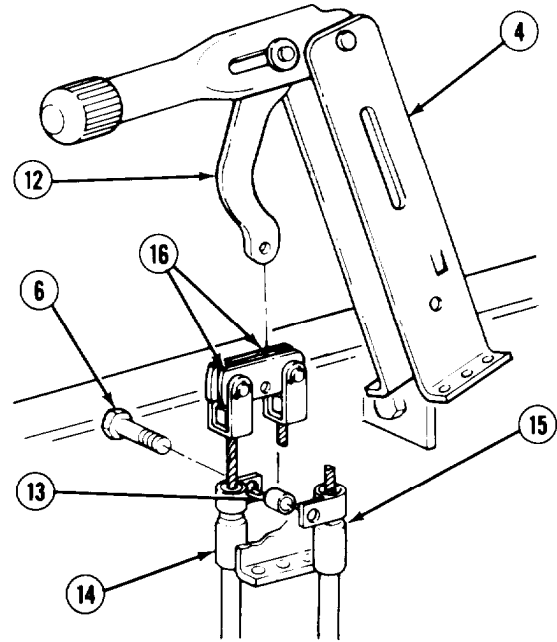


4-106. PARKING BRAKE LEVER AND LINKAGE REPLACEMENT (CONT).

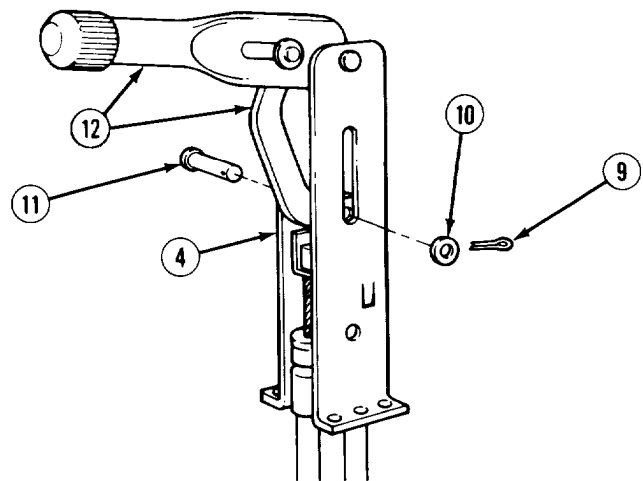
NOTE

Cables can only be correctly installed one way.

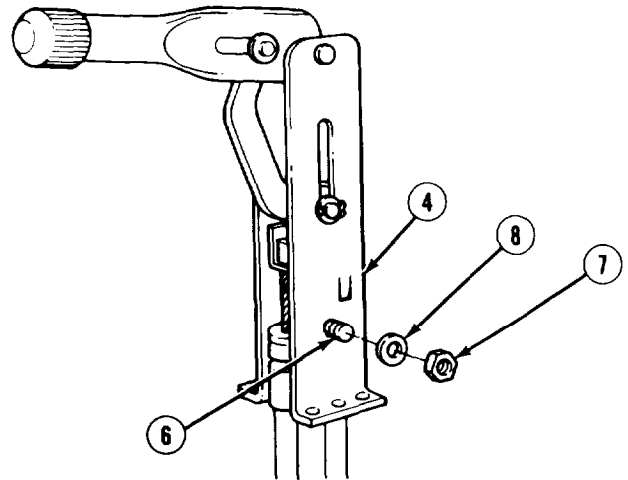
- (2) Position cable (14 and 15) and spacer (13) in housing (4) on screw (6).
- (3) Position lever (12) in between cable holders (16).



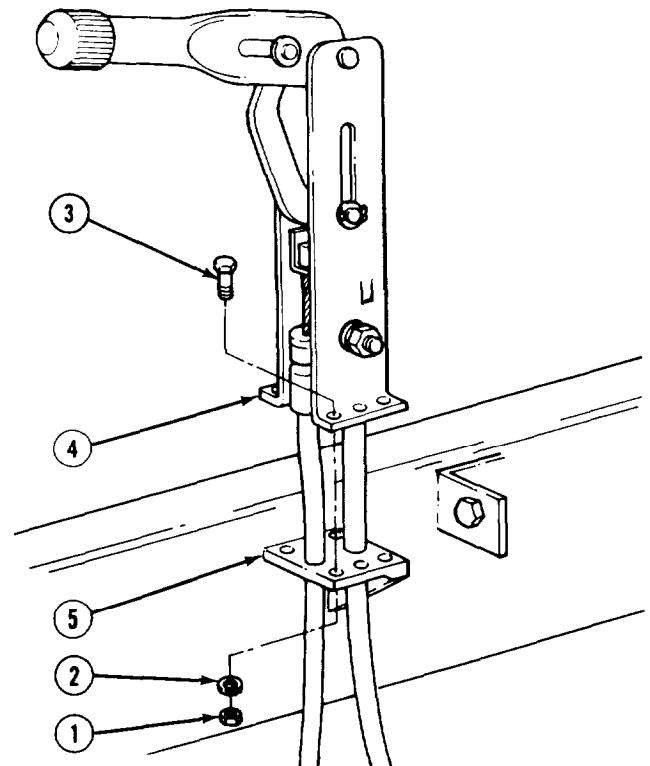
- (4) Install pin (11), washer (10), and cotter pin (9) through hole in housing (4) and lever (12).



- (5) Install washer (8) and locknut (7) on screw (6) already installed in housing (4).



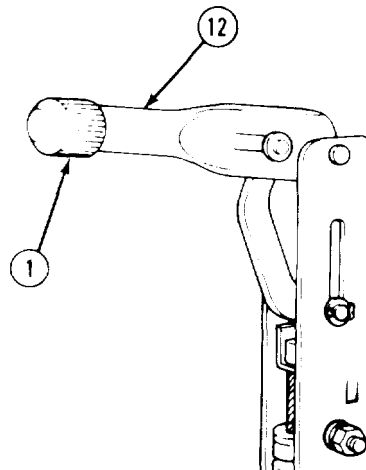
- (6) Install housing (4) on bracket (5) with four screws (3), washers (2), and locknuts (1).



4-106. PARKING BRAKE LEVER AND LINKAGE REPLACEMENT (CONT).

c. Adjustment.

- (1) To tighten the pull on parking brake lever, turn knob (1) on handle (12) to the right (clockwise).
- (2) To loosen the pull on parking brake lever, turn knob (1) to the left (counterclockwise).



NOTE

Follow-on Maintenance: Remove wheel chocks.

END OF TASK

4-107. MASTER CYLINDER REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Suitable container (capacity 1 qt. [0.9 liter])

Materials/Parts

Lockwashers (3)

Rubber boot

*Equipment Condition**TM or Para*

Para 2-13

Para 2-15

Condition Description

Parking brake set.

Aft floor deck raised
and supported.**a. Removal.****NOTE**

Place suitable container with a 1 qt.
(0.9 liter) capacity under master cylinder to
catch spilling fluid.

- (1) Loosen fitting (1) and remove tube (2) from master cylinder (3).
- (2) Loosen fitting (4) and remove tube (5).
- (3) Remove linkage (6) and rubber boot (7).

4-107. MASTER CYLINDER REPLACEMENT (CONT).

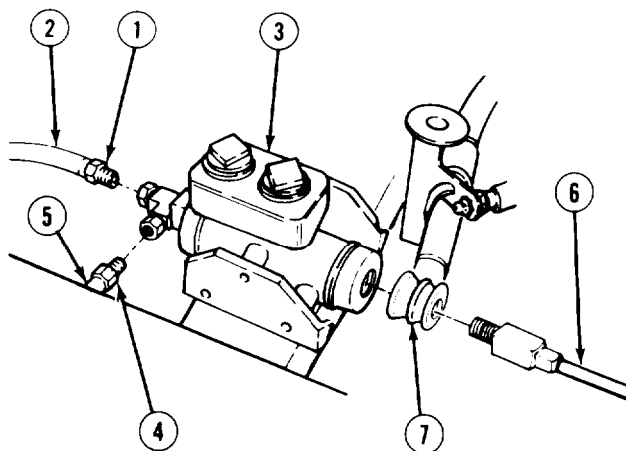
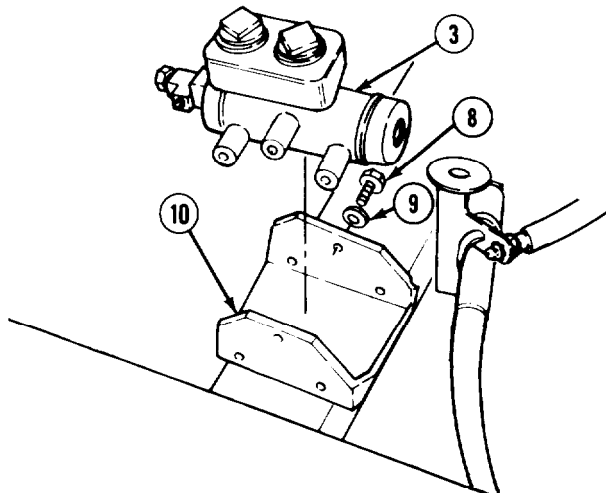
- (4) Remove three screws (8), lockwashers (9) and master cylinder (3) from bracket (10). Discard lockwashers.

b. Cleaning/Inspection.

- (1) Check brake tubes for cracks, holes, or rust.
- (2) Check fittings for good connection and leaks.
- (3) Replace all damaged parts.

c. Installation.

- (1) Install master cylinder (3) on bracket (10) with three lockwashers (9) and screws (8).
- (3) Install rubber boot (7) and linkage (6) on master cylinder (3).
- (4) Install tube (5) and tighten fitting (4).
- (5) Install tube (2) and tighten fitting (1).



NOTE

Follow-on Maintenance:

- Fill master cylinder with brake fluid (para 4-28).
- Lower aft floor deck (para 2-15).
- Bleed brake lines (4-110).

END OF TASK

4-108. BRAKE LINE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Compound, sealing, pipe thread (item 17, appendix E)
 BFS, brake fluid, silicone (item 21, appendix E)
 Tags, identification (item 55, appendix E)
 Ties, plastic (item 57, appendix E)
 Lo&washers (3)

Equipment Condition

TM or Para

Para 2-13

Para 2-15

Condition Description

Parking brake set.

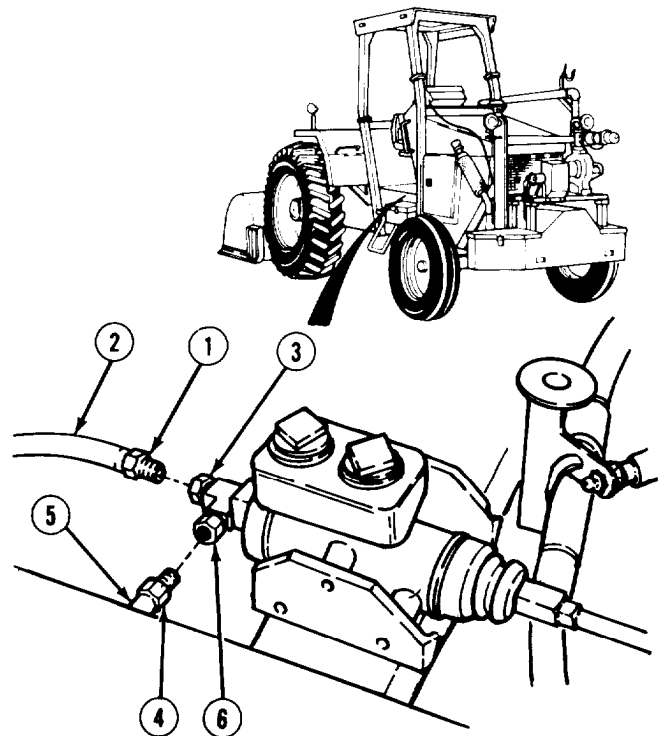
Aft floor deck raised.

Wheels chocked.

a. Removal.

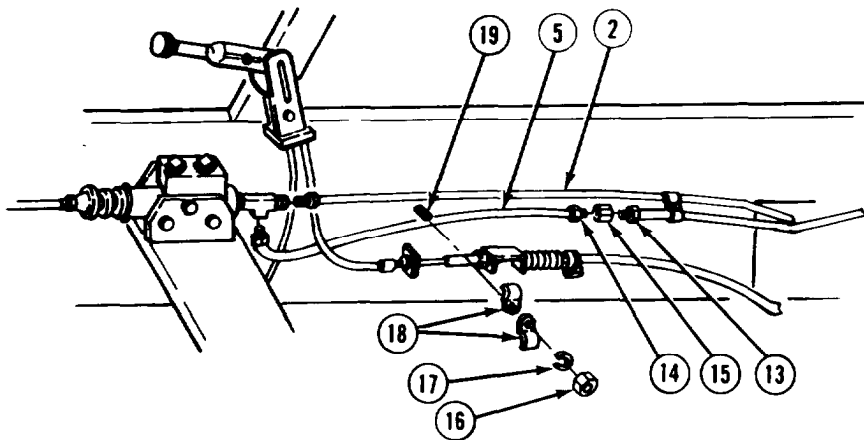
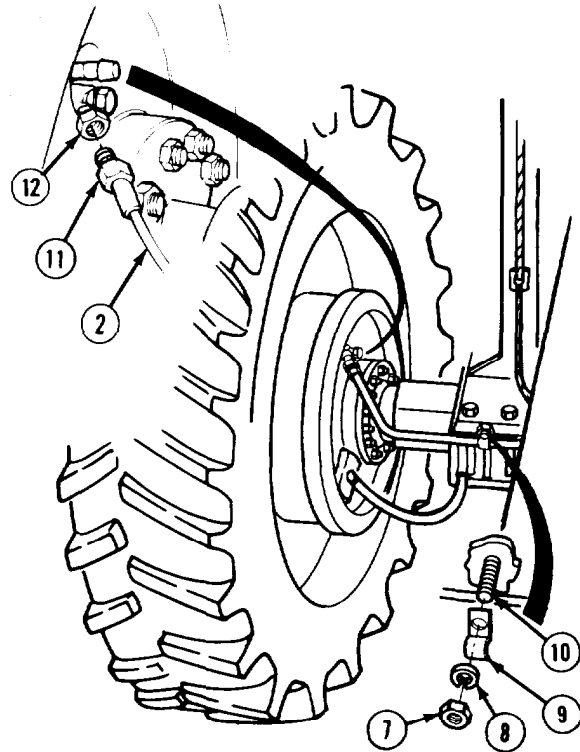
NOTE

- Plug holes and cap fittings to prevent spilling brake fluid.
 - Tag and mark tubes and fittings upon removal.
 - Cut plastic ties and necessary to remove brake tubes from vehicle.
- (1) Disconnect fitting (1) on brake tube (2) from adapter (3).
 - (2) Disconnect fitting (4) on brake tube (5) from adapter (6).

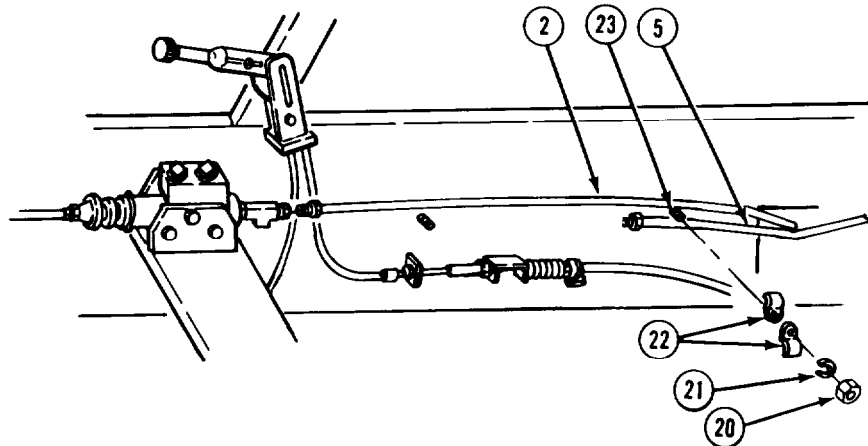


4-108. BRAKE LINE REPLACEMENT (CONT).

- (3) Remove nut (7), lockwasher (8), and clamp (9) from stud (10). Discard lockwasher.
- (4) Disconnect fitting (11), on brake tube (2), from adapter (12).
- (5) Repeat steps (3 and 4) for brake line (5) to other wheel.



- (6) Disconnect fittings (13 and 14), on brake tube (5), from union (15).
- (7) Remove nut (16), lockwasher (17), and two clamps (18) from stud (19). Discard lockwasher.
- (8) Remove front half of brake tube (5) and free brake tube (2).

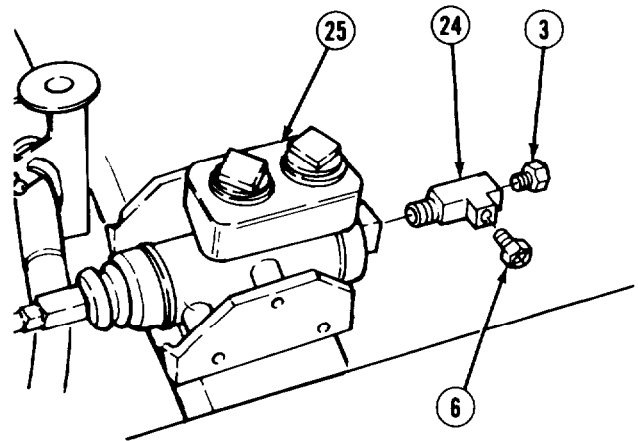


- (9) Remove nut (20), lockwasher (21), and two clamps (22) from stud (23) and remove brake tube (2) and rear half of brake tube (5). Discard lockwasher
- (10) Note position and remove two adapters (3 and 6) and elbow (24) from master cylinder (25).

b. Installation.

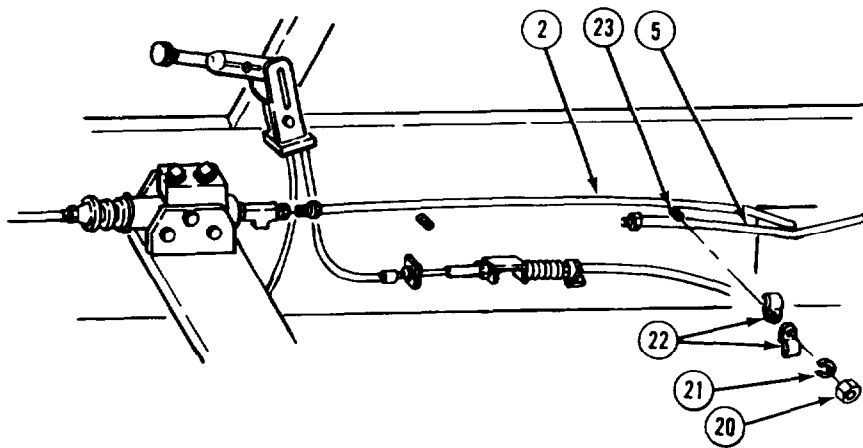
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.



- (1) Coat threads of two adapters (3 and 6) with pipe thread sealing compound and install in elbow (24).
- (2) Coat threads of elbow (24) with pipe thread sealing compound and install in master cylinder (25).

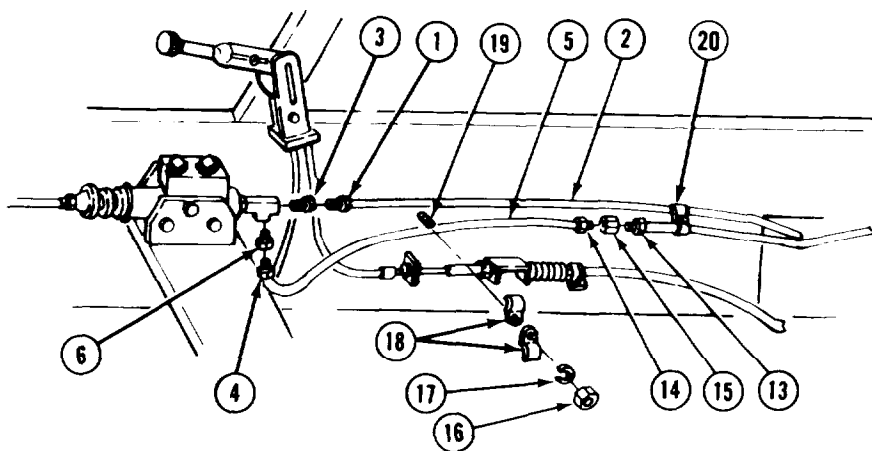
4-108. BRAKE LINE REPLACEMENT (CONT).



NOTE

Use plastic ties as necessary to secure brake tubes to vehicle.

- (3) Position two brake tubes (5 and 2) on vehicle and install two clamps (22) on stud (23) with lockwasher (21) and nut (20).
- (4) Install brake tube (2) and rear half of brake tube (5) behind clamps (22). Do not fully tighten nut (20).



- (5) Install two clamps (18) on stud (19) with lockwasher (17) and nut (16).
- (6) Install front half of brake line (5) and brake line (2) behind clamps (18). Do not fully tighten nut (16).

WARNING

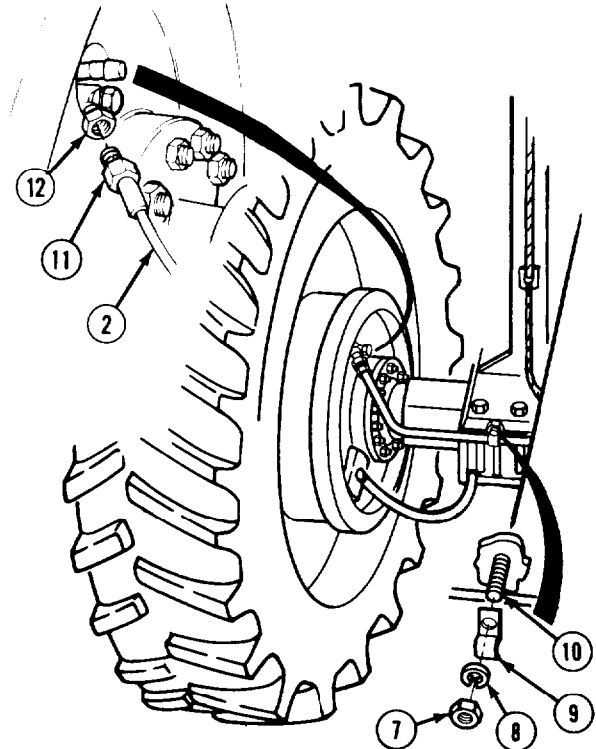
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (7) Coat threads of two fittings (13 and 14) with pipe thread sealing compound and connect to union (15).
- (8) Position brake tubes (2 and 5) so that fittings (1 and 4) can be connected to master cylinder adapters (3 and 6).

CAUTION

Be sure that clamps are positioned squarely and evenly over brake tubes before tightening clamp nuts or damage to brake tubes may result.

- (9) Tighten nuts (16 and 20).
- (10) Install fitting (11) in adapter (12).
- (11) Install clamp (9) lockwasher (8), and nut (7) on stud (10). Position brake tube (2) behind clamp and tighten nut.
- (12) Repeat steps (10 and 11) for brake tube (5) to other wheel.

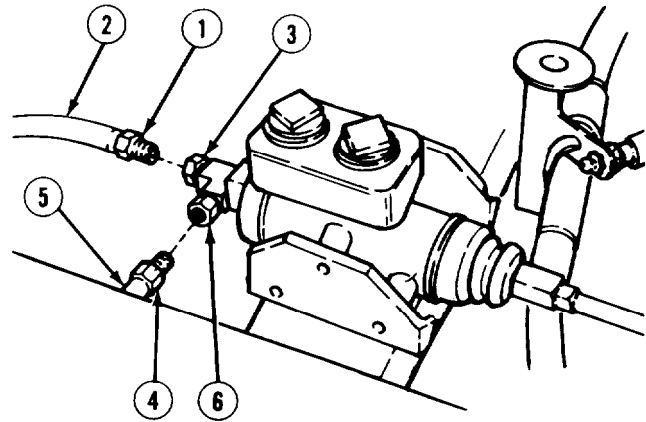


4-108. BRAKE LINE REPLACEMENT (CONT).

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (13) Coat threads of fitting (4) on brake line (5) with pipe thread sealing compound and connect to adapter (6).
- (14) Coat threads of fitting (1) on brake line (2) with pipe thread sealing compound and connect to adapter (3).



Follow-on Maintenance:

- Fill master cylinder with brake fluid (para 4-28).
- Lower aft floor deck (para 2-15).
- Bleed brake lines (4-110).

END OF TASK

4-109. BRAKE PEDAL AND LINKAGE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Pin, cotter
Locknut

Equipment Condition

TM or Para

Para 2-13

Para 4-132

Para 2-15

Condition Description

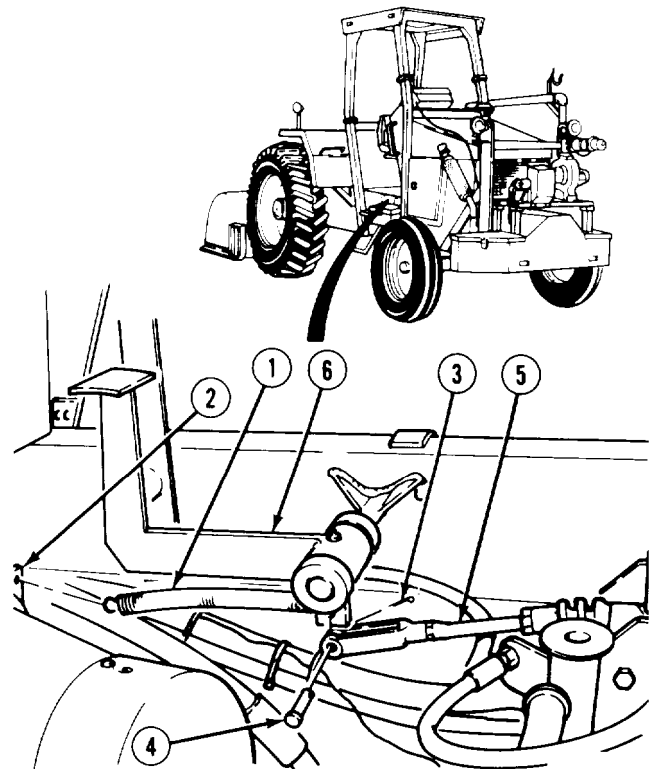
Parking brake set.

Forward floor plate removed.

Aft floor deck raised.

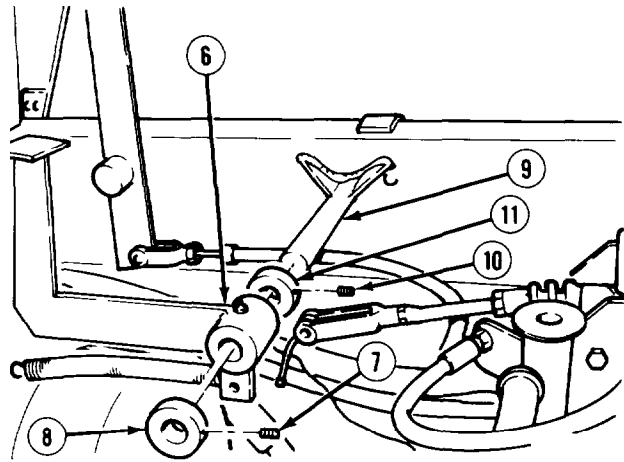
a. Removal.

- (1) Disconnect spring (1) from retainer (2).
- (2) Remove cotter pin (3), clevis pin (4), and clevis (5) from brake pedal (6). Discard cotter pin.



4-109. BRAKE PEDAL AND LINKAGE REPLACEMENT (CONT).

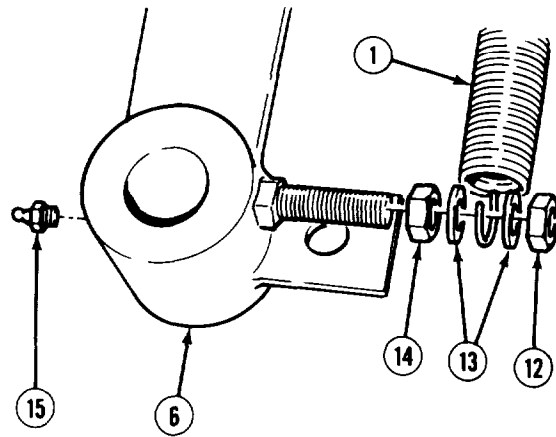
- (3) Remove setscrew (7), collar (8), and brake pedal (6) from trunnion (9).
- (4) Remove setscrew (10) and collar (11) from trunnion (9).



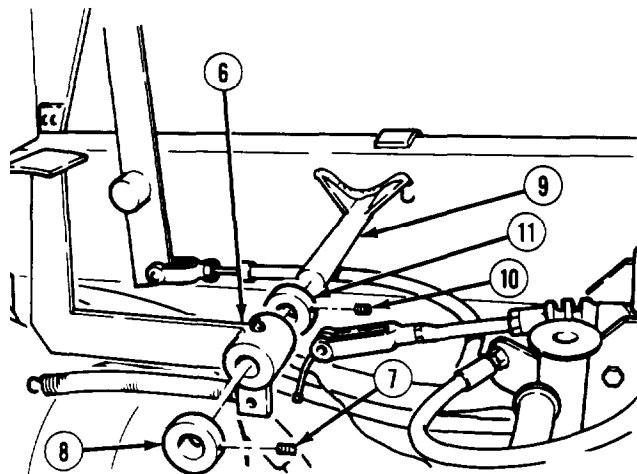
- (5) Remove locknut (12), two washers (13), spring (1), and jamnut (14) from brake pedal (6). Discard locknut.
- (6) Remove grease fitting (15).

b. Installation.

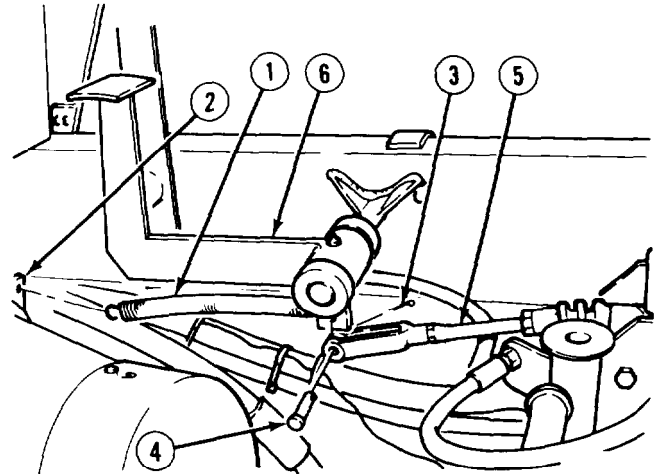
- (1) Install grease fitting (15) in brake pedal (6).
- (2) Install jamnut (14), two washers (13), spring (1), and locknut (12) on brake pedal (6).



- (3) Install collar (11) and setscrew (10) on trunnion (9).
- (4) Install brake pedal (6), collar (8), and setscrew (7) on trunnion (9).



- (5) Install clevis (5) on brake pedal (6) with clevis pin (4) and cotter pin (3).
- (6) Attach spring (1) to retainer (2).



NOTE

Follow-on Maintenance:

- Lower aft floor deck (para 2-15).
- Install forward floor plate (para 4-132).

END OF TASK

4-110. BLEEDING REAR BRAKES.

This task covers:

Bleeding

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Suitable container (capacity 1 qt. [0.9 liter])

Materials/Parts

BPS, brake fluid, silicone (item 21, appendix E)
 Hose, fuel - 1/4 in. ID

Personnel Required

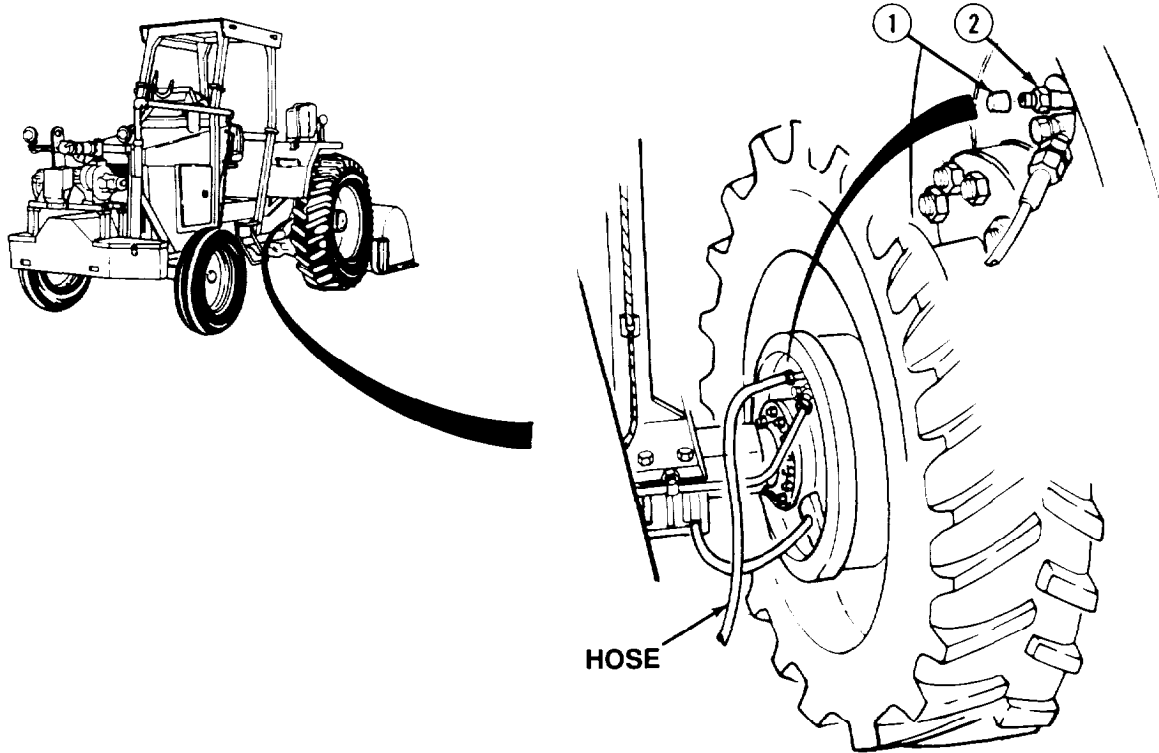
MOS62B, Construction vehicle repairer (2)

Equipment Condition

TM or Para
 Para 2-15

Condition Description
 Raise aft floor deck.

Bleeding



NOTE

- Both left- and right-hand rear wheel brakes are bled the same way. Right side shown.
 - Master cylinder must be filled with brake fluid.
 - Place suitable container with a 1 qt. (0.9 liter) capacity under brake lines to catch spilling fluid.
- (1) Remove rubber boot (1) and install 1/4 in. hose on bleed nipple (2).
 - (2) Mechanic holds hose over suitable container while assistant pumps brake pedal until brake pressure is felt.

- (3) Loosen bleed nipple (2).
- (4) Assistant holds brake pedal until all air has bubbled from hose on bleed nipple or pedal bottoms out. Mechanic tightens bleed nipple (2) before assistant releases pedal.

NOTE

Check fluid level and refill as necessary.

- (5) Repeat steps (2) through (4) until fluid coming from hose is free of air.
- (6) Remove hose and install rubber boot (1) on bleed nipple (2).
- (7) Repeat steps (1) through (6) for left hand rear wheel brake.

NOTE

Follow-on Maintenance: Lower aft floor deck (para 2-15).

END OF TASK

4-111. REAR BRAKE INSPECTION.

This task covers:

Inspection

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 5-74

Condition Description
Brake drum removed.

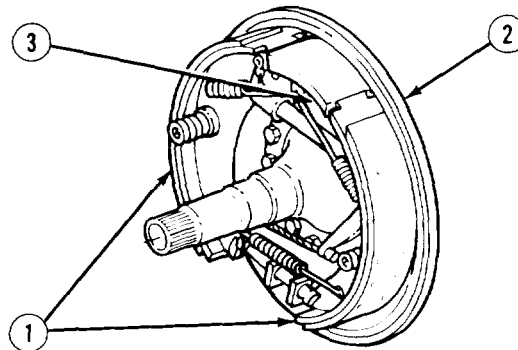
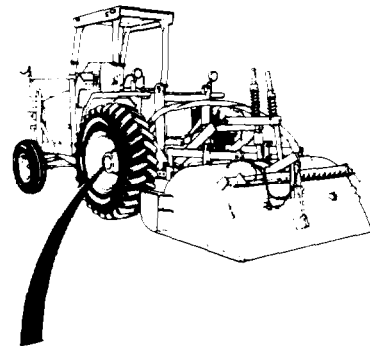
a. Inspection.

- (1) Inspect wheel cylinder (1) and backing plate (2) for evidence of leakage. Replace/repair wheel cylinder or brake lines if required.



Parts of the brake assembly may be coated with asbestos dust; breathing this dust can harm personnel.

- Use a filter mask approved for use against asbestos dust.
 - Never use compressed air or dry brush to clean these assemblies.
 - Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust.
 - Use water and a soft bristle brush or cloth to remove dirt or mud.
 - Do not allow grease or oil to contact brake linings. Linings can absorb grease and oil, causing early glazing and very poor braking action. Failure to do so could cause serious injury or death to personnel.
- (2) Inspect brake linings (3) for glazing. Replace or repair brake shoes if required.
 - (3) Measure thickness of brake linings (3). If brake linings are less than 1/8 inch (3 mm) thick at thinnest point, replace/repair brake shoes.



- (4) Check brake drums for excessive wear.
Replace brake drum if not within the following specifications:

Nominal Internal Diameter	15.738 in. (39.97 cm)
Maximum Usable Diameter	15.870 in. (40.31 cm)
Maximum Allowable Remachining Diameter	15.830 in. (40.21 cm)
Allowable Radial Variance	0.005 in. (0.01 cm)

NOTE

Follow-on Maintenance: Install brake drum (para 5-74).

END OF TASK

4-112. REAR BRAKE ADJUSTMENT.

This task covers:

Adjustment

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-17

Condition Description
Rear wheels raised.

Adjustment.

NOTE

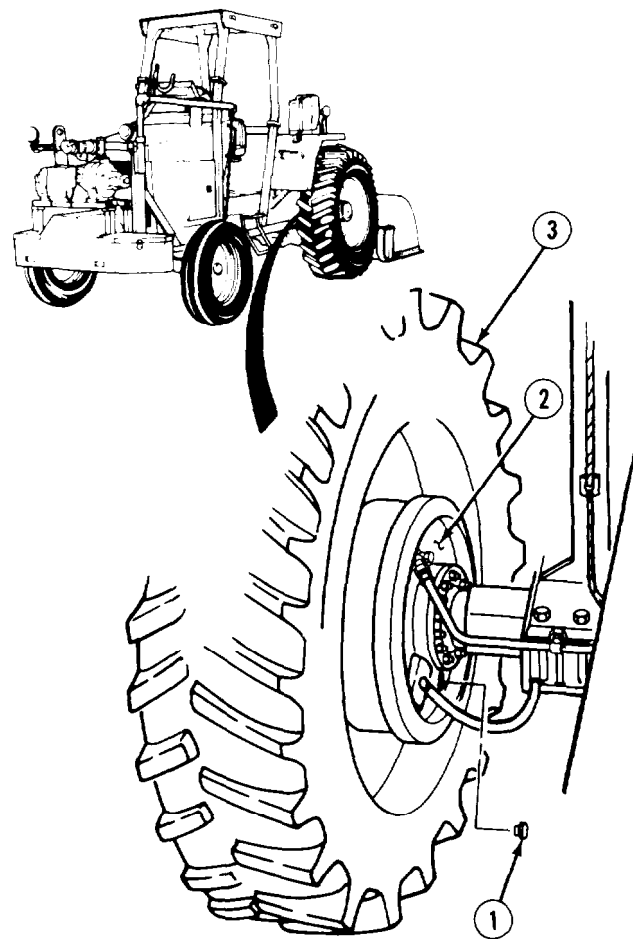
This procedure is the same for both left and right rear brakes.

- (1) Remove plug (1) from backing plate (2).
- (2) Spin wheel (3) while adjusting brake mechanism.
- (3) Adjust brakes until wheel (3) begins to drag, then back adjustment off slightly.

NOTE

Follow-on Maintenance: Lower rear wheels (para 4-17).

END OF TASK



4-113. FRONT WHEEL HUB REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Wrench, torque

*Equipment Condition*TM or Para
Para 4-115Condition Description
Front wheel removed.*Materials/Parts*

Cloth, lint-free (item 12, appendix E)

Grease, general purpose (item 25, appendix E)

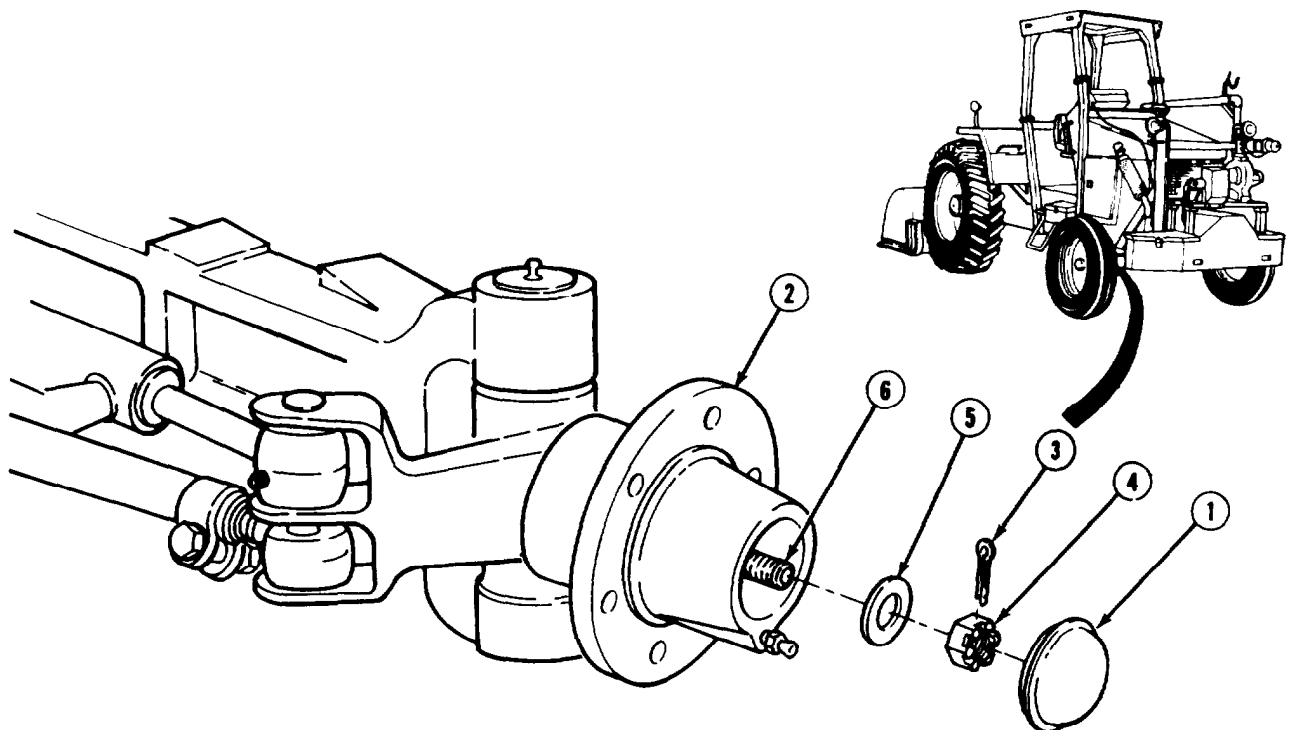
Solvent, drycleaning (item 54, appendix E)

Pin, cotter

Washer

Bushing

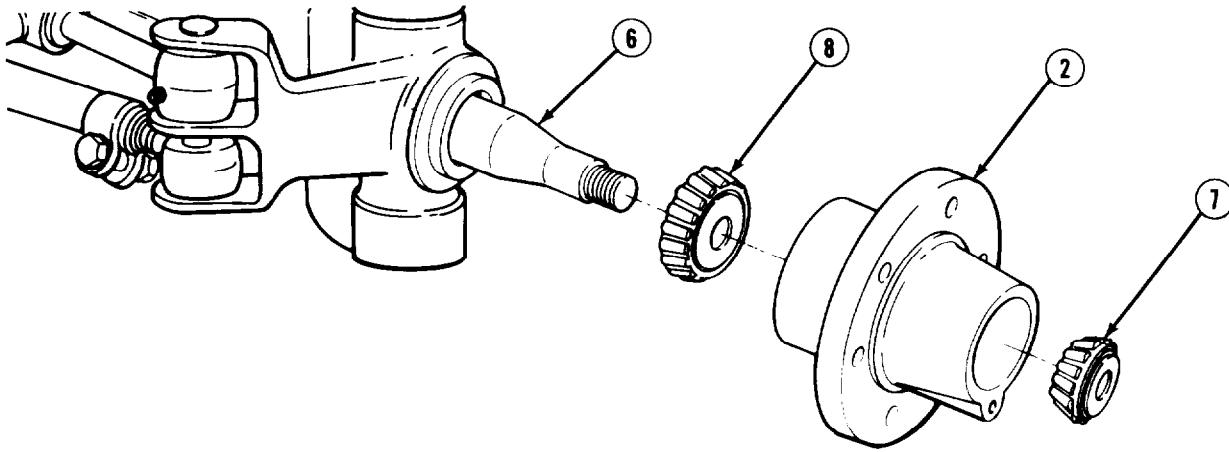
Seal

a. Removal.

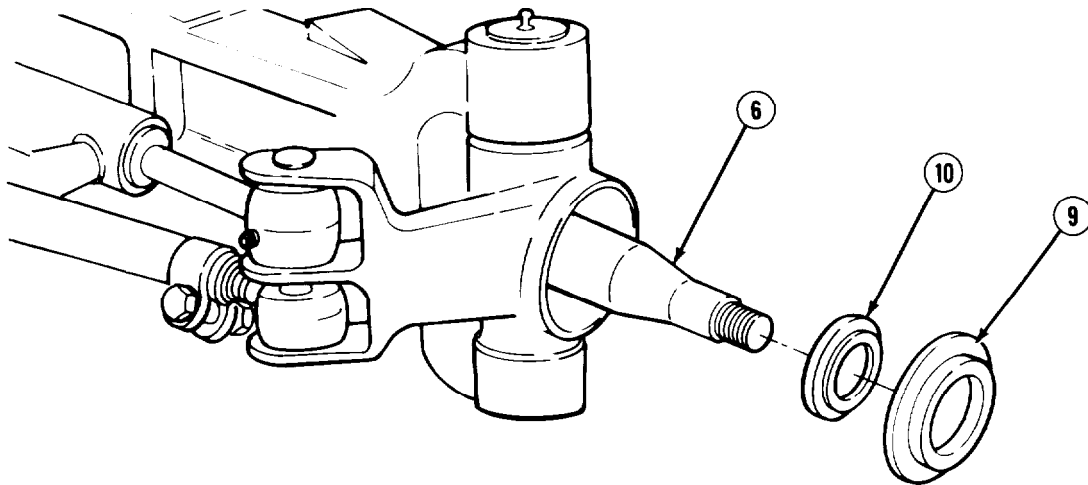
(1) Remove cap (1) from hub (2).

(2) Remove cotter pin (3), nut (4), and washer (5) from spindle shaft (6). Discard cotter pin and washer.

4-113. FRONT WHEEL HUB REPLACEMENT (CONT).

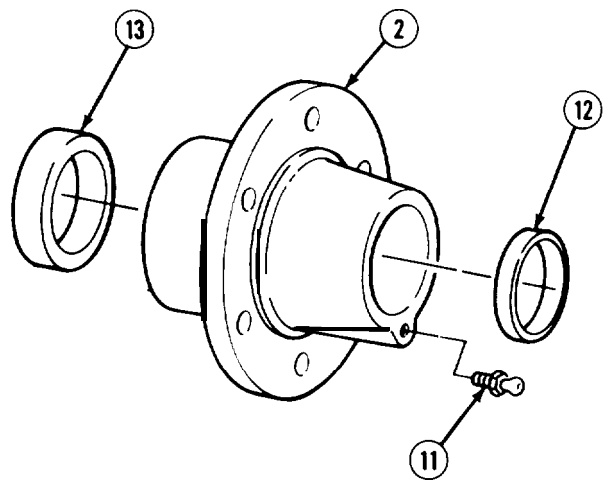


(4) Remove bearing (7), hub (2), and bearing (8) from shaft (6).



(5) Remove seal (9) and bushing (10) from shaft (6). Discard seal and bushing.

(6) Remove plug (11) and bearing cups (12 and 13) from hub (2).



6. *Cleaning/Inspection.*

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60%). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

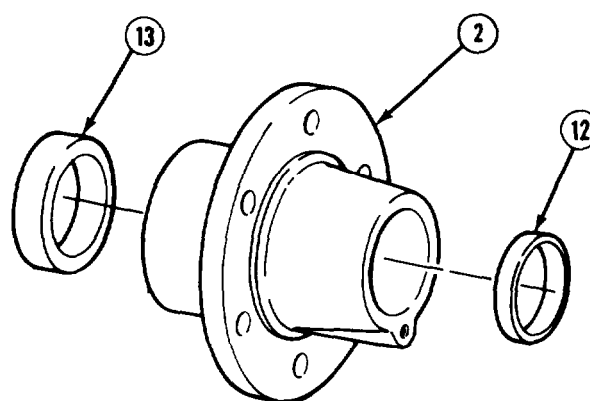
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

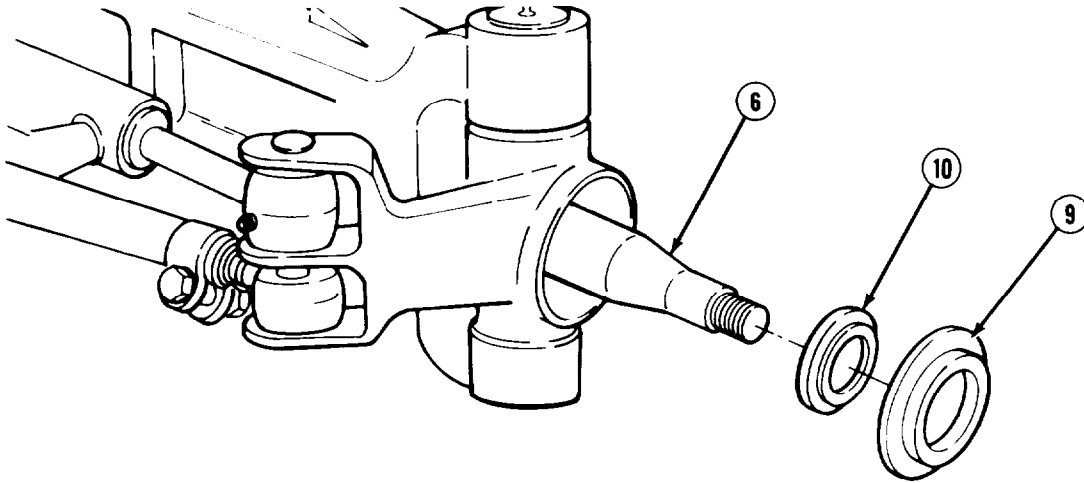
- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearings to air dry.
- (4) Check all metal parts for breaks, cracks, and sharp edges.
- (5) Check spindle shaft for nicks and burrs.
- (6) Check bearings for loose rollers and cracked or broken races.
- (7) If damaged, replace grease seals.

c. *Installation.*

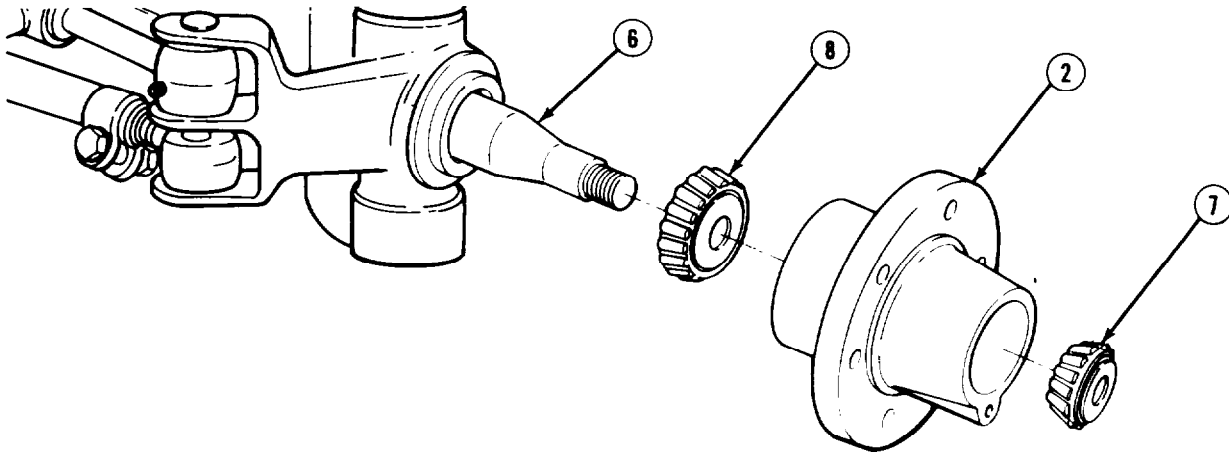
- (1) Install bearing cups (13 and 12) in hub (2).



4-113. FRONT WHEEL HUB REPLACEMENT (CONT).



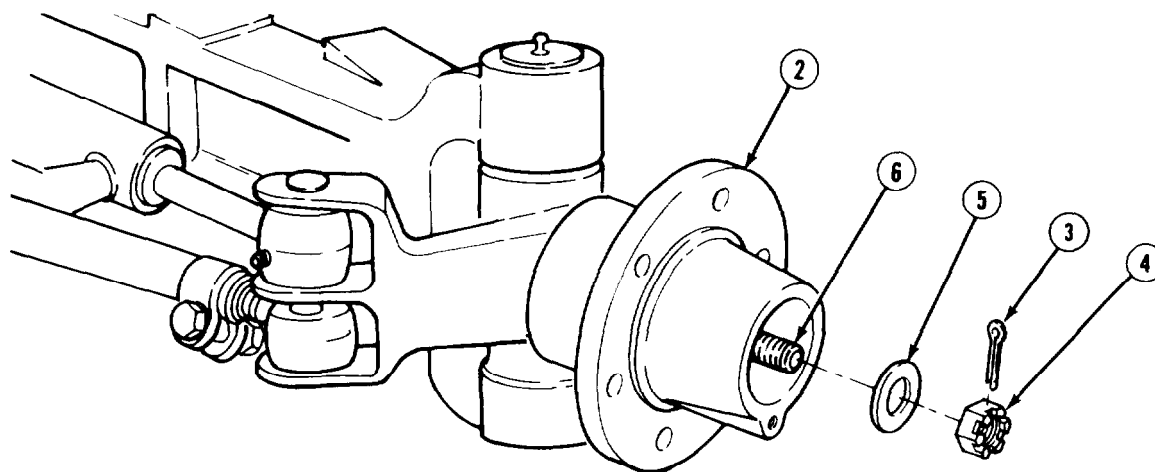
(2) Install bushing (10) and seal (9) on shaft (6). Apply grease to lips of seal (9).



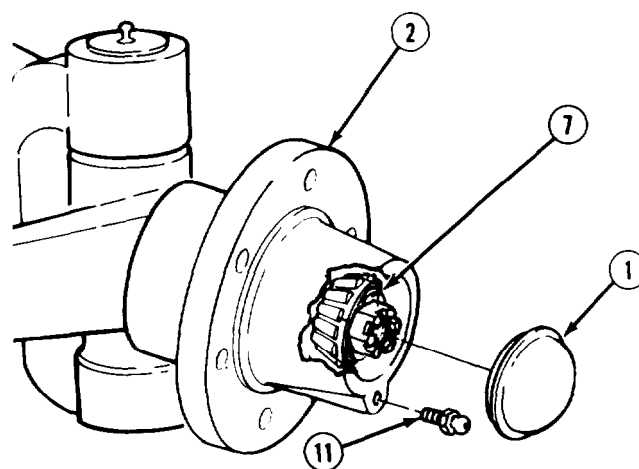
(3) Apply grease to bearing (8) and install on shaft (6).

(4) Install hub (2) on shaft (6).

(5) Install bearing (7) in hub (2).



- (6) Install washer (5) and nut (4) on shaft (6). Tighten nut 35 lb-ft (47 N°m).
- (7) Turn hub (2) several times. Tighten nut (4) again 35 lb-ft (47 N°m).
- (8) Install cotter pin (3).
- (9) Before installing plug (11), fill hub (2) with grease until grease begins to come through outer bearing cone (7). Install plug (11) in hub (2).
- (10) Install cap (1).



NOTE

Follow-on Maintenance: Install front wheel (para 4-115).

END OF TASK

4-114. REAR WHEEL REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting jack (10,000 lb capacity)

Wrench, torque

Personnel Required

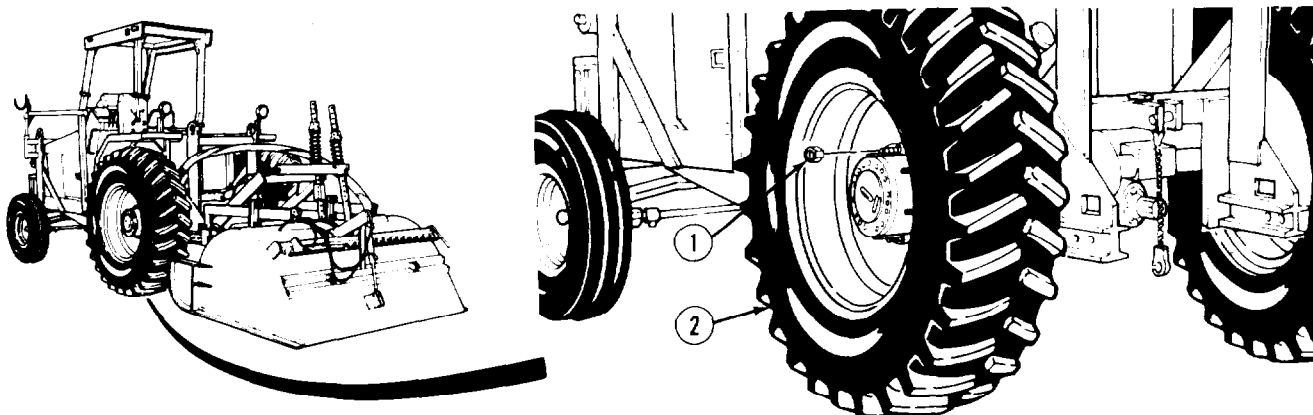
MOS62B, Construction equipment repairer (2)

a. Removal.

WARNING

- Do not place jack under any location except specific jacking points. Otherwise, vehicle may fall during maintenance and cause injury or death to personnel.
- Rear wheel weighs 375 lbs (170 kg) and should not be allowed to fall. Injury or death to personnel could result.

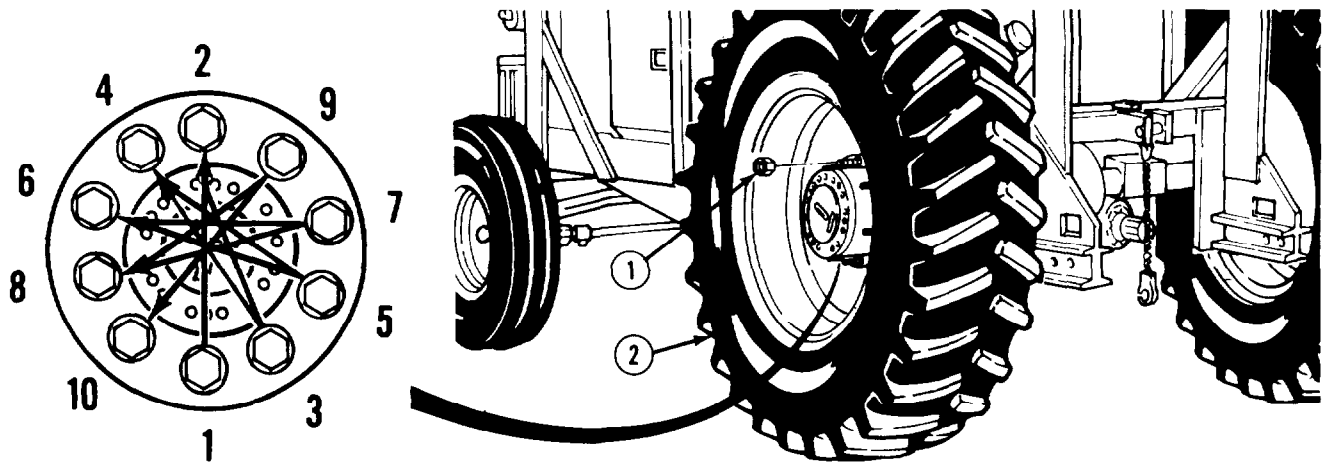
(1) Position jack under jacking point (para 4-17) on rear hitching frame and lift vehicle.



NOTE

Remove nuts in a cross-pattern fashion.

(2) Loosen 10 nuts (1) alternately on rear wheel (2).



- (3) Raise vehicle until rear wheel is off ground. Support vehicle with jack stand.
- (4) Remove 10 nuts (1) from rear wheel (2).
- (5) Remove rear wheel (2) from vehicle.

b. Cleaning/Inspection.

- (1) Inspect for damaged parts.
- (2) Replace all damaged parts.

c. Installation.

- (1) Position rear wheel (2) on vehicle.

NOTE

- When installing nuts, position wheel so that studs are centered in wheel holes.
 - Nuts should be installed in a cross pattern fashion. Install or tighten one nut then tighten or install the nut across from the one just installed.
- (2) Install 10 nuts (1) on rear wheel (2).
 - (3) Lower vehicle until rear wheel (2) is firmly grounded.
 - (4) Tighten nuts (1) 400 to 450 lb-ft (542 - 610 N°m).
 - (5) Remove jack.

END OF TASK

4-115. FRONT WHEEL REPLACEMENT.

his task covers:

- a. Removal b. Cleaning/Inspection c. Installation

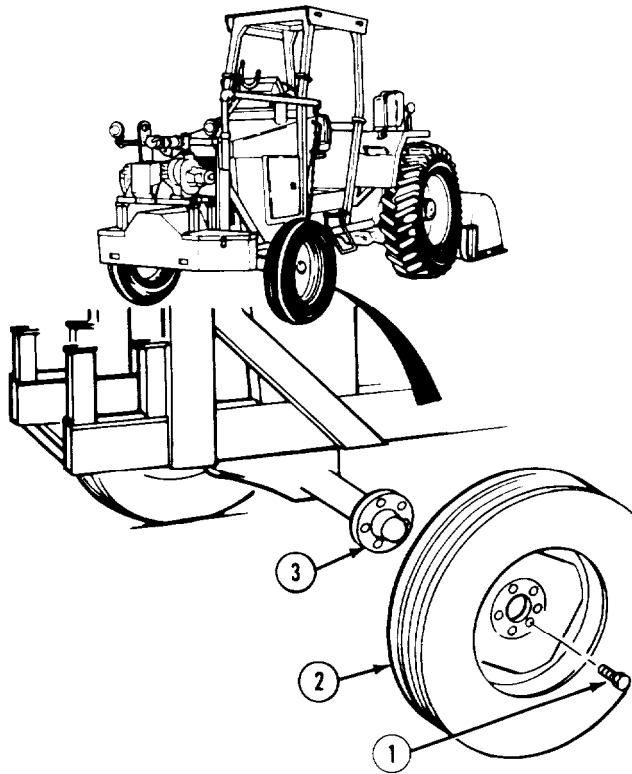
INITIAL SETUP

<p><i>Tools</i></p> <p>Tool kit, general mechanic’s: automotive</p> <p>Wrench, torque</p> <p>Lifting jack (10,000 lb capacity)</p> <p><i>Materials/Parts</i></p> <p>Oil, lubricating (item 36, appendix E)</p> <p><i>Personnel Required</i></p> <p>MOS62B, Construction equipment repairer (2)</p>	<p><i>Equipment Condition</i></p> <p>TM or Para</p> <p>Para 2- 13</p> <p><i>Condition Description</i></p> <p>Block rear wheels.</p> <p>Apply parking brake.</p> <p><i>General Safety Instructions</i></p> <p>Do not work on vehicle while vehicle is supported with lifts, or cranes. Use horses or other form of support.</p>
--	--

a. *Removal.*



- All personnel must stand clear during Removal and replacement of tire. Failure to do so may result in injury or death to personnel.
 - Do not place jack under any location except specific jacking points. Otherwise, vehicle may fall during maintenance and cause injury or death to personnel.
- (1) Position jack under jacking point (para 4-17) on front axle.
 - (2) Loosen six screws (1) alternately.
 - (3) Using a jack, lift front end of vehicle so that wheel (2) is off ground. Support vehicle with jack stand.
 - (4) Mechanic remove six bolts (1) in cross pattern, while wheel (2) is being supported by assistant.
 - (5) Remove wheel (2) from front axle (3).
 - (6) Repeat steps (1 through 5) for other wheel.



b. Cleaning/Inspection.

- (1) Inspect for damaged parts.
- (2) Replace all damaged parts.

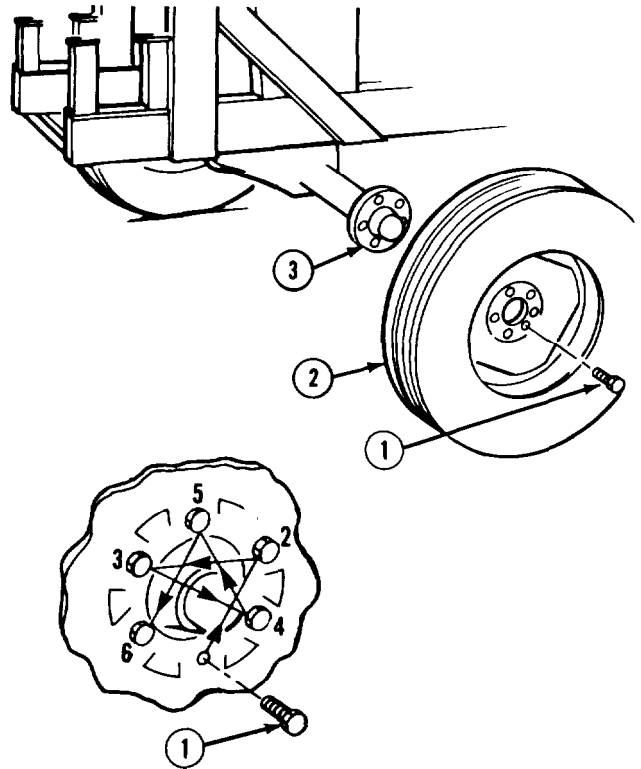
c. Installation.

- (1) Install wheel (2) on front axle (3).

NOTE

Apply a light coat of oil to screen threads before installing.

- (2) Install, in cross pattern, six screws (1). Tighten finger tight or until wheel (2) is snug.
- (3) Remove jack stands and lower vehicle.
- (4) Tighten six screws (1) to 130 to 150 lb-ft (176 - 203 N°m) in pattern indicated.
- (5) Repeat steps (1 through 4) for other wheel.
- (6) Remove jack.



END OF TASK

4-116. FRONT AND REAR TIRE REPAIR.

Refer to TM 9-2610-200-14 Operator, Unit, Direct Support, General Support Maintenance Manual for care, maintenance, repair and inspection of pneumatic tires and inner tubes.

4-117. STEERING WHEEL REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

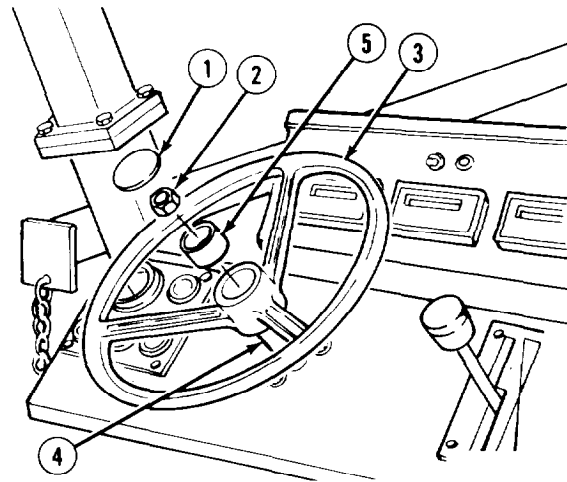
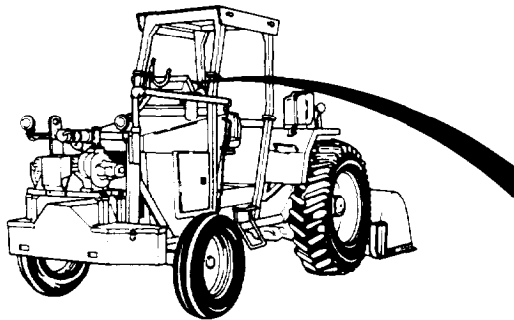
Tools

Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power

Equipment Condition

TM or Para
Para 2-13

Equipment Condition
Parking brake set

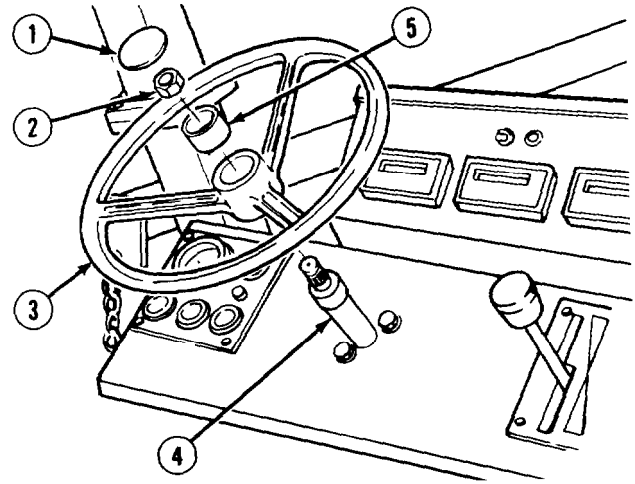


a. Removal.

- (1) Remove wheel cap (1) and nut (2) from steering wheel (3).
- (2) Remove steering wheel (3) from shaft (4) with steering wheel puller.
- (3) If damaged, remove hub insert (5) from steering wheel (3).

b. Installation.

- (1) If removed, install hub insert (5) in steering wheel (3).
- (2) Install steering wheel (3) on shaft (4).
- (3) Install nut (2) and wheel cap (1).

**END OF TASK**

4-118. STEERING CONTROL UNIT REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Shop equipment, automotive maintenance and repair: organizational maintenance supplemental no. 1, less power

Suitable container (capacity 1 qt. [0.9 liter])

Materials/Parts

- Tags, identification (item 55, appendix E)
- Lockwashers (2)
- Preformed packings (6)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 2-18

Para 4-128

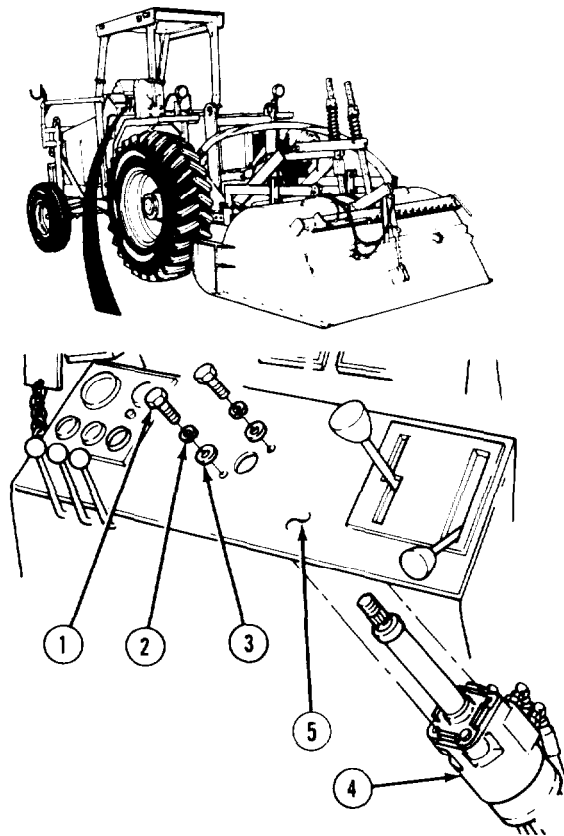
Para 4-117

Condition Description
Hydraulic tank valves closed.

Dash panel removed.
Steering wheel removed.

a. Removal.

- (1) Remove two screws (1), lockwashers (2), washers (3), and control unit assembly (4) from dash (5). Discard lockwashers.

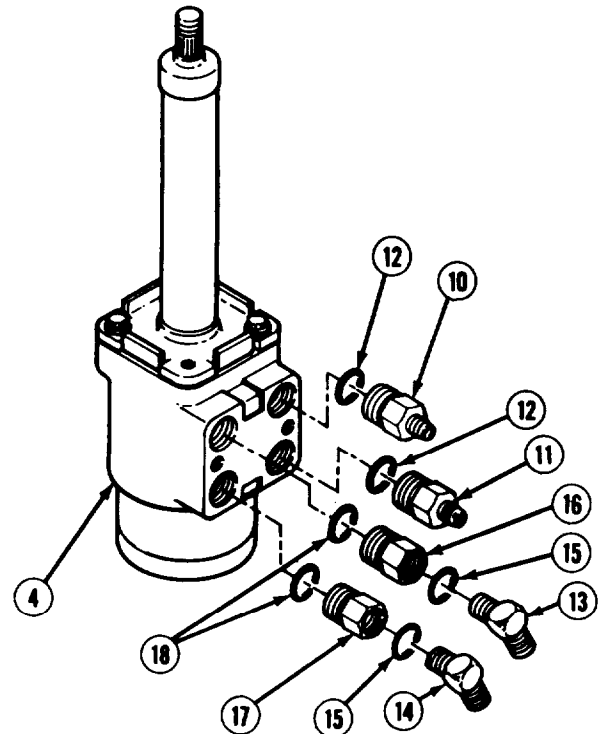
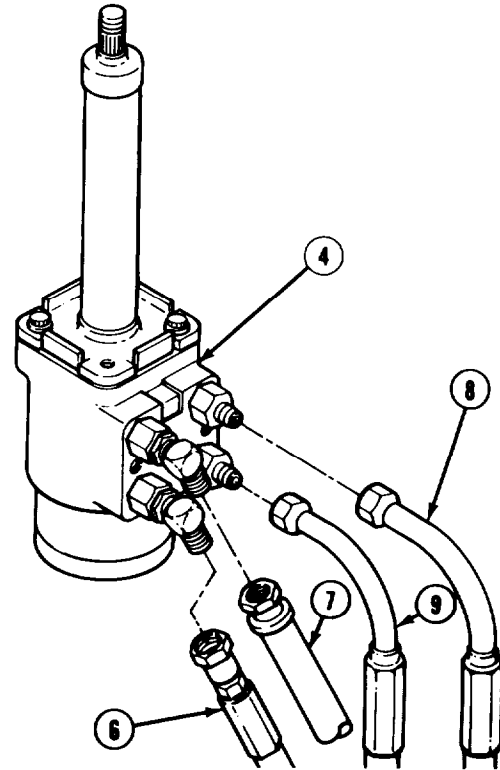


WARNING

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid with rags.

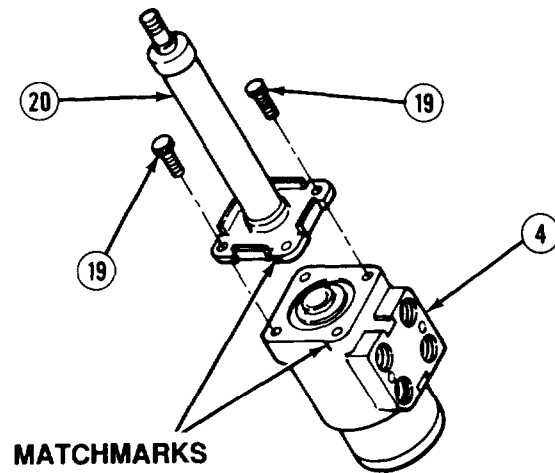
NOTE

- Tag and mark hydraulic hoses before disconnecting.
 - Place suitable container with a 1 qt. (0.9 liter) capacity under control unit to catch spilling fluid.
- (2) Tag, mark and disconnect two hydraulic hoses (6 and 7) from control unit assembly (4).
 - (3) Tag, mark and disconnect two hydraulic hoses (8 and 9).
 - (4) Remove two nipples (10 and 11) and preformed packings (12) from control unit assembly (4). Discard preformed packings.
 - (5) Remove two elbows (13 and 14), preformed packings (15), adapters (16 and 17), and preformed packings (18). Discard preformed packings.



4-118. STEERING CONTROL UNIT REPLACEMENT (CONT).

- (6) Tag, mark and remove two *screws* (19) and steering shaft (20) from control unit (4).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Wash metal parts in drycleaning solvent.

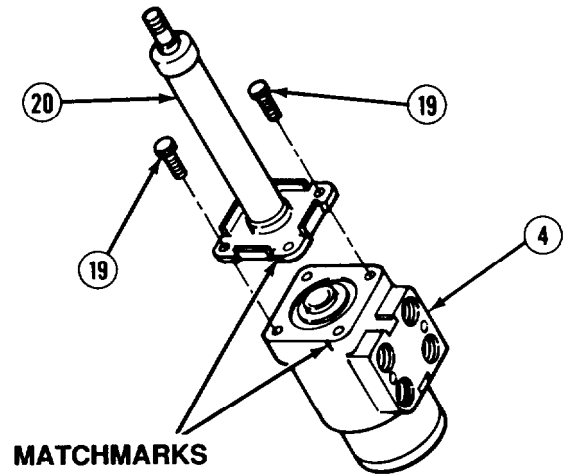
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

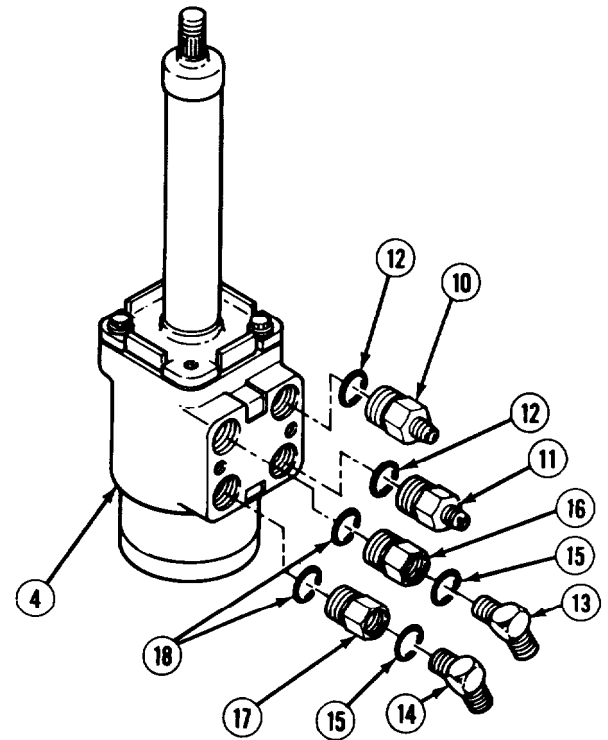
- (2) Dry with compressed air.
- (3) Check parts for damage.
- (4) Replace damaged parts.

c. *Installation.*

- (1) Install steering shaft (20) on control unit (4) with two screws (19).



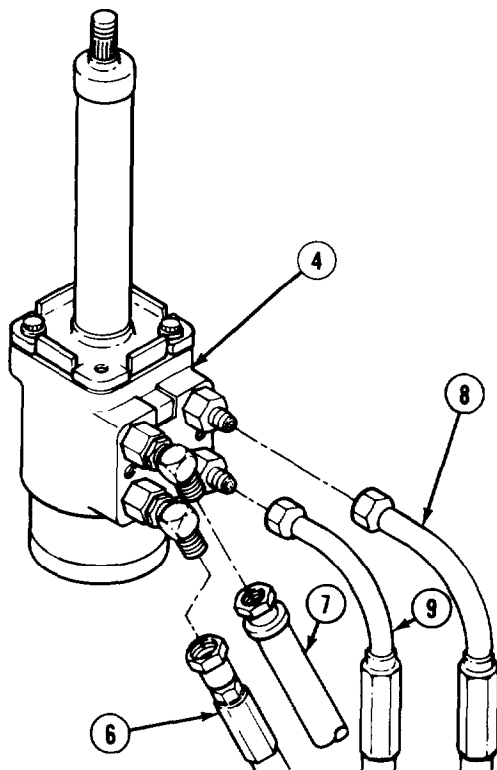
- (2) Install two preformed packings (18), adapters (17 and 16), preformed packings (15), and elbows (14 and 13) on control unit (4).
- (3) Install two preformed packings (12) and nipples (11 and 10) on control unit (4).



4-118. STEERING CONTROL UNIT REPLACEMENT (CONT).

Connect hydraulic hoses (9 and 8) on control unit (4).

Connect hydraulic hoses (7 and 6) on control unit (4).

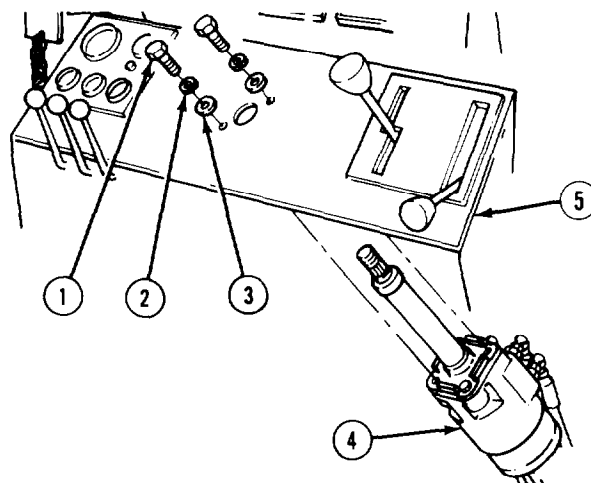


Install control unit assembly (4) in dash (5) with two washers (3), lockwashers (2) and screws (1).

NOTE

Follow-on Maintenance:

- Install steering wheel (para 4-117).
- Open hydraulic tank valves (para 2-18).
- Check connections for leaks,
- Install dash panel (para 4-128).



END OF TASK

4-119. EMERGENCY STEERING UNIT REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Suitable container (capacity 1 qt. to 9 liter)

Equipment Condition

TM or Para

Para 4-90

Condition Description

Negative battery cable disconnected.

Materials/Parts

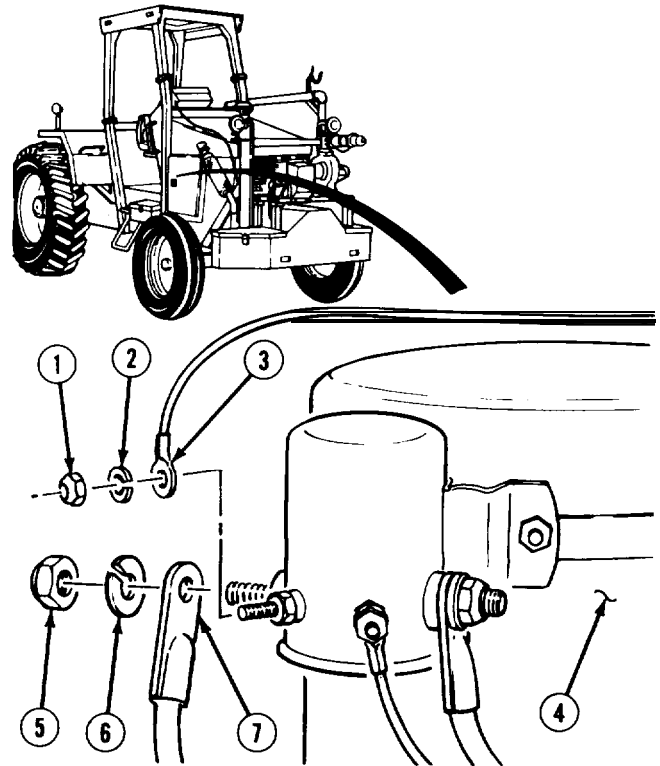
Tags, identification (item 55, appendix E)

Lo&washers (5)

*a. Removal.***NOTE**

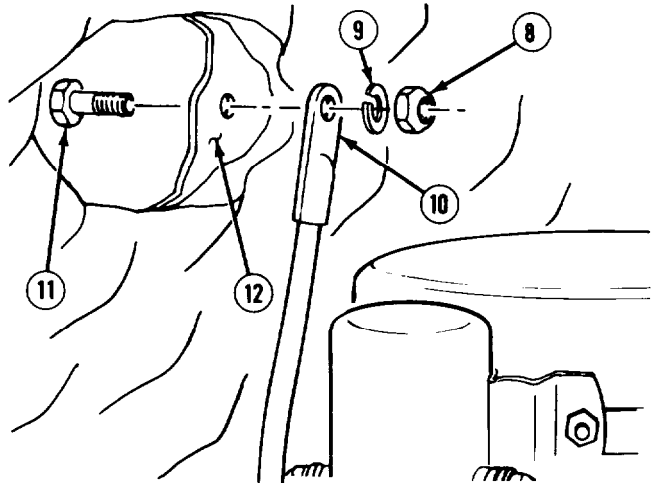
Tag and mark wires before removal.

- (1) Remove nut (1) and lockwasher (2). Tag, mark, and remove wire (3) from unit (4). Discard lockwasher.
- (2) Remove nut (5) and lockwasher (6). Tag, mark, and remove wire (7). Discard lockwasher.



4-119. EMERGENCY STEERING UNIT REPLACEMENT (CONT).

- (3) Remove nut (8), lockwasher (9), ground wire (10), and screw (11) from rear firewall (12). Discard lockwasher.

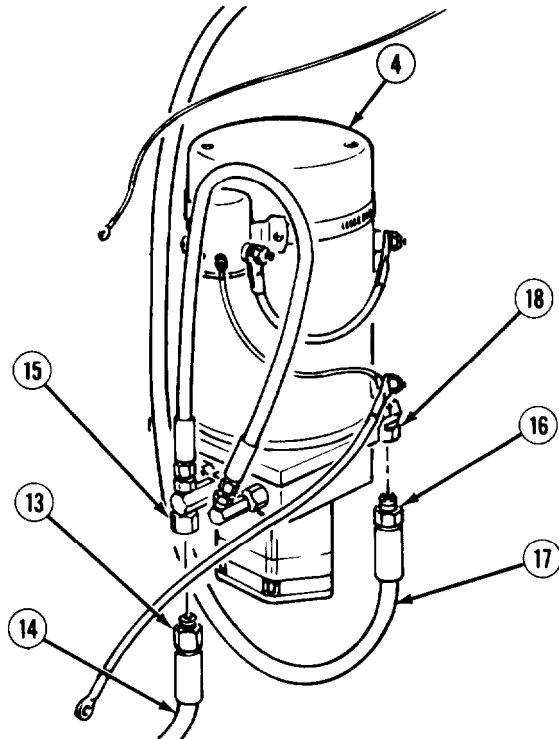


WARNING

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid with rags.

NOTE

- Tag and mark hoses before removal.
 - Place suitable container 1 qt. (0.9 liter) capacity under hoses to catch spilling fluid.
- (4) Loosen fitting (13). Tag, mark, and remove hose (14) from adapter (15) and unit (4).
- (5) Loosen fitting (16). Tag, mark, and remove hose (17) from adapter (18) and unit (4).



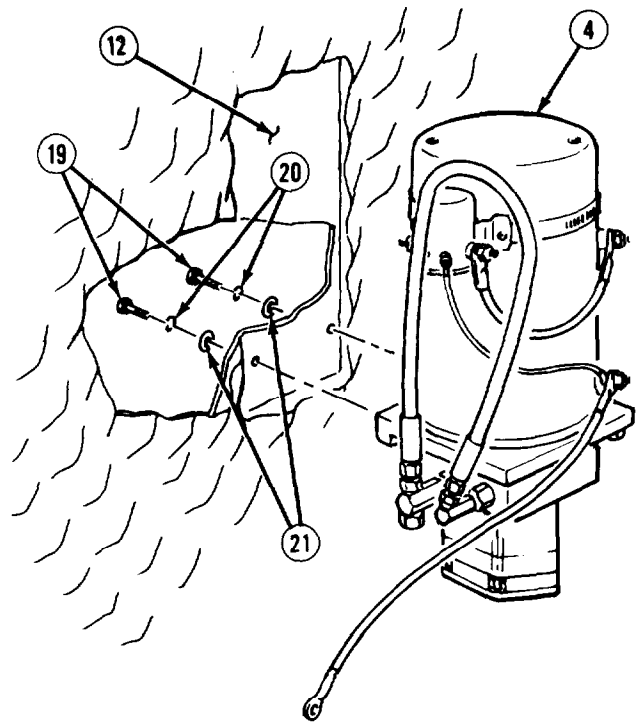
- (6) Remove two screws +(19), lockwashers (20), washers (21) and unit (4) from firewall (12). Discard lockwashers.

b. Cleaning/Inspection.

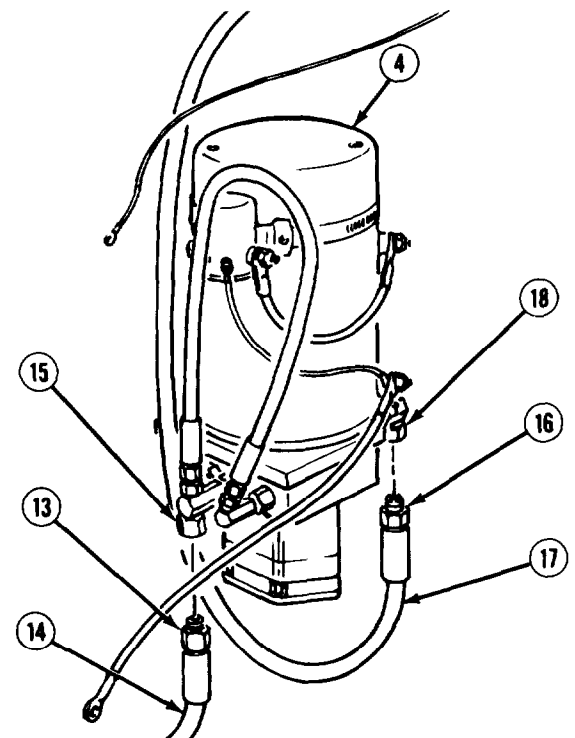
- (1) Check all wires for wear and tear.
- (2) Check unit for damaged parts.
- (3) Replace damaged parts.

c. Installation.

- (1) Position unit (4) on firewall (12).
- (2) Install two washers (21), lockwashers (20), and screws (19) on rear of firewall (12).

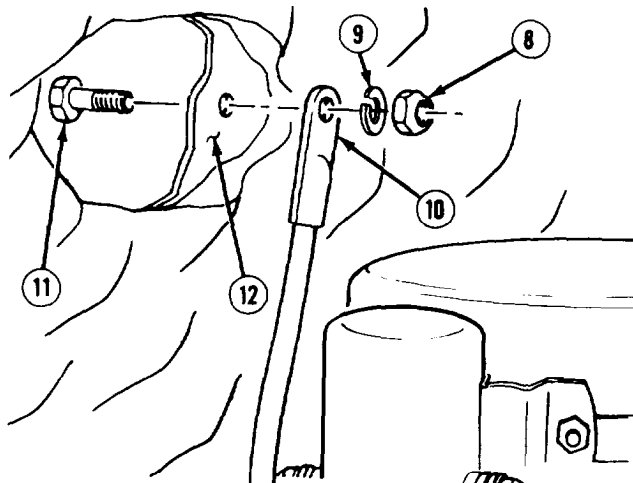


- (3) Install hose (17) on adapter (18) and unit (4). Tighten fitting (16).
- (4) Install hose (14) on adapter (15) and unit (4). Tighten fitting (13).



4-119. EMERGENCY STEERING UNIT REPLACEMENT (CONT).

- (5) Install screw (11), ground wire (10), lockwasher (9), and locknut (8) on front of firewall (12).

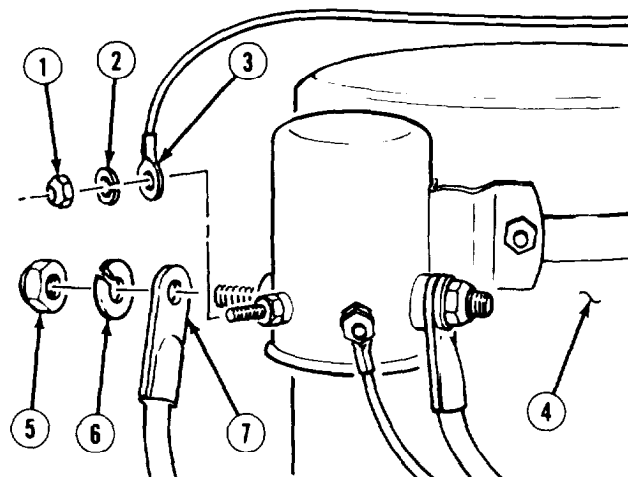


- (6) Install wire (7) on steering motor (4) with lockwasher (6) and nut (5).

- (7) Install wire (3) on steering motor (4) with lockwasher (2) and nut (1).

NOTE

Follow-on Maintenance: Connect negative battery cable (para 4-90).



END OF TASK

4-120. STEERING SYSTEM CHECK VALVE REPLACEMENT/REPAIR.

This task covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 2-14

Condition Description
Left/right engine doors opened.

Materials/Parts

Compound, sealing, pipe thread (item 17, appendix E)

Para 4-143

Steering hoses disconnected.

Fluid, hydraulic (item 23, appendix E)

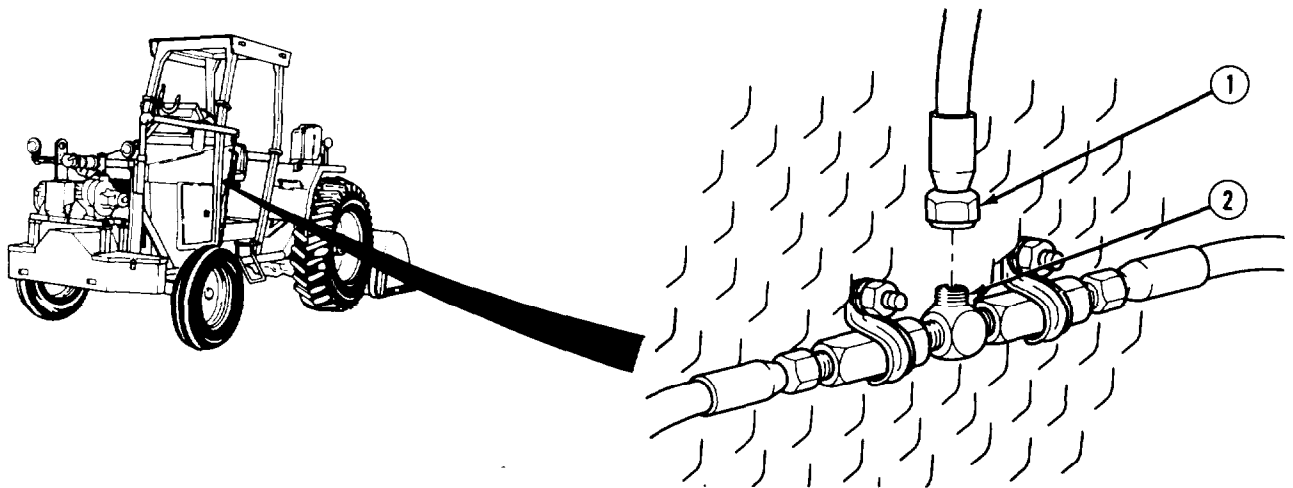
Para 4-128

Dash panel removed.

Tags, identification (item 55, appendix E)

Lockwashers (2)

a. Removal.



WARNING

Spilled hydraulic fluid is slippery. Clean spilled fluid immediately.

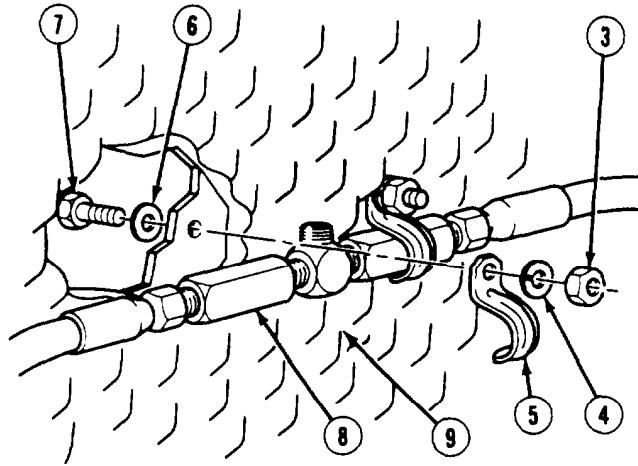
NOTE

- Place suitable container with a 1 qt. (0.9 liter) capacity under hose to catch spilling fluid.
- Tag and mark all hoses before disconnecting.

(1) Tag, mark, and remove hose (1) from tee (2).

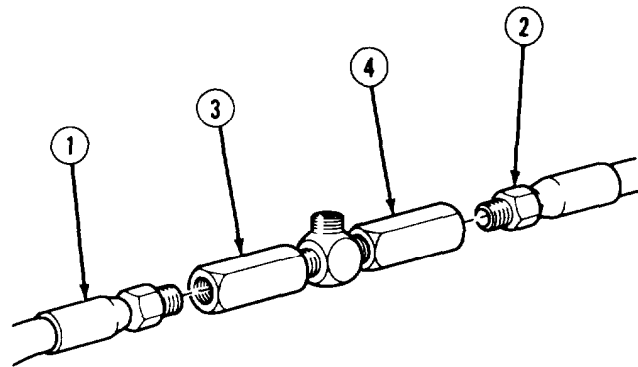
4-120. STEERING SYSTEM CHECK VALVE REPLACEMENT/REPAIR (CONT).

- (2) Remove two nuts (3), lockwashers (4), clamps (5), washers (6), screws (7) and check valve assembly (8) from firewall (9). Discard lockwashers.

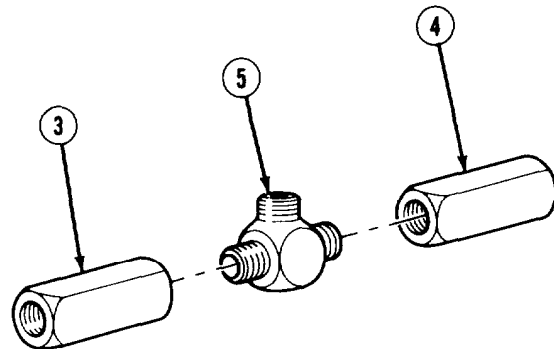


b. Disassembly.

- (1) Tag, mark and remove hoses (1 and 2) from check valves (3 and 4).



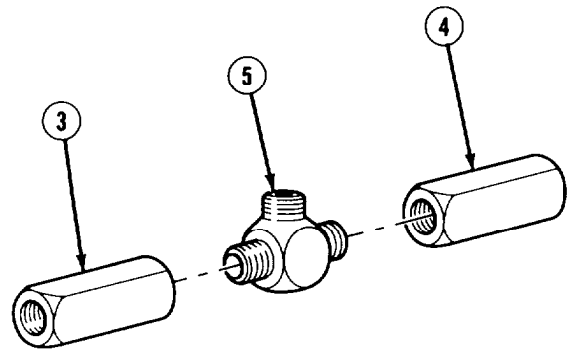
- (2) Remove check valves (3 and 4) from tee (5).



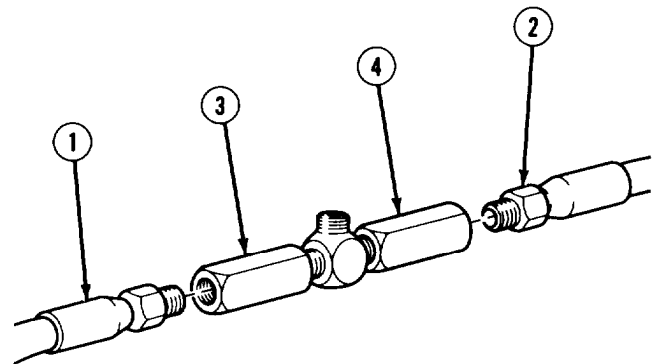
c. *Assembly.*

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

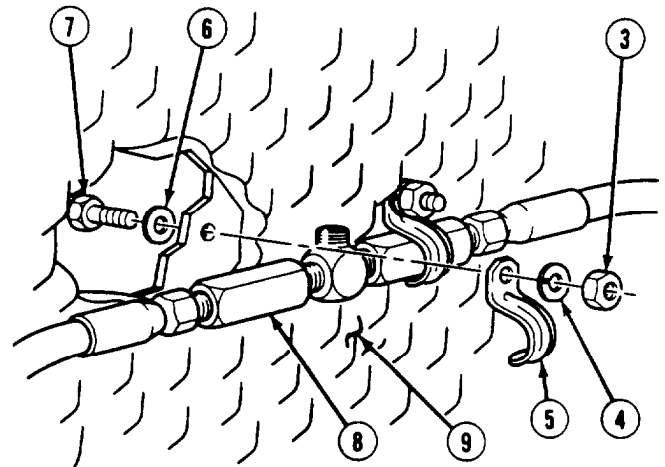


- (1) Coat threads of check valves (3 and 4) with pipe thread sealing compound and install on tee (5).
- (2) Coat thread of hoses (1 and 2) with pipe thread sealing compound and install on check valves (3 and 4).



d. *Installation.*

- (1) Install check valve assembly (8) on firewall (9) with two screws (7), washers (6), clamps (5), lockwashers (4), and nuts (3).



4-120. STEERING SYSTEM CHECK VALVE REPLACEMENT/REPAIR (CONT.).

WARNING

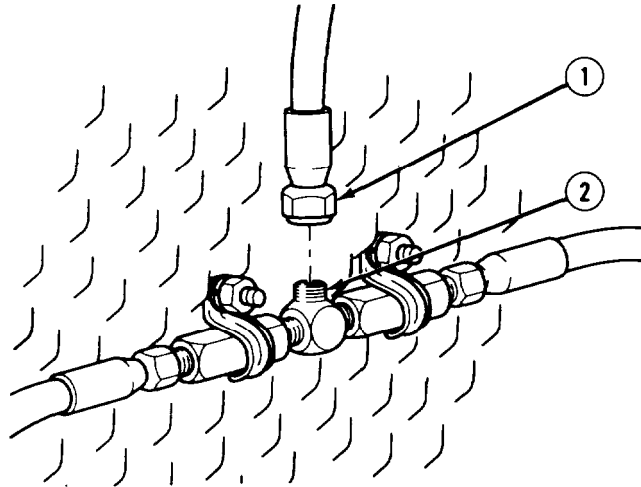
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Coat threads of hose (1) with pipe thread sealing compound and install on tee (2).

NOTE

Follow-on Maintenance:

- Install dash panel (para 4-128).
- Connect steering hoses (para 4-143).
- Check hydraulic fluid level and fill as needed (para 3-11).
- Close left/right engine doors (para 2-14).



END OF TASK

4-121. STEERING CYLINDER REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Lifting jack (10,000 lb [4536 kg] capacity)

Suitable container (capacity 1 gal. [3.8 liter])

Materials/Parts

Cloth, crocus (item 11, appendix E)

Fluid, hydraulic (item 23, appendix E)

Solvent, drycleaning (item 54, appendix E)

Materials/Parts

Tags, identification (item 55, appendix E)

Pins, cotter (2)

Equipment Condition

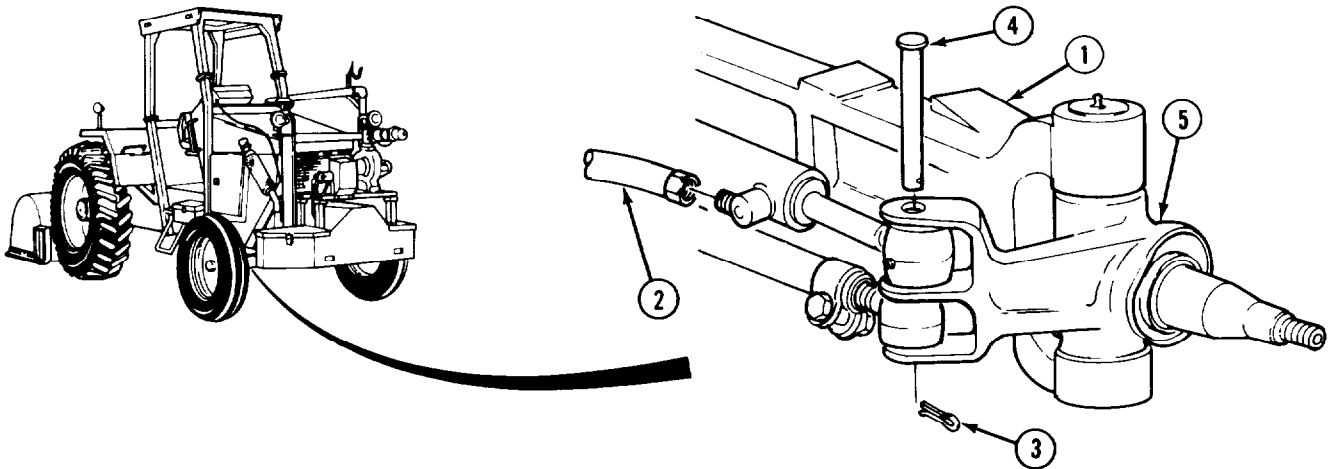
TM or para

Para 2-13

Condition Description

Wheels chocked.

Parking brake set.

a. Removal.**WARNING**

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid immediately with rags.

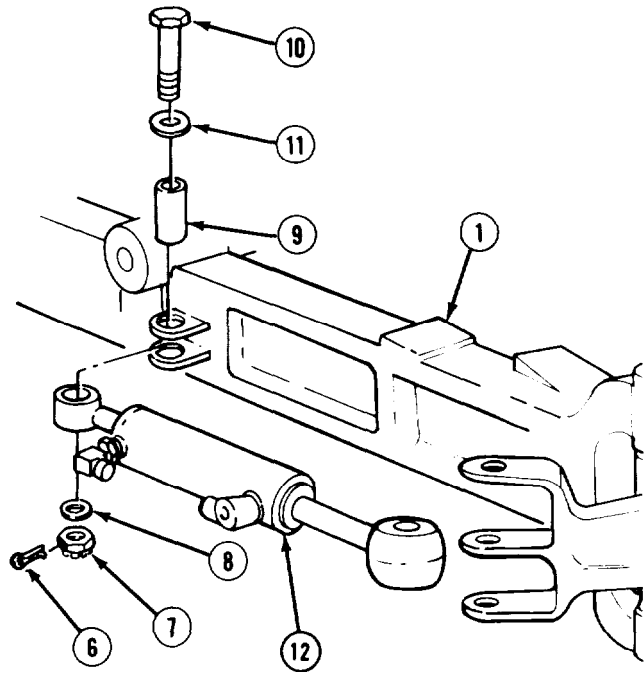
NOTE

- Use jackstands to support front of vehicle.
- Tag and mark hydraulic hoses before removal.
- Place suitable container with a 1 gallon (3.8 liters) capacity under power steering cylinder and hydraulic hoses to catch spilling hydraulic fluid.

- (1) Raise left end of front axle (1) with jack.
- (2) Tag, mark, and remove two hydraulic hoses (2).
- (3) Remove cotter pin (3) and pin (4) from right-hand knuckle (5). Discard cotter pin.

4-121. STEERING CYLINDER REPLACEMENT (CONT).

- (4) Remove cotter pin (6), nut (7), and washer (8). Discard cotter pin.
- (5) Remove sleeve (9), screw (10), and washer (11).
- (6) Remove cylinder (12) from axle (13).



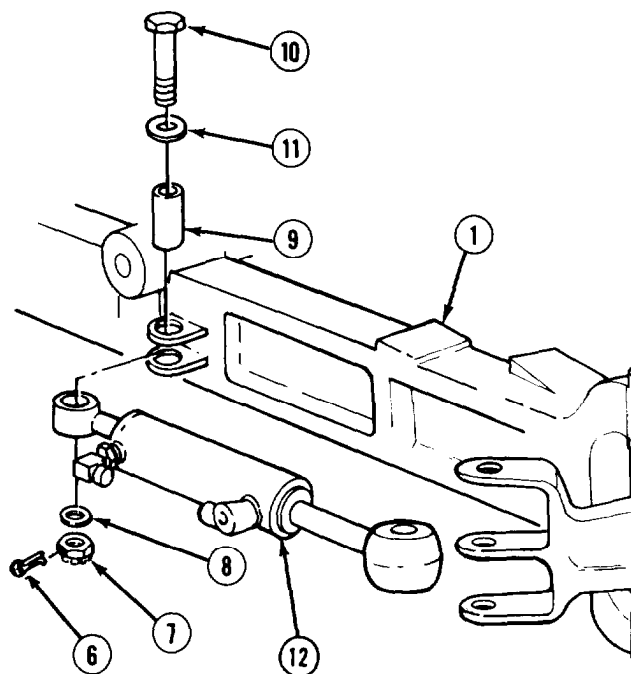
b. Cleaning/Inspection.

WARNING

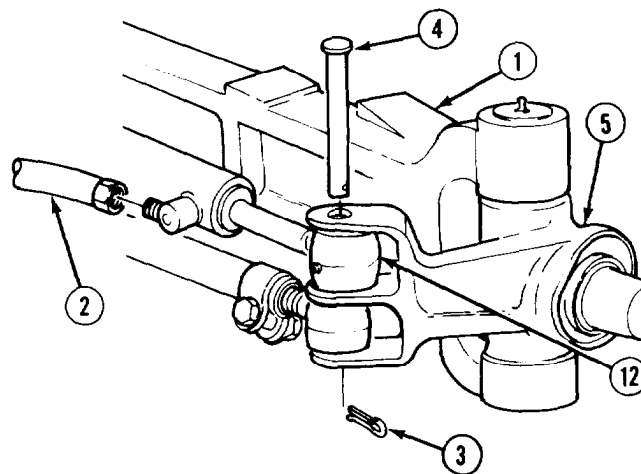
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38V) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.
 - (2) Check shaft for grooves on inside wall.
 - (3) Check rod guide and piston for nicks and gouges.
 - (4) Remove nicks and burrs with crocus cloth. Clean up rod threads with thread chasing tool if necessary.
 - (5) Replace piston rod if scored, pitted, bent, or damaged.
 - (6) Replace bushings if more than .005 inches (0.127 mm) out-of-round,

c. Installation.

- (1) Position cylinder (12) on axle (13).
- (2) Install washer (11), screw (10), and sleeve (9).
- (3) Install washer (8), nut (7), and cotter pin (6).



- (4) Install steering cylinder (12), pin (4), and cotter pin (3) on right-hand knuckle (5).
- (5) Connect two hydraulic hoses (2).
- (6) Lower left end of front axle (1) and remove jack.



NOTE

Follow-on Maintenance:

- 1 Check hydraulic fluid level and add as needed (para 3-11).
- 1 Check for leaks.

END OF TASK

4-122. BUMPER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Lifting device (607 lb [275 kg] capacity)

Materials/Parts

- Lockwashers (2)

Personnel Required

- MOS62B, Construction equipment repairer (2)

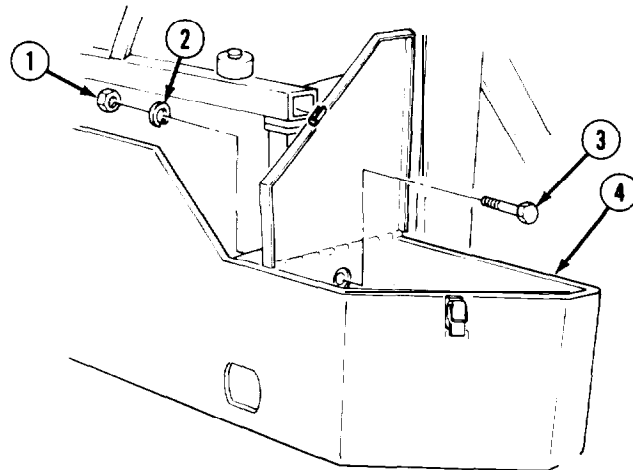
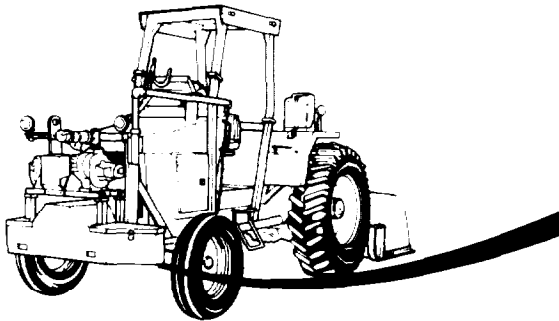
Equipment Condition

TM or Para
Para 4-97

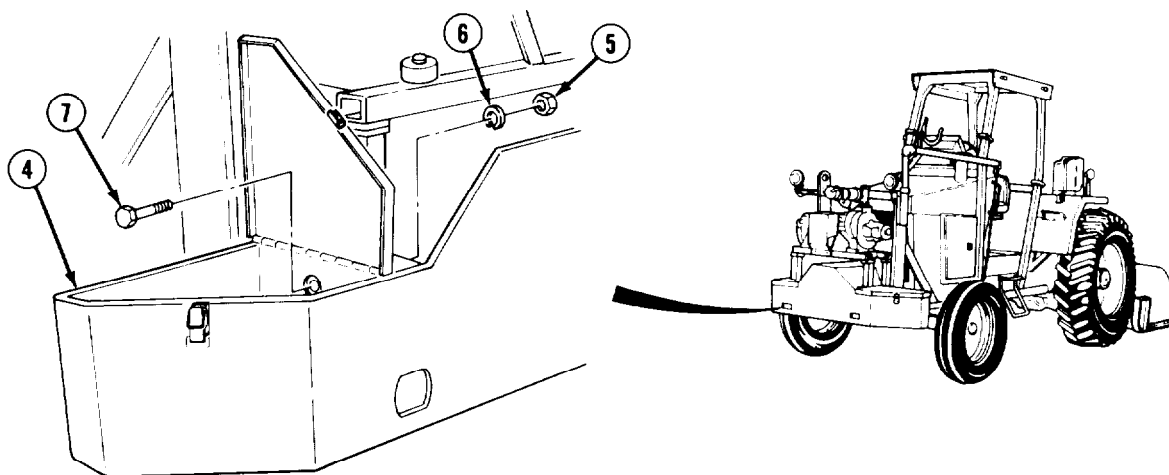
Para 2-13

Condition Description
Hydrostatic pump cover removed.
Parking brake set.

a. Removal.



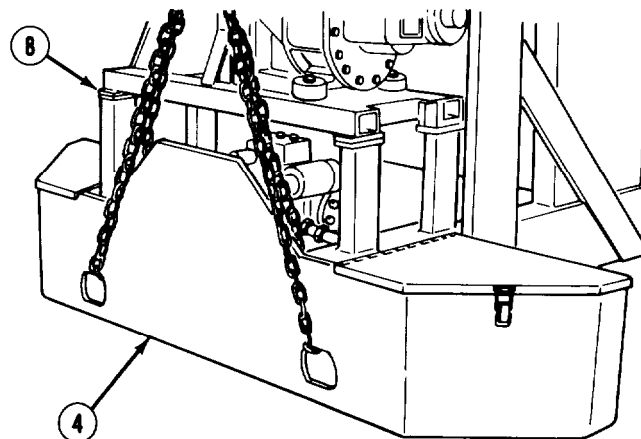
(1) Remove nut (1), lockwasher (2), and screw (3) from left side of bumper (4). Discard lo&washer.



- (2) Remove nut (5), lockwasher (6), and screw (7) from right side of bumper (4).

WARNING

- Bumper weighs 607 lbs (275 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.
 - All personnel must stand clear during lifting operations. A swinging or shifting load may cause injury or death to personnel.
- (3) The mechanic operates suitable lifting device while assistant closes tool box lids and guides bumper (4) away from frame (8).

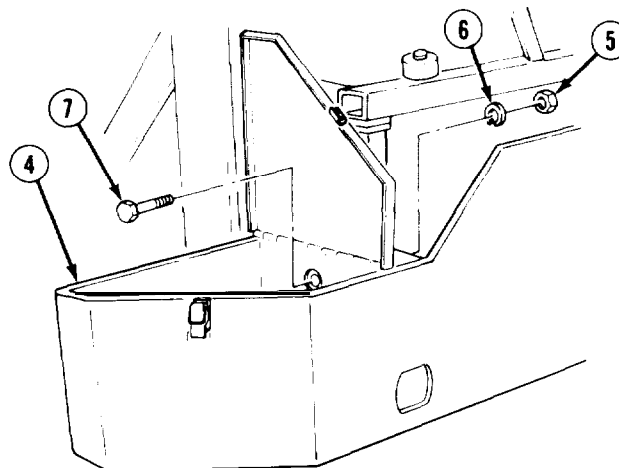


b. Installation.

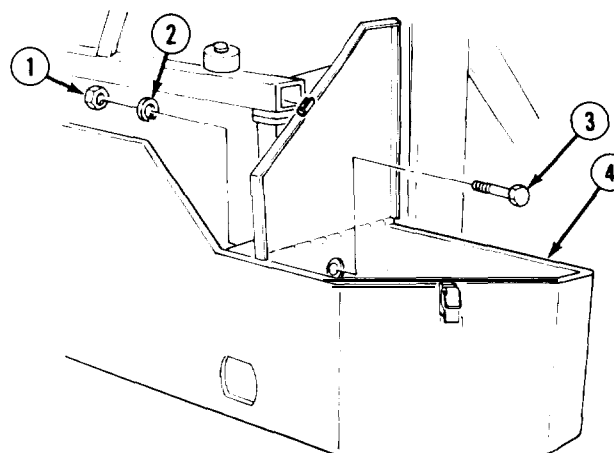
- (1) The mechanic operates suitable lifting device while assistant guides bumper (4) onto frame (8) and opens tool box lids.

4- 122. BUMPER REPLACEMENT (CONT).

- (2) Install right side of bumper (4) with screw (7), lockwasher (6), and nut (5).



- (3) Install left side of bumper (4) with screw (3), lockwasher (2), and nut (1).



NOTE

Follow-on Maintenance: Install hydrostatic pump cover (para 4-97).

END OF TASK

4-123. TOOL BOX LID REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-122

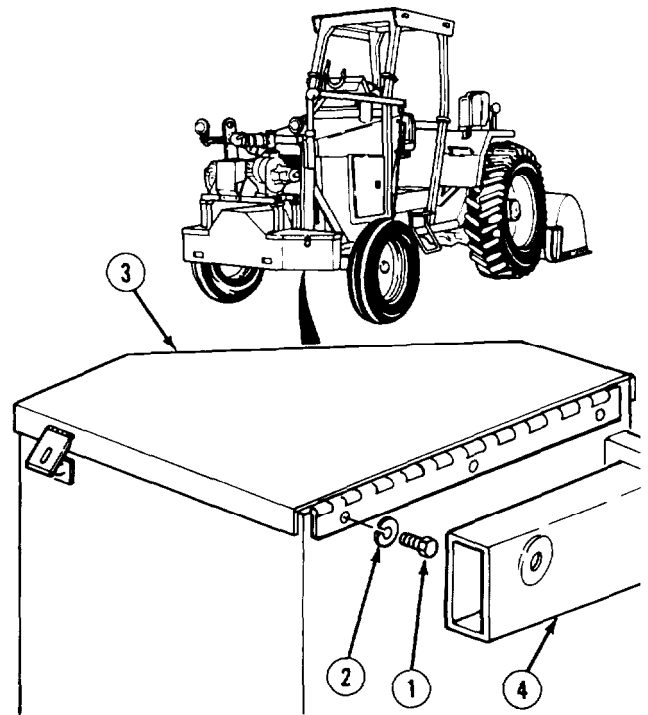
Condition Description
Bumper removed.

Materials/Parts

Lockwashers (6)

a. Removal.

- (1) Remove three screws (1), lockwashers (2), and left-hand tool box lid (3) from bumper (4). Discard lockwashers.

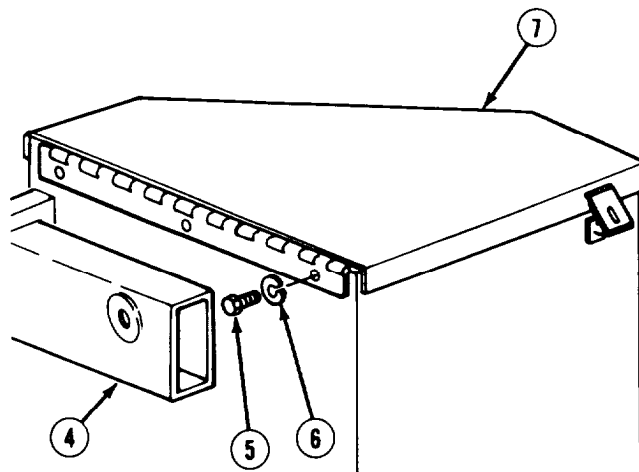


4-123. TOOL BOX LID REPLACEMENT (CONT).

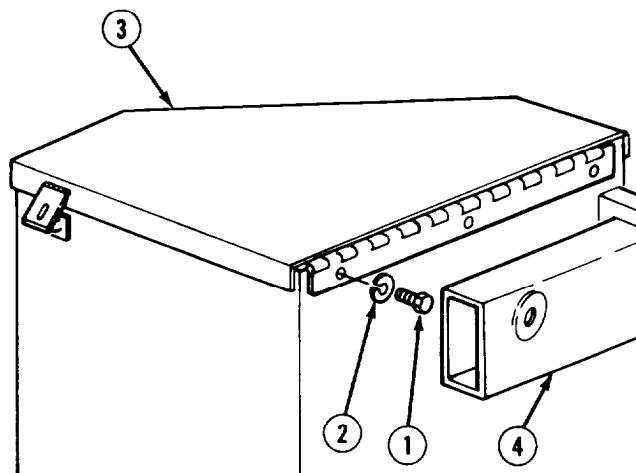
- (2) Remove three screws (5), lockwashers (6), and right-hand tool box lid (7) from bumper (4). Discard lo&washers.

b. Installation.

- (1) Install right-hand tool box lid (7) on bumper (4) with three lockwashers (6) and screws (5).



- (2) Install left-hand tool box lid (3) on bumper (4) with three lo&washers (2) and screws (1).



NOTE

Follow-on Maintenance: Install bumper (para 4-122).

END OF TASK

4-124. ROLLOVER PROTECTIVE STRUCTURE (ROPS) REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting device (400 lbs [180 kg] capacity)

Materials/Parts

Lockwashers (12)

Personnel Required

MOS62B, Construction equipment repairer (2)

a. *Removal.*

WARNING

- Keep clear of equipment when equipment is being raised or lowered. Equipment may fall and cause serious injury.
- Do not allow heavy items to swing while hanging by lifting device. Equipment may strike personnel and cause injury.
- Exercise extreme caution when working near cable or chain under tension. A snapped cable, shifting or swinging load may result in injury or death to personnel.

CAUTION

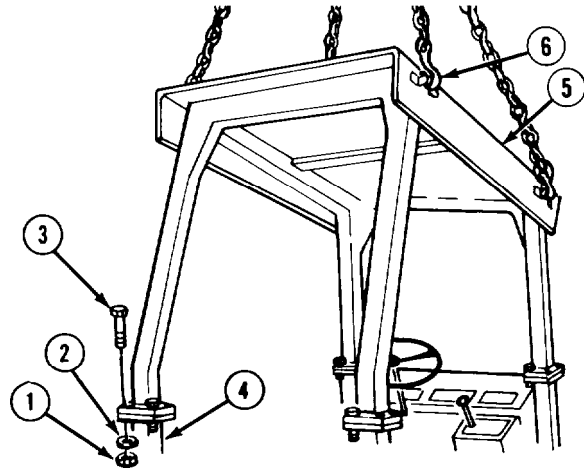
Hook rollover protective structure to suitable lifting device before any removal begins. Rollover protective device can slip and cause damage to equipment if not properly supported.

NOTE

- Leave one screw inserted at each corner of the rollover protective structure to prevent slippage or swinging.
- Steps are recommended for removal of ROPS to prevent damage to paint.

4-124. ROLLOVER PROTECTIVE STRUCTURE (ROPS) REPLACEMENT (CONT).

- (1) Remove 12 nuts (1), lockwashers (2), and screws (3) from rollover protection structure (ROPS) supports (4). Discard lockwashers.



WARNING

- ROPS weighs 395 lbs (179 kg). Attach suitable lifting device prior to removal or installation to prevent possible injury to personnel.
 - Do not allow heavy components to swing while hanging by lifting device. Equipment may strike personnel and cause injury.
- (2) Using suitable lifting device attached to four lifting points (6), remove ROPS (5) from supports (4).
 - (3) Remove remaining four screws (3) from ROPS (5).

b. Installation.

- (1) Connect suitable lifting device to four lifting points (6) on ROPS (5).
- (2) Install four screws (3) on ROPS (5); one in each corner.
- (3) Install ROPS (5) on ROPS supports (4). Align the four screws in the supports.
- (4) Install remaining 12 screws (3), lockwashers (2), and nuts (1) in ROPS (5). Tighten nuts.
- (5) Disconnect suitable lifting device.

END OF TASK

Q-125. HOOD REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools
Tool kit, general mechanic's: automotive

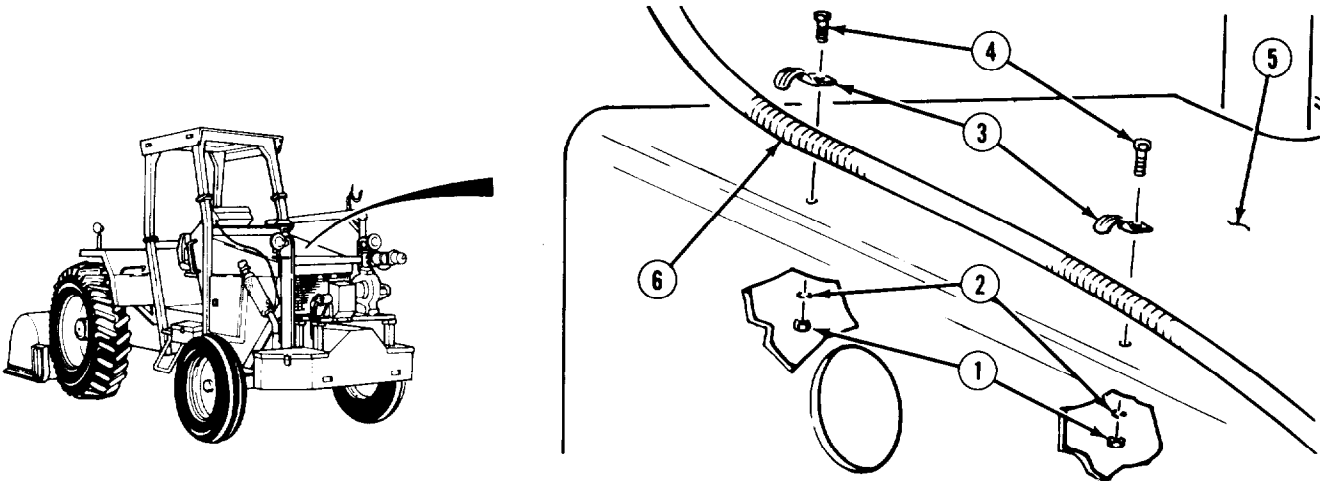
Equipment Condition
TM or Para
Para 4-59

Condition Description
Muffler and exhaust
pipes removed.

Materials/Parts
Lockwashers (6)

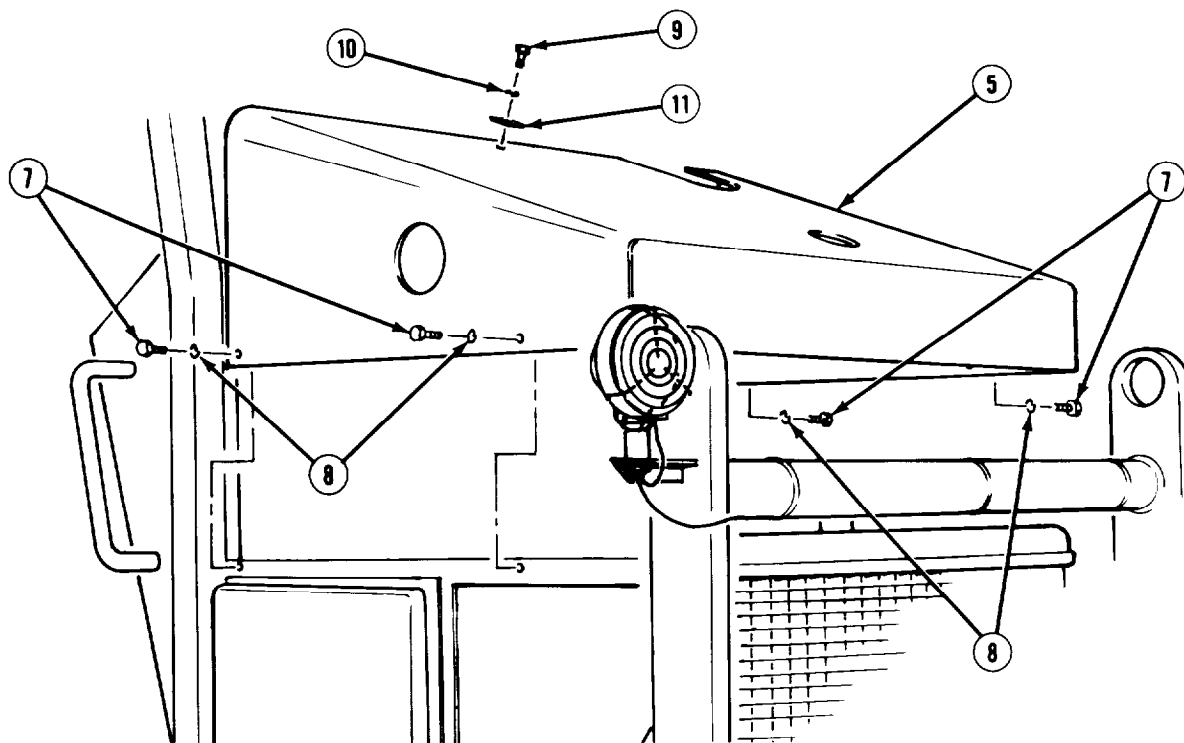
Personnel Required
MOS62B, Construction equipment repairer (2)

a. Removal.



- (1) Remove two nuts (1), lockwashers (2), clamps (3), and screws (4) from hood (5) and move wiring conduit (6) out of way. Discard lo&washers.

4-125. HOOD REPLACEMENT (CONT).

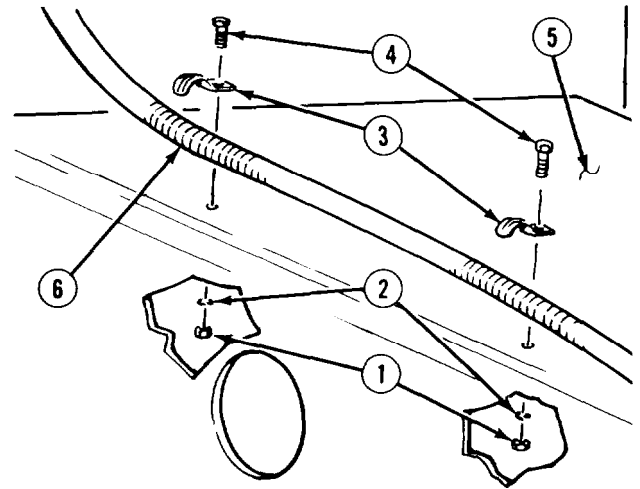


- (2) Remove four screws (7) and lockwashers (8) from hood (5). Discard lockwashers.
- (3) Loosen screw (9), washer (10), and turn retainer (11) to release hood (5).
- (4) Mechanic and assistant lift and remove hood (5) from vehicle.

b. Installation.

- (1) Mechanic and assistant position hood (5) on vehicle.
- (2) Install hood (5) with four screws (7) and lockwashers (8).
- (3) Install retainer (11) with washer (10) and screw (9).

- (4) Install wiring conduit (6) on hood (5) with two screws (4), clamps (3), lockwashers (2), and nuts (1).



NOTE

Follow-on Maintenance: Install muffler and exhaust pipes (para 4-58).

END OF TASK

4-126. ENGINE COMPARTMENT DOOR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

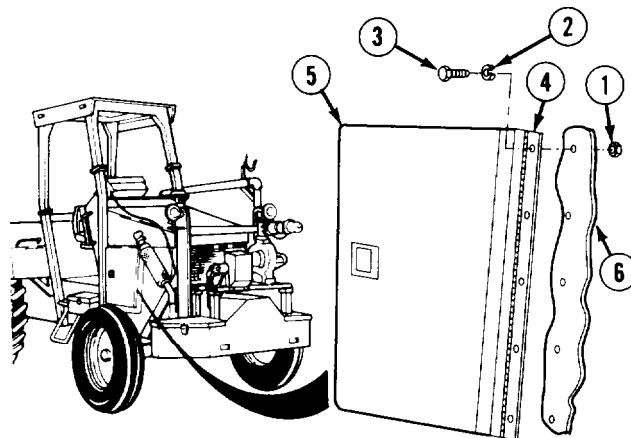
Lockwashers (10)

a. Removal.

NOTE

Both engine compartment doors are removed and install the same way. Right door shown.

- (1) Remove five nuts (1), lockwashers (2) and screws (3). Discard lo&washers.
- (2) Remove engine compartment doors (4) with hinges (5) from engine compartment wall (6).
- (3) Repeat steps (1) and (2) for other door.



b. Installation.

- (1) Align and install engine compartment door (4) with hinges (5) on engine compartment wall (6).
- (2) Install five screws (3) lockwashers (2) and nuts (1).
- (3) Repeat steps (1) and (2) for other door.
- (4) Check that doors open and close without binding or misalignment.

END OF TASK

4-127. FIREWALL REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive.
Lifting device (190 lb [86 kg] capacity)

Equipment Condition

TM or Para
Para 4-143

Condition Description
Hydraulic hoses (on firewall) removed.

Materials/Part.s

Locknuts (4)

Para 4- 118

Para 4-155

Steering unit removed.
Additive instrument panel removed.

Personnel Required

MOS62B, Construction equipment repairer (2)

Para 4-139

Valve bank assembly removed.

Equipment Condition

TM or Para

Para 4-42

Condition Description

Air cleaner assembly removed.

Para 4-79

Para 4-124

Ignition switch removed.
Rollover protection structure removed.

Para 4-55

Throttle/pump controls removed.

Para 4-119

Para 4-129

Emergency steering unit removed.

Para 4-73

Instrument panel removed.

Para 4-78

Door striker removed.
Firewall instrument removed.

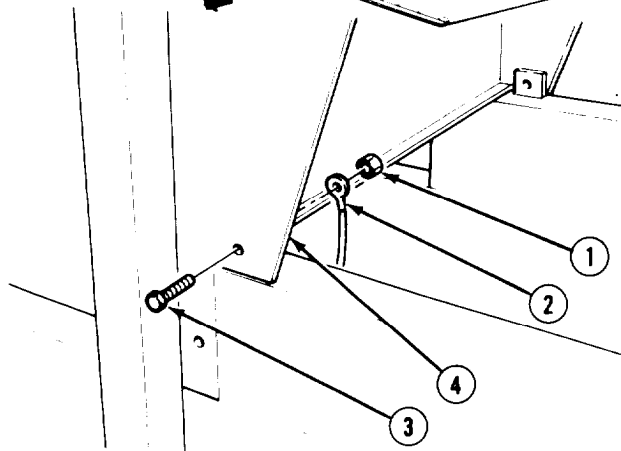
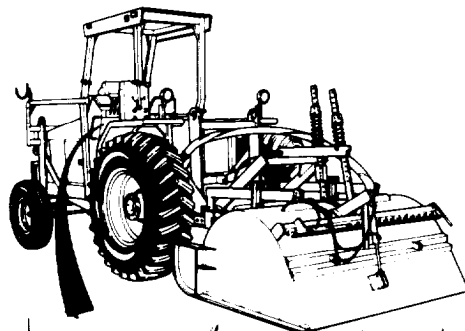
4-127. FIREWALL REPLACEMENT (CONT).

a. Removal.

WARNING

Firewall weighs 190 lbs (86 kg), attach a suitable lifting device prior to removal or installation to prevent possible injury or death to personnel.

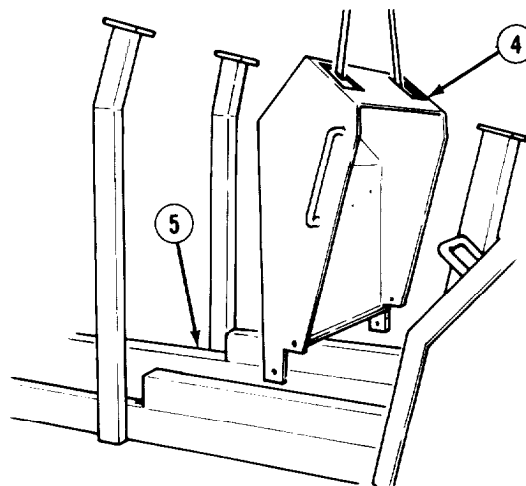
- (1) Remove four locknuts (1), ground wire (2) and screws (3) from firewall (4). Discard locknuts



NOTE

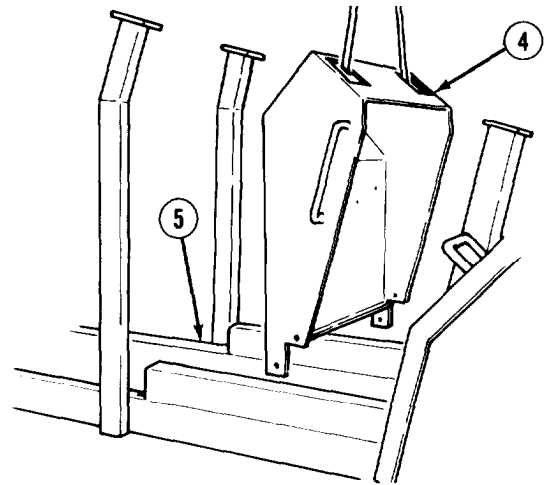
Make sure all hydraulic hoses and electrical wires are removed or set aside before removing firewall.

- (2) While the mechanic operates lifting device, the assistant guides and removes firewall (4) from frame (5).

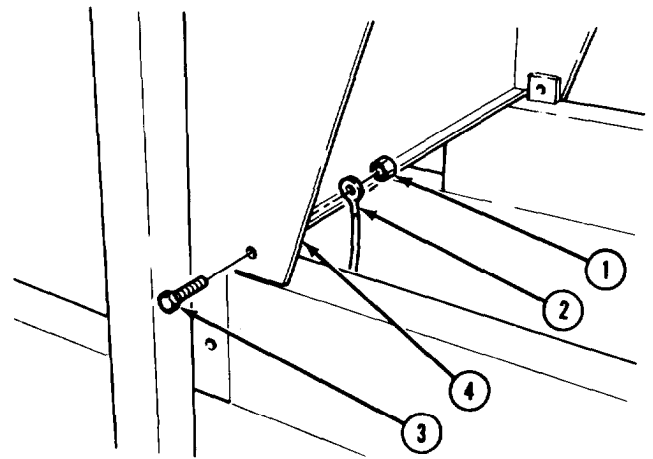


b. Installation.

- (1) While the mechanic operates lifting device, the assistant guides and installs firewall (4) on frame (5).



- (2) Install four screws (3), ground wire (2) and locknuts (1) to firewall (4).

**NOTE**

Follow-on Maintenance:

- Install throttle and pump control levers (para 4-55).
- Install door strikers (para 4-129).
- Install emergency steering unit (para 4-119).
- Install rollover protection structure (para 4-124).
- Install ignition switch (para 4-79).
- Install valve bank assembly (para 4-139).
- Install additive instrument panel (para 4-155).
- Install steering unit (para 4-118).
- Install hydraulic hoses (on firewall) (para 4-143).
- Install instrument panel (para 4-73).
- Install air cleaner assembly (para 4-42).
- Install firewall instruments (para 4-78).

END OF TASK

4-128. DASH PANEL REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

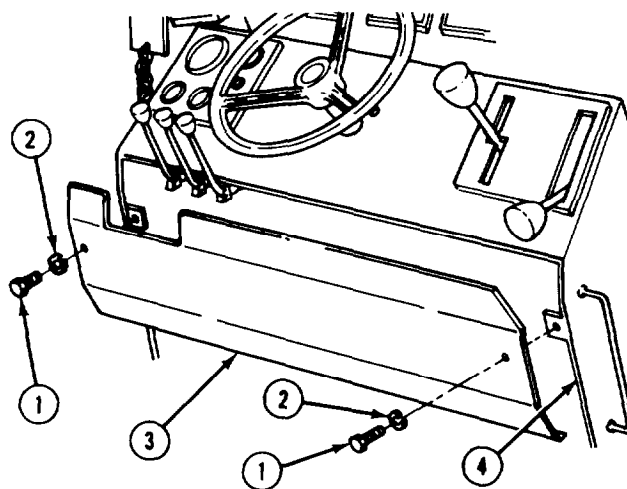
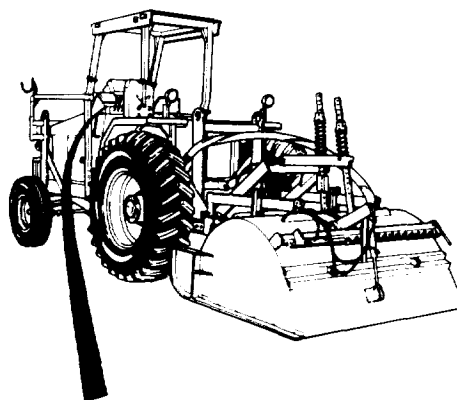
Materials/Parts

Lockwashers (2)

- a. **Removal.** Remove two screws (1) lo&washers (2) and dash panel (3) from dash (4).

b. Installation.

- (1) Position dash panel (3) on dash (4).
- (2) Install dash panel (3) with two lo&washers (2) and screws (1).



END OF TASK

4-129. ENGINE DOOR STRIKER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Lockwashers (4)

Equipment Condition

TM or Para
Para 2-14

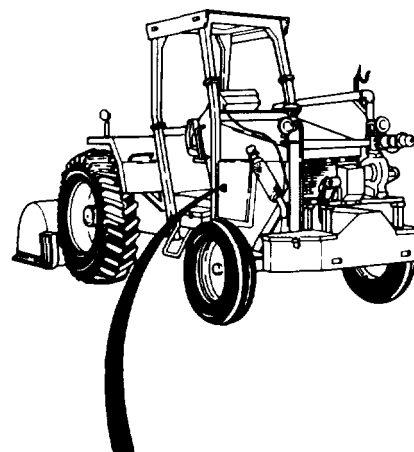
Condition Description
Left/right engine doors
opened.

a. Removal.

NOTE

Both engine door strikes are removed the same way. Right side shown.

- (1) Remove two screws (1) and lockwashers (2) from engine door striker (3). Discard lo&washers.
- (2) Remove engine door striker (3) from frame (4).
- (3) Repeat steps (1) and (2) for other striker.

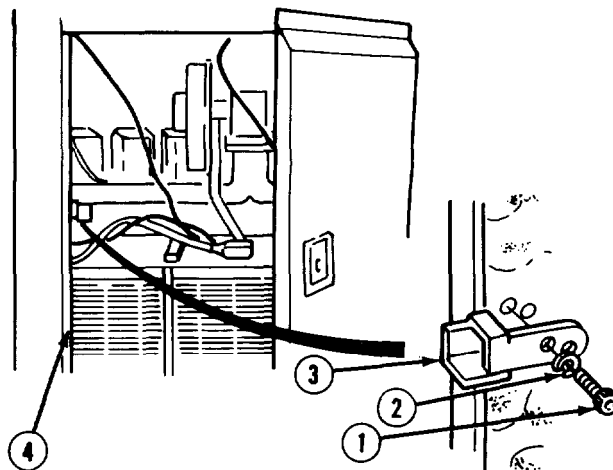


b. Installation.

- (1) Position engine door striker (3) on frame (4) and install two lockwashers (2) and screws (1).
- (2) Repeat step (1) for other striker.

NOTE

Follow-on Maintenance: Close left/right engine doors (para 2-14).



END OF TASK

4-130. ADDITIVE ACCESS COVER REPLACEMENT.

This task covers:

- a. Removal
- b. Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

References

TM 43-1039 Painting Instructions for Field Use

Materials/Parts

Lockwasher

a. Removal.

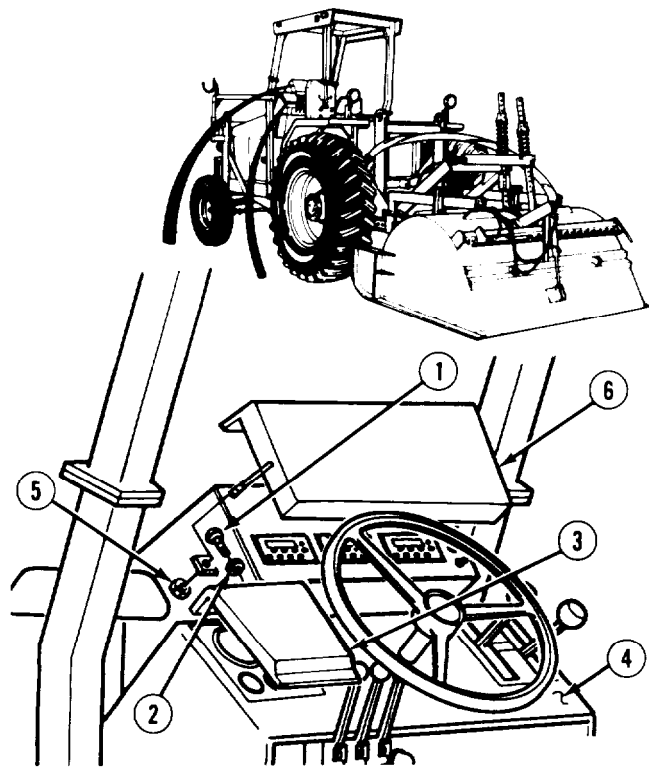
- (1) Remove screw (1) lockwasher (2), and cover (3) from instrument panel (4). Discard lo&washer.
- (2) Remove two nuts (5) and cover (6) from additive instrument panel (7).

b. Inspection.

- (1) Check covers (3 and 6) for scratched areas where paint is damaged and bare metal is exposed.
- (2) Repaint damaged areas as necessary according to TM 43-1039, Painting Instructions for Field Use.

c. Installation.

- (1) Install cover (6) on instrument panel (4) with two nuts (5).
- (2) Install cover (3) with lockwasher (2) and screw (1).



END OF TASK

4-131. REAR FENDER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Lockwashers (8)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para
Para 4-50

Condition Description

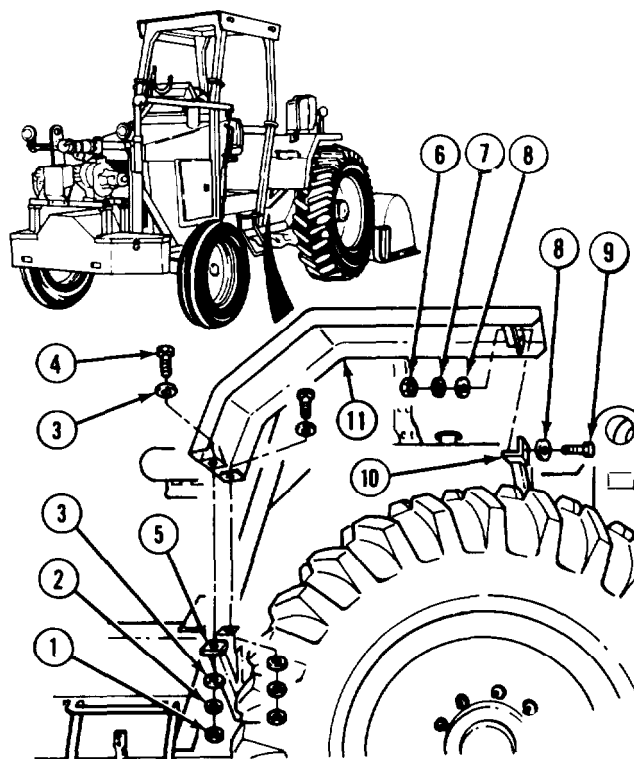
Fuel can assembly,
ratchet, and holder
removed.
Rear floodlights removed

a. Removal.

NOTE

Both rear fenders are removed the same way. Left side shown.

- (1) Remove two nuts (1) lockwashers (2) four washers (3) and two screws (4) from front fender bracket (5). Discard lockwashers.
- (2) Remove two nuts (6), lockwashers (7), four washers (8) and screws (9). Discard lockwashers.
- (3) Remove fender (11) from brackets (5 and 10).
- (4) Repeat steps (1) through (3) for other fender.



b. Installation.

- (1) Position fender (11) on front and rear brackets (5 and 10).
- (2) Install four screws (4 and 9), eight washers (3 and 8), four lockwashers (2 and 7) and nuts (1 and 6).
- (3) Repeat steps (1) and (2) for other fender.

NOTE

Follow-on Maintenance:

- Install floodlights (para 4-81).
- Install fuel can assembly, ratchet, and holder (para 4-50).

END OF TASK

4-132. FORWARD FLOOR PLATE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

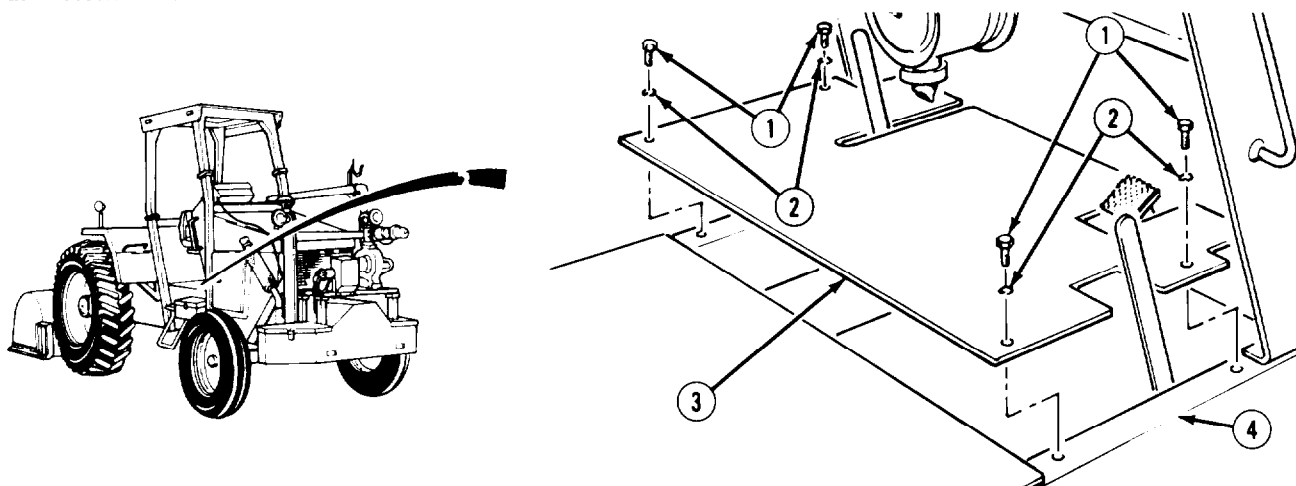
Personnel Required

MOS62B, Construction equipment repairer (2)

Materials/Parts

Lockwashers (4)

a. Removal.



- (1) Remove four screws (1) and lo&washers (2) from front floor panel (3). Discard lockwashers.
- (2) Mechanic and assistant remove front floor panel (3) from frame (4).

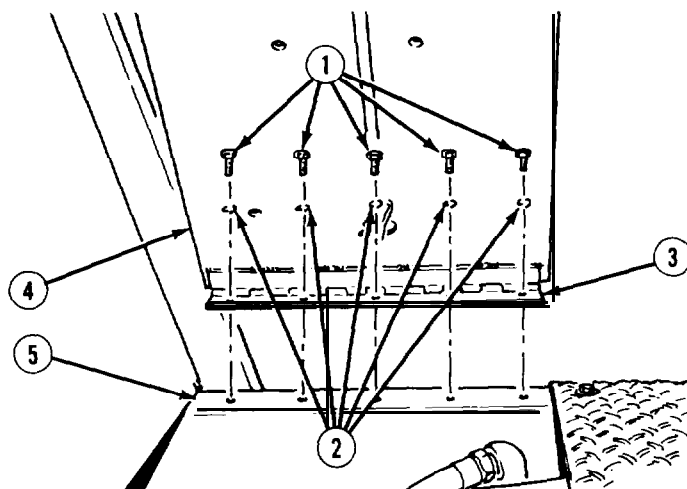
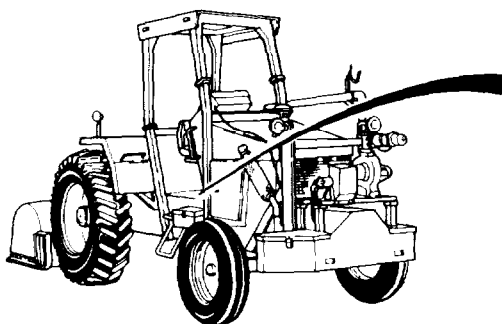
b. Installation.

- (1) Mechanic and assistant position front floor panel (3) on frame (4).
- (2) Install four lo&washers (2) and screws (1).

END OF TASK

4-133. AFT FLOOR DECK REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Personnel Required</i>	
Tool kit, general mechanic's: automotive	MOS62B, Construction equipment repairer (2)	
<i>Materials/Parts</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Lockwashers (5)	TM or Para Para 4-135	Operator's seat removed.

a. Removal.



- (1) Remove five screws (1) and lockwashers (2) from rear floor panel hinge (3). Discard lo&washers.
- (2) Mechanic and assistant remove rear floor panel (4) from frame (5).

b. Installation.

- (1) Mechanic and assistant position rear floor panel (4) on frame (5).
- (2) Install five lockwashers (2) and screws (1).

NOTE

Follow-on Maintenance: Install operator's seat (para 4-135).

END OF TASK

4-134. AFT FLOOR DECK PROP ROD REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-133

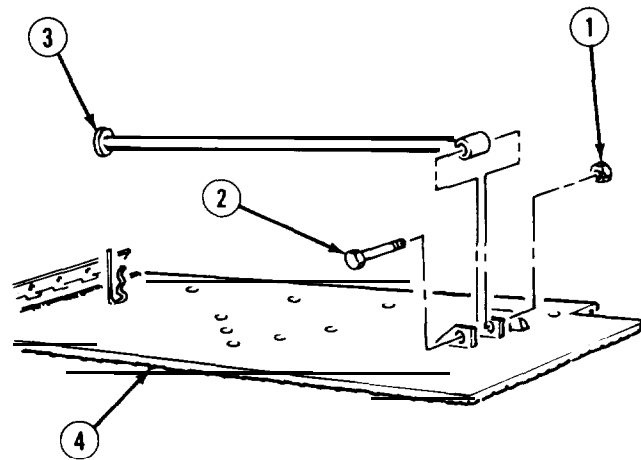
Condition Description

Aft floor deck removed.

Materials/Parts

Locknut

- a. **Removal.** Remove locknut (1), screw (2), and rear floor panel support bar (3) from rear floor panel (4). Discard locknut.
- b. **Installation.** Install rear floor panel support bar (3) on rear floor panel (4) with screw (2) and locknut (1).



NOTE

Follow-on Maintenance: Install rear floor panel (para 4-133).

END OF TASK

4-135. OPERATORS SEAT REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 3-130

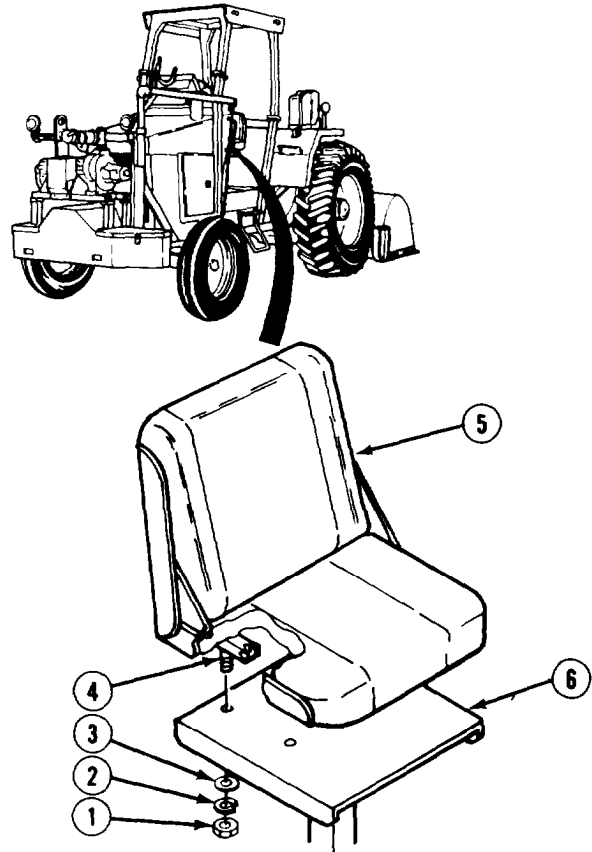
Condition Description
Aft floor deck removed.

Materials/Parts

Lockwashers (8)
Solvent, drycleaning (item 54, appendix E)

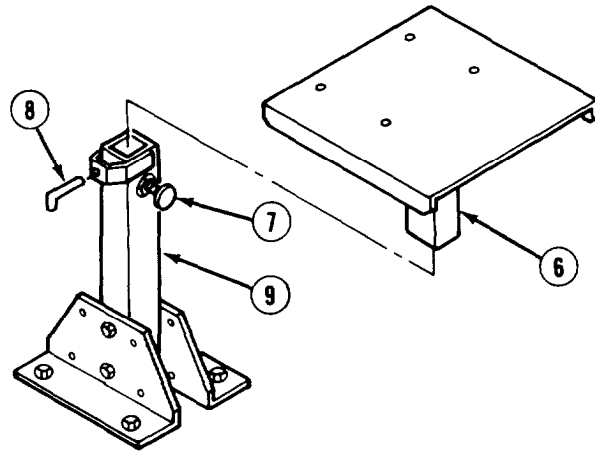
a. Removal.

- (1) Remove four nuts (1), lockwashers (2), and washers (3) from seat studs (4). Discard lockwashers.
- (2) Remove seat assembly (5) from elevation bar support (6).

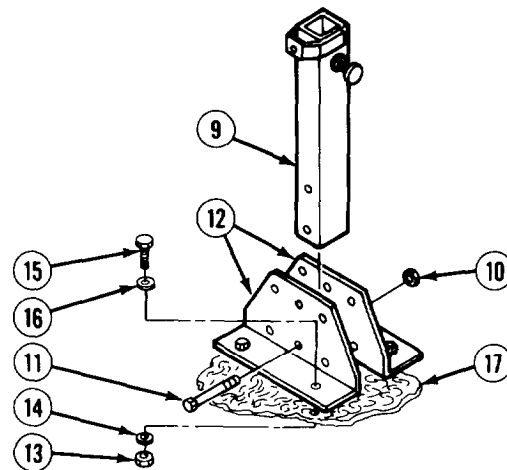


4-135. OPERATORS SEAT REPLACEMENT (CONT).

- (3) Loosen seat adjustment knob (7), pull control handle (8) and lift elevation bar support (6) out of base (9).



- (4) Remove two nuts (10) and screws (11) from support plates (12).
- (5) Remove base (9) from support plates (12).
- (6) Remove four nuts (13), lockwashers (14), screws (15), and washers (16) from support plates (12). Discard lo&washers.
- (7) Remove support plates (12) from rear floor panel (17).



b. Cleaning/Inspection.

- (1) Check seat cushions for tears and scrapes.
- (2) Check seat belts for worn or loose threads.
- (3) Check to see that seat belt buckle is in proper working order.
- (4) Check to see that seat belt is securely fastened to the floor of tractor.

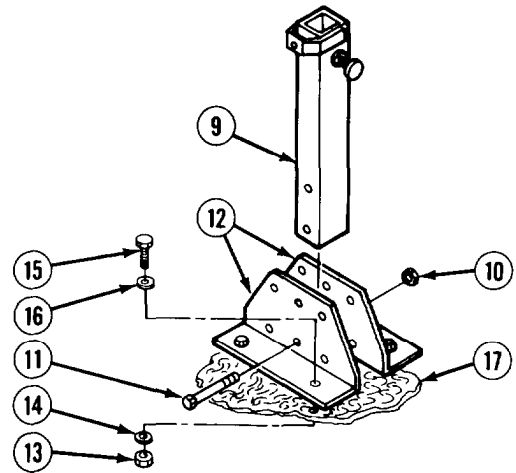
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38OC) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

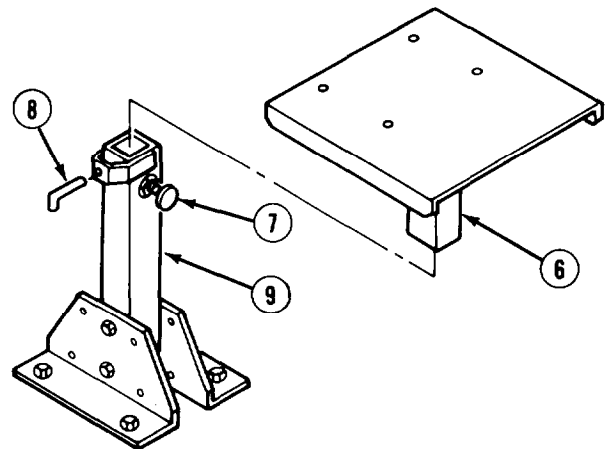
- (5) Clean all metal parts with a drycleaning solvent.
- (6) Clean seat cushions with mild detergent and water.

c. Installation.

- (1) Position support plates (12) on rear floor panel (17).
- (2) Install four screws (15), washers (16), lockwashers (14), and nuts (13).
- (3) Install base (9) between support plates (12).
- (4) Install two screws (11) and nuts (10) on support plates (12).



- (5) Install elevation bar support (6) by pulling control handle (8) and tightening seat adjustment knob (7). Re-insert control handle (8), lining up holes in base (9) and elevation bar support (6).

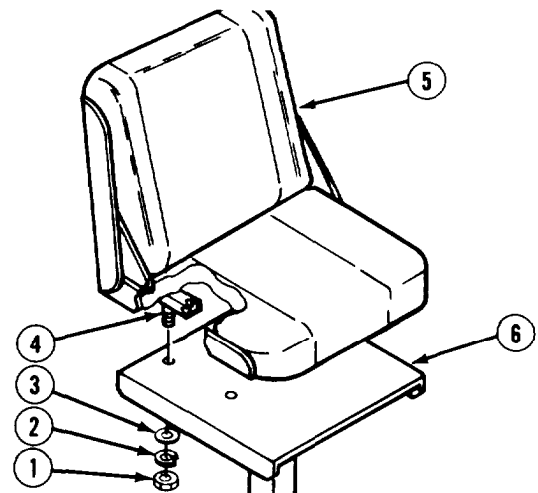


- (6) Install seat assembly (5) to elevation bar support (6) with four washers (3), lockwashers (2), and nuts (1) on seat studs (4).

NOTE

Follow-on Maintenance: Lower aft floor panel (para 4-133).

END OF TASK



4-136. DATA PLATES REPLACEMENT.	
This task covers:	
a. Removal	b. Installation
INITIAL SETUP	
<i>Tools</i> Tool kit, general mechanic's: automotive	<i>Materials/Parts</i> Rivets

a. Removal.

WARNING

- Drilling rivets while the battery is connected can cause electrical shock. Disconnect battery before using any electric tool.
- Use protective clothing. Goggles or safety glasses are recommended. Loose metal can fly up and cause eye injury.

CAUTION

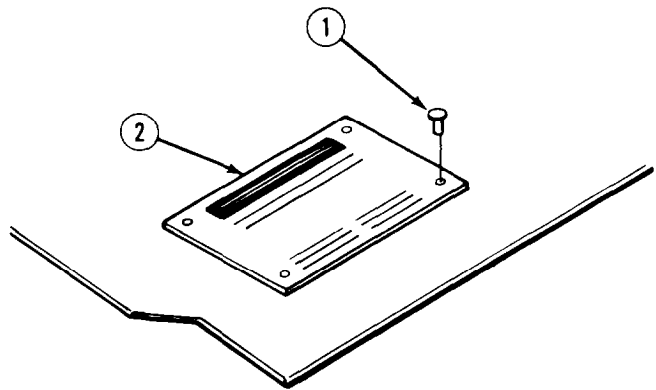
Care should be taken when drilling rivets. Damage to surrounding components is possible.

NOTE

This task is for reference only. It will never be necessary to remove all data plates at one time.

- (1) Using drill bit size comparable to rivet (1) size, drill out rivets (1) from front of data plate (2). Discard rivets.
- (2) Remove data plate (2) from component.

- b. Installation.** Position data plate (2) on component and install with rivets (1).



END OF TASK

4-137. SEAT BELT REPLACEMENT.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Locknuts (2)

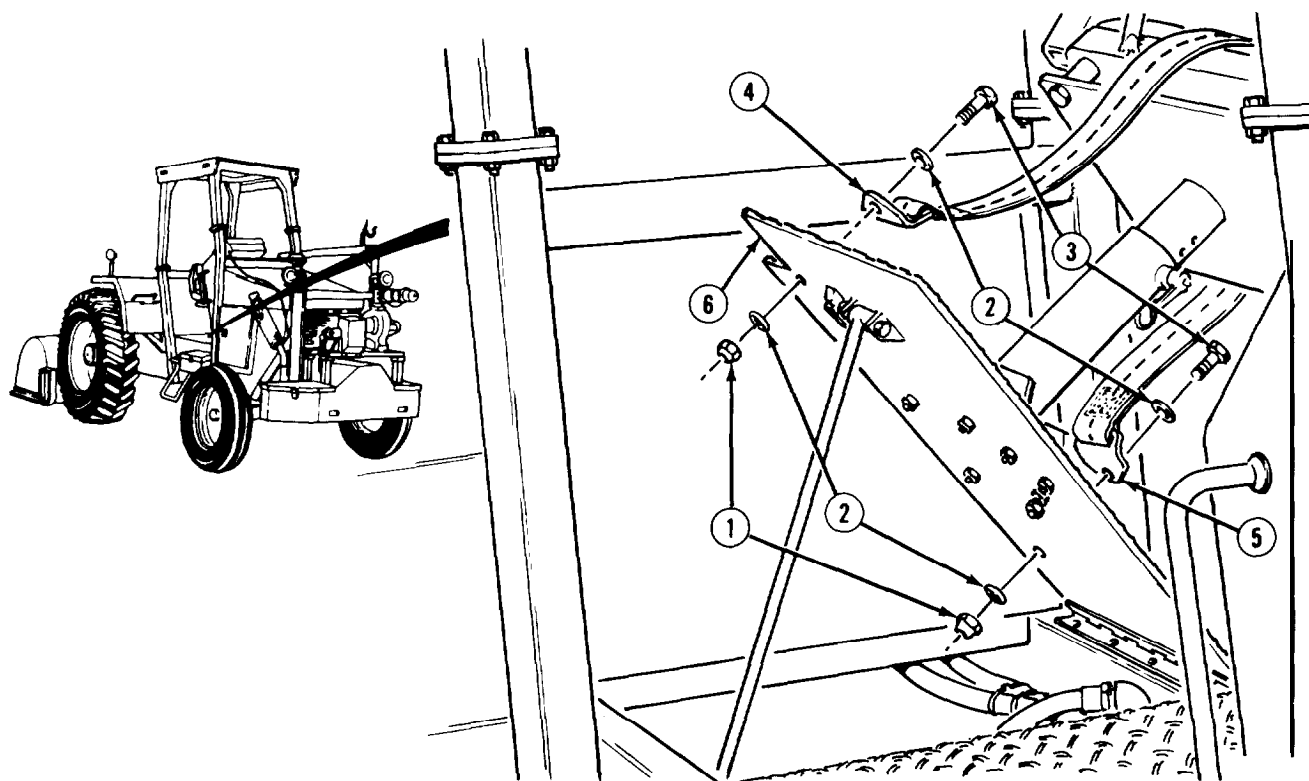
Equipment Condition

TM or Para

Para 2-15

Condition Description

Aft floor deck raised.



a. **Removal.** Remove two locknuts (1), four washers (2), two screws (3), and seat belts (4 and 5) from rear floor panel (6). Discard locknuts.

b. **Cleaning/Inspection.**

- (1) Clean seat belts with a soft bristle brush.
- (2) Check seat belts for loose threads and tears.
- (3) Check buckle for proper operation.

c. **Installation.** Install seat belts (4 and 5) on rear floor panel (6) with two screws (3), four washers (2), and two locknuts (1).

NOTE

Follow-on Maintenance: Lower aft floor deck (para 2-15).

END OF TASK

4-138. FLOW CONTROL VALVE ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive
 Suitable container (capacity 1 gal. [3.8 liter])

Materials/Parts

Packing, preformed
 Lockwashers (2)
 Tags, identification (item 55, appendix E)
 Fluid, hydraulic (item 23, appendix E)

Equipment Condition

TM or Para
 Para 2-19
 Para 4-132
Condition Description
 Hydraulic tank shut-off valves closed.
 Forward floor plate removed.

General Safety Instructions

Spilled hydraulic fluid is slippery. Clean up immediately or injury to personnel may result.

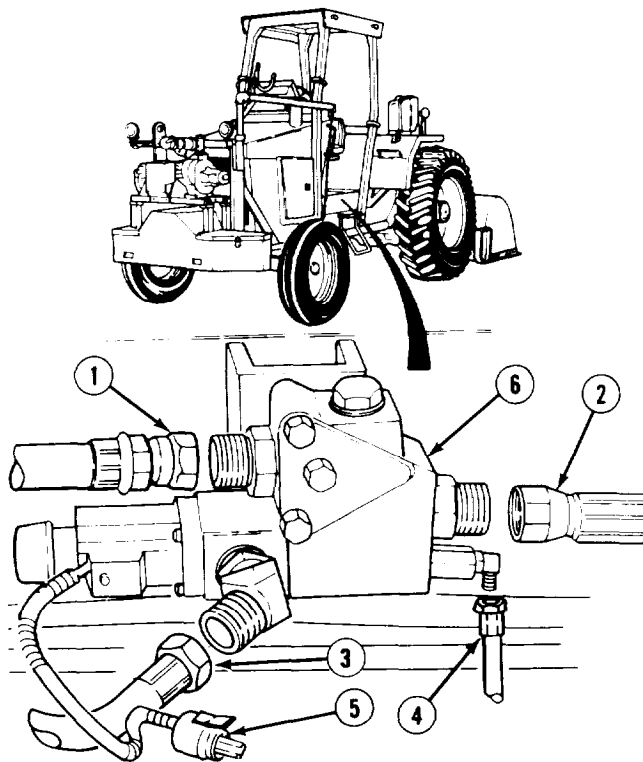
a. Removal.



Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

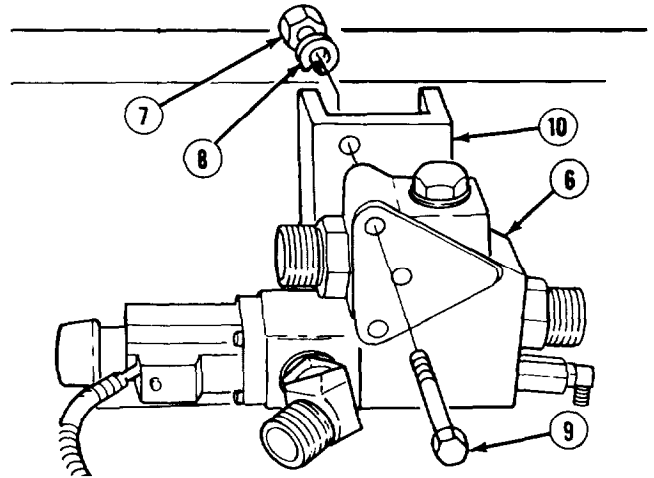
- Place suitable container with a 1 gallon (3.8 liters) capacity under vehicle to catch spilling fluid.
 - Tag and mark all hoses and wires before removal.
- (1) Remove hoses (1, 2, 3, and 4) and wire (5) from flow control valve (6).



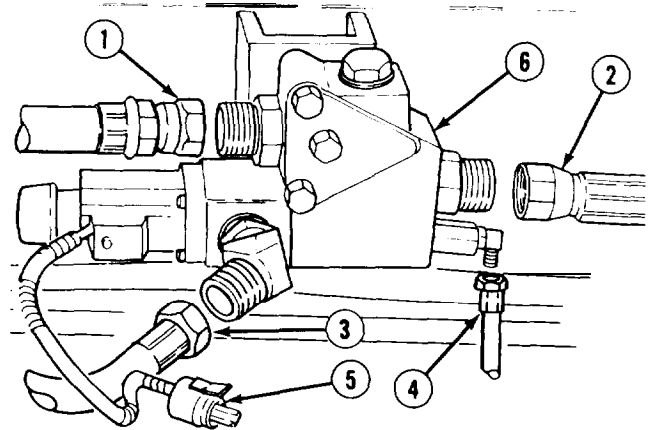
- (2) Remove two nuts (7), lockwashers (8), screws (9), and flow control valve (6) from mount (10). Discard lo&washers.

b. Installation.

- (1) Install flow control valve (6) on mount (10) with two screws (9), lockwashers (8), and nuts (7).



- (2) Install four hoses (4, 3, 2, and 1) and wire (5) on flow control valve (6).



NOTE

Follow-on Maintenance:

- Install forward floor plate (para 4-132).
- Open hydraulic tank shut-off valves (para 2-11).
- Fill hydraulic tank to proper level (para 3-11).

END OF TASK

4-139. VALVE BANK ASSEMBLY LEVERS AND LINKAGE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-128

Condition Description
Dash panel removed.

Materials/Parts

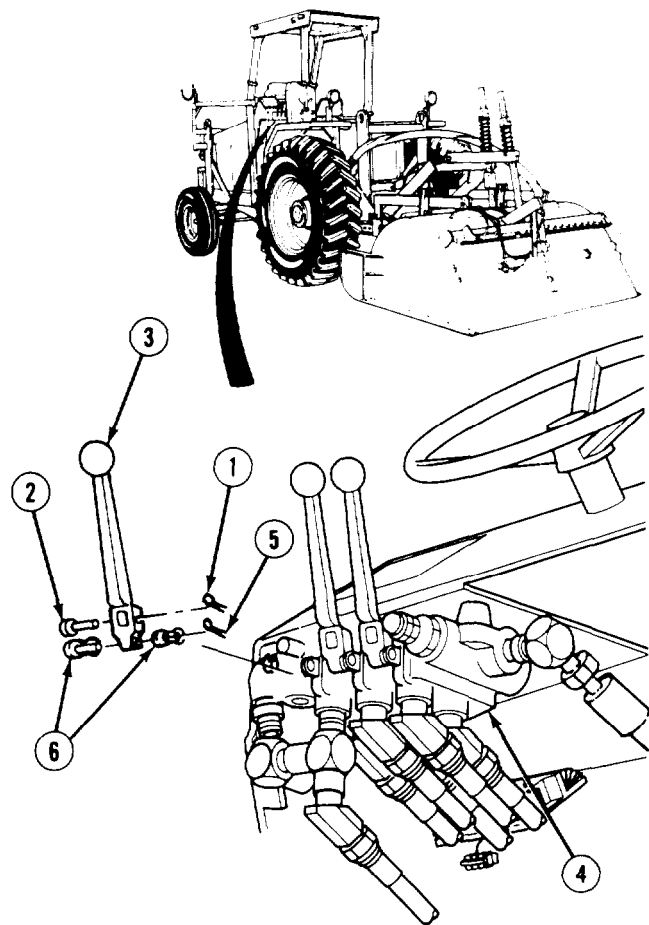
Pins, cotter (9)

a. Removal.

- (1) Remove three cotter pins (1) and pins (2) from valve handles (3) on control valve (4). Discard cotter pins.
- (2) Remove six cotter pins (5), three handle links (6), and valve handles (3) from control valve (4). Discard cotter pins.

b. Installation.

- (1) Install three valve handles (3) on control valve (4) with three handle links (6) and six cotter pins (5).
- (2) Install three pins (2) through valve handles (3) with cotter pins (1).



NOTE

Follow-on Maintenance: Install dash panel (para 4-128).

END OF TASK

4-140. HYDRAULIC FILTER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive
 Suitable container 1 gal. [3.8 liter])

Equipment Condition

TM or Para
 Para 2-13

Condition Description
 Parking brake set.

Materials/Parts

Filter, hydraulic
 Fluid, hydraulic (item 23, appendix E)

WARNING

Hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

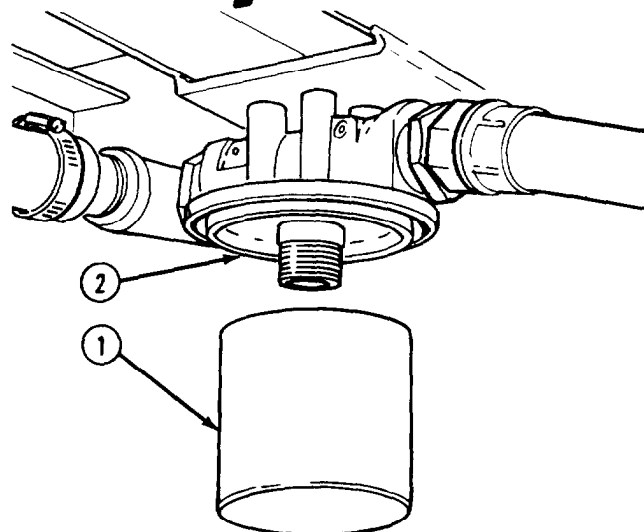
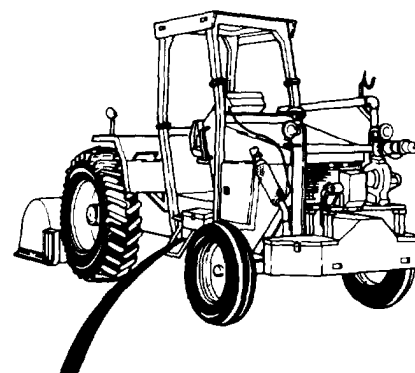
Place suitable container with a 1 gallon (3.8 liters) capacity under filter to catch spilling fluid.

- a. **Removal.** Remove filter (1) from base (2).
- b. **Installation.** Install filter (1) to base (2).

NOTE

Follow-on Maintenance: Fill hydraulic tank to proper level (para 3-11).

END OF TASK



4-141. HYDRAULIC FILTER ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

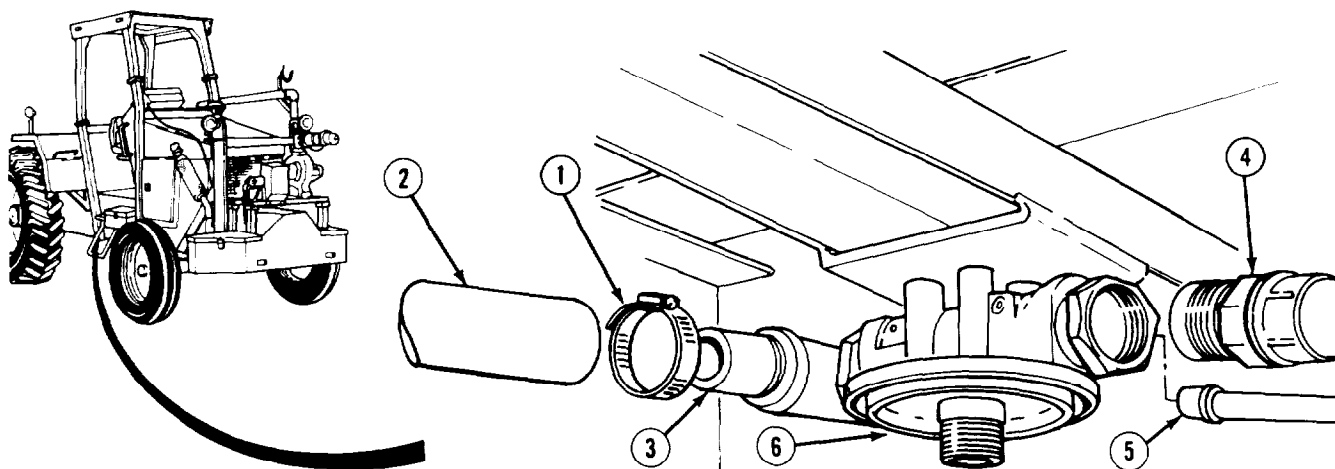
TM or Para
Para 4-140

Condition Description
Hydraulic filter element removed.

Materials/Parts

Sealant, hydraulic (item 52, appendix E)
Tags, identification (item 55, appendix E)
Lockwashers (4)
Screw, clamp
Fluid, hydraulic (item 23, appendix E)

a. Removal.



WARNING

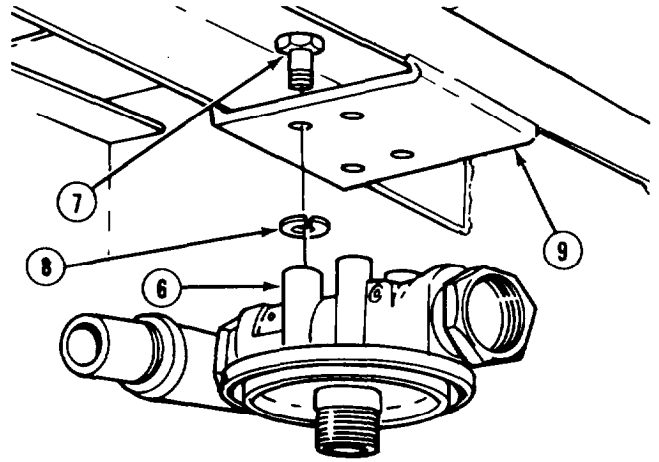
Spilled hydraulic fluid is slippery. Clean up spilled hydraulic fluid immediately or injury to personnel may result.

NOTE

Tag and mark all hoses before removal.

- (1) Loosen clamp (1) and remove hose (2) and clamp from nipple (3).
- (2) Remove hoses (4 and 5) from filter head (6).

- (3) Remove four screws (7), lockwashers (8), and filter head (6) from frame (9). Discard lockwashers.



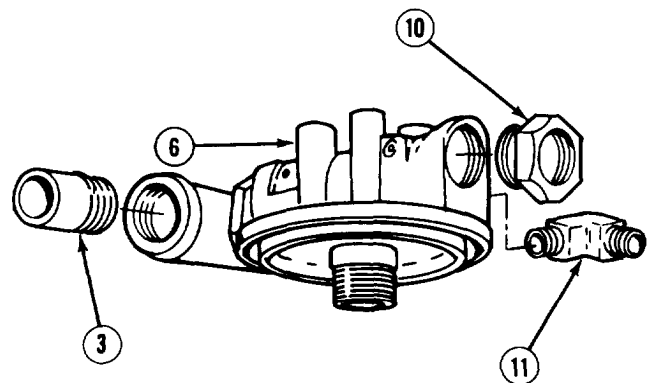
- (4) Remove nipple (3), reducer (10), and 90° elbow (11) from filter head (6).

b. Installation.

WARNING

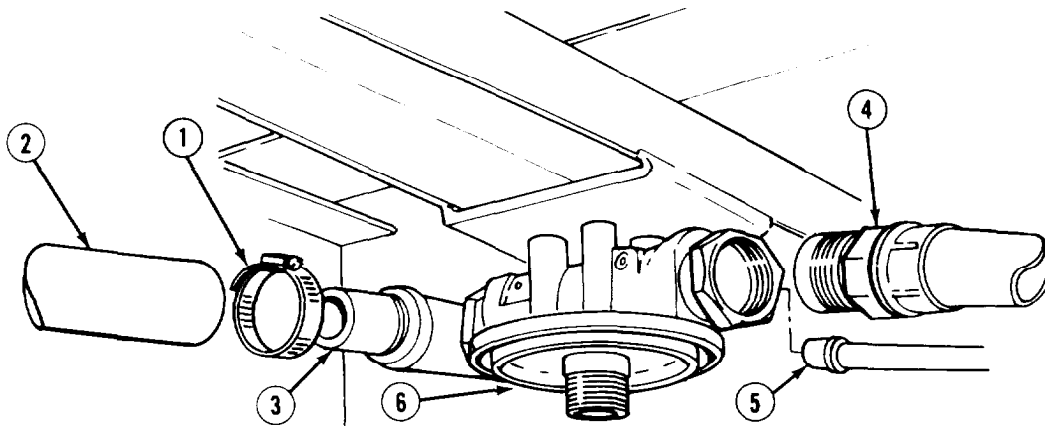
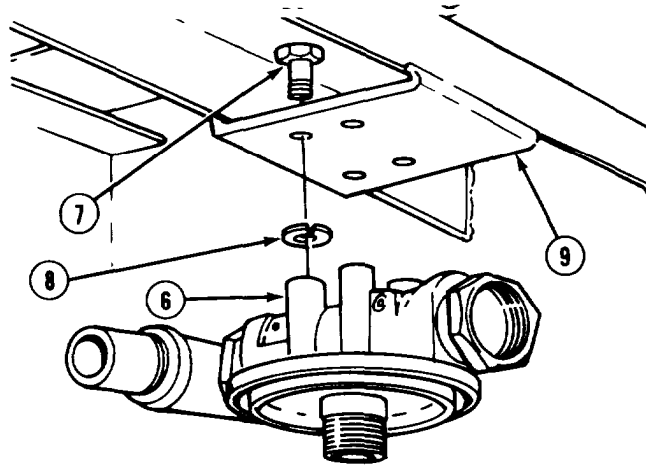
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply hydraulic thread sealant to threads of all fittings and install elbow (11), reducer (10), and nipple (3) on filter head (6).



4-141. HYDRAULIC FILTER ASSEMBLY REPLACEMENT (CONT).

- (2) Install filter head (6) on frame (9) with four lockwashers (8) and screws (7).



- (2) Install hoses (5 and 4) on filter head (6).
- (3) Install hose (2) on nipple (3) and tighten clamp (1).

NOTE

Follow-on Maintenance: Install hydraulic filter (para 4-140).

END OF TASK

4-142. HYDRAULIC TANK SCREENS REPLACEMENT (CONT).

b. Cleaning/Inspection.

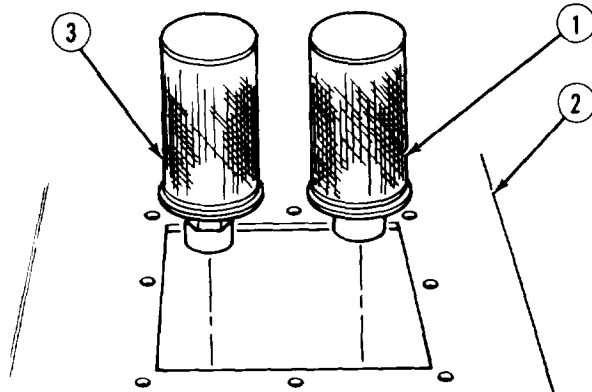
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

- (1) Clean screens with drycleaning solvent and dry with compressed air.
- (2) Inspect screens for holes.
- (3) Replace screens if damaged.

c. Installation.

- (1) Install screen (3) in tank (2).
- (2) Install screen (1) in tank (2).



NOTE

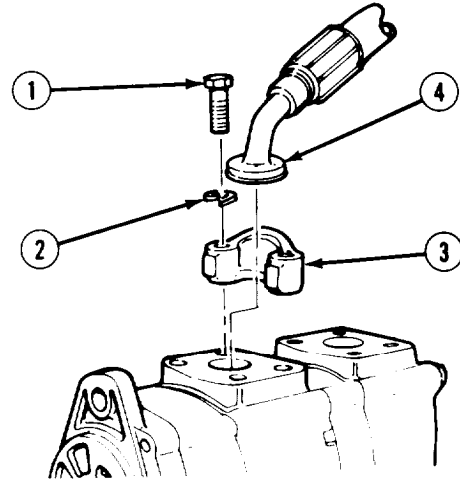
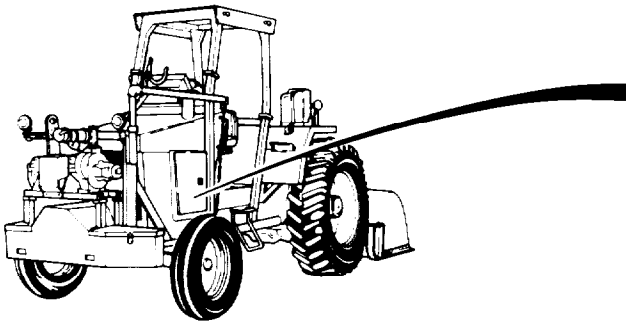
Follow-on Maintenance:

- Install hydraulic cap plates (para 4-49).
- Fill hydraulic tank (para 4-29).

END OF TASK

4-143. GENERAL HYDRAULIC HOSE REPLACEMENT (CONT).

a. Clamp Hose.



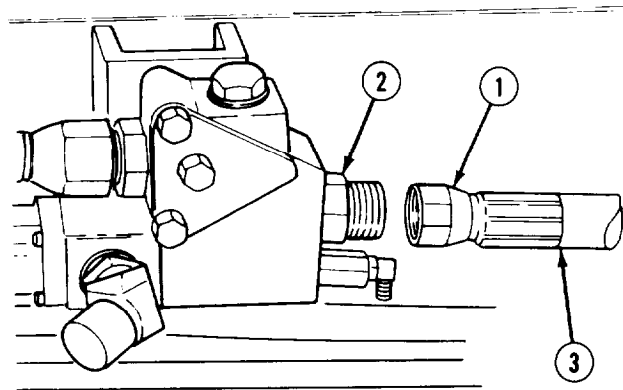
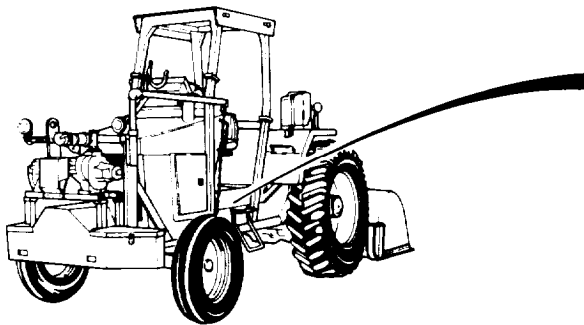
(1) Removal.

- (a) Remove four screws (1) and lo&washers (2) from two clamps (3). Discard lo&washers.
- (b) Remove clamps (3) and hose (4).

(2) Installation.

- (a) Install hose (4) and two clamps (3).
- (b) Install four lockwashers (2) and screws (1).

b. Disconnect Hose.



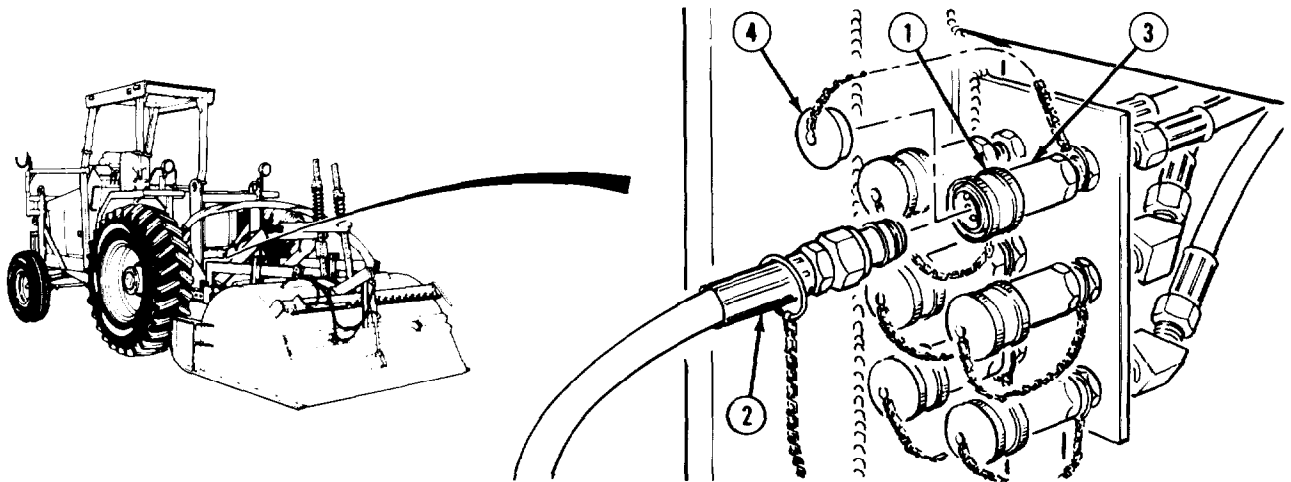
(1) Removal.

- (a) Loosen fitting (1) from fitting (2).
- (b) Remove hose (3) from fitting (2).

(2) Installation.

- (a) Install hose (3) on fitting (2).
- (b) Tighten fitting (1) on fitting (2).

c. *Quick disconnect Hose.*



(1) Removal.

- (a) Pull back on locking ring (1) and disconnect hose (2) from fitting (3).
- (b) Install dust cap (4) on fitting (3).

(2) Installation.

- (a) Remove dust cap (4) from fitting (3).
- (b) Pull back on locking ring (1) and connect hose (2) to fitting (3).

NOTE

Follow-on Maintenance:

- Lower aft floor deck (para 2-15).
- Close left/right engine doors (para 2-14).
- Fill hydraulic tank to proper level (para 3-11).

4-143. GENERAL HYDRAULIC HOSE REPLACEMENT (CONT).

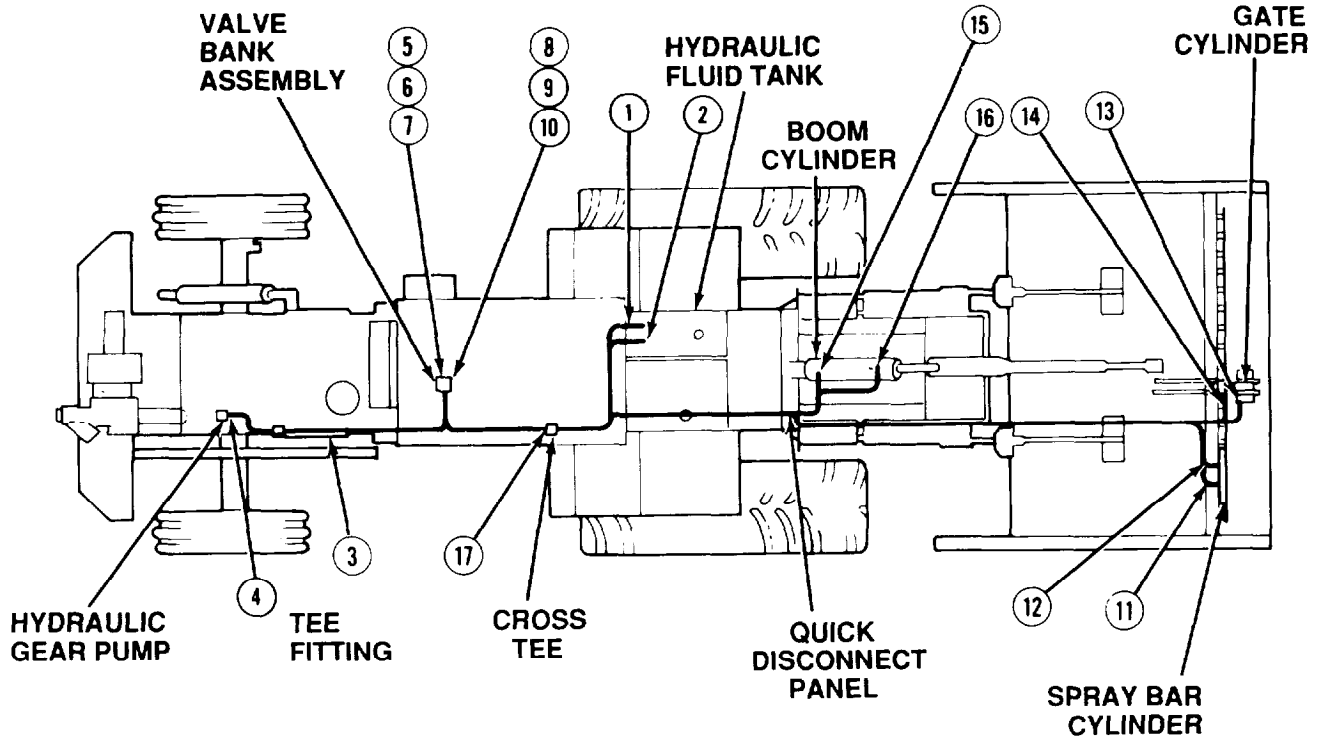


Table 4-5. Rotor System Hydraulic Hoses

Hose Number	Hose Name	From	To
1	Hydraulic Gear Pump Input Hose A	Tee Fitting	Hydraulic Gear Pump
2	Hydraulic Fluid Return Hose	Cross Tee	Hydraulic Fluid Tank
3	Hydraulic Gear Pump Input Hose B	Tee Fitting	Hydraulic Gear Pump
4	Hydraulic Control Valve Input Hose	Hydraulic Gear Pump	Hydraulic Control Valve
5	Boom Cylinder Hose A	Quick Disconnect Panel	Boom Control Valve
6	Boom Cylinder Hose B	Quick Disconnect Panel	Boom Control Valve
7	Gate Cylinder Hose A	Quick Disconnect Panel	Gate Control Valve
8	Gate Cylinder Hose B	Quick Disconnect Panel	Gate Control Valve
9	Spray bar Cylinder Hose A	Quick Disconnect Panel	Spray bar Control Valve

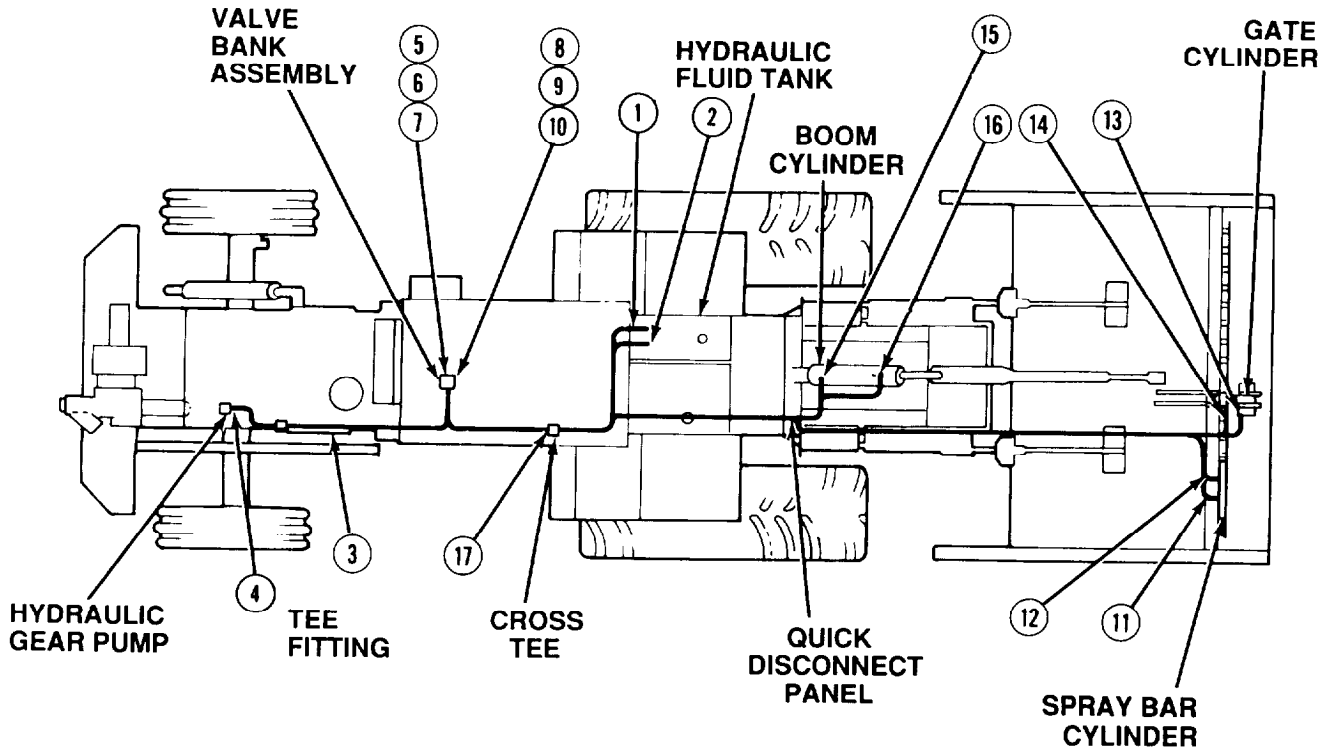


Table 4-5. Rotor System Hydraulic Hoses - CONT.

Hose Number	Hose Name	From	To
10	Spray bar Cylinder Hose B	Quick Disconnect Panel	Spray bar Control Valve
11	Boom Cylinder Hose C	Boom Cylinder	Quick Disconnect Panel
12	Boom Cylinder Hose D	Boom Cylinder	Quick Disconnect Panel
13	Gate Cylinder Hose C	Gate Cylinder	Quick Disconnect Panel
14	Gate Cylinder Hose D	Gate Cylinder	Quick Disconnect Panel
15	Spray bar Cylinder Hose C	Spray bar Cylinder	Quick Disconnect Panel
16	Spray bar Cylinder Hose D	Spray bar Cylinder	Quick Disconnect Panel
17	Hydraulic Bank Assembly Return Hose	Hydraulic Control Valve	Cross Tee

4-143. GENERAL HYDRAULIC HOSE REPLACEMENT (CONT).

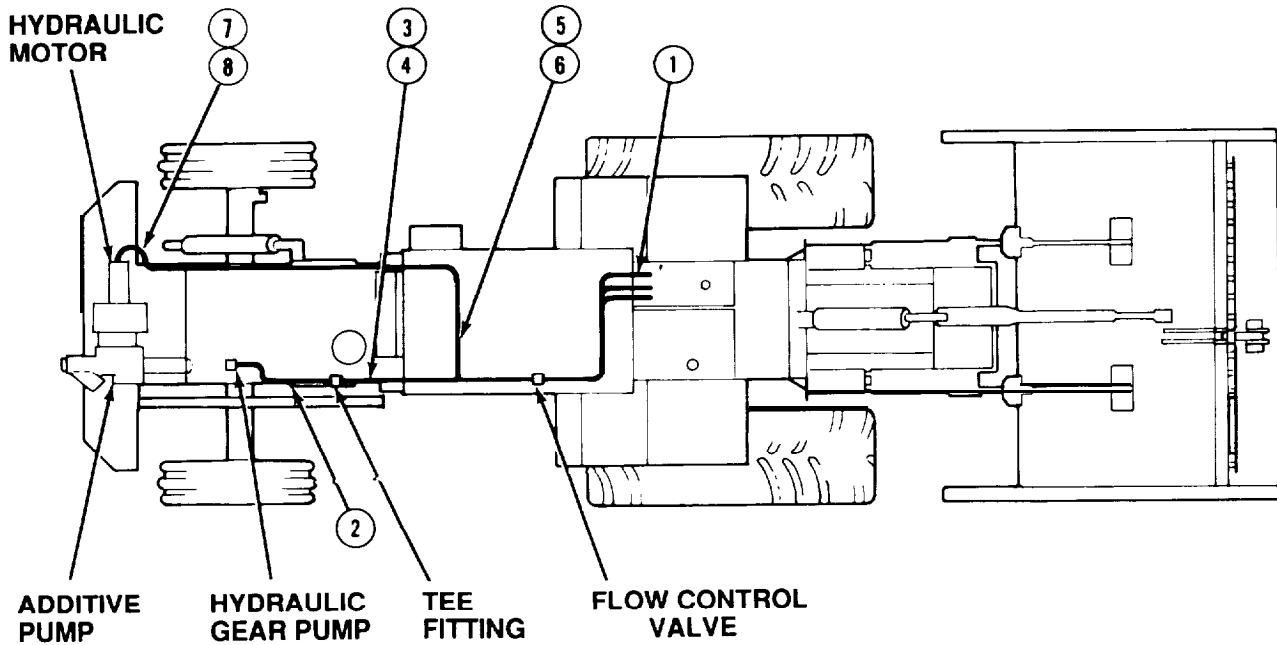


Table 4-6. Additive System Hydraulic Hoses

Hose Number	Hose Name	From	To
1	Hydraulic Gear Pump Input Hose A	Hydraulic Gear Pump	Hydraulic Control Valve
2	Hydraulic Gear Pump Input Hose C	Tee Fitting	Hydraulic Gear Pump
3	Flow Control Valve Input Hose	Hydraulic Gear Pump	Flow Control Valve
4	Hydraulic Motor Input Hose	Flow Control Valve	Hydraulic Motor
5	Flow Control Valve Return Hose	Flow Control Valve	Hydraulic Fluid Tank
6	Flow Control Valve Pressure Relief Hose	Flow Control Valve	Hydraulic Fluid Tank
7	Hydraulic Motor Pressure Relief	Hydraulic Motor	Hydraulic Fluid Tank
8	Hydraulic Motor Return Hose	Hydraulic Motor	Hydraulic Fluid Tank

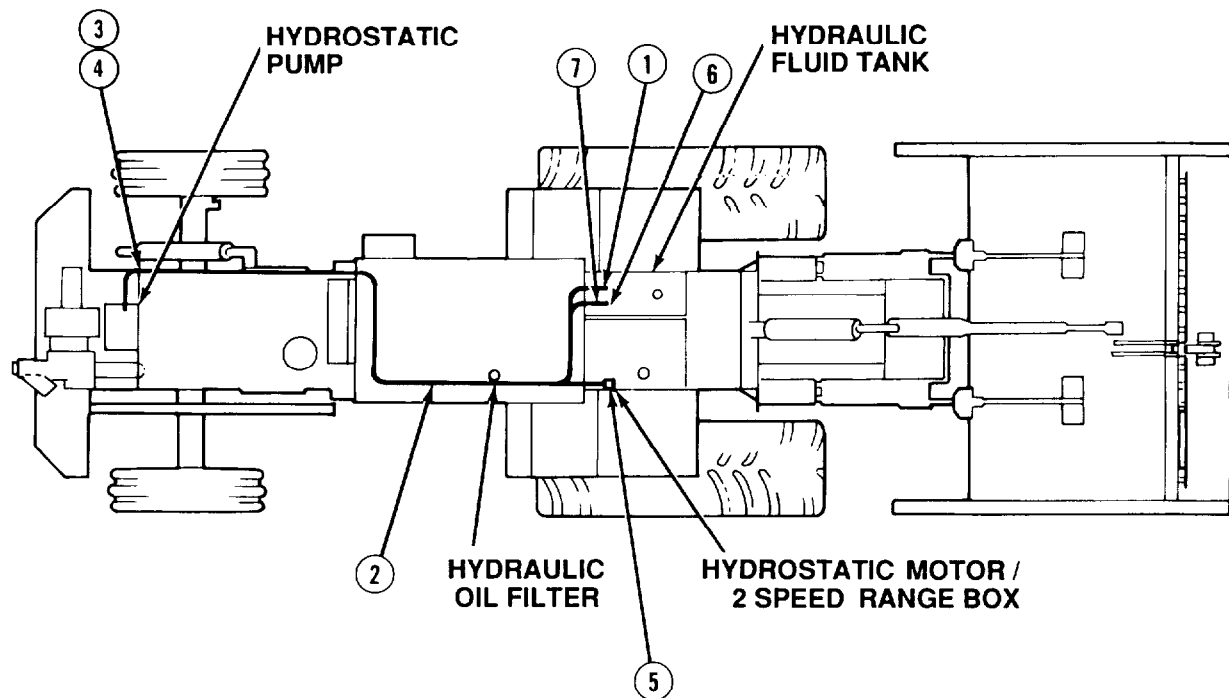


Table 4-7. Rotary Tiller Mixer Drive System Hydraulic Hoses

Hose Number	Hose Name	From	To
1	Hydraulic Filter Input Hose	Hydraulic fluid Tank	Hydraulic Filter
2	Hydrostatic Pump Input Hose	Hydraulic Filter	Hydrostatic Pump
3	Hydrostatic Pump Output Hose A	Hydrostatic Pump	Hydrostatic Motor
4	Hydrostatic Pump Output Hose B	Hydrostatic Pump	Hydrostatic Motor
5	Hydrostatic Pump Pressure Relief Hose	Hydrostatic Motor	Hydrostatic Pump
6	Hydrostatic Pump Return Hose	Hydrostatic Pump	Cross Tee
7	Hydraulic fluid Return Hose	Cross Tee	Hydraulic fluid Tank

4-143. GENERAL HYDRAULIC HOSE REPLACEMENT (CONT).

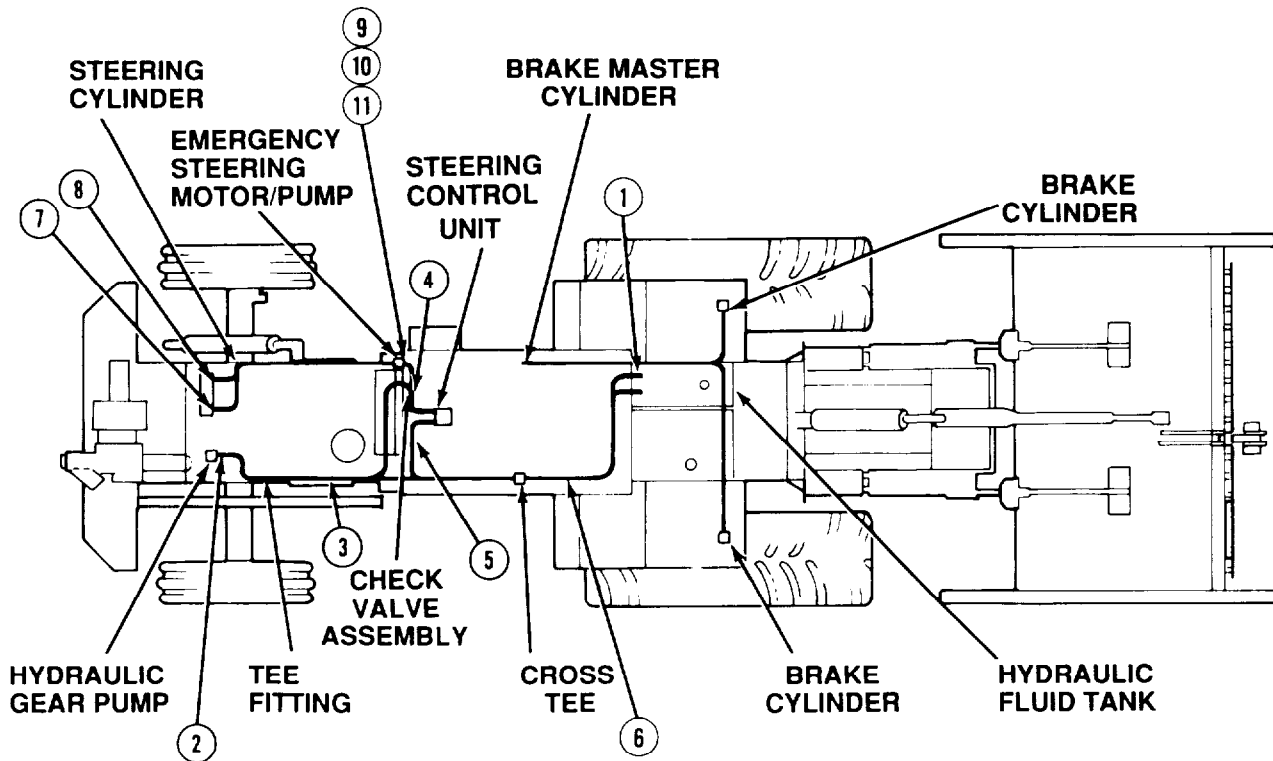


Table 4-8. Steering and Braking System Hydraulic Hoses

Hose Number	Hose Name	From	To
1	Hydraulic Gear Pump Input Hose A	Tee Fitting	Hydraulic Gear Pump
2	Hydraulic Gear Pump Input Hose B	Tee Fitting	Hydraulic Gear Pump
3	Steering Control Unit Input Hose A	Hydraulic Gear Pump	Steering Check Valve
4	Steering Control Unit Input Hose B	Check Valve	Steering Control Unit
5	Steering Control Unit Return Hose	Steering Control Unit	Cross Tee
6	Hydraulic fluid Return Hose	Cross Tee	Hydraulic fluid Tank
7	Steering Cylinder Hose A	Steering Control Unit	Steering Cylinder
8	Steering Cylinder Hose B	Steering Control Unit	Steering Cylinder

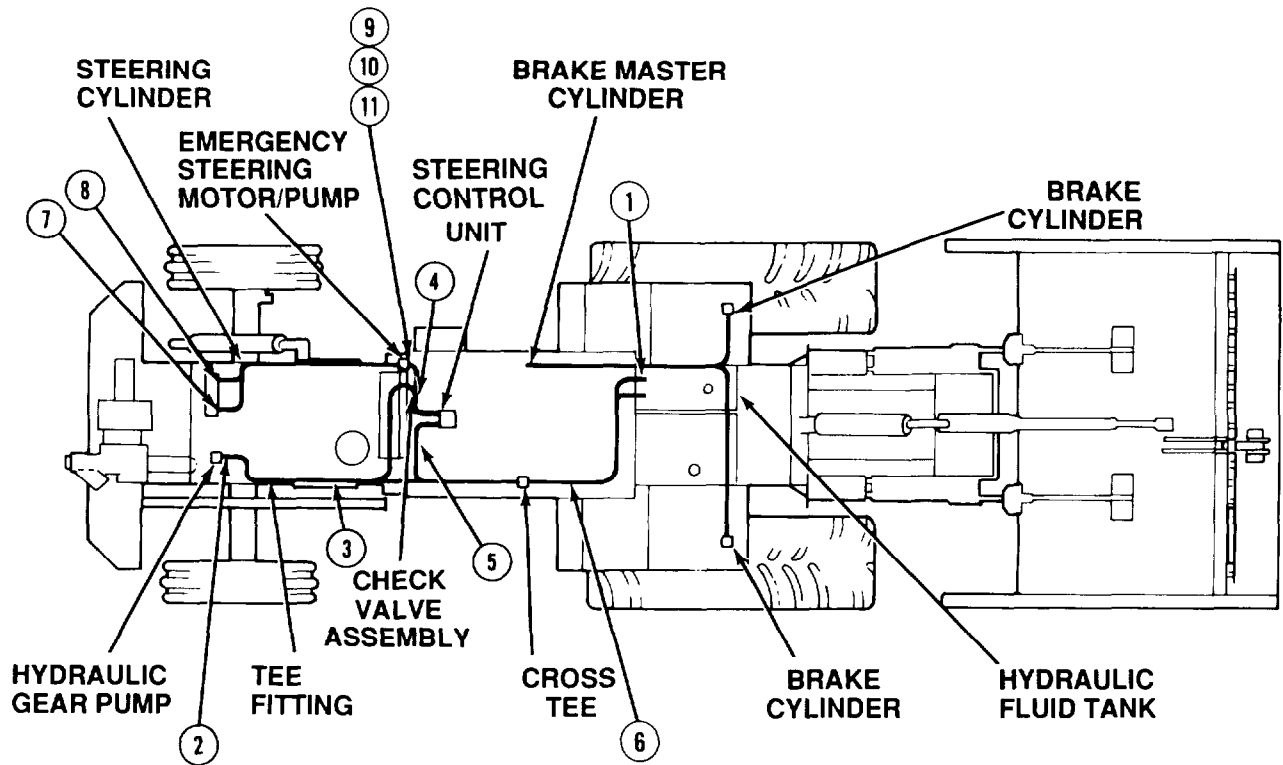


Table 4-8. Steering and Braking Systems Hydraulic Hoses - CONT.

Hose Number	Hose Name	From	To
9	Emergency Steering Pump Input Hose A	Hydraulic fluid Tank	Elbow on Steering Motor/Pump
10	Emergency Steering Pump Input Hose B	Elbow on Steering	Steering Motor/Pump
11	Steering Control Unit Input Hose C	Emergency Steering Motor/Pump	Check Valve

END OF TASK

4-144. HYDRAULIC PRESSURE SWITCH REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Suitable container (capacity 1 qt. [0.9 liter])

Equipment Condition

- TM or Para
- Para 4-90
- Para 4-128

- Condition Description*
- Negative battery cable disconnected.
- Dash panel removed.

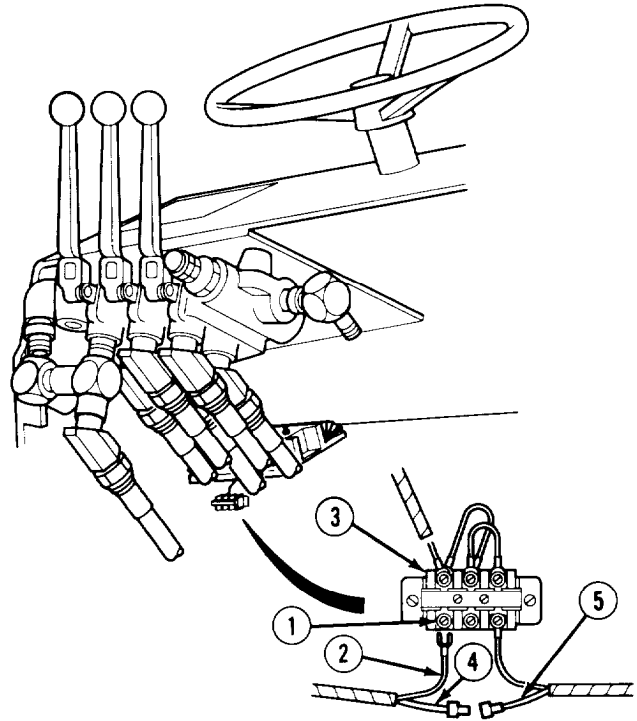
Materials/Parts

- Sealant, hydraulic (item 52, appendix E)
- Tag, identification (item 55, appendix E)

a. Removal.

NOTE

- Hydraulic hoses removed for clarity.
 - Tag and mark all wires before removal.
- (1) Loosen screw (1). Tag, mark and disconnect lead (2) from junction block (3).
 - (2) Tag, mark and disconnect wire (4) from wire (5).



WARNING

Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

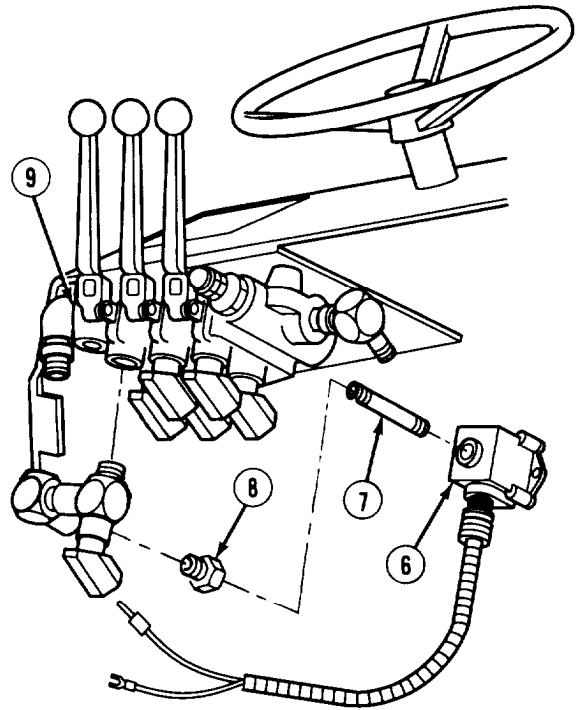
NOTE

- Hydraulic hoses removed for clarity.
 - Place suitable container with a 1 qt. (0.9 liter) capacity under sensor to catch spilling fluid.
- (3) Remove flow sensor (6), nipple (7), and adaptor (8) from bank valve (9).
 - (4) Remove adaptor (8) from nipple (7) and nipple from flow sensor (6).

b. Installation.**WARNING**

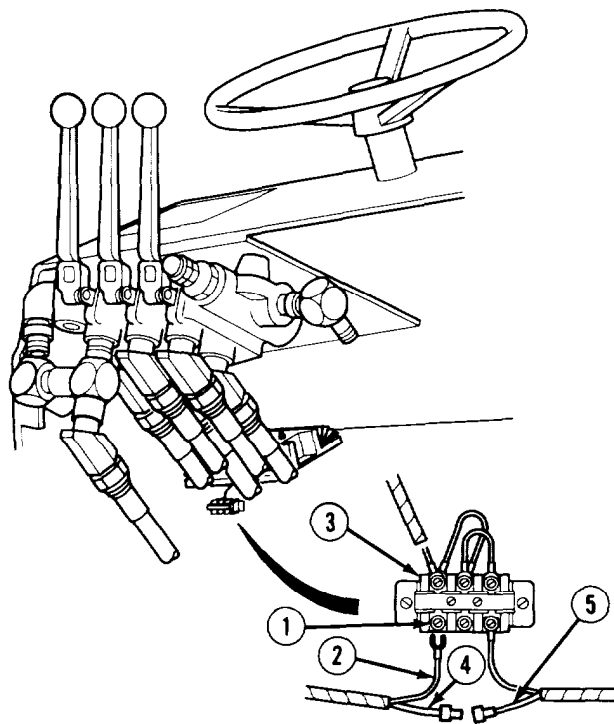
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply hydraulic thread sealant to threads of adaptor (8) and install in valve bank assembly (9).
- (2) Install nipple (7) and flow sensor (6) on adaptor (8).



4-144. HYDRAULIC PRESSURE SWITCH REPLACEMENT (CONT).

- (3) Connect wire (4) to wire (5).
- (4) Connect wire (2) to junction block (3) and tighten screw (1).



NOTE

Follow-on Maintenance:

- Install dash panel (para 4-128).
- Connect negative battery cable (para 4-90).

END OF TASK

4-145. BOOM HOIST CYLINDER REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Suitable container (capacity 1 gal. [3.8 liters])

Materials/Parts

- Pins, cotter (2)
- Cloth, lint-free (item 12, appendix E)
- Fluid, hydraulic (item 23, appendix E)
- Tag, identification (item 55, appendix E)
- Caps, plastic (2) (item 8, appendix E)

Equipment Condition

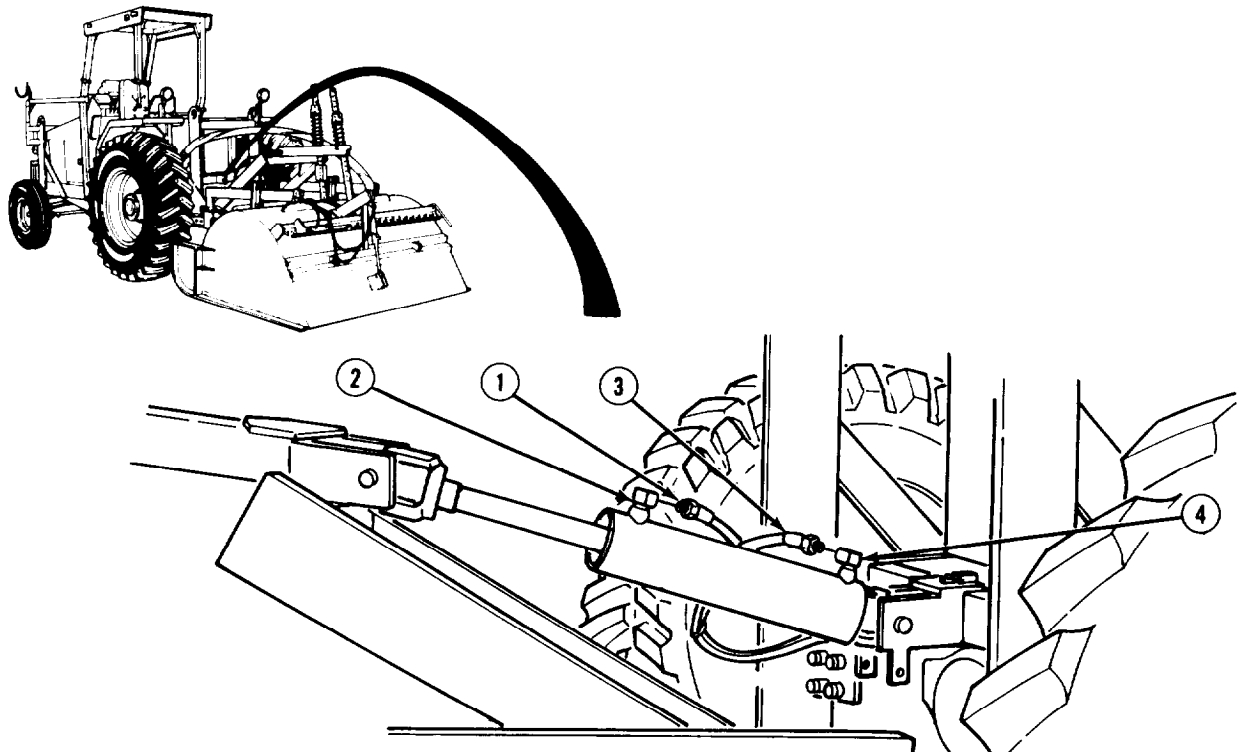
- TM or Para
- Para 2-10[c]
- Para 2-13
- Para 4-103

Condition Description
 Rotor fully lowered.
 Parking brake set.
 PTO drive shaft guard removed.

General Safety Instructions

Support rotor boom before removing boom hoist cylinder.

a. Removal.



4-145. BOOM HOIST CYLINDER REPLACEMENT (CONT).

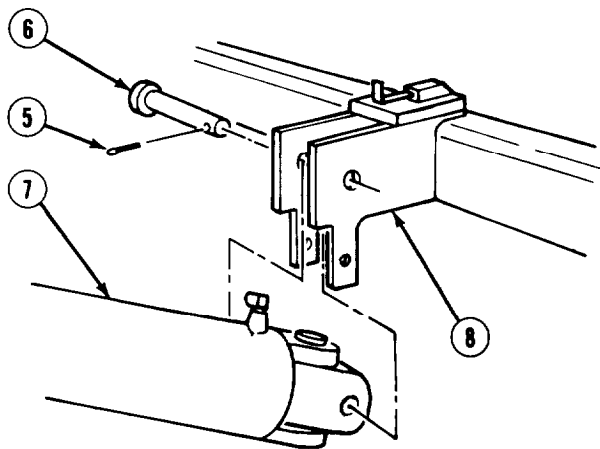
WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

NOTE

- Place suitable container with a 1 gallon (3.8 liters) capacity under hoses to catch spilling fluid.
- Tag and mark hydraulic hoses before disconnecting.
- Rotate hoses by hand while disconnecting to avoid kinking.

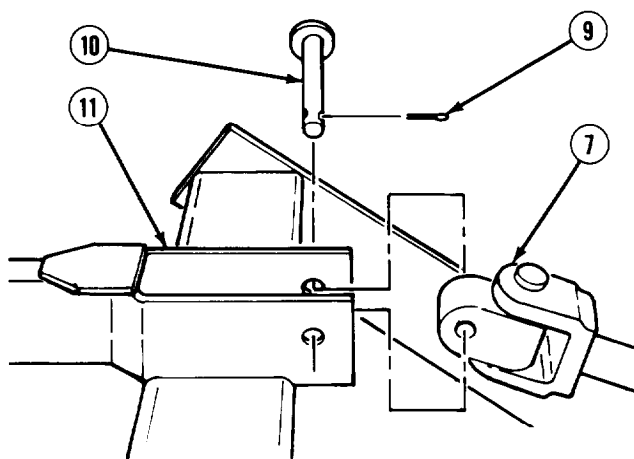
- (1) Tag, mark and disconnect hose (1) from elbow (2).
- (2) Tag, mark and disconnect hose (3) from elbow (4).
- (3) Remove cotter pin (5), pin (6), and housing end of boom hoist cylinder (7) from mounting bracket (8). Discard cotter pin.



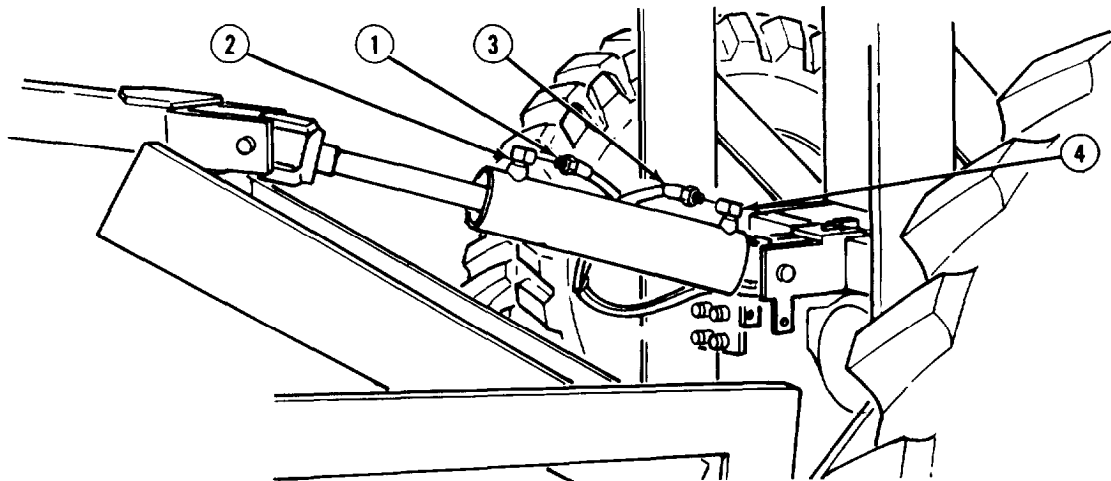
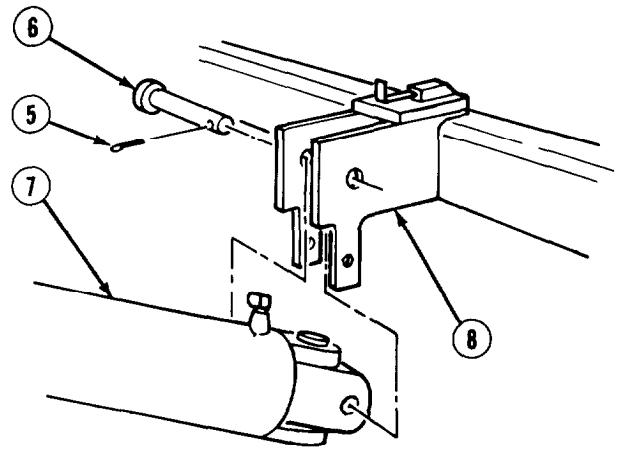
- (4) Remove cotter pin (9), pin (10), and shaft end of boom hoist cylinder (7) from mounting bracket (11). Remove cylinder from vehicle. Discard cotter pin.

b. Installation.

- (1) Install shaft end of boom hoist cylinder (7) in rotor mounting bracket (11) with pin (10) and cotter pin (9).



- (2) Install housing end of boom hoist cylinder (7) in mounting bracket (8) with pin (6) and cotter pin (5).



- (3) Connect hose (3) on elbow (4).
 (4) Connect hose (1) on elbow (2).

NOTE

Follow-on Maintenance:

- Install PTO drive shaft guard (para 4-103).
- Check hydraulic fluid level and add fluid as needed (para 3-11).

END OF TASK

4-146. GATE CYLINDER ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Suitable container (capacity 1 gal. [3.8 liters])

Materials/Parts

Pins, cotter (2)
Cloth, lint-free (item 12, appendix E)

Materials/Parts

Fluid, hydraulic (item 23, appendix E)
Tag, identification (item 55, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-10[c]	Rotor fully lowered.
Para 2-13	Parking brake set.

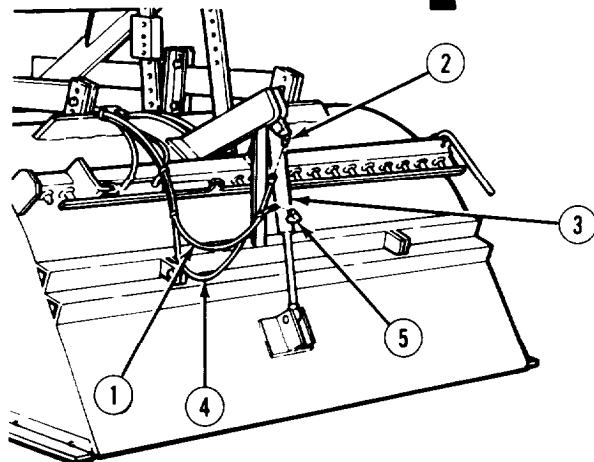
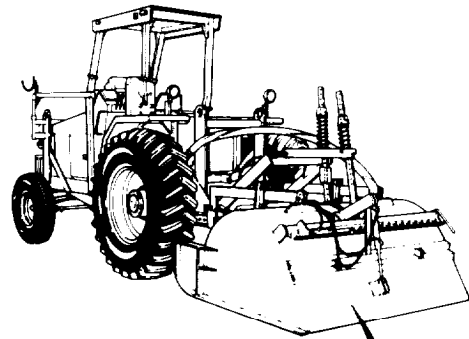
a. Removal.



Hydraulic fluid is slippery and can cause falls. To avoid injury, wipe up spilled fluid with rags.

NOTE

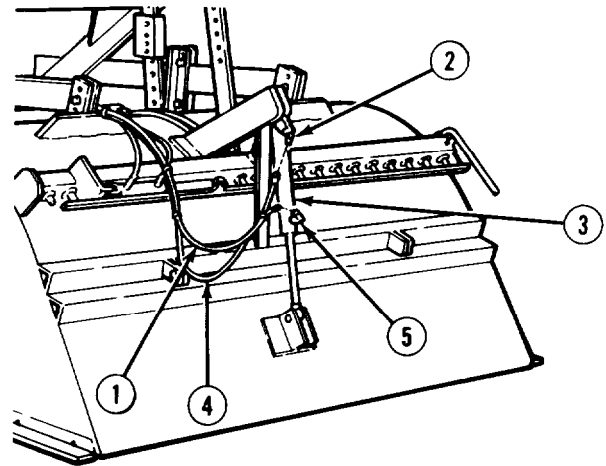
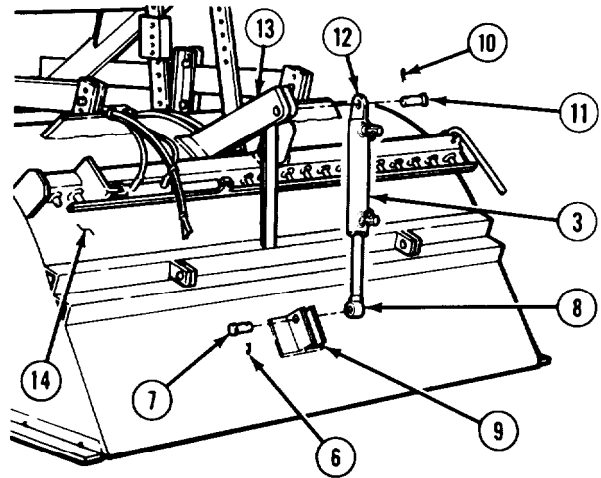
- Place suitable container with a 1 gallon (3.8 liters) capacity under gate to catch spilling fluid.
 - Tag and mark hydraulic hoses before removal.
- (1) Tag, mark and disconnect hydraulic hose (1) from elbow (2) on gate cylinder (3).
 - (2) Tag, mark and disconnect hydraulic hose (4) from elbow (5).



- (3) Remove cotter pin (6) and pin (7) from shaft end (8) of gate cylinder (3) and mounting bracket (9). Discard cotter pin.
- (4) Remove cotter pin (10) and pin (11) from barrel end (12) of gate cylinder (1). Remove cylinder from mounting bracket (13) on rotor hood (14). Discard cotter pin.

c. Installation.

- (1) Install barrel end (12) of gate cylinder (3) in mounting bracket (13) with pin (10) and cotter pin (9).
- (2) Install shaft end (8) of gate cylinder (1) in mounting bracket (9) with pin (7) and cotter pin (6).
- (3) Connect hydraulic hose (4) to elbow (5) on gate cylinder (3).
- (4) Connect hydraulic hose (1) to elbow (2).



NOTE

Follow-on Maintenance: Check hydraulic fluid level and add fluid as needed (para 3-11).

END OF TASK

4-147. SPRAY BAR CYLINDER ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Suitable container (capacity 1 gal. [3.8 liters])

Materials/Parts

Cotter pins (2)
 Cloth, lint-free (item 12, appendix E)
 Fluid, hydraulic (item 23, appendix E)
 Tag, identification (item 55, appendix E)

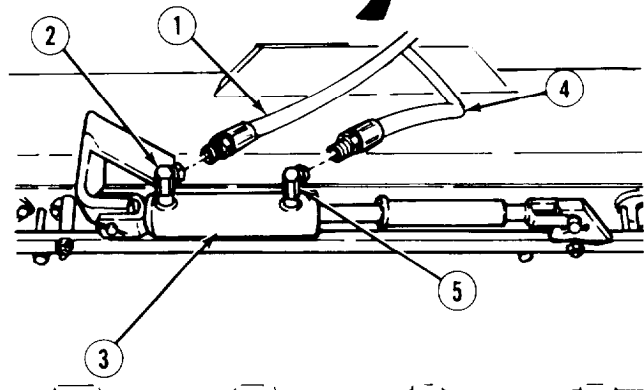
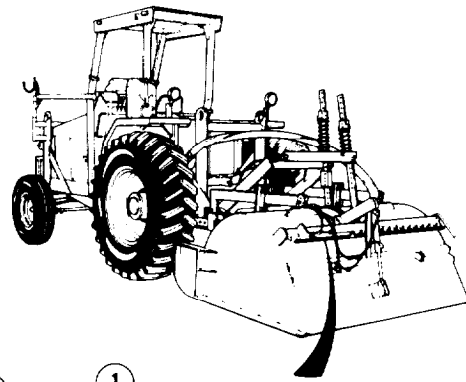
a. Removal.

WARNING

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid with rags.

NOTE

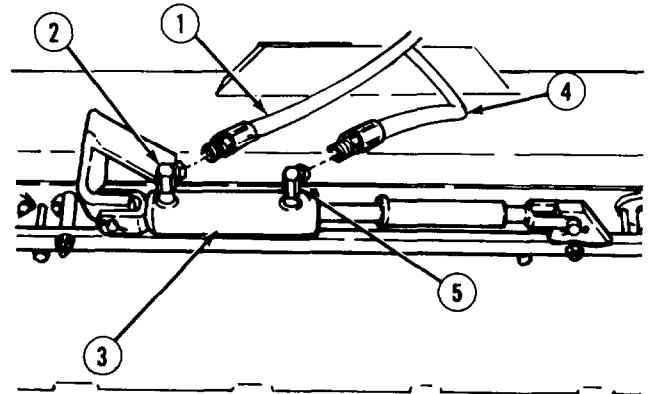
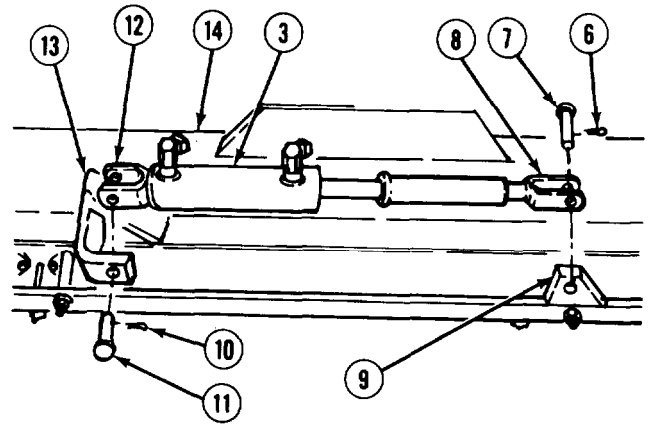
- Place suitable container with a 1 gallon (3.8 liters) capacity under spray bar cylinder to catch spilling fluid.
 - Tag and mark hydraulic hoses before disconnecting.
- (1) Tag, mark and remove hydraulic hose (1) from elbow (2) on spray bar cylinder (3).
 - (2) Tag, mark and remove hydraulic hose (4) from elbow (5).



- (3) Remove cotter pin (6) and pin (7) from shaft end (8) of spray bar cylinder (3) and shutoff bar (9). Discard cotter pin.
- (4) Remove cotter pin (10) and pin (11) from barrel end (12) of spray bar cylinder (3) and mounting bracket (13). Remove spray bar cylinder from spray bar (14). Discard cotter pin.

b. Installation.

- (1) Install barrel end (12) of spray bar cylinder (3) on mounting bracket (13) with pin (11) and cotter pin (10).
- (2) Install shaft end (8) of spray bar cylinder (3) on shutoff bar (9) with pin (7) and cotter pin (6).
- (3) Connect hydraulic hose (4) on elbow (5) on spray bar cylinder (3).
- (4) Connect hydraulic hose (1) on elbow (2).



NOTE

Follow-on Maintenance: Check hydraulic fluid level and add fluid as needed (para 3-11).

END OF TASK

4-148. HYDRAULIC CROSS REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Suitable container (capacity 1 gal. [3.8 liters])

Materials/Parts

- Lockwashers (2)
- Cloth, lint-free (item 12, appendix E)
- Fluid, hydraulic (item 23, appendix E)
- Sealant, hydraulic (item 52, appendix E)

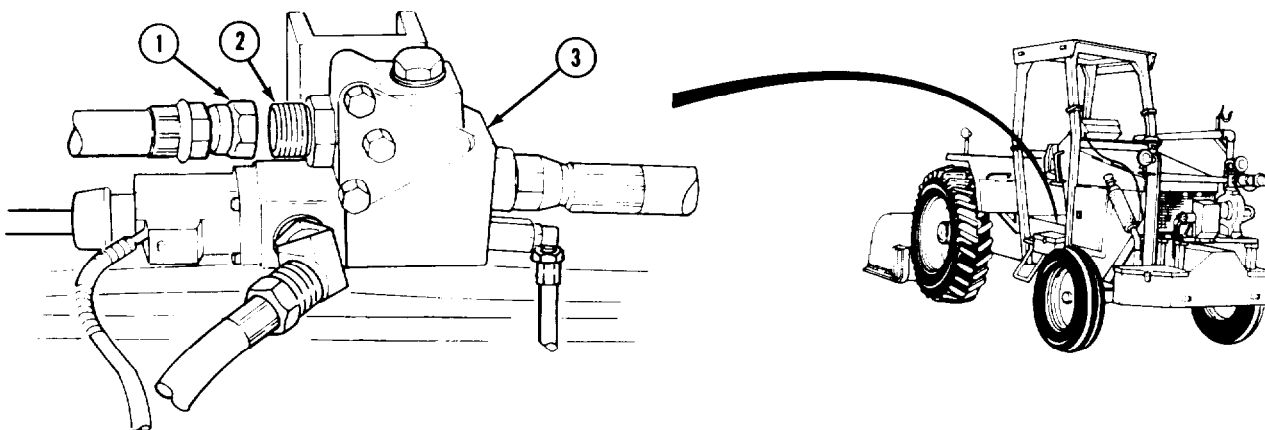
Materials/Parts

- Solvent, drycleaning (item 54, appendix E)
- Tag, identification (item 55, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-15	Aft floor deck raised.
Para 4-132	Forward floor plate removed.
Para 2-18	Hydraulic valve shut off

a. Removal.



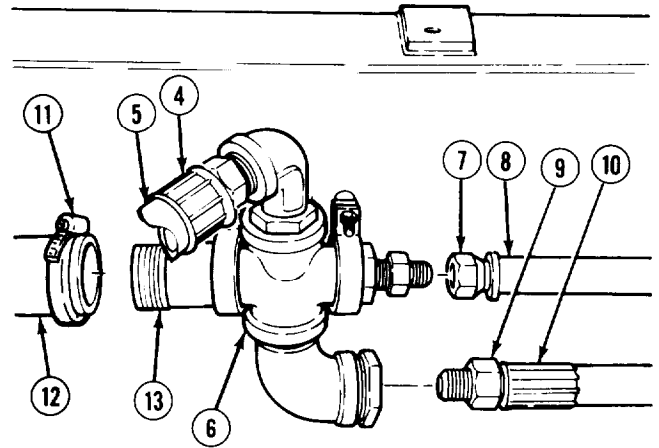
WARNING

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid with rags.

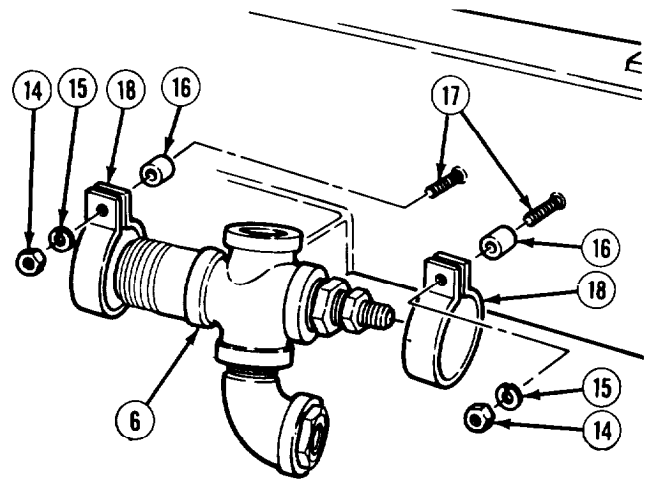
NOTE

- Place suitable container with a 1 gallon (3.8 liters) capacity under cross to catch spilling fluid.
 - Tag and mark all hoses prior to removal.
- (1) Tag, mark, and disconnect hose (1) from fitting (2) on flow control valve (3).

- (2) Tag, mark, and disconnect fitting (4) and hose (5) from cross (6).
- (3) Tag, mark, and disconnect fitting (7) and hose (8).
- (4) Tag, mark, and disconnect fitting (9) and hose (10).
- (5) Loosen clamp (11) on hose (12).
- (6) Tag, mark, and disconnect hose (12) and clamp (11) from king nipple (13).



- (7) Remove two nuts (14), lockwashers (15), and spacers (16) from studs (17). Discard lockwashers.
- (8) Remove two clamps (18) from cross (6).

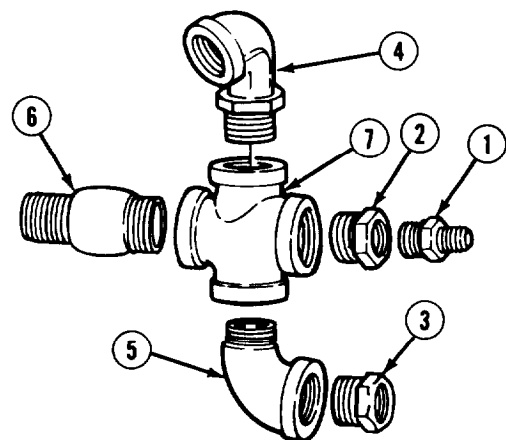


b. Disassembly.

NOTE

Observe position of fittings prior to removal to aid in installation.

- (1) Remove adaptor (1) and two bushings (2 and 3).
- (2) Remove two elbows (4 and 5) and king nipple (6) from cross (7).



4-148. HYDRAULIC CROSS REPLACEMENT/REPAIR (CONT).

c. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all threads on fittings and cross with drycleaning solvent.

WARNING

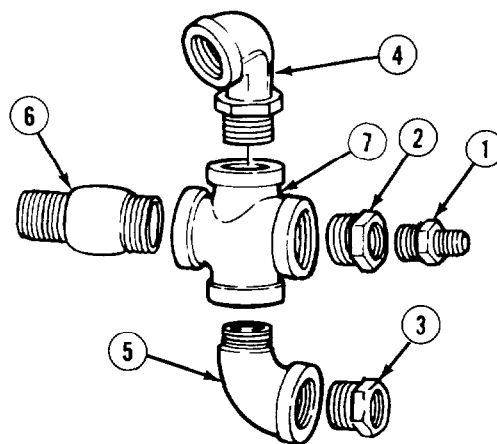
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

- (2) Dry all parts with compressed air.
- (3) Check for damaged parts.
- (4) Replace damaged parts.

d. Assembly.

WARNING

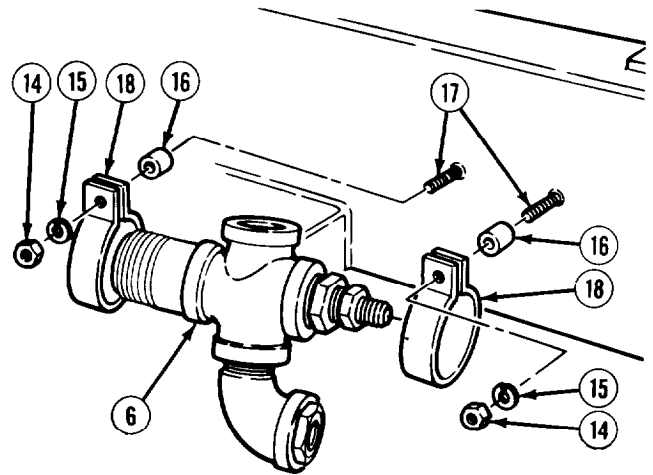
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.



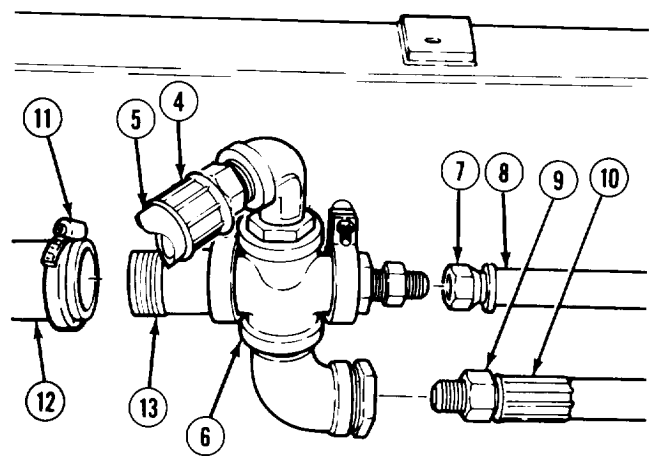
- (1) Apply hydraulic sealant to threads of king nipple (6) and two elbows (4 and 5).
- (2) Install king nipple (6) and two elbows (4 and 5) on cross (7).
- (3) Apply hydraulic sealant to threads of two bushings (2 and 3) and adaptor (1).
- (4) Install two bushings (2 and 3) and adaptor (1).

e. Installation.

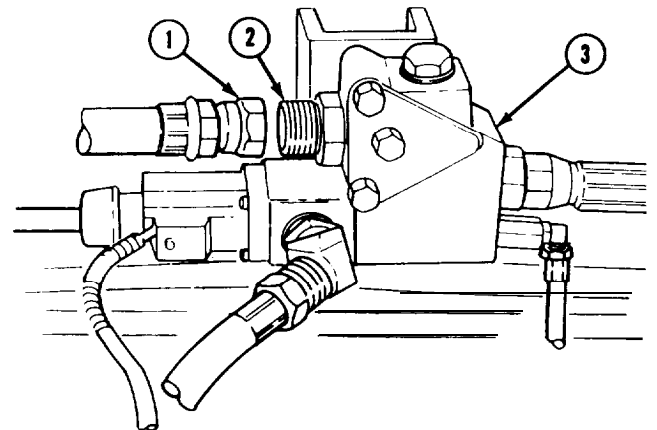
- (1) Install two spacers (16) on studs (17).
- (2) Install two clamps (18) and cross (6) on two studs (17).
- (3) Install two lockwashers (15), and nuts (14) on studs (17).



- (4) Connect hose (12) on king nipple (13) and tighten clamp (11) on cross (6).
- (5) Connect hose (10) and tighten fitting (9).
- (6) Connect hose (8) and tighten fitting (7).
- (7) Connect hose (5) and tighten fitting (4) on cross (6).



- (8) Connect hose (1) on fitting (2) of flow control valve (3).
- (9) Remove container and dispose of hydraulic fluid in accordance with local regulations.



NOTE

Follow-on maintenance:

- Install forward floor plate (para 4-132).
- Lower aft floor deck (para 2-15).
- Turn on hydraulic valve (para 2-18).
- Check hydraulic fluid level and add fluid as needed (para 3-11).

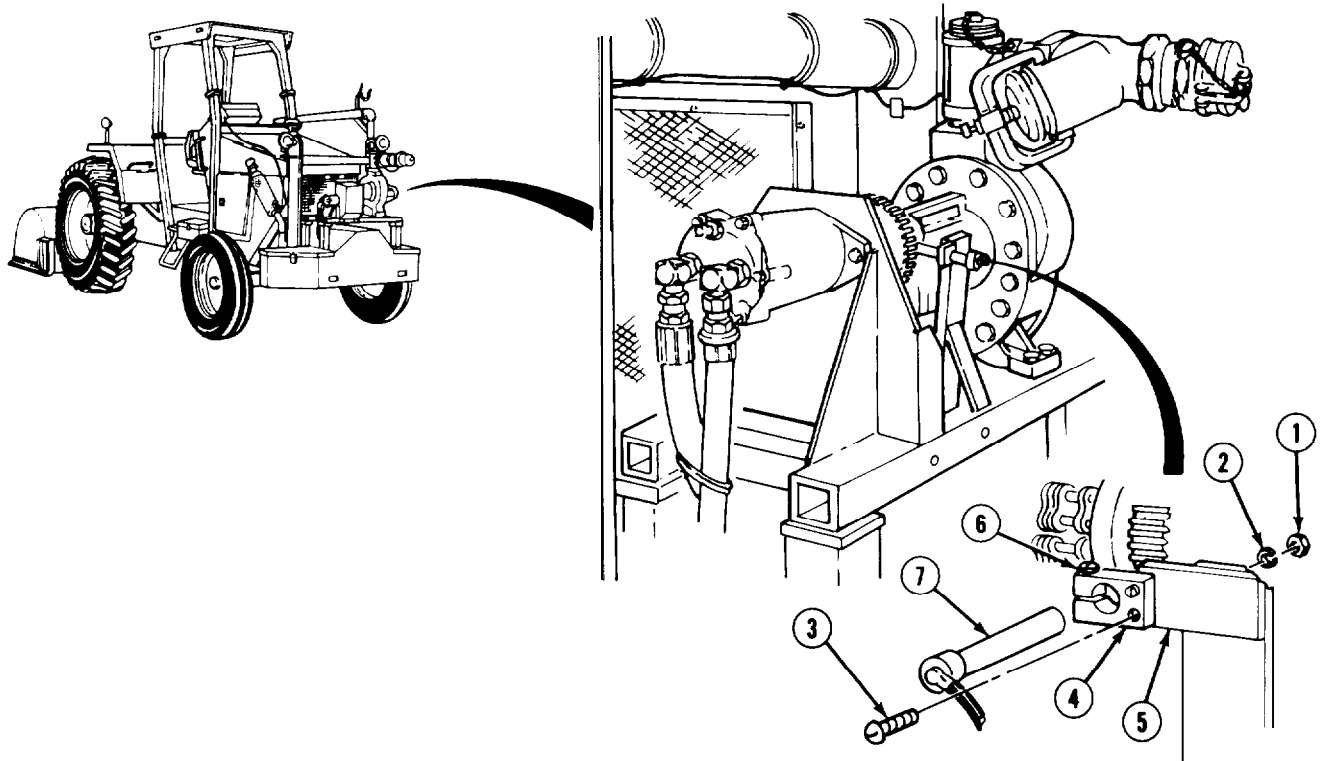
END OF TASK

4-149. HYDRAULIC/FUEL TANK REPLACEMENT.

The hydraulic reservoir and fuel tank are welded together; for this reason replacement procedures for hydraulic reservoir will be found under para 4-49 Fuel/Hydraulic Tank Replacement.

4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT.												
This task covers:												
a. Removal	b. Cleaning/Inspection	c. Installation										
INITIAL SETUP												
<i>Tools</i> Tool kit, general mechanic's: automotive Wrench, torque	<i>Materials/Parts</i> Ties, plastic (item 57, appendix E) Rubber wiper (para F-13, appendix F)											
<i>Materials/Parts</i> Lockwashers (14) Locknut Cloth, lint-free (item 12, appendix E) Solvent, drycleaning (item 54, appendix E)	<i>Equipment Condition</i> <table border="0"> <tr> <td><i>TM or Para</i></td> <td><i>Condition Description</i></td> </tr> <tr> <td>Para 4-130</td> <td>Additive access cover removed.</td> </tr> <tr> <td>Para 2-13</td> <td>Parking brake set.</td> </tr> <tr> <td>Para 4-90</td> <td>Negative battery cables disconnected.</td> </tr> <tr> <td>Para 4-153</td> <td>Additive coupling guard removed.</td> </tr> </table>	<i>TM or Para</i>	<i>Condition Description</i>	Para 4-130	Additive access cover removed.	Para 2-13	Parking brake set.	Para 4-90	Negative battery cables disconnected.	Para 4-153	Additive coupling guard removed.	
<i>TM or Para</i>	<i>Condition Description</i>											
Para 4-130	Additive access cover removed.											
Para 2-13	Parking brake set.											
Para 4-90	Negative battery cables disconnected.											
Para 4-153	Additive coupling guard removed.											

a. *Removal.*



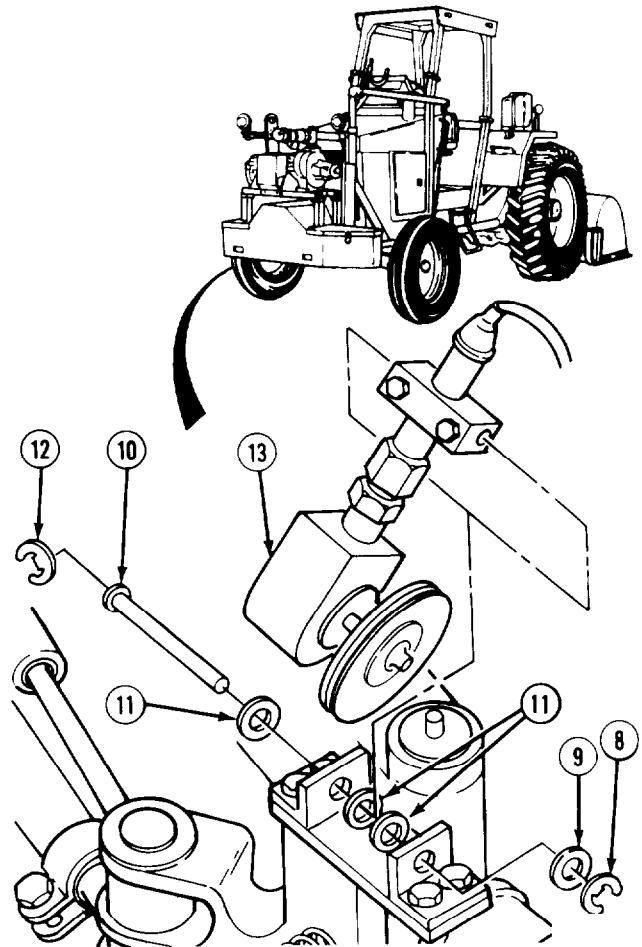
NOTE

Pump speed and ground travel speed sensor wires go through same conduit and are difficult to remove separately.

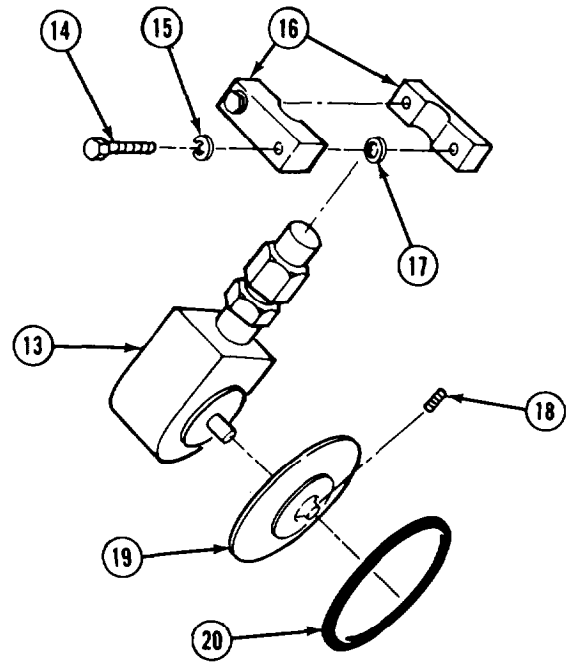
- (1) Remove two nuts (1), lockwashers (2), screws (3), and clamp (4) from bracket (5). Discard lockwashers.
- (2) Remove screw (6) and proximity sensor (7) from clamp (4).

4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT (CONT).

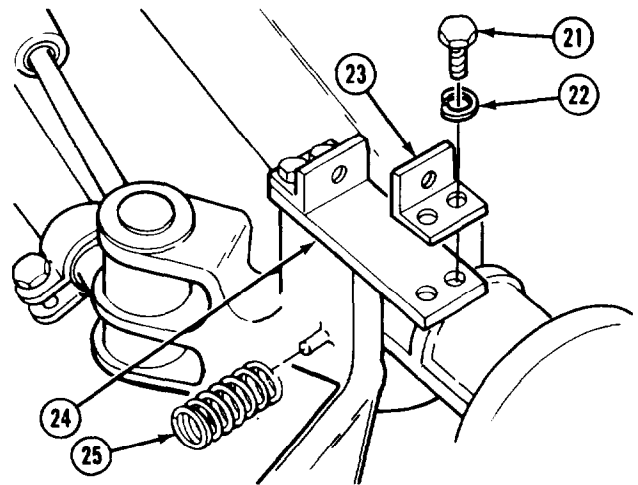
- (3) Remove retaining ring (8) and washer (9) from ground pin (10).
- (4) Note position and remove pin (10), three washers (11), retaining ring (12) and sensor unit (13).



- (5) Remove two screws (14), lockwashers (15), bracket halves (16), and washers (17) from sensor unit (13). Discard lockwashers.
- (6) Remove setscrew (18) and wheel (19) from sensor unit (13).
- (7) Remove tire (20) from wheel (19).



- (8) Remove four screws (21), lockwashers (22), and two brackets (23) from mount (24). Discard lockwashers.
- (9) Remove spring (25).

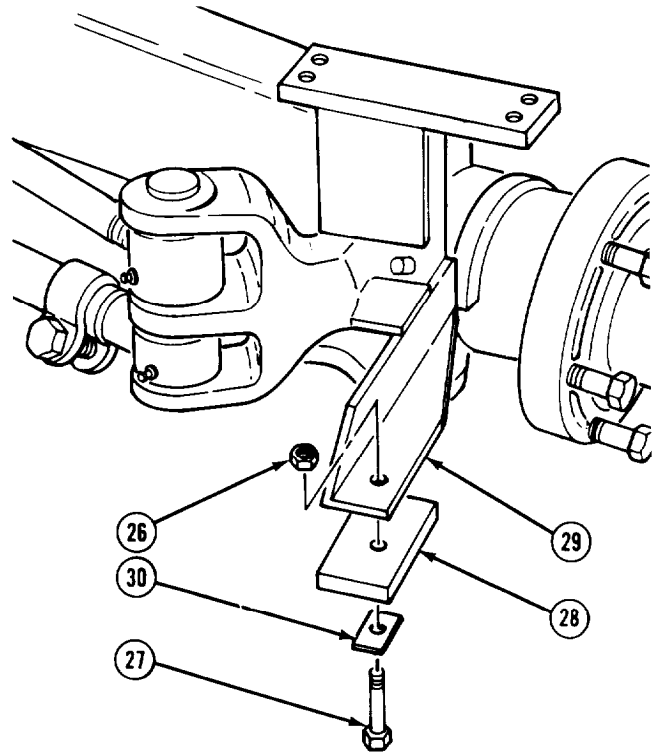


4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT (CONT).

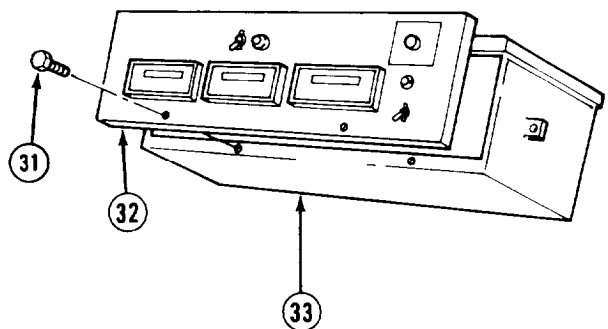
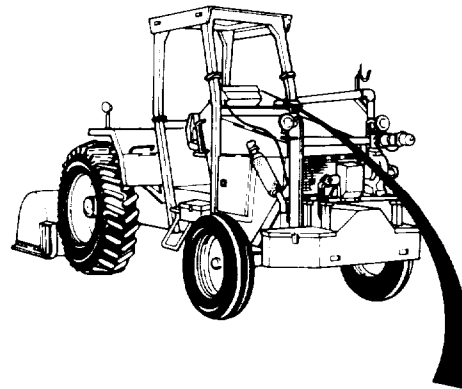
NOTE

Wiper mounting bracket is welded on front axle.

- (10) Remove locknut (26), screw (27), and rubber wiper (28) from wiper mounting bracket (29). Discard locknut.
- (11) Remove clamp plate (30) from rubber wiper (28) and discard rubber wiper.

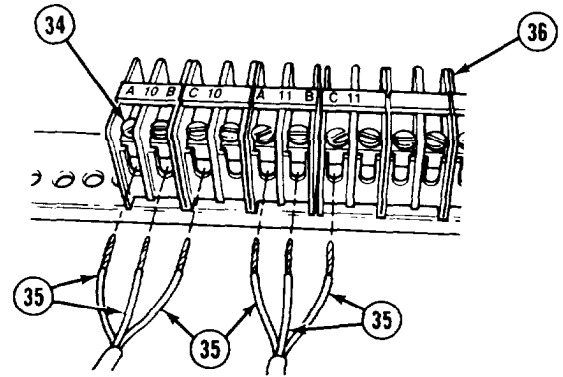


- (12) Remove two screws (31), and panel lid (32) from additive box (33).

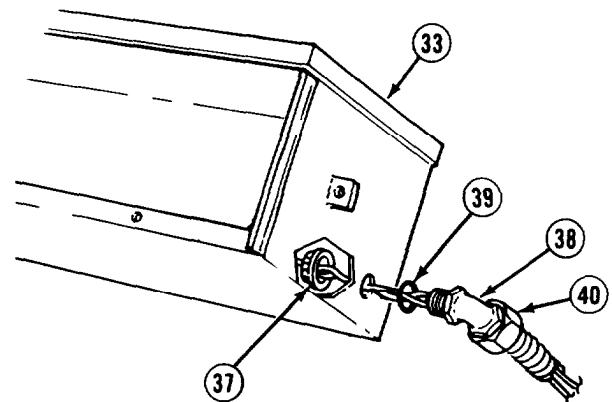


NOTE

- Cut plastic ties as necessary to remove cables.
 - Tag and mark wires before removal.
- (13) Loosen six screws (34) and remove six wires (35) from terminal board (36).

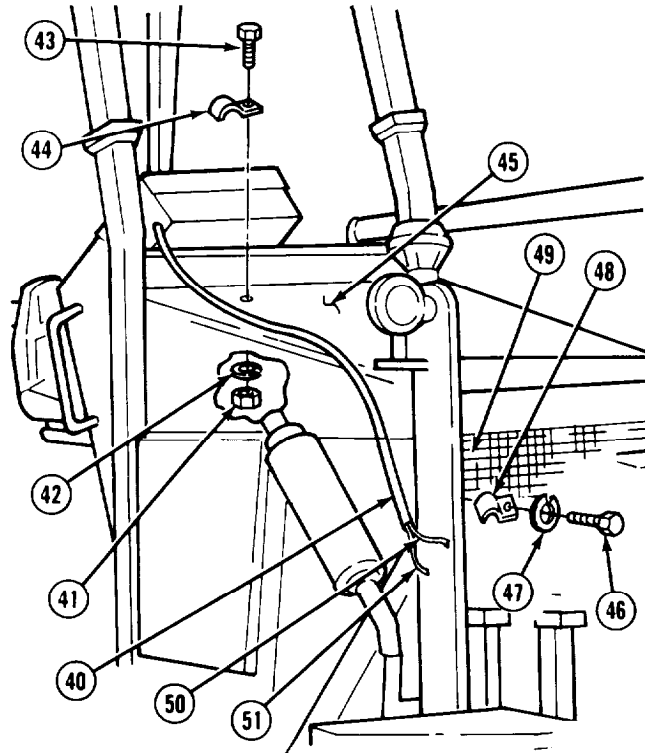


- (14) Remove nut (37) and elbow (38) from additive box (33).
- (15) If damaged, remove and discard preformed packing (39) from elbow (38).
- (16) Remove conduit (40) from elbow (38).



4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT (CONT.)

- (17) Remove two nuts (41), lockwashers (42), screws (43), clips (44) and conduit (40) from hood (45). Discard lockwashers.
- (18) Remove screw (46), lockwasher (47), clip (48) and conduit (40) from grille (49). Discard lockwasher.
- (19) Remove two cables (50 and 51) from conduit (40).



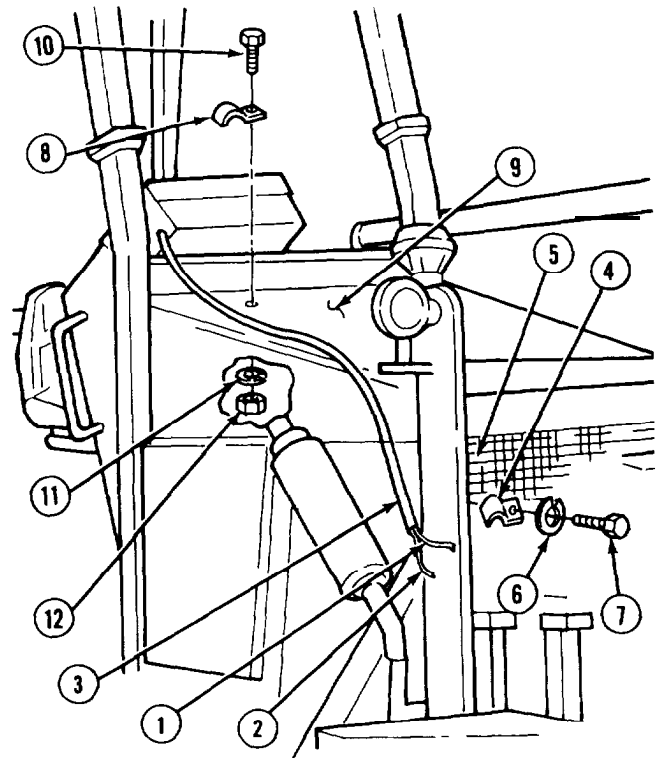
b. Cleaning/Inspection.

WARNING

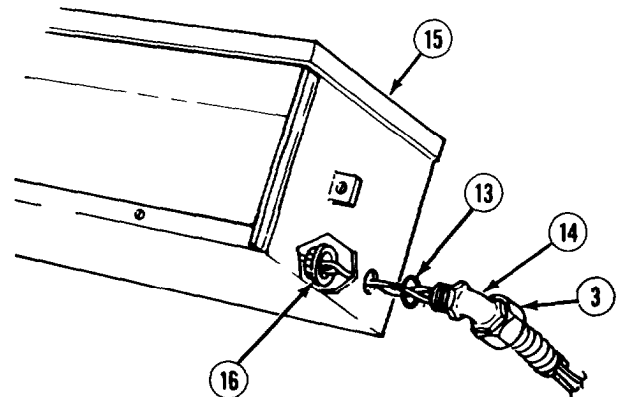
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean all parts with drycleaning solvent and dry with lint-free cloth or compressed air.
 - (2) Inspect all parts for cracks, dents, damage.
 - (3) Replace all damaged parts.

c. Installation.

- (1) Install two cables (1 and 2) in conduit (3).
- (2) Install conduit (3) and clip (4) on grille (5) with lockwasher (6) and screw (7).
- (3) Install conduit (3) and two clips (8) on hood (9) with two screws (10), lockwasher (11), and nuts (12).



- (4) If removed, install preformed packing (13) on elbow (14).
- (5) Install elbow (14) on box (15) with nut (16).
- (6) Install conduit (3) to elbow (14).

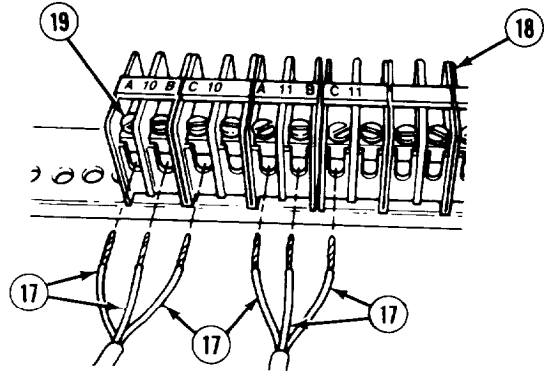


4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT (CONT).

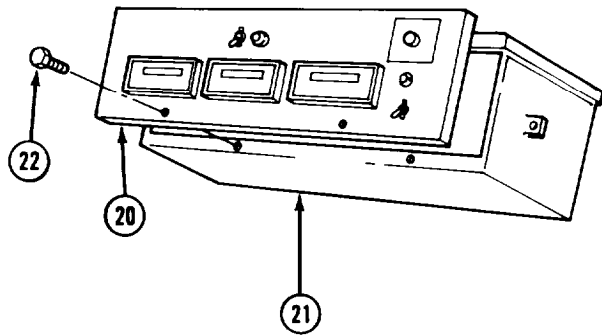
NOTE

Use plastic ties as necessary to attach cables to vehicle.

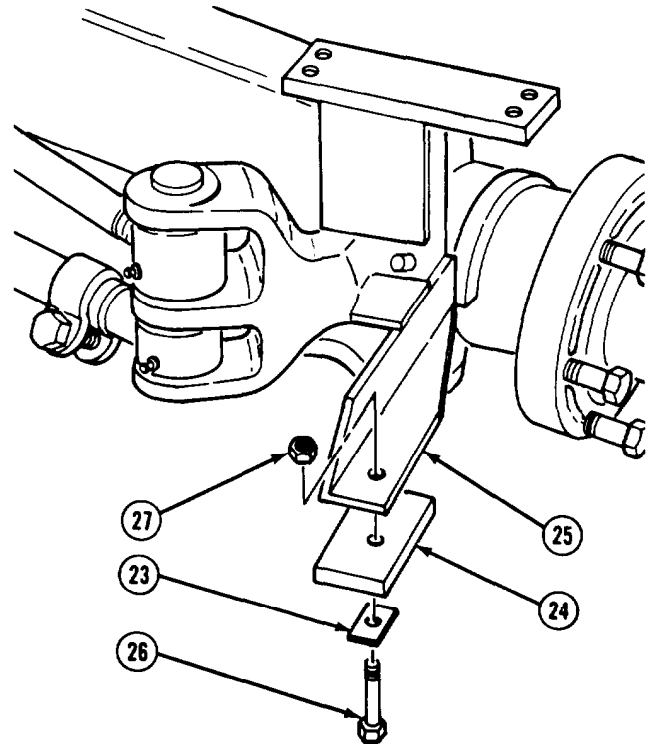
- (7) Install six wires (17) on terminal board (18) with six screws (19).



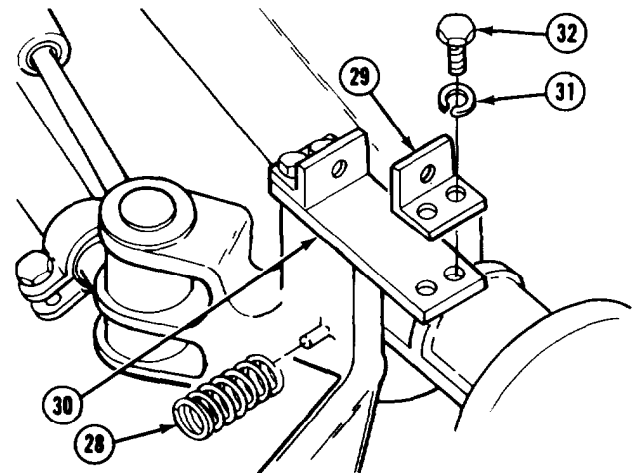
- (8) Install panel lid (20) on additive control box (21) with and screws (22). Tighten screws 180 lb-in (20 N•m).



- (9) Install clamp plate (23) in rubber wiper (24).
- (10) Install rubber wiper (24) on wiper mounting bracket (25) with screw (26) and locknut (27).

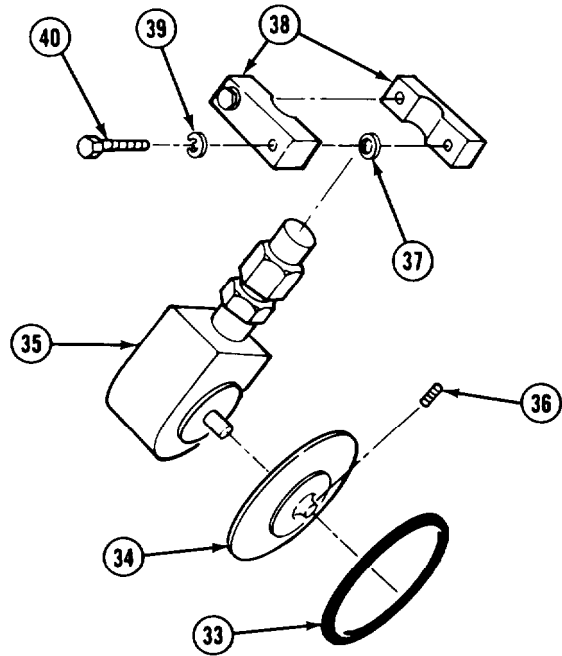


- (11) Install spring (28).
- (12) Loosely install two brackets (29) on mount (30) with four lockwashers (31) and screws (32).

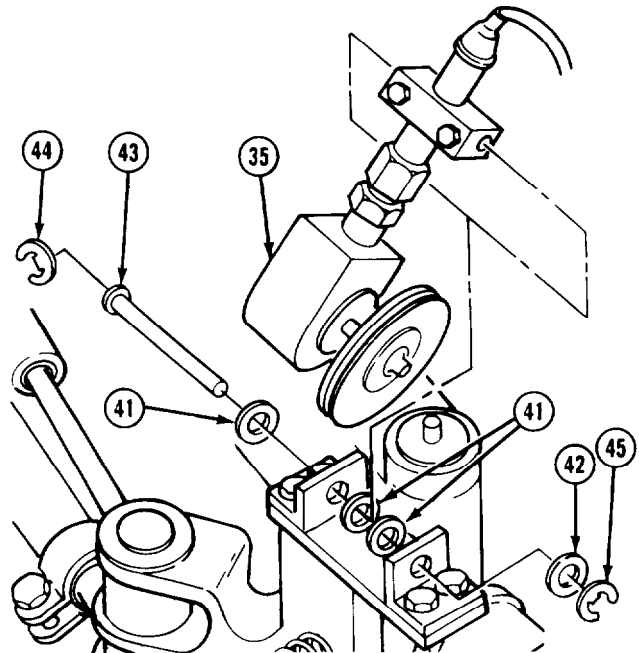


4-150. PUMP SPEED/GROUND SPEED TRAVEL SENSOR REPLACEMENT (CONT).

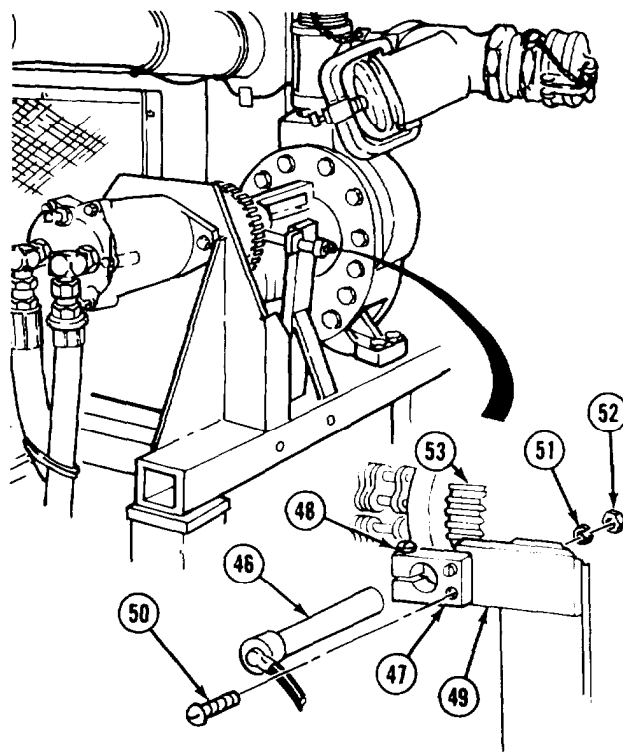
- (13) Install tire (33) on wheel (34).
- (14) Install wheel (34) on sensor unit (35) with setscrew (36).
- (15) Install two washers (37) between bracket halves (38) and install on sensor unit (35) with two lockwashers (39) and screws (40).



- (16) Install sensor unit (35) and four washers (41) with pin (43) and two retaining rings (44 and 45).



- (17) Loosely install proximity sensor (46) in clamp (47) with screw (48).
- (18) Install clamp (47) on bracket (49) with two screws (50), lockwasher (51), and nuts (52).
- (19) Using feeler gauge, measure 0.0020 in. (0.051 mm) between proximity sensor (46) and gear wheel (53); tighten screw (48) securely.



NOTE

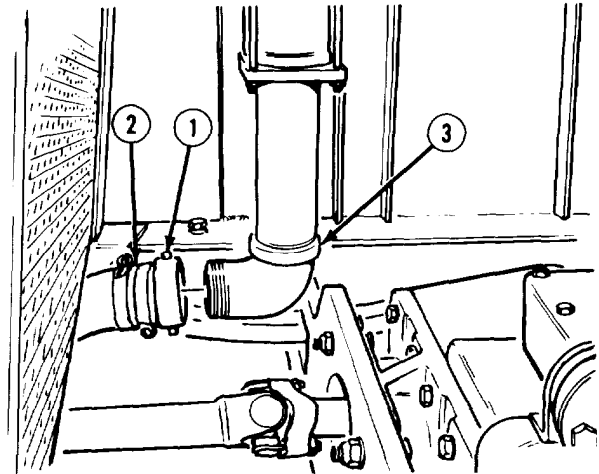
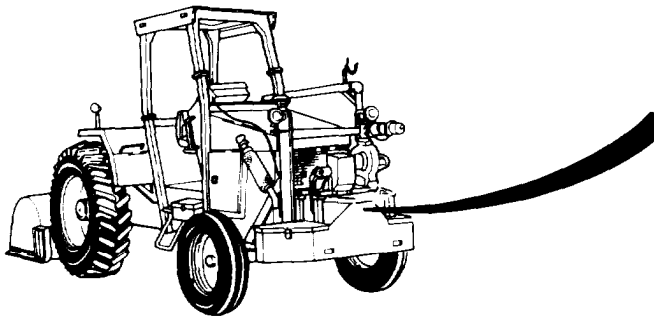
Follow-on maintenance:

- Install additive coupling guard (para 4-153).
- Connect negative battery cables (para 4-90).

END OF TASK

4-151. ADDITIVE (MIXER) PUMP ASSEMBLY REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Personnel Required</i>	
Tool kit, general mechanic's: automotive	MOS62B, Construction equipment repairer (2)	
Lifting device (capacity 500 lb [227 kg])	<i>Equipment Condition</i>	
Wrench, torque	TM or Para Para 4-97	<i>Condition Description</i> Hydrostatic pump cover removed.
Suitable container (capacity 5 gal. (19 liters))	Para 4-150	Pump speed sensor removed.
<i>Materials/Parts</i>	Para 4-152	Additive chain removed.
Lockwashers (4)		

a. Removal.



NOTE

Place suitable container with a 5 gallon (19 liters) capacity under pipe to catch spilling fluid.

(1) Loosen fitting (1) and remove hose (2) from pipe (3).

- (2) Matchmark pump (4) and mount (5).
- (3) Remove four nuts (6), lockwashers (7), and screws (8). Discard lockwashers.

WARNING

Additive pump weighs 297 lb. (135 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (4) While mechanic operates suitable lifting device, assistant guides additive pump (4) from mount (5).

b. Installation.

WARNING

Additive pump weighs 297 lb. (135 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

- (1) While mechanic operates suitable lifting device, assistant positions additive pump (4) on mount (5) and aligns matchmarks.
- (2) Install four screws (8), lockwashers (7), and nuts (6). Tighten nuts 75 lb-ft (102 N•m).
- (3) Position hose (2) on pipe (3) and tighten fitting (1).

NOTE

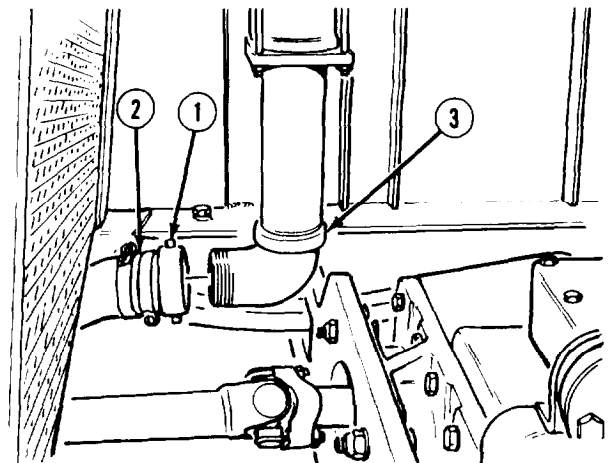
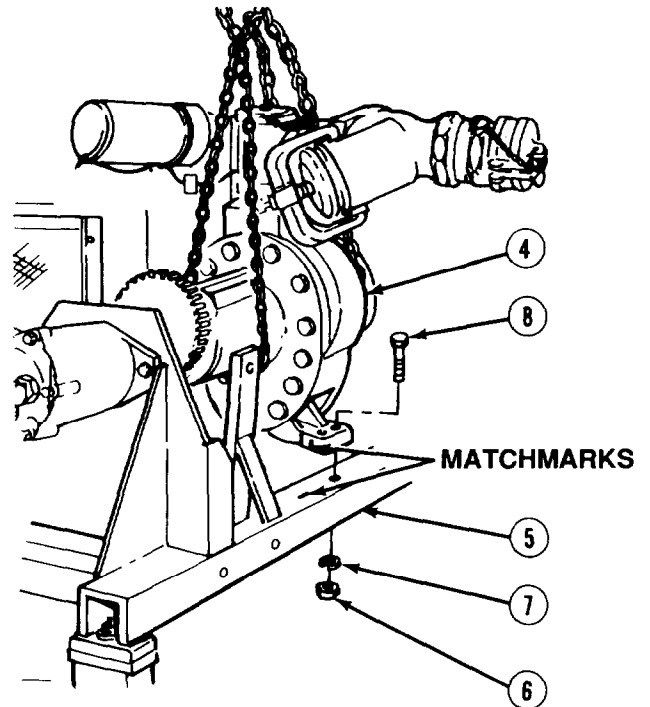
Follow-on Maintenance:

Install additive chain (para 4-152).

Install pump speed sensor (para 4-150).

Install hydrostatic pump cover (para 4-97).

END OF TASK



4-152. ADDITIVE CHAIN REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

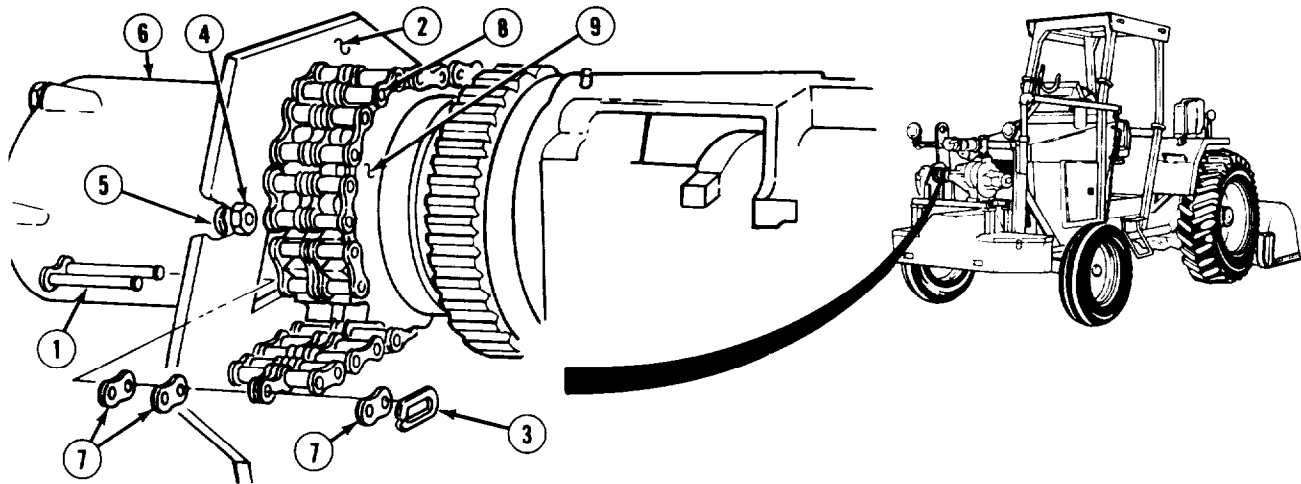
Equipment Condition

TM or Para
Para 4-90

Condition Description

Negative battery cables disconnected.
Additive coupling guard removed.

a. Removal.



NOTE

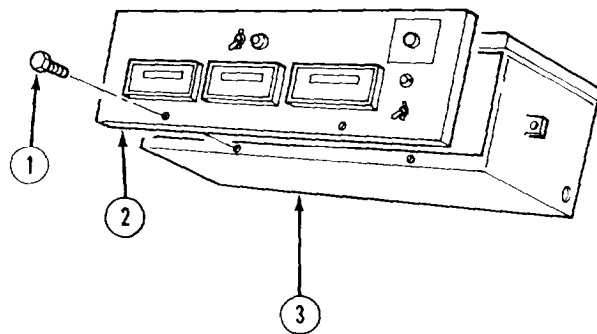
Refer to paragraph 2-12, steps 4, 5, and 6 to center master link.

- (1) Center master link pin (1) over hole in bottom of bracket (2).
- (2) Remove link retainer (3).
- (3) Loosen two nuts (4) on two screws (5) attaching motor (6) to bracket (2).
- (4) Raise motor (6) and remove master link pin (7), three spacers (8), and chain (9) from sprocket (10).

b. Installation.

- (1) Install chain (9) on sprocket (10) with three spacers (8) and master link pin (7).
- (2) Tighten two nuts (4) on screws (5) attaching motor (6) to bracket (2).

- (3) Install link retainer (3) on master link pin (1).



NOTE

Follow-on Maintenance:

- Install additive coupling guard (para 4-153).
- Connect negative battery cable (para 4-90).

END OF TASK

4-153. ADDITIVE COUPLING GUARD REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

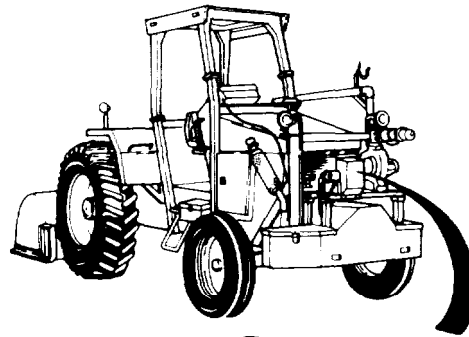
Tool kit, general mechanic's: automotive

Materials/Parts

Lockwashers (3)

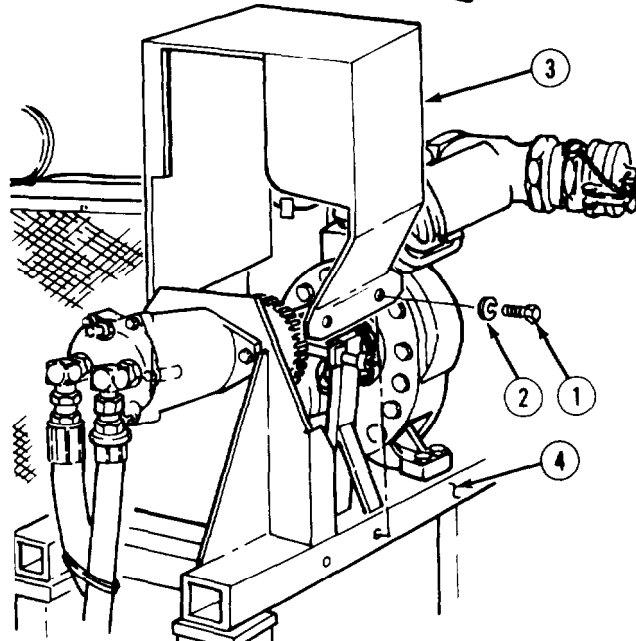
a. Removal.

- (1) Remove three screws (1) and lockwashers (2). Discard lockwashers.
- (2) Remove coupling guard (3) from pump frame (4).



b. Installation.

- (1) Position coupling guard (3) on pump frame (4).
- (2) Install three lockwashers (2) and screws (1).



END OF TASK

4-154. ADDITIVE PUMP STRAINER AND CONNECTIONS REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Shop equipment, organizational repair: light truck mounted

Material/Parts

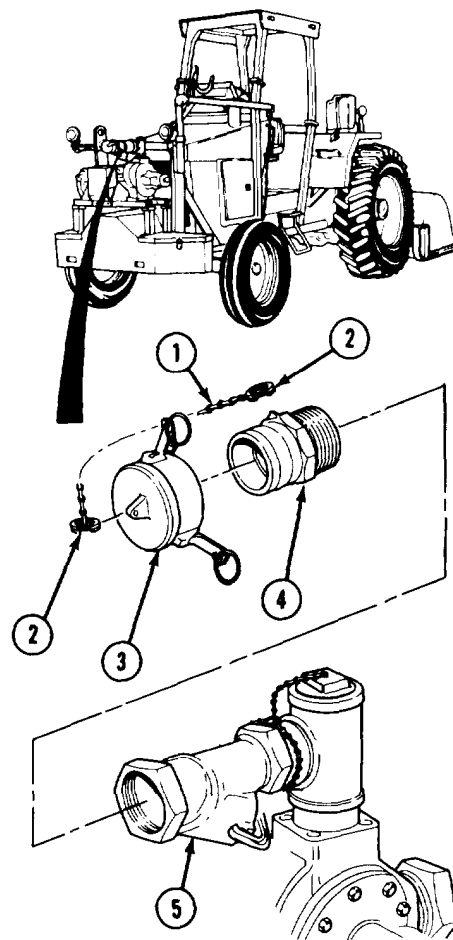
- Gasket
- Locknut
- Cloth, lint-free (item 12, appendix E)
- Sealant, hydraulic (item 52, appendix E)
- Solvent, drycleaning (item 54, appendix E)

Equipment Condition

- | | |
|-------------------|------------------------------|
| <i>TM or Para</i> | <i>Condition Description</i> |
| Para 2-13 | Parking brake set. |

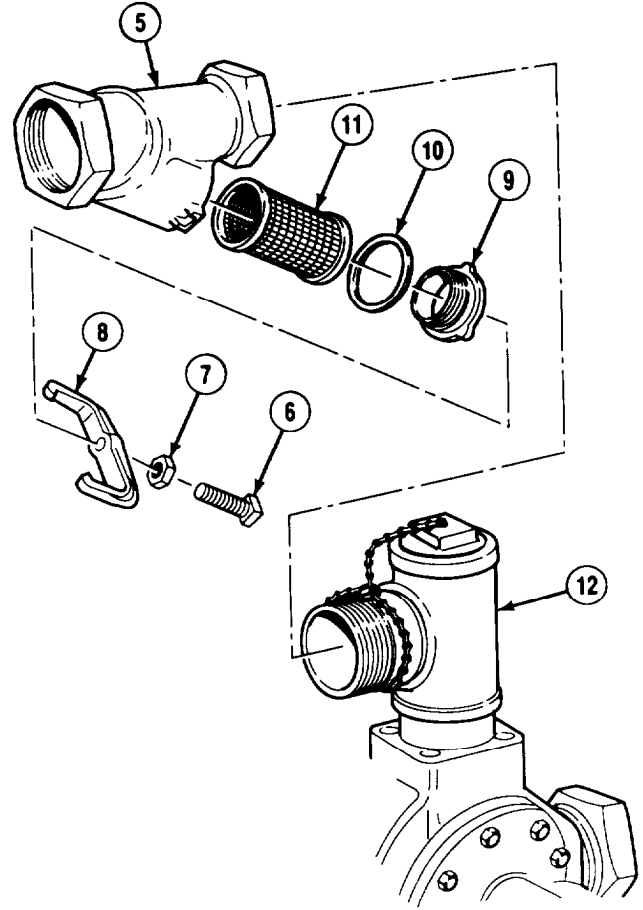
a. Removal.

- (1) Disconnect chain (1) from two split rings (2) and remove dust cap (3) from adaptor (4).
- (2) Remove adaptor (4) from strainer housing (5).
- (3) If damaged, remove two split rings (2) from dust cap (3) and adaptor (4).

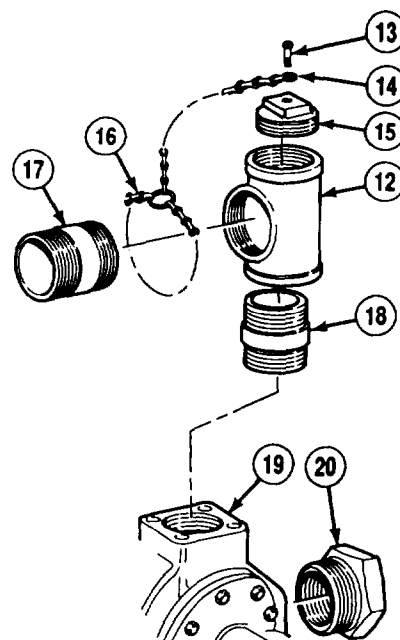


4-154. ADDITIVE PUMP STRAINER AND CONNECTIONS REPLACEMENT (CONT).

- (4) Remove screw (6), locknut (7), and yoke (8) from cap (9). Discard locknut.
- (5) Remove cap (9), gasket (10), and strainer (11) from strainer housing (5). Discard gasket.
- (6) Remove strainer housing (5) from tee (12).



- (7) Remove screw (13) and chain (14) from Plug (15).
- (8) Remove plug (15) from tee (12).
- (9) Remove chain (14) and split ring (16) from nipple (17).
- (10) Remove tee (12) with two nipples (17 and 18) from additive pump (19).
- (11) If damaged, place tee (12) in vise and remove two nipples (17 and 18) from tee (12).
- (12) If damaged, remove plug (20) from additive pump (19).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

- (1) Clean all metal parts and strainer with drycleaning solvent. Dry all metal parts with clean lint-free cloth or compressed air.
- (2) Inspect all parts for crack, wear, damaged threads, or missing parts.
- (3) Replace all damaged or missing parts.

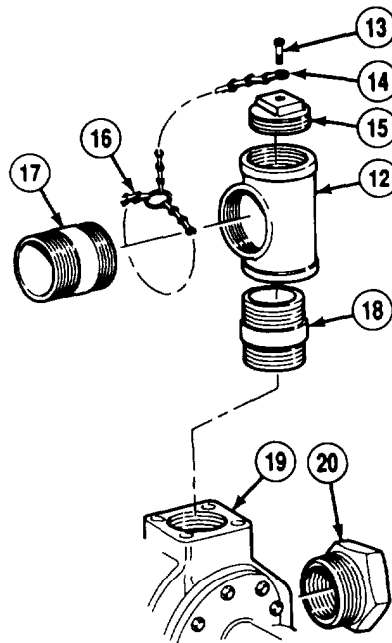
4-154. ADDITIVE PUMP STRAINER AND CONNECTIONS REPLACEMENT (CONT).

c. Installation.

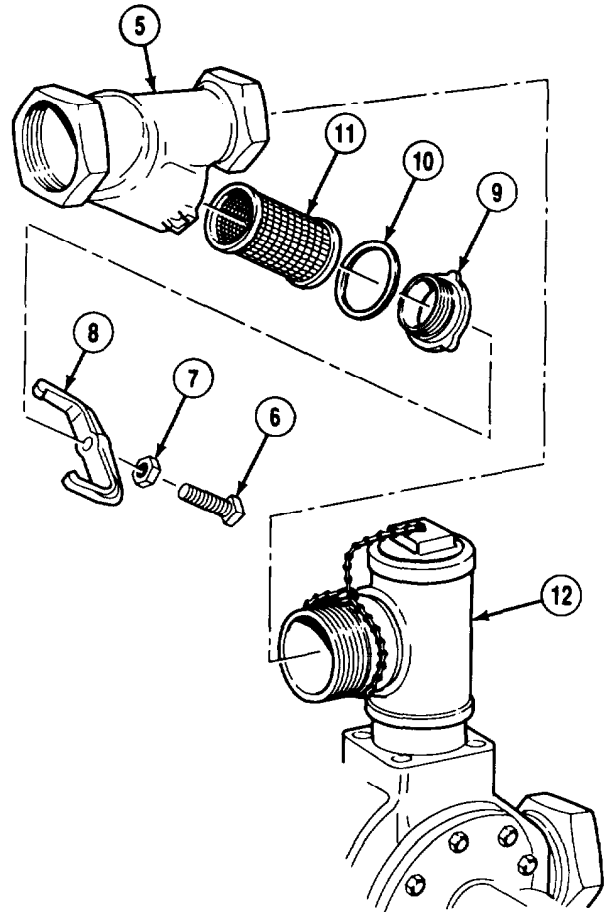
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) If removed, apply hydraulic sealant to threads of plug (20) and install plug on additive pump (19).
- (2) If removed, Apply hydraulic sealant to threads of two nipples (17 and 18) and install nipples in tee (12).
- (3) Install tee (12) on additive pump (19).
- (4) Install chain (14) and split ring (16) on nipple (17).
- (5) Apply hydraulic sealant to plug (15) and install plug (15) in tee (12).
- (6) Install chain (14) and screw (13) on plug (15).

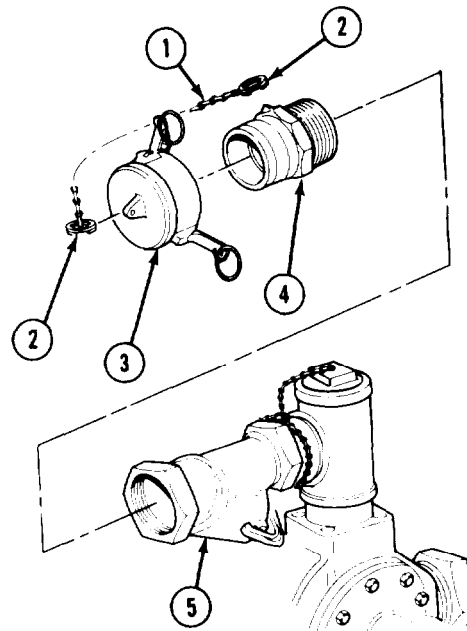


- (7) Apply hydraulic sealant to threads of strainer housing (5) and install strainer housing on tee (12).
- (8) Install strainer (11), gasket (10) and cap (9) in strainer housing (5).
- (9) Install yoke (8), locknut (7), and screw (6) on cap (9).



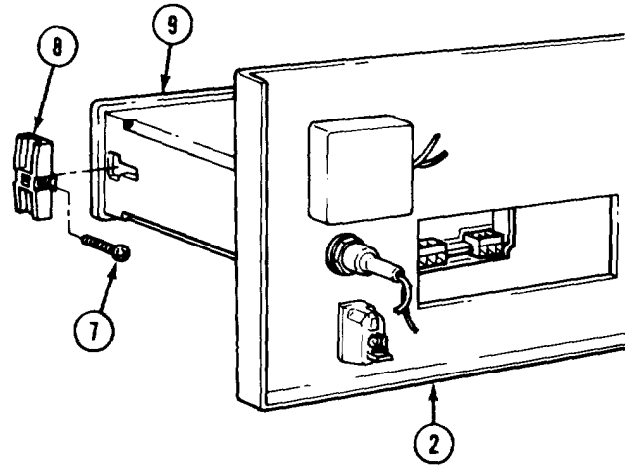
4-154. ADDITIVE PUMP STRAINER AND CONNECTIONS REPLACEMENT (CONT).

- (10) If removed, install two split rings (2) on adaptor (4) and dust cap (3).
- (11) Apply hydraulic sealant to threads of adaptor (4) and install on strainer housing (5).
- (12) Install dust cap (3) on adaptor (4).
- (13) Install chain (1) on two split rings (2).

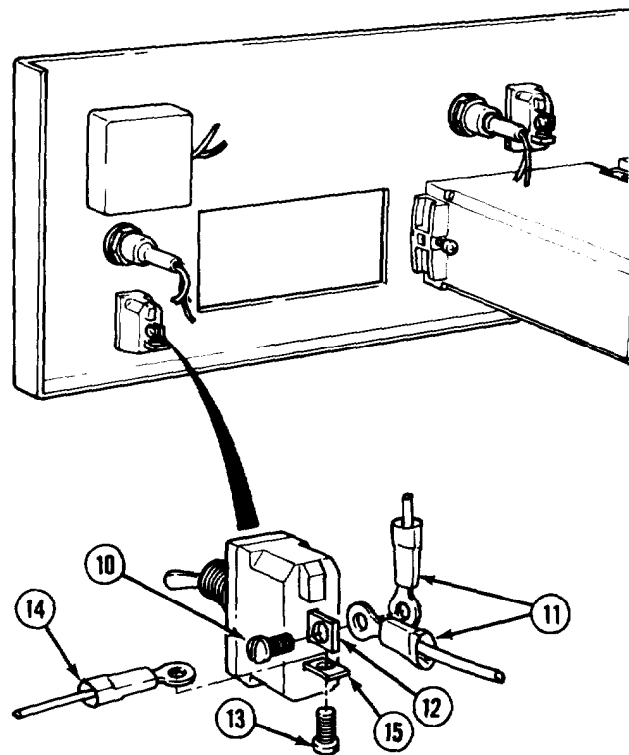


4-155. ADDITIVE INSTRUMENT PANEL REPAIR (CONT).

- (3) Remove two screws (7) from brackets (8).
- (4) Remove meter (9) from panel (2).



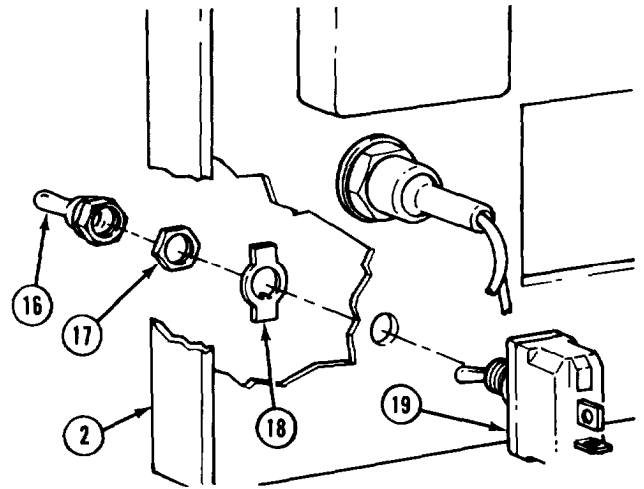
- (5) Remove screw (10). Tag, mark and remove two wires (11) from bracket (12).
- (6) Remove screw (13). Tag, mark and remove wire (14) from bracket (15).



NOTE

Both toggle switches are removed the same way. Steps (7) and (8) show right hand switch.

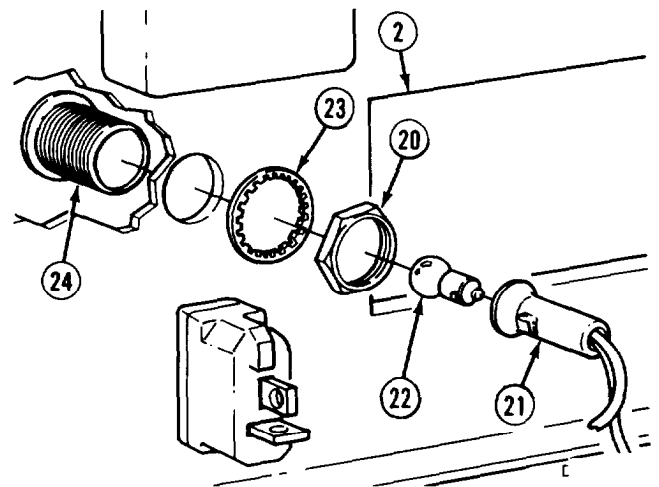
- (7) Remove rubber boot (16), jamnut (17) and washer (18) from front of panel (2).
- (8) Remove toggle switch (19) from rear of panel (2).



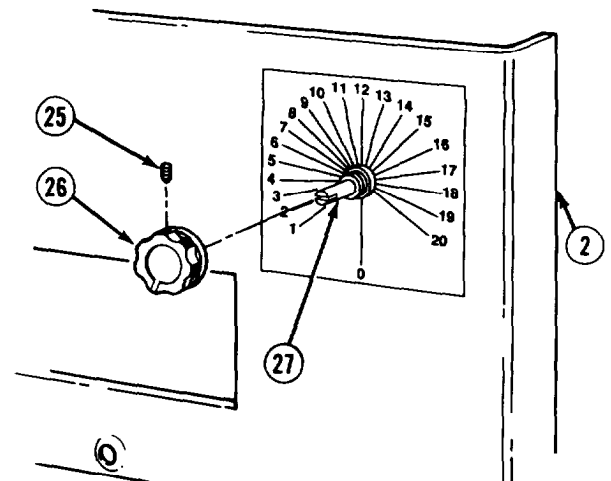
NOTE

Both lamp sockets are removed the same way. Steps (9) and (11) show right hand socket.

- (9) Loosen jamnut (20) and remove lamp socket (21) from back of panel (2).
- (10) Remove lamp (22) from lamp socket (21).
- (11) Remove jamnut (20), star washer (23), and lamp housing (24). Discard star washer.

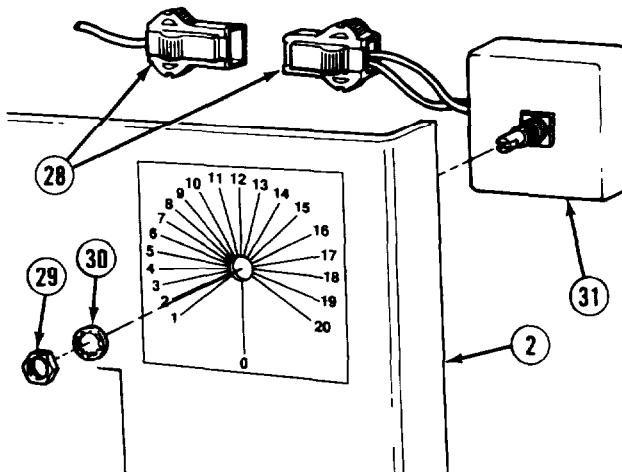


- (12) Loosen setscrew (25) and remove dial (26) from shaft (27) on panel (2).



4-155. ADDITIVE INSTRUMENT PANEL REPAIR (CONT).

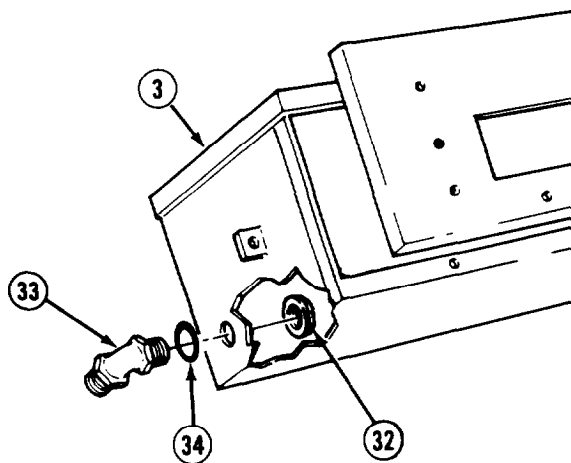
- (13) Disconnect plugs (28).
- (14) Remove jamnut (29), star washer (30), and flow control valve (31) from panel (2). Discard star washer.



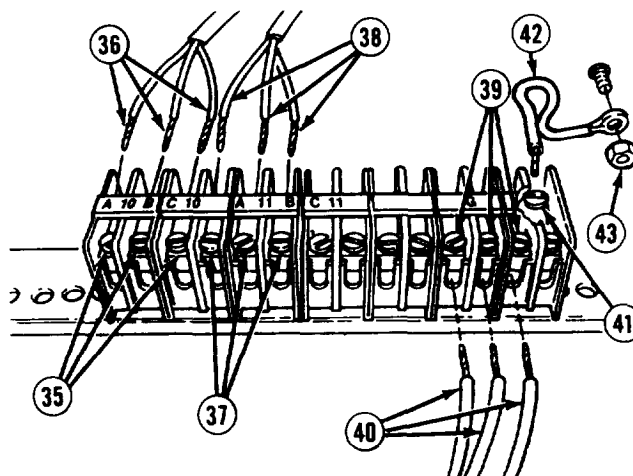
NOTE

Roth left and right elbows are removed the same way. Step (15) shows right hand elbow.

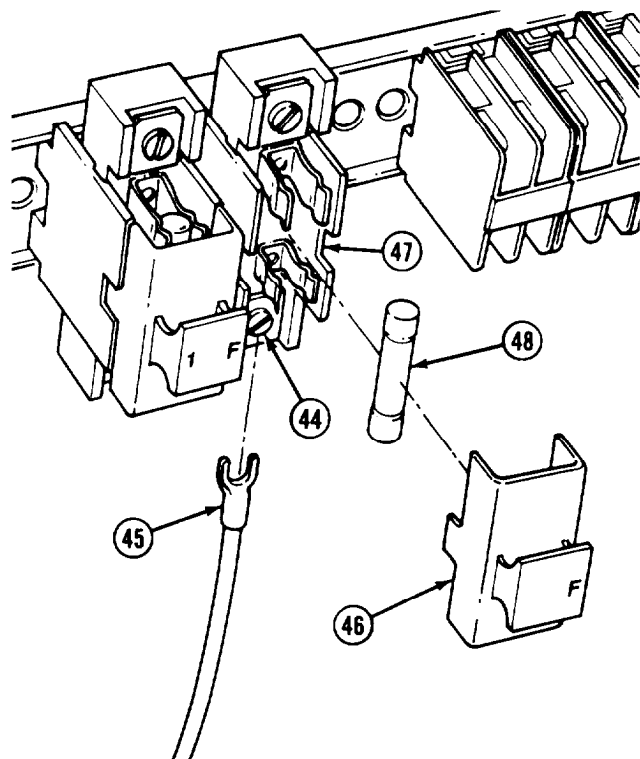
- (15) Remove nut (32), preformed packing (33), and elbow (34) from box (3). Discard preformed packing.



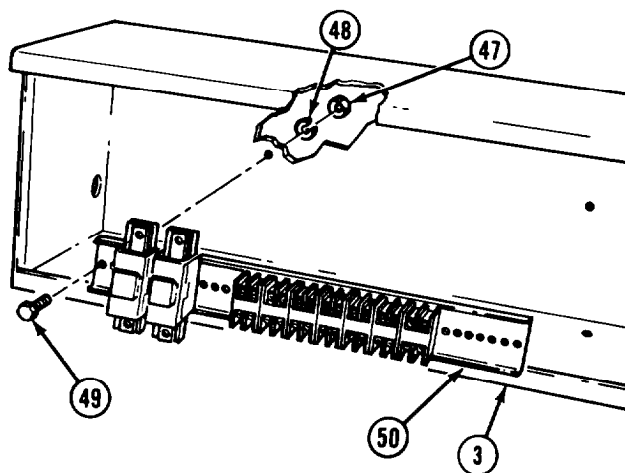
- (16) Loosen three screws (35). Tag, mark, and remove wires (36).
- (17) Loosen three screws (37). Tag, mark and remove wires (38).
- (18) Loosen three screws (39). Tag, mark and remove wires (40).
- (19) Loosen screw (41). Tag, mark and remove ground wire (42).
- (20) Remove nut (43). Tag, mark and ground wire (42).



- (21) Loosen two screws (44). Tag, mark and remove four wires (45).
- (22) Remove two fuse holders (46) from fuse port (47).
- (23) Remove two fuses (48) from fuse ports (46).



- (24) Remove two nuts (47), lockwashers (48) and screws (49) from terminal board (50). Discard lockwashers.
- (25) Remove terminal board (50) from box (3).



4-155. ADDITIVE INSTRUMENT PANEL REPAIR (CONT).

(26) Remove four nuts (51), lockwashers (52), and screws (53). Discard lockwashers.

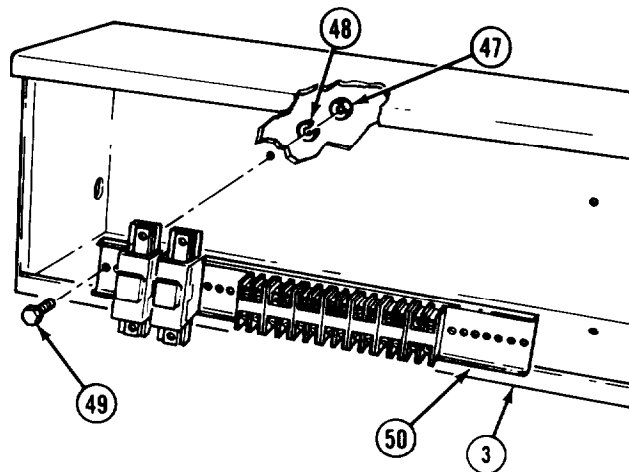
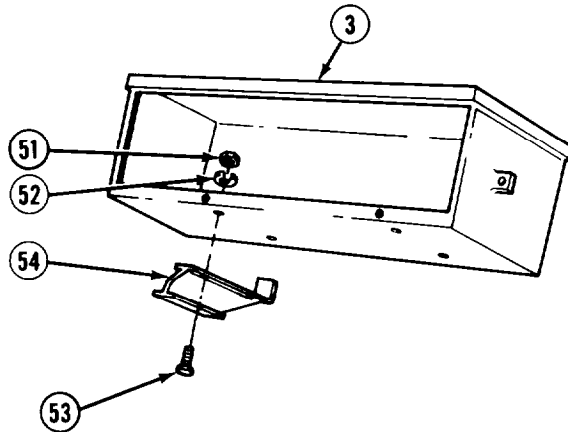
(27) Remove two box mounts (54) from box (3).

b. Inspection.

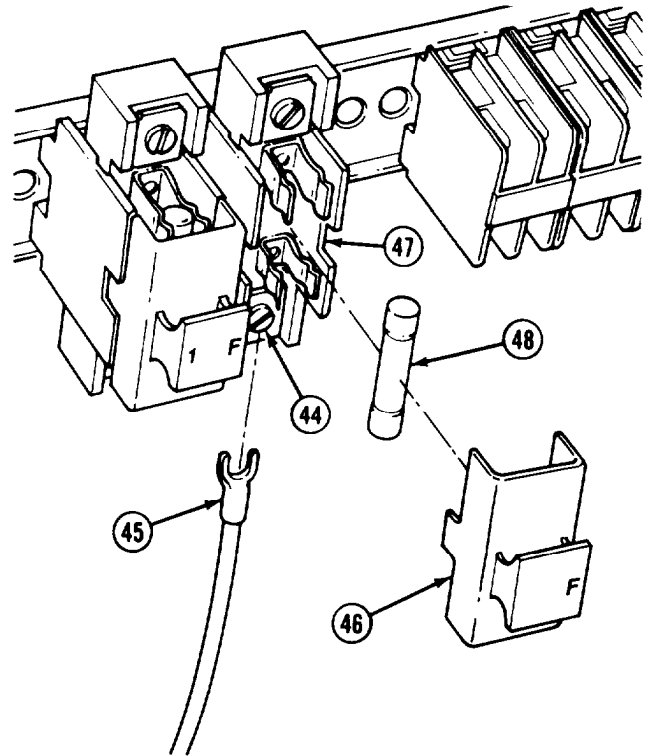
- (1) Wipe parts clean with lint-free cloth.
- (2) Check metal parts for damage.
- (3) Check wires, terminals, and fuses for cracks, burns, fraying, or other damage.
- (4) Test wires for continuity.
- (5) Replace damaged parts.

c. Assembly.

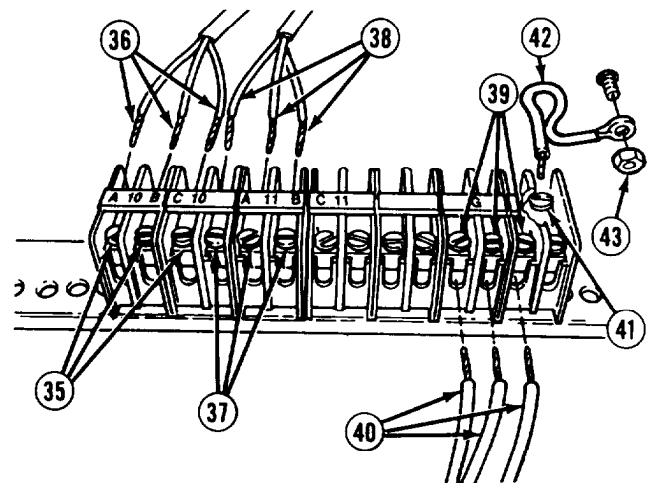
- (1) Install two box mounts (54) on box (3) with four screws (53), lockwashers (52), and nuts (51).
- (2) Install terminal board (50) in box (3) with two screws (49), lockwashers (48), and nuts (47).



- (3) Install two fuses (48) in fuse ports (47).
- (4) Install two fuse holders (46) in fuse ports (47).
- (5) Install four wires (45) and tighten two screws (44).



- (6) Install ground wire (42) with nut (43).
- (7) Install ground wire (42) and tighten screw (41).
- (8) Install three wires (40) and tighten screws (39).
- (9) Install three wires (38) and tighten screws (37).
- (10) Install three wires (36) and tighten screws (35).

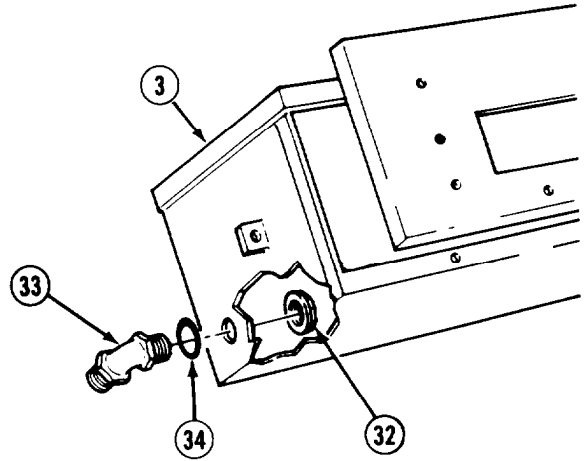


4-155. ADDITIVE INSTRUMENT PANEL REPAIR (CONT).

NOTE

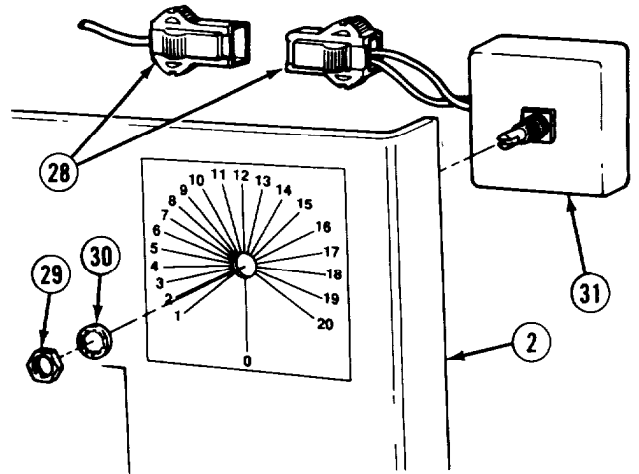
Both left and right elbows are installed the same way. Step (13) shows right hand elbow.

- (11) Install elbow (34) and preformed packing (33) in box (3) with nut (32).



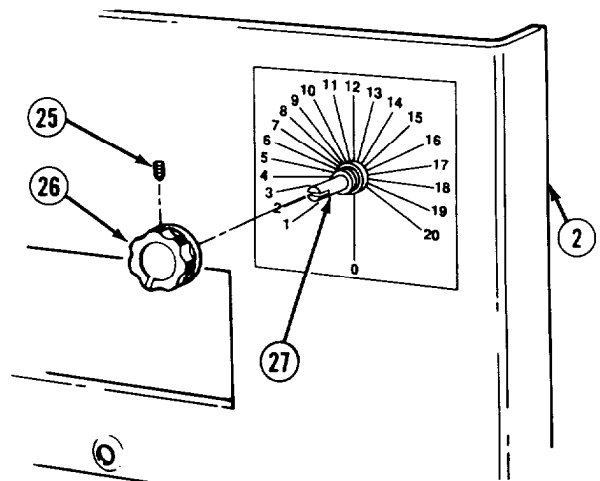
- (12) Install flow control valve (31), star washer (30), and jamnut (29) on panel (2).

- (13) Connect plugs (28).

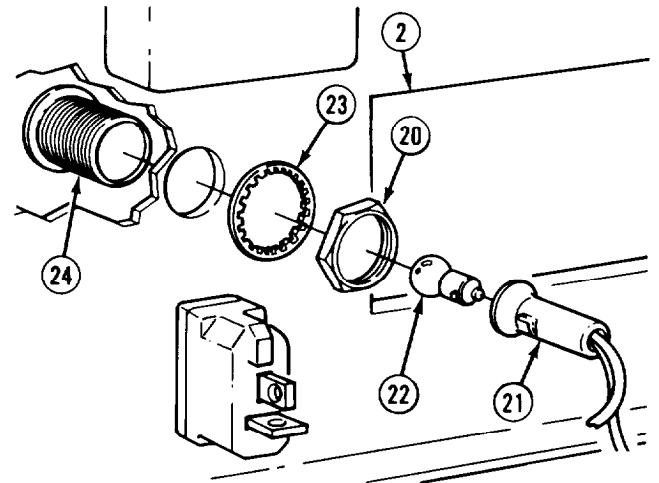


- (14) Install dial (25) on shaft (27) and panel (2).

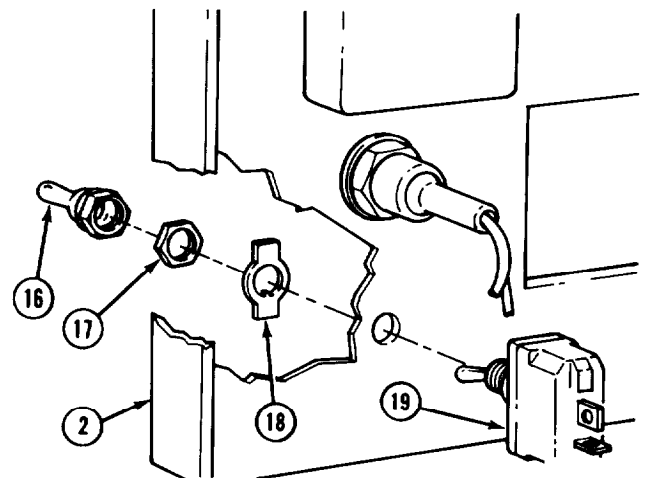
- (15) Tighten setscrew (25) in dial (26).



- (16) Install lamp (22) in lamp socket (21).
- (17) Install lamp socket (21) in panel (2).
- (18) Install jamnut (20) and star washer (23) on lamp housing (24).
- (19) Install lamp socket (21) in lamp housing (24).

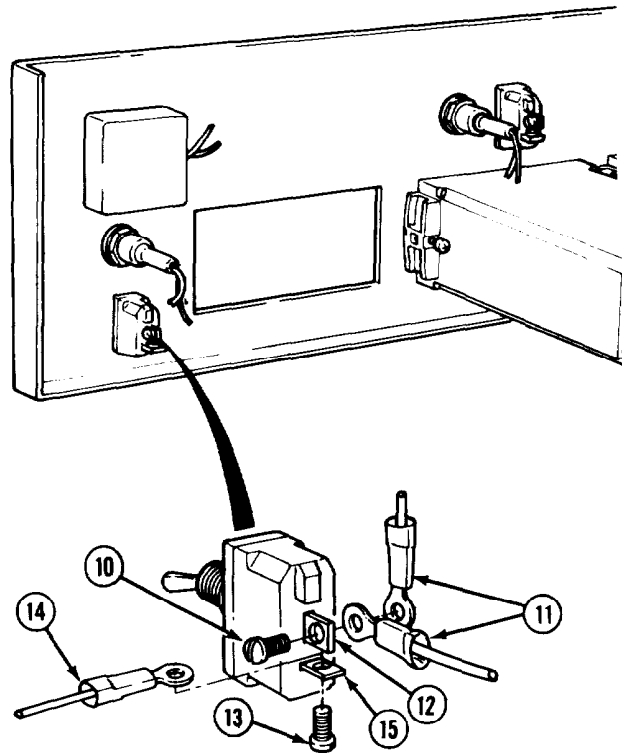


- (20) Install toggle switch (19) in panel (2).
- (21) Install washer (18), jamnut (17), and rubber boot (16) on toggle switch (19).

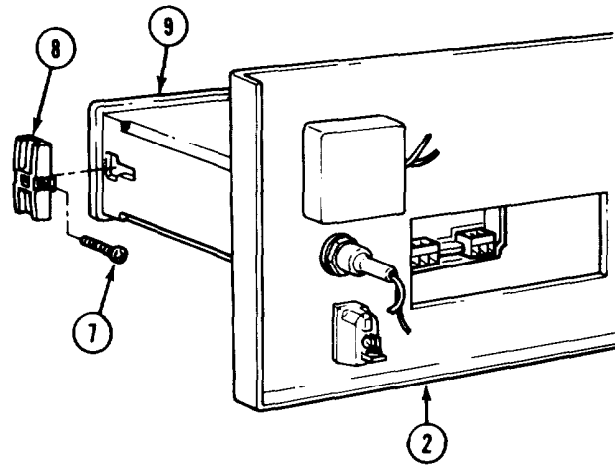


4-155. ADDITIVE INSTRUMENT PANEL REPAIR (CONT).

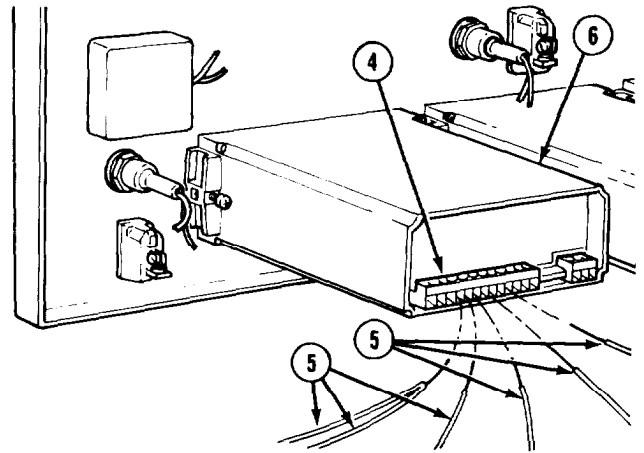
- (22) Install wire (14) on bracket (15) with screw (13).
- (23) Install wires (11) on bracket (12) with screw (10).



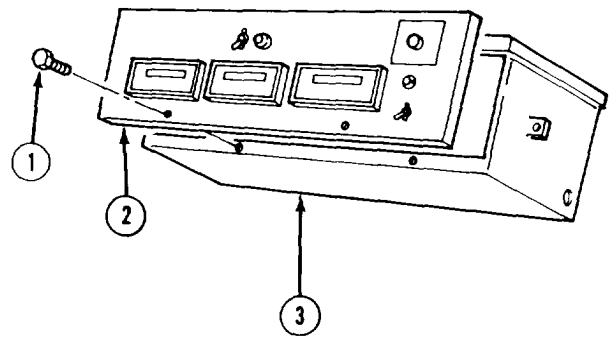
- (24) Install meter (9) in panel (2).
- (25) Install two brackets (8) and screws (7).



- (26) Install wires (5) in meter (6) and tighten screws (4).



- (27) Install panel (2) on box (3) with two screws (1).



NOTE

Follow-on Maintenance: Install additive control box (para 4-77).

END OF TASK

4-156. BAR STOPS AND SPRINGS REPLACEMENT.

This task covers:

a. Removal

b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 2-10[c]

Para 2-13

Condition Description

Rotor fully lowered.

Parking brake set.

Materials/Parts

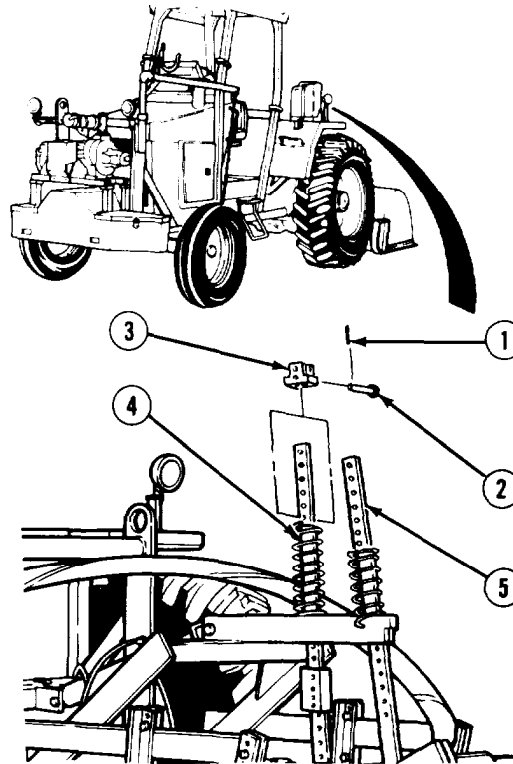
Pins, cotter (2)

a. Removal.

NOTE

Note position of bar stops prior to removal.

- (1) Remove two cotter pins (1) and clevis pins (2) from bar stops (3). Discard cotter pins.
- (2) Remove two bar stops (3) from rotor depth control bar (4) and hood depth control bar (5).



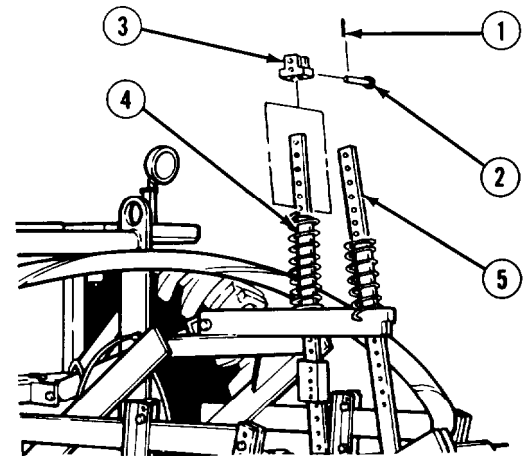
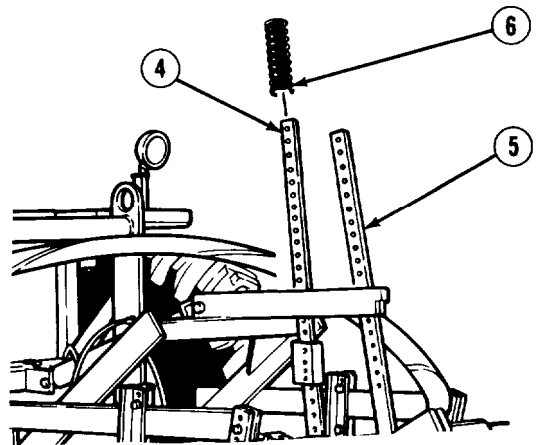
NOTE

Note size of springs on each bar.

- (3) Remove two coil springs (6) from rotor depth control bar (4) and hood depth control bar (5).

b. Installation.

- (1) Install two coil springs (6) on rotor depth control bar (4) and hood depth control bar (5).
- (2) Install two bar stops (3) on rotor depth control bar (4) and hood depth control bar (5).
- (3) Install two clevis pins (2) and cotter pins (1) on bar stops (3).



END OF TASK

4-157. ROTOR DEPTH CONTROL BLOCK REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para
Para 4-175

Condition Description
Rotor boom removed.

Materials/Parts

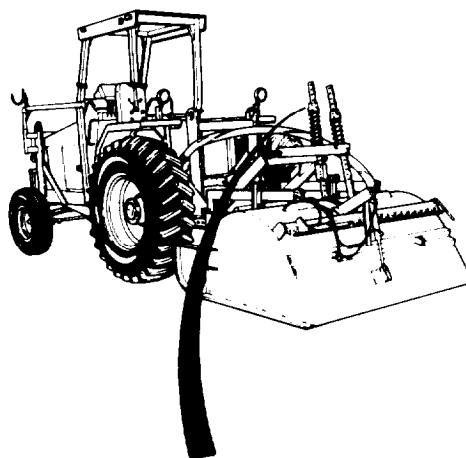
Pin, cotter

a. Removal.

NOTE

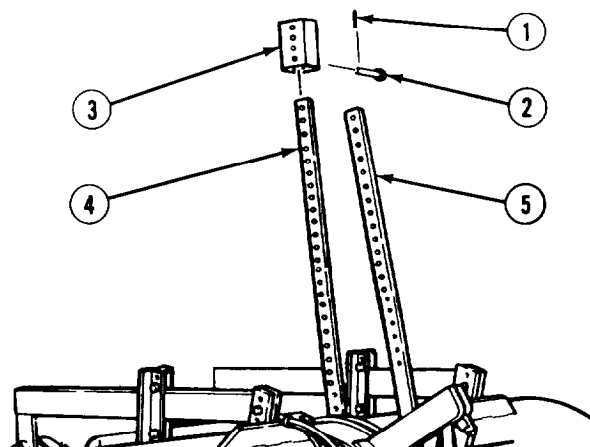
Note location of control block for correct installation.

- (1) Remove cotter pin (1), clevis pin (2) and control block (3) from rotor depth control bar (4). Discard cotter pin.
- (2) Repeat step (1) and remove remaining control block (3) from hood depth control bar (5).



b. Installation.

- (1) Install rotor depth control block (3) on rotor depth control bar (4) with clevis pin (2) and cotter pin (1).
- (2) Repeat step (1) and install remaining control block (3) on hood depth control bar (5).



NOTE

Follow-on maintenance: Install rotor boom (para 4-175).

END OF TASK

4-158. ROTOR DEPTH CONTROL BAR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Materials/Parts

Locknut

Equipment Condition

TM or Para

Para 4-156

Para 4-125

Condition Description

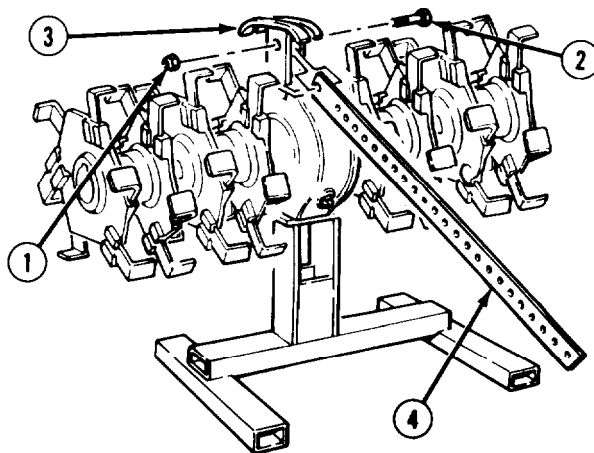
Bar stops and springs removed.

Hood removed.

a. Removal.

- (1) Remove locknut (1) and screw (2) from hood lift bracket (3). Discard locknut.
- (2) Remove rotor depth control bar (4) from hood lift control bracket (3).

- b. Installation.** Install rotor depth control bar (4) on hood lift control bracket (3) with screw (2) and locknut (1). Tighten locknut 280 lb-ft (380 N•m).



NOTE

Follow-on Maintenance:

- Install hood (para 4-125).
- Install bar stops and springs (para 4-156).

END OF TASK

4-159. HOOD DEPTH CONTROL BAR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 4-175

Condition Description

Rotor boom removed.

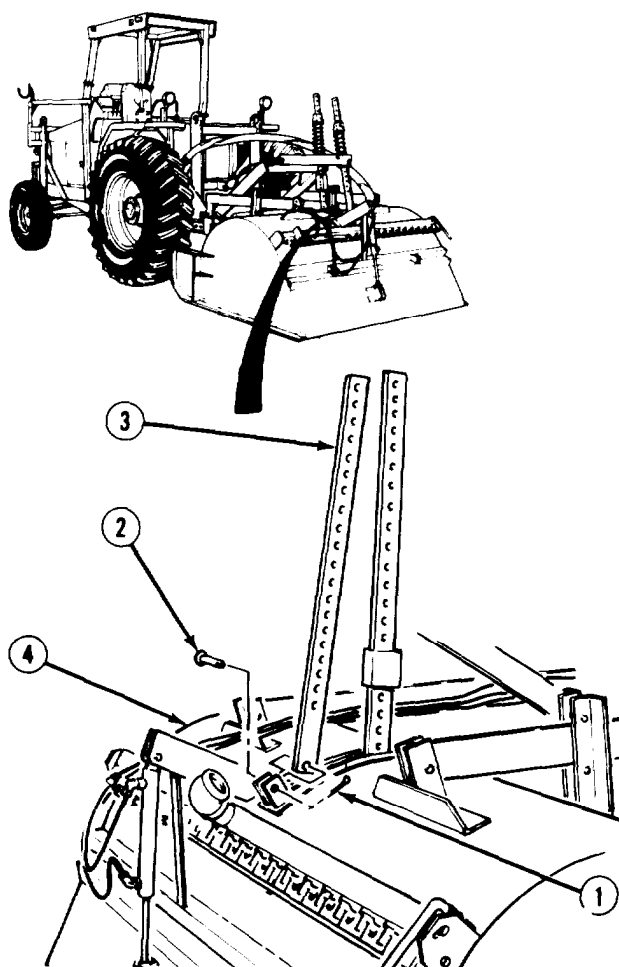
Materials/Parts

Pin, cotter

a. Removal.

- (1) Remove cotter pin (1) and clevis pin (2) from hood guide arm (3). Discard cotter pin.
- (2) Remove hood guide arm (3) from tiller (4).

- b. Installation.** Position hood guide arm (3) with clevis pin (2) and cotter pin (1) on tiller (4).



NOTE

Follow-on Maintenance: Install rotor boom (para 4-175).

END OF TASK

4-160. ROTOR SHOES REPLACEMENT.

This task covers:

- a. Removal b. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive
Wrench, torque

Equipment Condition

TM or Para
Para 2-10[b]

Condition Description
Rotor fully raised.

Material/Parts

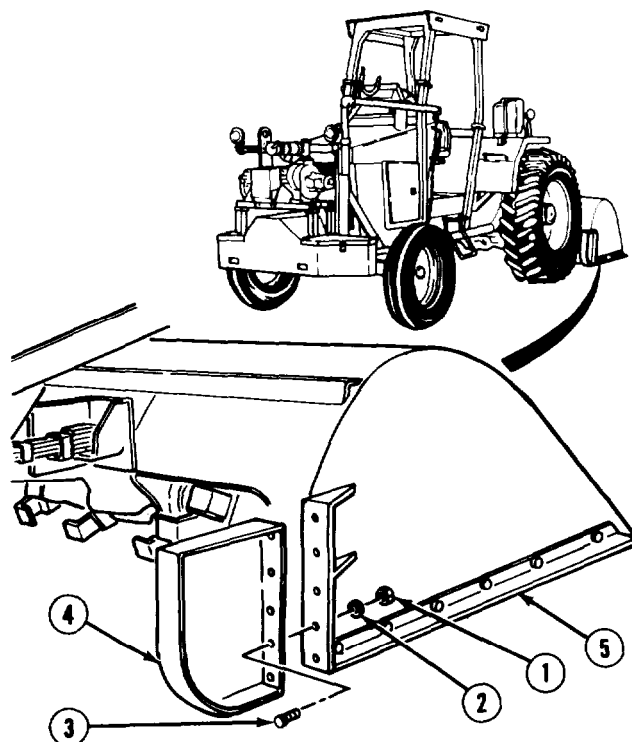
Lockwasher (10)

a. Removal.

- (1) Remove 10 nuts (1), lockwasher (2), and screws (3) from hood shoes (4). Discard lockwashers.
- (2) Remove hood shoes (4) from hood (5).

b. Installation.

- (1) Position hood shoes (4) on hood (5).
- (2) Install 10 screws (3), lockwasher (2), and nuts (1). Tighten screws 75 to 85 lb-ft (101-115 N•m).

**NOTE**

Follow-on Maintenance: Lower rotor assembly (para 2-10[c]).

END OF TASK

4-161. ROTOR HOOD REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting device (capacity 500 lb [227 kg])

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

<i>TM or Para</i>	Condition Description
Para 4-166	Additive system rotor hose disconnected.

Equipment Condition

Para 4-143	Hydraulic hoses removed
Para 4-159	Hood depth control bar removed.
Para 4-143	Boom hoist cylinder removed.
Para 4-177	Rotor hood guide arms removed.
Para 4-157	Rotor depth control block removed.
Para 4-176	Rotor assembly on stand,

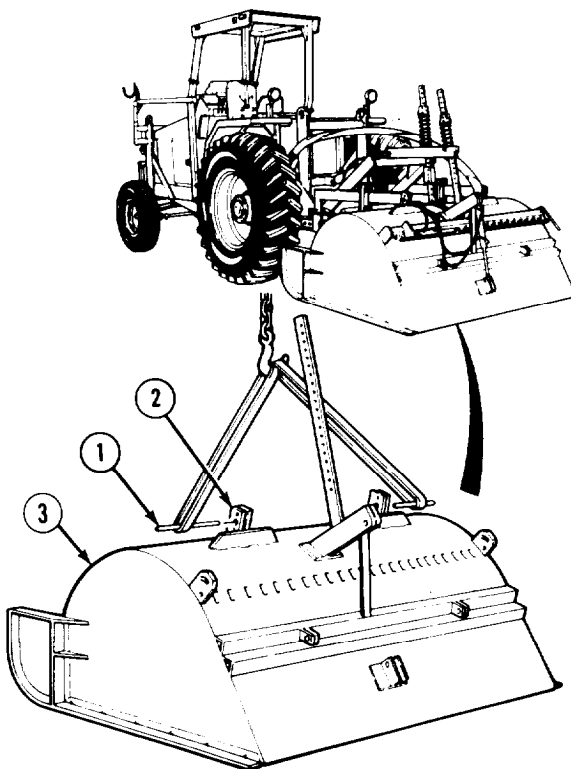
a. Removal.

- (1) Install two pins (1) in hood depth control bar brackets (2) and hood (3).

WARNING

Rotor hood weighs 280 lbs (380 kg). Attach suitable lifting device prior to removal or installation to prevent possible injury to personnel.

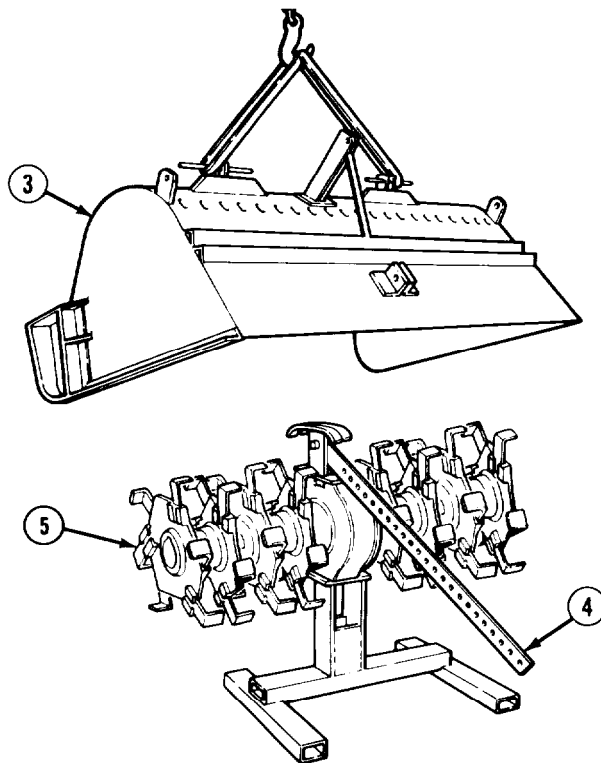
- (2) Install suitable lifting device.



WARNING

Rotor depth control bar should be stabilized before raising hood. As hood is raised, rotor depth control bar can fall and cause injury or death to personnel.

- (3) Mechanic operates suitable lifting device while assistant stabilizes hood (3) and rotor depth control bar (4).
- (4) Mechanic and assistant remove hood (3) from rotor (5).

**b. Cleaning/Inspection.**

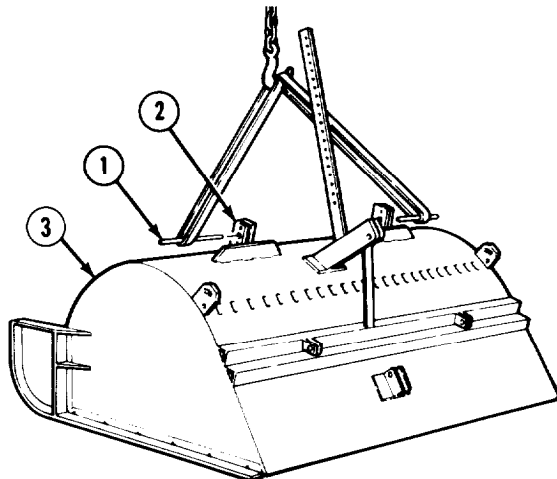
- (1) Check for damaged parts.
- (2) Replace all damaged parts.

c. Installation.

- (1) Mechanic operates suitable lifting device, while assistant stabilizes hood (3) and rotor depth control bar (4).
- (2) Mechanic and assistant install hood (3) on rotor control depth bar (4) and rotor (5).

4-161. ROTOR HOOD REPLACEMENT (CONT).

- (3) Remove suitable lifting device from two brackets (2).
- (4) Remove two pins (1) from hood (3).



NOTE

Follow-on Maintenance:

- Install rotor depth control block (para 4-157).
- Install rotor hood guide arms (para 4-177).
- Install boom hoist cylinder (para 4-145).
- Install hood depth control bar (para 4-159).
- Connect additive system rotor hose (para 4-166).

END OF TASK

4-162. ROTOR SKIS REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Materials/Parts

Lockwashers (12)

Equipment Condition

TM or Para
Para 2-10[b]

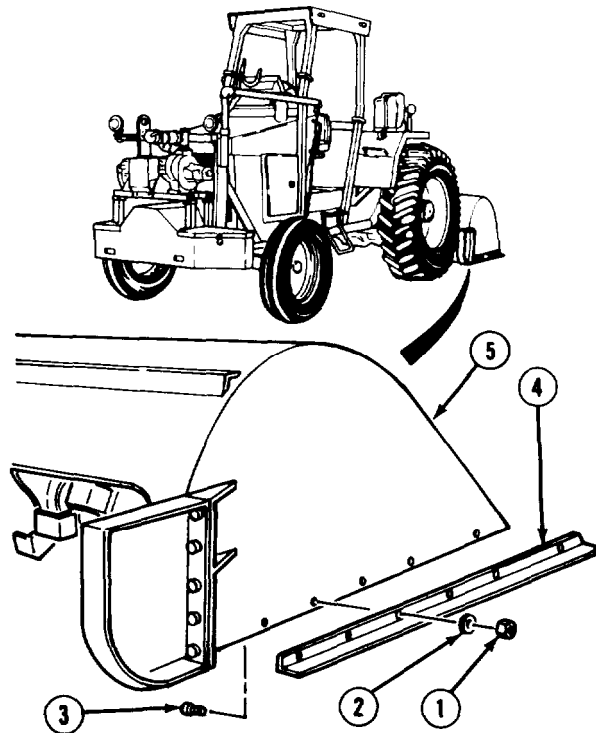
Condition Description
Rotor fully raised.

a. Removal.

- (1) Remove 12 nuts (1), lockwashers (2), and screws (3) from two hood skis (4). Discard lockwashers.
- (2) Remove two hood skis (4) from hood (5).

b. Installation.

- (1) Position two hood skis (4) on hood (5).
- (2) Install 12 screws (3), lockwashers (2), and nuts (1). Tighten screws 75 to 85 lb-ft (101 - 115 N•m).



NOTE

Follow-on Maintenance: Lower rotor assembly (para 2-10[c]).

END OF TASK

4-163. ROTOR TAILBOARD REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting device (capacity 500 lb [227 kg])

Materials/Parts

Cotter pins (2)

Personnel Required

MOS62B, Construction equipment repairer (2)

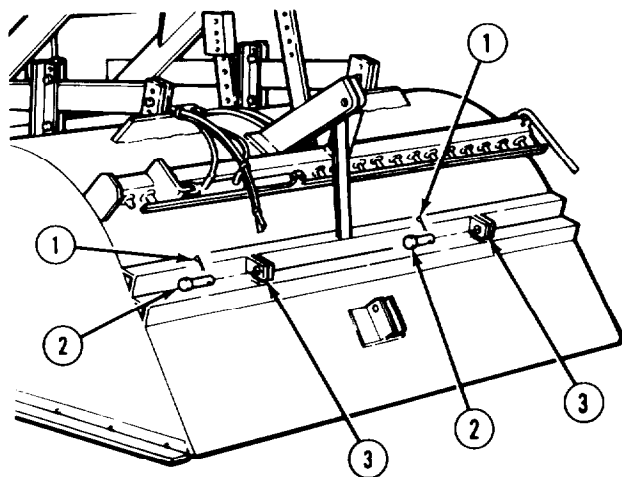
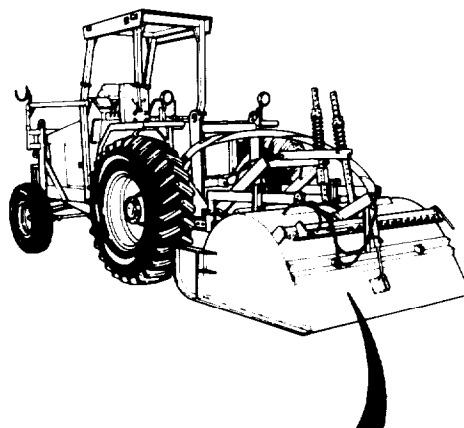
Equipment Condition

TM or Para
Para 4-146

Condition Description
Gate cylinder assembly removed.

a. Removal.

- (1) Remove two cotter pins (1) and pins (2) from tailboard mounting brackets (3). Discard cotter pin.



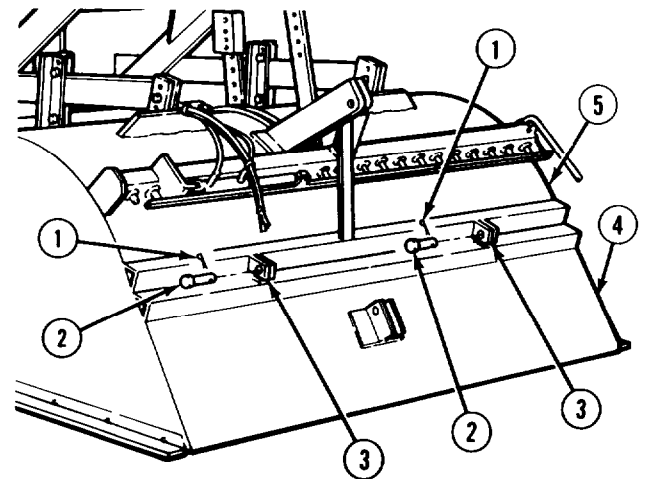
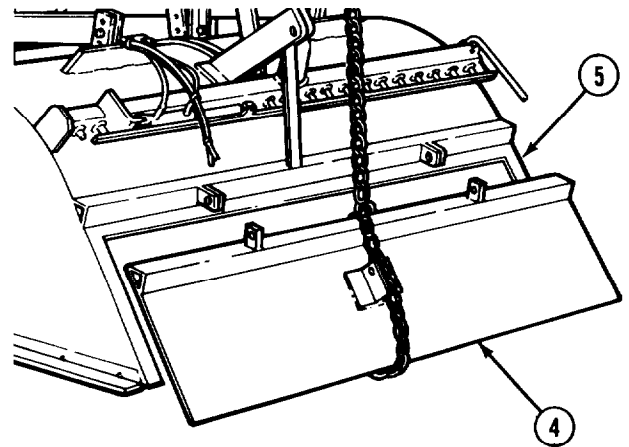
WARNING

Gate weighs 181 lbs (82 kg). Attach suitable lifting device prior to removal or installation to prevent possible injury to personnel.

- (2) While mechanic operates lifting device, assistant guides tailboard (4) from rotor hood (5).

b. Installation.

- (1) While mechanic operates lifting device, assistant positions tailboard (4) on rotor hood (5).
- (2) Install tailboard (4) on rotor hood (5) with pins (2) and cotter pins (1) in mounting bracket (3).

**NOTE**

Follow-on maintenance: Install gate cylinder (para 4-146).

END OF TASK

4-164. ROTOR DRIVE SHAFT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive
Wrench, torque

Materials/Parts

Sealant, hydraulic (item 52, appendix E)

Materials/Parts

Lo&washers (4)
Gasket

Equipment Condition

TM or Para
Para 4-176

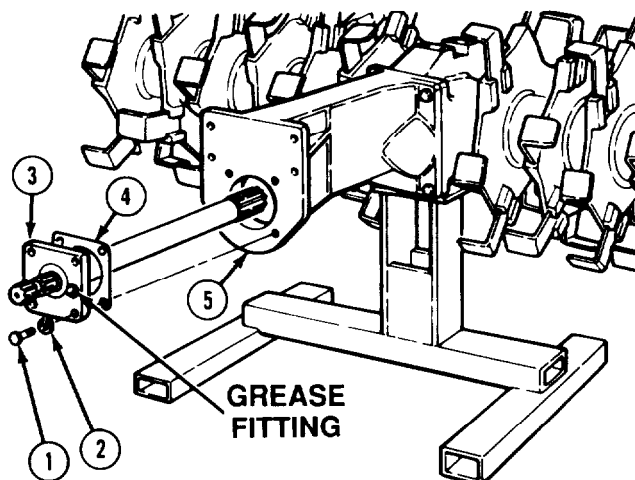
Condition Description
Rotor assembly on stand.

NOTE

Rotor hood is removed for clarity.

a. Removal.

- (1) Remove four screws (1) and lockwashers (2) from drive shaft assembly (3). Discard lockwashers.
- (2) Remove drive shaft assembly (3) and gasket (4) from torque tube housing (5). Discard gasket.



b. Installation.

NOTE

Be sure grease fitting is to the right or left side only.

- (1) Install gasket (4) and drive shaft assembly (3) on torque tube housing (5).

WARNING

Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Apply hydraulic thread sealant to thread of four screws (1) and install four lo&washers (2) and screws (1) in torque tube housing (5). Tighten screws (1) 75 to 85 lb-ft (101 - 115 N•m).
- (3) Lubricate grease fitting (figure 3-1).

NOTE

Follow-on Maintenance: Rotor assembly removed from stand (para 4-176).

END OF TASK

4-165. SPRAY BAR ASSEMBLY REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive
Wrench, torque

Materials/Parts

Lockwashers (46)
Locknuts (8)
Gaskets (21)
Cloth, lint-free (item 12, appendix E)
Sealant, silicone (item 16, appendix E)
Sealant, hydraulic (item 52, appendix E)

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para
Para 4-168

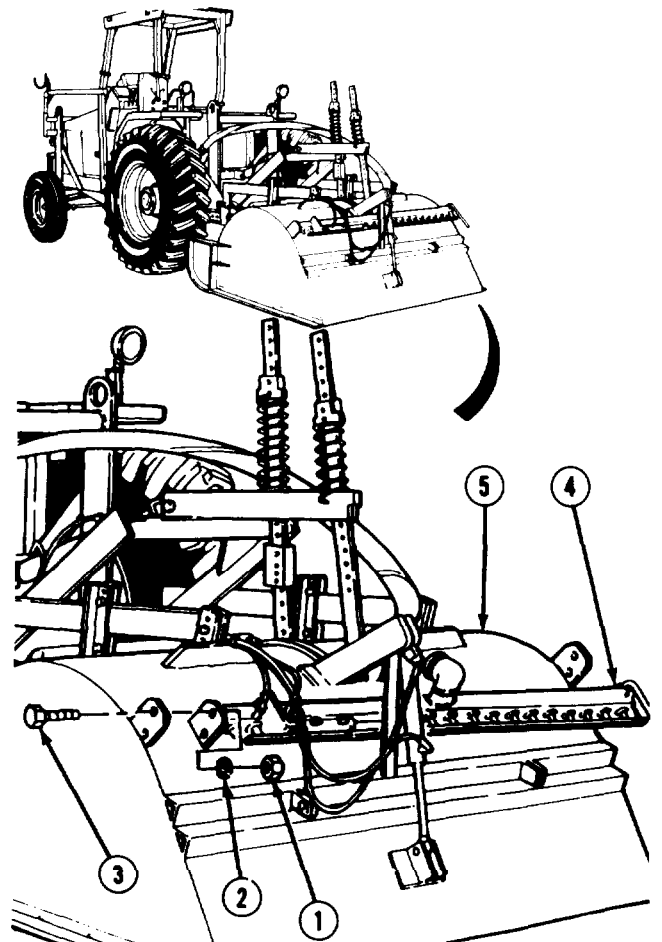
Condition Description
Additive system rotor hose removed.
Spray bar cylinder assembly removed.

a. Removal.

NOTE

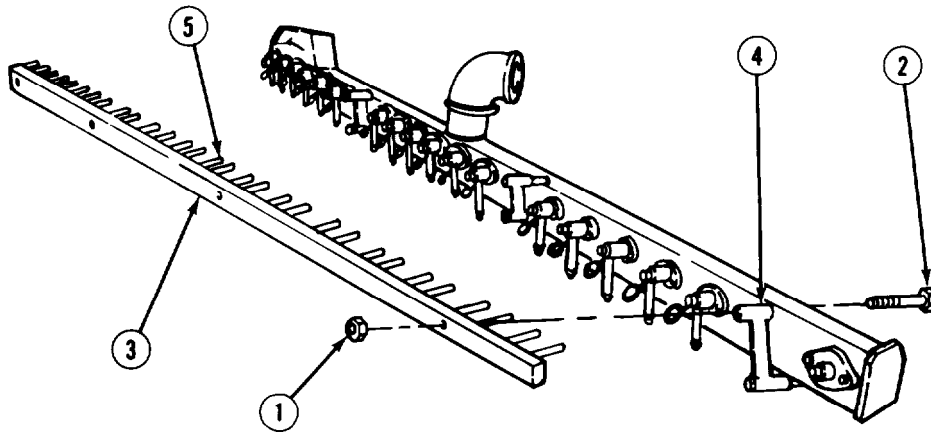
Mark position of spray bar screws in bracket for proper installation.

- (1) Remove four nuts (1), lockwashers (2), and screws (3) from spray bar assembly (4) and hood (5). Discard lockwashers.
- (2) Remove spray bar assembly (4) from hood (5).



4-165. SPRAY BAR ASSEMBLY REPLACEMENT/REPAIR (CONT).

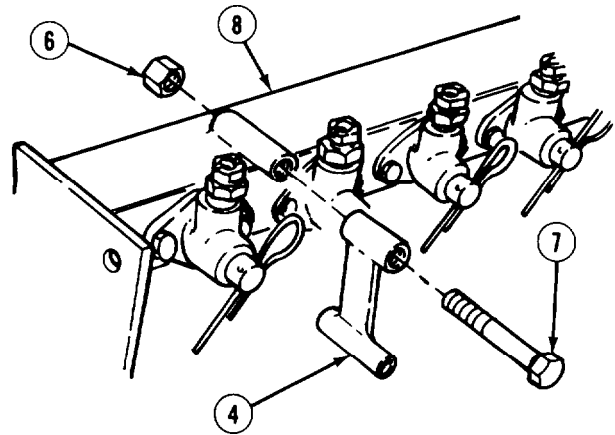
b. Disassembly.



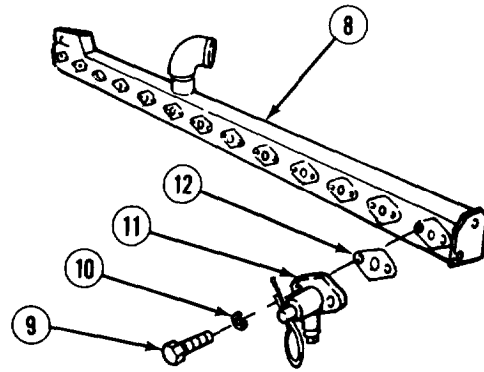
(1) Remove four locknuts (1), screws (2), and shutoff bar (3) from brackets (4). Discard locknuts.

(2) If damaged, remove 42 roll pins (5) from shutoff bar (3).

(3) Remove four locknuts (6), screws (7), and brackets (4) from spray bar (8). Discard locknuts.



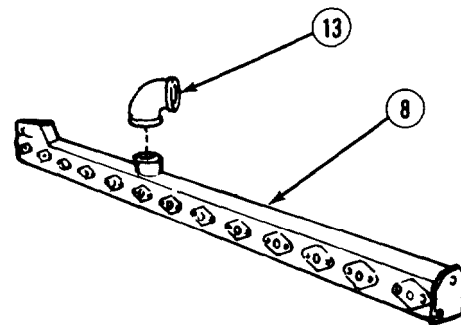
- (4) Remove 42 screws (9), lockwashers (10), 21 spray valve assemblies (11), and gaskets (12) from spray bar (8). Discard lockwashers and gaskets.



NOTE

Note position of elbow on spray bar for proper installation.

- (5) Remove elbow (13) from spray bar (8).



c. *Cleaning/Inspection.*

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

4-165. SPRAY BAR ASSEMBLY REPLACEMENT/REPAIR (CONT).

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

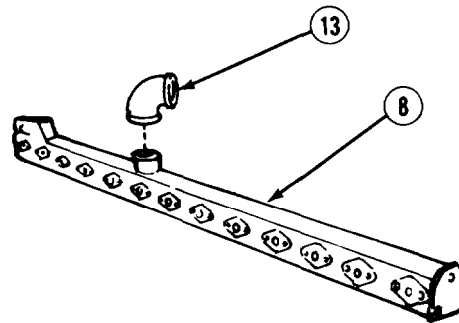
- (2) Use clean lint-free cloth or compressed air to dry all metal parts.
- (3) Clean all gasket material from spray bar.
- (4) Check spray bar for cracks, breaks, or other damage.
- (5) Check shutoff bar for bends, cracks, or other damage.

d. Assembly.

WARNING

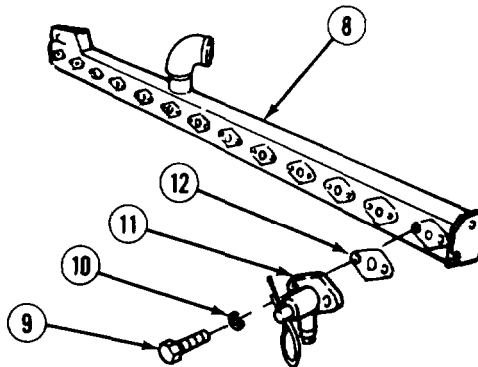
Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply hydraulic thread sealant to threads of elbow (13) and install elbow (13) on spray bar (8).

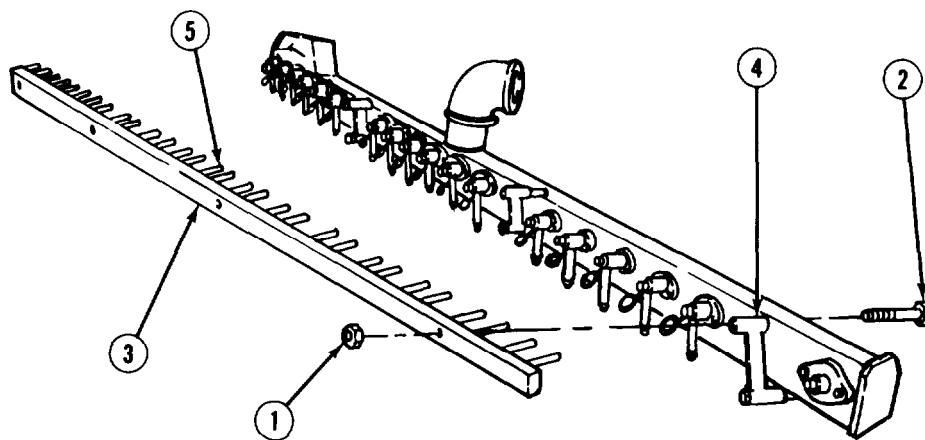
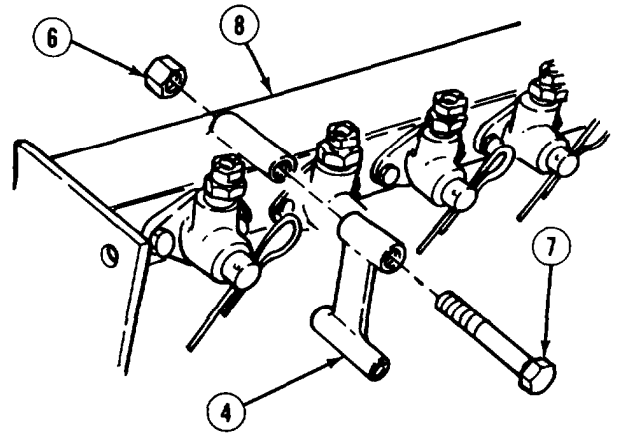


NOTE

- Apply small coating of silicone sealant to gaskets.
 - Apply thread sealant to threads of screws. Do not overtighten screws.
- (2) Install 21 gaskets (12) and spray valve assemblies (11) on spray bar (8) with 42 lockwashers (10) and screws (9).



- (3) Install four brackets (4) on spray bar (8) with four screws (7), and locknuts (6).

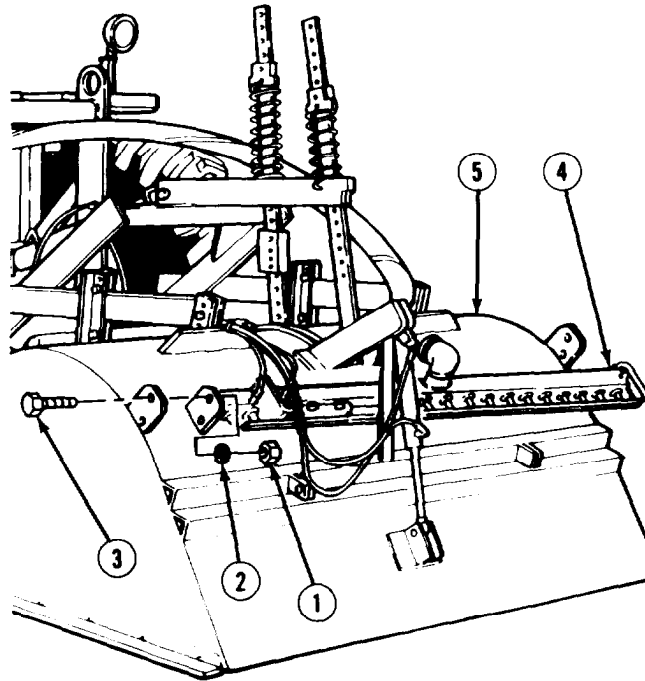


- (4) If removed, install 42 roll pins (5) in shutoff bar (3).
- (5) Install shutoff bar (3) brackets (4) with four screws (2) and locknuts (1).

4-165. SPRAY BAR ASSEMBLY REPLACEMENT/REPAIR (CONT).

e. Installation.

- (1) Position spray bar assembly (4) on hood (5).
- (2) Install spray bar assembly (4) on hood (5) with four screws (3), lockwashers (2), and nuts (1). Tighten screws 100 to 120 lb-ft (135 - 163 N•m).



NOTE

Follow-on Maintenance:

- Install spray bar cylinder (para 4-147).
- Install additive system rotor hose (para 4-168).

END OF TASK

4-166. ADDITIVE SYSTEM LOWER HOSE AND PIPING REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: automotive
- Wrench, torque
- Suitable container (capacity 5 gal. [19 liters])

Equipment Condition

TM or Para
Para 4-168

Condition Description
Additive system rotor hose disconnected from additive system pump piping.

Materials/Parts

- Lockwashers (4)
- Compound, sealing, pipe thread (item 17, appendix E)

a. *Removal.*



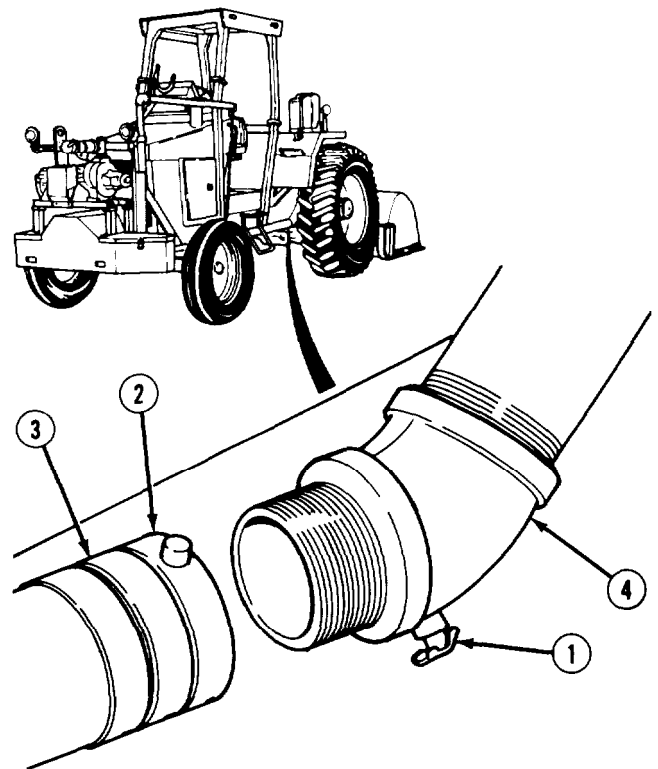
Spilled bituminous fluid is slippery. Clean up immediately or injury to personnel may result.

- (1) Close valve (1).

NOTE

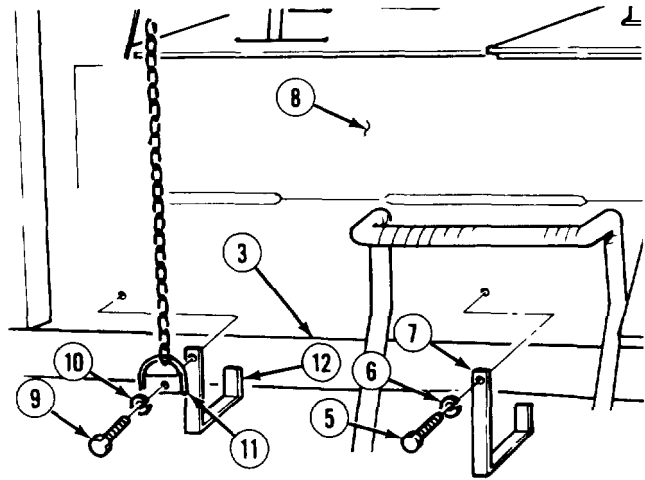
Place suitable container with a 5 gallon (19 liters) capacity under connector to catch spilling fluid.

- (2) Loosen fitting (2) and remove hose (3) from elbow (4).

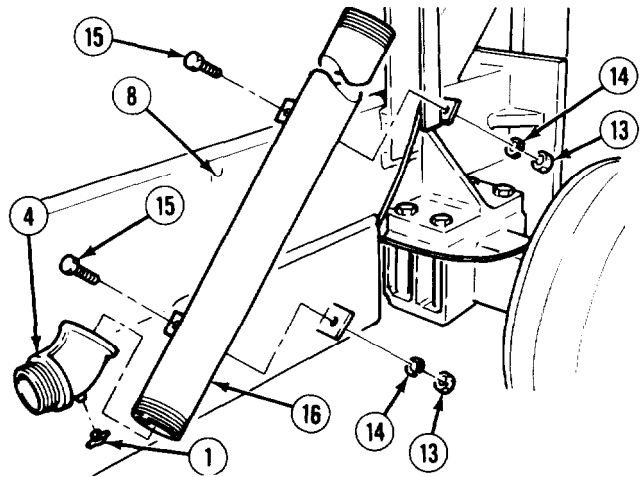


4-166. ADDITIVE SYSTEM LOWER HOSE AND PIPING REPLACEMENT (CONT).

- (3) Remove screw (5), lockwasher (6), and bracket (7) from frame (8). Discard lockwasher.
- (4) Remove screw (9), lockwasher (10), chain safety bracket (11), and bracket (12). Discard lockwasher.
- (5) Remove hose (3) from vehicle.



- (6) Remove two nuts (13), lockwashers (14), screws (15), and pipe (16) from frame (8). Discard lockwashers.
- (7) Remove valve (1) and elbow (4).



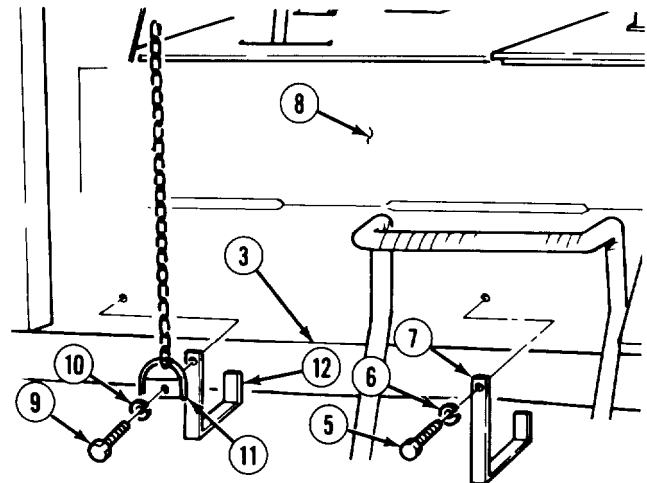
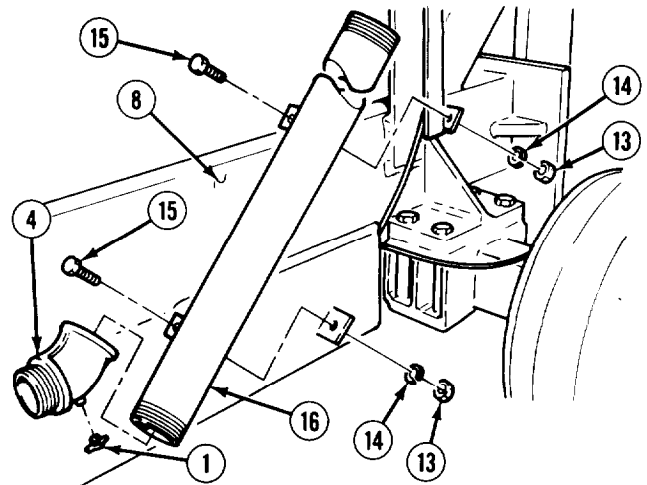
b. Cleaning/Inspection.

- (1) Check for damaged parts.
- (2) Check hose for wear and tear.
- (3) Check connections for working condition.
- (4) Replace all damaged parts.

c. *Installation.***WARNING**

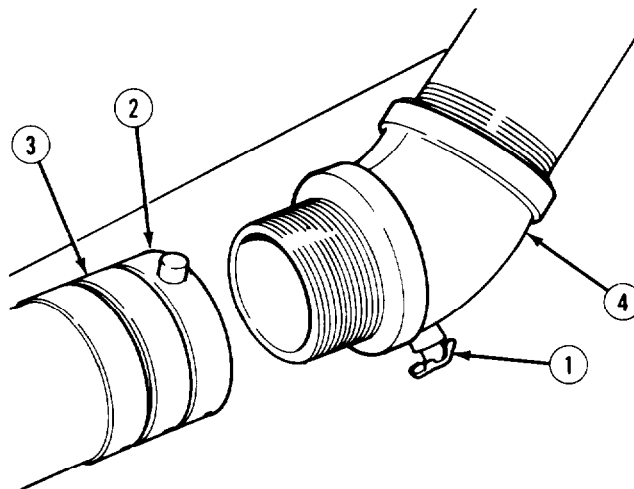
Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If sealant gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads with pipe thread sealing compound and install valve (1) in elbow (4) and elbow on pipe (16).
- (2) Install pipe (16) on frame (8) with two screws (15), lockwashers (14), and nuts (13). Tighten nuts 45 to 50 lb-ft (61- 68 N•m).
- (3) Position hose (3) on frame (8) and install bracket (12) and safety chain bracket (11) with lockwasher (10) and screw (9). Tighten screw 25 to 30 lb-ft (34 - 41 N•m).
- (4) Install bracket (7) with lo&washer (6) and screw (5). Tighten screw 25 to 30 lb-ft (34 - 41 N•m).



4-166. ADDITIVE SYSTEM LOWER HOSE AND PIPING REPLACEMENT (CONT).

- (5) Install hose (3) on elbow (4) and tighten fitting (2).
- (6) Close valve (1).



NOTE

Follow-on Maintenance: Connect additive system rotor hose to additive piping (para 4-168).

END OF TASK

4-167. ADDITIVE SYSTEM VALVE ASSEMBLY AND PIPING ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanics: automotive

Wrench, Pipe 36 in.

Suitable container (capacity 5 gal. [19 liters])

Equipment Condition

TM or Para

Para 4-151

Condition Description

Additive system pump removed.

Materials/Parts

Compound, sealing, pipe thread (item 17, appendix E)

Packing, preformed (3)

Ring, seal (2)

Washer, thrust (1)

a. *Removal.*

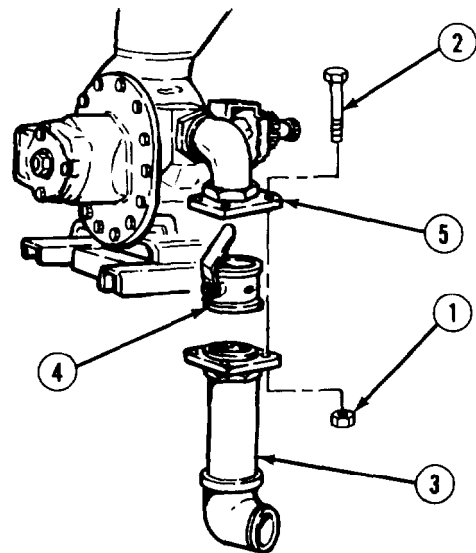


Spilled bituminous fluid is slippery. Clean up immediately or injury to personnel may result.

NOTE

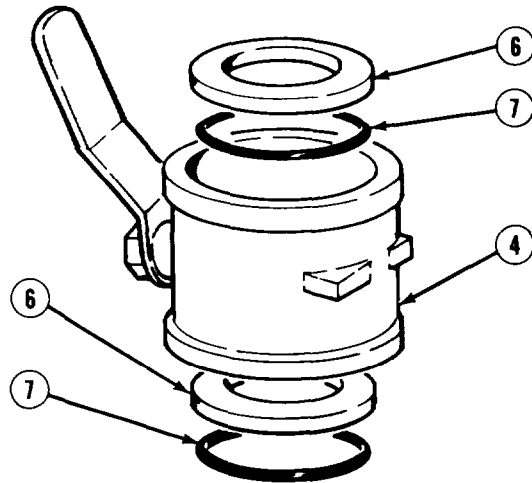
Place suitable container with a 5 gallon (19 liters) capacity under valve assembly to catch spilling fluid.

- (1) Remove four nuts (1), screws (2), lower body end and piping assembly (3), and valve body assembly (4) from upper body end (5).

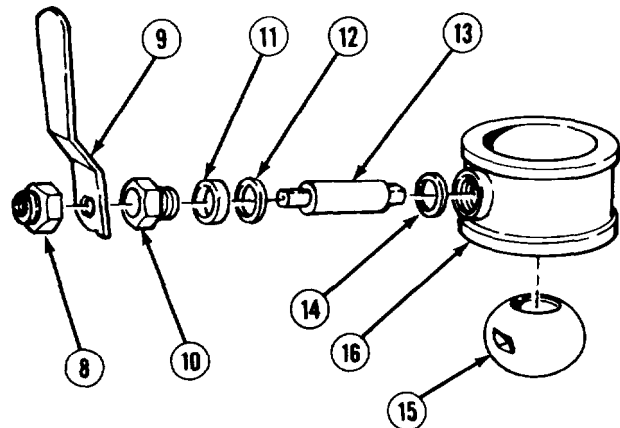


4-167. ADDITIVE SYSTEM VALVE ASSEMBLY AND PIPING ASSEMBLY REPLACEMENT (CONT).

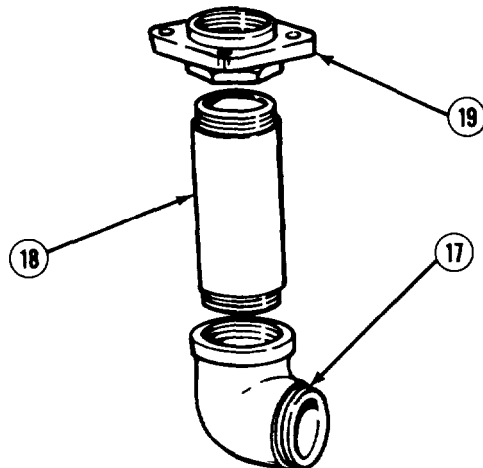
- (2) Remove two seal rings (6) and preformed packings (7) from valve body assembly (4). Discard preformed packings.



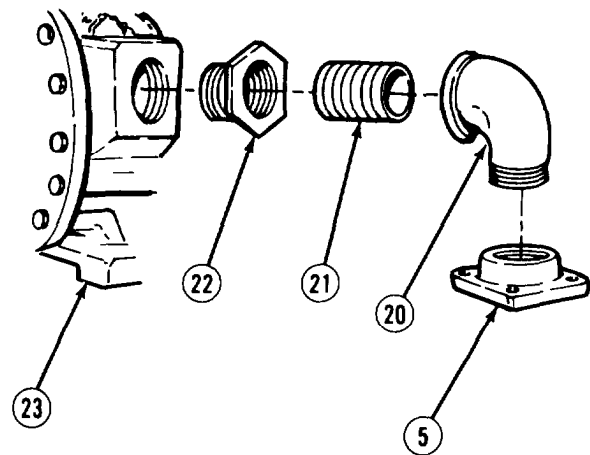
- (3) Remove nut (8), handle (9), packing nut (10), grounding washer (11), thrust washer (12), stem (13), thrust washer (14) and ball (15) from valve body (16).



- (4) Remove elbow (17) and pipe (18) from lower body end (19).



- (5) Remove upper body end (5), elbow (20), nipple (21), and reducer (22) from pump (23).

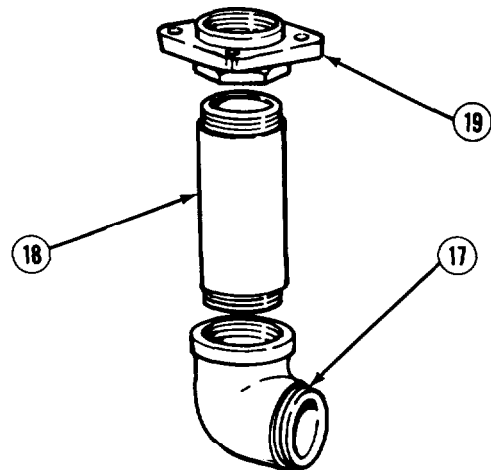


b. Installation.

WARNING

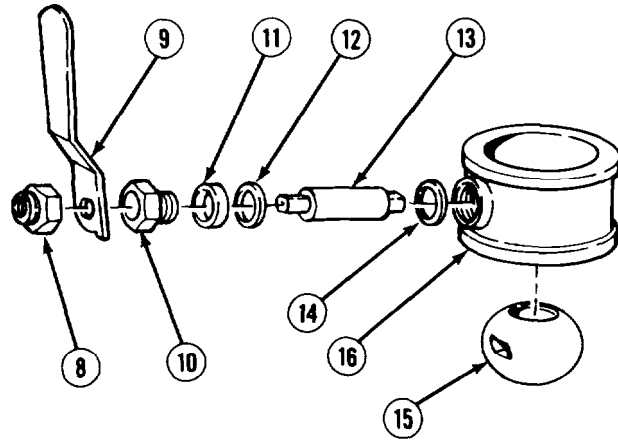
Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads with pipe thread sealing compound and install reducer (22), nipple (21), elbow (20), and upper body end (5) on pump (23).
- (2) Coat threads with pipe thread sealing compound and install pipe (18) and elbow (17) on lower body end (19).

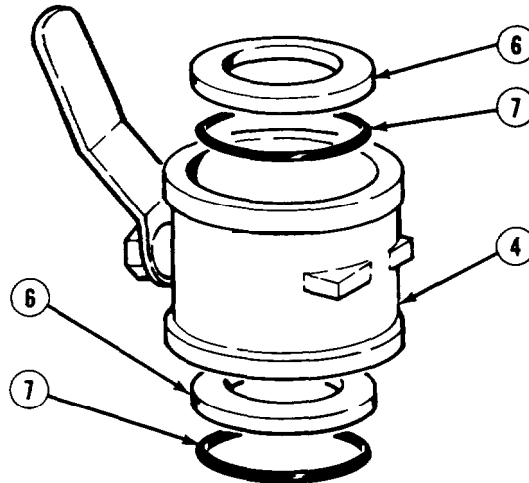


4-167. ADDITIVE SYSTEM VALVE ASSEMBLY AND PIPING ASSEMBLY REPLACEMENT (CONT).

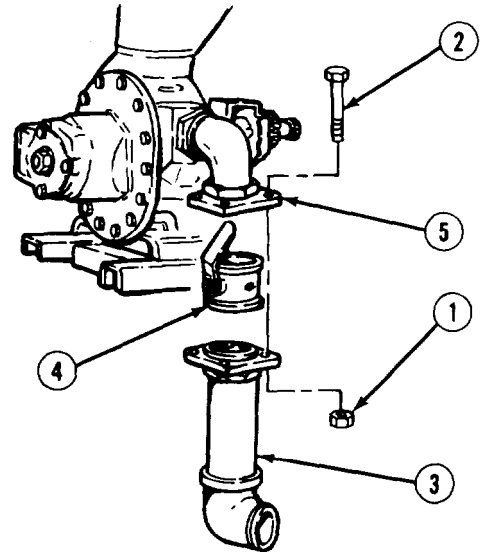
- (3) Install ball (15), thrust washer (14), stem (13), thrust washer (12), grounding washer (11), packing nut (10), handle (9), and nut (8) on valve body (16).



- (4) Install two preformed packings (7) and seal rings (6) in valve body (4).



- (5) Install valve body assembly (4) and lower body end and piping assembly (3) to upper body end (5) with four screws (2) and nuts (1). Tighten nuts 55 lb-ft (75 N•m).



NOTE

Follow-on Maintenance: Install additive system pump (para 4-151).

END OF TASK

4-168. ADDITIVE SYSTEM ROTOR HOSE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Material/Parts

Compound, sealing, pipe thread (item 17, appendix E)

General Safety Instructions

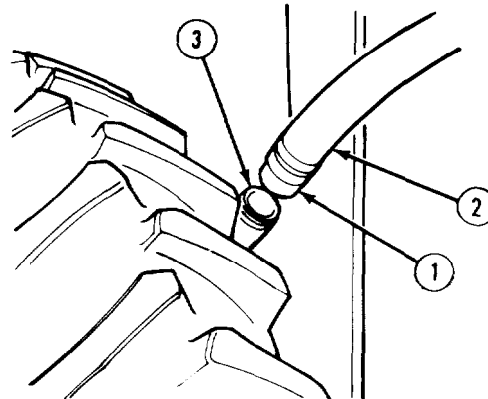
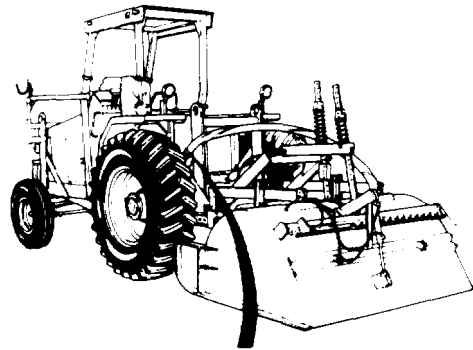
Bituminous fluid is slippery when spilled.

a. Removal.

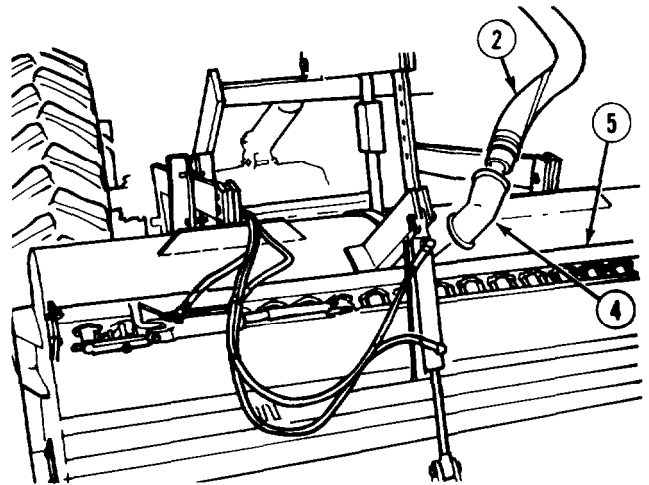


Spilled bituminous fluid is slippery. Clean up immediately or injury to personnel may result.

- (1) Loosen fitting (1) and remove hose (2) from Pipe (3).



- (2) Remove hose (2) from elbow (4).
- (3) Remove elbow (4) from spray bar (5).

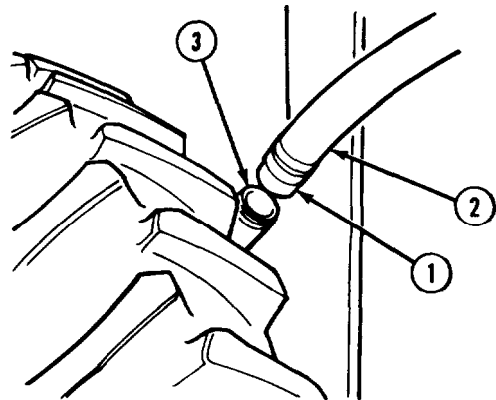


b. Installation.

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads of elbow (4) with pipe thread sealing compound and install on spray bar (5).
- (2) Install hose (2) on elbow (4).
- (3) Install hose (2) on pipe (3) and tighten fitting (1).



END OF TASK

4-169. BOOM AND CHAIN REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Boom chain (para F-19, appendix F)

a. Removal.

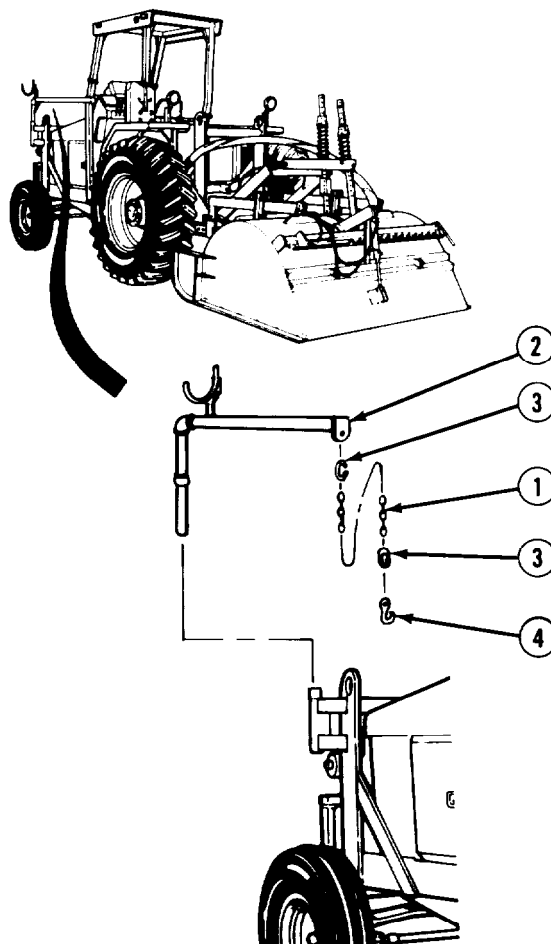
NOTE

Chain to boom can be removed without removing boom.

- (1) Unhook chain (1) and remove boom (2).
- (2) If damaged, remove two links (3) and hook (4) from chain (1).

b. Installation.

- (1) If removed, install hook (4) and two links (3) on chain (1).
- (2) Install boom (2) and hook chain (1).



END OF TASK

4-170. ROTOR PLOW REPLACEMENT.

This task covers:

- a. Removal b. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Jackstands (capacity 5,000 lb (2,268 kg))

Wrench, torque

Materials/Parts

Lockwashers (4)

Equipment Condition

TM or Para

Para 2-13

Para 2-10[b]

Condition Description

Parking brake set.

Rotor fully raised.

a. Removal.**WARNING**

Rotor assembly must be supported prior to working beneath or injury to personnel may result.

- (1) Remove three screws (1) and lockwashers (2) from plow (3). Discard lockwashers.
- (2) Remove plow (3) from beneath gear box (4).

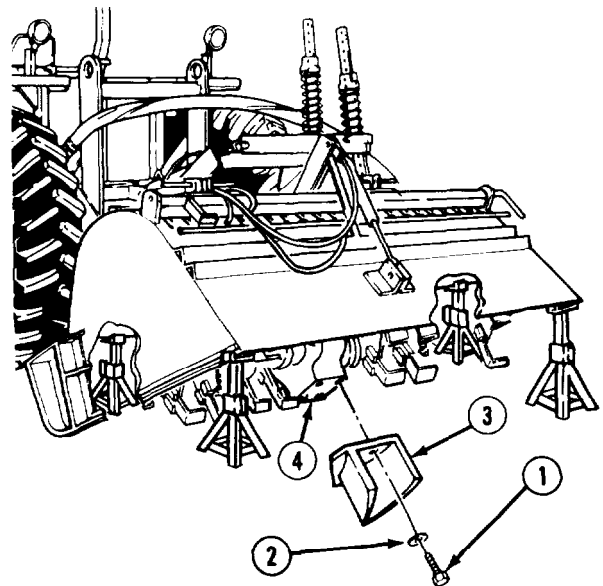
b. Installation.

- (1) Position plow (3) on bottom of gear box (4).
- (2) Install four lockwashers (2) and screws (1). Tighten screws 125 to 135 lb-ft (169 - 183 N•m).

NOTE

Follow-on Maintenance:

- Remove supports from under rotor.
- Lower rotor assembly (para 2-10[c]).

**END OF TASK**

4-171. ROTOR HOOD LIFT BRACKET REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

Lockwashers (4)

Equipment Condition

TM or Para

Para 4-161

Condition Description

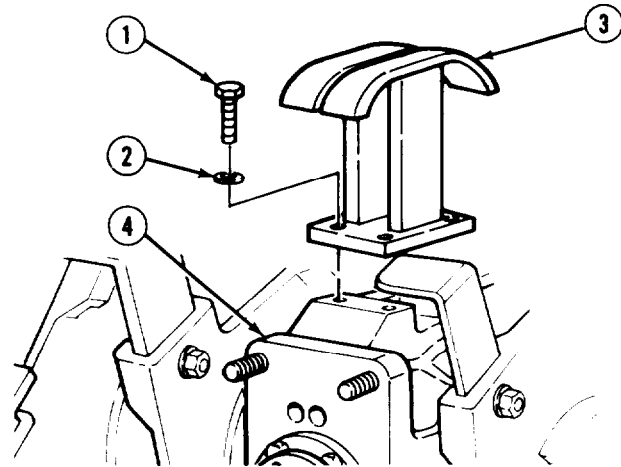
Rotor hood removed.

a. Removal.

- (1) Remove four screws (1) and lo&washers (2) from rotor hood guard (3). Discard lockwashers.
- (2) Remove rotor hood guard (3) from gear box (4).

b. Installation.

- (1) Position rotor hood guard (3) on gear box (4).
- (2) Install four lockwashers (2) and screws (1) in rotor hood guard (3). Tighten screws 90 to 100 lb-ft (122 - 135 N•m).



NOTE

Follow-on Maintenance: Install rotor hood (para 4-161).

END OF TASK

4-172. ROTOR SPRING REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Equipment Condition

TM or Para

Para 4-176

*Condition Description*Rotor disconnected and
on stand.*Materials/Parts*

Lockwashers (4)

Para 4-175

Boom removed.

a. Removal.**NOTE**

Both rotor springs are removed and installed the same way. Right spring bracket shown.

- (1) Remove four nuts (1), lockwashers (2), and screws (3) from spring bracket (4). Discard lockwashers.
- (2) Remove spring bracket (4) and spring (5) from frame (6).
- (3) Repeat steps (1) and (2) for other spring bracket.

b. Cleaning/Inspection.

- (1) Check for damaged parts.
- (2) Replace all damaged parts.

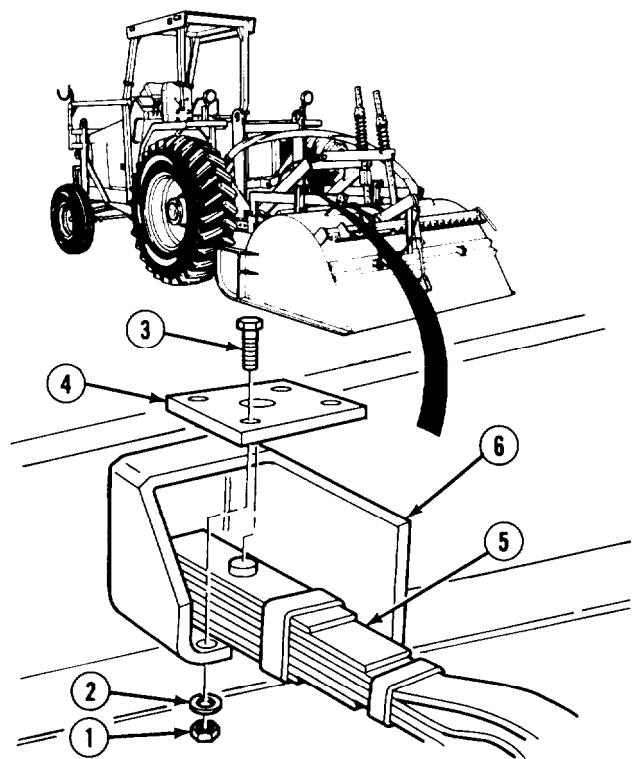
c. Installation.

- (1) Position spring (5) and spring bracket (4) on frame (6).
- (2) Install four screws (3), lockwashers (2), and nuts (1).
- (3) Repeat steps (1) and (2) for other spring bracket.

NOTE

Follow-on Maintenance:

- Install boom (para 4-175).
- Remove rotor from stand and install (para 4-176).

END OF TASK

4-173. ROTOR TINE REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Wrench, torque

Material/Parts

- Locknuts (60)
- Tines, left (30)
- Tines, right (30)

Equipment Condition

TM or Para
Para 2-10[b]
Para 4-90

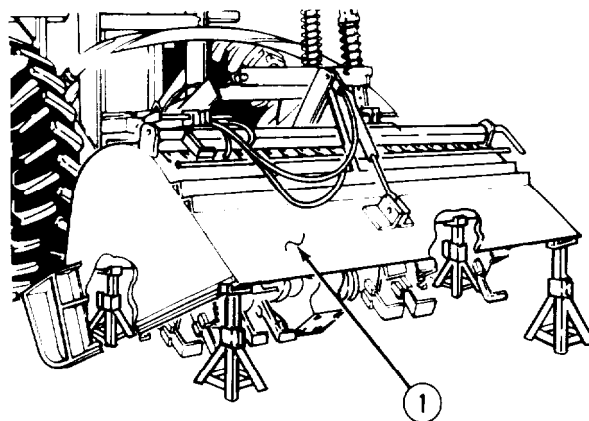
Condition Description
Rotor fully raised.
Negative battery cables disconnected.

a. Removal.



Rotor assembly must be supported prior to working beneath or injury to personnel may result.

- (1) Place supports beneath raised rotor assembly (1).

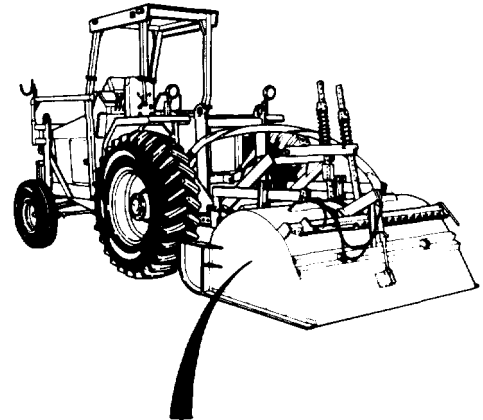


NOTE

This procedure is the same for both left- and right-hand tines.

Left- and right-hand tines must be installed correctly for proper rotor operation. Remove and replace all left-hand or all right-hand tines at one time to avoid incorrect installation.

- (2) Remove 60 locknuts (2), carriage bolts (3), and 30 tines (4) from 10 tine plates (5).



b. Cleaning/Inspection.

- (1) Inspect mounting areas on tine plates for damage.
- (2) Replace all tines as a set.

c. Installation.

NOTE

Install all left-hand or all right-hand tines at one time to avoid incorrect installation.

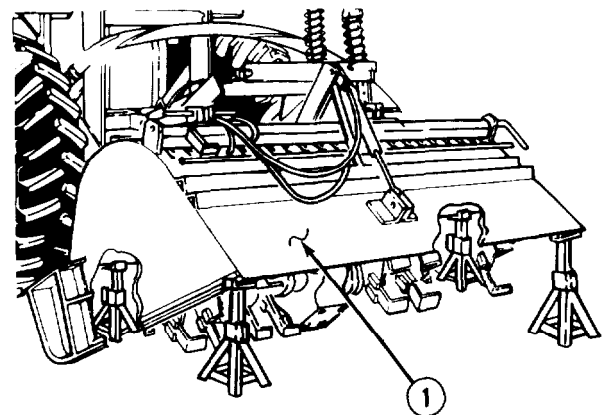
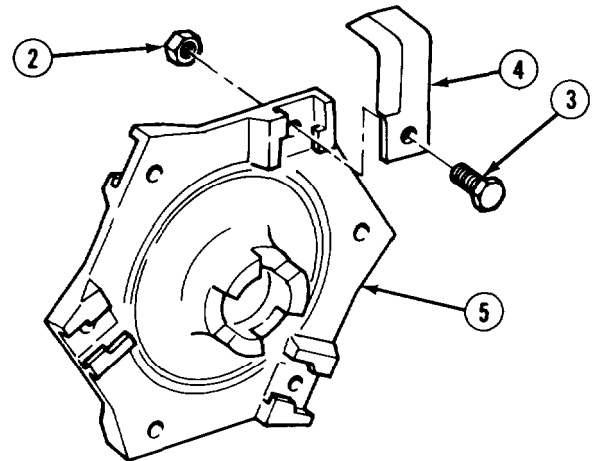
- (1) Install 30 tines (4) on 10 tine plates (5) with 60 carriage bolts (3) and locknuts (2). Tighten locknuts 260 to 280 lb-ft (352 -380 N•m)
- (2) Remove supports from rotor assembly (1).

NOTE

Follow on Maintenance:

- Connect negative battery cables (para 4-90).
- Lower rotor assembly (para 2-10[c]).

END OF TASK



4-174. ROTOR ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Lifting device (capacity 5000 lb [2268 kg])

Materials/Parts

Lockwashers (4)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 4-101

Para 4-143

Para 4-145

Para 4-168

Condition Description

PTO drive shaft removed

Hydraulic hoses disconnected.

Boom hoist cylinder removed.

Additive system rotor hose disconnected.

a. Removal.

NOTE

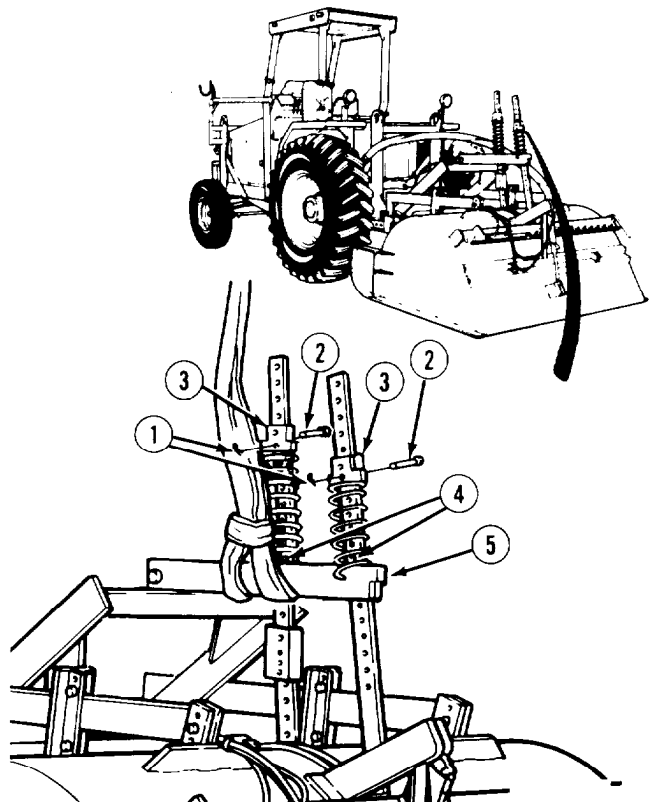
Mark location of blocks before removal for correct installation.

- (1) Remove two cotter pins (1) and two pins (2) from two blocks (3).
- (2) Install two pins (2) in two holes (4) directly above boom (5).

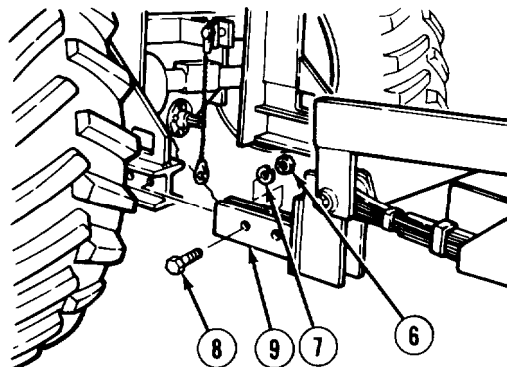
WARNING

Rotor weighs 4200 lbs (1905 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

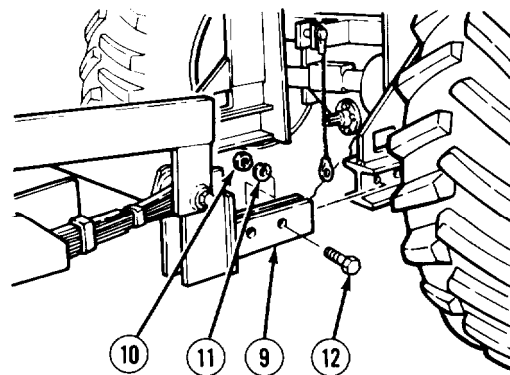
- (3) With suitable lifting device attached to boom (5), operate lifting device to remove slack in chain/strap.



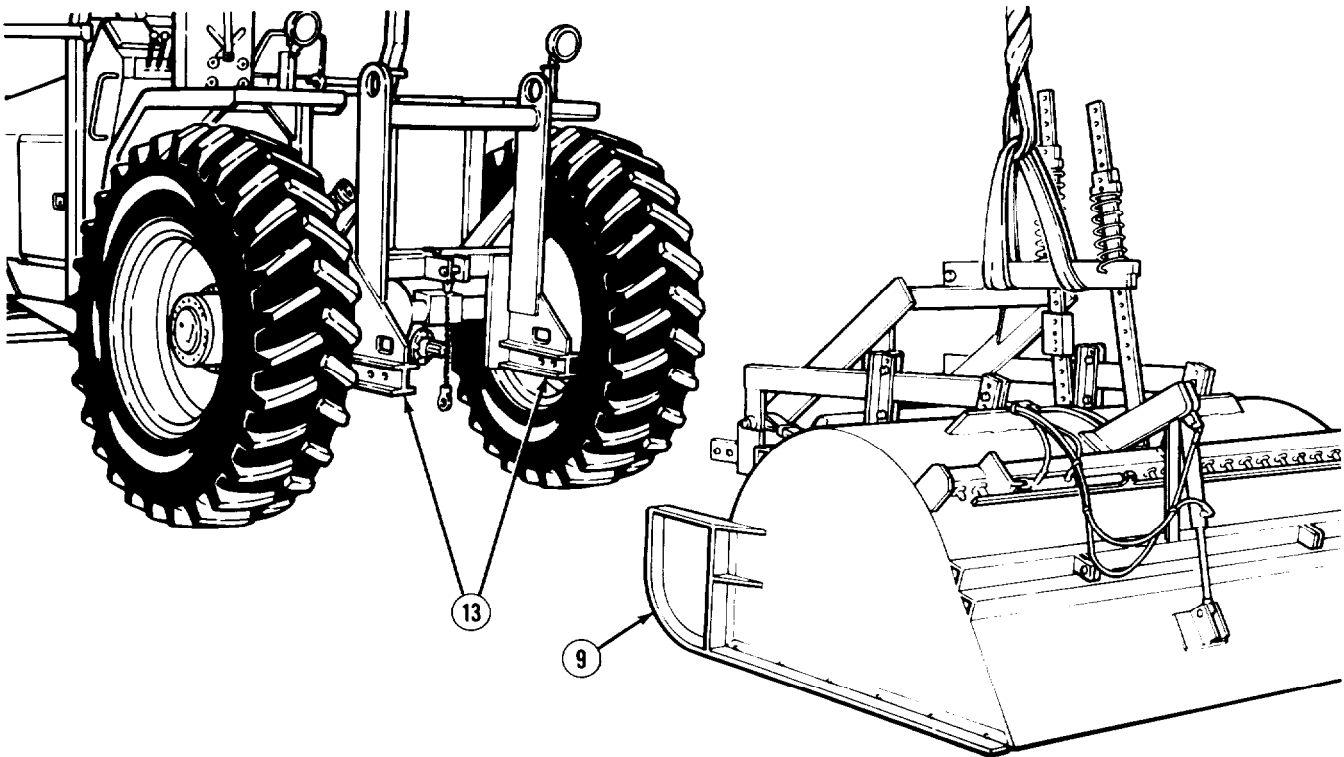
- (4) Remove two nuts (6), lockwashers (7), and screws (8) from left side of rotor (9).
Discard lockwashers.



- (5) Remove two nuts (10), lockwashers (11), and screws (12) from right side of rotor (9).
Discard lockwashers.



4-174. ROTOR ASSEMBLY REPLACEMENT (CONT).



WARNING

Rotor weighs 4200 lbs (1905 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

(6) Mechanic operates suitable lifting device while assistant guides rotor (9) away from vehicle mounts (13).

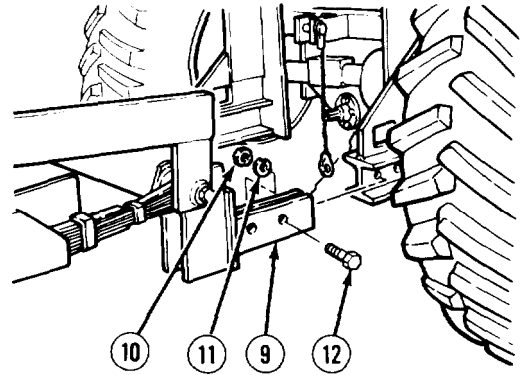
b. Installation.

WARNING

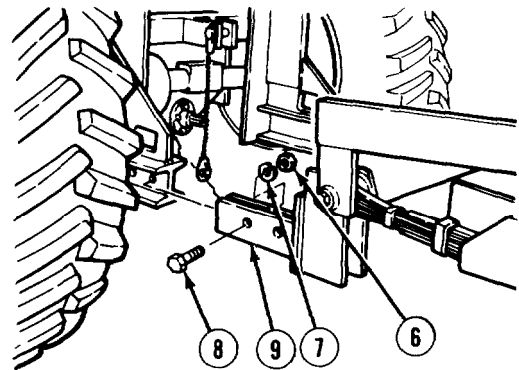
Rotor weighs 4200 lbs (1905 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

(1) Mechanic operates suitable lifting device while assistant guides rotor (9) to vehicle mounts (13).

- (2) Install right side of rotor (9) with two screws (12), lockwashers (11), and nuts (10).

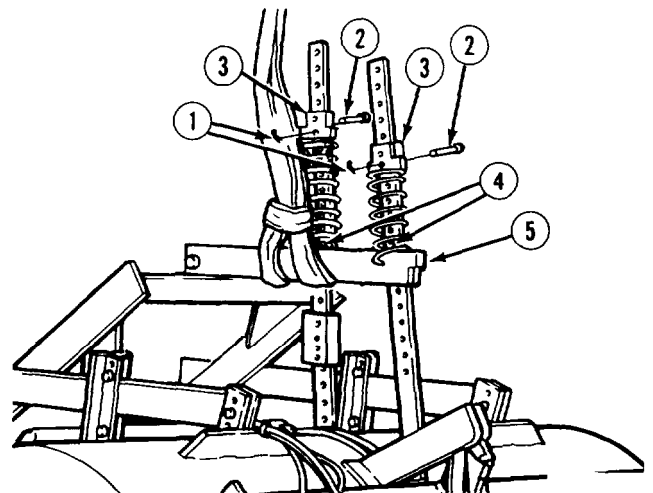


- (3) Install left side of rotor (9) with two screws (8), lockwashers (7), and nuts (6).



- (4) Remove two pins (2) from holes (4) and install in two blocks (3) with cotter pins (1), in previously marked positions.

- (5) Remove lifting device from boom (5).



4-174. ROTOR ASSEMBLY REPLACEMENT (CONT).

NOTE

Follow-on Maintenance:

- Install additive system rotor hose (para 4-168).
- Install boom hoist cylinder (para 4-145).
- Connect hydraulic hoses (para 4-143).
- Install PTO drive shaft (para 4-101).

END OF TASK

4-175. ROTOR BOOM REPLACEMENT.

This task covers:

- a. Removal b. Installation

INITIAL SETUP*Tools*

Tool kit, general mechanic's: automotive

Lifting device (capacity 500 lb [227 kg])

Materials/Parts

Pins, cotter (2)

Personnel Required

MOS62B, Construction equipment repairer (2)

*Equipment Condition**TM or Para*

Para 4-145

Para 4-156

Para 4-176

Condition Description

Hoist boom cylinder removed.

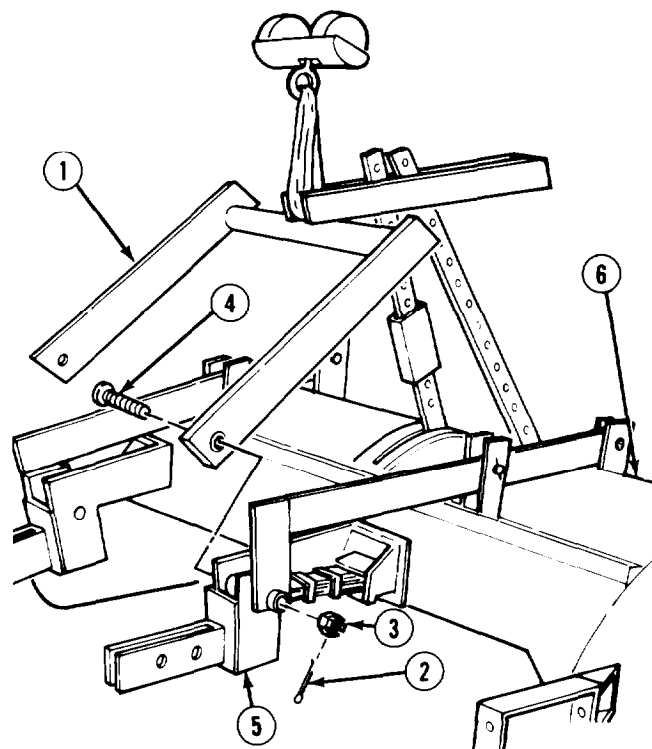
Bar stops and springs removed.

Rotor assembly on stand.

a. Removal.**WARNING**

Rotor boom weighs 220 lb (100 kg). Use suitable lifting device when removing boom from vehicle.

- (1) Attach suitable lifting device to rotor boom (1).
- (2) Remove two cotter pins (2), castle nuts (3) screws (4), and shackles (5) from boom (1). Discard cotter pins.
- (3) While assistant steadies boom (1), mechanic operates suitable lifting device to remove boom from tiller (6).



4-175. ROTOR BOOM REPLACEMENT (CONT).

b. Installation.

WARNING

Rotor boom weighs 220 lb (100 kg). Use a suitable lifting device when removing boom from vehicle.

- (1) While assistant steadies boom (1), mechanic operates suitable lifting device to install boom on tiller (6).
- (2) Install two shackles (5), screws (4), castle nuts (3), and cotter pins (2).
- (3) Remove lifting device.

NOTE

Follow-on Maintenance:

- Remove rotor assembly from stand (4-176).
- Install bar stops and springs (para 4-156).
- Install hoist boom cylinder (para 4-145).

END OF TASK

4-176. ROTOR ASSEMBLY ON STAND.

This task covers:

- a. Installation
- b. Removal

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Lifting device (capacity 5000 lb [2268 kg])

Rotor drive assembly stand (item F3, appendix F)

Wrench, torque

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 4-170

Para 4-174

Condition Description

Rotor plow removed.

Rotor assembly removed,

a. Installation.



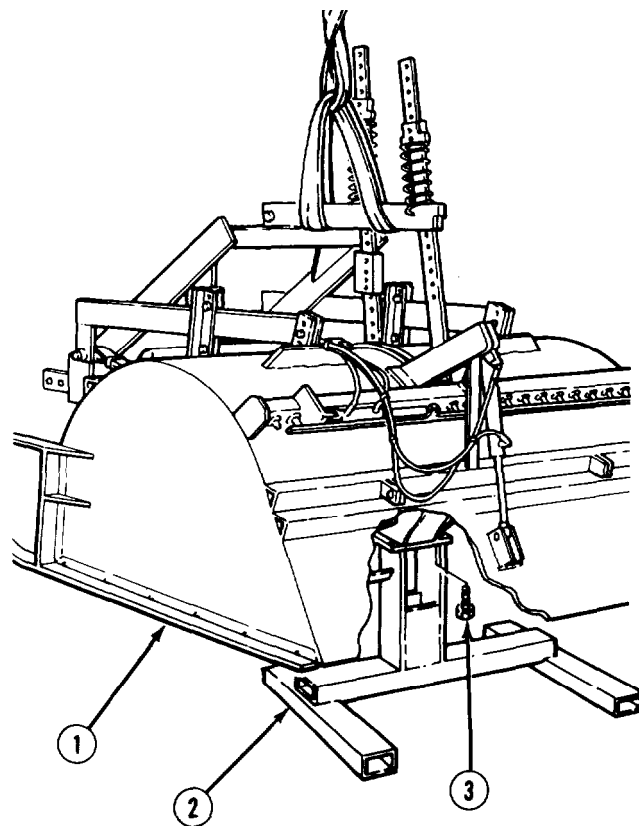
Rotor weighs 4200 lbs (1905 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (1) Mechanic operates suitable lifting device while assistant guides rotor assembly (1) on rotor stand (2).

NOTE

Screws are from rotor plow assembly.

- (2) Install rotor assembly (1) on rotor stand (2) with four screws (3). Tighten screws 250 lb-ft (339 N•m).



4-176. ROTOR ASSEMBLY ON STAND (CONT).

b. Removal.

- (1) Remove four screws (3).
- (2) Mechanic operates suitable lifting device while assistant guides and removes rotor assembly (1) from rotor stand (2).

NOTE

Follow-on maintenance:

- Install rotor assembly (para 4-174).
- Install rotor plow (para 4-170).

END OF TASK

4-177. ROTOR HOOD GUIDE ARMS REPLACEMENT.

This task covers:

- a. Removal b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Materials/Parts

Tags, identification (item 55, appendix E)

Cotter pins (4)

Equipment Condition

TM or Para

Para 4-143

Para 4-175

Condition Description

Hydraulic hoses removed

Rotor boom removed.

a. Removal.

NOTE

Tag and mark hydraulic hoses before removal.

- (1) Remove three nuts (1), six clamps (2) and four hydraulic hoses (3) from left hood guide arm (4).
- (2) Remove four cotter pins (5) and screws (6) from two hood guide arms (4). Discard cotter pins.
- (3) Mechanic and assistant slide hood guide arms (4) from rotor (7).

b. Installation.

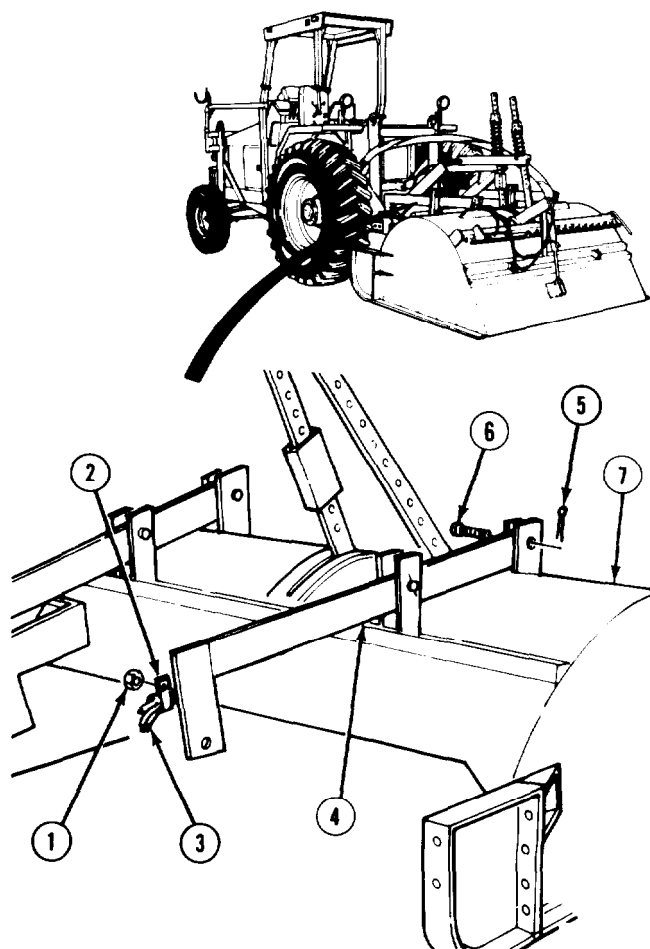
- (1) Mechanic and assistant position hood guide arms (4) on rotor (7).
- (2) Install four screws (6) and cotter pins (5) on hood guide arms (4).
- (3) Install hydraulic hoses (3), six clamps (2), and three nuts (1).

NOTE

Follow-on Maintenance:

- Install rotor boom (para 4-175).
- Connect hydraulic hoses (para 4-143).

END OF TASK



4-178. WHEEL END SERVICE.

This task covers:

- a. Draining
- b. Cleaning/Inspection
- c. Filling

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive
Suitable container (capacity 5 gal. [19 liters])

Material/Parts

Oil, lubricating, gear (item 32, appendix E)

Equipment Condition

TM or Para
Para 2-13
Condition Description
Parking brake set.

General Safety Instructions

Gear oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

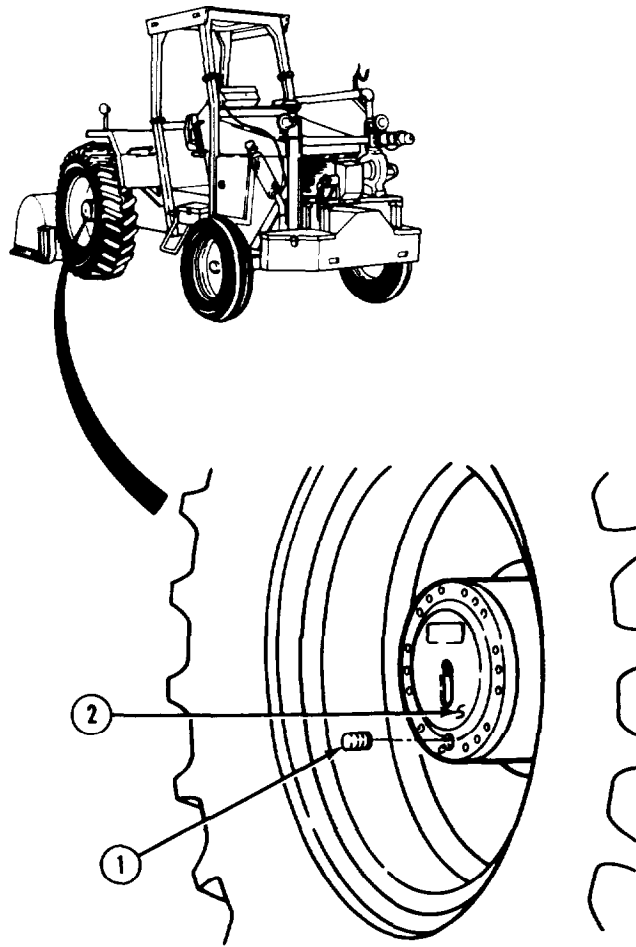
a. *Draining.*



Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

NOTE

- This procedure is the same for both wheel ends.
 - Fill/drain plug must be at bottom position to drain wheel end.
 - Place suitable container with a 5 gallon (19 liters) capacity under wheel end to catch spilling oil.
- (1) Remove till/drain plug (1) from wheel end (2).
 - (2) Allow oil to drain completely from wheel end (2).



b. Cleaning/Inspection.

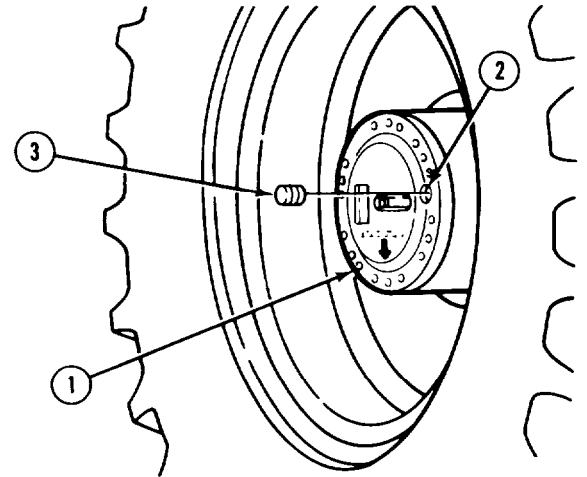
- (1) Clean plug and around hole.
- (2) Inspect all threads for crossed or peeled condition.
- (3) Replace damaged plug.
- (4) Dispose of drained fluids according to local regulations.

c. Filling.**NOTE**

Arrow on face of wheel end must be pointing down to fill wheel end.

- (1) Fill wheel end (1) with gear oil, as specified by MIL-L-2105C, through fill hole (2).
- (2) Wheel end (1) is full when oil level is just below fill hole (2).
- (3) When wheel end (1) is full, install fill/drain plug (3) in drive assembly (2).

END OF TASK



Section VI. PREPARATION FOR STORAGE AND SHIPMENT

4-179. INTRODUCTION.

Commanders are responsible for insuring that all material issued or assigned to their command is maintained in a serviceable condition, properly cared for, and that personnel under their command comply with technical instructions. Lack of time, lack of trained personnel or lack of proper tools may result in a unit being incapable of performing maintenance for which it is responsible. In such cases, unit commanders, with approval of major commanders, may place material that is beyond the maintenance capability of the unit in administrative storage or return it to supply agencies. When preparing the vehicle for administrative storage, the unit commander will be responsible for processing the material, including all tools and equipment, in such a manner as to protect it against corrosion, deterioration and physical damage during shipment or periods of administrative storage.

4-180. STORAGE INSTRUCTIONS.

a. Short Term Storage. No special provisions are required for short term storage of the vehicle. The unit should be started and operated at intervals no greater than 90 days.

b. Long Term Storage. To prepare the unit for long term storage:

- (1) Lubricate all fittings and oil can points according to Lubrication Chart (Figure 3-1).
- (2) Perform all PMCS procedures according to Tables 2-2 and 4-2.
- (3) Prepare fuel tank for long term storage:
 - (a) Drain fuel tank (para 4-29).
 - (b) Fog inside of fuel tank with preservative oil (item 40, appendix E).
 - (c) Coat threaded surfaces of fuel tank drain plug with preservative oil (item 40, appendix E).
 - (d) Remove fuel filler cap.
 - (e) Coat inside fuel cap components with preservative oil (item 40, appendix E).
 - (f) Cover fuel cap and internal components with barrier material (item 27, appendix E) and secure it with tape (item 56, appendix E).
 - (g) Secure fuel cap to vehicle.
- (4) Prepare fuel system for long term storage.
 - (a) Disconnect fuel supply line from fuel sediment bowl.

NOTE

A two compartment portable container with a three position valve is required when preserving vehicle fuel system for long term storage. The container is needed to supply fuel and preservative oil to the engine during preservation procedures. One side of container shall contain diesel fuel (item 29, appendix E). The other side of the container shall contain P-9 preservative oil (item 44, appendix E).

- (b) Connect fuel/preservative hose to fuel sediment bowl.

- (c) Disconnect fuel return hose from fuel return tube and place it in a suitable container for collecting fuel and preservative with a 55 gallon (208 liters) capacity (para 4-29).
 - (d) Open valve on fuel/preservative container to fuel position.
 - (e) Start engine (para 2-9) and allow it to operate at fast idle until engine is warm.
 - (f) Push throttle lever forward until engine is running at 3/4 speed (2,100 rpm).
 - (g) Turn fuel/preservative valve to preservative position.
 - (h) When undiluted preservative oil is flowing from the fuel return line, turn ignition key to "Off" position.
 - (i) Turn fuel/preservative valve to "Off" position.
 - (j) Disconnect fuel/preservative hose from fuel sediment bowl.
 - (k) Connect fuel supply hose to shut-off valve (para 4-47).
 - (l) Connect fuel return hose to fuel return tube (para 4-47).
 - (m) Discard fuel/preservative mixture collected during preservation process.
- (5) Prepare crankcase for long term storage.

NOTE

Level A and level C methods for preparing the crankcase for storage are different. The following instructions cover level A preservation methods. Level C only requires that the crankcase be filled to the operating level with lubricating oil as specified by the Lubrication Chart (Figure 3-1).

- (a) Drain oil from crankcase (para 3-6).
 - (b) Fill crankcase to operating level with preservative oil (item 40, appendix E).
 - (c) Attach a tag to crankcase till tube stating: "THIS CRANKCASE IS FILLED TO OPERATING LEVEL WITH PRESERVATIVE LUBRICATING OIL. DRAIN AND REFILL CRANKCASE TO OPERATING LEVEL ACCORDING TO TM 5-3985-369-14 BEFORE START UP."
- (6) Prepare air intake system for long term storage:
- (a) Remove air filter (para 3-8).
 - (b) Fog inside of air cleaner cannister with about one ounce of preservative oil (item 40, appendix E).

4-180. STORAGE INSTRUCTIONS (CONT).
--

CAUTION

Preservation oil will damage non-metallic air filter parts. Care should be used when applying preservation oil to air filter non-metallic parts.

- (c) Dip removed metallic air cleaner components in preservative oil (item 40, appendix E).
 - (d) Install air cleaner components (para 3-8).
 - (e) Wrap air intake restriction indicator with barrier material (item 28, appendix E).
 - (f) Disconnect air inlet tube from outlet side of air cleaner (para 4-43).
 - (g) Disconnect exhaust tube from turbocharger (para 4-58).
 - (h) Fog inside of air inlet tube toward turbocharger with about one ounce of preservative oil (item 42, appendix E).
 - (i) Install air inlet tube (para 4-43).
 - (j) Fog inside of turbocharger from exhaust side with about two ounces of preservative oil (item 40, appendix E).
 - (k) Fog exhaust tube toward muffler with MIL-L-21260 preservation oil.
 - (l) Install exhaust tube (para 4-58).
- (7) Prepare exhaust system for long term storage.
- (a) Clean painted and unpainted surfaces of exhaust pipes and muffler of dirt, rust, and scale.
 - (b) Repaint marred and damaged areas of Muffler And Exhaust Pipes.
 - (c) Coat unpainted surfaces of muffler and exhaust pipes with P-19 preservative oil (item 47, appendix E).
 - (d) Coat interior surfaces of muffler and exhaust pipes with preservative oil (item 40, appendix E).
- (8) Prepare drive belt and pulleys for long term storage:
- (a) Completely loosen tension of drive belt.
 - (b) Coat surfaces of unpainted pulley grooves with preservative oil (item 41, appendix E).
 - (c) Attach tag to drive shaft pulley stating: "BELT TENSION RELIEVED - ADJUST BEFORE STARTING ENGINE."
- (9) Prepare batteries for long term storage:
- (a) Remove battery cables (para 4-90).
 - (b) Coat battery terminals and cable connectors with P-6 preservative oil (item 41, appendix E).

- (c) Cover battery terminals and cable connectors with barrier material (item 27, appendix E) and secure it with tape (item 56, appendix E).
 - (d) Tape battery cables to their respective batteries with tape (item 56, appendix E).
 - (e) Package batteries with barrier material (item 28, appendix E) and secure to vehicle.
- (10) Prepare crankcase openings for long term storage:
- (a) Remove oil filler cap (para 3-6), oil dipstick (para 4-33), and engine breather tube (para 4-32).
 - (b) Cover oil filler, dipstick and crankcase breather openings with plastic caps (item 8, appendix E).
 - (c) Secure plastic covers in place with tape (item 56, appendix E).
- (11) Attach a tag to ignition switch (Figure 2-1) stating: “DEPROCESS THIS ENGINE IN ACCORDANCE WITH INSTRUCTIONS CONTAINED ON DA FORM 2258 OR DD FORM 1397 (ATTACHED TO THIS VEHICLE). IN ADDITION, THE AIR CLEANER, FILL CAPS, EXHAUST PIPES, BREATHER TUBE, AND DIPSTICK TUBE HAVE BEEN SEALED. REMOVE ALL SEALS BEFORE STARTING ENGINE.”
- (12) Prepare cooling system for long term storage:
- (a) Drain cooling system (para 3-7).
 - (b) Fill cooling system with 50% water and 50% antifreeze (item 2, appendix E).
 - (c) Attach a tag to radiator fill cap indicating lowest temperature cooling system can be exposed to before freezing.
- (13) Prepare additive system for long term storage:
- (a) Open spray bar (para 2-11).
 - (b) Coat unpainted parts of spray bar with P-1 preservative oil (item 42, appendix E).
 - (c) Coat exposed area of spray bar cylinder piston rod with P-6 or P-11 preservative oil (item 43 or 46, appendix E).
 - (d) Cover exposed area of spray bar cylinder piston rod with barrier material (item 28, appendix E). Barrier material should extend about two inches up on cylinder.
 - (e) Secure barrier material in place with tape (item 56, appendix E).
 - (f) Fog internal parts of additive pump with preservative oil (item 40, appendix E).
 - (g) Drain excess preservative oil from pump.
 - (h) Remove additive coupling guard (para 4-153).
 - (i) Coat pump drive chain with P-9 preservative oil (item 44, appendix E). Ensure preservative penetrates inner surfaces of rollers, pins, and bushings.

4-180. STORAGE INSTRUCTIONS (CONT).

- (j) Allow excess preservative oil to drain from chain, then coat chain with P-1 preservative oil (item 42, appendix E).
 - (k) Install additive coupling guard (para 4-153).
 - (l) Secure supply hose boom to vehicle (para 2-12).
- (14) Prepare rotor system for long term storage:
- (a) Lower rotor to ground (Figure 2-1).
 - (b) Lower tailboard completely (Figure 2-1).
 - (c) Coat unpainted rotor parts with P-1 preservative oil (item 42, appendix E).
 - (d) Coat exposed area of boom cylinder piston rod with P-6 or P-11 preservative oil (item 43 or 46 appendix E).
 - (e) Cover exposed area of boom cylinder piston rod with barrier material (item 28, appendix E). Barrier material should extend about two inches up on cylinder.
 - (f) Secure barrier material in place with tape (item 56, appendix E).
 - (g) Coat exposed area of tailboard cylinder piston rod with P-6 or P-11 preservative oil (item 43 or 46, appendix E).
 - (h) Cover exposed area of tailboard cylinder piston rod with barrier material (item 28, appendix E). Barrier material should extend about two inches up on cylinder.
 - (i) Secure barrier material in place with tape (item 56, appendix E).
- (15) Prepare instrument panel or long term storage:
- (a) Remove front and rear floodlights (para 4-81).
 - (b) Box lights individually with boxes (item 3, appendix E).
 - (c) Secure boxes to vehicle.
- (16) Prepare instrument panels for long term storage:
- (a) Install instrument panel covers (para 4-73).
 - (b) Seal edges between instrument panels and covers with tape (item 56, appendix E).
 - (c) Wrap vacuum gauge with barrier material (item 27, appendix E).
- (17) Coat inside of ignition switch with preservative oil (item 44, appendix E).
- (18) Coat unpainted surfaces of hydraulic control levers with Type P-1 preservative oil (item 42, appendix E).

- (19) Fill hydraulic oil tank to operating level according to Lubrication Chart (Figure 3-1).
- (20) Cover seat back and cushion with black polyethylene (item 51, appendix E).
- (21) Secure plastic with tape (item 56, appendix E).
- (22) Coat hinges and latches with P-10 preservative oil (item 45, appendix E).
- (23) Park vehicle in an accessible area.
- (24) Do not block tires.
- (25) Ensure that tires are not parked in grease or oil.

4-181. SHIPMENT INSTRUCTIONS.

- a. Perform all PMCS procedures according to Tables 2-2 and 4-2.

NOTE

Remove rollover protective structure (paragraph 4-124) for transport by semi-trailer when height restrictions will be encountered or for transport on C-130 or C-141 aircraft. Check with your local Transportation Movement Officer for restrictions.

- b. Refer to Figure 2-1 for tiedown points.

CHAPTER 5

DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT AND SUPPORT EQUIPMENT

5-1. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970 or CTA 8-100, as applicable to your unit. Table 5-1 lists tool kits required and authorized for use at Direct and General Support Maintenance. Reference code numbers listed in column one correspond to those listed in the same column on the MAC.

Table 5-1. Tool and Test Equipment Requirements

Tool or Test Equipment Ref Code	Maintenance Level	Nomenclature	Tool Kit Stock Number
2	O, F, H	Tool Kit, General Mechanic's: Automotive	5180-00-177-7033
	O, F, H	Shop Equipment, Organizational Repair: Light Truck Mounted	4910-01-236-0166
	O, F, H	Test set, battery: AN/PSM-13	6625-00-868-8344
	O, F, H	Analyzer Set, Engine: Portable Solid State (SET/ICE-PM)	4910-01-222-6589
	F, H	Tool Kit, General Mechanic's: Equipment Maintenance and Repair	5180-00-699-5273
	F, H	Shop Equipment, Contact Maintenance: Truck Mounted	4940-01-016-2262
	F, H	Shop Equipment, Contact Maintenance: Truck Mounted	4940-01-235-5080
	F, H	Tool Kit, Automotive: Fuel and Electrical System Repair	5180-00754-0655
	F, H	Shop Equipment, Electrical Repair: Semi-trailer Mounted	4940-00-294-9517
	F, H	Tool Kit, Electrical Equipment: TK-101/GSQ	5180-00-064-5178
	F, H	Tool Kit, Machinist: Posts/Camps/Stations	5280-00-511-1950
	F, H	Multimeter, digital	6625-01-265-6000
	F, H	Tool Outfit, Hydraulic System: Test and Repair, 3/4 Ton, Trailer Mounted	4940-01-036-5784
	F, H	Shop Equipment, Radiator Test and Repair: Field Maintenance, Composite, Shop B	4910-00-071-0747

5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

The MAC, appendix B, identifies the authority and responsibility for maintenance tasks listed in this manual. Tool kits, test equipment and diagnostic equipment required for performing direct and general support maintenance tasks are also identified in the MAC. The Mixer, Rotary Tiller Repair Parts and Special Tools List (RPSTL), TM 5-3895-369-24P lists Special tools, TMDE and support equipment required to perform direct and general support maintenance procedures contained in this manual.

5-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List, TM 5-3895-369-24P, covering direct and general maintenance for vehicle.

Section II. SERVICE UPON RECEIPT

Refer to Chapter 4, Section II.

Section III. DIRECT AND GENERAL SUPPORT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

5-4. MAINTENANCE INTRODUCTION.

Instructions in this section provide general procedures to be followed for inspection, removal, cleaning, repair, replacement, or installation of components, and testing authorized at the direct support/general support maintenance level as specified by the Maintenance Allocation Chart (MAC).

a. Servicing. All services are performed at the unit support level of maintenance according appendix B, Maintenance Allocation Chart.

b. Jacking Lift Points. For jacking lift points, refer to Chapter 4 (para 4-17).

c. Operational Checks. All operational checks included in the maintenance procedures will include the techniques and methods required to assure the satisfactory performance of vehicle. Reference the operator's instructions, Chapter 2, for start, run-up, and shutdown procedures.

d. Inspection of Components.

(1) Inspect all surfaces in contact with gaskets, packings, or seals for nicks and burrs which might damage the new seal upon assembly. If any defect is found, remove it before assembly.

NOTE

Defects which may cause bearing binding or misalignment are cause for rejection. Nicks or gouges outside race load areas are not cause for rejection.

(2) Inspect bearings for rusted or pitted balls, races, or separators. Inspect balls and races for abrasion and serious discoloration.

(3) Cuts or grooves parallel to ball or roller rotation and fatigue pits (not minor machine marks or scratches and cracks found during magnetic particle inspection) are causes for bearing rejection.

(4) Remove drain plugs from engine system components and inspect the sediment sticking to the plug. Grit or fine metal particles may indicate actual or potential component failure. A few fine particles are normal. This inspection will help to show defective parts before internal inspection of the component.

(5) Guidelines for rejection of gears by visual inspection are not listed because of varying conditions for gear application. The following descriptions of wear conditions may help to determine when parts are defective.

(a) Initial pitting may occur when gears are first started in service. When pitting reduces local high spots to allow enough contact area to carry load without further impairment, initial pitting is not serious.

(b) Destructive pitting continues to progress after initial pitting. If there is not enough contact area remaining to carry the load, rapid destruction may occur from continued use.

(c) Abrasive wear is surface damage caused by fine particles carried in lubricant or particles imbedded in tooth surfaces. Particles may be metal, sand, scale, or other impurities in oil or surrounding atmosphere.

(6) Inspect all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or contact with other parts of vehicle. Inspect the fitting threads for damage. Replace any defective part. After assembly and during initial vehicle operation, check for leaks.

(7) Inspect all wiring for chafed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.

(8) Visually inspect all castings and weldments for cracks.

(9) Clean all parts before inspection. Check for defects such as physical distortion, wear, cracks, and pitting.

e. Cleaning Procedures.

WARNING

- Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in a well ventilated area. Avoid contact with skin, eyes and clothing and don't breathe vapor. Do not use near open flame or excessive heat. The flash point is 100°F to 140°F (38°-60°C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.
- Compressed air used for cleaning and drying purposes must be reduced to 30 psi (207 kPa) and used only with adequate chip guarding and personal protection equipment.

(1) Do not use wire brushes, abrasive wheels, or compounds to clean parts, unless specifically approved in the detailed instructions. Dimensional characteristics of machined surfaces can be altered and may weaken a highly stressed part.

(2) Soak parts in drycleaning solvent P-D-680 (item 54, appendix E) and wash away deposits by sloshing or spraying. When necessary, brush with a soft bristle brush (item 5, appendix E) moistened in drycleaning solvent. Use a jet of compressed air to dry parts, except bearings, after cleaning. Bearings must drip and air dry.

5-4. MAINTENANCE INTRODUCTION (CONT).

(3) Do not clean rubber parts in drycleaning solvent. Wipe clean with a dry, clean, lint-free cloth (item 12, appendix E).

WARNING

Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

(4) A degreasing tub may be used to remove heavy grease and oil from metal parts. Use degreasing and depreserving cleaning compound (item 9, appendix E) as degreasing agent.

CAUTION

To prevent corrosion, part should be dipped in rust preventive within two hours of degreasing.

(5) Remove parts from degreasing machine and check all oil passages and cavities for cleanliness and freedom from obstruction before coating with rust preventive. Run a thin, flexible wire through oil passages to make sure they are not clogged. Use a pressure spray gun and drycleaning solvent to clean dirty passages.

(6) Parts soaked in carbon removal solution should be rinsed with drycleaning solvent. Rinse in a solvent spray booth equipped with a filter and hand spray gun, then use a soft bristle brush (item 5, appendix E) to remove carbon deposits. A cloth buffing wheel may also be used.

WARNING

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in a well ventilated area. Avoid contact with skin, eyes and clothing and don't breathe vapor. Do not use near open flame or excessive heat. The flash point is 100oF-140°F (38°.60°C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

(7) Electrical parts, such as coils, junction blocks, insulated wiring and switches, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean lint-free cloth moistened with drycleaning solvent P-D-680 (item 54, appendix E).

(8) When cleaning ball or roller bearings, place in a basket and suspend in a container of drycleaning solvent, P-D-680 (item 54, appendix E). If necessary, use soft bristle brush (item 9, appendix E) to remove caked grease or chips. Avoid rotating bearings before solid particles are removed to prevent damage to races and balls. When bearings have been cleaned, spin immediately in light lubricating oil (item 34, appendix E) to remove solvent.

(9) Do not clean preformed packings or other rubber parts in drycleaning solvent. Wipe with clean, dry lint-free cloth (item 12, appendix E).

(10) For exterior cleaning of frame and structural components, use detergent (item 19, appendix E), in a solution as recommended on the container. Leave application on items surface for approximately 10 minutes before rinsing. Rinse with hot or cold water under pressure. If available, use hot water under 80 to 120 lb (36 to 54 kg) pressure. An ordinary garden hose may be used if no other equipment is available. If pressurized water supply is not available, wash painted surfaces with a solution of 1/4 cup of soap chips (item 10, appendix E), to one gallon of water.

(11) Before disassembly of vehicle, clean exterior parts of vehicle thoroughly with drycleaning solvent P-D-680 (item 54, appendix E) to remove accumulated mud, tar, and grease.

(12) Electrical parts such as coils, connectors, switches, and insulated wiring should not be soaked or sprayed with cleaning solutions. Clean these parts with clean, lint-free cloth moistened with drying cleaning solvent P-D-680 (item 54, appendix E).

CAUTION

Do not use gasoline, diesel fuel, or other petroleum base products to clean or preserve hydraulic system components. Use of petroleum base products can change the lubricating quality of hydraulic oil and cause failure or damage to equipment.

(13) When cleaning hydraulic system components, use petroleum-free solvents. Clean and dry parts thoroughly to make sure no residue remains. If preservative coating is required before reassembly, apply a light film of the oil in which the component normally operates. If petroleum-free solvents are not available for cleaning, use hydraulic fluid compatible with that used in the vehicle system.

f. Removal and Disassembly of Components.

(1) When unpacking items, remove all packing material, barrier paper, tape, plastic bags, protective caps, and protective grease coatings.

(2) Use protective covers on open housings, lines, engine inlets, exhaust ducts, and other openings as soon as possible after disassembly to prevent moisture and foreign matter from entering engine. Wrap all parts in clean paper or dip parts in the oil in which the component normally operates.

(3) Cap or tape over all open tubes, hoses, fittings and engine component openings as soon as parts are removed.

CAUTION

Do not use tape to close off fuel or oil openings. Sticky surface of tape can mix with fuel and oil and cause engine malfunctions.

(4) Use suitable containers of appropriate size to catch fuel or oil when removing hoses and fittings.

(5) Remove and handle components carefully.

5-4. MAINTENANCE INTRODUCTION (CONT).

- (6) Inspect parts as removed for breaks, dents, cracks, surface defects, or other obvious damage.
- (7) Remove burrs from gear teeth with a fine-cut file.
- (8) Remove residue from bearing races with crocus cloth (item 11, appendix E).
- (9) Welding and brazing processes may be used to repair cracks in external parts, such as brackets, panels, and framework. Because of time required and the chance of subsequent failure, such repairs should be attempted only when replacement parts are not available. Welding and brazing of castings and running parts or parts under great stress will only be done in emergencies.
- (10) When installing studs in engine block use a proper driver. A worn stud driver may damage the end thread. Then a chasing die must be used before a nut can be screwed on. This procedure will remove plating and allow corrosion. Before installing a stud, inspect hole for chips. Blow out foreign matter and start stud by hand. Before final insertion, coat thread with a film of anti-seize compound (item 13, appendix E). Install stud to proper "setting height," which is the total projecting length.
- (11) Replace all broken, worn, or burned electrical wiring. Wires with broken strands must be replaced.
- (12) Replace all broken, frayed, crimped, or soft flexible hoses. Replace stripped or damaged fittings. Replace entire flexible hose if fittings are damaged. Hose clamp should not crimp hoses.
- (13) Replace any screw, nut, or fitting with damaged threads. Inspect tapped holes for thread damage. If cross-threading is evident, retap the hole for the next oversize screw or stud. If retapping will weaken the part, or if the cost of the part makes retapping impractical, replace the part. Chasing the threads with proper size tap or die may be adequate.
- (14) Reshape elongated mounting holes to round and drill to receive bushing with required inner diameter. Stake bushing in place with center punch.
- (15) Remove protective grease coatings from new parts before installation.
- (16) To replace a preformed packing, first clean groove, then stretch packing and place into position. Place component on flat surface and uniformly press packing into position.
- (17) Use a nonhardening pipe thread sealing compound (item 17, appendix E) to join piping.
- (18) Coat both sides of gasket with sealant. Remove all traces of previous gasket and sealant before installing new gasket.
- (19) Coat oil seals evenly with oil or grease before installing. Install oil seals with seal lip facing in, applying an even force to outer edge of seal. If oil seals are to be installed over keyed or splined shafts, use a guide to prevent sharp edge of the keyway or splines from cutting the seal. Construct guides of very thin gauge sheet metal and shape to the required diameter. Make certain guide edges are not sharp and arc bent slightly inward so they do not cut the seal.
- (20) When mounting bearings on shafts, always apply force to the inner races. When mounting bearings into housing, always apply the force to the outer races. Lubricate bearings before assembly with lubricant used in the related housing or container to provide the first run-in until lubricant from the system can reach the bearings.

- (21) To ease assembly and installation, tag and mark shims, connectors, wires, and mating ends of lines before disconnecting them. Identify similar parts to ensure correct assembly.
- (22) Before removal of any electrical component, disconnect battery cables (para 4-90).
- (23) Ensure that adequate clearance is available for removal of component. Disassemble vehicle to the extent necessary to provide adequate working clearance.
- (24) Use chain hoist, jack, or other aid when lifting heavy components. Lifting device should be positioned and attached to components to remove all strain from mounting hardware before last hardware is removed.
- (25) Discard preformed packings, gaskets, seals, and similar material when removed. Be sure that all traces of oil, gaskets, and sealants are removed. When possible, use wood or plastic probes and scrapers to prevent damage to machines surfaces.
- (26) Cotter pins, lockwashers, star washers, lockwire, self-locking nuts, and any similar locking devices must be discarded when removed. Self-locking fasteners that loosen up must be replaced, not tightened.
- (27) Remove parts only if repair or replacement is required. Do not disassemble a component any further than necessary to accomplish needed repairs.

g. Painting. Instructions for preparation of material for paint, how to paint, and materials to be used are in TM 43-0139. Instructions for camouflage painting, stenciling and marking military vehicles are called out in TB 43-0209. Data plates location and description are referenced in Chapter 2 (para 2-3).

h. Lubrication. Refer to Chapter 3 (para 3-1) for lubrication procedures and requirements for vehicle. The instructions include types and grades of lubrications used, lube points, locations and frequency of required lubrication,

i. Assembly.

- (1) Remove protective grease coatings from new parts before installation.
- (2) To replace preformed packings, first clean groove, then stretch packing into position. Rotate component on flat surface applying downward pressure to uniformly press packing into position. A light coating of fluid which the packing will operate in, will make assembly easier.
- (3) Coat oil seals evenly with oil or grease before installing. Install oil seals with seal lip facing in, applying an even force to the outer edge of seal. If oil seals are to be installed over keyed or splined shafts, use a guide to prevent sharp edges of the keyway or splines from cutting the seal. Guides can be very thin gauge sheet metal shaped to the required diameter. Make certain guide edges are not sharp and are bent slightly inward so they do not cut the seal.
- (4) Lubricate bearings before reassembly with the type of lubricant normally used in the related housing or container. This will provide lubrication during the first run-in until lubricant from the system can reach the bearings.

j. Installation. Put hoses, tubes, lines, and electrical wiring in place by matching identification tags, markings on equipment, and using illustrations presented. Use sealing compounds as required in each maintenance task. When installing screws and nuts, be sure to tighten to values given.

k. Welding Procedures. Welding may be used to repair cracks in steel parts. These repairs should be made only when replacement parts are not available. Do not weld running parts. Visually inspect all welds for cracks. Parts that carry a great load should receive magnetic particle inspection. Critical nonferrous parts may be inspected with florescent penetrant (item 50, appendix E).

5-4. MAINTENANCE INTRODUCTION (CONT).

1. Sheet Metal Repair. Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing. Repair minor skin cracks by installing patches.

Section IV. DIRECT AND GENERAL SUPPORT TROUBLESHOOTING.

5-5. TROUBLESHOOTING INTRODUCTION.

This section contains step-by-step procedures for identifying, locating, and isolating equipment malfunctions.

5-6 TROUBLESHOOTING SYMPTOMS.

The Direct and General Support Troubleshooting Symptom Index (Table 5-2) lists the most common malfunctions found during operation of vehicle. Tests or inspections and corrective actions should be performed in the order listed. This symptom index lists corrective actions that can be performed by direct and general support maintenance personnel.

5-7. DIRECT AND GENERAL SUPPORT TROUBLESHOOTING PROCEDURES.

Table 5-2 contains the malfunctions listed in Direct and General Support Troubleshooting Symptom Index. Pages 5-12 through 5-101 contain test and inspection instructions required to determine the malfunction's cause and corrective actions for repairing the faulty equipment. Operator and Unit Support Troubleshooting Procedures (Tables 3-2 and 4-2) should be performed before Direct and General Support Troubleshooting Procedures.

Table 5-2. System Symptom Index

Engine Fault Index

Fault	Description	Page
1.	Fails to crank or cranks slowly with clutch disengaged	5-12
2.	Engine cranks but will not start - no smoke from exhaust	5-16
3.	Engine hard to start or will not start - smoke from exhaust	5-20
4.	Engine starts but will not keep running	5-24
5.	Engine surges (speed changes)	5-28
6.	Engine idles rough	5-32
7.	Engine runs rough and misfires	5-38
8.	Engine rpm will not reach rated speed	5-44
9.	Engine fails to develop full power	5-46
10.	Engine exhaust smokes excessively	5-52
11.	Engine operating temperature too high	5-56
12.	Engine losing coolant	5-60
13.	Engine oil pressure too low	5-64
14.	Excessive oil consumption	5-72
15.	Fuel or oil leaking from exhaust manifold	5-78
16.	Compression knocks	5-82
17.	Excessive fuel consumption	5-84
18.	Excessive vibration	5-88
19.	Unusual engine noises	5-94

Vehicle Fault Index

Fault	Description	Page
2.	Vehicle does not move in forward or reverse correctly	5-98

1. ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED.

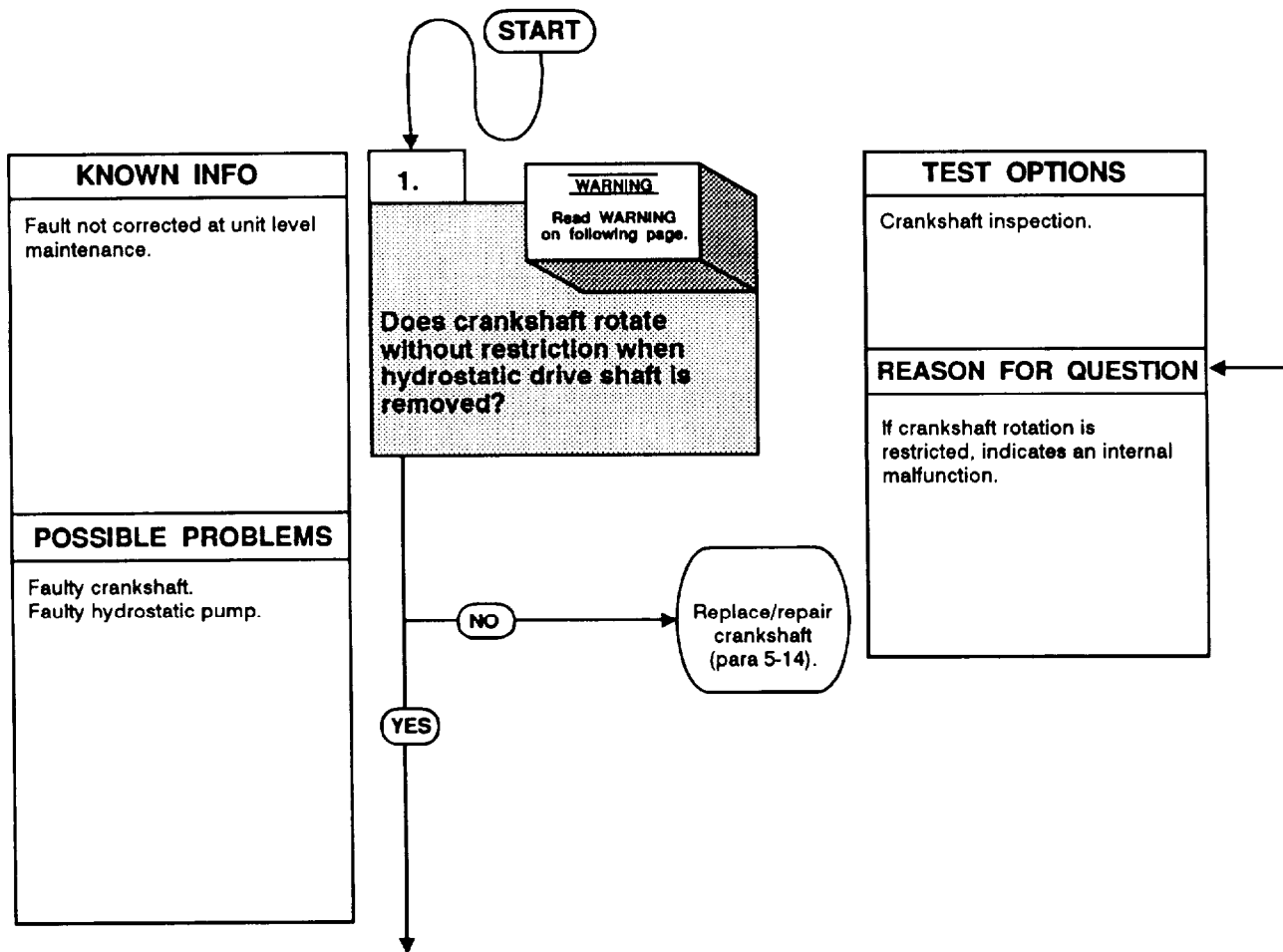
INITIAL SETUP

Equipment Condition

Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Holder, harmonic balancer

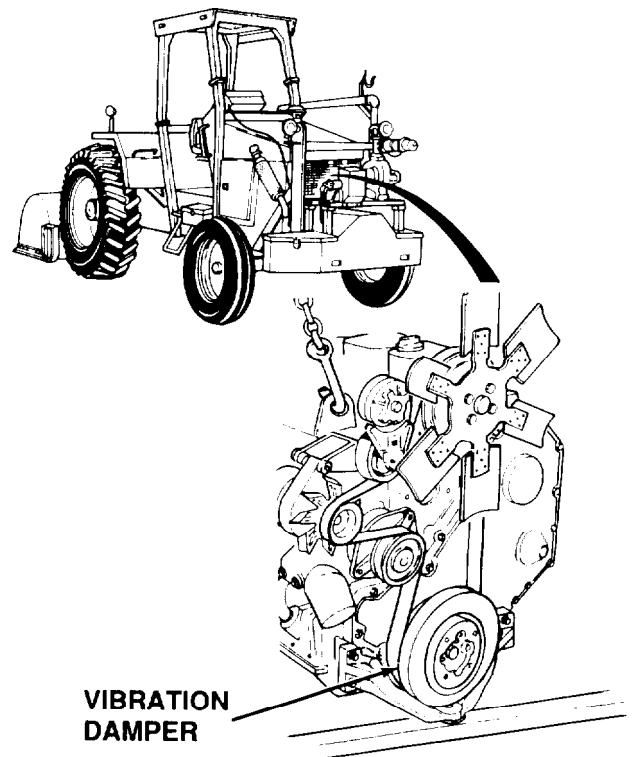


WARNING

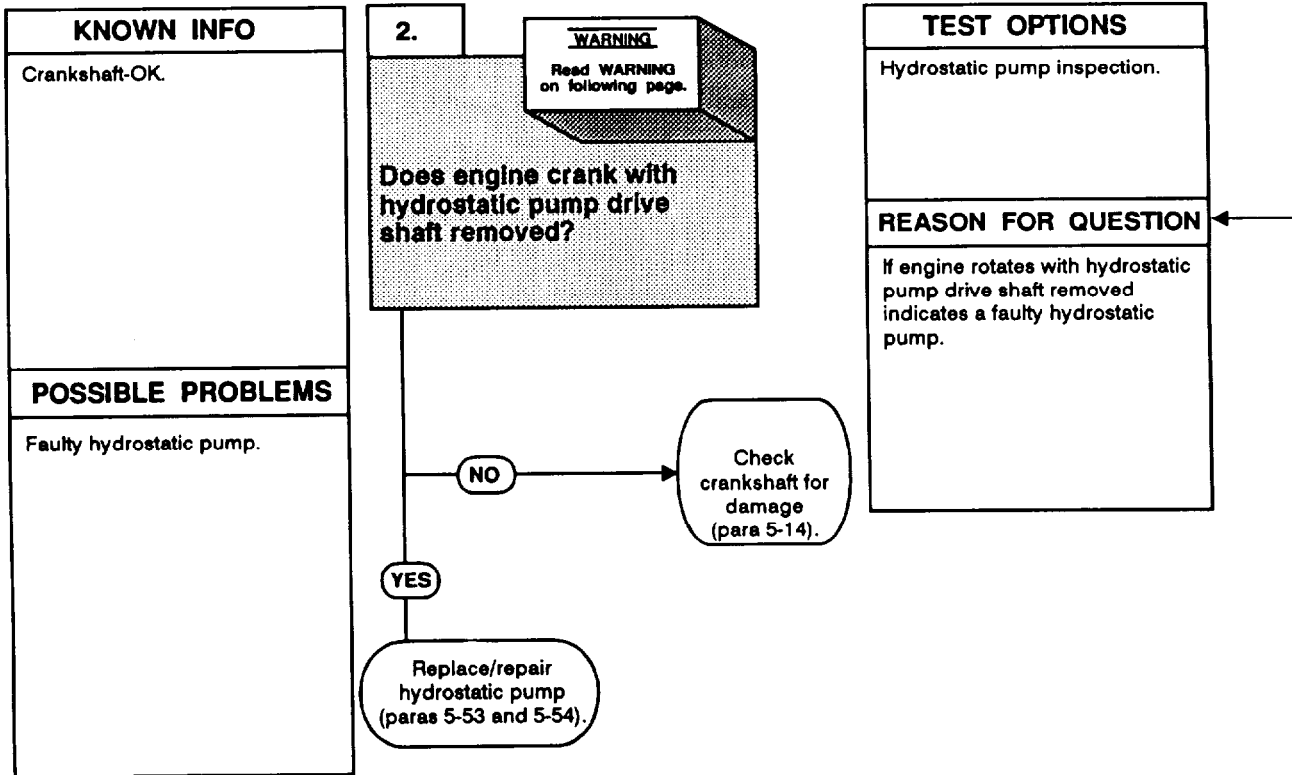
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

CRANKSHAFT INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove hydrostatic pump drive shaft (para 4-100).
- (3) Rotate vibration damper to check crankshaft for restriction
 - (a) If rotation is restricted, indicates internal malfunction. Replace engine (para 5-8).
 - (b) If rotation is not restricted, indicates faulty hydrostatic pump.

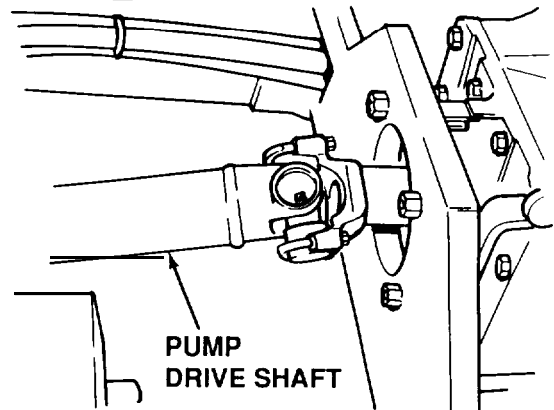
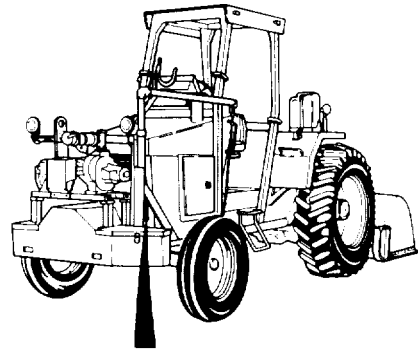


ENGINE FAILS TO CRANK OR CRANKS SLOWLY WITH CLUTCH DISENGAGED (CONT).



HYDROSTATIC PUMP INSPECTION

- (1) Remove hydrostatic pump drive shaft (para 4-100).
- (2) Try to start engine (pare 2-9).
 - (a) If engine starts, hydrostatic pump is faulty, remove pump and repair (para 5-53 and 554).
 - (b) If engine does not start, remove crankshaft and check for damage that would restrict engine movement (para 5-14).



2. ENGINE CRANKS BUT WILL NOT START - NO SMOKE FROM EXHAUST.

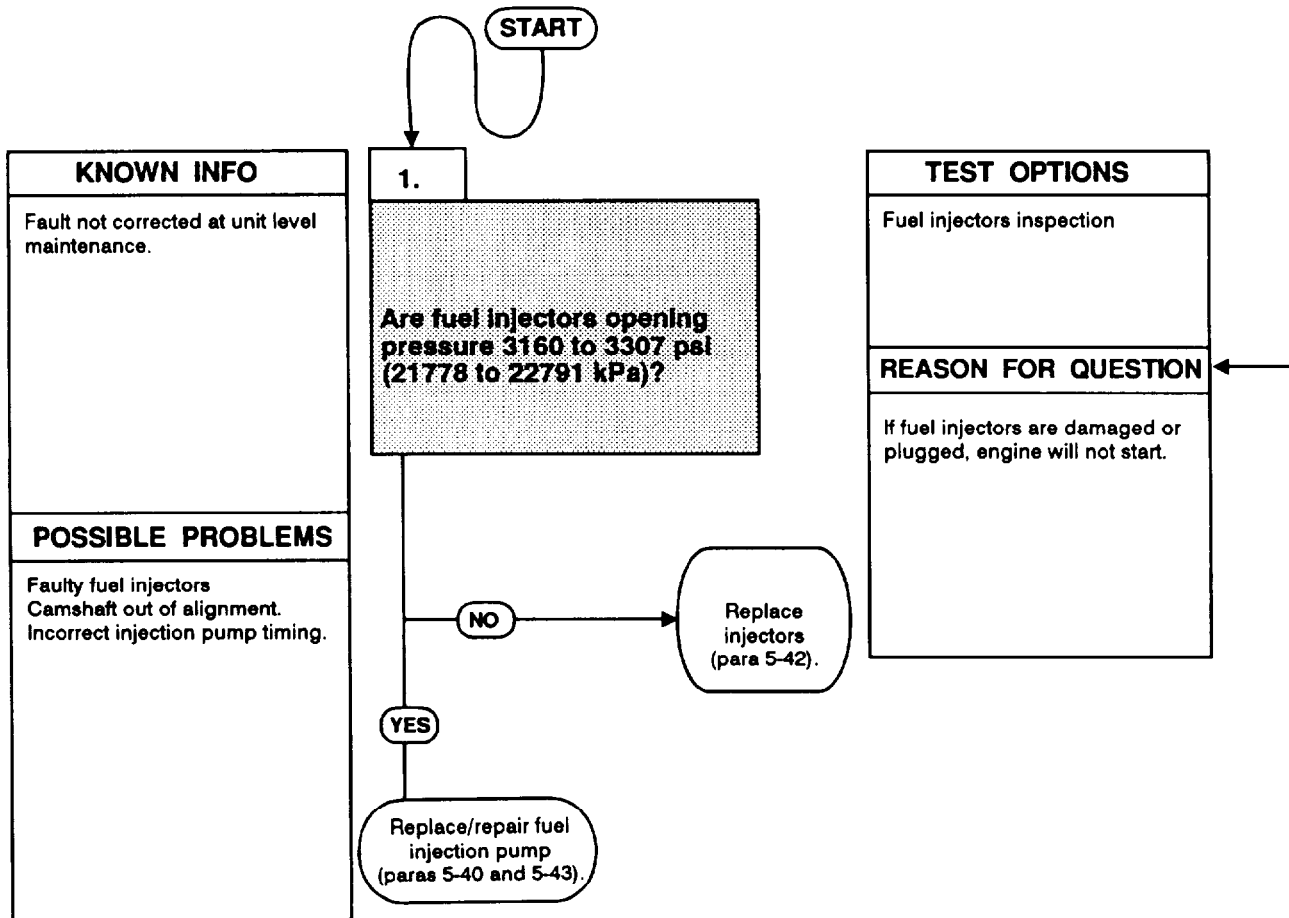
INITIAL SETUP

Equipment Condition

Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

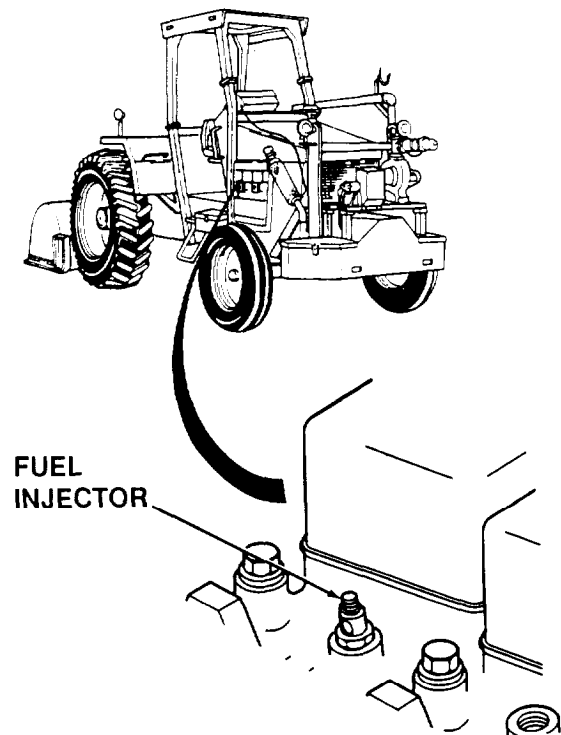


WARNING

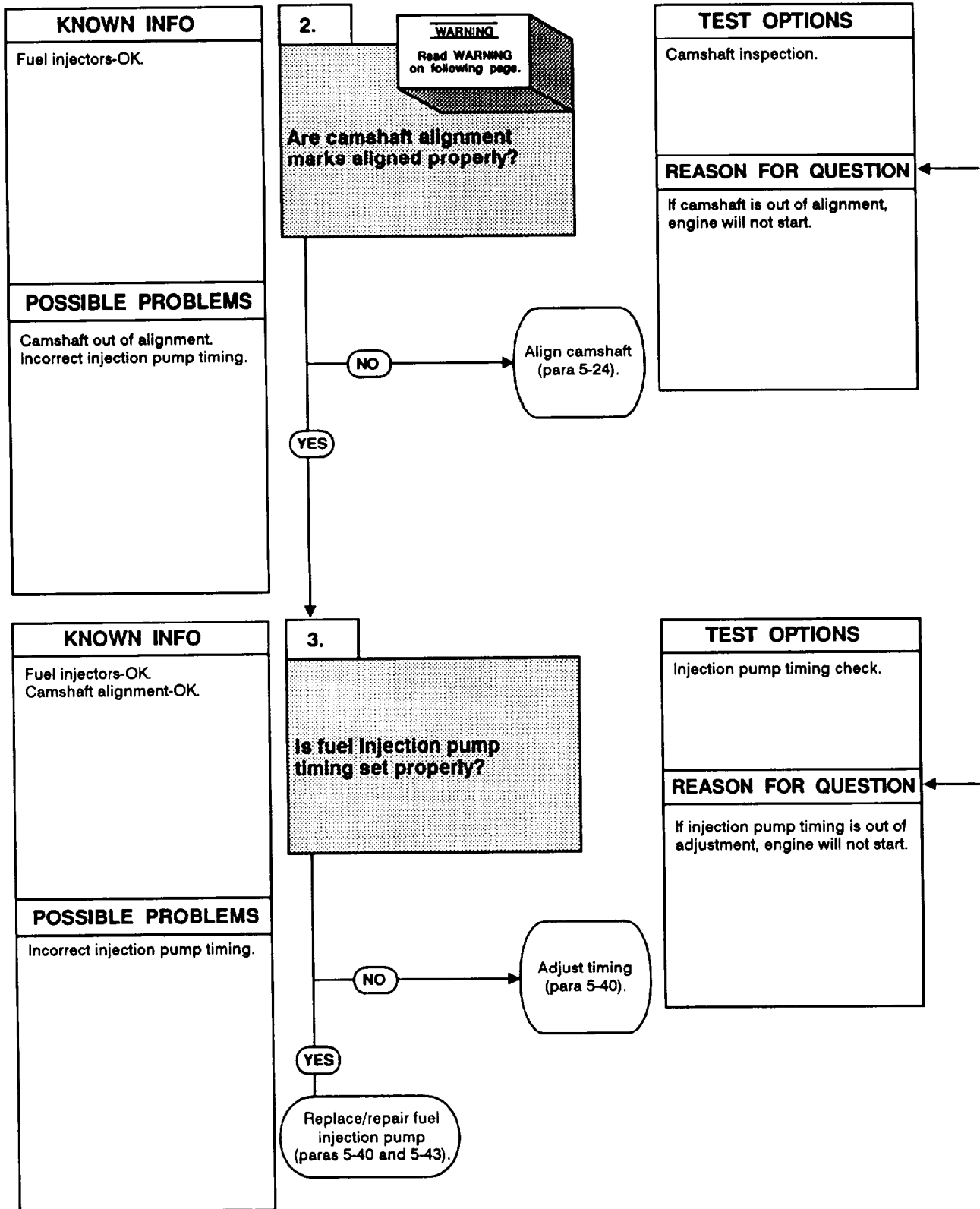
Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21773 to 22791 kPa) on all injectors
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty injection pump. Replace/repair injection pump (paras 5-40 and 5-43).



ENGINE CRANKS BUT WILL NOT START - NO SMOKE FROM EXHAUST (CONT).

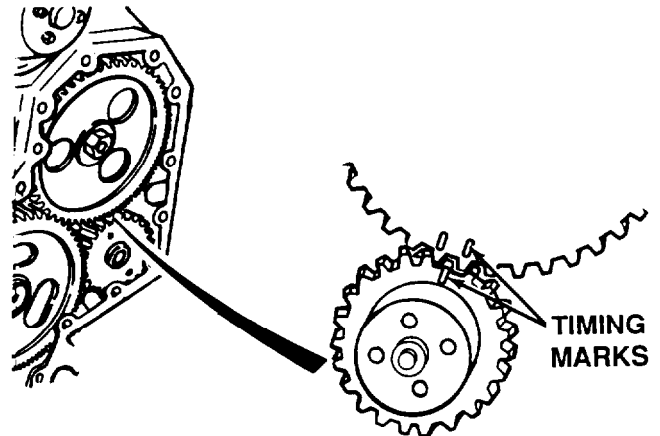


WARNING

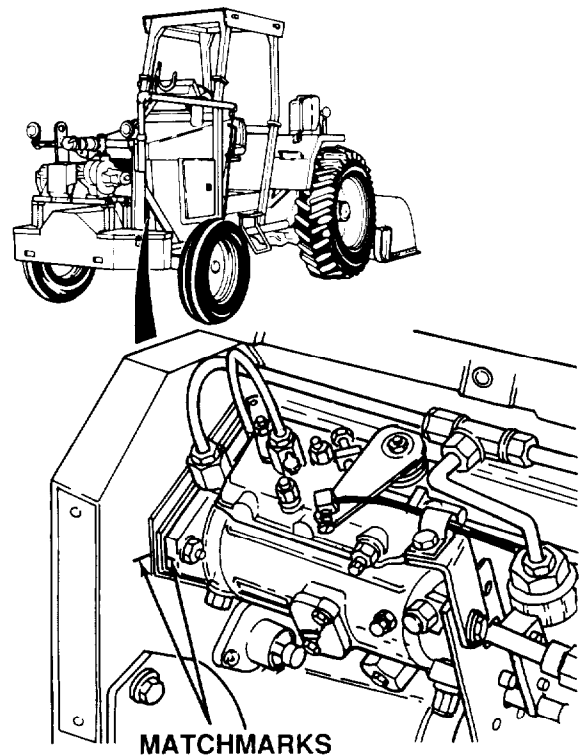
Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot: fuel can be ignited by a hot engine.

CAMSHAFT ALIGNMENT INSPECTION

- (1) Remove gear cover (para 526).
- (2) Check timing marks on camshaft gear and crankshaft gear.
 - (a) If timing marks are out of alignment, match timing marks (para 5-24).
 - (b) If timing marks are aligned correctly, indicates internal injection pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).

**INJECTION PUMP TIMING INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) if injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates internal injection pump malfunction. Replace/repair injection pump (paras 5-40 and 5-43).



3. ENGINE HARD TO START OR WILL NOT START-SMOKE FROM EXHAUST.

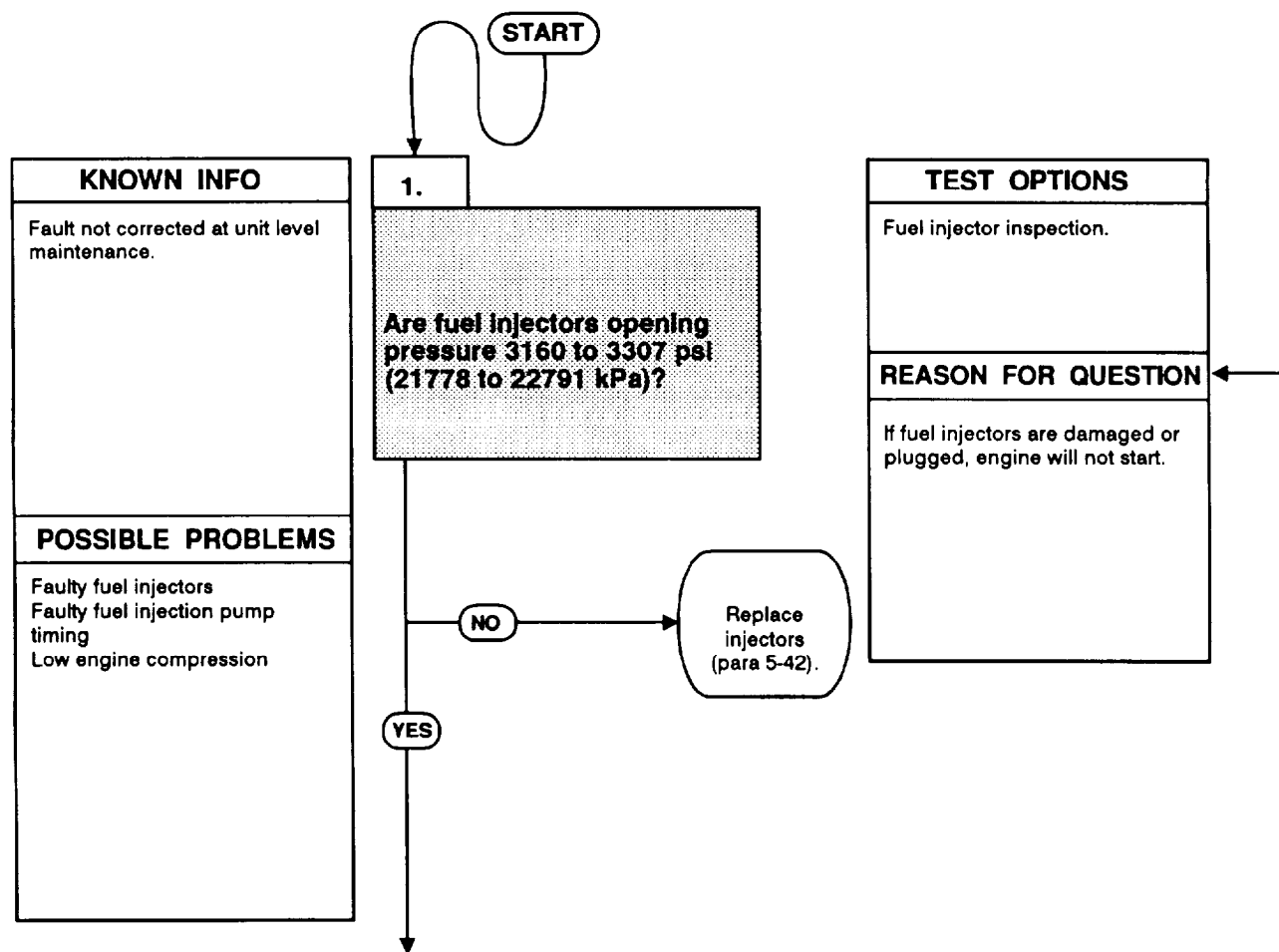
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

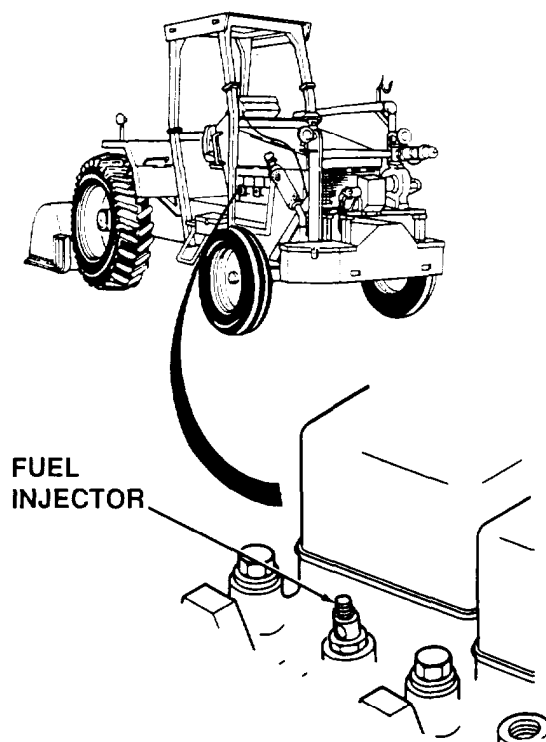


WARNING

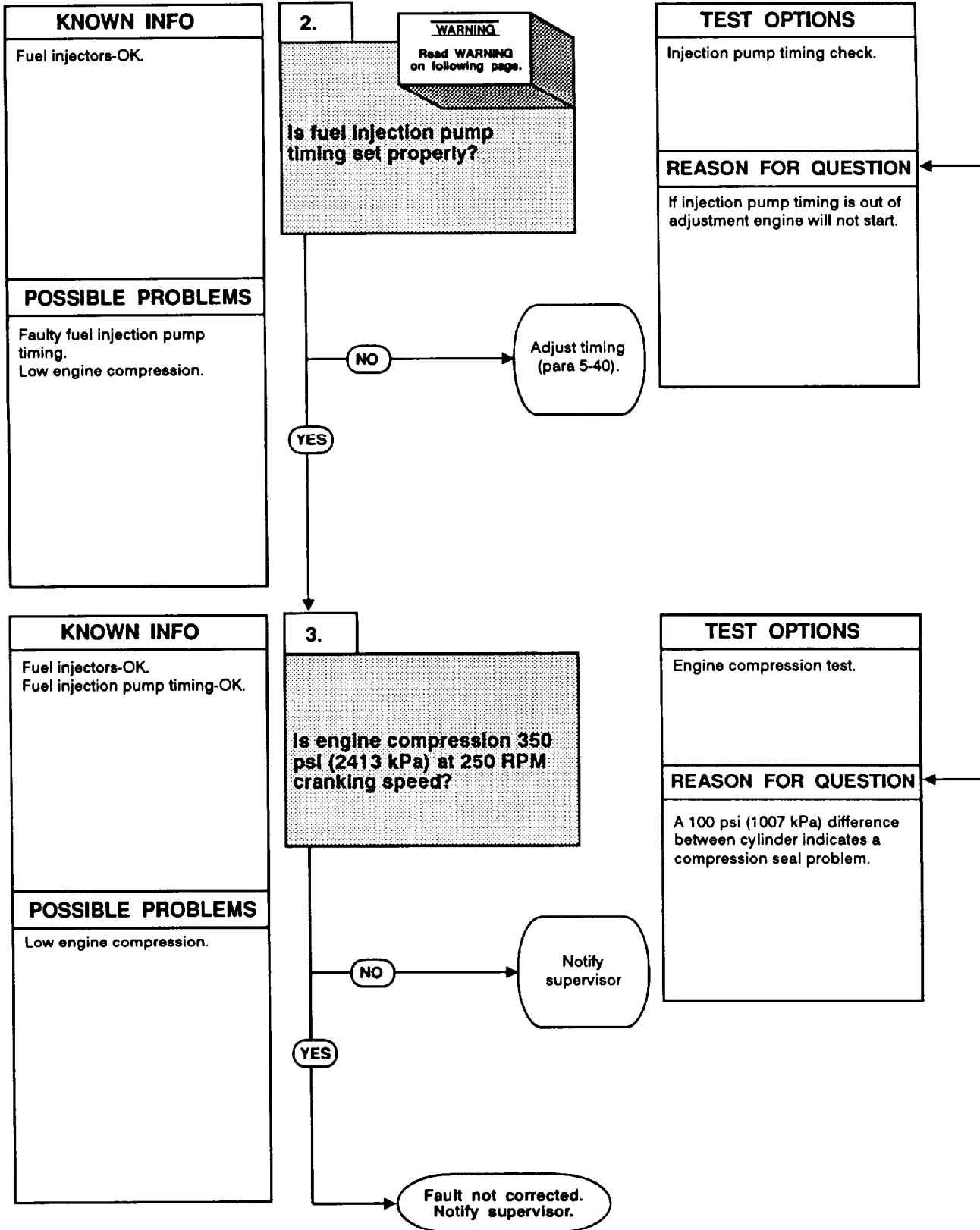
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.



ENGINE HARD TO START OR WILL NOT START-SMOKE FROM EXHAUST (CONT).

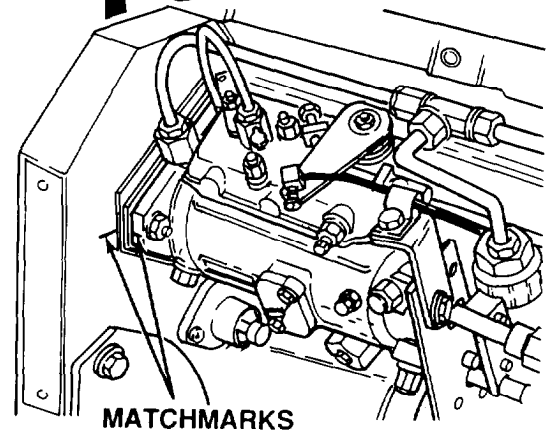
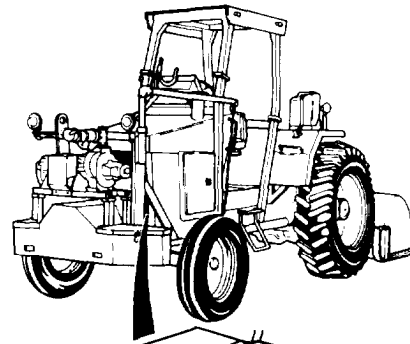


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

**INJECTION PUMP TIMING
INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates low engine compression.


ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem. Notify supervisor.

4. ENGINE STARTS BUT WILL NOT KEEP RUNNING.

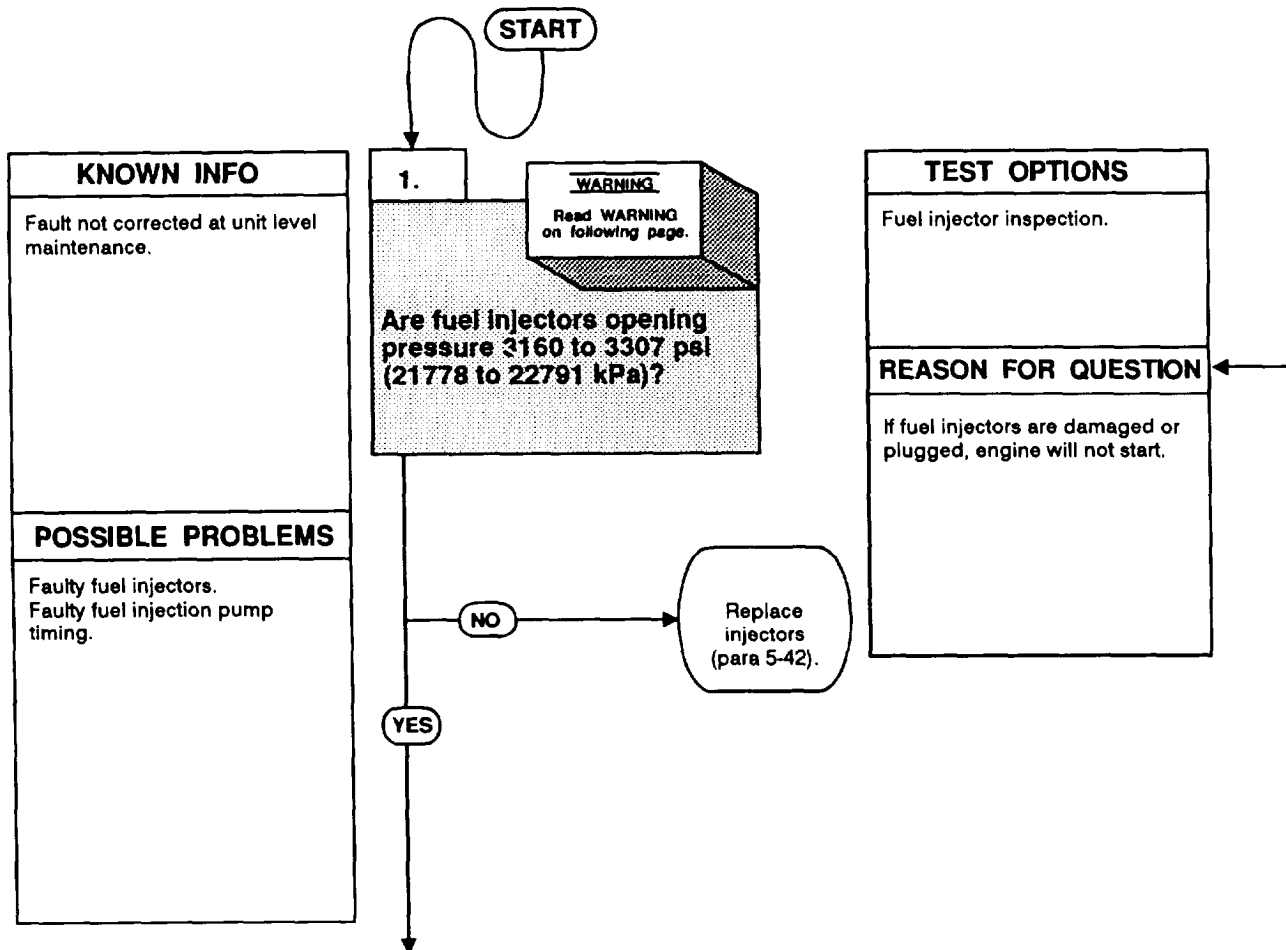
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Injector gauge pump
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

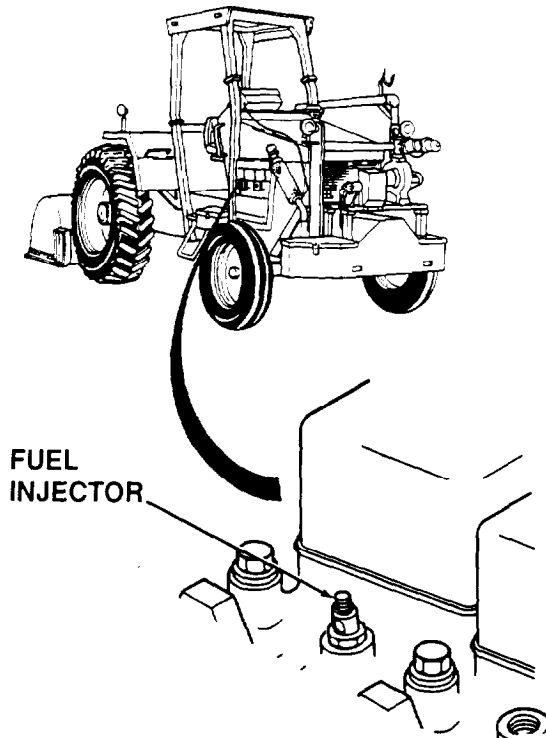


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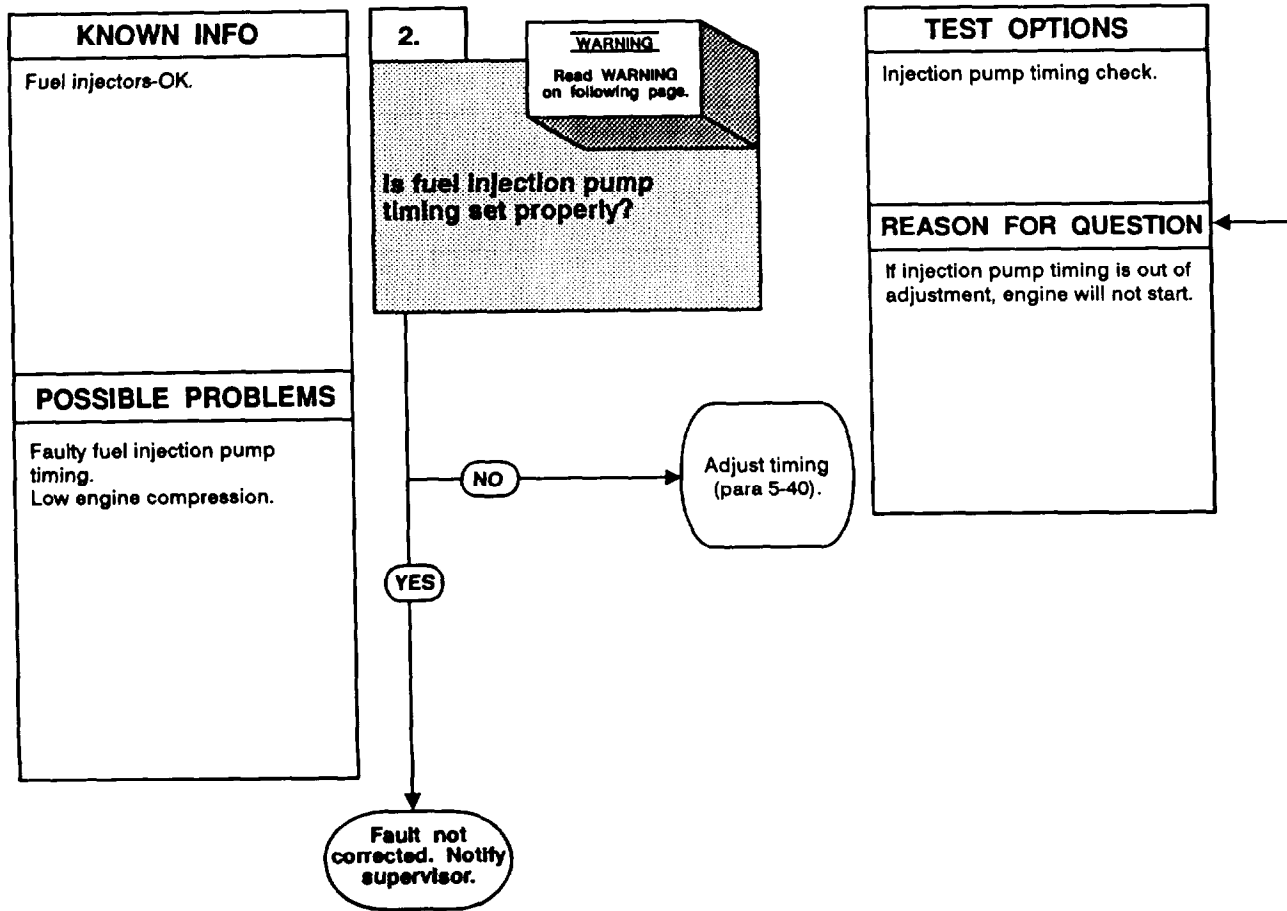
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.



ENGINE STARTS BUT WILL NOT KEEP RUNNING (CONT).

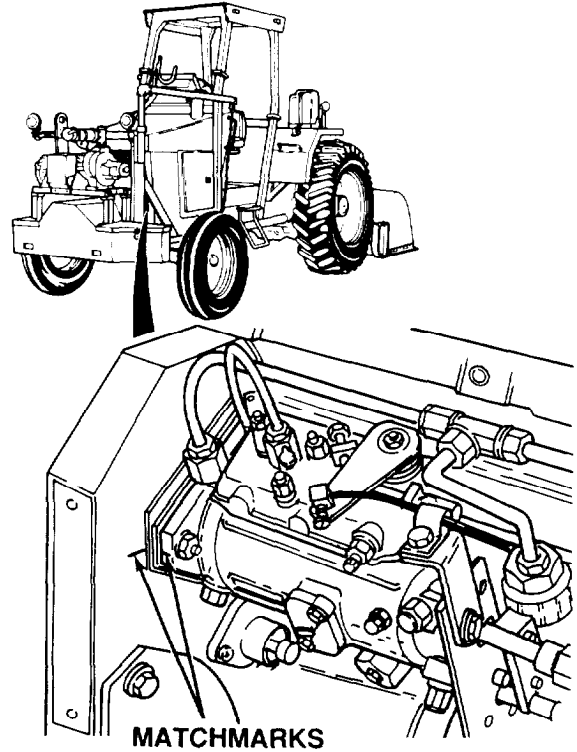


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates internal injection pump malfunction. Replace/repair injection pump (paras 5-40 and 5-43).

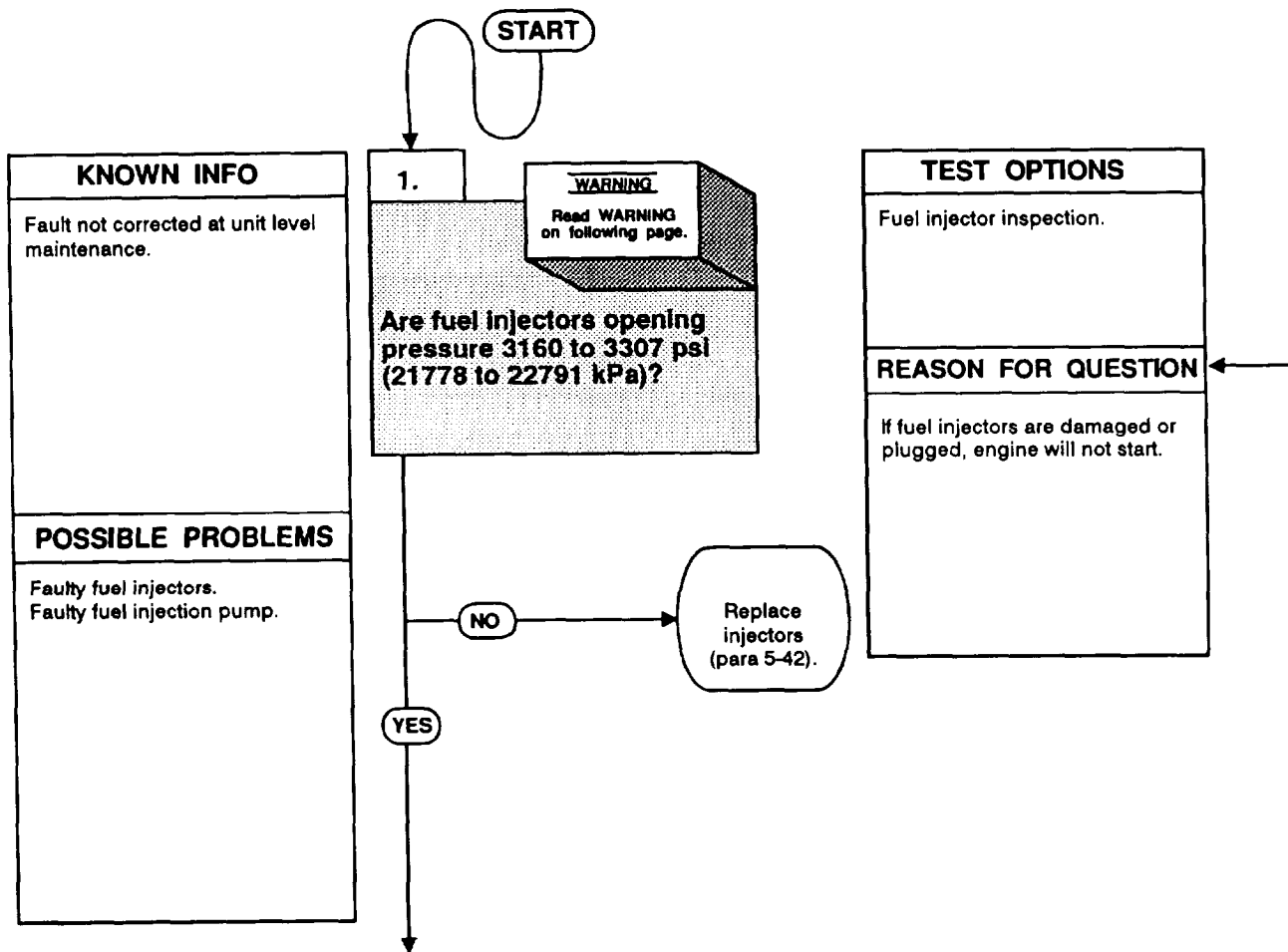


5. ENGINE SURGES (SPEED CHANGES).

INITIAL SETUP

Equipment Conditions
 Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

Tools and Special Tools
 Shop equipment, contact maintenance: truck mounted
 Injector gauge pump
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

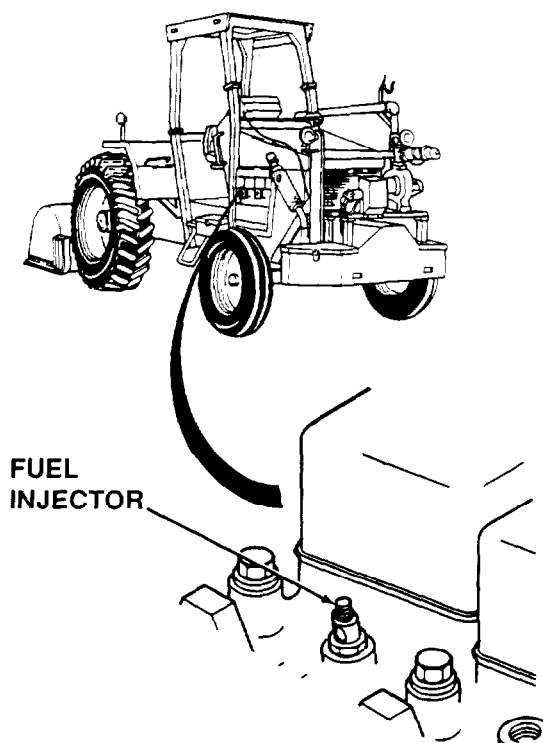


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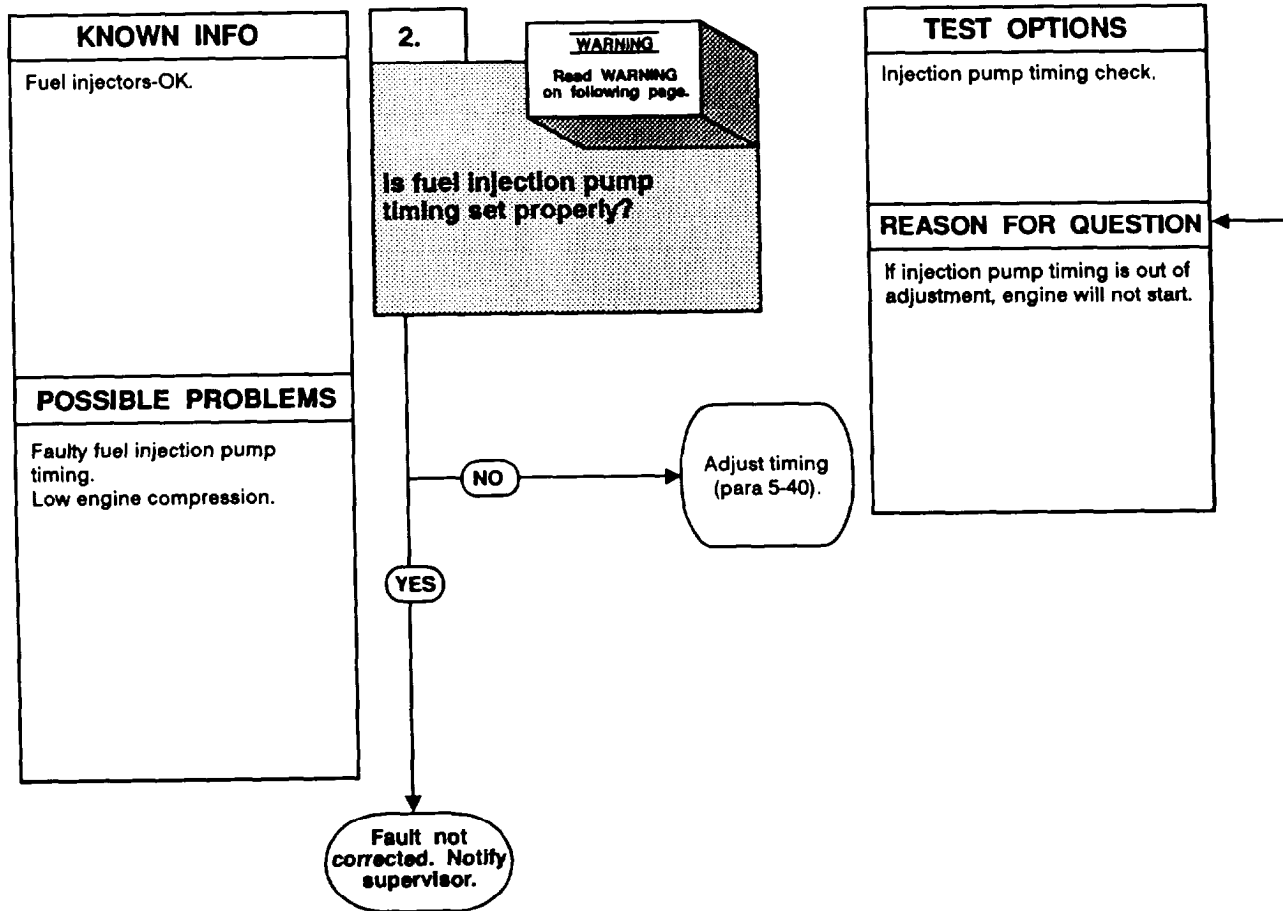
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.



ENGINE SURGES (SPEED CHANGES) (CONT).

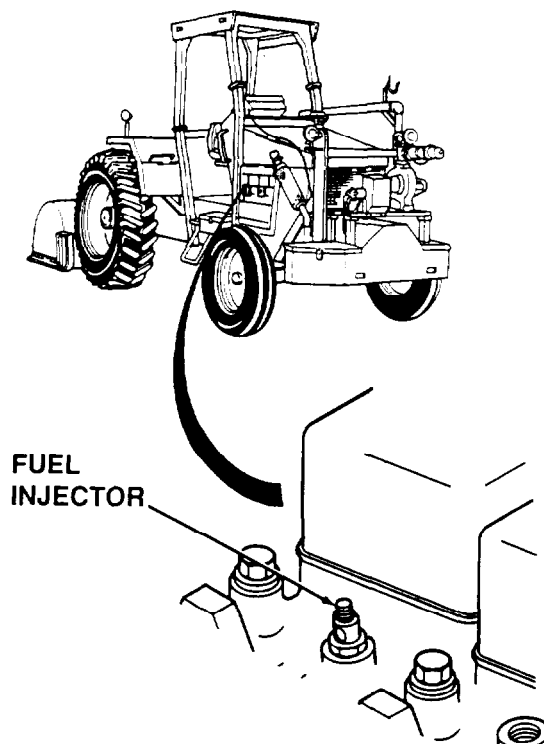


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates internal injection pump malfunction. Replace/repair injection pump (paras 5-40 and 5-43).



6. ENGINE IDLES ROUGH.

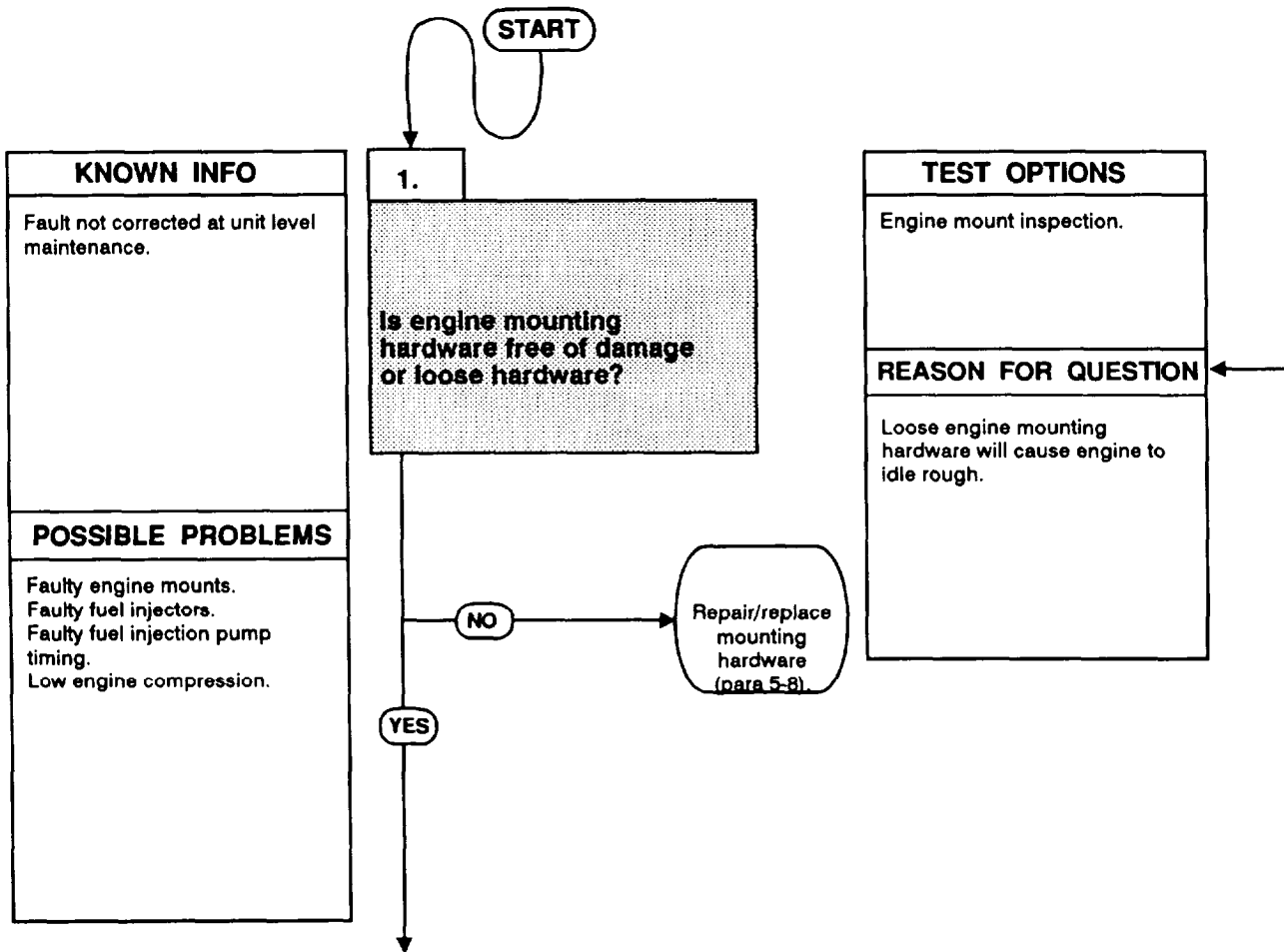
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (2-13).

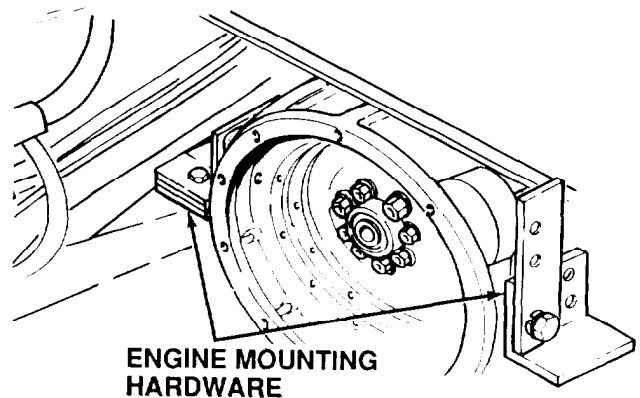
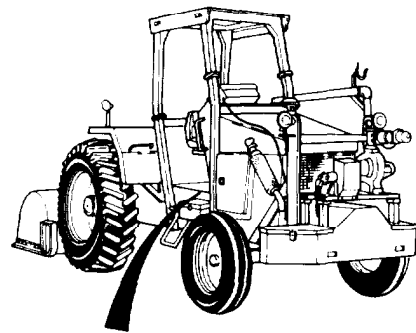
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (SWICE-R)
 Injector gauge pump

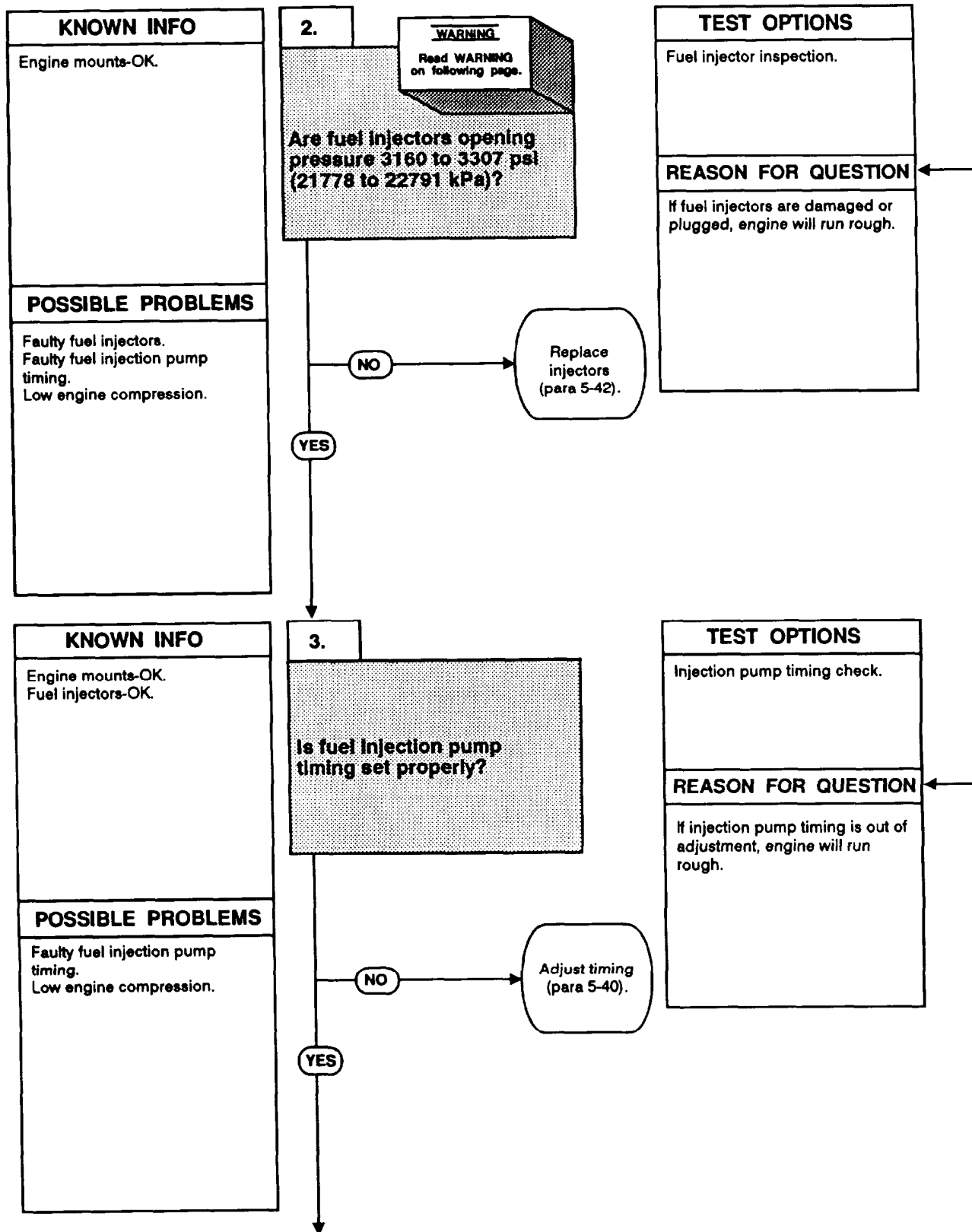


ENGINE MOUNT INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check for loose engine mounting hardware.
 - (a) If mounting hardware is loose or damaged, replace, as necessary (para 5-8).
 - (b) If mounting hardware is OK, indicates faulty fuel injectors.



ENGINE IDLES ROUGH (CONT).

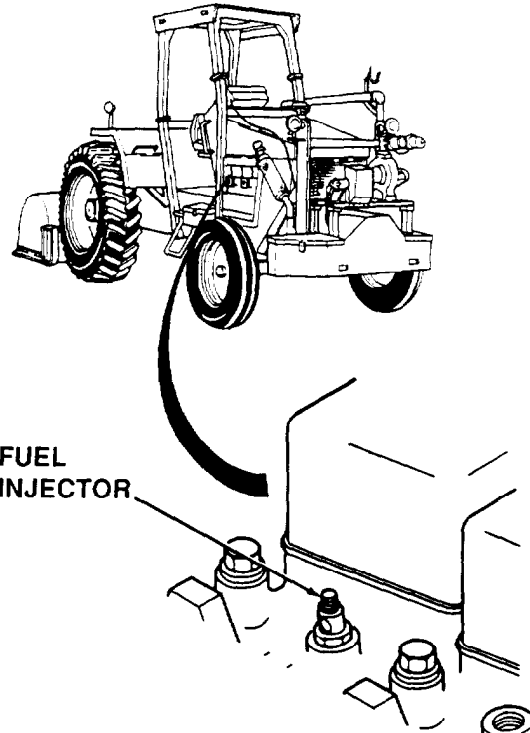


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

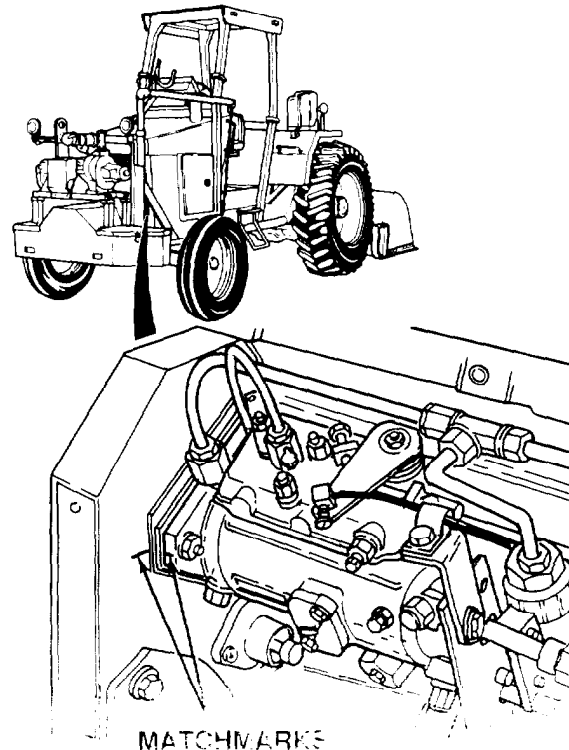
FUEL INJECTOR INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.

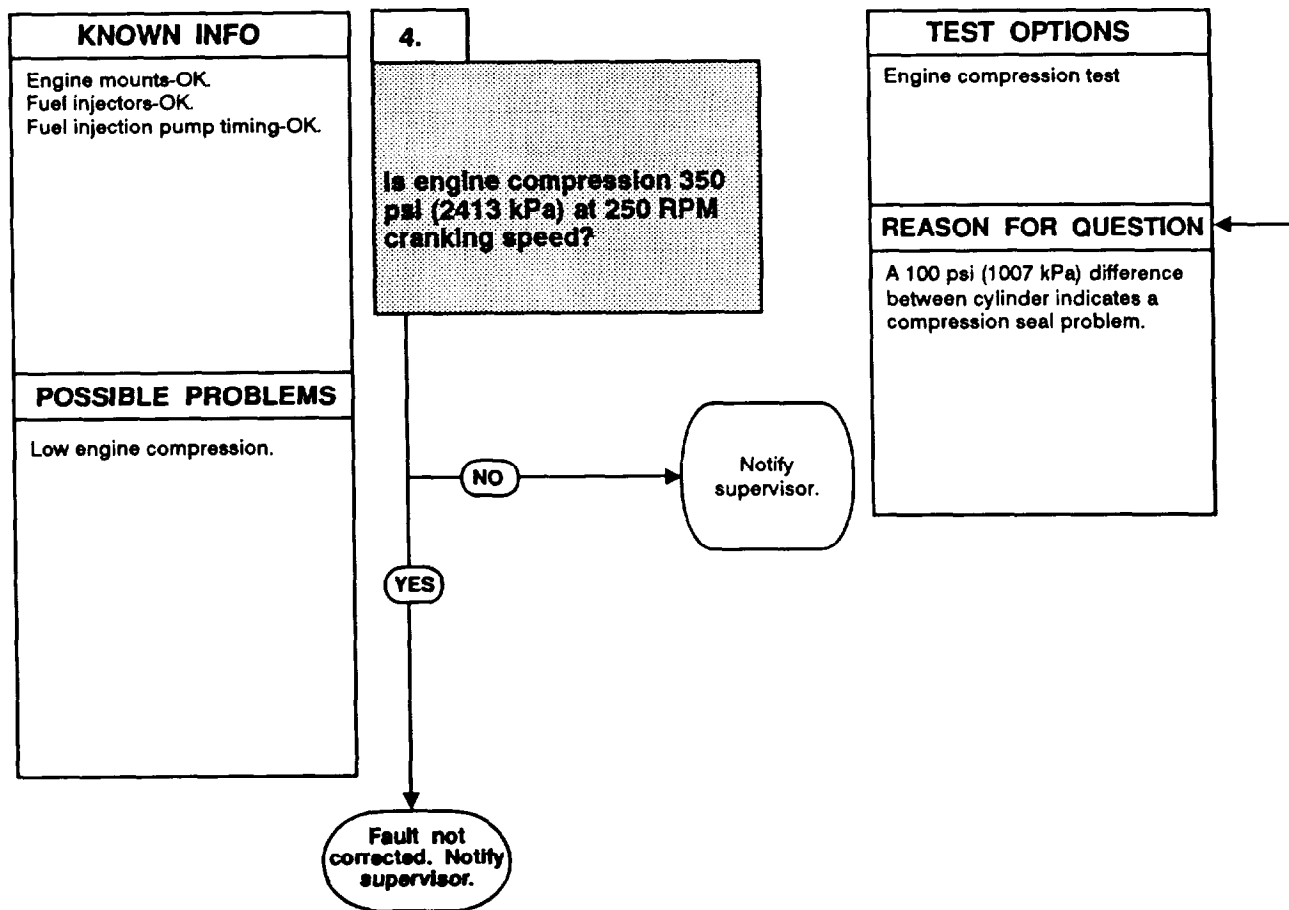


INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates low engine compression.



ENGINE IDLES ROUGH (CONT).



ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode.
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem, Notify supervisor.

7. ENGINE RUNS ROUGH AND MISFIRES.

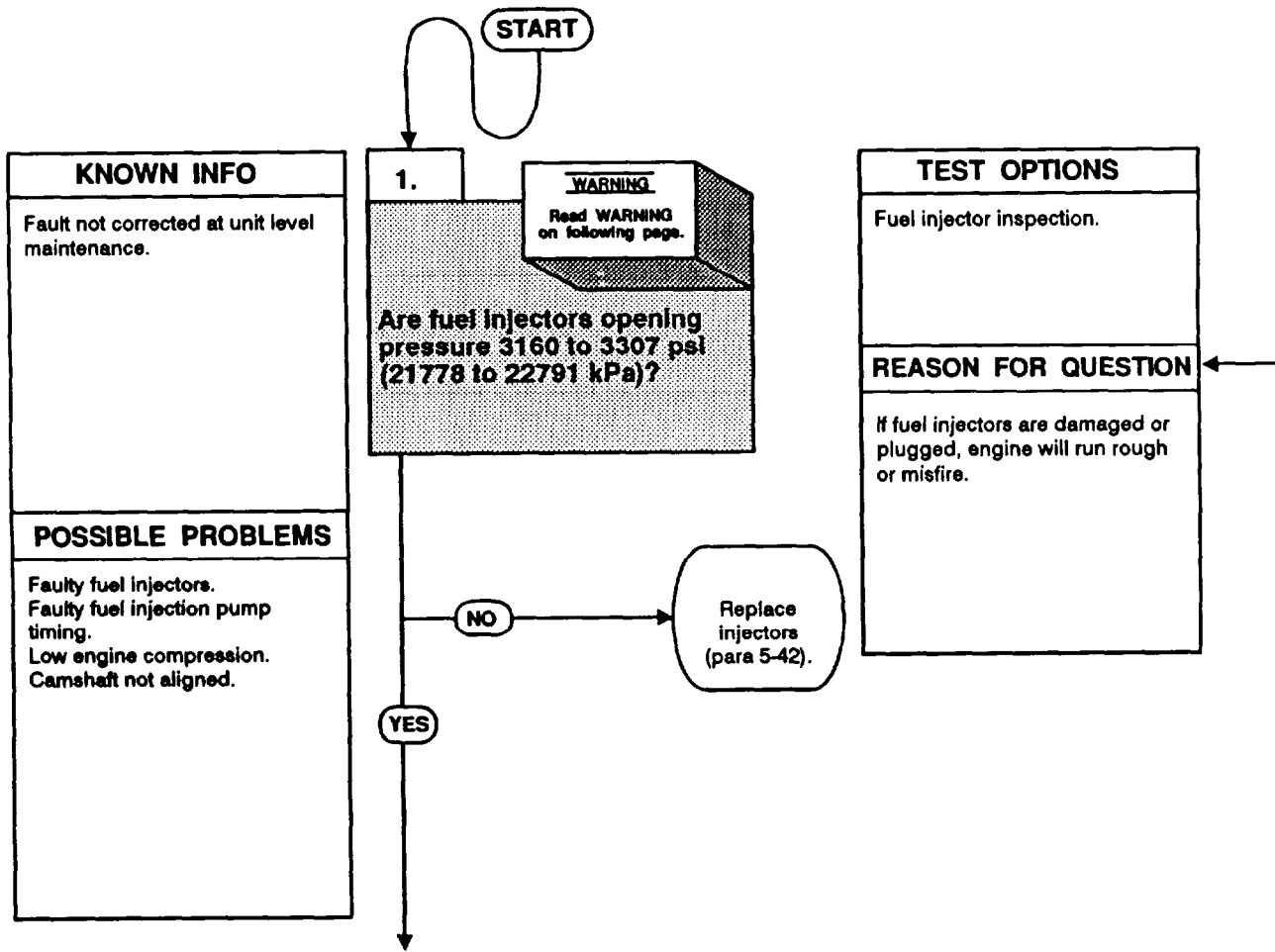
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tool and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

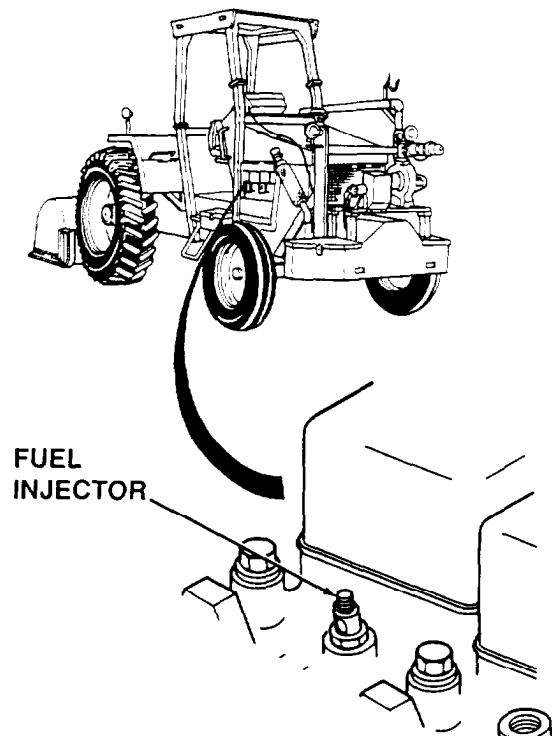


WARNING

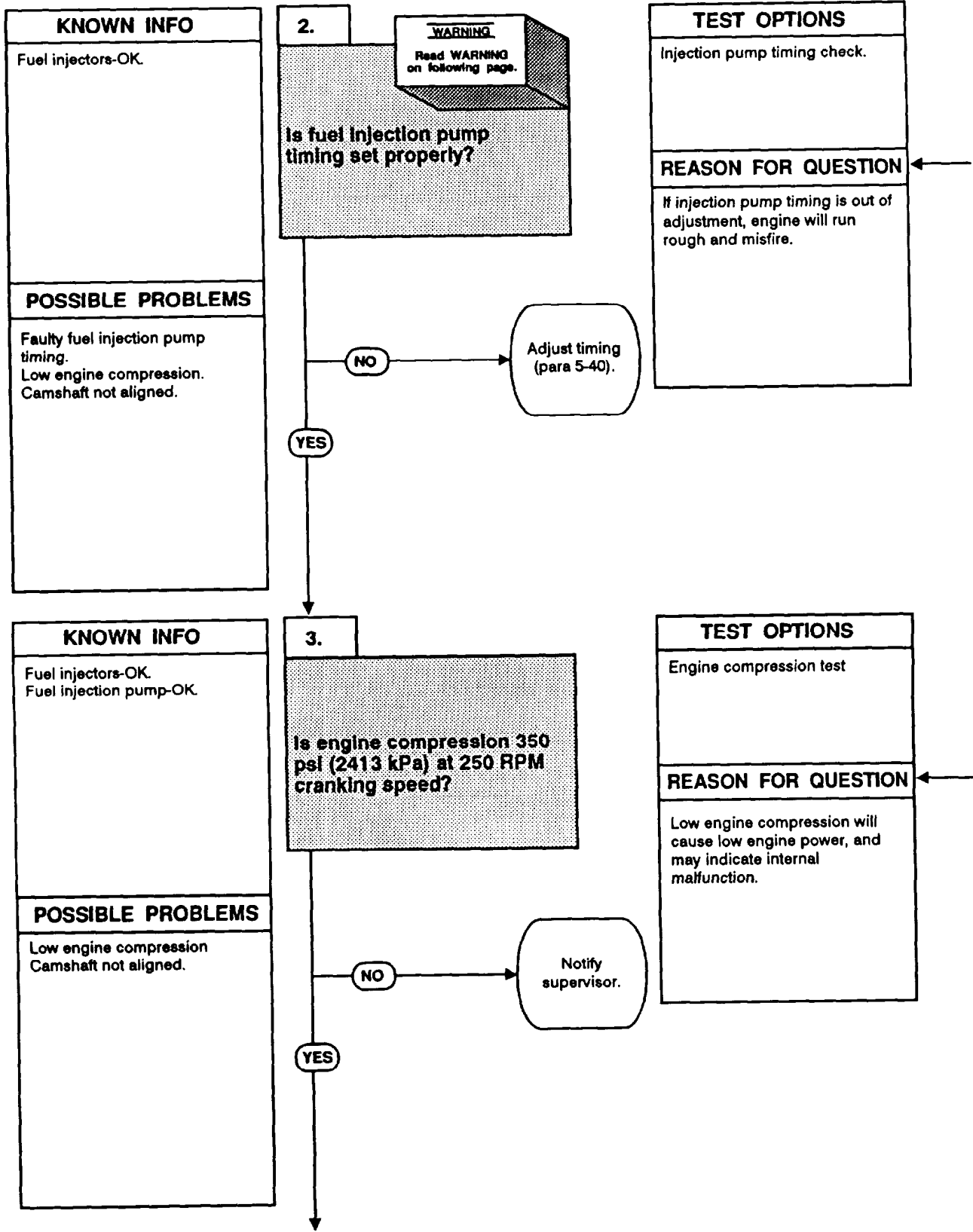
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine,

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.



ENGINE RUNS ROUGH AND MISFIRES (CONT).

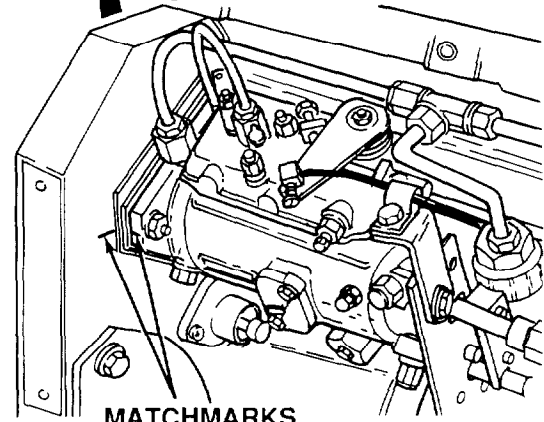
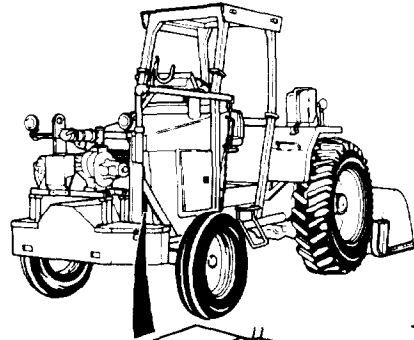


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

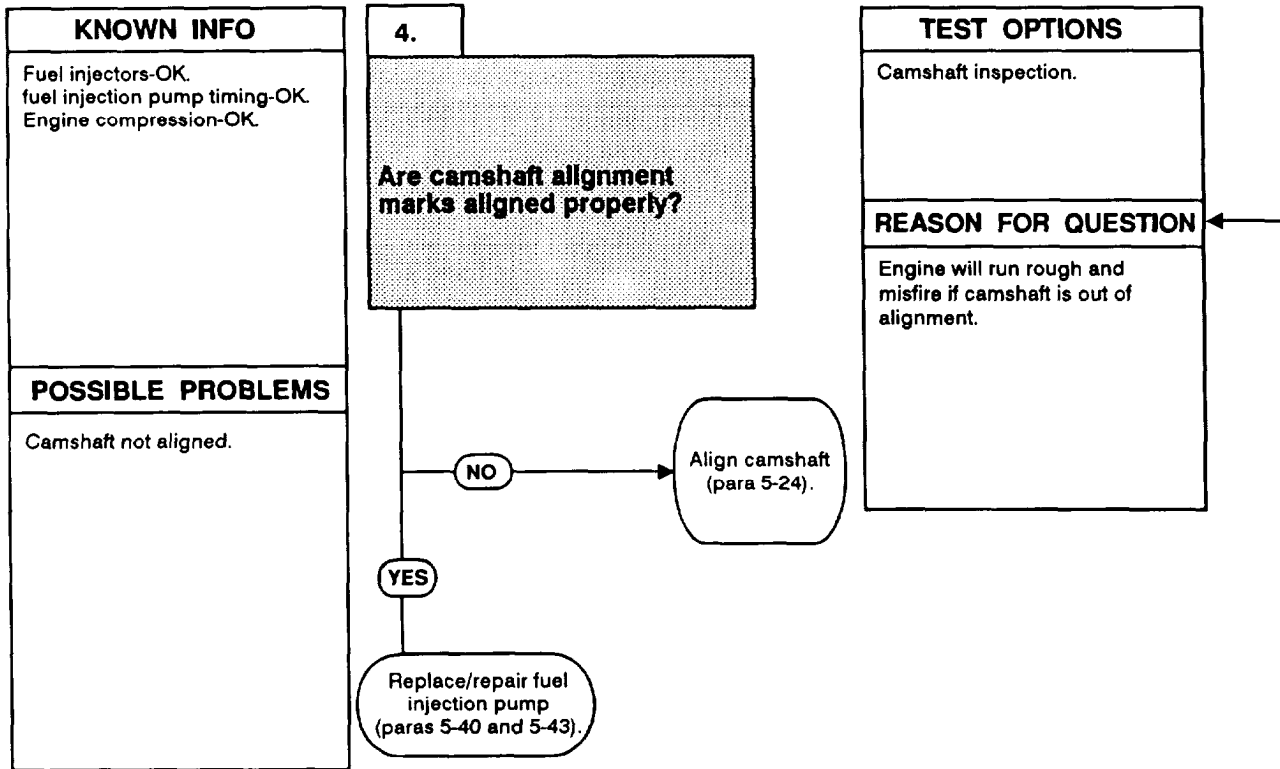
INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates low engine compression.

**ENGINE COMPRESSION TEST**

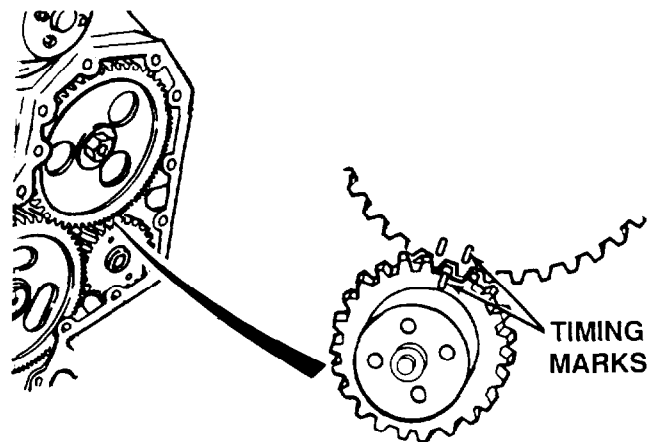
- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem; notify supervisor.
 - (b) If engine passes compression test, indicates camshaft is not aligned properly.

ENGINE RUNS ROUGH AND MISFIRES (CONT).



**CAMSHAFT ALIGNMENT
INSPECTION**

- (1) Remove gear cover (para 5-26).
- (2) Check timing marks on camshaft gear and crankshaft gear.
 - (a) If timing marks are out of alignment, match timing marks (para 5-24).
 - (b) If timing marks are matched, indicates internal injection pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).



8. ENGINE RPM WILL NOT REACH RATED SPEED.

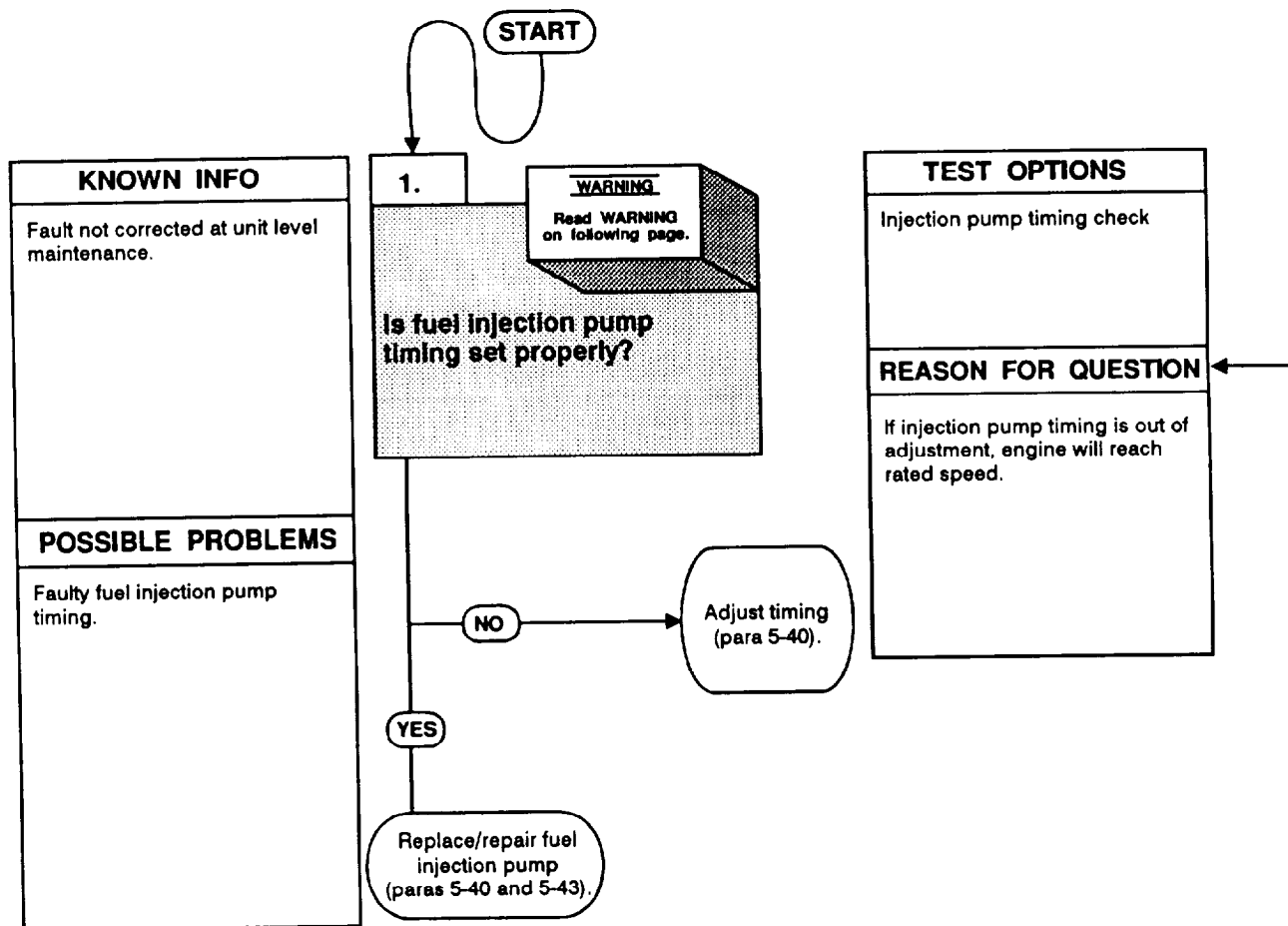
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted

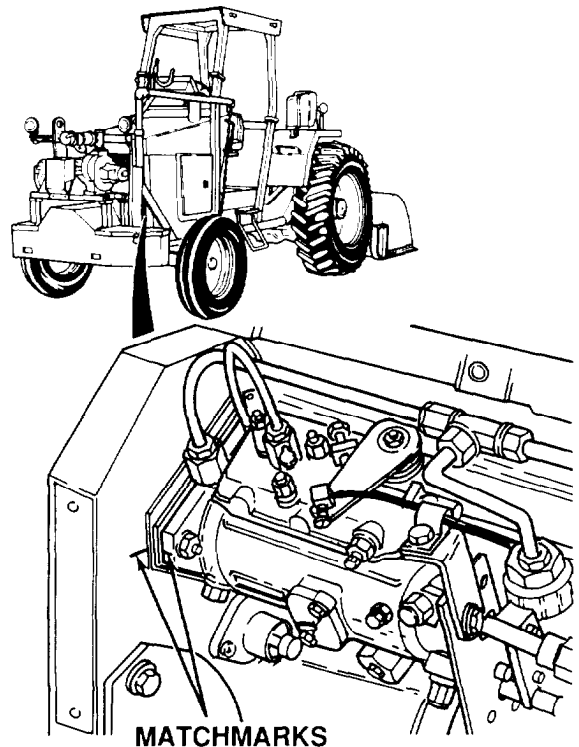


WARNING

Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel flings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

**INJECTION PUMP TIMING
INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates internal injector pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).



9. ENGINE FAILS TO DEVELOP FULL POWER.

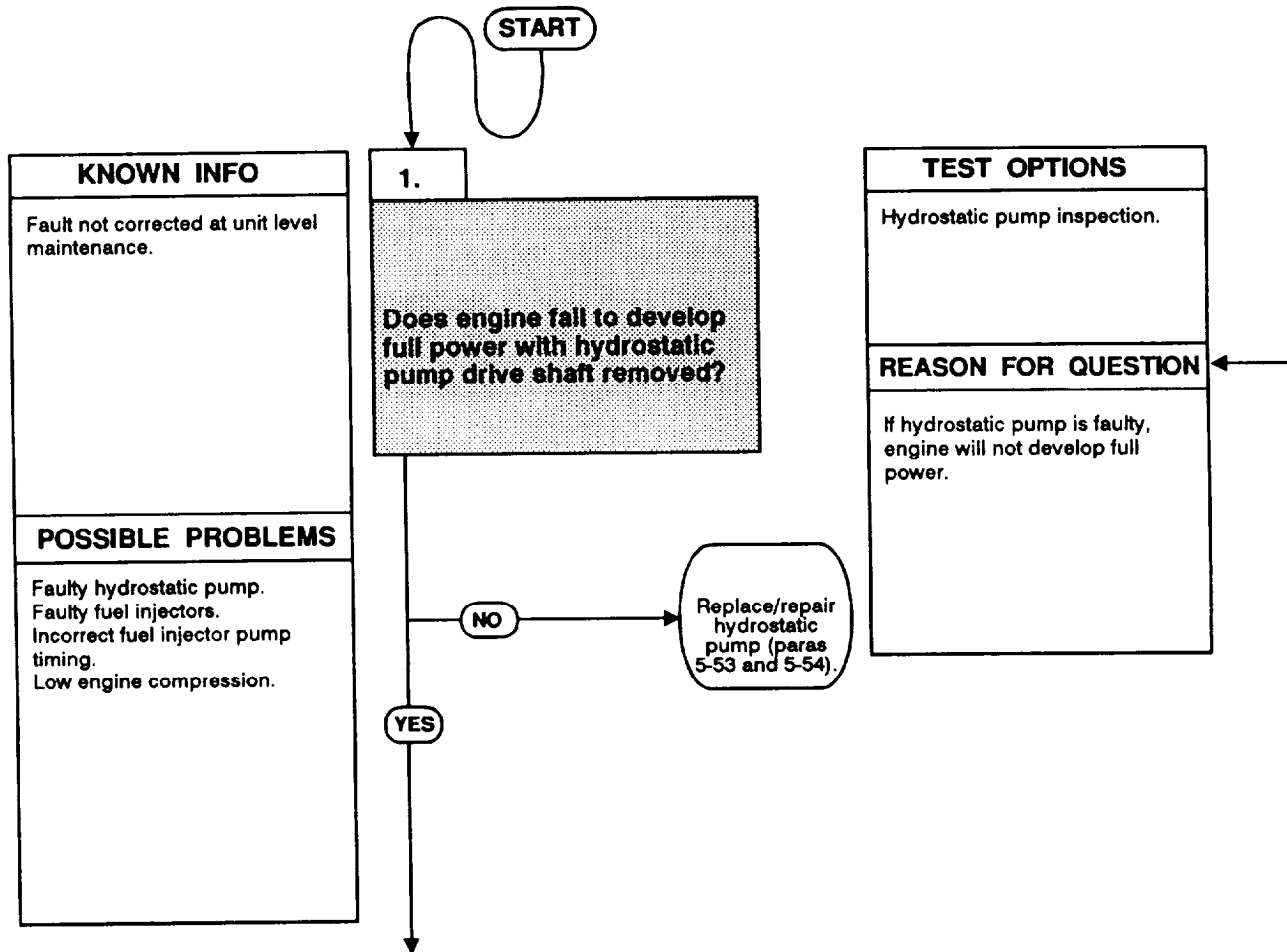
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

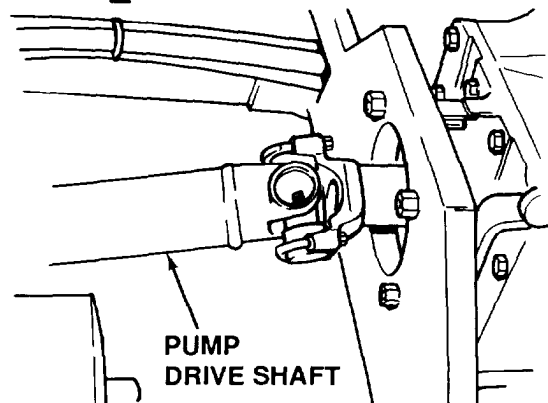
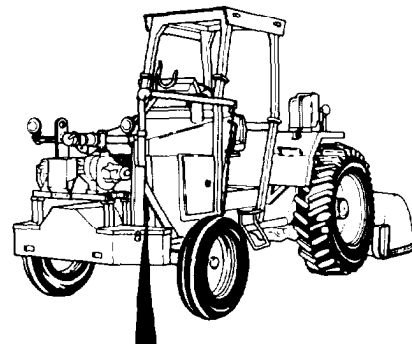
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

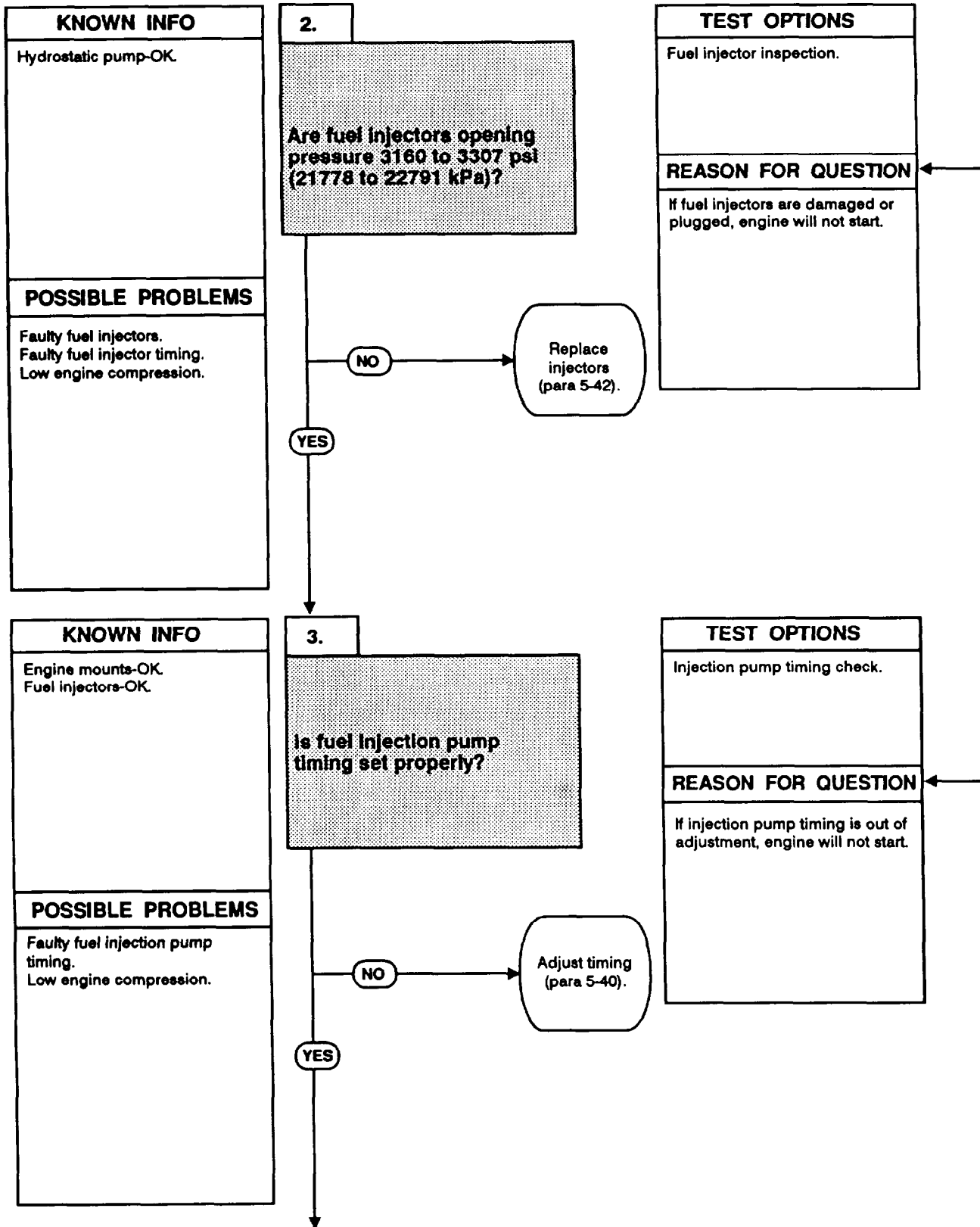


**HYDROSTATIC PUMP
INSPECTION**

- (1) Remove hydrostatic pump drive shaft (para 4-99).
- (2) Try to start engine (para 2-9).
 - (a) If engine reaches full power, hydrostatic pump is faulty, replace/repair (para 5-53 and 5-54).
 - (b) If engine does not reach full power, indicates faulty fuel injectors.



ENGINE FAILS TO DEVELOP FULL POWER (CONT).

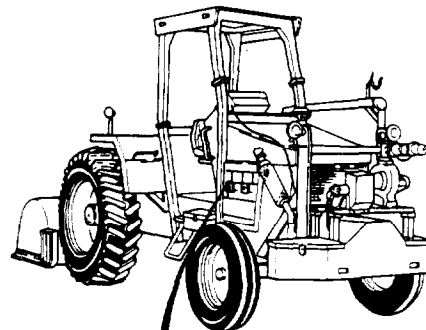


WARNING

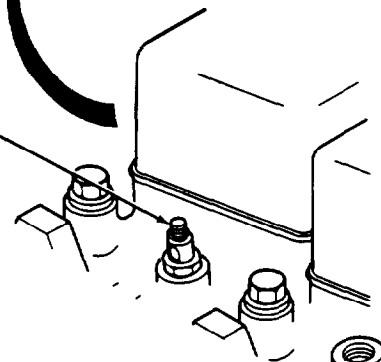
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTOR INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates incorrect injection pump timing.

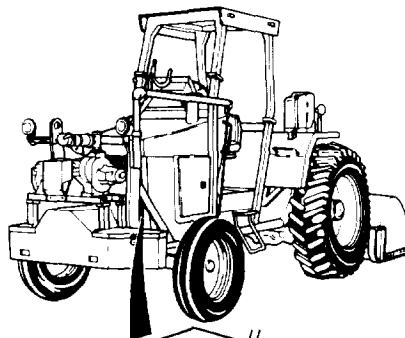


FUEL INJECTOR

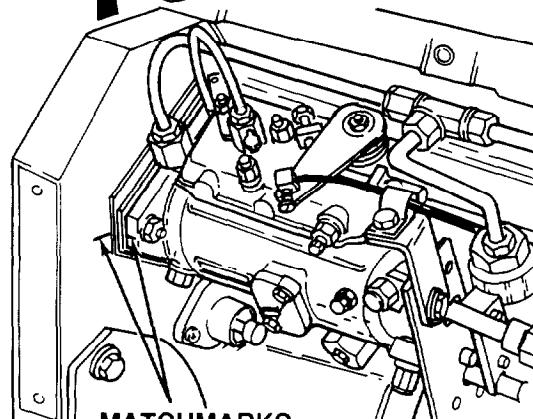


INJECTION PUMP TIMING INSPECTION

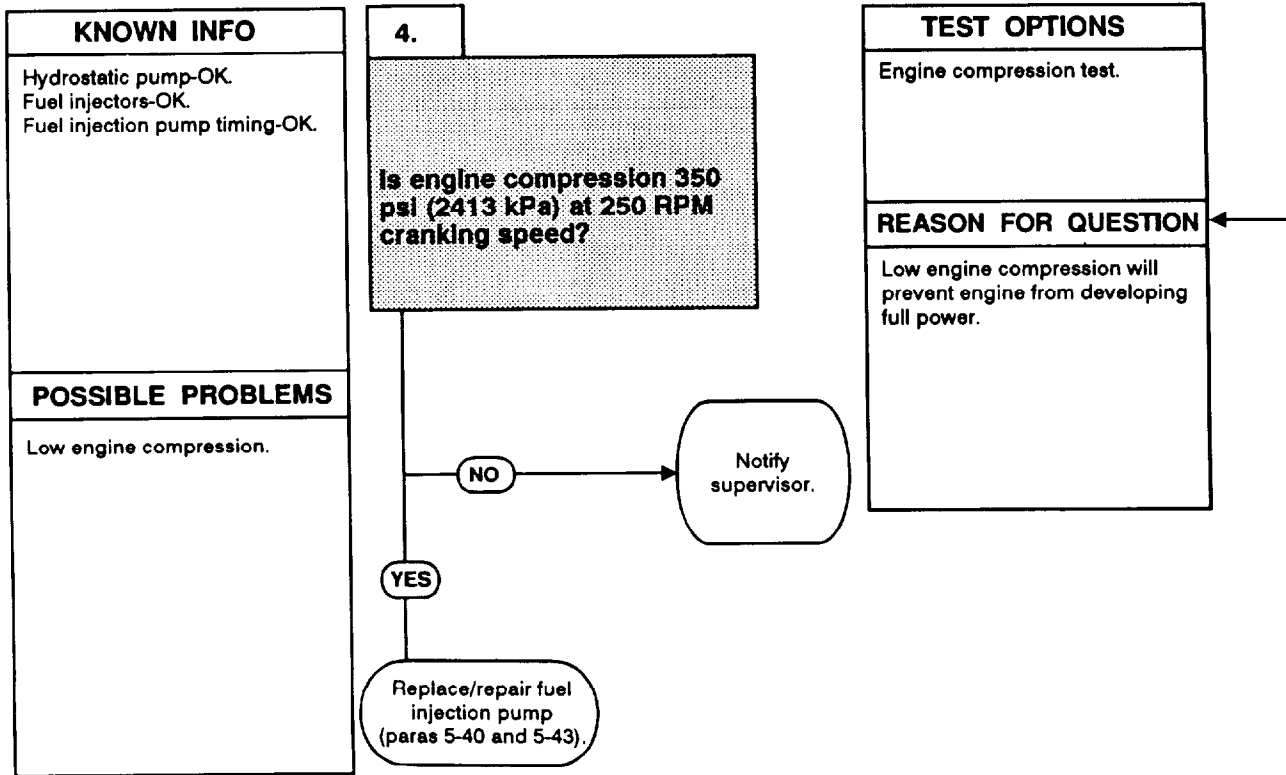
- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates low engine compression.



MATCHMARKS



ENGINE FAILS TO DEVELOP FULL POWER (CONT).



ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem, notify supervisor.
 - (b) If engine passes compression test, indicates internal injection pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).

10. ENGINE EXHAUST SMOKES EXCESSIVELY.

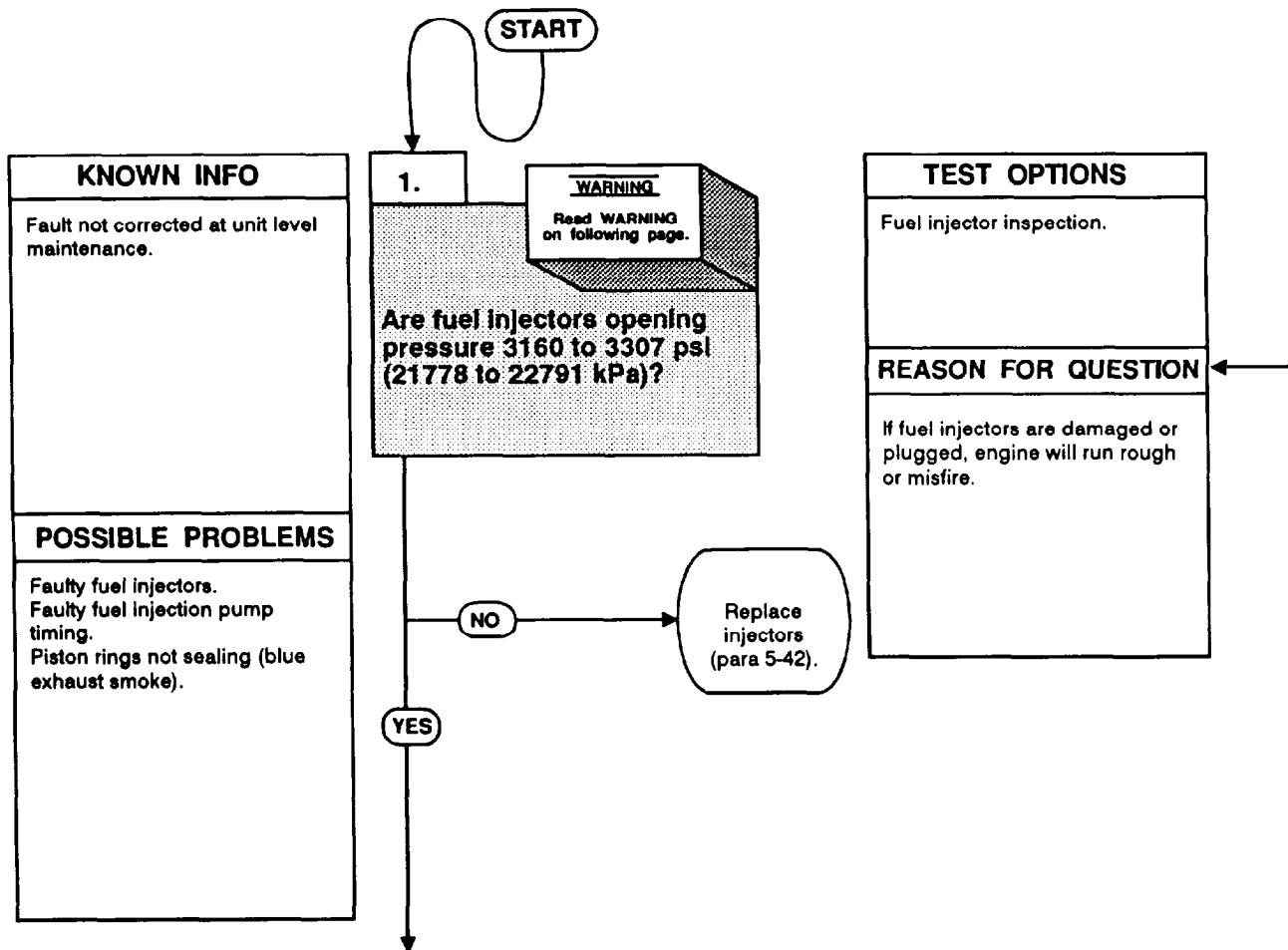
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 Injector gauge pump

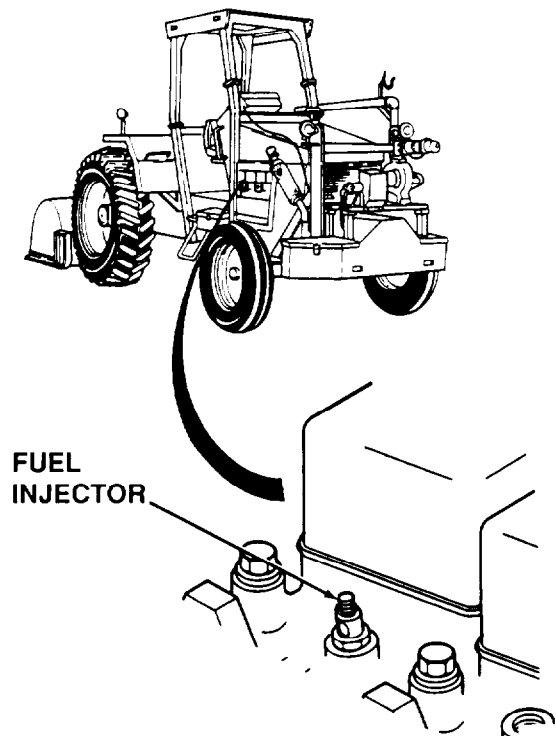


WARNING

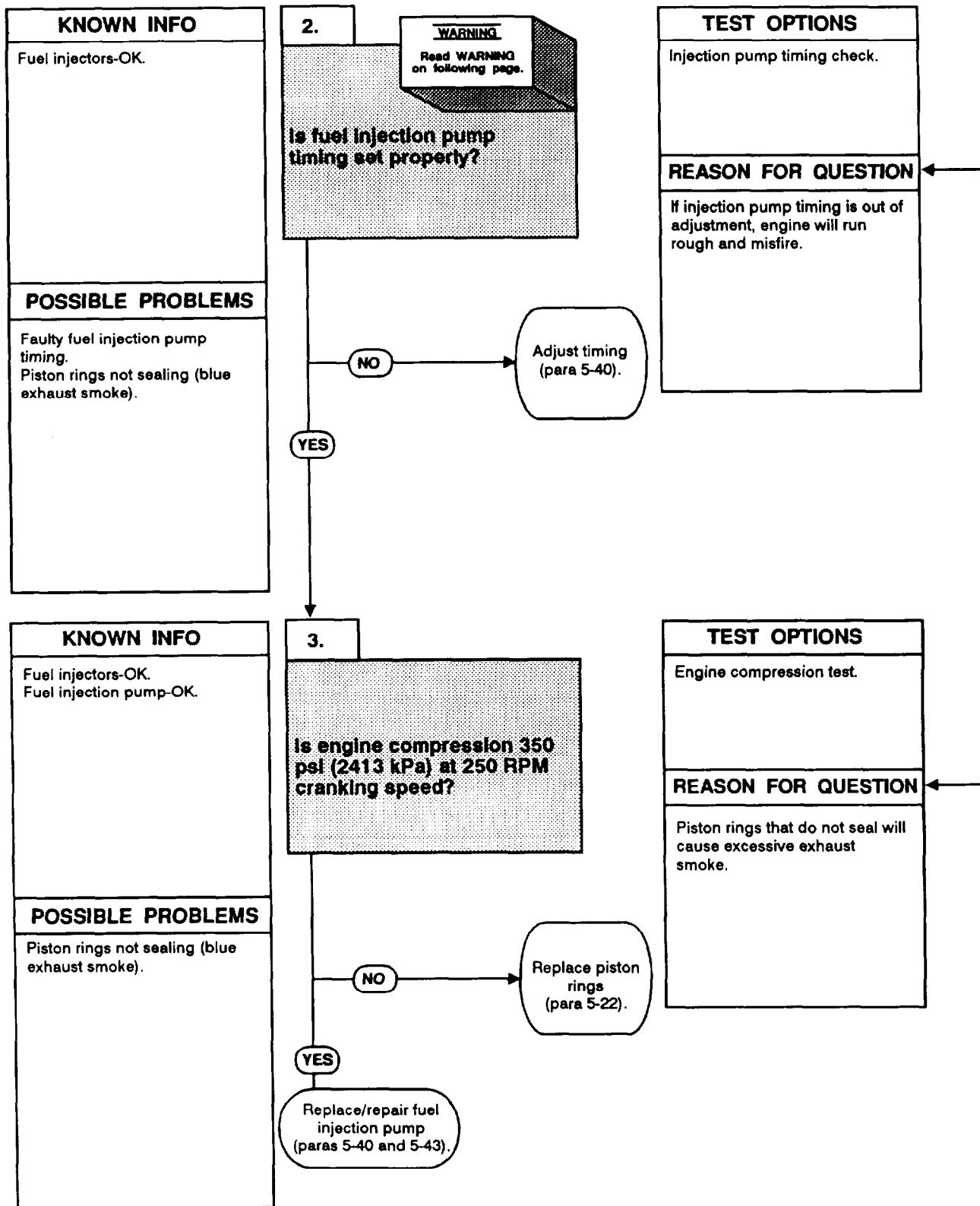
Post signs that read 'NO SMOKING WITHIN 50 FEET (15 m)' when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 5-42).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty fuel pump timing.



ENGINE EXHAUST SMOKES EXCESSIVELY (CONT).

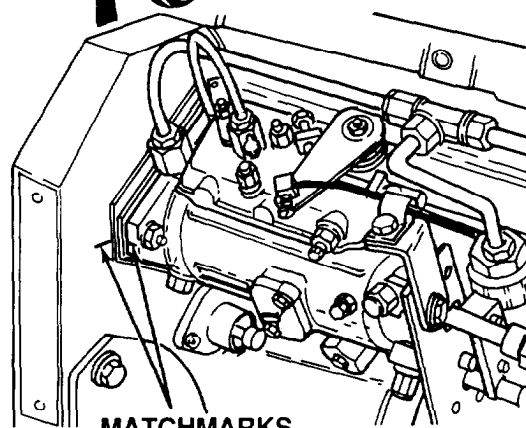
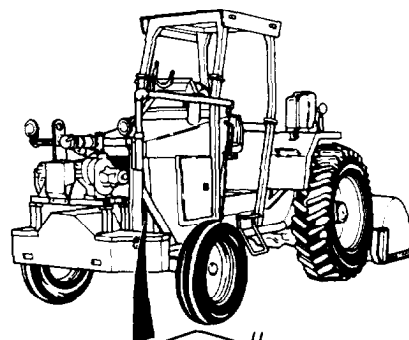


WARNING

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INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates low engine compression.

**ENGINE COMPRESSION TEST**

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates faulty piston rings. Replace piston rings (para 5-22).
 - (b) If engine passes compression test, indicates internal injection pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).

11. ENGINE OPERATING TEMPERATURE TOO HIGH.

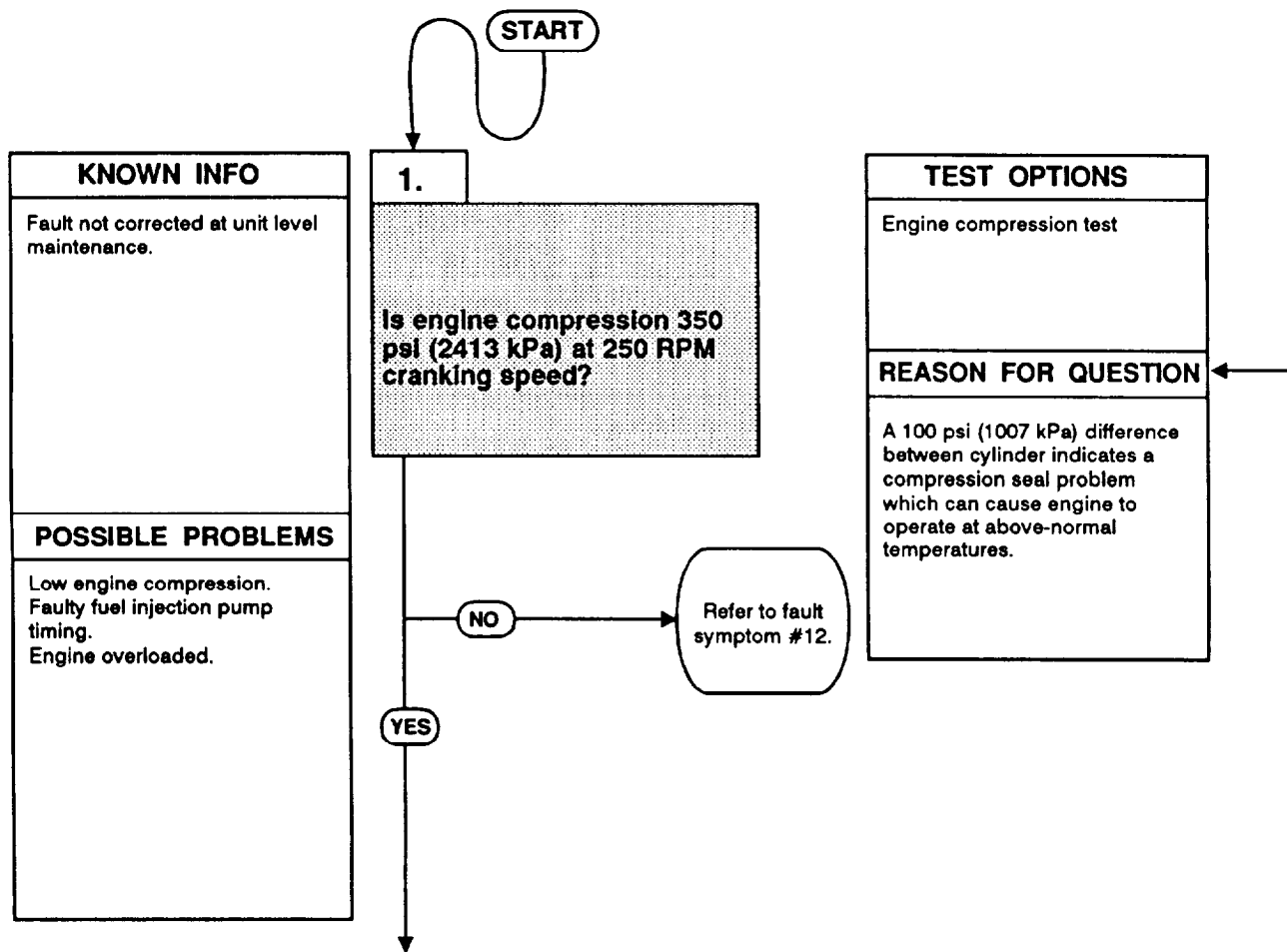
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

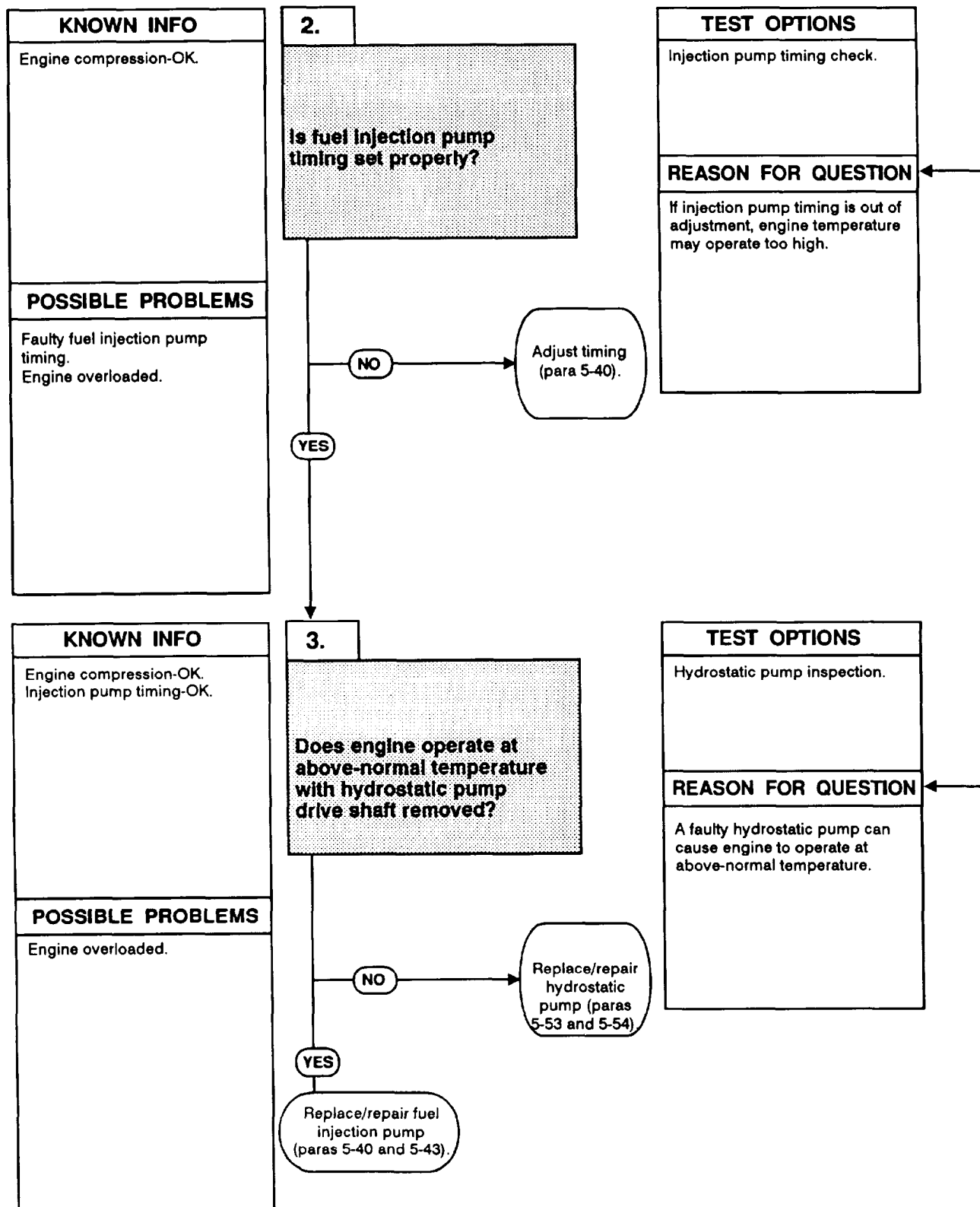
Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (SWICE-R)
 Injector gauge pump



ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem, notify supervisor.
 - (b) If engine passes compression test, indicates incorrect injection pump timing.

ENGINE OPERATING TEMPERATURE TOO HIGH (CONT).

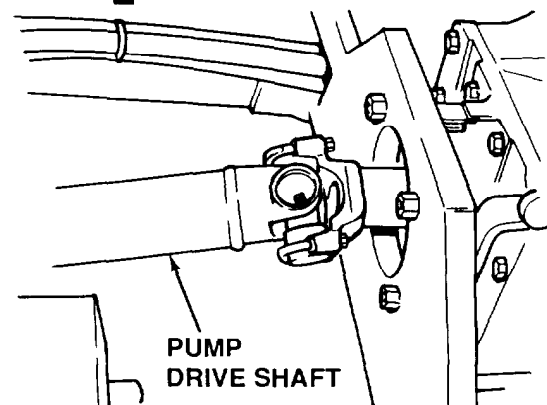
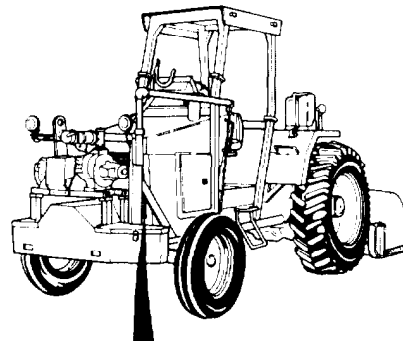
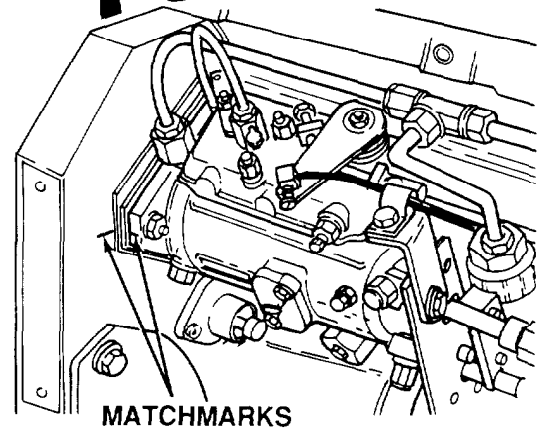
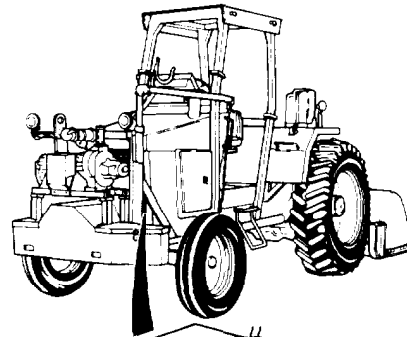


WARNING

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INJECTION PUMP TIMING INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates internal injection pump malfunction. Replace/repair fuel injection pump (paras 5-40 and 5-43).



HYDROSTATIC PUMP INSPECTION

- (1) Remove hydrostatic pump drive shaft (para 4-99).
- (2) Start engine (para 2-9).
 - (a) If engine operates at normal temperature, hydrostatic pump is faulty, replace/repair (para 5-53 and 5-54).
 - (b) If engine does not operate at normal temperatures, indicates faulty injection pump. Replace/repair fuel injection pump (paras 5-40 and 5-43).

12. ENGINE LOOSING COOLANT.

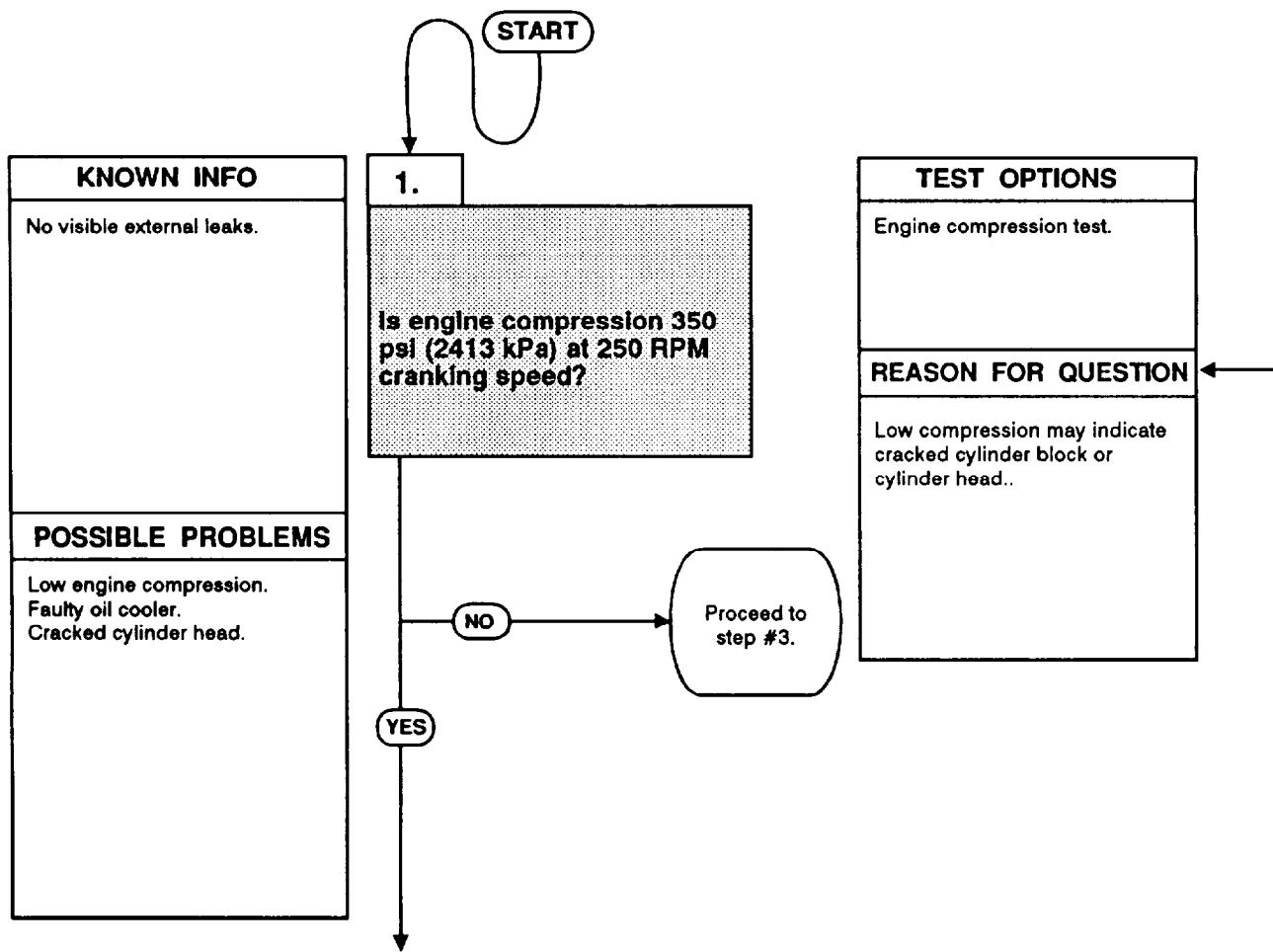
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

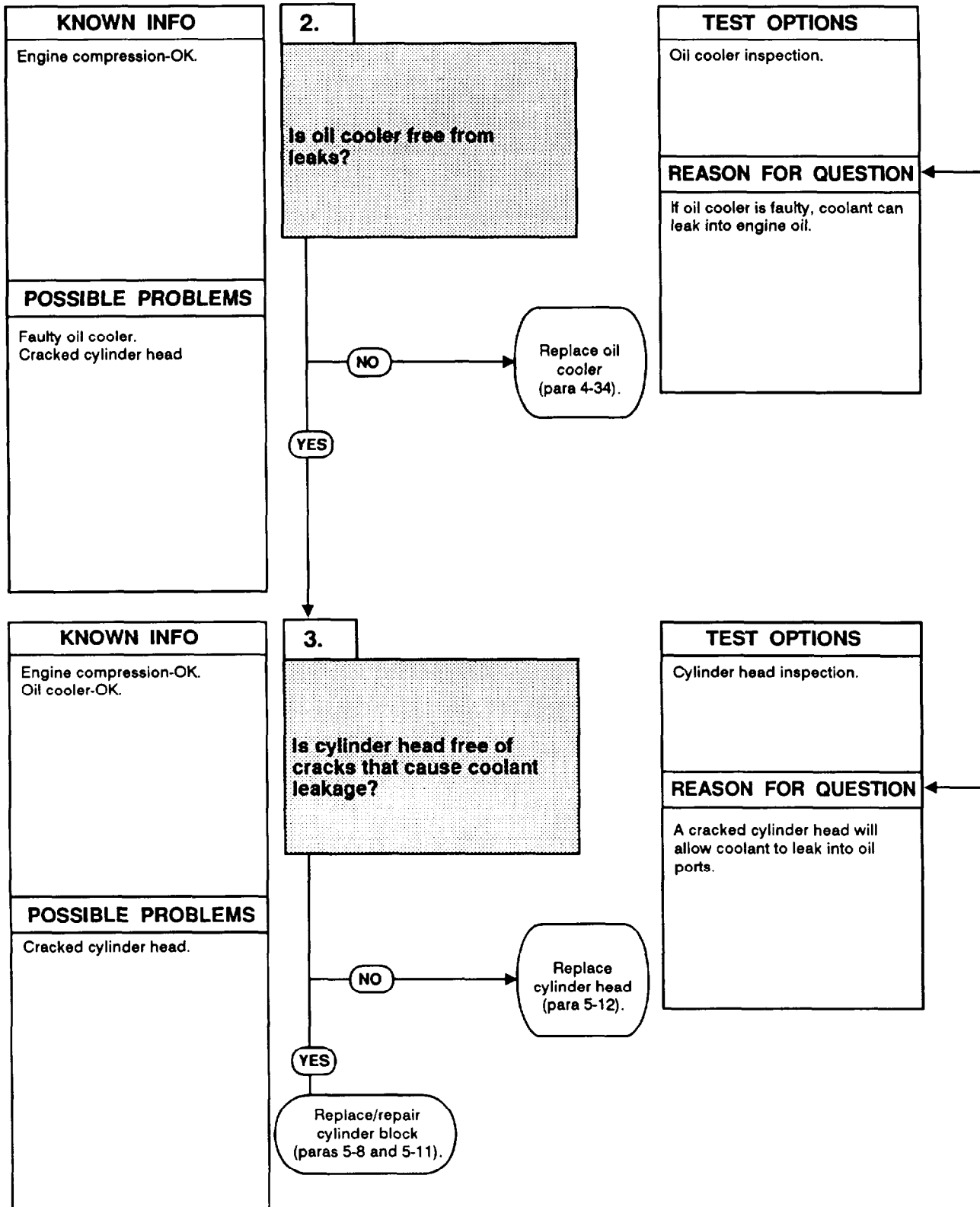
Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)



ENGINE COMPRESSION TEST

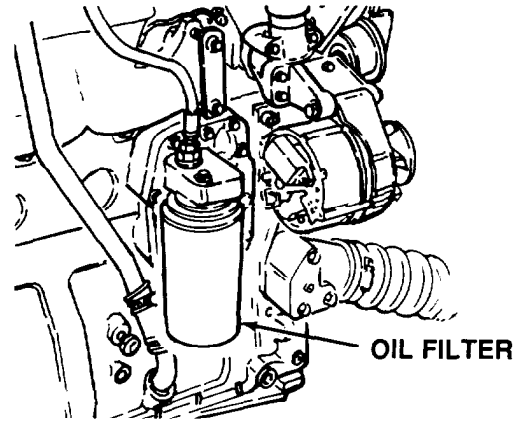
- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (3) Perform STE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders indicates a compression seal problem. Proceed to step #3.
 - (b) If engine passes compression test, indicates faulty oil cooler.

ENGINE LOOSING COOLANT (CONT).



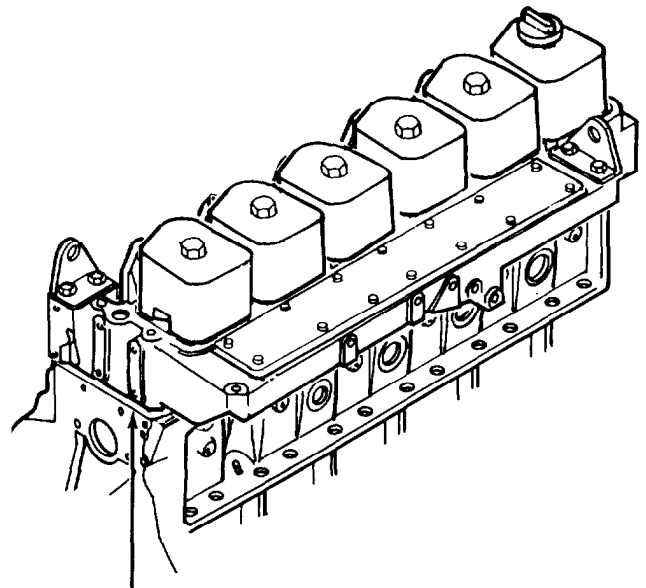
OIL COOLER INSPECTION

- (1) Right engine door open (para 2-14).
- (2) Remove engine oil cooler (para 4-34) and check for leaks.
 - (a) If oil cooler leaks, replace oil cooler (para 4-34).
 - (b) If oil cooler does not leak, indicates damaged or cracked cylinder head or head gasket.



CYLINDER HEAD INSPECTION

- (1) Remove cylinder head (para 5-12).
- (2) Inspect cylinder head for cracks or other obvious damage that would cause coolant to leak into oil (para 5-12).
 - (a) If cylinder head is damaged or cracked, replace cylinder head (para 5-12).
 - (b) If cylinder head is not damaged or cracked, indicates internal engine malfunction. Replace/repair cylinder block (paras 5-8 and 5-11).



CYLINDER HEAD GASKET

13. ENGINE OIL PRESSURE TOO LOW.

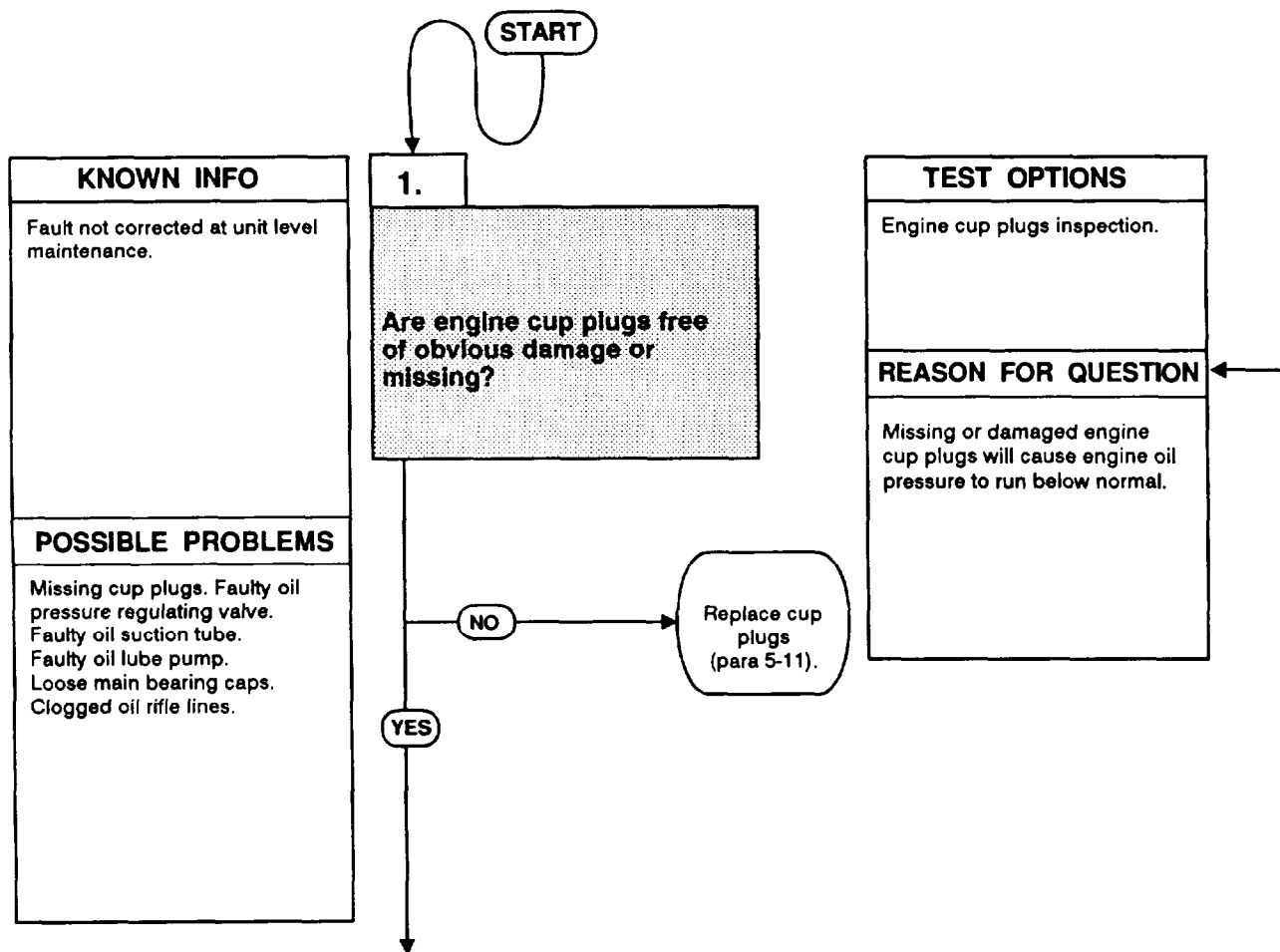
INITIAL SETUP

Equipment Conditions

- Parking brake set, (para 2-13).
- Engine removed, (para 5-8).
- Engine installed on engine stand, (para 5-9).

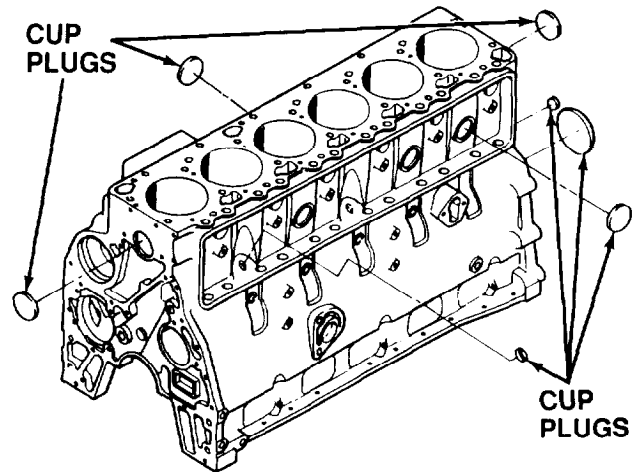
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted

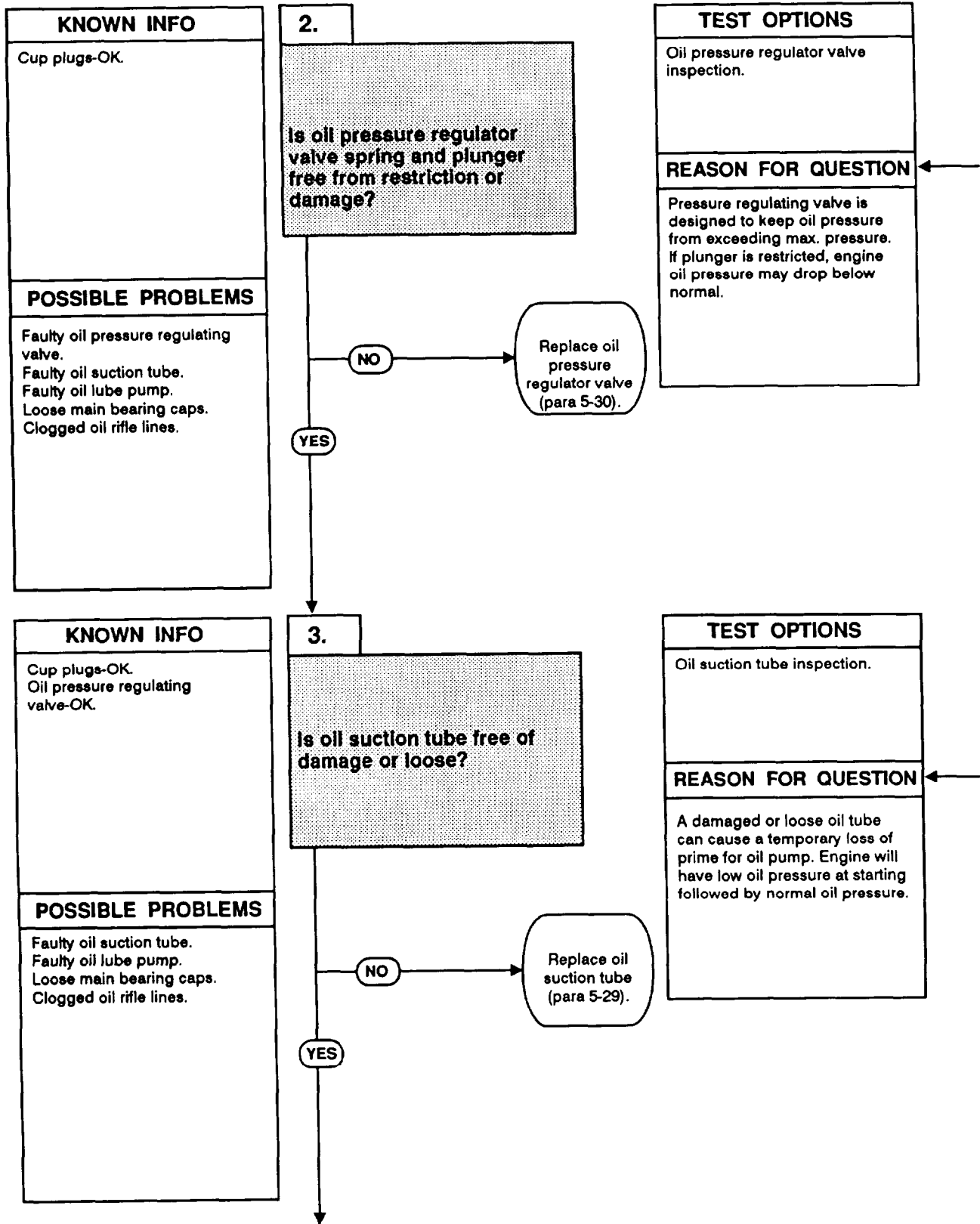


**ENGINE CUP PLUGS
INSPECTION**

- (1) Check for obvious damage and missing engine cup plugs.
 (a) If engine cup plugs are damaged or missing, replace (para 5-11).
 (b) If engine cup plugs are OK, indicates faulty oil pressure regulating valve.

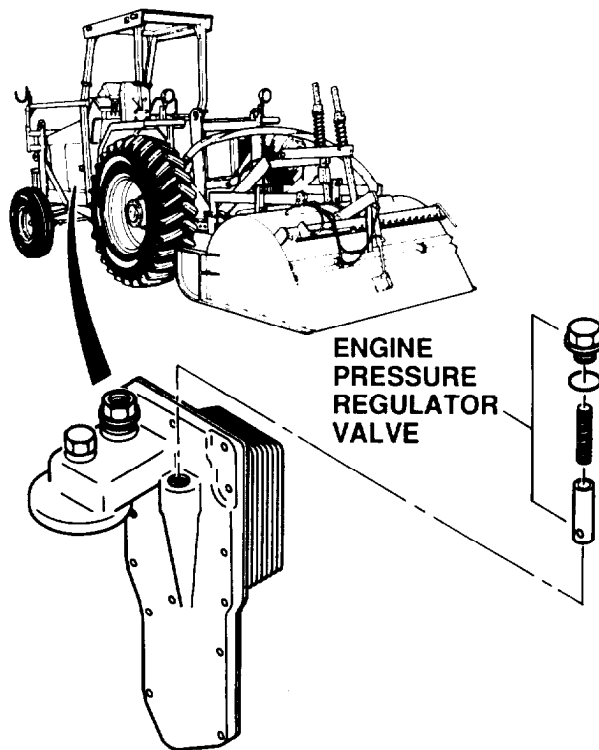


ENGINE OIL PRESSURE TOO LOW (CONT).



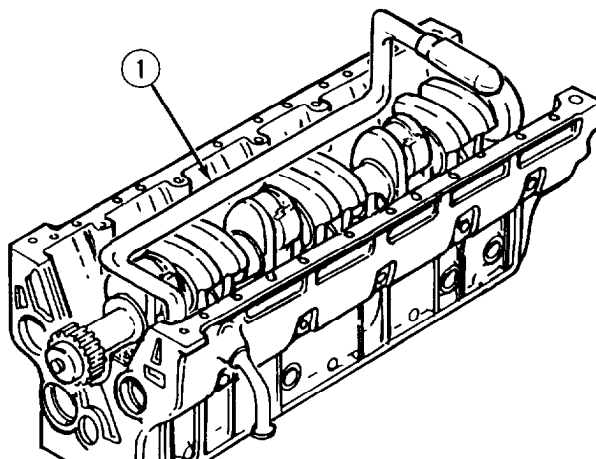
OIL PRESSURE REGULATOR VALVE INSPECTION

- (1) Remove oil pressure regulator valve (para 5-30).
- (2) Inspect valve spring and plunger for damage and restriction.
 - (a) If valve spring or plunger is damaged or restricted, replace (para 5-30).
 - (b) If valve spring and plunger are serviceable, indicates faulty oil suction tube.

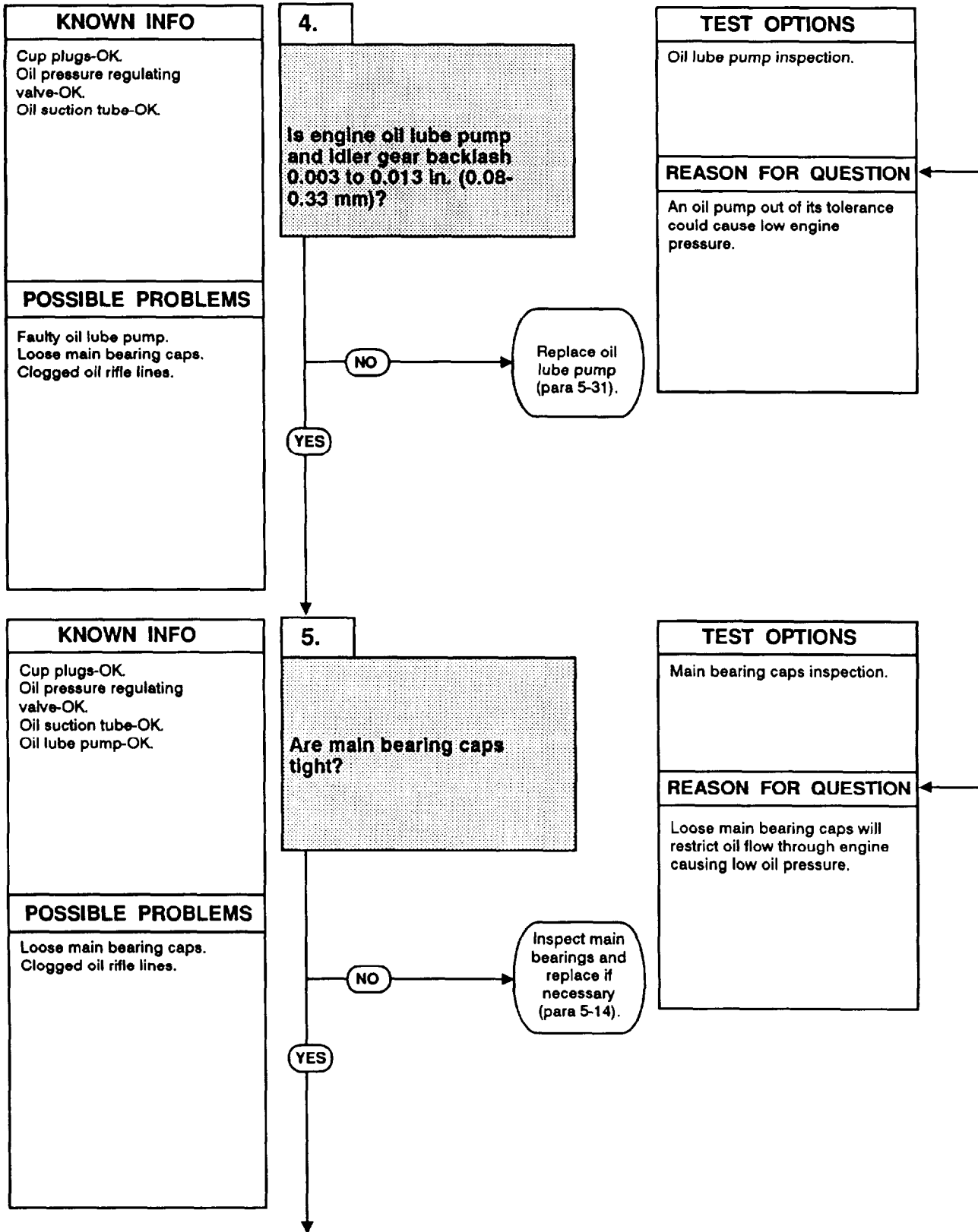


OIL SUCTION TUBE INSPECTION

- (1) Remove oil pan (para 5-29).
- (2) Inspect oil suction tube (1) for damage and tightness.
 - (a) If suction tube (1) is loose or damaged, tighten or replace (para 5-29).
 - (b) If suction tube (1) is tight or not damaged, indicates faulty oil lube pump.

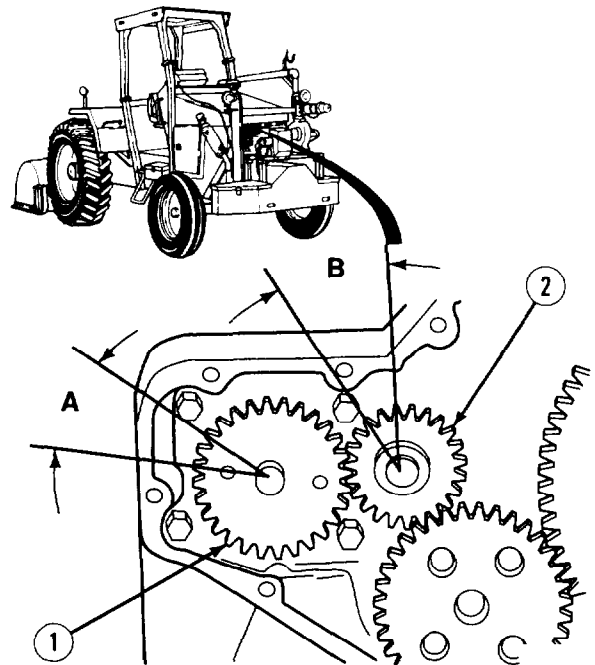


ENGINE OIL PRESSURE TOO LOW (CONT).



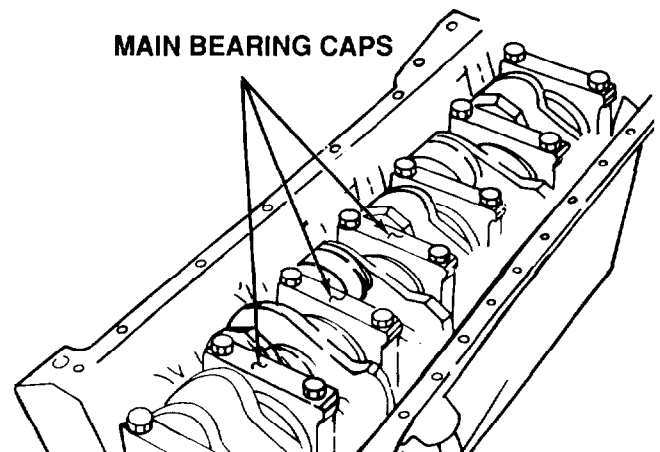
OIL LUBE PUMP INSPECTION

- (1) Remove gear cover (para 5-26).
- (2) Measure oil lube pump backlash at position A (para 5-31).
- (3) Normal backlash measurement is 0.003 to 0.013 in. (0.08-0.33 mm).
 - (a) If oil lube pump is not within limits, replace oil lube pump (para 5-31).
 - (b) If oil lube pump is within limits, indicates faulty main bearing caps.
- (4) Measure idler gear backlash at position B (para 5-31).
- (5) Normal backlash measurement is 0.003 to 0.013 in. (0.08-0.33 mm).
 - (a) If idler backlash is not within limits, replace oil pump (para 5-31).
 - (b) If idler gear backlash is within limits, indicates faulty main bearing caps.

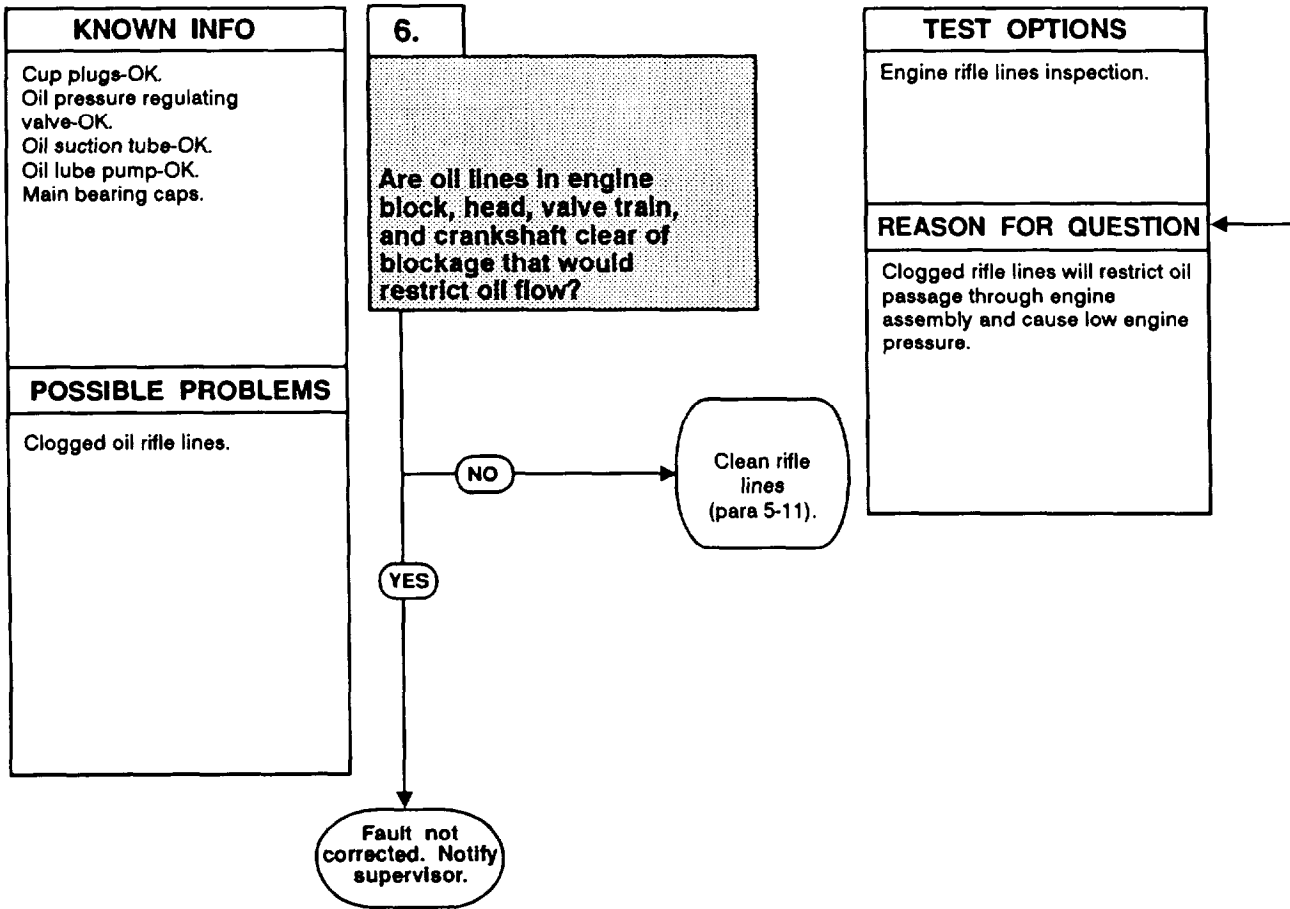


MAIN BEARING CAPS INSPECTION

- (1) Remove oil pan and suction tube (para 5-29).
- (2) Remove gear housing (para 5-28).
- (3) Turn engine upside down and check for loose main bearing caps (2).
 - (a) If main bearing caps are loose, inspect main bearings for damage (para 5-14).
 - (b) If main bearing caps are tight, indicates clogged oil rifle lines.



ENGINE OIL PRESSURE TOO LOW (CONT).



**ENGINE RIFLE LINES
INSPECTION**

- (1) Cylinder head assembly removed (para 5-12).
- (2) Camshaft removed (para 5-24).
- (3) Oil cooler removed (para 4-34).
- (4) Crankshaft removed (para 5-14).
- (5) Inspect all oil rifle lines in engine block, head, valve train, and crankshaft.
 - (a) If rifle oil lines are clogged, clean individual components in hot boiling water.
 - (b) If rifle oil lines are clear of restrictions, notify supervisor.

14. EXCESSIVE OIL CONSUMPTION.

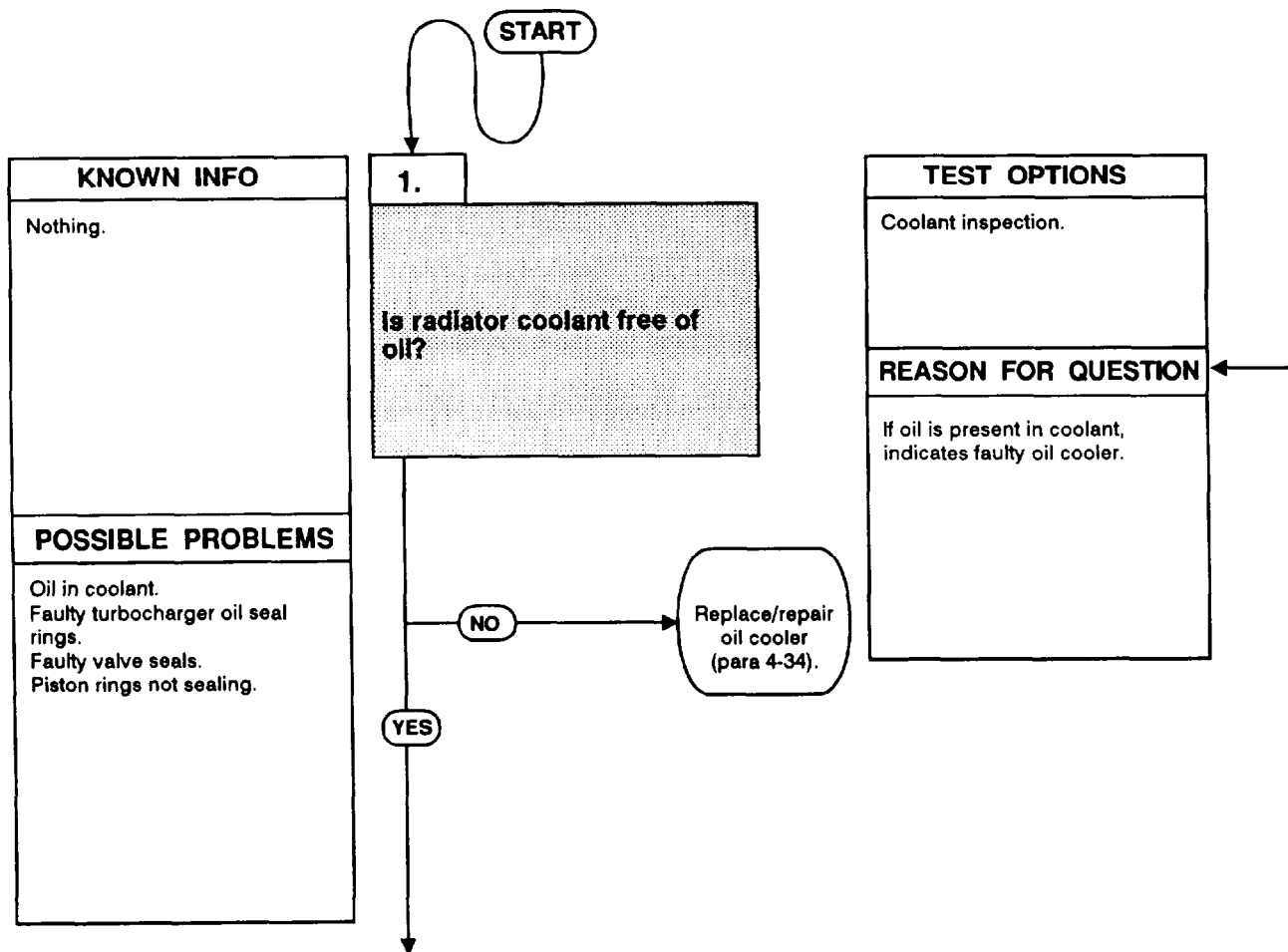
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

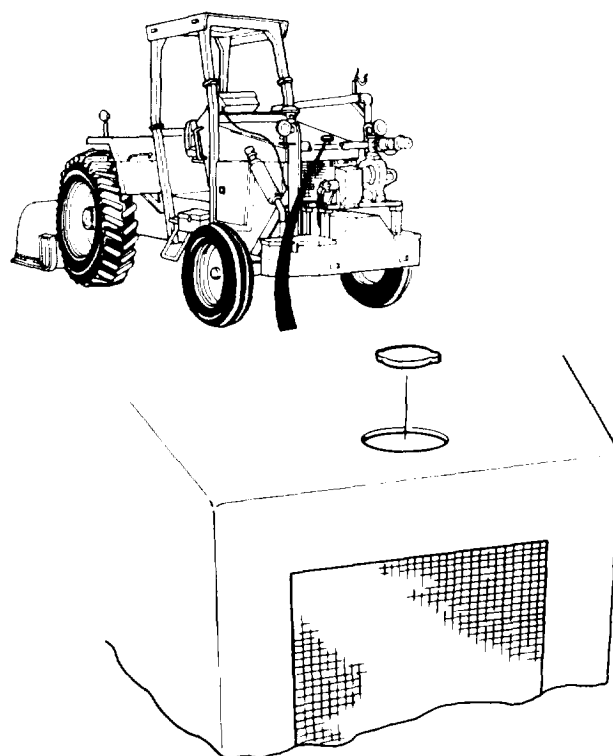
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)

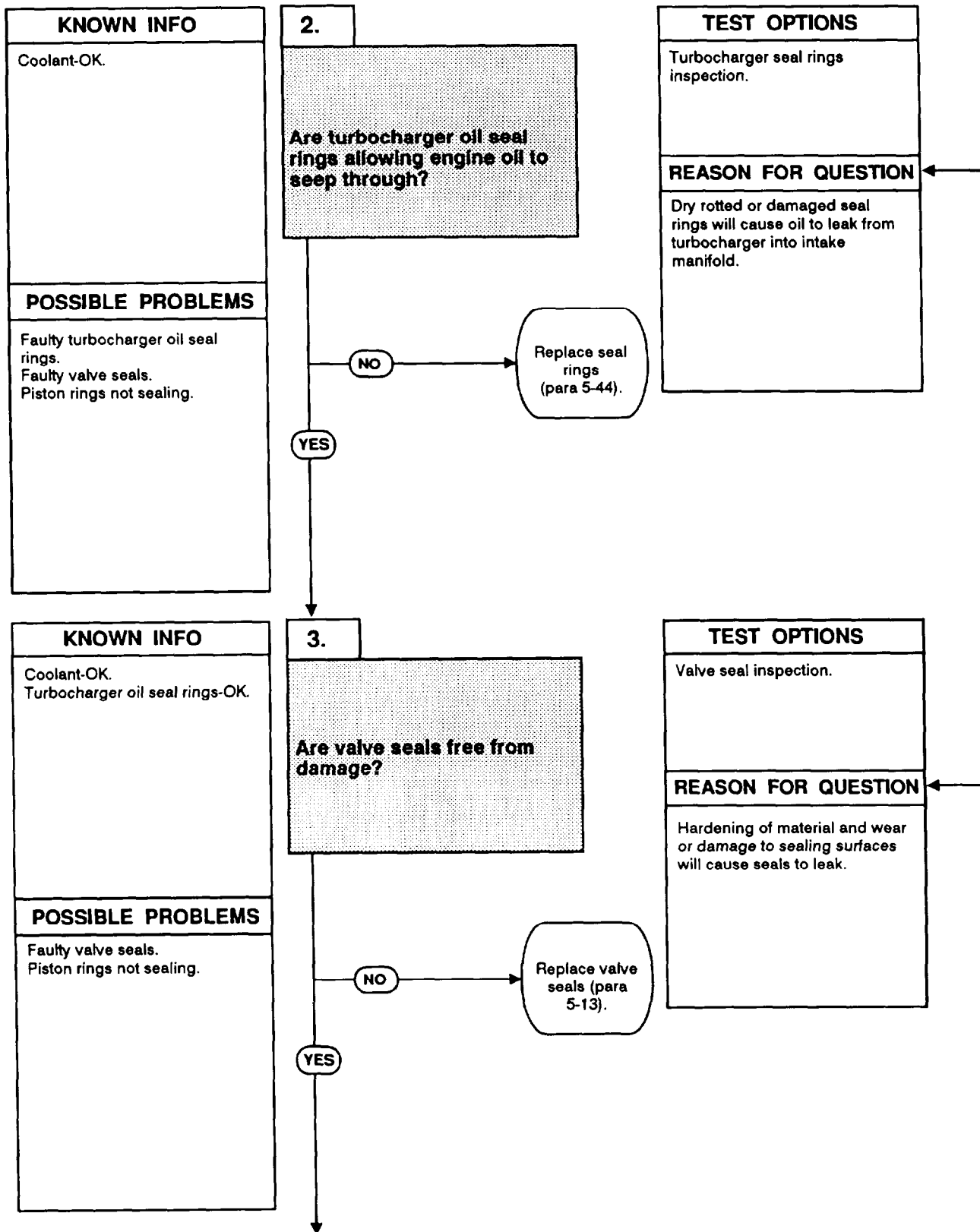


COOLANT INSPECTION

- (1) Remove radiator cap.
- (2) Inspect coolant in radiator for oil floating on top.
 - (a) If oil is present in coolant, indicates faulty oil cooler.
 - (b) If coolant is free of oil, indicates faulty valve seals.



EXCESSIVE OIL CONSUMPTION (CONT).

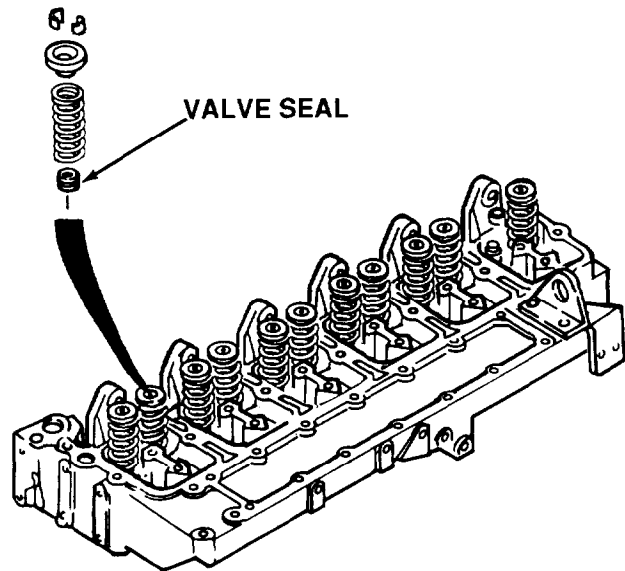


TURBOCHARGER OIL SEAL RINGS INSPECTION

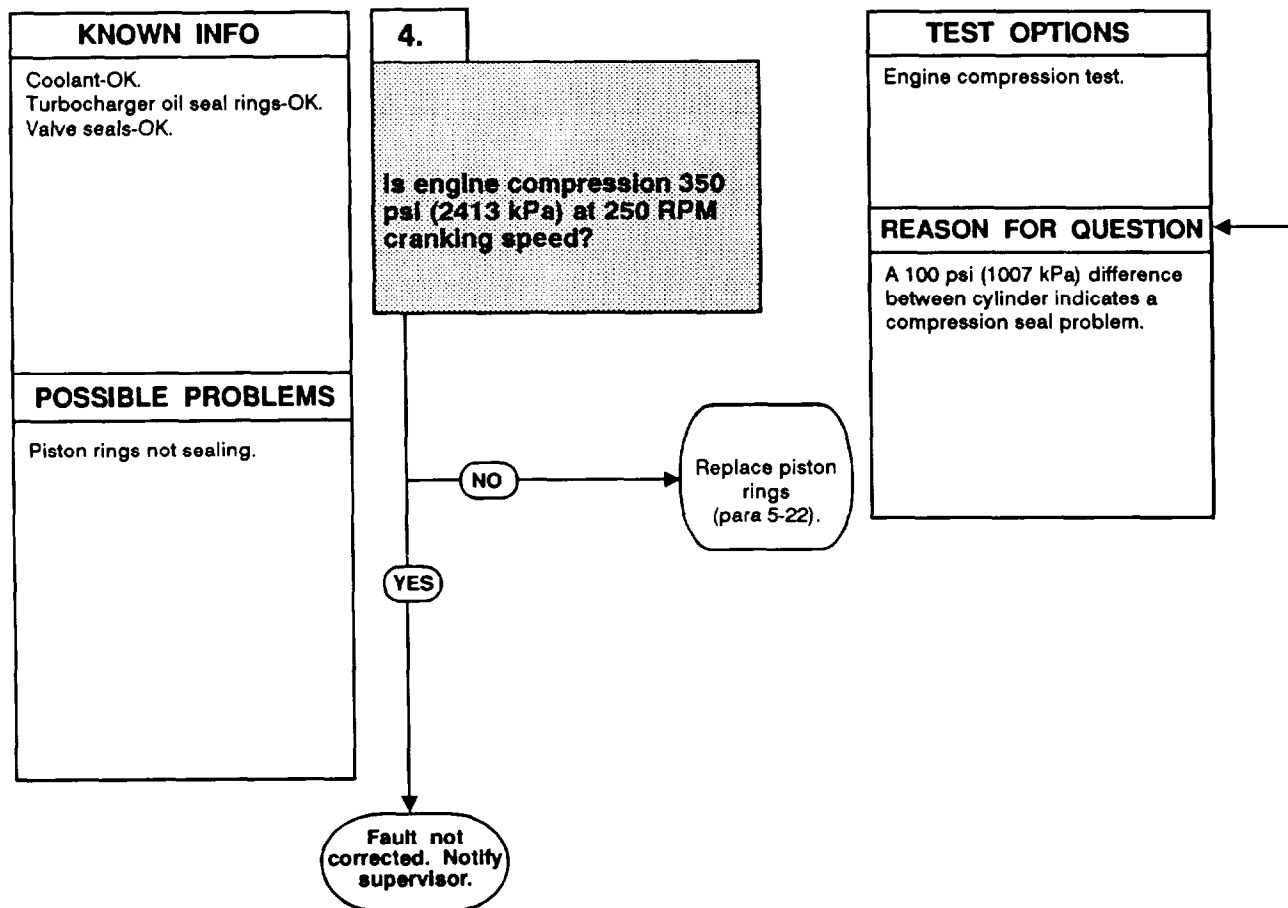
- (1) Remove air inlet pipe (para 445).
- (2) Inspect air inlet pipe for evidence of oil leakage.
 - (a) If evidence of oil leakage is present replace/repair turbocharger (paras 4-44 and 5-44).
 - (b) If no evidence of leakage is present, indicates faulty valve seals.

VALVE SEALS INSPECTION

- (1) Remove cylinder head (para 5-12).
- (2) Remove valve seals from cylinder head (para 5-13).
 - (a) If valve seals are damaged, replace (para 5-13).
 - (b) If valve seals are serviceable, indicates faulty piston rings.



EXCESSIVE OIL CONSUMPTION (CONT).



ENGINE COMPRESSION TEST

- (1) Close fuel shutoff valve (para 2-17).
- (2) Power up STU/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode.
- (3) Perform STWE/ICE-R pressure test #50 on each cylinder.
- (4) Engine compression should be 350 psi (2413 kPa) at 250 RPM cranking speed.
 - (a) A 100 psi (1007 kPa) difference between cylinders Indicates a compression seal problem. Replace piston rings (para 5-22).
 - (b) If engine passes compression test, notify supervisor.

15. FUEL OR OIL LEAKING FROM EXHAUST MANIFOLD.

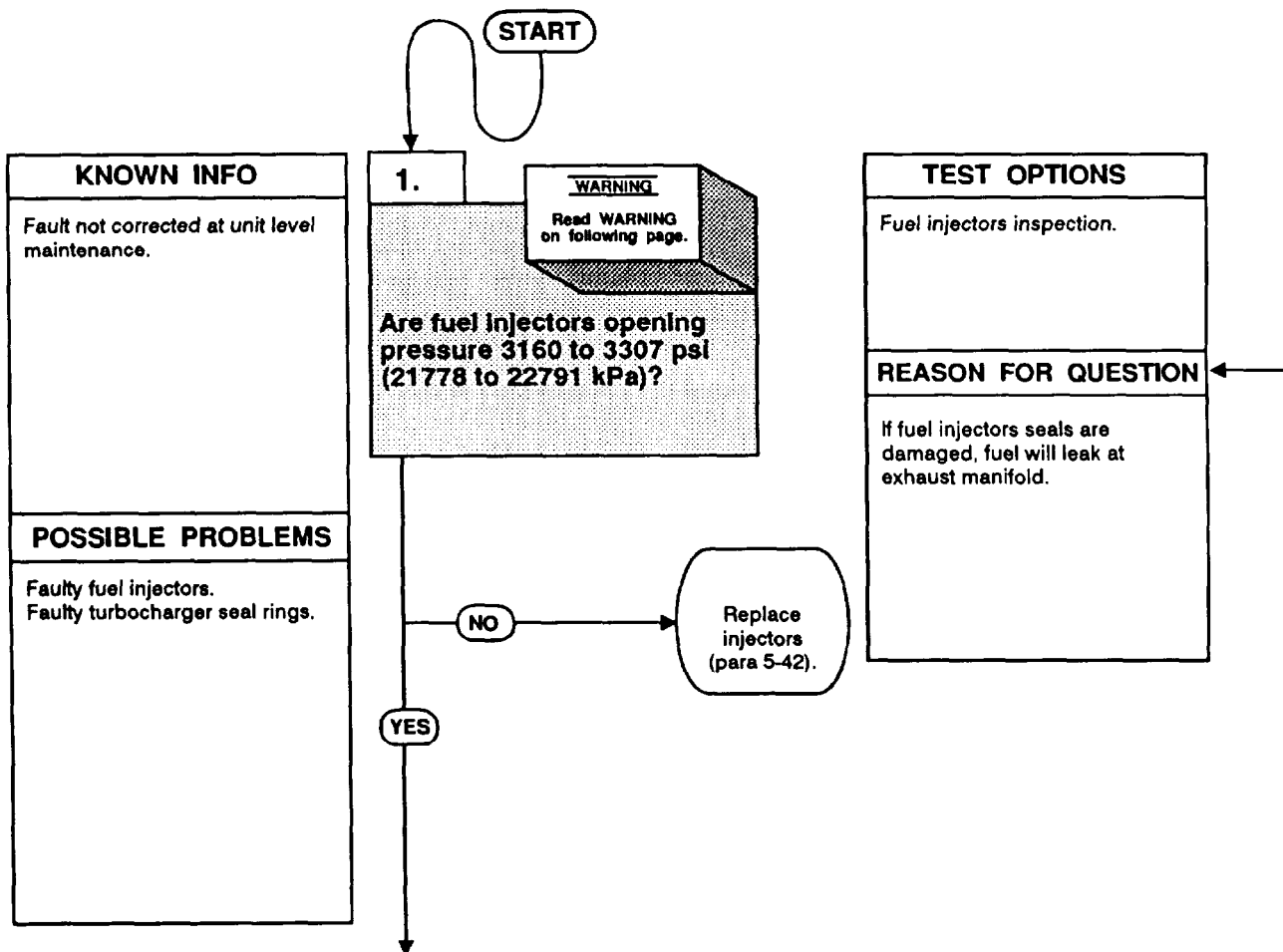
INITIAL SETUP

Equipment Condition

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Injector gauge pump

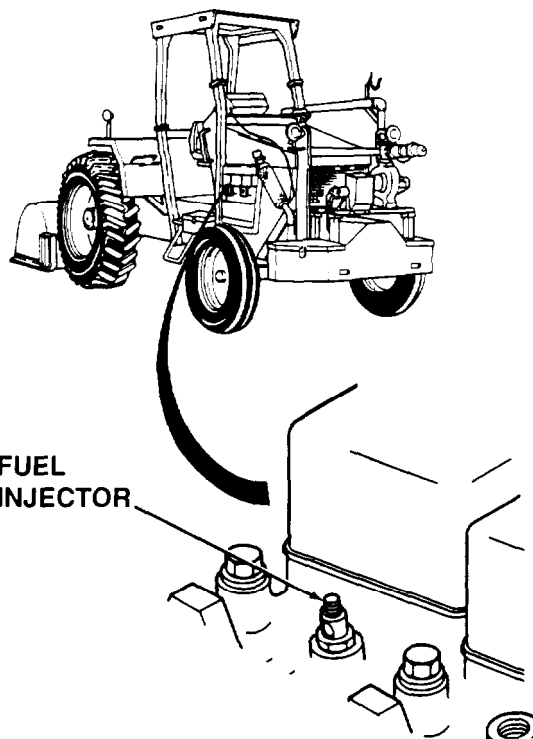


WARNING

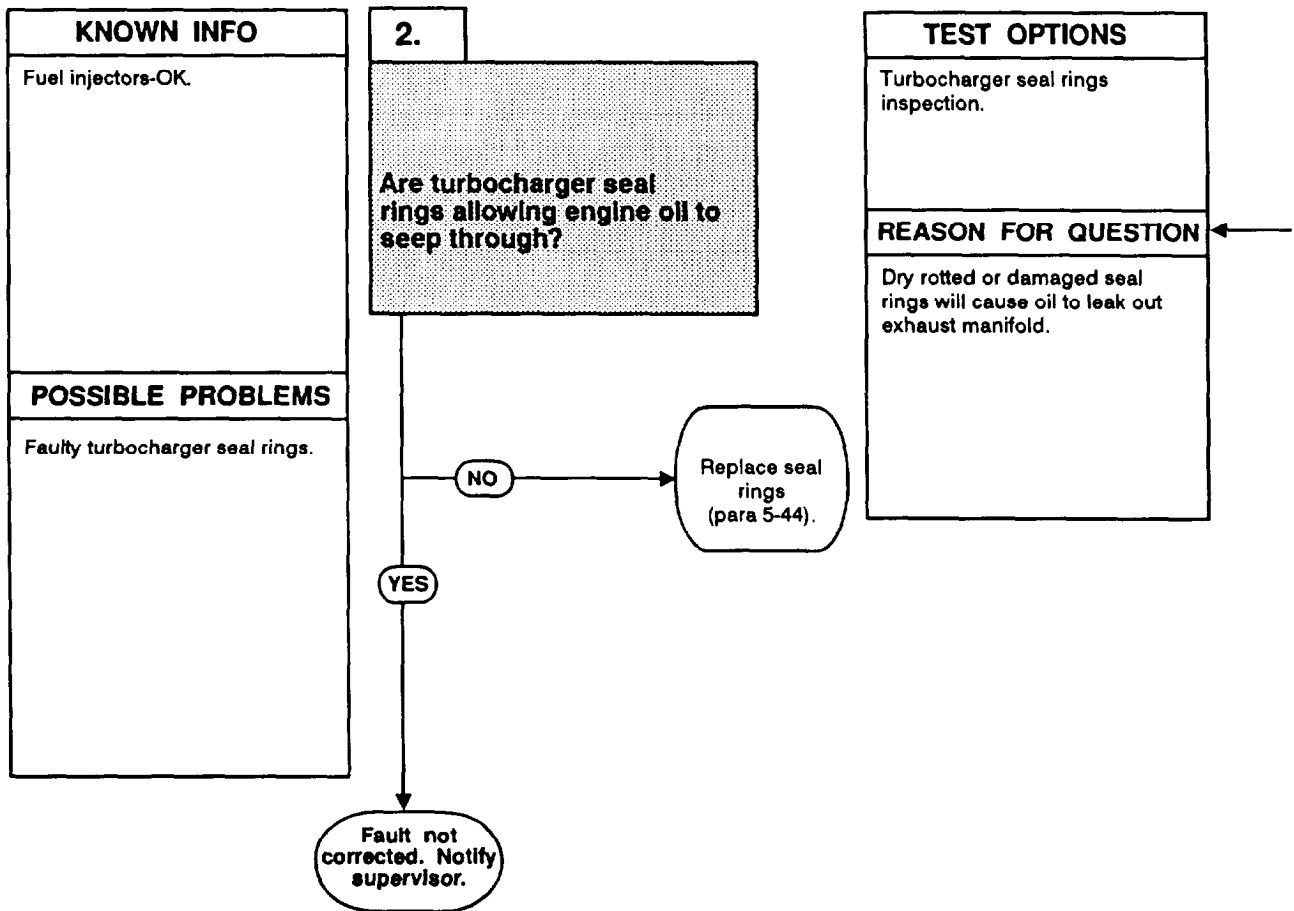
Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (pare 5-42).
- (3) Test fuel injectors (pare 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (pare 5-42).
 - (b) If fuel injectors open at opening pressure, indicates faulty turbocharger seal rings.



FUEL OR OIL LEAKING FROM EXHAUST MANIFOLD (CONT).



**TURBOCHARGER OIL SEAL
RINGS INSPECTION**

- (1) Remove air inlet pipe (para 445).
- (2) Inspect air inlet pipe for evidence of oil leakage.
 - (a) If evidence of oil leakage is present, replace/repair turbocharger (paras 4-44 and 5-44).
 - (b) If no evidence of leakage is present, notify supervisor.

16. COMPRESSION KNOCKS.

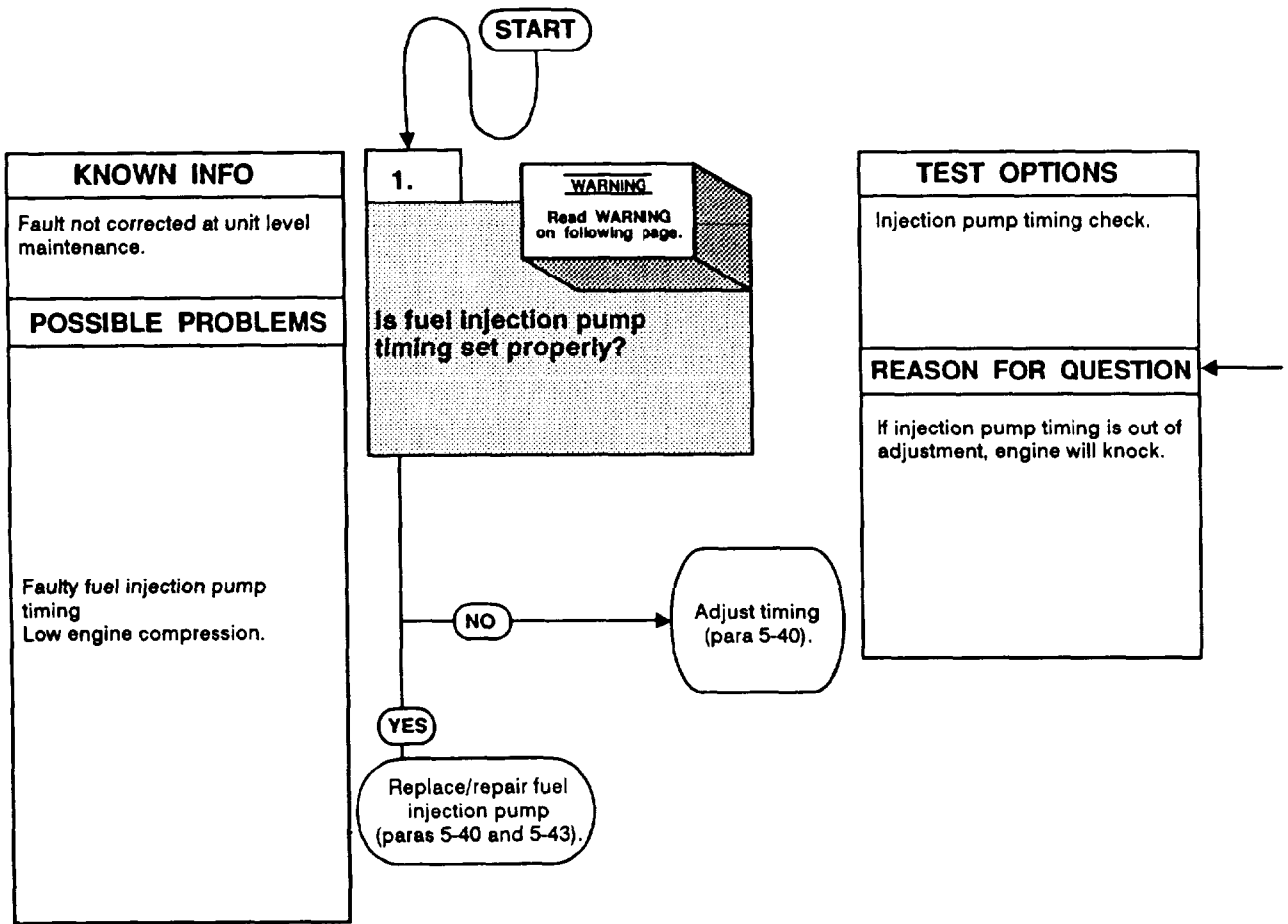
INITIAL SETUP

Equipment Condition

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13)

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted

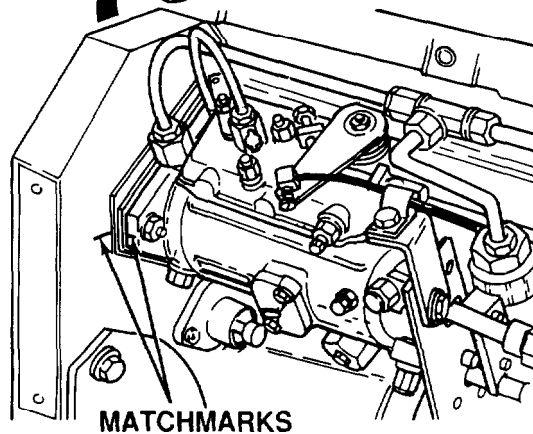
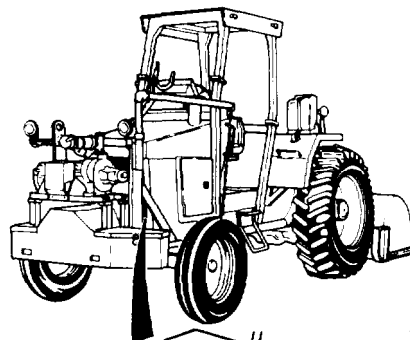


WARNING

Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

**INJECTION PUMP TIMING
INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, Indicates faulty injection pump. Replace/repair fuel injection pump (paras 5-40 and 5-43).



17. EXCESSIVE FUEL CONSUMPTION.

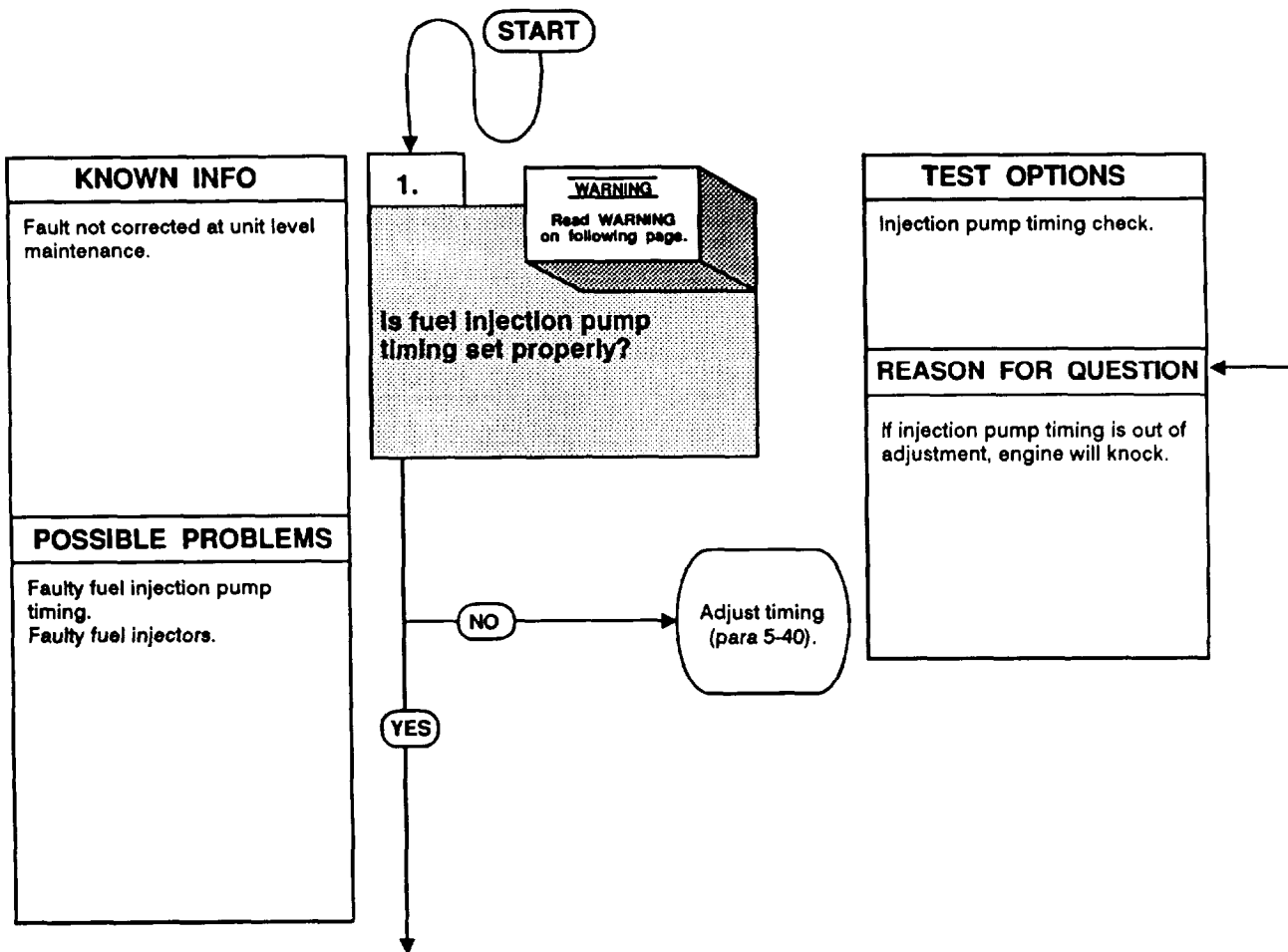
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13)

Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)

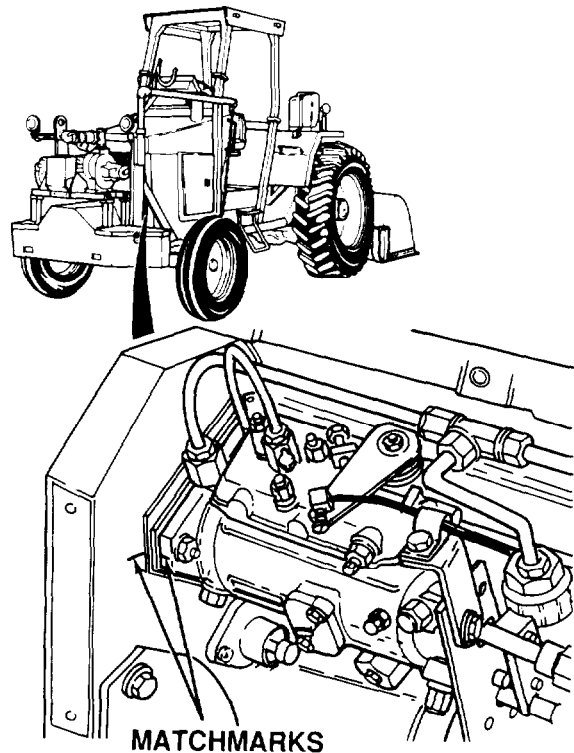


WARNING

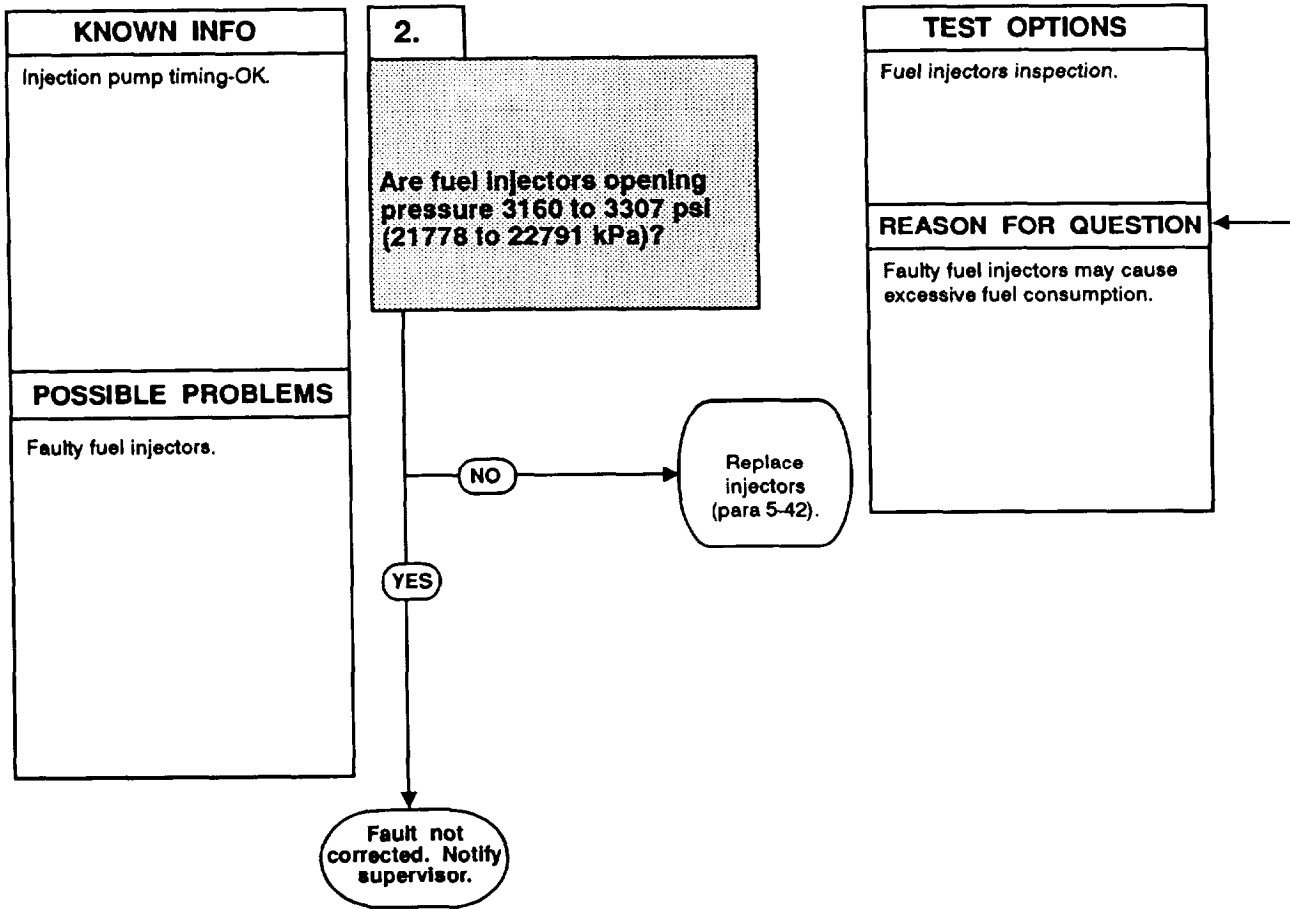
Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

**INJECTION PUMP TIMING
INSPECTION**

- (1) Remove negative battery cable (para 4-90).
- (2) Check injection pump timing (para 5-40).
 - (a) If injection pump is out of adjustment, reset timing (para 5-40).
 - (b) If timing is at proper setting, indicates faulty fuel injectors.



EXCESSIVE FUEL CONSUMPTION (CONT).

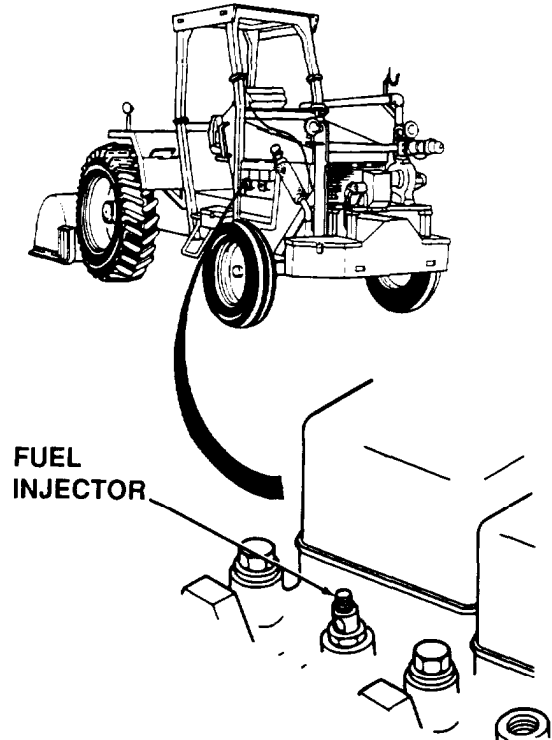


WARNING

Post signs that read "NO SMOKING WITHIN 50 FEET (15 m)" when working with open fuel lines or fuel tanks. Use caution when loosening intake fuel fittings. Fuel pressure is sufficient to penetrate skin and cause severe injury. Do not work on fuel system when engine is hot; fuel can be ignited by a hot engine.

FUEL INJECTORS INSPECTION

- (1) Remove negative battery cable (para 4-90).
- (2) Remove fuel injectors (para 542).
- (3) Test fuel injectors (para 5-42).
- (4) Opening pressure is 3160 to 3307 psi (21778 to 22791 kPa) on all injectors.
 - (a) If fuel injectors do not open at proper opening pressure, replace injectors (para 542).
 - (b) If fuel injectors open at opening pressure, notify supervisor.



18. EXCESSIVE VIBRATION.

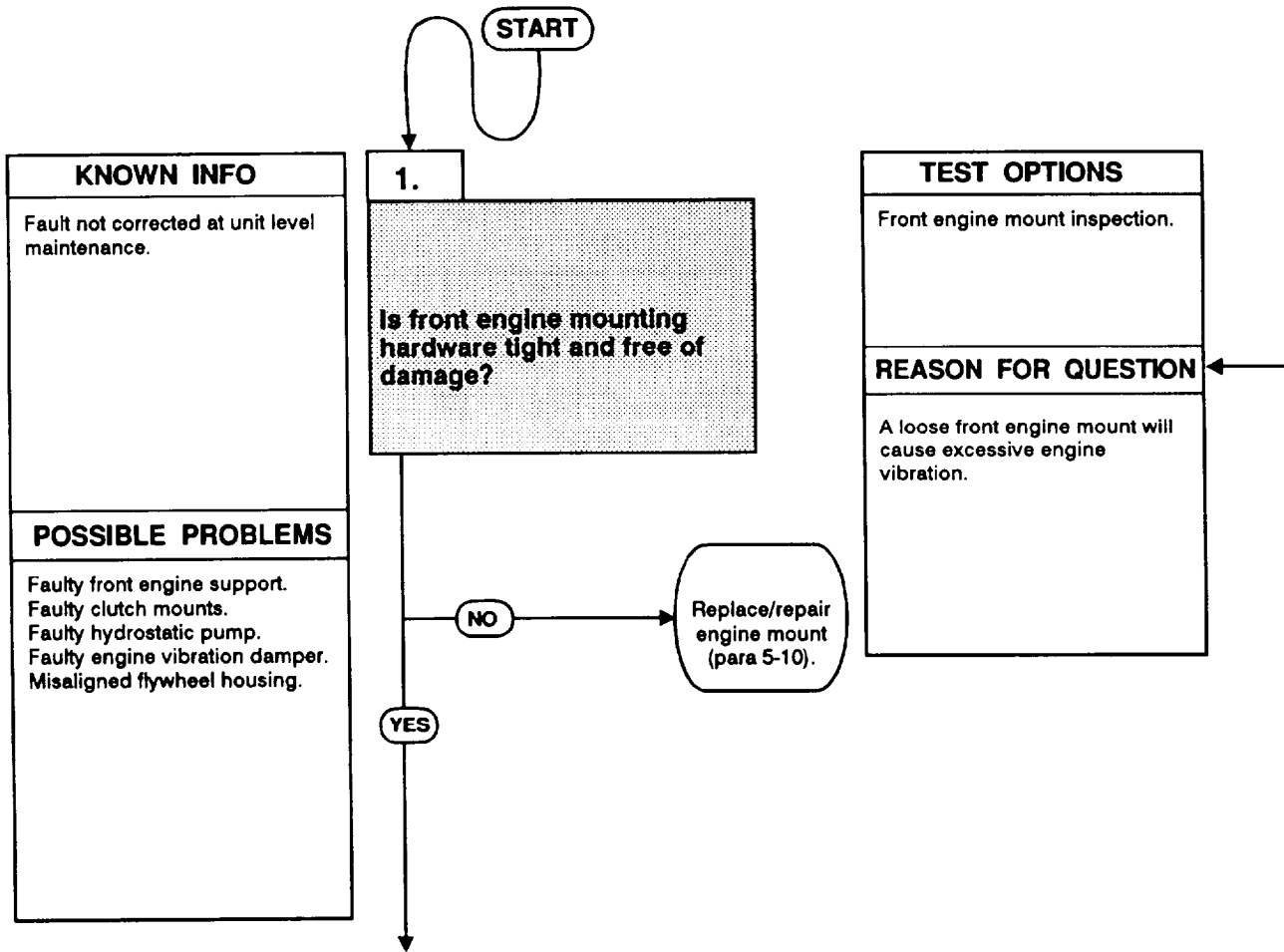
INITIAL SETUP

Equipment Conditions

- Parking brake set, (para 2-13).
- Engine removed, (para 5-8).
- Engine installed on engine stand, (para 59).

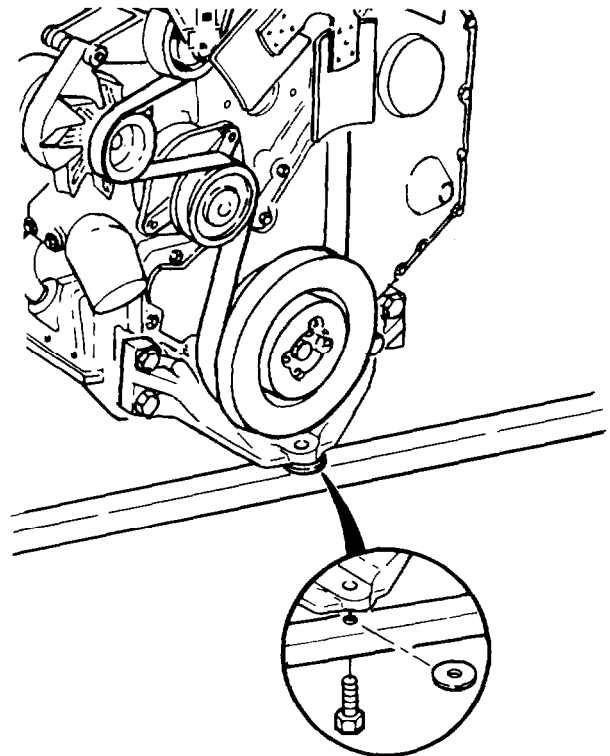
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted

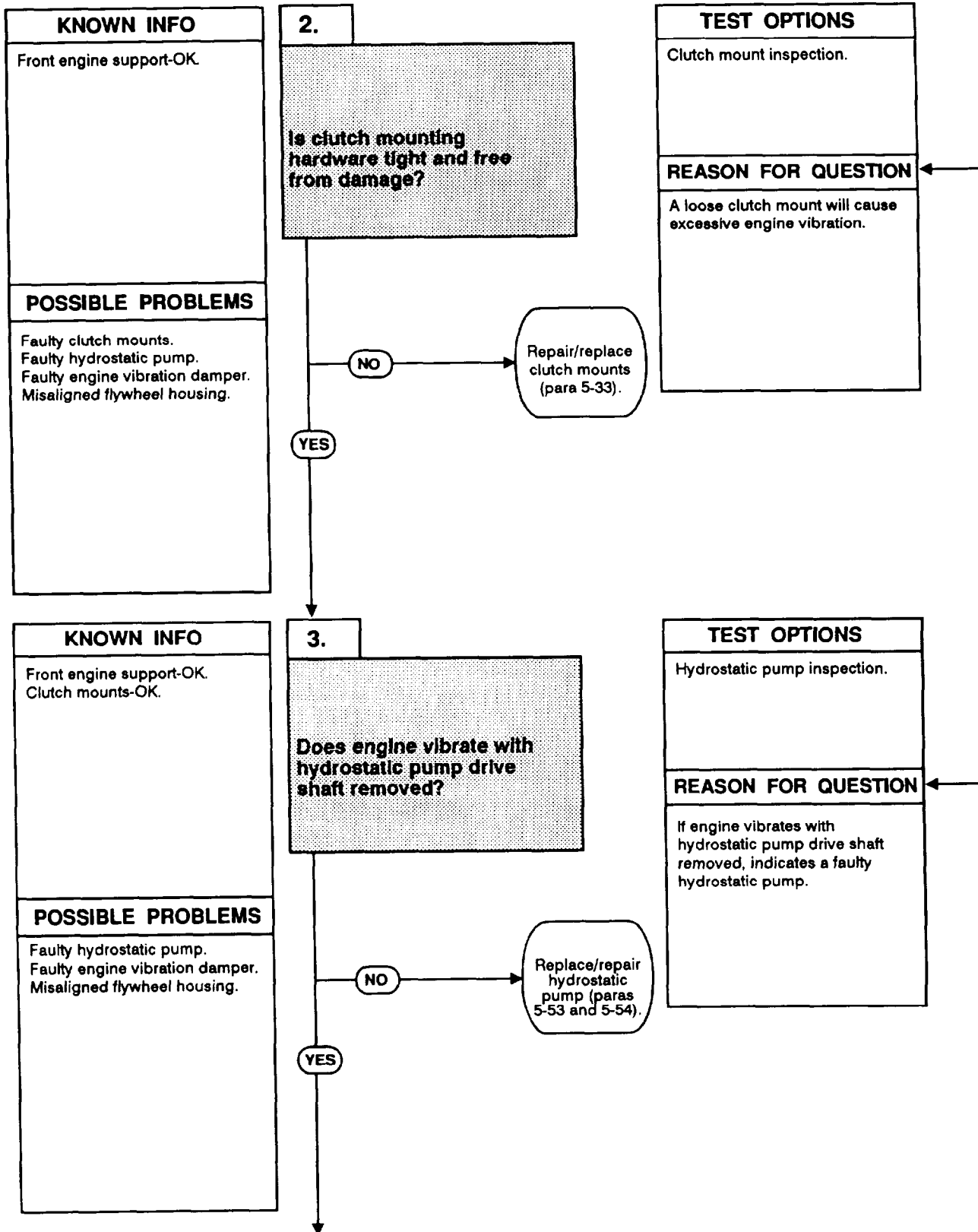


FRONT ENGINE MOUNT INSPECTION

- (1) Check front engine mount to ensure mounting hardware is tight and not damaged.
 - (a) If engine mount is loose or damaged, repair/replace (para 5-10).
 - (b) If engine mount is not loose or damaged, indicates faulty clutch mounts.

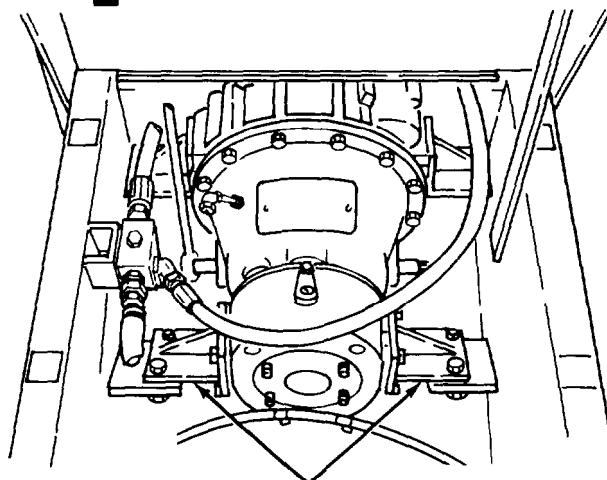
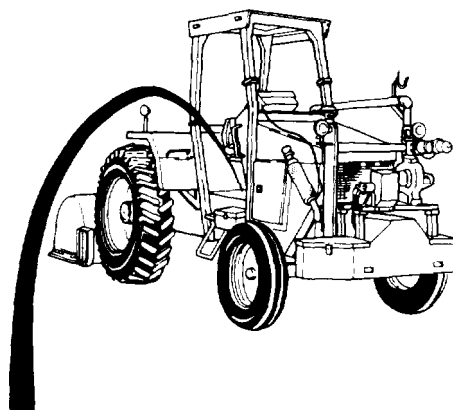


EXCESSIVE VIBRATION (CONT).



CLUTCH MOUNT INSPECTION

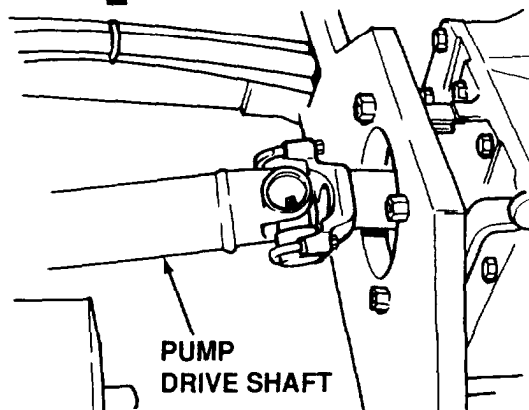
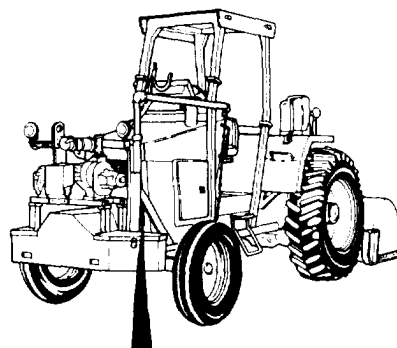
- (1) Raise aft floor deck (para 2-15)
- (2) Check clutch mounting hardware for damage and ensure mounts are tight.
 - (a) If clutch mounting hardware is loose or damaged, replace (para 5-33).
 - (b) If clutch mounting hardware is OK, indicates faulty hydrostatic pump.



CLUTCH MOUNTS

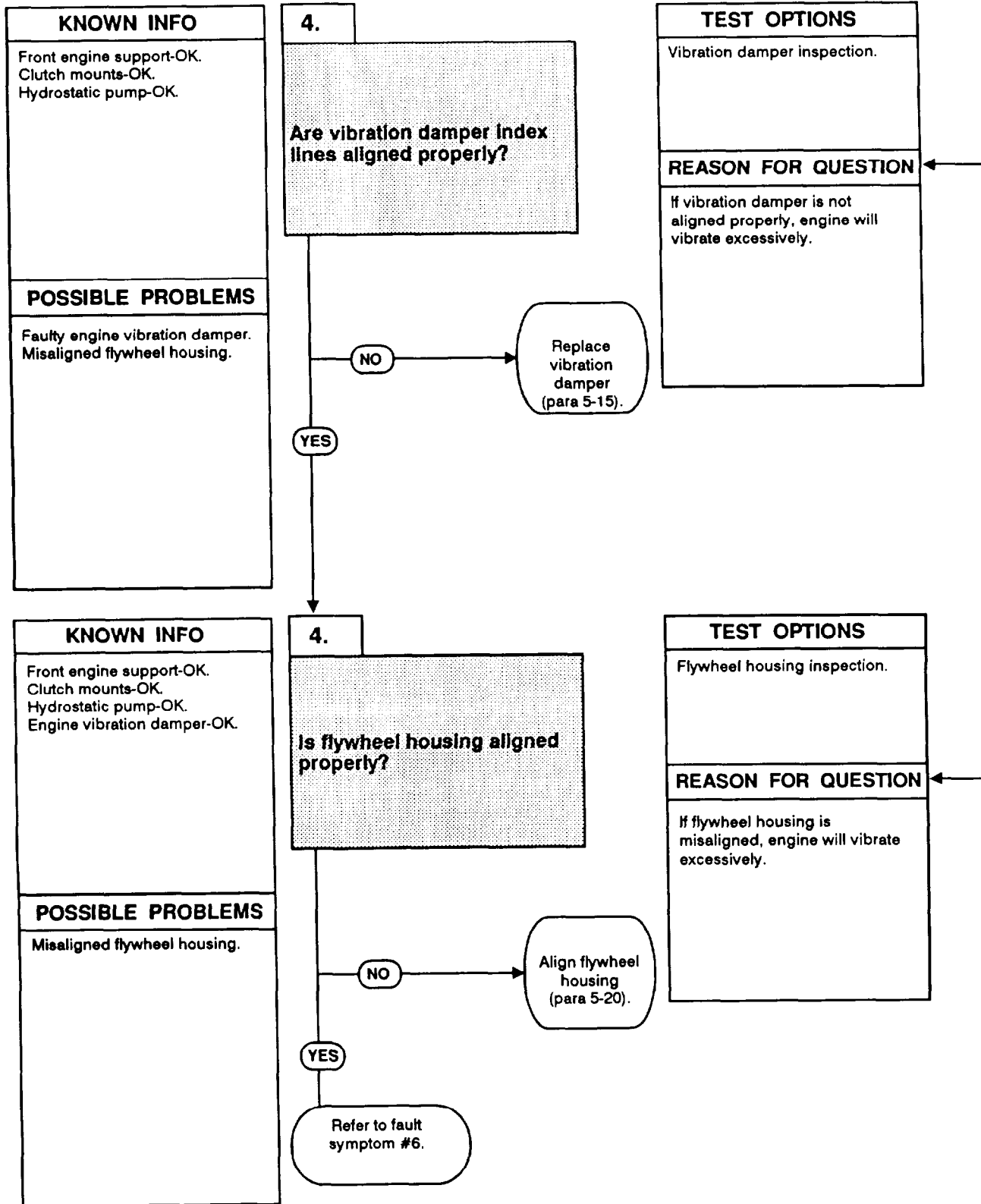
HYDROSTATIC PUMP INSPECTION

- (1) Remove hydrostatic pump drive shaft (para 4-100).
- (2) Start engine (para 2-9).
 - (a) If engine does not vibrate, hydrostatic pump is faulty. Replace/repair pump (paras 5-53 and 5-54).
 - (b) If engine vibrates with hydrostatic pump disconnected, indicates faulty vibration damper.



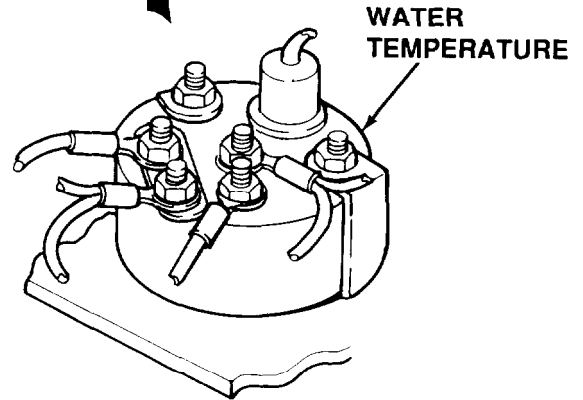
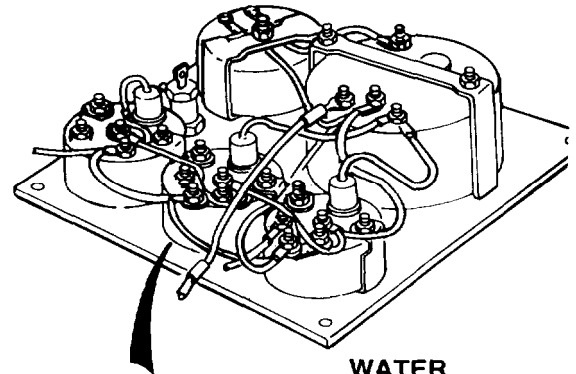
PUMP DRIVE SHAFT

EXCESSIVE VIBRATION (CONT).



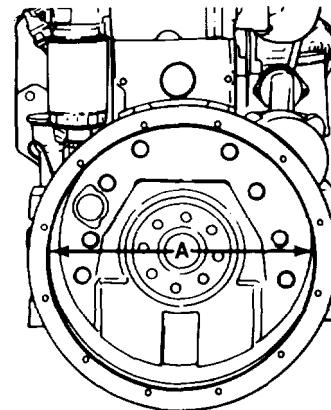
ENGINE VIBRATION DAMPER INSPECTION

- (1) Remove drive belt (para 466).
- (2) Remove vibration damper (para 515) and inspect alignment marks.
- (3) Measure distance between index lines (1) marked on damper.
 - (a) If measurement is more than 1/16 in. (1.59 mm), replace damper (para 515).
 - (b) If measurement is within limits, indicates misaligned flywheel housing



FLYWHEEL HOUSING INSPECTION

- (1) Remove engine (para 5-6).
- (2) Remove flywheel (para 5-16).
- (3) Measure housing bore at position A. Normal bore diameter is between 17.625 to 17.630 in. (447.66447.60 mm).
 - (a) If flywheel housing is not within limits, replace flywheel housing (para 5-20).
 - (b) If flywheel housing is within limits, refer to fault symptom #6.



19. UNUSUAL ENGINE NOISES.

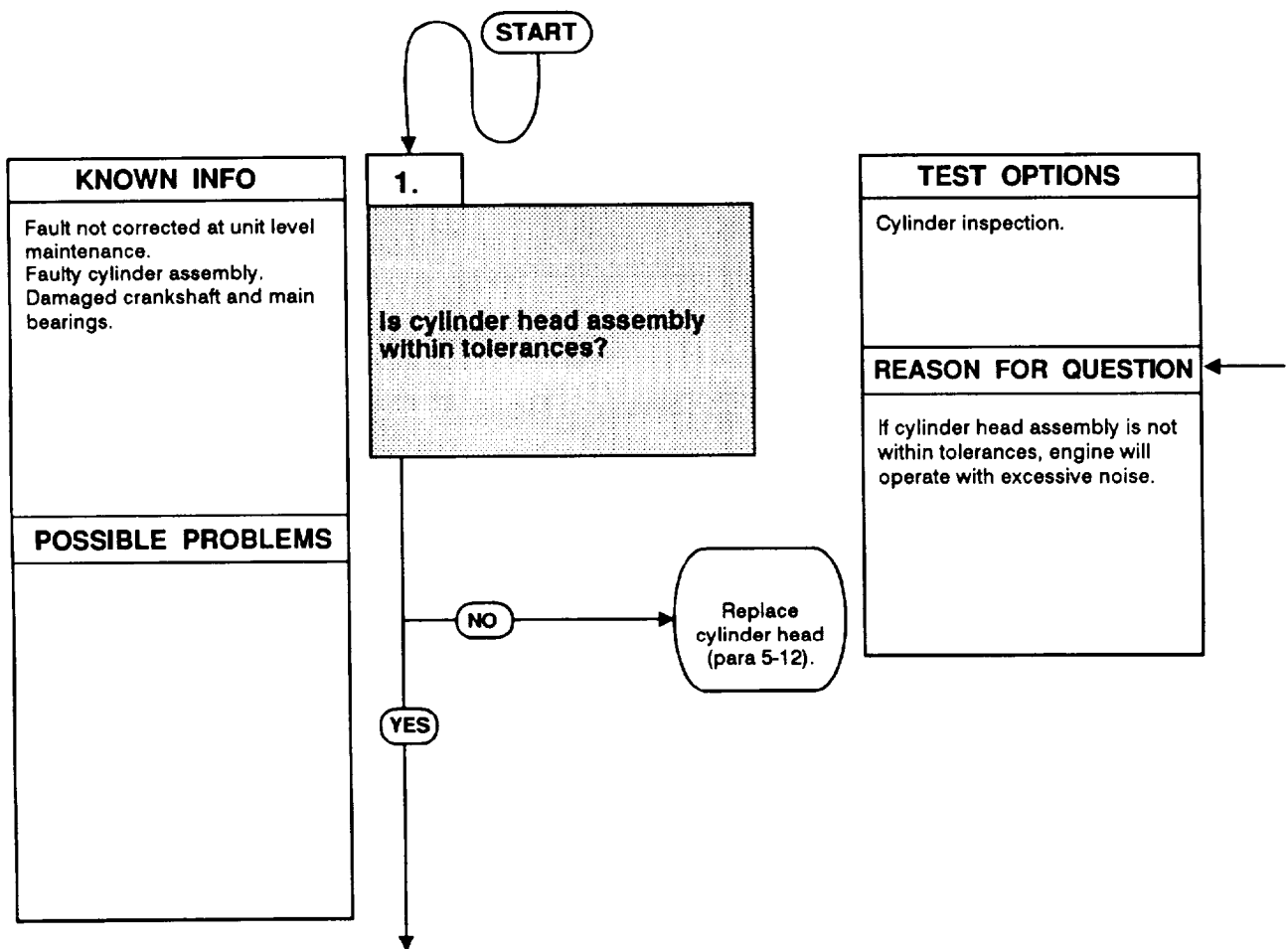
INITIAL SETUP

Equipment Conditions

- Parking brake set, (para 2-13).
- Engine removed, (para 5-8).
- Engine installed on engine stand, (para 5-9).

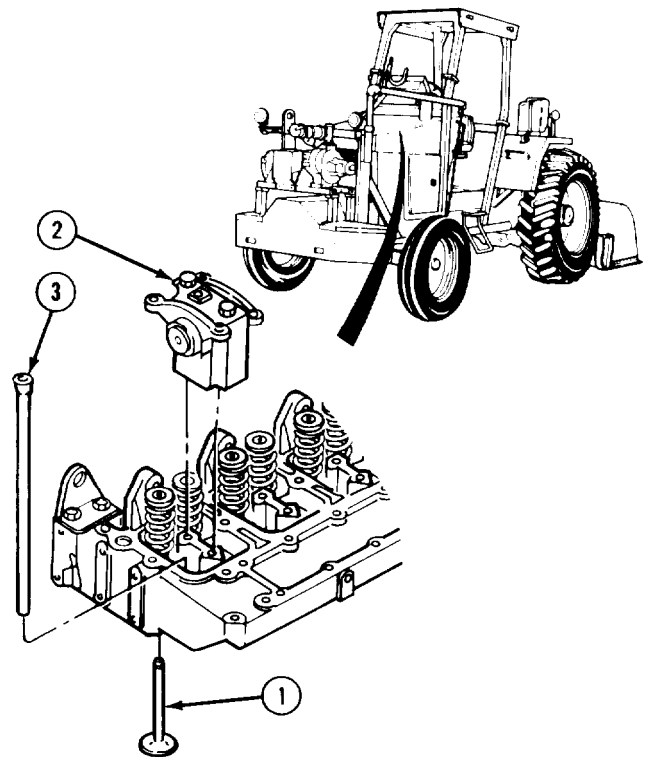
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted

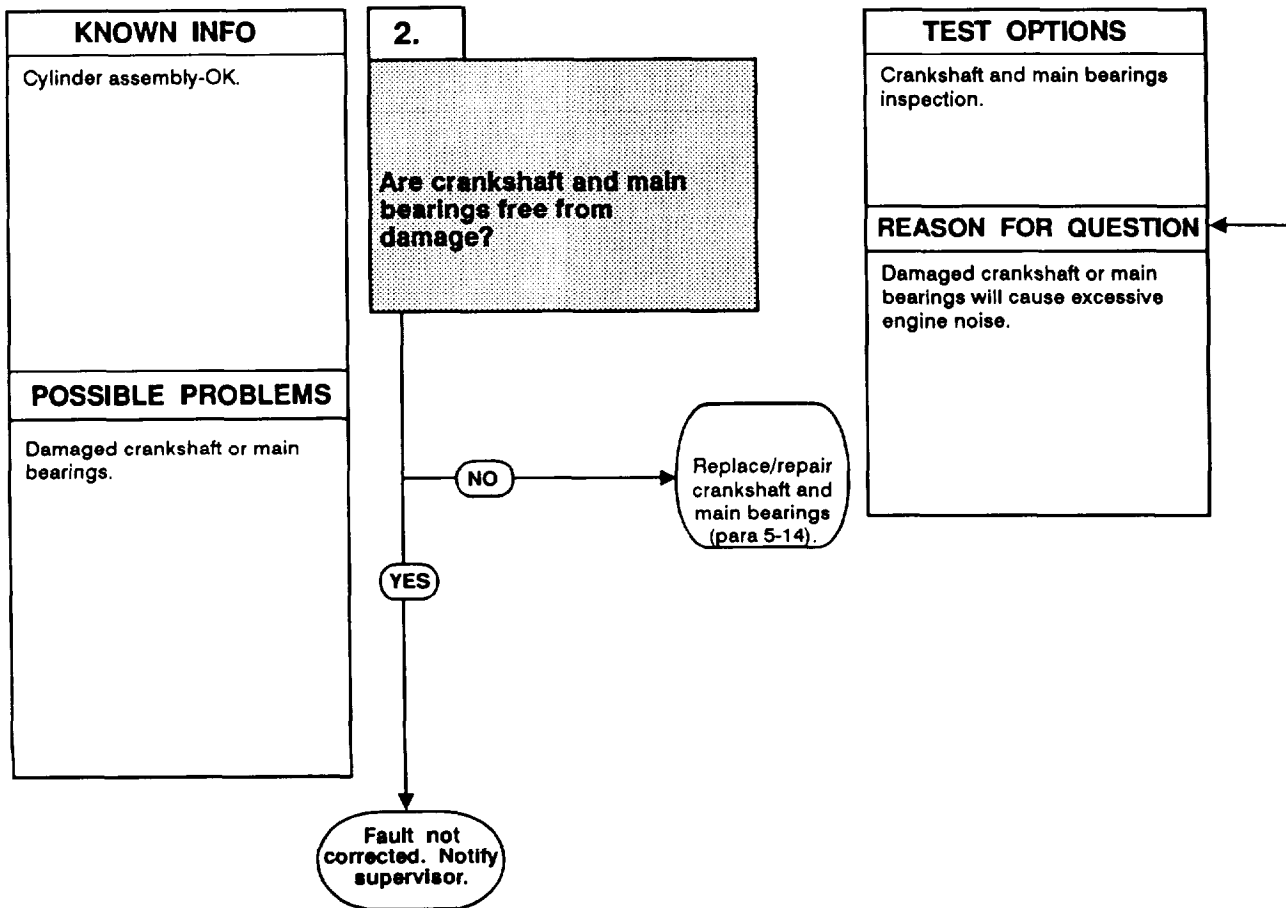


CYLINDER HEAD INSPECTION

- (1) Remove cylinder head (para 5-12).
- (2) Inspect valve stems (1), rocker levers (2), and push rods (3) for worn or damaged parts (para 5-13).
 - (a) Replace all worn or damaged parts (para 5-13).
 - (b) If cylinder head assembly is within tolerances, indicates loose or damaged crankshaft or main bearings.



UNUSUAL ENGINE NOISES (CONT).



**CRANKSHAFT AND MAIN
BEARING INSPECTION**

- (1) Remove oil pan and suction tube (para 5-29).
- (2) Remove gear housing (para 5-28).
- (3) Remove crankshaft and main bearings (para 5-14).
- (4) Check for damage to crankshaft and main bearings and caps.
 - (a) If crankshaft and main bearing caps are damaged, replace/repair (para 514).
 - (b) If crankshaft and main bearing are not damaged, notify supervisor.

20. VEHICLE DOES NOT MOVE IN FORWARD OR REVERSE CORRECTLY.

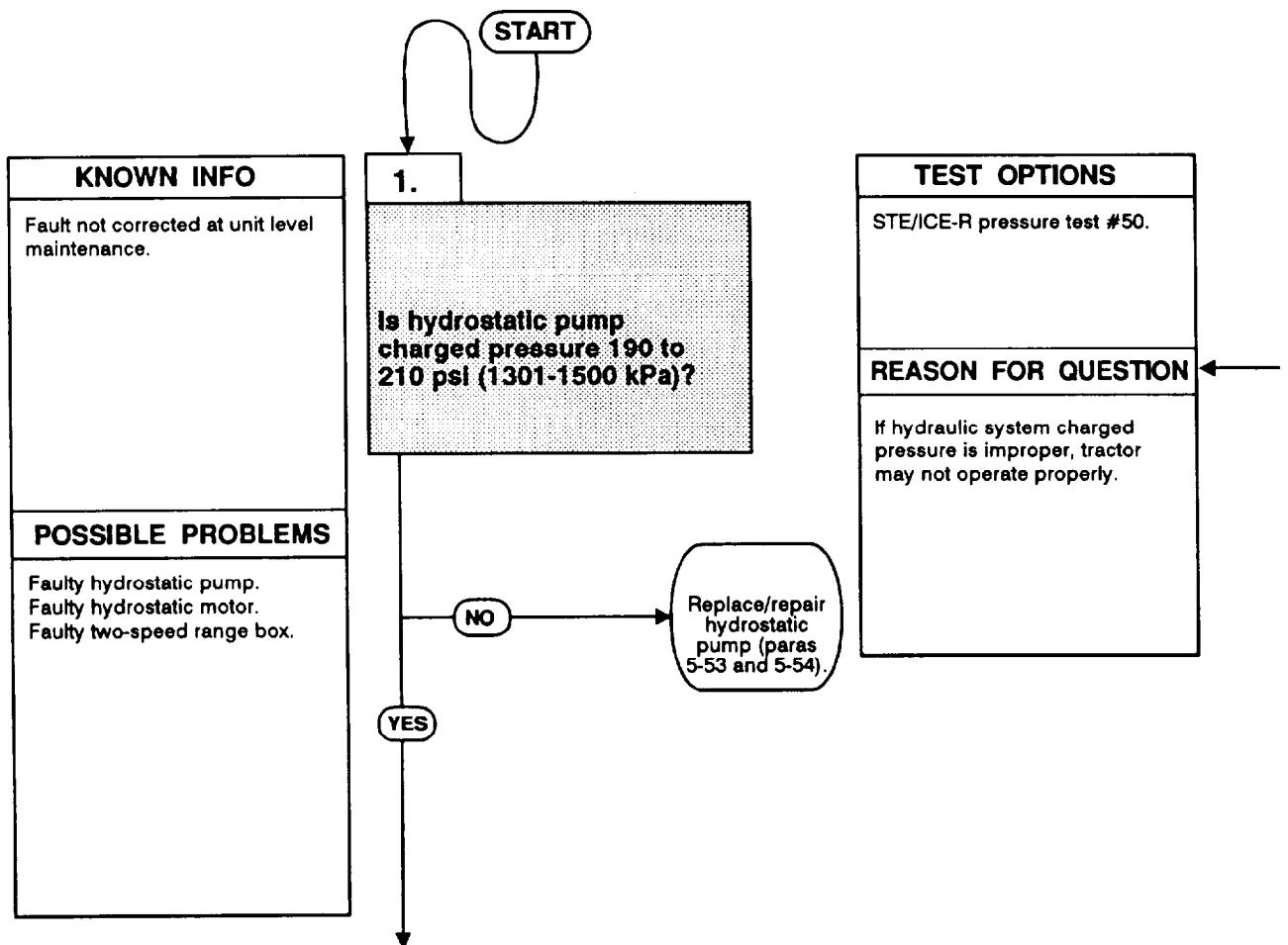
INITIAL SETUP

Equipment Conditions

Engine shut off, (para 2-10[c]).
 Parking brake set, (para 2-13).

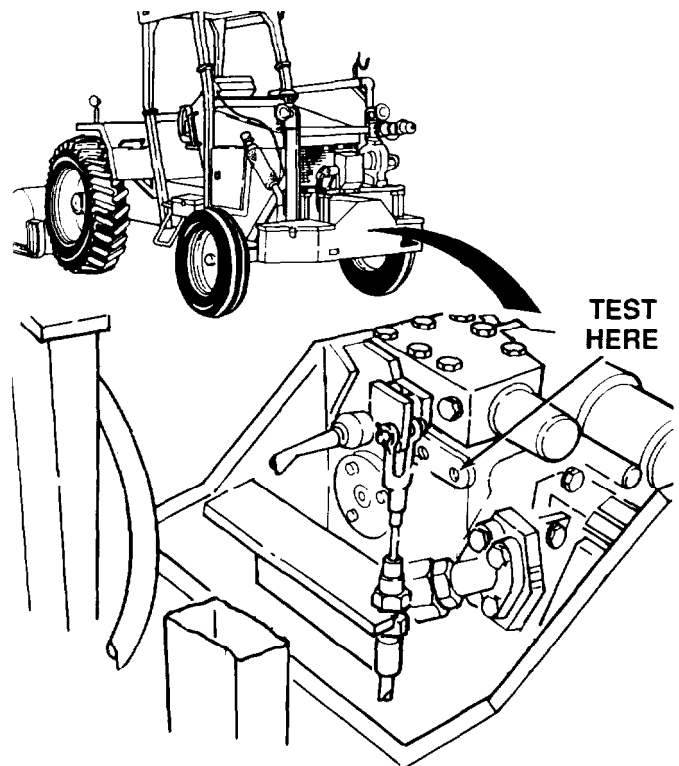
Tools and Special Tools

Shop equipment, contact maintenance: truck mounted
 Test set, Simplified Test Equipment for Internal Combustion Engines reprogrammable, (STE/ICE-R)
 7/16-20 O-ring fitting.

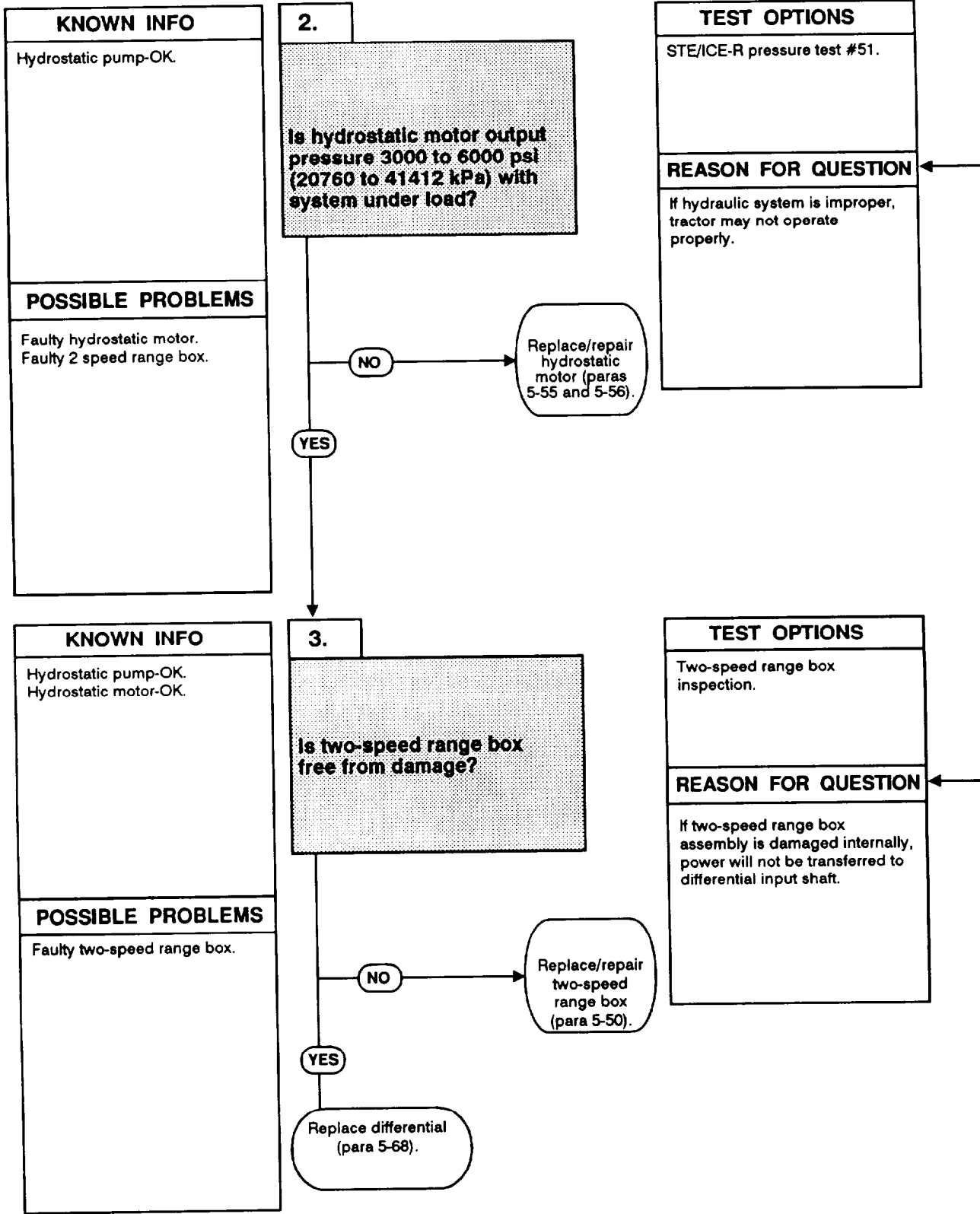


**STE/ICE-R PRESSURE TEST
#50**

- (1) Remove hydrostatic pump cover (para 4-97).
- (2) Remove output pressure line (para 5-53) from hydrostatic pump.
- (3) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Perform STE/ICE-R pressure test #50 at output port.
- (5) Hydrostatic pump charged pressure should be between 190 to 210 psi (1301-1500 kPa).
 - (a) If pump charged pressure is not within limits, replace/repair hydrostatic pump (paras 5-53 and p5-54).
 - (b) If pump charged pressure is within limits, indicates faulty hydrostatic motor.



VEHICLE DOES NOT MOVE IN FORWARD OR REVERSE CORRECTLY (CONT).

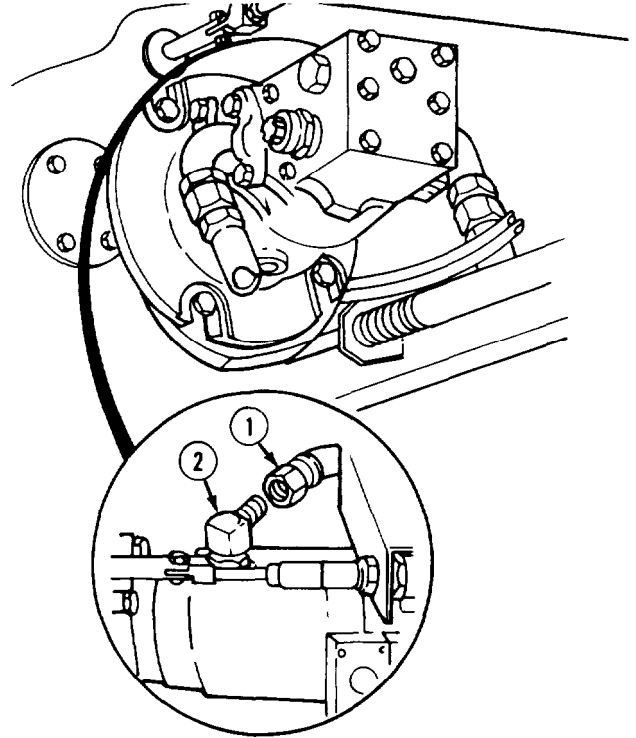


WARNING

The following procedure requires the ability to produce a sufficient load to create maximum system pressure. Take necessary precautions or injury or death to personnel could result.

**STE/ICE-R PRESSURE TEST
#51**

- (1) Prevent tractor from moving forward under load.
- (2) Remove output pressure line (para 5-55) from hydrostatic motor.
- (3) Power up STE/ICE-R to vehicle battery source (TM 9-4910-571-12&P, in TK mode).
- (4) Setup STE/ICE-R pressure test #51 at output port.
- (5) Start engine (para 2-9).
- (6) Engage hydrostatic motor (para 2-10).
- (7) Bring tractor up to operating speed (1800-2000 rpm)
- (8) Perform STE/ICE-R pressure test #51
- (9) Hydrostatic motor output pressure should be 3000 to 6000 psi (20760 to 41412 kPa).
 - (a) If output pressure is not within limits, replace motor (para 5-55).
 - (b) If pump output pressure is within limits, indicates faulty two-speed range box.



**TWO-SPEED RANGE BOX
INSPECTION**

- (1) Remove rear axle (para 5-64).
- (2) Remove two-speed range box from differential.
- (3) Inspect two-speed range box for damage (para 5-50).
- (4) If two-speed range box is damaged, replace/repair (para 5-50).
- (b) If two-speed range box is not damaged, replace/repair differential (paras 5-68 and 5-69).

Section V. MAINTENANCE PROCEDURES

5-8. ENGINE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Lifting device (capacity 1250 lbs [567 kg])
Wrench, torque

Materials/Parts

Lockwashers (14)
Locknuts (15)
Compound, sealing, pipe thread (item 17, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

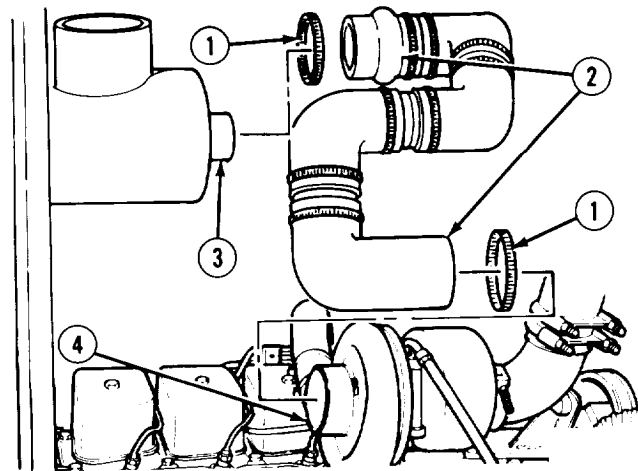
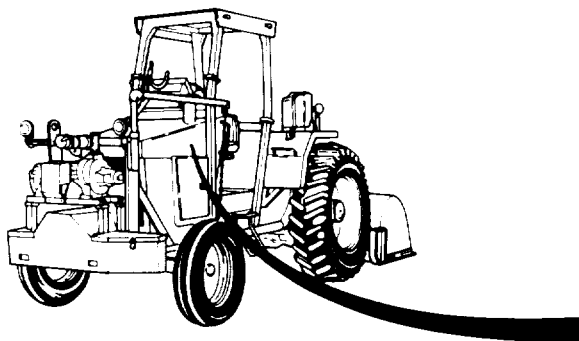
Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-126	Left/right engine doors removed.

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-125	Hood removed.
Para 4-195	Air cleaner assembly removed.
Para 4-87	Engine battery removed.
Para 4-24	Engine oil drained.
Para 4-59	Muffler assembly removed.
Para 4-56	Throttle linkage disconnected.
Para 4-100	Pump drive shaft assembly removed.
Para 5-33	Clutch assembly removed
Para 4-119	Emergency steering unit removed.
Para 4-60	Radiator removed.
Para 4-143	Hydraulic pump drive hoses removed.

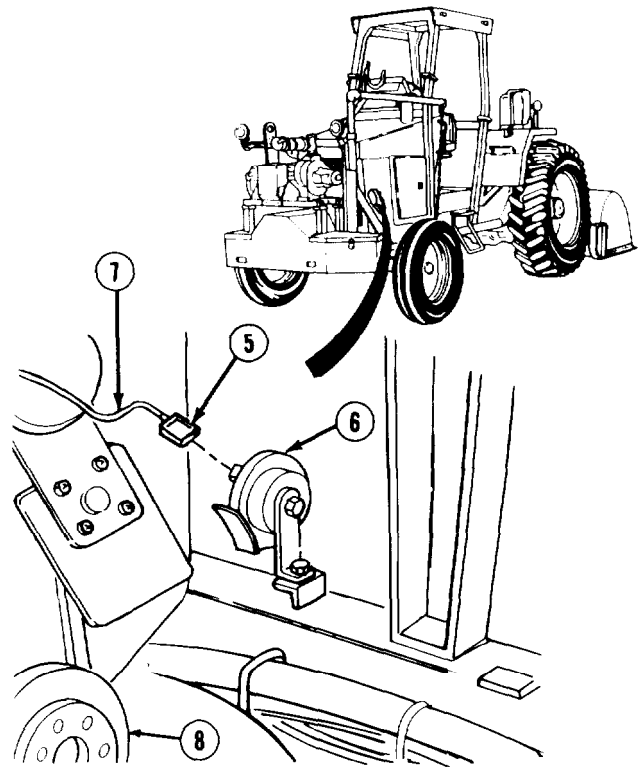
a. Removal.



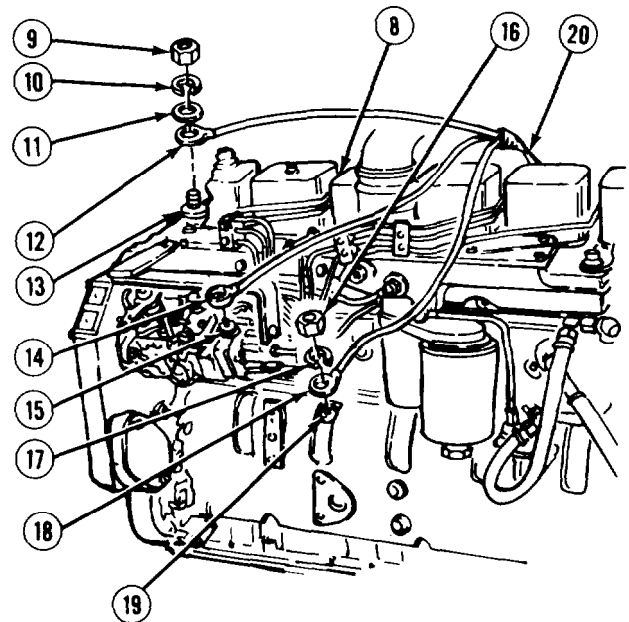
- (1) Loosen two clamps (1) and remove air cleaner hose assembly (2) from air cleaner (3) and turbocharger (4).

NOTE

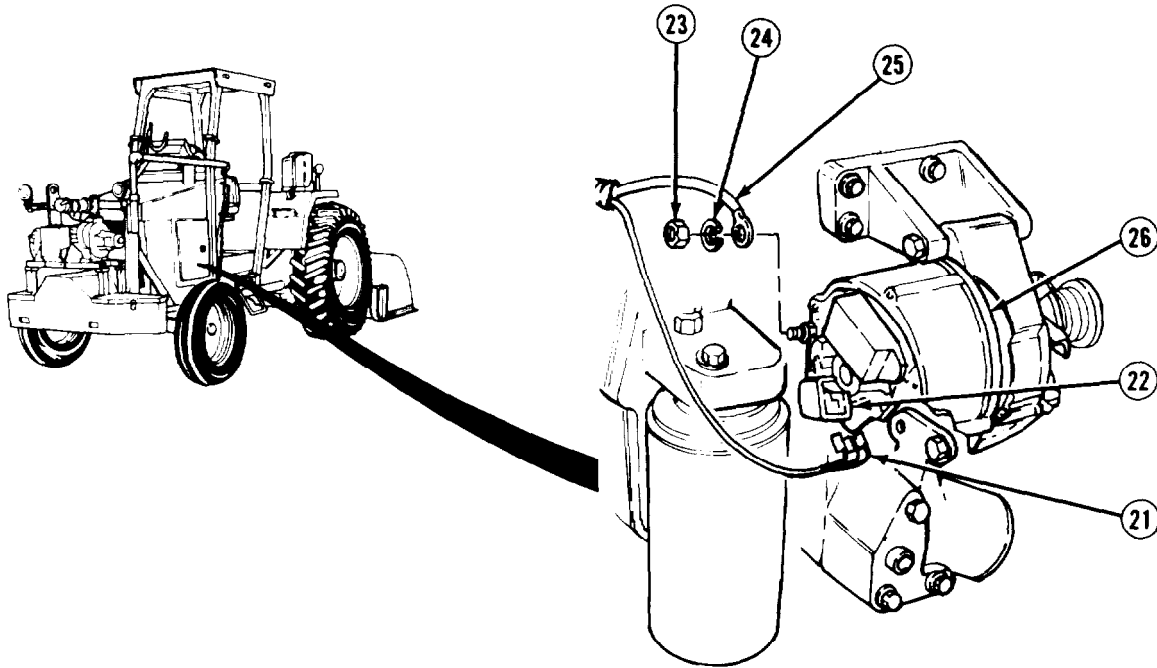
- Tag and mark wires before removal.
 - Cut plastic ties as necessary to remove wires.
- (2) Tag, mark, and disconnect connector (5) from horn (6).
 - (3) Remove wire (7) from engine (8).



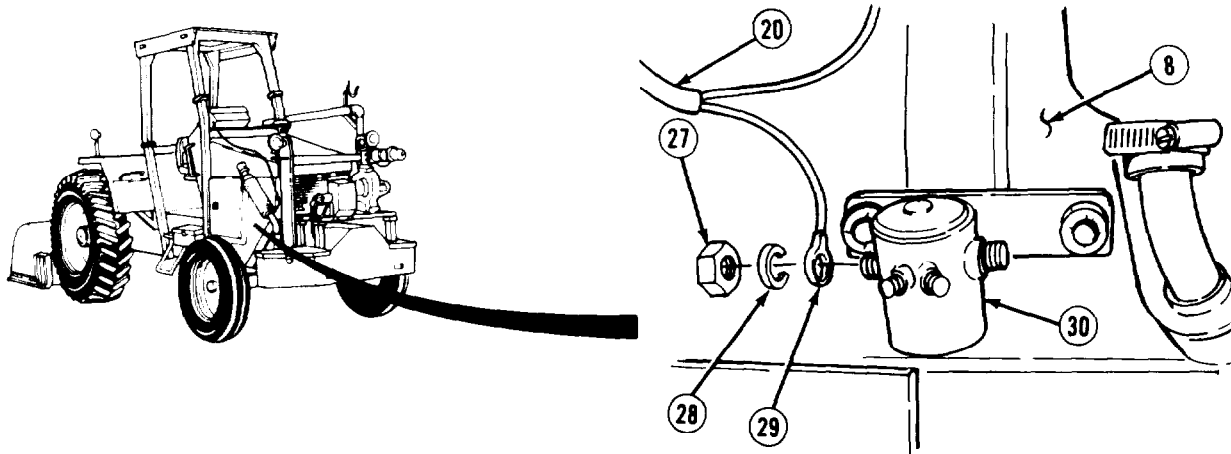
- (4) Remove nut (9), lockwasher (10), and washer (11). Discard lockwasher.
- (5) Tag, mark, and remove wire (12) from temperature sensor (13).
- (6) Tag, mark, and remove connector (14) from fuel injector solenoid (15).
- (7) Remove nut (16) and lockwasher (17). Discard lo&washer.
- (8) Remove wire (18) from oil sending unit (19).
- (9) Note position and separate harness (20) from engine (8).



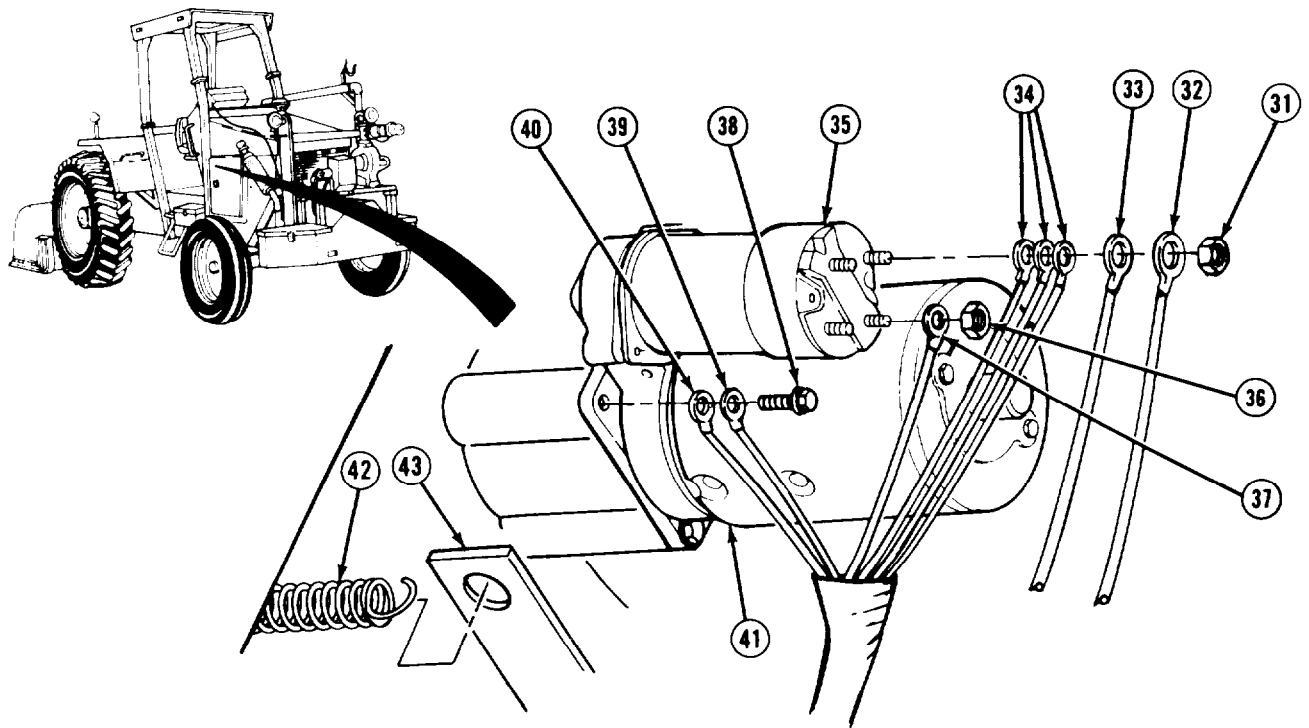
5-8. ENGINE REPLACEMENT (CONT).



- (10) Tag, mark, and disconnect three connectors (21) from alternator plug (22).
- (11) Remove nut (23) and lockwasher (24). Tag, mark, and remove wire (25) from alternator (26). Discard lockwasher (24).



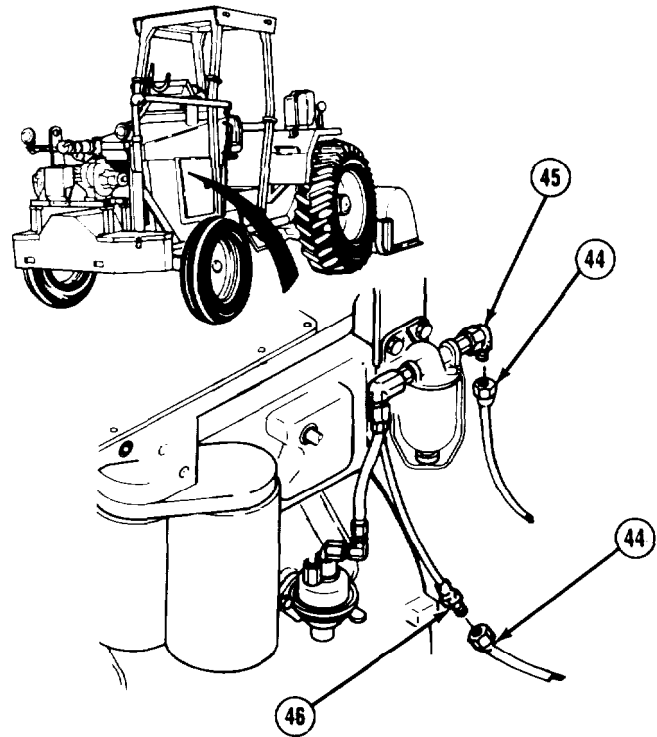
- (12) Remove four nuts (27) and lockwashers (28). Discard lockwashers.
- (13) Tag, mark, and remove four wires (29) from solenoid (30).
- (14) Note position and separate harness (20) from engine (8).



- (15) Remove nut (31). Tag, mark, and remove six wires (32, 33, and 34) from starter solenoid (35).
- (16) Remove nut (36) and wire (37).
- (17) Remove screw (38). Tag, mark, and remove two wires (39 and 40) from starter (41).
- (18) Remove spring (42) from bracket (43).

5-8. ENGINE REPLACEMENT (CONT).

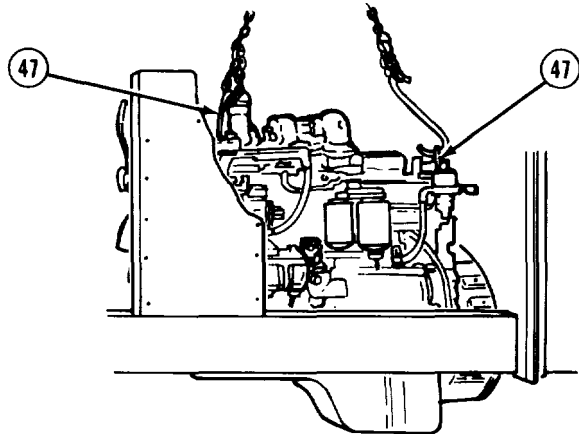
- (19) Tag, mark, and disconnect two fuel hoses (44) from elbow (45) and fuel return tube (46).

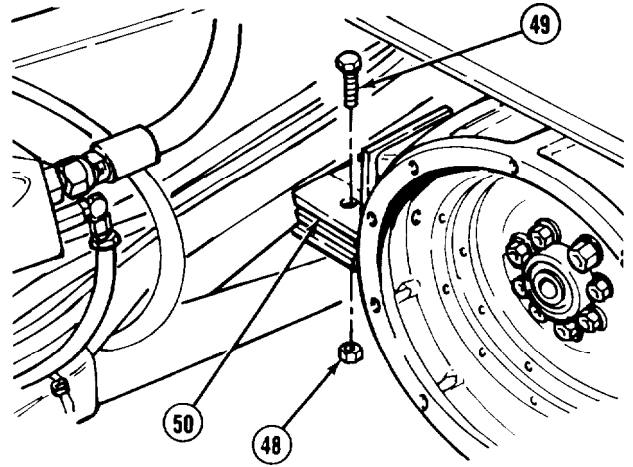
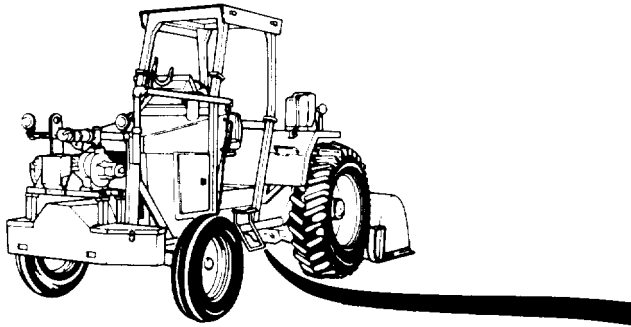


WARNING

Engine weighs 1025 lbs (465 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (20) Install a suitable lifting device to engine lifting brackets (47).





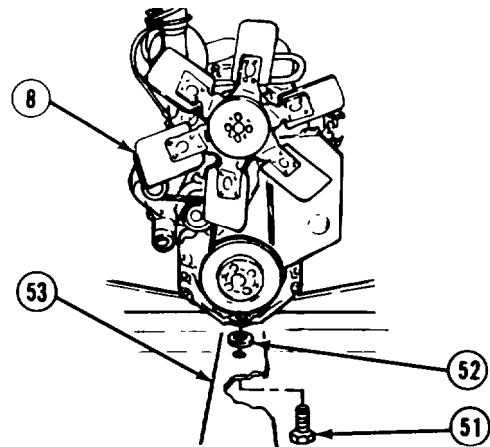
(21) Remove four locknuts (48) and screws (49) from two brackets (50). Discard locknuts.

(22) Remove screw (51) and front shock pad (52) from frame (53).

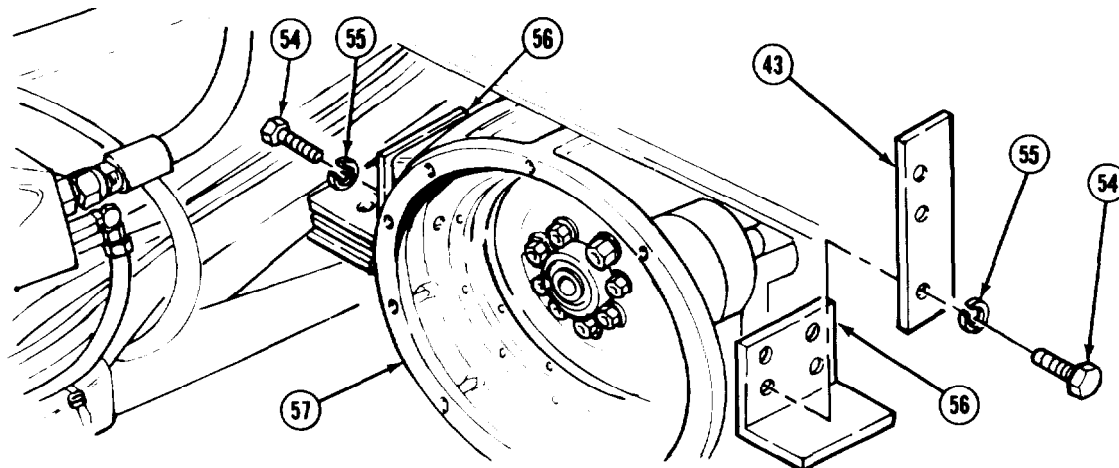
NOTE

Make sure front of engine is raised slightly so that engine clears vehicle. If engine will not clear vehicle, engine may need to be lowered onto mounts and lifting device adjusted.

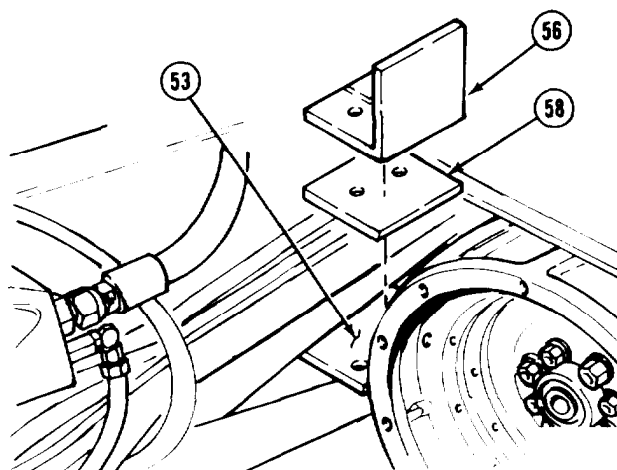
(23) Test lift engine (8).



5-8. ENGINE REPLACEMENT (CONT).



- (24) Remove eight screws (54), lockwashers (55), and bracket (43) from two mounting brackets (56) and flywheel housing (57). Discard lockwashers.
- (25) Remove two mounting brackets (56) and shock pads (58) from frame (53).



(26) Assistant operates lifting device while mechanic guides and removes engine (8) from frame (53).

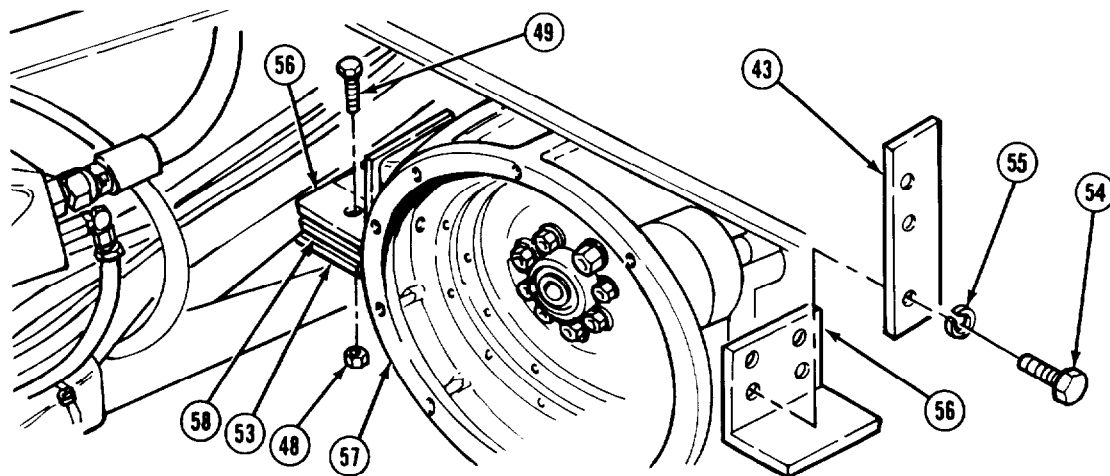
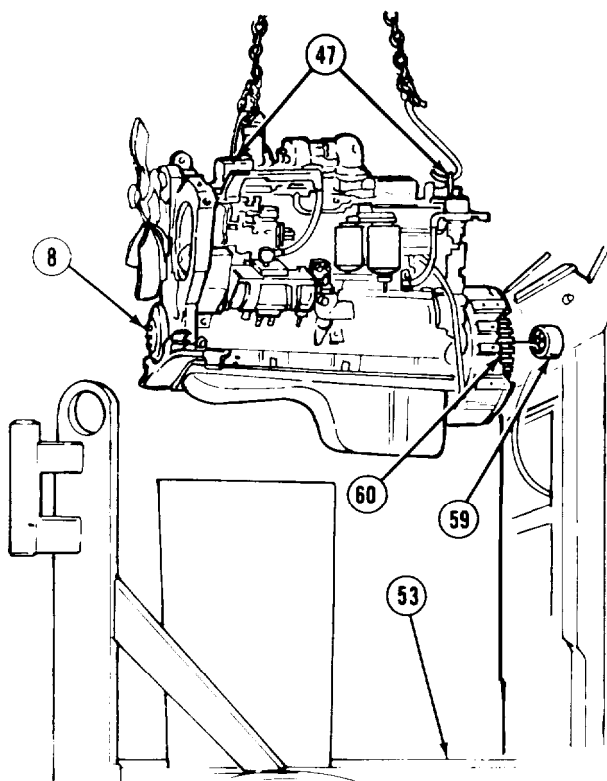
(27) Remove bearing (59) from flywheel (60).

b. Installation.

WARNING

Engine weighs 1025 lbs (465 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

- (1) Install bearing (59) in flywheel (60).
- (2) Attach suitable lifting device to engine lifting brackets (47).
- (3) Assistant operates lifting device while mechanic guides and positions engine (8) in frame (53) without completely lowering.



- (4) Install three brackets (43 and 56) on flywheel housing (57) with eight lockwashers (55) and screws (54). Tighten screws 150 lb-ft (203 N•m).
- (5) Position two shock pads (58) on frame (53) and install four screws (49) and locknuts (48) in brackets (50). Lower rear of engine and tighten locknuts 30 lb-ft (41 N•m).

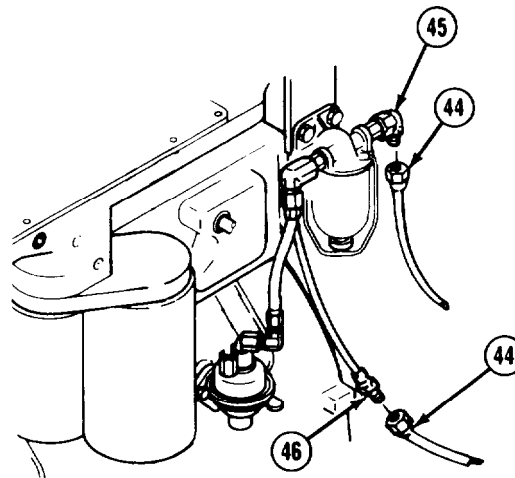
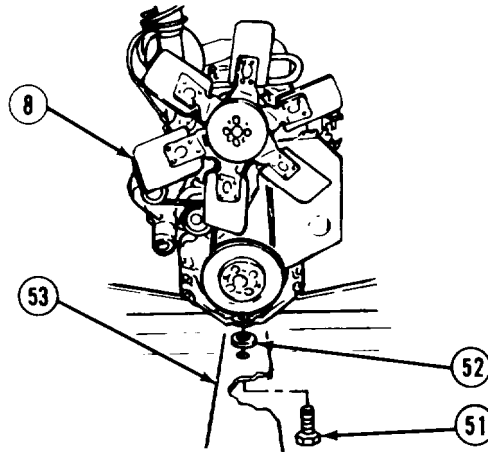
5-8. ENGINE REPLACEMENT (CONT).

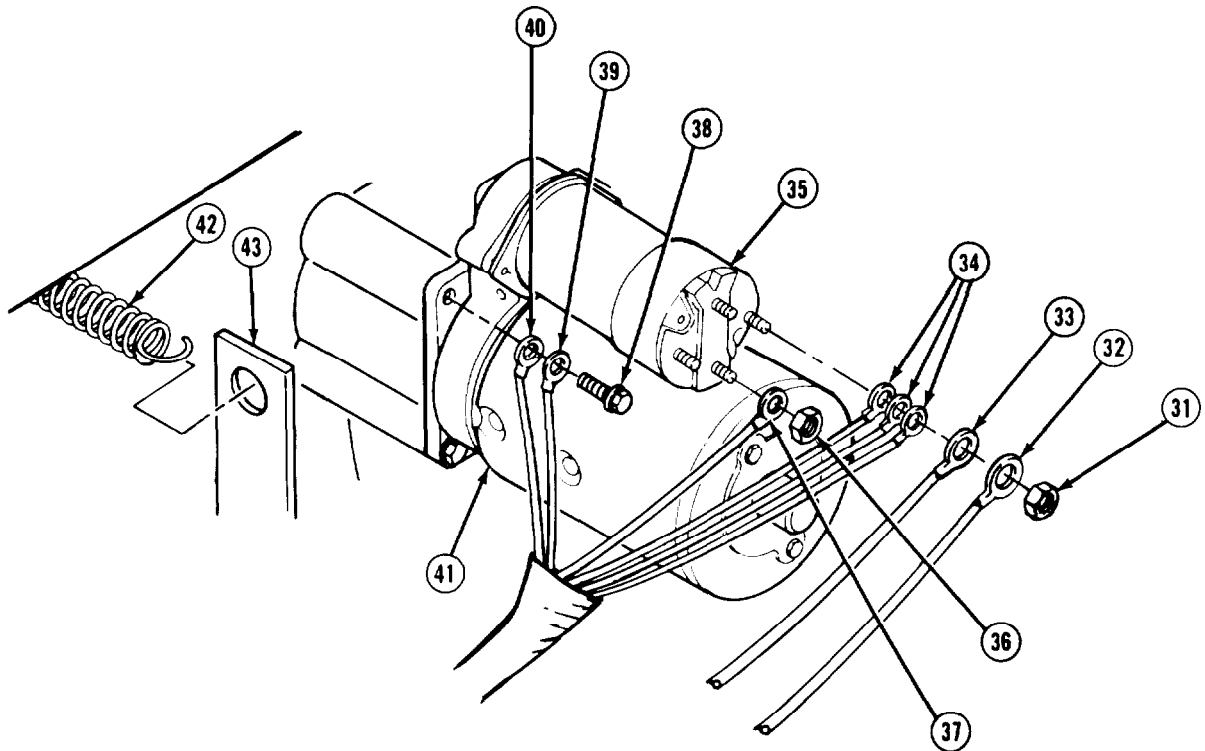
- (6) Position front shock pad (52) on frame (53).

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (7) Coat threads of screw (51) with pipe thread sealing compound and install. Lower front of engine and tighten screw 150 lb-ft (203 N-m).
- (8) Remove suitable lifting device.
- (9) Connect two fuel hoses (44) to sediment bowl (45) and fuel return tube (46).





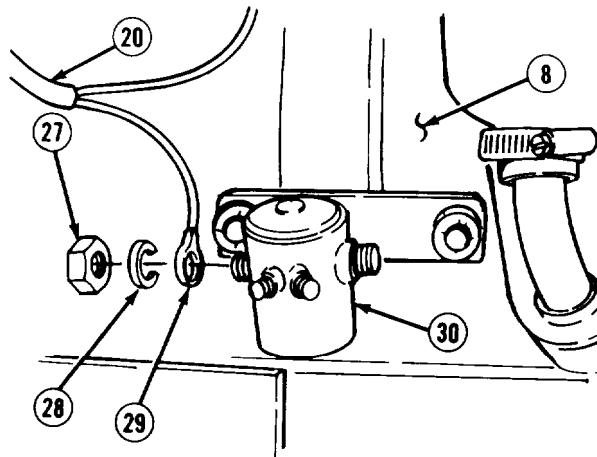
NOTE

Use plastic ties as necessary to secure wires.

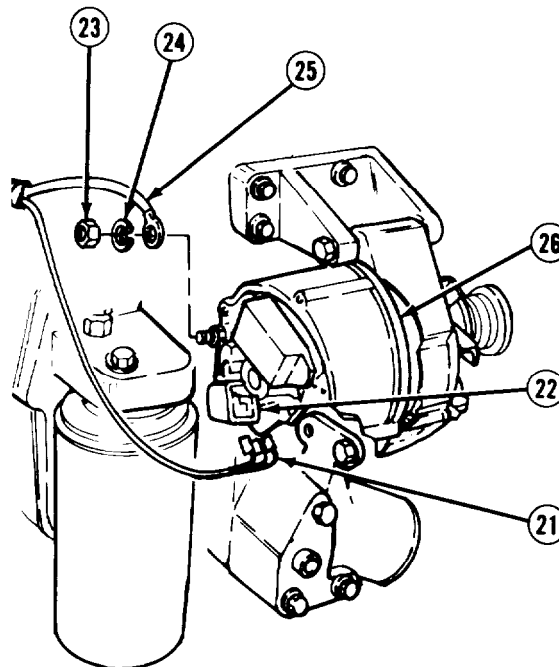
- (10) Install spring (42) on bracket (43).
- (11) Install two wires (39 and 40) on starter (41) with screw (38).
- (12) Install wire (37) with nut (36).
- (13) Install six wires (32, 33, and 34) on starter solenoid (35) with nut (31).

5-8. ENGINE REPLACEMENT (CONT).

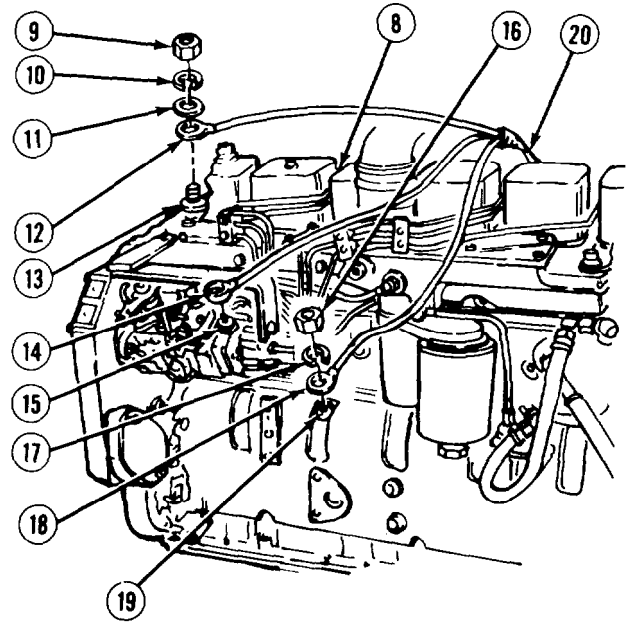
- (14) Position harness (20) on engine (8).
- (15) Install four wires (29) on solenoid (30) with four lockwashers (28) and nuts (27).
- (16) Install wire (25) on alternator (26) with lockwasher (24) and nut (23).



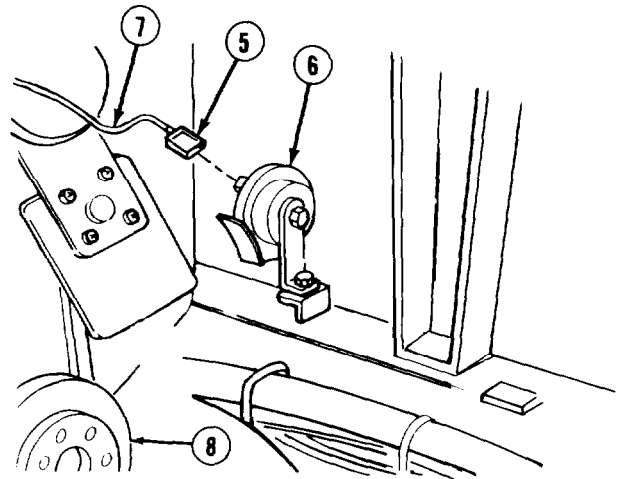
- (17) Connect three connectors (21) to alternator plug (22).



- (18) Position harness (20) on engine (8).
- (19) Install wire (18) on oil sending unit (19) with lockwasher (17) and nut (16).
- (20) Connect connector (14) to fuel injection solenoid (15).
- (21) Install wire (12) on temperature sensor (13) with washer (11), lockwasher (10) and nut (9).

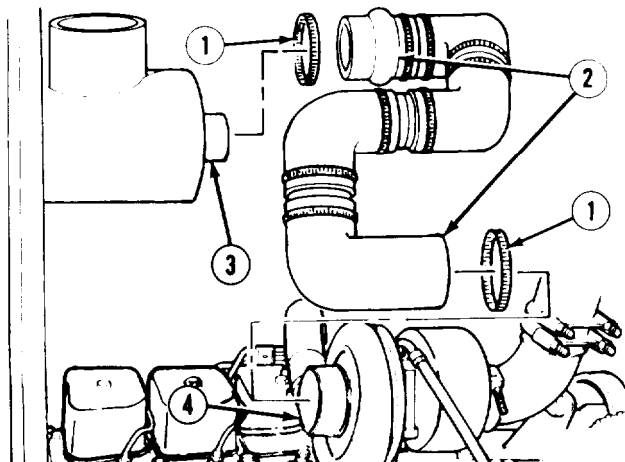


- (22) Position wire (7) on engine (8).
- (23) Connect connector (5) to horn (6).



5-8. ENGINE REPLACEMENT (CONT).

- (24) Install air cleaner hose assembly (2) on air cleaner (3) and turbocharger (4) with two clamps (1).



NOTE

Follow-on Maintenance:

- Install hydraulic pump drive hoses (para 4-143).
- Install radiator (para 4-60).
- Install emergency steering (para 4-119).
- Install clutch drive assembly (para 5-33).
- Install pump drive shaft assembly (para 4-100).
- Connect throttle linkage (para 4-56).
- Install muffler assembly (para 4-59).
- Install engine oil (para 4-24).
- Install engine battery (para 4-87).
- Install left/right engine doors (para 4-126).

END OF TASK

5-9. INSTALLATION/REMOVAL OF ENGINE ON STAND.

This task covers:

- a. Installation
- b. Removal

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair
 Lifting device (capacity 1250 lb [567 kg])
 Stand, engine

Equipment Condition

TM or Para
 Para 5-8
 Para 5-20

Condition Description
 Engine removed.
 Flywheel housing removed.

Personnel Required

MOS62B, Construction equipment repairer (2)

a. Installation.

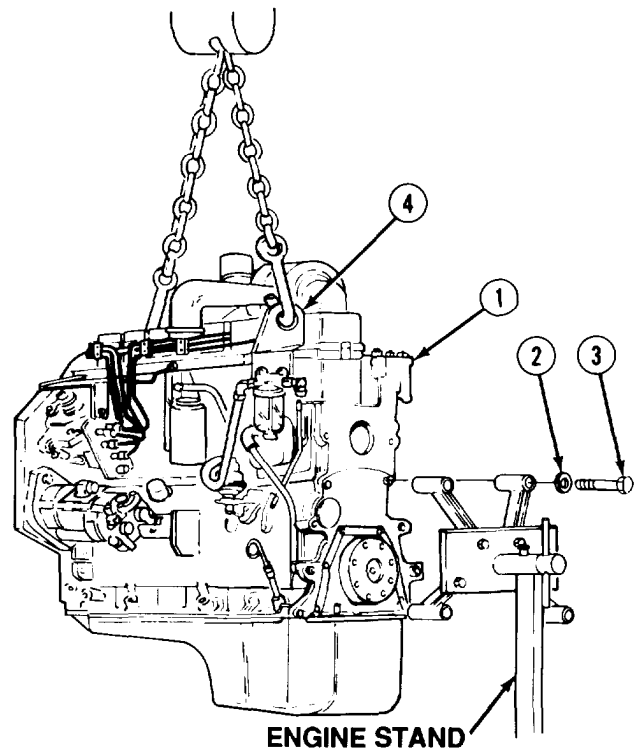
WARNING

Engine weighs 1025 lbs (465.4 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (1) Install engine (1) on stand with four washers (2) and screws (3).
- (2) Remove lifting device from two engine lifting brackets (4).

b. Removal.

- (1) Install suitable lifting device on two engine lifting brackets (4).
- (2) Remove four screws (3) and washers (2) from engine.



NOTE

Follow-on Maintenance:

- Install flywheel housing (para 5-20).
- Install engine (para 5-8).

END OF TASK

5-10. FRONT ENGINE MOUNT REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Lifting device (capacity 1000 lb [454 kg])
Wrench, torque

Equipment Condition

TM or Para

Para 5-9

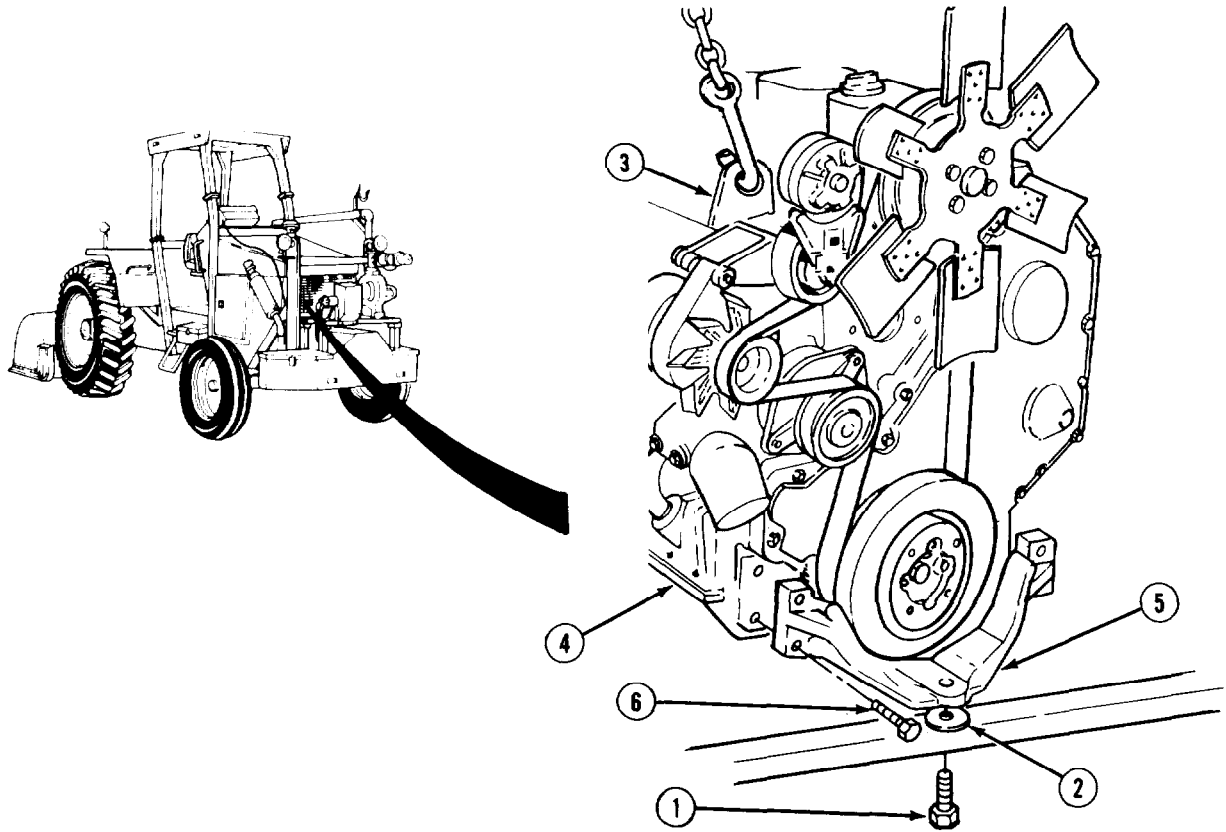
Condition Description

Engine installed on stand.

General Safety Instructions

If engine has previously been in operation, allow time for cooling before performing procedure.

a. Removal.

**NOTE**

- Perform step (1) only if engine is in vehicle.
 - If removing front engine mount with engine in vehicle, engine must be raised in front with suitable lifting device.
- (1) Remove screw (1) and shock pad (2).
 - (2) Attach suitable lifting device to front engine mount (3).
 - (3) Using suitable lifting device, raise engine (4) upward until there is a crack between engine and front engine mount (5).
 - (4) Remove four screws (6) and front engine mount (5) from front of engine block (4).

5-10. FRONT ENGINE MOUNT REPLACEMENT (CONT).

b. Installation.

NOTE

If installing front engine mount with engine in vehicle, engine must be raised in front with suitable lifting device.

- (1) Install front engine mount (5) on front of engine block (4) with four screws (6). Tighten screws 216 lb-in (24 N•m).
- (2) Using suitable lifting device lower engine (4) until engine mount (5) is in installation position.
- (3) If removed, install shock pad (2) and screw (1). Tighten screw 150 lb-ft (203 N•m).
- (4) Remove suitable lifting device from front engine mount (2).

NOTE

Follow-on Maintenance: Remove engine from stand and install in vehicle.

END OF TASK

5-11. CYLINDER BLOCK REPAIR.

This task covers:

- a. Inspection
- b. Disassembly
- c. Cleaning
- d. Assembly

INITIAL SETUP

Tools

Shop equipment, general purpose repair: semi-trailer mounted

Materials/Parts

- Chips, soap (item 10, appendix E)
- Detergent (item 19, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Oil, fuel (item 30, appendix E)
- Oil, lubricating (item 36, appendix E)
- Compound, retaining (item 18, appendix E)
- Compound, sealing, pipe thread (item 17, appendix E)

Equipment Condition

TM or Para

Para 5-8

Para 4-34

Para 5-12

Para 5-24

Para 5-14

Condition Description

Engine removed.

Oil cooler removed.

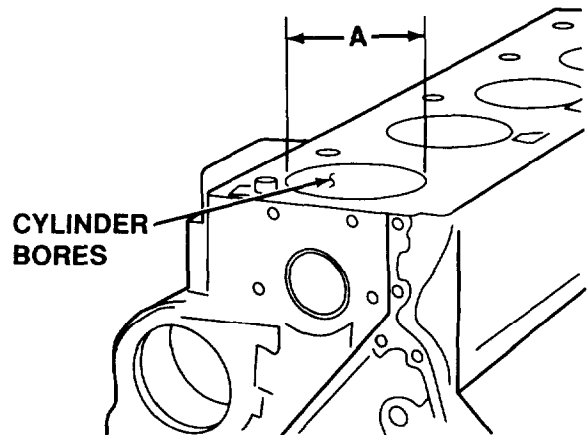
Cylinder head assembly removed.

Camshaft removed.

Crankshaft removed.

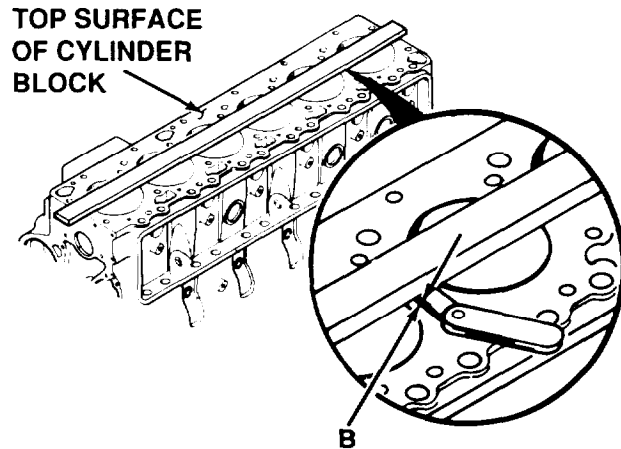
a. Inspection.

- (1) Check cylinder bores at position A approximately 1 in. (25.4 mm) deep and at 4.5 in. (114.3 mm) deep. Normal measurement is 4.0157 to 4.0203 in. (102.0 - 102.116 mm). If measurement is not within limits, use oversized pistons and rings to compensate.



5-11. CYLINDER BLOCK REPAIR (CONT).

- (2) Measure top surface of cylinder block for flatness at each position B. Variance measurement must be no greater than 0.002 in. (0.050 mm). If measurement is beyond limit, replace cylinder block.

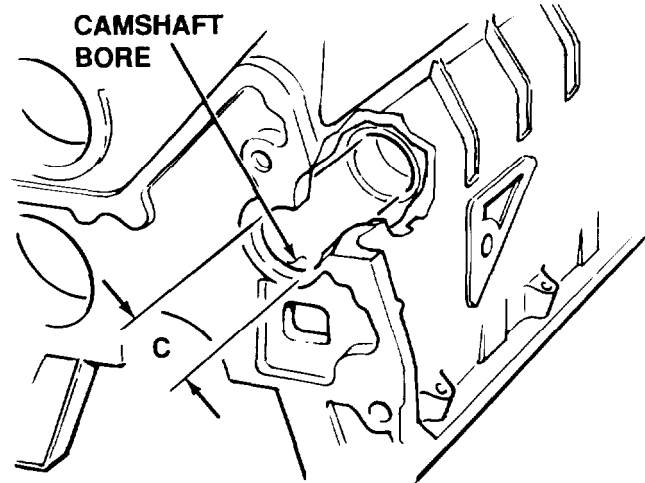


- (3) Check camshaft bores for scoring and excessive wear. If severe damage is found, replace cylinder block.

NOTE

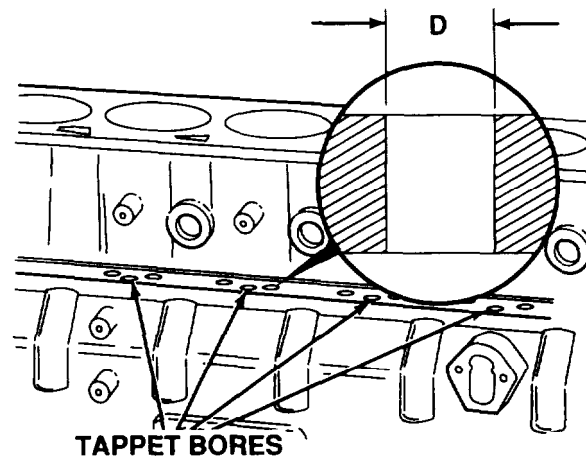
Limits below are for bores 2 and 5 only.

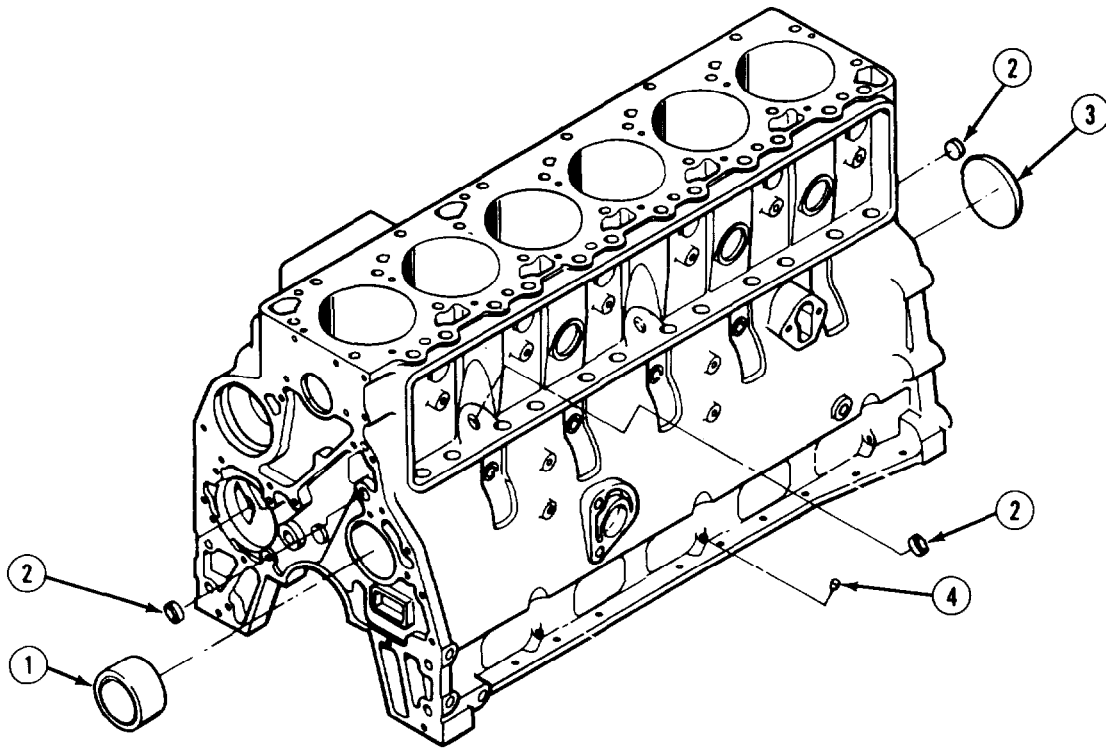
- (4) Check camshaft bores at position C. Normal measurement must be no greater than 2.1324 in. (54.164 mm). If measurement is beyond limit, replace cylinder block.



- (5) Check tappet bores for scoring or excessive wear. If damaged is excessive, replace cylinder block.

- (6) Measure tappet bores at position D. Normal measurement is 0.630 to 0.632 in. (16.0 - 16.055 mm). If measurement is less than limit, ream out tappet bores to size. If measurement is greater than limit, replace cylinder block.

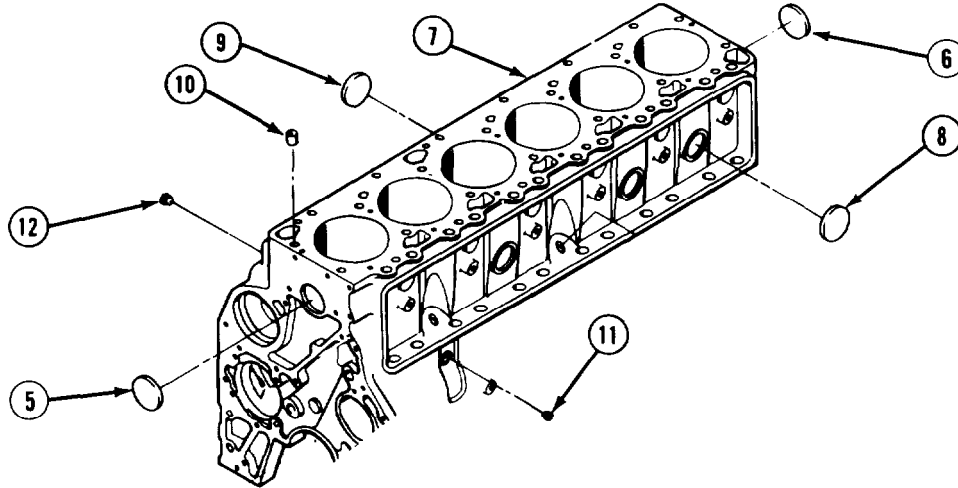




b. Disassembly.

- (1) If damaged, remove camshaft bushing (1) from camshaft bore.
- (2) If damaged, remove three cup plugs (2) from oil passages.
- (3) If damaged, remove expansion plug (3) from camshaft bore.
- (4) If damaged, remove expansion plug (4) from oil tiller base.

5-11. CYLINDER BLOCK REPAIR (CONT).



- (5) If damaged, remove cup plug (5) at front and cup plug (6) from back of cylinder block (7).
- (6) If damaged, remove four cup plugs (8) from tappet cover side and four cup plugs (9) from opposite side.
- (7) If damaged, remove two dowel rings (10) from top of cylinder block (7).
- (8) Remove two pipe plugs (11) on tappet cover side and pipe plug (12) near top on opposite side.

c. Cleaning.

- (1) Clean block in tank of hot water and soap at 190°F (88°C) for thirty minutes.
- (2) If new piston rings will not seat in cylinder bores, use multi-speed drill, 280 grit flexi-hone, and honing lube.
- (3) To make honing lube, mix one part diesel fuel and one part 30W engine oil.
- (4) Drill speed must be 300 to 400 RPM. Do one stroke per second.
- (5) Check bore after 10 strokes. Correct crosshatch angle is 15° to 25°. If crosshatch angle is 70°, drill speed is too slow or stroke is too fast. If crosshatch angle is 10°, drill speed is too fast or stroke is too slow.
- (6) If minor grooves are found, use 220 grit sizing hone to correct taper. Step (4) applies,
- (7) Check bore after 10 strokes. Maximum taper is 0.003 in. (0.076 mm).

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (8) Clean cylinders bores with detergent and hot water. Rinse with clean water and dry with compressed air.
- (9) Check cylinder bores for residue. If residue is found, repeat step (8).

WARNING

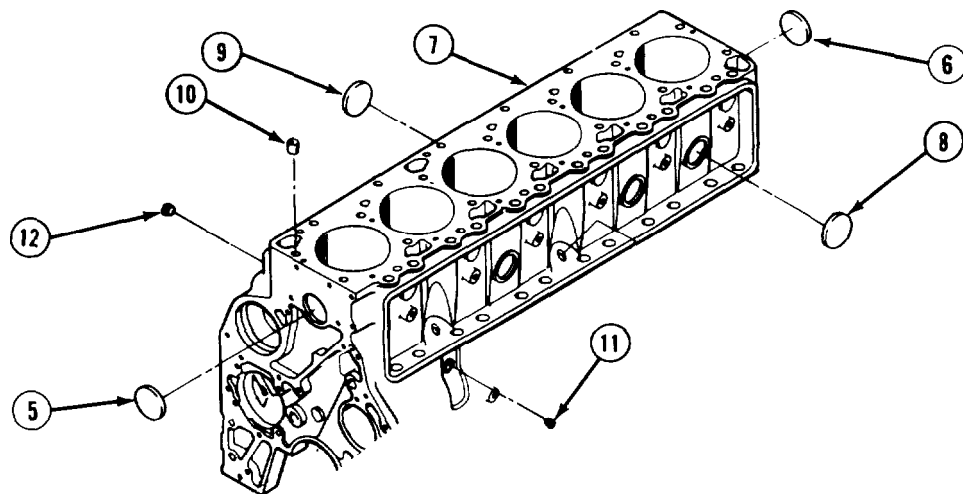
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100oF (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (10) Wash cylinder block in drycleaning solvent and clean out oil passages with long nylon brush.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (11) Rinse block in drycleaning solvent and dry with compressed air.

5-11. CYLINDER BLOCK REPAIR (CONT).

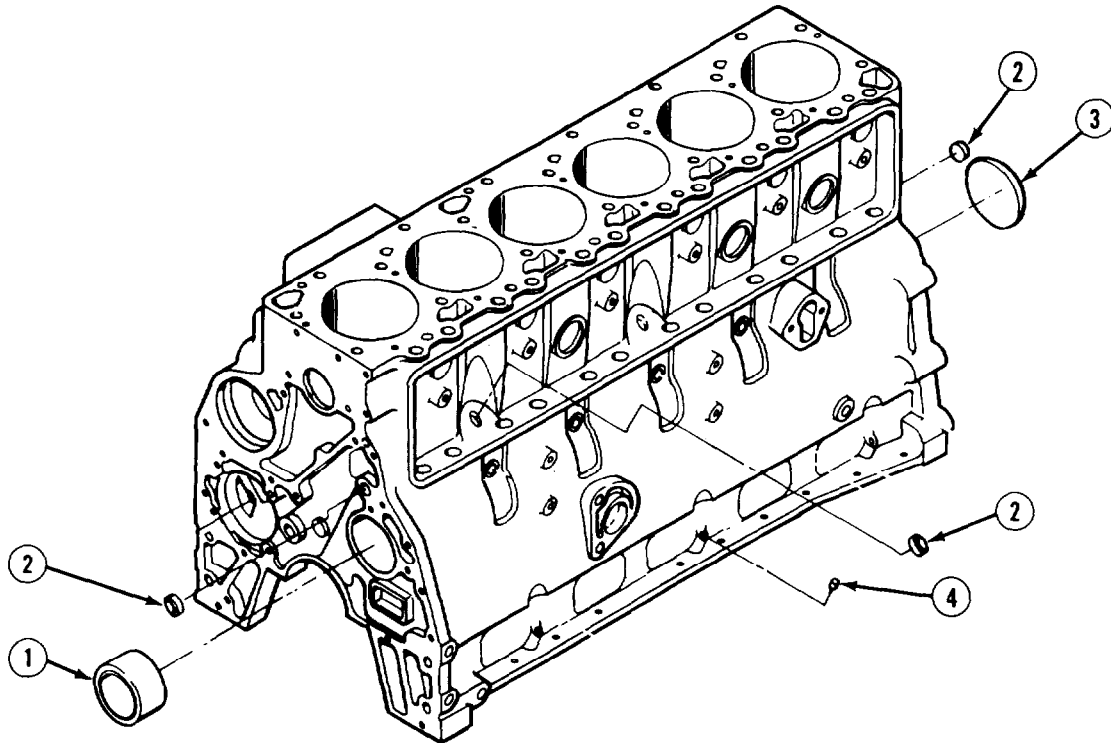


d. Assembly.

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads of three pipe plugs (11 and 12) with pipe thread sealing compound and install pipe plugs.
- (2) If removed, install two dowel rings (10) in top of cylinder block (7).
- (3) If removed, apply thin coat of retaining compound to lip of cup plugs (5,6,8, and 9).
- (4) If removed, install eight cup plugs (8 and 9). Ensure plugs are even with countersink in block.
- (5) If removed, install two cup plugs (5 and 6). Ensure plugs are even with countersink in block.



- (6) If removed, install expansion plug (4) in oil tiller base.

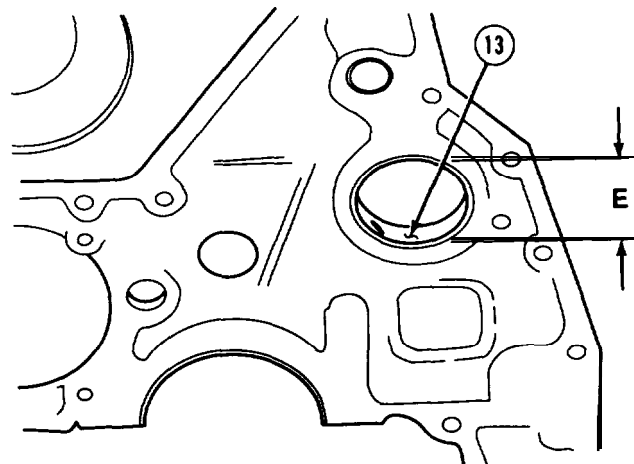
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (7) If removed, apply coat of and install expansion plug (3) in camshaft bore.
- (8) If removed, apply thin coat of retaining compound to outer diameter of three cup plugs (2).
- (9) If removed, install three cup plugs (2). Ensure cup plugs are even with countersink in block.
- (10) If removed, mark camshaft bushing (1) and bore to align oil hole.
- (11) Install camshaft bushing (1).
- (12) Ensure clearance of oil hole by passing through 0.128 in. (3.2 mm) rod. If rod will not pass through hole, remove camshaft bushing (1) and reinstall.

5-11. CYLINDER BLOCK REPAIR (CONT).

- (13) Measure camshaft bushing (13) at position E. Measurement must be no greater than 2.1317 in. (54.146 mm). If measurement is beyond limit, replace camshaft bushing.



NOTE

Follow-on Maintenance:

- Install crankshaft (para 5-14).
- Install camshaft (para 5-24).
- Install cylinder head assembly (para 5-12).
- Install oil cooler (para 4-34).
- Install engine assembly (para 5-8).

END OF TASK

5-12. CYLINDER HEAD ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Lifting device

Materials/Parts

Oil, engine lubricating, (item 37, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 5-23

Para 4-63

Condition Description

Rocker arm assemblies removed.

Thermostat removed.

Equipment Condition

TM or Para

Para 4-82

Para 4-56

Para 4-47

Para 4-51

Para 4-53

Para 4-67

Para 4-37

Para 4-46

Para 5-42

Condition Description

Water temperature sensor removed.

Throttle control cable and bracket removed.

Fuel lines and fittings removed.

Fuel filter head removed.

Fuel sediment bowl removed.

Fan assembly removed.

Exhaust manifold removed.

Manifold cover removed.

Fuel injectors removed.

General Safety Instructions

Engine block retains extreme heat during operation. Allow time for cooling before performing procedure.

5-12. CYLINDER HEAD ASSEMBLY REPLACEMENT (CONT).

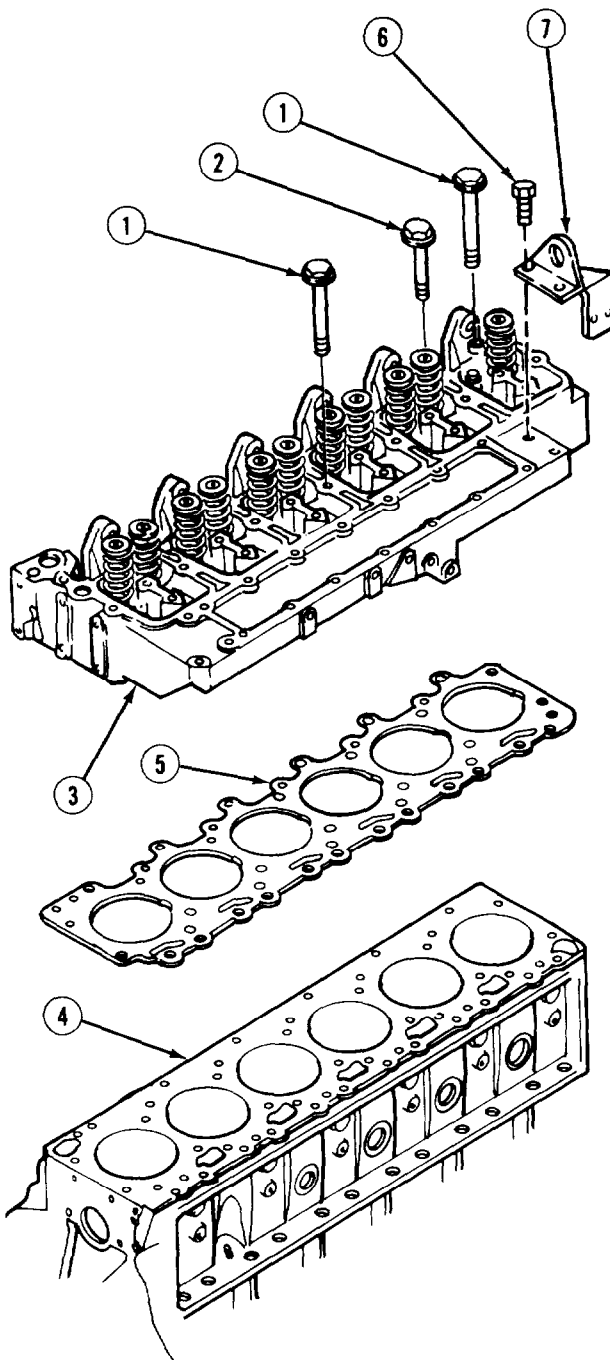
a. Removal.

- (1) Remove rocker arm assemblies (para 5-23).
- (2) Remove 20 screws (1 and 2).

WARNING

Cylinder head weighs 115 lbs (51.3 kg). Attach suitable lifting device prior to removal or installation to prevent possible injury to personnel.

- (3) Using suitable lifting device, remove cylinder head (3) from cylinder block (4) and place on firm stand.
- (4) Remove and discard cylinder head gasket (5).
- (5) Remove two screws (6) and lifting bracket (7).
- (6) Remove thermostat (para 4-63).



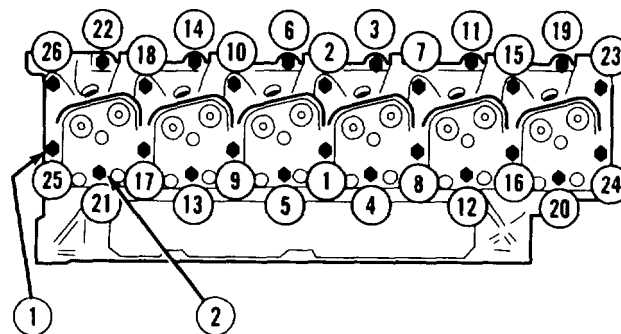
b. Installation.

CAUTION

Be sure to correctly align gasket with holes in engine block. Failure to do so could result in damage to engine.

- (1) Install thermostat (para 4-63).
- (2) Install lifting bracket (7) with two screws (6). Tighten screws 57 lb-ft (77 N•m).
- (3) Position gasket (5) on engine block (4).
- (4) Assistant operates suitable lifting device while mechanic guides and positions cylinder head (3) on engine block (4).
- (5) Install rocker arm assemblies (para 5-23).
- (6) Install 20 screws (2) and (1).

- (6) Install 20 screws (2 and 1).
- (7) Tighten screws (1 and 2) according to illustrated pattern and in following steps:
- Step 1: 29 lb-ft (40 N•m).
 - Step 2: 62 lb-ft (85 N•m).
 - Step 3: 92 lb-ft (126 N•m).



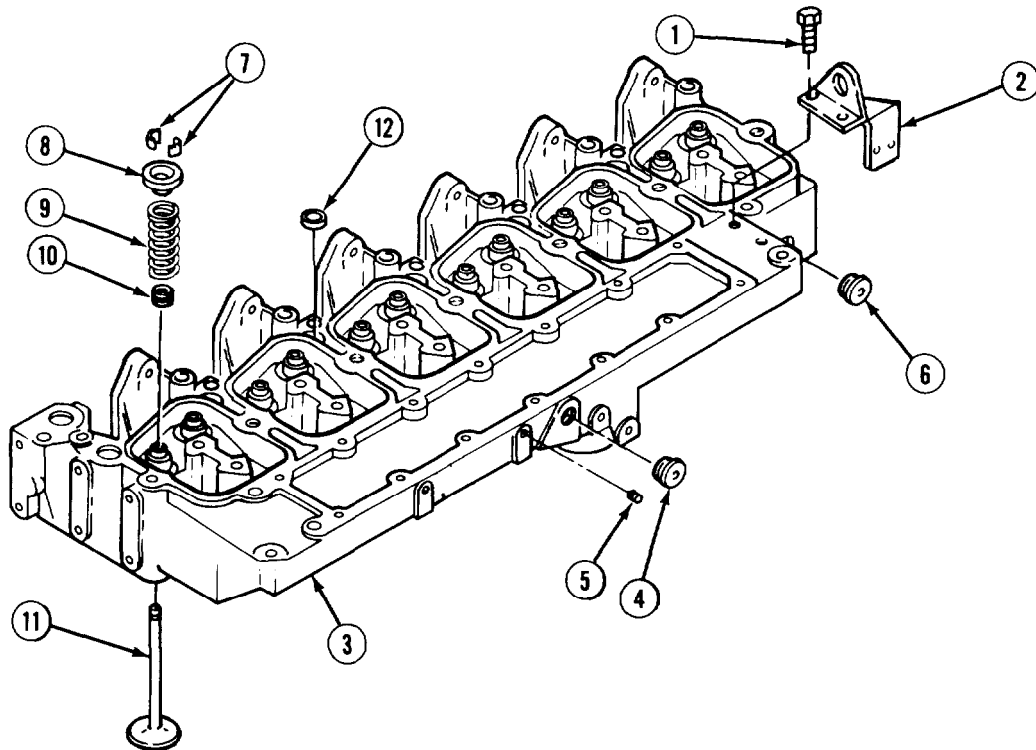
NOTE

Follow-on maintenance:

- Install fuel injectors (para 5-42).
- Install manifold cover (para 4-46).
- Install exhaust manifold (para 4-37).
- Install fan assembly (para 4-67).
- Install fuel sediment bowl (para 4-53).
- Install fuel filter head (para 4-51).
- Install fuel lines and fittings (para 4-47).
- Install throttle control cable and bracket (para 4-56).
- Install water temperature sensor (para 4-82).

END OF TASK

a. *Disassembly.*



NOTE

- All 12 valves are disassembled the same way.
 - If lifting bracket is not damaged or cylinder head is not being replaced, do not remove lifting bracket.
- (1) Remove two screws (1) and lifting bracket (2) from cylinder head (3).
 - (2) Remove seven pipe plugs (4,5, and 6).
 - (3) Disassemble each valve as follows:
 - (a) Disassemble and remove two valve collets (7), spring retainer (8), spring (9), and stem seal (10). Discard valve collets and stem seal.
 - (b) Tag and mark valve (11) to identify position. Also label a rack or piece of cardboard.
 - (c) Remove valve (11) and place in rack or cardboard according to mark.
 - (4) If damaged, remove five expansion plugs (12).

5-13. CYLINDER HEAD ASSEMBLY REPAIR (CONT).

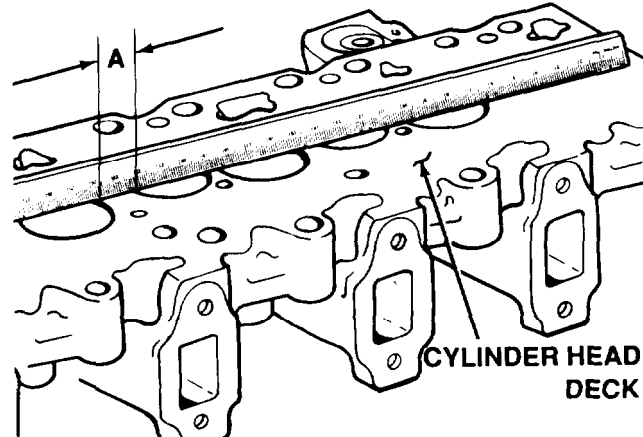
b. Cleaning/Inspection.

- (1) Clean injector nozzle seats with nylon tube brush.

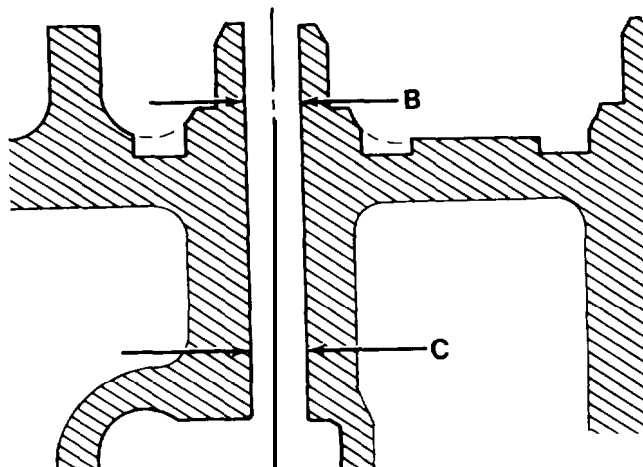
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Wash cylinder head in hot water and soap for 30 minutes. Rinse and use compressed air to dry.
- (3) Check cylinder head for nicks, erosion, cracks, and other damage.
- (4) Polish gasket surface of cylinder head using 400 grit waterproof silicon carbide abrasive paper.



- (5) Check cylinder head deck for distortion as indicated. Distortion can be no greater than 0.0039 in. (0.10 mm) within a 2 in. (50.8 mm) radius (distance A) or no greater than 0.003 in. (0.075 mm) end to end.
- (6) Check valve guides in cylinder head for scuffing or scoring. Ream valve guides to remove any surface damage.
- (7) Measure valve guide bores at positions B and C. Normal measurement is 0.3157 to 0.3185 in. (8.019 - 8.089 mm). If less than normal, rebore valve guide. If greater than normal, replace cylinder head.



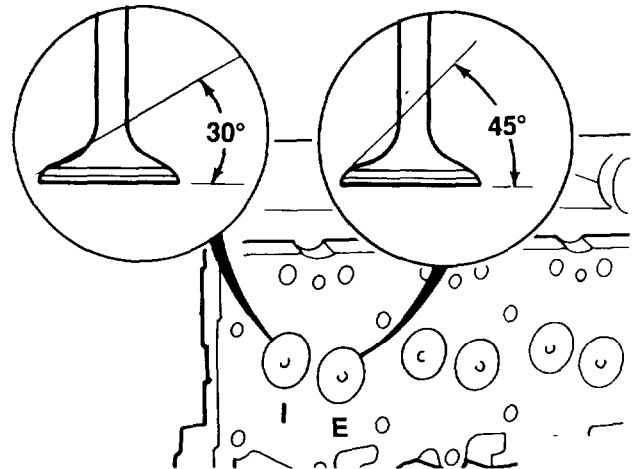
- (8) Clean valve heads with a soft wire wheel.
- (9) Clean and polish valve stem with crocus cloth. Remark valves according to head location.

NOTE

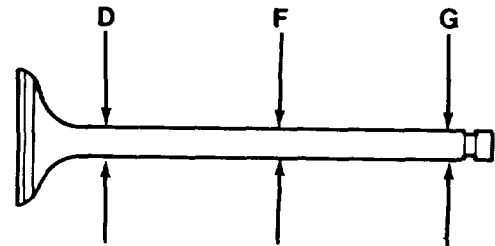
When replacing old valves, remember to mark new valves the same for correct assembly.

- (10) Check for abnormal wear on valve heads and stems. Replace valves that are bent or cannot be ground.

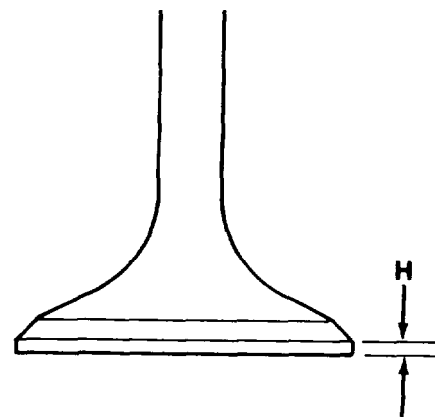
- (11) Measure seat angle of intake valve (position D). Normal measurement is 30°. Measure seat angle of exhaust valve (position E). Normal measurement is 45°.
- (12) If measurements are greater than normal, grind valve seat to correct angle. If measurements are less than normal, replace with service valve seat.



- (13) Measure valve stem at positions D, F, and G. Normal measurement is between 0.3126 to 0.3142 in. (7.94 - 7.98 mm). If above or below normal measurement, replace valve.

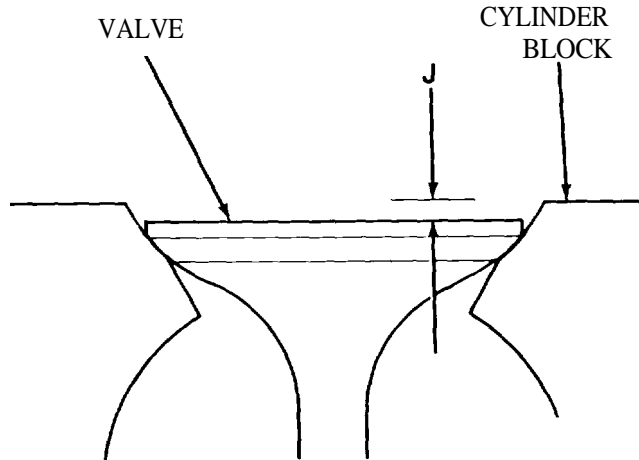


- (14) Measure valve rim at position H. If measurement is less than 0.031 in. (0.79 mm), replace valve.

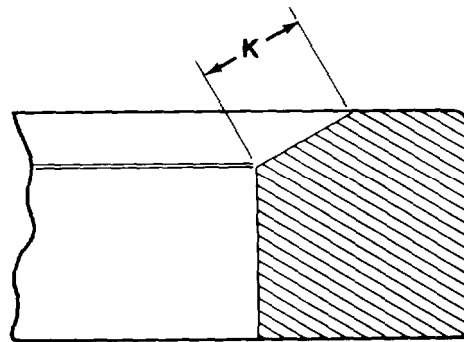


5-13. CYLINDER HEAD ASSEMBLY REPAIR (CONT).

- (15) Check valve stem tip for flatness. Resurface tip if required.
- (16) Install each valve in cylinder block matching marks made in disassembly.
- (17) Measure and record valve depth at position J. Normal measurement is between 0.039 to 0.060 in. (0.99 - 1.52 mm). If measurement is below normal, grind valve seat. If measurement is above normal, replace valve.
- (18) Check valve seats in cylinder head for burns, scratches and other damage. If surface is damaged, grind valve seats.

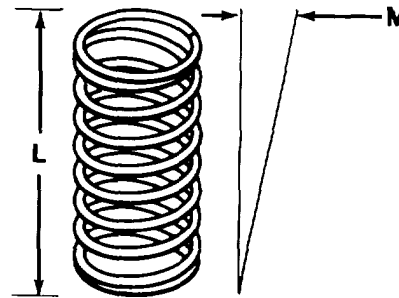


- (19) If valves were ground, repeat steps (12) and (13) to ensure consistent measurement of valve seats.
- (20) If valves were ground, measure valve depth again at position J. Calculate grinding depth by subtracting present measurement by the first measurement. Grinding depth should be no greater than 0.010 in. (0.254 mm). If greater, replace with service valve seat.
- (21) Mark cylinder head to identify ground valve seats.
- (22) Install each valve in cylinder block in accordance with matching marks made in disassembly.
- (23) Repeat step (18) to ensure proper valve depth.
- (24) Apply lapping compound to each valve and valve seat. Wipe lapping compound from valve and valve seat with lint-free cloth.
- (25) Measure valve seat width at position K. Normal measurement is between 0.060 to 0.080 in. (1.5 - 2 mm). If measurement is below normal, grind valve seat as required. If measurement is above normal, replace valve seat with service valve seat.

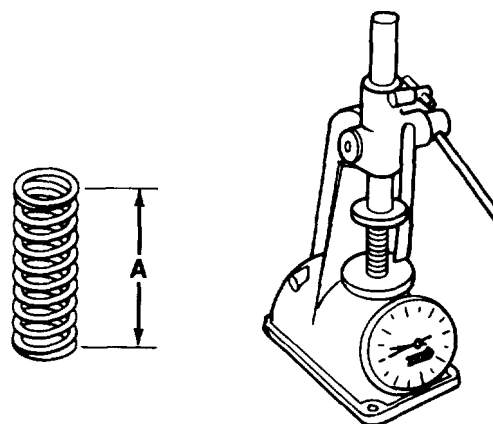


(26) Measure valve spring at position L. Normal free length is 2.190 in. (55.63 mm). If measurement is above or below normal length, replace spring.

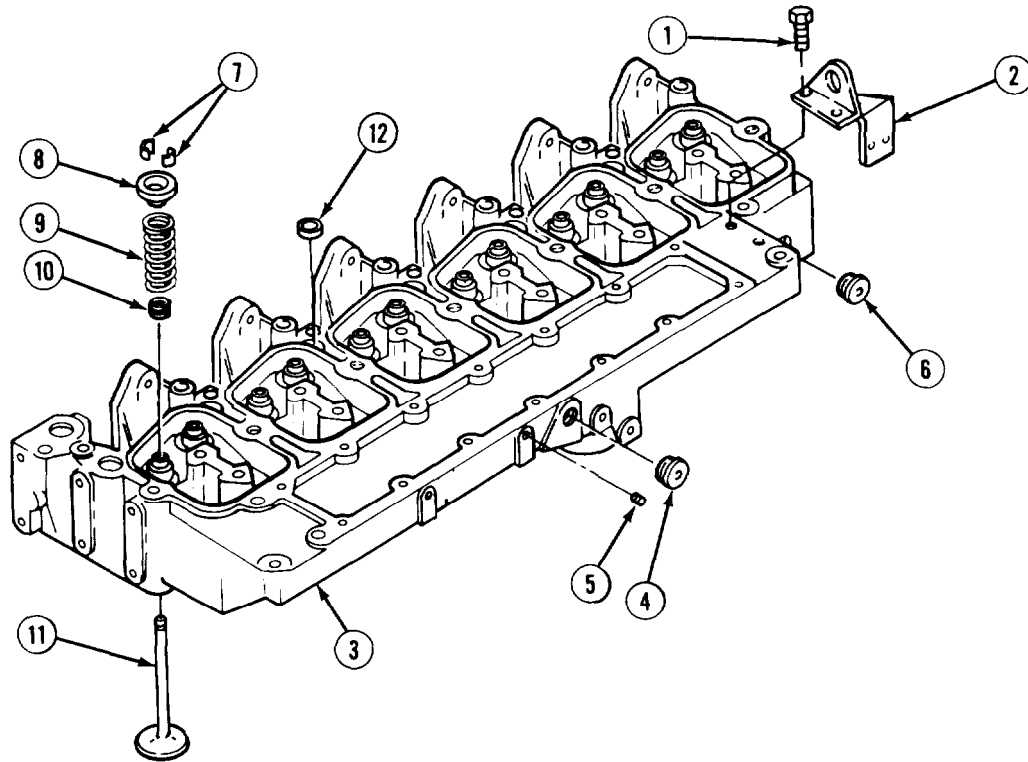
(27) Measure valve spring at position M. If inclination is greater than 0.039 in. (1 mm), replace valve spring.



(28) Measure valve spring tension at position N. A load of 65 to 72.2 lbs (29.483 to 32.749 kg) will compress spring to normal height of 1.94 in. (49.25 mm). If above or below normal height, replace spring.



5-13. CYLINDER HEAD ASSEMBLY REPAIR (CONT).



C. Assembly.

NOTE

All 12 valves are assembled the same way.

- (1) If removed, install five expansion plugs (12).

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Coat threads of seven pipe plugs (4,5, and 6) with thread sealing compound; install in cylinder head (3).
- (3) Assemble each valve as follows:
 - (a) Install valve (11) matching marks made during disassembly.
 - (b) Install stem seal (10), spring (9), spring retainer (8), and two valve collets (7).
 - (c) Tap spring (9) with plastic hammer to ensure collets (7) are sealed.
- (4) Install lifting bracket (2) with two screws (1).

NOTE

Follow-on maintenance: Install cylinder head assembly (para 5-12).

END OF TASK

5-14. CRANKSHAFT REPLACEMENT/REPAIR.

This task covers:

a. Removal

b. Cleaning/Inspection

c. Installation

INITIAL SETUP*Tools*

Shop equipment, contact maintenance: truck mounted

Materials/Parts

Solvent, drycleaning (item 54, appendix E)
 Oil, lubricating engine (item 35, appendix E)
 Brush, nylon tube (item 7, appendix E)
 Wear sleeves, top
 Wear sleeve, bottom
 Grease, general purpose (item 25, appendix E)
 Gloves, protective thermal
 Tags, identification (item 55, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

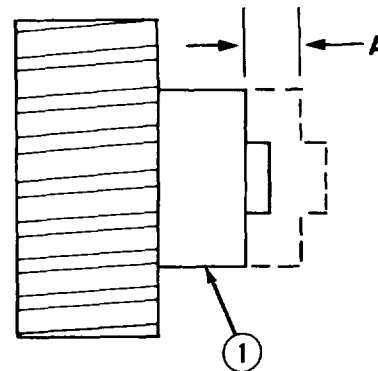
<i>TM or Para</i>	<i>Condition Description</i>
Para 5-9	Engine installed on stand
Para 5-28	Gear housing removed.
Para 5-29	Oil pan and suction tube removed.

General Safety Instructions

If engine has recently been in operation, allow engine time to cool before performing procedure.

8. Removal.

- (1) Measure and record end play at gear end of crankshaft (1) at position A. Normal measurement is 0.005 to 0.010 in. (0.13 - 0.25 mm). If measurement is above or below normal, correct with proper thrust bearing in installation.



5-14. CRANKSHAFT REPLACEMENT/REPAIR (CONT).

NOTE

Tag and mark all screws, bearing caps, rod caps, and bearing halves before removal.

- (2) Turn engine upside down and tag, mark, and remove 14 screws (2) and seven bearing caps (3).

NOTE

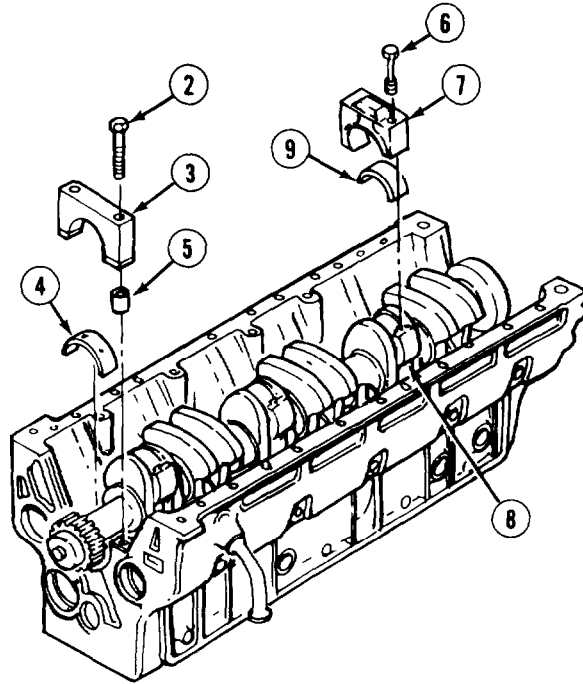
Bearing halves may stay with bearing caps or on crankshaft.

- (3) Tag, mark, and remove seven top bearing halves (4) from top bearing caps (3).
- (4) If damaged, remove 14 ring dowels (5) from seven bearing caps (3).
- (5) Tag, mark, and remove 12 screws (6) and six rod caps (7) from connecting rods (8).

NOTE

Rod bearing halves may stay with rod caps or on crankshaft.

- (6) Tag, mark, and remove six top rod bearing halves (9) from rod caps (7).



WARNING

Crankshaft weighs 123 lbs (55.3 kg).
Attach suitable lifting device prior to
removal or installation to prevent possible
injury to personnel.

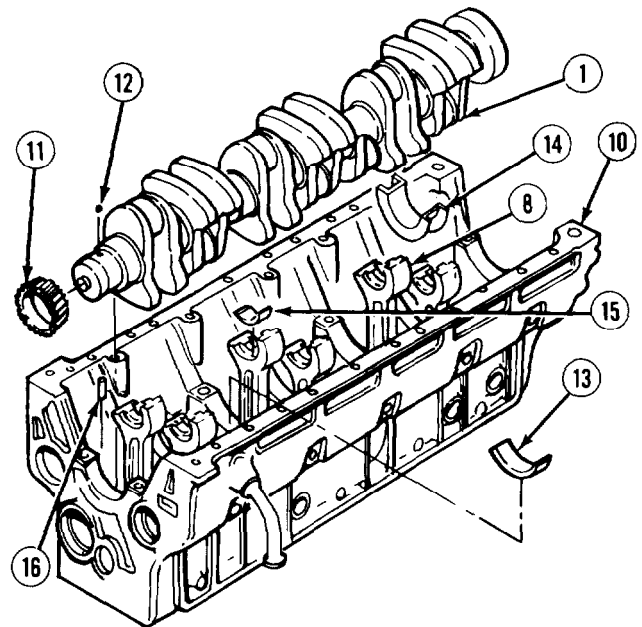
- (7) Attach suitable lifting device to crankshaft (1).
- (8) While mechanic operates suitable lifting device, assistant removes crankshaft (1) from cylinder block (10).
- (9) Remove gear (11) and key (12).

CAUTION

If top and bottom bearing halves are
exchanged, damage could result to
crankshaft journals.

NOTE

- Tag and mark all bearing halves before removal.
 - Bottom bearing shells may come out with rod caps or stay with crankshaft.
- (10) Tag, mark, and remove six bottom bearing halves (13) and thrust bearing half (14) from cylinder block (10).
 - (11) Tag, mark, and remove six bottom rod bearing halves (15) from connecting rods (8).
 - (12) If damaged, remove seven piston cooling nozzles (16) from cylinder block (10).



5-14. CRANKSHAFT REPLACEMENT/REPAIR (CONT).

b. Cleaning/Inspection.

- (1) Clean crankshaft oil drillings with nylon brush.

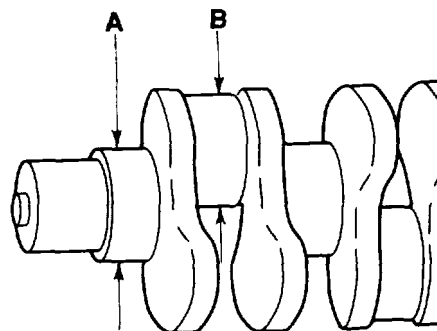
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Rinse crankshaft in drycleaning solvent and dry with compressed air.
- (3) Check crankshaft seals for grooving and scratches. If damage is found, replace wear sleeves.
- (4) Check rod and main journals for deep scoring and other damage.
- (5) Check crankshaft for visible warping and wear.
- (6) Check bearing caps for dents, cracks, and other visible damage.
- (7) Check crankshaft surface for burrs. Smooth surface as necessary.

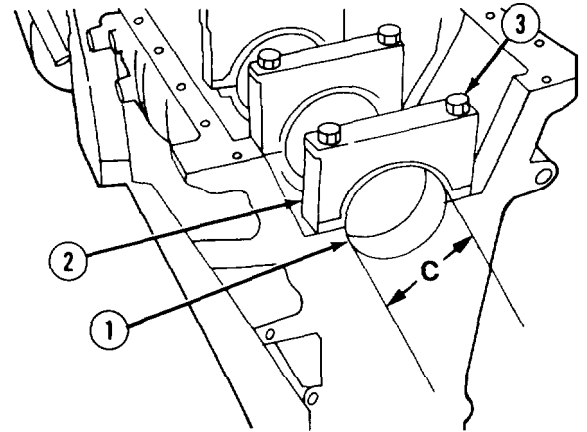
- (8) Measure and record main journal diameters at position A. Normal measurement is 3.2662 to 3.2682 in. (82.962 - 83.013 mm). If above or below normal measurement, replace crankshaft.

- (9) Measure rod journal diameters at position B. Normal measurement is 2.7150 to 2.7170 in, (68.962 - 69.013 mm). If above or below normal measurement, replace crankshaft.



(10) Determine main bearing clearance as follows:

- (a) Install 14 bearings (1) in seven bearing caps (2) and in cylinder block.
- (b) Install seven bearing caps (2) and 14 screws (3). Tighten screws 130 lb-ft (176 N-m).
- (c) Measure and record main bore diameters at position C. Maximum diameter is 3.2720 in. (83.109 mm). If measurement exceeds limit, replace bearings. If measurement is still above limit, replace top bearing caps.
- (d) Subtract position A (recorded in step [8]) from position C (C - A). Maximum clearance is 0.00475 in. (0.119 mm). If measurement exceeds limit, replace crankshaft.
- (e) Remove 14 screws (3), seven bearing caps (2), and 14 bearings (1).



C. Installation.

- (1) If removed, install seven piston cooling nozzles (16) in cylinder block (10).

CAUTION

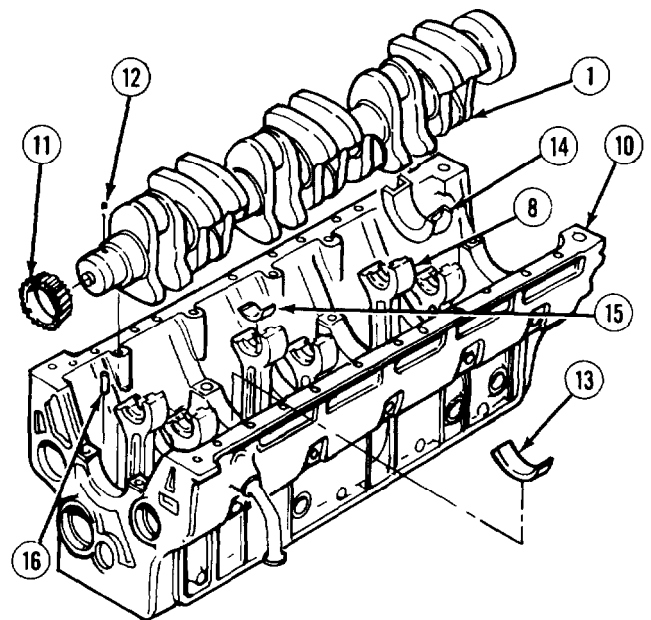
Do not apply grease on outer diameter of bearing halves or damage may result to bearing halves, related bearing caps, and crankshaft.

- (2) Lubricate six bottom rod bearing halves (15), thrust bearing half (14), and six bottom bearing halves (13) on convex side only with general purpose grease.

CAUTION

If top and bottom bearing halves are exchanged, damage could result to crankshaft journals.

- (3) Install six bottom rod bearing halves (15) on connecting rods (8).
- (4) Install thrust bearing half (14) and six bottom bearing halves (13) on cylinder block (10).
- (5) Install key (12) in crankshaft (1).



5-14. CRANKSHAFT REPLACEMENT/REPAIR (CONT).

CAUTION

Do not overheat gear. Permanent warpage will result to gear.

- (6) Heat gear (11) in oven for 45 minutes at 250°F(121°C).

WARNING

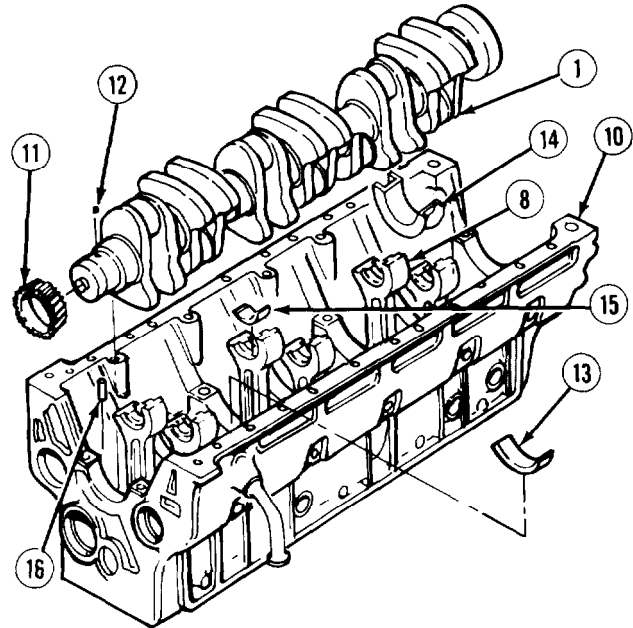
Wear thermal protective gloves when installing gear. Gear is hot and can cause severe burns to personnel.

- (7) Install gear (11) with timing mark facing out.

CAUTION

Use caution when installing crankshaft on connecting rods. Scratched or nicked rod journals may result in damage to engine assembly.

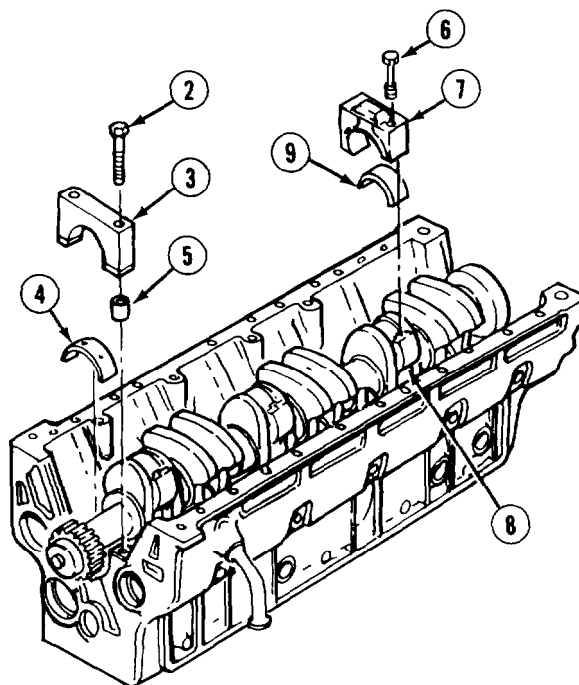
- (8) While assistant operates suitable lifting device, mechanic guides and installs crankshaft (1) in engine block (10).
- (9) Remove suitable lifting device from crankshaft (1).



CAUTION

Do not apply grease on outer diameter of bearing halves or damage may result to bearing halves, related bearing caps, and crankshaft.

- (10) Lubricate six top rod bearing halves (9) and seven top bearing halves (4) on convex side only with general purpose grease.
- (11) Install six top rod bearing halves (9) in six rod caps (7).
- (12) Lubricate threads of 12 screws (6) and underside of six rod caps (7) with engine oil.

**CAUTION**

Rod bearing caps and connecting rods have numbers located on one side. Numbers must be aligned and match. Failure to do so will result in damage to crankshaft and connecting rod assemblies.

- (13) Install six rod caps (7) on six connecting rods (8) with 12 screws (6). Do not tighten screws.
- (14) If removed, install 14 ring dowels (5) in seven bearing caps (3).

CAUTION

Do not apply grease on outer diameter of bearing halves or damage may result to bearing halves, related bearing caps, and crankshaft.

- (15) Lubricate seven top bearing halves (4) with general purpose grease.
- (16) Lubricate 14 screws (2) and seven bearing caps (3) with engine oil.

CAUTION

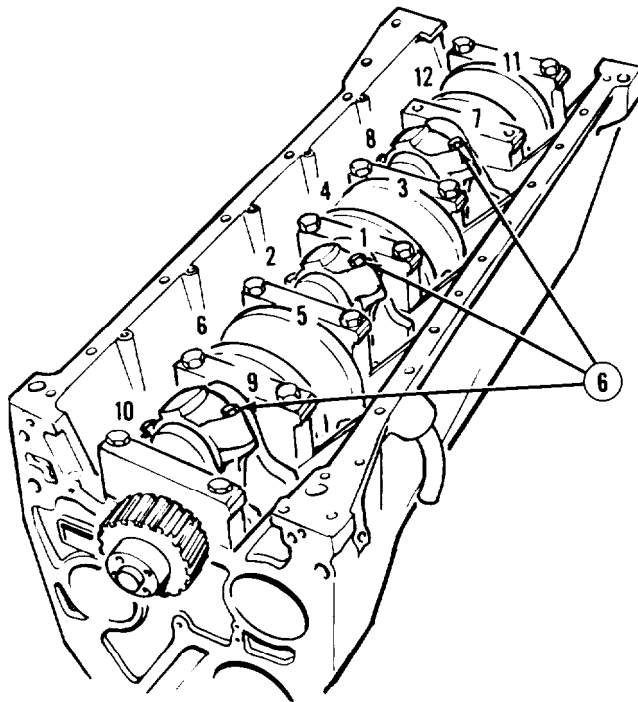
Bearing caps have numbers located on top near ring dowels. Numbers must face oil cooler side of engine beginning with number 1 at front of engine (fan side). Failure to properly install could cause damage to engine.

- (17) Install seven bearing caps (3) with 14 screws (2).

5-14. CRANKSHAFT REPLACEMENT/REPAIR (CONT).

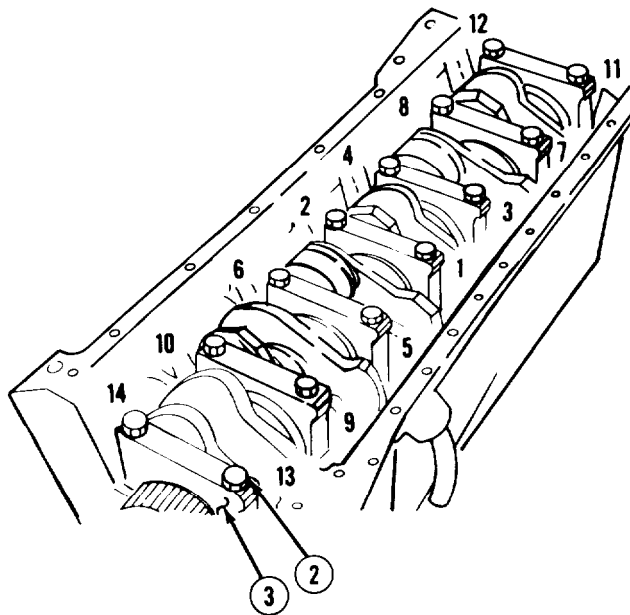
(18) Tighten 12 connecting rod screws (6) in pattern shown and in following steps:

- (a) Step 1: 26 lb-ft (35 N•m).
- (b) Step 2: 51 lb-ft (70 N•m).
- (c) Step 3: 73 lb-ft (100 N•m).

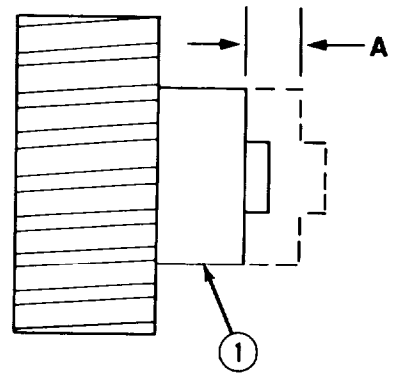


(19) Tighten 14 bearing cap screws (2) in pattern shown and in following steps:

- (a) Step 1: 44 lb-ft (60 N•m).
- (b) Step 2: 88 lb-ft (119 N•m).
- (c) Step 3: 129 lb-ft (176 N•m).



- (20) Measure end play again at gear end of crankshaft (1) at position A. Normal measurement is 0.005 to 0.010 in. (0.13 - 0.25 mm). If above or below normal measurement, correct with proper thrust bearing. If measurement is still not within normal limits, perform removal and replace crankshaft.



NOTE

Follow-on Maintenance:

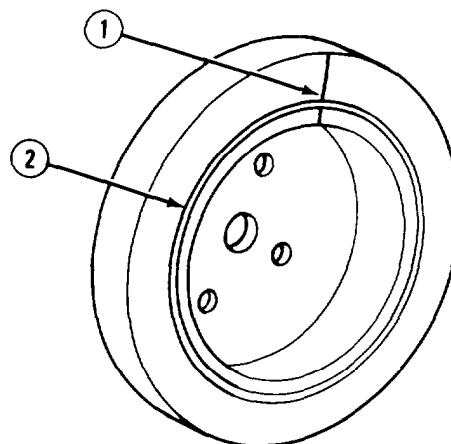
- Install oil pan and suction tube (para 5-29).
- Install gear housing (para 5-28).
- Remove engine from stand (para 5-9).

END OF TASK

b. Cleaning/Inspection.**WARNING**

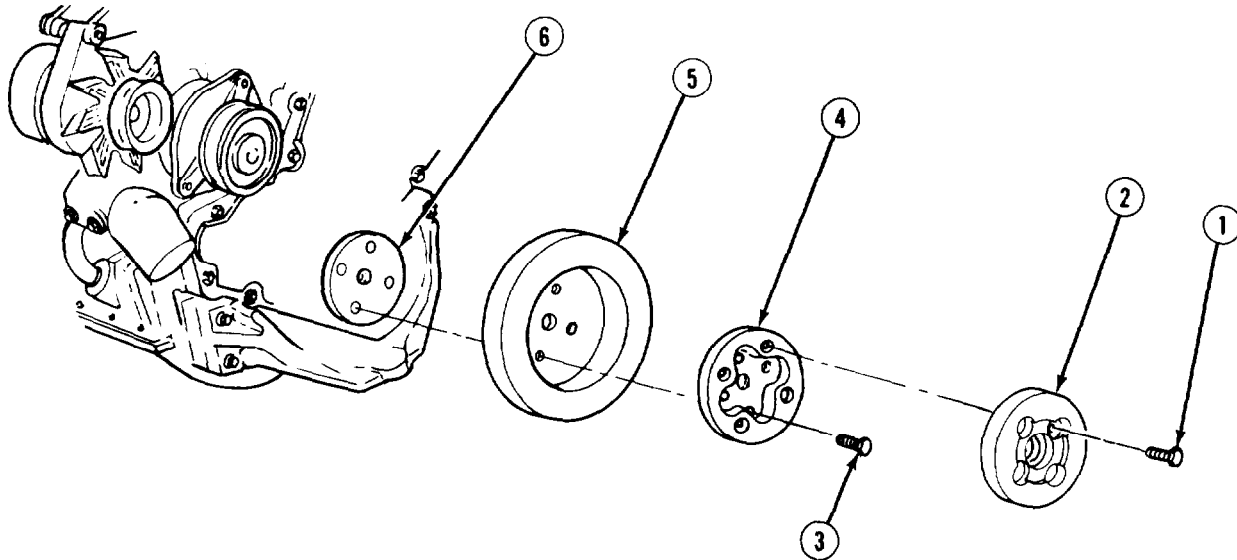
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (1) Clean damper and adaptor in hot soapy water using a nylon brush. Rinse with clean water and use compressed air to dry.
- (2) Measure distance between index lines (1). If measurement is more than 1/16 in. (1.59 mm), replace damper.
- (3) Check rubber member (2) of damper for deterioration and other damage. If damage is found, replace damper.
- (4) Check spacer and adaptor for signs of wear and other damage. Replace parts failing inspection.



5-15. VIBRATION DAMPER REPLACEMENT (CONT).

C. Installation.



- (1) Install damper (5) and spacer (4) on crankshaft (6) with four screws (3). Tighten screws incrementally to 85 lb-ft (115 N•m) by tightening all four screws to 30 lb-ft (27 N•m), 50 lb-ft (68 N•m), and finally 85 lb-ft (115 N•m).
- (2) Install adaptor (2) with four screws (1). Tighten screws 30 lb-ft (41 N•m).

NOTE

Follow-on maintenance: Install drive belt (para 4-68).

END OF TASK

5-16. ENGINE OIL SEALS REPLACEMENT.

This task covers:

- a. Removal b. Cleaning c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Materials/Parts

Cloth, lint-free (item 12, appendix E)

Oil seals (2)

Compound, sealing (item 16, appendix E)

Equipment Condition

TM or Para
Para 5-15

Para 5-18

Condition Description
Vibration damper removed.
Flywheel removed.

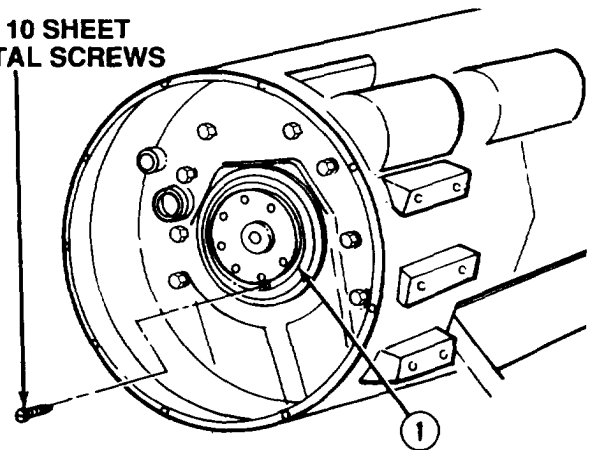
a. Removal.

NOTE

Both front and rear oil seals are removed the same way. Rear oil seal a shown.

- (1) Drill two holes 180° apart in rear seal (1) and install two No. 10 sheet metal screws.
- (2) Using No. 10 sheet metal screws remove rear seal (1). Discard rear seal (1) and No. 10 sheet metal screws.
- (3) Repeat steps (1) and (2) for front seal.

NO. 10 SHEET METAL SCREWS



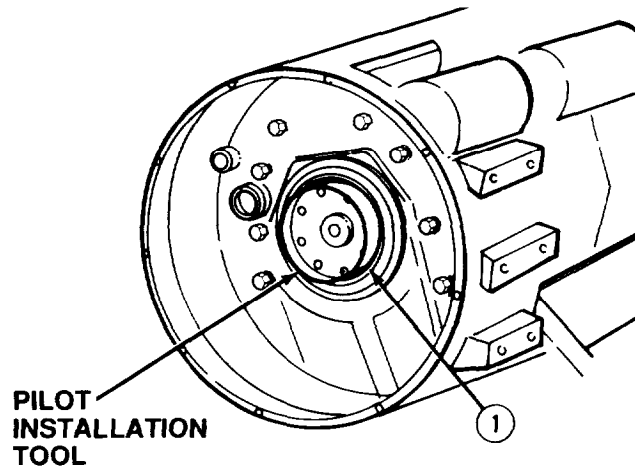
b. Cleaning. Wipe off all areas where oil has leaked with lint-free cloth.

5-16. ENGINE OIL SEALS REPLACEMENT (CONT).

c. Installation.

NOTE

- Both front and rear oil seals are installed the same way. Rear oil seal shown.
 - Pilot installation tool are supplied with replacement seals.
- (1) Insert rear seal (1) in pilot and install rear seal. Remove pilot.
 - (2) Seat rear seal (1) using installation tool.



WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (3) Apply coat of sealing compound on crankshaft and outside diameter of new front seal.
- (4) Repeat steps (1) and (2) for front seal.

NOTE

Follow-on Maintenance:

- Install flywheel (para 5-18).
- Install vibration damper (para 5-15).

END OF TASK

5-17. ENGINE REAR OIL SEAL AND COVER REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Wrench, torque

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
Solvent, drycleaning (item 54, appendix E)
Seal, oil
Gasket, rear cover
Packing, preformed

Equipment Condition

TM or Para
Para 5-20

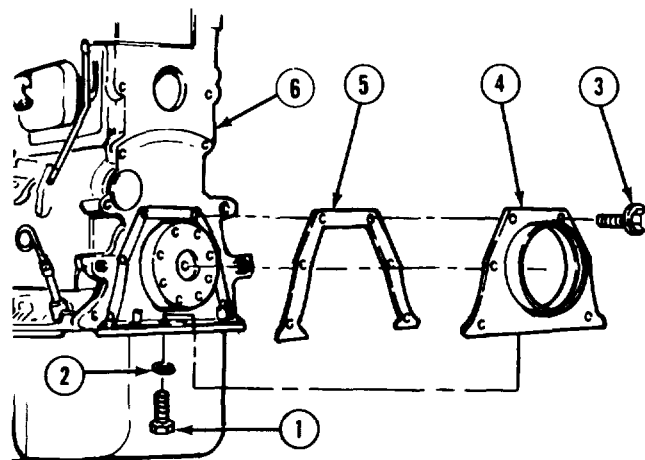
Condition Description
Flywheel housing removed.

General Safety Instructions

If engine has recently been in operation, allow engine time to cool before performing procedure

a. Removal.

- (1) Remove four screws (1) and washers (2).
- (2) Remove six screws (3), rear cover (4), and gasket (5) from engine block (6). Discard gasket.

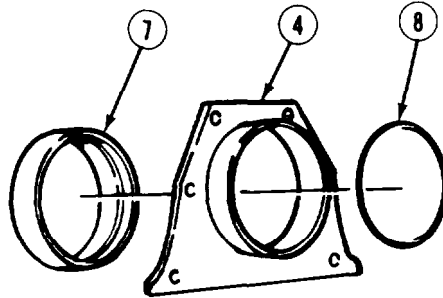


5-17. ENGINE REAR OIL SEAL AND COVER REPLACEMENT (CONT).

- (3) Remove oil seal (7) and preformed packing (8) from rear cover (4).

b. Cleaning/inspection.

WARNING



- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean rear cover with drycleaning solvent and dry with lint-free cloth.
 - (2) Check rear cover for cracks and wear. Replace rear cover if damaged.

c. Installation.

- (1) Install preformed packing (8) and oil seal (7) in rear cover (4).

NOTE

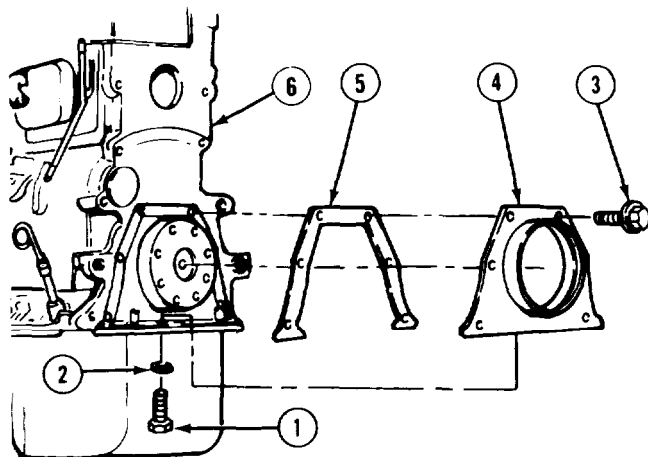
It may be necessary to trim gasket to align rear cover with oil pan.

- (2) Install gasket (5) and rear cover (4) on engine block (6) with six screws (3). Tighten screws 84 lb-in (N•m).
- (3) Install four washers (2) and screws (1). Tighten screws 216 lb-in (24 N•m).

NOTE

Follow-on Maintenance:

- Install flywheel housing (para 5-20).
- Fill engine with oil (para 4-24).



END OF TASK

5-18. FLYWHEEL REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 4-72

Para 5-8

Para 5-19

Condition Description

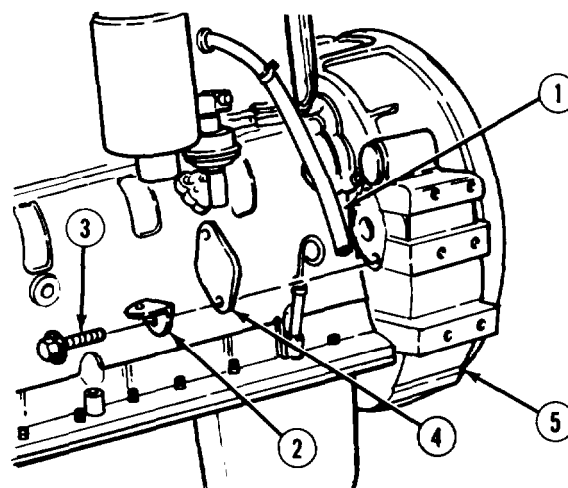
Starter removed.

Engine removed.

Ring gear removed.

a. Removal.

- (1) Remove hose (1) from bracket (2).
- (2) Remove two screws (3), bracket (2), and cover plate (4) from flywheel housing (5).

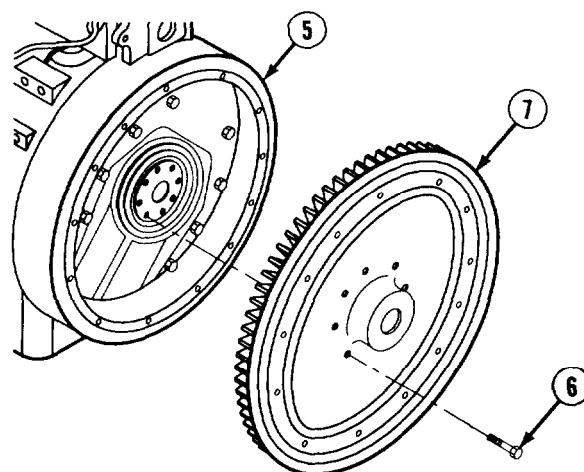


- (3) Remove eight screws (6) from flywheel (7).

WARNING

Use caution when removing flywheel. Ensure that engine block is secured or injury to personnel will result.

- (4) Stand against housing to prevent flywheel (7) from falling out.
- (5) Alternately tap on flywheel (7) through access hole and starter hole. Do this until top part of flywheel is loosened.
- (6) Hold top part of flywheel (7) place fingers through center hole, and remove flywheel (7) from flywheel housing (5).



5-18. FLYWHEEL REPLACEMENT (CONT).

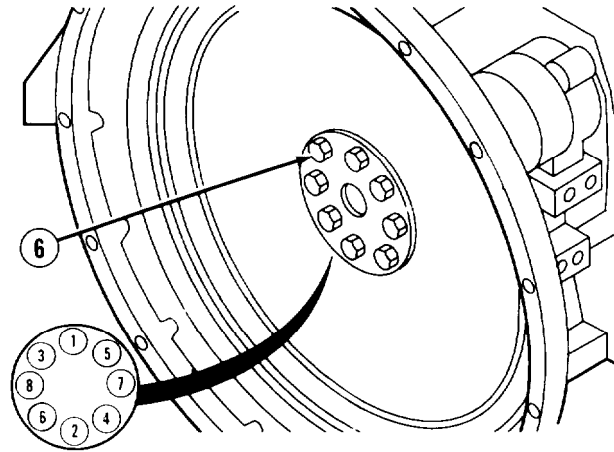
b. Installation.

- (1) Install flywheel (7) and lean against flywheel housing (5) to prevent flywheel from falling out.
- (2) Install eight screws (6).

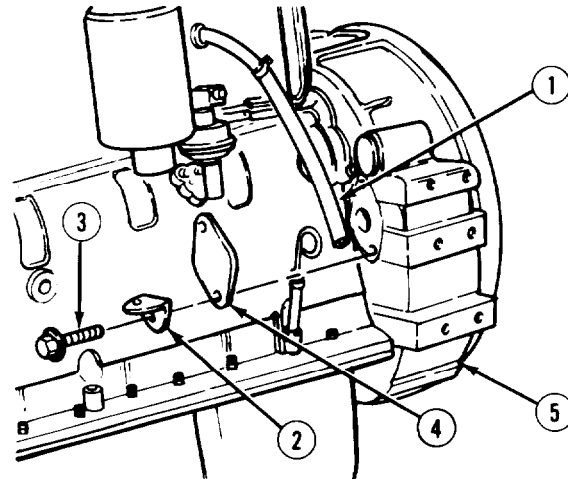
NOTE

It may be necessary to hold crankshaft to tighten screws.

- (3) Tighten eight screws (6) 101 lb-ft (137 N•m) in sequence shown.



- (4) Install cover plate (4) and bracket (2) on flywheel housing (5) with two screws (3). Tighten screws 216 lb-in (24 N•m).
- (5) Install hose (1) in bracket (2).



NOTE

Follow-on Maintenance:

- Install ring gear (para 5-19).
- Install engine assembly (para 5-8).
- Install starter (para 4-72).

END OF TASK

5-19. RING GEAR REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

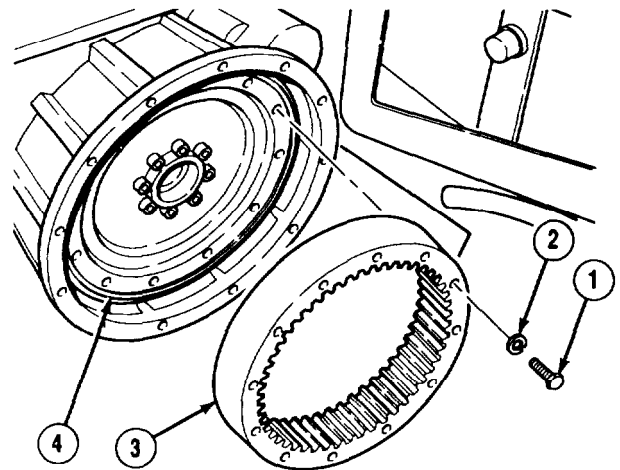
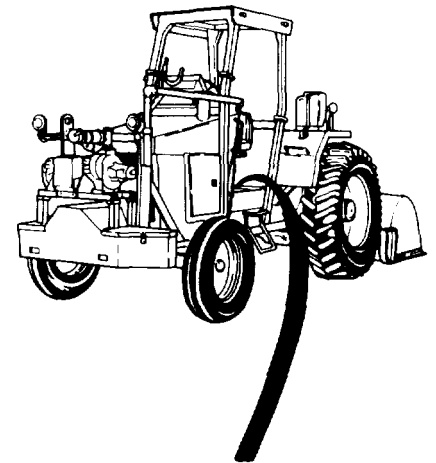
TM or Para
Para 5-33

Condition Description
Clutch drive assembly removed.

Materials/Parts

Lockwashers (8)

- a. **Removal.** Remove eight screws (1), lockwashers (2), and ring gear (3) from flywheel (4). Discard lockwashers.
- b. **Installation.** Position ring gear (3) on flywheel (4) and install with eight lockwashers (2) and screws (1). Tighten screws 50 lb-ft (68 N•m).



NOTE

Follow-on Maintenance: Install clutch drive assembly (para 5-33).

END OF TASK

5-20. FLYWHEEL HOUSING REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 5-18

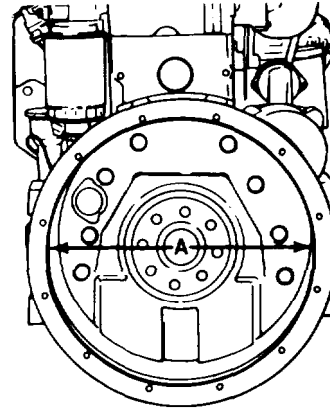
Condition Description
Flywheel removed.

Materials/Parts

Rear cover gasket
Gasket
Seal, oil

a. Removal.

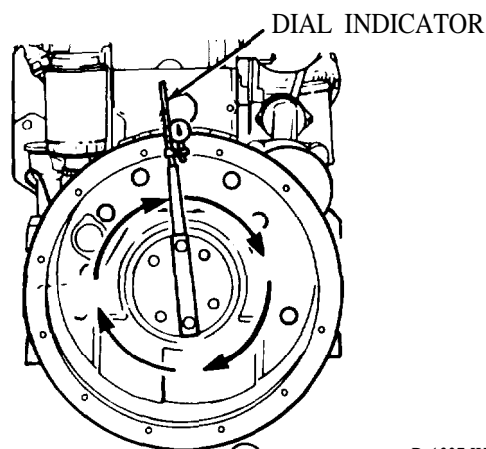
- (1) Measure housing bore at position A.
Normal bore diameter is between 17.625 to 17.630 in. (447.68 - 447.80 mm). If measurement is greater or less than limits, replace flywheel.



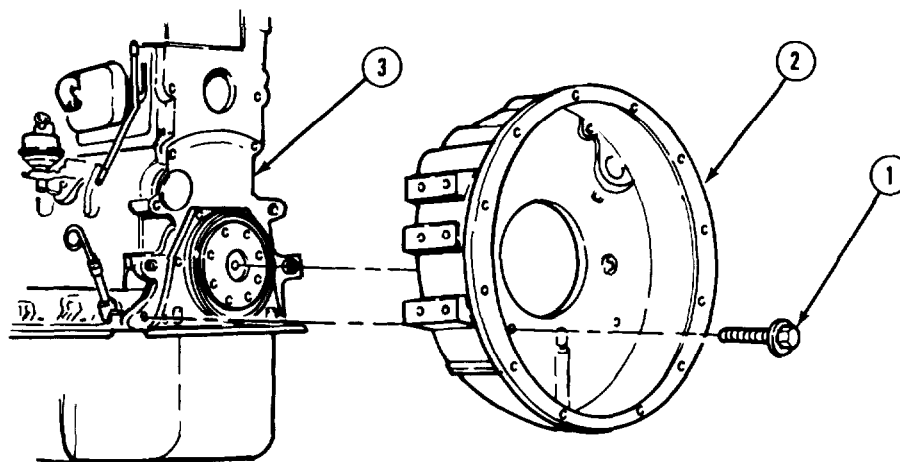
NOTE

Perform step (2) when troubleshooting a transmission vibration problem or checking flywheel housing face alignment.

- (2) Determine total indicator reading (TIR) as follows:
- (a) Mount dial indicator as shown.
 - (b) Adjust dial at 12 o'clock position until it reads zero. Rotate dial once to 12 o'clock position. Dial must read zero to get correct measurements.
 - (c) Slowly rotate dial to 3 o'clock, 6 o'clock, 9 o'clock, and 12 o'clock positions, recording measurements for each position.
 - (d) Raise rear of crankshaft to its upper limit with dial at 12 o'clock position. Record measurement. This measurement is called bearing clearance.
 - (e) Determine bearing clearance adjustment by subtracting 1/2 of bearing clearance from 6 o'clock position recorded in step (2 (c)).
 - (f) Add vertical measurements (12 o'clock position and bearing clearance adjustment).
 - (g) Add horizontal measurements (3 o'clock and 9 o'clock positions).
 - (h) Add totals from vertical and horizontal measurements to get total indicator reading (TIR).
 - (i) Maximum allowable TIR is 0.008 in. (0.20 mm). If measurement is greater than maximum allowable TIR, replace flywheel housing.

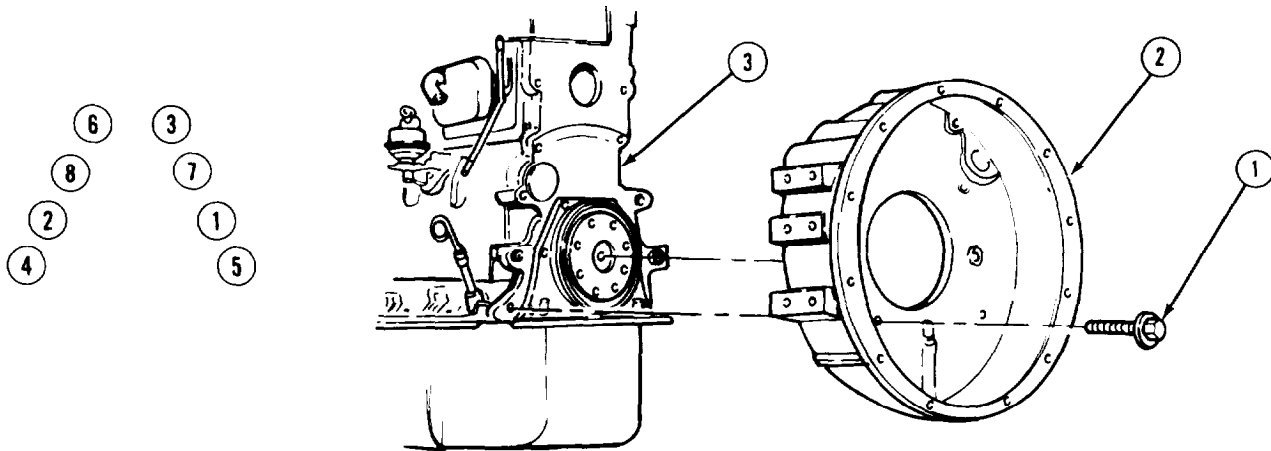


D-1327-W



- (3) Remove eight screws (1) and flywheel housing (2) from engine (3).

5-20. FLYWHEEL HOUSING REPLACEMENT (CONT).



(4) Remove rear cover gasket (4), seal (5), rear cover (6), and gasket (7). Discard gaskets and seal.

b. Installation.

- (1) Install gasket (7), rear cover (6), seal (5), and rear cover gasket (4) on housing (2).
- (2) Install flywheel housing (2) on engine (3) with eight screws (1). Tighten screws 57 lb-ft (77 N•m) according to pattern shown.

NOTE

Follow-on Maintenance: Install flywheel (para 5-18).

END OF TASK

5-21. FLYWHEEL HOUSING REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-------------|
| a. Disassembly | b. Cleaning/Inspection | c. Assembly |
|----------------|------------------------|-------------|

INITIAL SETUP

Tools

Shop equipment, general purpose repair: semi-trailer mounted

Equipment Condition

TM or Para
Para 5-20

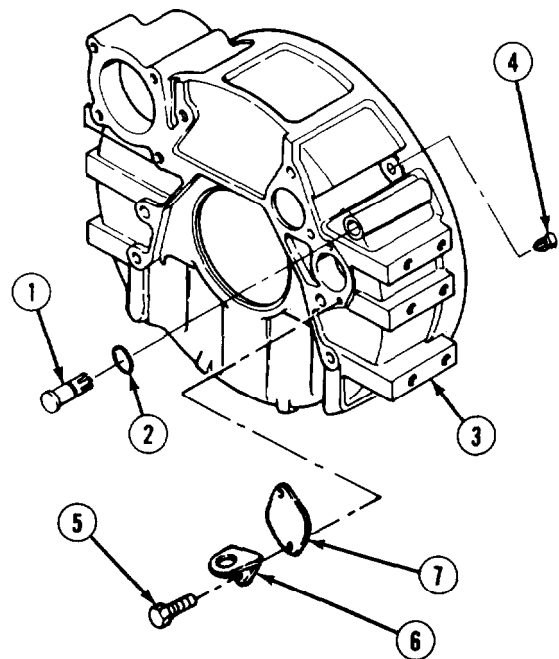
Condition Description
Flywheel housing removed.

Materials/Parts

Solvent, drycleaning (item 54, Appendix E)
Packing, preformed

a. Disassembly.

- (1) Remove plug (1) and preformed packing (2) from flywheel housing (3). Discard preformed packing.
- (2) Remove pipe plug (4).
- (3) Remove two screws (5), loop clamp (6), and access cover (7).



5-21. FLYWHEEL HOUSING REPAIR (CONT).

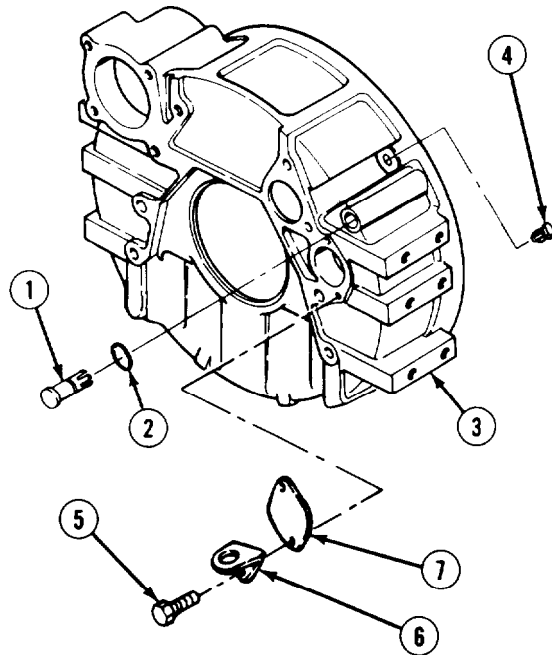
b. Cleaning/Inspection.

WARNING

- 1 Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- 1 If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- 1 Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean all parts with drycleaning solvent and dry with compressed air.
- (2) Check flywheel housing, plug, and rear cover for cracks and wear.
- (3) Replace all parts failing inspection.

c. Assembly.

- (1) Install access cover (7) and loop clamp (6) on flywheel housing (3) with two screws (5).
- (2) Install pipe plug (4).
- (3) Install new preformed packing (2) and plug (1).



NOTE

Follow-on Maintenance: Install flywheel housing (para 5-20).

END OF TASK

5-22. PISTON AND CONNECTING ROD REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para
Para 5-29

Para 5-12

Condition Description

Engine oil pan and suction tube removed.
Cylinder head assembly removed.

Materials/Parts

Brush, soft bristle (item 5, appendix E)

Cloth, lint-free (item 12, appendix E)

Detergent (item 19, appendix E)

Grease, general purpose (item 25, appendix E)

Oil, engine lubricating, (item 35, appendix E)

Solvent, drycleaning (item 54, appendix E)

5-22. PISTON AND CONNECTING ROD REPLACEMENT/REPAIR (CONT).

a. Removal.

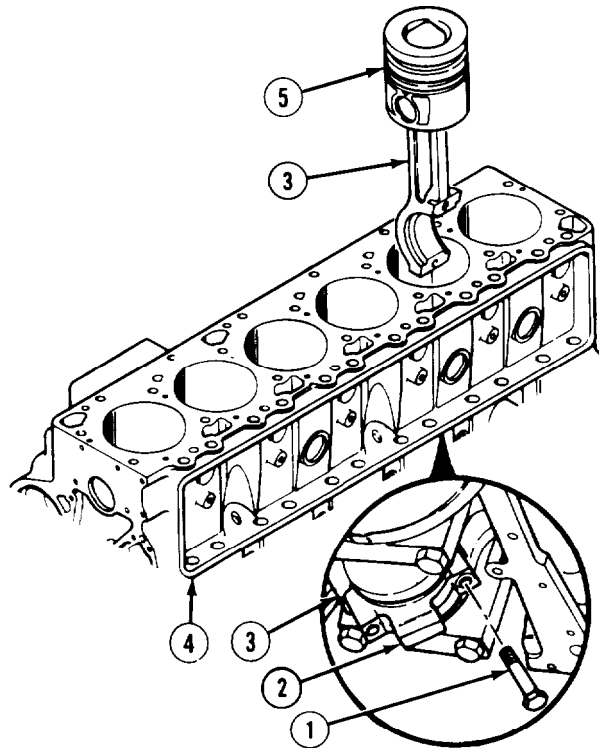
NOTE

- Engine can be turned on side while on stand to facilitate this task.
 - All six piston and rod assemblies are removed the same way.
 - Tag and mark all screws, rod caps, and bearing halves upon removal.
- (1) Tag, mark, and remove 12 screws (1) from six rod caps (2) and six connecting rods (3) in cylinder block (4).
 - (2) Mark each piston (5) according to cylinder number.

NOTE

Bottom bearing halves may come out with rod caps or stay with crankshaft.

- (3) Mechanic removes six pistons (5) and connecting rods (3) each as an assembly from top of cylinder block (4) while assistant pushes each assembly through cylinder block.

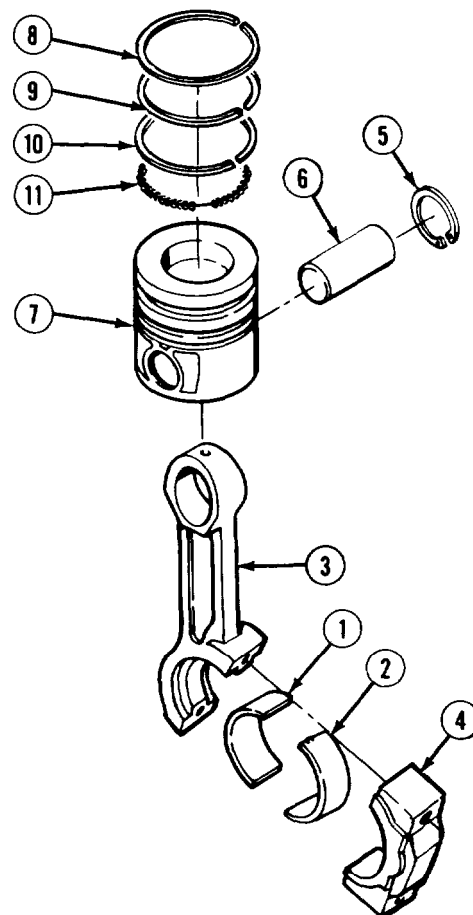


b. Disassembly.**CAUTION**

Do not exchange upper and lower bearing halves. Damage to engine assembly may result if bearing halves are not kept separate.

NOTE

- All six pistons and connecting rods are disassembled the same way.
 - Tag and mark all bearing halves upon removal.
- (1) Tag, mark, and remove 12 bearing halves (1 and 2) from six connecting rods (3) and rod caps (4).
 - (2) Remove two retaining rings (5) and wrist pin (6). Separate piston (7) from connecting rod (3).
 - (3) Remove top ring (8), intermediate ring (9), and oil control ring (10).
 - (4) Remove oil ring expander (11) from oil control ring (10).

**c. Cleaning/Inspection.****WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Soak pistons in a pan filled with drycleaning solvent until carbon deposits are easily removed.
 - (2) Wash pistons and connecting rods with hot water and detergent. Use a brush to remove carbon deposits.

5-22. PISTON AND CONNECTING ROD REPLACEMENT/REPAIR (CONT).

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (3) Dry all parts using compressed air or lint-free cloth.
- (4) Check piston and connecting rod for excessive wear and other damage. Replace parts failing inspection.
- (5) Check remaining parts for wear and other damage. Replace parts failing inspection.

- (6) Measure each piston (1) at position A.
Normal measurement is 4.0088 to 4.0117 in.
(101.823 - 101.896 mm). If above or below limits, replace piston.

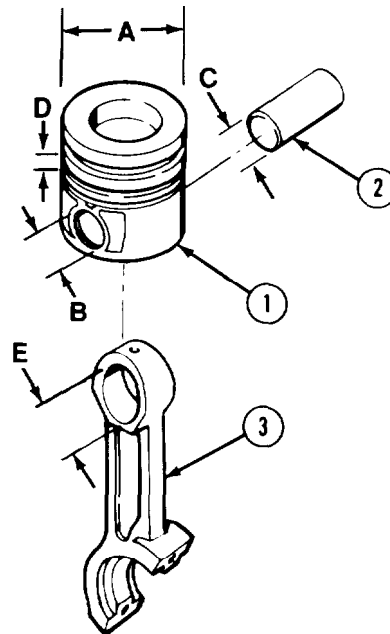
- (7) Measure each piston (1) at position B.
Normal measurement is 1.5750 to 1.5758 in.
(40.006 - 40.025 mm). If above or below limits, replace piston.

- (8) Measure each wrist pin (2) at position C.
Normal measurement is 1.5744 to 1.5749 in.
(39.990 - 40.0032 mm). If above or below limits, replace piston pin.

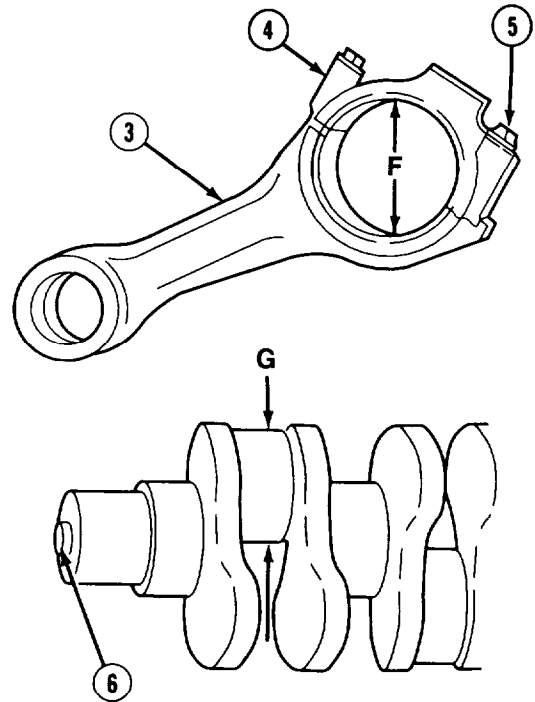
- (9) Install each ring on piston (1) and measure ring clearance (position D). If above or below limits, replace ring. Normal measurements are as follows:

- (a) Top ring is 0.003 to 0.0059 in.
(0.076 - 0.150 mm).
- (b) Intermediate ring is 0.003 to 0.0059 in.
(0.076 - 0.150 mm).
- (c) Oil control ring is 0.0016 to 0.0051 in. (0.040 - 0.130 mm).

- (10) Measure each connecting rod (3) at position E. Normal measurement is 1.5769 to 1.5784 in.
(40.053 - 40.092 mm). If above or below limits, replace connecting rod.



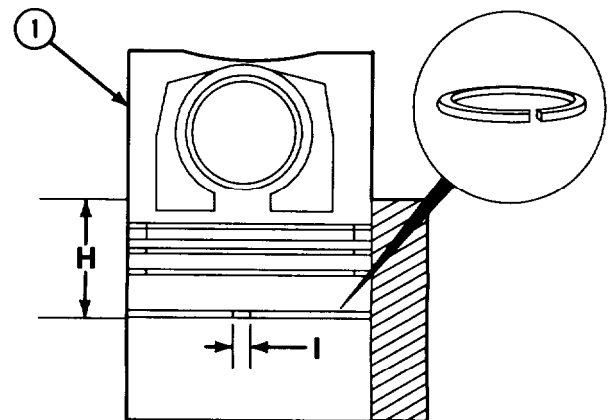
- (11) Determine rod bearing clearance for each rod as follows:
- Install six rod caps (4) on connecting rods (3) with 12 screws (5). Tighten screws 73 lb-ft (99 N-m).
 - Measure each connecting rod (3) at position F. Record smallest diameter.
 - Measure crankshaft (6) at position G for each rod (3). Normal measurement is 2.7150 to 2.7170 in. (68.962 - 69.013 mm).
 - Add smallest crankshaft and connecting rod measurements. Clearance should be no greater than 0.0035 in. (0.089 mm).
 - If rod bearing clearance exceeds measurement limit, replace bearings. If clearance still exceeds measurement limit, replace connecting rod and rod cap.



NOTE

To ensure proper measurement of rings, install rings with printed side up.

- Install each ring in cylinder approximately 3.5 in. (89 mm) deep (position H). Level ring using piston (1).
- Remove piston (1) and measure each ring gap at position I. If below or above limits, replace ring. Normal measurements are as follows:
 - Top ring is 0.0160 to 0.0275 in. (0.40 - 0.70 mm).
 - Intermediate ring is 0.0100 to 0.0215 in. (0.25 - 0.55 mm).
 - Oil control ring is 0.0100 to 0.0215 in. (0.25 - 0.55 mm).



5-22. PISTON AND CONNECTING ROD REPLACEMENT/REPAIR (CONT).

d. Assembly.

CAUTION

- Install rings with printed side up. Improper installation will cause damage to engine.
- End gaps of rings must be 120° apart from each other. Improper installation will cause damage to engine.

- (1) Lubricate rings (8,9, and 10) with engine oil.

NOTE

End gap of rings must be at opposite ends of each other.

- (2) Install oil ring expander (11) and oil control ring (10).
- (3) Install intermediate ring (9) and top ring (8).
- (4) Install one retaining ring (5) in piston (7).

CAUTION

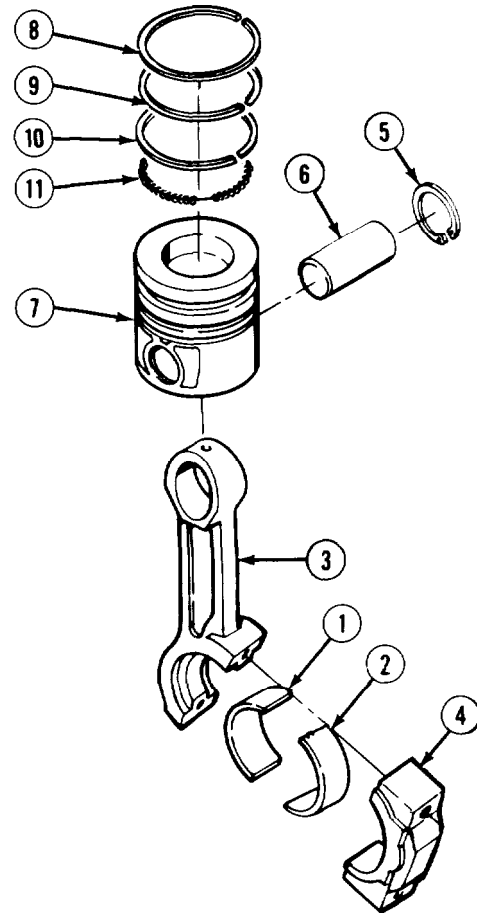
Markings on piston head and numbers on connecting rod must be oriented in same direction for proper assembly. Failure to do so will result in damage to engine.

- (5) Assemble piston (7) and connecting rod (3) securing with wrist pin (6).
- (6) Install remaining retaining ring (5).

CAUTION

Do not apply grease on outer diameter of bearing halves or damage may result to bearing halves, related bearing caps, and crankshaft.

- (7) Lubricate 12 bearing halves (1 and 2) with general purpose grease.
- (8) Assemble 12 bearings halves (1 and 2) in six connecting rods (3) with six rod caps (4).



e. *Installation.*

- (1) Lubricate connecting rod (3) and rod cap (2) threads with engine oil.
- (2) Position rod journal for piston (5) and connecting rod (3) to be installed bottom dead center (BDC).

CAUTION

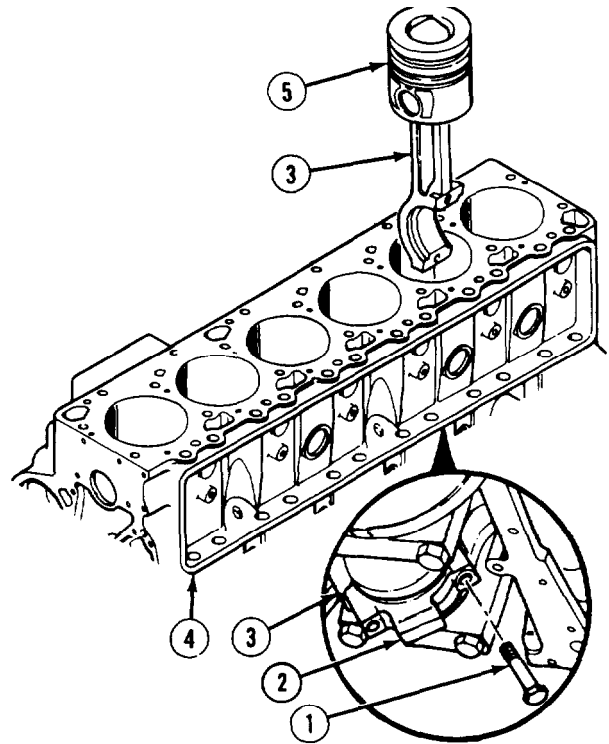
To properly install pistons, the word “front” on piston heads must be facing towards front of cylinder block. Failure to do so will result in damage to engine.

- (3) Mechanic aligns matchmarks and installs six pistons (5) and connecting rods (3) in respective cylinders while assistant guides connecting rods over crankshaft.

CAUTION

Rod bearing caps and connecting rods have numbers located on one side. Numbers must be aligned and match. Failure to do so will result in damage to crankshaft and connecting rod assemblies.

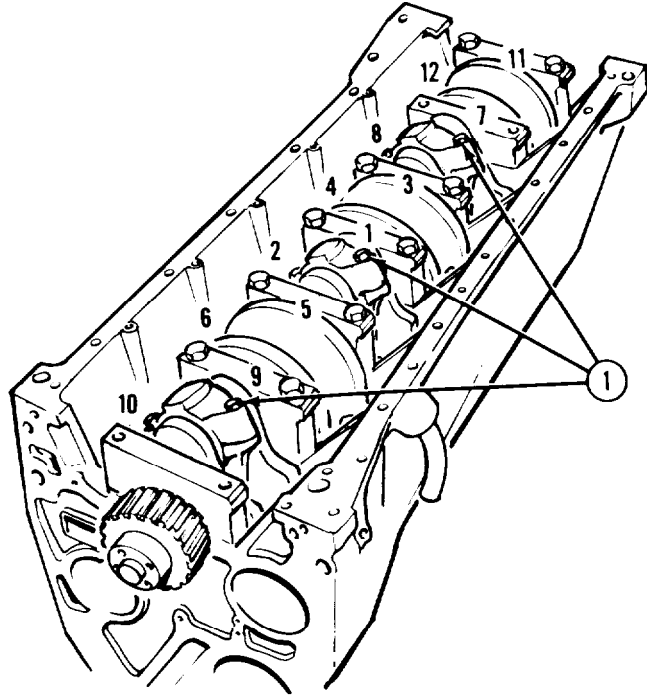
- (4) Install six rod caps (2) with 12 screws (1).



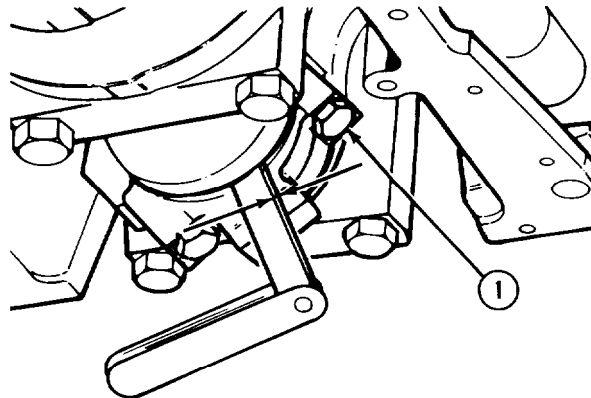
5-22. PISTON AND CONNECTING ROD REPLACEMENT/REPAIR (CONT.)

(5) Tighten 12 screws (1) in pattern shown and in following steps:

- (a) Step 1: 26 lb-ft (35 N•m).
- (b) Step 2: 51 lb-ft (70 N•m).
- (c) Step 3: 73 lb-ft (100 N•m).



(6) Measure side clearance between connecting rod and crankshaft as indicated. Side clearance limits are 0.004 to 0.012 in. (0.1 - 0.3 mm). If measurement is above or below limits, loosen screws (1), check connecting rod, and reinstall or replace. If measurement is still out of limits, check crankshaft (refer to para 5-14).



NOTE

Follow-on maintenance:

- Install cylinder head assembly (para 5-12).
- Install engine oil pan and suction tube (para 5-29).

END OF TASK

5-23. ROCKER ARM ASSEMBLY REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

- Detergent (item 19, appendix E)
- Oil, engine lubricating, (item 35, appendix E)
- Tags, identification (item 55, appendix E)

Equipment Condition

TM or Para
Para 4-31

Condition Description
Valve covers removed.

General Safety Instructions

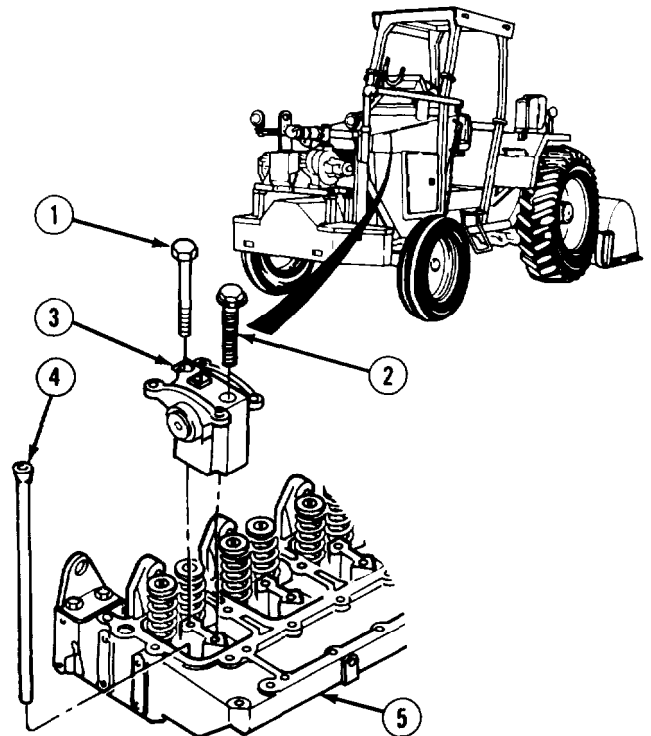
Engine retains extreme heat during operation. Allow time for cooling before performing procedure.

a. Removal.

NOTE

Tag and mark rocker arm assemblies before removal.

- (1) Tag, mark, and remove 12 screws (1 and 2) and six rocker arm assemblies (3).
- (2) Tag, mark, and remove 12 push rods (4) from cylinder head (5).



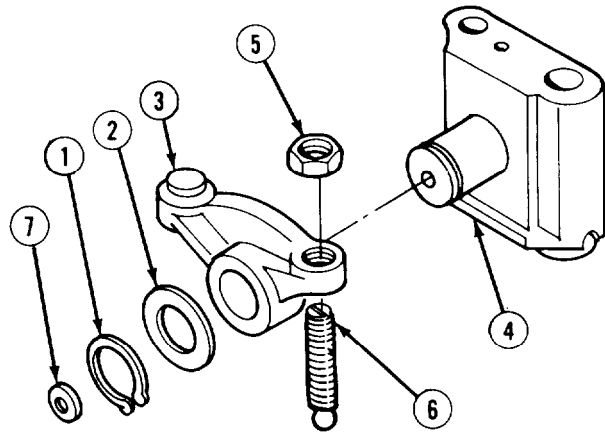
5-23. ROCKER ARM ASSEMBLY REPLACEMENT/REPAIR (CONT.).

b. Disassembly.

NOTE

All six rocker arms are disassembled the same way.

- (1) Remove two retaining rings (1), washers (2), and rocker arms (3) from arm support (4).
- (2) Remove two nuts (5) and pushrod adjusting screws (6).
- (3) If damaged, remove expansion plug (7) from arm support (4).

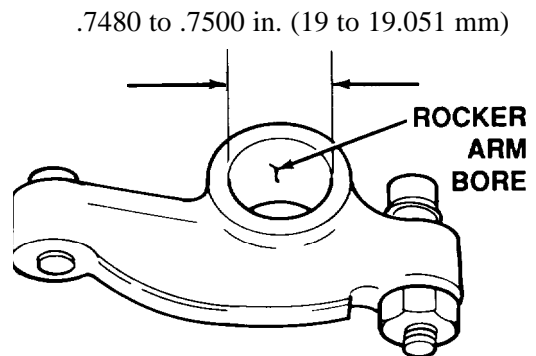


c. Cleaning/Inspection.

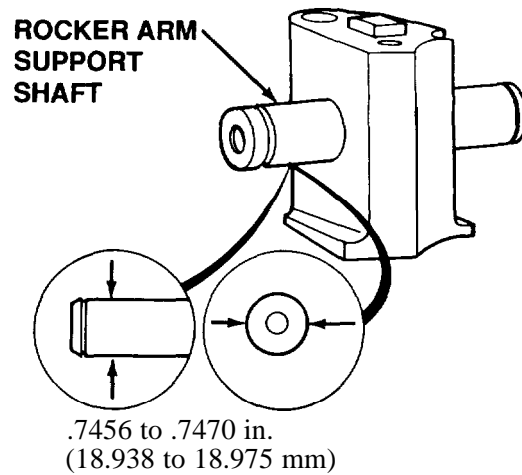
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (1) Clean all parts of rocker arm assembly in strong detergent and hot water. Rinse in clean hot water and use compressed air to dry all parts.
- (2) Check rocker arm for cracks, excessive wear, and other damage. Replace all rocker arms failing inspection.
- (3) Measure rocker arm bore as indicated. Normal measurement is 0.7480 to 0.7500 in. (19 - 19.051 mm). If above or below normal measurement, replace rocker arm.



- (4) Measure rocker arm support shaft as indicated. Normal diameter is 0.7456 to 0.7470 in. (18.938 - 18.975 mm). If above or below normal measurement, replace rocker arm support.

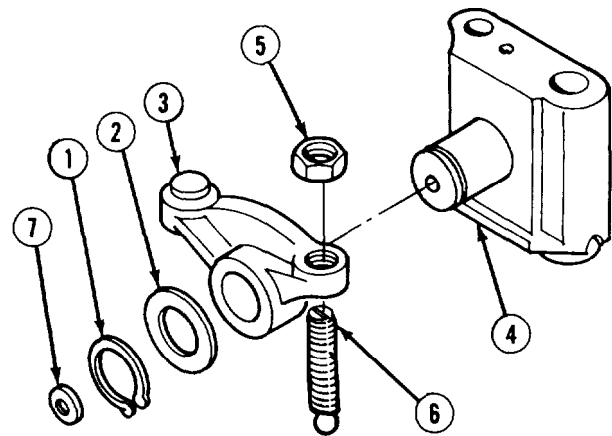


d. Assembly.

NOTE

All six rocker arm assemblies are assembled the same way.

- (1) Loosely install two pushrod adjusting screws (6) and nuts (5).
- (2) Lubricate shafts of arm support (4) with engine oil.



NOTE

Intake rocker arm is shorter than exhaust rocker arm. Compare rocker arms to ensure proper installation.

- (3) Install two rocker arms (3), washers (2), and retaining rings (1).



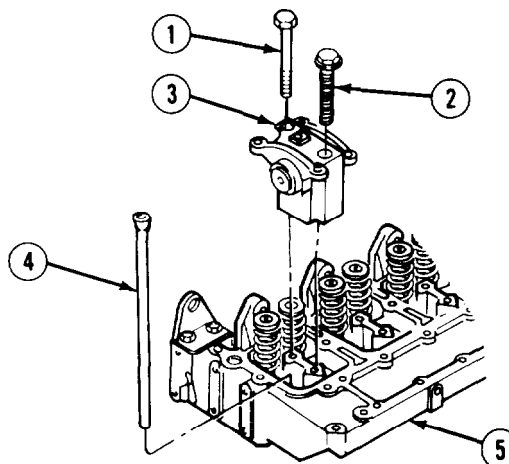
Check and ensure that rocker arms are installed in correct locations. Damage will result to engine if incorrectly installed.

- (4) If removed, install expansion plug (7) in arm support (4).

5-23. ROCKER ARM ASSEMBLY REPLACEMENT/REPAIR (CONT).

e. Installation.

- (1) Lubricate push rod (4) sockets and valves with engine oil and install 12 push rods in cylinder head (5).
- (2) Install six rocker arm assemblies (3) with 12 screws (1 and 2). Tighten screws (1) alternately at 216 lb-in (24 N•m). Tighten screws (2) in following steps:
 - (a) Step 1: 29 lb-ft (39 N•m).
 - (b) Step 2: 62 lb-ft (84 N•m).
 - (c) Step 3: 92 lb-ft (125 N•m).



NOTE

Follow-on Maintenance:

- Check torque on other cylinder head screws (para 5-12).
- Perform valve and rocker arm adjustments (para 4-31).

END OF TASK

5-24. CAMSHAFT REPLACEMENT/REPAIR.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: equipment maintenance and repair
- Shop equipment, general purpose repair: semi-trailer mounted
- Installation tool
- Wrench, torque

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 5-26	Gear cover removed.
Para 5-23	Rocker arm assemblies removed.

General Safety Instructions

If engine has recently been in operation, allow engine time to cool before performing procedure.

Materials/Parts

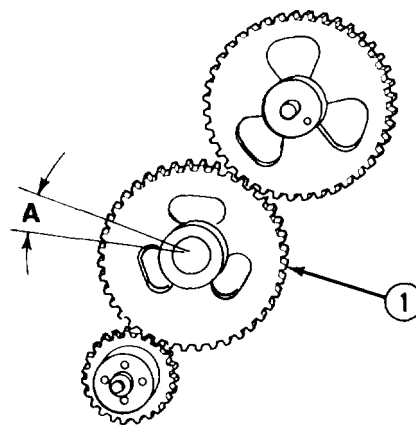
- Paper, abrasive, garnet, (item 48, appendix E)
- Cloth, lint-free (item 12, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Grease, general purpose (item 25, appendix E)
- Fluid, calibration (item 22, appendix E)

a. Removal.

NOTE

Hold adjoining gears to get a correct measurement of backlash.

- (1) Measure camshaft gear (1) backlash at position A. Normal measurement is 0.003 to 0.013 in. (0.08 - 0.33 mm). If above or below normal measurement, replace gear.



5-24. CAMSHAFT REPLACEMENT/REPAIR (CONT).

- (2) Insert wooden dowels into valve tappets through cylinder head. Band dowels together to prevent valve tappets from falling out of valve bores, or if on stand, first turn engine up side down and dowels will not be needed.
- (3) Remove two screws (2) from thrust plate (3).

CAUTION

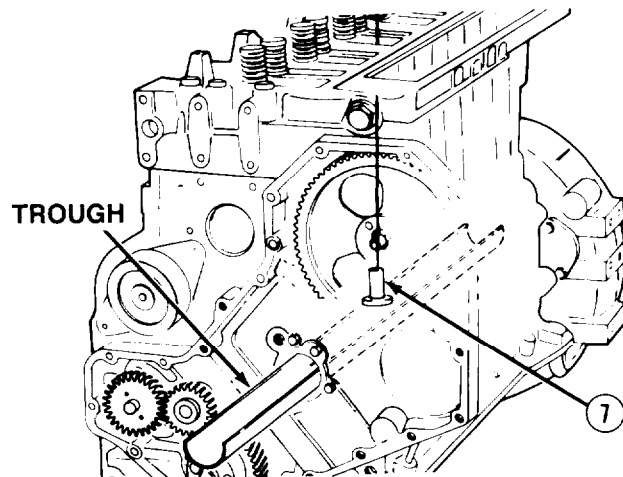
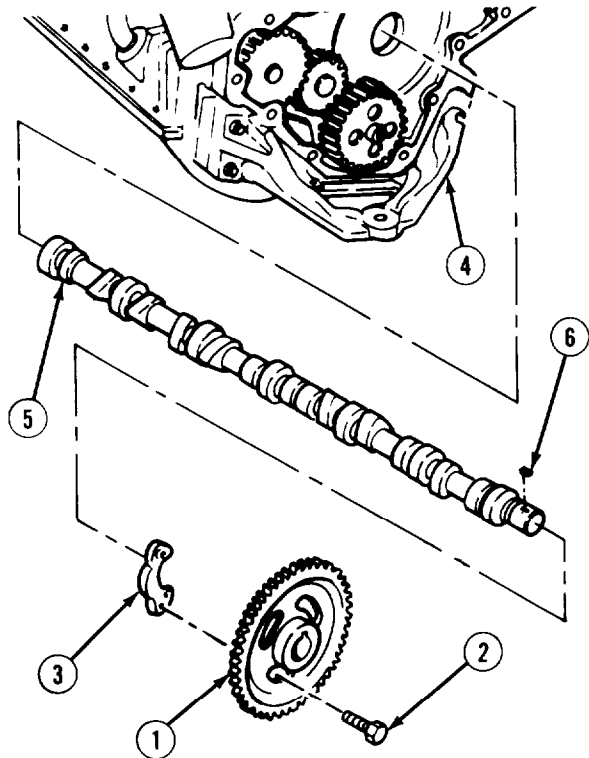
Thrust support will drop when gear is pulled. Ensure to catch thrust support or damage will result to thrust support.

- (4) Pull camshaft gear (1) partially out from engine block (4) and remove thrust plate (3).
- (5) Remove camshaft gear (1) and camshaft (5) as an assembly.
- (6) Remove camshaft gear (1) and key (6) from camshaft (5).
- (7) Place a trough through camshaft bore and remove banded wooden dowels in cylinder head.

NOTE

- Only remove one tappet at a time into trough. If more than one is removed, a tappet could fall into oil pan.
- If engine is upside down in stand and oil pan removed, tappets can be removed from bottom of engine block without using trough.

- (8) Remove 12 valve tappets (7) into trough.

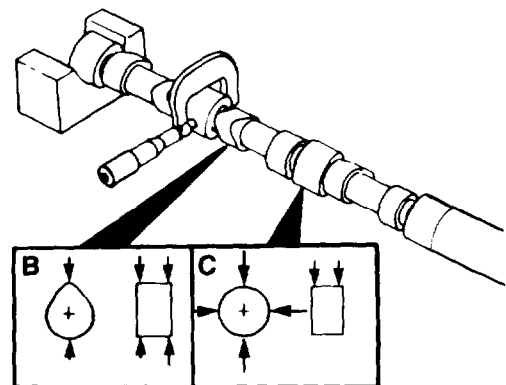


b. Cleaning/Inspection.

- (1) Remove all rough spots on camshaft with emery cloth and test oil.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean gear, camshaft, and valve tappets with drycleaning solvent and dry with lint-free cloth.
- (3) Inspect camshaft for scoring, cracks, and warping.
- (4) Inspect gear teeth for pitting, cracks, and warping.
- (5) Inspect socket, stem, and face of valve tappet for pitting, cracks, and excessive wear.
- (6) Measure camshaft valve lobes at position B.
If measurements are less than minimum, replace camshaft. Minimum limits are as follows:
- (a) Intake lobes are 1.852 in. (47.040 mm).
 - (b) Exhaust lobes are 1.841 in. (46.770 mm).
 - (c) Lift pump lobe is 1.398 in. (35.5 mm).
- (7) Measure camshaft journals at position C.
Minimum limit is 2.1245 in. (53.962 mm).
If measurement is less than minimum, replace camshaft.

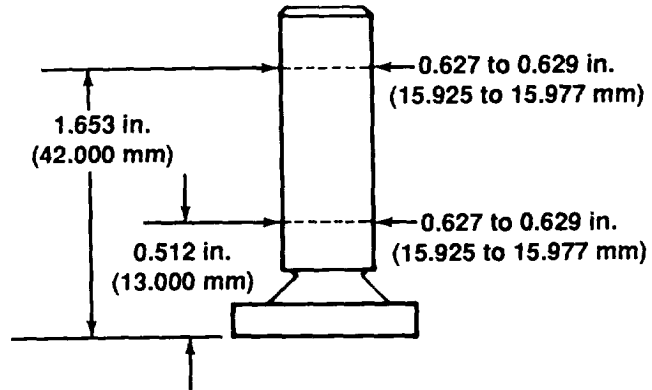


5-24. CAMSHAFT REPLACEMENT/REPAIR (CONT).

NOTE

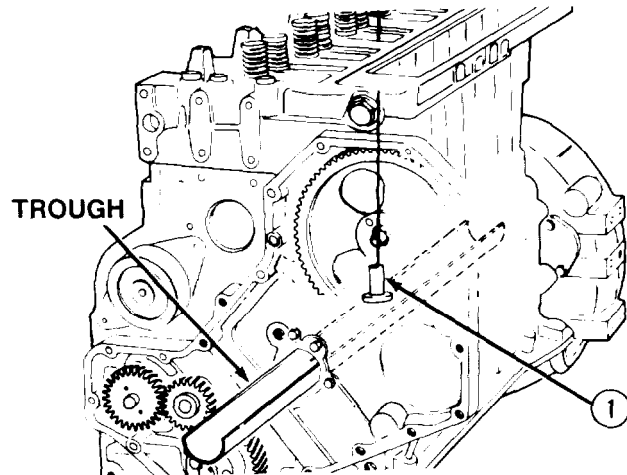
Height is measured from the base of tappet.

- (8) Measure valve tappet diameter at 0.512 in. (13 mm) high and at 1.653 in. (42 mm) high. Normal diameter is 0.627 to 0.629 in. (15.925 -15.977 mm). If measurement is above or below normal, replace valve tappet.



c. Installation.

- (1) Lubricate 12 valve tappets (1) with grease.
- (2) Drop installation tool through cylinder head into trough and pull out trough.
- (3) Install installation tool in valve tappet (1) and insert trough in camshaft bore.
- (4) Pull installation tool up inserting valve tappet (1) into tappet bore.
- (5) Turn trough over until convex side of trough rests against valve tappet (1).



- (6) Insert wooden dowel in valve tappet (1) and hold dowel until adjacent valve tappet is installed. Band adjacent dowels together.
- (7) Repeat steps (2) through (6) for remaining eleven valve tappets (1).

- (8) Lubricate camshaft (2) bores, journals, and lobes with grease.
- (9) If removed, install key (3) in camshaft (2).
- (10) Install camshaft (2) 2/3 of the way in cylinder block (leaving 1/3 outside of block).

CAUTION

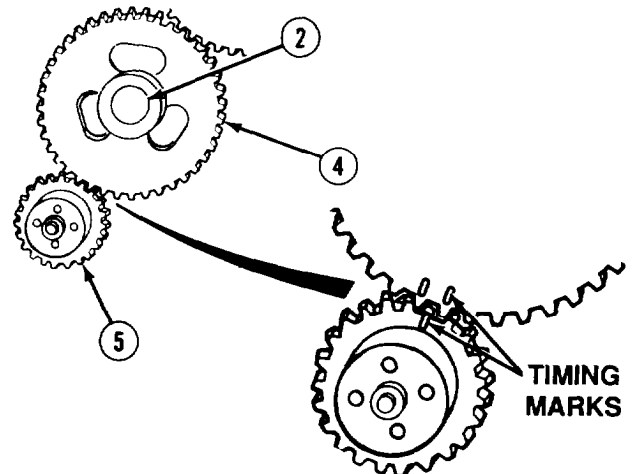
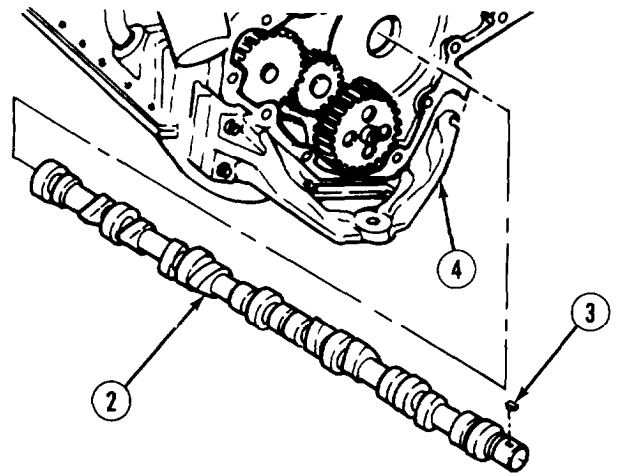
Do not overheat gear or irreparable damage to gear will result.

- (11) Heat camshaft (4) in suitable oven at 250°F (121°C) for 45 minutes.

WARNING

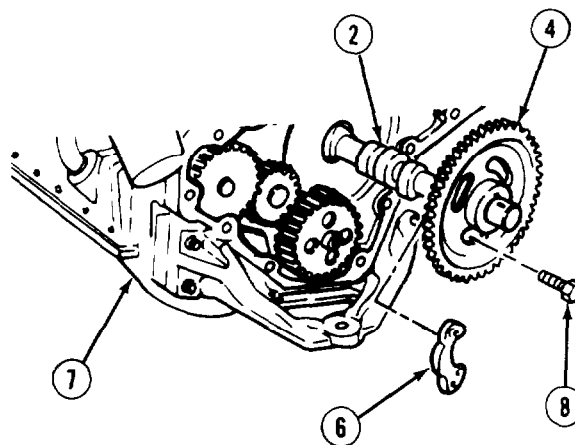
Wear protective gloves when installing camshaft gear. Gear is hot and can cause severe burns to personnel.

- (12) Install camshaft gear (4) on camshaft (2) loosely.
- (13) Check and ensure timing marks on camshaft gear (4) and crankshaft gear (5) are aligned.

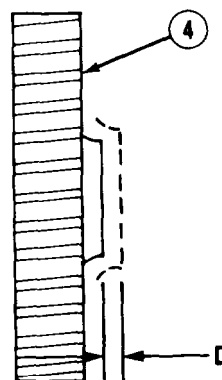


5-24. CAMSHAFT REPLACEMENT/REPAIR (CONT).

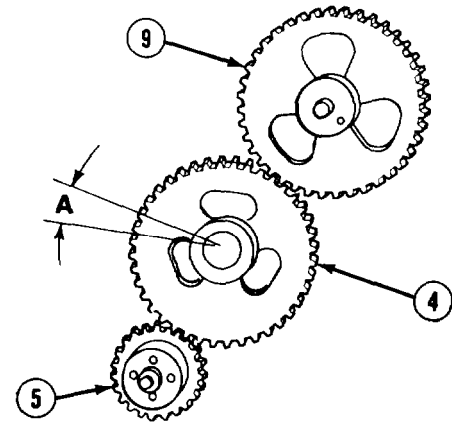
- (14) Lubricate thrust plate (6) with grease.
- (15) Install thrust plate (6) on camshaft (2).
- (16) Install camshaft gear (4) against thrust plate (6).
- (17) Install camshaft (2) completely in cylinder block (6).
- (18) Install two screws (8). Tighten screws 216 lb-in (24 N-m).



- (19) Measure camshaft gear (4) end play at position D. Normal measurement is 0.007 to 0.011 in. (0.17 - 0.29 mm). If above or below normal measurement, replace thrust plate.



- (20) Measure camshaft gear (4) backlash at position A. Normal measurement is 0.003 to 0.013 in. (0.08 -0.33 mm). If above or below normal measurement, replace gear. If measurement is still not correct, inspect crankshaft gear (5) (para 5-14) and fuel injection pump gear (9) (para 5-40).



NOTE

Follow-on maintenance:

- Install rocker arm assemblies (para 5-23).
- Install gear cover (para 5-26).

END OF TASK

b. Cleaning/Inspection.

- (1) Wipe off dust and dirt from tappet cover with cloth.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean out opening in tappet cover and breather baffle with drycleaning solvent. Dry with lint-free cloth.
 - (3) Check breather baffle for burnout and cracks.
 - (4) Check tappet cover for cracks.
 - (5) Replace all parts failing inspection.

c. Installation.**NOTE**

Ensure tag saying “front” on gasket is facing opposite of tappet cover.

- (1) Install gasket (6) on tappet cover (3).
- (2) Install baffle breather (5) on tappet cover (3).

NOTE

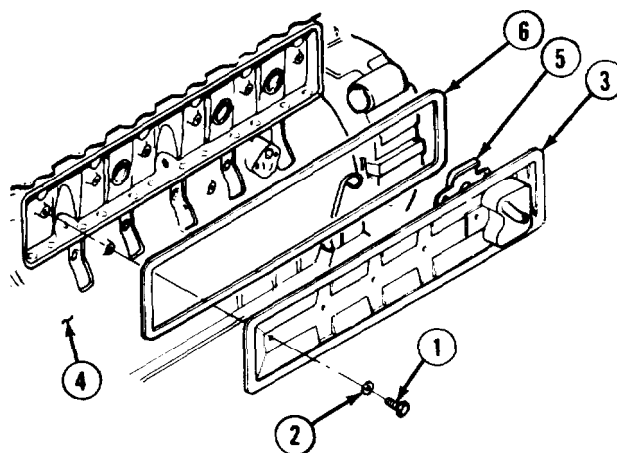
Other two screws are installed with fuel hoses.

- (3) Install tappet cover (3) and four grommets (2) with four screws (1). Tighten screws 216 lb-in (24 N•m).

NOTE

Follow-on maintenance:

- Install fuel injection pump (para 5-40).
- Install fuel filter head (para 4-51).
- Install fuel drain hoses removed (para 4-48).
- Install breather tube (para 4-32).



END OF TASK

5-26. GEAR COVER REPLACEMENT.

This task covers:

- a. Removal b. Cleaning/Inspection c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 5-15

Condition Description
Vibration damper removed.

Materials/Parts

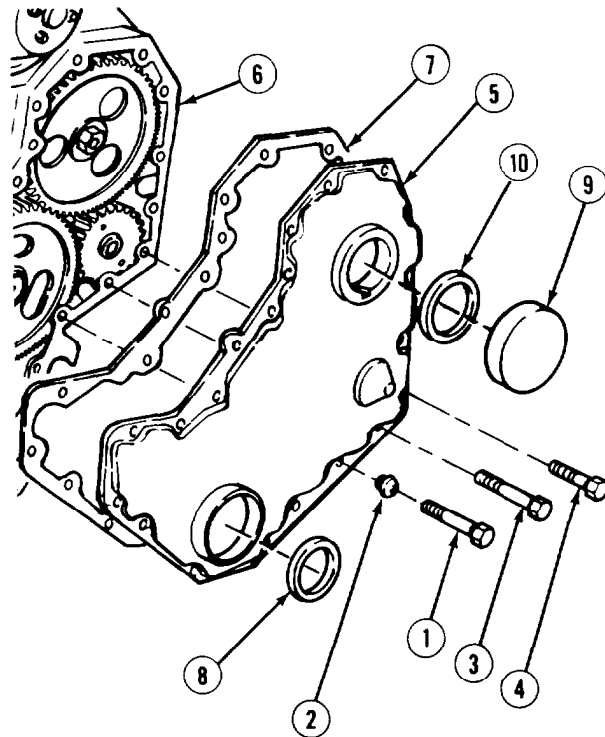
Seal, ring
Cloth, lint-free (item 12, appendix E)
Seal, oil
Gasket, cover

a. Removal.

NOTE

To remove access cover, perform steps (1), (2), and (5) only.

- (1) Remove screw (1) and belt guide (2).
- (2) Remove 19 screws (3 and 4) and gear cover (5) from gear housing (6).
- (3) Remove and discard cover gasket (7).
- (4) Remove and discard oil seal (8).
- (5) If damaged, remove access cover (9) and ring seal (10). Discard ring seal.



b. Cleaning/Inspection.

- (1) Clean all gasket material from gear housing and gear cover.
- (2) Wipe off dirt and oil from access cover, belt guide, and gear cover with clean cloth.
- (3) Check all parts for cracks, excessive wear, and other damage. Replace all parts failing inspection.

c. Installation.**NOTE**

Perform steps (4 and 5) only if access cover was alone removed.

- (1) If removed, install ring seal (10) and access cover (9) in gear cover (5).
- (2) Install oil seal (8).
- (3) Install cover gasket (7).
- (4) Install gear cover (5) on gear housing (6) with 19 screws (3 and 4). Tighten screws 216 lb-in (24 N•m).
- (5) Install belt guide (2) with screw (1). Tighten screw 216 lb-in (24 N•m).

NOTE

Follow-on maintenance: Install vibration damper (para 5-15).

END OF TASK

b. Installation.**NOTE**

If replacing timing pin alone, do steps (4 and 5) only.

- (1) Install seal ring (7) in timing housing (5).
- (2) Align matchmarks and install timing housing (5) on gear case (6) with two screws (4). Tighten screws 48 lb-in (5 N•m).
- (3) Install preformed packing (3) on timing pin (2).
- (4) Lubricate timing pin (2) with engine oil and install timing pin in timing housing (5) with retaining ring (1). Retaining ring must be installed no deeper than 0.059 in. (1.5 mm).
- (5) Install timing pin (2) and retaining ring (1). Retaining ring must be installed no deeper than 0.059 in. (1.5 mm).

NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

5-28. GEAR HOUSING REPLACEMENT/REPAIR.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: equipment maintenance and repair
- Shop equipment, general purpose repair: semi-trailer mounted
- Wrench, torque

Materials/Parts

- Cloth, lint-free (item 12, appendix E)
- Gear housing gasket

Equipment Condition

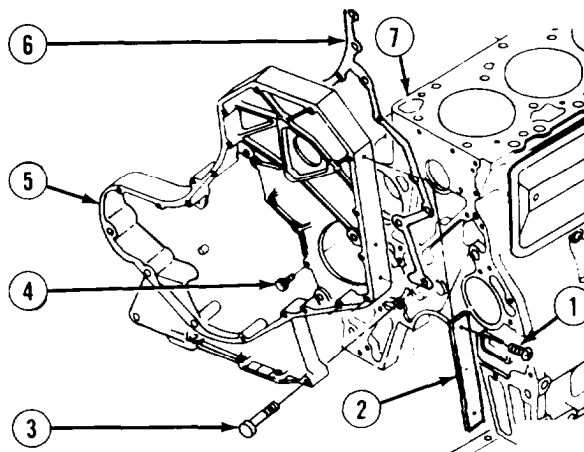
TM or Para	Condition Description
Para 5-26	Gear cover removed.
Para 5-31	Engine oil lube pump removed.
Para 5-24	Camshaft gear removed.
Para 5-40	Fuel injection pump removed.
Para 5-32	Hydraulic pump drive removed.

General Safety Instructions

If engine has previously been in operation, allow time for cooling before performing procedure.

a. Removal.

- (1) If damaged or illegible, remove two screws (1) and data plate (2).
- (2) Remove seven screws (3 and 4) and gear housing (5).
- (3) Remove and discard gear housing gasket (6) from cylinder block (7).



*b. Cleaning/Inspection.***WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean gear housing using drycleaning solvent and a lint-free cloth.
 - (2) Check housing for cracks and excessive wear. If damage is found, remove timing pin assembly (para 5-27) and replace gear housing.

c. Installation.

- (1) Install gear housing gasket (6) on cylinder block (7).
- (2) Install gear housing (5) with seven screws (4 and 3). Tighten screws 216 lb-in (24 N•m).
- (3) If removed, Install data plate (2) with two screws (1).
- (4) If removed, install timing pin (para 5-27).

NOTE

Follow-on maintenance:

- Install hydraulic pump drive (para 5-32).
- Install fuel injection pump (para 5-40).
- Install camshaft gear (para 5-24).
- Install engine oil lube pump (para 5-31).
- Install gear cover (para 5-26).

END OF TASK

5-29. ENGINE OIL PAN REPLACEMENT/REPAIR.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Gasket, oil pan

Gasket, suction tube

Materials/Parts

Washers, sealing (40)

Compound, sealing (item 16, appendix E)

Equipment Condition

TM or Para

Para 4-24

Condition Description

Engine oil drained.

General Safety Instructions

If engine has recently been in operation, allow oil time to cool before performing procedure.

a. Removal.

- (1) Remove plug (1) and washer (2).
- (2) Remove 40 screws (3), washers (4), oil pan (5) and gasket (6) from engine block (7). Discard gasket.
- (3) If damaged, remove plug (8) and washer (9).
- (4) Remove four screws (10 and 11), suction tube (12), and gasket (13). Discard gasket.

b. Cleaning/inspection.

- (1) Scrape gasket material and sealant from engine block and oil pan,

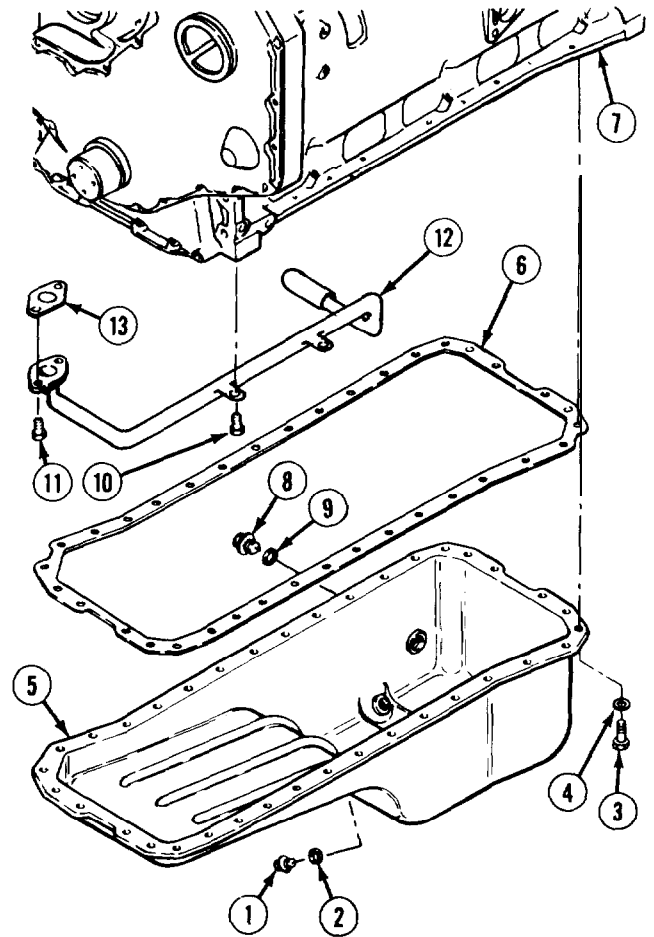
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean suction tube and oil pan with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (3) Dry suction tube and oil pan with compressed air.
- (4) Check oil pan for cracks, holes, and other damage.
- (5) Check suction tube for clogged vents, holes, cracks, and other damage.
- (6) Replace damaged parts.



5-29. ENGINE OIL PAN REPLACEMENT/REPAIR (CONT).

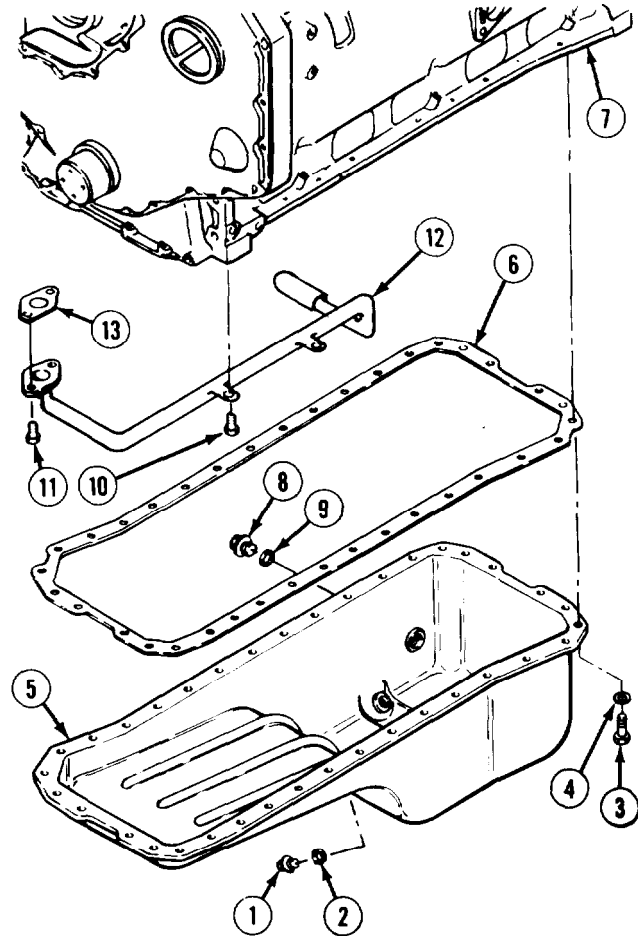
c. Installation.

- (1) Install gasket (13) and suction tube (12) with four screws (11 and 10). Tighten screws 216 lb-in (24 N•m).

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (2) Coat both sides of gasket (6) with sealant compound and install with printed side on engine block (7).
- (3) Install oil pan (5) with 40 washers (4) and screws (3). Tighten screws 216 lb-in (24 N•m).
- (4) Install two washers (9 and 2) and plugs (8 and 1). Tighten plugs 30 lb-ft (41 N•m).



NOTE

Follow-on Maintenance: Fill engine with engine oil (para 4-24).

END OF TASK

5-30. ENGINE OIL COOLER REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Packing, preformed

Packing, preformed

Equipment Condition

TM or Para

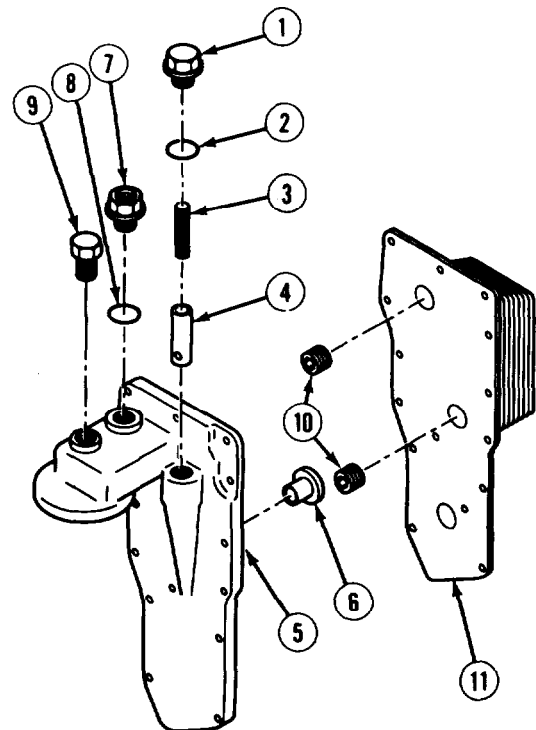
Para 4-34

Condition Description

Oil cooler removed.

a. Disassembly.

- (1) Remove plug (1), preformed packing (2), spring (3), and plunger (4) from filter head (5). Discard preformed packing.
- (2) Remove and discard relief valve (6) from back of filter head (5).
- (3) Remove reducer (7), preformed packing (8), and plug (9) from filter head (5).
- (4) If core will not be installed immediately, install protective plugs (10) in cooler core (11).



5-30. ENGINE OIL COOLER REPAIR (CONT).

b. Cleaning/Inspection.

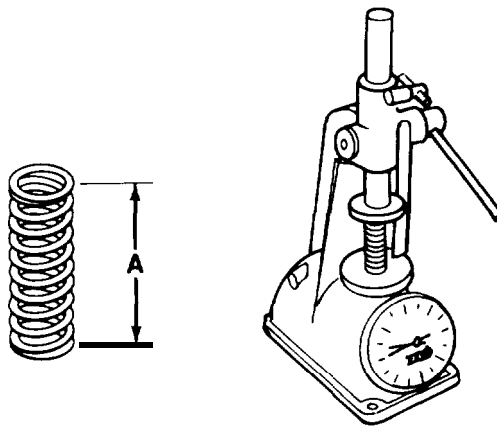
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Install plugs in cooler core and soak in drycleaning solvent. Remove deposits on plates with brush.
 - (2) Remove protective plugs and flush cooler core passages with clean drycleaning solvent.
 - (3) Check soldered joints on cooler core for corrosion and cracks.

WARNING

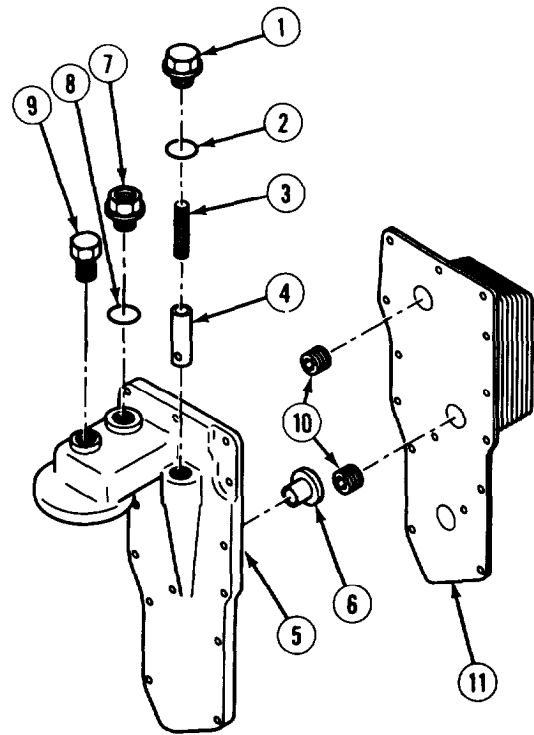
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (4) Pressurize collar core with air to 70 psi (483 kPa) and submerge in pan of water. Check for leaks. Dry with compressed air.
- (5) Check plunger for scratches and nicks.
- (6) Install plunger in filter head. If plunger does not move freely in bore, replace plunger.
- (7) Check plunger spring in the following manner:
 - (a) Measure height A of spring while applying 13.5 lbs (60 N) of pressure. Height must be no less than 1.77 in. (44.98 mm).
 - (b) Measure height A of spring while applying 20.5 lbs (91 N) of pressure. Height must be no less than 1.574 in. (39.98 mm).
 - (c) Replace spring if height is less than above limits.
- (8) Replace damaged parts.



c. Assembly.

- (1) If installing cooler core (11), remove protective plugs (10).
- (2) Install plug (9) on filter head (5). Tighten plug 144 lb-in (16 N•m).
- (3) Install preformed packing (8) and reducer (7) on filter head (5). Tighten reducer 204 lb-in (23 N•m).
- (4) Install relief valve (6) on filter head (5). Ensure that valve bottoms against step in filter head.
- (5) Install plunger (4), spring (3), preformed packing (2), and plug (1) on filter head (5). Tighten plug 74 lb-ft (100 N•m).

**NOTE**

Follow-on Maintenance: Install oil cooler (para 4-34).

END OF TASK

5-31. ENGINE OIL LUBE PUMP REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Wrench, torque

Equipment Condition

TM or Para
Para 5-26

Condition Description
Gear cover removed.

General Safety Instructions

If engine has recently been in operation, allow oil time to cool before performing procedure.

Materials/Parts

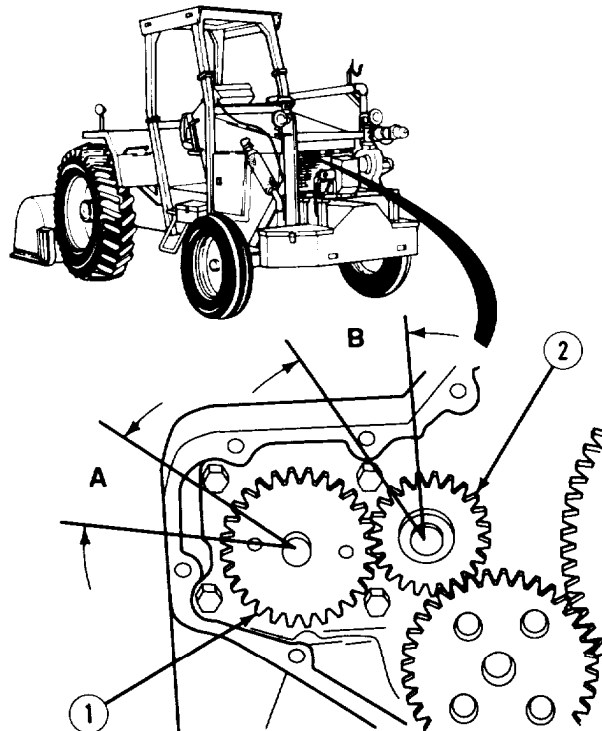
Oil, engine lubricating (item 35, appendix E)
Solvent, drycleaning (item 54, appendix E)

a. Removal.

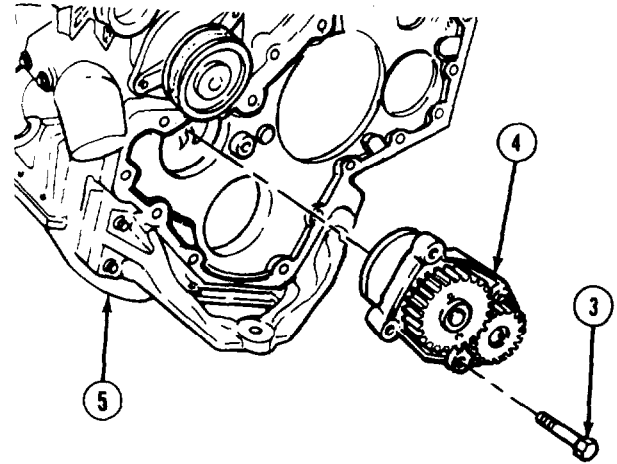
NOTE

Hold adjoining gears to obtain correct backlash measurement.

- (1) Measure oil pump gear (1) backlash at position A. Normal measurement is 0.003 to 0.013 in. (0.08 - 0.33 mm). If above or below normal measurement, replace oil pump.
- (2) Measure idler gear (2) backlash at position B. Normal measurement is 0.003 to 0.013 in. (0.08 - 0.33 mm). If above or below normal measurement, replace oil pump.



- (3) Remove four screws (3) and oil pump (4) from engine block (5).



b. Cleaning/Inspection.

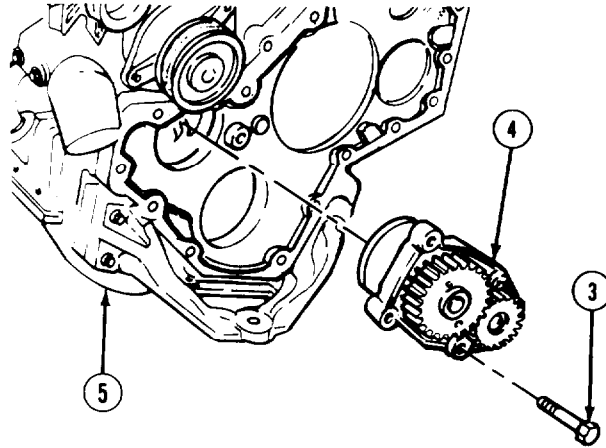
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean oil pump in drycleaning solvent and dry with compressed air.
 - (2) Check oil pump gears for chips, cracks, and excessive wear.
 - (3) Check generator and inside of oil pump housing for excessive wear and damage.
 - (4) Replace if damaged parts.

5-31. ENGINE OIL LUBE PUMP REPLACEMENT (CONT).

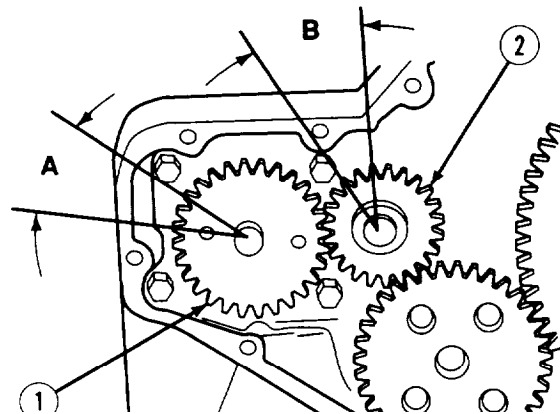
c. Installation.

- (1) Lubricate oil pump (4) with engine oil.
- (2) Install oil pump (4) in engine block (5). Ensure that idler gear shaft engages bore in cylinder block.
- (3) Install four screws (3). Tighten screws alternately 216 lb-in (24 N•m).



NOTE

- The following measurements are for new oil pump only.
 - Hold adjoining gears to obtain correct backlash measurement.
- (4) Measure oil pump gear (1) backlash at position A and idler gear (2) backlash at position B. Both normal measurements are 0.003 to 0.10 in. (0.08 to 0.25 mm). If above or below normal measurements, check camshaft gear (para 5-24).



NOTE

Follow-on Maintenance: Install gear cover (para 5-26).

END OF TASK

5-32. ENGINE HYDRAULIC PUMP DRIVE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 5-32

Condition Description
Hydraulic pump drive removed.

Materials/Parts

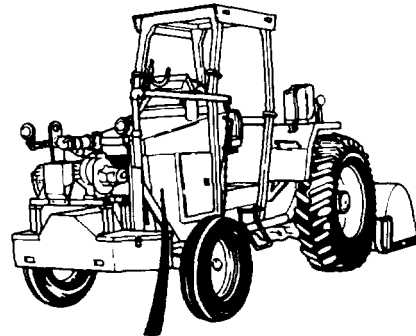
Compound, thread locking (item 15, appendix E)
Gasket

a. Removal.

NOTE

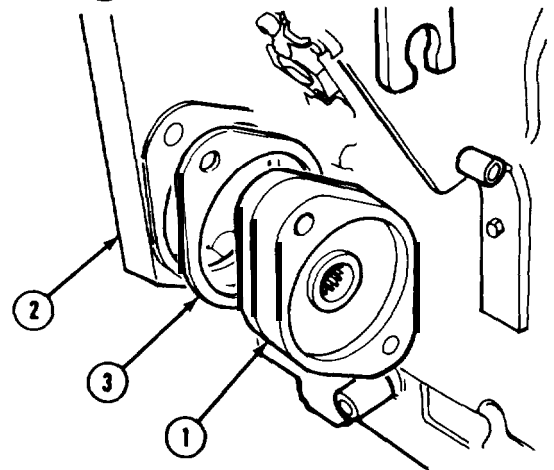
Two attaching screws were removed with gear pump assembly.

- (1) Remove pump drive (1) from gear housing (2).
- (2) Remove pump drive gasket (3) from accessory drive (1). Discard gasket.



b. Installation.

- (1) Install pump drive gasket (3) on accessory drive (1).
- (2) Install accessory drive (1) in gear housing (2). Ensure that gear mates properly with injection pump gear and camshaft gear inside housing.



NOTE

Follow-on Maintenance: Install hydraulic pump drive (para 5-32).

END OF TASK

5-33. CLUTCH DRIVE ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Lifting device (500 lb capacity [227 kg])

Wrench, torque

Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

Compound, thread locking (item 15, appendix E)

Lo&washers (19)

Locknuts (4)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para
Para 4-27

Para 4-124

Para 4-117

Para 4-132

Para4-93

Para 5-34

Para 5-36

Condition Description

Rotor drive assembly drained.

ROPS/FOPS removed.

Steering wheel removed.

Forward floor plate removed.

Ground wire removed.

Clutch lube hose removed from clutch assembly.

Output flange removed.

a. Removal.

WARNING

Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

- Place suitable container with a 5 gallon (19 liters) capacity under flow control valve to catch spilling fluid.
 - Brake pedal assembly removed for clarity.
- (1) Disconnect hydraulic hose (1) from flow control valve (2) and move hose out of way,

NOTE

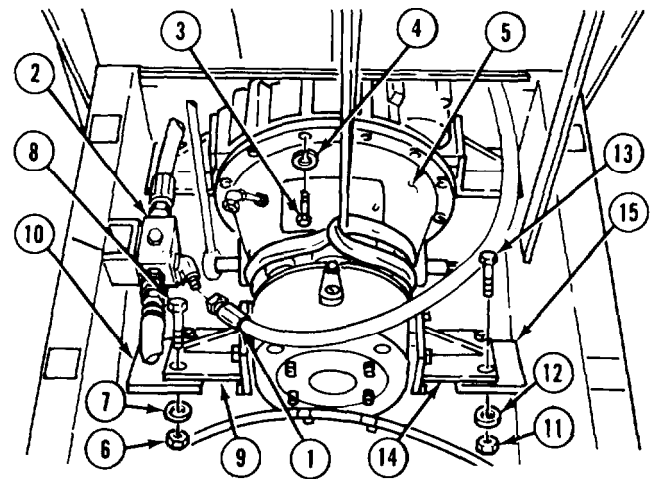
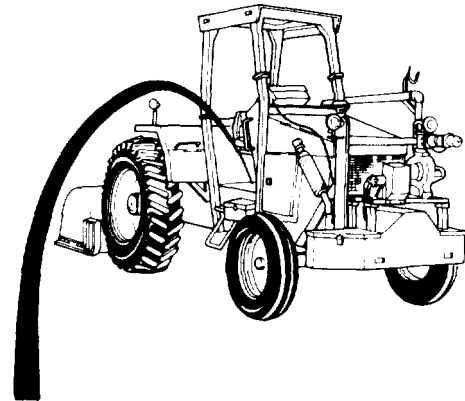
1 of 12 screws was removed with ground wire.

- (2) Remove 11 screws (3) and lockwashers (4) from clutch housing (5). Discard lockwashers.

WARNING

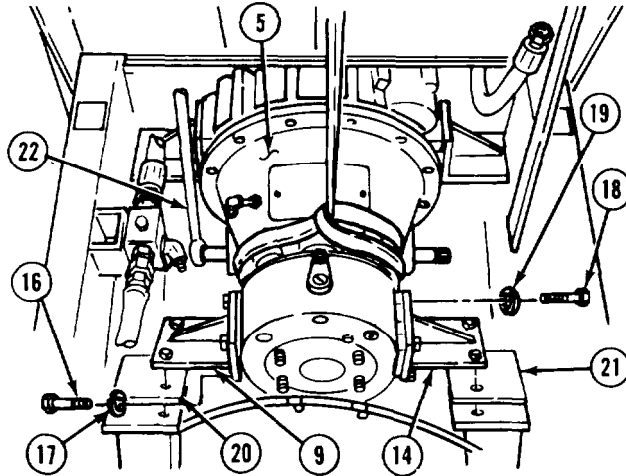
Clutch and drive assembly weighs 175 lbs (237 kg). Attach a suitable lifting device prior to removal to prevent possible injury to personnel.

- (3) Attach suitable lifting device to clutch (5).
- (4) Remove two locknuts (6), four washers (7), and two screws (8) from left clutch mount (9) and mounting bracket (10). Discard locknuts.
- (5) Remove two locknuts (11), four washers (12), and two screws (13) from right clutch mount (14) and mounting bracket (15). Discard locknuts.



5-33. CLUTCH DRIVE ASSEMBLY REPLACEMENT (CONT).

- (6) Remove four screws (16) and lockwashers (17) from left clutch mount (9) and clutch (5). Discard lockwashers.
- (7) Remove four screws (18) and lockwashers (19) from right clutch mount (14) and clutch (5). Discard lockwashers.
- (8) Remove both clutch mounts (9 and 14) and two rubber pads (20 and 21).
- (9) Mechanic operates lifting device while assistant holds clutch lever (22) and guides clutch assembly (5) from vehicle.



b. Installation.

WARNING

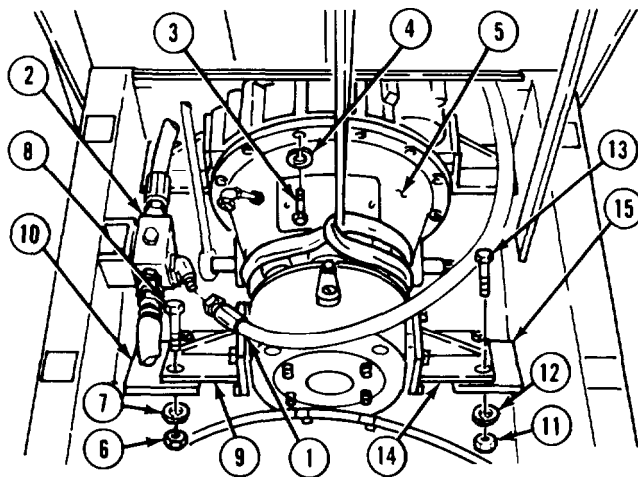
Clutch assembly weighs 175 lbs (237 kg). Attach a suitable lifting device prior to installation to prevent possible injury to personnel.

- (1) Mechanic operates lifting device while assistant moves clutch lever (22) back and guides clutch assembly (5) into place in vehicle.
- (2) Place rubber pad (21) beneath right clutch mount (14) and install clutch mount on clutch (5) with four lockwashers (19) and screws (18). Tighten screws 150 lb-ft (203 N•m).
- (3) Place rubber pad (20) beneath left clutch mount (9) and install clutch mount on clutch (5) with four lockwashers (17) and screws (16). Tighten screws 150 lb-ft (203 N•m).
- (4) Install right clutch mount (14) on mounting bracket (15) with two screws (13) four lockwashers (12) and two locknuts (11). Tighten locknuts 30 lb-ft (41 N•m).
- (5) Install left clutch mount (9) on mounting bracket (10) with two screws (8), four lockwashers (7), and two locknuts (6). Tighten locknuts 30 lb-ft (41 N•m).

NOTE

1 of 12 screws was removed with ground wire.

- (6) Install clutch (5) with 11 lockwashers (4) and screws (3). Tighten screws 45 lb-ft (61 N•m).
- (7) Connect hydraulic hose (1) to flow control valve (2).



NOTE

Follow-on Maintenance:

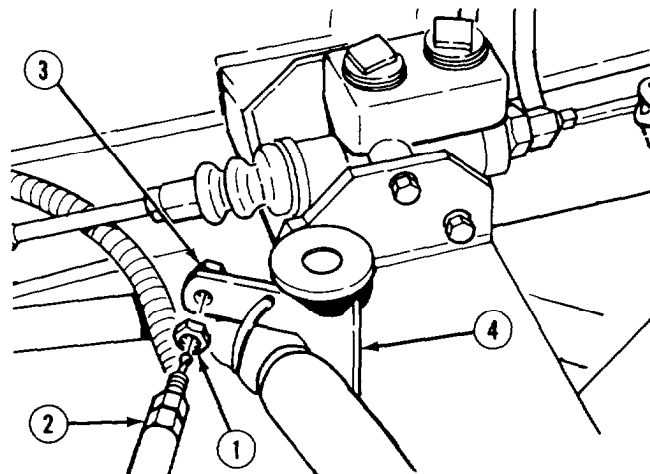
- Install output flange (para 5-36).
- Install clutch lube hose (para 5-34).
- Install ground wire (para 4-93).
- Install forward floor plate (para 4-132).
- Install steering wheel (para 4-117).
- Install ROPS/FOPS (para 4-124).
- Fill drive assembly (para 4-27).

END OF TASK

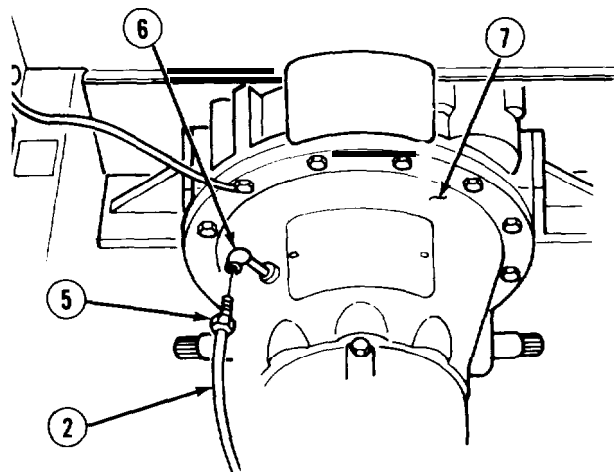
5-34. CLUTCH LUBE HOSE REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: automotive	TM or Para Para 2-15	Aft floor deck raised and supported.
	Para 4-132	Forward floor plate removed.

a. Removal.

- (1) Loosen nut (1).
- (2) Remove lube hose (2) from jamnut (3) and mounting bracket (4).
- (3) Remove jamnut (1) from lube hose (2).



- (4) Loosen fitting (5) and remove lube hose (2) from elbow (6) on clutch housing (7).

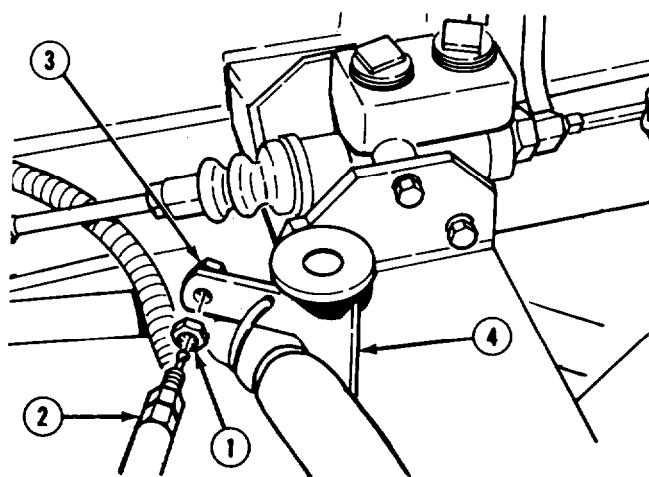
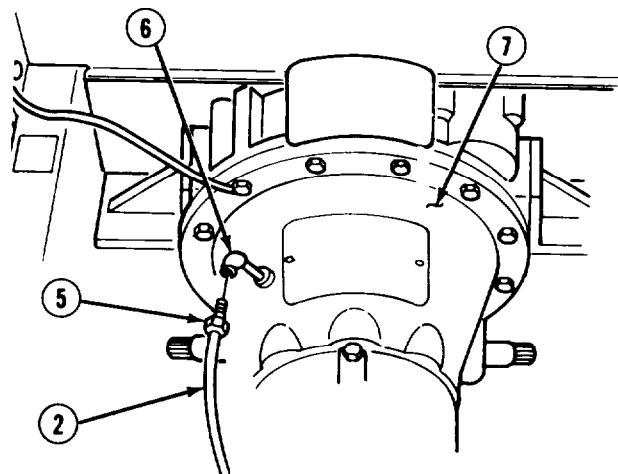


b. Cleaning/Inspection.

- (1) Check for damaged parts.
- (2) Replace damaged parts.
- (3) Fill with grease. See lube chart (figure 3-1).

c. Installation.

- (1) Install lube hose (2) in elbow (6) on clutch housing (7) and tighten fitting (5).
- (2) Install jamnut (1) on lube hose (2). See lube chart (figure 3-1).
- (3) Install lube hose (2) in mounting bracket (4) and jamnut (3).
- (4) Tighten jamnut (1) against mounting bracket (4).

**NOTE**

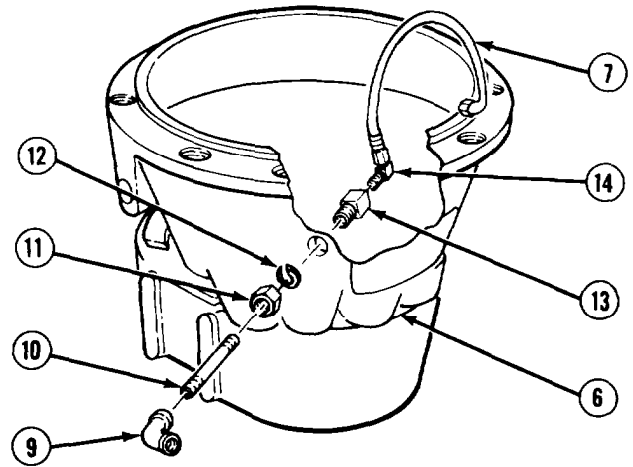
Follow-on Maintenance:

- Install forward plate (para 4-132).
- Lower aft floor deck (para 2-15).

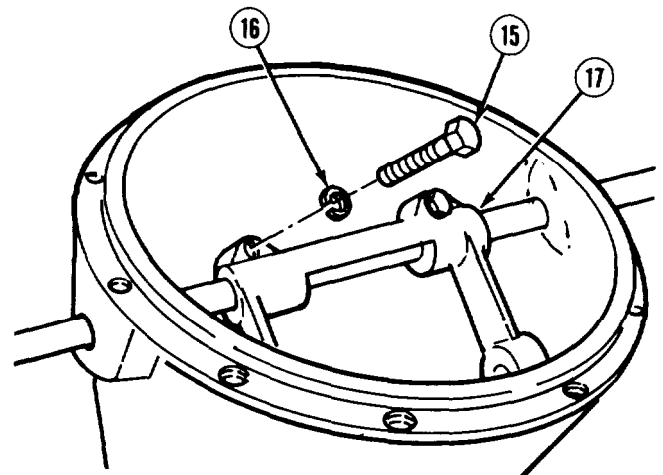
END OF TASK

- (4) Remove elbow (9), nipple (10), nut (11), lockwasher (12) from clutch housing (6). Discard lo&washer.

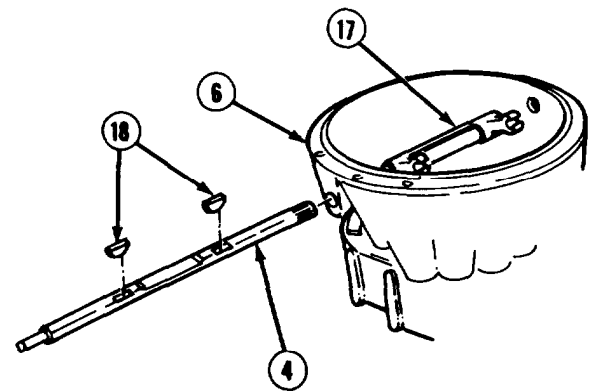
- (5) Remove reducer (13), elbow (14) grease hose (7) from clutch housing (6).



- (6) Remove two screws (15) and lockwashers (16) from throwout yoke (17). Discard lockwashers.

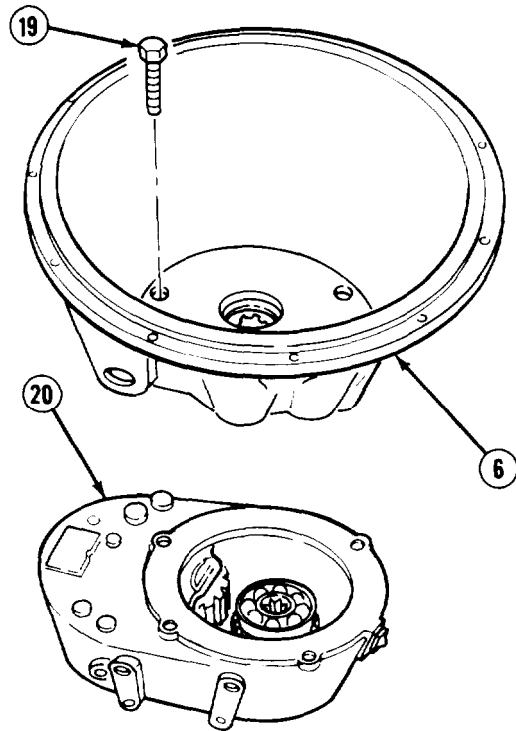


- (7) Slide throwout yoke (17) along shaft (4) and remove two keys (18), throwout yoke (17), and shaft (4) from clutch housing (6).

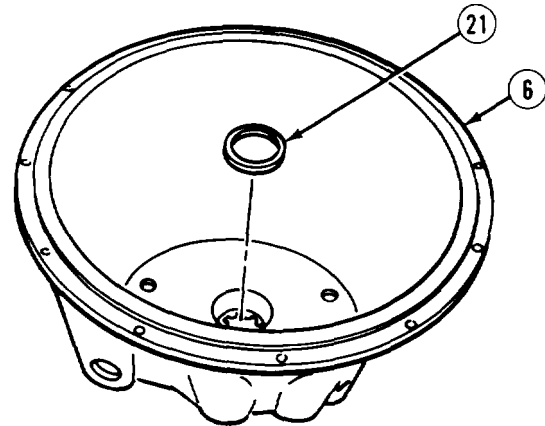


5-35. CLUTCH HOUSING REPAIR (CONT).

- (8) Remove four screws (19) and clutch housing (6) from drive assembly (20).



- (9) Remove grease seal (21) from clutch housing (6). Discard grease seal.



b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

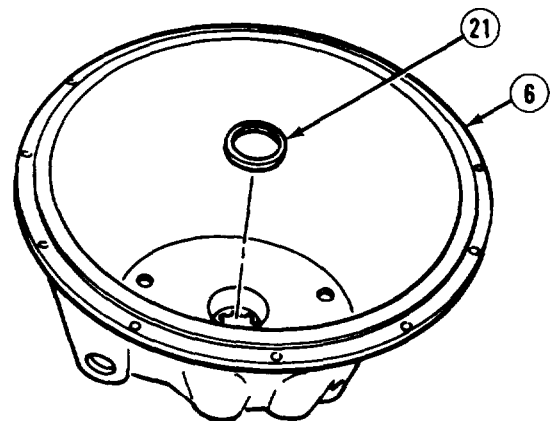
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry metal parts.
- (3) Check throwout yoke for breaks or cracks.
- (4) Check shaft for wear, scoring, nicks, or cracks.
- (5) Check grease hose and fittings for evidence of wear or damage.
- (6) Replace damaged parts.

c. Assembly.

- (1) Install grease seal (21) in clutch housing (6).

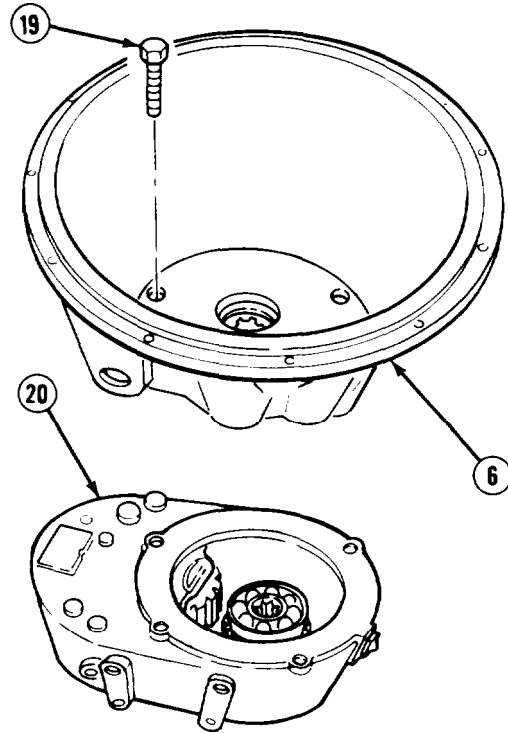


5-35. CLUTCH HOUSING REPAIR (CONT).

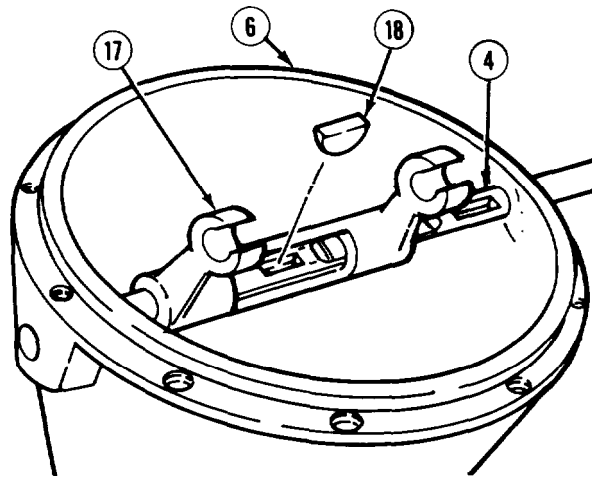
WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

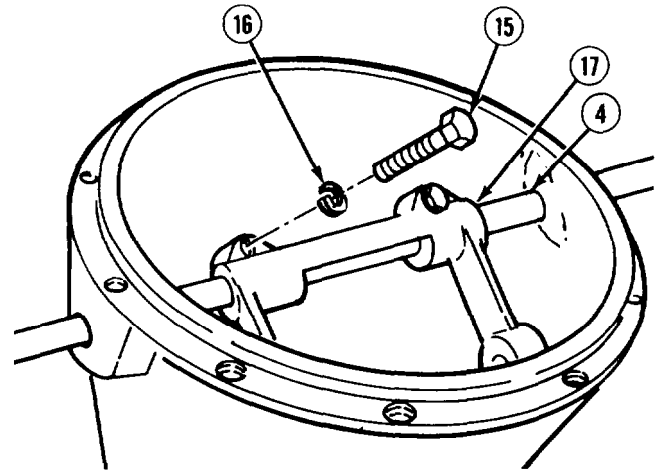
- (2) Apply sealant to face of drive assembly (20) and install clutch housing (6) with four screws (19). Tighten screws to 110 to 120 lb-ft (149 • 163 N•m).



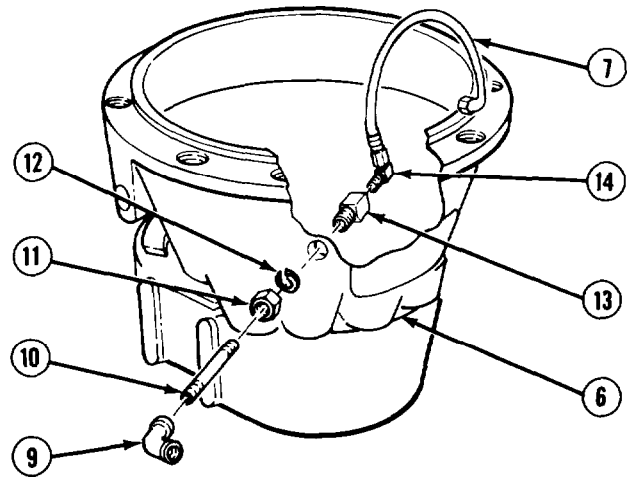
- (3) Install throwout yoke (17) and shaft (4) in clutch housing (6). Install two keys (18) in shaft.



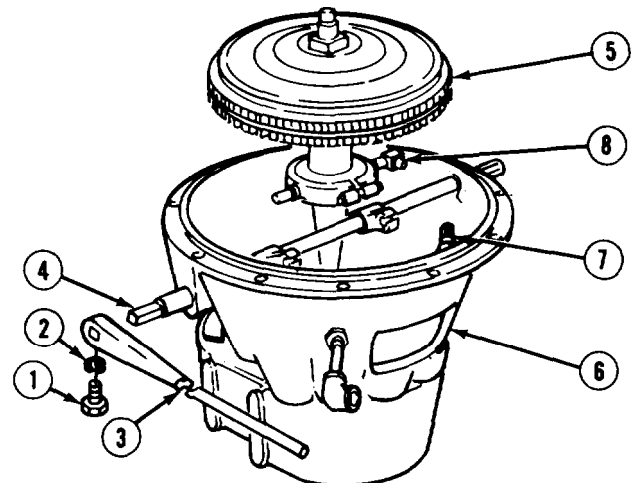
- (4) Position throwout yoke (17) on shaft (4) and install two lockwashers (16) and screws (15).



- (5) Install elbow (14) and reducer (13) on grease hose (7).
- (6) Install grease hose (7) in clutch housing (6) with lockwasher (12) and nut (11).
- (7) Install nipple (10) and elbow (9) in reducer (13).



- (8) While mechanic installs clutch assembly (5), assistant connects grease hose (7) to elbow (8).
- (9) Install the clutch assembly (5) into clutch housing (6).
- (10) Install handle (3) on shaft (4) with lockwasher (2) and screw (1).



NOTE

Follow-on Maintenance: Install clutch drive assembly (para 5-33).

END OF TASK

5-36. OUTPUT FLANGE ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Shop equipment, automotive maintenance and repair: organizational maintenance common no. 1, less power

Wrench, torque

Materials/Parts

Adhesive sealant, silicone (item 1, appendix E)

Equipment Condition

TM or Para

Para 4-132

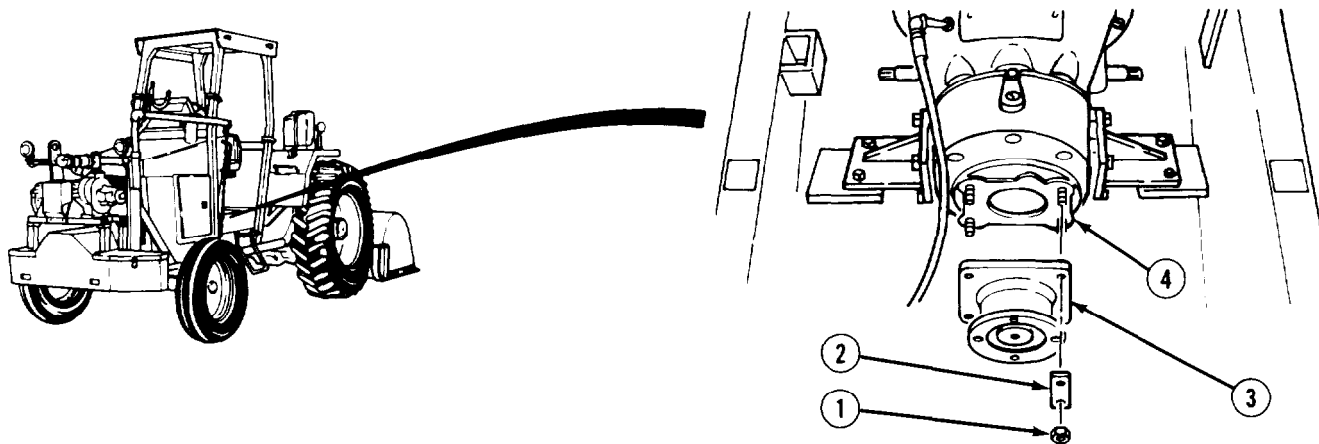
Para 4-102

Para 4-105

Condition Description
Forward floor plate removed.

Clutch drive shaft removed.

Parking brake cable removed.



a. Removal.

- (1) Remove four nuts (1) and two brackets (2) from output flange assembly (3).
- (2) Remove flange (3) from clutch face (4).

b. Installation.

WARNING

Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) Apply sealant to face of clutch (4) and install output flange assembly (3) and two brackets (2) with four nuts (1). Tighten nuts 250 to 270 lb-ft (339 - 366 N•m).

NOTE

Follow-on Maintenance:

- Install parking brake cable on clutch (para 4-105).
- Install clutch drive shaft to pillow block (para 4-102).
- Install forward floor plate (para 4-132).

END OF TASK

5-37. OUTPUT FLANGE ASSEMBLY REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Equipment Condition

TM or Para
Para 5-36

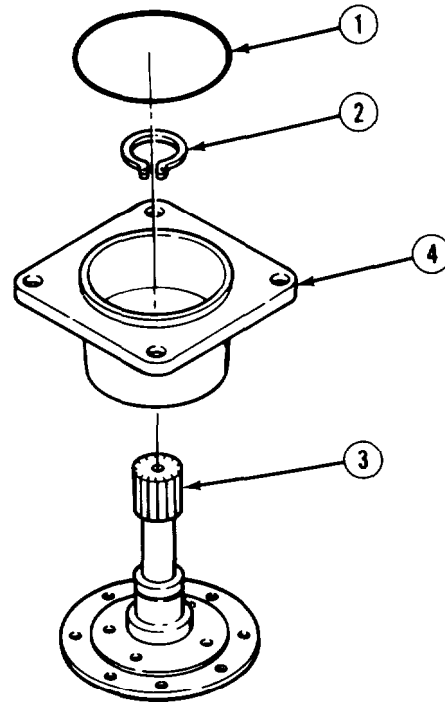
Condition Description
Output flange assembly removed.

Materials/Parts

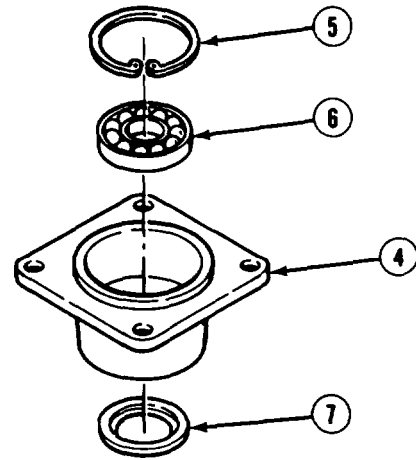
Cloth, lint-free (item 12, appendix E)
Packing, preformed
Seal
Grease, general purpose (item 25, appendix E)
Solvent, drycleaning (item 54, appendix E)

a. Disassembly.

- (1) Remove preformed packing (1) retaining ring (2) and shaft (3) from output flange plate (4). Discard preformed packing.



- (2) Remove retaining ring (5), bearing (6), and seal (7) from output flange plate (4). Discard seal.



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

WARNING

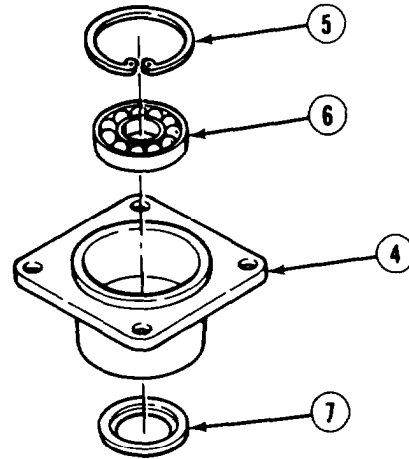
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearing to air dry.
- (4) Check flange plate breaks, cracks, or sharp edges.
- (5) Check shaft for nicks, gouges, or damaged splines.
- (6) Check bearings for galling, scoring, nicks, cracks, or pitting.
- (7) Replace damaged parts.

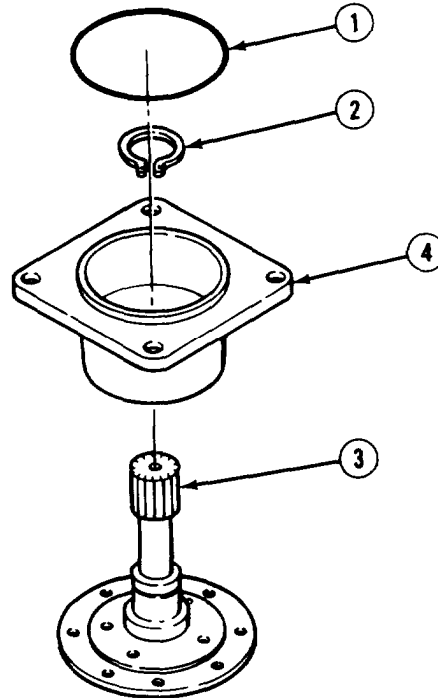
5-37. OUTPUT FLANGE ASSEMBLY REPAIR (CONT).

c. Assembly.

- (1) Install bearing (6), retaining ring (5), and seal (7) in output flange plate (4).



- (2) Install shaft (3), retaining ring (2), and preformed packing (1) in output flange plate (4).



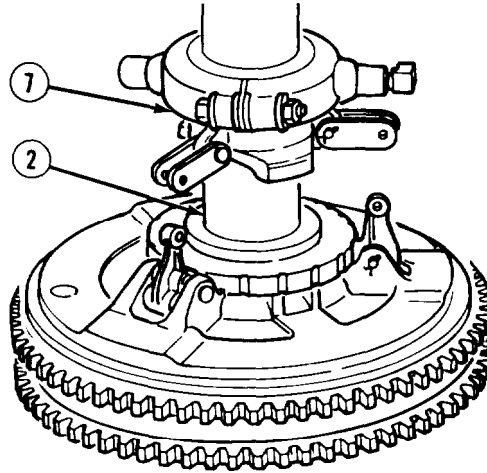
NOTE

Follow-on Maintenance: Install output flange assembly (para 5-36).

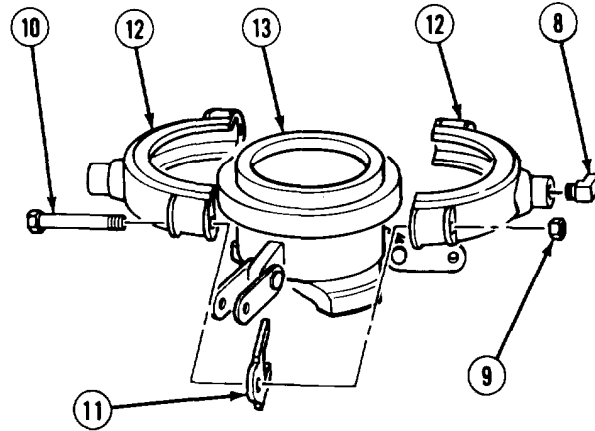
END OF TASK

5-38. CLUTCH ASSEMBLY REPAIR (CONT).

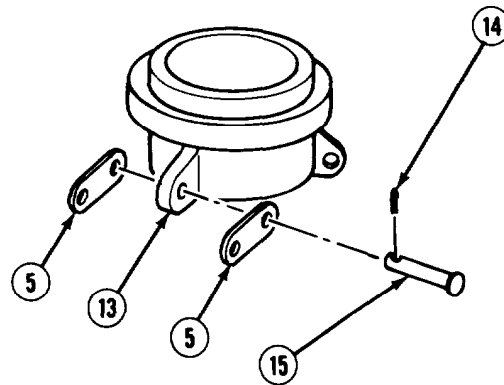
- (3) Remove collar assembly (7) from clutch shaft (2).



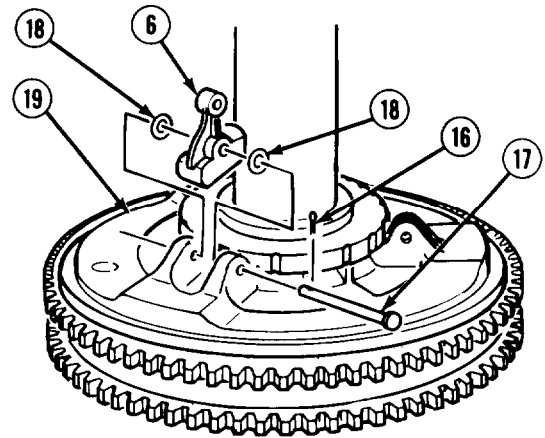
- (4) Remove elbow (8), two locknuts (9), screws (10), spacers (11), and collar halves (12) from sleeve (13). Discard locknuts.



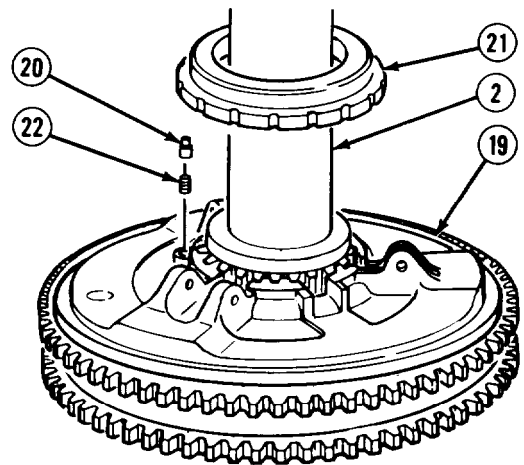
- (5) Remove three cotter pins (14), pins (15), and six links (5) from sleeve (13). Discard cotter pins.



- (6) Remove three cotter pins (16), pins (17), six spring washers (18), and three pawls (6) from retaining plate (19). Discard cotter pins.

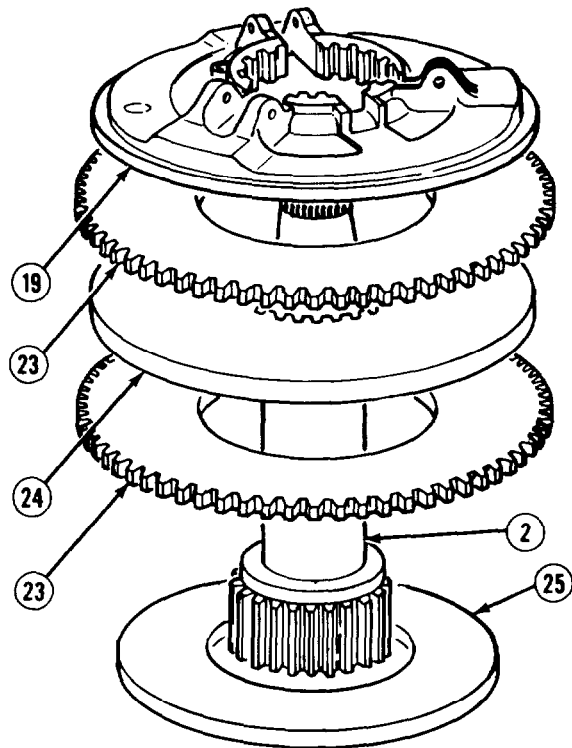


- (7) Depress adjusting pin (20), and remove adjusting ring (21) from clutch shaft (2).
- (8) Remove adjusting pin (20) and spring (22), from retaining plate (19).

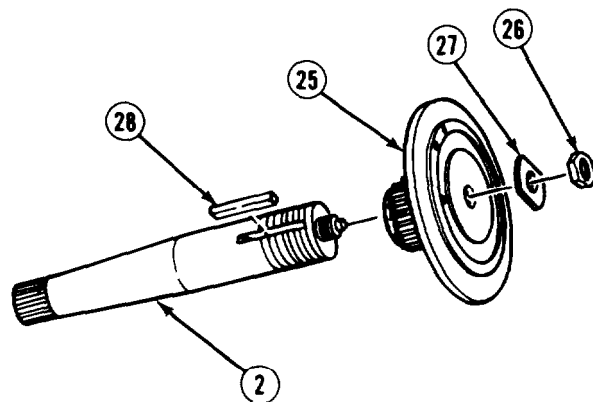


5-38. CLUTCH ASSEMBLY REPAIR (CONT).

- (9) Remove retaining plate (19), two clutch discs (23), and center plate (24) from back plate (25).



- (10) If damaged, remove locknut (26), lock-washer (27), back plate (25), and key (28) from clutch shaft (2). Discard locknut.



b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

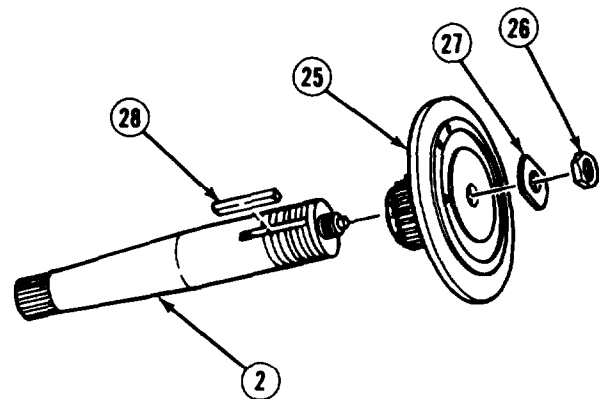
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry metal parts.
- (3) Check retaining plate, center plate, and back plate for galling, scoring, nicks, or cracks.
- (4) Check shaft for burrs, nicks, cracks, crossed threads, or damaged splines.
- (5) Check collar and sleeve for galling, scoring, nicks, or cracks.
- (6) Check pins for excessive wear.
- (7) Replace damaged parts.

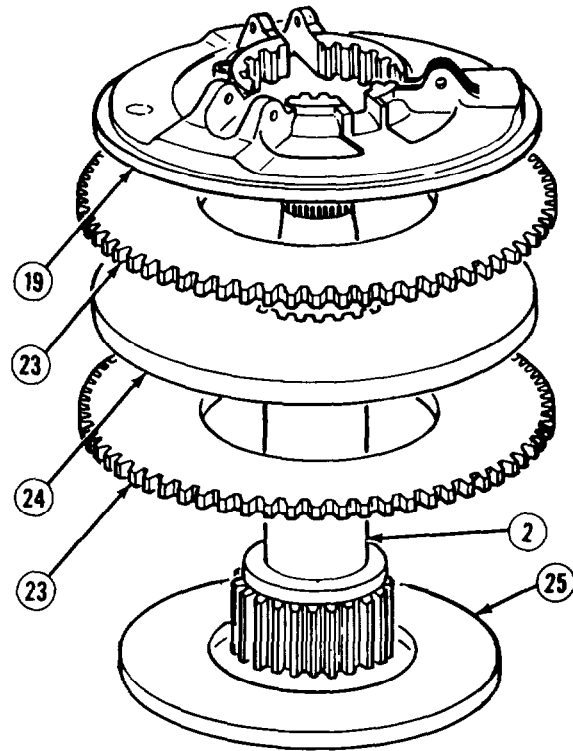
c. Assembly.

- (1) If removed, install back plate (25) on clutch shaft (2) with key (28), lockwasher (27), and locknut (26). Refer to measurement taken in disassembly step (1) and tighten locknut until the correct amount of thread (1) is exposed.
- (2) Bend lockwasher (27) against one side of locknut (26).

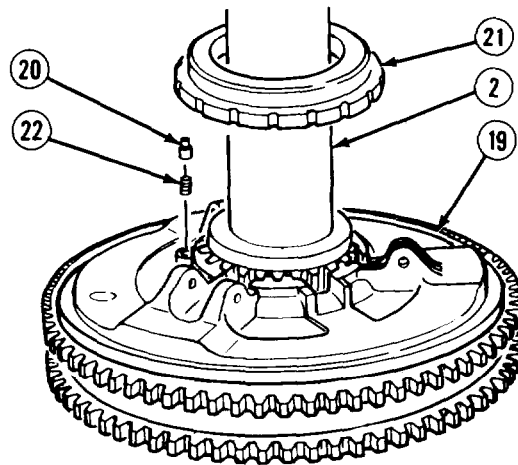


5-38. CLUTCH ASSEMBLY REPAIR (CONT).

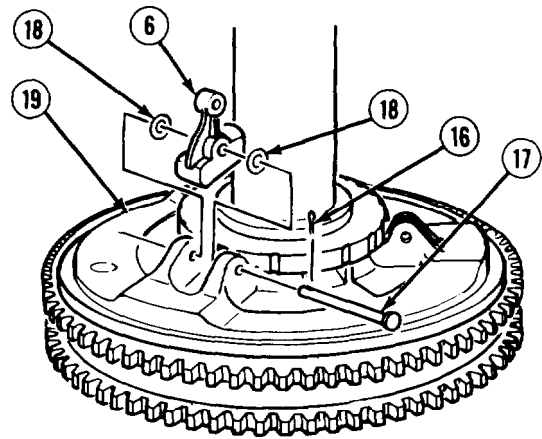
- (3) Install one clutch disc (23), center plate (24), remaining clutch disc (23), and retaining plate (19) over clutch shaft (2) on backplate (25).



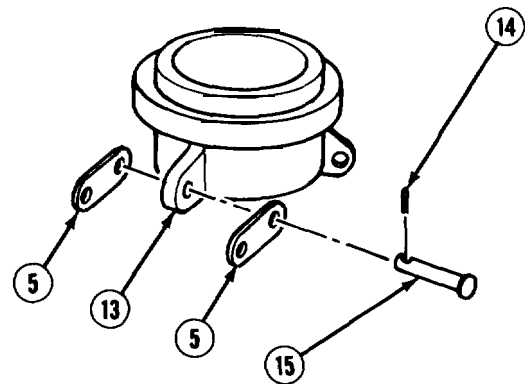
- (4) Install spring (22) and adjusting pin (20) in retaining plate (19).
- (5) Depress adjusting pin (20) and install adjusting ring (21) on clutch shaft (2). Tighten adjusting ring until it fits snugly against retaining plate (19).



- (6) Install three pawls (6) and six spring washers (18) on floating plate (19) with three pins (17) and cotter pins (16).

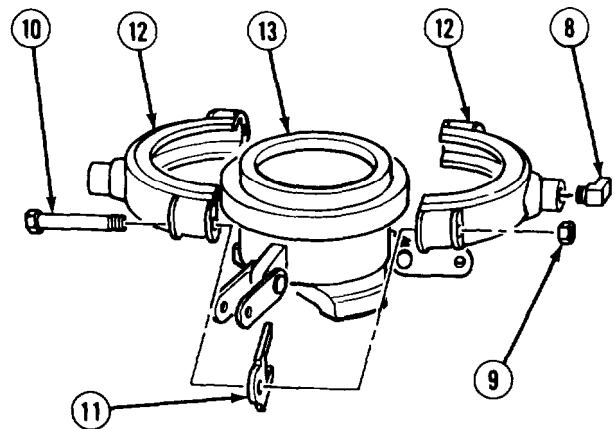


- (7) Install six links (5) on sleeve (13) with three pins (15) and cotter pins (14).



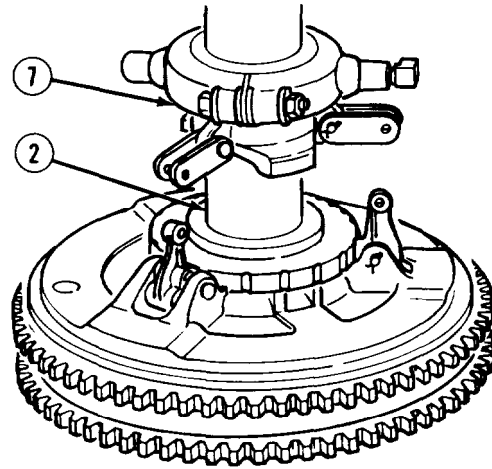
- (8) Install two collar halves (12) on sleeve (13) with two spacers (11), screws (10), and locknuts (9). Tighten nuts 25 to 30 lb-ft (34 - 41 N•m).

- (9) Install elbow (8) on collar (12).

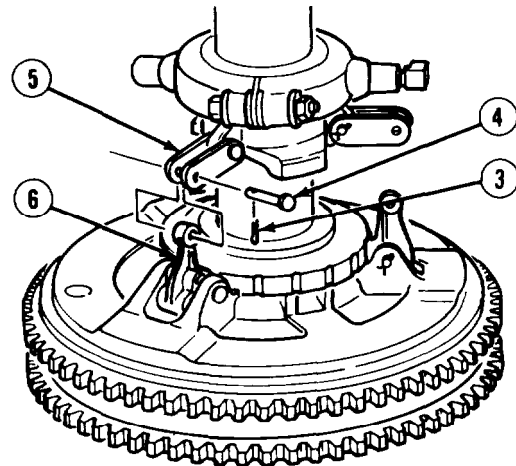


5-38. CLUTCH ASSEMBLY REPAIR (CONT).

- (10) Install collar assembly (7) on clutch shaft (2).



- (11) Attach three pairs of links (5) to pawls (6) with pins (4) and cotter pins (3).



NOTE

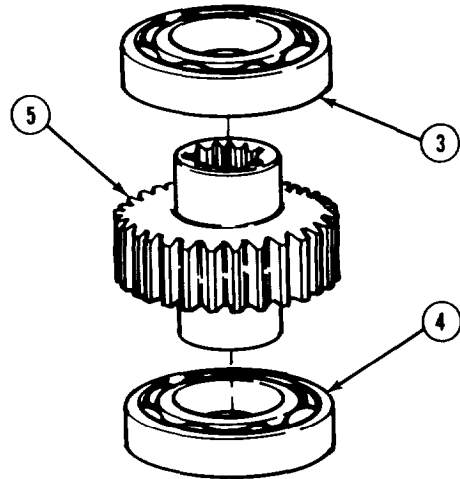
Follow-on Maintenance:

- Install clutch drive assembly (para 5-33).
- Lubricate clutch assembly (figure 3-1).

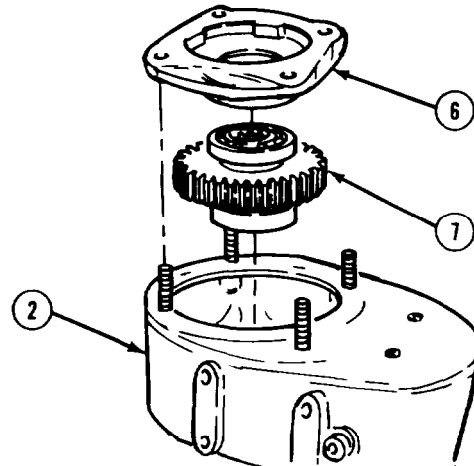
END OF TASK

5-39. DRIVE ASSEMBLY REPAIR (CONT).

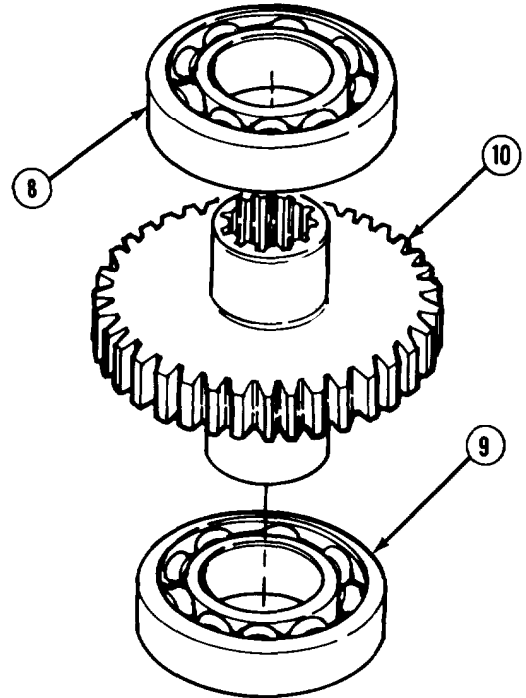
- (2) Remove bearings (3 and 4) from driven gear (5).



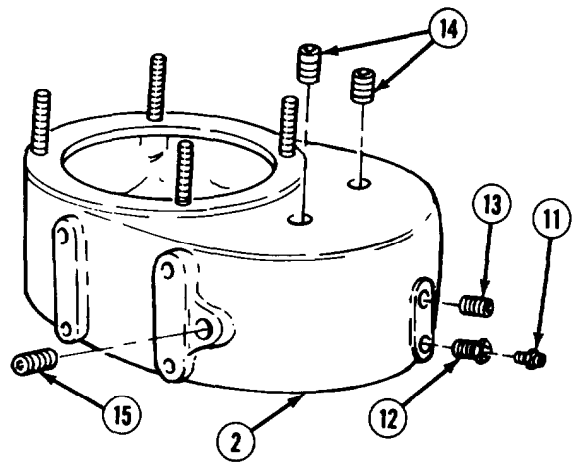
- (3) Turn drive housing (2) over and remove adaptor plate (6).
- (4) Remove drive gear assembly (7) from drive housing (2).



- (5) Remove bearings (8 and 9) from drive gear (10).

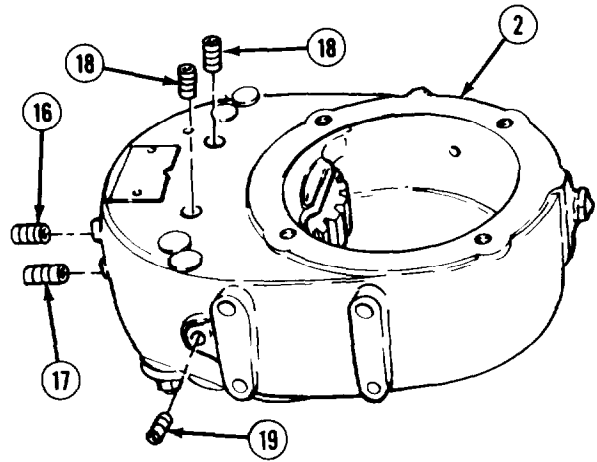


- (6) Remove breather (11), reducer bushing (12), and four plugs (13,14, and 15) from housing (2).



5-39. DRIVE ASSEMBLY REPAIR (CONT).

- (7) Turn drive housing (2) over remove magnetic plug (16) and four plugs (17,18, and 19).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearings to air dry.
- (4) Clean gasket material from housing (scraps) and adaptor.
- (5) Check housing and adaptor for breaks, cracks, or other damage.
- (6) Check bearings for galling, scoring, nicks, cracks, or pitting.

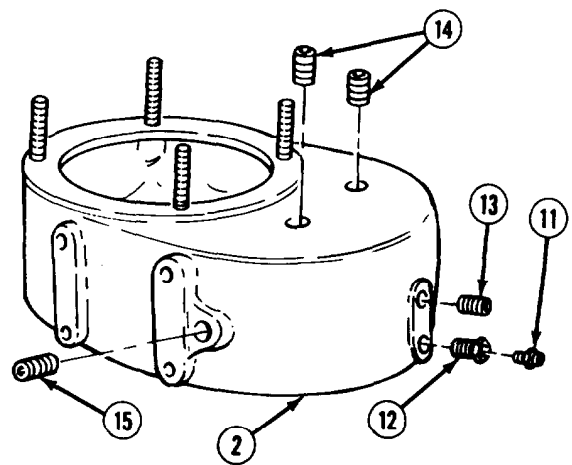
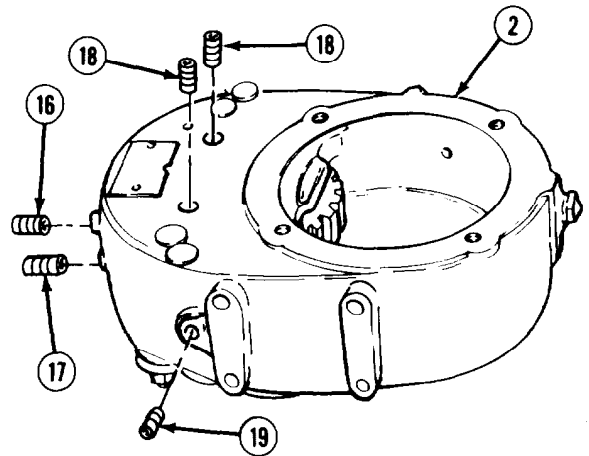
- (7) Check all threads for crossed or peeled condition.
- (8) Lubricate bearings with grease before installing.

c. *Assembly.*

WARNING

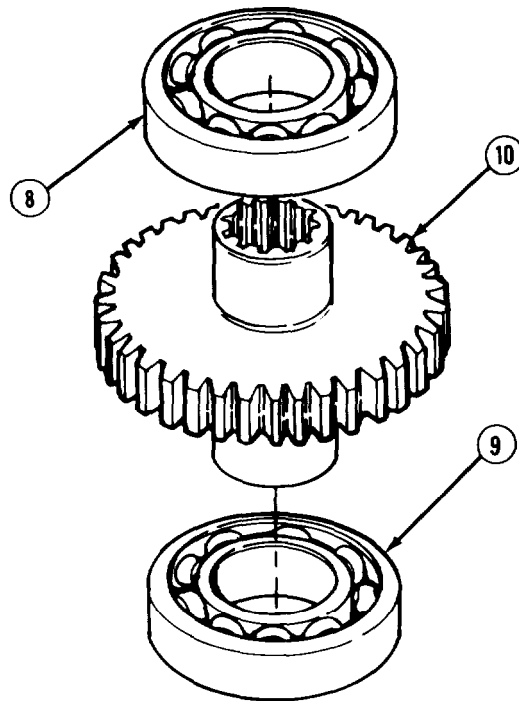
Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply hydraulic thread sealant to threads of four plugs (19,18, and 17) and magnetic plug (16) and install in drive housing (2).
- (2) Apply hydraulic sealant to threads of four plugs (15,14, and 13), reducer bushing (12), and breather (11) and install in drive housing (2).



5-39. DRIVE ASSEMBLY REPAIR (CONT).

- (3) Install bearings (9 and 8) on drive gear (10).



- (4) Install drive gear assembly (7) in drive housing (2).

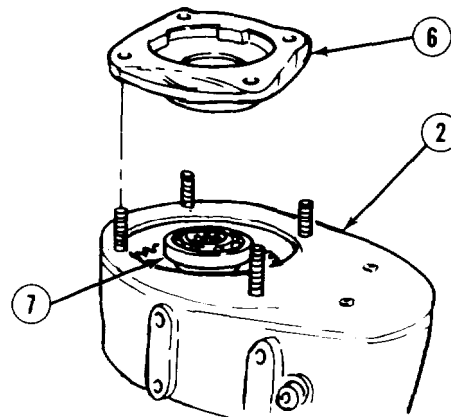
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

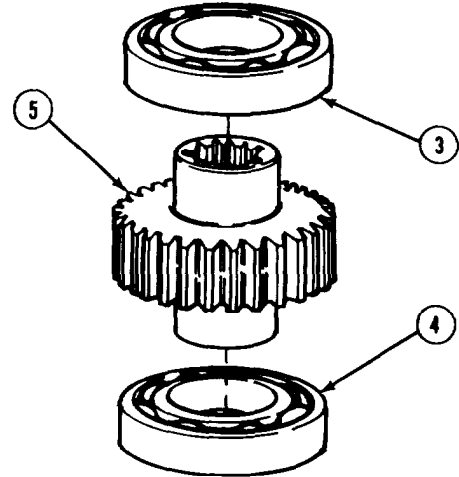
NOTE

In order to secure plate while adhesive sealant dries, four nuts from output flange assembly must be installed.

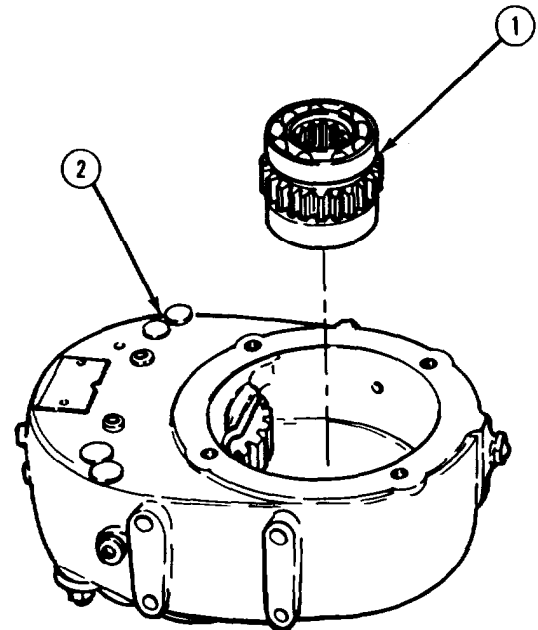
- (5) Apply sealant compound to face of drive housing (2) and install adaptor plate (6).



- (6) Install bearings (4 and 3) on driven gear (5).



- (7) Turn drive housing (2) over and install driven gear assembly (1).



NOTE

Follow-on Maintenance: Assemble clutch assembly (para 5-38).

END OF TASK

5-40. FUEL INJECTION PUMP REPLACEMENT.

This task covers:

- a. Pre-removal/Adjustment b. Removal c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Vibration damper holder

Materials/Parts

Injection pump gasket

Equipment Condition

TM or Para
Para 4-47

Para 4-56

Para 4-41

Para 5-26

Condition Description

Fuel lines to injector pump removed.

Throttle cable and bracket removed.

Shutdown solenoid removed.

Gear cover removed.

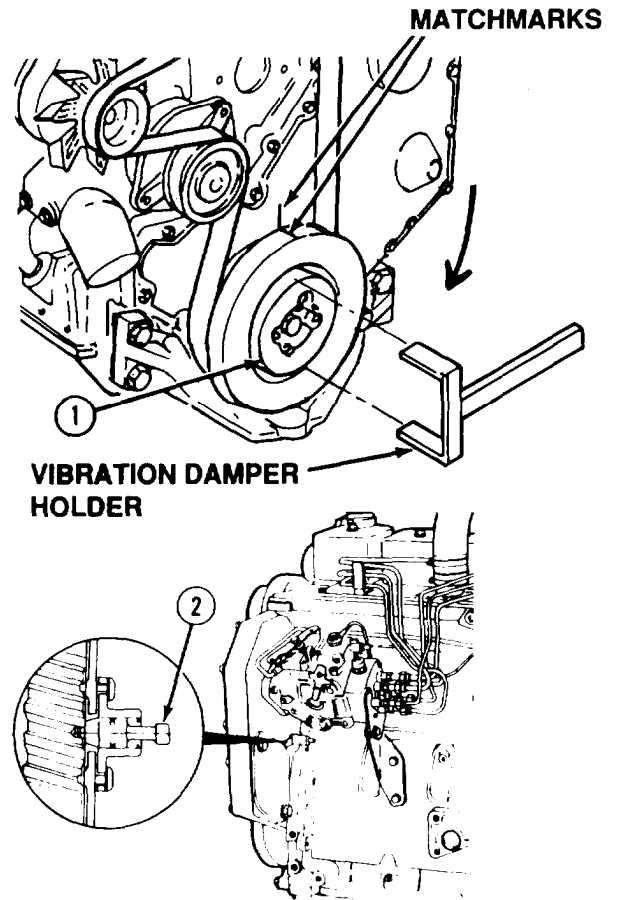
General Safety Instructions

Fuel is very flammable and can explode easily.

- a. **Pre-removal/Adjustment.** Locate top dead center (TDC) as follows:

NOTE

- A vibration damper holder is required for this task and must be fabricated (para F-7, appendix F).
- Timing pin will lock in when TDC is located.
 - (a) Place a vibration damper holder between screws (1) and turn to the right (clockwise) while depressing timing pin (2).
 - (b) Disengage timing pin (2).
 - (c) Matchmark vibration damper (3) and timing cover (4).

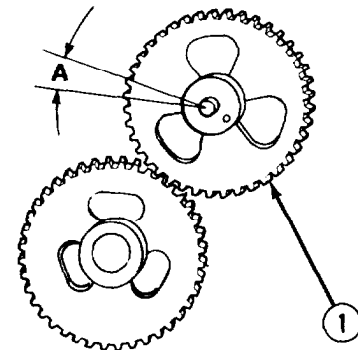


- b. **Removal.**

NOTE

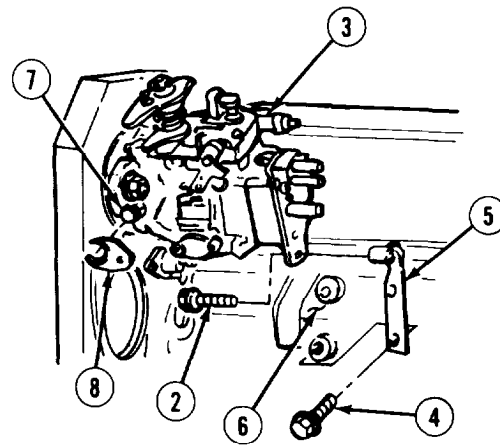
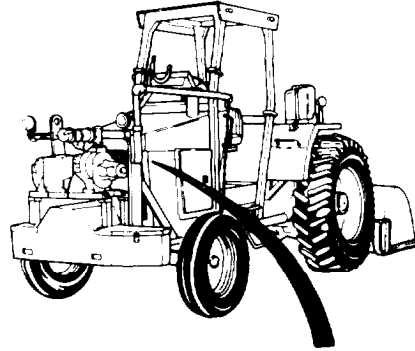
Hold adjoining (camshaft) gear while measuring backlash. This is to prevent reading from both gears.

- (1) Measure injection pump gear (1) backlash at position A. Normal measurement is 0.003 to 0.013 in. (0.08 - 0.33 mm). If measurement is above or below normal, replace gear.



5-40. FUEL INJECTION PUMP REPLACEMENT (CONT).

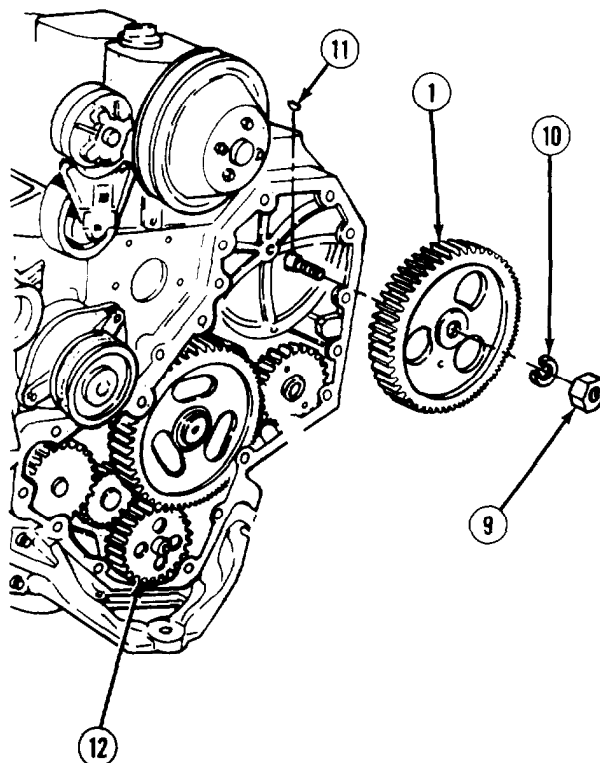
- (2) Remove screw (2) from injection pump (3).
- (3) Remove two screws (4) and brace (5) from engine block (8).
- (4) Loosen timing lock screw (7) and remove timing lock washer (8).
- (5) Tighten timing lock screw (7) 22 lb-ft (30 N•m).
- (6) Wire timing lock washer (8) to injection pump (3).



CAUTION

Hold crankshaft to prevent shaft of injection pump from turning. Otherwise damage to injection pump will result.

- (7) Remove nut (9) and spring washer (10). Discard spring washer.
- (8) Remove gear (1) and key (11) while holding crankshaft gear (12).

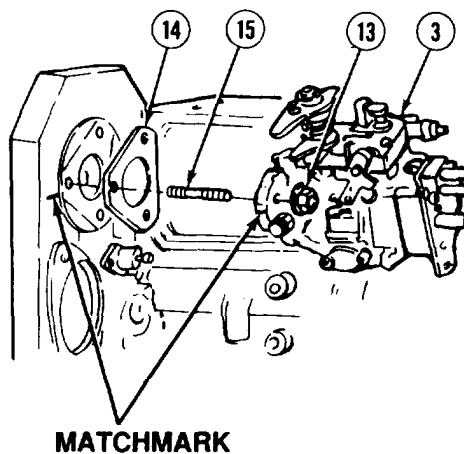


- (9) Matchmark and remove three nuts (13), injection pump (3), and gasket (14). Discard gasket.
- (10) If damaged, remove and discard three studs (15).

c. Installation.

NOTE

- Ensure that engine is at top dead center (TDC).
- Ensure that injection pump shaft is locked and shaft key is aligned with gear housing and gear.



- (1) If necessary, repeat step **a. Pre-removal/Adjustment** to locate TDC.
- (2) If removed, install three studs (15).
- (3) Install gasket (14).
- (4) Install injection pump (3) and three nuts (13). Hand-tighten nuts.

5-40. FUEL INJECTION PUMP REPLACEMENT (CONT).

CAUTION

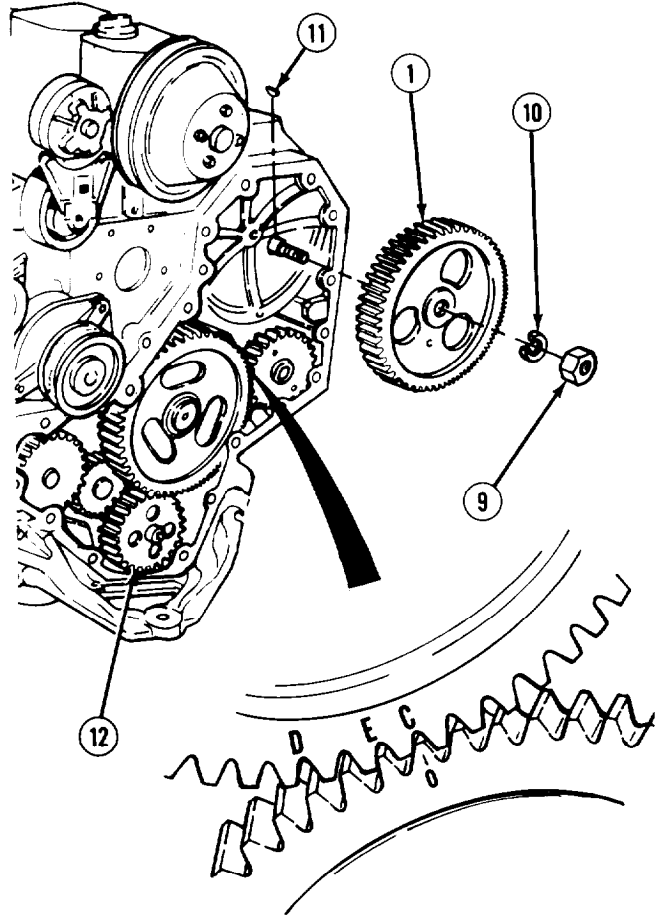
Ensure that letter C on injection pump gear aligns with timing mark on camshaft. Failure to align will result in damage to injection pump and engine.

- (5) Install gear (1) while holding crankshaft (12).

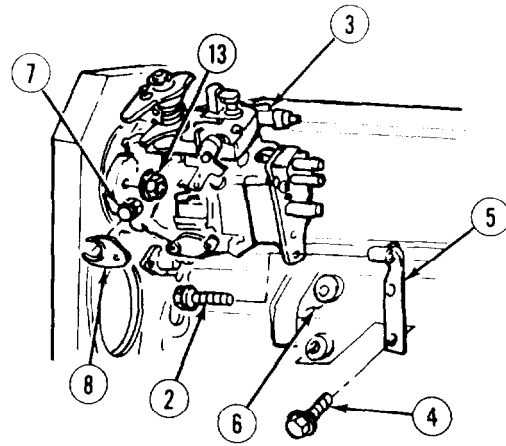
CAUTION

Disengage timing pin before tightening nut or damage may result to gear and timing pin.

- (6) Install spring washer (10) and nut (9). Tighten nut 132 to 180 lb-in (15 - 20 N•m).



- (7) If installing new injection pump (3), take up gear lash by rotating pump against direction of gear rotation.
- (8) If installing new injection pump (3), tighten three nuts (13) 216 lb-in (24 N•m). Permanently mark new injection pump to align with mark on gear housing.
- (9) If installing used injection pump (3), rotate injection pump to align scribe marks and tighten three nuts (13) 216 lb-in (24 N•m).
- (10) Remove timing lock washer (8) from injection pump (3).
- (11) Loosen timing lock screw (7) and install timing lock washer (8). Tighten screw 84 lb-in (10 N•m).
- (12) Install brace (5) with three screws (4 and 2). Tighten screws 216 lb-in (24 N•m).



NOTE

Follow-on maintenance:

- Install gear cover (para 5-26).
- Install shutdown solenoid (para 4-41).
- Install fuel control throttle and bracket (para 4-56).
- Install injection pump fuel lines (para 4-47).
- Bleed fuel system (para 4-54).

END OF TASK

5-41. ENGINE LOW IDLE SPEED ADJUSTMENT.

This task covers:

- a. Testing
- b. Adjustment

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 2-9

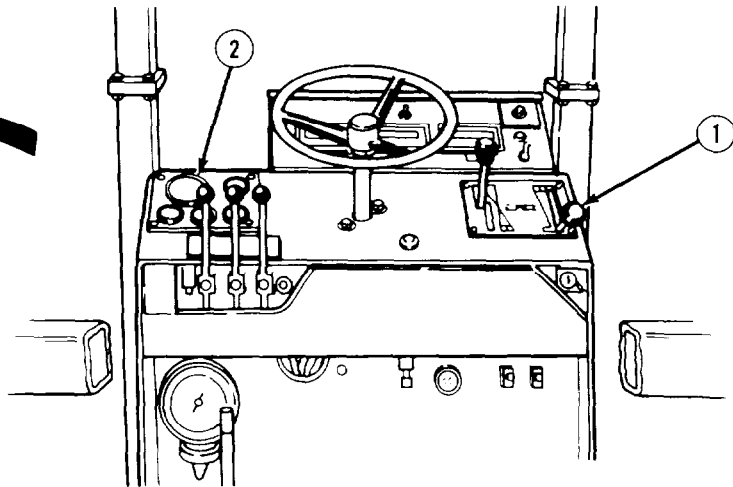
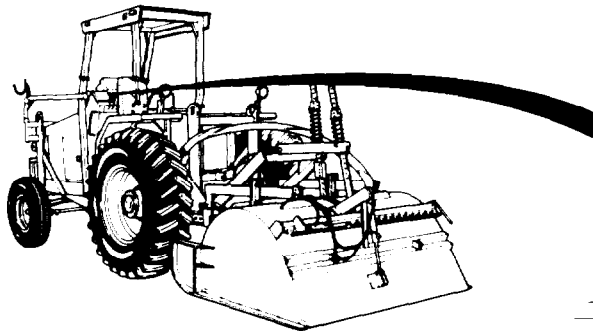
Para 2-14

Condition Description

Engine started.

Left engine door opened.

a. Testing.

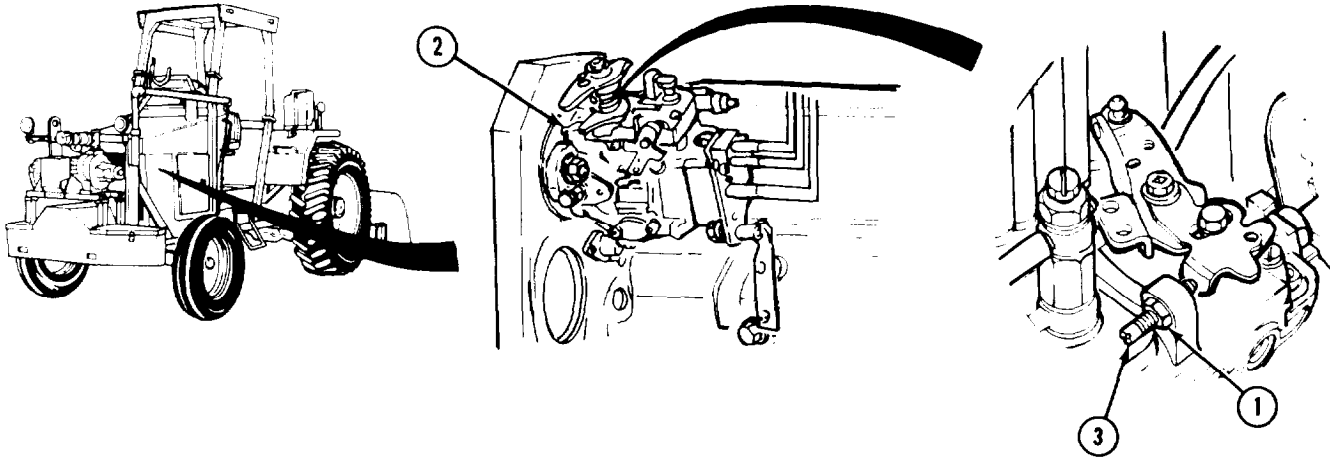


- (1) Set throttle (1) position for lowest idle speed.

NOTE

Ensure control lever on injection pump is flush against setscrew.

- (2) Check tachometer (2) for correct idle speed. If idle speed is not between 725 to 775 RPM, perform adjustment.



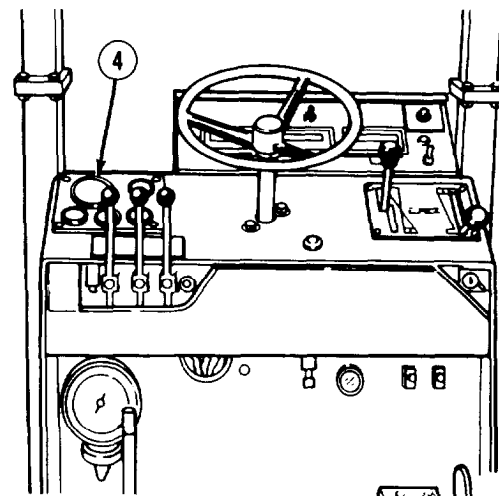
b. Adjustment.

- (1) Loosen nut (1) on injection pump (2).

NOTE

- To increase RPM, turn idle screw clock-wise. To decrease RPM, turn idle screw to the left (counterclockwise).
- Ensure control lever on injection pump is flush against setscrew for correct adjustment.

- (2) While mechanic adjusts idle screw (3), assistant checks tachometer (4). Adjust idle screw until idle speed is within 725 to 775 rpm. Tighten nut (1) 4.3 to 6.5 lb-ft (5.8 - 8.8 N•m).
- (3) If idle speed cannot be adjusted to limits, replace injection pump (para 5-40).



NOTE

Follow-on maintenance:

- Close left engine door (para 2-14).
- Turn engine off (para 2-10[c]).

END OF TASK

5-42. FUEL INJECTOR REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Test Equipment</i> Injector gauge pump	<i>Materials/Parts</i> Oil, penetrating (item 39, appendix E) Compound, anti-seize (item 13, appendix E) Gasket Washer, copper	
<i>Tools</i> Tool kit, master mechanics: automotive		
Shop equipment, general purpose repair: semi-trailer mounted	<i>Equipment Condition</i> <i>TM or Para</i> Para 4-44 Para 4-47	<i>Condition Description</i> Turbocharger removed. Injector fuel lines removed.
Wrench, torque		
<i>Materials/Parts</i> Solvent, drycleaning (item 54, appendix E) Oil, diesel fuel (item 30, appendix E) Brush, brass wire (item 4, appendix E) Fluid, calibrating (item 22, appendix E)	<i>General Safety Instructions</i> Fuel is very flammable and can explode easily.	

WARNING

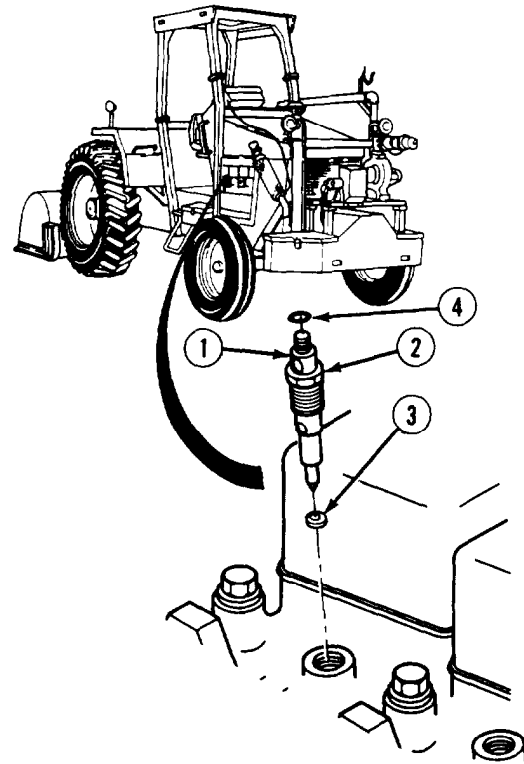
Fuel is very flammable and can explode easily. To avoid serious injury or death:

- Keep fuel away from open flame or any spark (ignition source).
- Keep at least a B-C fire extinguisher within easy reach when working with fuel or on a fuel system.
- Post signs that read “NO SMOKING WITHIN 50 FEET (15 m)” when working with open fuel, fuel hoses or fuel tanks.

*a. Removal.***NOTE**

All six fuel injectors are removed the same way.

- (1) If rust has formed on fuel injector (1), use penetrating oil on nut (2) and allow three minutes for soaking.
- (2) Tap fuel injector (1) with drift pin to loosen any rust.
- (3) While holding fuel injector (1), loosen nut (2) and remove fuel injector.
- (4) Remove and discard copper washer (3) and gasket (4).

*b. Cleaning/Inspection.*

- (1) Clean carbon off of valve using a brass wire brush.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (2) Clean nozzle holder with compressed air. New nozzle holders must be flushed with drycleaning solvent to remove protective coating.

5-42. FUEL INJECTOR REPLACEMENT (CONT).

- (3) Clean spray holes on end of valve. Rinse in drycleaning solvent and then in calibration fluid.
- (4) Check opening pressure as follows:
 - (a) Install fuel injector to injector gauge pump securely.
 - (b) Open valve and operate lever at one stroke per second.
 - (c) Read pressure when spray begins. Normal opening pressure is 3160 to 3307 psi (21778 - 22791 kPa).
- (5) Check spray pattern. Pattern must be a straight and steady stream.
- (6) Check leakage as follows:
 - (a) Open valve and operate lever.
 - (b) Hold pressure 290 psi (1999 kPa).
 - (c) No drops must fall within ten seconds.
- (7) Replace fuel injectors failing inspection.

c. Installation.

WARNING

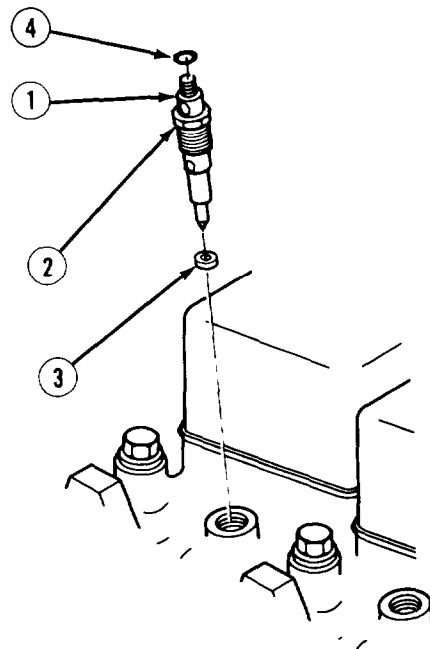
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply anti-seize compound on threads of nut (2).
- (2) Install copper washer (3).
- (3) Install fuel injector (1) and gasket (4). Tighten nut 44 lb-ft (60 N-m).

NOTE

Follow-on maintenance:

- Install injector fuel lines (para 4-47).
- Install turbocharger (para 4-44).
- Bleed fuel system (para 4-54).



END OF TASK

5-43. FUEL INJECTION PUMP REPAIR.

This task covers:

- | | |
|------------------------|---------------|
| a. Disassembly | c. Assembly |
| b. Cleaning/Inspection | d. Adjustment |

INITIAL SETUP

Tools

Shop equipment, fuel and electrical system engine: field maintenance, basic, less power

Equipment Condition

TM or Para
Para 5-40

Condition Description
Fuel injection pump removed.

Materials/Parts

- Cloth, lint free (item 12, appendix E)
- Fluid, calibration (item 20, appendix E)
- Grease, silicone (item 24, appendix E)
- Solvent, drycleaning (item 54, appendix E)
- Clip
- Gaskets (8)
- Lockwashers (2)
- Oil seal
- Plugs (2)
- Preformed packings (11)
- Sealing washers (2)
- Shims (13)

Special Environmental Conditions

Perform procedure in a clean and dry area.

5-43. FUEL INJECTION PUMP REPAIR (CONT).

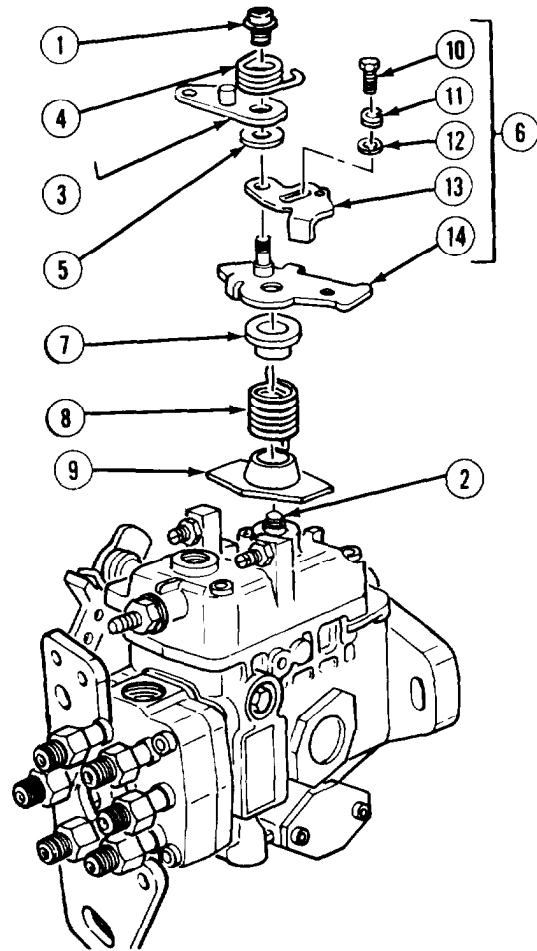
a. Disassembly.

- (1) Remove flange nut (1) and mark upper control lever (2) and control shaft (3) to align in assembly.
- (2) Remove upper spring (4), upper control lever (2), and intermediate disc (5).
- (3) Mark lower control lever assembly (6) to match scribe mark on control shaft (3) to align in assembly.
- (4) Remove lower control lever assembly (6), top spring seat (7) lower spring (8) and bottom spring seat (9).

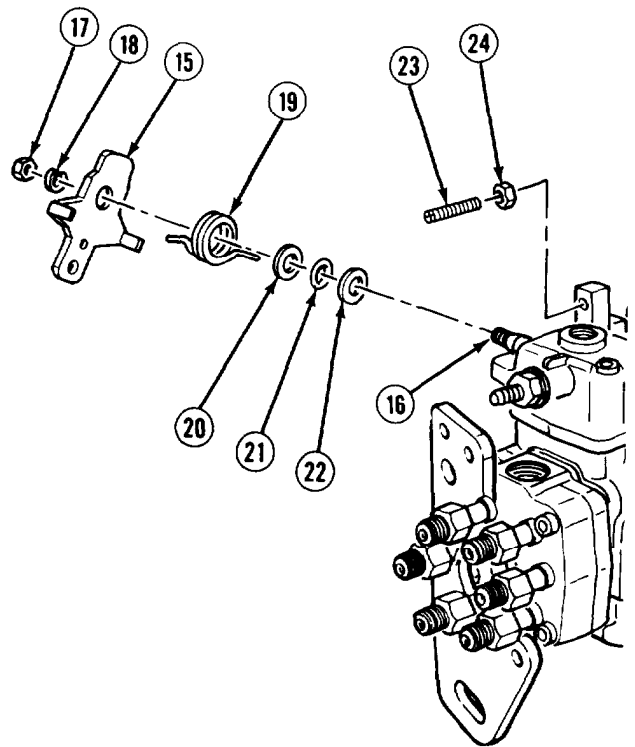
NOTE

Do not disassemble lower control lever assembly unless replacing a part.

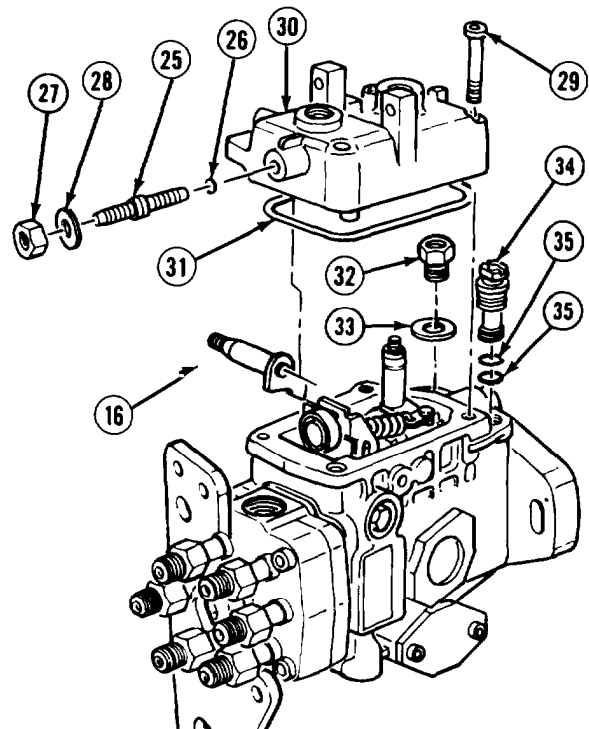
- (5) Remove screw (10), lockwasher (11), washer (12), and middle control lever (13) from bottom control lever (14). Discard lockwasher.



- (6) Mark manual lever (15) and lever shaft (16) to align in assembly.
- (7) Remove nut (17), lockwasher (18), manual lever (15), spring (19), and shim (20). Discard lockwasher and shim.
- (8) Remove preformed packing (21) and washer (22) from lever shaft (16). Discard preformed packing.
- (9) If damaged, remove two set screws (23) and nuts (24).



- (10) If damaged, remove full load adjusting screw (25), preformed packing (26), nut (27), and washer (28). Discard preformed packing.
- (11) Remove four screws (29) and housing cover (30).
- (12) Remove and discard preformed packing (30) from housing cover (29).
- (13) Remove lever shaft (16).
- (14) Remove adapter (32) and sealing washer (33). Discard sealing washer.
- (15) Remove control valve (34).
- (16) Remove and discard two preformed packings (35) from control valve (34).



5-43. FUEL INJECTION PUMP REPAIR (CONT).

NOTE

Mounting bracket is shown in art and is optional for the following steps.

- (17) Remove three screws (36 and 37) and support plate (38).

NOTE

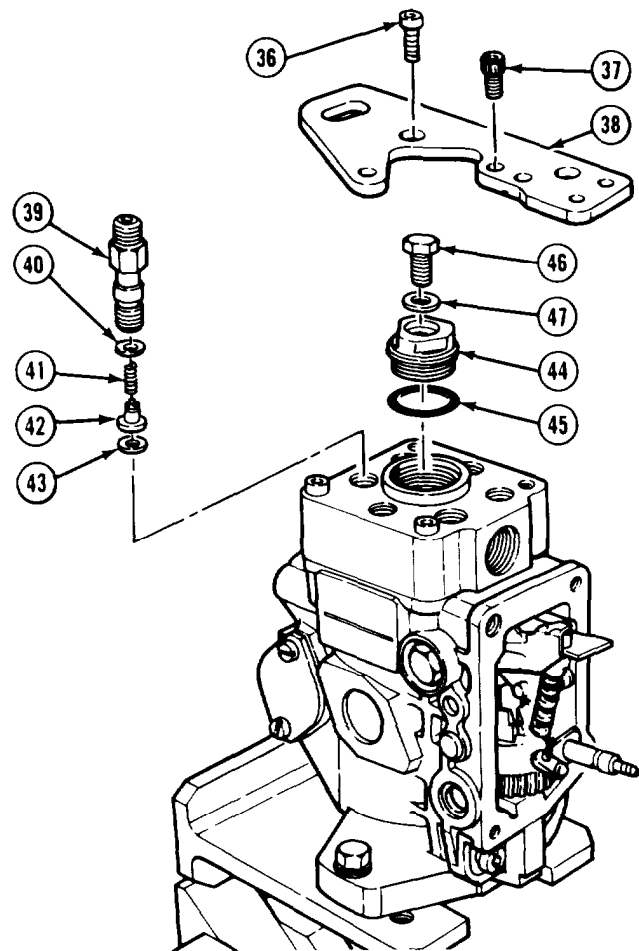
Letters are engraved on distributor head beside delivery valves. Tag pipe nipples according to letters for proper assembly.

- (18) Tag and remove six pipe nipples (39).

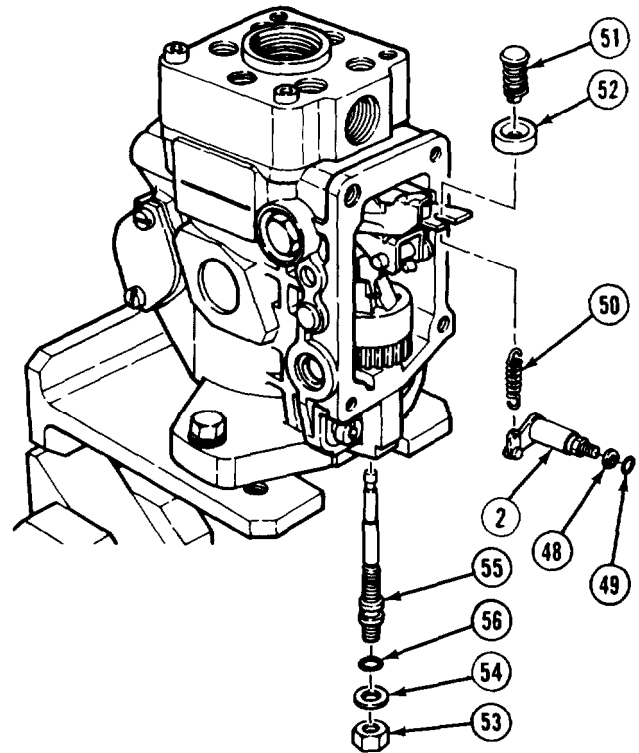
CAUTION

Delivery valves separate into halves. If delivery valves are dropped, damage will result.

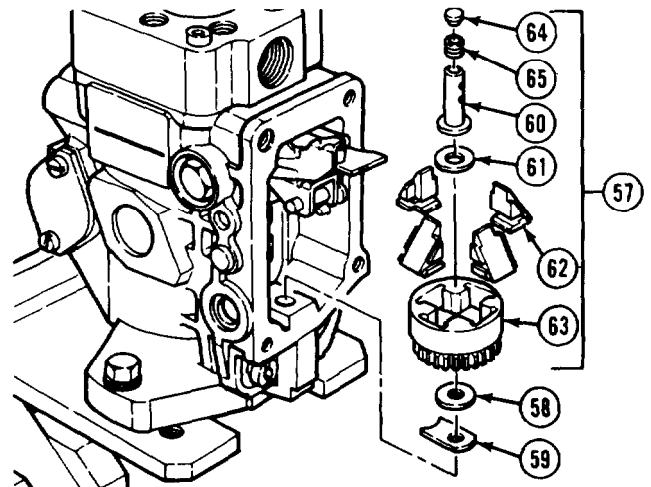
- (19) Remove six shims (40), springs (41), delivery valves (42), and gaskets (43). Discard shims and gaskets.
- (20) Remove screw plug (44) and preformed packing (45). Discard preformed packing.
- (21) Remove bleeder valve (46) and sealing washer (47). Discard sealing washer.



- (22) Remove washer (48) and preformed packing (49) from control shaft (2). Discard preformed packing.
- (23) Remove control shaft (2), governor spring (50) retaining pin (51) and pin seat (52).
- (24) Remove nut (53), washer (54), and governor shaft (55).
- (25) Remove and discard preformed packing (56) from governor shaft (55).

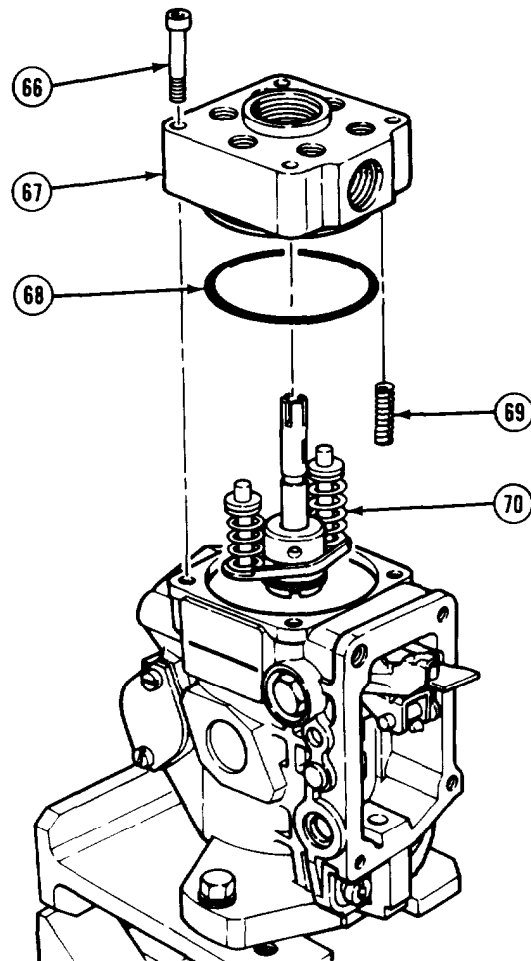


- (26) Remove flyweight holder assembly (57), washer (58), and shim (59).
- (27) Disassemble flyweight holder assembly as follows:
 - (a) Remove sleeve (60), washer (61), and four flyweights (62) from flyweight holder (63).
 - (b) Remove plug (64) and cap (65) from sleeve (60). Discard plug.



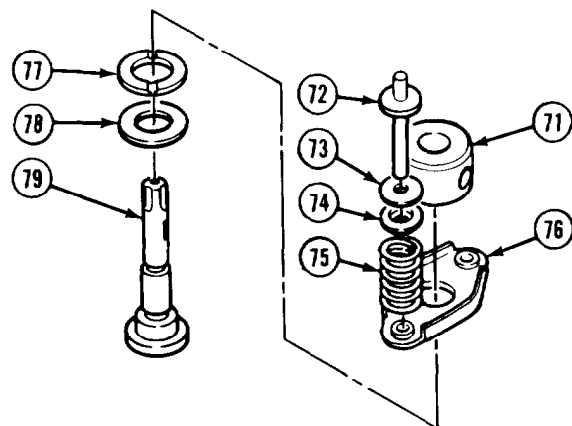
5-43. FUEL INJECTION PUMP REPAIR (CONT.).

- (28) Remove two screws (66) and distributor head (67).
- (29) Remove preformed packing (68) and two springs (69) from distributor head (67). Discard preformed packing.
- (30) Remove plunger assembly (70).

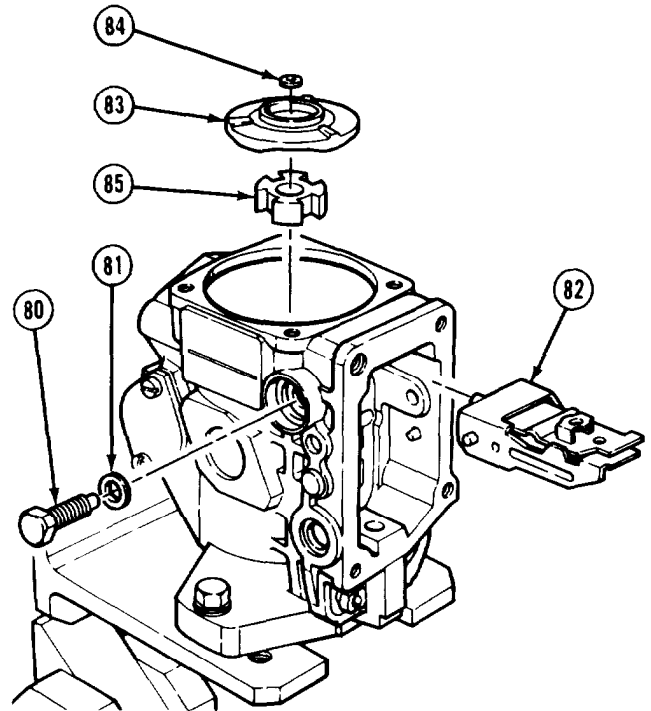


- (31) Disassemble plunger assembly as follows:

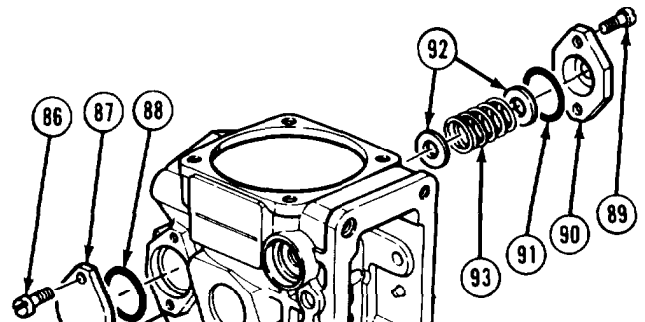
- (a) Remove control sleeve (71).
- (b) Remove two guide pins (72), shims (73), top spring seats (74), and springs (75). Discard shims.
- (c) Remove bottom spring seat (76), disc (77) and shim (78) from plunger (79). Discard shim.



- (32) Remove two screws (80), gaskets (81), and governor lever assembly (82). Discard gaskets.
- (33) Remove cam plate (83) and shim (84). Discard shim.
- (34) Remove slotted washer (85).

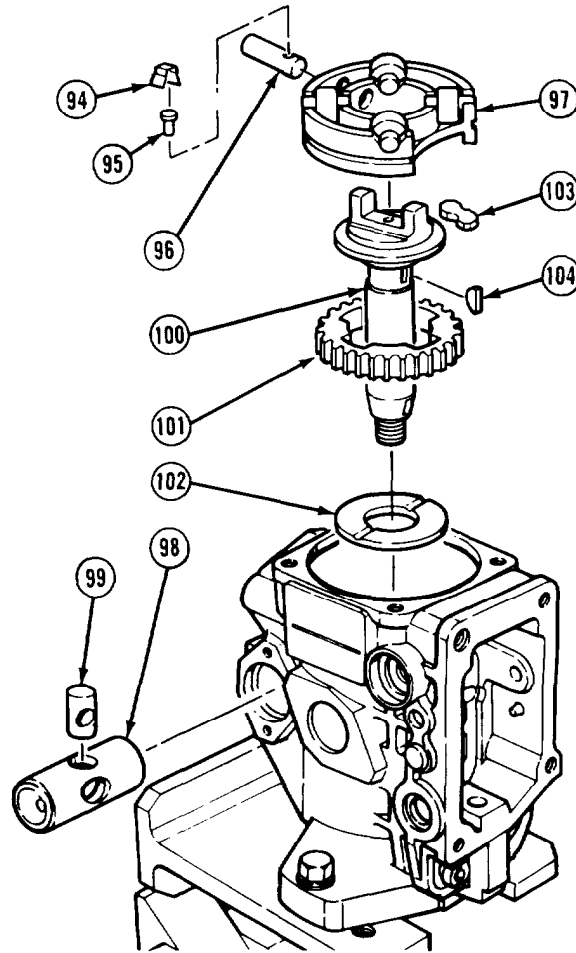


- (35) Remove two screws (86), right access cover (87), and preformed packing (88). Discard preformed packing.
- (36) Remove two screws (89), left access cover (90), preformed packing (91), two shims (92), and spring (93). Discard shims and preformed packing.



5-43. FUEL INJECTION PUMP REPAIR (CONT).

- (37) Remove clip (94) and pin (95). Discard clip.
- (38) Slide holder pin (96) to center of roller bearing (97) and remove roller bearing.
- (39) If damaged, remove holder pin (96).
- (40) Remove timing piston (98). Remove and discard plug (99).
- (41) Remove drive shaft (100) and spur gear (101) as an assembly and remove washer (102).
- (42) Disassemble drive shaft and spur gear as follows:
 - (a) Remove spur gear (101) and four coupling inserts (103).
 - (b) If damaged, remove two keys (104).



NOTE

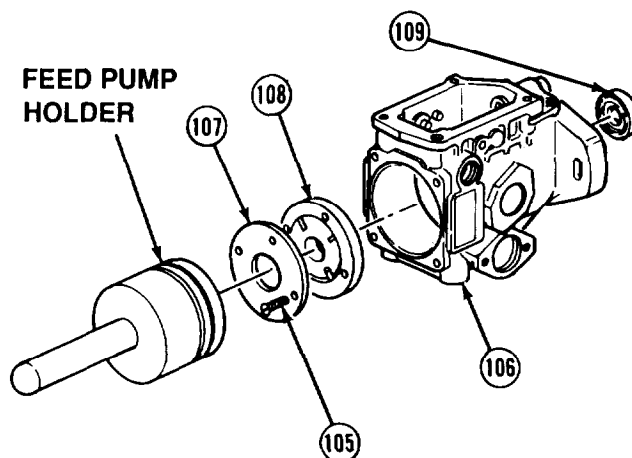
If used, mounting bracket must be removed for the following steps.

- (43) Remove two screws (105).
- (44) Install feed pump holder and tilt fuel pump housing (106) up.



Ensure not to drop blades in liner or damage to feed pump will result.

- (45) Remove support ring (107) and feed pump (108).
- (46) Remove and discard oil seal (109) from fuel pump housing (106).



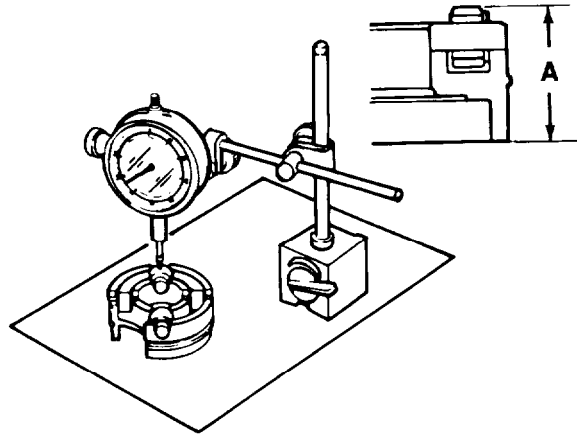
c. Cleaning/Inspection.

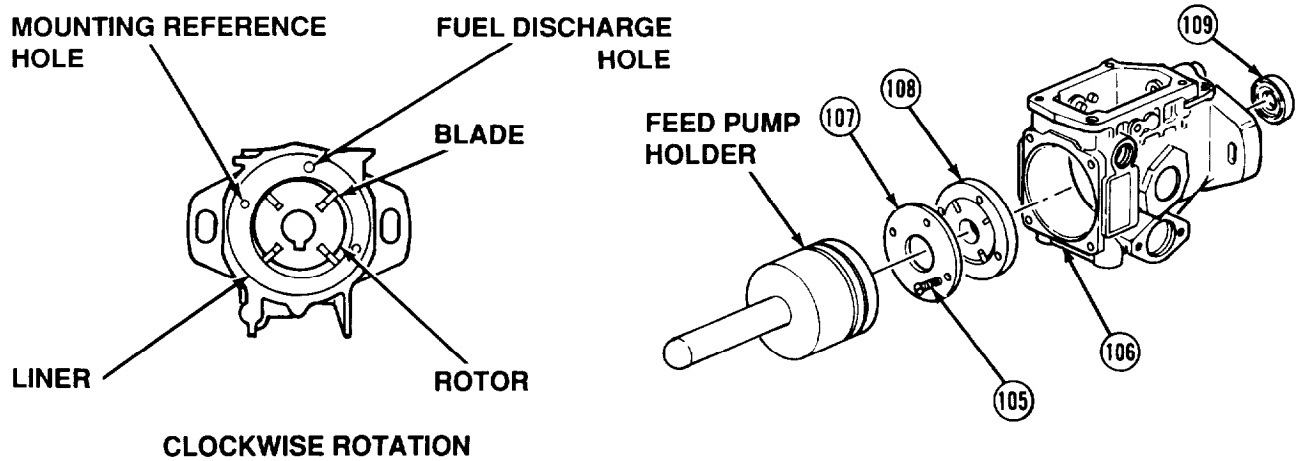
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 138°F (50°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Wash all metal parts with drycleaning solvent.
 - (2) Wipe off all parts with a lint free cloth.
 - (3) Inspect fuel pump housing for nicks, cracks, and burns.
 - (4) Inspect adapter and solenoid valve sealing surfaces for wear and orifices for blockage.
 - (5) Inspect spur gear teeth for pitting and cracks.
 - (6) Inspect governor lever assembly ball pin movement and lever action. If action has catches, replace governor lever assembly.
 - (7) Inspect roller bearings for wear and catches in rotation.

5-43. FUEL INJECTION PUMP REPAIR (CONT).

- (8) Measure each bearing height at position A.
If difference in heights is greater than
0.0008 in. (0.02 mm), replace roller bearing.
- (9) Inspect all remaining parts for wear.
- (10) Replace all parts failing inspection.





c. Assembly.

- (1) Install oil seal (109) in pump housing (106). Ensure oil seal is flush with housing.
 - (2) Align rotor in liner of feed pump (108). Two sides should be equally apart.
 - (3) Immerse support ring (107) in calibration fluid.
 - (4) Install support ring (107) on feed pump (108).
- Ensure that support ring is installed with notched side up. Failure to do so may result in damage to injection pump and engine.
 - Ensure that liner of feed pump is installed as indicated or fuel will not discharge and damage to injection pump will result.
- (5) Place feed pump holder on top of support ring (107) and install assembly upward while holding fuel pump house (106).
 - (6) Install two screws (105). Tighten screws 17 to 35 lb-in. (2 - 4 N•m).

5-43. FUEL INJECTION PUMP REPAIR (CONT).

NOTE

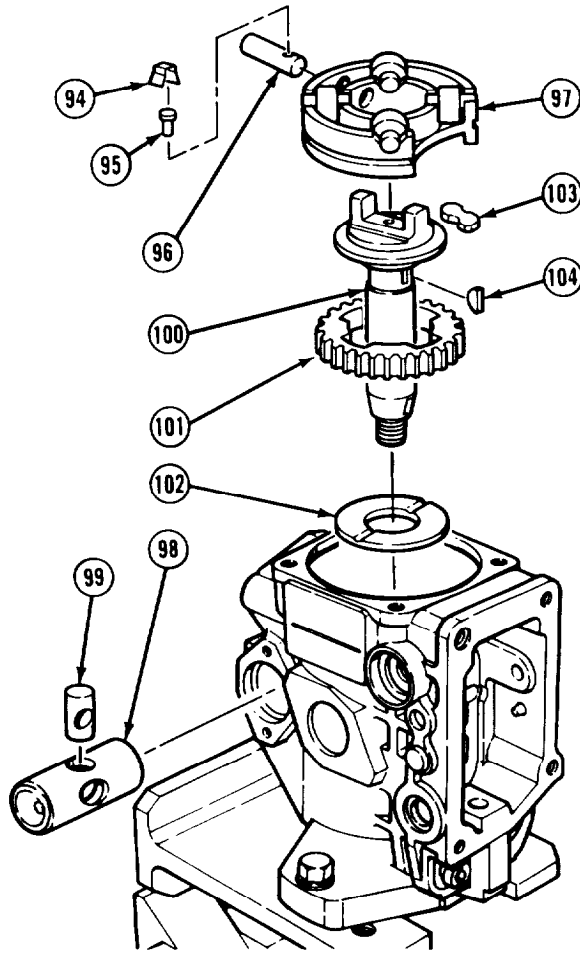
Mounting bracket is shown in art and is optional for the following steps.

- (7) Assemble drive shaft and spur gear as follows:
 - (a) Immerse spur gear (101) in calibration fluid.
 - (b) Install spur gear (101) on drive shaft (100) aligning notches.
 - (c) Apply grease to four coupling inserts (103).
 - (d) Install four coupling (103) inserts.
 - (e) If removed, install two keys (104).
- (8) Immerse washer (102) in calibration fluid.

CAUTION

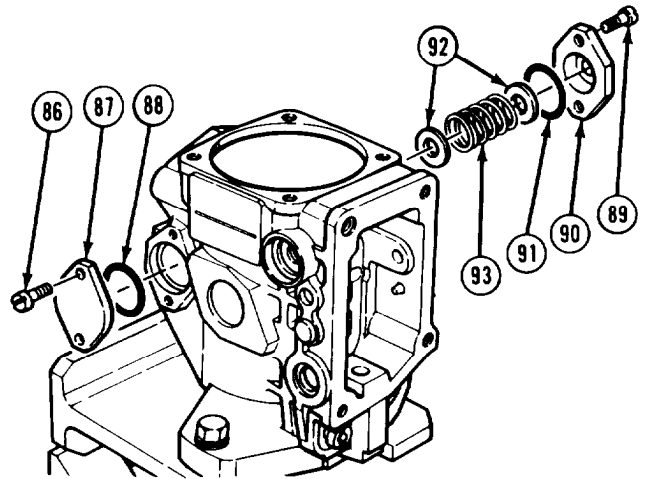
Ensure that drive shaft key way are aligned with fuel pump housing key way. Failure to do so will damage drive shaft and fuel pump housing.

- (9) Install washer (102) on drive shaft (100) and install drive shaft.
- (10) Apply grease to plug (99).
- (11) Install plug (99) with holes aligned with timing piston (98) holes.
- (12) Immerse timing piston (98) in calibration fluid.
- (13) Install timing piston (98) with high pressure side facing left and hole through plug (99) facing direction of roller holder pin (96) as shown.
- (14) If removed, immerse holder pin (96) in calibration fluid.
- (15) Install holder pin (96) in roller bearing (97) with hole facing up as shown.



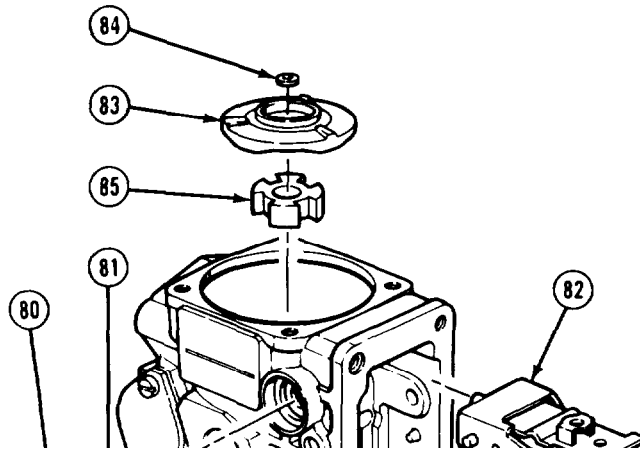
- (16) Immerse roller bearing (97) in calibration fluid.
- (17) Install roller bearing (97) with roller holder pin (%) is facing timing piston (98).
- (18) Slide holder pin (%) in timing piston (98).
- (19) Check timing piston (98) by moving back and forth. If movement is not smooth, slide holder pin (96) from timing piston (98) and apply grease to holder pin and repeat step (18). If movement is smooth, go to step (20).
- (20) Immerse pin (95) in calibration fluid.
- (21) Install pin (95) and clip (94).

- (22) Apply grease to two preformed packings (91 and 88).
- (23) Install two shims (92), spring (93), preformed packing (91), left access cover (90), and two screws (89). Tighten screws 60 to 86 lb-in. (7 - 10 N•m).
- (24) Install preformed packing (88), right access cover (87), and two screws (86). Tighten screws 60 to 86 lb-in. (7 - 10 N•m).



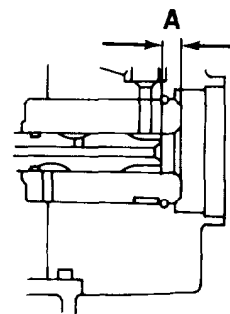
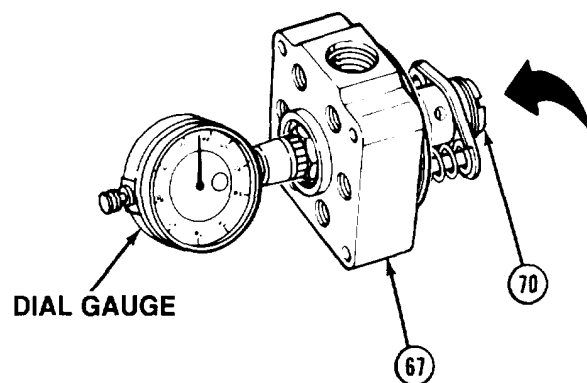
5-43. FUEL INJECTION PUMP REPAIR (CONT).

- (25) Install slotted washer (85) with larger hole facing up.
- (26) Install shim (84) and cam plate (83).
- (27) Install governor lever assembly (82) two gaskets (81) and screws (80).

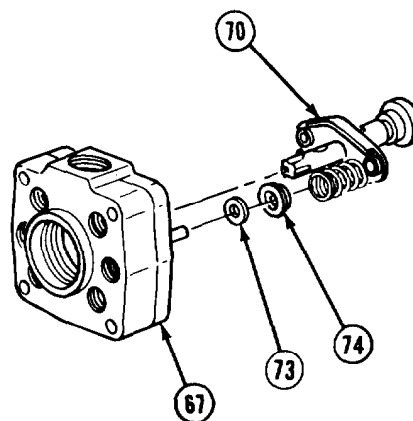


- (28) Determine plunger spring set length as follows:
 - (a) Install shim (78), disc (77), and bottom spring seat (76) on plunger (79).
 - (b) Install two guide pins (72) and two top spring seats (74) in distributor head (67).
 - (c) Install plunger (79) as an assembly on distributor head (67).

- (d) Install dial gage in distributor head (67).
- (e) Hold distributor head (67) horizontally and lightly press plunger (70).
- (f) Measure plunger spring set length at position A. If measurement is not within limits, perform all following steps. If measurement is within limits, go to step (29).



- (g) Remove plunger assembly (70) up to top spring seats (74) from distributor head (67).
- (h) Install two shims (73) on spring seats (74) and install plunger assembly (70) on distributor head (67).
- (i) Repeat steps (26) (e) and (26) (f).



5-43. FUEL INJECTION PUMP REPAIR (CONT).

(29) Determine plunger assembly adjustment as follows:

(a) Remove shim (84).



Ensure to align plunger groove with knock pin in cam plate or damage to injection pump may result.

(b) Install plunger assembly (70), distributor head (67) and four screws (66). Tighten screws 86 to 121 lb-in. (10 - 14 N•m).

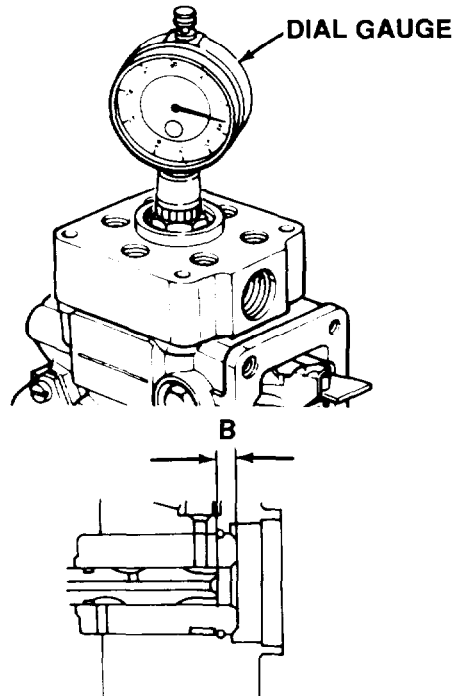
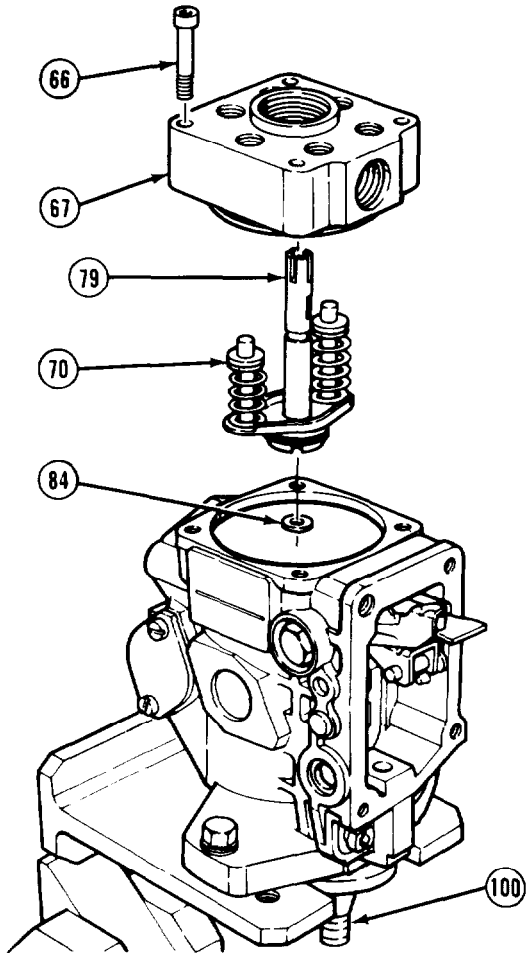
(c) Rotate drive shaft (100) until plunger (79) reaches bottom dead center.

(d) Measure plunger assembly (70) at position B.

(e) Remove four screws (66), distributor head (67) and plunger assembly (70).

(f) Install correct size shim (84) to get correct plunger assembly measurement.

(g) Remove dial gage.

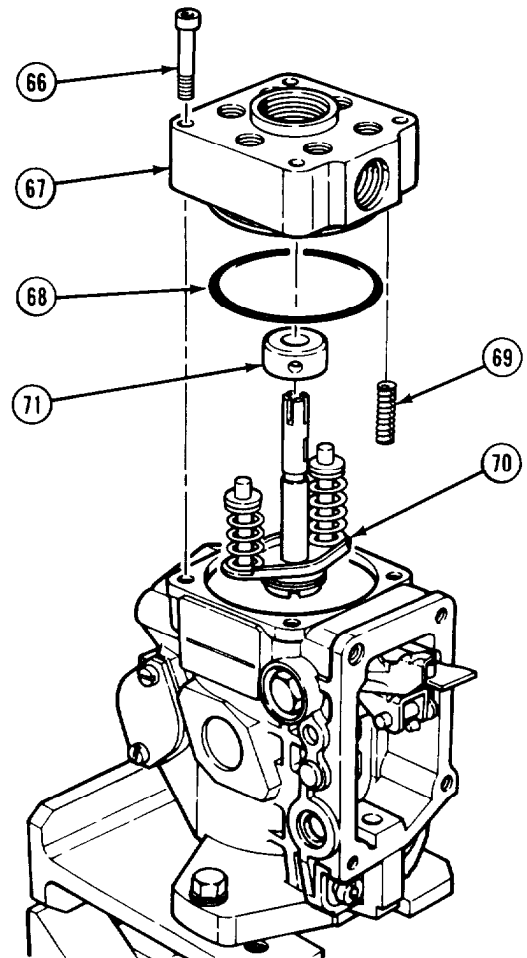


- (30) Install control sleeve (71) on plunger assembly (70).

NOTE

Ensure to align plunger groove with knock pin in cam plate.

- (31) Install plunger assembly (70).
- (32) Apply grease to two preformed packings (68).
- (33) Immerse two springs (69) in calibration fluid.
- (34) Install two springs (69) and preformed packing (68).
- (35) Install distributor head (67) and four screws (66). Tighten screws alternately 86 to 121 lb-in. (10 - 14 N•m).



5-43. FUEL INJECTION PUMP REPAIR (CONT).

(36) Assemble flyweight holder assembly as follows:

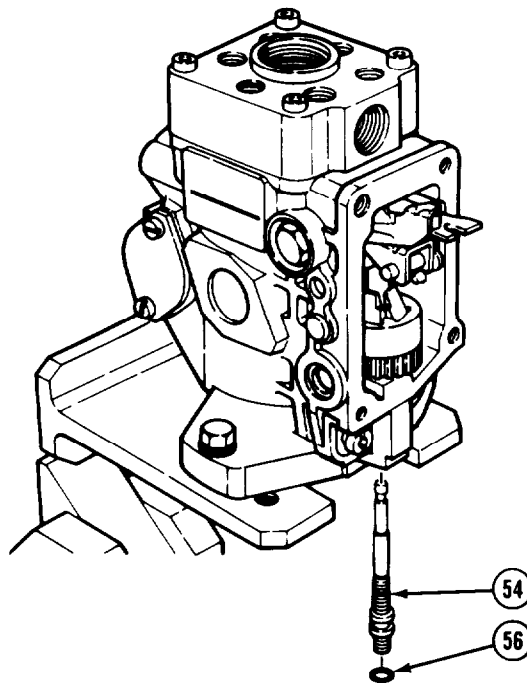
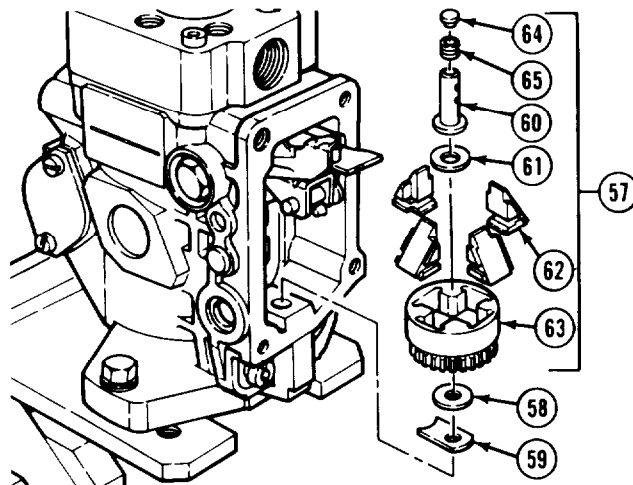
- (a) Install cap (65) and plug (64).
- (b) Immerse four flyweights (62), washer (61), and sleeve (60) in calibration fluid.
- (c) Install four flyweights (62) washer (61), and sleeve (60) in flyweight holder (63).

CAUTION

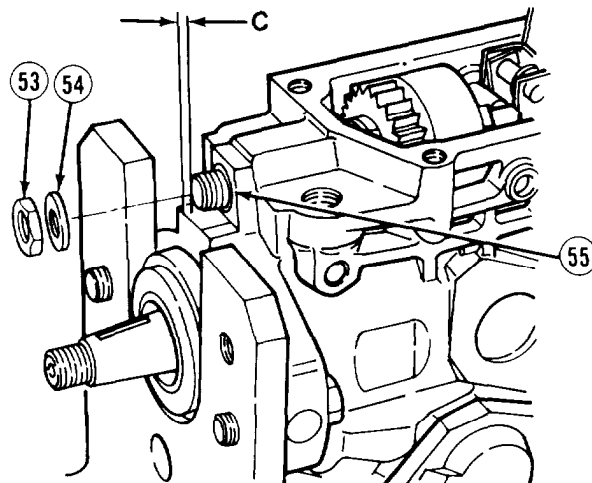
Ensure that square bottom of flyweight holder assembly is aligned with shim or injection pump will not function properly and damage may result.

(37) Install shim (59) washer (58), and flyweight holder assembly (57).

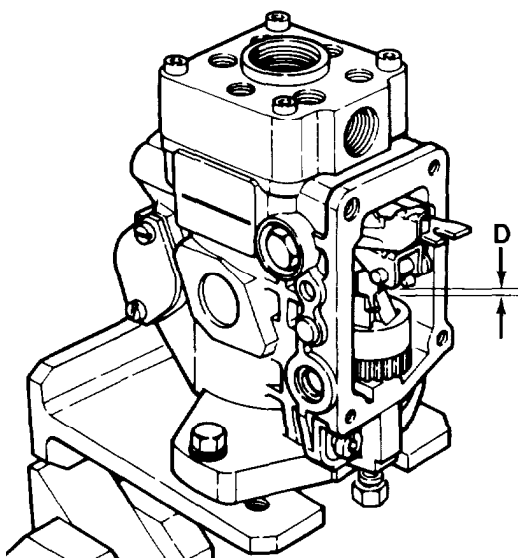
(38) Install preformed packing (56) on governor shaft (55) and install governor shaft.



- (39) Measure governor shaft (55) clearance at position C. Clearance limits are 0.059 to 0.0787 in. (1.5 - 2.0 mm). If measurement is not within limits, adjust governor shaft and measure clearance again. If measurement is within limits, go to step (40).
- (40) Install washer (54) and nut (53). Hold governor shaft (55) securely and tighten nut 148 to 191 lb-in. (17 - 22 N•m).

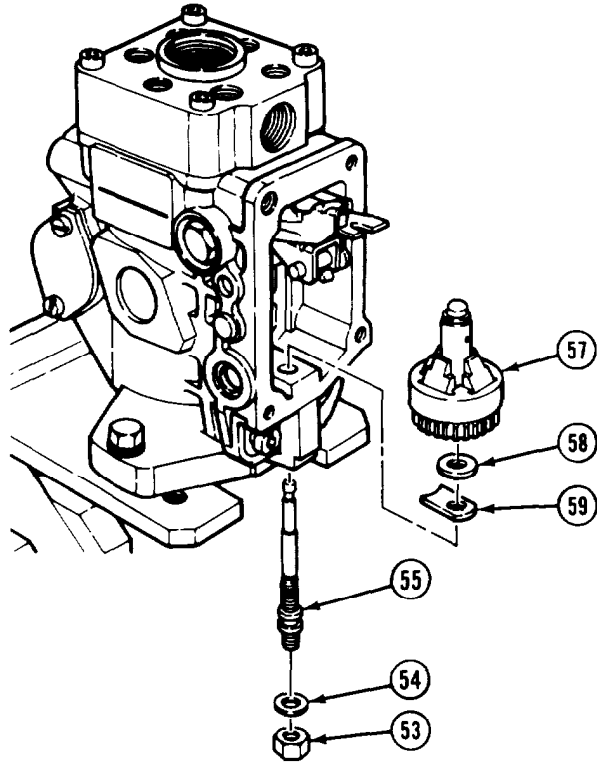


- (41) Measure flyweight holder assembly clearance at position D. Clearance limits are 0.0059 to 0.0138 in. (0.15 - 0.35 mm). If measurement is not within limits, perform steps (42) to (45). If measurement is within limits, go to step (46).

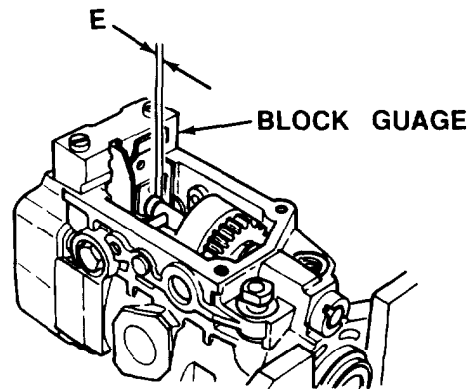


5-43. FUEL INJECTION PUMP REPAIR (CONT).

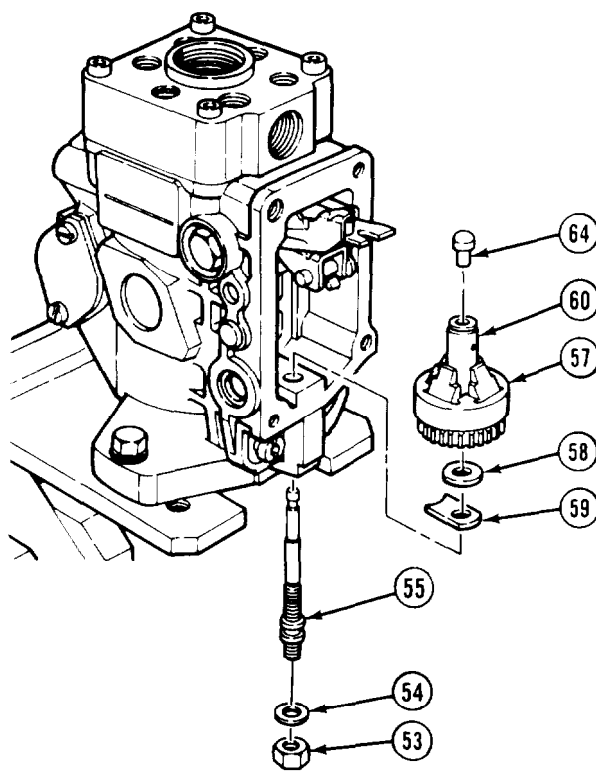
- (42) Remove nut (53) washer (54), governor shaft (55), flyweight holder assembly (57), washer (58), and shim (59).
- (43) Install correct size shim (59).
- (44) Install washer (58), flyweight holder assembly (57) and governor shaft (55).
- (45) Repeat steps (39) to (41).



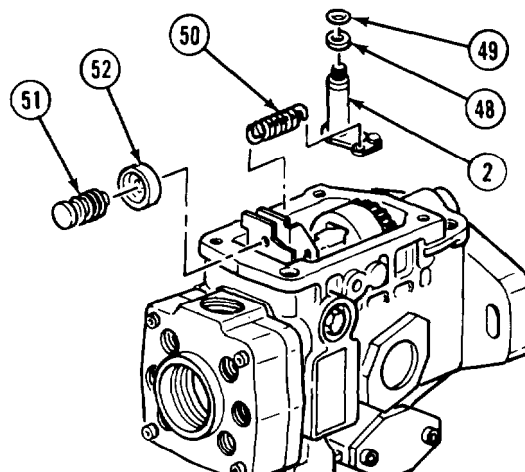
- (46) Determine starting stroke adjustment as follows:
 - (a) Install block gage with two screws. Ensure block gage groove faces governor lever.
 - (b) Measure starting stroke adjustment at position E. If measurement not within limits, perform steps (46) (c) to (46) (h). if measurement is within limits, go to step (44).



- (c) Remove nut (53), washer (54), and governor shaft (55).
- (d) Remove flyweight holder assembly (57) washer (58) and shim (59).
- (c) Remove plug (64) from sleeve (60).
- (f) Install correct six plug (64).
- (g) Install shim (59) washer (58), flyweight holder assembly (57), and governor shaft (55).
- (h) Repeat steps (36) and (37).
- (i) Remove two screws and block gage.



- (47) Install preformed packing (49) and washer (48) on control shaft (2).
- (48) Install pin seat (52), retaining pin (51), governor spring (50) and control shaft (2).



5-43. FUEL INJECTION PUMP REPAIR (CONT).

- (49) Install sealing washer (47) bleeder valve (46), and preformed packing (45) on screw plug (44).
- (50) Install screw plug (44). Tighten screw plug 50 lb-ft (67.7 N•m). Tighten bleeder valve (46) 121 to 174 lb-in. (14 - 20 N•m).
- (51) Install six shims (43) with flat side against pump assembly.

CAUTION

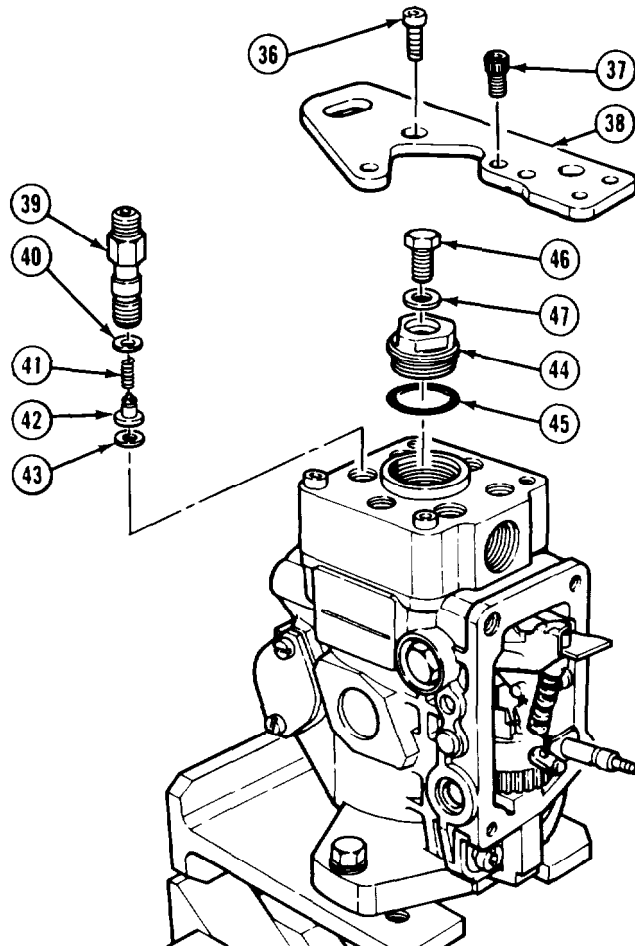
Delivery valves separate into halves. If delivery valves are dropped, damage will result.

- (52) Immerse six pipe nipples (39) springs (41), and delivery valves (42) in calibration fluid.

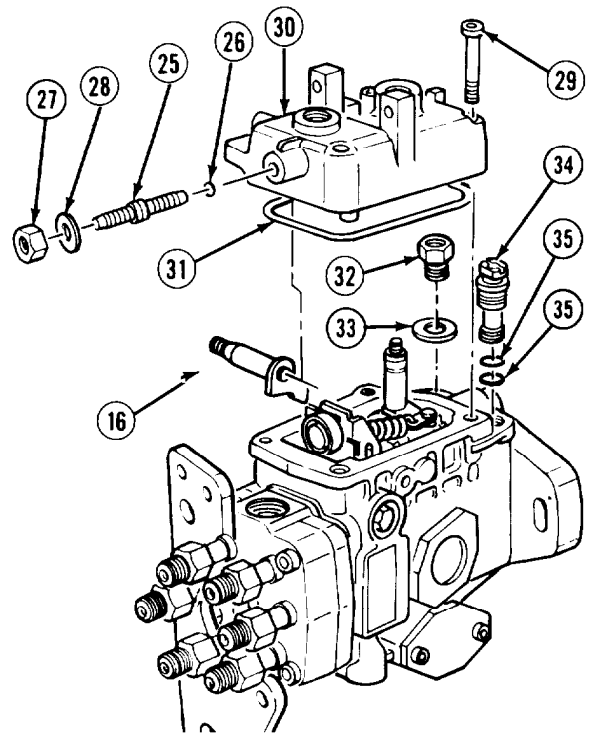
NOTE

Letters are engraved on distributor head beside delivery valves. Refer to tags on pipe nipples and match letters for proper assembly.

- (53) Install six needle valves (42) springs (41) shims (40), and pipe nipples (39). Tighten pipe nipples alternately at 23 lb-ft (30 N•m).
- (54) Remove two screws (36) and install support plate (38) with three screws (37 and 36). Tighten screw (37) 23 lb-ft (30 N•m) and screws (36) 86 to 258 lb-in. (10 - 29 N•m).



- (55) Install two preformed packings (35) on control valve (34).
- (56) Install control valve (34) sealing washer (33) and adapter (32). Tighten control valve 173 to 259 lb-in. (20 - 29 N•m). Tighten adapter 204 lb-in. (23 N•m).
- (57) Install lever shaft (16).
- (58) Apply grease to preformed packing (26) and install preformed packing in housing cover (30).
- (59) Install housing cover (30) and four screws (29). Tighten screws 60 to 86 lb-in. (7 - 10 N•m).
- (60) If removed, install preformed packing (26) full load adjusting screw (25) washer (28) and nut (27). Tighten nut 52 to 78 lb-in. (6 - 9 N•m).

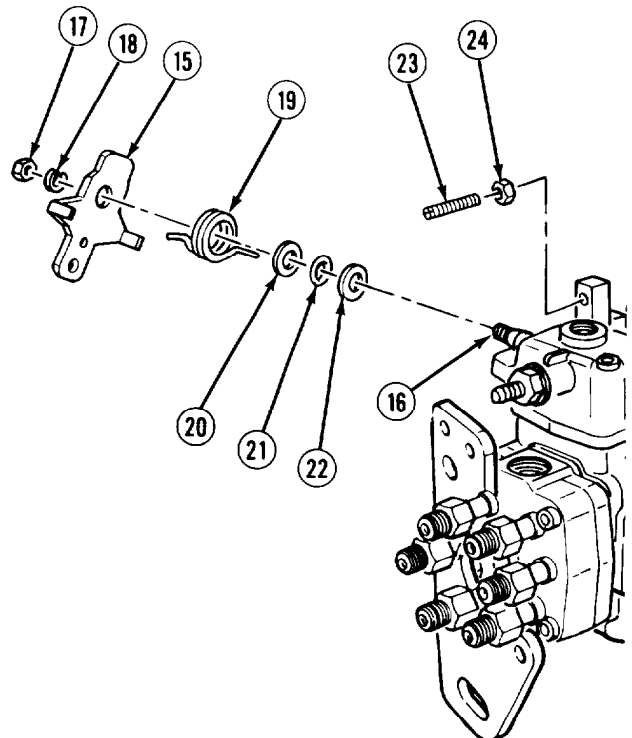


- (61) If removed, install two nuts (24) and set screws (23). Tighten nuts 52 to 78 lb-in. (6 - 9 N•m).
- (62) Install washer (22) and preformed packing (21) on lever shaft (16).

NOTE

Align manual lever and lever shaft scribe marks for proper assembly.

- (63) Install shim (20), spring (19), manual lever (15), lockwasher (18), and nut (17).



5-43. FUEL INJECTION PUMP REPAIR (CONT).

NOTE

Skip step (64) if lower control lever was not disassembled.

- (64) Install middle control lever (13) on bottom control lever (14) with washer (12), lockwasher (11), and screw (10).

NOTE

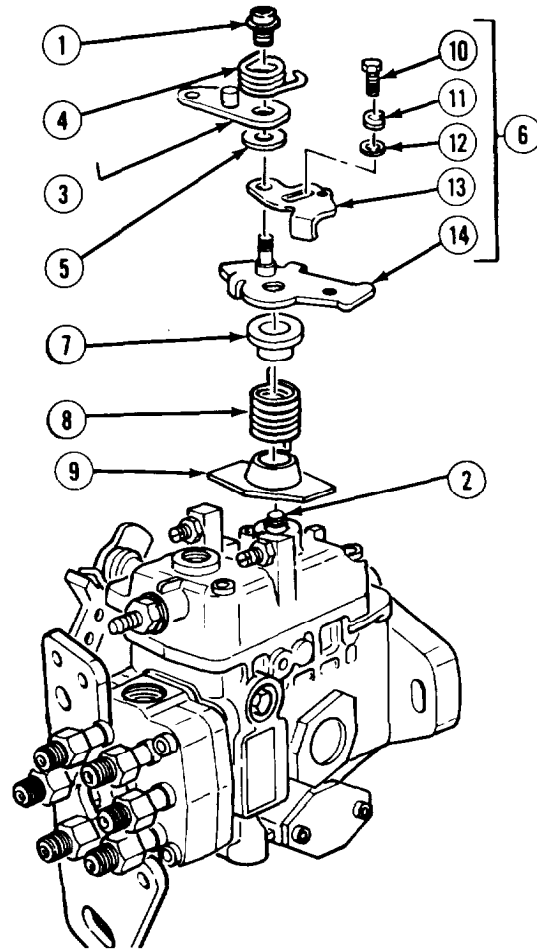
Ensure to align lower control lever and control shaft scribe marks for proper assembly.

- (65) Install bottom spring seat (9), lower spring (8) top spring seat (7), and lower control lever assembly (6).

NOTE

Ensure to align scribe marks on upper control lever and control shaft for proper assembly.

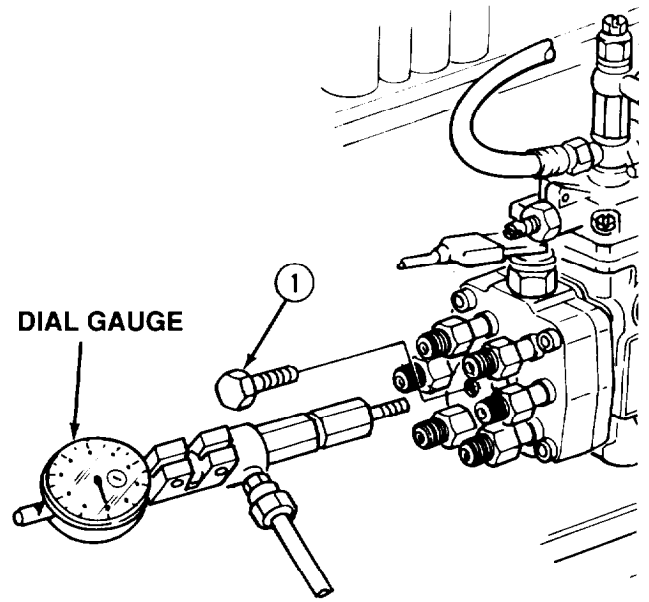
- (66) Install intermediate disc (5), upper control lever (3), upper spring (4), and flange nut (1) on control shaft (2). Tighten flange nut 60 to 86 lb-in. (7 - 10 N•m).



d. Adjustment.

(1) Adjust pre-stroke as follows:

- (a) Remove bleeder valve (1) and install dial gauge.
- (b) Set injection pump to top dead center and reset dial gauge to zero.
- (c) Rotate injection pump once and read dial gauge. If measurement is within limits go to step (f). If measurement is not within specified range, do steps (1) to (4), (11), (17), (22) to (26), (28), (30), (31) (a), (32), and (33) of *a. Disassembly* to remove shim.
- (d) Do steps (26), (27), (28) (d), (29), (30), (31) (35), (37) to (40), (47), (48), (54), (59), (65), and (66) of *c. Assembly* to install correct size shim.
- (e) Rotate injection pump once and read dial gauge to ensure correct pre-stroke adjustment.
- (f) Remove dial gage and install bleeder valve (1). Tighten bleeder valve 121 to 174 lb-in (14 - 20 N•m).



5-43. FUEL INJECTION PUMP REPAIR (CONT.)

- (2) Adjust full-load injection as follows:
- (a) Set control lever (2) in maximum speed position and check that governor operates at speed specified in calibration data. If speed is within limits, go to step (d). If speed is not within limits, do steps (1) to (4), (11), (17), (22) to (26), (29), (30), and (32) of *a. Disassembly* to remove governor lever assembly.
 - (b) Do steps (27), (31), (35), (37) to (40), (47), (48), (54), (59), (65), and (66) of *c. Assembly* to install governor lever assembly.
 - (c) Repeat step (a).

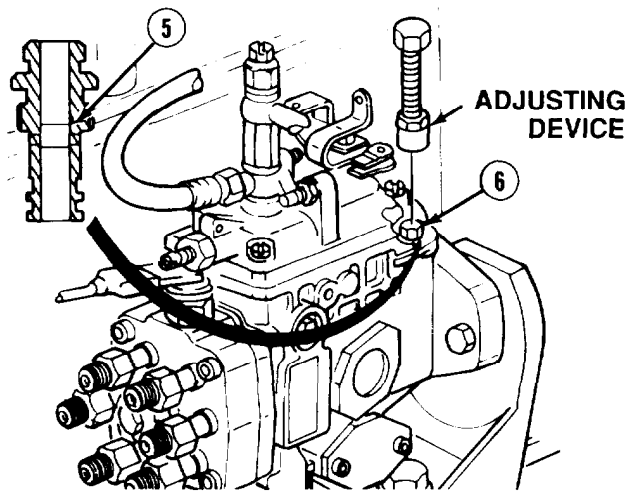
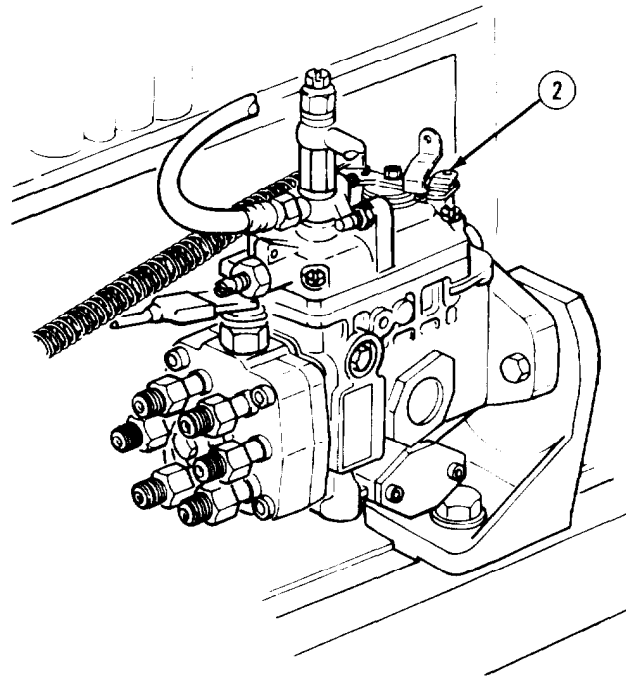
NOTE

Ensure to tighten nut (3) before each reading.

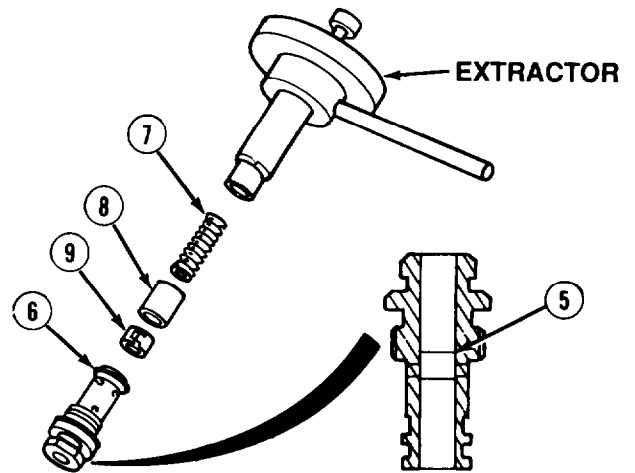
- (d) Measure injection quantity at speed specified in calibration data. If quantity is within limits, go to step (3). If quantity is not within limits, loosen nut (3) and adjust full-load adjusting screw (4). Tighten nut (3) 52 to 78 lb-in (6 - 9 N•m) and measure injection quantity again to ensure correct quantity.

- (3) Adjust supply pressure as follows:

- (a) Measure pump chamber pressure at speed indicated in calibration data. If pressure is within limits go to step (4). If pressure is below limits, install adjusting device and push in plug (5) in control valve (6). Remove adjusting device.
- (b) If measurement is above limits, remove control valve (6) and perform all following steps.

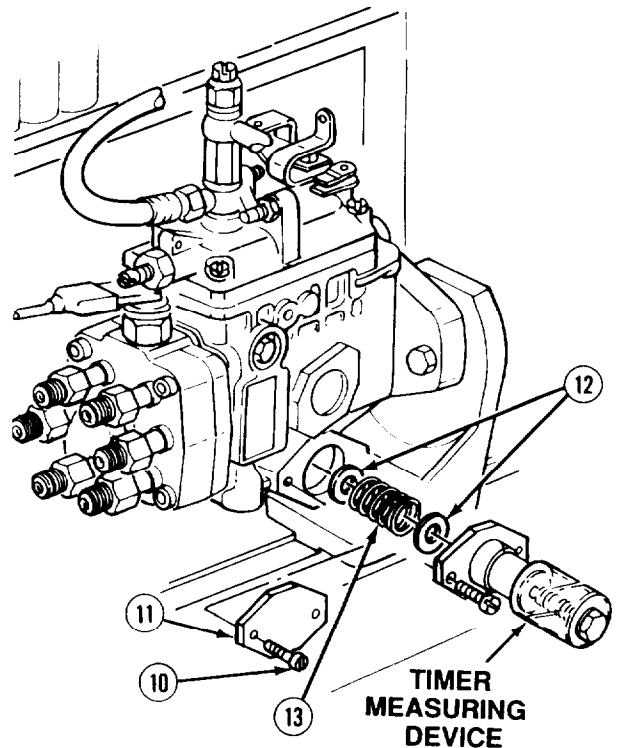


- (c) Using an extractor, disassemble control valve (6) and remove spring (7), piston (8) and spring ring (9).
- (d) Push plug (5) up to top of control valve (6).
- (e) Install spring ring (9), piston (8), and spring (7) in control valve (6).
- (f) Install control valve (6). Tighten control valve 173 to 259 lb-in. (20 - 29 N•m).
- (g) Measure pump chamber pressure at speed indicated in calibration data. If measurement is below limits, install adjusting device and push in plug (5) in control valve (6). Remove adjusting device. If measurement is within limits, go to step (4).



(4) Adjust timer stroke as follows:

- (a) Remove two screws (10) and right access cover (11) and install timer measuring device with two screws.
- (b) Rotate injection pump at speed specified in calibration data and check timer strokes. If measurement is within limits, go to step (6).
- (c) If measurement is not within limits, remove two screws, timer measuring device, two shims (12) and spring (13).
- (d) Install spring (13), two correct size shims (12), timer measuring device, and two screws.
- (e) Rotate injection pump and recheck timer stroke for correct measurement. If measurement is not within limits, repeat steps (c) and (d). If measurement is correct go to step (f).
- (f) Remove measuring device and install right access cover (11) with two screws (10). Tighten screws 60 to 86 lb-in. (7 - 10 N•m).
- (g) Repeat step (2).

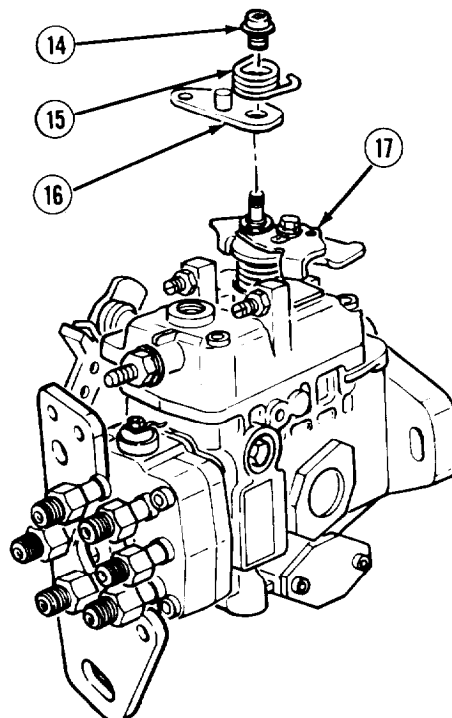


5-43. FUEL INJECTION PUMP REPAIR (CONT).

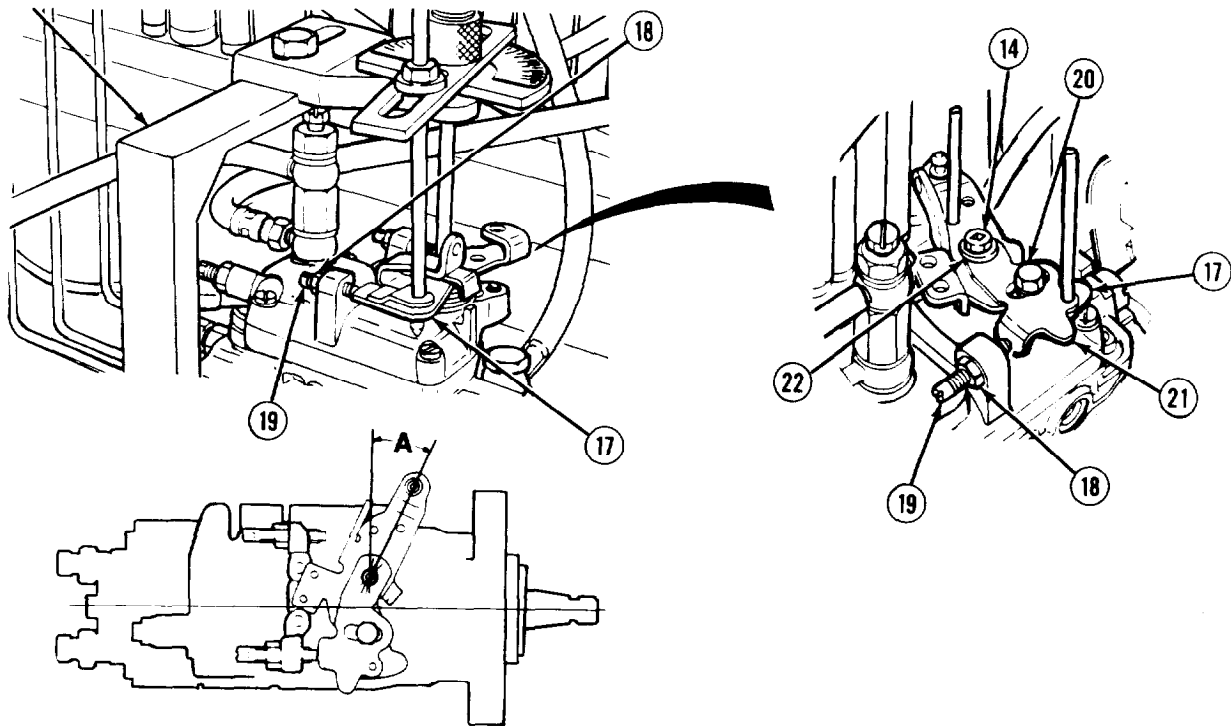
NOTE

upper spring will come off with upper control lever.

- (5) Remove flange nut (14), upper spring (15), and upper control lever (16).
- (6) Install flange nut (14) on lower control lever assembly (17). Tighten flange nut 60 to 86 lb-in (7 - 10 N•m).



INJECTION PUMP MEASURING DEVICE

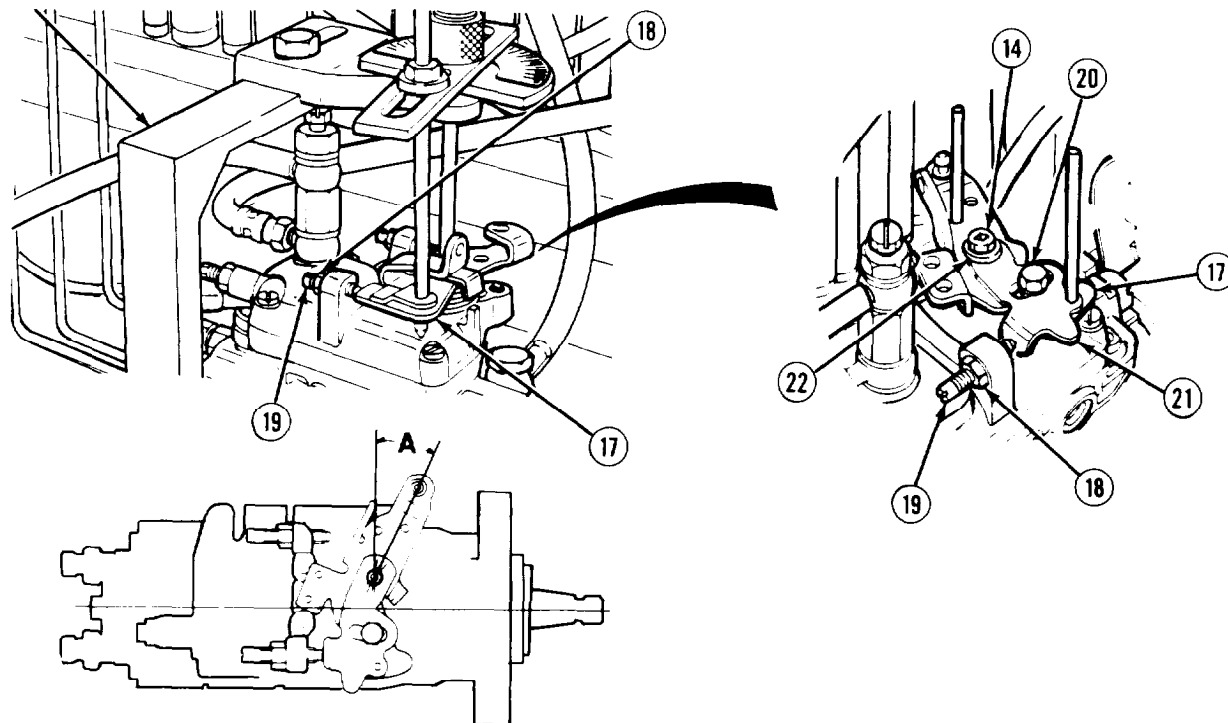


(7) Adjust idle injection quantity as follows:

- (a) Install injection pump measuring device and fix lower control lever assembly (17) in minimum speed position.
- (b) Measure injection quantity. If quantity is not within limits, loosen nut (18) and adjust idle screw (19) to get correct measurement. Tighten nut 52 to 78 lb-in. (6 - 9 N•m). If quantity is within limits, perform following steps.
- (c) Measure lower control lever assembly (17) angle at position A. If angle is not within limits, loosen screw (20) and adjust middle control lever (21) to get correct angle. Tighten screw securely and repeat step (a) to (b). If angle is within limits, go to step (9).
- (d) If angle at position A cannot be adjusted within limits, remove injection pump measuring device, flange nut (14), and intermediate disc (22).
- (e) Position lower control lever assembly (17) to get correct angle and install intermediate disc (22) and flange nut (14). Tighten flange nut 60 to 86 lb-in. (7 - 10 N•m).
- (f) Repeat steps (a) to (c).

5-43. FUEL INJECTION PUMP REPAIR (CONT).

INJECTION PUMP MEASURING DEVICE



(8) Measure excess fuel injection quantity as follows:

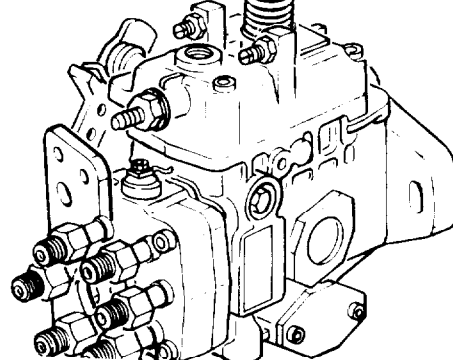
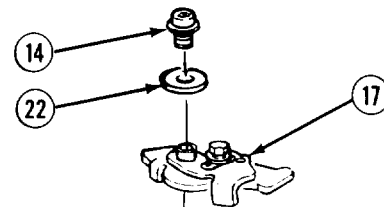
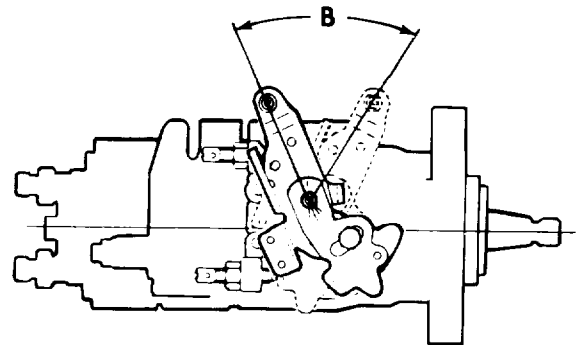
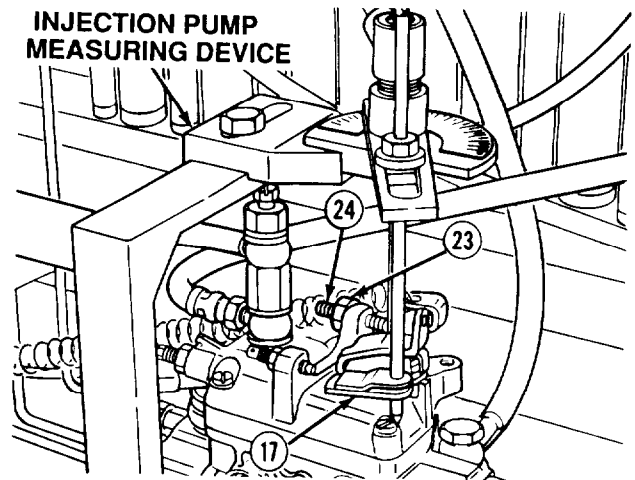
- (a) Set lower control lever assembly (17) in maximum speed position.
- (b) Operate pump at low speed specified in calibration data. Measure quantity of excess fuel. If quantity is within limits, go to step (10). If quantity is not within limits, remove flange nut (14), intermediate disc (22), and lower control lever assembly (17).
- (c) Do steps (11), (22), and (23) of *a. Disassembly* and steps (46) to (48), and (59) of *c. Assembly* to replace flyweight holder assembly plug.
- (d) Install lower control lever assembly (17), intermediate disc (22), and flange nut (14).
- (e) Repeat steps (a) and (b).

- (9) Adjust no-load maximum speed injection quantity as follows:
- (a) Install injection pump measuring device and fix lower control lever assembly (17) in maximum speed position.
 - (b) Operate pump at no-load maximum speed specified in calibration data.
 - (c) Measure injection quantity. If quantity is within limits, go to step (9) (d). If quantity is not within limits, loosen nut (23) and adjust maximum speed screw (24) to get correct measurement. Tighten nut 52 to 78 lb-in. (6 - 9 N•m).
 - (d) Measure lower control lever assembly (17) at position B. If angle is within limits, go to step (10). If angle is not within limits, remove injection pump measuring device, flange nut (14), and intermediate disc (22).
 - (e) Position lower control lever assembly (17) to get correct angle and install intermediate disc (22), flange nut (14), and injection pump measuring device. Tighten nut 60 to 86 lb-in. (7 - 10 N•m).
 - (f) Repeat steps (a) to (d) and (7) (a) to (7) (c).

NOTE

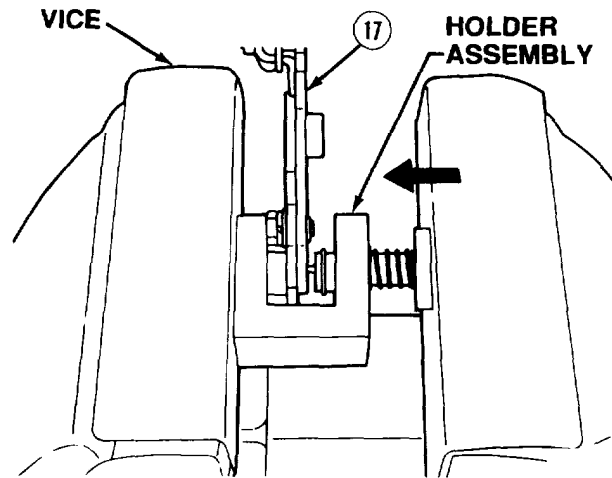
Note location of control lever assembly and scribe marks on control shaft.

- (10) Remove injection pump measuring device, flange nut (14), intermediate disc (22), and lower control lever assembly (17).

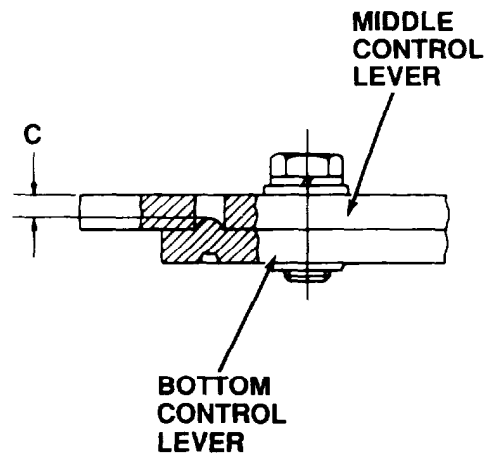


5-43. FUEL INJECTION PUMP REPAIR (CONT).

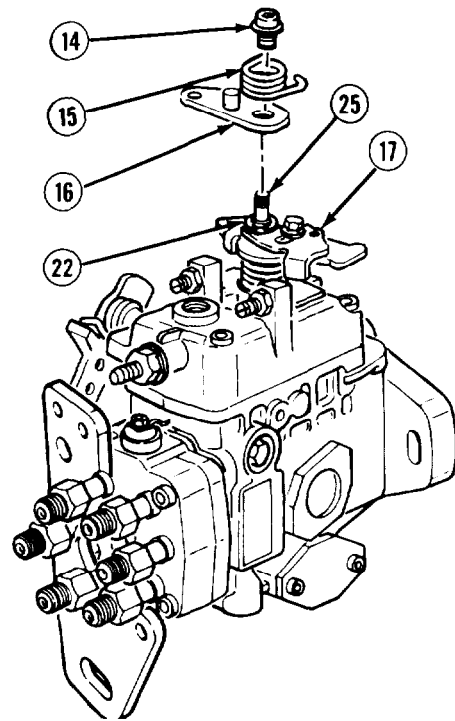
- (11) Install holder assembly in a vise.
- (12) Install and position lower control lever assembly's (17) top hole in holder assembly's guide pin. Tighten vise to deform middle and bottom control levers together.
- (13) Loosen vise and remove control lever assembly (37).



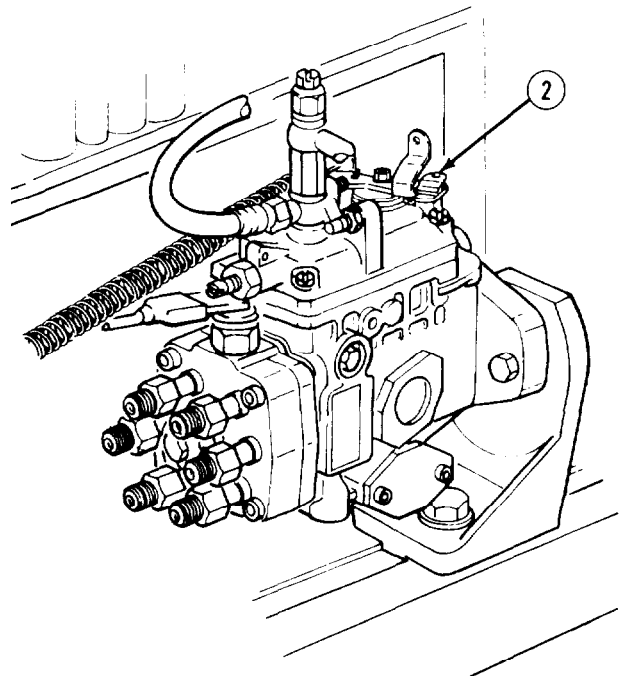
- (14) Measure deformation at position C. If measurement is less than 0.087 in. (2.2 mm), repeat steps (11) and (13).



- (15) Install and align scribe marks on lower control lever assembly (17) and control shaft (25).
- (16) Install intermediate disc (22), upper control lever (16), upper spring (15), and flange nut (14). Tighten nut 60 to 86 lb-in (7 - 10 N•m).

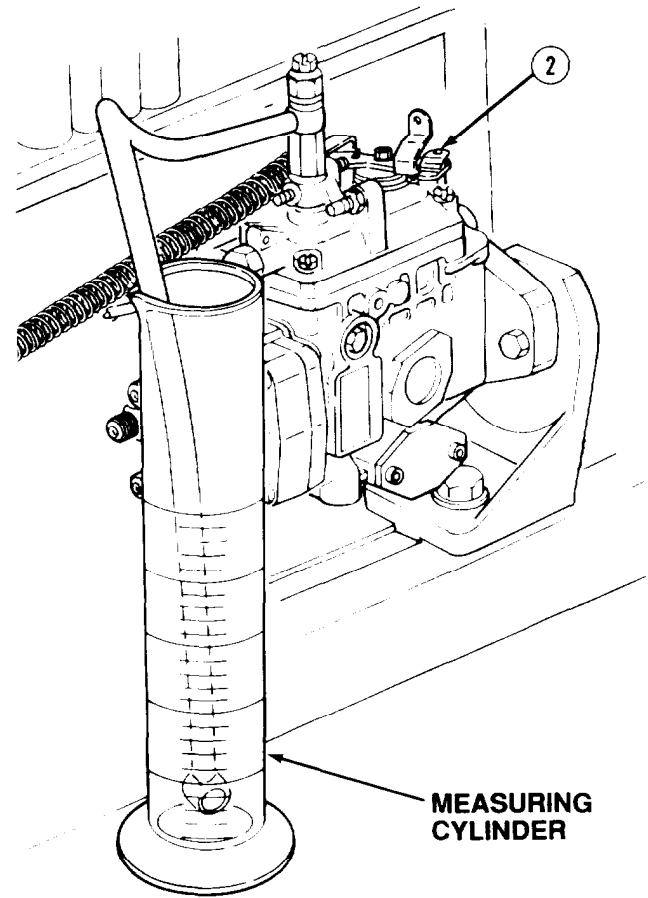


- (17) Repeat steps (7) and (9) to confirm correct idling and no-load maximum speed injection quantities.
- (18) Check pump chamber pressure at speeds specified in calibration data with control lever (2) in maximum position. If pressure is within limits, go to step (19). If pressure is not within limits, repeat step (3).
- (19) Repeat step (4) and check timer stroke at speeds specified in calibration data with control lever (2) in maximum position.



5-43. FUEL INJECTION PUMP REPAIR (CONT).

- (20) Set up measuring cylinder and measure overflow quantity from overflow valve at specified pump speed with control lever (2) in maximum position.
- (21) Check to ensure that magnet valve operates to end injection immediately at voltage, pump speed, and control lever (2) position specified in calibration data.



NOTE

Follow-on Maintenance: Install fuel injection pump (para 5-40).

END OF TASK

5-44. TURBOCHARGER REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly

INITIAL SETUP

Tools

- Tool kit, general mechanics: automotive
- Tool kit, general mechanic's: equipment maintenance and repair
- Shop equipment, general purpose repair: semi-trailer mounted
- Wrench, torque

Materials/Parts

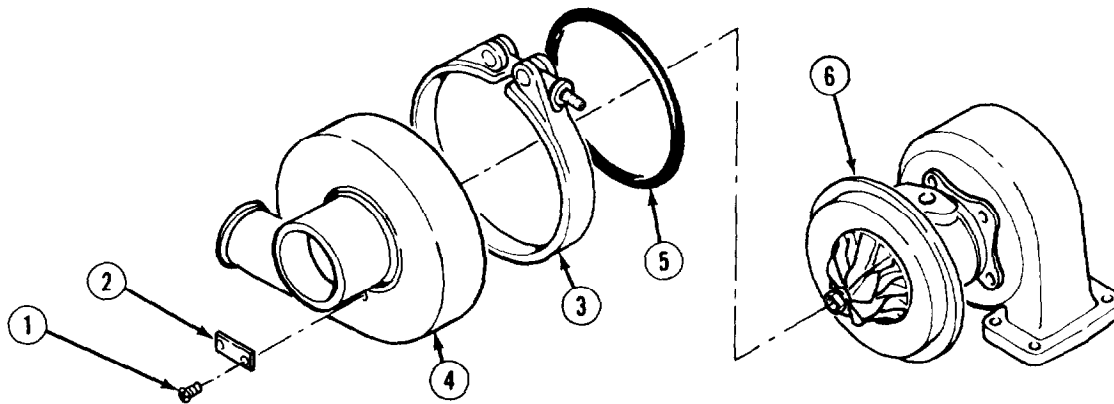
- Paper, abrasive, garnet (item 48, appendix E)
- Compound, anti-seize (item 13, appendix E)
- Oil, engine lubricating (item 35, appendix E)
- Turbine shaft split ring
- Oil slinger split ring
- Turbocharger shaft bearing
- Retaining rings (4)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-44	Turbocharger removed.

Materials/Parts

- Solvent, drycleaning (item 54, appendix E)
- Brush, stiff bristle (item 6, appendix E)
- Cloth, abrasive crocus (item 11, appendix E)



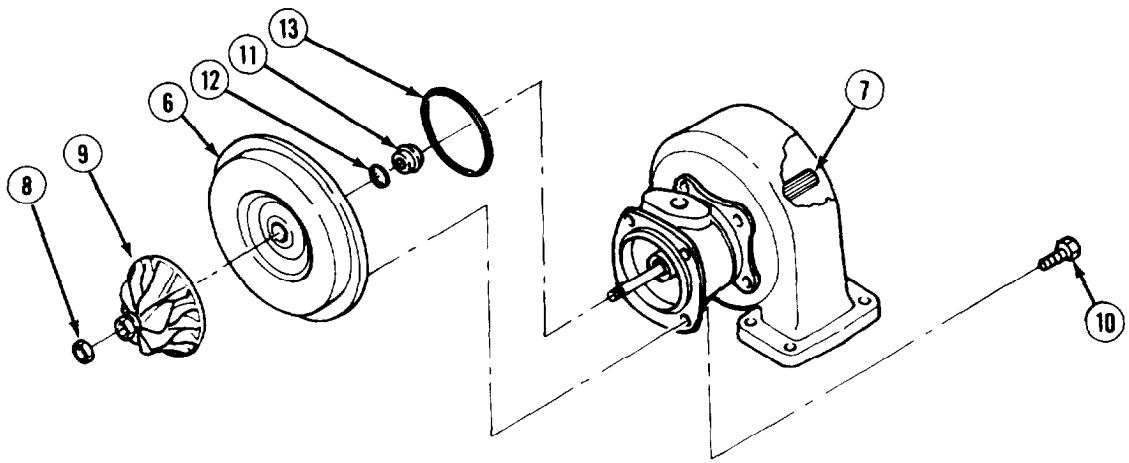
a. Disassembly.

NOTE

Only remove data plate if replacing compressor housing or data plate is damaged or illegible.

- (1) Remove two rivets (1) and data plate (2).
- (2) Note location and remove clamp (3), compressor housing (4), and preformed packing (5) from diffuser (6). Discard preformed packing.

5-44. TURBOCHARGER REPAIR (CONT).



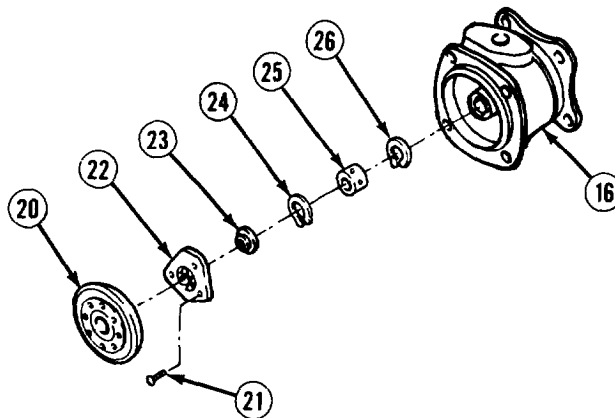
CAUTION

Impeller has left-handed threads. Remove correctly or damage to turbine shaft and nut will result.

- (3) Hold turbine shaft (7) and remove locknut (8) and impeller (9).
- (4) Remove four screws (10) and diffuser (6).
- (5) Remove oil slinger (11), split ring (12), and seal ring (13) from diffuser (6). Discard seal ring.
- (6) Remove four screws (14), two lockplates (15), and bearing housing (16) from turbine housing (17).
- (7) Remove turbine shaft (7), split ring (18), and heat shield (19) from turbine housing (7). Discard split ring.

D-1325-SM

- (8) Remove oil baffle (20), three screws (21), thrust bearing (22), and thrust collar (23) from bearing housing (16).
- (9) Remove two outer retaining rings (24), two bearings (25), and two inner retaining rings (26) from bearing housing (16). Discard retaining rings and bearings.



b. Cleaning/Inspection.

- (1) Check compressor housing for impeller contact. If damage is found replace housing. Damage shows turbine shaft to be out of balance or locknut unscrewed.
- (2) Check blades on impeller and on turbine shaft. Also check turbine shaft. If damage is found on either, turbine shaft and impeller must be replaced as an assembly.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (3) Clean all parts with stiff nylon brush and drycleaning solvent.
 - (4) Remove carbon build up from compressor and turbine housing using medium emery cloth.
 - (5) Polish bearing surfaces of turbine shaft with crocus cloth.

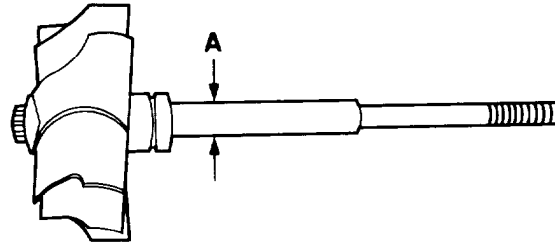
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (6) Rinse all parts with drycleaning solvent. Dry with compressed air.
- (7) Check all parts for cracks, excessive wear, and other damage. Replace all parts failing inspection.

5-44. TURBOCHARGER REPAIR (CONT).

- (8) Measure turbine shaft diameter at position A. If measurement is less than 0.432 in. (10.97 mm), replace turbine shaft.



c. Assembly.

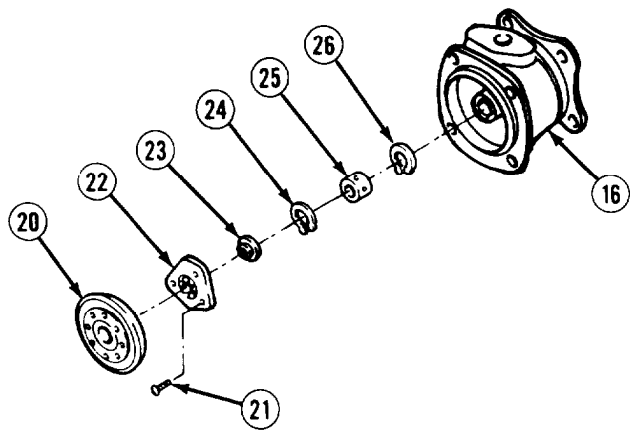
CAUTION

Beveled face of inner and outer retaining rings must be toward bearings. Failure to do so will result in damage to turbocharger.

- (1) Install two inner retaining rings (26), bearings (25), and outer retaining rings (24) in bearing housing (16).
- (2) Lubricate thrust bearing (22) with engine oil.

CAUTION

Scribe mark on oil baffle and thrust bearing must be aligned to ensure balance of turbine shaft. Failure to do so will result in damage to turbocharger.



- (3) Install thrust collar (23), thrust bearing (22), three screws (21), and oil baffle (20) on bearing housing (16). Tighten screws 40 lb-in. (4.5 N-m). Align balance mark on oil baffle and thrust bearing.

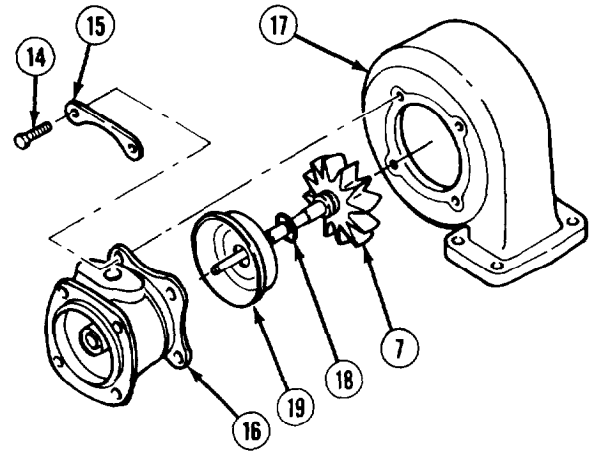
- (4) Position heat shield (19) on bearing housing (16).

NOTE

Rotating turbine shaft in assembly will properly seat split ring.

CAUTION

Scribe mark on impeller end of turbine shaft and oil baffle must be aligned to ensure balance of turbine shaft. Failure to do so will result in damage to turbocharger.



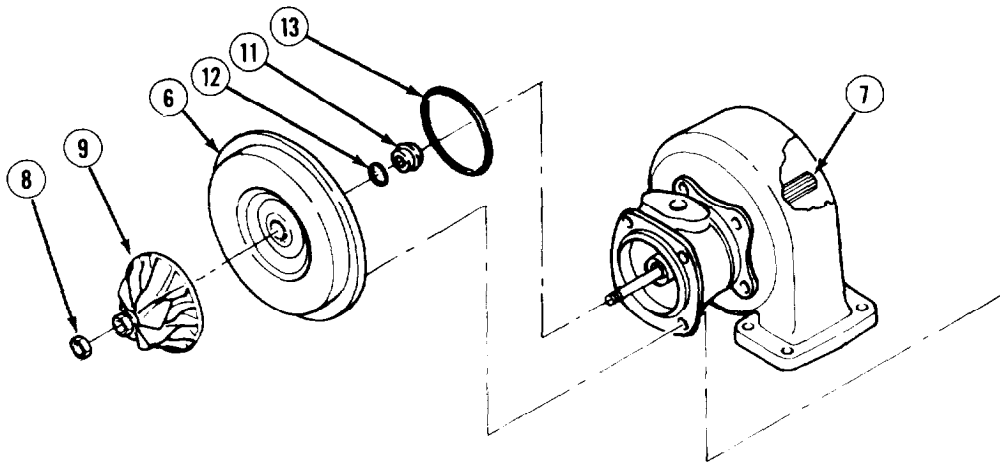
- (5) Install split ring (18) on turbine shaft (7) and assemble turbine shaft and bearing housing (16). Ensure that scribe marks on turbine shaft and oil baffle (20) are aligned.
- (6) Align scribe marks and install bearing housing (16) and turbine shaft (7) as an assembly in turbine housing (17).

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (7) Apply anti-seize compound on threads of four screws (14).
- (8) Install two lockplates (15) with four screws (14). Tighten screws 100 lb-in. (11.3 N•m).

5-44. TURBOCHARGER REPAIR (CONT).



- (9) Install split ring (12) on oil slinger (11).

CAUTION

Scribe mark on impeller end of turbine shaft and on oil slinger must be aligned to ensure balance of turbine shaft. Failure to do so will result in damage to turbocharger.

- (10) Install oil slinger (11) and align oil slinger in line with balance mark.
- (11) Install seal ring (13) in diffuser (6).
- (12) Position diffuser (6) on turbine shaft (7).

WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

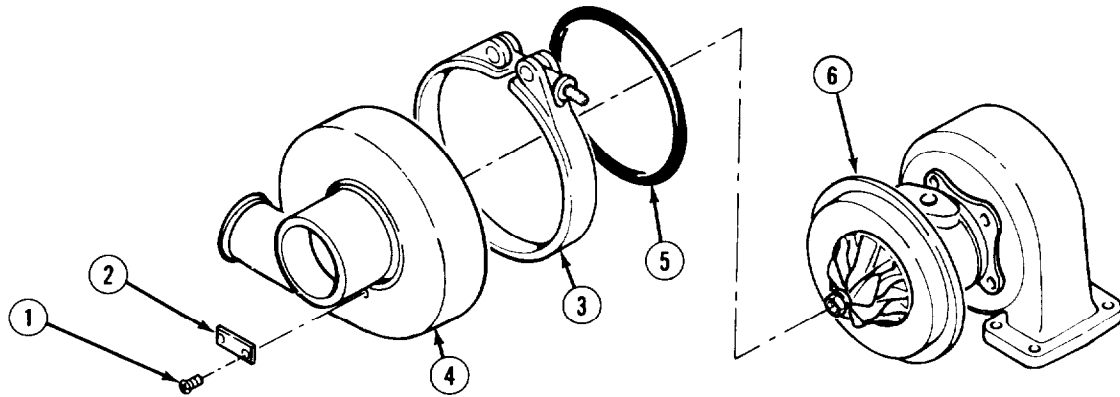
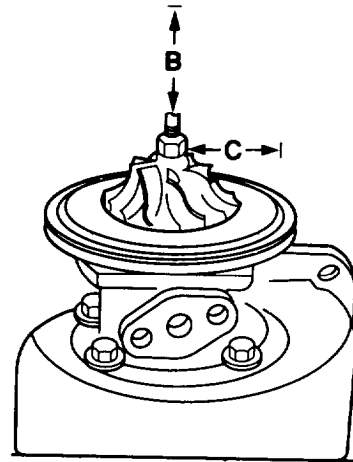
- (13) Apply anti-seize compound to threads of four screws (10).
- (14) Align matchmarks and install diffuser (6) with four screws (10). Tighten screws 50 lbs-in. (5.7 N-m).

CAUTION

Impeller has left-handed threads. Remove correctly or damage to turbine shaft and nut will result.

- (15) Install impeller (9) with locknut (8). Align balance marks on impeller and turbine shaft (6). Hold impeller and tighten nut 120 lbs-in. (14 N-m).

- (16) Measure shaft end play at position B.
Normal measurement is 0.001 to 0.003 in.
(0.03 - 0.08 mm). If measurement is not
within limits, replace thrust collar and
turbine shaft.
- (17) Measure radial clearance at position C.
Normal measurement is 0.012 to 0.018 in.
(0.30 - 0.46 mm). If measurement is not
within limits, replace bearings. If
measurement is still not within limits,
replace bearing housing.



- (18) Install preformed packing (5) in compressor housing (4).
- (19) Assemble compressor housing (4) on diffuser (6) and tighten clamp (3) 50 lb-in (5.7 N•m). Tap around
clamp with plastic hammer and tighten clamp again at same value.
- (20) If removed, install data plate (2) with two rivets (1).

NOTE

Follow-on Maintenance: Install turbocharger (para4-44).

END OF TASK

5-45. ALTERNATOR ASSEMBLY TESTING.		
This task covers:		
Testing		
INITIAL SETUP		
Tools	<i>Personnel Required</i>	
Tool kit, general mechanic's: equipment maintenance and repair	MOS63G, Fuel and electrical systems repairer	
	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, electrical equipment: TK-101/GSQ	TM or Para Para 4-70	Alternator removed.
Multimeter, Digital AN/PSM-45		

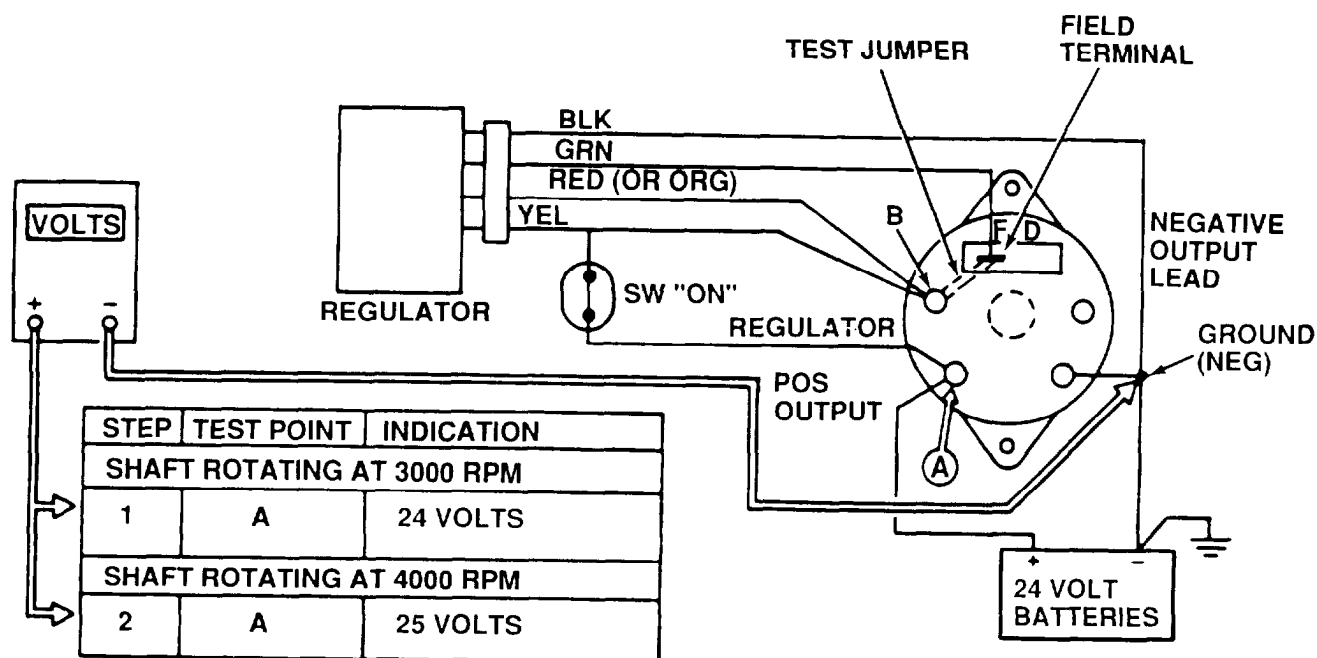
Testing.



- Do not, under any circumstances, short field terminal of alternator to ground. Permanent damage to regulator may occur.
- Do not disconnect voltage regulator while alternator is operating. Large voltage transient may occur and damage regulator.
- Do not disconnect alternator output lead from alternator while alternator is operating, as damping effect of battery will be lost. The voltage will rise to an extreme value and permanent damage to regulator may occur.
- Do not remove alternator from engine without first disconnecting ground battery cable. Permanent damage to regulator may result.

NOTE

- Battery used in electrical testing must be of correct voltage, and must be in good condition and fully charged.



WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

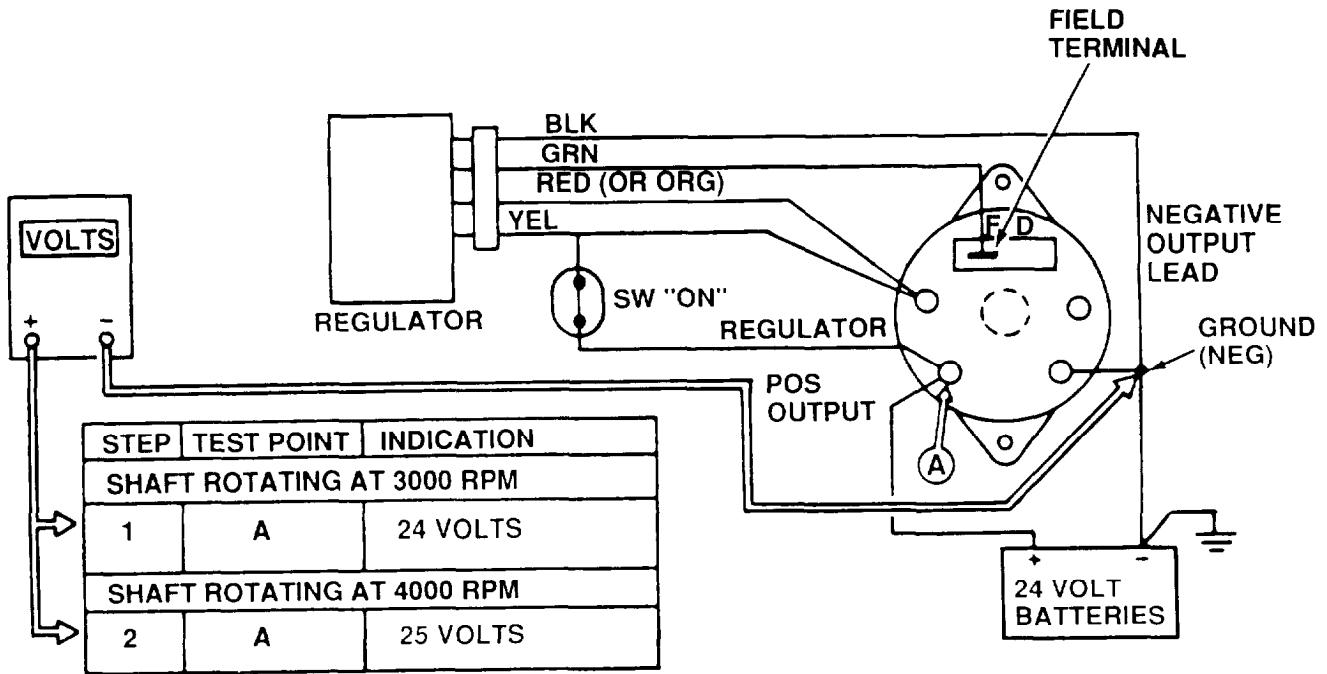
(1) Regulator test (open).

NOTE

Alternator should be mounted in vise, shaft rotating at 3000 rpm, with jumper wire installed between B and field terminal.

- (a) Measure voltage at terminal A. Meter should read approximately 24 volts.
- (b) Increase rpm to 4000. (To the right [clockwise] as viewed facing the fan.)
- (c) Measure voltage at terminal A. Voltage should increase to 24 to 25 volts.
- (d) Readings other than these indicate alternator is open and should be replaced.

5-45. ALTERNATOR ASSEMBLY TESTING (CONT).



(2) Regulator test (shorted).

NOTE

Mount alternator on test stand, shaft rotating at 3000 rpm to perform this test.

- (a) Measure voltage at terminal A. Meter should indicate approximately 24 volts.
- (b) Increase rpm to 4000. If voltage at A increases beyond 25 volts, regulator is shorted. Replace regulator.

NOTE

Follow-on Maintenance: Install alternator (para4-70).

END OF TASK

5-46. ALTERNATOR ASSEMBLY REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Testing
- d. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Tool kit, automotive: fuel and electrical system repair

Tool kit, electrical equipment: TK-101/GSQ

Multimeter, Digital AN/PSM-45

Materials/Parts

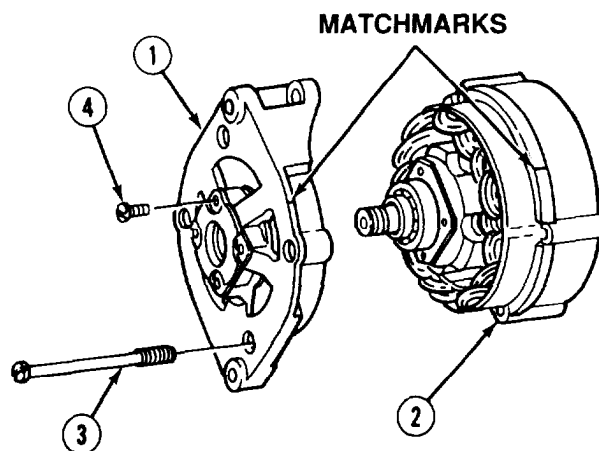
Solvent, drycleaning: (item 54, appendix E)
 Cloth, lint-free: (item 12, appendix E)

Equipment Condition

TM or Para	Condition Description
Para 4-70	Alternator removed.

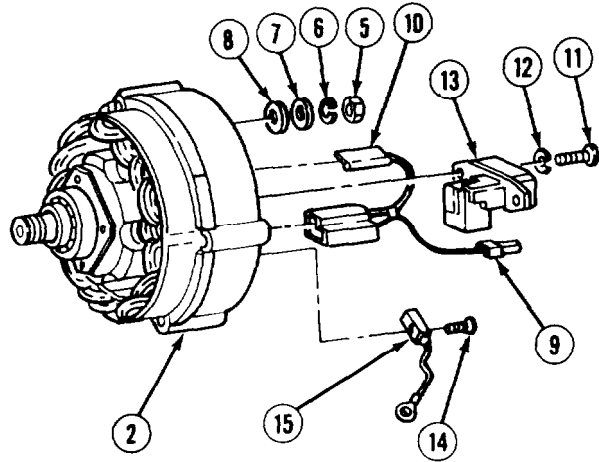
a. Disassembly.

- (1) Matchmark length of drive end shield (1) and alternator housing (2).
- (2) Remove eight screws (3 and 4) and shield (1) from housing (2).

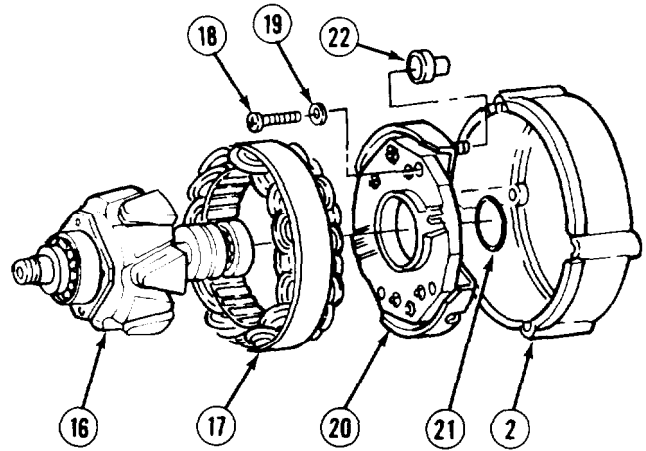


5-46. ALTERNATOR ASSEMBLY REPAIR (CONT).

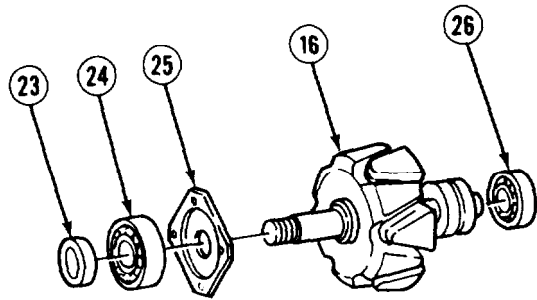
- (3) Remove nut (5), lockwasher (6), washer (7), and fiber washer (8), from housing (2). Discard lo&washer.
- (4) Tag, mark, and remove two connectors (9 and 10).
- (5) Remove two screws (11), lockwasher (12), and regulator/brush assembly (13).
- (6) Remove screw (14) and capacitor (15).



- (7) Remove rotor (16) and pull stator (17) from housing (2).
- (8) Remove three screws (18), spring washers (19), and rectifier (20) from housing (2).
- (9) Remove preformed packing (21) and spacer (22). Discard performed packing.



- (10) Remove collar (23), bearing (24) plate (25), and bearing (26) from rotor (16).

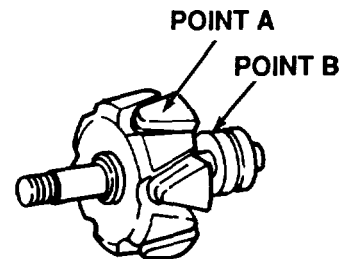


*b. Cleaning/Inspection.***WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).
- (1) Clean all metal parts with drycleaning solvent and dry with compressed air or with lint-free cloth.
 - (2) Check all parts for cracks, wear, and rust.
 - (3) Measure length of brushes. Minimum length of used brushes in 0.2 in. (5 mm). Minimum length of new brushes in 0.4 in. (10 mm).
 - (4) Replace parts failing inspection.

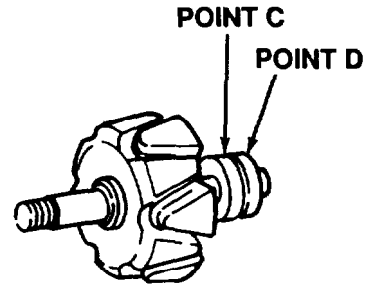
c. Testing.

- (1) Test rotor for short circuit at points A and B with 80 Vac. Indicator lamp must not light up.

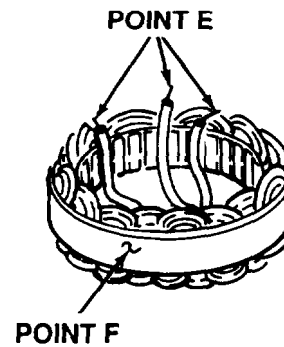


5-46. ALTERNATOR ASSEMBLY REPAIR (CONT).

- (2) Measure resistance of excitation winding in rotor at points C and D. Resistance value is 7.0Ohm to 7.10hm.

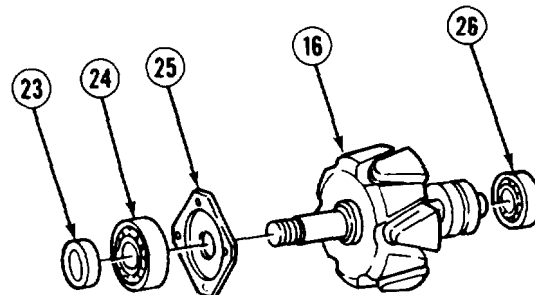


- (3) Test stator for short circuit at points E and F with 80 Vac. Indicator lamp must not light up.
- (4) Measure resistance of stator windings between phase lead-out wires (point E). Resistance value 0.14 Ohm to 0.24 Ohm.

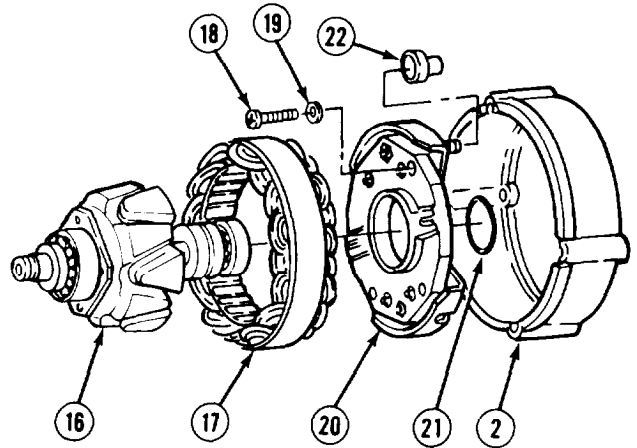


d. Assembly.

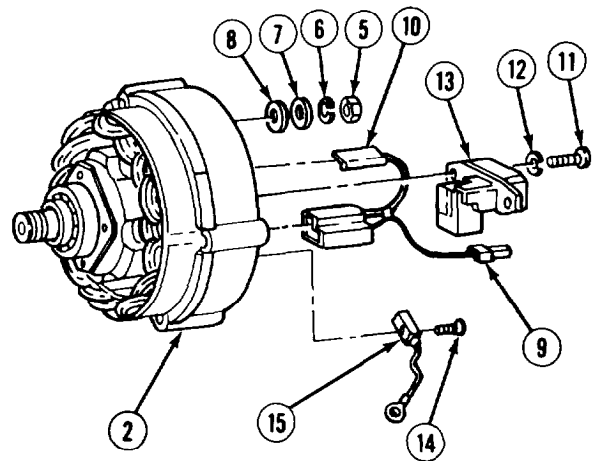
- (1) Install bearing (26) on rotor (16).
- (2) Install plate (25), bearing (24), and collar (23).



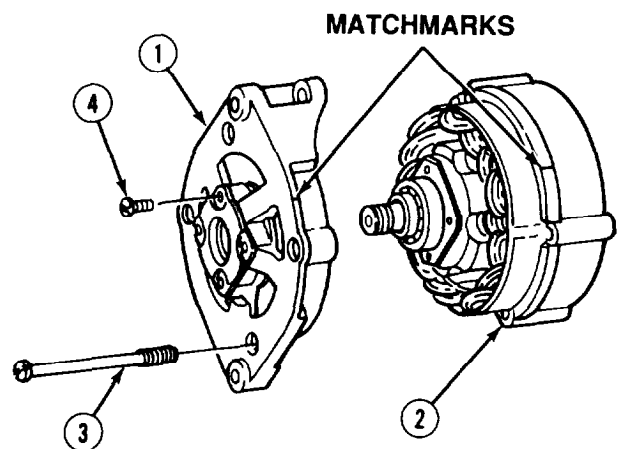
- (3) Install preformed packing (21) and spacer (22).
- (4) Install rectifier (20) in housing (2) with three spring washers (19) and screws (18).
- (5) Align matchmarks, position stator (17) in housing (2), and install rotor (16).



- (6) Install capacitor (15) with screw (14).
- (7) Install regulator brush assembly (13) with two lockwashers (12) and screws (11).
- (8) Install fiber washer (8), washer (7), lockwasher (6), and nut (5).
- (9) Connect two connectors (9 and 10).



- (10) Align matchmarks and install shield (1) on housing (2) with eight screws (3 and 4).



NOTE

Follow-on maintenance: Install alternator (para4-70).

END OF TASK

5-47. ALTERNATOR PULLEY AND FAN REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Wrench, torque

Materials/Parts

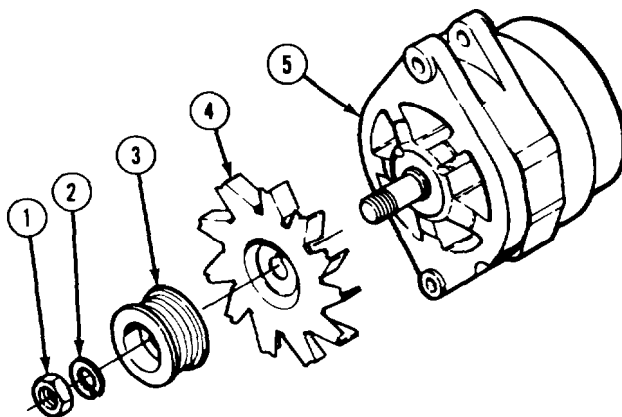
Lockwasher

Equipment Condition

TM or Para
Para 4-70

Condition Description
Alternator removed.

- a. Removal. Remove nut (1), lockwasher (2), pulley (3), and fan (4) from alternator (5).
- b. Installation. Install fan (4), pulley (3), lockwasher (2), and nut (1). Tighten nut 70 to 80 lb-ft (95 - 108 Nm).



NOTE

Follow-on Maintenance: Install alternator (para4-70).

END OF TASK

5-48. STARTER ASSEMBLY TESTING.

This task covers:

Testing

INITIAL SETUP*Tools*

Tool kit, general mechanic's: equipment maintenance and repair

Multimeter, digital AN/PSM-45

Tool kit, automotive: fuel and electrical system repair

Tools

Tool kit, electrical equipment: TK-101/GSQ

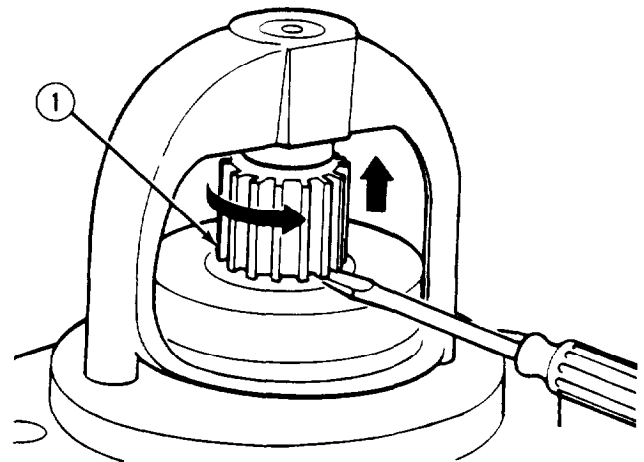
Equipment Condition

Para 4-72

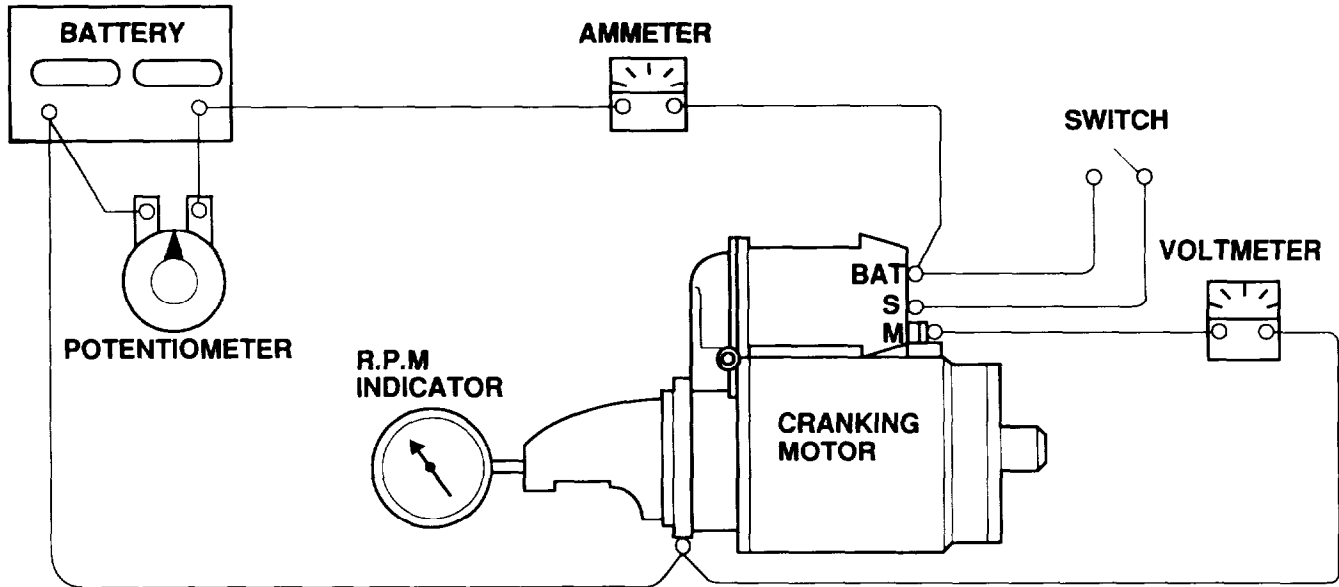
Starter removed.

Testing.

- (1) Rotate pinion (1) by hand. Pinion will not freewheel, it is normal for pinion to have some drag. Also, it may be necessary to pry pinion up to grip it.
- (2) If pinion (1) rotates normally, go to step three. If pinion will not rotate normally, refer to starter repair (para 5-49).



5-48. STARTER ASSEMBLY TESTING (CONT).



(3) Perform following no-load test prior to disassembly:

- (a) Connect voltmeter from starter motor terminal to starter motor frame. Connect negative battery cable to starter motor frame.
- (b) Mount tachometer to measure armature speed.

WARNING

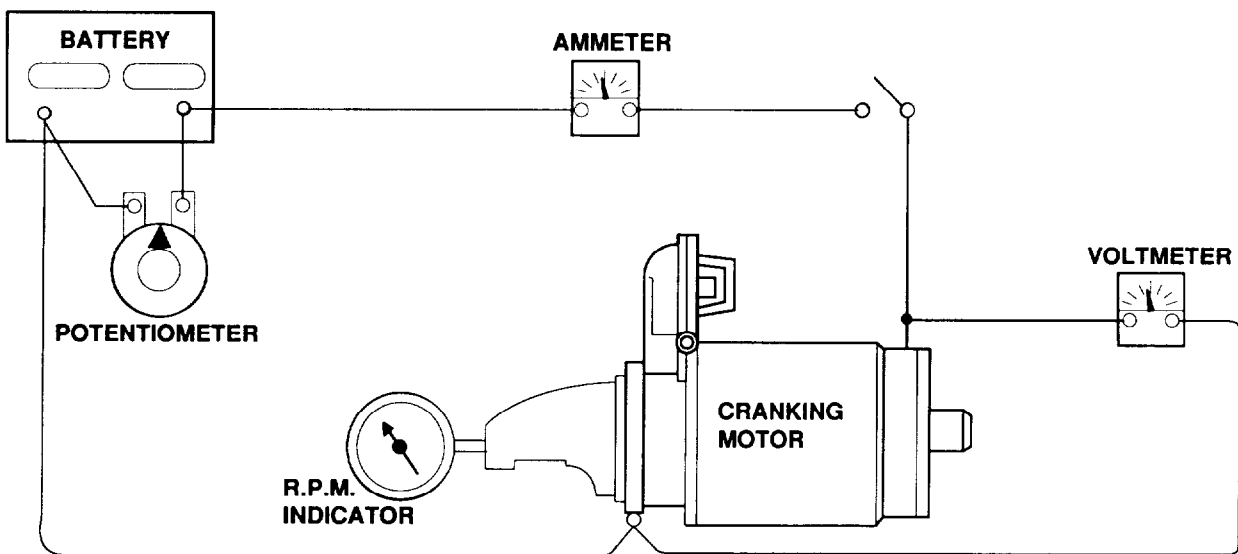
Ensure switch is open prior to connecting to starter solenoid. Electrical shock or physical injury may result if starter is energized while making final battery connection.

- (c) Connect switch to solenoid battery terminal and solenoid switch terminal.
- (d) Connect ammeter in series between positive side of battery and battery terminal on starter solenoid.
- (e) Connect potentiometer between positive and negative battery terminals.
- (f) Close switch to operate starter and adjust potentiometer until voltmeter indicates 24 Vdc.
- (g) Record ammeter and tachometer readings.
- (h) Open switch to de-energize starter.
- (i) Refer to Table 5-3 for current and rpm performance specifications.

Table 5-3. Starter No-Load Test Specifications

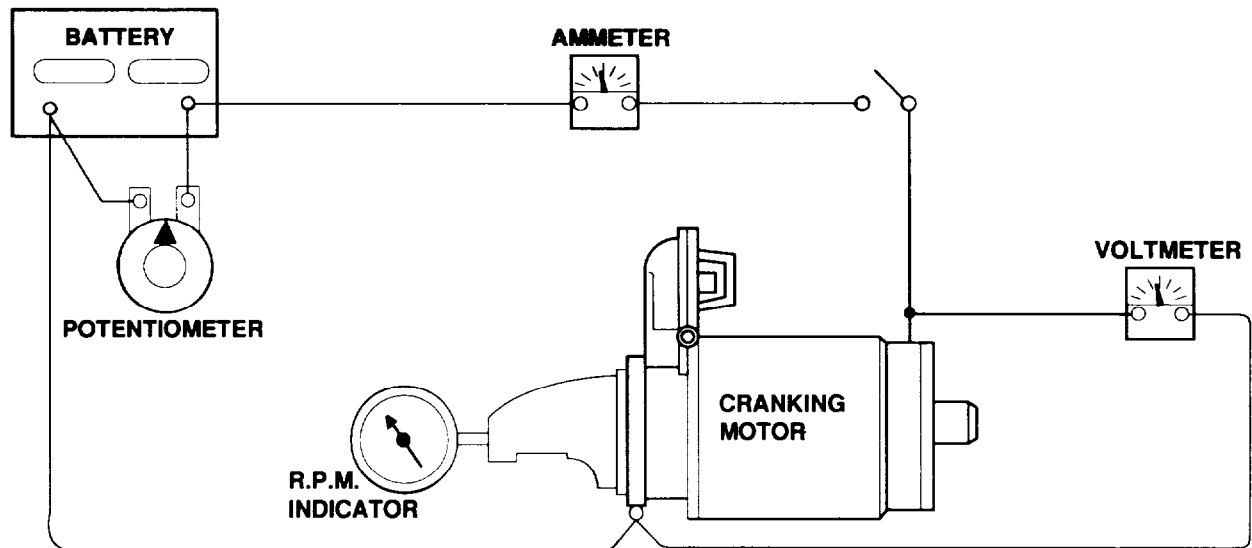
No-Load Test (Includes Solenoid Current)				
Volts	Min Amps	Max Amps	Min RPM	Max RPM
24	105	115	9000	13400

- (j) Remove test equipment from starter assembly. If measured performance is not within specifications, go to step four. If measured performance is within specifications, starter is functioning correctly.



- (4) If pinion rotates and measured performance is not within specifications, perform following no-load test.
- Remove solenoid (para 5-49).
 - Connect multimeter from starter motor terminal to starter motor frame.
 - Connect negative battery terminal to starter motor frame.
 - Mount tachometer to measure armature rpm.

5-48. STARTER ASSEMBLY TESTING (CONT).



WARNING

Ensure switch is open prior to connecting to starter solenoid. Electrical shock or physical injury may result if starter is energized while making final battery connection.

- (e) Connect one switch wire and one multimeter wire together. Connect remaining ammeter wire to positive terminal of battery and remaining switch wire to starter motor terminal.
- (f) Connect potentiometer between positive and negative terminals of battery.
- (g) Close switch to operate starter and adjust potentiometer until voltmeter indicates 24 Vdc.
- (h) Observe and record ammeter and rpm readings. Refer to Table 5-3 for performance specifications.
- (i) If starter is within performance specifications, replace solenoid (para 5-49) and go to step three in this paragraph.
- (j) If starter is not within performance specifications, repair starter (para 5-49).

END OF TASK

5-49. STARTER ASSEMBLY REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Testing
- d. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Tool kit, automotive: fuel and electrical system repair

Tool kit, electrical equipment: TK-101/GSQ

Multimeter, digital AN/PSM-45

Materials/Parts

Washers, lock (4)

Locknut

Gasket

Rivets (4)

Compound, sealing (item 16, appendix E)

Solvent, drycleaning (item 54, appendix E)

Cloth, lint-free (item 12, appendix E)

Cloth, abrasive crocus (item 11, appendix E)

Equipment Condition

TM or Para

Para 4-72

Para 5-48

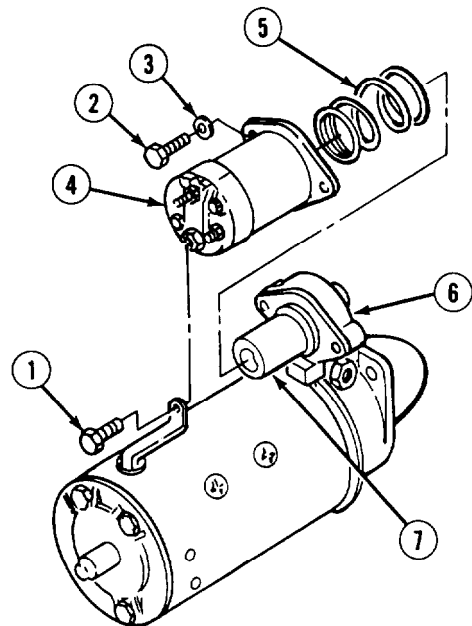
Condition Description

Starter removed.

Starter tested.

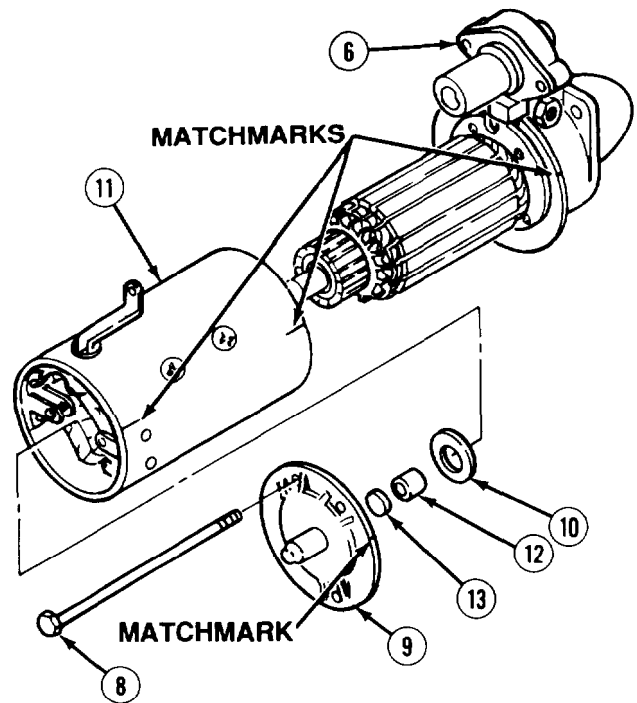
a. Disassembly.

- (1) Remove three screws (1 and 2), two lockwashers (3), solenoid (4), and spring (5) from drive housing (6) and plunger (7).

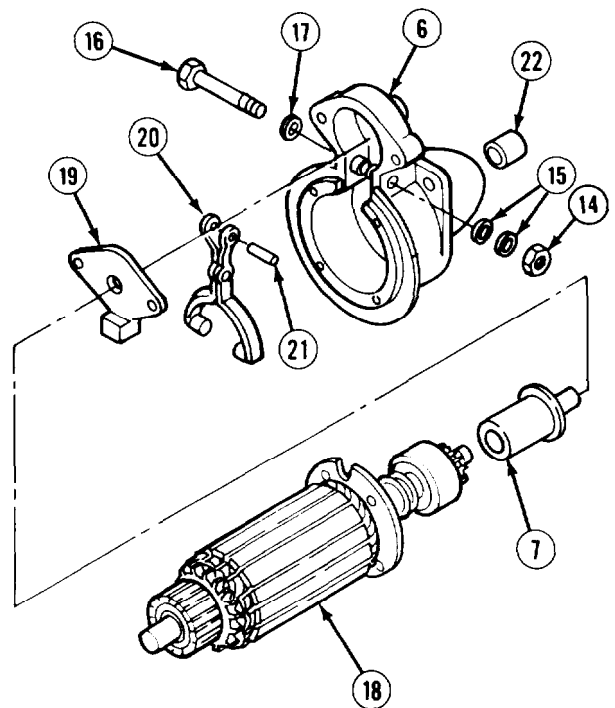


5-49. STARTER ASSEMBLY REPAIR (CONT).

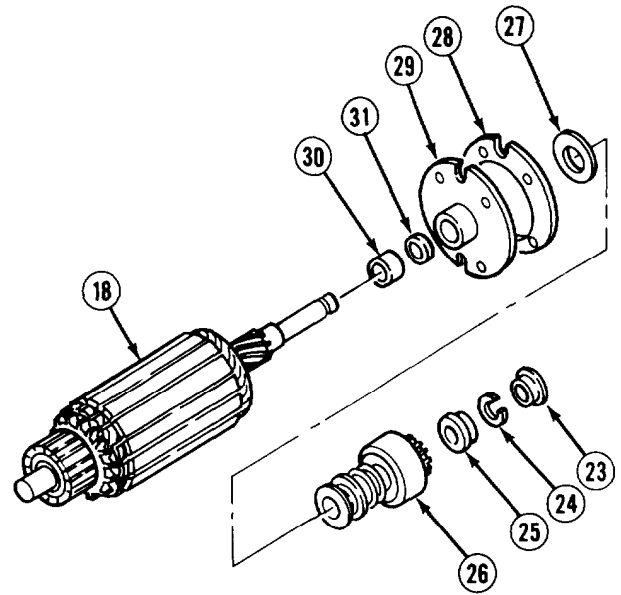
- (2) Matchmark and remove two screws (8), end cap (9), washer (10), and coil housing (11) from drive housing (6).
- (3) If damaged, remove bushing (12) and wick (13).



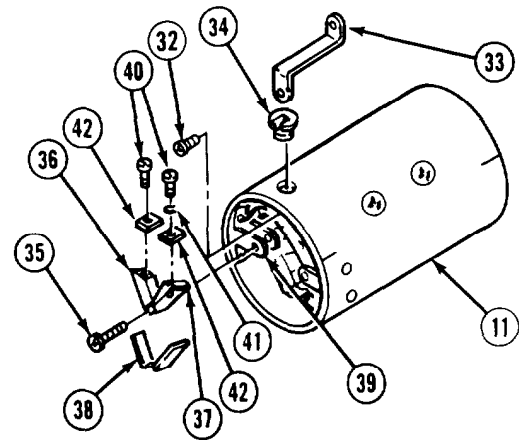
- (4) Remove locknut (14), two special washers (15), screw (16) and special washer (17) from drive housing (6). Discard locknut.
- (5) Remove armature (18) with plunger (7), rubber boot (19), and lever (20).
- (6) Remove pin (21) and separate parts.
- (7) If damaged, remove bushing (22) from drive housing (6).



- (8) Remove collar (23), retaining ring (24), collar (25), bendix (26), washer (27), gasket (28), and center bearing plate (29) from armature (18).
- (9) If damaged, remove oil seal (30) and bushing (31).

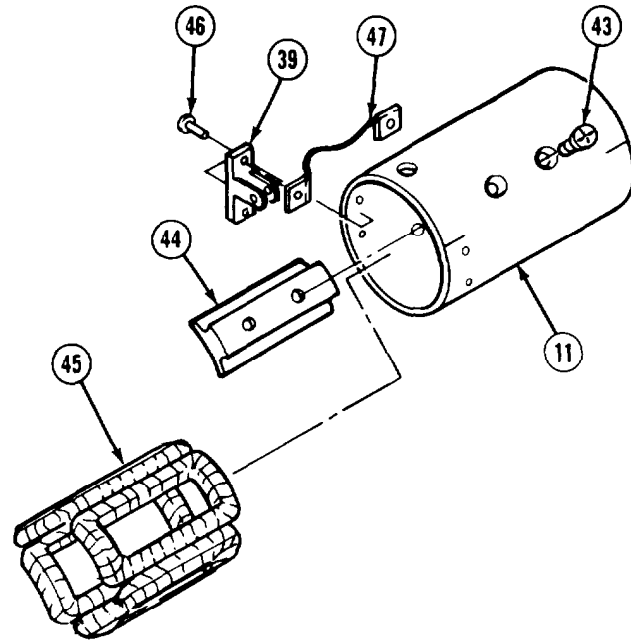


- (10) Remove screw (32), field connector (33), and grommet (34) from housing (11).
- (11) Remove two pins (35), brush holders (36), brush ground holders (37) and springs (38) from brackets (39).
- (12) Remove two screws (40), lockwasher (41), and brushes (42).



5-49. STARTER ASSEMBLY REPAIR (CONT).

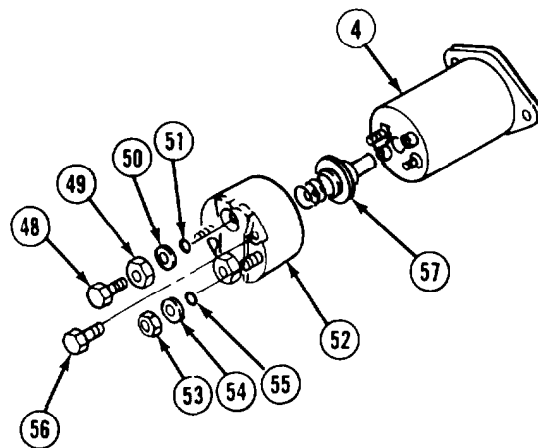
- (13) Remove eight screws (43), four pole shoes (44), and field coil assembly (45) from housing (11).
- (14) Remove four rivets (46), two brackets (39), and ground wires (47).



NOTE

If solenoid is to be tested, perform c. Testing, Step (3) before continuing.

- (15) Remove screw (48), nut (49), washer (50), and grommet (51) from solenoid end cap (52).
- (16) Remove nut (53), washer (54), and grommet (55).
- (17) Remove two screws (56), cap (52) and contact (57) from solenoid (4).



*b. Cleaning/Inspection.***WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts in drycleaning solvent except armature, field coil, and starter drive.
 - (2) Clean starter drive with clean dry cloth.
 - (3) Check field frame for cracks, breaks, or other obvious damage.
 - (4) Check armature shaft for rough surfaces or damaged, splices. Clean with No. 240 grit emery paper.
 - (5) Check commutator contact surface for rough surface, pits, scoring, burns, hard carbon, oil coat, and out-of-round.
 - (6) Check brushes for wear, distortion, or discoloration.
 - (7) Check brush springs for distortion.
 - (8) Check splines and gear teeth on starter drive for damage.
 - (9) Check bushings for damage or wear. If inside diameter of bushings is more than 0.005 inches (0.127 mm) larger than shaft diameter, replace bushings.
 - (10) Replace unserviceable parts.

c. Testing.

- (1) Check armature for short circuits, opens, and grounds as follows:
 - (a) Short circuits. Short circuits are located by rotating armature in growler with steel strip held on armature. Steel strip will vibrate on area of short circuit. Shorts between bars are sometimes produced by brush dust or copper between bars.
 - (b) Opens. Checking points where conductors are joined to commutator for loose connections causing arching and burning of commutator. If bars are not badly burned, leads to riser bars can be resoldered.
 - (c) Grounds. Grounds in armature can be detected by use of test lamp. If lamp lights when one test prod is placed on commutator and other test prod on armature core or shaft, armature is grounded.

5-49. STARTER ASSEMBLY REPAIR (CONT).

- (2) Check field coil for grounds and opens as follows:

NOTE

Ground check cannot be made if ground connection cannot be disconnected.

- (a) Grounds. Disconnect field coil ground connection. Using test lamp, connect one test prod to field frame and other to field connector. If lamp lights, field coils are grounded and must be repaired or replaced.
- (b) Opens. Connect test lamp prods to ends of field coils. If lamp does not light, field coils are open.

- (3) Perform starter solenoid ammeter test.

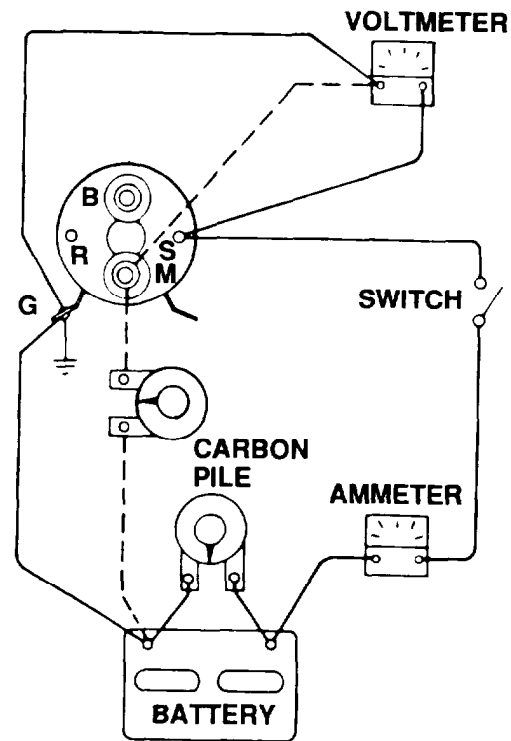
- (a) Connect positive battery cable to one side of the ammeter and the negative battery cable to solenoid ground.

WARNING

Ensure switch is open prior to connecting to starter solenoid: Electrical shock may result solenoid is energized while making final battery connection.

CAUTION

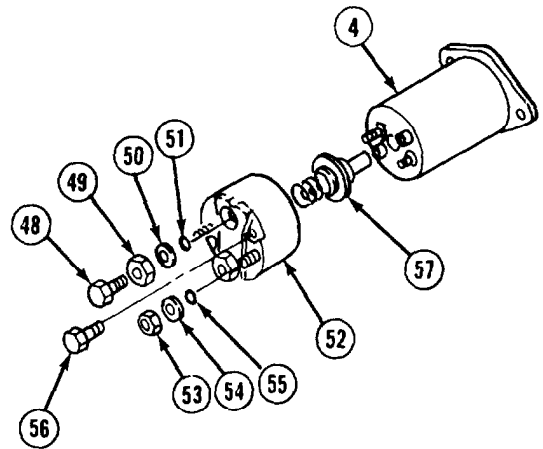
To prevent overheating, do not leave pull-in winding energized more than 15 seconds. Current draw will decrease as winding temperature increases.



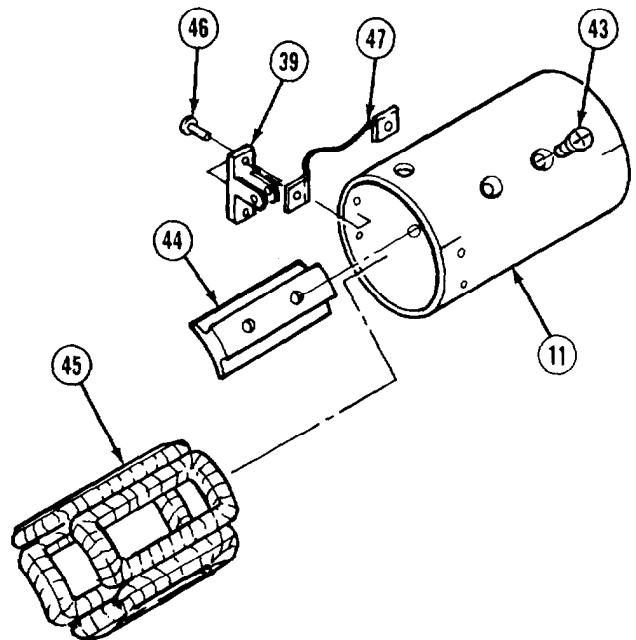
- (b) Connect switch leads to ammeter and solenoid switch terminal (S).
- (c) Connect voltmeter leads to solenoid ground and solenoid switch terminal (S).
- (d) Connect potentiometer across positive and negative battery terminals.
- (e) Close switch to operate starter and adjust potentiometer until voltmeter indicates 24 Vdc.
- (f) Observe ammeter reading. If reading is below or above 105 to 115 amps, replace starter solenoid.

d. Assembly.

- (1) Install contact (57) and cap (52) on solenoid (4) with two screws (56).
- (2) Install grommet (55), washer (54), and nut (53).
- (3) Install grommet (51), washer (50), nut (49) and screw (48).

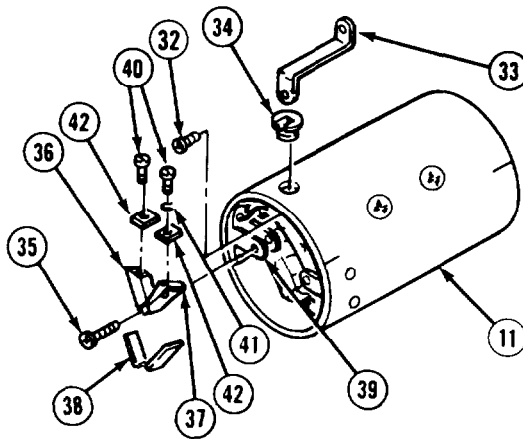


- (4) Install two brackets (39) and ground wires (47) on in housing (11) with four rivets (46).
- (5) Install field coil assembly (45) in housing (11) with four pole shoes (44) and eight screws (43).

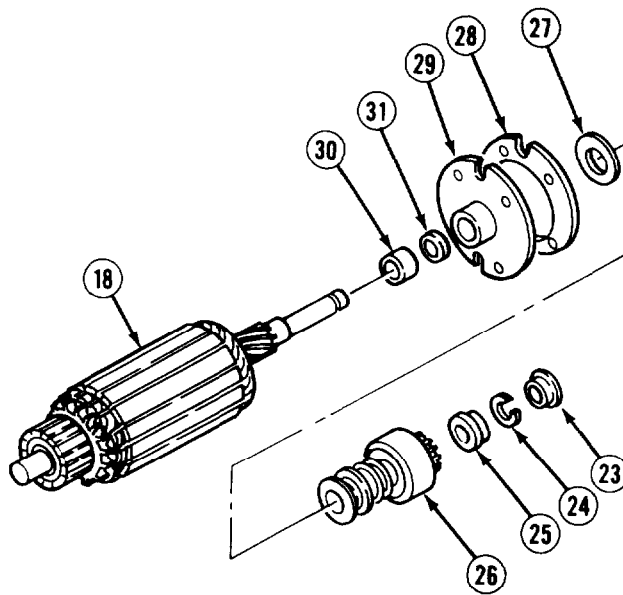


5-49. STARTER ASSEMBLY REPAIR (CONT).

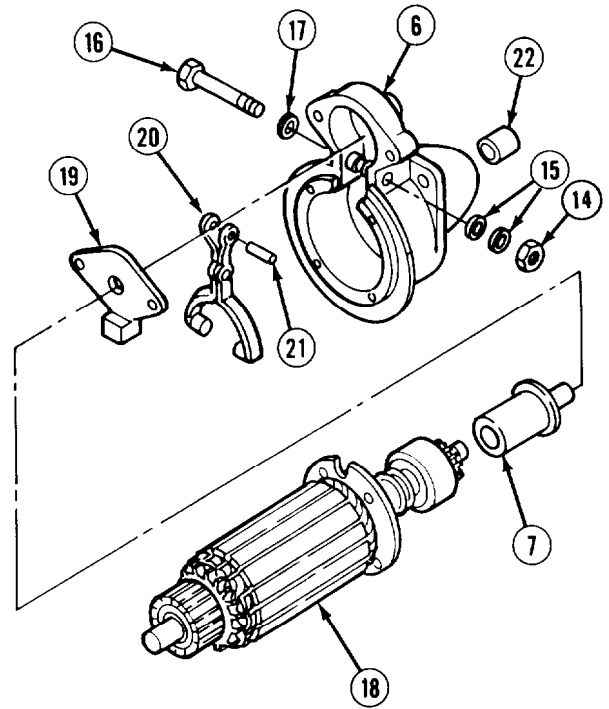
- (6) Install two brushes (42) with lo&washer (41) and two screws (40).
- (7) Install two brush holders (36), brush ground holders (37), and springs (38) in brackets (39) with two pins (35).
- (8) Install grommet (34) and field connector (33) in housing (11) with screw (32).



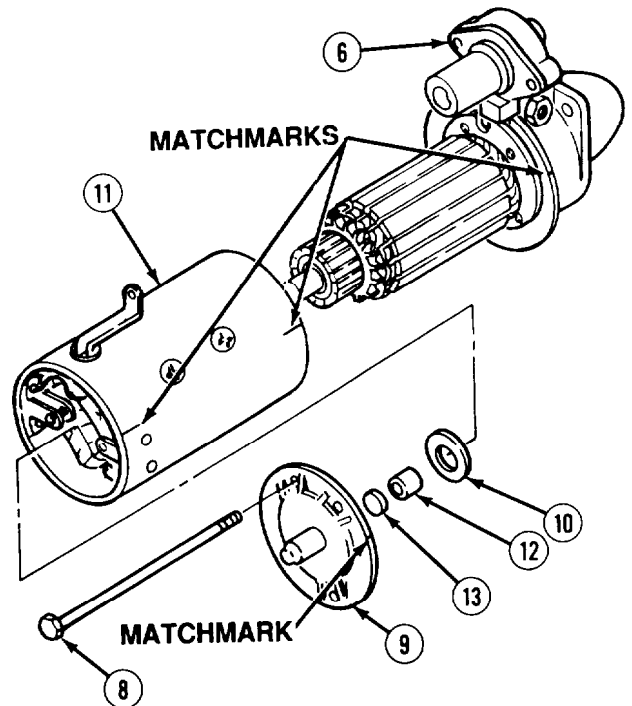
- (9) If removed, install bushing (31) and oil seal (30) in center bearing plate (29).
- (10) Install center bearing plate (29), gasket (28), washer (27), bendix (26), collar (25), retaining ring (24), and collar (23) on armature (18).



- (11) If removed, install bushing (22) in drive housing (6).
- (12) Install lever (20) and rubber boot (19) on plunger (7) with pin (21).
- (13) Position lever (20) on armature (18) and install in housing (6) with screw (16), three special washers (17 and 15), and locknut (14).
- (14) Fully seat rubber boot (19) in drive housing (6).

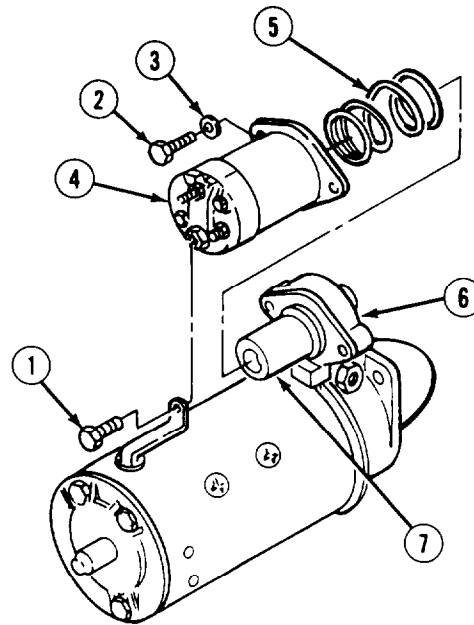


- (15) If removed, install wick (13) and bushing (12) in end cap (9).
- (16) Align matchmarks and install coil housing (11) washer (10) and end cap (9) on drive housing (6) with two screws (8).



5-49. STARTER ASSEMBLY REPAIR (CONT).

- (17) Install spring (5) and solenoid (4) over plunger (7) and on drive housing (6) with two lockwashers (3) and three screws (1 and 2).



NOTE

Follow-on maintenance: Install starter (para 4-72).

END OF TASK

5-50. TWO-SPEED RANGE BOX REPLACEMENT/REPAIR.

This task covers:

- | | | |
|------------|------------------------|-----------------|
| a. Removal | b. Cleaning/Inspection | c. Installation |
|------------|------------------------|-----------------|

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

Compound, sealing, (item 16, appendix E)
Solvent, drycleaning (item 54, appendix E)
Cloth, lint-free (item 12, appendix E)

Personnel Required

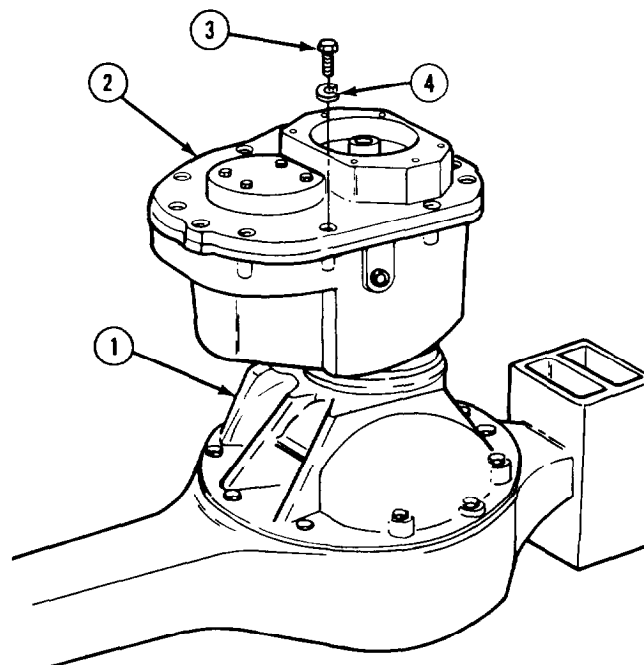
MOS62B, Construction equipment repairer (2)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 5-64	Rear axle removed.

a. Removal.

- (1) Support axle (1) so that range box cover (2) points upward.
- (2) Remove 12 screws (3) and washers (4) from cover (2).

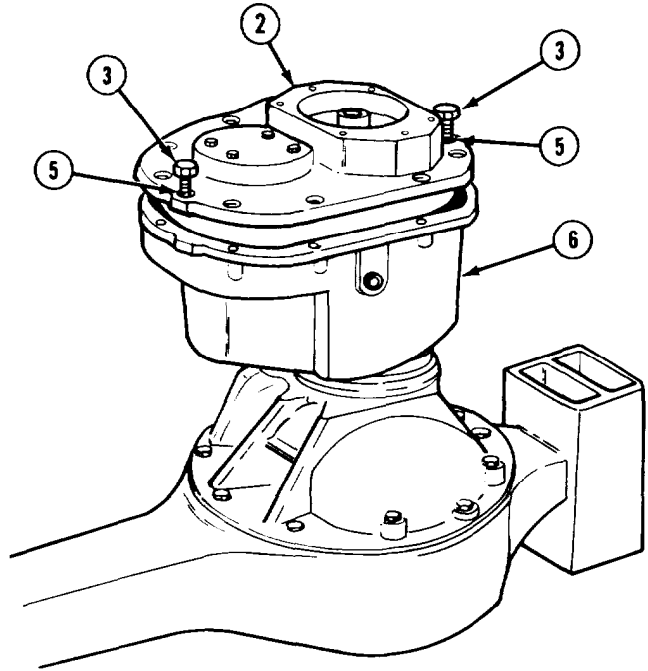


5-50. TWO-SPEED RANGE BOX REPLACEMENT/REPAIR (CONT).

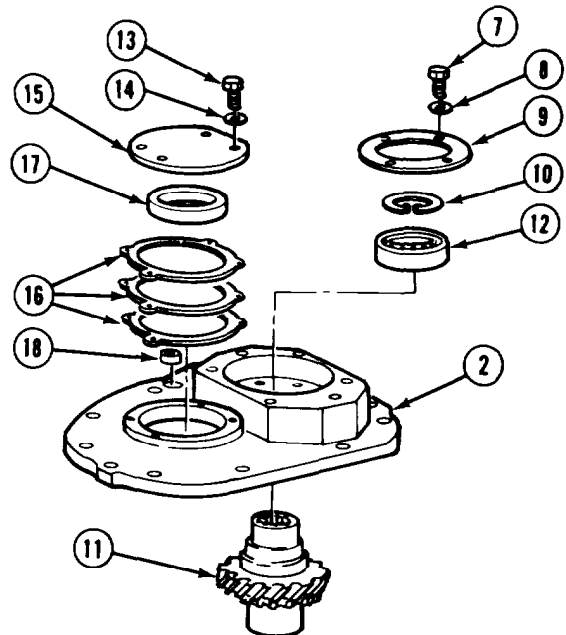
NOTE

Two of 12 screws removed in step (2) are used to remove cover.

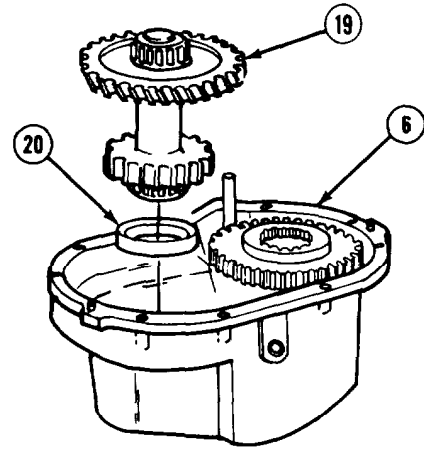
- (3) Insert two screws (3) in two holes (5) in cover (2); tighten screws and remove cover from range box case (6).



- (4) Remove four screws (7), washers (8), and bearing retainer (9) from cover (2).
- (5) Remove snap ring (10), input gear (11), and bearing (12) from cover (2).
- (6) Remove four screws (13), washers (14), bearing retaining cap (15), shims (16), and bearing cup (17) from cover (2).
- (7) Remove shift fork shaft seal (18) from cover (2).

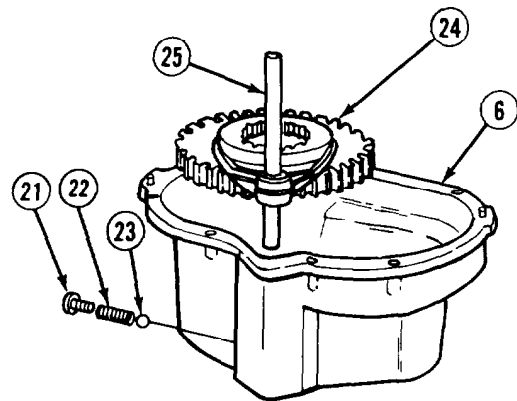


- (8) Remove helical and spur gear assembly (19) and bearing cup (20) from case (6).



- (9) Remove bolt (21), poppet (22), and ball (23) from case (6).

- (10) Remove output gear (24) and shift fork shaft (25) as an assembly from case (6).



5-50. TWO-SPEED RANGE BOX REPLACEMENT/REPAIR (CONT).

- (11) Remove straight roller bearing (26) from axle input gear (27).
- (12) Remove pinion nut (28), washer (29), and axle input gear (27).
- (13) Remove six case mounting bolts (30), washers (31), and case (6) from axle assembly (1).

b. Cleaning/Inspection.

- (1) Scrape sealing material from all sealing surfaces.

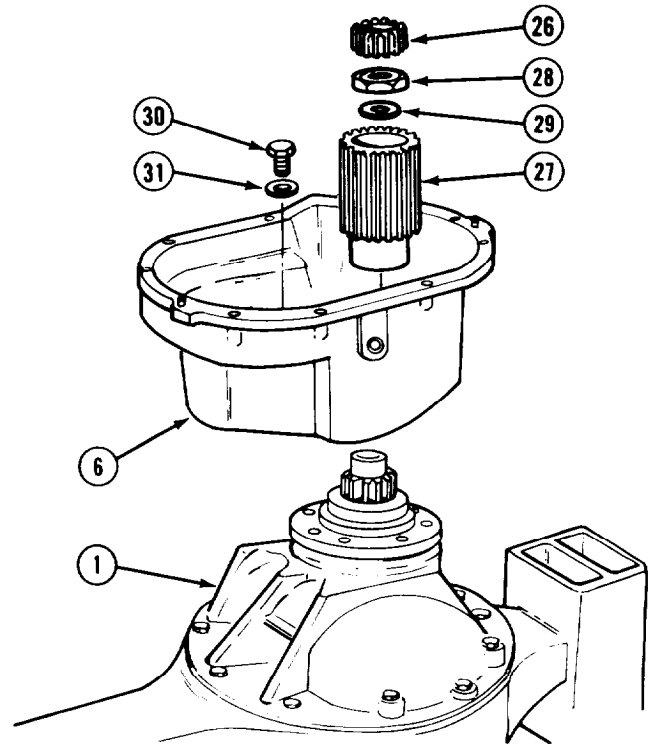
WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (3) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (4) Allow bearings to air dry.
- (5) Check all machined surfaces for damage.
- (6) Check gears for broken teeth, cracks, or other damage.



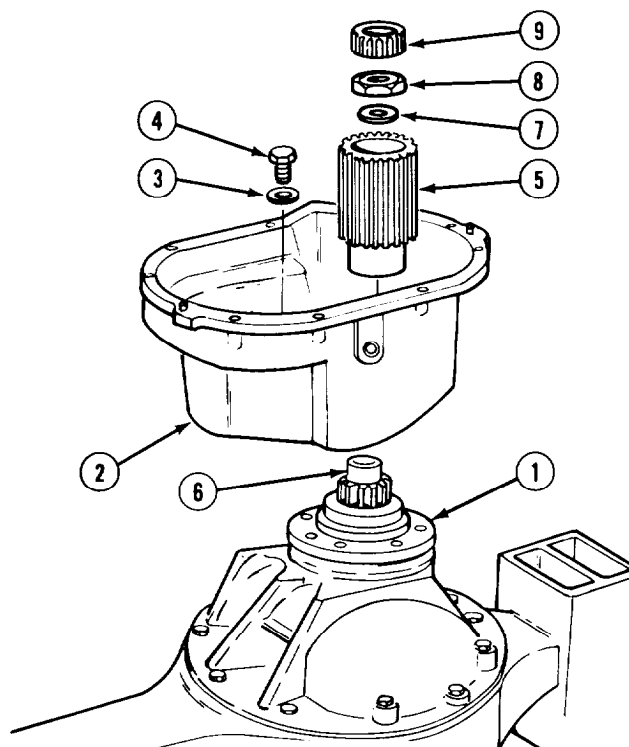
- (7) Check case housing and cover for cracks or damage.
- (8) Check all threads for peeled or crossed condition.
- (9) Check shims for damage. Replace if necessary.
- (10) Clean, check, and lubricate all bearings and splines prior to assembly.
- (11) Replace damaged parts.

c. Installation.

WARNING

Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) Apply a bead of sealing compound around pinion flange (1).
- (2) Install range box case (2) on pinion flange (1) with six washers (3) and screws (4). Tighten screws 115 to 125 lb-ft (156 - 169 N•m).
- (3) Install axle input gear (5) on pinion shaft (6).
- (4) Apply a bead of gasket sealant on bottom of washer (7) and install with pinion nut (8) on pinion shaft (6). Tighten nut 325 to 360 lb-ft (475 - 488 N•m).



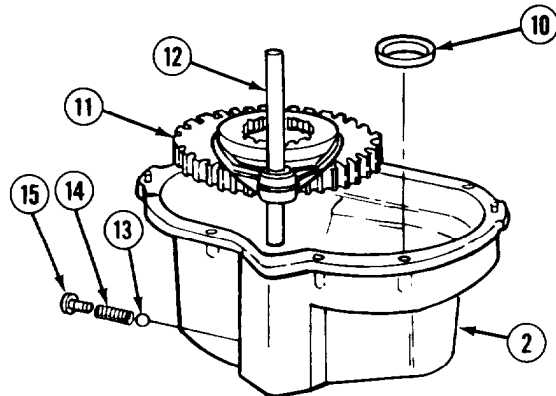
NOTE

Be sure bearing seats properly in input axle gear.

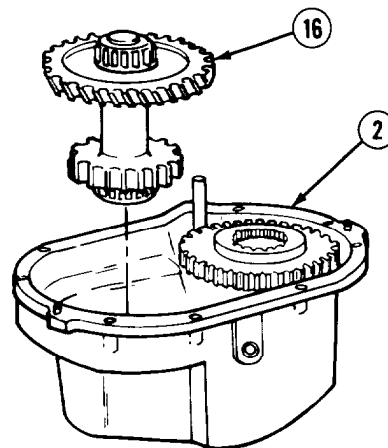
- (5) Install roller bearing (9) in input axle gear (5).

5-50. TWO-SPEED RANGE BOX REPLACEMENT/REPAIR (CONT).

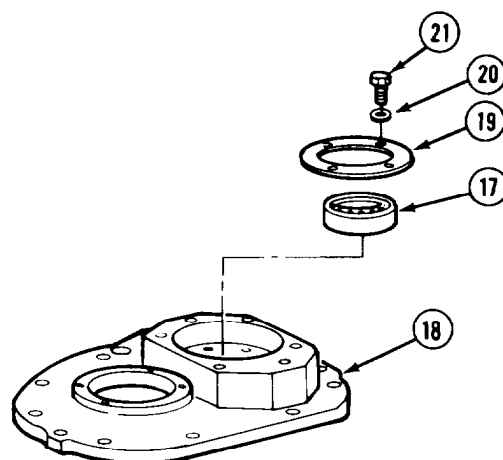
- (6) Install bearing cup (10) in case (2).
- (7) Install output gear (11) and shift fork shaft (12) as an assembly in case (2).
- (8) Install ball (13) poppet spring (14) and bolt (15) in case (2).



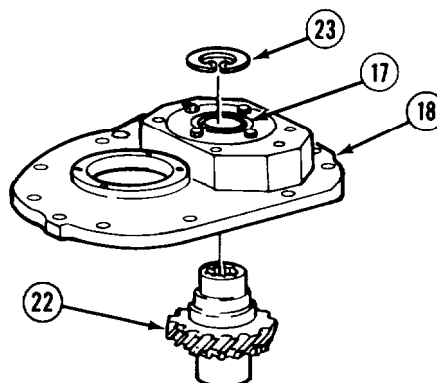
- (9) Install spur gear assembly (16) in case (2).



- (10) Install bearing (17) in cover (18) and secure with bearing retainer ring (19), four washers (20), and screws (21). Tighten screws 20 to 25 lb-ft (27 - 34 N \cdot m).



- (11) Install input shaft (22) in bearing (17) from beneath cover (18).
- (12) Install snap ring (23) on input shaft (22).

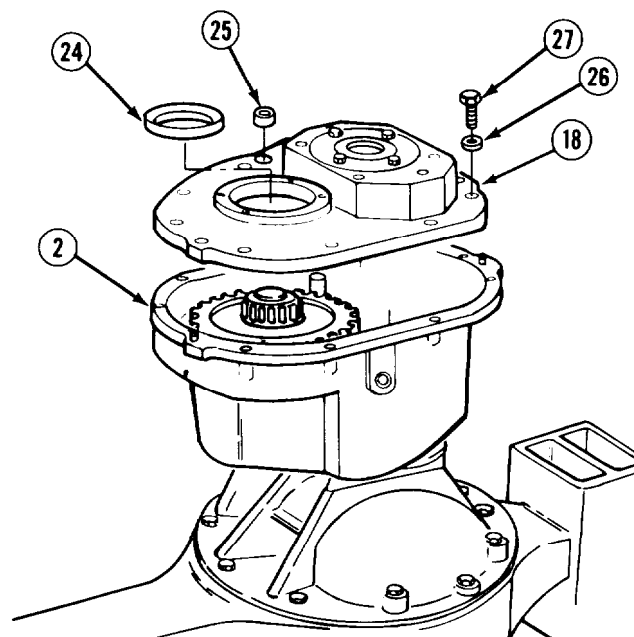


- (13) Install bearing cup (24) and shift fork shaft seal (25) in cover (18).

WARNING

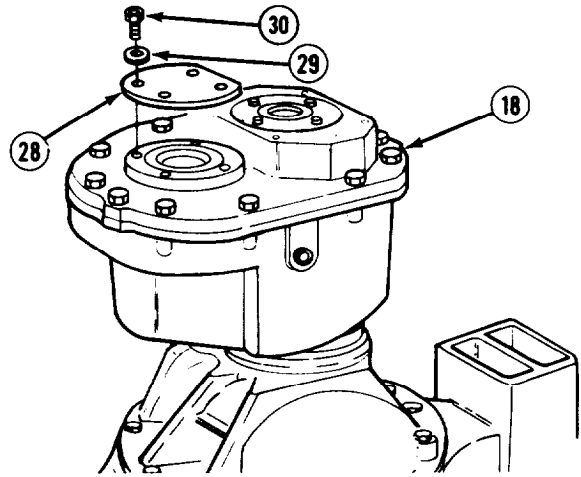
Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (14) Apply a bead of sealing compound around flanged edge of case (2).
- (15) Install cover (18) on case (2) with 12 washers (26) and screws (27). Tighten screws 20 to 25 lb-ft (27 - 34 Nm).

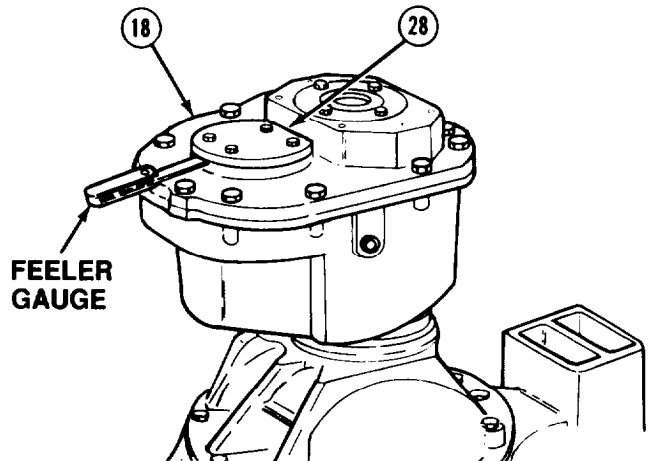


5-50. TWO-SPEED RANGE BOX REPLACEMENT/REPAIR (CONT).

- (16) Install bearing retaining cap (28), four washers (29), and screws (30) on cover (18) without shims. Tighten screws evenly.



- (17) Measure gap between cover (18) and cap (28) on three sides. Record the measurement.

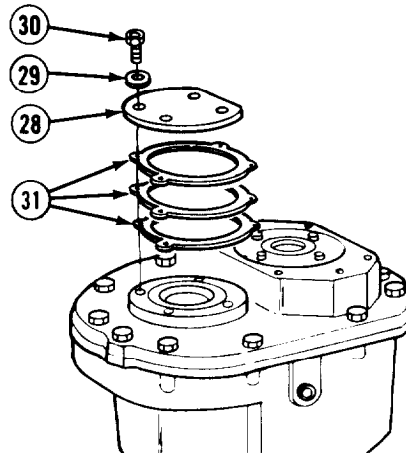


NOTE

Adding 0.005 to 0.010 in. (0.127 - 0.254 mm) to measurement recorded above allows for 0.007 to 0.012 in. (0.178 - 0.305 mm) end play for helical gear shaft.

- (18) Remove four washers (29), screws (30), and bearing cap (28). Install shims (31) with the combined thickness of measurement plus 0.005 to 0.010 in. (0.127 - 0.254 mm).

- (19) Install bearing cap (28), four washers (29), and screws (30). Tighten screws 25 to 30 lb-ft (34 - 41 N•m).



NOTE

Follow-on Maintenance:

- Install rear axle (para 5-64).
- Fill two-speed range box with gear oil (para 4-25).
- Check for leaks.

END OF TASK

5-51. HELICAL AND SPUR GEAR ASSEMBLY REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP*Tools*

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Materials/Parts

Solvent, drycleaning (item 54, appendix E)
Compound, sealing, (item 16, appendix E)
Lockwire

Equipment Condition

TM or Para
Para 5-50

Condition Description
Two-speed range box disassembled.

a. *Disassembly.*

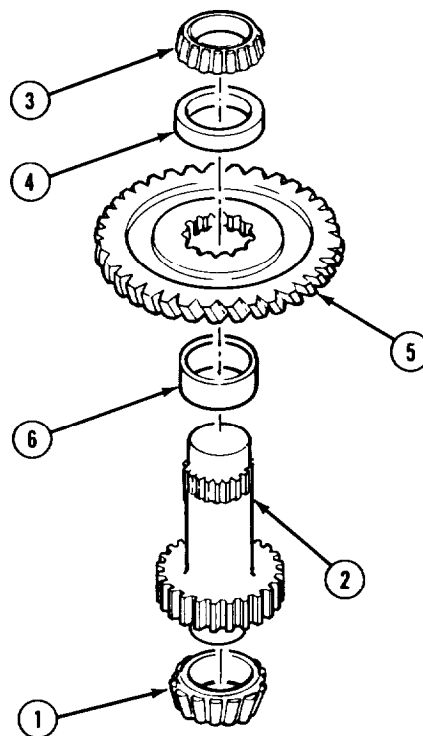


Be careful not to let shaft fall onto floor when bearing is pressed off, or damage may result.

NOTE

Helical and spur gear assembly is removed in two-speed range box disassembly.

- (1) Remove bearing (1) from spur gear end of shaft (2).
- (2) Remove bearing (3) from shaft (2).
- (3) Remove spacer (4), helical gear (5), and spacer (6) from shaft (2).



*b. Cleaning/Inspection.***WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all parts with drycleaning solvent.
 - (2) Check all machined surfaces for damage.
 - (3) Check bearings and bearing cups for damage.
 - (4) Replace damaged parts.

c. Assembly.

- (1) Install spacer (6), helical gear (5), and spacer (4) on shaft (2).
- (2) Install bearing (3) on shaft (2).
- (3) Install bearing (1) on spur gear end of shaft (2).

NOTE

Follow-on Maintenance: Assemble two-speed range box (para 5-50).

END OF TASK

5-52. SHIFT FORK REPAIR.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Equipment Condition

TM or Para

Para 5-50

Condition Description

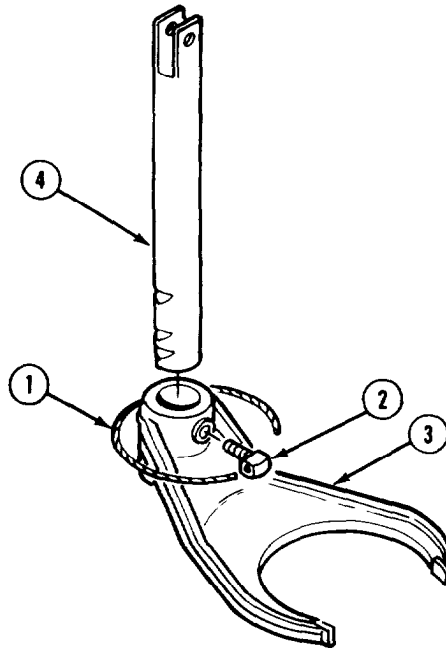
Two-speed range box removed/disassembled.

a. Disassembly.

NOTE

Shift fork is removed in two-speed range box removal/disassembly task.

- (1) Cut and discard lockwire (1).
- (2) Remove square head bolt (2) from shift fork (3).
- (3) Remove shift fork (3) from shift fork shaft (4).



b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.
 - (2) Check all machined surfaces for damage.
 - (3) Check all threads for peeled or crossed condition.

c. Assembly.

- (1) Install shift fork (3) on shift fork shaft (4).
- (2) Align holes in fork (3) and shaft (4). Install square head bolt (2). Tighten bolt 25 to 30 lb-ft (34 - 41 N•m).
- (3) Install lockwire (1) through bolt (2).

NOTE

Follow-on Maintenance: Assemble/Install two-speed range box (para 5-50).

END OF TASK

5-53. HYDROSTATIC PUMP REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Lifting device (capacity 500 lbs [227 kg])

Wrench, torque

Suitable container (capacity 5 gal. [19liters])

Materials/Parts

Pin, cotter
Lo&washers (8)

Materials/Parts

Locknuts (4)
Sealant, hydraulic (item 52, appendix E)

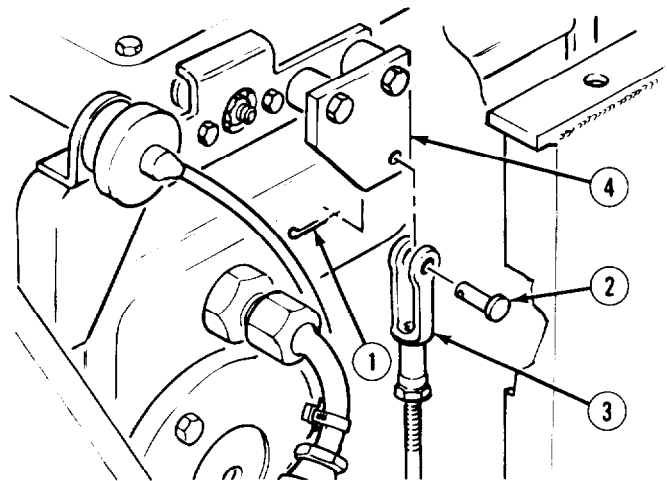
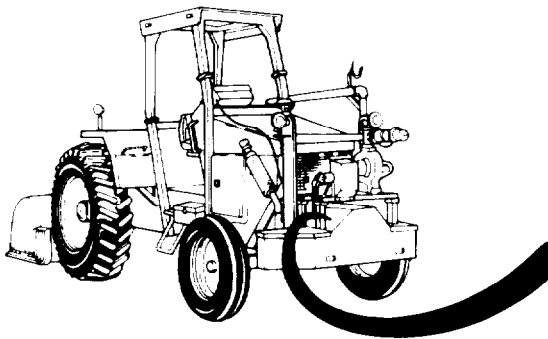
Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 5-80	Additive system motor removed.
Para 4-97	Hydrostatic pump cover removed.
Para 4-100	Pump drive shaft removed.

a. Removal.



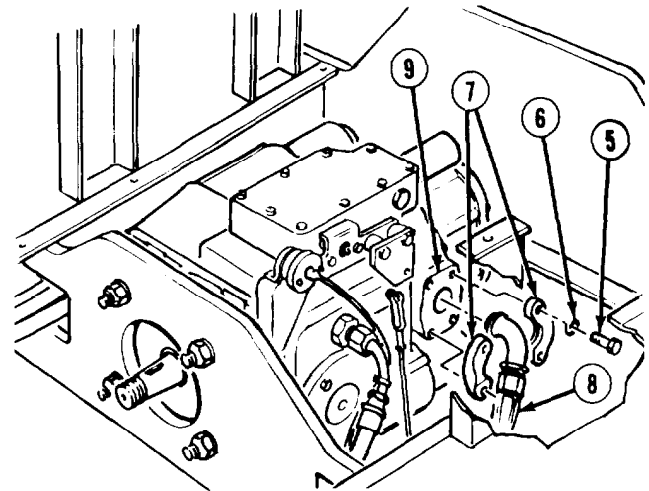
- (1) Remove cotter pin (1) and pin (2) from clevis (3). Discard cotter pin.
- (2) Remove clevis (3) from pump (4).

WARNING

Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

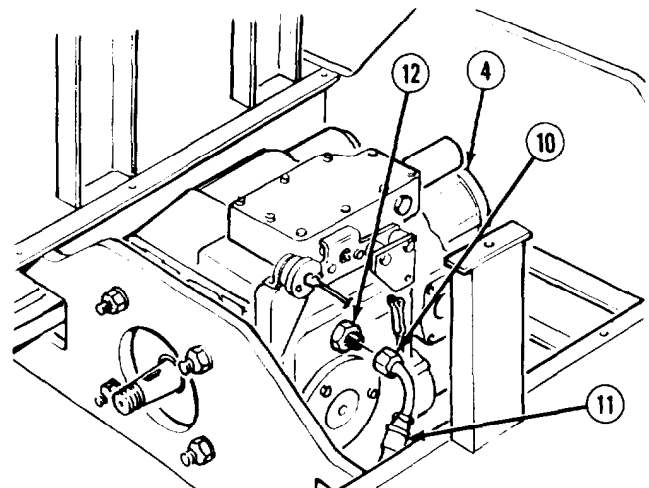
- Place suitable container with a 5 gallon (19 liter) capacity under hydrostatic pump to catch spilling fluid.
 - Tag and mark all hydraulic hoses before removal to catch spilling fluid.
- (3) Remove four screws (5) and lockwashers (6) from two brackets (7). Discard lockwashers.



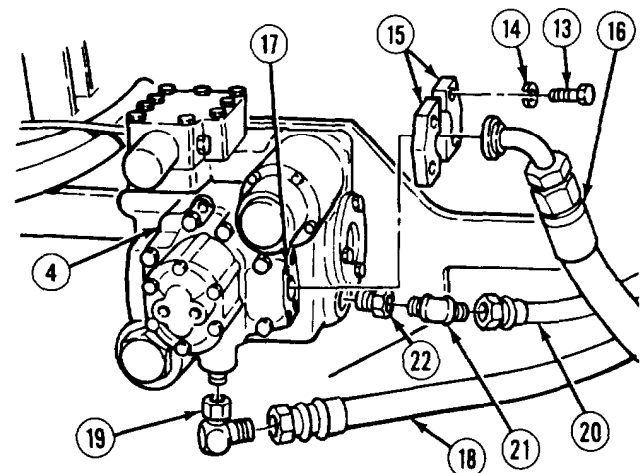
NOTE

Cap all hoses after removal to prevent contamination.

- (4) Remove two brackets (7) and hose (8) from port (9).
- (5) Loosen fitting (10) and remove hose (11) and adaptor (12) from pump (4).



- (6) Remove four screws (13) and lockwashers (14) from two brackets (15). Discard lockwashers.
- (7) Remove two brackets (15) and hose (16) from port (17).
- (8) Remove hose (18) and elbow (19) from pump (4).
- (9) Remove hose (20), elbow (21), and adaptor (22) from pump (4).



5-53. HYDROSTATIC PUMP REPLACEMENT (CONT).

WARNING

Hydrostatic pump weighs 145 lbs (66 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

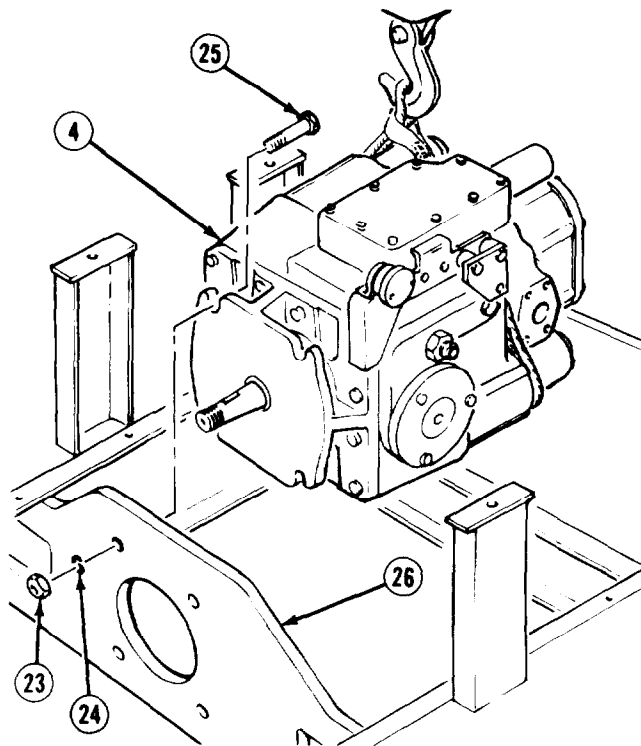
- (10) Attach suitable lifting device to pump (4) and remove four locknuts (23), washers (24), and screws (25) from frame (26). Discard locknuts.
- (11) While mechanic operates lifting device, assistant guides the pump (4) from frame (26).

b. Installation.

WARNING

Hydrostatic pump weighs 145 lbs (66 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

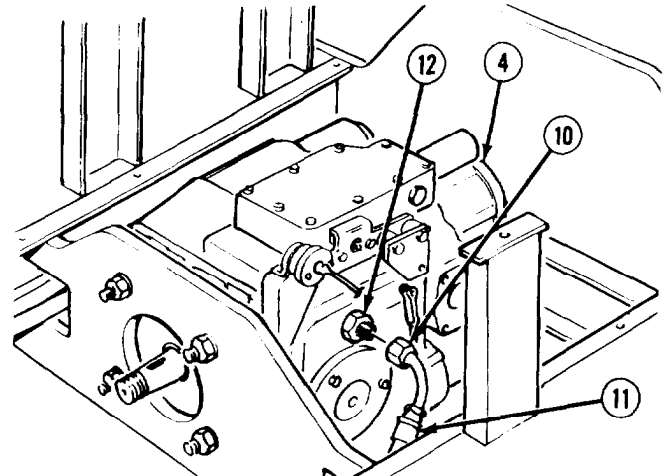
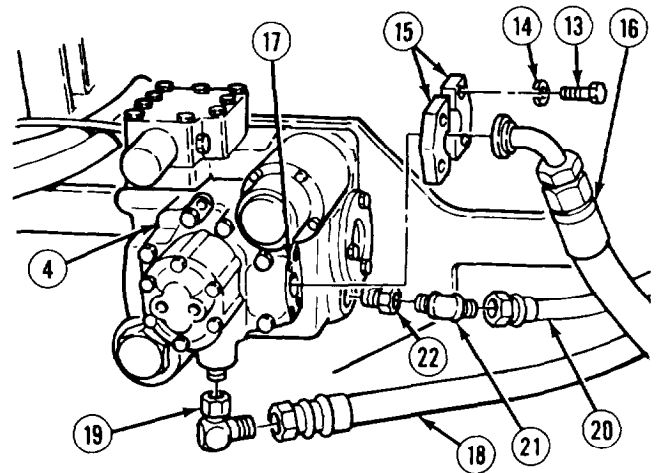
- (1) While mechanic operates lifting device, assistant guides the pump (4) onto frame (26).
- (2) Install pump (4) on frame (26) with four screws (25), washers (24), and locknuts (23). Remove lifting device. Tighten locknuts 75 to 100 lb-ft (102 - 136 N \cdot m).



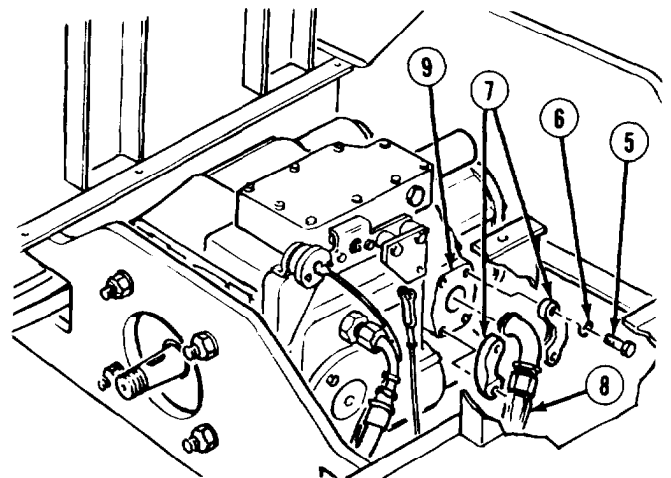
WARNING

Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (3) Apply hydraulic thread sealant to adaptor (22) and elbow (21) and install with hose (20) to pump (4).
- (4) Apply hydraulic thread sealant to elbow (19) and install with hose (18) on pump (4).
- (5) Secure hose (16) on port (17) with two brackets (15), four lockwashers (14), and screws (13).
- (6) Install hose (11) and tighten fitting (10) to adaptor (12) on pump (4).

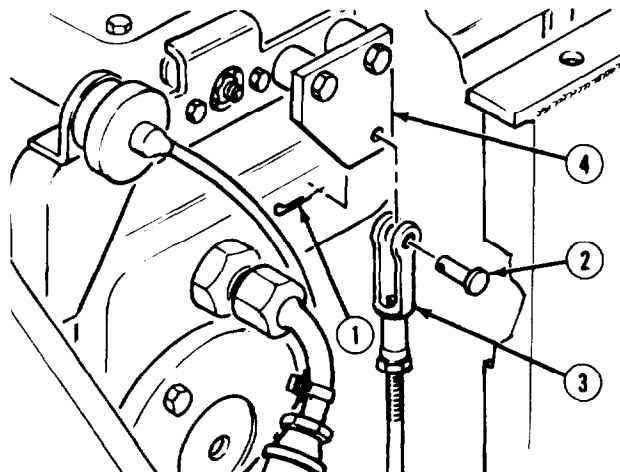


- (7) Secure hose (8) on port (9) with two brackets (7), four lockwashers (6), and screws (5).



5-53. HYDROSTATIC PUMP REPLACEMENT (CONT).

- (8) Install clevis (3) on pump (4) with pin (2) and cotter pin (1).



NOTE

Follow-on Maintenance:

- Install pump drive shaft (para 4-100).
- Hydrostatic pump cover (para 4-97).
- Install additive system motor (para 5-80).

END OF TASK

5-54. HYDROSTATIC PUMP REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)
Cloth, lint-free (item 12, appendix E)

Materials/Parts

Lockwashers (14)
Preformed packing (13)
Gaskets (4)
Shims (AR)
Rings, retaining
Seals (2)

Equipment Condition

TM or Para
Para 5-53

Condition Description
Hydrostatic pump removed.

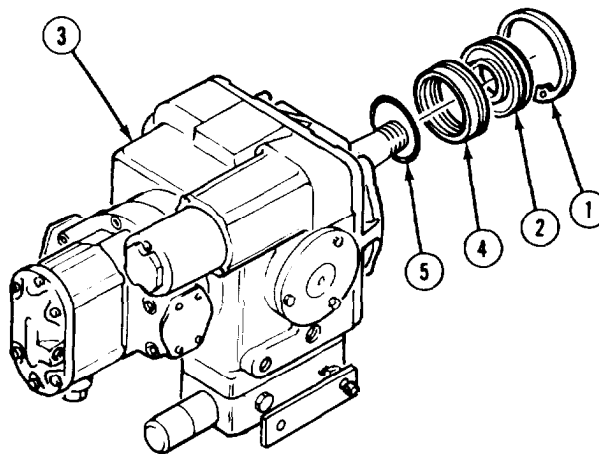
a. Disassembly.



- Protect exposed surfaces and cavities from damage and foreign material. Use caution so that rings and orifice plate remain in place and do not fall into pump housing.
- All surfaces exposed are critical and caution should be used to avoid damage.

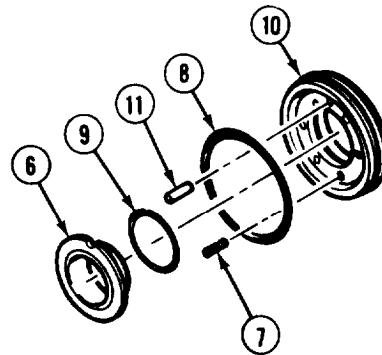
(1) Remove retaining ring (1) and seal assembly (2) from shaft end of pump (3). Discard retaining ring.

(2) Remove bronze seal (4) and preformed packing (5). Discard preformed packing.



5-54. HYDROSTATIC PUMP REPAIR (CONT).

- (3) Remove sealing ring (6), six springs (7), and preformed packings (8 and 9) from aluminum housing (10). Discard preformed packings.
- (4) If damaged, remove pin (11).



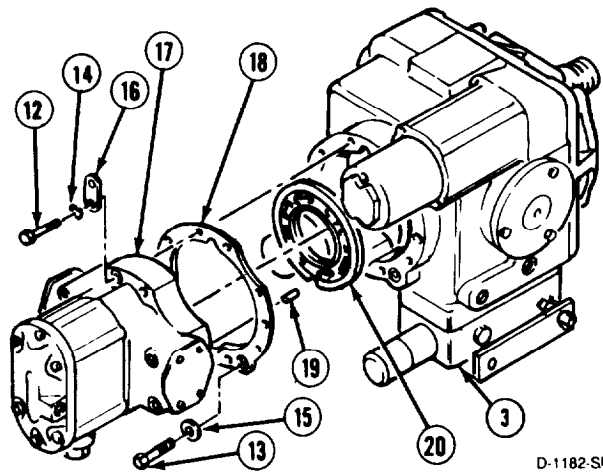
NOTE

Before removing charge pump, matchmark housing and main pump end cap.

- (5) Remove six screws (12 and 13), lo&washers (14 and 15), and lifting bracket (16) from end cap (17) to pump (3). Discard lo&washers. Two remaining screws should be opposite each other on top and bottom.

NOTE

End cap is under slight internal pressure. Care should be taken when removing last two screws.



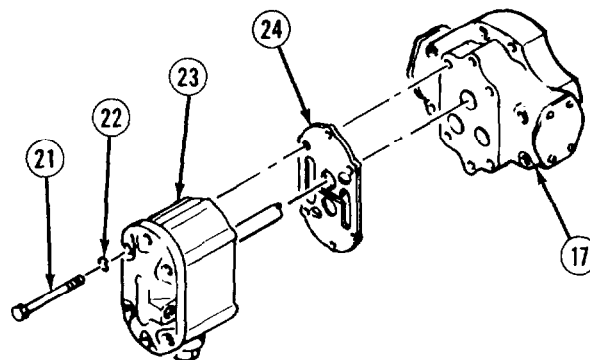
D-1182-SM

- (6) Remove remaining two screws (12), lo&washers (14), and end cap (17) from pump (3). Discard lo&washers.
- (7) Remove gasket (18), locating pin (19), and valve plate (20) from pump (3). Discard gasket.

NOTE

Before removing charge pump, matchmark housing and main pump end cap.

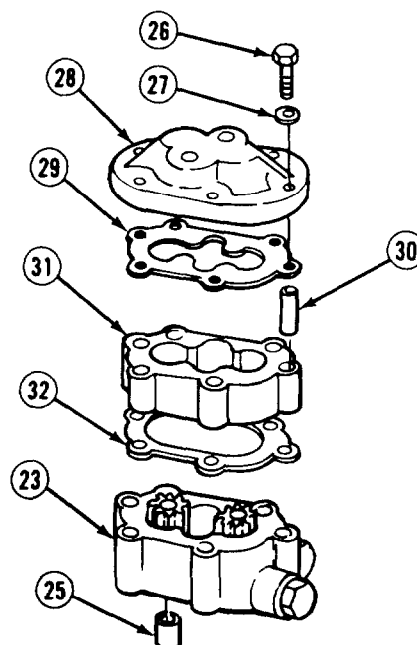
- (8) Remove four screws (21) and washers (22) that form rectangular pattern on rear of charge pump (23).
- (9) Remove charge pump (23) and gasket (24) from end cap (17). Discard gasket.



NOTE

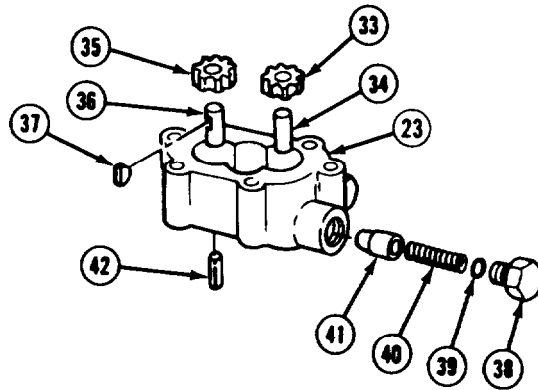
Removal of charge check valves requires drag link socket.

- (10) Remove spacer (25) from base of charge pump (23).
- (11) Remove two screws (26) and washers (27).
- (12) Remove end cap (28) and gasket (29). Discard gasket.
- (13) Remove two sleeves (30), middle housing (31) and gasket (32) from base (23).

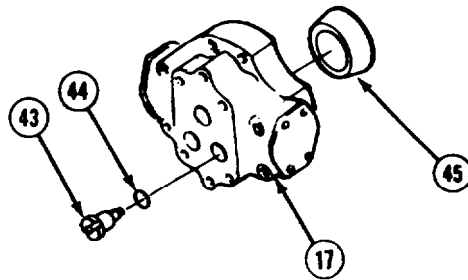


5-54. HYDROSTATIC PUMP REPAIR (CONT).

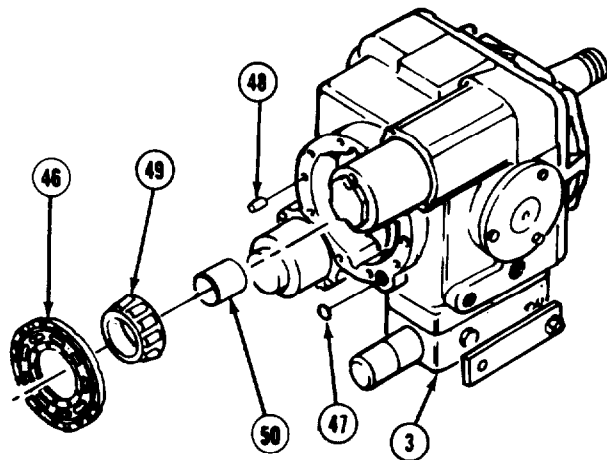
- (14) Remove idler gear (33) and shaft (34) from base (23).
- (15) Remove drive gear (35), shaft (36), and key (37).
- (16) Remove cap (38), preformed packing (39), spring (40), and poppet (41). Discard preformed packing.
- (17) If damaged, remove roll pin (42).



- (18) Remove two charge check valves (43) and preformed packing (44) from end cap (17). Discard preformed packing.
- (19) Remove bearing seat (45).



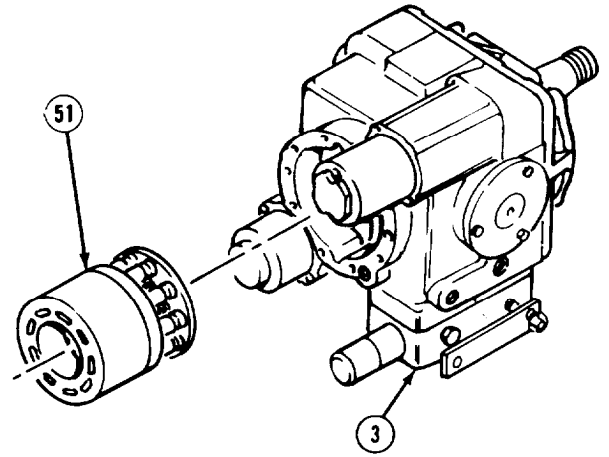
- (20) Remove bearing plate (46) and preformed packing (47) from pump (3). Discard preformed packing.
- (21) If damaged, remove two pins (48).
- (22) Remove rear bearing (49) and spacer (50) from pump (3).



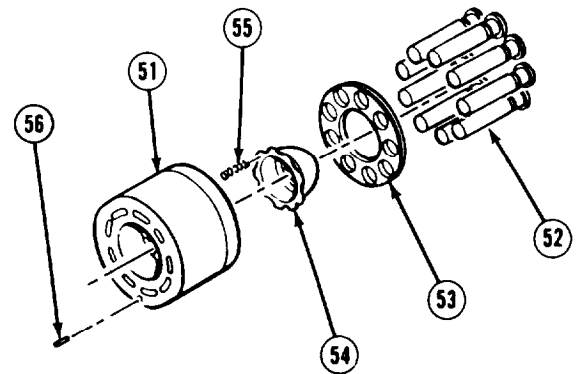
NOTE

Pistons may stay with pump or come out with cylinder block assembly.

- (23) Position pump (3) horizontally and remove cylinder block assembly (51).

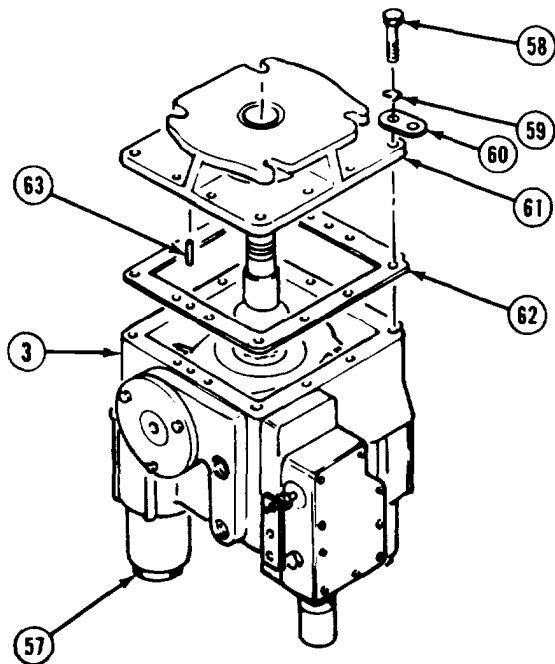


- (24) Remove eight pistons (52) from cylinder block (51).
- (25) Remove slip retainer (53) from pistons (52).
- (26) Remove retaining guide (54) and six springs (55) from cylinder block (51).
- (27) Remove pin (56) from cylinder block (51).

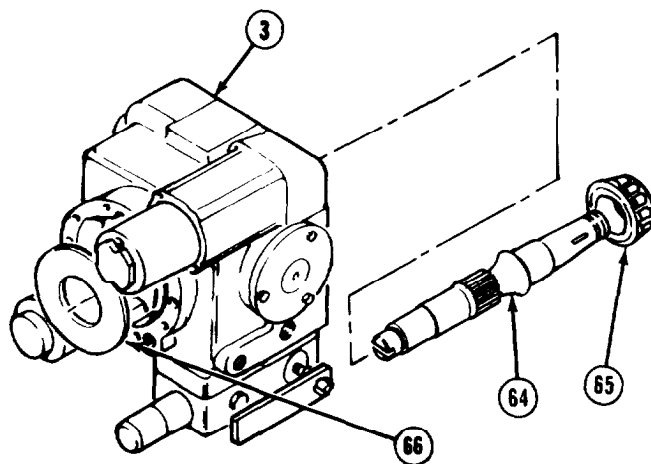


5-54. HYDROSTATIC PUMP REPAIR (CONT).

- (28) Position pump (3) on servo housings (57) and remove 12 screws (58), washers (59), lifting bracket (60), front cover (61), and gasket (62).
- (29) If damaged, remove pin (63) from front cover (61).



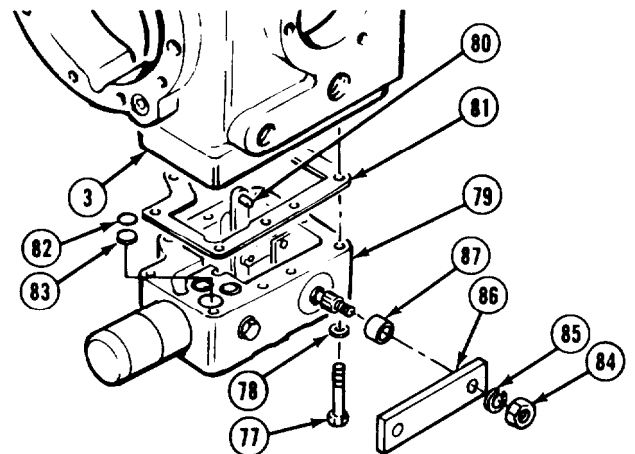
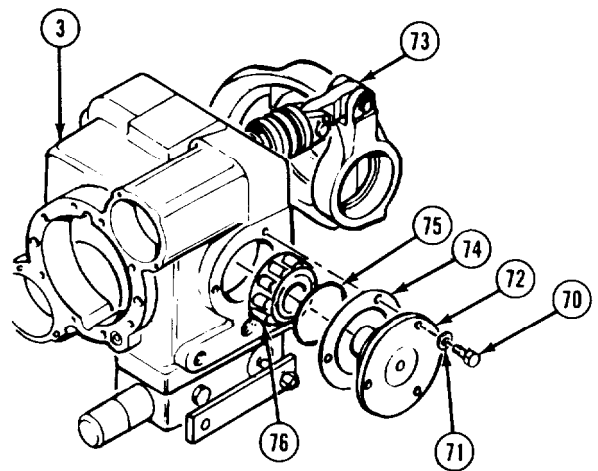
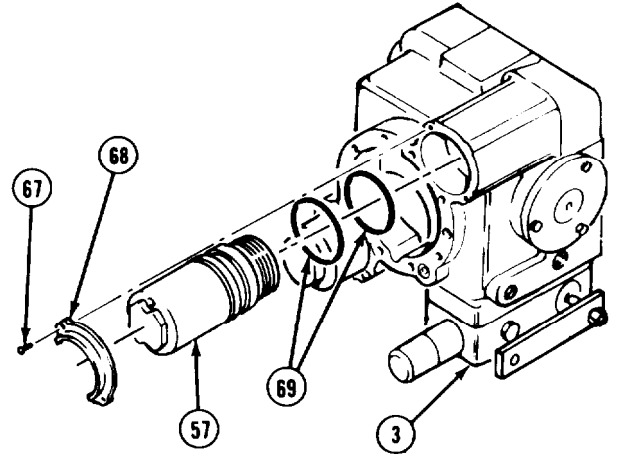
- (30) Remove shaft (64) from pump (3).
- (31) Remove bearing (65) from shaft (64).
- (32) Remove thrust plate (66).



NOTE

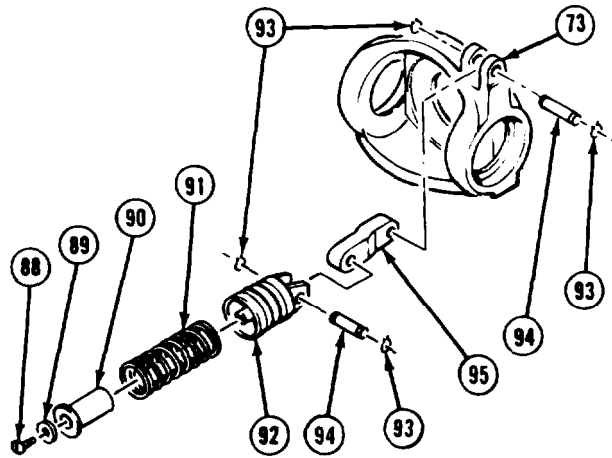
Mark all parts so zero swash plate angle will be retained when the parts are reassembled. Swash plate is held in zero by springs inside servo housings which are adjusted by turning the servo housing.

- (33) Remove four screws (67) and two locking retainers (68).
- (34) Mark height of two servo housings (57) in relation to pump (3) and remove servo housings and four preformed packings (69). Discard preformed packings.
- (35) Remove six screws (70), lockwashers (71), two trunnions (72), and swash plate (73). Discard lockwashers.
- (36) Note number and remove shims (74) and preformed packings (75) from trunnions (72). Discard preformed packings.
- (37) Remove two trunnion bearings (76).
- (38) Remove nine screws (77) and washers (78) from control (79).
- (39) Unhook control arm (80) and remove control (79) and gasket (81) from pump (3). Discard gasket.
- (40) Remove and discard three preformed packings (82) and aperture plug (83).
- (41) Remove nut (84) and lockwasher (85), lever (86), and spacer (87).



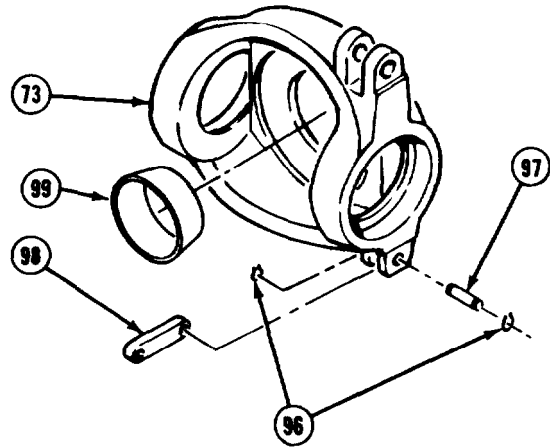
5-54. HYDROSTATIC PUMP REPAIR (CONT.).

- (42) Remove two screws (88) and washers (89).
- (43) Remove two spring retainers (90) and servo springs (91) from servo pistons (92).
- (44) Remove eight retaining rings (93), four pins (94) and two servo links (95) from swash plate (73) and two servo pistons (92).



- (45) Remove two retaining rings (96), pins (97), and feedback links (98) from swash plate (73).

- (46) Remove bearing race (99).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

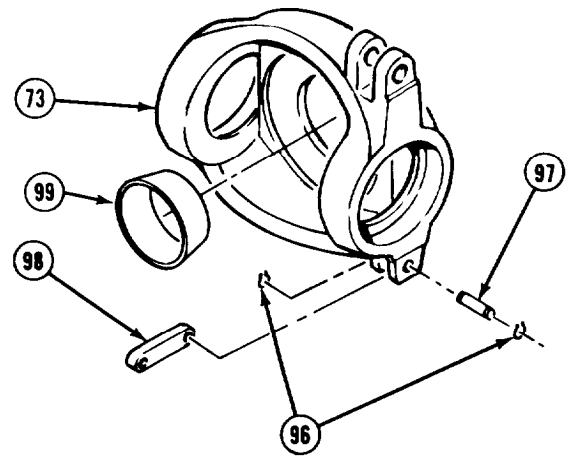
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearings to air dry.
- (4) Clean all sealing surfaces.
- (5) Check all machined surfaces for damage.
- (6) Check both case halves for cracks or damage.
- (7) Check all threads for peeled or crossed condition.
- (8) Replace all oil seals and damaged parts.
- (9) Apply petroleum jelly to preformed packing and seals prior to installation.
- (10) Replace control kit, if damaged.

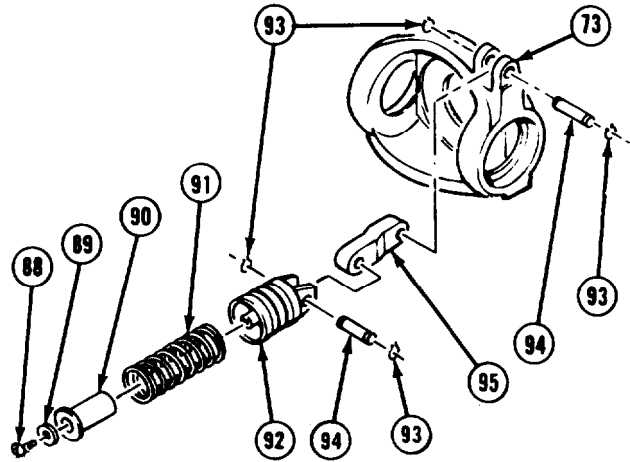
c. Assembly.

- (1) Install bearing race (99) and feedback links (98) in swash plate (73) with pins (97) and two retaining rings (96).

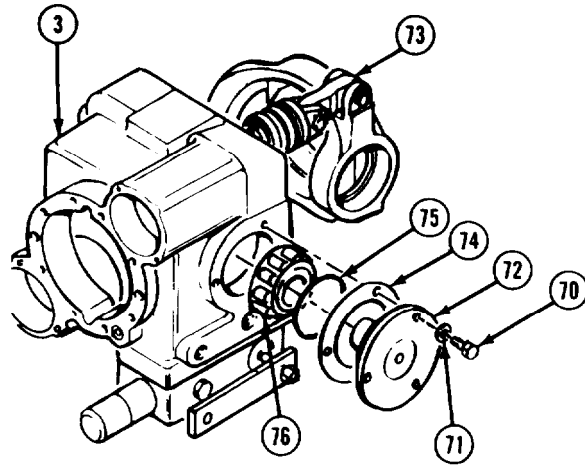


5-54. HYDROSTATIC PUMP REPAIR (CONT).

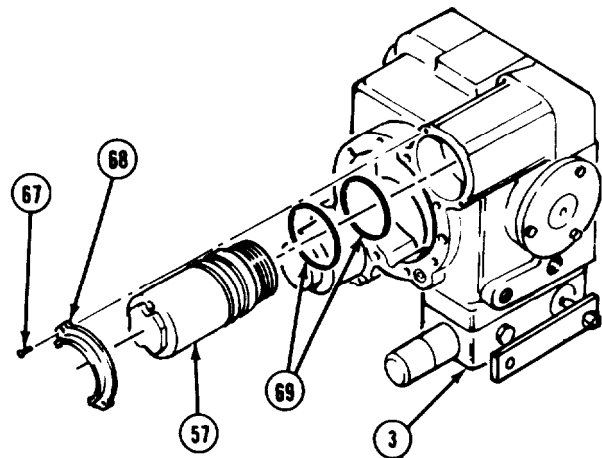
- (2) Install two servo links (95) and servo pistons (92) on swash plate (73) with four pins (94) and eight retaining rings (93).
- (3) If removed, install two servo springs (91) with spring retainers (90), washers (89), and screws (88).



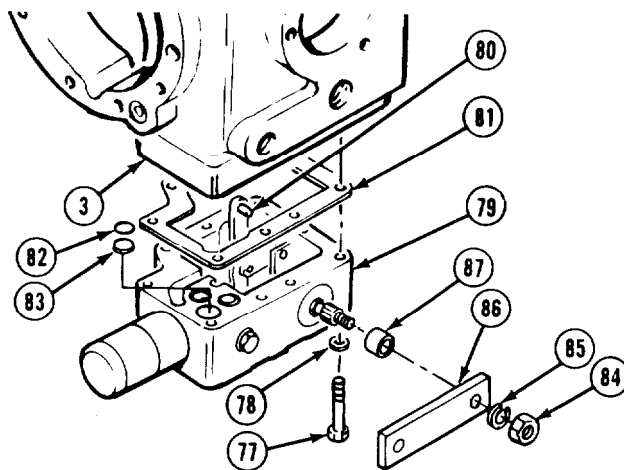
- (4) Position swash plate (73) in pump (3).
- (5) Install two bearings (76) on trunnions (72).
- (6) Install two preformed packings (75), shims (74), and trunnions (72) in pump (3) with six lockwashers (71) and screws (70). Tighten screws 27 to 37 lb-ft (36 - 50 N•m).



- (7) Install four preformed packings (69) and two servo housings (57) on pump (3).
- (8) Install two locking retainers (68) with four screws (67).



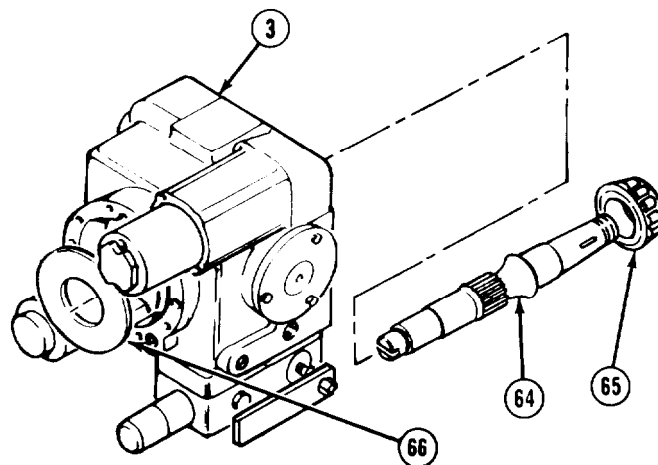
- (9) Install spacer (87) and lever (86) with lockwasher (85) and nut (84).
- (10) Install aperture plug (83) and three preformed packings (82) in control (79).
- (11) Hook control arm (80) and install gasket (81) and control (79) on pump (3) with nine washers (78) and screws (77).



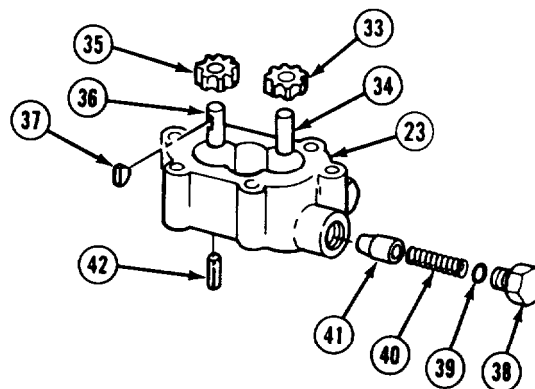
NOTE

If thrust washer will not stay in place, apply grease.

- (12) Install thrust plate (66) in pump (3).
- (13) Install bearing (65) on shaft (64).
- (14) Install shaft (64) in pump (3).

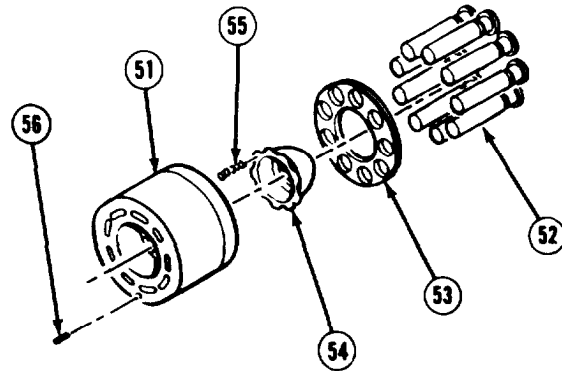


- (15) Position pump (3) on servo housings (57).
- (16) If removed, install pin (63) in front cover (61).
- (17) Install gasket (62), front cover (61), and lifting bracket (60) on pump (3) with 12 washers (59) and screws (58).



5-54. HYDROSTATIC PUMP REPAIR (CONT).

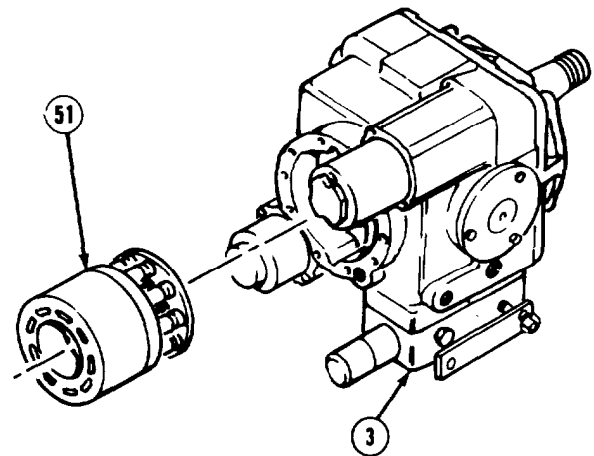
- (18) Install eight pistons (52) in retainer (53).
- (19) Install pin (56), six springs (55) and retaining guide (54) on cylinder block (51).
- (20) Install eight pistons (52) in cylinder block (51).



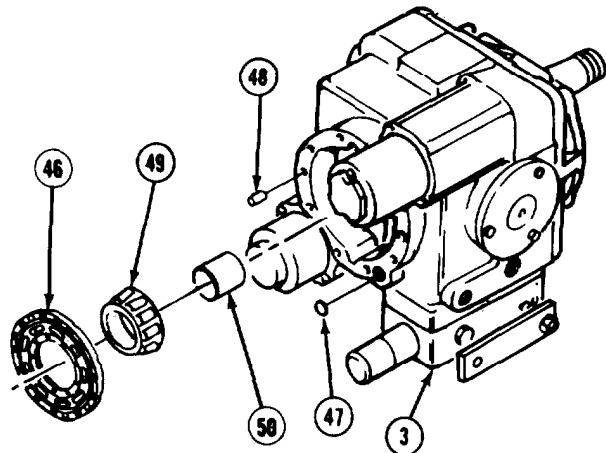
NOTE

Splines on shaft, retaining guide, and cylinder block only line up one way.

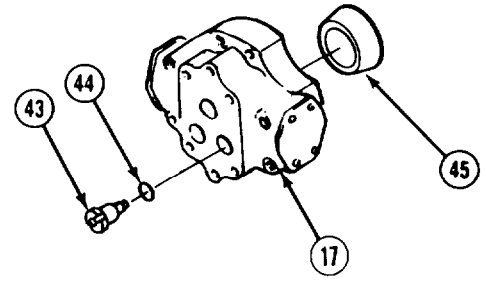
- (21) Install cylinder block (51) in pump (3).



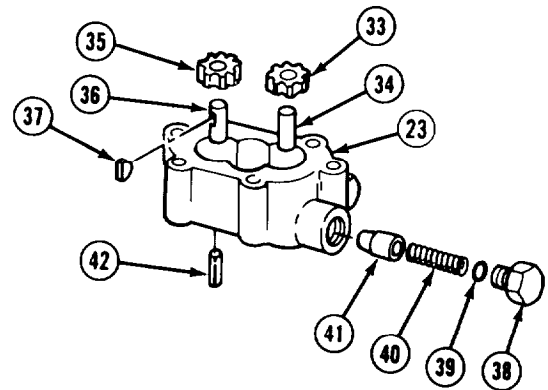
- (22) Install spacer (50) and rear bearing (49) in pump (3).
- (23) Install bearing plate (46) and preformed packing (47) in pump (3).
- (24) If removed, install two pins (48).



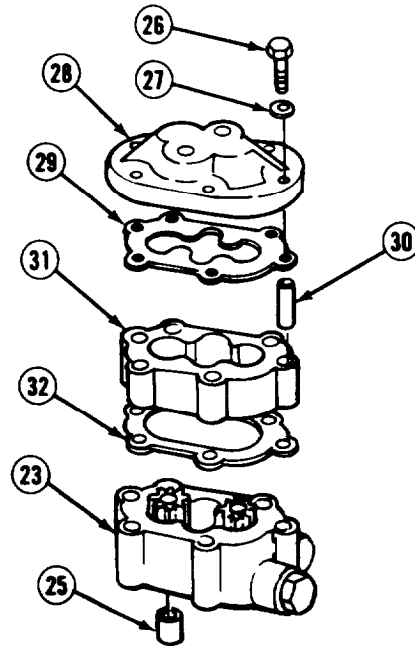
- (25) Install bearing seat (45) in end cap (17).
- (26) Install two preformed packings (44) and charge check valves (43).



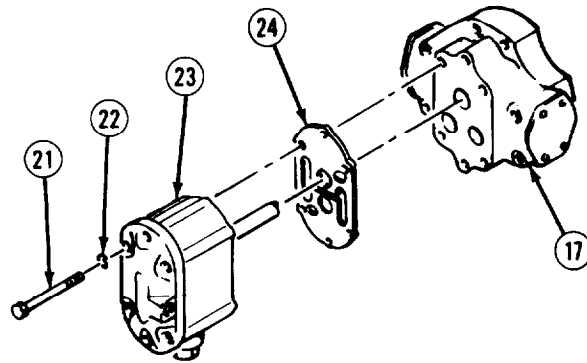
- (27) If removed, install roll pin (42) in base (23).
- (28) Install poppet (41), spring (40), preformed packing (39), and caps (38).
- (29) Install key (37) in shaft (36) and drive gear (35) in base (23).
- (30) Install shaft (34) and idler gear (33).



- (31) Install gasket (32), middle housing (31), and two sleeves (30) in base (23).
- (32) Install gasket (29) and end cap (28) with two washers (27) and screws (26).
- (33) Install spacer (25).



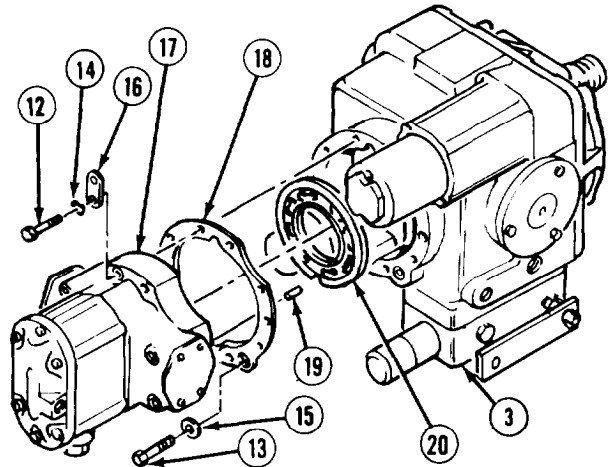
- (34) Install gasket (24) and charge pump (23) on end cap (17) with four washers (22) and screws (21). Tighten screws 27 to 37 lb-ft (36 - 50 N•m).



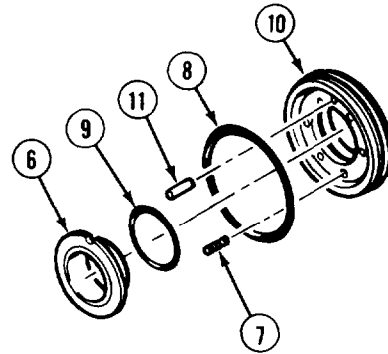
NOTE

End cap is under slight spring pressure. Install screws alternately in crisscross pattern, few threads at a time until cap seats evenly.

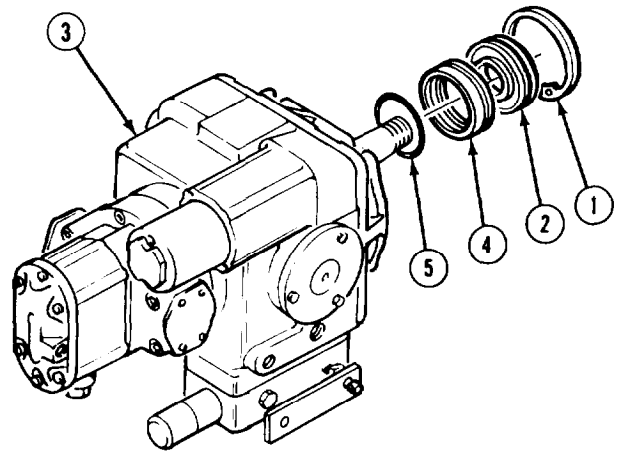
- (35) Install valve plate (20) and pin (19).
- (36) Install gasket (18), end cap (17) and lifting bracket (16) on pump (3) with eight washers (14 and 15) and screws (12 and 13).



- (37) If removed, install pin (11).
- (38) Install preformed packing (9) and six springs (7) in housing (10).
- (39) Install preformed packing (8) in sealing ring (6) and scaling ring on housing (10).



- (40) Install preformed packing (5) and bronze seal (4).
- (41) Install seal assembly (2) on shaft end of pump (3) with retaining ring (1).

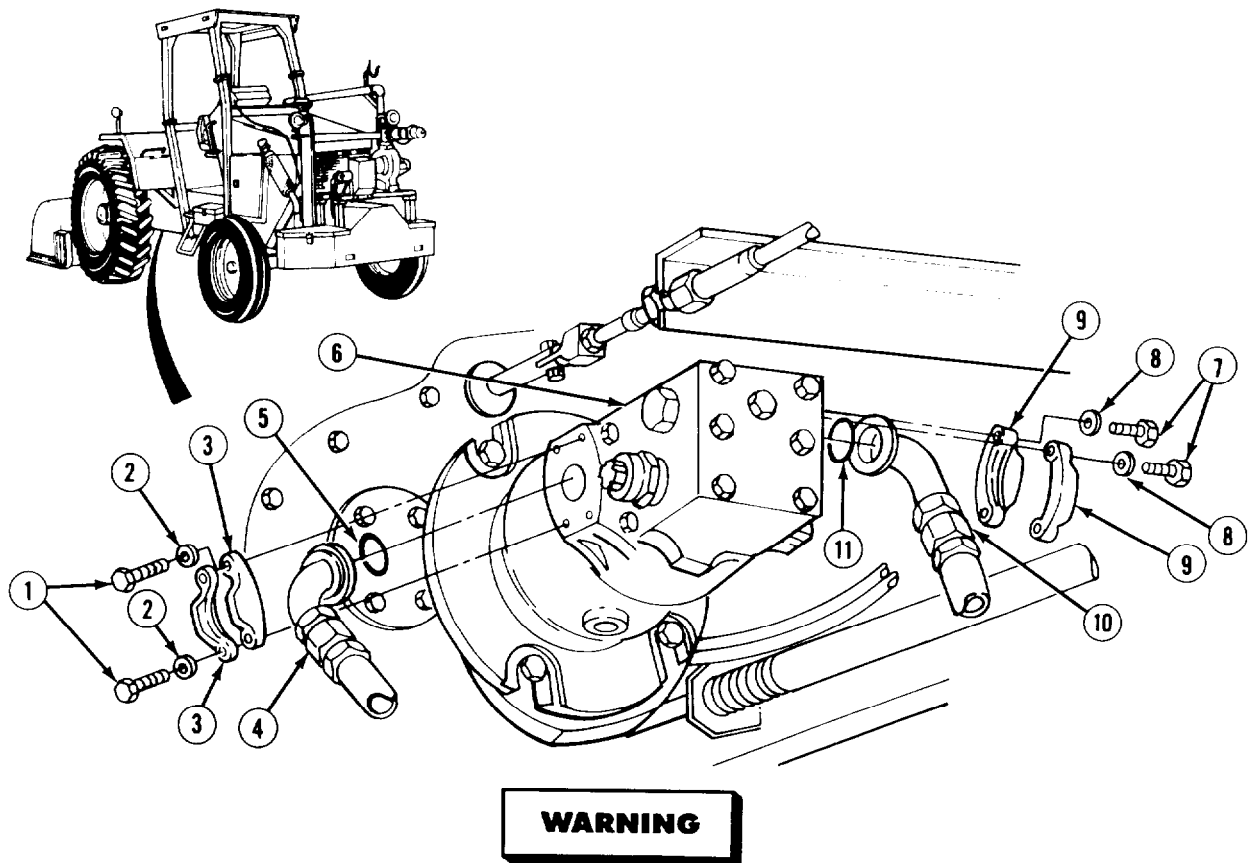


NOTE

Follow-on Maintenance: Install hydrostatic pump (para 5-53).

END OF TASK

5-55. HYDROSTATIC MOTOR REPLACEMENT.		
This task covers:		
a. Removal	b. Installation	
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Gasket	
Shop equipment, general purpose repair: semi-trailer mounted	Compound, sealing (item 16, appendix E)	
	Sealant, hydraulic (item 52, appendix E)	
	Tags, identification (item 55, appendix E)	
	<i>Personnel Required</i>	
Jackstand (capacity 200 lbs [91 kg])	MOS62B, Construction equipment repairer (2)	
Wrench, torque	<i>Equipment Condition</i>	
Suitable container (capacity 5 gal. [19 liters])	<i>TM or Para</i>	<i>Condition Description</i>
	Para 4-25	Two-speed range box drained.
<i>Materials/Parts</i>		
Lockwashers (12)		
Seals (2)		

a. *Removal.*

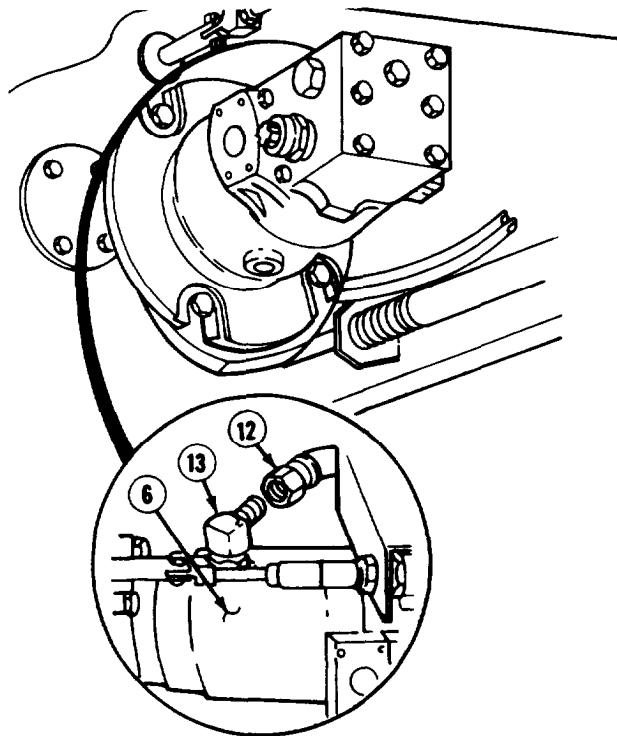
Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

- Place suitable container with a 5 gallon (19 liters) capacity under motor to catch spilling fluid.
 - Tag and mark hydraulic hoses before removal.
 - Plug hoses and ports to prevent contamination,
- (1) Remove four screws (1), lockwashers (2), two brackets (3), hydraulic hose (4), and seal (5) from motor (6). Discard lo&washers and seals.
 - (2) Remove four screws (7), lockwashers (8), two brackets (9), hydraulic hose (10), and seal (11) from motor (6). Discard lockwashers and seals.

5-55. HYDROSTATIC MOTOR REPLACEMENT (CONT).

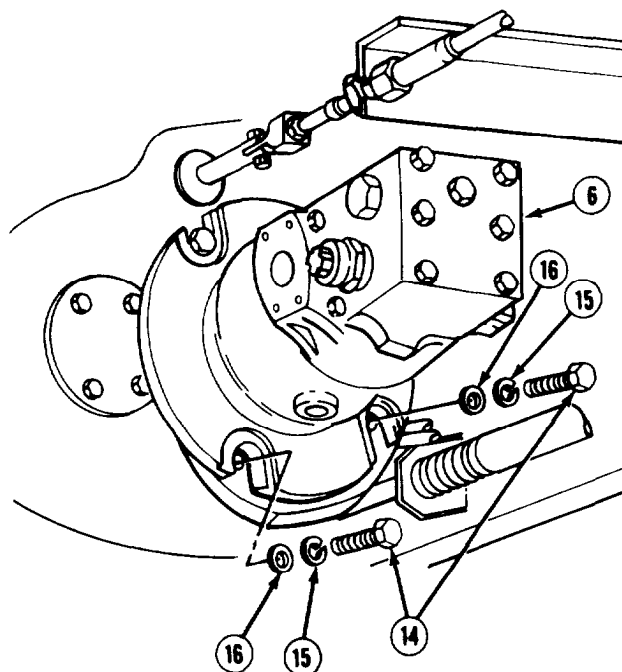
- (3) Remove hydraulic hose (12) from elbow (13) on motor (6).

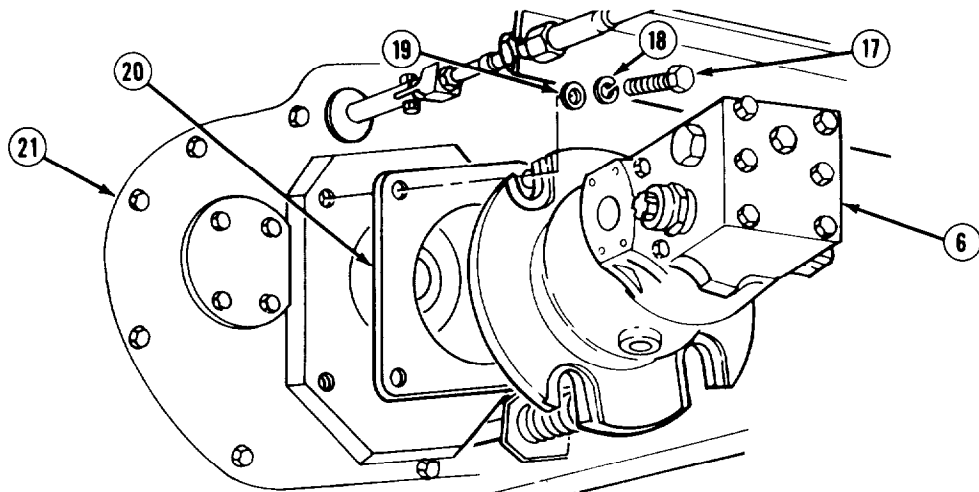


NOTE

When removing screws, place a jackstand under motor for added support.

- (4) Remove two screws (14), lockwashers (15), and washers (16) from motor (6). Discard lockwashers.





- (5) Remove two screws (17), lockwashers (18), and washers (19) from motor (6). Discard lockwashers.

WARNING

Hydrostatic motor weighs 90 lbs (41 kg). Use care when removing or injury to personnel may result.

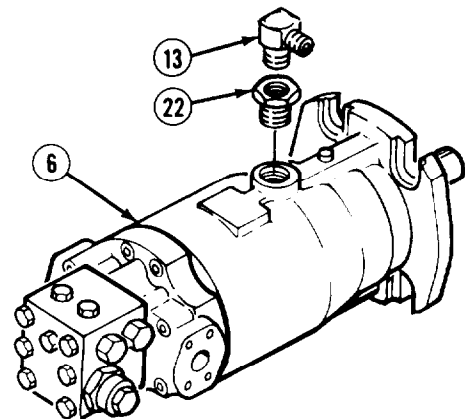
- (6) Mechanic and assistant remove motor (6) and gasket (20) from two-speed range box (21). Discard gasket.
- (7) Remove elbow (13) and adaptor (22) from motor (6).

b. Installation.

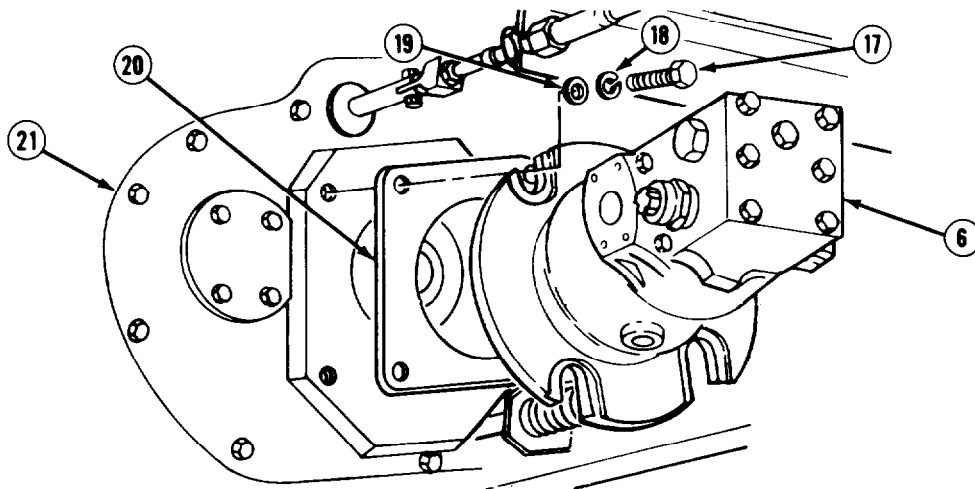
WARNING

Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (1) Apply hydraulic sealant to threads of adaptor (22) and elbow (13) and install on motor (6).



5-55. HYDROSTATIC MOTOR REPLACEMENT (CONT).



WARNING

Adhesive sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

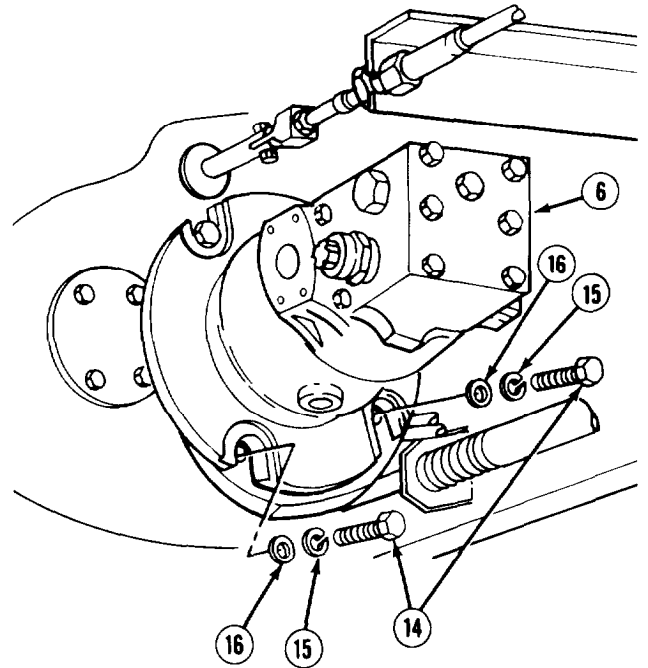
- (2) Apply sealing compound to both sides of gasket (20) and install on two-speed range box (21).

WARNING

Hydrostatic motor weighs 90 lbs (41 kg). Use care when installing or injury to personnel may result.

- (3) Mechanic and assistant install motor (6) and gasket (20) on two-speed range box (21) with two washers (19), lockwashers (18), and screws (17). Tighten screws 75 to 85 lb-ft (102 - 115 N•m).

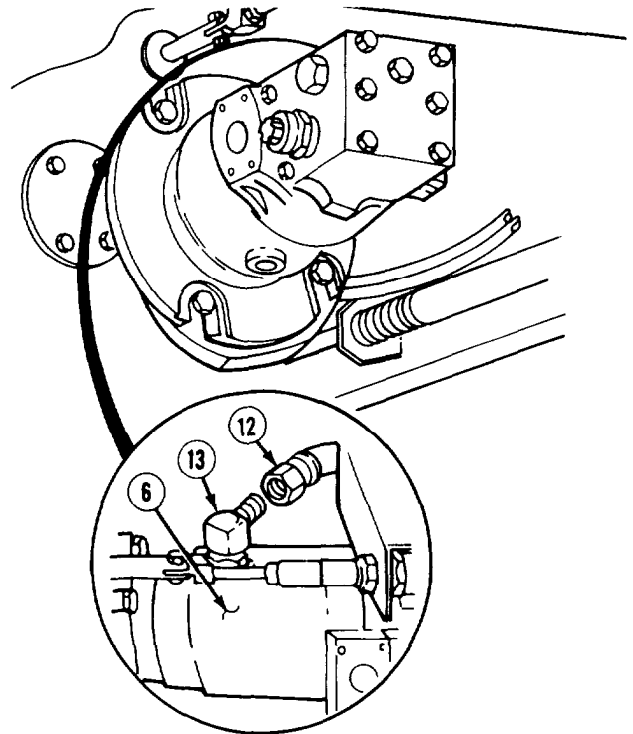
- (4) Install two washers (16), lockwashers (15), and screws (14). Tighten screws 75 to 85 lb-ft (102 - 115 N•m).



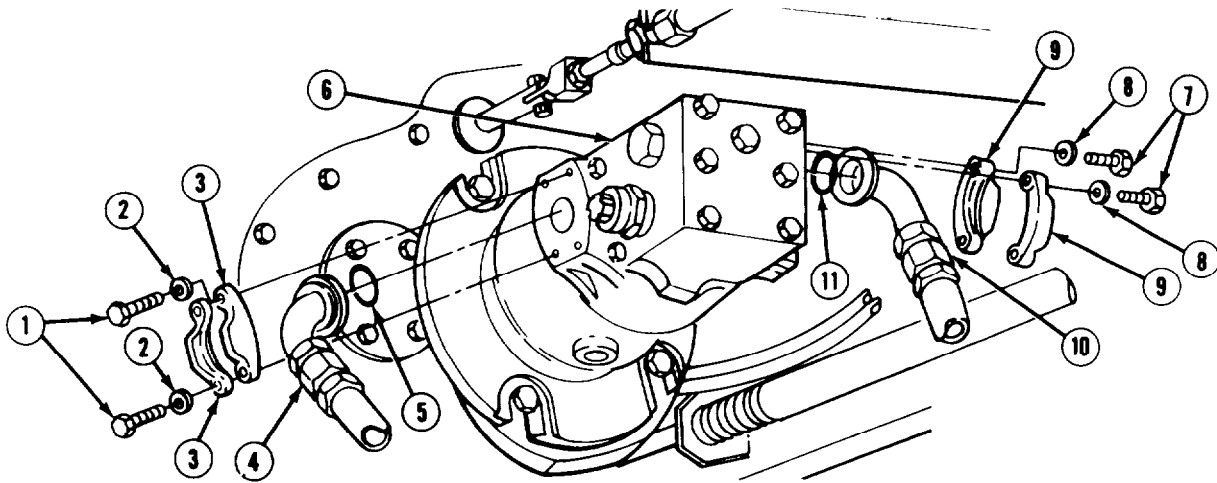
WARNING

Adhesive sealant can damage your eye
Wear safety goggles/glasses when using;
avoid contact with eyes. If sealant contacts
eyes, flush eyes with water and get
immediate medical attention.

- (5) Apply hydraulic sealant to threads of
hydraulic hose (12) and install on elbow (13)
at motor (6).



5-55. HYDROSTATIC MOTOR REPLACEMENT (CONT).



- (6) Install seal (11) and hydraulic hose (10) with two brackets (9), four lockwashers (8), and screws (7).
- (7) Install seal (5) and hydraulic hose (4) with two brackets (3), four lockwashers (2), and screws (1).

NOTE

Follow-on Maintenance: Fill two-speed range box (para 4-25).

END OF TASK

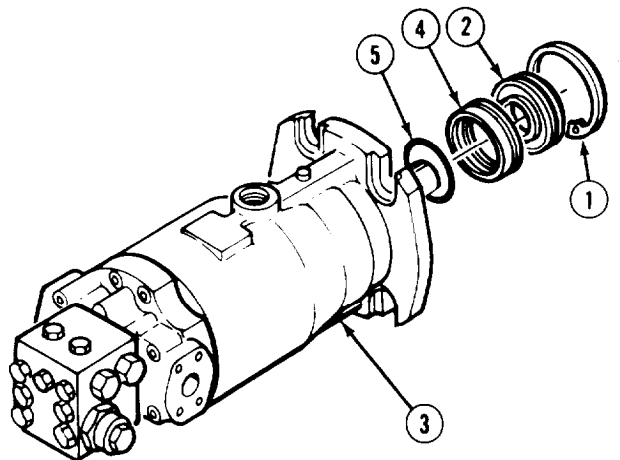
5-56. HYDROSTATIC MOTOR REPAIR.		
This task covers:		
a. Disassembly	b. Cleaning/Inspection	c. Assembly
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Seal Gasket Ring, retaining Packing, preformed (15) Rings, back-up (2) Solvent, drycleaning (item 54, appendix E) Cloth, lint-free (item 12, appendix E)	
Shop equipment, general purpose repair: semi-trailer mounted		
Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted		
Wrench, torque	<i>Equipment Condition</i>	<i>Condition Description</i>
	TM or Para Para 5-55	Hydrostatic motor removed.

a. *Disassembly.*



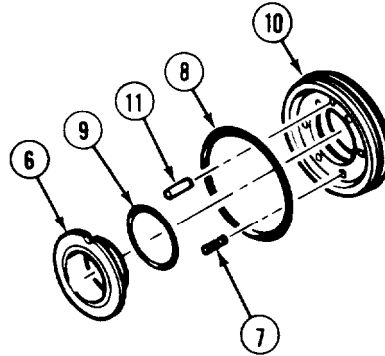
- Protect exposed surfaces and cavities from damage and foreign material. Use caution so that rings and orifice plate remain in place and do not fall into pump housing.
- All surfaces exposed are critical and caution should be used to avoid damage.

- (1) Remove retaining ring (1) and seal assembly (2) from shaft end of motor (3).
- (2) Remove bronze seal (4) and preformed packing (5). Discard preformed packing.

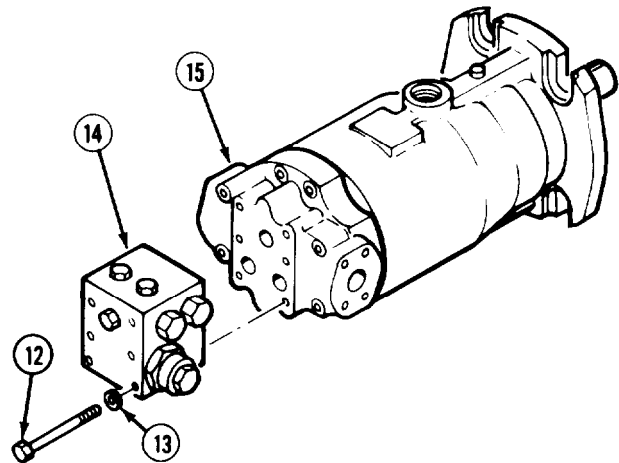


5-56. HYDROSTATIC MOTOR REPAIR (CONT).

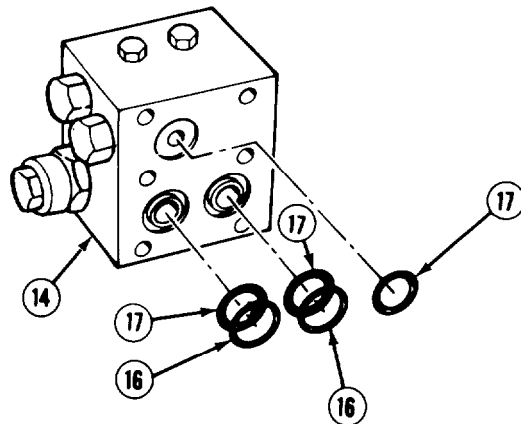
- (3) Remove sealing ring (6), six springs (7), and preformed packings (8 and 9) from aluminum housing (10). Discard preformed packings.
- (4) If damaged, remove pin (11).



- (5) Remove six screws (12) and lockwashers (13) from manifold (14). Discard lockwashers.
- (6) Remove manifold (14) from motor end cap (15).

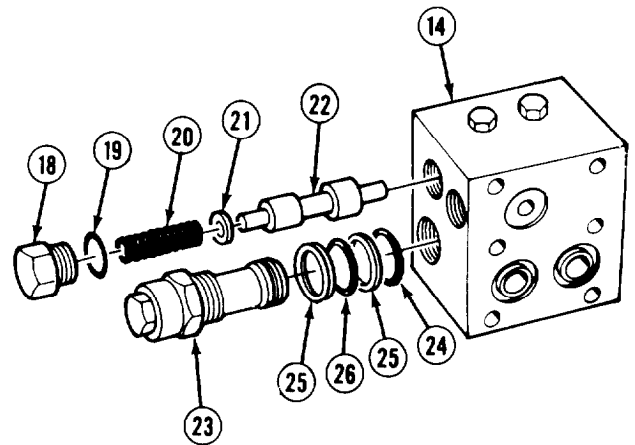


- (7) Remove and discard two back-up rings (16) and three preformed packings (17) from manifold (14).



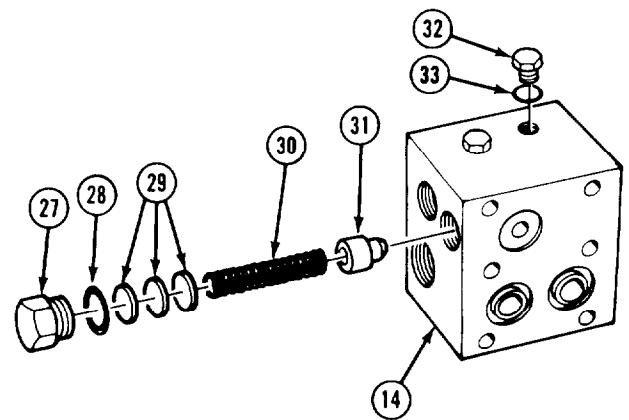
WARNING

Use care when removing hex plugs and washers. Hex plugs and washers are under spring tension and can act as projectiles when released and could cause severe eye injury.



- (8) Remove plug (18) and preformed packing (19) from manifold (14). Discard preformed packings.
- (9) Remove spring (20), spacer (21), and shuttle valve spool (22).
- (10) Remove two system relief valves (23) and preformed packings (24) from manifold (14). Discard preformed packings.
- (11) Remove four back-up rings (25) and two preformed packings (26). Discard preformed packings.
- (12) Remove plug (27) and preformed packing (28) from manifold (14). Discard preformed packing.

- (13) Remove shim packing (29), spring (30), and poppet (31).
- (14) Remove two plugs (32) and preformed packings (33). Discard preformed packings.

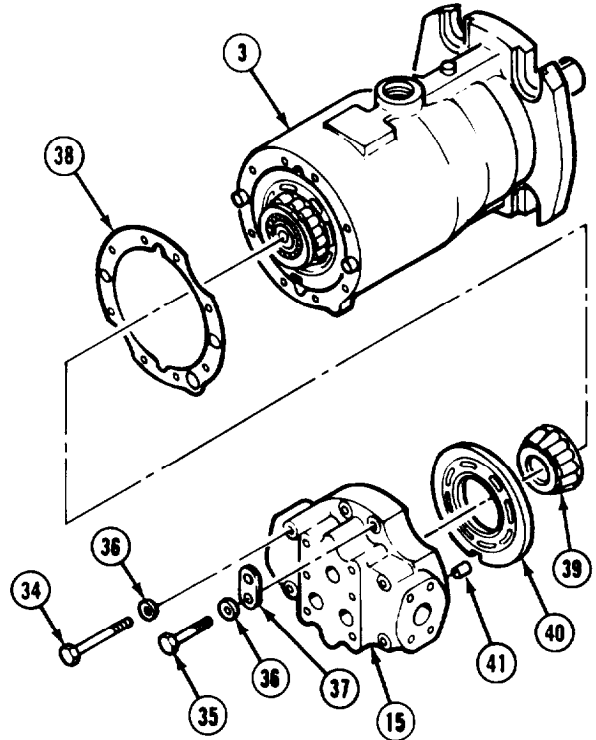


5-56. HYDROSTATIC MOTOR REPAIR (CONT).

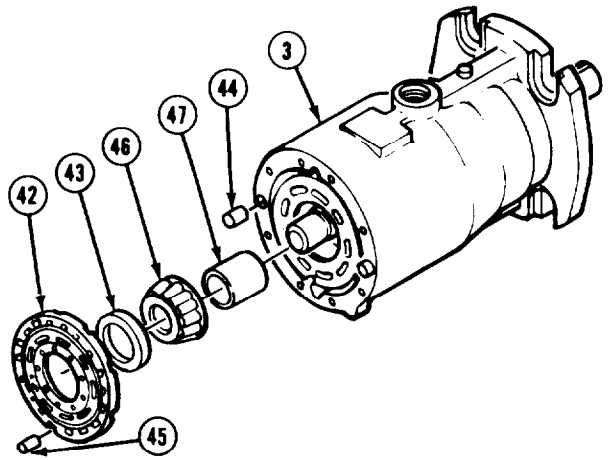
NOTE

End cap is under slight spring pressure. Care should be taken when removing last three screws.

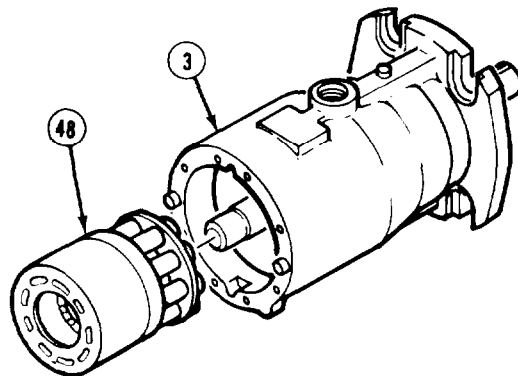
- (15) Remove screws (34 and 35), washers (36), and lifting bracket (37).
- (16) Remove end cap (15) from motor (3).
- (17) Remove gasket (38), bearing race (39), and valve plate (40) from motor end cap (15). Discard gasket.
- (18) If damaged, remove pin (41).



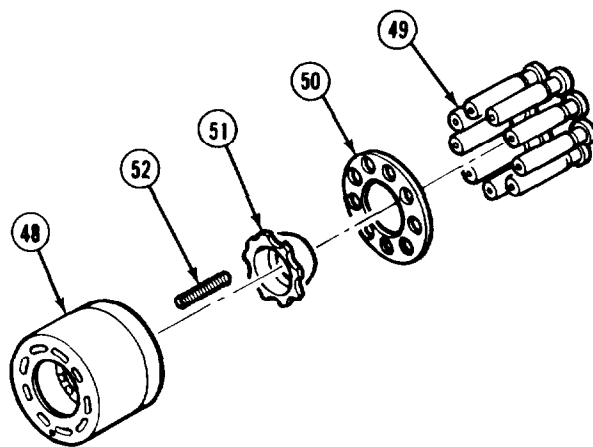
- (19) Remove bearing plate (42) and spacer (43) from motor (3).
- (20) If damaged, remove three pins (44 and 45).
- (21) Remove rear bearing (46) and spacer (47).



(22) Remove cylinder block (48) from motor (3).

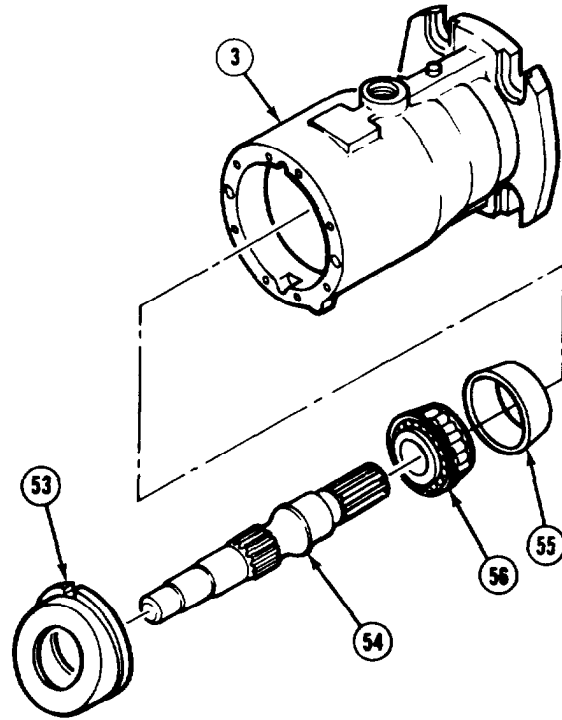


(23) Remove eight pistons (49), slip retainer (50), retaining guide (51), and six springs (52) from cylinder block (48).



5-56. HYDROSTATIC MOTOR REPAIR (CONT).

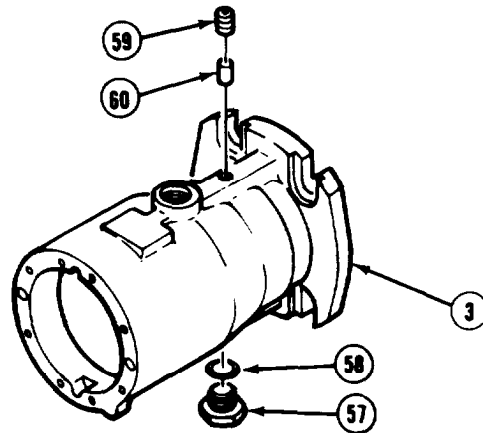
- (24) Remove swash plate (53) and motor shaft (54) from motor (3).
- (25) Remove bearing race (55) and bearing (56).



NOTE

Perform the following steps only if necessary,

- (26) Remove plug (57) and preformed packing (58). Discard preformed packing.
- (27) Remove plug (59) and pin (60) from motor (3).

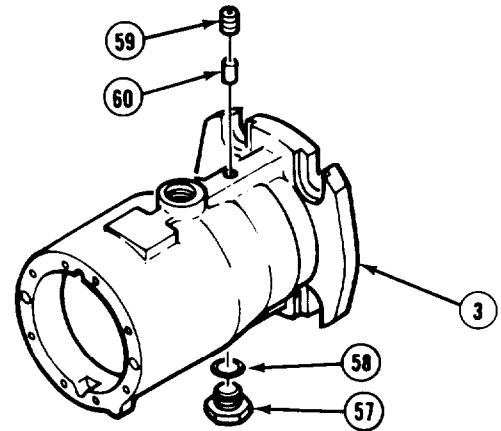


b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent and lint-free rags.
 - (2) Check for burrs or nicks on metal parts.
 - (3) Keep all internal mechanisms free of chemicals and dirt.
 - (4) Lubricate the swash plate, slippers and bores with clean hydraulic fluid.

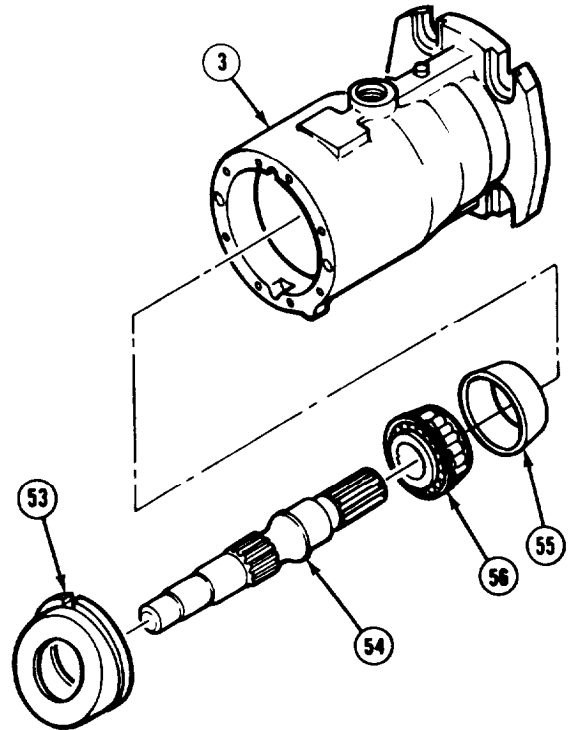
c. Assembly.

- (1) If removed, install pin (60) and plug (59) in motor (3).
- (2) If removed, install preformed packing (58) and plug (57) in motor (3).

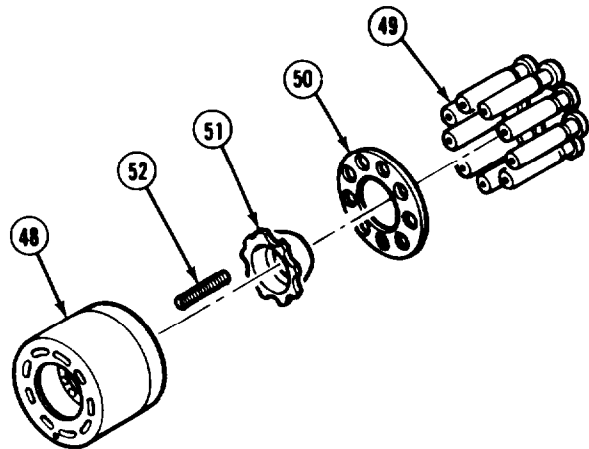


5-56. HYDROSTATIC MOTOR REPAIR (CONT.).

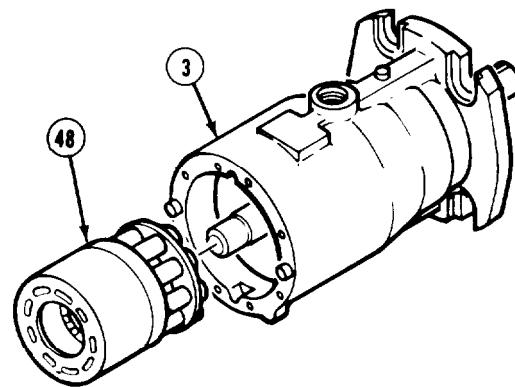
- (3) Install front bearing (56) on motor shaft (54).
- (4) Install bearing race (55), motor shaft (54), and swash plate (53) in motor (3).



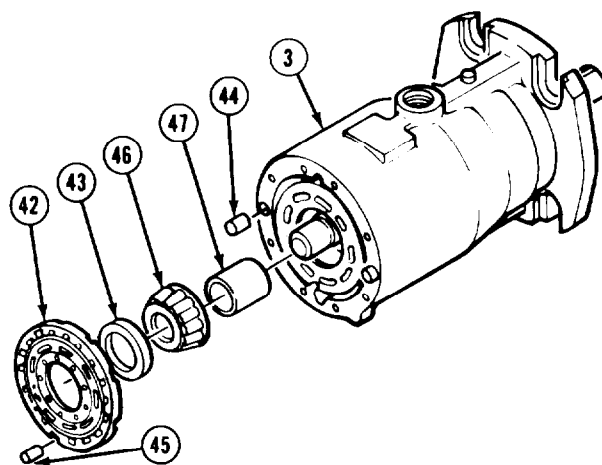
- (5) Install eight pistons (49) in slip retainer (50).
- (6) Install eight pistons (49), slip retainer (50), retaining guide (51), and six springs (52) in cylinder block (48).



- (7) Install cylinder block (48) in motor (3).

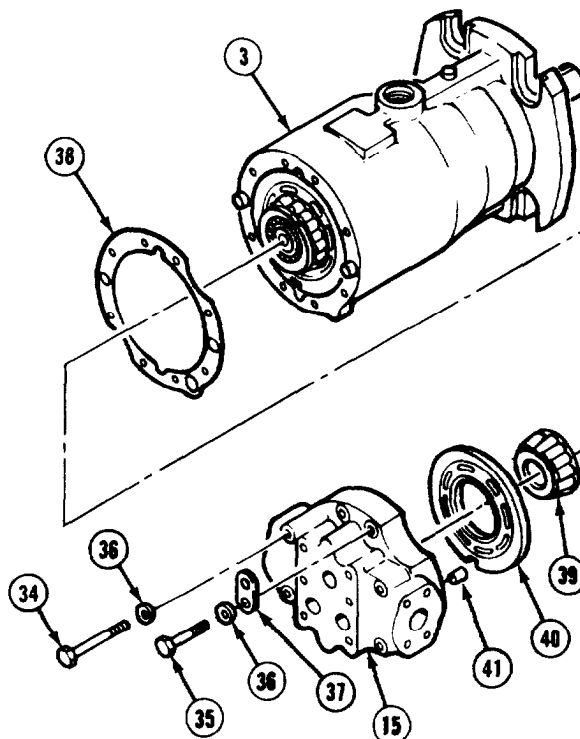


- (8) Install spacer (47) and rear bearing (46).
 (9) Install bearing plate (42) and spacer (43) in motor (3).
 (10) If removed, install three pins (44 and 45).

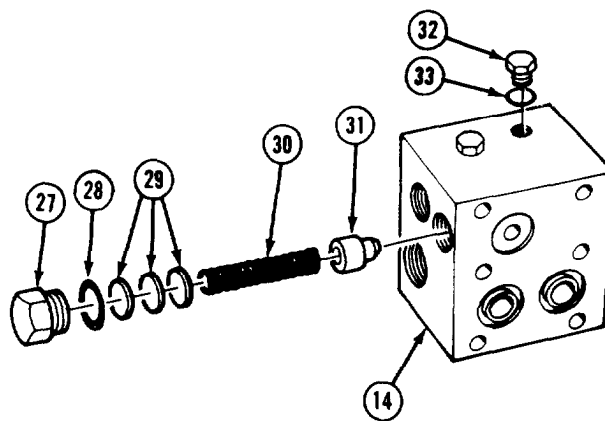


5-56. HYDROSTATIC MOTOR REPAIR (CONT).

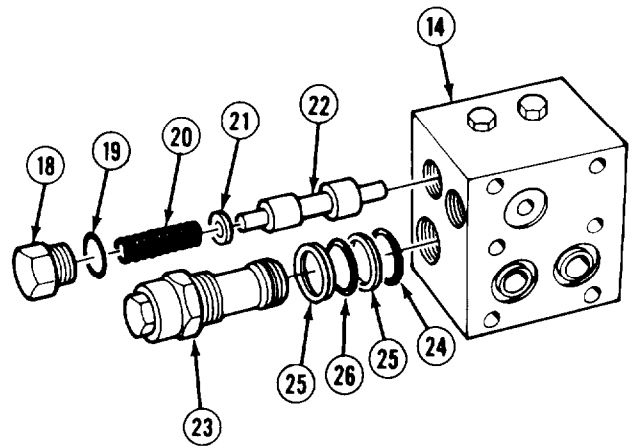
- (11) If removed, install pin (41).
- (12) Install bearing race (39), valve plate (40), and gasket (38), in end cap (15).
- (13) Install motor end cap (15) and lifting bracket (37) on motor (3) with eight washers (36) and screws (34 and 35). Tighten screws to 27 to 37 lb-ft (36 - 50 N•m).



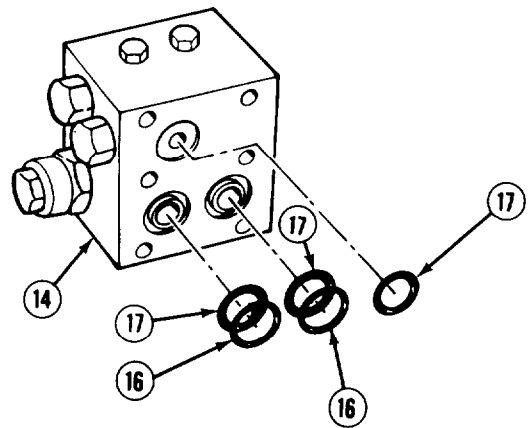
- (14) Install three preformed packings (33) and plugs (32).
- (15) Install poppet (31), spring (30), shims (29), preformed packing (28), and plug (27) in manifold (14).



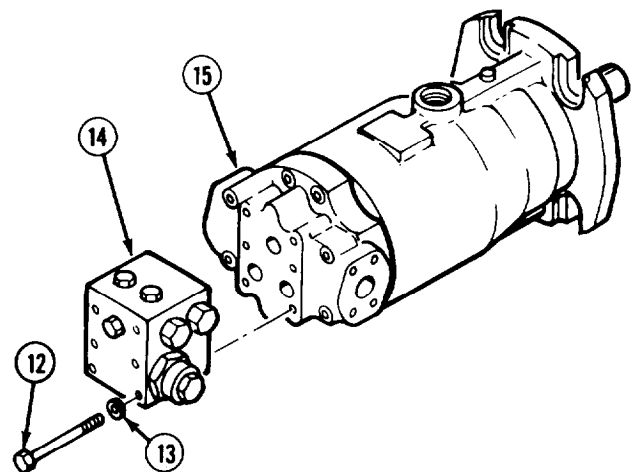
- (16) Install two preformed packings (26) and four back-up rings (25) in two system relief valves (23).
- (17) Install two preformed packing (24) and system relief valves (23) in manifold (14).
- (18) Install shuttle valve spool (22), spacer (21), and spring (20) in manifold (14) with two preformed packings (19) and plug (18).



- (19) Install three preformed packings (17) and two back-up rings (16) in manifold (14).

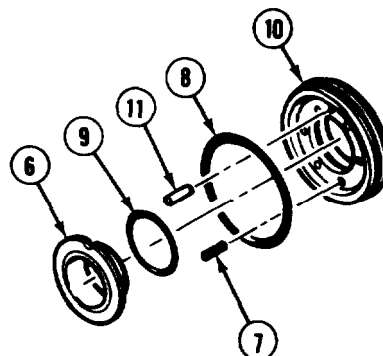


- (20) Install manifold (14) on motor end cap (15) with six lockwashers (13) and screws (12). Tighten screws 20 to 30 lb-ft (27 - 41 N·m).

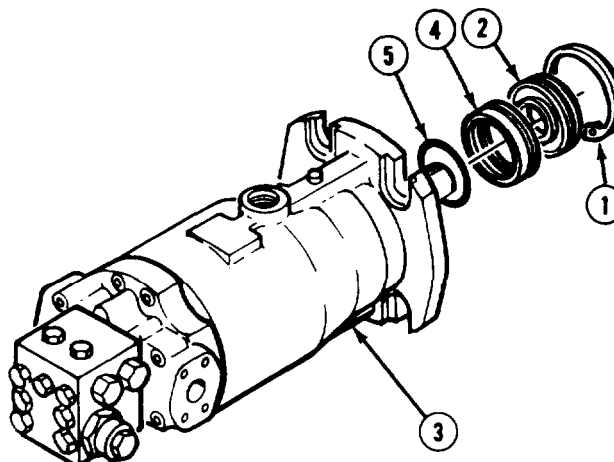


5-56. HYDROSTATIC MOTOR REPAIR (CONT).

- (21) If removed, install pin (11).
- (22) Install preformed packing (8) and six springs (7) in housing (10).
- (23) Install preformed packing (9) in sealing ring (6) and sealing ring on housing (10).



- (24) Install preformed packing (5) and bronze ring (4).
- (25) Install seal assembly (2) in motor (3) with retaining ring (1).



NOTE

Follow-on Maintenance: Install hydrostatic motor (para 5-55).

END OF TASK

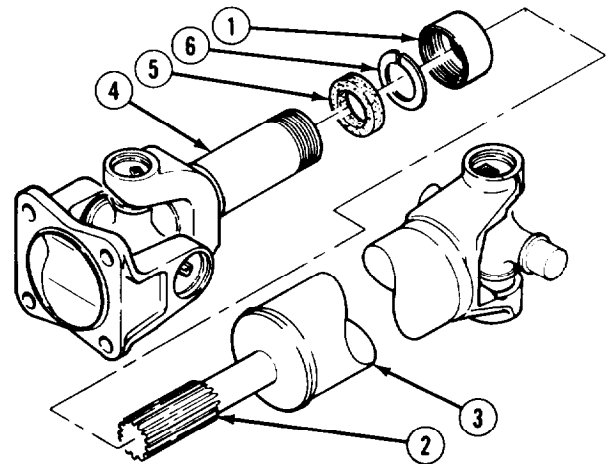
5-57. PUMP DRIVE SHAFT REPAIR.		
This task covers:		
a. Disassembly	b. Cleaning/Inspection	c. Assembly
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Clips (6)	
	Grease, general purpose (item 25, appendix E)	
	Cloth, lint-free (item 12, appendix E)	
	Solvent, drycleaning (item 54, appendix E)	
Shop equipment, general purpose repair: semi-trailer mounted	<i>Equipment Condition</i>	
<i>Materials/Parts</i>	<i>TM or Para</i>	<i>Condition Description</i>
Seal, cork	Para 4-100	Pump drive shaft removed.
Seal, grease (8)		

a. Disassembly.

NOTE

Matchmarks are stamped on drive shaft.

- (1) Unscrew cover (1) and push back on spline shaft (2) of drive shaft (3). Separate slip yoke (4).
- (2) Remove cork seal (5), split ring (6), and cover (1). Discard cork seal.

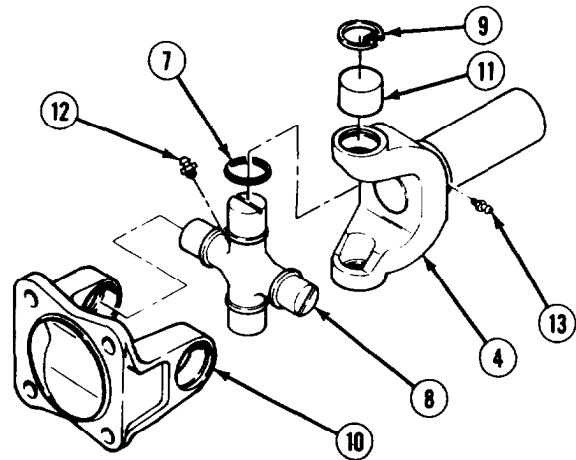


5-57. PUMP DRIVE SHAFT REPAIR (CONT).

- (3) Place slip yoke (4) in vise and slide four grease seals (7) down onto universal joint (8).
- (4) Remove four clips (9) from flange yoke (10) and slip yoke (4). Discard clips.

CAUTION

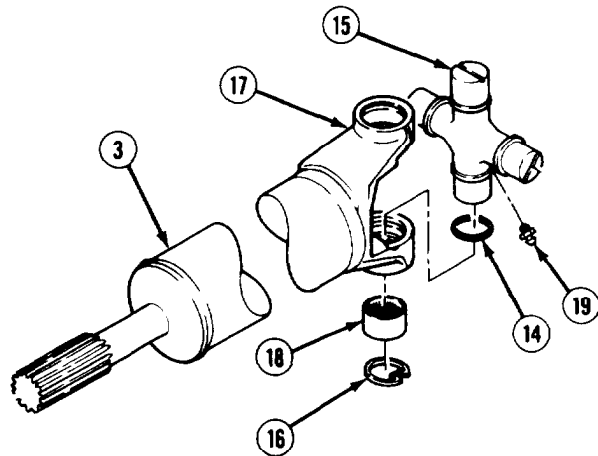
Be careful when removing bearing caps. Needle bearings may fall out and be damaged or lost.



- (5) Remove four bearing caps (11) from flange yoke (10) and slip yoke (4).
- (6) Remove flange yoke (10) and universal joint (8).
- (7) Remove four grease seals (7) and grease fitting (12) from universal joint (8). Discard seals.
- (8) Remove grease fitting (13) from slip shaft (4).
- (9) Place drive shaft (3) in vise and slide four grease seals (14) down onto universal joint (15).
- (10) Remove two clips (16) from drive shaft yoke (17). Discard clips.
- (11) Remove four bearing caps (18) from drive shaft yoke (17) and universal joint (15).

CAUTION

Be careful when removing bearing caps. Needle bearings may fall out and be damaged or lost.



- (12) Remove universal joint (15), four grease seals (14), and grease fitting (19). Discard seals.

b. Cleaning/Inspection.**WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings; allow bearings to air dry.
- (3) Check all parts for damage.
- (4) Replace all damaged parts.

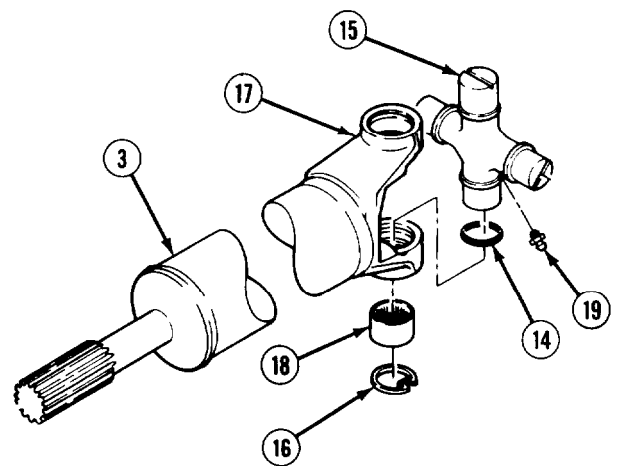
c. Assembly.

- (1) Install grease fitting (19) and position four grease seals (14) on universal joint (15).
- (2) Position universal joint (15) in drive shaft yoke (17).

CAUTION

Be careful when installing bearing caps. Needle bearings may fall out and be damaged or lost.

- (3) Apply grease to insides of four bearing caps (18) and install in drive shaft yoke (17) and universal joint (15).
- (4) Install two clips (16) and slide four grease seals (14) into place.

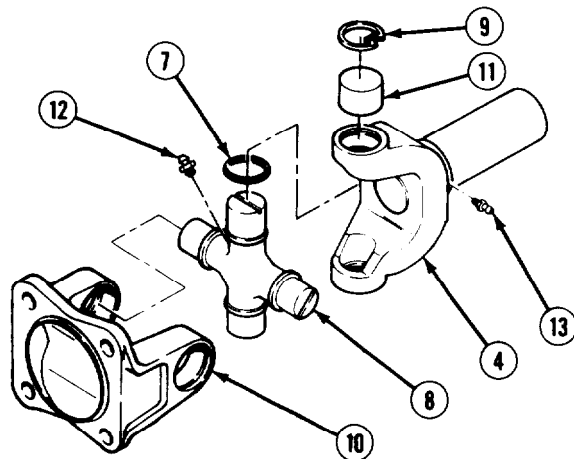


5-57. PUMP DRIVE SHAFT REPAIR (CONT).

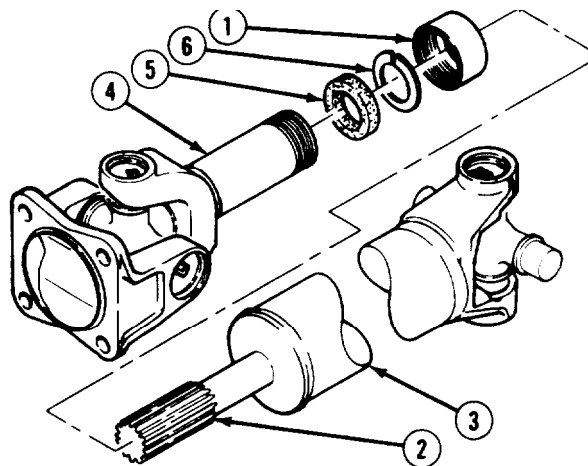
- (5) Install grease fitting (13) in slip yoke (4).
- (6) Install grease fitting (12) and position four grease seals (7) on universal joint (8).
- (7) Position universal joint (8) in flange yoke (10) and slip yoke (4).

CAUTION

Be careful when installing bearing caps. Needle bearings may fall out and be damaged or lost.



- (8) Apply grease to insides of four bearing caps (11) and install in slip yoke (4) and flange yoke (10).
- (9) Install four clips (9) and slide four grease seals (7) into place.
- (10) Position cover (1), split ring (6), and cork seal (5) on spline shaft (2) of drive shaft (3).
- (11) Align matchmarks and install slip yoke (4) on drive shaft (3) and tighten cover (1).



NOTE

Follow-on Maintenance: Install pump drive shaft (para 4-100).

END OF TASK

5-58. CLUTCH DRIVE SHAFT REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-------------|
| a. Disassembly | b. Cleaning/Inspection | c. Assembly |
|----------------|------------------------|-------------|

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Materials/Parts

Seals (4)
Clips (4)
Solvent, drycleaning (item 54, appendix E)

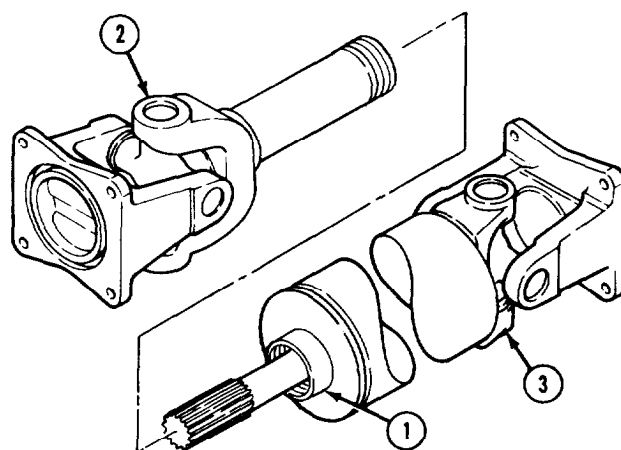
Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-102	Clutch drive shaft removed.

a. Disassembly.

NOTE

- Matchmarks already stamped into drive shaft.
 - This procedure is the same for both ends of the clutch drive shaft.
- (1) Remove seal (1) from slip yoke (2) and pull slip yoke from shaft (3).

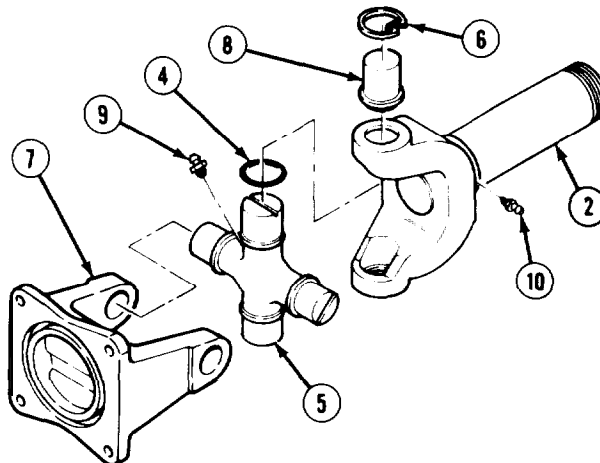


5-58. CLUTCH DRIVE SHAFT REPAIR (CONT).

- (2) Place slip yoke (2) in vise and slide four grease seals (4) down onto universal joint (5).
- (3) Remove four clips (6) from flange yoke (7) and slip yoke (2). Discard clips.

CAUTION

Be careful when removing bearing cups. Needle bearings may fall out and become damaged or lost.



- (4) Remove four bearing caps (8) from flange yoke (7) and slip yoke (2).
- (5) Remove flange yoke (7) and universal joint (5).
- (6) Remove seals (4) and grease fitting (9) from universal joint (5). Discard seals.
- (7) Remove grease fitting (10) from slip yoke (2).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Wash all metal parts in drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Dry all parts, except bearing cups, with compressed air. Let bearings air dry.
- (3) Check all parts for damage.
- (4) Replace damaged parts.

c. Assembly.

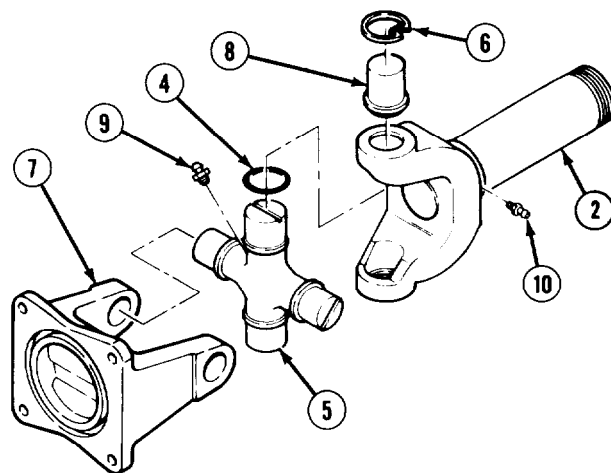
NOTE

This procedure is the same for both ends of the clutch drive shaft.

- (1) Install grease fitting (10) in slip yoke (2)
- (2) Install grease fitting (9) and position four seals (4) on universal joint (5).
- (3) Position universal joint (5), flange yoke (7), and slip yoke (2).

CAUTION.GPH;12p10;6 P10;TIFF
Be careful when installing bearing cups.
Needle bearings may fall out and become damaged or lost.

- (4) Apply grease in insides of four bearing cups (8) and install slip yoke (2) and flange yoke (7) over ends of universal joint.
- (5) Install four clips (6) and slide grease seals (4) into place.
- (6) Align matchmarks and install slip yoke (2) on drive shaft (3).
- (7) Install seal (3).

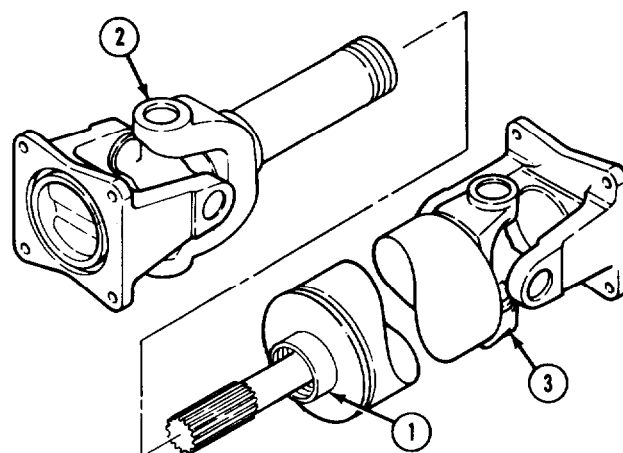


NOTE

Follow-on Maintenance:

- Install drive shaft (para 4-102)
- Lubricate drive shaft (figure 3-1).

END OF TASK



5-59. PTO DRIVE SHAFT REPAIR.

This task covers:

a. Disassembly

b. Cleaning/Inspection

c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Materials/Parts

Seals, grease (4)

Locknuts (2)

Grease, general purpose (item 25, appendix E)

Solvent, drycleaning (item 54, appendix E)

Equipment Condition

TM or Para

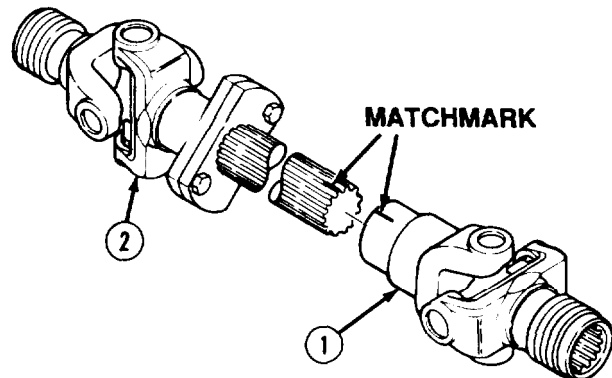
Para 4-101

Condition Description

PTO drive shaft removed

a. Disassembly.

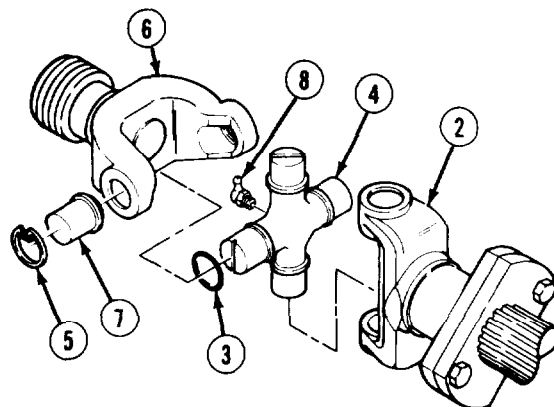
- (1) Matchmark and separate female yoke (1) from male yoke (2).



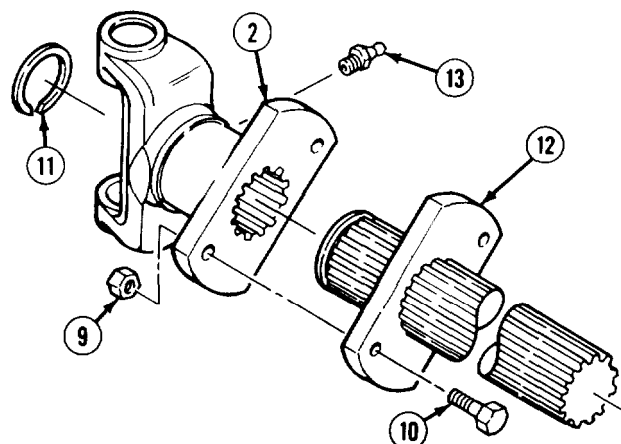
- (2) Place male yoke (2) in vise and slide four grease seals (3) down onto universal joint (4). Discard grease seals.
- (3) Remove four retaining rings (5) from quick disconnect yoke (6) and male yoke (2).

CAUTION

Be careful when removing bearing cups, or needle bearings may fall out and be damaged or lost.



- (4) Remove four bearing cups (7) from quick disconnect yoke (6) and male yoke (2).
- (5) Remove quick disconnect yoke (6) and universal joint (4) from male yoke (2).
- (6) Remove seals (3) and grease fitting (8) from universal joint (4).
- (7) Repeat steps (2) through (6) for female yoke.
- (8) Remove two locknuts (9) and screws (10). Discard locknuts.
- (9) Remove retaining ring (11) and shaft (12) from male yoke (2).
- (10) Remove grease fitting (13).



5-59. PTO DRIVE SHAFT REPAIR (CONT).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Wash all metal parts with drycleaning solvent.

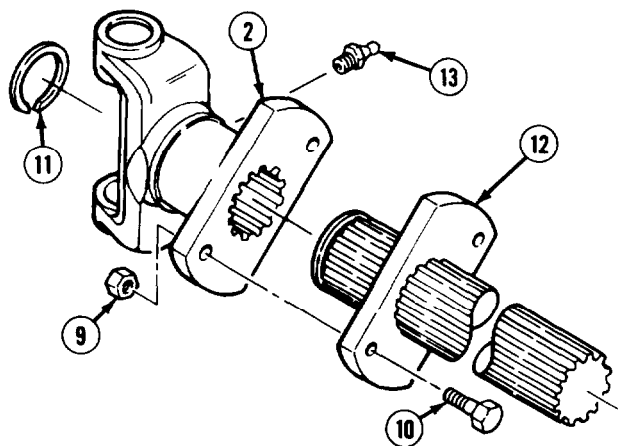
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Dry all parts, except bearing cups, with compressed air. Let bearings air dry.
- (3) Check parts for damage.
- (4) Replace damaged parts.

c. Assembly.

- (1) Install grease fitting (13) in valve yoke (2).
- (2) Install shaft (12) in valve yoke (2) with retaining ring (11).
- (3) Install two screws (10) and locknuts (9). Tighten nuts 204 lb-in (23 N•m).

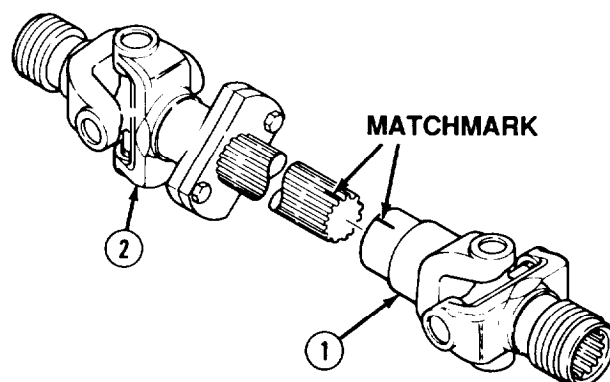
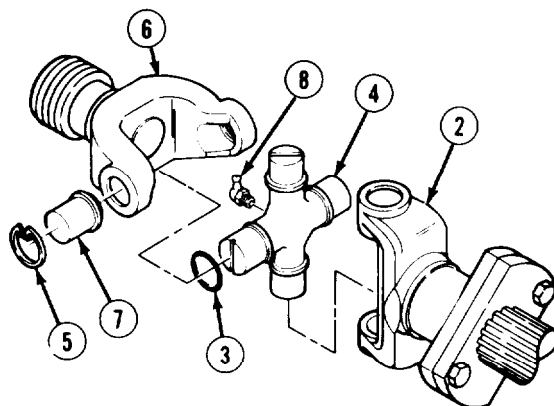


- (4) Install grease fitting (8) and position four seals (3) on universal joint (4).
- (5) Position universal joint (4), quick disconnect yoke (6) and male yoke (2).

CAUTION

Be careful when removing bearing cups, or needle bearings may fall out and be damaged or lost.

- (6) Apply grease to insides of four bearing cups (7) and install cups in male yoke (2) and quick disconnect yoke (6) over ends of universal joint (4).
- (7) Install four retaining rings (5) and slide grease seals (3) into place.
- (8) Repeat steps (1) through (7) for female yoke.
- (9) Align matchmarks and install male yoke (2) in female yoke (1).



NOTE

Follow-on Maintenance:

- Install PTO drive shaft (para 4-101).
- Lubricate PTO shaft (figure 3-1).

END OF TASK

5-60. ROTOR DRIVE SHAFT REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Materials/Parts
Seal

Materials/Parts

Star washer

Grease, general purpose, (item 25, appendix E)

Cloth, lint-free (item 12, appendix E)

Equipment Condition

TM or Para

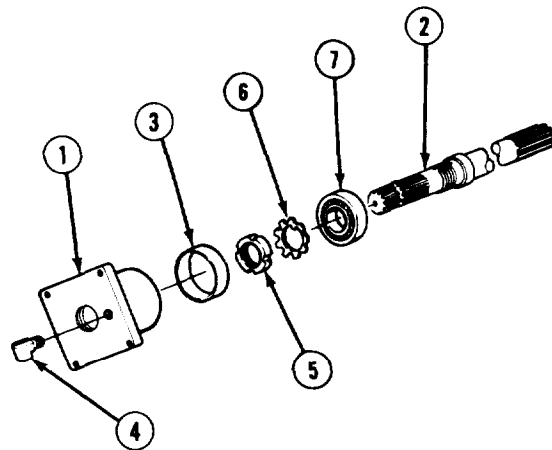
Para 4-164

Condition Description

Rotor drive shaft removed.

a. Disassembly.

- (1) Remove bearing and seal retainer (1) from shaft (2).
- (2) Remove seal (3) and grease fitting (4) from bearing and seal retainer (1). Discard seal.
- (3) Remove locknut (5) and star washer (6) from rotor drive shaft (2). Discard washer.
- (4) Remove bearing (7) from rotor drive shaft (2).



b. Cleaning/Inspection.

- (1) Check for damaged parts and replace.
- (2) Check shaft for burrs or nicks.
- (3) Clean shaft with clean lint-free cloth.

c. Assembly.

- (1) Install seal (3) in bearing and seal retainer (1) and fill retainer with grease.
- (2) Install grease fitting (4) in bearing and seal retainer (1).
- (3) Install bearing (7) on rotor drive shaft (2).
- (4) Install star washer (6) and locknut (5) on rotor drive shaft (2).
- (5) Install bearing and seal retainer (1) on rotor drive shaft (2).

NOTE

Follow-on Maintenance: Install rotor shaft (para 4-164).

END OF TASK

5-61. PILLOW BLOCK REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Wrench, torque

Materials/Parts

Compound, sealing, pipe thread (item 17, appendix E)

Cloth, lint-free (item 12, appendix E)

Grease, automotive and artillery (item 24, appendix E)

Solvent, drycleaning (item 54, appendix E)

References

TM 9-214, Inspection, Care, and Maintenance of Antifriction Bearings

Materials/Parts

Pins, cotter (2)

Seals (2)

Gaskets (2)

Lo&washers (8)

Gasket

Equipment Condition

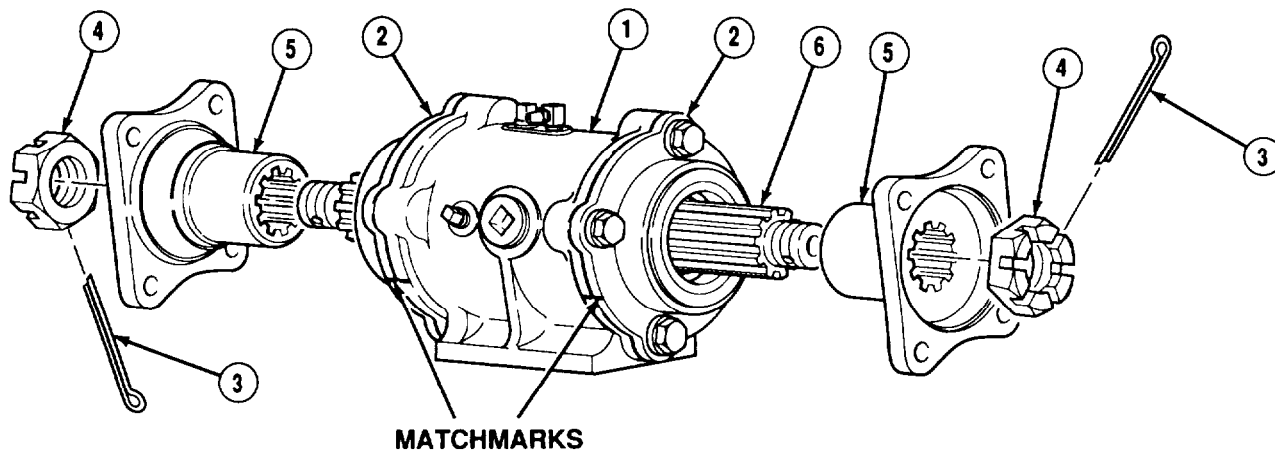
TM or Para

Para 4-104

Condition Description

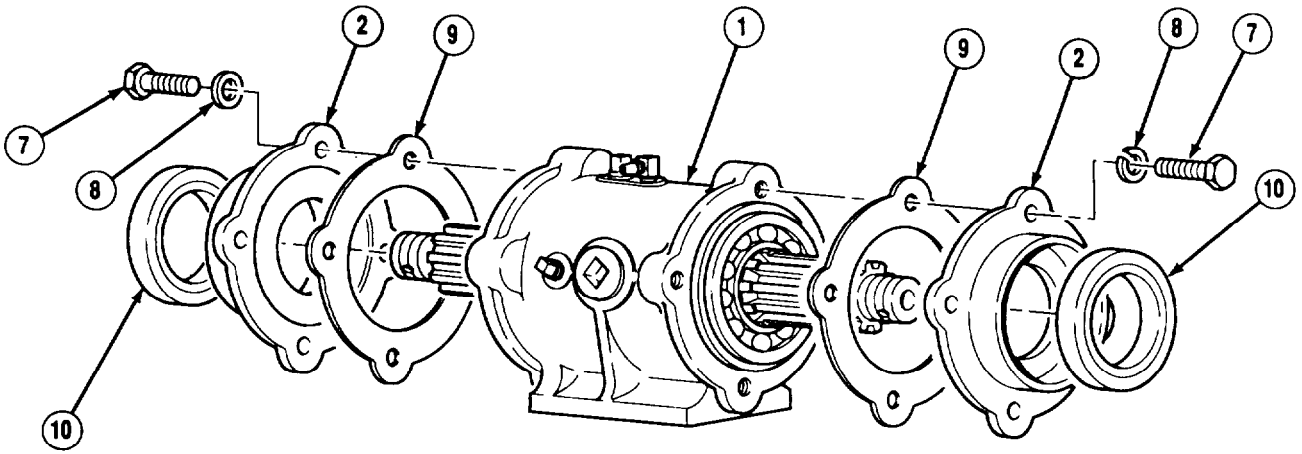
Pillow block removed

a. Disassembly.

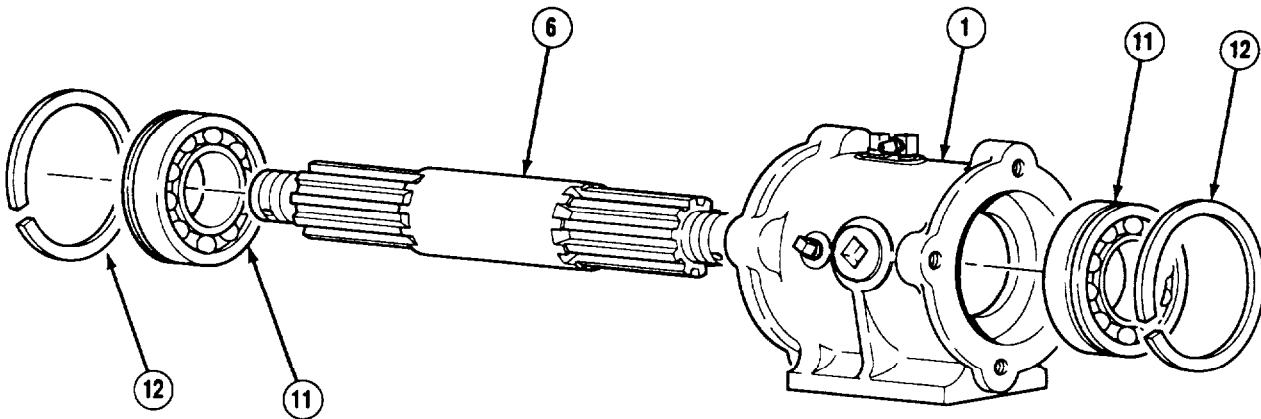


- (1) Matchmark pillow block housing (1) and two retainers (2).
- (2) Remove two cotter pins (3), castle nuts (4), and flanges (5) from shaft (6). Discard cotter pins.

5-61. PILLOW BLOCK REPAIR (CONT).

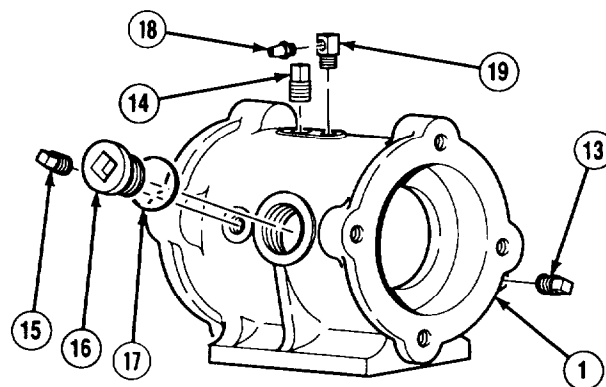


- (3) Remove four screws (7), lockwashers (8), two retainers (2), and two gaskets (9) from housing (1). Discard lockwashers and gaskets.
- (4) Remove two seals (10) from retainer (2). Discard seals.



- (5) Push shaft (6) and bearing (11) out of housing (1). Remove bearing from shaft.
- (6) Remove other bearing (11) from housing (1).
- (7) Remove two rings (12) from bearings (11).

- (8) Remove four plugs (13, 14, 15, and 16) and gasket (17) from housing (1). Discard gasket.
- (9) Remove grease fitting (18) and elbow (19) from housing (1).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearings to air dry.
- (4) Check block, retainers, and flange assemblies for breaks, cracks, or sharp edges.
- (5) Check bearings for galling, scoring, nicks, cracks, or pitting.
- (6) Replace damaged parts.

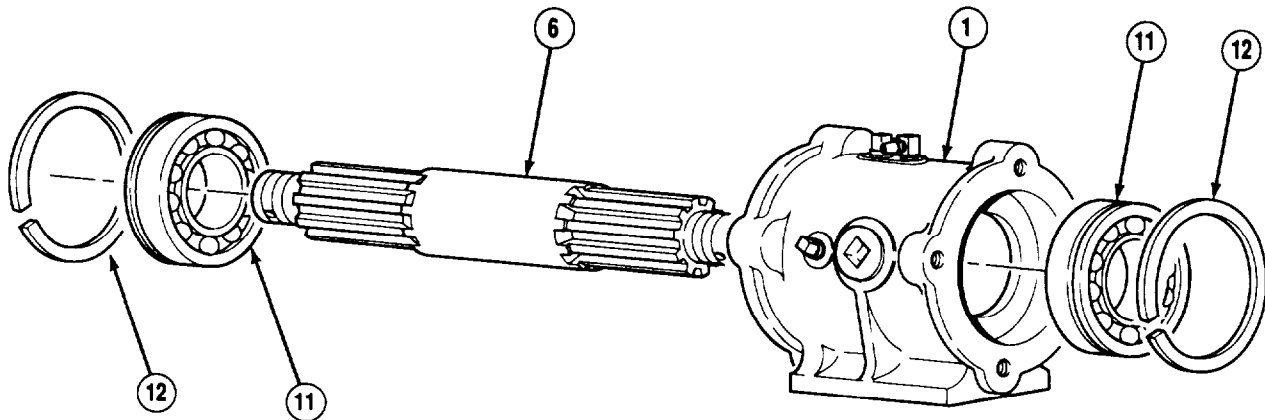
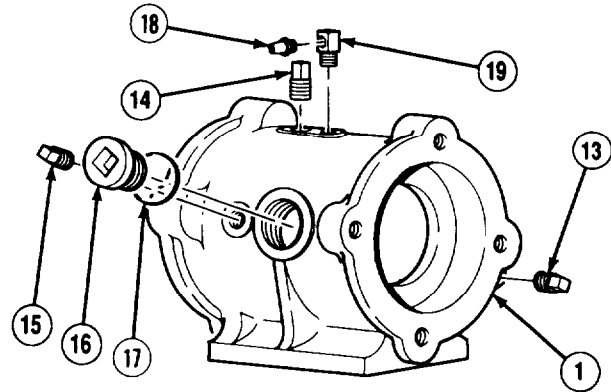
5-61. PILLOW BLOCK REPAIR (CONT).

c. Assembly.

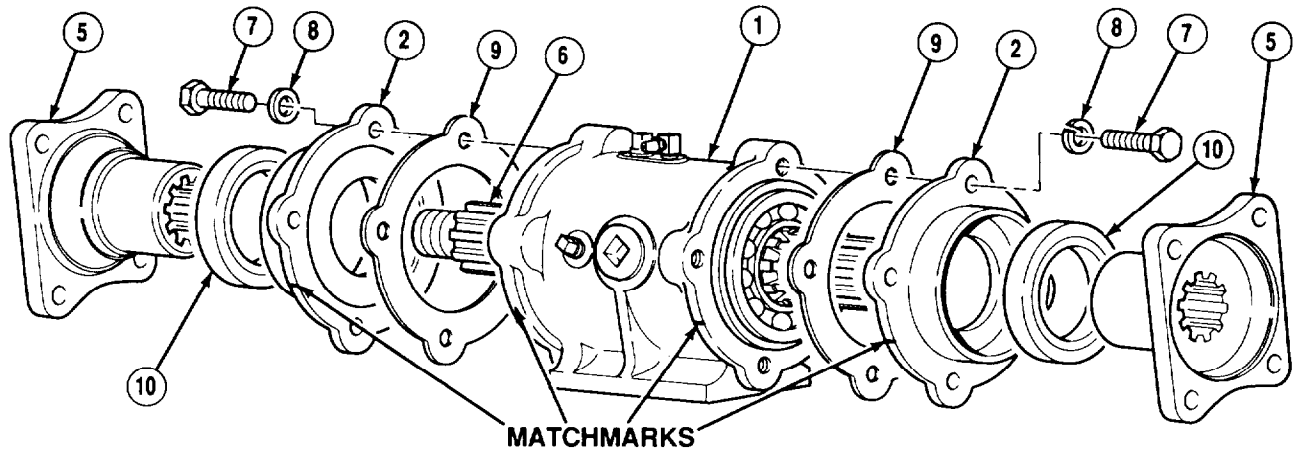
WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads of elbow (19) and grease fitting (18) with pipe thread sealing compound and install in pillow block housing (1).
- (2) Coat threads of four plugs (16, 15, 14, and 13) with pipe thread sealing compound and install gasket (17) and plugs.



- (3) Lubricate two bearings (11) and pack housing (1) with grease.
- (4) Install two rings (12) on bearings (11).
- (5) Install one bearing (11) in housing (1) and other bearing (11) on shaft (6).
- (6) Install shaft (6) in housing (1), making sure rings (12) are seated in housing.

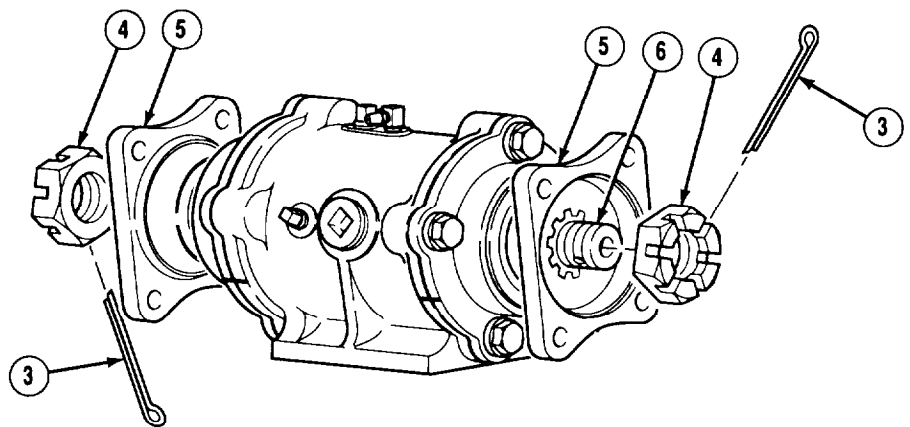


- (7) Install two seals (10) in retainers (2).

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (8) Coat two gaskets (9) with light coat of sealant and position on housing (1).
- (9) Position two flanges (5) in retainers (2) and install each on shaft (6) as an assembly.
- (10) Align matchmarks and install retainer (2) on housing (1) with four lo&washers (8) and screws (7). Tighten screws 110 lb-ft (149 N•m).



- (11) Install two castle nuts (4) and cotter pins (3) on shaft (6).

NOTE

Follow-on Maintenance: Install pillow block (para 4-104).

END OF TASK

5-62. FRONT AXLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: automotive

Lifting device (capacity 500 lb [227 kg])

Wrench, torque

Materials/Parts

Shims (AR)

Locknut

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 4-115

Para 4-121

Condition Description

Front wheels removed.

Steering cylinder hoses disconnected.

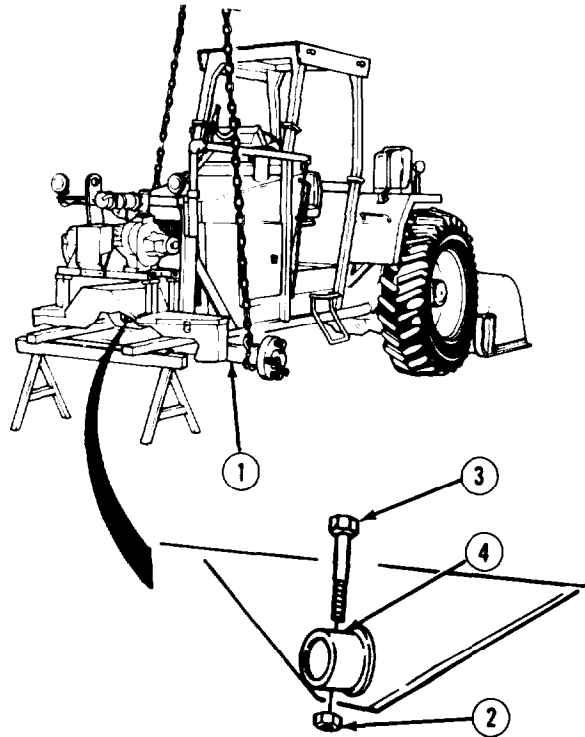
Ground speed sensor removed.

a. Removal.

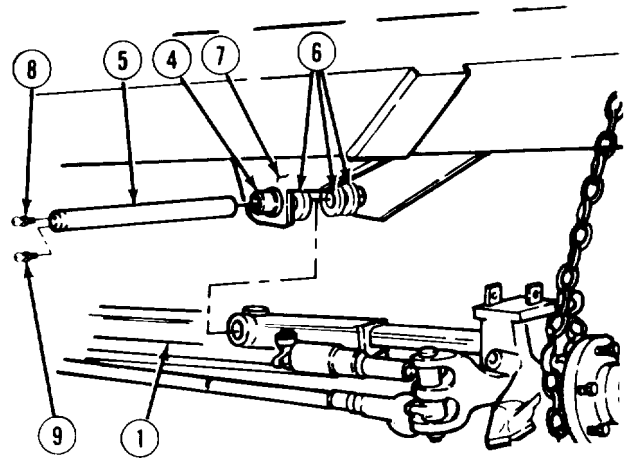


Front axle weighs 414 lbs (188 kg). Attach suitable lifting device prior to removal or installation to prevent possible injury to personnel.

- (1) Attach suitable lifting device to front axle (1).
- (2) Remove locknut (2) and screw (3) from center axle support (4). Discard locknut.

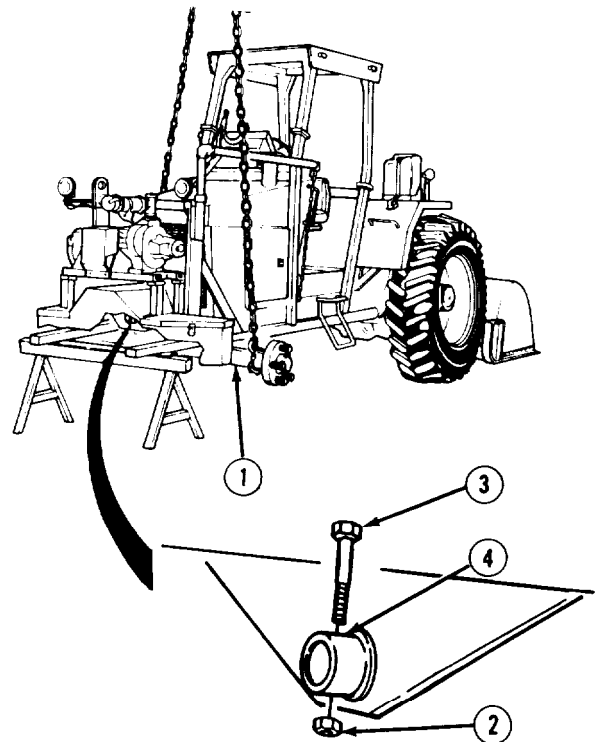


- (3) Remove center pin (5) and three shim (6) from center axle support (4).
- (4) While mechanic operates lifting device, assistant guides front axle (1) from vehicle (7).
- (5) Remove two grease fittings (8 and 9) from center pin (5).



b. Installation.

- (1) Install two grease fittings (8 and 9) in center pin (5).
- (2) Position axle (1) under vehicle (7).
- (3) Lubricate center pin (5) and install with three shims (6) in center support (4) and axle (1).
- (4) Install screw (3) and locknut (2) in center support (4) and center pin (5). Tighten nut 35 lb-ft (47 N•m).
- (5) Remove lifting device.



NOTE

Follow-on Maintenance:

- . Install steering cylinder hoses (para 4- 121).
- . Install ground speed indicator (para 4- 150).
- . Install front wheels (para 4-115).

END OF TASK

5-63. STEERING KNUCKLE REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment, maintenance and repair

Shop equipment, contact maintenance: truck mounted

Wrench, torque

Materials/Parts

Compound, thread locking (item 15, appendix E)
 Bushings (2)
 seals (2)

Materials/Parts

Locknut (2)
 Grease, general purpose (item 25, appendix E)
 Solvent, drycleaning (item 54, appendix E)

Equipment Condition

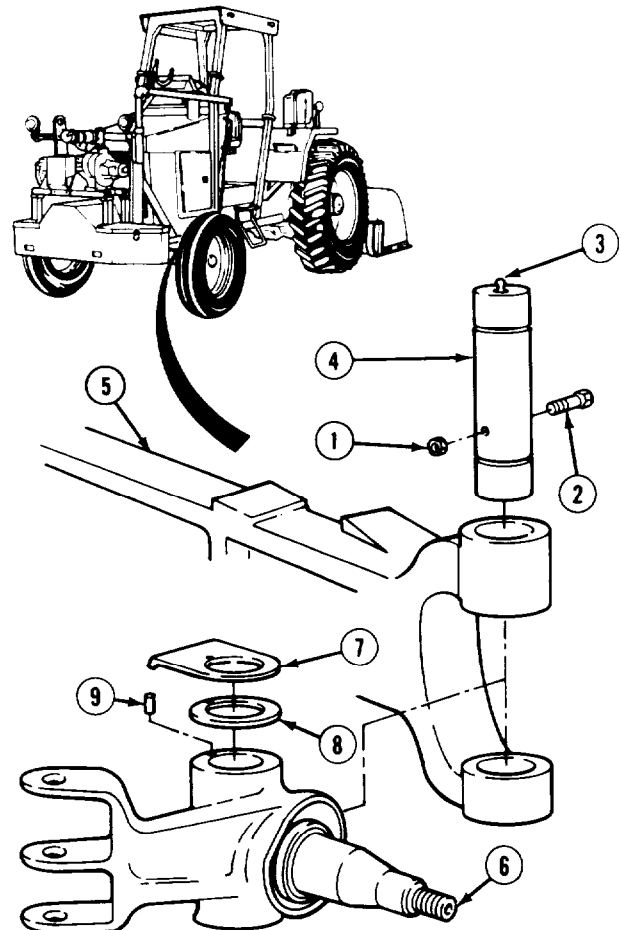
<i>TM or Para</i>	<i>Condition Description</i>
Para 5-75	Tie rod removed.
Para 4-113	Hub and bearings removed.
Para 4-121	Steering cylinder removed (if right side knuckle removed).

a. Removal.

NOTE

Procedures are the same for both sides.

- (1) Remove locknut (1) and screw (2). Discard locknut.
- (2) Remove two grease fittings (3) from king pin (4).
- (3) Using a soft steel rod, remove king pin (4) from axle (5).
- (4) Remove steering knuckle (6), thrust washer (7) and stop thrust washer (8) from axle (5).
- (5) If damaged remove spring pin (9).

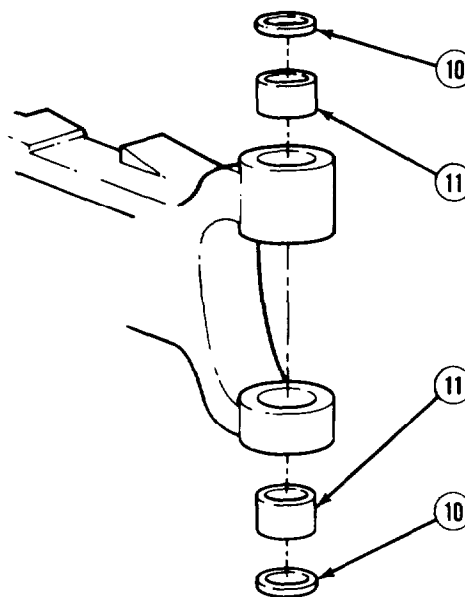


- (6) Remove and discard upper and lower seals (10).
- (7) If necessary, remove and discard upper and lower bushings (11).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.
 - (2) Check thrust washer and spring pin for wear or damage.
 - (3) Check machined surfaces for damage.
 - (4) Check threads for peeled or crossed condition.
 - (5) Replace damaged parts.



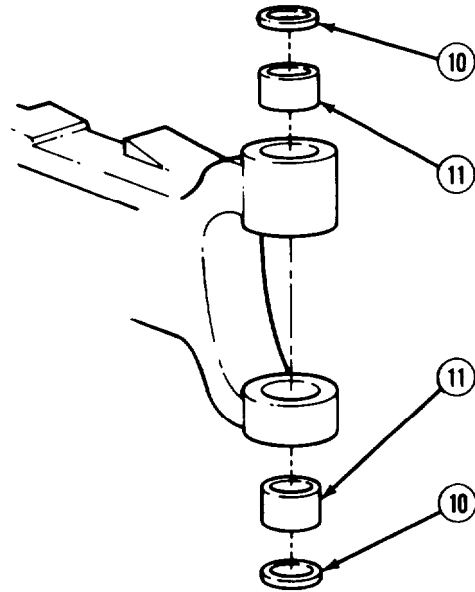
5-63. STEERING KNUCKLE REPLACEMENT (CONT).

c. Installation.

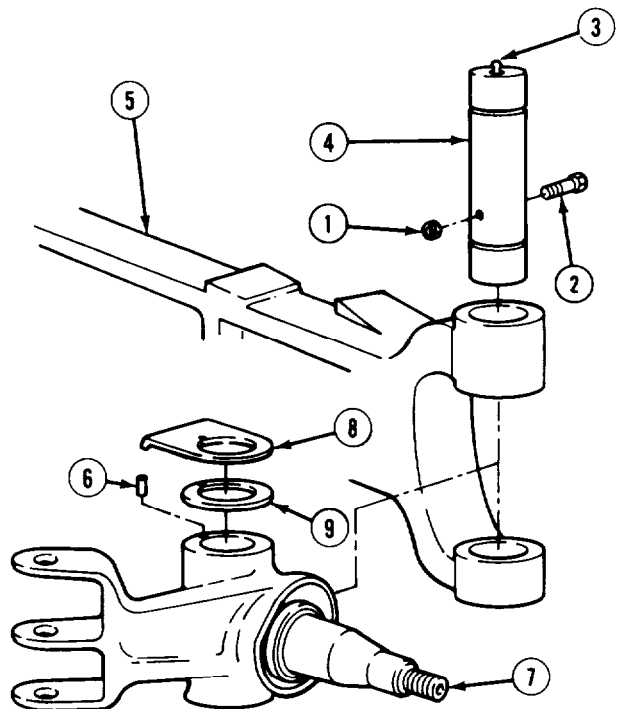
WARNING

Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Apply retaining compound to outside surface of bushings (11); install bushings flush to 0.01 in. (0.3 mm) recessed from spindle side of bores.
- (2) Install seals (10) tightly against bushings (11).



- (3) If removed install spring pin (9).
- (4) Install thrust washer (8), stop thrust washer (7), and steering knuckle (6) in axle (5).
- (5) Lubricate and install king pin (4) in axle (5).
- (6) Install two grease fittings (3) on king pin (4).
- (7) Install screw (2) and locknut (1). Tighten locknut 35 lb-ft (47 N-m).



NOTE

Follow-on Maintenance:

- Install steering cylinder if removed (para 4-121).
- Install tie rod (para 5-75).
- Install hub and bearings (para 4-113).

END OF TASK

5-64. REAR AXLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

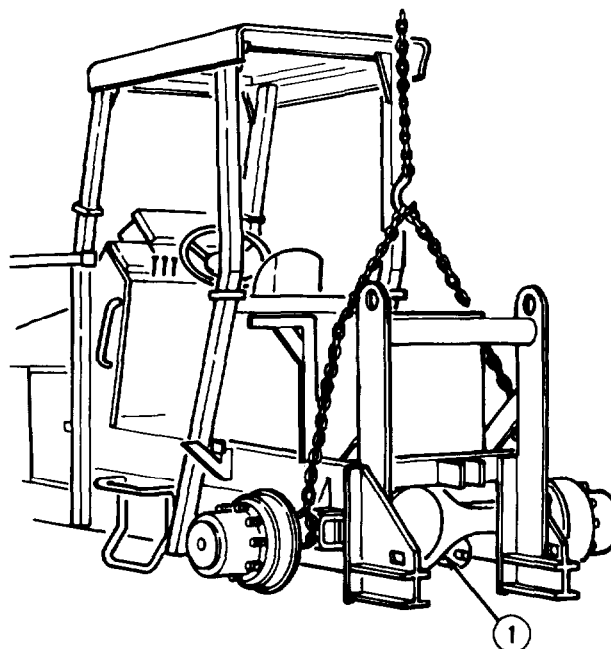
<i>Tools</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Tool kit, general mechanic's: equipment maintenance and repair	TM or Para Para 4-174	Rotor removed.
Lifting device (capacity 2000 lb [907 kg])	Para 4-114	Rear wheels removed.
Wrench, torque	Para 4-108	Brake lines disconnected.
<i>Materials/Parts</i>	Para 4-104	Pillow block removed.
Locknuts (8)	Para 5-55	Hydrostatic motor removed.
<i>Personnel Required</i>	Para 4-95	Two-speed linkage disconnected.
MOS62B, Construction equipment repairer (2)	Para 4-166	Additive system pipe removed.
	Para 4-25	Two-speed range box oil drained.

a. Removal.

WARNING

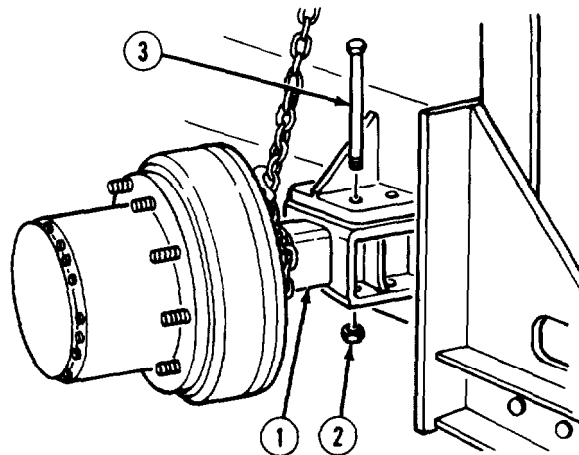
Rear axle weighs 1250 lbs (567 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (1) Attach a suitable lifting device to axle (1).

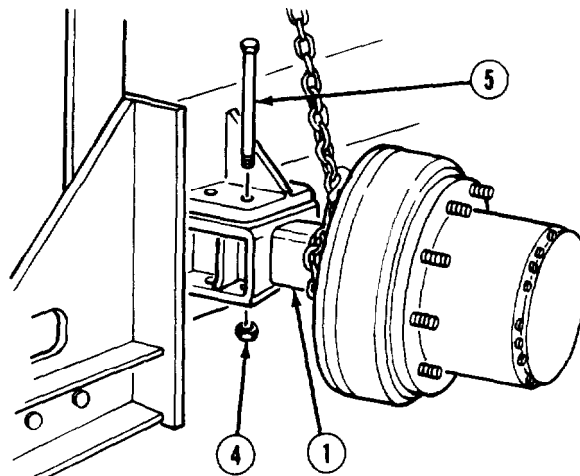


5-64. REAR AXLE REPLACEMENT (CONT).

- (2) Remove four locknuts (2) and screw (3) from left side of axle (1). Discard locknuts.



- (3) Remove four locknuts (4) and screws (5) from right side of axle (1). Discard locknuts.



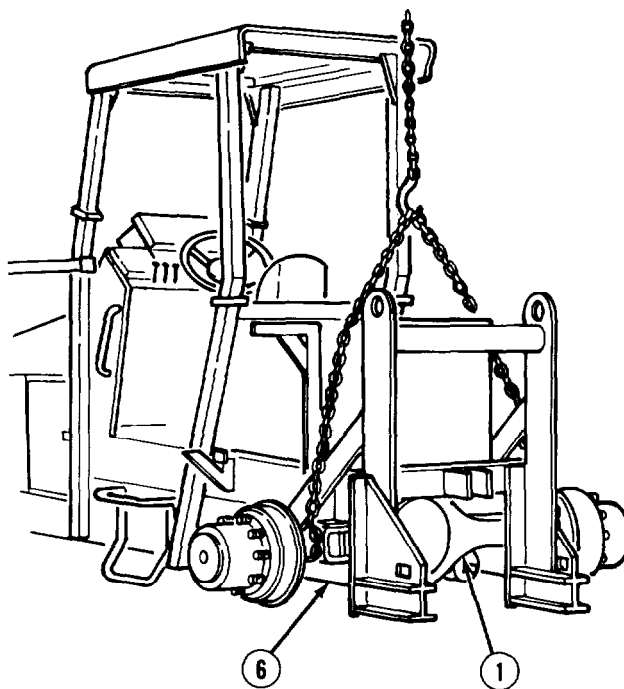
(4) While mechanic operates lifting device, assistant guides rear axle (1) from vehicle (6).

(5) Lower axle (1) and remove lifting device.

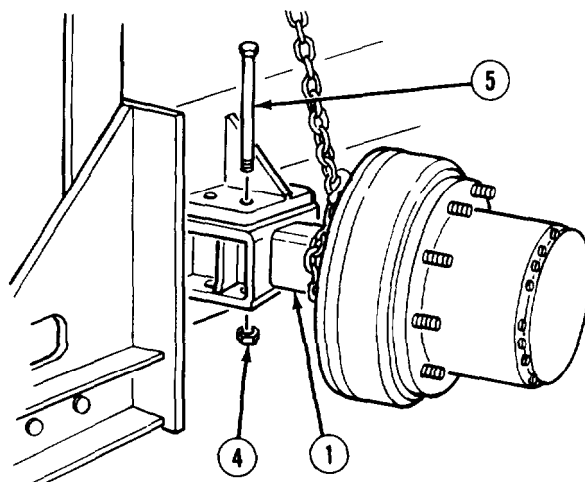
b. Installation.

Rear axle weighs 1250 lbs (567 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

- (1) Attach suitable lifting device to axle (1).
- (2) Mechanic operates lifting device while assistant guides axle (1) and positions on the vehicle (6).

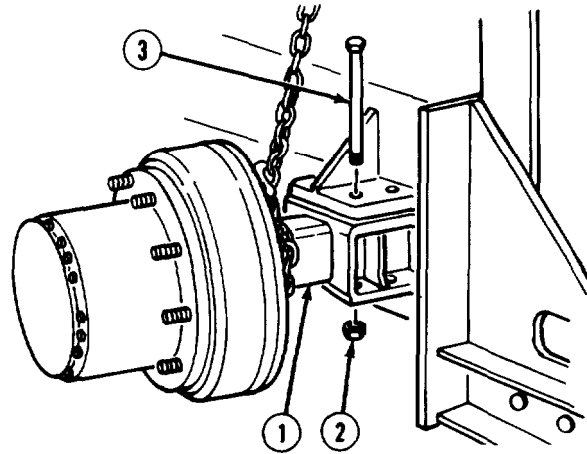


- (3) Install axle (1) on vehicle (6) with four screws (5) and locknuts (4) on right side. Tighten locknuts 265 to 275 lb-ft (359 - 373 N•m).



5-64. REAR AXLE REPLACEMENT (CONT).

- (4) Install four screws (3) and locknuts (2) on left side of axle. Tighten locknuts 265 to 275 lb-ft (359 - 373 N•m).



NOTE

Follow-on Maintenance:

- . Fill two-speed range box (para 4-25).
- . Install additive system pipe (para 4-166).
- . Connect two-speed linkage (para 4-95).
- . Install hydrostatic motor (para 5-55).
- . Install pillow block (para 4-104).
- . Connect brake lines (para 4-108).
- . Install rotor (para 4-174).

END OF TASK

5-65. SPINDLE REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

Wrench, torque

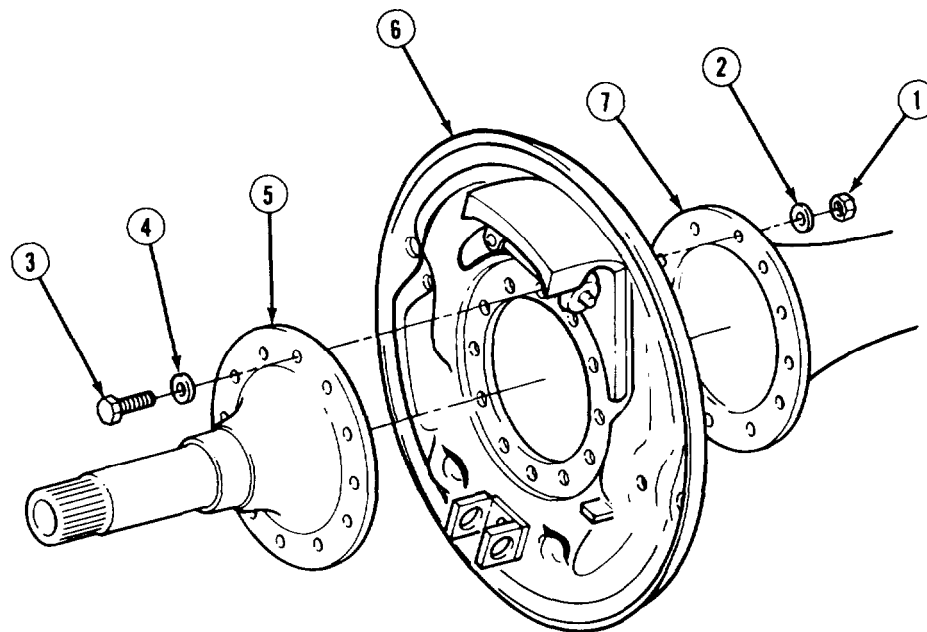
Equipment Condition

TM or Para
Para 4-108

Para 5-70

Condition Description

Brake lines disconnected.
Brake assembly removed.

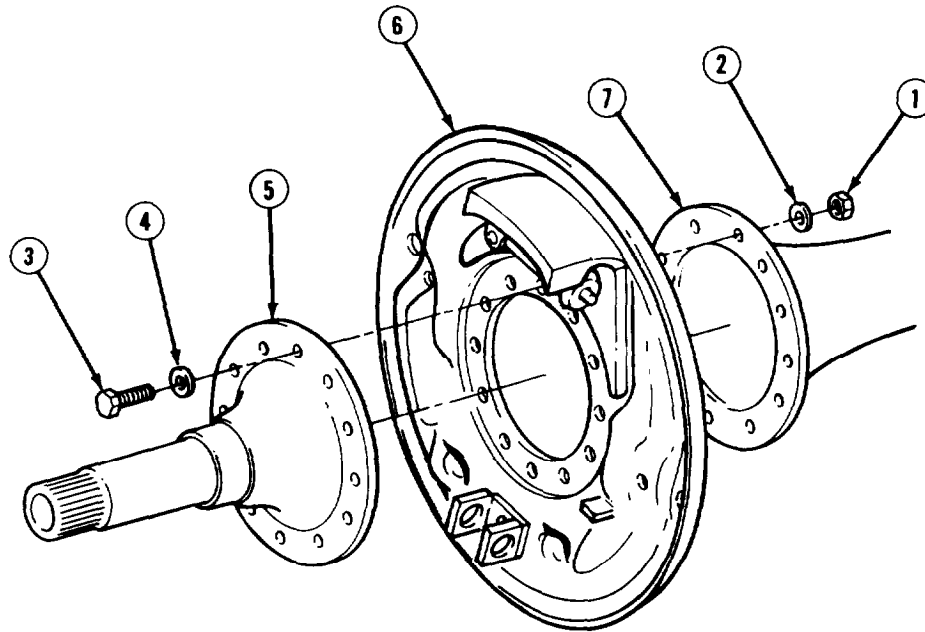


NOTE

- . This procedure is same for both spindles.
- . There are only nine washers on front of backing plate. Mark three positions with no washers.

- a. **Removal.** Remove 12 locknuts (1), washers (2), screws (3), nine washers (4) spindle (5) and backing plate (6) from axle housing (7).

5-65. SPINDLE REPLACEMENT (CONT).



NOTE

Installation uses same art as removal.

- b. Installation.** Install spindle (5) and backing plate (6) on axle housing (7) with 12 screws (3), nine washers (4), 12 washers (2), and locknuts (1). Tighten locknuts to 80 to 100 lb-ft (108 - 136 N•m).

NOTE

Follow-on Maintenance:

- . Install brake assembly (para 5-70).
- . Connect brake lines (para 4-108).

END OF TASK

5-66. WHEEL END AND AXLE SHAFT REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Wrench, torque

Materials/Parts

Solvent, drycleaning (item 54, appendix E)

Materials/Parts

Cloth, lint-free (item 12, appendix E)
Compound, sealing (item 15, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-114	Rear wheels removed.
Para 4-178	Wheel ends drained.

a. Removal.

NOTE

This procedure is the same for both wheel ends.

- (1) Remove 18 screws (1) from drive flange (2).

NOTE

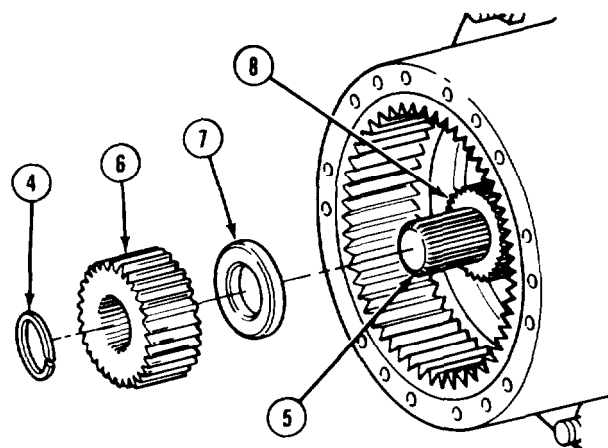
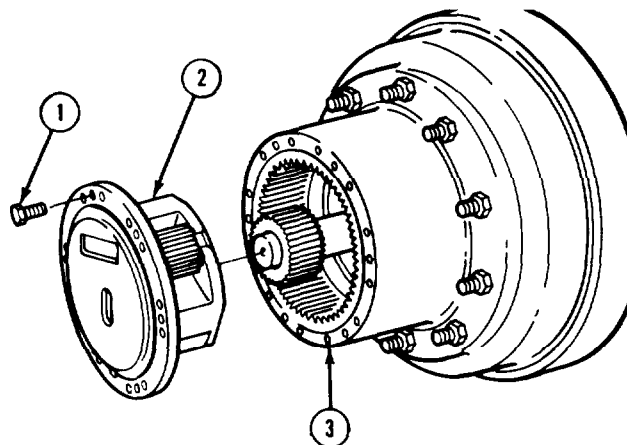
Tap drive flange to break loose from hub if necessary.

- (2) Remove flange (2) from hub (3).

- (3) Remove retaining ring (4) from axle shaft (5).

- (4) Remove sun gear (6) and spacer (7) from axle shaft (5).

- (5) Remove axle (5) from axle housing (8).

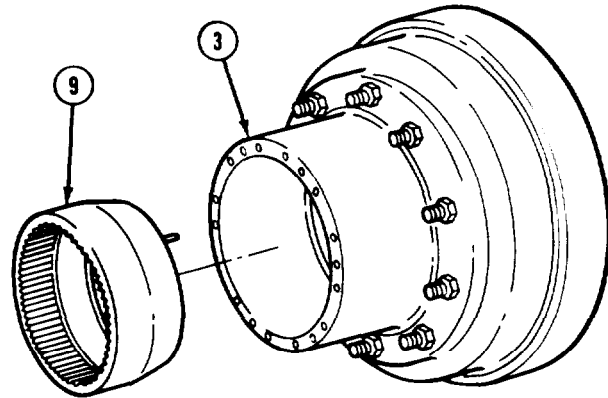


5-66. WHEEL END AND AXLE SHAFT REPLACEMENT (CONT).

NOTE

Due to tight fit, it may be necessary to remove ring gear from spindle with puller.

- (7) Remove ring gear (9) from hub (3).



b. Cleaning/Inspection.

- (1) Scrape old sealing material from drive flange and hub.

WARNING

- . Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- . If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (2) Clean all metal parts with drycleaning solvent.

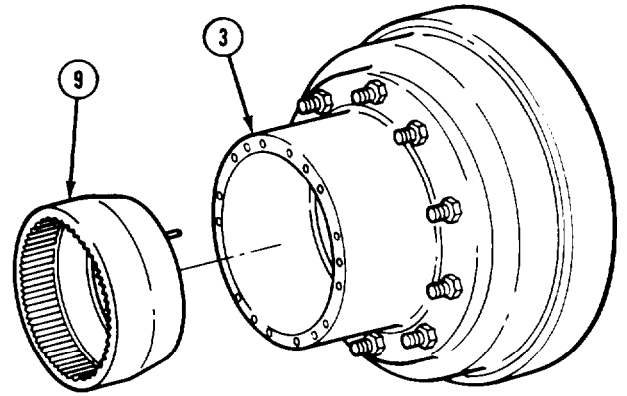
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

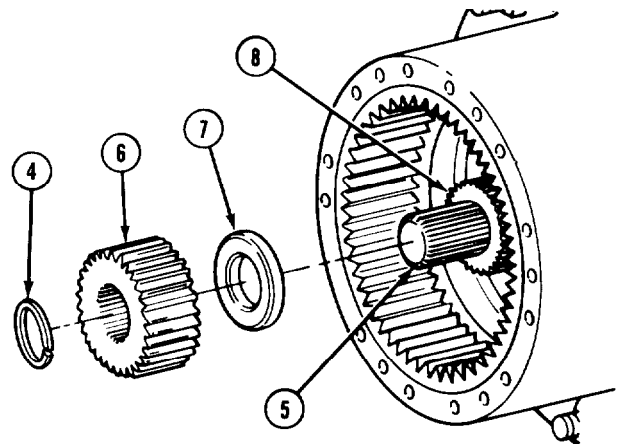
- (3) Use clean lint-free cloth or compressed air to dry all parts.
- (4) Check all machined surfaces for damage.
- (5) Check hub and drive flange for cracks or damage.
- (6) Check all threads for peeled or crossed condition.
- (7) Replace damaged parts.

c. Installation.

- (1) Install ring gear (9) in hub (3).



- (2) Install axle shaft (5) in axle housing (8).
- (3) Install spacer (7) and sun gear (6) on axle shaft (5).
- (4) Install retaining ring (4) on axle shaft (5).



5-66. WHEEL END AND AXLE SHAFT REPLACEMENT (CONT).

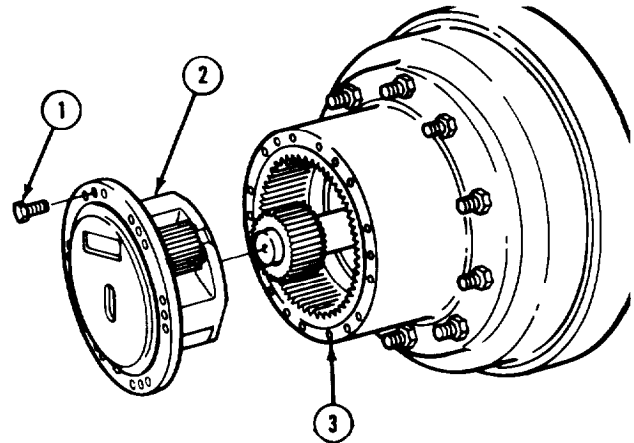
WARNING

Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

CAUTION

Do not use silicone sealer on drive flange or drive flange may eventually work loose causing severe damage.

(7) Apply sealant on inside face of drive flange (2).



NOTE

Bolt holes may be aligned by rotating hub.

(8) Align gears and install drive flange assembly (2) on hub (3) with 18 screws (1). Tighten screws 90 to 100 lb-ft (122 - 136 N•m).

NOTE

Follow-on Maintenance:

- . Install rear wheels (para 4-114).
- . Fill wheel ends with gear oil (para 4-178).
- . Check for leaks.

END OF TASK

5-67. WHEEL END REPAIR.		
This task covers:		
a. Disassembly	b. Cleaning/Inspection	c. Assembly
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Solvent, drycleaning (item 54, appendix E)	
<i>Materials/Parts</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Cloth, lint-free (item 12, appendix E)	TM or Para	Wheel ends removed.
Grease, general purpose (item 25, appendix E)	Para 5-66	

a. Disassembly.

NOTE

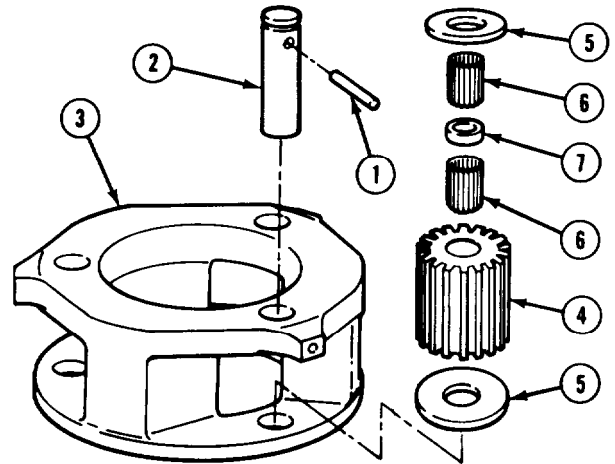
This procedure is the same for both wheel ends.

- (1) Remove three roll pins (1) from three planetary gear shafts (2).
- (2) Remove three planetary gear shafts (2) from drive flange (3).

NOTE

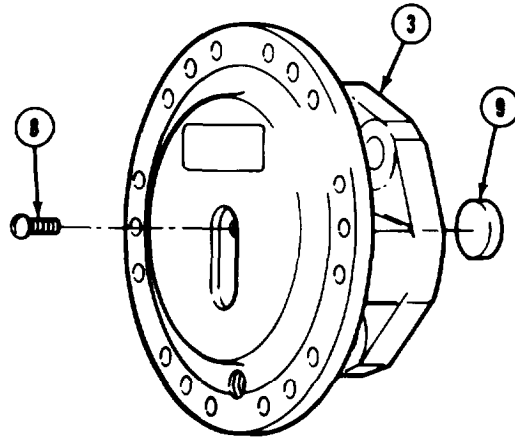
Planetary gears are supported on planetary shafts by two rows of needle bearings that are separated by a ring spacer in center with a thrust washer on each end.

- (3) Remove three planetary gears (4) and six thrust washers (5).
- (4) Remove two rows (25 each) of needle bearings (6), and ring spacer (7) from each planetary gear (4).



5-67. WHEEL END REPAIR (CONT).

- (5) Remove screw (8) and, if necessary thrust button (9) from drive flange (3).



b. Cleaning/Inspection.

- (1) Scrape old sealant from drive flange.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (2) Clean all metal parts with drycleaning solvent.

WARNING

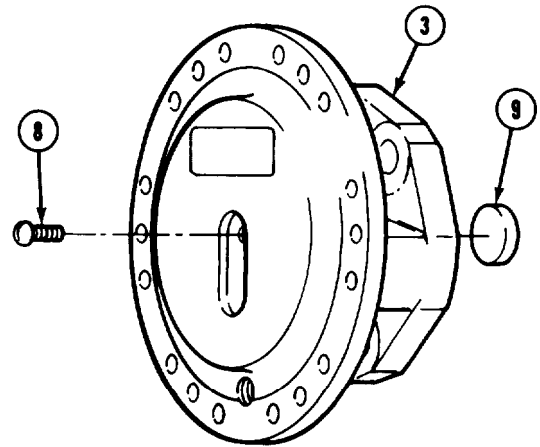
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (3) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (4) Allow bearings to air dry.
- (5) Check drive flange for cracks or damage.
- (6) Check all metal parts for breaks, cracks, and sharp edges.
- (7) Check machined parts for nicks and burrs.

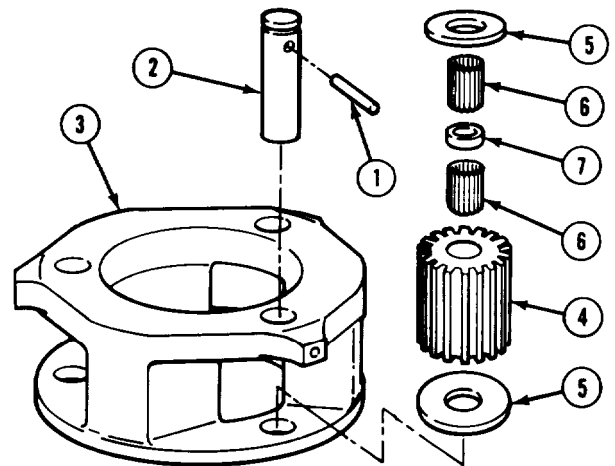
- (8) Check needle roller bearings for galling, scoring, nicks, cracks, or pitting.
- (9) Check thrust button for damage.
- (10) Replace all damaged parts.

c. Assembly.

- (1) Install screw (8) and, if removed, thrust button (9) in drive flange (3).



- (2) Apply grease inside each planetary gear (4) and install two rows of 25 needle roller bearings (6) separated by ring spacer (7).
- (3) Install six thrust washers (5) and three planetary gears (4) on drive flange (3).
- (4) Install three planetary gear shafts (2) in drive flange (3). Align holes in gear shafts with holes in drive flange.
- (5) Install three roll pins (1) in gear shafts (2).



NOTE

Follow-on Maintenance: Install wheel end (para 5-66).

END OF TASK

5-68. DIFFERENTIAL ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Cleaning/Inspection
- c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Lifting device (capacity 200 lb [91 kg])

Wrench, torque

Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

- Adhesive-sealant, silicone (item 1, appendix E)
- Cloth, lint-free (item 12, appendix E)
- Compound, retaining (item 18, appendix E)
- Oil, lubricating, gear (item 31, appendix E)
- Solvent, drycleaning (item 54, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

Equipment Condition

TM or Para

Para 5-64

Para 5-50

Para 5-66

Condition Description

Rear axle removed.

Two-speed range box removed from rear axle.

Wheel ends and axle shafts removed from rear axle.

a. Removal.

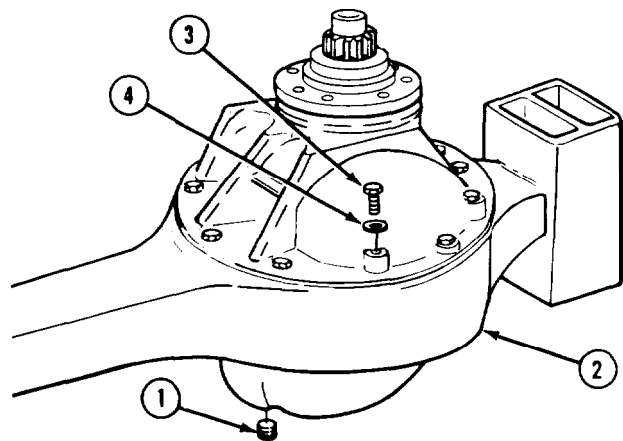


Spilled oil is slippery. Clean up spilled oil immediately or injury to personnel may result.

NOTE

Place suitable container with a 5 gallon (19 liters) capacity under axle housing to catch drained oil.

- (1) Remove plug (1) and drain gear oil from axle housing (2).
- (2) Remove 10 screws (3) and washers (4).



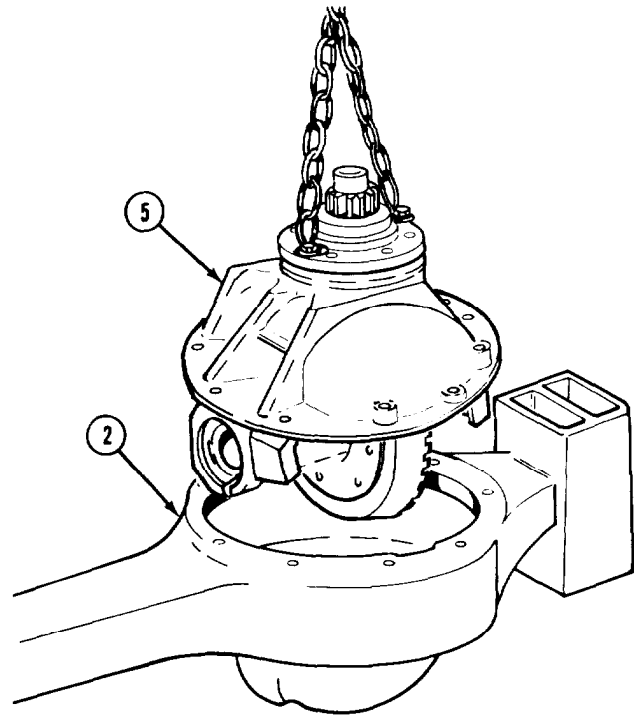
WARNING

Differential carrier weighs 152 lbs (69 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

CAUTION

Do not strike differential carrier to loosen. Tap around flange edge to avoid damage.

- (3) Attach suitable lifting device to differential carrier (5).
- (4) While mechanic operates lifting device, assistant guides differential carrier (5) from axle housing (2).

**b. Cleaning/Inspection.**

- (1) Scrape dirt and old sealant from mounting surface on axle housing and differential carrier.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Use drycleaning solvent to clean axle housing and differential carrier.
 - (3) Use clean lint-free cloth to wipe dry.
 - (4) Check mounting surfaces for nicks, burrs, or other damage.
 - (5) Check carrier and housing for cracks or damage.
 - (6) Check all threads for peeled or crossed condition. Replace if damaged.

5-68. DIFFERENTIAL ASSEMBLY REPLACEMENT (CONT).

c. Installation.

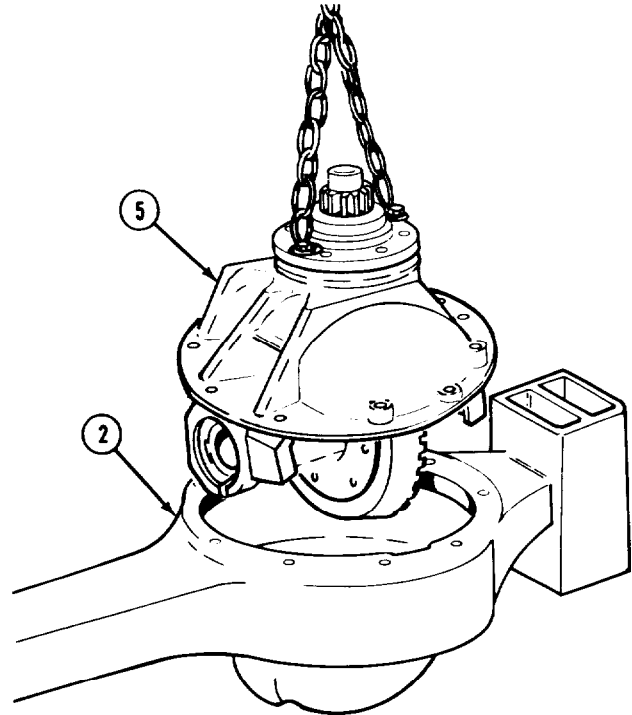
WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well ventilated area. If sealant gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

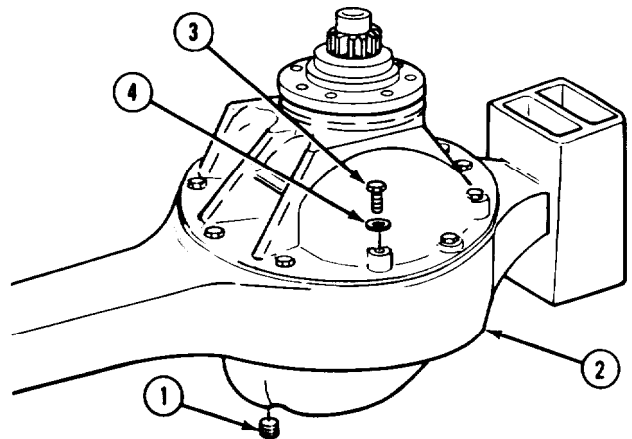
- (1) Apply bead of sealant adhesive to differential mounting surface of axle housing (2).

WARNING

Differential carrier weighs 152 lbs (69 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.



- (2) While mechanic operates lifting device, assistant guides differential carrier (5) on axle housing (2).
- (3) Apply sealant to threads of screws (3).
- (4) Install washers (4) and screws (3). Tighten screws 50 to 70 lb-ft (68 - 95 N•m).
- (5) Apply sealant to drain lug (1) and install in axle housing (2).
- (6) Allow one-hour curing time for adhesive before adding gear oil to axle housing.



NOTE

Follow-on Maintenance:

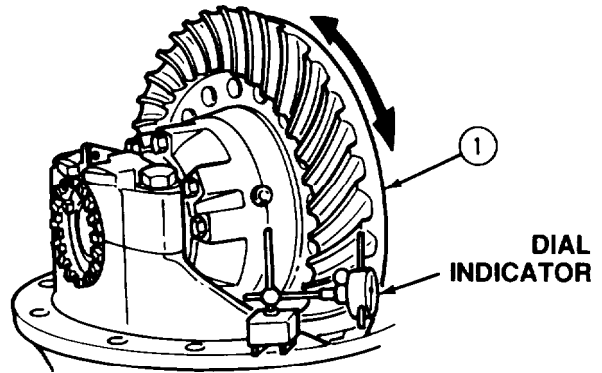
- . Install rear axle (para 5-64).
- . Install two-speed range box on rear axle (para 5-50).
- . Install wheel ends and axles (para 5-66).
- . Fill two-speed range box, rear axle, and wheel ends with gear oil (figure 3-1).
- . Check for leaks.

END OF TASK

5-69. DIFFERENTIAL ASSEMBLY REPAIR.						
This task covers:						
a. Disassembly	b. Cleaning/Inspection	c. Assembly				
INITIAL SETUP						
<p><i>Tools</i></p> <p>Tool kit, general mechanic's: equipment maintenance and repair</p> <p>Shop equipment, general purpose repair: semi-trailer mounted</p> <p>Indicator, dial</p> <p>Lifting device (capacity 200 lb [90 kg])</p> <p>Wrench, torque</p> <p>Scale, spring</p> <p><i>Materials/Parts</i></p> <p>Pins, cotter (2)</p> <p>Locknuts (8)</p> <p>Rivets (14)</p> <p>seal</p>	<p><i>Materials/Parts</i></p> <p>Cloth, lint-free (item 12, appendix E)</p> <p>Compound, retaining (item 18, appendix E)</p> <p>Dye, marking (Prussian Blue) (item 20, appendix E)</p> <p>Grease, general purpose (item 25, appendix E)</p> <p>Solvent, drycleaning (item 54, appendix E)</p> <p>bone</p> <p><i>Personnel Required</i></p> <p>MOS62B, Construction equipment repairer (2)</p> <p><i>Equipment Condition</i></p> <table border="0"> <tr> <td><i>TM or Para</i></td> <td><i>Condition Description</i></td> </tr> <tr> <td>Para 5-68</td> <td>Differential assembly removed.</td> </tr> </table>	<i>TM or Para</i>	<i>Condition Description</i>	Para 5-68	Differential assembly removed.	
<i>TM or Para</i>	<i>Condition Description</i>					
Para 5-68	Differential assembly removed.					

a. Disassembly.

- (1) Measure ring gear (1) backlash with dial indicator. Record measurement.



WARNING

Prussian Blue dye is poisonous and can burn skin on contact. Over exposure to dye can cause heart and skin problems, dizziness, and unconsciousness.

(2) Check tooth contact pattern. Paint 1/3 of teeth on ring gear (1) with Prussian Blue dye. Roll ring gear 1/3 turn, then rock ring gear forward and backward to set pattern in dye. Record ring gear tooth pattern.

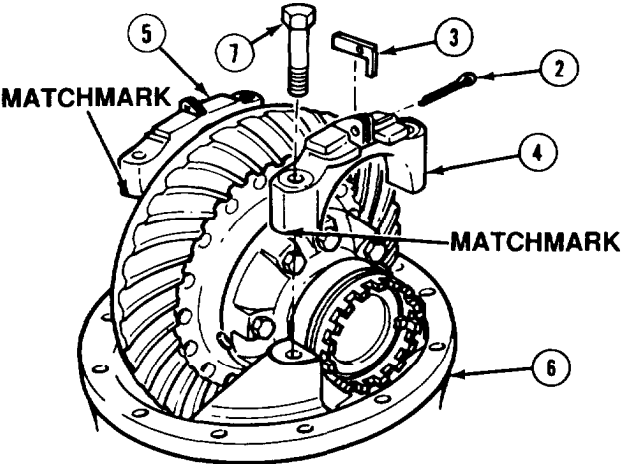
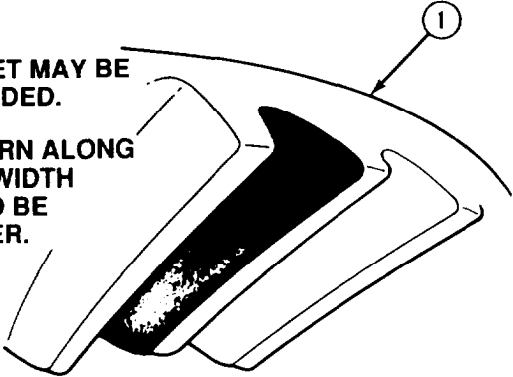
(3) Remove two cotter pins (2) and locks (3) from bearing caps (4 and 5).

(4) Matchmark bearing caps (4 and 5) and carrier (6) for correct assembly.

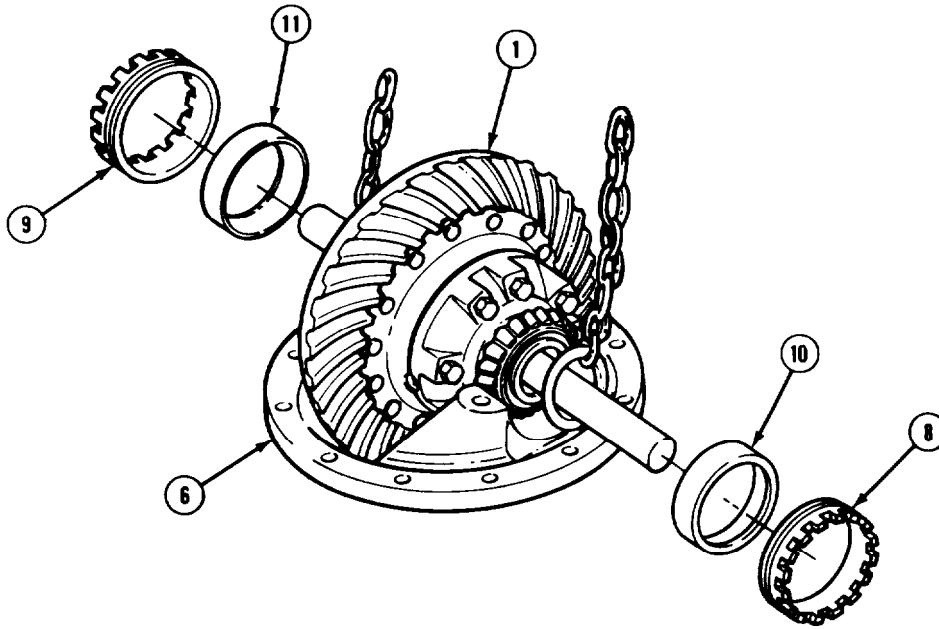
(5) Remove four bearing cap retaining screws (7) and two bearing caps (4 and 5).

USED GEAR PATTERN

- POCKET MAY BE EXTENDED.
- PATTERN ALONG FACE WIDTH COULD BE LONGER.



5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).



WARNING

Differential assembly weighs 152 lbs (69 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

CAUTION

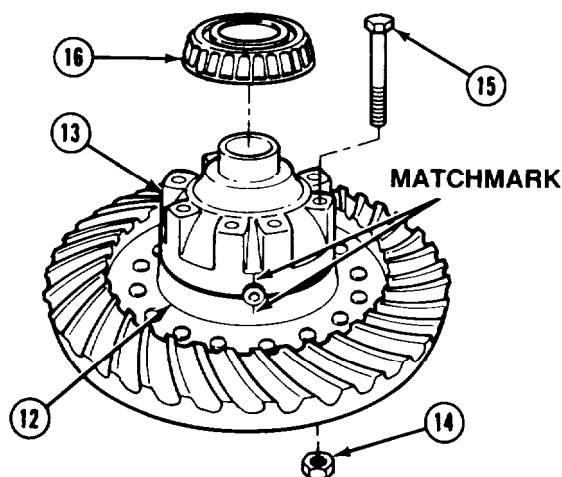
Avoid damaging ring and pinion gears. If either is damaged, both parts **must** be replace as complete set.

NOTE

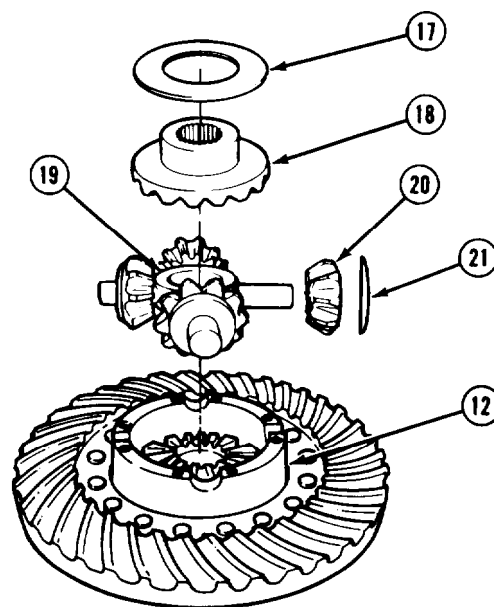
The ring gear must be tilted to clear casting inside carrier.

- (7) Attach lifting device through ring gear (1). While mechanic operates lifting device, assistant guides ring gear and assembled parts out of carrier (6).
- (8) Place ring gear (1) and assembled parts on clean work surface and remove lifting device.
- (9) Remove adjusting rings (8 and 9) and bearing cups (10 and 11).

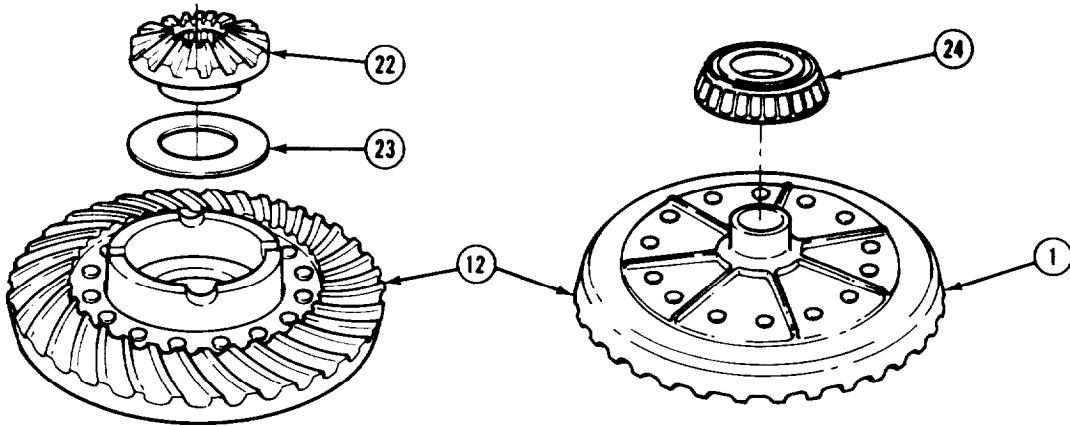
- (10) Matchmark left-hand (12) and right-hand (13) differential case halves for correct alignment in assembly.
- (11) Remove eight locknuts (14), screws (15), and right-hand case half (13) from left-hand case half (12). Discard locknuts.
- (12) Remove bearing cone (16) from right-hand case half (13).



- (13) Remove thrust washer (17) and side gear (18) from left-hand case half (12).
- (16) Remove cross shaft (19), four differential pinions (20), and four thrust washers (21).



5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).



- (17) Remove differential side gear (22) and thrust washer (23) from left-hand case half (12).
- (18) Remove bearing cone (24) from back of left-hand case half (12).

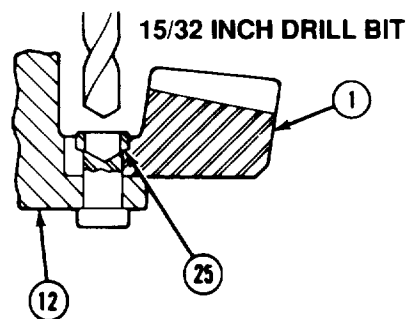
WARNING

Keep hands out from under ring gear. Do not allow ring gear to drop. Ring gear is heavy and can cause injury if dropped on hands.

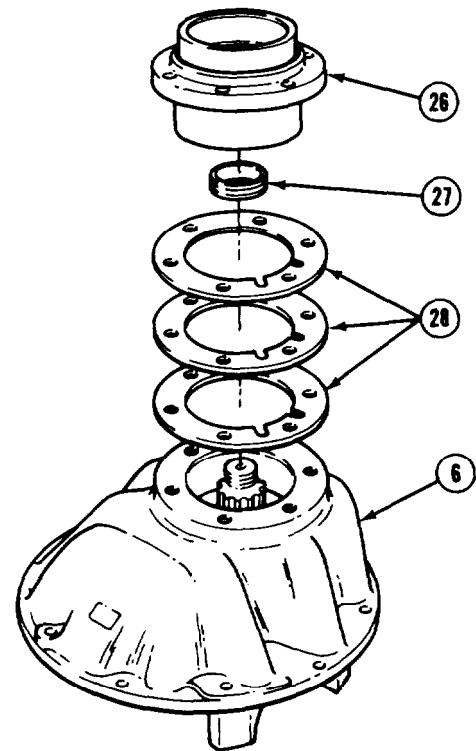
CAUTION

Do not use a chisel to remove rivet heads.
Damage to differential case may result.

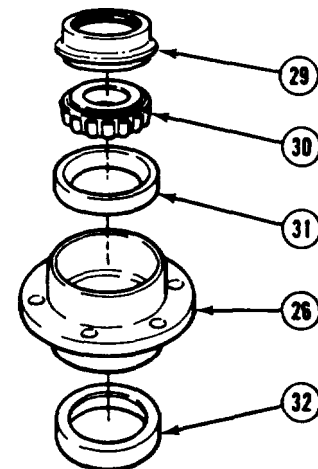
- (19) Carefully center punch each of 14 rivet heads (25) securing ring gear (1) to left-hand case half (12).
- (20) Use a 15/32 inch drill bit to drill through rivet heads (25) to depth of 1/4 inch as shown.
- (21) Using rounded punch, drive out remaining portion of 14 rivets (25). Discard rivets.



- (22) Remove bearing retainer cap (26), preload spacer (27), and shims (28) from differential carrier (6). Record number and size of shims.



- (23) Remove oil seal (29), bearing (30), and bearing cups (31 and 32) from bearing retainer cap (26). Discard seal.



5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

NOTE

Due to a tight fit, it may be necessary to tap the pinion to remove from differential carrier.

- (24) Remove pinion (33) from differential carrier (6).
- (25) Remove bearing cone (34) and bearing assembly (35) from pinion shaft (33).

b. Cleaning/Inspection.

- (1) Scrape old sealant from differential carrier.

WARNING

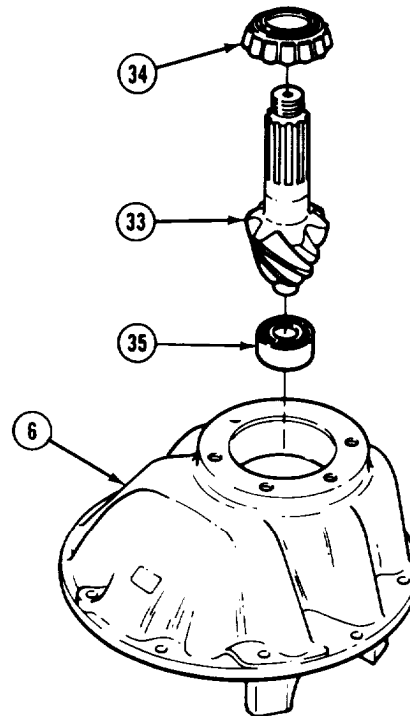
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (2) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

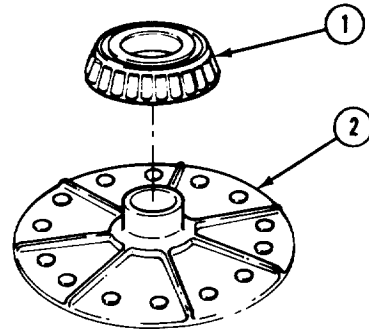
- (3) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (4) Allow bearings to air dry.
- (5) Check all metal parts for breaks, cracks, and sharp edges.



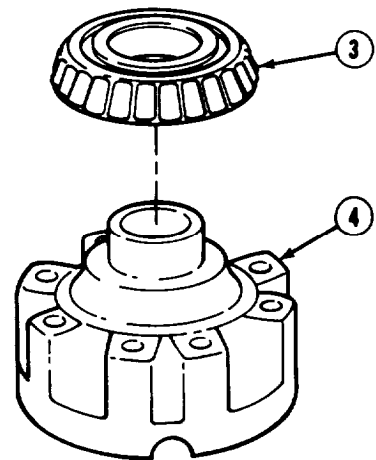
- (6) Check machined parts for nicks and burrs.
- (7) Check bearings for loose rollers and cracked or broken races.
- (8) Coat all bearings with lubricating oil.
- (9) If pinion or ring gear is bad, replace both as a matched set.
- (10) Replace damaged parts.

c. Assembly.

- (1) Install bearing cone (1) on left-hand case half (2).

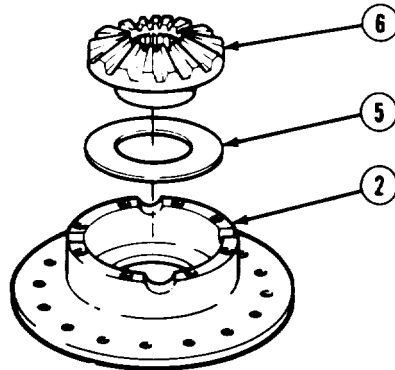


- (2) Install bearing cone (3) on right-hand case half (4).

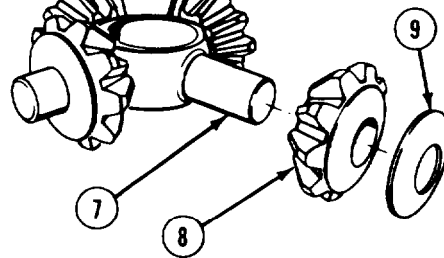


5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

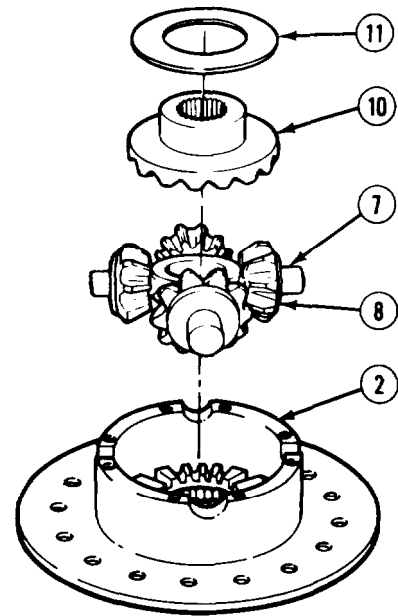
- (3) Install thrust washer (5) and side gear (6) in left-hand case half (2).



- (4) Lubricate cross shaft (7). Install four differential pinions (8) and four thrust washers (9) on cross shaft (7).



- (5) Install cross shaft (7) and assembled parts in left-hand case half (2).
- (6) Turn differential pinions (8) to make sure they turn freely.
- (7) Install side gear (10) and thrust washer (11) on differential pinions (8).



- (8) Align matchmarks and install right-hand case half (4) on left-hand case half (2).

NOTE

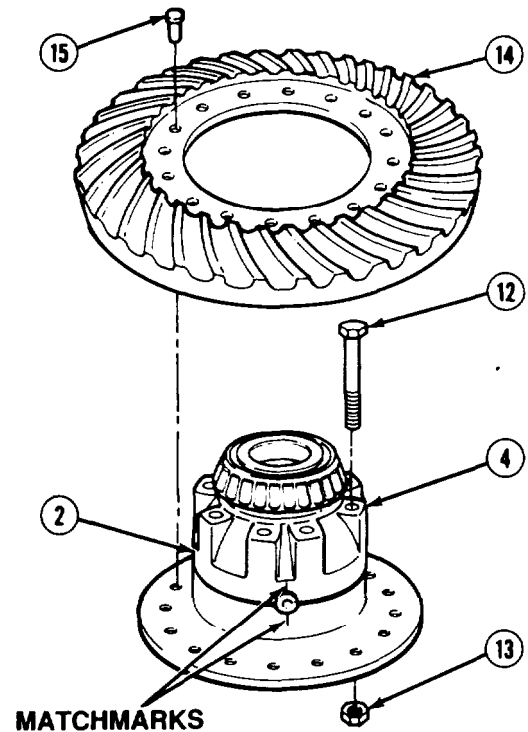
Place differential case in holding device before tightening locknuts.

- (9) Install eight screws (12) and locknuts (13). Alternately tighten locknuts 80 to 90 lb-ft (108 - 122 N•m).

NOTE

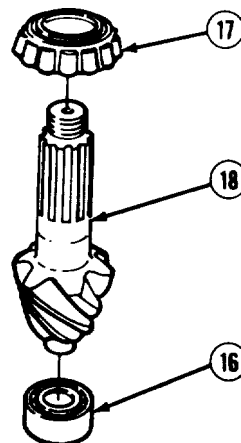
Rivets, securing ring gear to differential case, require 20 to 25 U.S. tons (18.1 - 22.7 metric tons) of pressure per rivet. Make sure you use a suitable hydraulic or mechanical press.

- (10) Install ring gear (14) to left-hand case half (2) with 14 rivets (15).

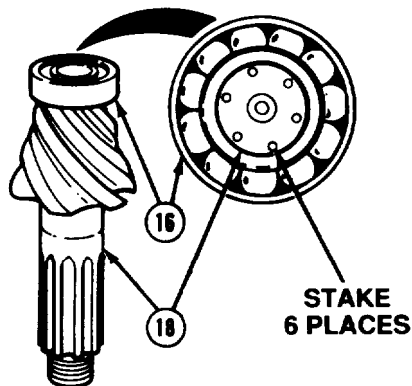


5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

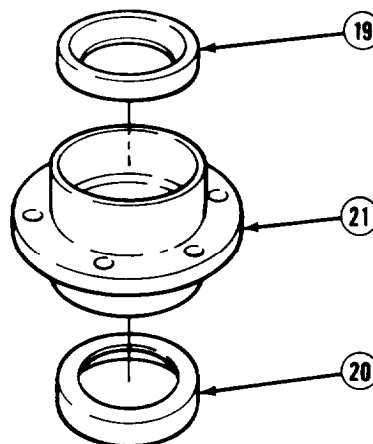
- (11) Install bearing assembly (16) and bearing cone (17) onto pinion shaft (18).



- (12) Stake bearing assembly (16) to pinion shaft (18) in six places as shown.



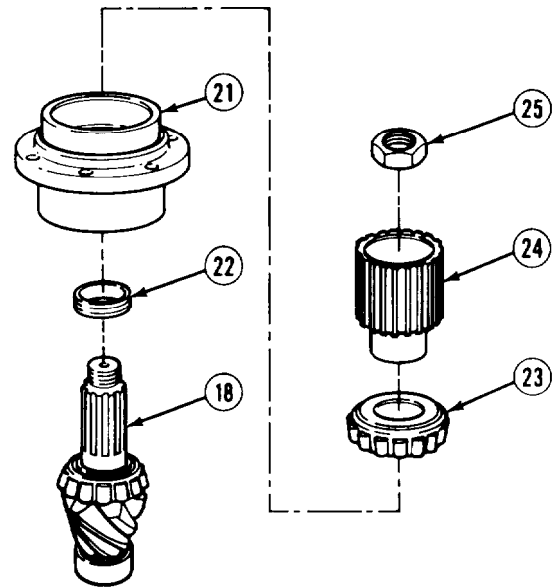
- (13) Install outer bearing cups (19) and inner bearing cups (20) in bearing retainer cap (21).



- (14) Install the bearing preload spacer (22) onto the pinion shaft (18).

NOTE

- Use axle input gear and pinion nut from two-speed range box removal task.
 - Do not install oil seal in bearing retainer cap at this time.
- (15) Install bearing retainer cap (21), bearing (23), axle input gear (24), and pinion nut (25) on pinion shaft (18). Tighten nut 325 lb-ft (440 N-m).

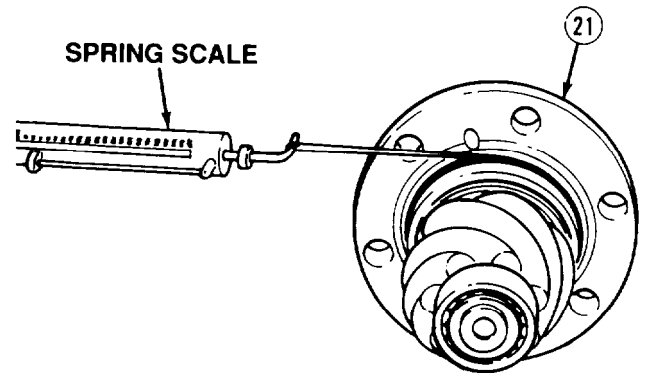


- (16) Attach spring scale to bearing retainer cap (21).

NOTE

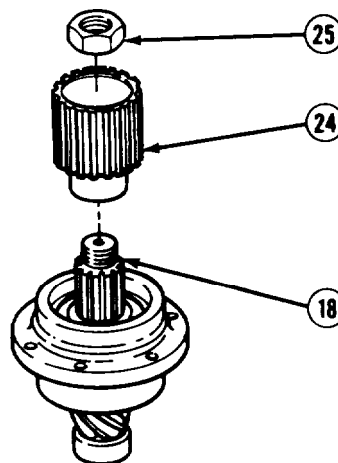
A 0.001 in. (0.025 mm) change in bearing preload spacer thickness, changes spring scale reading by approximately 10 lbs (4.5 kg).

- (17) Pull spring scale until bearing retainer cap (21) begins to turn. Check that spring scale reads 5 to 14 lbs (2.3 - 6.4 kg) while bearing retainer cap is moving. If spring scale reading is too high or too low, replace bearing preload spacer until the correct spring scale reading is obtained.

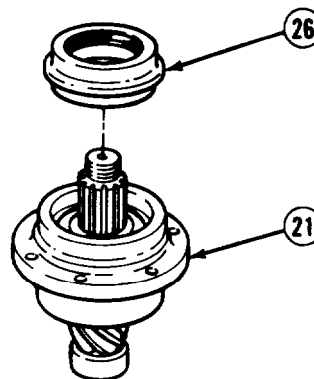


5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

- (18) After obtaining spring scale reading of 5 to 14 lbs (2.3 - 6.4 kg), remove pinion nut (25) and axle input gear (24) from pinion shaft (18).

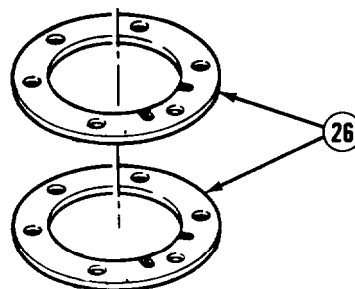


- (19) Install oil seal (26) in bearing retainer cap (21).

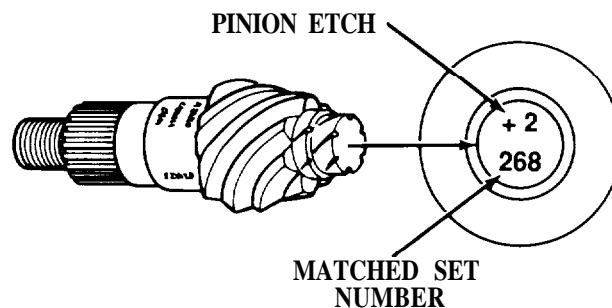


NOTE

- If original ring and pinion gear set is reused, install the same shims as removed and go to step (23). If new gear set is used, continue with step (20).
 - Replace old pinion shims if bent or mutilated.
- (20) Measure thickness of each old pinion shim (26) separately. Add measurements to get total thickness of original build-up.



(21) Note +, -, or 0 etched on bottom of both new and original ring and pinion gear sets. Adjust shim thickness to compensate for the difference between both figures as shown in Table 5-4, Pinion Markings. Use Table 5-4 as follows:



- (a) Locate +, -, or 0 number, from bottom of original pinion shaft, in appropriate column in Table 5-4.
- (b) Locate +, -, or 0 number, from bottom of new pinion shaft, in appropriate column in Table 5-4.
- (c) Find the box where original and new numbers intersect.
- (d) Either add to, or subtract from, original shim build-up as recorded in step (20). For example: If the original pinion shaft is etched +2, and new pinion shaft is etched -1, subtract 0.003 inch (0.076 mm) from total thickness of original shims. Remove or replace shims as appropriate.

Table 5-4. Pinion Markings

Old Pinion Marking	New Pinion Marking								
	- 4	- 3	- 2	- 1	0	+1	+2	+3	+4
+4	-0.008 .203	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0
+3	-0.007 .178	-0.006 .152	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025
+2	-0.006 .152	- 0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051
+1	-0.005 .127	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076
0	-0.004 .102	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102
-1	-0.003 .076	-0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127
- 2	- 0.002 .051	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152
-3	-0.001 .025	0	+0.001 .025	+0.002 .051	+0.003 .076	+0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178
- 4	0	+0.001 .025	+0.002 .051	+0.003 .076	+ 0.004 .102	+0.005 .127	+0.006 .152	+0.007 .178	+0.008 .203

0.000 TOP (INCHES)
.000 BOTTOM MM)

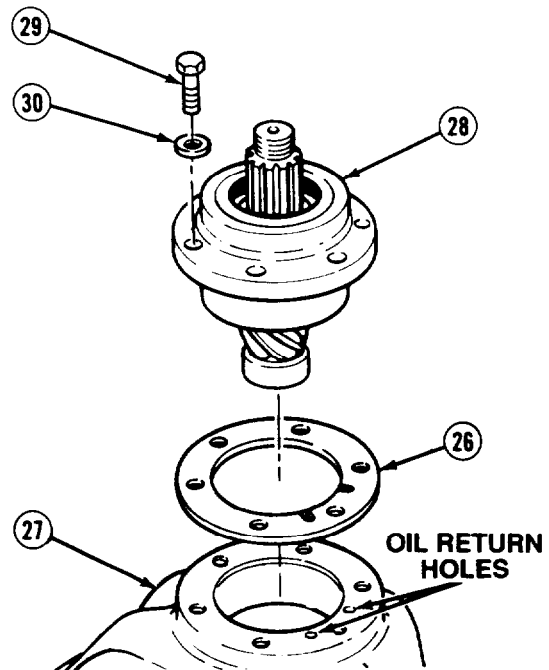
5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

- (22) Position shims (26) carefully on differential carrier (27) so oil return holes align properly.

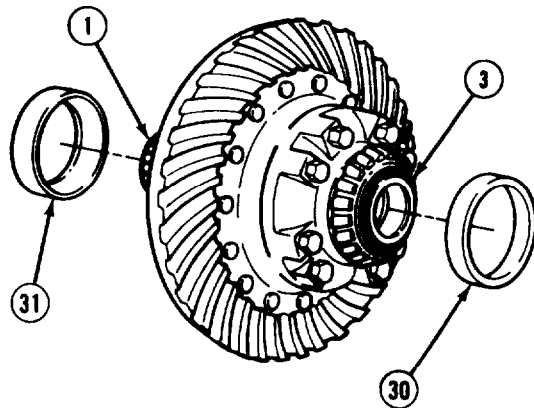
CAUTION

Be certain mounting surfaces and shims are free of dirt and nicks or leaks may occur and pinion position can be affected resulting in damage to differential carrier.

- (23) Install pinion assembly (28) in differential carrier (27).
- (24) Apply retaining compound to six screws (29) and install with washers (30). Tighten screws 100 to 120 lb-ft (135 - 162 N-m).



- (25) Install bearing cups (30 and 31) on bearings (3 and 1).



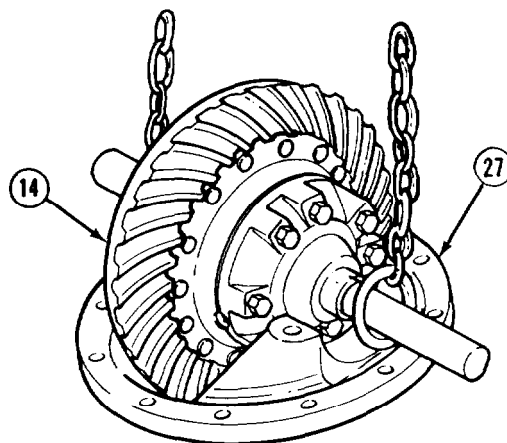
WARNING

Differential weighs 152 lbs (69 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

CAUTION

Avoid damaging ring and pinion gears. If either is damaged, both parts must be replaced as a complete set.

- (26) Attach lifting device through ring gear (14) and assembled parts.



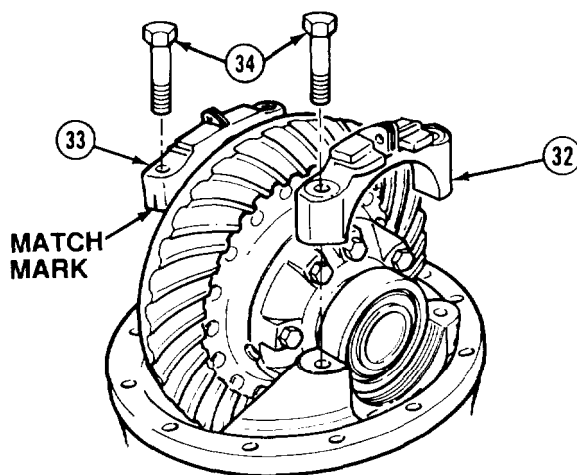
NOTE

The ring gear must be tilted to clear casting inside carrier.

- (27) Mechanic operates lifting device while assistant guides ring gear (14) and assembled parts into differential carrier (27).

NOTE

Install matchmarked bearing cap to matchmark on differential carrier.

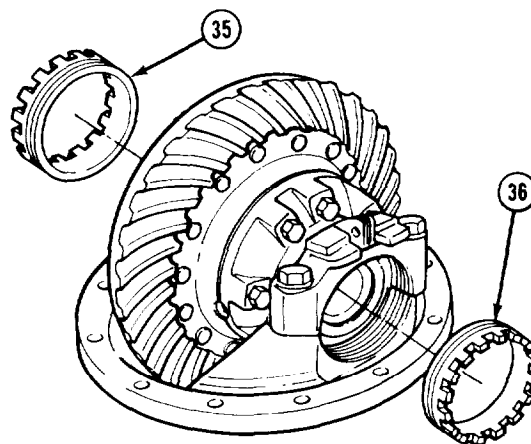


- (28) Remove lifting device and install bearing caps (32 and 33) with screws (34) finger-tight.

CAUTION

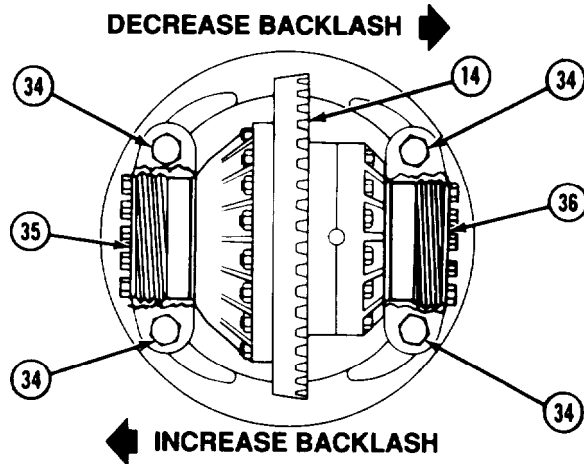
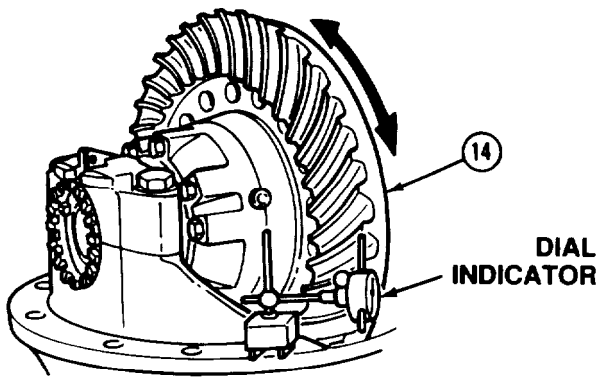
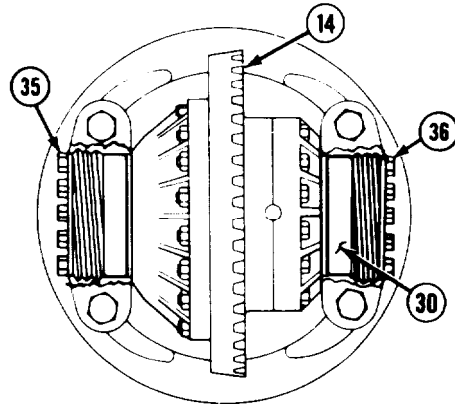
Threads on adjusting rings can be damaged if adjusting rings are not installed carefully.

- (29) Install adjusting rings (35 and 36).



5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

- (30) Tighten adjusting ring (35) until ring gear (14) has 0 (zero) backlash.
- (31) Tighten adjusting ring (36) until bearing cup (30) is seated.



NOTE

If old pinion and ring gear are used, backlash should be the same as recorded in Disassembly step (1). If new pinion and ring gear are used, set backlash to specification etched on ring gear.

- (32) With a dial indicator, check ring and pinion backlash in four equally spaced positions around ring gear (14). Tighten adjusting rings (35 and 36) until gear backlash is set to correct specifications.
- (33) If backlash needs to be increased, proceed as follows:
 - (a) Loosen adjusting ring (36) five or six notches.
 - (b) Loosen adjusting ring (35) one notch.
 - (c) Tighten adjusting ring (36) until adjusting ring resists movement, then tighten two or three more notches. Check for correct backlash.
- (34) If backlash needs to be decreased, proceed as follows:

- (a) Loosen adjusting ring (36) five or six notches.
- (b) Tighten adjusting ring (35) one notch.
- (c) Tighten adjusting ring (36) until adjusting ring resists movement, then tighten two or three more notches. Check for correct backlash.

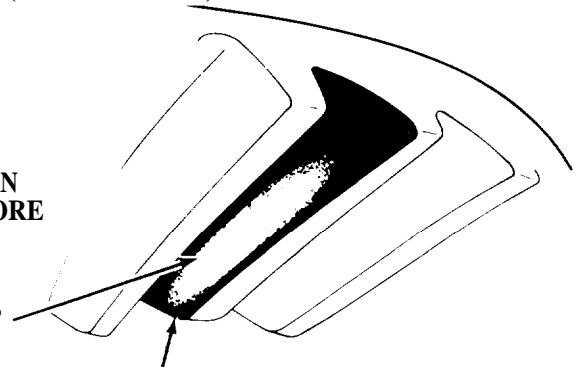
NOTE

If the backlash tolerance does not vary more than 0.002 inch (0.050 mm), the setting is acceptable.

- (35) Tighten four bearing cap screws (34) 150 to 160 lb-ft (200 - 220 N•m).
- (36) Paint 1/3 of teeth on ring gear (14) with Prussian Blue dye.
- (37) Roll ring gear (14) 1/3 turn, then rock ring gear forward and backward to set pattern in dye,

CORRECT PATTERN (NEW GEARING)

- **COULD VARY IN LENGTH. PATTERN SHOULD COVER 1/2 TOOTH OR MORE (FACE WIDTH).**
- **PATTERN SHOULD BE EVENLY CENTERED BETWEEN TOOTH TOP LAND AND ROOT.**



. **PATTERN SHOULD BE CLEAR OF TOOTH TOE.**

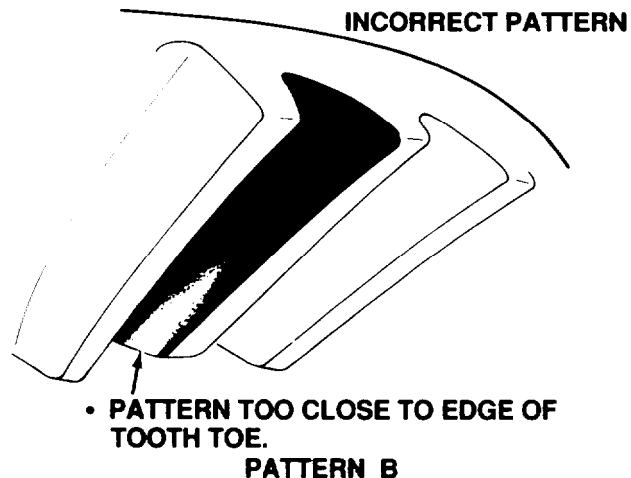
PATTERN A

NOTE

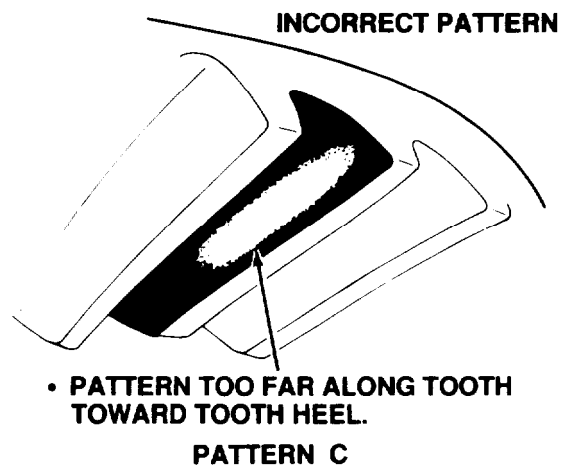
- . A correct gear pattern for a used pinion and ring gear is clear of the toe and centers evenly along the face of gear tooth, but can be any length and shape and is acceptable as long as pattern does not run off gear tooth at any point.
 - . If gear pattern was correct at disassembly, then gear pattern after assembly should be the same.
 - . If pattern is not the same, review steps (32) through (34) and adjust backlash as required until pattern that was recorded at disassembly is reached.
 - . If pattern was incorrect (pattern runs off gear tooth) at disassembly then, after assembly, review steps (32) through (34) and adjust backlash as required until correct gear pattern (pattern does not run off gear teeth) is reached.
 - . Remember, a correct gear pattern for a used pinion and ring gear does not have to match PATTERN A (correct pattern for new gearing).
 - . If new pinion and ring gear are used, tooth pattern should be like correct PATTERN A. If tooth pattern does not look like A, check patterns B through E to find one that looks close to ring gear tooth pattern, then do step that follows incorrect pattern.
- (38) If tooth contact is like pattern A, do not adjust. Go to step (43).

5-69. DIFFERENTIAL ASSEMBLY REPAIR (CONT).

- (39) If tooth contact is like pattern B, increase backlash. Repeat step (34).



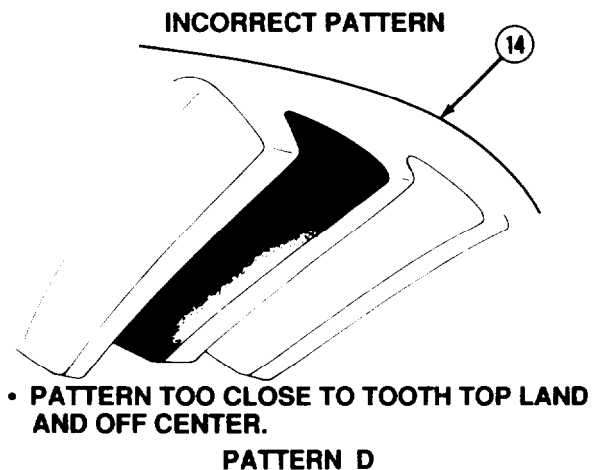
- (40) If tooth contact pattern is like pattern C, decrease backlash. Repeat step (35).



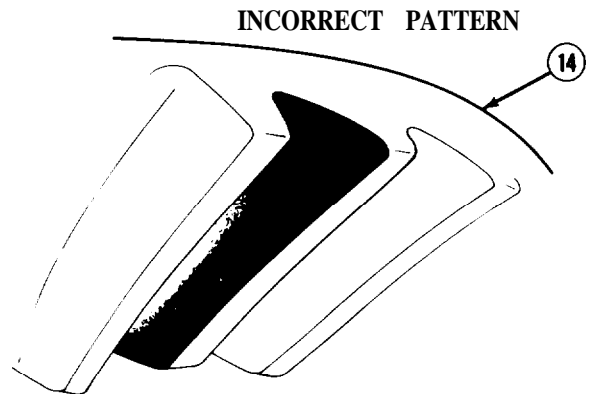
NOTE

To remove or add shims in steps (41) and (42), remove pinion assembly [steps (22) through (24) of Disassembly]. After shims are removed or added, install pinion assembly [steps (22) through (31)].

- (41) If tooth contact is like pattern D, move pinion closer to ring gear (14) by removing shims, then repeat step (32).



- (42) If tooth contact is like pattern E, move pinion away from ring gear (14) by adding shims, then repeat step (32).



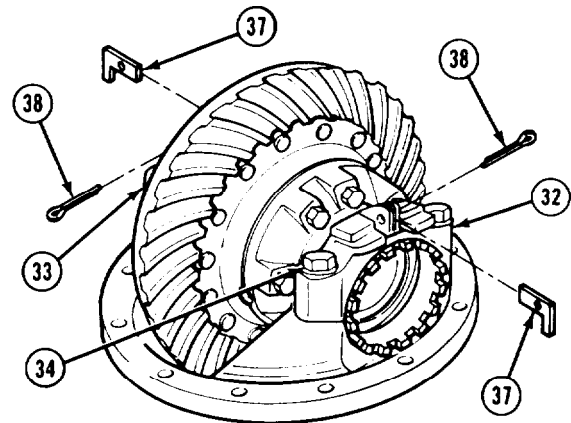
• PATTERN TOO CLOSE OR OFF TOOTH ROOT.
PATTERN E

- (43) When proper ring gear pattern is achieved, tighten differential bearing cap screws (34) 150 to 160 lb-ft (200 - 220 N•m).

NOTE

Bearing adjuster may be turned slightly to align lock.

- (44) Install two adjuster locks (37) and cotter pins (38) on bearing caps (32 and 33).

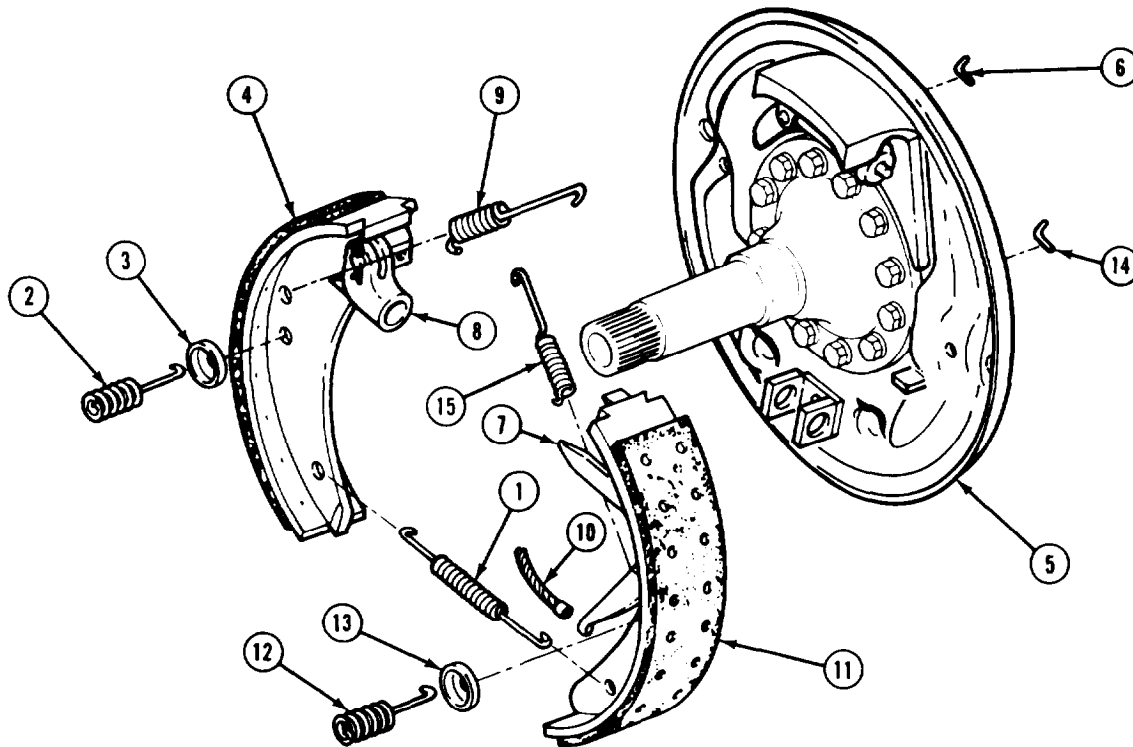


NOTE

Follow-on Maintenance: Install differential assembly (para 5-68).

END OF TASK

5-70. BRAKE ASSEMBLY REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<p><i>Tools</i></p> <p>Tool kit, general mechanic's: equipment maintenance and repair</p> <p>Brake spring tool</p>	<p><i>Materials/Parts</i></p> <p>Oil, lubricating (item 36, appendix E)</p> <p>Solvent, drycleaning (item 54, appendix E)</p>	
<p><i>Materials/Parts</i></p> <p>Washer, lock</p> <p>Pins, cotter (2)</p> <p>Grease, general purpose (item 25, appendix E)</p>	<p><i>Equipment Condition</i></p> <p>TM or Para Para 5-74</p>	<p><i>Condition Description</i></p> <p>Brake drum, hub, and bearings removed.</p>
	<p><i>General Safety Instructions</i></p> <p>Brake shoes contain asbestos; wear proper protective equipment.</p>	



a. **Removal.****WARNING**

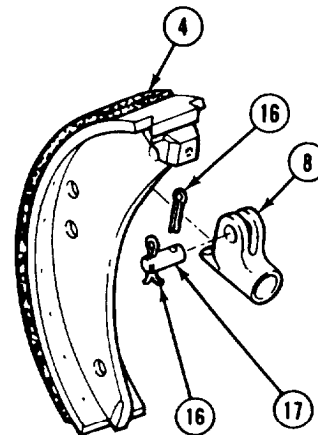
Parts of the brake assembly may be coated with asbestos dust; breathing this dust can harm personnel.

- . Use a filter mask approved for use against asbestos dust.
- . Never use compressed air or dry brush to clean these assemblies.
- . Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust.
- . Use water and a soft bristle brush or cloth to remove dirt or mud.

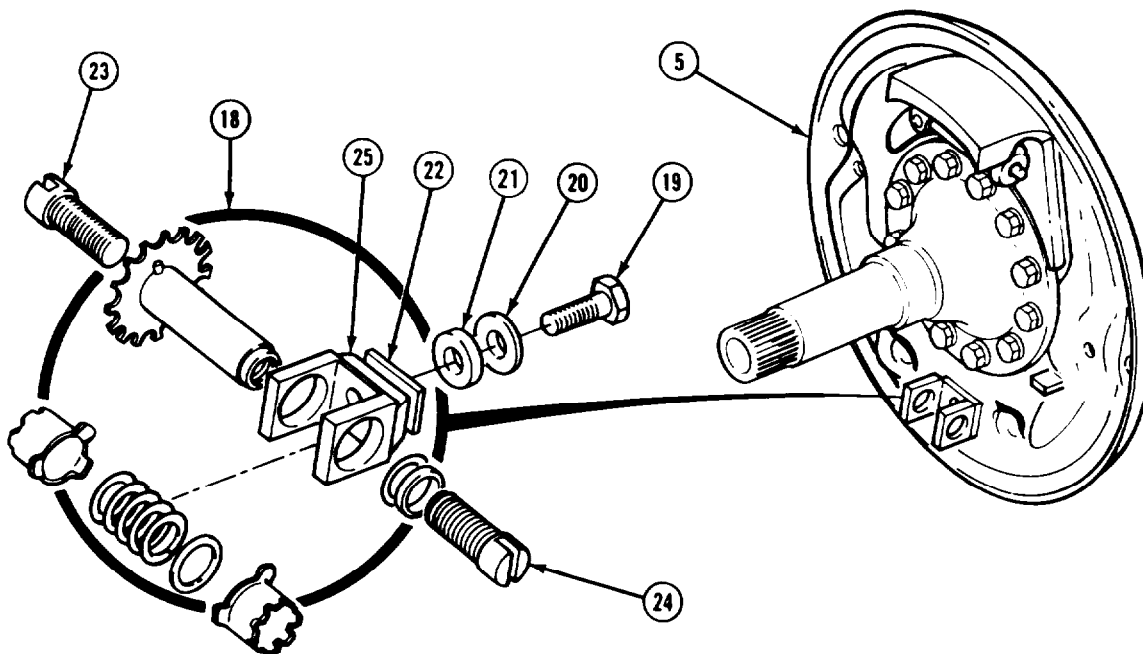
NOTE

Both left and right brake assemblies are removed the same way. This procedure is the same for both brake assemblies.

- (1) Remove lower shoe retaining spring (1).
- (2) Remove shoe hold down spring (2) and spring plate (3) from the primary brake shoe (4) by pushing spring toward backing plate (5) while removing hold-down spring retaining pin (6).
- (3) Pull primary brake shoe (4) so that hand brake anchor rod (7) drops out of socket (8).
- (4) Raise primary shoe (4) and remove upper shoe retaining spring (9) and primary shoe.
- (5) Remove hand brake cable (10) from secondary shoe (11).
- (6) Remove shoe hold down spring (12), spring plate (13), and hold-down spring retaining pin (14) from secondary brake shoe (11).
- (7) Raise secondary shoe (11) and remove upper shoe retaining spring (15) and secondary shoe.
- (8) If damaged remove two cotter pins (16), pin (17), and socket (8) from primary shoe (4). Discard cotter pins.



5-70. BRAKE ASSEMBLY REPLACEMENT (CONT).



- (9) To remove manual adjuster (18), remove screw (19), lockwasher (20), washer (21), and shim (22). Discard lo&washer.
- (10) Remove adjusting screws (23 and 24) and assembled parts from bracket (25).

b. Cleaning/inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

CAUTION

Do not use petroleum based solvents to clean brake parts or damage to lining and rubber parts will occur.

- (1) Clean all metal parts with drycleaning solvent.

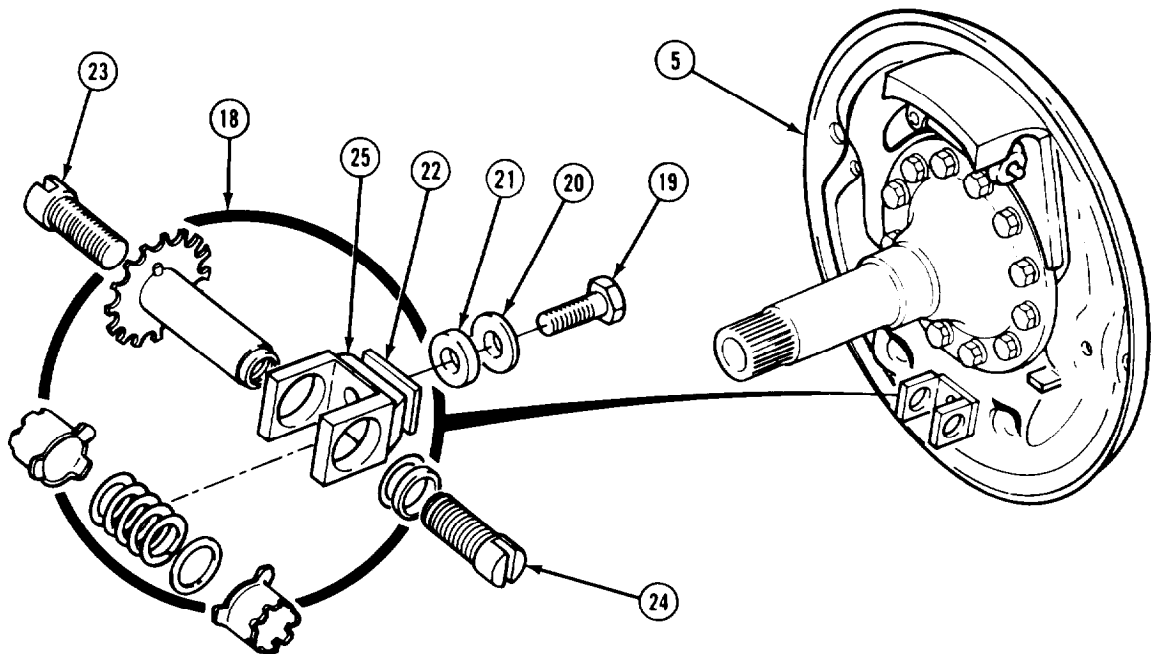
- (2) Check all parts for damage, cracks, breaks, or deterioration. Replace unserviceable parts.

WARNING

Do not allow grease or oil to contact brake linings. Linings can absorb grease and oil, causing early glazing and very poor braking action. Failure to do so could cause serious injury or death to personnel.

- (3) Measure thickness of brake linings. If brake linings are less than 1/8 in. (3 mm) thick at thinnest point, brake shoes must be replaced or repaired (refer to para 5-71, Brake Shoe Repair for repair of secondary brake shoe).

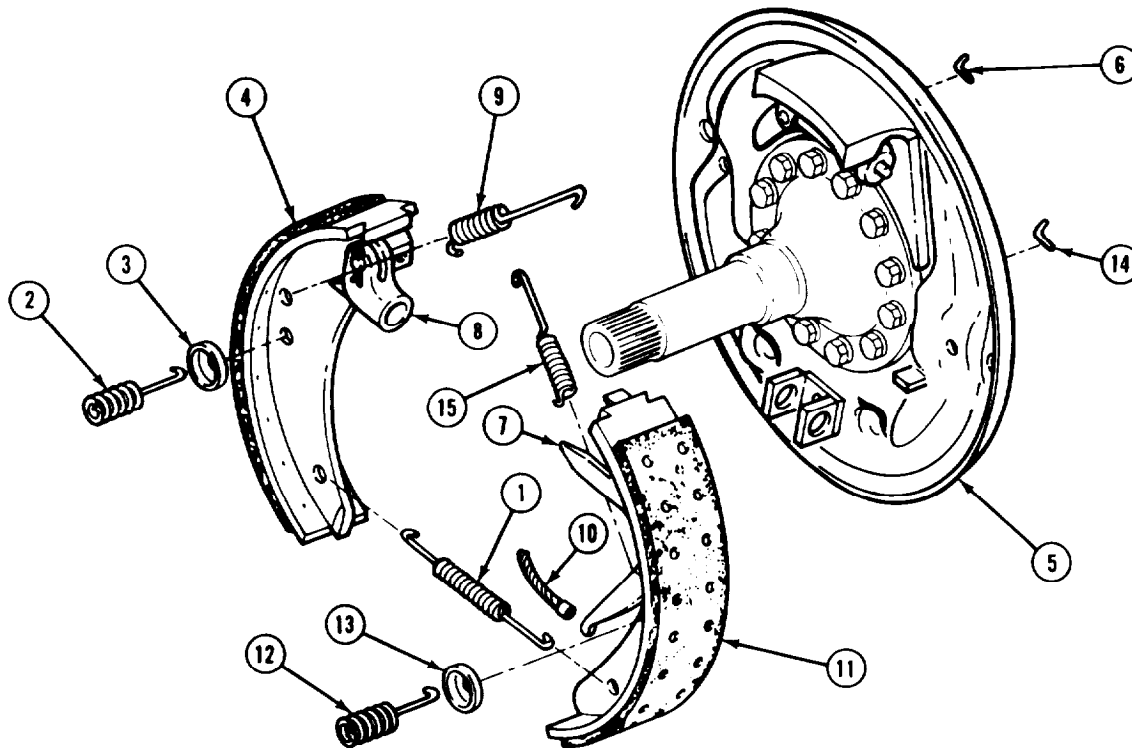
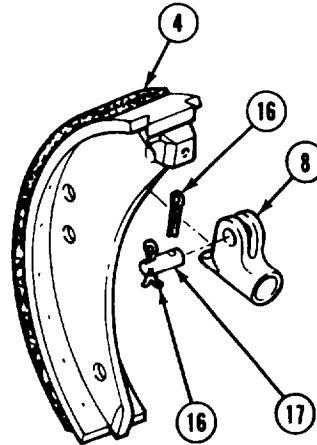
c. Assembly.



- (1) To assemble manual adjuster (18), install assembled hardware and bracket (25) **on** backing plate (5) with screw (19), lockwasher (20), washer (21) and shim (22).
- (2) Apply lubricant to all points of contact and threads of adjusting screws (24 and 23). Install adjusting screws in bracket (25). Turn adjusting screws all the way in.

5-70. BRAKE ASSEMBLY REPLACEMENT (CONT).

- (3) Install socket (8), pin (17), and two cotter pins (16) on primary shoe (4).



- (4) Install secondary shoe (11) with upper retaining spring (15). Move secondary shoe down into position.
- (5) Secure secondary shoe (11) to backing plate (5) with spring plate (13) and hold down spring (12). Push hold down spring through hole on backing plate and secure with retainer pin (14).
- (6) Connect hand brake cable (10) to secondary shoe (11).

- (7) Install primary shoe (4) with upper retaining spring (9). Move primary shoe down into position so hand brake anchor rod (7) can be installed in socket (8).
- (8) Secure primary shoe (4) to backing plate (5) with spring plate (3) and hold down spring (2). Push hold down spring through hole on the backing plate and secure with retainer pin (6).
- (9) Install lower retaining spring (1).

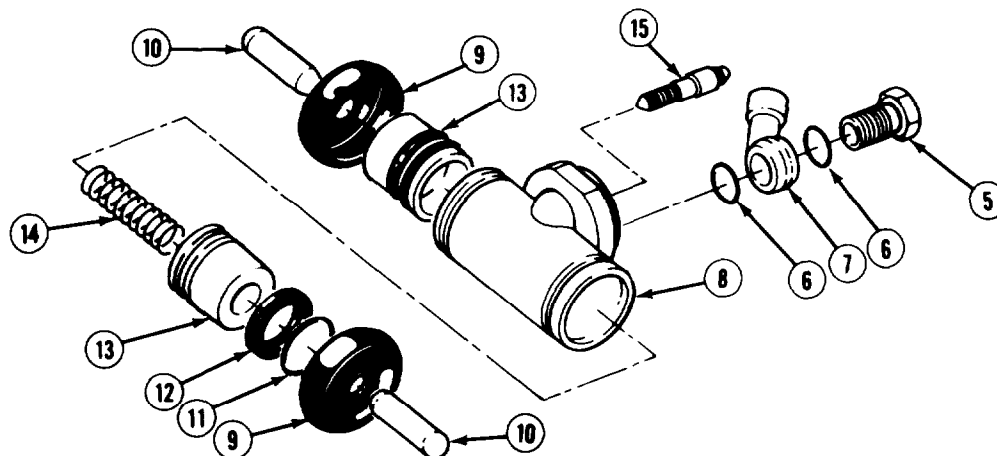
NOTE

Follow-on Maintenance:

- . Install brake drum, hub, and bearings (para 5-74).
- . Adjust brakes (para 4-112).

END OF TASK

5-72. WHEEL CYLINDER REPLACEMENT/REPAIR (CONT).



- (2) Remove screw (5), two copper sealing rings (6), and hydraulic adaptor (7) from wheel cylinder (8). Discard copper sealing rings.
- (3) Remove two dust covers (9), push rods (10), outer seals (11), inner seals (12), pistons (13), and spring (14) from wheel cylinder (8). Discard seals.
- (4) Remove bleed valve (15) from wheel cylinder (8).

b. Cleaning/Inspection.

WARNING

- . Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- . If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

CAUTION

Do not use petroleum based solvents to clean brake parts or damage to lining and rubber parts will occur

- (1) Clean all metal parts with drycleaning solvent.

WARNING

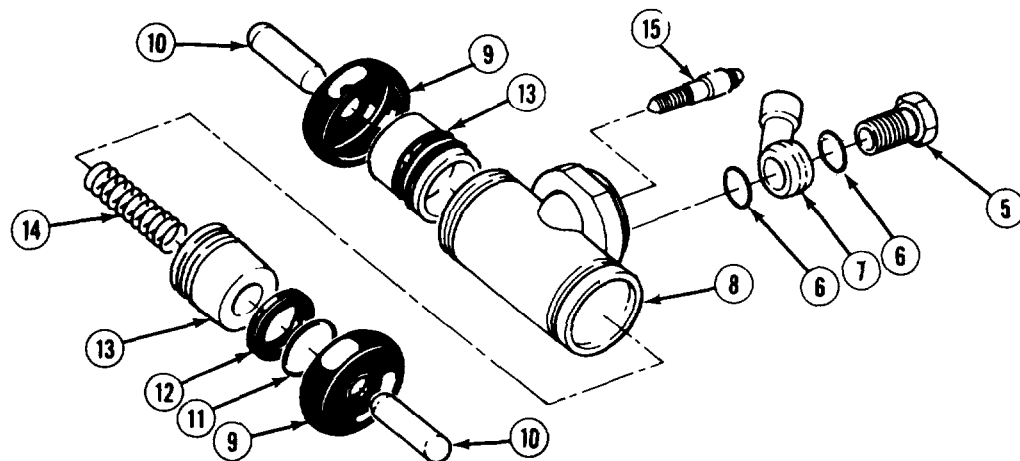
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry wheel cylinder.
- (3) Check wheel cylinder for damage, cracks, or evidence of leakage.

WARNING

Honing of wheel cylinders is not permitted.

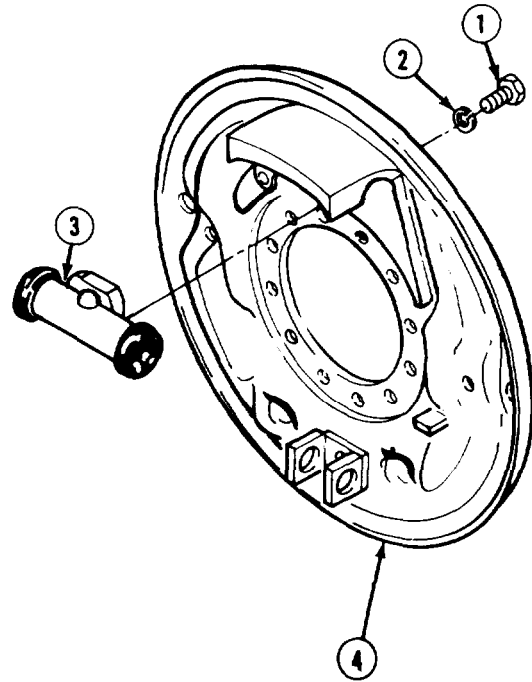
- (4) Check inner bore of cylinder for grooves, pitting, or scoring. Replace cylinder if any of these conditions exist.
- (5) Replace damaged parts.

c Assembly.

- (1) Install bleed valve (15) in wheel cylinder (8).
- (2) Lubricate outer seals (11) and inner seals (12) with brake fluid.
- (3) Install spring (14), two pistons (13) inner seals (12), outer seals (11), push rods (10), and dust covers (9) in wheel cylinder (8).
- (4) Install hydraulic adaptor (7), two copper sealing rings (6) and screw (5). Tighten screw 22 to 26 lb-ft (30 - 35 N^om).

5-72. WHEEL CYLINDER REPLACEMENT/REPAIR (CONT).

- (5) Install wheel cylinder (3) on backing plate (4) with two lockwashers (2) and screws (1). Tighten screws 120 to 144 lb-in (14 - 16 N^om).



NOTE

Follow-on Maintenance:

- Install brake assembly (para 5-70).
- Connect brake lines (para 4-108).
- Bleed brakes (4-110).

END OF TASK

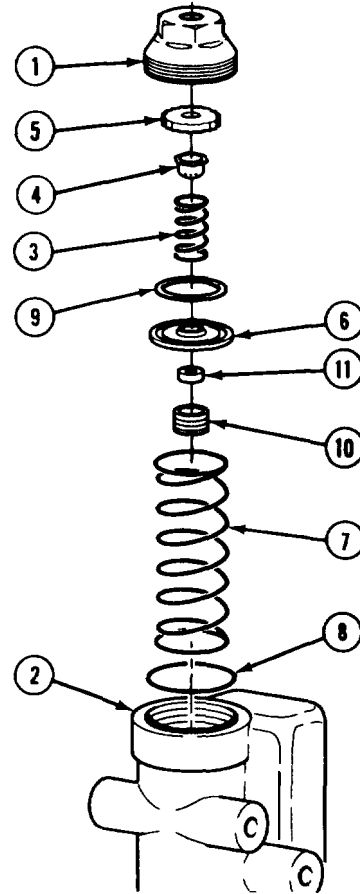
5-73. MASTER CYLINDER REPAIR (CONT).

a. Disassembly.

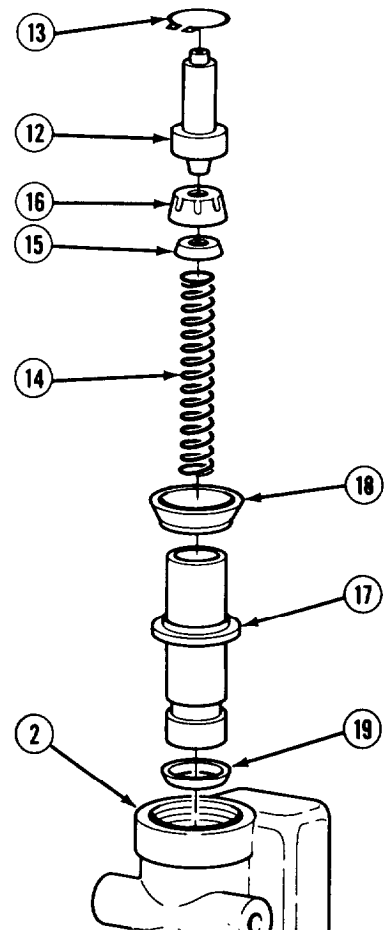
WARNING

End plug is under spring pressure. Care should be taken during disassembly. Spring can cause serious injury to personnel.

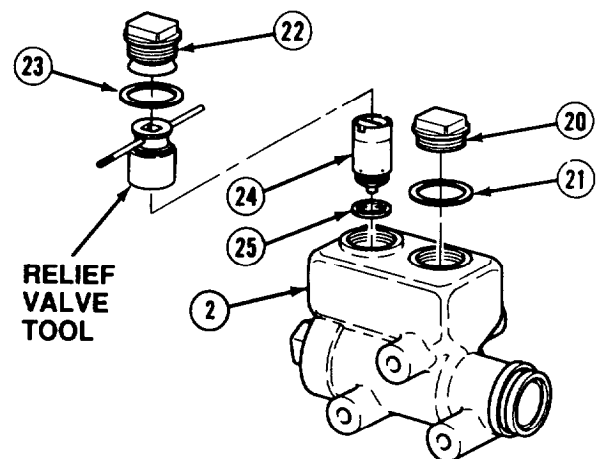
- (1) Remove end plug (1) from housing (2).
- (2) Remove check valve spring (3), check valve (4), and check valve seat (5).
- (3) Remove retainer (6), spring (7), and preformed packing (8). Discard preformed packing.
- (4) Remove gasket (9), spanner retainer (10), and seat (11) from retainer (6).



- (5) Push down on piston (12) and remove snap ring (13), piston, and spring (14).
- (7) Remove retainer (15) and cap (16) from piston (12).
- (8) Remove piston (17) from housing (2).
- (9) Remove two caps (18 and 19) from piston (17).



- (10) Remove plug (20) and gasket (21) from housing (2).
- (11) Remove plug (22) and gasket (23).
- (12) Using relief valve tool, remove relief valve assembly (24) and washer (25).



5-73. MASTER CYLINDER REPAIR (CONT).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.
 - (2) Check master cylinder for grooves, pitting, or scoring. Replace master cylinder if any of these conditions exist.

WARNING

Honing of master cylinder is not permitted.

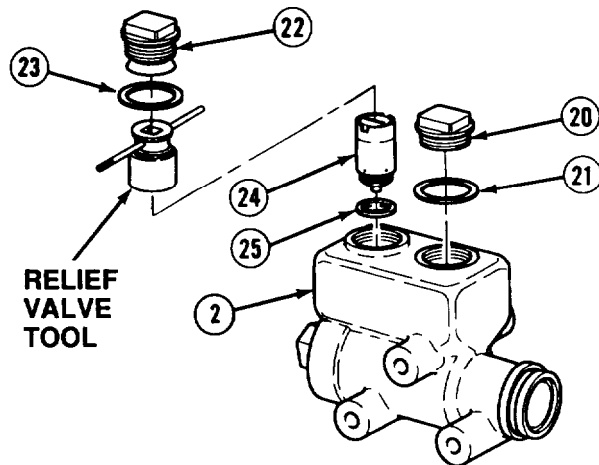
- (3) Measure bore in housing. Bore range is 1.65 to 1.85 in. (41.91 - 46.99 mm). If not within range replace.
- (4) Replace damage parts.

c. Assembly.

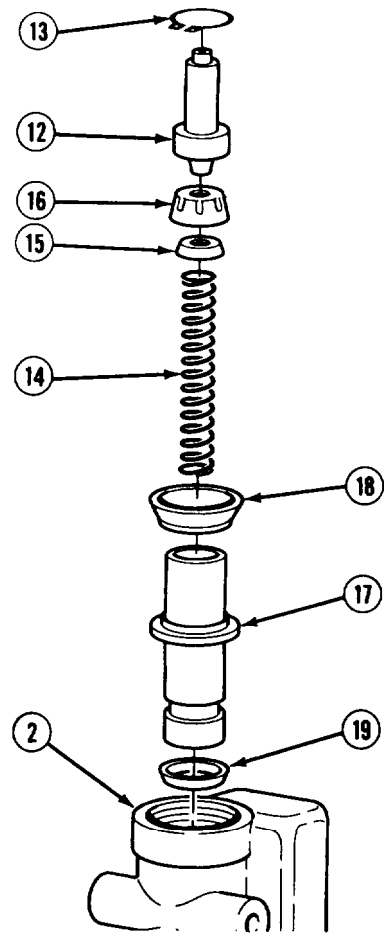
NOTE

Lubricate seals with brake fluid before assembly.

- (1) Install washer (24) and relief valve assembly (25) in housing (2).
- (2) Using relief valve tool, install gasket (23) and plug (22) in housing (2).
- (3) Install gasket (21) and plug (20) in housing (2).

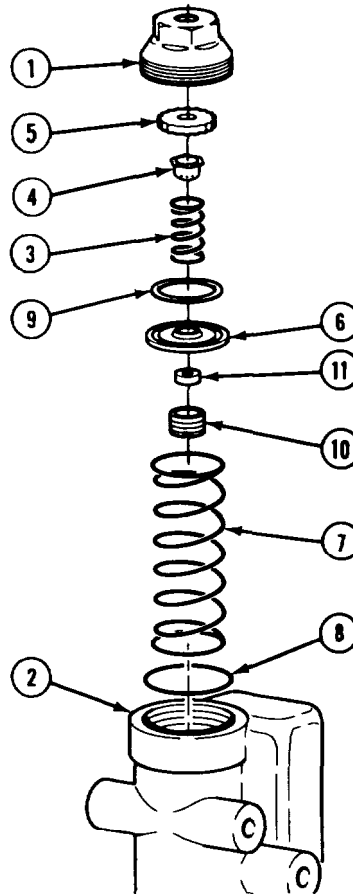


- (4) Install two caps (18 and 19) on piston (17) and install piston in housing (2).
- (5) Install cap (16) and retainer (15) on piston (12).
- (6) Install spring (14) and piston (12) in housing (2) with snap ring (13).



5-73. MASTER CYLINDER REPAIR (CONT).

- (7) Install seat (11) in retainer (6) with spanner retainer (10).
- (8) Install seal (9) in retainer (6).
- (9) Install spring (7) and retainer (6) in housing (2).
- (10) Install check valve seat (5), check valve (4), and check valve spring (3).
- (11) Push down on spring (3), by installing end plug (1) on retainer (6) and housing (2).



NOTE

Follow-on Maintenance: Install master cylinder (para 4-107).

END OF TASK

5-74. REAR BEARING, HUB, AND BRAKE DRUM REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Wrench, spanner, 3-pin (para F-6, appendix F)

Wrench, torque

Lifting device (capacity 500 lb [227 kg])

Materials/Patts

Seal, oil

Cloth, lint-free (item 12, appendix E)

Solvent, drycleaning (item 54, appendix E)

Personnel Required

MOS62B, Construction equipment repairer (2)

References

TM 9-214, Inspection, Care, and Maintenance of Antifriction Bearings

Equipment Condition

TM or Para

Para 5-65

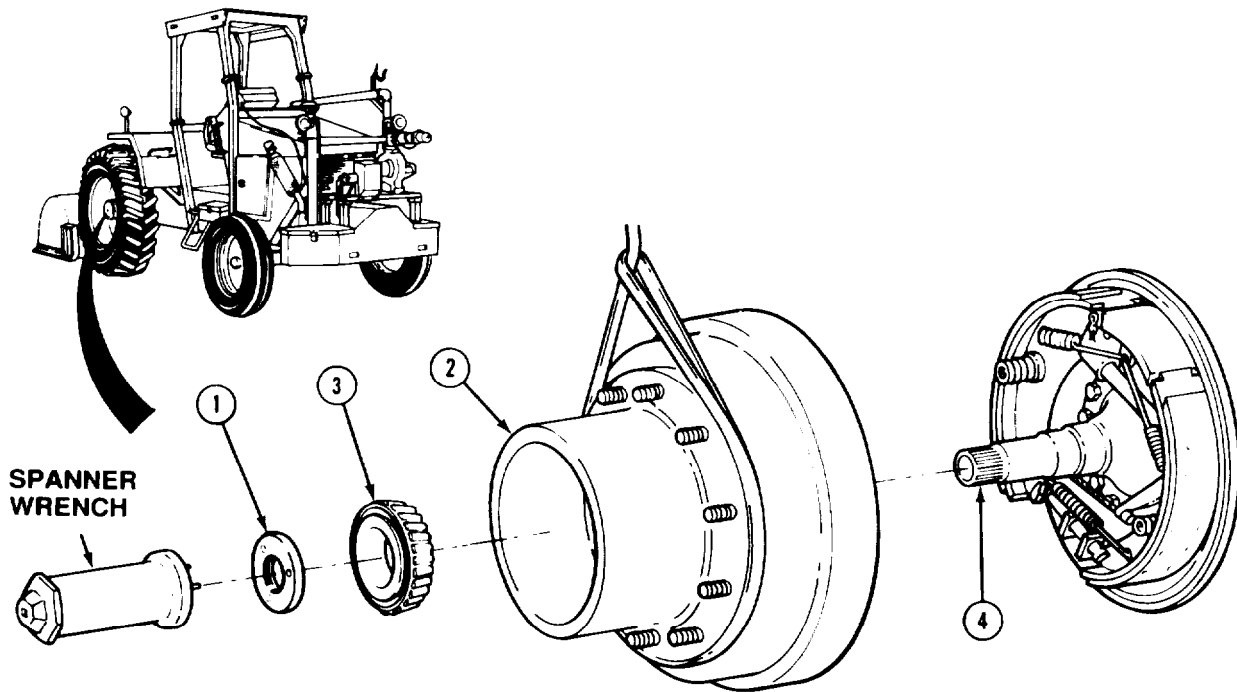
Condition Description

Wheel end and axle shaft removed.

General Safety Instructions

Brake shoes contain asbestos; wear proper protective equipment.

5-74. REAR BEARING, HUB, AND BRAKE DRUM REPLACEMENT (CONT).



Disassembly.

WARNING

Parts of the brake assembly may be coated with asbestos dust; breathing this dust can harm personnel.

- Use a filter mask approved for use against asbestos dust.
- Never use compressed air or dry brush to clean these assemblies.
- Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust.
- Use water and a soft bristle brush or cloth to remove dirt or mud.

NOTE

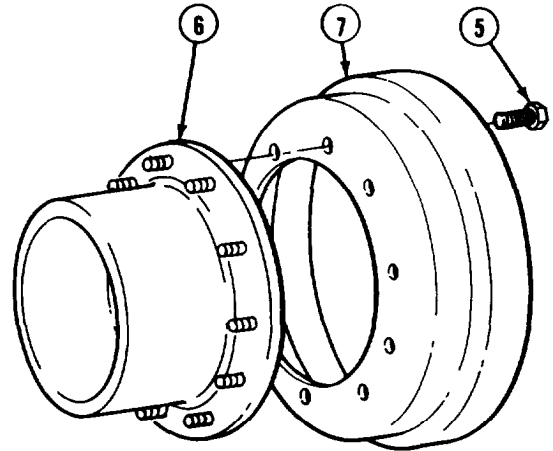
A three-pin face spanner is required for this task and must be fabricated (para F-6, appendix F).

- (1) Using a 3-pin spanner wrench, remove wheel bearing adjusting nut (1).
- (2) Slide hub and brake drum assembly (2) forward slightly and then push back, exposing outer wheel bearing (3) enough to remove.

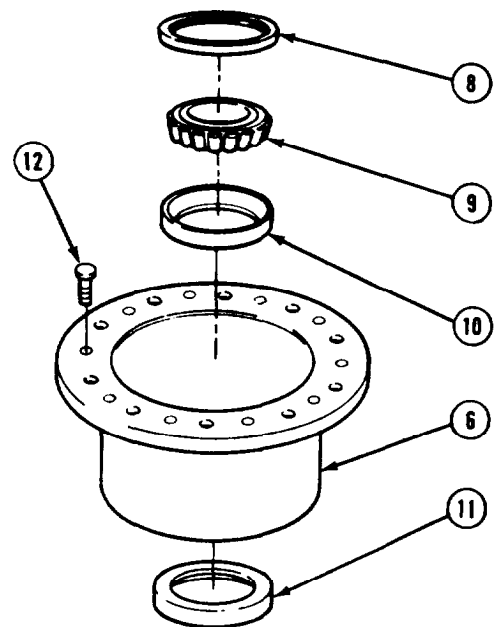
WARNING

Hub and brake drum assembly weighs 175 lb (80 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (3) Attach a suitable lifting device to hub and brake drum assembly (2).
- (4) While mechanic operates suitable lifting device, assistant works hub and brake drum assembly (2) from spindle (4).
- (5) Remove 18 screws (5) and hub (6) from brake drum (7).



- (6) Place hub (6) down and remove oil seal (8) and inner wheel bearing (9). Discard oil seal.
- (7) Remove wheel bearing cups (10 and 11) from hub (6) with suitable puller or drift.
- (8) If necessary, remove 20 studs (12) from hub (6).



5-74. REAR BEARING, HUB, AND BRAKE DRUM REPLACEMENT (CONT).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

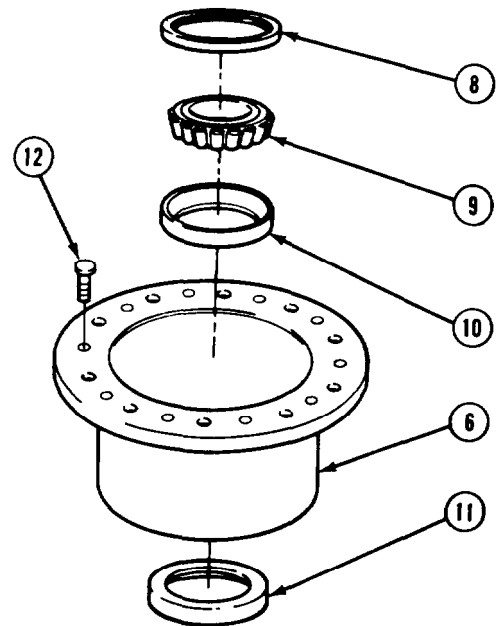
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shields, gloves, etc.).

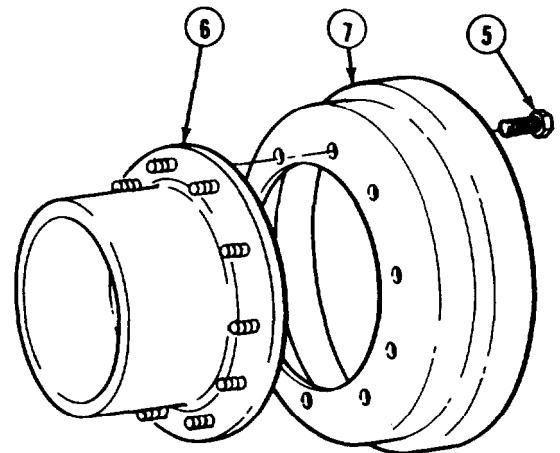
- (2) Use a lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Check thread for crossed or peeled conditions.
- (4) Check brake drums for excessive wear. Replace brake drum if not within the following specifications:
- | | |
|----------------------------------|-----------------------|
| Nominal Internal Diameter | 15.738 in. (39.97 cm) |
| Maximum Usable Diameter | 15.870 in. (40.31 cm) |
| Max. Allow. Remachining Diameter | 15.830 in. (40.21 cm) |
| Allowable Radial Variance | 0.005 in. (0.01 cm) |
- (5) Check all parts for damage, cracks, breaks, or deterioration. Replace unserviceable parts.
- (6) Replace damaged parts.

c. Assembly.

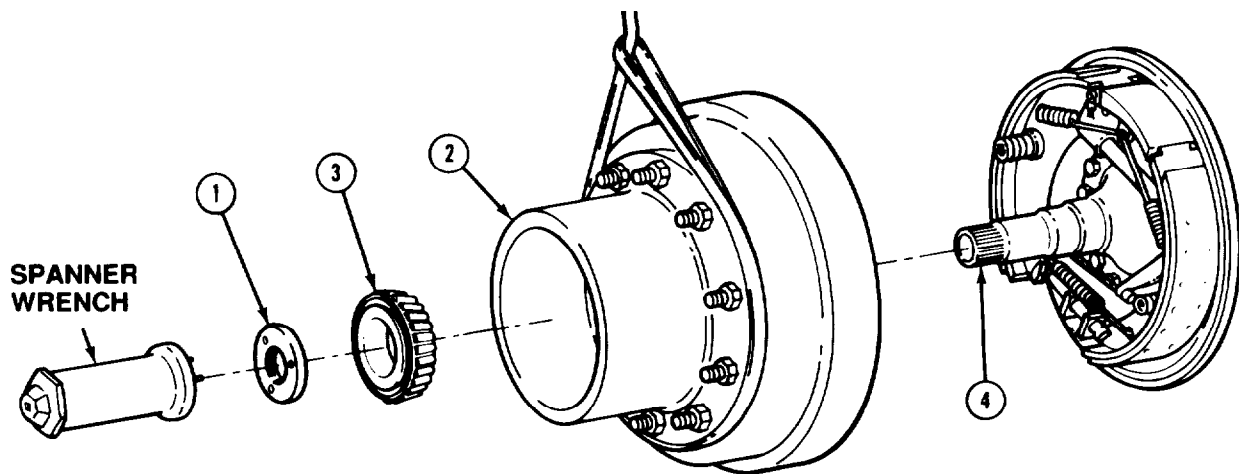
- (1) If removed, install 20 studs (12) in hub (6).
- (2) Install bearing cups (11 and 10) in hub (6).
- (3) Install inner wheel bearing (9) and oil seal (8) in hub (6).



- (4) Install hub (6) on brake drum (7) with 18 screws (5). Tighten screws 174 to 191 lb-ft (236 - 259 N^om).



5-74. REAR BEARING, HUB, AND BRAKE DRUM REPLACEMENT (CONT).



WARNING

Hub and brake drum assembly weighs 175 lb (80 kg). Attach suitable lifting device prior to installation to **prevent** possible injury to personnel.

- (5) While mechanic operates suitable lifting device, assistant guides hub and drum assembly (2) onto spindle (4).

NOTE

Be sure to align a hole in adjusting nut to a spline on the spindle.

- (6) Install outer bearing (3) and adjusting nut (1). Tighten nut 200 to 250 lb-ft (271 - 339 N°m), then back off **nut 1/8** turn. Rotate hub to be sure it revolves freely.

NOTE

Follow-on Maintenance: Install wheel end(s) and axle shaft(s) (para 5-65).

END OF TASK

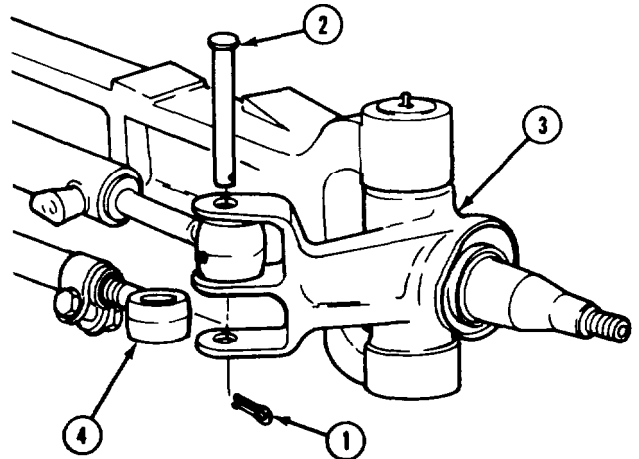
5-75. TIE ROD REPLACEMENT/REPAIR.		
This task covers:		
a. Removal	c. Cleaning/Inspection	
b. Disassembly	d. Assembly	
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Bushings (2) Pins, cotter (2) Solvent, drycleaning (item 54, appendix E)	
Shop equipment, general purpose repair: semi-trailer mounted	<i>Equipment Condition</i>	
Wrench, torque	<i>TM or Para</i>	Condition Description
	Para 4-115	Front right wheel removed.
	Para 2-13	Parking brake set.

a. Removal.

NOTE

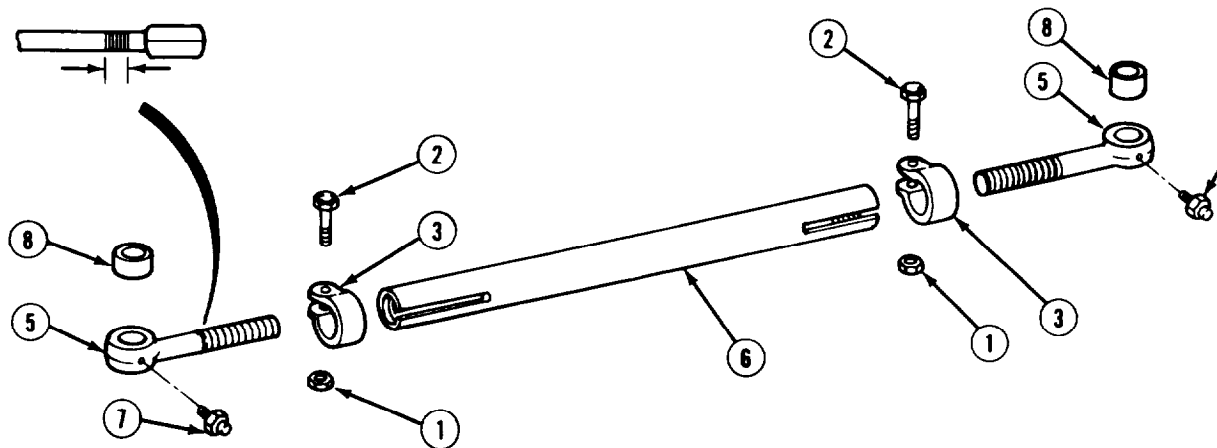
This procedure is the same for both tie rod ends. Right tie rod end shown.

- (1) Remove two cotter pins (1) and pins (2), from steering knuckle (3). Discard cotter pins.
- (2) Remove tie rod (4) from steering knuckle (3).



5-75. TIE ROD REPLACEMENT/REPAIR (CONT).

b. Disassembly.



NOTE

Toe-in should be checked whenever tie rod ends are loosened or removed.

- (1) Remove two nuts (1), screws (2), and clamps (3) from tie rod (4).

NOTE

Before removing tie rod ends, measure amount of exposed threads.

- (2) Measure amount of exposed threads on tie rod end as shown. Record measurement.
- (3) Remove tie rod ends (5) from tube (6).
- (4) Remove two grease fittings (7) from tie rod ends (5).
- (5) If necessary, remove two bushings (8) from tie rod ends (5).

c. Cleaning/Inspection.

WARNING

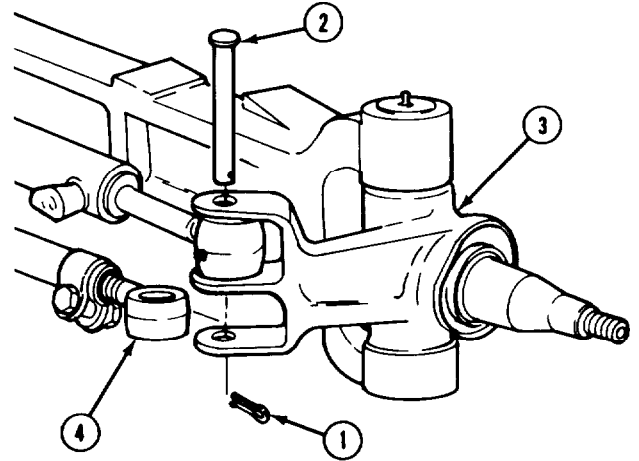
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

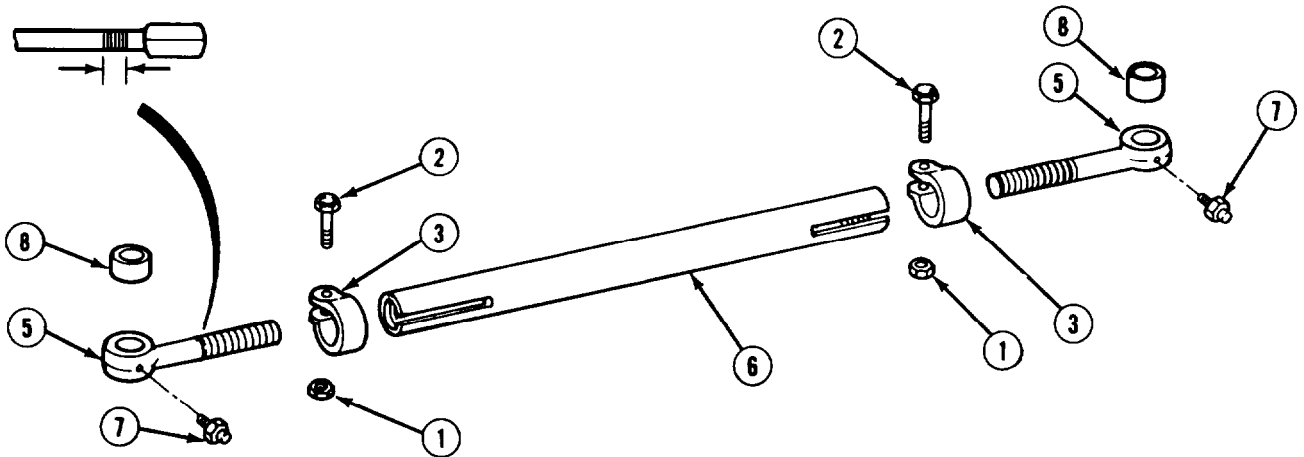
- (2) Clean sealing surfaces.
- (3) Check machined surfaces for damage.
- (4) Replace damaged parts.

d. Assembly.

- (1) If removed, install two bushings (8) in tie rod ends (5).
- (2) Install two grease fittings (7) in tie rod ends (5).
- (3) Install clamps (3), screws (2), and nuts (1) on tube (6). Do not tighten.
- (4) Install tie rod ends (5) in tube (6) until measurement recorded during disassembly is reached. Tighten nuts 70 lb-ft (95 N-m).



e. Installation.



- (1) Install tie rod (4) in steering knuckles (3).
- (2) Install two pins (2) and cotter pins (1) on each steering knuckle (3). Tighten nuts 70 lb-ft (95 N^om).

NOTE

Follow-on Maintenance:

- 1 Install front right wheel (para 4-115).
- 1 Lubricate fittings (figure 3-1).

END OF TASK

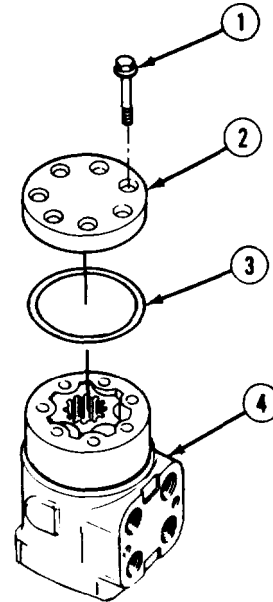
5-76. STEERING CONTROL UNIT REPAIR.		
This task covers:		
a. Disassembly	b. Cleaning/Inspection	c. Assembly
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Fluid, hydraulic (item 23, appendix E)	
Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted	Sealant, hydraulic (item 52, appendix E)	
Wrench, torque	Solvent, drycleaning (item 54, appendix E)	
<i>Materials/Parts</i>	<i>Equipment Condition</i>	
Preformed packings (6)	TM or Para	<i>Condition Description</i>
Seal (4)	Para 4-118	Steering control unit removed.

a. *Disassembly.*



Do not overtighten vise as distortion of control unit housing may result in damage to unit.

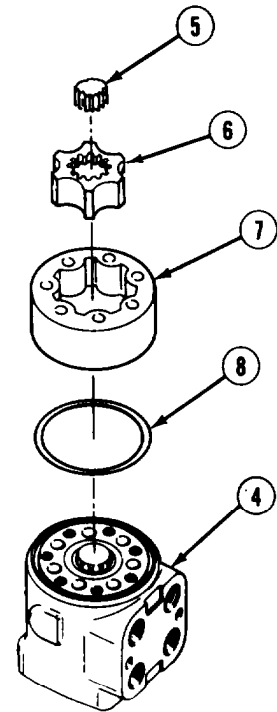
- (1) Remove seven screws (1), end cap (2), and seal (3) from control unit housing (4). Discard seal.



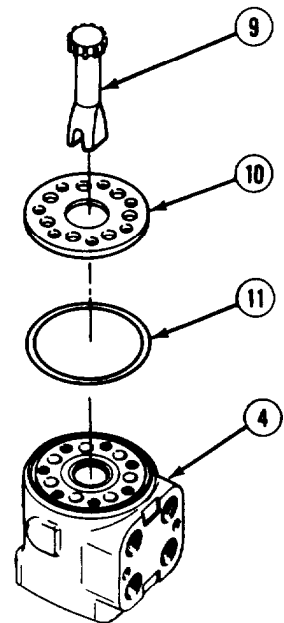
CAUTION

When removing meter, be careful not to drop star, or damage may result.

- (2) Remove spacer (5), star, (6), meter (7), and seal (8) from control unit housing (4). Discard seal.



- (3) Remove drive (9), spacer plate (10), and seal (11) from control unit housing (4). Discard seal.



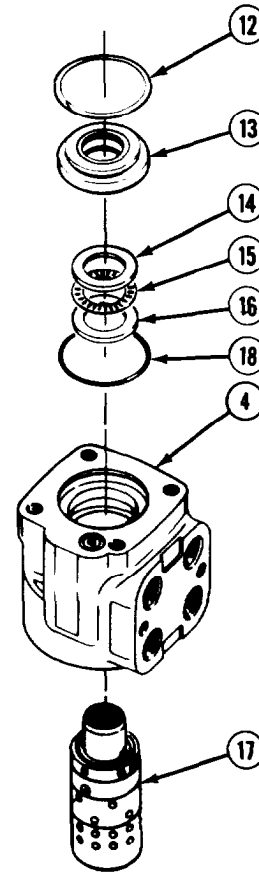
5-76. STEERING CONTROL UNIT REPAIR (CONT).

- (4) Turn control unit housing (4) over and remove retaining ring (12) and seal gland bushing (13).
- (5) Remove bearing race (14), needle thrust bearing (15), and bearing race (16) from spool and sleeve assembly (17).

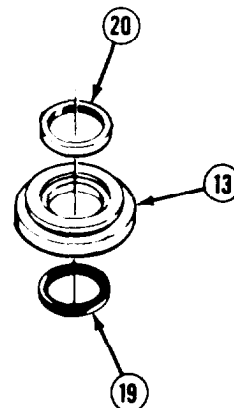
CAUTION

Rotate spool and sleeve assembly slowly when removing to prevent damage that can occur from binding.

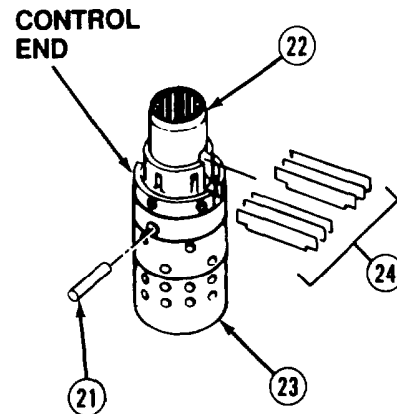
- (6) Remove spool and sleeve assembly (17) from control unit housing (4).
- (7) Remove and discard preformed packing (18) from spool and sleeve assembly (17).



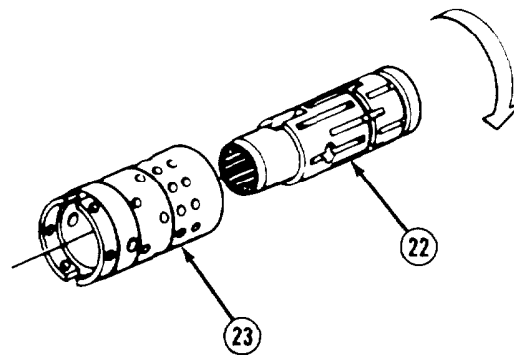
- (8) Remove preformed packing (19) and seal (20) from seal gland bushing (13). Discard preformed packing and seal.



- (9) Remove pin (21) from spool (22).
- (10) Push spool (22) partially from control end of sleeve (23) and carefully remove centering springs (24).

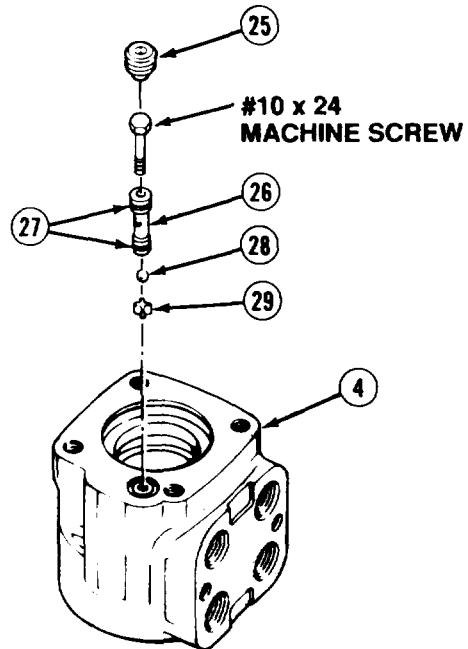


- (11) Push spool (22) back through opposite end of sleeve (23) and remove. Rotate spool slowly when removing from sleeve.



5-76. STEERING CONTROL UNIT REPAIR (CONT).

- (12) Remove setscrew (25) from control unit housing (4).
- (13) Install machine screw into end of check ball seat (26); using screw, pull seat from control unit housing (4).
- (14) Remove and discard two preformed packings (27) from check ball seat (26). Discard preformed packings.
- (15) Tip control unit housing (4) and remove check ball (28) and check ball retainer (29).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shields, gloves, etc.).

- (2) Use compressed air to dry all parts except bearings.
- (3) Allow bearings to air dry.

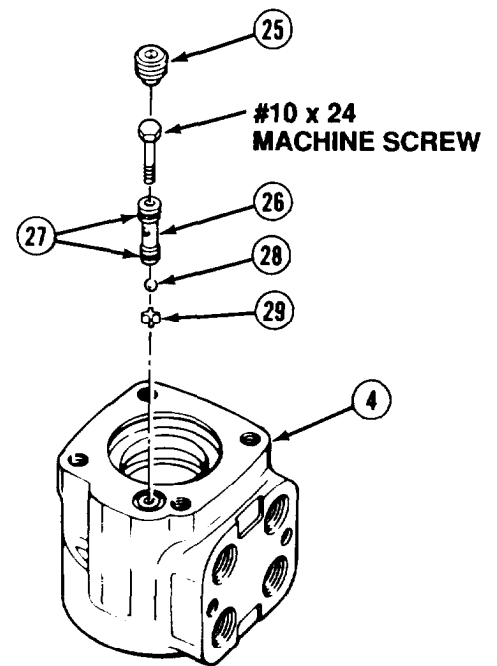
- (4) Check all mating surfaces for scratches, nicks, or burrs.
- (5) Check all machined surfaces for scratches, nicks, or burrs.
- (6) Check control unit housing for cracks or damage.
- (7) Check all threads for peeled or crossed condition.
- (8) Replace all seals, preformed packings, and damaged parts.
- (9) Lubricate all seals and preformed packings with clean hydraulic fluid.
- (10) Do not over-lubricate seals on meter section.
- (11) Coat metal parts with light hydraulic fluid to aid in assembly.

c. Assembly.

NOTE

Make sure that check ball retainer sits straight and is not tilted.

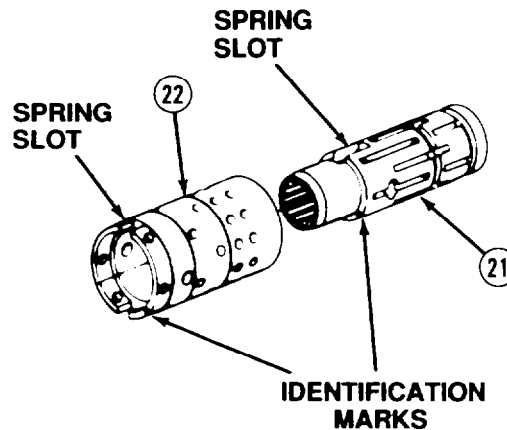
- (1) Install check ball retainer (29) and check ball (28) in control unit housing (4).
- (2) Install two preformed packings (27) on check ball seat (26).
- (3) Using a machine screw, install check ball seat (26) in control unit housing (4) without twisting or damaging seals.
- (4) Install setscrew (25) and tighten setscrew 100 lb-in. (11.3 N°m).



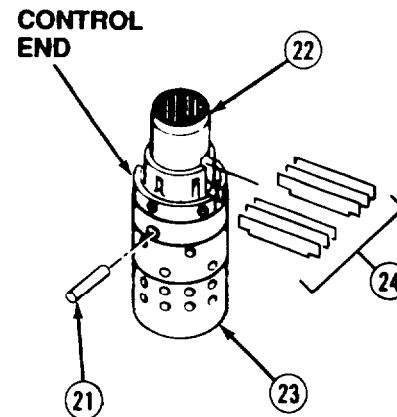
5-76. STEERING CONTROL UNIT REPAIR (CONT).

NOTE

- Some spool and sleeve sets are marked; if present, align marks as shown.
 - Spool should rotate smoothly in sleeve with finger-tip force applied at splined end.
- (5) Assemble spool (22) and sleeve (23) carefully so that the spring slots line up at the same end. Rotate spool while sliding parts together.



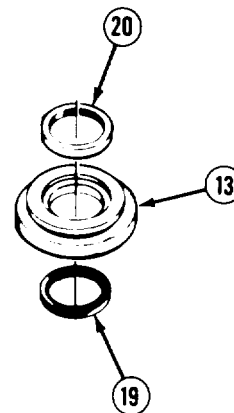
- (6) Install two sets of three springs (24) with notches facing sleeve (23) and arched centers back-to-back.
- (7) Center installed springs so that they push down evenly and flush with upper surface of the spool (22) and sleeve (23).
- (8) Install pin (21) through spool (22) and sleeve (23) until pin is flush on both sides.



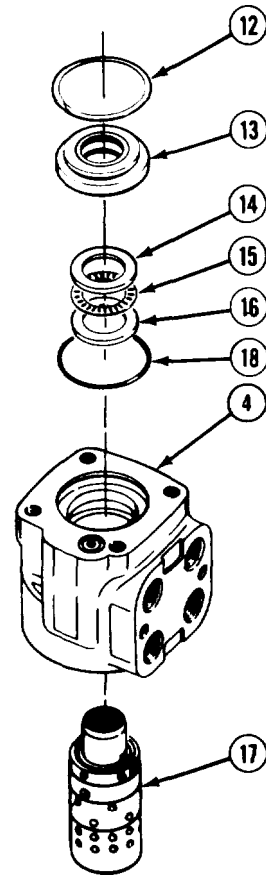
CAUTION

Make sure that no parts tilt or slide out of position while installing spool and sleeve assembly. Keep pin in horizontal position. Do not push end of spool and sleeve assembly past end of housing. Damage to spool and sleeve assembly or housing may result if these precautions are not followed.

- (9) Install seal (20) and preformed packing (19) in seal gland bushing (13).



- (10) Install preformed packing (18) on spool and sleeve assembly (17) and carefully install spool and sleeve assembly into control unit housing (4) with a slight rotating movement, until end of assembly is flush with end of housing. Make sure spool rotates freely with slight finger-tip pressure at splined end.
- (11) Install preformed packing (18), bearing race (16), thrust needle bearing (15), and bearing race (14).
- (12) Install seal gland bushing (13) and retaining ring (12).



5-76. STEERING CONTROL UNIT REPAIR (CONT).

NOTE

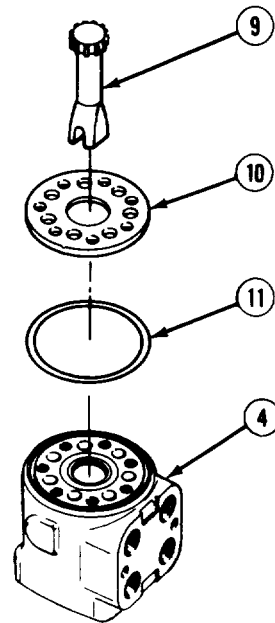
Clean upper surface of housing by wiping with palm of clean hand. Clean each flat surface of meter section parts the same way before reassembly.

- (13) Install seal (11) and spacer plate (10) on control unit housing (4). Align bolt holes in spacer plate with tapped holes in control unit housing.

NOTE

When installing drive in spool and sleeve, make sure drive engages pin.

- (14) Install drive (9) in control unit housing (4).



CAUTION

When installing meter, be careful not to drop star, or damage may result.

NOTE

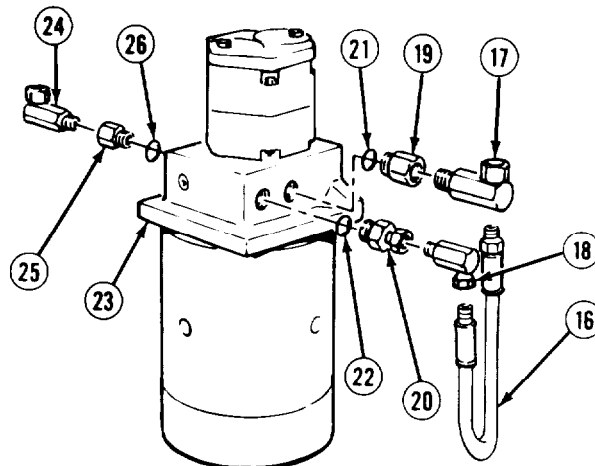
Side of star with chamfer on inner splines faces inside of control unit.

- (15) Install seal (8) and star (6) in meter (7); install assembled meter on control unit housing (4).

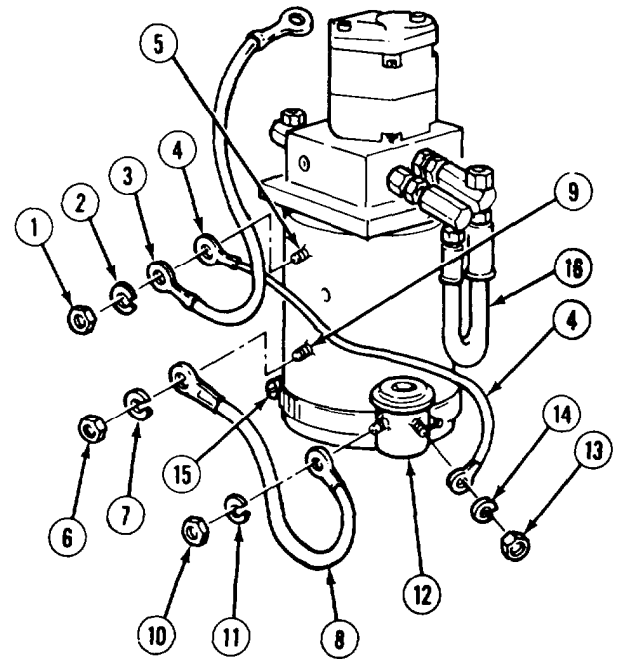
NOTE

It may be necessary to remove and install meter a few times until holes line up and star fits over drive.

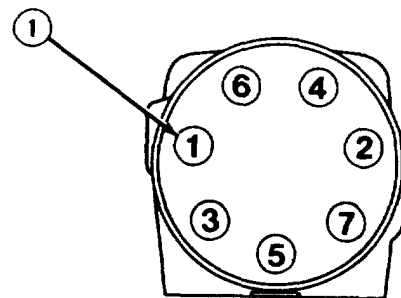
- (16) Align bolt holes in meter (7) with tapped holes in control unit housing (4) while fitting star (6) easily over drive (9).
- (17) Install drive spacer (5) in star (6).



- (18) Install seal (3) and end cap (2) with seven dry screws (1) on control unit housing (4).



- (19) Pretighten screws 150 lb-in (16.9 N-m), then tighten, in sequence shown, to 275 lb-in (31.1 N°m).



NOTE

Follow-on Maintenance: Install steering control unit (para 4-118).

END OF TASK

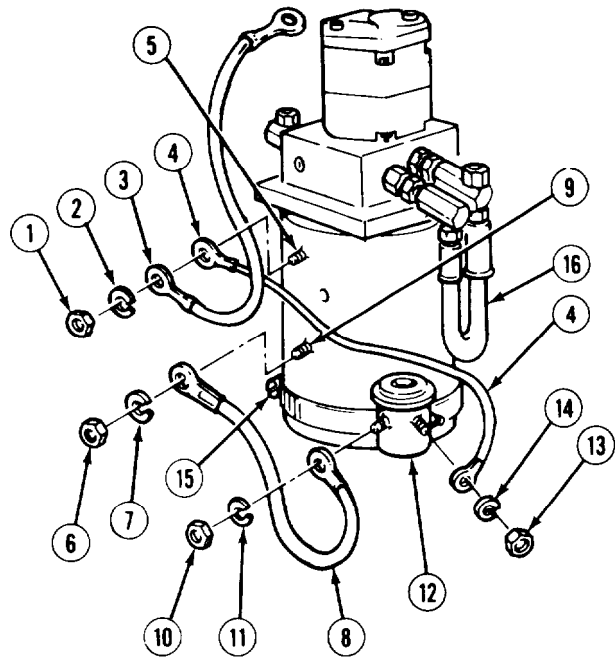
5-77. EMERGENCY STEERING UNIT REPAIR.		
This task covers:		
a. Disassembly	b. Cleaning/Inspection	c. Assembly
INITIAL SETUP		
<i>Tools</i>	<i>Materials/Parts</i>	
Tool kit, general mechanic's: equipment maintenance and repair	Cloth, lint-free (item 12, appendix E) Fluid, hydraulic (item 23, appendix E) Solvent, drycleaning (item 54, appendix E) Sealant, hydraulic (item 52, appendix E) Tag, identification (item 55, appendix E)	
Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted		
Wrench, torque		
<i>Materials/Parts</i>	<i>Equipment Condition</i>	<i>Condition Description</i>
Lockwashers (8) Preformed packings (4)	TM or Para Para 4-119	Emergency steering unit removed.

a. Disassembly.

NOTE

Tag and mark all wires before removal.

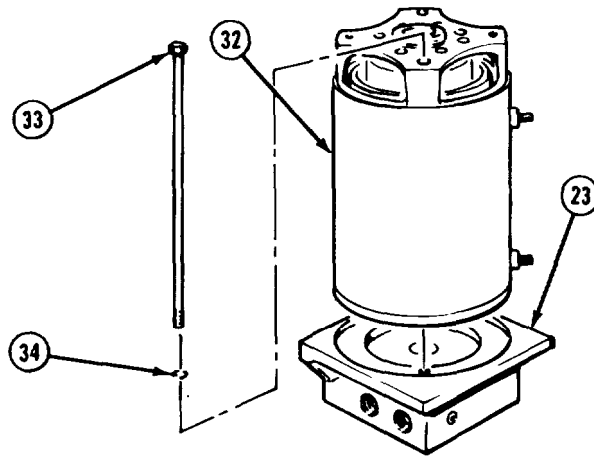
- (1) Tag, mark, and remove nut (1), lockwasher (2), ground lead (3) and grey solenoid lead (4) from terminal (5). Discard lo&washer.
- (2) Tag, mark, and remove nut (6), lo&washer (7), and black solenoid lead (8) from terminal (9). Discard lockwasher.
- (3) Remove nut (10), lockwasher (11) and black solenoid lead (8) from solenoid (12). Discard lockwasher.
- (4) Remove nut (13), lockwasher (14), and grey solenoid lead (4) from solenoid (12). Discard lo&washer.
- (5) Loosen clamp (15) and remove solenoid (12).



- (6) Remove hose (16) from fittings (17 and 18).
- (7) Remove two fittings (17 and 18), adaptors (19 and 20), and preformed packings (21 and 22) from motor base (23). Discard preformed packing.
- (8) Remove fitting (24), adaptor (25), and preformed packing (26). Discard preformed packing.
- (9) Remove two screws (27) and lockwashers (28) from pump (29). Discard lockwashers.
- (10) Remove pump (29) from motor base (23).
- (11) Remove two screws (30) and motor cap (31) from motor (32).

5-77. EMERGENCY STEERING UNIT REPAIR (CONT).

- (12) Remove two screws (33), lockwashers (34), and motor (32) from motor base (23). Discard lockwashers.



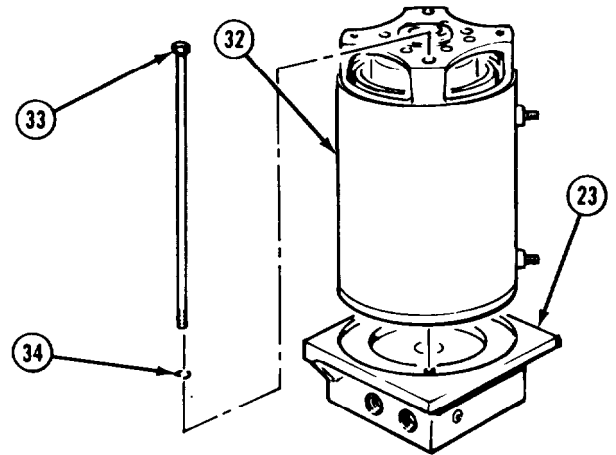
b. Cleaning/Inspection.

WARNING

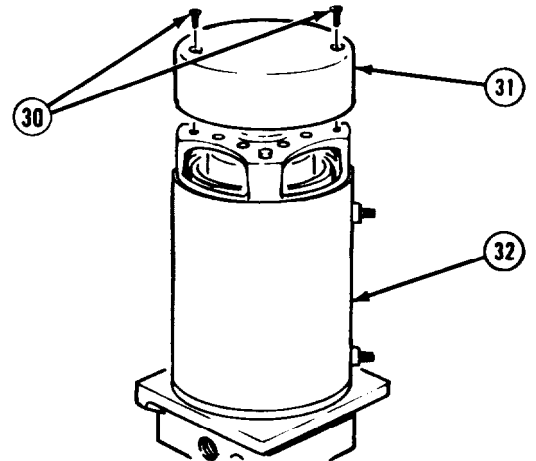
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
 - Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shields, gloves, etc.).
- (1) Clean all metal parts with drycleaning solvent and dry with lint-free cloth or compressed air.
 - (2) Check housing and components for cracks and wear.
 - (3) Check threads for crossed or peeled condition.
 - (4) Replace damaged parts.

c. **Assembly.**

- (1) Install motor (32) on motor base (23) with two lockwashers (34) and screws (33).



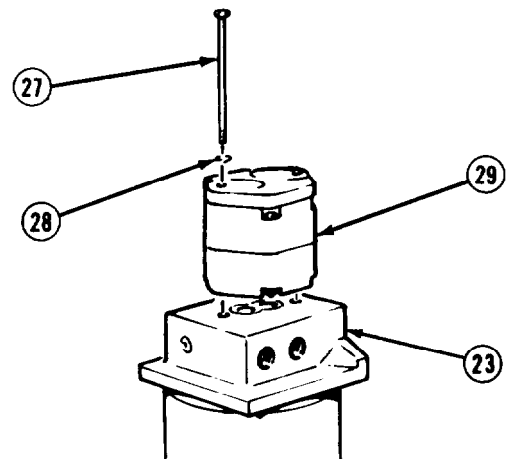
- (2) Install motor cap (31) on motor (32) with two screws (30).



NOTE

Apply thin coat of hydraulic fluid to seals before installing pump on motor base.

- (3) Install pump (29) on motor base (23) with two lo&washers (28) and screws (27). Tighten screws 20 to 27 lb-in (2.3 - 3 N°m).

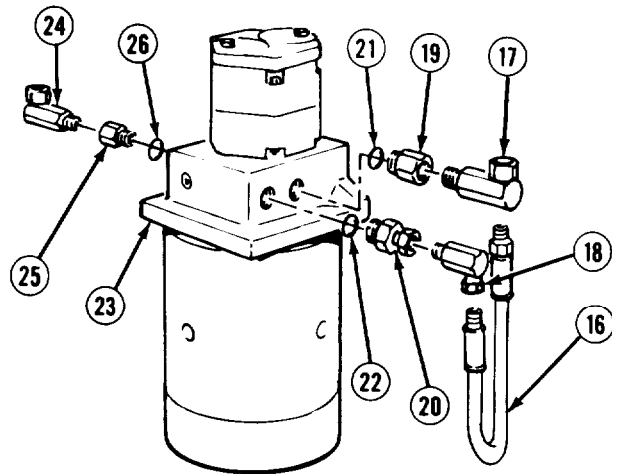


5-77. EMERGENCY STEERING UNIT REPAIR (CONT.)

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

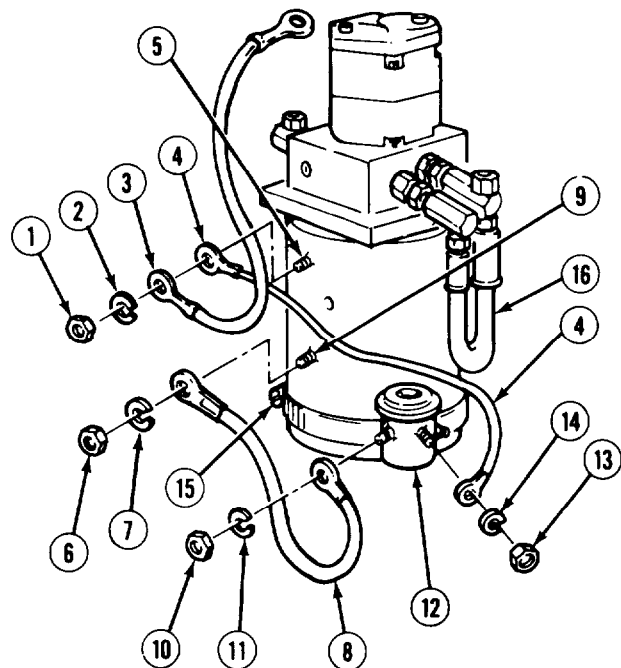
- (4) Apply hydraulic sealant to threads of three fittings (24,18, and 17) and three adaptors (25,20, and 19).
- (5) Install preformed packing (26), adaptor (25) and fitting (24) on motor base (23).
- (6) Install two preformed packings (21 and 22), adaptors (19 and 20), and fittings (17 and 18) on motor base (23).
- (7) Install hose (16) to fittings (17 and 18)
- (8) Install solenoid (12) and tighten clamp (15) securely.



NOTE

Refer to tags to properly install wires.

- (9) Install grey solenoid lead (4) on solenoid (12) with lockwasher (14), and nut (13).
- (10) Install black solenoid lead (8) on solenoid (12) with lockwasher (11) and nut (10).
- (11) Install solenoid lead (8) on terminal (9) with lockwasher (7) and nut (6).
- (12) Install grey solenoid lead (4) and ground lead (3) on terminal (5) with lockwasher (2) and nut (1).



NOTE

Follow-on Maintenance: Install emergency steering unit (para 4-119).

END OF TASK

5-78 STEERING CYLINDER REPAIR.

This task covers:

a. Disassembly

b. Cleaning/Inspection

c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted

Wrench, torque

Suitable container (capacity 1 gal. [3.9 liters])

Materials/Parts

Seals (6)

Ring, back-up seal (3)

Ring, wear

Cloth, lint-free (item 12, appendix E)

Solvent, drycleaning (item 54, appendix E)

Equipment Condition

TM or Para

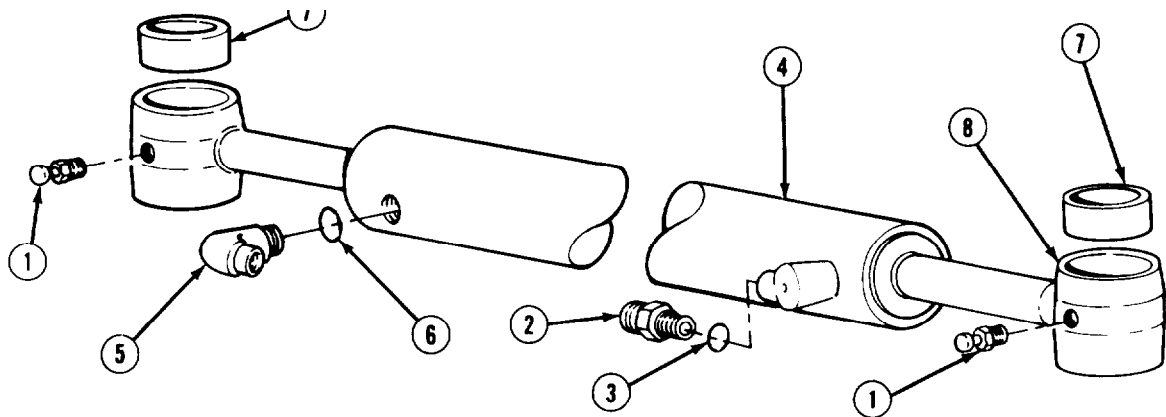
Para 4-121

Condition Description
Steering cylinder removed.

Materials/Parts

Bushings (2)

Packing, preformed (2)



a. Disassembly.

- (1) Remove two grease fittings (1), fitting (2), and preformed packing (3) from cylinder (4). Discard preformed packing.
- (2) Remove elbow (5) and preformed packing (6). Discard preformed packing.
- (3) If damaged, remove two bushings (7) from ends (8). Discard bushings.

5-78. STEERING CYLINDER REPAIR (CONT).

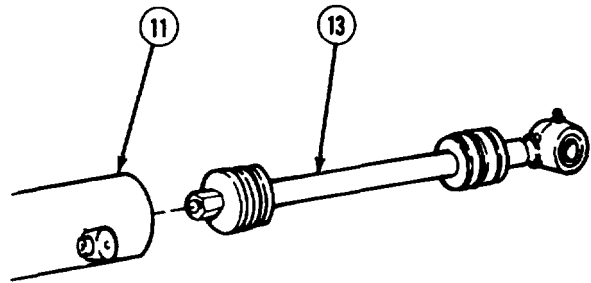
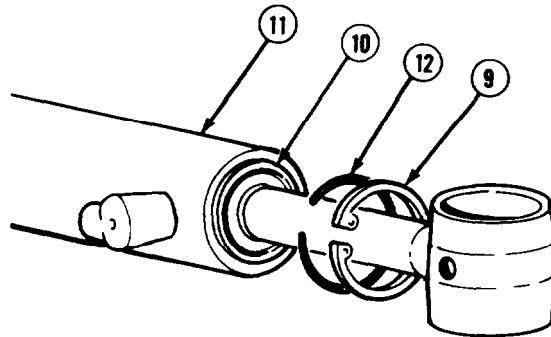
WARNING

Oil is slippery and can cause falls. To avoid injury, wipe up spilled oil with rags.

NOTE

Place suitable container with a 1 gallon (3.9 liters) capacity under cylinder to catch spilling fluid.

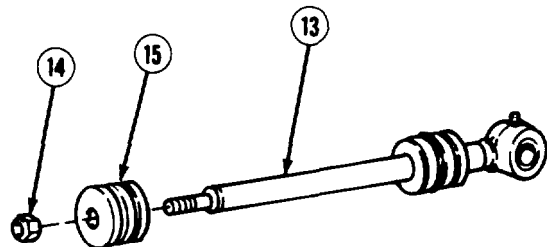
- (4) Remove retaining ring (9).
- (5) Tap rod guide (10) into cylinder housing (11) and remove retaining ring (12).
- (6) Remove shaft (13) from cylinder housing (11).



NOTE

Do not discard locknut on end of shaft unless damaged.

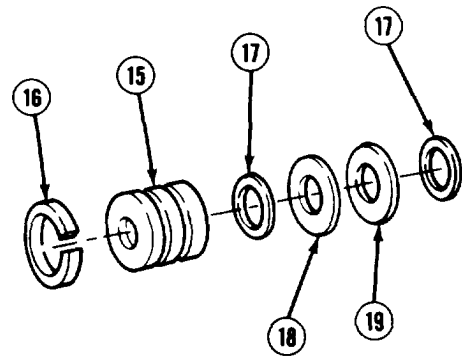
- (7) Remove locknut (14) from shaft (13).
- (8) Remove piston (15) from shaft (13).



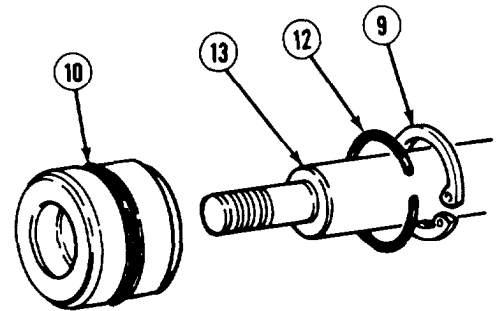
NOTE

If replacing with new piston, discard old piston with seals. New piston is unitized and has no seals to replace.

- (9) Remove wear ring (16) two back-up ring seals (17) and seals (18 and 19) from piston (15). Discard wear ring, back-up ring, and seals.



- (10) Remove rod guide (10), retaining ring (9), and retaining ring (12) from shaft (13).



5-78. STEERING CYLINDER REPAIR (CONT).

- (11) Remove seal (20) and back-up ring seal (21) from outside of rod guide (10). Discard seal and back-up ring seal.
- (12) Remove three seals (22) from inside rod guide (10). Discard seals.

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

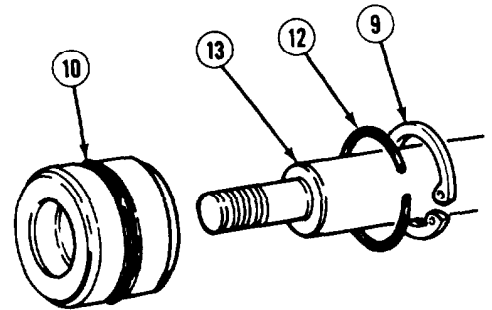
WARNING

Compressed air is used for cleaning purposes and must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles, gloves, etc.).

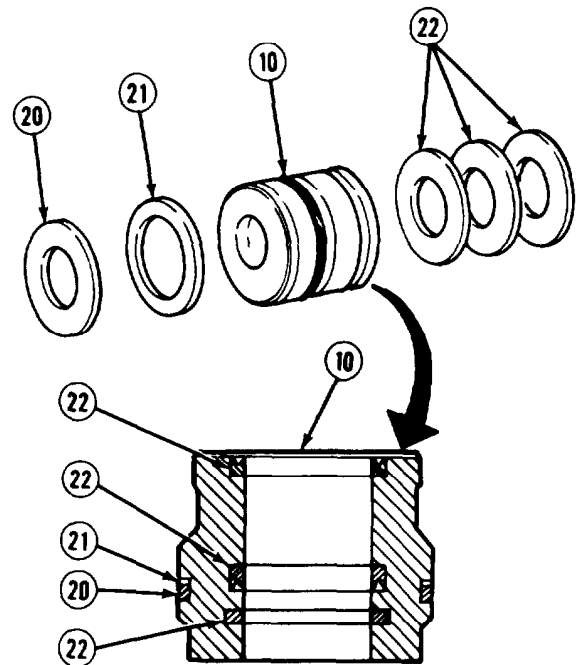
- (2) Use lint-free cloth, or compressed air to dry all metal parts.
- (3) Check parts for nicks, galling, or cracks.
- (4) Check bushings and seals for damage.
- (5) Replace damaged parts.

c Assembly.

- (1) Install three seals (22) in rod guide (10).
- (2) Install back-up ring (21) and seal (20) on rod guide (10).



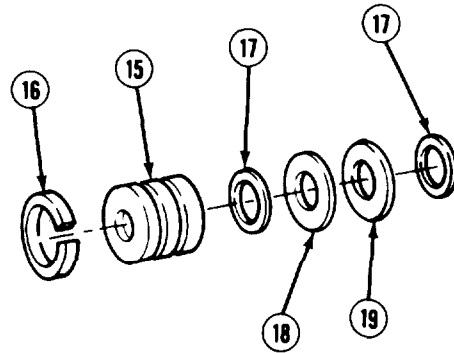
- (3) Install retaining ring (12), retaining ring (9), and rod guide (10) on shaft (13).



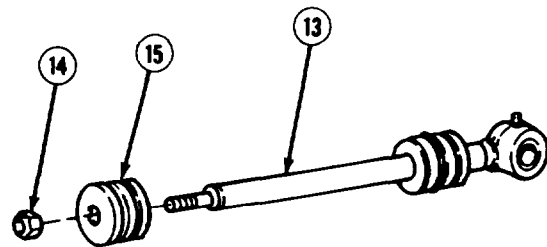
5-78. STEERING CYLINDER REPAIR (CONT).

NOTE

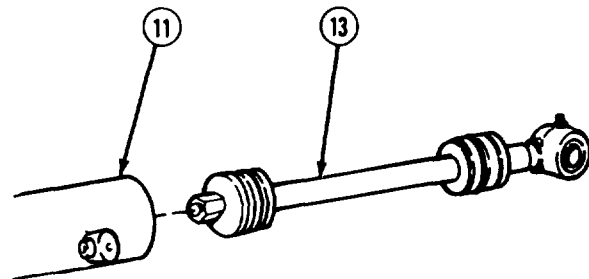
- Skip step (6) if old piston is being used. If using unitized piston, go to step (6).
 - Cap seal can be made more pliable by warming with hands or placing in hot water for 5 minutes. Install immediately.
- (4) Install seal (19), seal (18) two back-up ring seals (17), and wear ring (16) on piston (15).



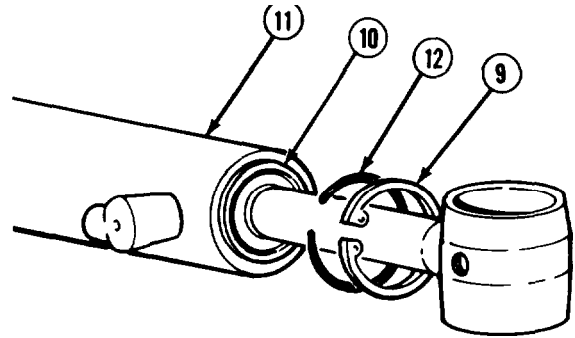
- (5) Install piston (15) on shaft (13).
- (6) Install locknut (14) on shaft (13). Tighten locknut 35 to 40 lb-ft (47 - 54 N-m).



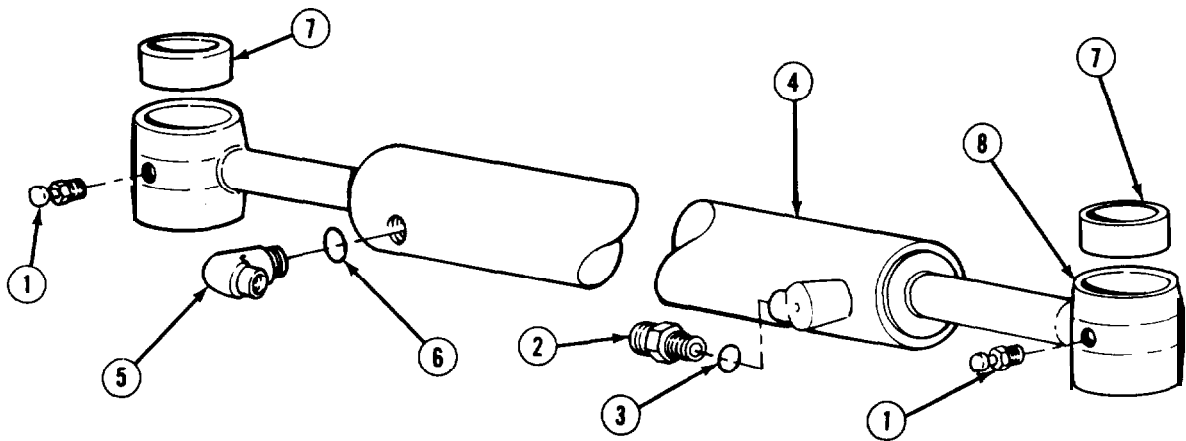
- (7) Install shaft (13) in cylinder housing (11).



- (8) Install rod guide (10) into cylinder housing (11) and install retaining ring (12).
- (9) Install retaining ring (9).



- (10) If removed, install bushings (7) in ends (8).
- (11) Install preformed packing (6) and elbow (5) in cylinder (4).
- (12) Install preformed packing (3), fitting (2), and grease fittings (1) in cylinder (4).



NOTE

Follow-on Maintenance: Install steering cylinder (para 4-121).

END OF TASK

5-79. MAIN FRAME ASSEMBLY REPAIR.

This task covers:

R e p a i r

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, contact maintenance: truck mounted

References

TM 9-237

Equipment Condition

TM or Para
Para 4-90

Condition Description
Negative battery cables disconnected.

Special Environmental Conditions

Work in a well lighted, dry area.

Repair.



- Unsafe welding practices can cause serious injury from fire, explosions, or harmful agents. Allow only authorized personnel to weld or cut metals, and follow safety precautions in TM 9-237. Protective goggles and clothing must be worn; adequate protective equipment used, a suitable tire extinguisher kept near by; and requirements of TM 9-237 strictly followed.
 - Disconnect negative battery cable before start of welding. Electrical shock could occur causing injury or death to personnel.
- (1) Reweld damaged areas on frame in accordance with TM 9-237 weldment requirements for plain carbon steel. Class 1, Type 4 instructions apply.
 - (2) Inspect for and clean corroded areas.
 - (3) Replace all bent or damaged frame members using conventional repair methods.

NOTE

Follow-on maintenance: Connect negative battery cables (para 4-90).

END OF TASK

5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-----------------|
| a. Removal | c. Cleaning/Inspection | e. Installation |
| b. Disassembly | d. Assembly | |

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Tool kit, machinist: Posts/Camps/Stations

Wrench, torque

Suitable container (capacity 1 gal. [3.9 liters])

Materials/Parts

Lockwashers (2)

Packing, preformed (4)

Materials/Parts

Seal

Solvent, drycleaning (item 54, appendix E)

Tags, identification (item 55, appendix E)

Equipment Condition

TM or Para

Para 2-18

Para 4-151

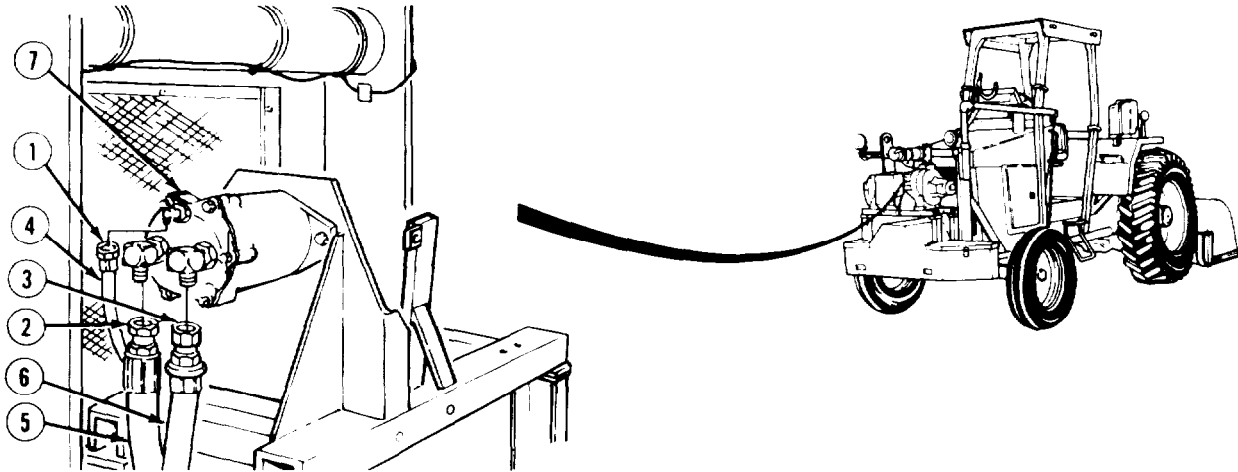
Condition Description

Hydraulic tank valves closed.

Additive pump removed.

5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT.).

a. Removal.



WARNING

Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

NOTE

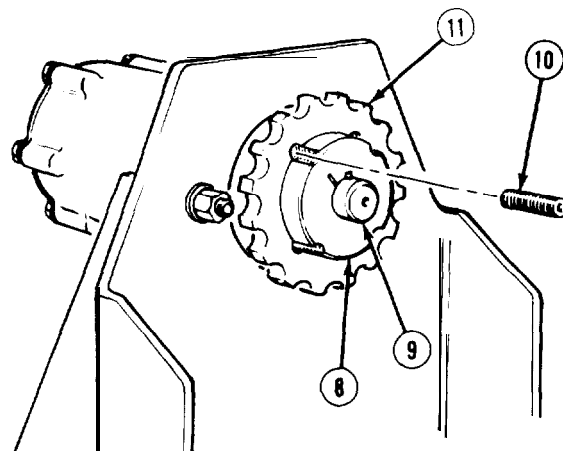
- Place suitable container with a 1 gallon (3.9 liters) capacity under hoses to catch spilling fluid.
- Tag and mark all hoses prior to removal.

- (1) Loosen fittings (1,2, and 3) and disconnect hoses (4,5, and 6) from hydraulic motor (7).
- (2) Measure distance between bushing (8) and end of shaft (9). Record measurement.
- (3) Remove two setscrews (10) from bushing (8).

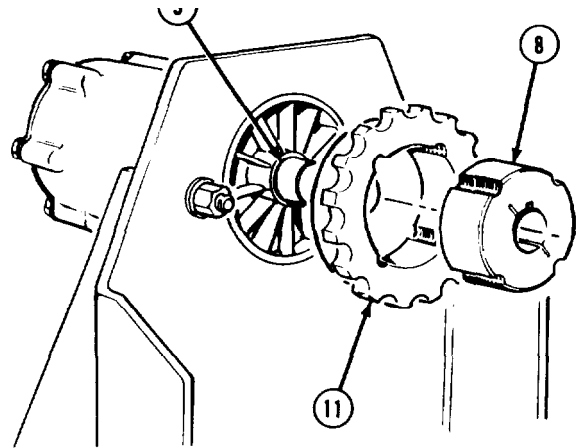
NOTE

It may be necessary to tap opposite side of sprocket for complete removal from bushing.

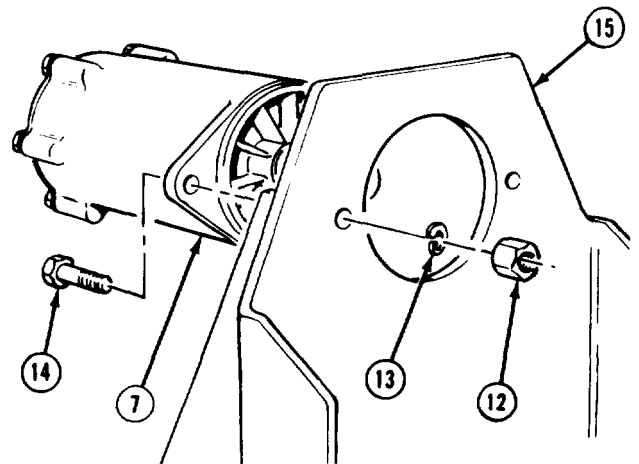
- (4) Install one setscrew (10) into empty hole on bushing (8). Loosen sprocket (11) from bushing (8) by tightening setscrew (10).



- (5) Remove bushing (8) and sprocket (11) from motor shaft (9).

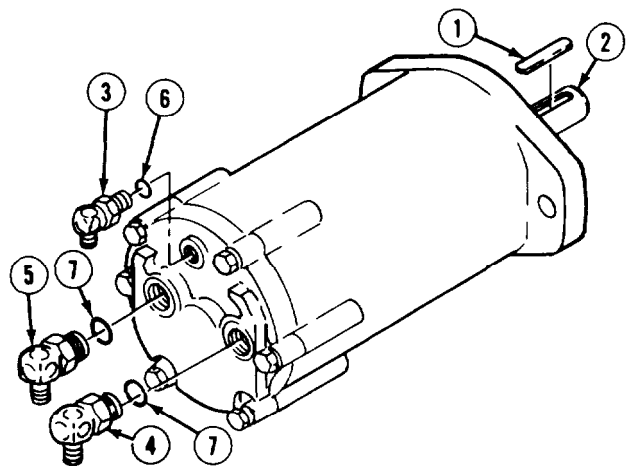


- (6) Remove two nuts (12), lockwashers (13), screws (14) and motor (7) from pump frame (15). Discard lockwashers.



b. Disassembly.

- (1) Remove key (1) from shaft (2).
- (2) Note position and remove three elbows (3,4, and 5) and preformed packings (6 and 7). Discard preformed packings.



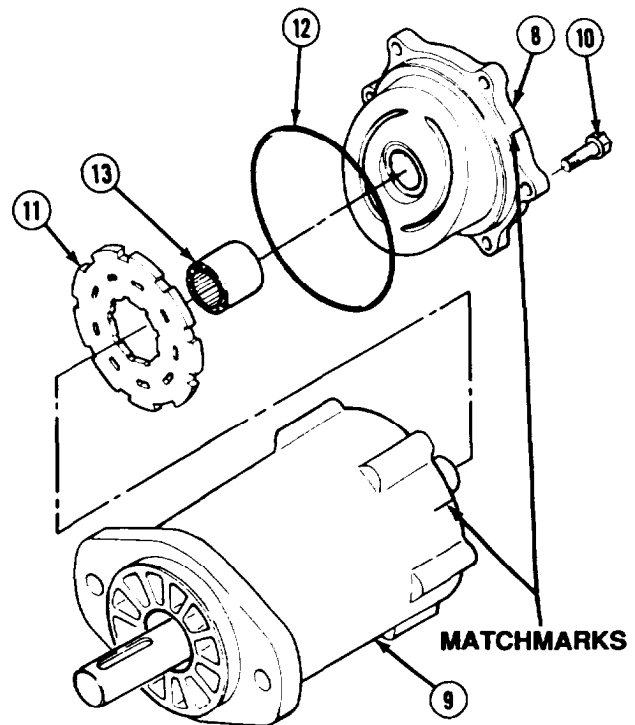
5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT).

- (3) Matchmark backing plate (8) and housing (9).

NOTE

Backing plate has gentle spring pressure.

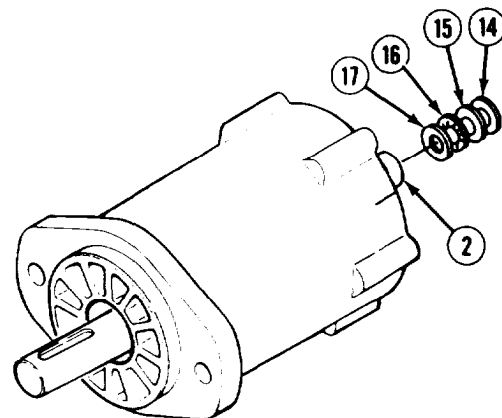
- (4) Remove six screws (10), backing plate (8), cam plate (11), and preformed packing (12). Discard preformed packing.
- (5) If damaged, remove roller bearing (13) from backing plate (8).



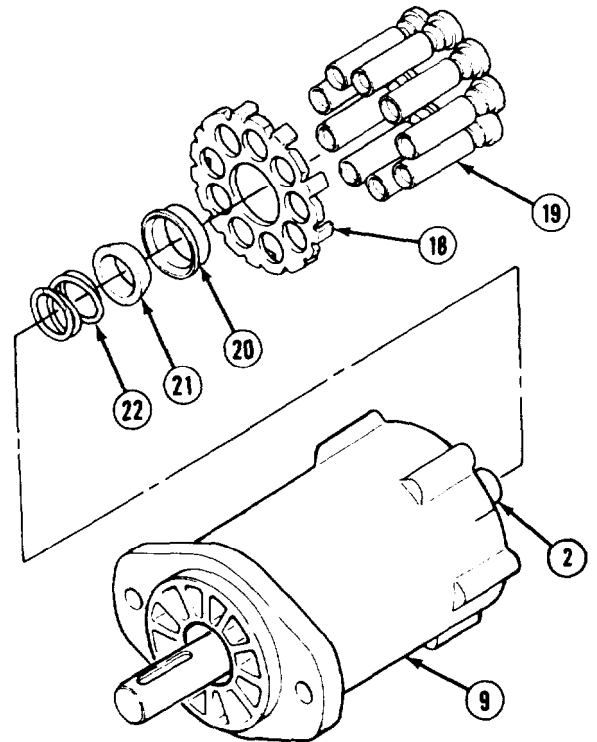
NOTE

Washers may come off with backing plate.

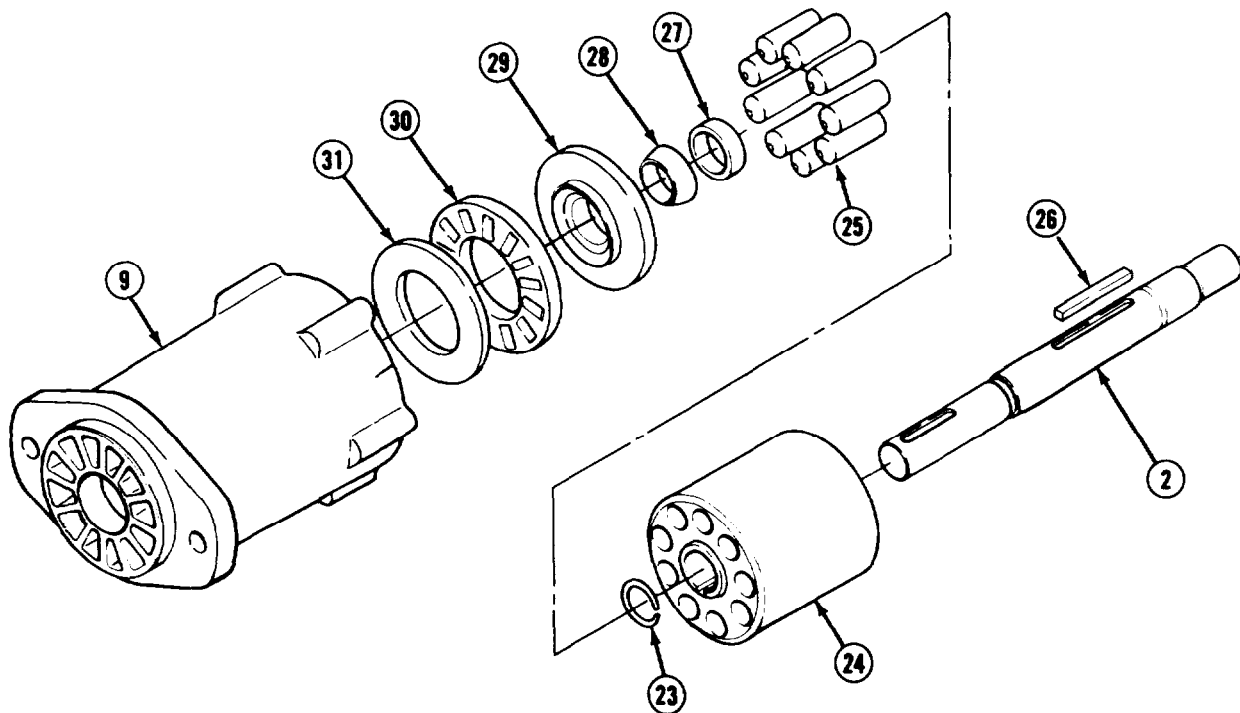
- (6) Remove shim (14), washer (15), thrust washer (16), and washer (17) from shaft (2).



- (7) Remove spider (18), nine pistons (19), pilot (20), sleeve spacer (21), and spring (22) from housing (9).



5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT).



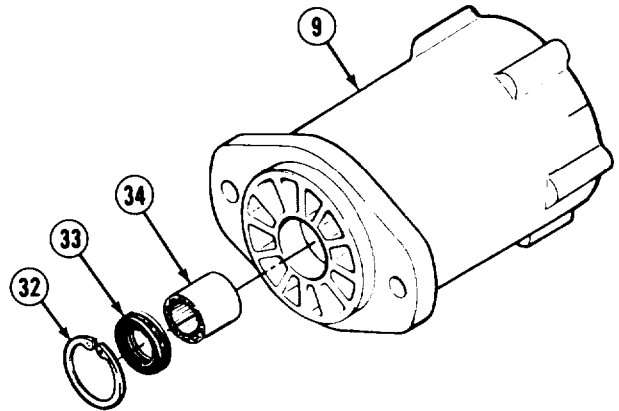
- (8) Remove retaining ring (23) from shaft (2).

NOTE

Some pistons will stay with housing. Note how pistons are installed in cylinder.

- (9) Remove shaft (2), cylinder (24), and nine pistons (25) from housing (9).
- (10) Remove cylinder (24) and key (26) from shaft (2).
- (11) Remove spacer (27), sleeve spacer (28), piston (29), thrust bearing (30), and thrust washer (31).

- (12) Remove retaining ring (32) and seal (33).
Discard seal.
- (13) If damaged, remove roller bearing (34) from housing (9).



c. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all parts in drycleaning solvent.

WARNING

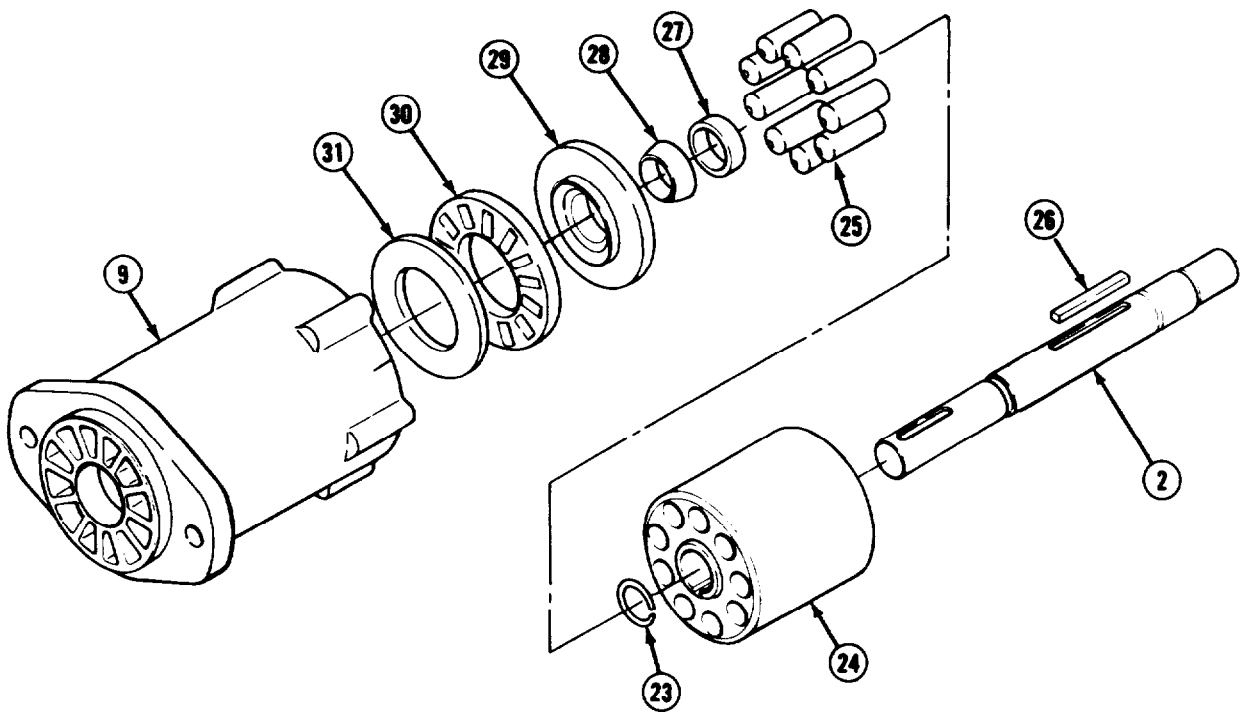
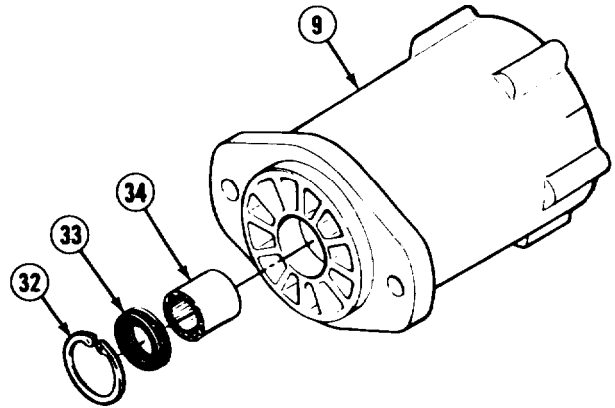
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Dry all parts with compressed air except bearings.
- (3) Allow bearings to air dry.
- (4) Check all parts for burrs, crossed or peeled threads or other damage.
- (5) Replace all damaged parts.

5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT).

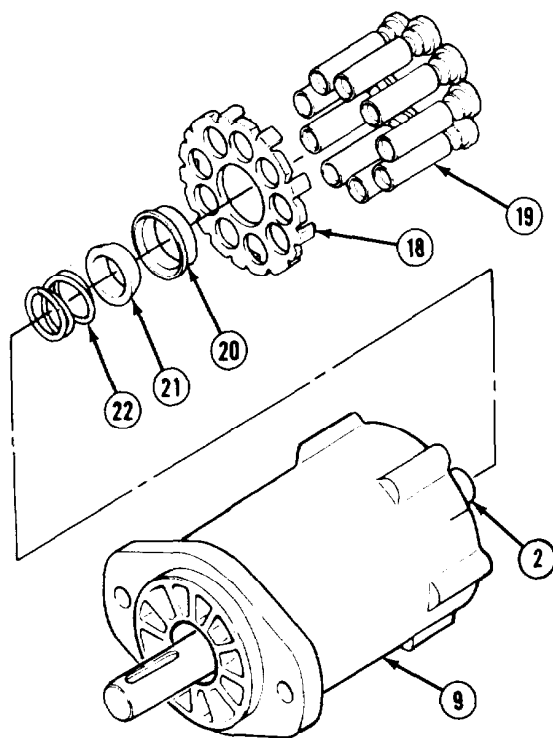
d. Assembly.

- (1) If removed, install roller bearing (34) in housing (9).
- (2) Install seal (33) and retaining ring (32).

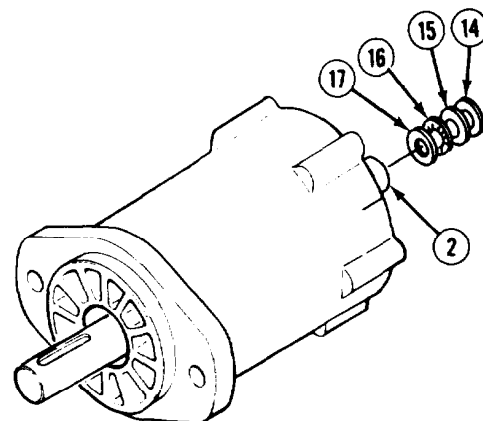


- (3) Position thrust washer (31) in housing (9).
- (4) Install cylinder (24) on shaft (2) with key (26) and retaining ring (23).
- (5) Position nine pistons (25) in cylinder (24).
- (6) Position thrust bearing (30), piston race (29), sleeve spacer (28) and spacer (27), on shaft (2) and install shaft in housing (9) as an assembly.

- (7) Install spring (22) and sleeve spacer (21) on shaft (2).
- (8) Install nine pistons (19) and pilot (20) in spider (18) and install spider on shaft (2).

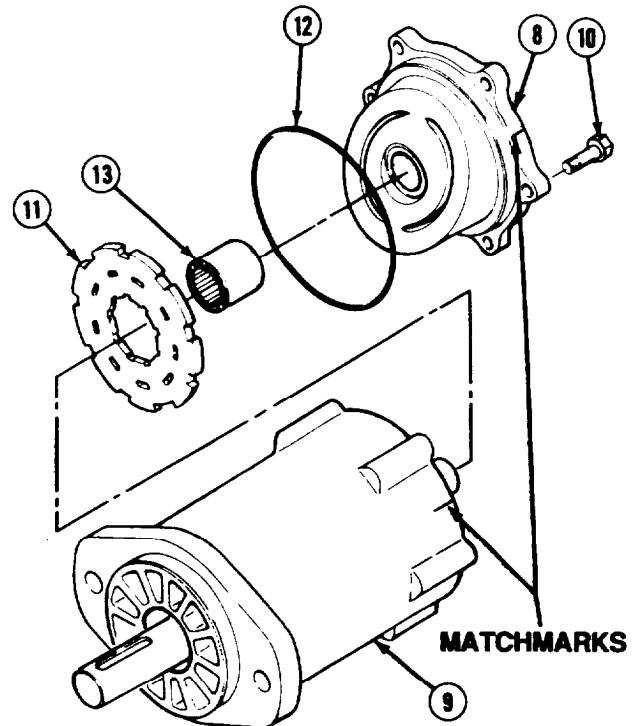


- (9) Install washer (17), thrust washer (16), washer (15), and shim (14) on shaft (2).



5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT).

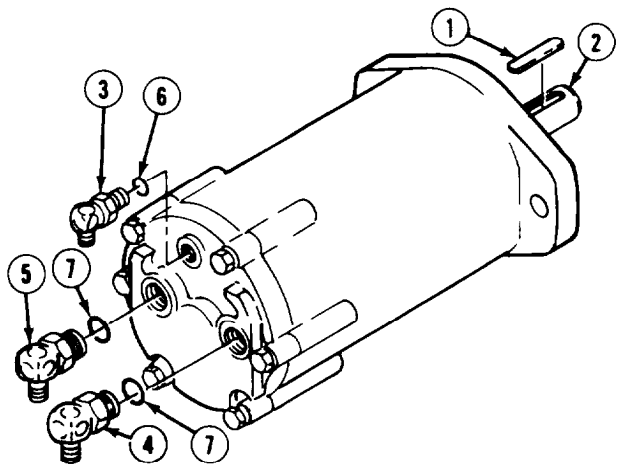
- (10) If removed, install roller bearing (13) in backing plate (8).
- (11) Position cam plate (11) in housing (9).
- (12) Align matchmarks and install preformed packing (12) and backing plate (8) with six screws (10). Tighten screws alternately 32 lb-ft (43 N-m).



WARNING

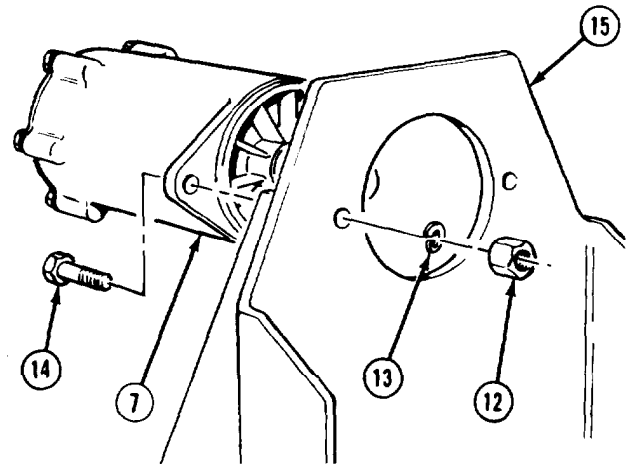
Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (13) Coat threads of three elbows (3,4, and 5) with hydraulic sealant.
- (14) Install three preformed packings (6 and 7) and elbows (3,4, and 5).
- (15) Install key (1) in shaft (2).



e. Installation.

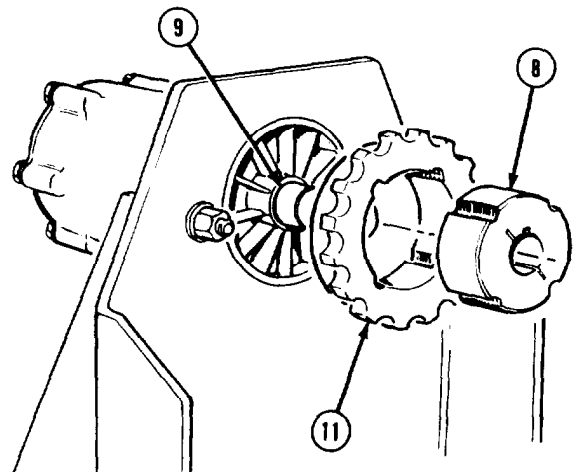
- (1) Install motor (7) to pump frame (15) with two screws (14), lockwashers (13), and nuts (12). Tighten nuts 75 to 85 lb-ft (102 - 115 N•m).



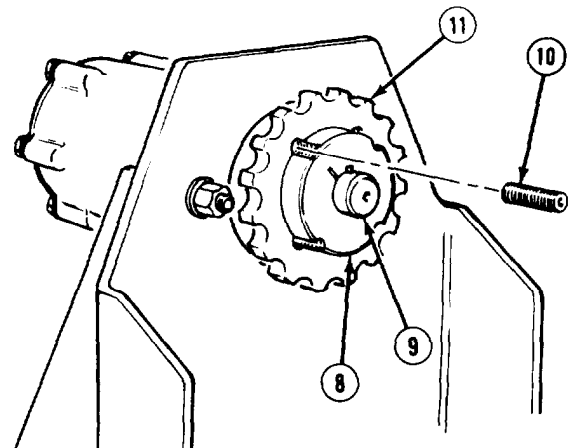
NOTE

Ensure that hole patterns on bushing and sprocket match when installing on motor shaft.

- (2) Install sprocket (11) on motor shaft (9) and install bushing (8) in sprocket.

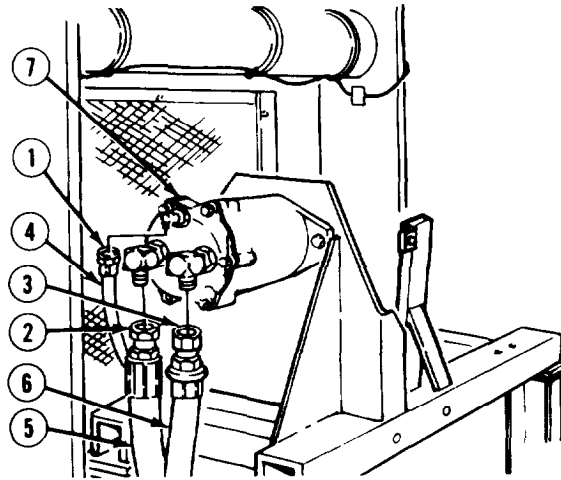


- (3) Install two setscrews (10) in bushing (8).
- (4) Alternately tighten setscrews 23 lb-ft (32 N•m).
- (5) Using a drift, tap bushing (8) until measurement recorded during removal is reached. Tighten setscrews (10) again 75 to 85 lb-ft (101 - 116 N •m).



5-80. ADDITIVE SYSTEM MOTOR REPLACEMENT/REPAIR (CONT).

- (6) Connect hoses (6,5, and 4) on additive motor (7) and tighten fittings (3,2, and 1).
- (7) After initial run-in, and periodically thereafter, repeat steps (4) and (5).



NOTE

Follow-on Maintenance:

- Install additive system pump (para 4-151).
- Open hydraulic tank valves (para 2-18).

END OF TASK

5-81. HYDRAULIC GEAR PUMP ASSEMBLY REPLACEMENT.

This task covers:

- a. Removal
- b. Installation

INITIAL SETUP

Tools

- Tool kit, general mechanic's: equipment maintenance and repair
- Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted
- Wrench, torque
- Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

- Compound, sealing, pipe thread (item 17, appendix E)
- Compound, retaining (item 18, appendix E)
- Tags, identification (item 55, appendix E)
- Hydraulic pump gasket
- Lockwashers (14)
- Preformed packings (4)
- Locknut

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-14	Left engine door opened.

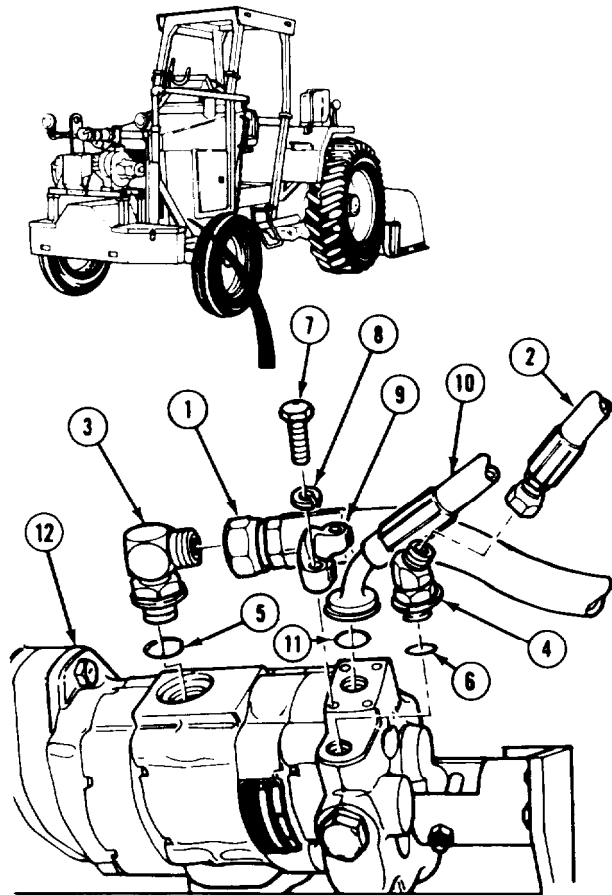
5-81. HYDRAULIC GEAR PUMP ASSEMBLY REPLACEMENT (CONT).

a. Removal.

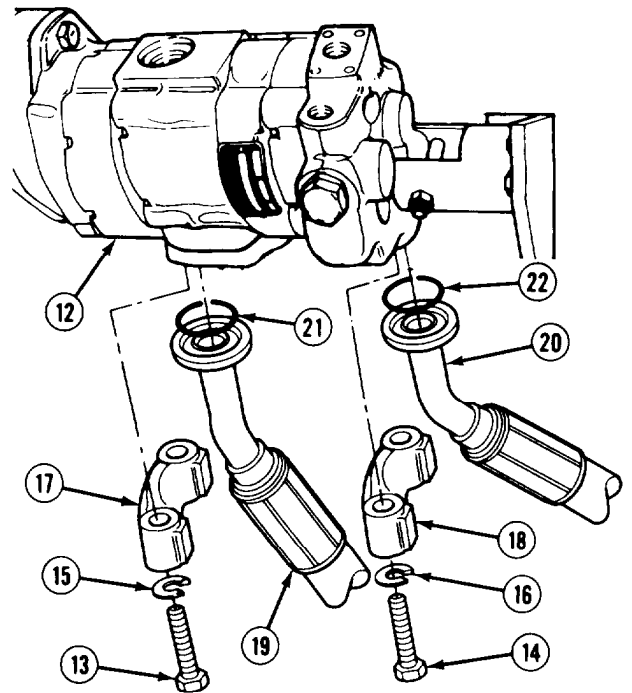
NOTE

- Tag and mark all hydraulic hoses before removal.
- Place suitable container with a 5 gallon capacity (19 liters) under pump to catch spilling fluid.
- Install protective plugs in pump and hoses upon removal.

- (1) Disconnect two hoses (1 and 2).
- (2) Note position and remove two elbow pipes (3 and 4) and preformed packings (5 and 6). Discard preformed packings.
- (3) Remove four screws (7), lockwashers (8), and two coupling halves (9). Discard lockwashers.
- (4) Remove hose (10) and preformed packing (11) from pump (12). Discard preformed packing.



- (5) Remove eight screws (13 and 14), lockwashers (15 and 16), and four coupling halves (17 and 18). Discard lockwashers.
- (6) Remove two hydraulic hoses (19 and 20).
- (7) Remove and discard two preformed packings (21 and 22).

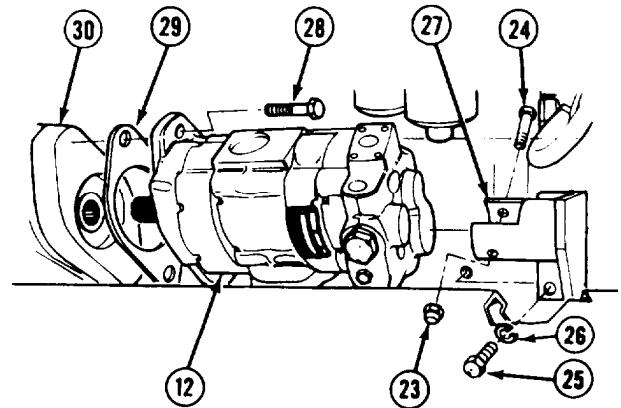


- (8) Remove locknut (23) and screw (24). Discard locknut.
- (9) Remove two screws (25), lockwashers (26), and brace (27). Discard lockwashers.

NOTE

Pump accessory drive and gasket may come off with pump.

- (10) Remove two screws (28), hydraulic pump (12) and gasket (29) from accessory drive (30). Discard gasket.



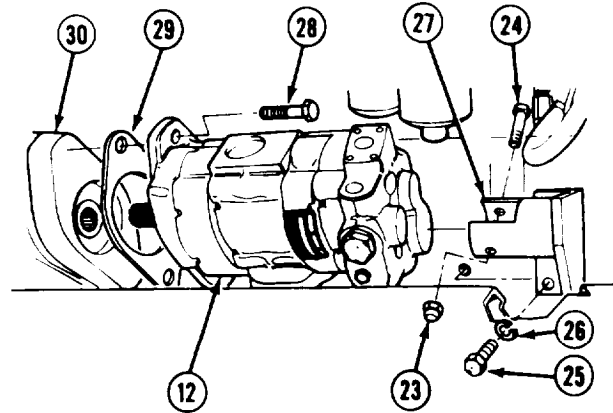
5-81. HYDRAULIC GEAR PUMP ASSEMBLY REPLACEMENT (CONT).

b. Installation.

WARNING

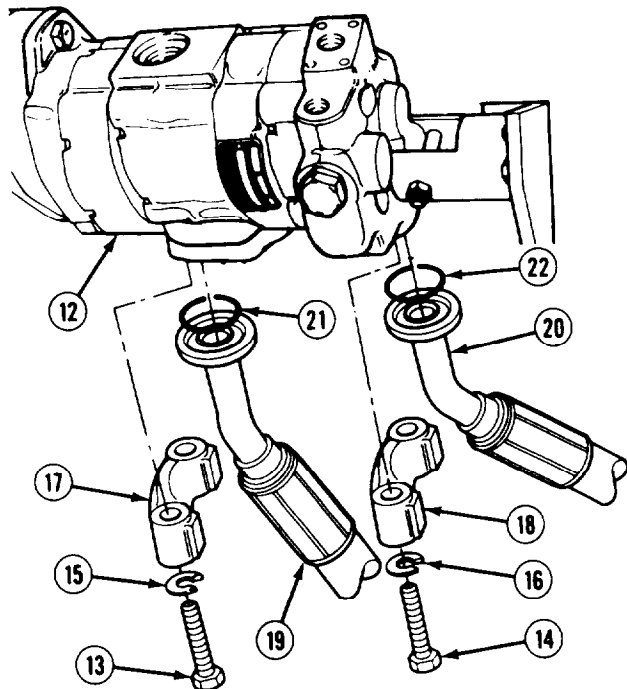
Sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (1) Coat threads of two screws (28) with retaining compound.
- (2) Install gasket (29) and hydraulic pump (12) on accessory drive (30) with two screws (28). Tighten screws 60 lb-ft (80 N•m).



- (3) Install brace (27) with two lockwashers (26) and screws (25). Tighten screws 45 to 50 lb-ft (61 - 69 N •m).
- (4) Install screw (24) and locknut (23).

- (5) Install two preformed packings (21 and 22) and hydraulic hoses (19 and 20) on pump (12) with four coupling halves (17 and 18), eight lockwashers (15 and 16) and screws (13 and 14). Tighten screws (13) 75 lb-ft (102 N •m). Tighten screws (14) 50 lb-ft (68 N •m).

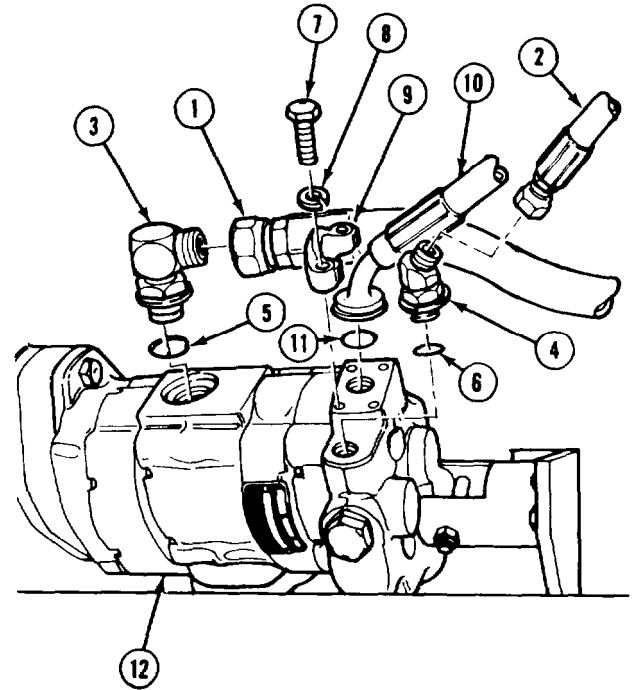


- (6) Install preformed packing (11) and hose (10) on pump (12) with two coupling halves (9), four lo&washers (8) and screws (7). Tighten screws 30 lb-ft (41 N•m).

WARNING

Adhesive sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (7) Coat threads of two elbow pipes (3 and 4) with pipe thread scaling compound.
- (8) Install two preformed packings (6 and 5) and elbow pipes (4 and 3).
- (9) Connect two hydraulic hoses (1 and 2).



NOTE

Follow-on maintenance: Close left engine door (para 2-14).

END OF TASK

5-82. HYDRAULIC GEAR PUMP ASSEMBLY REPAIR.

This task covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Disassembly

INITIAL SETUP

Tools

- Tool kit, general mechanic's: equipment maintenance and repair
- Shop equipment, general purpose repair: semi-trailer mounted
- Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted

Materials/Parts

- Solvent, drycleaning (item 54, appendix E)
- Preformed packings (8)
- Preformed packings (4)
- Preformed packings (4)
- Back-up rings (4)
- Lockwashers (4)
- Preformed packing (4)
- Retaining ring

Materials/Parts

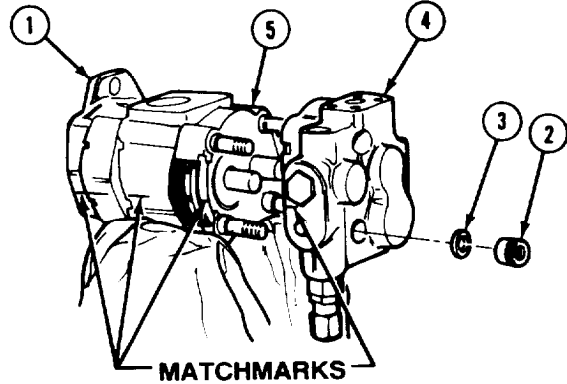
- Adhesive-sealant, silicone (item 1, appendix E)
- Cloth, lint-free (item 12, appendix E)
- Fluid, hydraulic (item 23, appendix E)
- Grease, silicone (item 26, appendix E)

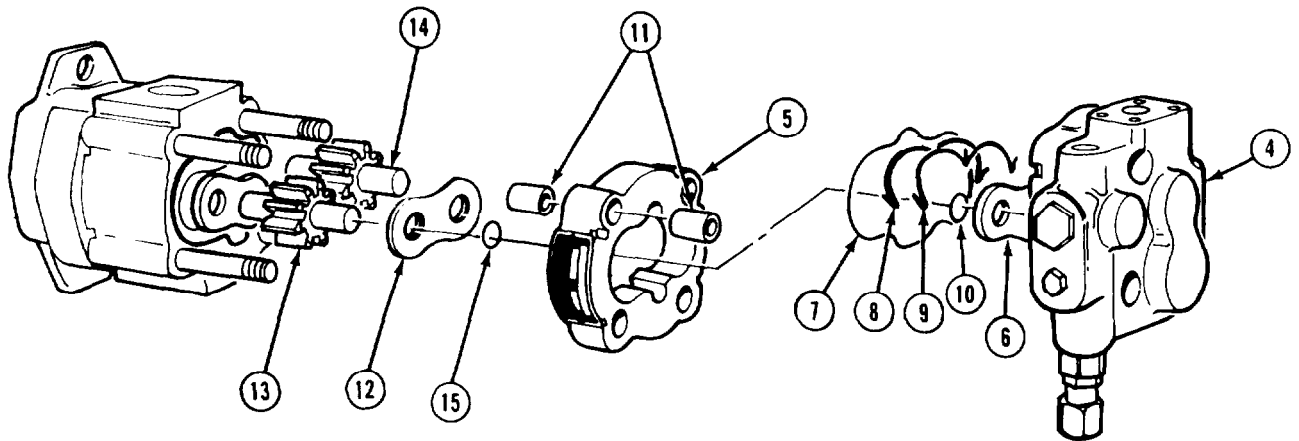
Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 5-81	Hydraulic gear pump assembly removed.

a. Disassembly.

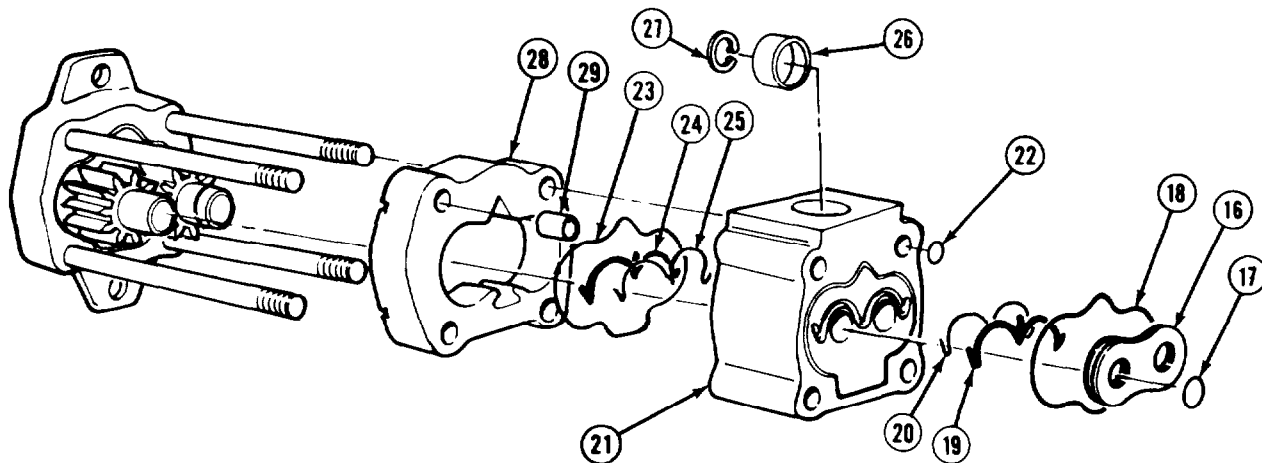
- (1) Matchmark all sections of pump assembly (1).
- (2) Remove four nuts (2), lockwashers (3) and cover plate (4) from rear gear plate (5). Discard lockwashers.



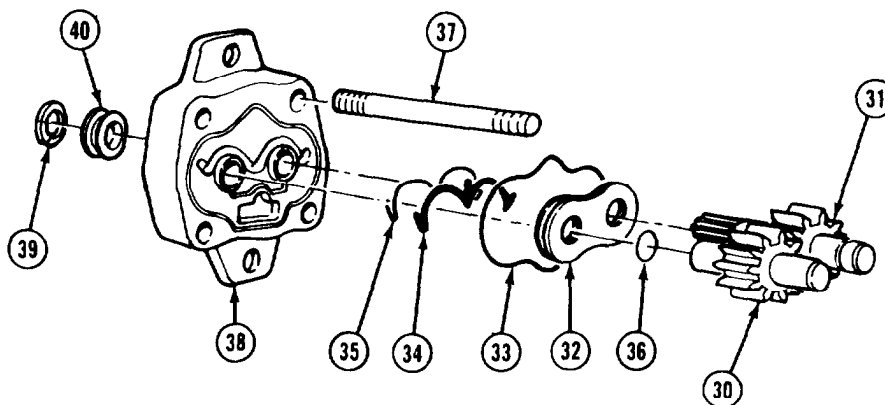


- (3) Remove pressure plate (6), two preformed packings (7 and 8), and retaining ring (9) from cover plate (4). Discard preformed packings and retaining ring.
- (4) Remove and discard two preformed packings (10) from pressure plate (6). Discard preformed packing.
- (5) Remove rear gear plate (5).
- (6) If damaged, remove and discard eight sleeves (11).
- (7) Remove pressure plate (12) from idler gear (13) and drive gear (14).
- (8) Remove and discard two preformed packings (15) from pressure plate (12).
- (9) Remove idler gear (13) and drive gear (14).

5-82. HYDRAULIC GEAR PUMP ASSEMBLY PUMP (CONT).

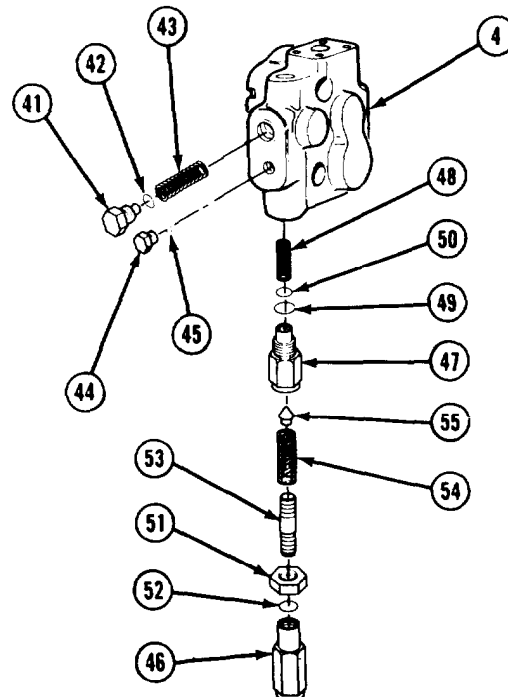


- (10) Remove pressure plate (16).
- (11) Remove and discard two preformed packings (17) from pressure plate (16).
- (12) Remove two preformed packings (18 and 19), and retaining ring (20) from connector plate (21). Discard preformed packings and retaining ring.
- (13) Remove connector plate (21) and four preformed packings (22). Discard preformed packings.
- (14) Remove preformed packings (23 and 24) and retaining ring (25) from front side of connector plate (21). Discard retaining ring and preformed packings.
- (15) Remove shaft coupling (26) from inside connector plate (21).
- (16) If necessary, remove retaining ring (27) from shaft coupling (26).
- (17) Remove front gear plate (28).
- (18) If necessary, remove and discard eight sleeves (29).



- (19) Remove idler gear (30), drive gear (31), pressure plate (32), two preformed packings (33 and 34), and retaining ring (35). Discard preformed packings and retaining ring.
- (20) Remove and discard two preformed packings (36) from pressure plate (32).
- (21) If damaged, remove four studs (37) from flange plate (38).
- (22) Remove retaining ring (39) and shaft seal (40). Discard shaft seal.

- (23) Remove plug (41) preformed packing (42) and spring (43) from cover plate (4). Discard preformed packing.
- (24) Remove plug (44) and preformed packing (45). Discard preformed packing.
- (25) Remove cap (46), plug (47), spring (48) and two preformed packings (49 and 50). Discard preformed packings.
- (26) Remove locknut (51), preformed packing (52), setscrew (53), spring (54), and cone (55) from plug (47). Discard preformed packing.



5-82. HYDRAULIC GEAR PUMP ASSEMBLY PUMP (CONT).

b. Cleaning/Inspection.

WARNING

- 1 Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - 1 If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all parts in drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

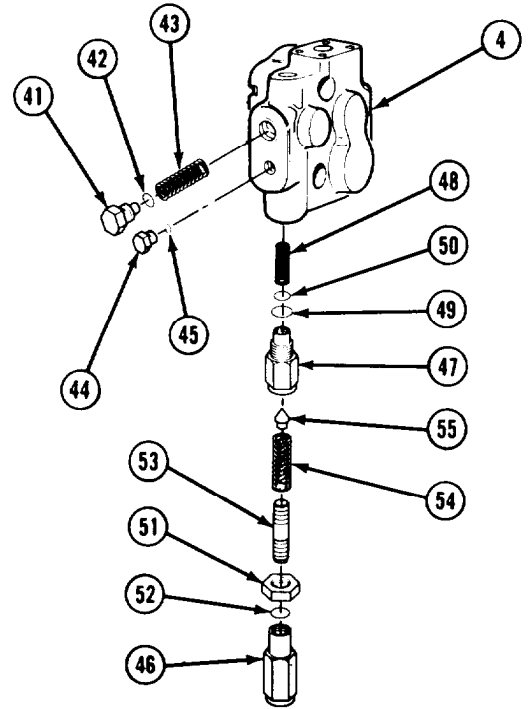
- (2) Dry parts with lint-free cloth or compressed air.
- (3) Check gear teeth for pitting, cracks, and excessive wear.
- (4) Check gear shaft, journals, and face for excessive wear.
- (5) Check pressure plates, on the bronze side, for visible wear marks.
- (6) Check bores in gear plate. Discharge side should have milled groove in the center of gear plate. Metal is sometimes pulled out of surface. This is not critical to operation of pump. Grooves must not exceed 0.015 in. (0.3810 mm).
- (7) Replace damaged parts.

d. Assembly.

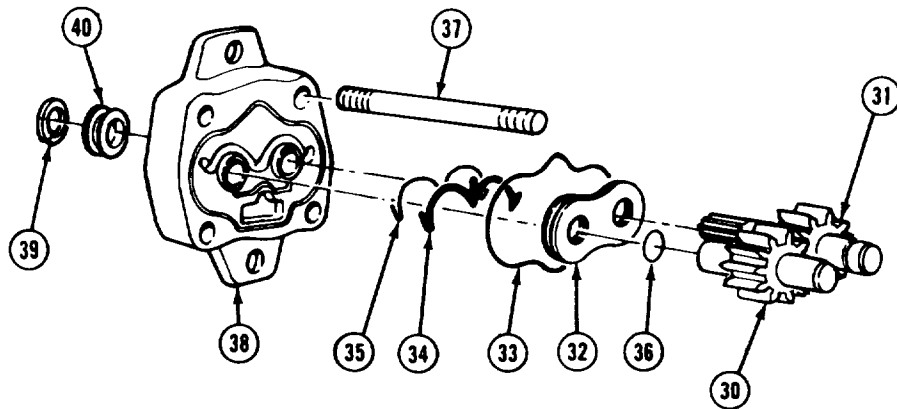
NOTE

Lubricate all preformed packings and retaining rings with hydraulic fluid prior to assembly.

- (1) Install cone (55), spring (54), screw (53), locknut (51) and preformed packing (52) in plug (47).
- (2) Install spring (48), two preformed packings (50 and 49), and plug (47) in gear plate (4).
- (3) Install cap (46).
- (4) Install preformed packing (45) and plug (44).
- (5) Install spring (43) preformed packing (42), and plug (41).



5-82. HYDRAULIC GEAR PUMP ASSEMBLY PUMP (CONT).



WARNING

Adhesive-sealant causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

- (6) Apply silicone adhesive-sealant to shaft seal (40).

CAUTION

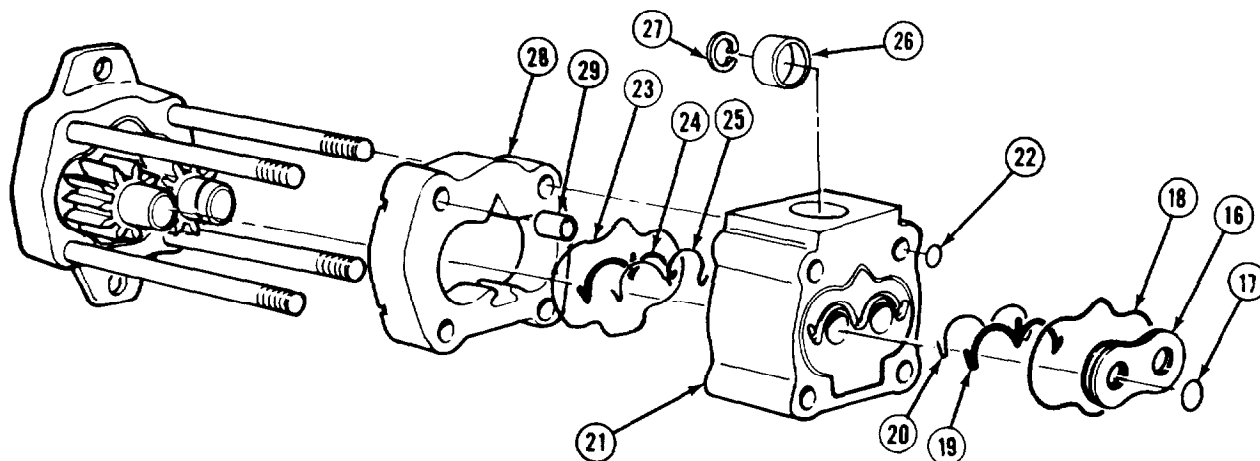
Bottom of seals metal casing must face out from flange plate. Incorrect installation will result in contamination of hydraulic fluid and damage to hydraulic components.

- (7) Install shaft seal (40) and retaining ring (39).
- (8) If removed, install four studs (37) in flange plate (38).
- (9) Install two preformed packings (36) in pressure plate (32).

NOTE

Pressure plate grooves must face gears.

- (10) Install retaining ring (35), two preformed packings (33 and 34) and pressure plate (32).
- (11) Apply grease to splined shaft of drive gear (31) and install in flange plate (38).
- (12) Install idler gear (30) in flange plate (38).



- (13) If removed, install eight sleeves (29) in front gear plate (28).
- (14) Align matchmarks and install front gear plate (28).
- (15) If removed, install retaining ring (27) in shaft coupling (26).
- (16) Install two preformed packings (17) in two pressure plates (16).
- (17) Install retaining ring (25), two preformed packings (24 and 23) on connector plate (21).
- (18) Install retaining ring (20), two preformed packings (19 and 18) on connector plate (21).

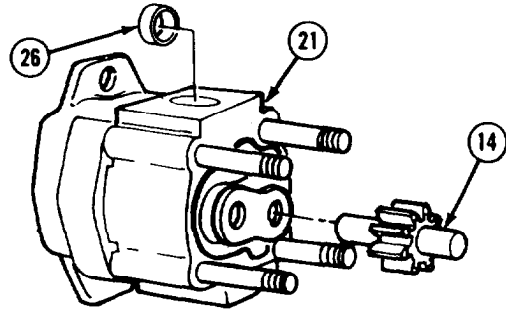
CAUTION

Hole at top of bearing plate extends only part way. This side must face front gear plate or damage may result to pump.

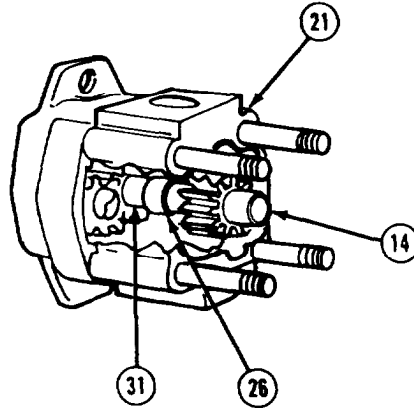
- (19) Align matchmarks and install connector plate (21) loosely.
- (20) Install two preformed packings (17) in pressure plate (16).
- (21) Install pressure plate (16) on connector plate (21).

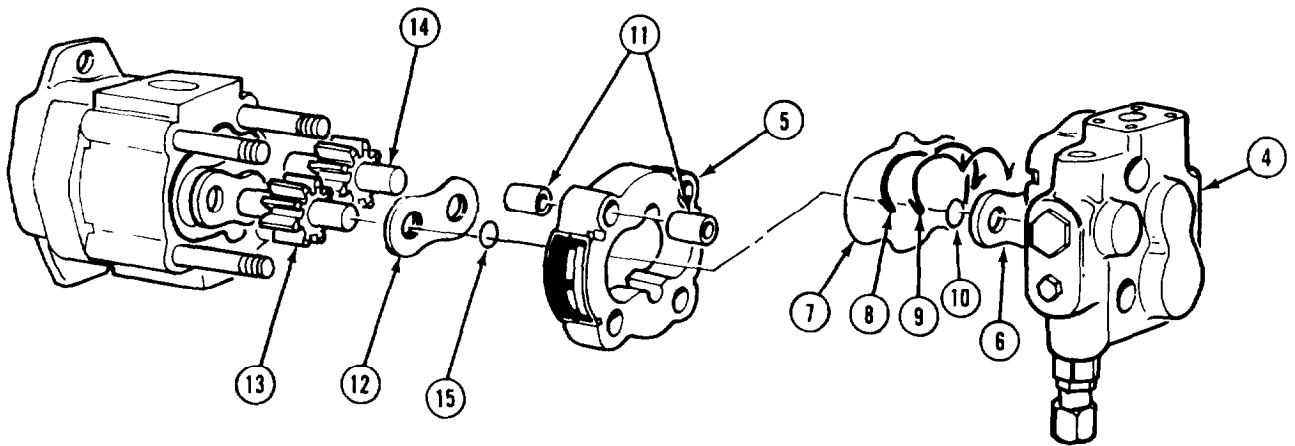
5-82. HYDRAULIC GEAR PUMP ASSEMBLY PUMP (CONT).

- (22) Install coupling (26) and drive gear (14) in connector plate (21).



- (23) Make sure that coupling (26) connects drive gear (31) and drive gear (14) in connector plate (21).

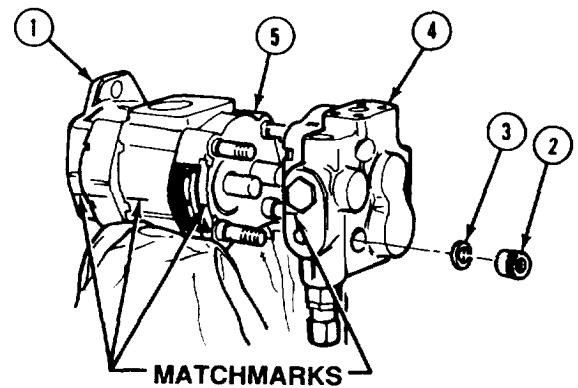




CAUTION

If new gear plate is used, dowels must be installed or damaged will result to pump.

- (24) Install idler gear (13).
- (25) Install two preformed packings (15) in pressure plate (12).
- (26) Install pressure plate (12) on gears (13 and 14).
- (27) If removed, install eight sleeves (11) in rear gear plate (5).
- (28) Align matchmarks and install rear gear plate (4) and pressure plate (5).
- (29) Install retaining ring (9) and two preformed packings (7 and 8) in cover plate (4).
- (30) Install cover plate (4) against rear gear plate (5) with four lockwashers (2) and nuts (3) on pump assembly (1). Tighten nuts.



NOTE

Follow-on Maintenance: Install hydraulic gear pump assembly (para 5-81).

END OF TASK

5-83. VALVE BANK ASSEMBLY REPLACEMENT.

This task covers:

a. Removal

b. Installation

c. Testing

INITIAL SETUP

Test Equipment

Pressure gauge

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted

Suitable container (capacity 1 gal. [3.9 liters])

Materials/Parts

Sealant, hydraulic (item 52, appendix E)
 Tags, identification (item 55, appendix E)
 Caps, plastic (8) (item 8, appendix E)
 Lockwashers (3)
 Cotter pins (9)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-139	Valve bank assembly levers and linkage removed.
Para 4-138	Flow control valve assembly removed.

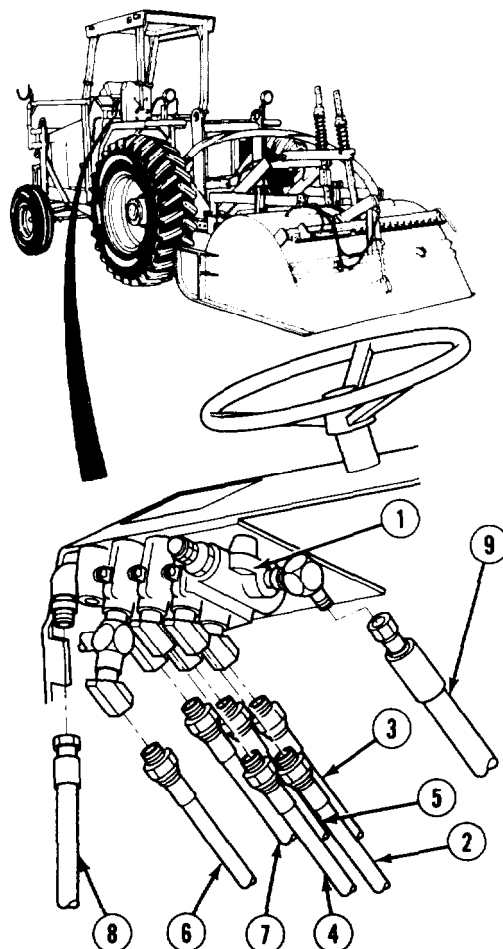
a. *Removal.***WARNING**

Hydraulic fluid is very slippery and can cause falls. To avoid injury, wipe up fluid with rags.

- (1) Place a suitable container with a 1 gal. (3.9 liters) capacity under the valve bank (1) to catch spilling fluid.

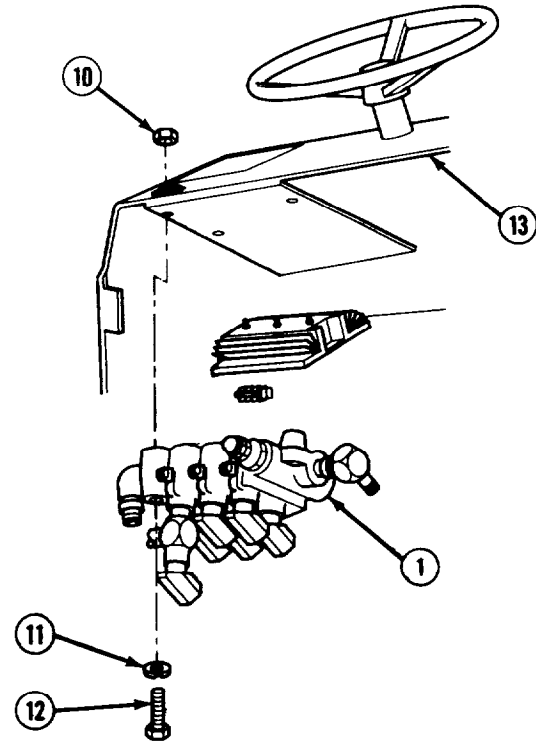
NOTE

- Tag and mark hoses before disconnecting.
 - Cap all hoses after removal.
- (2) Tag, mark, and disconnect four hydraulic hoses (2,3,4, and 5).
 - (3) Tag, mark, and disconnect two hydraulic hoses (6 and 7).
 - (4) Tag, mark, and disconnect two hydraulic hoses (8 and 9).



5-83. VALVE BANK ASSEMBLY REPLACEMENT (CONT).

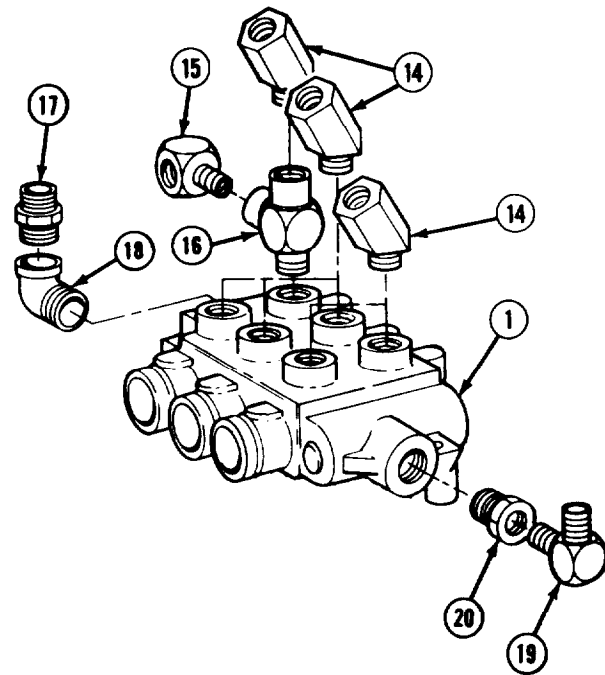
- (5) Remove two nuts (10), three lockwashers (11), screws (12), and valve bank (1) from dash (13). Discard lockwashers.



NOTE

Note position of fittings before removal for proper installation.

- (6) Place bank valve (1) in vise and remove six elbows (14) from valve bank (1). Cap ports to prevent contamination.
- (7) Remove elbow (15) and tee (16) from valve bank (1). Cap port.
- (8) Remove nipple (17) and elbow (18) from valve bank (1).
- (9) Remove elbow (19) and adaptor (20) from valve bank (1).



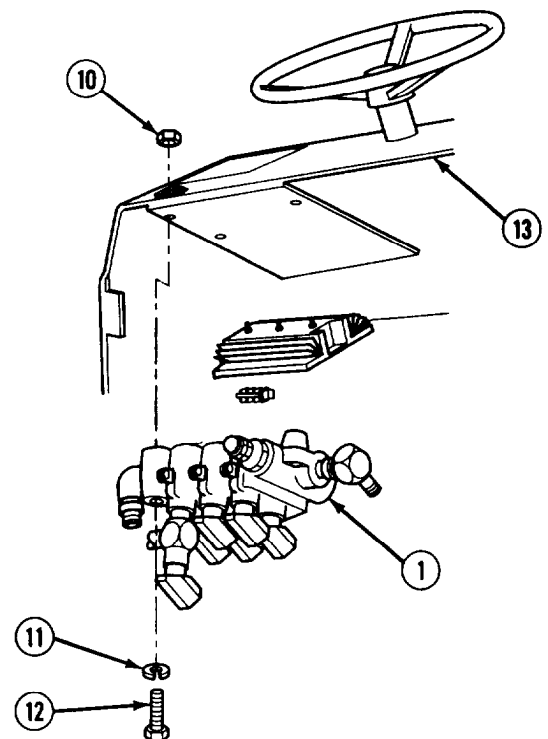
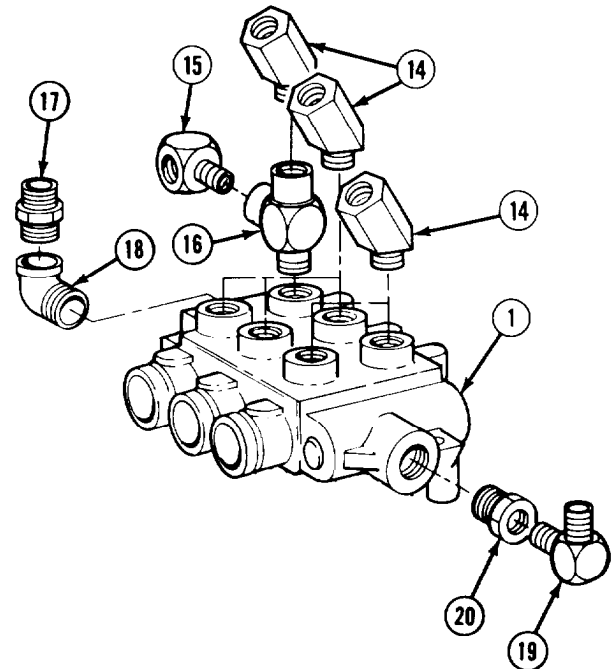
b. Installation.

Sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

NOTE

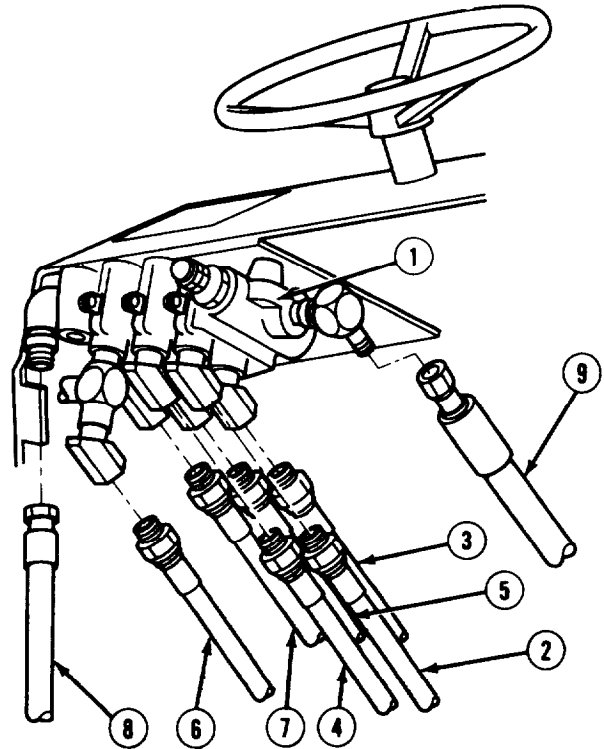
All non-tapered hydraulic fittings require a coating of hydraulic sealant on threads when assembling.

- (1) Install adaptor (20) and elbow (19) on valve bank (1).
- (2) Install elbow (18) and nipple (17).
- (3) Install tee (16) and elbow (15).
- (4) Install six elbows (14).
- (5) Install valve bank (1) in dash (13) with three screws (12), lockwashers (11), and two nuts (10).



5-83. VALVE BANK ASSEMBLY REPLACEMENT (CONT).

- (6) Connect two hydraulic hoses (8 and 9) to valve bank (1).
- (7) Connect two hydraulic hoses (6 and 7) to valve bank (1).
- (8) Connect four hydraulic hoses (2,3,4, and 5) to valve bank (1).



NOTE

Follow-on Maintenance:

- Install flow control bank assembly (para 4-138).
- Install valve bank assembly control levers and linkage (para 4-139).

END OF TASK

5-84. VALVE BANK ASSEMBLY REPAIR.

This task covers:

- | | | |
|----------------|------------------------|-------------|
| a. Disassembly | b. Cleaning/Inspection | c. Assembly |
|----------------|------------------------|-------------|

INITIAL SETUP

Tools

- Tool kit, general mechanic's: equipment maintenance and repair
- Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted
- Wrench, torque

Materials/Parts

- Lockwasher (3)
- Preformed packings (4)
- Seals (7)
- Fluid, hydraulic (item 23, appendix E)
- Solvent, drycleaning (item 54, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 5-83	Valve bank assembly removed.

a. Disassembly.

NOTE

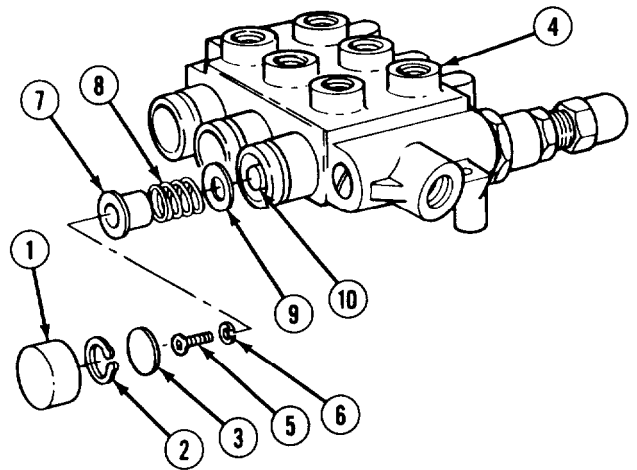
Remove and repair one spool assembly at a time to ensure that spools do not become mismatched to an incorrect bore.

- (1) Remove rubber boot (1).
- (2) Remove snap ring (2) and stop disc (3) from valve body (4).



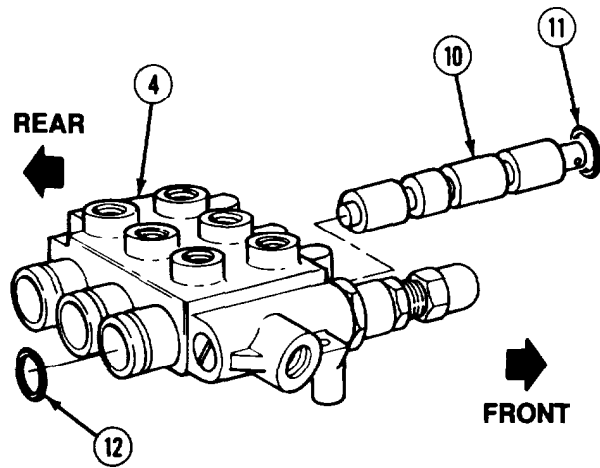
When removing spool assemblies, be careful not to scratch or damage the spool or the bore. If damaged, the entire valve assembly must be replaced.

- (3) Remove spring assembly screw (5), lockwasher (6), stop collar (7), centering spring (8), and stop washer (9) from spool (10). Discard lockwasher.

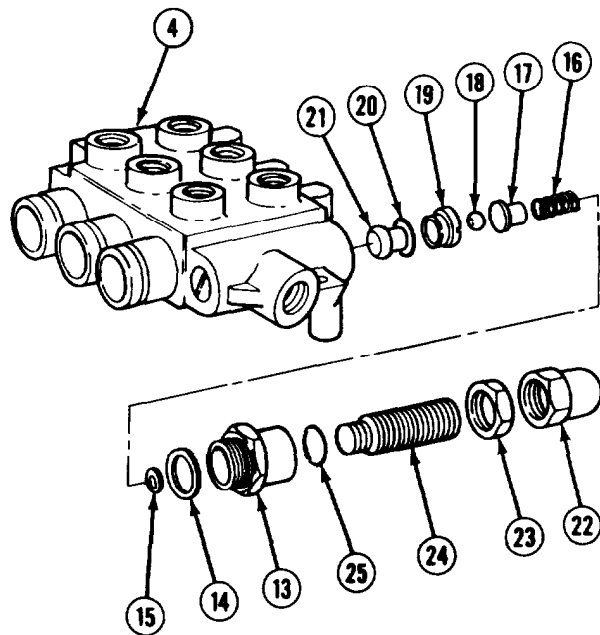


5-84. VALVE BANK ASSEMBLY REPAIR (CONT).

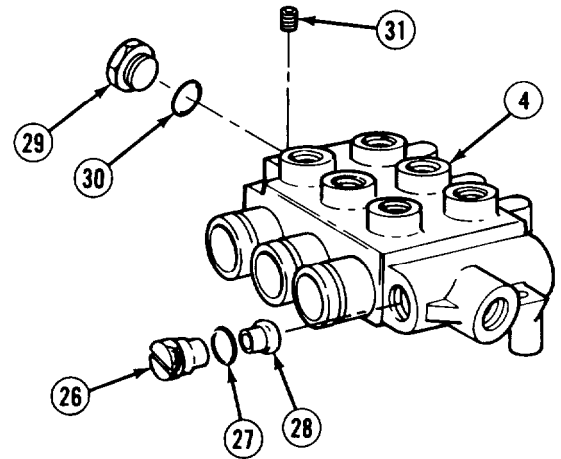
- (4) Push spool (10) toward rear of valve body (4), until front seal (11) is exposed. Carefully remove and discard front seal.
- (5) Push spool (10) toward the front of the valve body (4), until rear seal (12) is exposed. Carefully remove and discard rear seal.
- (6) Remove spool (10) from the front of the valve body (4).
- (7) Repeat steps (1) thru (6) for other two spool assemblies.



- (8) Remove relief body (13), preformed packing (14), washer (15), and relief spring (16) from valve body (4). Discard preformed packing.
- (9) Carefully tip valve body (4) and remove spring spacer (17) and relief ball (18).
- (10) Relief valve seat (19), preformed packing (20), and check poppet (21). Discard preformed packing.
- (11) Remove two nuts (22 and 23), adjusting screw (24) and preformed packing (25) from relief body (13). Discard preformed packing.



- (12) Remove check plug (26), preformed packing (27), and check poppet (28) from valve body (4). Discard preformed packing.
- (13) Remove cap (29) and seal (30) from valve body (4).
- (14) If damaged, remove plug (31).



b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning.
 - (2) Thoroughly clean seal grooves in valve body.

WARNING

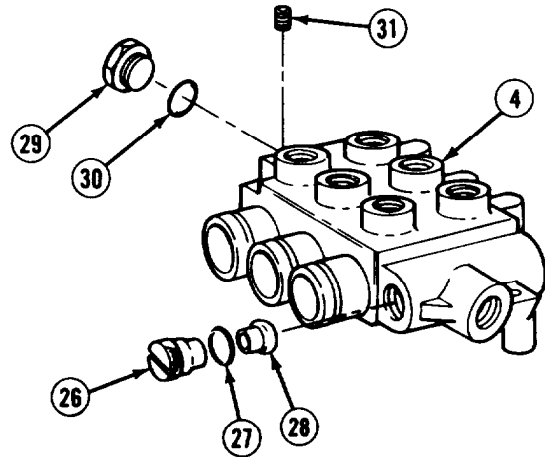
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shields, gloves, etc.).

- (3) Use compressed air to dry valve body, spools, and fittings.
- (4) Check spools for scratches or damage.
- (5) Check bores for scratches or damage.
- (6) Check valve body for cracks or damage.
- (7) Check all threads for peeled or crossed condition.
- (8) Replace damaged parts.
- (9) Lubricate spools with hydraulic fluid prior to installation.

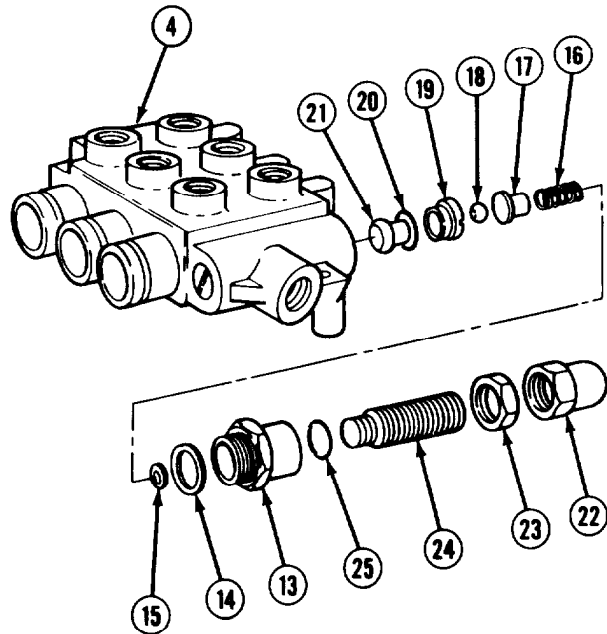
5-84. VALVE BANK ASSEMBLY REPAIR (CONT).

c. Assembly.

- (1) If removed, install plug (31) in valve body (4).
- (2) Install seal (30) and cap (29).
- (3) Install check poppet (28), preformed packing (27), and check plug (26).



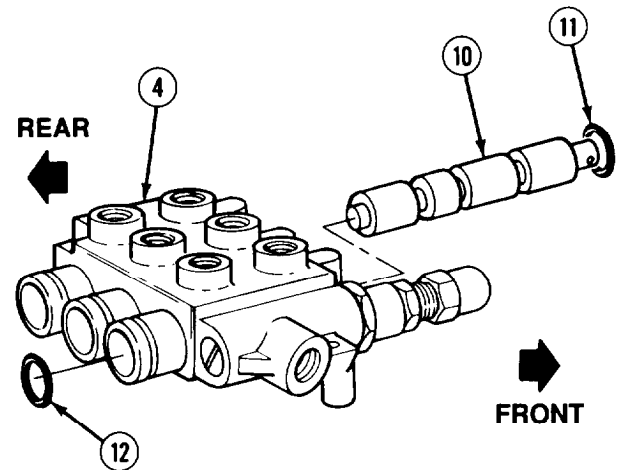
- (4) Install preformed packing (25), adjusting screw (24) and two nuts (23 and 22) on relief body (13).
- (5) Install check poppet (21) preformed packing (20), relief valve seat (19) relief ball (18) spring spacer (17), and relief spring (16) in valve body (4).
- (6) Install washer (15) preformed packing (14) and relief body (13).



CAUTION

When installing spool assemblies, be careful not to scratch or damage spool or bore. If damaged, entire valve assembly must be replaced.

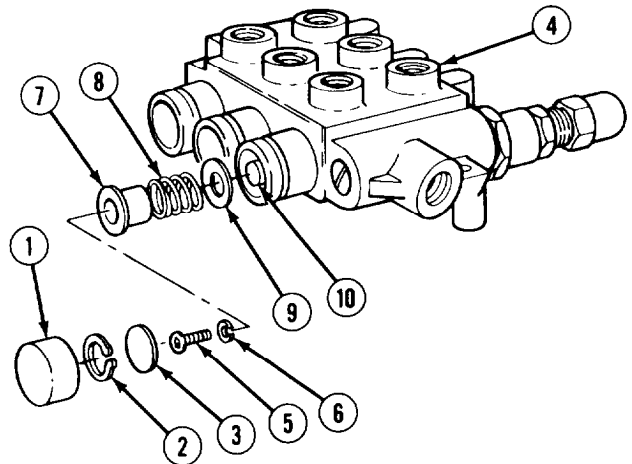
- (7) Install spool (10) in valve body (4) through the front.
- (8) Push spool (10) toward rear of valve body (4) until groove for front seal (11) is exposed. Install front seal and ensure front seal has seated without becoming twisted.



CAUTION

Do not push spool too far toward front of valve body or damage to front seal may result.

- (9) Push spool (10) toward front of valve body (4) until groove for rear seal (12) is exposed. Install rear seal. Make certain it has seated and without becoming twisted.
- (10) Push spool (10) back toward rear of valve body (4) with a twisting motion, until 1/4 in. (6 mm) of spool shank remains exposed at front of valve body.
- (11) Install stop washer (9), centering spring (8), stop collar (7), lockwasher (6), and spring assembly screw (5). Tighten screw to 98 lb-in (11 N•m).
- (12) Install stop disc (3), snap ring (2) and rubber boot (1) on valve body (4).
- (13) Repeat procedures (7) thru (12) for remaining two spool assemblies.



NOTE

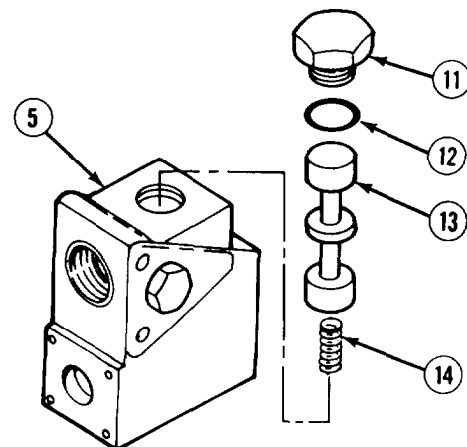
Follow-on maintenance: Install valve bank assembly (para 5-83).

END OF TASK

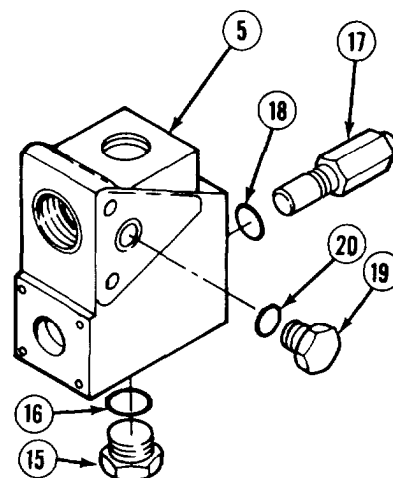
WARNING

Compensator spool is under spring pressure. Care should be taken when removing. Spring could cause eye damage to personnel.

- (5) Remove port plug (11), preformed packing (12), compensator spool (13), and spring (14) from valve body (5). Discard preformed packings.



- (6) Remove port plug (15) and preformed packing (16) from valve body (5). Discard preformed packing.
- (7) Remove relief valve assembly (17) and preformed packing (18). Discard preformed packing.
- (8) Remove plug (19) and preformed packing (20). Discard preformed packing.

**b. Cleaning/Inspection.****WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes and do not breathe vapors. Keep away from heat of flame. Never smoke when using solvent; the flash point for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

5-85. FLOW CONTROL VALVE REPAIR (CONT).

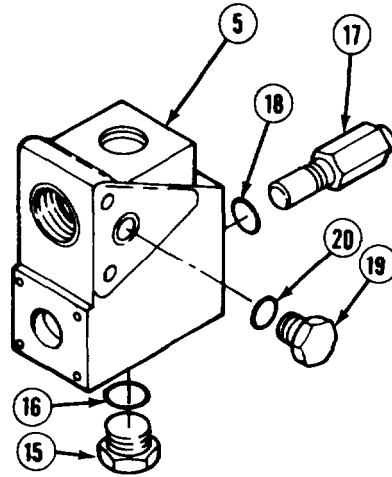
WARNING

Compressed air is used for cleaning purposes and will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles, gloves, etc.).

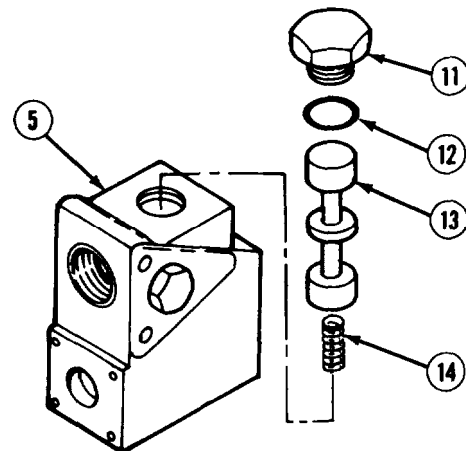
- (2) Dry all parts with compressed air.
- (3) Check parts for damage.
- (4) Replace damaged parts.

c. Assembly.

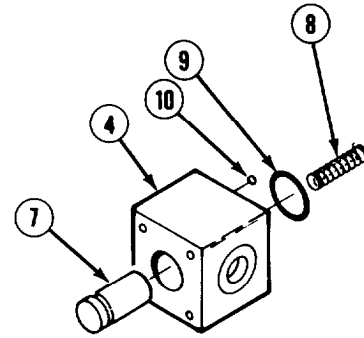
- (1) Install preformed packing (20) and plug (19) in valve body (5).
- (2) Install preformed packing (18) and relief valve assembly (17).
- (3) Install preformed packing (16) and port Plug (15).



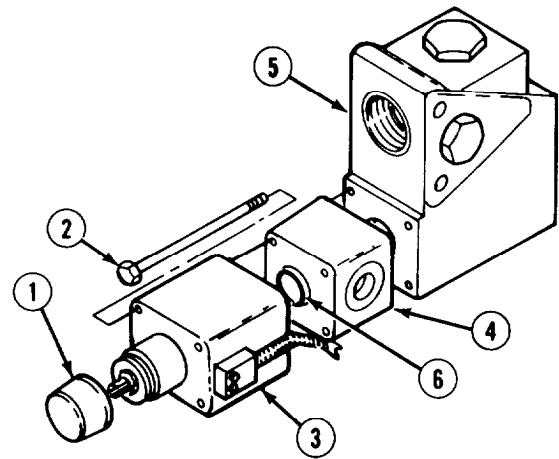
- (4) Install spring (14), compensator spool (13), preformed packing (12), and port plug (11) in valve body (5).



- (5) Install four preformed packings (9 and 10), servo spring (8), and servo spool (7) in valve body (5).



- (6) Install preformed packing (6) on solenoid (3).
- (7) Install servo housing (4) and solenoid (3) with four screws (2) on valve body (5).
- (8) Install rubber boot (1).



NOTE

Follow-on Maintenance: Install flow control valve (para 4-138).

END OF TASK

5-86. BOOM HOIST CYLINDER REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Tool outfit, hydraulic system: test and repair, 3/4 ton, trailer mounted

Wrench, torque

Suitable container (capacity 1 gal. [3.9 liters])

Material/Parts

Cloth, abrasive crocus (item 11, appendix E)

Fluid, hydraulic (item 23, appendix E)

Materials/Parts

Sealant, hydraulic (item 52, appendix E)

Solvent, drycleaning (item 54, appendix E)

Packing, preformed (3)

Ring, wear

Seal, crown

Ring, retaining

Ring, back-up (2)

Wiper, rod

Equipment Condition

TM or Para

Para 4- 145

Condition Description

Boom hoist cylinder removed.

a. Disassembly.



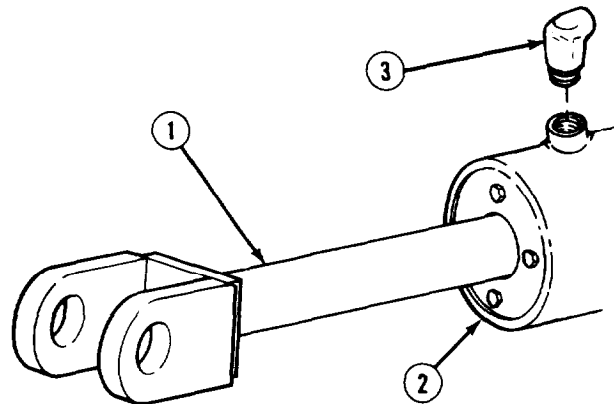
Spilled hydraulic fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

- (1) Extend piston rod (1) from cylinder body (2).

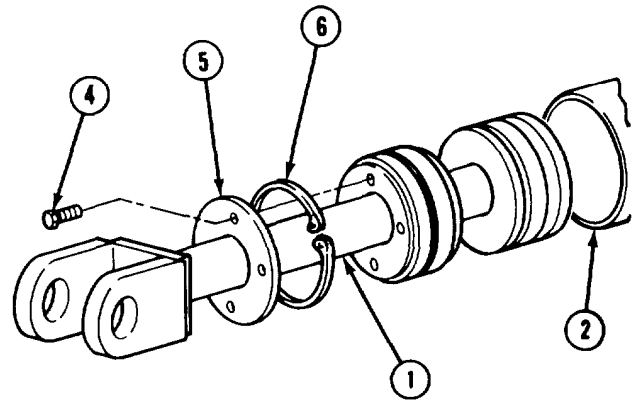
NOTE

Observe position of elbows, prior to removal, to aid installation.

- (2) Remove two elbows (3) from cylinder body (2).
 (3) Turn ports down and allow hydraulic fluid to drain into suitable container with a 1 gallon (3.9 liters) capacity..



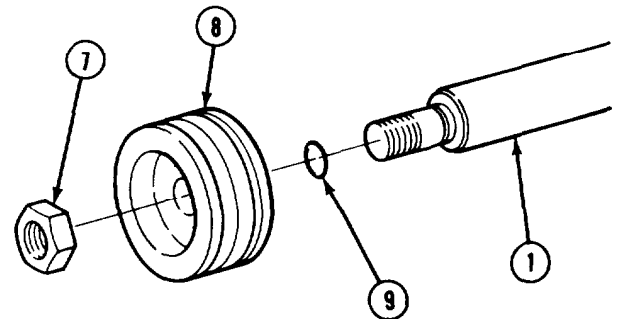
- (4) Remove four screws (4) and slide retaining plate (5) away from cylinder body (2).
- (5) Slide internal retaining ring (6) away from cylinder body (2).
- (6) Remove piston rod (1) and assembled parts from cylinder body (2).



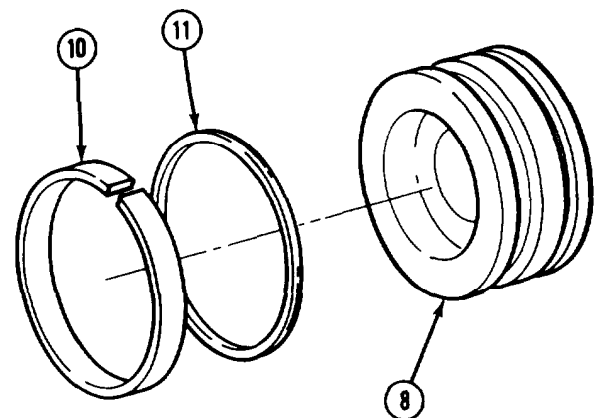
NOTE

Do not discard locknut unless damaged.

- (7) Remove locknut (7) and piston (8) from piston rod (1).
- (8) Remove and discard preformed packing (9) from piston rod (1).

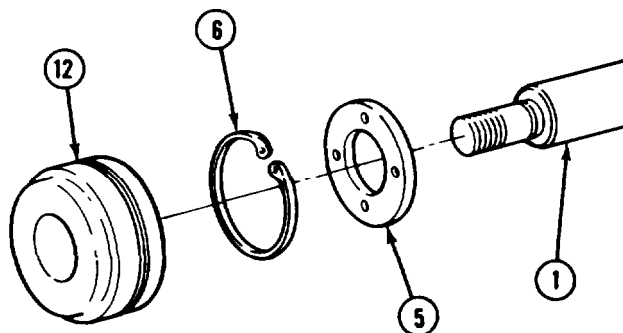


- (9) Remove and discard wear ring (10) and crown seal (11) from piston (8).



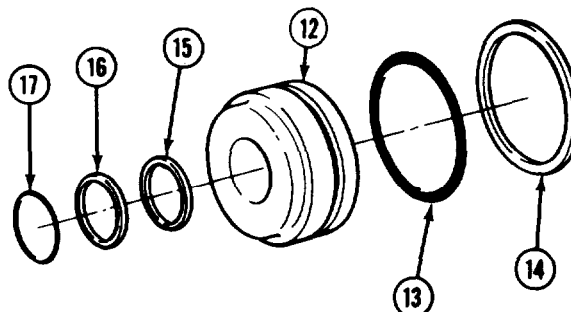
5-86. BOOM HOIST CYLINDER REPAIR (CONT).

- (10) Remove piston rod guide (12), internal retaining ring (6), and retainer plate (5) from piston rod (1). Discard internal retaining ring.



- (11) Remove and discard preformed packing (13) and back-up ring (14) from piston rod guide (12).

- (12) Remove and discard rod wiper (15), back-up ring (16), and preformed packing (17) from piston rod guide (12).



b. Cleaning/Inspection.

WARNING

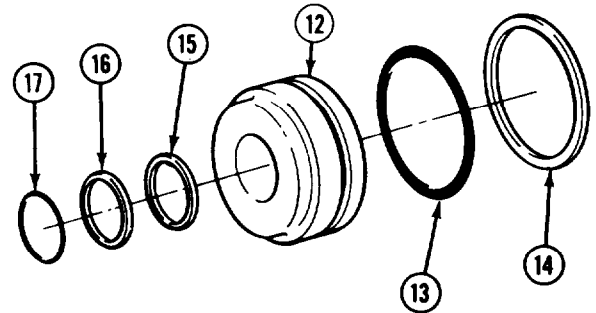
- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

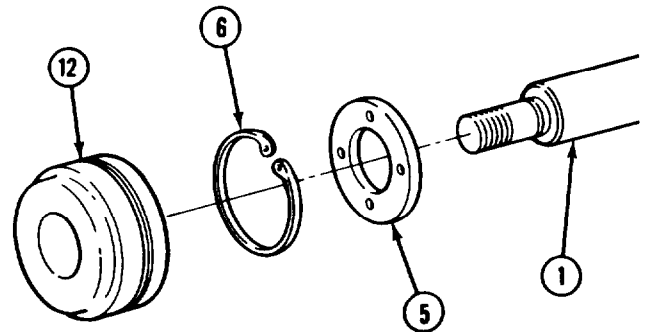
- (2) Check cylinder body for grooves on inside wall.
- (3) Check piston rod guide and piston for nicks and gouges.
- (4) Check piston rod threads for nicks and burrs.
- (5) Remove nicks and burrs with crocus cloth. Clean up threads as necessary.
- (6) Replace piston rod if scored, pitted, bent, or damaged.

c. Assembly.

- (1) Install preformed packing (17), back-up ring (16), and rod wiper (15) in piston rod guide (12).
- (2) Install back-up ring (14) and preformed packing (13) on piston rod guide (12).

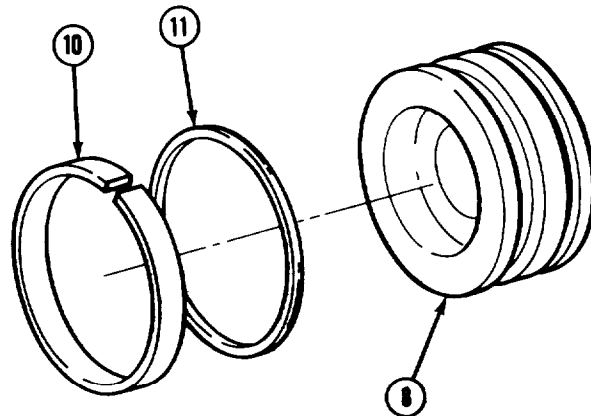


- (3) Install retaining plate (5), retaining ring (6), and piston rod guide (12) on piston rod (1).



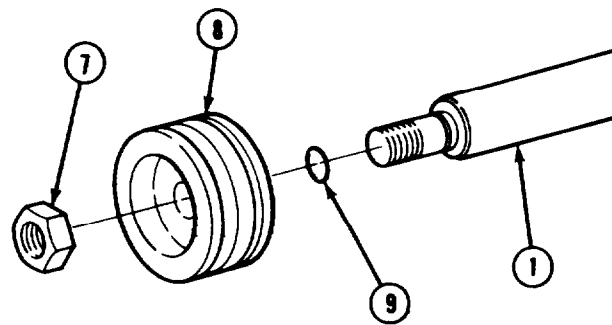
5-86. BOOM HOIST CYLINDER REPAIR (CONT).

- (4) Install crown seal (11) and wear ring (10) on piston (8).



- (5) Install preformed packing (9) on piston rod (1).

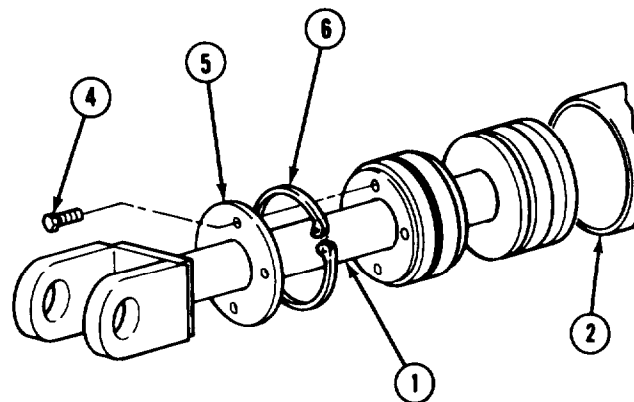
- (6) Install piston (8) and locknut (7) on piston rod (1). Tighten locknut 450 to 500 lb-ft (610 - 678 N•m).



- (7) Lubricate piston rod (1), assembled parts, and inside of cylinder body (2) with hydraulic fluid.

- (8) Install piston rod (1) and assembled parts in cylinder body (2) with retaining ring (6).

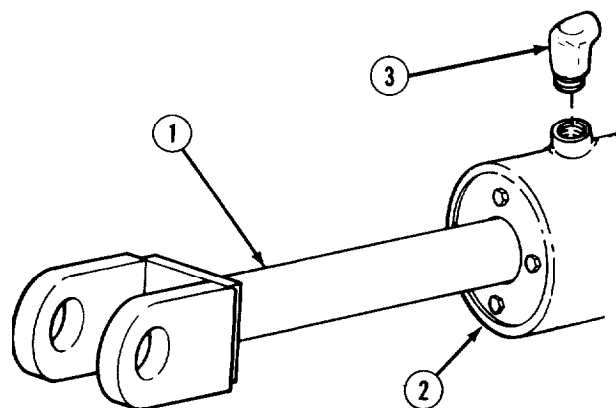
- (9) Install retaining plate (5) with four screws (4). Tighten screws 216 to 240 lb-ft (293 - 325 N•m).



WARNING

Sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.

- (10) Apply hydraulic sealant to threads of two elbows (3). With piston rod (1) extended, install elbows in cylinder body (2).

**NOTE**

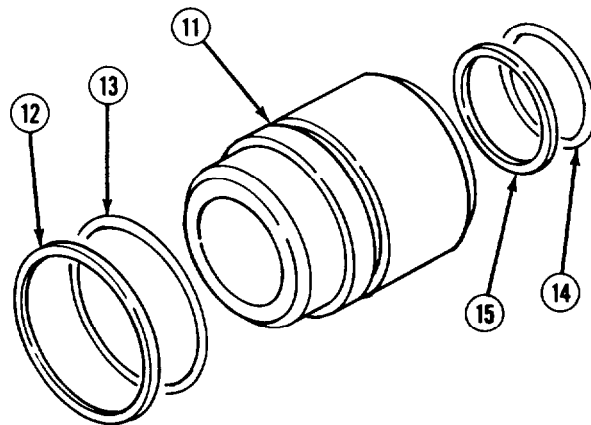
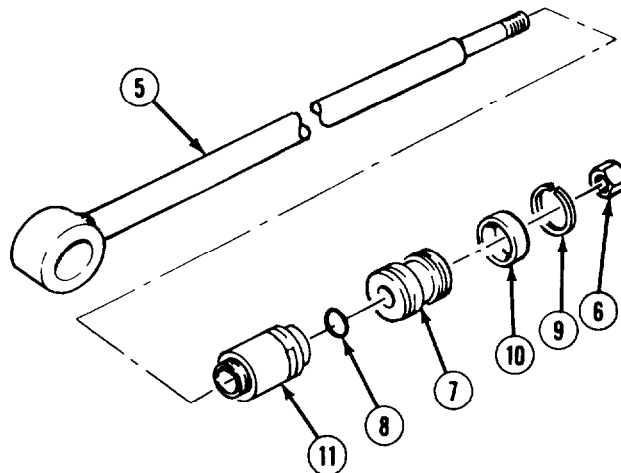
Follow-on Maintenance: Install boom hoist cylinder (para 4-145).

END OF TASK

NOTE

Do not discard locknut unless damaged.

- (4) Remove locknut (6) and piston (7) from piston rod (5). Discard locknut.
- (5) Remove and discard preformed packing (8) from piston rod (5).
- (6) Remove and discard wear ring (9) and crown seal (10) from piston (7).
- (7) Remove rod guide (11) from piston rod (5).
- (8) Remove and discard preformed packing (12) and back-up ring (13) from rod guide (11).
- (9) Remove and discard back-up ring (14) and preformed packing (15) from rod guide (11).

**b. Cleaning/Inspection.****WARNING**

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (1) Clean all metal parts with drycleaning solvent.

5-87. GATE CYLINDER REPAIR (CONT)

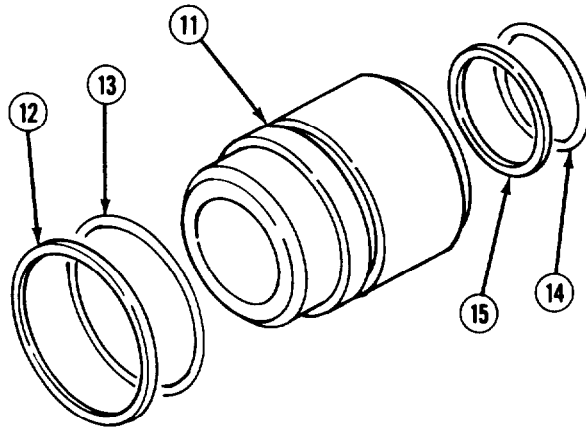
WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

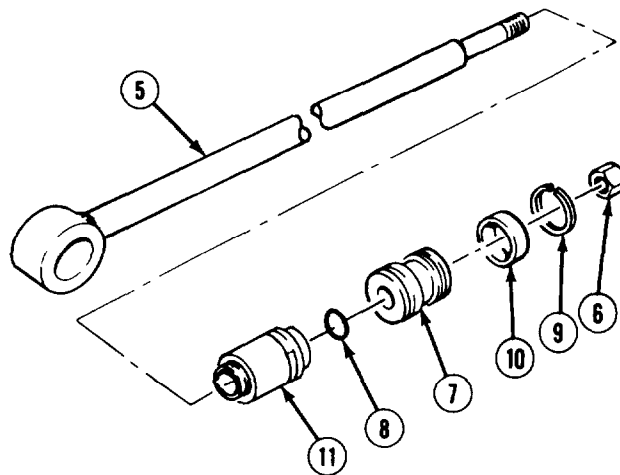
- (2) Dry with compressed air.
- (3) Check cylinder body for grooves on inside wall.
- (4) Check piston rod guide and piston for nicks and gouges.
- (5) Check piston rod threads for nicks and burrs.
- (6) Remove nicks and burrs with crocus cloth. Clean up threads as necessary.
- (7) Replace piston rod if scored, pitted, bent, or damaged.

c. Assembly.

- (1) Install preformed packing (15) and back-up ring (14) in rod guide (11).
- (2) Install back-up ring (13) and preformed packing (12) on rod guide (11).



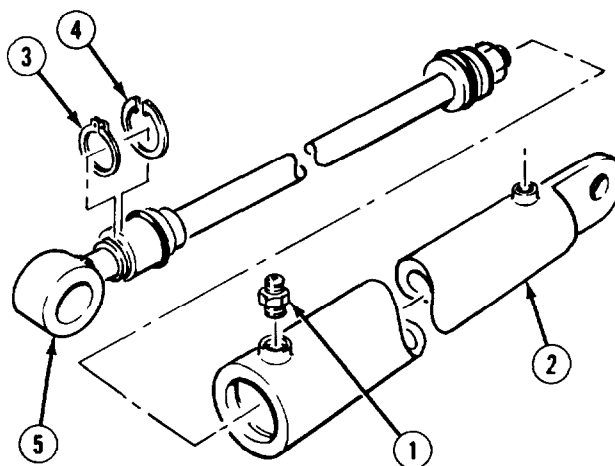
- (3) Install rod guide (11) on piston rod (5).
- (4) Install crown seal (10) and wear ring (9) on piston (7).
- (5) Install preformed packing (8) on piston rod (5).
- (6) Install piston (7) on piston rod (5) with locknut (6).



- (7) Lubricate piston rod (5), assembled parts, and inside of cylinder body (2) with hydraulic fluid.
- (8) Install piston rod (5) and assembled parts in cylinder body (2) with two retaining rings (3 and 4).

WARNING

Sealant can damage your eyes. Wear safety goggles/glasses when using; avoid contact with eyes. If sealant contacts eyes, flush eyes with water and get immediate medical attention.



- (9) Apply hydraulic sealant to threads of two fittings (1) and install fittings in cylinder body (2).

NOTE

Follow-on Maintenance: Install gate cylinder (para 4-146).

END OF TASK

5-88. ADDITIVE SYSTEM PUMP REPAIR.

This task covers:

- a. Disassembly b. Cleaning/Inspection c. Assembly

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Shop equipment, general purpose repair: semi-trailer mounted

Wrench, torque

Suitable container (capacity 5 gal. [19 liters])

Materials/Parts

Packing, preformed

Set, packing

Gaskets (2)

Locknuts (2)

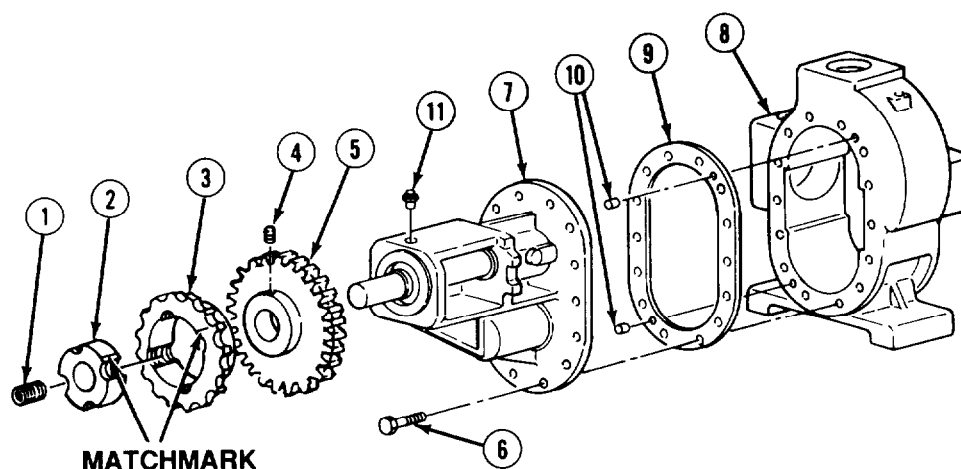
Nut, lock and seal

Cloth, lint-free (item 12, appendix E)

Solvent, drycleaning (item 54, appendix E)

Equipment Condition

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-151	Additive pump assembly removed.
Para 4-154	Additive strainer and connections removed.

a. *Disassembly.*

- (1) Matchmark and remove two setscrews (1) from bushing (2) and coupling (3).
- (2) Install one setscrew (1) in hole matchmarked. Tighten setscrew until coupling (3) is loosened from bushing (2).
- (3) Remove setscrew (1), bushing (2), and coupling (3).
- (4) Loosen setscrew (4) and remove spur gear (5).
- (5) If damaged, remove setscrew (4).

WARNING

Spilled bituminous fluid is slippery. Clean up spilled fluid immediately or injury to personnel may result.

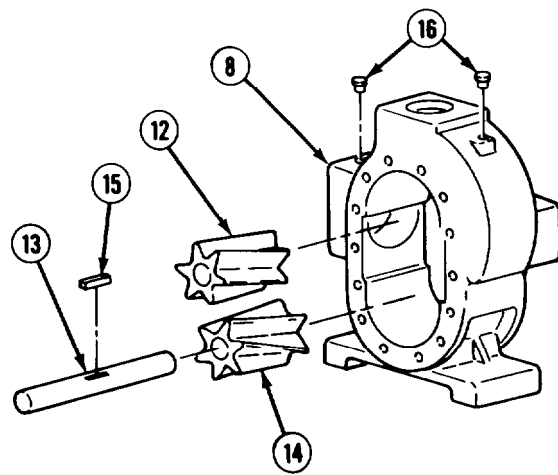
NOTE

Place pump assembly over suitable container, with a 5 gallon (19 liters) capacity, to catch bituminous fluid when backplate is loosened from case.

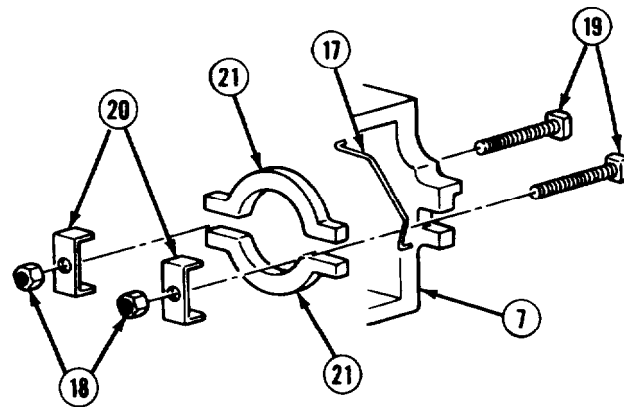
- (6) Remove 14 screws (6) from backplate (7). Loosen backplate from case (8) and allow bituminous fluid to drain into suitable container.
- (7) Remove backplate (7), gasket (9), and two dowel pins (10) from case (8). Discard gasket.
- (8) Remove lubrication fitting (11) from backplate (7).

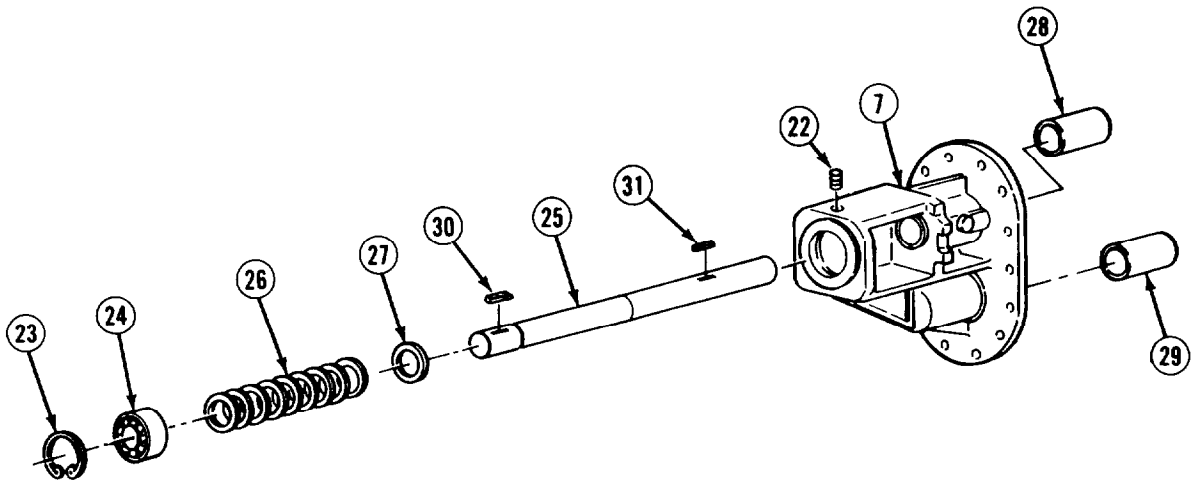
5-88. ADDITIVE SYSTEM PUMP REPAIR (CONT).

- (9) Remove left-hand gear (12), idler shaft (13), and right-hand gear (14) from case (8).
- (10) Remove key (15) from idler shaft (13).
- (11) Remove pipe plugs (16) from case (8).



- (12) Remove spring clip (17) from backplate (7).
- (13) Remove two locknuts (18), square head bolts (19), clips (20), and packing glands (21). Discard locknuts.



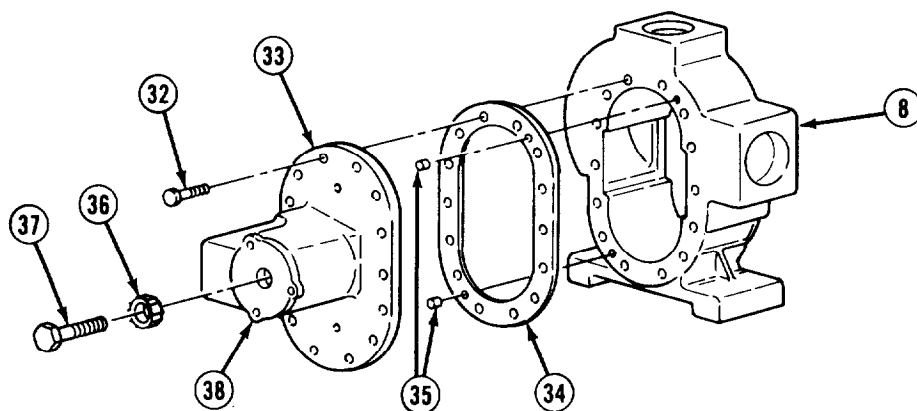


- (14) Loosen two setscrews (22) and remove retaining ring (23), bearing assembly (24), and drive shaft (25) from backplate (7).
- (15) If damaged, remove two setscrews (22) from bearing assembly (24).
- (16) Remove packing set (26) and packing washer (27) from backplate (7). Discarding packing set.

NOTE

Only remove sleeve bearings if necessary/damaged.

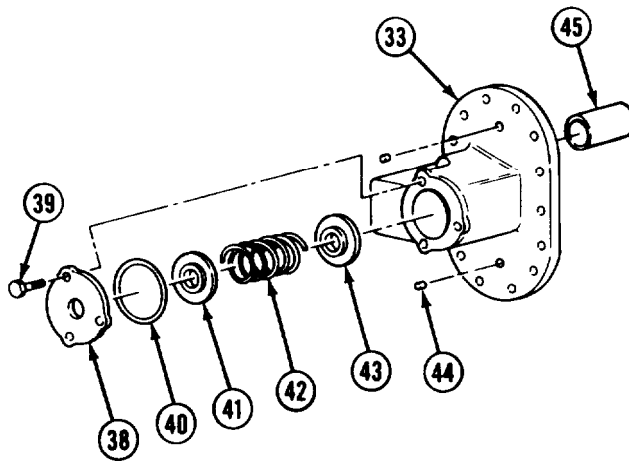
- (17) Remove sleeve bearings (28 and 29) from backplate (7).
- (18) Remove two keys (30 and 31) from drive shaft (25).



- (19) Remove 14 screws (32), faceplate (33), gasket (34), and two dowel pins (35) from case (8). Discard gasket.
- (20) Loosen lock and seal nut (36). Remove adjusting screw (37) and nut from plug cap (38). Discard lock and seal nut.

5-88. ADDITIVE SYSTEM PUMP REPAIR (CONT).

- (21) Remove three screws (39) and plug cap (38) from faceplate (33).
- (22) Remove and discard preformed packing (41) from plug cap (38).
- (23) Remove poppet and guide (41), spring (42), and poppet and guide (43) from faceplate (33).
- (24) Remove two pipe plugs (44) from faceplate (33).



NOTE

Only remove sleeve bearings if necessary/damaged.

- (25) Remove two sleeve bearings (45).

b. Cleaning/Inspection.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

- (1) Clean all metal parts with drycleaning solvent.

WARNING

Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (2) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (3) Allow bearings to air dry.
- (4) Clean sealing surfaces.

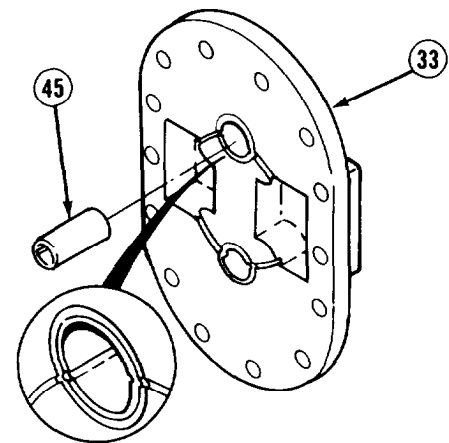
- (5) Check sealing surfaces for nicks, burrs, or other damage.
- (6) Check machined surfaces for damage.
- (7) Check backplate, case, and faceplate for cracks or other damage.
- (8) Check shafts for nicks, burrs, excessive wear, or scoring.
- (9) Check sleeve bearings for scoring, galling, nicks, excessive wear, or any other damage.
- (10) Check threads for peeled or crossed condition.
- (11) Replace damaged parts.

c. Assembly.

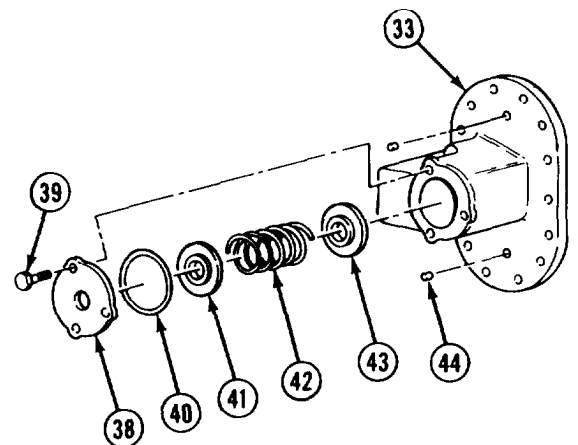
NOTE

- Aline new or existing sleeve bearing oil grooves with oil grooves in faceplate.
- If installing new sleeve bearings, do step (1). If sleeve bearings are not replaced, go to step (2).

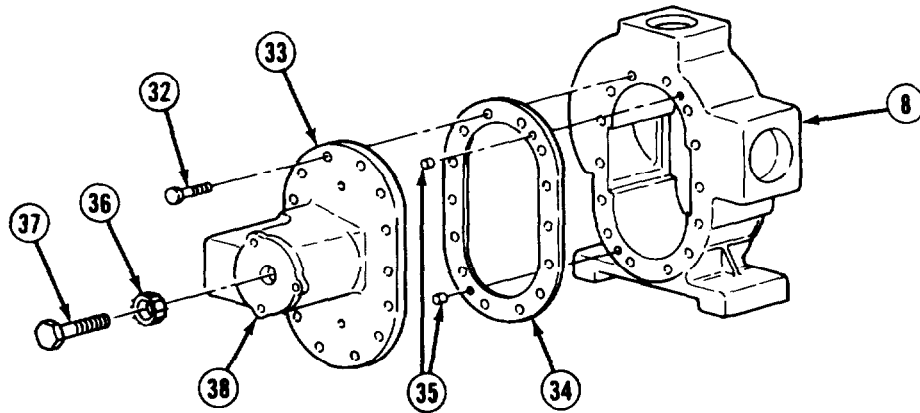
- (1) Install and notch two bearing sleeves (45) to depth of faceplate (33) oil grooves.



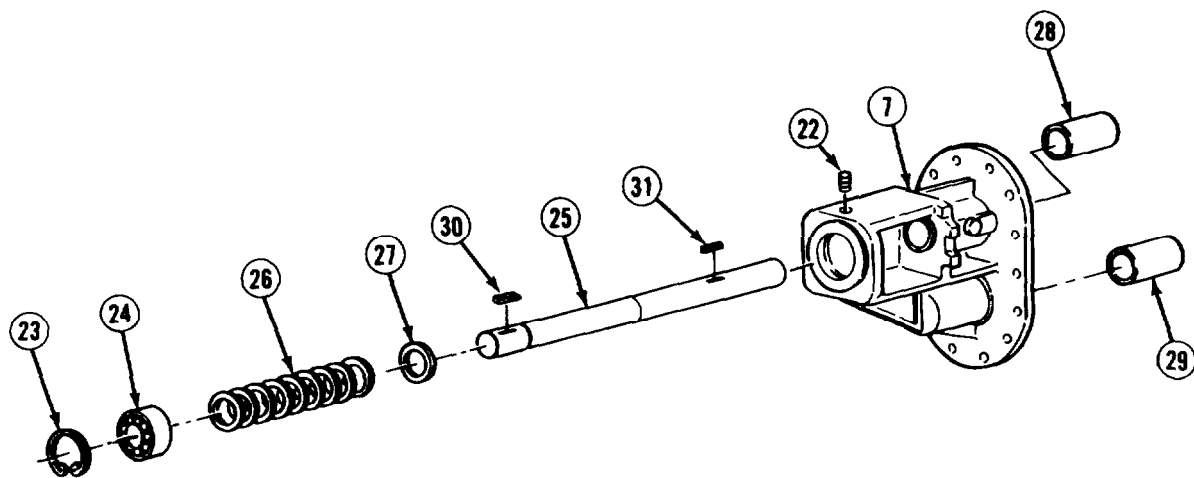
- (3) Install two pipe plugs (44) in faceplate (33).
- (4) Install poppet and guide (43) spring (42), and poppet and guide (41) in faceplate (33).
- (5) Install preformed packing (40) in plug cap (38).
- (6) Install plug cap (38) with three screws (39). Tighten screws 35 lb-ft (47 N •m).



5-88. ADDITIVE SYSTEM PUMP REPAIR (CONT).



- (7) Install lock and seal nut (36) on adjusting screw (37) and install screw in plug and cap (38).
- (8) Turn adjusting screw (37) until 1 5/8 in. (41.28 mm) gap exists between face of plug cap (38) and top of adjusting screw. Tighten lock and seal nut (36).
- (9) Install two dowel pins (35), gasket (34) and faceplate (33) on case (3) with 14 screws (32). Tighten screws 35 lb-ft (47 N•m).



- (10) Install two keys (30 and 31) in drive shaft (25).
- (11) Install sleeve bearings (28 and 29) in backplate (7).
- (12) Install packing washer (27) and packing set (26) in backplate (7).
- (13) Install drive shaft (25) and bearing (24) in backplate (7) with retaining ring (23).
- (14) If removed, install two setscrews (22) in bearing assembly (24).
- (15) Install bearing assembly (24) and retaining ring (23). Tighten two setscrews (22).

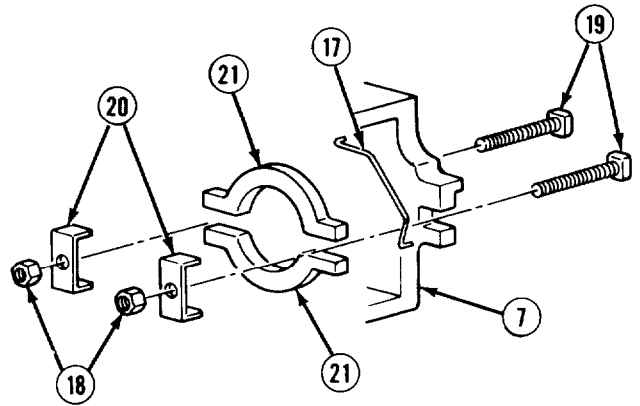
- (16) Install two packing glands (21) and clips (20) with square head bolts (19) and locknuts (18).

NOTE

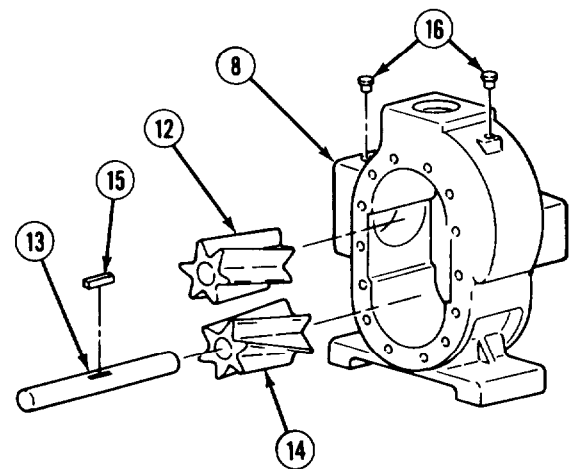
Do not allow packing gland to become cocked during assembly.

- (17) Tighten two locknuts (18) evenly to ensure proper seating of packing gland (21). After seating packing gland, loosen locknuts 1/2 turn.

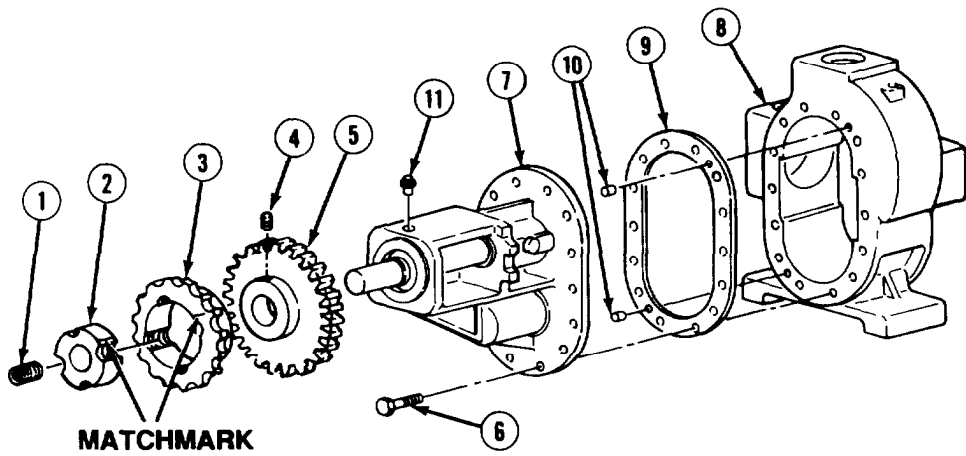
- (18) Install spring clip (17) in backplate (7).



- (19) Install two pipe plugs (16) in case (8).
- (20) Install key (15) in idler shaft (13).
- (21) Install right-hand gear (14), idler shaft (13), and left-hand gear (12) in case (8).



5-88. ADDITIVE SYSTEM PUMP REPAIR (CONT).



- (22) Install lubrication fitting (11) in backplate (7).
- (23) Install two dowel pins (10), gasket (9), and backplate (7) on case (8) with 14 screws (6). Tighten screws 35 lb-ft (47 N •m).
- (24) If removed, install setscrew (4) in spur gear (5).
- (25) Install spur gear (5) and tighten setscrew (4).

NOTE

Do not install setscrew in the hole that is matchmarked.

- (26) Aline matchmarks and install coupling (3), bushing (2), and two setscrews (1).

NOTE

Follow-on Maintenance:

- Install additive strainer and connections removed (para 4-154).
- Install additive pump assembly (para 4-148).

END OF TASK

5-89. PUMP FRAME REPLACEMENT.

This task covers:

- a. Removal b. Installation

INITIAL SETUP

Tools

Tool kit, general mechanic's: equipment maintenance and repair

Personnel Required

MOS62B, Construction equipment repairer (2)

Materials/Parts

Lockwasher (6)

Equipment Condition

TM or Para

Para 4-151

Condition Description

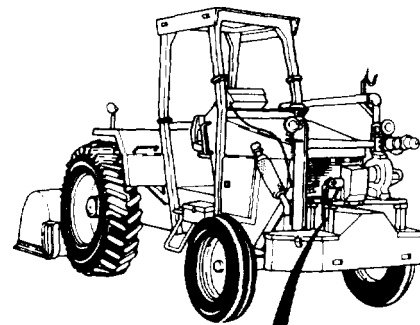
Additive pump assembly removed.

Para 5-80

Additive system motor removed.

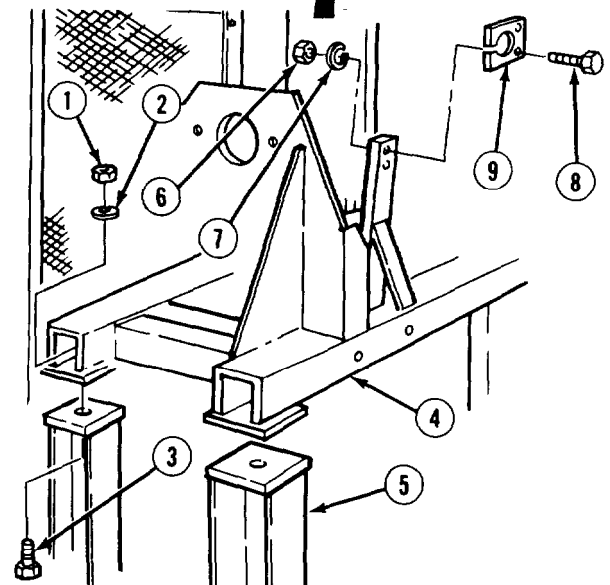
a. Removal.

- (1) Remove four nuts (1) lockwashers (2), screws (3) and pump frame (4) from vehicle frame (5). Discard lo&washers.
- (2) Remove two nuts (6), lockwashers (7), screws (8), and mounting block (9) from pump frame (4). Discard lo&washers.



b. Installation.

- (1) Install mounting block (9) on pump frame (4) with two screws (8) lo&washers (7), and nuts (6).
- (2) Install pump frame (4) on vehicle frame (5) with four screws (3). lockwashers (2), and nuts (1).



NOTE

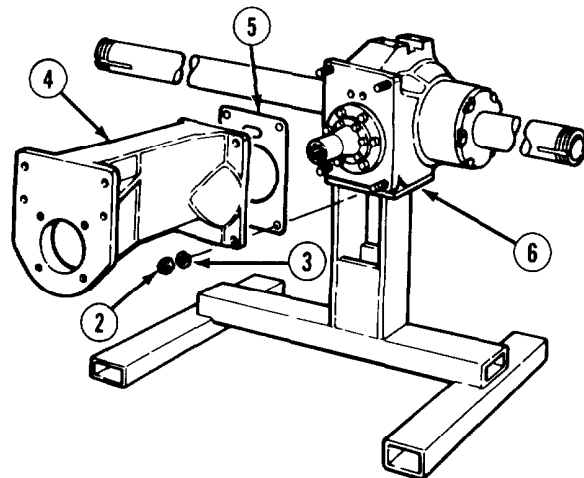
Follow-on maintenance:

- Install additive system motor (para 5-80).
- Install additive pump assembly (para 4-151).

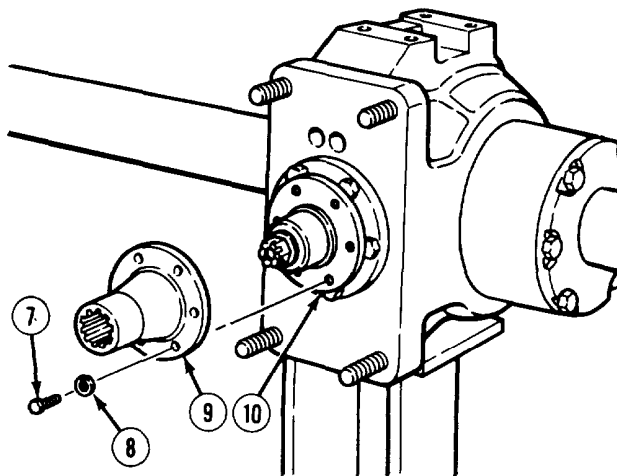
END OF TASK

5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (2) Remove four nuts (2), lockwashers (3), torque tube housing (4) and gasket (5) from gear housing (6). Discard lockwashers and gaskets.



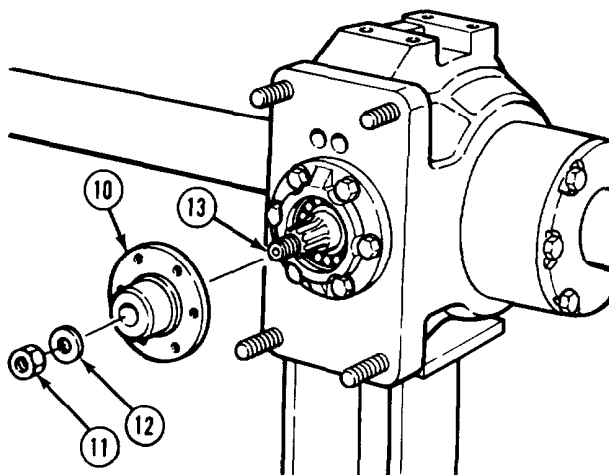
- (3) Remove eight screws (7) lockwashers (8), and adaptor (9) from adaptor coupling (10). Discard lockwashers.



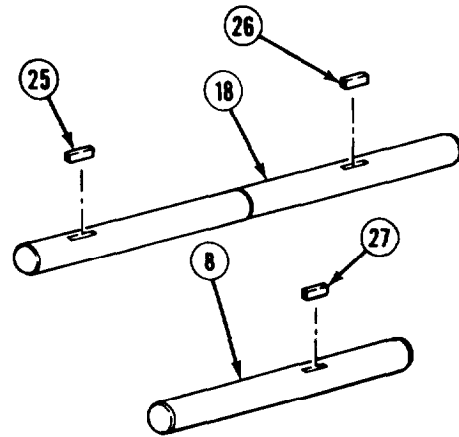
NOTE

Save locknut for use in step (5).

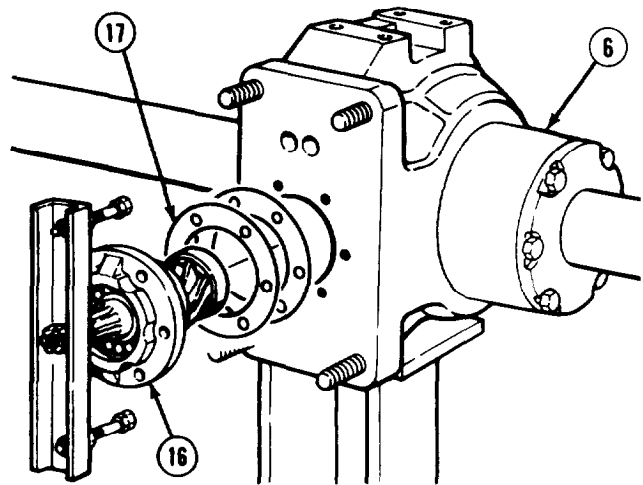
- (4) Remove locknut (11), washer (12), and adaptor coupling (10) from pinion shaft (13).



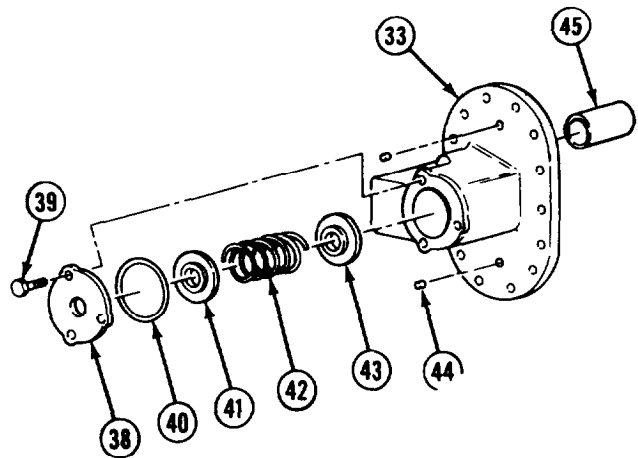
- (5) Remove six screws (14) and lockwashers (15) from pinion bearing cage (16). Using locknut (11), install rotor drive pinion puller to bearing cage (16). Discard lockwashers.



- (6) Remove bearing cage (16) and shims (17) from gear housing (6). Measure and record number and size of each shim.

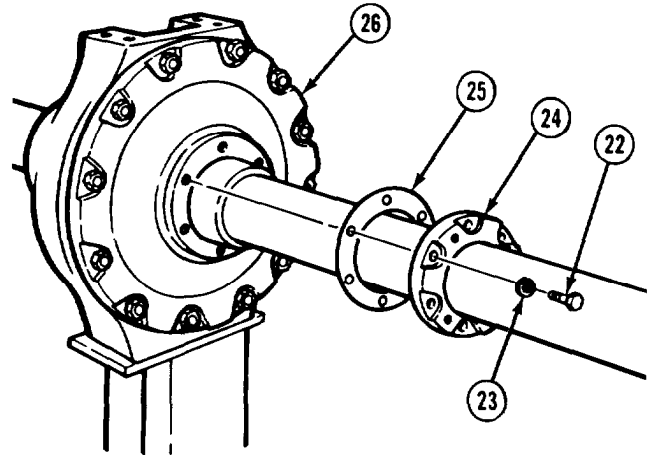


- (7) Remove six screws (18), lockwashers (19), bearing retainer (20), and gasket (21) from left side of gear housing (6). Discard lockwashers and gasket.

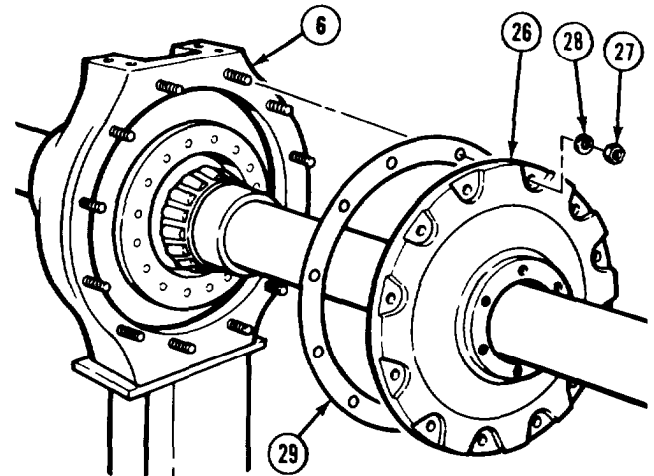


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (8) Remove six screws (22), lockwashers (23), bearing retainer (24), and gasket (25) from gear cover (26). Discard lockwashers and gasket.



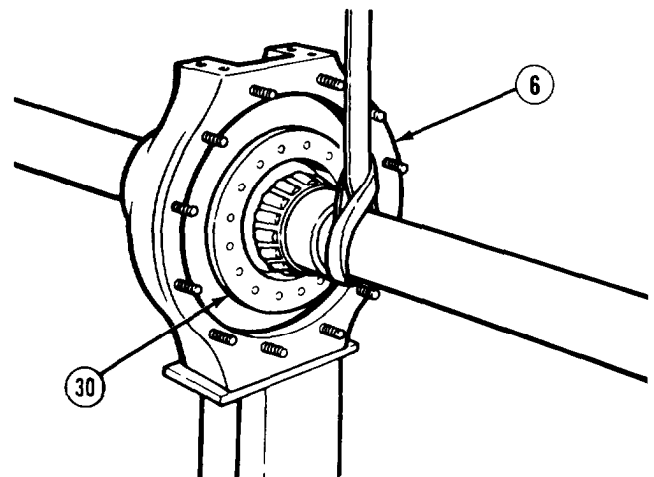
- (9) Remove 12 nuts (27), lockwashers (28), gear cover (26), and gasket (29) from gear housing (6). Discard lockwashers and gasket.



WARNING

Axle assembly weighs 250 lbs (339 kg). Attach suitable device prior to removal to prevent possible injury to personnel.

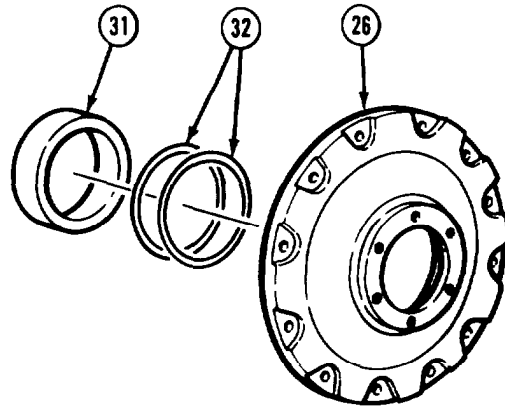
- (10) Attach suitable lifting device to axle assembly (30).
- (11) While mechanic operates lifting device, assistant guides axle assembly (30) from gear housing (6).



NOTE

Note position of shims for assembly.

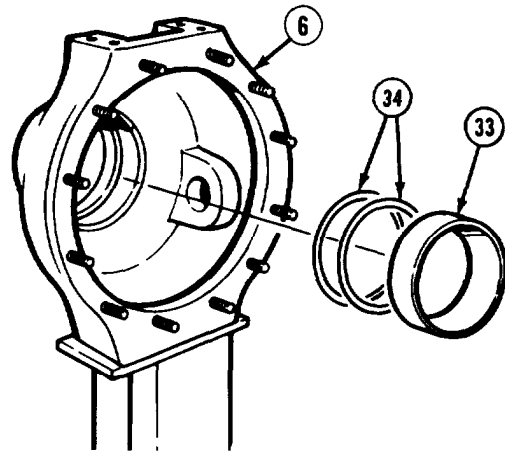
- (12) Remove bearing cup (31) and shims (32) from gear cover (26).



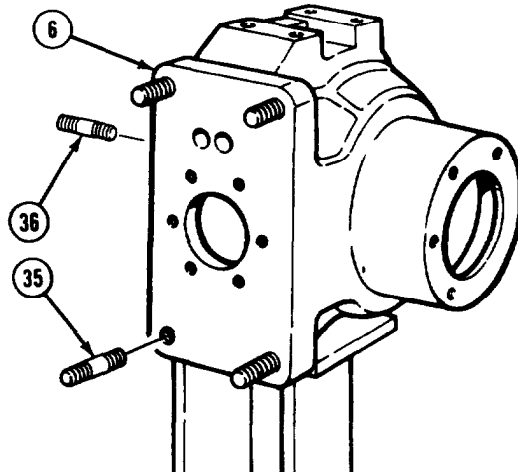
NOTE

Note position of shims for assembly.

- (13) Remove bearing cup (33) and shims (34) from left side of gear housing (6).

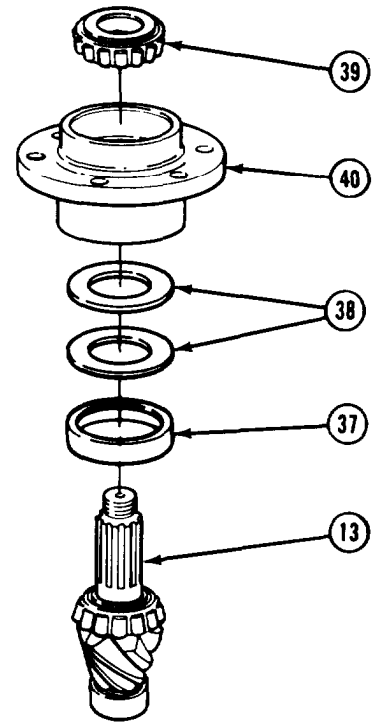


- (14) If damaged, remove four studs (35) and 12 studs (36) from gear housing (6). Discard studs.

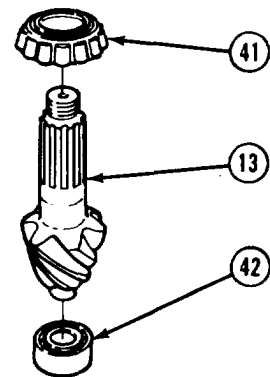


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

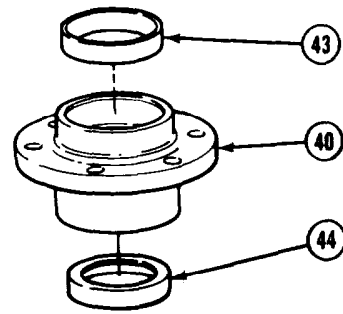
- (15) Remove pinion shaft (13), spacer (37), shims (38), and bearing (39) from bearing cage (40). Measure and record number and size of shims.



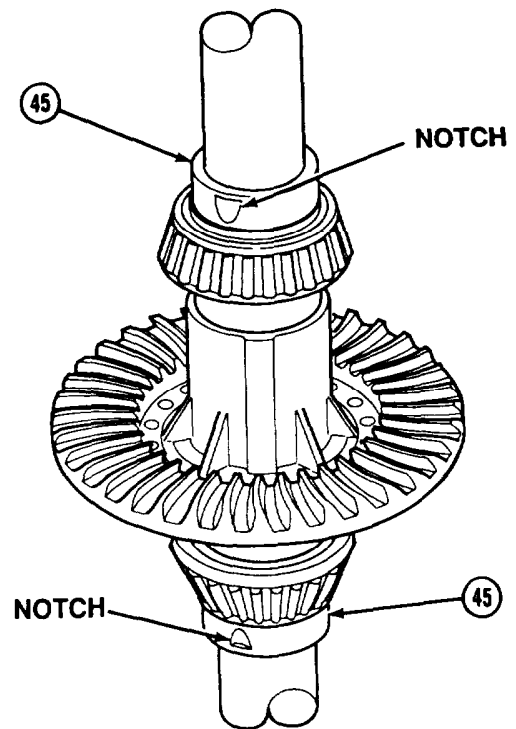
- (16) Remove bearing cone (41) and roller bearing (42) from shaft (13).



- (17) Remove bearing cups (43 and 44) from bearing cage (40).



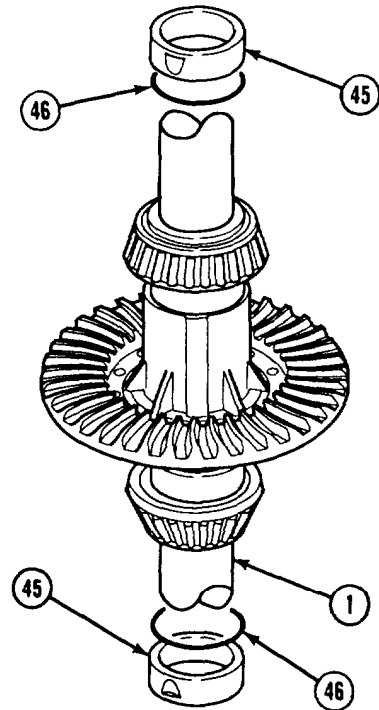
- (18) Grind two notches on each side of two thrust sleeves (45).



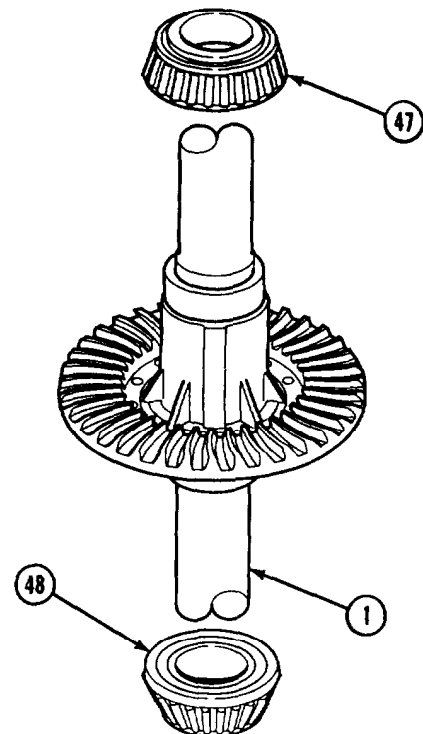
5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).**CAUTION**

Do not try to remove thrust sleeves without heating. Thrust sleeves are pressed on. Wear thermal gloves.

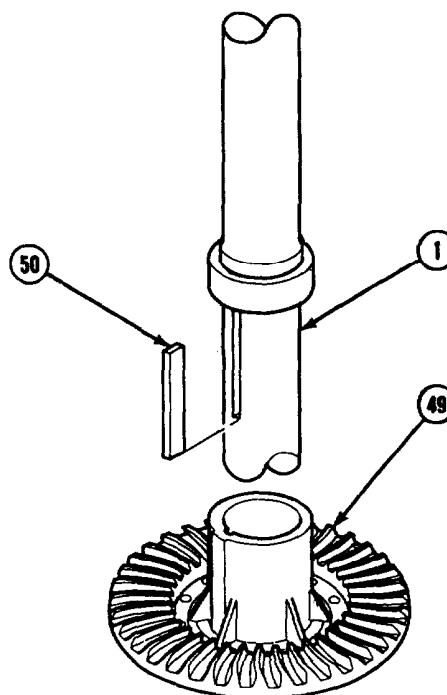
- (19) Remove and discard thrust sleeves (45) and two preformed packings (46) from axle (1).



- (20) Remove bearing cones (47 and 48) from axle (1).



- (21) Remove hub assembly (49) and key (50) from axle (1).



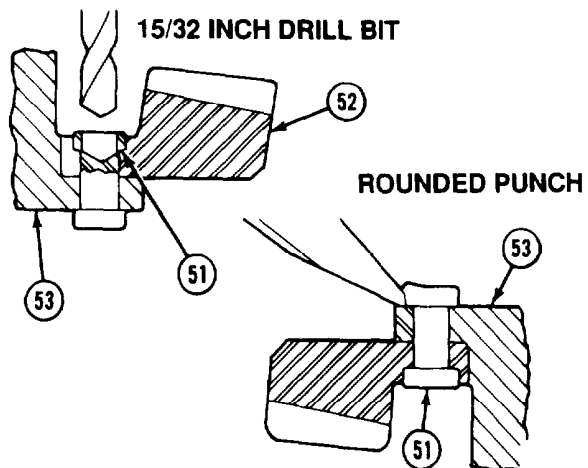
WARNING

Keep hands out from under ring gear. Do not allow ring gear to drop. Ring gear is heavy and can cause injury if dropped on hands.

CAUTION

Do not use a chisel to remove rivet heads, as damage to ring gear may result.

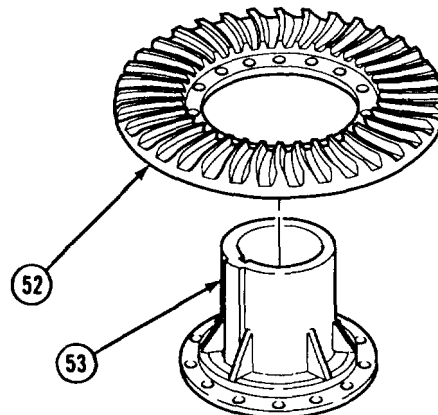
- (22) Center punch each of 16 rivets (51) securing ring gear (52) to hub (53).



- (23) Use a 15/32 in. drill bit to drill through rivet heads (51) to depth of 1/4 inch.

5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (24) Drive out remaining portion of 16 rivets and separate ring gear (52) from hub (53). Discard rivets.



b. Cleaning/Inspection.

- (1) Scrape old gasket material from gear housing.

WARNING

- Drycleaning solvent (P-D-680) is TOXIC and flammable. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes, and do not breathe vapors. Keep away from heat or flame. Never smoke when using solvent; the flashpoint for type I drycleaning solvent is 100°F (38°C) and for type II is 140°F (60°C). Failure to do so may result in injury or death to personnel.
 - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- (2) Clean all metal parts with drycleaning solvent.

WARNING

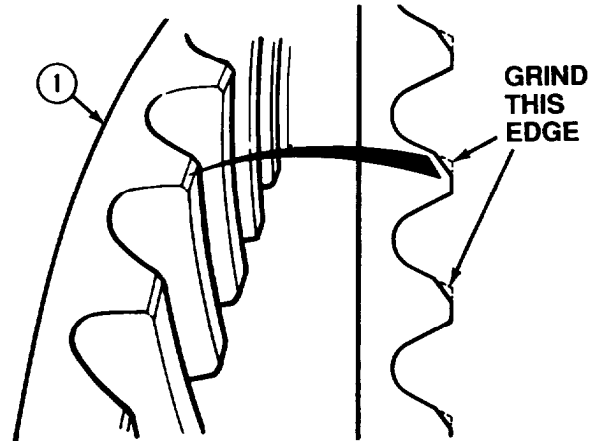
Compressed air used for cleaning purposes must not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc).

- (3) Use clean lint-free cloth or compressed air to dry all metal parts except bearings.
- (4) Allow bearings to air dry.
- (5) Check all metal parts for breaks, cracks, and sharp edges.
- (6) Check machined parts for nicks and burrs.
- (7) Check bearings for loose rollers and cracked or broken races.

- (8) If pinion or ring gear is bad, replace both as matched set.
- (9) Replace all damaged parts.

c. Assembly.

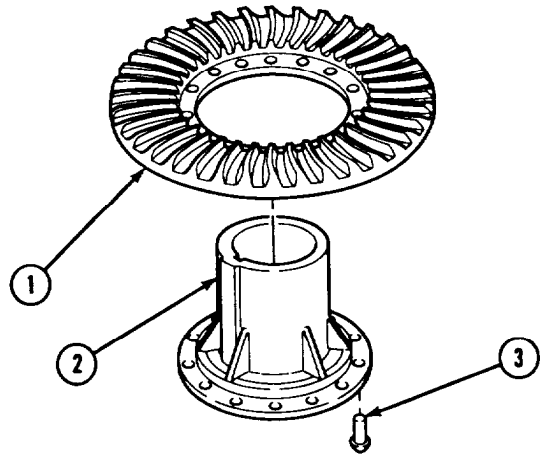
- (1) If original ring gear (1) is used, go to step (2). If new ring gear is used, grind off edge of new ring gear, as shown, for installation clearance.



NOTE

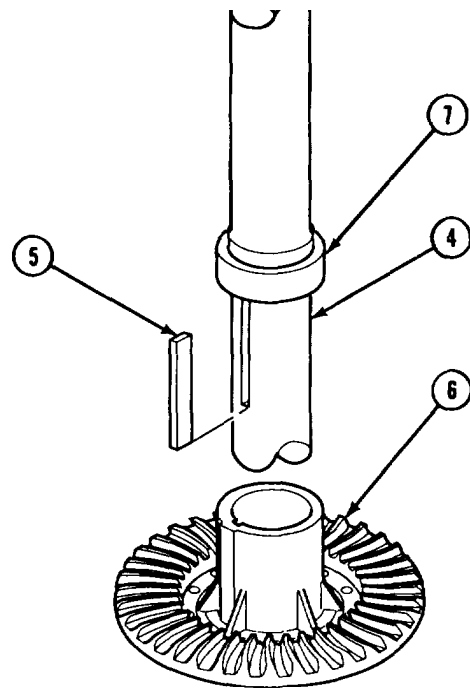
Rivets, securing ring gear to hub, require 20 to 25 U.S. tons (18.1 - 22.7 metric tons) of pressure per rivet. Use a suitable hydraulic or mechanical press.

- (2) Install ring gear (1) on hub (2) with 16 rivets (3).



5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (3) Apply anti-seize compound to center of axle (4). Install key (5) and hub assembly (6) on axle. Make sure that hub assembly is completely against shoulder (7).



CAUTION

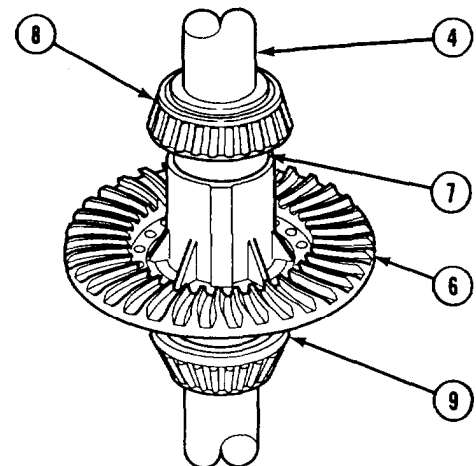
Do not heat bearings to more than 225°F (107°C) or bearings will be damaged and become unserviceable.

- (4) Heat bearings (8 and 9) in oven.

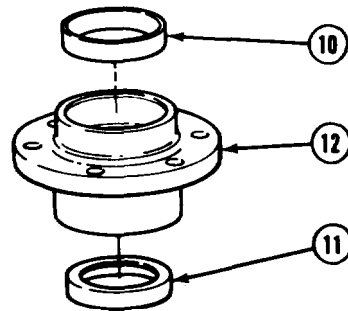
WARNING

Handle hot bearings carefully with proper protective equipment or injury to personnel may result.

- (5) Carefully install bearing (8) on axle (4). Be sure that bearing is completely against axle shoulder (7).
- (6) Carefully install bearing (9) on axle (4). Be sure that bearing is completely against gear hub assembly (6).



- (7) Install bearing cups (10 and 11) in bearing cage (12).



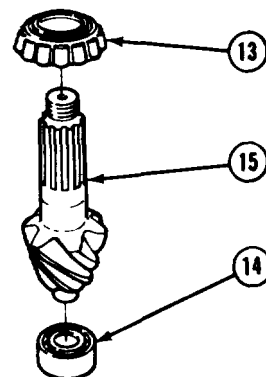
CAUTION

Do not heat bearing cone to more than 225°F (107°C) or bearing cone will be damaged and become unserviceable.

- (8) Heat bearing cone (13) in oven.

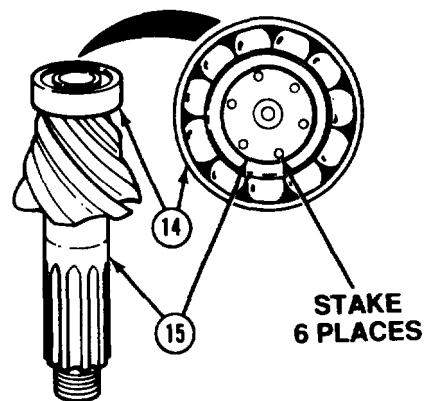
WARNING

Handle hot bearing cone carefully with proper protective equipment or injury to personnel may result.



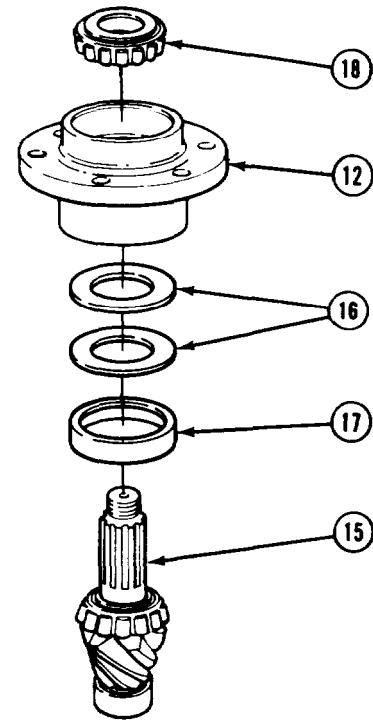
- (9) Install bearing cone (13) and roller bearing (14) on pinion shaft (15).

- (10) Stake roller bearing (14) on shaft (15) in six places, as shown.

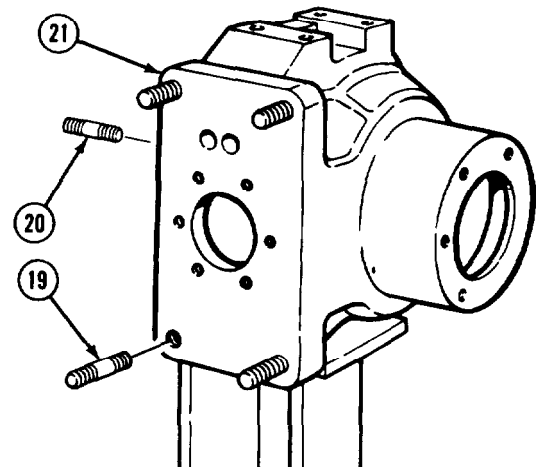


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

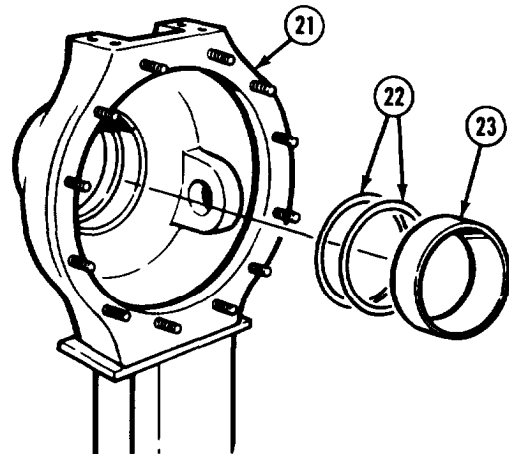
- (11) Install shim package (16), spacer (17), pinion shaft (15), and bearing (18) in bearing cage (12).
- (12) Spin cage (12) on shaft (15). Add or remove shims (16) accordingly. Normal shim range is 0.010 to 0.015 in. (0.1257 - 0.1381 mm).



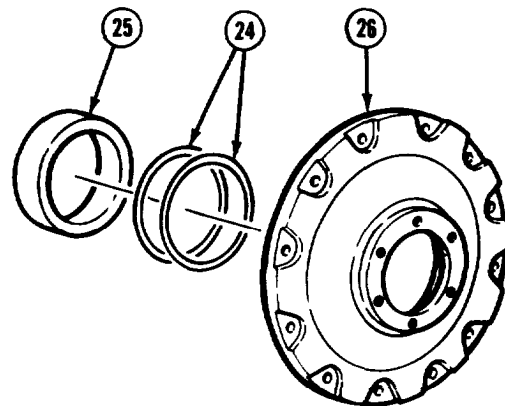
- (13) If removed, install four studs (19) and 12 studs (20) on gear housing (21).



- (14) Install shim package (22) and bearing cup (23) in left side of gear housing (21).



- (15) Install shim package (24) and bearing cup (25) in gear cover (26).



5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

WARNING

Prussian Blue dye is poisonous and can burn skin on contact. Over-exposure to dye can cause heart and skin problems, dizziness, and unconsciousness.

- (16) Paint one-third of teeth on ring gear (1) with Prussian Blue dye.

WARNING

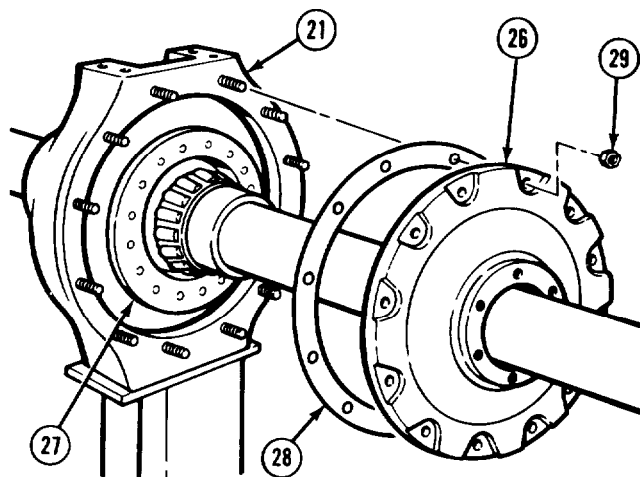
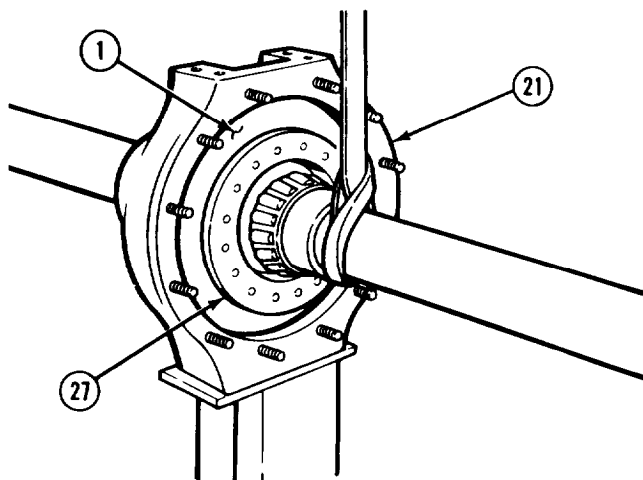
Shaft assembly weighs 250 lbs (339 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

- (17) Attach suitable lifting device to axle assembly (27).
 (18) While mechanic operates suitable lifting device, assistant guides axle assembly (27) in gear housing (21).
 (19) Install gasket (28), gear cover (26), and nuts (29) on gear housing (21).

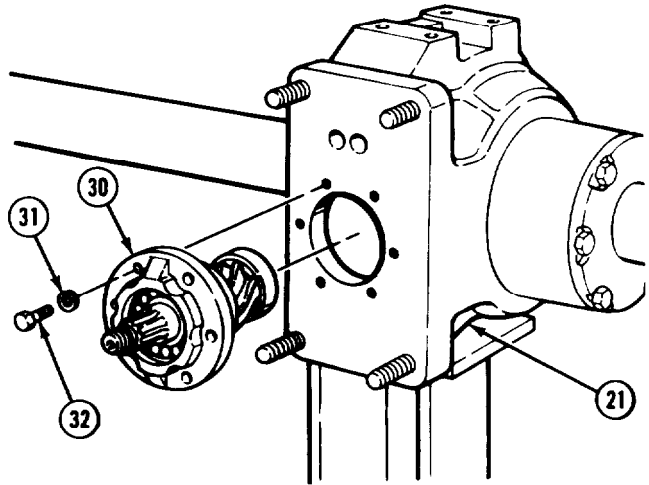
NOTE

To remove or add shims in step (20), remove ring gear assembly (Disassembly steps [9] through [13]). After shims are removed or added, install ring gear assembly (Assembly steps [17] through [19]).

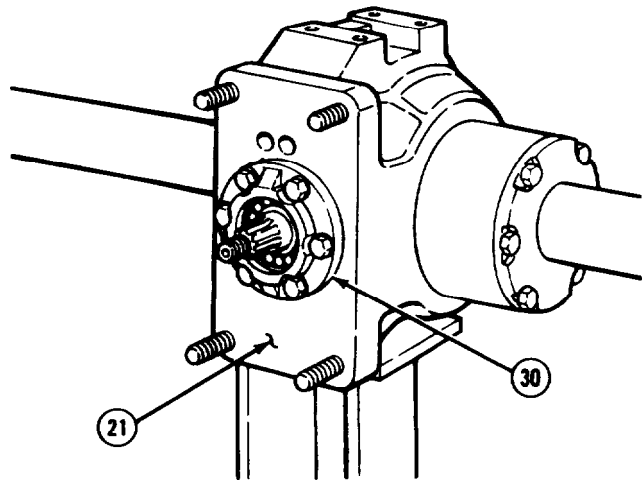
- (20) Turn axle assembly (27). There should be slight drag while turning. Add or remove shims as necessary.



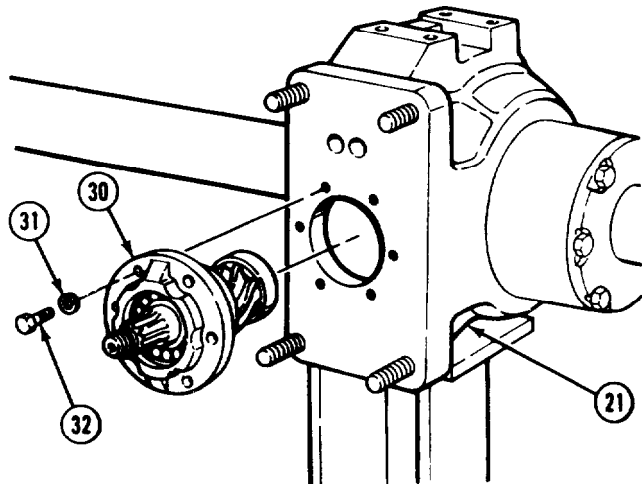
- (21) Install bearing cage assembly (30) in gear housing (21) with six lockwashers (31) and screws (32). Tighten screws 125 lb-ft (170 N•m).



- (22) Measure and record space between bearing cage assembly (30) and face of housing (21).

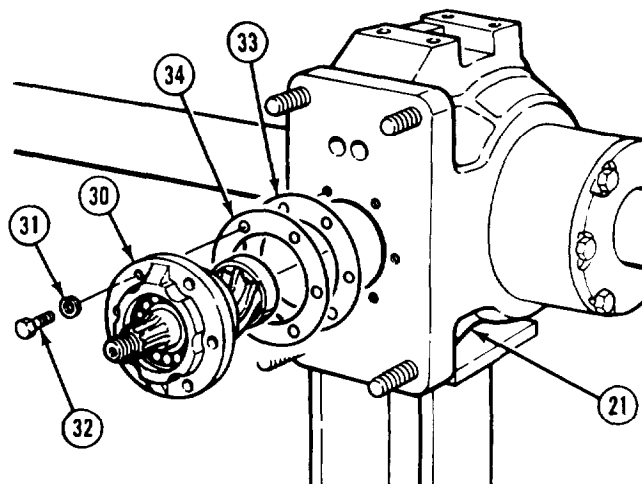


- (23) Remove six screws (32), lockwashers (31), and bearing cage assembly (30) from gear housing (21).

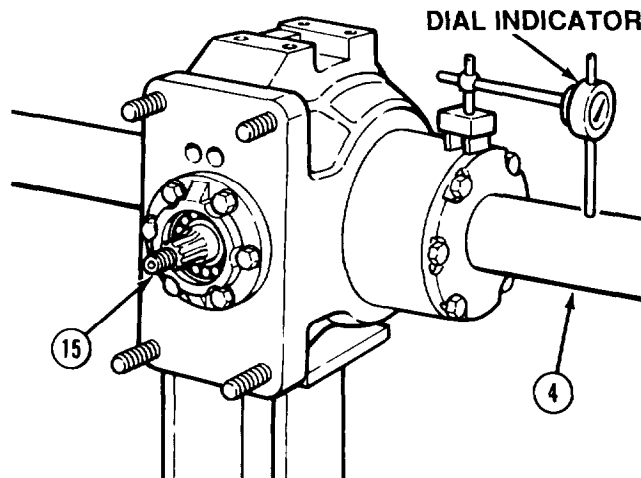


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

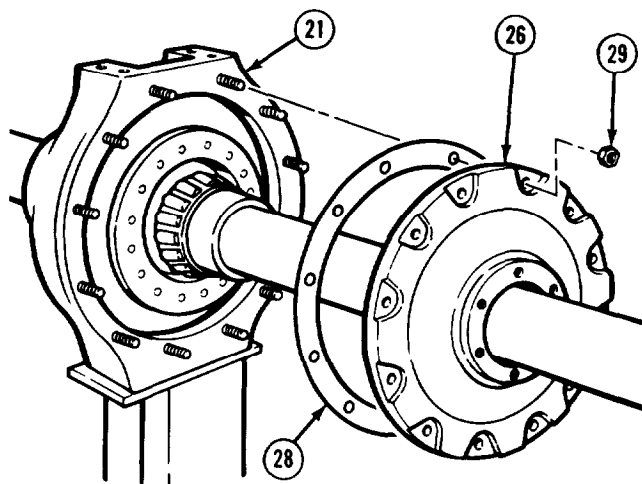
- (24) Install shims (33), with the thickness equal to the measurement recorded during disassembly, plus an additional shim (34) of .003 in. thickness to bearing cage assembly (30).
- (25) Install bearing cage assembly (30) in gear housing (21) with six lockwashers (31) and screws (32). Tighten screws 125 lb-ft (170 N•m).



- (26) Rotate pinion shaft (15) several times to obtain correct pattern in dye on ring gear.
- (27) Using a dial indicator, measure and record ring and pinion backlash in four equally spaced positions around axle (4).
- (28) If backlash is within 0.006 - 0.012 in. (0.152 - 0.305 mm), go to step (42). If backlash is not within these limits, continue to step (29).



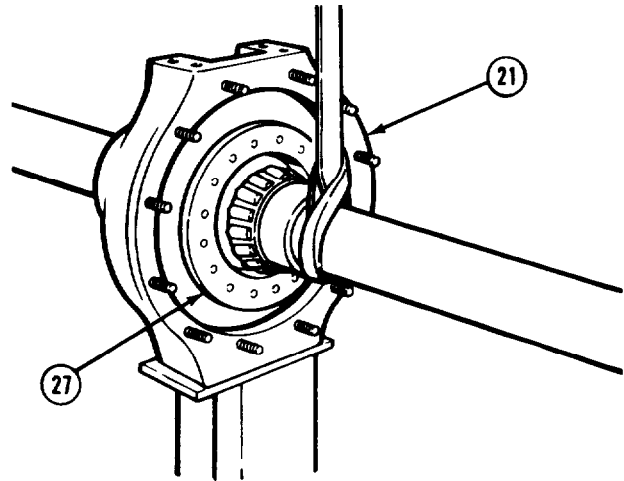
- (29) Remove nuts (29), gear cover (26), and gasket (28) from gear housing (21).



WARNING

Shaft assembly weighs 250 lbs (170 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

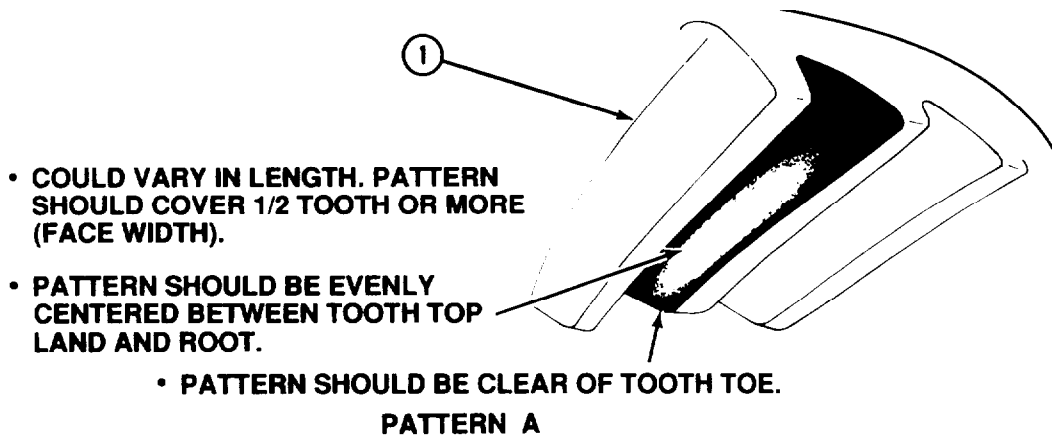
- (30) Attach suitable lifting device to shaft assembly (27).
- (31) While mechanic operates lifting device, assistant guides shaft assembly (27) from gear housing (21).



NOTE

- A correct gear pattern for a used pinion and ring gear is clear of toe and centers evenly along face of gear tooth, but can be any length and shape and is acceptable as long as pattern does not run off gear tooth at any point.
- If gear pattern was correct at disassembly, then gear pattern after assembly should be the same.
- Remember, a correct gear pattern for a used pinion and ring gear does not have to match PATTERN A (correct pattern for new gearing).
- If new pinion and ring gear are used, tooth pattern should be like correct PATTERN A. If tooth pattern does not look like A, check pattern B through E to find one that looks close to ring gear tooth pattern, then do step that follows incorrect pattern.

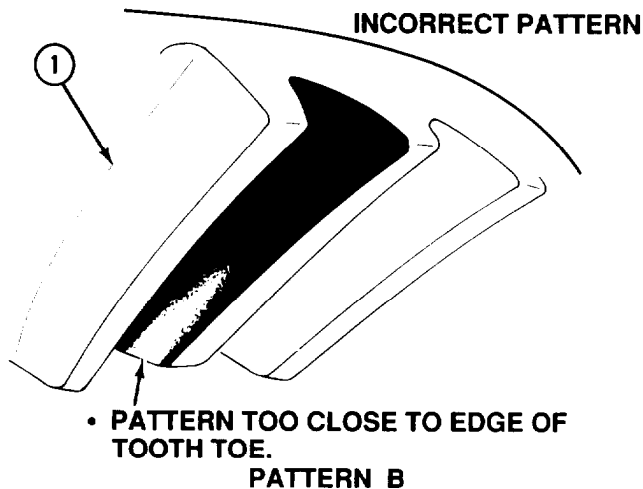
CORRECT PATTERN (NEW GEARING)



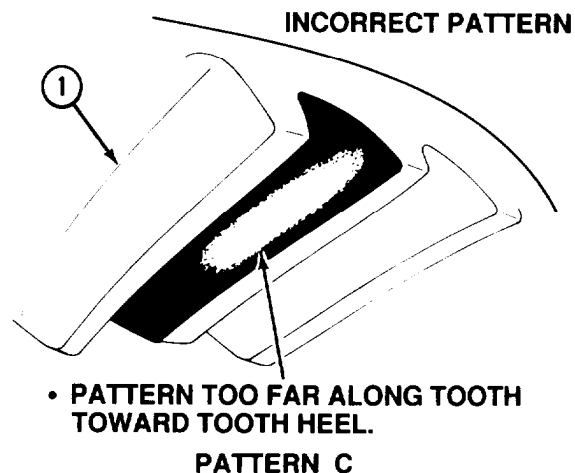
- (32) Read dye pattern on ring gear (1).
- (33) If tooth contact is like PATTERN A, do not adjust. Go to step (40).

5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (34) If tooth contact pattern on ring gear (1) is like **PATTERN B**, increase backlash. Go to step (38).



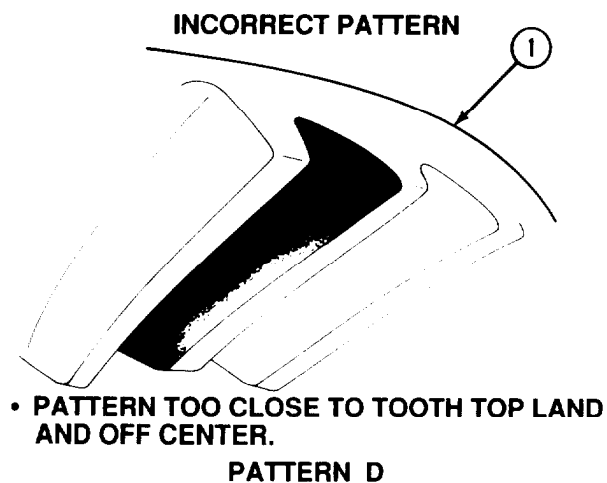
- (35) If tooth contact pattern on ring gear (1) is like **PATTERN C**, decrease backlash. Go to step (39).



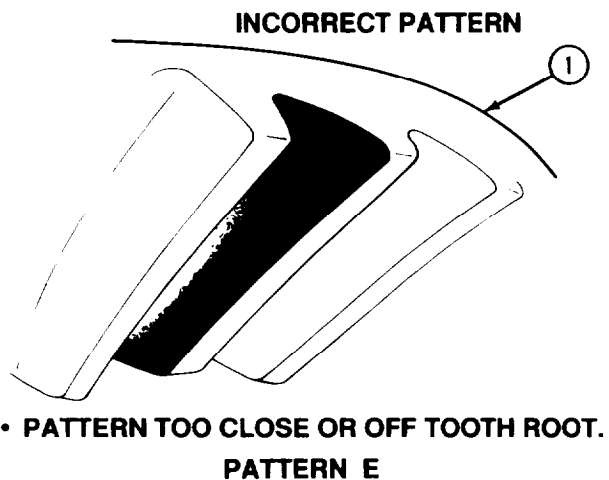
NOTE

To remove or add shims in steps (36) and (37) remove pinion cage assembly (Disassembly steps [5] through [6]). After shims have been removed or added, install pinion cage assembly (Assembly step [25]).

- (36) If tooth contact pattern on ring gear (1) is like **PATTERN D**, move pinion closer to ring gear by removing shims, then repeat steps (27) and (28).

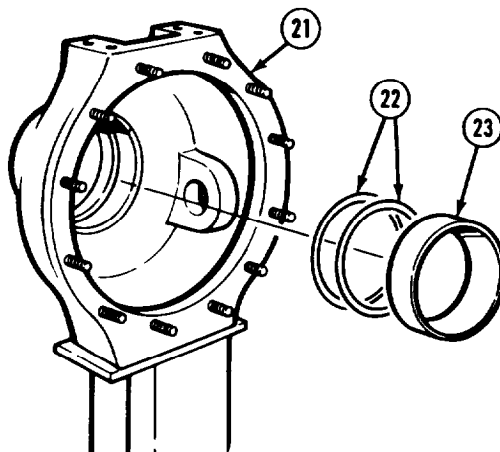


- (37) If tooth contact pattern on ring gear (1) is like PATTERN E, move pinion away from ring gear by adding shims, then repeat steps (27) and (28).



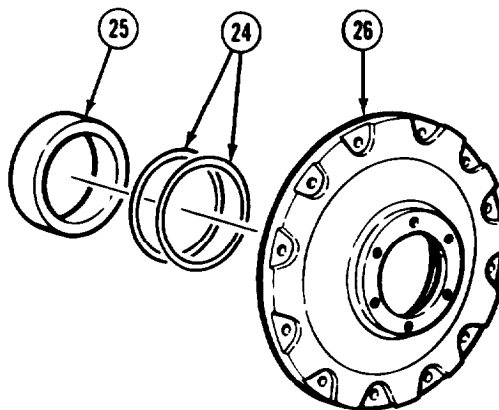
- (38) To Increase backlash, proceed as follows:

- (a) Remove bearing cup (23) and one of two shims (22) from gear housing (21).
- (b) Install remaining shims (22) and bearing cup (23) in gear housing (21).
- (c) Repeat steps (26) through (36).



- (39) To decrease backlash, proceed as follows:

- (a) Remove bearing cup (25) and one of two shims (24) from cover (26).
- (b) Install remaining shims (24) and bearing cup (25) in cover (26).
- (c) Repeat steps (26) through (36).

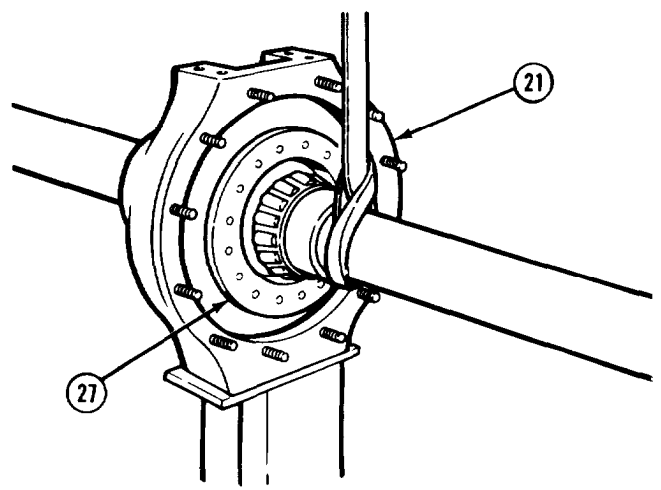


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

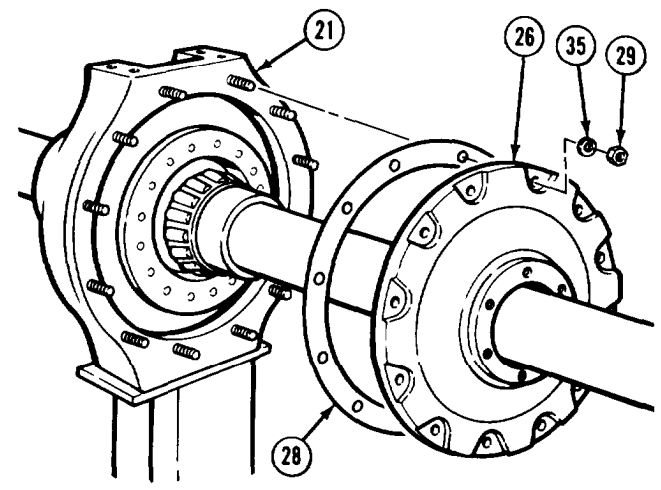
WARNING

Shaft assembly weighs 250 lbs (339 kg). Attach suitable lifting device prior to installation to prevent possible injury to personnel.

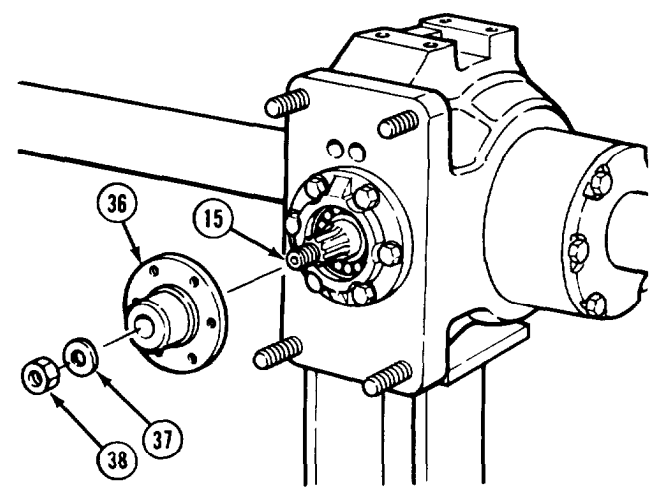
(40) While mechanic operates suitable lifting device, assistant guides shaft assembly (27) in gear housing (21).



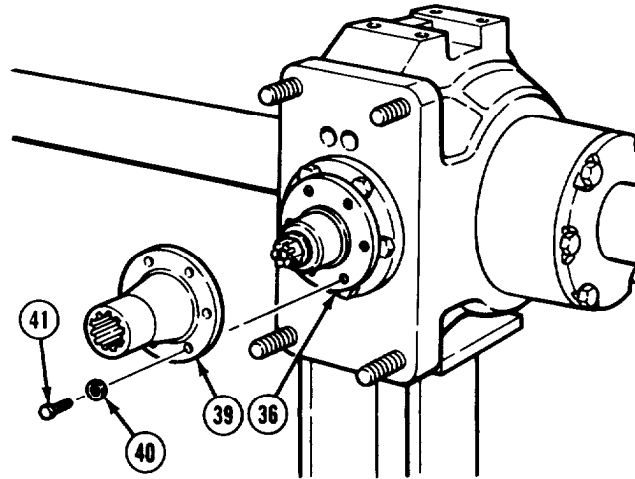
(41) Install gasket (28), gear cover (26), lockwashers (35) and nuts (29) on gear housing (21). Tighten nuts 225 lb-ft (305 N•m).



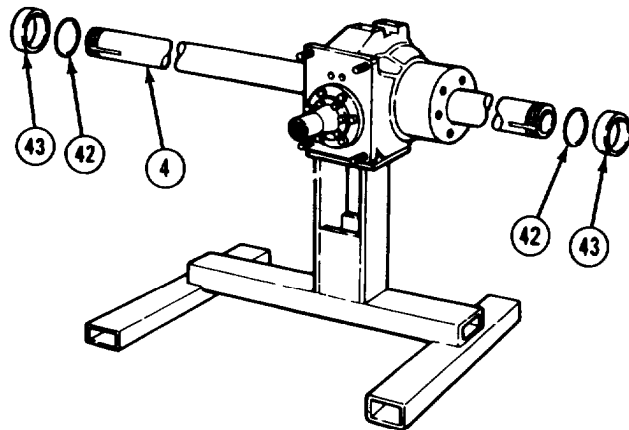
(42) Install adaptor coupling (36) washer (37), and locknut (38), on pinion shaft (15).



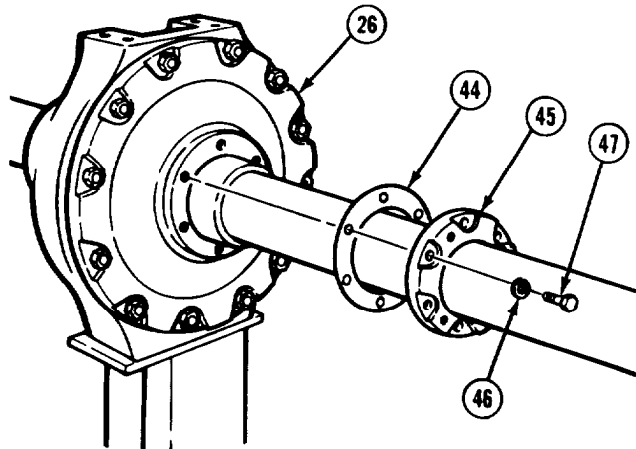
- (43) Install adaptor (39) on adaptor coupling (36) with eight lock-washers (40) and screws (41). Tighten screws 35 lb-ft (47 N•m).



- (44) Install two preformed packings (42) and thrust sleeves (43) on axle (4).

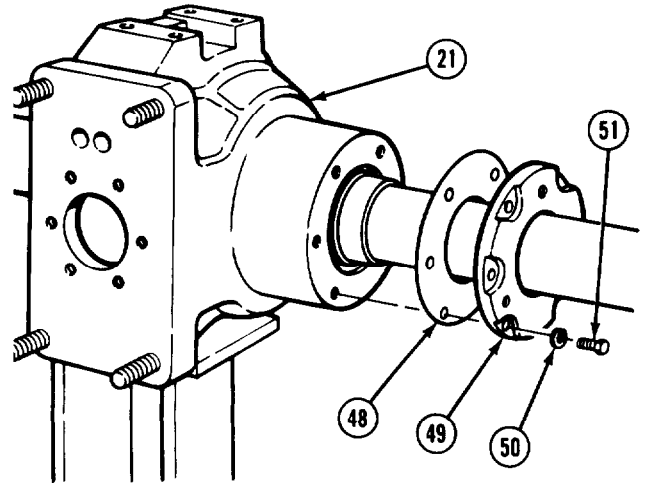


- (45) Install gasket (44), bearing retainer (45), six lockwashers (46), and screws (47) on gear cover (26). Tighten screws 35 lb-ft (47 N•m).

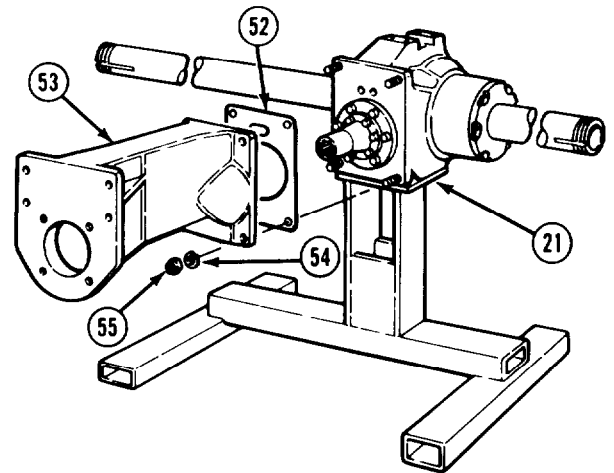


5-90. ROTOR DRIVE ASSEMBLY REPAIR (CONT).

- (46) Install gasket (48), bearing retainer (49), six lockwashers (50), and screws (51) on gear housing (21). Tighten screws 35 lb-ft (47 N•m).



- (47) Install gasket (52) and torque tube (53) to gear housing (21) with four lockwashers (54) and nuts (55). Tighten nuts 400 to 425 lb-ft (542 - 576 N•m).



NOTE

Follow-on Maintenance:

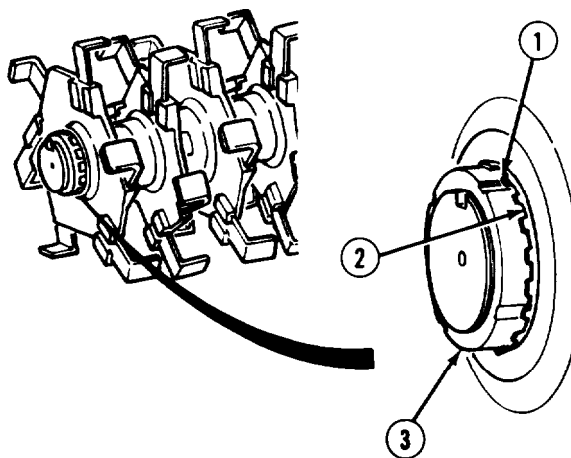
- Install rotor tine plates (para 5-91).
- Install rotor drive shaft assembly (para 4-164).

END OF TASK

5-91. ROTOR TINE PLATE REPLACEMENT.		
This task covers:		
a. Removal	b. Cleaning/Inspection	c. Installation
INITIAL SETUP		
<i>Tools</i>	<i>References</i>	
Tool kit, general mechanic's: equipment maintenance and repair	TM 9-237 Operator's Manual for Welding Theory and Application	
Lifting device (capacity 500 lb [227 kg])	<i>Personnel Required</i>	
Wrench, spanner nut	MOS62B, Construction equipment repairer (2)	
<i>Material/Parts</i>	<i>Equipment Condition</i>	
Lockwashers (2)	<i>TM or Para</i>	<i>Condition Description</i>
	Para 4-174	Rotor assembly disconnected.
	Para 4-161	Rotor hood removed.

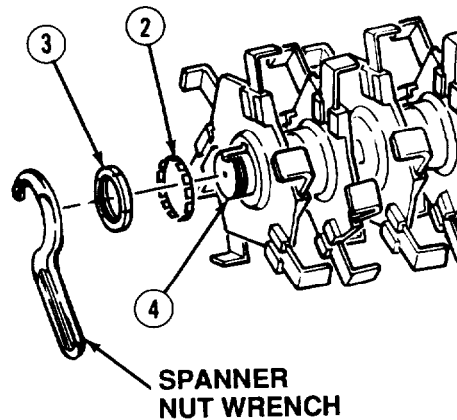
a. Removal.

- (1) Pry locking tab (1) on two lockwashers (2) away from two nuts (3).



5-91. ROTOR TINE PLATE REPLACEMENT (CONT).

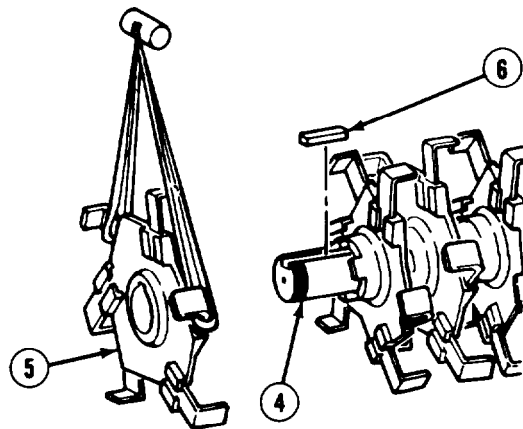
- (2) Using spanner nut wrench, remove two nuts (3) and lockwashers (2) from shaft (4).

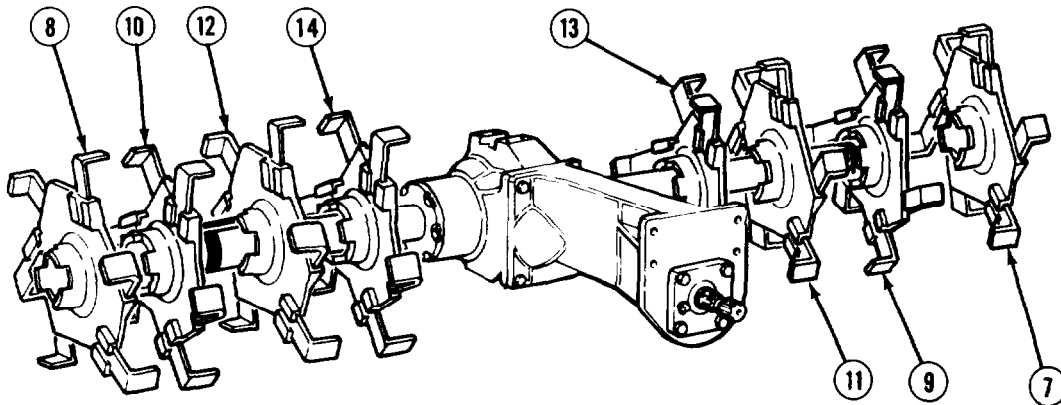


WARNING

Tine plates weigh 75 lbs (34 kg). Attach suitable lifting device prior to removal to prevent possible injury to personnel.

- (3) Using suitable lifting device remove two end tine plates (5) and keys (6) from shaft (4).





- (4) Remove eight tine plates (7 through 14) in order specified.

b. Cheaning/Inspection

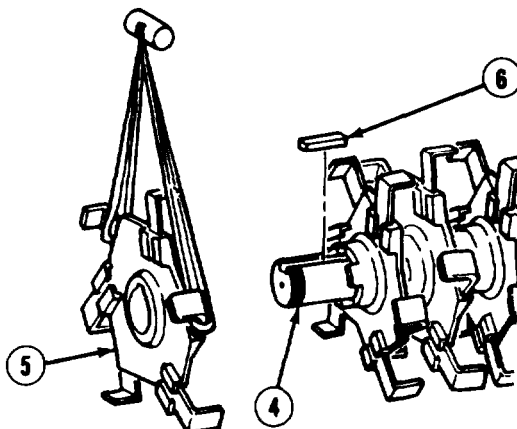


Avoid contact with steam. Steam can cause burns, blindness, and other serious injury. Ensure the wearing of protective aprons, gloves, and safety goggles when using live steam.

- (1) Clean tine plates with steam.
- (2) Check all parts for damage. Replace damaged parts.

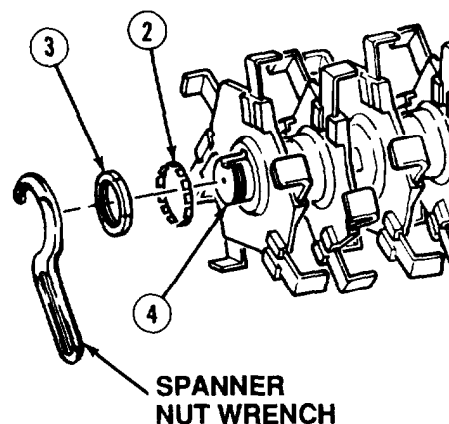
c. Installation

- (1) Install eight tine plates (7 through 14) in order specified.
- (2) Install two keys (6) and end tine plates (5) on shaft (4).

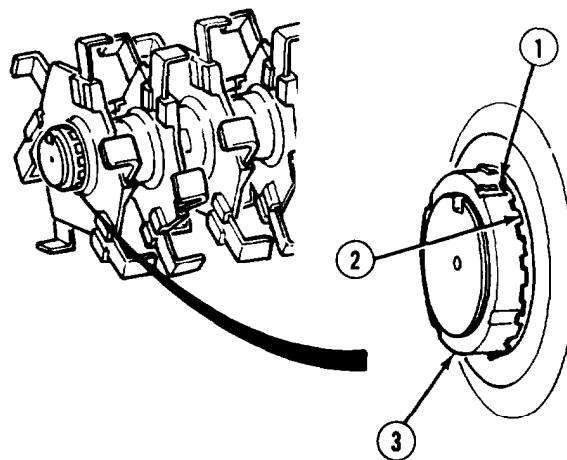


5-91. ROTOR TINE PLATE REPLACEMENT (CONT).

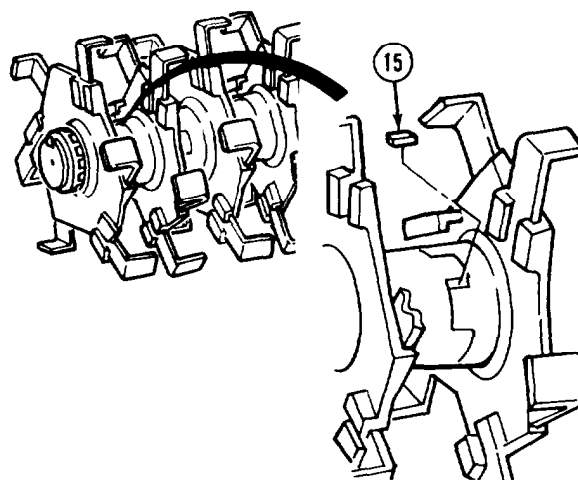
- (3) Using spanner nut wrench, install two lockwashers (2) and nuts (3) on shaft (4).



- (4) Bend locking tabs (1) on two lockwashers (2) to lock nuts (3).



- (5) If installing new tine plate(s), position plate block (15) between new plates and tackweld in place in accordance with TM 9-237.



NOTE

Follow-on Maintenance:

- Install rotor hood (para 4-161).
- Connect rotor assembly (para 4-174).

END OF TASK

5-92. LUBRICATION INSTRUCTIONS.

Refer to Lubrication Chart (figure 3-1) for unit support lubrications.

Section VI. PREPARATION FOR STORAGE AND SHIPMENT

Refer to Chapter 4, Section VI.

APPENDIX A

REFERENCES

A-1 SCOPE

This appendix lists all forms, field manuals, technical manuals, and other publications referenced in this manual. Other manuals that should be consulted for additional information about mixer operation are also listed herein.

A-2. PUBLICATION INDEX.

The following index should be consulted frequently for late changes or revisions to documents listed herein. This index also lists new publications relating to material covered in this manual.

Consolidated Index of Army Publications and Blank Forms DA Pam 25-30

A-3. FORMS.

The following forms are referenced within this manual. Refer to DA Pam 25-30 for index of blank forms.

- Standard Form 46, U.S. Government Motor Vehicle Operator’s Identification Card.
- Standard Form 91, Operator’s Report of Motor Vehicle Accident.
- Recommended Changes to DA Publications and Blank Forms (DA Form 2028,2028-2).

Refer to DA Pam 738-750, The Army Maintenance Management System (TAMMS), for instructions to the use of maintenance forms required during the operation of this manual.

A-4. OTHER PUBLICATIONS.

a. Safety.

Safety Inspection and Testing of Lifting DevicesTB 43-0142
 First Aid for SoldierFM 21-11

b. Vehicle Operation.

Vehicle Recovery Operations FM 20-22
 Desert Operation FM 90-3
 Mountain Operation FM 90-6
 River Crossing FM 90-13

c. Cold Weather Operation and Maintenance.

Operation and Maintenance of Ordnance Material in Extreme Cold
 Weather (0 degrees to -65 degrees F) FM 9-207
 Basic Cold Weather Manual FM 31-70
 Northern Operations FM 31-71

d. Maintenance and Repair.

Charging System Troubleshooting (The Easy Way) DA Pam 750-33
 Metal Body Repair and Related Operations TC 9-510
 Ordinance Tracked and Wheeled Vehicle Hull and Chassis Wiring, Repair of TB ORD 650
 Description, Use, Bonding Techniques, and Properties of Adhesives TB ORD 1032
 Purging, Cleaning, and Coating Interior Ferrous and Terne Sheet Vehicle Fuel Tanks TB 43-0212
 Use of Antifreeze and Cleaning Compounds in Engine Cooling Systems T-B 750-651
 Rigging TM 5-725
 Inspection, Care, and Maintenance of Antifriction Bearings TM 9-214
 Welding Theory and Application '1-M 9-237
 Care and Use of Hand Tools and Measuring Tools TM 9-243
 Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordinance Material and
 Related Materials Including Chemicals TM 9-247
 Painting Instructions for Field Use TM 43-0139
 Color, Marking, and Camouflage Painting of Military Vehicles TB 43-0209
 Inspection, Use and Tightening of Metal Fasteners Used on Tank-Automotive Equipment TB 430218
 Operator, Unit, Direct Support, and General Support Maintenance Manual
 for Repair and Inspection of Pneumatic Tires and Inner Tubes TM 9-2610-200-14
 STE/ICE-R TM 9-4910-571-12&P
 STE/ICE-R TM 9-4910-571-34&P
 Tool Outfit, Hydraulic Systems Test and Repair (HSTRU) TM 9-4940-468-14
 Operator, Unit, Direct Support and General Support Maintenance Manual
 for Lead Acid Storage Batteries TM 9-6140-200-14

e. Decontamination.

NBC (Nuclear, Biological, and Chemical) Defense FM 21-40

f. General.

Principles of Automotive Vehicles TM 9-8000
 Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use TM 750-244-6
 Product Quality Deficiency Report SF 368

APPENDIX B

MAINTENANCE ALLOCATION CHART (MAC)

Section I. INTRODUCTION

B-1. GENERAL

a. This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or 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 levels which are shown on the MAC in column (4) as:

Unit - includes two subcolumns, C (operator crew) and 0 (unit) maintenance;

Direct Support - includes an F subcolumn;

General Support - includes an H subcolumn;

Depot - includes a D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section 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 by measuring the mechanical, pneumatic, hydraulic, 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; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

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

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

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

B-2. MAINTENANCE FUNCTIONS (CONT).

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Rep/ace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3rd position code of the SMR code.

i. Repair. The application of maintenance services¹, including fault location/troubleshooting², removal/installation, and disassembly/assembly procedures, and maintenance actions⁴ 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.

i. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications, i.e., DMWR. Overhaul is normally the highest degree of maintenance performed by the Army.

¹Services - Inspect test, service, adjust, align, calibrate, and/or replace.

²Fault - Location/trouble shooting - The process of investigating and detecting the cause of equipment malfunctions; the act of isolating a fault within a system or unit under test (UUT).

³Disassembly/Assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

⁴Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

B-3. EXPLANATION OF COLUMNS IN SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher-assembly, End item group number shall be "OO"

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

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(the level 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 level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

- | | |
|------------------------------|--|
| C Operator or Crew | L Specialized Repair Activity (SRA) ⁵ |
| O Organizational Maintenance | H General Support Maintenance |
| F Direct Support | D Depot Maintenance |

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

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

⁵Specialized Repair Activity (SRA) - This maintenance level is not included in Section II, Column 4, of the Maintenance Allocation Chart. Functions to this level of maintenance are identified by a work-time figure in the “H” column of Section II, Column 4, and an associated Reference Code is used in Remarks, Column 6. this code is keyed to Section IV, Remarks, and the SRA complete repair application is explained there.

<p>B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENT, SECTION III.</p>
--

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 Level. The lowest level of maintenance authorized to use the tool or test equipment.

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

d. Column 4, Tool Kit. The national stock number of the tool or test equipment,

Section II. MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct support	General support	Depot		
			C	O	F	H	D		
01	ENGINE								
0100	Engine Assembly: Engine Assembly, Diesel (Main Power)	Inspect Test Service Replace Repair Overhaul	0.1	0.5 1.5	16	40 45		1,2	o A
0101	Crankcase, Block, Cylinder Head: Cylinder Block Cylinder Head Assembly	Replace Repair Replace Repair			10	20 8.0 8.0		2	
0102	Crankshaft: Crankshaft Oil Seals	Replace Repair Replace			8.0	4.0 16		2	A
0103	Flywheel Assembly: Flywheel Housing, Flywheel	Replace Replace Repair			2.0 2.5	2.0		2	
0104	Pistons, Connecting Rods Piston Assembly Connecting Rod Assembly	Replace Repair Replace Repair				8.0 6.0 3.0 6.0		2	

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			unit		Direct Support	General Support	Depot		
			C	0	F	H	D		
0105	/alves, Camshaft and timing System:							1,2	
	Valve and Injector Operating Mechanism	Adjust Replace		1.5		4.0			
	Camshaft	Repair Replace				3.0	4.0		
	Timing System	Adjust		1.5					
	Valve Cover	Inspect Replace	0.1						O
	Gear Cover	Replace Repair				1.5 1.0			
0106	Engine Lubrication Sys:							1,2	
	Oil Cooler	Replace Repair		4.0		2.0			
	Oil Pan	Replace				4.0			O
	Lines and Fittings	Replace Repair		1.0 1.0					0
0 2	CLUTCH								
0200	Clutch Assembly:							1,2	
	Drive Assembly	Service Replace Repair		0.4		1.5	2.0		0
	Clutch Assembly	Adjust Replace Repair		1.0		2.0	2.5		0
	Output Flange Assembly	Replace Repair				1.0 1.0			
03	FUEL SYSTEM								
0302	Fuel Pumps:							2	
	Fuel Injection Pump	Calibrate Test Replace Adjust Repair Overhaul				6.0 1.0	1.0 1.5 10 16		P A

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unlt		Direct support	General support	Depot		
			c	0	F	H	D		
0304	Air Cleaner: Air Cleaner Assembly	Inspect Service Replace Repair	0.1 0.5	0.2 1.0				1	
0305	Supercharger, Blower, Turbocharger: Turbocharger	Replace Repair		1.5	3.0			1.2	B.
0306	Tanks, tines, Fittings, Headers: Fuel Tank	Service Replace Repair	0.2	2.0 1.5				1	N, O
	Fuel Lines, Fittings	Replace Repair		1.0 1.0					
0309	Fuel Fitters: Fuel Filter and Water Separator	Inspect Replace	0.1	1.0				1	
0312	Accelerator, Throttle or Choke Controls: Throttle Controls	Inspect Adjust Replace	0.2	1.0 2.5				1	
04	EXHAUST SYSTEM								
0401	Muffler and Pipes: Muffler and Exhaust Pipe	Inspect Replace	0.1	1.5				1	
05	COOLING SYSTEM								
0501	Radiator, Evaporative Cooler or Heat Exchanger Radiator Assembly	Inspect Service Replace Repair	0.1	1.0 3.5	4.0			1,2	

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code	
			Unit		Direct Support	General Support	Depot			
			C	0	F	H	D			
0505	Fan Assembly:							1		
	Fan Assembly	Inspect Replace	0.1	1.0						0
	Drive Belt	inspect Replace	0.1	1.0						0
06	ELECTRICAL SYSTEM									
0601	Alternator:							192		
	Alternator Assembly	Test Replace Repair		0.2 0.5	3.0					
	Alternator Fan	Replace			0.5					
0603	Starting Motor:							1,2		
	Starter Assembly	Test Replace Repair		0.2 1.0	3.0					
0607	Instrument or Engine Control Panel:							1		
	Instrument Panel Assembly	Replace Repair		0.5 1.0						
	Meters	Inspect Replace	0.1	1.5						0
	Gauges, Lamps	Inspect Replace	0.1	0.5						0
	Switches	Replace		0.5						0
	Wiring	inspect Replace Repair	0.1	1.0 1.0						0
0609	Lights:							1		
	Floodlights	Replace Repair		0.5 0.5						0

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
0610	Sending Units and Warning Switches:							1	
	Sending Units	Inspect Replace	0.1	0.5					O
0611	Horn Siren:							1	
	Backup Warning Horn	Replace Repair		0.5 0.5					O
0612	Batteries, Storage:							1	
	Battery	Inspect Service Test Replace	0.1	0.2 0.2 0.5					O
	Battery Box	Inspect Replace Repair	0.1	2.0 1.0					O
	Battery Cables	Inspect Service Replace Repair	0.1	0.2 0.5 0.5					O
07	TRANSMISSION								
0710	Transmission Assembly, (Hydro-Static) and Associated Pans:							1.2	
	2-speed Range Box (Mixer Propel System)	Service Replace Repair		0.3	3.0		4.0		
0721	Coolers, Pumps, Motors:							1, 2	
	Pump, Hydraulic (Vari-Dlvy)	Test Replace Repair			2.0		0.5 4.0		D
	Motor, Hydraulic (Fxd Dlvy)	Test Replace Repair			2.0		0.5 4.0		E
	Filters	Service Replace		0.5 1.0					

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct Support	General support	Depot		
			c	0	F	H	D		
09 0900	Manifold Valve, Assembly	Replace Repair			2.0		4.0		F
	Lines, Fittings, Hoses	Inspect Replace Repair	0.1	2.0	4.0				0
	Pump Control	Adjust Replace		1.0 2.5					
	PROPELLER, PROPELLER SHAFTS, UNIV JOINTS, COUPLER & CLAMP ASSY.								
	Propeller Shafts:							1, 2	
	U-joint Shaft Assembly (Engine to Pump)	Replace Repair		1.0	2.5				G, 0
	Driveline Assembly (Clutch to Pillow block)	Replace Repair		1.0	2.5				G, 0
	Pillow Block Assembly	Replace Repair		1.0	2.0				
	U-joint Shaft Assembly (Pillow block to Rotor)	Service Replace Repair	0.2	1.0	2.5				G, 0
	FRONT AXLE								
1000	Front Axle Assembly:							1,2	
	Front Axle Assembly	Service Replace Repair		1.0	4.0		4.0		
11	REAR AXLE								
1100	Rear Axle Assembly:							1, 2	
	Rear Axle Assembly	Service Replace Repair		0.5	8.0		8.0		0
1102	Differential:							1. 2	
	Differential Assembly	Replace Repair			2.0		4.0		H

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
1103	Planetary or Final Drive: Planetary Drive	Service Replace Repair		1.0	2.5	4.0		1,2	
12	BRAKES								
1201	Hand Brakes: Parking Brake Assembly	Inspect Service Replace	0.1	0.2 1.0				1	O
1292	Service Brakes: Brake Assembly (Brake Shoe & Lining, Lever Cross, Rivets)	Inspect Service Adjust Replace Repair		0.2 0.4 1.0	4.0 2.0			1,2	
	Brake Shoes & Lining	Inspect Replace Repair		0.2	1.0 2.0				
1204	Hydraulic Brake System: Master Cylinder	Service Replace Repair		0.2 1.5	1.0			1,2	I
	Wheel Cylinder	Replace Repair			1.0 1.9				J
	Hydraulic Lines and Hoses	Inspect Replace	0.1	1.0					O
1206	Mechanical Brake System: Brake Pedal; Linkage	Adjust Replace		0.5 1.0				1	
13	WHEELS								
1311	Wheel Assembly: Wheel Assembly	Inspect Replace	0.1	1.0				1	O

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct Support	General Support	Depot		
			C	0	F	H	D		
1313	Bearings, Front Axle	Adjust Replace		0.2 0.5				1	
	Bearings, Rear Axle	Adjust Replace			1.5 3.0			2	
	Drum, Brake	Replace Repair			1.0 1.5				
	Tires, Tubes, Tire Chains:							1	
	Tire and Tube	Inspect Service Replace Repair	0.1 0.2		2.0 2.0				0
14	STEERING								
1401	Tie Rod	Service Replace	0.2		0.5			1,2	0
1407	Power Steering Gear Assy.							1,2	
1410	Steering Control Unit	Replace Repair		2.0		3.0			K
	Hydraulic Pump or Fluid Motor Assembly:							2	
1411	Emergency Steering (24V dc)	Replace Repair		1.0		2.0			
	Hoses, Lines, Fittings:							1	
1412	Hoses, Lines	Inspect Replace	0.1		1.0				0
	Hydraulic or Air Cylinders:							1,2	
1415	Cylinder Assy., Hyd.	Replace Repair		1.5		4.0			
	Remote Control Devices: (Steering)							1,2	
	Emergency Steering System	Replace Repair		1.0		1.5			

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level				(5) Tools and Equipment Ref Code	(6) Remarks Code	
			Unit		Direct Support	General Support			Depot
			C	O		H			D
15	FRAME, TOWING ATTACHMENTS AND DRAWBARS								
1501	Frame Assembly:					2			
	Main Frame Assembly	Inspect Repair	0.1			4.0			
18	BODY, CAB, HOOD & HULL								
1801	Body, Cab, Hood & Hull Assemblies:								
	Rollover Protective Structure/Falling Object Protective Structure (ROPS/FOPS)	Inspect Replace	0.1	1.0					
1802	Fenders:					1			
	Fenders	Inspect Replace	0.1	2.0				0	
1805	Floors, Subfloors:					1			
	Floorboards	Inspect Replace	0.1	2.0				0	
1806	Upholstery Seats and carpets:					1			
	Operator's Seat	Inspect Replace	0.1	1.0					
1808	Stowage Racks, boxes:					1			
	Tool Box	Inspect Replace Repair	0.1	0.5 1.0				0	
22	BODY, CHASSIS & HULL ACCESSORY ITEMS								
2210	Data Plates and Instruction Holders:					1			
	Instruction, Data, Warning, Caution, Shipping, Identification Plates, etc.							0	

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Unit		Direct Support	General Support	Dept		
			C	O	F	H	D		
24	HYDRAULIC AND FLUID SYSTEMS								
2401	Hydraulic Pumps:						2		
	Gear Pump Assembly	Replace Repair			2.0	4.0			
2402	Manifold and/or control valves:						1,2		
	Control Valve Assy. (Directional)	Replace Repair			2.0	2.0			
	Flow Control Valve (Proportioning)	Replace Repair		1.5	1.0				
2403	Hydraulic Controls and/or Manual Controls:						1		
	Levers and Linkage	Inspect Service Replace Repair	0.1 0.2					0	
				0.4 0.8					
2406	Strainers, Filters, Lines & Fittings, etc.:						1,2		
	Hoses and Fittings	Inspect Replace Repair	0.1	1.0	1.0			0	
	Filter Assembly	Service Replace Repair	0.5	0.5 0.5				0	
2407	Hydraulic Cylinders:						102		
	Cylinder Assy., Boom Hoist	Replace Repair		0.5	4.0			L	
	Cylinder Assy., Gate	Replace Repair		0.5	4.0			M	
	Cylinder Assy., Spray Bar	Replace Repair		0.5	4.0				

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level				(5) Equipment Ref Code	(6) Remarks Code	
			Unit		Support	Support			Depot
			C	0	F	H			D
2408	Tanks, Reservoir: Hydraulic Reservoir	Seervice Replace Repair	0.2	2.0 2.0				N, O	
47	GAUGES (NON-ELECTRICAL), WEIGHING (1 MEASURING DEVICE								
4701	Instruments (Speed and Distance) :						1		
	Ground Speed Sensor	Test Replace		0.2 0.5					
	Tachometer	inspect Replace	0.1	0.5				0	
4702	Gauges, Mountings, Lines and Fittings:						1		
	Pressure Gauges	Inspect Replace	0.1	0.5				0	
	Temperature Gauges	Inspect Replace	0.1	0.5				0	
	Quantity Gauges	Inspect Replace	0.1	0.5				0	
4705	Flow Meters and Regulators:						1		
	Flow Meter	Inspect Test Replace	0.1	0.2 0.5				0	
73	CONCRETE AND ASPHALT EQUIPMENT COMPONENTS								
7300	Mixer, Rotary Tiller								
7303	Controls (Machinery): Meter Recording Unit	Adjust Replace		0.2 0.9			1,2	0	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

Table B-1. Tool and Test Equipment Requirements

Tool/Test Equip Ref	Maint Code Level	Nomenclature	Tool Kit Stock Number	CAGE/ Part Number
1	O,F,H	Tool Kit, General Mechanics: Automotive	5180-00-177-7033	50980/ SC 5180-90-N26
	0 3 3	Shop Equipment, Automotive Maintenance and Repair: Organizational Maintenance Supplemental No. 1, Less Power	4910-00-754-0653	19204/ SC 4910-95-CL-A73
	QF,H	Shop Equipment, Automotive Maintenance and Repair: Organizational Maintenance Common No. 1, Less Power	4910-00-754-0654	19204/ SC 4910-95-CL-A74
	W , H	Shop Equipment, Organizational Repair: Light Truck Mounted	4910-01-236-0166	98255t SEORTM
	QF,H	Test Set, Battery: AN/PSM-13	6625-00-868-8344	80058/ AN/PSM-13
	QF,H	Analyzer Set, Engine: Portable Solid State (STE/ICE-PM)	4910-01-222-6589	19207/ 1225926
2	F,H	Tool Kit, General Mechanics: Equipment Maintenance and Repair	5180-00-699-5273	50980/ SC 5180-90-CL-NO5
	F,H	Shop Equipment, Contact Maintenance: Truck Mounted	4940-01-016-2262	98255/ SECM-1975
	F,H	Shop Equipment, General Purpose Repair: Semi-trailer Mounted	4940-01-235-5080	98255/ SEGP-RSM
	F,H	Tool Kit, Automotive: Fuel and Electrical System Repair	5180-00-754-0655	19204/ SC 5180-95-CL-B08
	F,H	Shop Equipment, Electrical Repair: Semi-trailer Mounted, Army	4940-00-294-9517	19099/ SC 4940-97-CL-E06
	F,H	Tool Kit, Electrical Equipment: TK-101/ GSQ	5180-00-064-5178	80058/ TK-101 GISSUEG
	F,H	Tool Kit, Machinist: Posts/Camps/Stations	5280-00-511-1950	19204/ SC 5280-95-CL-A02
	F,H	Multimeter, Digital AN/PSM-45	6625-01-265-6000	89536/ 27-FM-W-ACCE

Tab/e B-1. Tool and Test Equipment Requirements - CONT.

Tool/Test Equip Ref Code	Maint Level	Nomenclature	Tool Kit Stock Number	CAGE/ Part Number
	F,H	Tool Outfit, Hydraulic System: Test and Repair, 3/4 Ton, Trailer Mounted	4940-01-036-5784	97403/ 1322E6880
	F,H	Shop Equipment, Radiator Test and Repair: Field Maintenance, Composite, Shop B	4910-00-071-0747	19204/SC 4910-95-CLA-76

Section IV. REMARKS

Reference Code	Remarks
A	Function performed by Specialized Repair Activity (SRA).
B	Turbocharger repair kit available. Turbocharger overhaul kit available.
C	Rotor assembly is a balanced assembly and cannot be interchanged.
D	A charge pump kit; a charge check valve kit; a shaft seal kit; and a controls kit are available.
E	A manifold valve kit and a shaft seal kit are available.
F	An O-ring kit for valve spools and a valve handle kit are available.
G	A U-joint repair kit is available.
H	A repair kit is available.
I	A cylinder repair kit is available.
J	A brake cylinder seal kit and a brake cylinder and piston kit are available.
K	A seal kit and a centering spring kit are available.
L	A seal and ring kit is available.
M	A seal and wear ring kit is available.
N	Hydraulic reservoir and fuel tank are one assembly.
O	Preventive Maintenance Checks and Services (PMCS).
P	Complete function is only authorized to be performed by TDA GS units that are authorized FITS (LIN WO3030).

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for the Mixer, Rotary Tiller to help you inventory the items for safe and efficient operation of the equipment.

C-2. GENERAL.

The Components of End Item (COEI) and Basic Issue Items (BII) lists are divided into the following sections.

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

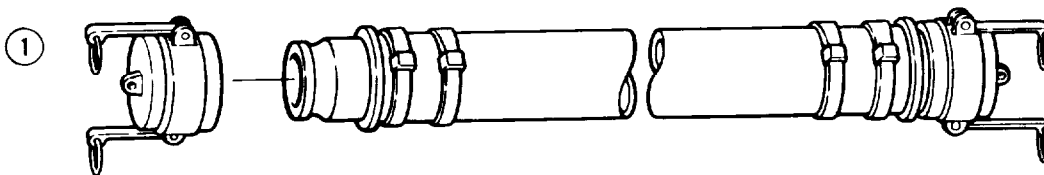
b. Section III, Basic Issue Item. These essential items are required to place the vehicle in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the vehicle during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in tabular listings.

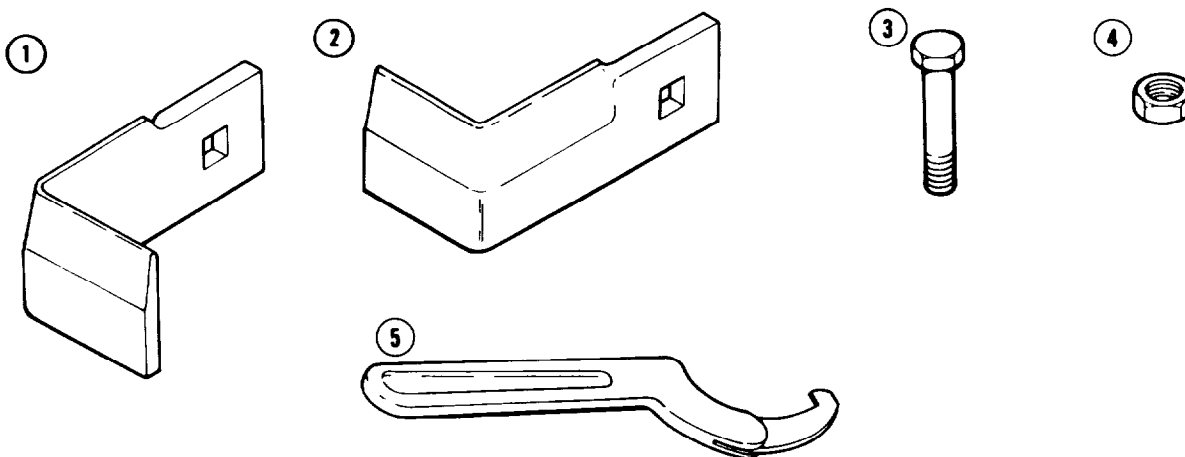
- a. Column (1), Illus Number.* Gives you the number of the item illustrated,
- b. Column (2), National Stock Number.* Identifies the stock number of the item to be used for requisitioning purposes.
- c. Column (3), Description and Usable On Code.* Identifies the federal item name (in all capital letters) followed by a minimum description when needed. The last line below the description is the CAGE (commercial and Government entity) code (in parenthesis) and the part number.
- d. Column (4), U/M (Unit of Measure).* 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), Qty Req'd.* Indicates the quantity required.

Section II. COMPONENT OF END ITEM LIST



(1) Illus Number	(2) National Stock Number	(3) Description Cage and Part Number	Usable On Code	(4) U/M	(5) Qty Reqd
1		Hose Assembly, Additive Suction (IGX90) 47HW-3-300EAL-300EAL-192		ea	1

Section III. BASIC ISSUE ITEMS LIST



(1) Illus Number	(2) National Stock Number	(3) Description Cage and Part Number	Usable On Code	(4) U/M	(5) Qty Reqd
1	3895-00-129-3285	Tine, RH, (64559) 00000377		ea	32
2	3895-01-294-6073	Tine, LH, (64559) 00000378		ea	32
3	5306-01-008-6674	Bolt, Machine, grade 5,5/16-18 X 2 (10988) 13-532		ea	6
4	5310-01-352-3126	Nut, SLFLKG, HEX, 5/16, (55653) 11-10044		ea	6
5	5120-00-277-9077	Spanner Nut Wrench, (54275) 38D34310		ea	1

APPENDIX D
ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items that are authorized for support of the Mixer, Rotary Tiller.

D-2. GENERAL.

The Additional Authorization list identifies items that are not issued with the vehicle and do not have to be turned in with the mixer. The items included on this list are authorized for use by the Common Table of Allowance (CTA), Modified Table of Equipment (MTOE), Table of Distributed Allowance (TDA), or Joint Table of Allowance (JTA).

D-3. EXPLANATION OF LISTING.

The Additional Authorization List is divided into four columns: national stock number, description, unit of measure (U/M), and quantity authorized (Qty Auth). The names of the columns are self explanatory. In addition to the name of the authorized item, the description column also lists the items part number, the Commercial and Government Entity (CAGE) code, and the usable on code.

Section II. ADDITIONAL AUTHORIZATION LIST

The are no additional authorization components issued with the vehicle.

National Stock Number	Description CAGE & Part Number Usable On Code	U/M	Qty Auth
4210-00-889-2221	Extinguisher, Fire, 2% lb, 5-B:C, O-E-915, Type III, Class 2	ea	1

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIAL LIST

Section I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the Mixer, Rotary Tiller. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts and Hydraulic Items).

E-2. EXPLANATION OF COLUMNS.

- a. Column (1) - Item.* This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., Use cleaning compound, item 5, app. E).
- b. Column (2) - Level.* This column identifies the lowest level of maintenance that requires the listed items.
- C - Operator/Crew
 - O - Organizational Maintenance
 - F - Direct Support Maintenance
- c. Column (3) - National Stock Number.* This is the national stock number assigned to the item; use it to request or requisition the item.
- d. Column (4) - Description.* Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for 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 SUPPLIES AND MATERIAL LIST

Table E-1. Expendable Supplies and Material List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O,F	8040-00-843-0802	Adhesive-Sealant, Silicone RTV, General Purpose (MIL-A-46106) 3 oz tube	oz
2	O	6850-00-181-7929 6850-00-181-7933 6850-00-181-7940	Antifreeze, Ethylene Glycol: Inhibited, heavy duty, single package, (MIL-A-46153) 1-gal bottle 5-gal can 55-gal drum	gal gal gal
3	O		Box, shipping, fiberboard (PP-B-636)	
4	F		Brush, brass wire	ea
5	F		Brush, Soft Bristle	ea
6	F	7920-00-205-2401	Brush, Stiff Bristle (MIL-B-43871)	ea
7	F	7920-00-056-5525	Brush, tube, nylon	ea
8	O	5340-00-298-9112	Cap, plastic (MIL-C-5501)	
9		6850-00-584-4077 6850-00-224-6665 6850-00-224-6666	Cleaning Compound, Solvent: Degreasing and Depreserving, self-emulsifying (MIL-C-11090) 1-gal can 5-gal can 55-gal drum	gal gal gal
10	C F	7930-00-634-3935	Chips, Soap: (P-S-579) 200-lb drum	lb
11	O,F	5350-00-192-5052	Cloth, Abrasive: Crocus, ferric oxide and quartz. Jean cloth backing, exposed coat, 9x11 sheet, 50-sh package, P-C-458, type 1, class 1.	pg
12	O,F	7902-00-044-9281	Cloth, Lint-Free: (MIL-C-85043) 10-lb box	lb
13	O,F	8030-00-597-5367	Compound, Anti-Seize, High Temperature (MIL-A-907) 2-1/2 lb can	lb
14		5350-00-193-7227	Compound, Lapping and Grinding (A-A-1203) 1-lb can	lb
15	O,F	8030-00-148-9833	Compound, Sealing, Lubricating, Wicking, Thread Locking, Anaerobic, Single Component (MIL-S-46163) Type I, Grade K	bx

Table E-1. Expendable Supplies and Material fist

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
16	O,F		Compound, Sealing, Permatex	
17	O,F	8030-01-054-0740	Compound, Sealing, Pipe Thread	ea
18	F	8030-00-181-7603 8030-00-181-7529	Compound, Retaining, Loctite (MIL-R-46082) 50cc 250cc	cc cc
19	C,F	7930-00-282-9699	Detergent: Non sudsing, general purpose, liquid (80244) MIL-D-16791 type 1, 1-gal can	gal
20	F		Dye, Marking (Prussian Blue)	
21	O	9150-01-102-9455 9150-01-123-3152 9150-01-072-8379	Fluid, Brake, Silicone: BFS (MIL-B-46176A) 1-gal can 5-gal can 55-gal drum	gal gal gal
22	F	6850-00-656-0810	Fluid, Calibrating (MIL-C-7024) bulk	gal
23	F	9150-00-935-9807 9150-00-935-9808 9150-00-935-9809 9150-00-935-9810	Fluid, Hydraulic, Petroleum base: OHT (MIL-H-6083) 1-qt can 1-gal can 5-gal can 55-gal drum	qt gal can gal
24	C,F	9150-00-065-0029 9150-01-197-7690 9150-00-190-0907	Grease, Automotive and Artillery (MIL-G-10924) 2 1/4-oz tube 1 3/4-lb can 35-lb can	oz lb lb
25	O,F	9150-01-091-9336	Grease, General Purpose, Lithium Base 1 1/2-lb can	lb
26	C,F	9150-00-145-0161	Grease, Silicone: Medium (MIL-G-46886) 8 oz tube	oz oz
27	O	8135-00-753-4662	Material, barrier, grade C (MIL-B-121)	
28	O	8135-00-292-9719	Material, barrier, grade A, (MIL-B-121)	

Table E-1. Expendable Supplies and Material List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
29	C	9140-00-286-5286 9140-00-286-5287 9140-00-286-5288 9140-00-286-5289	Oil, Fuel, Diesel DF-1 Winter (VV-F-800) Bulk 5-gal can 55-gal drum, 16 gage 55-gal drum, 18 gage	gal gal gal gal
30	C,F	9140-00-286-5294 9140-00-286-5295 9140-00-286-5296 9140-00-286-5297	Oil, Fuel, Diesel DF-2 Regular (VV-F-800) Bulk 5-gal can 55-gal drum, 16-gage 55-gal drum, 18 gage	gal gal gal gal
31	C,O	9150-01-035-5390 9150-01-035-5391	Oil, Lubricating, Gear, GO 75 (MIL-L-2105) 1-qt can 5-gal can	qt gal
32	C,O	9150-01-035-5393 9150-01-035-5394	Oil, Lubricating, Gear GO 80/90 (MIL-L-2105) 5-gal can 55-gal drum	gal gal
33	O	9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	Oil, Lubricating, OEA Ice, Subzero (MIL-L-46167) 1-qt can 5-gal can 55-gal drum	qt gal gal
34	C	9150-00-189-6727 9150-00-186-6668 9150-00-191-2772	Oil, Lubricating, OE/HDO 10 (MIL-L-2104) 1-qt can 5-gal can 55-gal drum	qt gal gal
35	C,O,F	9150-01-152-4117	Oil, Lubricating: Internal combustion engine, tactical service (MIL-L-2104) (OE/HDO 15/40) 1-qt can	qt
36	C,O,F	9150-00-186-6681 9150-00-188-9858 9150-00-189-6729	Oil, Lubricating, OE/HDO 30 (SAE 30) (MIL-L-2104) 1-qt can 5-gal can 55-gal drum	qt gal gal
37	C,F	9150-00-405-2987 9150-00-189-6730 9150-00-188-9862	Oil, Lubricating, OE/HDO 40 (SAE 40) (MIL-L-2104) bulk 1-qt can 55-gal drum	gal qt gal

Table E-1. Expendable Supplies and Material List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
38	C	9150-00-188-9864 9150-00-188-9865 9150-00-188-9867	Oil, Lubricating OE/HDO 50 (MIL-L-2104) 1-qt can 5-gal can 55-gal drum	qt gal gal
39	F	9150-00-261-7899 9150-00-231-6689 9150-00-223-4119	Oil, penetrating (VV-L-800) 1-pt 1-qt 1-gal	pt qt gal
40	O	9150-00-153-0207	Oil, preservative, grade 30, type II (MIL-L-21260)	qt
41	O		Oil, preservative (MIL-P-46093)	gl
42	O		Oil, preservative, type P-1 (MIL-P-46002)	gl
43	O		Oil, preservative, type P-6 (MIL-P-116)	gl
44	O		Oil, preservative, type P-9 (VV-L-800)	gl
45	O		Oil, preservative, type P-10 (MIL-P-116)	gl
46	O		Oil, preservative, type P-11 (MIL-P-116)	gl
47	O		Oil, preservative, type P-19 (MIL-P-116)	gl
48	F	5350-00-221-0884 5350-00-271-7930	Paper, Abrasive, Garnet (Emery Cloth) (P-P-121), SO-grit, 50-sheet package 180-grit, 100-sheet package	ea ea
49	O,F	5350-00-619-9167 5350-00-619-9166 5350-00-264-3485	Paper, Abrasive, Silicon Carbide, Waterproof (P-P-101) 50-sheet package 50-grit 80-grit 100-grit	
50			Penetrant, Fluorescent (MIL-C-1949)	
51	O		Polyethylene, black, 6 mil (L-P-378)	
52	O,F		Sealant, Hydraulic	

Table E-1. Expendable Supplies and Material List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
53	O	6810-00-233-1715	Sodium Carbonate, Anhydrous (A-A-41)	lb
54	O,F	6850-00-664-5685 6850-00-281-1985	Solvent, Drycleaning: (P-D-680) Type II 1-qt can 1-gal can	qt gal
55	O,F	8135-00-178-9200	Tags, Identification (MIL-S-29190) 1,000 per carton	carton
56	O	7510-00-663-3732	Tape, Packaging, Waterproof (PPP-T-60)	rl
57	O	5975-00-984-6582	Ties, Cable: Plastic (MIL-S-29190)	hd

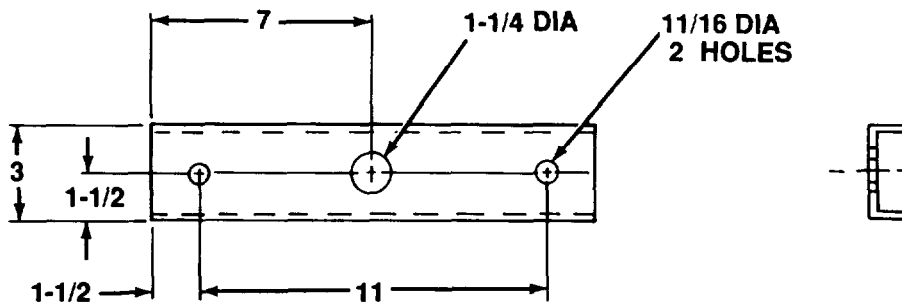
APPENDIX F

MANUFACTURED ITEMS LIST

F-1. INTRODUCTION.

This appendix includes complete instructions for manufacturing or fabricating items needed for Unit Support Maintenance. A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the figure which covers fabrication criteria. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

F-2. ROTOR DRIVE PINION PULLER FABRICATION.



NOTES:

1. FABRICATE FROM 3 IN. x 5# CHANNEL.
2. CUT CHANNEL TO 14 IN. LONG.
3. DRILL TWO HOLES 11/16 IN. DIAMETER.
4. DRILL 1-1/4 IN. DIAMETER HOLE.
5. PROVIDE TWO MS51967-21, 5/8-11 x 4-1/2 IN. HEX HEAD SCREWS (SHIPPED LOOSE WITH FABRICATION).
6. PROVIDE 5/8-11 IN. HEX NUT (SHIPPED LOOSE WITH FABRICATION).
7. PROVIDE PINION NUT -- PART NUMBER 19205 (CAGE 81118).
8. ALL DIMENSIONS ARE INCHES.

Figure F-1. Rotor Drive Pinion Puller

F-3. ROTOR DRIVE ASSEMBLY STAND FABRICATION.

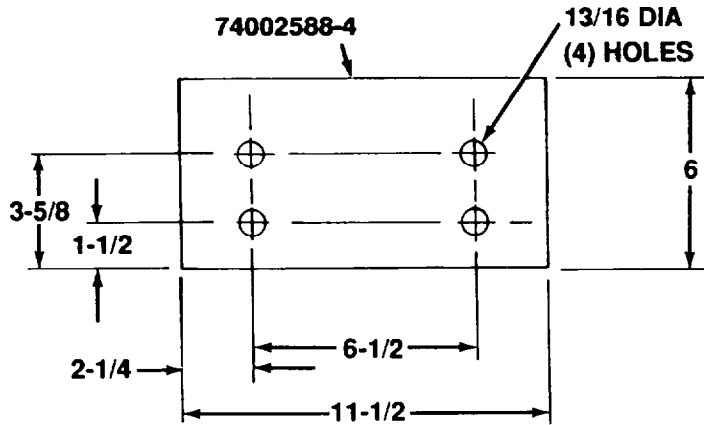
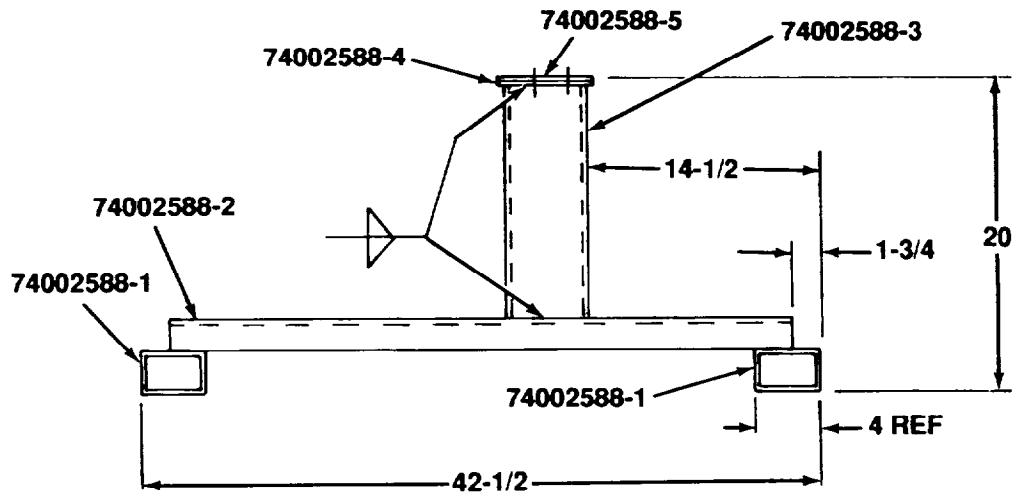
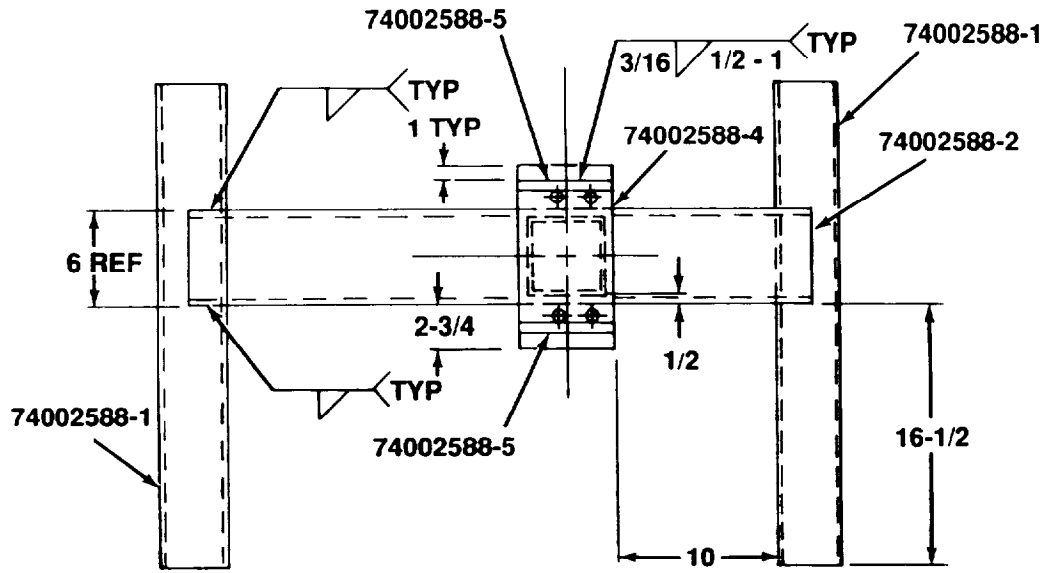


Figure F-2. Rotor Drive Assembly Stand (Sheet 1 of 2)

NOTES:

1. FABRICATE FROM THE FOLLOWING MATERIALS:
 TWO 74002588-1, 1/4 IN. x 3 IN. x 3/8 IN. RECTANGULAR STEEL TUBING x 30 1/2 IN. LONG.
 ONE 74002588-2, 6 IN. x 10.5# CHANNEL x 39 IN. LONG.
 ONE 74002588-3, 5 IN. x 5 IN. x 3/8 IN. SQUARE STEEL TUBING x 14 1/2 IN. LONG.
 ONE 74002588-4, 1/4 IN. x 6 IN. x 11-1/2 IN. LONG, HOT ROLLED STEEL.
 TWO 74002588-5, 1/4 IN. x 3/4 IN. x 6 IN. LONG, HOT ROLLED STEEL.
 FOUR MS90725-185, 3/4-10 x 1-1/2 IN. LONG, HEX HEAD SCREWS (SHIPPED LOOSE WITH FABRICATION).
2. DRILL FOUR 13/16 IN. DIAMETER HOLES IN 74002588-4 PLATE.

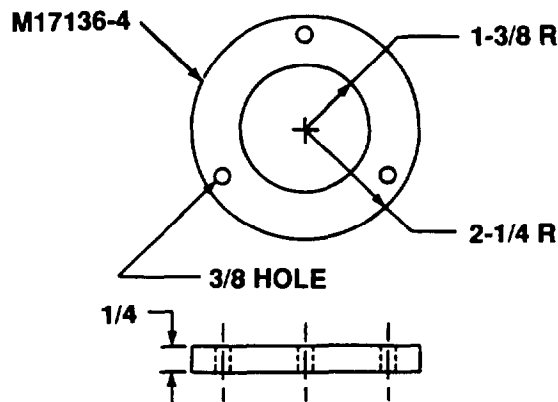
WARNING

UNSAFE WELDING PRACTICES CAN CAUSE SERIOUS INJURY FROM FIRE, EXPLOSIONS, OR HARMFUL AGENTS. ALLOW ONLY AUTHORIZED PERSONNEL TO WELD OR CUT METALS, AND FOLLOW SAFETY PRECAUTIONS IN TM 9-237. PROTECTIVE CLOTHING AND GOGGLES MUST BE WORN; ADEQUATE PROTECTIVE EQUIPMENT USED, A SUITABLE FIRE EXTINGUISHER KEPT NEARBY; AND REQUIREMENTS OF TM 9-237 STRICTLY FOLLOWED.

3. POSITION AND WELD TWO 74002588-5 BARS TO 74002588-4 PLATE.
4. POSITION AND WELD 74002588-4 PLATE TO 74002588-3 TUBING.
5. POSITION AND WELD TWO 74002588-1 TUBING TO 74002588-2 TUBING.
6. POSITION AND WELD 74002588-3 TUBING TO 74002588-2 CHANNEL.
7. ALL DIMENSIONS ARE IN INCHES.

Figure F-2. Rotor Drive Assembly Stand (Sheet 2)

F-4. DRIVE PIN PLATE FABRICATION.

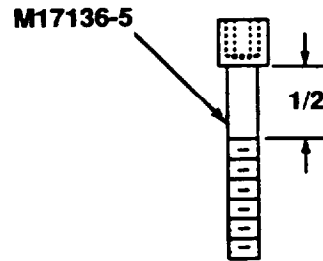


NOTES:

1. FABRICATE FROM 1010/1018 1/4 IN., COLD ROLLED STEEL PLATE.
2. CUT 2-1/4 IN. OUTSIDE RADIUS x 1-3/8 IN. INSIDE RADIUS RING FROM 1010/1016 1/4 IN., COLD ROLLED STEEL PLATE.
3. DRILL THREE 3/8 IN. DIAMETER HOLES EQUALLY SPACED ON 3-1/2 IN. BOLT CIRCLE.
4. ALL DIMENSIONS ARE IN INCHES.

Figure F-3. Drive Pin Plate

F-5. DRIVE PIN FABRICATION.

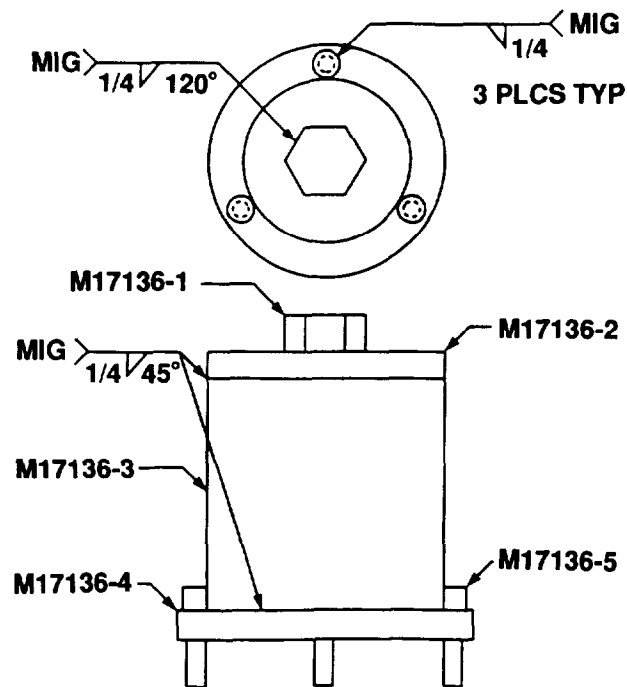


NOTES:

1. FABRICATE FROM MS51975-16, 5/16-18 IN. x 2-1/2 IN. LONG, SOCKET HEAD SCREW.
2. CUT THREE MS5197-16 SCREWS 1/2 IN. BELOW HEAD OF SCREW.
3. GRIND 1/16 IN. CHAMFER ON END OF THREE SCREWS.
4. ALL DIMENSIONS ARE IN INCHES.

Figure F-4 Drive Pin

F-6. THREE-PIN FACE SPANNER WRENCH.



NOTES-

1. FABRICATE FROM THE FOLLOWING MATERIALS:
 ONE M17136-1, MS51967-35 1-1/4 IN. HEX NUT.
 ONE M17136-2, 1/4 IN. x 3 IN. OUTSIDE DIAMETER, COLD ROLLED STEEL.
 ONE M17136-3, 3 IN. OUTSIDE DIAMETER x 2-1/2 IN. INSIDE DIAMETER, COLD ROLLED STEEL PIPE X 4 IN. LONG,
 ONE M17136-4 DRIVE PIN PLATE (SEE FIGURE F-3).
 THREE M17136-5 DRIVE PINS (SEE FIGURE F-4).

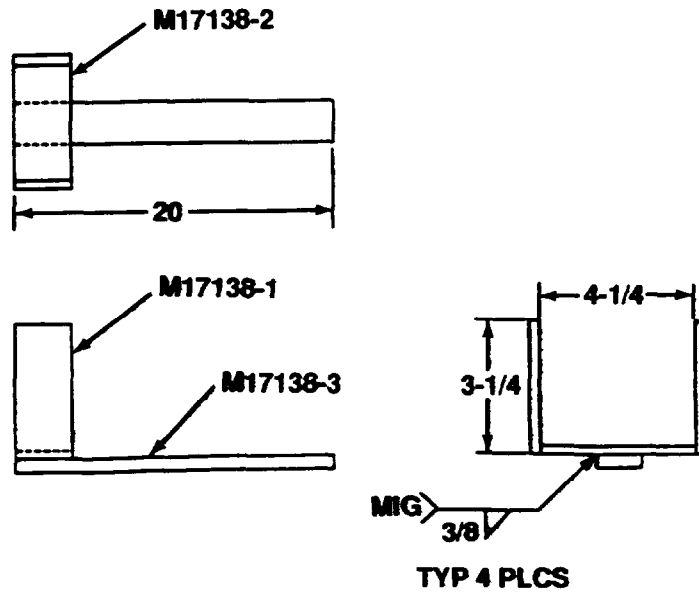
WARNING

UNSAFE WELDING PRACTICES CAN CAUSE SERIOUS INJURY FROM FIRE, EXPLOSIONS, OR HARMFUL AGENTS. ALLOW ONLY AUTHORIZED PERSONNEL TO WELD OR CUT METALS, AND FOLLOW SAFETY PRECAUTIONS IN TM 9-237. PROTECTIVE CLOTHING AND GOGGLES MUST BE WORN; ADEQUATE PROTECTIVE EQUIPMENT USED, A SUITABLE FIRE EXTINGUISHER KEPT NEARBY; AND REQUIREMENTS OF TM 9-237 STRICTLY FOLLOWED.

2. POSITION AND WELD M17136-1, 1-1/4 IN. NUT TO NUT PLATE MI 7136-2.
3. POSITION AND WELD M17136-2 NUT PLATE TO M17136-3 PIPE.
4. INSERT AND WELD THREE M17136-5 DRIVE PINS IN M17136-4 DRIVE PIN PLATE.
5. POSITION AND WELD M17136-4 DRIVE PIN PLATE TO M17136-3 PIPE.
6. ALL DIMENSIONS ARE IN INCHES.

Figure F-5. Three-Pin Face Spanner Wrench

F-7. VIBRATION DAMPER HOLDER FABRICATION.



NOTES:

1. FABRICATE FROM THE FOLLOWING MATERIALS:
 TWO M17138-1, 3/8 IN. x 1-1/2 IN. COLD ROLLED STEEL x 3-1/4 IN. LONG.
 ONE M17138-2, 3/8 IN. x 1-1/2 IN. COLD ROLLED STEEL x 4-1/4 IN. LONG.
 ONE M17138-3, 3/8 IN. X 1-1/2 IN. COLD ROLLED STEEL X 20 IN. LONG.

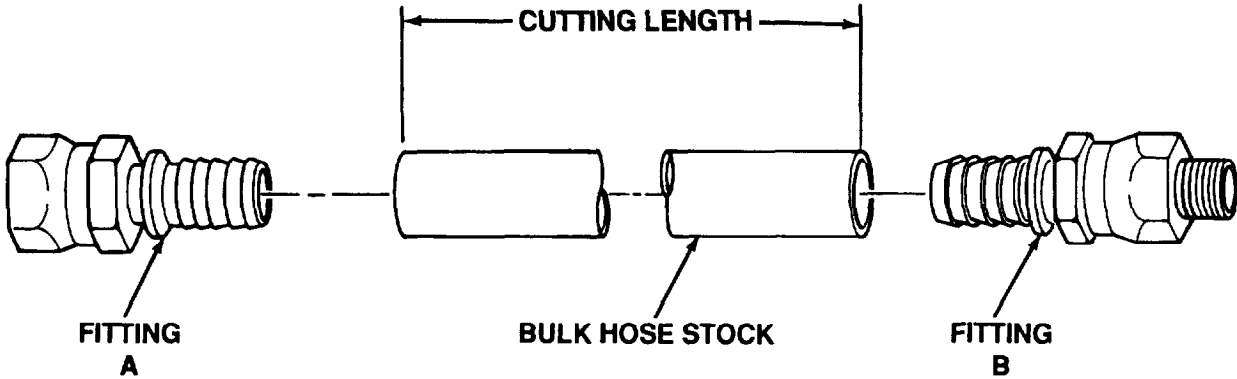
WARNING

UNSAFE WELDING PRACTICES CAN CAUSE SERIOUS INJURY FROM FIRE, EXPLOSIONS, OR HARMFUL AGENTS. ALLOW ONLY AUTHORIZED PERSONNEL TO WELD OR CUT METALS, AND FOLLOW SAFETY PRECAUTIONS IN TM 9-237. PROTECTIVE CLOTHING AND GOGGLES MUST BE WORN; ADEQUATE PROTECTIVE EQUIPMENT USED, A SUITABLE FIRE EXTINGUISHER KEPT NEARBY; AND REQUIREMENTS OF TM 9-237 STRICTLY FOLLOWED.

2. POSITION AND WELD TWO M17138-1 STEEL BARS TO M17138-2 STEEL BAR.
3. POSITION AND WELD M17138-2 STEEL BAR TO M17138-3 STEEL BAR.
4. ALL DIMENSIONS ARE IN INCHES.

Figure F-6. Vibration Damper Holder.

F-8. VACUUM AND PNEUMATIC HOSE ASSEMBLIES FABRICATION.



NOTES:

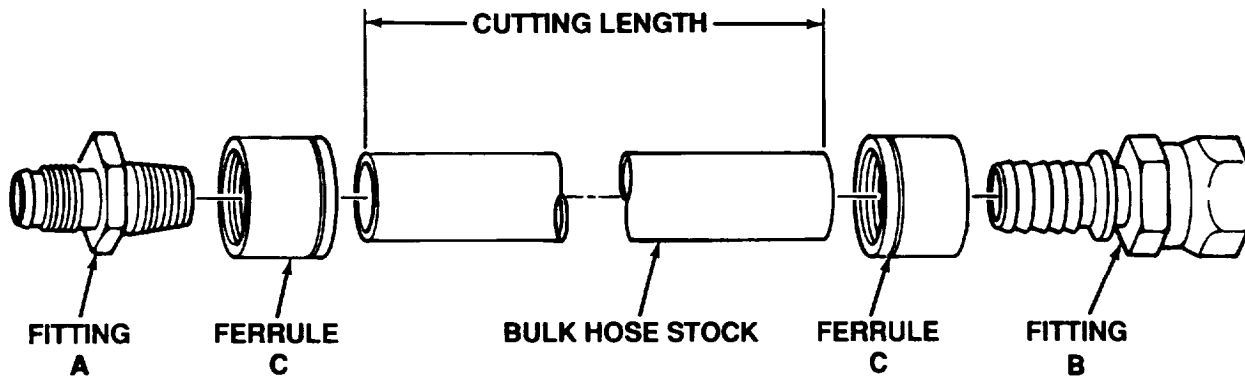
1. OBTAIN ALL COMPONENTS REQUIRED TO FABRICATE DESIRED HOSE ASSEMBLY (TABLE F-1).
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. PLACE FITTING A IN VISE.
4. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
5. PLACE FITTING B IN VISE.
6. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.

Figure F-7. Vacuum and Pneumatic Hoses.

Table F-1. Vacuum and Pneumatic Hose Assemblies and Fittings.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Ferrule C
4LOLA-2FP-2MP-80	4LOLA	80(2032)	274-0402	272-0402	N/A
4LOLA-2FP-2MP-27	4LOLA	27 (686)	274-0402	272-0402	N/A

F-9. HYDRAULIC HOSE FABRICATION.



NOTES:

NOTE

TABLE F-2 LISTS SEVERAL CONFIGURATIONS OF HYDRAULIC HOSES. THE FOLLOWING FABRICATION INSTRUCTIONS APPLY TO ALL OF THE LISTED CONFIGURATIONS.

1. OBTAIN ALL COMPONENTS REQUIRED TO FABRICATE DESIRED HOSE ASSEMBLY (TABLE F-2).
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. SLIDE FERRULES C ON HOSE AS NECESSARY.
4. PLACE FITTING A IN VISE.
5. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
6. PLACE FITTING B IN VISE.
7. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
8. SLIDE ONE EACH FERRULE TO END OF HOSE UNTIL THEY ARE AGAINST FITTINGS A AND B.
9. CRIMP FERRULES TO HOSE.

Figure F-8. Hydraulic Hoses.

Table F-2. Hydraulic Hose Assemblies and Components.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Fitting C
16C13-16FJX-16FJX-126	16C13	126 (3200)	16PCM-16FJX	16PCM-16FJX	16PCM-2F
16C13-16FJX-16FJX-119	16C13	119 (3023)	16PCM-16FJX	16PCM-16FJX	16PCM-2F
12LOLA-12FJX-12FJX-124	12LOLA	124 (3150)	288-1217	288-1217	N/A
16C4-12FJX-12MP-110	16C4	110 (2794)	16-12FJX	16-12MP	16PC1F-C4

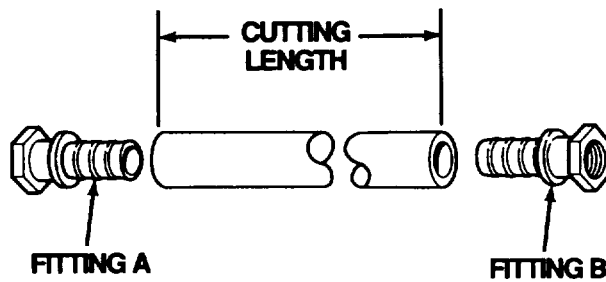
Table F-2. Hydraulic Hose Assemblies and Components - CONT.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Fitting C
12C4-12MP- 12FXJ4-5M-126	12C4	126 (3200)	12C4-12MP	12C2-12FJX45M	12PC1F-C4
4MIT-6FJX- 6FJX-90	4MIT	90 (2286)	4-6FJX	4-6FJX	4PC1F-M1A
6LOLA-6RFSX- 6RFSX-70	6LOLA	70 (1778)	6LOC-6RFSX	6LOC-6RFSX	N/A
6MIT-6FJX- 6FPX-24	6MIT	24 (610)	6-6FJX	6-6FPX	6PC1F-M1A
6MIT-6FJX- 6MPX-38	6MIT	38 (965)	6-6FJX	6-6MPX	6PC1F-M1A
6MIT-6MP- 6MP-29-1/2	6MIT	29.5 (749)	6-6MP	6-6MP	6PC1F-M1A
4MIT-4MP-4MP-19	4MIT	19 (483)	4-4MP	4-4MP	4PC1F-M1A
8MIT-8MP-8MP-78	8MIT	78 (1981)	8-8MP	8-8MP	8PC1F-M1A
4LOLA-4FJX- 4FJX-53	4LOLA	53 (1346)	288-407	288-407	N/A
6LOR-6RFJX- 6RFJX-142	6LOR	142 (3607)	288-609	288-609	N/A
12C2AT-12FJX- 12FJX-113	12C2AT	113 (2870)	12-12FJX	12PC1FA	N/A
12C4-12FJX- BLANK-138	12C4	138 (3505)	12C4-12FJX	N/A	12PC1F-C4
12C2AT-12FJX- 12FJX-40	12C2AT	40 (1016)	12-12FJX	12-12FJX	12PC1FA
16C4-16FJX- 16MP-48	16C4	48 (1219)	16C4-16FJX	16-16MP	16PC1F-C4
1711100-13	20C4	13 (330)	N/A	N/A	N/A
1710700-16	24C4	16 (406)	N/A	N/A	N/A
1710700-68	24C4	68 (1727)	N/A	N/A	N/A
8MIT-6FJX- 12FL45-55	8MIT	55 (1397)	8-6FJX	8-12FL45	8PC1F-M1A
8MIT-8MPX- 8MPX-71	8MIT	71 (1803)	8-8MPX	N/A	8PC1F-M1A
74002221-30-1/2	16C4	30.5 (775)	N/A	N/A	N/A
74002221-34	16C4	34 (864)	N/A	N/A	N/A
4MIT-8MPX- 6FP-142	4MIT	142 (3607)	4-8MPX	4-8MPX	4PC1F-M1A

Table F-2. Hydraulic Hose Assemblies and Components - CONT.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Ferrule C
4MIT-6MP-6MP-32	4MIT	32 (813)	4-6MP	4PC1F-M1A	N/A
4MIT-6MP-4MP-130	4MIT	130 (3302)	4-6MP	4-4MP	4PC1F-M1A
4CIT-4MP-6MP-96	4CIT	96 (2438)	4-6MP	4-4MP	4PC1FA

F-10. FUEL HOSE ASSEMBLY FABRICATION.



NOTES:

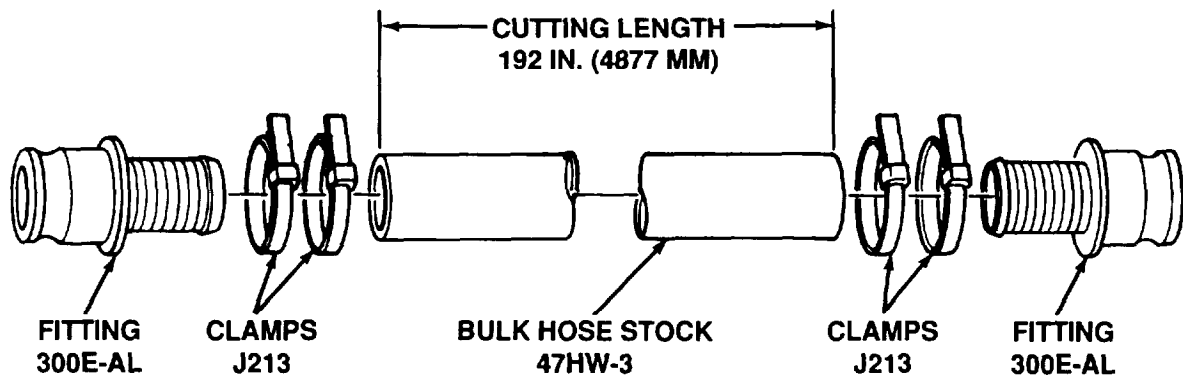
1. OBTAIN AU COMPONENTS REQUIRED TO FABRICATE DESIRED HOSE ASSEMBLY (TABLE F-3).
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. PLACE FITTING A IN VISE.
4. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
5. PLACE FITTING B IN VISE.
6. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.

Figure F-9. Fuel Hoses.

Table F-3. Fuel Hose Assemblies and Components.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Ferrule C
6LOLA-6RFSX-6RFSX-24	6LOLA	24 (610)	6LOC-6RFSX	6LOC-6RFSX	N/A
6LOLA-6FSX-6SFX-27	6LOLA	27 (686)	284-0610	284-0610	N/A

F-11. ADDITIVE SUCTION HOSE FABRICATION.

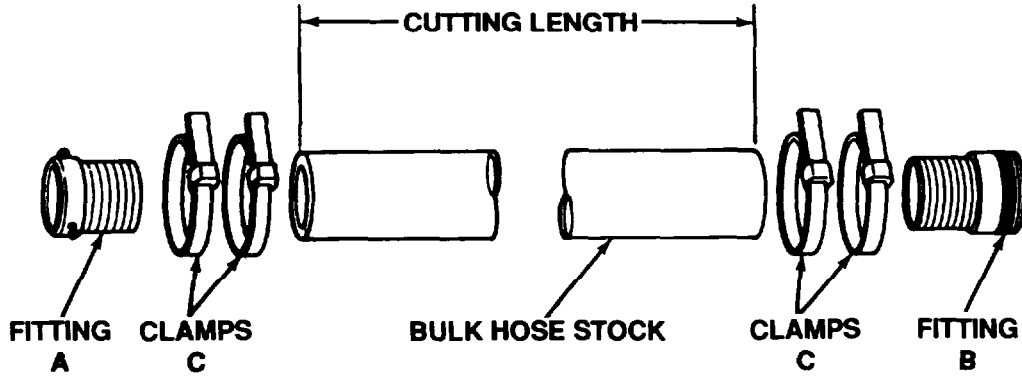


NOTES.

1. OBTAIN ALL COMPONENTS REQUIRED TO FABRICATE THE SUCTION HOSE ASSEMBLY.
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. SLIDE FOUR CLAMPS OVER HOSE.
4. PLACE FITTING A IN VISE.
5. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
6. PLACE FITTING B IN VISE.
7. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
8. SLIDE CLAMPS DOWN TO FITTING. LEAVE ABOUT 1/2 INCH BETWEEN CLAMPS AND BETWEEN FITTING AND END CLAMP.
9. TIGHTEN CLAMPS.

Figure F-10. Additive Suction Hose.

F-12. ADDITIVE SOLUTION HOSE ASSEMBLY FABRICATION.



NOTES:

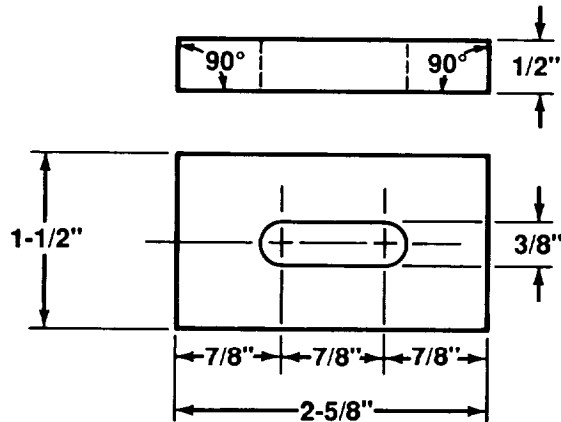
1. OBTAIN ALL COMPONENTS REQUIRED TO FABRICATE DESIRED HOSE ASSEMBLY (TABLE F-5).
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. SLIDE FOUR CLAMPS OVER HOSE.
4. PLACE FITTING A IN VISE.
5. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
6. PLACE FITTING B IN VISE.
7. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
8. SLIDE CLAMPS DOWN TO FITTING. LEAVE ABOUT 1/2 INCH BETWEEN CLAMPS AND BETWEEN FITTING AND END CLAMP.
9. TIGHTEN CLAMPS.

Figure F-11. Additive Solution Hose.

Table F-4. Additive Solution Hose Assemblies and Components.

Hose Assembly Manufacturer's Part Number	Bulk Hose Part Number	Cutoff Length Inches (mm)	Fitting A	Fitting B	Clamp C
47HW-2-1/2-AB 250F-AE250F-113	47HW	113 (2870)	FAB250F	FAB250F	J213
47HW-2-1/2-AB 250f-AB250F-128	47HW	128 (2870)	FAB250F	ST30	J213

F-13. GROUNDSPPEED SENSOR WIPER FABRICATION.

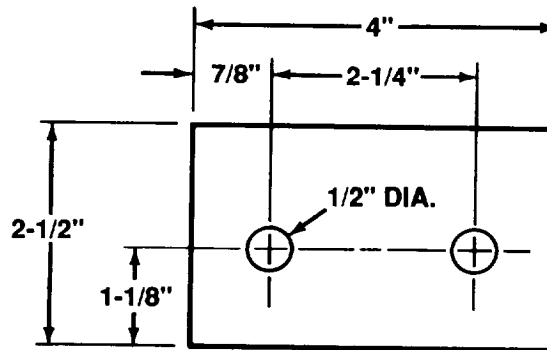


NOTES:

1. OBTAIN ENOUGH 1/2 IN. (13 MM) THICK RUBBER STOCK, PN 41-1255-11, TO FABRICATE A SENSOR.
2. CUT 2-5/8 IN. BY 1-1/2 IN (87 MM BY 38 MM) WIPER FROM RUBBER STOCK AS INDICATED.
3. CUT 3/8 IN. (10 MM) WIDE BY 1 IN. (25.4 MM) LONG HOLE IN CENTER OF WIPER AS INDICATED.

Figure F-12. Groundspeed Sensor Wiper.

F-14. CLUTCH PAD FABRICATION.

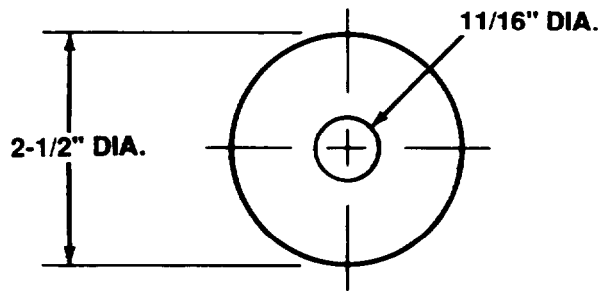


NOTES:

1. OBTAIN ENOUGH 1/4 IN. (6 MM) THICK RUBBER STOCK, PN 41-1254-18, TO FABRICATE CLUTCH PAD.
2. CUT 4 IN. BY 2-1/2 IN. (102 MM BY 64 MM) CLUTCH PAD FROM RUBBER STOCK AS INDICATED.
3. CUT TWO 1/2 IN (13 MM) DIAMETER HOLES IN CLUTCH PAD AS INDICATED.

Figure F-13. Clutch Pad.

F-15. FRONT ENGINE MOUNT PAD FABRICATION.

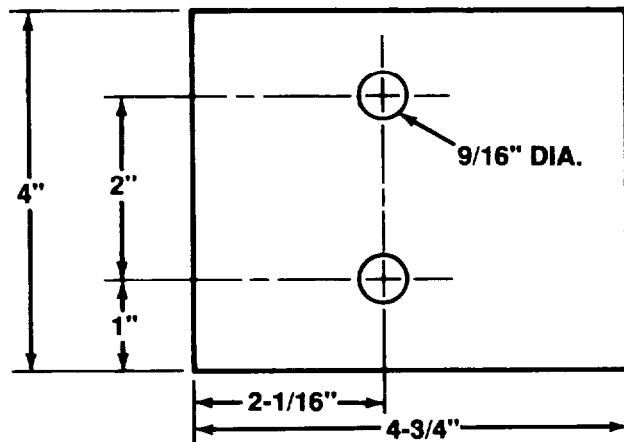


NOTES:

1. OBTAIN ENOUGH 3/8 IN. (10 MM) THICK RUBBER STOCK, PN 47-71760-24, TO FABRICATE ENGINE MOUNT PAD.
2. CUT A ROUND 2-1/2 IN. (102 MM) DIAMETER PAD FROM RUBBER STOCK AS INDICATED.
3. CUT 11/16 IN. (17 MM) DIAMETER HOLE IN CENTER OF PAD AS INDICATED.

Figure F-14. Front Engine Mount Pad.

F-16. REAR ENGINE MOUNT PAD.

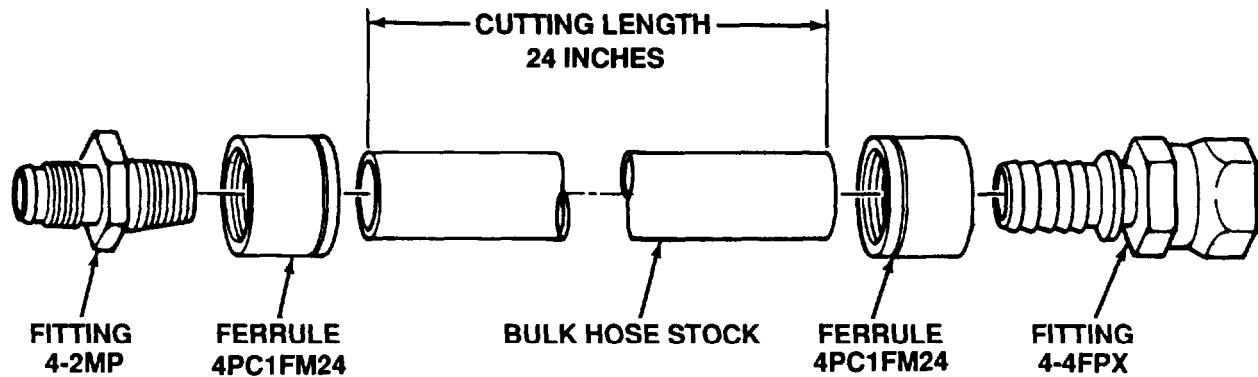


NOTES

1. OBTAIN ENOUGH 3/8 IN. (10 MM) THICK RUBBER STOCK, PN 47-71760-24, TO FABRICATE ENGINE MOUNT PAD.
2. CUT 4 IN. BY 4-3/4 IN. (102 MM BY 121 MM) REAR ENGINE MOUNT PAD FROM RUBBER STOCK AS INDICATED.
3. CUT TWO 9/16 IN. (14 MM) DIAMETER HOLES IN PAD AS INDICATED.

Figure F-15. Rear Engine Mount Pad.

F-17. CLUTCH LUBRICATION HOSE.

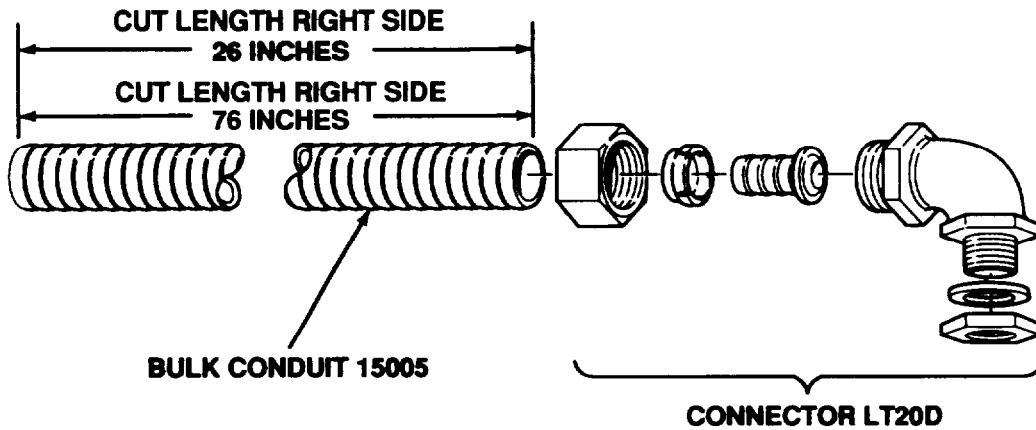
NOTES

1. OBTAIN ENOUGH BULK HOSE, PN 4M2T, TO FABRICATE LUBRICATION HOSE.
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT HOSE TO INDICATED LENGTH.
3. SLIDE FERRULES C ON HOSE AS NECESSARY.
4. PLACE FITTING A IN VISE.
5. SLIDE AND TURN HOSE ON FITTING A UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
6. PLACE FITTING B IN VISE.
7. SLIDE AND TURN HOSE ON FITTING B UNTIL HOSE BOTTOMS AGAINST FITTING. BACK OFF 1/4 TURN.
8. SLIDE ONE EACH FERRULE TO END OF HOSE UNTIL THEY ARE AGAINST FITTINGS A AND B.
9. CRIMP FERRULES TO HOSE.

Figure F-16. Clutch Lubrication Hose.

F-18. ADDITIVE CONTROL BOX CONDUIT FABRICATION.

Two lengths of conduit are connected to the additive system control box. A 26 in. (660 mm) length is connected to the left side of the control box, and a 76 in. (1930 mm) length is connected to the right side of the control box. Both of these conduits are fabricated the same way. The instructions listed below apply to the fabrication of both conduits.

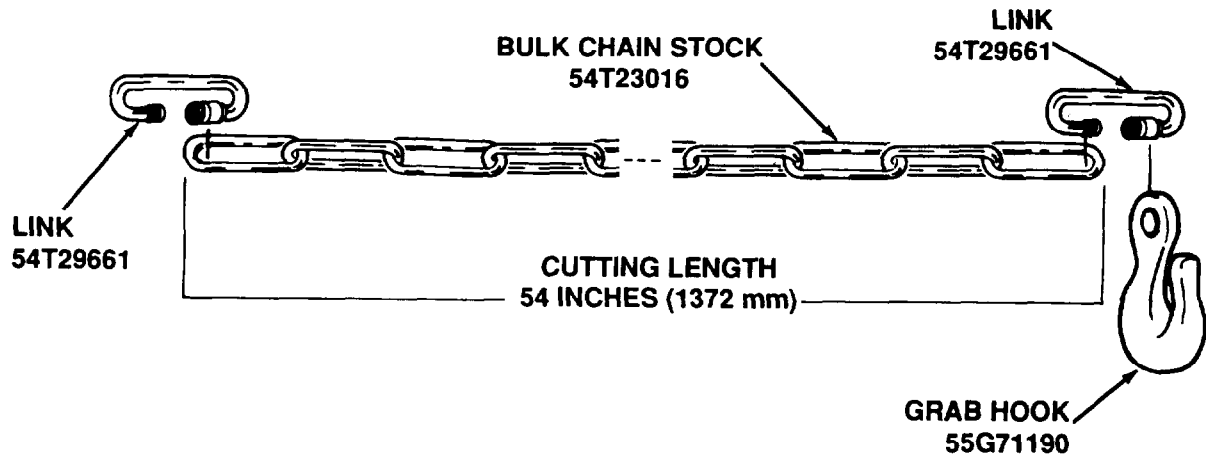


NOTES:

1. OBTAIN ENOUGH BULK CONDUIT, PN 15005, TO FABRICATE CONDUIT TO DESIRED LENGTH.
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT CONDUIT TO INDICATED LENGTH.
3. INSTALL ONE CONNECTOR, PN LT20D, ON ONE END OF CONDUIT.

Figure F-17. Additive Control Box Conduit,

F-19. BOOM CHAIN FABRICATION.



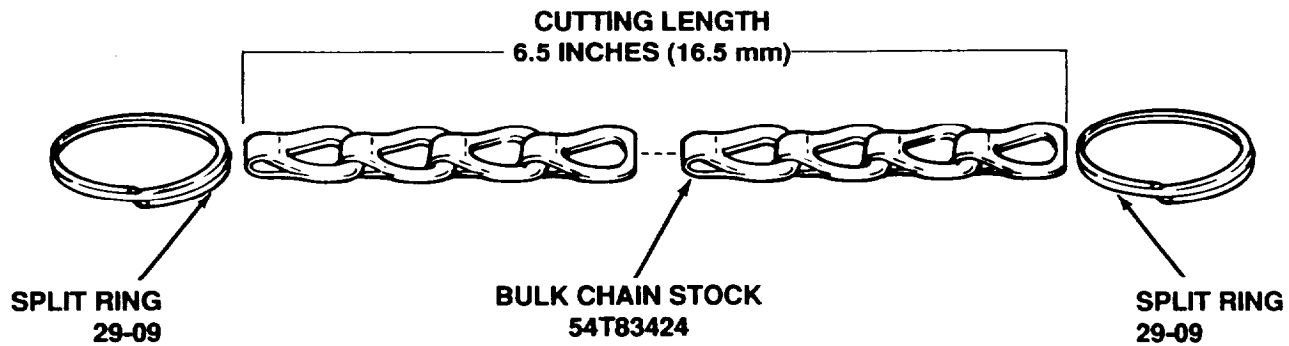
NOTES:

1. OBTAIN ENOUGH BULK CHAIN, PN 54T23016, TO FABRICATE BOOM CHAIN TO DESIRED LENGTH.
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT CHAIN TO DESIRED LENGTH.
3. INSTALL TWO LINKS, PN 54T29661, ON ENDS OF CHAIN AS INDICATED.
4. INSTALL GRAB HOOK, PN 55G71190, ON ONE LINK AS INDICATED.

Figure F-18. Boom Chain.

F-20. DUST CAP CHAIN FABRICATION.

The dust cap chain is used in two places. The chain length is the same for each application. Split rings are used to attach the chain to other components. One application requires two split rings and the other requires one.

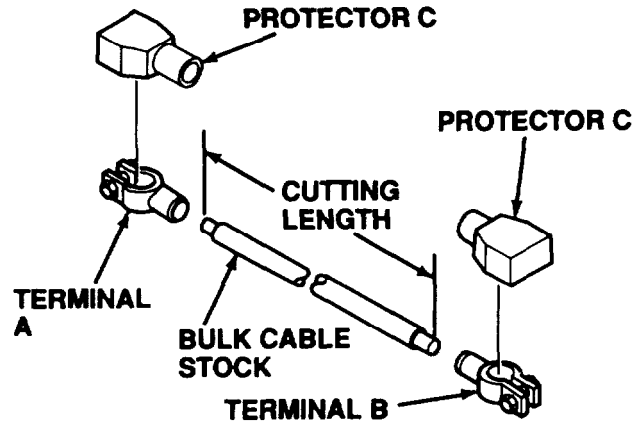


NOTES:

1. OBTAIN ENOUGH BULK CHAIN, PN 54T83424, TO FABRICATE BOOM CHAIN TO DESIRED LENGTH.
2. USE A FINE TOOTHED HACKSAW OR SUITABLE CUTTING DEVICE, AND CUT CHAIN TO DESIRED LENGTH.
3. INSTALL REQUIRED NUMBER OF SPLIT RINGS, PN T29-09, ON ENDS OF CHAIN AS INDICATED.

Figure F-19. Dust Cap Chain.

F-21. BATTERY CABLE FABRICATION.



NOTES.

1. Obtain all components required to fabricate desired battery cable (Table F-5).
2. Use a fine toothed hacksaw or suitable cutting device, and cut cable to indicated length.
3. Remove about 1 in. (25 mm) of insulation from each end of cable.
3. Slide terminal protectors A and B over cable as indicated.
4. Place lug A on cable.
5. Place lug B on cable.
6. Crimp lugs on cables.

Figure F-20. Battery Cable.

Table F-5. Battery Cables and Components.

Battery Cable Manufacturer's Part Number	Bulk Cable Part Number	Cutoff Length Inches (mm)	Battery Cable Terminal A	Battery Cable Terminal B	Terminal Protector C
74002286	8020-100B	43 (1092)	4020-005N	4820-005F	5724-005B
74002285	8120-100R	48 (1219)	4020-005P	4020-005N	5724-005R & 5724-005B
74002287	8120-100R	15-1/2 (394)	4020-005P	4820-005F	5724-005R

F-22. ADDITIVE SYSTEM GROUND WIRES AND JUMPERS.

There are three wires in the additive system control box that are used as a jumper and ground wires. The locations of these wires are illustrated in TO 5-3895-369-24P. Table F-6 lists the three wires.

Table F-6. Additive System Ground Wires.

Wire Manufacturer's Part Number	Bulk Wire Part Number	Cutoff Length Inches (mm)	Wire Gauge
74002598	8916-5	6 (152)	14
74002599	8916-2	8 (203)	14
74002600	8916-5	10 (254)	14

F-23. RADIATOR OVERFLOW HOSE FABRICATION.

The radiator overflow hose is fabricated from bulk hose stock, PN 210-05. The overflow hose is fabricated by cutting a 40 in. (1016 mm) length of the bulk hose with a fine toothed hacksaw or suitable cutting device.

F-24. BATTERY BOX EDGING FABRICATION.

Battery box edging is fabricated from bulk edging material, PN R750AB2332. The edging is fabricated by cutting a 4-1/2 in. (114 mm) length from the bulk edging with a fine toothed hacksaw or suitable cutting device.

APPENDIX G

TORQUE LIMITS

G-1. INTRODUCTION.

This appendix provides torque values for U.S. standard (Tables G-1 and G-2) and metric (Table G-3) attaching hardware.

G-2. U.S. STANDARD SCREWS TORQUE VALUES.

Tables G-1 and G-2 list torque values for U.S. standard screws, nuts, and bolts.

Table G-1. U.S. Standard Torque Value (Dry Fasteners).

SIZE			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 OR 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	Pound Feet	Newton Meters	Pound Feet	Newton Meters	Pound Feet	Newton Meters	Pound Feet	Newton Meters
1/4	20	6.35	5	7	8	11	10	14	12	16
1/4	28	6.35	6	9	10	14	12	16	14	19
5/16	18	7.94	11	15	17	23	21	28	25	34
5/16	24	7.94	12	16	19	26	24	33	25	34
3/8	16	9.53	20	27	30	41	40	54	45	61
3/8	24	9.53	23	31	35	47	45	61	50	68
7/16	14	11.11	30	41	50	68	60	81	70	95
7/16	20		35	47	55	75	70	95	80	108
1/2	13	12.70	50	68	75	102	95	129	110	149
1/2	20		55	75	90	122	100	135	120	163
9/16	12	14.29	65	88	110	149	135	183	150	203
9/16	18		75	102	120	163	150	203	170	231
5/8	11	15.88	90	122	150	203	190	258	220	298
5/8	18		100	136	180	244	210	285	240	325
3/4	10	19.05	160	217	260	353	320	434	380	515
3/4	16		180	244	300	407	360	488	420	597
7/8	9	22.23	140	190	400	542	520	705	600	814
7/8	14		155	210	440	597	580	786	660	895
1	8	25.40	220	298	580	786	800	1085	900	1220
1	12		240	325	640	868	860	1186	1000	1356
1-1/8	7	25.53	300	407	800	1085	1120	1519	1280	1736
1-1/8	12		340	461	880	1193	1260	1709	1440	1953
1-1/4	7	31.75	420	570	1120	1519	1580	2142	1820	2468
1-1/4	12		460	624	1240	1681	1760	2387	2000	2712
1-3/8	6	34.93	560	759	1460	1980	2080	2820	2380	3227
1-3/8	12		640	868	1680	2278	2380	3227	2720	3688
1-1/2	6	36.10	740	1003	1940	2631	2780	3770	3160	4285
1-1/2	12		840	1139	2200	2983	3100	4204	3560	4827

Table G-2. U.S. Standard Torque Value (Wet Fasteners).

SIZE			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 OR 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	Pound Feet	Newton Meters	Pound Feet	Newton Meters	Pound Feet	Newton Meters	Pound Feet	Newton Meters
1/4	20	6.35	4	6	6	8	8	11	9	12
1/4	28	6.35	5	7	7	9	9	12	10	14
5/16	18	7.94	8	11	13	18	16	22	18	24
5/16	24	7.94	9	12	14	19	18	24	20	27
3/8	16	9.53	15	20	23	31	30	41	35	47
3/8	24	9.53	17	23	25	34	30	41	35	47
7/16	14	11.11	24	33	35	47	45	61	55	75
7/16	20		25	34	40	54	50	68	60	81
1/2	13	12.70	35	47	55	75	70	95	80	108
1/2	20		40	54	65	88	80	108	90	122
9/16	12	14.29	50	68	80	108	100	136	110	149
9/16	18		55	75	90	122	110	149	130	176
5/8	11	15.88	70	95	110	149	140	190	170	231
5/8	18		80	108	130	176	160	217	180	244
3/4	10	19.05	120	163	200	271	240	325	280	380
3/4	16		140	190	220	298	280	380	320	434
7/8	9	22.23	110	149	300	407	400	542	460	624
7/8	14		120	163	320	434	440	597	500	678
1	8	25.40	160	217	440	597	600	814	680	922
1	12		170	231	480	651	660	895	740	1003
1-1/8	7	25.53	220	298	600	814	840	1139	960	1302
1-1/8	12		260	353	660	895	940	1275	1080	1464
1-1/4	7	31.75	320	434	840	1139	1100	1492	1360	1844
1-1/4	12		360	488	920	1248	1320	1790	1500	2034
1-3/8	6	34.93	420	570	1100	1492	1560	2115	1780	2414
1-3/8	12		460	624	1260	1709	1780	2414	2040	2766
1-1/2	6	36.10	560	760	1460	1980	2820	2820	2360	3200
1-1/2	12		620	841	1640	2224	2320	3146	2660	3607

G-3. METRIC TORQUE VALUES.

Table G-3 list torque values for metric screws, nuts, and bolts.

Table G-3. Metric Torque Values (Dry Fasteners).

SIZE		METRIC GRADE 8.8		METRIC GRADE 10.9		METRIC GRADE 12.9	
Dia. Inches	Millimeters	Pound Feet	Newton Meters	Pound Feet	Newton Meters	Pound Feet	Newton Meters
.157	4	2	3	3	4	4	5
.197	5	4	5	6	8	7	9
.237	6	7	9	10	14	11	15
.276	7	11	15	16	22	20	27
.315	8	18	24	25	34	29	39
.394	10	32	45	47	64	58	79
.473	12	58	79	83	113	100	136
.630	16	144	195	196	266	235	319
.709	18	190	258	269	365	323	438
.788	20	260	353	366	496	440	597
.867	22	368	499	520	705	678	919
.946	24	470	637	664	900	794	1077
1.064	27	707	959	996	1351	1235	1675
1.182	30	967	1311	1357	1840	1630	2210

APPENDIX H

SCHEMATICS AND DIAGRAMS

H-1. INTRODUCTION.

This appendix provides Mixer, Rotary Tiller wiring and hydraulic diagrams. The diagrams are divided into the following six areas:

Main Wiring Harness	Figure H-1
Emergency Steering Power Wiring Assembly	Figure H-2
Additive System Wiring	Figure H-3
Floodlights and Back Up Alarm Wiring	Figure H-4
Horn Wiring Harness	Figure H-5
Hydraulic Diagram	Figure H-6

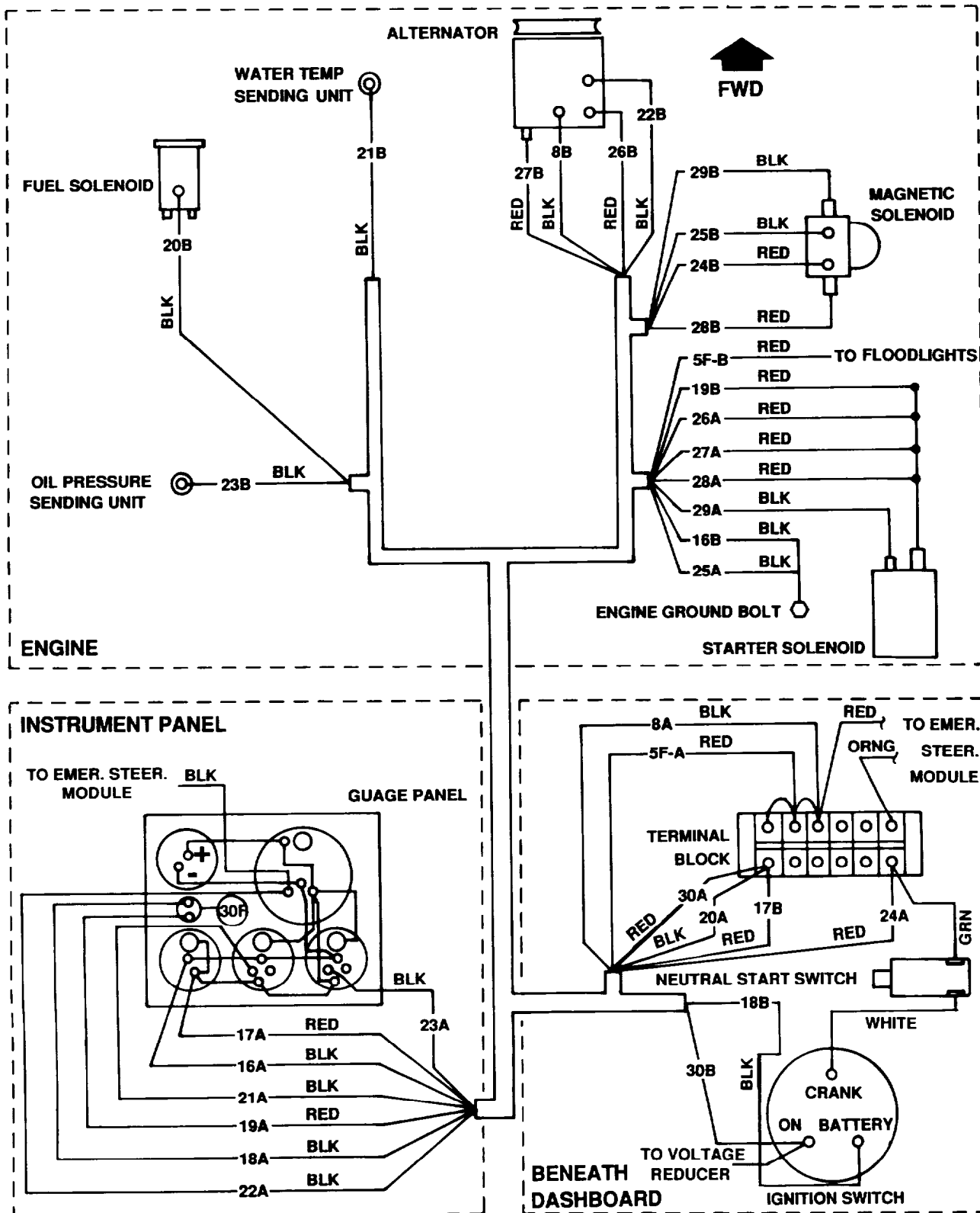


Figure H-1 Main Wiring Harness - 24V.

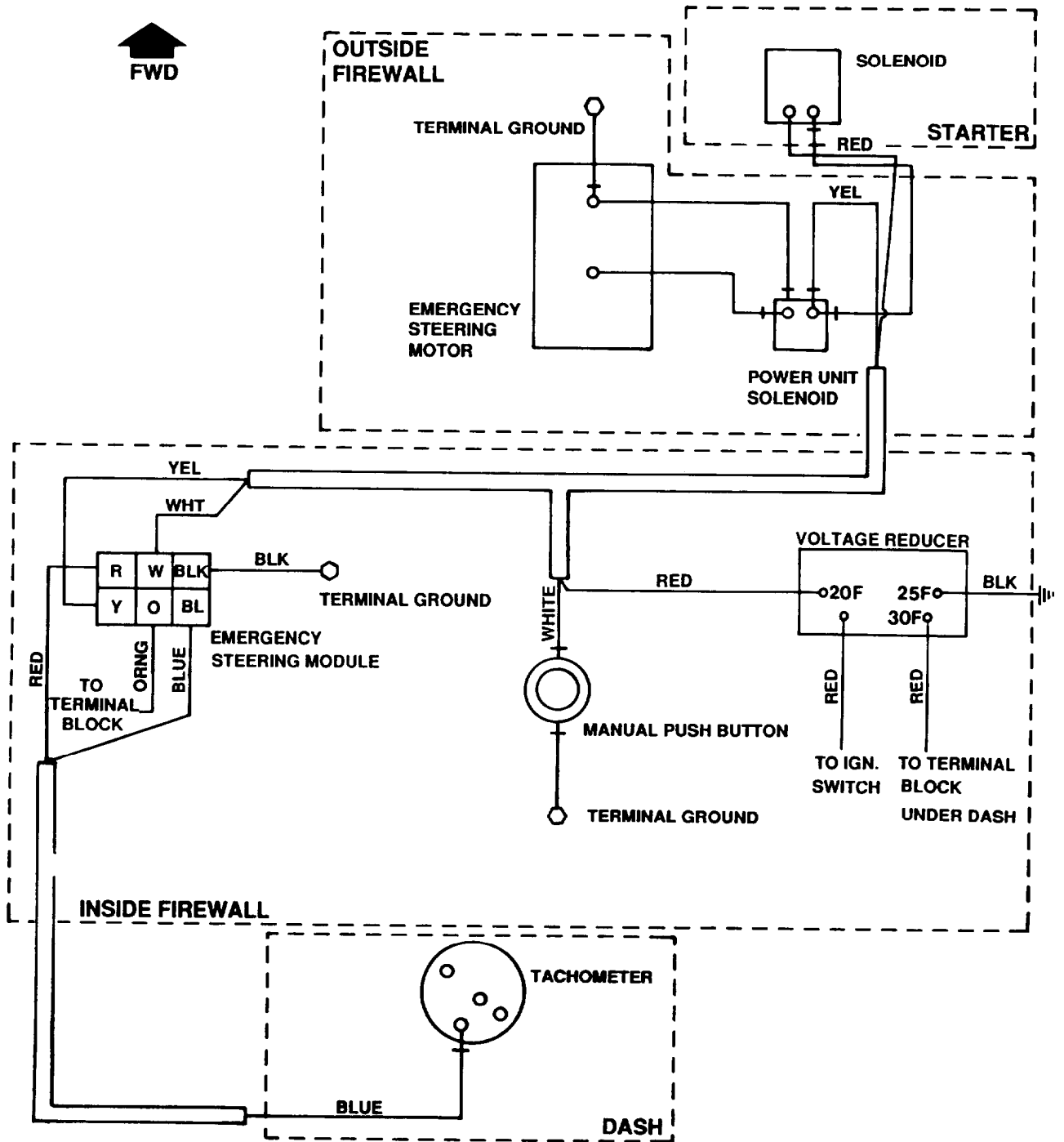


Figure H-2. Emergency Steering Power Wiring Assembly - 24V.

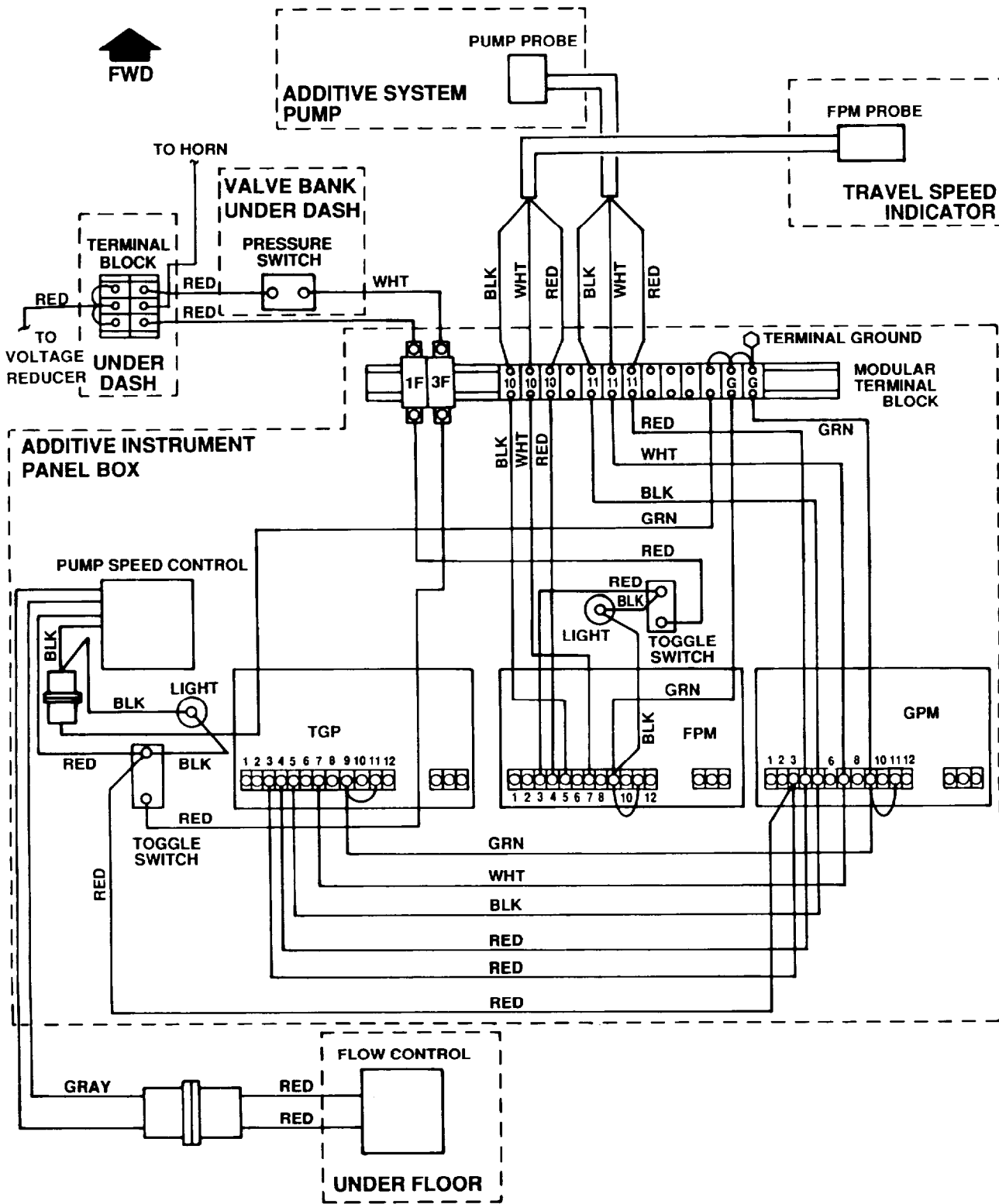


Figure H-3. Additive System Wiring - 12V.

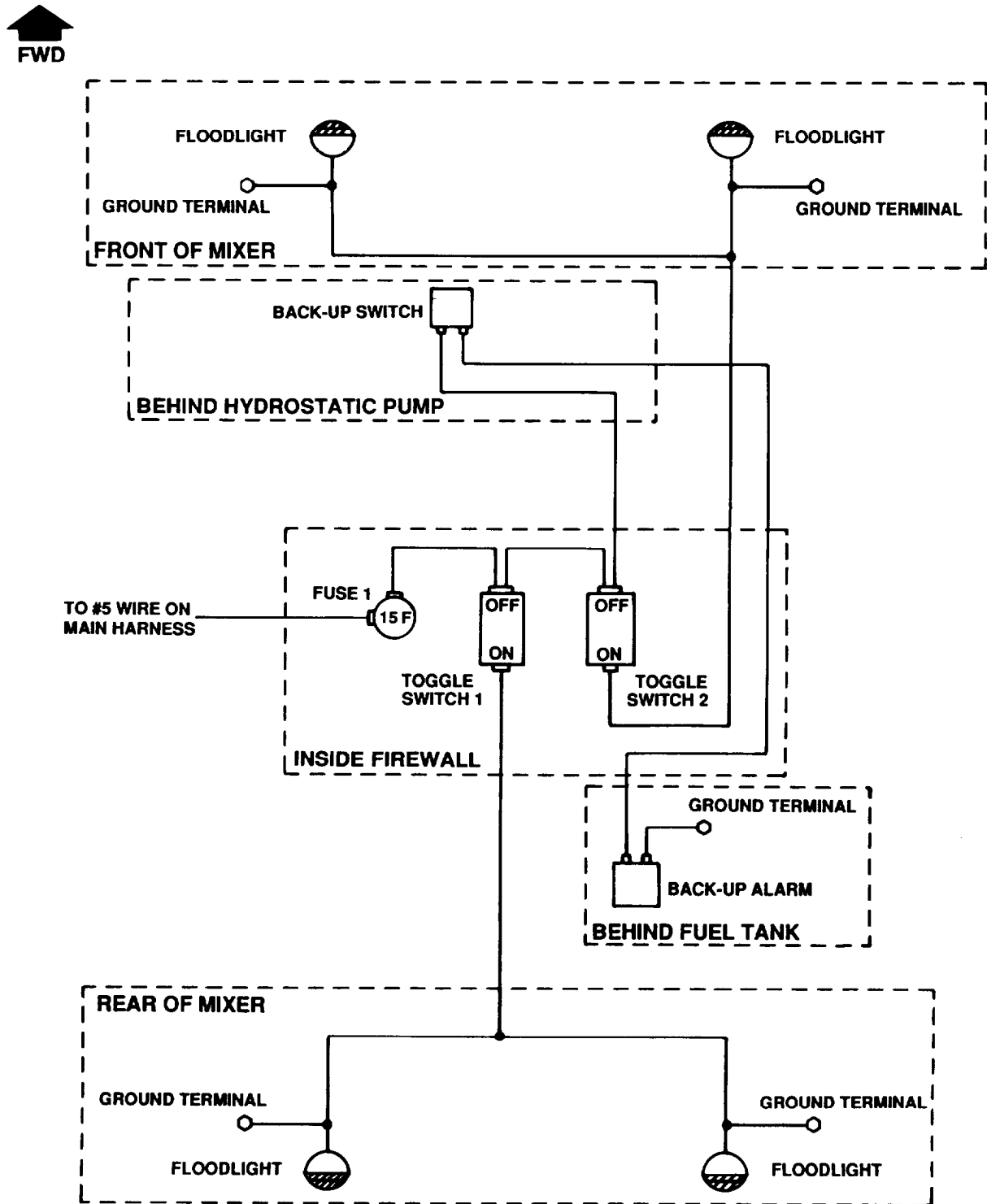


Figure H-4. Floodlights and Back Up Alarm Wiring - 24V.

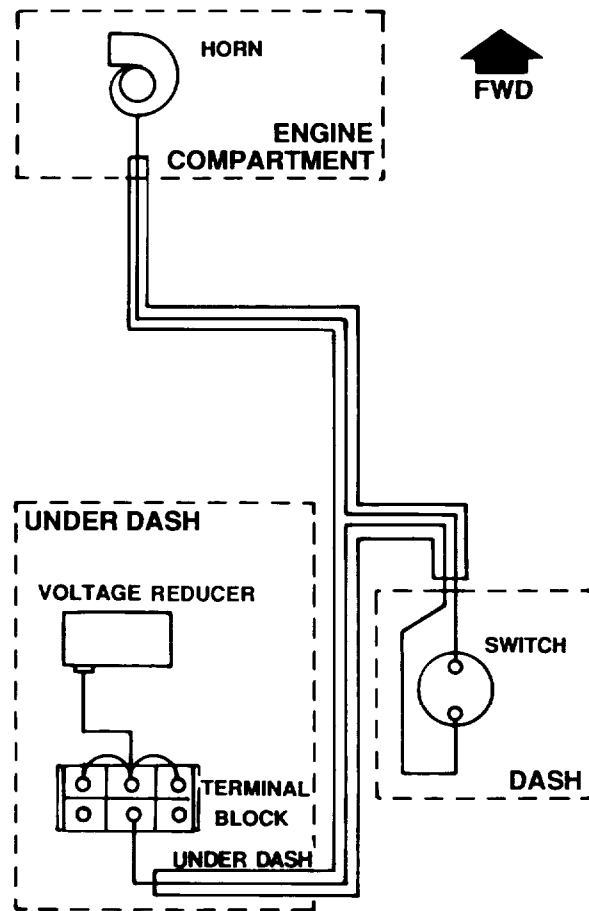


Figure H-5. Horn Wiring Harness - 12V.

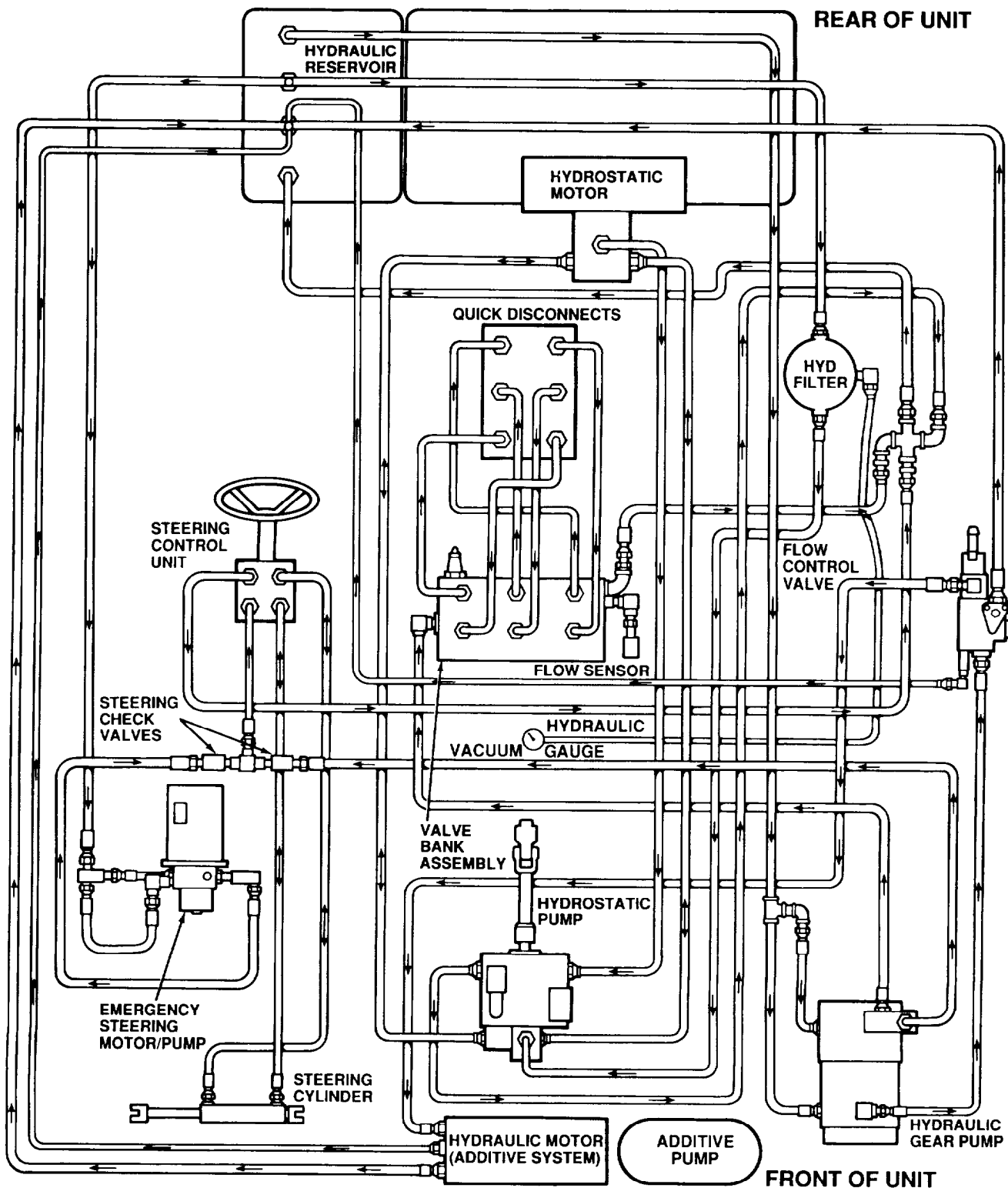


Figure H-6. Hydraulic Schematic

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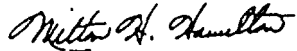
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By Order of the Secretary of the Army:

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

Official:



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

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Item 10. Change illustration. Reason: Tube end shown assembled on wrong side of lever cam.

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THE METRIC SYSTEM AND EQUIVALENTS

WEIGHT MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 lb.
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$
 212° Fahrenheit is equivalent to 100° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
its	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
ometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



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