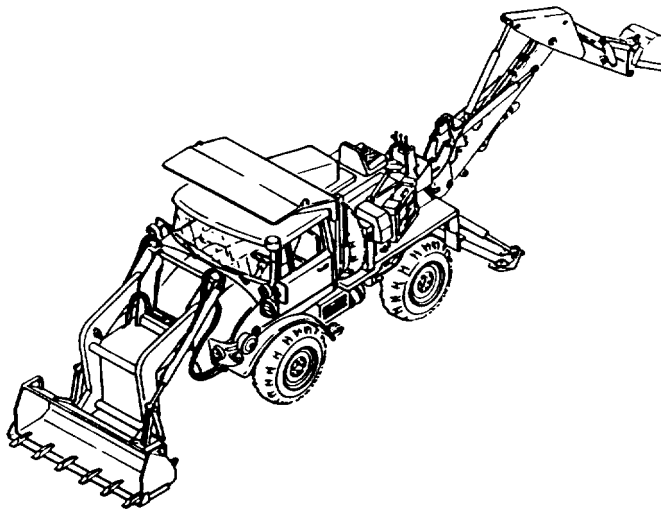


## TECHNICAL MANUAL

### DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL FOR

TRACTOR, WHEELED, 4 X 4 DED  
SMALL EMPLACEMENT EXCAVATOR (SEE)  
(NSN 2420-01-160-2754) (EIC:EDL)



TRACTOR, WHEELED, 4 X 4 DED  
HIGH MOBILITY MATERIAL HANDLER (HMMH)  
(NSN 2420-01-205-8636)

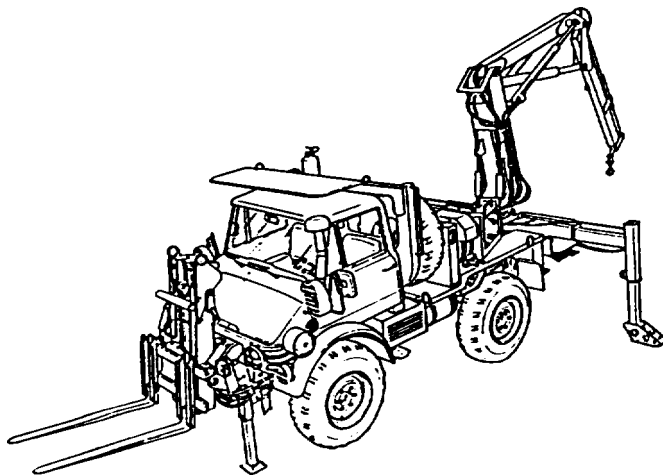


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HEADQUARTERS, DEPARTMENT OF THE ARMY

28 JULY 1993

This manual along with TM5-2420-224-20-1 and TM5-2420-224-20-2 supersedes  
TM5-2420-224-24 dated December 1989

Approved for public release; distribution unlimited.

CHANGE

NO. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, D.C., 7 October 2003

**DIRECT AND GENERAL SUPPORT  
MAINTENANCE MANUAL  
FOR  
TRACTOR, WHEELED, 4 X 4 DED  
SMALL EMPLACEMENT EXCAVATOR (SEE)  
(NSN 2420-01-160-2754) (EIC:EDL)**

**AND**

**TRACTOR, WHEELED, 4 X 4 DED  
HIGH MOBILITY MATERIAL HANDLER (HMMH)  
(NSN 2420-01-205-8636)**

TM 5-2420-224-34, dated 28 July 1993, is updated as follows:

1. File this sheet in front of the manual for reference.
2. New or changed material is indicated by a vertical bar adjacent to the material and/or change designators at the bottom of the affected page.
3. New or changed illustrations are indicated by a miniature pointing hand adjacent to the updated area.
4. Remove old pages and insert new pages as indicated below:

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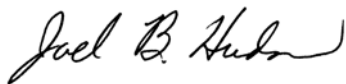
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DA Form 2028

By Order of the Secretary of the Army:

PETERJ.SCHOOMAKER  
*General, United States Army*  
*Chief of Staff*

Official:



JOEL B. HUDSON  
*Administrative Assistant to the*  
*Secretary of the Army*  
0222003

DISTRIBUTION:

To be distributed in accordance with the Initial Distribution Number (IDN) 380974 requirements for TM 5-2420-224-34.

**WARNING**

CARBON MONOXIDE POISONING CAN BE DEADLY

CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS, WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.

CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL-COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE:

1. DO NOT operate engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms, If either is present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm, DO NOT PERMIT EXERCISE; if necessary, administer artificial respiration (see FM 21-11).

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.



---

**WARNING**

## COMPRESSED AIR

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

---

**WARNING**

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. Flash point is 100°-138° F (38°-50°C). If you become dizzy while using drycleaning 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.

---

**WARNING**

Remove rings, bracelets, wristwatches, and neck chains before working on vehicle. Jewelry can catch on equipment and cause injury, or may short across an electrical circuit and cause severe burns or electrical shock.

---

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**WARNING**

Gear will be hot enough to burn you on contact. Wear heat-resistant gloves when handling hot gear.

---

**WARNING**

Allow engine to cool before performing maintenance on the muffler, exhaust pipe, exhaust manifold, or turbocharger. If necessary, use insulated pads and gloves.

**W A R N I N G**

When testing fuel injector nozzles, wear safety goggles and keep hands and fingers away from the spray of fluid being ejected. The spray is under extreme pressure and could penetrate deeply into the body tissues, causing injury and illness.

**W A R N I N G**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

**W A R N I N G**

Support weight of transmission before separating from engine. Failure to do so could result in serious personal injury.

**W A R N I N G**

Axle thrust tube weighs 55 pounds (25 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting axle thrust tube.

**W A R N I N G**

Wheel assembly weighs 170 pounds (77 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting wheel assembly.

**W A R N I N G**

Support drag link during disconnect of ball joint from pitman arm. Failure so could result in injury to personnel.

**W A R N I N G**

Control arm weighs more than 50 pounds (23 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting control arm.

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**WARNING**

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Left platform weighs 150 pounds (68 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting left platform.

---

**WARNING**

---

Right platform weighs 136 pounds (62 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting right platform.

---

**WARNING**

---

High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

---

**WARNING**

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Crane inner boom weighs 219 pounds (99 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane inner boom.

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**WARNING**

---

Crane outer boom weighs 119 pounds (89 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane outer boom.

---

**WARNING**

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Crane extension boom weighs 172 pounds (78 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane extension boom.

---

**WARNING**

---

Forklift mounting bracket weighs 199 pounds (90 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mounting bracket.

**W A R N I N G**

Crane assembly weighs 1,625 pounds (738 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane assembly.

**W A R N I N G**

Backhoe assembly without main frame weighs 1,767 pounds (803 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting backhoe assembly without main frame.

**W A R N I N G**

Backhoe frame section weighs 489 pounds (223 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting frame section.

**W A R N I N G**

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.

**W A R N I N G**

Engine assembly weighs 1,320 pounds (599 kilograms), To avoid personal injury, use a hoist or suitable lifting device when lifting engine assembly.

**W A R N I N G**

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. injury or death to personnel could result.

**W A R N I N G**

Transmission assembly weighs 638 pounds (290 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting transmission assembly.

---

**WARNING**

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Rear frame section and subframe weigh 598 pounds (272 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting rear frame section and subframe.

---

**WARNING**

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Make sure both front or rear wheels are blocked front and rear to prevent roll off. Failure to do so could result in serious personnel injury.

---

**WARNING**

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Cab weighs 618 pounds (281 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting cab.

---

**WARNING**

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Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

**WARNING**

Forklift mast assembly weighs 587 pounds (267 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mast assembly.

---

**WARNING**

---

Forklift carriage assembly weighs 356 pounds (162 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift carriage assembly.

---

**WARNING**

---

Forklift lift cylinder weighs 101 pounds (46 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift lift cylinder.

**W A R N I N G**

Do not work on forklift lift cylinder with load on forks or while anyone is near forklift controls. To do so could result in injury to personnel.

**W A R N I N G**

Forklift rail upright weighs 172 pounds (78 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift rail upright.

**W A R N I N G**

Forklift upright weighs 196 pounds (89 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift upright.

**W A R N I N G**

Forklift rotator assembly weighs 356 pounds (162 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift rotator assembly.

**W A R N I N G**

Crane mast weldment weighs 492 pounds (223 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane mast weldment.

**W A R N I N G**

Crane base weldment weighs 205 pounds (93 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane base weldment.

**W A R N I N G**

Fuel is very flammable and can explode easily. To avoid serious injury or death, clean fuel tank to purge any flammable liquid or vapors before welding, grinding, or using any heat producing device near the fuel tank.

---

**WARNING**

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Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in well-ventilated area. Failure to do so could result in injury to personnel.

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**WARNING**

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Keep all personnel clear when using lifting device during removal and installation of transmission assembly. Failure to do so could result in injury to personnel.

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**WARNING**

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Support rear axle during removal. Failure to do so could result in injury to personnel.

---

**WARNING**

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

---

**WARNING**

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SEE/HMMH should not be operated with front loader (SEE) or forklift (HMMH) or backhoe (SEE) or crane (HMMH) removed, except in a maintenance facility. When maintenance is required and front loader or forklift or backhoe or crane is removed, never operate SEE/HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with either front loader or forklift or backhoe or crane removed. This could cause loss of control and injury to personnel or damage to vehicle.

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**WARNING**

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Edges of glass may be sharp. To avoid personal injury, wear protective gloves when handling glass.

**W A R N I N G**

Cascade box housing weighs 78 pounds (36 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting cascade box housing.

**W A R N I N G**

Wear safety goggles when performing leakage tests on valves. Failure to do may result in serious eye injury due to high pressure oil.

**W A R N I N G**

Never use gasoline to clean parts. Gasoline is highly flammable. Serious personal injury could result if fuel ignites during cleaning.

**W A R N I N G**

Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection are required.

**W A R N I N G**

Drilling and grinding operations are hazardous to the eyes. Eye protection is required.

**W A R N I N G**

On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. Avoid prolonged contact with skin.

**W A R N I N G**

Solvents used with spray gun must be used in spray booth with filter. Face shield must be used by personnel operating spray gun. Failure to do so could result in serious injury to personnel.





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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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Approved for public release; distribution unlimited.

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## HOW TO USE THIS MANUAL

This manual has an edge index that will help you find specific information in a hurry. Simply spread the pages in the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with your selected topic printed in the front cover block.

### **OVERVIEW**

This manual is organized by chapters, sectoins, and appendices. A summary of the organization of this manual, by major divisions, follows:

Front cover index gives you a quick reference to chapters, sections, and appendices that you will use often.

**WARNINGS**—All warnings you should observe while working on or around the SEE/HMMH are shown in this part of the manual. These are repeated in the parts of hte manual where they apply.

Table of Contents—The contents of the chapters and appendices are listed here.

Chapter 1—This chapter contains general information about the SEE/HMMH.

Chapter 2—This chapter outlines troubleshooting of the SEE/HMMH and their systems. It includes a troubleshooting index, by symptom and system, for troubleshooting. Other sections include information on tools, repair parts, general maintenance instructions, and general hydraulic system repair methods.

Chapters 3 thru 21—These chapters contain step-by-step instructions for doing the maintenance tasks. Each system of the SEE/HMMH has its own chapter, and any special tools, equipment, or supplies you may need for a task are listed,

Appendix A—This appendix lists the technical manuals and other publications you may have to refer to while working on the SEE/HMMH.

Appendix B—This appendix lists the expendable supplies and materials you will need while performing maintenance on the SEE/HMMH.

Appendix C—This appendix describes any manufactured items you will need for performing maintenance on the SEE/HMMH.

Appendix D—This appendix describes the proper method of tightening fasteners.

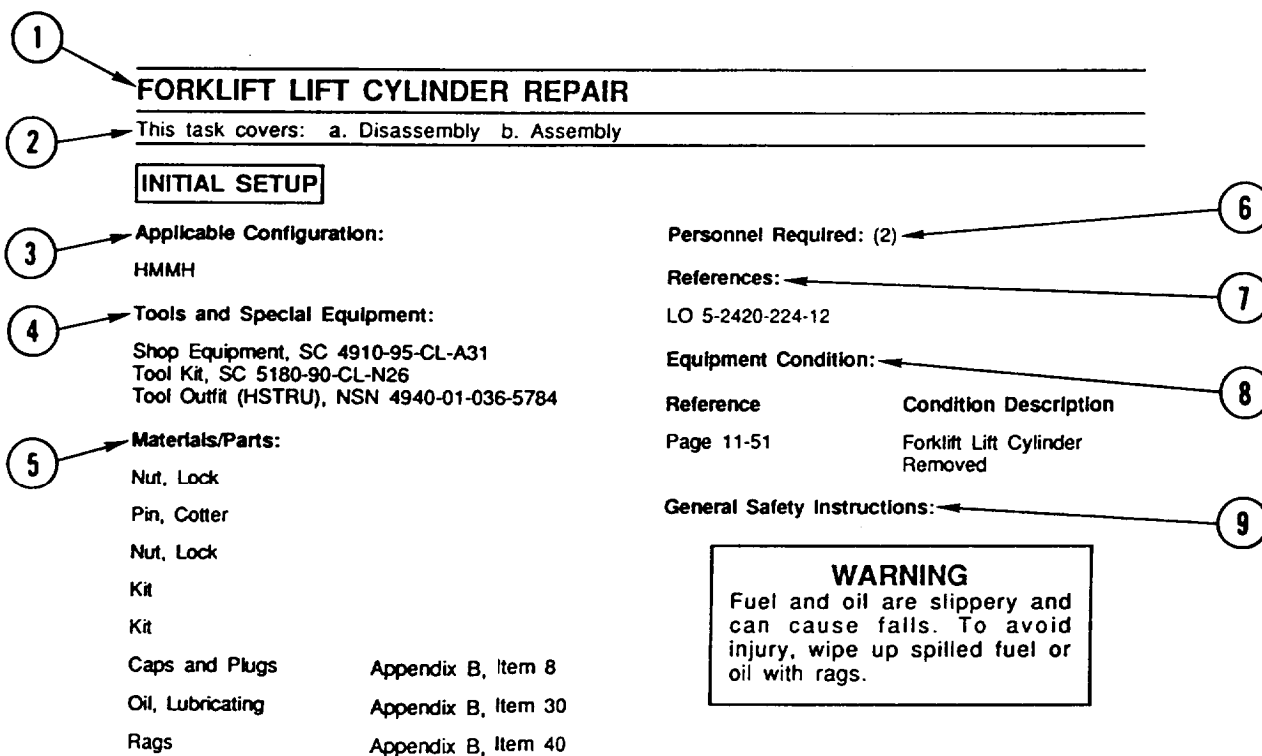
Index—The index is an alphabetical listing of the contents of this manual.

Back Cover—The inside back cover contains a metric conversion table.

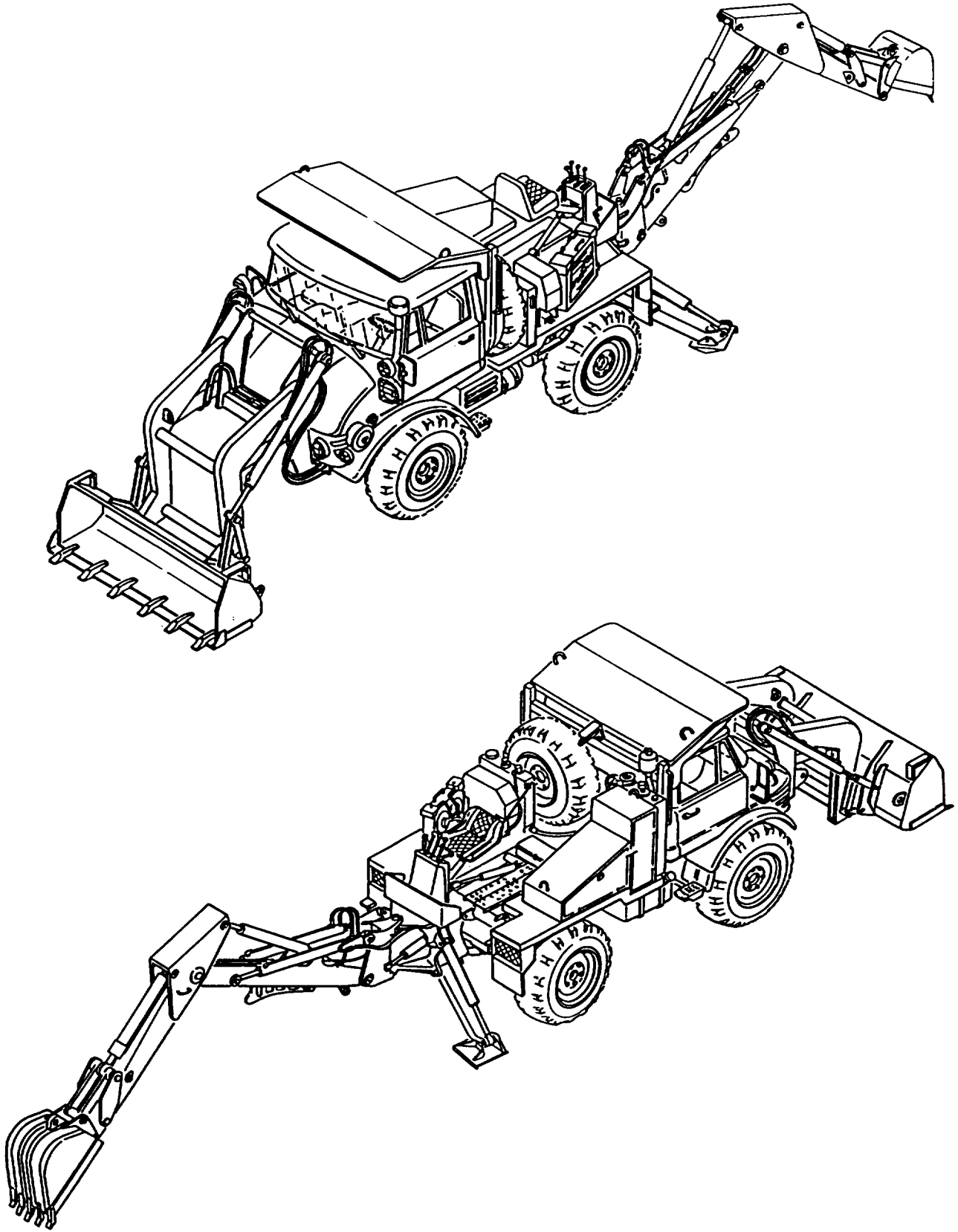
### **USING THE MANUAL ON THE JOB**

Find the task or component that needs repair by using the Index (page Index-1), then turn to the page listed for that task or component.

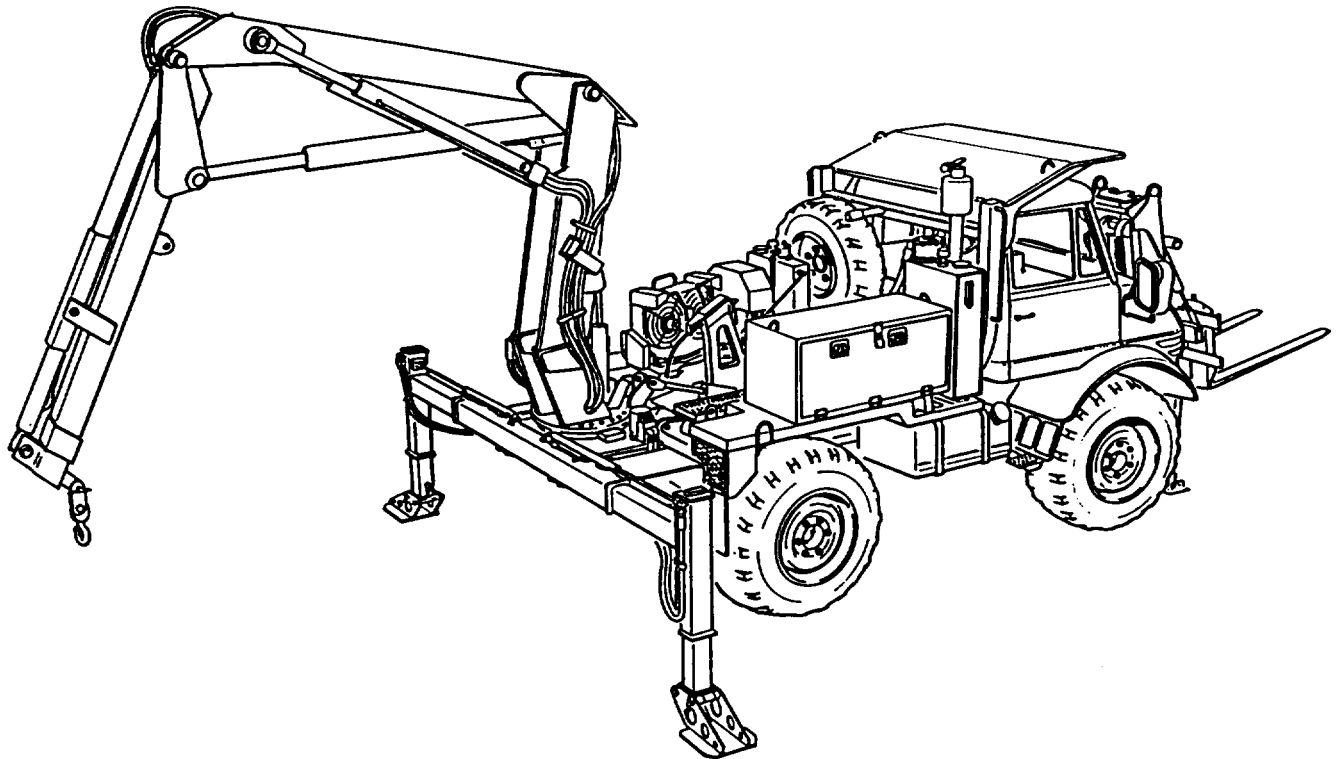
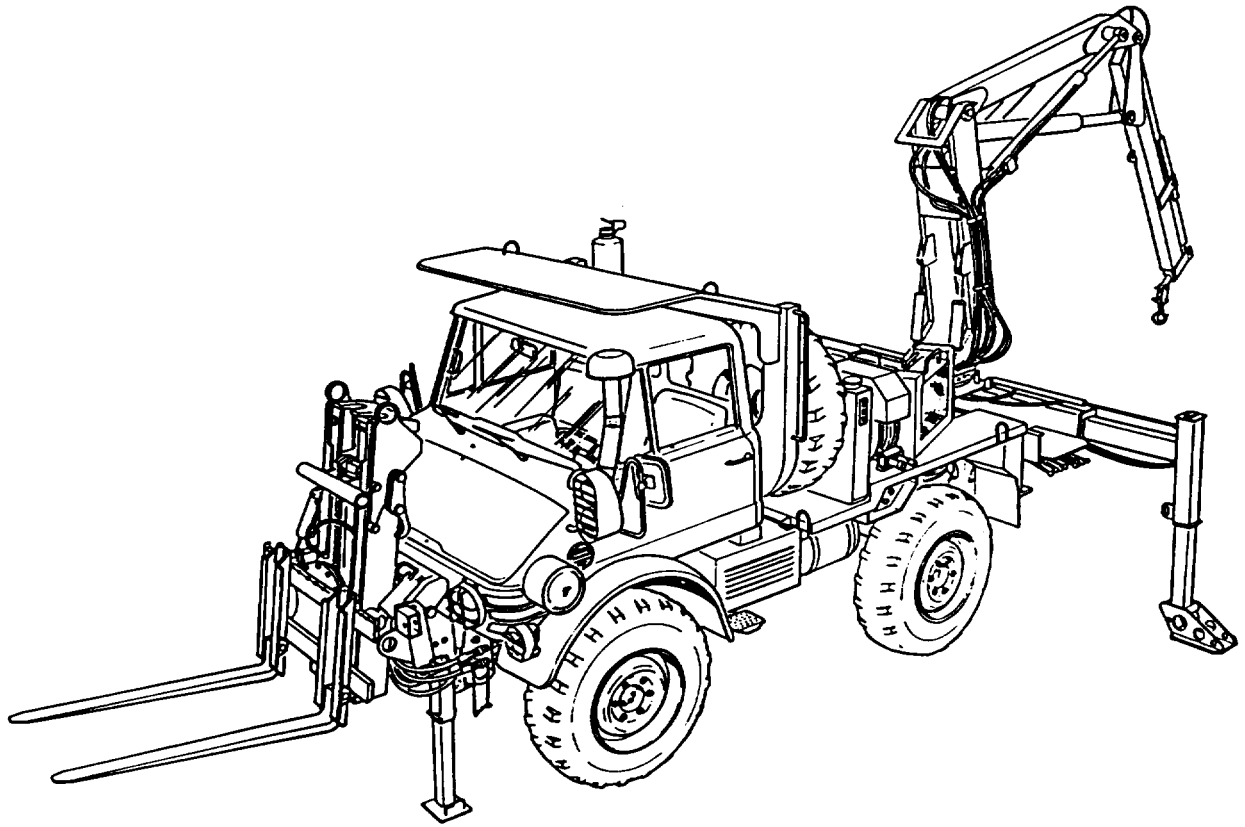
Read the INITIAL SETUP procedures, and gather the necessary items and personnel. Pay attention to the warnings. The INITIAL SETUP sheet is described on page xi.



1. TITLE—This is the name of the task.
2. TASK COVERS—This lists all the tasks included in the module.
3. APPLICABLE CONFIGURATION—If the task is applicable to only one of the vehicles, SEE or HMMH (as appropriate) will be listed here.
4. TOOLS AND SPECIAL EQUIPMENT—These are the tools and equipment you will need to do the task.
5. MATERIALS/PARTS—These are the supplies you will need to do the task. If parts or materials are required, they are listed here or referenced to Appendix B.
6. PERSONNEL REQUIRED—Personnel required to perform a task will be identified if the task requires more than one.
7. REFERENCES—These are the other technical publications you will need to do the task.
8. EQUIPMENT CONDITION—This is the condition(s) the vehicle must be in before you start the task. Other tasks that must be done first are listed by page number or by technical manual number if another manual is required.
9. GENERAL SAFETY INSTRUCTIONS—These are the safety precautions that must be observed while you are doing the task.
10. FOLLOW-ON MAINTENANCE—These are the tasks listed at the end of the procedure that must be completed to return the vehicle to an operational condition.



Small Emplacement Excavator (SEE)



High Mobility Material Handler (HMMH)





# CHAPTER 1 INTRODUCTION

Page

## SCOPE

A list of sections contained in this chapter is shown below.

Section I. General Information .....	1-1
Section II. Equipment Description and Data .....	1-2
Section III. Principles of Operation .....	1-2

## Section I. GENERAL INFORMATION

### OVERVIEW

Type of Manual. Direct and General Support Maintenance.

Model Number and Equipment Name.

Model No. FLU419 Tractor, Wheeled, 4 x 4 DED Small Emplacement Excavator (SEE) with attachments, NSN 2420-01-160-2754 (EIC:EDL).

Model No. FLU10344 Tractor, Wheeled, 4 x 4 DED High Mobility Material Handler (HMMH) with attachments, NSN 2420-01-205-8636.

Purpose of Equipment:

The SEE is used for excavating, loading, lifting, and grading on various types of terrain. The vehicle is equipped with a front loader, backhoe, chain saw, pavement breaker, and hammer drill and is capable of rapid deployment for constructing protective positions.

The HMMH is used for material handling with forklift and crane attachments. The vehicle is equipped with an impact wrench to assist in maintenance of other equipment and is capable of rapid deployment.

### MAINTENANCE FORMS, RECORDS, AND REPORTS

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

### DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

When the tactical situation requires that Army materiel be abandoned, refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use, for procedures on destruction of the vehicle(s).

### PREPARATION FOR STORAGE OR SHIPMENT

Instructions for storage and shipment, including administrative storage, are found in TM 740-90-1, MIL-V-62038D, and TM 5-2420-224-20.

## REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

If your vehicle needs improvement, let us know. Send us a Quality Deficiency Report. 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 (QDR) and mail it to:

U.S. Army Tank-automotive and Armaments Command  
ATTN: AMSTA-TR-E/PQDRMS 267  
6501 E. 11 Mile Road  
Warren, MI 48397-5000

## WARRANTY INFORMATION

The vehicles are warranted by Freightliner Corporation in accordance with TB 5-2420-224-15. Warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your direct and general support maintenance shop.

## METRIC SYSTEM

The equipment described herein contains metric components and requires metric common and special tools; therefore, metric units in addition to English units will be used throughout the manual. An English-to-metric conversion table is included as the last page of this manual inside the back cover.

# Section II. EQUIPMENT DESCRIPTION

## OVERVIEW

This section contains information that can be useful when performing direct and general support maintenance tasks on the SEE/HMMH. For equipment operating data, refer to TM 5-2420-224-10.

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

Refer to TM 5-2420-224-10 and TM 5-2420-224-20 for equipment characteristics, capabilities, and features.

## LOCATION AND DESCRIPTION OF COMPONENTS

Refer to TM 5-2420-224-10 and TM 5-2420-224-20 for location and description of components.

## EQUIPMENT DIFFERENCES

Refer to TM 5-2420-224-10 and TM 5-2420-224-20 for equipment differences.

# Section III. PRINCIPALS OF OPERATION

## PRINCIPALS OF OPERATION

Refer to TM 5-2420-224-10 and TM 5-2420-224-20 for principals of operation.

## CHAPTER 2 DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

### SCOPE

This chapter contains information for troubleshooting the SEE/HMMH, as well as general maintenance instructions. The following sections are included in this chapter:

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Section II. Troubleshooting . . . . .	2-2
Section III. General Maintenance Instructions . . . . .	2-32
Section IV. General Hydraulic System Repair Methods . . . . .	2-39

### Section I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

#### OVERVIEW

This section includes information on tools and equipment you need to support the SEE and HMMH tractors.

#### **COMMON TOOLS AND EQUIPMENT**

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit. Tool kits required for each task in this manual are listed on the INITIAL SETUP page of each task.

#### **SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT**

Special tools required to maintain the SEE/HMMH are listed in the Maintenance Allocation Chart (TM 5-2420-224-20) and on the INITIAL SETUP page of each task. Special tools are also listed in the Repair Parts and Special Tools List (TM5-2420-224-24P). Tools that are to be fabricated are described and listed in Appendix C of this manual.

#### REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (TM5-2420-224-24P).

## Section II. TROUBLESHOOTING

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### OVERVIEW

---

This section contains troubleshooting, testing, and repair information for the SEE/HMMH. Make sure the problem is real. Be sure the electrical or hydraulic power is on when needed. Refer to the preliminary troubleshooting procedures before you start troubleshooting, and during troubleshooting when referenced.

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Preliminary Troubleshooting Procedures . . . . .	2-2
Troubleshooting Symptom Index. . . . .	2-3
Troubleshooting Table . . . . .	2-5

---

### PRELIMINARY TROUBLESHOOTING PROCEDURES

---

#### NOTE

Fluid leaks are classified as Class I Class II, or Class III:

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

Class II: Leakage of fluid great enough to form drops, but not enough to cause drops to drip from the item being checked or observed.

Class III: Leakage of fluid great enough to form drops that fall from the item being checked or observed.

Before starting any specific troubleshooting procedures, perform the following:

1. Visually check for ruptured oil hoses or tubes, and for Class II or Class III leaks.
2. Check for mechanical jamming or binding caused by rocks or other foreign matter,
3. Check fluid levels in subject area and service as required (LO 5-2420-224-12).
4. Relieve hydraulic pressure (TM 5-2420-224-20) and air pressure (TM 5-2420-224-20) before opening any hydraulic or air lines.

Troubleshooting Symptom Index (Cont)

Malfunction Number	Malfunction	Troubleshooting Procedure Page
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Table 2-1. Troubleshooting

Malfunction	Test or Inspection	Corrective Action
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## ENGINE

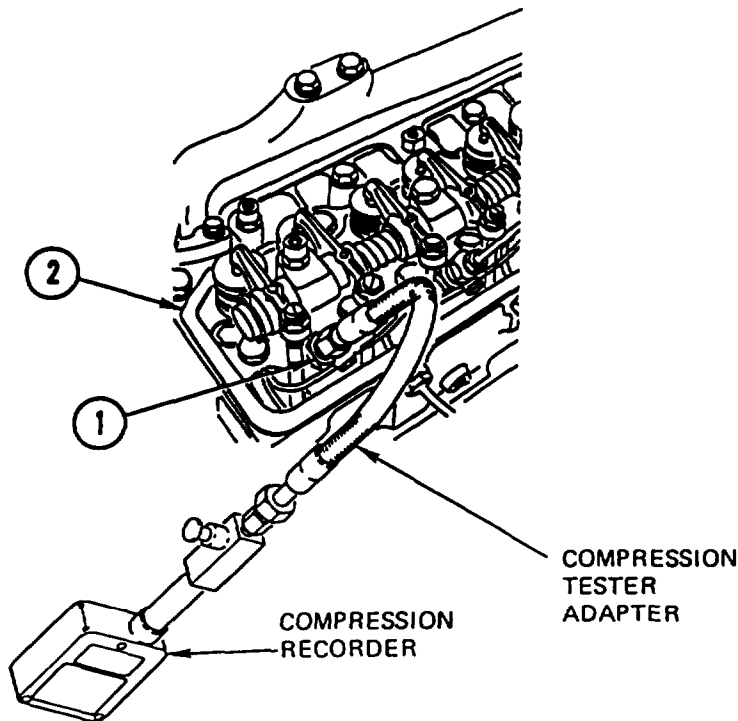
## 1. ENGINE CRANKS BUT WILL NOT START OR HARD TO START.

Step 1. Remove fuel injector nozzles. Check for blocked fuel injector spray holes by performing fuel injector spray pattern test (page 13-65).

- Repair fuel injector nozzle(s) (page 13-65).

Step 2. Perform compression test as follows:

- Run engine until it reaches normal operating temperature of 140°-185°F (60°-85° C). Shut off engine.
- Remove six fuel injector nozzles (page 3-41).
- Crank engine several times to remove carbon flakes and dirt.



- Clean fuel injector nozzle seat base (1) in cylinder head (2).
- Place compression tester adapter (P/N 352 589 00 21 00) into protective sleeve. Install nozzle holder nut. Tighten nozzle holder nut to 50 lb-ft (68 N·m).
- Connect compression recorder to compression tester adapter. Crank engine several times until highest reading is obtained. Record highest reading. Minimum acceptable compression reading is 284 psi (20 bar).



**Table 2-1. Troubleshooting (Cont)**

Malfunction	Test or Inspection	Corrective Action
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**ENGINE (CONT)**

- g. Repeat steps d thru f for remaining cylinders. If minimum compression reading is not 284 psi (20 bar), squirt approximately 1 oz engine oil into cylinder. Crank engine several times and repeat steps d thru f for each cylinder.
  - If compression reading is higher after second test, on any cylinder, excessive bypass of air between piston and cylinder bore is indicated. Replace piston rings (page 13-31).
  - If compression reading remains approximately the same after second test, replace valves and valve guides (page 13-2).
  - If variation between cylinders exceeds 21.3 psi (1.47 bar), replace piston rings (page 13-31).

Step 3. Check fuel injection pump timing (page 3-50).

- If timing is correct and problem persists, replace fuel injection pump (page 3-43).
- If timing is not correct, time fuel injection pump (page 3-50).

**2. ENGINE RUNS ROUGH OR LACKS POWER.**

Step 1. Check fuel injection pump timing (page 3-50).

- if timing is correct and problem persists, replace fuel injection pump (page 3-43).
- If timing is not correct, time fuel injection pump (page 3-50).

Step 2. Remove fuel injector nozzles. Check for blocked fuel injector spray holes by performing fuel injector spray pattern test (page 13-65).

- Repair fuel injector nozzle(s) (page 13-65).

Step 3. Perform Malfunction 1, step 2.

**3. FUEL CONSUMPTION EXCESSIVE.**

Check fuel injection pump timing (page 3-50).

- If timing is correct and problem persists, replace fuel injection pump (page 3-43).
- If timing is not correct, time fuel injection pump (page 3-50).

**4. ENGINE OIL PRESSURE LOW.**

Step 1. Check for blocked oil suction tube on engine oil pump (page 13-60).

- Clean oil suction tube, or replace if required (page 13-60).

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
<b>ENGINE (CONT)</b>		
	Step 2.	Check for worn or damaged engine oil pump (page 13-60). <ul style="list-style-type: none"> <li>• Repair engine oil pump, or replace if required (page 13-60).</li> </ul>
	Step 3.	Check for worn or damaged piston rod bearings, main bearings, and camshaft bearings (pages 13-15, 13-31, 13-43). <ul style="list-style-type: none"> <li>• Replace bearing(s) (pages 13-15, 13-31, 13-43).</li> </ul>
5.	ENGINE OIL CONSUMPTION EXCESSIVE.	
	Perform Malfunction 1, step 2.	
6.	ENGINE OIL DILUTED WITH FUEL.	
	Remove fuel injection pump (page 3-43). Inspect shaft seal for evidence of fuel leakage. <ul style="list-style-type: none"> <li>• Replace fuel injection pump (page 3-43).</li> </ul>	
7.	ENGINE OIL DILUTED WITH ENGINE COOLANT.	
	Step 1.	Check for leaks in engine oil cooler element. <ul style="list-style-type: none"> <li>• Replace defective part(s) (page 3-30).</li> </ul>
	Step 2.	Check for damaged cylinder head gasket. <ul style="list-style-type: none"> <li>• Replace cylinder head gasket (page 3-25).</li> </ul>
	Step 3.	Check for cracked cylinder head. <ul style="list-style-type: none"> <li>• Replace cylinder head (page 3-25).</li> </ul>
8.	ENGINE VIBRATES EXCESSIVELY.	
	Step 1.	Check for damaged vibration damper. <ul style="list-style-type: none"> <li>• Replace vibration damper (page 3-56).</li> </ul>
	Step 2.	Check for loose or out-of-balance flywheel (page 13-25). <ul style="list-style-type: none"> <li>• Tighten flywheel (page 13-25).</li> </ul>
	Step 3.	Measure alinement of flywheel to flywheel housing (page 13-25). <ul style="list-style-type: none"> <li>• If flywheel is outside limits, adjust alinement (page 13-25).</li> </ul>

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**TRANSMISSION**

9. TRANSMISSION WILL NOT OPERATE IN ANY FORWARD OR REVERSE GEAR.

**NOTE**

- Vehicle Master disconnect switch must be on, ignition switch set to on and clutch pedal fully depressed. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all electrical troubleshooting steps.

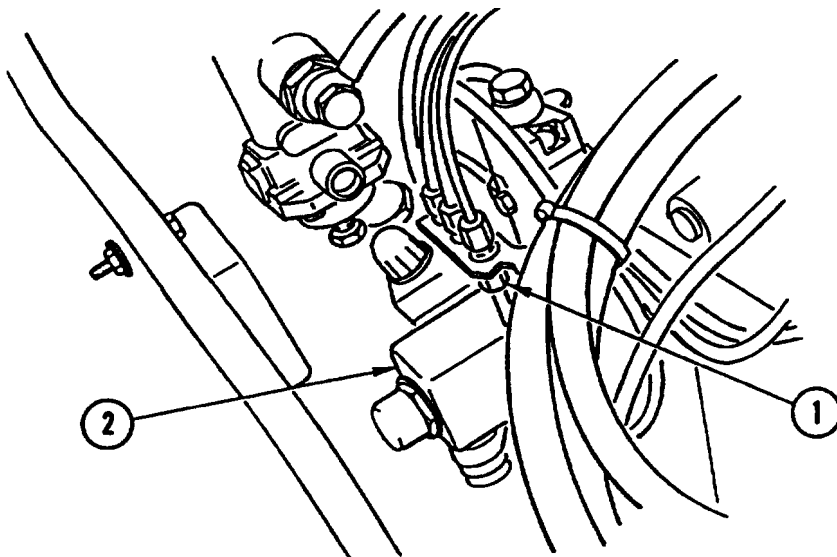
Step 1. Check for air supply between overflow valve and air shift solenoid.

**NOTE**

Overflow valve is located above the muffler and attached to the frame cross member.

- If air supply is present at air shift solenoid, go to step 2.
- If air supply is not present at air shift solenoid, adjust/replace overflow valve (refer to TM 5-2420-224-20-2, page 4-304).

Step 2. Check air shift solenoid as follows:



- Disconnect fitting (1) from air shift solenoid valve (2).
- Have assistant turn on vehicle MASTER disconnect switch and ignition switch and depress clutch completely.

Table 2-1. Troubleshooting (Cont)

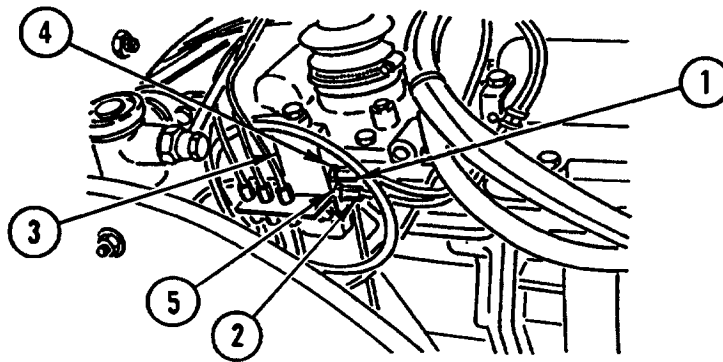
Malfunction	Test or Inspection	Corrective Action
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**TRANSMISSION (CONT)**

- c. Check for air flow from air shift solenoid valve (2).
  - If there is air flow, reconnect fitting (1) and go to step 2.
  - If there is no air flow, go to step 3.

- Step 3. Check air shift solenoid for +24 VDC (refer to TM 5-2420-224-20-1, page 3-186).
- If +24 VDC is not present, inspect and repair wiring 23A.
  - If +24 VDC is present, go to step 4.

Step 4. Check air shift valve as follows:



- a. Disconnect two fittings (1 and 2) from air shift valve (3).
- b. Have assistant turn on vehicle MASTER disconnect switch and ignition switch and depress clutch completely.
- c. Check for air flow from either port (4 and 5) of air shift valve (3).
  - If there is air flow, note from which port air flows and perform steps d and e.
  - If there is no air flow from either port, replace air shift valve (page 3-90).



Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
<b>TRANSMISSION (CONT)</b>		
	<p>d. Have assistant turn on vehicle MASTER disconnect switch and ignition switch and depress clutch completely.</p> <p>e. Move shift collar on shift control either up or down and check for air flow from port opposite port noted in step c.</p>	<ul style="list-style-type: none"> <li>• If there is air flow, go to step 5.</li> <li>• If there is no air flow, replace air shift valve (page 3-90).</li> </ul>
Step 5.	<p>With system air pressure normal (106 PSI), and clutch pedal depressed, check to see if air supply is present at transmission access cover (intermediate speed shift cover).</p>	<ul style="list-style-type: none"> <li>• If air supply is present, remove transmission access cover (page 3-83) and inspect shift piston for damage. Repair access cover (page 15-65).</li> <li>• If air supply is not present, inspect airlines and fittings between air shift solenoid and access cover for leaks or damage. Repair or replace as required.</li> </ul>
10. TRANSMISSION LOCKS UP IN GEAR.		
Step 1.	<p>Check for damaged shift controls.</p>	<ul style="list-style-type: none"> <li>• If damaged, replace shift control(s) (page 3-96).</li> </ul>
Step 2.	<p>Remove top cover (page 3-86) and inspect for damaged shift forks.</p>	<ul style="list-style-type: none"> <li>• If damaged, repair top cover (page 15-54).</li> </ul>
11. TRANSMISSION SLIPS IN ALL RANGES.		
	<p>Check for worn or damaged clutch.</p>	<ul style="list-style-type: none"> <li>• If worn beyond limits or damaged, replace clutch (page 3-63).</li> </ul>
12. CLUTCH SLIPS OR DRAGS.		
Step 1.	<p>Check for warped clutch disc or pressure plate.</p>	<ul style="list-style-type: none"> <li>• If warped, replace clutch (page 3-63).</li> </ul>
Step 2.	<p>Check for grease or oil on clutch disc facings and for worn clutch facings.</p>	<ul style="list-style-type: none"> <li>• Replace clutch (page 3-63).</li> </ul>

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**TRANSMISSION (CONT)**

13. PTO WILL NOT ENGAGE OR EXCESSIVELY NOISY.

- Step 1. Check PTO control linkage adjustment.
  - Adjust PTO control linkage (page 3-81).
- Step 2. Check for PTO and transmission gear damage.
  - Repair PTO (page 15-70) and/or transmission (page 15-1).

14. FRONT AXLE PROPELLER SHAFT WILL NOT TURN.

- Step 1. Check for loose or sheared propeller shaft mounting bolts.
  - Tighten, or replace propeller shaft mounting bolt(s) (page 3-102).
- Step 2. Check for broken or damaged U-joints.
  - Replace U-joint(s) (page 3-103).

15. TRANSMISSION GEARS NOISY DURING SHIFTING.

- Step 1. Remove top cover (page 3-86) and inspect for damaged shift forks.
  - Repair top cover (page 15-54).
- Step 2. Disassemble transmission (page 15-1) and check for damaged transmission gear synchronizers.
  - Repair transmission (page 15-1).

**BRAKES AND AIR SYSTEM**

16. DUAL BRAKE GAGE IN CAB WILL NOT INDICATE CORRECT PRESSURE.

**NOTE**

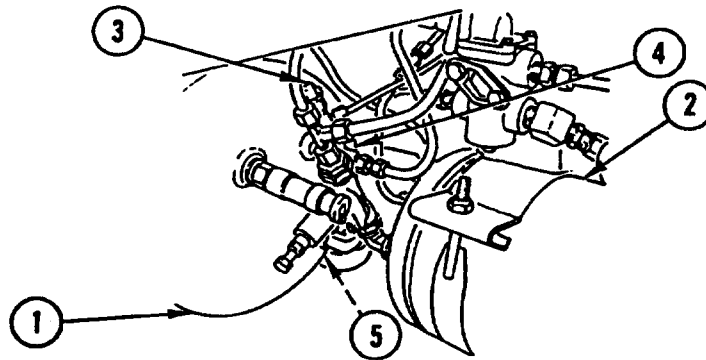
Perform the following steps after verifying air compressor is operating.

- Step 1. Check for correct fluid regulating valve operation as follows:

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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## BRAKES AND AIR SYSTEM (CONT)



- Relieve air pressure (TM 5-2420-224-20) completely from air tanks (1 and 2).
- Attach 0-200 psi (0-14 bar) pressure gage to test connection (3).

**NOTE**

When fluid regulating valve reaches cut-out pressure, there will be an audible "pop". Inspect all air supply lines.

- Start and run engine at idle until fluid regulating valve reaches cut-out pressure.
- Compare pressure readings between 0-200 psi (0-14 bar) pressure gage and dual brake gage. Both readings must be the same.
  - If pressure on both gages is zero, go to step e.
  - If pressure on both gages is the same, but less than 106 psi (7.3 bar), go to step 2.
  - If pressure on dual brake gage is different than pressure on 0-200 psi (0-14 bar) pressure gage, replace dual brake gage (TM 5-2420-224-20).
- Remove 0-200 psi (0-14 bar) pressure gage from test connection (3).
- Relieve air pressure (TM 5-2420-224-20) completely from air tanks (1 and 2).
- Attach 0-200 psi (0-14 bar) pressure gage to test connection (4).
- Repeat steps c and d.
  - If pressure on both gages is zero, replace fluid regulating valve (TM 5-2420-224-20).
  - If pressure on both gages is the same, replace large air pressure tank overflow valve (5) (TM 5-2420-224-20).

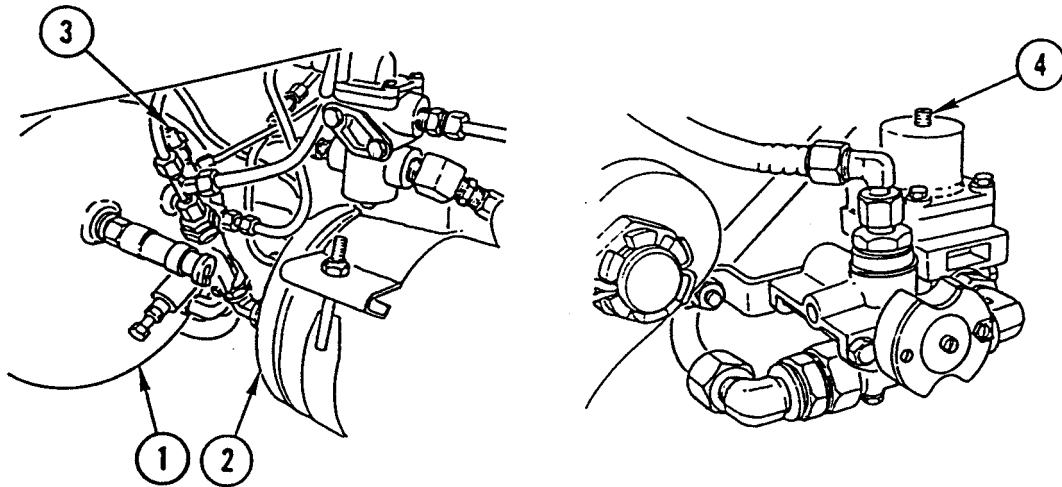


Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**BRAKES AND AIR SYSTEM (CONT)**

Step 2. Check fluid regulating valve adjustment as follows:



- a. Relieve air pressure (TM 5-2420-224-20) completely from air tanks (1 and 2).
- b. Attach 0-200 psi (0-14 bar) pressure gage to test connection (3).

**NOTE**

When fluid regulating valve reaches cut-out pressure, there will be an audible "pop".

- c. Start and run engine at idle until fluid regulating valve reaches cut-out pressure.
- d. Compare pressure readings between 0-200 psi (0-14 bar) pressure gage and dual brake gage. Both readings must be approximately 106 psi (7.3 bar).
  - If both readings are not approximately 106 psi (7.3 bar), turn fluid regulating valve adjusting screw (4) 1/4-turn to right to increase pressure, or 1/4-turn to left to decrease pressure. Relieve air pressure (TM 5-2420-224-20) from air tanks (1 and 2) to approximately 80 psi (5.5 bar) and repeat steps c and d until cut-out pressure is approximately 106 psi (7.3 bar).
  - If correct cut-out pressure cannot be attained, replace fluid regulating valve (TM 5-2420-224-20).

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**BRAKES AND AIR SYSTEM (CONT)**

**NOTE**

The brake pressure regulator (ALB) valve replacement and adjustment are General Support level maintenance tasks.

16.1 BRAKING UNEVEN.

Check brake pressure regulator (ALB valve) for proper adjustment as follows:

- a. Follow guidance for BRAKE PRESSURE REGULATOR VALVE (ALB VALVE) ADJUSTMENT (page 7-5).
- b. If brake pressure regulator (ALB valve) is defective, follow guidance for REPLACEMENT (page 7-1).



Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**BRAKES AND AIR SYSTEM (CONT)**

## 17. INTERMEDIATE SPEED SHIFT VALVE WILL NOT OPERATE.

Step 1. Check dual brake gage in cab for indication of 106 psi.

- If 106 psi is not indicated, perform Malfunction 16, step 2.

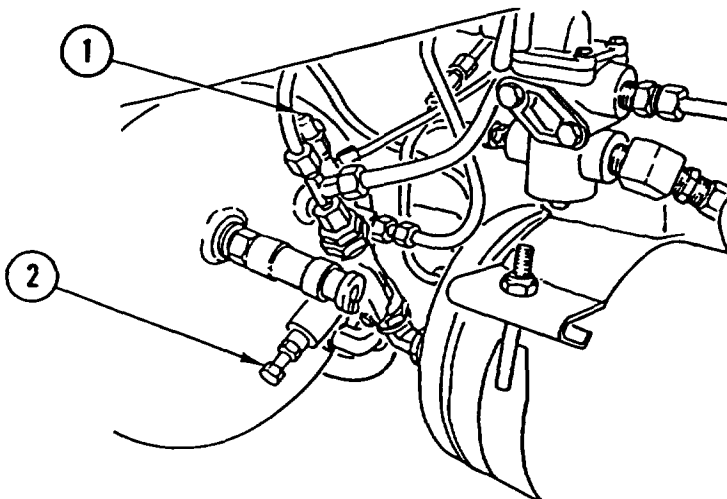
Step 2. Check operation of four-wheel drive/differential lock and crane/backhoe engine RPM switches.

- If four-wheel drive/differential lock and crane/backhoe engine RPM switches do not operate properly, replace accessory air supply overflow valve (TM 5-2420-224-20).
- If four-wheel drive/differential lock and crane/backhoe engine RPM switches operate properly, perform Malfunction 9, step 1.

## 18. TRAILER BRAKES WILL NOT DISENGAGE.

Check trailer brake system as follows:

- Check dual brake gage in cab for indication of 106 psi.
  - If 106 psi is not indicated, perform Malfunction 16, step 2.
- Check that trailer air supply valve is in ON position and trailer hand brake valve is in OFF position.



- Attach 0-200 psi (0-14 bar) pressure gage to test connection (1). Check 0-200 psi (0-14 bar) pressure gage for indication of approximately 106 psi (7.3 bar).
  - If 106 psi is not indicated, replace small air pressure tank overflow valve (2) (TM 5-2420-224-20).

Table 2-1. Troubleshooting (Cont)

Malfunction

Test or inspection

Corrective Action

STEERING SYSTEM

NOTE

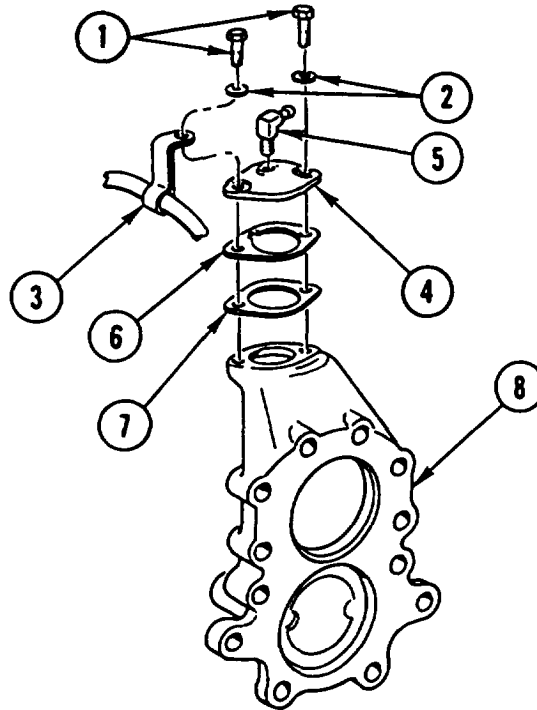
Before troubleshooting steering system, check oil level with engine running. Oil that foams easily is not recommended due to its tendency to retain air.

19. STEERING HARD TO MOVE FULL RIGHT AND LEFT.

NOTE

Perform the following steps on both steering knuckles.

Step 1. Check for proper steering knuckle lubrication as follows:



- a. Remove two cap screws (1), two washers (2), clamp (3), cap (4), and lubrication fitting (5). Discard lubrication fitting.
- b. Remove and discard washer(s) (6) and seal ring (7).
- c. Visually check for proper lubrication of steering knuckle (8).
  - If steering knuckle is properly lubricated, reassemble parts and go to step 2.
  - If steering knuckle is not properly lubricated, replace parts in Bearing Parts Kit, P/N 419-330-0012 (page 16-25).

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**STEERING SYSTEM (CONT)**

Step 2. Check steering knuckle for binding or excessive tightness as follows:

- a. Remove tie rod and drag link (TM 5-2420-224-20).
- b. Raise vehicle enough to clear wheel from ground.
- c. Move wheel fully left and right and check for free and smooth movement with no binding.
  - If wheel binds or does not move freely, replace steering knuckle (page 5-16).
  - If wheel does not bind and moves freely, replace power steering gear (page 7-11).

**HYDRAULIC SYSTEM**

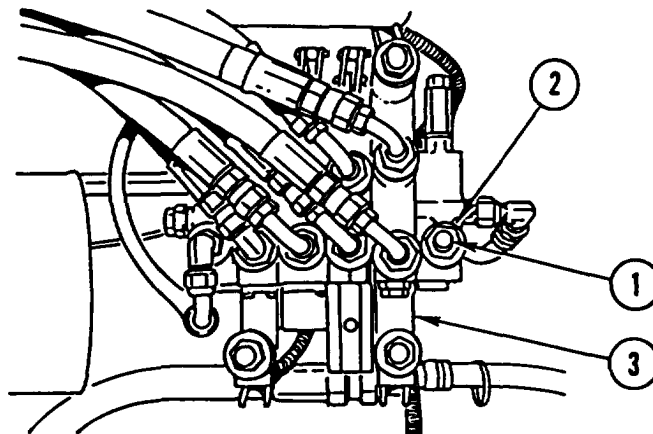
20. FRONT OR REAR HYDRAULIC PUMP NOISY.

**NOTE**

Perform step 1 for front hydraulic pump. Perform step 2 for rear hydraulic pump.

Step 1. Check front loader/forklift relief valve pressure as follows:

- a. Park vehicle on level surface and set parking brake.
- b. Open front loader/forklift travel lock valves.
- c. Leave front loader/forklift in transport position.



- d. Remove cap (1) from fitting in inlet (2) of front loader/forklift control valve (3) located behind cab.

Table 2-1. Troubleshooting (Cont)

## Malfunction

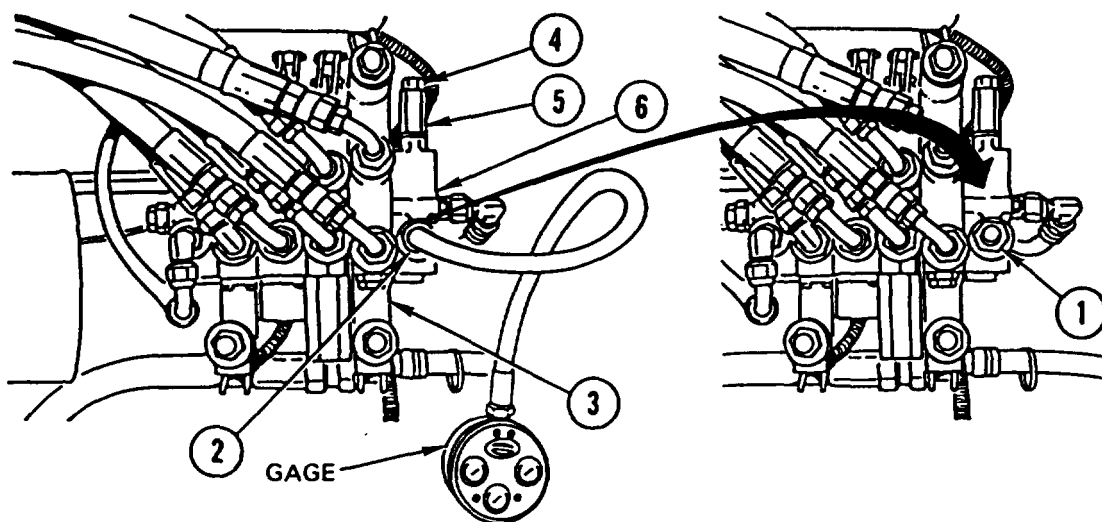
## Test or Inspection

## Corrective Action

## HYDRAULIC SYSTEM (CONT)

## NOTE

The 0-5000 psi (0-345 bar) pressure gage must be calibrated. If not, performance of front loader/forklift circuits and tool circuits will not be correct.



- e. Connect 0-5000 psi (0-345 bar) pressure gage to fitting in inlet (2) of control valve (3).
- f. Start and run engine at idle speed of 2000 rpm.
- g. Move bucket control lever into rollback position and hold for 15 seconds; then place lever in neutral for 30 seconds.
- h. Repeat steps f and g until oil is at operating temperature of 120°F (49°C)
- i. Keep engine running at 2000 rpm.
- j. Move bucket control tilt lever into rollback/tilt back position and read 0-5000 psi (0-345 bar) pressure gage. Pressure reading must be 2450 psi (169 bar).
  - If pressure reading is not 2450 psi (169 bar), repeat steps i and j while holding bucket control lever in dump/forward tilt position.
  - If pressure reading is still not 2450 psi (169 bar), hold adjusting screw (4) and loosen lock nut (5) on relief valve (6). Turn adjusting screw (4) to right to increase pressure, or left to decrease pressure. Hold adjusting screw (4), tighten lock nut (5), and check 0-5000 psi (0-345 bar) pressure gage for reading of 2450 psi (169 bar). Repeat as necessary.
  - If 2450 psi (169 bar) cannot be attained, go to step 3.

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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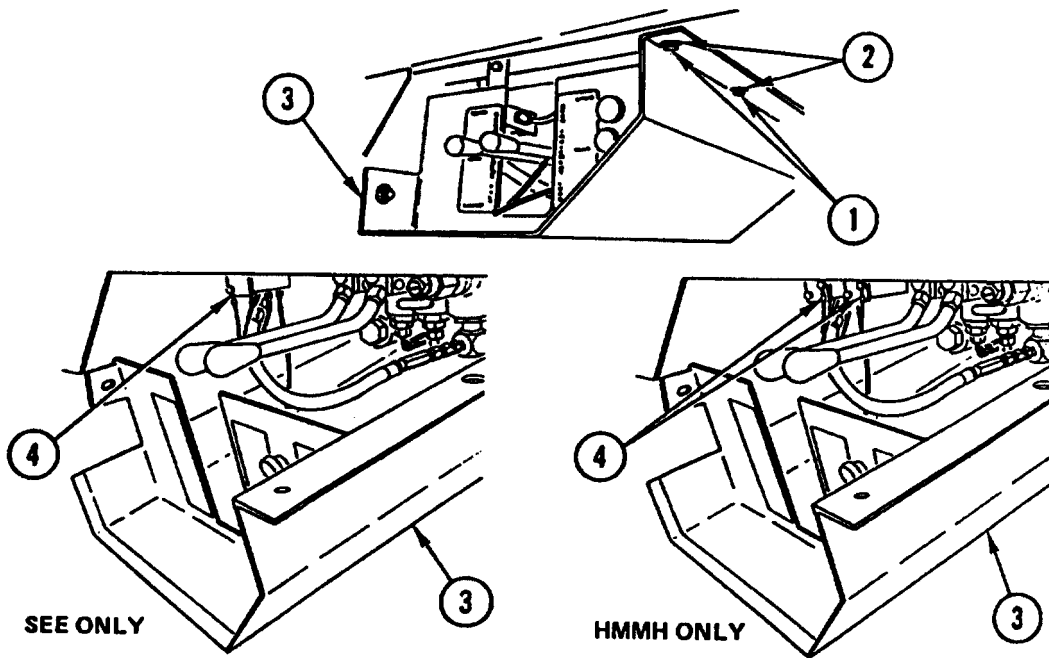
**HYDRAULIC SYSTEM (CONT)**

- k. Disconnect 0-5000 psi (0-345 bar) pressure gage from fitting in inlet (2) of control valve (3).
- l. Install cap (1) on fitting in inlet (2) of control valve (3).

Step 2. Check backhoe/crane relief valve pressure as follows:

**NOTE**

Make sure front loader/forklift is resting on flat surface and backhoe/crane is in three-point stance.



- b. Remove seven screws (1) and seven washers (2) from cover (3).

**NOTE**

Step c is for SEE only.

- c. Disconnect wire (4) and set cover (3) aside.

**NOTE**

Step d is for HMMH only.

- d. Disconnect two wires (4) and set cover (3) aside.



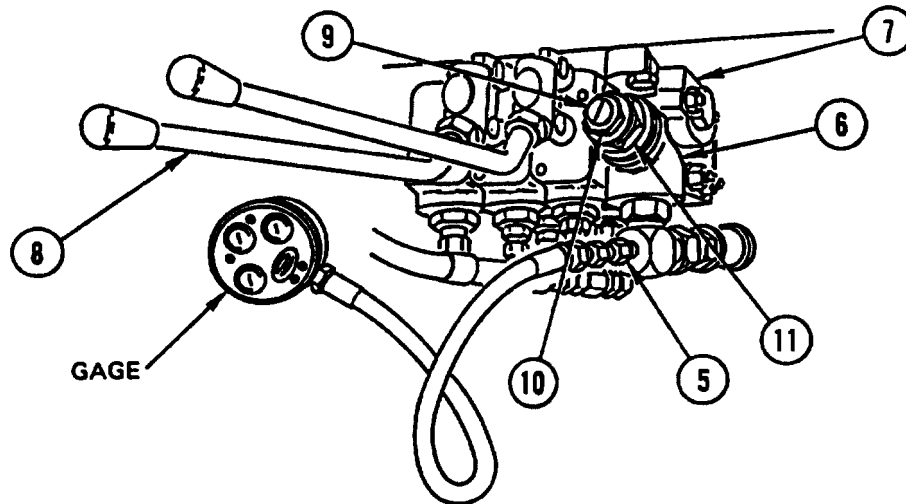
Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**HYDRAULIC SYSTEM (CONT)**

**NOTE**

The 0-5000 psi (0-345 bar) pressure gage must be calibrated. If not, performance of backhoe/crane circuits and tool circuits will not be correct.



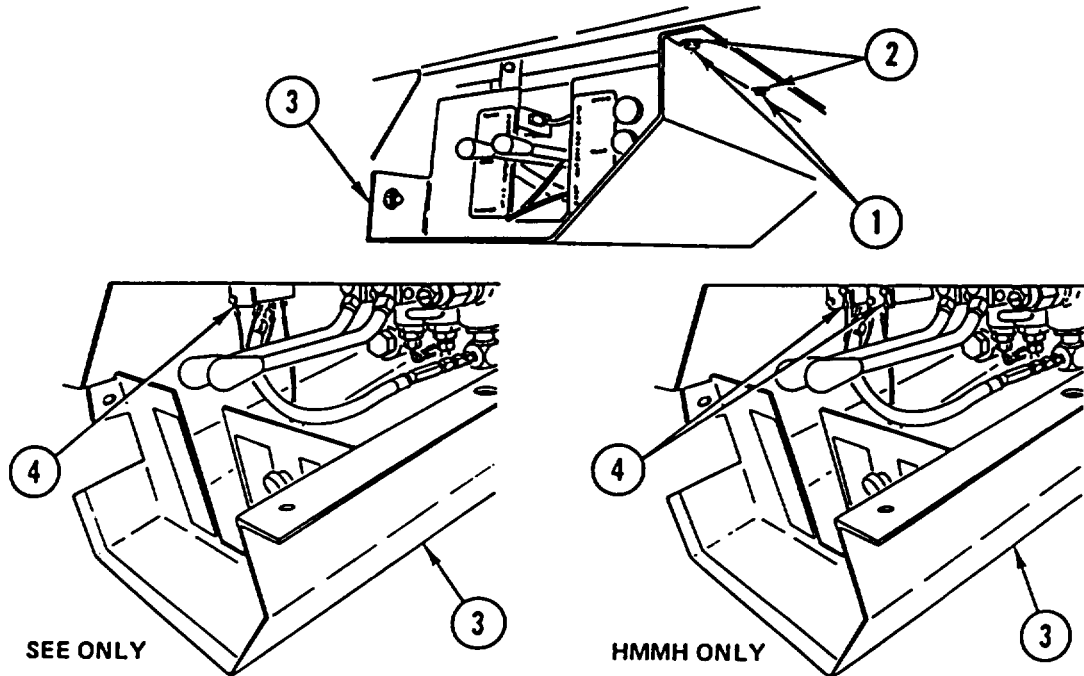
- e. Connect 0-5000 psi (0-345 bar) pressure gage to test port (5) on inlet section (6) of control valve (7).
- f. Start and run engine at idle speed of 2000 rpm.
- g. Place lock control lever (8) in up position and hold for 15 seconds; then place lever in neutral for 30 seconds.
- h. Repeat steps f and g until hydraulic oil cooler turns on. Oil will then be at operating temperature of 120°F (49°C).
- i. Keep engine running at 2000 rpm.
- j. Place lock control lever (8) in up position and read 0-5000 psi (0-345 bar) pressure gage. Reading must be 2450 psi (169 bar).
  - If pressure reading is not 2450 psi (169 bar), hold adjusting screw (9) and loosen lock nut (10) on relief valve (11). Turn adjusting screw (9) to right to increase pressure, or to left to decrease pressure. Hold adjusting screw (9), tighten lock nut (10), and check 0-5000 psi (0-345 bar) pressure gage for reading of 2450 psi (169 bar). Repeat as necessary.
  - If 2450 psi (169 bar) cannot be attained, go to step 3.

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**HYDRAULIC SYSTEM (CONT)**

k. Disconnect 0-5000 psi (0-345 bar) pressure gage from test port (5) on inlet section (6) of control valve (7).



**NOTE**

Step l is for HMMH only.

- l. Install cover (3) and connect two wires (4).

**NOTE**

Step m is for SEE only.

- m. Install cover (3) and connect wire (4).
- n. Install seven washers (2) and seven screws (1) in cover (3).

Table 2-1. Troubleshooting (Cont)

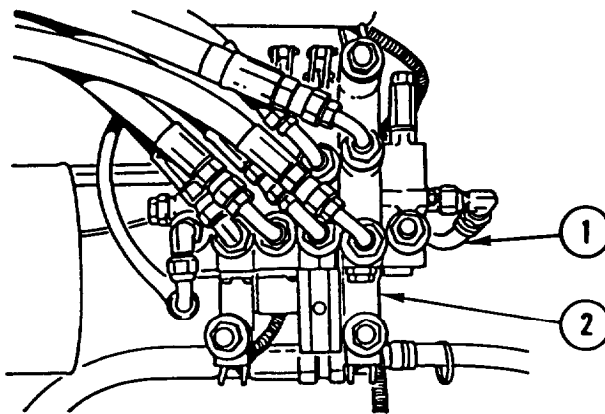
Malfunction	Test or Inspection	Corrective Action
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**HYDRAULIC SYSTEM (CONT)**

Step 3. Check front or rear hydraulic pump flow rate as follows:

**NOTE**

Procedure is the same for both front and rear hydraulic pumps. Front hydraulic pump is shown for step a.



- a. Disconnect hydraulic hose (1) from inlet side of control valve (2). Install threaded cap on control valve (2) inlet.

**CAUTION**

Make sure flow meter gpm gage will record in excess of 75 gpm. Failure to do so may result in damage to flow meter or hydraulic pump.

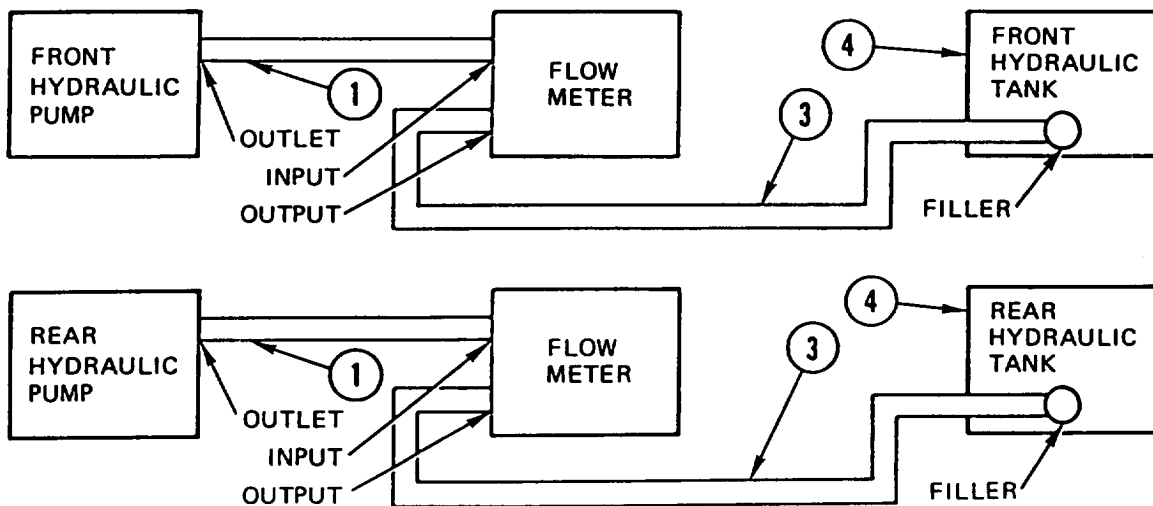


Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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### HYDRAULIC SYSTEM (CONT)

- b. Connect hydraulic hose (1) to input side of flow meter.
- c. Connect hose (3) to outlet side of flow meter. Place other end of hose (3) into hydraulic tank (4).

#### NOTE

- Make sure load valve on flow meter is completely open.
- Make sure engine idle speed is maintained at 2000 rpm during entire test. Failure to do so may result in incorrect readings and improper evaluation of hydraulic pump flow rate.

- d. Start and run engine at idle speed of 2000 rpm.

#### NOTE

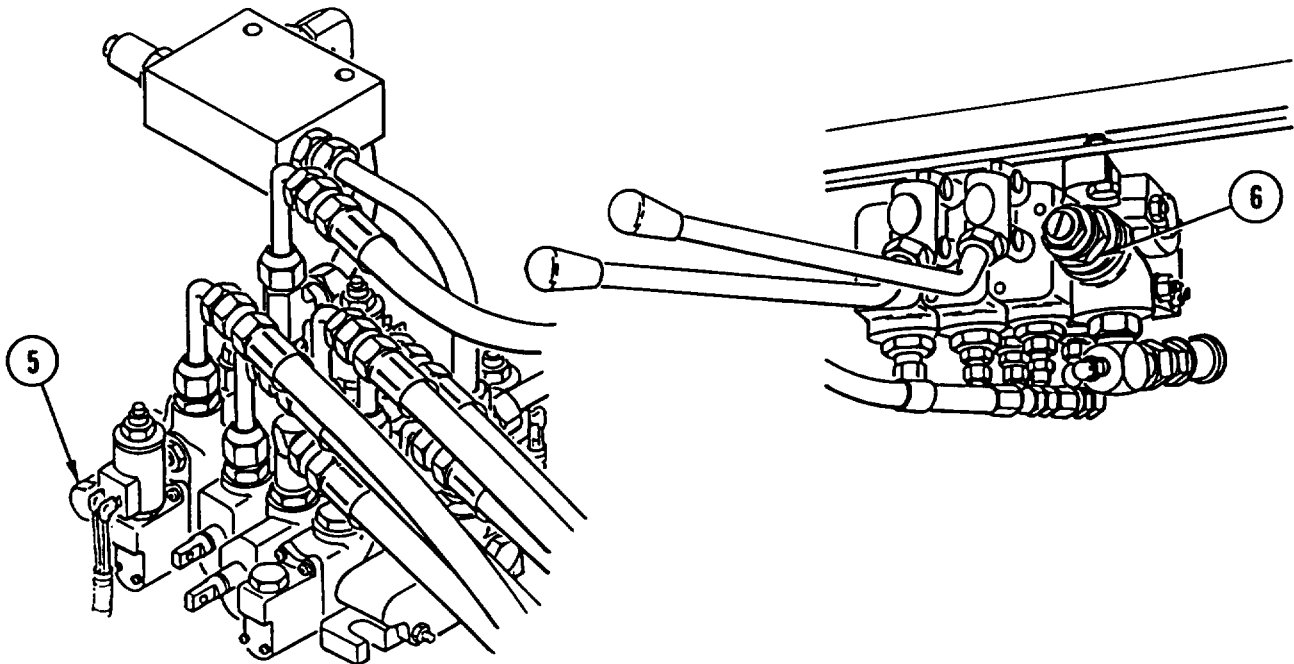
Monitor oil temperature during entire test. Do not allow oil temperature to exceed 140° F (60 °C). Failure to do so may result in incorrect readings and improper evaluation of hydraulic pump flow rate.

- e. Cycle oil until oil is at operating temperature of 120° F (49°C).
- f. Record flow rate.
- g. Close load valve until 1000 psi (69 bar) is noted on flow meter. Record flow rate.
- h. Open load valve until 0 psi (0 bar) is noted on flow meter.
- i. Close load valve until 1500 psi (103.4 bar) is noted on flow meter. Record flow rate.
- j. Open load valve until 0 psi (0 bar) is noted on flow meter.
- k. Close load valve until 2000 psi (138 bar) is noted on flow meter. Record flow rate.
- l. Open load valve until 0 psi (0 bar) is noted on flow meter.
- m. Close load valve until 2450 psi (169 bar) is noted on flow meter. Record flow rate.
- n. Shut off engine.
- o. Divide flow rate recorded in step m by flow rate recorded in step f. This is the percentage of hydraulic pump efficiency.
  - If hydraulic pump efficiency is less than 75 percent, replace front or rear hydraulic pump (TM 5-2420-224-20).

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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HYDRAULIC SYSTEM (CONT)



- If hydraulic pump efficiency is more than 75 percent, replace front loader/forklift relief valve (5) or backhoe/crane relief valve (6) (TM 5-2420-224-20).

21. HYDRAULIC SYSTEM OIL OVERHEATS.

**NOTE**

- Perform step 1 for front hydraulic system.
- Perform step 2 for rear hydraulic system.

Step 1. Check front loader/forklift relief valve pressure.

- Perform Malfunction 20, step 1.

Step 2. Check backhoe/crane relief valve pressure.

- Perform Malfunction 20, step 2.

22. BACKHOE/CRANE WILL NOT TILT INTO OR OUT OF TRANSPORT POSITION.

Perform Malfunction 20, step 2.

23. HYDRAULIC FUNCTION SLUGGISH.

Perform Malfunction 20, step 3.

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
<b>FORKLIFT</b>		
24. ERRATIC UP AND DOWN MOVEMENT OF FORKLIFT.	Step 1. Check for air in lift cylinder.	<ul style="list-style-type: none"> <li>• Bleed air from lift cylinder (page 11-51).</li> </ul>
	Step 2. Check lift cylinder sequencing.	<ul style="list-style-type: none"> <li>• Sequence lift cylinder (page 11-51).</li> </ul>
	Step 3. Check load rollers adjustment.	<ul style="list-style-type: none"> <li>• Adjust load roller(s) (page 20-155).</li> </ul>
	Step 4. Check for bent or damaged lift cylinder plungers.	<ul style="list-style-type: none"> <li>• Replace lift cylinder (page 11-51).</li> </ul>
	Step 5. Check for leaks or binding of front loader/forklift control valve.	<ul style="list-style-type: none"> <li>• Replace front loader/forklift control valve (page 11-28).</li> </ul>
<b>HD45 HAMMER DRILL</b>		
25. HAMMER DRILL WILL NOT OPERATE OR OPERATES SLOWLY.	Step 1. Check for low accumulator charge (pressure hose will pulse more than normal).	<ul style="list-style-type: none"> <li>• Charge accumulator (page 21-1).</li> </ul>
	Step 2. Perform Malfunction 20.	
<b>IMPACT WRENCH</b>		
26. IMPACT WRENCH PERFORMS POORLY OR HAS LOW IMPACT.	Step 1. Perform Malfunction 20.	
	Step 2. Check for broken hammer pins.	<ul style="list-style-type: none"> <li>• Replace hammer pin(s) (page 21-15).</li> </ul>
27. IMPACT WRENCH OPERATES TOO FAST.	Step 1. Check engine rpm setting.	<ul style="list-style-type: none"> <li>• Set engine rpm to 2000 rpm.</li> </ul>
	Step 2. Check for damaged relief spring or valve sleeve.	<ul style="list-style-type: none"> <li>• Repair impact wrench (page 21-15).</li> </ul>

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or inspection	Corrective Action
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**IMPACT WRENCH (CONT)**

28. IMPACT WRENCH WILL NOT OPERATE.

- Step 1. Check for sticking or broken trigger controls.
- Repair impact wrench (page 21-15).
- Step 2. Perform Malfunction 20.

**BR67 PAVEMENT BREAKER**

29. PAVEMENT BREAKER WILL NOT OPERATE OR OPERATES SLOWLY.

- Step 1. Check for low accumulator charge (pressure hose will pulse more than normal).
- Charge accumulator (page 21-24).
  - If charge loss continues, repair pavement breaker (page 21-24).
- Step 2. Perform Malfunction 20.

**CHAIN SAW**

30. CHAIN SAW WILL NOT OPERATE.

Perform Malfunction 20.

**BACKHOE**

31. ALL BACKHOE FUNCTIONS SLUGGISH.

- Step 1. Perform Malfunction 20.
- Step 2. Check for incorrect pressure setting for safety relief valves as follows:
- a. Cycle circuit(s) to be tested until oil is at operating temperature of 120°F (49°C).
  - b. Place backhoe in three-point stance.
  - c. Shut off engine.
  - d. Relieve hydraulic pressure by moving controls back and forth.
  - e. Disconnect hydraulic hose from port to be tested.
  - f. Connect hand pump to port to be tested.
  - g. Stroke hand pump until sufficient pressure is built up in circuit to open safety relief valve.
  - h. Continue to stroke hand pump until ail airhas been pumped out of lines.

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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**BACKHOE (CONT)**

- i. Record highest pressure and compare with acceptable ranges shown below:

Swing Section Valve

A and B ports. . . . . 1700-1900 psi (115.6-129.2 bar)

Boom Section Valve

A port (upper) . . . . . 925-1075 psi (62.9-73.1 bar)

B port (lower) . . . . . 2400-2650 psi (163.2-180.2 bar)

Dipper Section Valve

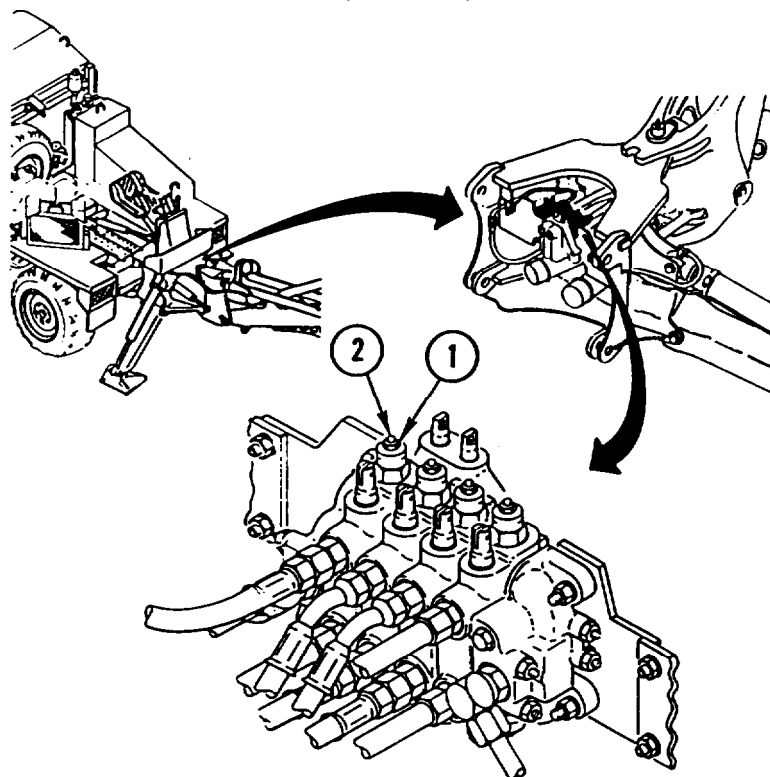
A and B ports. . . . . 2400-2650 psi (163.2-180.2 bar)

Bucket Section Valve

A and B ports. . . . . 2400-2650 psi (163.2-180.2 bar)

**NOTE**

Adjustment is the same for both ports. A port is shown.



- If safety relief valve pressure is not correct, loosen lock nut (1). Turn adjusting screw (2) to right to increase pressure, or left to decrease pressure. Repeat until correct pressure is attained.



**Table 2-1. Troubleshooting (Cont)**

Malfunction	Test or Inspection	Corrective Action
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**BACKHOE (CONT)**

- j. When safety relief valve pressure is correct, perform leak test on all safety relief valves (page 20-69).

**32. BACKHOE STOPS ABRUPTLY WHEN SWUNG FULL LEFT OR RIGHT.**

Step 1. Check for damage to relief valve in end of swing cylinder.

- Replace relief valve (page 11-10).

Step 2. Disassemble swing cylinder and check for damage to pin inside swing cylinder.

- Replace damaged part(s) (page 20-105).

**33. BACKHOE SWINGS CORRECTLY BUT WILL NOT STOP WHEN SWING CONTROL RETURNED TO NEUTRAL.**

Check for damaged springs or valve disc in swing section valve.

- Repair swing section valve (page 20-51).

**34. BACKHOE BOOM DRIFTS WHEN LOADED AND CONTROLS IN NEUTRAL.**

Check for dirty or defective cylinder load check valves in boom section valve.

- Clean, or repair boom section valve (page 20-59).

**35. STABILIZER(S) WILL NOT HOLD BACKHOE IN PLACE.**

Check for clogged or defective check valves in stabilizer control valves as follows:

- a. With engine stopped, backhoe in operating position, and stabilizers in down position, pull left stabilizer control lever inward. If cylinder starts to retract, immediately release lever.
- b. Repeat step a using right stabilizer control lever. Vehicle movement indicates defective check valve(s) in stabilizer control valve on side of vehicle that moved.
  - Replace stabilizer control valve (page 11-12).

**36. LOAD FALLS WHEN CONTROL VALVE ACTUATED.**

Check for damaged load check valves in backhoe control valve.

- Repair backhoe control valve (page 20-41).

**CRANE**

**37. CRANE CONTROLS WILL NOT RESPOND.**

Step 1. Check PTO control linkage adjustment.

- Adjust PTO control linkage (page 3-81).

Table 2-1. Troubleshooting (Cont)

**Malfunction**

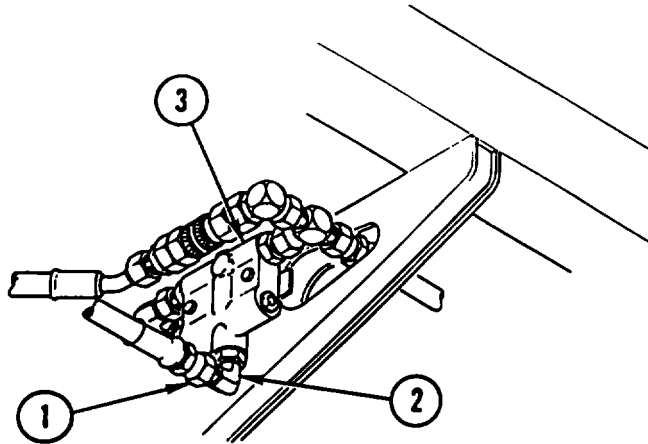
**Test or Inspection**

**Corrective Action**

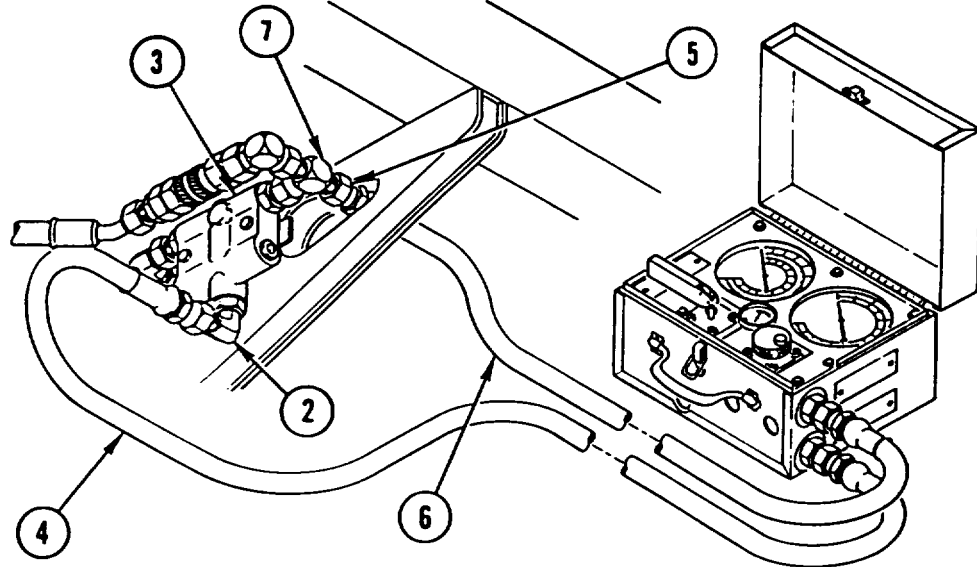
**CRANE (CONT)**

Step 2. Perform Malfunction 20.

Step 3. Check flow rate of oil coming from flow regulating valve as follows:



- a. Disconnect input hose (1) from elbow fitting (2) at valve (3).



- b. Connect flow meter input hose (4) to elbow fitting (2).
- c. Disconnect output hose (5) from valve (3).
- d. Connect flow meter output hose (6) to tee fitting (7).
- e. Start engine and increase engine rpm to 1100 rpm by engaging RPM switch on control tower.

Table 2-1. Troubleshooting (Cont)

**Malfunction**

**Test or Inspection**

**Corrective Action**

**CRANE (CONT)**

**NOTE**

Monitor oil temperature during entire test. Do not allow oil temperature to exceed 140°F (60°C). Failure to do so may result in incorrect readings of flow rate.

- f. Cycle oil until oil is at operating temperature of 120°F (49°C).
- g. Close load valve until 1000 psi (69 bar) is noted on flow meter.
- h. Open load valve until 0 psi (0 bar) is noted on flow meter.
- i. Close load valve until 1500 psi (103.4 bar) is noted on flow meter.
- j. Open load valve until 0 psi (0 bar) is noted on flow meter.
- k. Close load valve until 2000 psi (137.9 bar) is noted on flow meter. Flow rate at this time should be 9 gpm (34 lpm).

If flow rate is not 9 gpm (34 lpm), replace flow regulating valve (page 11-22).

38. CRANE OPERATION SLOWS DOWN.

Perform Malfunction 37, step 3.

39. CRANE OPERATION UNUSUALLY NOISY, YIELDS OR DRIFTS.

- Check holding valve on noisy cylinder as follows:
  - a. Lift maximum load for crane approximately 6-8 in. off ground.
  - b. Extend outer boom to its maximum.
  - c. Shut off engine.
  - d. Monitor down drift of load for approximately 10 minutes.
    - If there is any down drift of load, replace holding valve on cylinder that drifts down.

**FRONT LOADER**

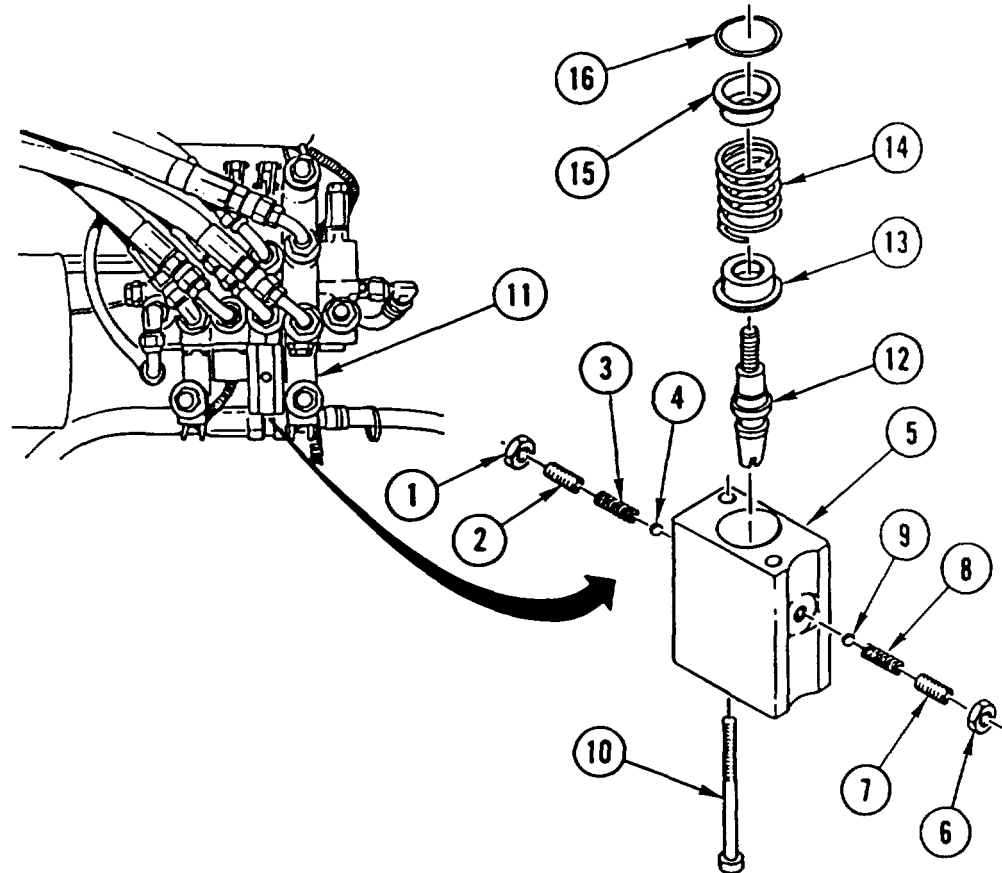
40. CONTROL VALVE WILL NOT HOLD IN FLOAT POSITION.

Check for worn or damaged parts in mechanical detent. If parts are worn or damaged, adjust float detent as follows:

Table 2-1. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action
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## FRONT LOADER (CONT)



- Loosen jam nut (1) and remove socket head screw (2), spring (3), and ball (4) from bottom of housing (5).
- Loosen jam nut (6) and remove socket head screw (7), spring (8), and ball (9) from top of housing (5).
- Remove two socket head capscrews (10) and housing (5) from control valve (11).
- Inspect spool end (12) for damage.

**NOTE**

If spool end is damaged, perform steps e and f. If spool end is not damaged, go to step g.

- Remove spool end (12), spring retainer (13), spring (14), spring retainer (15), and packing (16) from housing (5). Discard packing.

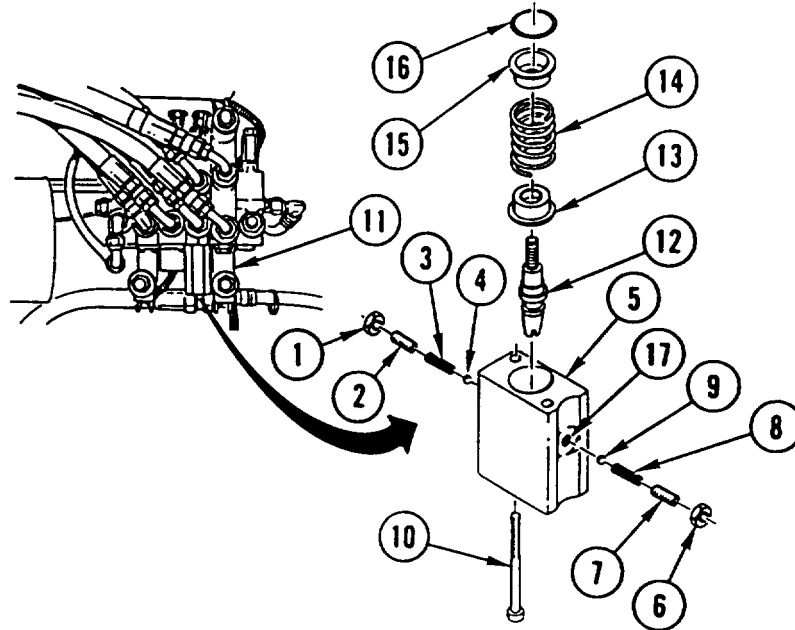
Table 2-1. Troubleshooting (Cont)

Malfunction

Test or inspection

Corrective Action

FRONT LOADER (CONT)



NOTE

Make sure spool end bottoms out completely.

- f. install new packing (16), spring retainer (15), spring (14), spring retainer (13), and spool end (12) in housing (5).
- g. Coat bore of housing (5) with GAA and install housing (5) on control valve (11).
- h. install two socket head capscrews (10) in housing (5).
- i. Fill two detent holes (17) with GAA.

NOTE

During steps j and k, install socket head screws only three turns.

- j. install ball (9), spring (8), and socket head screw (7) in top of housing (5).
- k. install ball (4), spring (3), and socket head screw (2) in bottom of housing (5).
- l. Tighten two socket head screws (7 and 2) until slight resistance is felt.
- m. Engage loader lift lever in cab in float position and make sure float lock is achieved.

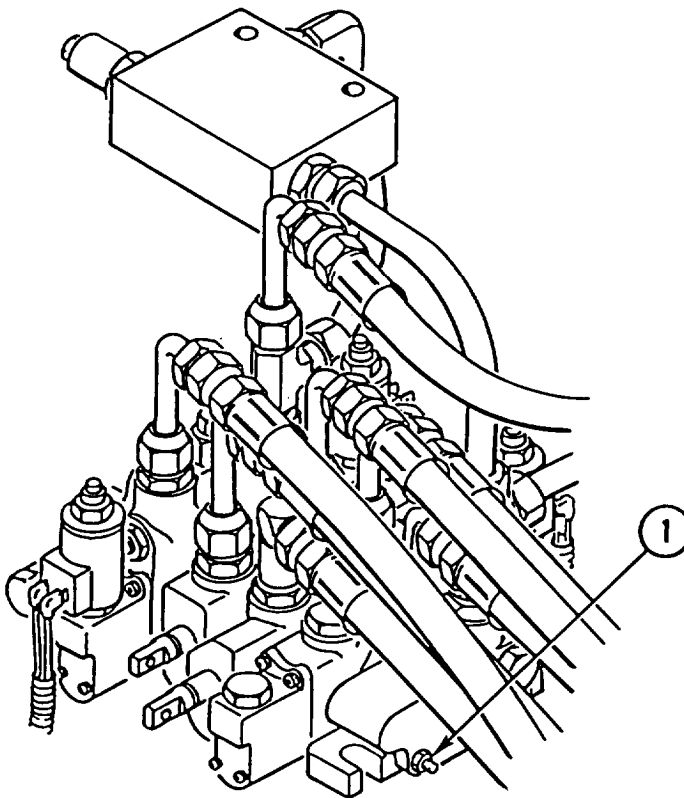
Table 2-1. Troubleshooting (Cont)

Malfunction	Test or inspection	Corrective Action
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## FRONT LOADER (CONT)

- n. Operate loader lift lever to check for smooth movement in all directions.
- o. if movement is not smooth or float lock is not achieved, turn two socket head screws (7 and 2) either in or out to accomplish smooth movement and proper float lock.
- p. Hold two socket head screws (7 and 2) in place and tighten two jam nuts (6 and 1).
  - if problem continues, replace control valve (page 11-28).

## 41. CONTROL VALVE STICKS OR WORKS HARD.



Step 1. Check if control valve tie rod nuts (1) are too tight.

- Tighten tie rod nut(s) to  $16 \pm 2$  lb-ft ( $32.5 \pm 2.7$  N.m).

Step 2. Check for incorrectly adjusted detent.

- Perform Malfunction 40.

## Section III. GENERAL MAINTENANCE INSTRUCTIONS

### OVERVIEW

This section describes general maintenance instructions that apply to all parts of this manual. To avoid repetition, these procedures will not be described in specific maintenance sections.

### **GENERAL REMOVAL INSTRUCTIONS**

1. **Work Required.** Remove only those parts needing repair or replacement. Do not disassemble a component any further than needed.
2. **Preparation.** Before removing any part of the electrical, hydraulic, or air systems, make certain system is not energized or pressurized. Disconnect battery cables. Relieve all pressure from air system. Make sure brakes are locked and that all controls are in OFF position before starting any removal procedure.
3. **Removal.** Make sure there is enough clearance to remove part. Disassemble adjacent parts as needed to provide working clearance.
4. **Lifting.** Always use chain hoist, jack, or other aid when lifting heavy parts. Make certain load limit of lifting device exceeds weight being lifted. Position and rig lifting device before disconnecting part for removal.
5. **Identification.** Tag or mark all similar parts, such as electrical leads, before disconnecting and removing such parts. This will make proper assembly easier. Be sure to identify mating ends of electric lines, hydraulic lines, and air tubes as they are disconnected.
6. **Position of Valves.** Before removing valve handles, mark or diagram their positions when open and closed. This will help during assembly.

### **GENERAL DISASSEMBLY INSTRUCTIONS**

1. **Cleanliness.** Work area must be kept as clean as possible. This will prevent injury or contamination of internal parts. This is especially true for valves, cylinders, and other hydraulic or air system parts.
2. **Expendable Parts.** As indicated in this manual, all gaskets, packings, and seals removed during repair must be discarded and replaced with new parts. These items are usually damaged during removal. In the same way, all lockwire, cotter pins, and like items must be replaced at time of assembly.
3. **Removing Seals.** When removing gaskets, packings, or seals, do not use any metal tool that will scratch the surfaces next to these items.
4. **Disassembly.** Before disassembly of any item, study the illustration carefully. Note relationship of internal parts. Knowing details of a component will speed up disassembly and assembly and will help avoid mistakes.
5. **Parts Protection.** To prevent moisture and dirt from entering open housings, lines, and other openings, apply protective caps and plugs as soon as possible after disassembly. Wrap all removed parts in clean paper or coat parts with solid lubricant preservative.

## **GENERAL CLEANING INSTRUCTIONS**

### **WARNING**

- Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breath vapors. Do not use near open flame or excessive heat. Flash point is 100° -138°F (38°-50°C). If you become dizzy while using drycleaning 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.
- Never use gasoline to clean parts. Gasoline is highly flammable. Serious personal injury could result if fuel ignites during cleaning.

### **CAUTION**

- Petroleum solvents may damage parts that are in contact with hydraulic fluids.
- To prevent damage to equipment, do not clean tires, lubricant seals, rubber hoses, or electrical components with solvent mixture.

1. Cleaning Solvents. Use only approved cleaning solvents to clean parts. Drycleaning solvent, SD-2 (P-D-680) is commonly used. Always work in a well-ventilated area.

### **WARNING**

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

2. Removing Deposits. After soaking parts in solvent, wash away deposits by flushing or spraying. Where necessary, brush with a soft-bristle brush moistened in solvent. Use compressed air to dry all parts, except bearings. Bearings must be allowed to air dry.
3. Tools. Do not use abrasive wheels or compounds when cleaning parts, unless called for in detailed instructions. These procedures may weaken a highly stressed part.
4. Ball and Roller Bearings. When cleaning ball or roller bearings, place them in a basket and suspend them in a container of drycleaning solvent. If needed, use a brush to remove bearing before solid particles are removed to prevent damaging races and balls. When bearings have been cleaned, coat them lightly with lubricating oil to remove solvent. Refer to TM 9-214 for additional instructions on cleaning bearings.
5. Rubber Parts. Do not clean rubber parts in drycleaning solvent. Clean by washing with a mild solution of soap and water. Wipe with a clean, dry, lint-free cloth.



## **GENERAL CLEANING INSTRUCTIONS (CONT)**

### **WARNING**

Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection are required.

6. Exterior Parts. Steam clean all exterior parts thoroughly before removing. This will make inspection and disassembly easier.

### **WARNING**

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breath vapors. Do not use near open flame or excessive heat. Flash point is 1000-138°F (38" -50" C). If you become dizzy while using drycleaning 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.

Solvents used with spray gun must be used in spray booth with filter. Face shield must be used by personnel operating spray gun. Failure to do so could result in serious injury to personnel.

7. Engine. Cab. and Body. Use a spray gun and solvent mixture for cleaning exterior of engine, cab, and body. Allow mixture to remain on item surface for about 10 minutes before rinsing. Rinse with hot water under 80-120 pounds of pressure, if available. An ordinary garden hose with nozzle may be used if other equipment is not available. Rinse thoroughly.
8. Decreasing Machine. A decreasing machine may be used to remove heavy grease and oil accumulations from metal parts.
9. Passages. After removing parts from decreasing machine, and before coating with rust preventive, check all oil passages and cavities for dirt or blockage. A thin, flexible wire should be run through oil passages to make certain they are not clogged. Individual passages that are dirty may be cleaned using a pressure spray gun and drycleaning solvent.

### **CAUTION**

To prevent corrosion, parts should be dipped in rust preventive compound within 2 hours after decreasing.

10. Electrical Parts. Electrical parts, such as coils, junction blocks, switches, and igniters, which use insulating materials, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean, lint-free cloth moistened with drycleaning solvent.
11. Electrical Grounds. Clean electrical ground contacts with emery cloth.
12. Oil and Fuel Tank. Pay special attention to all warnings and cautions when working on fuel tank. Oil and fuel tanks should be flushed, using a spray gun and drycleaning solvent.

13. Battery. Exterior surfaces of the electrical system and battery should be cleaned with a weak solution of baking soda and water. Apply solution with a bristle brush to remove corrosion.

#### **WARNING**

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breath vapors. Do not use near open flame or excessive heat. Flash point is 100° -138° F (38° -50°C). If you become dizzy while using drycleaning 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.

#### **CAUTION**

To prevent damage to equipment, never use gasoline or other petroleum-base products to clean or preserve hydraulic system parts.

14. Hydraulic System. When cleaning hydraulic system parts, use drycleaning solvent SD-2 (P-D-680). Clean and dry parts thoroughly to make sure no residue remains. If a coating of preservative is required before assembly, apply a light film of solid lubricant preservative. If petroleum-free solvents are not available, use the same hydraulic fluid as used in the hydraulic system.

### **GENERAL INSPECTION INSTRUCTIONS**

1. Sealing Surfaces. Inspect all surfaces in contact with gaskets, packings, or seals. Make sure there are no nicks, burrs, or scratches. If any defect is found, remove or repair it as outlined under General Repair Instructions in this manual.
2. Bearings. Check bearings for rusted or pitted balls, races, or separators. Check balls and races for brinnelling, abrasion, and serious discoloration. Refer to TM 9-214 for additional instructions for bearings. Following are causes for bearing rejection:
  - Cuts or grooves parallel to ball or roller rotation
  - Fatigue pits (not minor machine marks or scratches)
  - Cracks
3. Inspection. Inspection consists of checking for defects such as distortion, wear, cracks, and pitting. Parts under heavy load or pressure must be inspected more thoroughly. Clean all parts before inspection.
4. Drain Plugs. When removing drain plugs from transmission, engine, or hydraulic system components, inspect sediment adhering to plug, A buildup of grit and/or fine metal particles may indicate part failure. A few fine particles are normal. This inspection is effective in determining defective parts prior to internal inspection of parts.
5. Gears. Gear inspection cannot be described in detail here; there are too many differences in size and shape of gears. The following steps can be used to make a general visual inspection of all gears. Follow all steps listed in General Repair Instructions for final inspection.
  - Normal Wear. Loss of metal from the surface of gear teeth. Wear must not prevent gears from meshing or performing properly.
  - Initial Pitting. This may occur when a pair of gears is first started in service. It may continue until most high spots have been reduced, as long as contact surfaces are not affected. This pitting is not necessarily serious.

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## **GENERAL INSPECTION INSTRUCTIONS (CONT)**

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- Destructive Pitting. This type of pitting occurs after initial pitting, often at an increasing rate. This will destroy contact area and reduce the gear's ability to carry a load. Rapid destruction will occur with use.
  - Abrasive Wear. This damage is caused by the fine particles that may come from many sources: metal detached from gear teeth or bearings, abrasives not completely removed before assembly, sand or scale from castings, or other impurities in oil or air.
  - Scoring. Slight scoring, scuffing, galling, or other surface damage is identified by tears or scratches in the direction of sliding. It starts in areas having the highest stress and speed. This is usually at the tip of the teeth.
  - Burning. Burning is indicated by discoloration and loss of hardness due to excessive temperature. This is caused by too much friction resulting from overload, overspeed, lack of backlash, or faulty lubrication. If discoloring can be wiped off with clean cloth, such discoloring usually can be traced to oilburn-trains, which are not serious.
  - Rolling. This damage occurs mainly on plastic gears. Rolling is when material is pushed out of shape without breaking off. This is caused by heavy, even loads; sliding; or overheating.
  - Brinelling. This can be identified by tiny indentations or ridges on the shoulder or race of a bearing.
6. Splines. Inspect shaft splines for wear, pitting, rolling, peening, and fatigue cracks. In many cases, the same inspection procedure will apply to gears. However, the problem will often be much less pronounced. Have a magnetic particle inspection performed on splines, if needed.
  7. Tubes, Hoses, Fittings, and Connections. Check all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or rubbing against other parts of the truck. Inspect air tubes for kinks. Inspect the fitting threads for damage. Replace any part found defective. Following assembly and during initial operation, check for leaks. No leakage is permissible.
  8. Electrical Parts. Inspect all wiring harnesses for chafed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.
  9. Metal Parts. Visually inspect all castings and weldments for cracks. Parts that carry a great load should receive magnetic particle inspection. Critical nonferrous parts may be inspected with fluorescent penetrant.

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## **GENERAL REPAIR INSTRUCTIONS**

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### **WARNING**

Drilling and grinding operations are hazardous to the eyes. Eye protection is required.

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1. Burrs. Remove burrs from gear teeth with a fine-cut file or hand grinder. Remove burrs on closely fitted mating surfaces by lapping the surfaces with emery cloth.
2. Exterior Parts. Chassis and exterior painted parts may be resurfaced where paint is damaged, or where parts have been repaired, by using an abrasive disc driven by a flexible shaft. Paint metal surfaces as required per TM 5-2420-224-20.
3. Bearings. Remove residue and oil stain from bearing races with emery cloth.

**NOTE**

The following procedure is used with polished and machined steel parts not protected by cadmium, tin, copper, or other plating or surface treatment. Bare metal surfaces must be free of moisture when protective coating is applied.

4. Protective Parts. During repair operations, protect bare steel surfaces from rusting when not actually undergoing repair work. Dip parts in, or spray them with, corrosion preventive compound. The same protective coating may be applied to other metals to prevent rust. Aluminum parts may require protection in atmospheres having a high salt content. Steel parts must always be protected.
5. Welding. Welding and brazing may be used to repair cracks in external steel parts, such as brackets, panels, and light framework. These repairs should be made only when replacement parts are not available. Do not weld or braze castings, running parts, or parts under great stress, except in emergencies. When welding is required, refer to TM 9-237.
6. Stud Installation. When installing studs in engine block and axle housings, use a driver designed for the stud to be installed. A worn stud driver may damage the end thread. This makes it necessary to use a chasing die before a nut can be screwed on. This procedure will remove cadmium plating and allow corrosion, which will make future disassembly difficult and cause stud to be backed out with nut. Before driving a stud, inspect hole for chips and liquid. Blow out any foreign matter. Start stud by hand. If it will not start into hole, it is too large or has defective end thread. Before final insertion, coat thread with antiseize compound; turn stud in slowly to prevent overheating and galling of casting metal.
7. Electrical Parts. Replace all broken, worn, or burned electrical wiring. Wires with several broken strands must be replaced. Broken strands will increase the resistance of the wire and impair efficiency of electrical components, especially the ignition system.
8. Hoses. Replace all broken, frayed, crimped, or soft flexible lines and hoses, Replace stripped or damaged fittings. Replace entire flexible hose if fittings are damaged. Make sure hose clamps do not crimp hoses.
9. Fasteners. Replace any bolt, screw, nut, or fitting with damaged threads. Inspect tapped holes for thread damage. If cross-threading or galling is evident, retap the holes for the next oversize screw or stud. When retapping will weaken the part, or when the cost of the part makes retapping impractical, replace the damaged part. Chasing threads with the proper size tap or die may often be enough.
10. Dents. Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing.
11. Sheet Metal Repair. Repair minor skin cracks by installing patches.
12. Mounting Holes. Reshape oval mounting holes to round. Drill to receive bushing with required inner diameter. Stake bushing in place with center punch.

<b>GENERAL ASSEMBLY INSTRUCTIONS</b>
--------------------------------------

1. Preparation. Remove grease from new parts before installation.
2. Packing Installation. Lubricate all packings with a thin coating of light lubricating oil before installation. Slightly stretch packing and place into position. Rotate component on flat surface or uniformly press the packing into position.

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## **GENERAL ASSEMBLY INSTRUCTIONS (CONT)**

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3. Pipe Joints. Use sealing compound or thread sealing tape when joining piping.
4. Gaskets. To provide added sealing for gasket. coat both sides with sealant. Remove all traces of previous gasket and sealant before installing new gasket.
5. Silicone Sealant (Sealing Compound).

### **WARNING**

On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. Avoid prolonged contact with skin.

Silicone sealant is often used instead of a gasket to seal mating parts. Mating parts must be clean, dry, and free of oil or grease for proper adhesion. After silicone sealant has been applied, mating parts must be assembled within 15 minutes. Silicone sealant starts to set up in 15 minutes and takes 24 hours to completely cure. Excess silicone sealant should be wiped off after assembling mating parts.

6. Oil Seals. Install oil seals with seal lip facing toward lubricant, applying an even force to outer edge of seal. Coat oil seals evenly with grease before installing. If oil seals will be installed over keyed or splined shafts, use a guide. This will prevent sharp edge of keyway or splines from cutting the leather or neoprene seal. Construct guides of very thin gage sheet metal and shape to required diameter. However, make certain guide edges are not sharp. Bend them slightly inward so they do not cut the seal.
7. Seal Rings. Coat seal rings with oil and carefully install into their bores. If seal rings must be installed over threaded parts, temporarily wrap the threads with tape to protect the seal ring; then remove the tape.
8. Bearings and Shafts. During assembly of shafts and bearings in housings, first mount bearing on shaft, then install the assembly by applying force to shaft. When mounting bearings on shafts, always apply force to the inner races of the bearing.
9. Bearing Lubrication. 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.

---

## **GENERAL INSTALLATION INSTRUCTIONS**

---

1. Preparation. Before installing any parts, make sure they are clean and that both mounting surfaces are clean and free of oil and grease (unless otherwise noted).
2. Installation. Make sure there is enough clearance to install part. Disassemble adjacent parts as needed to provide working clearance.
3. Lifting. Always use chain hoist, jack, or other aid when lifting heavy parts. Make certain load limit of lifting device exceeds weight being lifted. Position and rig lifting device before connecting part for installation.

## **GENERAL LUBRICATION INSTRUCTIONS**

Keep a light coat of lubricating oil on parts during repair procedures to prevent rusting. Lubricate parts during repair and assembly as required by LO 5-2420-224-12.

## **GENERAL TORQUE VALUE INSTRUCTIONS**

Use the torque values listed in the maintenance Procedures, if they are given. When no torque values are given in the maintenance procedures, refer to the torque value guide in Appendix D.

# **Section IV. GENERAL HYDRAULIC SYSTEM REPAIR METHODS**

## **OVERVIEW**

This section contains repair methods for the hydraulic system. If special repair methods or procedures are required for the hydraulic system or related parts, these methods or procedures are included in the individual maintenance procedures in Chapters 3 thru 21.

## **GENERAL REPAIR METHODS**

### **WARNING**

High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

### **CAUTION**

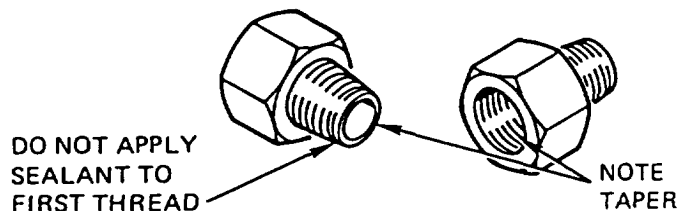
- Always clean around fittings before disconnecting or connecting hose of fittings. Make sure area is clean before installing hydraulic components. Failure to do so could result in damage to equipment.
- Cover, cap, or plug all openings, ports, and tube or hose ends when disconnected. Failure to do so could result in damage to equipment.
- Mate a fitting only with a fitting designed to mate. Because two fittings will screw together is no guarantee they will not leak. Never depend on trial and error. To do so could result in damage to equipment.
- Fittings must be installed and hand-tightened. If a fitting cannot be hand-tightened, it may be cross-threaded or have damaged threads. Use wrench only for final tightening. Failure to do so could result in damage to equipment.
- Do not use pipe dope as sealer on any fitting. Pipe dope can separate from fittings causing control valves and relief valves to become contaminated and fail.
- It is possible to screw a male NPT into a female straight thread, but fitting will leak. NPT has a slight taper.

## GENERAL REPAIR METHODS (CONT)

### CAUTION

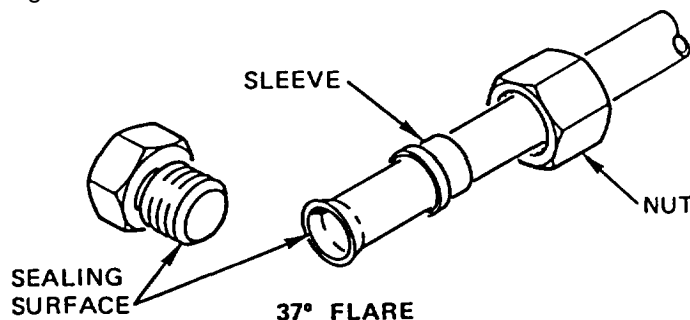
- Do not attempt to use parts of a 37-degree flare fitting and a flareless fitting with each other. Fitting will leak.
- When connecting NPTs, use care not to overtighten. If overtightened, female pipe thread will split.
- Do not apply sealant to first thread of NPT fitting. If sealant enters hydraulic system, it may cause components to fail.
- Be careful when installing preformed packings. Sharp threads can nick packing, causing it to leak.
- Do not overtighten a flareless connection. Overtightening can cause leakage requiring replacement of entire tube assembly.
- When connecting a hose to fitting, always use two wrenches. Use one wrench to turn swivel nut onto fitting and other wrench to keep hose or tube from rotating. Failure to do so could result in damage to equipment.

The following describes the types of fittings used in the vehicles. Refer to this information when performing hydraulic maintenance tasks.

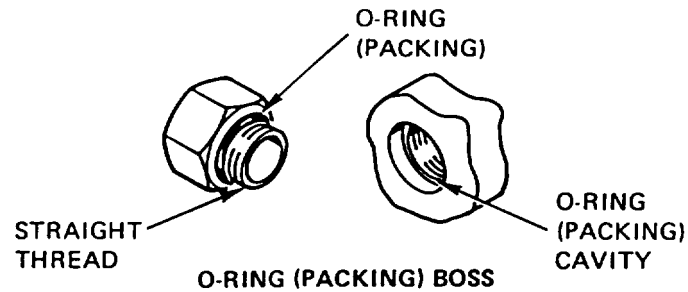


### NATIONAL PIPE THREAD (NPT)

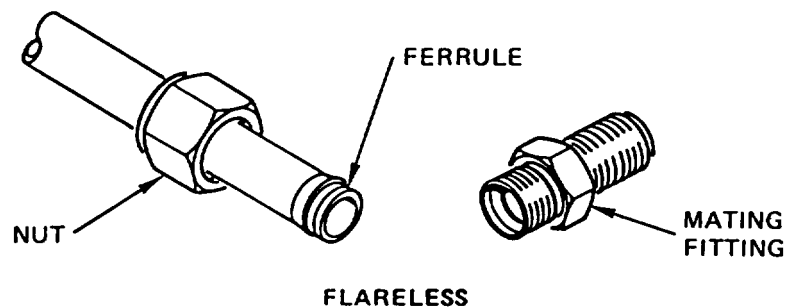
1. National Pipe Thread (NPT). This thread differs from others in that it is tapered. To obtain a proper seal with NPT, a sealant must be used. The sealant should be applied to male threads. Use care not to overtighten.



2. 37-Degree Flare. The 37-degree flare connection has a male straight thread that mates with a female straight thread. The sealing surface for this connection is the angled nose at the end of the male fitting. The nose mates with a similar surface in the female 37-degree flare fitting. These sealing surfaces must be free of nicks and scratches to seal properly.



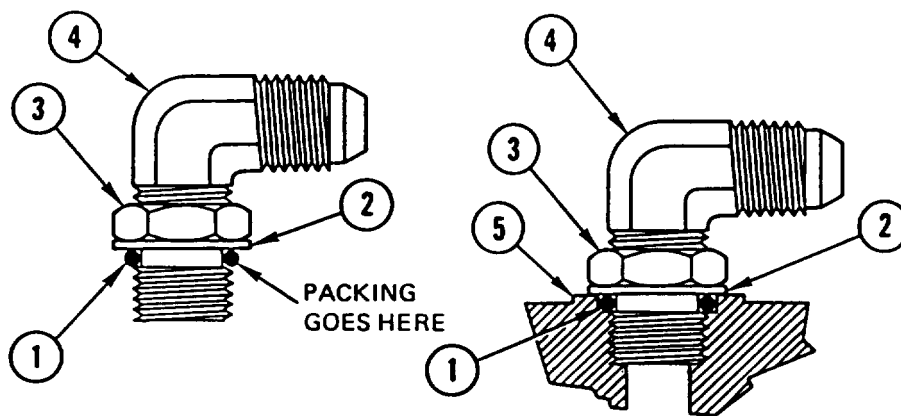
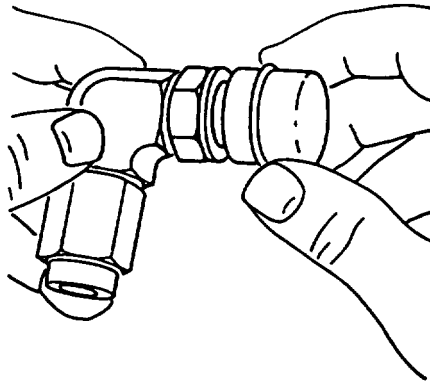
3. O-Ring (Preformed Packing) Boss. The boss connection has a straight thread. The seal for this connection has a preformed packing that fits on top of the thread. This packing is squeezed into the extra space at the top of the female thread and seals the connection.



4. Flareless. This fitting has a straight thread. The female fitting contains a ferrule that mates with a cavity in the male fitting. Use care not to overtighten to avoid damage to the ferrule.
5. Installation of Preformed Packings.
- Before installing a new packing, inspect threads and packing seat for nicks, cracks, and distortion.
  - Make sure the packing is correct type and size. If not sure, check Repair Parts and Special Tools List (TM5-2420-224-24P).
  - Before installing a new packing, apply coat of lubricating oil to packing (Appendix B, Item 30).
  - When installing a packing, always protect it from cuts or nicks. Do not install packing directly over threads. If available, install packing over a plastic or rubber thread guard supplied with new fittings. If no thread guard is available, protect packing by wrapping fitting threads with heavy, smooth, lint-free paper or tape.
  - If a backup washer is used with the packing, it must be free of cuts, nicks, and distortion. An unserviceable backup washer can cause packing to distort or rupture when hydraulic pressure is applied, resulting in a leak.
  - Always make sure packing is not damaged, twisted, or distorted after installation.
6. Installation of Adjustable Fittings.
- Apply coat of lubricating oil (Appendix B, Item 30) to new packing.



**GENERAL REPAIR METHODS (CONT)**



**CAUTION**

Packing must be located fully in groove and not on threads.

- b. Using suitable thread guard, install packing (1) and backup washer (2) in groove.
- c. Turn lock nut (3) down until lock nut just contacts backup washer (2).
- d. Install fitting (4) in boss (5) until backup washer (2) makes contact with boss.
- e. Position fitting (4) in desired position by backing fitting out up to one full turn. Hold fitting (4) in desired position and tighten lock nut (3).

## CHAPTER 3 POWER PACKAGE MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the power package. A list of sections contained in this chapter is shown below.

	<b>Page</b>
Section I. Engine Assembly and Related Parts .....	3-1
Section II. Clutch and Related Parts .....	3-63
Section III. Transmission and Related Parts .....	3-68
Section IV. Propeller Shafts and Related Parts .....	3-102

### Section I. ENGINE ASSEMBLY AND RELATED PARTS

#### OVERVIEW

This section illustrates and describes procedures for maintenance of the engine and related parts. A list of tasks contained in this section is shown below.

	<b>Page</b>
Engine Replacement .....	3-2
Engine Mount Replacement .....	3-18
Engine Oil Filter Replacement and Repair .....	3-20
Exhaust Manifold Replacement .....	3-23
Cylinder Head Replacement .....	3-25
Push Rod Cover Replacement .....	3-29
Oil Cooler and Gasket Replacement .....	3-30
Air Compressor Replacement and Repair .....	3-34
Fuel Injector Nozzle Replacement .....	3-41
Fuel Injection Pump Replacement .....	3-43
Fuel Injection Pump Timing .....	3-50
Timing Gear Cover, Gears, and Case Replacement .....	3-56

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## ENGINE REPLACEMENT

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This task covers: a. Removal b. Installation

---

**INITIAL SETUP**

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Shop Equipment, SC 4910-95-CL-A63

**Materials/Parts:**

- Gasket
- Nut (3)
- Washer, Lock
- Washer, Lock
- Washer, Lock
- Nut, Lock
- Seal (2)
- Washer, Lock
- Seal (2)
- Seal (2)
- Seal (2)
- Strap, Tiedown (5)
- Seal
- Nut, Lock (4)

**Personnel Required:** (2)

**References:**

- LO 5-2420-224-12
- TM 5-2420-224-20

**Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
LO 5-2420-224-12	Engine Oil Drained
TM 5-2420-224-20	Cooling System Drained
TM 5-2420-224-20	Batteries Disconnected
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Oil Pressure Sender Removed
TM 5-2420-224-20	Engine Temperature Switch Removed
TM 5-2420-224-20	Alternator Removed
TM 5-2420-224-20	Polarity Breaker Removed
TM 5-2420-224-20	Suppressor Filters Removed
TM 5-2420-224-20	Water Temperature Sending Unit Removed
TM 5-2420-224-20	Heater Hoses and Clamps Removed
TM 5-2420-224-20	Fan Impeller Removed
Page 7-14	Power Steering Pump and Bracket Removed

## ENGINE REPLACEMENT (CONT)

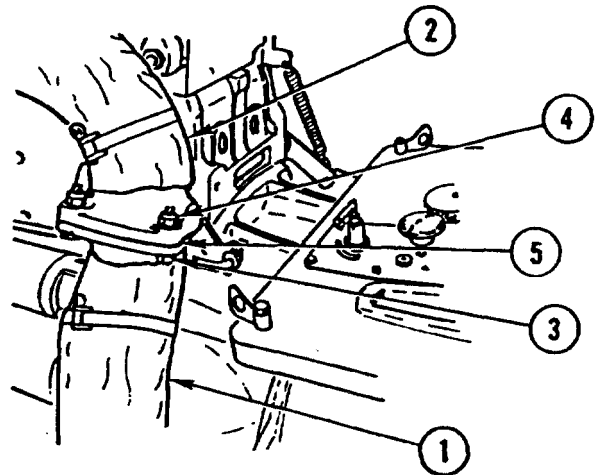
### General Safety Instructions:

#### WARNING

- Engine assembly weighs 1,320 pounds (599 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting engine assembly.
- Support weight of transmission before separating from engine. Failure to do so could result in serious personal injury.

### REMOVAL

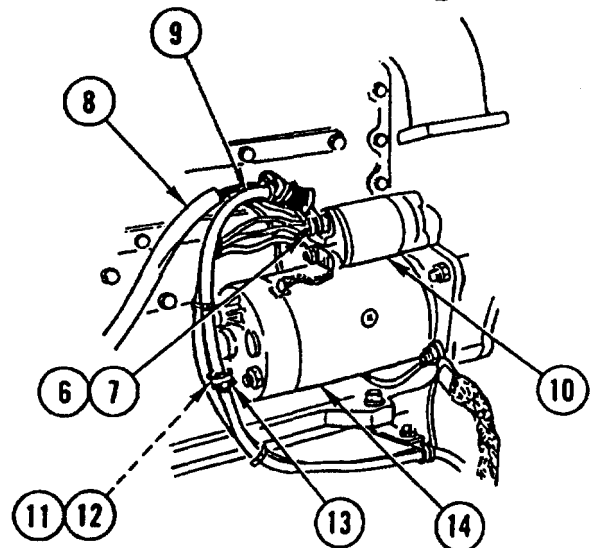
1. DISCONNECT exhaust PIPE (1) from manifold (2) by removing three screws (3), three nuts (4), and gasket (5). DISCARD GASKET and NUTS.



#### NOTE

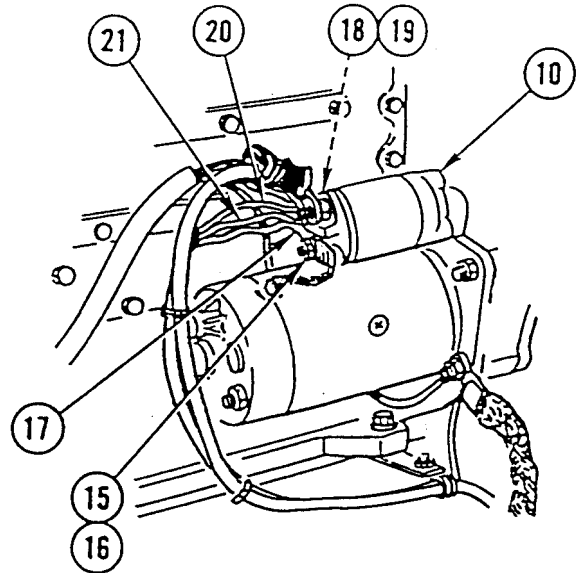
Tag all lines, leads, and attaching hardware prior to removal to aid in installation.

2. REMOVE nut (6), lock washer (7), and two WIRES (8 and 9) from starter solenoid (10). DISCARD lock WASHER.
3. REMOVE screw (11), washer (12), and CLAMP (13) from starter (14).

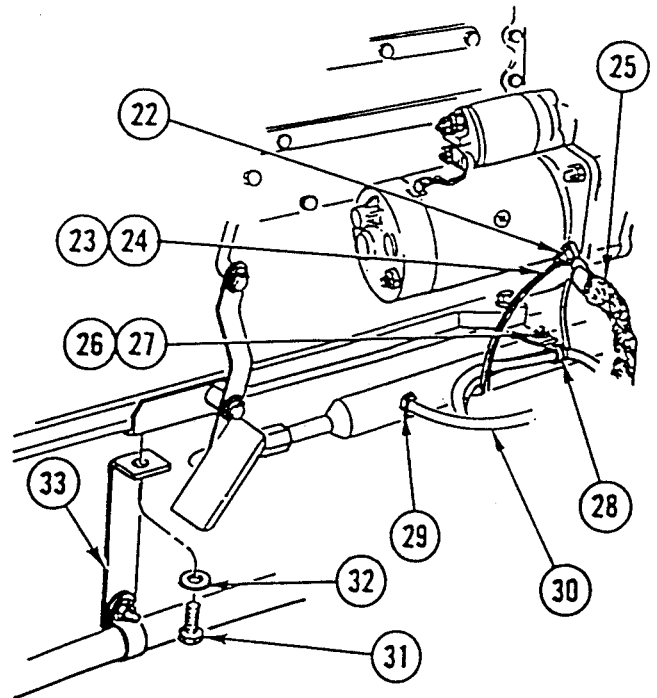


## ENGINE REPLACEMENT (CONT)

4. REMOVE nut (15), lock washer (16), and WIRE (17) from starter solenoid (10). DISCARD lock WASHER.
5. REMOVE screw (18), lock washer (19), and two WIRES (20 and 21). DISCARD lock WASHER.

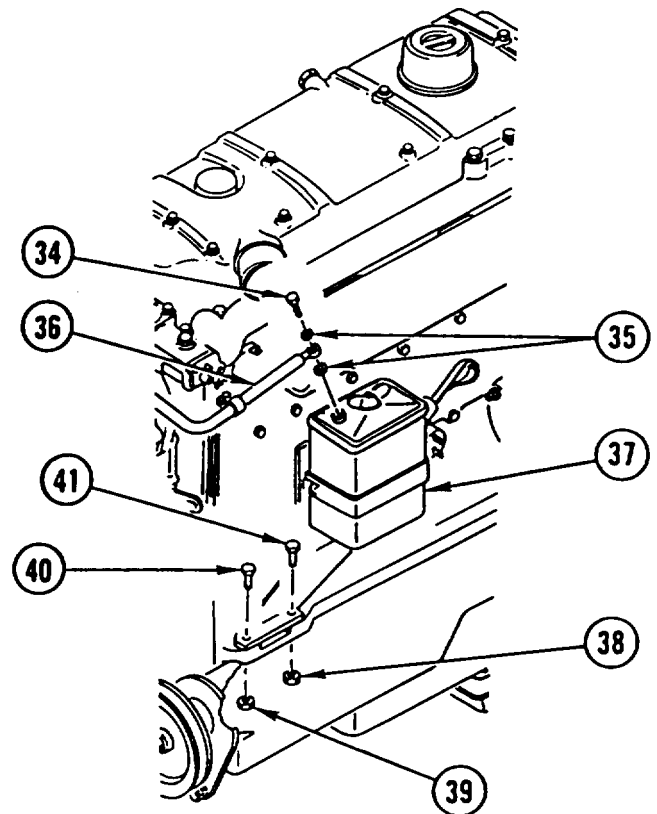


6. REMOVE nut (22), wires (23 and 24), and ground STRAP (25).
7. REMOVE LOCK NUT (26) and washer (27) and SET CLAMP (28) aside. DISCARD lock NUT.
8. LOOSEN NUT (29) and DISCONNECT HOSE (30).
9. REMOVE SCREW (31) and washer (32) and SET BRACKET (33) aside.
10. INSTALL washer (32) and SCREW (31).

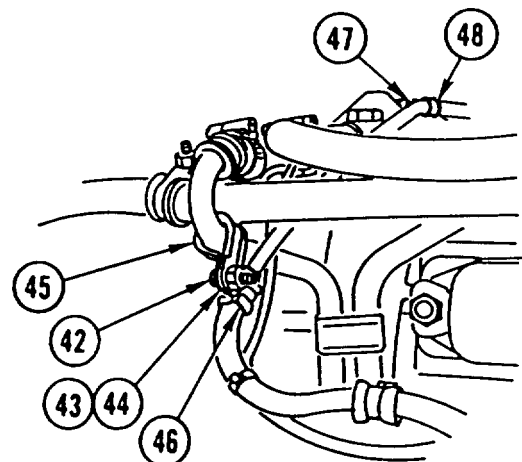


## ENGINE REPLACEMENT (CONT)

11. REMOVE screw (34), two seals (35), and CONNECTOR (36) from power steering oil tank (37). DISCARD SEALS.
12. REMOVE two nuts (38 and 39) and two SCREWS (40 and 41) and MOVE power steering oil TANK (37) out of the way.



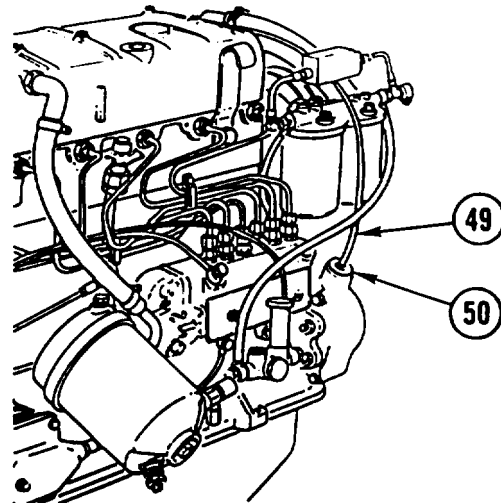
13. REMOVE SCREW (42), nut (43), and lock washer (44) and SEPARATE two CLAMPS (45 and 46). DISCARD lock WASHER.
14. TEMPORARILY INSTALL SCREW (42), nut (43), and new lock washer (44). DO NOT TIGHTEN NUT (43).
15. REMOVE screw (47) and CLAMP (48).



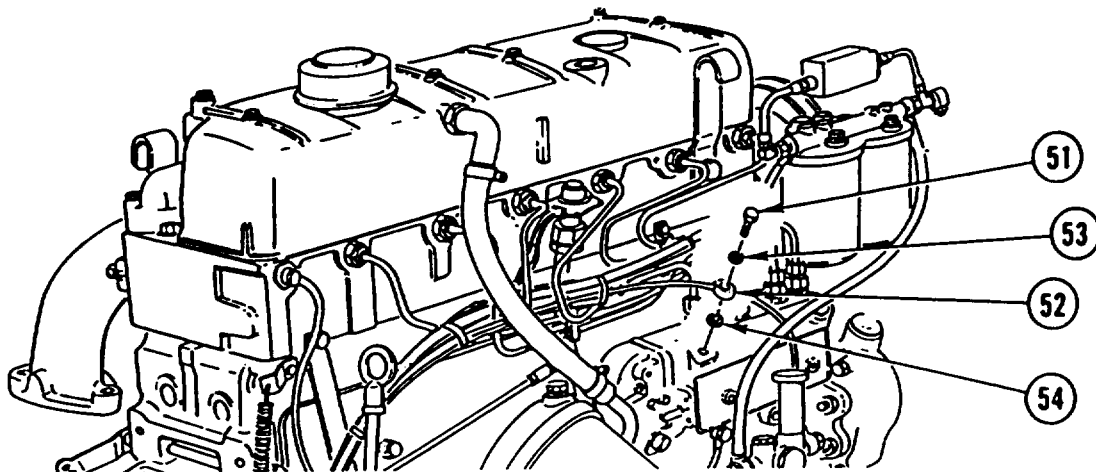
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**ENGINE REPLACEMENT (CONT)**

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16. DISCONNECT breather TUBE (49) from hourmeter (50).

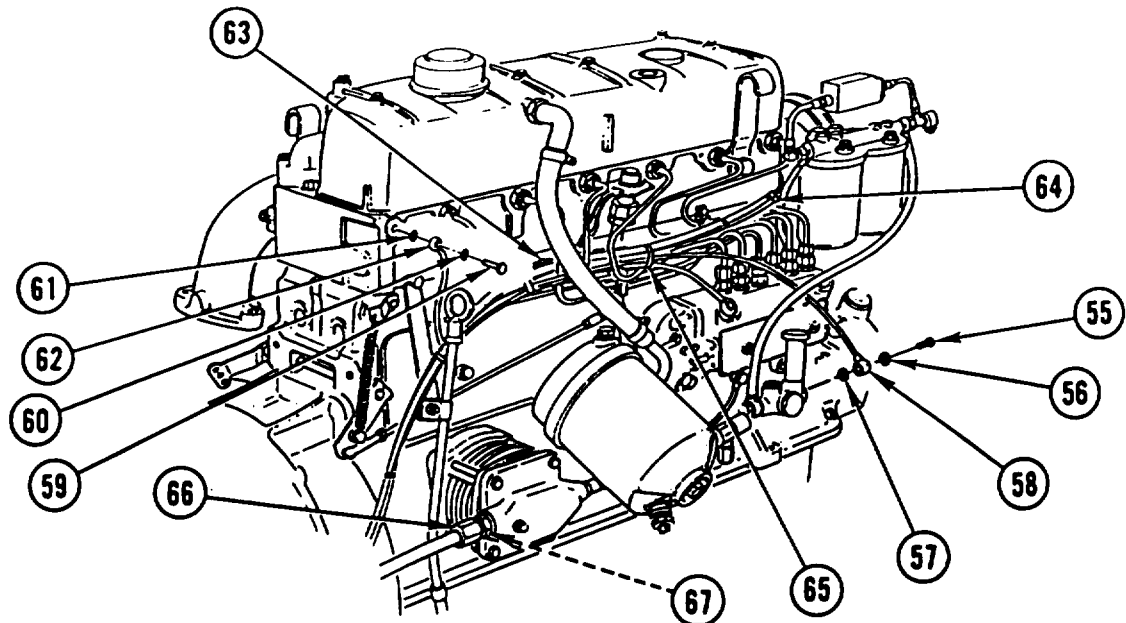


17. REMOVE screw (51), UNION (52), and two seals (53 and 54). DISCARD SEALS.

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**ENGINE REPLACEMENT (CONT)**

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18. REMOVE screw (55), two seals (56 and 57), and UNION (58). DISCARD SEALS.
19. REMOVE screw (59), two seals (60 and 61), and CONNECTOR (62). DISCARD SEALS.
20. DISCONNECT two PLUGS (63 and 64).
21. REMOVE and DISCARD tiedown STRAPS (65).
22. DISCONNECT air compressor outlet TUBE (66) and REMOVE SEAL (67). DISCARD SEAL.



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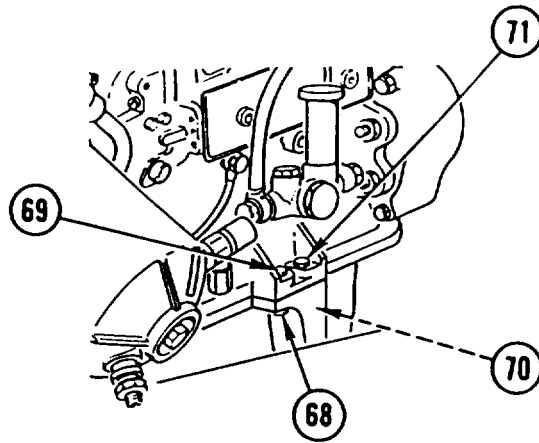
## ENGINE REPLACEMENT (CONT)

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**NOTE**

Repeat step 23 for both sides of engine.

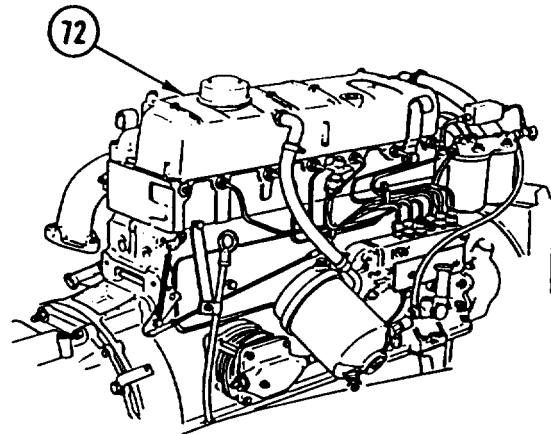
23. REMOVE lock nut (66), BOLT (69), lock nut (70), and BOLT (71). DISCARD lock NUTS.



**NOTE**

Attach lifting device to engine from right side of vehicle.

24. ATTACH suitable lifting DEVICE to sling points and LIFT ENGINE (72) 2.0-2.5 in. (50-60 mm).

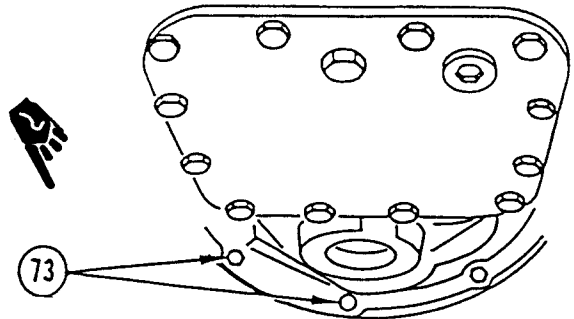


## ENGINE REPLACEMENT (CONT)

### NOTE

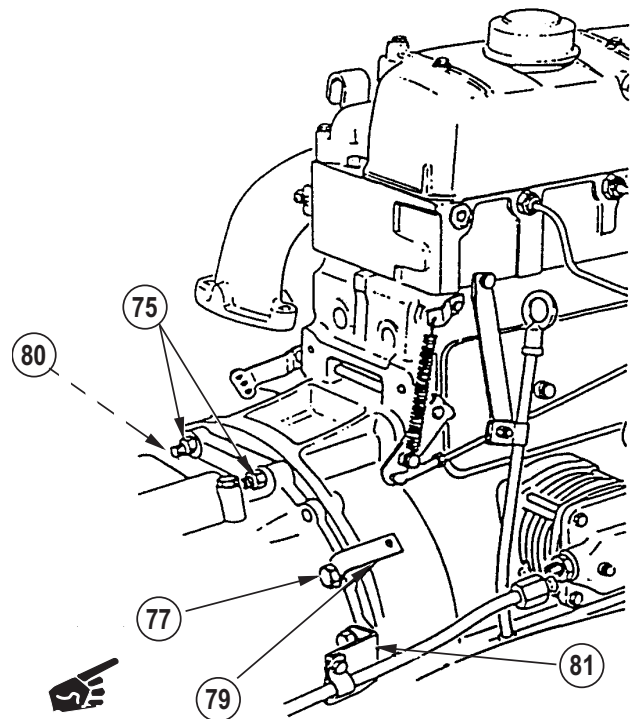
Some vehicles may have two nuts and two studs, instead of two bolts.

25. REMOVE two BOLTS (73) from underside of engine and transmission.



26. REMOVE two NUTS (75).

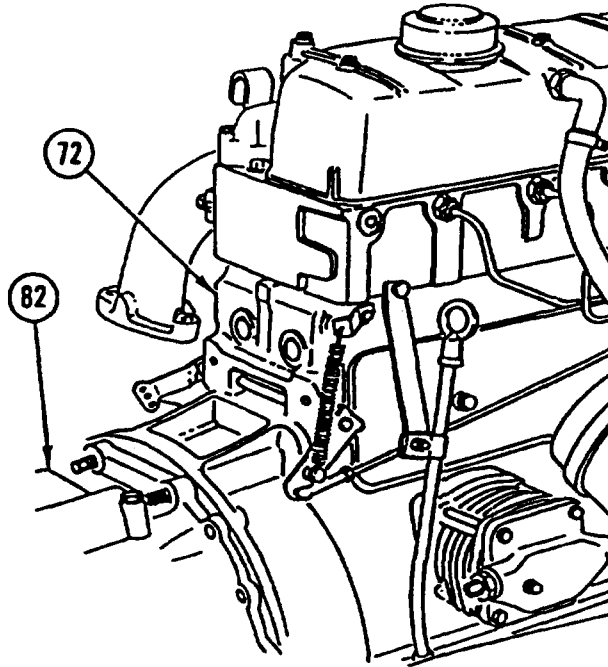
27. REMOVE nine bolts (77) and three BRACKETS (79, 80, and 81).



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## ENGINE REPLACEMENT (CONT)

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28. Using suitable lifting DEVICE, LIFT SLIGHTLY and SUPPORT front of TRANSMISSION (82) from underneath.

### CAUTION

- Make sure engine clears transmission shaft before lifting from vehicle to prevent damage to equipment.
- Make sure engine has sufficient clearance to avoid contact with cab or surrounding components to prevent damage to equipment.

### NOTE

Always remove and install engine from right side of vehicle.

29. MOVE ENGINE (72) FORWARD to clear studs and transmission (82) and REMOVE ENGINE (72) from vehicle.
30. REMOVE AIR CYLINDER (TM 5-2420-224-20).
31. REMOVE COOLANT EXPANSION TANK (TM 5-2420-224-20).
32. REMOVE STE/ICE-R FUEL PRESSURE SWITCH (TM 5-2420-224-20).
33. REMOVE CLUTCH (page 3-83).

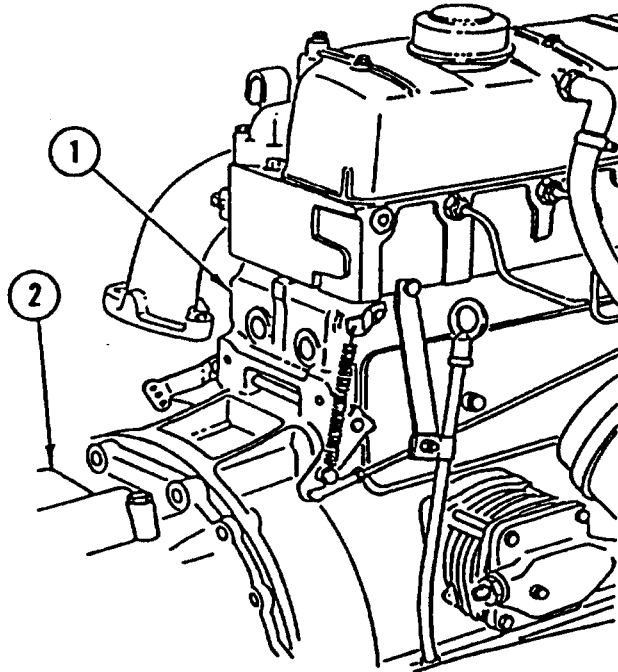
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## ENGINE REPLACEMENT (CONT)

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### INSTALLATION

1. INSPECT clutch release BEARING and REPLACE IF REQUIRED. REFER TO CLUTCH RELEASE LEVER AND SHAFT REPLACEMENT (page 3-66).
2. INSTALL CLUTCH (page 3-63).
3. INSTALL AIR CYLINDER (TM 5-2420-224-20).
4. INSTALL COOLANT EXPANSION TANK (TM 5-2420-224-20).
5. INSTALL STE/ICE-R FUEL PRESSURE SWITCH (TM 5-2420-224-20).



### CAUTION

Make sure engine clears transmission shaft during installation to prevent damage to equipment.

### NOTE

Always remove and install engine from right side of vehicle.

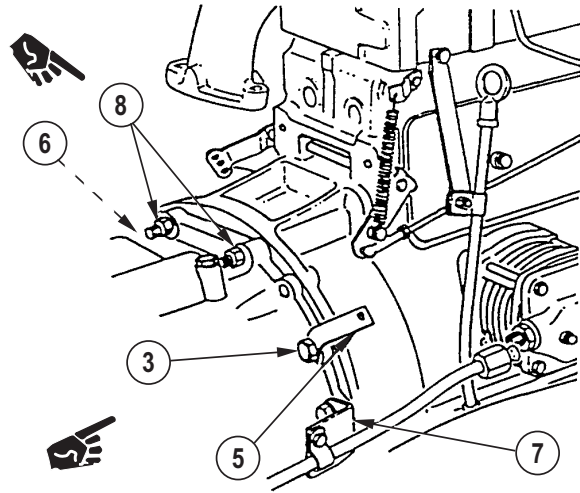
6. USING suitable lifting DEVICE, ALINE STUDS on engine (1) to transmission (2) and INSTALL.

## ENGINE REPLACEMENT (CONT)

### NOTE

Leave engine 2.0-2.5 in. (50-60 mm) off front mounts to allow clearance for installation of engine to transmission.

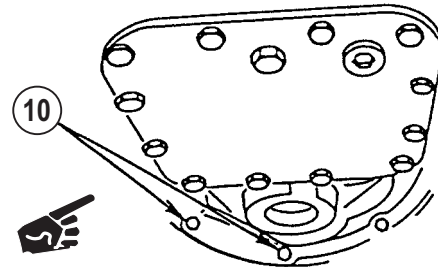
7. INSTALL nine bolts (3) and three BRACKETS (5, 6, and 7).
8. INSTALL two nuts (8).



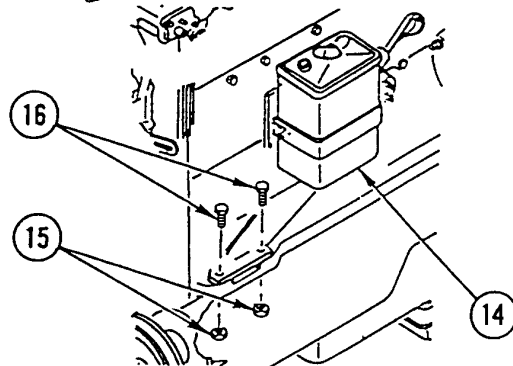
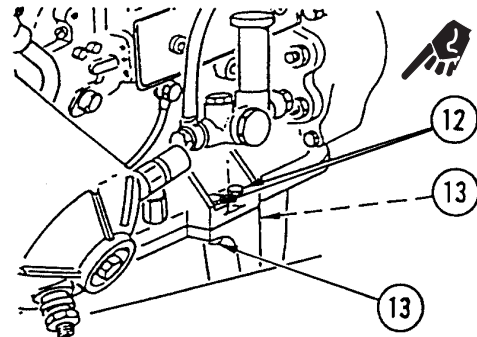
### NOTE

Some vehicles may have two nuts and two studs, instead of two bolts.

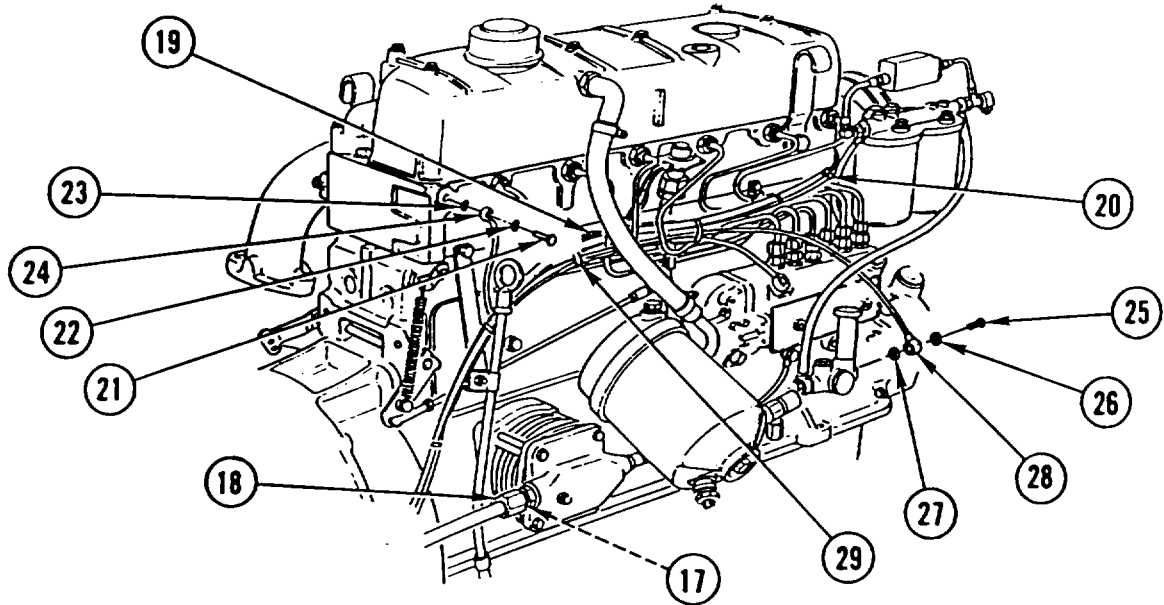
9. INSTALL two BOLTS (10) to underside of engine and transmission. TIGHTEN 11 BOLTS (3 and 10) and two NUTS (8) to 31 lb-ft (42 N.m).



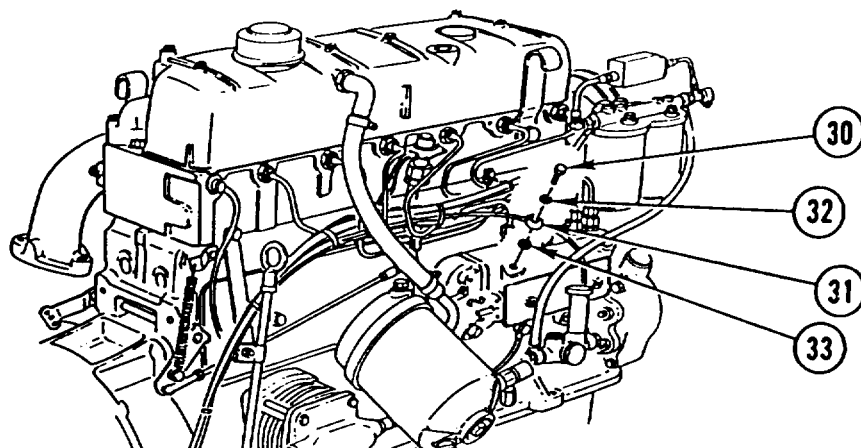
10. REMOVE SUPPORT from under transmission.
11. LOWER ENGINE onto mounts and INSTALL two bolts (12) and two new lock nuts (13).
12. INSTALL power steering oil TANK (14), two nuts (15), and two screws (16).
13. REMOVE lifting DEVICE and TIGHTEN four NUTS (13 and 15) to 104 ±15 lb-ft (140 ± 20 N.m).



## ENGINE REPLACEMENT (CONT)



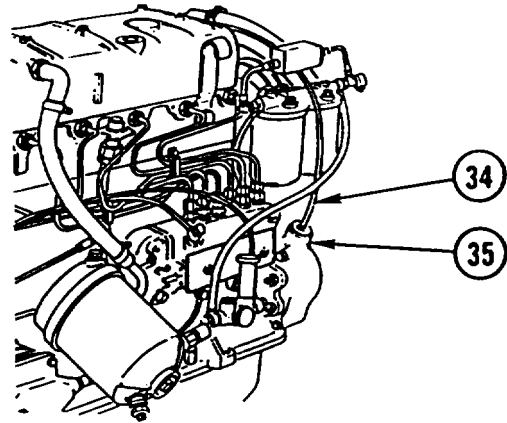
14. INSTALL new SEAL (17) and CONNECT air compressor outlet TUBE (18).
15. CONNECT two PLUGS (19 and 20).
16. INSTALL screw (21), two new seals (22 and 23), and CONNECTOR (24).
17. INSTALL screw (25), two new seals (26 and 27), and UNION (28).
18. INSTALL new tiedown STRAPS (29).



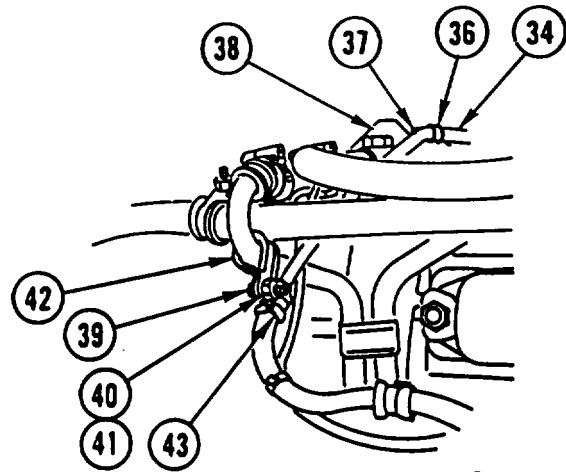
19. INSTALL screw (30), UNION (31), and two new seals (32 and 33).

## ENGINE REPLACEMENT (CONT)

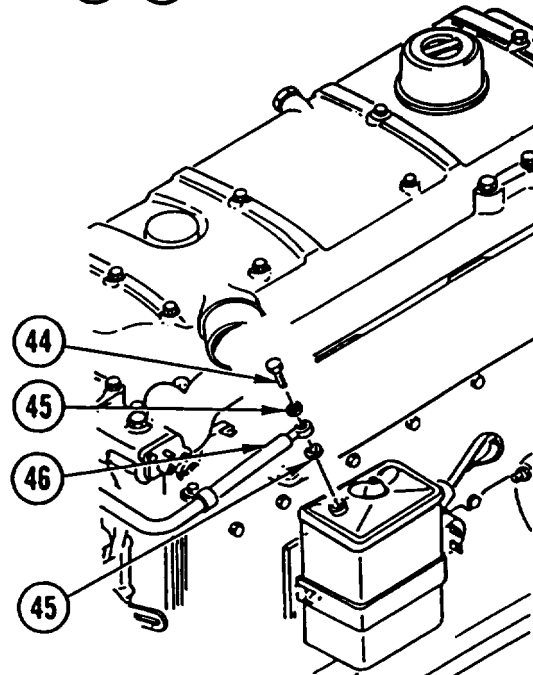
20. CONNECT breather TUBE (34) to hounmeter (35).



21. INSTALL CLAMP (36) on breather tube (34).
22. INSTALL CLAMP (36) and screw (37) on water outlet (38).
23. REMOVE SCREW (39), nut (40), and lock washer (41).
24. JOIN two CLAMPS (42 and 43) together and INSTALL SCREW (39), nut (40), and lock washer (41).

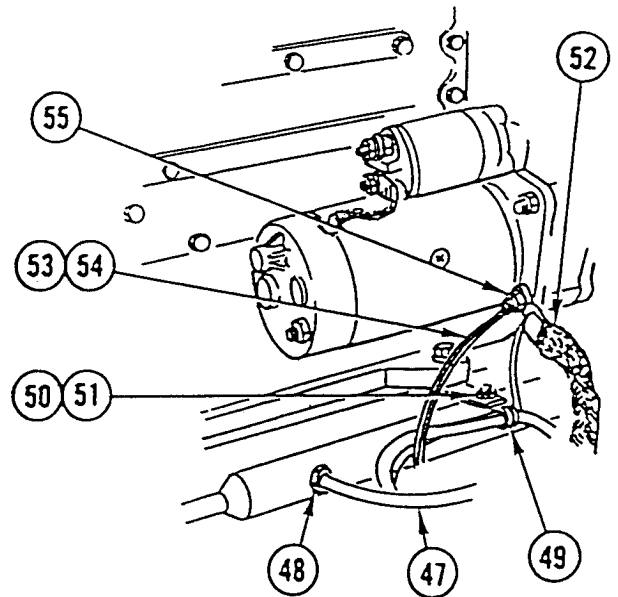


25. INSTALL screw (44), two new seals (45), and CONNECTOR (46).
26. INSTALL POLARITY BREAKER (TM 5-2420-224-20).
27. INSTALL two SUPPRESSOR FILTERS (TM 5-2420-224-20).
28. INSTALL ALTERNATOR (TM 5-2420-224-20).

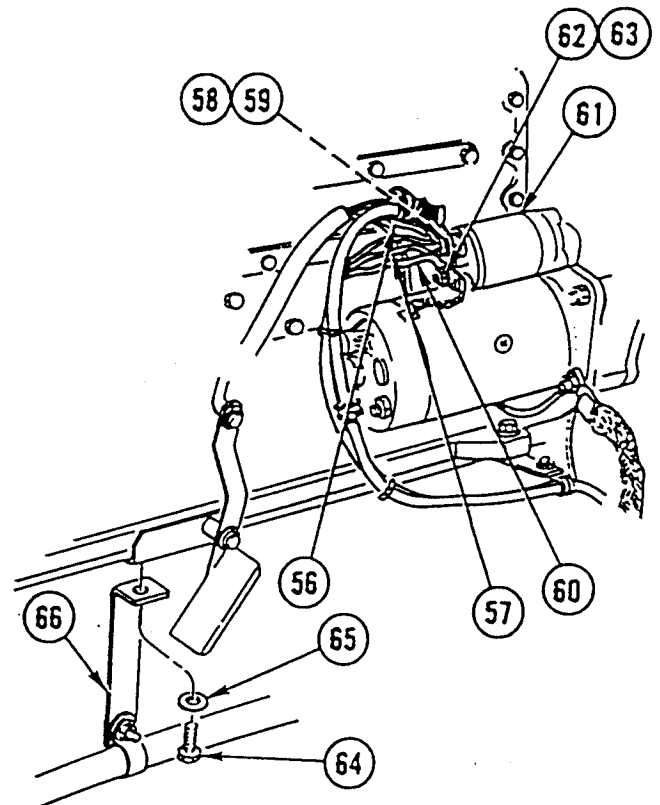


## ENGINE REPLACEMENT (CONT)

29. CONNECT HOSE (47) and TIGHTEN NUT (48).
30. INSTALL CLAMP (49), new lock nut (50), and washer (51).
31. INSTALL ground STRAP (52), two wires (53 and 54), and nut (55).



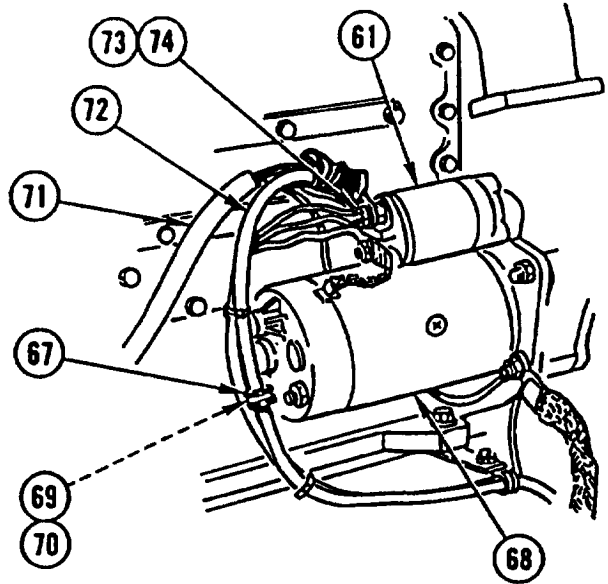
32. INSTALL two wires (56 and 57), screw (58), and new lock washer (59).
33. INSTALL wire (60) to starter solenoid (61) and INSTALL NUT (62) and new lock washer (63).
34. REMOVE SCREW (64) and washer (65).
35. INSTALL BRACKET (66), washer (65), and screw (64).





## ENGINE REPLACEMENT (CONT)

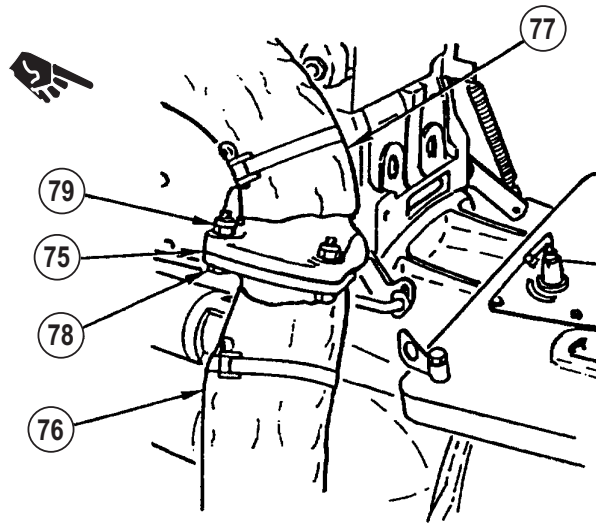
36. INSTALL CLAMP (67) to starter (68) and INSTALL SCREW (69) and washer (70).
37. INSTALL two WIRES (71 and 72) to starter solenoid (61) and INSTALL NUT (73) and new lock washer (74).



### NOTE

Long screw is installed on engine side of exhaust pipe.

38. INSTALL new gasket (75) on exhaust PIPE (76). CONNECT exhaust PIPE (76) to manifold (77) and INSTALL three SCREWS (78) and three new nuts (79). TIGHTEN NUTS to 34 lb-ft (45 N.m).



---

**ENGINE REPLACEMENT (CONT)**

---

**NOTE**

Follow-on Maintenance:

- Install power steering pump and bracket without follow-on tasks (page 7-14).
- Install front rent hydraulic pump belt (TM 5-2420-224-20).
- Install fan impeller (TM 5-2420-224-20).
- Install heater hoses and clamps without follow-on tasks (TM 5-2420-224-20).
- Install water temperature sending unit without follow-on tasks (TM 5-2420-224-20).
- Install engine temperature switch (TM 5-2420-224-20).
- Install oil pressure sender (TM 5-2420-224-20).
- Adjust clutch slave cylinder (TM 5-2420-224-20).
- Service cooling system (TM 5-2420-224-20).
- Service engine (LO 5-2420-224-12).
- Bleed fuel system (TM 5-2420-224-20).
- Lower cab (TM 5-2420-224-20).

---

## ENGINE MOUNT REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Nut, Lock (4)  
Washer, Lock (2)

#### Personnel Required: (2)

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
Page 7-14	Power Steering Pump Removed
TM 5-2420-224-20	Front Hydraulic Pump Removed

#### General Safety Instructions:

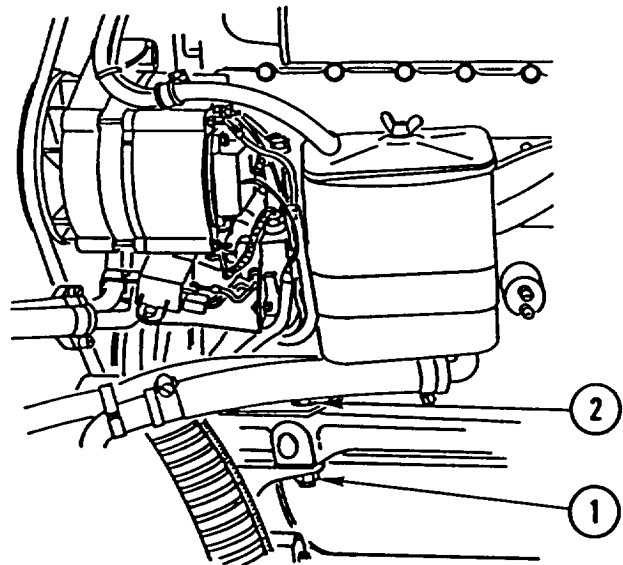
#### WARNING

Engine assembly weighs 1,320 pounds (599 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting engine assembly.

---

## REMOVAL

1. REMOVE four lock nuts (1) and four CAPSCREWS (2). DISCARD lock NUTS.

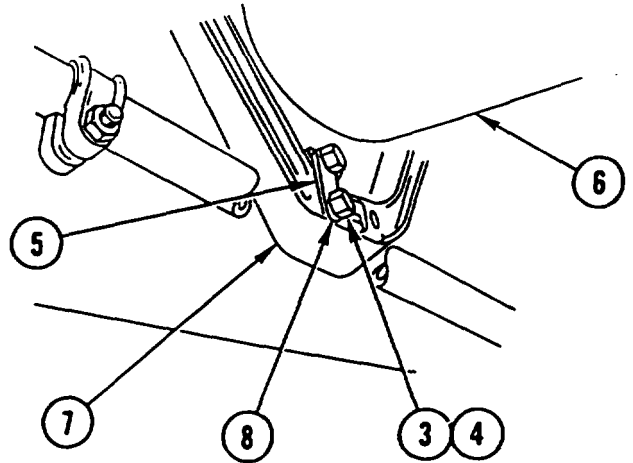


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## ENGINE MOUNT REPLACEMENT (CONT)

---

2. REMOVE two headed pins (3), two lock washers (4), and two SPACERS (5). DISCARD lock WASHERS.
3. RAISE ENGINE assembly (6) 2 in. (50.8 mm) and REMOVE engine SUPPORT (7).
4. REMOVE MOUNT (8) from engine support (7).




---

## INSTALLATION

---

1. INSTALL MOUNT (8) in engine support (7).
2. INSTALL engine SUPPORT (7) and LOWER ENGINE assembly (6).
3. INSTALL two SPACERS (5), two new lock washers (4), and two headed pins (3).
4. INSTALL four CAPSCREWS (2) and four new lock nuts (1).

### NOTE

Follow-on Maintenance:

Install front hydraulic pump (TM 5-2420-224-20).

Install power steering pump (page 7-14).

## ENGINE OIL FILTER REPLACEMENT AND REPAIR

This task covers: a. Removal b. Disassembly c. Inspection d. Assembly e. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Packing (2)

Gasket

Seal

Seal

Seal (2)

Seal (2)

Rags

Appendix B, Item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

##### Reference

TM 5-2420-224-20

Page 3-18

##### Condition Description

Engine Oil Filter Element  
 Removed

Engine Mount Removed

#### General Safety:

### WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

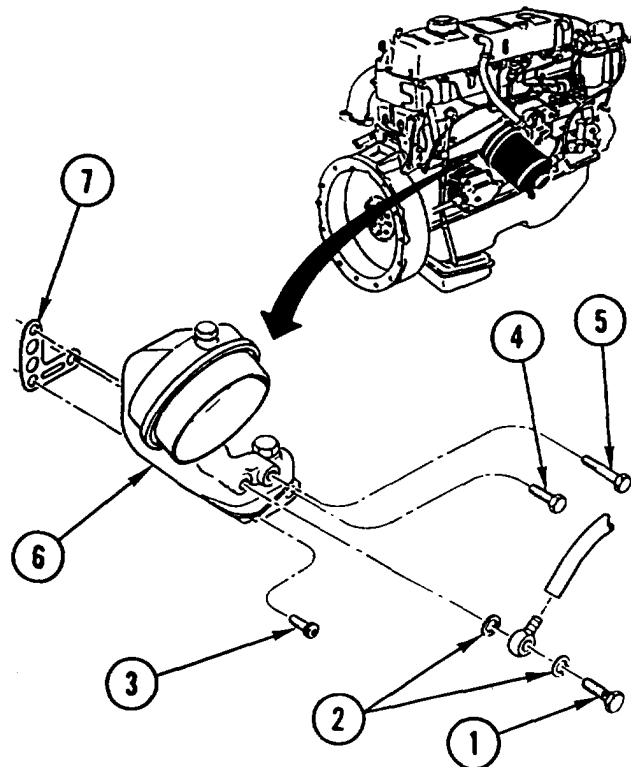
### REMOVAL

1. REMOVE BOLT (1) and two packings (2). DISCARD PACKINGS.

#### NOTE

Have container available to catch oil that may spill while removing filter assembly.

2. REMOVE screw (3), two bolts (4 and 5), COVER (6), and gasket (7). DISCARD GASKET.



---

**ENGINE OIL FILTER REPLACEMENT AND REPAIR (CONT)**

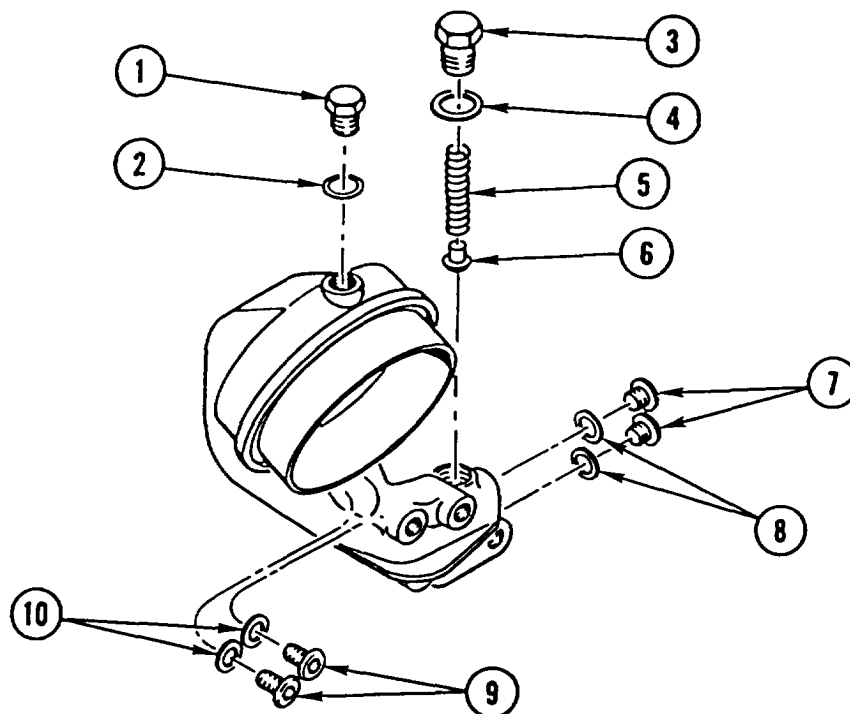

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**DISASSEMBLY**

1. REMOVE PLUG (1) and seal (2). DISCARD SEAL.
2. REMOVE plug (3), seal (4), spring (5), and valve DISC (6). DISCARD SEAL.
3. REMOVE two PLUGS (7) and two seals (8). DISCARD SEALS.
4. REMOVE two PLUGS (9) and two seals (10). DISCARD SEALS.

**INSPECTION**

Measure length of spring. Replace spring if length is less than or exceeds 2.6 in. (66 mm).


**ASSEMBLY**

1. INSTALL two PLUGS (9) and two new seals (10).
2. INSTALL two PLUGS (7) and two new seals (8).
3. INSTALL valve DISC (6), spring (5), new seal (4), and plug (3).
4. INSTALL PLUG (1) and new seal (2).

---

## ENGINE OIL FILTER REPLACEMENT AND REPAIR (CONT)

---

### INSTALLATION

#### CAUTION

Make sure all gasket material has been removed from mating surfaces to prevent damage to equipment.

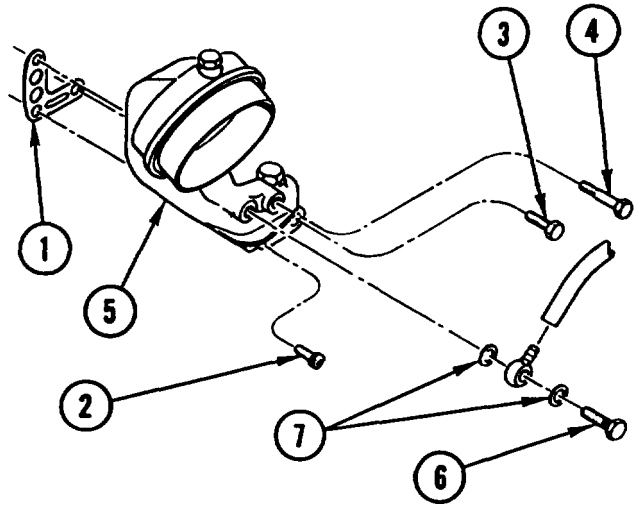
1. INSTALL new gasket (1), screw (2), two bolts (3 and 4), and COVER (5). TIGHTEN SCREW and BOLTS to 44 lb-ft (60 N.m).
2. INSTALL BOLT (6) and two new packings (7).

#### NOTE

Follow-on Maintenance:

Install engine oil filter element (TM 5-2420-224-20).

Install engine mount (page 3-18).



## EXHAUST MANIFOLD REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Spring  
Tension (2)

Washer, Spring  
Tension

Nut (3)

Gasket

Gasket (2)

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted

#### General Safety Instructions:

### WARNING

#### BURN HAZARD

Allow engine to cool before performing maintenance on the muffler, exhaust pipe, exhaust manifold, or turbocharger. If necessary, use insulated pads and gloves.

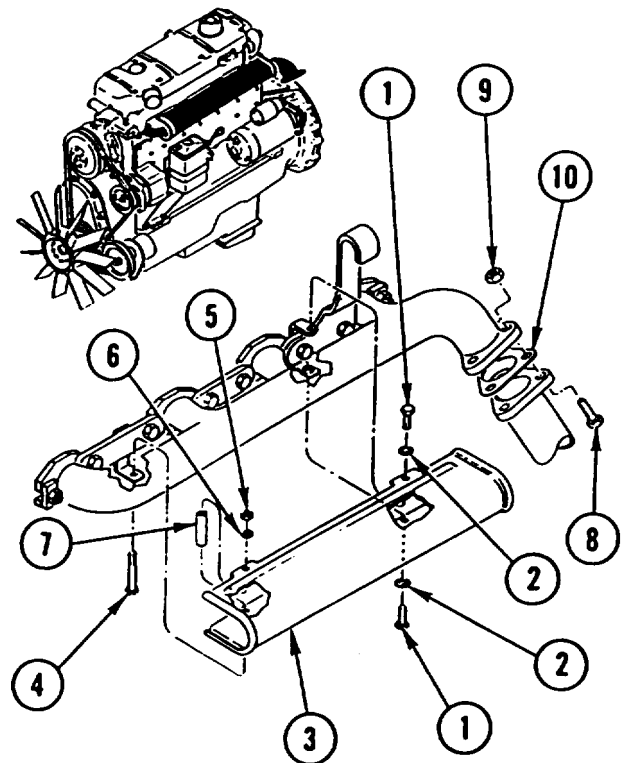
### REMOVAL

1. REMOVE two BOLTS (1) and two spring tension washers (2) from screening plate (3). DISCARD spring tension WASHERS.
2. REMOVE screw (4), nut (5), spring tension washer (6), spacer (7), and screening PLATE (3). DISCARD spring tension WASHER.

#### NOTE

Tag screws prior to removal to aid in installation.

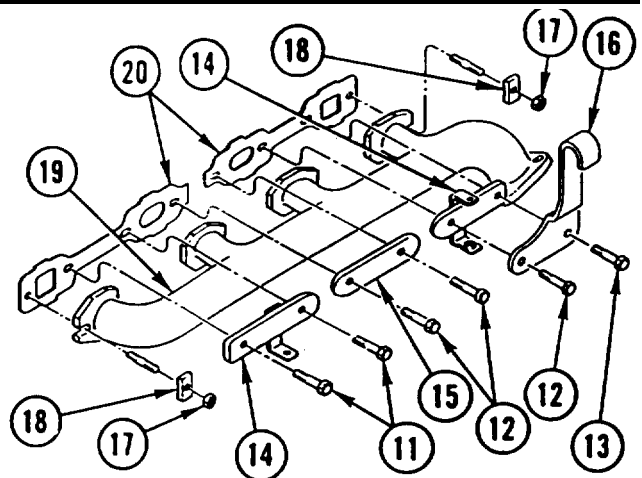
3. REMOVE three SCREWS (8) and three nuts (9). DISCARD NUTS.
4. REMOVE and DISCARD GASKET (10).





## EXHAUST MANIFOLD REPLACEMENT (CONT)

5. REMOVE two screws (11), three bolts (12), bolt (13), two BRACKETS (14), clamp (15), and rear suspension EYE (16).
  6. REMOVE two nuts (17), two straps (18), and exhaust MANIFOLD (19).
- REMOVE and DISCARD two GASKETS (20).

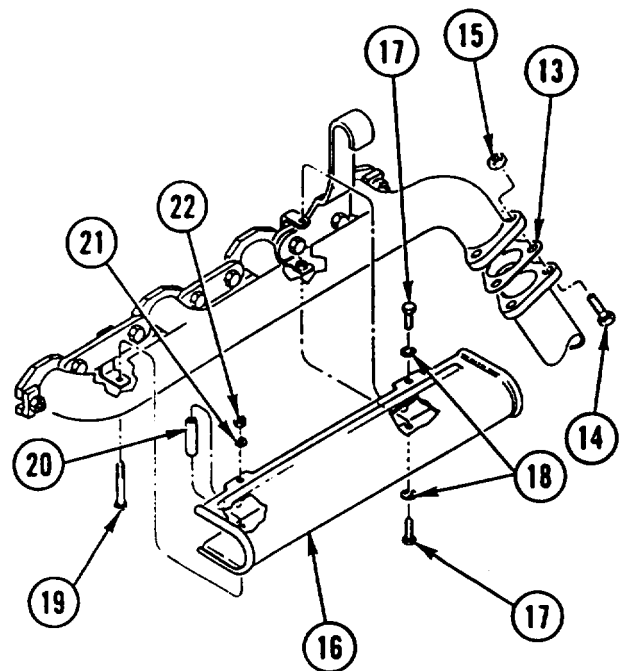
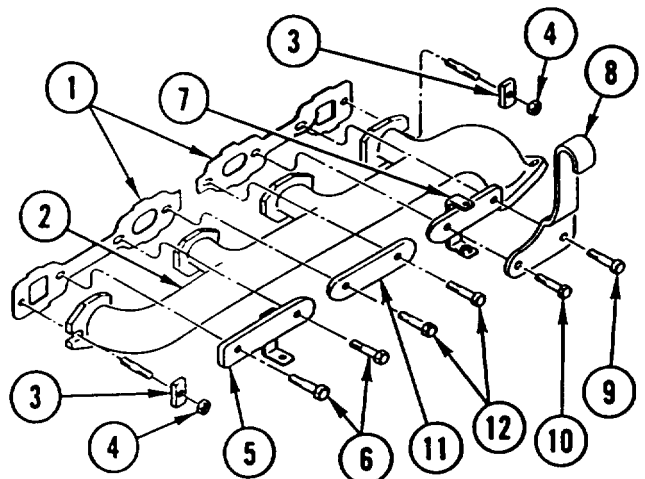


### INSTALLATION

#### CAUTION

Make sure all gasket material has been removed from mating surfaces to prevent damage to equipment.

1. INSTALL two new gaskets (1) and exhaust MANIFOLD (2). INSTALL two STRAPS (3) and two nuts (4).
2. INSTALL BRACKET (5) and two screws (6).
3. INSTALL BRACKET (7), rear suspension EYE (8), and two bolts (9 and 10).
4. INSTALL CLAMP (11) and two bolts (12).
5. TIGHTEN two SCREWS (6) and four BOLTS (9, 10, and 12) to 22 lb-ft (30 N.m).
6. INSTALL new GASKET (13), three screws (14), and three new nuts (15).
7. TIGHTEN three NUTS (15) to 34 lb-ft (45 N.m).
8. INSTALL screening PLATE (16), two screws (17), and two new spring tension washers (18).
9. INSTALL screw (19), SPACER (20), new spring tension washer (21), and nut (22).



#### NOTE

Follow-on Maintenance:  
Lower cab (TM 5-2420-224-20).

---

## CYLINDER HEAD REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Socket, P/N FRXM17  
 Wrench, P/N 000 589 07 03 00

**Materials/Parts:**

**Gasket**

Oil, Lubricating                      Appendix B, Item 30

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

Page 3-23

**Condition Description**

Valve Cover and Gasket  
 Removed

Fuel Filter Assembly  
 Removed

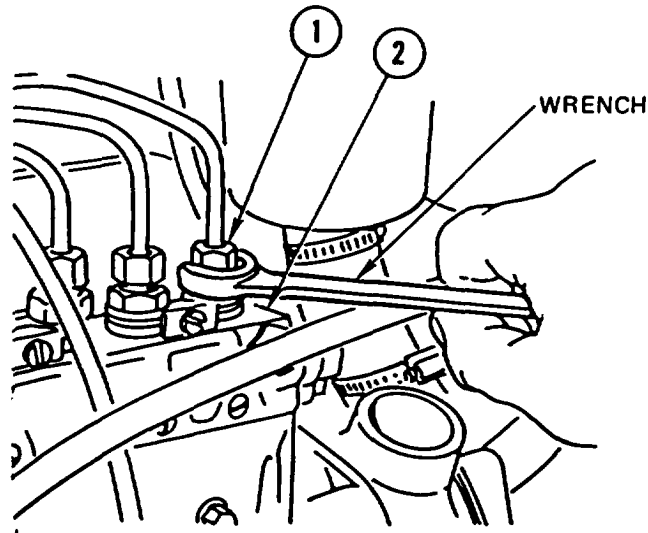
Water Manifold and  
 Gasket Removed

STE/iCE-R Tachometer  
 Drive and Cable  
 Removed

Exhaust Manifold  
 Removed

---

### REMOVAL



**NOTE**

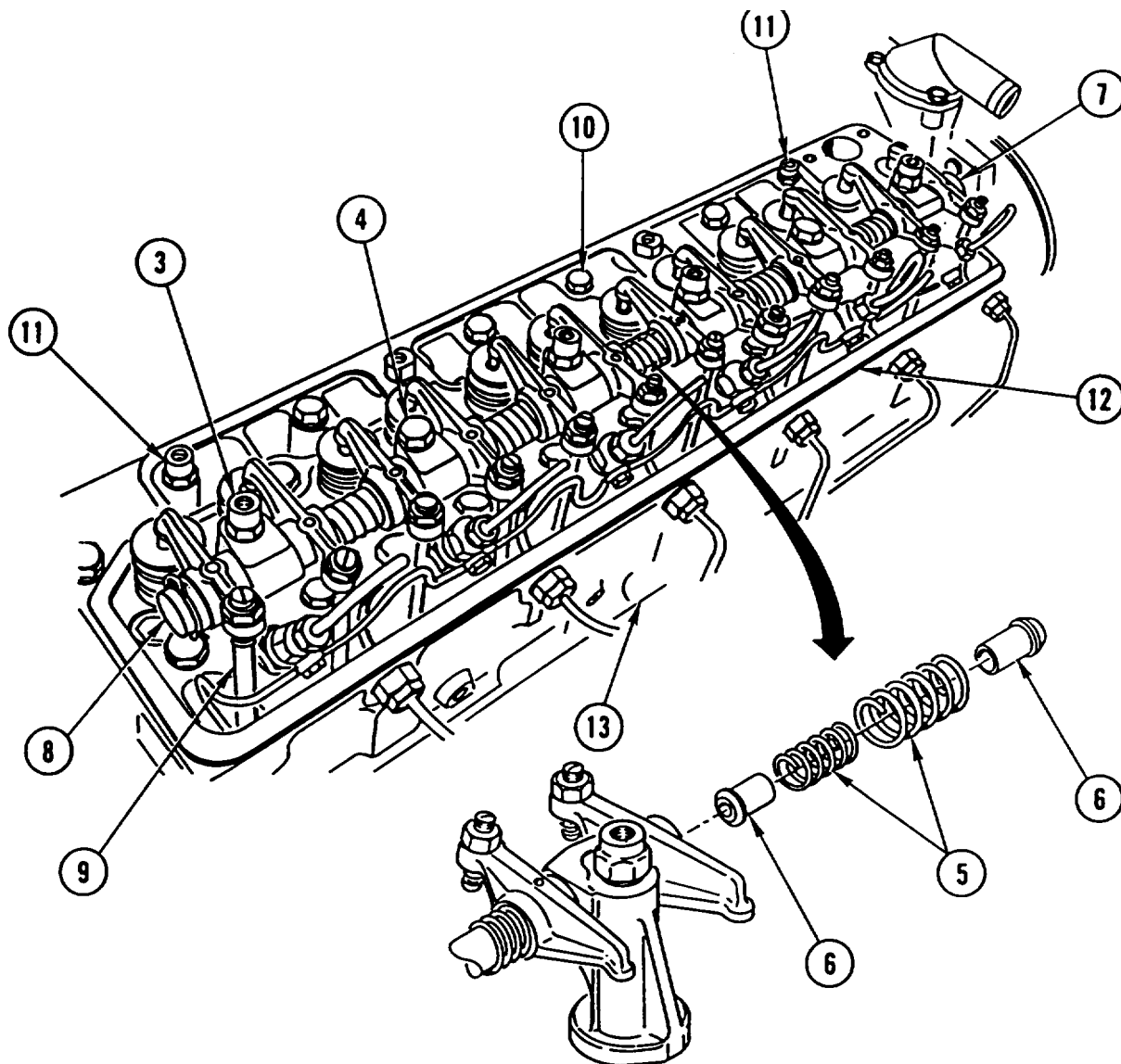
Tag lines prior to disconnecting to aid in connecting.

1. USING WRENCH, LOOSEN six CAPNUTS and DISCONNECT six fuel TUBES (1) from fuel pump (2).

---

**CYLINDER HEAD REPLACEMENT (CONT)**

---



**NOTE**

Remove rocker arm assemblies one at a time.

2. REMOVE four bolts (3), two bolts (4), two springs (5), two nipples (6), and rocker ARM assemblies (7 and 8).

**NOTE**

Tag push rods prior to removal to aid in installation.

3. REMOVE 12 push RODS (9).
4. REMOVE 23 BOLTS (10) and 2 BOLTS (11) from cylinder head (12).
5. REMOVE cylinder HEAD (12) and gasket (13). DISCARD GASKET.

## CYLINDER HEAD REPLACEMENT (CONT)

### INSTALLATION

#### CAUTION

Make sure all gasket material has been removed from mating surfaces to prevent damage to equipment.

1. INSTALL new GASKET (1) with word TOP or "OBEN" UP.
2. MEASURE length of 23 BOLTS (2). Maximum allowable length is 4.41 in. (112 mm). REPLACE any BOLT(S) (2) that exceed maximum length.
3. APPLY light COAT of LUBRICATING OIL to THREADS of 23 bolts (2) and 2 BOLTS (3).
4. INSTALL cylinder HEAD (4), 23 bolts (2), and 2 bolts (3).

#### NOTE

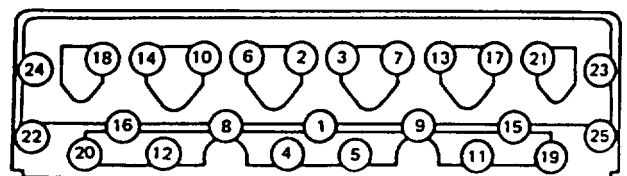
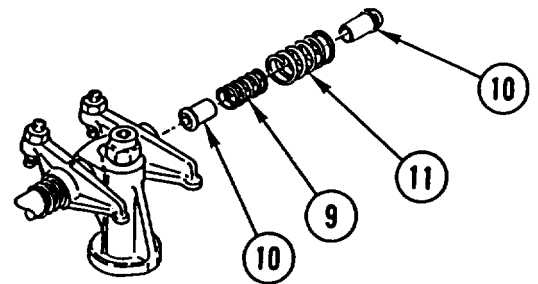
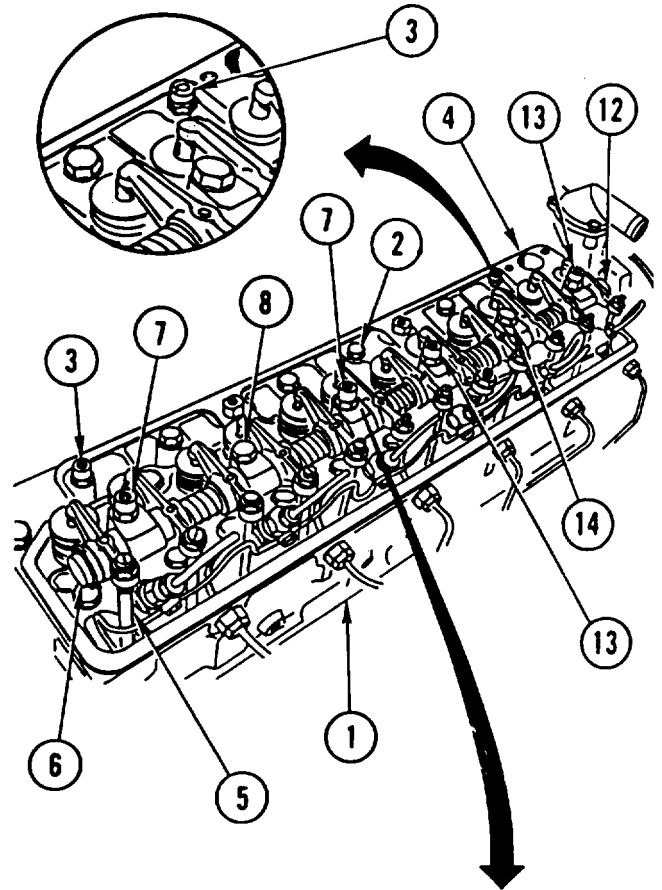
Each tightening sequence must be completed before performing next step.

5. USING SEQUENCE shown, TIGHTEN 25 BOLTS (2 and 3) to following values:  
 Step a: 44 lb-ft (60 N.m)  
 Step b: 66 lb-ft (90 N.m)  
 Step c: 81 lb-ft (110 N.m)
6. INSTALL 12 push RODS (5).
7. INSTALL rocker ARM assembly (6), two bolts (7), and bolt (8).

#### NOTE

Make sure large end of nipple assembly is facing rear of engine.

8. INSTALL spring (9), two nipples (10), (11), rocker ARM assembly (12); two bolts (13), and bolt (14). TIGHTEN BOLTS (7, 8, 13 and 14) to 74 lb-ft (100 N.m).



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## CYLINDER HEAD REPLACEMENT (CONT)

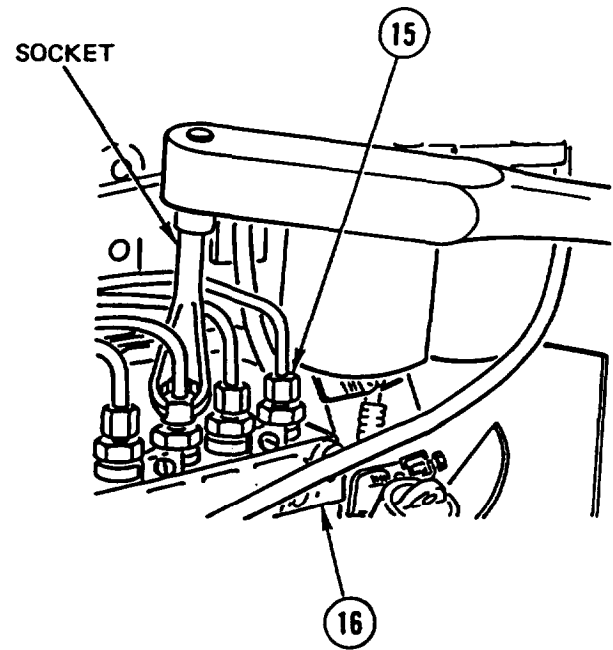
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9. USING SOCKET, CONNECT six fuel TUBES (15) to fuel pump (16). TIGHTEN six CAPNUTS to 18 lb-ft (25 N.m).
10. AFTER DRIVING 300-900 miles (500-1500 km), RETIGHTEN cylinder head BOLTS.

### NOTE

Follow-on Maintenance:

Install exhaust manifold (page 3-23).  
Install water manifold and gasket (TM 5-2420-224-20).  
Install fuel filter assembly (TM 5-2420-224-20).  
Install STE/ICE-R tachometer drive and cable (TM 5-2420-224-20).  
Adjust valves (TM 5-2420-224-20).  
Install valve cover and gasket (TM 5-2420-224-20).



---

## PUSH ROD COVER REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

#### Materials/Parts:

Seal

#### Reference

TM 5-2420-224-20

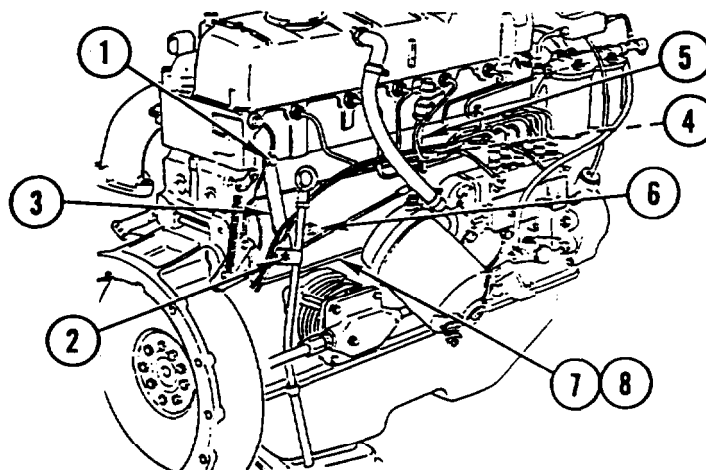
#### Condition Description

Cab Tilted

---

### REMOVAL

1. REMOVE screw (1), nut (2), and BRACKET (3).
2. REMOVE screw (4) and tachometer DRIVE (5).
3. REMOVE four screws (6), push rod COVER (7), and seal (8). DISCARD SEAL.



### INSTALLATION

1. INSTALL new seal (8), push rod COVER (7), and four screws (6). TIGHTEN SCREWS to 32 lb-ft (43 N.m).
2. INSTALL tachometer DRIVE (5) and screw (4).
3. INSTALL BRACKET (3), nut (2), and screw (1).

#### NOTE

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).

---

## OIL COOLER AND GASKET REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Spring  
Tension (3)

Seal

Packing

Kit, Parts

#### References:

LO 5-2420-224-12  
TM 5-2420-224-20

#### Equipment Condition:

##### Reference

LO 5-2420-224-12

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

##### Condition Description

Oil Drained

Coolant Drained

Starter Removed

Oil Pressure Sender  
Removed

Alternator Removed

Power Steering Tank  
(Reservoir) Removed

Polarity Breaker Removed

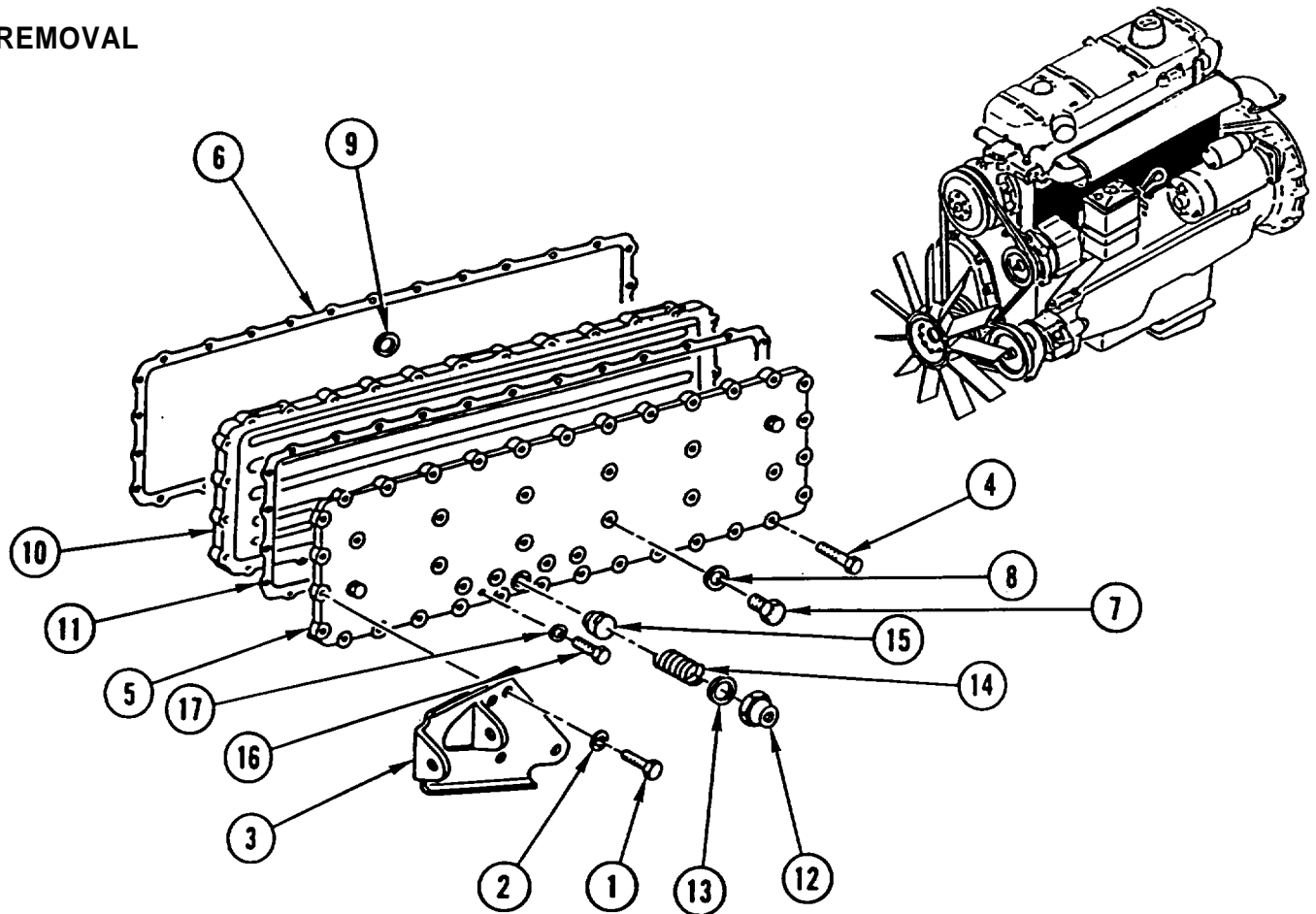
Suppressor Filters  
Removed

Engine Temperature  
Switch Removed

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**OIL COOLER AND GASKET REPLACEMENT (CONT)**


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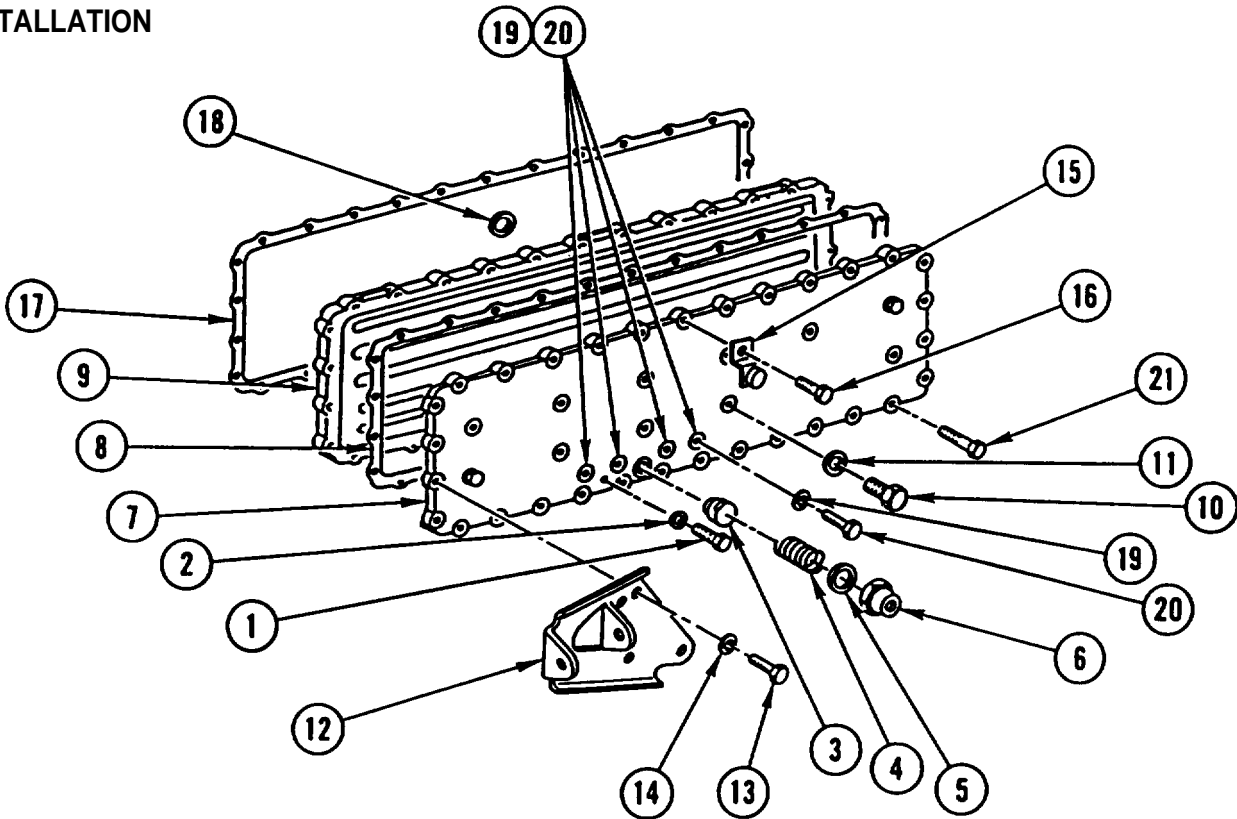
**REMOVAL**

1. REMOVE three screws (1), three spring tension washers (2), and alternator BRACKET (3). DISCARD spring tension WASHERS.
2. REMOVE remaining 28 outer screws (4), oil cooler COVER (5), and gasket (6). DISCARD GASKET.
3. REMOVE 16 inner screws (7), 16 metal seals (8), and four GASKETS (9). DISCARD SEALS and GASKETS.
4. REMOVE oil cooler COVER (5) from cooler (10) and REMOVE GASKET (11). DISCARD GASKET.
5. REMOVE plug (12), packing (13), spring (14), and VALVE (15). DISCARD PACKING.
6. REMOVE PLUG (16) and seal (17). DISCARD SEAL.



**OIL COOLER AND GASKET REPLACEMENT (CONT)**

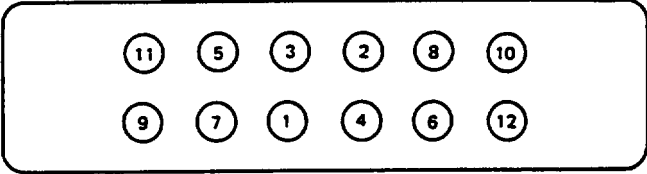
**INSTALLATION**



1. INSTALL PLUG (1) and new seal (2).
2. INSTALL VALVE (3), spring (4), new packing (5), and plug (6).

**CAUTION**  
 Make sure all gasket material has been removed from mating surfaces to prevent damage to equipment.

3. INSTALL oil cooler COVER (7) and new gasket (8) on cooler (9) and INSTALL 12 inner SCREWS (10) and 12 new metal seals (11). TIGHTEN SCREWS to 24 lb-ft (35 N.m) using tightening sequence shown.





---

## AIR COMPRESSOR REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Assembly  
f. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A63  
 Wrench, P/N 352 589 03 07 00

#### Materials/Parts:

Set, Bearing  
 Kit, Paris  
 Kit, Parts  
 Compound, Sealing      Appendix B, Item 16

#### References:

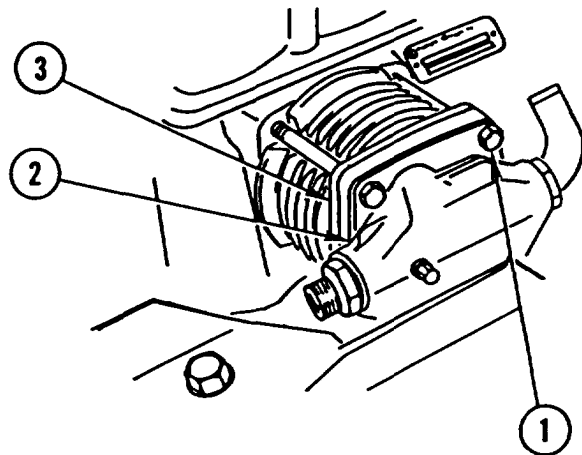
TM 5-2420-224-20

#### Equipment Condition:

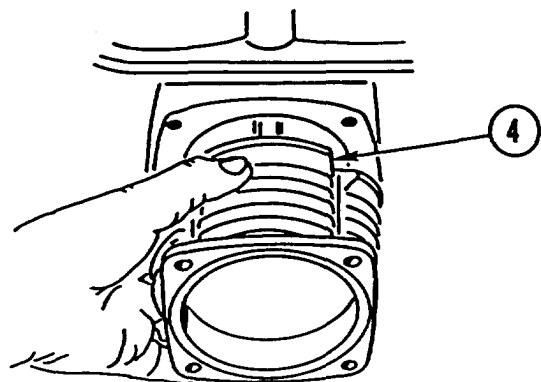
Reference	Condition Description
TM 5-2420-224-20	Air System Supply Lines and Fittings Disconnected
TM 5-2420-224-20	Right Front Fender and Splash Guard Removed

### REMOVAL

1. REMOVE four screws (1), cylinder HEAD (2), and gasket (3). DISCARD GASKET.

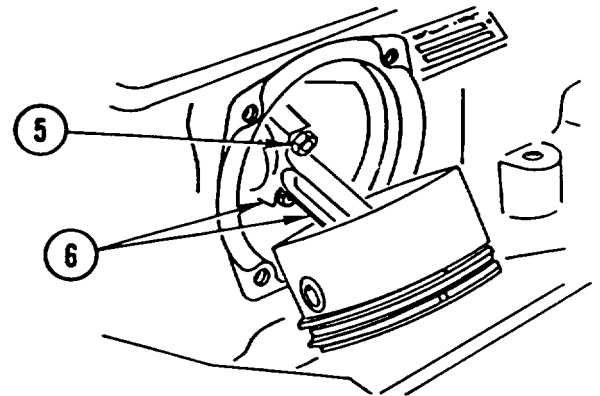


2. REMOVE cylinder LINER (4).



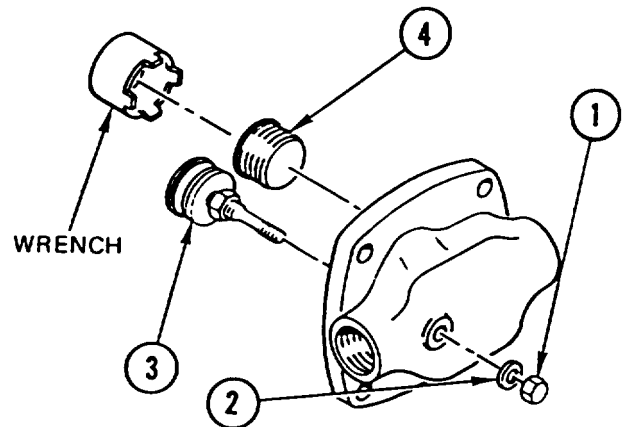
## AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)

- REMOVE two nuts (5) and both parts of connecting ROD (6).

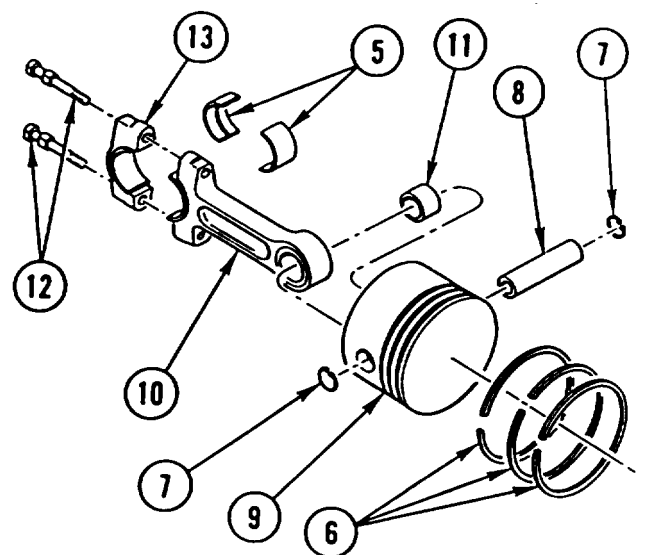


### DISASSEMBLY

- REMOVE nut (1), gasket (2), and pressure VALVE (3). DISCARD GASKET and pressure VALVE.
- USING WRENCH, REMOVE and DISCARD suction VALVE (4).



- REMOVE and DISCARD bearing SET (5).
- REMOVE and DISCARD three RINGS (6).
- REMOVE two retaining rings (7), pin (8), and PISTON (9) from connecting rod (10).
- IF DAMAGED, REMOVE BUSHING (11) from connecting rod (10).
- IF DAMAGED, REMOVE two BOLTS (12) from end cap (13).



### CLEANING

During cleaning of piston, make sure all carbon deposits are removed from ring grooves.

**AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)**

**INSPECTION**

1. Measure diameter of camshaft journal to determine bearing set to be installed. (Refer to table.) If journal measurement is between repair stages, use repair stage closest to measurement.

Example:

repair stage I = 1.256 in. (31.902 mm)  
 repair stage II = 1.250 in. (31.750 mm)  
 journal measurement = 1.254 in. (31.851 mm)

Use repair stage I

If journal measurement is less than 1.230 in. (31.234 mm), replace camshaft.

2. Inspect cylinder liner for scratches, gouges, pitting, and nicks. Replace cylinder liner if any of these defects are present.
3. Measure cylinder liner bore twice (in line with camshaft journal, and at 90 degrees to camshaft journal) at three different places along liner. If cylinder bore deviation is more than 0.0012 in. (0.030 mm), replace cylinder liner.
4. Measure inside diameter of bushing. If diameter is more than 0.6312-0.6318 in. (16.022-16.038 mm), replace bushing.
5. Inspect piston for damage. Replace if damaged.
6. Check end gap of each ring by inserting squarely into cylinder and measuring with feeler gage. Gap should be 0.016-0.026 in. (0.406-0.660 mm).
7. Check piston ring side clearance with new rings installed. Ring side clearance should be 0.0004-0.0018 in. (0.010-0.045 mm). If side clearance is not within this measurement, replace piston.

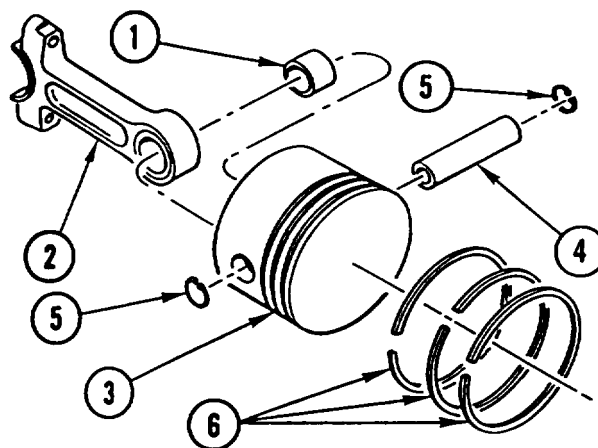
**Camshaft Journal**

Repair Stage	Camshaft Journal	Bearing Set
	In. (mm)	In. (mm)
Standard	1.259-1.260 (31.984-32.000)	1.260 (32.000)
Standard I	1.255-1.256 (31.884-31.900)	1.256 (31.900)
Stage I	1.249-1.250 (31.734-31.750)	1.250 (31.750)
Stage II	1.239-1.240 (31.484-31.500)	1.240 (31.500)
Stage III	1.229-1.230 (31.234-31.250)	1.230 (31.250)

## AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)

### ASSEMBLY

1. IF REMOVED, INSTALL new BUSHING (1) in connecting rod (2).
2. INSTALL PISTON (3), pin (4), and two retaining rings (5) on connecting rod (2).

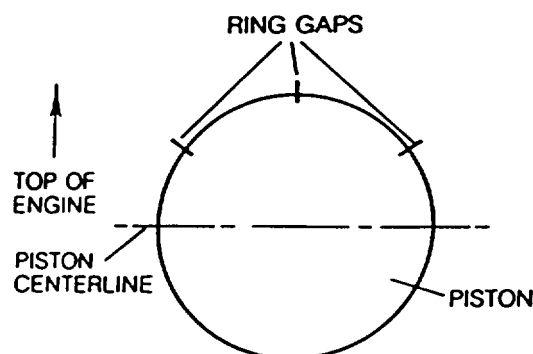


3. STARTING from BOTTOM of piston (3), INSTALL three new RINGS (6) so that openings are offset and above centerline of piston, as shown.

#### NOTE

Bearing half with groove is installed in end cap.

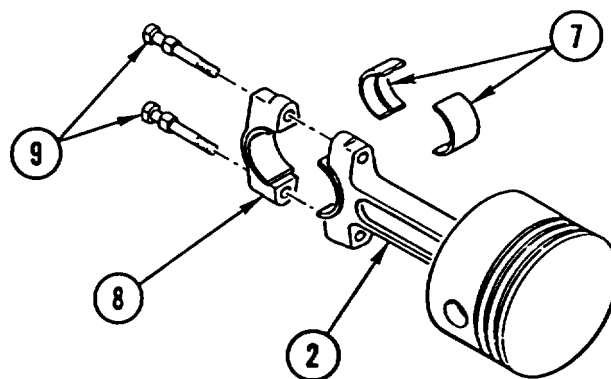
4. INSTALL new bearing SET (7) in end cap (8) and connecting rod (2).



#### NOTE

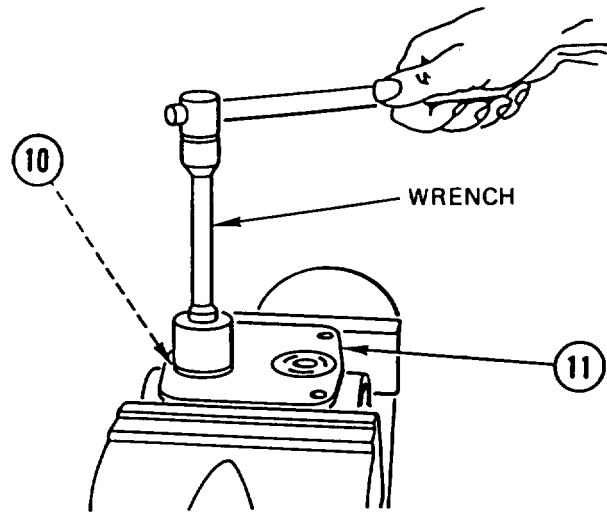
Make sure flat sides of bolts are toward center of end cap.

5. IF REMOVED, INSTALL two new BOLTS (9) in end cap (8).

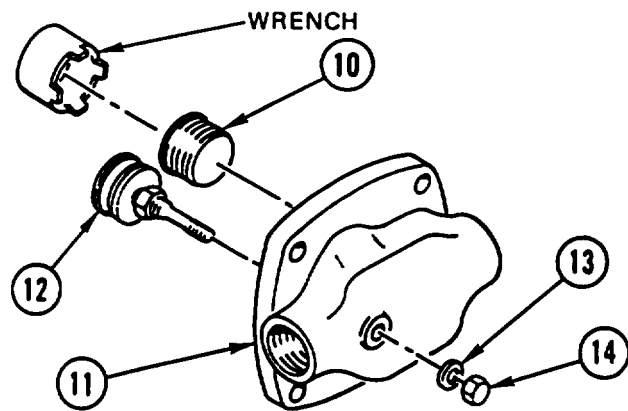


**AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)**

6. USING WRENCH, INSTALL new suction VALVE (10) in cylinder head (11). TIGHTEN VALVE to 133 ±15 lb-ft (180 ±20 N•m).



7. INSTALL new pressure VALVE (12), new gasket (13), and nut (14). TIGHTEN NUT to 7 ±1 lb-ft (10 ±1 N•m).

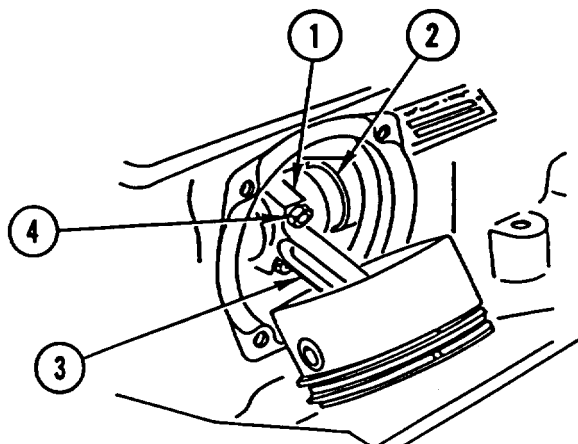


**INSTALLATION**

**CAUTION**

Flat side of each bolt must be facing center of bottom portion of connecting rod to prevent damage to equipment.

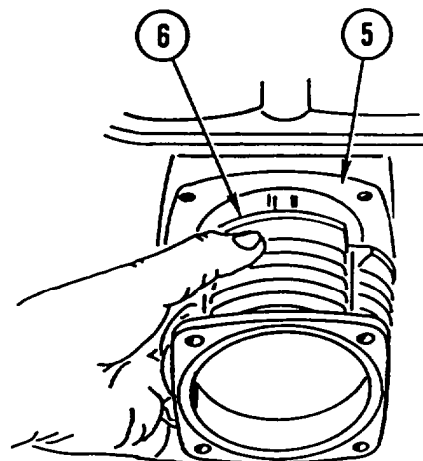
1. INSTALL bottom portion of connecting ROD (1) on camshaft (2).
2. INSTALL upper portion of connecting ROD (3) and two nuts (4). TIGHTEN NUTS to 11-15 lb-ft (15-20 N•m).



**AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)**

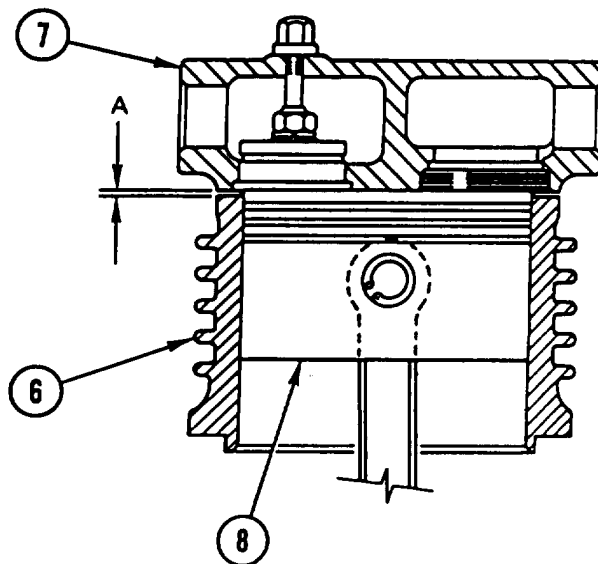
**WARNING**

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.



3. APPLY light COAT of SEALING COMPOUND on cylinder BLOCK (5).
4. USING ring COMPRESSOR, INSTALL cylinder LINER (6).

5. TO DETERMINE gasket THICKNESS, MEASURE DISTANCE A between cylinder LINER (6) and cylinder HEAD (7) with piston (8) at Top Dead Center.



6. SELECT GASKET from measurement determined in STEP 5:

Piston Protrusion Above Liner . . . . .	0.010-0.018 in. (0.25-0.45 mm)
Use Head Gasket Size . . . . .	0.026-0.032 in. (0.65-0.80 mm)
Piston Protrusion Above Liner . . . . .	0.018-0.028 in. (0.45-0.70 mm)
Use Head Gasket Size . . . . .	0.034-0.037 in. (0.85-0.95 mm)



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## AIR COMPRESSOR REPLACEMENT AND REPAIR (CONT)

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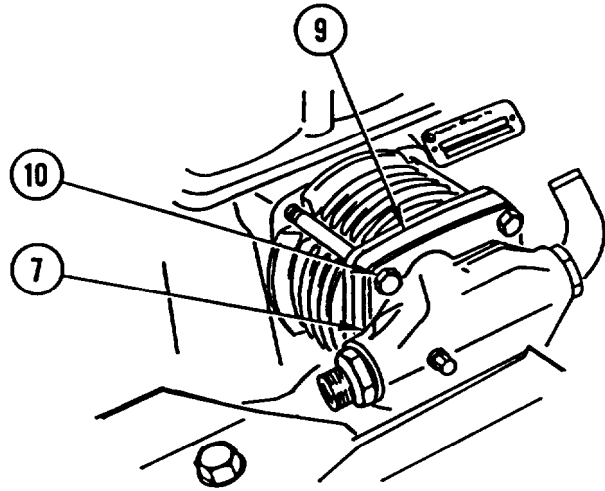
**NOTE**

If air inlet elbow pipe was removed from head, connect it before installing head.

7. INSTALL new gasket (9), cylinder HEAD (7), and four screws (10). TIGHTEN SCREWS to 26 lb-ft (35 NŹm).

**NOTE**

Follow-on Maintenance:  
Connect air system supply lines and fittings (TM 5-2420-224-20).  
Install right front fender and splash guard (TM 5-2420-224-20).



## FUEL INJECTOR NOZZLE REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

**Tools and Special Equipment:**

Puller, P/N 352 589 00 33 00  
 Socket, P/N 000 589 75 09 00

**Materials/Parts:**

Seal

**References:**

TM 5-2420-224-20

**Equipment Condition:**

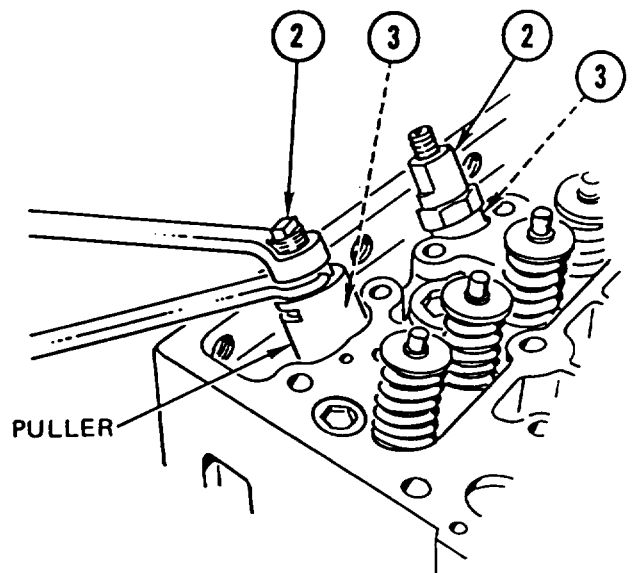
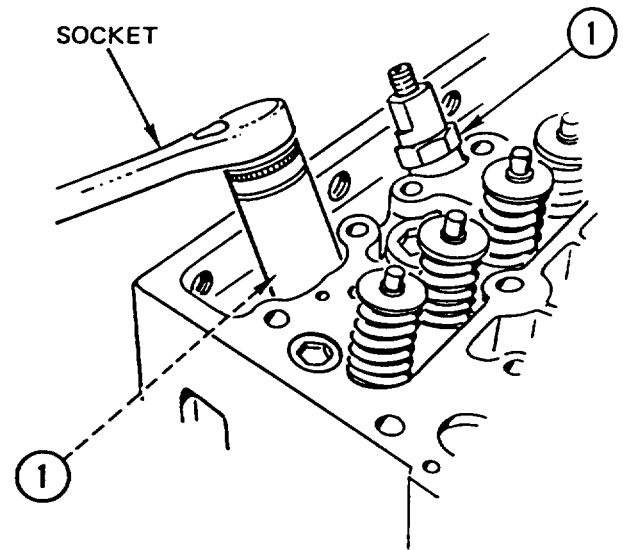
Reference	Condition Description
TM 5-2420-224-20	Fuel Injector Lines Removed

### REMOVAL

**NOTE**

Procedure is the same for all nozzles.

1. USING SOCKET, REMOVE nozzle HOLDER (1).
  
2. USING PULLER, REMOVE injector NOZZLE (2).
  
3. REMOVE copper SEAL (3) and measure thickness. DISCARD SEAL.



### INSPECTION

Test nozzles (page 13-65).

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## FUEL INJECTOR NOZZLE REPLACEMENT (CONT)

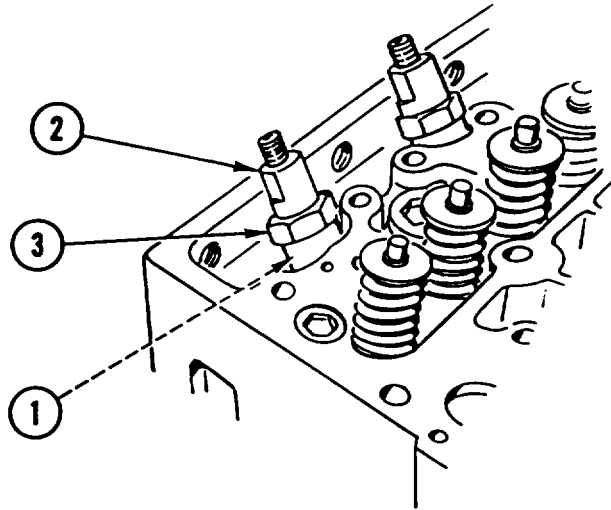
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### INSTALLATION

#### NOTE

Procedure is the same for all nozzles.

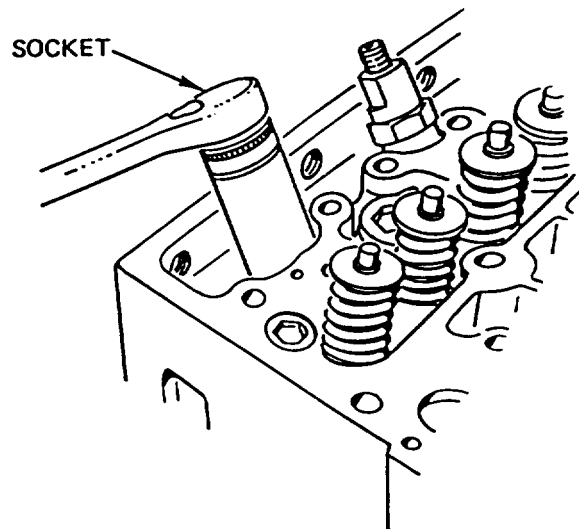
1. INSTALL new copper SEAL (1) the same thickness as one removed.
2. INSTALL injector NOZZLE (2).



3. USING SOCKET, INSTALL nozzle HOLDER (3) and TIGHTEN to 43-50 lb-ft (60-70 N•m).

#### NOTE

Follow-on Maintenance:  
Install fuel injector lines (TM 5-2420-224-20).



## FUEL INJECTION PUMP REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Socket, P/N FRXM17  
 Wrench, P/N 000 589 07 03 00

#### Materials/Parts:

Seal (2)  
 Seal (4)  
 Packing (2)  
 Seal (2)  
 Gasket  
 Washer, Spring  
 Tension  
 Key  
 Seal  
 Compound, Sealing      Appendix B, item 15

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Accelerator Linkage Disconnected
Page 3-20	Engine Oil Fitter Removed

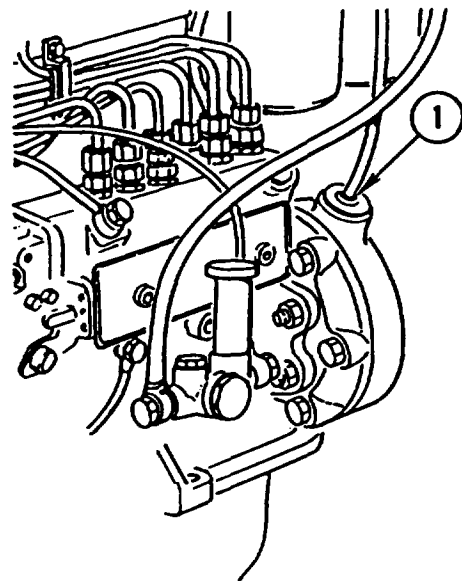
#### General Safety instructions:

**WARNING**

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

### REMOVAL

1. Disconnect timing gear case VENT (1).

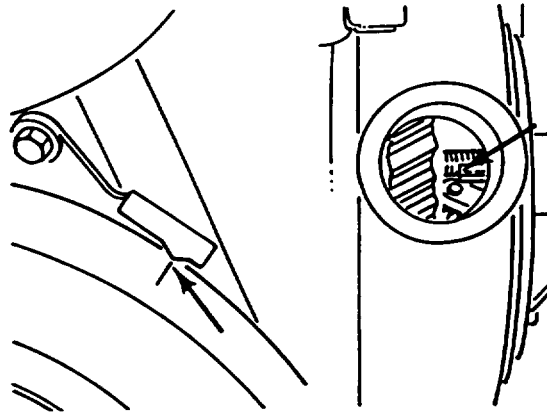


## FUEL INJECTION PUMP REPLACEMENT (CONT)

### NOTE

Arrow in timing gear case must point to mark on fuel injection pump drive gear, and FB mark (start of delivery) on timing pointer must be aligned with FB mark on vibration damper.

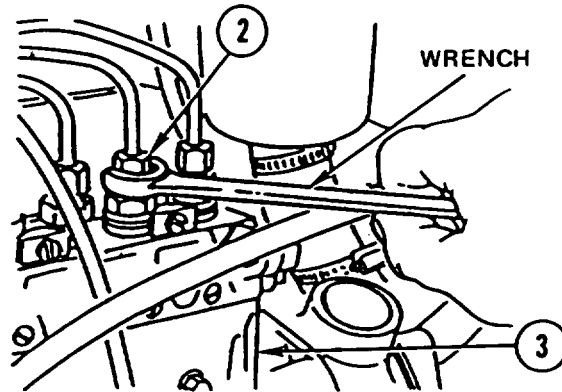
2. MOVE No. 1 CYLINDER to start of delivery in impression stroke.



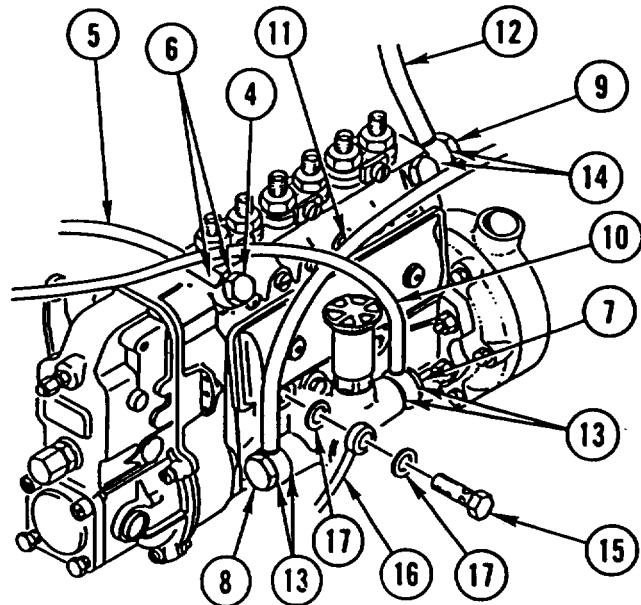
### NOTE

Tag all lines prior to disconnecting to aid in connecting.

3. USING WRENCH, LOOSEN six CAPNUTS and DISCONNECT six injection TUBES (2) from fuel injection pump (3).

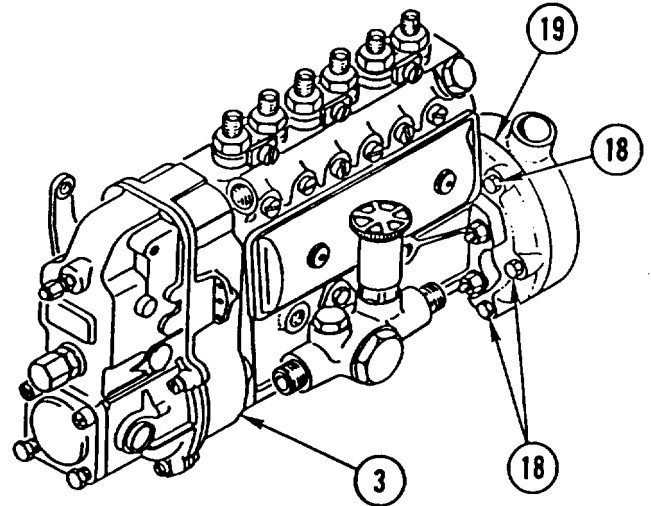


4. REMOVE fuel return hose bolt (4), fuel return HOSE (5), and two seals (6). DISCARD SEALS.
5. REMOVE three fuel hose bolts (7, 8, and 9), three fuel HOSES (10, 11, and 12), four seals (13), and two packings (14). DISCARD SEALS and PACKINGS.
6. REMOVE oil supply hose bolt (15), oil supply HOSE (16), and two seals (17). DISCARD SEALS.

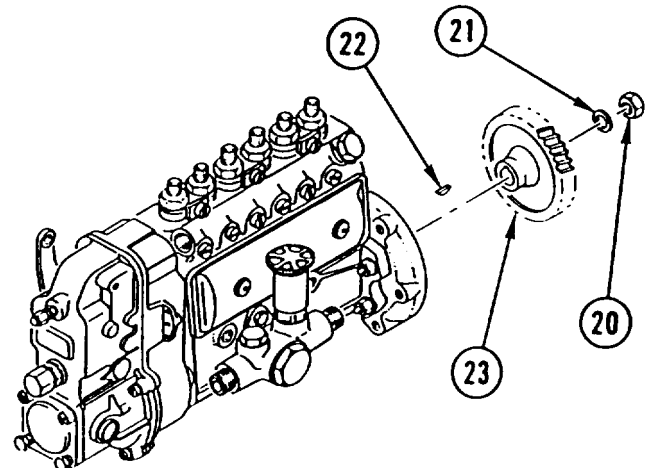


## FUEL INJECTION PUMP REPLACEMENT (CONT)

7. REMOVE five screws (18), fuel injection PUMP (3), and gasket (19). DISCARD GASKET.

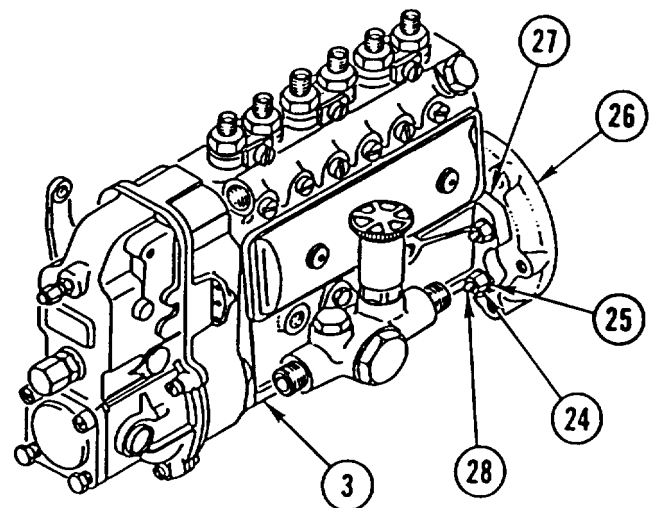


8. REMOVE nut (20), spring tension washer (21), key (22), and GEAR (23). DISCARD spring tension WASHER and KEY.



9. REMOVE four nuts (24), four washers (25), pump SUPPORT (26), and seal (27) from fuel injection pump (3). DISCARD SEAL.

10. IF DAMAGED, REMOVE four STUDS (28) from pump support (26).

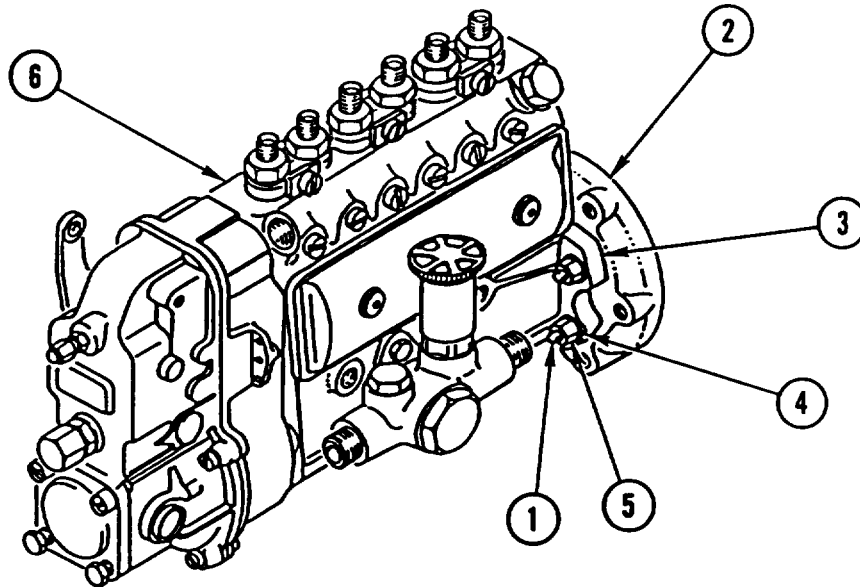


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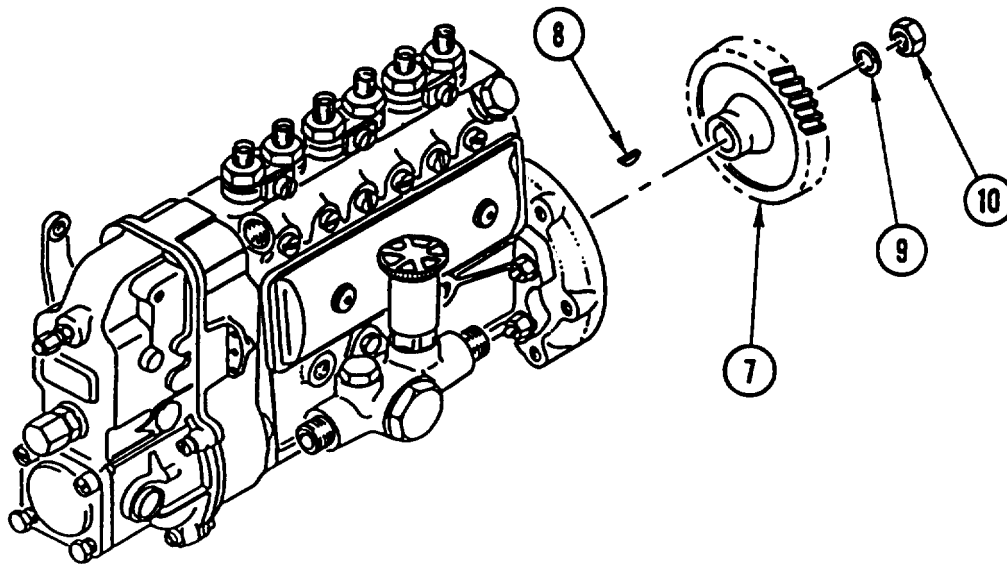
## FUEL INJECTION PUMP REPLACEMENT (CONT)

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### INSTALLATION



1. IF REMOVED, INSTALL four new STUDS (1) on pump support (2).
2. INSTALL new seal (3), pump SUPPORT (2), four washers (4), and four nuts (5) on fuel injection pump (6). TIGHTEN NUTS to 37 lb-ft (50 N•m).

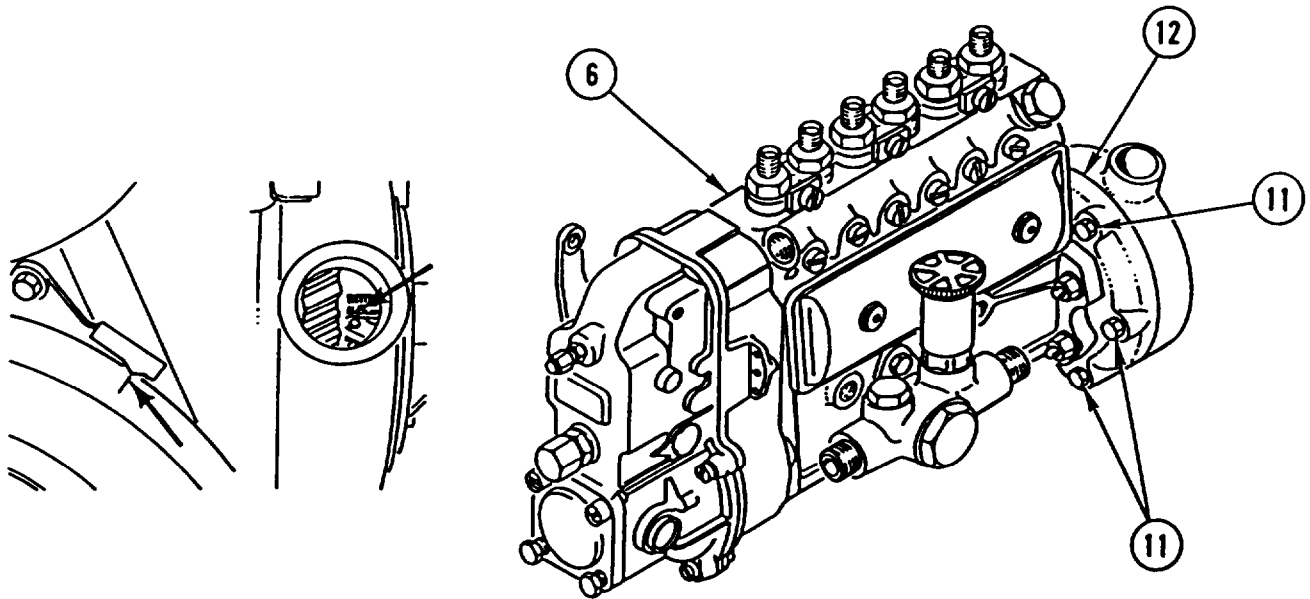


3. INSTALL GEAR (7), new key (8), new spring tension washer (9), and nut (10). TIGHTEN NUT to 221 lb-ft (300 N•m).

---

**FUEL INJECTION PUMP REPLACEMENT (CONT)**


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**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.

**CAUTION**

Make sure all gasket material has been removed from mating surfaces to prevent damage to equipment.

**NOTE**

- Make sure FB mark on timing pointer is aligned with FB mark on vibration damper.
- Rotate gear on fuel injection pump so that marked tooth will align with arrow in timing gear case, when installed.

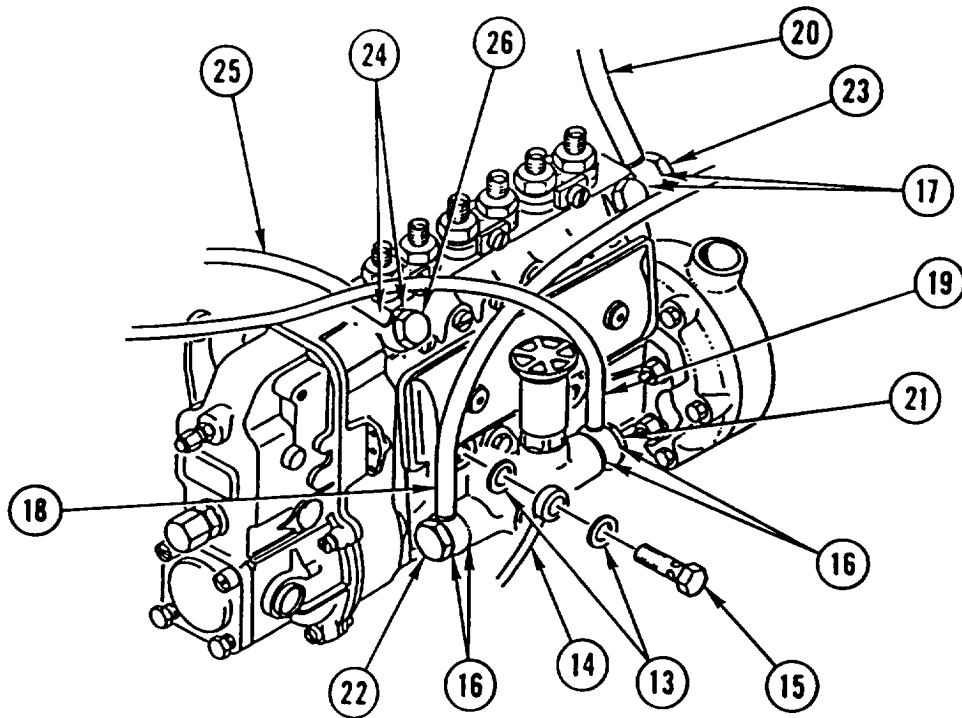
4. APPLY COAT of SEALING COMPOUND to THREADS of five screws (11).
5. INSTALL new gasket (12), fuel injection PUMP (6), and five screws (11).



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## FUEL INJECTION PUMP REPLACEMENT (CONT)

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### CAUTION

During steps 6 thru 8, make sure seals and packings are installed on each side of banjo fittings. Failure to do so could result in fuel and oil leaks.

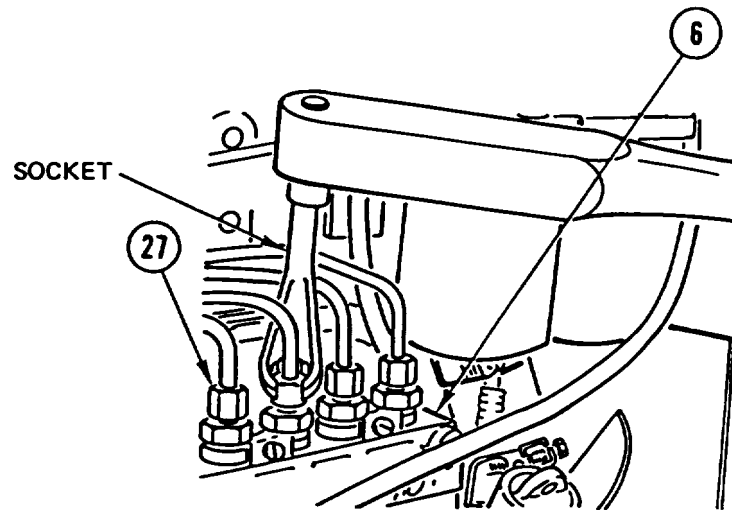
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6. INSTALL two new seals (13), oil supply HOSE (14), and oil supply hose bolt (15).
7. INSTALL four new seals (16), two new packings (17), three fuel HOSES (18, 19, and 20), and three fuel hose bolts (21, 22, and 23).
8. INSTALL two new seals (24), fuel return HOSE (25), and fuel return hose bolt (26).

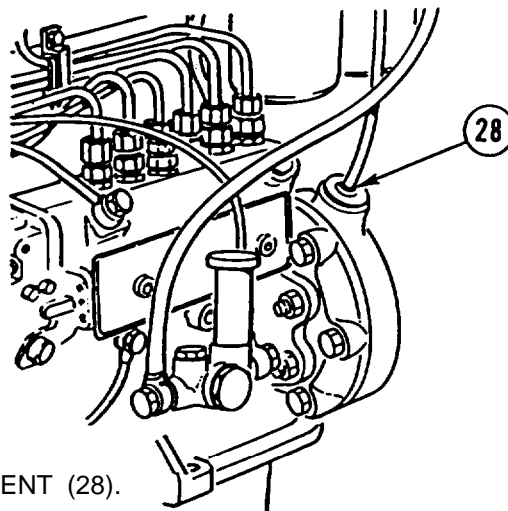
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**FUEL INJECTION PUMP REPLACEMENT (CONT)**


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9. USING SOCKET, CONNECT six injection TUBES (27) on fuel injection pump (6). TIGHTEN six CAPNUTS to 18 lb-ft (25 N•m).



10. CONNECT timing gear case VENT (28).

**NOTE**

Follow-on Maintenance:

- Install engine oil filter (page 3-20).
- Time fuel injection pump (page 3-50).
- Connect accelerator linkage (TM 5-2420-224-20).
- Lower cab (TM 5-2420-224-20).

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## FUEL INJECTION PUMP TIMING

---

This task covers: Timing

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Socket, P/N FRXM17  
Tank, P/N 001 589 65 21 00  
Tube, P/N 636 589 02 23 00  
Wrench, P/N 000 589 07 03 00

#### Materials/Parts:

Fuel, Diesel                      Appendix B, Item 22  
Rags                                      Appendix B, Item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Accelerator Linkage Disconnected

#### General Safety Instructions:

#### WARNING

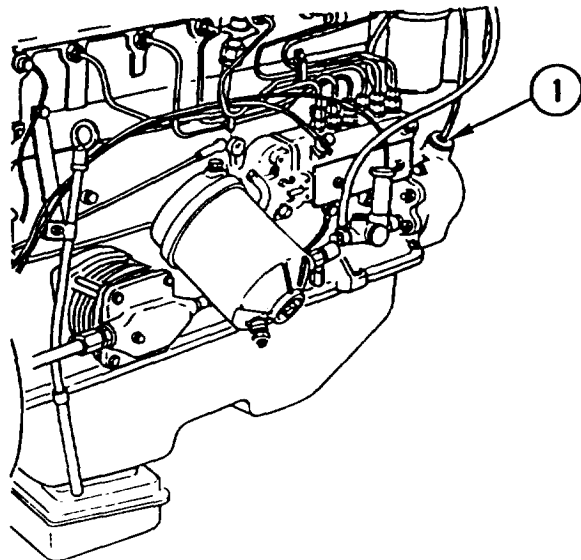
Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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### TIMING

1. Disconnect timing gear case vent (1).

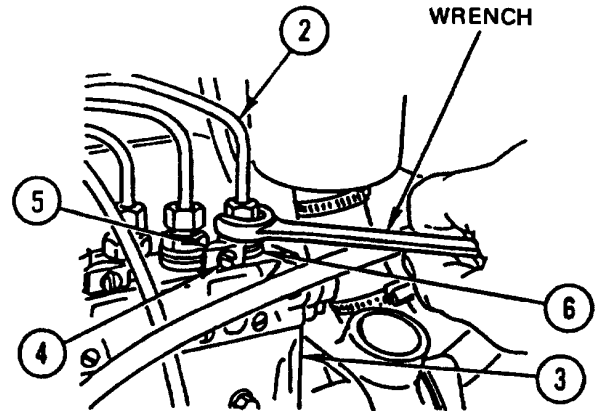


## FUEL INJECTION PUMP TIMING (CONT)

### NOTE

Tag all lines prior to disconnecting to aid in connecting.

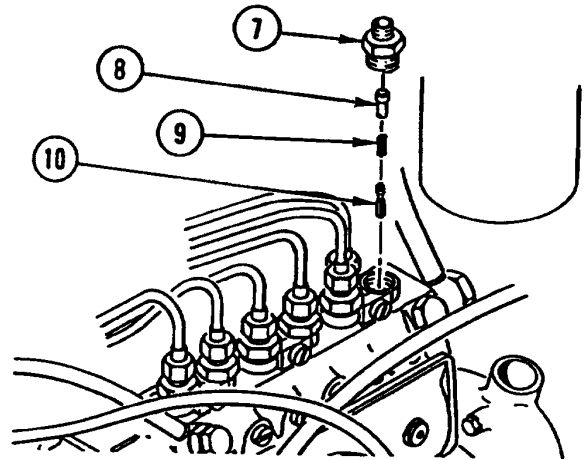
2. Using wrench, loosen capnut and disconnect No. 1 injection tube (2) from fuel injection pump (3).
3. Loosen screw (4) and remove rim clamp (5) from No. 1 cylinder (6) of fuel injection pump (3).



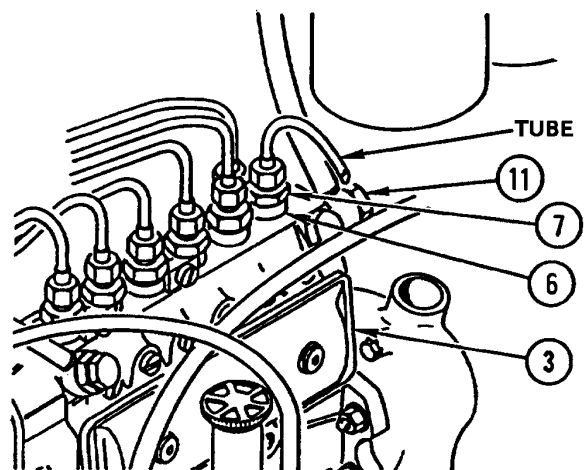
### CAUTION

Do not remove valve cone, spring, or breather with a magnet. Damage to fuel injection pump could result.

4. Remove pipe union (7), valve cone (8), spring (9), and breather (10).



5. Install pipe union (7) in No. 1 cylinder (6) of fuel injection pump (3).
6. Install tube on No. 1 cylinder (6).
7. Disconnect fuel supply hose (11).



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## FUEL INJECTION PUMP TIMING (CONT)

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8. Install tank and fill with clean fuel.

**NOTE**

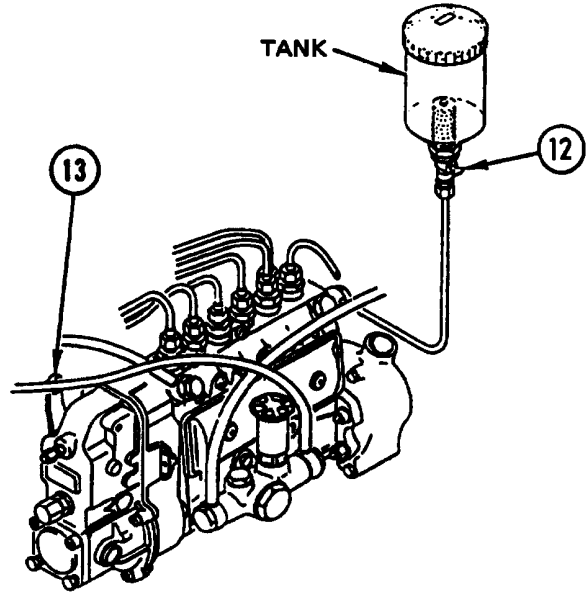
Arrow in gear case must point to mark on fuel injection pump drive gear, and FB mark (start of delivery) on timing pointer must be aligned with FB mark on vibration damper.

9. Turn crankshaft to right until No. 1 cylinder is at start of delivery in compression stroke.

**NOTE**

Have suitable container available to catch fuel that will drip from tube.

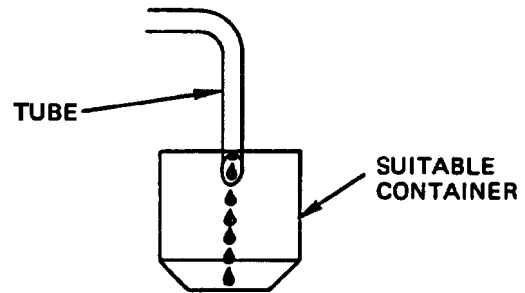
10. Open isolating cock (12) on tank and loosen cap to avoid vacuum lock.
11. Set throttle lever (13) in forward position.



**NOTE**

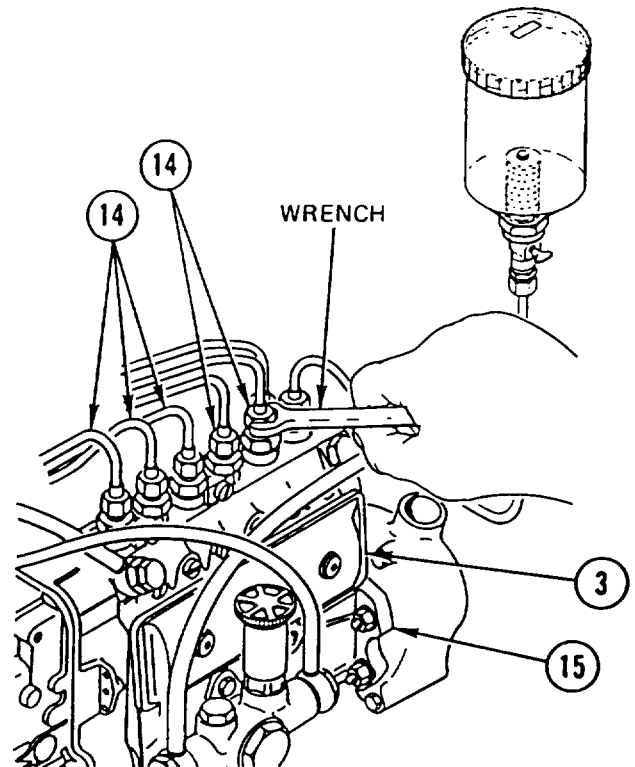
Monitor fuel flow in step 12 for 3-5 minutes.

12. Monitor flow of fuel at tube. If setting is correct, fuel will flow at a rate of one drop every 15-20 seconds.

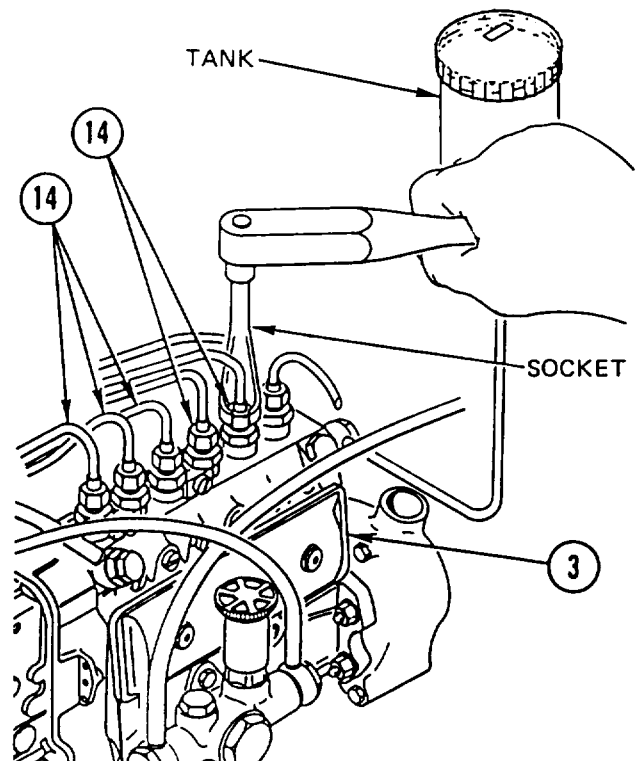


## FUEL INJECTION PUMP TIMING (CONT)

13. If fuel is flowing too fast or too slow, loosen five capnuts using wrench. Disconnect remaining five injection tubes (14).
14. Loosen four nuts (15) and turn fuel injection pump (3) either toward engine to slow fuel flow or away from engine to increase fuel flow. Continue until fuel flow is correct.
15. Tighten four nuts (15) to 37 lb-ft (50 N•m).



16. Connect five injection tubes (14) to fuel injection pump (3). Using socket, tighten five capnuts to 18 lb-ft (25 N•m).
17. Remove tank.



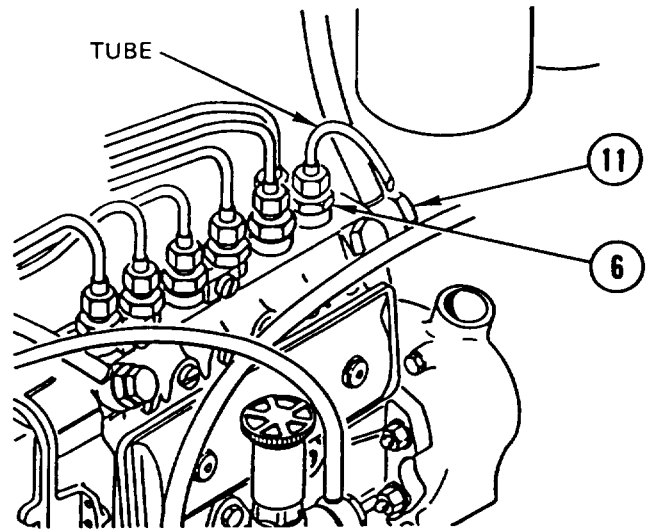
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## FUEL INJECTION PUMP TIMING (CONT)

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18. Connect fuel supply hose (11).

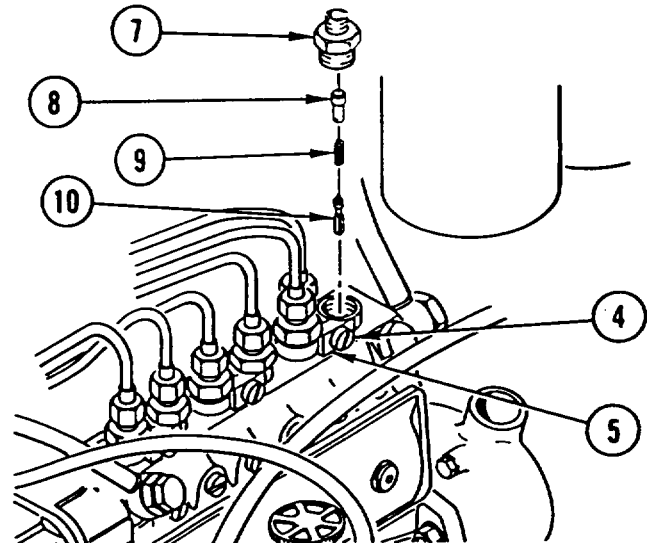
19. Remove tube from No. 1 cylinder (6).



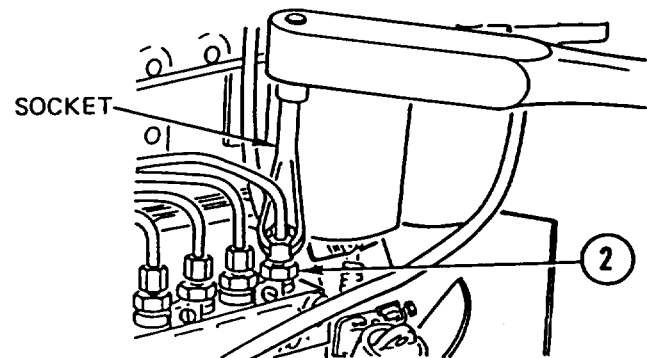
20. Remove pipe union (7).

21. install valve cone (8), spring (9), breather (10), and pipe union (7).

22. Install rim clamp (5) and tighten screw (4).



23. Install No. 1 injection tube (2). Using socket, tighten capnut to 18 lb-ft (25 N•m).



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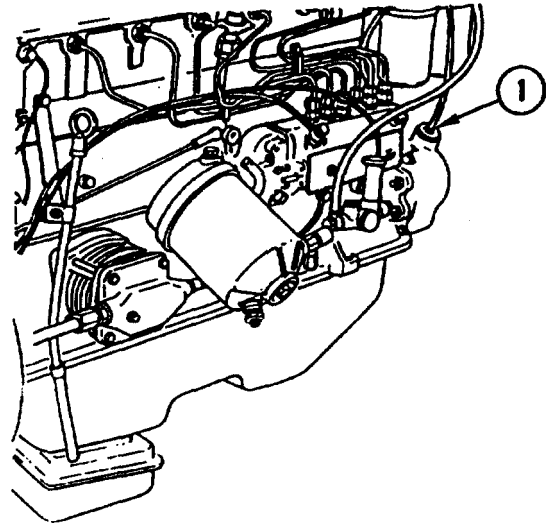
## FUEL INJECTION PUMP TIMING (CONT)

---

24. Install timing gear case vent (1).

### NOTE

Follow-on Maintenance:  
Connect accelerator linkage (TM  
5-2420-224-20).  
Bleed fuel system (TM 5-2420-  
224-20).  
Lower cab (TM 5-2420-224-20).





## TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Installing Tool, P/N 352 589 07 15 00  
 Puller, P/N 355 589 00 33 00

#### Materials/Parts:

Gasket  
 Seal  
 Key  
 Gasket

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Fan Impeller Removed
TM 5-2420-224-20	Counter Engine Revolution (Hourmeter) Removed
TM 5-2420-224-20	Fan Belt Removed
Page 3-43	Fuel Injection Pump Removed

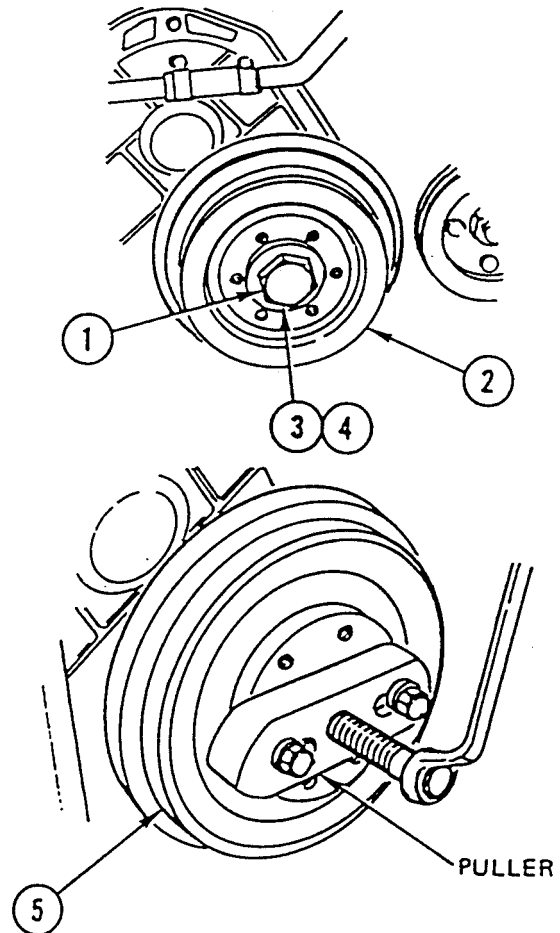
### REMOVAL

#### NOTE

Prior to performing step 1, place transmission shift lever in first gear position.

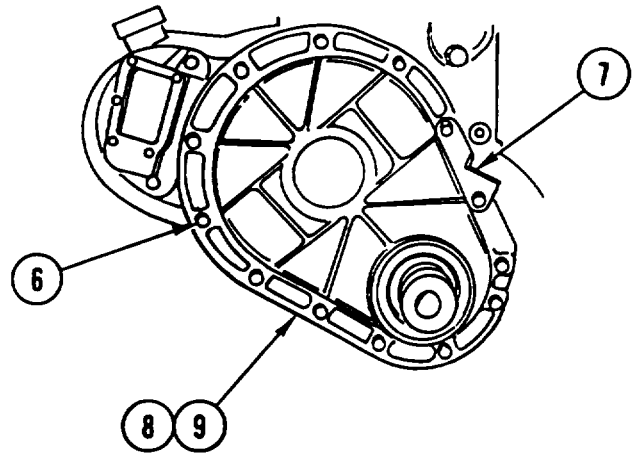
1. REMOVE bolt (1), PULLEY (2), and bearing SLEEVE (3) from crankshaft (4).

2. USING PULLER, REMOVE vibration DAMPER (5).

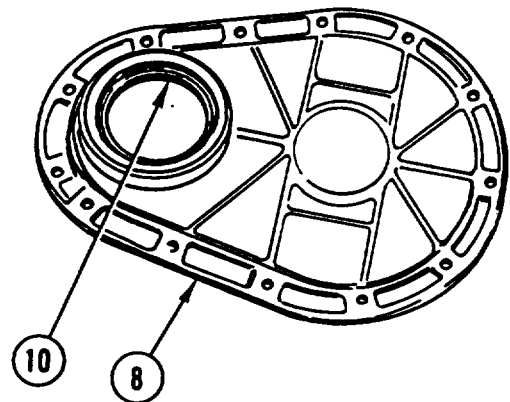


**TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)**

3. REMOVE 13 screws (6), timing pointer (7), timing gear COVER (8), and gasket (9). DISCARD GASKET.

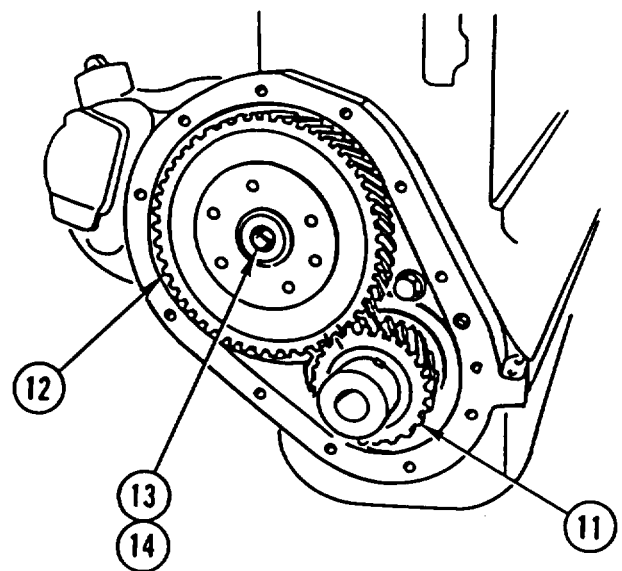


4. REMOVE SEAL (10) from timing gear cover (8). DISCARD SEAL.



5. ROTATE GEARS (11 and 12) until single mark on crankshaft gear (11) is between the two marks on camshaft gear (12).

6. REMOVE socket head SCREW (13) from camshaft (14).

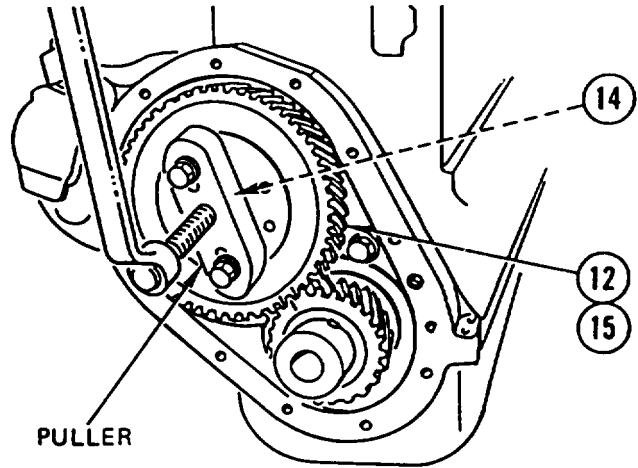


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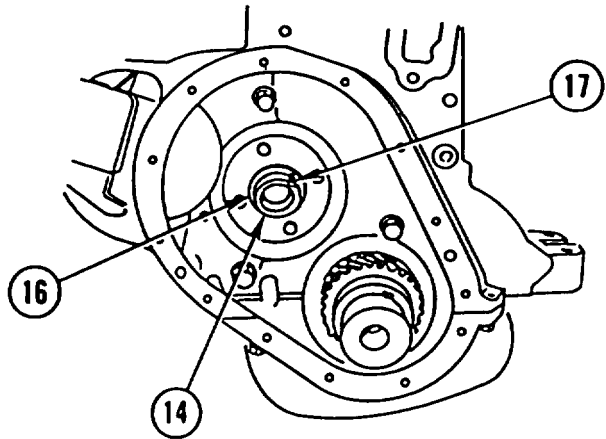
**TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)**

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7. USING PULLER, REMOVE camshaft GEAR (12) and drive GEAR (15) from camshaft (14).

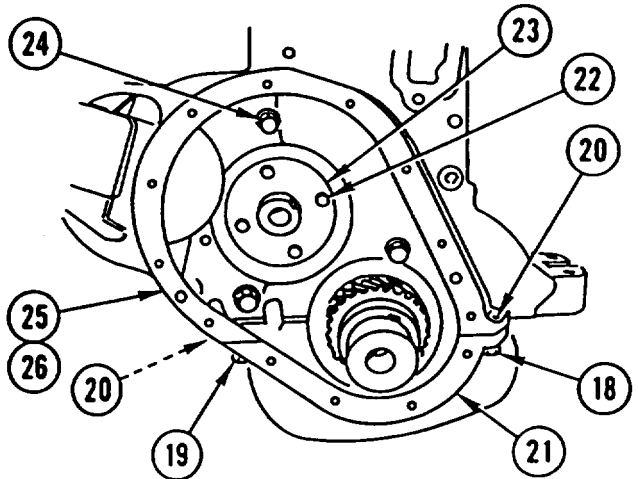


8. REMOVE washer (16) and woodruff KEY (17) from camshaft (14). DISCARD woodruff KEY.



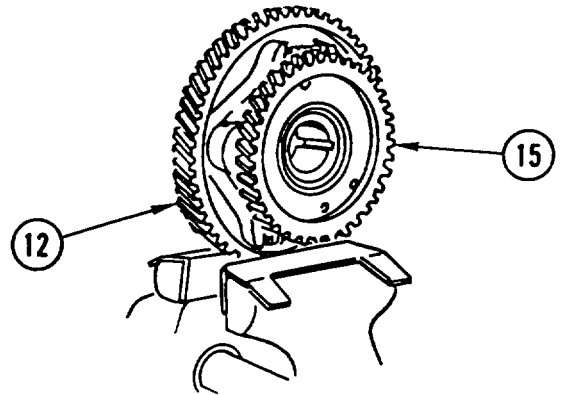
9. REMOVE two screws (18 and 19), two pins (20), and lower part of timing gear CASE (21).

10. REMOVE four screws (22), thrust washer (23), three screws (24), upper timing gear CASE (25), and gasket (26). DISCARD GASKET.



## TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)

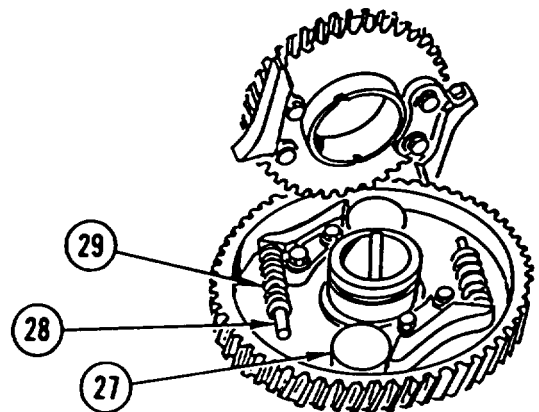
11. INSTALL camshaft GEAR (12) in soft-jawed VISE and PRY two GEARS (12 and 15) apart.



12. REMOVE two WEIGHTS (27), two pins (28), and two springs (29).

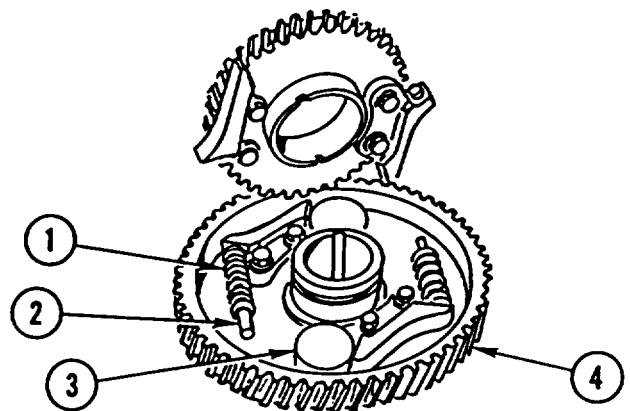
### INSPECTION

1. Inspect gears for wear or damage.
2. Inspect cover for cracks.



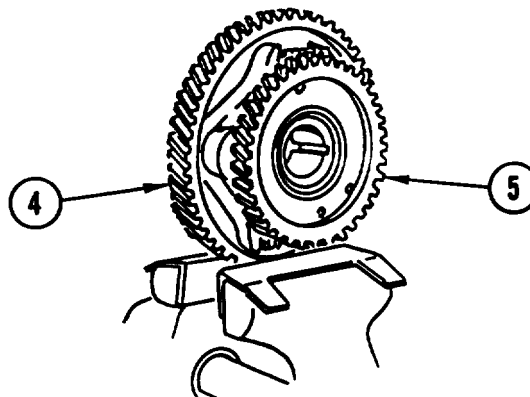
### INSTALLATION

1. INSTALL two springs (1), two pins (2), and two WEIGHTS (3) in camshaft gear (4).

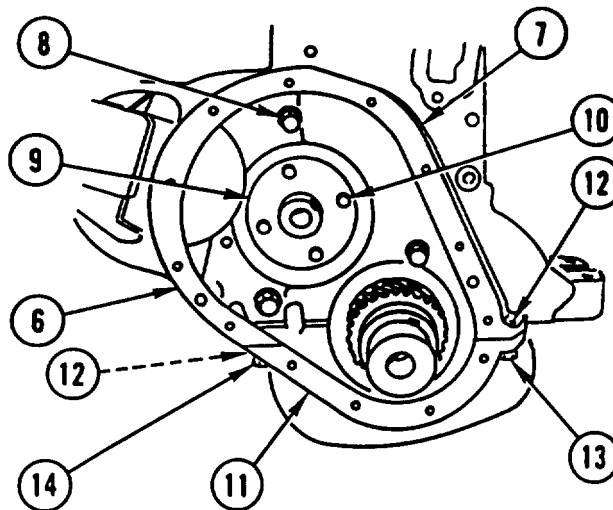


**TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)**

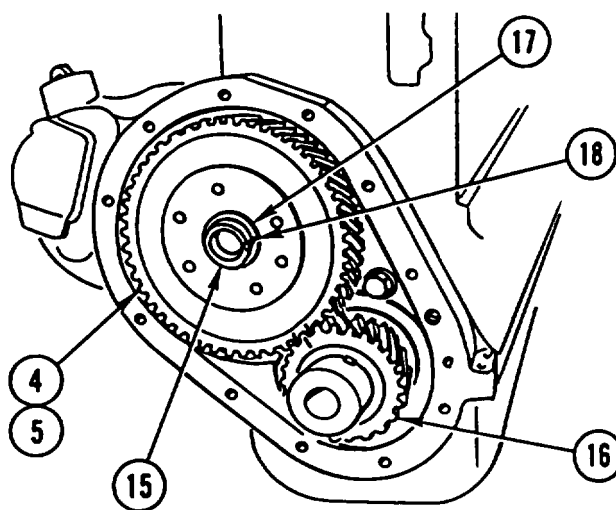
2. INSTALL drive GEAR (5) on camshaft gear (4).



3. INSTALL new gasket (6), upper timing gear CASE (7), three screws (8), thrust washer (9), and four screws (10).
4. INSTALL lower part of timing gear CASE (11), two pins (12), and two screws (13 and 14).

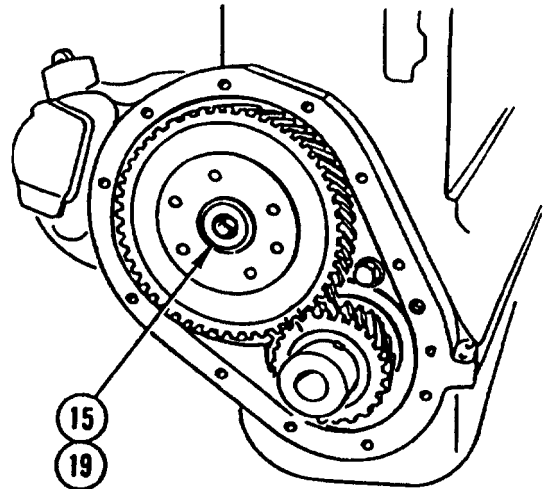


5. INSTALL drive GEAR (5) and camshaft GEAR (4) on camshaft (15) making sure that single mark on crankshaft gear (16) is between the two marks on camshaft gear (4).
6. INSTALL WASHER (17) on camshaft (15).
7. INSTALL new woodruff KEY (18) in camshaft (15).

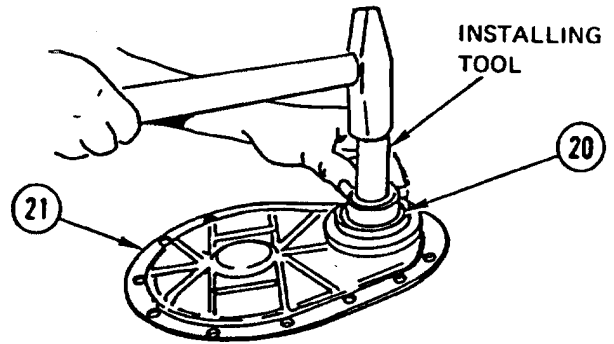


**TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)**

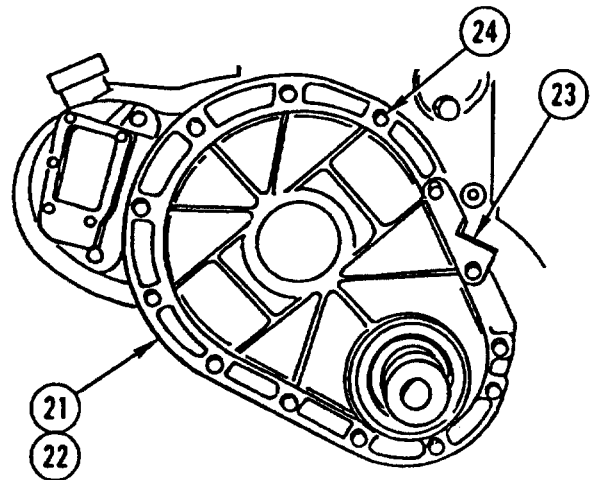
8. INSTALL socket head SCREW (19) in camshaft (15). TIGHTEN to 221 lb-ft (300 N.m).



9. USING INSTALLING TOOL, INSTALL new SEAL (20) in timing gear cover (21).



10. INSTALL new gasket (22), timing gear COVER (21), timing pointer (23), and 13 screws (24). TIGHTEN SCREWS to 71 lb-in. (800 N.cm).



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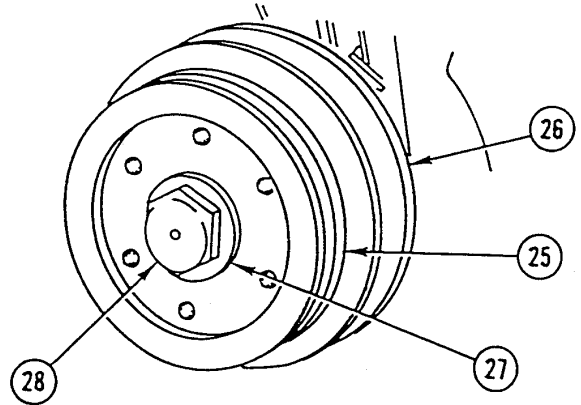
## TIMING GEAR COVER, GEARS, AND CASE REPLACEMENT (CONT)

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**NOTE**

Prior to performing step 11, place transmission shift control lever in first gear position.

11. INSTALL vibration DAMPER (25), pulley (26), bearing SLEEVE (27), and bolt (28). TIGHTEN BOLT to 360-400 lb-ft (500-550 N.m).



**NOTE**

Follow-on Maintenance:  
Install fan impeller (TM 5-2420-224-20).  
Install fan belt (TM 5-2420-224-20).  
Install counter engine revolution (Hourmeter) (TM 5-2420-224-20).  
Install fuel injection pump (page 3-43).

## Section II. CLUTCH AND RELATED PARTS

### OVERVIEW

This section illustrates and describes procedures for maintenance of the clutch and related parts. A list of tasks contained in this section is shown below.

	Page
Clutch Replacement .....	3-63
Clutch Release Lever and Shaft Replacement and Adjustment .....	3-66

### CLUTCH REPLACEMENT

This task covers: a. Removal b. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Installing Tool, P/N 406 589 00 61 00

**Equipment Condition:**

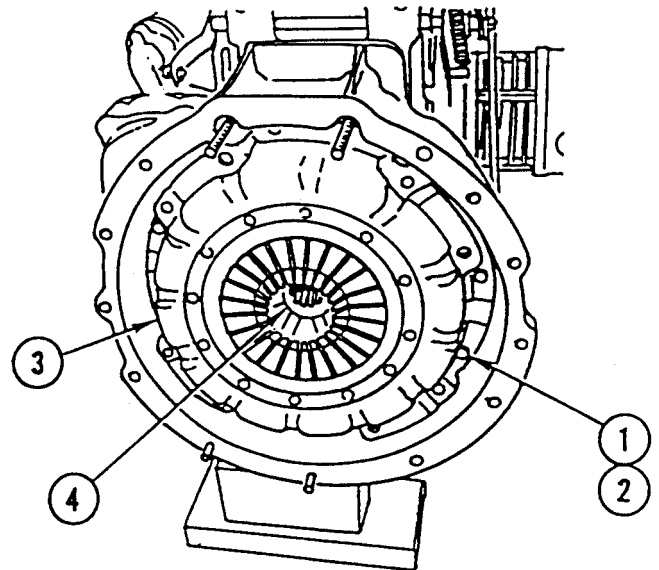
Reference	Condition Description
Page 3-2	Engine Removed

**Materials/Parts:**

Washer, Spring Tension (8)  
 Bearing

#### REMOVAL

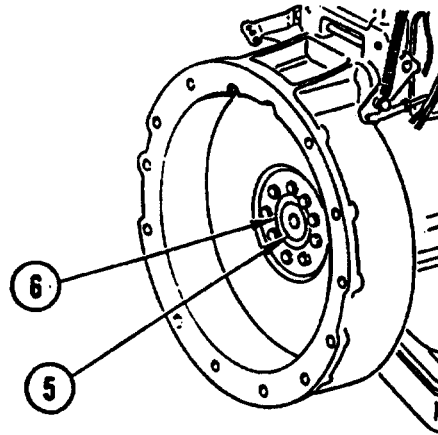
1. REMOVE eight screws (1), eight spring tension washers (2), clutch PLATE (3), and clutch DISC (4). DISCARD spring tension WASHERS.





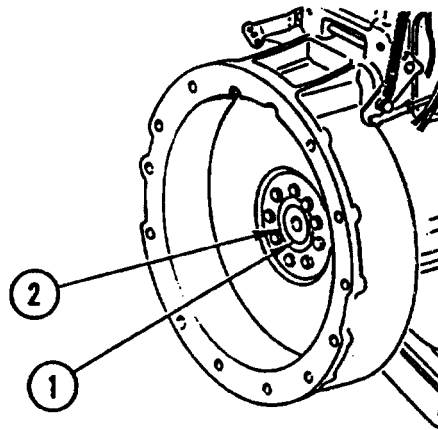
## CLUTCH REPLACEMENT

2. USING suitable PULLER, REMOVE BEARING AND COVER ASSEMBLY (5) from crankshaft (6). DISCARD BEARING.



### INSTALLATION

1. INSTALL NEW BEARING AND COVER ASSEMBLY (1) in crankshaft (2).



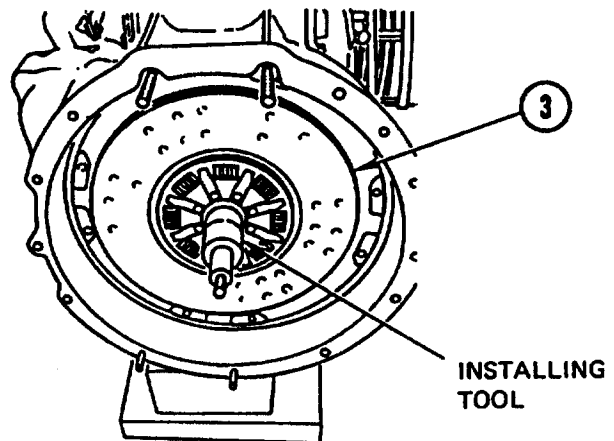
### CAUTION

- During installation, make sure collar on clutch disc is facing flywheel to prevent damage to equipment.
- Make sure flywheel and clutch plate are clean and free of grease and oil or damage to clutch will result.

### NOTE

Always replace the clutch plate and clutch disc as a set.

2. USING INSTALLING TOOL, INSTALL clutch DISC (3).



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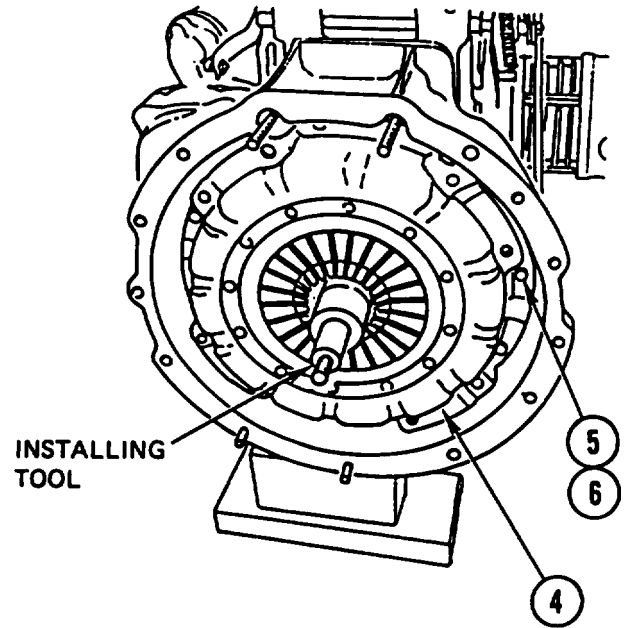
**CLUTCH REPLACEMENT (CONT)**

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3. INSTALL clutch PLATE (4), eight screws (5), and eight new spring tension washers (6). TIGHTEN SCREWS to 22 lb-ft (29 N•m).
4. REMOVE INSTALLING TOOL.

**NOTE**

Follow-on Maintenance:  
Install engine (page 3-2).



## CLUTCH RELEASE LEVER AND SHAFT REPLACEMENT AND ADJUSTMENT

This task covers: a. Removal b. Installation c. Adjustment

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Equipment Condition:

Reference	Condition Description
Page 3-2	Engine Removed

#### Materials/Parts:

Washer, Spring  
 Tension (2)

Bearing

Oil, Lubricating                      Appendix B, Item 30

### REMOVAL

1. DISCONNECT SPRING (1) from clutch lever (2).

#### NOTE

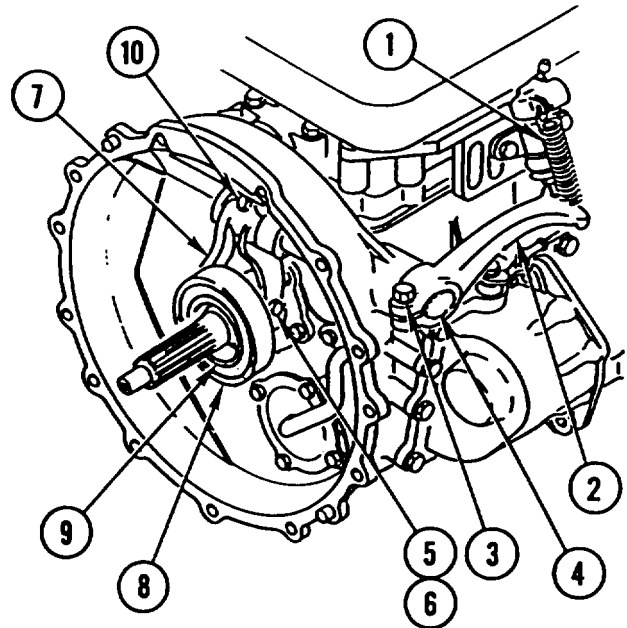
Prior to performing step 2, matchmark clutch lever and shaft to aid in installation.

2. REMOVE bolt (3) and clutch LEVER (2) from shaft (4).
3. REMOVE two SCREWS (5) and two spring tension washers (6) from clutch release lever (7). DISCARD spring tension WASHERS.
4. REMOVE BEARING (8) and washer (9). DISCARD BEARING.

#### NOTE

Prior to performing step 5, matchmark shaft and clutch release lever to aid in installation.

5. REMOVE bolt (10), shaft (4), and clutch release LEVER (7).



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## CLUTCH RELEASE LEVER AND SHAFT REPLACEMENT AND ADJUSTMENT (CONT)

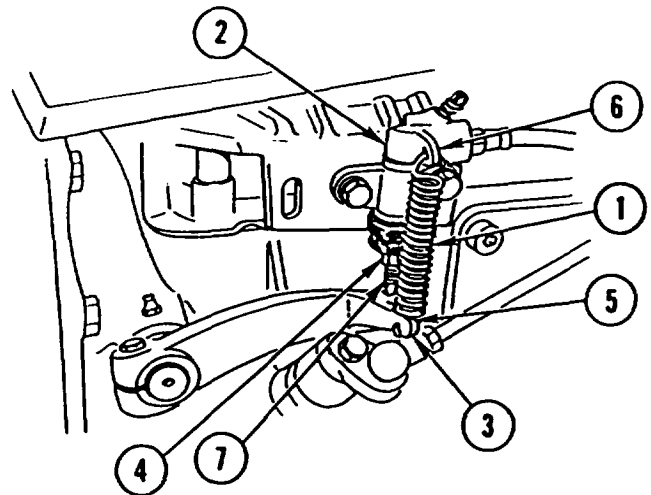
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### INSTALLATION

1. INSTALL clutch release LEVER (7), shaft (4), and bolt (10) as match marked during Removal.
2. APPLY COAT of LUBRICATING OIL to WASHER (9) and INSTALL washer (9) and new BEARING (8).
3. INSTALL two new spring tension washers (6) and two SCREWS (5) in clutch release lever (7).
4. INSTALL clutch LEVER (2) and bolt (3) in shaft (4) as matchmarked during Removal.
5. CONNECT SPRING (1) to clutch lever (2).
6. INSTALL ENGINE (page 3-2).

### ADJUSTMENT

1. Remove spring (1) from clutch slave cylinder (2) and clutch-lever (3).
2. Loosen lock nut (4).
3. Move clutch lever (3) down until it stops.
4. Insert a measuring device between clutch lever top surface (5) and bottom surface of spring bracket (6). Raise clutch lever (3). Movement of clutch lever must be 1/8 in. (3 ±0.5 mm).
5. Turn adjusting pin (7) to adjust clearance. When proper clearance is obtained, tighten lock nut (4).
6. Attach spring (1) to clutch slave cylinder (2) and clutch lever (3).



## Section III. TRANSMISSION AND RELATED PARTS

### OVERVIEW

This section illustrates and describes procedures for maintenance of the transmission and related parts. A list of tasks contained in this section is shown below.

	Page
Transmission Replacement . . . . .	3-68
Power Take-Off (PTO) Replacement . . . . .	3-79
Power Take-Off (PTO) Control Linkage Replacement and Adjustment . . . . .	3-81
Transmission Access Cover Replacement . . . . .	3-83
Transmission Top Cover Replacement . . . . .	3-86
Air Shift Solenoid Valve Replacement . . . . .	3-88
Air Shift Valve Replacement . . . . .	3-90
Transmission Shift Lines Replacement . . . . .	3-92
Transmission Shift Controls Replacement . . . . .	3-96
Transmission Mount Replacement . . . . .	3-99

### TRANSMISSION REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A63

**Materials/Parts:**

Strap, Tiedown (4)  
 Packing (3)  
 Washer, Lock (4)  
 Seal (2)  
 Washer, Spring Tension (2)  
 Grease, Molybdenum Disulfide      Appendix B, Item 24

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20  
 LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe (SEE) or Crane (HMMH) in Three-Point Stance
Page 3-2	Engine Removed
TM 5-2420-224-20	Floor Platform Removed
Page 3-96	Transmission Shift Controls Removed

## TRANSMISSION REPLACEMENT (CONT)

### Equipment Condition (Cont):

Reference	Condition Description
LO 5-2420-224-12	Transmission Drained
Page 5-1	Front Axle Assembly Removed (Steps 1 thru 30 Only)
Page 6-1	Rear Axle Assembly Removed (Steps 5, 14, and 18 thru 20 Only)

### General Safety Instructions (Cont):

#### WARNING

- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.
- Keep all personnel clear when using lifting device during removal and installation of transmission assembly. Failure to do so could result in injury to personnel.

### General Safety Instructions:

#### WARNING

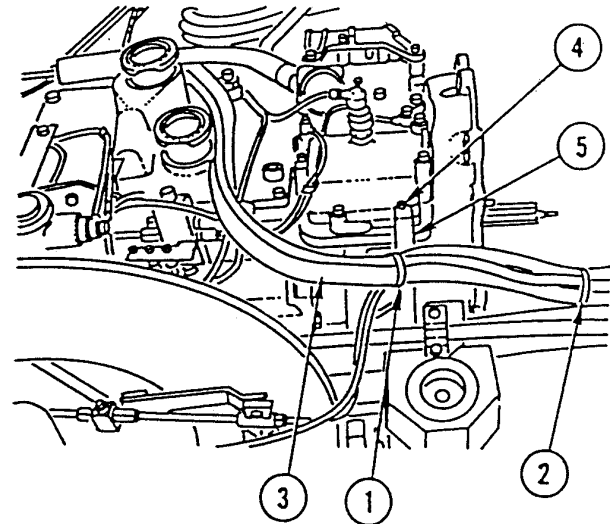
- Transmission assembly weighs 638 pounds (290 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting transmission assembly.

## REMOVAL

### NOTE

Procedure is the same for both vehicles.

1. REMOVE and DISCARD tiedown STRAPS (1 and 2).
2. MOVE STE/ICE-R wiring HARNESS (3) aside.
3. REMOVE SCREW (4) and SET BRACKET (5) aside.



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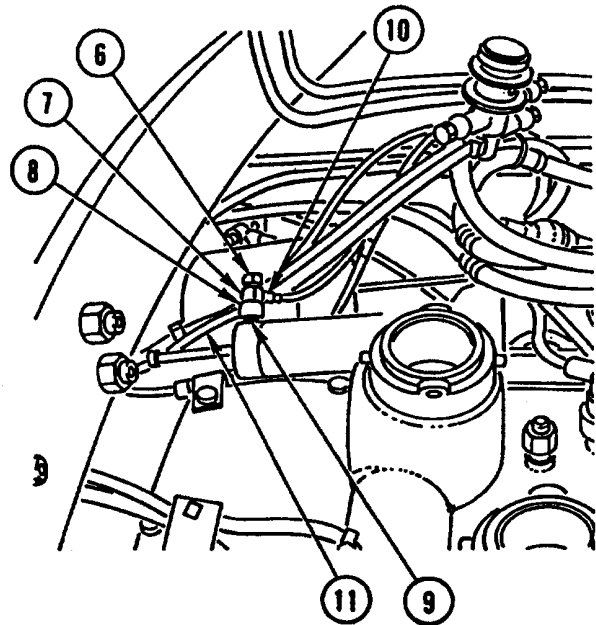
## TRANSMISSION REPLACEMENT (CONT)

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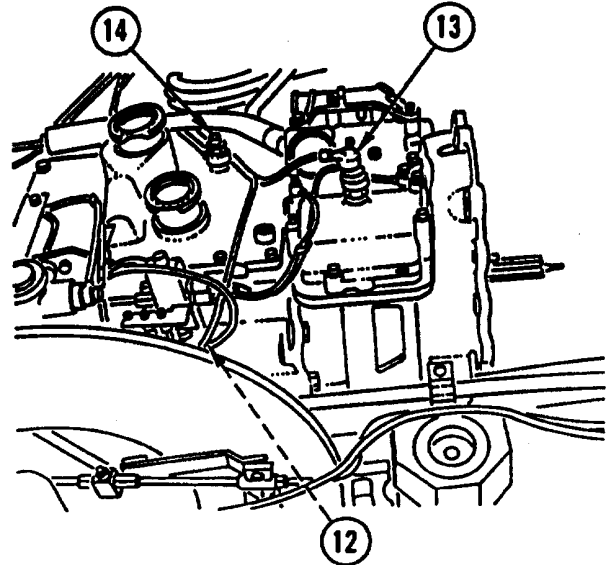
### NOTE

Tag all lines and electrical connectors prior to disconnecting to aid in connecting.

4. REMOVE fluid passage BOLT (6) and three packings (7, 8, and 9) and DISCONNECT two HOSES (10 and 11). DISCARD PACKINGS.



5. DISCONNECT three electrical CONNECTORS (12, 13, and 14).



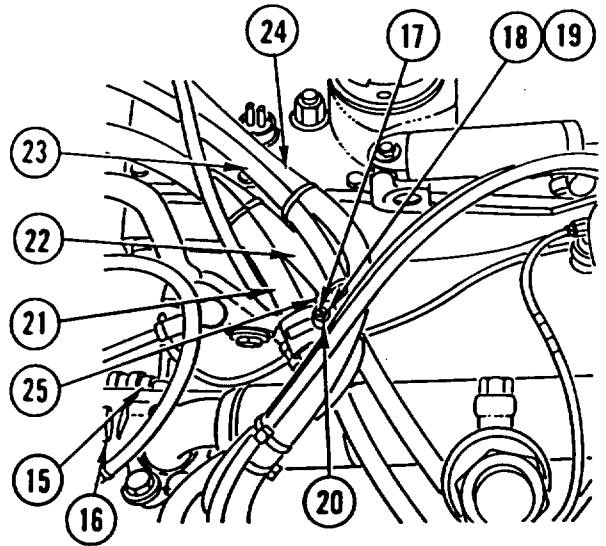
## TRANSMISSION REPLACEMENT (CONT)

6. DISCONNECT electrical CONNECTOR (15) from Power Take-Off (16).

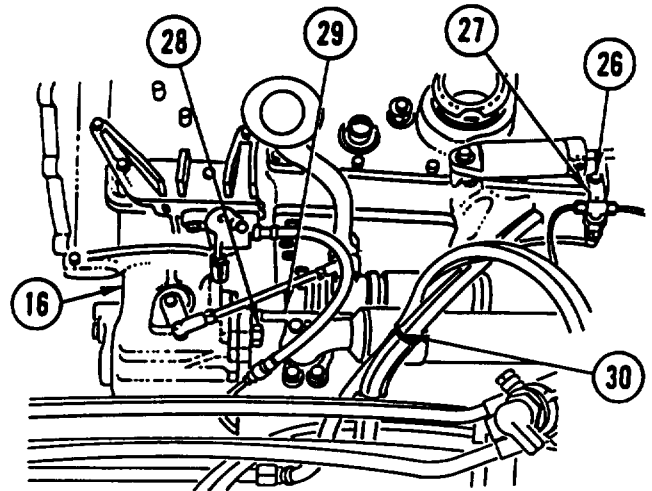
**NOTE**

Tag air lines and battery cables held by clamps prior to removal to aid in installation.

7. REMOVE nut (17), two CLAMPS (18 and 19), and screw (20).
8. MOVE two battery CABLES (21 and 22) and two air HOSES (23 and 24) and SET wiring HARNESS (25) aside.



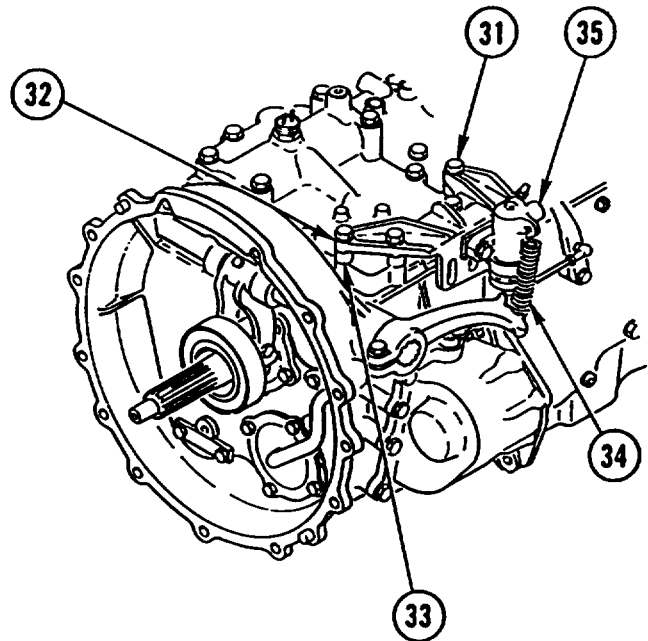
9. REMOVE SCREW (26) and SET BRACKET (27) aside.
10. REMOVE two BOLTS (28) from hydraulic pump (29) and DISENGAGE PUMP (29) from PTO (16).
11. REMOVE and DISCARD tiedown STRAPS (30).



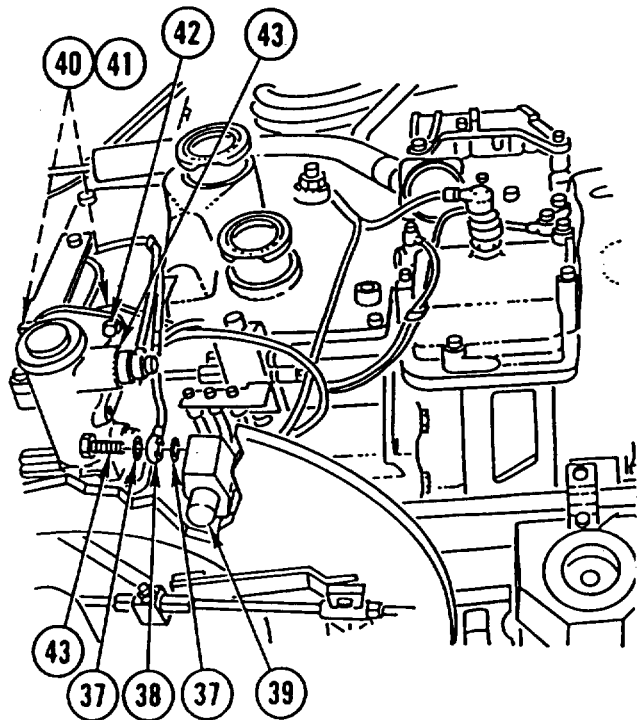


## TRANSMISSION REPLACEMENT (CONT)

12. REMOVE four screws (31), four lock washers (32), four spacers (33), and SPRING (34). DISCARD lock WASHERS.
13. MOVE clutch slave CYLINDER and MOUNT (35) aside.



14. REMOVE fluid passage BOLT (36), two seals (37), and FITTING (38) from intermediate speed mechanism (39). DISCARD SEALS.
15. REMOVE two nuts (40), two washers (41), and two SCREWS (42) and LAY pressure reducing VALVE assembly (43) aside.

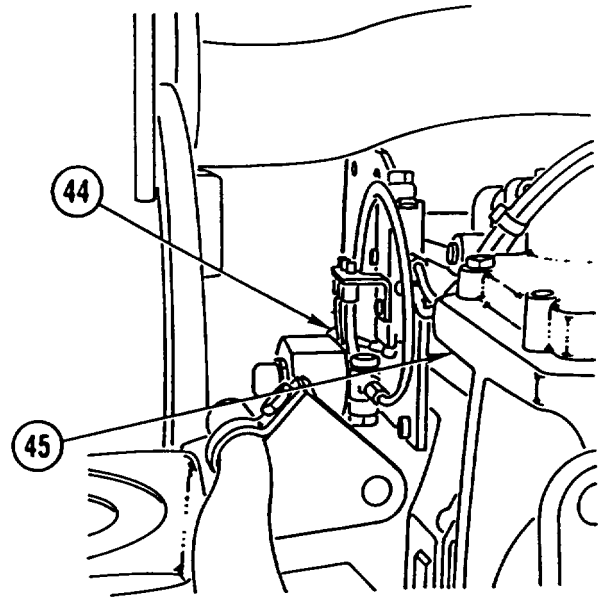


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**TRANSMISSION REPLACEMENT (CONT)**

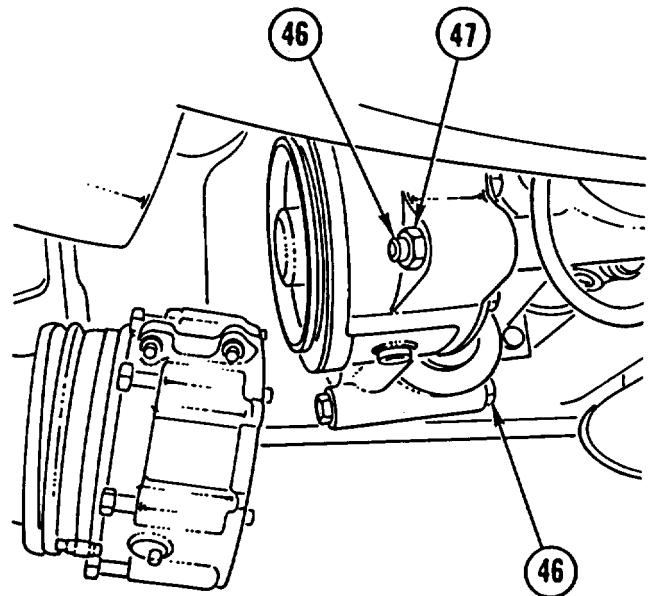
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16. DISCONNECT speedometer CABLE (44) from transmission (45).
17. ATTACH suitable lifting DEVICE to transmission (45).

**NOTE**

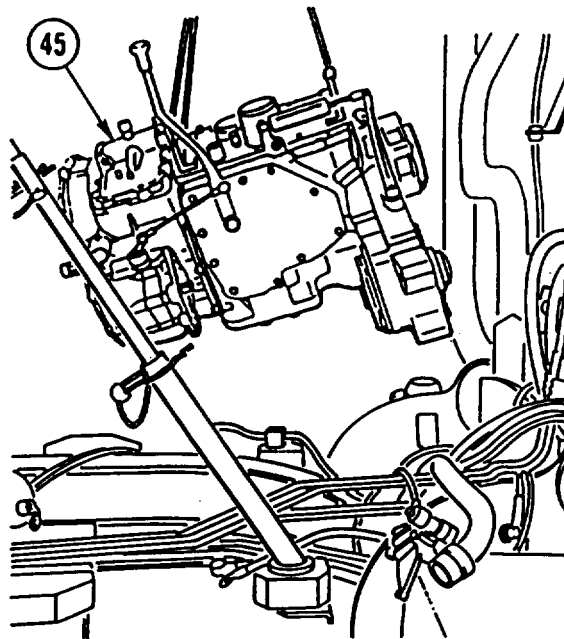
Leave four screws (46) in place to help support transmission during removal.

18. REMOVE four NUTS (47).

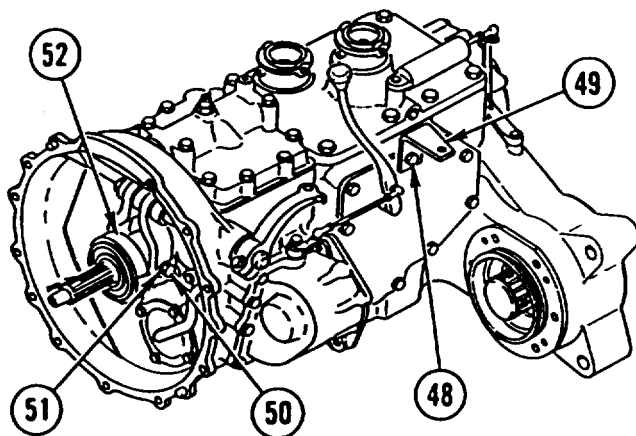


## TRANSMISSION REPLACEMENT (CONT)

19. USING suitable lifting DEVICE, REMOVE TRANSMISSION (45).
20. REMOVE lifting DEVICE.



21. REMOVE screw (48) and BRACKET (49). INSTALL SCREW (48).
22. REMOVE two capscrews (50), two spring tension washers (51), and WASHER with BEARING (52). DISCARD spring tension WASHERS.



### INSPECTION

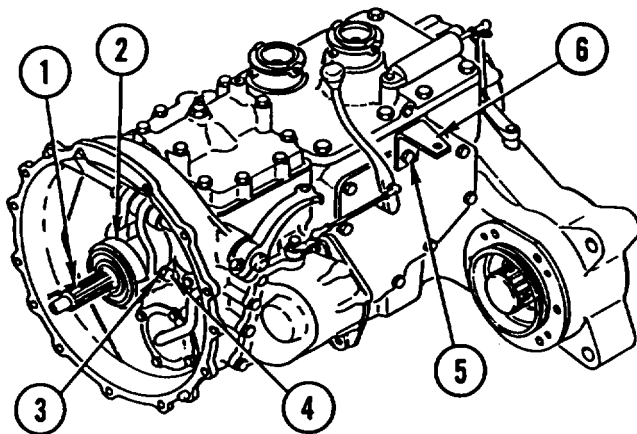
Inspect transmission for damage, missing parts, and fluid leakage.

### INSTALLATION

#### NOTE

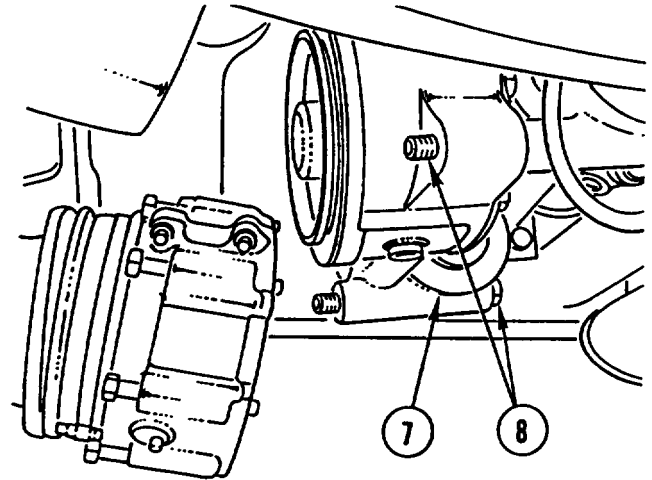
Procedure is the same for both vehicles.

1. APPLY COAT of MOLYBDENUM DISULFIDE GREASE to input SHAFT (1).
2. INSTALL WASHER with BEARING (2), two new spring tension washers (3), and two capscrews (4).
3. REMOVE SCREW (5). INSTALL BRACKET (6) and screw (5).



## TRANSMISSION REPLACEMENT (CONT)

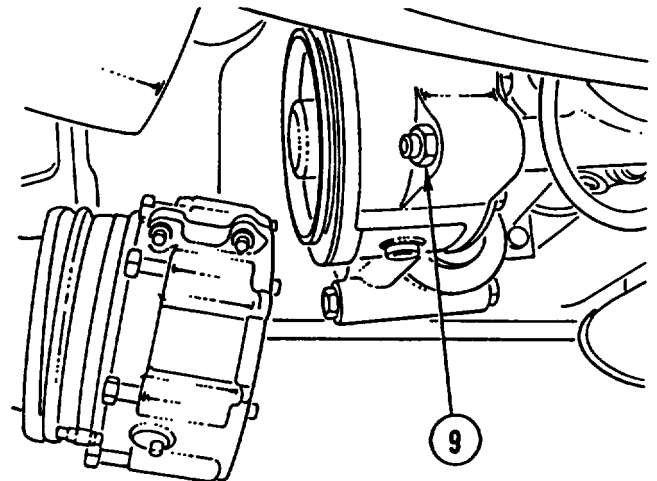
4. ATTACH suitable lifting DEVICE to transmission (7).
5. USING lifting DEVICE, INSTALL TRANSMISSION (7) in vehicle and on four rear mount screws (8).



6. INSTALL four NUTS (9). TIGHTEN NUTS to 192 lb-ft (260 N•m).

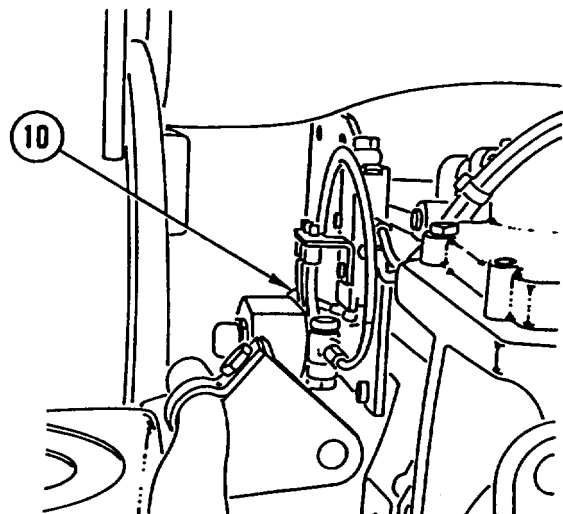
**WARNING**

Prior to performing step 7, insert floor jack under front of transmission. Failure to do so could result in injury to personnel and damage to transmission.



7. REMOVE lifting DEVICE.

8. CONNECT speedometer CABLE (10).

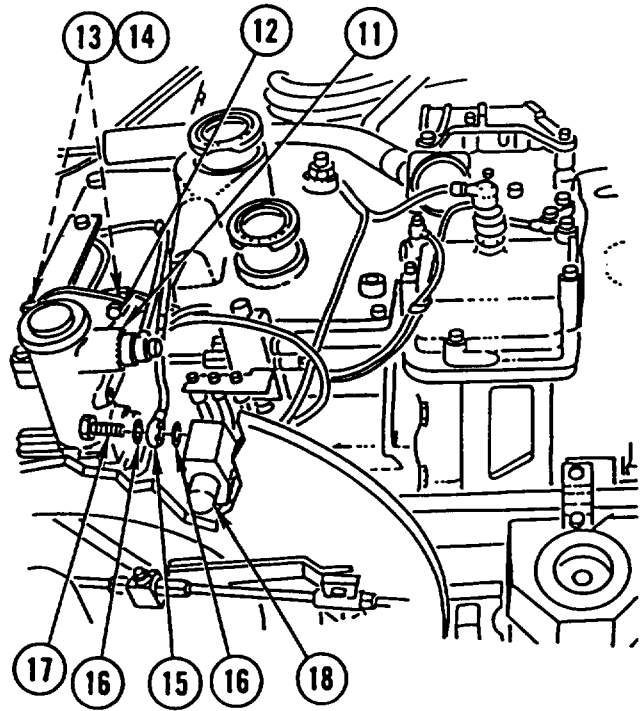


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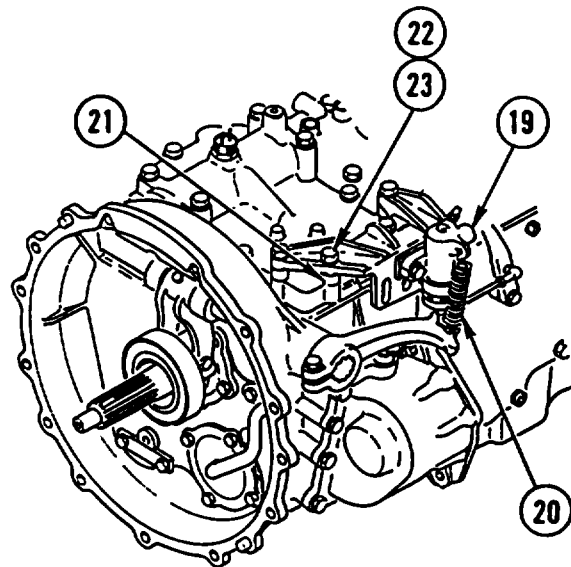
## TRANSMISSION REPLACEMENT (CONT)

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9. INSTALL pressure reducing VALVE assembly (11), two screws (12), two washers (13), and two nuts (14).
10. INSTALL FITTING (15), two new seals (16), and fluid passage BOLT (17) to intermediate speed mechanism (18).

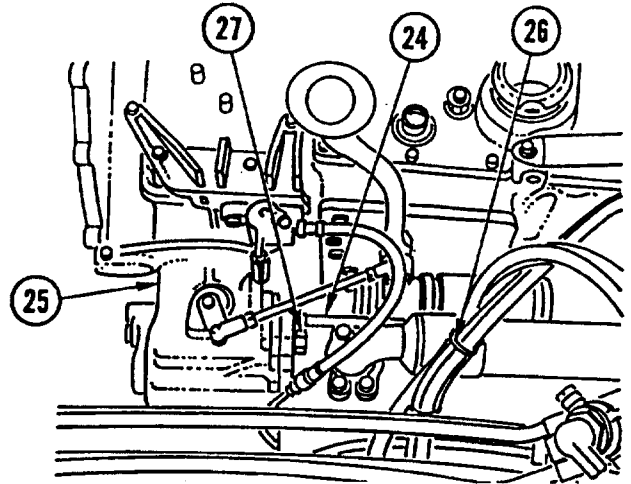


11. INSTALL clutch slave CYLINDER and MOUNT (19), spring (20), four spacers (21), four new lock washers (22), and four screws (23).

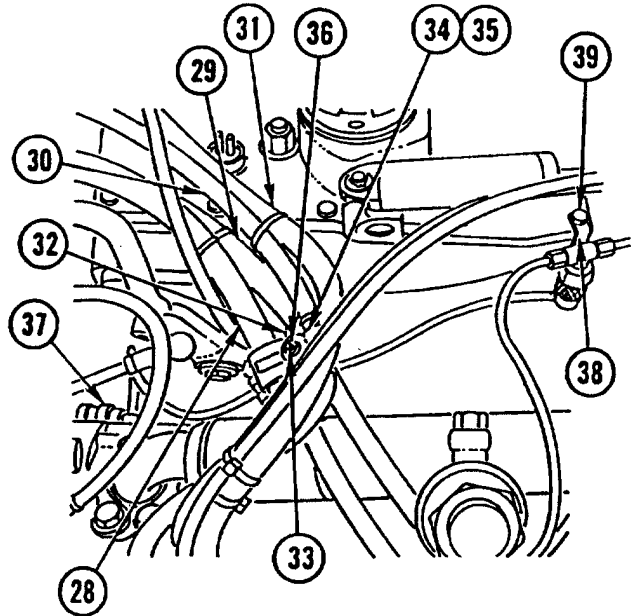


## TRANSMISSION REPLACEMENT (CONT)

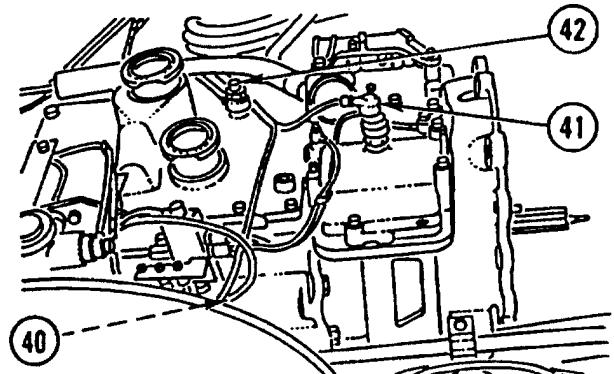
12. ALINE SPLINES on hydraulic PUMP (24) and PTO (25).
13. INSTALL new tiedown STRAPS (26).
14. INSTALL two BOLTS (27).



15. POSITION two battery CABLES (28 and 29), two air HOSES (30 and 31), and wiring HARNESS (32) in place.
16. INSTALL screw (33), two CLAMPS (34 and 35), and nut (36).
17. CONNECT electrical CONNECTOR (37).
18. INSTALL BRACKET (38) and screw (39).

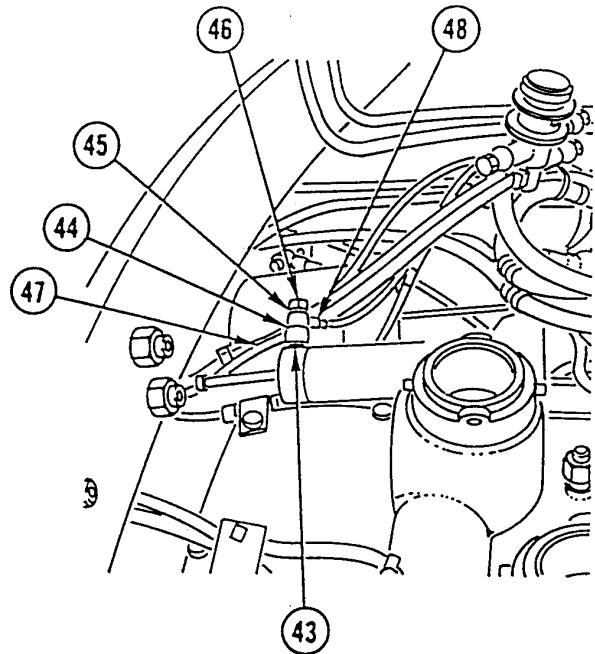


19. CONNECT three electrical CONNECTORS (40, 41, and 42).



## TRANSMISSION REPLACEMENT (CONT)

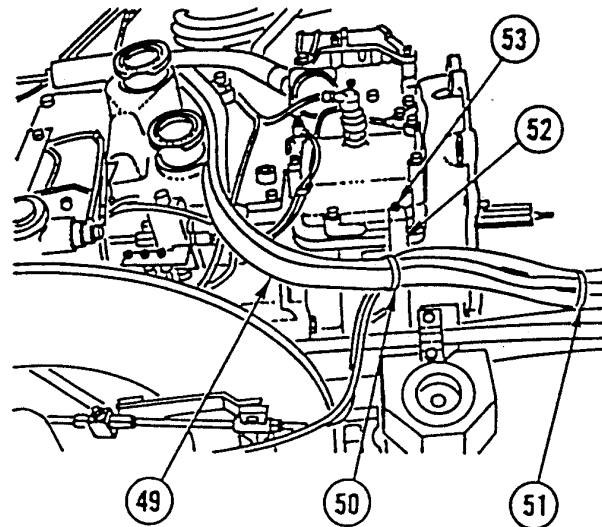
20. INSTALL three new packings (43, 44, and 45) and fluid passage BOLT (46) and CONNECT two HOSES (47 and 48).
21. POSITION STE/ICE-R wiring HARNESS (49) in place.
22. INSTALL new tiedown STRAPS (50 and 51).
23. POSITION BRACKET (52) and INSTALL SCREW (53).



### NOTE

**Follow-on Maintenance:**

- Fill transmission with oil (LO 5-2420-224-12).
- Install transmission shift controls (page 3-96).
- Install floor platform (TM 5-2420-224-20).
- Install engine (page 3-2).
- Install rear axle (steps 3 and 13 thru 20, Page 6-1).
- Install front axle (steps 6 thru 35, page 5-1).
- Bleed brake system (TM 5-2420-224-20).



## POWER TAKE-OFF (PTO) REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Compound, Sealing Appendix B, Item 16

**References:**

TM 5-2420-224-20  
 LO 5-2420-224-12

**Equipment Condition:**

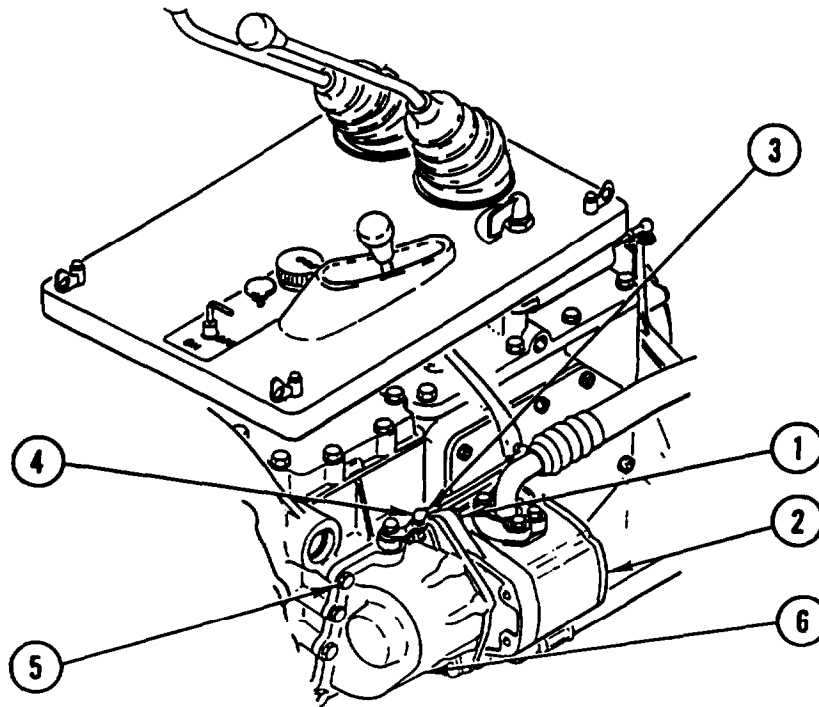
**Reference**

TM 5-2420-224-20  
 LO 5-2420-224-12

**Condition Description**

Cab Tilted  
 Transmission Fluid Drained

### REMOVAL



1. REMOVE two mounting BOLTS (1) and MOVE rear hydraulic PUMP (2) toward rear of vehicle.

**CAUTION**

To prevent damage to transmission, do not remove mounting bolt on PTO shaft.

2. REMOVE CLIP (3) from PTO lever arm (4).
3. REMOVE PTO lever ARM (4).
4. REMOVE eight mounting screws (5) and PTO (6).

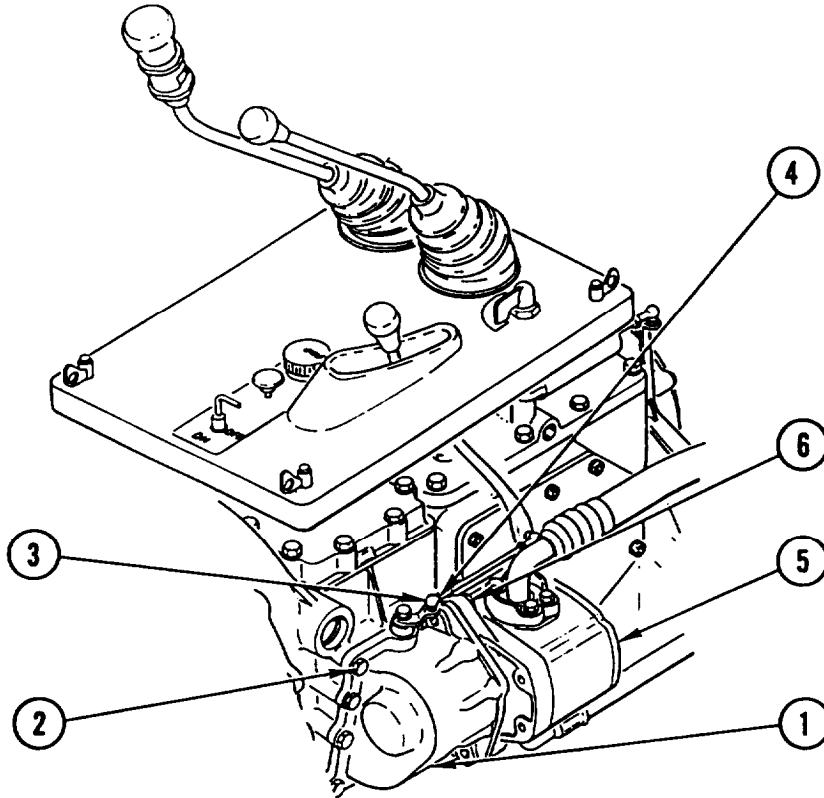


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## POWER TAKE-OFF (PTO) REPLACEMENT (CONT)

---

### 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 light COAT of SEALING COMPOUND to mounting FLANGE of PTO (1).
2. INSTALL PTO (1) and eight mounting screws (2).
3. INSTALL PTO lever ARM (3) and clip (4).
4. MOVE rear hydraulic PUMP (5) forward and INSTALL two mounting BOLTS (6).

### NOTE

Follow-on Maintenance:

Fill transmission fluid (LO 5-2420-224-12).  
Lower cab (TM 5-2420-224-20).

## POWER TAKE-OFF (PTO) CONTROL LINKAGE REPLACEMENT AND ADJUSTMENT

This task covers: a. Removal b. Installation c. Adjustment

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Packing (2)

Packing

#### References:

TM 5-2420-224-20

#### Equipment Condition:

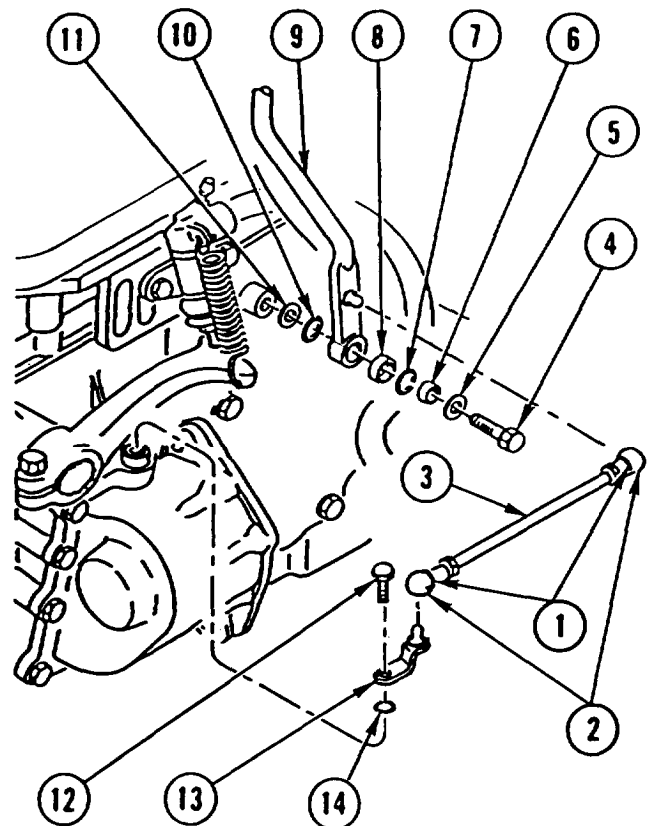
Reference	Condition Description
TM 5-2420-224-20	Cab Tilted

### REMOVAL

1. REMOVE two clips (1), two ball sockets (2), and control LEVER (3).
2. REMOVE capscrew (4), washer (5), bearing (6), packing (7), bushing (8), LEVER (9), packing (10), and washer (11). DISCARD PACKINGS.
3. REMOVE capscrew (12), control LEVER assembly (13), and packing (14). DISCARD PACKINGS.

### INSTALLATION

1. INSTALL new packing (14), control LEVER assembly (13), and capscrew (12).
2. INSTALL washer (11), new packing (10), LEVER (9), bushing (8), new packing (7), bearing (6), washer (5), and capscrew (4).
3. INSTALL control LEVER (3), two ball sockets (2), and two clips (1).



---

## POWER TAKE-OFF (PTO) CONTROL LINKAGE REPLACEMENT AND ADJUSTMENT (CONT)

---

### **ADJUSTMENT**

1. Remove clip from rod end.
2. Lift rod end off ball socket.
3. Loosen lock nut.
4. Turn rod end to increase/decrease length of rod. Length of rod from ball pivot to center of ball pivot is 7.5 in. (190 mm).

#### **NOTE**

Follow-on Maintenance:  
Lower cab (TM 5-2420-224-20).

## TRANSMISSION ACCESS COVER REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Seal (4)

Compound, Sealing Appendix B, Item 16

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Floor Platform Removed
TM 5-2420-224-20	Air Pressure Relieved

#### General Safety Instructions:

#### WARNING

- Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.
- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

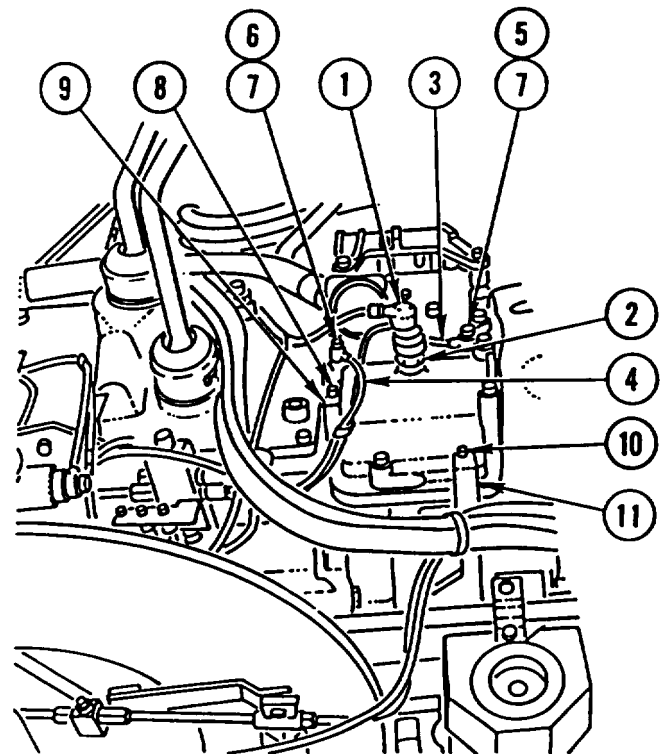
### REMOVAL

1. DISCONNECT electrical CONNECTOR (1) from switch (2).

#### NOTE

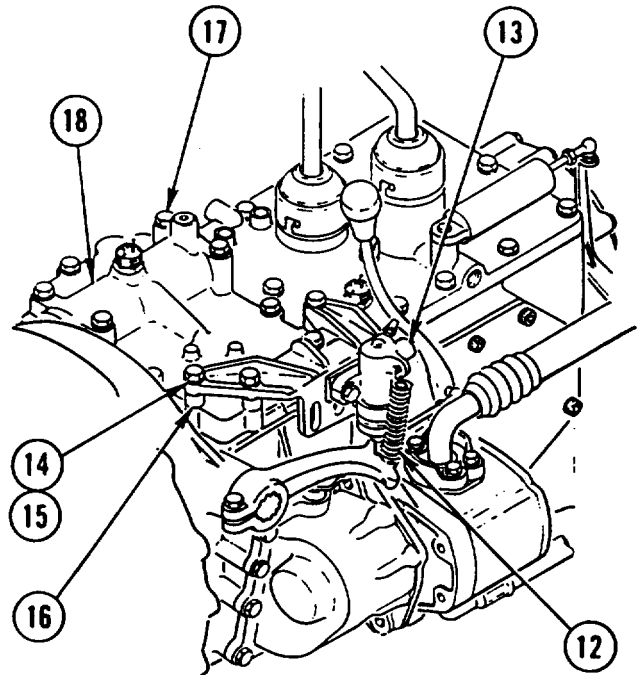
Tag air lines prior to disconnecting to aid in connecting.

2. DISCONNECT two air LINES (3 and 4) by REMOVING two hollow SCREWS (5 and 6) and four seals (7). DISCARD SEALS.
3. REMOVE SCREW (8) and SET BRACKET (9) aside.
4. REMOVE SCREW (10) and SET BRACKET (11) aside.



## TRANSMISSION ACCESS COVER REPLACEMENT (CONT)

5. DISCONNECT SPRING (12) from clutch slave cylinder (13).
6. REMOVE four SCREWS (14), four washers (15), and four spacers (16) and SET clutch slave CYLINDER (13) aside.
7. REMOVE six screws (17) and transmission access COVER (18).



### INSTALLATION

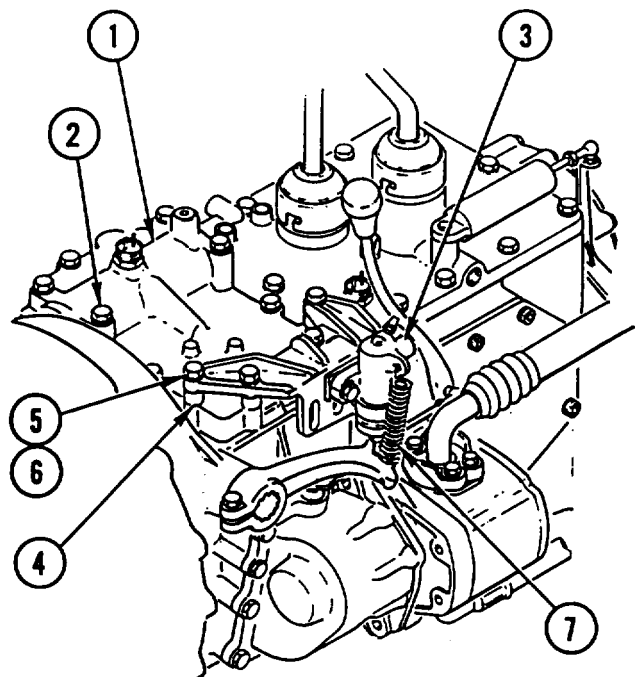
#### NOTE

- Make sure both mating surfaces are completely clean prior to applying sealing compound.
- While performing step 1, make sure access cover pin is engaged with shifting fork in transmission.

#### 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 COAT of SEALING COMPOUND to both mating SURFACES and INSTALL transmission access COVER (1) and six screws (2).
2. POSITION clutch slave CYLINDER (3) and INSTALL four spacers (4), four washers (5), and four SCREWS (6).
3. CONNECT SPRING (7) to clutch slave cylinder (3).



---

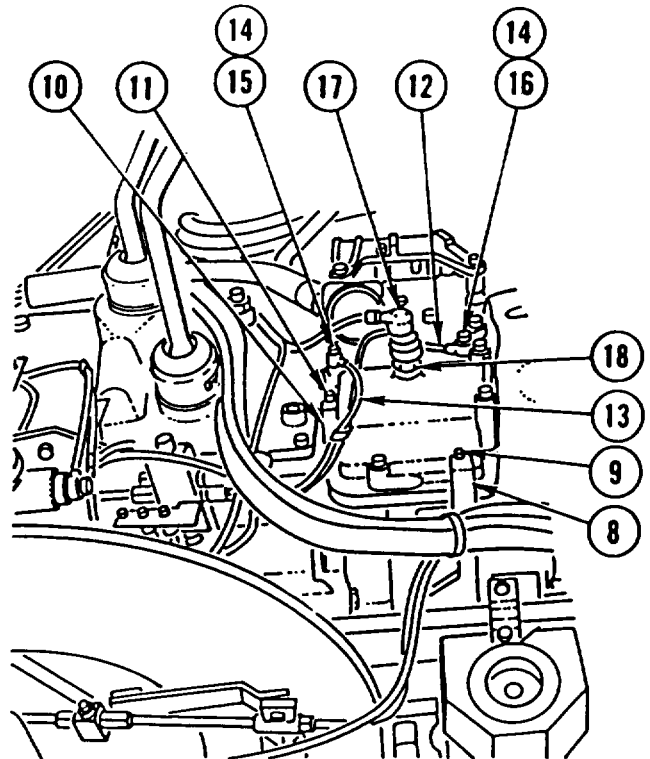
**TRANSMISSION ACCESS COVER REPLACEMENT (CONT)**

---

4. POSITION BRACKET (8) and INSTALL SCREW (9).
5. POSITION BRACKET (10) and INSTALL SCREW (11).
6. CONNECT two air LINES (12 and 13) by INSTALLING four new seals (14) and two hollow SCREWS (15 and 16).
7. CONNECT electrical CONNECTOR (17) to switch (18).

**NOTE**

Follow-on Maintenance:  
Install floor platform (TM 5-2420-224-20).



---

## TRANSMISSION TOP COVER REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

Materials/Parts:

Adhesive

Appendix B, Item 3

Equipment Condition:

Reference

Page 3-68

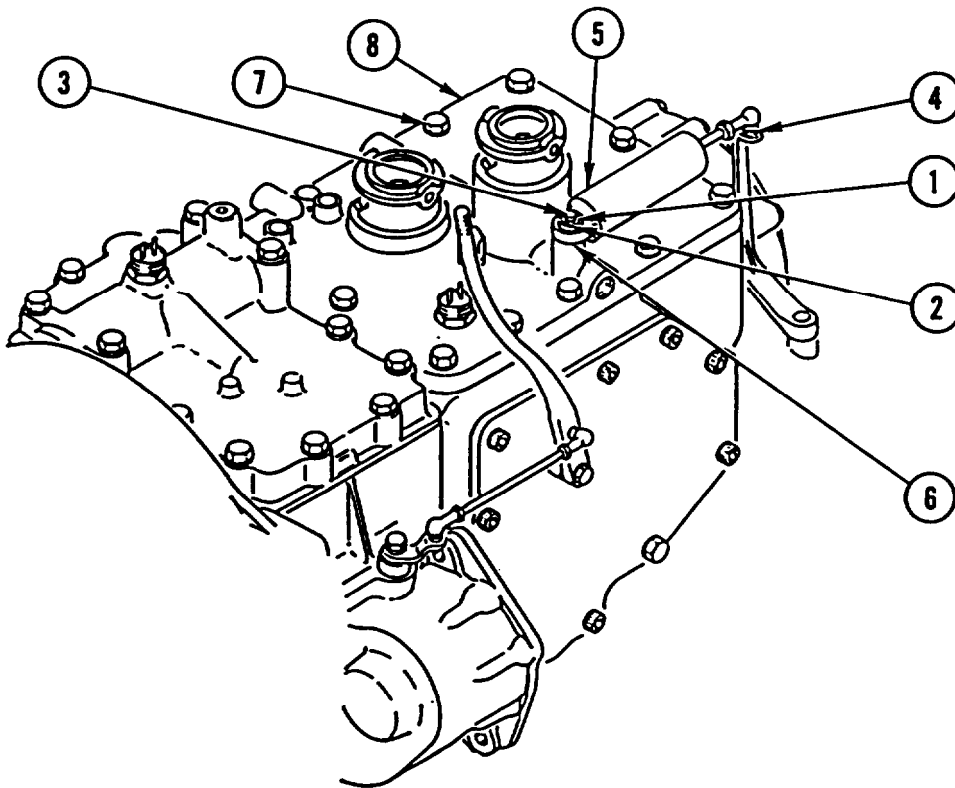
Condition Description

Transmission Removed

---

### REMOVAL

1. REMOVE retaining RING (1) and washer (2) from pin (3).
2. REMOVE clip (4) and CYLINDER (5) from pin (3) and SET CYLINDER (5) aside.
3. REMOVE WASHER (6).
4. REMOVE 12 screws (7) and COVER assembly (8).



---

**TRANSMISSION TOP COVER REPLACEMENT (CONT)**

---

**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 COAT of ADHESIVE to COVER assembly (8) and to THREADS of 12 screws (7) and INSTALL COVER assembly (8) and 12 screws (7). TIGHTEN SCREWS to 18 lb-ft (25 N.m).
2. INSTALL washer (6), CYLINDER (5), and clip (4) on pin (3).
3. INSTALL washer (2) and retaining RING (1) on pin (3).

**NOTE**

Follow-on Maintenance:

Install transmission (page 3-68).



---

## AIR SHIFT SOLENOID VALVE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Packing, Preformed (2)

Washer (2)

Adapter, Straight Tube

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Air Pressure Relieved

#### General Safety Instructions:

#### **WARNING**

- Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.
- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

---

### **REMOVAL**

1. DISCONNECT electrical CONNECTOR (1) from air shift solenoid valve (2).

#### **NOTE**

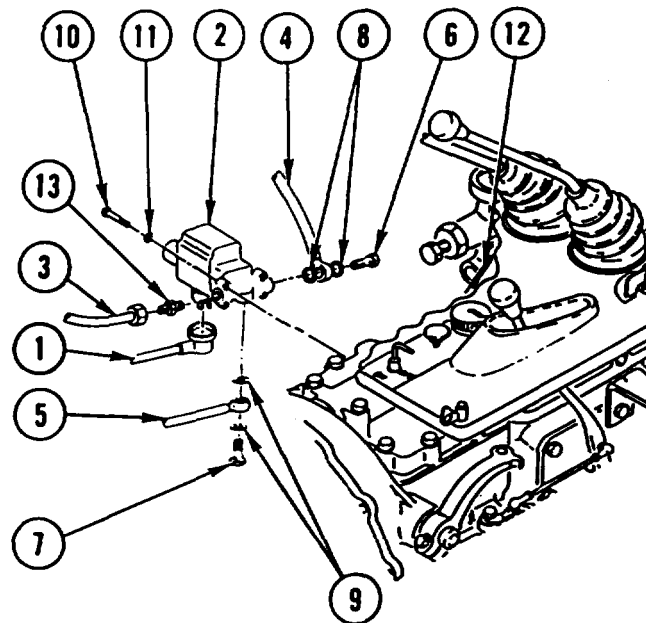
Tag all air lines prior to disconnecting to aid in connecting.

2. DISCONNECT air LINE (3) from air shift solenoid valve (2).
3. DISCONNECT two air LINES (4 and 5) from air shift solenoid valve (2) by REMOVING two fluid passage BOLTS (6 and 7), two preformed packings (8), and two washers (9). DISCARD preformed PACKINGS and WASHERS.
4. REMOVE two screws (10), two washers (11), and air shift solenoid VALVE (2) from mounting bracket (12).
5. REMOVE straight tube ADAPTER (13) from air shift solenoid valve (2). DISCARD straight tube ADAPTER.

---

**AIR SHIFT SOLENOID VALVE REPLACEMENT (CONT)**


---


**INSTALLATION**

1. INSTALL new straight tube ADAPTER (13) in air shift solenoid valve (2).
2. INSTALL air shift solenoid VALVE (2), two washers (11), and two screws (10) on mounting bracket (12).
3. CONNECT two air LINES (4 and 5) to air shift solenoid valve (2) by INSTALLING two new preformed packings (8), two new washers (9), and two fluid passage BOLTS (6 and 7).
4. CONNECT air LINE (3) to air shift solenoid valve (2).
5. CONNECT electrical CONNECTOR (1) to air shift solenoid valve (2).

**NOTE**

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).

---

## AIR SHIFT VALVE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Lock (2)

Packing, Preformed (7)

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Air Pressure Relieved

#### General Safety Instructions:

#### WARNING

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.

---

### REMOVAL

1. REMOVE SCREW (1) and lock washer (2) and SET BRACKET (3) aside. DISCARD lock WASHER.

#### NOTE

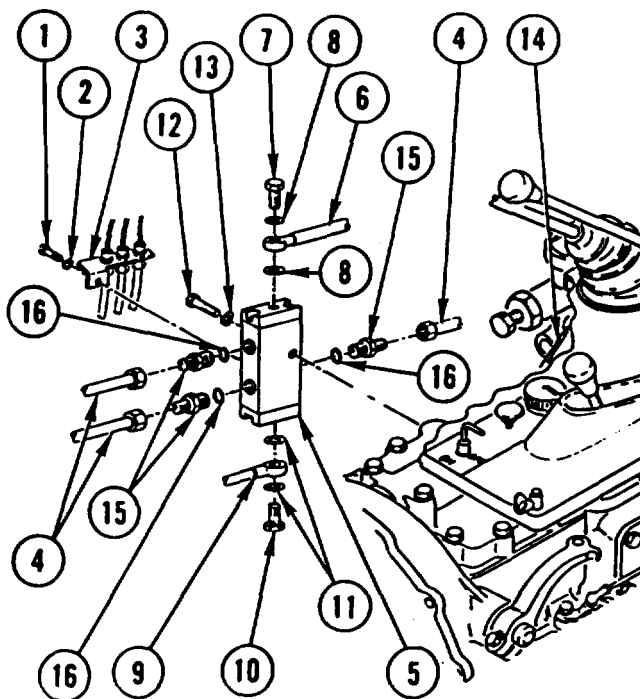
Tag all air lines prior to disconnecting to aid in connecting.

2. DISCONNECT three air LINES (4) from air shift valve (5).
3. DISCONNECT air LINE (6) from air shift valve (5) by REMOVING fluid passage BOLT (7) and two preformed packings (8). DISCARD preformed PACKINGS.
4. DISCONNECT air LINE (9) from air shift valve (5) by REMOVING hollow SCREW (10) and two preformed packings (11). DISCARD preformed PACKINGS.
5. REMOVE screw (12), lock washer (13), and air shift VALVE (5) from mounting bracket (14). DISCARD lock WASHER.
6. REMOVE three ADAPTERS (15) and three preformed packings (16) from air shift valve (5). DISCARD preformed PACKINGS.

---

**AIR SHIFT VALVE REPLACEMENT (CONT)**


---


**INSTALLATION**

1. INSTALL three new preformed packings (16) and three ADAPTERS (15) on air shift valve (5).
2. INSTALL air shift VALVE (5), new lock washer (13), and screw (12) on mounting bracket (14).
3. CONNECT air LINE (9) to air shift valve (5) by INSTALLING two new preformed packings (11) and hollow SCREW (10).
4. CONNECT air LINE (6) to air shift valve (5) by INSTALLING two new preformed packings (8) and fluid passage BOLT (7).
5. CONNECT three air LINES (4) to air shift valve (5).
6. POSITION BRACKET (3) and INSTALL new lock washer (2) and SCREW (1).

**NOTE**

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).

---

## TRANSMISSION SHIFT LINES REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Sleeve, Compression

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition	Description
TM 5-2420-224-20	Cab Tilted	
TM 5-2420-224-20	Air Pressure Relieved	

#### General Safety Instructions:

#### WARNING

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.

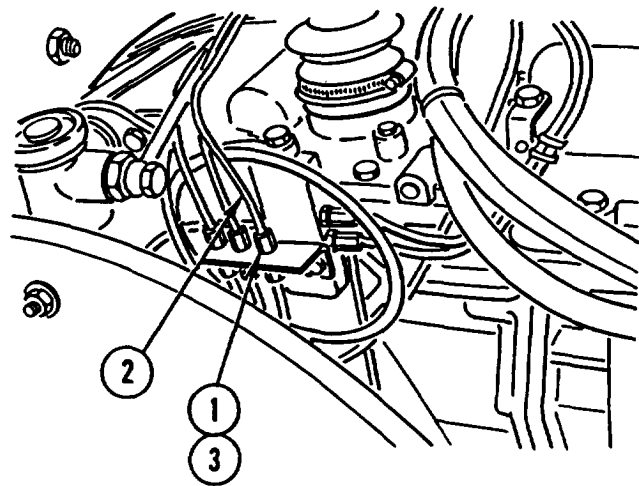
---

## REMOVAL

#### NOTE

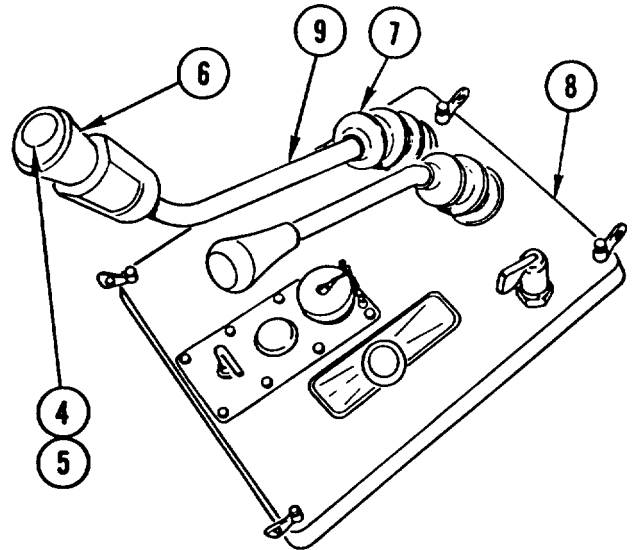
- Procedure is the same for all three transmission shift lines.
- If all three transmission shift lines are to be disconnected, tag connectors on bar prior to disconnecting to aid in connecting.

1. LOOSEN NUT (1) and DISCONNECT transmission shift HOSE (2).
2. REMOVE compression SLEEVE (3) and nut (1). DISCARD compression SLEEVE.

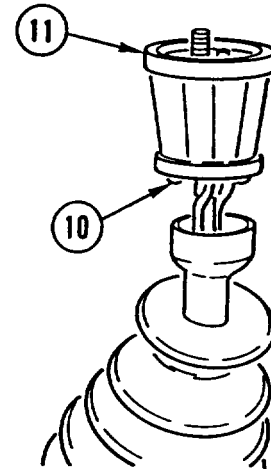


## TRANSMISSION SHIFT LINES REPLACEMENT (CONT)

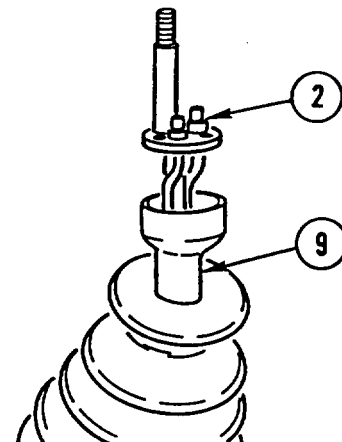
3. REMOVE CAP (4), nut (5), and knob (6).
4. REMOVE BELLOWS (7) from floor platform (8) and SLIDE BELLOWS (7) UP lever (9) enough to clear hole in lever (9).



5. REMOVE three screws (10) and VALVE (11).



6. REMOVE transmission shift HOSE (2) from lever (9).



---

## TRANSMISSION SHIFT LINES REPLACEMENT (CONT)

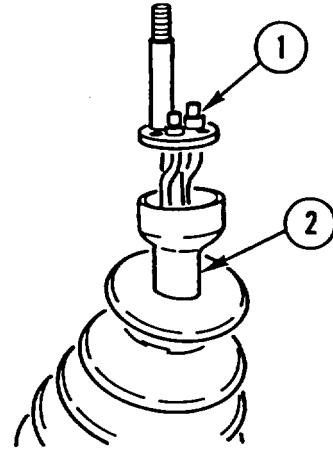
---

### INSTALLATION

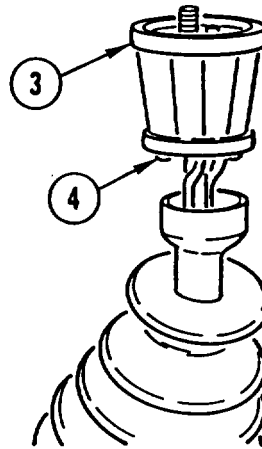
#### NOTE

Procedure is the same for all three transmission shift lines.

1. INSTALL transmission shift HOSE (1) in lever (2).

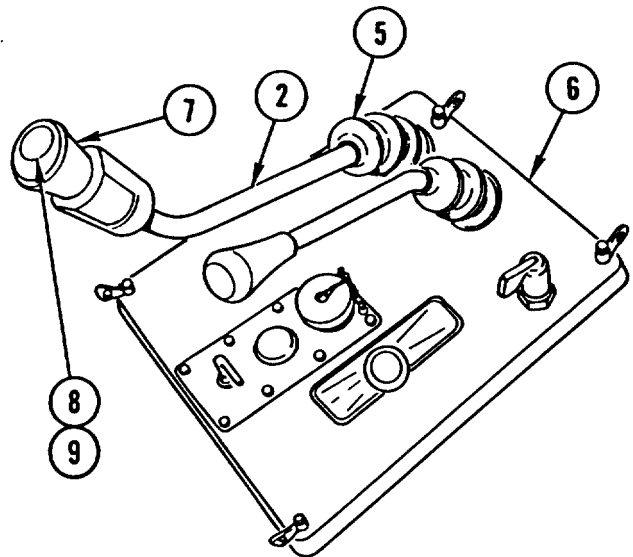


2. INSTALL VALVE (3) and three screws (4).



3. SLIDE BELLOWS (5) DOWN lever (2) and INSTALL BELLOWS (5) in floor platform (6).

4. INSTALL knob (7), nut (8), and CAP (9).



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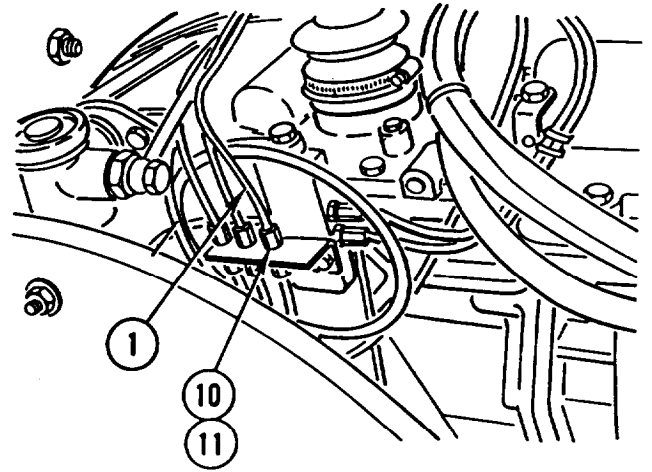
**TRANSMISSION SHIFT LINES REPLACEMENT (CONT)**

---

5. INSTALL nut (10) and new compression SLEEVE (11).
6. CONNECT transmission shift HOSE (1) and TIGHTEN NUT (11).

**NOTE**

Follow-on Maintenance:  
Lower cab (TM 5-2420-224-20).





## TRANSMISSION SHIFT CONTROLS REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

##### Reference

Page 3-92

TM 5-2420-224-20

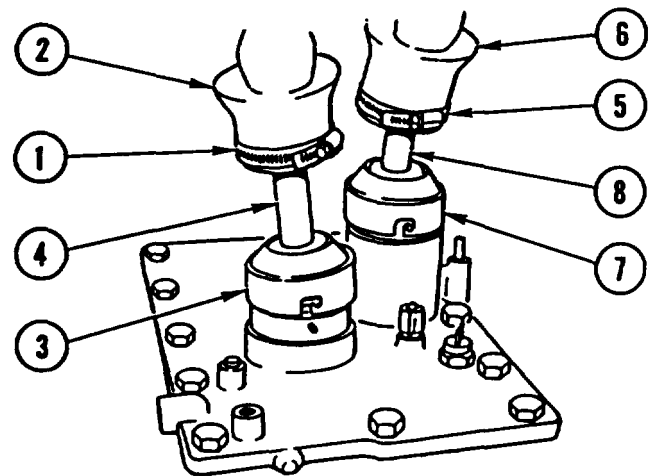
##### Condition Description

Transmission Shift Lines  
Removed

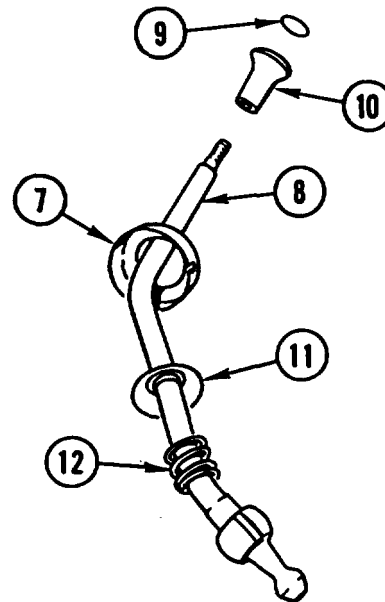
Floor Platform Removed

### REMOVAL

1. LOOSEN CLAMP (1), PULL UP BELLOWS (2), and ROTATE COVER (3) to left to unlock.
2. REMOVE main shift LEVER (4).
3. LOOSEN CLAMP (5), PULL UP BELLOWS (6), and ROTATE COVER (7) to left to unlock.
4. REMOVE group selector LEVER (8).



5. REMOVE plate (9) and KNOB (10) from group selector lever (8).
6. REMOVE COVER (7), spherical piece (11), and spring (12).



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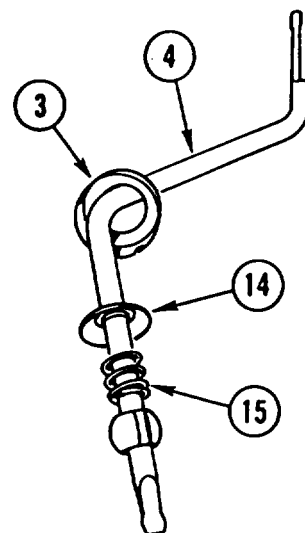
**TRANSMISSION SHIFT CONTROLS REPLACEMENT (CONT)**

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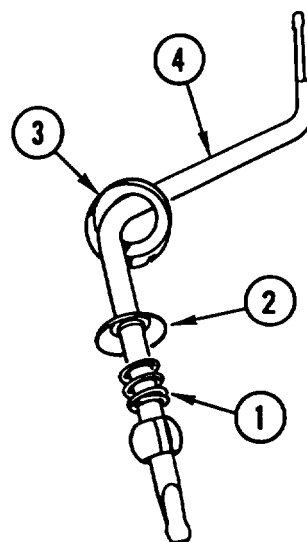
7. REMOVE COVER (3), spherical piece (14), and spring (15) from main shift lever (4).

**INSPECTION**

Inspect levers and springs for cracks or damage.

**INSTALLATION**

1. INSTALL spring (1), spherical piece (2), and COVER (3) on main shift lever (4).



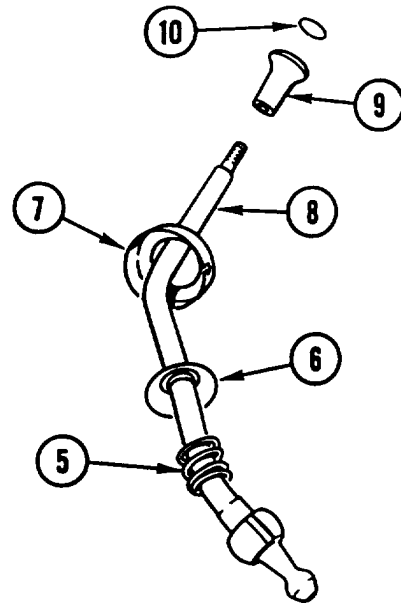
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**TRANSMISSION SHIFT CONTROLS REPLACEMENT (CONT)**

---

2. INSTALL spring (5), spherioal piece (6), and COVER (7) on group selector lever (8).

3. INSTALL KNOB (9) and plate (10).

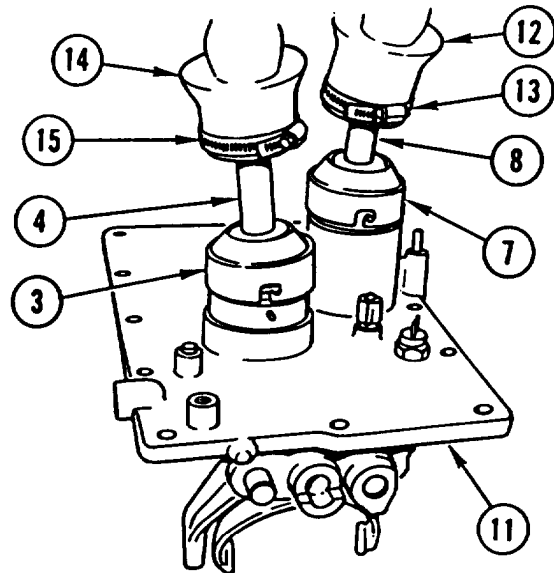


4. INSTALL group selector LEVER (8) in transmission top cover (11) and ROTATE COVER (7) to right to lock.

5. INSTALL BELLOWS (12) and TIGHTEN CLAMP (13).

6. INSTALL main shift LEVER (4) and ROTATE COVER (3) to right to lock.

7. INSTALL BELLOWS (14) and TIGHTEN CLAMP (15).



**NOTE**

Follow-on Maintenance:

Install transmission shift lines (page 3-92).

Install floor platform (TM 5-2420-224-20).

## TRANSMISSION MOUNT REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Personnel Required: (2)**

**Equipment Condition:**

**Reference**

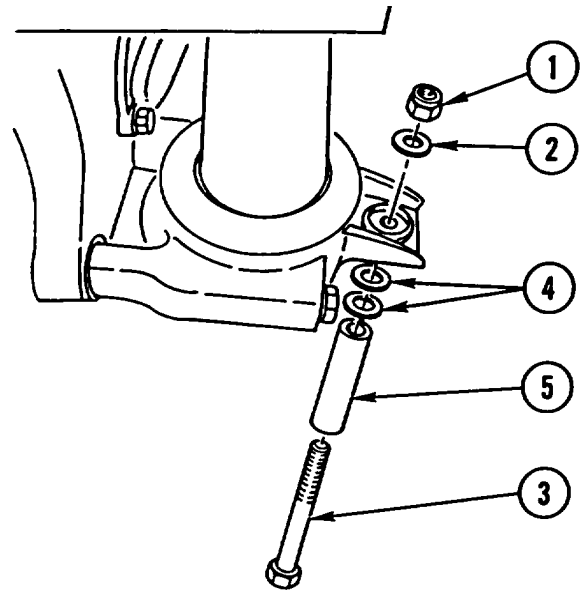
Page 3-68

**Condition Description**

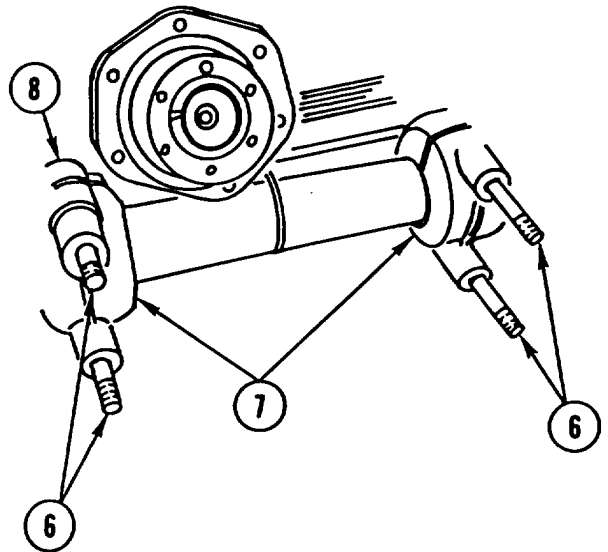
Transmission Removed

### REMOVAL

1. REMOVE nut (1), washer (2), capscrew (3), two bushings (4), and SPACER (5).



2. REMOVE four capscrews (6), two bearing brackets (7), and two bearing COVERS (8).

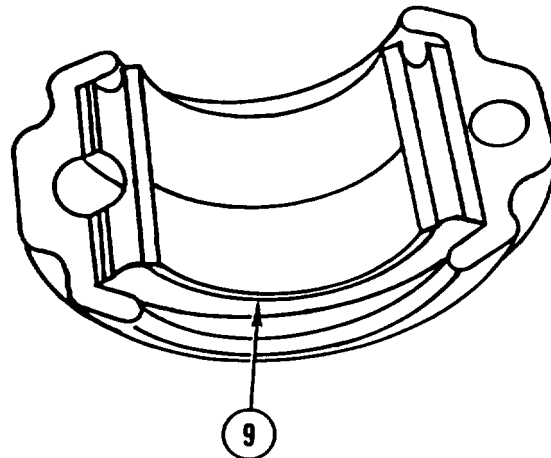


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**TRANSMISSION MOUNT REPLACEMENT (CONT)**

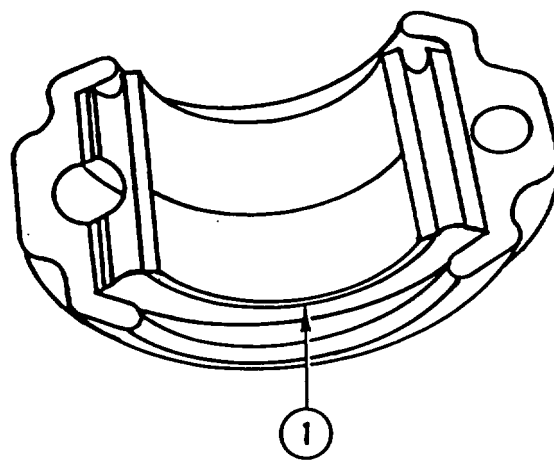
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3. REMOVE four GROMMETS (9).

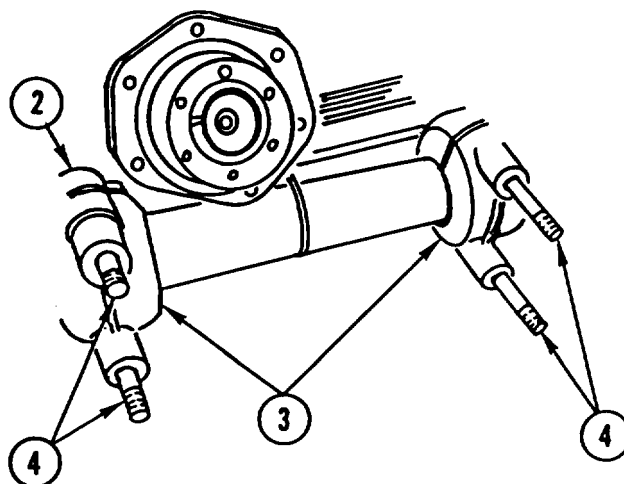


**INSTALLATION**

1. INSTALL four GROMMETS (1).



2. INSTALL two bearing COVERS (2), two bearing brackets (3), and four capscrews (4).



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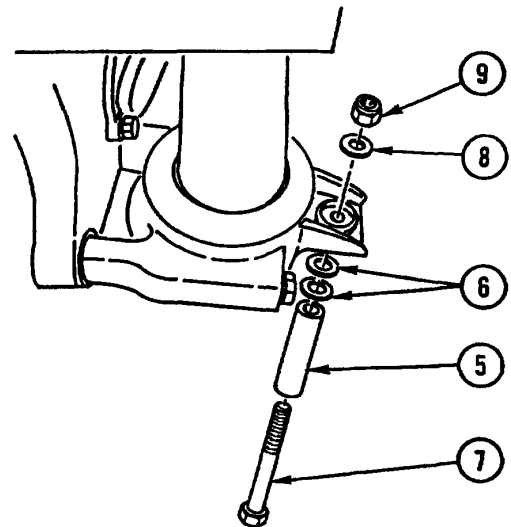
**TRANSMISSION MOUNT REPLACEMENT (CONT)**

---

3. INSTALL SPACER (5), two bushings (6), capscrew (7), washer (8), and nut (9).

**NOTE**

Follow-on Maintenance:  
Install transmission (page 3-68).



## Section IV. PROPELLER SHAFTS AND RELATED PARTS

### OVERVIEW

This section illustrates and describes procedures for maintenance of the propeller shafts and related parts. A list of tasks contained in this section is shown below:

	Page
Propeller Shaft Replacement .....	3-102
U-Joint Replacement .....	3-103
Axle Thrust Tube Replacement .....	3-105

### PROPELLER SHAFT REPLACEMENT

This task covers: a. Removal b. Installation

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Grease Appendix B, Item 24

#### REMOVAL

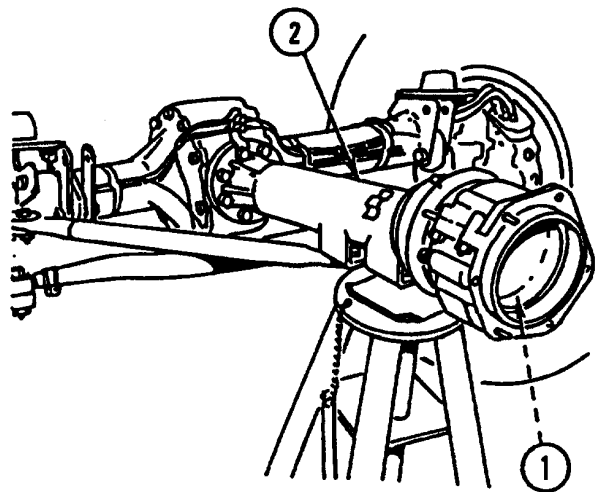
##### NOTE

- If replacing front propeller shaft, perform Removal steps 1 thru 30 of Front Axle Assembly Replacement (page 5-1).
- If replacing rear propeller shaft, perform steps 1 thru 21 of Rear Axle Assembly Replacement (page 6-1).

REMOVE propeller SHAFT (1) from axle thrust tube (2).

#### INSTALLATION

1. Apply a coat of grease to spline.
- 1A. INSTALL propeller SHAFT (1) in axle thrust tube (2).
2. IF FRONT propeller SHAFT was REMOVED, PERFORM Installation STEPS 11 thru 35 of FRONT AXLE ASSEMBLY REPLACEMENT (page 5-1).
3. IF REAR propeller SHAFT was REMOVED, PERFORM Installation STEPS 14 thru 33 of REAR AXLE ASSEMBLY REPLACEMENT (page 6-1).



---

## U-JOINT REPLACEMENT

---

This task covers: a. Removal b. Inspection c. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Kit, U-Joint

#### Equipment Condition:

##### Reference

Page 3-102

##### Condition Description

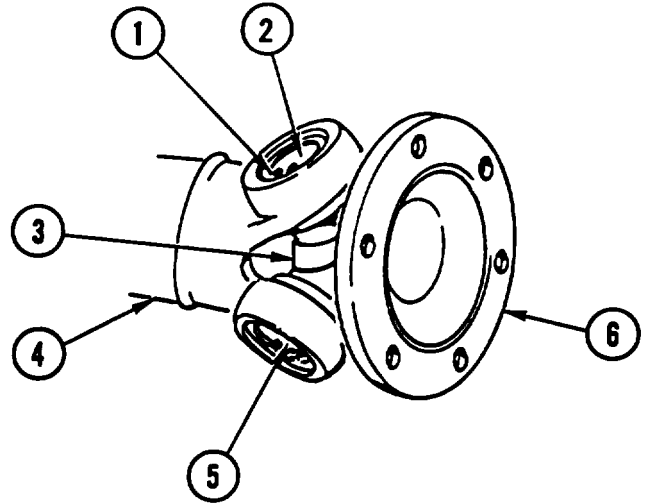
Front or Rear Propeller  
Shaft Removed

## REMOVAL

### NOTE

Procedure is the same for both U-joints.

1. REMOVE and DISCARD four retaining RINGS (1).
2. USING suitable PRESS, REMOVE two bearing caps (2) and cross SHAFT (3) from shaft (4). DISCARD bearing CAPS.
3. USING suitable PRESS, REMOVE two bearing caps (5) and cross SHAFT (3) from yoke (6). DISCARD bearing CAPS and cross SHAFT.



## INSPECTION

1. Inspect shaft for wear or cracks.
2. Inspect flange for burrs, wear, or cracks.
3. Inspect flange mounting bolt holes for elongation.



---

## U-JOINT REPLACEMENT (CONT)

---

### INSTALLATION

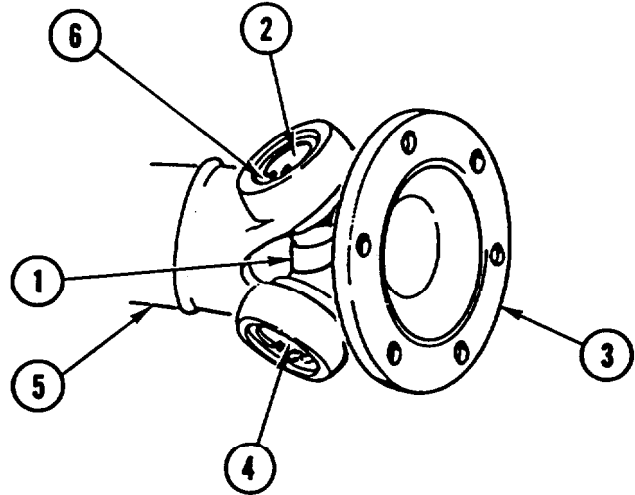
#### NOTE

Procedure is the same for both U-joints.

1. USING suitable PRESS, INSTALL new cross SHAFT (1) and two new bearing caps (2) in yoke (3).
2. USING suitable PRESS, INSTALL new cross SHAFT (1) and two new bearing caps (4) in shaft (5).
3. INSTALL four new retaining RINGS (6).

#### NOTE

Follow-on Maintenance:  
Install front or rear propeller shaft  
(page 3-102).



## AXLE THRUST TUBE REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Guide, P/N 406 589 01 59 00  
 Installer, P/N 435 489 01 35 00  
 Installing Tool, P/N 406 589 03 59 00  
 Puller, P/N 000 589 34 33 00  
 Puller, P/N 000 589 63 33 00

#### Materials/Parts:

Housing  
 Washer, Lock (4)  
 Seal  
 Packing  
 Shim(s)  
 Seal (2)  
 Compound, Sealing Appendix B, Item 15  
 Grease, Molybdenum Appendix B, Item 24  
 Disulfide  
 Twine, Cotton 4 Ft Long Appendix B, Item 49

#### Equipment Condition:

Reference	Condition Description
Page 5-1 or 6-1	Front or Rear Axle Assembly Removed
Page 5-14 or 6-12	Front or Rear Axle Thrust Arms Removed
Page 3-102	Front or Rear Propeller Shaft Removed

#### General Safety Instructions:

### WARNING

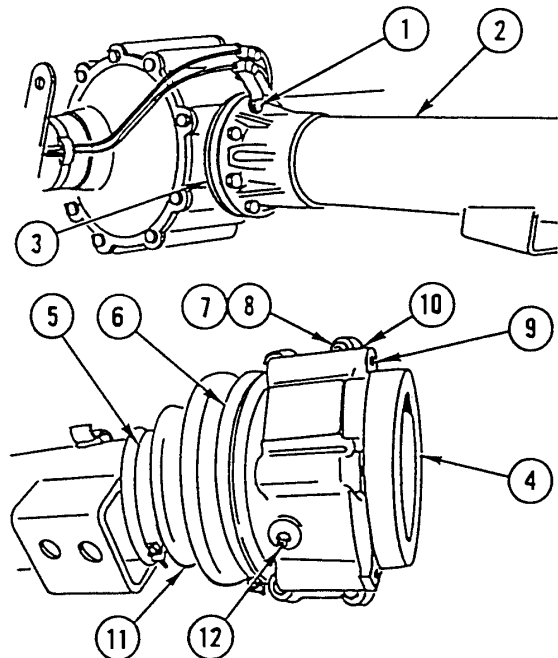
Axle thrust tube weighs 55 pounds (25 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting axle thrust tube.

### REMOVAL

#### NOTE

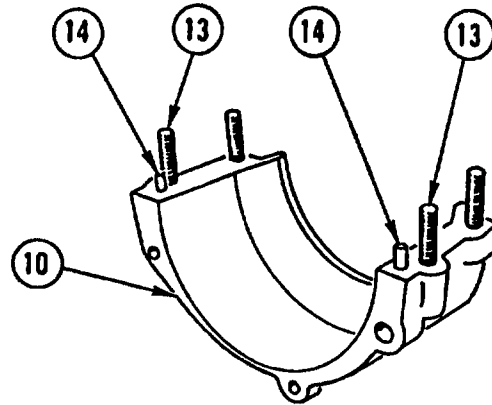
Procedure is the same for both thrust tubes.

1. REMOVE eight bolts (1) and axle thrust TUBE (2) from pinion shaft assembly (3).
2. REMOVE and DISCARD HOUSING (4).
3. LOOSEN CLAMP (5) and CLAMP (6).
4. REMOVE four nuts (7), four lock washers (8), HOUSING (9), and HOUSING (10). RETAIN lock WASHERS.
5. REMOVE BELLOWS (11) and two clamps (5 and 6).
6. REMOVE FITTING (12) from HOUSING (9).



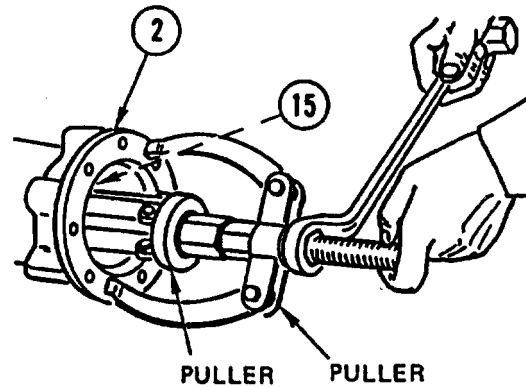
## AXLE THRUST TUBE REPLACEMENT (CONT)

7. IF WORN or DAMAGED, REMOVE four STUDS (13) from HOUSING (10).
8. IF WORN or DAMAGED, REMOVE two PINS (14).
9. USING PULLERS, REMOVE SEAL (15) from axle thrust tube (2). DISCARD SEAL.



### INSPECTION

1. Inspect bellows for tears or cracks.
2. Inspect axle thrust tube and two housings for cracks, scoring, or other defects.

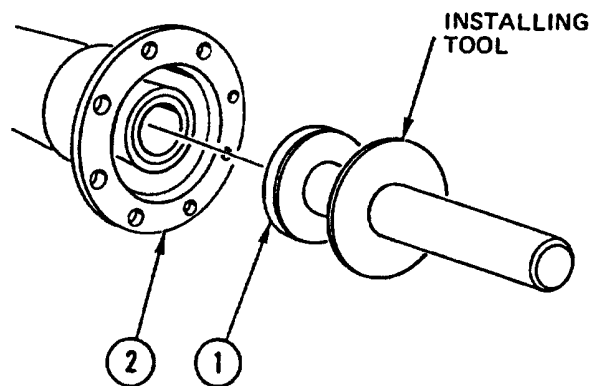


### INSTALLATION

#### NOTE

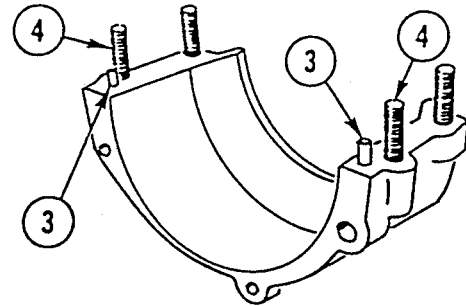
Procedure is the same for both thrust tubes.

1. USING INSTALLING TOOL, INSTALL new SEAL (1) in axle thrust tube (2).



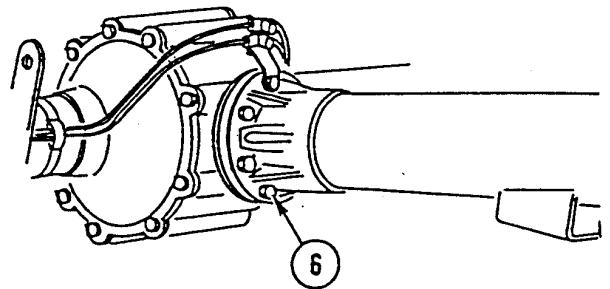
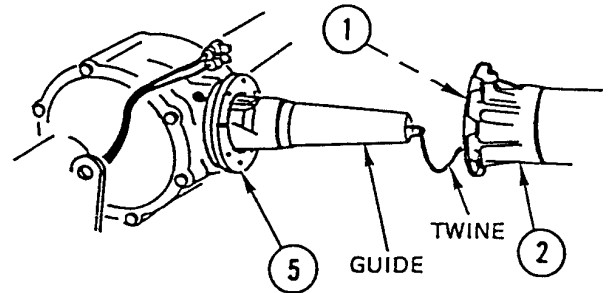
## AXLE THRUST TUBE REPLACEMENT (CONT)

2. IF REMOVED, INSTALL two new PINS (3).
3. IF REMOVED, INSTALL four new STUDS (4).
4. APPLY COAT of MOLYBDENUM DISULFIDE GREASE to SEAL (1).

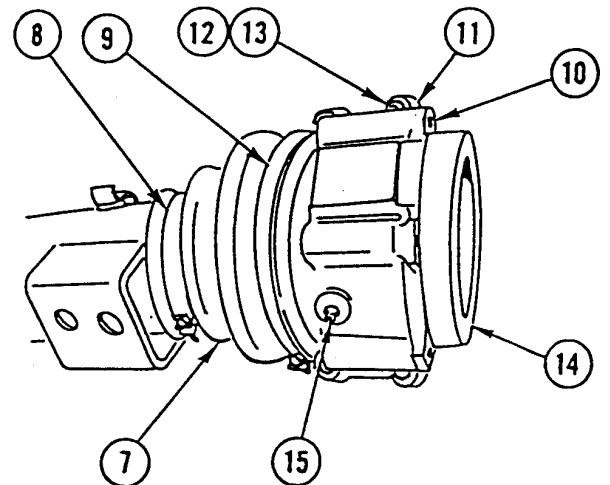


**WARNING**

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 attention.

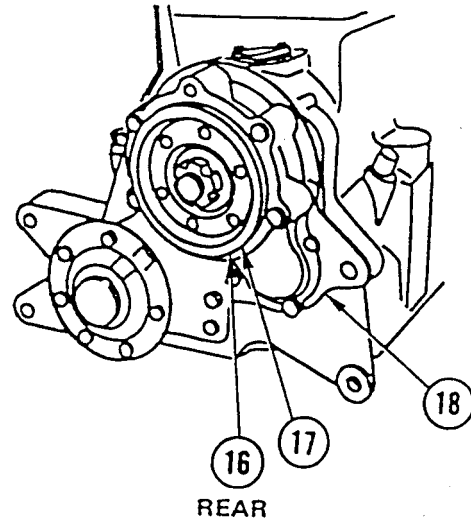


5. APPLY COAT of SEALING COMPOUND to mating SURFACES of thrust tube (2) and pinion shaft assembly (5).
6. USING GUIDE, POSITION thrust TUBE (2) on pinion shaft assembly (5).
7. APPLY COAT of SEALING COMPOUND to eight BOLTS (6) and INSTALL eight BOLTS (6). TIGHTEN BOLTS to 67 lb-ft (90 N.m).
8. INSTALL BELLOWS (7) and two clamps (8 and 9). DO NOT TIGHTEN CLAMPS.
9. INSTALL two HOUSINGS (10 and 11), four nuts (12), and four lock washers (13).
10. TIGHTEN two CLAMPS (8 and 9).
11. INSTALL new HOUSING (14).
12. INSTALL FITTING (15).

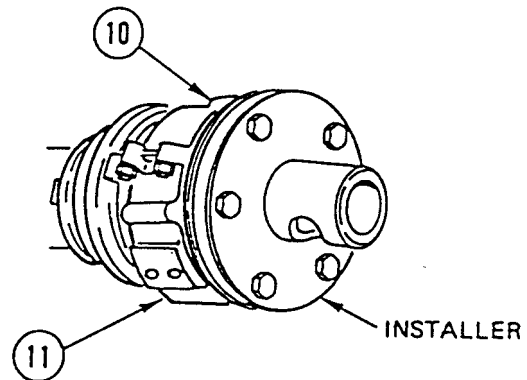


## AXLE THRUST TUBE REPLACEMENT (CONT)

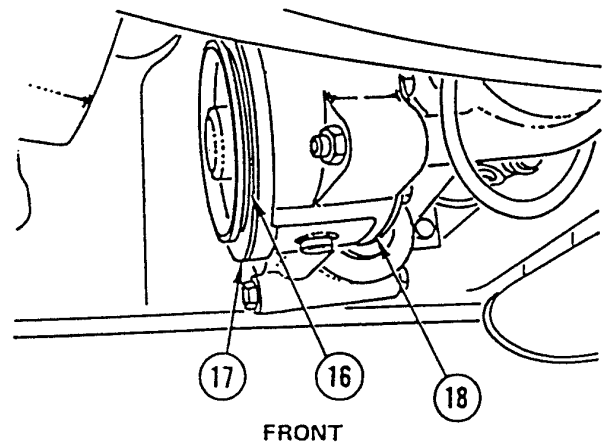
13. REMOVE PACKING (16) and SHIM(S) (17) from transmission housing (18). DISCARD PACKING and SHIM(S).



14. INSTALL INSTALLER on two housings (10 and 11) using suitable bolts and nuts. DO NOT TIGHTEN.
15. EVENLY TIGHTEN NUTS and BOLTS while moving installer up and down until a noticeable change in resistance is felt.
16. USING feeler GAGE, MEASURE GAP between two housings (10 and 11) and installer in three different locations.
17. AVERAGE MEASUREMENTS from step 16 to obtain thickness of shim(s) to be installed.
18. REMOVE INSTALLER from two housings (10 and 11).



19. INSTALL new SHIM(S) (17), equal to thickness determined in step 17, on transmission (18).
20. INSTALL new PACKING (16) on transmission housing (18).



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**AXLE THRUST TUBE REPLACEMENT (CONT)**

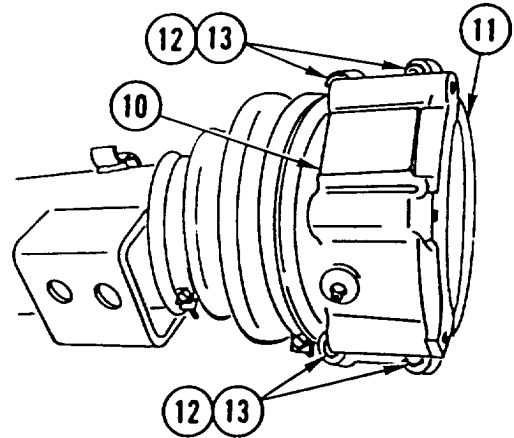
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21. REMOVE four nuts (12), four lock washers (13), HOUSING (10), and HOUSING (11). DISCARD lock WASHERS.

**NOTE**

Follow-on Maintenance:

- Install front or rear propeller shaft (page 3-102).
- Install front or rear axle thrust arms (page 5-14 or 6-12).
- Install front or rear axle assembly (page 5-1 or 6-11).





## CHAPTER 4 ELECTRICAL SYSTEM MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the electrical system. A list of tasks contained in this chapter is shown below.

	Page
Alternator Bearings Replacement.. . . . .	4-2
Regulator Replacement . . . . .	4-4
Starter Brushes Replacement . . . . .	4-6
Main Wiring Harness Replacement.. . . . .	4-10
Alternator Cable Assembly Replacement . . . . .	4-28
Crane Mast Floodlight Wiring Harness Replacement . . . . .	4-30
Trailer Wiring Harness Replacement. . . . .	4-32
Dome Light Cable Assembly Replacement . . . . .	4-34
Hazard Warning Light Wiring Harness Replacement . . . . .	4-36
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Forklift Wiring Harness Replacement. . . . .	4-42
Forklift Wiring Harness Replacement . . . . .	4-44
Forklift Power Cable Replacement . . . . .	4-46
Forklift Connector to Fuse Holder Wiring Harness Replacement . . . . .	4-46
Cab Floor separation Point to Hydraulic Suspension Lockout Wiring Harness Replacement . . . . .	4-50
Cab Floor Separation Point to Rear Wall Wiring Harness Replacement . . . . .	4-52
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Frame Wiring Harness Replacement. . . . .	4-58
Suppressor Filter Electrical Lead Replacement . . . . .	4-66
Cap Plug Connector to Heater Panel Switch and Master Light Switch Wiring Harness Replacement . . . . .	4-68
Chassis Wiring Harness Replacement . . . . .	4-70
Throttle Solenoid Electrical Leads Replacement . . . . .	4-74



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## ALTERNATOR BEARINGS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Spring  
Tension (4)

Packing

Kit, Parts

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Alternator Removed
Page 4-4	Regulator Removed

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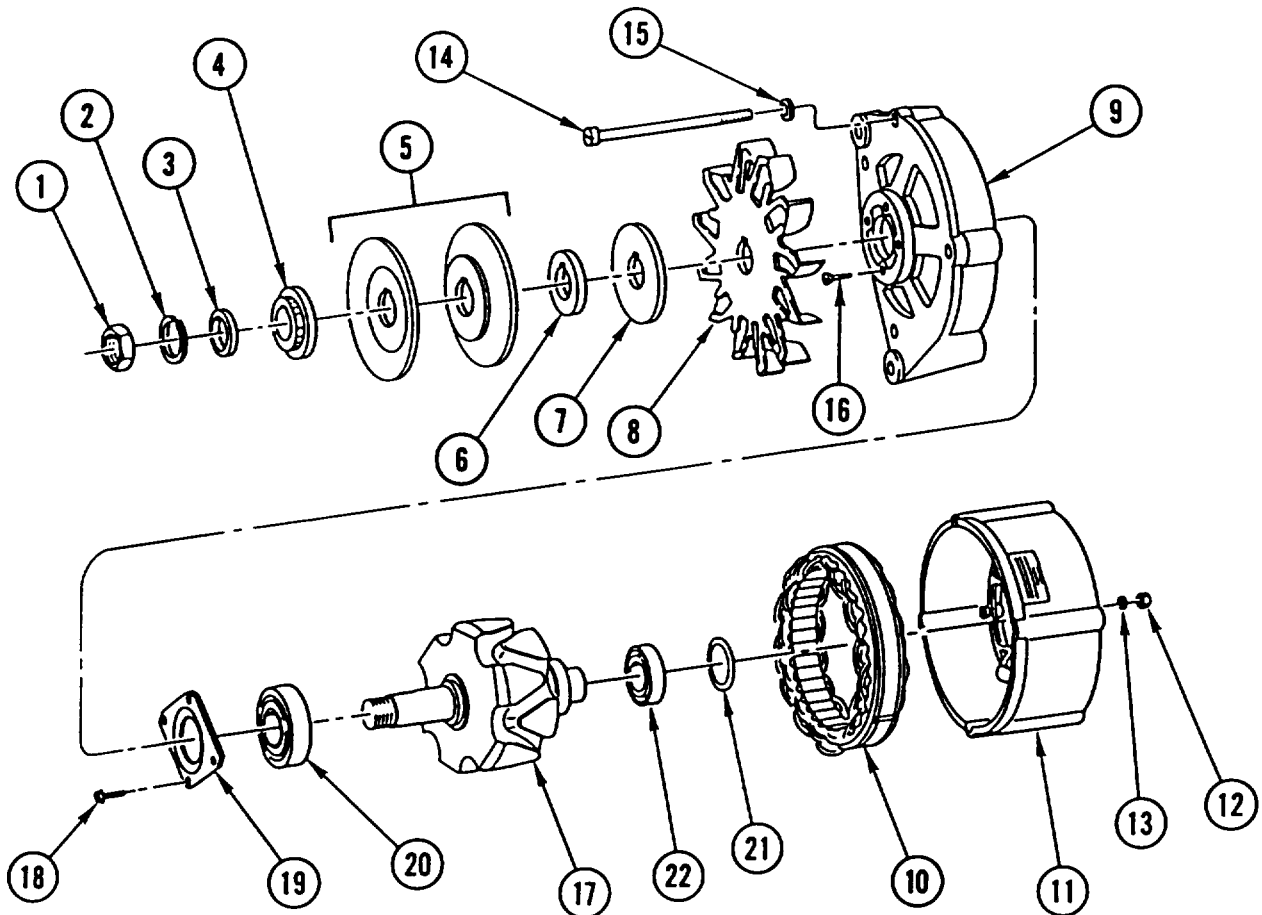
### REMOVAL

1. REMOVE nut (1), retaining ring (2), washer (3), retainer (4), pulley (5), spacer (6), spacer (7), and IMPELLER (8).
2. MATCHMARK front HOUSING (9), STATOR (10), and rear HOUSING (11).
3. REMOVE four nuts (12), four spring tension washers (13), four capscrews (14), four washers (15), four screws (16), and front HOUSING (9). DISCARD spring tension WASHERS.
4. REMOVE ROTOR (17), four screws (18), and cover (19).
5. USING suitable PULLER, REMOVE BEARING (20).
6. REMOVE and DISCARD PACKING (21).
7. USING suitable PULLER, REMOVE BEARING (22).

---

**ALTERNATOR BEARINGS REPLACEMENT (CONT)**


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**INSTALLATION**

1. INSTALL BEARING (22) and new packing (21).
2. INSTALL bearing (20), cover (19), four screws (18), and ROTOR (17).
3. ALINE MATCHMARKS on rear HOUSING (11), STATOR (10), and front HOUSING (9).
4. INSTALL front HOUSING (9), four screws (16), four washers (15), four capscrews (14), four new spring tension washers (13), and four nuts (12).
5. INSTALL IMPELLER (8), spacer (7), spacer (6), pulley (5), retainer (4), washer (3), retaining ring (2), and nut (1).

**NOTE**

Follow-on Maintenance:

Install regulator (page 4-4).  
 Install alternator (TM 5-2420-224-20).

---

## REGULATOR REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Spring  
Tension (2)

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition	Description
TM 5-2420-224-20	Cab Tilted	

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

REMOVE two screws (1), two spring tension washers (2), and REGULATOR (3). DISCARD spring tension WASHERS.

### INSTALLATION

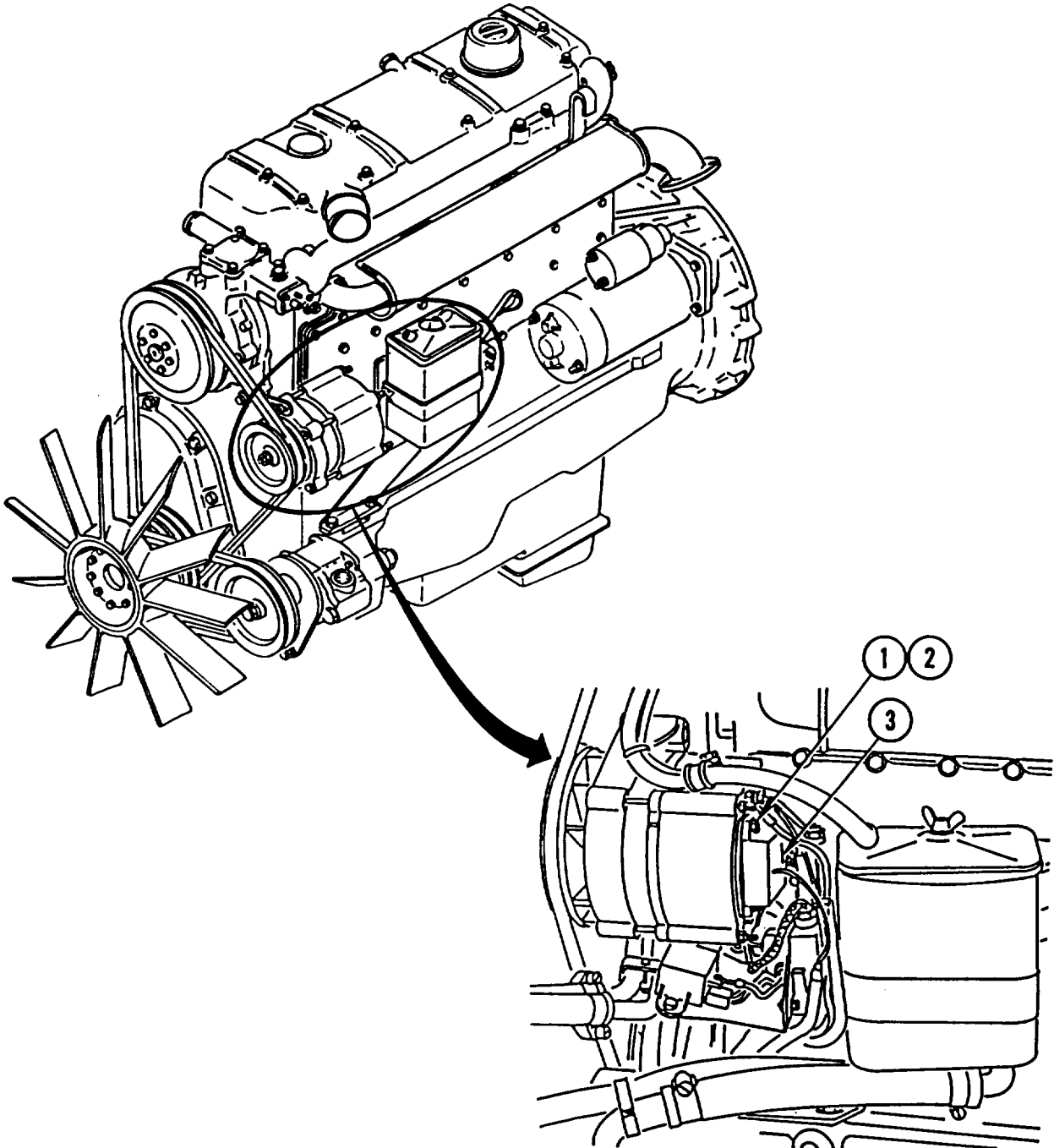
INSTALL REGULATOR (3), two new spring tension washers (2), and two screws (1).

#### NOTE

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).

REGULATOR REPLACEMENT (CONT)



---

## STARTER BRUSHES REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC4910-95-CL-A31  
 Dowel (4), Appendix C, Item 1

#### References:

TM 5-2420-224-20

#### Equipment condition:

#### Materials/Parts:

Screw (2)

Gasket

Kit

#### Reference

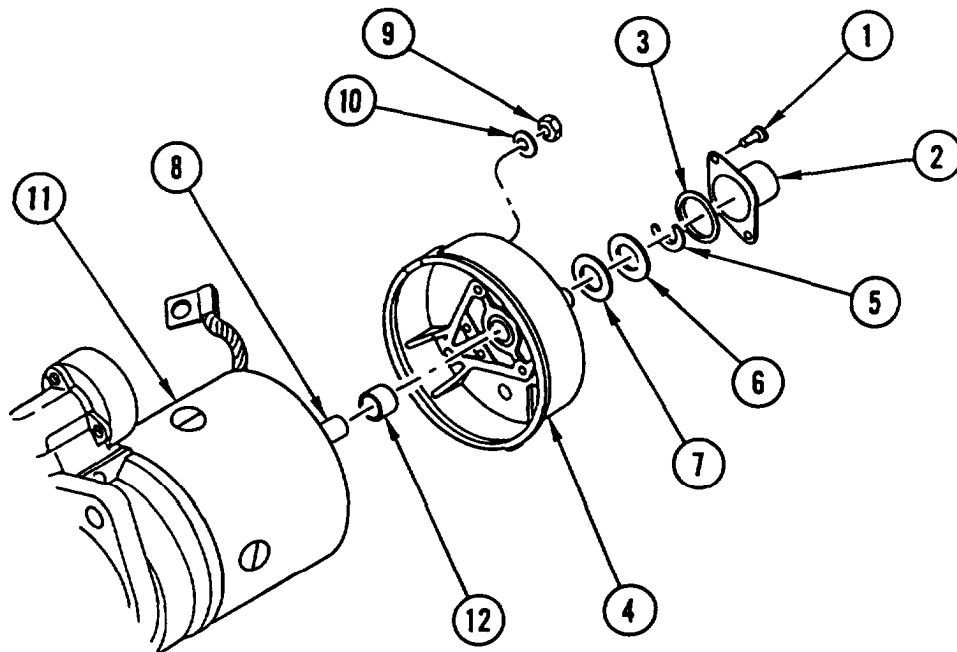
TM 5-2420-224-20

#### Condition Description

Starter Removed

---

### REMOVAL



1. REMOVE two screws (1), end BELL (2), and gasket (3) from end bell (4), DISCARD SCREWS and GASKET.

#### NOTE

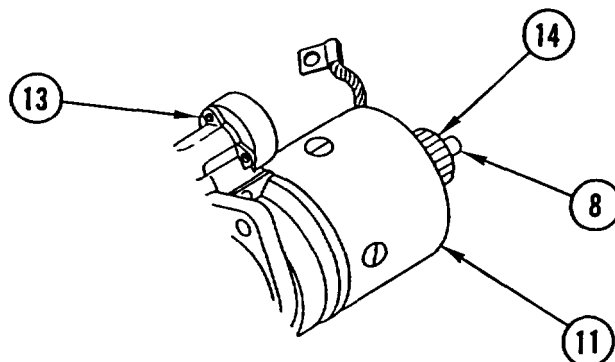
Shims and washers may or may not be present. if present, note quantity of shims and washers removed to aid in assembly.

2. REMOVE and DISCARD lock washer RING (5), SHIM(S) (6), and WASHER(S) (7) from armature (8).
3. REMOVE two nuts (9), two washers (10), and end BELL (4) from housing (11).
4. IF DAMAGED, REMOVE BUSHING (12) from end bell (4).

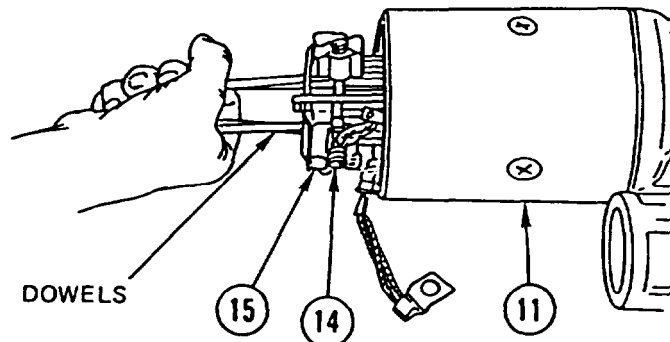
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**STARTER BRUSHES REPLACEMENT (CONT)**


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5. REMOVE HOUSING (11) from housing (13) UNTIL brush set BRACKET (14) is approximately HALF-WAY off armature (8).

**CAUTION**

Install dowels carefully to prevent damage to brushes.

6. INSTALL four DOWELS in brush holder (15). HOLD four DOWELS together and REMOVE HOUSING (11).

**CAUTION**

Use care to avoid damaging brushes.

7. REMOVE four DOWELS from brush holder (15).

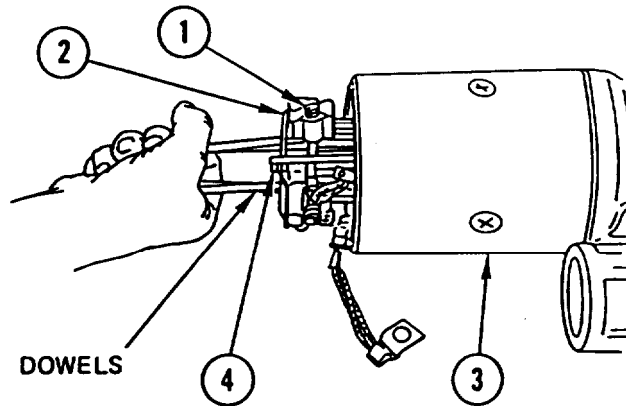
**NOTE**

Brush set bracket may be attached to brush holder and housing with screws or it may be soldered. If brush set bracket is soldered, do not perform step 8 until inspection has been performed and replacement of brush holder is determined to be necessary.

8. IF DAMAGED, REMOVE brush set BRACKET (14) from brush holder (15) and housing (11).

## STARTER BRUSHES REPLACEMENT (CONT)

### INSTALLATION

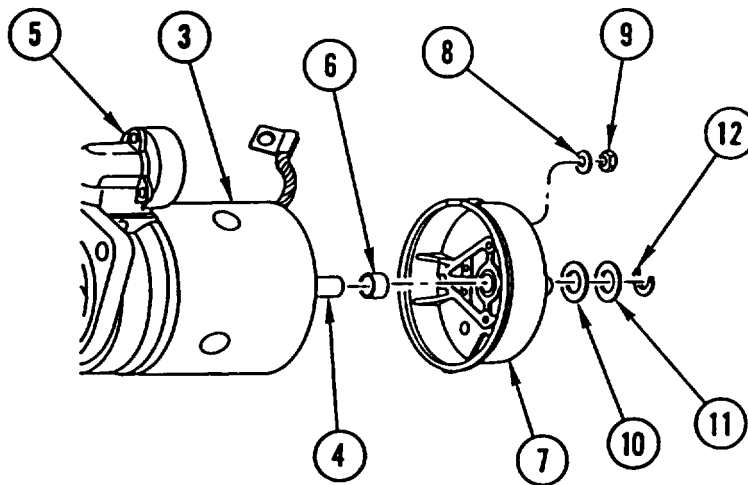


1. IF REMOVED, INSTALL new brush set BRACKET (1) in brush holder (2) and housing (3).

### CAUTION

Use care to avoid damaging brushes.

2. INSTALL BRUSH in its bracket on brush holder (2). INSTALL DOWEL in brush holder (2) approximately half the width of brush to hold brush in place.
3. REPEAT STEP 2 for remaining three brushes in brush set bracket (1).
4. HOLD four DOWELS together and INSTALL HOUSING (3) and brush holder (2) over armature (4).

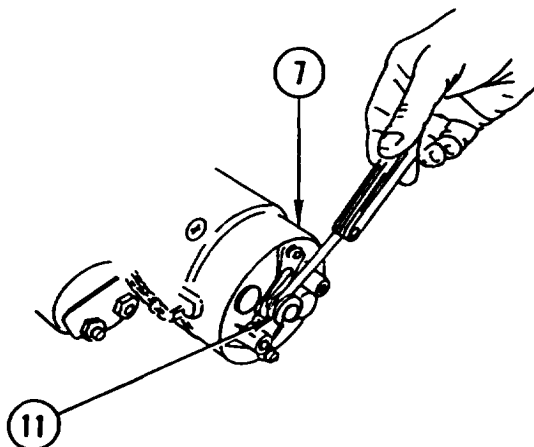


5. REMOVE four DOWELS and completely INSTALL HOUSING (3) in housing (5).
6. IF REMOVED, INSTALL new BUSHING (6) in end bell (7).
7. INSTALL end BELL (7), two washers (8), and two nuts (9) on housing (3).
8. INSTALL new washer(s) (10), new shim(s) (11), and new lock washer RING (12) as noted during Removal.

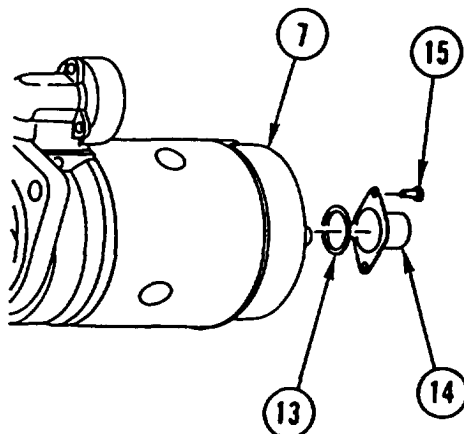
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**STARTER BRUSHES REPLACEMENT (CONT)**

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9. USING feeler GAGE. MEASURE GAP between shim(s) (11 ) and end bell (7). Measurement MUST be 0.002-0.016 in. (0.05-0.4 mm). If measurement is NOT corrected, ADD or REMOVE SHIM(S) to achieve correct measurement.



10. INSTALL new gasket (13), end BELL (14), and two new screws (15) on end bell (7).

**NOTE**

Follow-on Maintenance:  
 Install starter (TM 5-2420-224-20).



## MAIN WIRING HARNESS REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit; SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

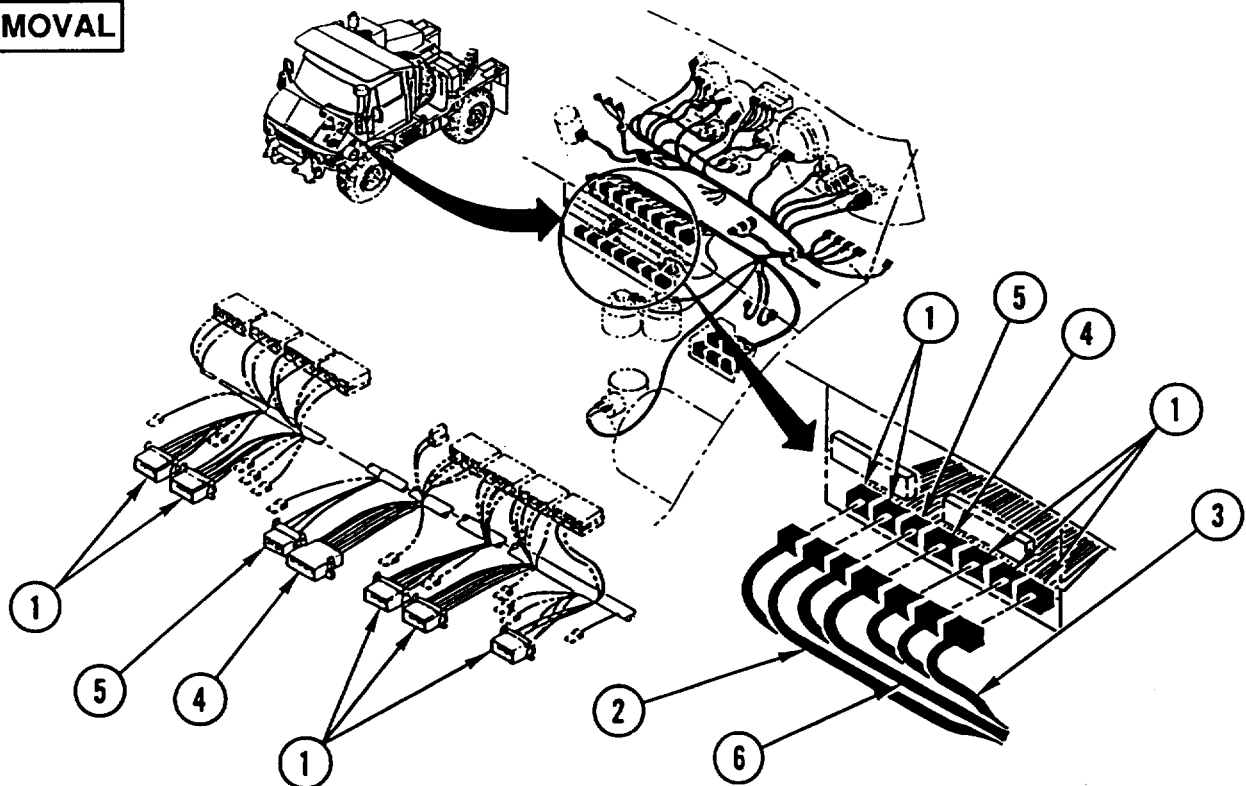
Reference	Condition Description
TM 5-2420-224-20	Fuse Holders Removed
TM 5-2420-224-20	Air Cleaner Ducts Removed
TM 5-2420-224-20	Relays Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

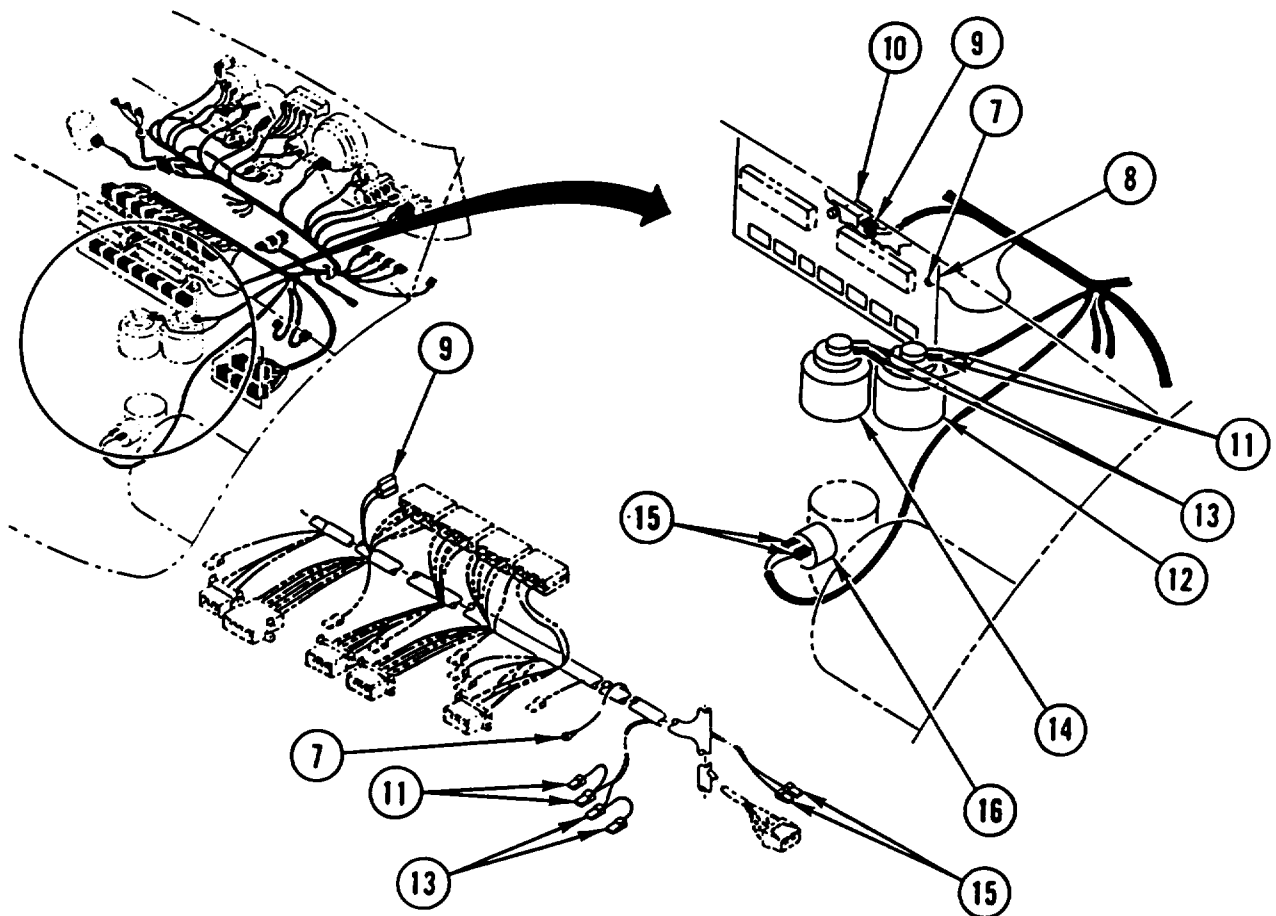
### REMOVAL



## MAIN WIRING HARNESS REPLACEMENT (CONT)

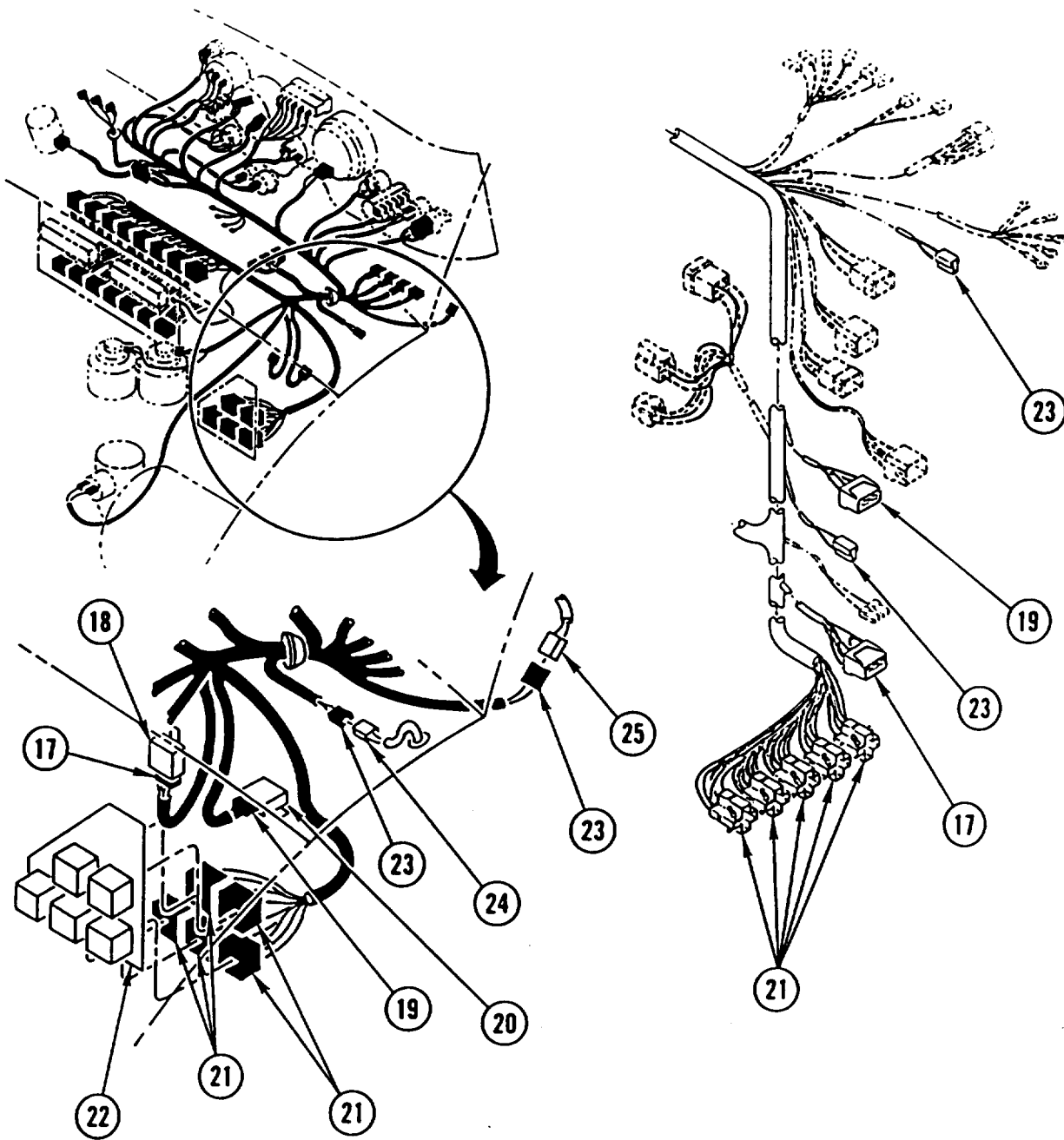
### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps and screw terminals. Discard tiedown strap(s).
  - Only remove hardware securing wiring harness or lead to be removed.
1. DISCONNECT five 6-pin CONNECTORS (1) from auxiliary headlight, front composite light, and blackout driving light wiring harness (2) and frame wiring harness (3).
  2. Disconnect 8-pin CONNECTOR (4) and 4-pin CONNECTOR (5) from alternator cable assembly (6).



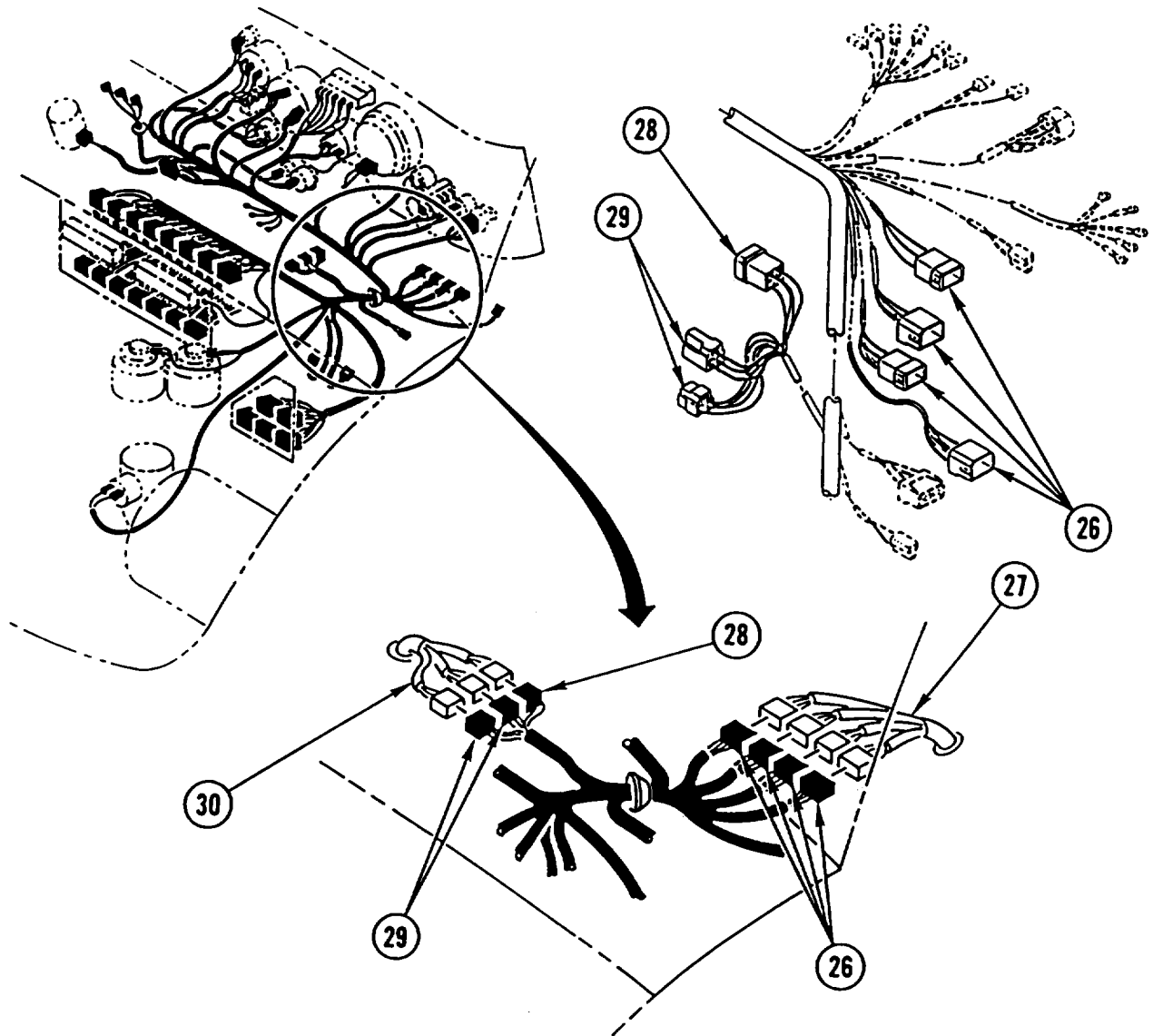
3. Disconnect TERMINAL (7) from mounting bracket (8).
4. Disconnect 2-pin CONNECTOR (9) from diode (10).
5. Disconnect two CONNECTORS (11) from clutch hydraulic reservoir (12).
6. Disconnect two CONNECTORS (13) from brake fluid reservoir (14).
7. Disconnect two CONNECTORS (15) from air cleaner restrictor indicator switch (16).

**MAIN WIRING HARNESS REPLACEMENT (CONT)**



8. DISCONNECT 6-pin CONNECTOR (17) from warning horn delay relay (18).
9. DISCONNECT 6-pin CONNECTOR (19) from wiper switch (20).
10. DISCONNECT five 5-pin CONNECTORS (21) from mounting bracket (22).
11. DISCONNECT two 2-pin CONNECTORS (23) from cab heater lead (24) and dome light cable assembly (25).

**MAIN WIRING HARNESS REPLACEMENT (CONT)**

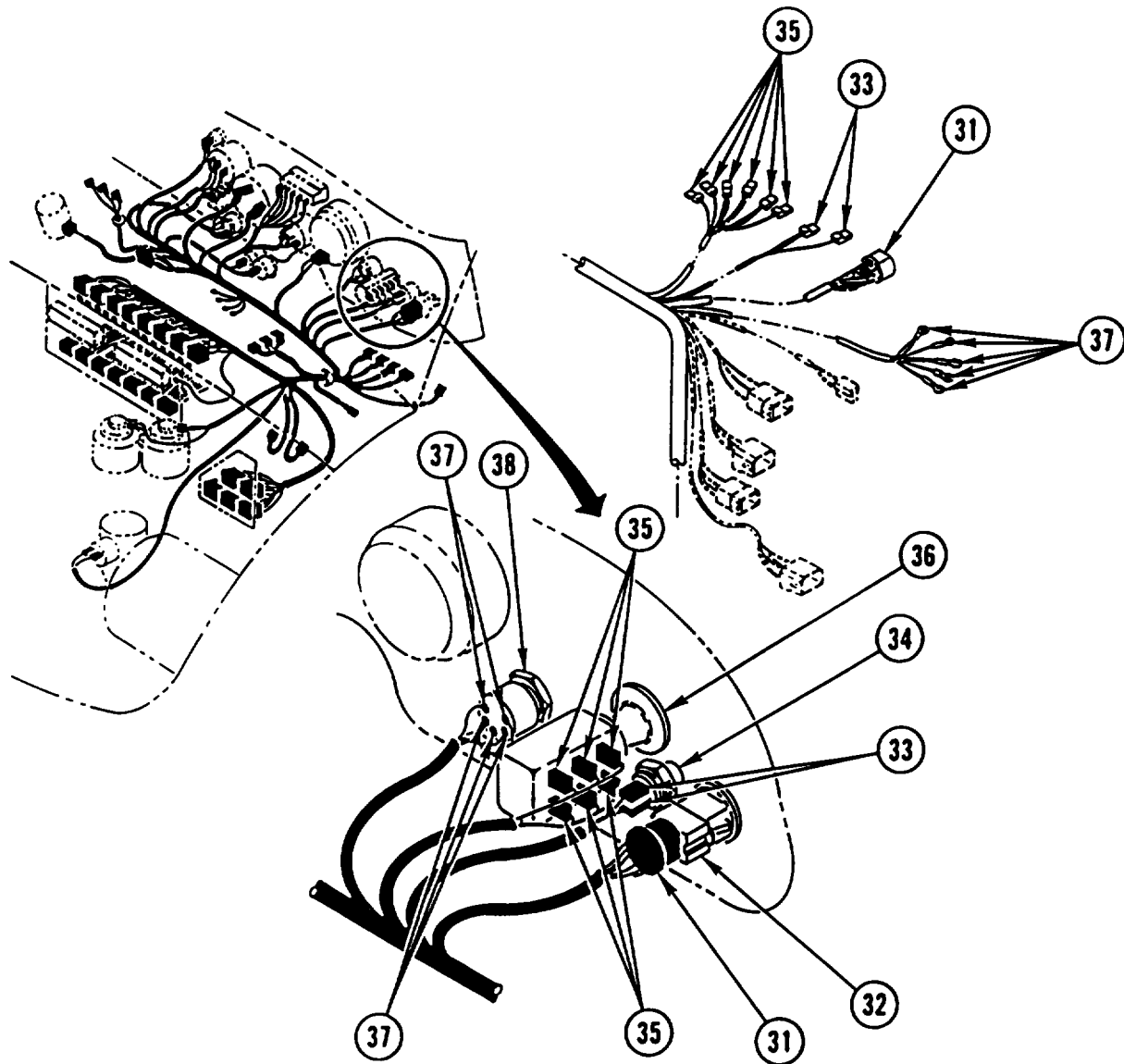


12. DISCONNECT four 4-pin CONNECTORS (26) from cap plug connector to heater panel switch and master light switch wiring harness (27).
13. DISCONNECT 4-pin CONNECTOR (28) and two 3-pin connectors (29) from hazard warning light wiring harness (30).

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**MAIN WIRING HARNESS REPLACEMENT (CONT)**

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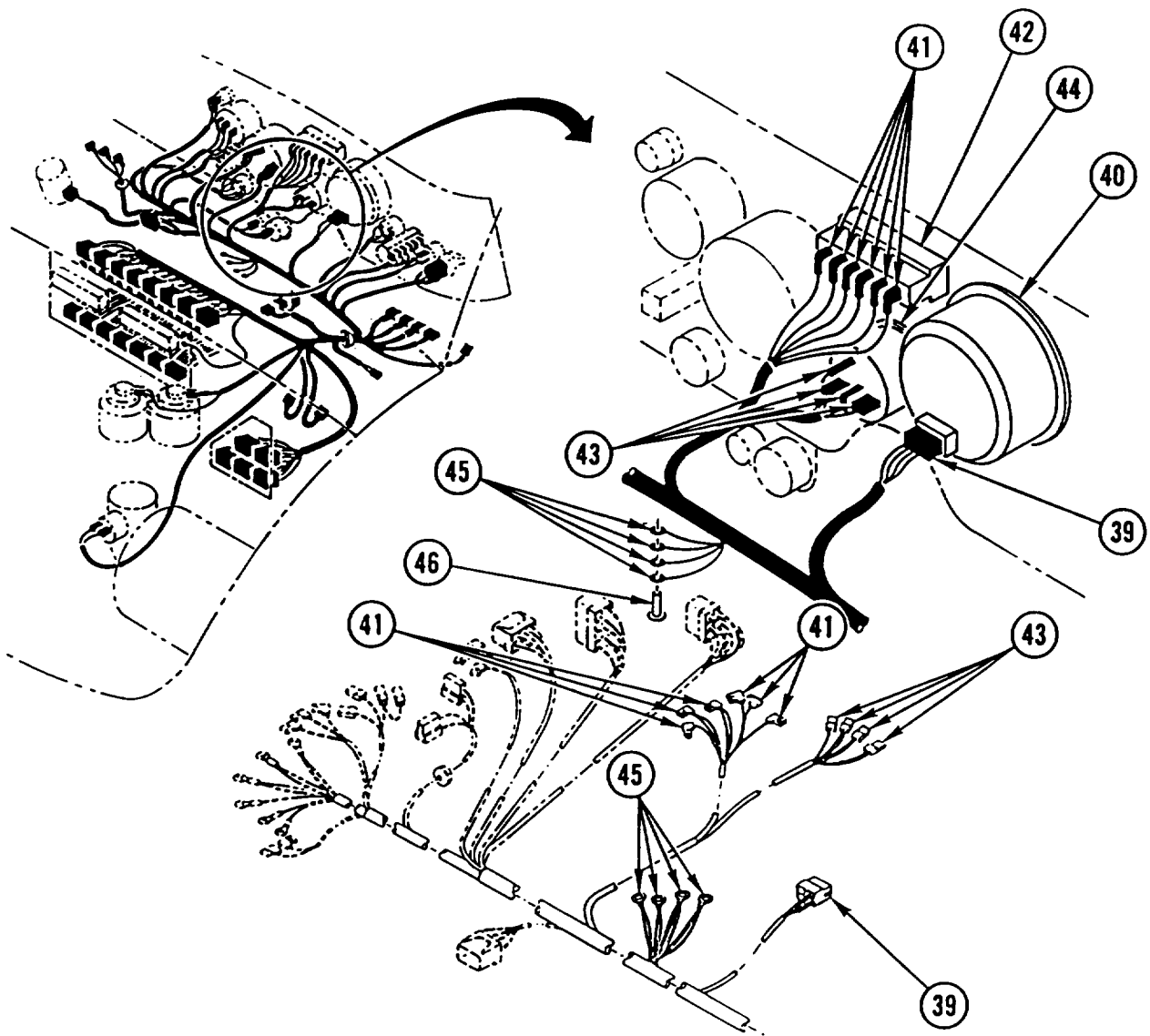


14. DISCONNECT 10-pin CONNECTOR (31) from hazard warning switch (32).
15. DISCONNECT two CONNECTORS (33) from starter switch (34).
16. DISCONNECT six CONNECTORS (35) from windshield wiper/washer switch (36).
17. DISCONNECT five TERMINALS (37) from ignition switch (38).

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**MAIN WIRING HARNESS REPLACEMENT (CONT)**


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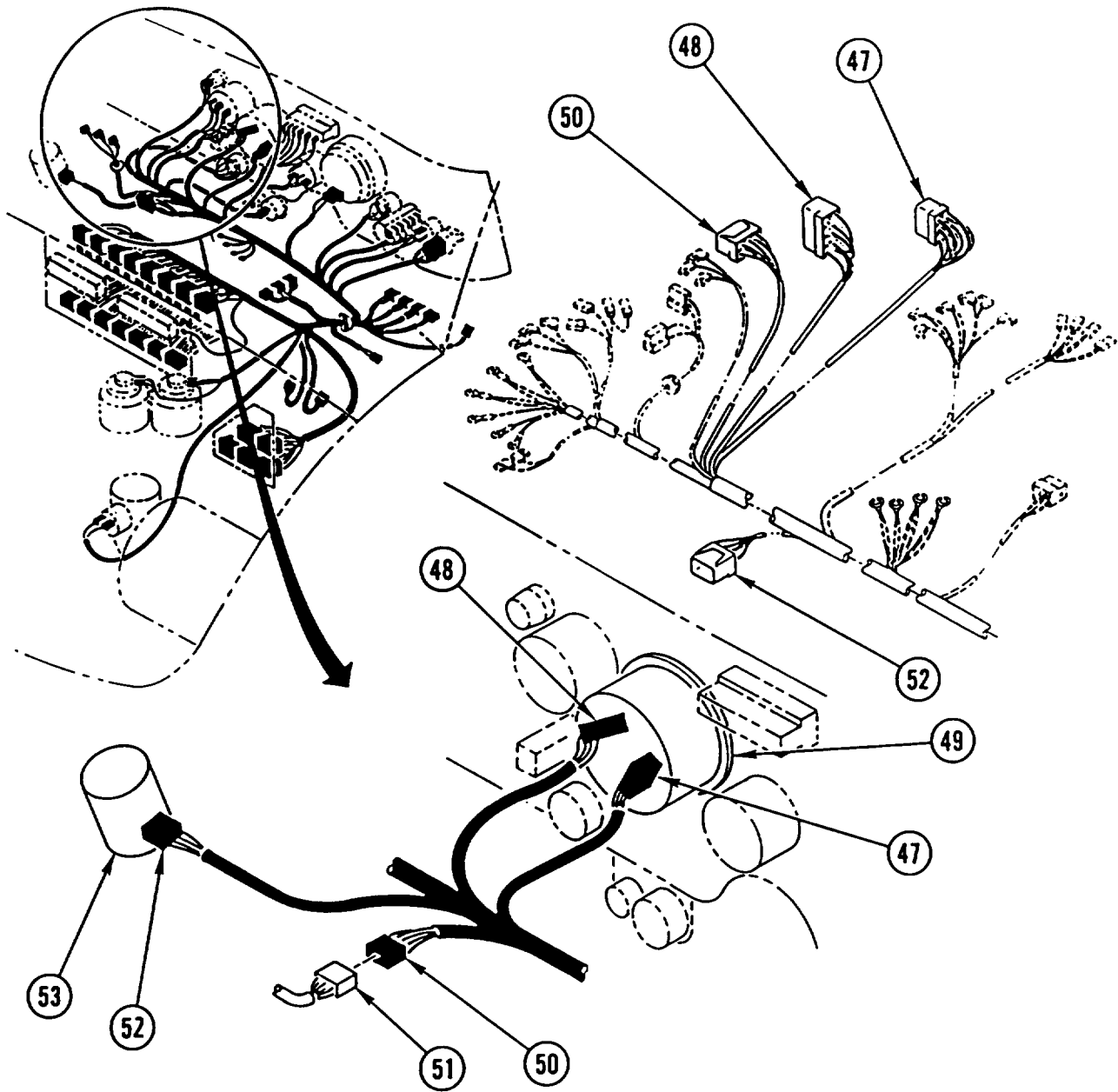


18. DISCONNECT 4-pin CONNECTOR (39) from speedometer (40).
19. DISCONNECT six CONNECTORS (41) from instrument cluster panel light (42).
20. DISCONNECT four CONNECTORS (43) from tachometer (44).
21. DISCONNECT four TERMINALS (45) from ground stud (46).

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**MAIN WIRING HARNESS REPLACEMENT (CONT)**

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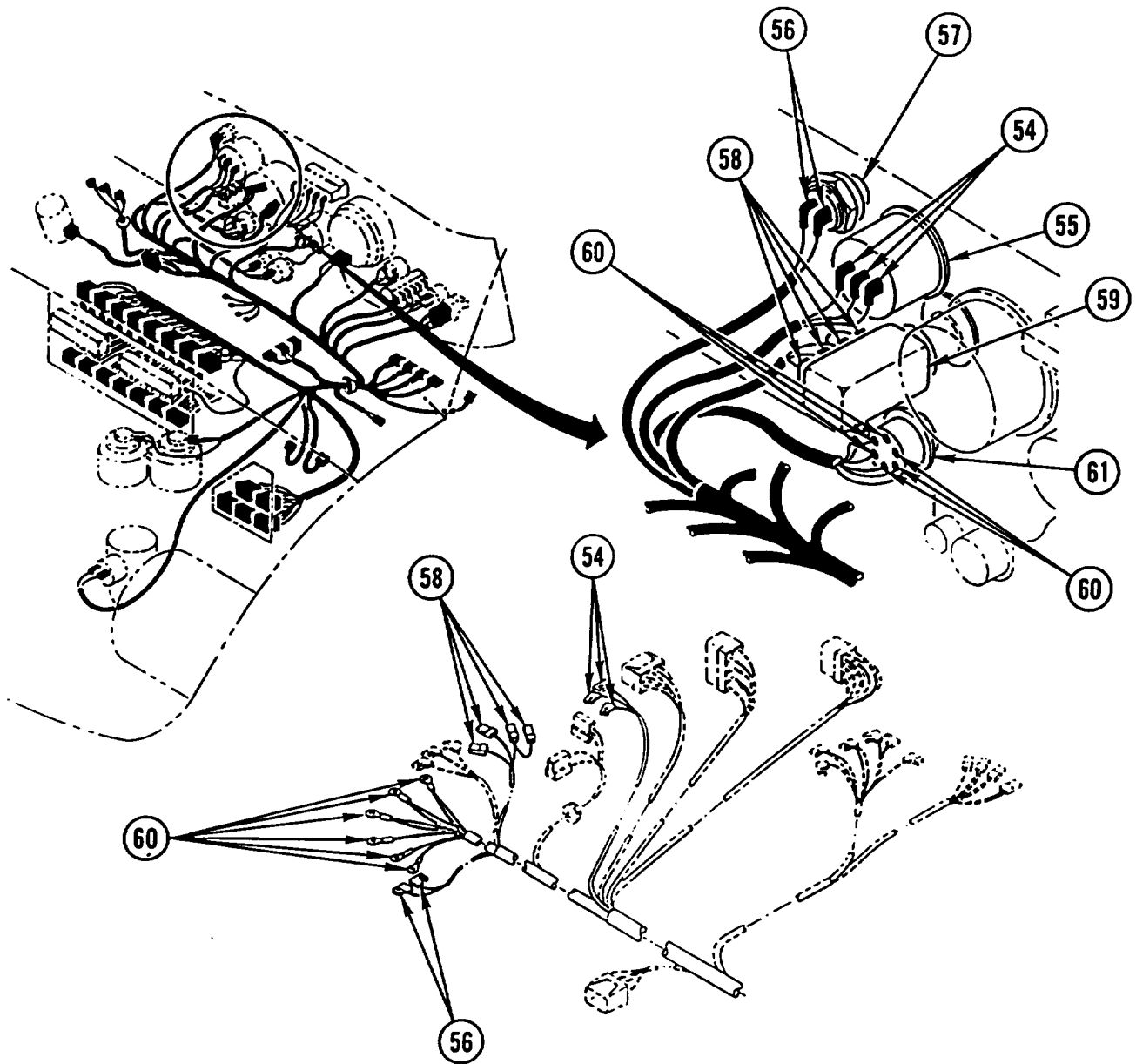


- 22. DISCONNECT 6-pin CONNECTOR (47) and 8-pin connector (48) from liquid indicator (49).
- 23. DISCONNECT 6-pin CONNECTOR (50) from horn, low beam/high beam switch lead (51).
- 24. DISCONNECT 6-pin CONNECTOR (52) from windshield wiper motor (53).

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**MAIN WIRING HARNESS REPLACEMENT (CONT)**


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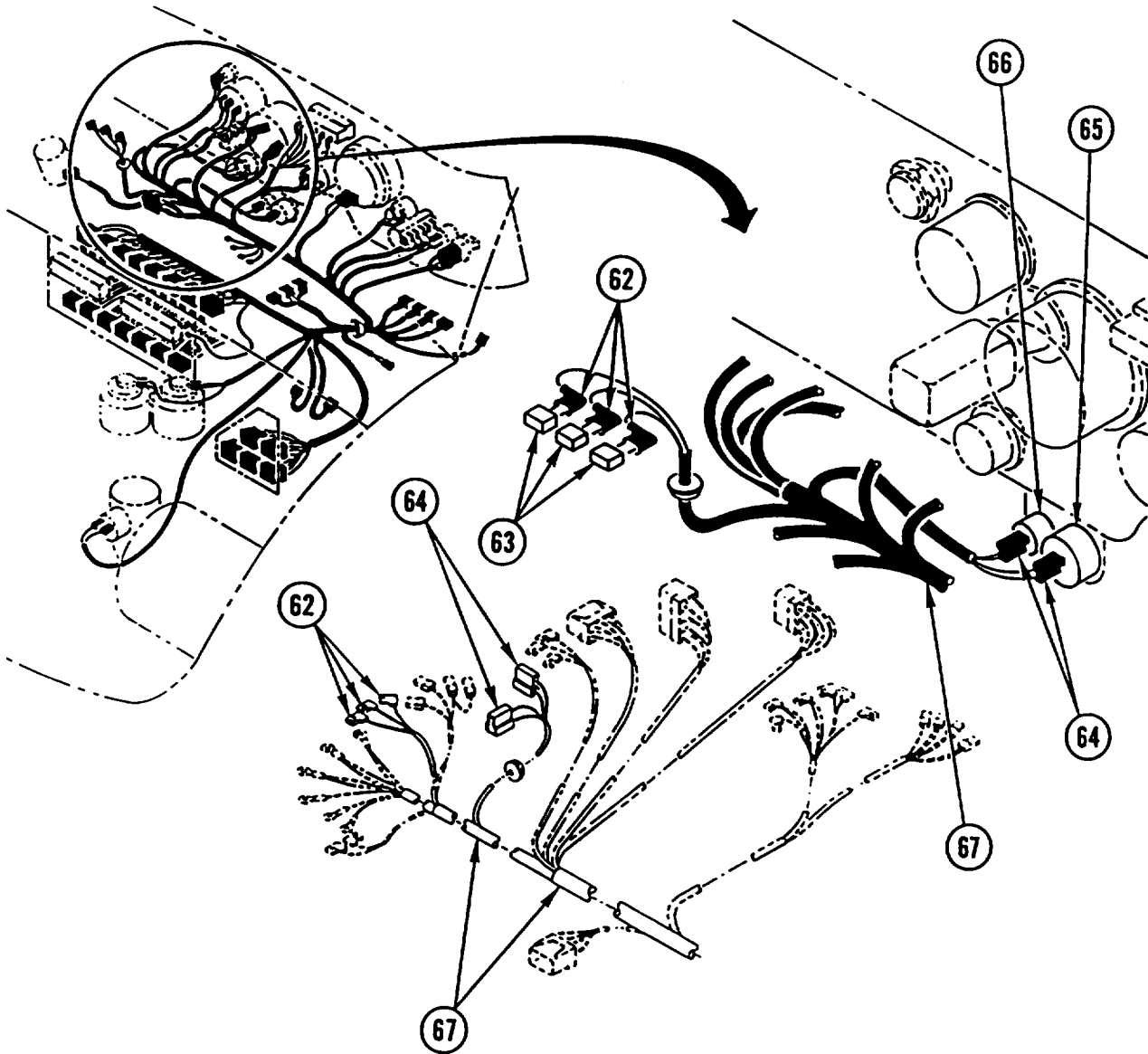
25. DISCONNECT three CONNECTORS (54) from (55).
26. DISCONNECT two CONNECTORS (56) from check engine switch (57).
27. DISCONNECT four CONNECTORS (58) from cold start switch (59).
28. DISCONNECT six TERMINALS (60) from turn signal lever switch (61).



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**MAIN WIRING HARNESS REPLACEMENT (CONT)**

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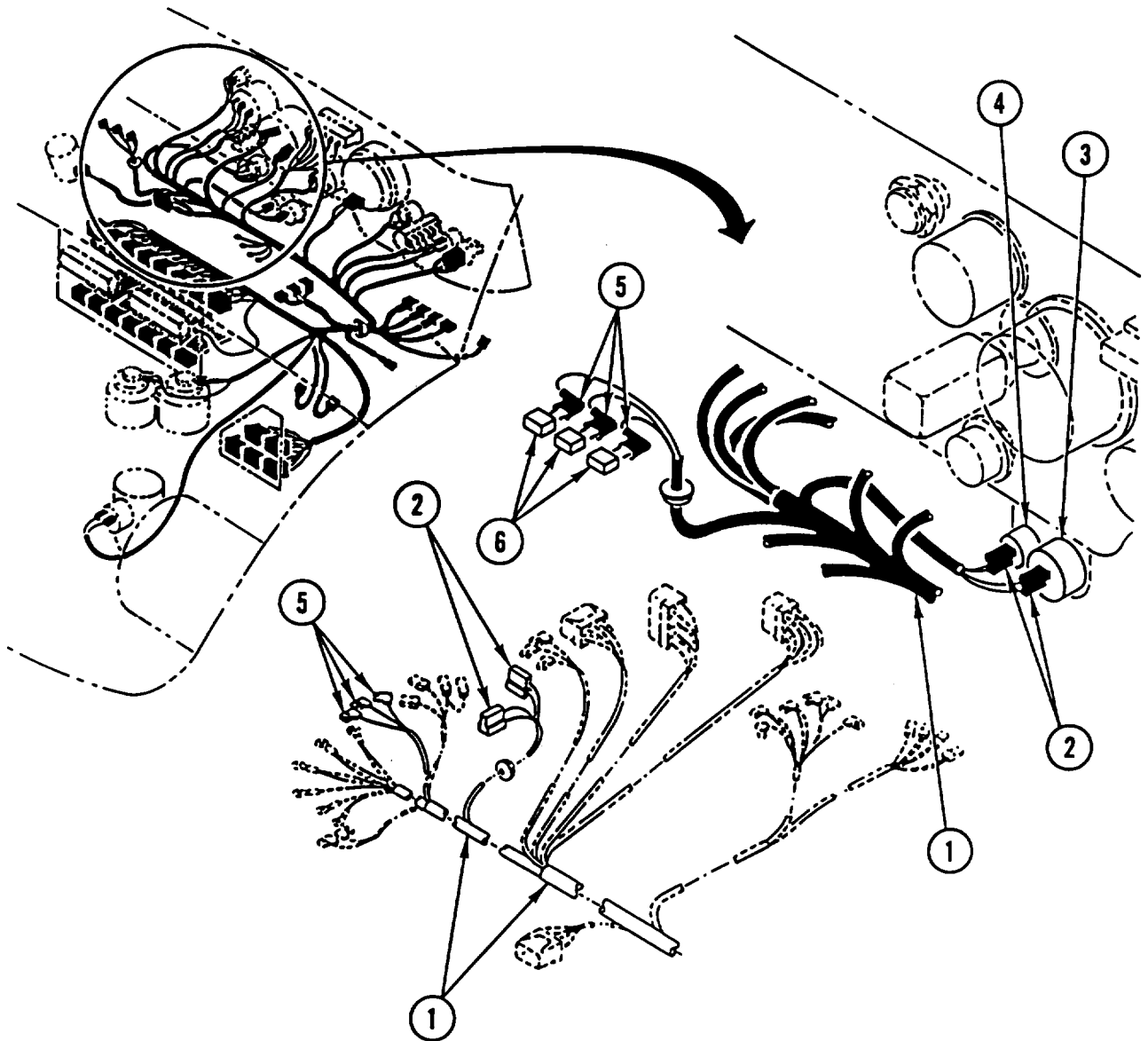


29. DISCONNECT three CONNECTORS (62) from three windshield heater connectors (63).
30. DISCONNECT two 2-pin CONNECTORS (64) from low pressure warning buzzer (65) and plug (66).
31. REMOVE main wiring HARNESS (67) from vehicle.

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**MAIN WIRING HARNESS REPLACEMENT (CONT)**


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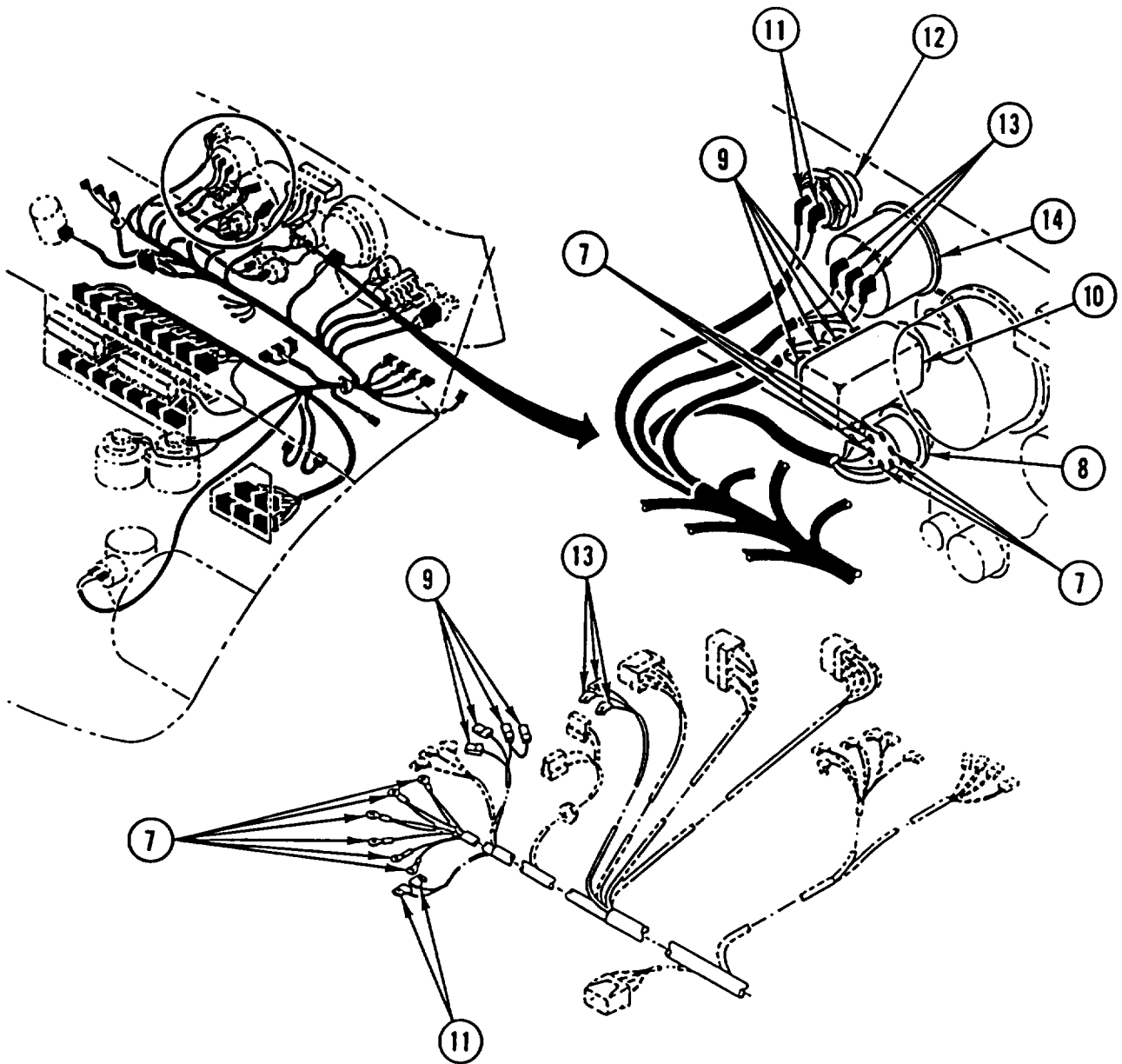
**INSTALLATION**
**NOTE**

Make sure main wiring harness is secure and all hardware is tight.

Install new tiedown strap(s).

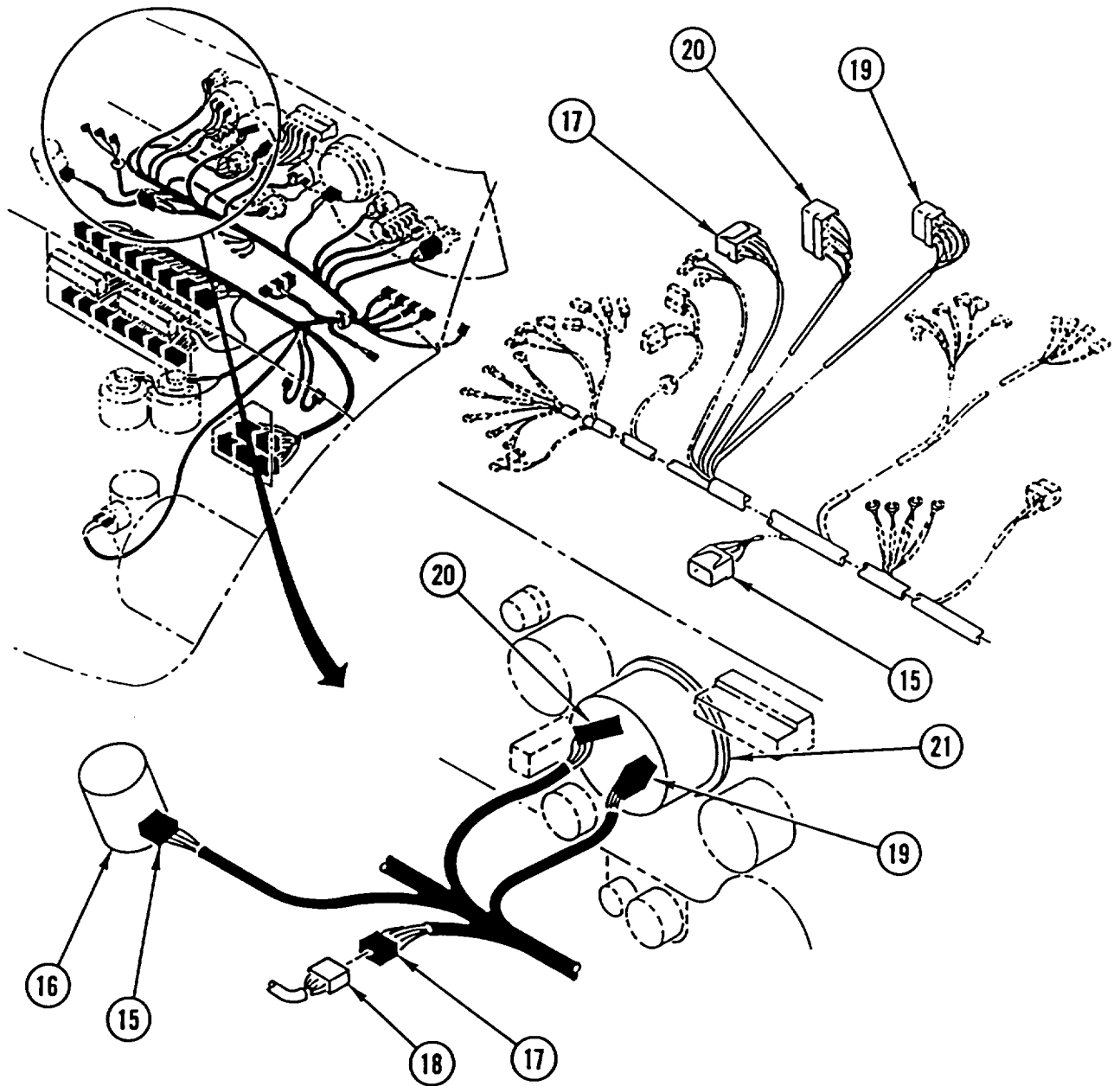
1. INSTALL main wiring HARNESS (1) in vehicle.
2. CONNECT two 2-pin CONNECTORS (2) to low pressure warning buzzer (3) and plug (4).
3. CONNECT three CONNECTORS (5) to three windshield heater connectors (6).

**MAIN WIRING HARNESS REPLACEMENT (CONT)**



4. CONNECT six TERMINALS (7) to turn signal lever switch (8).
5. CONNECT four CONNECTORS (9) to cold start switch (10).
6. CONNECT two CONNECTORS (11) to check engine switch (12).
7. CONNECT three CONNECTORS (13) to ammeter (14).

**MAIN WIRING HARNESS REPLACEMENT (CONT)**

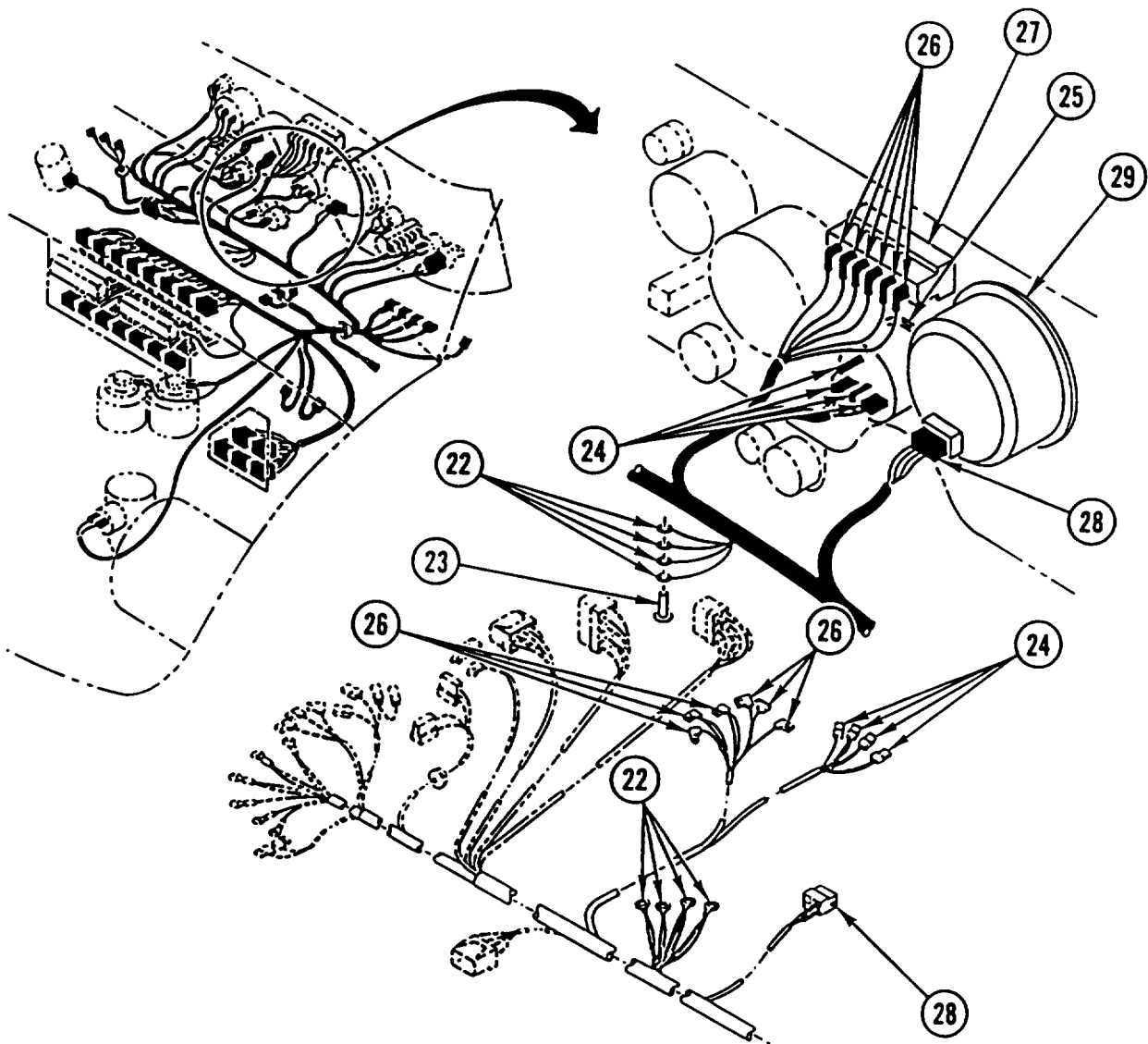


8. CONNECT 6-pin CONNECTOR (15) to windshield wiper motor (16).
9. CONNECT 6-pin CONNECTOR (17) to horn, low beam/high beam switch lead (18).
10. CONNECT 6-pin CONNECTOR (19) and 8-pin connector (20) to liquid indicator (21).

---

**MAIN WIRING HARNESS REPLACEMENT (CONT)**

---

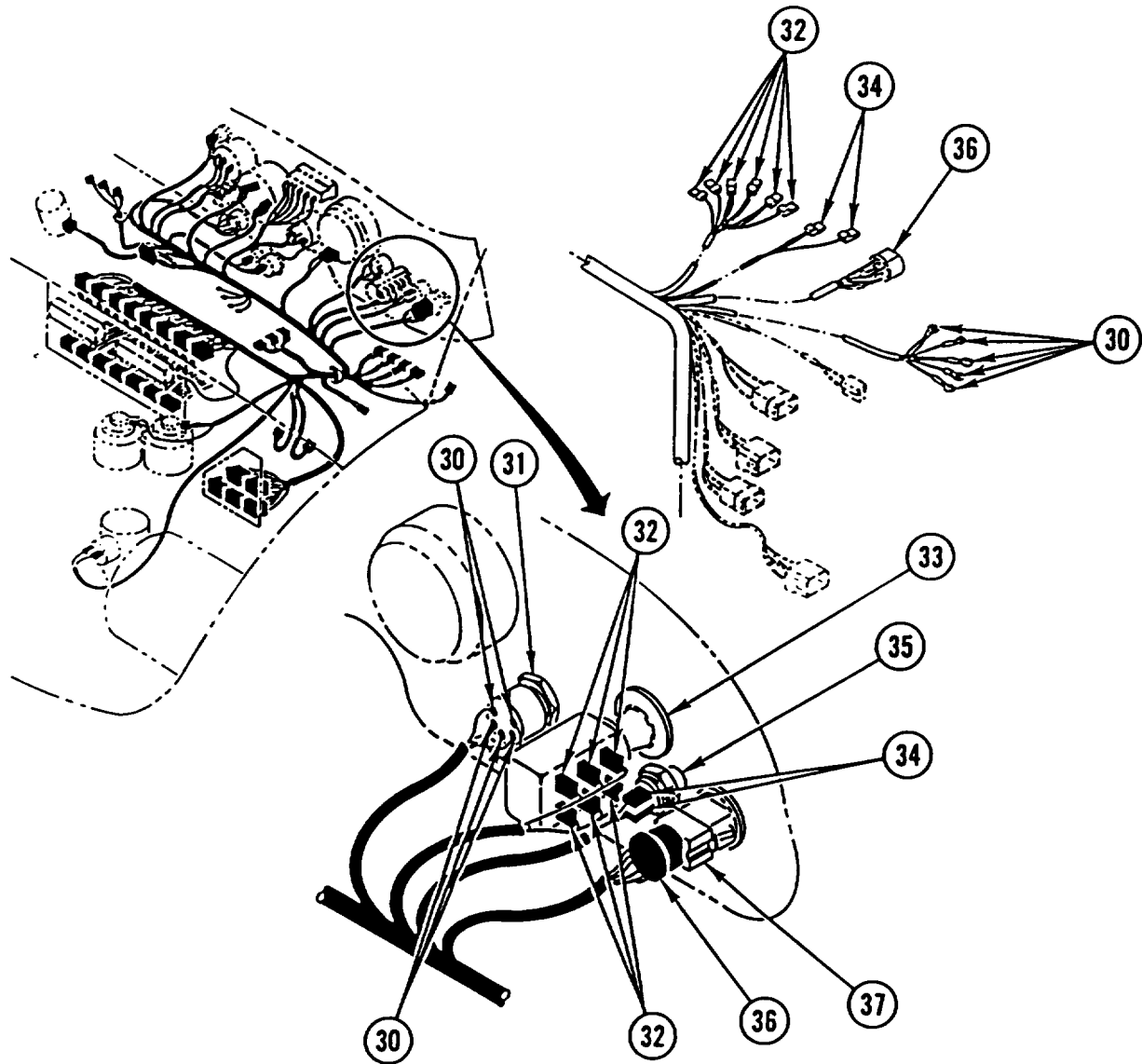


11. CONNECT four TERMINALS (22) to ground stud (23).
12. CONNECT four CONNECTORS (24) to tachometer (25).
13. CONNECT six CONNECTORS (26) to instrument cluster panel light (27).
14. CONNECT 4-pin CONNECTOR (28) to speedometer (29).

---

**MAIN WIRING HARNESS REPLACEMENT (CONT)**


---

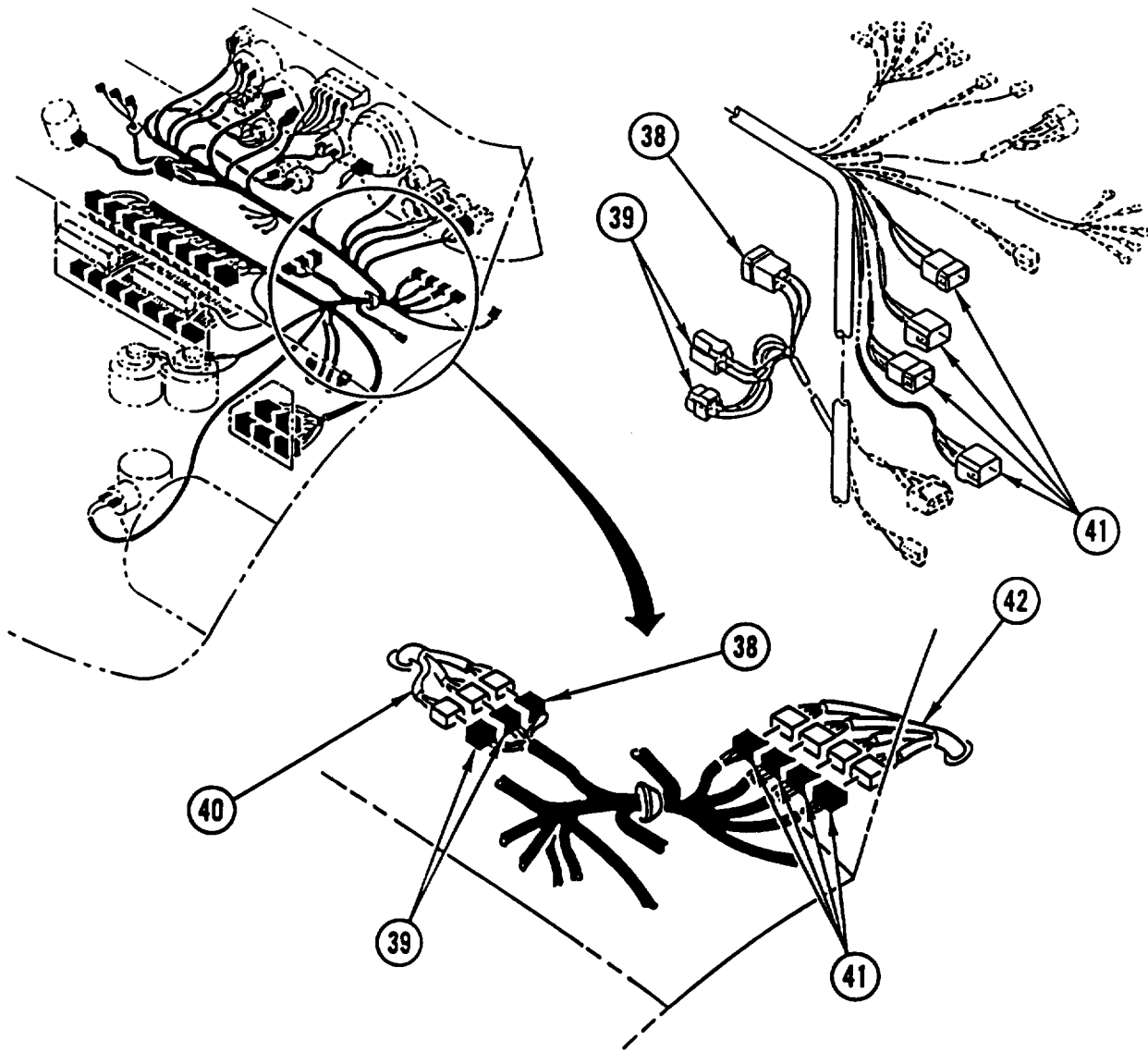


15. CONNECT five TERMINALS (30) to ignition switch (31).
16. CONNECT six CONNECTORS (32) to windshield wiper/washer switch (33).
17. CONNECT two CONNECTORS (34) to starter switch (35).
18. CONNECT 10-pin CONNECTOR (36) to hazard warning switch (37).

---

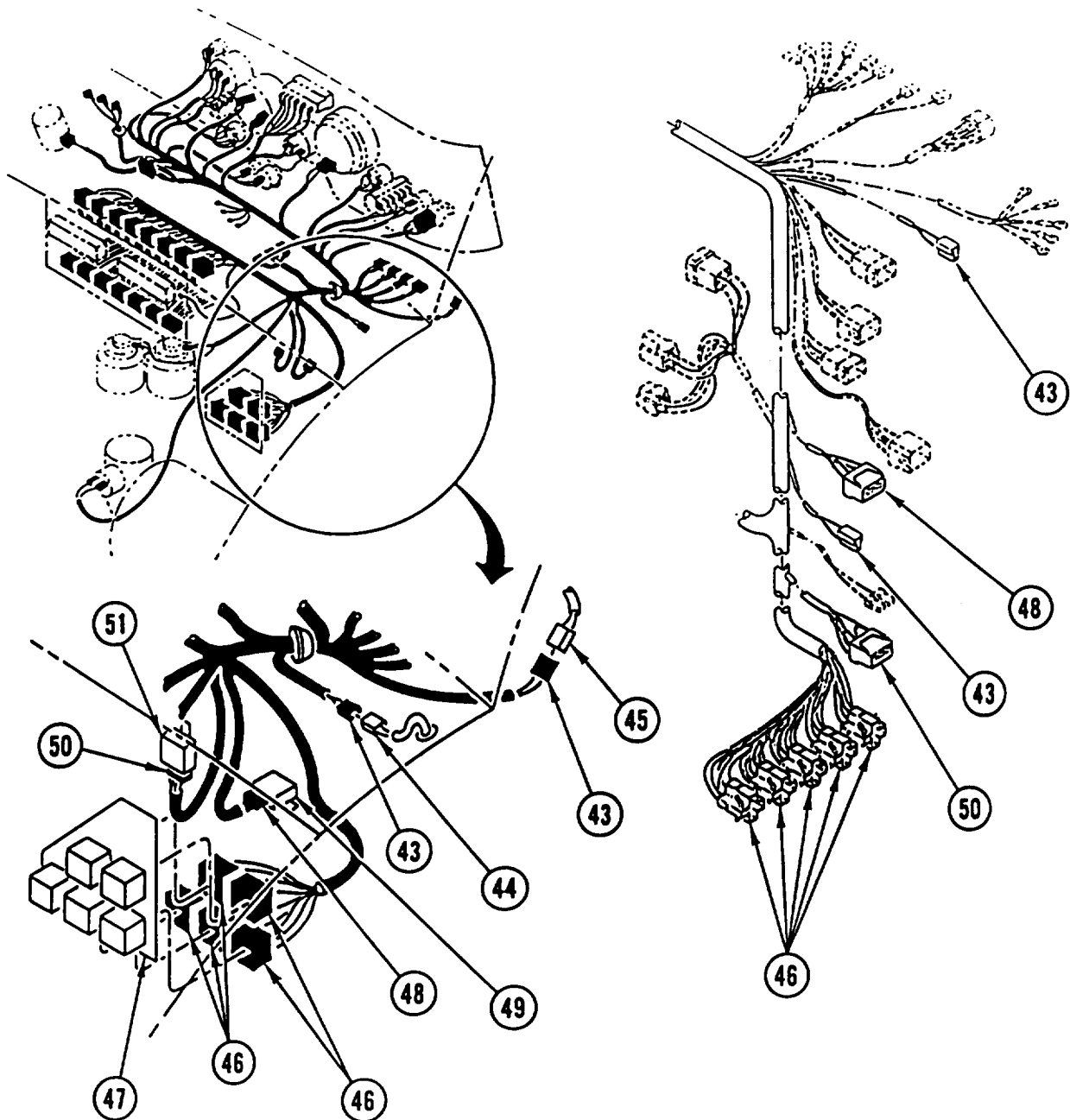
**MAIN WIRING HARNESS REPLACEMENT (CONT)**

---



19. CONNECT 4-pin CONNECTOR (38) and two 3-pin connectors (39) to hazard warning light wiring harness (40).
20. CONNECT four 4-pin CONNECTORS (41) to cap plug connector to heater panel switch and master light switch wiring harness (42).

**MAIN WIRING HARNESS REPLACEMENT (CONT)**



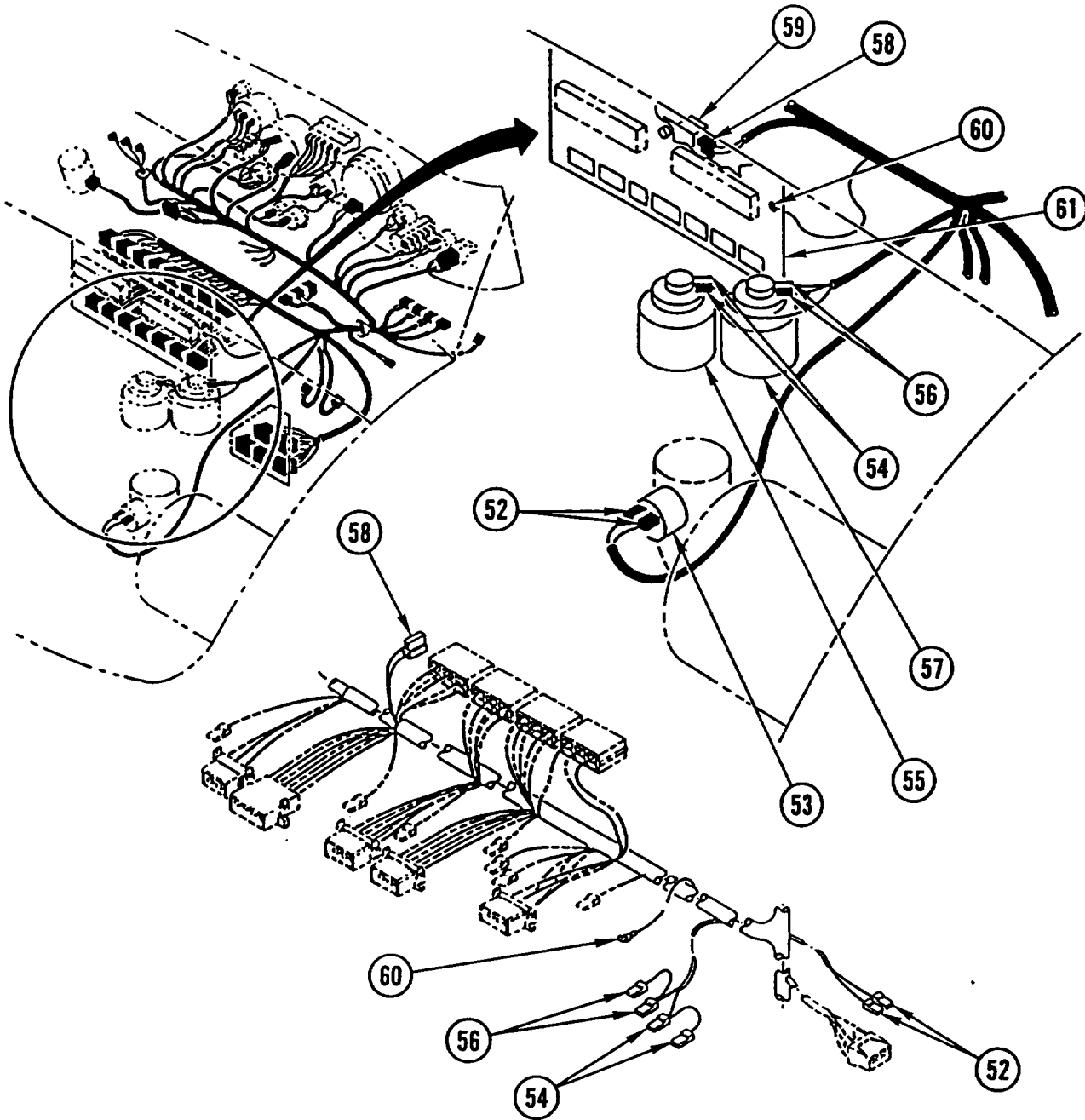
21. CONNECT two 2-pin CONNECTORS (43) to cab heater lead (44) and dome light cable assembly (45).
22. CONNECT five 5-pin CONNECTORS (46) to mounting bracket (47).
23. CONNECT 6-pin CONNECTOR (46) to wiper switch (49).
24. CONNECT 6-pin CONNECTOR (50) to warning horn delay relay (51).



---

**MAIN WIRING HARNESS REPLACEMENT (CONT)**

---

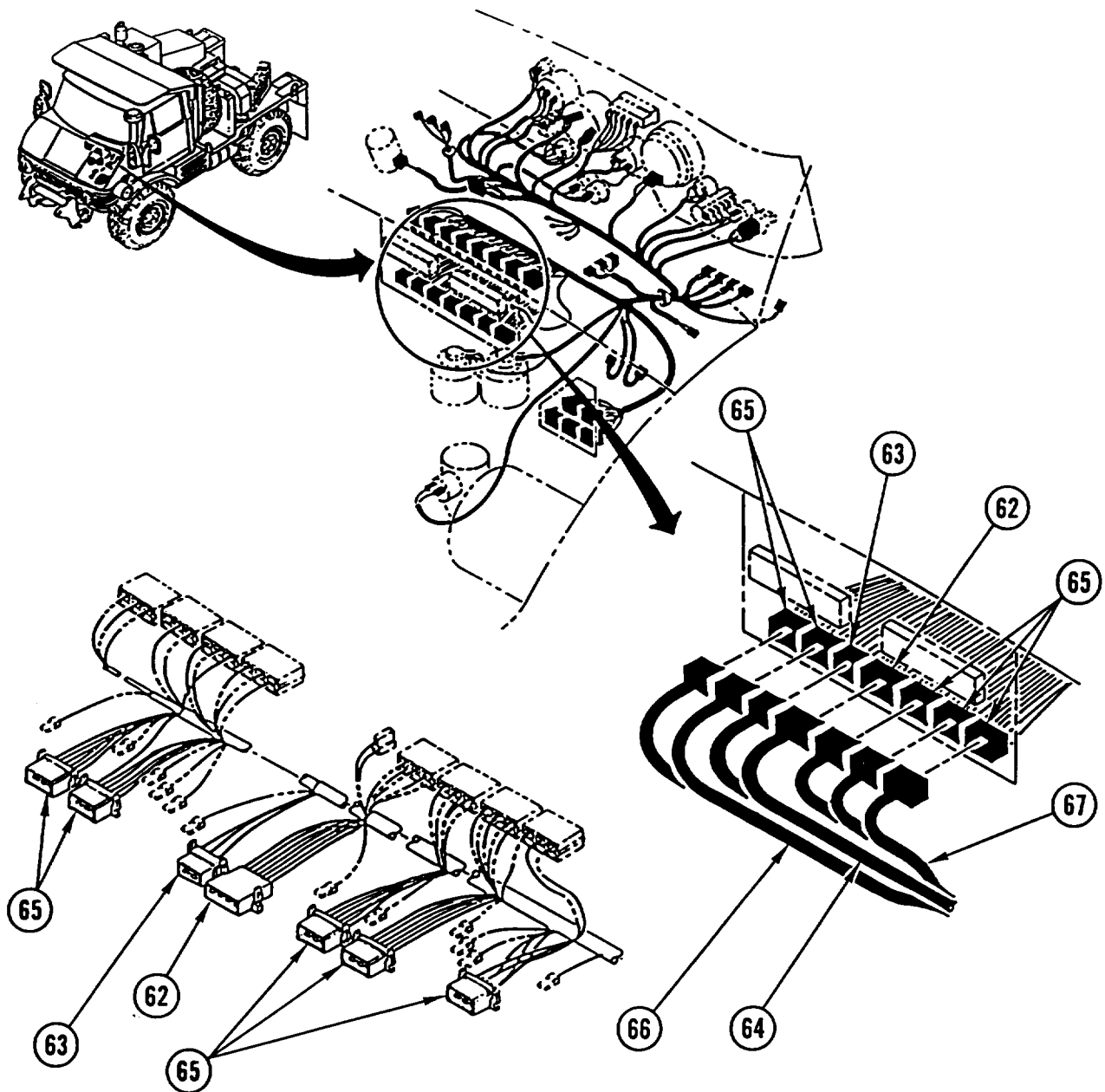


- 25. CONNECT two CONNECTORS (52) to air cleaner restrictor indicator switch (53).
- 26. CONNECT two CONNECTORS (54) to brake fluid reservoir (55).
- 27. CONNECT two CONNECTORS (56) to clutch hydraulic reservoir (57).
- 28. CONNECT 2-pin CONNECTOR (58) to diode (59).
- 29. CONNECT TERMINAL (60) to mounting bracket (61).

---

**MAIN WIRING HARNESS REPLACEMENT (CONT)**


---



30. CONNECT 8-pin CONNECTOR (62) and 4-pin connector (63) to alternator cable assembly (64).
31. CONNECT five 6-pin CONNECTORS (65) to auxiliary headlight, front composite light, and blackout driving light wiring harness (66) and frame wiring harness (67).

**NOTE**

Follow-on Maintenance:

- Install fuse holders (TM 5-2420-224-20).
- Install air cleaner ducts (TM 5-2420-224-20).
- Install relays (TM 5-2420-224-20).

---

## ALTERNATOR CABLE ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

##### Reference

##### Condition Description

TM 5-2420-224-20

Cab Tilted

#### General Safety Instructions:

##### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE alternator CABLE assembly using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure alternator cable assembly is secure and all hardware is tight.
- Install new tiedown strap(s).

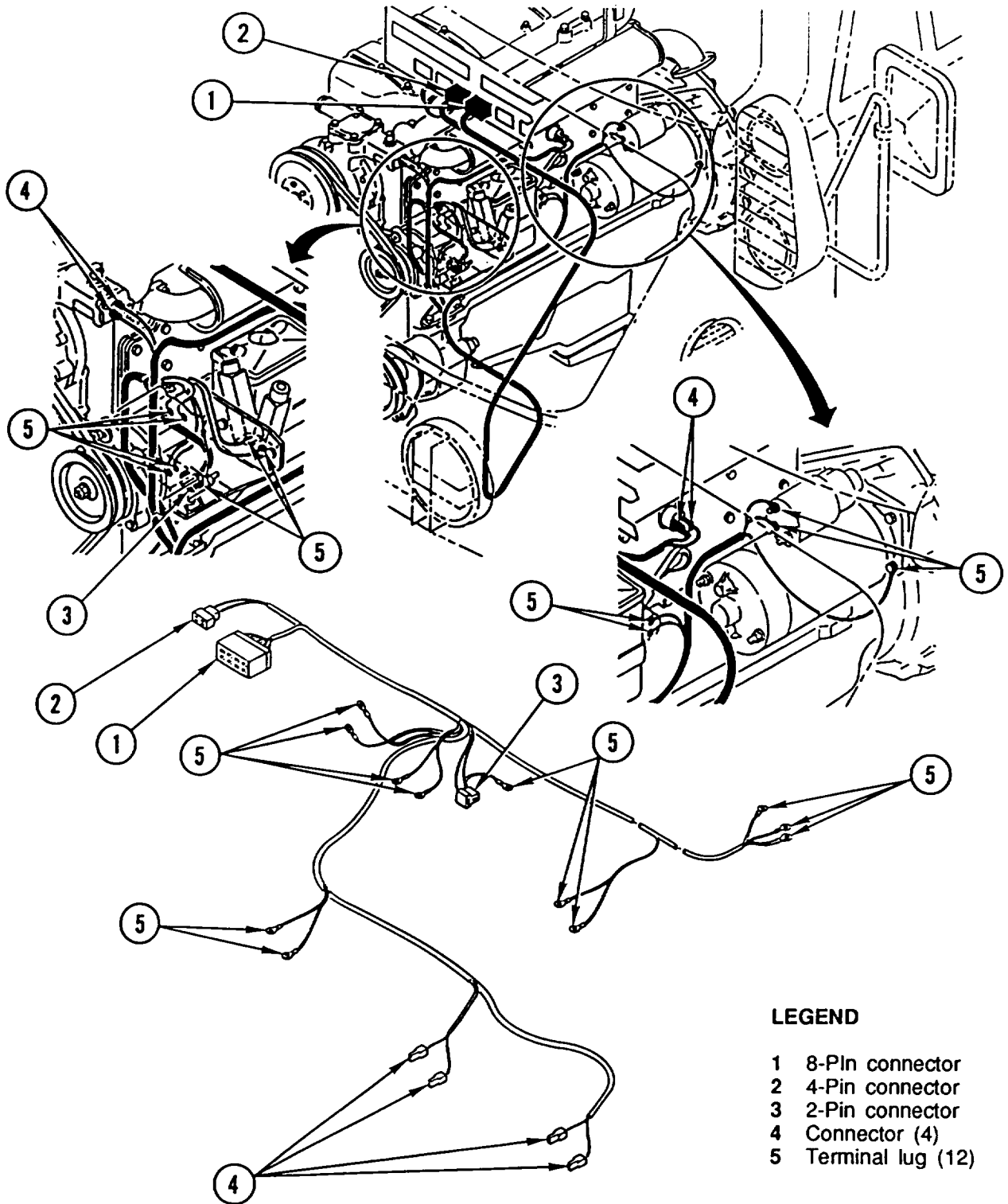
INSTALL alternator CABLE assembly using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).

**ALTERNATOR CABLE ASSEMBLY REPLACEMENT (CONT)**



**LEGEND**

- 1 8-Pin connector
- 2 4-Pin connector
- 3 2-Pin connector
- 4 Connector (4)
- 5 Terminal lug (12)

---

## CRANE MAST FLOODLIGHT WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Strap, Tiedown                      Appendix B, Item 44

**General Safety Instructions:**

**WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

**NOTE**

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE crane mast floodlight wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

**NOTE**

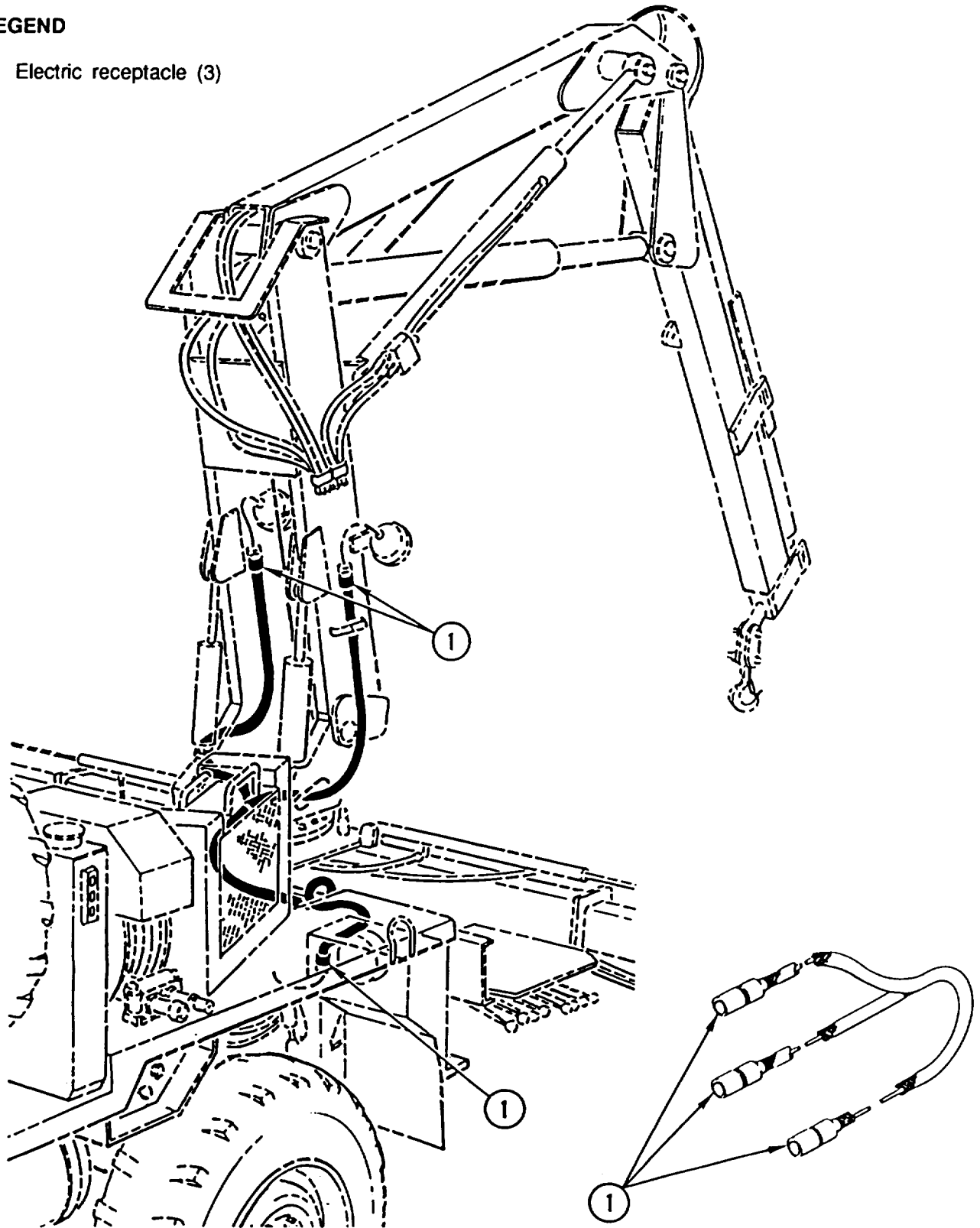
- Make sure crane mast floodlight wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL crane mast floodlight wiring HARNESS using illustration and legend as a guide.

# CRANE MAST FLOODLIGHT WIRING HARNESS REPLACEMENT (CONT)

## LEGEND

- 1 Electric receptacle (3)



---

## TRAILER WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### General Safety instructions:

#### **WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE trailer wiring HARNESS using illustration and legend as a guide.

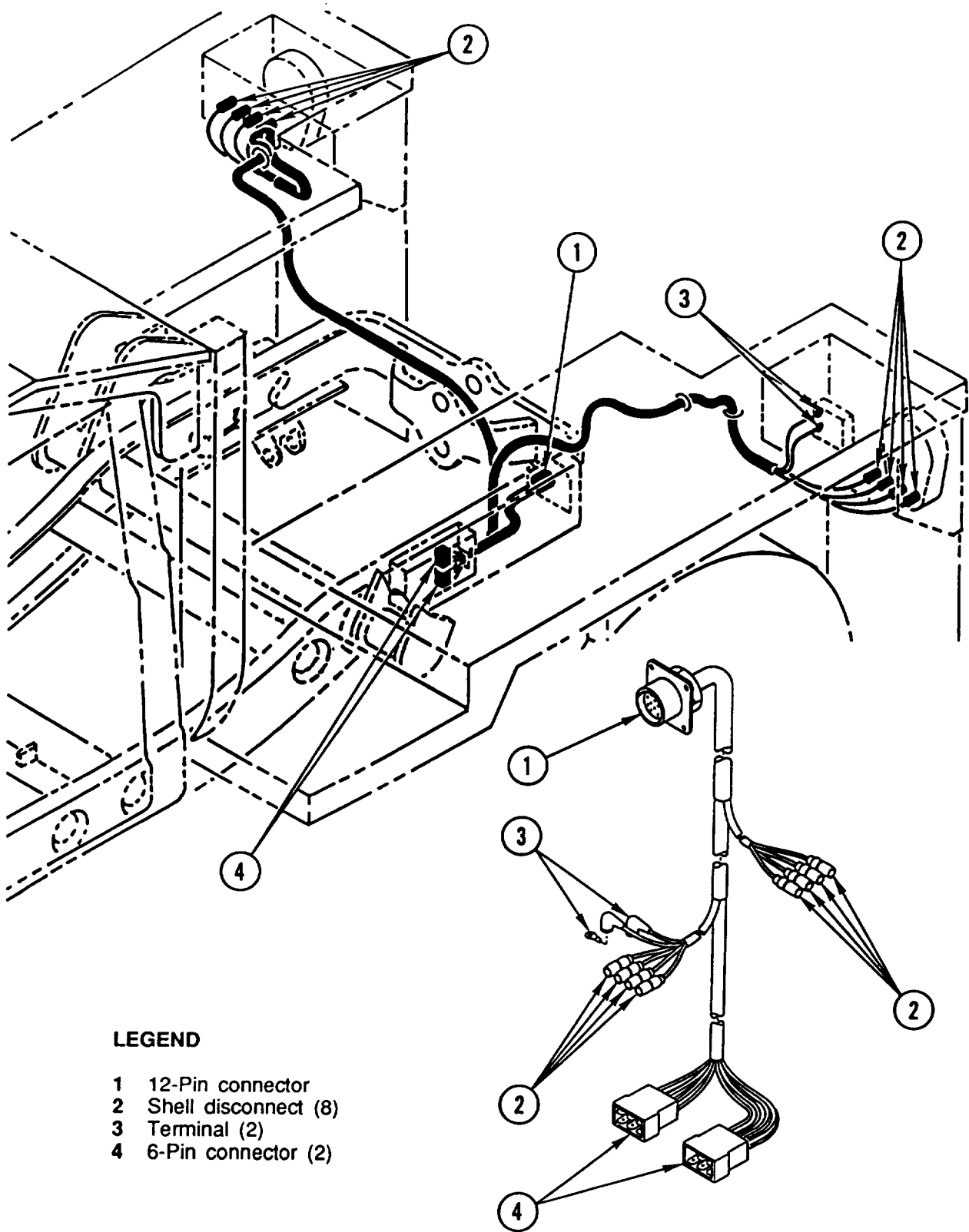
### INSTALLATION

#### NOTE

- Make sure trailer wiring harness is secure and all hardware is tight.
- install new tiedown strap(s).

INSTALL trailer wiring HARNESS using illustration and legend as a guide.

# TRAILER WIRING HARNESS REPLACEMENT (CONT)





---

## DOMELIGHT CABLE ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown Appendix B, Item 44

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

Ž Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).

- Only remove hardware securing wiring harness or lead to be removed.

REMOVE dome light CABLE assembly using illustration and legend as a guide.

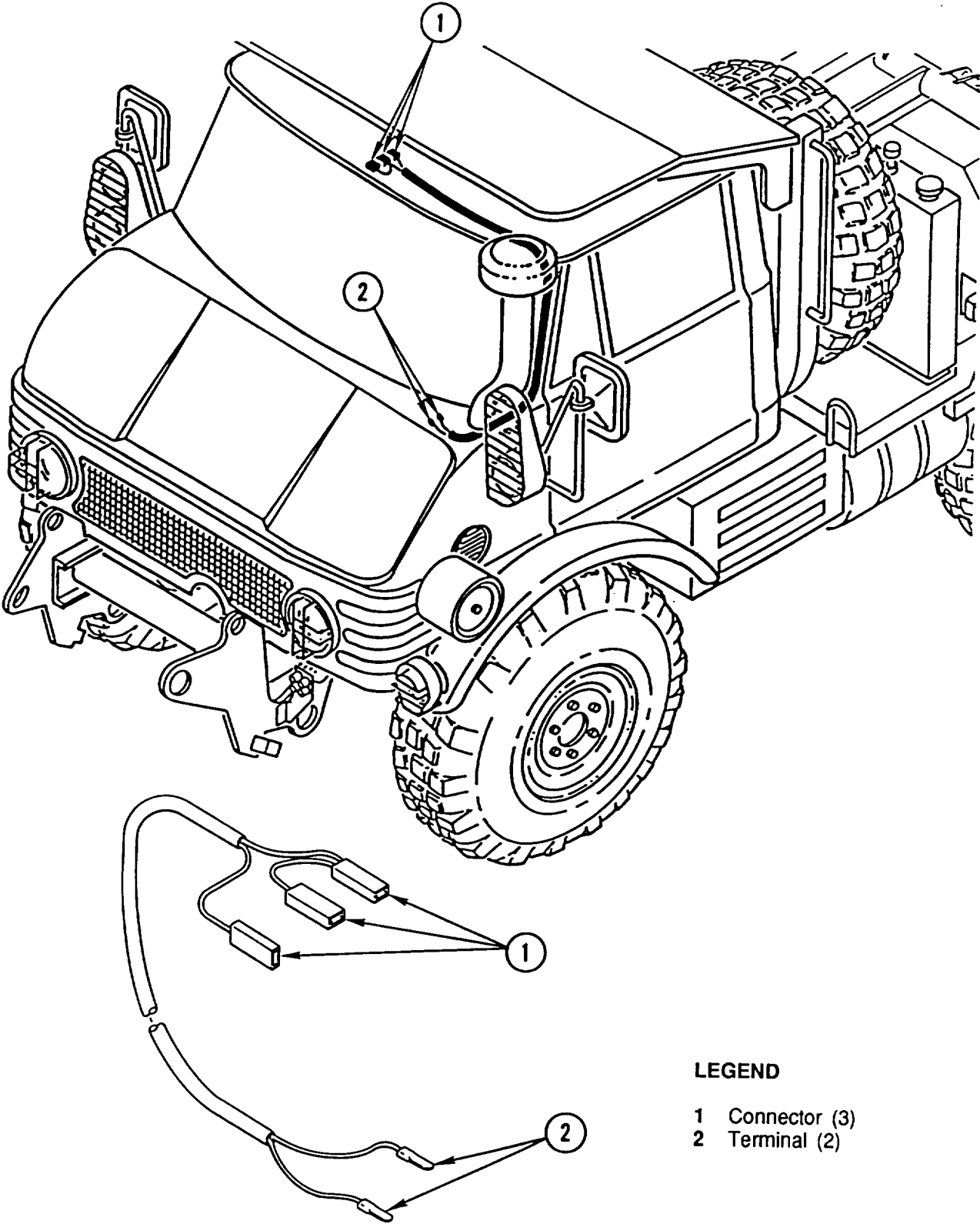
### INSTALLATION

#### NOTE

- Make sure dome light cable assembly is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL dome light CABLE assembly using illustration and legend as a guide.

**DOME LIGHT CABLE ASSEMBLY REPLACEMENT (CONT)**



**LEGEND**

- 1 Connector (3)
- 2 Terminal (2)

---

## HAZARD WARNING LIGHT WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, [tern 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Air Cleaner Ducts Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE hazard warning light wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure hazard warning light wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL hazard warning light wiring HARNESS using illustration and legend as a guide.

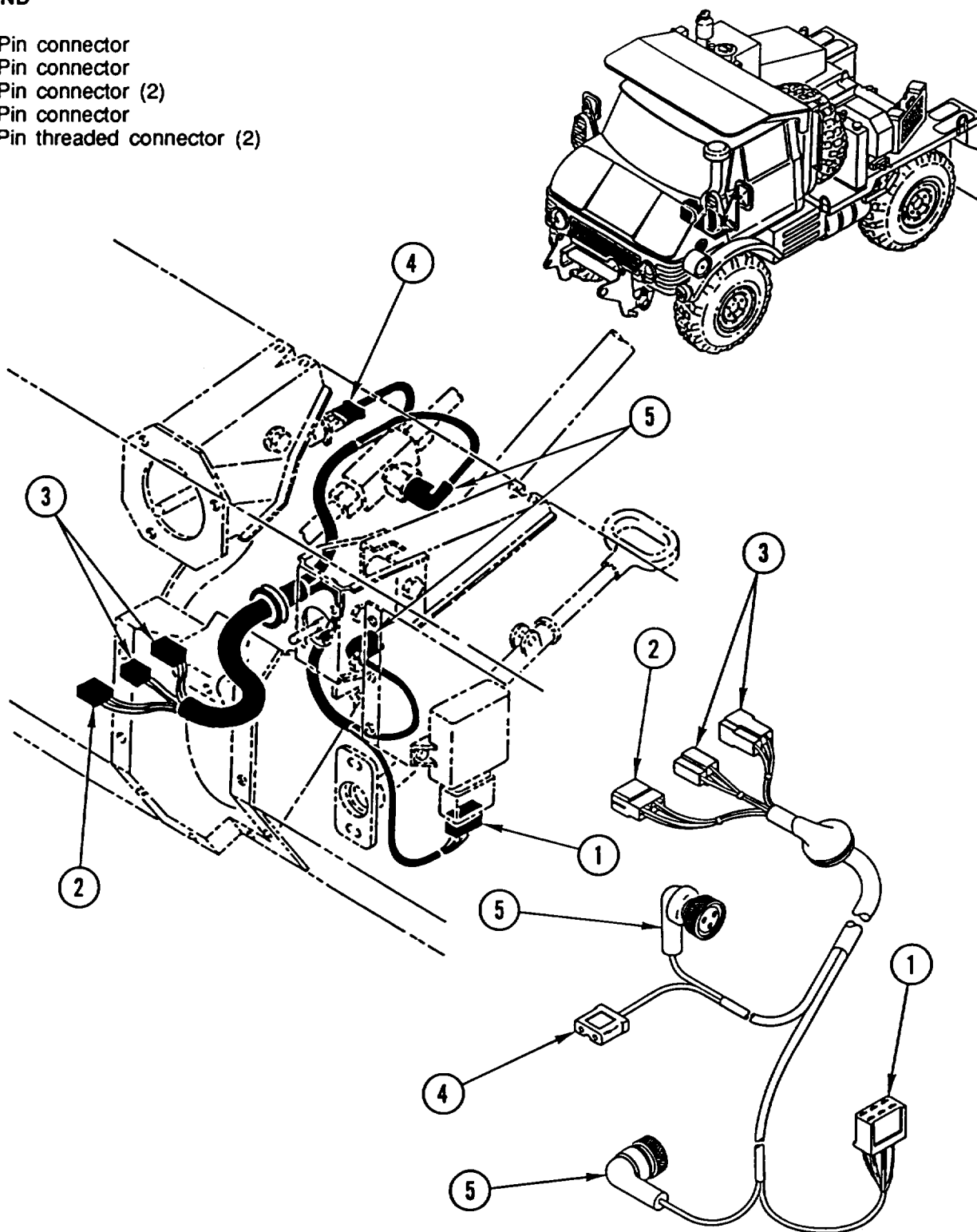
#### NOTE

Follow-on Maintenance:  
Install air cleaner ducts (TM 5-2420-224-20).

**HAZARD WARNING LIGHT WIRING HARNESS REPLACEMENT (CONT)**

**LEGEND**

- 1 8-Pin connector
- 2 4-Pin connector
- 3 3-Pin connector (2)
- 4 2-Pin connector
- 5 3-Pin threaded connector (2)



---

## AUXILIARY HEADLIGHT, FRONT COMPOSITE LIGHT, AND BLACKOUT DRIVING LIGHT WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Air Cleaner Ducts Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE auxiliary headlight, front composite light, and blackout driving light wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

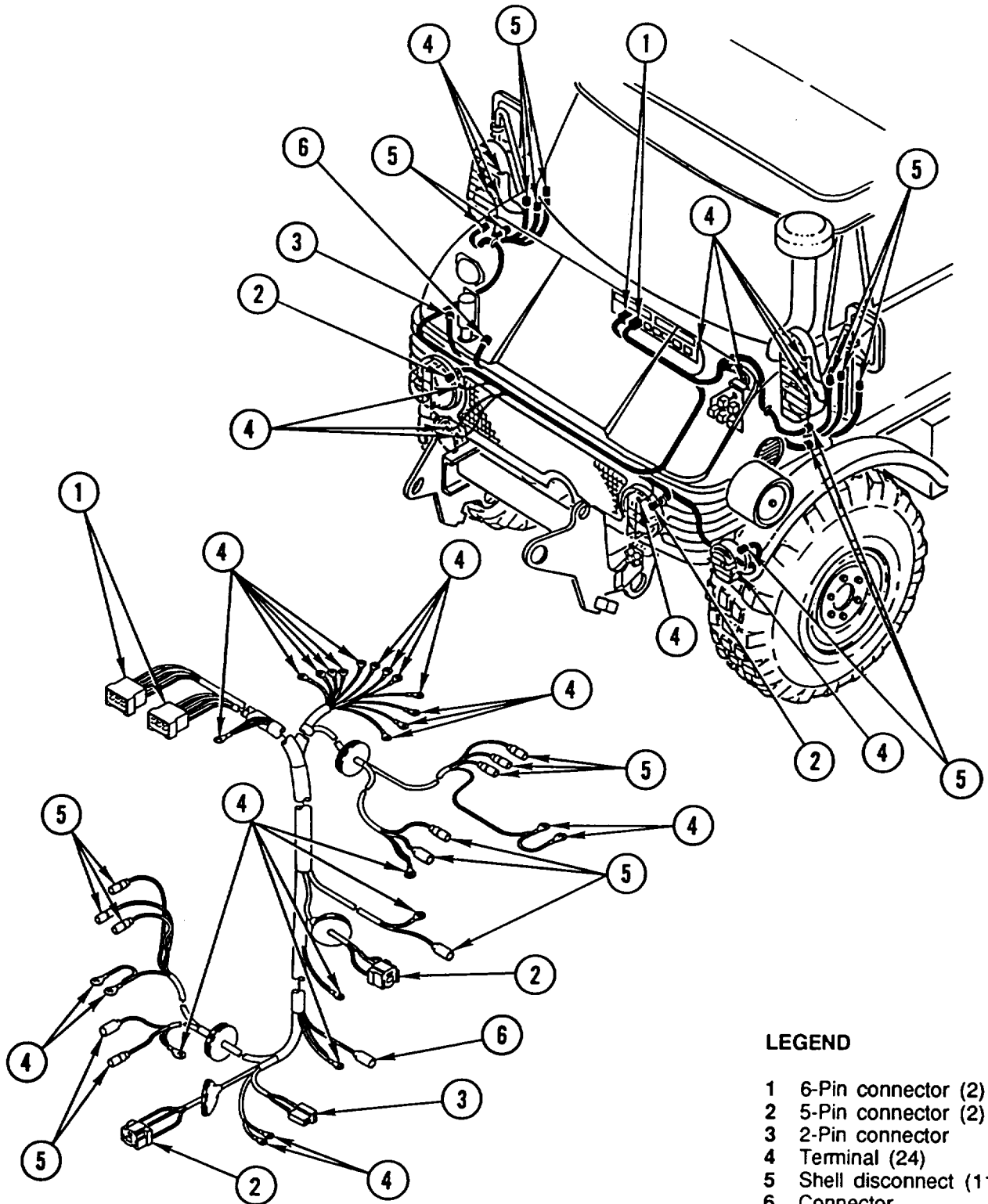
- Make sure auxiliary headlight, front composite light, and blackout driving light wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL auxiliary headlight, front composite light, and blackout driving light wiring HARNESS using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:  
Install air cleaner ducts (TM 5-2420-224-20).

**AUXILIARY HEADLIGHT, FRONT COMPOSITE LIGHT, AND BLACKOUT DRIVING LIGHT WIRING HARNESS REPLACEMENT (CONT)**



---

## STE/ICE-R WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit; SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE STE/ICE-R wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure STE/ICE-R wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

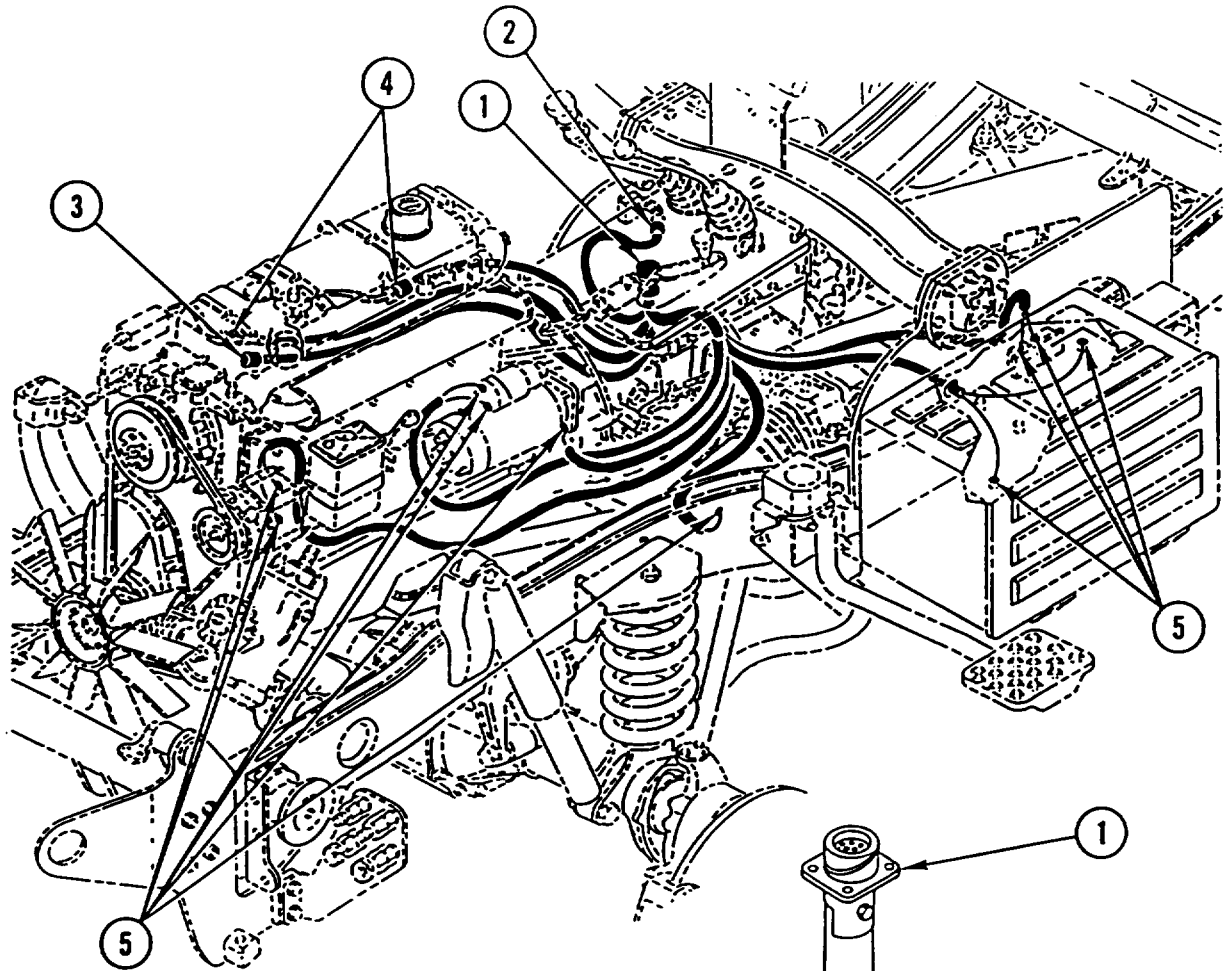
INSTALL STE/ICE-R wiring HARNESS using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:

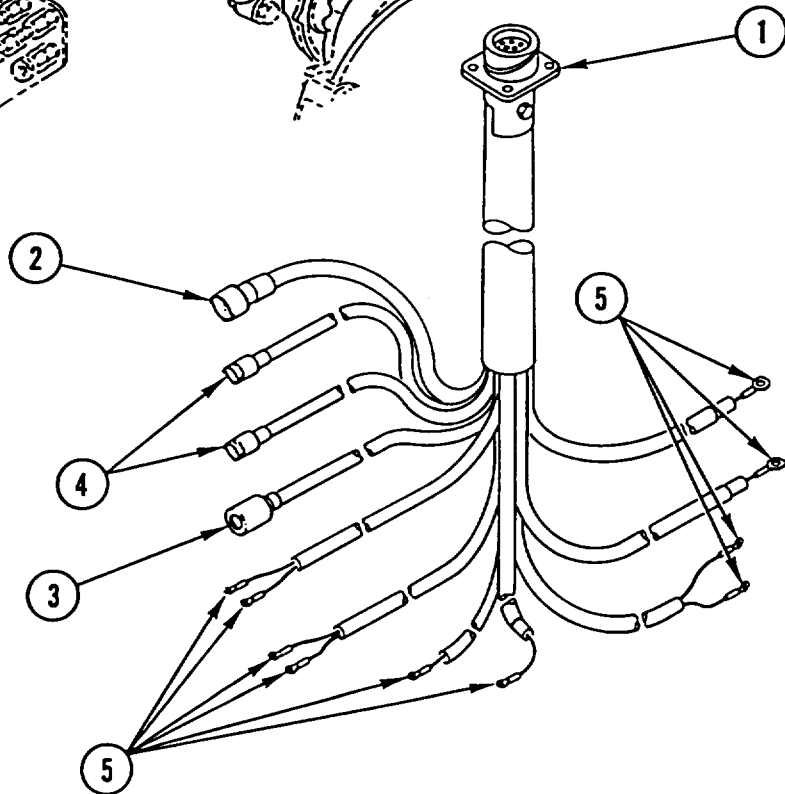
Lower cab (TM 5-2420-224-20).

**STE/ICE-R WIRING HARNESS REPLACEMENT (CONT)**



**LEGEND**

- 1 Connector
- 2 10-Pin shell connector
- 3 4-Pin shell connector
- 4 2-Pin shell connector (2)
- 5 Terminal (10)





---

## **FORKLIFT WIRING HARNESS REPLACEMENT**

---

This task covers: a. Removal b. Installation

---

### **INITIAL SETUP**

#### **Applicable Configuration:**

HMMH (Reg. No. UC053E thru UC053K)

#### **Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### **Materials/Parts:**

Strap, Tiedown                      Appendix B, Item 44

#### **References:**

TM 5-2420-224-20

#### **Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Fuse Holders Removed

#### **General Safety Instructions:**

### **WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### **REMOVAL**

#### **NOTE**

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE forklift wiring HARNESS using illustration and legend as a guide.

### **INSTALLATION**

#### **NOTE**

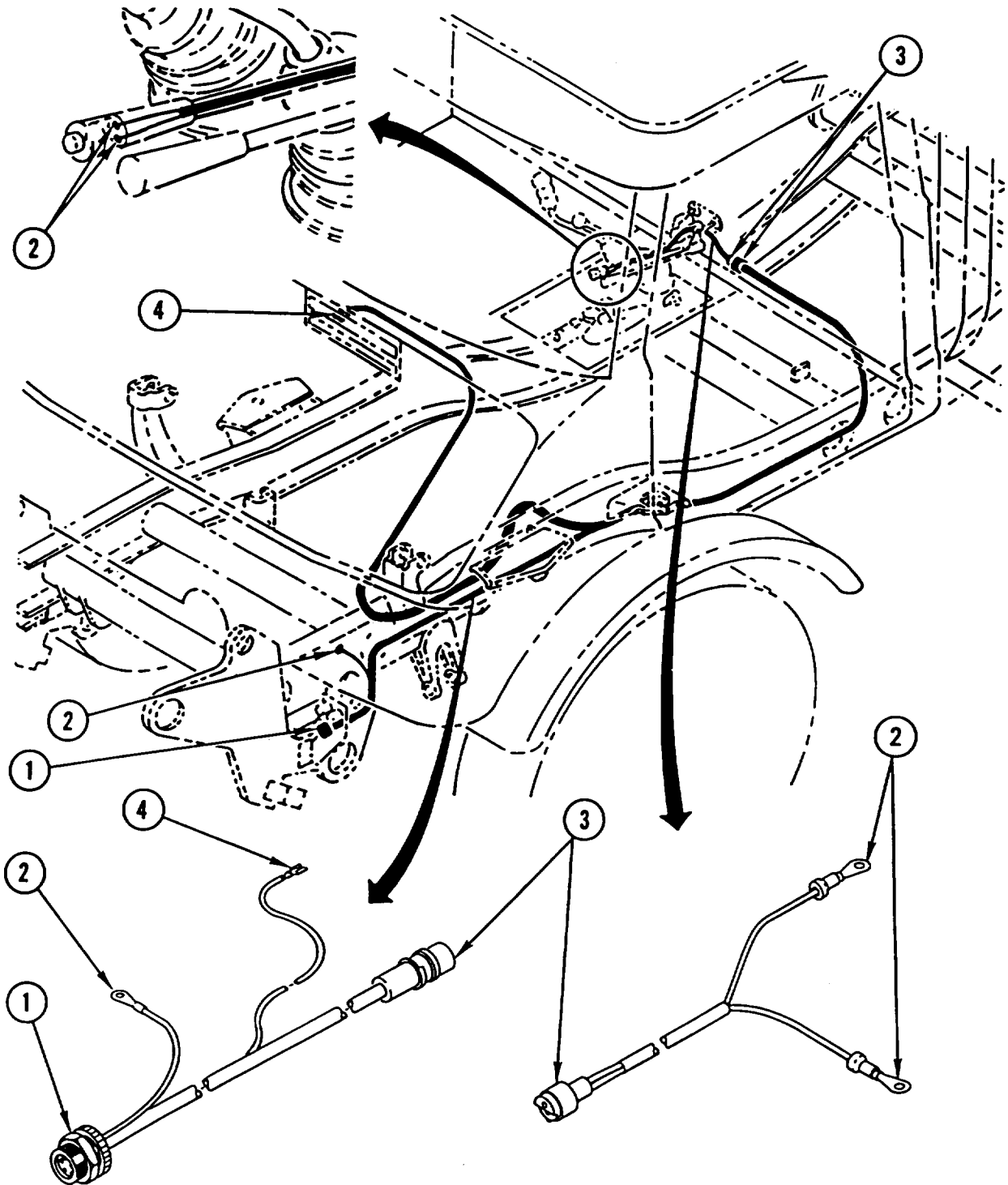
- Make sure forklift wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL forklift wiring HARNESS using illustration and legend as a guide.

#### **NOTE**

Follow-on Maintenance:  
Install fuse holders (TM 5-2420-224-20).

**FORKLIFT WIRING HARNESS REPLACEMENT (CONT)**



**LEGEND**

- 1 4-Pin connector
- 2 Terminal (3)
- 3 3-Pin shell connector (2)
- 4 Connector

---

## **FORKLIFT WIRING HARNESS REPLACEMENT**

---

This task covers: a. Removal b. Installation

---

### **INITIAL SETUP**

#### **Applicable Configuration:**

HMMH (Reg. No. UC053L and On)

#### **Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### **Materials/Parts:**

Strap, Tiedown                      Appendix B, Item 44

#### **References:**

TM 5-2420-224-20

#### **Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Fuse Holders Removed

#### **General Safety Instructions:**

### **WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### **REMOVAL**

#### **NOTE**

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE forklift wiring HARNESS using illustration and legend as a guide.

### **INSTALLATION**

#### **NOTE**

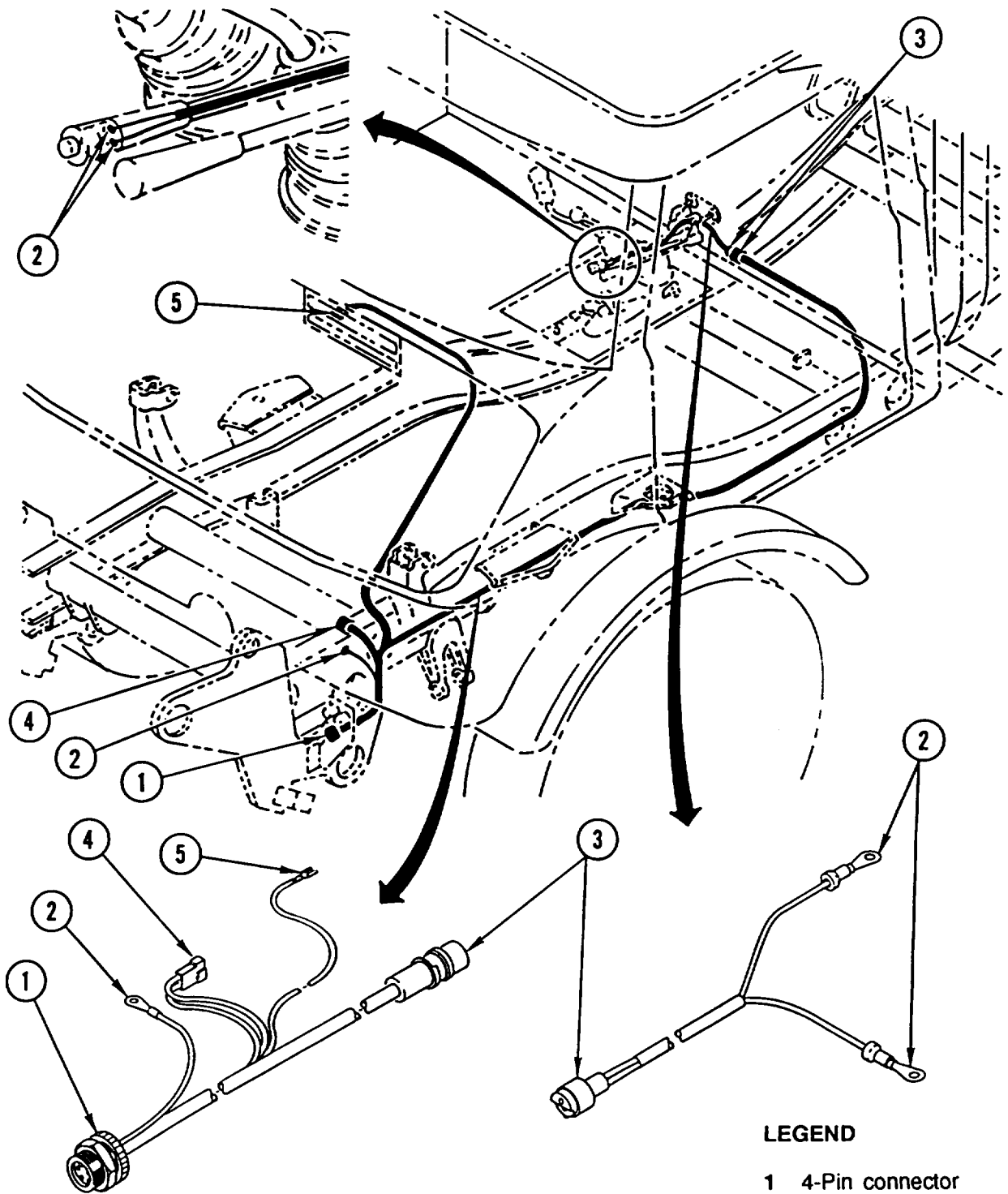
- Make sure forklift wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL forklift wiring HARNESS using illustration and legend as a guide.

#### **NOTE**

Follow-on Maintenance:  
Install fuse holders (TM 5-2420-224-20).

**FORKLIFT WIRING HARNESS REPLACEMENT (CONT)**



**LEGEND**

- 1 4-Pin connector
- 2 Terminal (3)
- 3 3-Pin shell connector (2)
- 4 2-Pin connector
- 5 Connector

---

## FORKLIFT POWER CABLE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Strap, Tiedown                      Appendix B, Item 44

**General Safety Instructions:**

**WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

**NOTE**

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tie down strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE forklift power CABLE using illustration and legend as a guide.

### INSTALLATION

**NOTE**

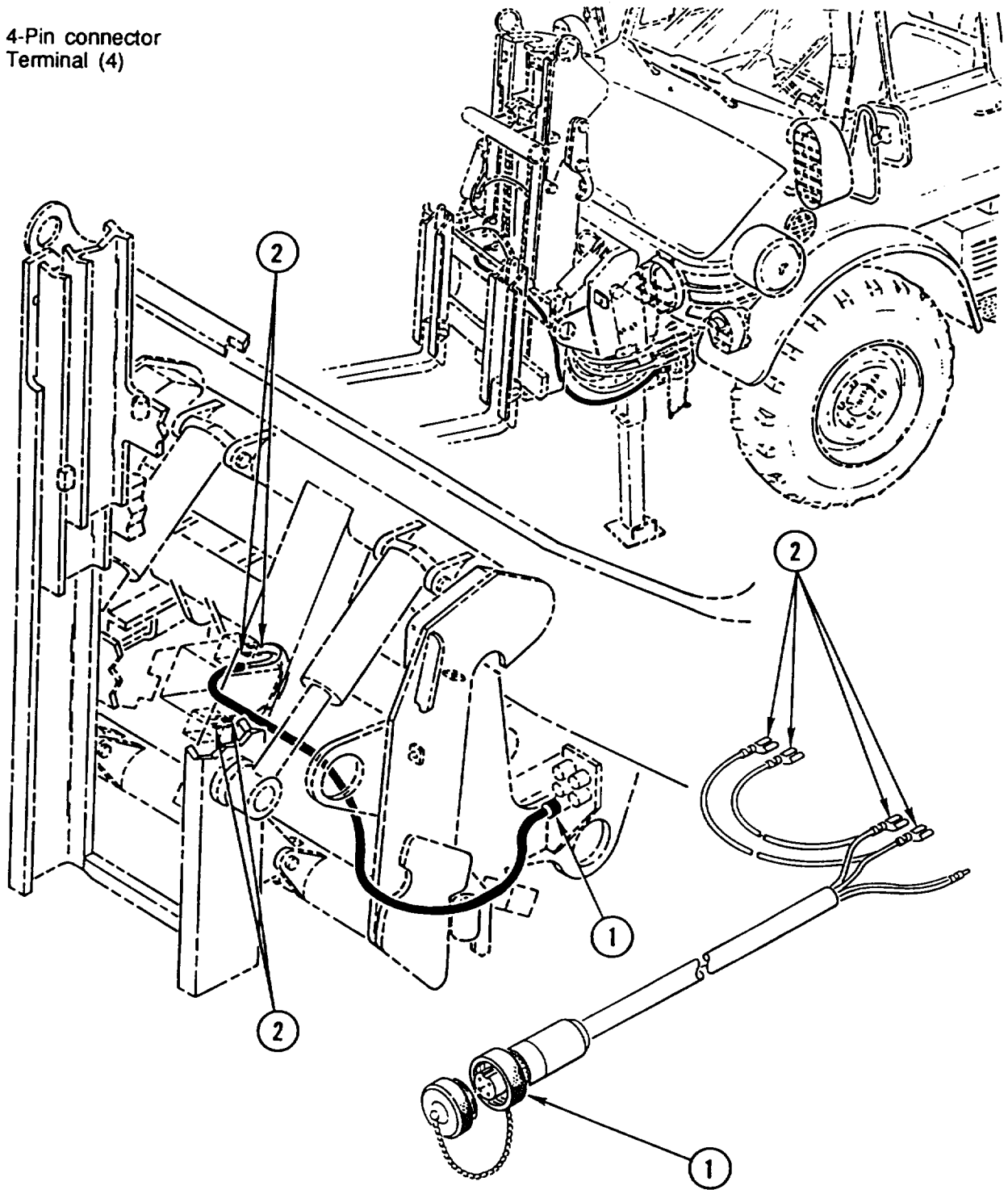
- Ž Make sure forklift power cable is secure and all hardware is tight.
- Ž Install new tiedown strap(s).

INSTALL forklift power CABLE using illustration and legend as a guide.

# FORKLIFT POWER CABLE REPLACEMENT (CONT)

## LEGEND

- 1 4-Pin connector
- 2 Terminal (4)



---

## FORKLIFT CONNECTOR TO FUSE HOLDER WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH (Reg. No. UC053L and on)

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Strap, Tiedown                      Appendix B, item 44

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Fuse Holders Removed
TM 5-2420-224-20	Air Cleaner Ducts Removed

**General Safety Instructions:**

**WARNING**

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

**NOTE**

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE forklift connector to fuse holder wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

**NOTE**

- Make sure forklift connector to fuse holder wiring harness is secure and all hardware is tight.
- install new tiedown strap(s).

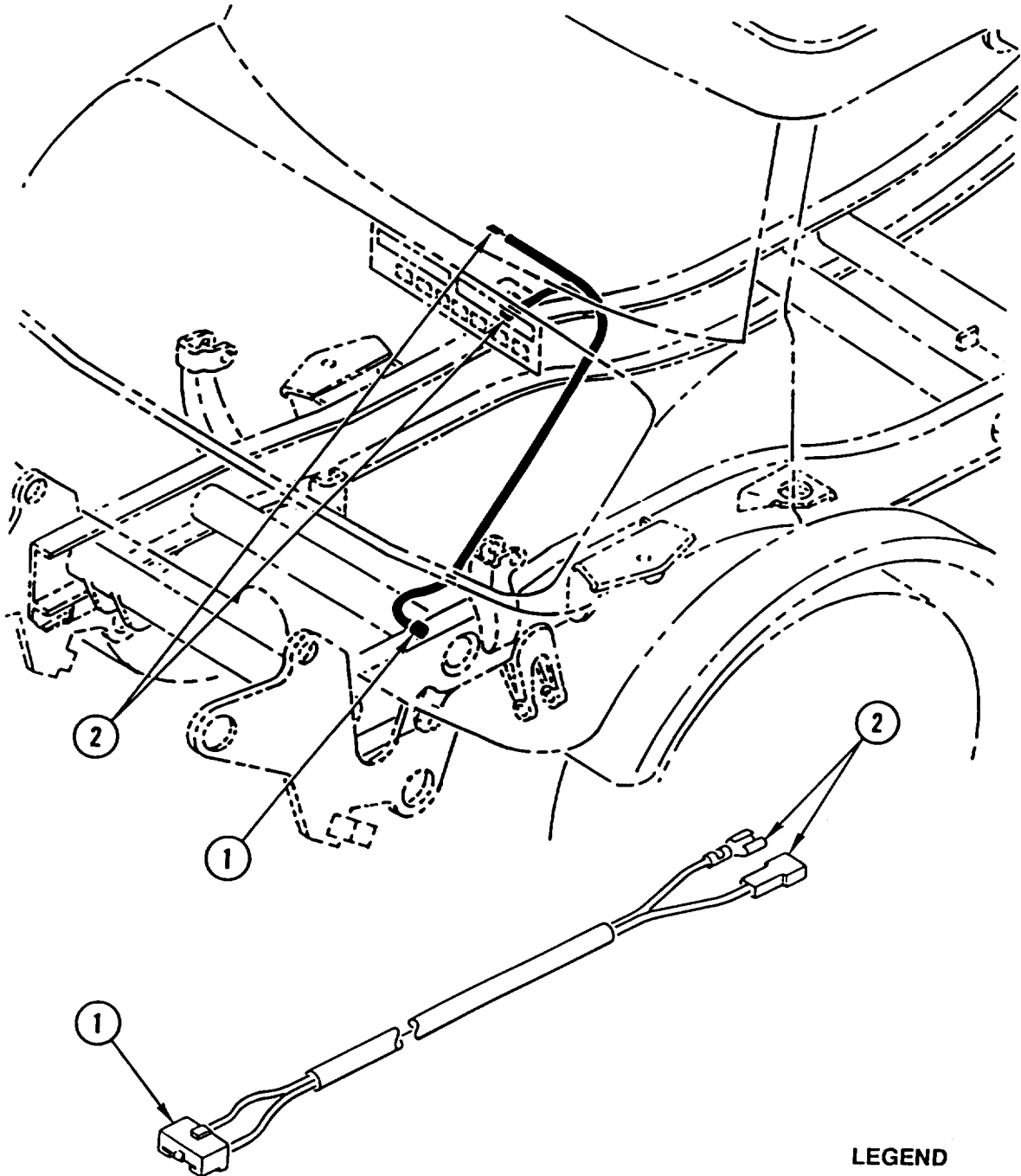
INSTALL forklift connector to fuse holder wiring HARNESS using illustration and legend as a guide.

## FORKLIFT CONNECTOR TO FUSE HOLDER WIRING HARNESS REPLACEMENT (CONT)

### NOTE

Follow-on Maintenance:

- Install fuse holders (TM 5-2420-224-20).
- Install air cleaner ducts (TM 5-2420-224-20).



### LEGEND

- 1 2-Pin connector
- 2 Connector (2)



---

## CAB FLOOR SEPARATION POINT TO HYDRAULIC SUSPENSION LOCKOUT WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

HMMH

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Gasket

Strap, Tiedown                      Appendix B, Item 44

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

• Discard gasket.

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE cab floor separation point to hydraulic suspension lockout wiring HARNESS using illustration and legend as a guide.

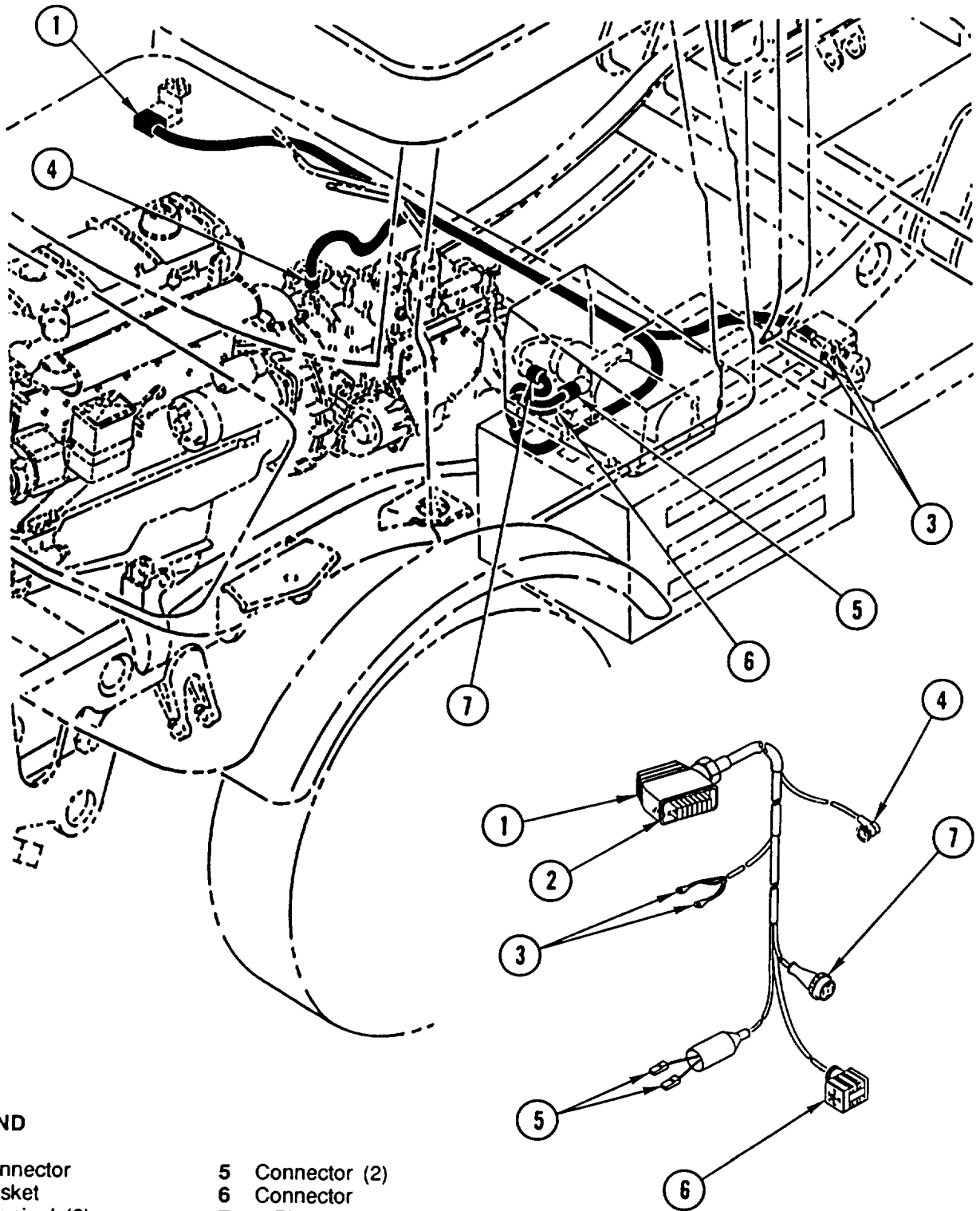
### INSTALLATION

#### NOTE

- Make sure cab floor separation point to hydraulic suspension lockout wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).
- Install new gasket.

INSTALL cab floor separation point to hydraulic suspension lockout wiring HARNESS using illustration and legend as a guide.

CAB FLOOR SEPARATION POINT TO HYDRAULIC SUSPENSION  
 LOCKOUT WIRING HARNESS REPLACEMENT (CONT)



**LEGEND**

- |                   |                   |
|-------------------|-------------------|
| 1 Connector       | 5 Connector (2)   |
| 2 Gasket          | 6 Connector       |
| 3 Terminal (2)    | 7 4-Pin connector |
| 4 2-Pin connector |                   |

---

## CAB FLOOR SEPARATION POINT TO REAR WALL WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

HMMH

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Passenger Seat and Framework Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Ž Only remove hardware securing wiring harness or lead to be removed.

REMOVE cab floor separation point to rear wall wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure cab floor separation point to rear wall wiring harness is secure and all hardware is tight.
- Ž Install new tiedown strap(s).

INSTALL cab floor separation point to rear wall wiring HARNESS using illustration and legend as a guide.

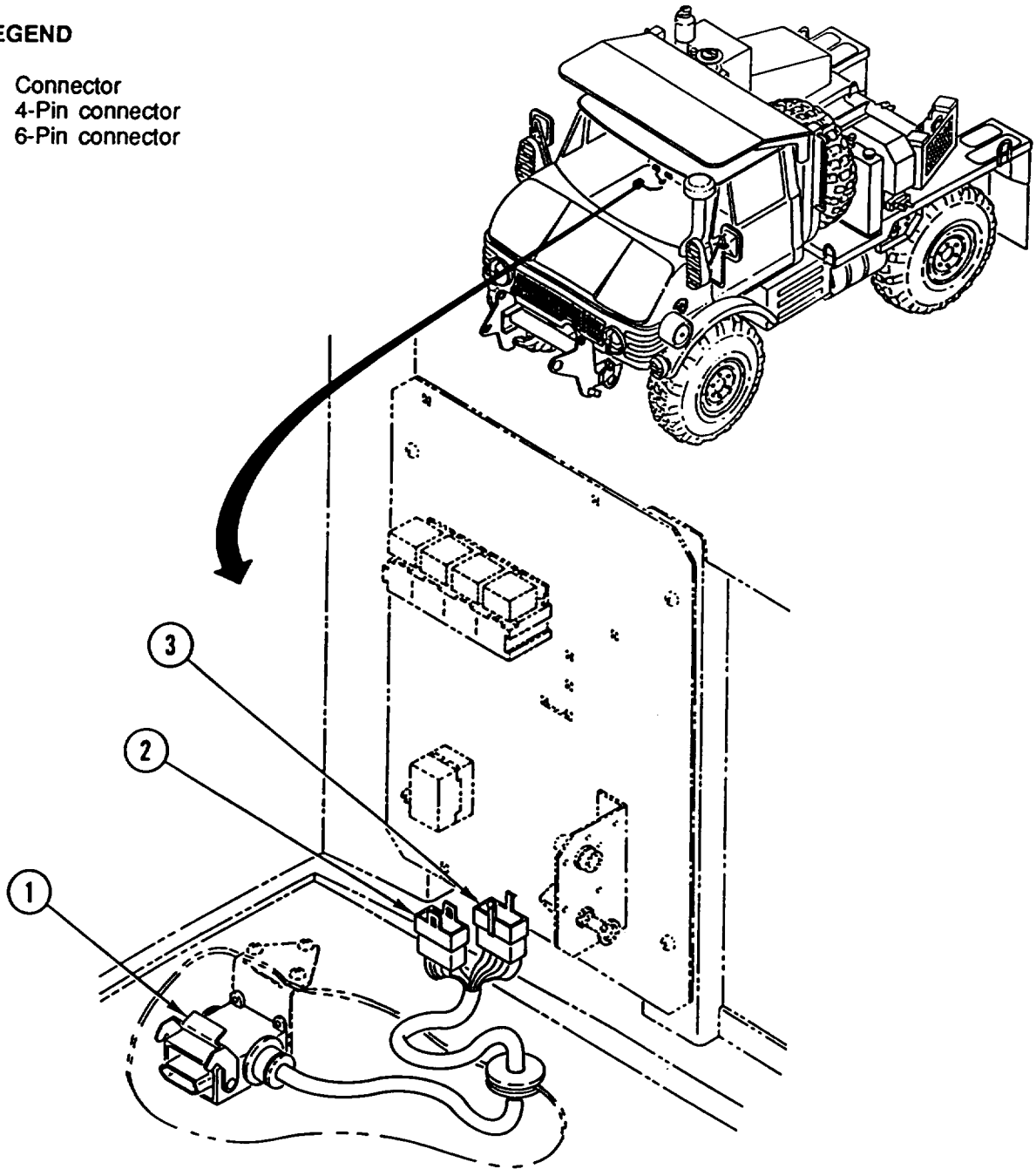
**CAB FLOOR SEPARATION POINT TO REAR WALL WIRING HARNESS REPLACEMENT (CONT)**

**NOTE**

Follow-on Maintenance:  
Install passenger seat and framework (TM 5-2420-224-20).

**LEGEND**

- 1 Connector
- 2 4-Pin connector
- 3 6-Pin connector



---

## FUSE HOLDER TO HYDRAULIC SUSPENSION LOCKOUT/REAR WALL WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

HMMH (Reg. No. UC053E thru UC053K)

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Til Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Fuse Holders Removed
TM 5-2420-224-20	Passenger Seat and Framework Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with loop clamps and screw terminals.
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE fuse holder to hydraulic suspension lockout/rear wall wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

Make sure fuse holder to hydraulic suspension lockout/rear wall wiring harness is secure and all hardware is tight.

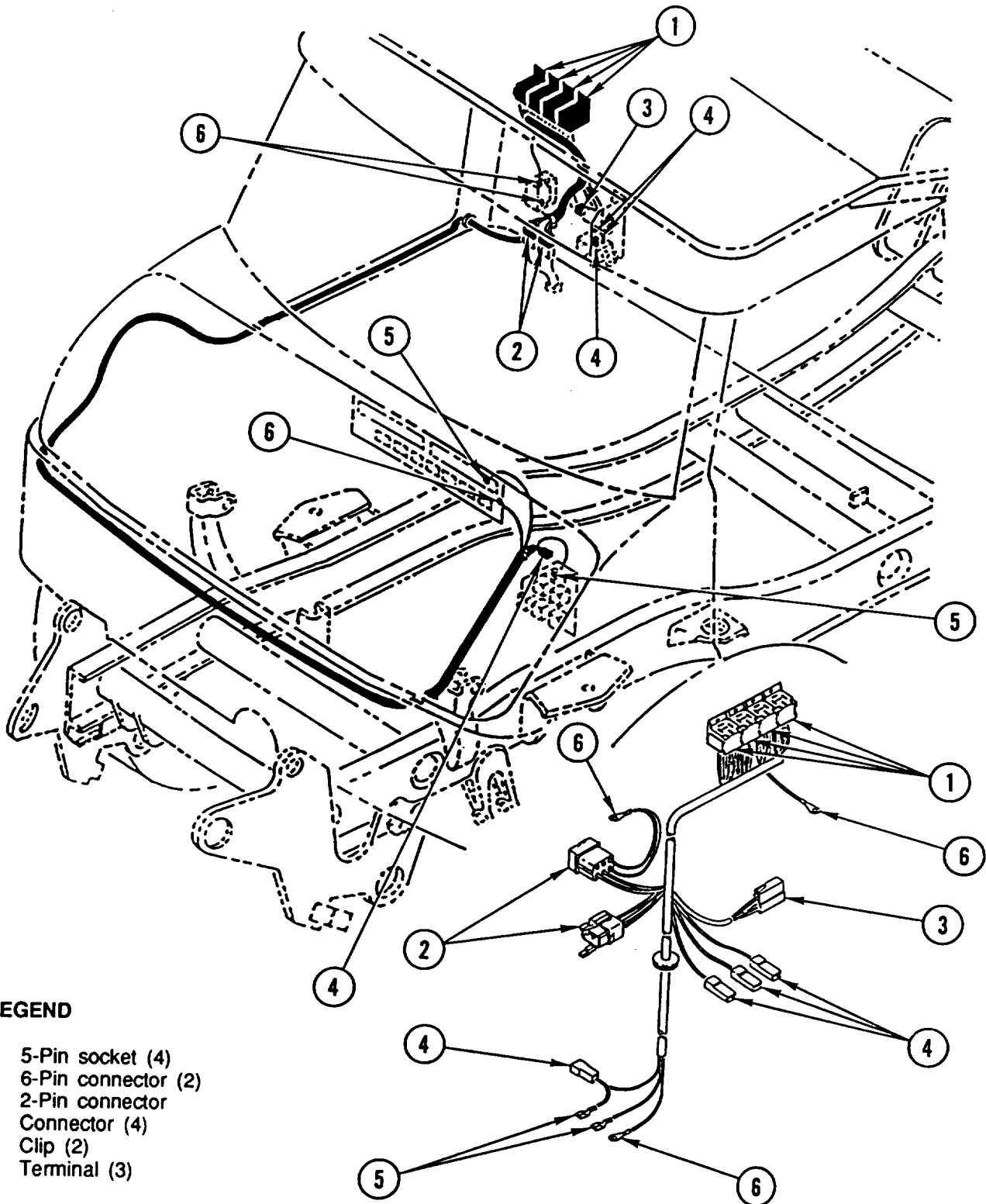
INSTALL fuse holder to hydraulic suspension lockout/rear wall wiring HARNESS using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:

Install fuse holders (TM 5-2420-224-20).  
Install passenger seat and framework (TM 5-2420-224-20).

**FUSE HOLDER TO HYDRAULIC SUSPENSION LOCKOUT/REAR WALL WIRING HARNESS REPLACEMENT (CONT)**



**LEGEND**

- 1 5-Pin socket (4)
- 2 6-Pin connector (2)
- 3 2-Pin connector
- 4 Connector (4)
- 5 Clip (2)
- 6 Terminal (3)

---

## FUSE HOLDER TO HYDRAULIC SUSPENSION LOCKOUT/REAR WALL WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

HMMH (Reg. No. UC053L and On)

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Fuse Holders Removed
TM 5-2420-224-20	Passenger Seat and Framework Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with loop clamps and screw terminals.
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE fuse holder to hydraulic suspension lookout/rear wall wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

Make sure fuse holder to hydraulic suspension lookout/rear wall wiring harness is secure and all hardware is tight.

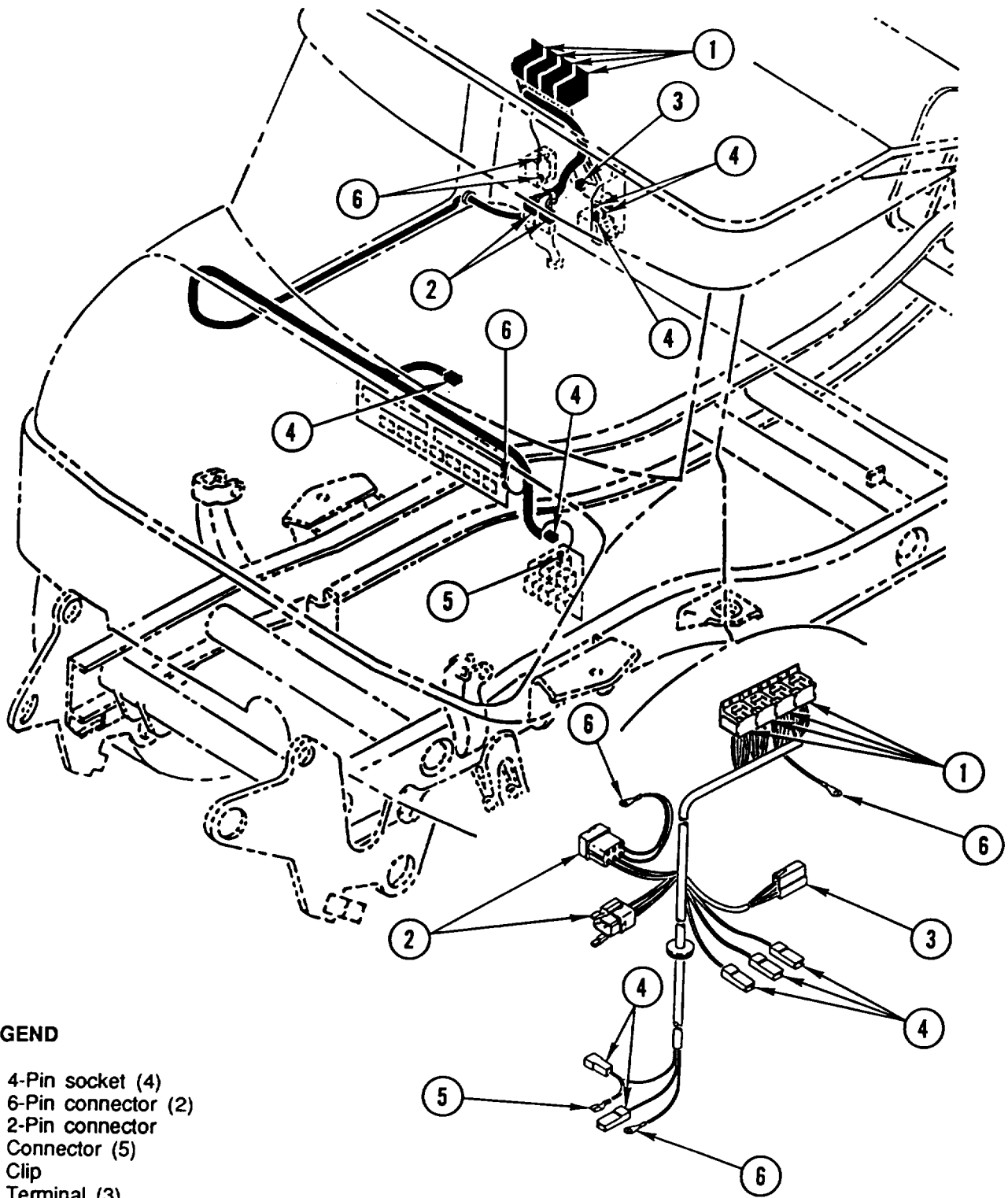
INSTALL fuse holder to hydraulic suspension lookout/rear wall wiring HARNESS using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:

Install fuse holders (TM 5-2420-224-20).  
Install passenger seat and framework (TM 5-2420-224-20).

**FUSE HOLDER TO HYDRAULIC SUSPENSION LOCKOUT/REAR WALL  
WIRING HARNESS REPLACEMENT (CONT)**



**LEGEND**

- 1 4-Pin socket (4)
- 2 6-Pin connector (2)
- 3 2-Pin connector
- 4 Connector (5)
- 5 Clip
- 6 Terminal (3)



## FRAME WIRING HARNESS REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

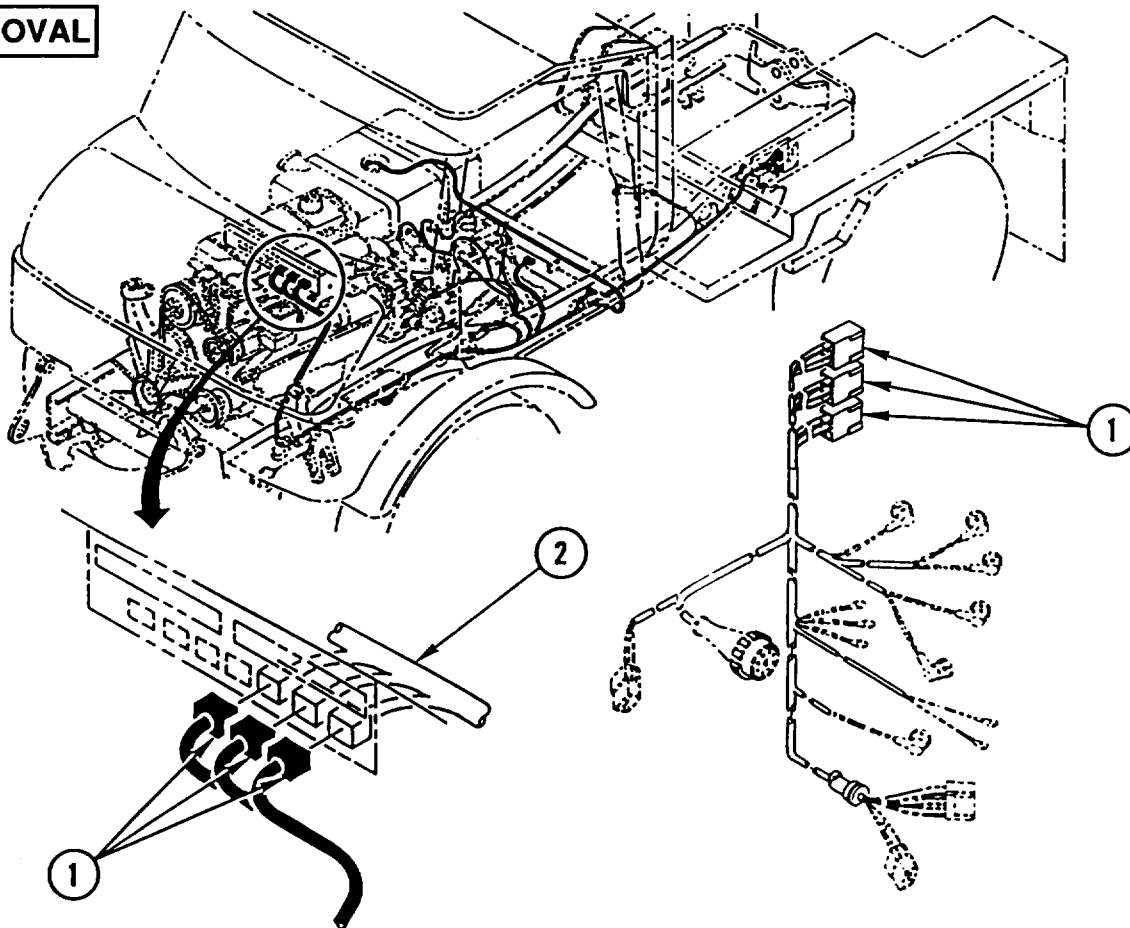
Reference	Condition Description
TM 5-2420-224-20	Cab Tilted

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

### REMOVAL

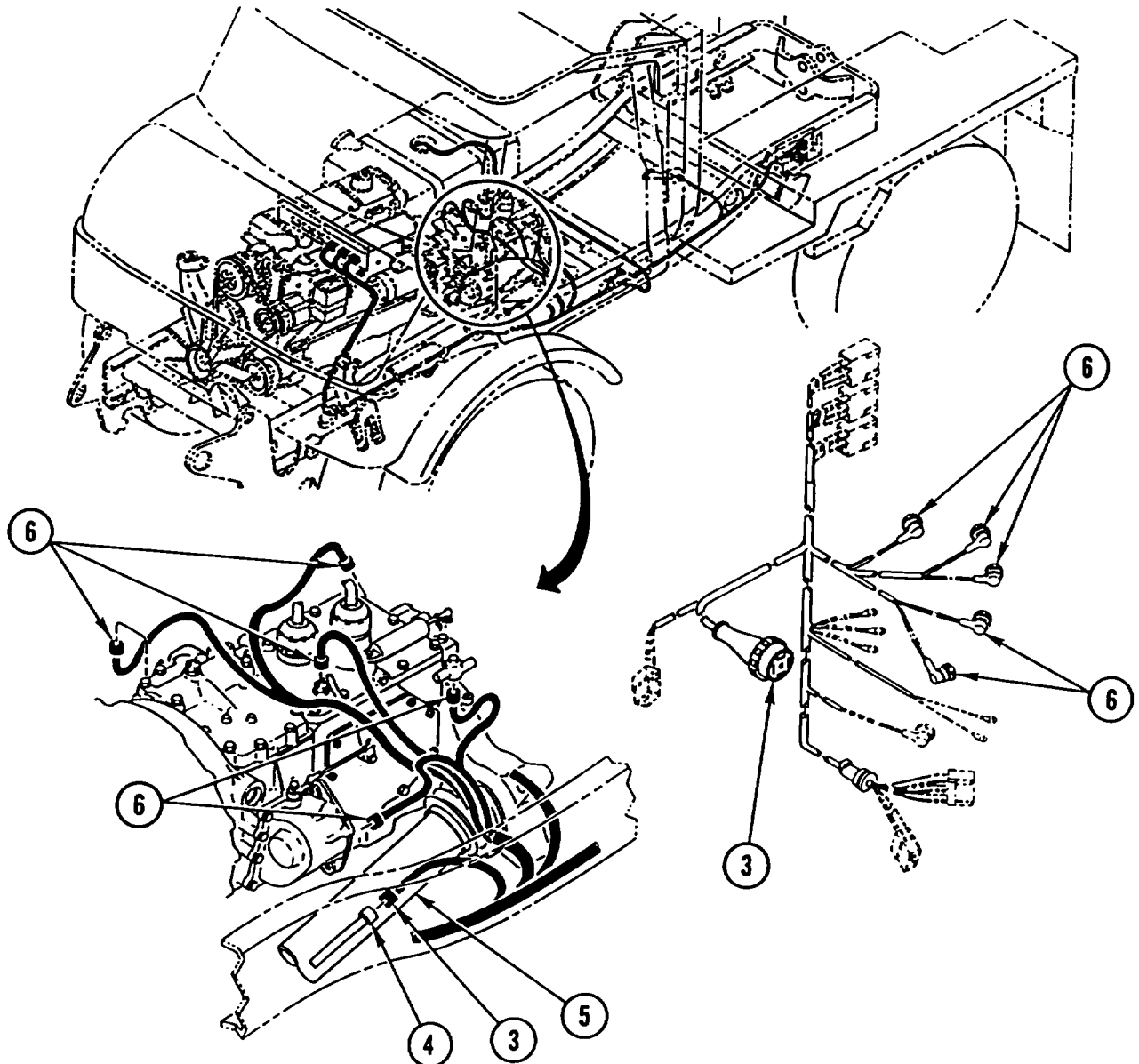


## FRAME WIRING HARNESS REPLACEMENT (CONT)

### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

1. DISCONNECT three 6-pin CONNECTORS (1) from main wiring harness (2).

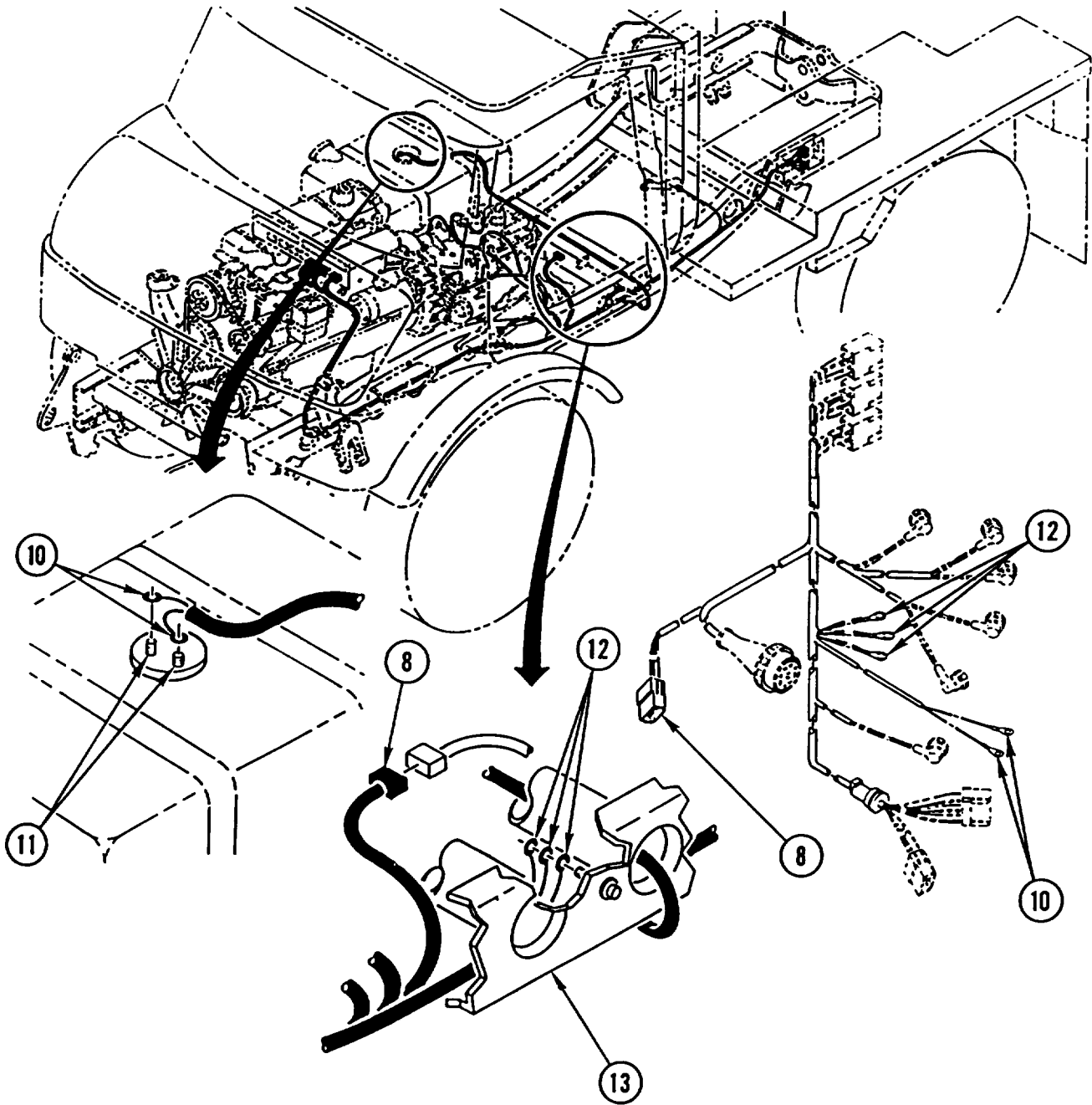


2. DISCONNECT 4-pin CONNECTOR (3) from front disc brake pad indicator wiring harness (4) on torque tube (5).
3. DISCONNECT five 2-pin CONNECTORS (6) from transmission assembly (7).

---

**FRAME WIRING HARNESS REPLACEMENT (CONT)**

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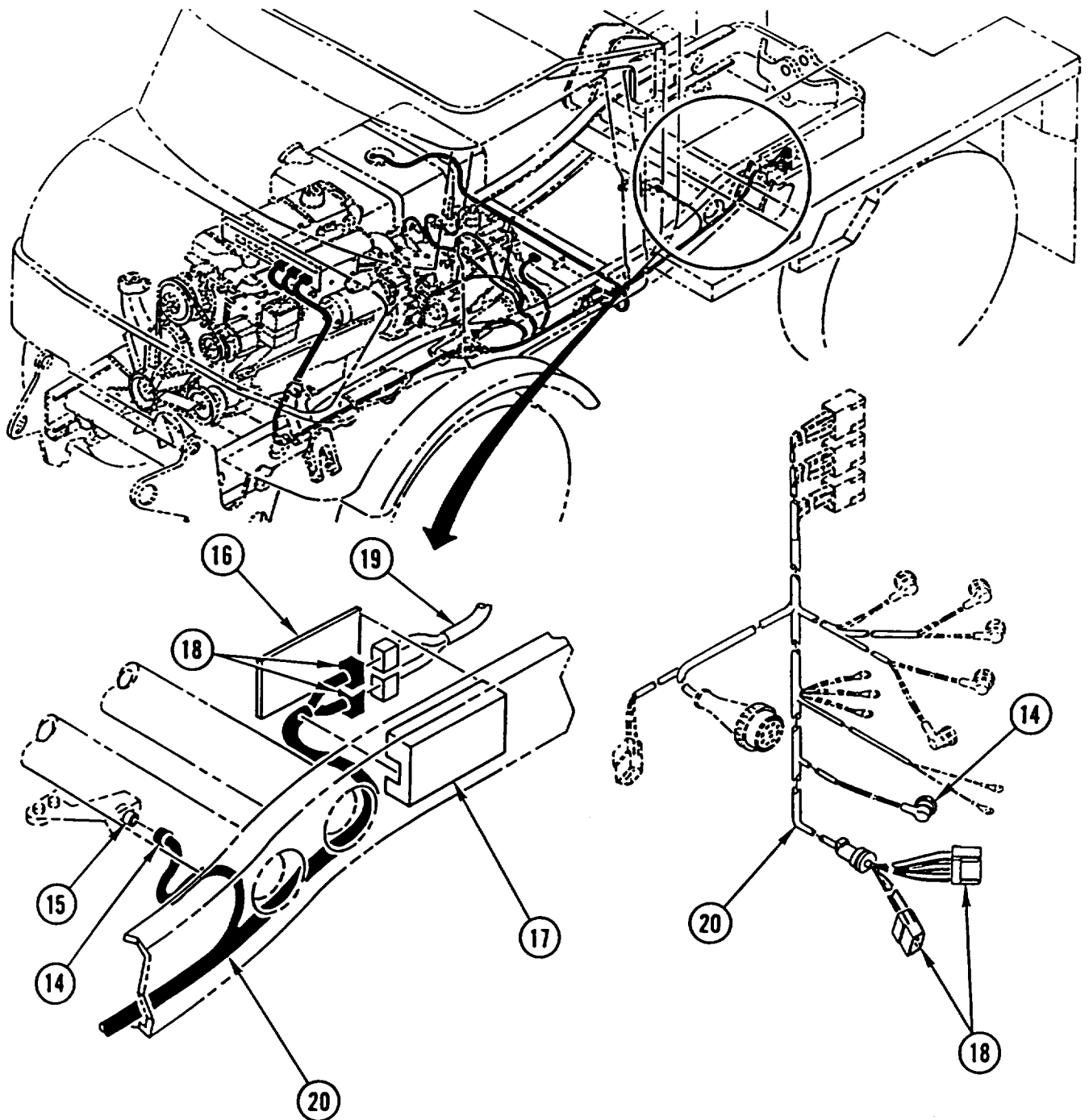


4. DISCONNECT 4-pin CONNECTOR (8) from chassis wiring harness (9).
5. DISCONNECT two TERMINALS (10) from fuel level gage (11).
6. DISCONNECT three TERMINALS (12) from frame (13).

---

**FRAME WIRING HARNESS REPLACEMENT (CONT)**


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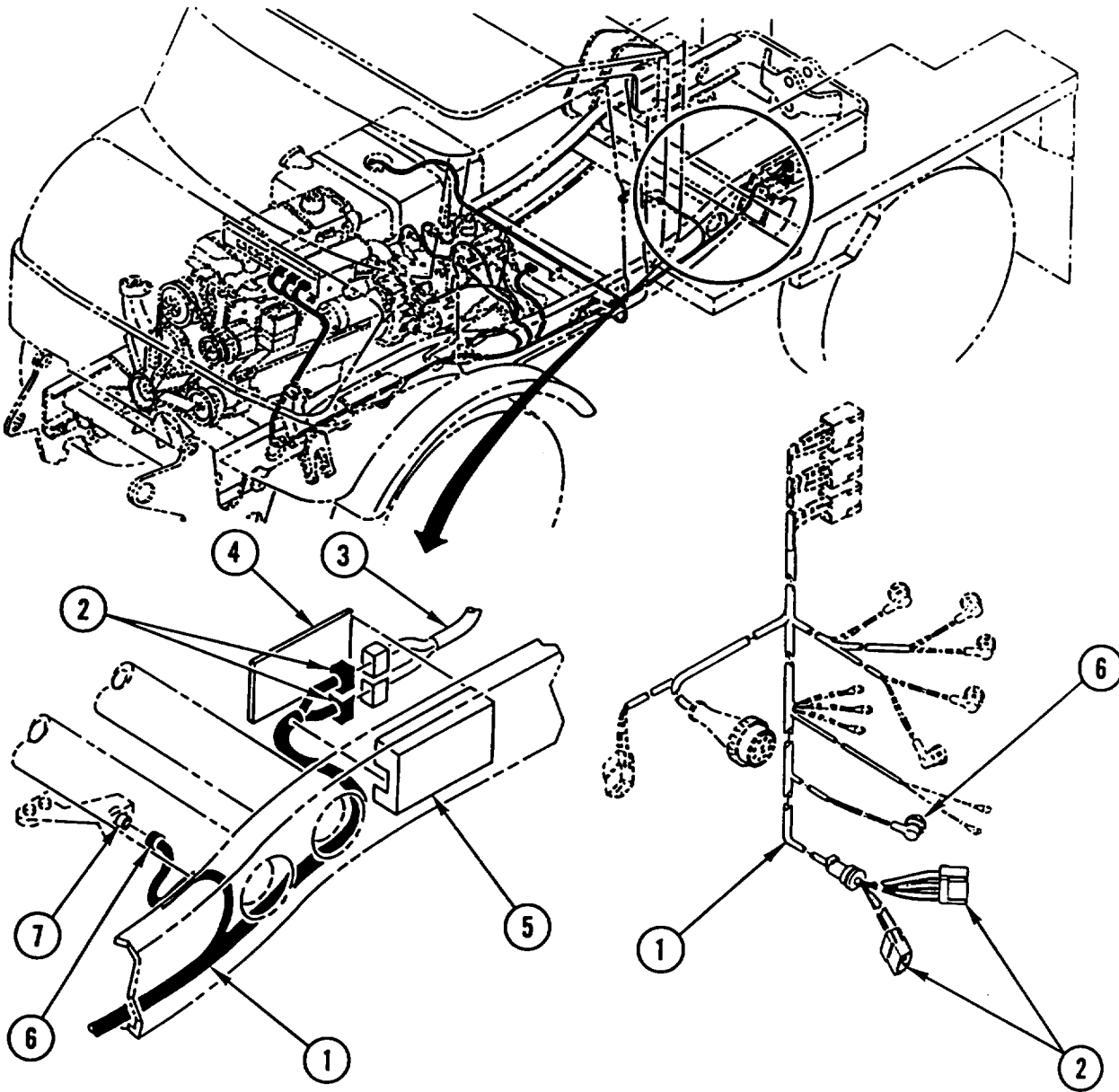
7. DISCONNECT 2-pin CONNECTOR (14) from parking brake switch (15).
8. REMOVE COVER (16) from box (17) and DISCONNECT two 6-pin CONNECTORS (18) from trailer wiring harness (19).
9. REMOVE frame wiring HARNESS (20) from vehicle.

---

## FRAME WIRING HARNESS REPLACEMENT (CONT)

---

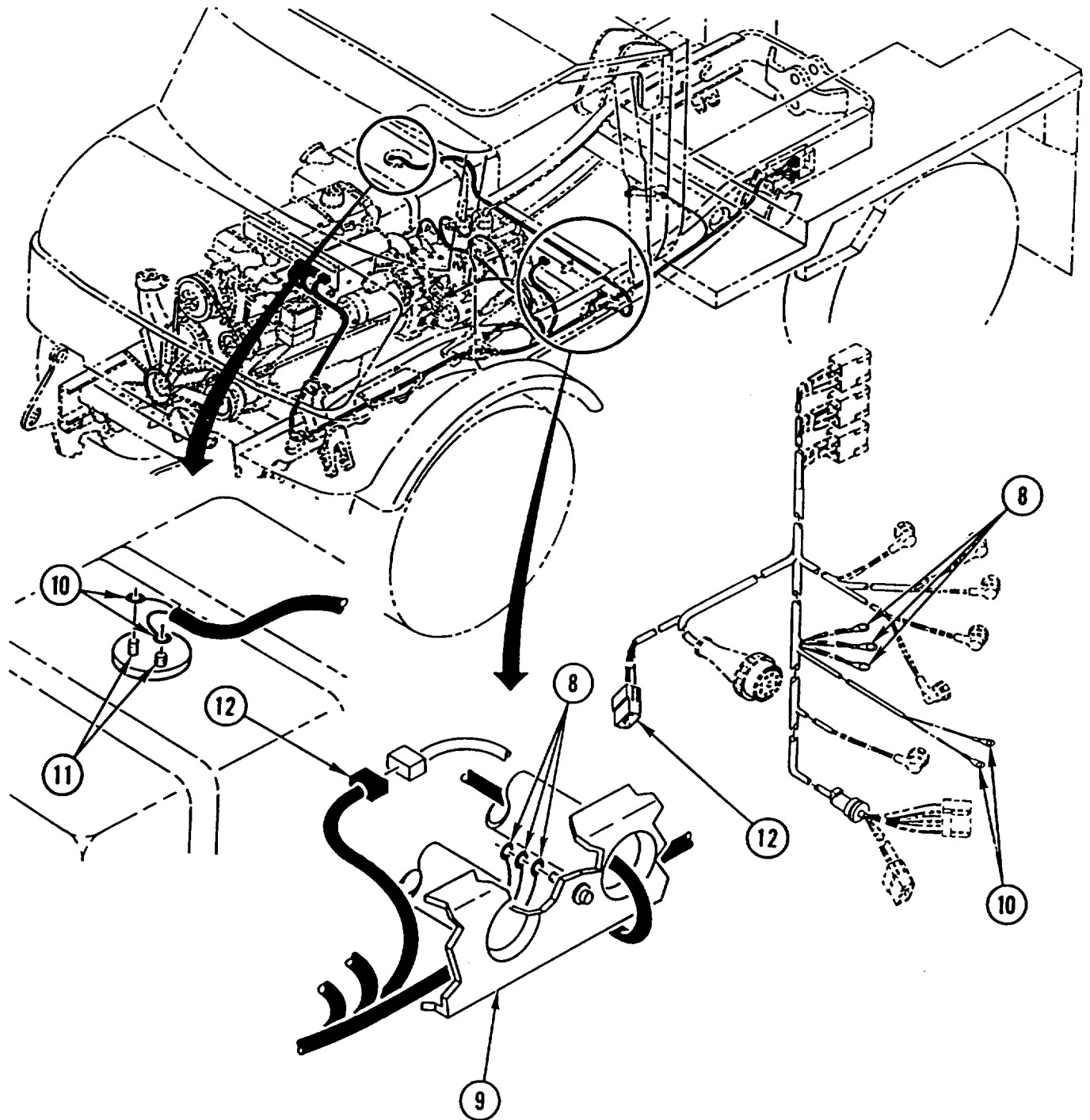
### INSTALLATION



#### NOTE

- Make sure frame wiring harness is secure and all hardware is tight.
- Ž Install new tiedown strap(s).

1. INSTALL frame wiring HARNESS (1) in vehicle.
2. CONNECT two 6-pin CONNECTORS (2) to trailer wiring harness (3) and INSTALL COVER (4) on box (5).
3. CONNECT 2-pin CONNECTOR (6) to parking brake switch (7).

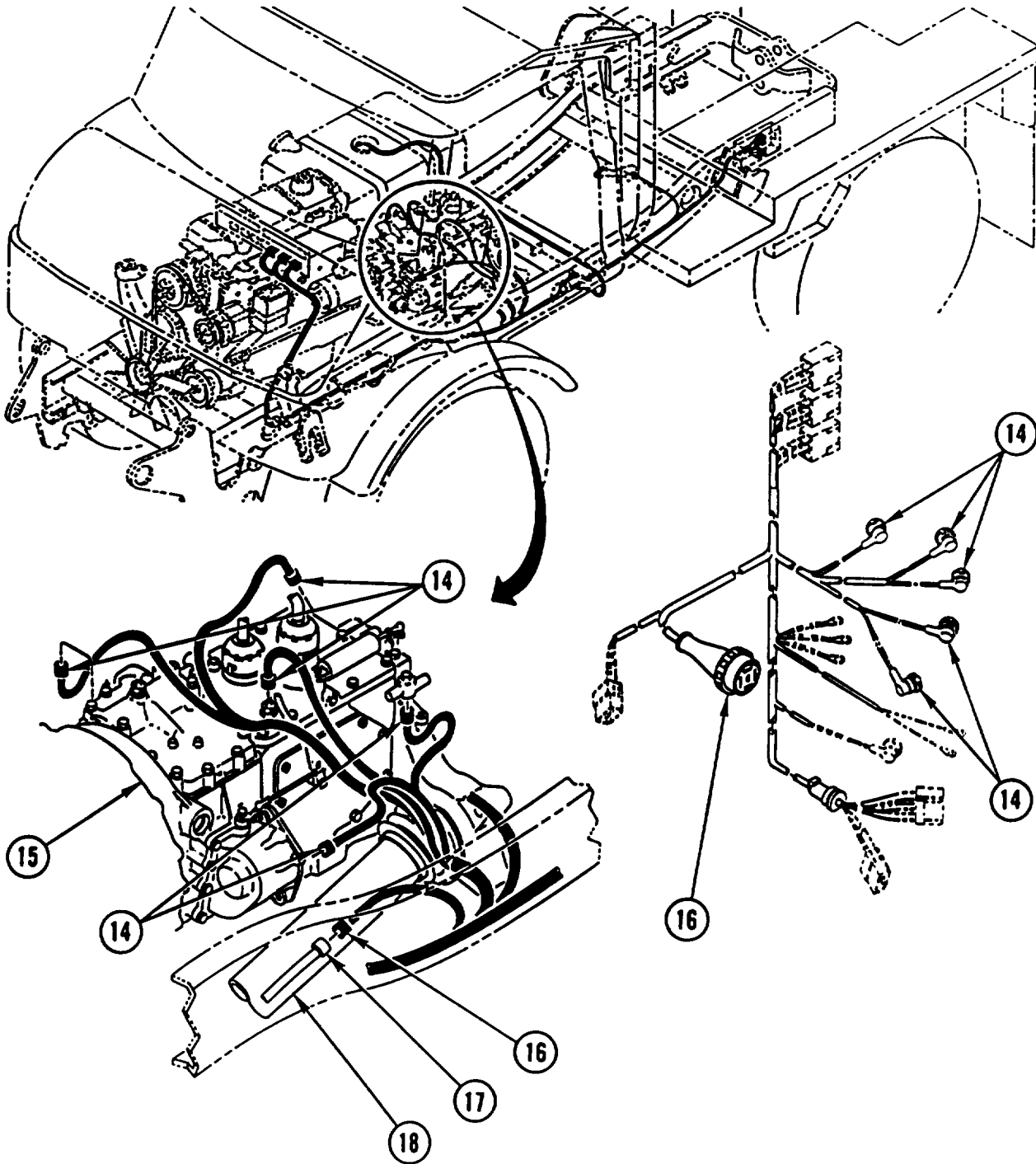
**FRAME WIRING HARNESS REPLACEMENT (CONT)**

4. CONNECT three TERMINALS (8) to frame (9).
5. CONNECT two TERMINALS (10) to fuel level gage (11).
6. CONNECT 4-pin CONNECTOR (12) to chassis wiring harness (13).

---

**FRAME WIRING HARNESS REPLACEMENT (CONT)**

---

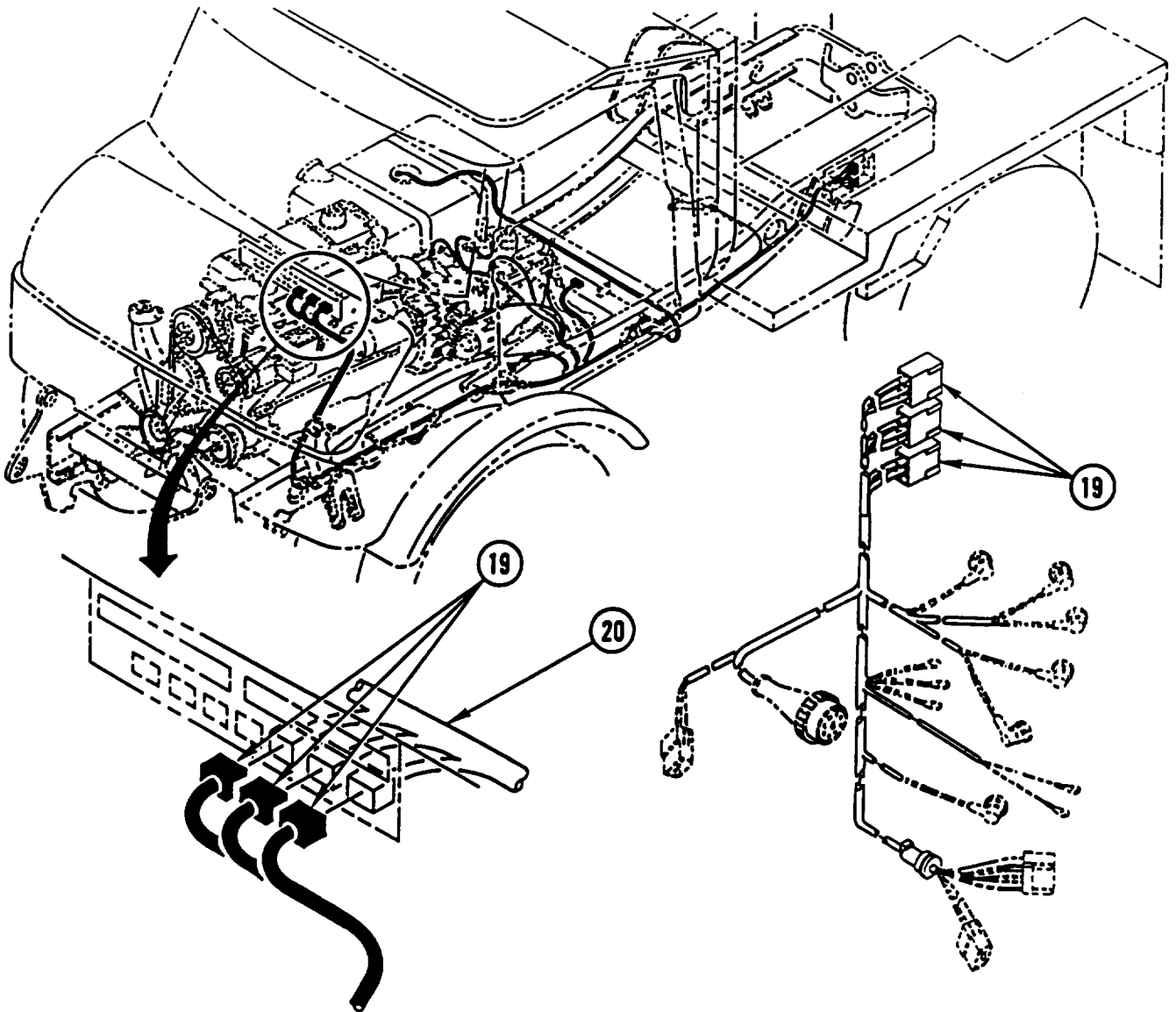


7. CONNECT five 2-pin CONNECTORS (14) to transmission assembly (15).
8. CONNECT 4-pin CONNECTOR (16) to front disc brake pad indicator wiring harness (17) on torque tube (18).

---

**FRAME WIRING HARNESS REPLACEMENT (CONT)**

---



9. CONNECT three 6-pin CONNECTORS (19) to main wiring harness (20).

**NOTE**

Follow-on Maintenance:

Lower cab (TM 5-2420-224-20).



---

## SUPPRESSOR FILTER ELECTRICAL LEAD REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Suppressor Filter Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Procedure is the same for both suppressor filters.
- Wiring harnesses and leads are secured to vehicle with loop clamps and screw terminals.
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE suppressor filter electrical LEAD using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Procedure is the same for both suppressor filters.
- Make sure suppressor filter electrical lead is secure and all hardware is tight.

INSTALL suppressor filter electrical LEAD using illustration and legend as a guide.

#### NOTE

Follow-on Maintenance:

Install suppressor filter (TM 5-2420-224-20).

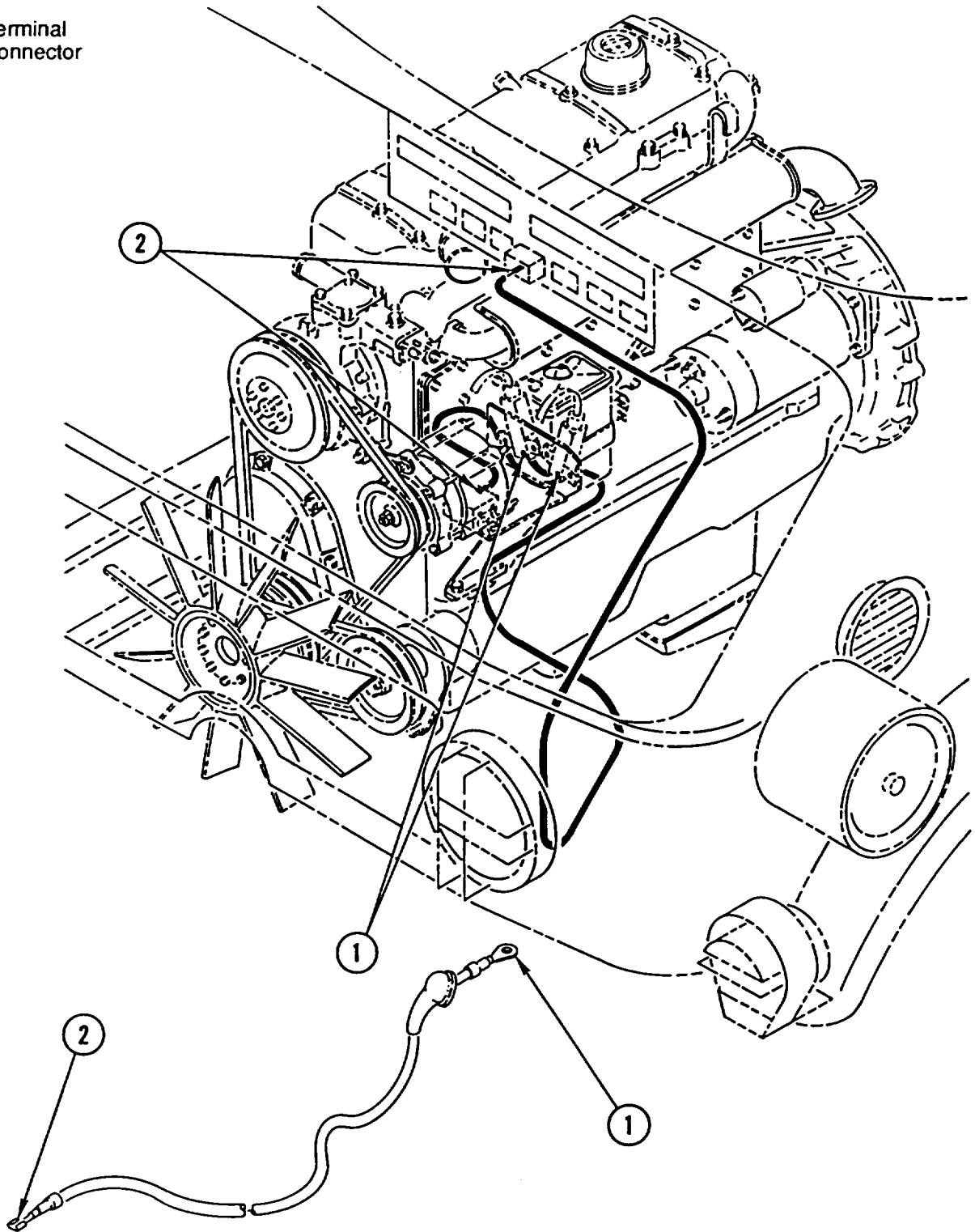
---

## SUPPRESSOR FILTER ELECTRICAL LEAD REPLACEMENT (CONT)

---

### LEGEND

- 1 Terminal
- 2 Connector



---

## CAP PLUG CONNECTOR TO HEATER PANEL SWITCH AND MASTER LIGHT SWITCH WIRING HARNESS REPLACEMENT

---

This task covers. a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Air Cleaner Ducts Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE cap plug connector to heater panel switch and master light switch wiring HARNESS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure cap plug connector to heater panel switch and master light switch wiring harness is secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL cap plug connector to heater panel switch and master light switch wiring HARNESS using illustration and legend as a guide.

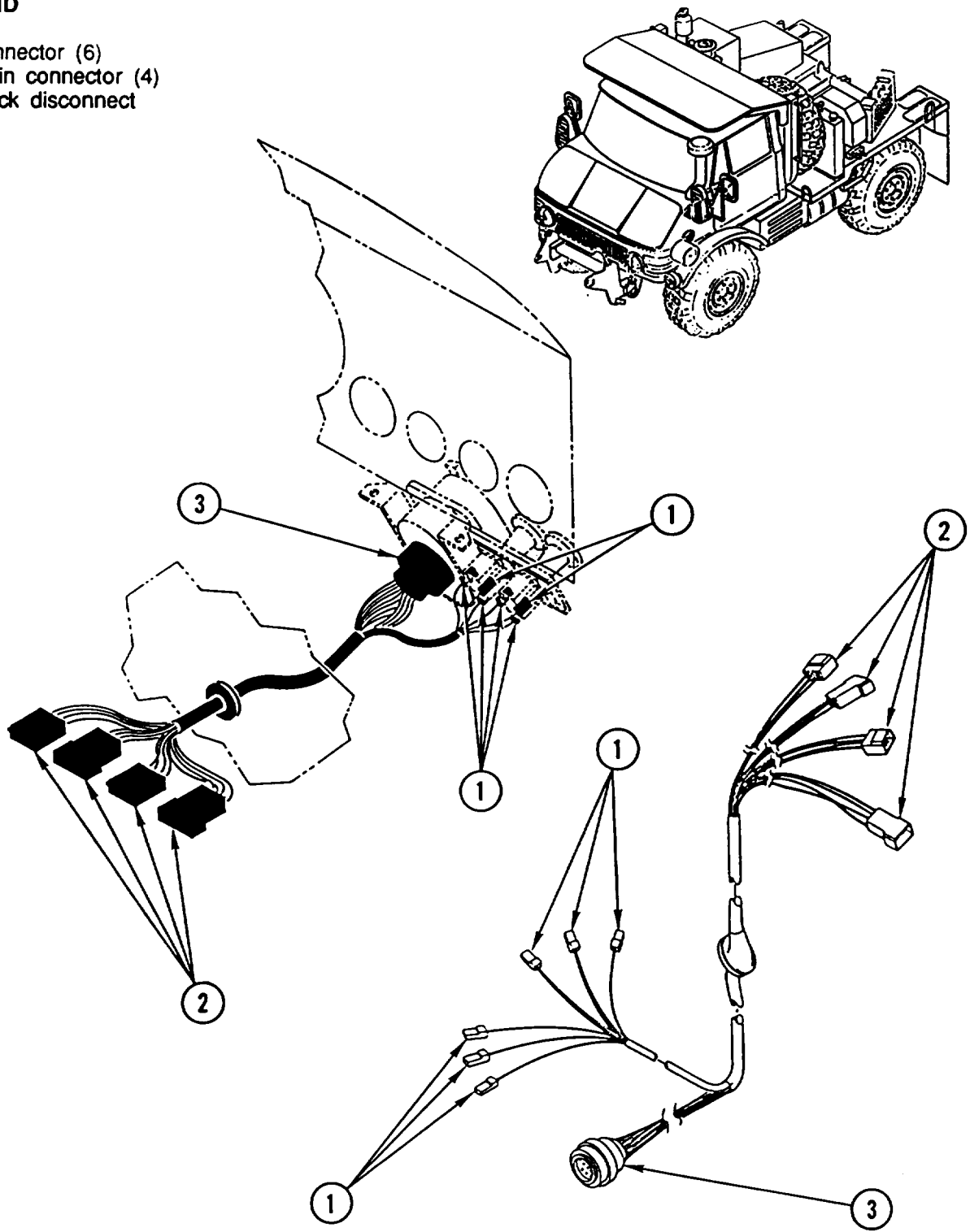
#### NOTE

Follow-on Maintenance:  
Install air cleaner ducts (TM 5-2420-224-20).

**CAP PLUG CONNECTOR TO HEATER PANEL SWITCH AND MASTER LIGHT SWITCH WIRING HARNESS REPLACEMENT (CONT)**

**LEGEND**

- 1 Connector (6)
- 2 4-Pin connector (4)
- 3 Quick disconnect



---

## CHASSIS WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Tool and Work Light Switches Removed
TM 5-2420-224-20	Bucket and Auxiliary Throttle Switches (SEE) or Auxiliary Throttle Switch (HMMH) Removed
TM 5-2420-224-20	Work Lights Removed

#### General Safety Instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

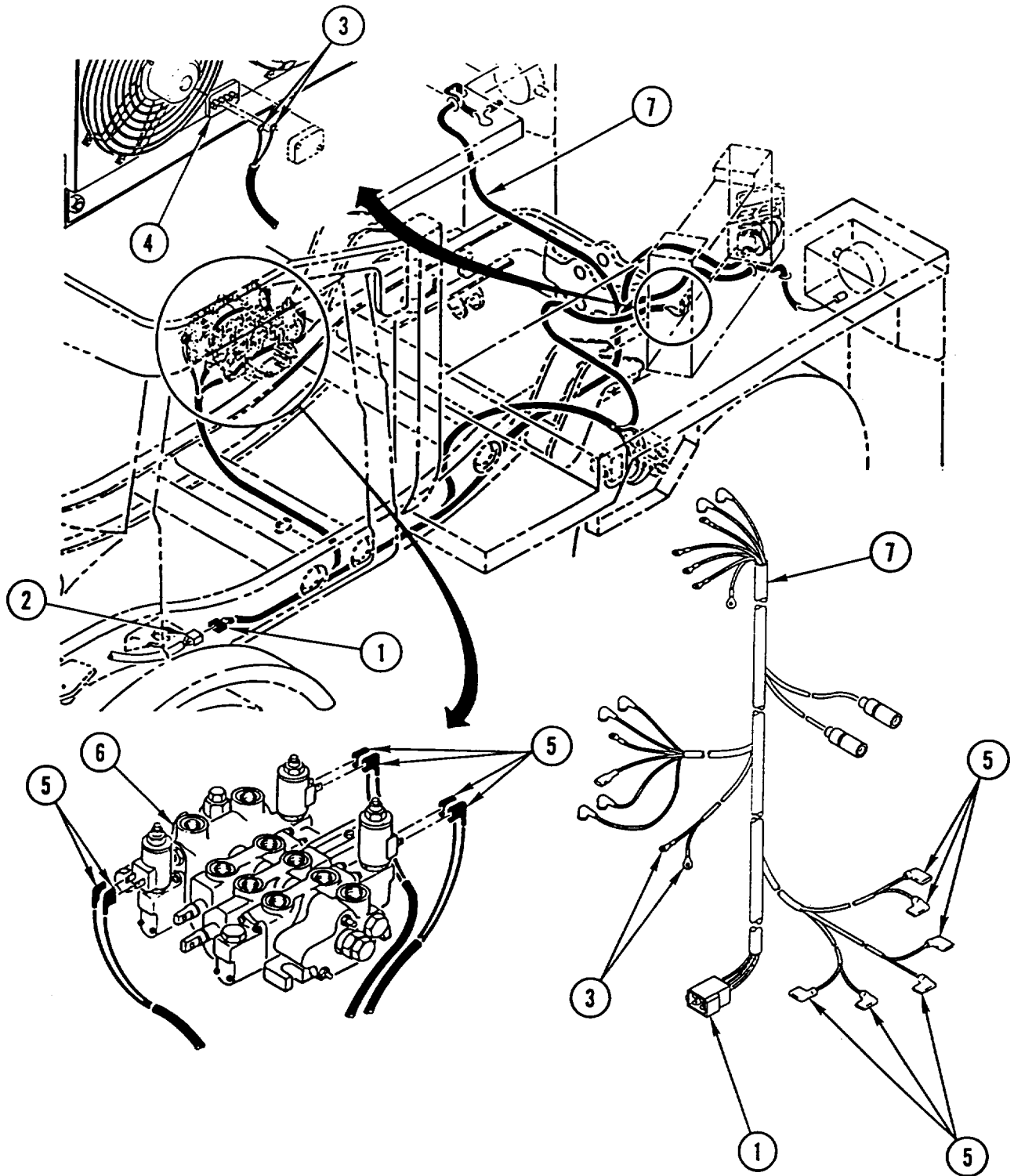
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### REMOVAL

#### NOTE

- Procedure is the same for both vehicles.
  - Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
  - Only remove hardware securing wiring harness or lead to be removed.
1. DISCONNECT 4-pin CONNECTOR (1) from frame wiring harness (2).
  2. DISCONNECT two TERMINALS (3) from hydraulic oil cooler thermal switch (4).
  3. DISCONNECT six CONNECTORS (5) from front loader/forklift control valve (6).
  4. REMOVE chassis wiring HARNESS (7) from vehicle.

# CHASSIS WIRING HARNESS REPLACEMENT (CONT)



---

## CHASSIS WIRING HARNESS REPLACEMENT (CONT)

---

### **INSTALLATION**

#### **NOTE**

- Procedure is the same for both vehicles.
  - Make sure chassis wiring harness is secure and all hardware is tight.
  - Install new tiedown strap(s).
1. INSTALL chassis wiring HARNESS (1) in vehicle.
  2. CONNECT six CONNECTORS (2) to front loader/forklift control valve (3).
  3. CONNECT two TERMINALS (4) to hydraulic oil cooler thermal switch (5).
  4. CONNECT 4-pin CONNECTOR (6) to frame wiring harness (7).

#### **NOTE**

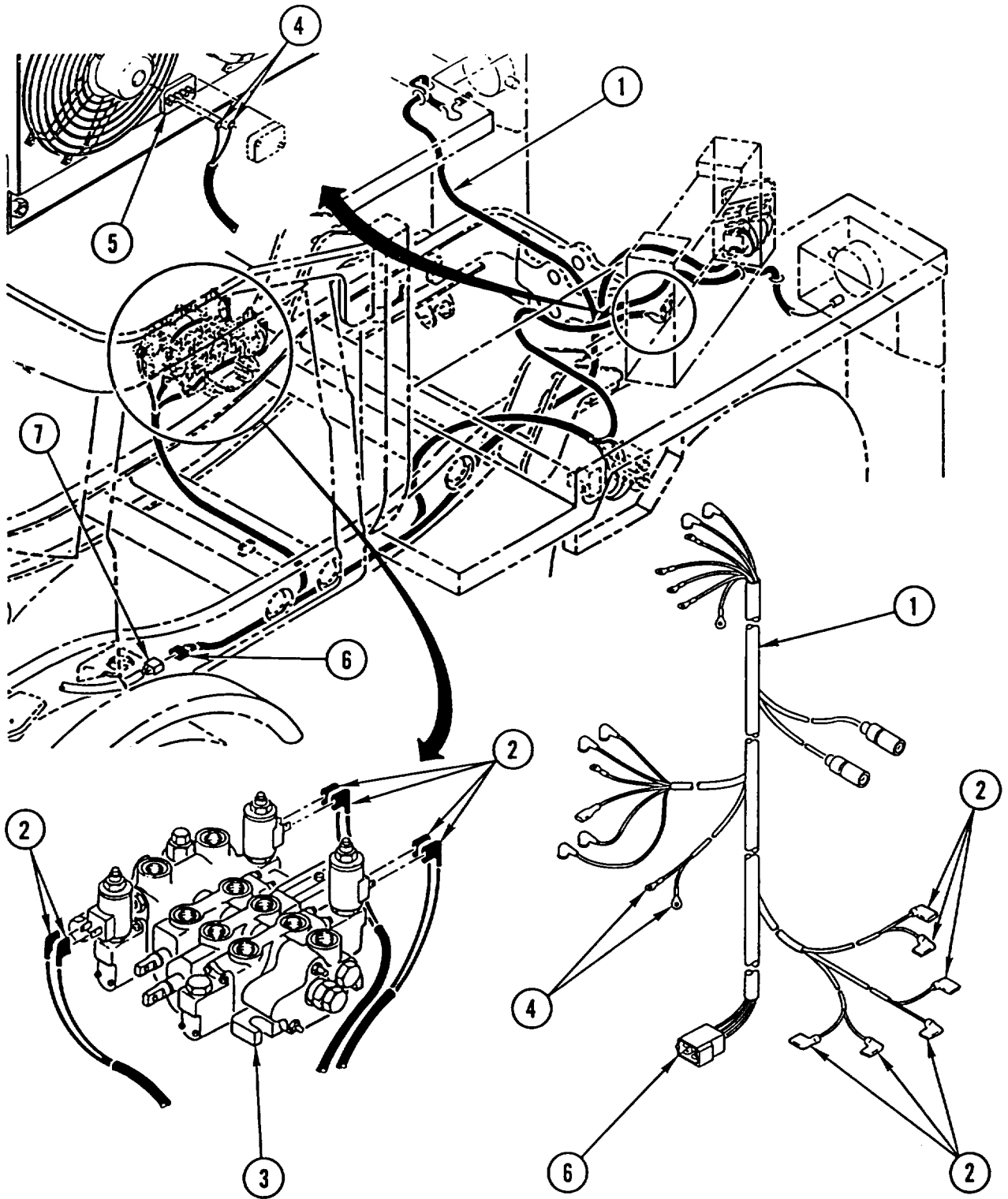
Follow-on Maintenance:

Install tool and work light switches (TM 5-2420-224-20).

Install bucket and auxiliary throttle switches (SEE) or auxiliary throttle switch (HMMH) (TM 5-2420-224-20).

Install work lights (TM 5-2420-224-20).

CHASSIS WIRING HARNESS REPLACEMENT (CONT)





---

## THROTTLE SOLENOID ELECTRICAL LEADS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap, Tiedown                      Appendix B, Item 44

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Tool and Work Light Switches Removed

#### General Safety instructions:

#### WARNING

Remove or disconnect batteries and turn vehicle MASTER disconnect switch OFF prior to performing maintenance in immediate battery area or working on electrical system. Such disconnections prevent electrical shock to personnel or equipment.

---

### REMOVAL

#### NOTE

- Wiring harnesses and leads are secured to vehicle with tiedown straps, loop clamps, and screw terminals. Discard tiedown strap(s).
- Only remove hardware securing wiring harness or lead to be removed.

REMOVE throttle solenoid electrical LEADS using illustration and legend as a guide.

### INSTALLATION

#### NOTE

- Make sure throttle solenoid electrical leads are secure and all hardware is tight.
- Install new tiedown strap(s).

INSTALL throttle solenoid electrical LEADS using illustration and legend as a guide.

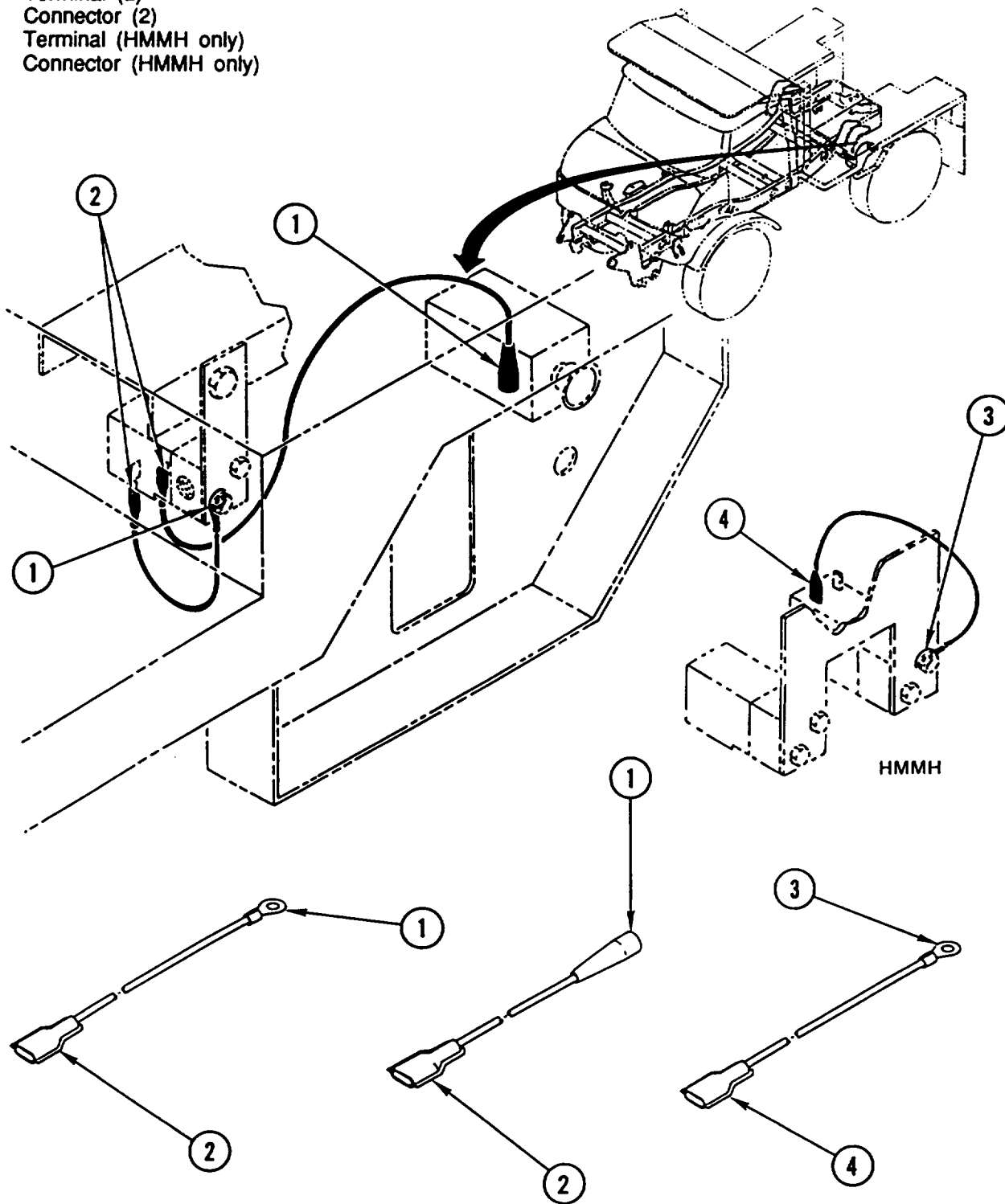
#### NOTE

Follow-on Maintenance:  
Install tool and work light switches (TM 5-2420-224-20).

**THROTTLE SOLENOID ELECTRICAL LEADS REPLACEMENT (CONT)**

**LEGEND**

- 1 Terminal (2)
- 2 Connector (2)
- 3 Terminal (HMMH only)
- 4 Connector (HMMH only)





## CHAPTER 5 FRONT AXLE MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the front axle. A list of tasks contained in this chapter is shown below.

	<b>Page</b>
Front Axle Assembly Replacement .....	5-1
Front Axle Thrust Arms Replacement .....	5-14
Steering Knuckle and Front Axle Final Drive Replacement .....	5-16

### FRONT AXLE ASSEMBLY REPLACEMENT

This task covers: a. Removal b. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Remover, P/N 406 589 05 33 00  
 Wrench, P/N 000 589 51 03 00

**Materials/Parts:**

Pin, Cotter  
 Nut, Lock  
 Washer, Lock  
 Seal (2)  
 Nut, Lock (2)  
 Packing (2)  
 Washer, Lock (4)  
 Ring, Seal (4)  
 Compound, Sealing           Appendix B, Item 15  
 Grease, Molybdenum       Appendix B, Item 24  
 Disulfide  
 Rags                               Appendix B, Item 40

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20  
 LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Exhaust Pipe (Front) Removed
TM 5-2420-224-20	Front Loader (SEE) or Forklift (HMMH) Removed
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Front Axle Torsion Bar Removed
LO 5-2420-224-12	Transmission Drained
LO 5-2420-224-12	Front Axle Center Housing Drained
LO 5-2420-224-12	Wheel Hub Drive Drained

**General Safety Instructions:**

**WARNING**

- Wheel assembly weighs 170 pounds (77 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting wheel assembly.

## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

### General Safety Instructions (Cont):

#### WARNING

- Control arm weighs more than 50 pounds (23 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting control arm.
- Support drag link during disconnect of ball joint from pitman arm. Failure to do so could result in injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up all spilled fuel or oil with rags.
- 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.

### General Safety Instructions (Cont):

#### WARNING

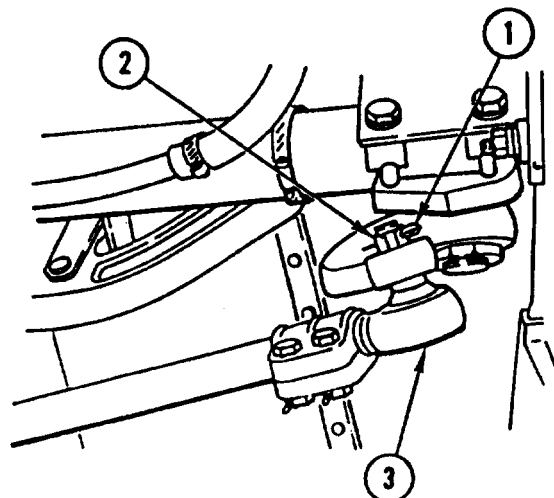
- SEE/HMMH should not be operated with front loader (SEE) or forklift (HMMH) removed, except in a maintenance facility. When maintenance is required and front loader or forklift is removed, never operate SEE/HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with either front loader or forklift removed. This could cause loss of control and injury to personnel or damage to vehicle.

### REMOVAL

#### NOTE

Procedure is the same for both vehicles except as noted.

1. REMOVE cotter pin (1) and castellated NUT (2) from drag link (3). DISCARD cotter PIN.

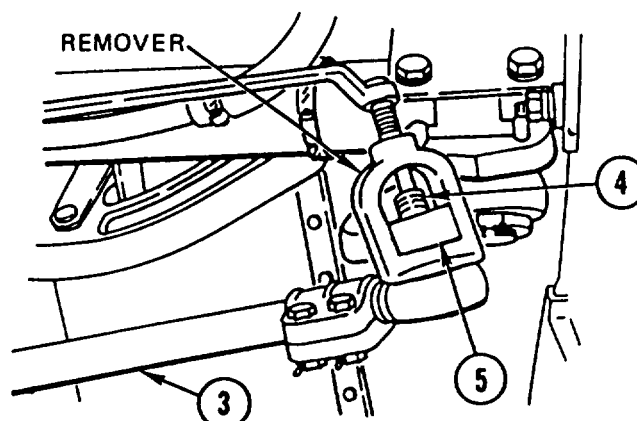


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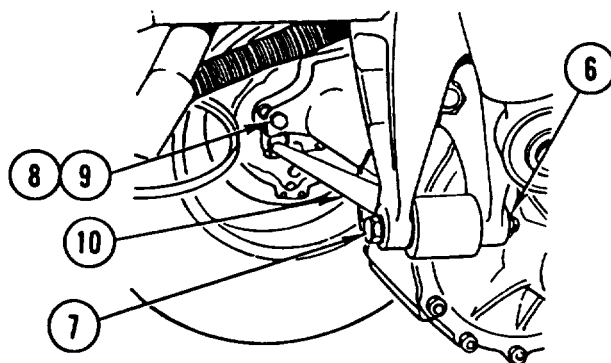
**FRONT AXLE ASSEMBLY REPLACEMENT (CONT)**


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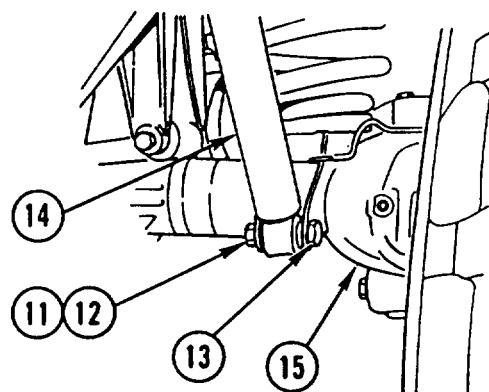
2. USING REMOVER, DISCONNECT ball JOINT (4) from pitman arm (5).
3. SWING drag LINK (3) aside.



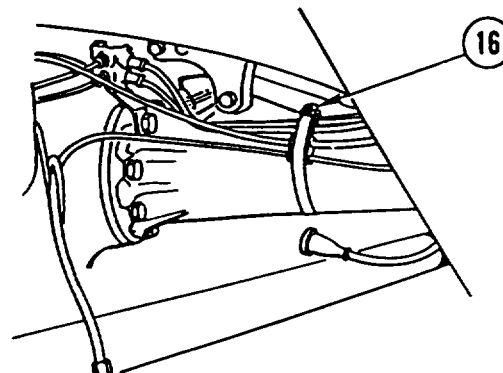
4. REMOVE lock nut (6), screw (7), screw (8), lock washer (9), and control ARM (10). DISCARD lock NUT and lock WASHER.



5. REMOVE nut (11), lock washer (12), and SCREW (13) and DISCONNECT left front shock ABSORBER (14) at axle (15). REINSTALL SCREW (13), lock washer (12), and nut (11).
6. REPEAT STEP 5 for right front shock absorber.



7. REMOVE CLAMP (16).



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## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

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**NOTE**

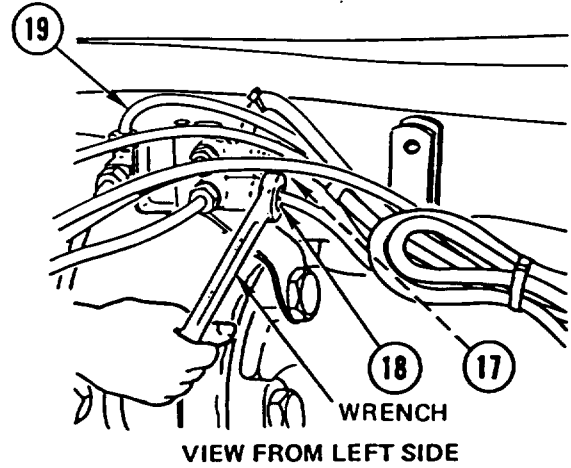
Tag all lines prior to disconnecting to aid in connecting.

8. USING WRENCH, DISCONNECT two brake LINES (17 and 18).

**NOTE**

Step 9 is for HMMH only.

9. DISCONNECT hydraulic suspension lockout LINE (19)

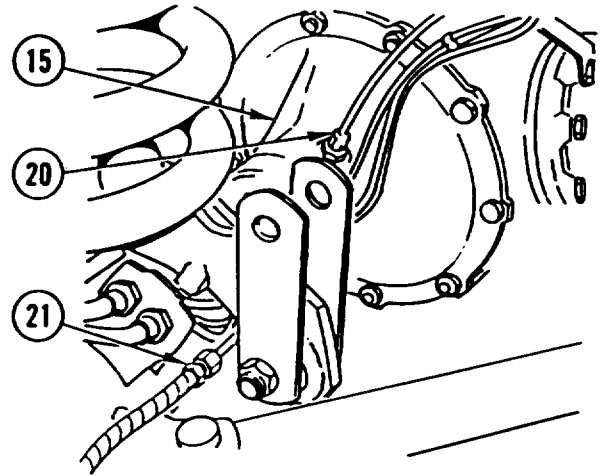


10. DISCONNECT differential lock air HOSE (20) from left side of axle (15).

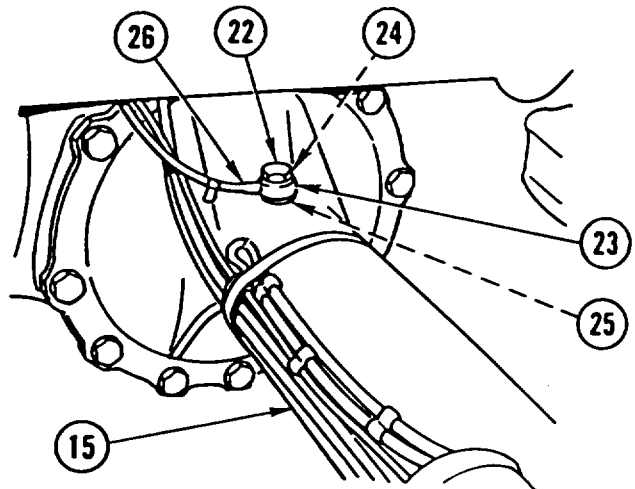
**NOTE**

Step 11 is for HMMH only.

11. DISCONNECT hydraulic suspension lockout HOSES (21) from both sides of vehicle.



12. REMOVE fluid passage BOLT (22), union (23), and two seals (24 and 25) and DISCONNECT axle vent HOSE (26) from right side of axle (15). DISCARD SEALS.

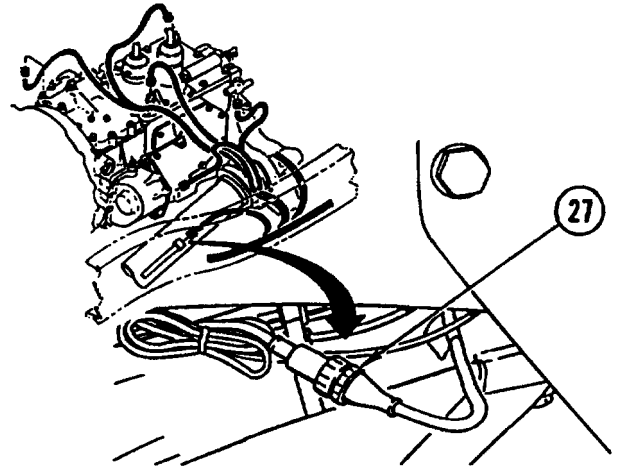


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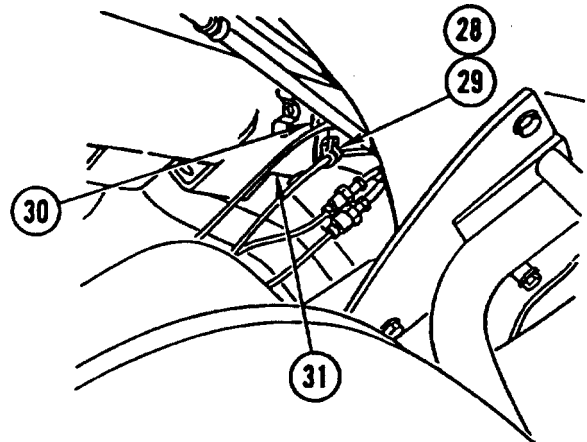
**FRONT AXLE ASSEMBLY REPLACEMENT (CONT)**

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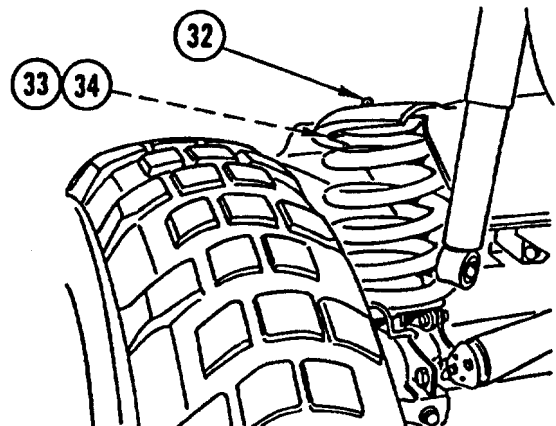
13. DISCONNECT brake wear indicator CONNECTOR (27).



14. REMOVE screw (28), CLAMP (29), and CLAMP (30) from torque tube (31).



15. REMOVE lock nut (32), screw (33), and COVER (34) from right front spring mount. DISCARD lock NUT.

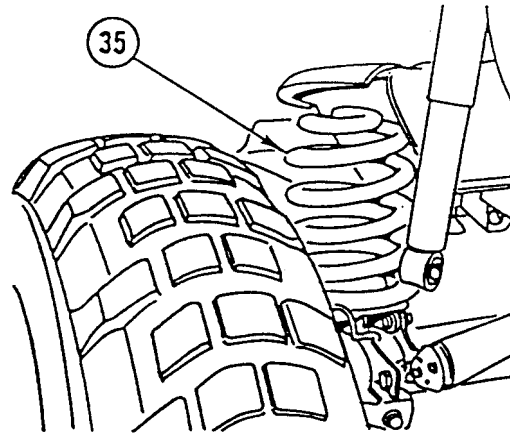


16. REPEAT STEP 15 for left front spring mount.

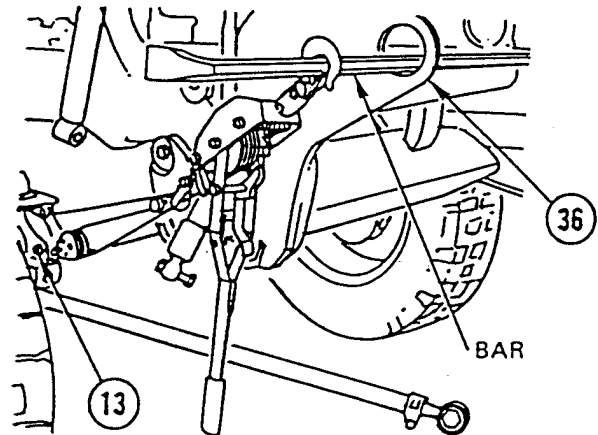


## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

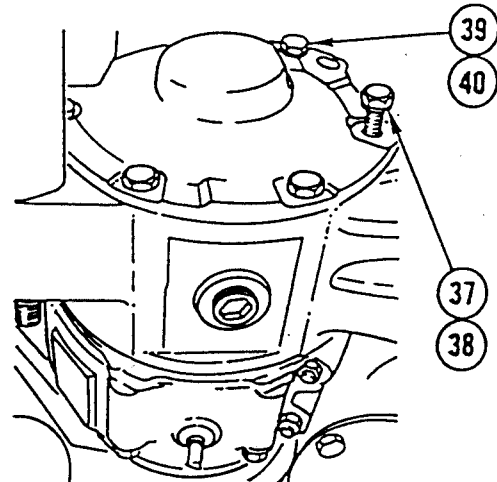
17. USING suitable JACK or lifting device, RAISE VEHICLE off right front spring (35).
18. REMOVE SPRING (35) and LOWER VEHICLE back onto jack stand.
19. REPEAT STEPS 17 and 18 for left front spring.



20. INSTALL suitable BAR through two lifting eyes (36).
21. INSTALL suitable cable PULLER to right front axle shock absorber mounting screw (13) and bar.
22. REPEAT STEP 21 for left front axle.

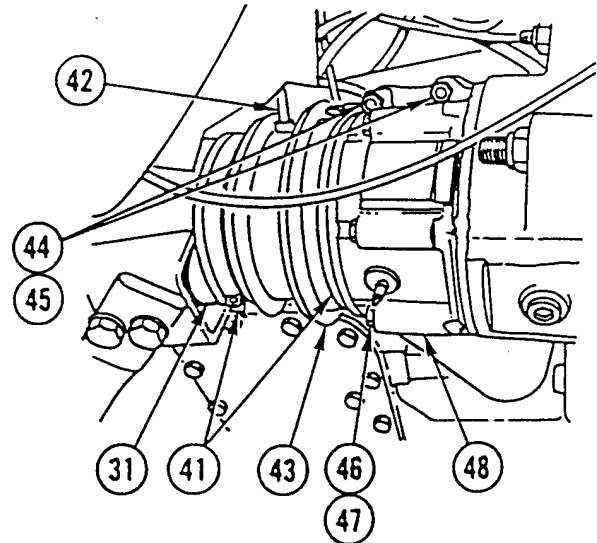


23. REMOVE SCREW (37), PACKING (38), SCREW (39), and PACKING (40). DISCARD PACKINGS.



## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

24. REMOVE two clamps (41) and vent HOSE (42).
25. SLIDE BELLOWS (43) down torque tube (31).
26. REMOVE four NUTS (44) and four lock washers (45). DISCARD lock WASHERS.
27. REMOVE four screws (46), four SEAL RINGS (47), and lower housing HALF (48). DISCARD SEAL RINGS.



### WARNING

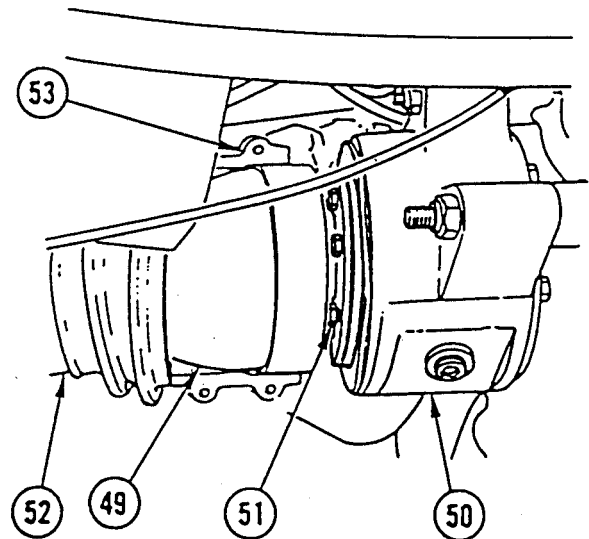
Place a suitable support under torque tube and one wheel. Failure to do so could result in injury to personnel.

28. USING suitable cable PULLER, PULL AXLE forward until torque ball housing (49) separates from transmission (50).

### NOTE

Front wheel can be rotated to gain access to screws in step 29.

29. REMOVE six SCREWS (51).
30. REMOVE front AXLE assembly (52) and upper housing HALF (53).

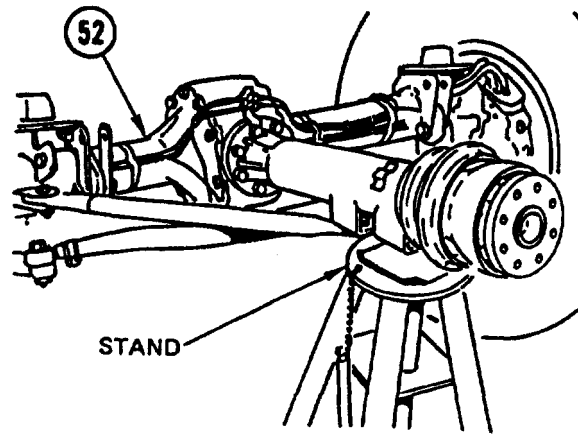


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## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

---

31. PLACE AXLE (52) on suitable STANDS.
32. REMOVE BAR installed in step 20.
33. REMOVE TIE ROD (TM 5-2420-224-20).
34. REMOVE DRAG LINK (TM 5-2420-224-20).
35. REMOVE FRONT BRAKE CALIPERS HYDRAULIC LINES AND FITTINGS (TM 5-2420-224-20).
36. REMOVE HYDRAULIC SUSPENSION LOCKOUT LINES AND FITTINGS (HMMH) (TM 5-2420-224-20).
37. REMOVE FRONT BRAKE CALIPERS (TM 5-2420-224-20).
38. REMOVE FRONT PROPELLER SHAFT (page 3-102).
39. REMOVE FRONT AXLE THRUST TUBE (page 3-105).



### INSTALLATION

#### NOTE

Procedure is the same for both vehicles except as noted.

1. INSTALL TIE ROD (TM 5-2420-224-20).
2. INSTALL DRAG LINK (TM 5-2420-224-20).
3. INSTALL FRONT BRAKE CALIPERS HYDRAULIC LINES AND FITTINGS (TM 5-2420-224-20).
4. INSTALL HYDRAULIC SUSPENSION LOCKOUT LINES AND FITTINGS (HMMH) (TM 5-2420-224-20).

## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

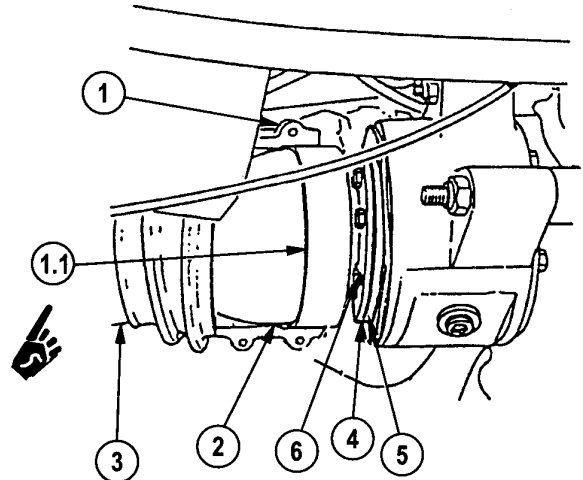
5. INSTALL FRONT BRAKE CALIPERS (TM 5-2420-224-20).
6. INSTALL FRONT AXLE THRUST TUBE (page 3-105).
7. INSTALL FRONT PROPELLER SHAFT (page 3-102).
8. POSITION upper housing HALF (1) and HOUSING (1.1) on axle thrust tube (2).
9. WITH VEHICLE on suitable jack STANDS, RAISE VEHICLE and place front axle assembly (3) in position.

### WARNING

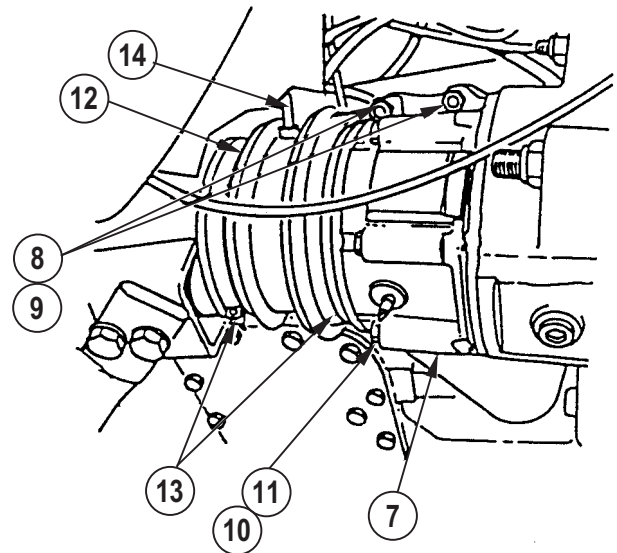
Place a suitable support under torque tube and one wheel. Failure to do so could result in injury to personnel.

### CAUTION

Make sure slots are aligned in shaft and transmission during installation to prevent damage to equipment.

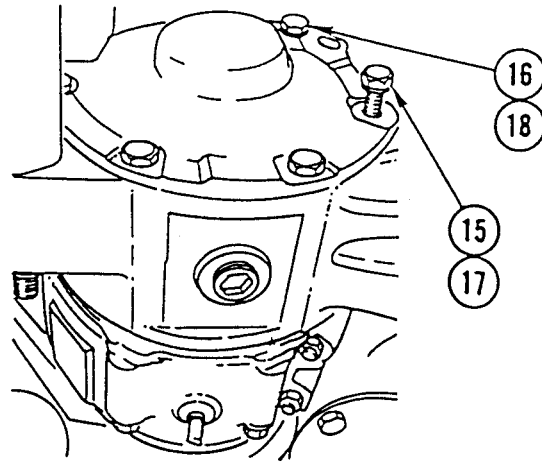


10. APPLY COAT of MOLYBDENUM DISULFIDE GREASE to propeller shaft FLANGE (4) and ALINE propeller shaft FLANGE (4) with transmission output flange (5).
11. APPLY COAT of SEALING COMPOUND to six SCREWS (6) and INSTALL. TIGHTEN SCREWS to 42 lb-ft (56 N.m).
12. INSTALL lower housing half (7), four new lock washers (8), and four nuts (9). HAND TIGHTEN.
13. APPLY COAT of SEALING COMPOUND to four SCREWS (10) and INSTALL four SCREWS (10) and four new SEAL RINGS (11). TIGHTEN SCREWS to 45 lb-ft (60 N.m). TIGHTEN NUTS (9) to 45 lb-ft (60 N.m).
14. SLIDE BELLOWS (12) up and INSTALL two CLAMPS (13). TIGHTEN CLAMPS.
15. INSTALL vent HOSE (14) on bellows (12).

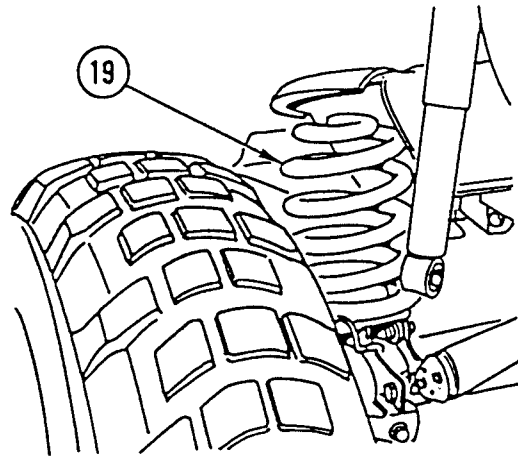


## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

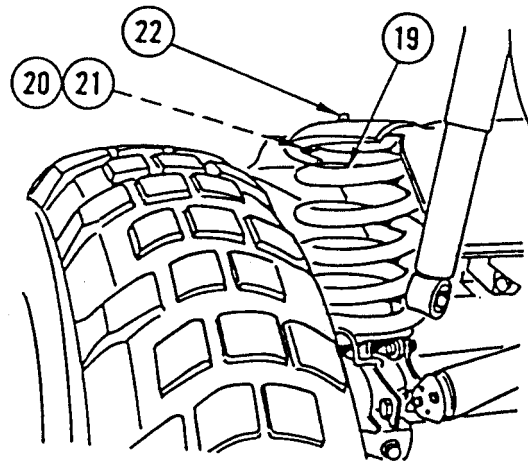
16. APPLY COAT of SEALING COMPOUND to two SCREWS (15 and 16) and INSTALL SCREW (15), new PACKING (17), SCREW (16), and new PACKING (18). TIGHTEN SCREWS to 45 lb-ft (60 N.m).



17. USING suitable LIFTING DEVICE, RAISE VEHICLE off jack stands as required and place right spring (19) in position.
18. REPEAT STEP 17 for left spring.
19. LOWER VEHICLE onto jack stands

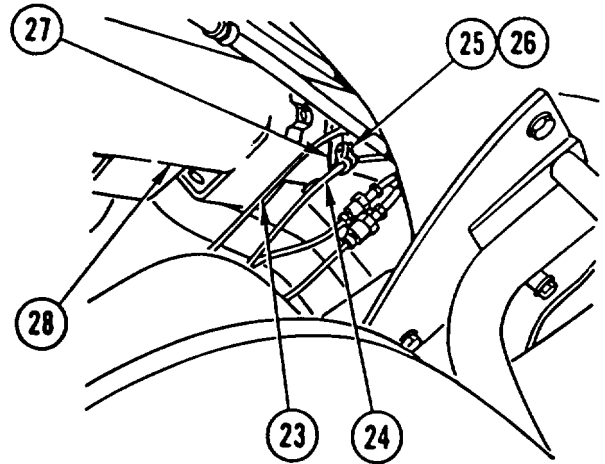


20. INSTALL screw (20), COVER (21), and new lock nut (22). TO COMPLETE installation of right spring (19), TIGHTEN to 103 lb-ft (140 N.m).
21. REPEAT STEP 20 for left spring.

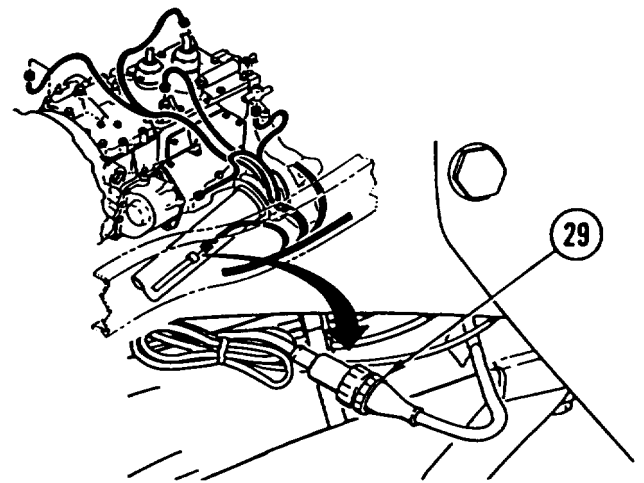


**FRONT AXLE ASSEMBLY REPLACEMENT (CONT)**

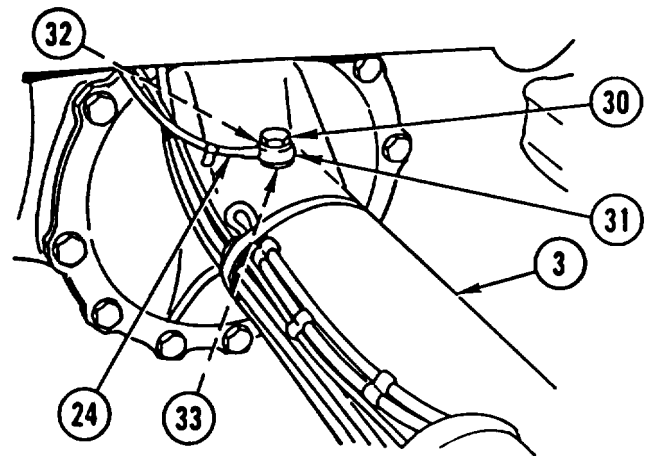
22. INSTALL differential lock air HOSE (23), axle vent HOSE (24), screw (25), clamp (26), and clamp (27) to torque tube (28).



23. CONNECT brake wear indicator CONNECTOR (29).



24. INSTALL fluid passage bolt (30), union (31), two new seals (32 and 33), and axle vent HOSE (24) to right side of axle assembly (3).



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## FRONT AXLE ASSEMBLY REPLACEMENT (CONT)

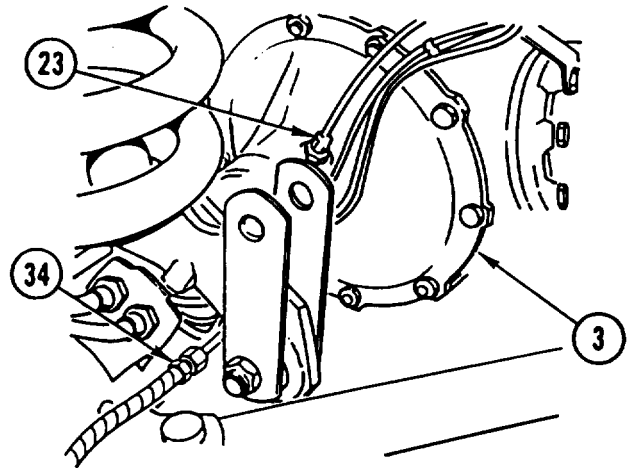
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25. CONNECT differential lock air HOSE (23) to left side of axle assembly (3).

**NOTE**

Step 26 is for HMMH only.

26. CONNECT hydraulic suspension lockout HOSES (34) on both sides of vehicle.

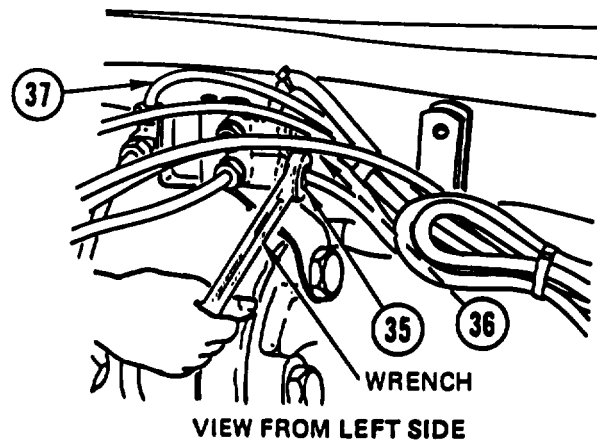


27. USING WRENCH, CONNECT two brake LINES (35 and 36).

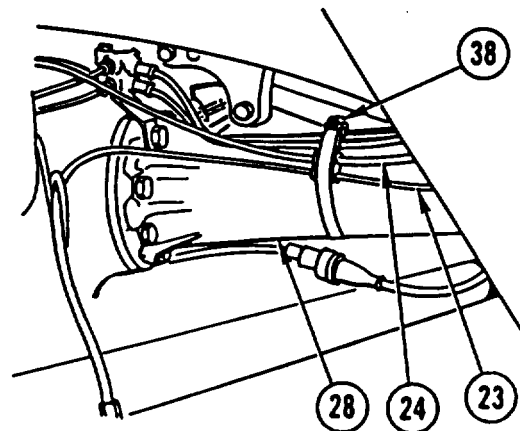
**NOTE**

Step 28 is for HMMH only.

28. CONNECT hydraulic suspension lockout LINE (37).



29. INSTALL differential lock air HOSE (23), axle vent HOSE (24), and clamp (38) to torque tube (28).

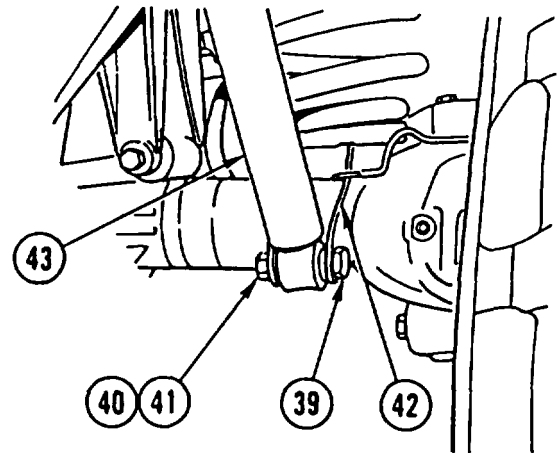


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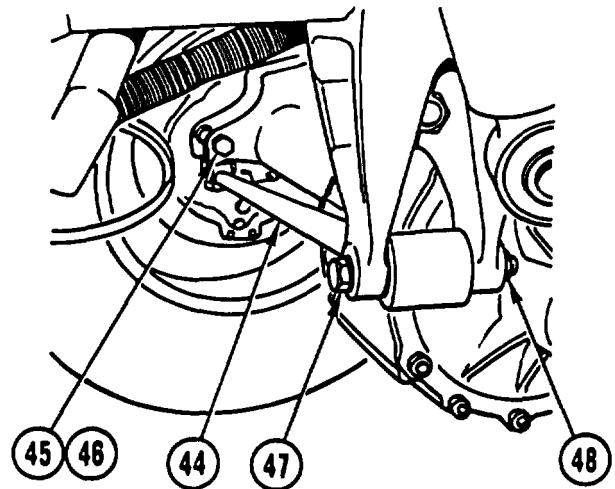
**FRONT AXLE ASSEMBLY REPLACEMENT (CONT)**


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30. REMOVE SCREW (39), nut (40), and lock washer (41) from left front shock absorber mount (42). DISCARD lock WASHER.
31. INSTALL left front shock ABSORBER (43), screw (39), nut (40), and new lock washer (41). TIGHTEN to 177 lb-ft (240 N.m).
32. REPEAT STEPS 30 and 31 for right front shock absorber.
33. LIFT VEHICLE and REMOVE jack STANDS.

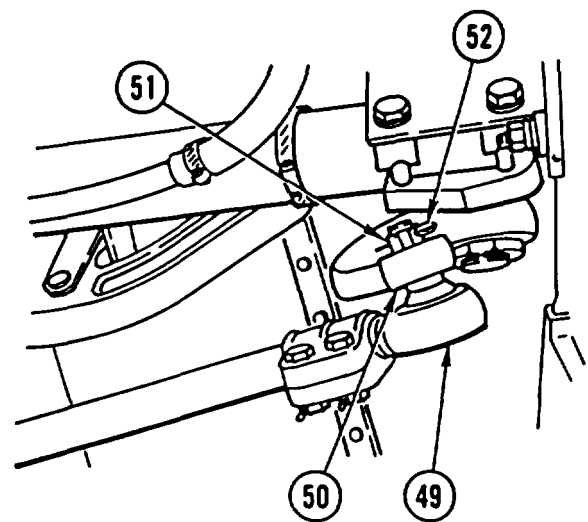


34. INSTALL control ARM (44), screw (45), new lock washer (46), screw (47), and new lock nut (46). TIGHTEN to 133 lb-ft (180 N.m).
35. INSERT drag link ball JOINT (49) into pitman arm (50) and INSTALL castellated NUT (51) and new cotter pin (52). TIGHTEN NUT to 111 lb-ft (150 N.m).

**NOTE**

## Follow-on Maintenance:

Install front loader (SEE) or forklift (HMMH) (TM 5-2420-224-20).  
 Install exhaust pipe (front) (TM 5-2420-224-20).  
 Install front axle torsion bar (TM 5-2420-224-20).  
 Lower cab (TM 5-2420-224-20).  
 Fill front axle center housing with oil (LO 5-2420-224-12).  
 Fill wheel hub drive with oil (LO 5-2420-224-12).  
 Fill transmission with fluid (LO 5-2420-224-12).  
 Bleed and test brakes (TM 5-2420-224-20).





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## FRONT AXLE THRUST ARMS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Lock (8)

Washer, Spring  
Tension (4)

Compound, Sealing            Appendix B, Item 15

#### General Safety instructions:

#### 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.

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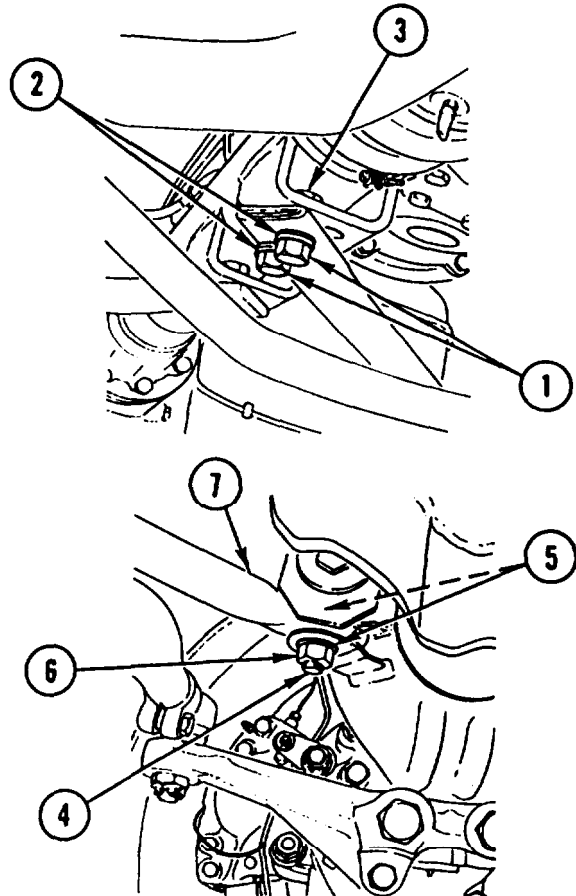
### REMOVAL

#### NOTE

Procedure is the same for both front axle thrust arms.

1. REMOVE two SCREWS (1), four lock washers (2), and two nuts (3). DISCARD lock WASHERS.

2. REMOVE screw (4), two spring tension washers (5), nut (6), and front axle thrust ARM (7). DISCARD spring tension WASHERS.

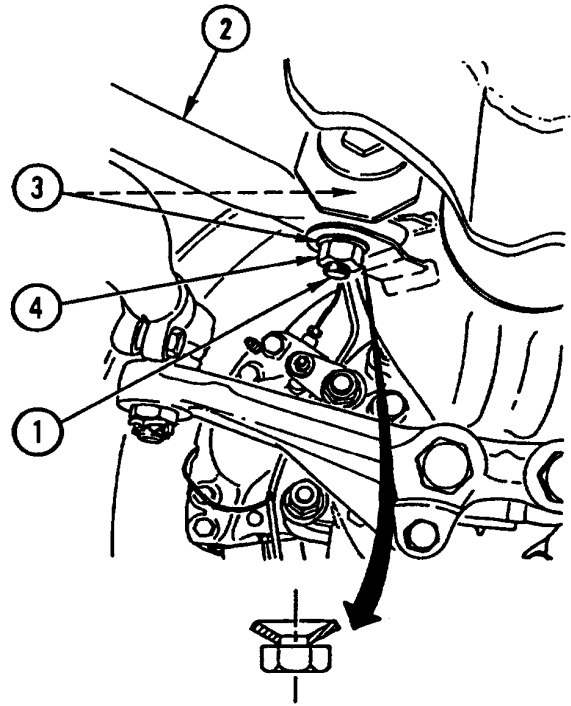


## FRONT AXLE THRUST ARMS REPLACEMENT (CONT)

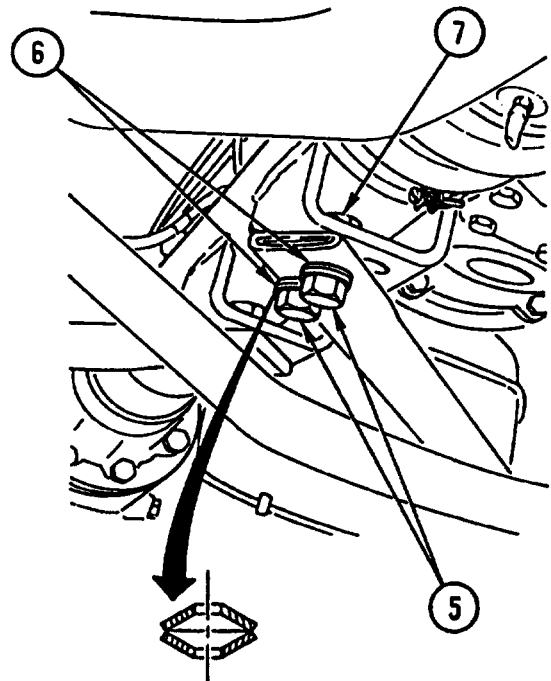
### NOTE

Procedure is the same for both front axle thrust arms.

1. APPLY COAT of SEALING COMPOUND to SCREW (1) and INSTALL front axle thrust ARM (2), screw (1), two new spring tension washers (3) (with concave side facing away from nut), and nut (4). TIGHTEN NUT to 184 lb-ft (250 N.m).



2. APPLY COAT of SEALING COMPOUND to two SCREWS (5) and INSTALL two screws (5), four new lock washers (6) (with concave sides facing each other), and two nuts (7). TIGHTEN NUTS to 184 lb-ft (250 N.m).



## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Installation Tool, P/N 387 589 02 15 00  
 Installing Tool, P/N 387 589 01 15 00  
 Puller, P/N 406 589 07 33 00  
 Puller, P/N 000 589 30 33 00  
 Puller, P/N 000 589 34 33 00

#### Materials/Parts:

Washer, Spring Tension (2)  
 Seal (2)  
 Seal (2)  
 Kit, Parts  
 Compound, Sealing Appendix B, Item 15

#### Materials/Parts (Cont):

Grease, Molybdenum Appendix B, Item 24  
 Disulfide

#### References:

TM 5-2420-224-20  
 LO 5-2420-224-12

#### Equipment Condition:

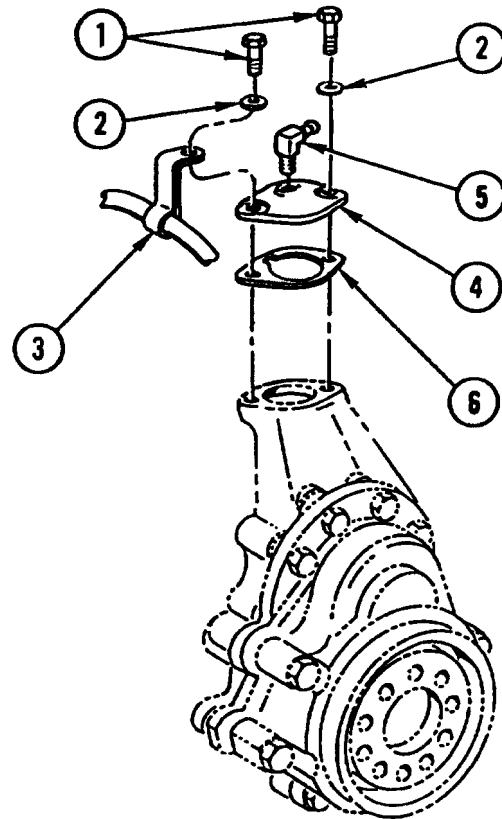
Reference	Condition Description
TM 5-2420-224-20	Front Brake Calipers Removed
TM 5-2420-224-20	Drag Link Removed
TM 5-2420-224-20	Tie Rod Removed

### REMOVAL

#### NOTE

Procedure is the same for both sides.

1. REMOVE two capscrews (1), two spring tension washers (2), clamp (3), PLATE (4), and lubrication fitting (5). DISCARD two spring tension washers (2).
2. REMOVE and DISCARD WASHER(S) (6).

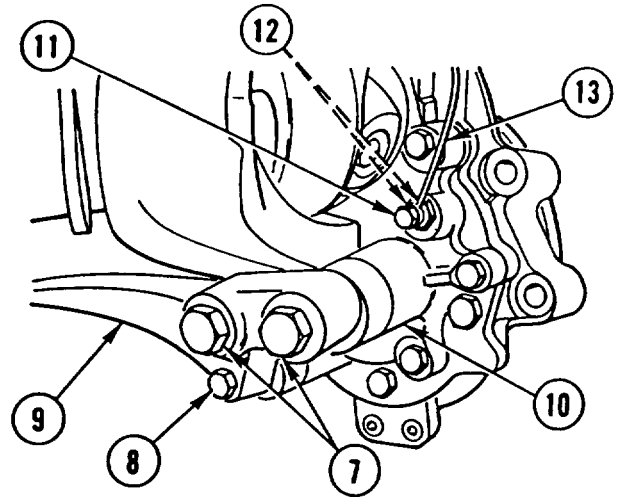


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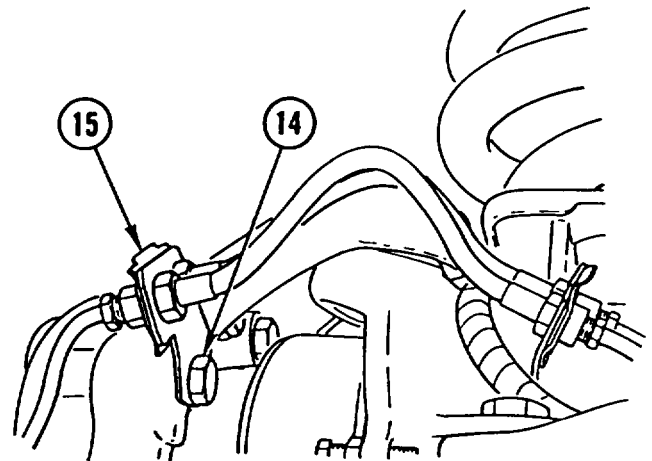
**STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)**

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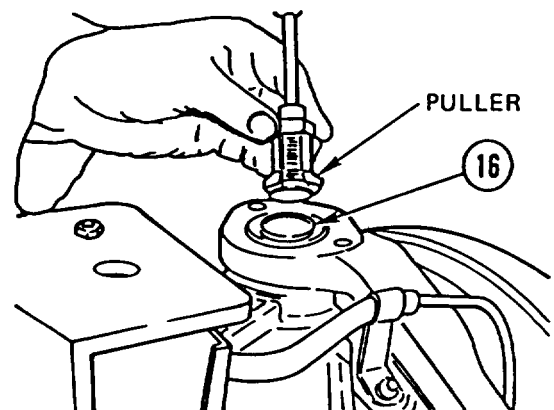
3. REMOVE two expansion capscrews (7), capscrew (8), steering ARM (9), and LINK (10).
4. REMOVE bolt (11), two seals (12), and HOSE (13). DISCARD SEALS.



5. REMOVE SCREW (14) and RELEASE brake hose CLAMP (15).



6. USING PULLER, REMOVE and DISCARD BEARING (16).

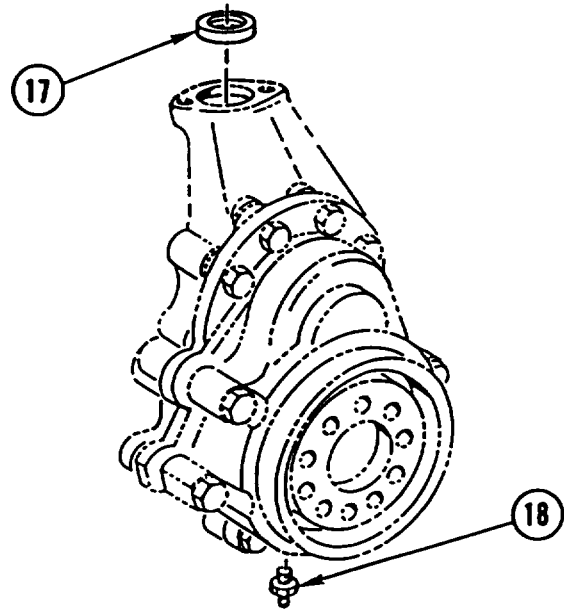


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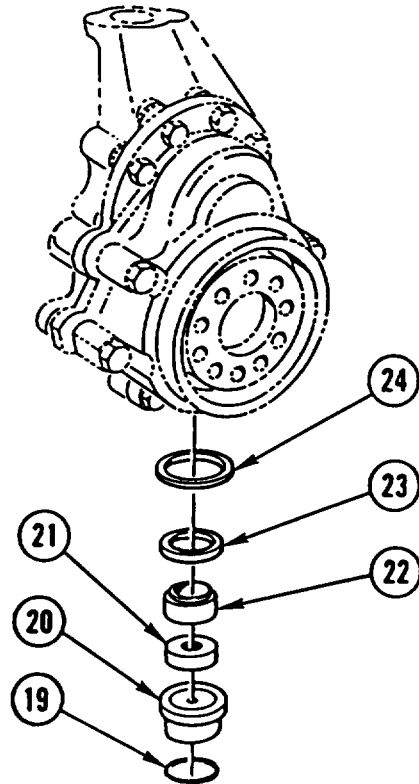
## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)

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7. REMOVE and DISCARD SEAL (17).
8. REMOVE lubrication FITTING (18).

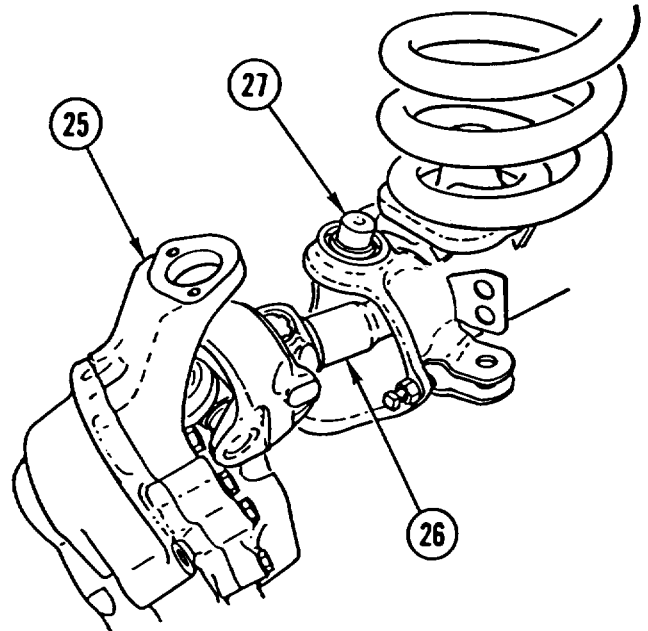


9. REMOVE and DISCARD seal RING (19), BUSHING (20), seal RING (21), BEARING (22), RING (23), and seal RING (24).

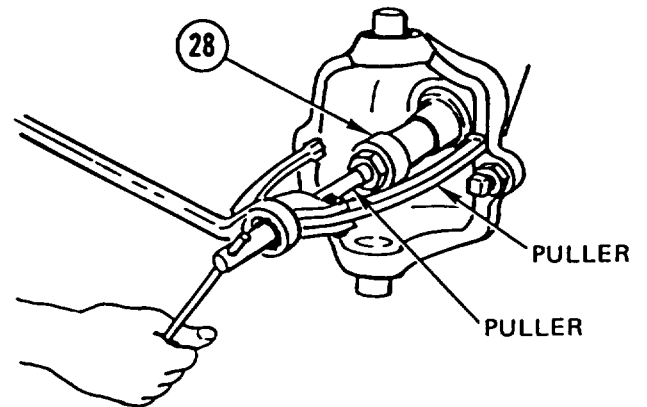


**STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT  
(CONT)**

10. REMOVE final DRIVE (25) and propeller SHAFT assembly (26) from axle (27).

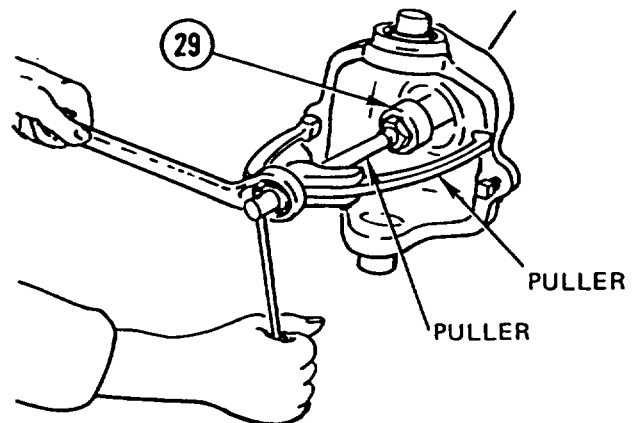


11. USING PULLERS, REMOVE and DISCARD two SEALS (28).



**CAUTION**  
Be careful not to damage retaining ring behind bearing.

12. IF DAMAGED, USING PULLERS, REMOVE BEARING (29).



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## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)

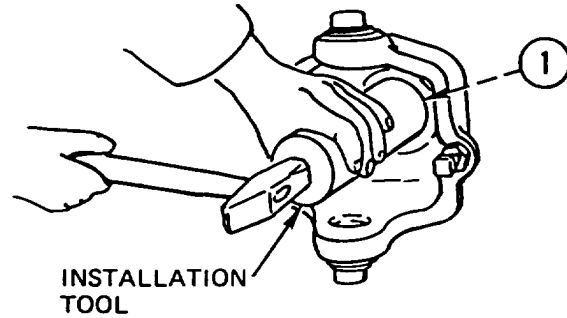
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### INSTALLATION

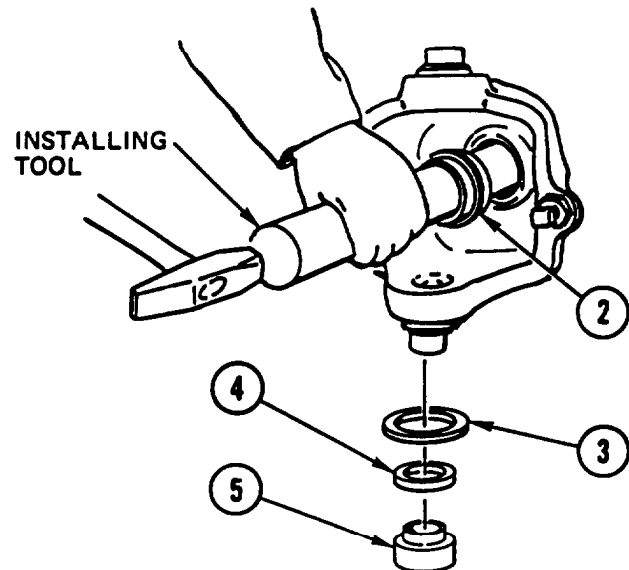
#### NOTE

- Procedure is the same for both sides.
- Apply coat of molybdenum disulfide grease to bearings and seals prior to installation.

1. IF REMOVED, USING INSTALLATION TOOL, INSTALL new BEARING (1).

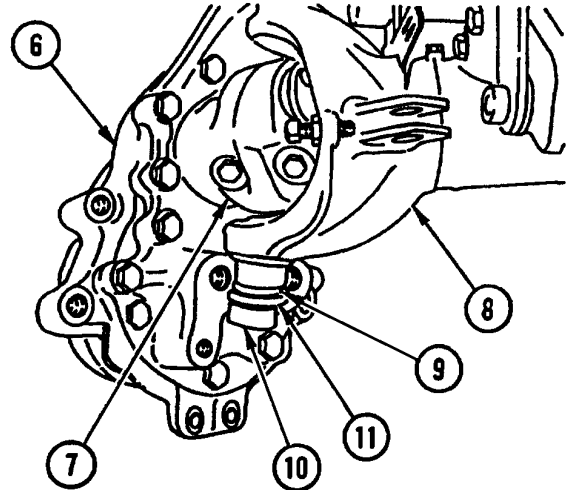


2. USING INSTALLING TOOL, INSTALL two new SEALS (2) with lips facing inward.
3. INSTALL new seal ring (3), new ring (4) with bevel facing downward, and new BEARING (5).



## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)

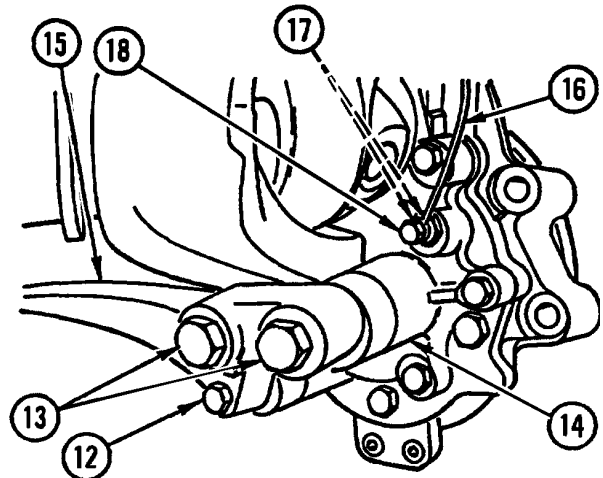
4. INSTALL final DRIVE (6) and propeller SHAFT assembly (7) in axle (8).
5. INSTALL new seal ring (9), new BUSHING (10), and new seal ring (11).



### 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.

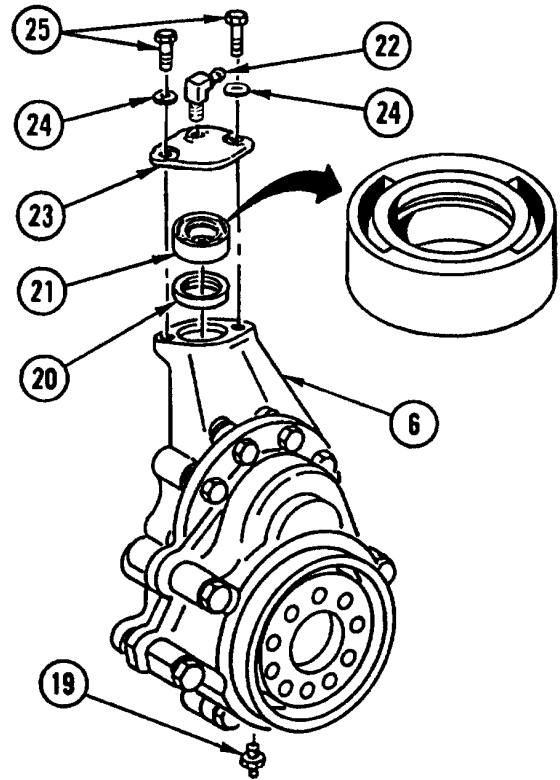
6. APPLY COAT of SEALING COMPOUND to three CAPSCREWS (12 and 13).
7. INSTALL LINK (14), steering ARM (15), capscrew (12), and two expansion capscrews (13). TIGHTEN two CAPSCREWS (13) to 295 lb-ft (400 N.m). TIGHTEN CAPSCREW (12) to 133 lb-ft (180 N.m).
8. INSTALL HOSE (16), two new seals (17), and bolt (18).



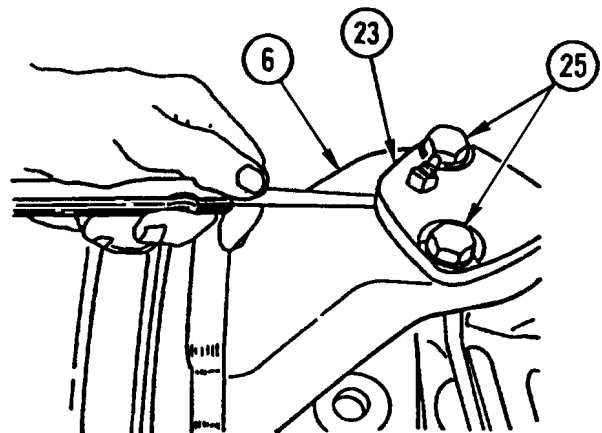


## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)

9. INSTALL lubrication FITTING (19).
10. INSTALL new SEAL (20) with bevel facing upward.
11. INSTALL new BEARING (21) with recesses on outer edge facing forward and extractor groove facing upward.
12. INSTALL lubrication fitting (22), PLATE (23), two new spring tension washers (24), and two capscrews (25). TIGHTEN CAPSCREWS (25) just enough to make MOVEMENT of final drive (6) STIFF.

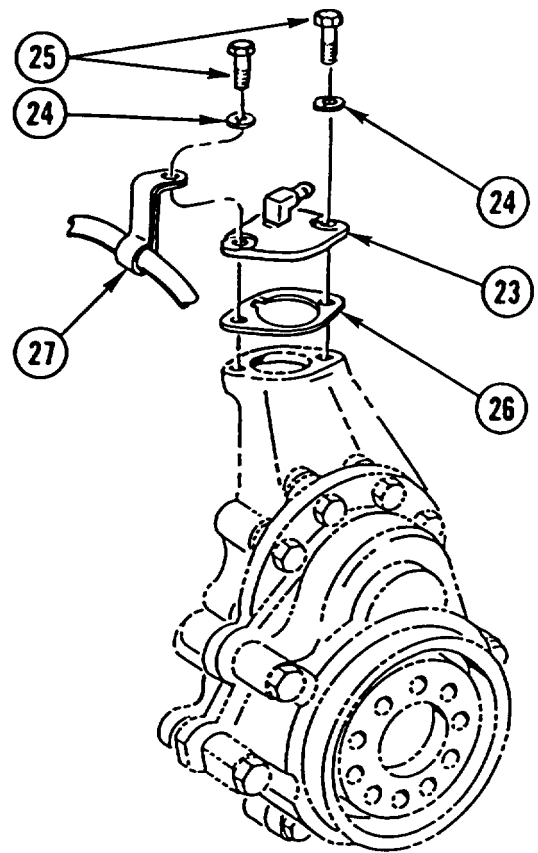


13. BACK OUT two CAPSCREWS (25) just enough until final drive (6) MOVES SMOOTHLY.
14. USING feeler GAGE, MEASURE SPACE between final drive (6) and plate (23). Measurement is equal to thickness of new washer(s).



## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPLACEMENT (CONT)

15. REMOVE two capscrews (25), two spring tension washers (24), and PLATE (23). INSTALL new WASHER(S) (26). DISCARD spring tension WASHERS.
16. INSTALL PLATE (23), clamp (27), two new spring tension washers (24), and two capscrews (25).

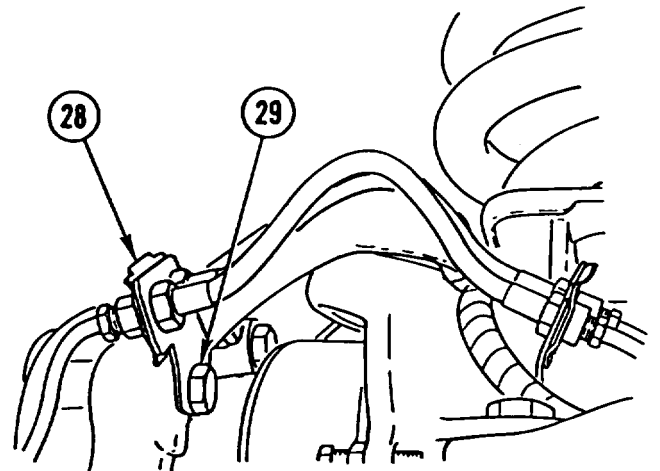


17. INSTALL brake hose CLAMP (28) and screw (29).

**NOTE**

Follow-on Maintenance:

- Install front brake calipers (TM 5-2420-224-20).
- Install drag link (TM 5-2420-224-20).
- Install tie rod (TM 5-2420-224-20).
- Service front axle (LO 5-2420-224-12).
- Service steering knuckle (LO 5-2420-224-12).





## CHAPTER 6 REAR AXLE MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the rear axle. A list of tasks contained in this chapter is shown below.

	<b>Page</b>
Rear Axle Assembly Replacement .....	6-1
Rear Axle Thrust Arms Replacement .....	6-12
Rear Axle Final Drive Hub Gears and Axle Shaft Replacement .....	6-15

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### REAR AXLE ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Installation

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Wrench, P/N 000 589 51 03 00

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20  
 LO 5-2420-224-12

**Materials/Parts:**

Nut, Lock  
 Screw, Lock  
 Washer, Lock  
 Nut, Lock (2)  
 Nut, Lock  
 Nut, Lock  
 Nut, Lock  
 Washer, Lock (4)  
 Washer, Spring Tension (6)  
 Packing  
 Compound, Sealing      Appendix B, Item 15  
 Grease, Molybdenum      Appendix B, Item 24  
 Disulfide  
 Rags      Appendix B, Item 40  
 Strap, Tiedown      Appendix B, Item 43

**Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Rear Tires Removed
TM 5-2420-224-20	Spare Tire and Mount Removed
LO 5-2420-224-12	Rear Axle Center Housing Drained
LO 5-2420-224-12	Wheel Hub Drive Drained
TM 5-2420-224-20	Backhoe (SEE) or Crane (HMMH) in Three-Point Stance

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## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

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### General Safety Instructions:

#### WARNING

- Control arm weighs more than 50 pounds (23 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting control arm.
- Support rear axle during removal. Failure to do so could result in injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up all spilled fuel or oil with rags.

### General Safety Instructions (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.

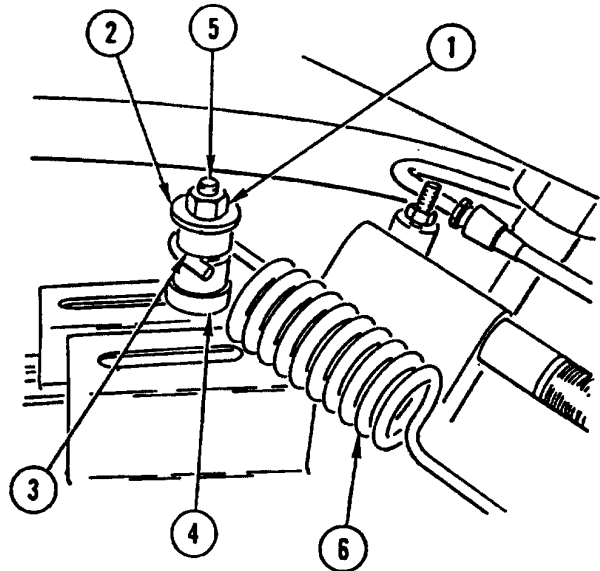
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## REMOVAL

#### NOTE

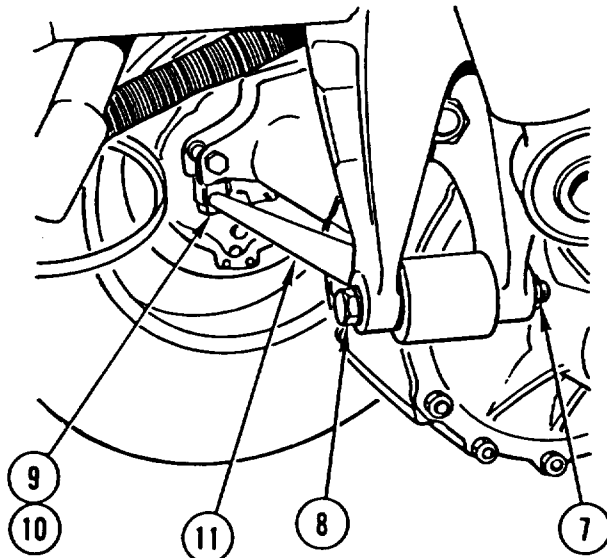
Procedure is the same for both vehicles.

1. REMOVE nut (1), washer (2), two spacers (3), washer (4), and BOLT (5) and DISCONNECT ALB valve SPRING (6).

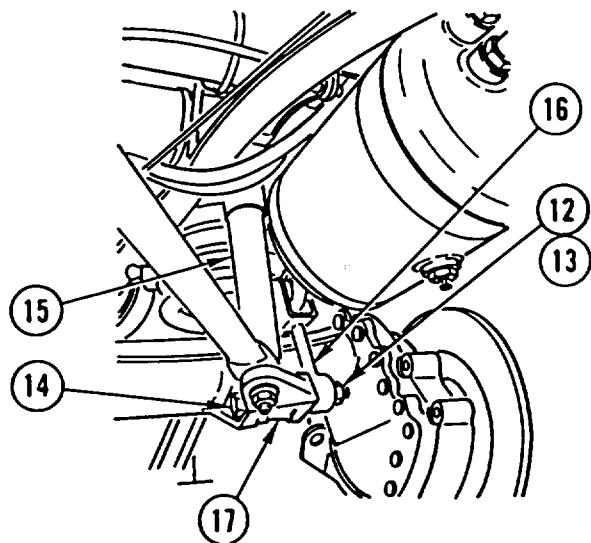


**REAR AXLE ASSEMBLY REPLACEMENT (CONT)**

2. REMOVE lock nut (7), screw (8), lock screw (9), lock washer (10), and control ARM (11). DISCARD lock NUT, lock SCREW, and lock WASHER.



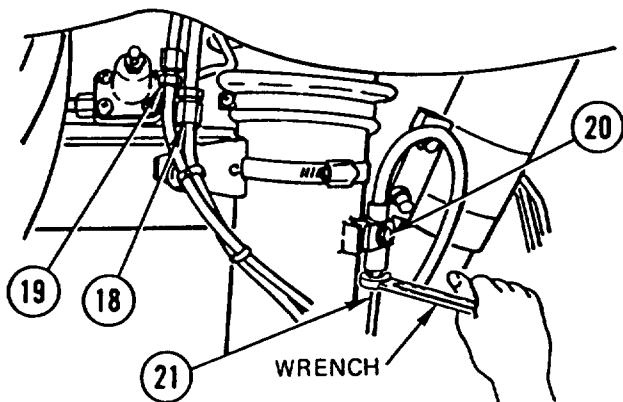
3. REMOVE lock nut (12), washer (13), and SCREW (14) and DISCONNECT left rear shock ABSORBER (15) and torsion bar LINK (16) at left rear shock absorber mount (17). DISCARD lock NUT.
4. REPEAT STEP 3 for right rear shock absorber.



**NOTE**

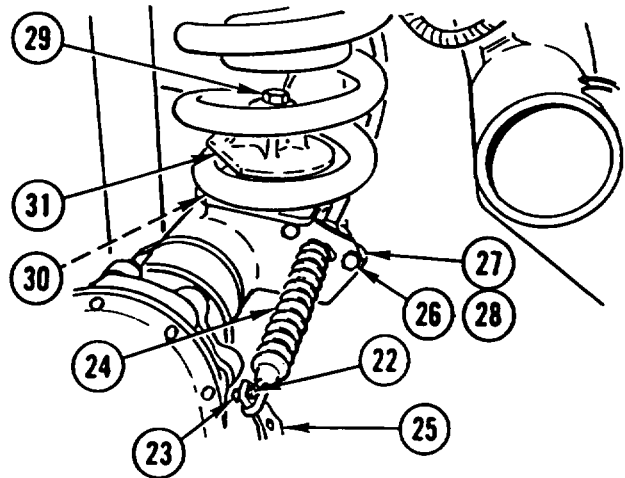
Tag all lines prior to disconnecting to aid in connecting.

5. DISCONNECT two air HOSES (18 and 19).
6. LOOSEN SCREW (20) and RELEASE brake HOSE (21).
7. USING WRENCH, DISCONNECT brake HOSE (21).

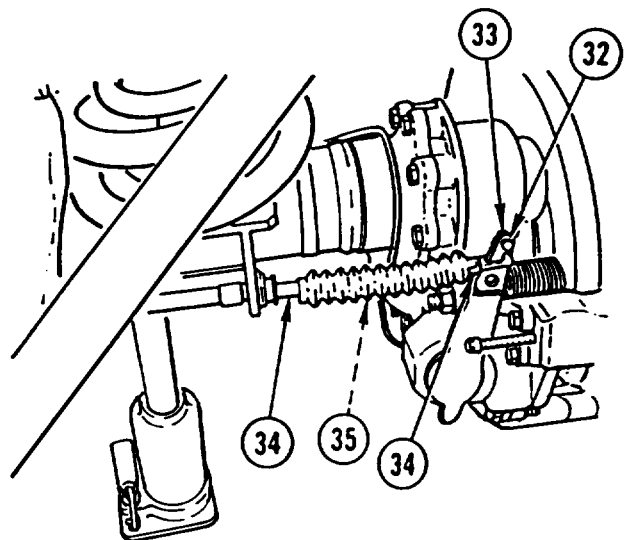


## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

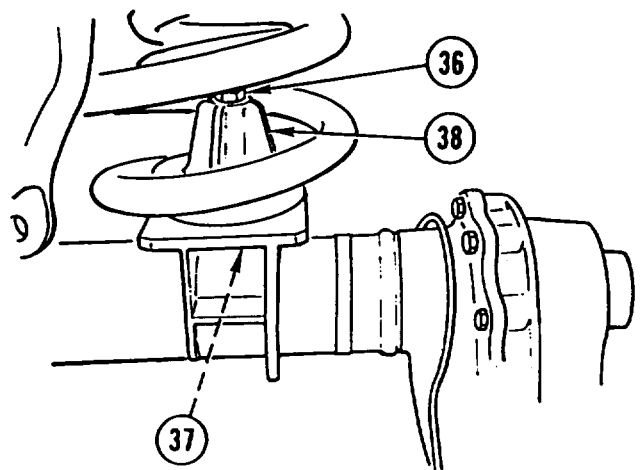
8. REMOVE BOLT (22) and lock nut (23) and LIFT left parking brake wire ROPE (24) from parking brake lever (25). DISCARD lock NUT.
9. REMOVE two screws (26), two nuts (27), two washers (28), and left parking brake wire ROPE (24).
10. REMOVE SCREW (29) and nut (30) from left spring shackle (31).



11. REMOVE bolt (32), lock nut (33), tiedown straps (34), and right parking brake wire ROPE (35). DISCARD lock NUT.

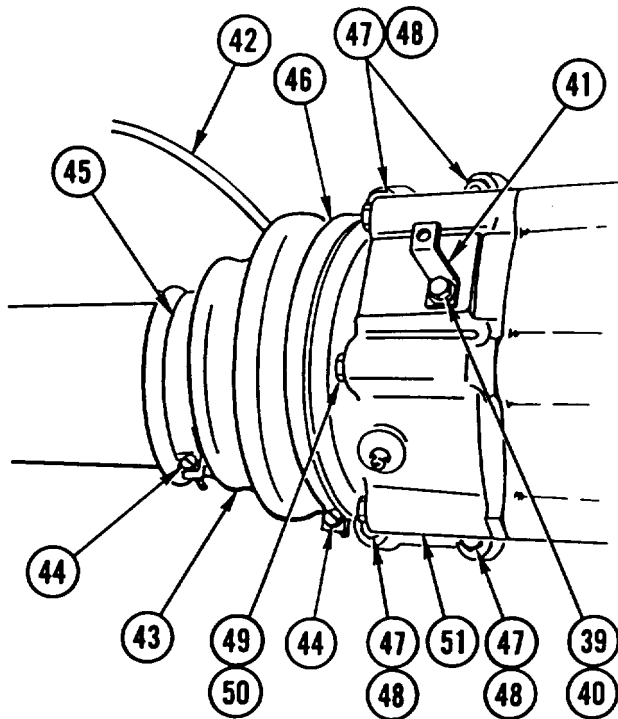


12. REMOVE BOLT (36) and lock nut (37) from right spring cover (38). DISCARD lock NUT.



**REAR AXLE ASSEMBLY REPLACEMENT (CONT)**

13. POSITION transmission JACK or equivalent under differential of rear axle.
14. REMOVE screw (39), washer (40), and BRACKET (41).
15. REMOVE vent HOSE (42) from bellows (43).
16. LOOSEN two SCREWS (44), REMOVE two CLAMPS (45 and 46), and SLIDE BELLOWS (43) back toward axle.
17. REMOVE four NUTS (47) and four lock washers (48). DISCARD lock WASHERS.
18. REMOVE six SCREWS (49) and six spring tension washers (50). DISCARD spring tension WASHERS.
19. REMOVE two HOUSINGS (51).



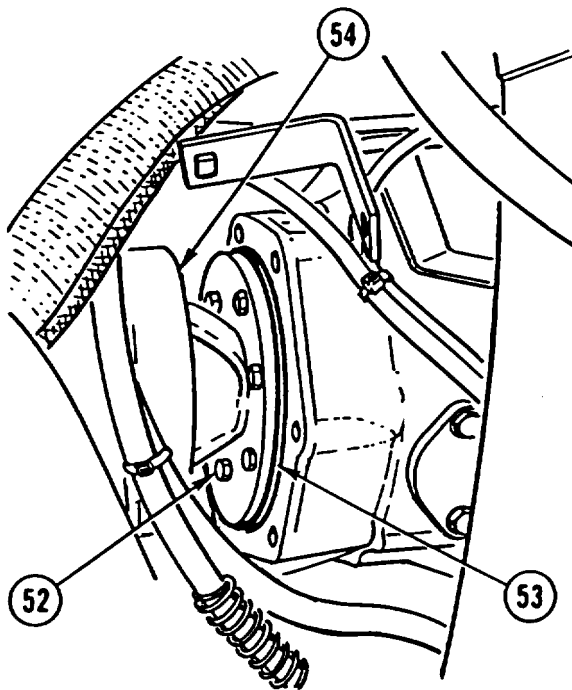
**NOTE**

To gain access to all screws, rotate propeller shaft.

20. REMOVE six SCREWS (52) and packing (53). DISCARD PACKING.

**CAUTION**  
Support axle torque tube prior to removal to prevent damage to equipment.

21. REMOVE rear AXLE assembly (54) and PLACE ON suitable STANDS.



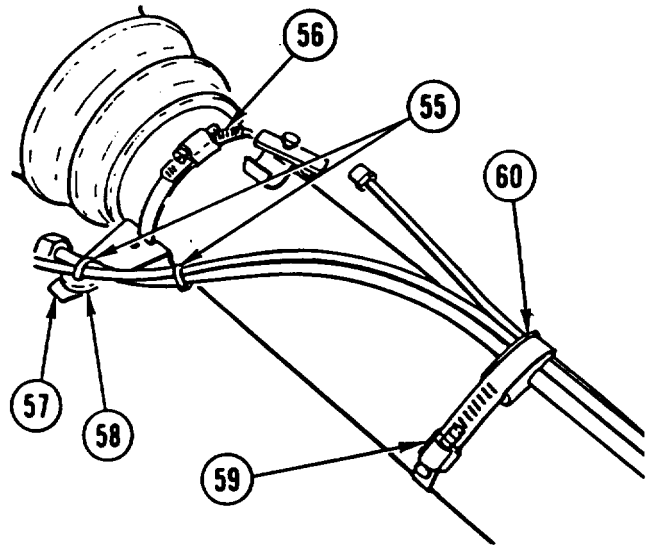


**REAR AXLE ASSEMBLY REPLACEMENT (CONT)**

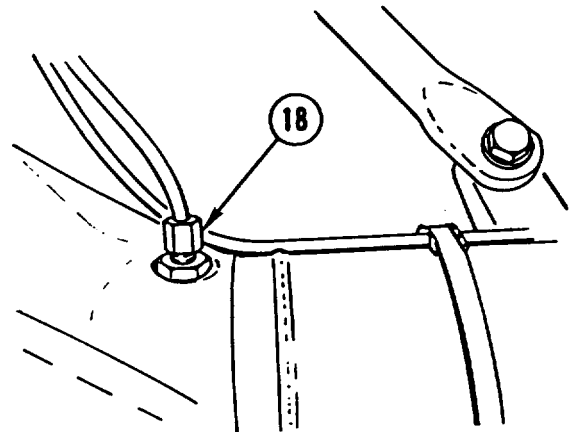
**NOTE**

Number of tiedown straps varies between vehicles.

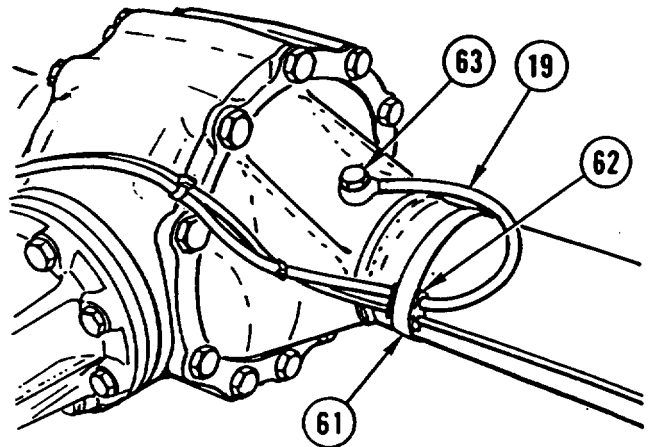
- 22. REMOVE tiedown STRAP(S) (55).
- 23. REMOVE clamp (56), BRACKET (57), and grommet (58).
- 24. REMOVE two clamps (59) and four clamp BLOCKS (60).



- 25. REMOVE air HOSE (18).



- 26. REMOVE clamp (61), clamp block (62), bolt (63), and air HOSE (19).
- 27. REMOVE REAR BRAKE CALIPERS HYDRAULIC LINES AND FITTINGS (TM 5-2420-224-20).
- 28. REMOVE REAR BRAKE CALIPERS (TM 5-2420-224-20).
- 29. REMOVE REAR PROPELLER SHAFT (page 3-102).
- 30. REMOVE REAR AXLE THRUST TUBE (page 3-105).



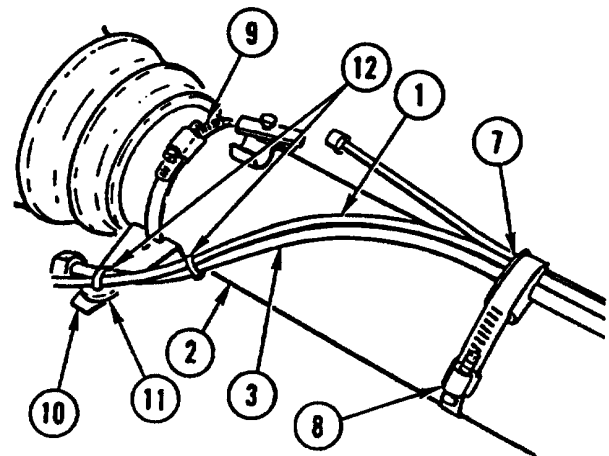
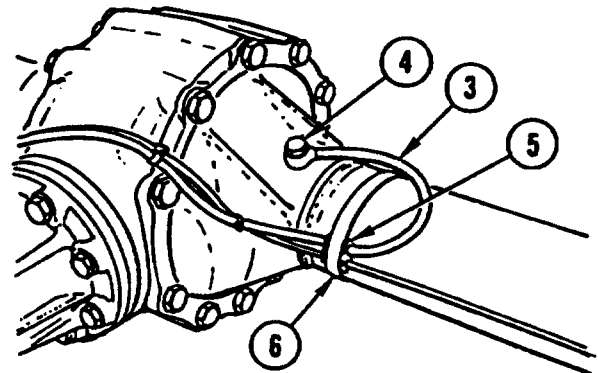
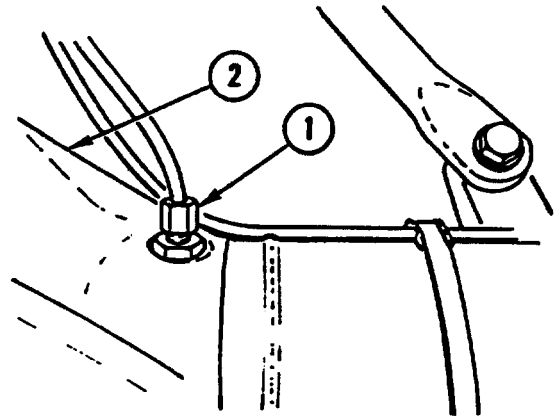
## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

### INSTALLATION

#### NOTE

Procedure is the same for both vehicles.

1. INSTALL REAR BRAKE CALIPERS HYDRAULIC LINES AND FITTINGS (TM 5-2420-224-20).
2. INSTALL REAR BRAKE CALIPERS (TM 5-2420-224-20).
3. INSTALL REAR AXLE THRUST TUBE (page 3-105).
4. INSTALL rear PROPELLER SHAFT (page 3-102).
5. INSTALL air HOSE (1) to rear axle assembly (2).
6. INSTALL air HOSE (3), bolt (4), clamp block (5), and clamp (6).
7. INSTALL four clamp BLOCKS (7) and two clamps (8) securing two air hoses (1 and 3) to rear axle assembly (2).
8. INSTALL clamp (9), BRACKET (10), and grommet (11).
9. INSTALL tiedown STRAP(S) (12) as required to secure two air hoses (1 and 3).



## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

10. PLACE rear AXLE assembly (2) on transmission JACK or equivalent.
11. INSTALL new PACKING (13). INSTALL HOUSING (2.1).

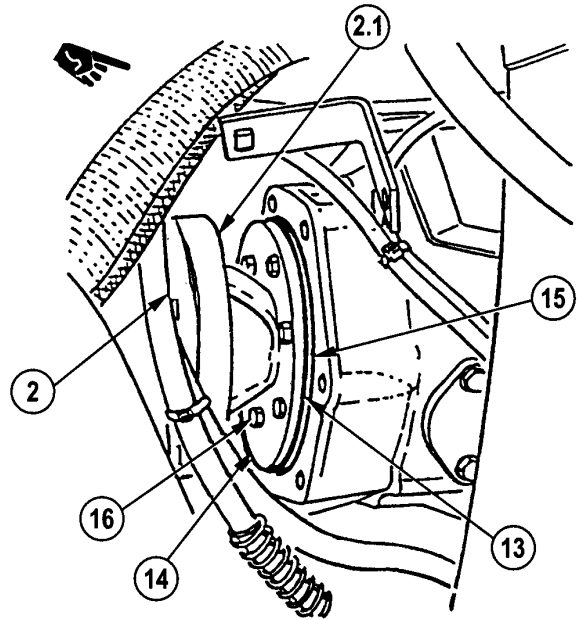
### CAUTION

Support axle torque tube prior to installing rear axle assembly to prevent damage to equipment.

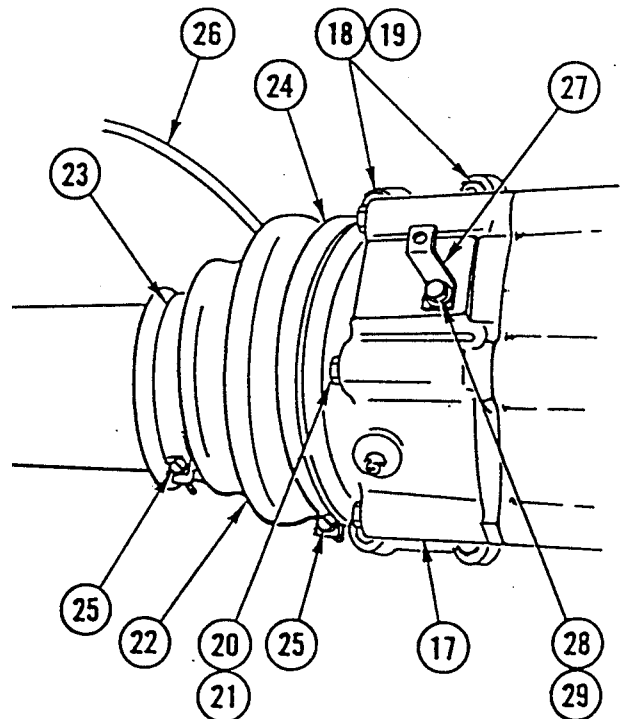
12. WITH VEHICLE on suitable jack STANDS, RAISE VEHICLE and PLACE rear AXLE assembly (2) in position.

### CAUTION

Make sure slots are aligned in shaft and transmission during installation to prevent damage to equipment.

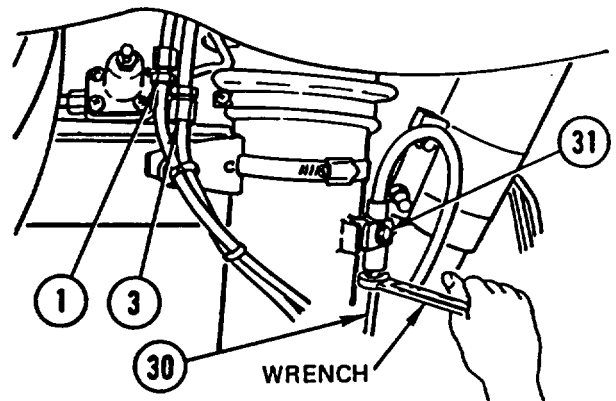


13. APPLY COAT of MOLYBDENUM DISULFIDE GREASE to propeller shaft FLANGE (14) and ALINE propeller shaft FLANGE (14) with transmission output FLANGE (15).
14. APPLY COAT of SEALING COMPOUND to six SCREWS (16). INSTALL six SCREWS (16) and TIGHTEN to 42 lb-ft (56 N.m).
15. INSTALL two HOUSINGS (17), four new lock washers (18), and four nuts (19). TIGHTEN NUTS hand-tight.
16. APPLY COAT of SEALING COMPOUND to six SCREWS (20). INSTALL six SCREWS (20) and six new spring tension washers (21) until SNUG.
17. TIGHTEN four NUTS (19) to 45 lb-ft (60 N.m).
18. TIGHTEN six SCREWS (20) to 42 lb-ft (56 N.m).
19. INSTALL BELLOWS (22) and clamps (23 and 24). TIGHTEN two SCREWS (25).
20. INSTALL vent HOSE (26) in bellows (22).
21. INSTALL BRACKET (27), screw (28), and washer (29).



## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

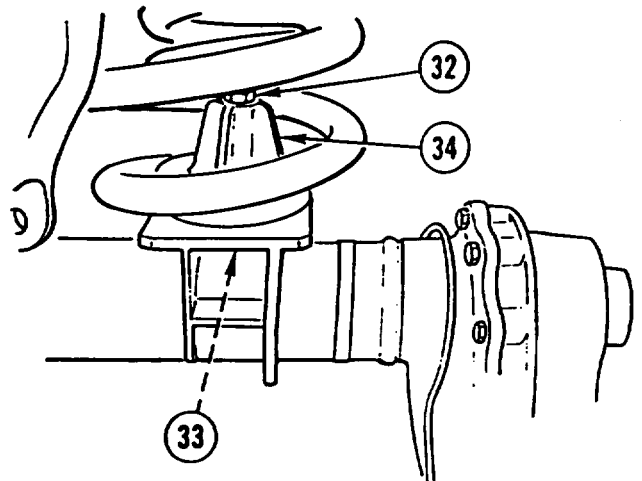
22. USING WRENCH, CONNECT brake HOSE (30).
23. INSTALL brake HOSE (30) and TIGHTEN SCREW (31).
24. CONNECT two air HOSES (1 and 3).



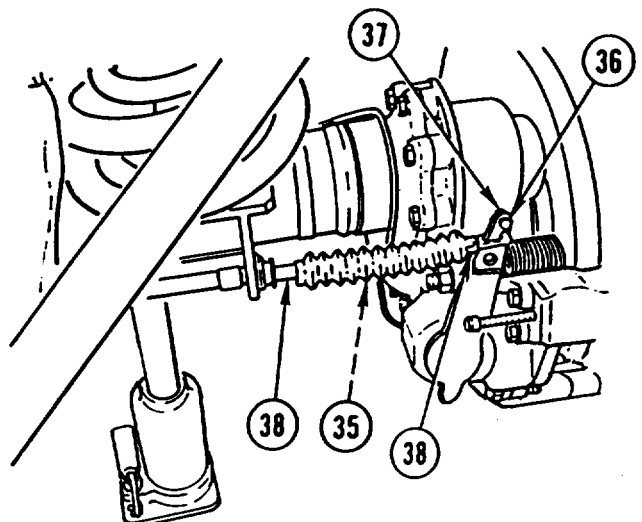
### NOTE

Align bottom of spring with stop on spring cover.

25. INSTALL BOLT (32) and new lock nut (33) in right spring rover (34).



26. INSTALL right parking brake wire ROPE (35), bolt (36), new lock nut (37), and tie straps (38).

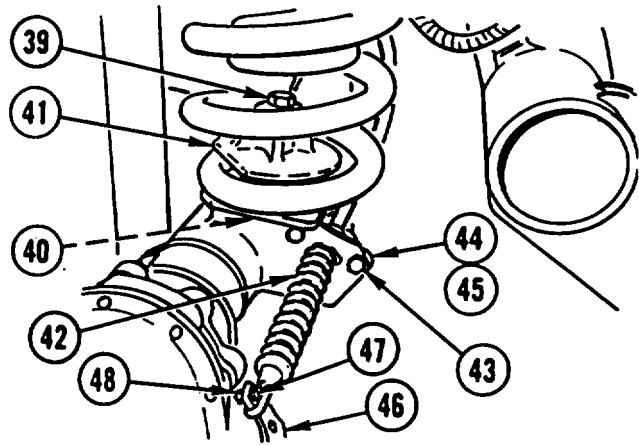


## REAR AXLE ASSEMBLY REPLACEMENT (CONT)

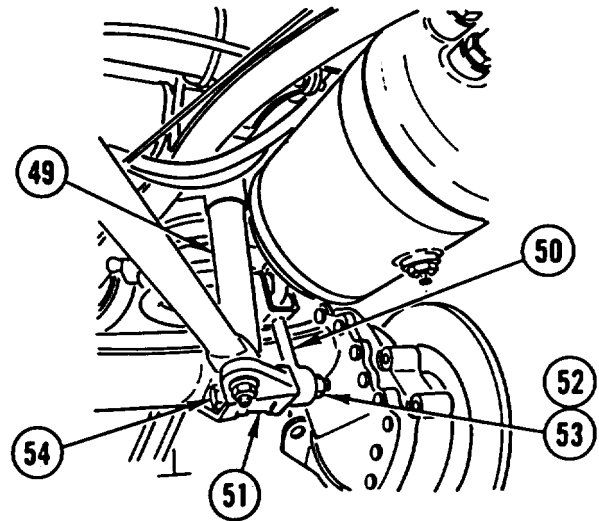
### NOTE

Aline bottom of spring with stop on spring shackle.

27. INSTALL SCREW (39) and nut (40) in left spring shackle (41).
28. INSTALL left parking brake wire ROPE (42), two screws (43), two washers (44), and two nuts (45).
29. INSTALL left parking brake wire ROPE (42) in parking brake lever (46) with bolt (47) and new lock nut (48).



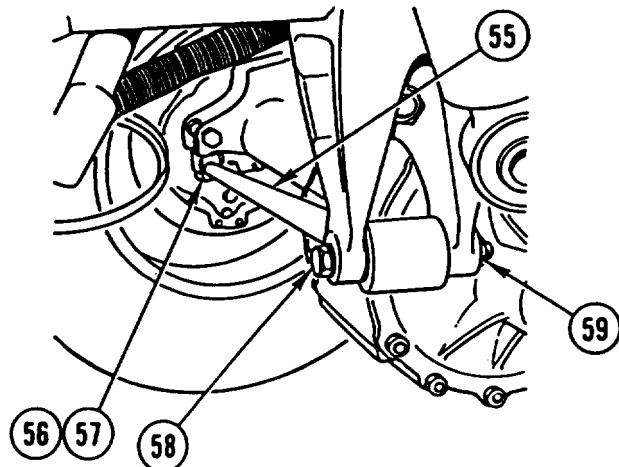
30. CONNECT left rear shock ABSORBER (49) and torsion bar LINK (50) at left rear shock absorber mount (51) and INSTALL new lock nut (52), washer (53), and SCREW (54). TIGHTEN SCREW to 178 lb-ft (240 N.m).
31. REPEAT STEP 30 for right rear shock absorber.



### CAUTION

Position control arm to avoid interference with rear axle to prevent damage to equipment.

32. INSTALL control ARM (55), new lock screw (56), new lock washer (57), screw (58), and new lock nut (59). TIGHTEN to 133 lb-ft (180 N.m).



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**REAR AXLE ASSEMBLY REPLACEMENT (CONT)**

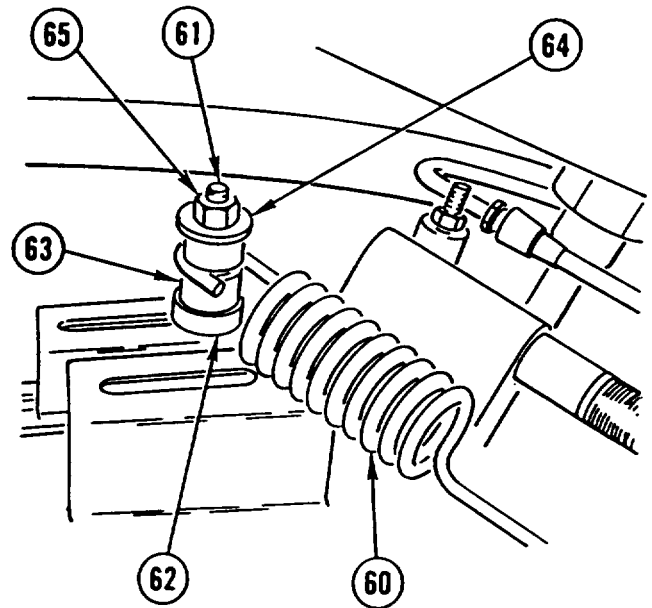
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33. CONNECT ALB valve SPRING (60) and INSTALL BOLT (61), washer (62), two spacers (63), washer (64), and nut (65).

**NOTE**

## Follow-on Maintenance:

Install rear tires (TM 5-2420-224-20).  
Install spare tire and mount (TM 5-2420-224-20).  
Fill rear axle center housing with oil (LO 5-2420-224-12).  
Fill wheel hub drive with oil (LO 5-2420-224-12).  
Bleed and test brakes (TM 5-2420-224-20).  
Service ball joint (LO 5-2420-224-12).  
Adjust brake pressure regulator (ALB valve) (page -).  
Adjust parking brake (TM 5-2420-224-20).



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## REAR AXLE THRUST ARMS REPLACEMENT

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This task covers: a. Removal b. Installation

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Lock (4)

Washer, Lock (2)

Compound, Sealing Appendix B, item 15

#### General Safety Instructions:

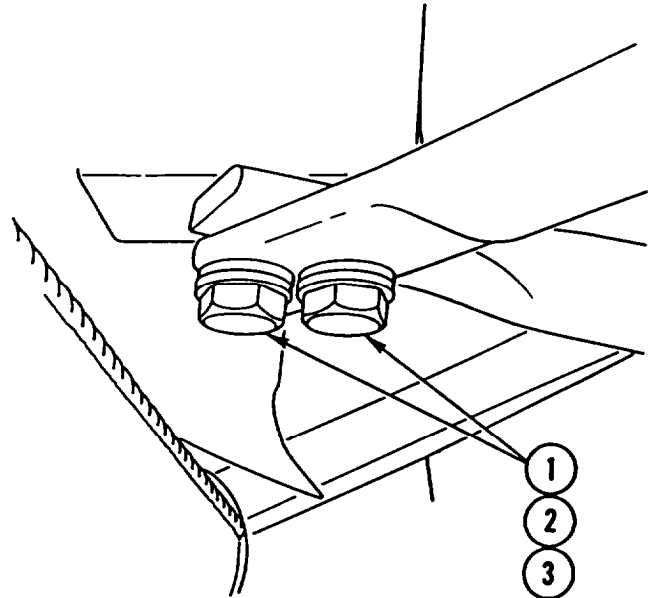
##### WARNING

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.

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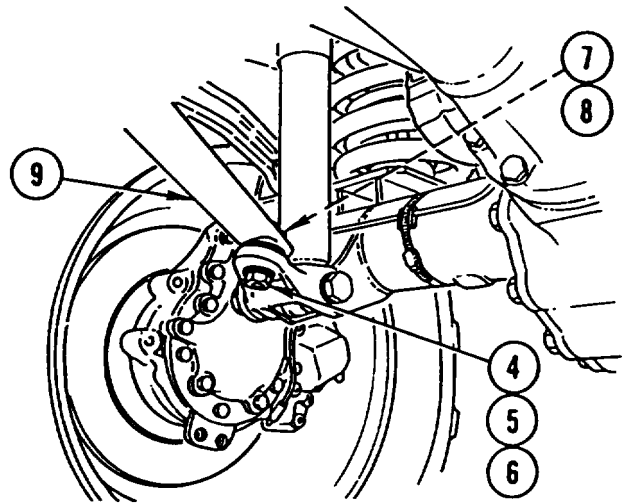
### REMOVAL

1. REMOVE two SCREWS (1), four lock washers (2), and two nuts (3). DISCARD lock WASHERS.

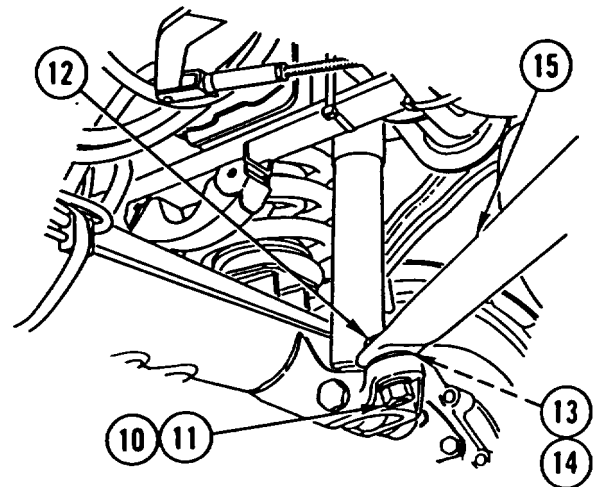


**REAR AXLE THRUST ARMS REPLACEMENT (CONT)**

2. REMOVE nut (4), lock washer (5), screw (6), index plate (7), washer (8), and left rear axle thrust ARM (9). DISCARD lock WASHER.

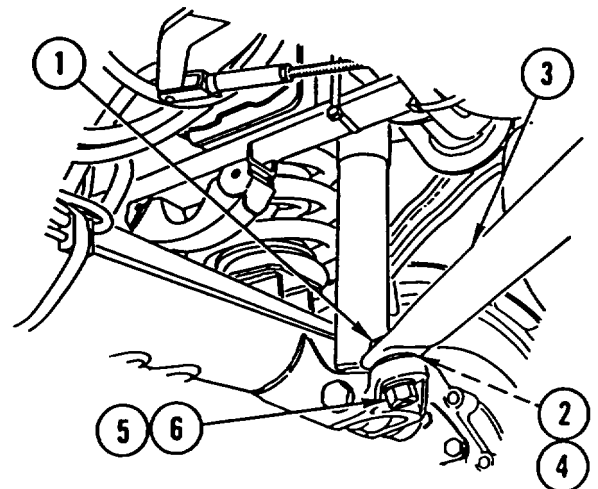


3. REMOVE nut (10), lock washer (11), screw (12), index plate (13), washer (14), and right rear axle thrust ARM (15). DISCARD lock WASHER.



**INSTALLATION**

1. APPLY COAT of SEALING COMPOUND to SCREW (1) and INSTALL screw (1), washer (2), right rear axle thrust ARM (3), index plate (4), new lock washer (5), and nut (6). TIGHTEN NUT to 184 lb-ft (250 N.m).



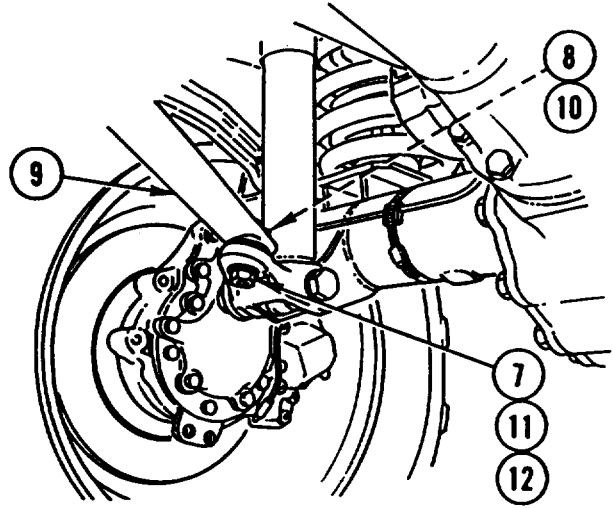


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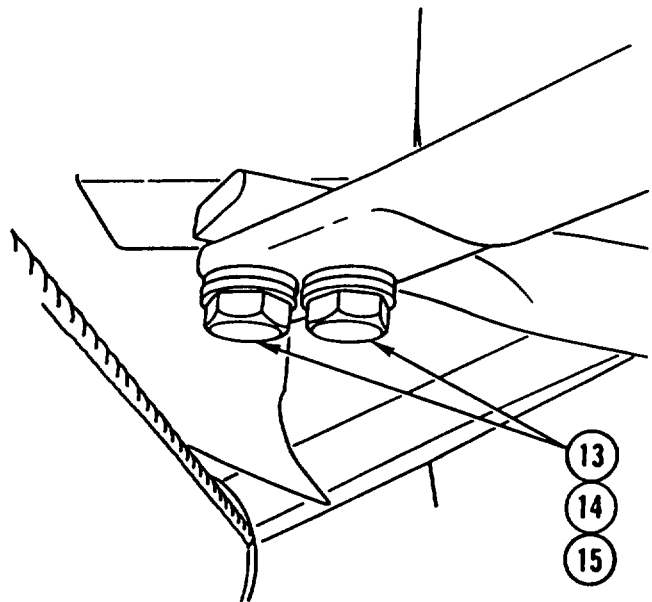
## REAR AXLE THRUST ARMS REPLACEMENT (CONT)

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2. APPLY COAT of SEALING COMPOUND to SCREW (7) and INSTALL screw (7), washer (8), left rear axle thrust ARM (9), index plate (10), new lock washer (11), and nut (12). TIGHTEN NUT to 184 lb-ft (250 N.m).



3. APPLY COAT of SEALING COMPOUND to two SCREWS (13) and INSTALL two SCREWS (13), four new lock washers (14), and two nuts (15). TIGHTEN SCREWS to 184 lb-ft (250 N.m).



# REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

## INITIAL SETUP

### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Puller, P/N 000 589 35 33 00

### Materials/Parts:

Washer, Spring Tension  
 Washer, Spring Tension  
 Seals  
 Ring, Wear  
 Bearing  
 Compound, Sealing Appendix B, Item 15  
 Compound, Sealing Appendix B, Item 16  
 Rags Appendix B, Item 40

### References:

TM 5-2420-224-20  
 TM 9-214  
 LO 5-2420-224-12

### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Rear Brake Calipers Removed

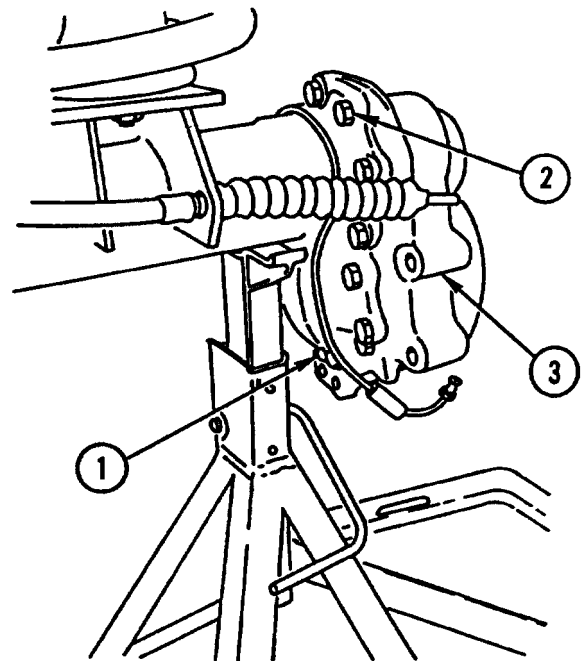
### General Safety Instructions:

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

## REMOVAL

1. REMOVE drain PLUG (1) and DRAIN FLUID into suitable container.
2. REMOVE 12 screws (2) and rear axle final drive HOUSING (3).

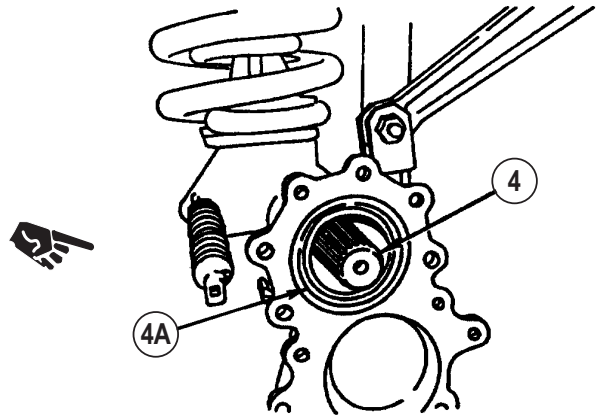


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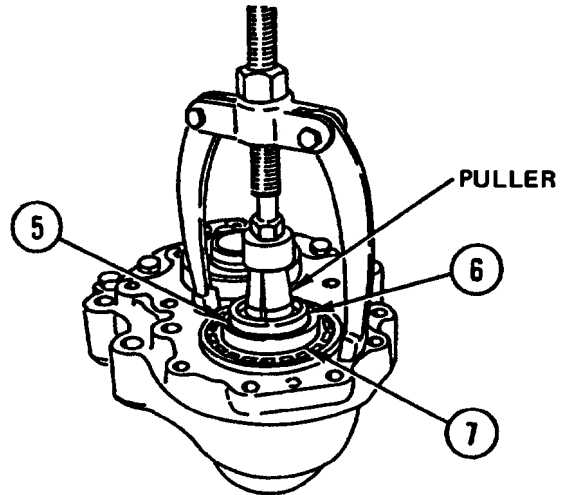
## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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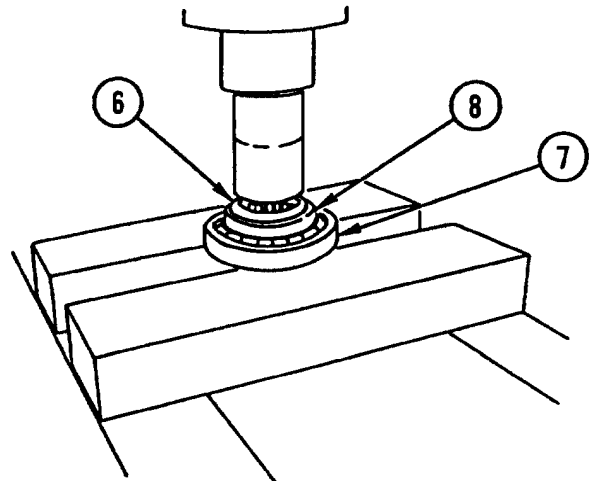
3. REMOVE axle SHAFT (4) and SEAL (4A). DISCARD SEAL.



4. REMOVE and DISCARD spring tension WASHER (5).
5. USING PULLER and suitable PULLER, REMOVE GEAR (6) and bearing (7).



6. Using suitable PRESS, REMOVE bearing (7) and spacer (8) from gear (6).

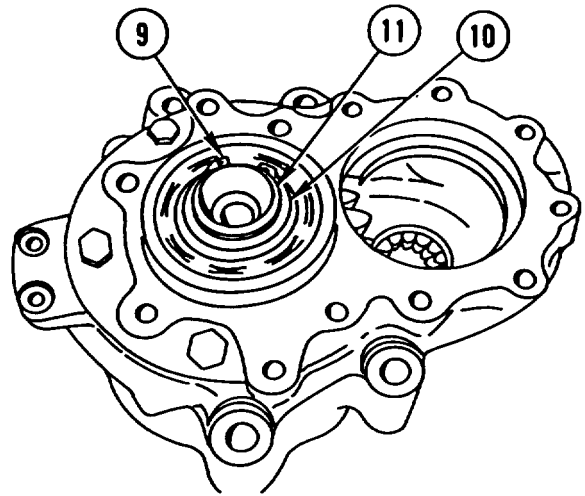


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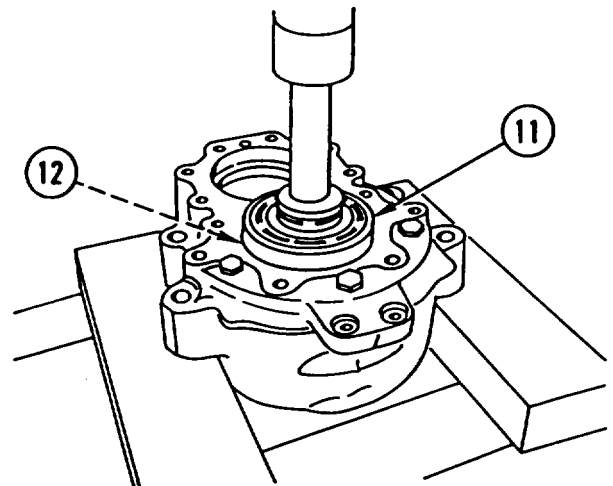
## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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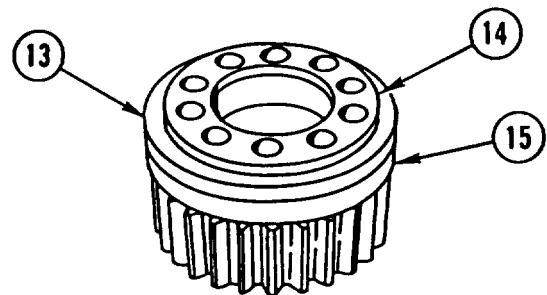
7. REMOVE spring tension washer (9) and SPACER(S) (10) from gear (11). DISCARD spring tension WASHER.



8. USING suitable PRESS, REMOVE GEAR (11) and any shim(s) (12).



9. REMOVE and DISCARD SEAL (13), wear RING (14), and BEARING (15).

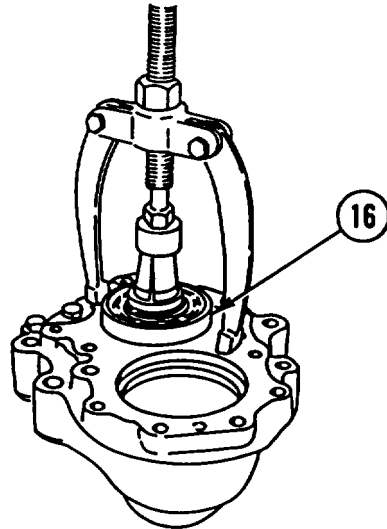


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## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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10. USING suitable PULLER, REMOVE BEARING (16).

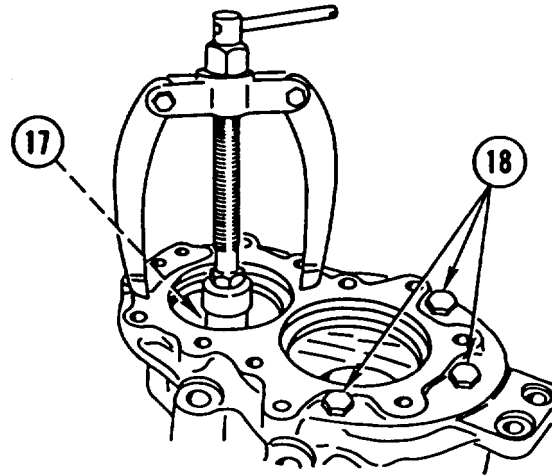


11. USING suitable PULLER, REMOVE BEARING (17).

12. IF DAMAGED, REMOVE three PLUGS (18).

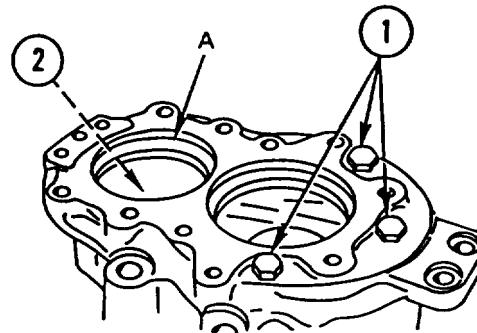
### INSPECTION

1. Inspect housing for galling, cracks, or stripped threads.
2. Inspect bearings (TM 9-214).
3. Inspect gears for worn or broken teeth.
4. inspect axle for cracks.



### INSTALLATION

1. IF REMOVED, INSTALL three new PLUGS (1).
2. MEASURE and RECORD depth of bearing seat A.
3. USING suitable INSTALLER, INSTALL BEARING (2).

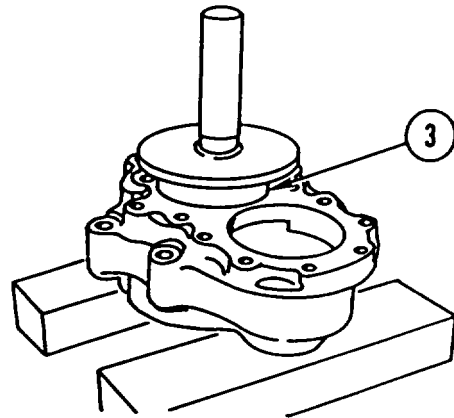


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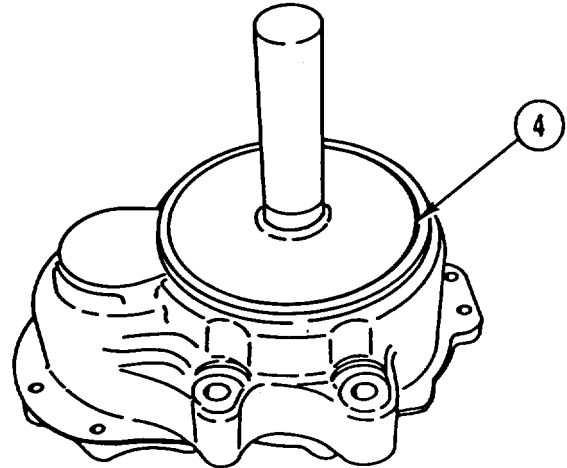
## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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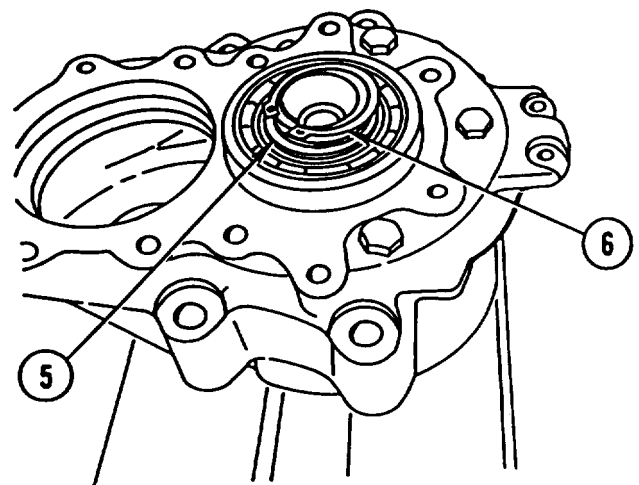
4. USING suitable PRESS and suitable INSTALLER, INSTALL BEARING (3).



5. USING suitable PRESS and suitable INSTALLER, INSTALL GEAR (4).



6. INSTALL SPACER(S) (5) and new spring tension washer (6).

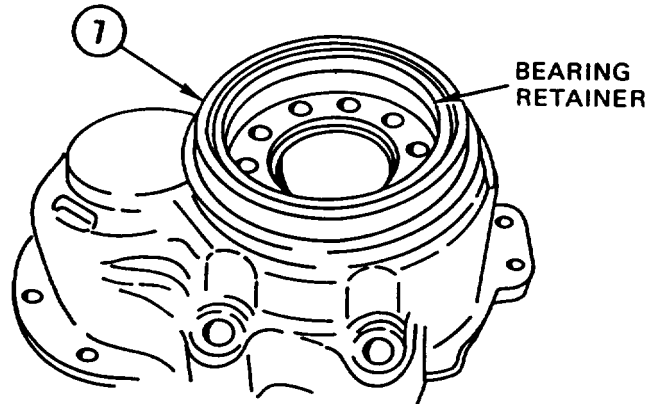


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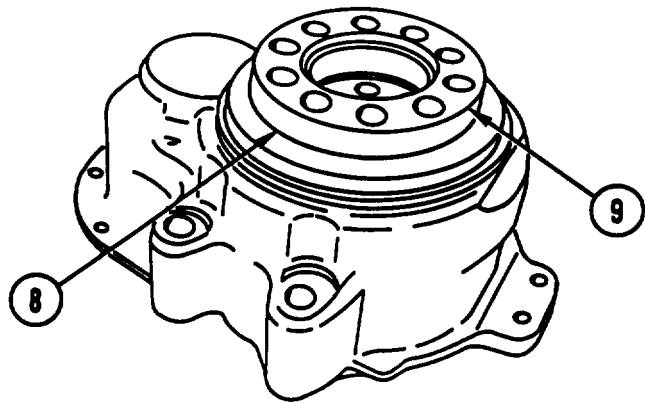
## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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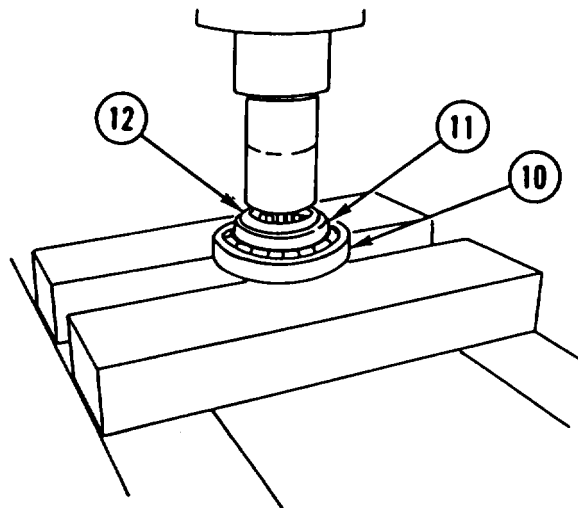
7. USING suitable INSTALLER, INSTALL new BEARING (7). DISCARD bearing RETAINER.



8. INSTALL new SEAL (8) and new wear RING (9).



9. USING suitable PRESS, INSTALL BEARING (10) and spacer (11) on gear (12).

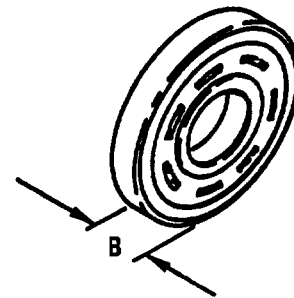
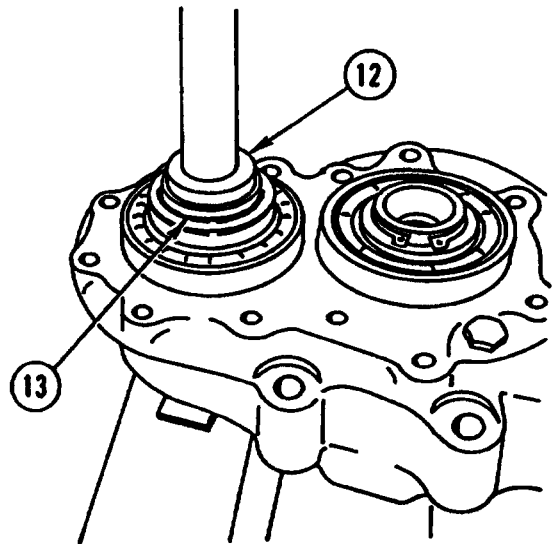


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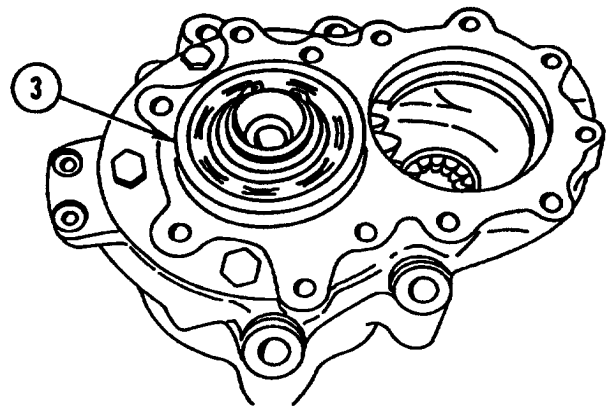
## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

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10. USING suitable PRESS, INSTALL GEAR (12).
11. INSTALL new spring tension WASHER (13).



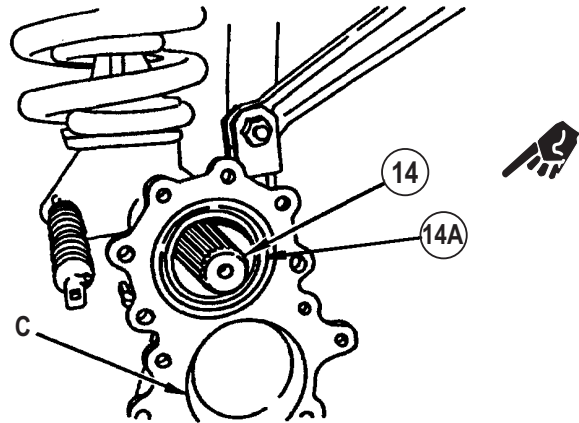
12. MEASURE and RECORD dimension B for bearing (3).





## REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT REPLACEMENT (CONT)

13. MEASURE and RECORD dimension C.
14. ADD A from step 2 and C from step 13.
15. SUBTRACT total in step 14 from B in step 12 to determine shim thickness.
16. INSTALL axle SHAFT (14) and new SEAL (14A).

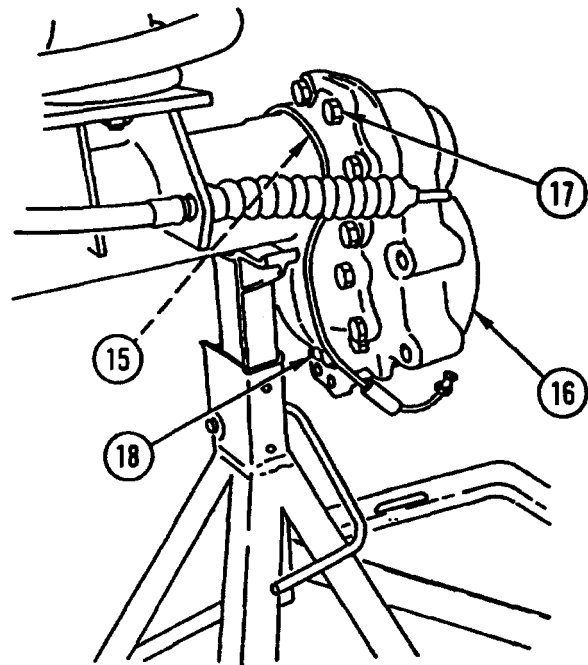


17. INSTALL SHIM(S) (15) per step 15.

### 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 attention.

18. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to mounting FLANGE of rear axle final drive housing (16). APPLY COAT of SEALING COMPOUND (Appendix B, Item 15) to THREADS of 12 screws (17), INSTALL rear axle final drive HOUSING (16) and two screws (17). Tighten SCREWS to 75 lb-ft (100 N.m).
19. FILL rear axle final drive HUB with gear oil (LO 5-2420-224-12).
20. INSTALL drain PLUG (18).



### NOTE

Follow-on Maintenance:  
Install rear brake calipers (TM 5-2420-224-20).

## CHAPTER 7 BRAKE AND STEERING SYSTEMS MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the brake and steering systems. A list of tasks contained in this chapter is shown below.

	Page
Brake Pressure Regulator (ALB Valve) Replacement . . . . .	7-1
Brake Pressure Regulator (ALB Valve) Adjustment . . . . .	7-5
Power Steering Gear Replacement . . . . .	7-11
Power Steering Pump and Bracket Replacement.. . . .	7-14
Pitman Arm Replacement . . . . .	7-17

### BRAKE PRESSURE REGULATOR (ALB VALVE) REPLACEMENT

This task covers: a. Removal b. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Spring  
Tension (2)

Seal (2)

Rags

Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Backhoe (SEE) or Crane (HMMH) in Three-Point Stance

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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## BRAKE PRESSURE REGULATOR (ALB VALVE) REPLACEMENT (CONT)

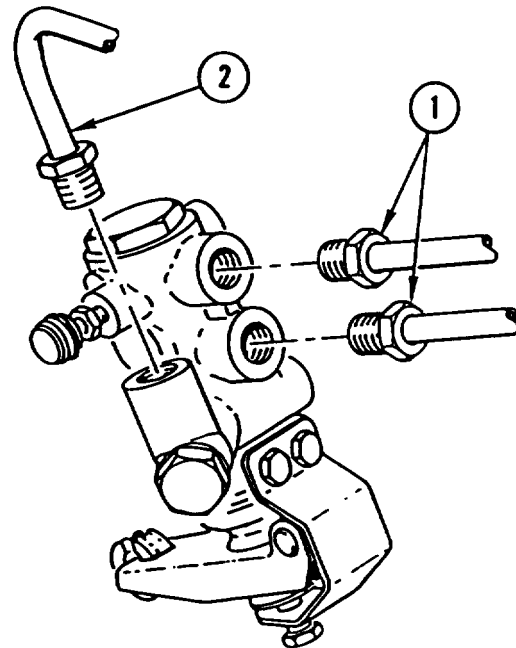
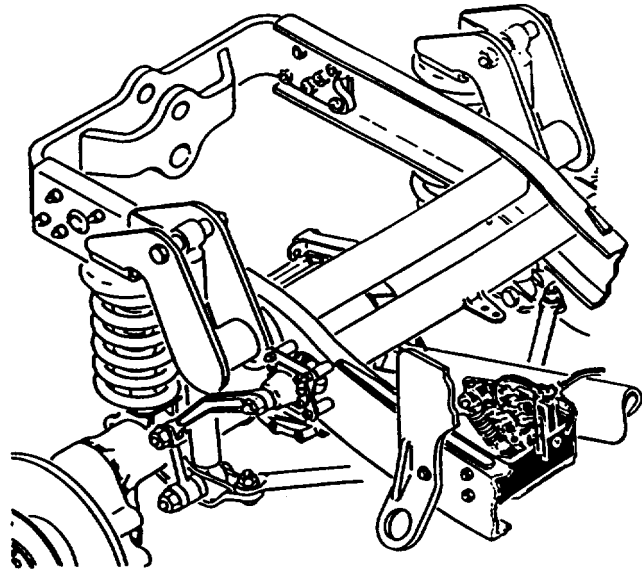
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### REMOVAL

#### NOTE

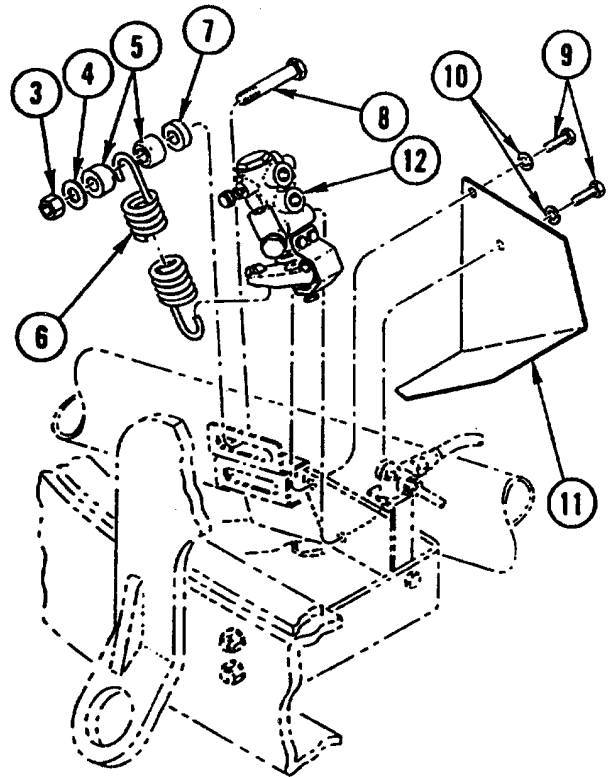
- Procedure is the same for both vehicles.
- Tag lines prior to disconnecting to aid in connecting.
- Have suitable container available to catch any brake fluid that may spill out.

1. DISCONNECT two brake LINES (1) and brake HOSE (2).

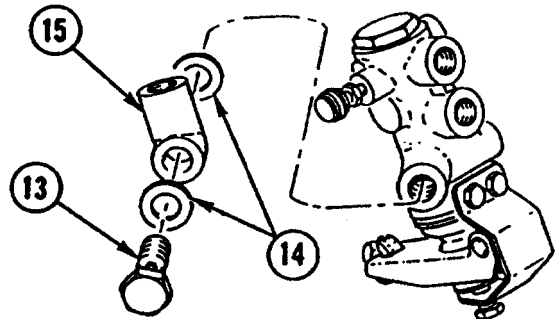


## BRAKE PRESSURE REGULATOR (ALB VALVE) REPLACEMENT (CONT)

2. REMOVE nut (3), washer (4), two spacers (5), SPRING (6), washer (7), and screw (8).
3. REMOVE two bolts (9), two spring tension washers (10), access cover (11), and brake pressure REGULATOR (ALB) valve (12). DISCARD spring tension WASHERS.



4. REMOVE hollow bolt (13), two seals (14), and FITTING (15). DISCARD SEALS.

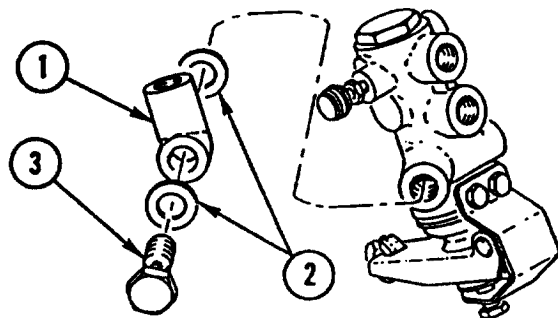


### INSTALLATION

#### NOTE

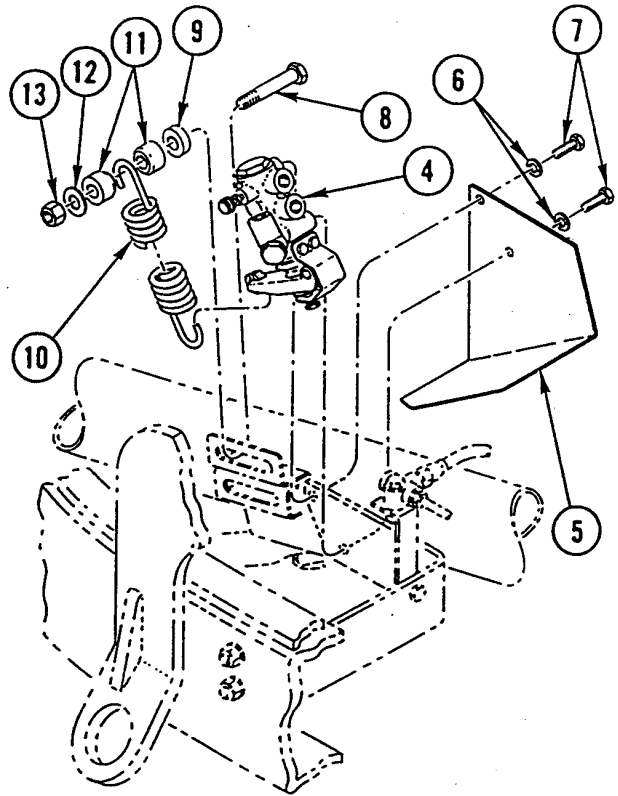
Procedure is the same for both vehicles.

1. INSTALL FITTING (1), two new seals (2), and hollow bolt (3). DO NOT TIGHTEN hollow BOLT (3).



## **BRAKE PRESSURE REGULATOR (ALB VALVE) REPLACEMENT (CONT)**

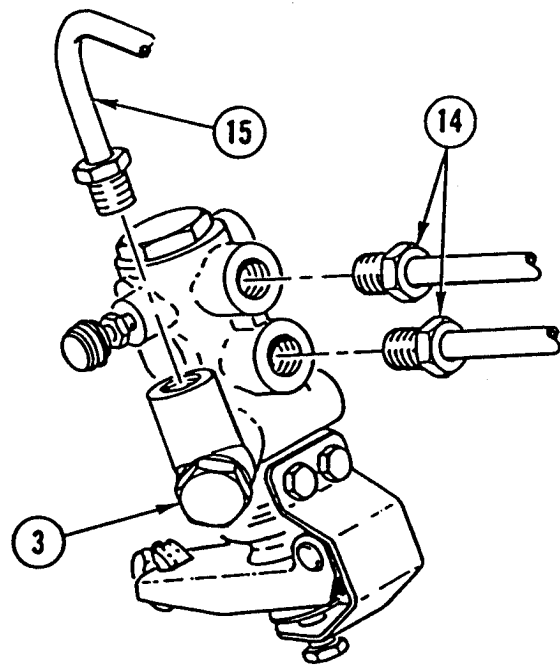
2. INSTALL brake pressure REGULATOR (ALB valve) (4), access cover (5), two new spring tension washers (6), and two bolts (7).
3. INSTALL SCREW (8), washer (9), SPRING (10), two spacers (11), washer (12), and nut (13).



4. CONNECT two brake LINES (14) and brake HOSE (15).
5. TIGHTEN hollow BOLT (3).

### **NOTE**

Follow-on Maintenance:  
Bleed brake system (TM 5-2420-224-20).  
Adjust brake pressure regulator (ALB valve) (page 7-5).



---

## BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT

---

This task covers: a. Installation b. Testing c. Adjustment d. Removal

---

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Gage Panel, P/N 0005896421 00

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Spare Tire and Mount Removed
TM 5-2420-224-20	Vehicle Blocked
TM 5-2420-224-10	Parking Brake Released
TM 5-2420-224-20	Outside Engine Hood Removed

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20  
 TM 5-2420-224-10

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## INSTALLATION

### CAUTION

- Only silicone brake fluid may be used in gauge to prevent damage to equipment.
- If gauge is used with silicone brake fluid, do not mix with standard brake fluid to prevent damage to equipment.

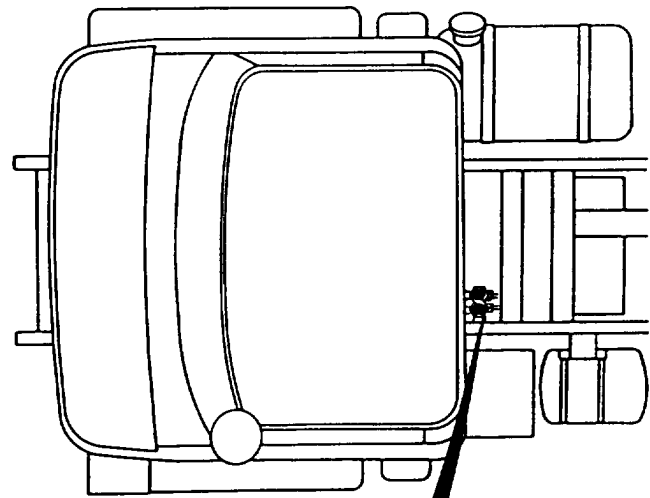
### NOTE

Procedure is the same for both vehicles.

1. CHECK that fuel TANK is full.
2. CHECK that hydraulic TOOLS are STORED on vehicle and FRONT LOADER (SEE) or FORKLIFT (HMMH) and BACKHOE (SEE) or CRANE (HMMH) are STOWED in transport position.
3. CHECK that brake fluid LEVELS are at operating level. BEFORE CONNECTING GAUGE to brake system, MARK brake fluid LEVEL on reservoirs.
4. CHECK that hydraulic RESERVOIRS are at operating level.

**BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT (CONT)**

5. REMOVE BACKHOE (SEE) or CRANE (HMMH) from TRANSPORT position and PLACE in WORK position (TM 5-2420-224-10).



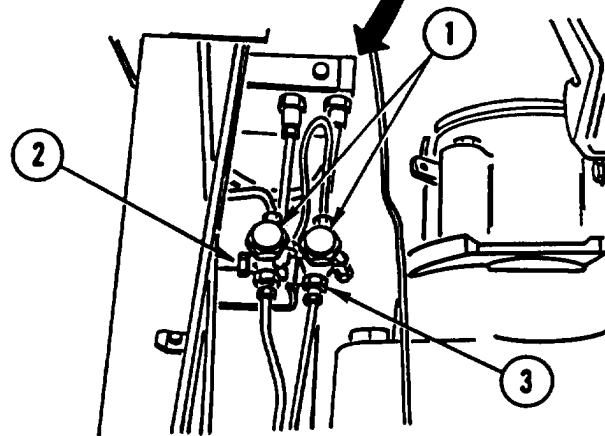
6. REMOVE two CAPS (1) from test connections (2 and 3).

7. INSTALL two male quick-coupler FITTINGS provided with gage panel.

8. CONNECT two pressure gage HOSES (4) to test connections as follows:

a. PLACE pressure gage HOSE from GAGE A of GAGE PANEL to CONNECTION of CIRCUIT 1 (2) of vehicle MODULATED test port.

b. PLACE pressure gage HOSE from GAGE B of GAGE PANEL to CONNECTION of CIRCUIT 2 (3) vehicle UNMODULATED test port.



**TESTING**

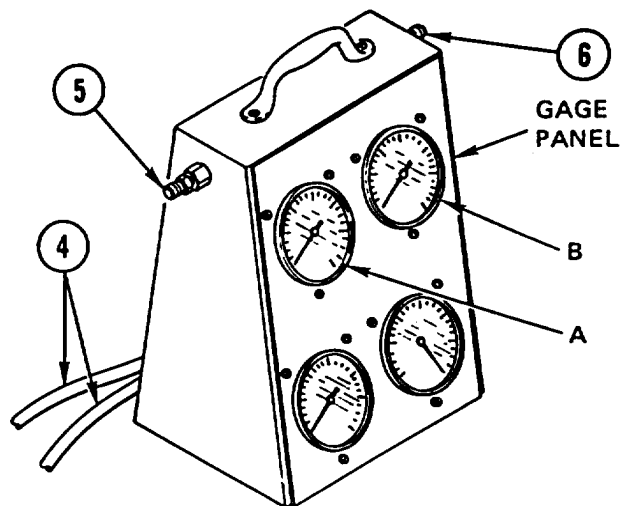
1. Purge/bleed pressure gage at two bleed port fittings (5 and 6) located on each side of gage by pressing brake pedal several times.

2. While pressing brake pedal to full actuation (floor) and holding, open bleed port (5) on left side of gage panel for gage A. Close bleed port (5) for gage A.

3. Repeat until there is steady, clear flow of brake fluid.

4. Repeat procedure for right side of gage panel by bleeding port (6) for gage B.

5. After purging/bleeding gages, gage panel is ready to be used to adjust ALB valve.



## BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT (CONT)

### ADJUSTMENT

#### NOTE

For fail-safe adjustment, rear axle load must be released.

1. To release rear axle load, remove control spring (1) connecting ALB valve (2) to rear torque tube (3), or use backhoe (SEE) or crane (HMMH) outriggers to raise rear tires completely off the ground.

#### CAUTION

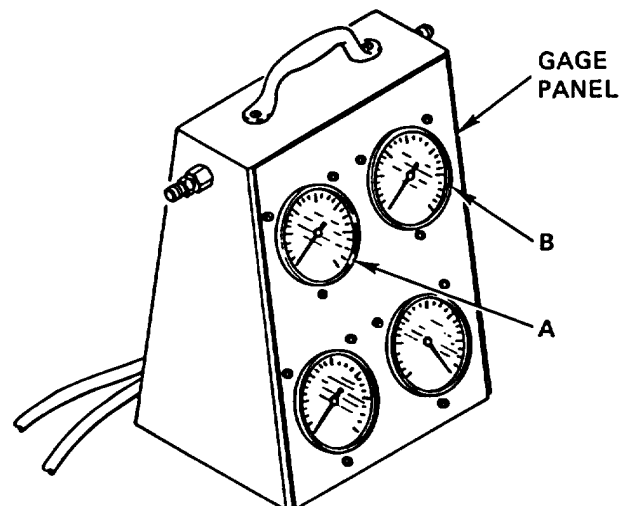
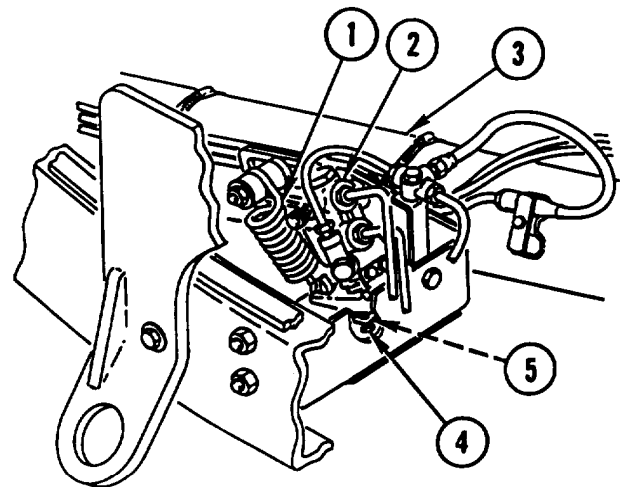
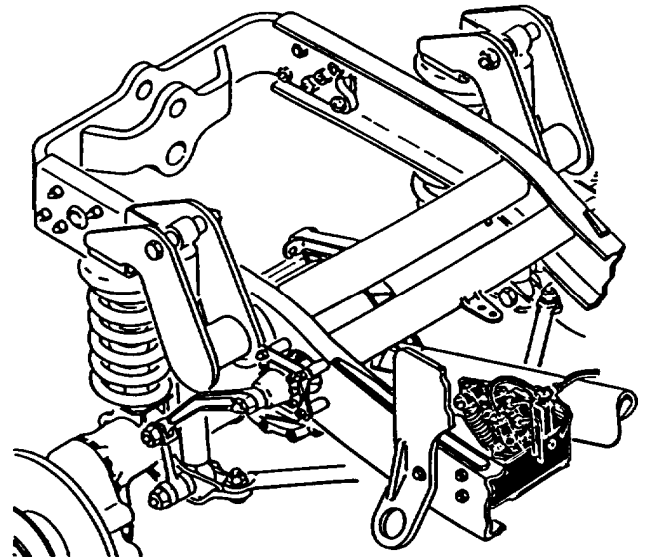
After spring tension has been released, make sure air pressure of vehicle brake system is not below 90 psi (6 bar) as indicated on air pressure gage located on instrument panel to prevent damage to equipment.

2. Position gage panel so gages can be read accurately. Slowly press brake pedal until full brake pedal pressure is achieved. Both pressure gages should rise until gage A reads modulated fall-safe pressure setting of 515 psi (35 bar). Tolerance of  $\pm 44$  psi ( $\pm 3$  bar) is permissible. Gage B of unmodulated circuit should read approximately 1924-2072 psi (130-140 bar).

#### NOTE

- Pressure of gage A must be set to 515 psi (35 bar).
- Do not apply brake pedal pressure while adjusting ALB valve.

3. To obtain setting for gage A, adjust screw (4) on ALB valve (2) as necessary. Tolerance of  $\pm 44$  psi ( $\pm 3$  bar) is permissible.
4. Loosen retainer lock nut (5) and turn screw (4) clockwise to increase pressure or counterclockwise to decrease pressure, to obtain required setting. Tighten retainer lock nut.



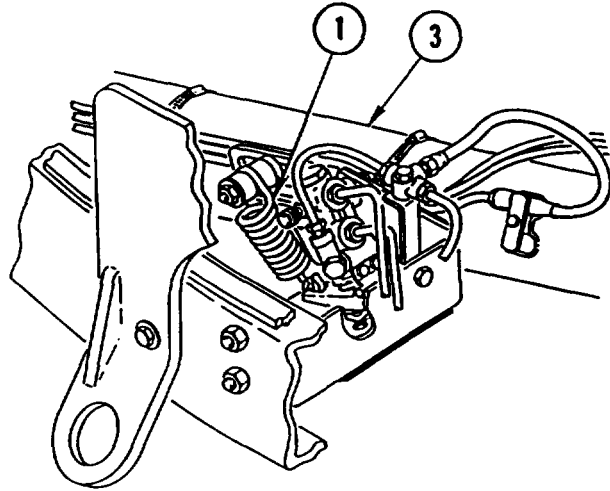


**BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT (CONT)**

**NOTE**

If adjustment setting cannot be obtained and gage readings fluctuate after rechecking, it may be necessary to bleed brake system (TM 5-2420-224-20) and repeat Adjustment steps 1 thru 5.

5. Press brake pedal several times to activate brake system. Recheck gage reading for proper pressure setting.



**CAUTION**

Before performing steps 6 thru 13, ALB fail-safe pressure setting must be completed to prevent damage to equipment.

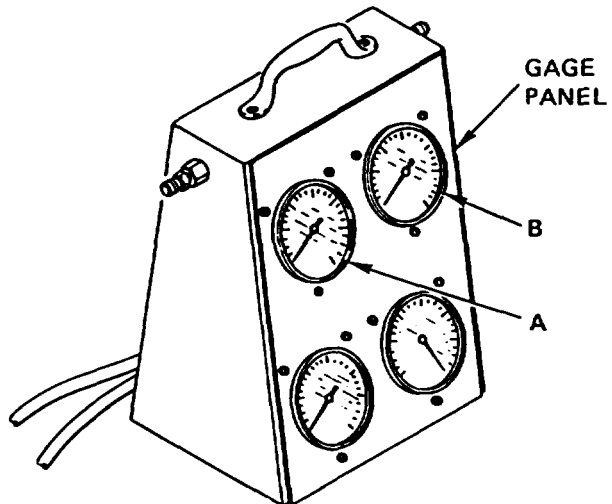
6. Install spare tire (TM 5-2420-224-20).
7. If removed, install control spring (1) to rear torque tube (3) or retract outriggers.
8. Place backhoe (SEE) or crane (HMMH) in transport position (TM 5-2420-224-10).

**CAUTION**

Make sure air pressure of vehicle brake system is not below 90 psi (6 bar) as indicated on air pressure gage located on instrument panel to prevent damage to equipment.

**NOTE**

Gage A indicates pressure of modulated circuit 1. This pressure is proportionate to rear axle load with vehicle in transport position.



9. Position gage panel so gages can be read accurately. Slowly press brake pedal until full pedal pressure is achieved. Both pressure gages should rise until gage A reads modulated rear axle load pressure setting of 1352 psi (92 bar). Tolerance of  $\pm 44$  psi ( $\pm 3$  bar) is permissible. Gage B of unmodulated circuit should read approximately 1924-2072 psi (130-140 bar).

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**BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT (CONT)**


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**NOTE**

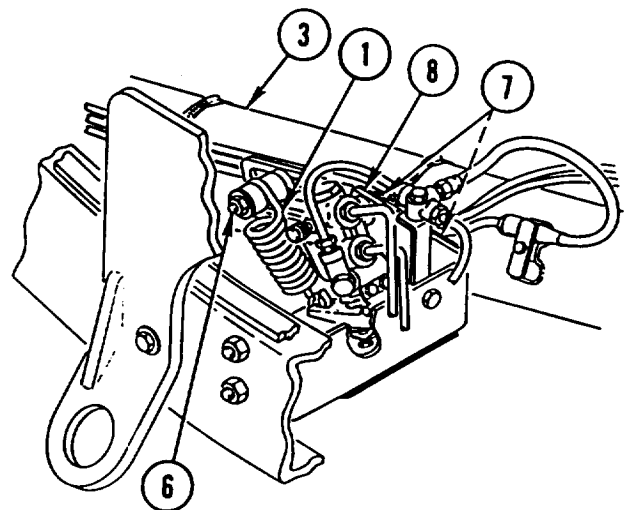
- Forward movement will decrease spring tension, which will drop ALB brake pressure.
- Backward movement will increase spring tension, which will increase ALB brake pressure.
- Do not apply brake pressure while adjusting spring.

10. If necessary, adjust ALB rear axle load pressure to 1352 psi (92 bar) by loosening and moving control spring mounting bolt (6) on torque tube (3) forward or backward. Tolerance of  $\pm 44$  psi ( $\pm 3$  bar) is permissible.

11. Tighten mounting bolt (6).

12. If rear axle load pressure is too high and control spring (1) is at maximum forward position in elongated hole on torque tube (3), perform the following:

- a. Loosen two 19 mm bolts (7) on ALB valve mounting bracket (8) located on right side of frame rail behind fuel tank.
- b. Rotate ALB valve mounting bracket (8) upward to gain additional adjustment freeplay.
- c. Tighten two ALB valve bracket mounting bolts (7).
- d. Adjust rear axle load pressure according to specifications in step 10, above.

**NOTE**

If adjustment setting cannot be obtained and gage readings fluctuate after rechecking, it may be necessary to bleed brake system (TM 5-2420-224-20) and repeat Adjustment steps 6 thru 13.

13. Press brake pedal several times to activate brake system. Recheck gage reading for proper pressure setting.

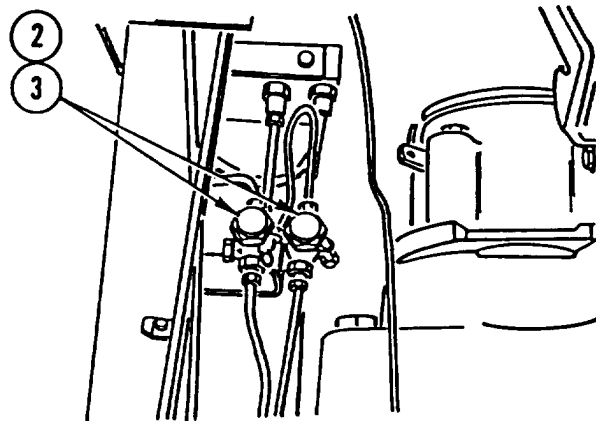
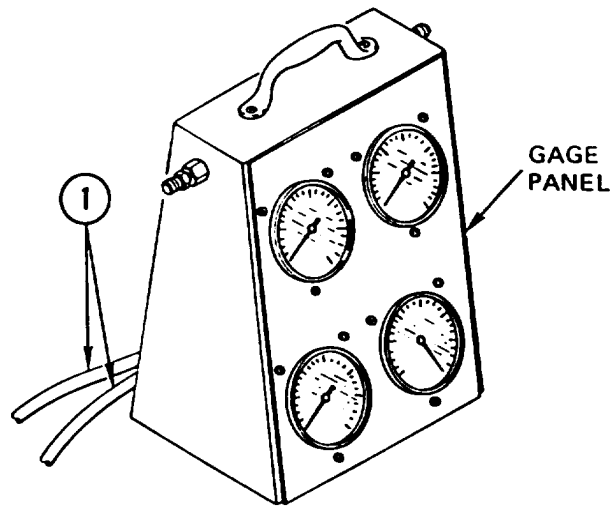
## BRAKE PRESSURE REGULATOR (ALB VALVE) ADJUSTMENT (CONT)

### REMOVAL

#### NOTE

Procedure is the same for both vehicles.

1. REMOVE BACKHOE (SEE) or CRANE (HMMH) from TRANSPORT position and PLACE in WORK position (TM 5-2420-224-10).
2. REMOVE SPARE TIRE (TM 5-2420-224-20).
3. DISCONNECT pressure gage HOSES (1) from vehicle test ports (2) and REMOVE two male quick-coupler FITTINGS from test ports (2).
4. INSTALL two CAPS (3) and HAND-TIGHTEN.
5. PLACE two male quick-coupler FITTINGS back INSIDE gage panel.
6. CHECK that brake fluid LEVEL remains at level previously marked.
7. PLACE BACKHOE (SEE) or CRANE (HMMH) in TRANSPORT position (TM 5-2420-224-10).



#### NOTE

Follow-on Maintenance:  
 install spare tire and mount (TM 5-2420-224-20).  
 Install outside engine hood (TM 5-2420-224-20).  
 Unblock vehicle (TM 5-2420-224-20).

## POWER STEERING GEAR REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Puller, P/N 406589053300

#### Materials/Parts:

Pin, Cotter  
 Seal (2)

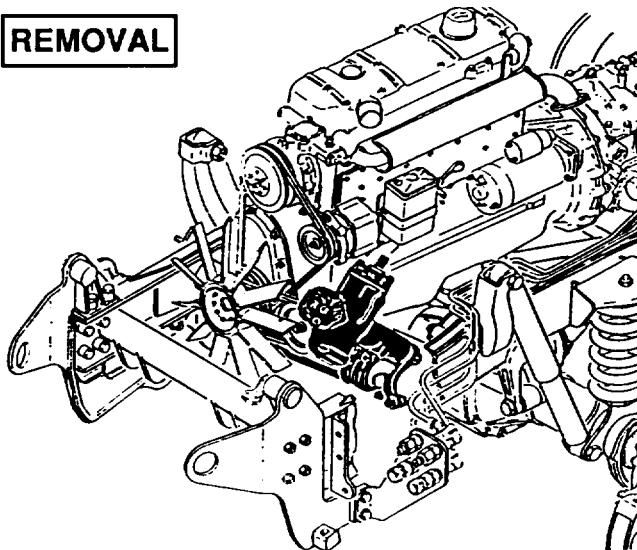
#### References:

TM 5-2420-224-20  
 LO 5-2420-224-12

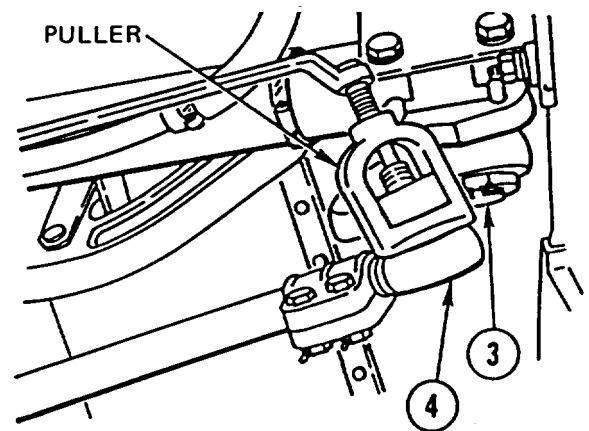
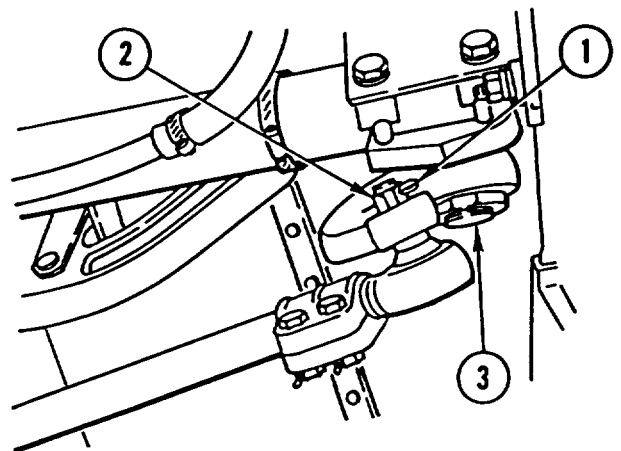
#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
LO 5-2420-224-12	Power Steering Reservoir Drained

### REMOVAL



1. REMOVE cotter pin (1) and castellated NUT (2) from power steering gear (3). DISCARD cotter PIN.
2. USING PULLER, DISCONNECT pitman ARM (4) from power steering gear assembly (3).

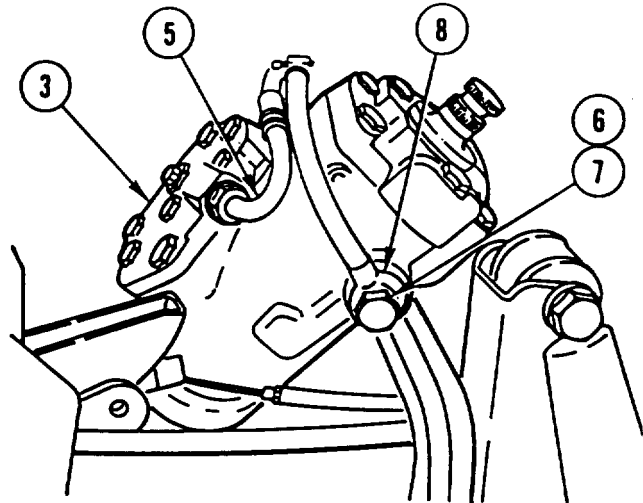


**POWER STEERING GEAR REPLACEMENT (CONT)**

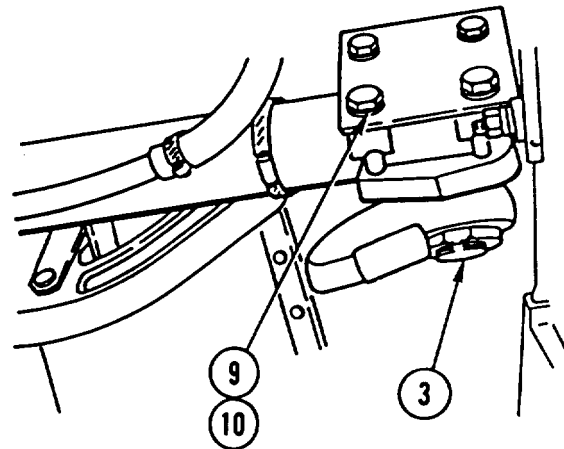
**NOTE**

Tag all lines prior to disconnecting to aid in connecting.

3. DISCONNECT TUBE (5) from power steering gear assembly (3).
4. REMOVE hollow BOLT (6) and two seals (7) and DISCONNECT TUBE (8). DISCARD SEALS.



5. USING suitable HOIST, SUPPORT weight of power steering GEAR assembly (3).
6. REMOVE four screws (9), four washers (10), and power steering GEAR assembly (3).



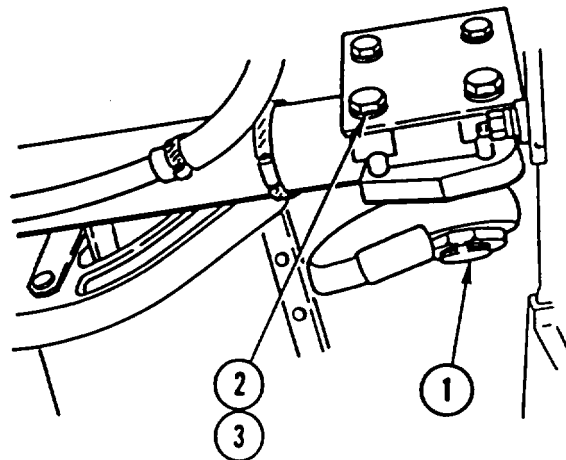
**INSPECTION**

1. Inspect housings for galling, cracks, or stripped threads.

Inspect splines on steering shaft for damage.

**INSTALLATION**

1. USING suitable HOIST, INSTALL power steering GEAR assembly (1), four screws (2), and four washers (3). TIGHTEN two SMALLER SCREWS to 144 lb-ft (195 N.m) and two LARGER SCREWS to 173 lb-ft (235 N.m).

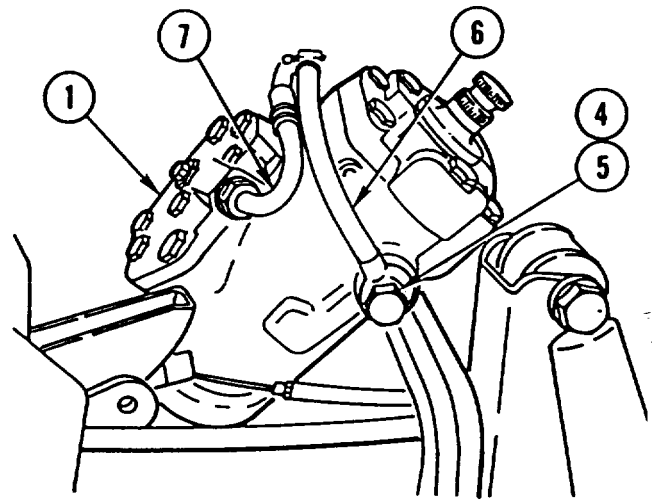


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**POWER STEERING GEAR REPLACEMENT (CONT)**


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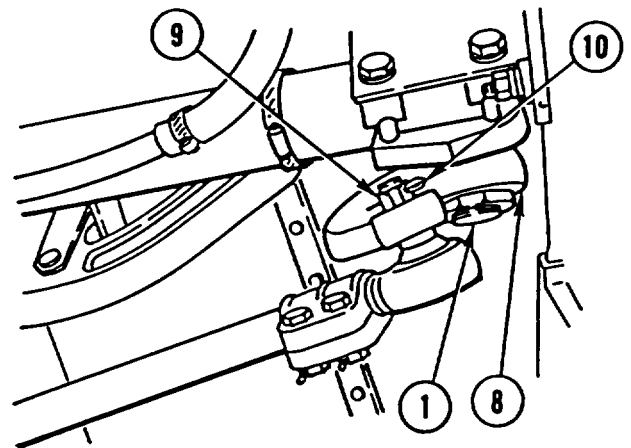
2. INSTALL hollow BOLT (4) and two new seals (5) and CONNECT TUBE (6) to power steering gear assembly (1).
3. CONNECT TUBE (7).



4. CONNECT pitman ARM (8) on power steering gear assembly (1) and INSTALL castellated NUT (9) and new cotter pin (10).

**NOTE**

Follow-on Maintenance:  
 Fill power steering reservoir  
 (LO 5-2420-224-12).  
 Lower cab (TM 5-2420-224-20).



---

## POWER STEERING PUMP AND BRACKET REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Strap  
 Nut, Lock  
 Washer, Spring  
 Tension (4)  
 Washer, Lock

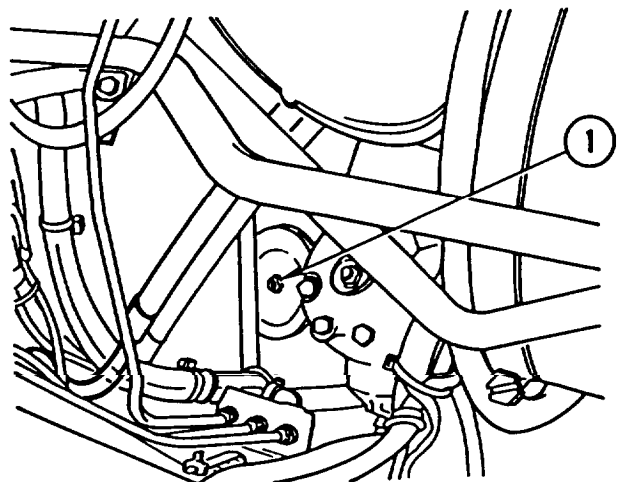
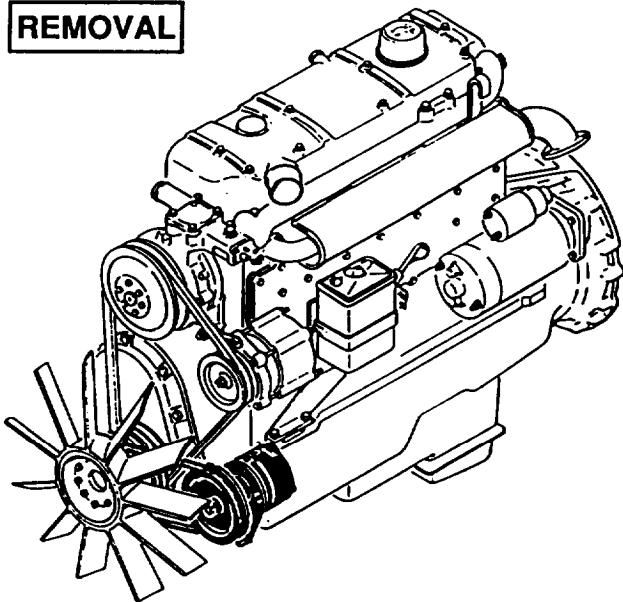
#### References:

TM 5-2420-224-20  
 LO 5-2420-224-12

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Tilted
LO 5-2420-224-12	Power Steering Reservoir Drained
TM 5-2420-224-20	Front Plate Removed

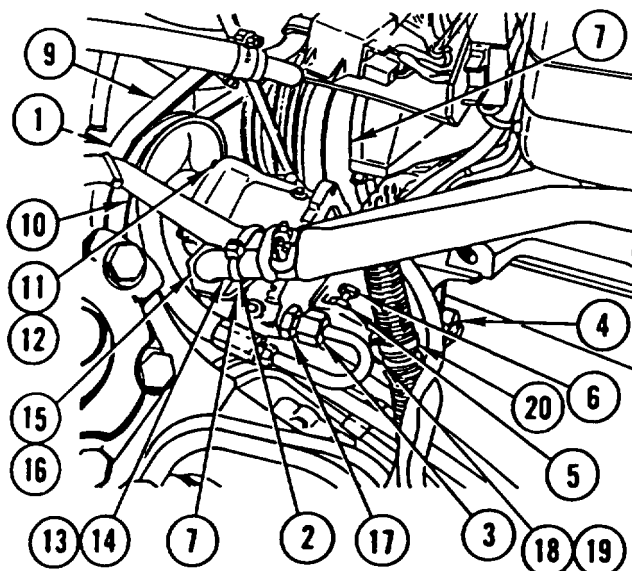
### REMOVAL



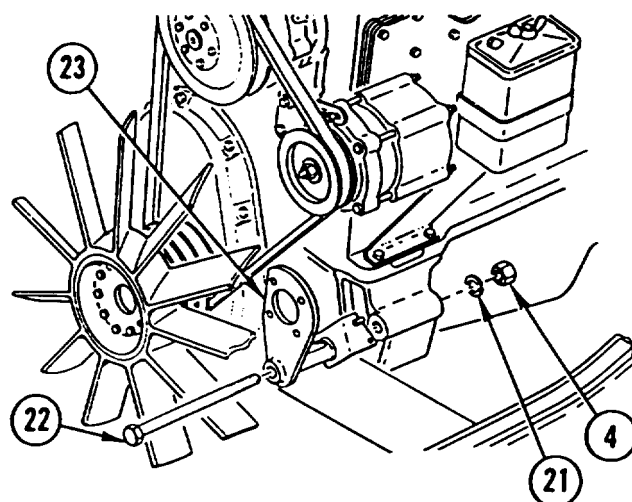
1. LOOSEN lock NUT (1).
2. REMOVE and DISCARD STRAP (2).
3. DISCONNECT HOSE assembly (3).
4. LOOSEN NUT (4) and NUT (5) and TURN adjusting SCREW (6) in.
5. ROTATE power steering PUMP (7) toward engine (8), DISCONNECT BELT' (9), and ROTATE power steering PUMP (7) away from engine (8) as far as it will go.

**POWER STEERING PUMP AND BRACKET REPLACEMENT (CONT)**

6. REMOVE lock nut (1) and PULLEY (10). DISCARD lock NUT.
7. REMOVE four bolts (11), four spring tension washers (12), and power steering PUMP (7). DISCARD spring tension WASHERS.
8. REMOVE TUBE (13) and fitting (14).
9. REMOVE compression sleeve (15) and union NUT (16) from tube (13).
10. REMOVE FITTING (17).
11. REMOVE bolt (18), washer (19), and CLAMP (20).

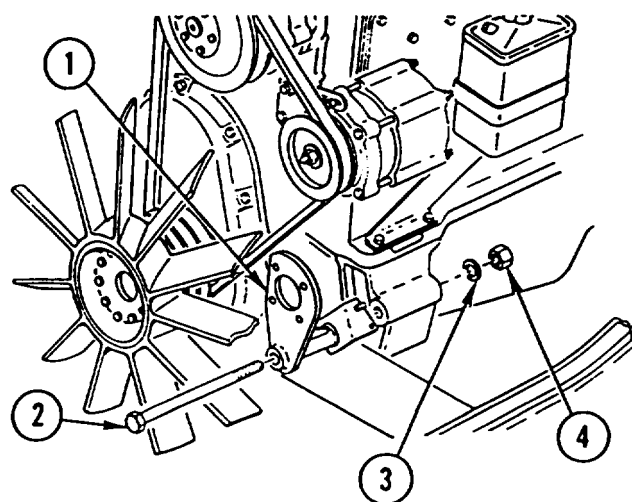


12. REMOVE nut (4), lock washer (21), screw (22), and BRACKET (23). DISCARD lock WASHER.



**INSTALLATION**

1. INSTALL BRACKET (1), screw (2), new lock washer (3), and nut (4). HAND TIGHTEN.



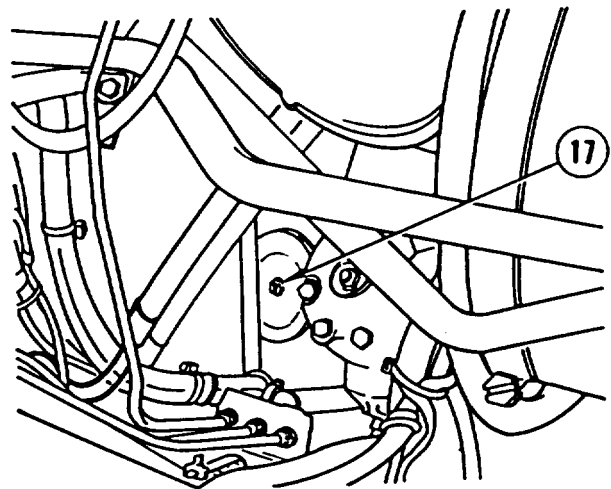
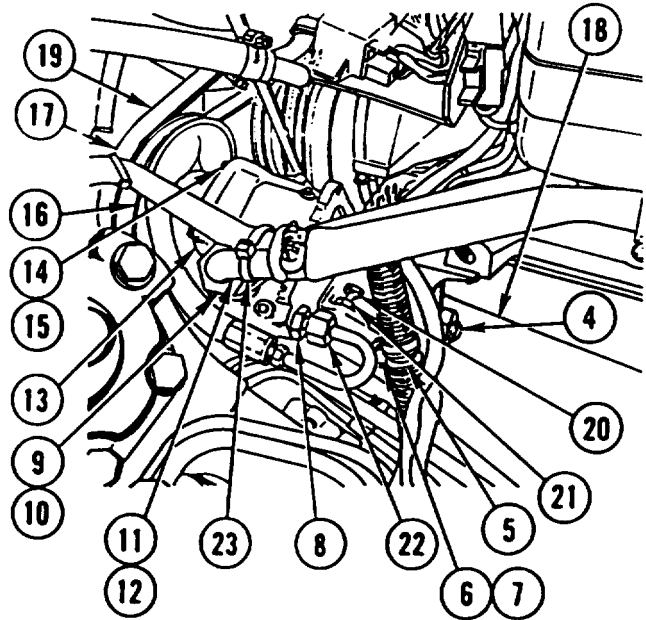


**POWER STEERING PUMP AND BRACKET REPLACEMENT (CONT)**

2. INSTALL CLAMP (5), washer (6), and bolt (7).
3. INSTALL FITTING (8).
4. INSTALL union NUT (9) and compression sleeve (10) in tube (11).
5. INSTALL filling (12) and TUBE (11).
6. INSTALL power steering PUMP (13), four new spring tension washers (14), and four bolts (15).
7. INSTALL PULLEY (16) and new lock nut (17).
8. ROTATE power steering PUMP (13) toward engine (18), CONNECT BELT (19), and TURN adjusting SCREW (20) out until belt tension of 1/2 in. (10-15 mm) is attained. TIGHTEN NUT (21).
9. CONNECT HOSE assembly (22).
10. INSTALL new STRAP (23).
11. TIGHTEN NUT (4) and lock NUT (17) to 66 lb-ft (90 N.m).

**NOTE**

Follow-on Maintenance:  
 Install front plate (TM 5-2420-224-20).  
 Fill power steering reservoir (LO 5-2420-224-12).  
 Lower cab (TM 5-2420-224-20).



## PITMAN ARM REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Puller, P/N 406 589 06 33 00

#### References:

TM 5-2420-224-20

#### Equipment Condition:

#### Materials/Parts:

Washer

#### Reference

TM 5-2420-224-20

#### Condition Description

Drag Link Removed

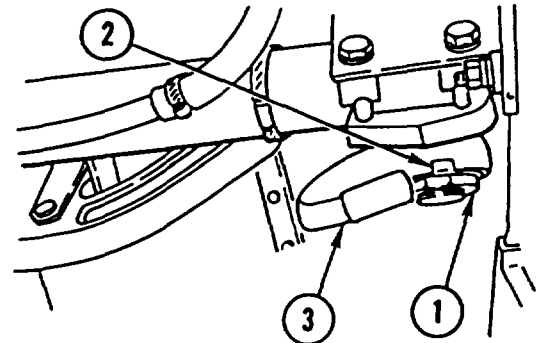
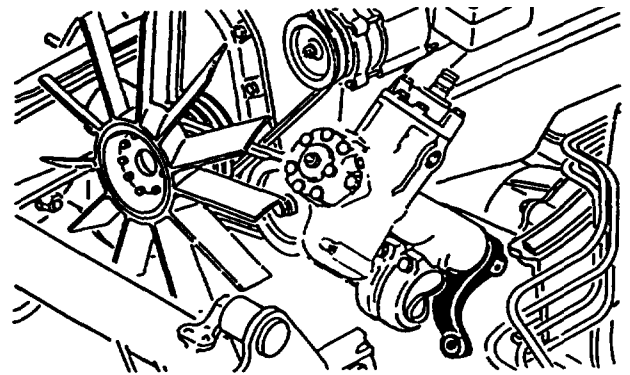
### REMOVAL

1. REMOVE NUT (1) and washer (2). DISCARD WASHER.

#### CAUTION

Do not loosen pitman arm by means of hammer blows. Damage to internal steering components may result.

USING PULLER, REMOVE pitman ARM (3).



### INSTALLATION

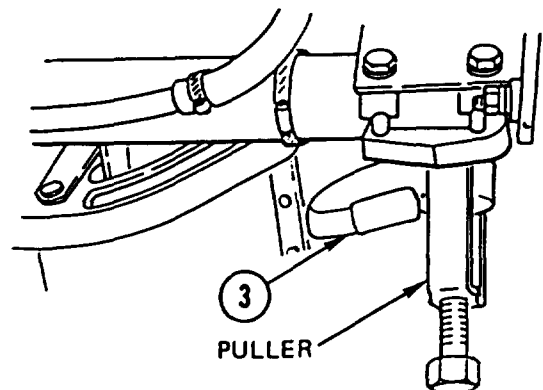
#### CAUTION

Do not install pitman arm by means of hammer blows. Damage to internal steering components may result.

1. INSTALL pitman ARM (3), new washer (2), and nut (1). TIGHTEN to 258-295 lb-ft (350-400 N.m).
2. BEND TAB on washer (2) toward pitman arm (3).

#### NOTE

Follow-on Maintenance:  
 Install and adjust drag link (TM 5-2420-224-20).





## CHAPTER 8 FRAME AND TOWING ATTACHMENTS MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the frame and towing attachments. A list of tasks contained in this chapter is shown below.

	Page
Rear Frame Section and Subframe Replacement . . . . .	8-1
Forklift Mounting Bracket Replacement . . . . .	8-7
Left Platform Replacement . . . . .	8-9
Right Platform Replacement . . . . .	8-13

---

### REAR FRAME SECTION AND SUBFRAME REPLACEMENT

---

This task covers: a. Removal b. Installation

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Nut, Lock  
 Washer, Lock (4)  
 Compound, Sealing      Appendix B, item 15

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

TM 5-2420-224-20

Page 8-9

Page 8-13

**Condition Description**

Backhoe Assembly (SEE) Removed (HMMH)

Chassis Tool Box/Deck Plate Removed

Backhoe Subframe Deck (SEE) Removed

Crane Travel Lock (HMMH) Removed

Backhoe Latch Cylinder (SEE) or Crane Latch Cylinder (HMMH) Removed

Fuel Tank Removed

Air Pressure Tanks Removed

Left Platform (SEE) Removed

Right Platform (SEE) Removed

## REAR FRAME SECTION AND SUBFRAME REPLACEMENT (CONT)

### General Safety Instructions:

#### WARNING

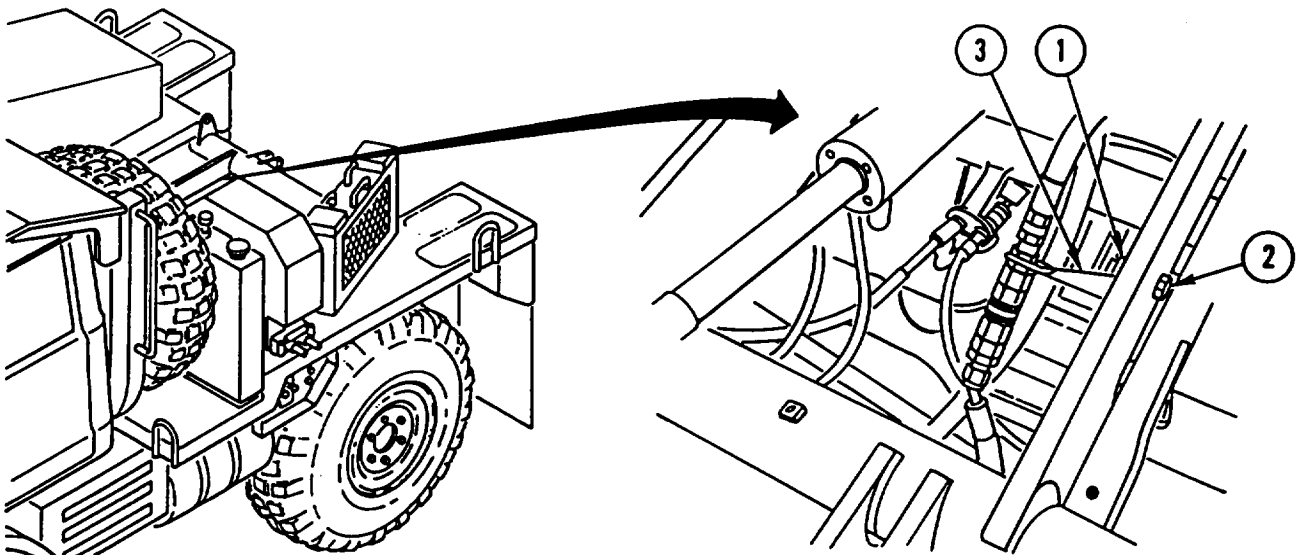
- SEE/HMMH should not be operated with backhoe (SEE) or crane (HMMH) removed, except in a maintenance facility. When maintenance is required and backhoe or crane is removed, never operate SEE/HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with either backhoe or crane removed. This could cause loss of control and injury to personnel or damage to vehicle.

### General Safety Instructions (Cont):

#### WARNING

- Rear frame section and subframe weigh 598 pounds (272 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting frame section and subframe.
- 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.

### REMOVAL



#### NOTE

Procedure is the same for both vehicles.

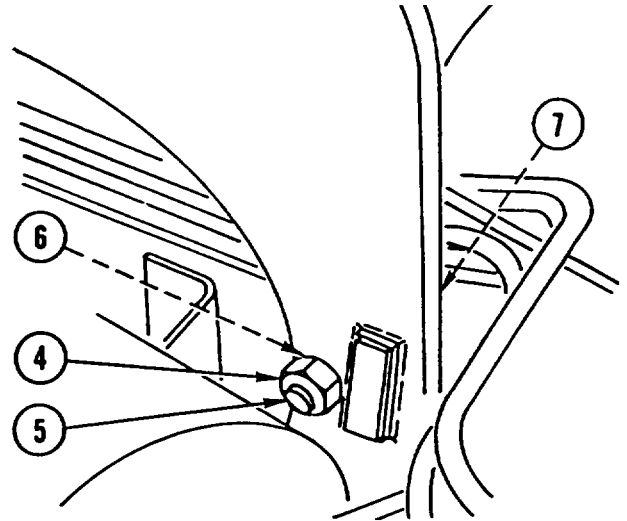
1. REMOVE lock nut (1), bolt (2), and BRACKET (3). DISCARD lock NUT.

## REAR FRAME SECTION AND SUBFRAME REPLACEMENT (CONT)

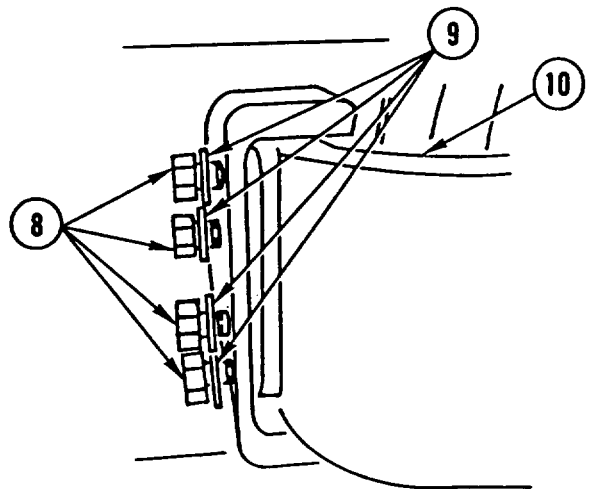
**NOTE**

Steps 2 thru 4 are the same for both sides of vehicle.

2. REMOVE nut (4), BOLT (5), and bushing (6) from subframe (7).



3. REMOVE four SCREWS (8) and four washers (9) from rear frame section (10).

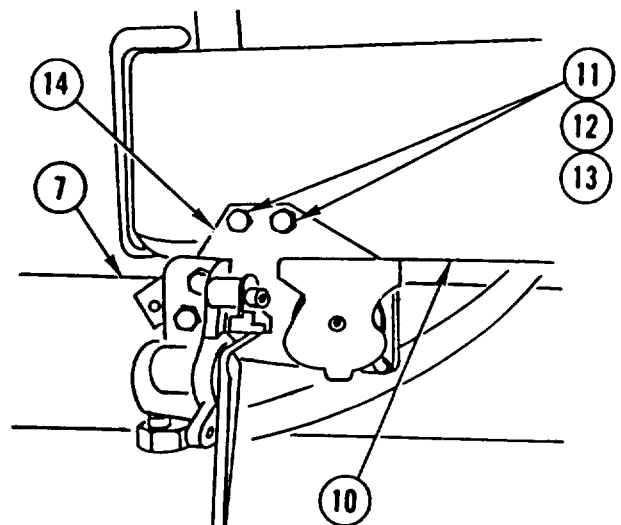


4. REMOVE two nuts (11), two lock washers (12), two capscrews (13), and BRACKET (14) from rear frame section (10). DISCARD lock WASHERS.

**NOTE**

Rear frame section and subframe must be removed as an assembly.

5. REMOVE rear frame SECTION (10) and SUBFRAME (7) as an assembly.

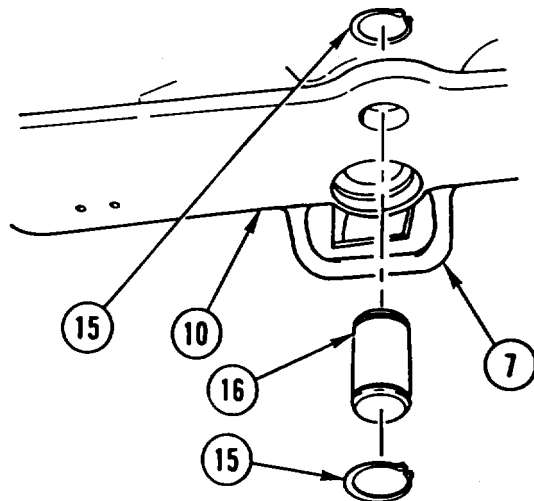


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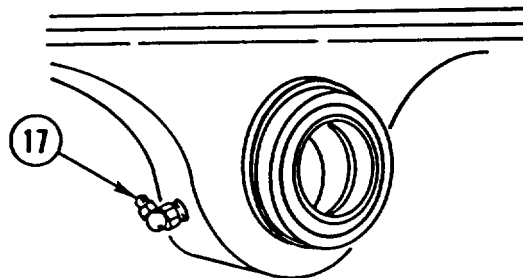
**REAR FRAME SECTION AND SUBFRAME REPLACEMENT (CONT)**

---

6. REMOVE two retaining rings (15), pin (16), and rear frame SECTION (10) from subframe (7).



7. IF DAMAGED, REMOVE lubrication FITTING (17).



---

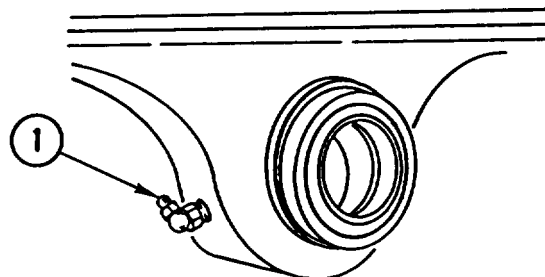
**INSTALLATION**

---

**NOTE**

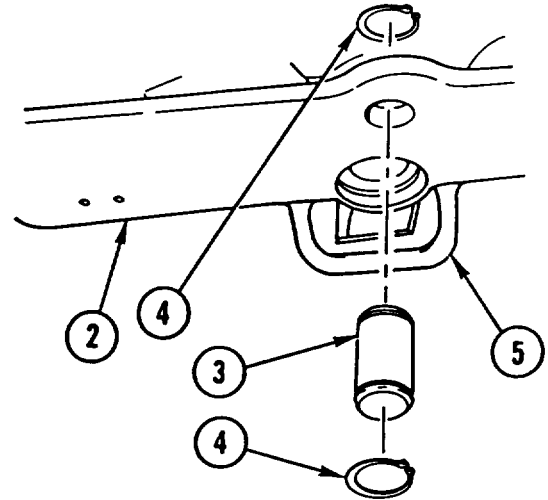
Procedure is the same for both vehicles.

1. IF REMOVED, INSTALL new lubrication FITTING (1).



**REAR FRAME SECTION AND SUBFRAME REPLACEMENT (CONT)**

2. INSTALL rear frame SECTION (2), pin (3), and two retaining rings (4) on subframe (5).



**NOTE**

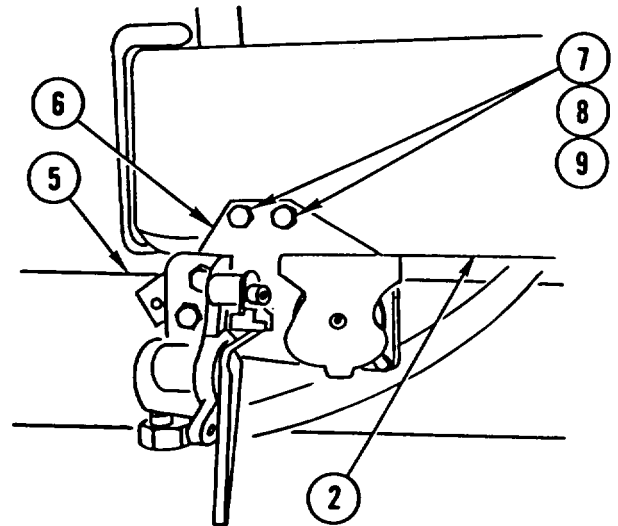
Rear frame section and subframe must be installed as an assembly.

3. INSTALL SUBFRAME (5) and rear frame SECTION (2) as an assembly.

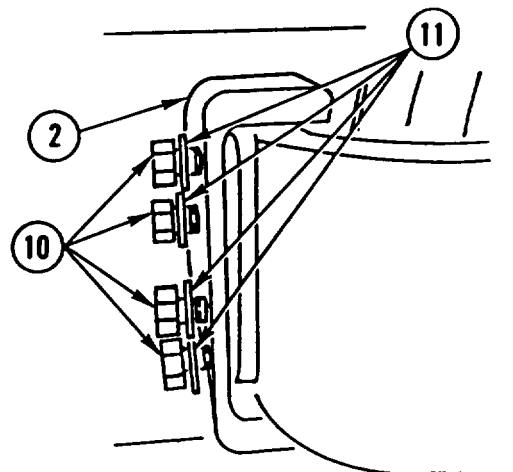
**NOTE**

Steps 4 thru 6 are the same for both sides of vehicle.

4. INSTALL BRACKET (6), two capscrews (7), two new lock washers (8), and two nuts (9) in rear frame section (2).



5. APPLY COAT of SEALING COMPOUND to four SCREWS (10) and INSTALL four washers (11) and four SCREWS (10) in rear frame section (2). TIGHTEN TOP SCREWS to 150 lb-ft (203 N.m). TIGHTEN LOWER SCREWS to 220 lb-ft (298 N.m).



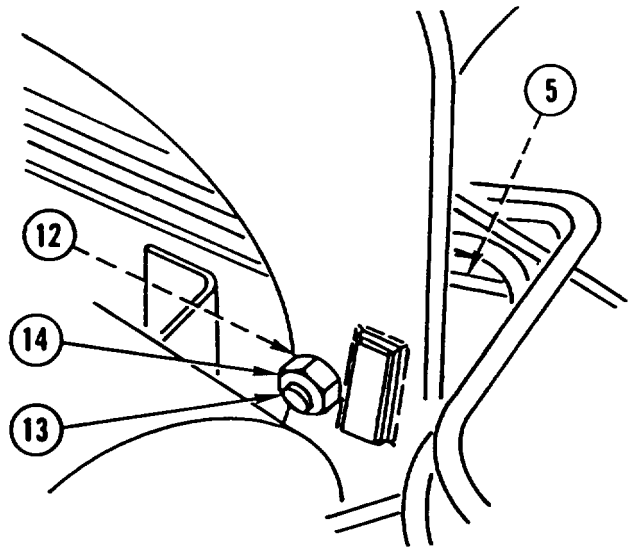


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## REAR FRAME SECTION AND SUBFRAME REPLACEMENT (CONT)

---

6. INSTALL BUSHING (12) in subframe (5).
7. APPLY COAT of SEALING COMPOUND to BOLT (13) and INSTALL BOLT (13) and nut (14) in subframe (5). TIGHTEN NUT to 600 lb-ft (814 N.m).

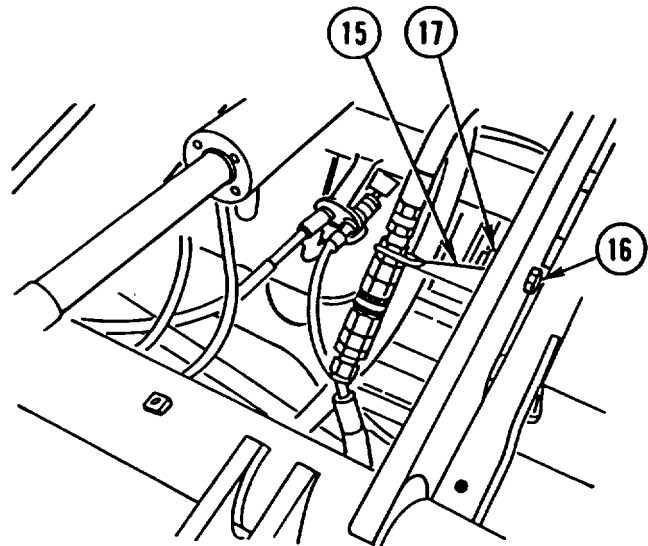


8. INSTALL BRACKET (15), bolt (16), and new lock nut (17).

### NOTE

#### Follow-on Maintenance:

- Install right platform (SEE) (page 8-13).
- Install left platform (SEE) (page 8-9).
- Install fuel tank (TM 5-2420-224-20).
- Install air pressure tanks (TM 5-2420-224-20).
- Install backhoe latch cylinder (SEE) or crane latch cylinder (HMMH) (TM 5-2420-224-20).
- Install crane travel lock (HMMH) (TM 5-2420-224-20).
- Install backhoe subframe deck (SEE) (TM 5-2420-224-20).
- Install chassis tool box/deck plate (TM 5-2420-224-20).
- Install backhoe assembly (SEE) or crane (HMMH) (TM5-2420-224-20).



---

## FORKLIFT MOUNTING BRACKET REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-X31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (2)

Washer, Lock (2)

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Forklift Removed

**General Safety Instructions:**

**W A R N I N G**

- HMMH should not be operated with forklift removed, except in a maintenance facility. When maintenance is required and forklift is removed, never operate HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with forklift removed. This could cause loss of control and injury to personnel or damage to vehicle.
  
- Forklift mounting bracket weighs 199 pounds (90 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mounting bracket.

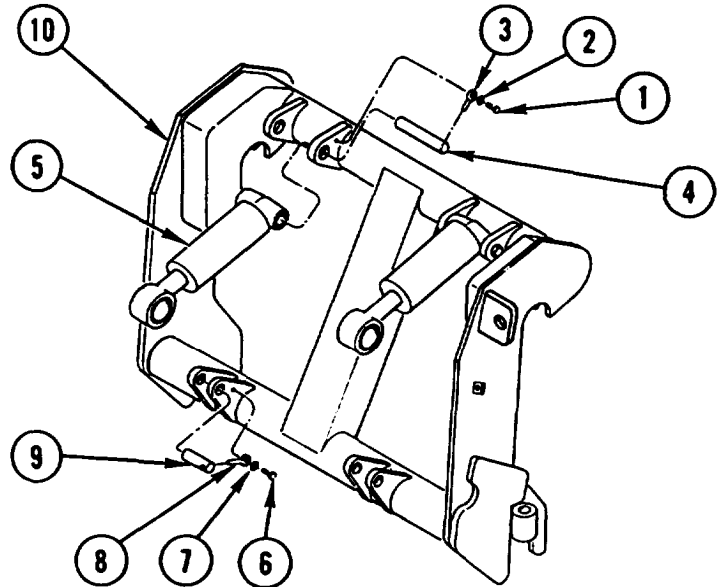
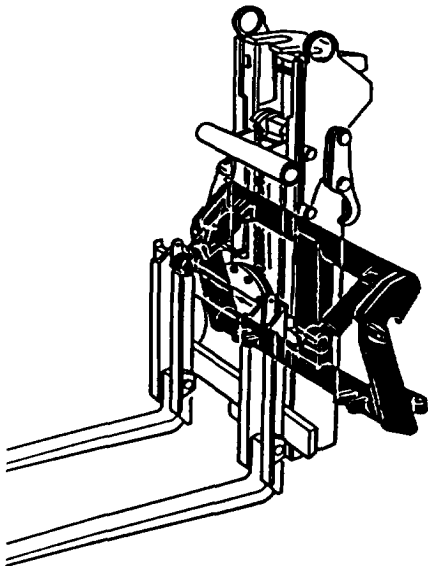
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## FORLIFT MOUNTING BRACKET REPLACEMENT (CONT)

---

### REMOVAL

1. REMOVE two capscrews (1), two lock washers (2), two eyebolts (3), and two PINS (4). DISCONNECT two tilt CYLINDERS (5). DISCARD lock WASHERS.
2. REMOVE two capscrews (6), two lock washers (7), two eyebolts (8), two pins (9), and forklift mounting BRACKET (10). DISCARD lock WASHERS.



### INSTALLATION

1. INSTALL forklift mounting BRACKET (10), two pins (9), two eyebolts (8), two new lock washers (7), and two capscrews (6).
2. CONNECT two tilt CYLINDERS (5). INSTALL two PINS (4), two eyebolts (3), two new lock washers (2), and two capscrews (1).

#### NOTE

Follow-on Maintenance:  
Install forklift (TM 5-2420-224-20).

## LEFT PLATFORM REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Nut, Lock (2)

Nut, Lock (4)

Compound, Sealing Appendix B, Item 15

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backup Alarm Removed
TM 5-2420-224-20	Left Rear Composite Stoplight/Taillight Removed
TM 5-2420-224-20	Work Light Removed

**Equipment Condition (Cont):**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Oil Cooler Removed
TM 5-2420-224-20	Hose Reel Assembly Removed
TM 5-2420-224-20	Front Hydraulic Tank Removed
Page 11-5	Tilt and Latch Control Valve Removed

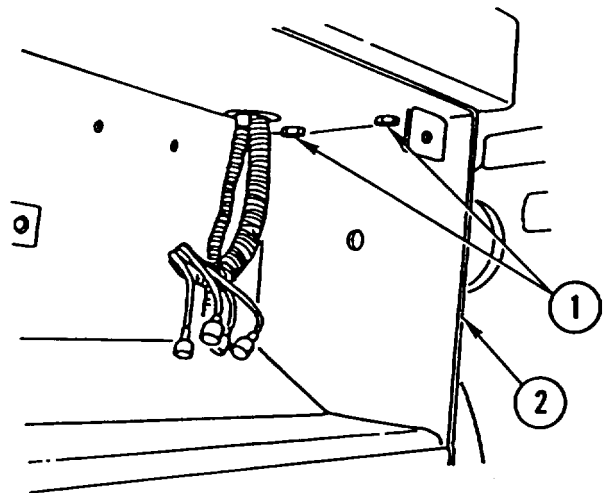
**General Safety Instructions:**

**WARNING**

Left platform weighs 150 pounds (68 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting left platform.

### REMOVAL

1. REMOVE four screws (1) and BOX (2).

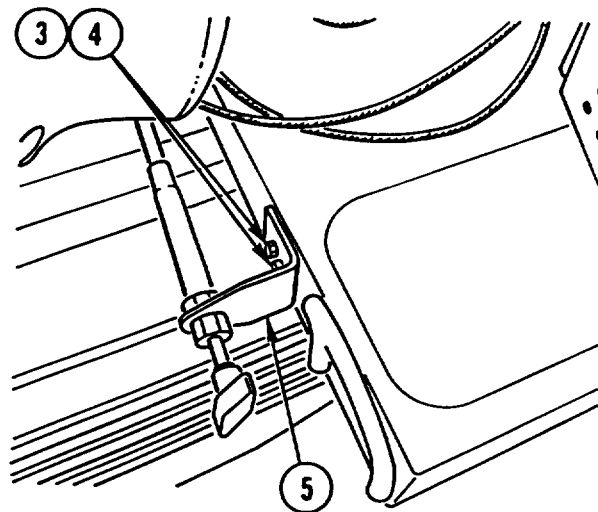


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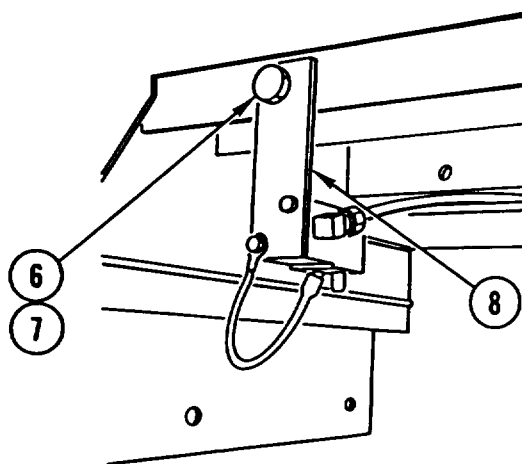
## LEFT PLATFORM REPLACEMENT (CONT)

---

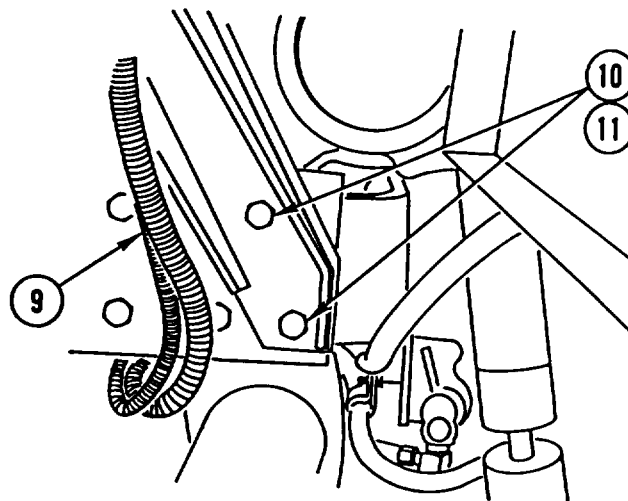
2. REMOVE two lock nuts (3), two BOLTS (4), and SET BRACKET (5) aside. DISCARD lock NUTS.



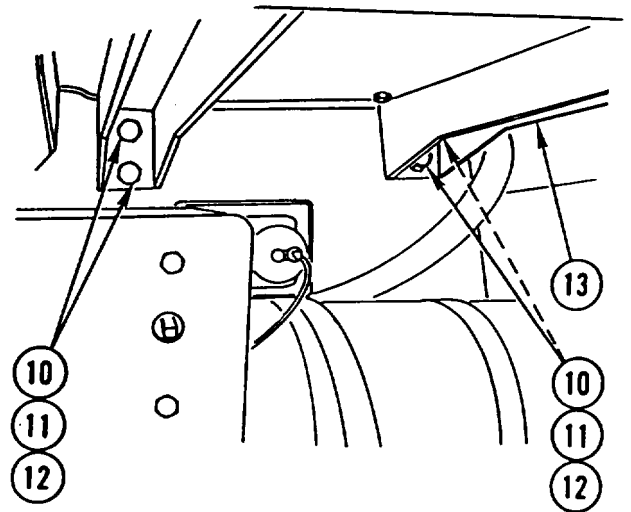
3. REMOVE screw (6), nut (7), and BRACKET (8).



4. DISCONNECT wiring HARNESS (9).
5. USING suitable HOIST, REMOVE six screws (10), six washers (11), four lock nuts (12), and left PLATFORM (13). DISCARD lock NUTS.



**LEFT PLATFORM REPLACEMENT (CONT)**



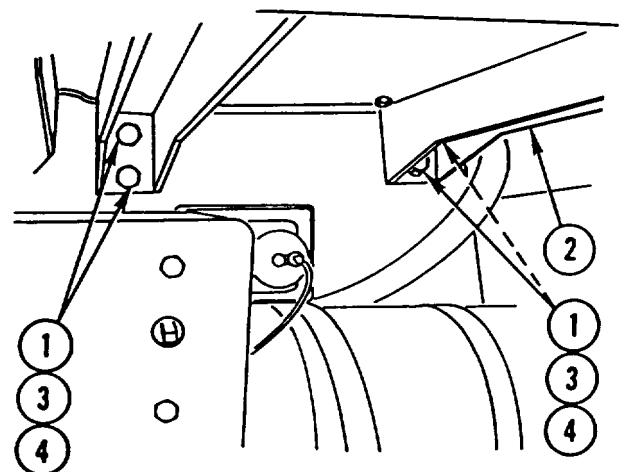
**INSPECTION**

1. Inspect for corrosion and damage.
2. Check mounting holes to chassis for elongation.
3. Inspect non-slip surfaces for traction.

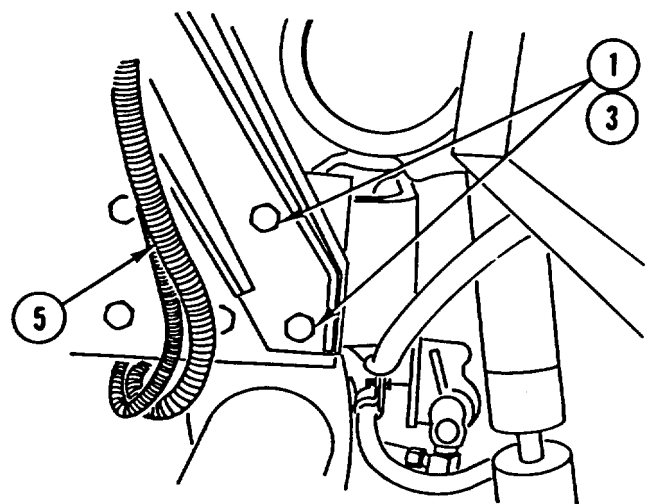
**INSTATLLATION**

**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 COAT of SEALING COMPOUND to six SCREWS (1). USING suitable HOIST, INSTALL left PLATFORM (2), six screws (1), six washers (3), and four new lock nuts (4). TIGHTEN SCREWS to 220 lb-ft (298 N.m).
2. CONNECT wiring HARNESS (5).

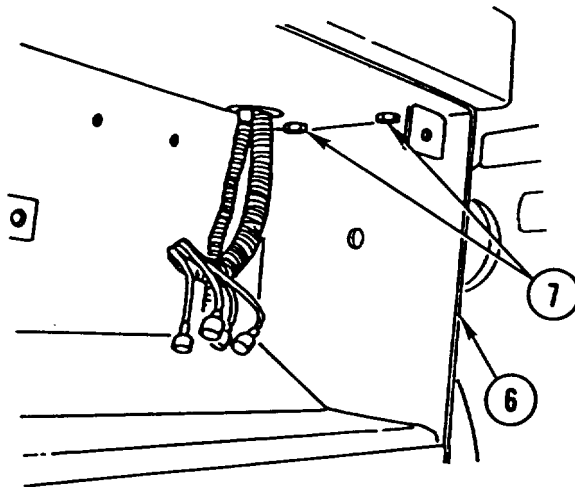


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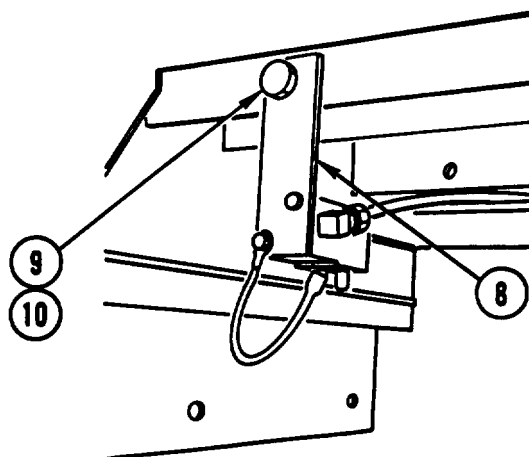
## LEFT PLATFORM REPLACEMENT (CONT)

---

3. INSTALL BOX (6) and four screws (7).



4. INSTALL BRACKET (8), screw (9), and nut (10).

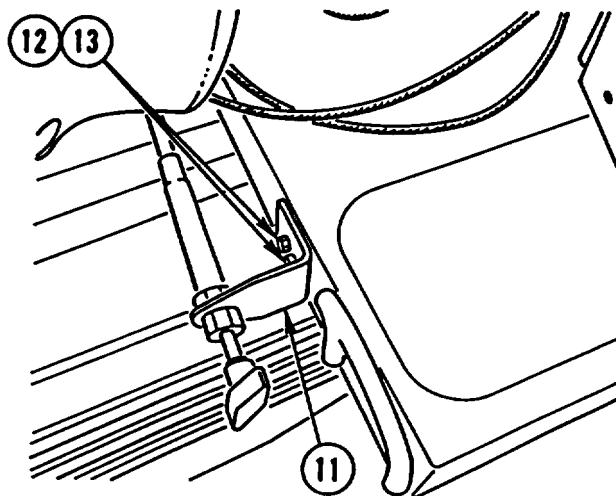


5. INSTALL BRACKET (11), two bolts (12), and two new lock nuts (13).

### NOTE

#### Follow-on Maintenance:

- Install backup alarm (TM 5-2420-224-20).
- Install left rear composite stoplight/taillight (TM 5-2420-224-20).
- Install work light (TM 5-2420-224-20).
- Install hydraulic oil cooler (TM 5-2420-224-20).
- Install hose reel assembly (TM 5-2420-224-20).
- Install front hydraulic tank (TM 5-2420-224-20).
- Install tilt and latch control valve (page 11-5).



---

## RIGHT PLATFORM REPLACEMENT

---

This task covers: a. Removal b. Inspection c. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Nut, Lock (4)  
 Compound, Sealing      Appendix B, Item 15

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

**Condition Description**

TM 5-2420-224-20	Right Rear Composite Stoplight~Taillight Removed
TM 5-2420-224-20	Work Light Removed
TM 5-2420-224-20	Hydraulic Accessory Box Removed
TM 5-2420-224-20	Rear Hydraulic Tank Removed

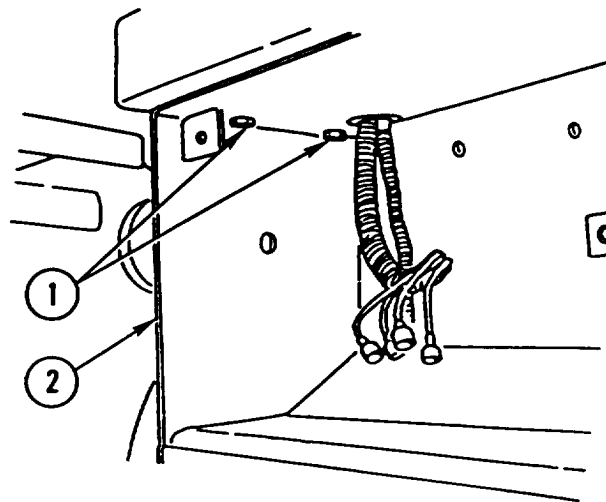
**General Safety Instructions:**

**WARNING**

Right platform weighs 136 pounds (62 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting right platform.

---

### REMOVAL



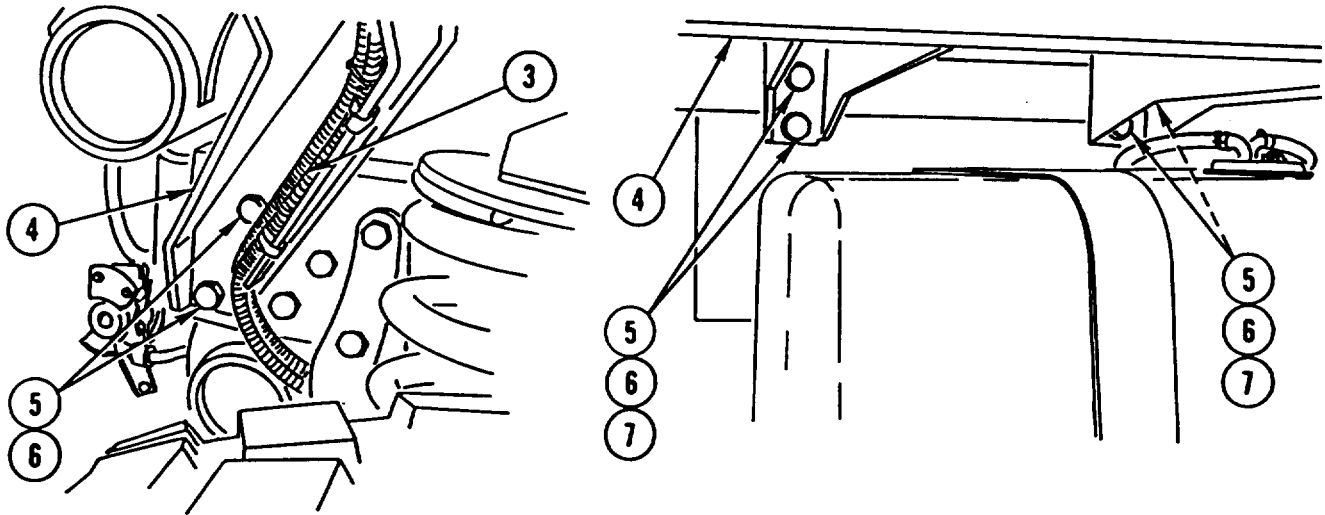
1. REMOVE four screws (1) and BOX (2).



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## RIGHT PLATFORM REPLACEMENT (CONT)

---



2. REMOVE wiring HARNESS (3) from right platform (4).
3. USING suitable HOIST, REMOVE six screws (5), six washers (6), four lock nuts (7), and right PLATFORM (4). DISCARD lock NUTS.

### **INSPECTION**

1. Inspect for corrosion and damage.
2. Check mounting holes to chassis for elongation.
3. Inspect non-slip surfaces for traction.

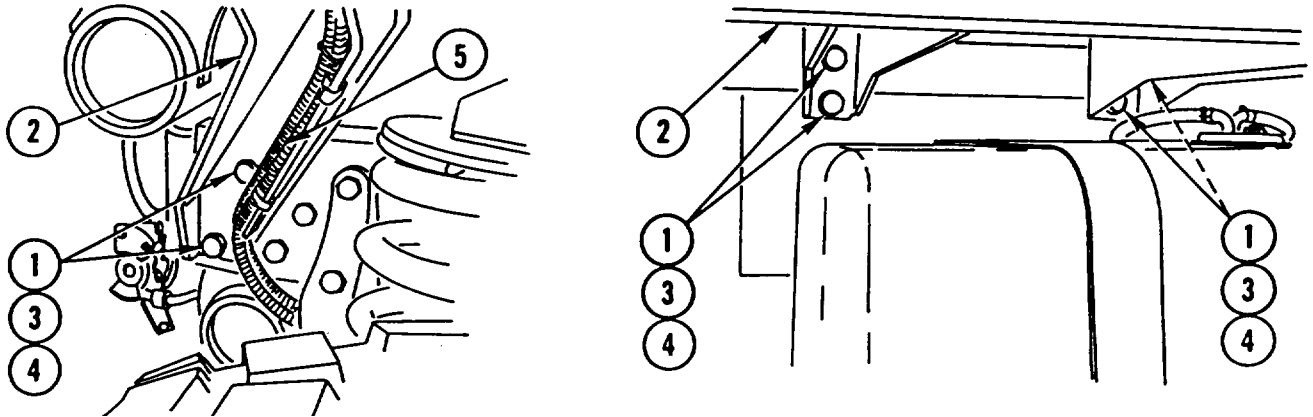
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**RIGHT PLATFORM REPLACEMENT (CONT)**


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**INSTALLATION**

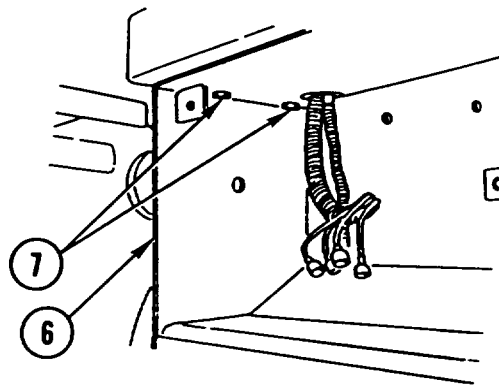

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**W A R N N G**

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 COAT of SEALING COMPOUND to six SCREWS (1). USING suitable HOIST, INSTALL right PLATFORM (2), six screws (1), six washers (3), and four new lock nuts (4). TIGHTEN SCREWS to 220 lb-ft (298 N.m).
2. INSTALL wiring HARNESS (5) in right platform (2).



3. INSTALL BOX (6) and four screws (7).

**NOTE**

Follow-on Maintenance:

Install right rear composite stoplight/taillight (TM 5-2420-224-20).  
 Install work light (TM 5-2420-224-20).  
 Install hydraulic accessory box (TM 5-2420-224-20).  
 Install rear hydraulic tank (TM 5-2420-224-20).



## CHAPTER 9 SPRINGS MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the springs. A list of tasks contained in this chapter is shown below.

	Page
Front Spring Replacement . . . . .	9-1
Rear Spring Replacement . . . . .	9-4

### FRONT SPRING REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Nut , Lock

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Vehicle Blocked

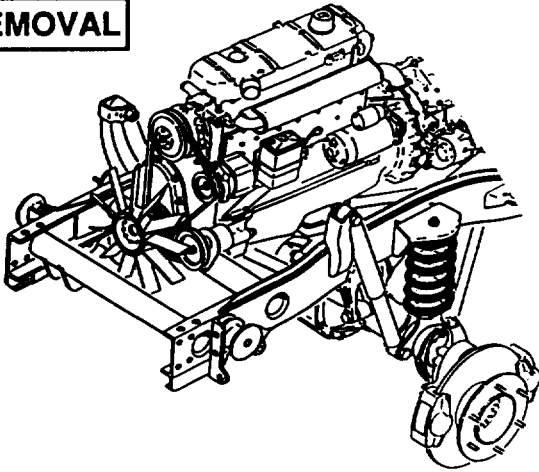
**General Safety Instructions:**

**W A R N I N G**

Make sure both rear wheels are blocked front and rear to prevent roll off. Failure to do so could result in serious personnel injury.

**FRONT SPRING REPLACEMENT (CONT)**

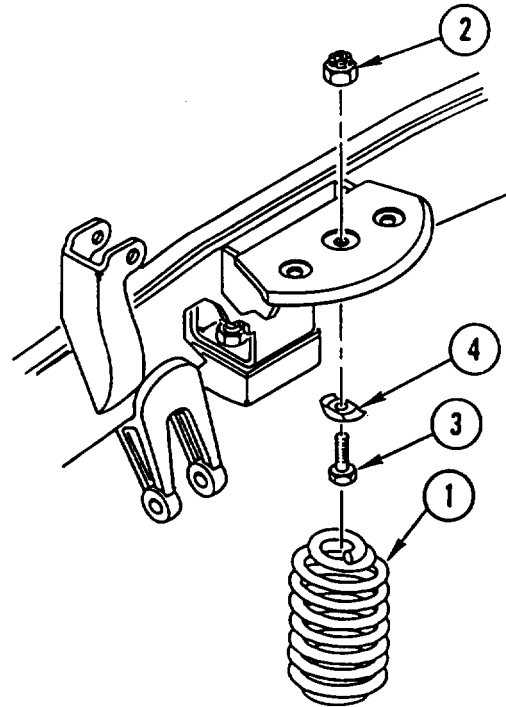
**REMOVAL**



**NOTE**

Procedure is the same for both front springs.

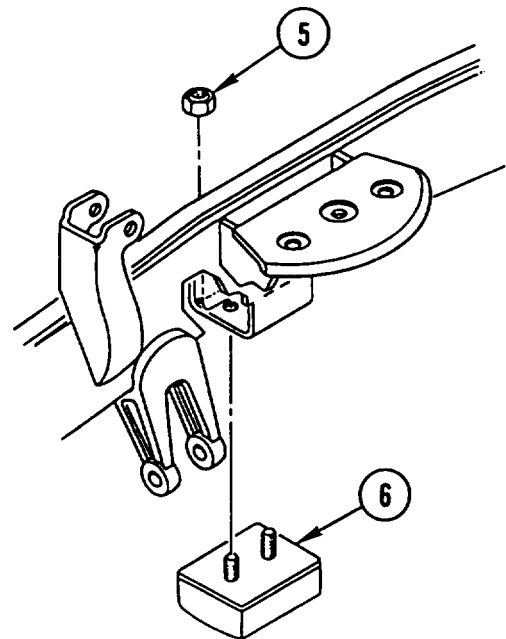
1. USING suitable JACK or suitable LIFTING DEVICE, LIFT VEHICLE enough to take entire load off front spring (1).
2. REMOVE lock nut (2), screw (3), cover (4), and front SPRING (1). DISCARD lock NUT.



REMOVE two nuts (5) and BUMPER (6).

**INSPECTION**

Measure spring length. Allowable spring length is 11.8 in.  $\pm 0.2$  in. (300 mm  $\pm 5$  mm). If spring is not within measurements, replace spring.



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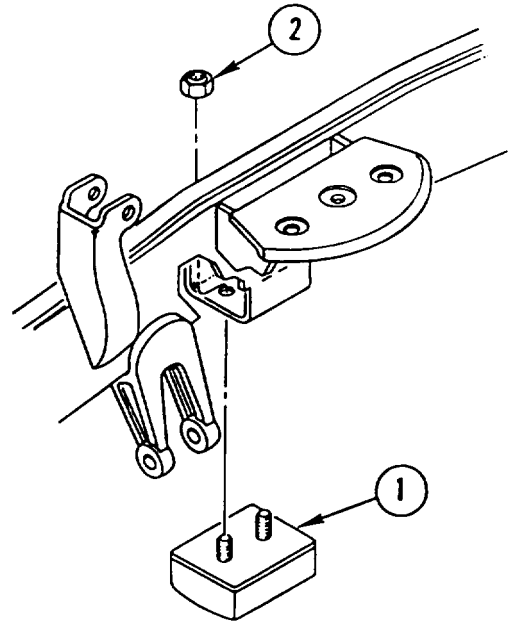
**FRONT SPRING REPLACEMENT (CONT)**

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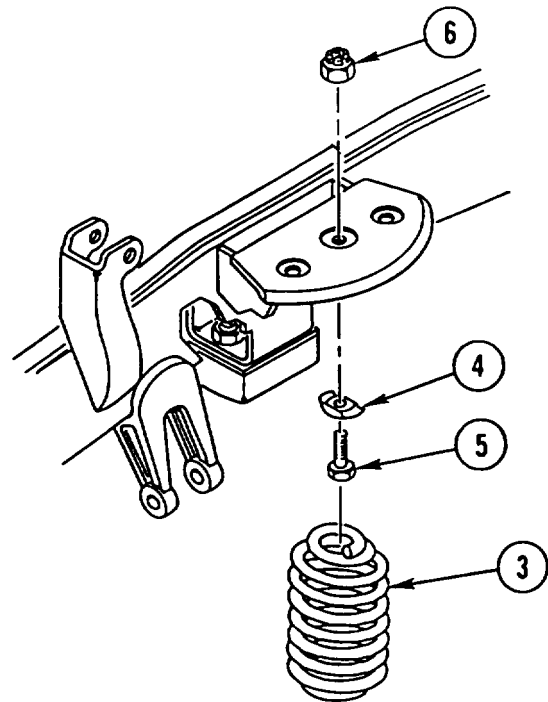
**INSTALLATION****NOTE**

Procedure is the same for both front springs.

1. INSTALL BUMPER (1) and two nuts (2).



2. INSTALL front SPRING (3), cover (4), screw (5), and new lock nut (6). TIGHTEN to 190 lb-ft (140 N.m).
3. LOWER VEHICLE to the ground.



## REAR SPRING REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Nut, Lock

Nut, Lock

#### References:

TM 5-2420-224-20

#### Equipment Condition:

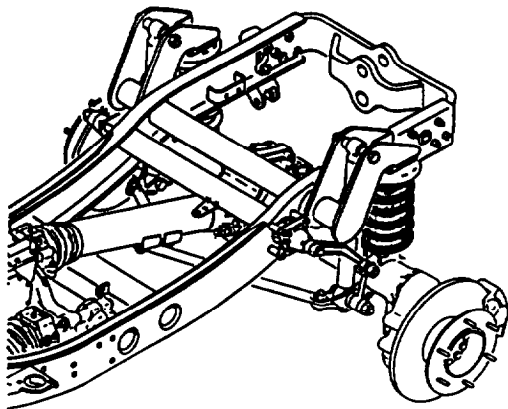
Reference	Condition Description
TM 5-2420-224-20	Vehicle Blocked

#### General Safety Instructions:

#### WARNING

Make sure both front wheels are blocked front and rear to prevent roll off. Failure to do so could result in serious personnel injury.

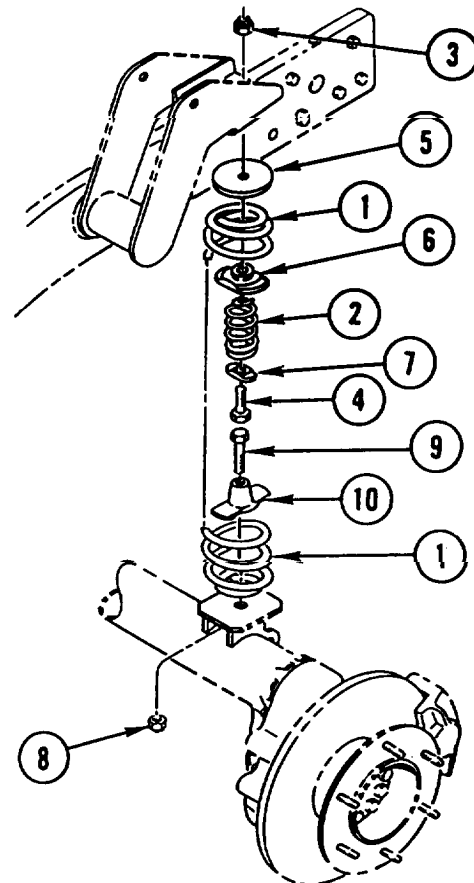
### REMOVAL



#### NOTE

Procedure is the same for both rear springs.

1. USING suitable JACK or suitable LIFTING DEVICE, LIFT VEHICLE enough to take entire load off two springs (1 and 2).

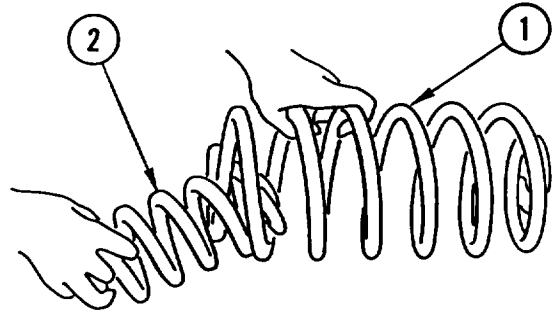


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## REAR SPRING REPLACEMENT (CONT)

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2. REMOVE lock nut (3), screw (4), two PLATES (5 and 6), and PAWL (7). DISCARD lock NUT.
3. REMOVE lock nut (8), screw (9), cover (10), and two SPRINGS (1 and 2). DISCARD lock NUT.
4. REMOVE auxiliary SPRING (2) from outer spring (1).



### INSPECTION

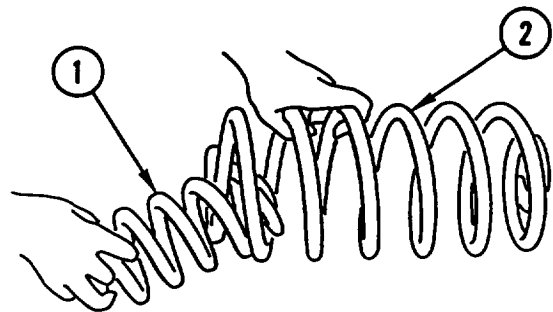
1. Measure outer spring length. Allowable spring length is 14.4 in.  $\pm 0.2$  in. (365 mm  $\pm 5$  mm).
2. Measure auxiliary spring length. Allowable spring length is 8.9 in.  $\pm 0.3$  in. (225 mm  $\pm 8$  mm).
3. If spring(s) are not within measurements, replace spring(s).

### INSTALLATION

#### NOTE

Procedure is the same for both rear springs.

1. INSTALL auxiliary SPRING (1) in outer spring (2).



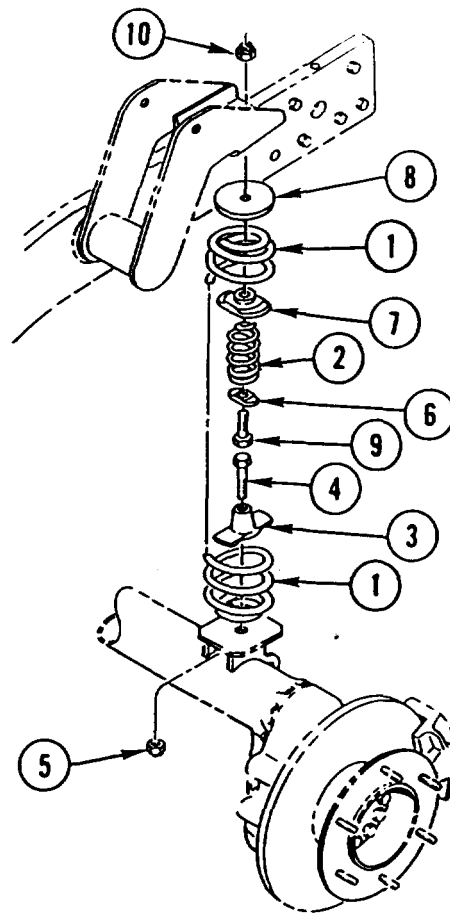


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## REAR SPRING REPLACEMENT (CONT)

---

2. INSTALL two SPRINGS (1 and 2), cover (3), screw (4), and new lock nut (5).
3. INSTALL PAWL (6), two PLATES (7 and 8), screw (9), and new lock nut (10). TIGHTEN to 190 lb-ft (140 N.m).
4. LOWER VEHICLE to the ground.



## CHAPTER 10 BODY AND CAB MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the body and cab. A list of tasks contained in this chapter is shown below.

	Page
Roll-Over Protection (ROPS) Replacement . . . . .	10-1
Cab Replacement . . . . .	10-9
Windshield Replacement . . . . .	10-18
Rear Windows Replacement . . . . .	10-20

---

### ROLL-OVER PROTECTION (ROPS) REPLACEMENT

---

This task covers: a. Removal b. Inspection c. Installation

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Nut, Lock (4)  
Compound, Sealing      Appendix B, Item 15

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe (SEE) or Crane (HMMH) in Three-Point Stance
TM 5-2420-224-20	Cab Tilted
TM 5-2420-224-20	Backhoe Travel Lock (SEE) Removed

**Equipment Condition (Cont):**

Reference	Condition Description
TM 5-2420-224-20	Air Pressure Tanks Removed
TM 5-2420-224-20	Hydraulic Pressure Relieved
Page 11-28	Front Loader Control Valve and Bracket (SEE) or Forklift Control Valve and Bracket (HMMH) Removed
Page 8-9	Left Platform (SEE) Removed
Page 8-13	Right Platform (SEE) Removed

---

## ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)

---

### General Safety Instructions:

**WARNING**

High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

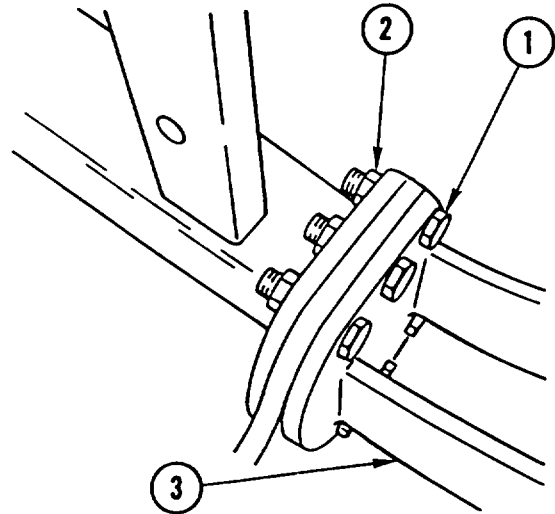
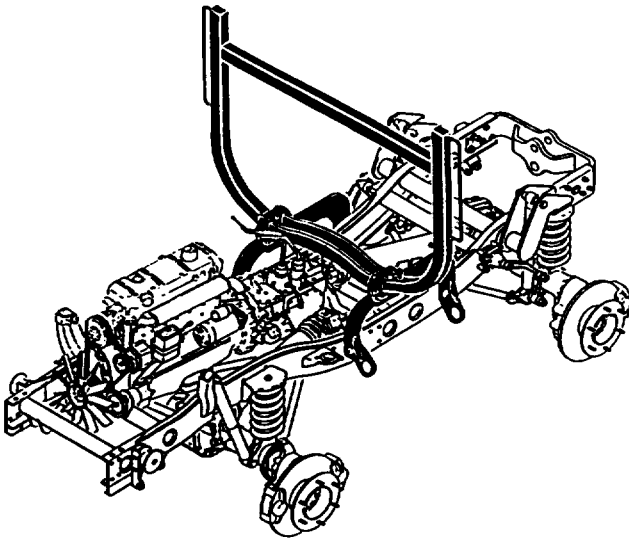
### General Safety Instructions (Cont):

**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.

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## REMOVAL



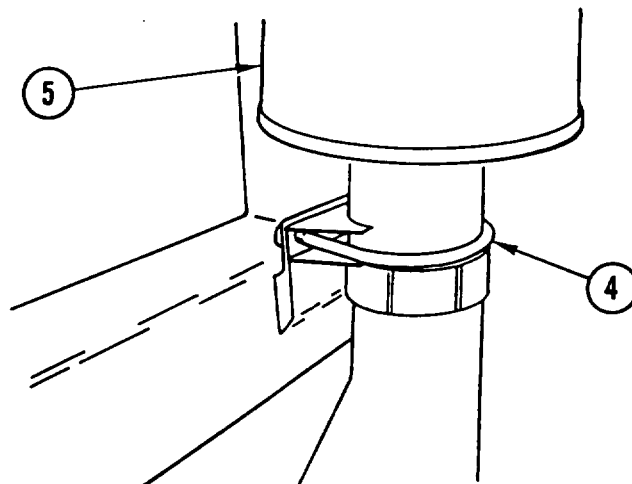
**NOTE**

Procedure is the same for both vehicles.

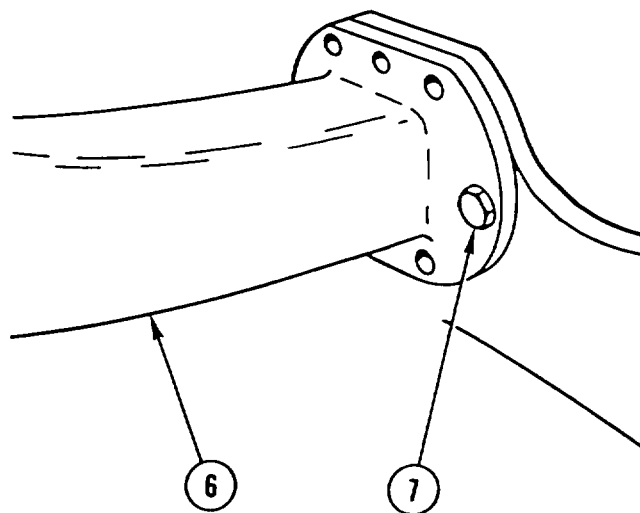
1. REMOVE six BOLTS (1) and six nuts (2).
2. REPEAT STEP 1 for other side and REMOVE BRACKET (3).

**ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)**

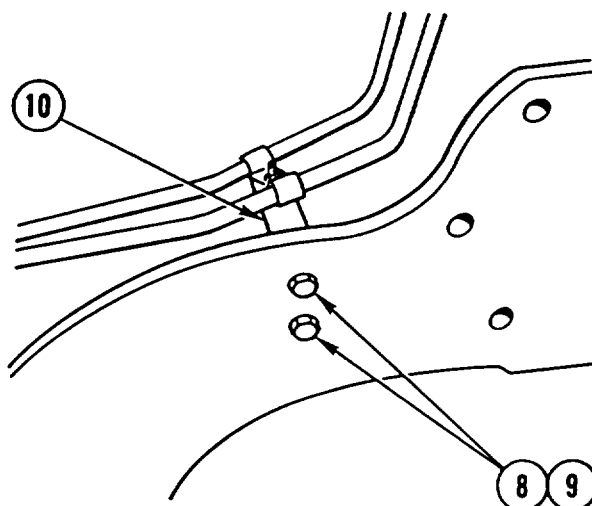
3. REMOVE CLAMP (4) and DISCONNECT MUFFLER (5).



4. SUPPORT frame SECTION and REMOVE four screws (7) and protective BAR (6).



5. REMOVE two BOLTS (8) and two nuts (9) and DISCONNECT BRACKET (10).



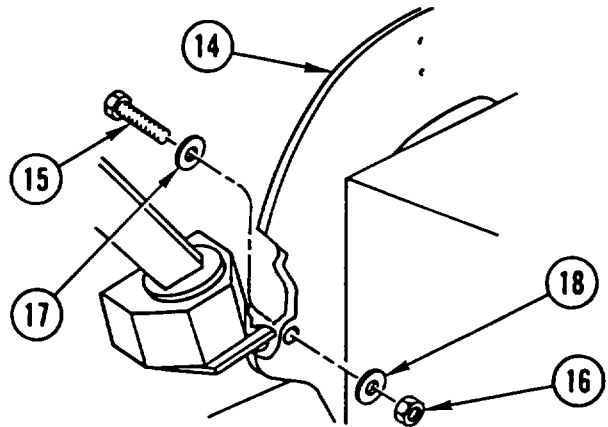
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## ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)

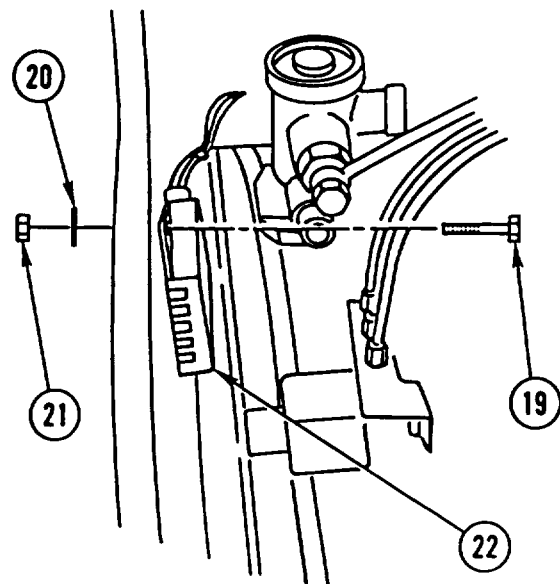
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6. REMOVE screw (11), lock nut (12), and two BUSHINGS (13) from bracket (14). DISCARD lock NUT.

7. SUPPORT BRACKET (14) and REMOVE SCREW (15), lock nut (16), two bushings (17 and 18), and BRACKET (14). DISCARD lock NUT.

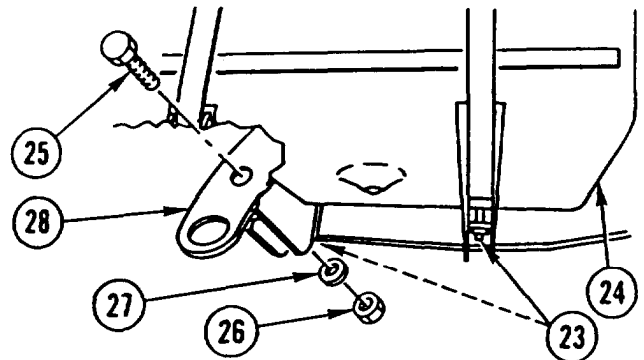


8. REMOVE SCREW (19), washer (20), and nut (21) and DISCONNECT STE/ICE-R RESISTOR (22).

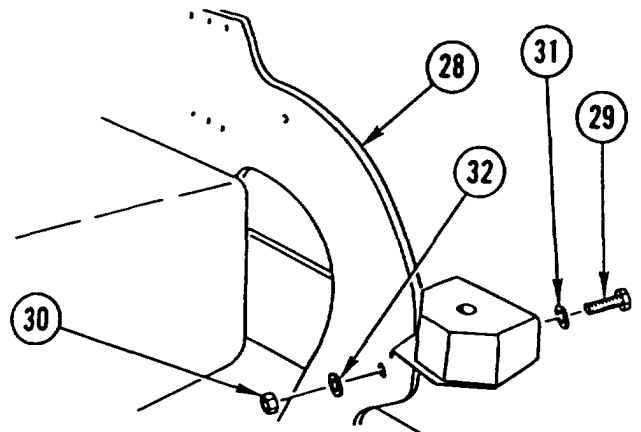


## ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)

9. LOOSEN two NUTS (23) and SLIDE fuel TANK (24) forward enough to clear screw (25).
10. REMOVE screw (25), lock nut (26), and BUSHING (27) from bracket (28). DISCARD lock NUT.



11. SUPPORT BRACKET (28) and REMOVE screw (29), lock nut (30), two bushings (31 and 32), and BRACKET (28). DISCARD lock NUT.



### INSPECTION

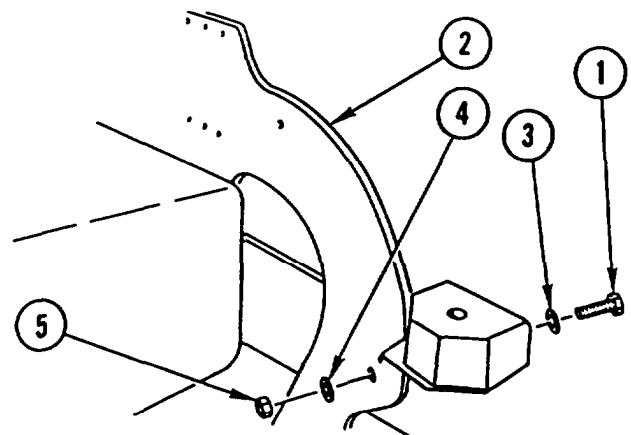
1. Inspect all parts for cracks and corrosion.
2. Inspect hand grips for secure mounting points.
3. Inspect brackets for stripped threads.

### INSTALLATION

#### NOTE

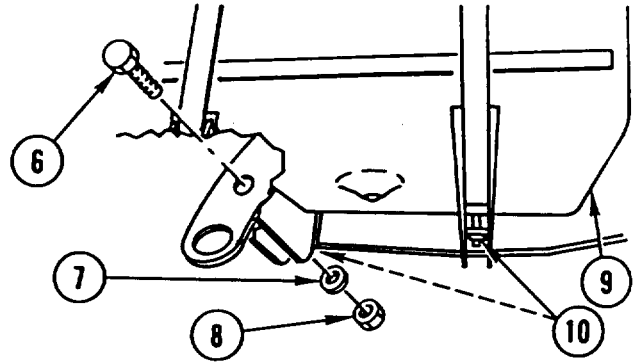
Procedure is the same for both vehicles.

1. APPLY COAT of SEALING COMPOUND to SCREW (1) and INSTALL BRACKET (2), screw (1), two bushings (3 and 4), and new lock nut (5). TIGHTEN lock NUT to 615 lb-ft (834 N.m).

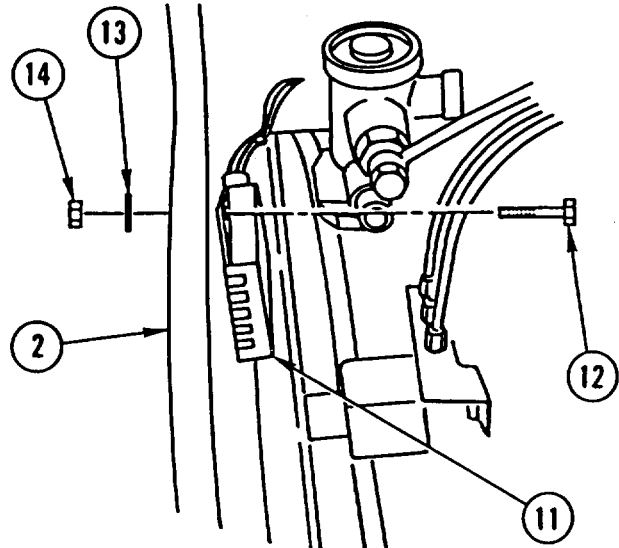


**ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)**

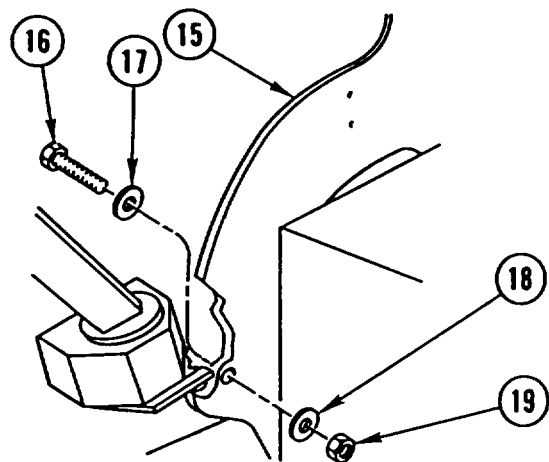
2. APPLY COAT of SEALING COMPOUND to SCREW (6) and INSTALL screw (6), BUSHING (7), and new lock nut (8). TIGHTEN lock NUT to 615 lb-ft (834 N.m).
3. SLIDE fuel TANK (9) back and TIGHTEN two NUTS (10).



4. CONNECT STE/ICE-R RESISTOR (11) and INSTALL SCREW (12), washer (13), and nut (14) on bracket (2).

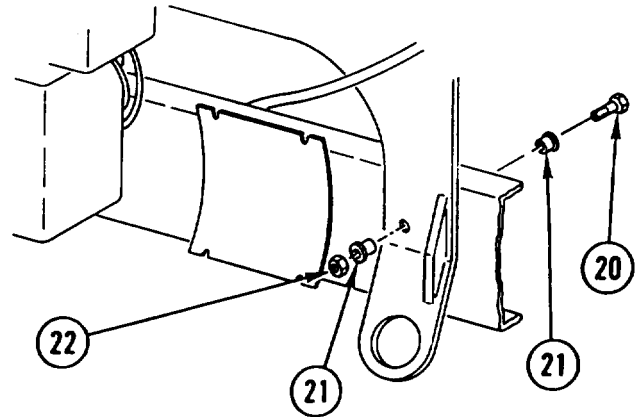


5. INSTALL BRACKET (15), screw (16), two bushings (17 and 18), and new lock nut (19). TIGHTEN lock NUT to 615 lb-ft (834 N.m).

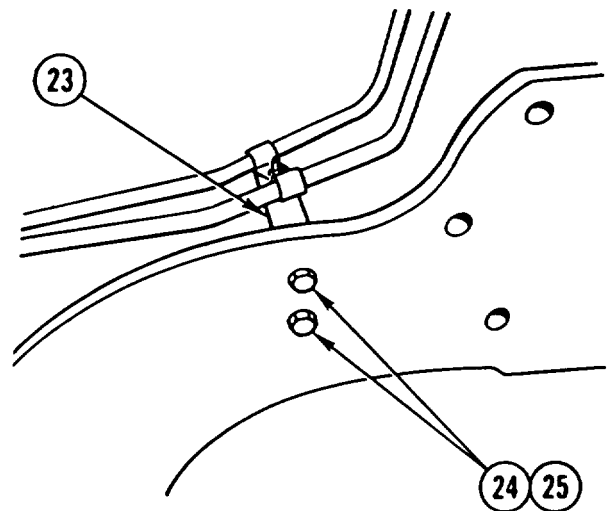


## ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)

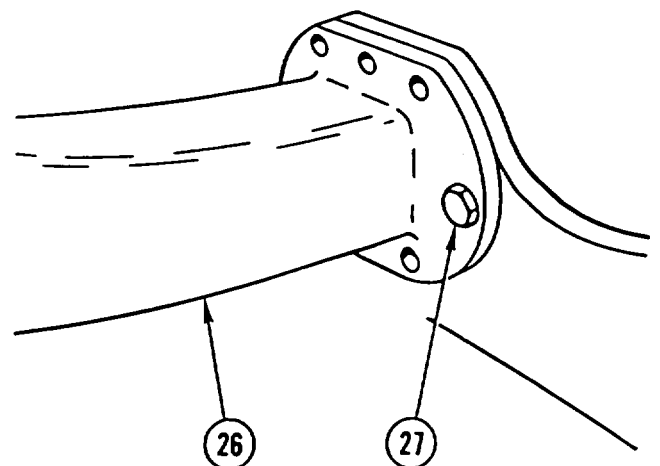
6. INSTALL screw (20), two BUSHINGS (21), and new lock nut (22).



7. CONNECT BRACKET (23) and INSTALL two BOLTS (24) and two nuts (25).



8. INSTALL protective BAR (26) and two screws (27) on each side of frame section.



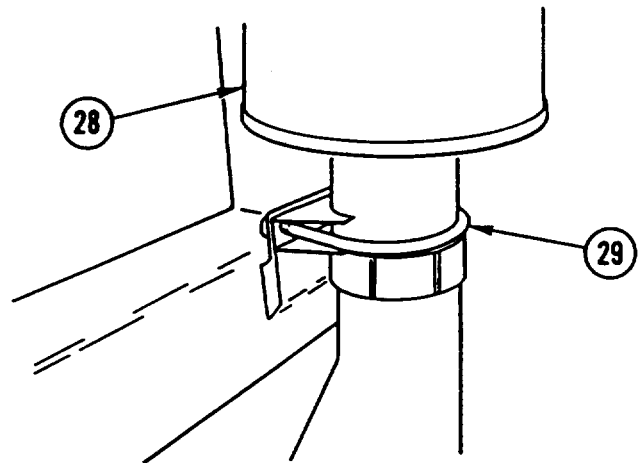


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## ROLL-OVER PROTECTION (ROPS) REPLACEMENT (CONT)

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9. CONNECT MUFFLER (28) and INSTALL CLAMP (29).

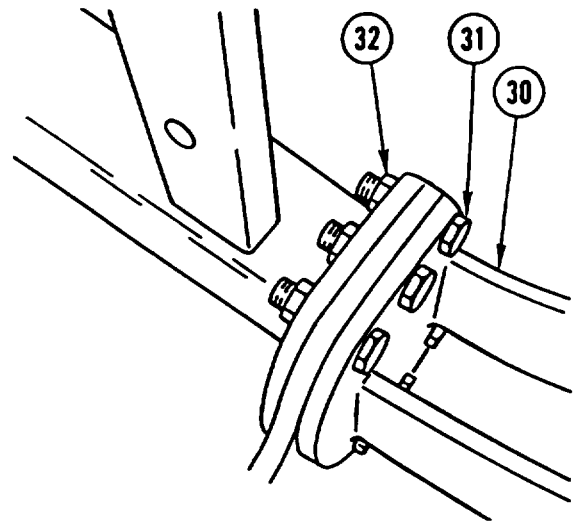


10. INSTALL BRACKET (30), six bolts (31), and six nuts (32). TIGHTEN BOLTS to 179 lb-ft (244 N.m).
11. SUPPORT BRACKET (30) and INSTALL six BOLTS (31) and six nuts (32) on other side. TIGHTEN BOLTS to 179 lb-ft (244 N.m).

### NOTE

#### Follow-on Maintenance:

- Lower cab (TM 5-2420-224-20).
- Install left platform (SEE) (page 8-9).
- Install right platform (SEE) (page 8-13).
- Install front loader control valve and bracket (SEE) or forklift control valve and bracket (HMMH) (page 11-28).
- Install backhoe travel lock (SEE) (TM 5-2420-224-20).
- Install air pressure tanks (TM 5-2420-224-20).



---

## CAB REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Personnel Required:** (4)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

**Condition Description**

TM 5-2420-224-20 Front Loader (SEE) or Forklift (HMMH) Removed

TM 5-2420-224-20 Fuse Holders Removed

TM 5-2420-224-20 Air Cleaner Removed

TM 5-2420-224-20 Air Cleaner Ducts Removed

TM 5-2420-224-20 Vertical Air Intake Pipe Removed

TM 5-2420-224-20 Master Light Switch Removed

TM 5-2420-224-20 Relays Removed

TM 5-2420-224-20 Headlights Removed

TM 5-2420-224-20 Auxiliary Headlights Removed

TM 5-2420-224-20 Horn Removed

TM 5-2420-224-20 Air Brake Booster Removed

TM 5-2420-224-20 Trailer Service Air Supply Lines and Fittings Removed

TM 5-2420-224-20 Trailer Emergency Air Supply Lines and Fittings Removed

TM 5-2420-224-20 Air Pressure and Accessory Air Supply Lines and Finings Removed

**Equipment Condition (Cont):**

**Reference**

**Condition Description**

TM 5-2420-224-20 Brake Booster and Air Pressure Lines and Fittings Removed

TM 5-2420-224-20 Protection/Relay Valve Lines and Fittings Removed

TM 5-2420-224-20 Tandem Valve Removed

TM 5-2420-224-20 Trailer Hand Brake Air Supply Lines and Fittings Removed

TM 5-2420-224-20 Spare Tire and Mount Removed

TM 5-2420-224-20 Canopy (FOPS) Removed

TM 5-2420-224-20 Front Fenders and Splash Guards Removed

TM 5-2420-224-20 Cab Doors Removed

TM 5-2420-224-20 Exterior Rear View Mirrors Removed

TM 5-2420-224-20 Windshield Wiper/Washer Motor Removed

TM 5-2420-224-20 Windshield Wiper/Washer Motor Linkage Removed

TM 5-2420-224-20 Defroster and Air Tubes Removed

TM 5-2420-224-20 Clutch Pedal Removed

TM 5-2420-224-20 Brake Pedal Removed

TM 5-2420-224-20 Hand Throttle Removed

TM 5-2420-224-20 Turn Signal Lever Removed

TM 5-2420-224-20 Press-to-Test Switch Removed

TM 5-2420-224-20 Indicator (Gage) Removed

TM 5-2420-224-20 Tachometer Removed

TM 5-2420-224-20 Ignition Switch Removed

---

**CAB REPLACEMENT (CONT)**

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**Equipment Condition (Cont):**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Windshield Wiper/Washer Switch Removed
TM 5-2420-224-20	Starter Switch Removed
TM 5-2420-224-20	Hazard Warning Switch Removed
TM 5-2420-224-20	Ammeter Removed
TM 5-2420-224-20	Cold Start Switch Removed
TM 5-2420-224-20	Horn, Low Beam/High Beam Switch Removed
TM 5-2420-224-20	Instrument Cluster Panel Light Removed
TM 5-2420-224-20	Windshield Heater Control Switch Removed
TM 5-2420-224-20	Dome Light Removed
TM 5-2420-224-20	Parking Brake Controls Removed
TM 5-2420-224-20	Trailer Hand Brake Valve Removed
TM 5-2420-224-20	Trailer Hand Brake Valve Lines and Fittings Removed
TM 5-2420-224-20	Cab Drain Plug Removed
TM 5-2420-224-20	Steering Upper Shaft Bearing Removed
TM 5-2420-224-20	Operator Seat and Framework Removed
TM 5-2420-224-20	Passenger Seat and Framework Removed
TM 5-2420-224-20	Seat Belts Removed
TM 5-2420-224-20	Sun Visors, Clothes Hooks, and Grip Handles Removed
TM 5-2420-224-20	Roof Liner Removed
TM 5-2420-224-20	Interior Rear View Mirror Removed
TM 5-2420-224-20	Cab Heater Removed

**Equipment condition (Cont):**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Speedometer Removed
TM 5-2420-224-20	Inclinometer (SEE) Removed
TM 5-2420-224-20	Cab Shock Absorbers and Mountings Removed
TM 5-2420-224-20	Clutch Hydraulic Reservoir Lines and Fittings Removed
TM 5-2420-224-20	Clutch Master Cylinder Removed
TM 5-2420-224-20	Cold Start Aid Removed
TM 5-2420-224-20	Accelerator Pedal and Linkage Removed
TM 5-2420-224-20	Windshield Wiper/Washer Switch Relay Removed
TM 5-2420-224-20	Warning Delay Relay Removed
TM 5-2420-224-20	Hydraulic Suspension Lockout Controls (HMMH) Removed
TM 5-2420-224-20	Auxiliary Light Control Switch Removed
TM 5-2420-224-20	Brake Light Diode Removed
TM 5-2420-224-20	Front Blackout Light Removed
TM 5-2420-224-20	Front Composite Lights Removed
TM 5-2420-224-20	Turn Signal Flasher Relay Removed
TM 5-2420-224-20	Engine Start Switch Removed
TM 5-2420-224-20	Brake Light Switch Removed
TM 5-2420-224-20	Protection/Relay Valve Removed
TM 5-2420-224-20	Brake Master Cylinder Hydraulic Lines and Fittings Removed

**CAB REPLACEMENT (CONT)**

**Equipment Condition (Cont):**

Reference	Condition Description
TM 5-2420-224-20	Steering Wheel Bracket and Seal Removed
TM 5-2420-224-20	Cab Door Seals Removed
TM 5-2420-224-20	Cab Floor Linings Removed
TM 5-2420-224-20	Windshield Wipers Removed
TM 5-2420-224-20	Windshield Washer Reservoir Removed
TM 5-2420-224-20	Windshield Washer Pump Removed
TM 5-2420-224-20	Heater Hoses and Clamps Removed
TM 5-2420-224-20	Data Plates Removed
TM 5-2420-224-20	Front Loader (SEE) or Forklift (HMMH) Control Valve Controls Removed
TM 5-2420-224-20	Speedometer Drive Shaft Removed
Page 11-28	Front Loader (SEE) or Forklift (HMMH) Control Valve and Bracket Removed
Page 4-28	Alternator Cable Assembly Removed
Page 4-34	Dome Light Cable Assembly Removed
Page 4-36	Hazard Warning Light Wiring Harness Removed
Page 4-42	Forklift Wiring Harness (HMMH) Removed
Page 4-48	Forklift Connector to Fuse Holder Wiring Harness (HMMH) Removed
Page 4-52	Cab Floor Separation Point to Rear Wall Wiring Harness (HMMH) Removed

**Equipment Condition (Cont):**

Reference	Condition Description
Page 4-54	Fuse Holder to Hydraulic Suspension Lockout/Rear Wall Wiring Harness (HMMH) Removed
Page 4-58	Frame Wiring Harness Removed
Page 4-66	Suppressor Filter Electrical Lead Removed
Page 4-68	Cap Plug Connector to Heater Panel Switch and Master Light Switch Wiring Harness Removed
Page 4-70	Chassis Wiring Harness Removed
Page 4-38	Auxiliary Headlight, Front Composite Light, and Blackout Driving Light Wiring Harness Removed
Page 4-10	Main Wiring Harness Removed
Page 10-18	Windshield Removed
Page 10-20	Rear Windows Removed

**General Safety Instructions:**

**WARNING**

- SEE/HMMH should not be operated with front loader (SEE) or forklift (HMMH) removed, except in a maintenance facility. When maintenance is required and front loader or forklift is removed, never operate SEE/HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with either front loader or forklift removed. This could cause loss of control and injury to personnel or damage to vehicle.

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**CAB REPLACEMENT (CONT)**

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**General Safety Instructions (Cont):**

**WARNING**

- Cab weighs 618 pounds (281 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting cab.

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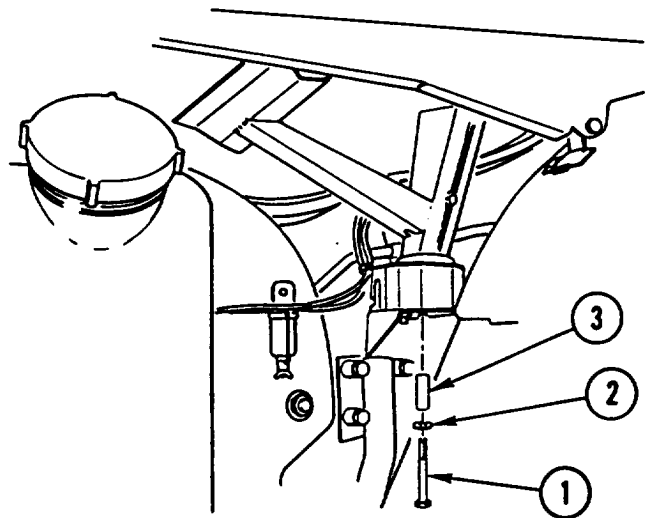
**REMOVAL**

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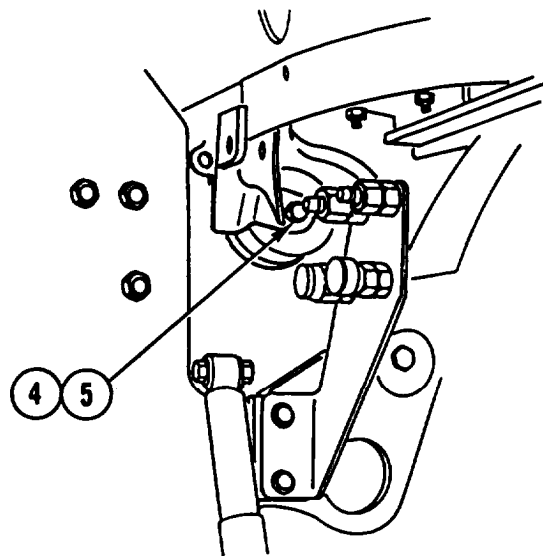
**NOTE**

Procedure is the same for both vehicles.

1. REMOVE cab mounting screw (1), washer (2), and SPACER (3) from each side of vehicle.



2. REMOVE SCREW (4) and washer (5) from front left side.



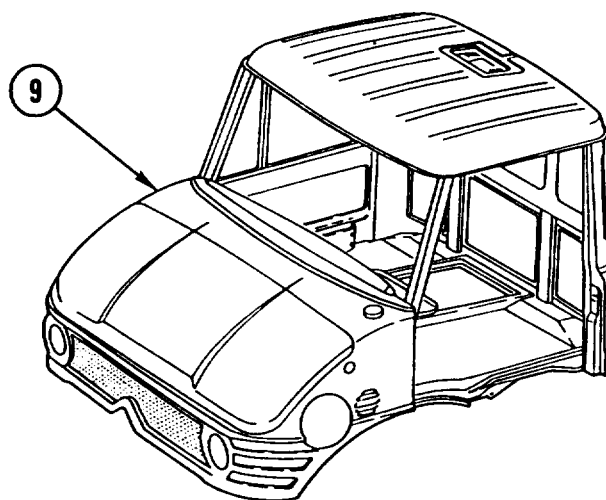
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**CAB REPLACEMENT (CONT)**

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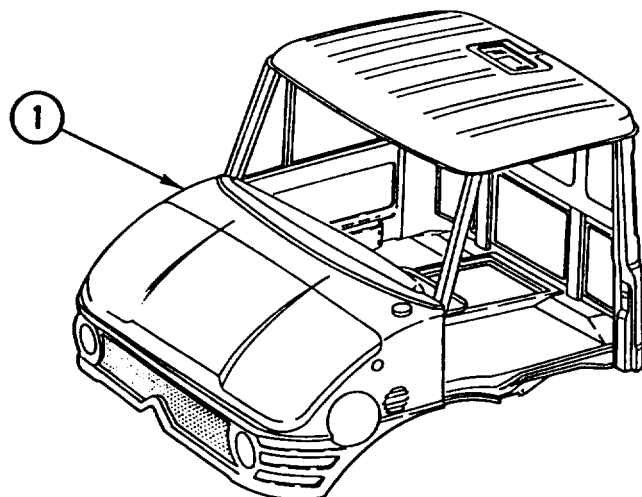
3. REMOVE screw (6), washer (7), and BODY assembly (8) from front right side.

4. REMOVE CAB (9) from vehicle.

**INSTALLATION****NOTE**

Procedure is the same for both vehicles,

1. INSTALL CAB (1) on vehicle.

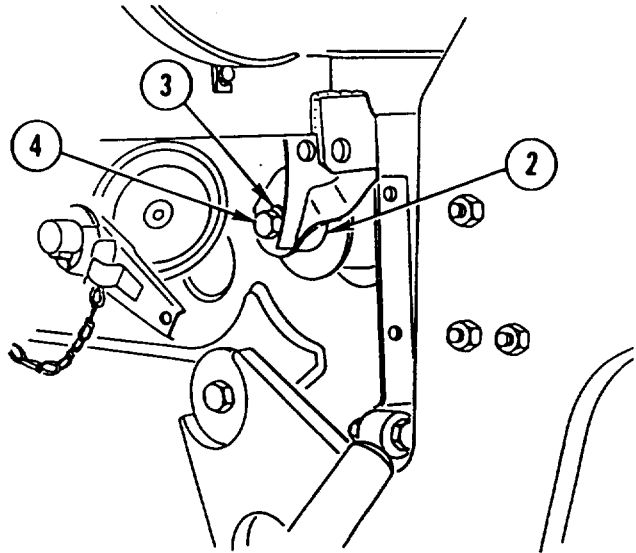


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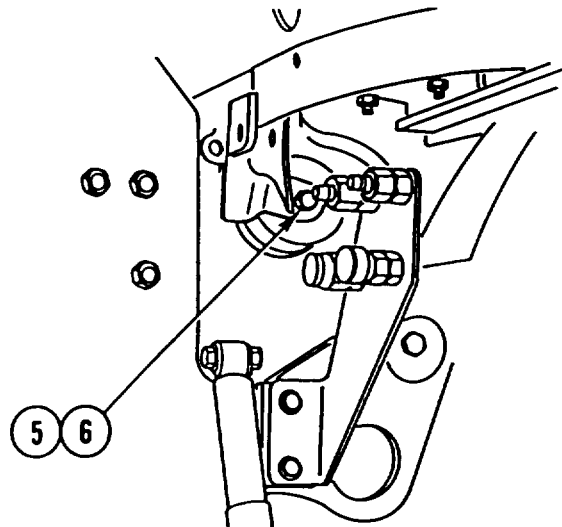
**CAB REPLACEMENT (CONT)**

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2. INSTALL BODY assembly (2), washer (3), and screw (4) on front right side.



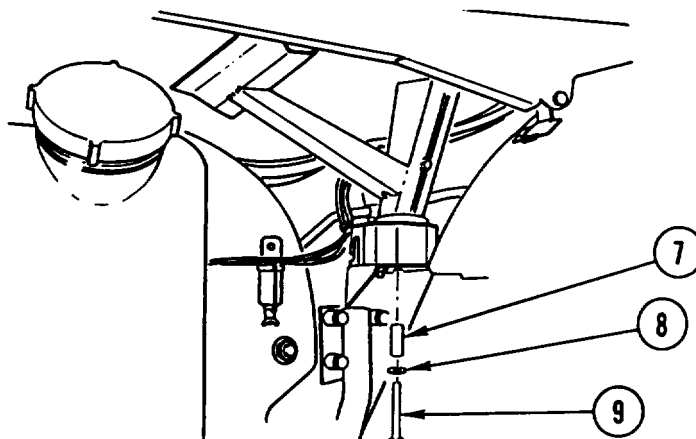
3. INSTALL washer (5) and SCREW (6) on front left side.



---

**CAB REPLACEMENT (CONT)**


---



4. INSTALL SPACER (7), washer (8), and cab mounting screw (9) on each side of vehicle.

**NOTE**

Install rear windows (page 10-20)  
 Install windshield (page 10-18).  
 Install main wiring harness (page 4-10).

Install auxiliary headlight, front composite light, and blackout driving light wiring harness (page 4-38).

Install chassis wiring harness (page 4-70).

Install cap plug connector to heater panel switch and master light switch wiring harness (page 4-68).

Install suppressor filter electrical lead (page 4-66).

Install frame wiring harness (page 4-58).

Install fuse holder to hydraulic suspension lockout/rear wall wiring harness (HMMH) (page 4-54).

Install cab floor separation point to rear wall wiring harness (HMMH) (page 4-52).

Install forklift connector to fuse holder wiring harness (HMMH) (page 4-48).

Install forklift wiring harness (HMMH) (page 4-42).

Install hazard warning light wiring harness (page 4-36).

Install dome light cable assembly (page 4-34).

Install alternator cable assembly (page 4-28).

**Follow-on Maintenance (Cont):**

Install front loader (SEE) or forklift (HMMH) control valve and bracket (page 11-28).

Install Speedometer drive shaft (TM 5-2420-224-20).

Install front loader (SEE) or forklift (HMMH) control valve controls (TM 5-2420-224-20).

Install data plates (TM 5-2420-224-20).

Install heater hoses and clamps (TM 5-2420-224-20).

Install windshield washer pump (TM 5-2420-224-20).

Install windshield washer reservoir (TM 5-2420-224-20).

Install windshield wipers (TM 5-2420-224-20).

Install cab floor linings (TM 5-2420-224-20).

Install cab door seals (TM 5-2420-224-20).

Install steering wheel bracket and seal (TM 5-2420-224-20).

Install brake master cylinder hydraulic lines and fittings (TM 5-2420-224-20).

Install protection/relay valve (TM 5-2420-224-20).

Install brake light switch (TM 5-2420-224-20).

Install engine start switch (TM 5-2420-224-20).

Install turn signal flasher relay (TM 5-2420-224-20).



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**CAB REPLACEMENT (CONT)**

---

Follow-on Maintenance (Cont):

Install front composite lights (TM 5-2420-224-20).  
 Install front blackout light (TM 5-2420-224-20).  
 Install brake light diode (TM 5-2420-224-20).  
 Install auxiliary light control switch (TM 5-2420-224-20).  
 Install hydraulic suspension lockout controls (HMMH) (TM 5-2420-224-20).  
 Install warning delay relay (TM 5-2420-224-20).  
 Install windshield wiper/washer switch relay (TM 5-2420-224-20).  
 Install accelerator pedal and linkage (TM 5-2420-224-20).  
 Install cold start aid (TM 5-2420-224-20).  
 Install clutch master cylinder (TM 5-2420-224-20).  
 Install clutch hydraulic reservoir lines and fittings (TM 5-2420-224-20).  
 Install cab shock absorbers and mountings (TM 5-2420-224-20).  
 Install inclinometer (SEE) (TM 5-2420-224-20).  
 Install speedometer (TM 5-2420-224-20).  
 Install cab heater (TM 5-2420-224-20).  
 Install interior rear view mirror (TM 5-2420-224-20).  
 Install roof liner (TM 5-2420-224-20).  
 Install sun visors, clothes hooks, and grip handles (TM 5-2420-224-20).  
 Install seat belts (TM 5-2420-224-20).  
 Install passenger seat and framework (TM 5-2420-224-20).  
 Install steering upper shaft bearing (TM 5-2420-224-20).  
 Install cab drain plug (TM 5-2420-224-20).  
 Install trailer hand brake valve lines and fittings (TM 5-2420-224-20).  
 Install trailer hand brake valve (TM 5-2420-224-20).

Follow-on Maintenance (Cont):

Install parking brake controls (TM 5-2420-224-20).  
 Install dome light (TM 5-2420-224-20).  
 Install windshield heater control switch (TM 5-2420-224-20).  
 Install instrument cluster panel light (TM 5-2420-224-20).  
 Install horn, low beam/high beam switch (TM 5-2420-224-20).  
 Install cold start switch (TM 5-2420-224-20).  
 Install ammeter (TM 5-2420-224-20).  
 Install hazard warning switch (TM 5-2420-224-20).  
 Install starter switch (TM 5-2420-224-20).  
 Install windshield wiper/washer switch (TM 5-2420-224-20).  
 Install ignition switch (TM 5-2420-224-20).  
 Install tachometer (TM 5-2420-224-20).  
 Install indicator (gage) (TM 5-2420-224-20).  
 Install press-to-test switch (TM 5-2420-224-20).  
 Install turn signal lever (TM 5-2420-224-20).  
 Install hand throttle (TM 5-2420-224-20).  
 Install brake pedal (TM 5-2420-224-20).  
 Install clutch pedal (TM 5-2420-224-20).  
 Install defroster and air tubes (TM 5-2420-224-20).  
 Install windshield wiper/washer motor linkage (TM 5-2420-224-20).  
 Install windshield wiper/washer motor (TM 5-2420-224-20).  
 Install exterior rear view mirrors (TM 5-2420-224-20).  
 Install cab doors (TM 5-2420-224-20).  
 Install front fenders and splash guards (TM 5-2420-224-20).  
 Install canopy (FOPS) (TM 5-2420-224-20),  
 Install spare tire and mount (TM 5-2420-224-20).

---

**CAB REPLACEMENT (CONT)**

---

## Follow-on Maintenance (Cont):

Install trailer hand brake air supply lines and fittings (TM 5-2420-224-20).

Install tandem valve (TM 5-2420-224-20).

Install protection/relay valve lines and fittings (TM 5-2420-224-20).

Install brake booster and air pressure lines and fittings (TM 5-2420-224-20).

Install air pressure and accessory air supply lines and fittings (TM 5-2420-224-20).

Install trailer emergency air supply lines and fittings (TM 5-2420-224-20).

Install trailer service air supply lines and fittings (TM 5-2420-224-20).

Install air brake booster (TM 5-2420-224-20).

Install horn (TM 5-2420-224-20).

Install auxiliary headlights (TM 5-2420-224-20).

Install headlights (TM 5-2420-224-20).

Install relays (TM 5-2420-224-20).

Install master light switch (TM 5-2420-224-20).

Install vertical air intake pipe (TM 5-2420-224-20).

install air cleaner ducts (TM 5-2420-224-20).

Install air cleaner (TM 5-2420-224-20).

Install fuse holders (TM 5-2420-224-20).

Install front loader (SEE) or forklift (HMMH) (TM 5-2420-224-20).

---

## WINDSHIELD REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Seal, Windshield

Chips, Soap                      Appendix B, Item 9

Twine, Cotton,                  Appendix B, Item 49  
1/8-in.-Diameter

Personnel Required: (2)

**General Safety Instructions:**

**WARNING**

- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.
- Edges of glass may be sharp. To avoid personal injury, wear protective gloves when handling glass.

---

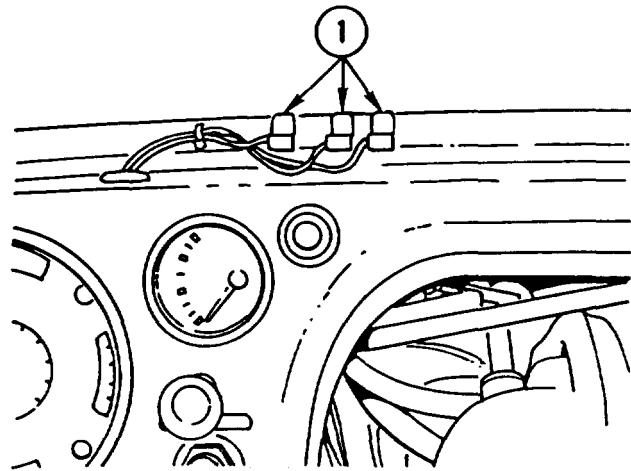
### REMOVAL

---

**NOTE**

Tag electrical connectors prior to disconnecting to aid in connecting.

1. DISCONNECT three electrical CONNECTORS (I).



---

**WINDSHIELD REPLACEMENT (CONT)**


---

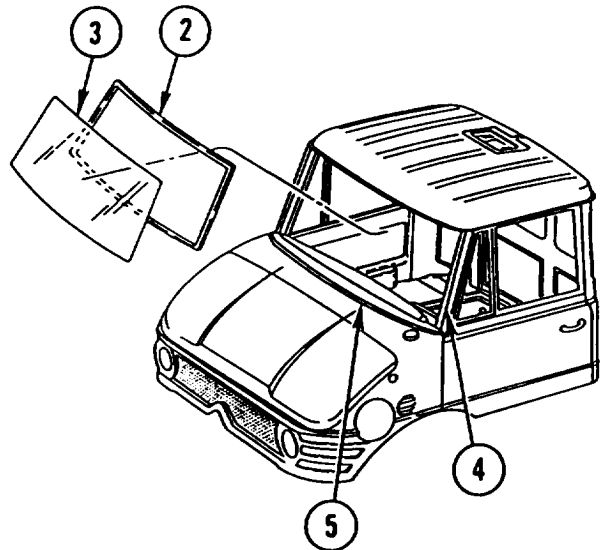
2. LIFT CORNER of windshield SEAL (2) and PUSH WINDOW (3) out. DISCARD windshield SEAL.

---

**INSTALLATION**


---

1. COAT EDGE of WINDOW (3) with SOAP and WATER solution.
2. INSTALL new windshield SEAL (2) around window (1).
3. COAT GROOVE on outside of SEAL (2) with SOAP and WATER solution.
4. INSTALL 1/8-in. cotton TWINE in groove on outside of seal (2).
5. APPLY SOAP and WATER solution around FLANGE (4) in window opening (5).
6. INSTALL WINDOW (3) starting with bottom edge, and work all the way around window (3) by PULLING cotton TWINE from groove.
7. TAP WINDOW (3) all the way around to make sure window (3) is seated in window opening (5).
8. CONNECT three electrical CONNECTORS (1).



---

## REAR WINDOWS REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

---

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Seal, Window

Chips, soap Appendix B, item 9

Twine, Cotton, 1/8-in.-Diameter Appendix B, Item 49

Personnel Required: (2)

#### Equipment Condition:

##### Reference

Page 10-1

##### Condition Description

Roll-Over Protection (ROPS) Removed

#### General Safety instructions:

### WARNING

Edges of glass may be sharp. To avoid personal injury, wear protective gloves when handling glass.

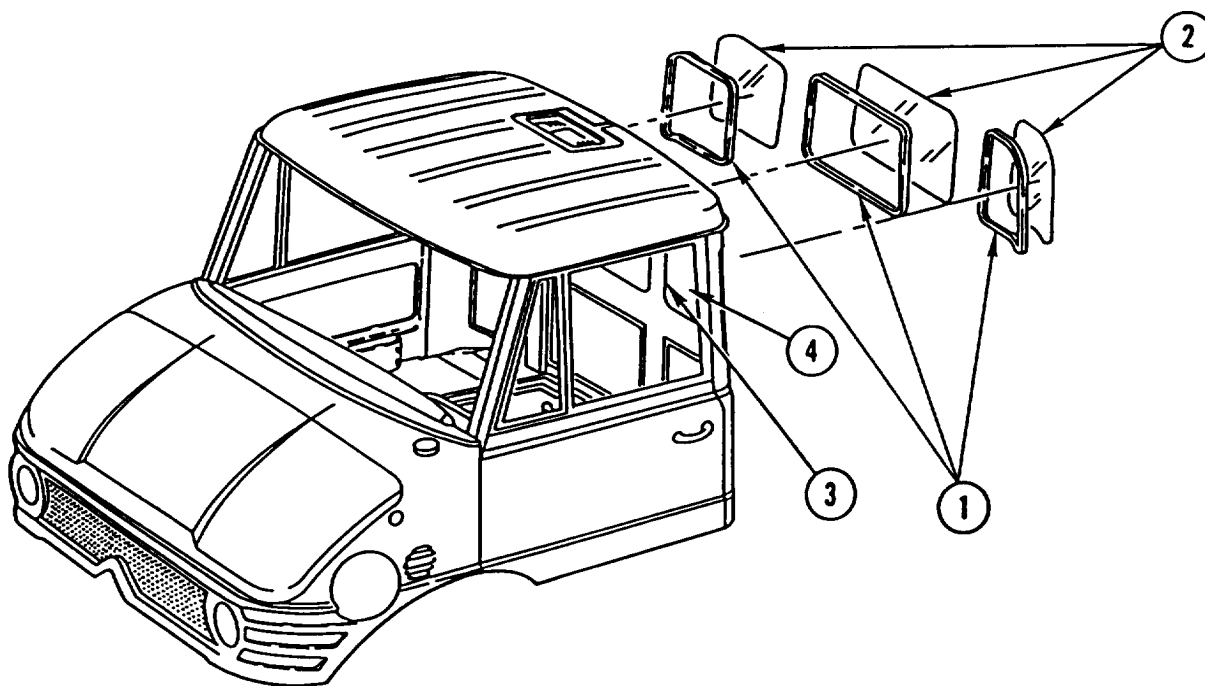
---

## REMOVAL

### NOTE

Procedure is the same for all rear windows.

LIFT corner of window SEAL (1) and PUSH WINDOW (2) out. DISCARD window SEAL.



---

**REAR WINDOWS REPLACEMENT (CONT)**

---

**INSTALLATION****NOTE**

Procedure is the same for all rear windows.

1. COAT EDGE of WINDOW (2) with SOAP and WATER solution.
2. INSTALL new window SEAL (1) around window (2).
3. COAT GROOVE on outside of SEAL (1) with SOAP and WATER solution.
4. INSTALL 1/8-in. cotton TWINE in groove on outside of seal (1).
5. APPLY SOAP and WATER solution around FLANGE (3) in window opening (4).
6. INSTALL WINDOW (2) starting with bottom edge, and work all the way around window (2) by PULLING cotton TWINE from groove.
7. TAP WINDOW (2) all the way around to make sure window (2) is seated in window opening (4).

**NOTE**

Follow-on Maintenance:

Install Roll-Over Protection (ROPS) (page 10-1).



**CHAPTER 11  
HYDRAULIC SYSTEM MAINTENANCE**

**OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the hydraulic system. A list of tasks contained in this chapter is shown below.

	Page
Hydraulic Oil Cooler Fan Replacement . . . . .	11-2
Tilt And Latch Control Valve Replacement and Adjustment . . . . .	11-5
Backhoe Swing Cylinder Relief Valve Replacement . . . . .	11-10
Backhoe Stabilizer Control Valve Replacement . . . . .	11-12
Backhoe Control Valve Replacement . . . . .	11-15
Crane Flow Regulating Valve Replacement . . . . .	11-22
Crane Valve Bank Replacement . . . . .	11-24
Crane Valve Bank Relief Valve Replacement . . . . .	11-26
Front Loader/Forklift Control Valve and Bracket Replacement and Adjustment . . . . .	11-28
Forklift Valve Replacement . . . . .	11-37
Forklift Mast Assembly Replacement . . . . .	11-40
Forklift Carriage Assembly Replacement . . . . .	11-44
Forklift Lift Cylinder Replacement, Bleeding, and Sequencing . . . . .	11-51
Forklift Bootstrap Chain Replacement and Adjustment . . . . .	11-57
Forklift Carriage Chain Replacement. . . . .	11-67



---

**HYDRAULIC OIL COOLER FAN REPLACEMENT**

---

This task covers: a. Removal b. Installation

---

**INITIAL SETUP**

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (4)

Washer, Lock (4)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Oil Cooler Removed

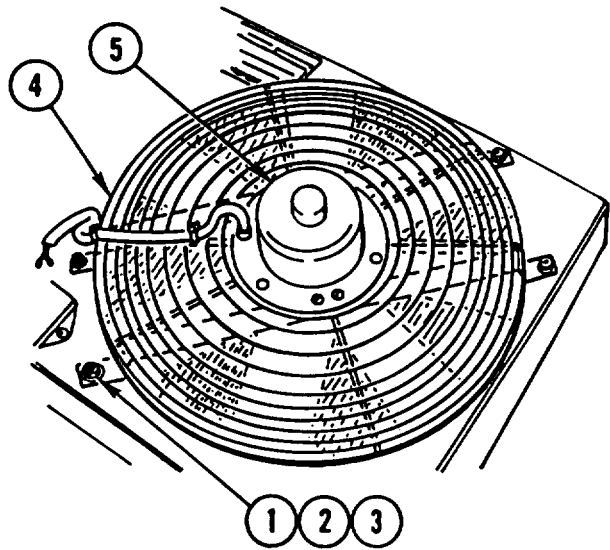
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**REMOVAL**

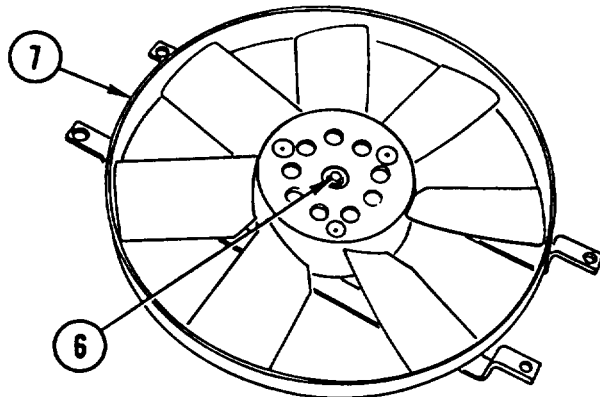
**NOTE**

Procedure is the same for both fans.

1. REMOVE four nuts (1), four lock washers (2), four washers (3), guard (4), and FAN (5). DISCARD lock WASHERS.

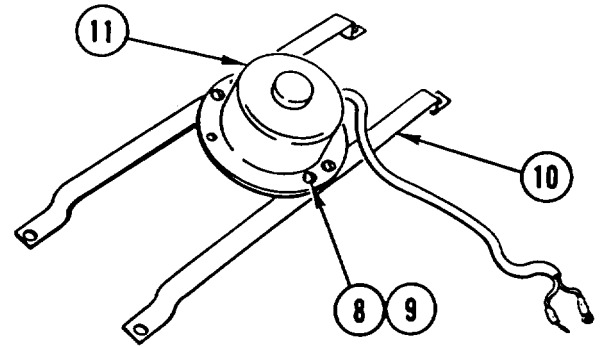


2. REMOVE retaining ring (6) and IMPELLER (7).



**HYDRAULIC OIL COOLER FAN REPLACEMENT (CONT)**

3. REMOVE four screws (8), four lock washers (9), two supports (10), and MOTOR (11). DISCARD lock WASHERS.

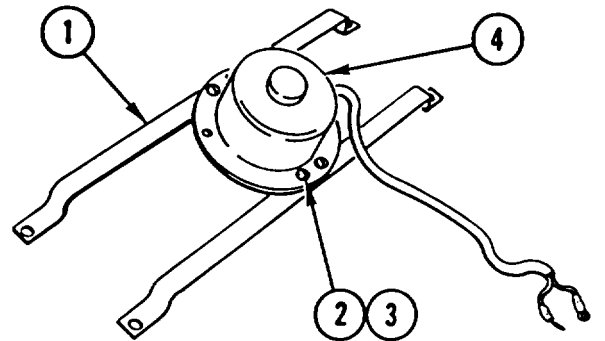


**INSTALLATION**

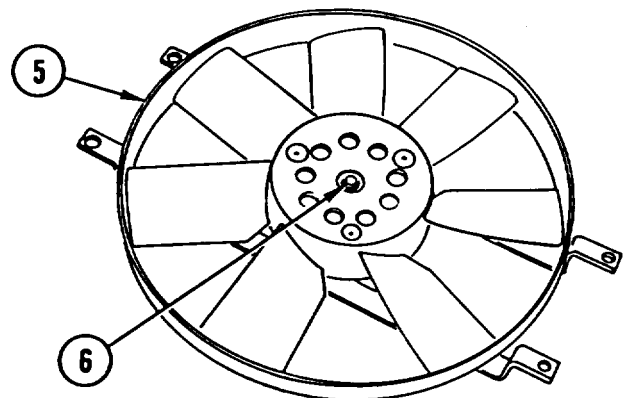
**NOTE**

Procedure is the same for both fans.

1. INSTALL two SUPPORTS (1), four lock washers (2), and four screws (3) on motor (4).



2. INSTALL IMPELLER (5) and retaining ring (6).



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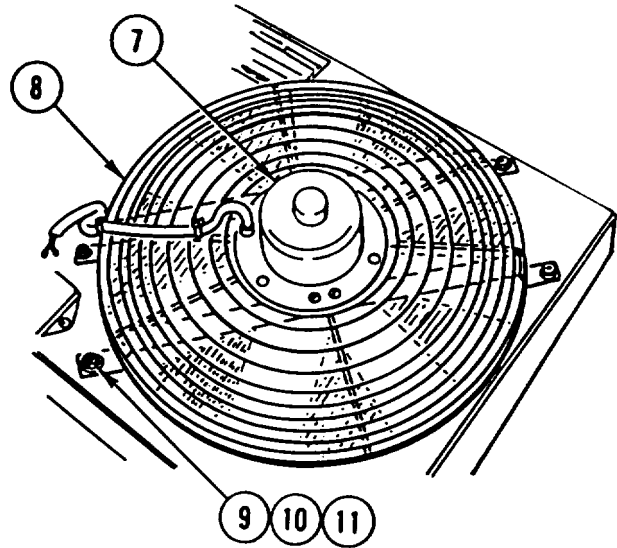
HYDRAULIC OIL COOLER FAN REPLACEMENT (CONT)

---

3. INSTALL FAN (7), guard (8), four washers (9), four new lock washers (10), and four nuts (11).

**NOTE**

Follow-on Maintenance:  
Install hydraulic oil cooler (TM 5-2420-224-20).



---

**TILT AND LATCH CONTROL VALVE REPLACEMENT AND ADJUSTMENT**

---

This task covers: a. Removal b. Installation c. Adjustment

---

**INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Packing (7)  
 Caps and Plugs Appendix B, Item 8  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Pressure Relieved

**General Safety Instructions:**

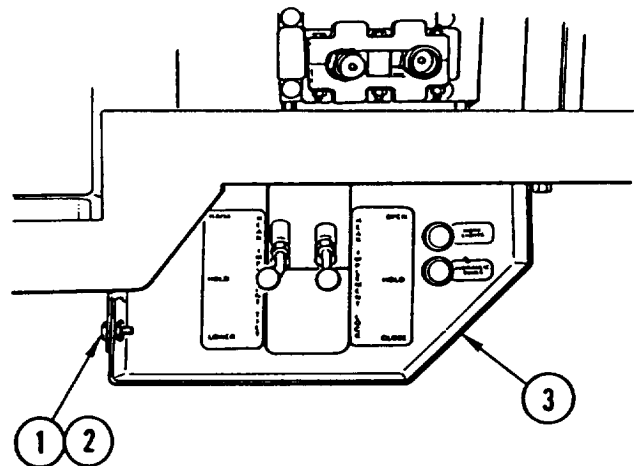
**WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**REMOVAL**

1. REMOVE seven SCREWS (1) and seven washers (2) from cover (3).

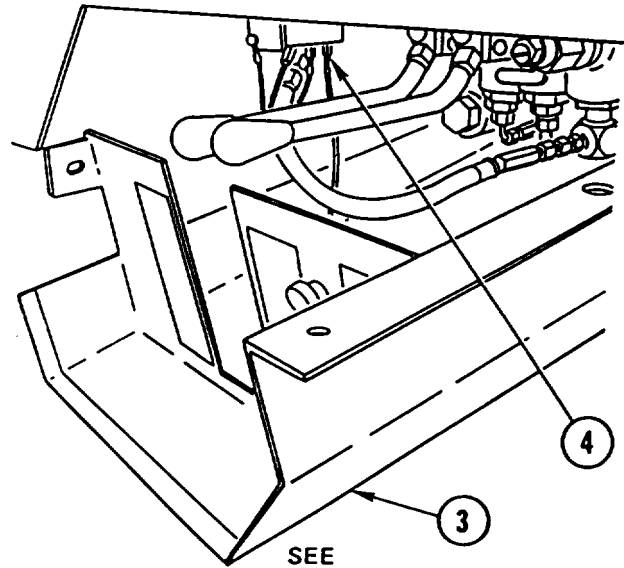


**TILT AND LATCH CONTROL VALVE REPLACEMENT AND ADJUSTMENT  
(CONT)**

**NOTE**

Step 2 is for the SEE. Step 3 is for the HMMH.

2. DISCONNECT WIRE (4) and set cover (3) aside.



3. DISCONNECT two WIRES (4) and set cover (3) aside.

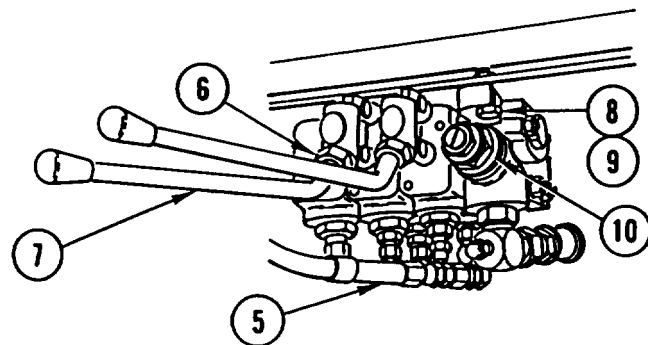
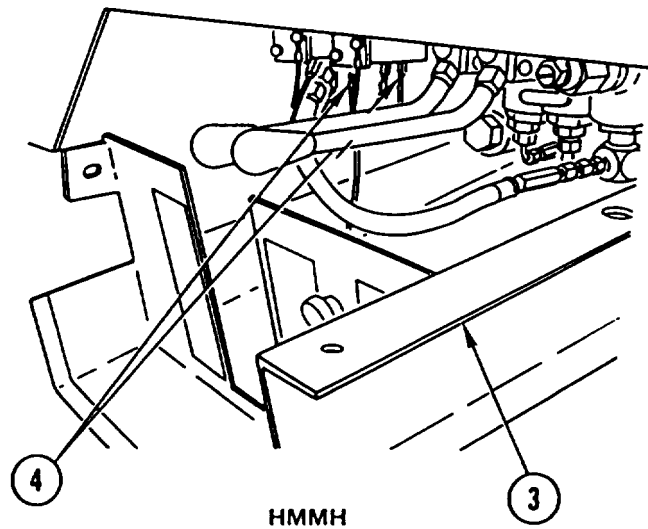
**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

**NOTE**

- Tag lines prior to disconnecting to aid in connecting.
- Have suitable container available to catch oil.

4. DISCONNECT eight HOSES (5). INSTALL CAPS or PLUGS.
5. LOOSEN two lock NUTS (6) and REMOVE two HANDLES (7).
6. REMOVE three screws (8), three washers (9), and control VALVE (10).



---

**TILT AND LATCH CONTROL VALVE REPLACEMENT AND ADJUSTMENT  
(CONT)**

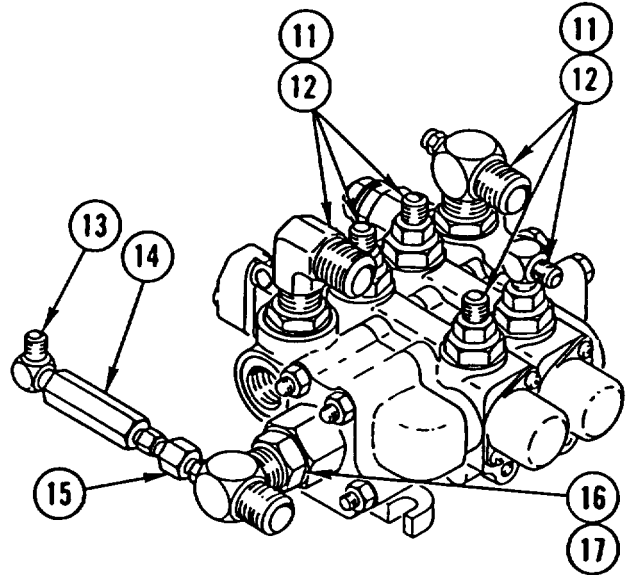
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- REMOVE six FITTINGS (11 ) and six packings (12). DISCARD PACKINGS.

**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

- REMOVE fitting (13), control VALVE (14), fitting (15), fitting (16), and packing (17). INSTALL CAPS or PLUGS. DISCARD PACKING.

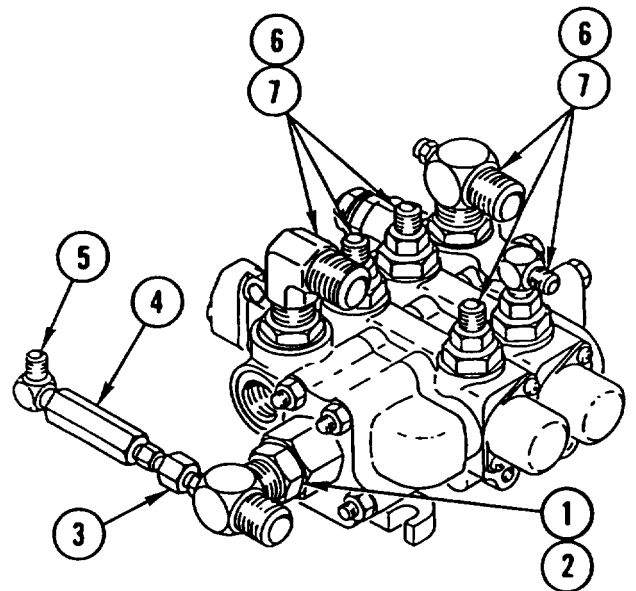



---

**INSTALLATION**

---

- REMOVE CAPS or PLUGS. INSTALL new packing (1), fitting (2), fitting (3), control VALVE (4), and fitting (5).
- INSTALL six new packings (6) and six FITTINGS (7).

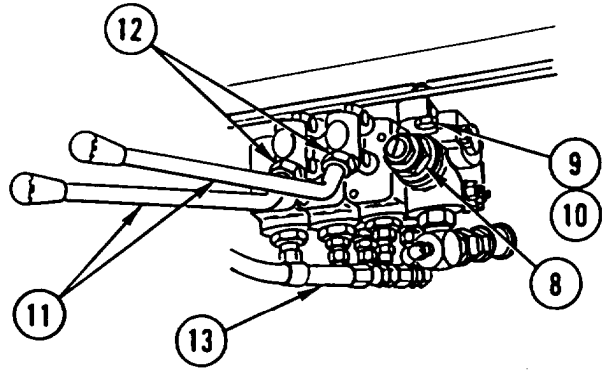


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**TILT AND LATCH CONTROL VALVE REPLACEMENT AND ADJUSTMENT  
(CONT)**

---

3. INSTALL VALVE (8), three washers (9), and three screws (10).
4. INSTALL two HANDLES (11) and tighten two lock nuts (12).
5. REMOVE CAPS or PLUGS. CONNECT eight HOSES (13).
6. PERFORM ADJUSTMENT.




---

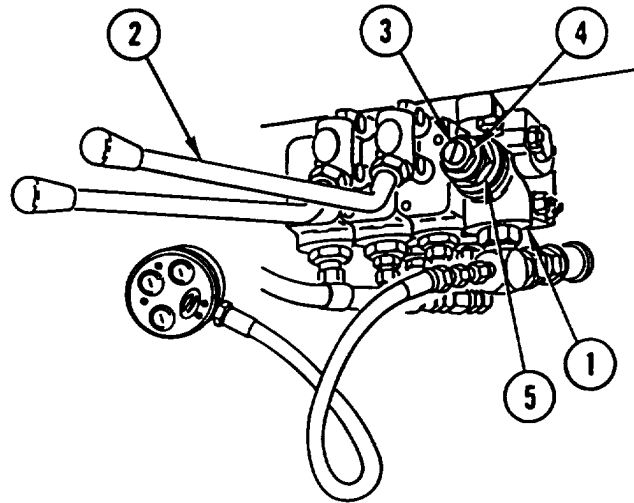
**ADJUSTMENT**

---

**NOTE**

Vehicle must be parked on level surface with front loader (SEE) or forklift (HMMH) resting on flat surface, and parking brake must be set.

1. Connect 0-5000 psi (0-352.1 bar) gage to test port on inlet section of control valve (1).
2. Perform following to achieve hydraulic oil operating temperature:
  - a. Start and run engine at 2000 rpm using hand throttle.
  - b. Place lock control lever (2) in **u p** position and hold for 15 seconds.
  - c. Place lock control lever (2) in neutral position for 30 seconds.
  - d. Repeat until hydraulic oil cooler turns on.
3. While maintaining engine speed of 2000 rpm, place lock control lever (2) in up position and read pressure gage. Pressure must be 2450 psi (172.5 bar). If reading is not correct, adjust control valve (1) according to following:
  - a. While holding adjusting screw (3), loosen lock nut (4) on main relief valve (5) on inlet section of control valve (1).



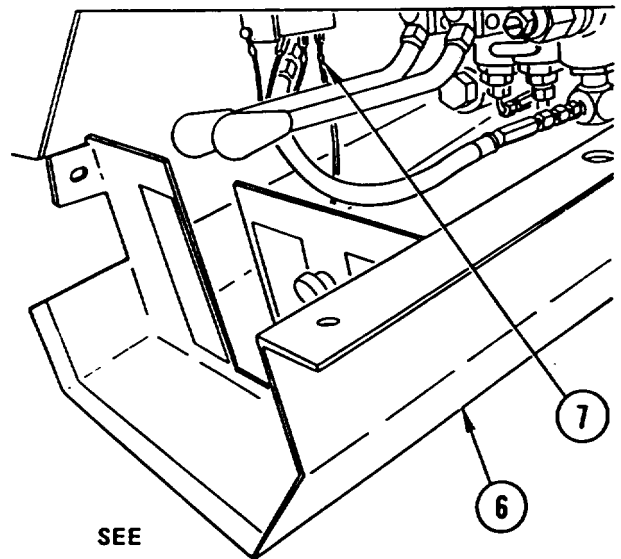
**TILT AND LATCH CONTROL VALVE REPLACEMENT AND ADJUSTMENT  
(CONT)**

- b. To increase pressure setting, turn adjusting screw (3) to right. To decrease pressure setting, turn adjusting screw (3) to left.
  - c. Tighten lock nut (4) while holding adjusting screw (3).
  - d. Repeat steps 2 and 3 to check pressure setting. Readjust, if necessary.
4. Remove 0-5000 psi (0-352.1 bar) gage from test port on inlet section of control valve (1).

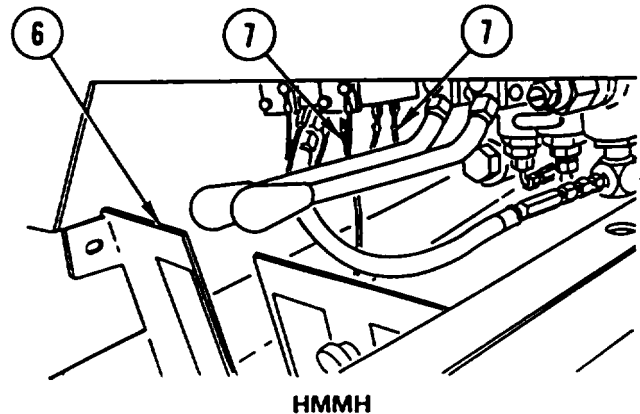
**NOTE**

Step 5 is for the SEE. Step 6 is for the HMMH.

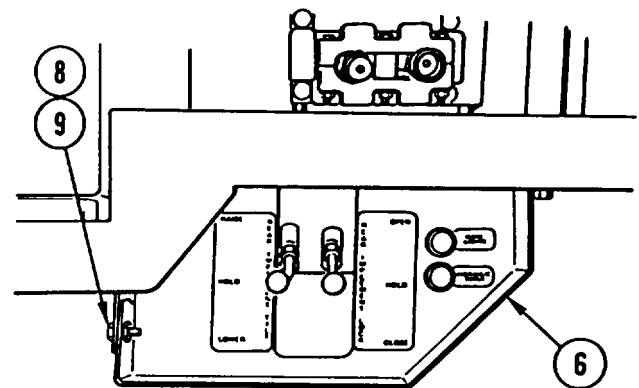
5. Set cover (6) in place and connect wire (7).



6. Set cover (6) in place and connect two wires (7).



7. Install cover (6), seven washers (8), and seven screws (9).





---

## BACKHOE SWING CYLINDER RELIEF VALVE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

SEE

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Packing

Ring, Backup

Packing

Rags Appendix B, Item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Hvdraulic Pressure Relieved

#### General Safety Instructions:

#### WARNING

- High pressure hydraulics [oil under 2450 psi (16,893 kPa) operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

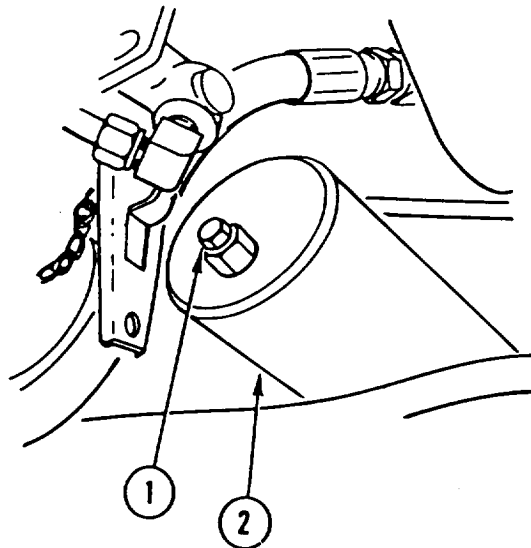
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### REMOVAL

---

#### NOTE

- Procedure is the same for both relief valves.
  - Have suitable container available to catch hydraulic fluid upon removal of relief valve.
- REMOVE relief VALVE (1) from swing cylinder (2).



---

**BACKHOE SWING CYLINDER RELIEF VALVE REPLACEMENT (CONT)**

---

2. REMOVE and DISCARD PACKING (3), backup RING (4), and PACKING (5) from relief valve (1).

---

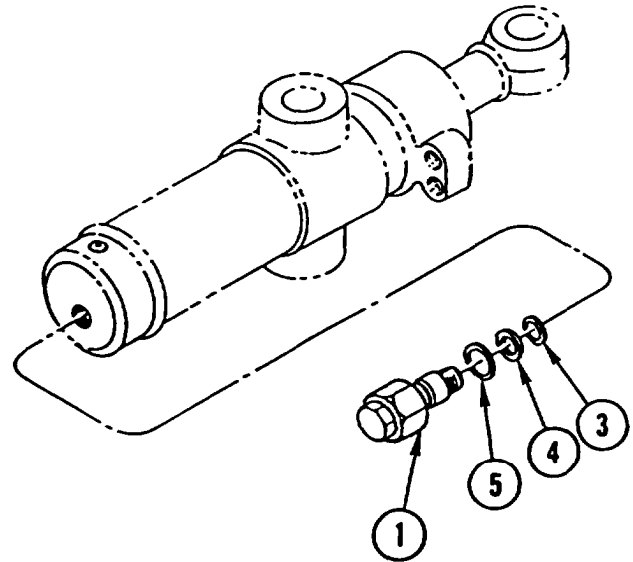
**INSTALLATION**

---

**NOTE**

Procedure is the same for both relief valves.

1. INSTALL new PACKING (3), new backup RING (4), and new PACKING (5).
2. INSTALL relief VALVE (1) in swing cylinder (2).



---

## BACKHOE STABILIZER CONTROL VALVE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

SEE

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Lock (2)

Packing (6)

Caps and Plugs                      Appendix B, item 8

Rags                                      Appendix B, Item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Backhoe Assembly Removed
TM 5-2420-224-20	Backhoe Control Levers Disconnected

#### General Safety Instructions:

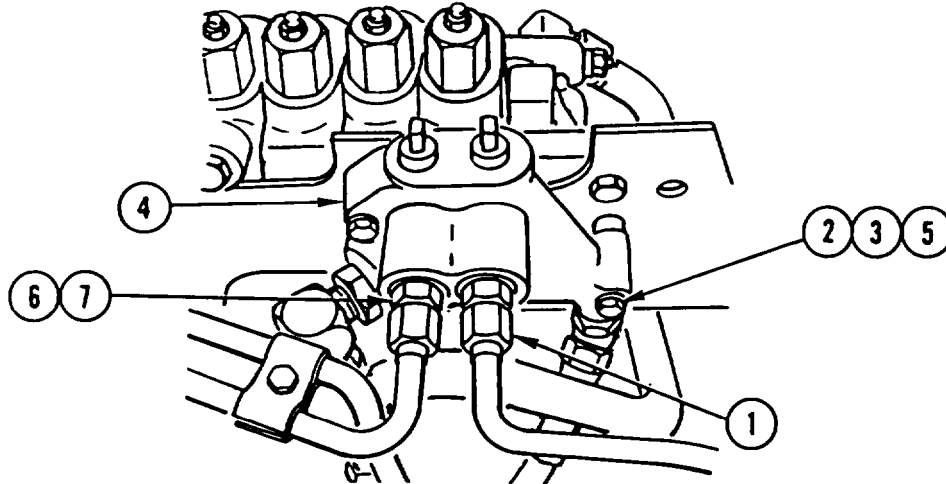
#### WARNING

- SEE should not be operated with backhoe removed, except in a maintenance facility. When maintenance is required and backhoe is removed, never operate SEE at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with backhoe removed. This could cause loss of control and injury to personnel or damage to vehicle.
- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**BACKHOE STABILIZER CONTROL VALVE REPLACEMENT (CONT)**


---

**REMOVAL****CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

**NOTE**

Tag lines prior to disconnecting to aid in connecting.

1. DISCONNECT six hydraulic TUBES (1). INSTALL CAPS or PLUGS,
2. REMOVE two bolts (2), two lock washers (3), stabilizer control VALVE (4), and four washers (5). DISCARD lock WASHERS.
3. REMOVE six ADAPTERS (6) and six packings (7). DISCARD PACKINGS.

**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

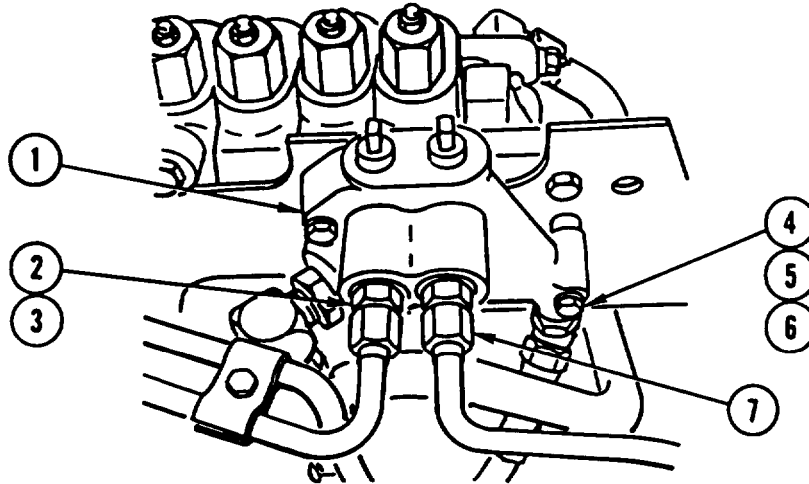
4. INSTALL six CAPS or PLUGS in stabilizer control valve (4).

---

**BACKHOE STABILIZER CONTROL VALVE REPLACEMENT (CONT)**

---

**INSTALLATION**



1. REMOVE six CAPS or PLUGS from stabilizer control valve (1).
2. INSTALL six new packings (2) and six ADAPTERS (3).
3. INSTALL four washers (4), stabilizer control VALVE (1), two new lock washers (5), and two bolts (6).
4. REMOVE CAPS or PLUGS. CONNECT six hydraulic LINES (7).

**NOTE**

Follow-on Maintenance:  
Connect backhoe control levers (TM 5-2420-224-20).  
Install backhoe assembly (TM 5-2420-224-20).

---

**BACKHOE CONTROL VALVE REPLACEMENT**

---

This task covers: a. Removal b. Installation c. Testing d. Adjustment

---

**INITIAL SETUP**

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Nut , Lock  
 Washer, Lock (3)  
 Packing (8)  
 Packing (2)  
 Caps and Plugs                      Appendix B, Item 8  
 Rags                                      Appendix B, Item 40

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe Control Tower Removed
TM 5-2420-224-20	Hydraulic Pressure Relieved

**General Safety Instructions:**

**W A R N I N G**

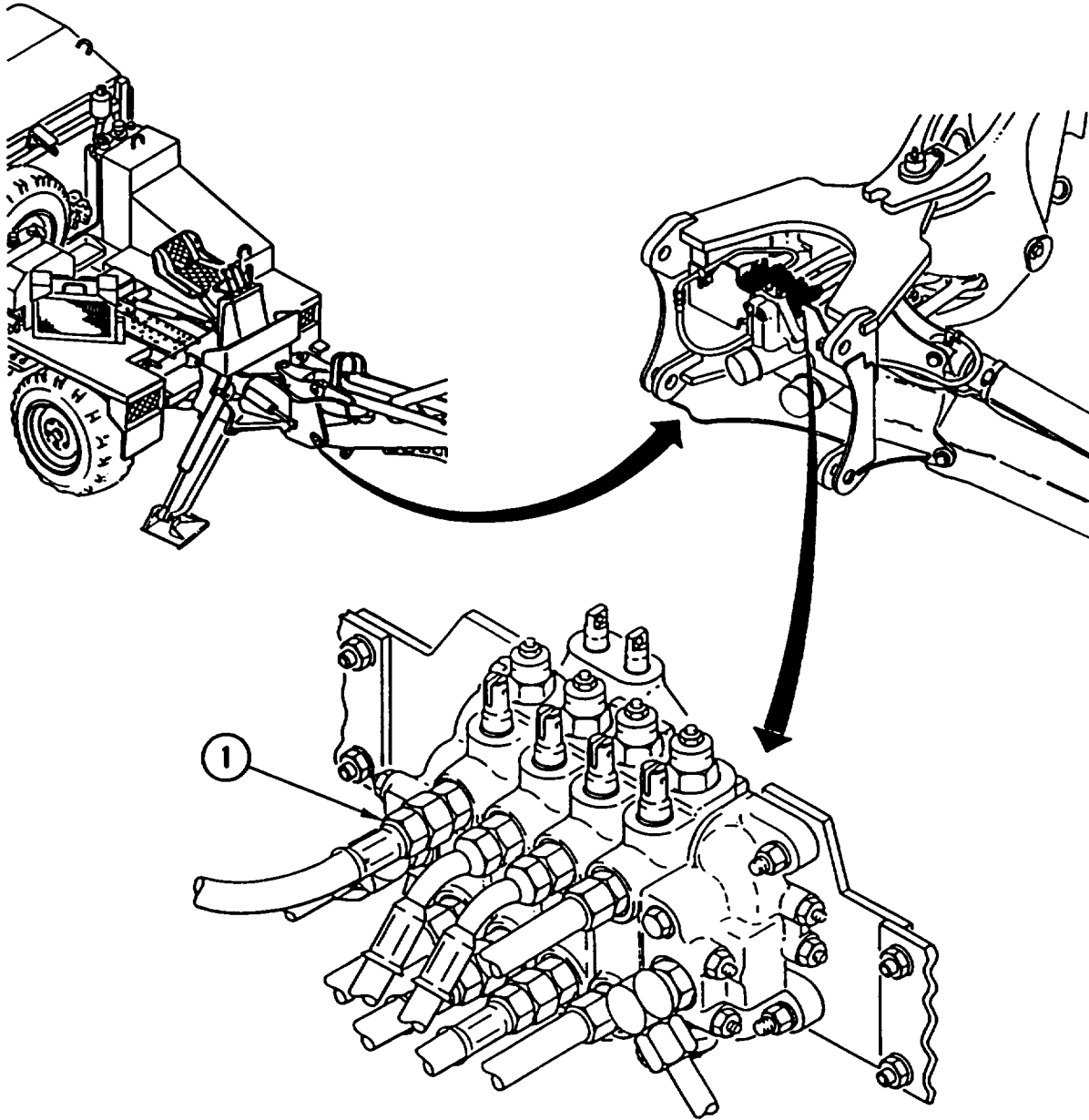
- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Wear safety goggles when performing leakage tests on valves. Failure to do so may result in serious eye injury due to high pressure oil.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**BACKHOE CONTROL VALVE REPLACEMENT (CONT)**

---

**REMOVAL**



**NOTE**

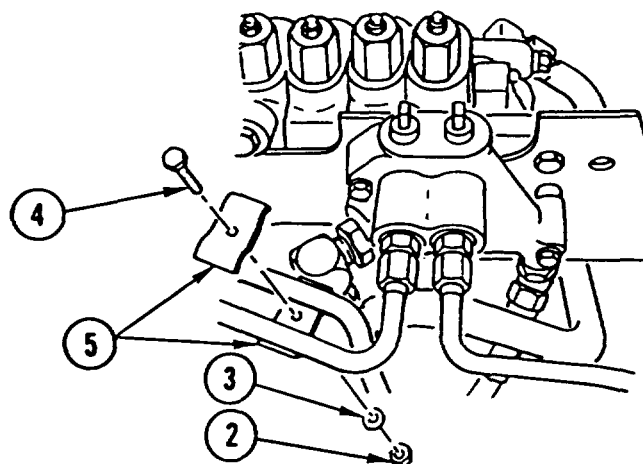
- Have suitable container available to catch hydraulic fluid in hoses.
- Tag lines prior to disconnecting to aid in connecting.

1. DISCONNECT 10 TUBES (1).

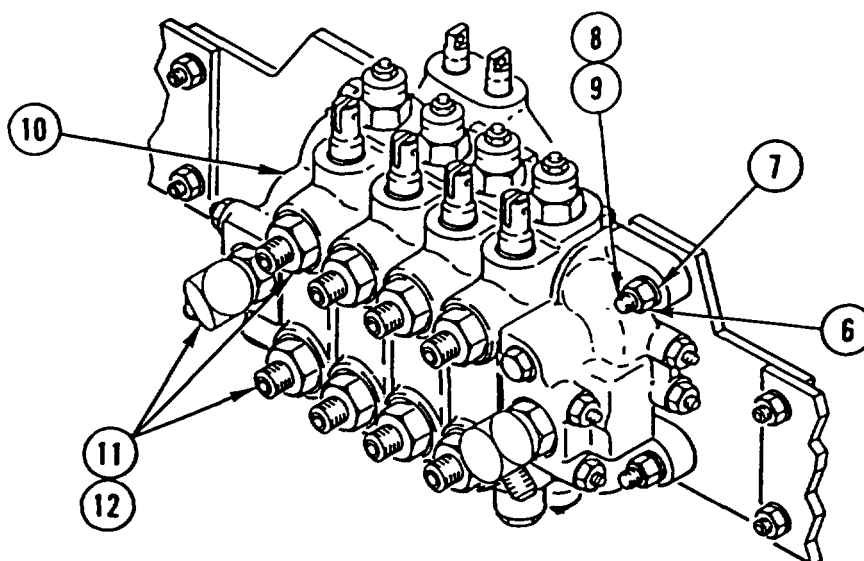
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**BACKHOE CONTROL VALVE REPLACEMENT (CONT)**


---



2. REMOVE lock nut (2), washer (3), bolt (4), and STRAP (5). DISCARD lock NUT.



3. REMOVE three nuts (6), three lock washers (7), three washers (8), three screws (9), and backhoe control VALVE (10). DISCARD lock WASHERS.
4. REMOVE 10 ADAPTERS (11) and 10 packings (12). DISCARD PACKINGS.

---

**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

---

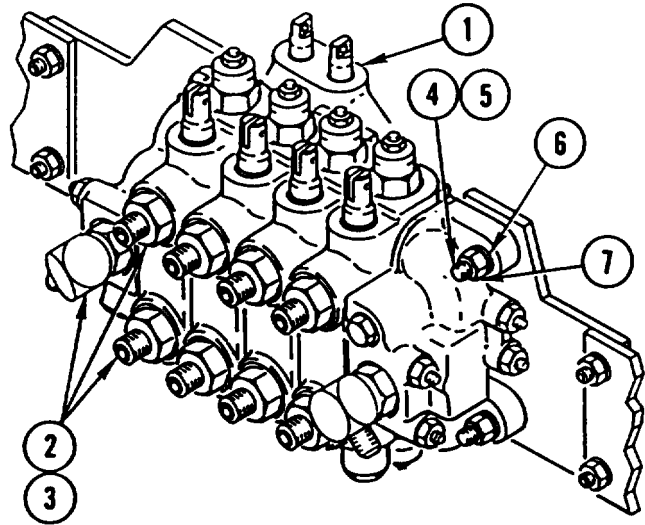
5. INSTALL 10 CAPS or PLUGS in fitting holes of backhoe control valve (10).



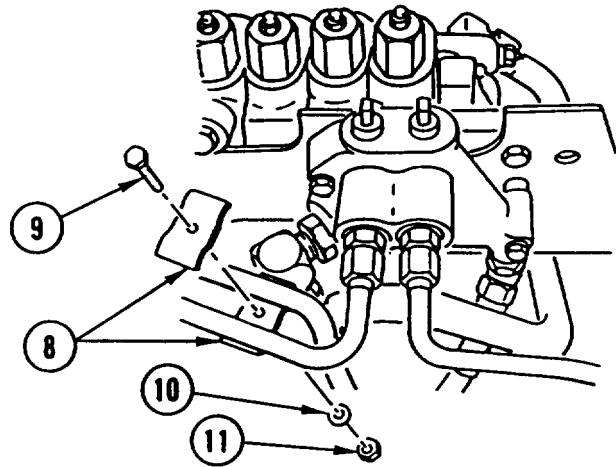
**BACKHOE CONTROL VALVE REPLACEMENT (CONT)**

**INSTALLATION**

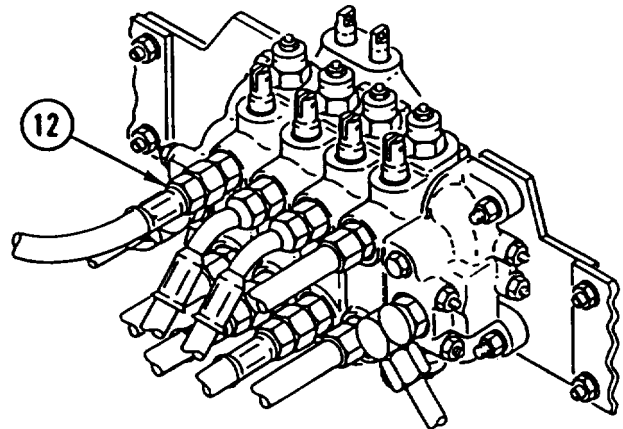
1. REMOVE 10 CAPS or PLUGS from fitting holes in backhoe control valve (1).
2. INSTALL 10 new packings (2) and 10 ADAPTERS (3).
3. INSTALL backhoe control VALVE (1), three screws (4), three washers (5), three new lock washers (6), and three nuts (7).



4. INSTALL STRAP (8), bolt (9), washer (10), and new lock nut (11).

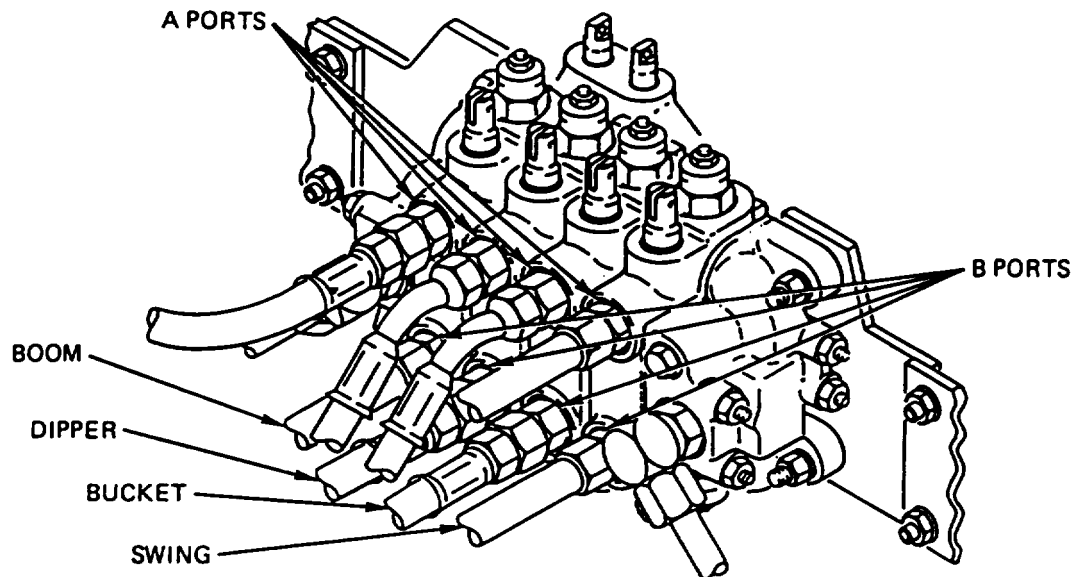


5. CONNECT 10 TUBES (12).



## BACKHOE CONTROL VALVE REPLACEMENT (CONT)

### Safety Relief Valve



1. Warm hydraulic oil by cycling circuits to be tested.
2. Place backhoe in three-point stance (TM 5-2420-224-20).
3. Shut off engine.
4. Disconnect hydraulic tube from port to be tested.
5. Connect hand pump in port to be tested.
6. Stroke hand pump until sufficient pressure is built up in circuit to open safety relief valve.
7. Continue to stroke hand pump until all air has been pumped out of lines.
8. Record highest pressure and compare with allowable pressures shown below:

#### Swing Section Valve

A and B Ports . . . . . 1700-1900 psi (115.6-129.2 bar)

#### Boom Section Valve

A Port (Upper) . . . . . 925-1075 psi (62.9-73.1 bar)  
 B Port (Lower) . . . . . 2400-2650 psi (163.2-180.2 bar)

#### Dipper Section Valve

A and B Ports . . . . . 2400-2650 psi (163.2-180.2 bar)

#### Bucket Section Valve

A and B Ports . . . . . 2400-2650 psi (163.2-180.2 bar)

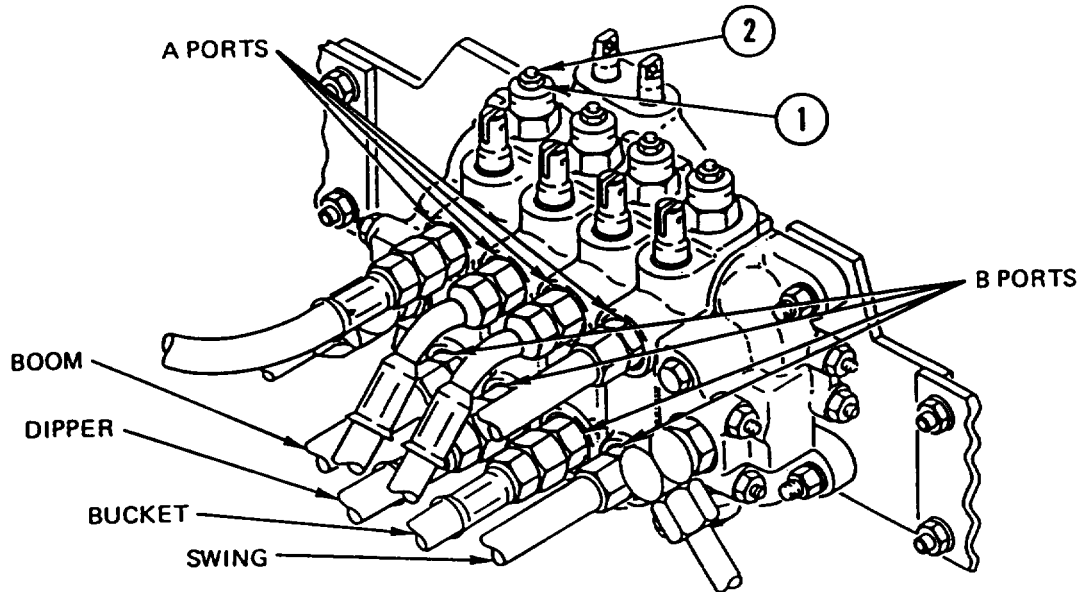
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**BACKHOE CONTROL VALVE REPLACEMENT (CONT)**

---

**ADJUSTMENT**

**Safety Relief Valve**



1. Loosen lock nut (1).
2. Turn adjusting screw (2) in to increase pressure. Turn adjusting screw (2) out to decrease pressure.
3. Repeat testing and adjustment until correct pressure is obtained.
4. If correct pressure cannot be obtained, replace safety relief valve.
5. When safety relief valve pressure is correct, perform leak test.

**Leak Test**

**NOTE**

Perform steps 1 thru 3 to check high-pressure safety relief valves.

1. Stroke pump until pressure is built up to less than opening pressure of safety relief valve.

**NOTE**

It normally takes minimum of 15-30 seconds to bleed down to approximately 1000 psi (68 bar).

2. Allow pump to sit and monitor pressure for 30-45 seconds. Pressure should have, dropped to approximately 500 psi (34 bar) and should not drop off to 0 for a few minutes.

---

**BACKHOE CONTROL VALVE REPLACEMENT (CONT)**

---

3. If pressure drops off quicker, there is excessive leakage in circuit being tested. Check following:

Tube connections  
Safety relief packings  
Poppet seat in safety relief valve  
Oil passing by valve spool  
Valve spool not returning to neutral position  
Possible cracks in backhoe control valve

**NOTE**

Perform steps 4 thru 6 to check low-pressure safety relief valves.

4. Stroke pump until pressure is built up to less than opening pressure of safety relief valve.

**NOTE**

It normally takes minimum of 15 seconds to bleed down to approximately 300 psi (20.4 bar).

5. Allow pump to sit and monitor pressure for 30-45 seconds. Pressure should not have dropped to, and should not drop off to, 0 for a few minutes.
6. If pressure drops off quicker, there is excessive leakage in circuit being tested. Check following:

Tube connections  
Safety relief packings  
Poppet seat in safety relief valve  
Oil passing by valve spool  
Valve spool not returning to neutral position  
Possible cracks in control valve

**NOTE**

Follow-on Maintenance:

Install backhoe control tower (TM 5-2420-224-20).

---

## CRANE FLOW REGULATING VALVE REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

---

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Packing

Packing

Packing

Caps and Plugs            Appendix B, Item 8

Rags                        Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

**Condition Description**

TM 5-2420-224-20

Crane in Three-Point  
Stance

TM 5-2420-224-20

Hydraulic Pressure  
Relieved

**General Safety Instructions:**

**WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

### REMOVAL

---

**CAUTION**

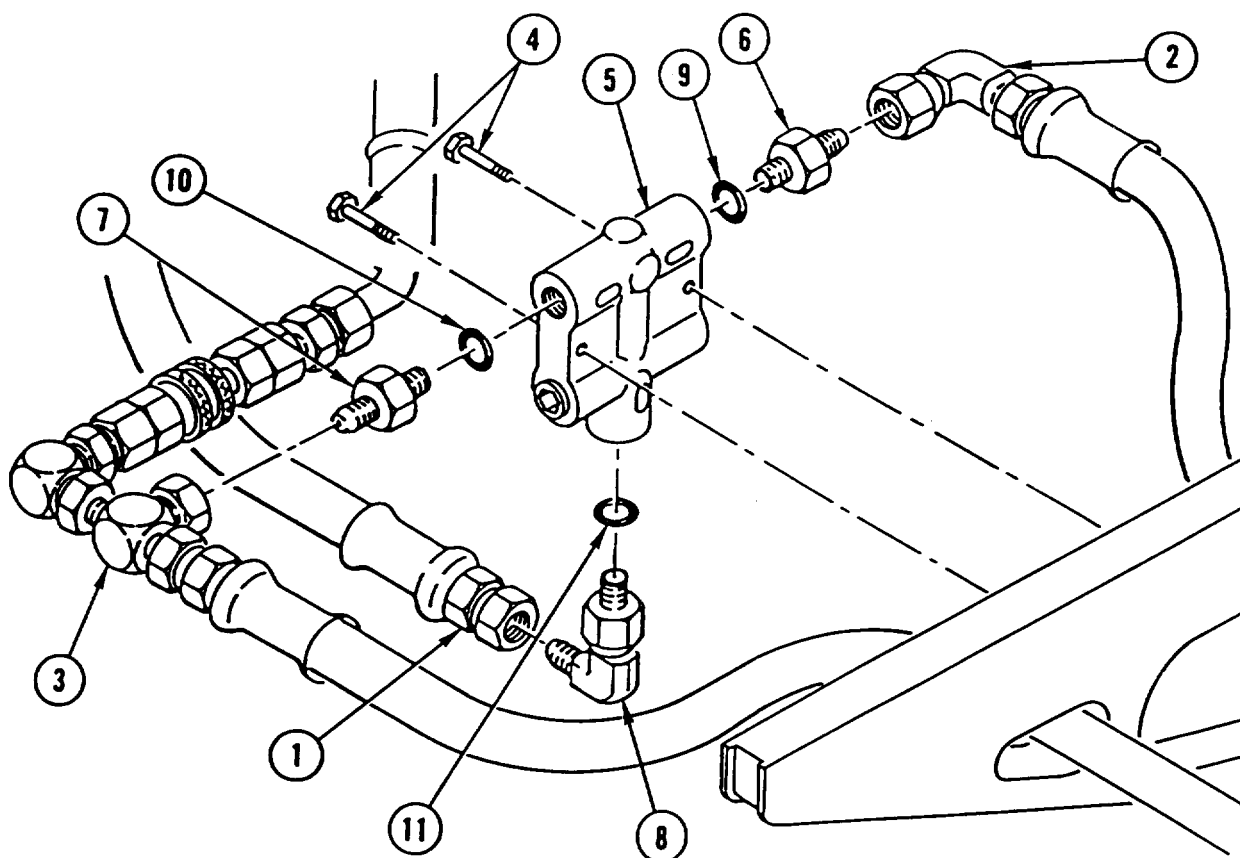
Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

1. DISCONNECT hydraulic HOSE (1), elbow (2), and tee (3). INSTALL CAP or PLUG.
2. REMOVE two bolts (4) and flow regulating VALVE (5).
3. REMOVE two ADAPTERS (6 and 7), elbow (8), and three packings (9, 10, and 11). DISCARD PACKINGS.

---

**CRANE FLOW REGULATING VALVE REPLACEMENT (CONT)**


---

**INSTALLATION**

1. INSTALL three new packings (11, 10, and 9), two ADAPTERS (6 and 7), and elbow (8) in flow regulating valve (5).
2. INSTALL flow regulating VALVE (5) and two bolts (4).
3. REMOVE CAP or PLUG. CONNECT elbow (2), tee (3), and hydraulic HOSE (1).

---

## CRANE VALVE BANK REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Applicable Configuration:

HMMH

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

#### Materials/Parts:

Pin, Cotter (8)

Nut, Lock (4)

Packing

Packing

Packing (16)

Caps and Plugs                      Appendix B, Item 8

Rags                                      Appendix B, Item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

##### Reference

TM 5-2420-224-20

**TM 5-2420-224-20**

##### Condition Description

Crane in Three-Point  
Stance

**Hydraulic Pressure  
Relieved**

#### General Safety Instructions:

#### WARNING

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

## REMOVAL

1. REMOVE eight cotter pins (1) and eight straight PINS (2). DISCARD cotter PINS.

#### NOTE

Tag control rods prior to disconnecting to aid in connecting.

2. DISCONNECT eight control RODS (3) from valve bank (4).

#### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

---

**CRANE VALVE BANK REPLACEMENT (CONT)**


---

3. REMOVE eight cotter pins (4) and eight straight PINS (5). DISCARD cotter PINS.
4. DISCONNECT eight control RODS (6) from valve bank(7).

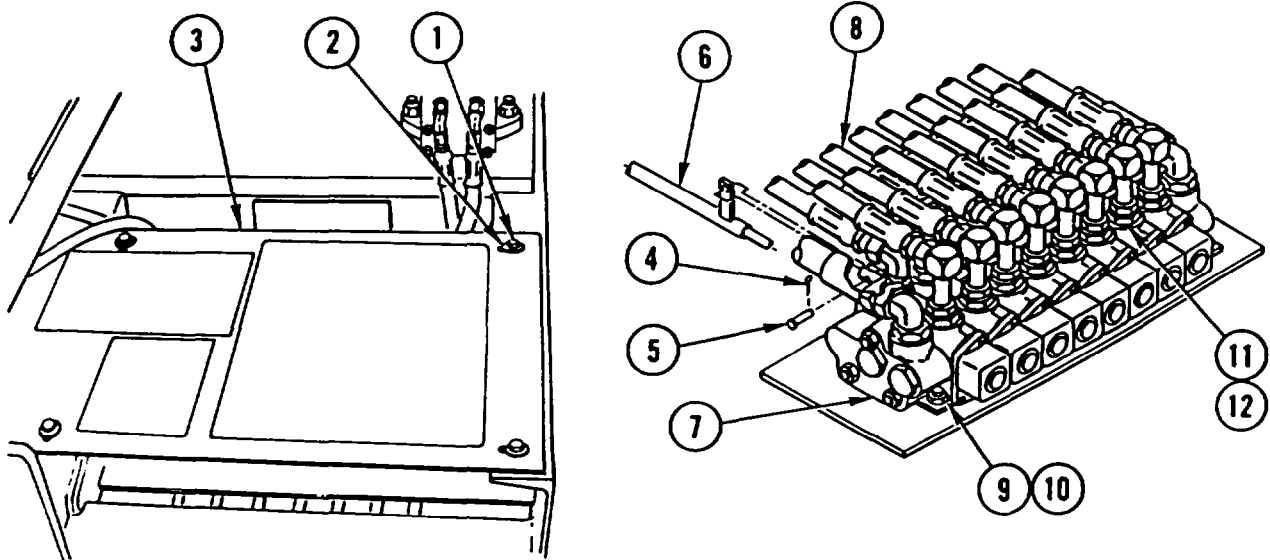
**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

**NOTE**

Tag lines prior to disconnecting to aid in connecting.

5. DISCONNECT 18 hydraulic HOSES (8). INSTALL CAPS or PLUGS.
6. REMOVE four lock nuts (9), four screws (10), and valve BANK (7). DISCARD lock NUTS.
7. REMOVE 18 FITTINGS (11) AND 18 packings (12). INSTALL CAPS or PLUGS. DISCARD PACKINGS.

**INSTALLATION**

1. REMOVE CAPS or PLUGS. INSTALL 18 new packings (12) and 18 FITTINGS (11).
2. INSTALL valve BANK (7), four screws (10), and four new lock nuts (9).
3. REMOVE CAPS or PLUGS. CONNECT 18 hydraulic HOSES (8).
4. CONNECT eight control RODS (6) to valve bank (7).
5. INSTALL eight straight PINS (5) and eight new cotter pins (4).
6. INSTALL COVER (3), four new lock washers (2), and four capscrews (1).



---

**CRANE VALVE BANK RELIEF VALVE REPLACEMENT**

---

This task covers: a. Removal b. Installation

---

**INITIAL SETUP****Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Packing

Packing

Packing

Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Pressure Relieved

**General Safety Instructions:****WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**REMOVAL****NOTE**

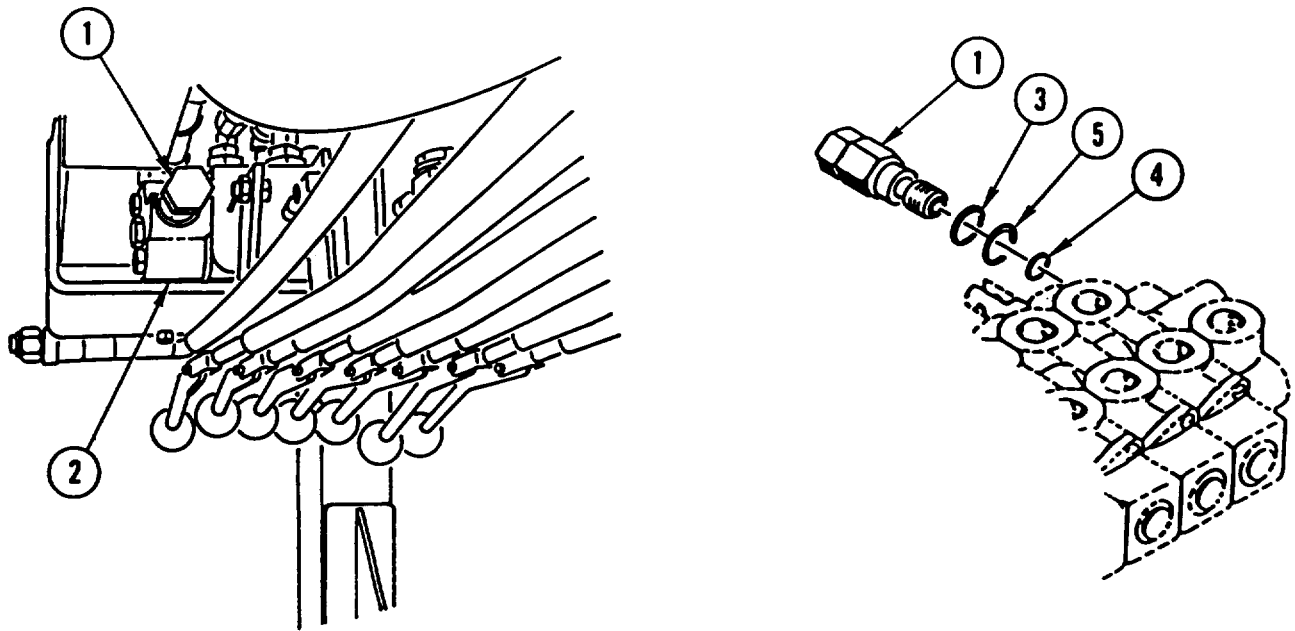
Have large capacity container available to catch hydraulic fluid.

1. REMOVE crane valve bank relief VALVE (1) from crane valve bank (2).
2. REMOVE three PACKINGS (3, 4, and 5) from crane valve bank relief valve (1). DISCARD PACKINGS.

---

**CRANE VALVE BANK RELIEF VALVE REPLACEMENT (CONT)**

---



---

**INSTALLATION**

---

1. INSTALL three new PACKINGS (5, 4, and 3) on crane valve bank relief valve (1).
2. INSTALL crane valve bank relief VALVE (1) in crane valve bank (2).

---

## FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET REPLACEMENT AND ADJUSTMENT

---

This task covers: a. Removal b. Inspection c. Installation d. Adjustment

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

#### Materials/Parts:

Packing (12)  
Nut, Lock (4)  
Pin, Cotter (2)  
Caps and Plugs                      Appendix B, Item 8  
Rags                                      Appendix B, Item 40

#### References:

TM 5-2420-224-20  
TM 5-2420-224-10

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Pressure Relieved

#### General Safety Instructions:

#### **WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

**REMOVAL**

**CAUTION**  
Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

**NOTE**

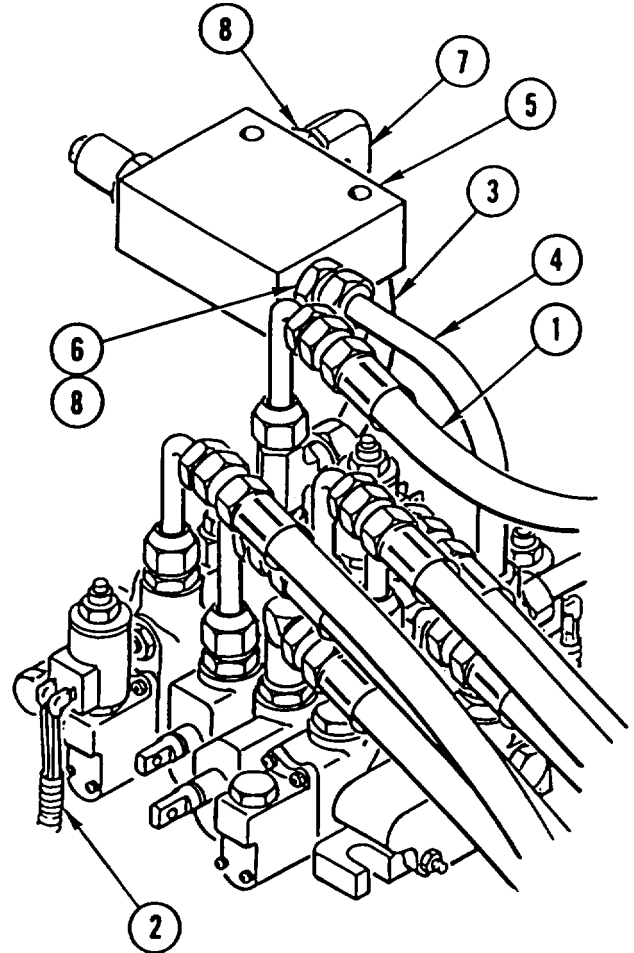
Tag lines and electrical leads prior to disconnecting to aid in connecting.

1. DISCONNECT 10 hydraulic HOSES (1). INSTALL CAPS or PLUGS.
2. DISCONNECT six electrical LEADS (2).

**NOTE**

- Steps 3 and 4 are for the SEE tractor only.
- Tag lines prior to removal to aid in installation.

3. REMOVE two tubes (3 and 4) and MANIFOLD (5).
4. REMOVE ADAPTER (6), elbow (7), and two packings (8). INSTALL CAPS or PLUGS. DISCARD PACKINGS.

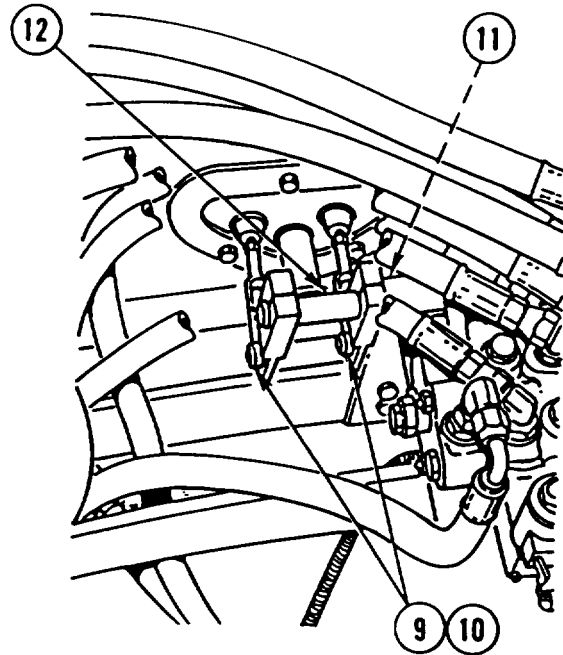


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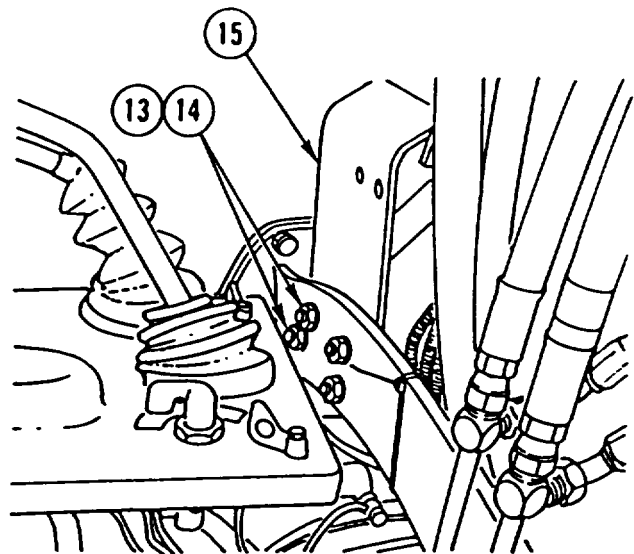
**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

---

5. REMOVE two clips (9) and two PINS (10) to DISCONNECT front loader/forklift CONTROLS.
6. REMOVE two BOLTS (11) from lever bracket (12).



7. REMOVE four screws (13), four lock nuts (14), and BRACKET (15). DISCARD lock NUTS.



---

**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

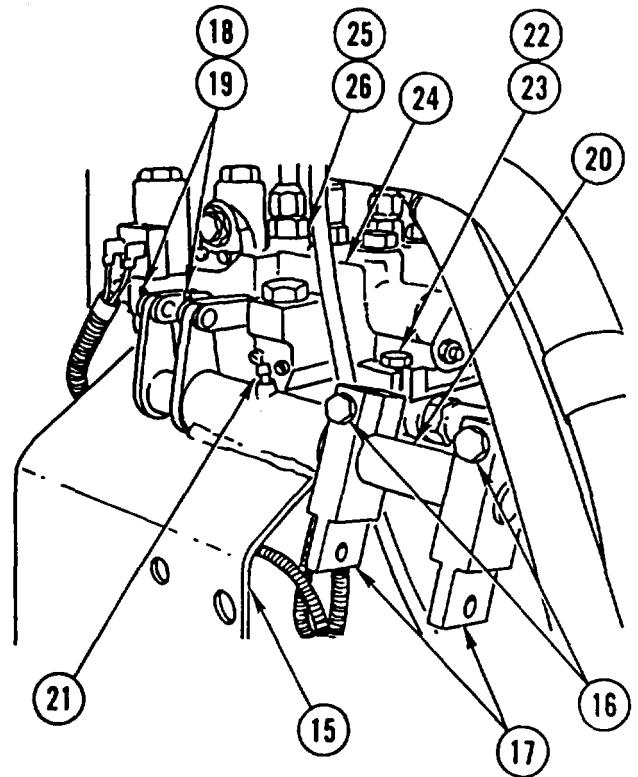
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8. LOOSEN two SCREWS (16) and REMOVE two CLAMPS (17).
9. REMOVE two cotter pins (18), two pins (19), and LEVER (20). DISCARD cotter PINS.
10. REMOVE lubrication FITTING (21).
11. REMOVE three bolts (22), three nuts (23), and control VALVE (24) from bracket (15).

**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

12. REMOVE 10 ADAPTERS (25) and 10 packings (26). INSTALL CAPS or PLUGS. DISCARD PACKINGS.




---

**INSPECTION**

1. Inspect control valve for damage and stripped threads.
2. Inspect solenoid valves for corrosion and bent or broken connectors.

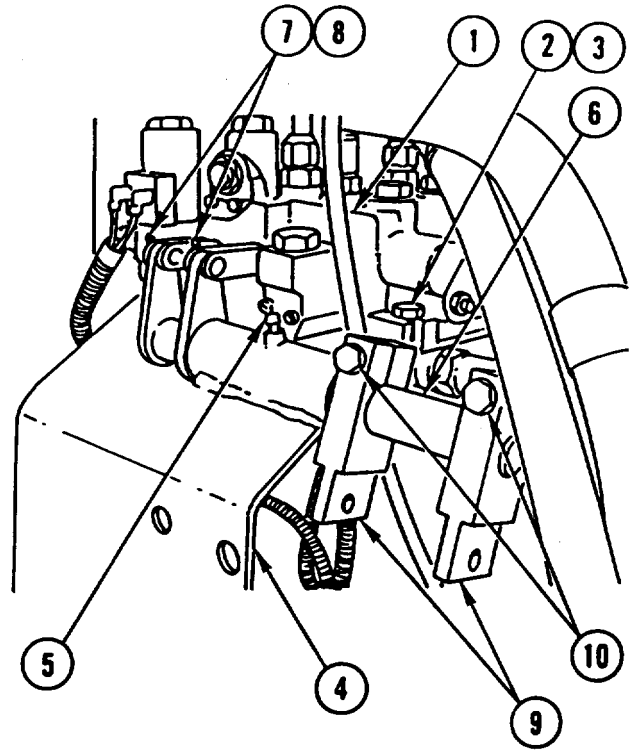
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**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

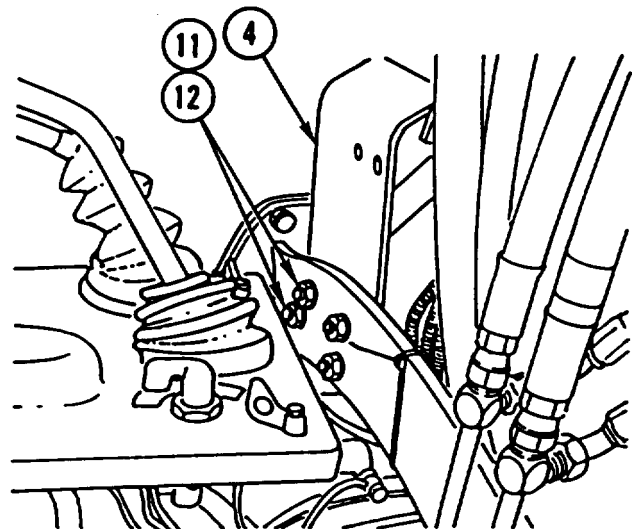
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**INSTALLATION**

1. INSTALL control VALVE (1), three bolts (2), and three nuts (3) on bracket (4).
2. INSTALL lubrication FITTING.
3. INSTALL LEVER (6), two pins (7), and two new cotter pins (8).
4. INSTALL two CLAMPS (9). DO NOT TIGHTEN SCREWS (10).

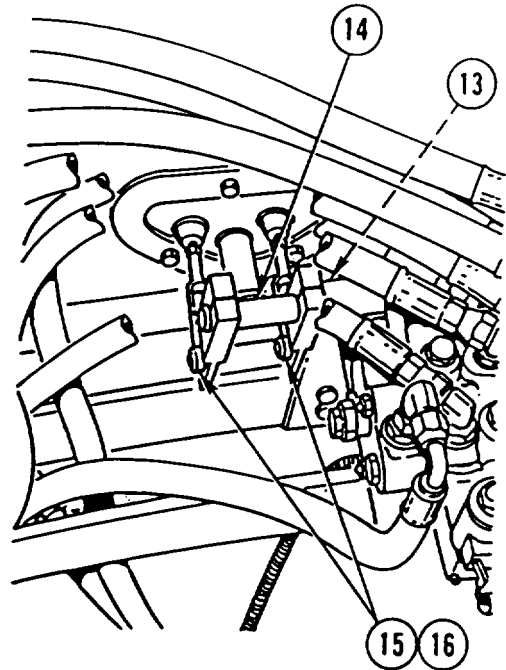


5. INSTALL BRACKET (4), four screws (11 ), and four new lock nuts (12).



**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET REPLACEMENT AND ADJUSTMENT (CONT)**

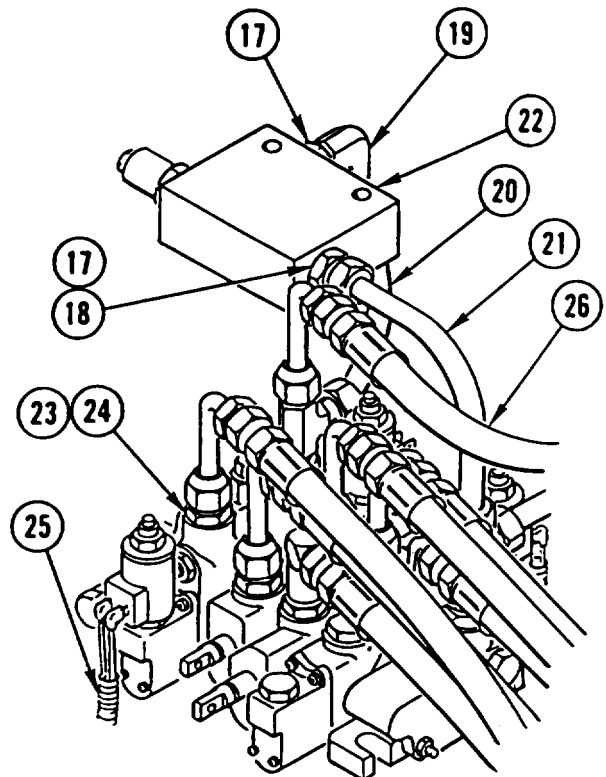
6. INSTALL two BOLTS (13) in lever bracket (14).
7. INSTALL two PINS (15) and two clips (16) on front loader/forklift controls.



**NOTE**

Steps 8 and 9 are for the SEE tractor only.

8. REMOVE CAPS or PLUGS. INSTALL two new packings (17), ADAPTER (18), and elbow (19).
9. INSTALL two TUBES (20 and 21) and MANIFOLD (22).
10. REMOVE CAPS or PLUGS. INSTALL 10 new packings (23) and 10 ADAPTERS (24).
11. CONNECT six electrical LEADS (25).
12. REMOVE CAPS or PLUGS. CONNECT 10 hydraulic HOSES (26).
13. ADJUST control VALVE.





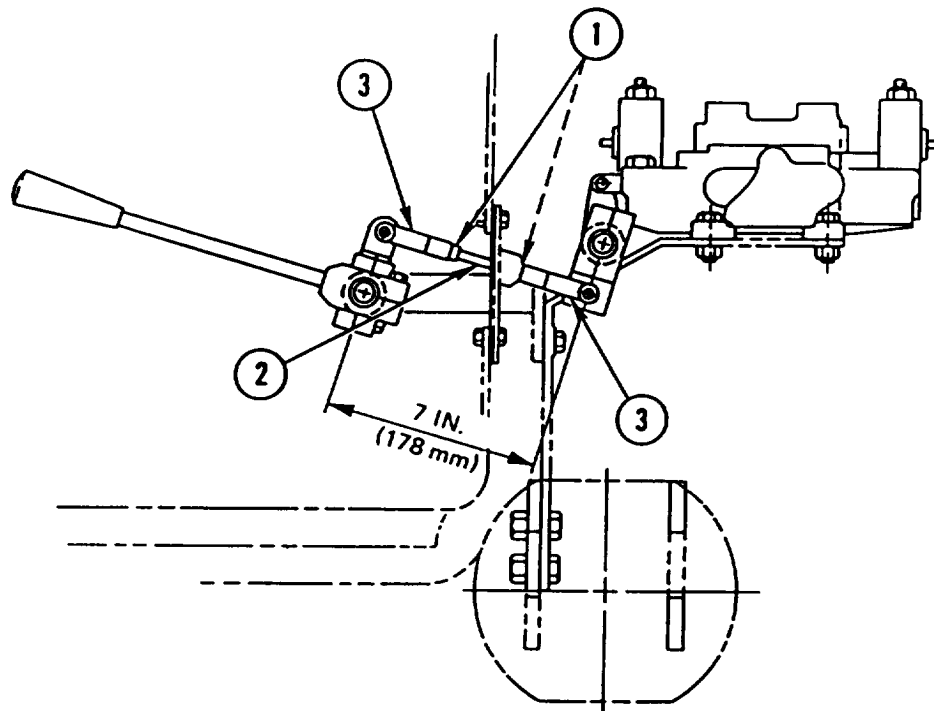
---

**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

---

**ADJUSTMENT**

**Operator Controls**



Loosen two jam nuts (1) and rotate rod (2) until measurement of 7 in. (178 mm) is attained between center points of clevis (3).

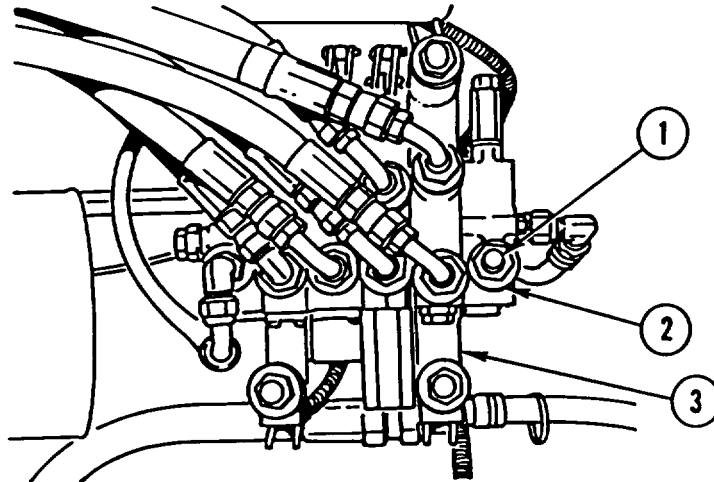
**Front Loader/Forklift Control Valve**

1. Park vehicle on level surface and set parking brake.
2. Open front loader/forklift transport lock valves (TM 5-2420-224-10).
3. Leave front loader or forklift in transport position.

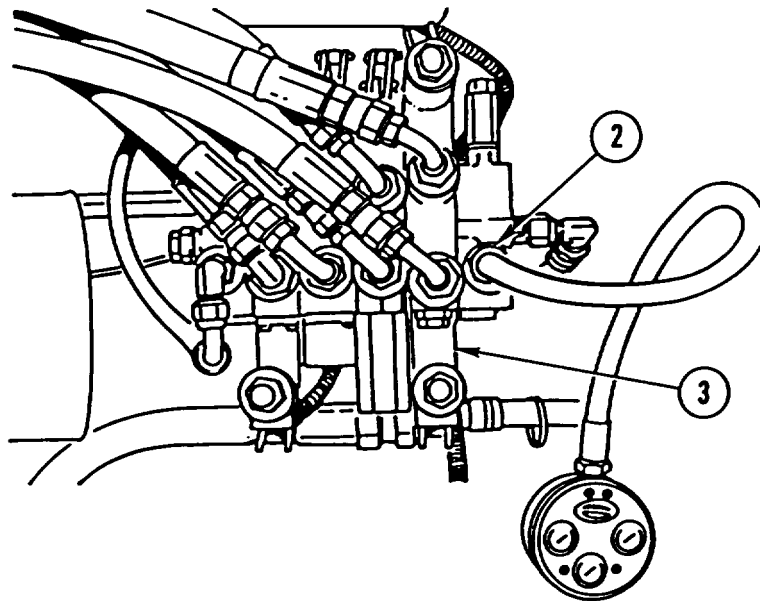
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**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

---



4. Remove cap (1) from fitting in inlet (2) of control valve (3) located behind cab.

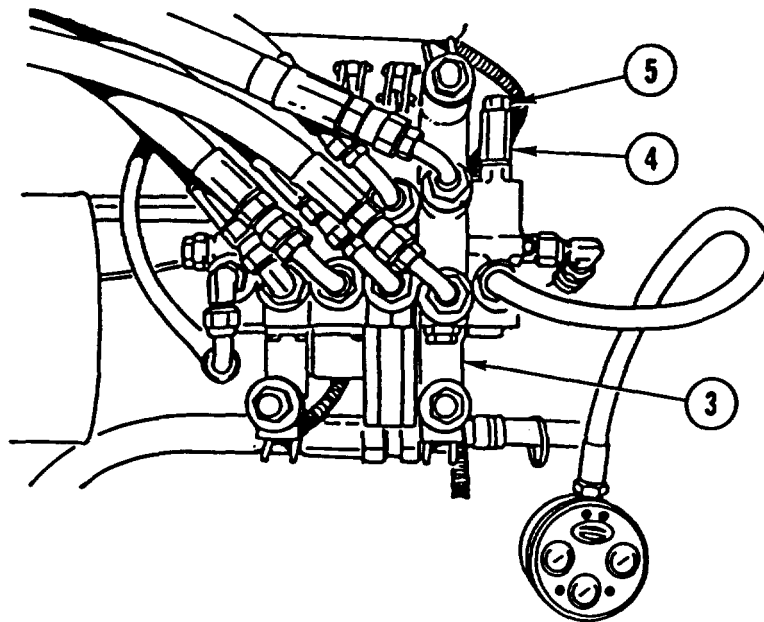


5. Connect 0-5000 psi pressure gage to fitting in inlet (2) of control valve (3).

---

**FRONT LOADER/FORKLIFT CONTROL VALVE AND BRACKET  
REPLACEMENT AND ADJUSTMENT (CONT)**

---



**NOTE**

Pressure gage must be calibrated. If not, performance of front loader/forklift circuits and tool circuits will not be correct.

6. Operate control valve (3) until oil reaches operating temperature (120°F) by performing the following:
  - a. Start and run engine at 2000 rpm.
  - b. Move bucket control lever into rollback position and hold for 15 seconds.
  - c. Place control lever in neutral for 30 seconds.
  - d. Repeat until oil in hydraulic system is at operating temperature.
7. Keep engine running at 2000 rpm.
8. Move bucket control tilt lever into rollback/tilt back position. Hold bucket/forks in this position and read pressure gage.
9. Pressure reading must be set at 2450 psi. If pressure reading is not correct, repeat steps 7 and 8 while holding bucket control lever in dump/forward tilt position. If pressure reading is still not correct, adjust main relief valve by performing the following:
  - a. Loosen lock nut (4) on main relief valve adjusting screw (5).
  - b. Turn adjusting screw (5) into main relief valve to increase pressure setting; turn adjusting screw (5) out of main relief valve to decrease pressure setting.
  - c. Tighten lock nut (4).
10. Check pressure setting for 2450 psi. Adjust or repair main relief valve as necessary.

---

**FORKLIFT VALVE REPLACEMENT**

---

This task covers: a. Removal b. Installation

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Packing (8)

Caps and Plugs                      Appendix B, Item 8

Rags                                      Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
TM 5-2420-224-20	Forklift Removed
TM 5-2420-224-20	Hydraulic Pressure Relieved

**General Safety Instructions:**

**W A R N I N G**

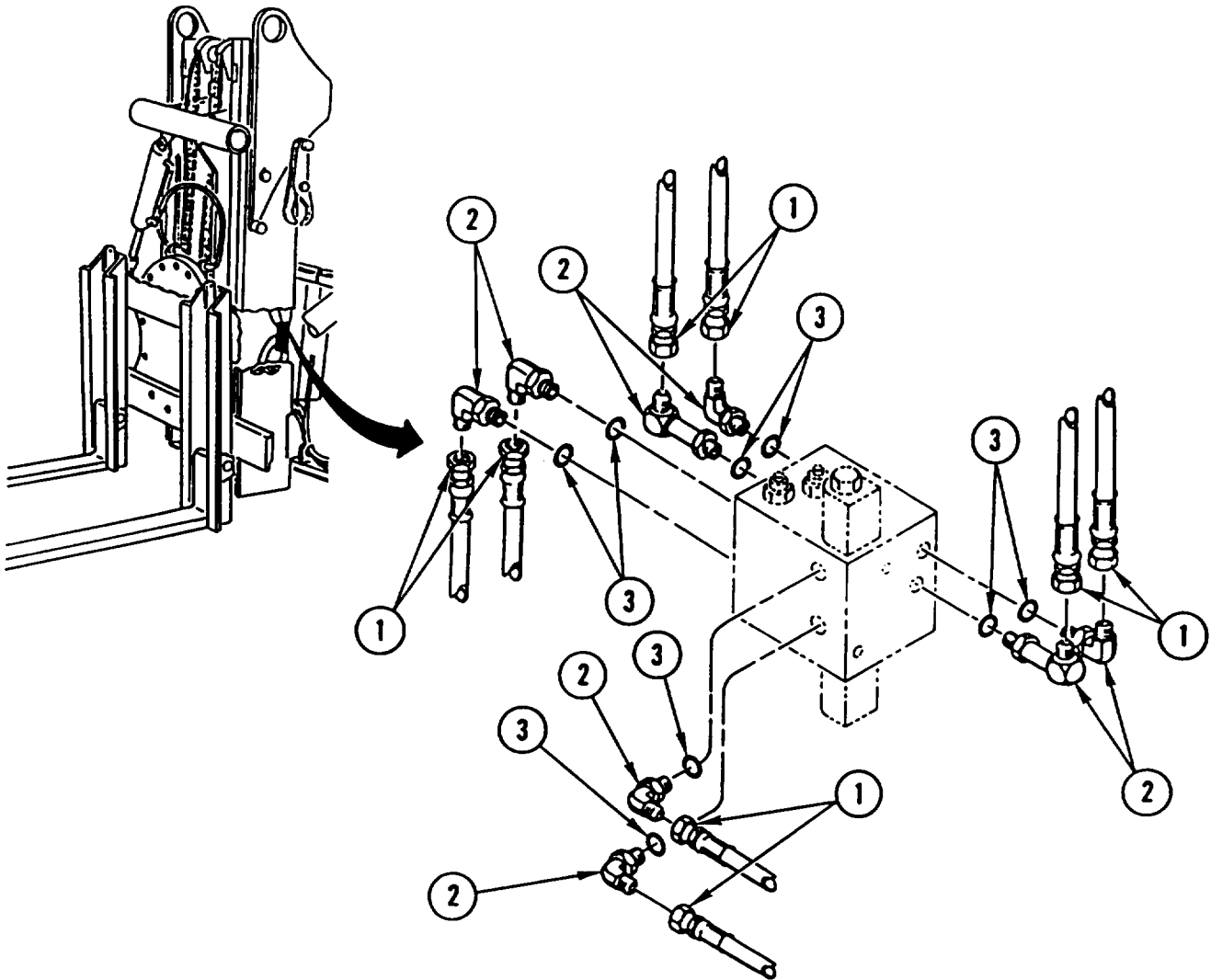
- HMMH should not be operated with forklift removed, except in a maintenance facility. When maintenance is required and forklift is removed, never operate HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with forklift removed. This could cause loss of control and injury to personnel or damage to vehicle.
- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**FORKLIFT VALVE REPLACEMENT (CONT)**

---

**REMOVAL**



**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

**NOTE**

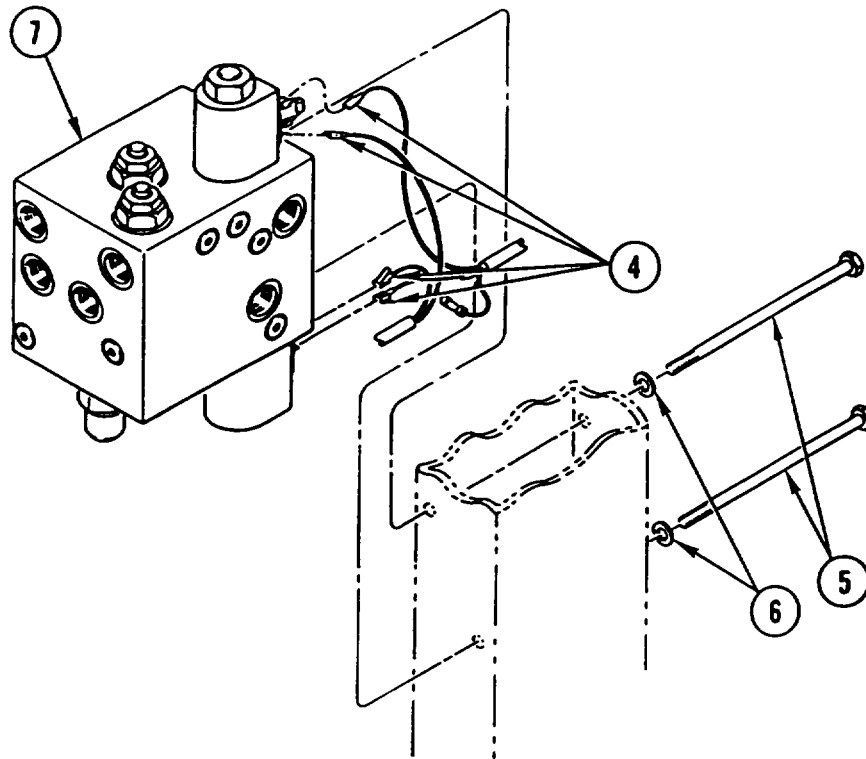
Tag lines prior to disconnecting to aid in connecting.

1. DISCONNECT eight hydraulic HOSE ASSEMBLIES(1). INSTALL CAPS or PLUGS.
2. REMOVE eight ELBOWS (2) and eight packings (3). INSTALL CAPS or PLUGS. DISCARD PACKINGS.

---

**FORKLIFT VALVE REPLACEMENT (CONT)**


---

**NOTE**

Tag electrical connections prior to disconnecting to aid in connecting.

3. DISCONNECT four electrical CONNECTIONS (4).
4. REMOVE two cap screws (5), two washers (6), and VALVE (7).

**INSTALLATION**

1. INSTALL VALVE (7), two washers (6), and two cap screws (5).
2. CONNECT four electrical CONNECTIONS (4).
3. REMOVE CAPS or PLUGS. INSTALL eight new packings (3) and eight ELBOWS (2).
4. REMOVE CAPS or PLUGS. CONNECT eight hydraulic HOSE ASSEMBLIES (1).

**NOTE**

Follow-on Maintenance:

Install forklift (TM 5-2420-224-20).

## FORKLIFT MAST ASSEMBLY REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (2)

Caps and Plugs Appendix B, Item 8

Rags Appendix B, Item 40

**Personnel Required: (2)**

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition	Description
Page 11-51	Removed	Forklift Lift Cylinder
Page 11-44	Removed	Forklift Carriage Assembly
TM 5-2420-224-20	Relieved	Hydraulic Pressure

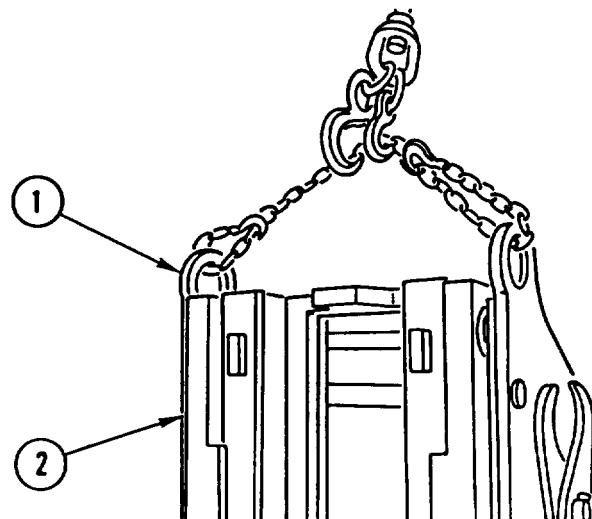
**General Safety Instructions:**

**WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Forklift mast assembly weighs 587 pounds (267 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mast assembly.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

### REMOVAL

1. ATTACH suitable LIFTING DEVICE to lift eyes (1) on mast assembly (2).

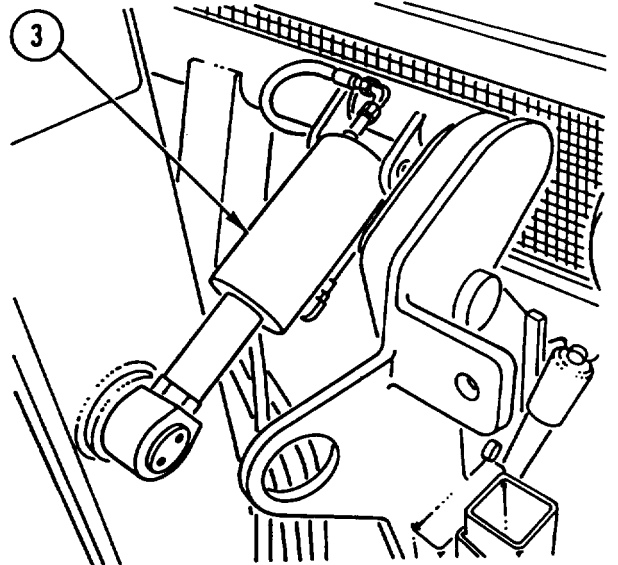


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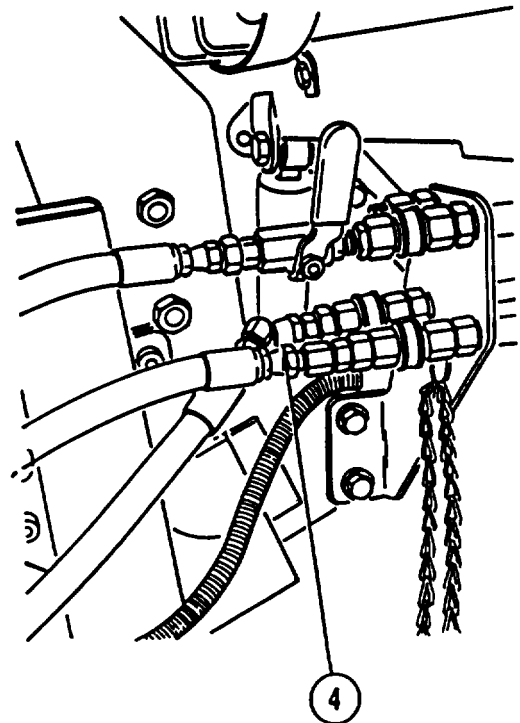
**FORKLIFT MAST ASSEMBLY REPLACEMENT (CONT)**

---

2. REMOVE FORKLIFT TILT CYLINDERS (3)  
(TM 5-2420-224-20).



3. DISCONNECT hydraulic hose QUICK  
DISCONNECT (4).





## FORKLIFT MAST ASSEMBLY REPLACEMENT (CONT)

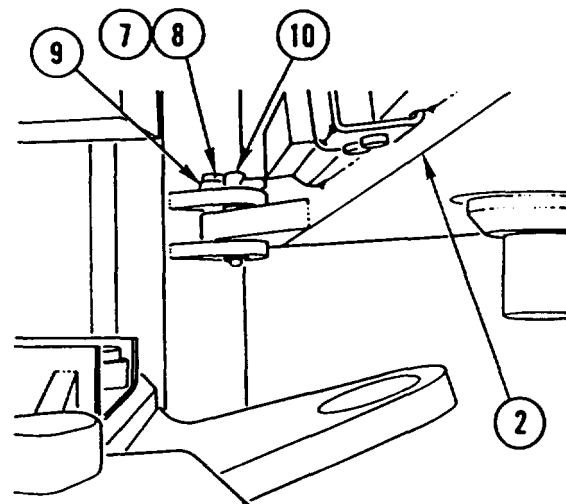
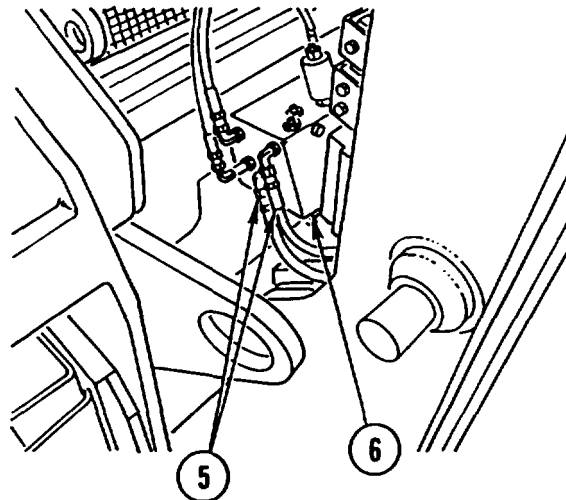
### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

### NOTE

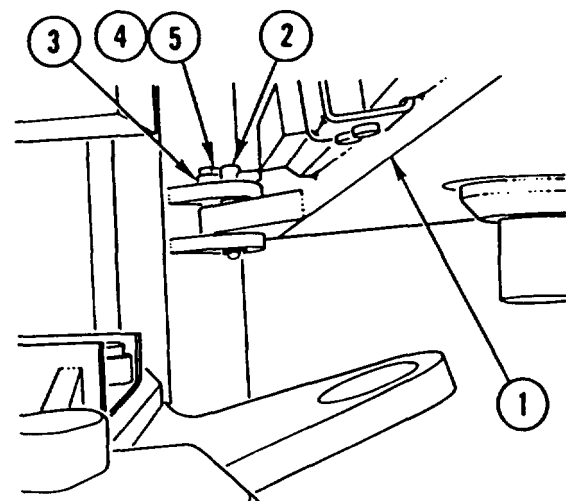
Tag lines prior to disconnecting to aid in connecting.

4. DISCONNECT two hydraulic HOSES (5) from valve (6). INSTALL CAPS or PLUGS.
  
5. REMOVE two screws (7), two lock washers (8), two eye bolts (9), and two PINS (10). DISCARD lock WASHERS.
  
6. MOVE MAST assembly (2) AWAY from vehicle and set down on flat surface.



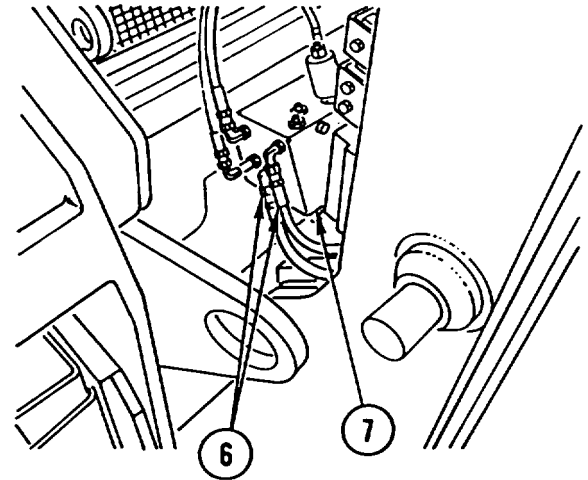
### INSTALLATION

1. MOVE MAST assembly (1) TO VEHICLE and INSTALL two PINS (2), two eye bolts (3), two new lock washers (4), and two screws (5).

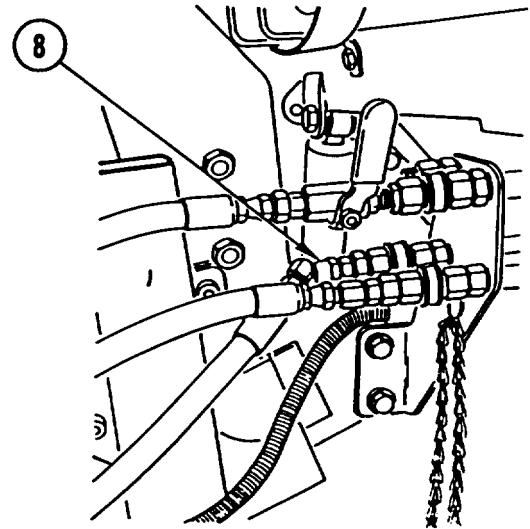


**FORKLIFT MAST ASSEMBLY REPLACEMENT (CONT)**

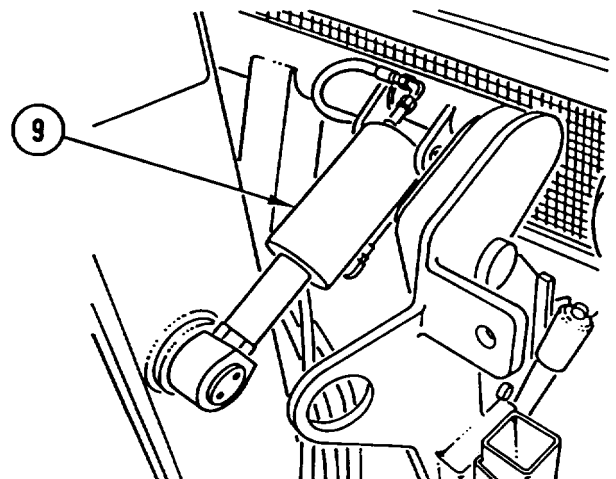
2. REMOVE CAPS or PLUGS. CONNECT two hydraulic HOSES (6) to valve (7).



3. CONNECT hydraulic hose QUICK DISCONNECT (8).



4. INSTALL FORKLIFT TILT CYLINDERS (9) (TM 5-2420-224-20).



**NOTE**

Follow-on Maintenance:  
 Install forklift lift cylinder (page 11-51).  
 Install forklift carriage assembly (page 11-44).

---

## FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Inspection c. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Pin, Cotter (2)

Washer, Lock (2)

Caps and Plugs Appendix B, item 8

Rags Appendix B, item 40

**Personnel Required: (2)**

**References:**

TM 5-2420-224-20  
LO 5-2420-224-12

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Forklift Forks Removed

**General Safety Instructions:**

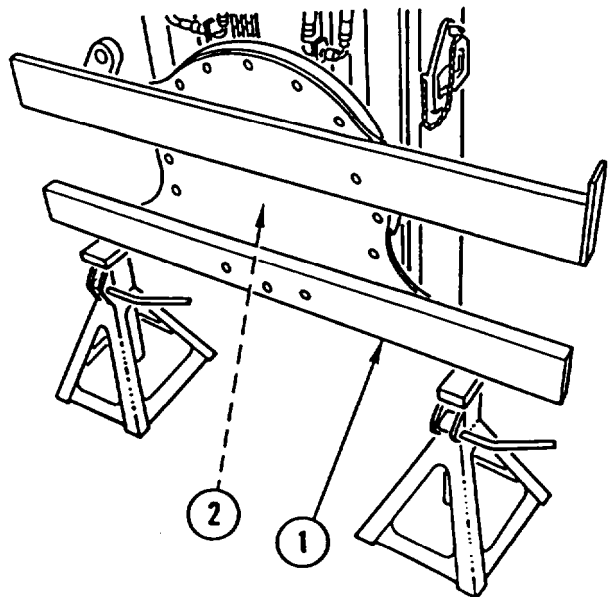
**WARNING**

- Forklift carriage assembly weighs 356 pounds (162 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift carriage assembly.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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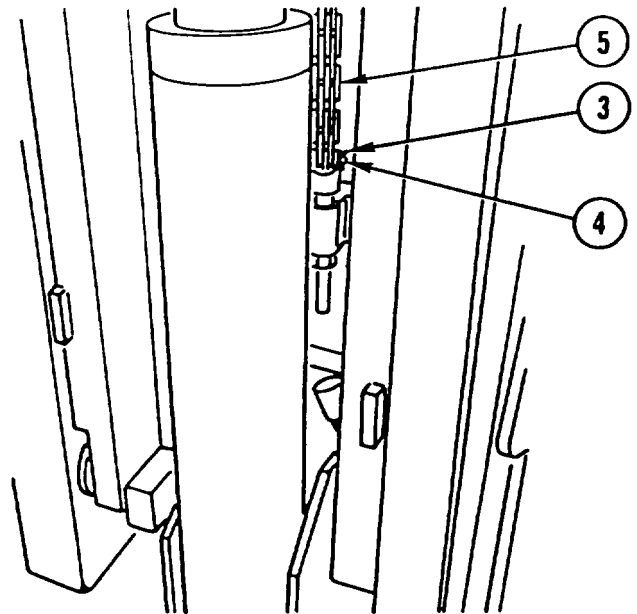
### REMOVAL

1. ATTACH suitable HOIST to carriage assembly (1) and LIFT CARRIAGE assembly (1) enough to clear chain anchors (2).



## FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)

2. REMOVE two cotter pins (3) and two PINS (4) and DISCONNECT two carriage CHAINS (5). DISCARD cotter PINS.



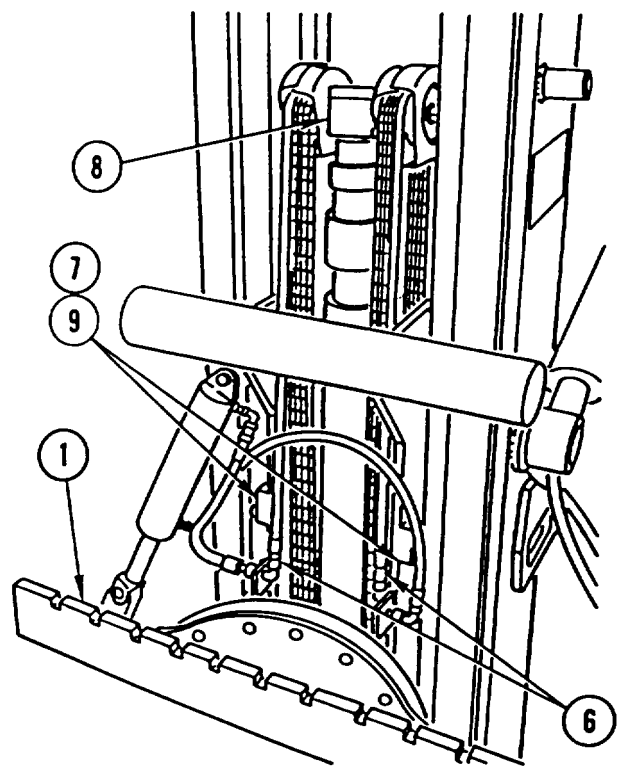
### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

### NOTE

Tag lines prior to disconnecting to aid in connecting.

3. DISCONNECT two hydraulic HOSES (6). INSTALL CAPS or PLUGS.
4. LOWER CARRIAGE assembly (1) enough to allow carriage roller screw assemblies (7) to be below crosshead assembly (8).
5. BACK OUT two carriage roller SCREW assemblies (7) enough to clear carriage rollers (9).



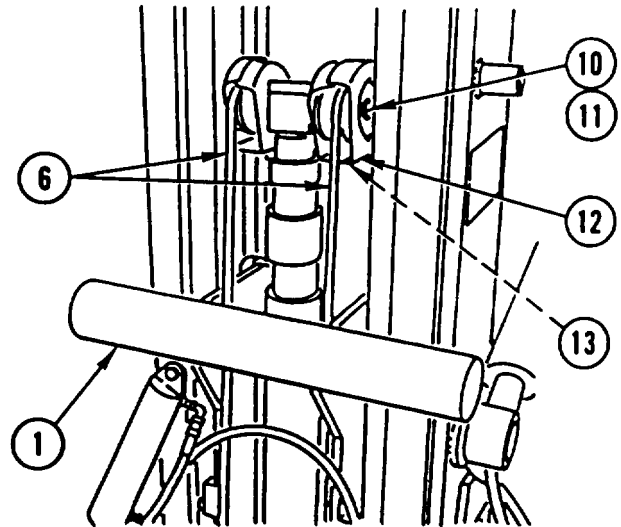
## FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)

6. REMOVE two capscrews (10), two lock washers (11), two access COVERS (12), and two spacers (13) and SET two hydraulic HOSES (6) ASIDE. DISCARD lock WASHERS.

**CAUTION**

During step 7, be careful not to allow hoses or chains to bind. To do so could result in damage to hoses and/or chains.

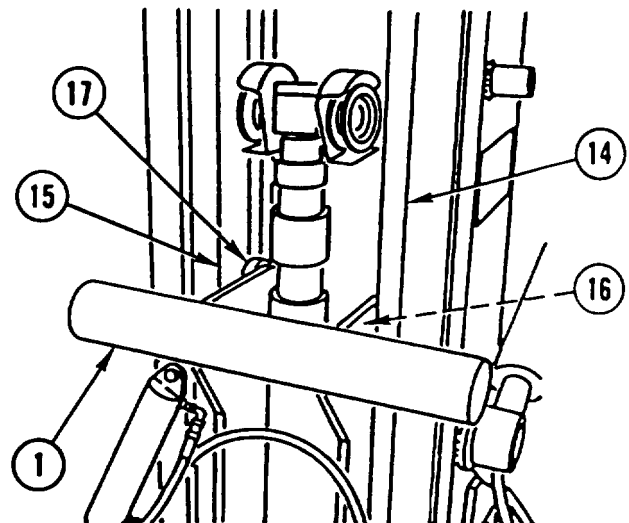
7. LOWER CARRIAGE assembly (1) completely to floor.



**NOTE**

If mast cylinder is inoperative, use suitable lifting device to raise mast.

8. RAISE MAST (14) until inner upright channel (15) clears carriage load bearings (16 and 17).
9. BACK VEHICLE AWAY from carriage assembly (1).

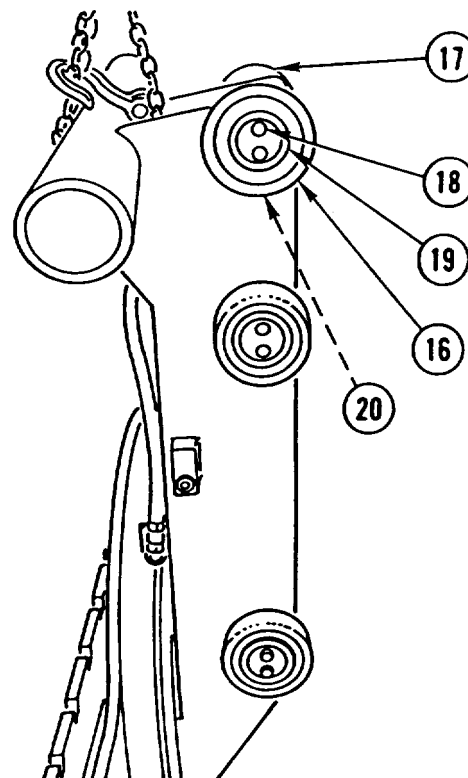


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**FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)**


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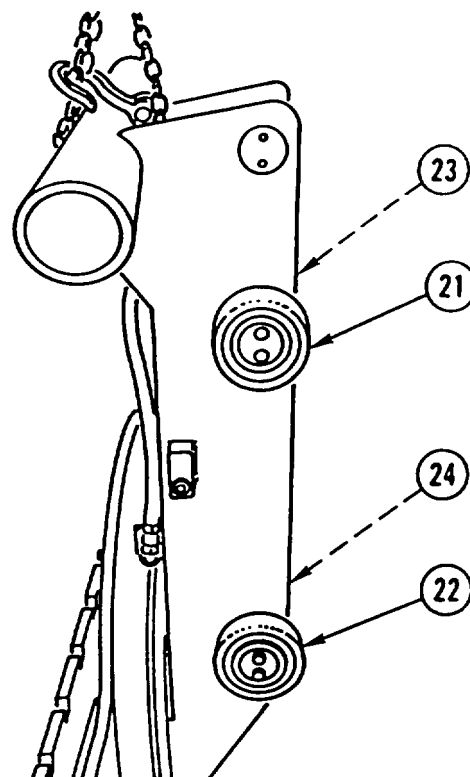
10. REMOVE four bolts (18), two retainers (19), two carriage load BEARINGS (16 and 17), and spacers (20).



11. REMOVE four bearings (21, 22, 23, and 24).

**INSPECTION**

1. Inspect bearings for excessive wear, flat spots, and cracks. If any of these conditions are present, replace bearing.
2. Inspect roller bearings by turning them on their shafts. Replace rollers with roughness or noticeable restrictions to turning.
3. Inspect all welds in carriage. Replace carriage assembly if any welds are cracked.
4. Inspect stub shafts for damage or cracks. If either of these conditions are present, replace carriage assembly.
5. Inspect forklift carriage chains (page 11-67).



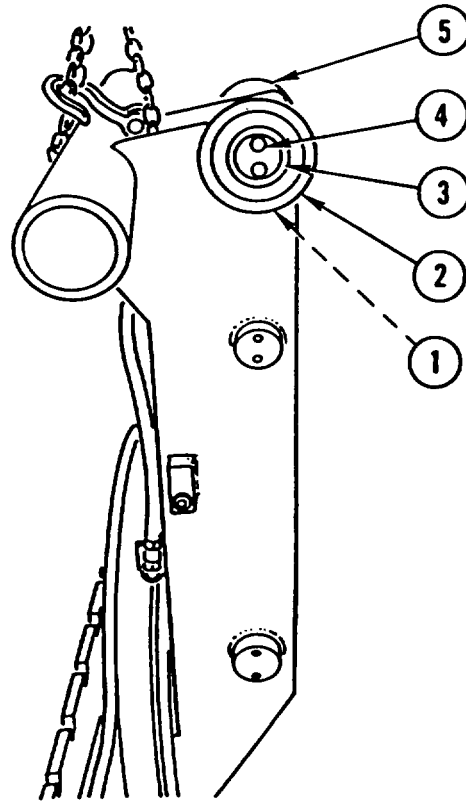
**FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)**

**INSTALLATION**

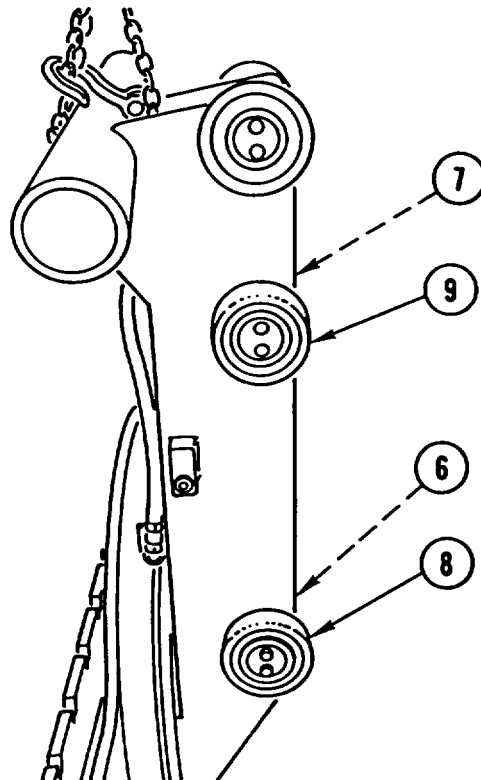
**NOTE**

- Make sure inner upright channels have been properly lubricated (LO 5-2420-224-12).
- Install equal number of spacers with each bearing.

1. INSTALL spacers (1), carriage load BEARING (2), retainer (3), and two bolts (4).
2. REPEAT STEP 1 for carriage load bearing (5).

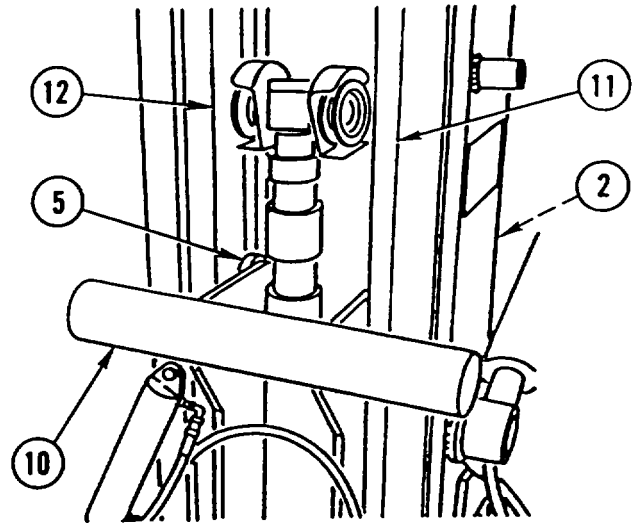


3. INSTALL four BEARINGS (6, 7, 8, and 9).

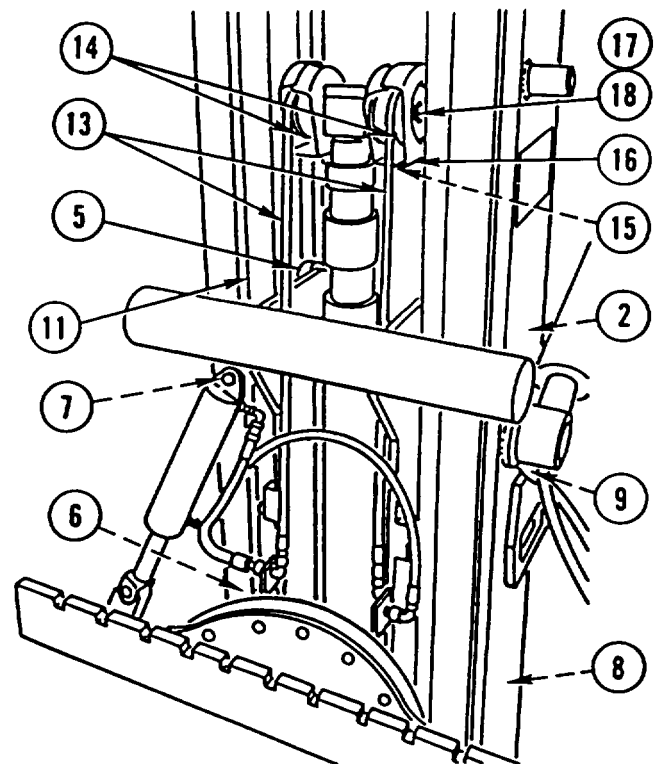


**FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)**

4. USING SUITABLE HOIST, POSITION CARRIAGE assembly (10) in front of vehicle.
5. RAISE MAST (11) until inner upright channel (12) clears carriage load bearings (2 and 5).
6. CAREFULLY MOVE VEHICLE to position where inner upright channel (12) can be lowered onto carriage assembly (10).



7. LOWER MAST (11). REMOVE CAPS or PLUGS. INSTALL two hydraulic HOSES (13) over two outer rollers (14). INSTALL two spacers (15), two access COVERS (16), two new lock washers (17), and two capscrews (18).
8. CHECK six BEARINGS (2, 5, 6, 7, 8, and 9) for proper shimming. Total clearance should be no greater than 0.030 in. (0.762 mm) at the tightest point throughout the total mast travel.





**FORKLIFT CARRIAGE ASSEMBLY REPLACEMENT (CONT)**

9. INSTALL two carriage CHAINS (19) over two inner bearings (20).

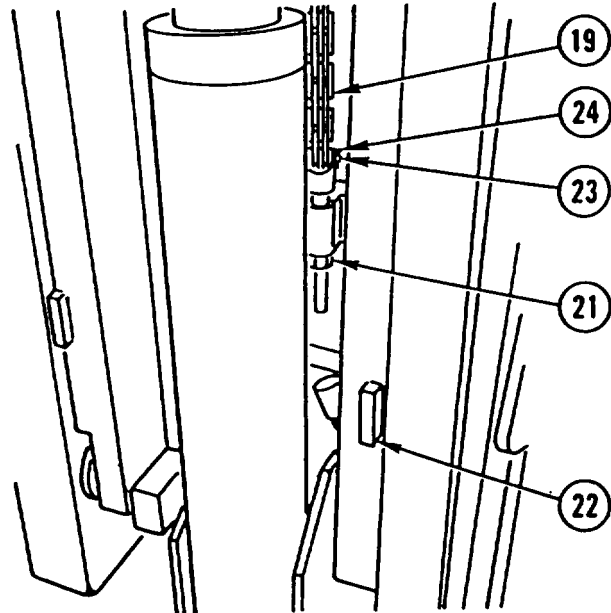
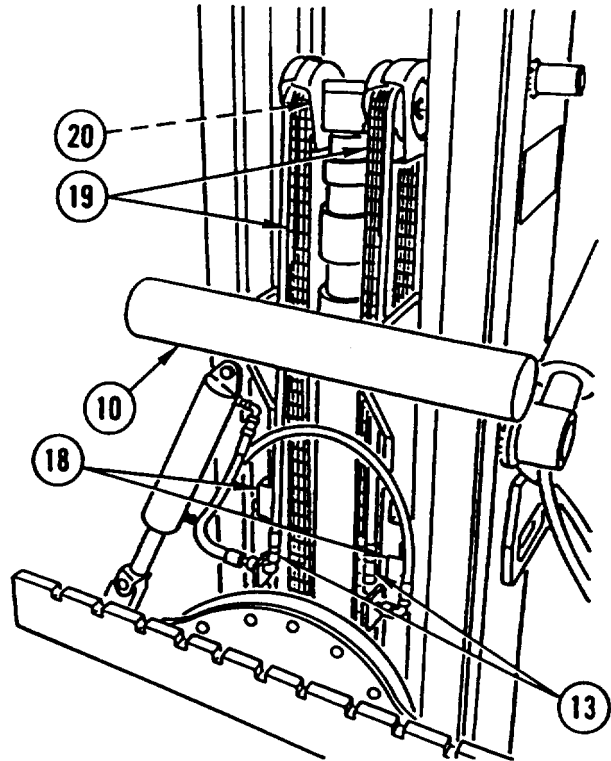
**CAUTION**

During step 10, make sure chains and hoses do not bind to prevent possible damage to chains and hoses.

10. RAISE CARRIAGE assembly (10) enough to clear chain anchors (21).
11. RUN IN two carriage roller SCREW assemblies (22) and TIGHTEN to 100-110 lb-ft (135-149 N.m).
12. CONNECT two carriage CHAINS (19) and INSTALL two PINS (23) and four new cotter pins (24).
13. REMOVE CAPS or PLUGS. CONNECT two hydraulic HOSES (13).

**NOTE**

Follow-on Maintenance:  
 Install forklift forks (TM 5-2420-224-20).  
 Adjust forklift carriage chains (TM 5-2420-224-20).



# FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING

This task covers: a. Removal b. Installation c. Bleeding d. Sequencing

## INITIAL SETUP

### Applicable Configuration:

HMMH

### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tube, P/N 661507  
 Tubing, P/N 661922  
 Key, P/N 609T-3/16

### Materials/Parts:

Caps and Plugs                      Appendix B, Item 8  
 Rags                                      Appendix B, item 40

### Personnel Required: (2)

### References:

TM 5-2420-224-20  
 LO 5-2420-224-12

### Equipment Condition:

Reference	Condition Description
Page 11-44	Forklift Carriage Assembly Removed
TM 5-2420-224-20	Forklift Crosshead Removed
TM 5-2420-224-20	Hydraulic Pressure Relieved

### General Safety Instructions:

#### WARNING

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Forklift lift cylinder weighs 101 pounds (46 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift lift cylinder.
- Do not work on forklift lift cylinder with load on forks or while anyone is near forklift controls. To do so could result in injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

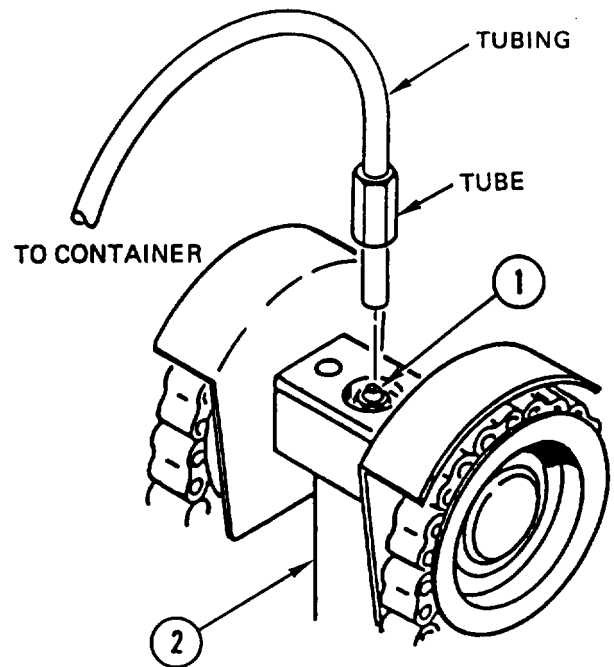
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## FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING (CONT)

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### REMOVAL

1. LOOSEN bleeder VALVE (1). USING TUBE and TUBING, BLEED off hydraulic PRESSURE in lift cylinder (2).



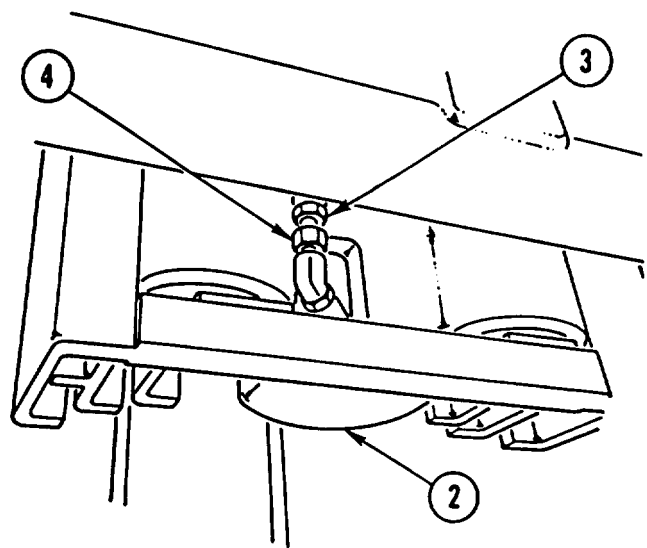
### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

### NOTE

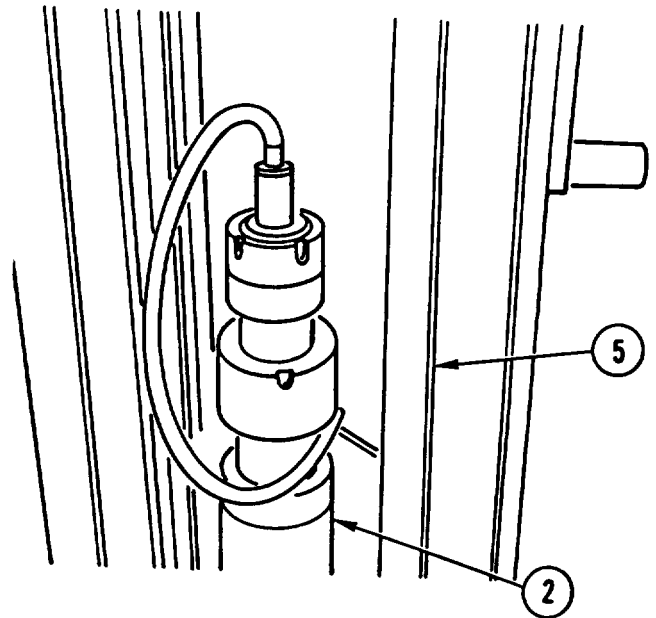
Have suitable container available to catch oil that may leak out.

2. DISCONNECT HOSE assembly (3) from base of lift cylinder (2). INSTALL CAP or PLUG on fitting (4).



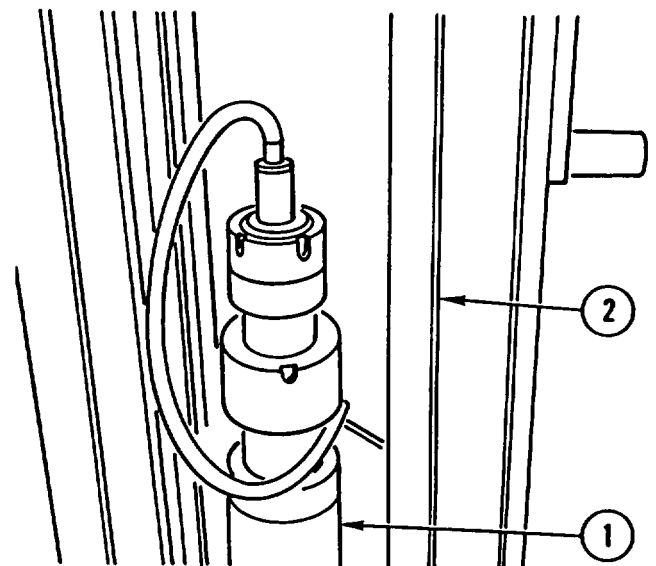
**FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING (CONT)**

3. USING suitable HOIST, LIFT lift CYLINDER (2) clear of mast (5).



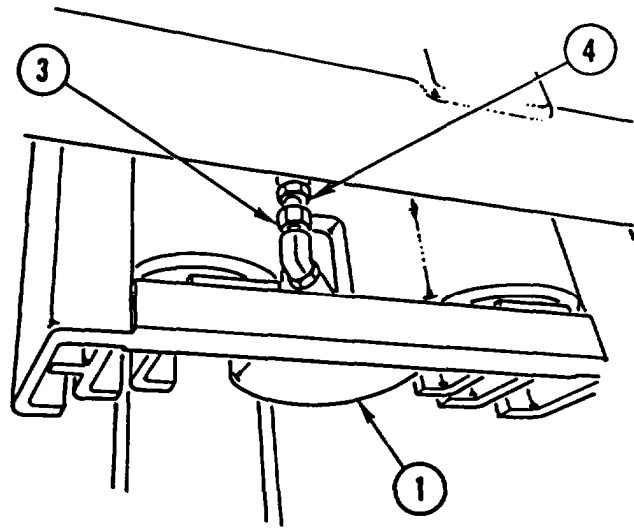
**INSTALLATION**

1. USING suitable HOIST. INSTALL lift CYLINDER (1) in mast (2).



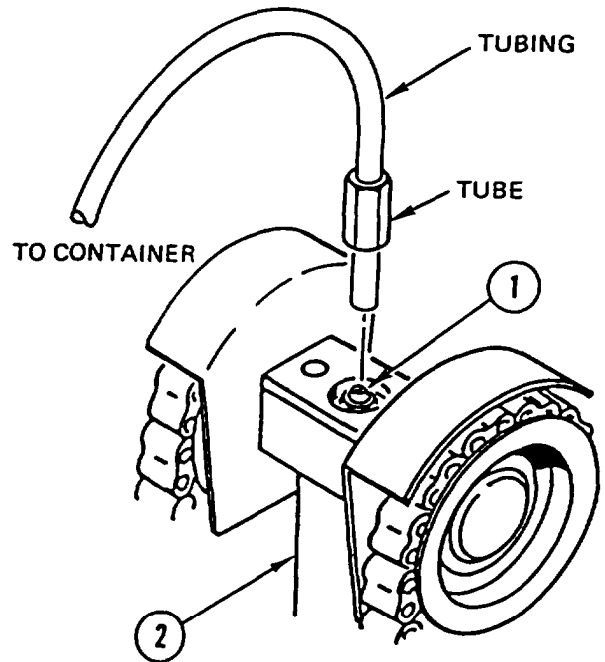
**FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING (CONT)**

2. REMOVE CAP or PLUG from fitting (3). CONNECT HOSE assembly (4) to base of lift cylinder (1).
3. INSTALL FORKLIFT CROSSHEAD (TM 5-2420-224-20).
4. INSTALL FORKLIFT CARRIAGE ASSEMBLY (PAGE 11-44).



**BLEEDING**

1. With no load on forks, extend and retract mast thru one complete cycle.
2. With mast fully lowered, check vehicle hydraulic tank and top off as necessary (LO 5-2420-224-12).
3. Raise and retract mast completely at least four more times. This will force air in system to lift cylinder center cavity under bleeder valve (1).
4. Raise carriage assembly approximately 10 in. (25.4 cm) off ground.
5. Slide tubing through tube and onto bleeder valve (1) located on top of lift cylinder (2). Place other end of tubing in suitable container to catch oil.
6. Open bleeder valve (1) no more than 1/4-turn with tube. Weight of carriage assembly will force air and hydraulic oil out of lift cylinder through bleeder valve (1).
7. If carriage assembly reaches bottom of its travel before all air is bled, close bleeder valve (1) and repeat steps 4 thru 6.
8. When oil stream no longer contains air bubbles, close bleeder valve (1) and tighten to 25-27 lb-ft (44.9-46.6 N.m).
9. Fill hydraulic tank (LO 5-2420-224-12).



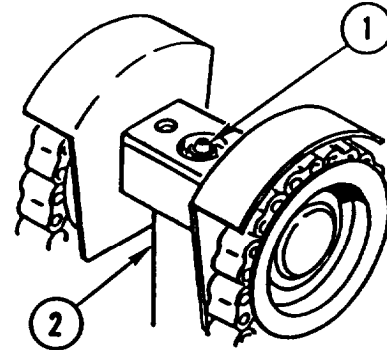
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## FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING (CONT)

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### SEQUENCING

1. Remove bleeder valve (1) on top of slave plunger (2).

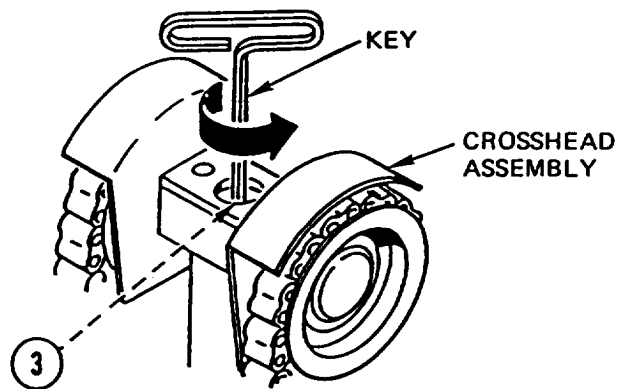


2. Insert key into bleed hole and engage adjusting nut (3).

**NOTE**

Adjusting nut is crimped slightly to prevent free-turning, resulting in stiff movement.

3. Turn adjusting nut (3) counterclockwise until it bottoms. Do not force adjusting nut after it bottoms.
4. Turn adjusting nut (3) clockwise two full turns to provide initial adjustment. Remove key and install bleeder valve (1).

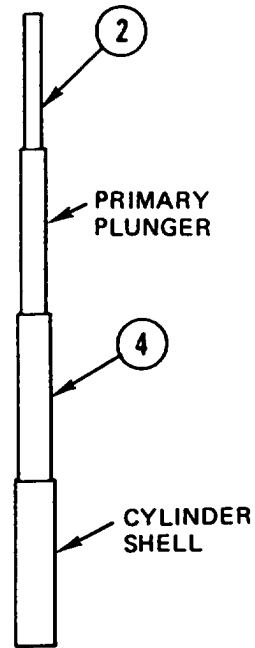


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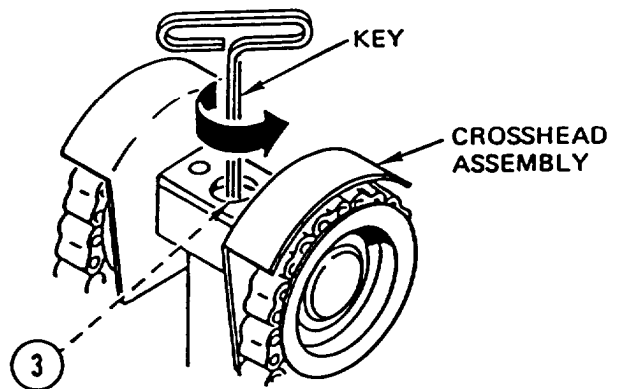
## FORKLIFT LIFT CYLINDER REPLACEMENT, BLEEDING, AND SEQUENCING (CONT)

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5. Operate lift cylinder with half-capacity load to check for proper sequencing. If slave plunger (2) extends too fast and master plunger (4) does not extend at all, sequence valve is not opening. Turn adjusting nut (3) clockwise one turn only. Repeat steps 1 thru 4.



6. Repeat step 5 until lift cylinder sequences properly. Turn adjusting nut (3) maximum of 10 turns.
7. When lift cylinder sequences properly, turn adjusting nut (3) clockwise one turn only to ensure positive adjustment.
8. Extend and retract lift cylinder completely. If lift cylinder does not operate smoothly or seems spongy, repeat steps 3 thru 8 of BLEEDING, above.



---

## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT

---

This task covers: a. Removal b. Installation c. Adjustment

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (2)

Nut, Lock

Washer, Lock (2)

Washer, Lock (2)

Washer, Lock (2)

Washer, Lock (6)

Washer, Lock (4)

Pin, Cotter (4)

Pin, Cotter (2)

Nut, Lock (2)

Washer, Lock (4)

Pin, Cotter (4)

Pin, Cotter (4)

Caps and Plugs

Appendix B, Item 8

Rags

Appendix B, Item 40

**Personnel Required: (2)**

**General Safety Instructions:**

**W A R N I N G**

- Forklift rail upright weighs 172 pounds (78 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift rail upright.
- Forklift upright weighs 196 pounds (89 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift upright.
- Forklift mast assembly weighs 587 pounds (267 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mast assembly.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

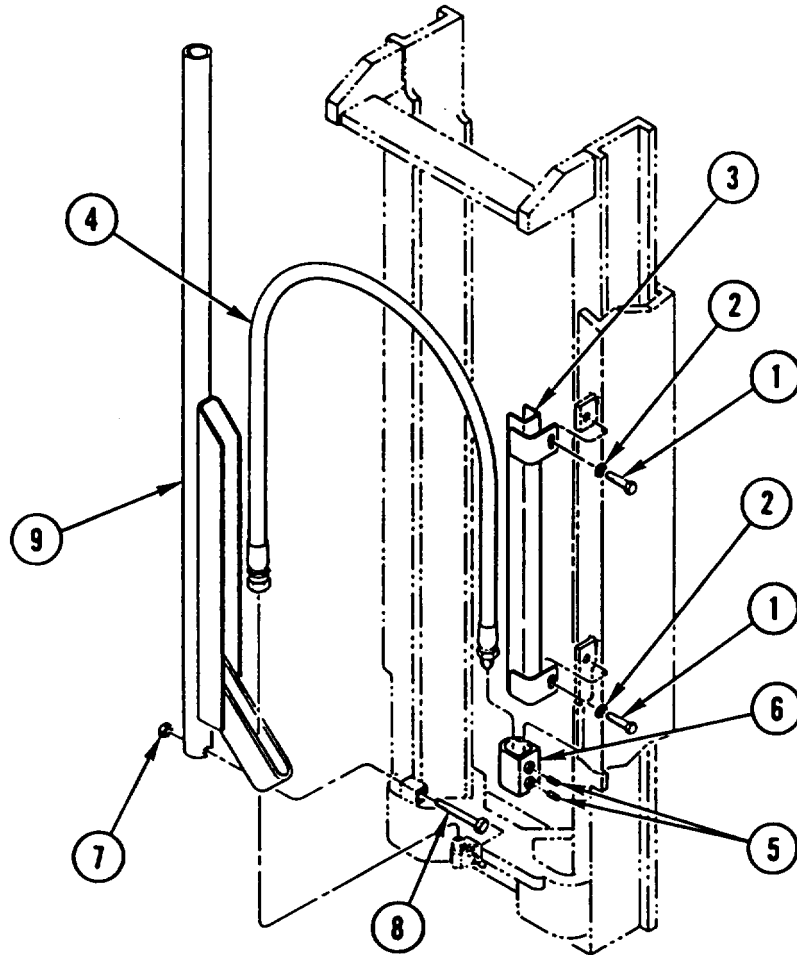


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## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)

---

### REMOVAL



1. REMOVE two capscrews (1), two lock washers (2), and GUIDE (3). DISCARD lock WASHERS.

#### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

#### Note

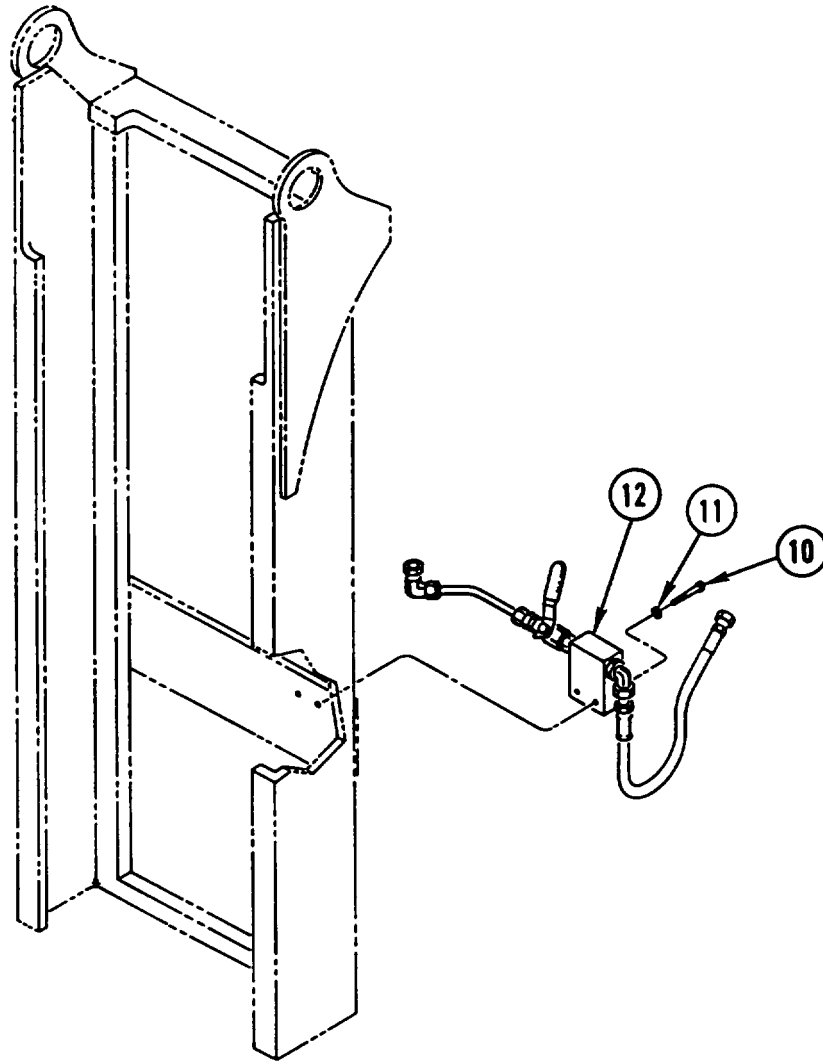
Tag all lines prior to disconnecting to aid in connecting.

2. DISCONNECT HOSE assembly (4). INSTALL CAPS or PLUGS.
3. REMOVE two setscrews (5) and CLAMP (6) from hose assembly (4).
4. REMOVE lock nut (7), capscrew (8), and GUIDE (9). DISCARD lock NUT.

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**FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT  
(CONT)**

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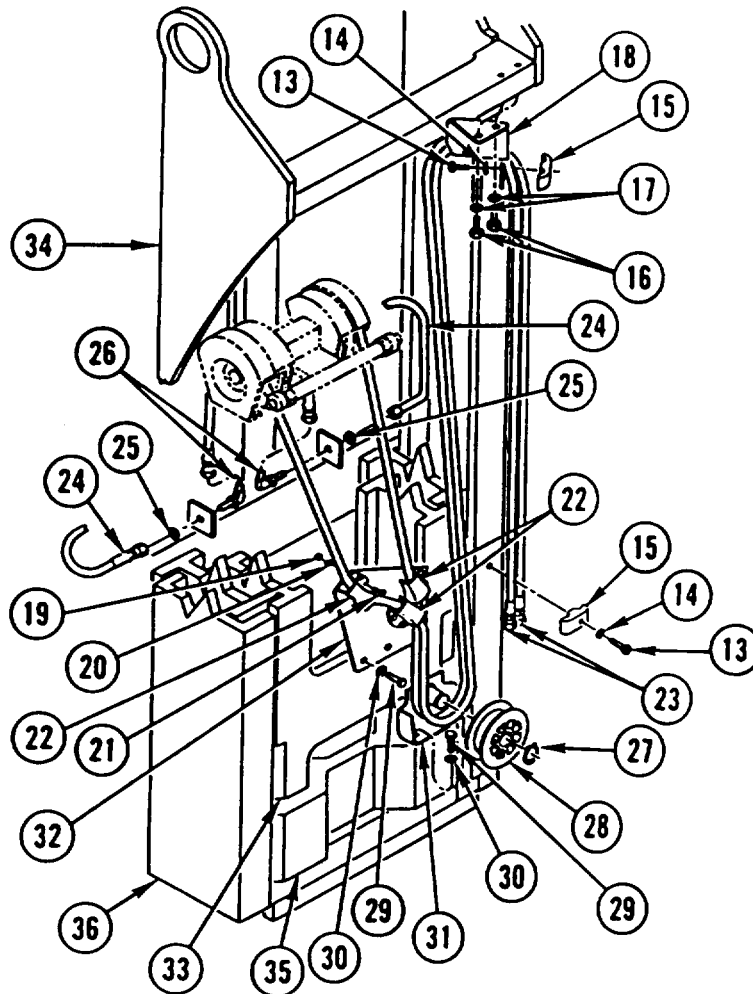


5. REMOVE two capscrews (10), two lock washers (11), and junction BLOCK (12). DISCARD lock WASHERS.

---

## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)

---



6. REMOVE two capscrews (13), two lock washers (14), and two CLAMPS (15). DISCARD lock WASHERS.
7. REMOVE two capscrews (16), two lock washers (17), and BRACKET (18). DISCARD lock WASHERS.
8. REMOVE six nuts (19), six lock washers (20), six capscrews (21), and three GUIDES (22). DISCARD lock WASHERS.

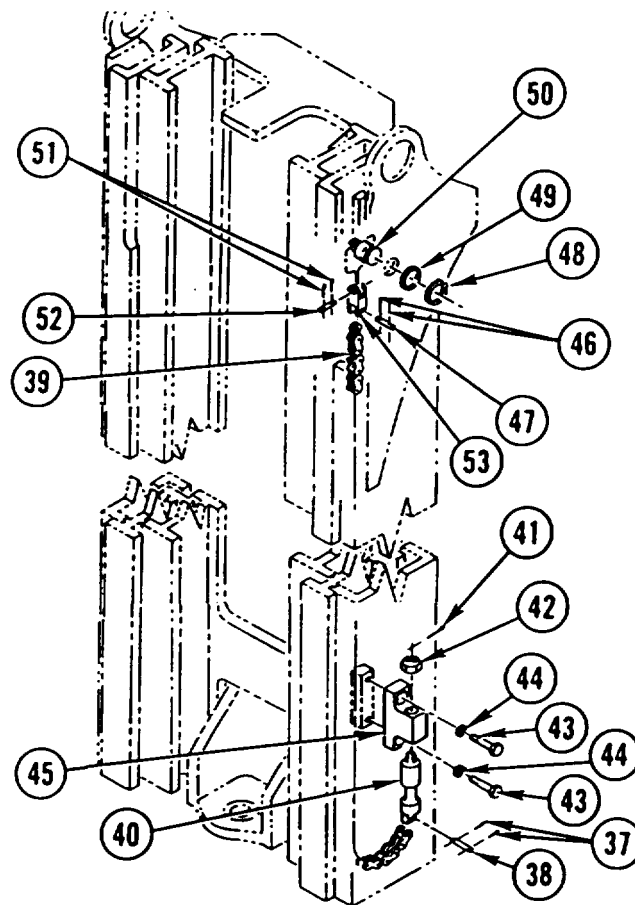
**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

9. DISCONNECT and REMOVE two HOSES (23). INSTALL CAPS or PLUGS.
10. DISCONNECT and REMOVE two HOSES (24). INSTALL CAPS or PLUGS.

## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)

11. REMOVE two nuts (25) and two ELBOWS (26).
12. REMOVE retaining ring (27) and PULLEY (28).
13. REMOVE four capscrews (29), four lock washers (30), and two BRACKETS (31 and 32). DISCARD lock WASHERS.
14. REMOVE rail UPRIGHT (33) from mast assembly (34).
15. REMOVE UPRIGHT (35) from outer upright (36).



### Note

Steps 16 thru 21 are the same for both bootstrap chains.

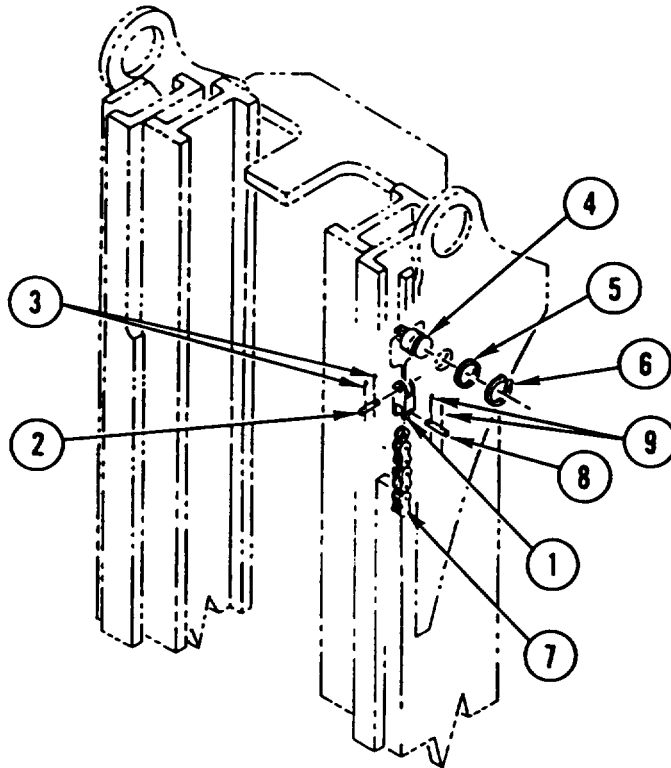
16. REMOVE two cotter pins (37) and PIN (36) and DISCONNECT bootstrap CHAIN (39) from chain anchor (40). DISCARD cotter PINS.
17. REMOVE cotter pin (41), lock nut (42), and chain ANCHOR (40). DISCARD cotter PIN and lock NUT.
18. REMOVE two capscrews (43), two lock washers (44), and ROLLER (45). DISCARD lock WASHERS.
19. REMOVE TWO cotter pins (46), pin (47), and bootstrap CHAIN (39). DISCARD cotter PINS.
20. REMOVE retaining ring (48), shim(s) (49), and STAKE (50).
21. REMOVE two cotter pins (51), pin (52), and connecting LINK (53) from stake (50). DISCARD cotter PINS.

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## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)

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### INSTALLATION

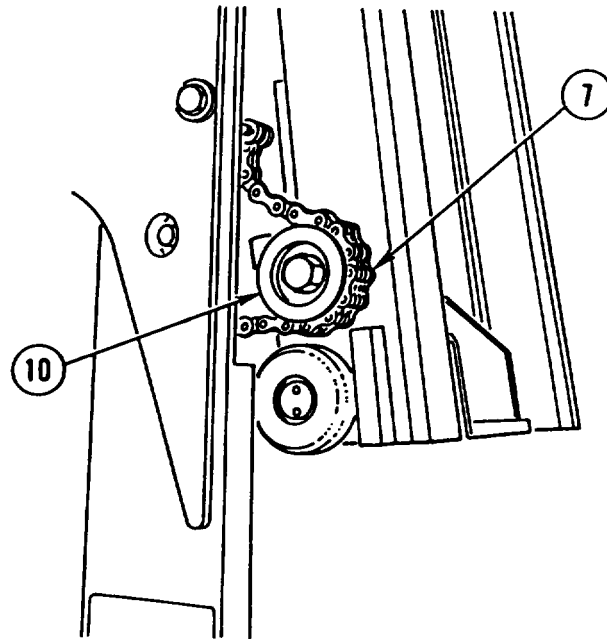


#### NOTE

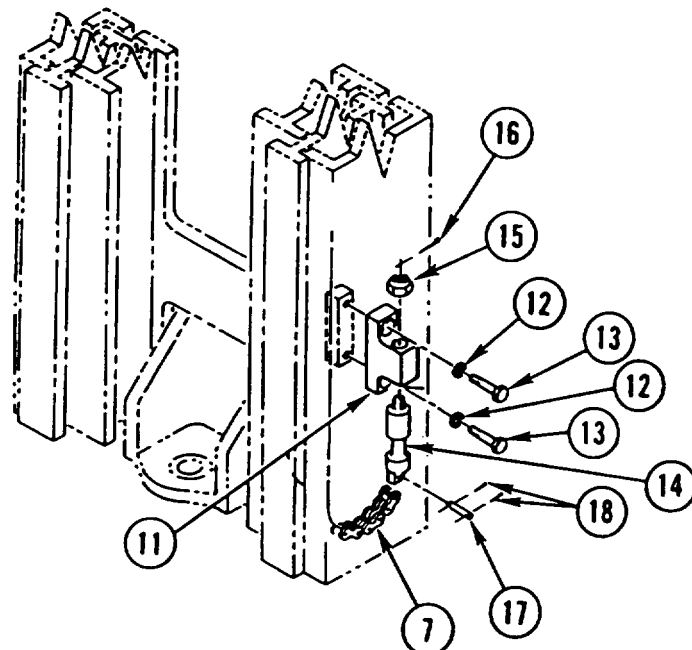
Steps 1 thru 7 are the same for both bootstrap chains.

1. INSTALL adapter LINK (1), pin (2), and two new cotter pins (3) in stake (4).
2. INSTALL STAKE (4), shim(s) (5), and retaining ring (6).
3. INSTALL bootstrap CHAIN (7), pin (8), and two new cotter pins (9).

## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)



4. ROUTE bootstrap CHAIN (7) over bearing (10) as shown.

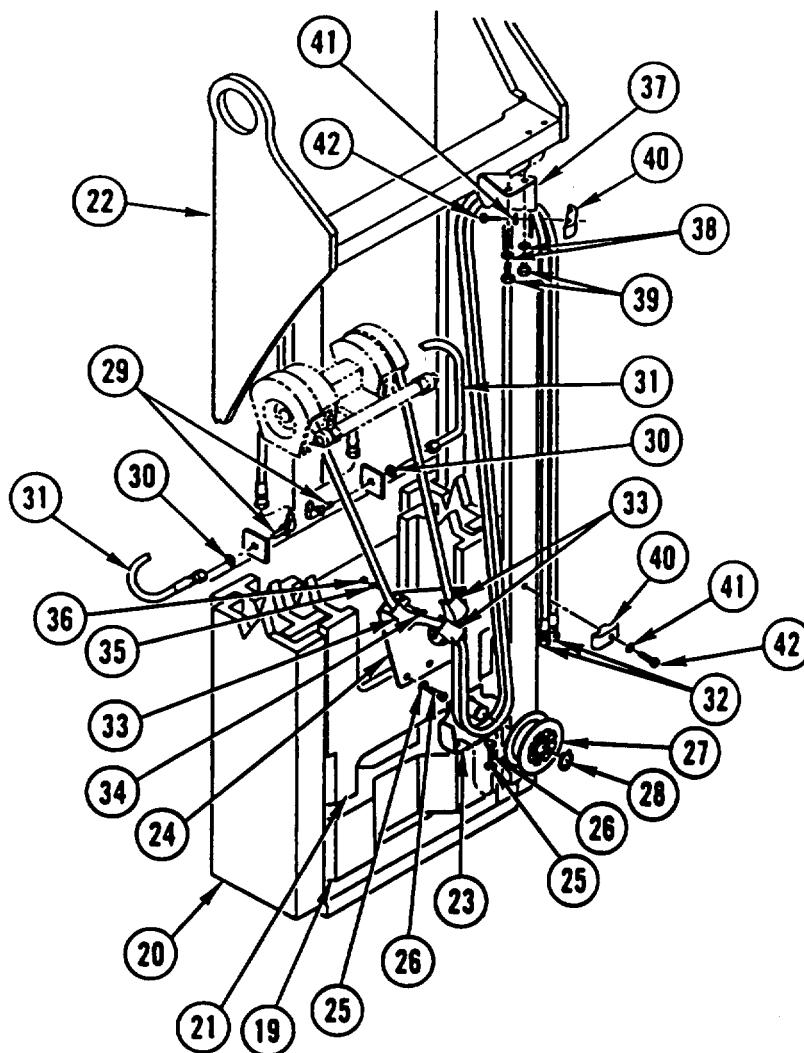


5. INSTALL ROLLER (11), two lock washers (12), and two capscrews (13).
6. INSTALL chain ANCHOR (14), new lock nut (15), and new cotter pin (16).
7. CONNECT bootstrap CHAIN (7) to chain anchor (14) and INSTALL PIN (17) and two new cotter pins (18).

---

**FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT  
(CONT)**

---

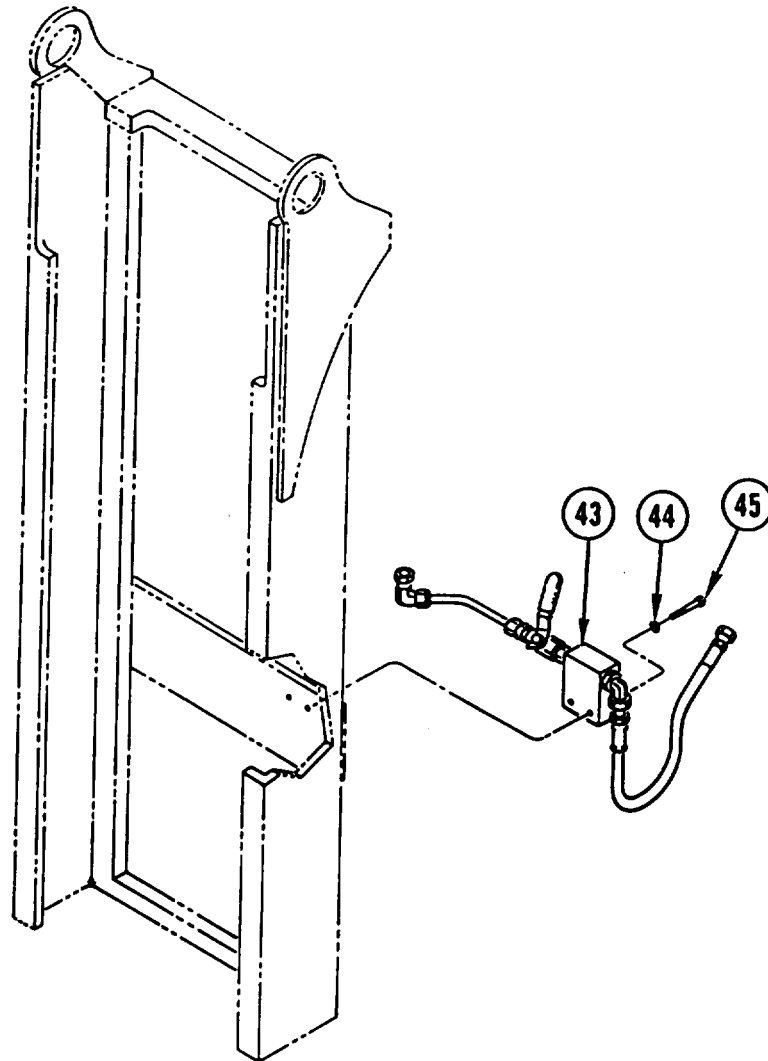


8. INSTALL UPRIGHT (19) in outer upright (20).
9. INSTALL rail UPRIGHT (21) in upright (19).
10. TURN MAST assembly (22) OVER.
11. INSTALL two BRACKETS (23 and 24), four lock washers (25), and four capscrews (26).
12. INSTALL PULLEY (27) and retaining ring (28).
13. INSTALL two ELBOWS (29) and two nuts (30).
14. REMOVE CAPS or PLUGS. INSTALL and CONNECT two HOSES (31).
15. REMOVE CAPS or PLUGS. INSTALL and CONNECT two HOSES (32).
16. INSTALL three GUIDES (33), six capscrews (34), six new lock washers (35), and six nuts (36).
17. INSTALL BRACKET (37), two new lock washers (38), and two capscrews (39).
18. INSTALL two CLAMPS (40), two new lock washers (41), and two capscrews (42).

---

**FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT  
(CONT)**

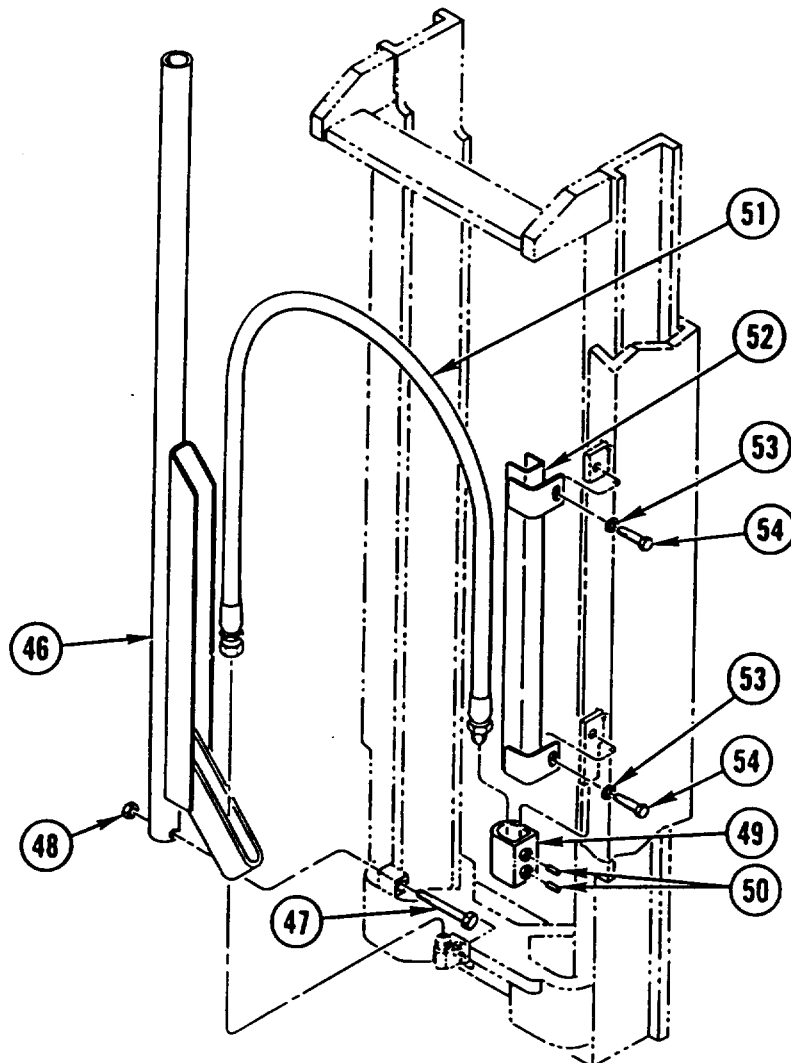
---



19. INSTALL junction BLOCK (43), two new lock washers (44), and two cap screws (45).



## FORKLIFT BOOTSTRAP CHAIN REPLACEMENT AND ADJUSTMENT (CONT)



20. INSTALL GUIDE (46), capscrew (47), and new lock nut (48).
21. INSTALL CLAMP (49) and two setscrews (50) on hose assembly (51).
22. REMOVE CAPS or PLUGS. CONNECT HOSE assembly (51).
23. INSTALL GUIDE (52), two new lock washers (53), and two capscrews (54).

### **ADJUSTMENT**

1. Raise mast until chain adjusting nut is just above outer upright.
2. Tighten or loosen adjusting nut to adjust one bootstrap chain to achieve equal dimension. Adjust other bootstrap chain until equal tension is achieved.
3. Lower mast and check adjustment. All channels should be even with each other at bottom within 1/6 in. (4.17 mm).

## FORKLIFT CARRIAGE CHAIN REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

**Applicable Configuration**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Pin, Cotter (6)

Nut, Lock (2)

**Equipment Condition:**

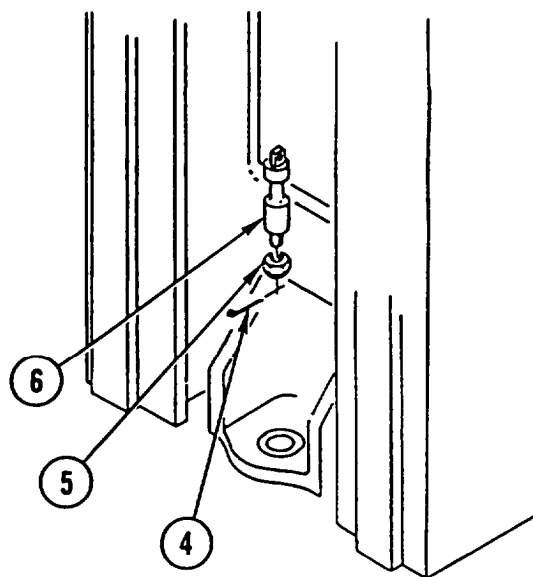
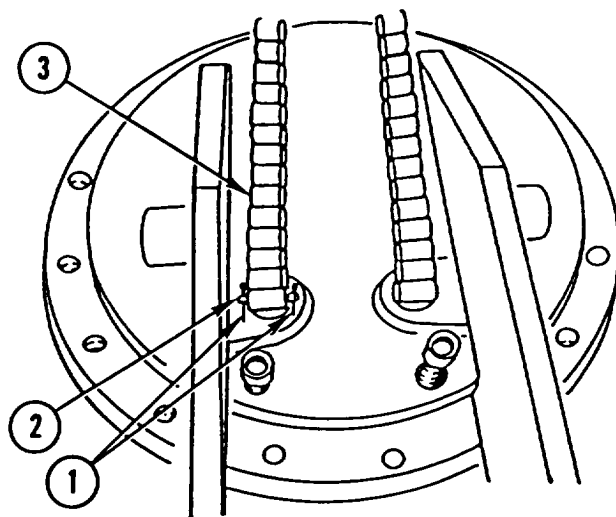
Reference	Condition Description
Page 11-44	Forklift Carriage Assembly Removed

### REMOVAL

**NOTE**

Procedure is the same for both carriage chains.

1. REMOVE two cotter pins (1) and PIN (2) and DISCONNECT carriage CHAIN (3). DISCARD cotter PINS.
  
2. REMOVE cotter pin (4), lock nut (5), and chain ANCHOR (6). DISCARD rotter PIN and lock NUT.



### INSPECTION

If either carriage chain must be replaced, replace both chains.

---

## FORKLIFT CARRIAGE CHAIN REPLACEMENT (CONT)

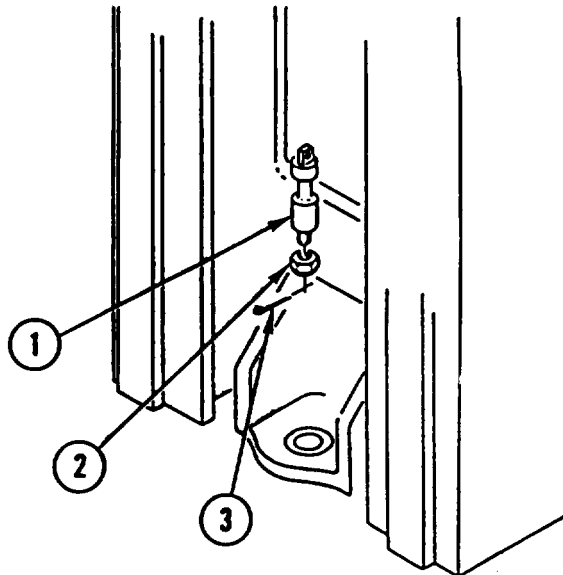
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### INSTALLATION

#### NOTE

Procedure is the same for both carriage chains.

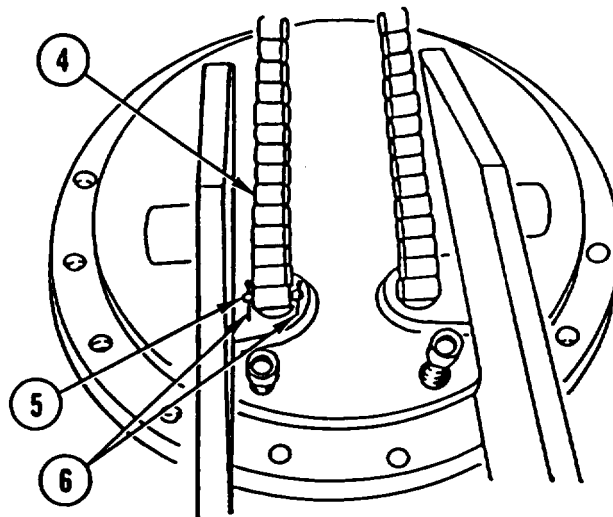
1. INSTALL chain ANCHOR (1), new lock nut (2), and new cotter pin (3).



2. CONNECT carriage CHAIN (4) and INSTALL PIN (5) and two new cotter pins (6).

#### NOTE

Follow-on Maintenance:  
Install forklift carriage assembly  
(page 11-44).



## CHAPTER 12 CRANES, SHOVELS, AND EARTHMOVING EQUIPMENT MAINTENANCE

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the cranes, shovels, and earthmoving equipment. A list of tasks contained in this chapter is shown below.

	Page
Backhoe Main Frame Replacement and Repair . . . . .	12-1
Crane Mast Replacement and Repair . . . . .	12-6
Crane Inner Boom Replacement . . . . .	12-13
Crane Outer Boom Replacement . . . . .	12-15
Crane Extension Boom Replacement . . . . .	12-17
Crane Gear Bearing Replacement . . . . .	12-19
Crane Intermediate Gear Replacement . . . . .	12-25
Crane Drive Gear and Bushings Replacement . . . . .	12-29
Crane Pinion Gear Replacement . . . . .	12-31
Crane Pinion Gear Bushings Replacement . . . . .	12-34

---

### BACKHOE MAIN FRAME REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Inspection c. Repair d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, Welding, SC 4940-95-CL-B19

**Materials/Parts:**

Nut, Lock

**Personnel Required:** (3)

**References:**

TM 5-2420-224-20  
 TM 9-237

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe Stabilizers Removed
TM 5-2420-224-20	Backhoe Swing Cylinders Removed
TM 5-2420-224-20	Backhoe Control Tower Removed
TM 5-2420-224-20	Pintle Assembly Removed

## BACKHOE MAIN FRAME REPLACEMENT AND REPAIR (CONT)

**Equipment Condition (Cont):**

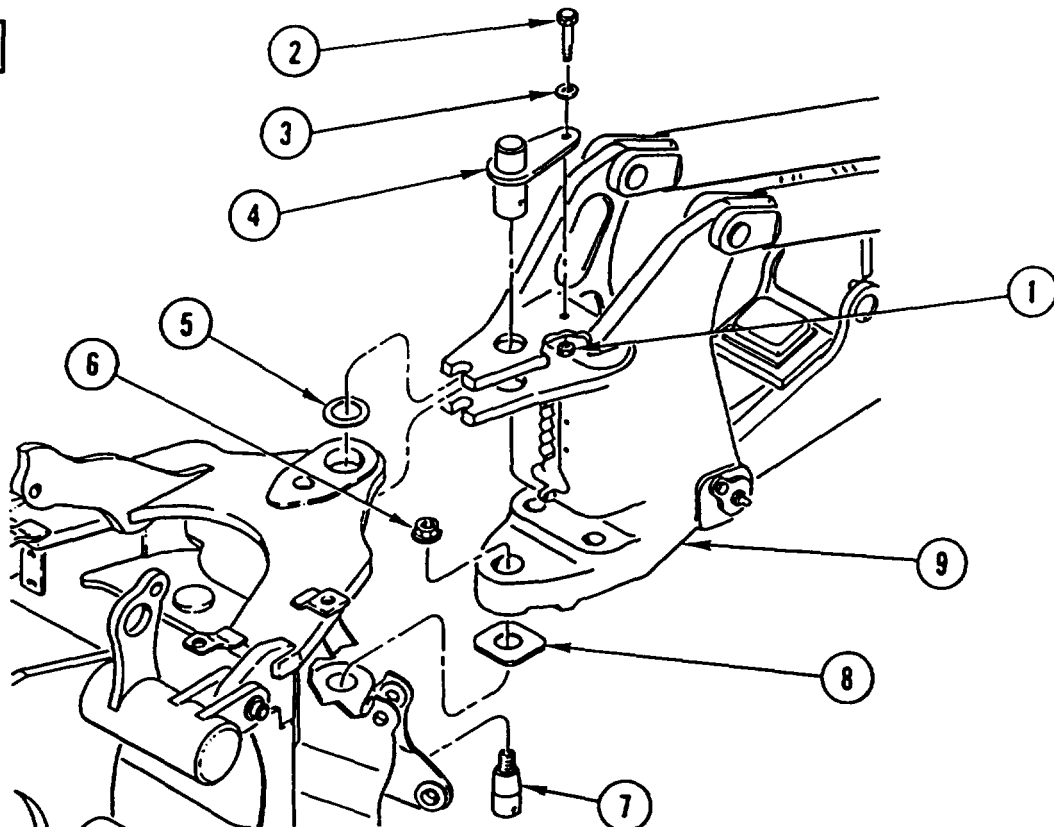
**General Safety Instructions:**

Reference	Condition Description
Page 11-15	Backhoe Control Valve Removed
Page 11-12	Backhoe Stabilizer Control Valve Removed

**WARNING**

- Backhoe assembly without main frame weighs 1,767 pounds (803 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting backhoe assembly without main frame.
- Backhoe frame section weighs 489 pounds (223 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting frame section.

**REMOVAL**

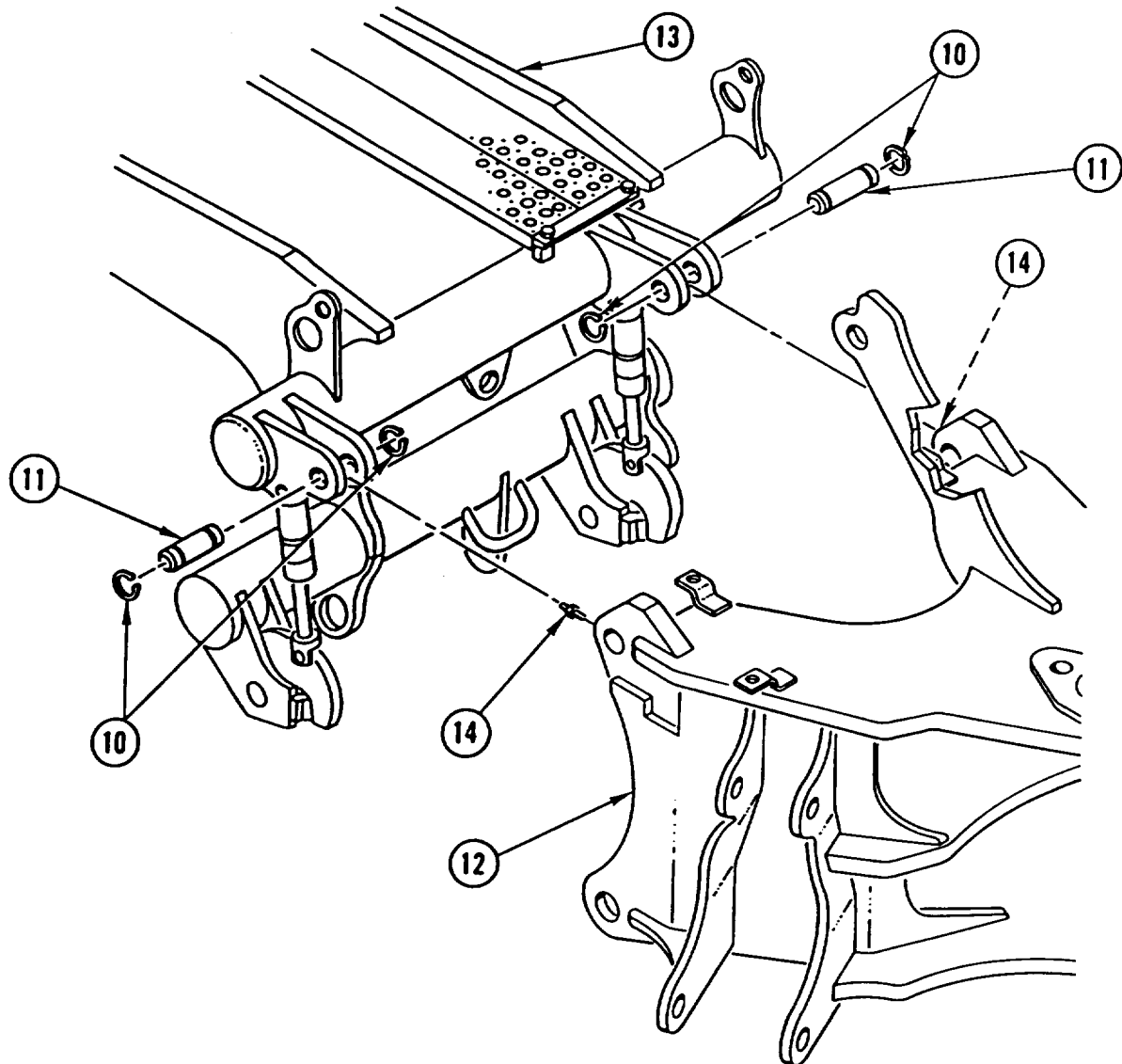


1. REMOVE lock nut (1), capscrew (2), washer (3), PIN (4), and shim (5). DISCARD lock NUT.
2. REMOVE nut (6), pin (7), spacer (8), and DIPPER, BOOM, and swing TOWER assembly (9). MOVE assembly (9) ASIDE.

---

**BACKHOE MAIN FRAME REPLACEMENT AND REPAIR (CONT)**


---



3. REMOVE four retaining rings (10), two pins(n), and frame SECTION (12) from subframe (13).
4. IF DAMAGED, REMOVE two lubrication FITTINGS (14).

**INSPECTION**

If any parts are worn or damaged or if frame section is cracked, tag frame section for repair.

**REPAIR**

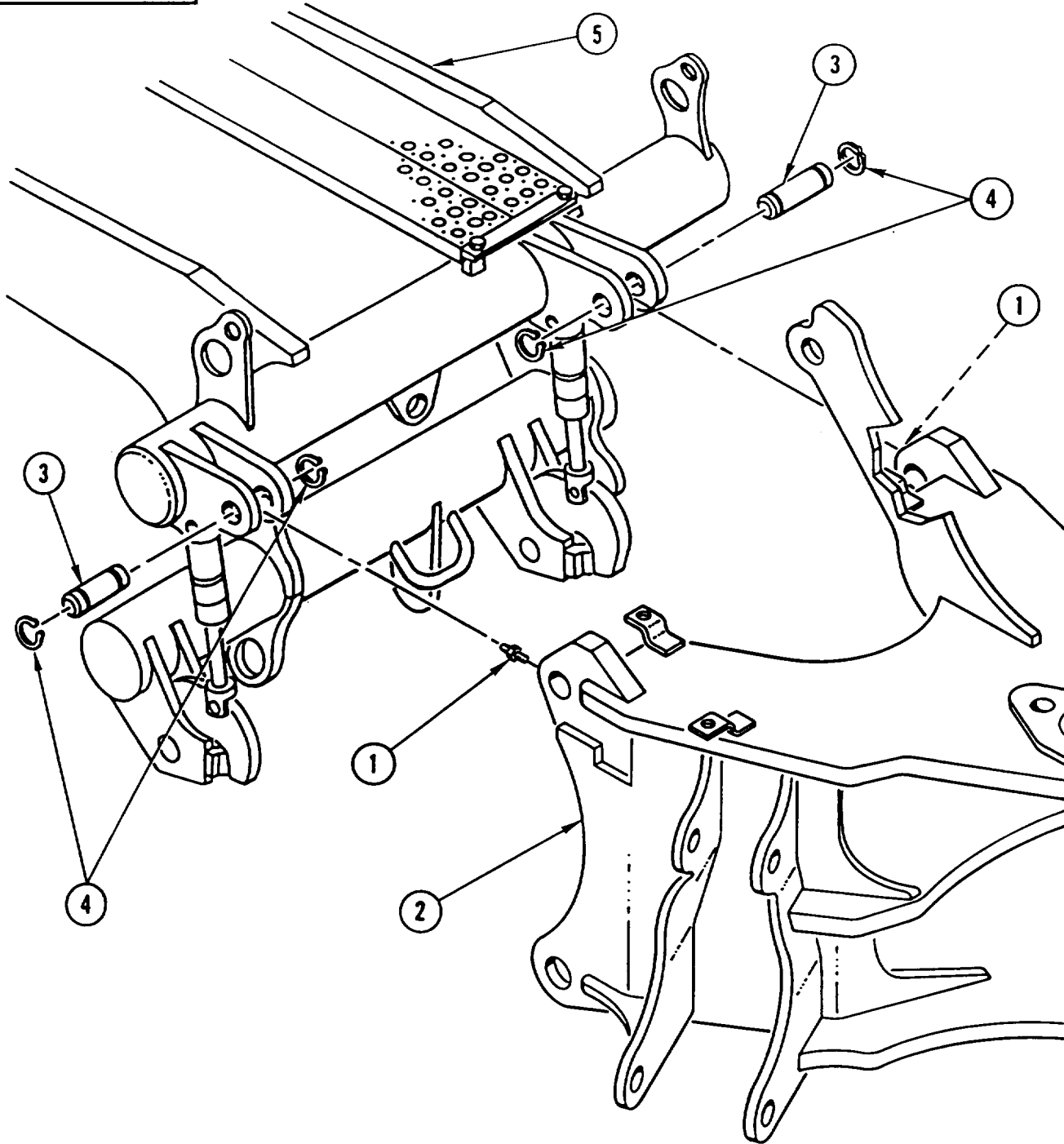
Weld any cracks found in frame (TM 9-237).

---

**BACKHOE MAIN FRAME REPLACEMENT AND REPAIR (CONT)**

---

**INSTALLATION**

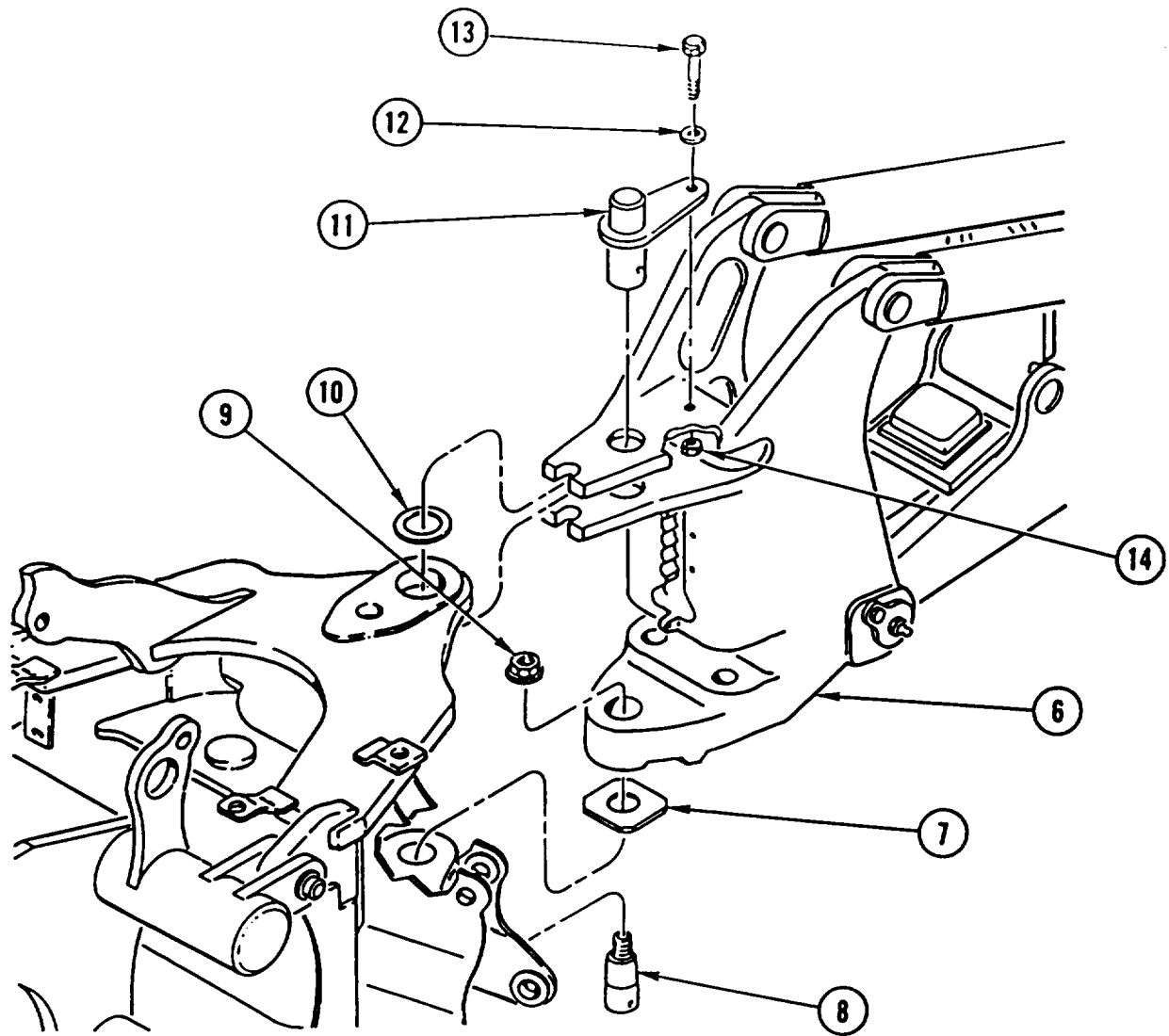


1. IF REMOVED, INSTALL two new lubrication FITTINGS (1).
2. INSTALL frame SECTION (2), two pins (3), and four retaining rings (4) on subframe (5).

---

**BACKHOE MAIN FRAME REPLACEMENT AND REPAIR (CONT)**


---



3. INSTALL DIPPER, BOOM, and swing TOWER assembly (6), spacer (7), pin (8), and nut (9).
4. INSTALL shim (10), PIN (11), washer (12), capscrew (13), and new lock nut (14).

**NOTE**

## Follow-on Maintenance:

- Install backhoe stabilizer control valve (page 11-12).
- Install backhoe control valve (page 11-15).
- Install pintle assembly (TM 5-2420-224-20).
- Install backhoe control tower (TM 5-2420-224-20).
- Install backhoe swing cylinders (TM 5-2420-224-20).
- Install backhoe stabilizers (TM 5-2420-224-20).



## CRANE MAST REPLACEMENT AND REPAIR

This task covers: a. Removal b. Disassembly c. Assembly d. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, Welding, SC 4940-95-CL-B19

**Materials/Parts:**

Washer, Lock (15)  
 Nut, Lock (4)  
 Capscrew (18)  
 Nut, Lock (4)

**Personnel Required:** (3)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
Page 12-13	Crane Inner Boom Removed
TM 5-2420-224-20	Work Lights Removed
TM 5-2420-224-20	Crane Mast Locking Cylinders Removed

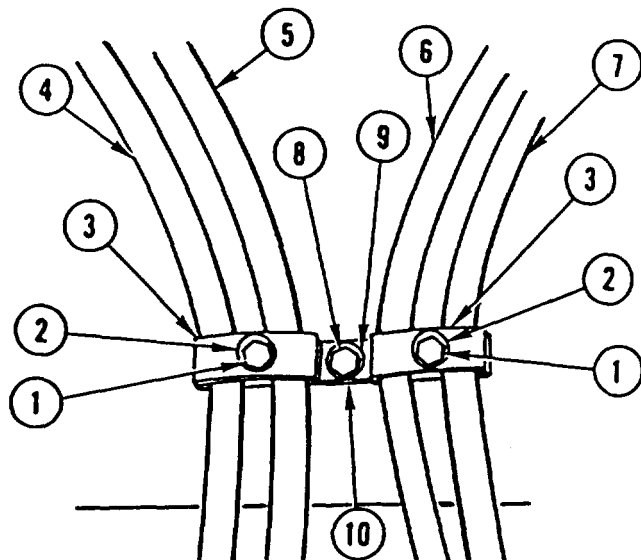
**General Safety Instructions:**

**WARNING**

- Crane mast weldment weighs 492 pounds (223 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane mast weldment.
- Crane base weldment weighs 205 pounds (93 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane base weldment.

### REMOVAL

1. REMOVE two capscrews (1), four lock washers (2), and two hose STRAPS (3). SET four HOSES (4, 5, 6, and 7) ASIDE. DISCARD lock WASHERS.
2. REMOVE capscrew (8), lock washer (9), and hose strap (10). DISCARD lock WASHER.

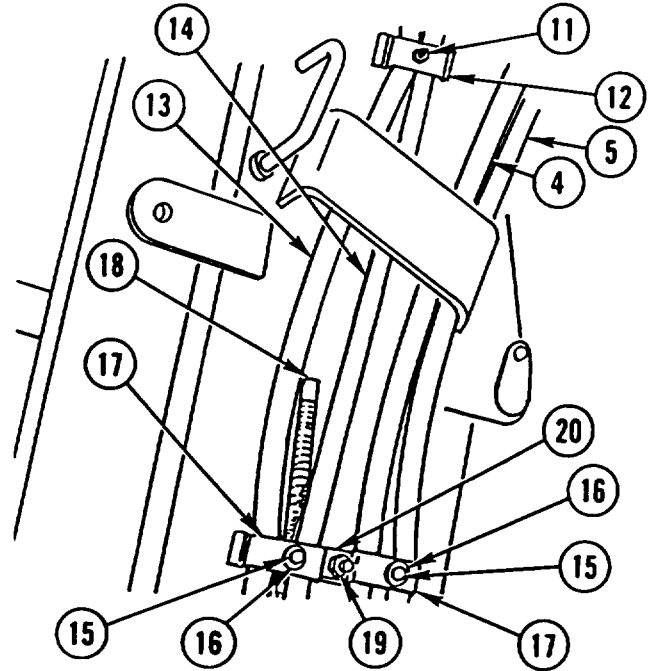


**CRANE MAST REPLACEMENT AND REPAIR (CONT)**

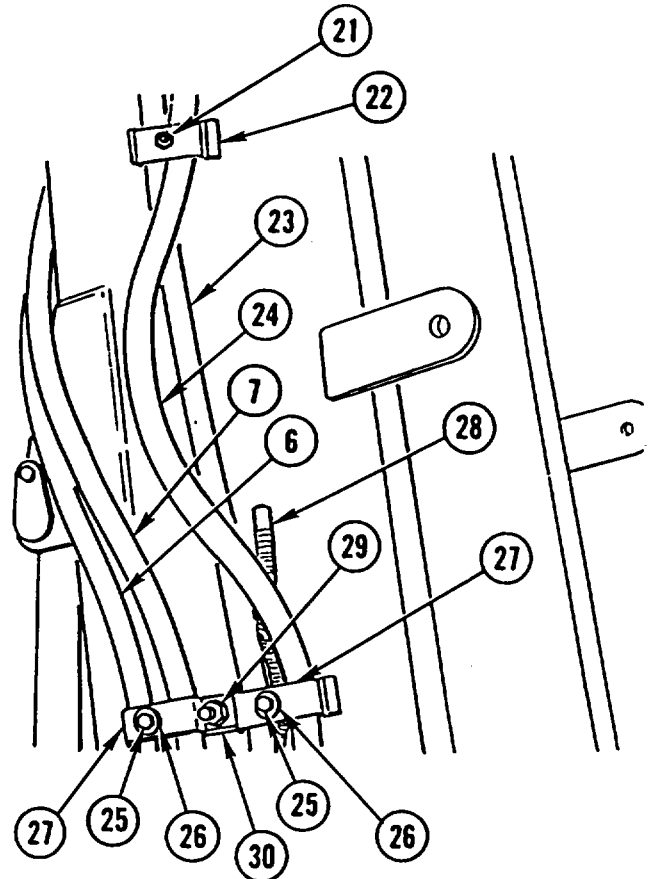
**NOTE**

Tag all lines prior to removal to aid in installation.

3. REMOVE lock nut (11) and hose STRAP (12). SET two HOSES (13 and 14) ASIDE. DISCARD lock NUT.
4. REMOVE two capscrews (15), four lock washers (16), and two hose STRAPS (17). SET four HOSES (4, 5, 13, and 14) and electrical CABLE (18) ASIDE. DISCARD lock WASHERS.
5. REMOVE lock nut (19) and hose STRAP (20). DISCARD lock NUT.



6. REMOVE lock nut (21) and hose STRAP (22). SET two HOSES (23 and 24) aside. DISCARD lock NUT.
7. REMOVE two capscrews (25), four lock washers (26), and two hose STRAPS (27). SET four HOSES (6, 7, 23, and 24) and electrical CABLE (28) ASIDE. DISCARD lock WASHERS.
8. REMOVE lock nut (29) and hose STRAP (30). DISCARD lock NUT.



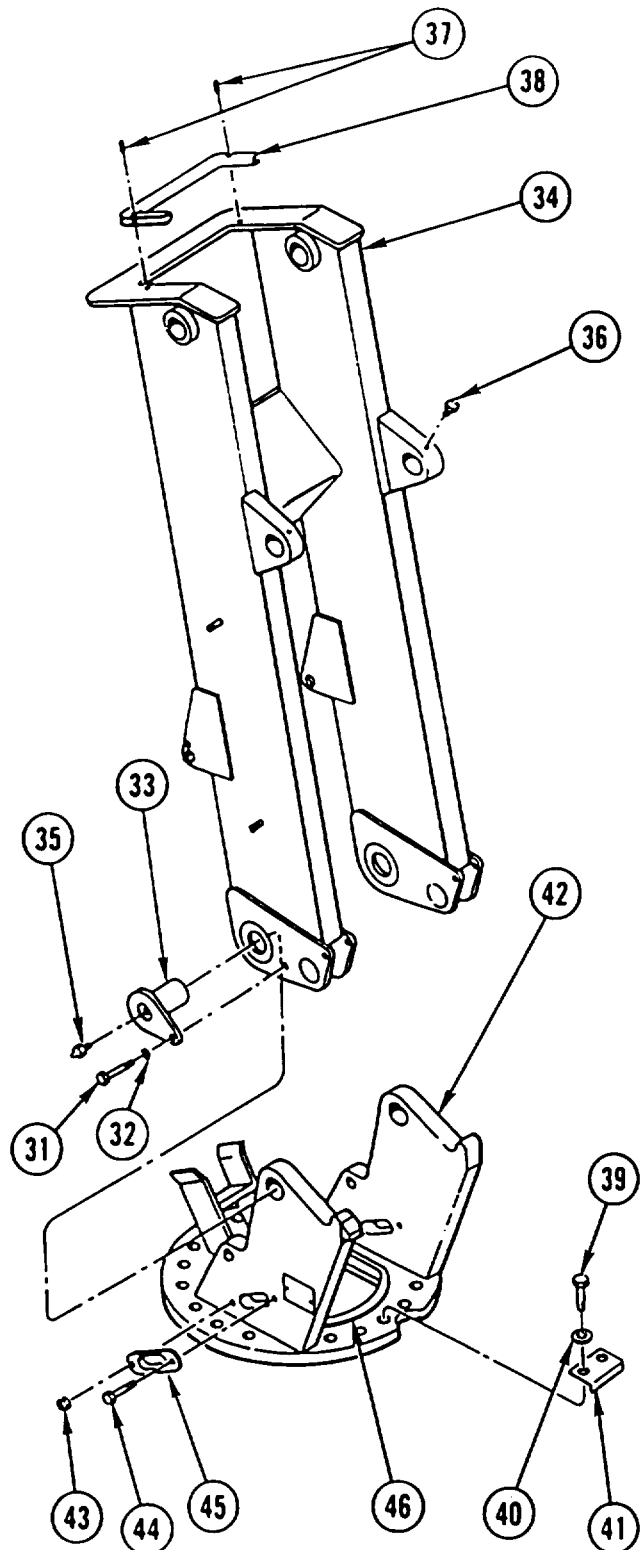
**CRANE MAST REPLACEMENT AND REPAIR (CONT)**

9. REMOVE two capscrews (31), two lock washers (32), two pins (33), and mast WELDMENT (34). DISCARD lock WASHERS.
10. IF DAMAGED, REMOVE two lubrication FITTINGS (35) from two pins (33).
11. IF DAMAGED, REMOVE two lubrication FITTINGS (36) from mast weldment (34).
12. REMOVE two spring pins (37) and hose GUARD (38).

**CAUTION**

Feed hoses through hose guards of base weldment very carefully. Failure to do so could result in damage to hoses.

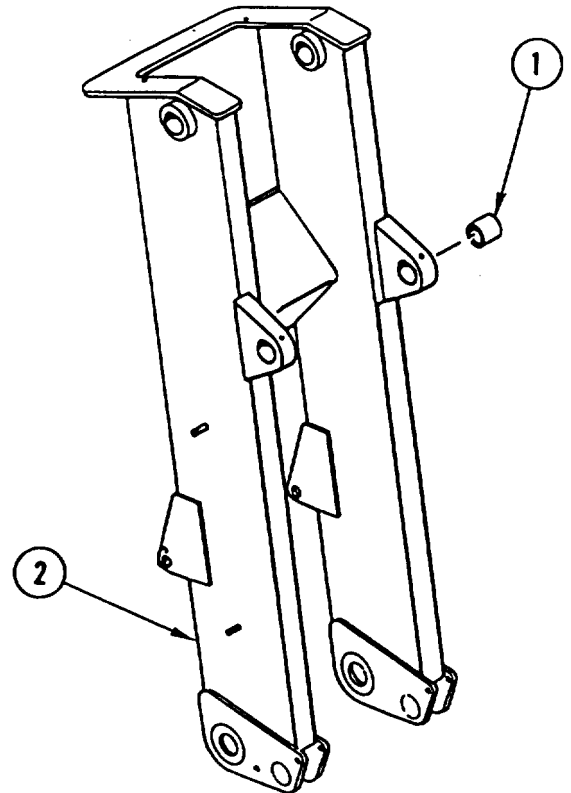
13. REMOVE 18 capscrews (39), 18 washers (40), cover (41), and base WELDMENT (42). DISCARD CAPSCREWS.
14. REMOVE four lock nuts (43), four capscrews (44), and four hose GUARDS (45). DISCARD lock NUTS.
15. REMOVE two hose GUARDS (46).



**CRANE MAST REPLACEMENT AND REPAIR (CONT)**

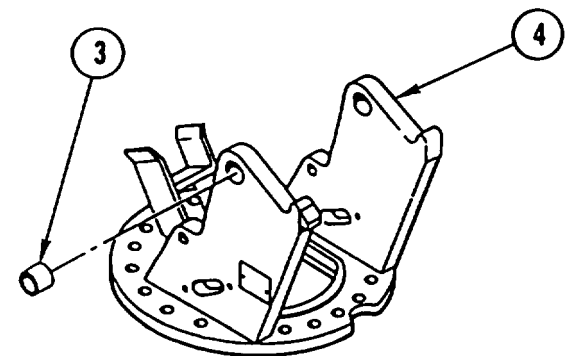
**DISASSEMBLY**

1. REMOVE two BUSHINGS (1) from mast weldment (2).
2. REMOVE two BUSHINGS (3) from base weldment (4).



**ASSEMBLY**

1. INSTALL two BUSHINGS (3) in base weldment (4).
2. INSTALL two BUSHINGS (1) in mast weldment (2).



**CRANE MAST REPLACEMENT AND REPAIR (CONT)**

**INSTALLATION**

1. INSTALL two hose GUARDS (1).
2. INSTALL four hose GUARDS (2), four capscrews (3), and four new lock nuts (4).

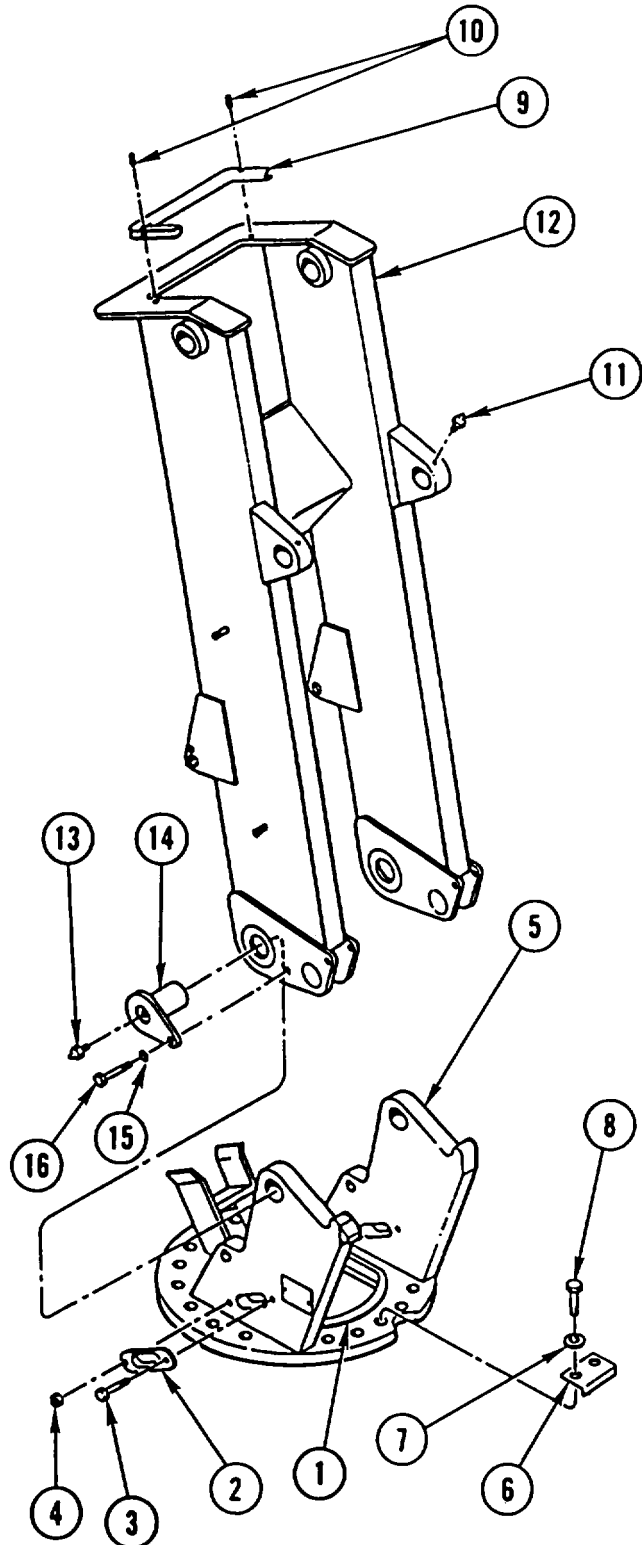
**CAUTION**

Feed hoses through hose guards of base weldment very carefully. Failure to do so could result in damage to hoses.

**NOTE**

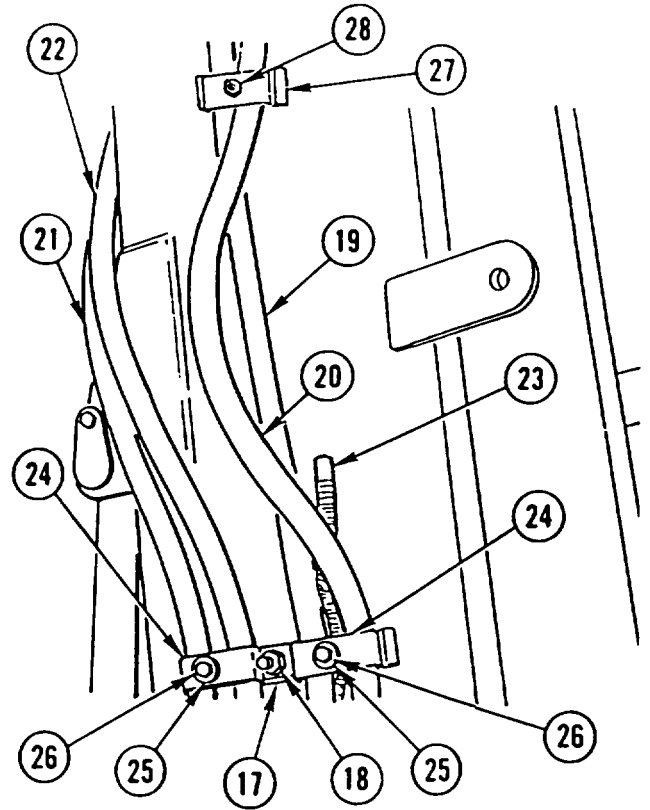
Make sure cover is installed over notch in base weldment.

3. INSTALL base WELDMENT (5), cover (6), 18 washers (7), and 18 new capscrews (8).
4. INSTALL hose GUARD (9) and two spring pins (10).
5. IF REMOVED, INSTALL two new lubrication FITTINGS (11) in mast weldment (12).
6. IF REMOVED, INSTALL two new lubrication FITTINGS (13) in two pins (14).
7. INSTALL mast WELDMENT (12), two pins (14), two new lock washers (15), and two capscrews (16).

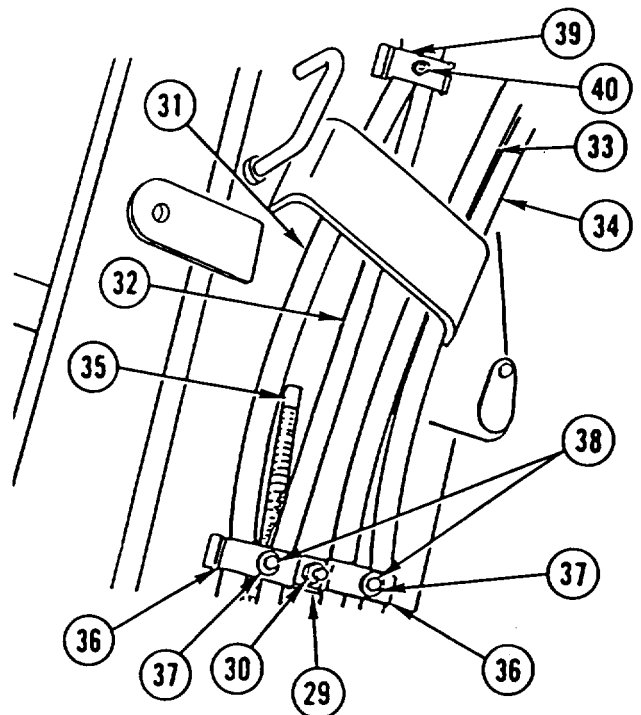


**CRANE MAST REPLACEMENT AND REPAIR (CONT)**

8. INSTALL hose STRAP (17) and new lock nut (18).
9. INSTALL four HOSES (19, 20, 21, and 22), electrical CABLE (23), two hose straps (24), four new lock washers (25), and two capscrews (26).
10. INSTALL two HOSES (19 and 20), hose strap (27), and new lock nut (28).



11. INSTALL hose STRAP (29) and new lock nut (30).
12. INSTALL four HOSES (31, 32, 33, and 34), electrical CABLE (35), two hose straps (36), four new lock washers (37), and two capscrews (38).
13. INSTALL two HOSES (31 and 32), hose strap (39), and new lock nut (40).



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## CRANE MAST REPLACEMENT AND REPAIR (CONT)

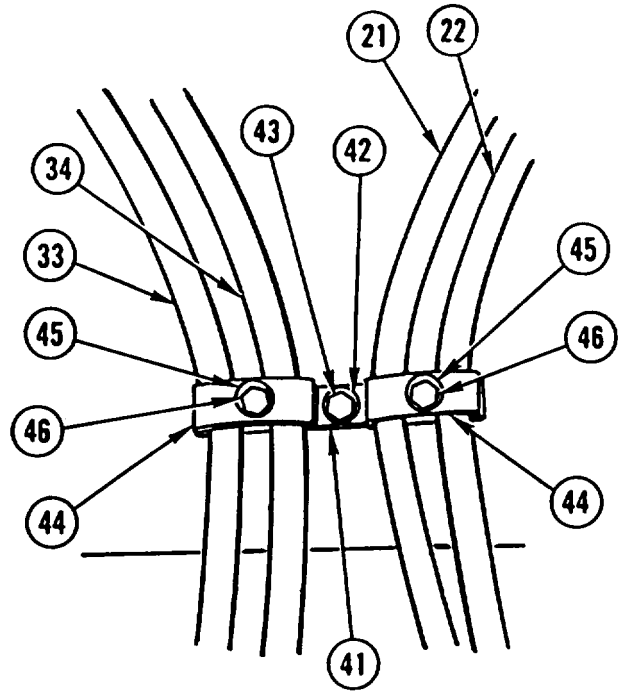
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14. INSTALL hose STRAP (41), new lock washer (42), and capscrew (43).
15. INSTALL four HOSES (21, 22, 33, and 34), two hose straps (44), four new lock washers (45), and two capscrews (46).

**NOTE**

Follow-on Maintenance:

Install crane mast locking cylinders (TM 5-2420-224-20).  
Install work lights (TM 5-2420-224-20).  
Install crane inner boom (page 12-13).



## CRANE INNER BOOM REPLACEMENT

This task covers: a. Removal b. Installation

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-9042L-N26

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

TM 5-2420-224-20

Page 12-15

**Condition Description**

Crane Inner Boom Lift  
 Cylinders Removed

Crane Inner Boom Lift  
 Cylinder Hydraulic Lines  
 and Fittings Removed

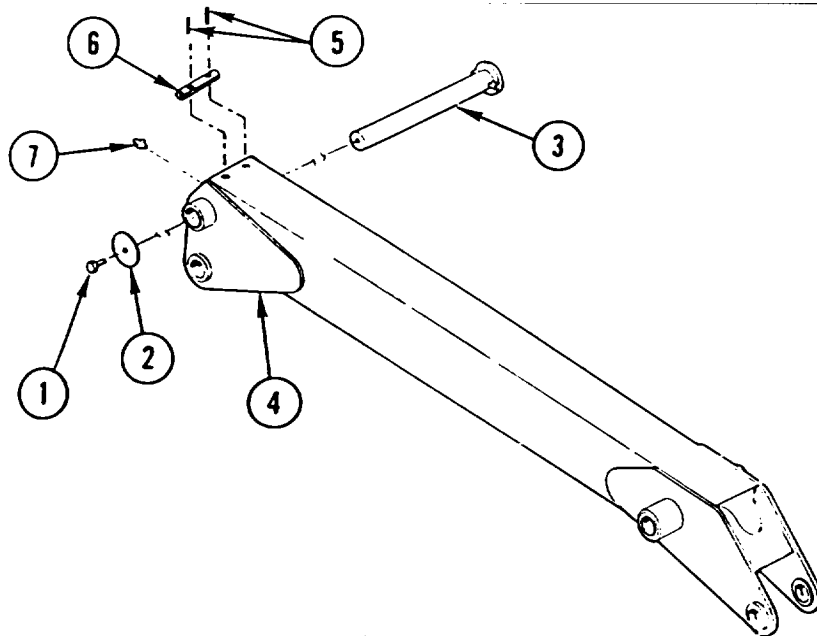
Crane Outer Boom  
 Removed

**General Safety Instructions:**

**WARNING**

Crane inner boom weighs 219 pounds (99 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane inner boom.

**REMOVAL**



2. REMOVE two spring pins (5) and hose GUARD (6).
3. IF DAMAGED, REMOVE lubrication FITTING (7).

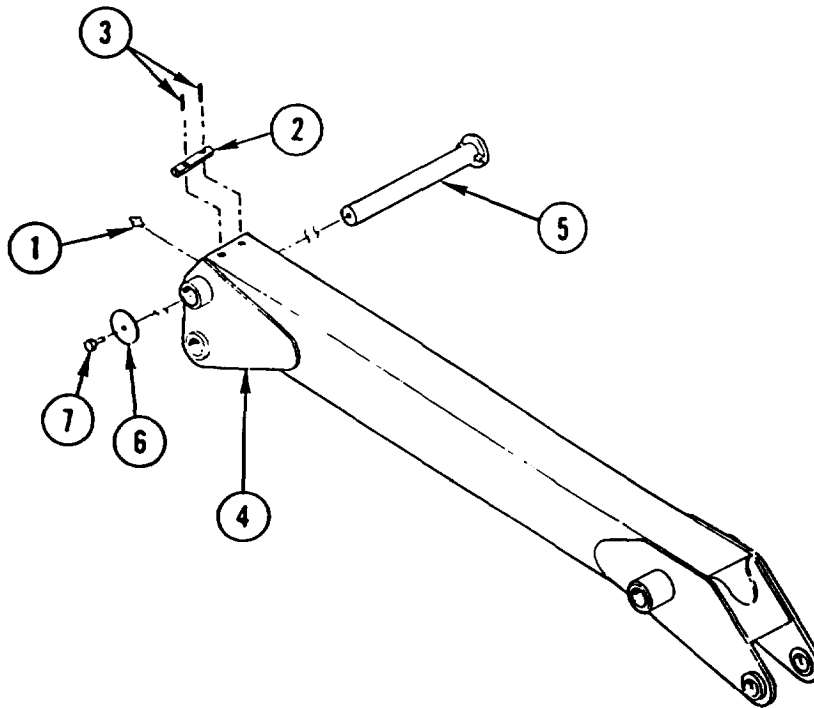


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## CRANE INNER BOOM REPLACEMENT (CONT)

---

### INSTALLATION



1. IF REMOVED, INSTALL new lubrication FITTING (1).
2. INSTALL hose GUARD (2) and two spring pins (3).
3. USING suitable HOIST, INSTALL inner BOOM (4), pin (5), retainer plate (6), and capscrew (7).

#### NOTE

Follow-on Maintenance:

Install crane inner boom lift cylinders (TM 5-2420-224-20).  
Install crane inner boom lift cylinder hydraulic lines and fittings (TM 5-2420-224-20).  
Install crane outer boom (page 12-15).

## CRANE OUTER BOOM REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

**Condition Description**

TM 5-2420-224-20

Crane Outer Boom  
 Cylinder Removed

TM 5-2420-224-20

Crane Outer Boom  
 Cylinder Hydraulic Lines  
 and Fittings Removed

Page 12-17

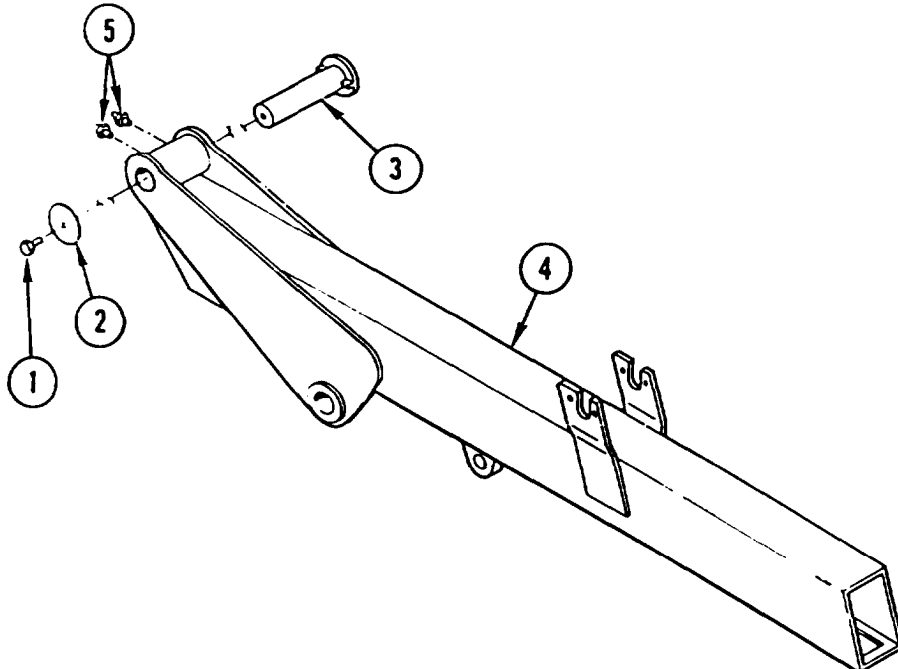
Crane Extension Boom  
 Removed

**General Safety Instructions:**

**WARNING**

Crane outer boom weighs 119 pounds (89 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane outer boom.

### REMOVAL



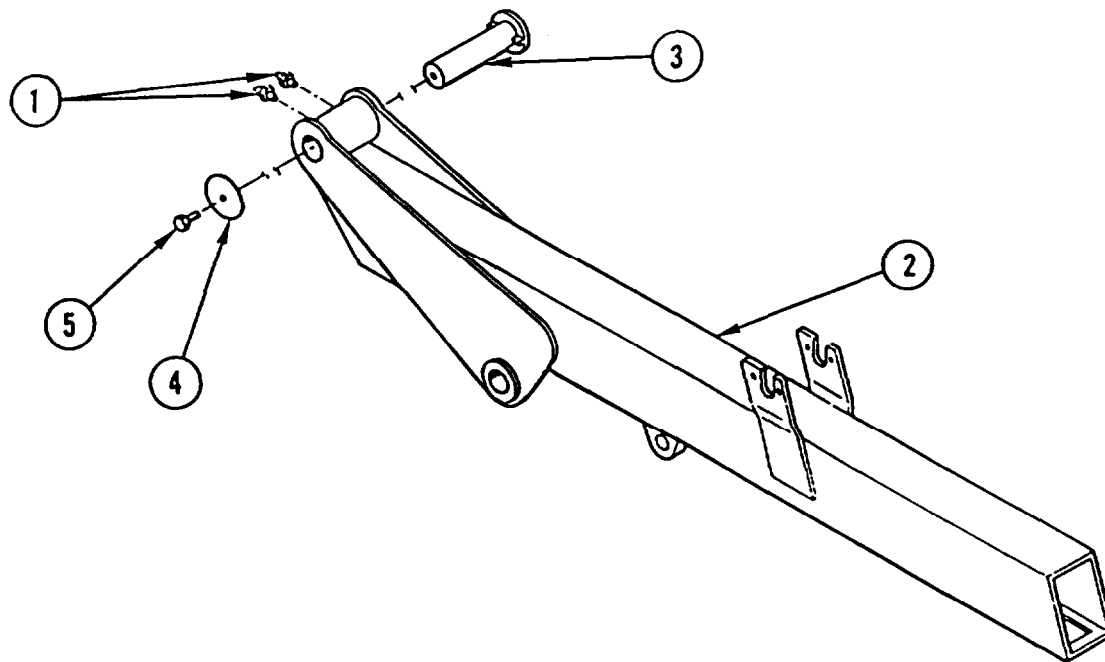
1. USING suitable HOIST, REMOVE capscrew (1), washer (2), pin (3), and outer BOOM (4).
2. IF DAMAGED, REMOVE two lubrication FITTINGS (5).

---

## CRANE OUTER BOOM REPLACEMENT (CONT)

---

### INSTALLATION



1. IF REMOVED, INSTALL two new lubrication FITTINGS (1).
2. USING suitable HOIST, INSTALL outer BOOM (2), pin (3), washer (4), and capscrew (5).

#### NOTE

Follow-on Maintenance:

- Install crane outer boom cylinder (TM 5-2420-224-20).
- Install crane outer boom cylinder hydraulic lines and fittings (TM 5-2420-224-20).
- Install crane extension boom (page 12-17).

## CRANE EXTENSION BOOM REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Personnel Required:** (2)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane External End Extension Cylinder Removed
TM 5-2420-224-20	Crane Hook Assembly Removed

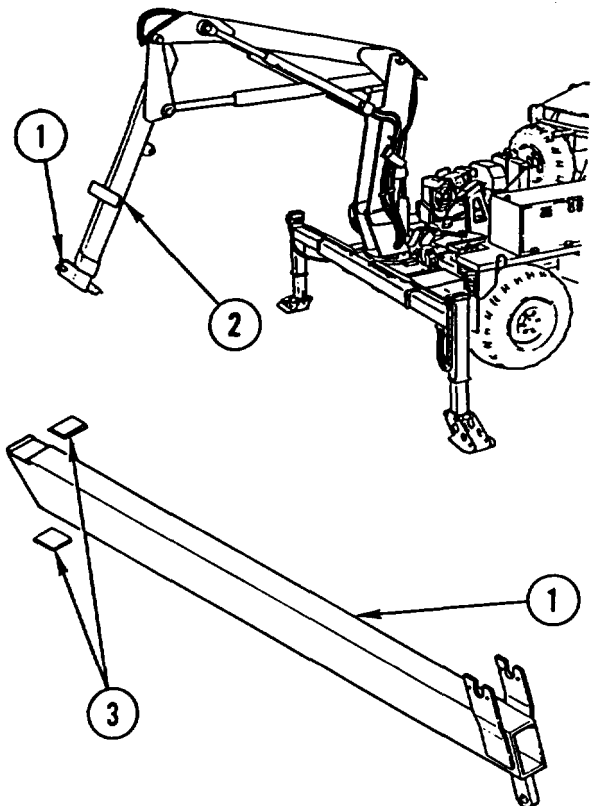
**General Safety Instructions:**

**WARNING**

Crane extension boom weighs 172 pounds (78 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane extension boom.

### REMOVAL

1. USING suitable HOIST, REMOVE extension BOOM (1) from outer boom (2).
2. REMOVE two friction LININGS (3).



---

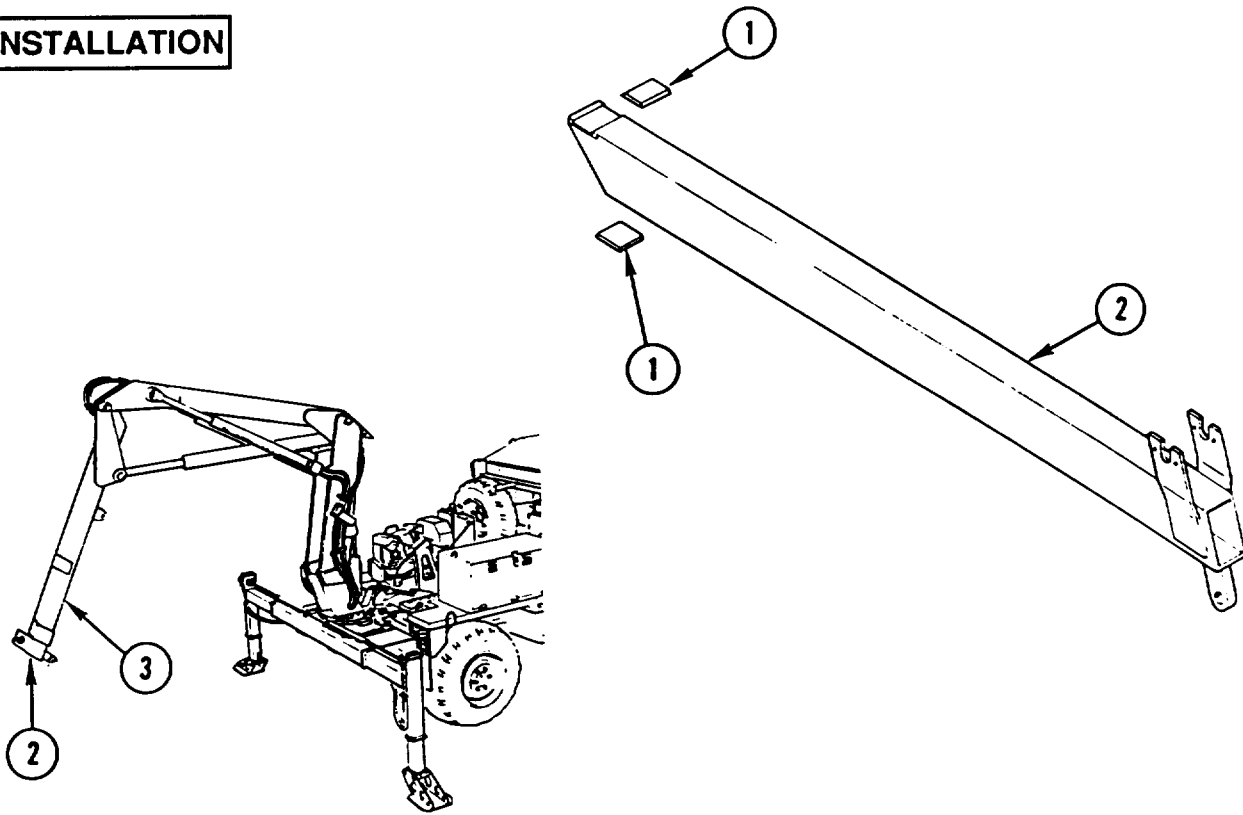
## CRANE EXTENSION BOOM REPLACEMENT (CONT)

---

### INSPECTION

With friction linings installed, measure height of friction lining above level surface of extension boom. Thickness of friction lining above metal surface should not be less than 0.04-0.06 in. (0.1-0.2 cm). If measurement is less, replace friction lining.

### INSTALLATION



1. INSTALL two friction LININGS (1).
2. USING suitable HOIST, carefully SLIDE extension BOOM (2) into outer boom (3).

### NOTE

Follow-on Maintenance:

Install crane external end extension cylinder (TM 5-2420-224-20).  
Install crane hook assembly (TM 5-2420-224-20).

---

## CRANE GEAR BEARING REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-AM  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (4)

Capscrew (36)

Caps and Plugs                      Appendix B, Item 8

Compound, Seating                Appendix B, Item 15

Rags                                      Appendix B, Item 40

**Personnel Required:** (3)

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Pressure Relieved

**General Safety Instructions:**

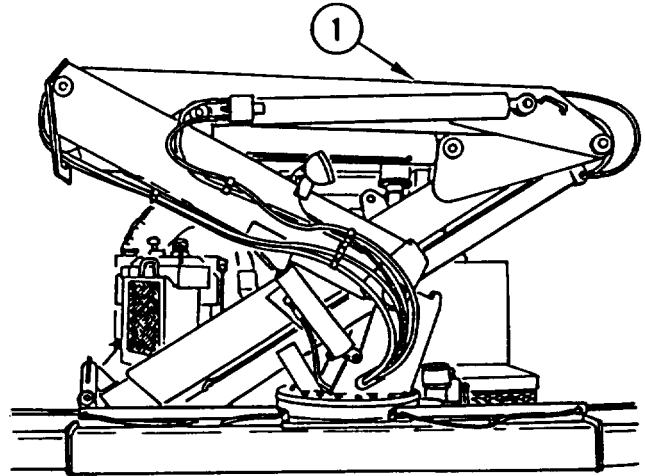
**W A R N I N G**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Crane assembly weighs 1,625 pounds (738 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting crane assembly.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- 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.

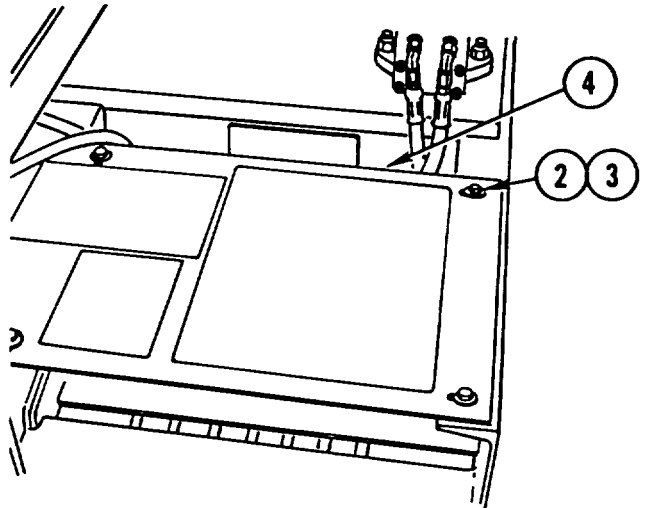
## CRANE GEAR BEARING REPLACEMENT (CONT)

### REMOVAL

1. PLACE CRANE (1) in position shown.



2. REMOVE four capscrews (2), four lock washers (3), and COVER (4). DISCARD lock WASHERS.



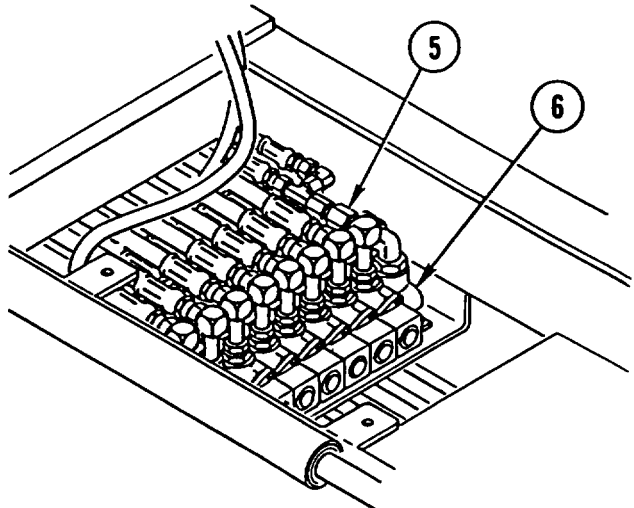
#### CAUTION

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

#### NOTE

Tag all lines prior to disconnecting to aid in connecting.

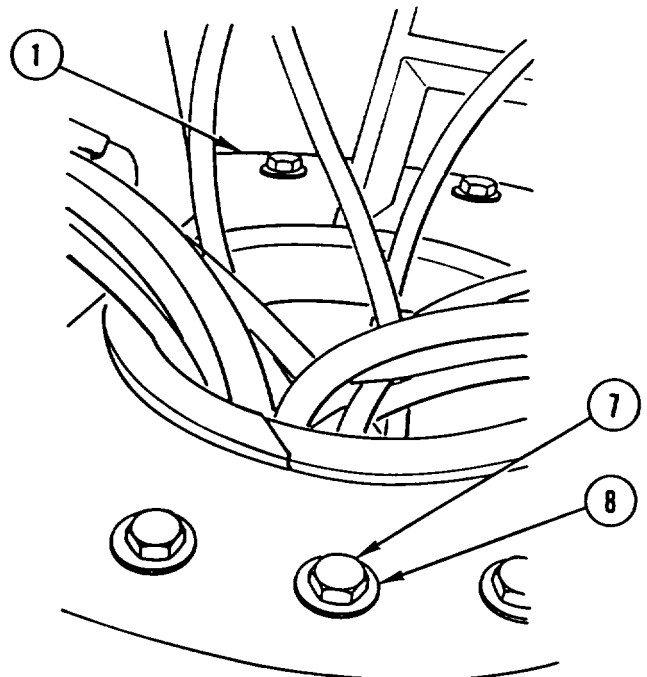
3. DISCONNECT 16 hydraulic HOSES (5) from valve body (6). INSTALL CAPS or PLUGS.



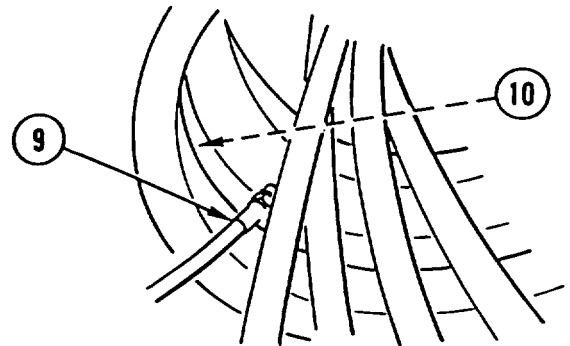
**CRANE GEAR BEARING REPLACEMENT (CONT)**

**CAUTION**  
Carefully feed hydraulic hoses through opening to prevent damage to hoses.

- REMOVE 18 capscrews (7), 18 washers (8), and CRANE assembly (1). DISCARD CAPSCREWS.

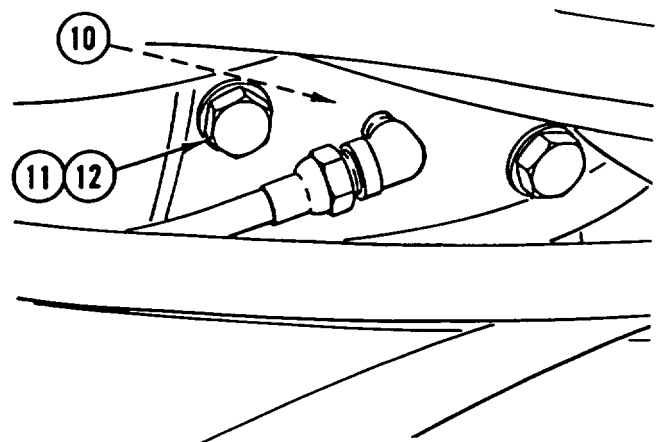


- DISCONNECT lubrication LINE (9) on gear bearing (10) and set aside.



**CAUTION**  
Support gear bearing to prevent gear bearing from dropping.

- REMOVE 18 capscrews (11), 18 washers (12), and gear BEARING (10). Discard capscrews.



**CLEANING**

Thoroughly clean top of base and bottom of gear bearing. Both mating surfaces must be completely clean and dry with no oil or grease present.



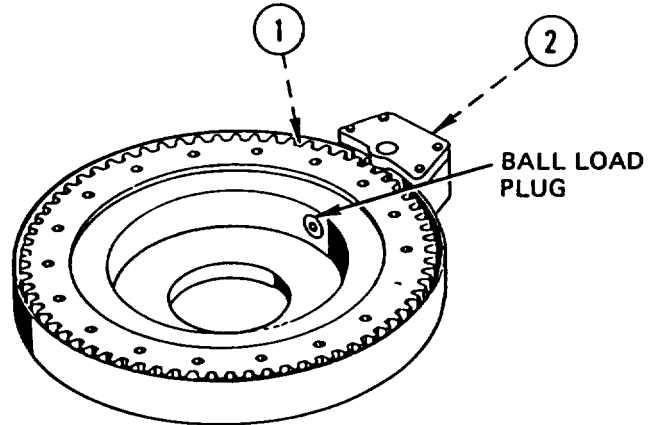
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## CRANE GEAR BEARING REPLACEMENT (CONT)

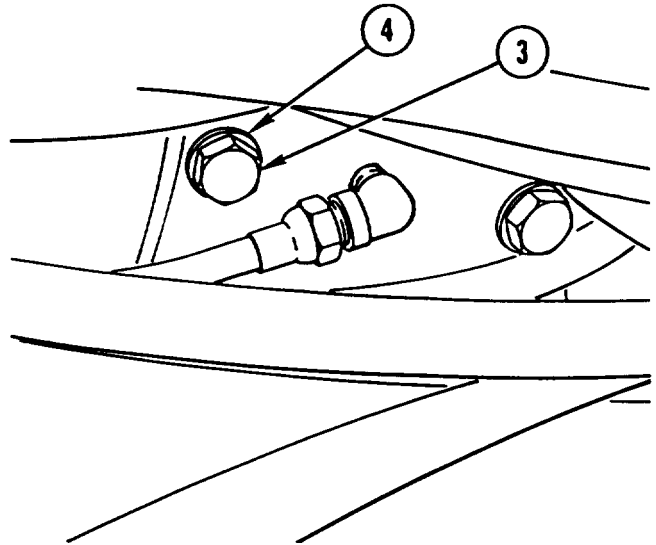
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### INSTALLATION

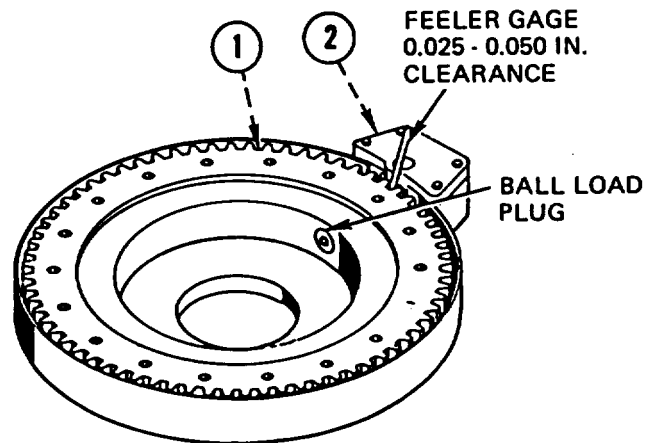
1. INSTALL gear BEARING (1) with ball loading plug next to pinion gear(2).



2. APPLY COAT of SEALING COMPOUND to 18 new CAPSCREWS (3) and INSTALL 18 CAPSCREWS (3) and 18 washers (4). DO NOT TIGHTEN CAPSCREWS.

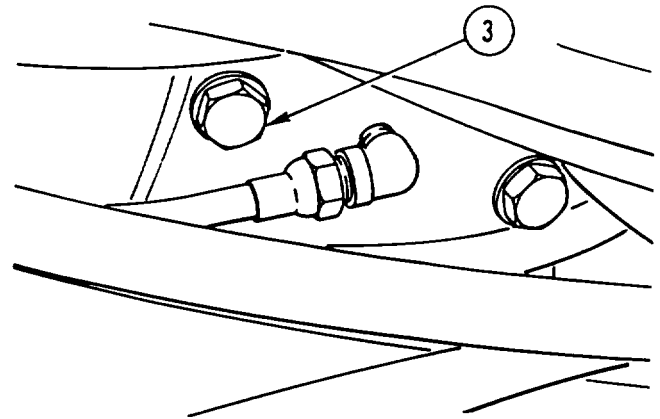


3. USING feeler GAGE, CHECK BACKLASH between gear bearing (1) and pinion gear (2). PERMISSIBLE BACKLASH is 0.025-0.050 in. (0.84-1.3 mm). MOVE gear BEARING (1) to obtain desired backlash.

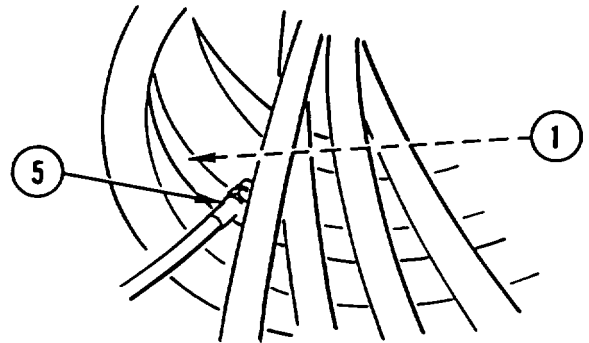


## CRANE GEAR BEARING REPLACEMENT (CONT)

4. WHEN desired BACKLASH has been SET, TIGHTEN 18 CAPSCREWS (3) to 500 lb-ft (678 N.m).
5. REPEAT STEP 3. If BACKLASH is OUT of TOLERANCE, LOOSEN 18 CAPSCREWS (3). REPEAT STEPS 3 and 4 until backlash is correct.



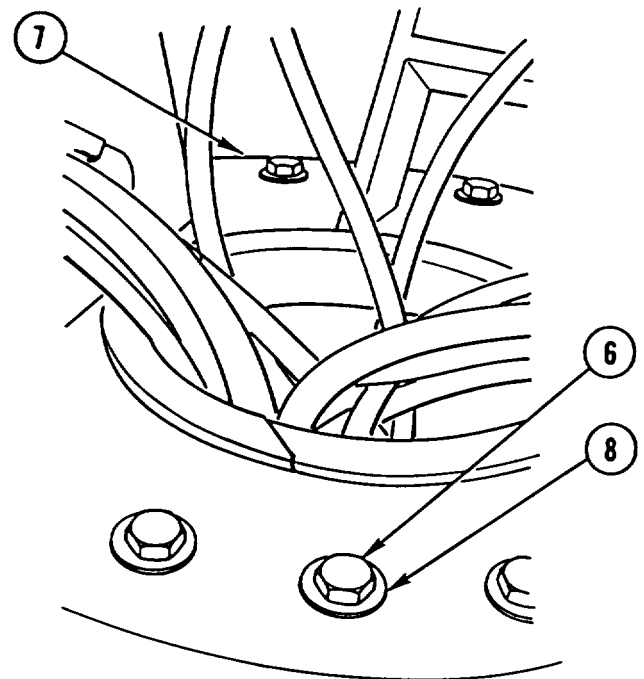
6. CONNECT lubrication LINE (5) to gear bearing (1).



**CAUTION**

Carefully feed hydraulic hoses through opening to prevent damage to hoses.

7. APPLY COAT of SEALING COMPOUND to 18 new CAPSCREWS (6) and INSTALL CRANE assembly (7), 18 cap screws (6), and 18 washers (8). TIGHTEN CAPSCREWS to 500 lb-ft (678 N.m).

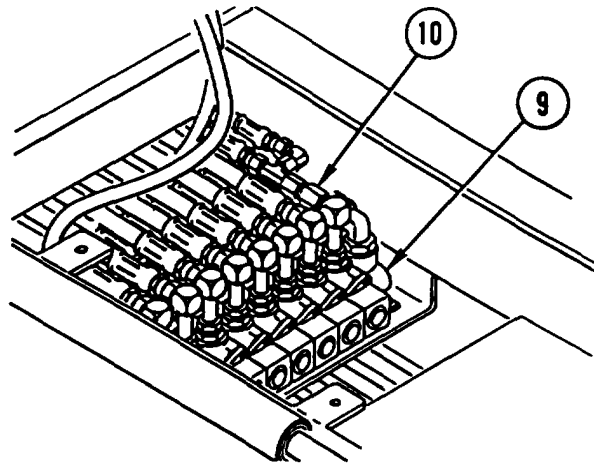


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**CRANE GEAR BEARING REPLACEMENT (CONT)**

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8. REMOVE CAPS or PLUGS from valve body (9) and hydraulic hoses (10). CONNECT 16 hydraulic HOSES (10).

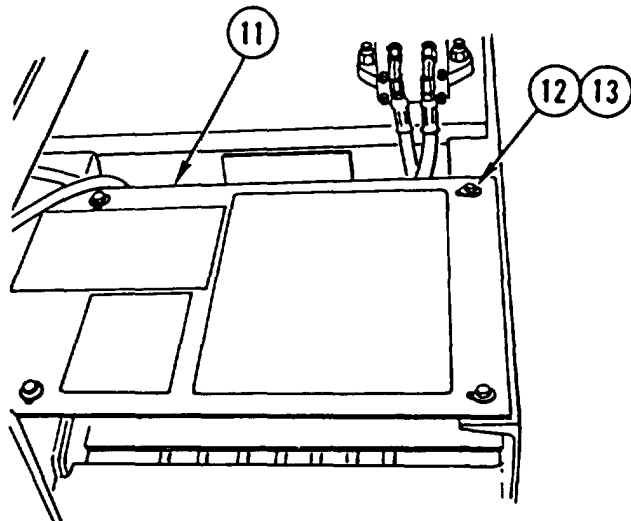


9. INSTALL COVER (11), four new lock washers (12), and four capscrews (13).

**NOTE**

Follow-on Maintenance:

1. Start vehicle and purge air from hydraulic system.
2. Attach crane to load equal to maximum rated load for crane.
3. Lift full rated load and swing load completely around in both directions. Actuate controls very slowly and keep load as close as possible to ground. Set load down.
4. Place crane in three-point stance (TM 5-2420-224-20).
5. Shut down vehicle.



**WARNING**

After swinging full rated load, all gear bearing mounting capscrews must be checked to ensure that capscrews were tightened properly. Failure to perform this check can result in crane failure and/or serious personnel injury or death.

6. Check tightness of all capscrews. Tighten again, if necessary.

## CRANE INTERMEDIATE GEAR REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (4)

Washer, Lock (2)

Caps and Plugs Appendix B, item 8

Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane in Three-Point Stance
Page 12-31	Crane Pinion Gear Removed
TM 5-2420-224-20	Hydraulic Pressure Relieved

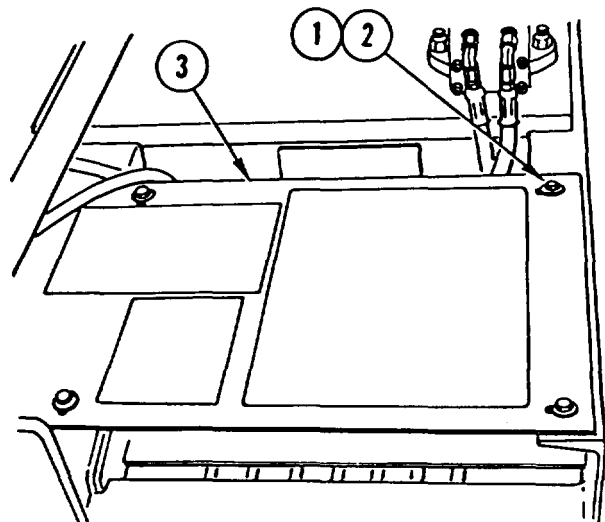
**General Safety Instructions:**

**WARNING**

- High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

### REMOVAL

1. REMOVE four screws (1), four lock washers (2), and COVER (3). DISCARD lock WASHERS.



**CRANE INTERMEDIATE GEAR REPLACEMENT (CONT)**

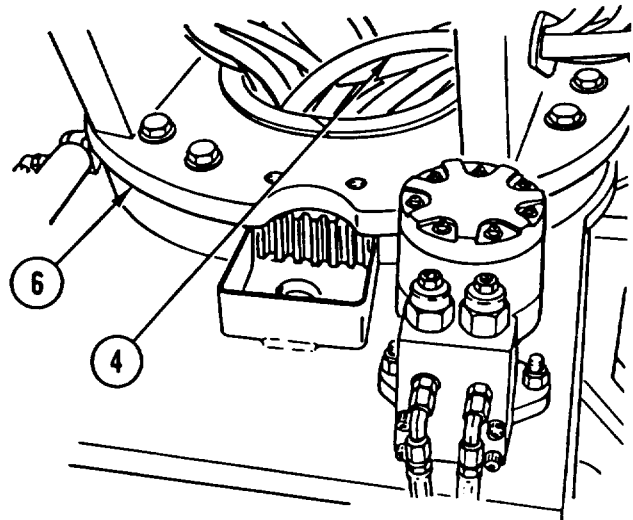
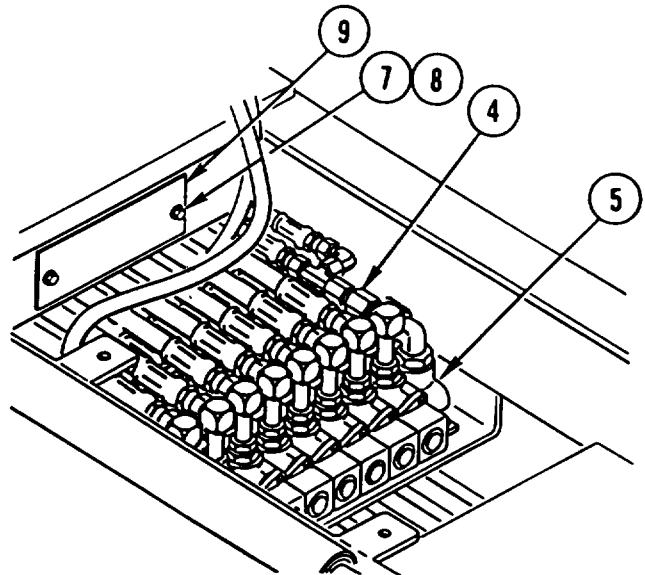
**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

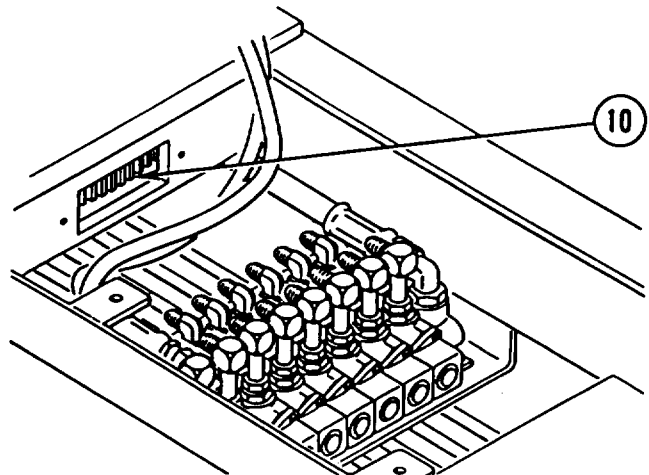
**NOTE**

Tag lines prior to disconnecting to aid in connecting.

2. DISCONNECT 14 hydraulic HOSES (4) from valve body (5). INSTALL CAPS or PLUGS.
3. PULL 14 hydraulic HOSES (4) through base weldment (6) and SET ASIDE.
4. REMOVE two capscrews (7), two lock washers (8), and COVER (9). DISCARD lock WASHERS.



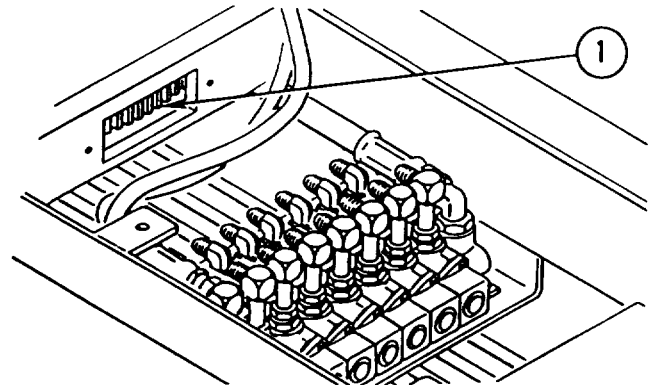
5. REMOVE intermediate GEAR (10) by PUSHING intermediate GEAR (10) toward LEFT SIDE of vehicle.



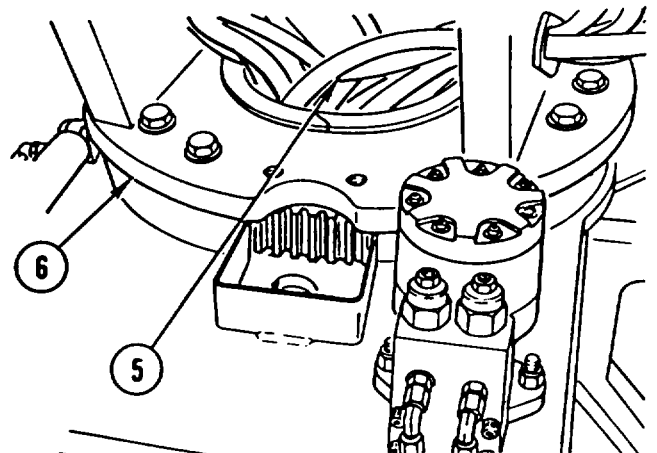
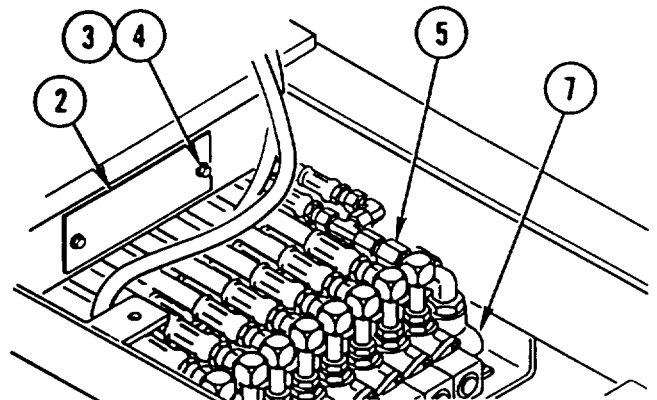
## CRANE INTERMEDIATE GEAR REPLACEMENT (CONT)

### INSTALLATION

1. INSTALL intermediate GEAR (1) from left side of vehicle.



2. INSTALL COVER (2), two new lock washers (3), and two capscrews (4).
3. CAREFULLY PUSH 14 hydraulic HOSES (5) back through base weldment (6).
4. REMOVE CAPS or PLUGS. CONNECT 14 hydraulic HOSES (5) to valve body (7).



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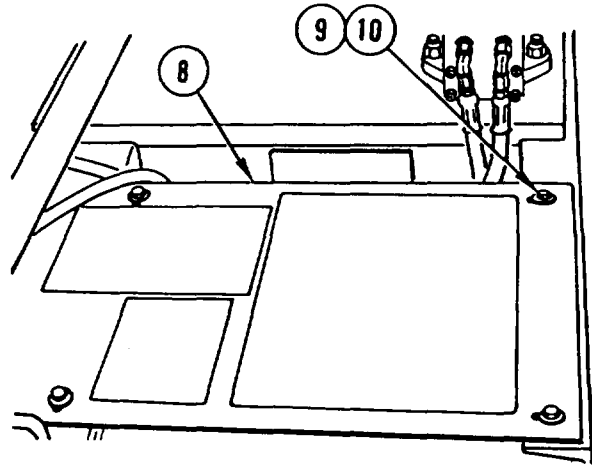
## CRANE INTERMEDIATE GEAR REPLACEMENT (CONT)

---

5. INSTALL COVER (8), four new lock washers (9), and four screws (10).

**NOTE**

Follow-on Maintenance:  
Install crane pinion gear (page  
12-31).



## CRANE DRIVE GEAR AND BUSHINGS REPLACEMENT

This task covers: a. Removal b. installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 inserter and Remover, P/N 92091200  
 consisting of:  
 Nut (2), P/N MS51967-23  
 Spacer, P/N 60102782  
 Cylinder, P/N RCH-302  
 Extractor, P/N 60102777  
 Spacer, P/N 60102776  
 Bushing, P/N 60102784  
 Bushing, P/N 60100783  
 Ring, P/N 60102781

**References:**

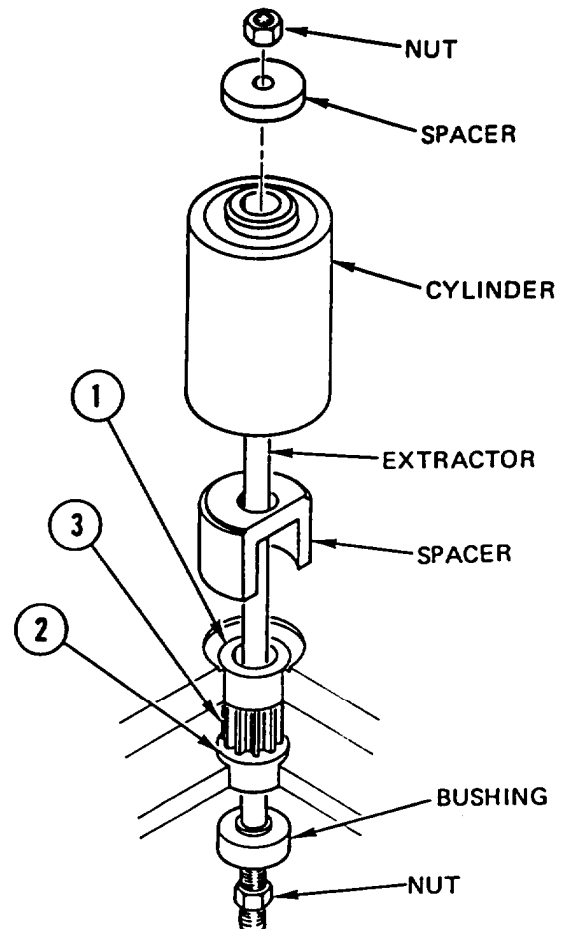
TM 5-2420-224-20  
 LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane in Three-Point Stance
TM 5-2420-224-20	Crane Hydraulic Motor Removed

### REMOVAL

1. INSTALL inserter and remover tools in following order:  
 Spacer  
 Cylinder  
 Spacer  
 Nut  
 Extractor  
 Bushing  
 Nut
2. TIGHTEN NUT until puller is completely SNUGGED UP.
3. APPLY hydraulic PRESSURE to jack until two BUSHINGS (1 and 2) and drive GEAR (3) have been REMOVED.
4. REMOVE TOOLS.





---

## CRANE DRIVE GEAR AND BUSHINGS REPLACEMENT (CONT)

---

### INSTALLATION

1. INSTALL drive GEAR (1), two BUSHINGS (2 and 3), and tools in following order:

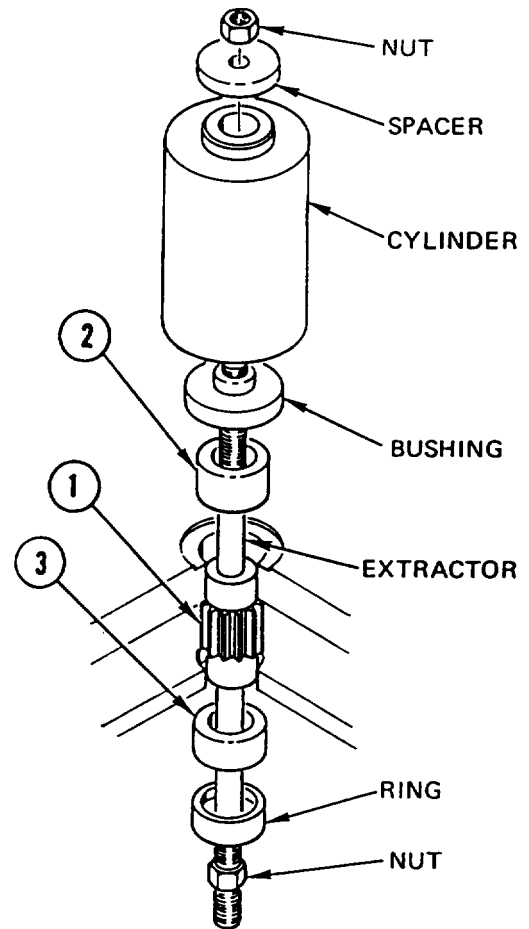
Extractor  
Bushing (3)  
Ring  
Nut  
Drive gear (1)  
Bushing (2)  
Bushing  
Cylinder  
Spacer  
Nut

2. APPLY hydraulic PRESSURE until two BUSHINGS (2 and 3) are completely SEATED.
3. REMOVE TOOLS.

#### NOTE

Follow-on Maintenance:

Install crane hydraulic motor (TM 5-2420-224-20).  
Lubricate drive gear and two bushings (LO 5-2420-224-12).



## CRANE PINION GEAR REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Materials/Parts:**

Washer, Lock (2)

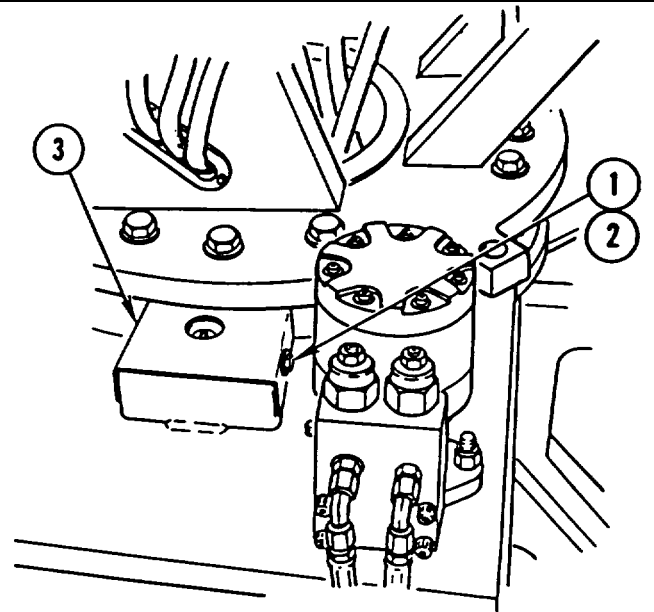
**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31

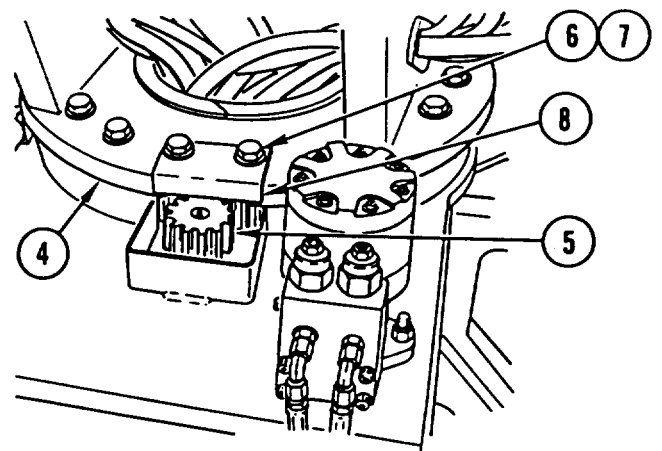
Tool Kit, SC 5180-90-CL-N26

### REMOVAL

1. REMOVE two screws (1), two lock washers (2), and COVER (3). DISCARD lock WASHERS.



2. ROTATE CRANE until notch on base weldment (4) is positioned over pinion gear (5).
3. REMOVE two capscrews (6), two washers (7), and COVER (8).



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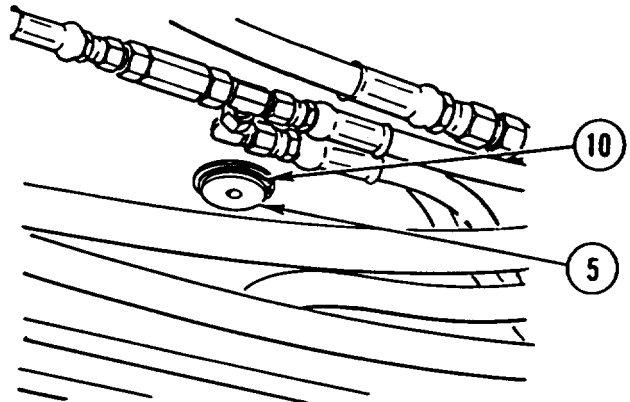
## CRANE PINION GEAR REPLACEMENT (CONT)

---

4. IF DAMAGED, REMOVE lubrication FITTING (9).

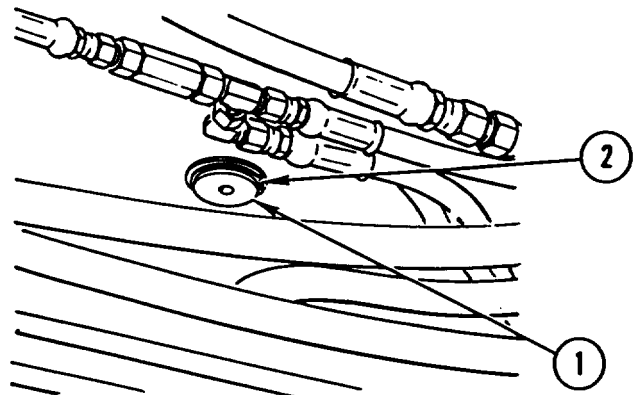


5. REMOVE retaining ring (10) and pinion GEAR (5).



### **INSTALLATION**

1. INSTALL pinion GEAR (1) and retaining ring (2).

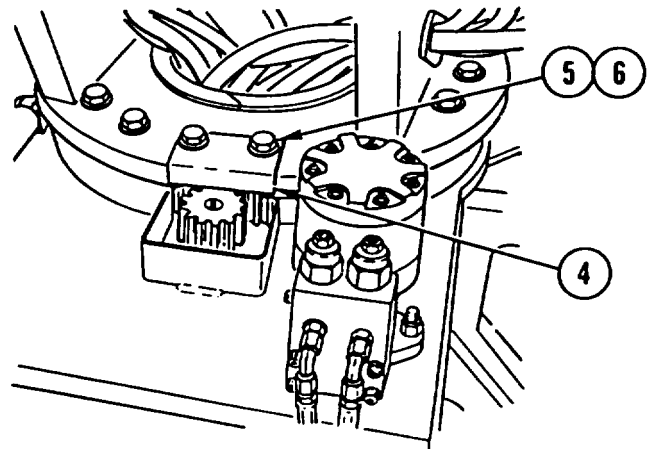


## CRANE PINION GEAR REPLACEMENT (CONT)

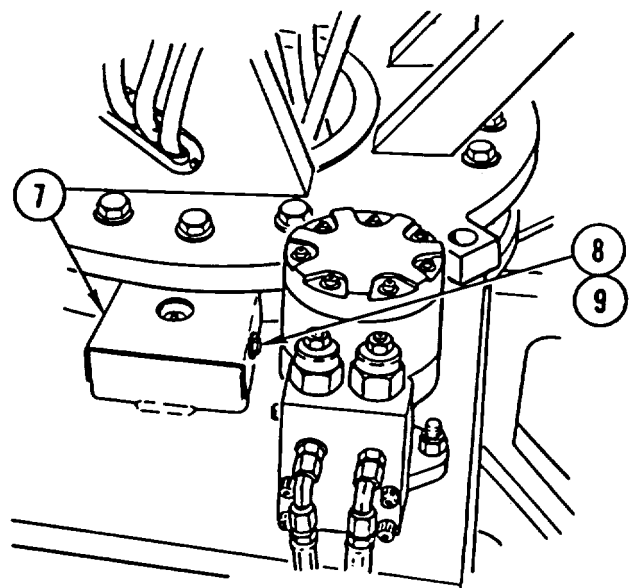
2. IF REMOVED, INSTALL new lubrication FITTING (3).



3. INSTALL COVER (4), two washers (5), and two capscrews (6).



4. INSTALL COVER (7), two new lock washers (8), and two screws (9).



## CRANE PINION GEAR BUSHINGS REPLACEMENT

This task covers: a. Removal b. Cleaning c. Installation

### INITIAL SETUP

**Applicable configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Coupling Assembly, P/N 9795  
 Hose Assembly, P/N ST49D5  
 Inserter and Remover, P/N 92091200  
 consisting of:  
 Nut, P/N 72062011  
 Spacer, P/N 60105358  
 Cylinder, P/N RCH-302  
 Stud, P/N 91565A736  
 Nut, P/N 01857-007  
 Plate, P/N 60105496  
 Stud, P/N 60102775  
 Ring (2), P/N 60102779  
 Bushing, P/N 60102778  
 Bushing, P/N 60102780

**References:**

LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
Page 12-25	Crane Intermediate Gear Removed
Page 12-31	Crane Pinion Gear Removed

### REMOVAL

1. INSTALL inserter and remover tools in following order:

- Plate
- Stud
- Nut
- Cylinder
- Stud
- Spacer
- Nut
- Ring
- Ring

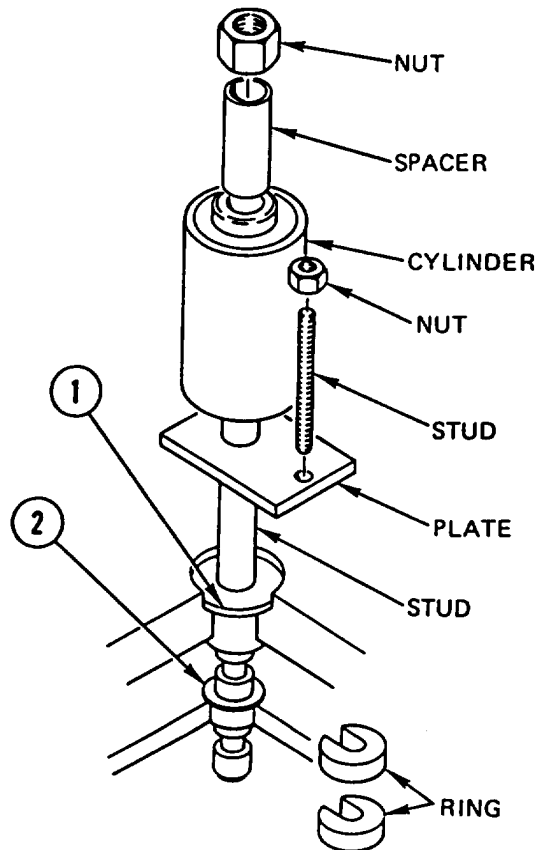
2. TIGHTEN NUT until puller is completely SNUGGED UP.

3. APPLY hydraulic PRESSURE to jack until two pinion gear BUSHINGS (1 and 2) have been REMOVED.

REMOVE TOOLS.

### CLEANING

Clean cavity completely of all old lubricant.



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**CRANE PINION GEAR BUSHINGS REPLACEMENT (CONT)**


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**INSTALLATION**

1. INSTALL two pinion gear BUSHINGS (1 and 2) and TOOLS in following order

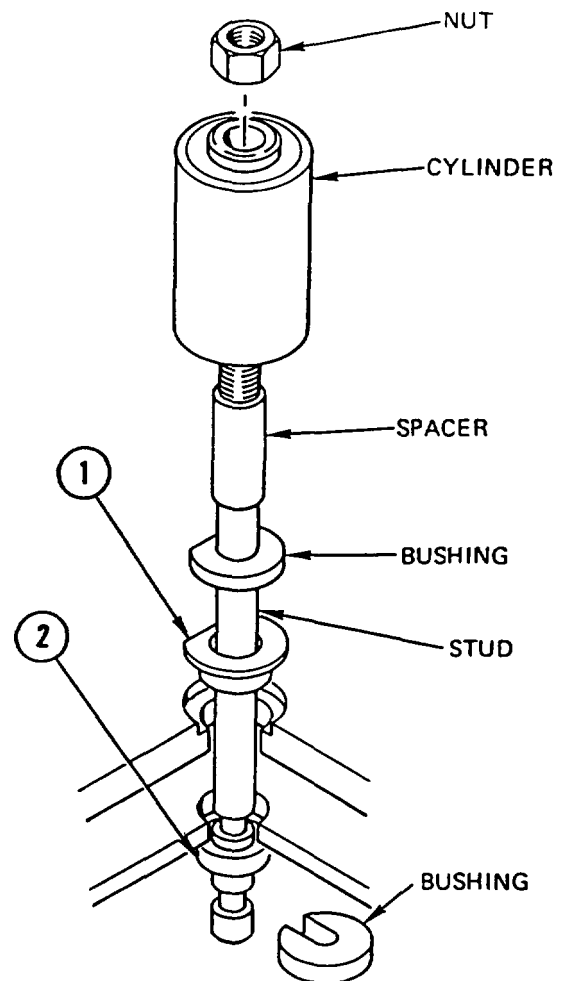
Bushing (1)  
 (flat side facing intermediate gear)  
 Bushing  
 (flat side facing intermediate gear)  
 Spacer  
 Stud  
 Bushing (2)  
 Bushing  
 Cylinder  
 Nut

2. TIGHTEN NUT enough to apply SLIGHT amount of PRESSURE on two pinion gear bushings (1 and 2).
3. APPLY hydraulic PRESSURE until two pinion gear BUSHINGS (1 and 2) are completely SEATED.
4. REMOVE TOOLS.

**NOTE**

Follow-on Maintenance:

Install crane intermediate gear (page 12-25).  
 Install crane pinion gear (page 12-31).  
 Lubricate crane pinion gear (LO 5-2420-224-12).





## CHAPTER 13 ENGINE, FUEL, AND COOLING REPAIR INSTRUCTIONS

### OVERVIEW

This chapter contains maintenance instructions for repair of the engine and fuel and cooling systems. A list of sections contained in this chapter is shown below.

	<b>Page</b>
Section I. Engine Repair .....	13-1
Section II. Fuel System Repair .....	13-65
Section III. Cooling System Repair .....	13-71

### Section I. ENGINE REPAIR

#### OVERVIEW

This section illustrates and describes procedures for repair of the engine. A list of tasks contained in this section is shown below.

	<b>Page</b>
Cylinder Head Repair .....	13-2
Crankshaft, Main Bearings, and Rear Seals Replacement .....	13-15
Crankshaft Pulley Replacement .....	13-24
Flywheel Replacement and Repair.....	13-25
Flywheel End Bell Replacement .....	13-28
Flywheel Ring Gear Replacement .....	13-29
Pistons, Rings, Connecting Rods, and Bearings Replacement .....	13-31
Rocker Arms, Push Rods, and Tappets Replacement .....	13-37
Camshaft and Bearings Replacement .....	13-43
Cylinder Block Repair .....	13-48
Oil Pan Replacement .....	13-58
Oil Pump Replacement and Repair .....	13-60
Engine Testing .....	13-78 ■



## CYLINDER HEAD REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Drift Pin, P/N 615 589 01 15 00  
 Gauge, P/N 001 589 53 21 00  
 Installation Tool, P/N 346 589 03 15 00  
 Installation Tool, P/N 352 589 00 43 00  
 Mandrel, P/N 117 589 03 23 00  
 Mandrel, P/N 617 589 05 23 00  
 Puller, P/N 352 589 00 33 00  
 Reamer, P/N 000 589 11 53 00  
 Reamer, P/N 000 589 10 53 00  
 Reamer, P/N 000 589 18 53 00  
 Removal Tool, P/N 110 589 02 15 00  
 Socket, P/N 000 589 75 09 00  
 Wrench, P/N 346 589 51 03 00

#### Materials/Parts:

Kit, Parts  
 Grease, Silicone Appendix B, Item 25  
 Oil, Lubricating Appendix B, Item 30

#### References:

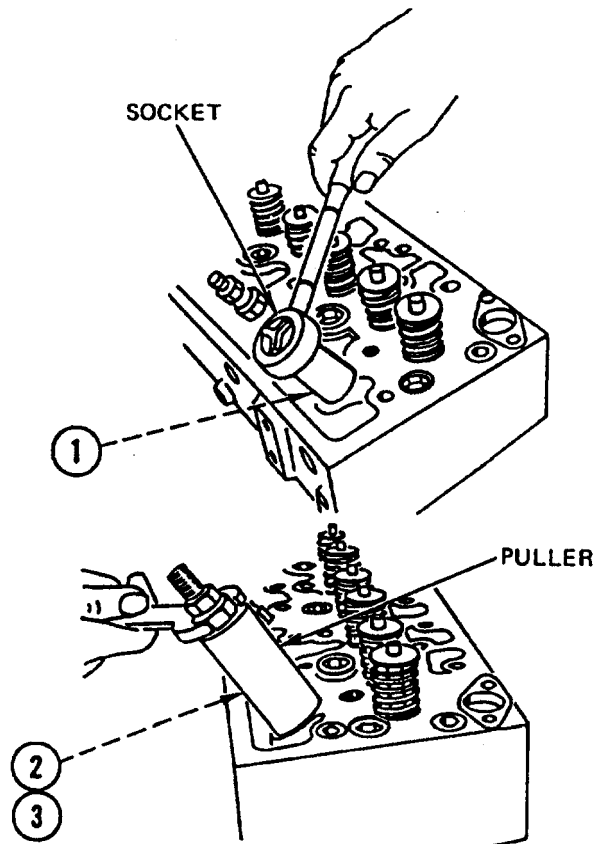
TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Fuel Tank Lines and Fittings Removed
Page 3-25	Cylinder Head Removed

### DISASSEMBLY

1. USING SOCKET, REMOVE six injector nozzle HOLDERS (1).
2. USING PULLER, REMOVE six INJECTORS (2) and seal rings (3). DISCARD seal RINGS.

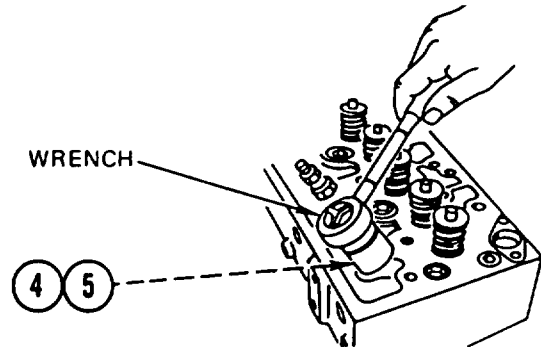


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**CYLINDER HEAD REPAIR (CONT)**

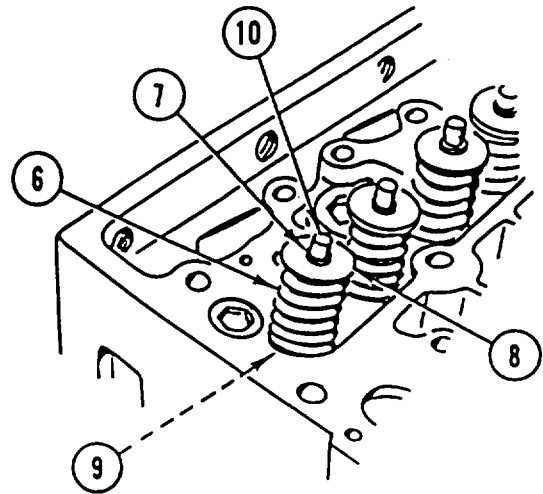

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3. USING WRENCH, REMOVE six stepped SPACERS (4) and six packings (5). DISCARD PACKINGS.

**NOTE**

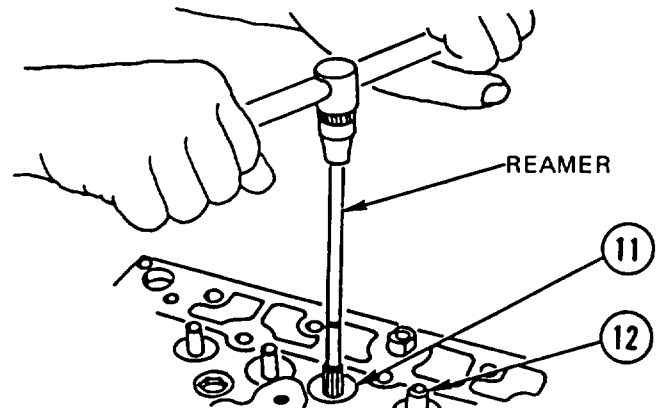
Procedure is the same for all valves.

4. COMPRESS SPRING (6) and REMOVE COLLET (7).

**NOTE**

Tag valves after removal to aid in installation.

5. RELEASE SPRING (6) and REMOVE retainer (8), spring (6), washer (9), and VALVE (10).

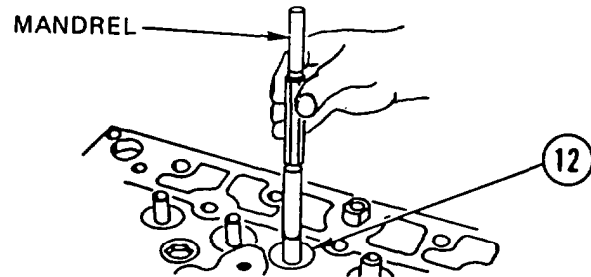
**NOTE**

Perform steps 6 thru 11 to determine if valve guides are to be replaced.

6. USING 9-mm REAMER, REMOVE carbon DEPOSITS from intake valve guide (11).
7. INSTALL 9-mm MANDREL in intake valve guide (11). Fit should be SNUG. There is NO allowable TOLERANCE.
8. REPEAT STEPS 6 and 7 for each intake valve guide.
9. USING 10-mm REAMER, REMOVE carbon DEPOSITS from exhaust valve guide (12).

**CYLINDER HEAD REPAIR (CONT)**

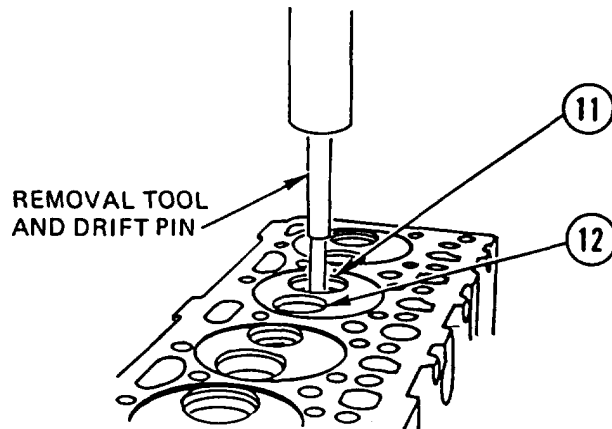
- 10. INSTALL 10-mm MANDREL in exhaust valve guide (12). Fit should be SNUG. There is NO allowable TOLERANCE.
- 11. REPEAT STEPS 9 and 10 for each exhaust valve guide.



**NOTE**

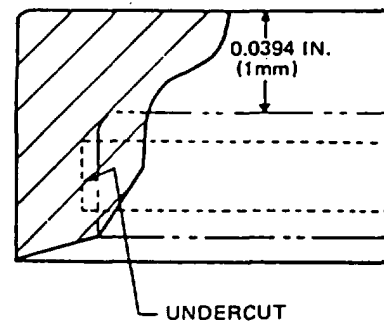
Perform steps 12 thru 16 only if fit was not snug in steps 7 and 10.

- 12. USING REMOVAL TOOL and DRIFT PIN, REMOVE intake and exhaust valve GUIDES (11 and 12).



**CAUTION**  
 Do not ream through thickness of valve seat as the counterbore will be damaged. Leave 0.0394-in. (1-mm) thickness.

- 13. REAM valve SEAT (13) to REMOVE seating FACE.
- 14. UNDERCUT valve SEAT (13) as shown.



FIRST REAMING —————  
 SECOND REAMING - - - - -

UNDERCUT SEAT (EXHAUST SEAT EXAMPLE)

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**CYLINDER HEAD REPAIR (CONT)**


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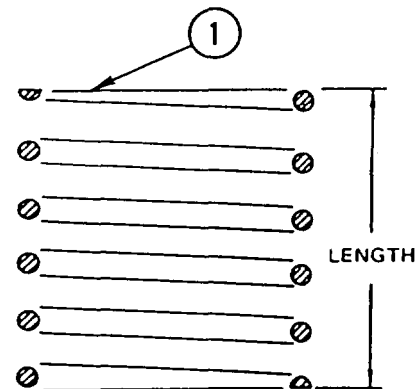
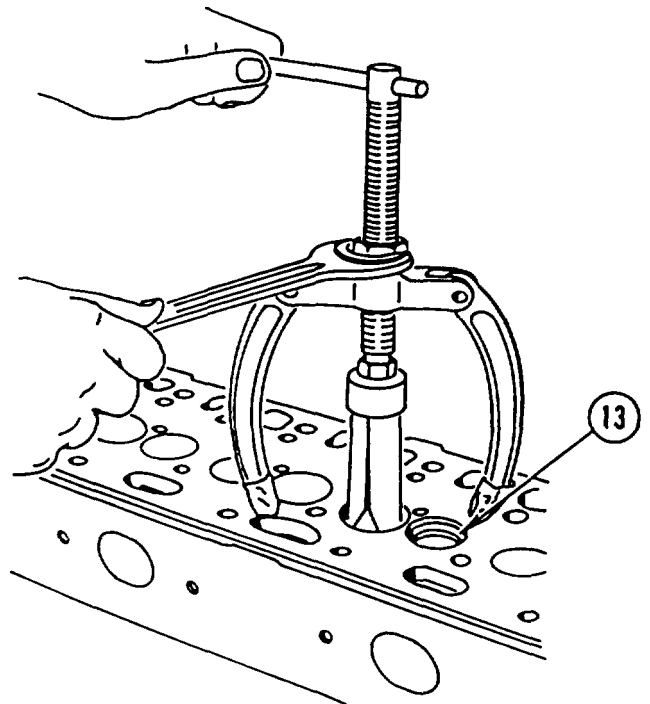
**CAUTION**

Use protector pads under puller supports to prevent damage to cylinder head.

15. USING suitable PULLER, REMOVE valve SEAT (13).
16. REPEAT STEPS 13 thru 15 for each valve seat.

**INSPECTION**

1. Test fuel injector nozzles (page 13-65).
2. Inspect stepped spacers for damaged threads, pits, scoring, or damaged slots. Replace if damaged.
3. Inspect injector nozzle holders for damaged threads and/or damaged flats. Replace if damaged.
4. Measure valve spring (1) length. Acceptable length is 2.382 in. (60.5 mm).
5. Measure valve spring (1) length with 62.9 -69.8 lbf (280-310 N) applied. Acceptable length is 1.838 in. (46.70 mm).
6. Measure valve spring (1) length with 125.7-138.9 lbf (559-618 N) applied. Acceptable length is 1.385 in. (35.18 mm).



---

**CYLINDER HEAD REPAIR (CONT)**

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7. Inspect each valve (2) for cracks, burns, warpage, wear, or bent stems. Replace if damaged.
8. Measure each valve (2) in accordance with following table. If valves do not meet specifications, replace valves.

**Valve Specifications**

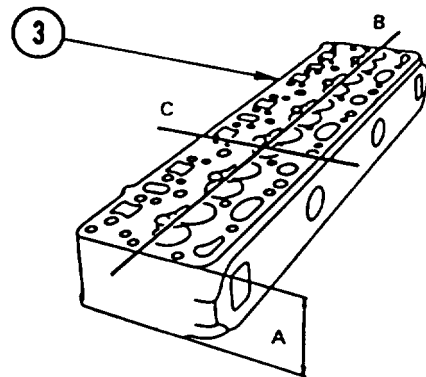
	<b>Intake</b>	<b>Exhaust</b>
	In. (mm)	In. (mm)
Valve Stem Diameter A	0.3518-0.3523 (8.935-8.950)	0.3907-0.3913 (9.925-9.940)
Valve Seat Diameter B	1.732 (44.0)	1.417 (36.0)
Valve Head Diameter C	1.728-1.736 (43.9-44.1)	1.413-1.421 (35.9-36.1)
Height D New	0.098-0.110 (2.5-2.8)	0.098-0.110 (2.5-2.8)
Valve Seat Width E	0.110-0.138 (2.8-3.5)	0.138-0.165 (3.5-4.2)
Valve Seat Angle F	45 degrees + 10 minutes	45 degrees + 10 minutes
Valve Length	5.524-5.539 (140.3-140.7)	5.524-5.539 (140.3-140.7)

## CYLINDER HEAD REPAIR (CONT)

9. Inspect cylinder head (3) for cracks in valve areas and injector areas. Replace cylinder head if cracked.
10. Measure cylinder head (3) height, warpage, and water jacket thickness as shown. Check warpage and height at 2-in. intervals.

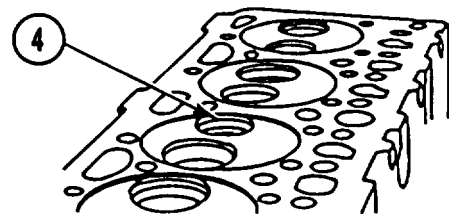
### Cylinder Head

	In.	(mm)
Standard New Head Height A	<u>3.625</u>	<u>(92.1)</u>
	3.618	(91.9)
Minimum Height	3.579	(90.9)
Max Warpage Cylinder Block Mating Surface (lengthwise) B	0.002	(0.05)
Max Warpage Cylinder Block Mating Surface (crosswise) C	0	(0)
Min Wall Thickness of Water Jacket	0.23	(6.0)



11. If cylinder head (3) shows warpage or gasket surface shows pit marks or pin holes, machine cylinder head gasket surface.

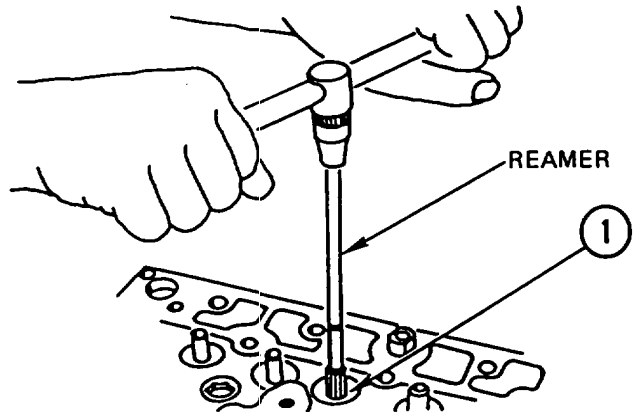
12. Inspect valve seat counterbores (4) for pitting, cracks, bums, warpage, and blow-by on valve contact face. If any of these conditions exist, tag cylinder head for repair.



**CYLINDER HEAD REPAIR (CONT)**

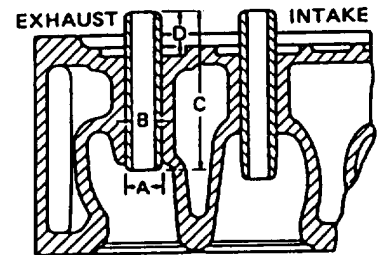
**ASSEMBLY**

1. USING REAMER, REAM valve guide BORE (1) to next higher repair stage as shown in following table.



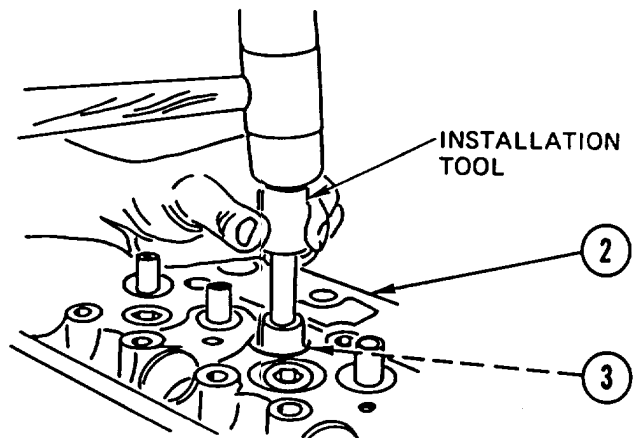
**Valve Guide Specifications**

Repair Stage	Bore in Cylinder Head A In. (mm)	Valve Guide Outside Diameter A, Interference Fit In. (mm)	Valve Guide Inside Diameter B, Final	
			Intake In. (mm)	Exhaust In. (mm)
Standard	0.5906-0.5913 (15.000-15.018)	0.5917-0.5924 (15.026-15.046)	0.3543-0.3552 (9.000-9.022)	0.3937-0.3946 (10.000-10.022)
Stage I	0.5984-0.5991 (15.200-15.218)	0.5995-0.6002 (15.228-15.246)	0.3543-0.3552 (9.000-9.022)	0.3937-0.3946 (10.000-10.022)



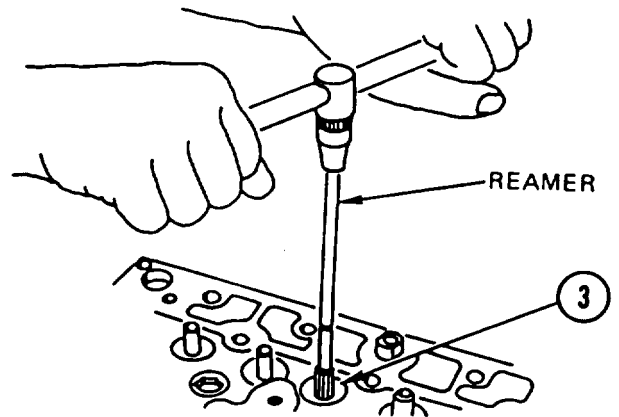
**WARNING**  
 Cylinder head will be hot enough to burn you on contact. Wear heat-resistant gloves when handling hot cylinder head.

2. HEAT cylinder HEAD (2) to 212°F (100°C) and FREEZE new valve GUIDES.
3. APPLY light COAT of LUBRICATING OIL to new valve GUIDES (3).
4. USING INSTALLATION TOOL, INSTALL valve GUIDES (3) in cylinder head (2).

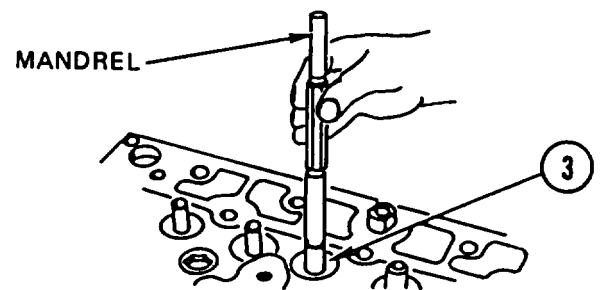


## CYLINDER HEAD REPAIR (CONT)

5. USING 9-mm and 10-mm REAMERS, REAM all new valve GUIDES (3).



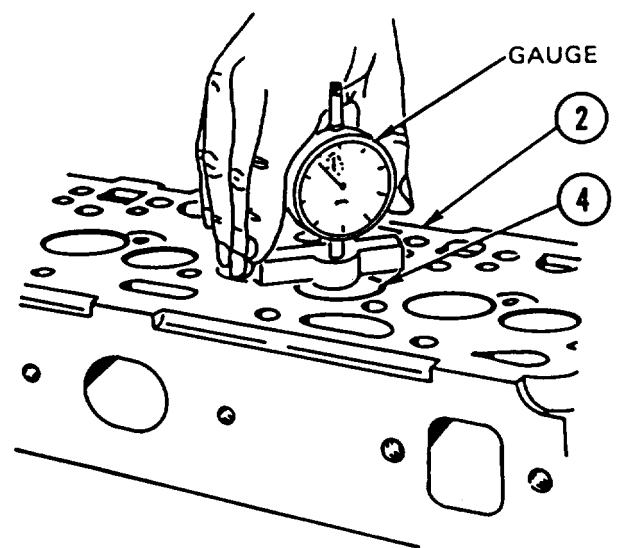
6. AFTER REAMING, USING 9-mm and 10-mm MANDRELS, CHECK valve GUIDES (3).



### NOTE

Make sure valve guides are within specifications, or new, before checking valve seat counterbore irregularity. The common center is lost when new guides are installed. Therefore, check valve seat counterbore irregularity whenever valve guides are replaced, and reface counterbores as necessary.

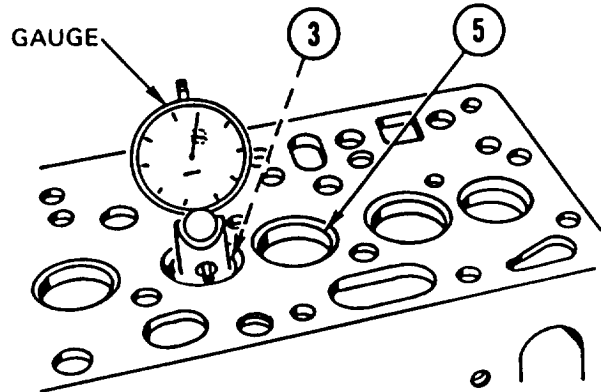
7. INSTALL each VALVE (4) in its guide. USING GAUGE, MEASURE DISTANCE between valve (4) face and cylinder head (2). ACCEPTABLE DISTANCE is 0.028-0.047 in. (0.7-1.2 mm).



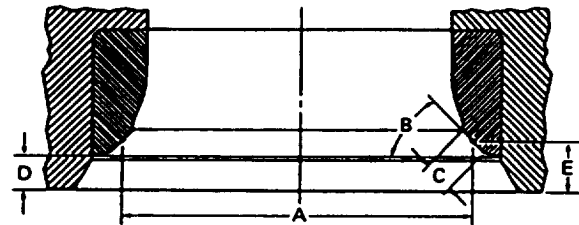


**CYLINDER HEAD REPAIR (CONT)**

8. CHECK valve seat COUNTERBORES (5) for irregularity USING GAUGE and irregularity control DEVICE. MAXIMUM IRREGULARITY between valve guide (3) and valve seat counterbore (5) is 0.0012 in. (0.03 mm).



9. USING following TABLE, CHECK WIDTH of each valve seat COUNTERBORE (5). IF NECESSARY, REFACE counterbore (step 13).



**Valve Seat Counterbores**

	OM 352 (all) and OM 352A (through 812343)		OM 352A (from 812344)	
	Intake	Exhaust	Intake	Exhaust
	In. (mm)	In. (mm)	In. (mm)	In. (mm)
Diameter A	1.708-1.710 (43.370-43.400)	1.392-1.394 (35.379-35.400)	1.575 (40.0)	1.339 (34.0)
Valve Seat Angle B	45°	45°	29° 55'-30°	44°50'-45°
Seat Width C	0.063-0.079 (1.6-2.0)	0.079-0.098 (2.0-2.5)	0.051-0.094 (1.3-2.4)	0.071-0.118 (1.8-3.0)
Valve Seat Insert Recess from Cylinder Head D	0.110-0.118 (2.8-3.0)	0.102-0.110 (2.6-2.8)	0.142-0.154 (3.6-3.9)	0.114-0.126 (2.9-3.2)
Reference Dimension E	—	—	0.154-0.161 (3.9-4.1)	0.154-0.161 (3.9-4.1)
Valve Face Recess from Cylinder Head	0.028-0.047 (0.7-1.2)	0.028-0.047 (0.7-1.2)	0.028-0.047 (0.7-1.2)	0.028-0.047 (0.7-1.2)
Maximum Concentricity Deviation of Valve Seat to Valve Guide	0.0012 (0.03)	0.0012 (0.03)	0.0012 (0.03)	0.0012 (0.03)

\*If valve seat machining causes dimension to be exceeded, valve seat insert must be replaced.

## CYLINDER HEAD REPAIR (CONT)

**WARNING**

Cylinder head will be hot enough to burn you on contact. Wear heat-resistant gloves when handling hot cylinder head.

10. HEAT cylinder HEAD (2) to 212°F (100°C) and COOL valve SEATS-in liquid nitrogen for 5 minutes.

**WARNING**

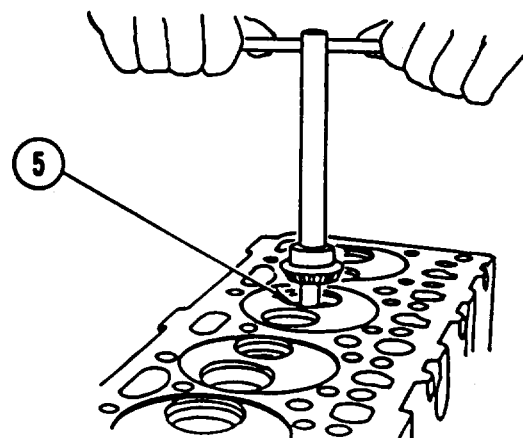
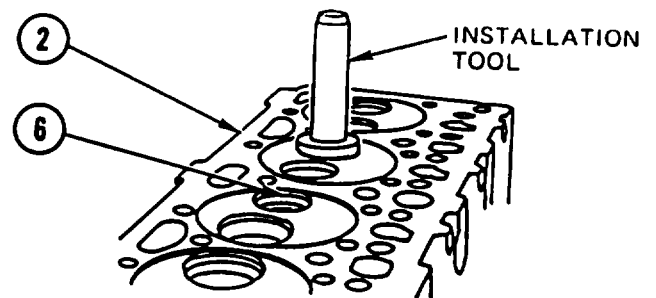
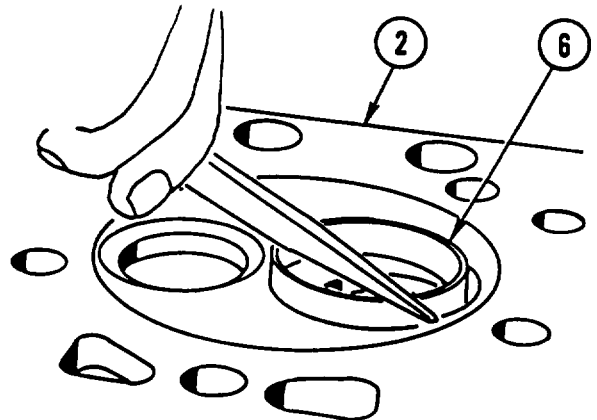
Do not touch liquid nitrogen or valve seats with bare hands. Severe frostbite will result.

11. CAREFULLY REMOVE valve SEATS (6) from coolant and QUICKLY INSTALL them in heated cylinder head (2).

12. USING INSTALLATION TOOL, TAP valve SEATS (6) into cylinder head (2).

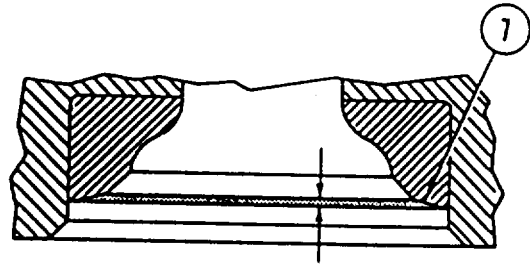
13. USING 90-degree REAMER or GRINDSTONE with correct size pilot shaft, REFACE intake and exhaust valve seat COUNTERBORES (5). REMOVE ONLY ENOUGH material to obtain smooth seat.

14. USING TABLE on page 13-10, CHECK WIDTH of each valve seat COUNTERBORE (5).

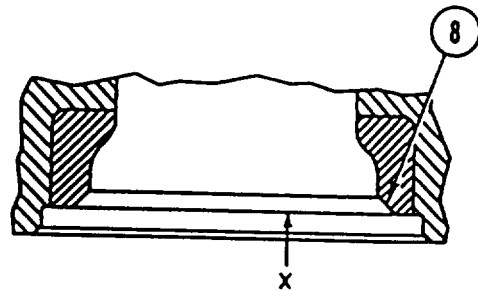


**CYLINDER HEAD REPAIR (CONT)**

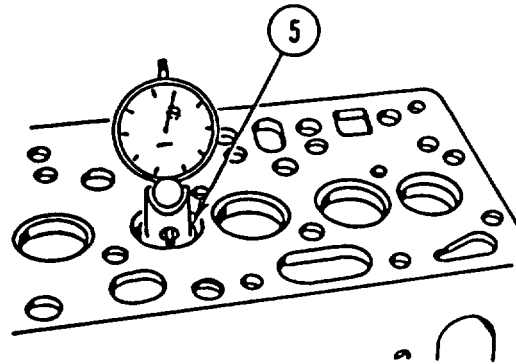
15. TO CORRECT exhaust valve seat COUNTERBORE width (7), USE 150-degree REAMER or GRINDSTONE to remove material from face of counterbore (5).



16. TO CORRECT intake valve seat COUNTERBORE width (8), USE plane REAMER to remove material from face of counterbore (5).



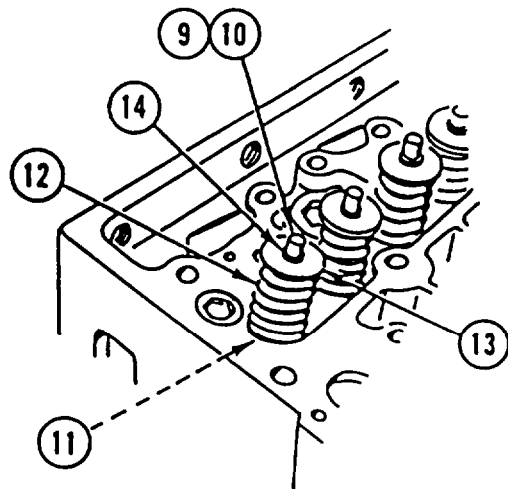
17. REMOVE all CHIPS and GRIT from valve seat counterbores (5).
18. CHECK all valve seat COUNTERBORES (5) for irregularity (step 8).



**NOTE**

Procedure is the same for all valves.

19. APPLY COAT of LUBRICATING OIL to valve STEM (9).
20. INSTALL VALVE (10), washer (11), spring (12), and retainer (13).
21. COMPRESS SPRING (12) and INSTALL COLLET (14). The split must be equal on both sides of collet.
22. LIGHTLY TAP all valve STEMS to ensure proper seating of entire valve assembly.

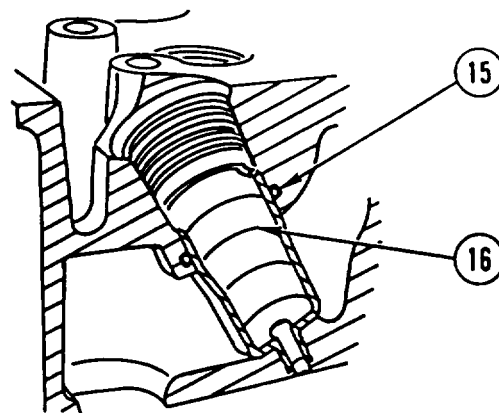


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**CYLINDER HEAD REPAIR (CONT)**

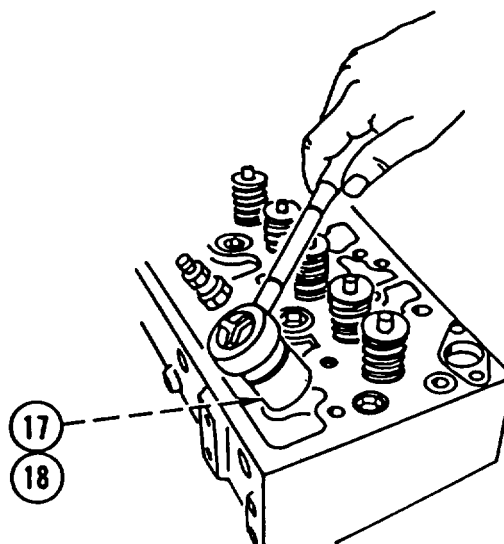

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23. APPLY COAT of SILICONE GREASE to six new PACKINGS (15) and INSTALL six PACKINGS (15).
24. USING WRENCH, INSTALL six stepped SPACERS (16) and TIGHTEN to 37 lb-ft (50 N.m).

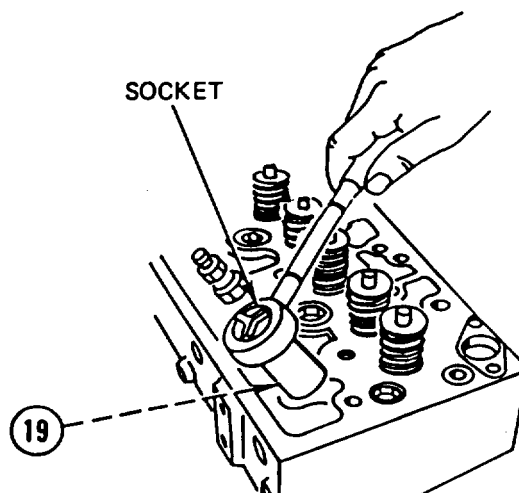
**NOTE**

Make sure new seal rings are same thickness as ones removed.

25. INSTALL six new seal RINGS (17).
26. INSTALL six INJECTORS (18).



27. USING SOCKET, INSTALL six injector nozzle HOLDERS (19) and TIGHTEN to 43-50 lb-ft (60-70 N.m).



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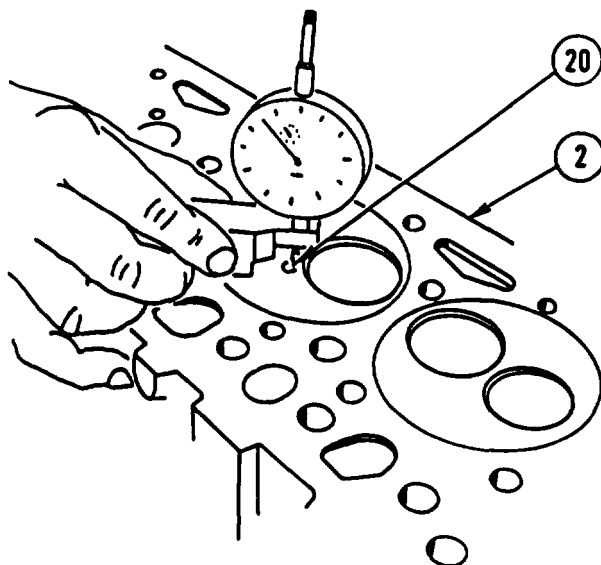
## CYLINDER HEAD REPAIR (CONT)

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28. MEASURE injector nozzle PROJECTION (20) below surface of cylinder head (2). Nozzle tip PROJECTION MUST be 0.070-0.098 in. (1.8-2.5 mm). If measurement is GREATER, ADD washer(s). If measurement is LESS, REMOVE washer(s).

**NOTE**

Follow-on maintenance:  
Install cylinder head (page 3-25).  
Install fuel tank lines and fittings  
(TM 5-2420-224-20).



## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT

This task covers: a. Removal b. inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Gauge, P/N 001 589 53 21 00  
 Holder, P/N 363 589 02 21 00  
 Installing Tool, P/N 352 589 01 31 00  
 Puller, P/N 312 589 07 33 00

#### Materials/Parts:

Seal (2)  
 Pin (2)  
 Adhesive Appendix B, Item 2  
 Grease, Automotive and Artillery (GAA) Appendix B, Item 23

#### Equipment Condition:

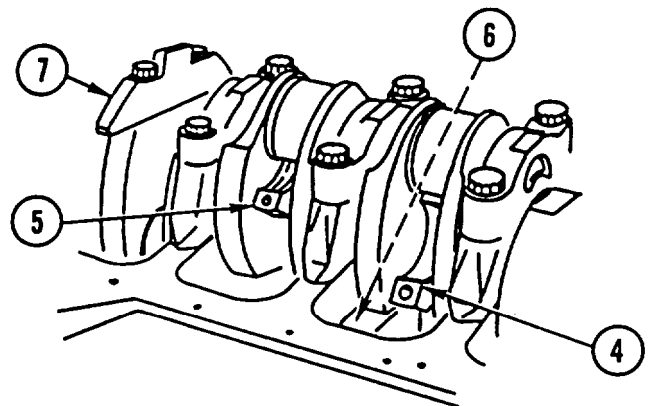
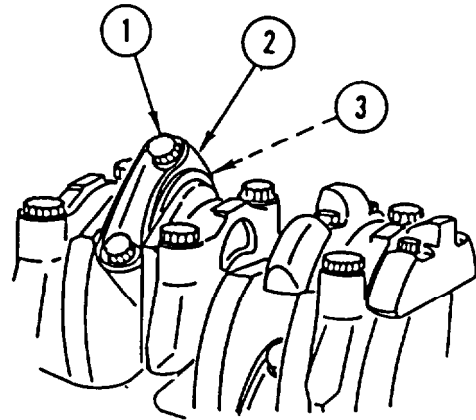
Reference	Condition Description
Page 3-2	Engine Removed
Page 13-25	Flywheel Removed
Page 13-28	Flywheel End Bell Removed
Page 13-60	Oil Pump Removed
Page 3-56	Timing Gear Cover, Gears, and Case Removed
Page 3-41	Fuel Injector Nozzles Removed

### REMOVAL

#### NOTE

Steps 1 and 2 are the same for all connecting rods.

1. REMOVE two bolts (1), lower half of connecting ROD (2), and bearing half (3).
2. REMOVE each bearing HALF (4) BEFORE PUSHING connecting RODS (5) into cylinders (6) far enough to clear counterweights (7).



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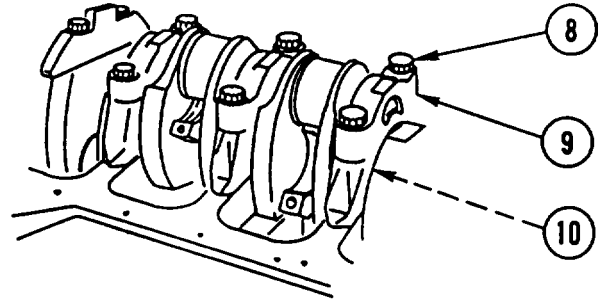
## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

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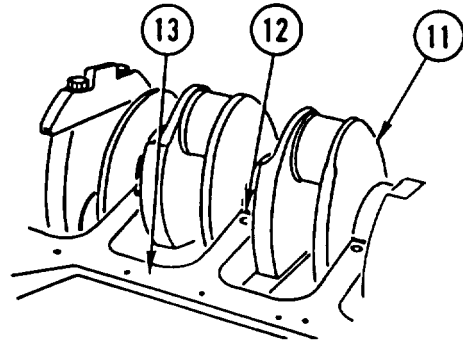
### NOTE

Steps 3 through 6 are the same for all crankshaft bearing caps.

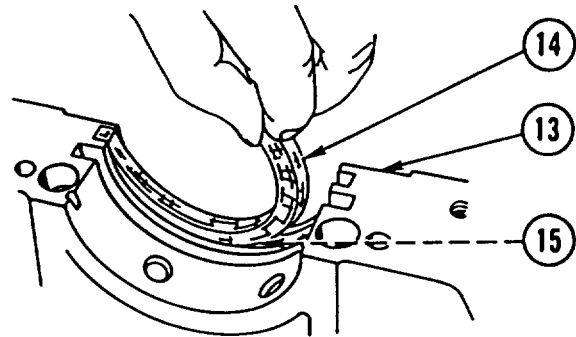
3. REMOVE two bolts (8), bearing CAP (9), and bearing half (10).



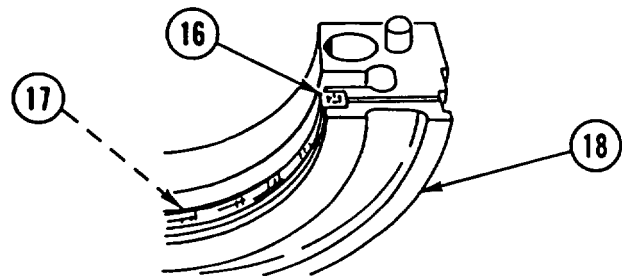
4. REMOVE CRANKSHAFT (11) and seven bearing halves (12) from crankcase (13).



5. REMOVE rear oil SEAL (14) and pin (15) from crankcase (13). DISCARD SEAL and PIN.



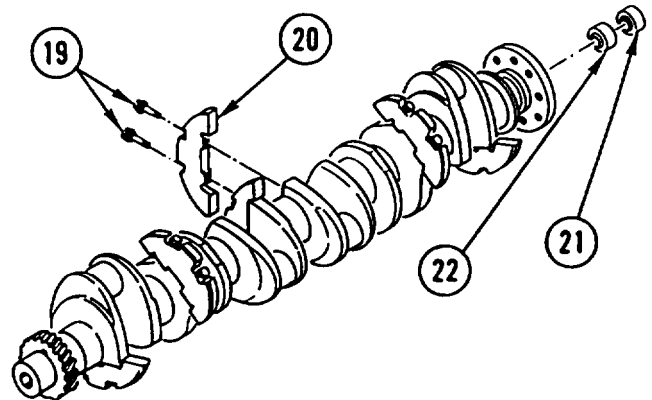
6. REMOVE rear oil SEAL (16) and pin (17) from rear bearing cap (18). DISCARD SEAL and PIN.



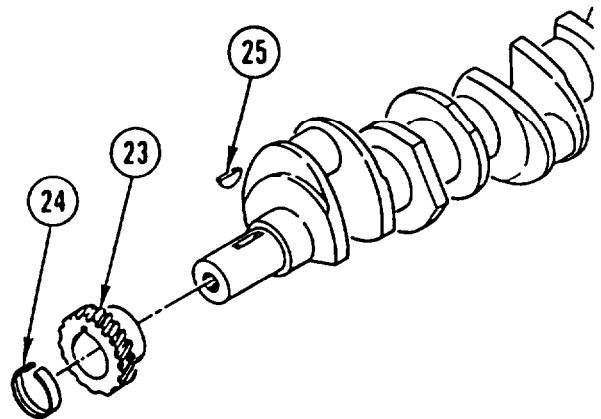
## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

### NOTE

- Tag counterweights prior to removal to aid in installation.
  - Perform step 7 only with engine serial numbers under 941675.
7. REMOVE 12 bolts (19) and 6 COUNTERWEIGHTS (20).
  8. REMOVE bearing (21) and COVER (22).



9. USING PULLER, REMOVE GEAR (23), intermediate piece (24), and key (25).

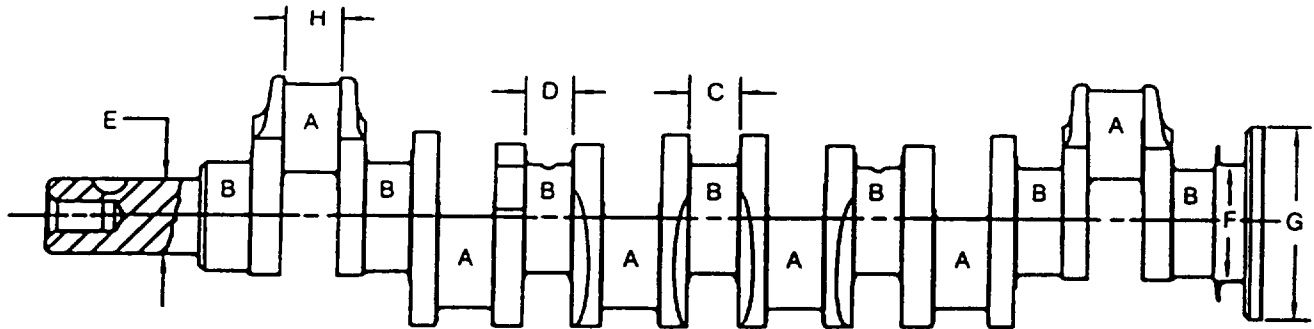


### INSPECTION

1. Inspect crankshaft for pitting, gouges, and scratches. If any of these conditions exist, tag crankshaft for repair and install new crankshaft.
2. Inspect crankshaft for cracks. If crankshaft is cracked, reject crankshaft assembly.
3. Make all journal measurements listed in following table. If any measurements are not within any stage listed, tag crankshaft assembly for repair and install new crankshaft assembly. If any journal measurement is less than lowest dimension in stage IV, reject crankshaft assembly.
4. Make all other measurements in table. If any measurement is lower than minimum shown, reject crankshaft assembly.



**CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT  
(CONT)**



**Crankshaft Repair Stage Specifications**

Repair Stage	Connecting Rod Journal Diameter A	Main Bearing Journal Diameter B	Thrust Bearing Journal Width C (Fit 0)	Main Journal Width D (6 places)	Shaft Diameter E
	In. (mm)	In. (mm)	In. (mm)	In. (mm)	In. (mm)
Standard	2.3620-2.3628 (59.995-60.015)	3.4642-3.4649 (87.99-88.01)	1.2598-1.2623 (32.000-32.062)	1.2598-1.2677 (32.000-32.200)	1.9686-1.9692 (50.002-50.018)
Standard I	2.3581-2.3588 (59.895-59.915)	3.4602-3.4610 (87.89-87.91)			
Stage I	2.3522-2.3530 (59.745-59.765)	3.4543-3.4551 (87.74-87.76)			
Stage II	2.3423-2.3431 (59.495-59.515)	3.4445-3.4453 (87.49-87.51)			
Stage III	2.3325-2.3333 (59.245-59.265)	3.4346-3.4354 (87.24-87.26)			
Stage IV	2.3226-2.3234 (58.995-59.015)	3.4248-3.4256 (86.99-87.01)			

Repair Stage	Shaft Diameter F	Flange Diameter G	Connecting Rod Journal Width H
	In. (mm)	In. (mm)	In. (mm)
Standard	3.5777-3.5798 (90.874-90.928)	5.1210-5.1220 (129.975-130.000)	1.4933-1.5012 (37.930-38.130)
Standard I			
Stage I			
Stage II			
Stage III			
Stage IV			

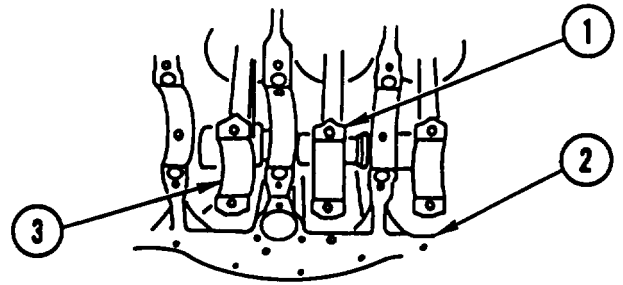
## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

### INSTALLATION

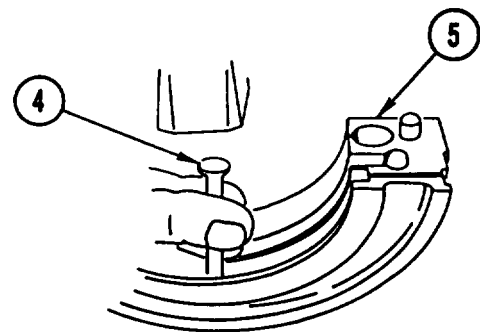
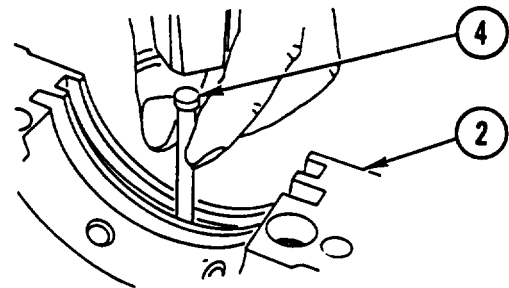
#### CAUTION

Make sure oil holes in bearings are aligned with holes in crankcase to prevent damage to equipment.

1. INSTALL flanged bearing HALF (1) in center position of crankcase (2) and six unflanged bearing HALVES (3) in remaining positions.



2. INSTALL two new PINS (4) in rear bearing cap (5) and rear of crankcase (2).

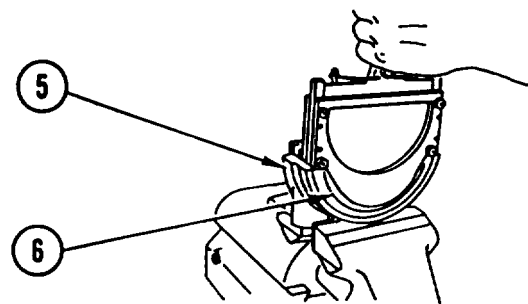
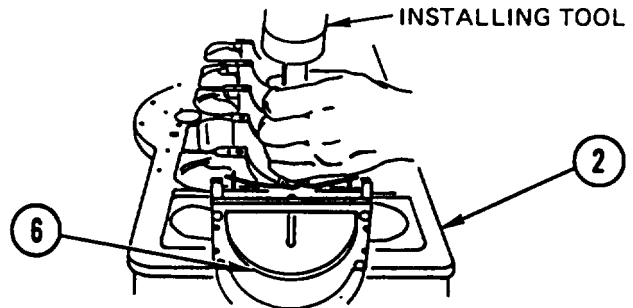


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## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

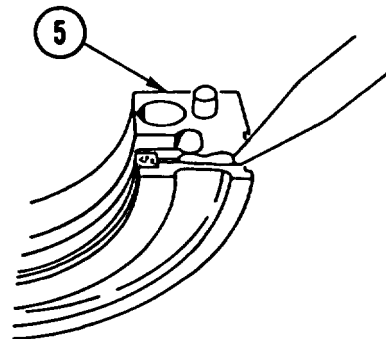
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USING INSTALLING TOOL, INSTALL two new SEALS (6) in rear bearing cap (5) and crankcase (2) and APPLY COAT of GAA.



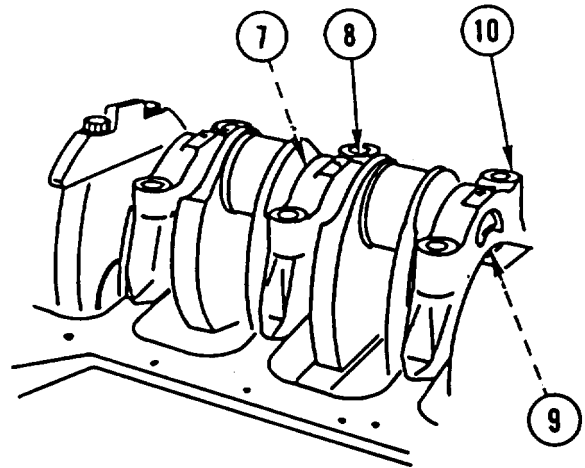
**WARNING**  
Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

4. FILL GROOVES in rear bearing cap (5) with ADHESIVE.

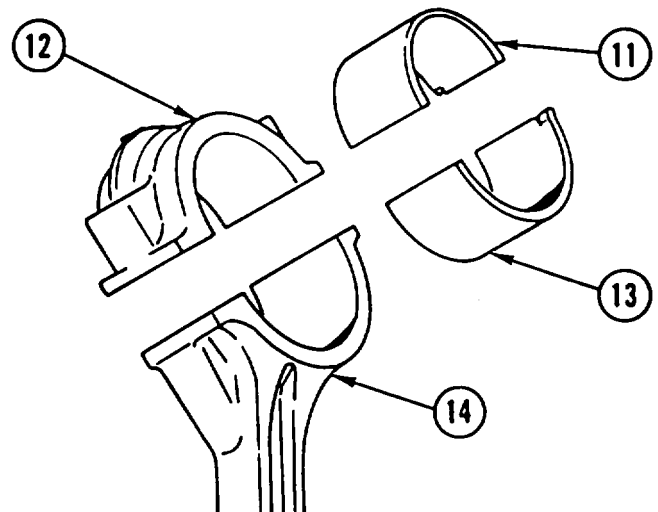


## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

5. INSTALL flanged bearing HALF (7) on center bearing cap (8) and six unflanged bearing HALVES (9) on remaining bearing caps (10).



6. INSTALL six bearing HALVES (11) on connecting rods (12) and six bearing HALVES (13) on six lower connecting rods (14).

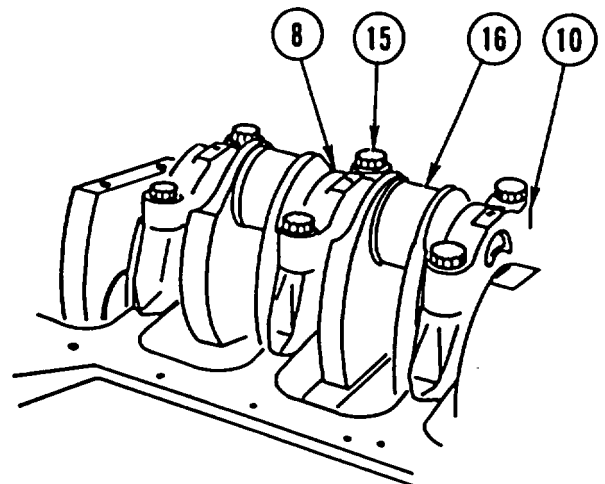


7. CHECK LENGTH of 14 bolts (15). MAXIMUM ALLOWABLE length is 4.84 in. (123 mm). REPLACE BOLT(S) that exceed allowable length.

### NOTE

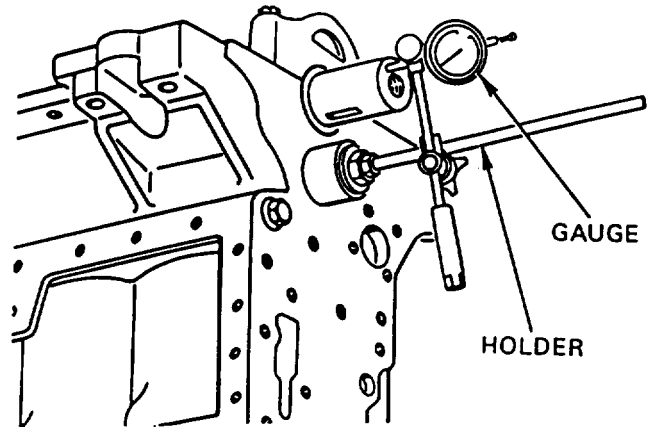
Bearing caps are numbered and must be installed in order with numbers toward front.

8. INSTALL CRANKSHAFT (16), 7 bearing caps (8 and 10), and 14 bolts (15). TIGHTEN BOLTS to 37-44 lb-ft (50-60 N.m). Startling from center cap and working toward ends alternately, TIGHTEN a SECOND TIME 90-110 degrees.



## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

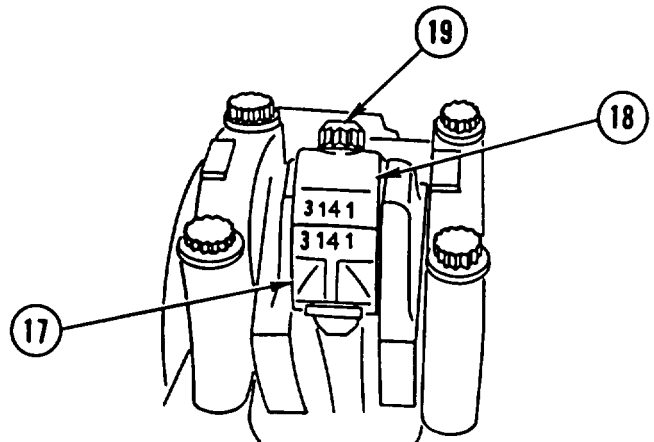
9. USING GAUGE and HOLDER. MEASURE crankshaft END PLAY. MAXIMUM ALLOWABLE end play is 0.008-0.011 in. (0.19-0.29 mm).



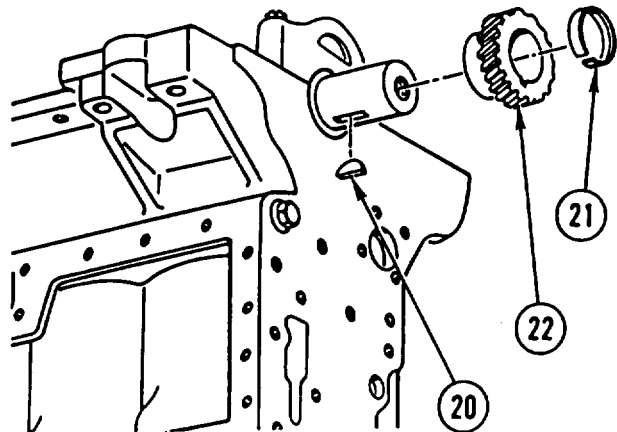
**CAUTION**

Numbers on each upper and lower connecting rod must be the same to prevent damage to equipment.

10. PULL six connecting RODS (17) to crankshaft and INSTALL six lower connecting RODS (18). TIGHTEN 12 BOLTS (19) to 30-37 lb-ft (40-50 N.m). TIGHTEN a SECOND TIME 90-110 degrees.



11. INSTALL key (20), intermediate piece (21), and GEAR (22).



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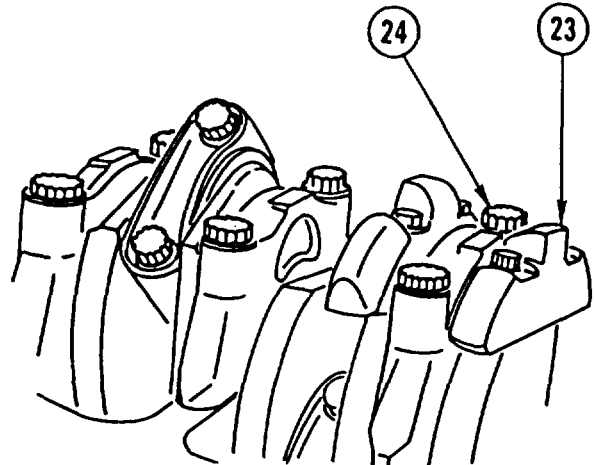
## CRANKSHAFT, MAIN BEARINGS, AND REAR SEALS REPLACEMENT (CONT)

---

### NOTE

Perform step 12 only with engine serial numbers under 941675.

12. INSTALL 6 COUNTERWEIGHTS (23) and 12 bolts (24). TIGHTEN BOLTS for counterweight marked 11 to 59-66 lb-ft (80-90 N.m). TIGHTEN REMAINING BOLTS to 22 +7 lb-ft (30 +10 N.m). TIGHTEN a SECOND TIME 90 +20 degrees.

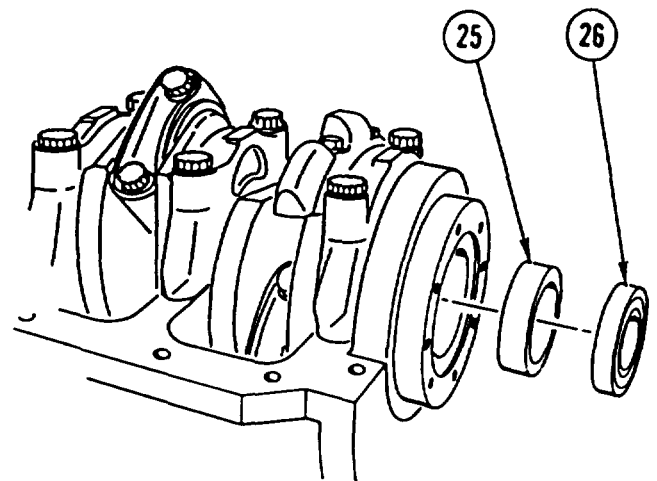


13. INSTALL COVER (25) and bearing (26).

### NOTE

Follow-on Maintenance:

Install flywheel end bell (page 13-28).  
 Install flywheel (page 13-25).  
 Install oil pump (page 13-60).  
 Install timing gear cover, gears, and case (page 3-56).  
 Install fuel injector nozzles (page 3-41).  
 Install engine (page 3-2).



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## CRANKSHAFT PULLEY REPLACEMENT

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This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Equipment Condition:

##### Reference

TM 5-2420-224-20

##### Condition Description

Fan Impeller Removed

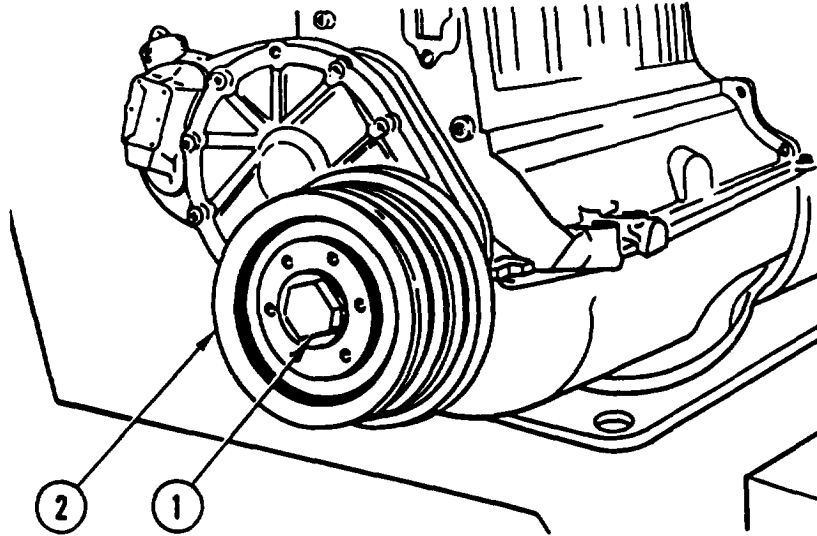
#### References:

TM 5-2420-224-20

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### REMOVAL

REMOVE bolt (1) and PULLEY (2).



### INSTALLATION

INSTALL PULLEY (2) and bolt (1). TIGHTEN BOLT to 369-406 lb-ft (500-550 N.m).

#### NOTE

Follow-on Maintenance:

Install fan impeller (TM 5-2420-224-20).

## FLYWHEEL REPLACEMENT AND REPAIR

This task covers: a. Removal b. Inspection c. Repair d. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Gauge, 001 5895321 00  
 Holder, 3635890221 00

#### Materials/Parts:

Compound, Sealing Appendix B, Item 15

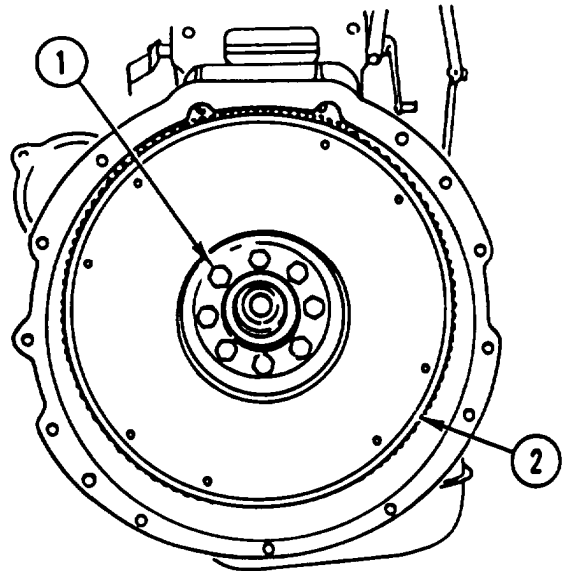
Personnel Required: (2)

#### Equipment Condition:

Reference	Condition Description
Page 3-2	Engine Removed
Page 3-63	Clutch Removed

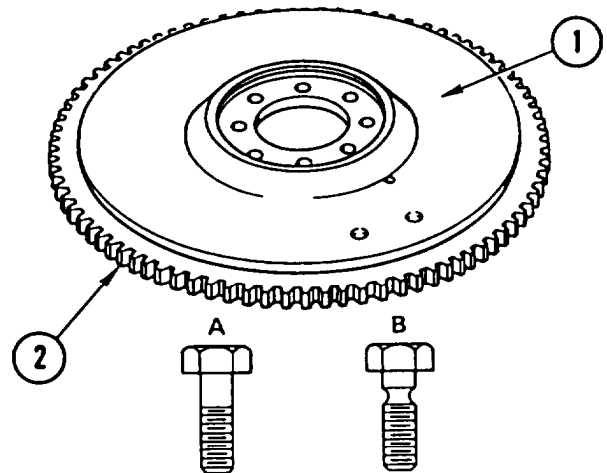
### REMOVAL

REMOVE eight screws (1) and FLYWHEEL (2).



### INSPECTION

1. Inspect flywheel friction surface (1) for scoring, cracks, burnt areas, and rough spots.
2. Inspect flywheel ring gear (2) for damaged teeth and replace ring gear if necessary (page 13-29.)
3. Inspect screws for damaged threads and/or excessive stretch. Maximum acceptable length is 1.035 in. (26.3 mm). If either condition exists, replace screw(s). The two types of screws (A is new; B is old, and no longer available) should not be mixed on the same engine.

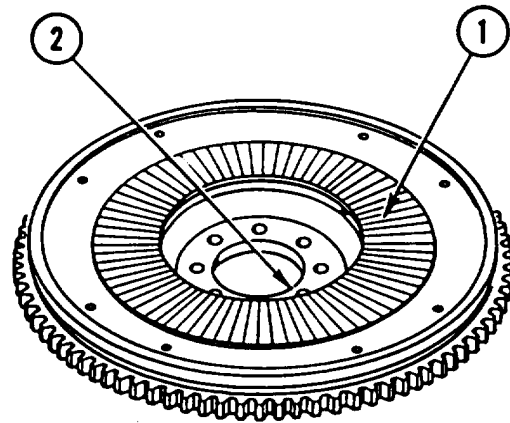




## FLYWHEEL REPLACEMENT AND REPAIR (CONT)

### REPAIR

1. Prior to machining flywheel friction surface (1), measure distance from friction surface (1) to mounting area (2). Record measurement.
2. Machine flywheel friction surface (1) to repair any damage. Do not exceed dimensional limit of 0.0394 in. (1 mm).
3. Machine mounting area (2) to maintain measurement taken-in step 1.

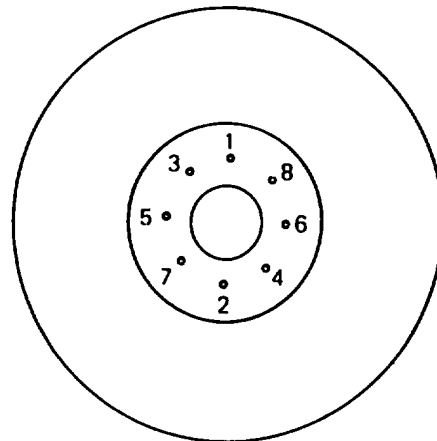
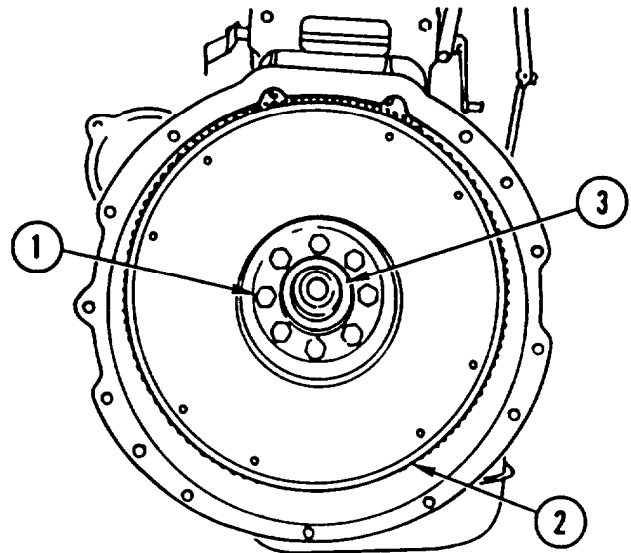


### INSTALLATION

#### 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 COAT of SEALING COMPOUND to eight SCREWS (1). INSTALL FLYWHEEL (2) on crankshaft flange (3) and INSTALL eight SCREWS (1). TIGHTEN SCREWS to 22-29 lb-ft (29-39 N.m) in sequence shown.

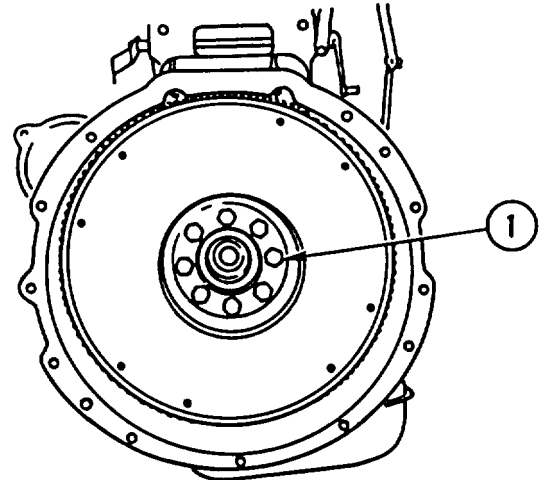


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**FLYWHEEL REPLACEMENT AND REPAIR (CONT)**

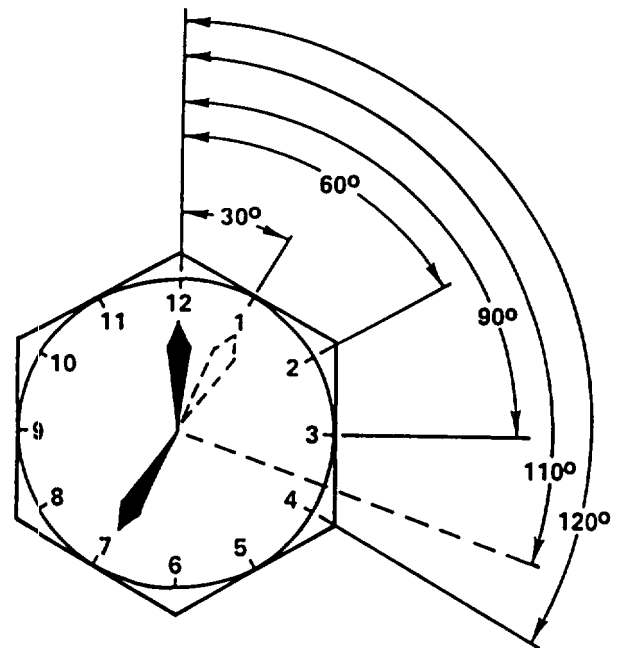
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2. TIGHTEN eight SCREWS (1) an additional 90-110 degrees using same sequence.
3. USING GAUGE and HOLDER, MEASURE flywheel lateral RUNOUT. MAXIMUM ALLOWABLE runout is 0.004 in. (0.10 mm).
4. USING GAUGE and HOLDER, MEASURE flywheel radial RUNOUT. MAXIMUM ALLOWABLE runout is 0.0099 in.



**NOTE**

Follow Maintenance:  
 Install clutch (page 3-63).  
 Install engine (page 3-2).



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## FLYWHEEL END BELL REPLACEMENT

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This task covers: a. Removal b. Installation

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Washer, Lock (4)

#### References:

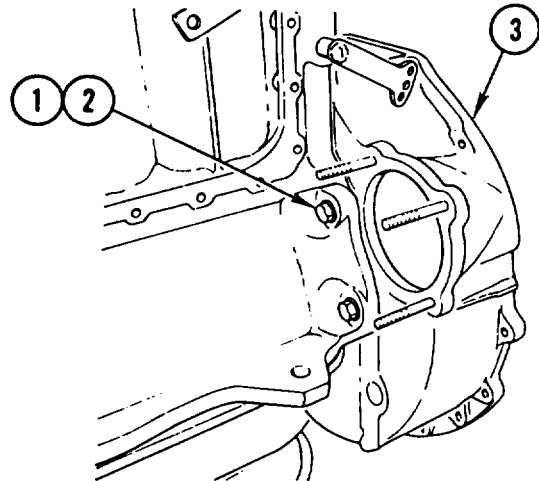
TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
Page 3-2	Engine Removed
TM 5-2420-224-20	Starter Removed
Page 13-25	Flywheel Removed

### REMOVAL

1. REMOVE four screws (1), four lock washers (2), and flywheel end BELL (3). DISCARD lock WASHERS.
2. REMOVE two PINS (4).



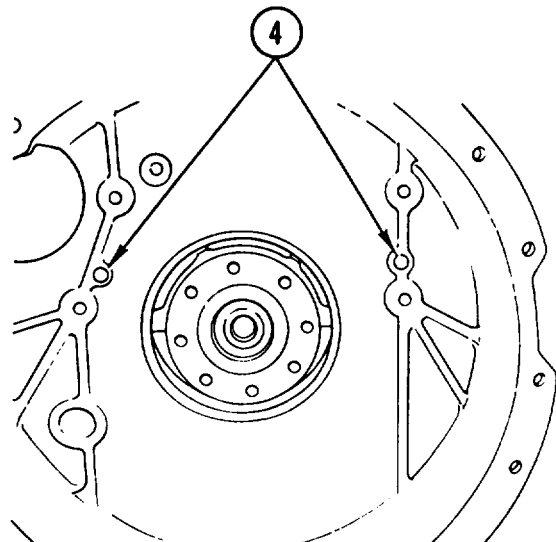
### INSTALLATION

1. INSTALL two PINS (4).
2. INSTALL flywheel end BELL (3), four new lock washers (2), and four screws (1).

#### NOTE

Follow-on Maintenance:

Install flywheel (page 13-25).  
Install starter (TM 5-2420-224-20).  
Install engine (page 3-2).



## FLYWHEEL RING GEAR REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Gauge, P/N 001 589 53 21 00  
 Holder, P/N 363 589 02 21 00

#### Materials/Parts:

Indicator, Temperature Appendix B, Item 26

#### Equipment Condition:

Reference	Condition Description
Page 13-25	Flywheel Removed

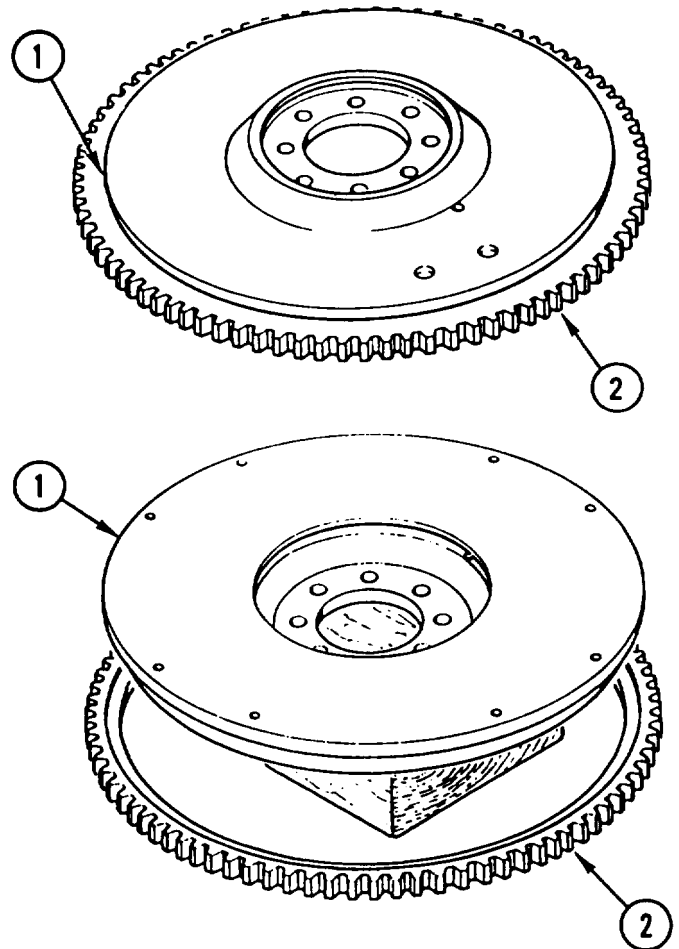
General Safety Instructions:

**WARNING**

Gear will be hot enough to burn you on contact. Wear heat-resistant gloves when handling hot gear.

### REMOVAL

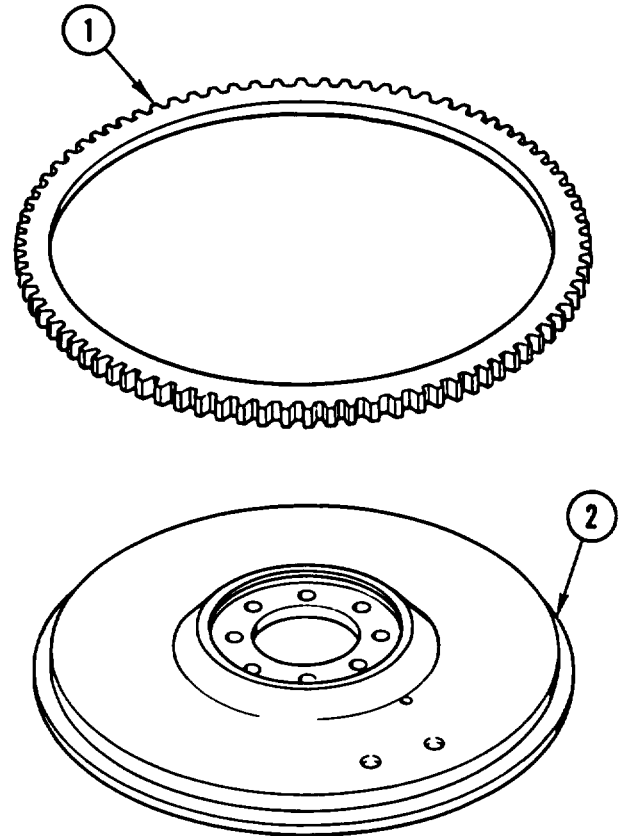
HEAT outer portion of FLYWHEEL (1) and STRIKE ring GEAR (2) EVENLY around the top until ring gear falls off.



## FLYWHEEL RING GEAR REPLACEMENT (CONT)

### INSTALLATION

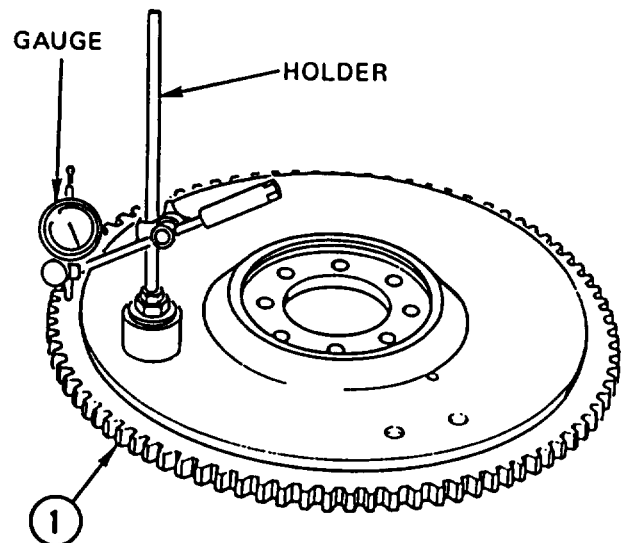
1. APPLY COAT of TEMPERATURE INDICATOR every few inches on outer edge of ring GEAR (1).
2. HEAT ring GEAR (1) until temperature indicator turns to LIQUID. HEAT from INSIDE diameter at 400° F (204°C).
3. PRESS ring GEAR (1) onto flywheel (2) with recess in ring gear (1) facing flywheel shoulder.



4. USING GAUGE and HOLDER, CHECK lateral RUNOUT of ring gear (1). Runout CANNOT be more than 0.020 in. (0.5 mm).

#### NOTE

Follow-on Maintenance:  
Install flywheel (page 13-25).



## PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Socket, P/N 352 589 01 09 00

#### Materials/Parts:

Kit; Parts

Kit, Parts

#### Equipment Condition:

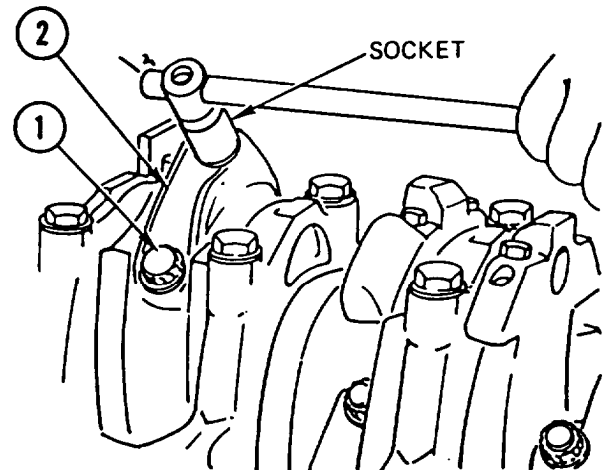
Reference	Condition Description
Page 3-2	Engine Removed
Page 13-60	Oil Pump Removed
Page 3-25	Cylinder Head Removed

### REMOVAL

#### NOTE

Rotate crankshaft for access for removal of bolts and lower connecting rods.

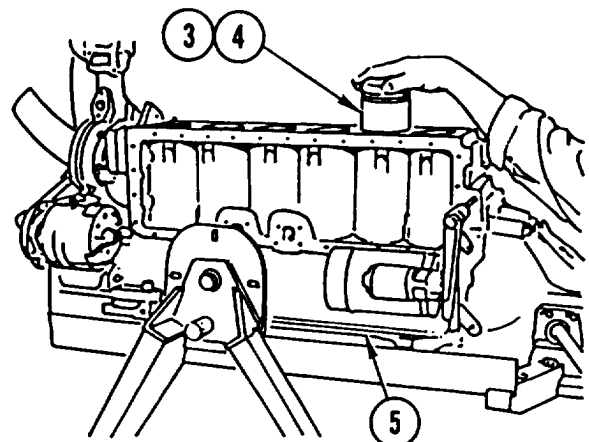
1. Using SOCKET, REMOVE two bolts (1) and lower connecting ROD (2).



#### NOTE

Both halves of connecting rod are a matched set. Tag parts for installation.

2. REMOVE PISTON (3) and upper connecting rod (4) by PUSHING from bottom of crankcase (5).

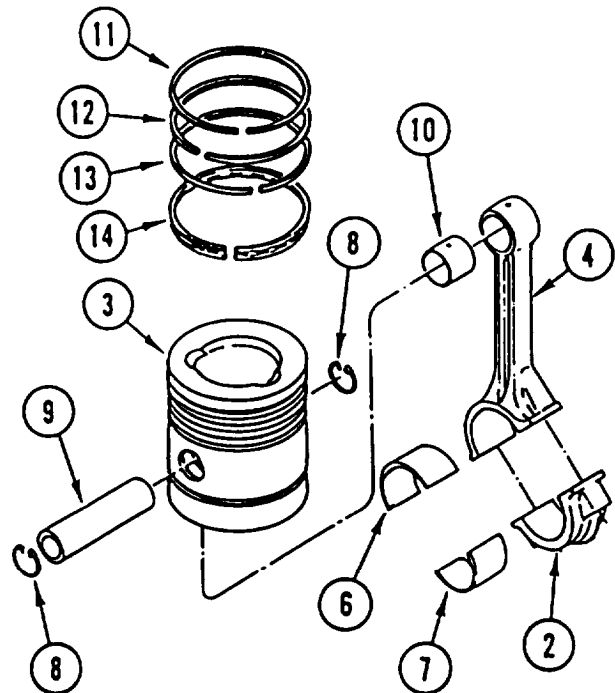


## PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT (CONT)

3. REMOVE and DISCARD two bearing HALVES (6 and 7) from upper and lower connecting rods (4 and 2).
4. REMOVE two retaining rings (8), pin (9), and PISTON (3) from upper connecting rod (4).
5. IF DAMAGED, REMOVE BUSHING (10).
6. REMOVE and DISCARD four RINGS (11, 12, 13, and 14).
7. REPEAT STEPS 1 thru 6 for remaining pistons.

### CLEANING

Check ring grooves and make sure all carbon deposits have been removed.



### INSPECTION

1. Inspect connecting rods for cracks, bends, and warpage. If any of these conditions exist, replace connecting rod with connecting rod of same color code. Maximum permissible difference in weight between any two connecting rods is 0.7 oz (20 g).
2. Measure inside diameter of small end bushing. Measurement should be 1.42 in, (36.03-36.04 mm). If measurement is exceeded, replace bushing with appropriate size bushing.

Connecting Rod Bushings

		In.	(mm)
OD	Normal	1.540	(39.075)
		1.538	(39.045)
	Repair Stage I	1.547	(39.275)
		1.546	(39.245)
	Repair Stage II	1.559	(39.575)
		1.558	(39.545)
ID	Rough Dimension	1.391	(35.300)
		1.389	(35.250)
	Finished Dimension	1.420	(36.040)
		1.419	(36.030)

**PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT (CONT)**

3. If bushing measurement is acceptable, inspect bushing for scratches, gouges, nicks, and cracks. If any of these conditions exist, replace bushing.
4. Measure connecting rod journals on crankshaft and compare with following table. If any measurements are not within any stage listed, remove crankshaft and tag for repair. Install new crankshaft. If any measurements are less than lowest dimension in stage IV, reject crankshaft assembly.

**Crankshaft Repair Stage Specifications**

Repair Stage	Connecting Rod Journal Diameter
	In. (mm)
Standard	2.3620-2.3628 (59.995-60.015)
Standard I	2.3581-2.3588 (59.895-59.915)
Stage I	2.3522-2.3530 (59.745-59.7651)
Stage II	<b>2.3423-2.3431</b> <b>(59.495-59.515)</b>
Stage III	<b>2.3325-2.3333</b> <b>(59.245-59.265)</b>
Stage IV	2.3226-2.3234 (58.995-59.015)

5. Inspect pistons for excessive wear, burn spots, cracks, and gouges. If any of these conditions exist, reject piston assembly.
6. Check ring groove width. If not within tolerance, reject piston.

**Piston Rings**

Piston Ring No.	Groove Width	
	In.	(mm)
I	<u>0.119</u> 0.118	(3.030) (3.015)
II	<u>0.121</u> 0.120	(3.060) (3.045)
III	<u>0.121</u> 0.120	(3.060) (3.045)
IV	<u>0.218</u> 0.217	(5.540) (5.525)



## PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT (CONT)

### INSTALLATION

#### NOTE

Perform steps 1 thru 3 only if installing new bushing.

1. USING suitable PRESS, INSTALL new BUSHING (1) in upper connecting rod (2).
2. USING upper connecting ROD (2) as a guide, DRILL a 0.12-in. (3-mm) oil HOLE through bushing (1).
3. REAM inside diameter of BUSHING (1) to 1.419-1.420 in. (36.030-36.040 mm).
4. IF cylinder BORE in crankcase (3) has been BORED OUT, SELECT appropriate replacement PISTON from following table.
5. INSTALL PISTON (4), pin (5), and two retaining rings (6) on upper connecting rod (2).

#### Replacement Pistons

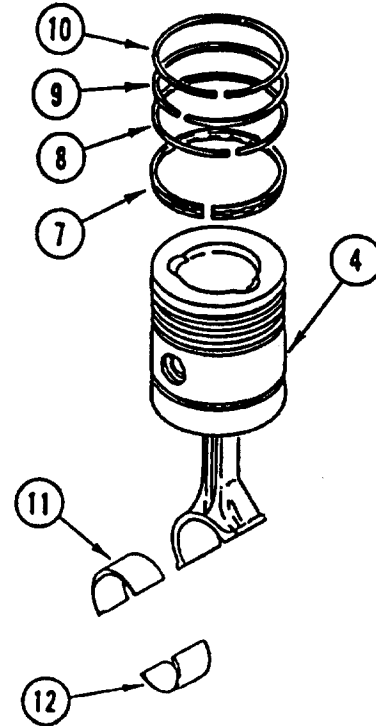
Repair Stage	Cylinder Bore		Total Height, Crankcase		Piston Diameter	
	In.	(mm)	In.	(mm)	In.	(mm)
Normal	<u>3.822</u>	<u>(97.010)</u>	<u>14.15</u> <u>14.14</u>	<u>(359.10)</u> <u>(359.00)</u>	<u>3.822</u>	<u>(97.000)</u>
	<u>3.821</u>	<u>(96.990)</u>				
Normal I	<u>3.825</u>	<u>(97.085)</u>				
	<u>3.824</u>	<u>(97.065)</u>				
Normal II	<u>3.827</u>	<u>(97.135)</u>			<u>3.827</u>	<u>(97.125)</u>
	<u>3.826</u>	<u>(97.115)</u>				
Stage I	<u>3.842</u>	<u>(97.510)</u>	<u>14.13</u>	<u>(358.70)</u> <u>(358.60)</u>	<u>3.842</u>	<u>(97.500)</u>
	<u>3.841</u>	<u>(97.490)</u>				
Stage II	<u>3.862</u>	<u>(98.010)</u>	<u>14.12</u>	<u>(358.50)</u> <u>(358.40)</u>	<u>3.861</u>	<u>(98.000)</u>
	<u>3.861</u>	<u>(97.990)</u>				
Stage III	<u>3.881</u>	<u>(98.510)</u>	<u>14.11</u>	<u>(358.25)</u> <u>(358.15)</u>	<u>3.881</u>	<u>(98.500)</u>
	<u>3.880</u>	<u>(98.490)</u>				

## PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT (CONT)

### NOTE

Rings are packaged in order in which they are to be installed. Do not remove a ring until ready to install.

- INSTALL four new RINGS (7, 8, 9, and 10) on piston (4) starting at the bottom, with openings 180 degrees apart.
- AFTER rings are installed, CHECK ring GAP and VERTICAL clearance with following table. If GAP is NOT WITHIN tolerance, REPLACE with new set.



### NOTE

Make sure tang snaps into slot of connecting rod.

- INSTALL new upper connecting rod bearing HALF (11).

### NOTE

Make sure tang snaps into slot of connecting rod.

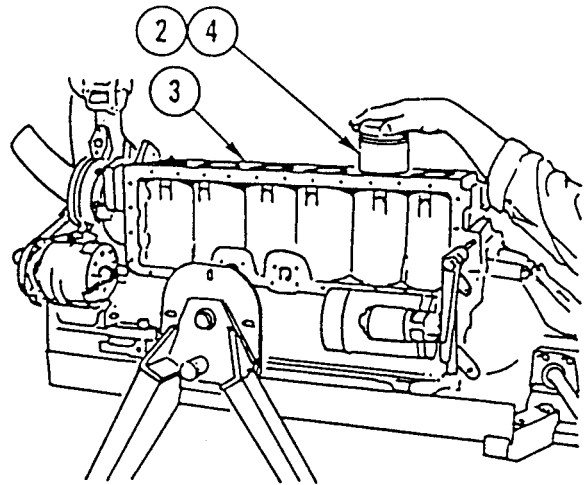
- INSTALL new lower connecting rod bearing HALF (12).

### Rings

Groove	I		II		III		IV	
	Compression Rings				Oil Scraper Rings			
Piston Ring Designation	Keystone Ring		Taper Face Compression Ring		Bevelled Ring with Spring Expander			
	In.	(mm)	In.	(mm)	In.	(mm)	In.	(mm)
Gap Clearance	<u>0.021</u> 0.013	<u>(0.55)</u> (0.35)	<u>0.021</u> 0.013	<u>(0.55)</u> (0.35)	0.015	<u>(0.40)</u>	0.001	<u>(0.25)</u>
Vertical Clearance	<u>0.003</u> 0.002	<u>(0.808)</u> (0.044)	0.003	<u>(0.802)</u> (0.055)	0.002	<u>(0.062)</u>	0.001	<u>(0.035)</u>

## PISTONS, RINGS, CONNECTING RODS, AND BEARINGS REPLACEMENT (CONT)

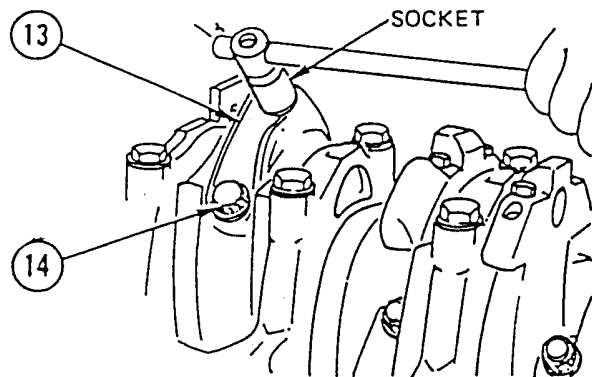
10. INSTALL PISTON (4) and upper connecting rod (2) in crankcase (3) from top with ARROW on piston POINTING FORWARD.



### CAUTION

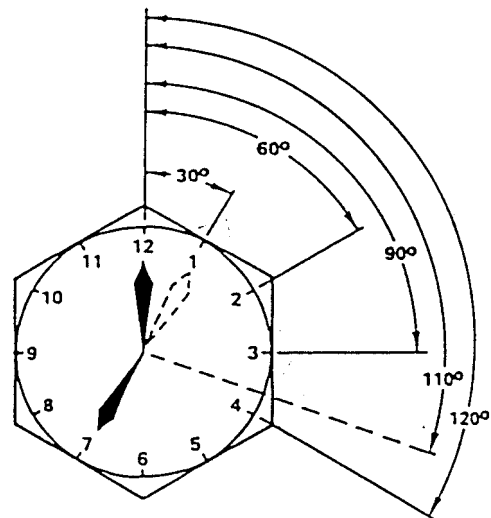
When installing connecting rods and caps, make sure numbers match. Failure to do so will result in damage to engine.

11. Using SOCKET, INSTALL lower connecting ROD (13) and two bolts (14). TIGHTEN BOLTS to 30-37 lb-ft (40-50 N.m). TIGHTEN a SECOND TIME 90-110 degrees.
12. REPEAT STEPS 1 thru 11 for remaining pistons.



### NOTE

Follow-on Maintenance:  
Install cylinder head (page 3-25).  
Install oil pump (page 13-60).  
Install engine (page 3-2).



## ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT

This task covers: a. Removal b. Inspection c. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

##### Reference

TM 5-2420-224-20

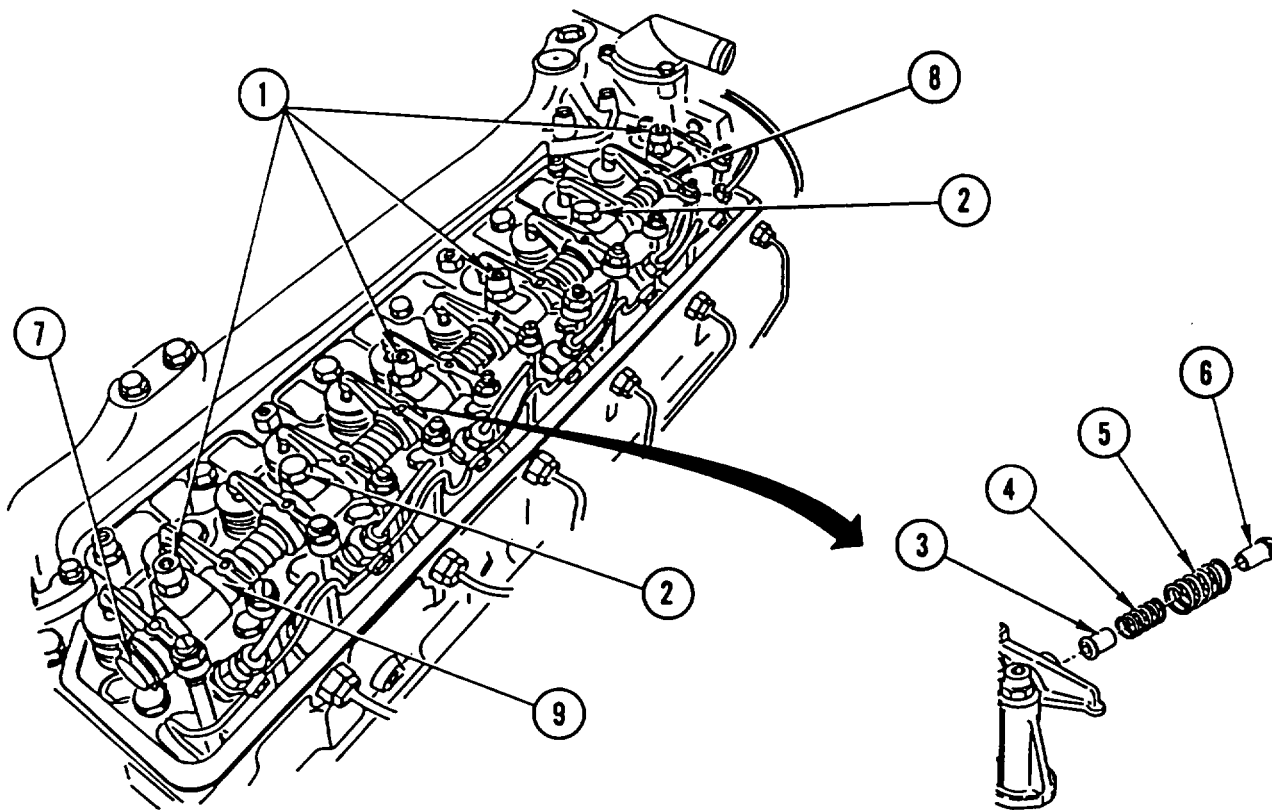
Page 3-29

##### Condition Description:

Valve Cover and Gasket  
 Removed

Push Rod Cover  
 Removed

### REMOVAL



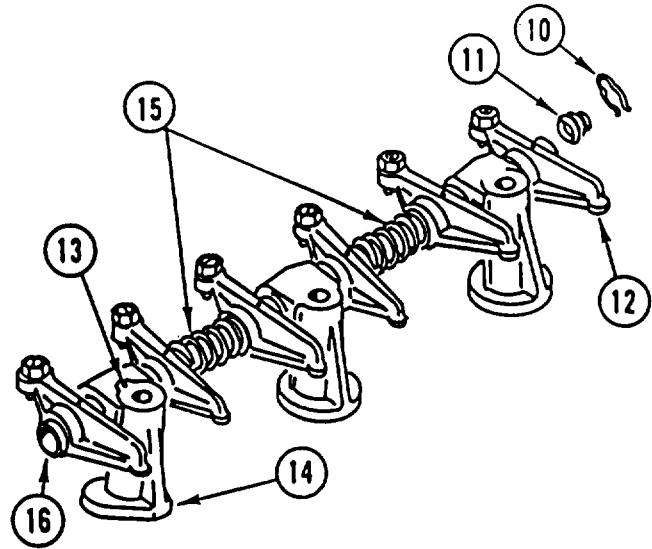
1. REMOVE four bolts (1), two bolts (2), spacer (3), spring (4), spring (5), nipple (6), two rocker ARMS (7 and 8), and shim (9) if present.

## ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT (CONT)

### NOTE

Tag rocker arm assemblies prior to removal to aid in installation.

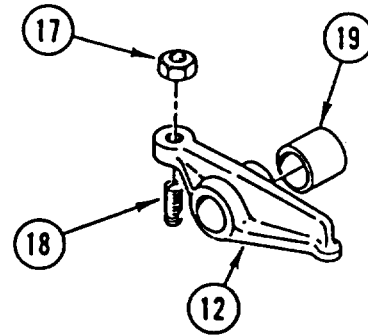
2. REMOVE clip (10), spring (11), six rocker ARM assemblies (12), setscrew (13), three brackets (14), and two springs (15) from spindle (16).
3. REPEAT STEP 2 for other rocker arm.



### NOTE

Step 4 is the same for all rocker arm assemblies.

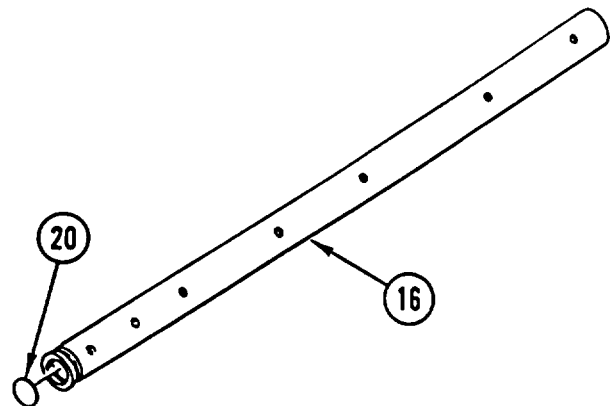
4. REMOVE nut (17), SETSCREW (18), and BUSHING (19) IF DAMAGED, from each rocker arm assembly (12).



### NOTE

Step 5 is the same for both spindles.

5. REMOVE expansion PLUG (20) from spindle (16).



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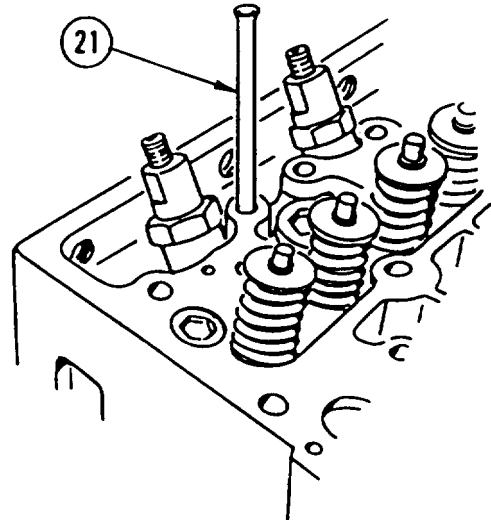
**ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT (CONT)**

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**NOTE**

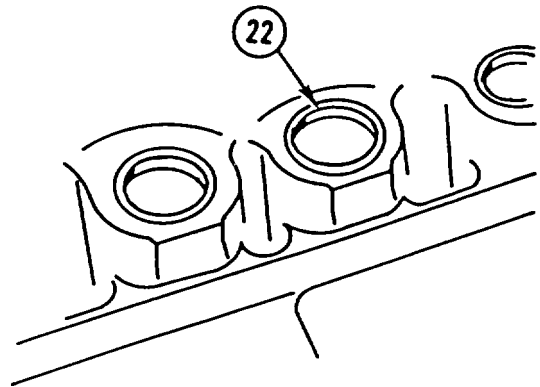
Tag push rods after removal to aid in installation.

6. REMOVE 12 push RODS (21).

**NOTE**

Tag tappets after removal to aid in installation.

7. REMOVE 12 TAPPETS (22).

**INSPECTION**

1. Inspect springs for cracks.
2. Inspect rocker arm assembly bushings for wear and gouges.
3. Inspect push rods for bends.
4. Inspect tappets for external wear and scoring on sides and wear on push rod contact area.

**ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT (CONT)**

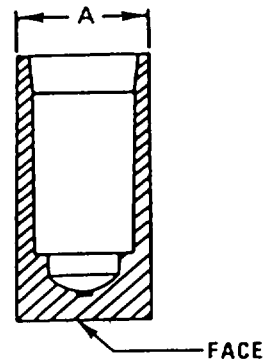
- Check tappet face for excessive wear and nonperpendicularity to sides. Maximum deviation is 0.012 in. (0.03 mm). See table below.

**NOTE**

- Replace tappets if worn or maximum nonperpendicularity is exceeded. Slight pit marks on tappet face are not cause for replacement, except if pitting is on the edge.
- Always install new tappets if new camshaft has been installed.

**Tappets**

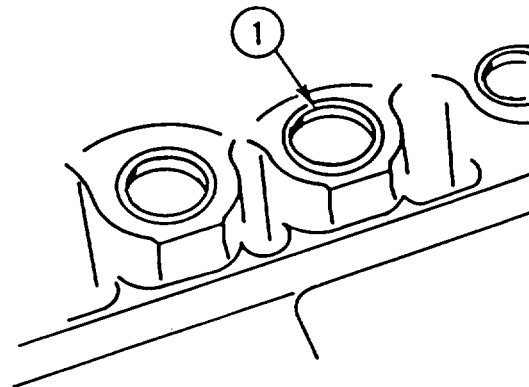
Repair Stage	Outside Diameter A	
	In.	(mm)
Standard	<u>1.1020</u>	<u>(27.99)</u>
	1.1016	(27.98)
Stage I	<u>1.1098</u>	<u>(28.19)</u>
	1.1094	(28.18)
Stage II	<u>1.1216</u>	<u>(28.49)</u>
	1.1212	(28.48)
Stage III	<u>1.1315</u>	<u>(28.74)</u>
	1.1311	(28.73)



- Measure clearance between tappet and engine block bore. Allowable clearance is 0.0004-0.0020 in. (0.010-0.053 mm). If clearance is less than 0.0004 in. (0.010 mm), enlarge engine block bore. If clearance is greater than 0.0020 in. (0.053 mm), reject engine block.

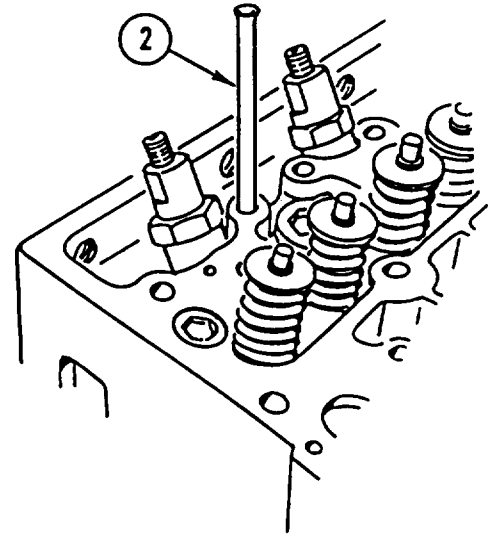
**INSTALLATION**

- INSTALL 12 TAPPETS (1).



**ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT (CONT)**

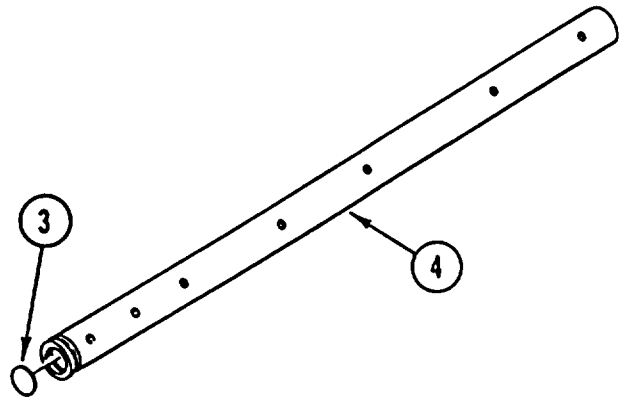
2. INSTALL 12 push RODS (2).



**NOTE**

Step 3 is the same for both spindles.

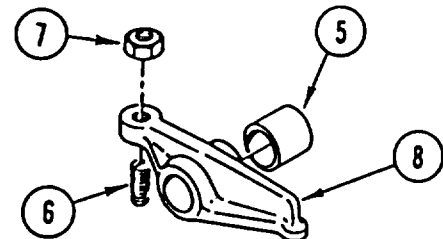
3. INSTALL expansion PLUG (3) in spindle (4).



**NOTE**

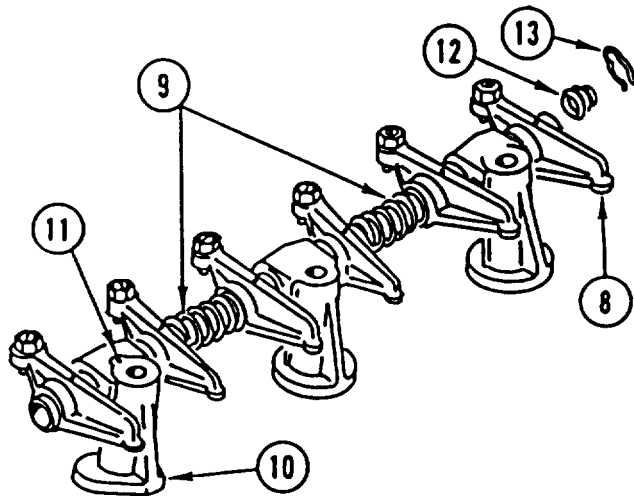
- Steps 4 and 5 are the same for all rocker arm assemblies.
- Make sure oil holes in bushing and rocker arm are alined.

4. IF REMOVED, INSTALL new BUSHING (5).
5. INSTALL SETSCREW (6) and nut (7) in rocker arm assembly (8).

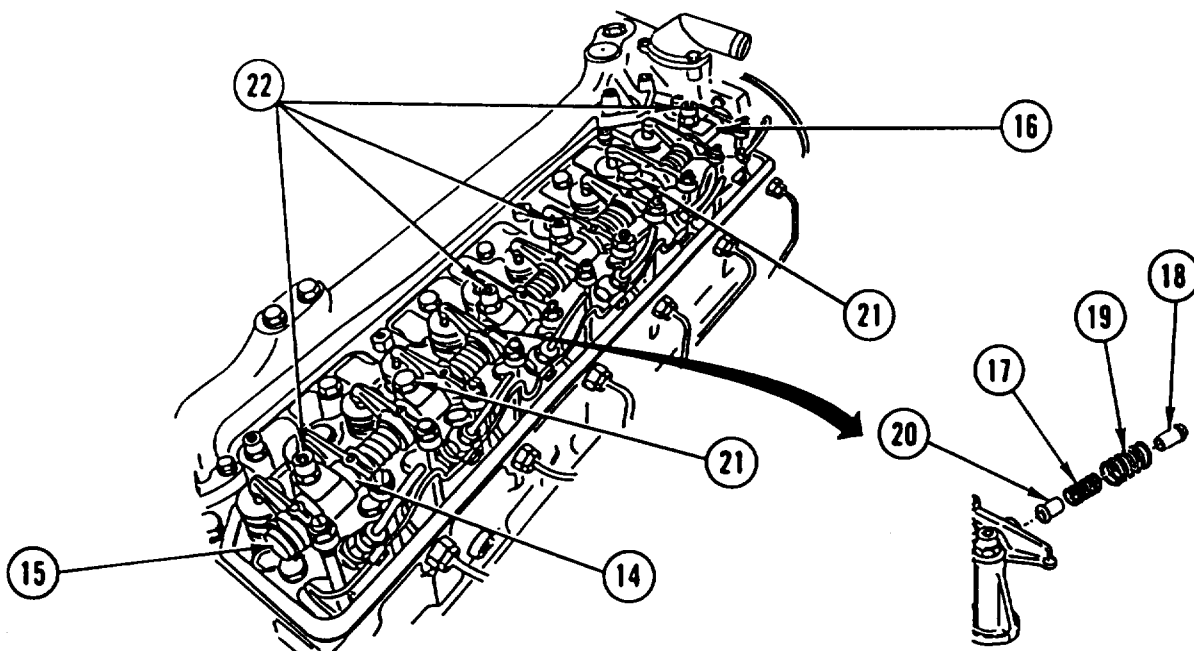




## ROCKER ARMS, PUSH RODS, AND TAPPETS REPLACEMENT (CONT)



6. INSTALL two springs (9), three brackets (10), setscrew (11), six rocker ARM assemblies (8), spring (12), and clip (13).
7. REPEAT STEP 6 for other rocker arm.



8. IF REMOVED, INSTALL SHIM (14).
9. INSTALL two rocker ARMS (15 and 16), spring (17), nipple (18), spring (19), spacer (20), two bolts (21), and four bolts (22). TIGHTEN BOLTS to 74-81 lb-ft (100-110 N.m).

### NOTE

Follow-on Maintenance:

Install push rod cover (page 3-29).  
 Adjust valves (TM 5-2420-224-20).  
 Install valve cover and gasket (TM 5-2420-224-20).

---

## CAMSHAFT AND BEARINGS REPLACEMENT

---

This task covers: a. Removal b. Inspection c. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Gauge, P/N 001 5695321 00  
 Holder, P/N 3635890221 00

#### Materials/Parts:

Oil, Lubricating                      Appendix B, Item 30

#### Equipment Condition:

Reference	Condition Description
Page 3-2	Engine Removed
Page 3-56	Timing Gear Cover, Gears, and Case Removed
Page 3-25	Cylinder Head Removed
Page 3-29	Push Rod Cover Removed
Page 13-60	Oil Pump Removed
Page 3-34	Air Compressor Removed

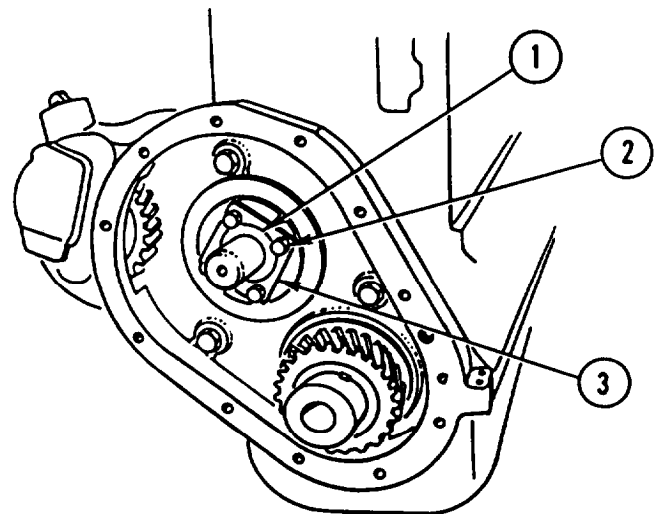
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### REMOVAL

**CAUTION**

Screws used on thrust plate must not be used anywhere else due to difference of threads. Damage to equipment could occur.

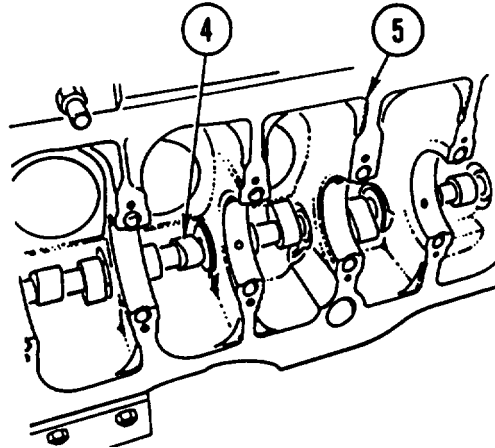
1. REMOVE thrust washer (1), four screws (2), and thrust BEARING (3).



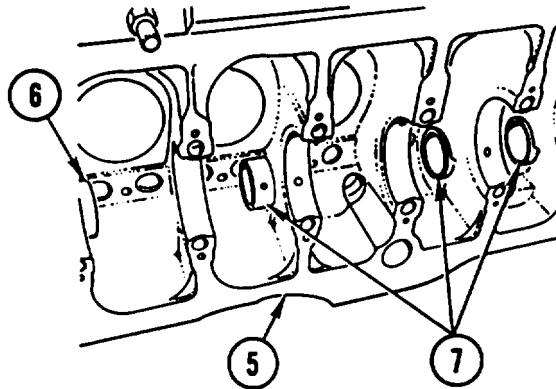
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## CAMSHAFT AND BEARINGS REPLACEMENT (CONT)

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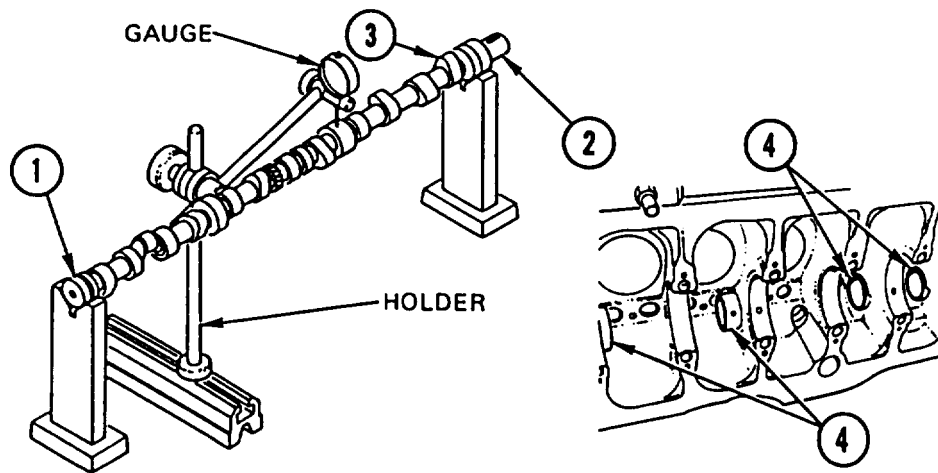


2. REMOVE CAMSHAFT (4) from crankcase (5).



3. REMOVE sleeve BEARING (6) from front of crankcase (5).
4. REMOVE three camshaft BEARINGS (7) from crankcase (5).

### INSPECTION



1. Using gauge and holder, check camshaft radial runout at cam bearing journals (1). If runout exceeds 0.0009 in. (0.025 mm), replace camshaft (2).

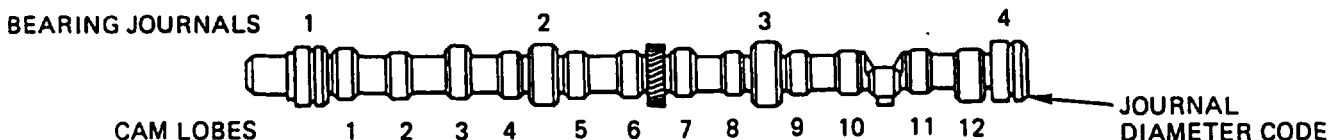
## CAMSHAFT AND BEARINGS REPLACEMENT (CONT)

- If cam lobes (3) and/or cam bearing journals (1) show pitting, scoring, flat areas, bums, or excessive wear, replace camshaft (2).
- Measure inner diameter of four bearings (4) using following table.

### NOTE

To obtain proper inner diameter for bearing(s), bearing(s) must be installed in cylinder block and be line bored to proper diameter for each journal.

- To use table, determine journal diameter code. Using code, determine standard to be used. Once standard has been determined, refer to table for proper bearing inner diameter.



Journal Diameter	Stamped Code	Journal Diameter		Bearing Shell ID (Final)		
		In.	(mm)	In.	(mm)	
Standard	— IN					
Standard	1	<u>2.2031</u>	<u>(55.960)</u>	<u>2.2055</u>	<u>(56.020)</u>	
		2.2024	(55.941)	2.2043	(55.990)	
		2	<u>2.1933</u>	<u>(55.710)</u>	<u>2.1956</u>	<u>(55.770)</u>
			2.1925	(55.691)	2.1944	(55.740)
	3	<u>2.1834</u>	<u>(55.460)</u>	<u>2.1858</u>	<u>(56.520)</u>	
2.1927		(55.441)	2.1846	(55.490)		
4	<u>2.1736</u>	<u>(55.210)</u>	<u>2.1759</u>	<u>(56.270)</u>		
	2.1728	(55.191)	2.1747	(55.240)		
Air Compressor	<u>1.2598</u>	<u>(32.000)</u>	—	—		
	1.2592	(31.984)				
Standard I	1	<u>2.1992</u>	<u>(55.860)</u>	<u>2.2015</u>	<u>(56.920)</u>	
		2.1984	(55.841)	2.2003	(55.890)	
	2	<u>2.1893</u>	<u>(55.610)</u>	<u>2.1917</u>	<u>(55.670)</u>	
		2.1886	(55.591)	2.1905	(55.640)	
	3	<u>2.1795</u>	<u>(55.360)</u>	<u>2.1818</u>	<u>(55.420)</u>	
2.1787		(55.341)	2.1807	(55.390)		
4	<u>2.1696</u>	<u>(55.110)</u>	<u>2.1720</u>	<u>(55.170)</u>		
	2.1689	(55.091)	2.1708	(55.140)		
Air Compressor	<u>2.2559</u>	<u>(31.900)</u>	—	—		
	2.2552	(31.884)				

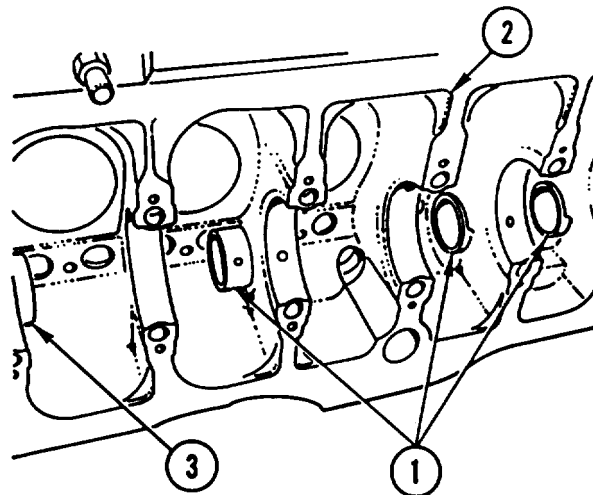
## CAMSHAFT AND BEARINGS REPLACEMENT (CONT)

### INSTALLATION

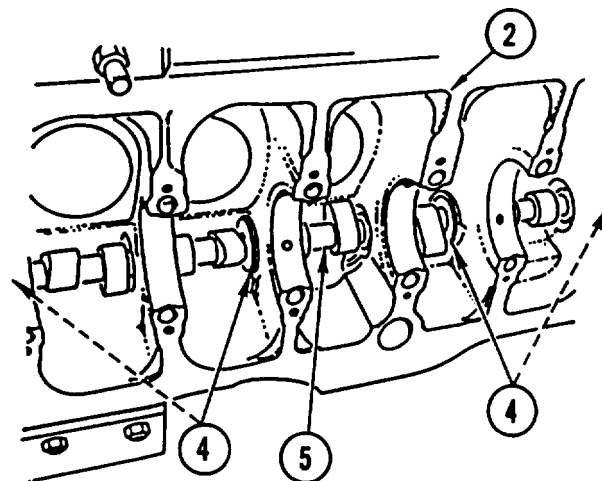
#### NOTE

Make sure camshaft journal holes are thoroughly cleaned and free of any foreign material.

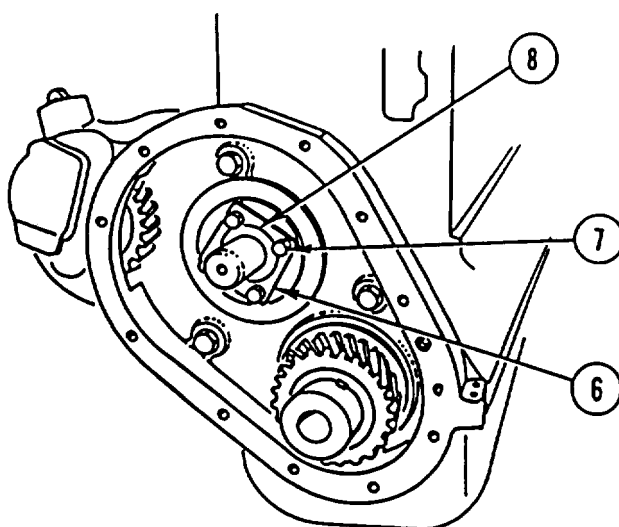
1. INSTALL three camshaft BEARINGS (1) in crankcase (2).
2. INSTALL sleeve BEARING (3) in front of crankcase (2).



3. APPLY COAT of LUBRICATING OIL to four JOURNALS (4) and CAREFULLY INSTALL CAMSHAFT (5) in crankcase (2).



4. INSTALL thrust BEARING (6), four screws (7), and thrust washer (8). TIGHTEN SCREWS to 26 lb-ft (35 N.m).



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**CAMSHAFT AND BEARINGS REPLACEMENT (CONT)**

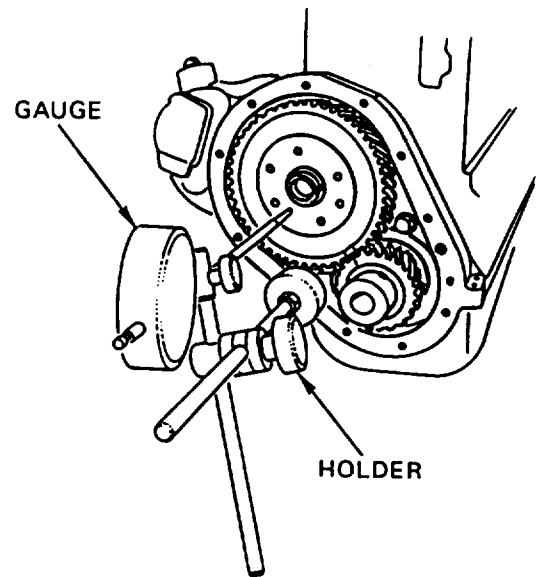
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5. INSTALL TIMING GEARS (page 3-56).
6. USING GAUGE and HOLDER, MEASURE camshaft END PLAY. End play reading should be 0.004-0.20 in. (0.11-0.52 mm). If end play is MORE than 0.20 in. (0.52 mm), REPLACE thrust BEARING (6).

**NOTE**

Follow-on Maintenance:

- Install air compressor (page 3-34).
- Install oil pump (page 13-60).
- Install push rod cover (page 3-29).
- Install cylinder head (page 3-25).
- Install timing gear cover (page 3-56).
- Install engine (page 3-2).



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## CYLINDER BLOCK REPAIR

---

This task covers: a. Disassembly b. Inspection c. Repair d. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 STE/ICE-R, NSN 4910-00-124-2554  
 Tool Set A, P/N 419-000-7458  
 Tool Set B, P/N 419-000-7558  
 Tool Set C, P/N 419-000-7658

#### Materials/Parts:

Kit, Parts  
 Chips, Soap Appendix B, Item 9  
 Cloth, Emery Appendix B, Item 10  
 Oil, Lubricating Appendix B, Item 30

#### Equipment Condition:

##### Reference

Page 3-2 Engine Removed  
 Page 3-63 Clutch Removed  
 Page 3-25 Cylinder Head Removed  
 Page 13-28 Flywheel End Bell  
 Removed

##### Condition Description

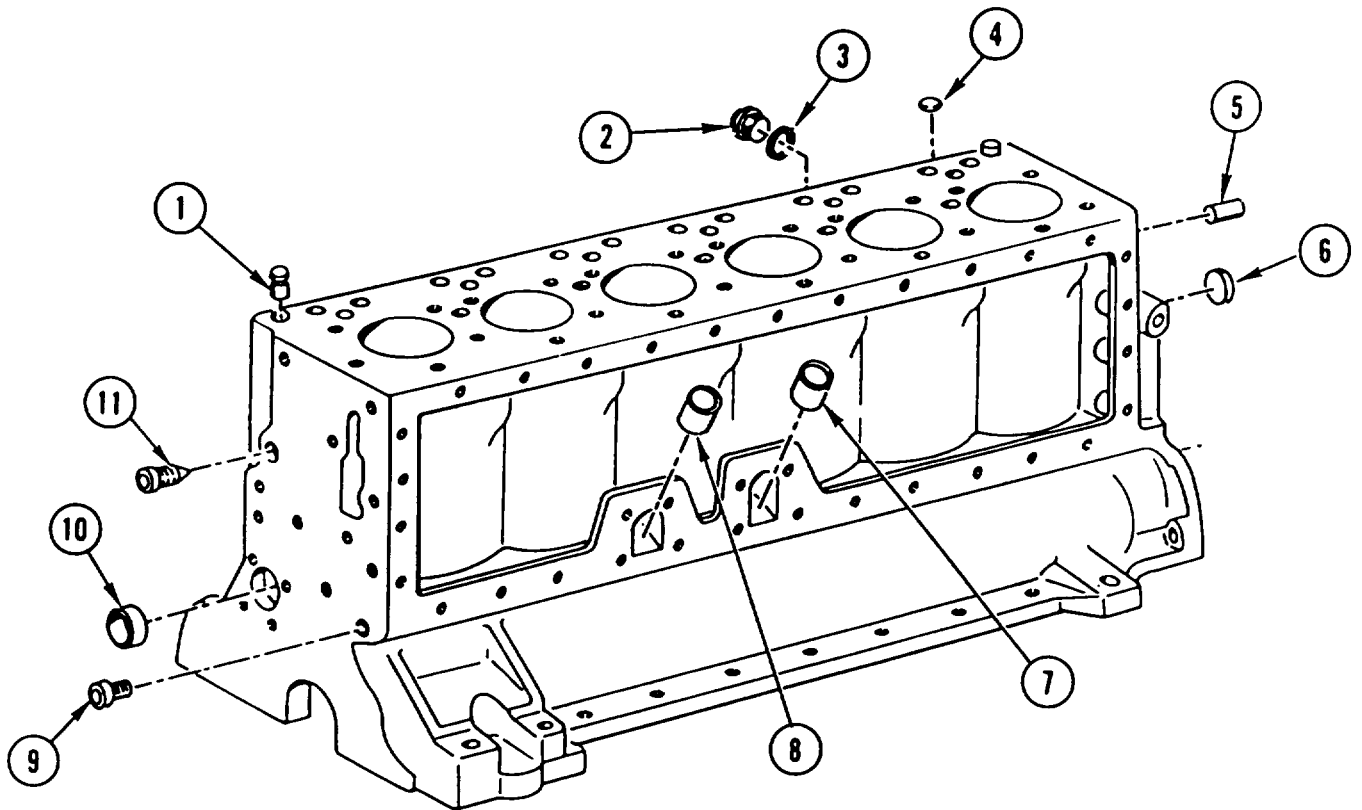
#### Equipment Condition (Cont):

##### Reference

Page 13-37 Rocker Arms, Push Rods,  
 and Tappets Removed  
 Page 13-60 Oil Pump Removed  
 Page 13-15 Crankshaft, Main Bearings,  
 and Rear Seals Removed  
 Page 13-31 Pistons, Rings,  
 Connecting Rods, and  
 Bearings Removed  
 Page 3-56 Timing Gear Cover,  
 Gears, and Case  
 Removed  
 Page 3-34 Air Compressor Removed  
 Page 3-29 Push Rod Cover  
 Removed  
 Page 3-30 Oil Cooler and Gasket  
 Removed  
 Page 3-43 Fuel Injection Pump  
 Removed  
 Page 13-43 Camshaft and Bearings  
 Removed

**CYLINDER BLOCK REPAIR (CONT)**

**DISASSEMBLY**



**LEGEND**

- |           |             |
|-----------|-------------|
| 1 Pin (2) | 7 Spacer    |
| 2 Plug    | 8 Bushing   |
| 3 Seal    | 9 Plug (2)  |
| 4 Plug    | 10 Plug (4) |
| 5 Pin (2) | 11 Plug     |
| 6 Plug    |             |

**NOTE**

Discard seal.

REMOVE all PARTS from crankcase USING ILLUSTRATION and LEGEND as a guide.

**INSPECTION**

1. Inspect all parts for wear, thread damage, bends, and cracks. Replace parts if any of these conditions are present, except as noted.
2. If any threads in crankcase have been damaged, attempt to renew using thread chaser. If thread pattern cannot be renewed, replace crankcase.



---

**CYLINDER BLOCK REPAIR (CONT)**

---

3. Using straightedge and feeler gage, check warpage of top of crankcase at 1-in. intervals along length. Maximum allowable warpage cannot exceed 0.0007 in. (0.17 mm). If warpage exceeds maximum limit, tag crankcase for repair.
4. Using straightedge and feeler gage, check warpage of top of crankcase at 1-in. intervals along width. Maximum allowable warpage cannot exceed 0.0012 in. (0.030 mm). If warpage exceeds maximum limit, tag crankcase for repair.
5. Measure total height of crankcase and refer to following table. If measurement is between repair stages, tag crankcase for repair. If measurement is less than 14.11 in. (358.15 mm), replace crankcase.

**Crankcase**

	<b>In.</b>	<b>(mm)</b>
<b>Total Height of Crankcase (production size)</b>	<u>14.148</u>	<u>(359.10)</u>
	14.144	(359.00)
<b>Repair Stage I</b>	<u>14.132</u>	<u>(358.70)</u>
	14.128	(358.60)
<b>Repair Stage II</b>	<u>14.124</u>	<u>(358.50)</u>
	14.120	(358.40)
<b>Repair Stage III</b>	<u>14.115</u>	<u>(358.25)</u>
	14.111	(358.15)

6. Inspect top of crankcase for peaks and valleys. If any are present, measure distance between each peak and valley. Acceptable depth of each valley is 0.0001-0.0002 in. (0.003-0.005 mm). If maximum depth is exceeded, tag crankcase for repair. If repair would cause total height to be less than allowable in step 5, replace crankcase.
7. Inspect honing pattern of each cylinder bore. If pattern has been even slightly destroyed, tag crankcase for repair.

---

**CYLINDER BLOCK REPAIR (CONT)**


---

8. Measure inside diameter of each cylinder bore at two points 90 degrees apart, at six locations along length of bore. Maximum amount bore can be out-of-round or tapered is 0.0004 in. (0.01 mm). If measurement is exceeded, tag crankcase for repair.
9. Compare diameter measurements from step 8 with following table. If measurements are between repair stages, tag crankcase for repair. If any measurement is larger than 3.881 in. (98.510 mm), replace crankcase.

**Cylinder Bores**

Repair Stage	Cylinder Bore	
	In.	(mm)
Normal	<u>3.822</u>	<u>(97.010)</u>
	3.821	(96.990)
Normal I	<u>3.825</u>	<u>(97.085)</u>
	3.824	(97.065)
Normal II	<u>3.827</u>	<u>(97.135)</u>
	3.826	(97.115)
Stage I	<u>3.842</u>	<u>(97.510)</u>
	3.841	(97.490)
Stage II	<u>3.861</u>	<u>(98.010)</u>
	3.860	(97.990)
Stage III	<u>3.881</u>	<u>(98.510)</u>
	3.880	(98.490)

10. Inspect each cylinder bore for peaks and valleys. If any are present, measure distance between each peak and valley. Acceptable depth of each valley is 0.0001-6.0002 in. (0.003-0.005 mm). If maximum depth is exceeded, tag crankcase for repair. If repair would exceed maximum diameter shown in table, replace crankcase.
11. Measure diameter of camshaft bearing bores. Diameter must be 2.364-2.365 in. (60.000-60.030 mm). If any bore exceeds 2.365 in. (60.030 mm), replace crankcase.

---

## CYLINDER BLOCK REPAIR (CONT)

---

12. Measure diameter of tappet bores and refer to following table. If measurements are between repair stages, tag crankcase for repair. If any measurement exceeds 1.134 in. (28.783 mm), replace crankcase.

### Valve Tappet Bores

Repair Stage	Tappet Bore	
	In.	(mm)
Normal	<u>1.105</u>	<u>(28.033)</u>
	1.103	(28.000)
Stage I	<u>1.112</u>	<u>(28.233)</u>
	1.111	(28.200)
Stage II	<u>1.124</u>	<u>(28.533)</u>
	1.123	(28.500)
Stage III	<u>1.134</u>	<u>(28.783)</u>
	1.133	(28.750)

---

### REPAIR

---

**W A R N I N G**

Before machining crankcase, make sure crankcase is properly secured. Failure to do so could result in injury to personnel.

1. If crankcase top is warped or has peaks and valleys, machine deck to next repair stage shown in Crankcase table in Inspection, above. If machining deck will bring height of crankcase below allowable limits, replace crankcase.
2. If crankcase height is between repair stages, machine to next repair stage, unless that machining will bring height of crankcase below allowable limits.

---

**CYLINDER BLOCK REPAIR (CONT)**


---

**NOTE**

If inspection shows that cylinder boring is required, bore all six cylinders to next repair stage.

3. Secure crankcase on drill press.
4. Aline cylinder to be bored with drill. Center drill above return point of first piston ring at TDC.

---

**CAUTION**


---

Bore crankcase cylinders in following order: 1-3-5-2-4-6. Failure to do so could cause thermal stress on cylinder walls.

---

5. Clamp boring tool onto drill. Using the two following tables, bore cylinder to within 0.002 in. (0.05 mm) of final diameter.

**Cylinder Bores**

Repair Stage	Cylinder Bore	
	In.	(mm)
Normal	<u>3.822</u>	<u>(97.010)</u>
	3.821	(96.990)
Normal I	<u>3.825</u>	<u>(97.085)</u>
	3.824	(97.065)
Normal II	<u>3.827</u>	<u>(97.135)</u>
	3.826	(97.115)
Stage I	<u>3.842</u>	<u>(97.510)</u>
	3.841	(97.490)
Stage II	<u>3.861</u>	<u>(98.010)</u>
	3.860	(97.990)
Stage III	<u>3.881</u>	<u>(98.510)</u>
	3.880	(98.490)

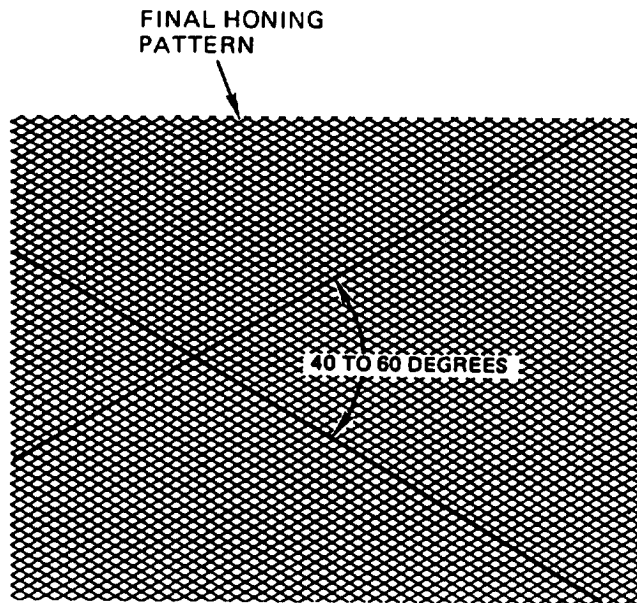
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## CYLINDER BLOCK REPAIR (CONT)

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### Machining Specifications

Equipment Required to Bore and Hone Cylinders on Unsleeved Engines	
<b>Precision Drill Press</b>	
Speed (approximate) . . . . .	250-280 rpm
Feed (Drilling) . . . . .	0.0016-0.0024 in./rev (0.04-0.06 mm/rev)
<b>Honing Machine</b>	
Working Pressure . . . . .	36-44 psi (2.5-3.0 bar)
Speed (approximate) . . . . .	60-100 rpm
Number of Passes . . . . .	30-40
Honing Angle . . . . .	120 degrees
Up and Down Cycle . . . . .	45/minute
Grinding Stone Grade . . . . .	120-150
Advance Step . . . . .	6.7-8.7 in./rev (170-220 mm/rev)
Surface Roughness . . . . . of Cylinder Bore	118-197 $\mu$ in (3-5 $\mu$ m)
Surface Roughness . . . . . of Deck	315-640 $\mu$ in (8-16 $\mu$ m)



6. After boring cylinders, inspect top of cylinder block in accordance with inspection steps 3 and 4. if necessary, machine top to next repair stage.
7. Bevel inner top edge of cylinder to 30 degrees.

**NOTE**

Properly honed cylinder has dull, unglazed surface with roughness of 118-197  $\mu$ in (3-5  $\mu$ m).

8. Hone cylinders to finished dimension using Machining Specifications table above. Honing pattern must be 40-60 degrees as shown.
9. Use emery cloth to remove any burrs or sharp edges from bottom of cylinders.

---

**CYLINDER BLOCK REPAIR (CONT)**

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**CAUTION**

Make sure all machining residue is removed before assembling engine. Failure to do so could result in increased engine wear and reduced service life of engine.

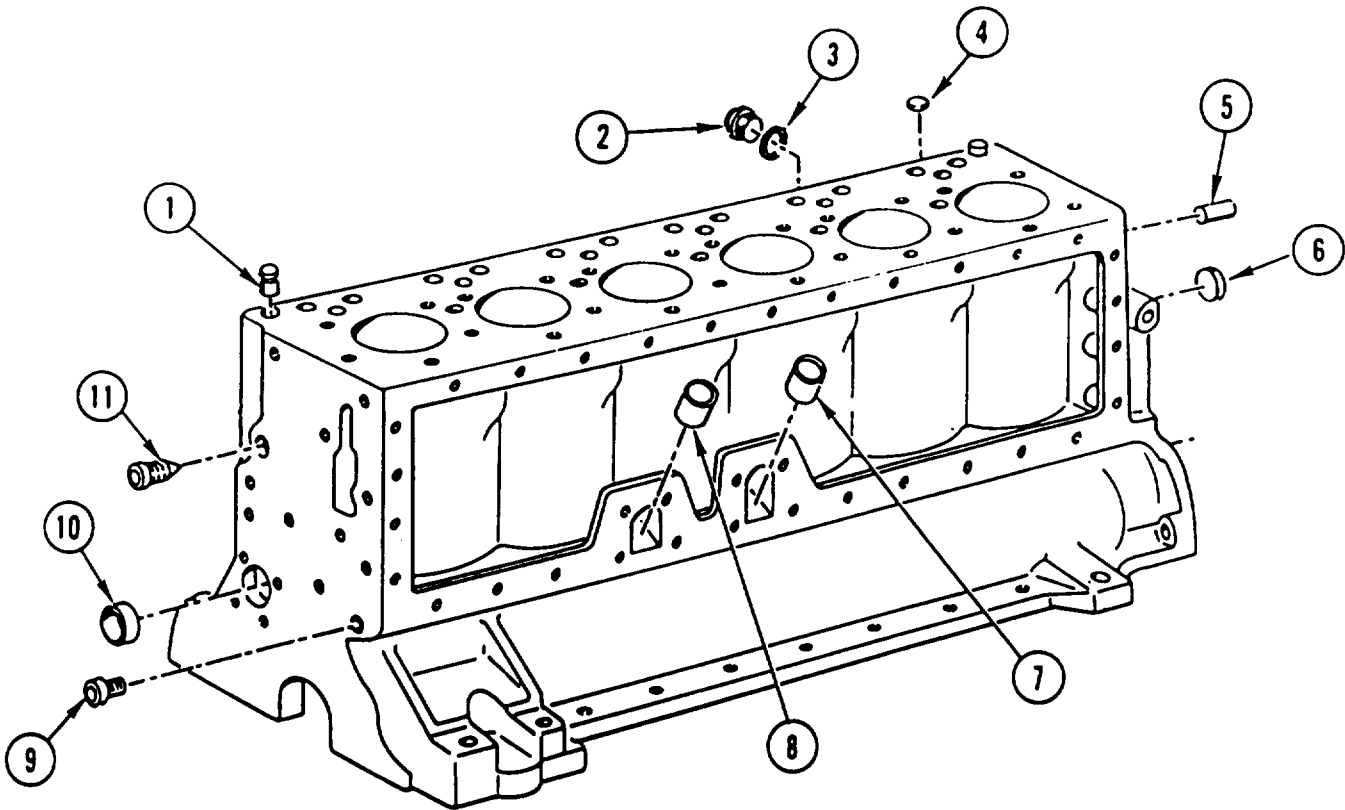
10. Clean cylinder block thoroughly with soap and water. Dry cylinder bores immediately after cleaning and apply light coat of lubricating oil.
11. If top of engine requires machining, remove only amount of material necessary to obtain measurements of next repair stage shown on page 13-53.
12. If different size tappet is to be installed upon assembly of engine, bore tappet holes in cylinder block so that clearance between tappet and engine bore is 0.004-0.0020 in. (0.10-0.053 mm).

---

**CYLINDER BLOCK REPAIR (CONT)**

---

**ASSEMBLY**



**LEGEND**

- 1 Pin (2)
- 2 Plug
- 3 Seal
- 4 Plug
- 5 Pin (2)
- 6 Plug
- 7 Spacer
- 8 Bushing
- 9 Plug (2)
- 10 Plug (4)
- 11 Plug

---

**CYLINDER BLOCK REPAIR (CONT)**

---

**NOTE**

Install new seal.

INSTALL all PARTS in crankcase using ILLUSTRATION and LEGEND as a guide.

**NOTE**

Follow-on Maintenance:

- Install camshaft and bearings (page 13-43).
- Install fuel injection pump (page 3-43).
- Install oil cooler and gasket (page 3-30).
- install push rod cover (page 3-29).
- Install air compressor (page 3-34).
- Install timing gear cover, gears, and case (page 3-56).
- Install pistons, rings, connecting rods, and bearings (page 13-31).
- Install crankshaft, main bearings, and rear seals (page 13-15).
- Install oil pump (page 13-60).
- Install rocker arms, push rods, and tappets (page 13-37).
- Install flywheel end bell (page 13-28).
- Install cylinder head (page 3-25).
- Install clutch (page 3-63).
- Install engine (page 3-2).



---

## OIL PAN REPLACEMENT

---

This task covers: a. Removal b. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Materials/Parts:

Packing

Seal

Packing

Kit, Gasket

Adhesive

Appendix B, Item 2

#### Equipment Condition:

##### Reference

Page 3-2

TM 5-2420-224-20

##### Condition Description

Engine Removed

Accelerator Pedal  
 and Linkage Removed  
 (Engine Linkage Only)

---

### REMOVAL

1. REMOVE gage ROD (1), cap (2), and spacer (3).
2. REMOVE nut (4), bolt (5), washer (6), clamp (7), guide TUBE (8), and packing (9). DISCARD PACKING.
3. REMOVE bolt (10) and BRACKET (11).
4. REMOVE 4 nuts (12), 2 screws (13), 16 screws (14), 2 long screws (15), 2 washers (16), oil PAN (17), and 4 gaskets (18, 19, 20, and 21). DISCARD GASKETS.
5. REMOVE PLUG (22) and seal (23). DISCARD SEAL.
6. REMOVE PLUG (24) and packing (25). DISCARD PACKING.
7. REMOVE four STUDS (26) from cylinder block.

### INSTALLATION

1. INSTALL four STUDS (26) in cylinder block.
2. INSTALL PLUG (24) and new packing (25).
3. INSTALL PLUG (22) and new seal (23).

### 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.

## OIL PAN REPLACEMENT (CONT)

### CAUTION

Make sure all gasket material has been removed from all mating surfaces to prevent damage to equipment.

- INSTALL two new GASKETS (18 and 20). APPLY ADHESIVE to ENDS of gaskets.

### NOTE

Make sure ends of two gaskets (18 and 20) are coated with adhesive and in contact with two gaskets (19 and 21).

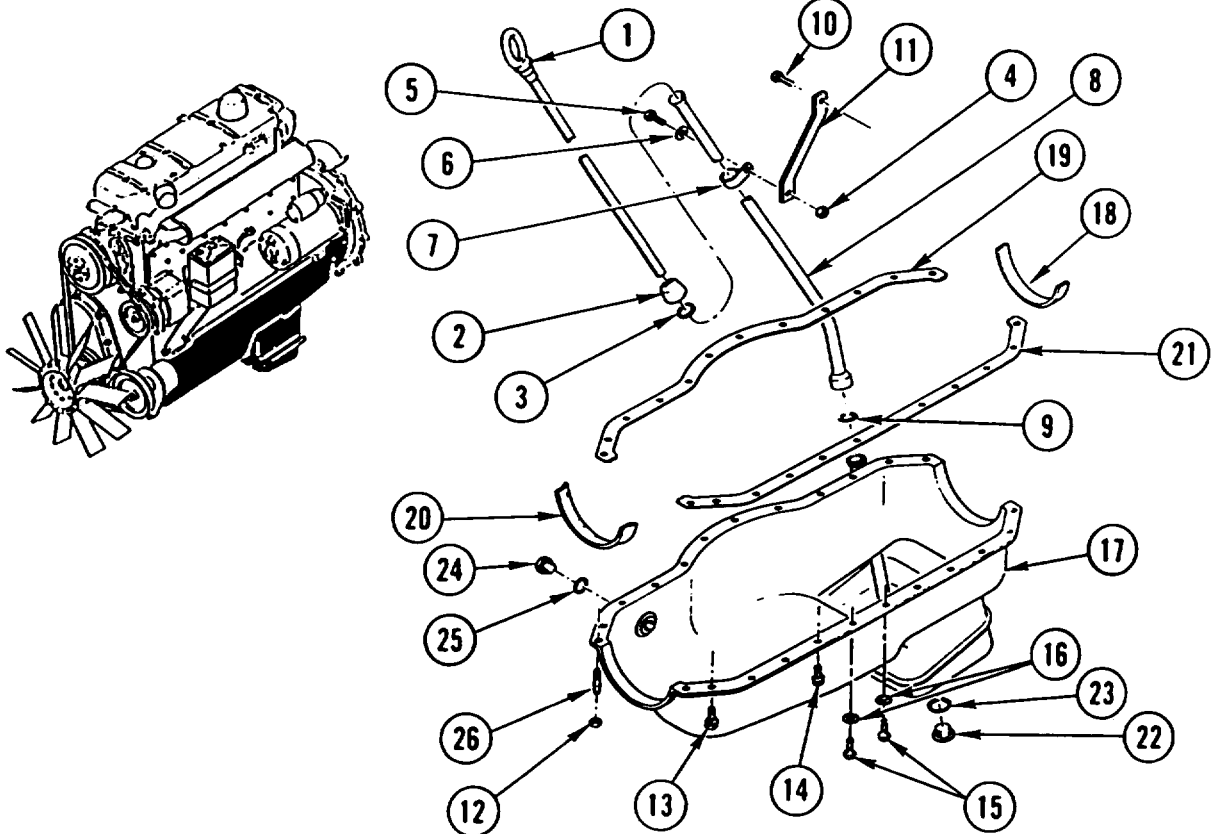
- INSTALL two new GASKETS (19 and 21).
- INSTALL oil PAN (17), 4 nuts (12), 2 screws (13), 2 washers (16), 2 long screws (15), and 16 screws (14).
- INSTALL BRACKET (17) and bolt (10).
- INSTALL new packing (9), guide TUBE (8), clamp (7), bolt (5), washer (6), and nut (4).
- INSTALL spacer (3), cap (2), and gage ROD (1).

### NOTE

Follow-on Maintenance:

Install engine (page 3-2).

Install accelerator pedal and linkage (engine linkage only) (TM 5-2420-224-20)



---

## OIL PUMP REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Inspection d. Assembly e. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Compound, Sealing            Appendix B, Item 14

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
Page 3-2	Engine Removed
Page 13-58	Oil, Pan Removed
TM 5-2420-224-20	Engine Oil Fitter Element Removed

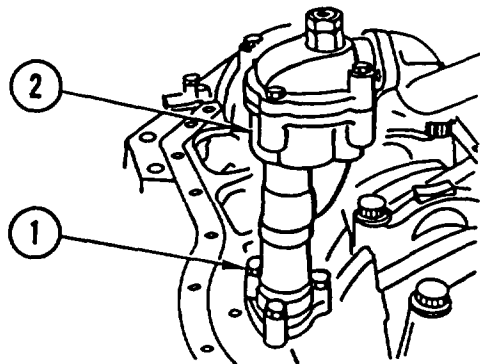
### WARNING

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.

---

### REMOVAL

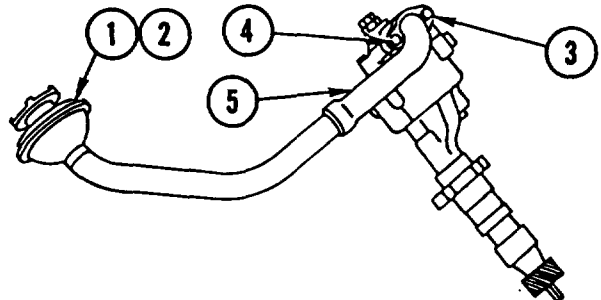
REMOVE three screws (1) and oil PUMP (2).




---

### DISASSEMBLY

1. REMOVE retaining ring (1) and suction CHAMBER (2).
2. REMOVE screw (3), bolt (4), and suction PIPE (5).



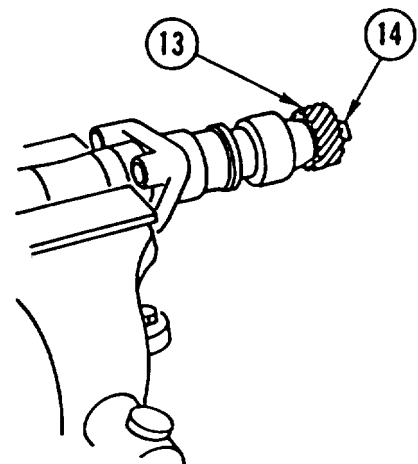
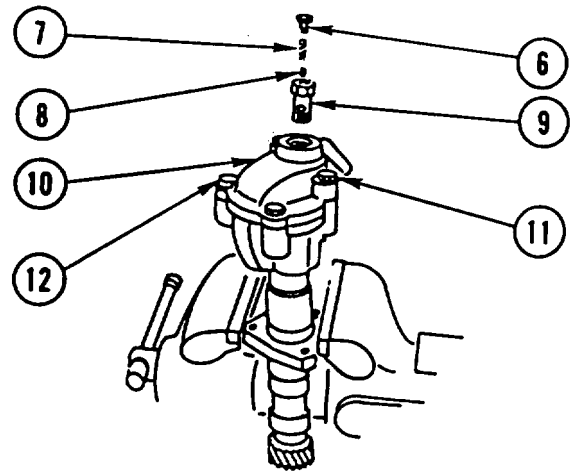
## OIL PUMP REPLACEMENT AND REPAIR (CONT)

3. REMOVE plug (6), spring (7), piston (8), and HOUSING (9) from cover (10).
4. REMOVE three screws (11), bolt (12), and COVER (10).

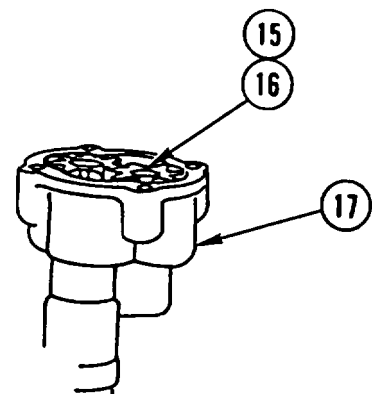
**CAUTION**

Make sure puller is centered on tab of drive shaft. Failure to do so could result in damage to tab.

5. USING suitable PULLER, REMOVE GEAR (13) from drive shaft (14).

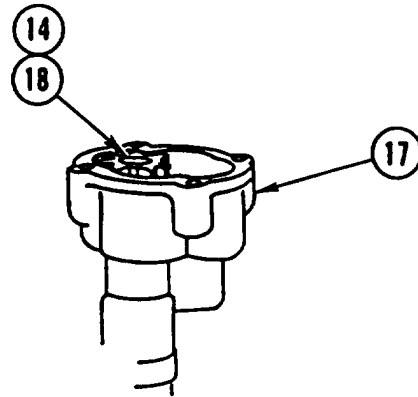


6. REMOVE GEAR (15) and SHAFT (16) from housing (17).
7. USING suitable PRESS, REMOVE GEAR (15) from shaft (16).



## OIL PUMP REPLACEMENT AND REPAIR (CONT)

8. USING suitable PRESS, REMOVE GEAR (18) and drive SHAFT (14) from housing (17).
9. USING suitable PRESS, REMOVE GEAR (18) from drive shaft (14).

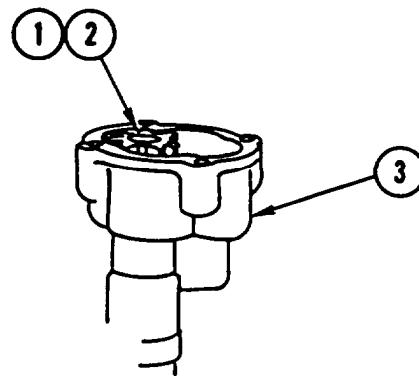


### INSPECTION

1. Check gears for worn or broken teeth.
2. Check housing and cover for cracks or damage.

### ASSEMBLY

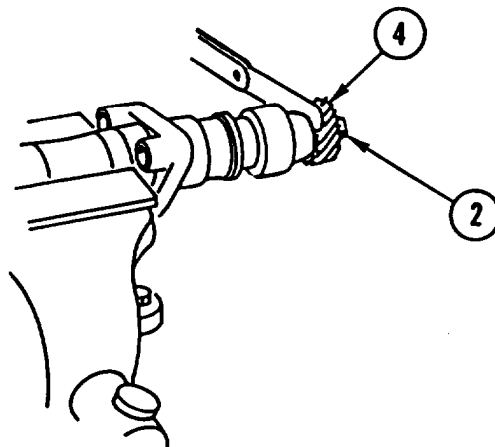
1. USING suitable PRESS, INSTALL GEAR (1) on drive shaft (2).
2. USING suitable PRESS, INSTALL drive SHAFT (2) and GEAR (1) in housing (3).



#### WARNING

Gear will be hot enough to burn you on contact. Wear heat-resistant gloves when handling hot gear.

3. HEAT GEAR (4) to 176°F (80°C) and INSTALL on drive shaft (2).



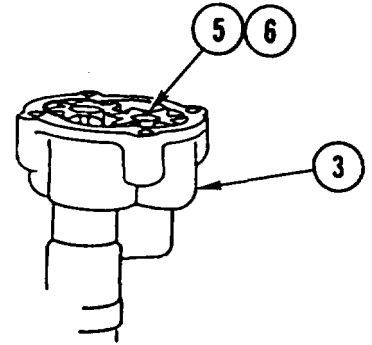
4. USING feeler GAGE, CHECK END PLAY of drive shaft (2) and gear (4). End play should be 0.0012-0.0028 in. (0.30-0.07 mm).

---

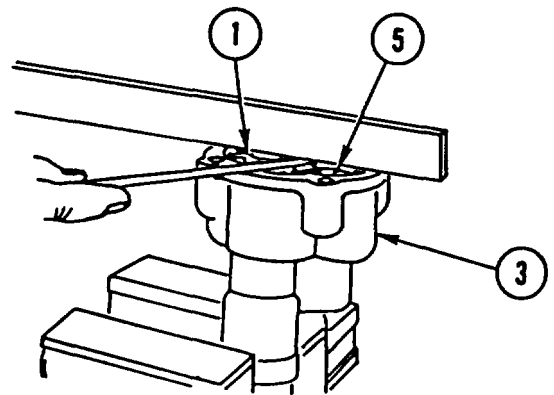
**OIL PUMP REPLACEMENT AND REPAIR (CONT)**


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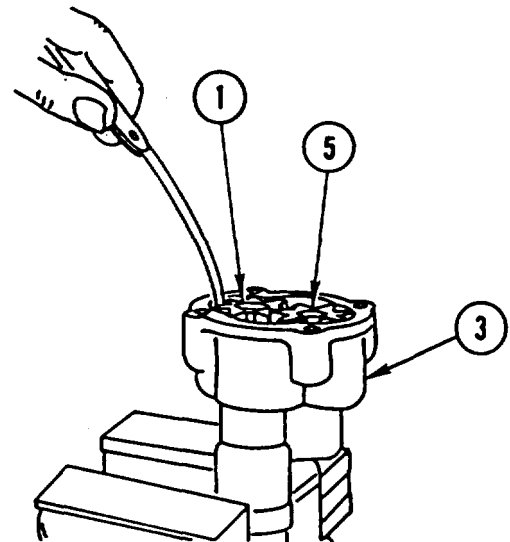
5. USING suitable PRESS, INSTALL GEAR (5) on shaft (6).
6. USING suitable PRESS, INSTALL GEAR (5) and SHAFT (6) in housing (3).



7. USING feeler GAGE and STRAIGHTEDGE, CHECK CLEARANCE between gears (1 and 5) and housing (3). Clearance should be 0.0010-0.0035 in. (0.025-0.089 mm).



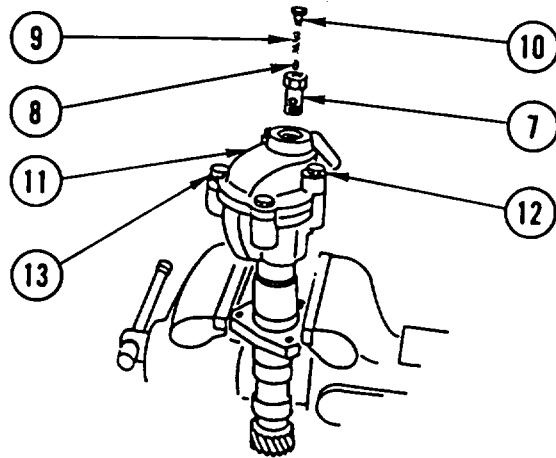
8. USING feeler GAGE, CHECK radial CLEARANCE between gears (1 and 5) and sides of housing (3). Radial clearance should be 0.001-0.005 in. (0.030-0.130 mm).



## OIL PUMP REPLACEMENT AND REPAIR (CONT)

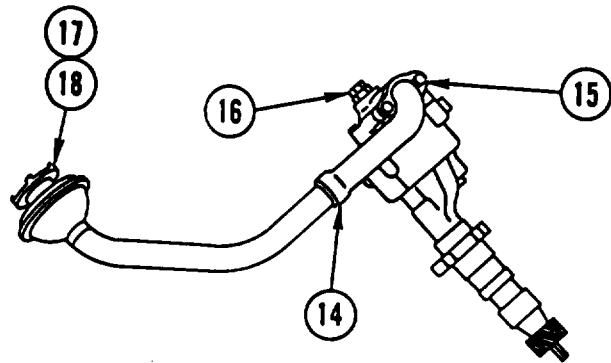
9. APPLY COAT of SEALING COMPOUND to THREADS of housing (7) and INSTALL HOUSING (7), piston (8), spring (9), and plug (10) in cover (11). TIGHTEN to 11-18 lb-ft (15-25 N.m).

10. INSTALL COVER (11), three screws (12), and bolt (13). TIGHTEN SCREWS and BOLT to 25 lb-ft (35 N.m).



11. INSTALL suction PIPE (14), screw (15), and bolt (16). TIGHTEN SCREW and BOLT to 15-18 lb-ft (20-25 N.m).

12. INSTALL suction CHAMBER (17) and retaining ring (18).



### INSTALLATION

APPLY COAT of SEALING COMPOUND to three SCREWS (1) and INSTALL oil PUMP (2) and three screws (1). TIGHTEN SCREWS to 25 lb-ft (35 N.m).

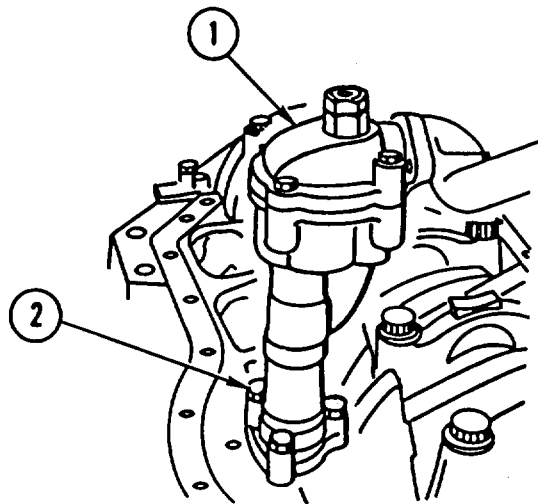
#### NOTE

Follow-on Maintenance:

Install oil pan (page 13-58).

Install engine (page 3-2).

Install engine oil filter element (TM 5-2420-224-20).



## Section II. FUEL SYSTEM REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the fuel system. A list of tasks contained in this section is shown below.

	Page
Fuel injector Nozzle Test and Repair . . . . .	13-65
Fuel Tank Repair . . . . .	13-69

---

### FUEL INJECTOR NOZZLE TEST AND REPAIR

---

This task covers: a. Test b. Disassembly c. Cleaning d. Assembly

---

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, Fuel and Electrical,  
 SC 4910-95-CL-A01  
 Holding Device, P/N 403 589 00 31 00  
 Test Set, NSN 4910-00-317-8265  
 Wrench, P/N 000 589 01 13 00

##### General Safety Instructions:

**WARNING**

When testing fuel injector nozzles, wear safety goggles and keep hands and fingers away from the spray of fluid being ejected. The spray is under extreme pressure and could penetrate deeply into the body tissues, causing injury and illness.

##### Materials/Parts:

Fuel, Diesel                      Appendix B, Item 22

##### Equipment Condition:

Reference	Condition Description
Page 3-41	Fuel Injector Nozzles Removed

---

### TEST

#### NOTE

Test the complete set of injector nozzles, even if only one nozzle is suspect.

##### Nozzle Preparation

1. Using wire brush, carefully remove any carbon residue from injector nozzles.
2. Install an injector nozzle on test set.



---

## FUEL INJECTOR NOZZLE TEST AND REPAIR (CONT)

---

### Opening Pressure Test

1. Work pump lever slowly until nozzle begins to spray; read opening pressure. Opening pressure should read 2610 psi (180 bar).
2. If opening pressure is too high or too low, disassemble, clean, and adjust injector nozzle.

#### NOTE

To lower pressure, use thinner washers. To raise pressure, use thicker washers. Use no more than two washers in any injector nozzle. If more than two washers are needed, replace pressure spring.

3. If necessary, replace injector nozzle.

### Leak Test

1. Work pump lever slowly until pressure gage reads 2320 psi (160 bar). Nozzle does not leak if drops do not appear at nozzle mouth within 10 seconds. If injector nozzle leaks, disassemble and clean.

#### CAUTION

Increase pressure slowly and release pressure slowly, to avoid damaging test set.

2. If nozzle still leaks after cleaning nozzle body and needle, replace both nozzle body and needle.

### Spray Pattern and Chatter Behavior

1. Spray Pattern: To use test set correctly, gently depress lever several times until resistance is felt on each stroke. Then apply one full stroke slowly and observe the spray. At very low test pressure, spray pattern should be spread with rough atomization. In the chatterless range, spray pattern should be tighter but atomized. As the pressure increases, spray pattern should become complete and finely atomized.
2. Chatter Behavior: Good chatter during fast and slow lever motion; short chatterless ranges can occur in between.

If spray pattern or chatter is not as described above, disassemble, clean, and adjust injector nozzle. If necessary, replace injector nozzle.

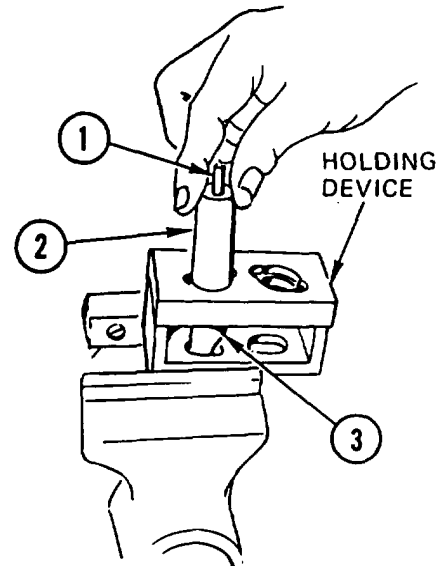
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**FUEL INJECTOR NOZZLE TEST AND REPAIR (CONT)**

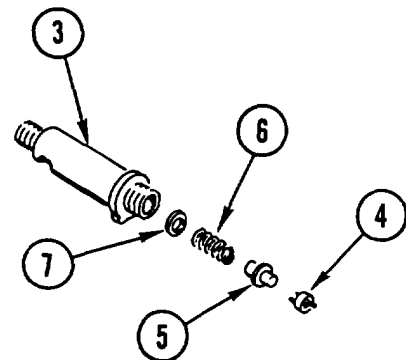

---

**DISASSEMBLY**

1. INSTALL injector NOZZLE (1) in HOLDING DEVICE.
2. USING WRENCH, REMOVE NUT (2) from body (3).
3. REMOVE spacer disc (4), PLUNGER (5), spring (6), and spacer (7) from body (3).



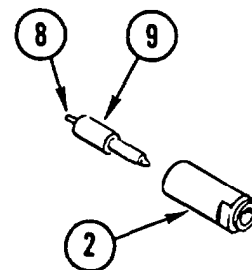
4. REMOVE nozzle (8) and nozzle BODY (9) from nut (2).




---

**CLEANING**

1. Clean body, nozzle body, and nozzle using clean diesel fuel.
2. Place nozzle in nozzle body.
3. Lift nozzle one-third of the way out of nozzle body and release nozzle.
4. Nozzle should seat in nozzle body by itself. If nozzle does not seat, clean both parts again. If nozzle still does not seat in nozzle body, replace both nozzle and nozzle body.
5. Clean remaining parts in clean diesel fuel. Make sure all carbon deposits have been removed.



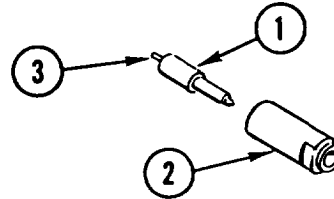
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## FUEL INJECTOR NOZZLE TEST AND REPAIR (CONT)

---

### ASSEMBLY

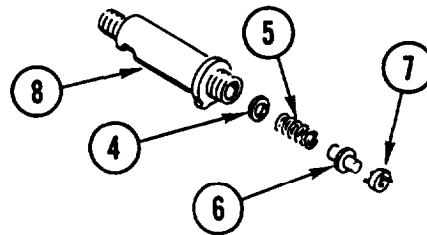
1. INSTALL nozzle BODY (1) in nut (2).
2. INSTALL NOZZLE (3) in nozzle body (1).



### NOTE

Quantity of spacer discs may vary to obtain proper opening pressure.

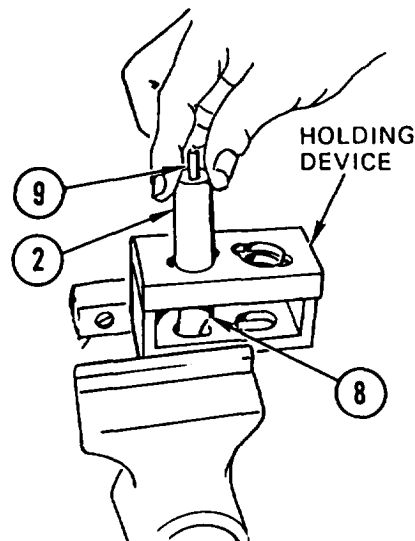
3. INSTALL spacer (4), spring (5), PLUNGER (6), and spacer disc (7) in body (8).



4. USING WRENCH, INSTALL NUT (2) in body (8).
5. INSTALL injector NOZZLE (9) in HOLDING DEVICE. TIGHTEN BODY (8) to 43-50 lb-ft (60-70 N.m).
6. TEST fuel INJECTOR (TEST, above).

### NOTE

Follow-on Maintenance:  
Install fuel injector nozzles (page 3-41).



---

## FUEL TANK REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, Welding, SC 4940-95-CL-B19

#### Materials/Parts:

Chips, Soap                      Appendix B, item 9

#### Personnel Required: (2)

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Fuel Tank Removed

#### General Safety Instructions:

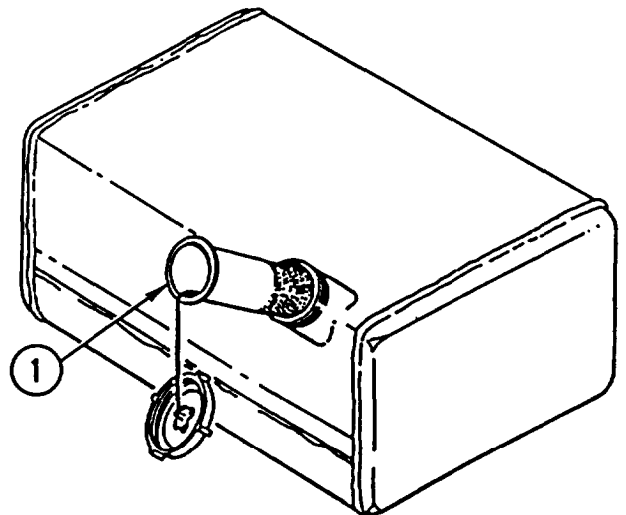
### WARNING

- Fuel is very flammable and can explode easily. To avoid serious injury or death, clean fuel tank to purge any flammable liquid or vapors before welding, grinding, or using any heat producing device near the fuel tank.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in well-ventilated area. Failure to do so could result in injury to personnel.

---

### DISASSEMBLY

REMOVE fuel filler CAP and strainer element assembly (1).



---

## FUEL TANK REPAIR (CONT)

---

### CLEANING

1. Using soap, thoroughly steam clean fuel tank including upper portion of fuel tank where rust may have formed.

#### WARNING

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

2. Completely dry fuel tank with compressed air.
3. Thoroughly clean fuel filler cap and strainer element assembly.
4. Remove and clean fuel filter pre-sediment bowl and filter (TM 5-2420-224-20).

### INSPECTION

Inspect fuel tank for damage or cracks.

### ASSEMBLY

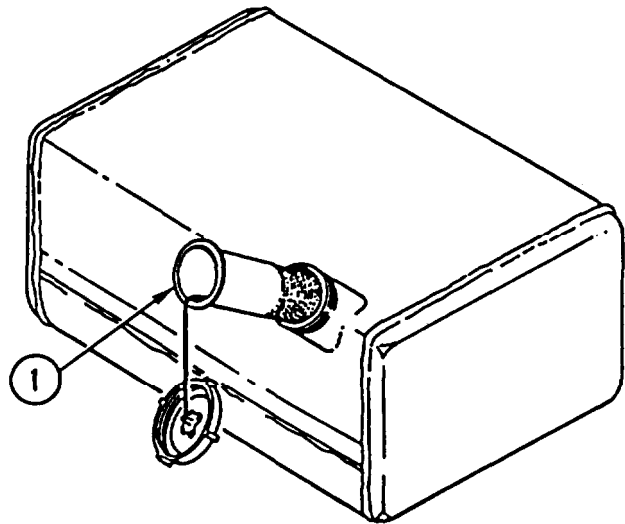
INSTALL fuel filler CAP and strainer element assembly (1).

#### NOTE

Follow-on Maintenance:

Install fuel tank (TM 5-2420-224-20).

Replace fuel filters (TM 5-2420-224-20).



## Section III. COOLING SYSTEM REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the cooling system. A list of tasks contained in this section is shown below.

	Page
Radiator Repair . . . . .	13-71
Water Pump Repair . . . . .	13-73

### RADIATOR REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Shop Equipment, Radiator, SC 4940-95-CL-A76
- Plug Set, Radiator, NSN 4910-00-273-3660

**References:**

- TM 5-2420-224-20
- TM 750-254
- FM 43-2

**Materials/Parts:**

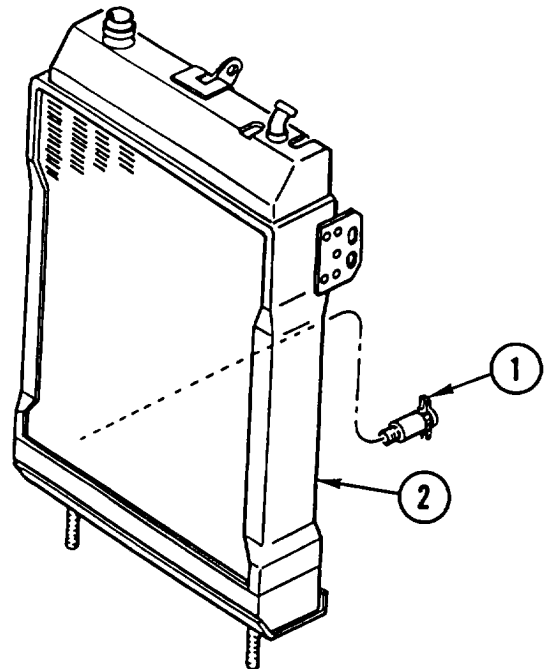
- Compound, Sealing                      Appendix B, Item 17

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Radiator Removed

### DISASSEMBLY

REMOVE DRAINCOCK (1) from radiator (2).



---

## RADIATOR REPAIR (CONT)

---

### CLEANING

Reverse flush radiator core (TM 750-254).

### INSPECTION

1. Inspect all parts for breaks, cracks, rust, and corrosion.
2. inspect radiator core for leaks.

### REPAIR

Repair leaks in radiator core (TM 750-254 and FM 43-2).

### ASSEMBLY

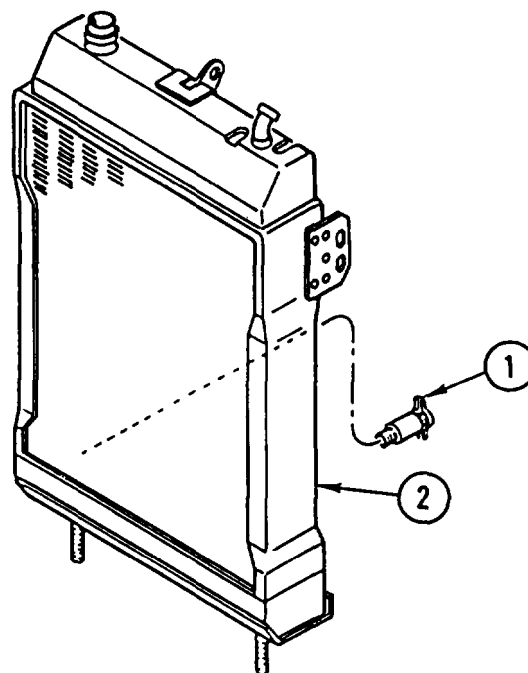
#### WARNING

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.

APPLY COAT of SEALING COMPOUND to THREADS of draincock (1) and INSTALL DRAINCOCK (1) in radiator (2).

#### NOTE

Follow-on Maintenance:  
Install radiator (TM 5-2420-224-20).



## WATER PUMP REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26  
Shop Set, SC 4910-95-CL-A31

#### Materials/Parts:

Kit, Gasket

#### References:

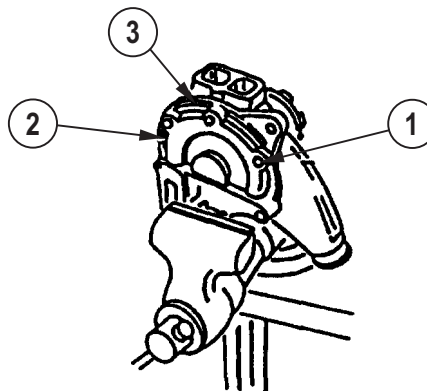
TM 5-2420-224-20  
TM 9-214

#### Equipment Condition:

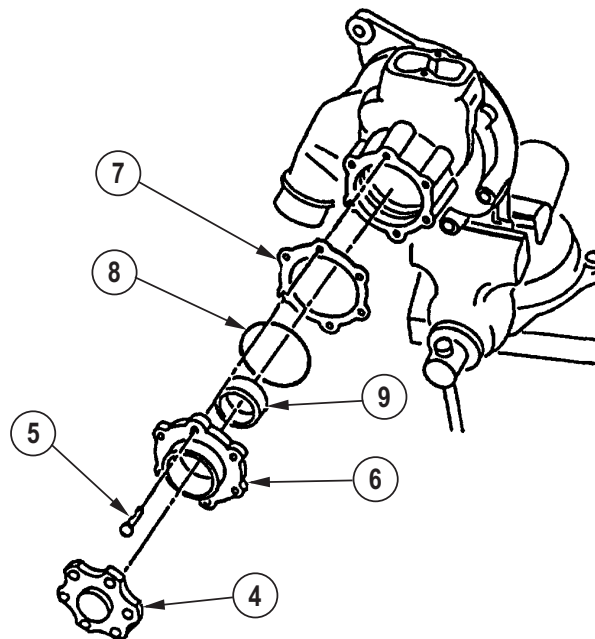
Reference	Condition Description
TM 5-2420-224-20	Water Pump Removed

### DISASSEMBLY

1. REMOVE four bolts (1), rear COVER (2), and gasket (3). DISCARD GASKET.



2. USING suitable PULLER, REMOVE INSERT (4).
3. REMOVE six screws (5), RETAINER (6), gasket (7), packing (8), and seal (9). DISCARD GASKET, PACKING, and SEAL.



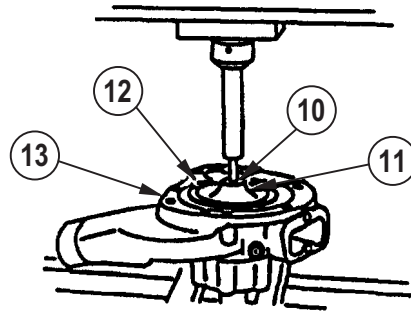


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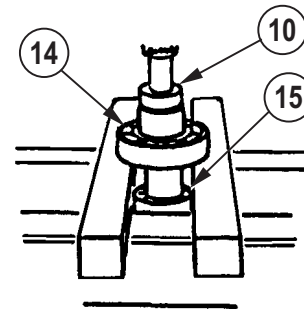
## WATER PUMP REPAIR (CONT)

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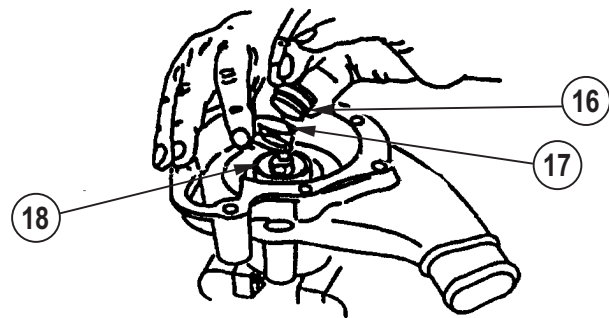
4. USING suitable PRESS, REMOVE SHAFT (10).
5. REMOVE IMPELLER (11) and seal (12) from pump (13). DISCARD IMPELLER and SEAL.



6. USING suitable PRESS, REMOVE large BEARING (14) and small BEARING (15) from shaft (10).



7. REMOVE seal (16), SPRING (17), and seal (18). DISCARD SEALS.



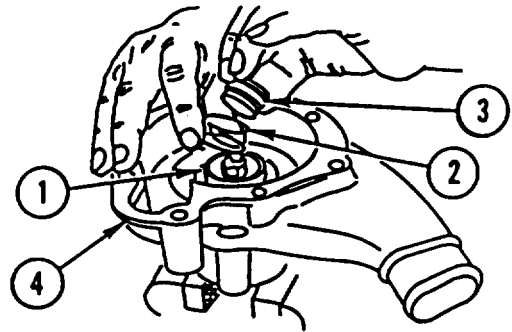
### INSPECTION

1. Inspect hub, impeller, spring, and shaft for cracks and damage.
2. Inspect bearings (TM 9-214).

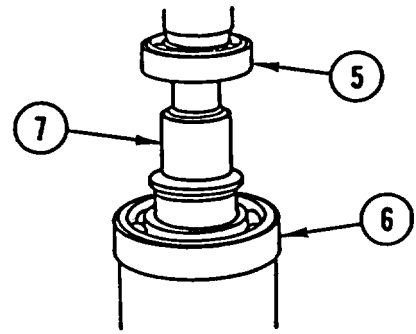
## WATER PUMP REPAIR (CONT)

### ASSEMBLY

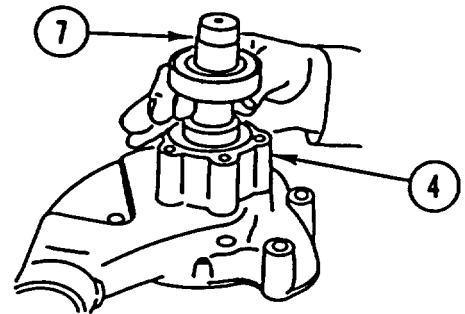
1. INSTALL new seal (1), SPRING (2), and new seal (3) in pump (4).



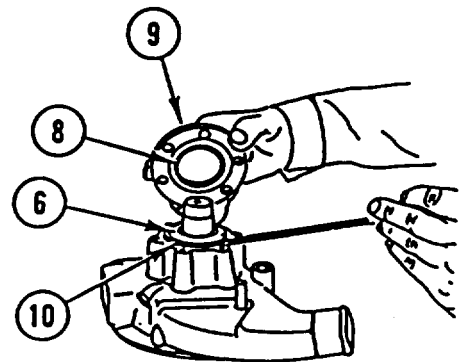
2. USING suitable PRESS, INSTALL small BEARING (5) and large BEARING (6) on shaft (7).



3. INSTALL SHAFT (7) in pump (4).



4. INSTALL new SEAL (8) in retainer (9).
5. INSTALL new PACKING (10) around large bearing (6).



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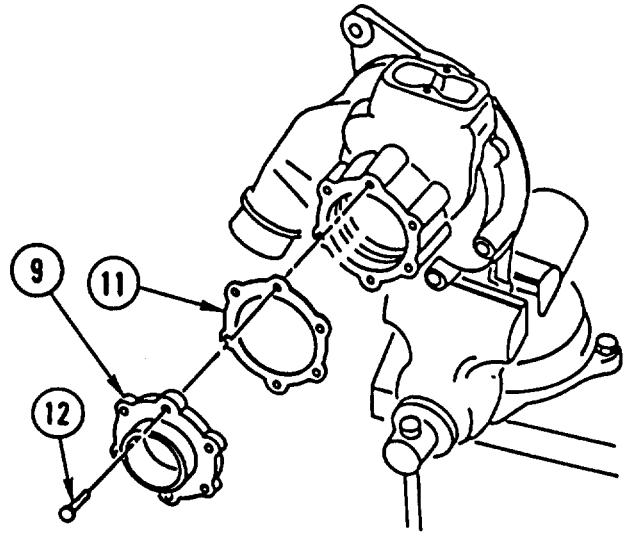
## WATER PUMP REPAIR (CONT)

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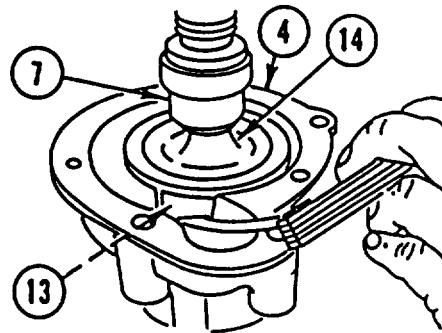
**CAUTION**

Make sure all gasket material has been removed from both mating surfaces to prevent damage to equipment.

6. INSTALL RETAINER (9), new gasket (11), and six screws (12).



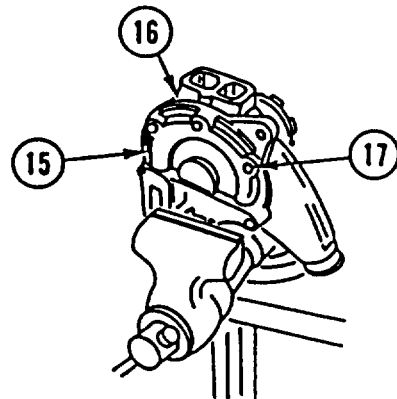
7. INSTALL new seal (13) and new IMPELLER (14) on shaft (7).
8. USING feeler GAGE, CHECK CLEARANCE between impeller (14) and pump (4). Clearance should be 0.012-0.043 in. (0.30-1.1 mm).



**CAUTION**

Make sure all gasket material has been removed from both mating surfaces to prevent damage to equipment.

9. INSTALL rear COVER (15), new gasket (16), and four bolts (17).



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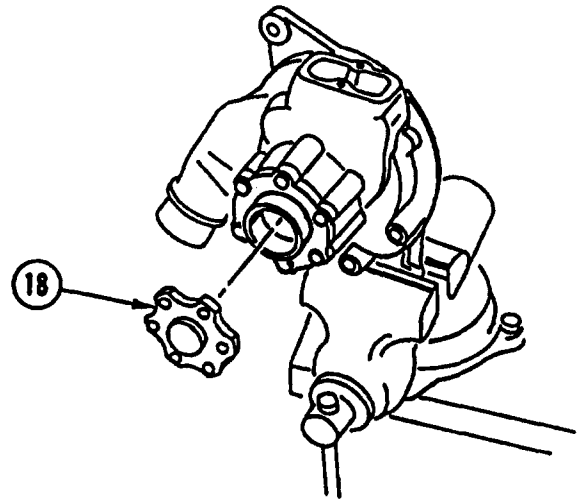
**WATER PUMP REPAIR (CONT)**

---

10. USING suitable PRESS, INSTALL INSERT (18).

**NOTE**

Follow-on Maintenance  
Install water pump (TM 5-2420-  
224-20).



**OVERVIEW**

This section illustrates and describes procedures for testing the engine assembly.

---

**ENGINE TESTING**

---

This task covers: a. Testing

---

**INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Dynamometer

**References:**

AR 750-22  
LO 5-2420-224-12  
TM 5-2420-224-10  
TM 5-2420-224-20

**General Safety Instructions:**

**WARNING**

- Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

**General Safety Instructions (Cont):**

**WARNING**

- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in well-ventilated area. Failure to do so could result in injury to personnel.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**TESTING**

1. Install engine on dynamometer and check engine oil level on dipstick. Add oil as required per LO 5-2420-224-12.
2. Prior to starting engine, adjust valve clearance per TM 5-2420-224-20 and adjust fuel injection pump timing (page 3-50). Refer to TM 5-2420-224-10 for engine specifications.
3. Prime fuel system per TM 5-224-2420-10, Chapter 3, para 3-5, steps b thru h.
4. Start engine and check for ease of starting.
5. Run engine at low idle (700-750 rpm) for 5 minutes. Adjust idle speed as required by turning adjusting screw on end of governor. Accelerate engine and check governed speed (2800 rpm). Check all gages for proper operation; inspect for leaks. Reduce engine speed to idle.
6. Increase engine speed to 1700 rpm and run for 5 minutes. Output torque should indicate 232 lb-ft (314 N.m).
7. Increase engine speed to 2800 rpm and run for 5 minutes. Output horsepower should indicate 110 hp (81 kW).

## ENGINE TESTING (CONT)

8. Reduce engine speed to idle and run until engine temperatures stabilize.
9. Stop engine and inspect engine for fuel, oil, and coolant leaks.
10. Remove the valve cover per TM 5-2420-224-20-2 and remove the rocker arm assemblies (page 13-37).
11. Following the sequence shown in Figure 1, loosen the number 1 (one) head bolt one-eighth to one-quarter turn; then tighten the bolt to 81 lb-ft (110 N.m). Re-torque the remaining head bolts one at a time using the same procedure. Under no circumstances must all bolts be loosened at once.

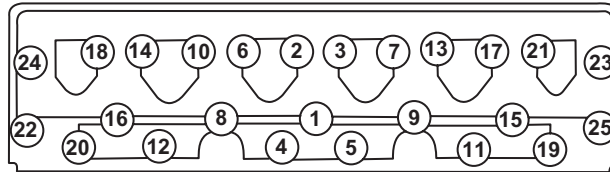


Figure 1

12. Install the rocker arm assemblies (page 13-40).
13. Adjust the valve lash per TM 5-2420-224-20-2.
14. Install the valve cover per TM 5-2420-224-20-2.
15. Run the engine according to the values listed in Table 1.

Time (minutes)	Engine Speed (RPM)	Minimum Oil Pressure PSI (BAR)
10	2600	29.0 (2.0)
10	1600	29.0 (2.0)
10	1170	29.0 (2.0)
10	750	9.0 (0.6)

Table 1

16. Stop engine. Check the fluid levels and look for any leaks. Correct as necessary. Remove from dynamometer.



## CHAPTER 14 ELECTRICAL SYSTEM REPAIR INSTRUCTIONS

### OVERVIEW

This chapter contains maintenance instructions for repair of the electrical system. A list of sections contained in this chapter is shown below.

	Page
Section I. Alternator Repair . . . . .	14-1
Section II. Starter Repair . . . . .	14-8
Section III. Battery Repair . . . . .	14-17

### Section I. ALTERNATOR REPAIR

---

#### ALTERNATOR REPAIR

---

This task covers: a. Disassembly b. Testing c. Inspection d. Assembly

---

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A3I  
Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Washer, Spring  
Tension (4)  
  
Washer, Spring  
Tension

##### References:

TM 9-214

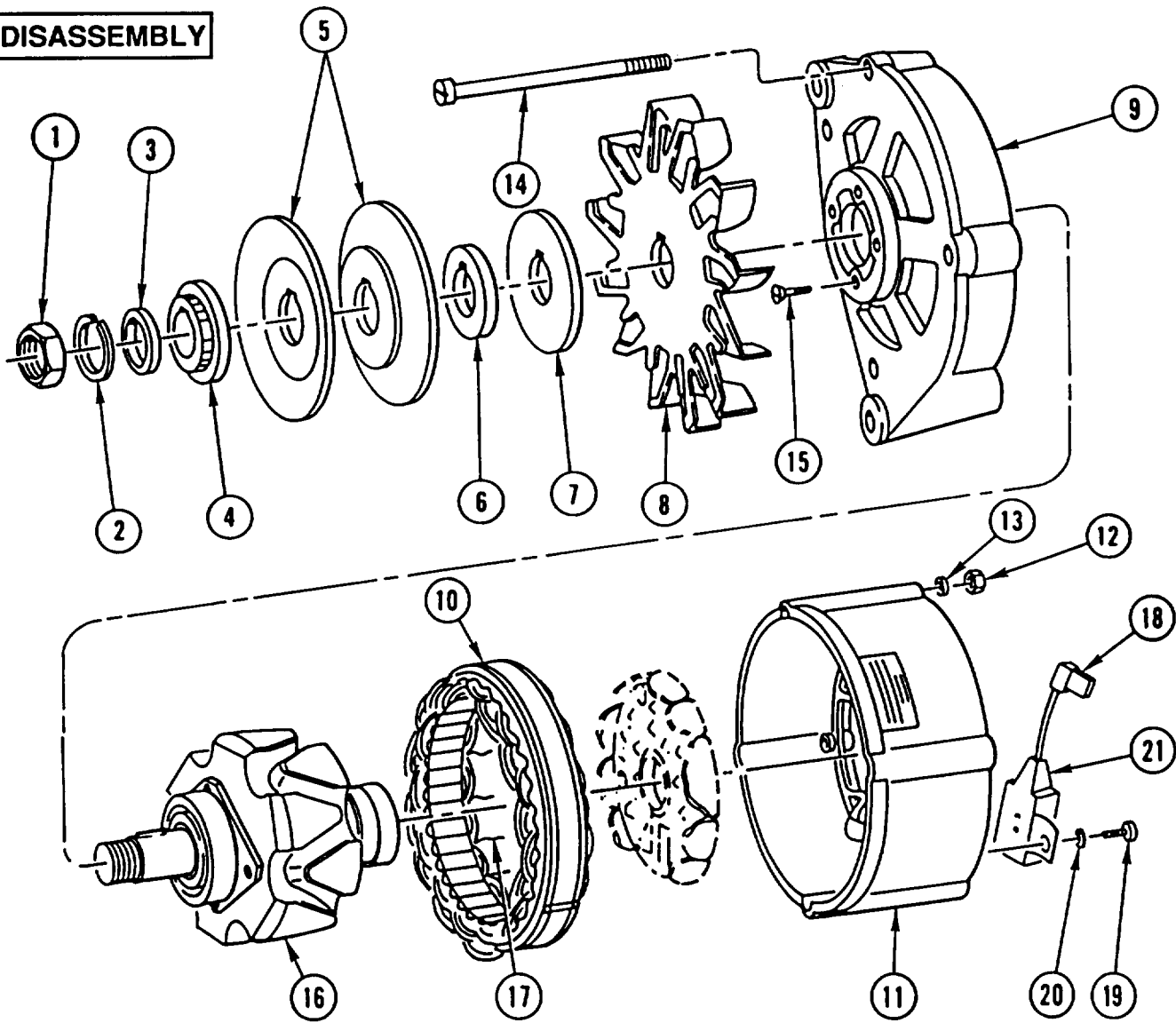
##### Equipment Condition:

Reference	Condition Description
Page 4-4	Regulator Removed



**ALTERNATOR REPAIR (CONT)**

**DISASSEMBLY**



1. REMOVE nut (1), retaining ring (2), washer (3), retainer (4), pulley (5), spacer (6), spacer (7), and IMPELLER (8).
2. MATCHMARK front HOUSING (9), STATOR (10), and rear HOUSING (11).
3. REMOVE four nuts (12), four spring tension washers (13), four capscrews (14), four screws (15), and front HOUSING (9). DISCARD spring tension WASHERS.
4. REMOVE ROTOR (16).

**NOTE**

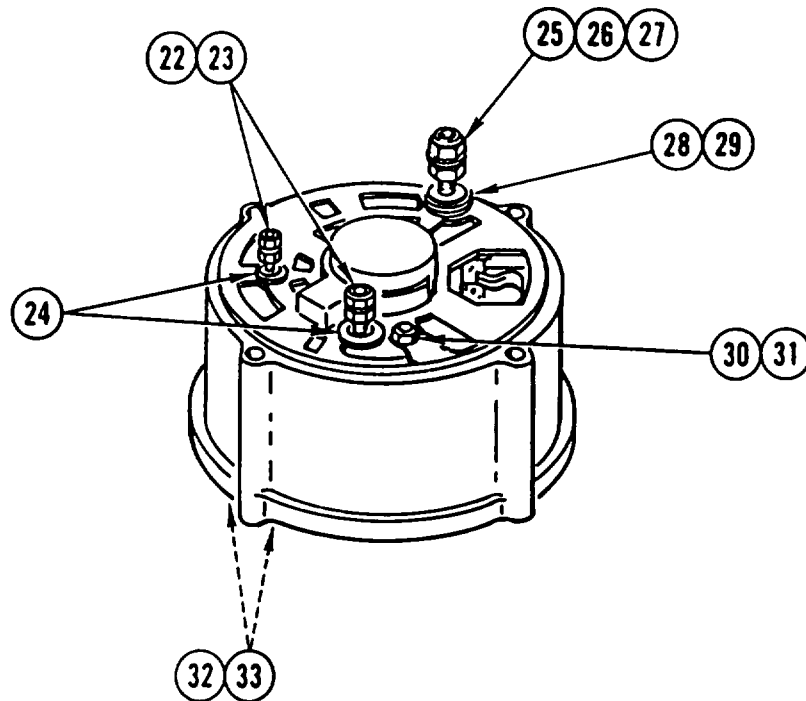
Tag wires and solder points prior to disconnecting to aid in connecting.

5. DISCONNECT four LEADS (17) and REMOVE STATOR (10).
6. DISCONNECT CONNECTOR (18) and REMOVE screw (19), spring tension washer (20), and CONDENSER (21). DISCARD spring tension WASHER.

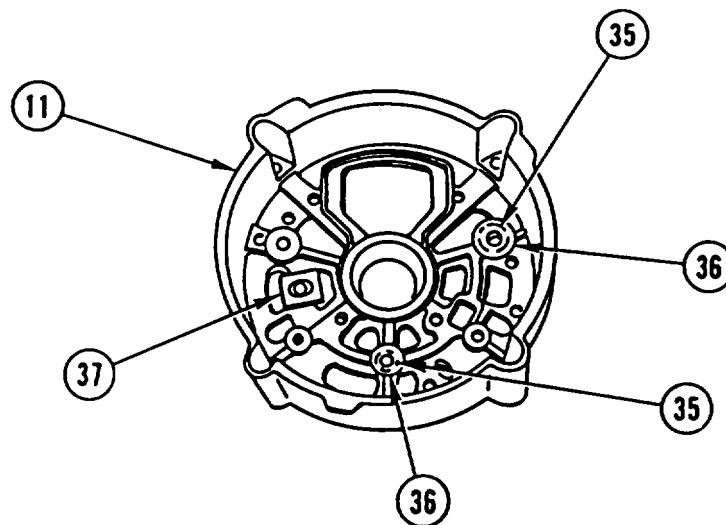
---

**ALTERNATOR REPAIR (CONT)**

---



7. REMOVE four nuts (22), two washers (23), and four insulators (24).
8. REMOVE nut (25), washer (26), nut (27), two washers (28), and two INSULATORS (29).
9. REMOVE two NUTS (30) and washer (31).
10. REMOVE two screws (32), two washers (33), and RECTIFIER (34).



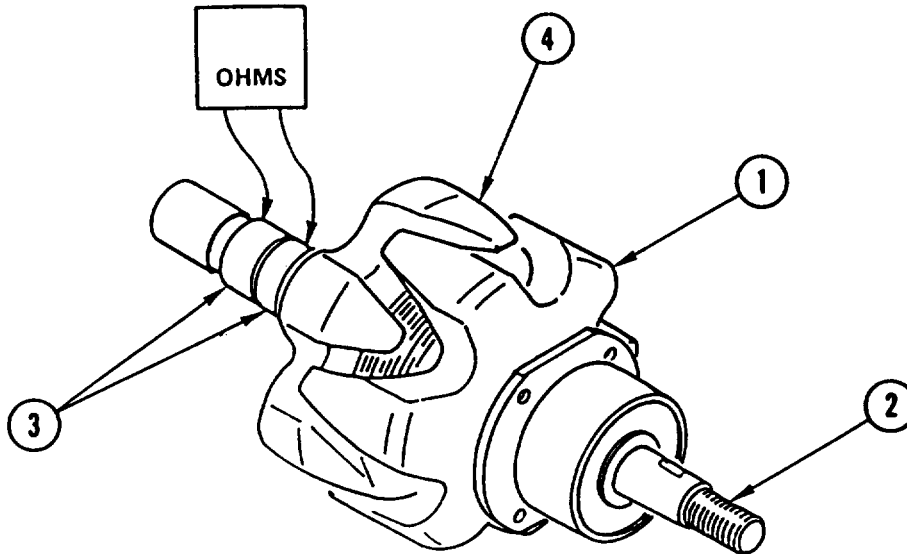
11. REMOVE two washers (35), two INSULATORS (36), and two INSULATORS (37) from rear housing (11).

---

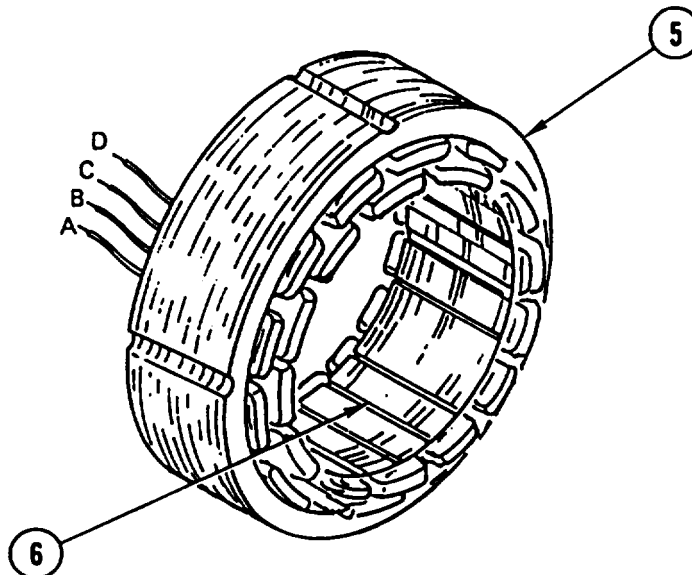
**ALTERNATOR REPAIR (CONT)**

---

**TESTING**



1. Test rotor assembly (1) as follows:
  - a. With ohmmeter connected between rotor end (2) and either of two slip rings (3), no reading should be obtained. If any reading is obtained, rotor coil (4) is grounded and must be replaced.
  - b. Check rotor coil (4) resistance by connecting ohmmeter across both slip rings (3). If resistance is greater than 9.0 ohms, rotor assembly (1) must be replaced.



2. Test stator (5) as follows (note each reading):
  - a. Connect one ohmmeter lead to bare metal surface on stator lamination (6). Connect other lead to each of four stator (5) terminals. High resistance reading should be obtained each time. If there is no reading or ohmmeter reads zero, replace stator (5).

---

**ALTERNATOR REPAIR (CONT)**

---

b. Connect ohmmeter leads as follows:

- A and B
- A and C
- A and D
- B and C
- B and D
- C and D

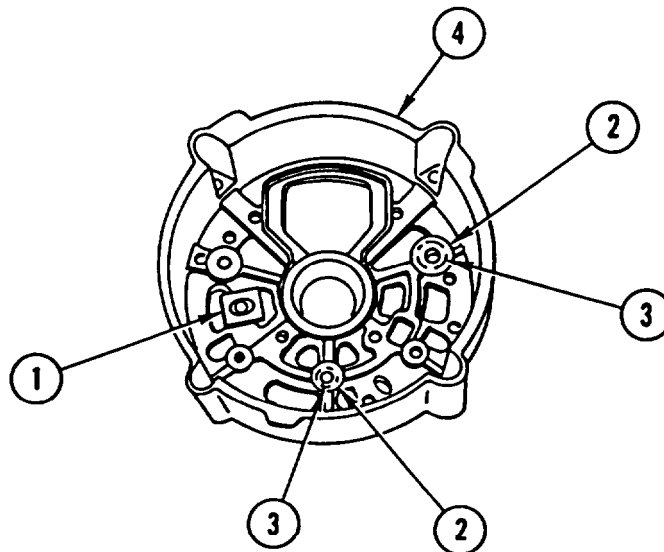
Each measurement should be approximately equal. If difference is great between any two readings, or if any reading exceeds 0.24 ohms, replace stator (5).

---

**INSPECTION**

---

1. Inspect for burned or charred components (i.e., stator, rotor, etc.).
2. Inspect bearings (TM 9-214).

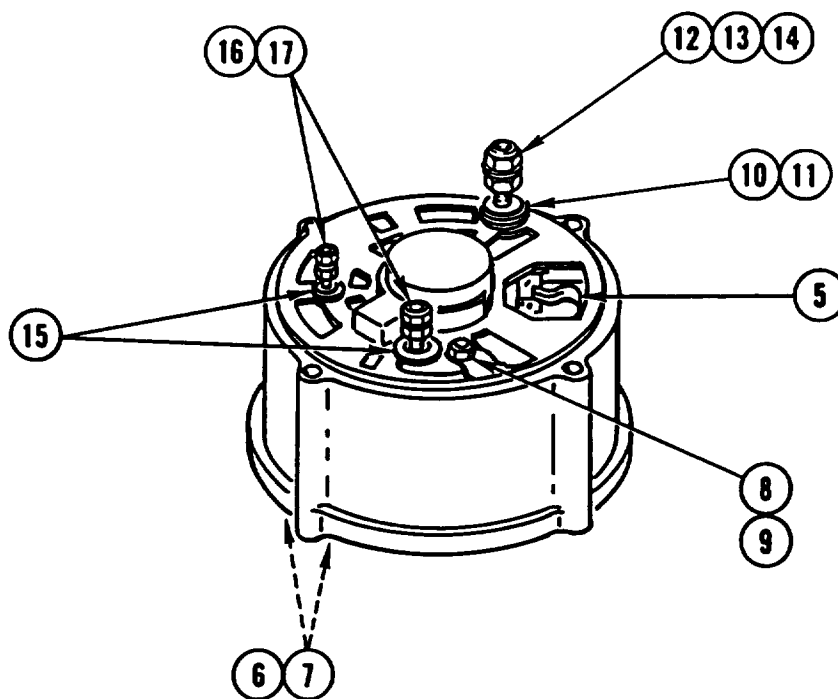
**ASSEMBLY**

1. INSTALL two INSULATORS (1), two INSULATORS (2), and two washers (3) in rear housing (4).

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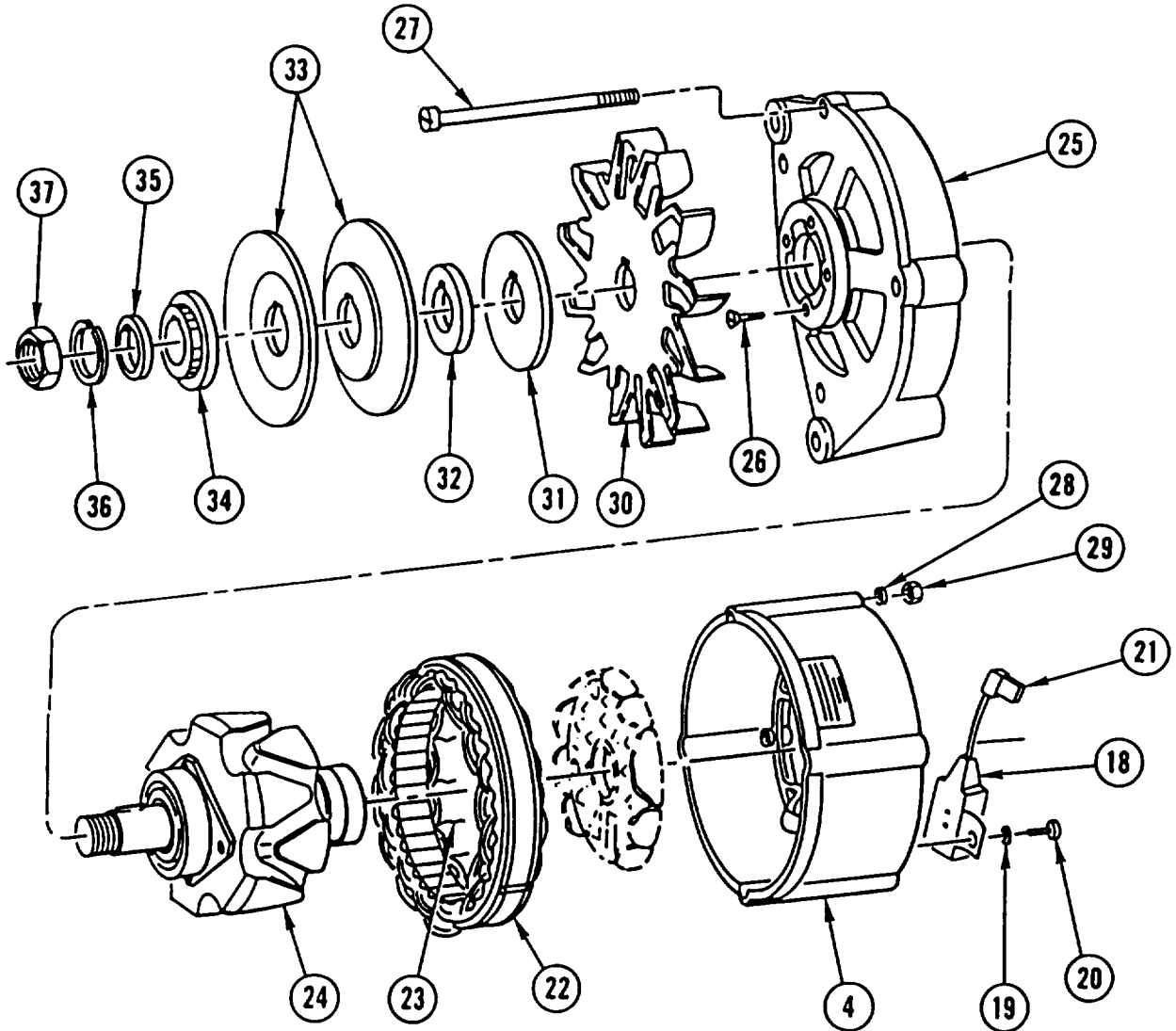
**ALTERNATOR REPAIR (CONT)**

---



2. INSTALL RECTIFIER (5), two washers (6), and two screws (7).
3. INSTALL washer (8) and two NUTS (9).
4. INSTALL two INSULATORS (10), two washers (11), nut (12), washer (13), and nut (14).
5. INSTALL four INSULATORS (15), two washers (16), and four nuts (17).

**ALTERNATOR REPAIR (CONT)**



6. INSTALL CONDENSER (18), new spring tension washer (19), and screw (20) and CONNECT CONNECTOR (21).
7. INSTALL STATOR (22) and SOLDER four LEADS (23).
8. INSTALL ROTOR (24).
9. ALINE MATCHMARKS on rear HOUSING (4), STATOR (22), and front HOUSING (25).
10. INSTALL front HOUSING (25), four screws (26), four capscrews (27), four new spring tension washers (28), and four nuts (29).
11. INSTALL IMPELLER (30), spacer (31), spacer (32), pulley (33), retainer (34), washer (35), retaining ring (36), and nut (37).

**NOTE**

Follow-on Maintenance:

Install regulator (page 4-4).

## Section II. STARTER REPAIR

### STARTER REPAIR

This task covers: a. Disassembly b. Inspection c. Testing d. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 5180-95-CL-B08  
 Shop Equipment, SC 4910-95-CL-A01  
 Dowel (4), Appendix C, item 1  
 Flat Washer, 9/16 ID

**References:**

TM 5-2420-224-20

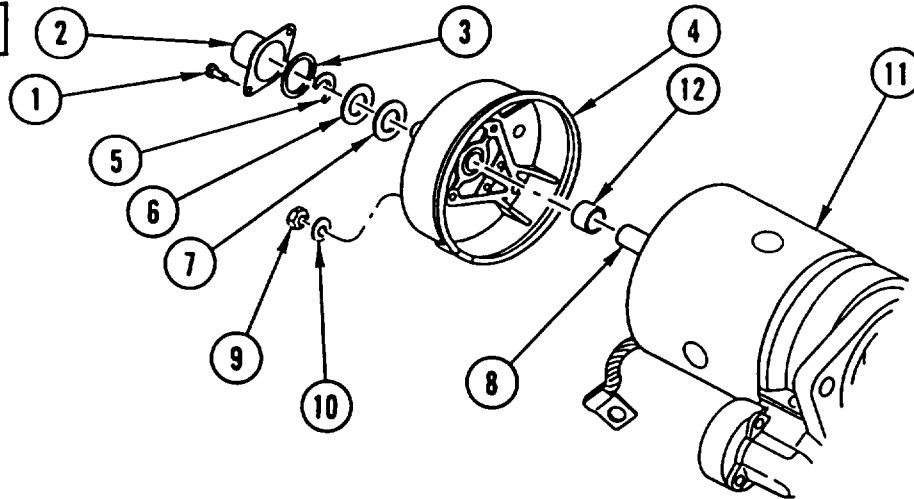
**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Starter Solenoid Removed

**Materials/Parts:**

Screw (2)  
 Gasket  
 Washer, Lock

#### DISASSEMBLY



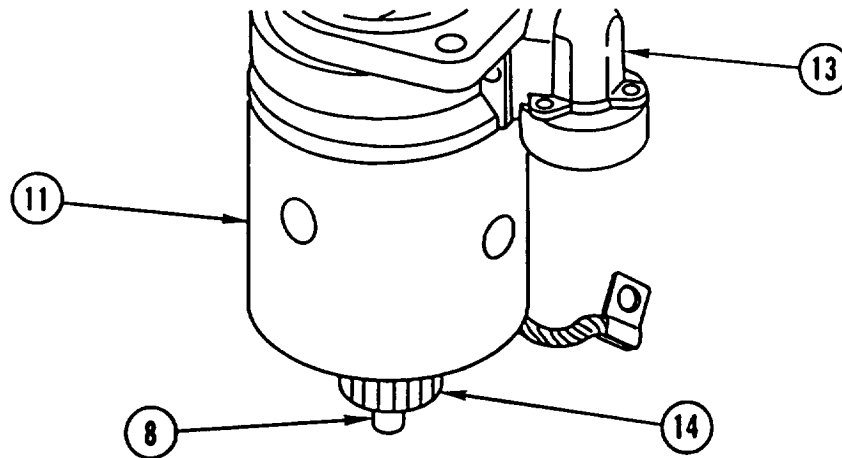
1. REMOVE two screws (1), end BELL (2), and gasket (3) from end bell (4). DISCARD SCREWS and GASKET.

**NOTE**

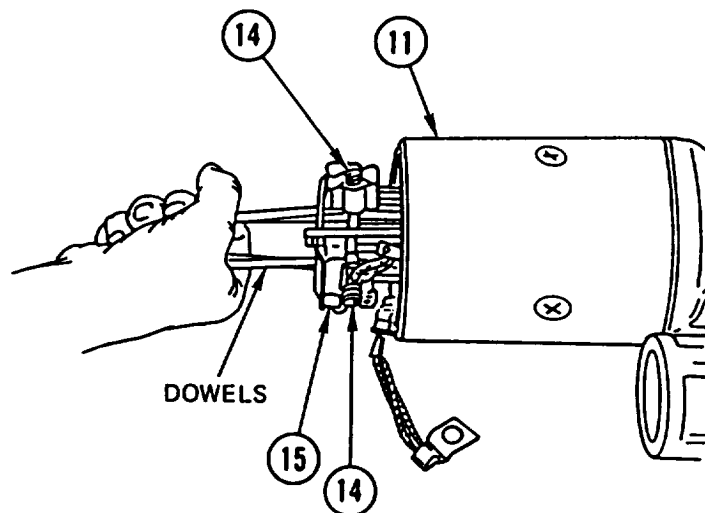
Shims and washers may or may not be present. if present, note quantity of shims and washers removed to aid in assembly.

2. REMOVE and DISCARD lock washer RING (5), SHIM(S) (6), and WASHER(S) (7) from armature (8).
3. REMOVE two nuts (9), two washers (10), and end BELL (4) from housing (11).
4. IF DAMAGED, REMOVE BUSHING (12) from end bell (4).

**STARTER REPAIR (CONT)**



5. REMOVE HOUSING (11) from housing (13) until brush set bracket (14) is approximately HALF-WAY off armature (8).



**CAUTION**  
Install and remove dowels carefully to prevent damage to brushes.

6. INSTALL four DOWELS in brush holder (15). HOLD four DOWELS together and REMOVE HOUSING (11).
7. REMOVE four DOWELS from brush holder (15).

**NOTE**

Brush set bracket may be attached to brush holder and housing with screws or it may be soldered. If brush set bracket is soldered, do not perform step 8 until inspection has been performed and replacement of brush holder is determined to be necessary.

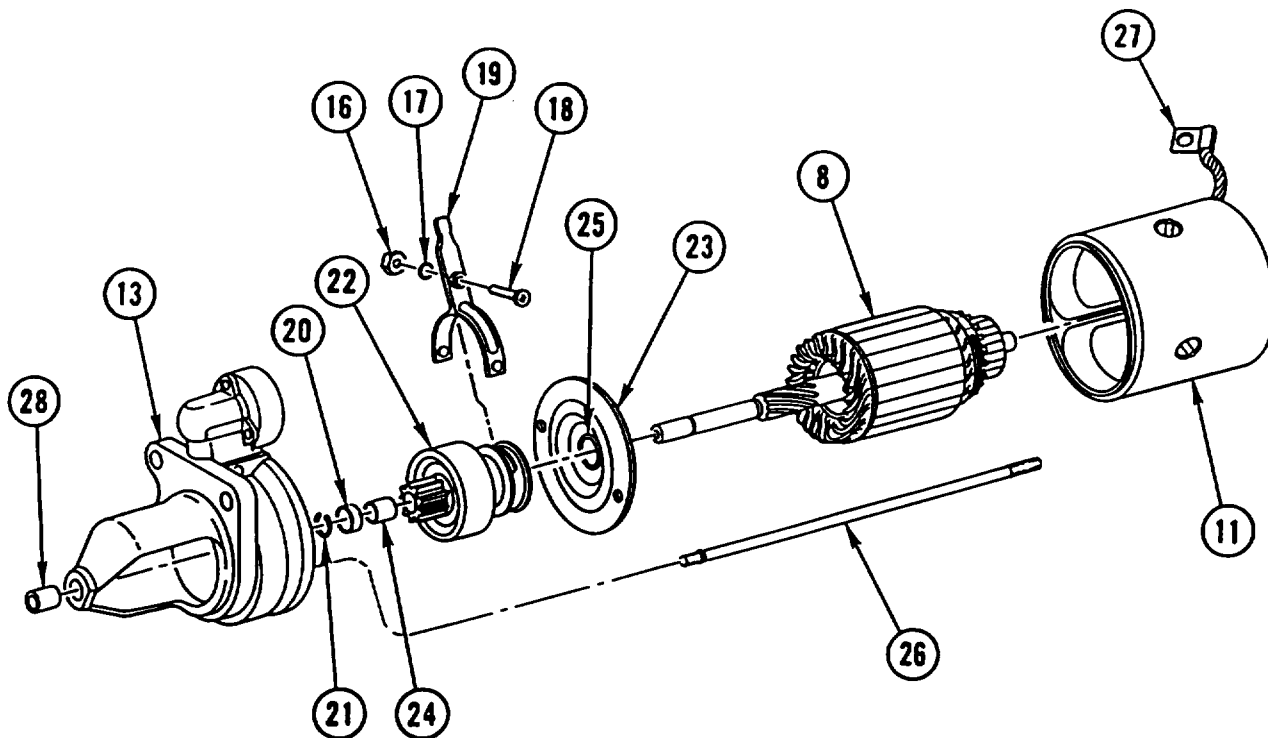
8. IF DAMAGED, REMOVE brush set BRACKET (14) from brush holder (15) and housing (11).



---

**STARTER REPAIR (CONT)**

---



9. REMOVE nut (16), lock washer (17), bolt (18), ARMATURE (8), and lever (19) from housing (13). DISCARD lock WASHER.
10. REMOVE RING (20) from snap ring (21).
11. REMOVE snap ring (21), ring (20), PINION (22), and intermediate plate (23) from armature (8). DISCARD snap RING.
12. IF DAMAGED, REMOVE sleeve BEARING (24) from pinion (22).
13. IF DAMAGED, REMOVE BUSHING (25) from intermediate plate (23).
14. REMOVE two RODS (26) from housing (13).
15. REMOVE starting COIL (27) from housing (11).
16. IF DAMAGED, REMOVE BUSHING (28) from housing (13).

---

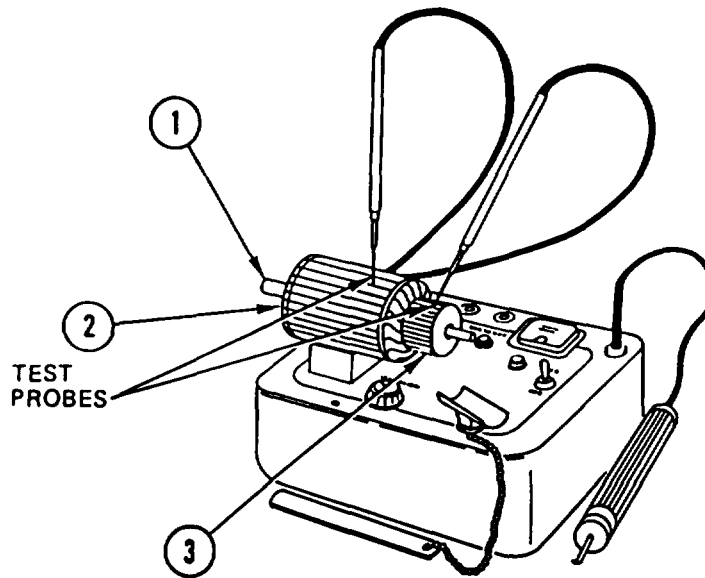
**STARTER REPAIR (CONT)**


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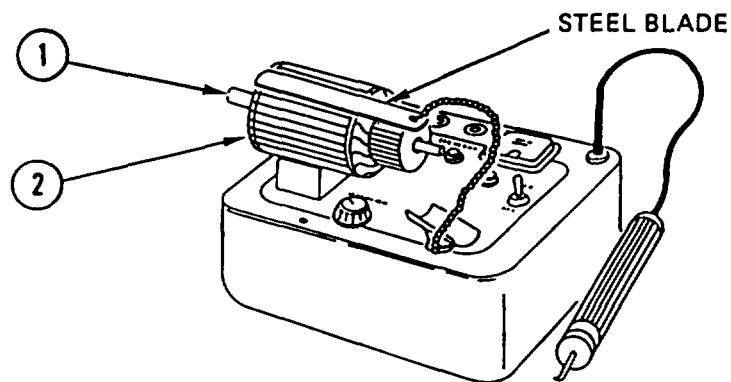
**INSPECTION**

Measure length of all four starter brushes. Replace all four brushes if any one brush is worn to length of 0.34 in. (9 mm) or less.

---

**TESTING**


1. Place armature (1) in growler of armature test set and turn on power.
2. Touch first test probe to armature core (2) and other test probe to commutator bars (3). If lamp lights, armature winding or commutator is grounded; replace armature.

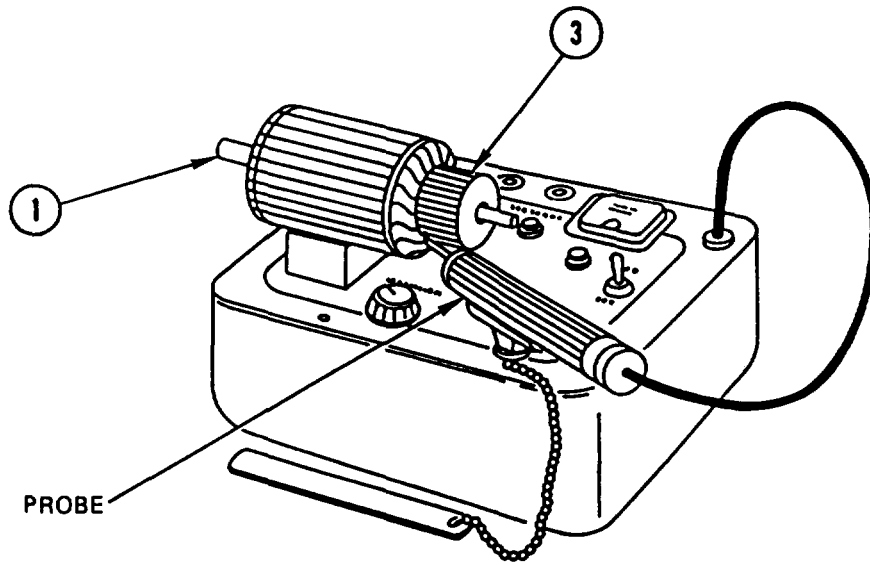


3. Hold steel blade parallel with and touching armature core (2).
4. Slowly rotate armature (1) one or more revolutions. If steel blade vibrates, armature (1) is shorted; replace armature.

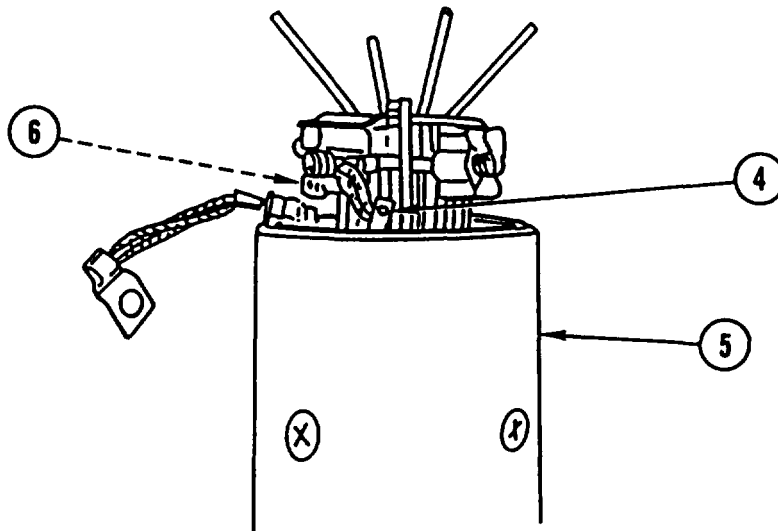
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**STARTER REPAIR (CONT)**

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5. Following directions provided with tester and using probe, test commutator bars (3) for abnormal readings that will indicate a short, open, or poor connection. If any of these conditions are present, replace armature (1).



**NOTE**

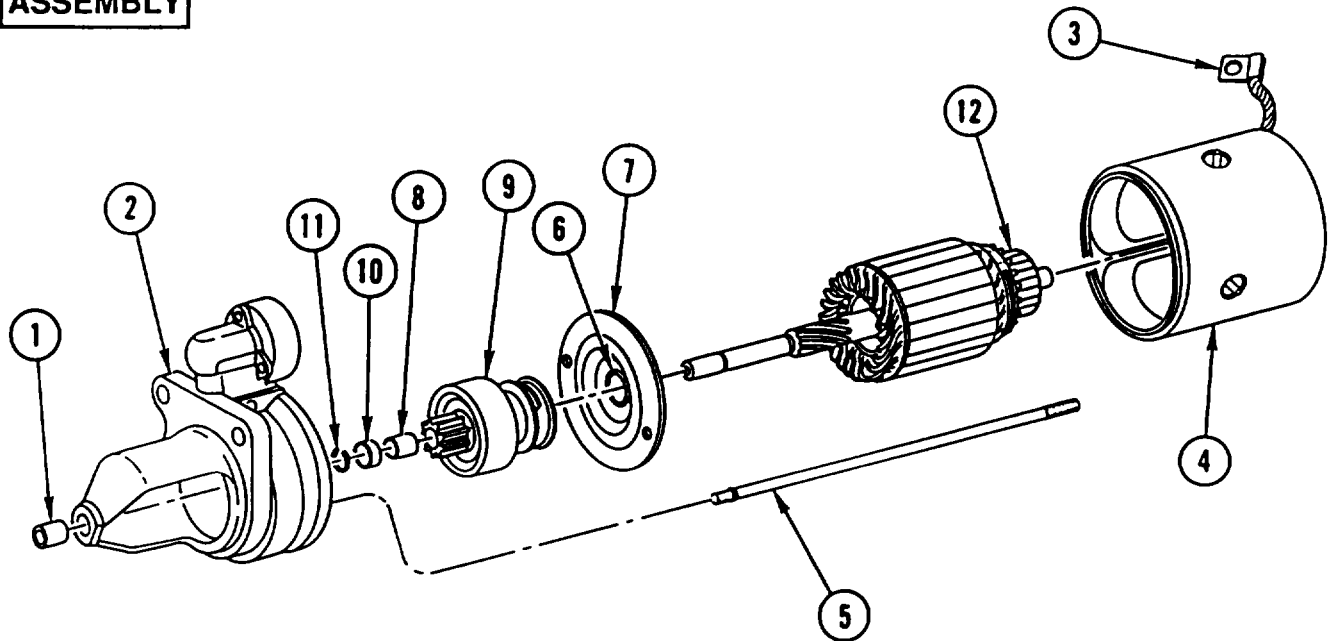
If brush holder has not been removed, make sure brush holder does not contact housing while performing step 6.

6. Using multimeter set to check continuity, check between field connector (4) and housing (5). Meter reading should be infinity. If meter deflects toward zero, replace housing.
7. Repeat step 6 for field connector (6) on opposite side of housing (5).

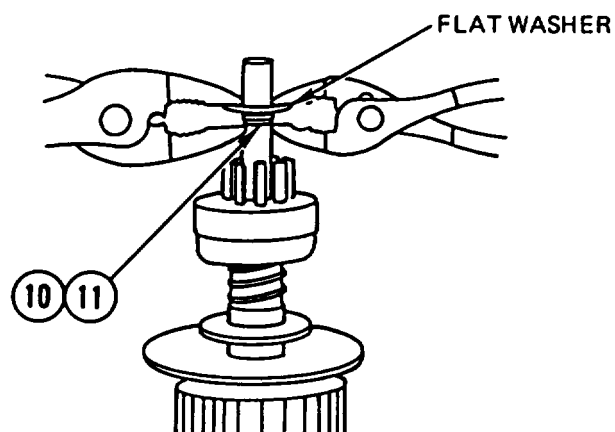
---

**STARTER REPAIR (CONT)**


---

**ASSEMBLY**


1. IF REMOVED, INSTALL new BUSHING (1) in housing (2).
2. INSTALL starting COIL (3) on housing (4).
3. INSTALL two RODS (5) in housing (2).
4. IF REMOVED, INSTALL new BUSHING (6) in intermediate plate (7).
5. IF REMOVED, INSTALL new sleeve BEARING (8) in pinion (9).
6. INSTALL intermediate plate (7), PINION (9), ring (10), and new snap ring (11) on armature (12).

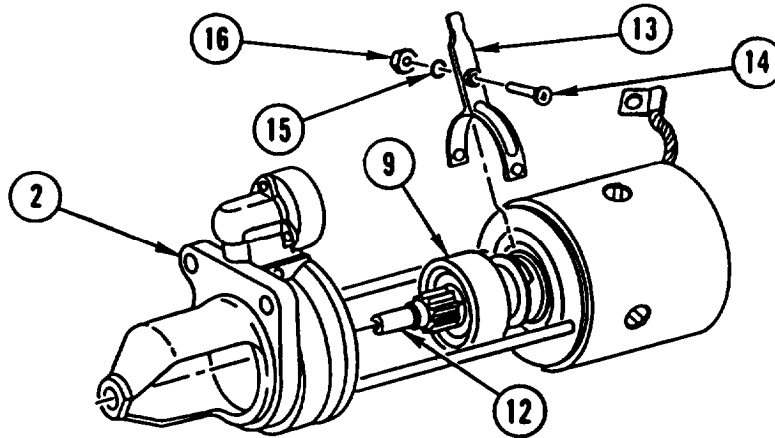


7. USING 9/16 ID FLAT WASHER and two pairs of PLIERS, INSTALL RING (10) over snap ring (11), as shown.

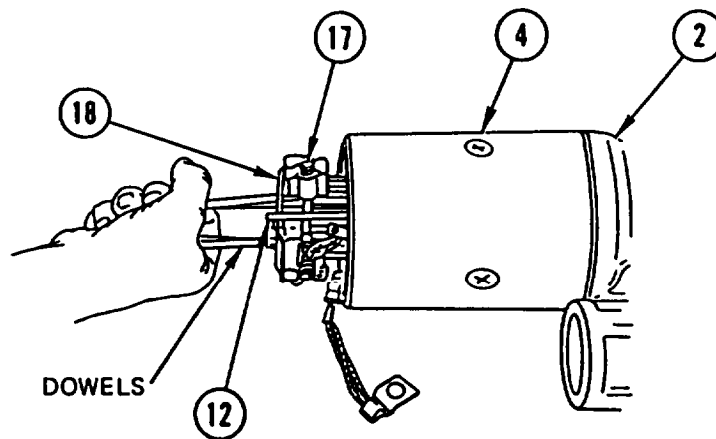
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**STARTER REPAIR (CONT)**

---



8. INSTALL LEVER (13) on pinion (9) and INSTALL LEVER (13) and ARMATURE (12) in housing (2).
9. INSTALL BOLT (14), new lock washer (15), and nut (16) in housing (2) through lever (13).



10. IF REMOVED, INSTALL new brush set BRACKET (17) in brush holder (18) and housing (4).

**CAUTION**

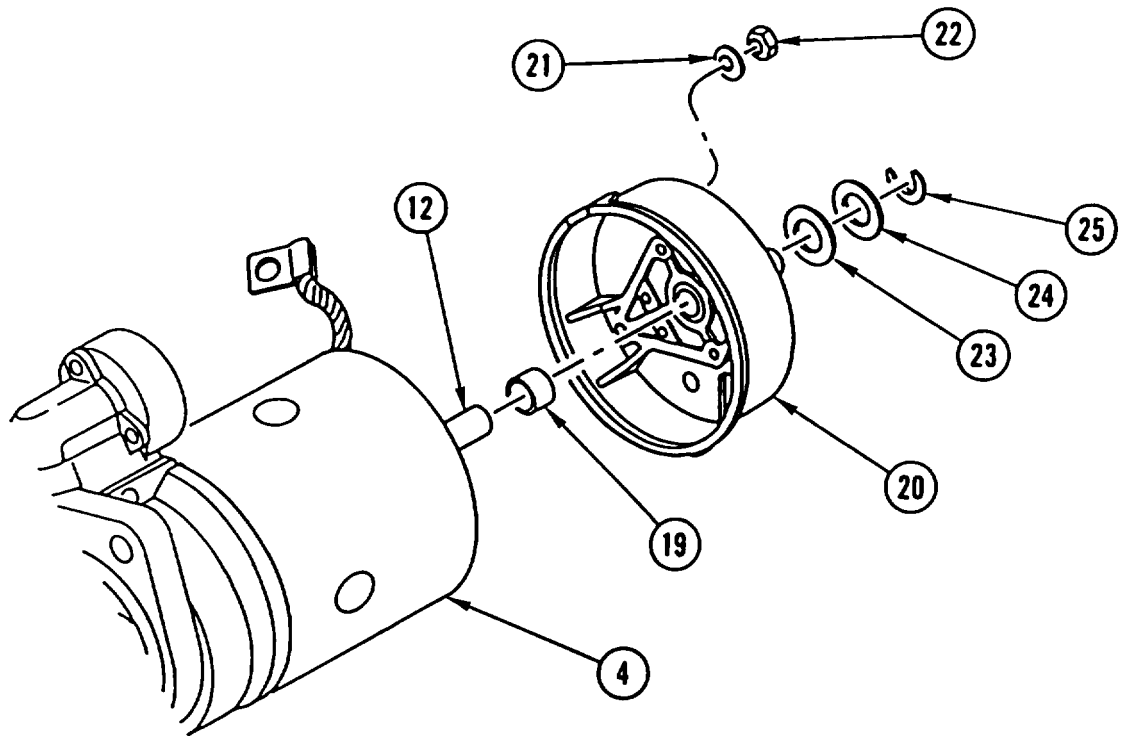
Use care to avoid damaging brushes.

11. INSTALL BRUSH in its bracket on brush holder (18). INSTALL DOWEL in brush holder (18) approximately half the width of brush to hold brush in place.
12. REPEAT STEP 11 for remaining three brushes in brush set bracket (17).
13. HOLD four DOWELS together and INSTALL HOUSING (4) and brush holder (18) over armature (12).
14. REMOVE four DOWELS and completely INSTALL HOUSING (4) in housing (2).

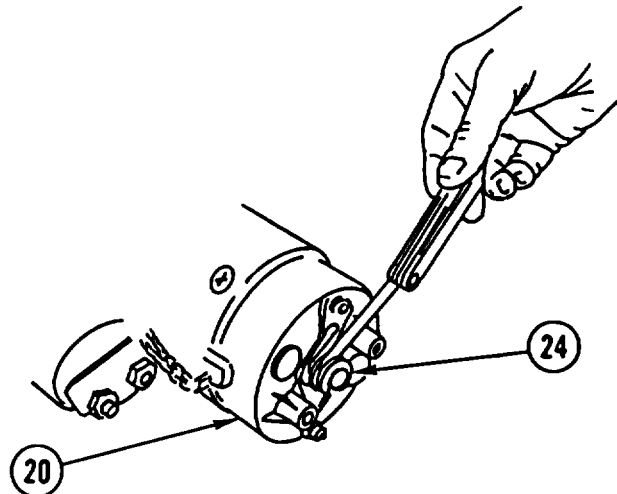
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**STARTER REPAIR (CONT)**


---



15. IF REMOVED, INSTALL new BRUSHING (19) in end bell (20).
16. INSTALL end BELL (20), two nuts (22) on housing (4).
17. INSTALL new washer(s) (23), new shim(s) (24), and new lock washer RING (25) as noted during Removal.

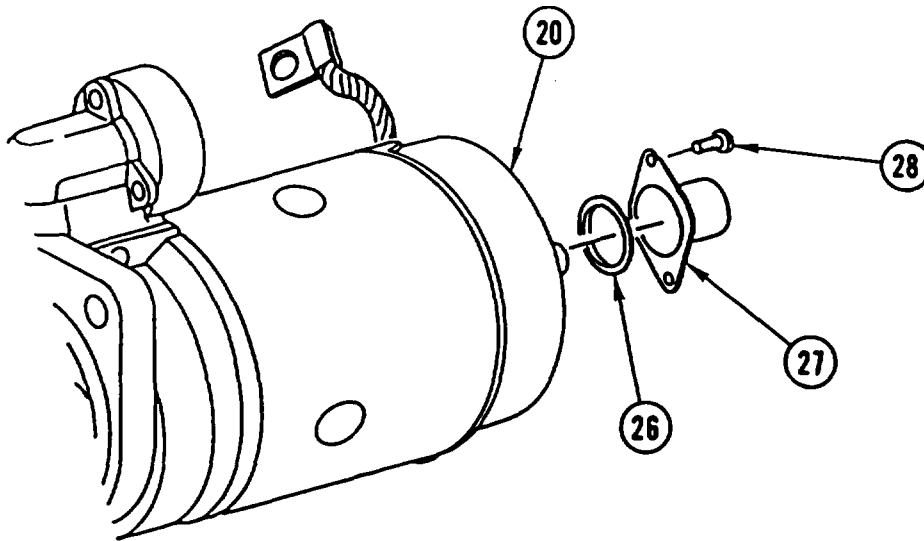


18. USING feeler GAGE, MEASURE GAP between shim(s) (24) and end bell (20). Measurement MUST be 0.002-0.016 in. (0.05-0.4 mm). If measurement is NOT correct, ADD or REMOVE SHIM(S) to achieve correct measurement.

---

**STARTER REPAIR (CONT)**

---



19. INSTALL new gasket (26), end BELL (27), and two new screws (28) on end bell (20).

**NOTE**

Follow-on Maintenance:  
Install starter solenoid (TM 5-2420-224-20).

### Section III. BATTERY REPAIR

---

#### BATTERY REPAIR

---

This task covers: Repair

---

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, Battery, SC 4940-95-CL-A38

##### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Battery Removed

##### References:

TM 5-2420-224-20  
 TM 9-6140-200-14

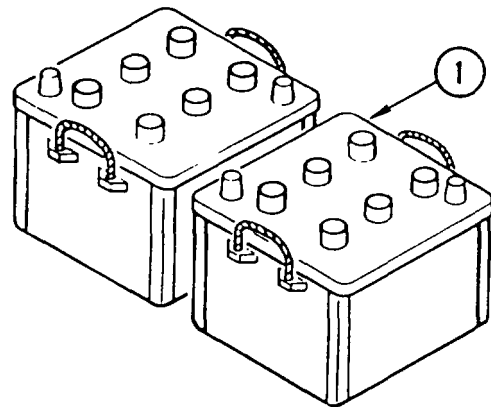
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#### REPAIR

Repair battery (1) (TM 9-6140-200-14).

##### NOTE

Follow-on Maintenance:  
 Install battery (TM 5-2420-224-20).







## CHAPTER 15 TRANSMISSION REPAIR INSTRUCTIONS

### OVERVIEW

This chapter contains maintenance instructions for repair of the transmission. A list of sections contained in this chapter is shown below.

	<b>Page</b>
Section I. Transmission Repair .....	15-1
Section II. Transmission Top Cover Repair .....	15-54
Section III. Transmission Access Cover Repair .....	15-65
Section IV. Power Take-Off (PTO) Repair .....	15-70

### Section I. TRANSMISSION REPAIR

---

#### TRANSMISSION REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Blocking Tool, P/N 406 589 06 63 00  
 Bushing Guide, P/N 406 589 01 07 02  
 Dial Gage, P/N 001 589 53 21 00  
 Dial Gage Holder, P/N 363 589 02 21 00  
 Fabricated Tool, Appendix C, Item 2  
 Fabricated Tool, Appendix C, Item 3  
 Fabricated Tool, Appendix C, Item 4  
 Installer, P/N 406 589 03 14 00  
 Installer, P/N 406 589 06 43 00  
 Installer, P/N 406 589 02 61 00  
 Installer, P/N 406 589 12 43 00  
 Installer, P/N 441 589 00 33 00  
 Puller, P/N 001 589 45 33 00  
 Puller, P/N 000 589 35 33 00  
 Puller, P/N 000 589 34 33 00  
 Puller, P/N 000 589 82 33 00  
 Puller, P/N 000 589 52 34 00  
 Slotted Nut Wrench, P/N 406 589 01 07 01  
 Slotted Nut Wrench, P/N 406 589 02 07 00  
 Test Mandrel, P/N 406 589 00 21 00

**Materials/Parts:**

Gasket  
 Gasket  
 Packing  
 Seal  
 Packing  
 Gasket  
 Packing (2)  
 Gasket  
 Sleeve, Crushable  
 Seal  
 Washer, Spring Tension  
 Ring, Seal  
 Pin, Cotter (2)  
 Gasket (2)  
 Seal

## TRANSMISSION REPAIR (CONT)

### Materials/Parts (Cont):

Packing	
Packing	
Plug	
Packing	
Gasket	
Seal	
Seal	
Compound, Sealing	Appendix B, Item 14
Compound, Sealing	Appendix B, Item 16
Grease, Automotive and Artillery (GAA)	Appendix B, Item 23
Grease, Molybdenum Disulfide	Appendix B, Item 24
Oil, Lubricating	Appendix B, Item 30

### References:

TM 9-214

### Equipment Condition:

Reference	Condition Description
Page 3-68	Transmission Removed and Mounted on Stand
Page 3-96	Transmission Shift Controls Installed
Page 3-66	Clutch Release Lever and Shaft Removed

### General Safety Instructions:

#### 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 open; flush with water for 15 minutes and get immediate attention.

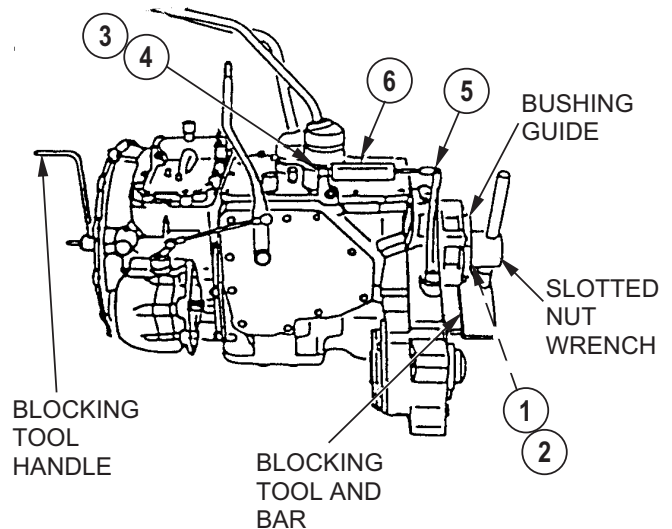
## DISASSEMBLY

### NOTE

Transmission shift controls are required for disassembly and assembly. Controls are removed during transmission removal.

Power flow in cascade box must not be interrupted.

1. ENGAGE first GEAR and USING SLOTTED NUT WRENCH, BUSHING GUIDE, BLOCKING TOOL and BAR, and BLOCKING TOOL HANDLE, REMOVE slotted NUT (1) and plug (2).
2. REMOVE retaining ring (3), two washers (4), clip (5), and front-wheel drive PLUNGER (6).



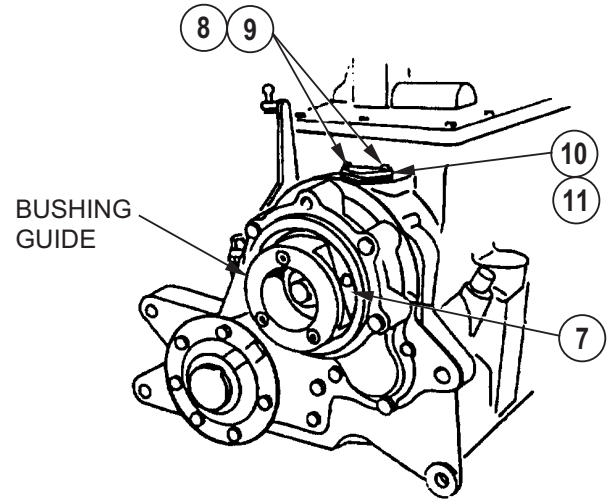
## TRANSMISSION REPAIR (CONT)

3. USING BUSHING GUIDE and suitable PULLER, REMOVE FLANGE (7).

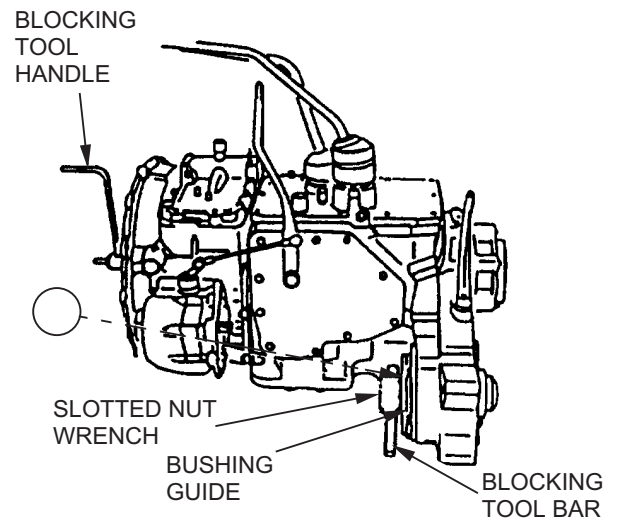
**NOTE**

Oil ring may have separate retaining plate.

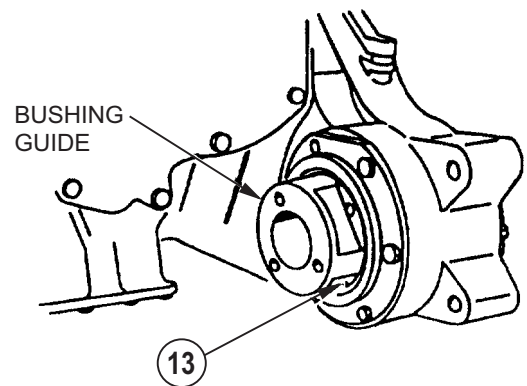
4. REMOVE two bolts (8), two washers (9), oil RING (10), and gasket (11). DISCARD GASKET.



5. ENGAGE front-wheel drive LEVER and, USING SLOTTED NUT WRENCH, BUSHING GUIDE, BLOCKING TOOL HANDLE, and BLOCKING TOOL BAR, REMOVE NUT (12) from front drive output.



6. USING BUSHING GUIDE and suitable PULLER, REMOVE output FLANGE (13) from front drive output.

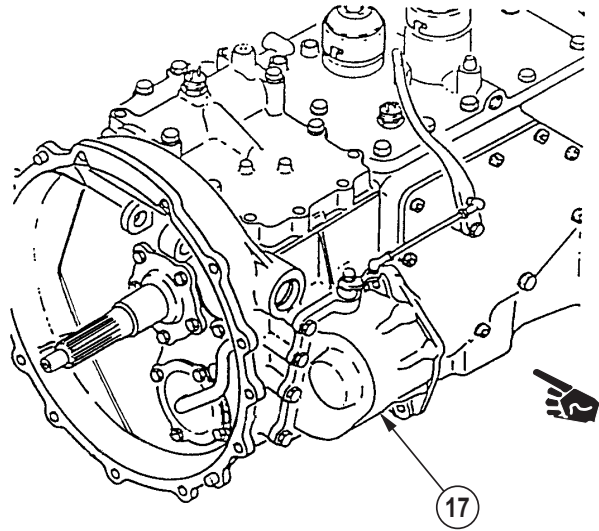


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## TRANSMISSION REPAIR (CONT)

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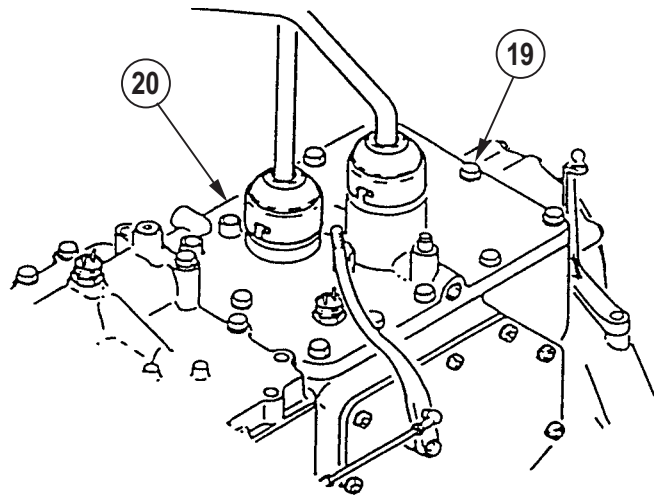
7. REMOVE POWER TAKE-OFF (PTO) (17) (page 3-79).



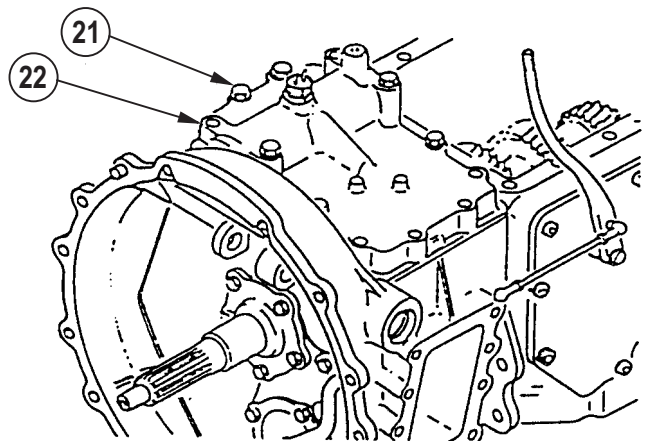
**NOTE**

Make sure manual control levers are in neutral position.

8. REMOVE twelve screws (19) and COVER assembly (20).



9. REMOVE six SCREWS (21) and PRY OFF access COVER (22).

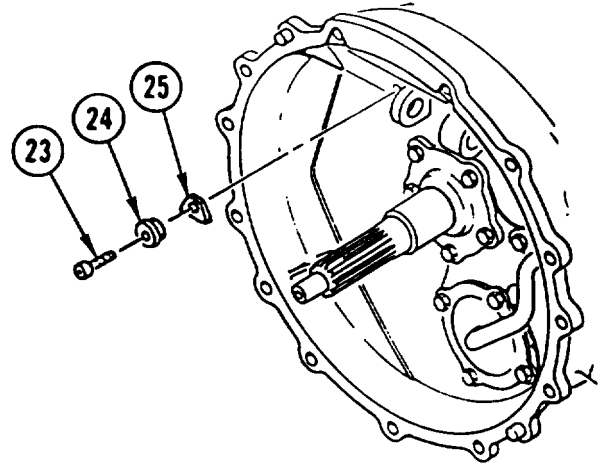


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**TRANSMISSION REPAIR (CONT)**

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10. REMOVE screw (23), LOCK (24), and lock (25).

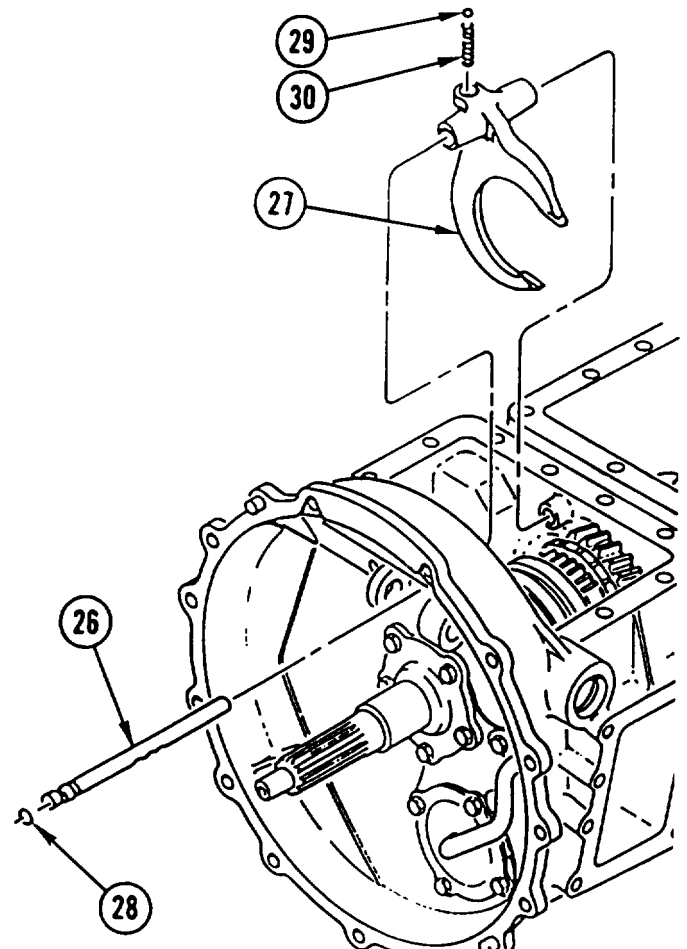


11. REMOVE rod (26), shifter FORK (27), and packing (28). DISCARD PACKING.

**NOTE**

Be careful not to lose ball and spring.

12. REMOVE BALL (29) and spring (30) from shifter fork (27).

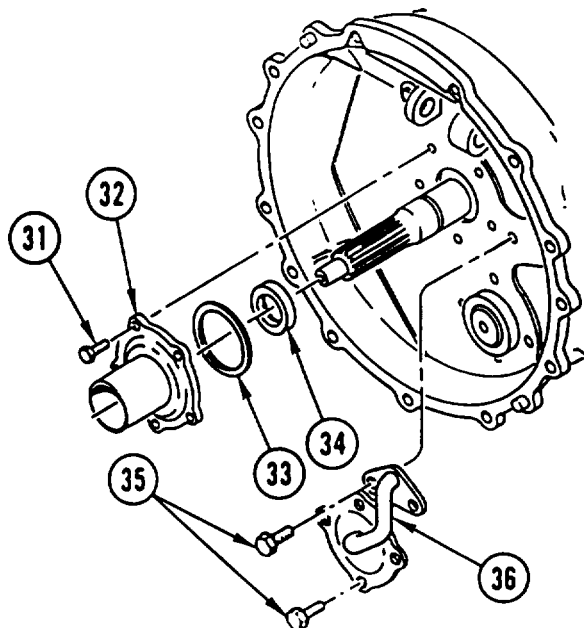


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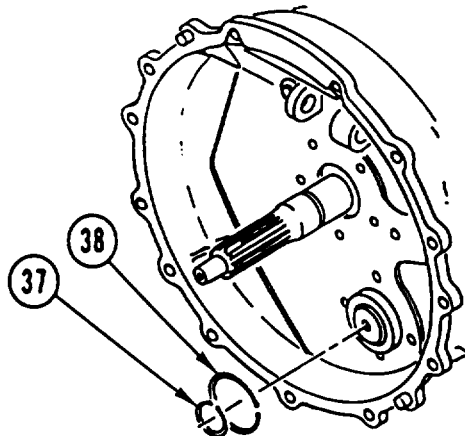
**TRANSMISSION REPAIR (CONT)**

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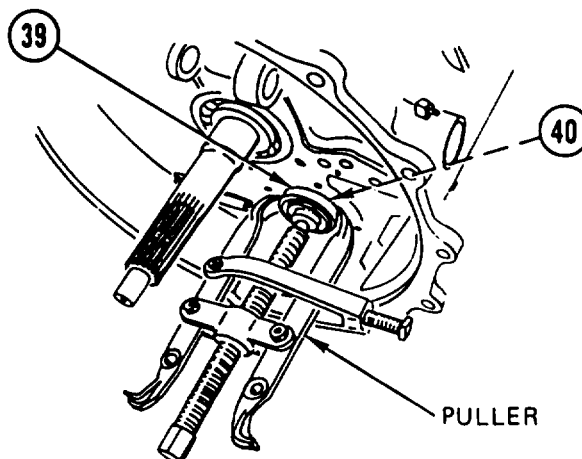
- 13. REMOVE five screws (31), INSERT (32), spacer(s) (33), and seal (34). DISCARD SEAL.
- 14. REMOVE six screws (35) and bearing COVER (36).



- 15. REMOVE two retaining RINGS (37 and 38).

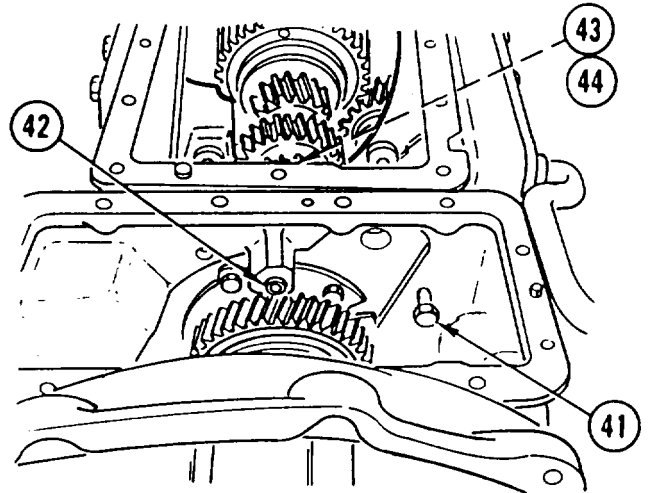


- 16. USING PULLER, REMOVE BEARING (39) and spacer(s) (40).



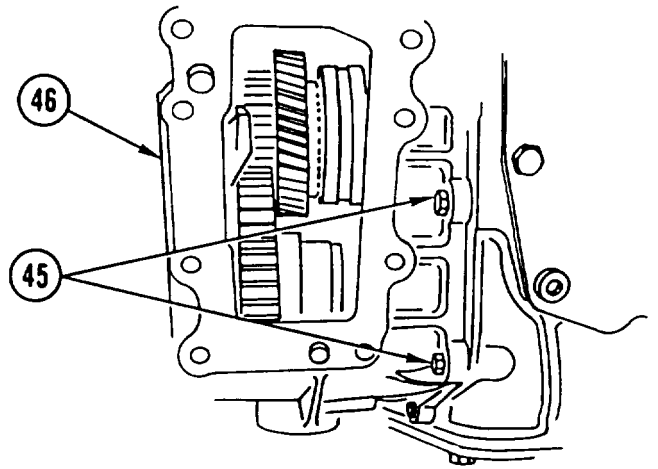
**TRANSMISSION REPAIR (CONT)**

17. REMOVE SCREW (41), screw (42), washer (43), and nut (44).



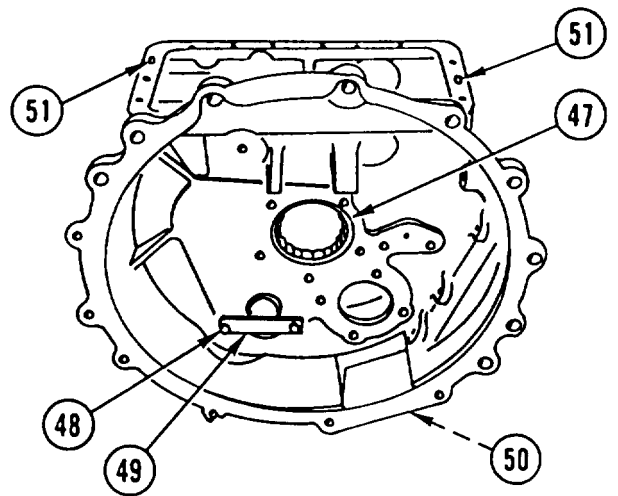
**WARNING**  
 Cascade box housing weighs 78 pounds (36 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting cascade box housing.

18. REMOVE seven screws (45) and cascade box HOUSING (46).



19. REMOVE BEARING (47), two screws (48), lock (49), and plug (50).

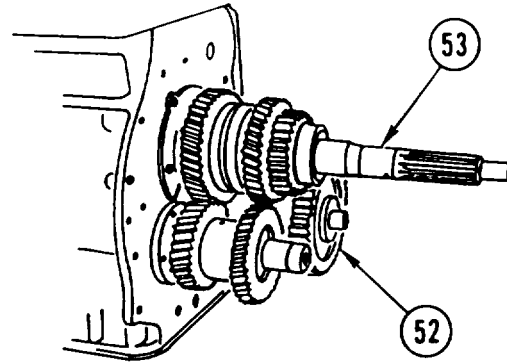
20. IF DAMAGED, REMOVE two PINS (51).



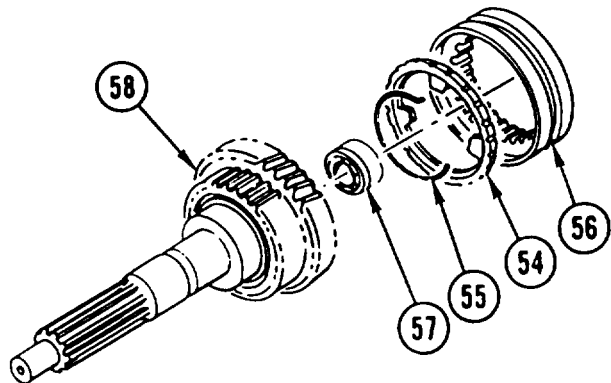


**TRANSMISSION REPAIR (CONT)**

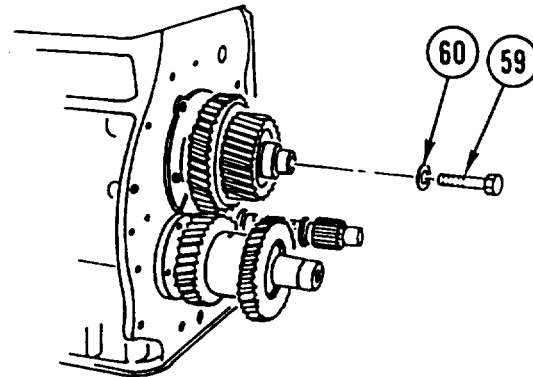
21. REMOVE PTO GEAR (52) and front input SHAFT assembly (53).



22. REMOVE synchronizer (54), flat spring (55), COLLAR (56), and bearing (57) from gear (58).

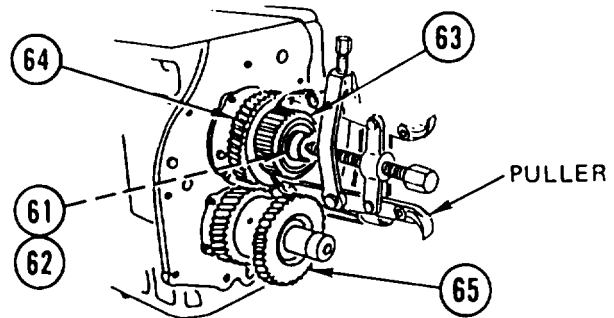


23. REMOVE SCREW (59) and washer (60).



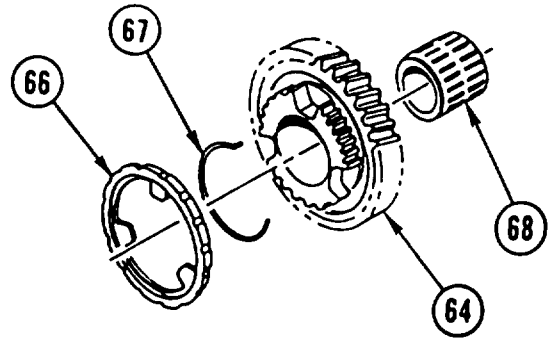
24. USING PULLER, REMOVE bearing (61), spacer (62), and GEAR (63).

25. REMOVE gear (64) and intermediate GEAR (65).

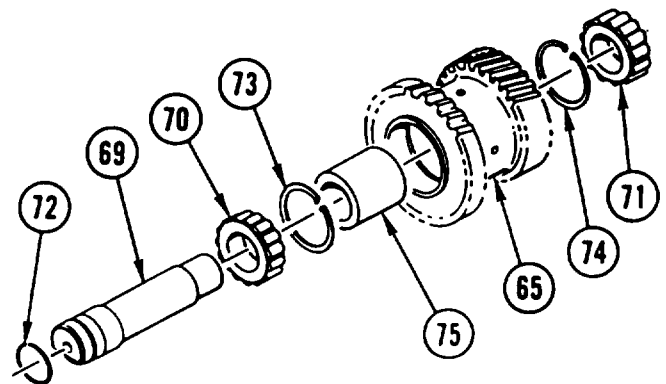


**TRANSMISSION REPAIR (CONT)**

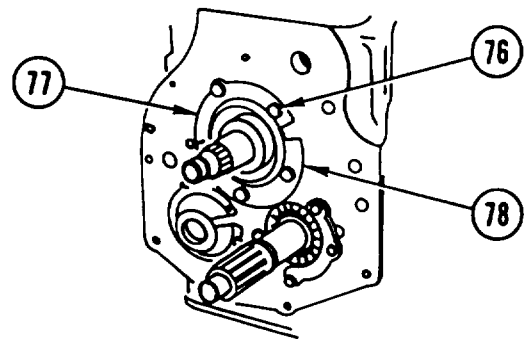
26. REMOVE synchronizer (66), flat spring (67), and BEARING (68) from gear (64).



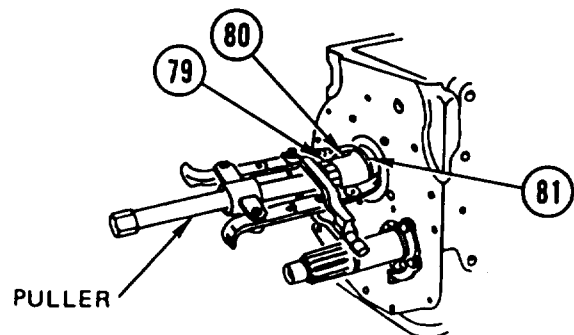
27. USING suitable PRESS, REMOVE SHAFT (69), two bearings (70 and 71), packing (72), two piston rings (73 and 74), and spacer (75) from intermediate gear (65). DISCARD PACKING.



28. REMOVE five screws (76) and two retaining RINGS (77 and 78).

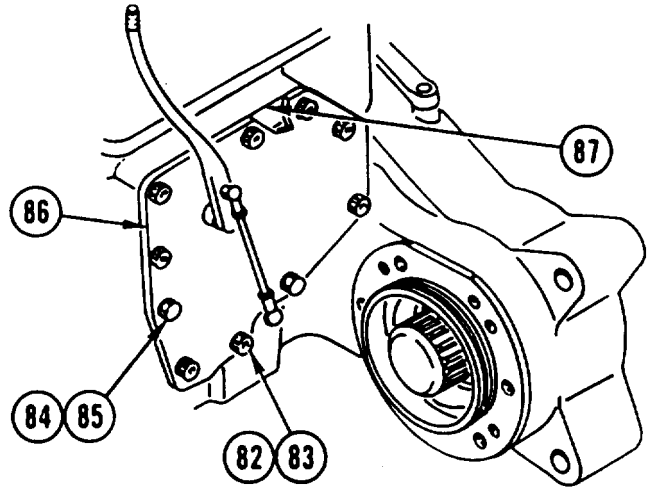


29. USING PULLER, REMOVE BEARING (79), spacer (80), and thrust bearing washer (81).



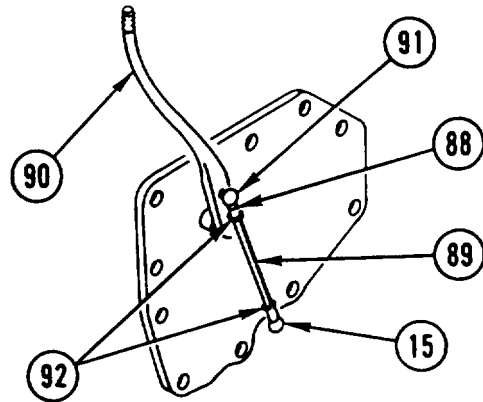
**TRANSMISSION REPAIR (CONT)**

30. REMOVE eight screws (82), eight washers (83), two capscrews (84), two washers (85), COVER (86), and gasket (87). DISCARD GASKET.

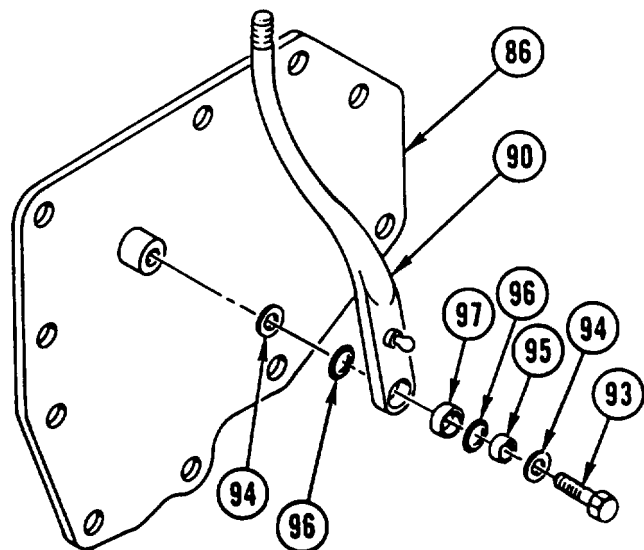


31. REMOVE CLIP (88) and LEVER (89) from lever (90).

32. REMOVE two SOCKETS (15 and 91) and two nuts (92) from lever (89).

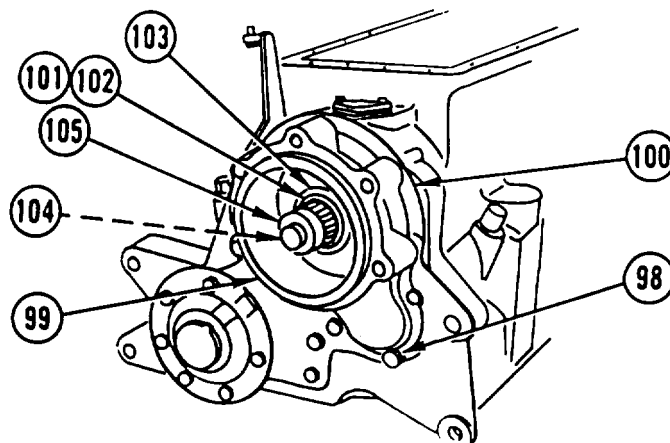


33. REMOVE screw (93), two washers (94), sleeve bearing (95), two packings (96), bushing (97), and LEVER (90) from cover (86). DISCARD PACKINGS.

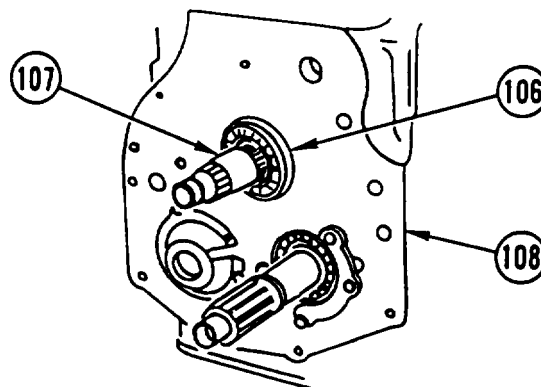


**TRANSMISSION REPAIR (CONT)**

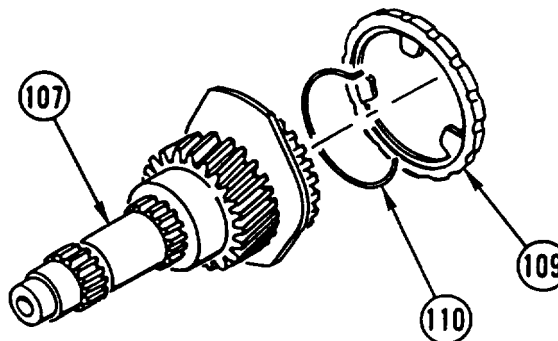
- 34. REMOVE three SCREWS (98).
- 35. USING PULLER, REMOVE HOUSING (99), gasket (100), crushable sleeve (101), bearing (102), and seal (103). DISCARD GASKET, crushable SLEEVE, and SEAL.
- 36. LOOSEN SCREW (104) in output shaft (105).



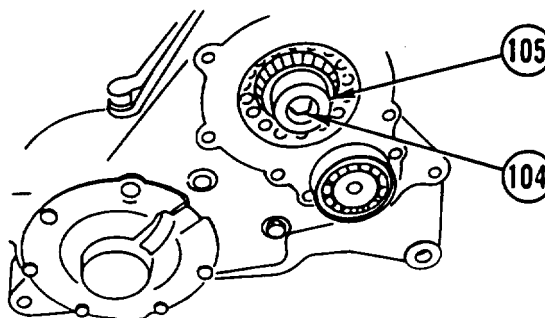
- 37. USING PULLER, REMOVE BEARING (106). REMOVE rear input SHAFT (107) from housing (108).



- 38. REMOVE SYNCHRONIZER (109) and flat spring (110) from rear input shaft (107).

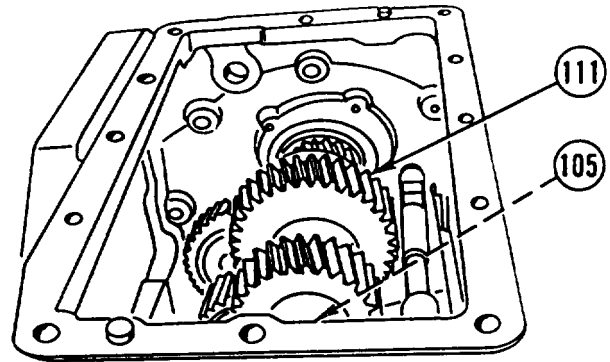


- 39. REMOVE SCREW (104) from output shaft (105).

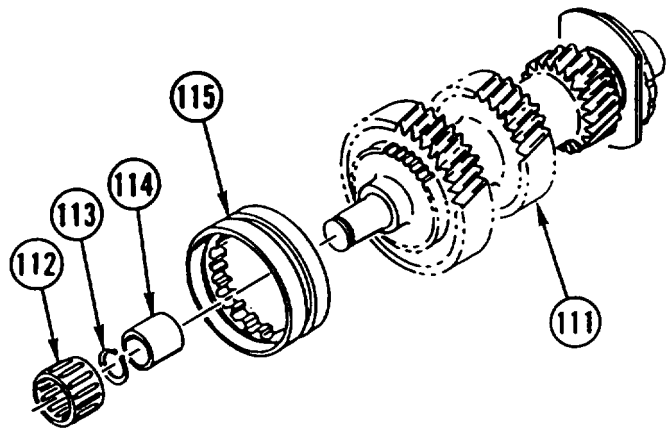


**TRANSMISSION REPAIR (CONT)**

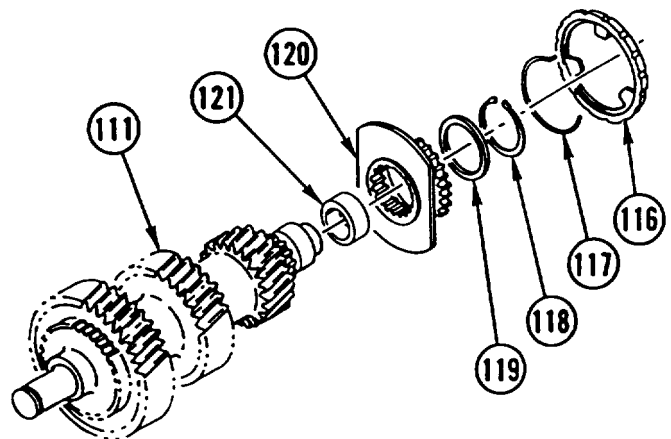
40. REMOVE main gear SHAFT (111) and output shaft (105).



41. REMOVE RETAINER and ROLLER (112) from main gear shaft (111).
42. REMOVE retaining ring (113), bearing ring (114), and GEAR (115).

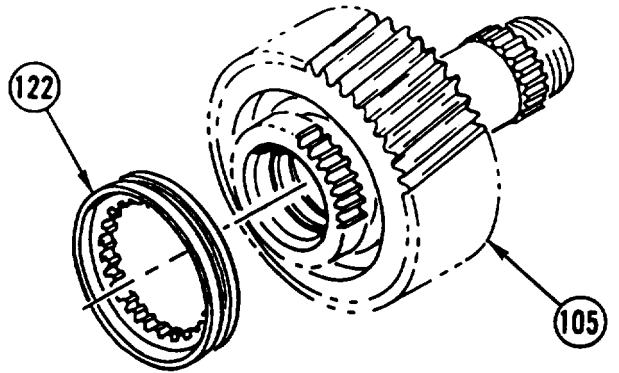


43. REMOVE synchronizer (116), flat spring (117), retaining ring (118), washer (119), and GEAR (120).
44. REMOVE bearing RACE (121) from main gear shaft (111).

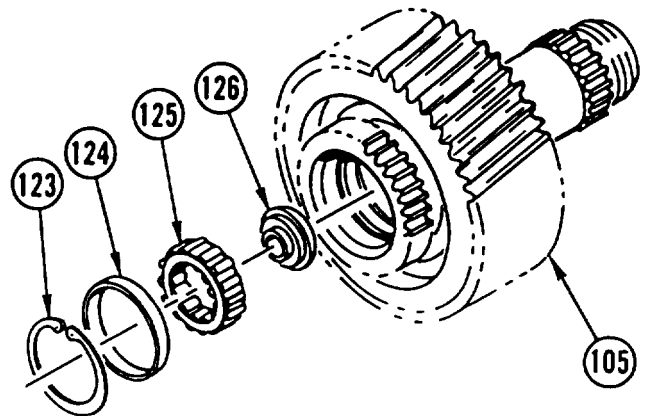


**TRANSMISSION REPAIR (CONT)**

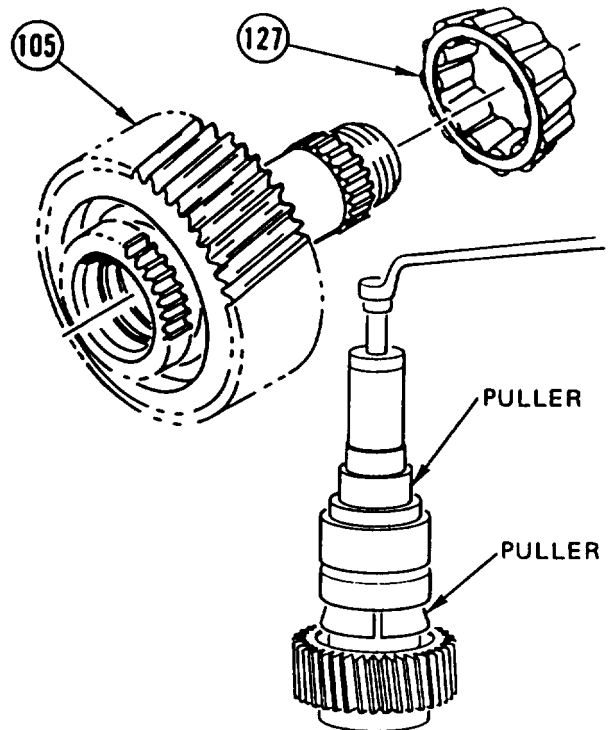
45. REMOVE fourth gear COLLAR (122) from output shaft (105) gear.



46. REMOVE spring tension washer (123), spacer (124), two-piece BEARING (125), and shoulder washer (126) from output shaft (105) DISCARD spring tension WASHER.



47. USING PULLERS, REMOVE BEARING (127) from output shaft (105).

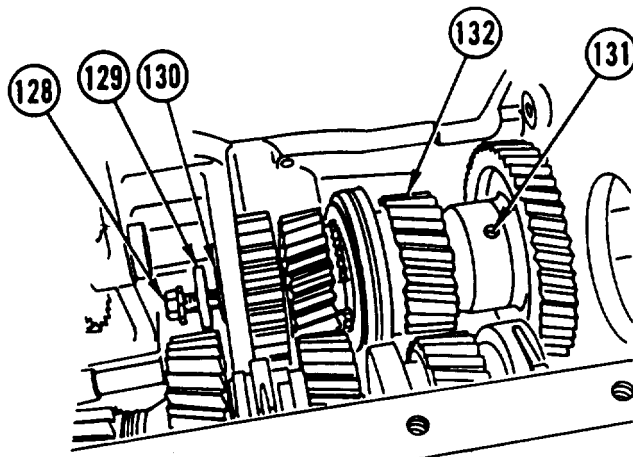


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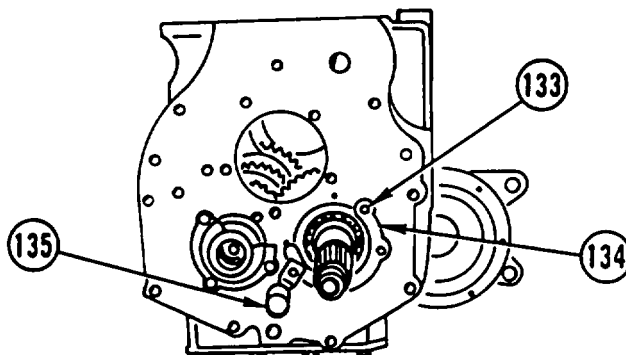
**TRANSMISSION REPAIR (CONT)**

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48. REMOVE screw (128), washer (129), thrust bearing washer (130), and PIN (131) from initial stage shaft assembly (132).



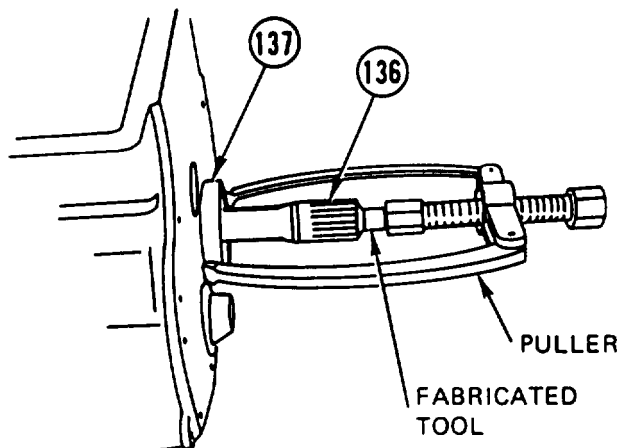
49. REMOVE four screws (133), cap (134), and metallic HOSE (135).



**NOTE**

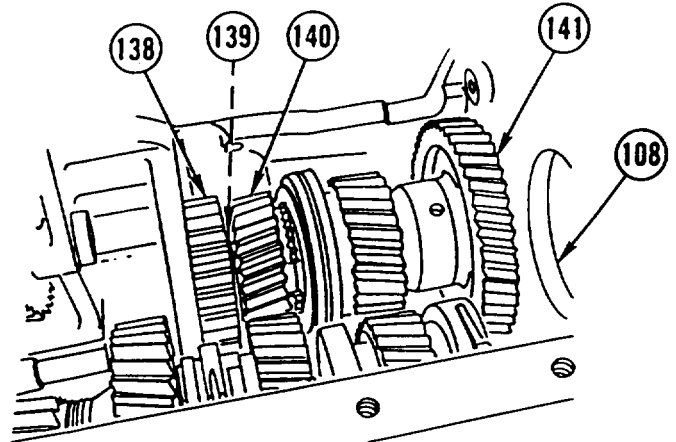
Shaft is installed in a three-piece bearing. During removal, bearing cover may come off bearing.

50. USING PULLER and FABRICATED TOOL (Appendix C, Item 3), REMOVE primary SHAFT (136) and bearing (137).

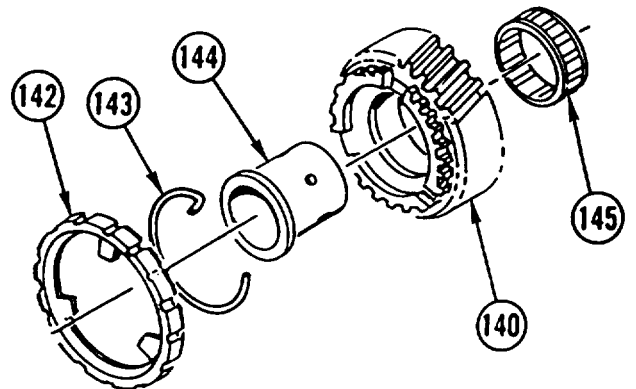


**TRANSMISSION REPAIR (CONT)**

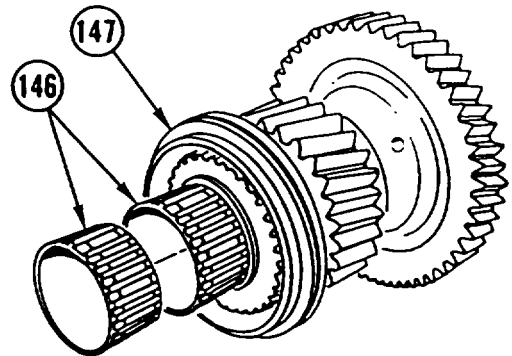
- 51. REMOVE gear (138), bearing (139), and reverse GEAR (140) from housing (108).
- 52. REMOVE GEAR assembly (141) from housing (108).



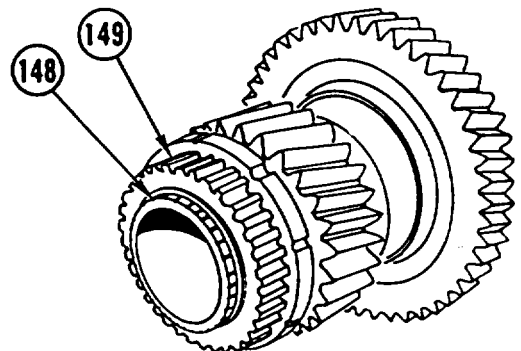
- 53. REMOVE synchronizer (142), flat spring (143), BEARING (144), and bearing (145) from reverse gear (140).



- 54. REMOVE two BEARINGS (146).
- 55. REMOVE COLLAR (147).



- 56. REMOVE retaining ring (148) and GEAR (149).



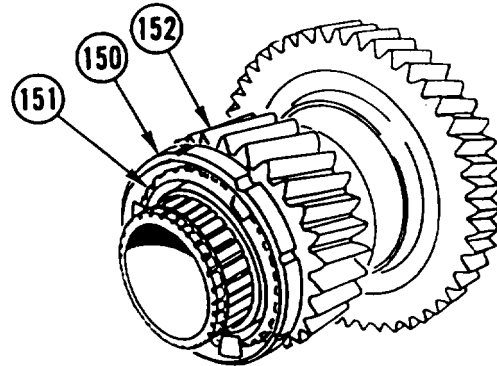


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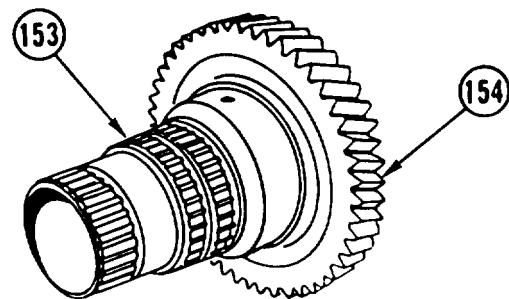
**TRANSMISSION REPAIR (CONT)**

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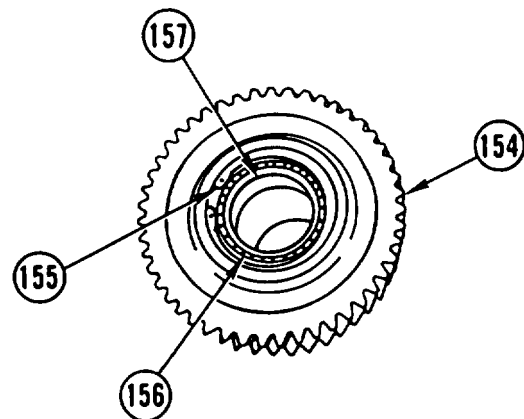
57. REMOVE synchronizer (150), flat spring (151), and forward-low range GEAR (152).



56. REMOVE RETAINER and ROLLER (153) from spur gear (154).

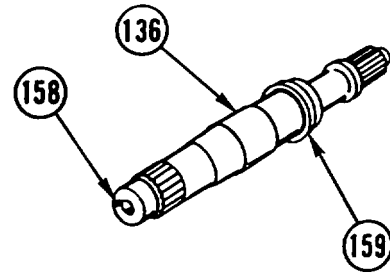


59. REMOVE retaining ring (155), two-piece BEARING (156), and spacer (157) from spur gear (154).

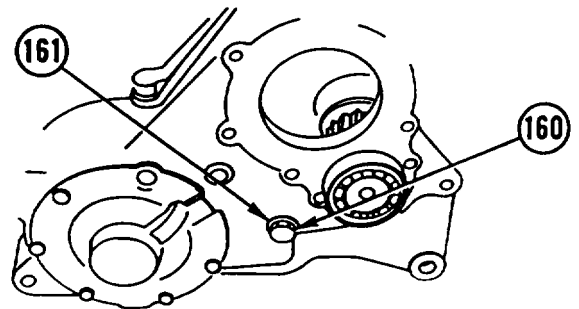


## TRANSMISSION REPAIR (CONT)

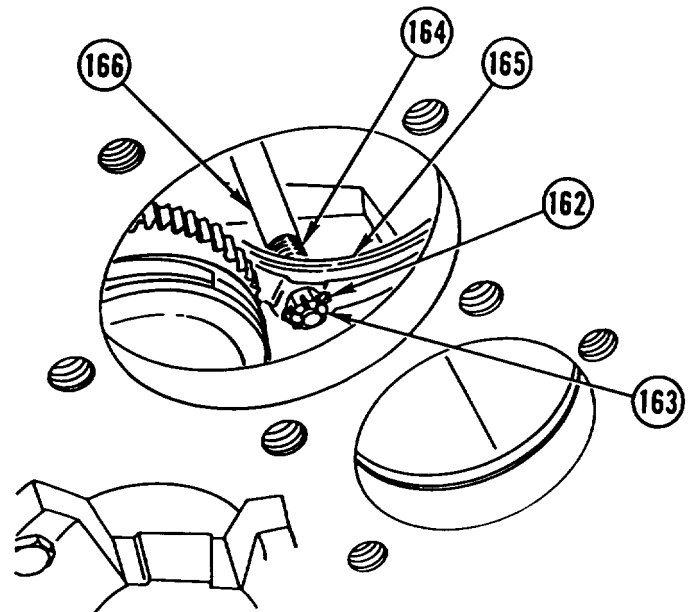
60. IF DAMAGED, REMOVE PIN (158) from primary shaft (136).
61. REMOVE BEARING (159) from primary shaft (136).



62. REMOVE PLUG (160) and seal ring (161). DISCARD seal RING.



63. REMOVE cotter pin (162), nut (163), 16 conical spring washers (164), FORK (165), and rod (166). DISCARD rotter PIN.

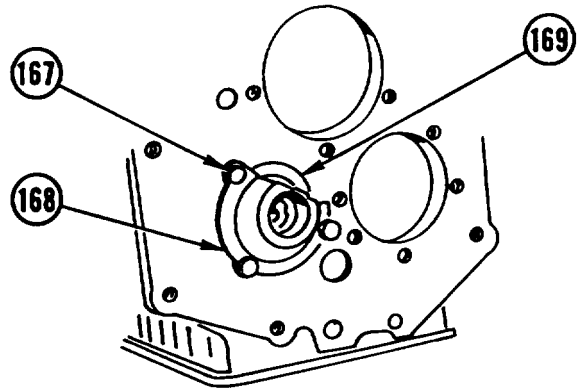


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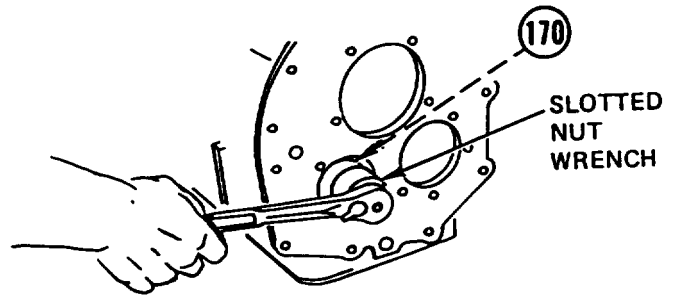
**TRANSMISSION REPAIR (CONT)**

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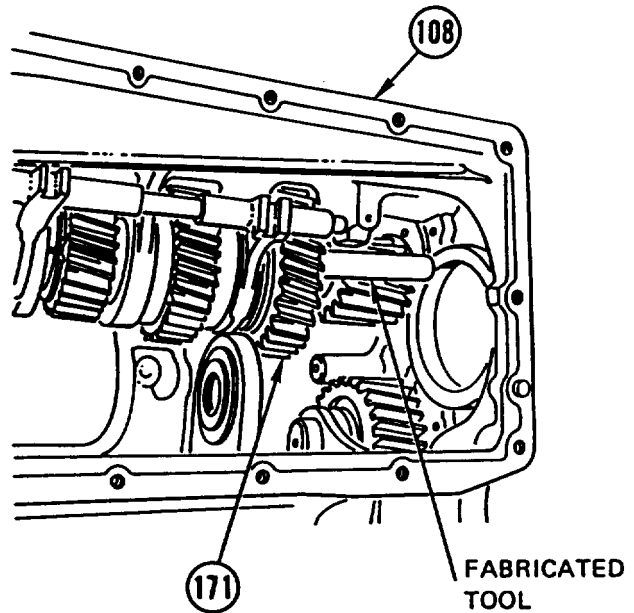
64. REMOVE three screws (167), FLANGE (166), and spacer washer (169).



65. USING SLOTTED NUT WRENCH, REMOVE slotted NUT (170).



66. INSTALL FABRICATED TOOL (Appendix C, Item 4) between third gear CLUSTER (171) and housing (108).

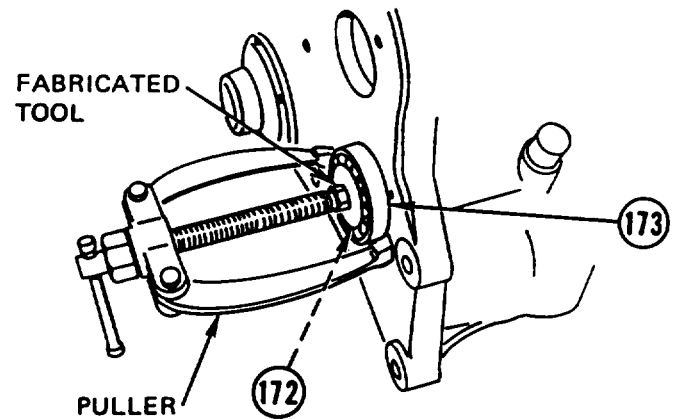


## TRANSMISSION REPAIR (CONT)

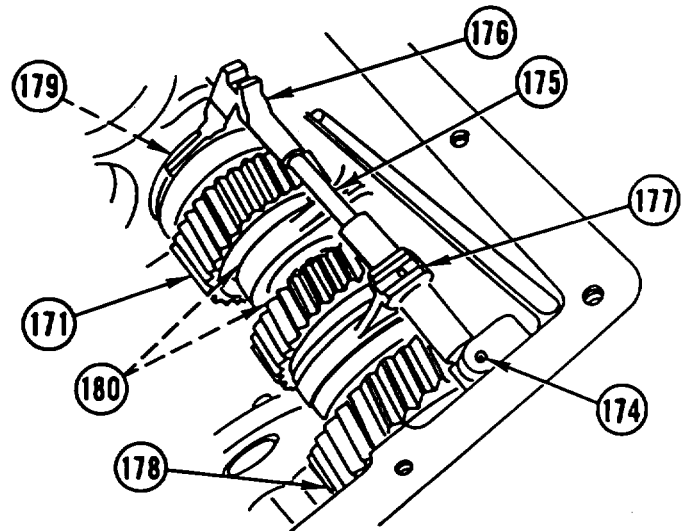
### NOTE

During performance of step 67, when countershaft is removed, all pieces will drop into bottom of housing.

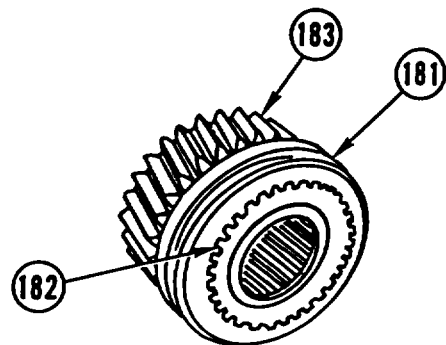
67. USING PULLER and FABRICATED TOOL (Appendix C, Item 2), REMOVE COUNTER-SHAFT (172) and bearing (173).



68. REMOVE pin (174), rod (175), two FORKS (176 and 177), third gear cluster (171), first and second gears cluster (178), tube spacer (179), and two thrust bearing washers (180).



69. REMOVE spur gear (181) and GEAR (182) from third gear (183).



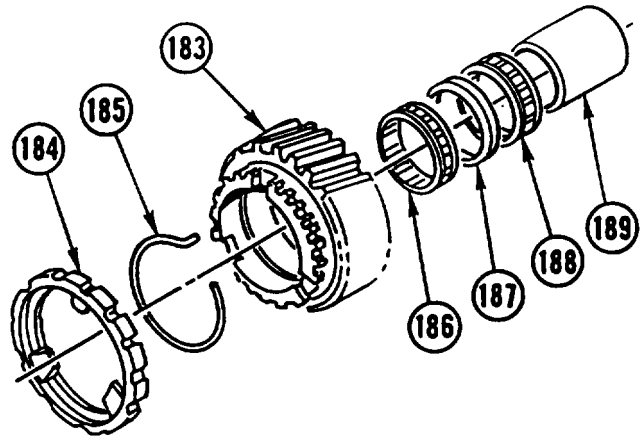
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**TRANSMISSION REPAIR (CONT)**

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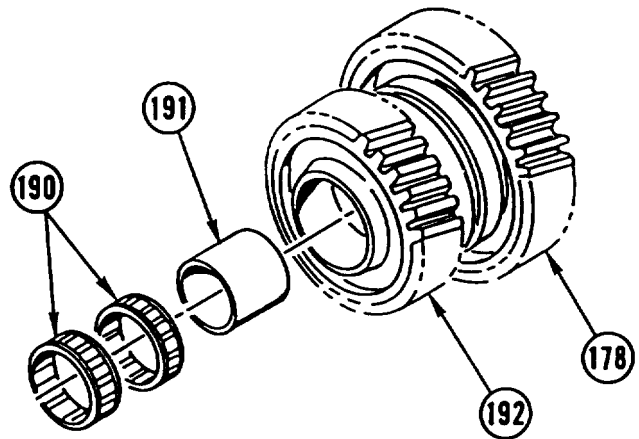
70. REMOVE SYNCHRONIZER (184) and flat spring (185) from third gear (183).

71. REMOVE roller (186), spacer (187), roller (188), and BUSHING (189) from third gear (183).

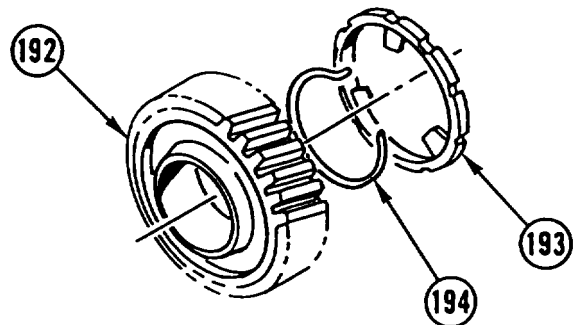


72. REMOVE two rollers (190) and sleeve BUSHING (191).

73. REMOVE second GEAR (192) from first and second gears cluster (178).

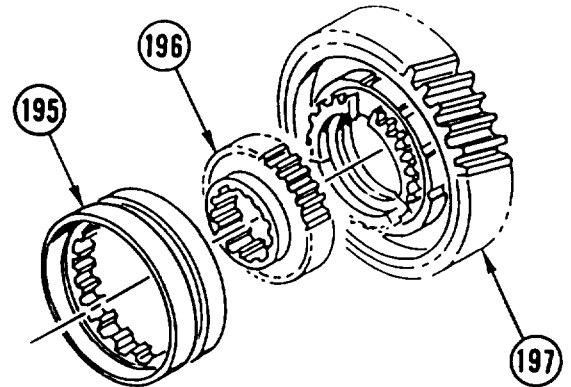


74. REMOVE SYNCHRONIZER (193) and flat spring (194) from second gear (192).

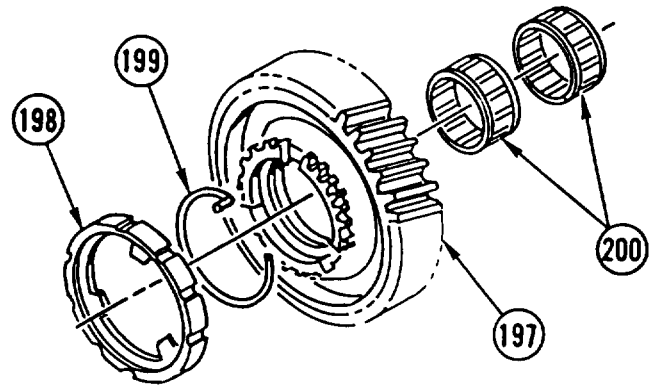


**TRANSMISSION REPAIR (CONT)**

75. REMOVE COLLAR (195) and first gear (196) from gear (197).



76. REMOVE synchronizer (198), flat spring (199), and two BEARINGS (200) from gear (197).

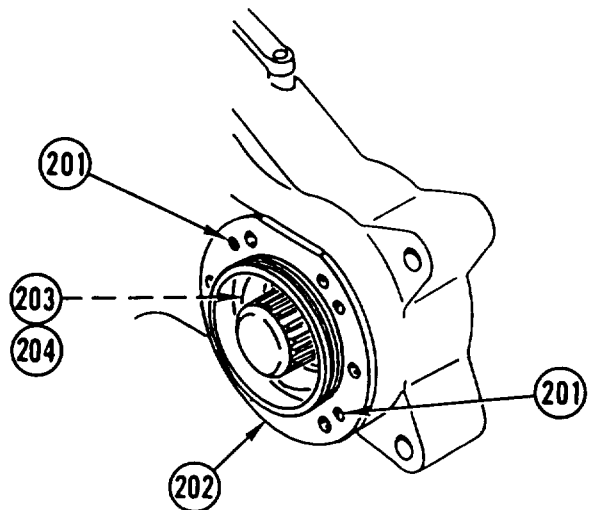


77. REMOVE two SCREWS (201) from flange (202).

**CAUTION**

Use care removing flange to prevent damage to mating surface.

78. USING PULLER, REMOVE FLANGE (202), spacer (203), and gasket (204). DISCARD GASKET.

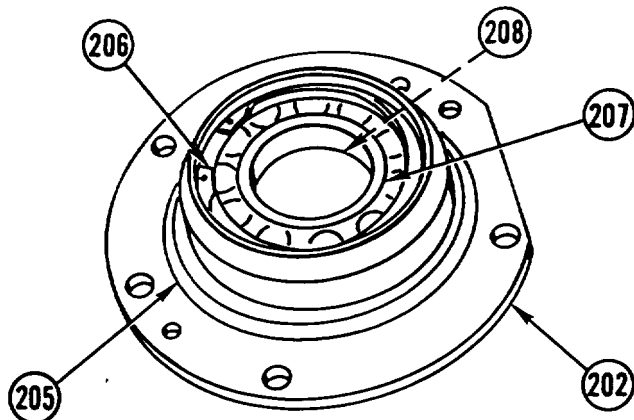


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**TRANSMISSION REPAIR (CONT)**

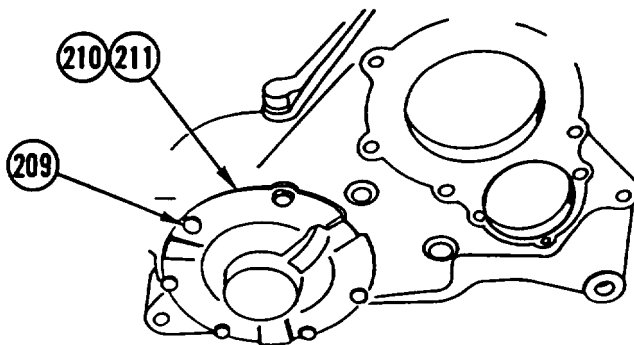
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79. REMOVE packing (205), retaining ring (206), BEARING (207), and seal (208) from flange (202). DISCARD PACKING and SEAL.

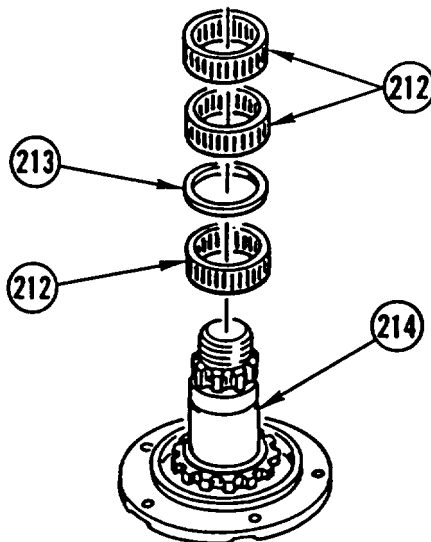


80. REMOVE four SCREWS (209) and PRY OFF COVER (210).

81. REMOVE and DISCARD GASKET (211).

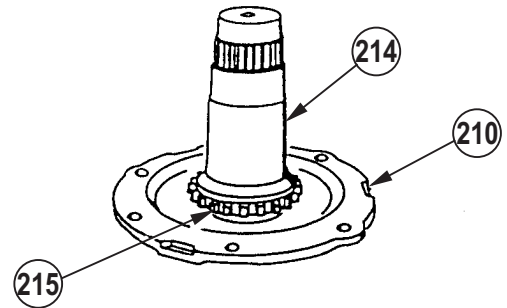


82. REMOVE three RETAINERS and ROLLERS (212) and spacer (213) from output shaft (214).

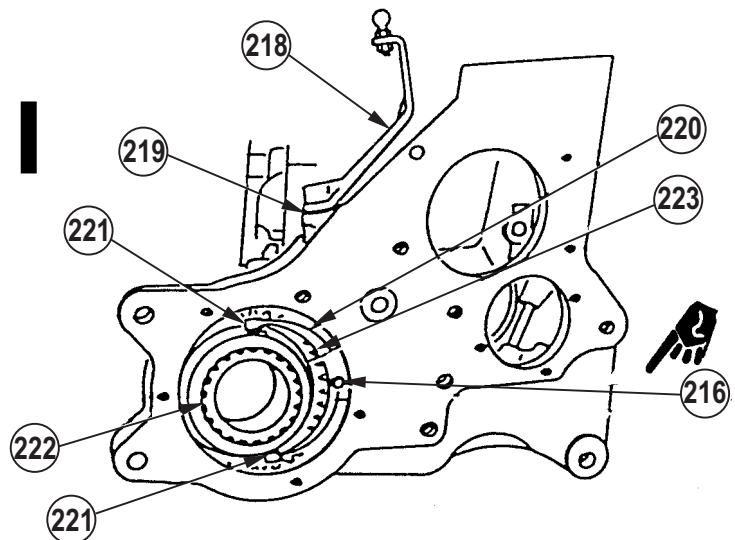


## TRANSMISSION REPAIR (CONT)

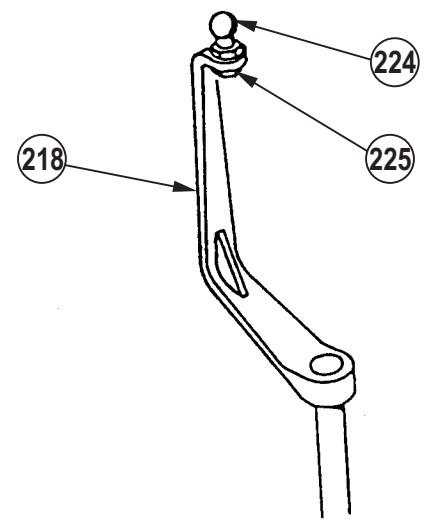
83. REMOVE output SHAFT (214) from cover (210).
84. USING PULLER, REMOVE BEARING (215) from cover (210).



85. REMOVE screw (216), LEVER (218), and packing (219). DISCARD PACKING.
86. REMOVE shifter fork (220), two pins (221), synchronizer (222), and front-wheel drive GEAR (223).



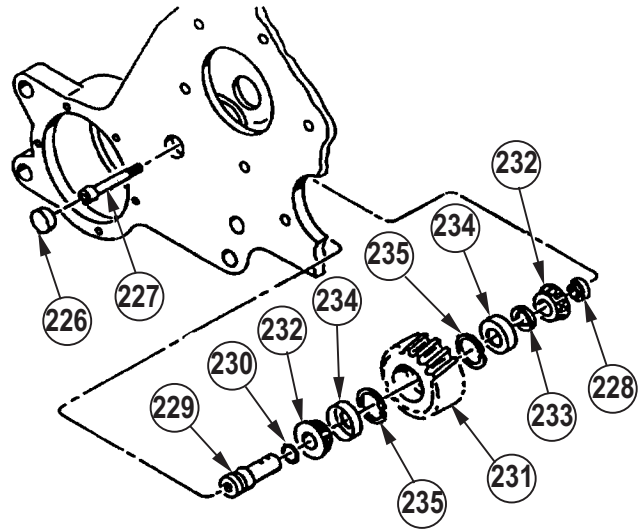
87. REMOVE BEARING (224) and nut (225) from lever (218).



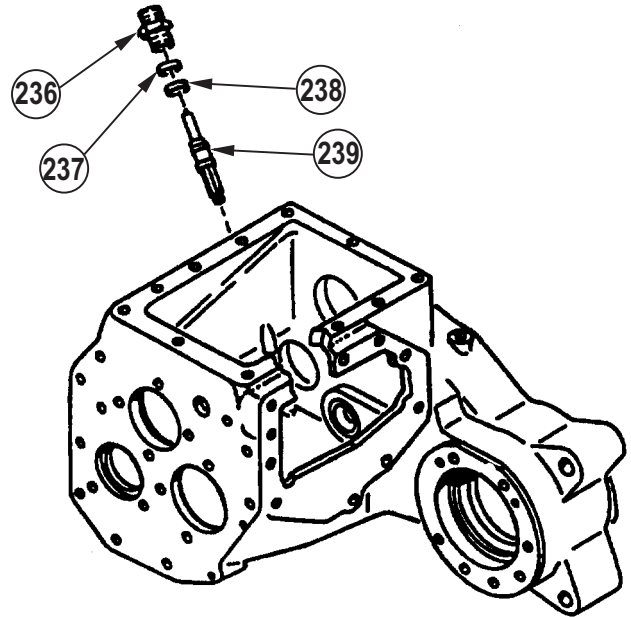


## TRANSMISSION REPAIR (CONT)

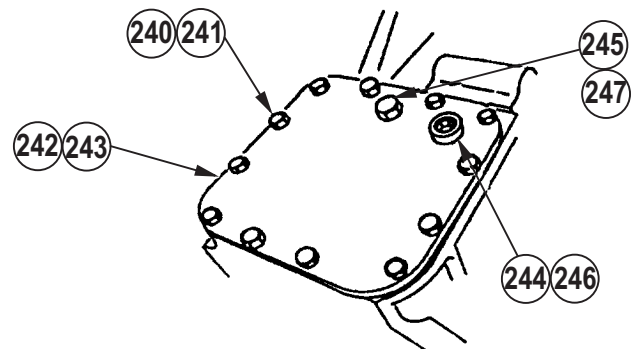
88. REMOVE PLUG (226), screw (227), and nut (228). DISCARD PLUG.
89. REMOVE PIN (229) and packing (230) from front-wheel drive idler gear (231). DISCARD PACKING.
90. REMOVE two BEARINGS (232), ring (233), two bearing cups (234), and two retaining rings (235) from front-wheel drive idler gear (231).



91. REMOVE nut (236), bushing (237), sleeve bushing (238), and SHAFT (239).



92. REMOVE 12 screws (240), 12 washers (241), COVER (242), gasket (243), 2 drain plugs (244 and 245), and 2 seals (246 and 247). DISCARD GASKET and SEALS.



## TRANSMISSION REPAIR (CONT)

93. REMOVE three BEARINGS (248, 249, and 250).
94. IF DAMAGED, REMOVE two pins (251) and drain PLUG (252).

### INSPECTION

1. Inspect housings for cracks, galling, and stripped threads.
2. Inspect gears for galling, cracks, and worn or broken teeth.
3. Inspect bearings (TM 9-214).

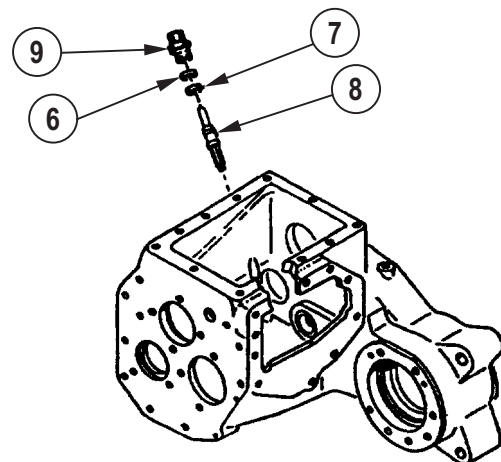
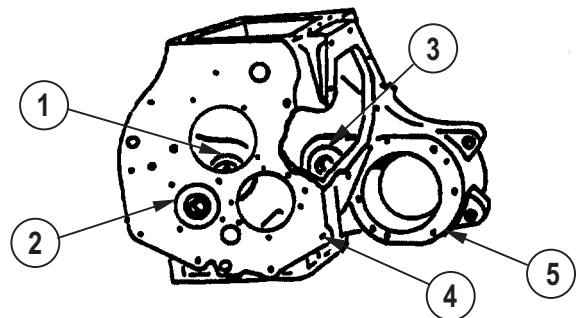
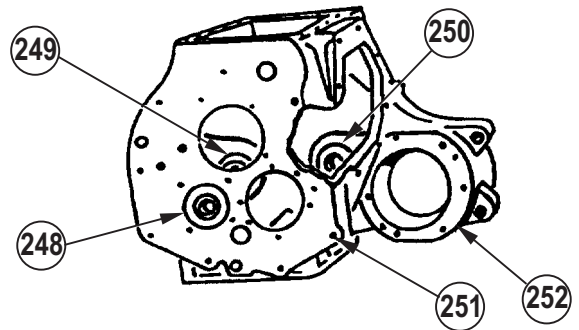
### ASSEMBLY

#### NOTE

- Apply coat of lubricating oil to bearings prior to assembly.
- Bearings (1 and 3) must be installed with flange front of housing.

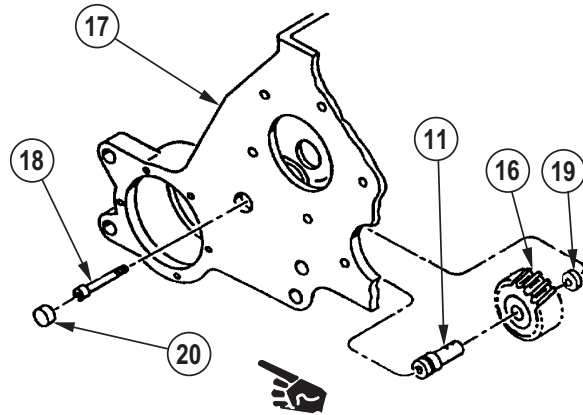
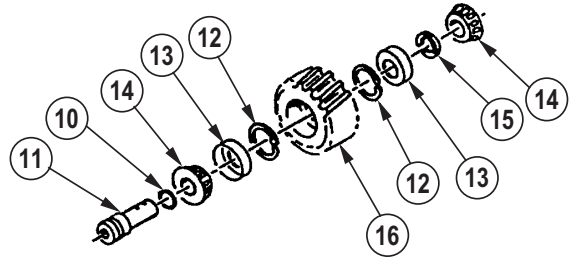
1. INSTALL three bearings (1, 2, and 3).
2. IF REMOVED, INSTALL two new PINS (4) and new drain PLUG (5).

3. INSTALL bushing (6), sleeve bushing (7), SHAFT (8), and nut (9).



## TRANSMISSION REPAIR (CONT)

4. INSTALL new PACKING (10) on pin (11).
5. REMOVE two retaining rings (12), two bearing cups (13), two BEARINGS (14), and ring (15) in front-wheel drive idler gear (16).
6. INSTALL front-wheel drive idler gear (16) assembly in housing (17).
7. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to SCREW (18) and INSTALL PIN (11), screw (18) and nut (19). TIGHTEN SCREW to 36 lb-ft (49 N.m).
8. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to PLUG (20) and INSTALL PLUG.



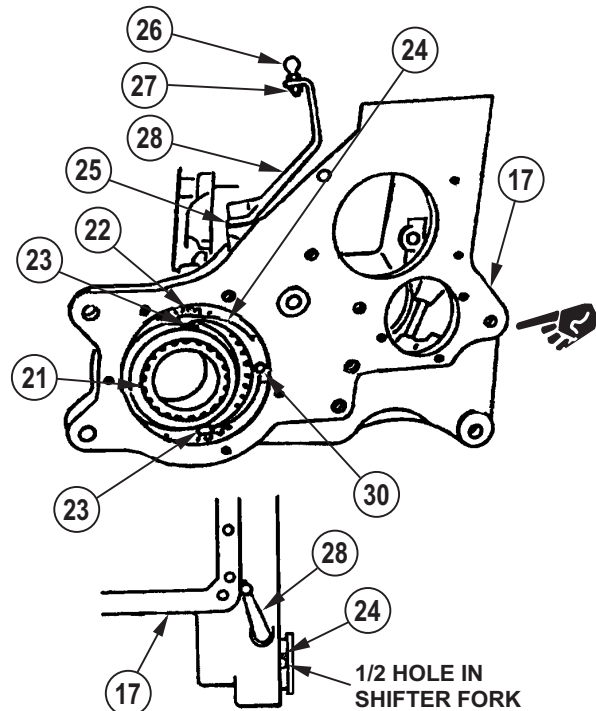
### NOTE

Install synchronizer with collar facing front-wheel drive gear.

9. INSTALL front-wheel drive GEAR (21), synchronizer (22), two pins (23), and shifter fork (24).
10. INSTALL new PACKING (25) in housing (17).
11. INSTALL BEARING (26) and nut (27) on lever (28).
12. INSTALL LEVER (28) in shifter fork (24). POSITION LEVER so half of hole in shifter fork (24) is visible when lever (28) is in contact with housing (17).

### NOTE

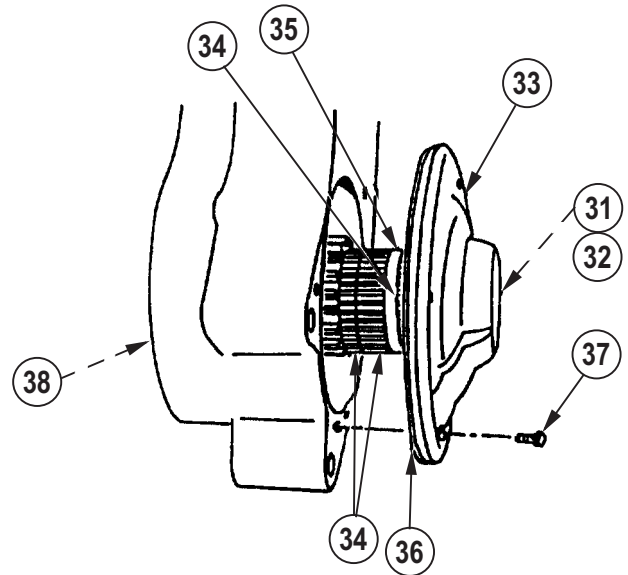
Screw must pass through groove in lever.



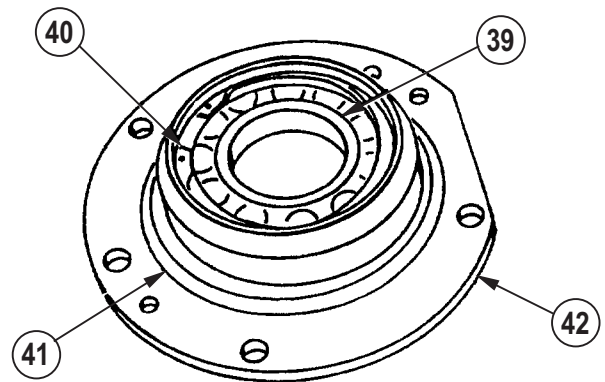
13. INSTALL SCREW (30).

## TRANSMISSION REPAIR (CONT)

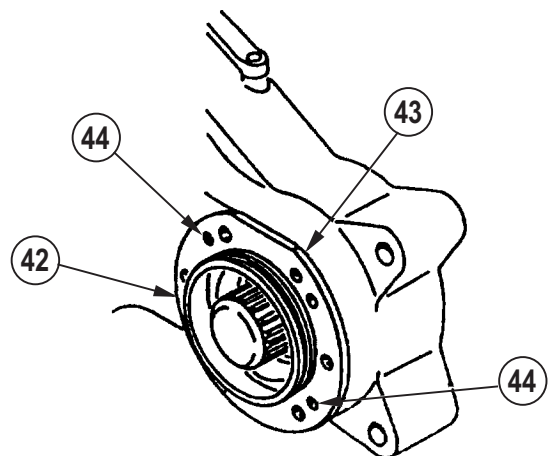
14. INSTALL bearing (31) and output SHAFT (32) in COVER (33).
15. INSTALL three RETAINERS and ROLLERS (34) and SPACER (35) on output shaft (32).
16. INSTALL new gasket (36) and COVER (33).
17. INSTALL four SCREWS (37) and TIGHTEN to 36 lb-ft (49 N.m).
18. INSTALL SPACER (38) on output shaft (32).



19. INSTALL BEARING (39), retaining ring (40), and new packing (41) in flange (42).

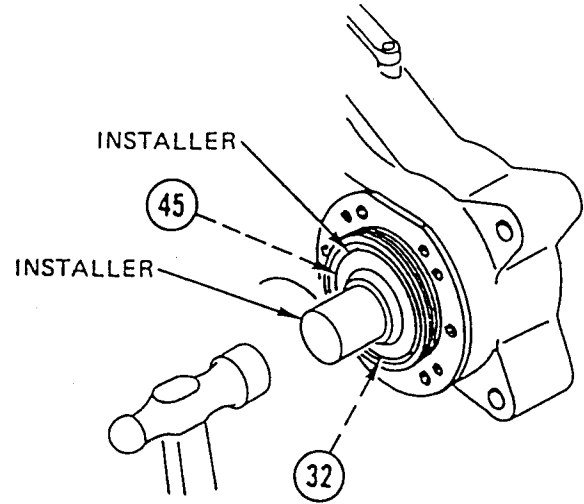


20. INSTALL new gasket (43), FLANGE (42), and two screws (44).

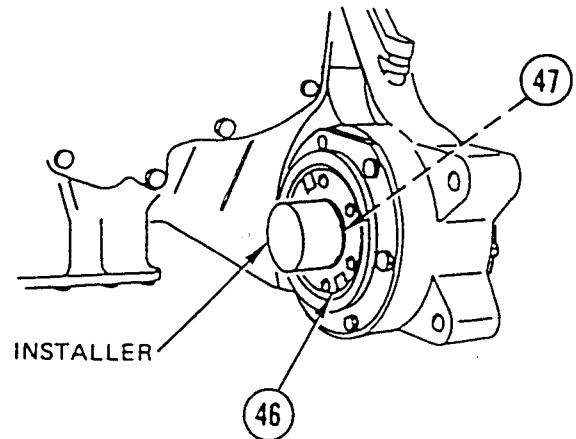


## TRANSMISSION REPAIR (CONT)

21. APPLY COAT of GAA to new SEAL (45). USING INSTALLERS, INSTALL SEAL (45).
22. APPLY COAT of MOLYBDENUM DISULFIDE GREASE to output SHAFT (32).



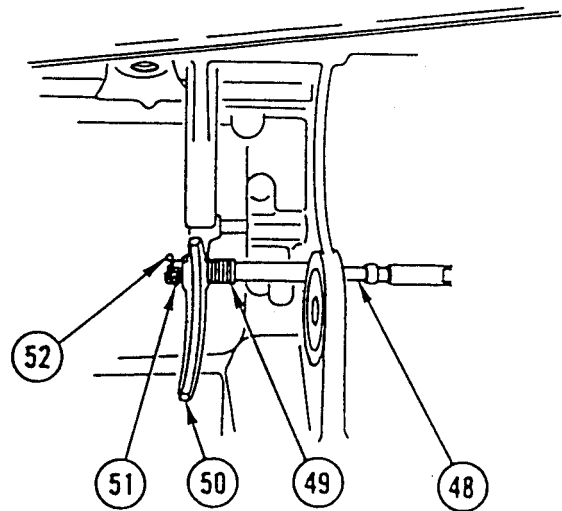
23. USING INSTALLER, INSTALL output FLANGE (46) and nut (47). HAND-TIGHTEN NUT.



### CAUTION

Sixteen conical spring washers must be installed in pairs inside-face to inside-face to make eight pairs to prevent damage to equipment.

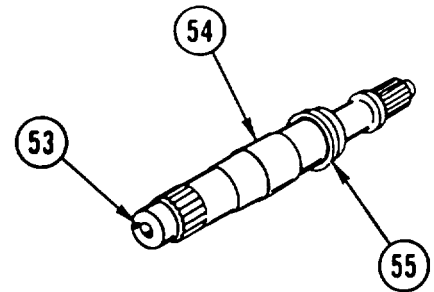
24. INSTALL rod (48), 16 conical spring washers (49), FORK (50), nut (51), and new cotter pin (52). DO NOT BEND cotter PIN.



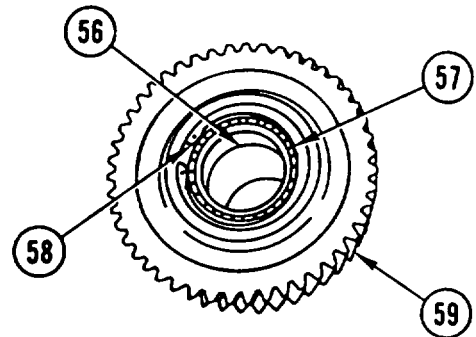
## TRANSMISSION REPAIR (CONT)

25. IF REMOVED, INSTALL new PIN (53) in primary shaft (54).

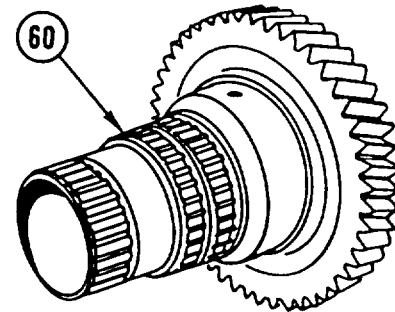
26. INSTALL BEARING (55) on primary shaft (54).



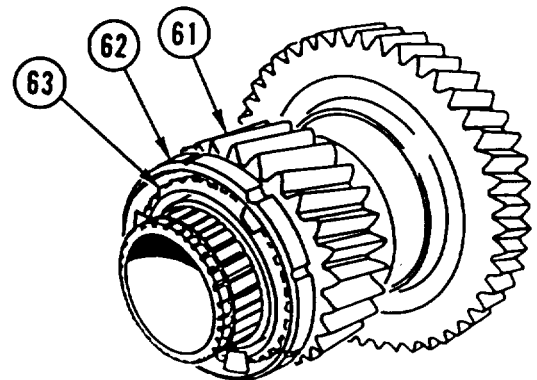
27. INSTALL spacer (56), two-piece BEARING (57), and retaining ring (58) in spur gear (59).



28. INSTALL RETAINER and ROLLER (60).



29. INSTALL forward-low range gear (61), SYNCHRONIZER (62), and flat spring (63).

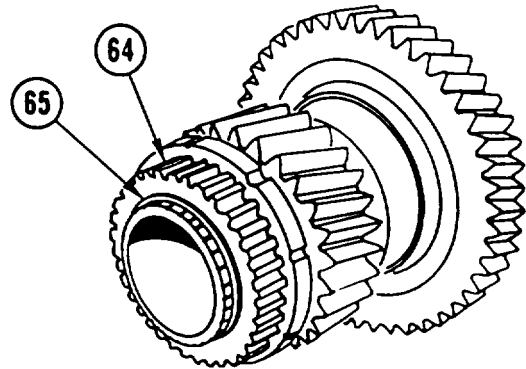


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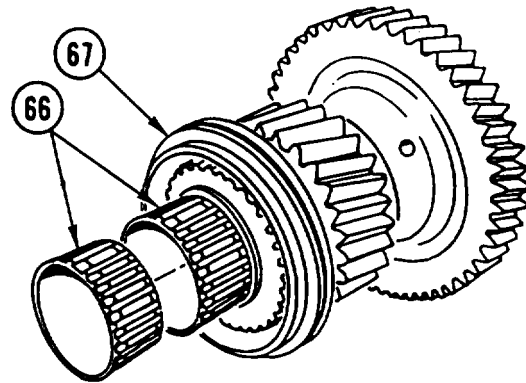
**TRANSMISSION REPAIR (CONT)**

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30. INSTALL GEAR (64) and retaining ring (65).



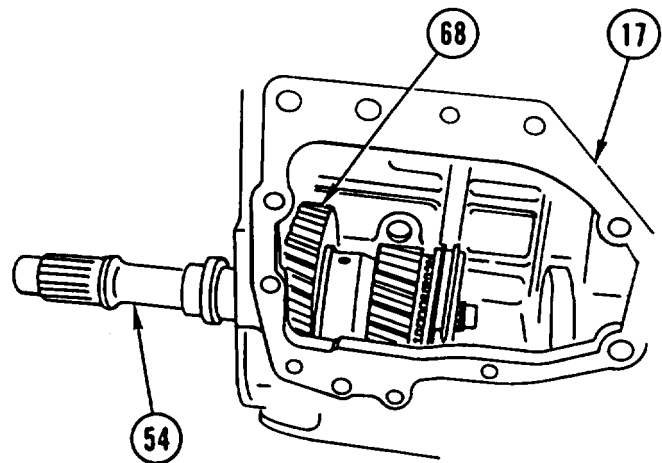
31. INSTALL two bearings (66) and COLLAR (67).



**NOTE**

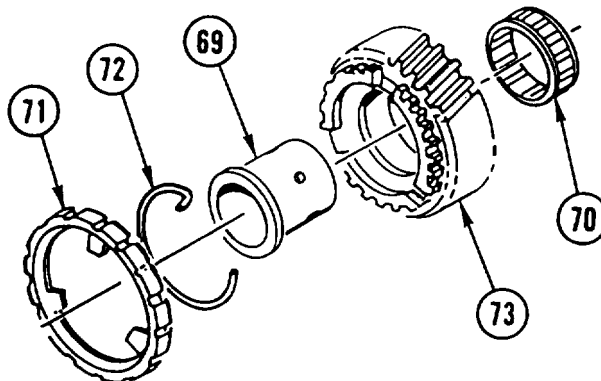
Make sure collar engages in fork.

32. INSTALL GEAR assembly (66) from step 31 in housing (17) and INSTALL primary SHAFT (54) enough to hold gears in place.

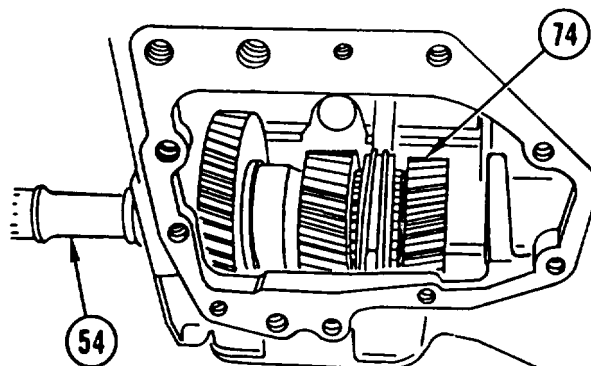


**TRANSMISSION REPAIR (CONT)**

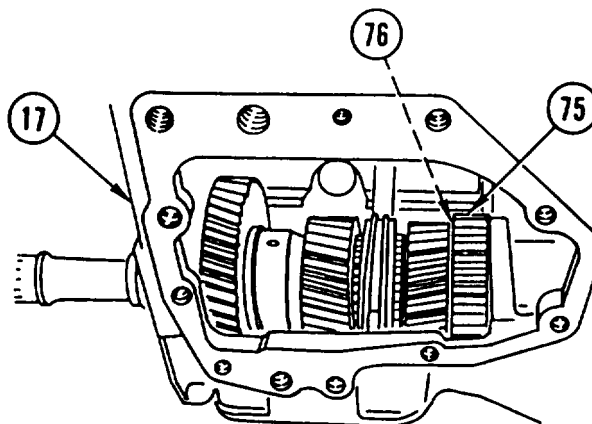
33. INSTALL bearing (69), BEARING (70), synchronizer (71), and flat spring (72) on reverse gear (73).



34. INSTALL GEAR assembly (74) from step 33 on primary shaft (54).



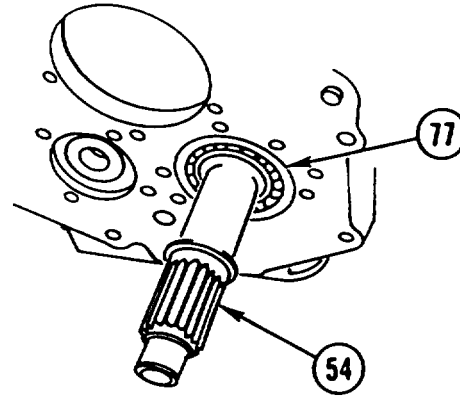
35. INSTALL GEAR (75) with bearing (76) toward front of housing (17).



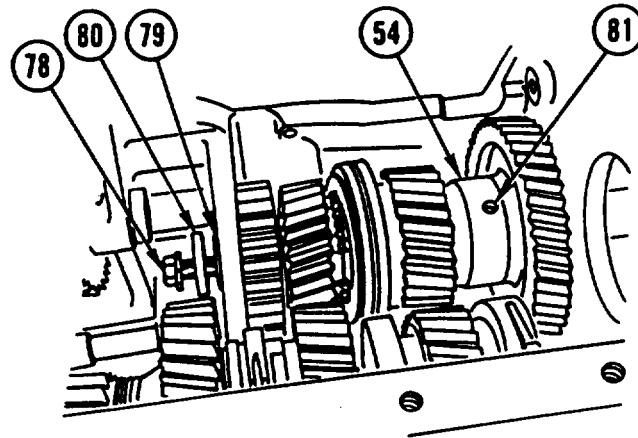


## TRANSMISSION REPAIR (CONT)

36. COMPLETE INSTALLATION of primary shaft (54) and INSTALL BEARING (77).

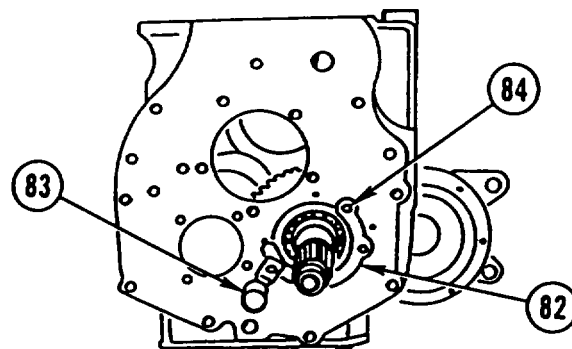


37. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to SCREW (78) and INSTALL thrust bearing WASHER (79), washer (80), and screw (78). TIGHTEN SCREW to 36 lb-ft (49 N•m), and STAKE.



38. INSTALL PIN (81) flush with primary shaft (54).

39. INSTALL cap (82), metallic HOSE (83), and four screws (84). TIGHTEN SCREWS to 18 lb-ft (25 N•m).

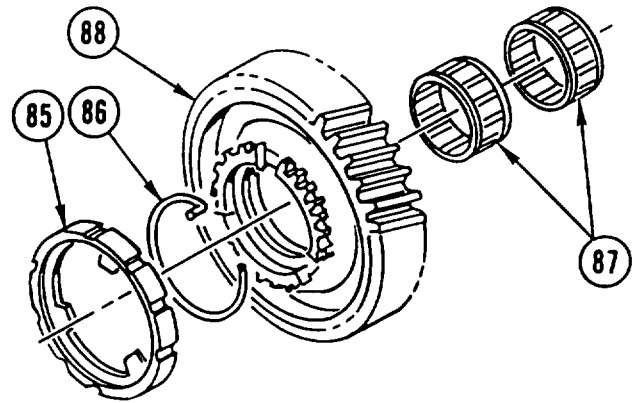


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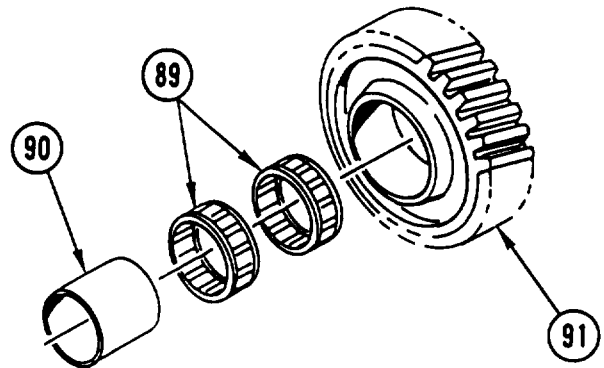
**TRANSMISSION REPAIR (CONT)**

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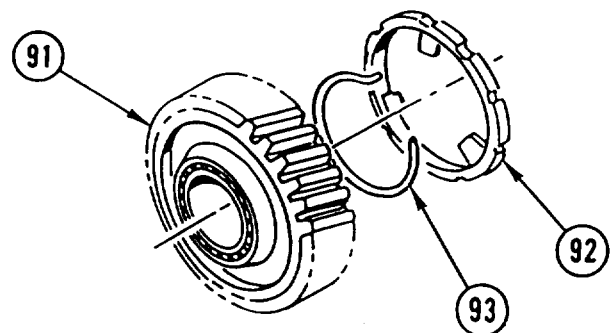
40. INSTALL synchronizer (85), flat spring (86), and two BEARINGS (87) on first gear (88).



41. INSTALL two ROLLERS (89) and sleeve bushing (90) in second gear (91).



42. INSTALL SYNCHRONIZER (92) and flat spring (93) on second gear (91).

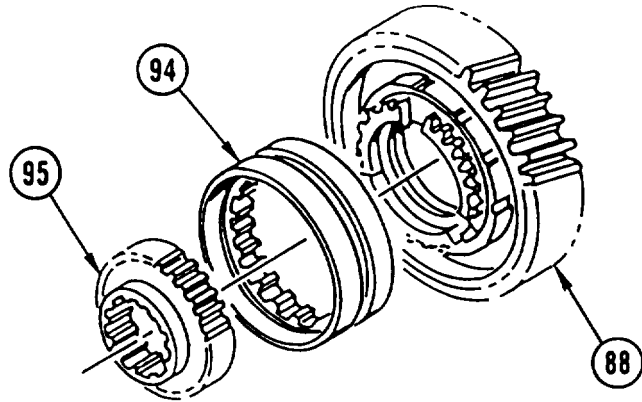


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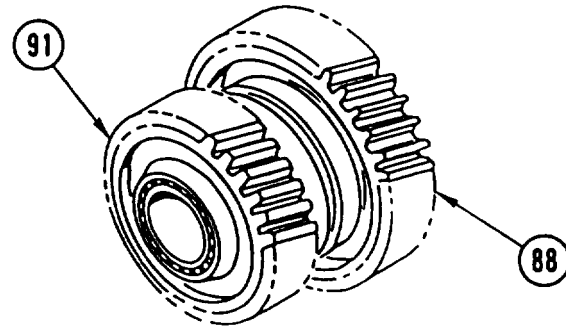
**TRANSMISSION REPAIR (CONT)**

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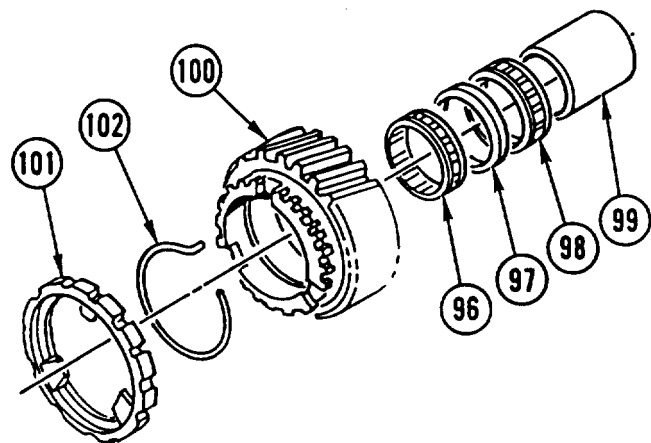
43. INSTALL collar (94) and GEAR (95) on first gear (88).



44. INSTALL first GEAR (88) on second gear (91).

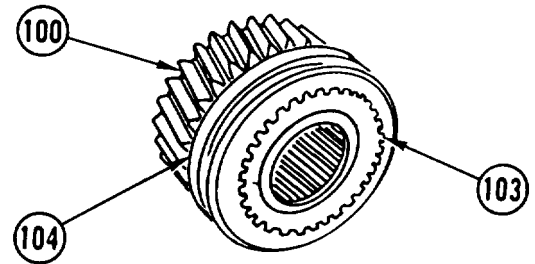


45. INSTALL roller (96), spacer (97), roller (98), and BUSHING (99) in third gear (100).
46. INSTALL SYNCHRONIZER (101) and flat spring (102) on third gear (100).

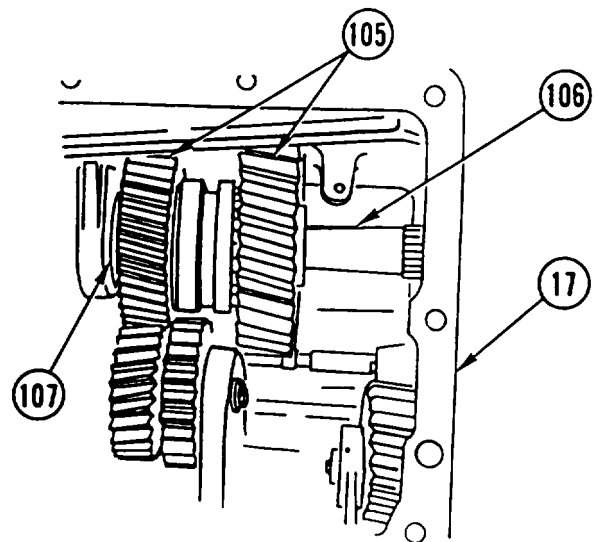


## TRANSMISSION REPAIR (CONT)

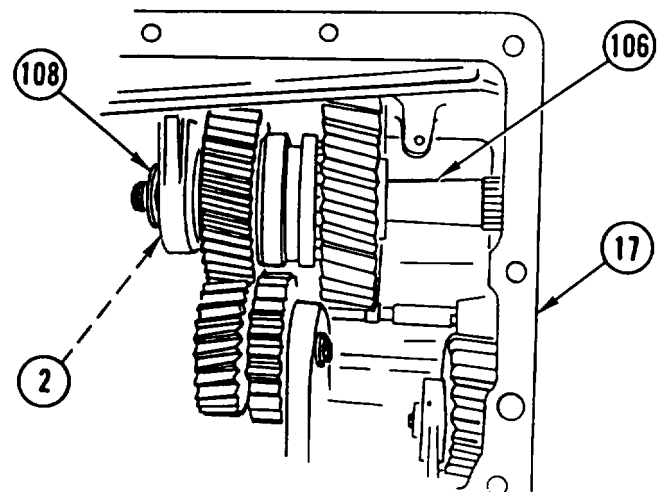
47. INSTALL gear (103) and spur GEAR (104) on third gear (100).



48. INSTALL first and second gears CLUSTER (105), and INSTALL COUNTERSHAFT (106) enough to hold gears in place.
49. INSTALL thrust bearing WASHER (107) with flange toward rear of housing (17).



50. PUSH COUNTERSHAFT (106) through bearing (2) in housing (17) and INSTALL thrust bearing WASHER (108) with flange toward front of housing (17).

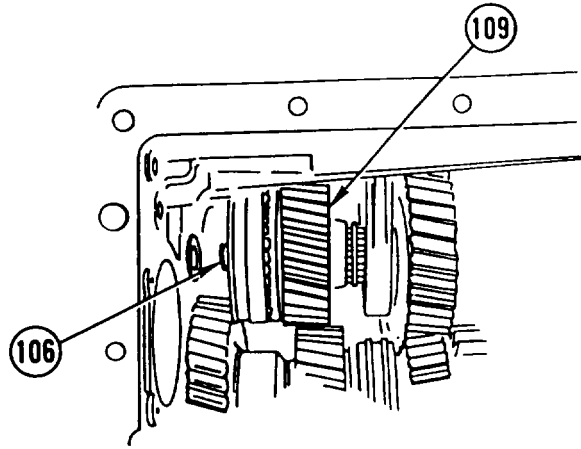


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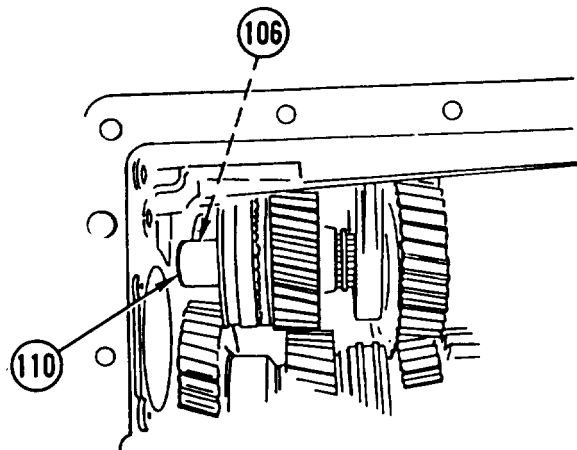
**TRANSMISSION REPAIR (CONT)**

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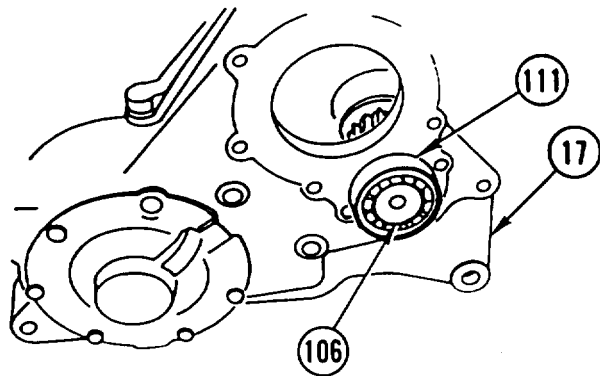
51. INSTALL third gear CLUSTER (109) on countershaft (106).



52. INSTALL tube SPACER (110) on countershaft (106) and PUSH COUNTERSHAFT all the way through.



53. INSTALL BEARING (111) on countershaft (106) at rear of housing (17).

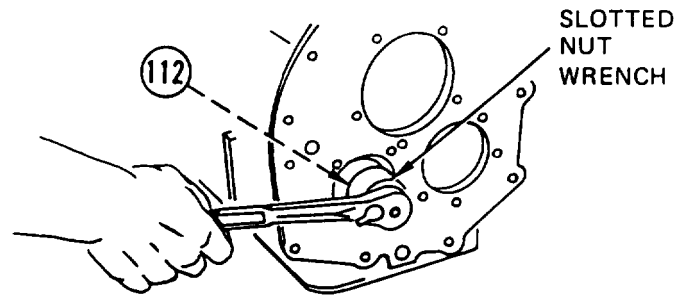


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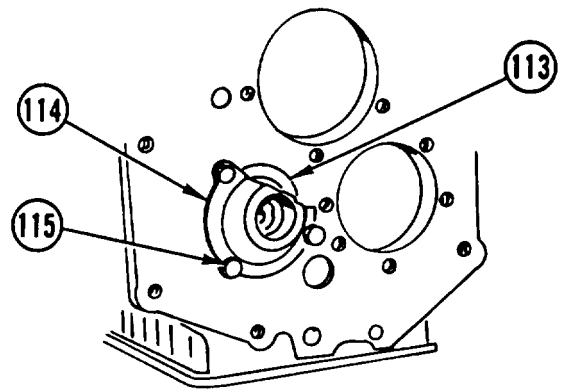
**TRANSMISSION REPAIR (CONT)**


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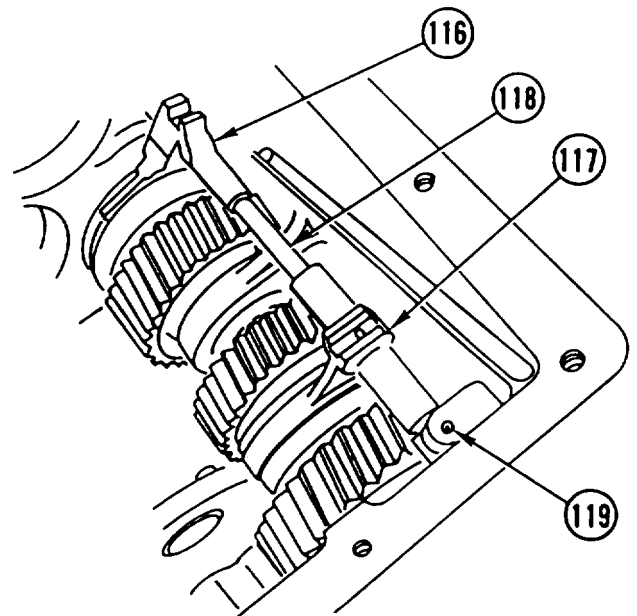
54. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to slotted NUT (112). USING SLOTTED NUT WRENCH, INSTALL slotted NUT (112), TIGHTEN to 125 lb-ft (170 N•m), and STAKE.



55. INSTALL spacer washer (113), FLANGE (114), and three screws (115). TIGHTEN SCREWS to 18 lb-ft (25 N•m).



56. INSTALL two forks (116 and 117), ROD (118), and pin (119).

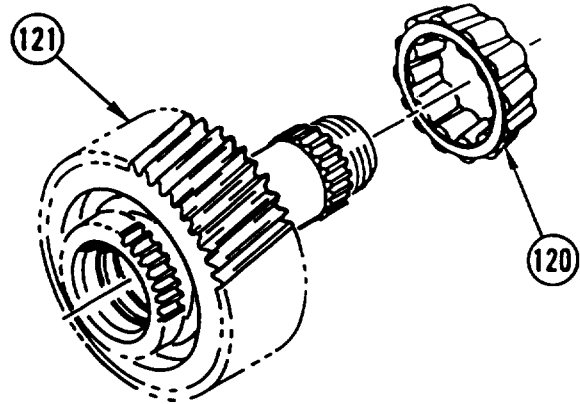


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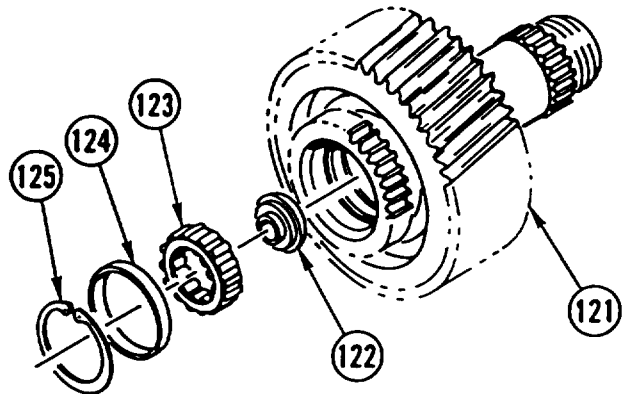
## TRANSMISSION REPAIR (CONT)

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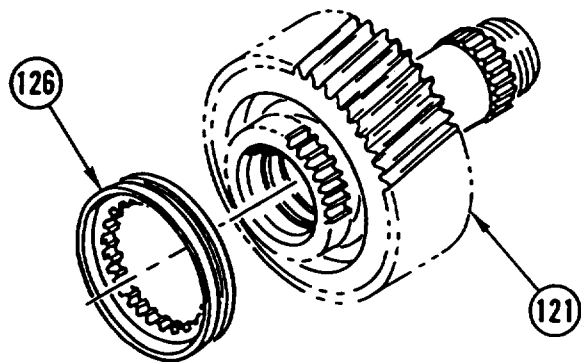
57. INSTALL BEARING (120) on output shaft (121).



58. INSTALL shoulder washer (122), two-piece BEARING (123), spacer (124), and new spring tension washer (125) in output shaft (121).

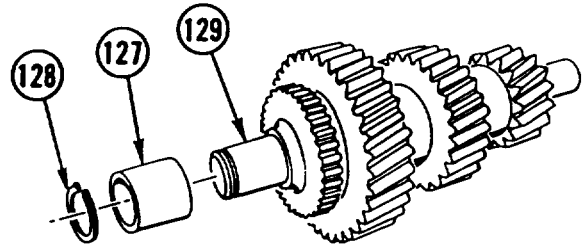


59. INSTALL fourth gear COLLAR (126) on output shaft (121) gear.

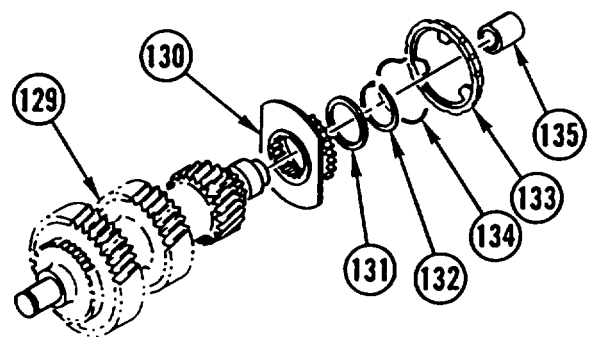


## TRANSMISSION REPAIR (CONT)

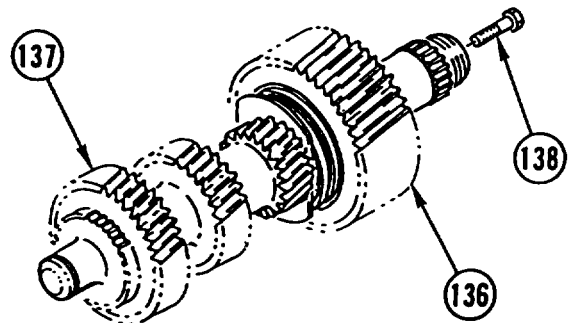
60. INSTALL bearing RING (127) and retaining ring (128) on main gear shaft (129).



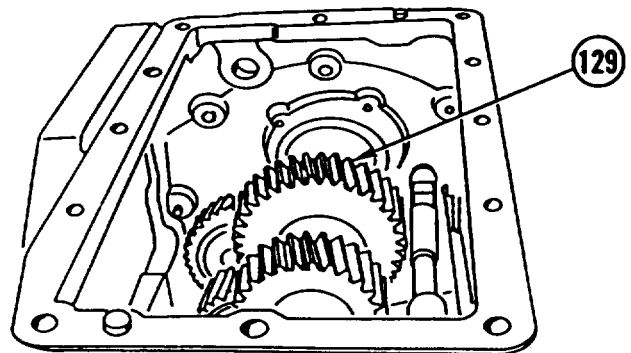
61. INSTALL GEAR (130), washer (131), and retaining ring (132) on main gear shaft (129).
62. INSTALL SYNCHRONIZER (133) and flat spring (134).
63. INSTALL bearing RACE (135) on main gear shaft (129).



64. INSTALL GEAR assembly (136) from step 59 on gear assembly (137) from step 63.
65. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to SCREW (138). INSTALL SCREW (138) and TIGHTEN to 36 lb-ft (49 N.m).



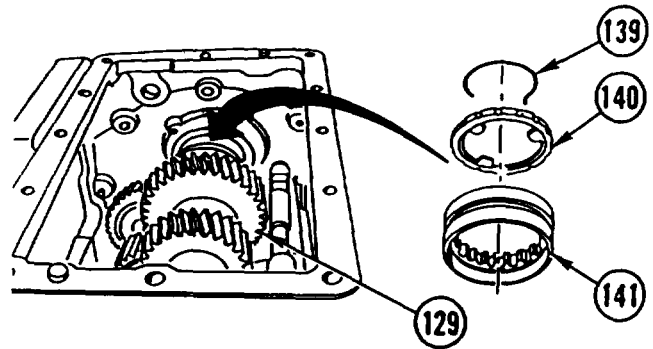
66. INSTALL main gear SHAFT assembly (129) from step 65.



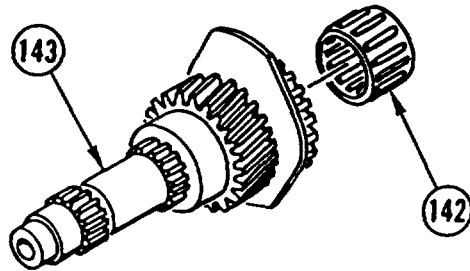


**TRANSMISSION REPAIR (CONT)**

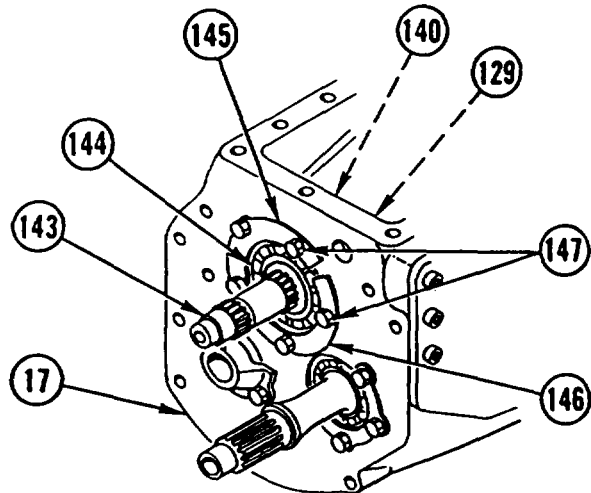
67. INSTALL flat spring (139), synchronizer (140), and GEAR (141) on main gear shaft assembly (129).



68. INSTALL RETAINER and ROLLER (142) on rear input shaft (143).

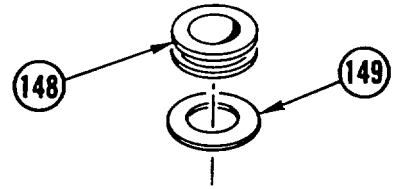


69. INSTALL rear input SHAFT (143) on main gear shaft assembly (129) in housing (17). Make sure SYNCHRONIZER (140) MESHES with rear input shaft (143).
70. INSTALL BEARING (144) in housing (17) with outside groove toward front of transmission.
71. INSTALL two retaining RINGS (145 and 146) and five screws (147). TIGHTEN SCREWS to 18 lb-ft (25 N.m).

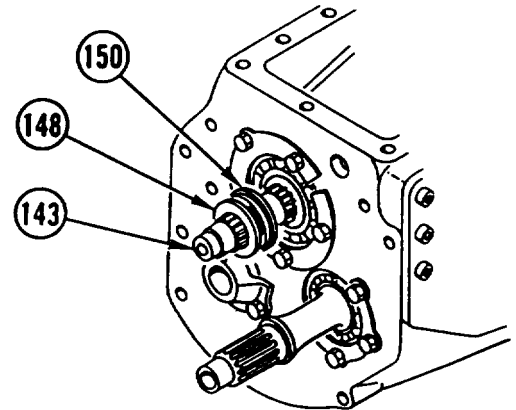


**TRANSMISSION REPAIR (CONT)**

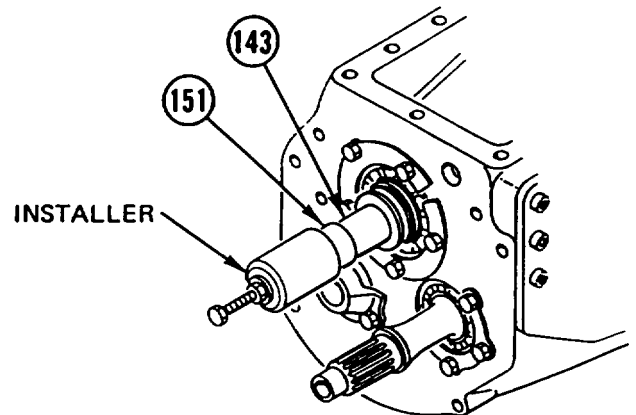
72. INSTALL thrust bearing WASHER (148) on spacer (149).



73. INSTALL SPACER assembly (150) from step 72 on rear input shaft (143) with thrust bearing washer (148) toward front of transmission.



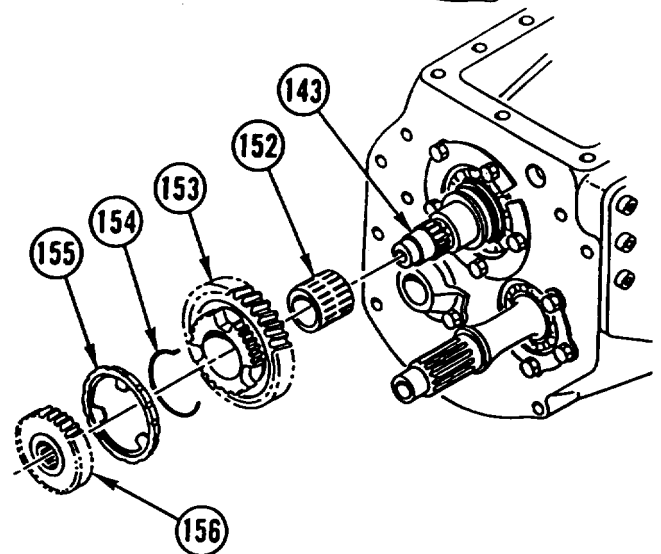
74. USING INSTALLER, INSTALL BEARING (151) on rear input shaft (143).



**NOTE**

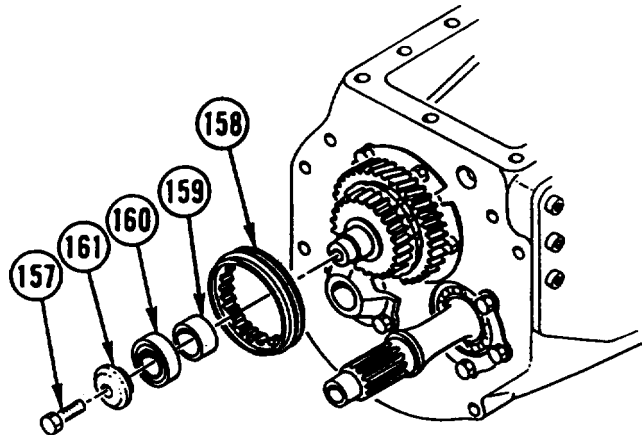
Tapered end of gear teeth must be facing forward end of transmission.

75. INSTALL bearing (152), GEAR (153), flat spring (154), synchronizer (155), and gear (156) on rear input shaft (143).

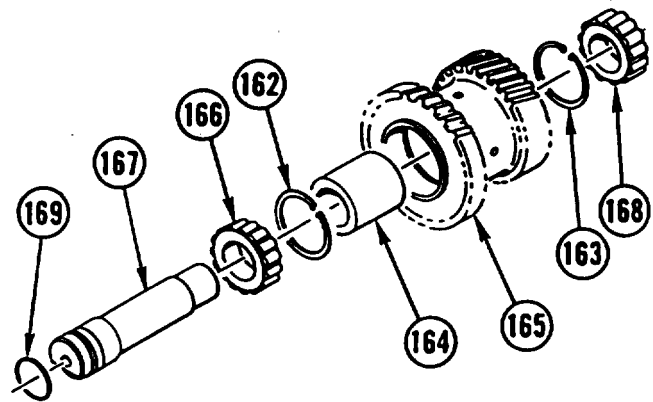


**TRANSMISSION REPAIR (CONT)**

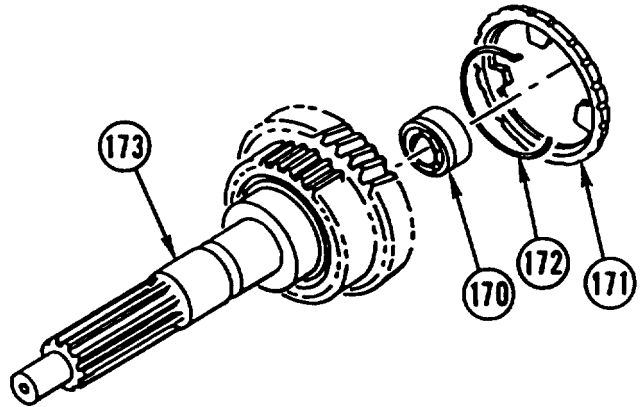
76. APPLY COAT of SEALING COMPOUND (Appendix B, Item 14) to THREADS of screw (157) and INSTALL COLLAR (158), spacer (159), bearing (160), washer (161), and screw (157). TIGHTEN SCREW to 51 lb-ft (70 N•m).



77. INSTALL two piston rings (162 and 163) and SPACER (164) in intermediate gear (165).
78. USING suitable PRESS, INSTALL BEARING (166) on shaft (167).
79. INSTALL SHAFT (167) in intermediate gear (165).
80. INSTALL BEARING (168) and new packing (169) on shaft (167).

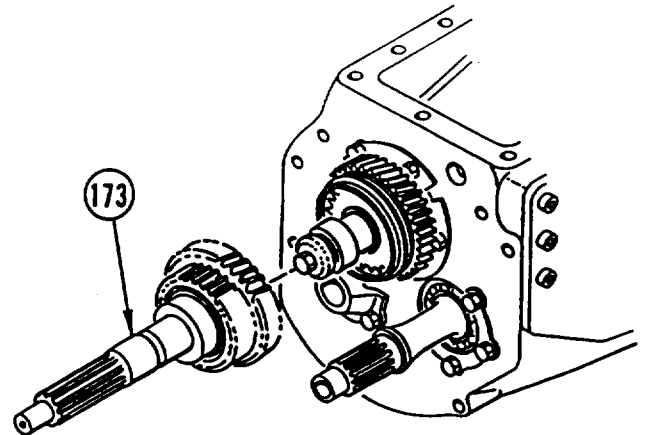


81. INSTALL BEARING (170), synchronizer (171), and flat spring (172) in front input shaft (173).



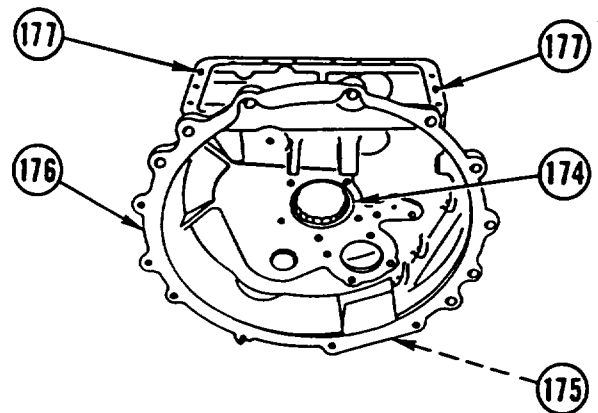
## TRANSMISSION REPAIR (CONT)

82. INSTALL front input SHAFT (173).



83. INSTALL bearing (174) and PLUG (175) in cascade box housing (176).

84. IF REMOVED, INSTALL two new PINS (177).

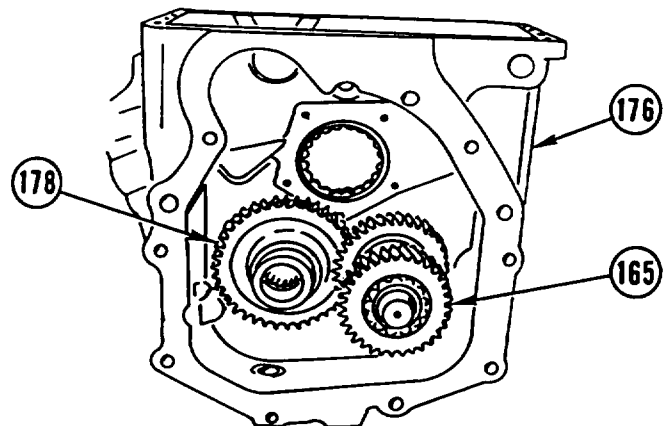


85. INSTALL PTO GEAR (178) in cascade box housing (176).

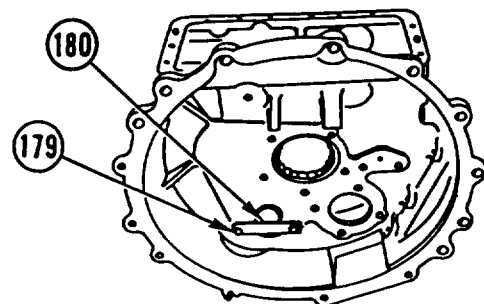
**NOTE**

Make sure notch on intermediate gear shaft is facing toward bottom of cascade box housing.

86. INSTALL intermediate GEAR (165) in cascade box housing (176).



87. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to two SCREWS (179) and INSTALL LOCK (180) and two screws (179). TIGHTEN SCREWS to 18 lb-ft (25 N•m).

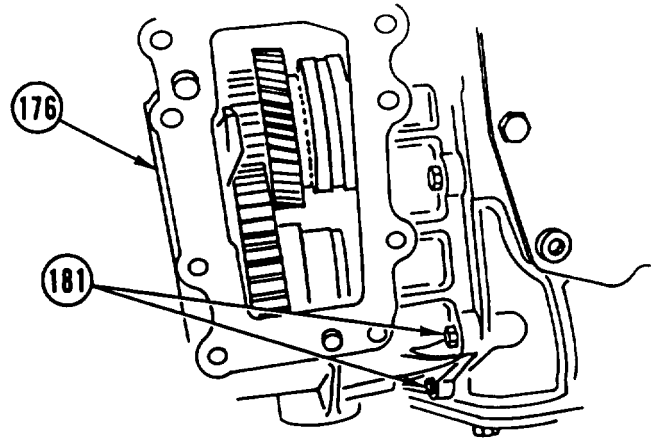


**TRANSMISSION REPAIR (CONT)**

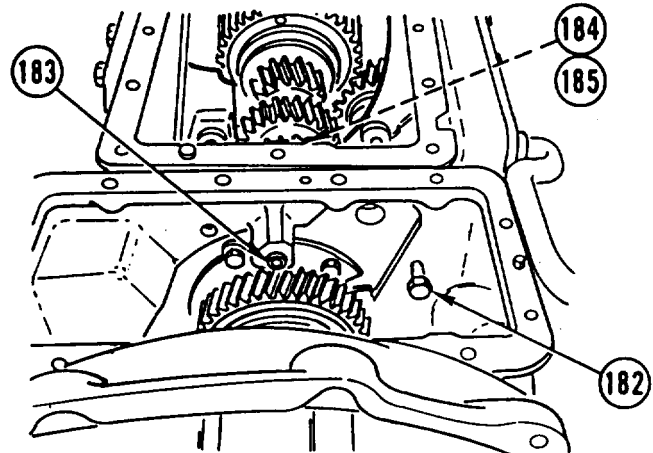
**WARNING**

Cascade box housing weighs 78 pounds (36 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting cascade box housing.

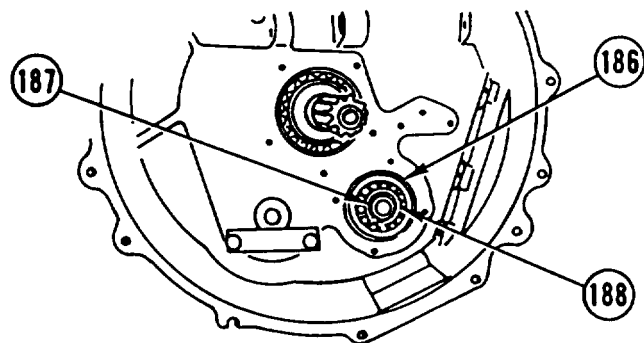
- 88. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to cascade box housing (176) FLANGE and seven SCREWS (181) and INSTALL cascade box HOUSING (176) and seven screws (181). TIGHTEN SCREWS to 36 lb-ft (49 N•m)



- 89. INSTALL SCREW 18 lb-ft (49 N•m).
- 90. INSTALL SCREW (183), washer (184), and nut (185). TIGHTEN SCREW to 18 lb-ft (25 N•m).



- 91. INSTALL BEARING (186) until center of bearing contacts shaft shoulder with outside groove toward front of transmission.
- 92. INSTALL retaining RING (187).
- 93. USING feeler GAGE, MEASURE DISTANCE between retaining ring (187) and bearing (186).
- 94. TO DETERMINE spacer THICKNESS, SUBTRACT 0.004 in. (0.1 mm) from measurement obtained in STEP 93.
- 95. REMOVE retaining RING (187) and INSTALL SPACER(S) (188).
- 96. REINSTALL retaining RING (187).

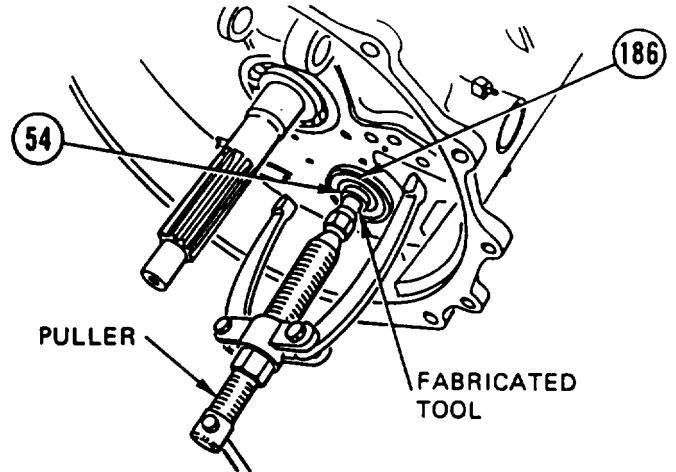


## TRANSMISSION REPAIR (CONT)

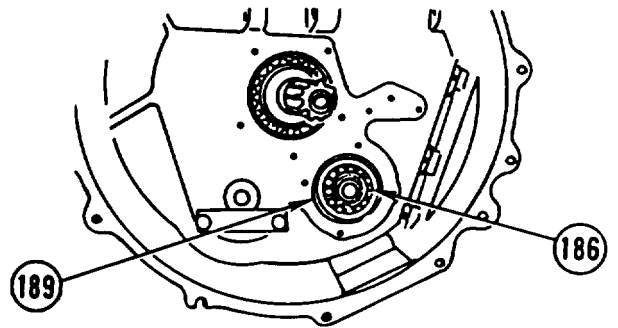
### NOTE

Perform step 97 only if outer retaining ring groove of bearing is not exposed enough to allow installation of outer retaining ring.

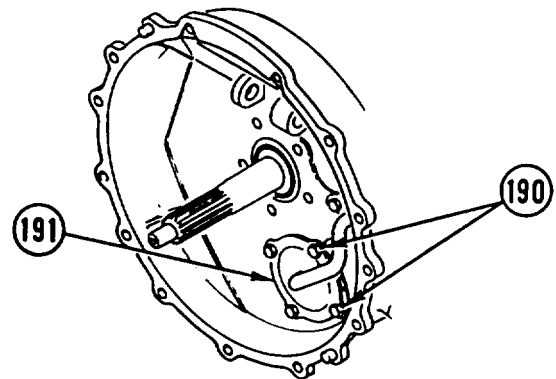
97. USING PULLER and FABRICATED TOOL (Appendix C, Item 2), PULL primary SHAFT (54) only enough to expose outer retaining ring groove on bearing (186).



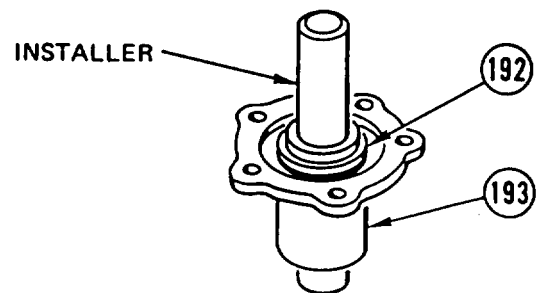
98. INSTALL retaining RING (189) on bearing (186).



99. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to THREADS of six screws (190) and bearing COVER (191). INSTALL bearing COVER (191) and six screws (190). TIGHTEN SCREWS to 18 lb-ft (25 N•m).



100. USING INSTALLER, INSTALL new SEAL (192) in insert (193).



**TRANSMISSION REPAIR (CONT)**

**NOTE**

Make sure bearing is seated prior to taking measurement.

101. MEASURE PROJECTION of BEARING (174).

102. MEASURE DEPTH of bearing SEAT in insert (193) to determine spacer thickness to obtain AXIAL play of 0.01-0.02 in. (0.5-0.6 mm).

103. SUBTRACT measurement obtained in STEP 101 from measurement obtained in STEP 102.

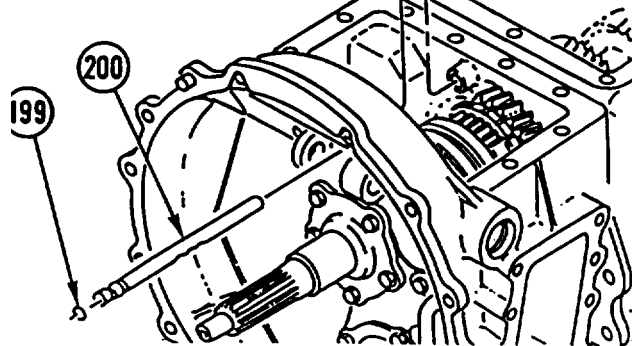
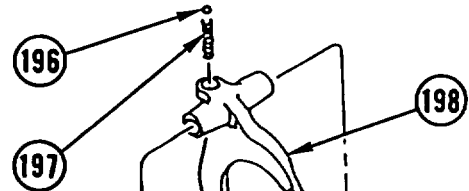
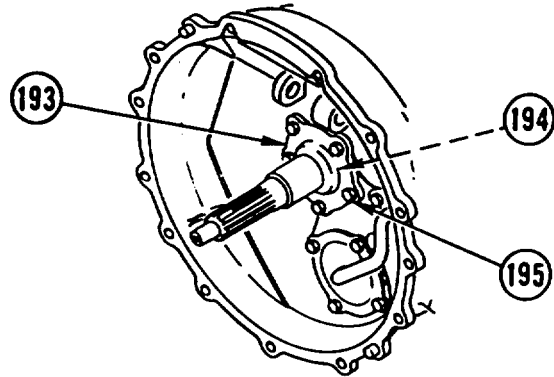
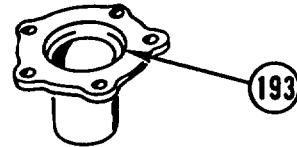
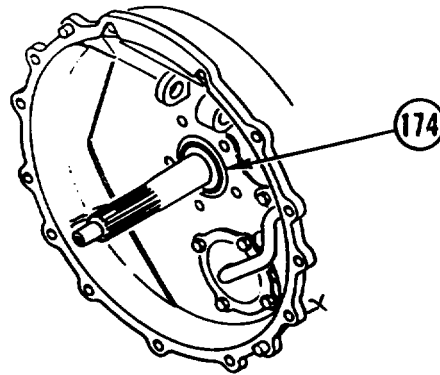
104. SUBTRACT 0.022 in. (0.55 mm) from result obtained in STEP 103 to determine spacer thickness.

105. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to INSERT (193) and INSTALL INSERT (193), spacer(s) (194), and five screws (195). TIGHTEN SCREWS to 18 lb-ft (25 N•m).

106. INSTALL BALL (196) and spring (197) in shifter fork (198).

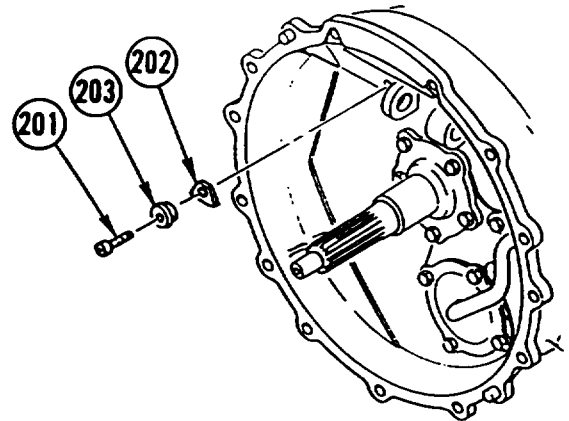
107. INSTALL new PACKING (199) on rod (200).

108. INSTALL shifter FORK (198) and rod (200) while pressing ball (196) downward.

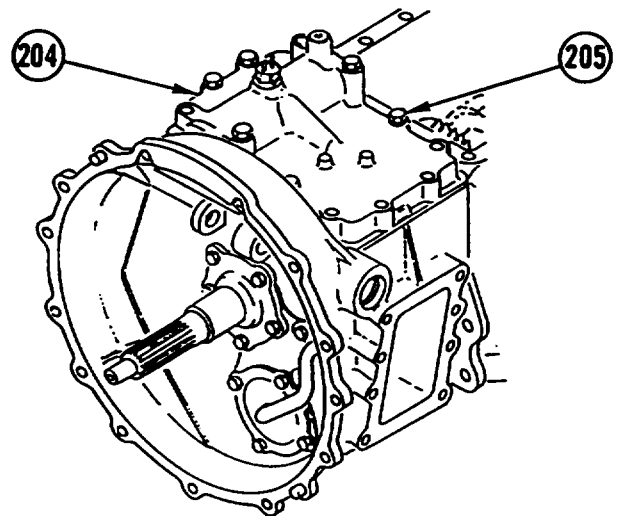


## TRANSMISSION REPAIR (CONT)

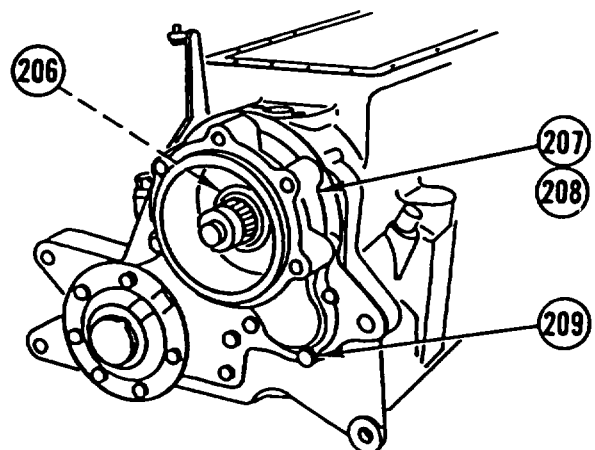
109. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to THREADS of screw (201) and INSTALL lock (202), LOCK (203), and screw (201).



110. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to access COVER (204) and COAT of SEALING COMPOUND (Appendix B, Item 14) to THREADS of six screws (205). INSTALL access COVER (204) and six screws (205). TIGHTEN SCREWS to 18 lb-ft (25 N•m).



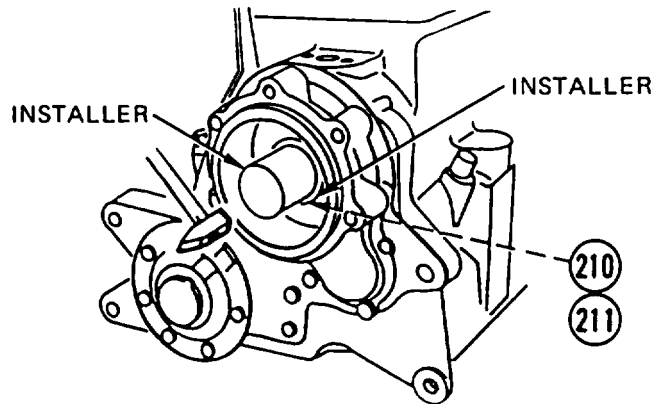
111. INSTALL new crushable sleeve (206), new gasket (207), HOUSING (208), and three screws (209). TIGHTEN SCREWS evenly to 36 lb-ft (49 N•m).



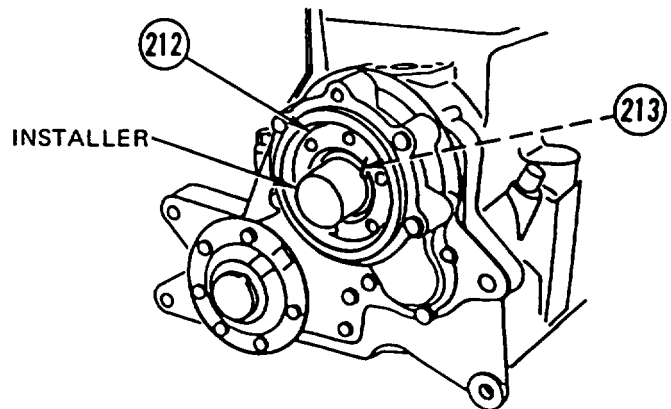


## TRANSMISSION REPAIR (CONT)

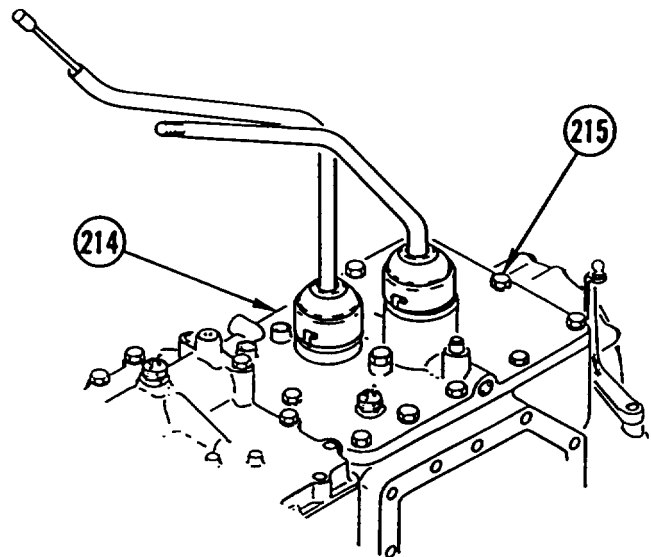
- 112. USING INSTALLER, INSTALL BEARING (210).
- 113. APPLY COAT of GAA to new SEAL (211). USING INSTALLERS, INSTALL SEAL (211).



- 114. USING INSTALLER, INSTALL FLANGE (212).
- 115. INSTALL slotted NUT (213) and HAND-TIGHTEN.



- 116. SET both shift LEVERS in cover assembly (214) in neutral position.
- 117. APPLY COAT of SEALING COMPOUND (Appendix B, Item 16) to COVER assembly (214) and THREADS of 12 screws (215). INSTALL COVER assembly (214) and 12 screws (215). TIGHTEN SCREWS to 18 lb-ft (25 N•m).

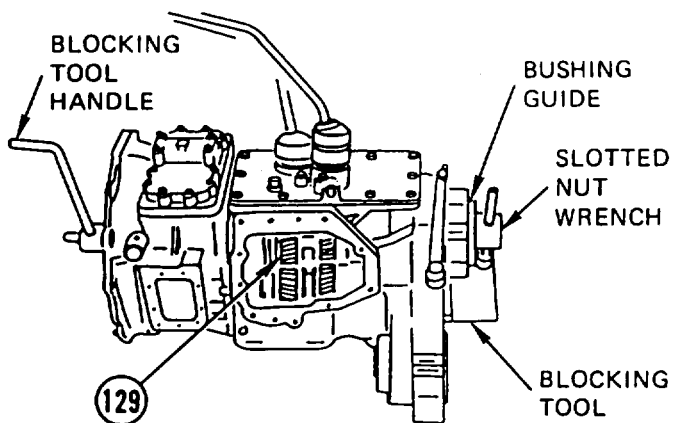


**TRANSMISSION REPAIR (CONT)**

**NOTE**

Install slotted nut wrench with notch in position to be easily visible.

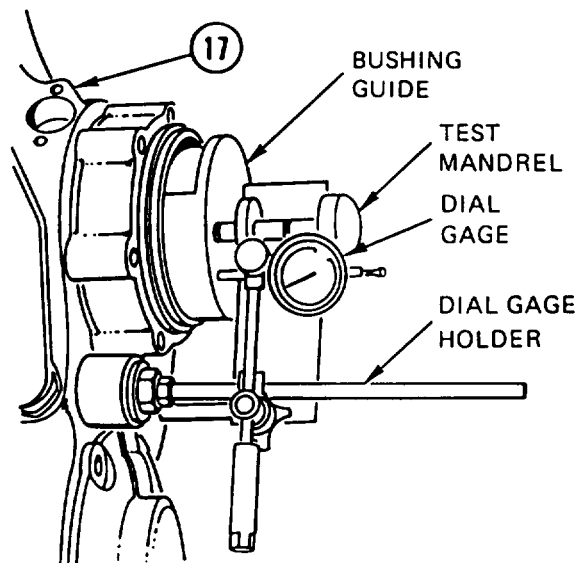
- 118. INSTALL BUSHING GUIDE, BLOCKING TOOL, SLOTTED NUT WRENCH and BLOCKING TOOL HANDLE.
- 119. ENGAGE first GEAR and TURN main gear SHAFT assembly (129) in CLOCKWISE direction until resistance is felt.
- 120. REMOVE SLOTTED NUT WRENCH.



**NOTE**

Dial gage plunger must be against bushing guide flange.

- 121. INSTALL DIAL GAGE, DIAL GAGE HOLDER, and test MANDREL on housing (17).
- 122. PUSH TEST MANDREL FORWARD and ZERO DIAL GAGE.
- 123. PULL TEST MANDREL BACK and NOTE READING of end play measurement.
- 124. REMOVE TEST MANDREL and DIAL GAGE.

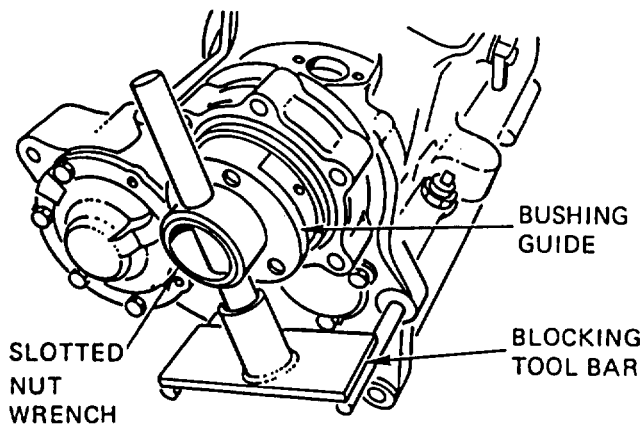


- 125. INSTALL SLOTTED NUT WRENCH and BLOCKING TOOL BAR.

**NOTE**

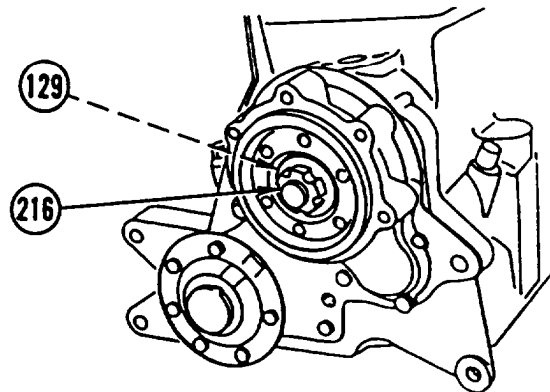
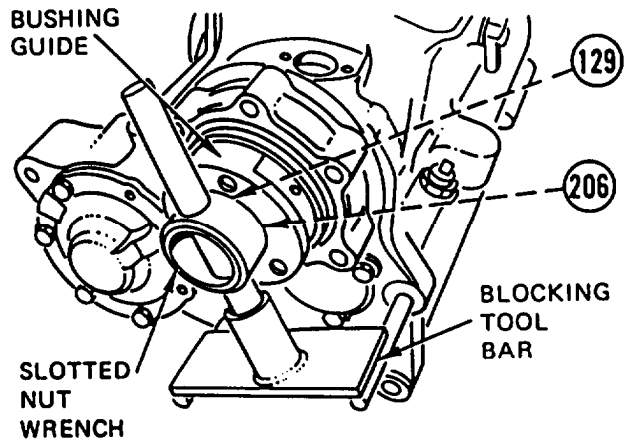
One division on scale of dial gage is equal to one division on scale of bushing guide, which is 0.0004 in. (0.01 mm).

- 126. MARK INCREMENT on BUSHING GUIDE that is in line with notch on SLOTTED NUT WRENCH.
- 127. DIVIDE READING obtained in STEP 123 by Two.

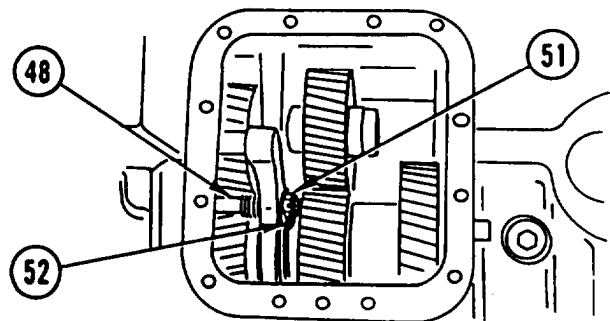


**TRANSMISSION REPAIR (CONT)**

- 128. FROM notch in SLOTTED NUT WRENCH, COUNT to RIGHT number of increments on BUSHING GUIDE, as determined in STEP 127, and MARK BUSHING GUIDE.
- 129. ENGAGE first GEAR and TURN main gear SHAFT assembly (129) to RIGHT until notch on SLOTTED NUT WRENCH aligns with mark determined in STEP 128.
- 130. REPEAT STEPS 120 thru 125.
- 131. ADD 0.0008 in. (0.02 mm) to reading from STEP 123. This equals number of increments to be counted on BUSHING GUIDE.
- 132. FROM MARK made in STEP 126, COUNT to RIGHT number of increments on BUSHING GUIDE, as determined in STEP 131, and MARK BUSHING GUIDE.
- 133. ENGAGE first GEAR and TURN main gear SHAFT assembly (129) to RIGHT until increment marked in STEP 132 is at notch on BUSHING GUIDE. If main gear shaft is turned too far, REPLACE crushable SLEEVE (206) and REPEAT STEPS 119 thru 132.
- 134. INSTALL PLUG (21 6) in rear of main gear shaft assembly (129).



- 135. REMOVE cotter PIN (52) and POSITION shift controls to neutral. DISCARD cotter PIN.
- 136. SELECT forward and reverse GEARS and MEASURE GAPS A and B with feeler GAGE.



## TRANSMISSION REPAIR (CONT)

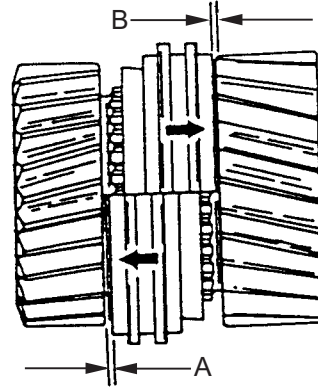
### NOTE

Gaps for forward and reverse must be identical.

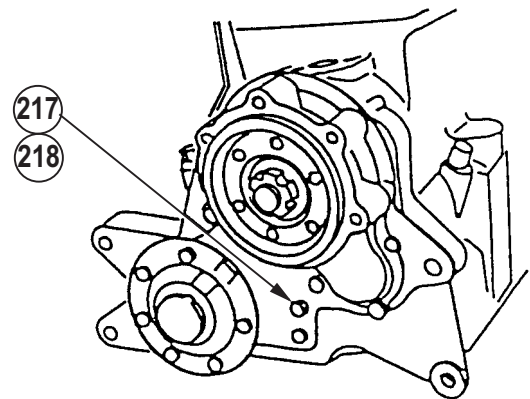
137. IF forward and reverse GAPS are NOT equal, TURN ROD (48) while HOLDING NUT (51).

138. REPEAT STEPS 136 and 137 until equal measurement is obtained.

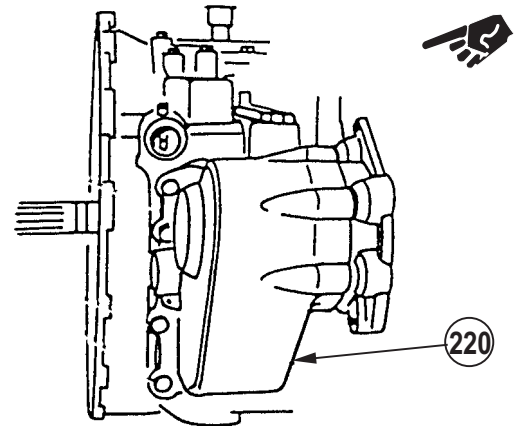
139. INSTALL new cotter PIN (52).



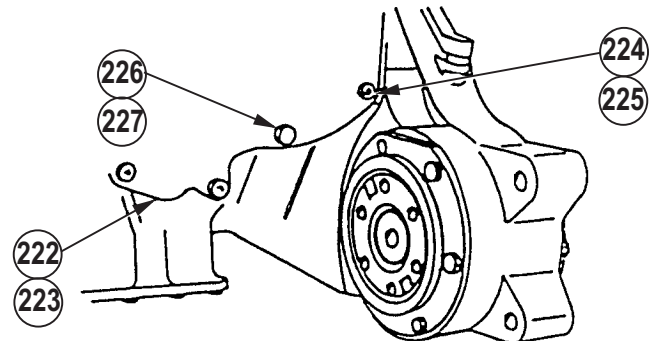
140. INSTALL PLUG (217) and new seal ring (218).



141. INSTALL POWER TAKE-OFF (PTO) (220) (page 3-79).

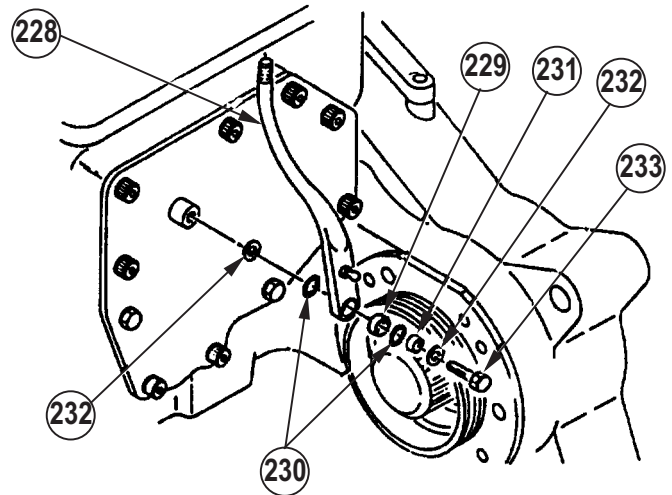


142. INSTALL new gasket (222), COVER (223), eight screws (224), eight washers (225), two capscrews (226), and two washers (227).



## TRANSMISSION REPAIR (CONT)

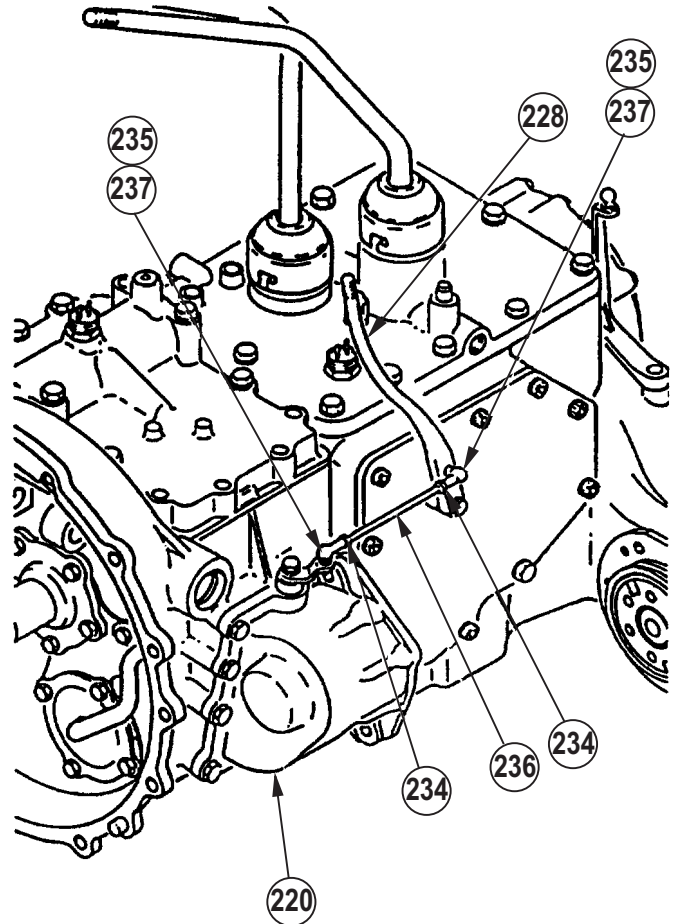
143. INSTALL LEVER (228), bushing (229), two new packings (230), sleeve bearing (231), two washers (232), and screw (233).



144. INSTALL two nuts (234) and two SOCKETS (235) on lever (236).

145. RETATE two SOCKETS (235) until overall length of 8.46 in. (215 mm) is attained. TIGHTEN two NUTS (234) against two sockets (235).

146. CONNECT LEVER (236) to lever (228) and POWER TAKE-OFF (PTO) (220) and INSTALL two CLIPS (237).



## TRANSMISSION REPAIR (CONT)

147. INSTALL front-wheel drive PLUNGER (238), two washers (239), and retaining ring (240).

**NOTE**

Transmission must be in low-range first gear with front-wheel drive lever engaged.

148. USING SLOTTED NUT WRENCH, BLOCKING TOOL HANDLE and BAR, and BUSHING GUIDE, TIGHTEN and STAKE NUT (241).

149. INSTALL SOCKET (242) of front-wheel drive plunger (238) and clip (243) on lever (28).

**NOTE**

Oil ring may have separate retaining plate.

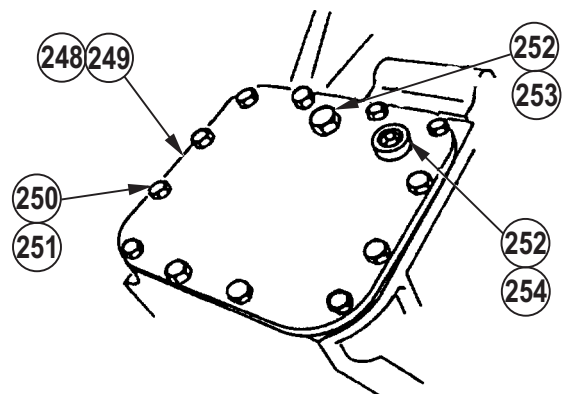
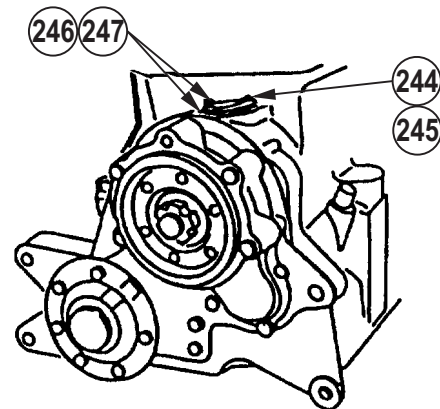
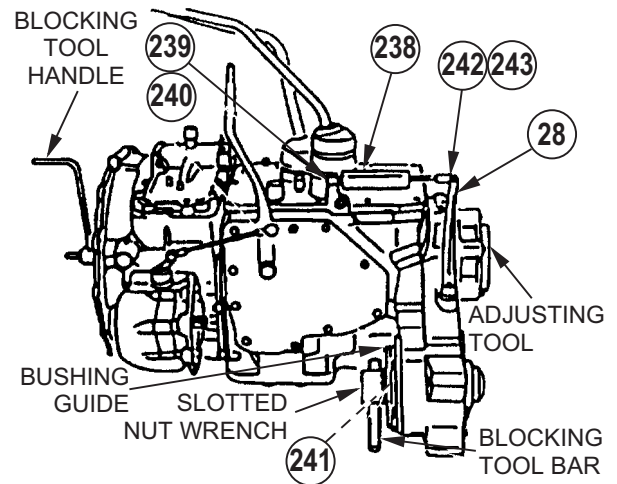
150. INSTALL new gasket (244), oil RING (245), two washers (246), and two bolts (247).

151. INSTALL new gasket (248), COVER (249), 12 washers (250), and 12 screws (251).

152. INSTALL two new seals (252) and two drain PLUGS (253 and 254).

**NOTE**

Follow-on Maintenance:  
 Remove transmission shift controls (page 3-96).  
 Install clutch release lever and shaft (page 3-66).  
 Remove transmission from stand and (page 3-68).



## Section II. TRANSMISSION TOP COVER REPAIR

### TRANSMISSION TOP COVER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shift Tester Plate, P/N 441 589 00 21 00

##### Equipment Condition:

Reference	Condition Description
Page 3-86	Transmission Top Cover Removed

##### Materials/Parts:

Ring, Seal

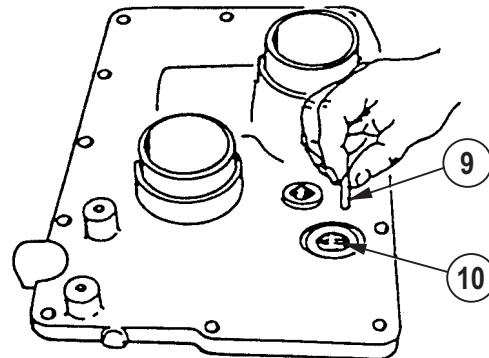
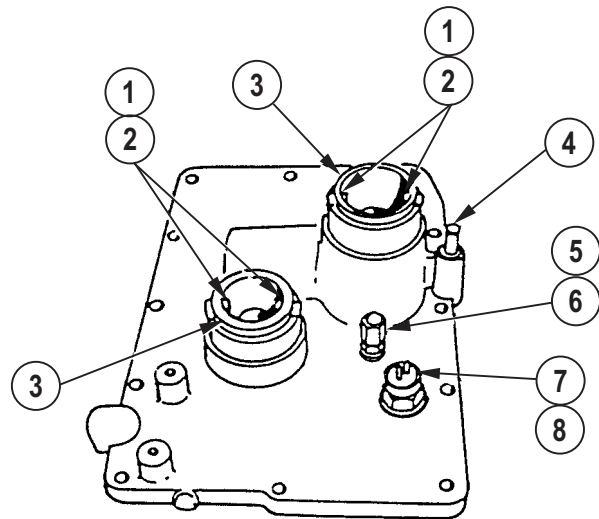
Washer

Compound, Sealing Appendix B, Item 14

Oil, Lubricating Appendix B, Item 30

#### DISASSEMBLY

1. REMOVE four tee head bolts (1), four retaining rings (2), two BUSHINGS (3), and pin (4).
2. REMOVE BREATHER (5), and seal ring (6). DISCARD seal RING.
3. REMOVE pressure SWITCH (7) and washer (8). DISCARD WASHER.
4. REMOVE PIN (9) from pressure switch port (10).
5. TURN ASSEMBLY OVER.

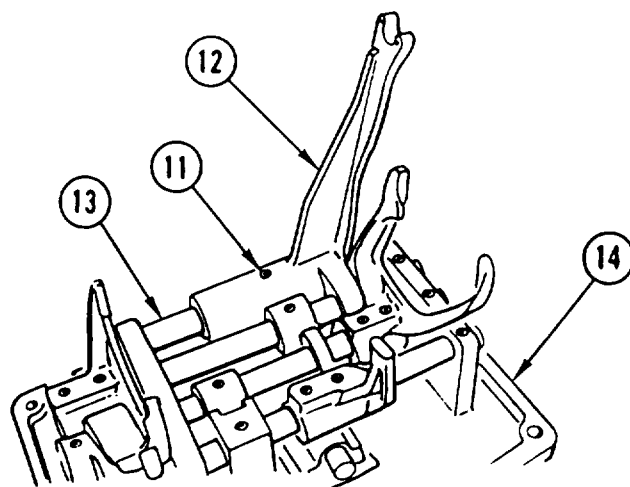


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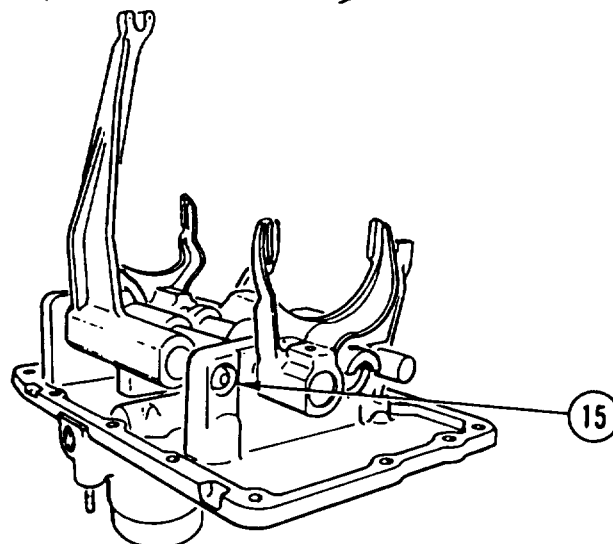
**TRANSMISSION TOP COVER REPAIR (CONT)**

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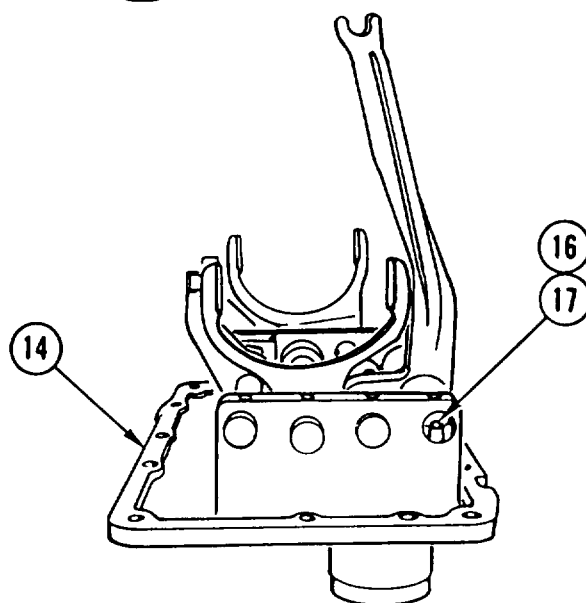
6. REMOVE PIN (11) from shifting frame (12).
7. REMOVE LEVER (13) from cover (14).



8. REMOVE two BALLS (15).



9. REMOVE SPRING (16) and plug (17) from cover (14).



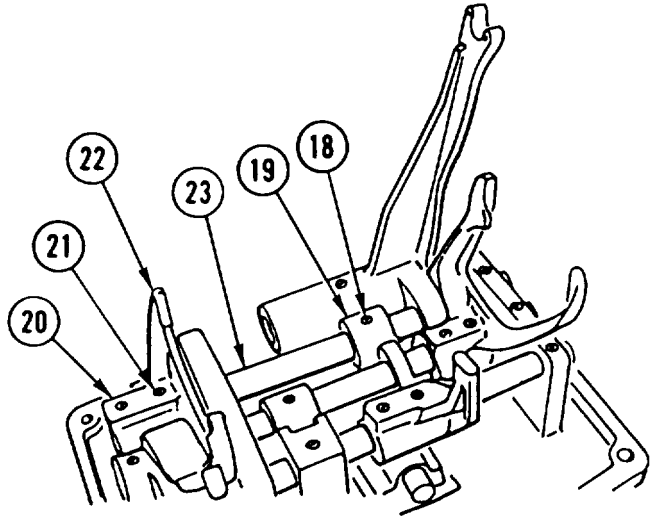


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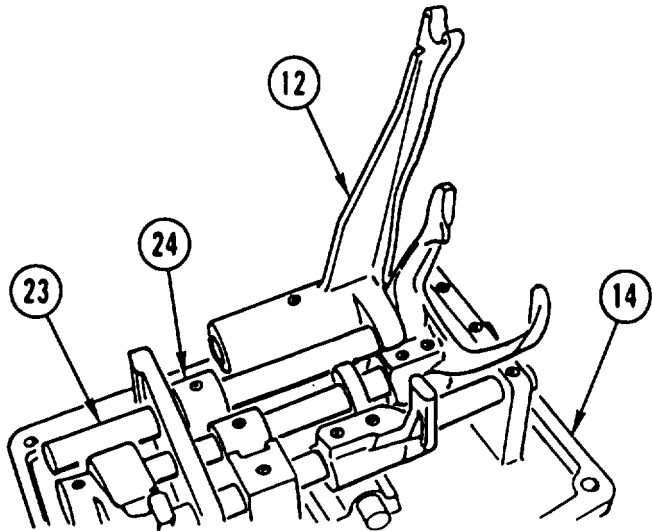
## TRANSMISSION TOP COVER REPAIR (CONT)

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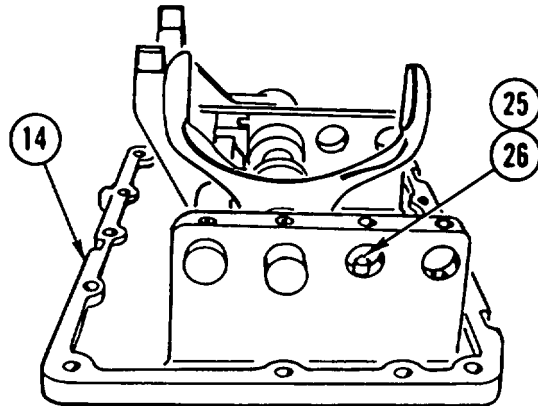
10. REMOVE PIN (18) from follower (19).
11. REMOVE two setscrews (20 and 21) and shift FORK (22) from lever (23).



12. REMOVE LEVER (23), shifting frame (12), and follower (24) from cover (14).

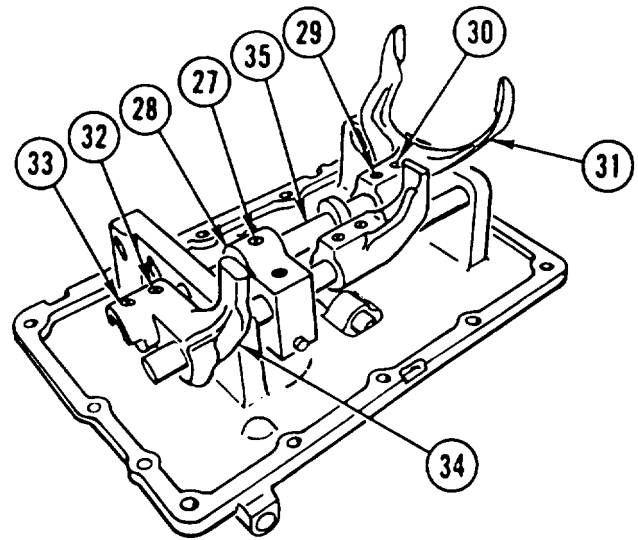


13. REMOVE spring (25) and PLUG (26) from cover (14).

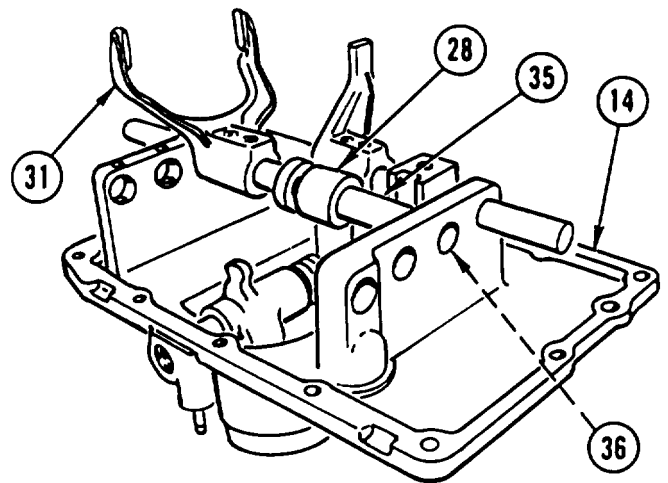


## TRANSMISSION TOP COVER REPAIR (CONT)

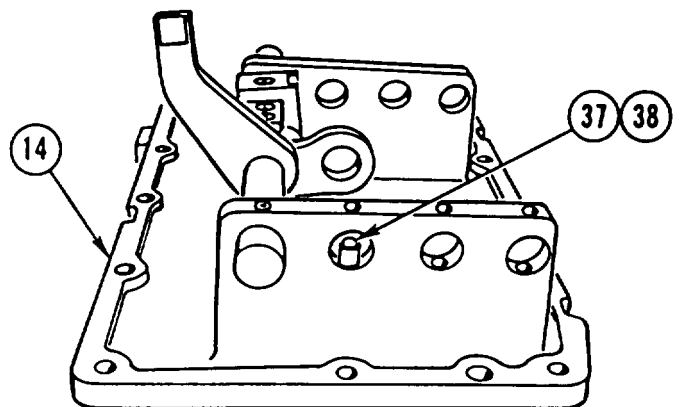
14. REMOVE PIN (27) from follower (28) and REMOVE two SETSCREWS (29 and 30) from shifter fork (31).
15. REMOVE two setscrews (32 and 33) and shifter FORK (34) from lever (35).



16. REMOVE two BALLS (36) from cover (14).
17. REMOVE FOLLOWER (28) from lever (35).
18. REMOVE LEVER (35) and shifter FORK (31) from cover (14).



19. REMOVE spring (37) and PLUG (38) from cover (14).

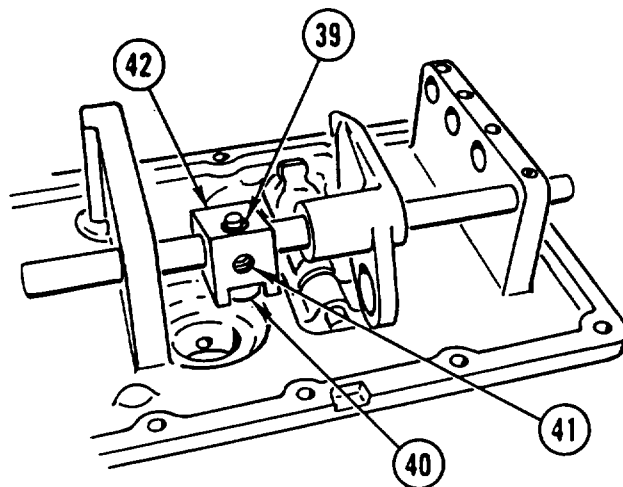


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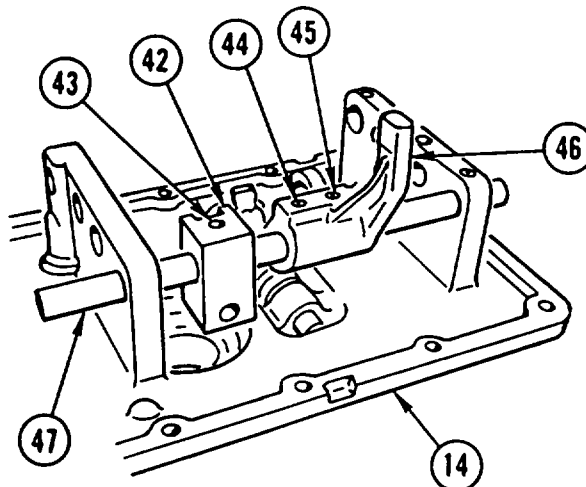
## TRANSMISSION TOP COVER REPAIR (CONT)

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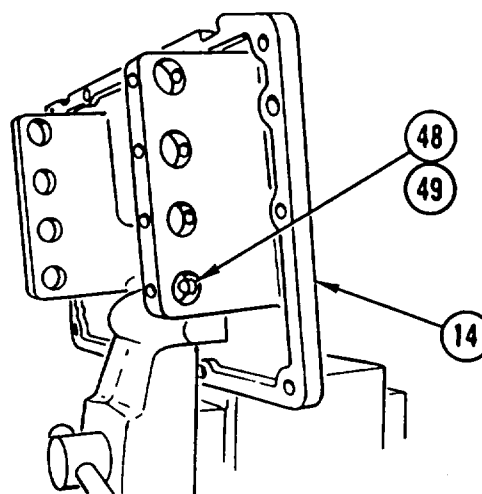
20. REMOVE retaining ring (39), PIN (40), and spring (41) from follower (42).



21. REMOVE PIN (43) from follower (42).
22. REMOVE two SETSCREWS (44 and 45) from shifting tongue (46).
23. REMOVE LEVER (47), follower (42), and shifting tongue (46) from cover (14).

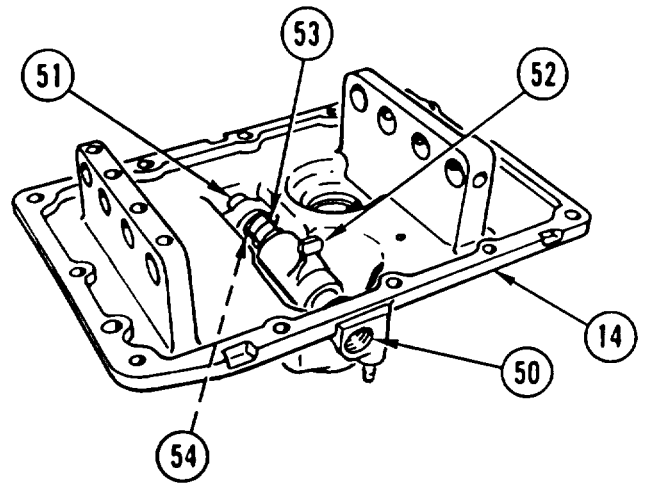


24. REMOVE spring (48) and PLUG (49) from rover (14).

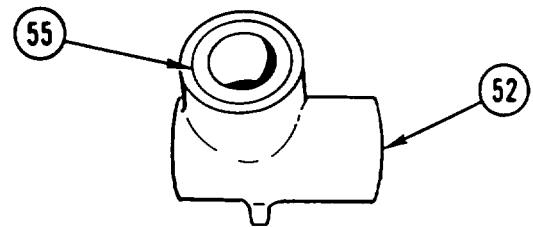


## TRANSMISSION TOP COVER REPAIR (CONT)

25. REMOVE plug (50), pin (51), LEVER (52), spring (53), and washer (54) from cover (14).

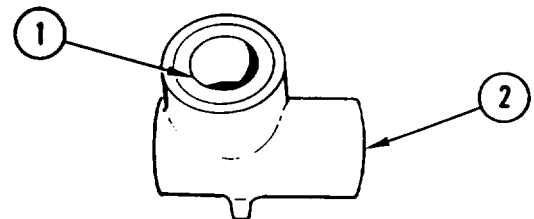


26. REMOVE BUSHING (55) from lever (52).

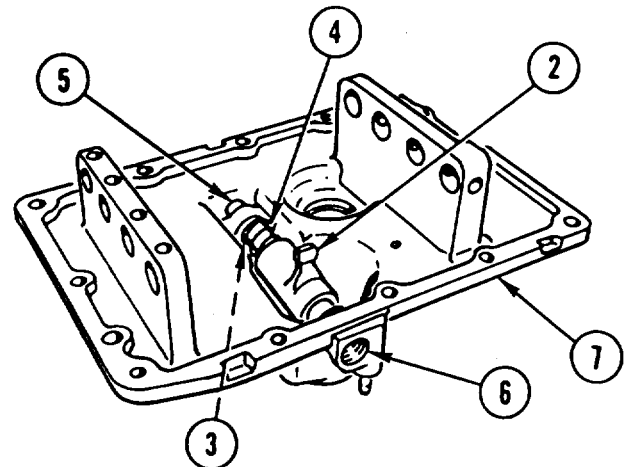


### ASSEMBLY

1. APPLY COAT of LUBRICATING OIL to BUSHING (1).
2. INSTALL BUSHING (1) in lever (2).



3. INSTALL washer (3), spring (4), LEVER (2), pin (5), and plug (6) in cover (7).

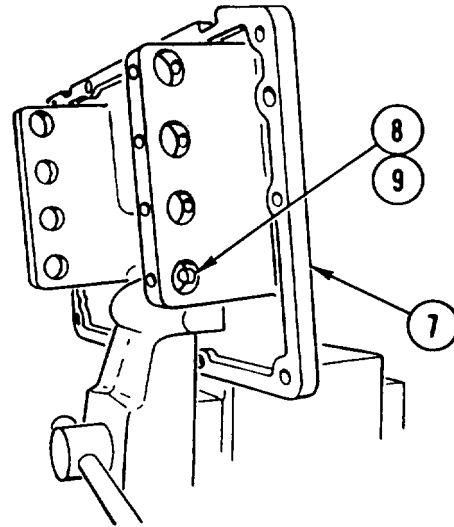


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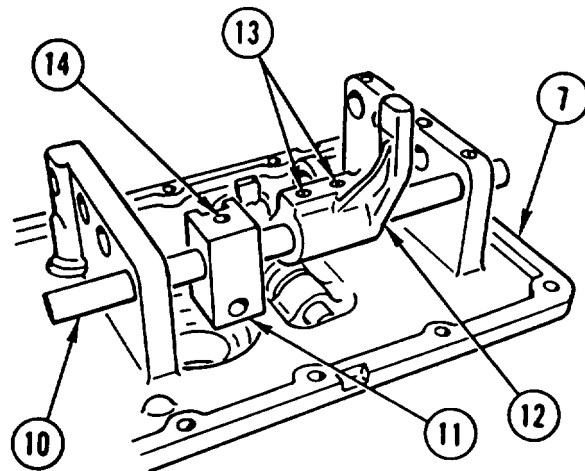
## TRANSMISSION TOP COVER REPAIR (CONT)

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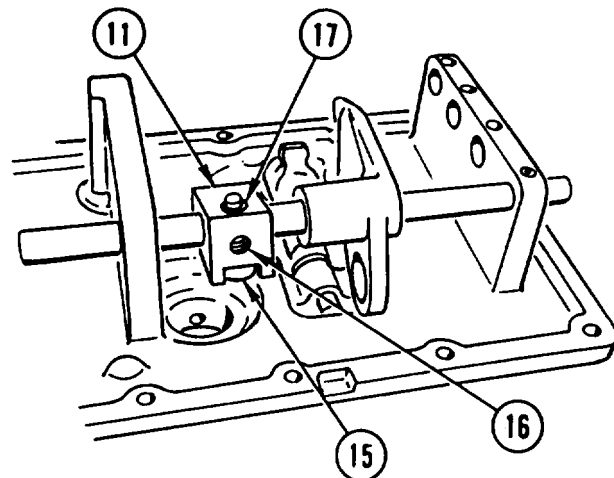
4. INSTALL spring (8) and PLUG (9) in cover (7).



5. INSTALL LEVER (10), follower (11), shifting tongue (12), two setscrews (13), and pin (14) in cover (7).



6. ALINE HOLES and INSTALL PIN (15), spring (16), and retaining ring (17) in follower (11).

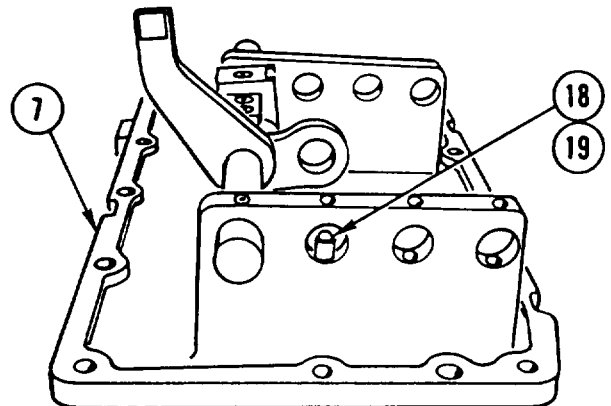


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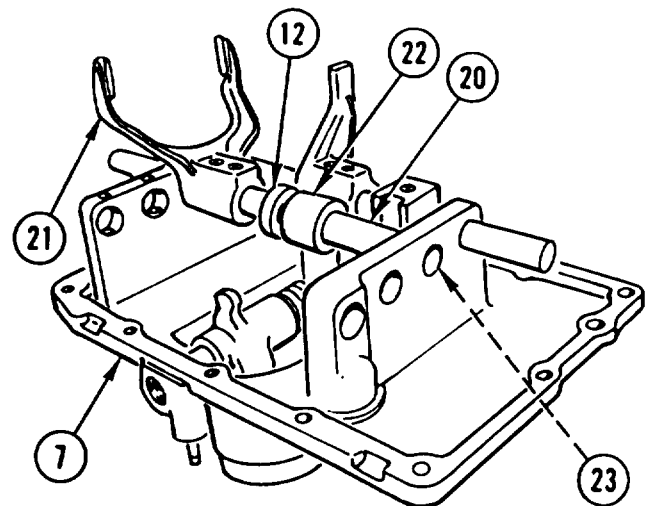
**TRANSMISSION TOP COVER REPAIR (CONT)**


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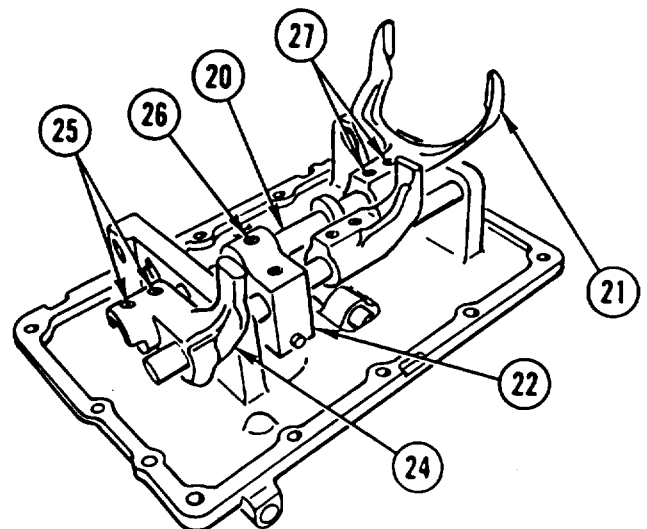
7. INSTALL PLUG (18) and spring (19) in cover (7).



8. INSTALL LEVER (20) and shifter FORK (21) in cover (7) and through shifting tongue (12).
9. INSTALL FOLLOWER (22) on lever (20).
10. INSTALL two BALLS (23) in cover (7).
11. COMPLETE INSTALLATION of LEVER (20) in cover (7).



12. INSTALL shifter FORK (24) and two setscrews (25) on lever (20).
13. ALINE HOLES and INSTALL PIN (26) in follower (22) and INSTALL two SETSCREWS (27) in shifter fork (21).

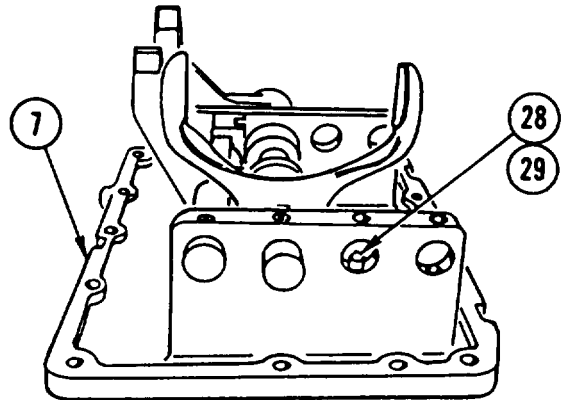


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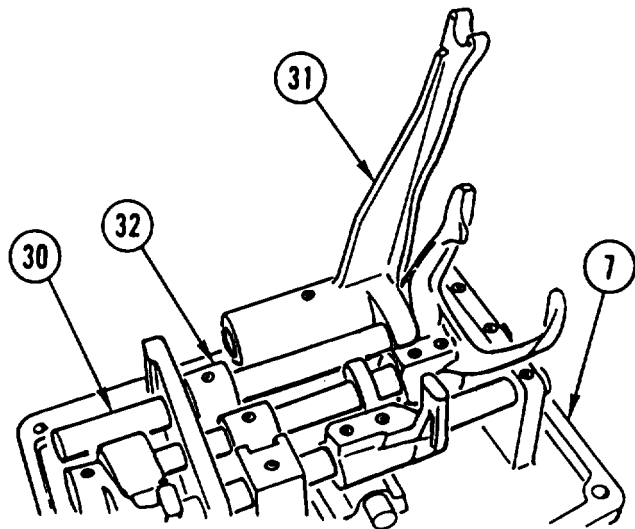
## TRANSMISSION TOP COVER REPAIR (CONT)

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14. INSTALL PLUG (28) and spring (29) in cover (7).

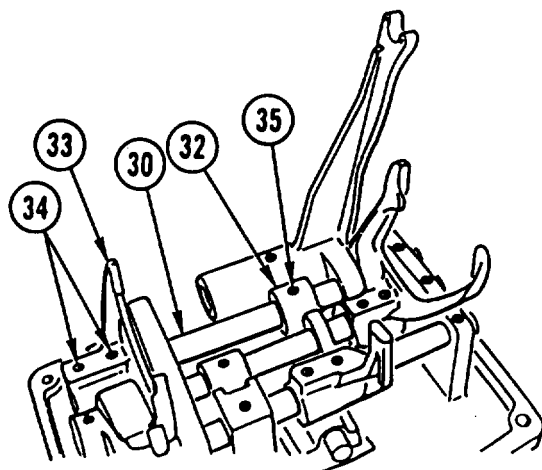


15. INSTALL LEVER (30), shifting frame (31), and follower (32) in cover (7).



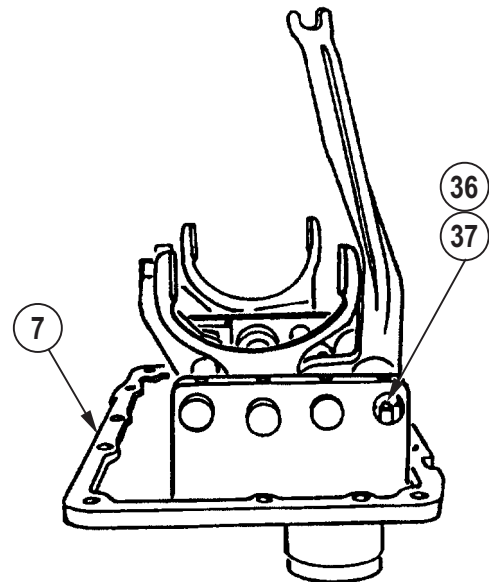
16. INSTALL shifter FORK (33) and two setscrews (34) on lever (30).

17. INSTALL PIN (35) in follower (32).



## TRANSMISSION TOP COVER REPAIR (CONT)

18. INSTALL PLUG (36) and spring (37) in cover (7).

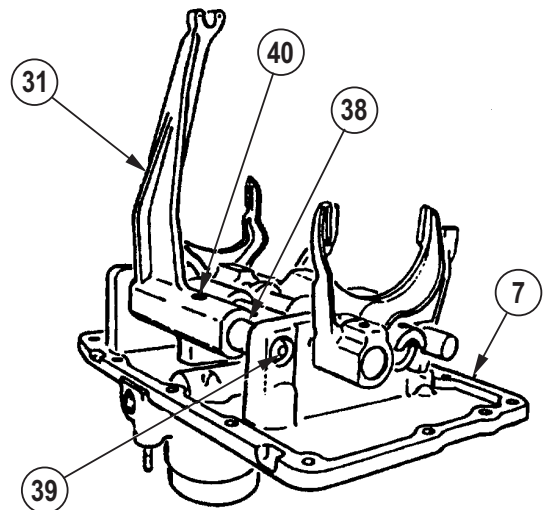


19. INSTALL LEVER (38) in cover (7) and through shifting frame (31).

20. INSTALL two BALLS (39) in cover (7).

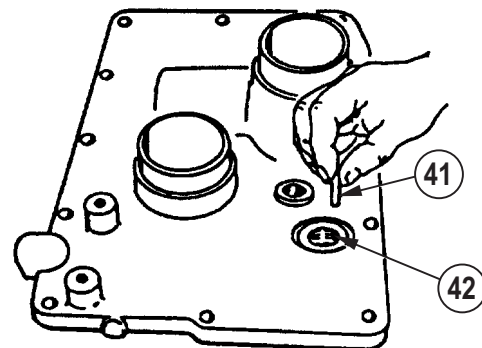
21. COMPLETE INSTALLATION of LEVER (38) in cover (7).

22. ALINE HOLES and INSTALL PIN (40) in shifting frame (31).



23. TURN ASSEMBLY OVER.

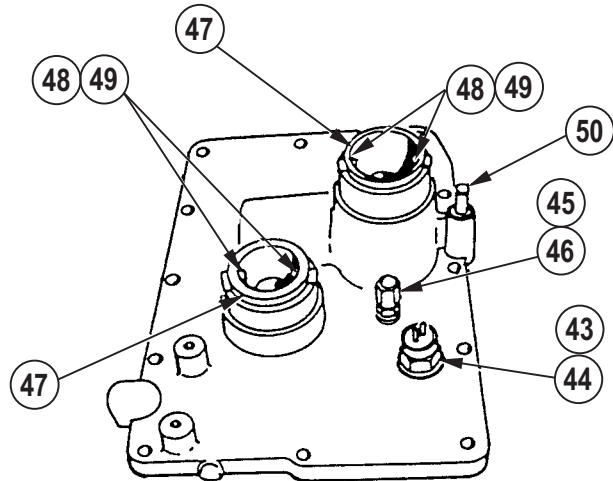
24. INSTALL PIN (41) in pressure switch port (42).



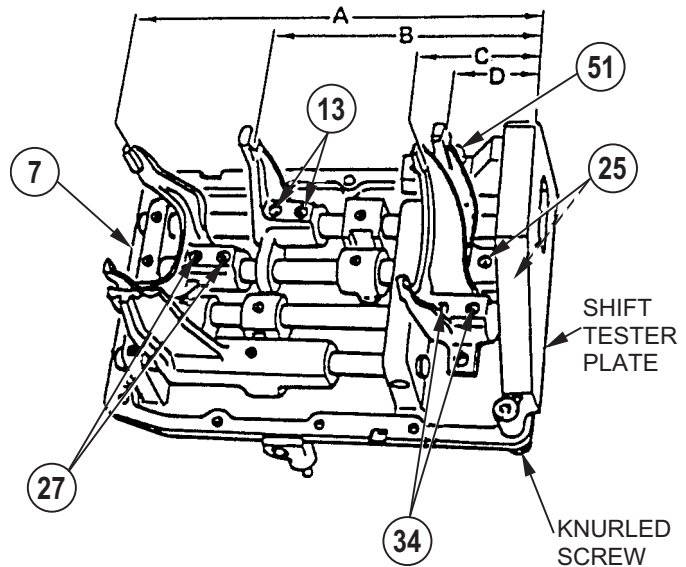


## TRANSMISSION TOP COVER REPAIR (CONT)

- 25. INSTALL pressure SWITCH (43) and new washer (44).
- 26. INSTALL BREATHER (45) and new seal ring (46).
- 27. INSTALL two bushings (47), four tee head bolts (48), four retaining rings (49), and pin (50).



- 28. REMOVE two knurled SCREWS from shift tester plate.
- 29. MOUNT SHIFT TESTER PLATE on underside of cover (7) by INSTALLING one cover mounting BOLT (51) and two knurled SCREWS through to of cover (7).



- 30. REMOVE eight SETSCREWS (13, 25, 27, and 34) and APPLY COAT of SEALING COMPOUND to SETSCREWS. REINSTALL eight SETSCREWS (13, 25, 27, and 34) but DO NOT TIGHTEN setscrews.
- 31. TO ADJUST shift FORKS and shift FINGERS, one setscrew must be screwed OUT and the other setscrew screwed IN. REPEAT until settings in following table are obtained with eight setscrews (13, 25, 27, and 34) tightened.

Designation	Setting
A. Shift fork for 4th speed sliding sleeve on main shaft	12.539 ±0.004 in. (318.5 ±0.1 mm)
B. Shift finger 1st/2nd speed sliding sleeve on countershaft	8.878 ±0.004 in. (225.5 ±0.1 mm)
C. Shift fork for fast group (stage II) sliding sleeve on main shaft	3.258 ±0.004 in. (82.75 ±0.1 mm)
D. Shift finger for 3rd speed sliding sleeve on countershaft	2.783 ±0.004 in. (70.7 ±0.1 mm)

### NOTE

Follow-on Maintenance:  
Install transmission top cover  
(page 3-86).

## Section III. TRANSMISSION ACCESS COVER REPAIR

### TRANSMISSION ACCESS COVER REPAIR

This task covers: a. Disassembly b. Assembly c. Adjustment

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shift Tester Plate, P/N 441 589 00 21 00

**Materials/Parts (Cont):**

Packing (2)  
 Oil, Lubricating Appendix B, Item 30

**Materials/Parts:**

Seal  
 Gasket  
 Packing

**Equipment Condition:**

Reference	Condition Description
Page 3-83	Transmission Access Cover Removed

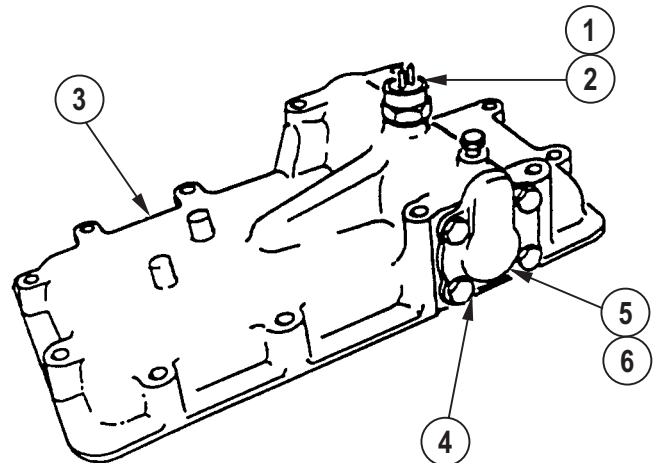
#### DISASSEMBLY

1. REMOVE differential SWITCH (1) and seal (2) from access cover (3). DISCARD SEAL.

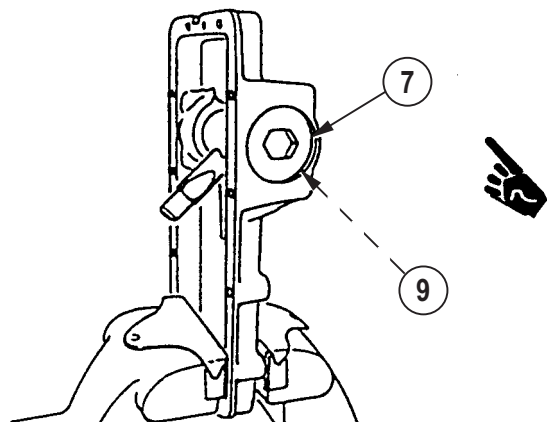
**NOTE**

Gasket quantity may vary, as gaskets are used as shims.

2. REMOVE four screws (4), COVER (5), and gasket(s) (6). DISCARD GASKET(S).



3. REMOVE PLUG (7) and spacer(s) (9).

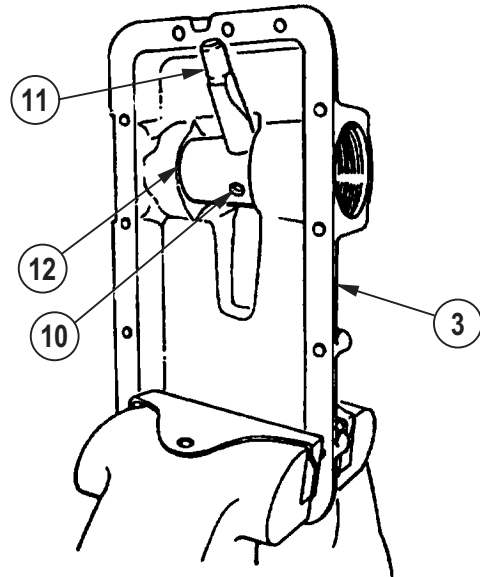


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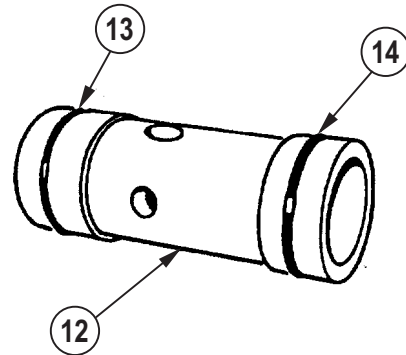
## TRANSMISSION ACCESS COVER REPAIR (CONT)

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4. REMOVE pin (10) and shifting FINGER (11).
5. REMOVE PISTON (12) from access cover (3).

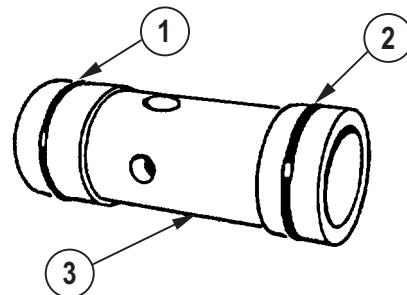


6. REMOVE and DISCARD two PACKINGS (13 and 14) from piston (12).



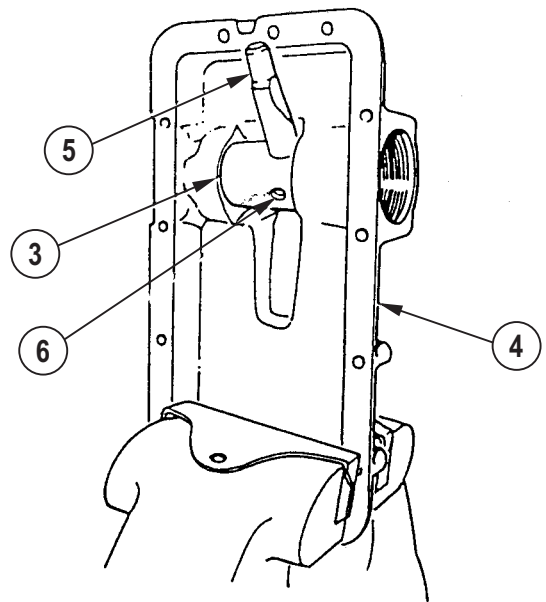
### ASSEMBLY

1. APPLY COAT of LUBRICATING OIL to two new PACKINGS (1 and 2).
2. INSTALL two PACKINGS (1 and 2) on piston (3).

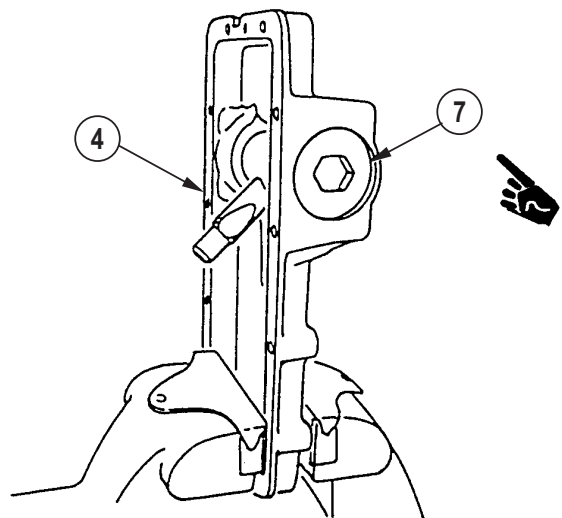


## TRANSMISSION ACCESS COVER REPAIR (CONT)

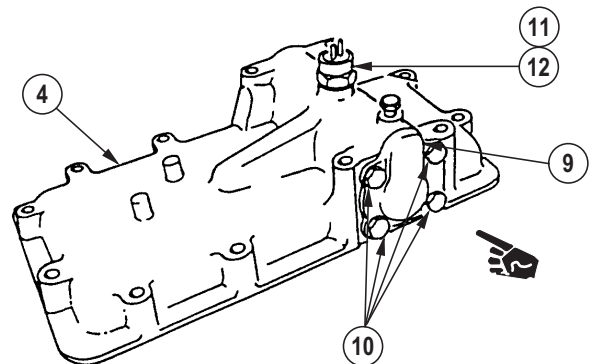
3. INSTALL PISTON (3) in access cover (4).
4. INSTALL shifting FINGER (5) and pin (6) in piston (3).



5. INSTALL PLUG (7) in access cover (4).



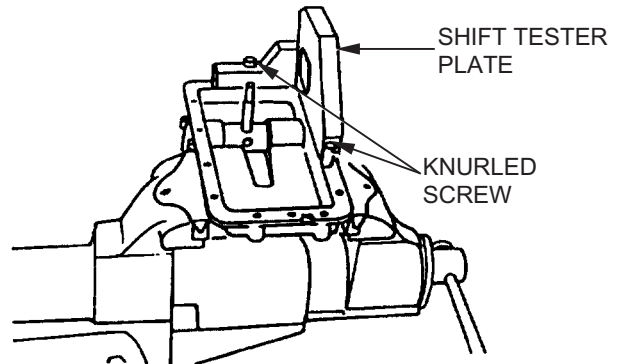
6. INSTALL COVER (9) and four screws (10).
7. INSTALL differential SWITCH (11) and new seal (12) in access cover (4).



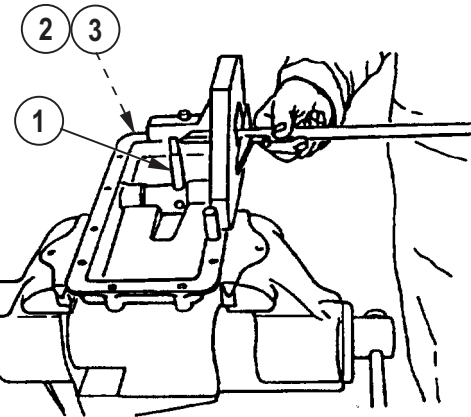
## TRANSMISSION ACCESS COVER REPAIR (CONT)

### ADJUSTMENT

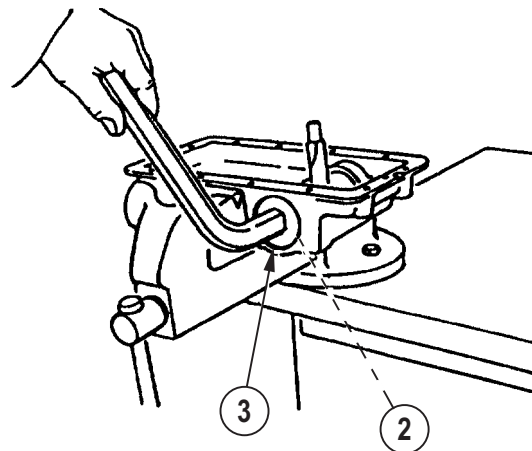
1. Attach shift tester plate using two knurled screws.
2. Check that cover and screw plug are firmly seated.



3. Move shifting finger (1) into shift position "engage". Measure and determine spacer(s) (2) on plug (3). Set dimension  $2.835 \pm 0.004$  in. ( $72.0 \pm 0.01$  mm).



4. REMOVE plug (3).
5. INSTALL previously determined number of spacer(s) (2).
6. INSTALL plug (3).

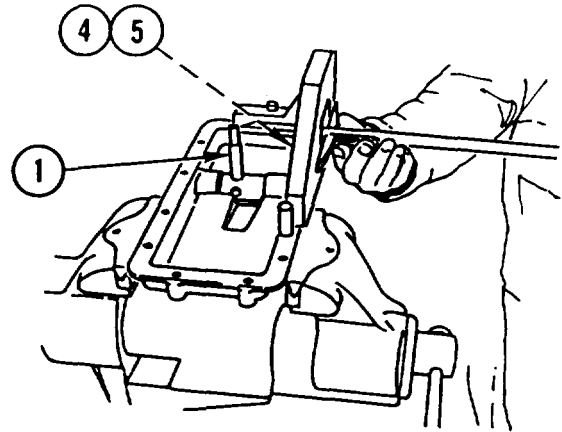


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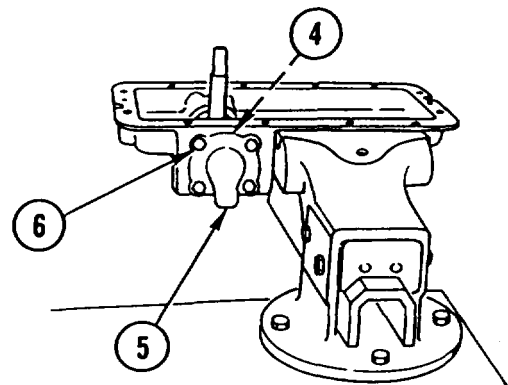
**TRANSMISSION ACCESS COVER REPAIR (CONT)**

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7. Move shifting finger (1) into shift position "disengage".
8. Measure and determine gasket(s) (4) on cover (5). Set dimension  $3.543 \pm 0.004$  in. ( $90.0 \pm 0.1$  mm).



9. Remove four screws (6) and cover (5).
10. Install previously determined number of new gasket(s) (4).
11. Install cover (5) and four screws (6).
12. Recheck setting dimensions.

**NOTE**

Follow-on Maintenance:  
Install transmission access cover  
(page 3-83).

## Section IV. POWER TAKE-OFF (PTO) REPAIR

### POWER TAKE-OFF (PTO) REPAIR

This task covers: a. Disassemble b. Inspection c. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

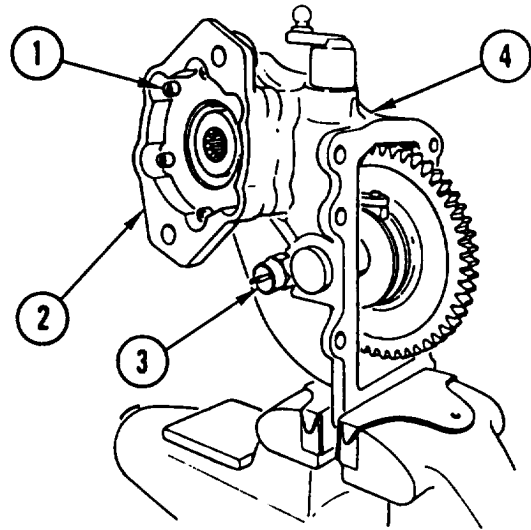
Seal  
 Packing  
 Packing  
 Oil, Lubricating                      Appendix B, Item 30

**Equipment Condition:**

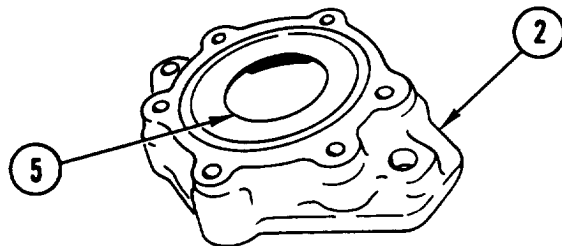
Reference	Condition Description
Page 3-79	Power Take-Off (PTO) Removed

#### DISASSEMBLY

1. REMOVE six screws (1), flange (2), and push SWITCH (3) from Power Take-Off assembly (4).



2. REMOVE SEAL (5) from flange (2). DISCARD SEAL.



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**POWER TAKE-OFF (PTO) REPAIR (CONT)**

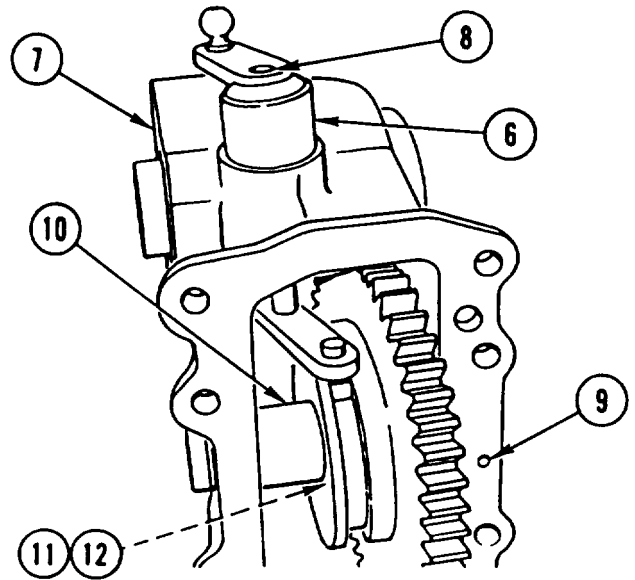

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3. MARK POSITION of lever (6) to housing (7).
4. REMOVE socket head screw (8) and LEVER (6).

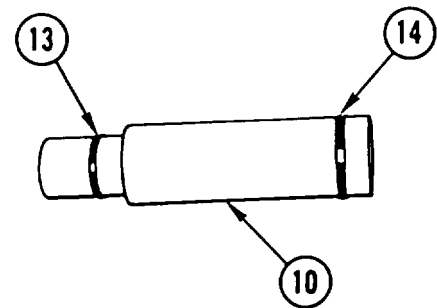
**NOTE**

Spring and ball will fall out with removal of shaft.

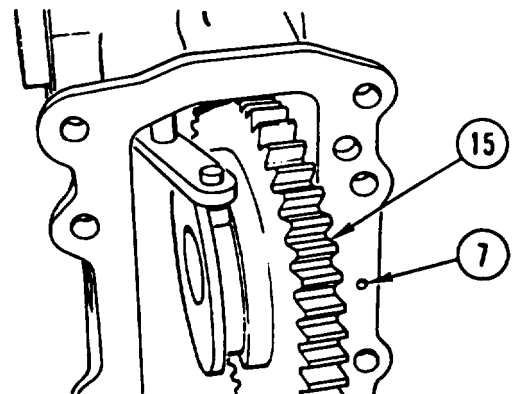
5. REMOVE pin (9), SHAFT (10), spring (11), and ball (12).



6. REMOVE two PACKINGS (13 and 14) from shaft (10). DISCARD PACKINGS.



7. REMOVE GEAR (15) from housing (7).



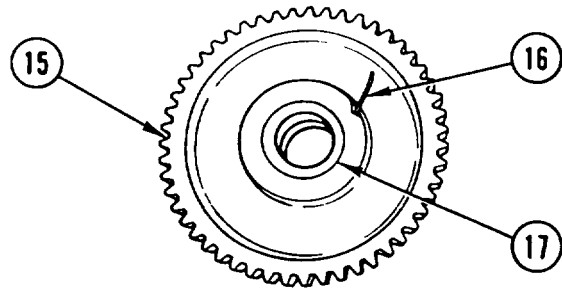


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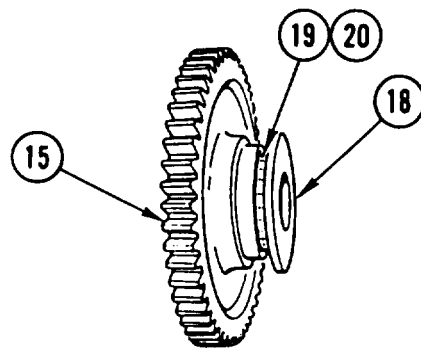
## POWER TAKE-OFF (PTO) REPAIR (CONT)

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8. REMOVE LOCK (16) and thrust washer (17) from gear (15).

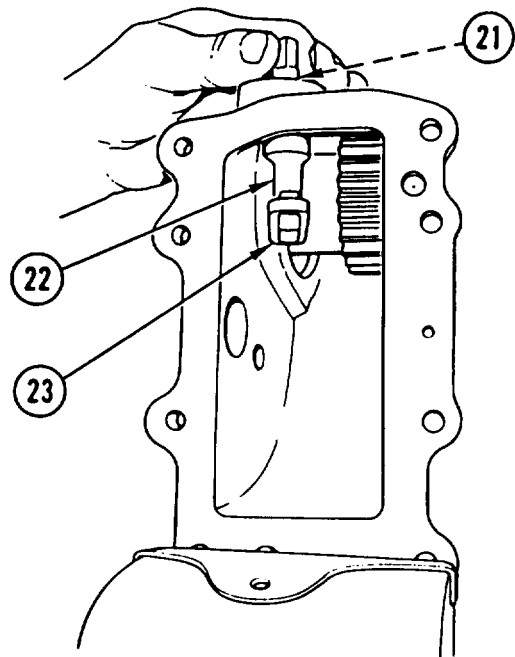


9. REMOVE BUSHING (18) and two retainers and rollers (19 and 20) from gear (15).



10. REMOVE bushing (21) and selector ROD (22).

11. REMOVE PIN (23) from selector rod (22).

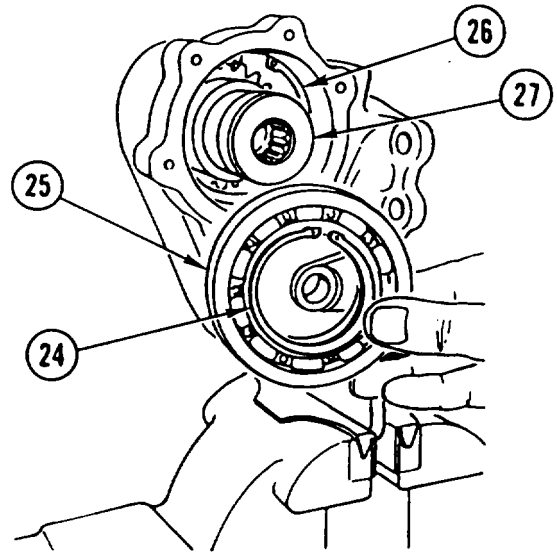


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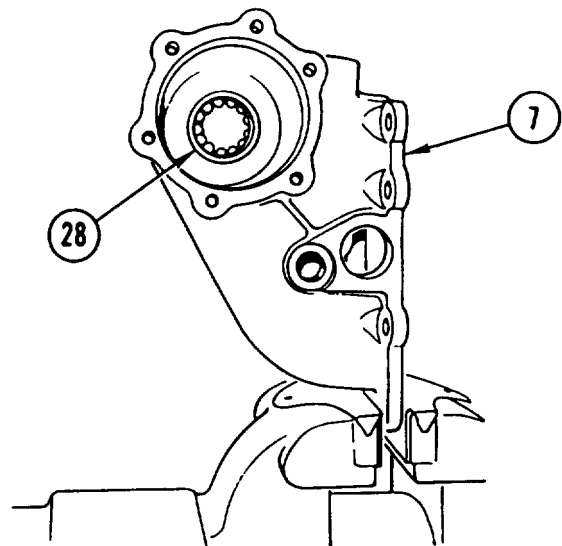
**POWER TAKE-OFF (PTO) REPAIR (CONT)**

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12. REMOVE ring (24), BEARING (25), and ring (26).
13. REMOVE gear SHAFT (27).



14. USING suitable PULLER, REMOVE BEARING (28) from housing (7).

**INSPECTION**

1. Inspect gear shaft for scratches or scoring.
2. Inspect gear and bearings for wear or damage.
3. Inspect housing for cracks.

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## POWER TAKE-OFF (PTO) REPAIR (CONT)

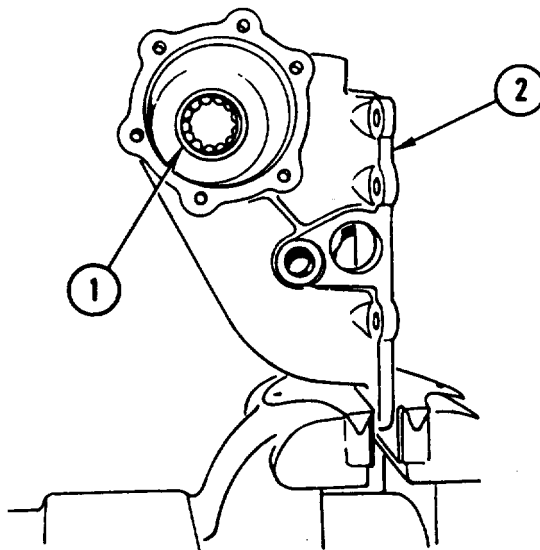
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### ASSEMBLY

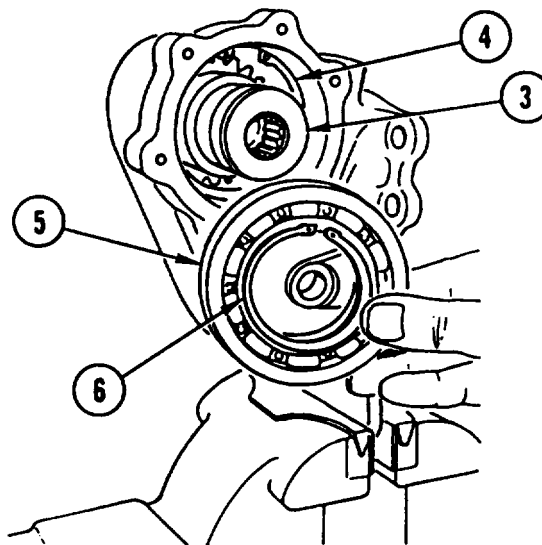
#### NOTE

Apply coat of lubricating oil to packings and seal prior to assembly.

1. INSTALL BEARING (1) in housing (2).

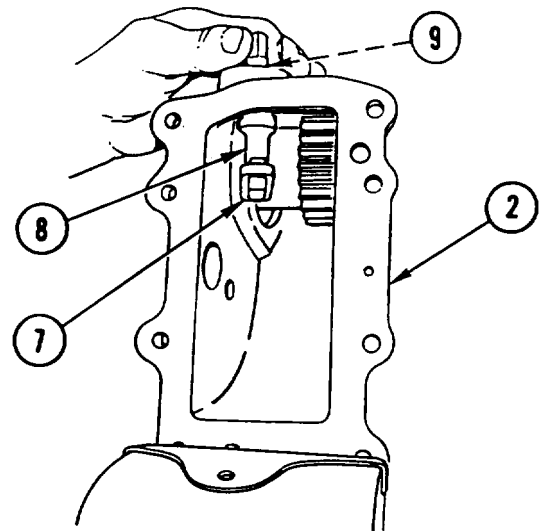


2. INSTALL gear SHAFT (3).
3. INSTALL ring (4), BEARING (5), and ring (6).

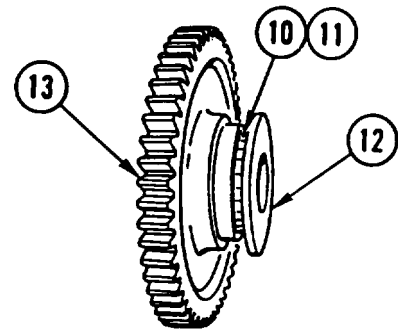


## POWER TAKE-OFF (PTO) REPAIR (CONT)

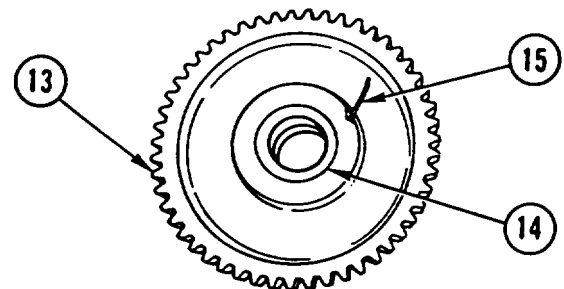
4. INSTALL PIN (7) in selector rod (8).
5. INSTALL selector ROD (8) and bushing (9) in housing (2).



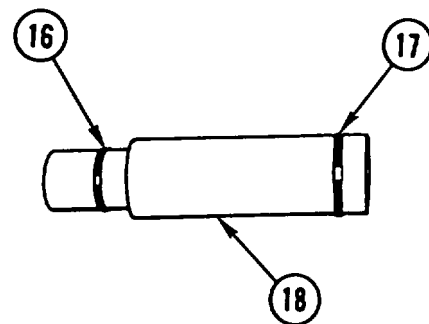
6. INSTALL two retainers and rollers (10 and 11) and BUSHING (12) in gear (13).



7. INSTALL thrust washer (14) and LOCK (15) in gear (13).



8. INSTALL two new PACKINGS (16 and 17) on shaft (18).

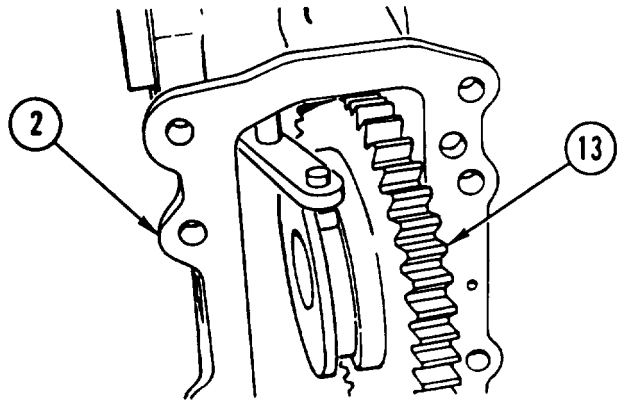


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**POWER TAKE-OFF (PTO) REPAIR (CONT)**

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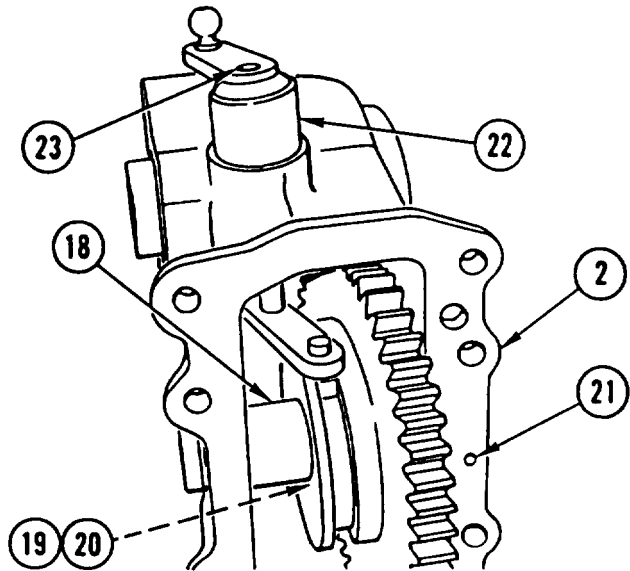
9. INSTALL GEAR (13) in housing (2).



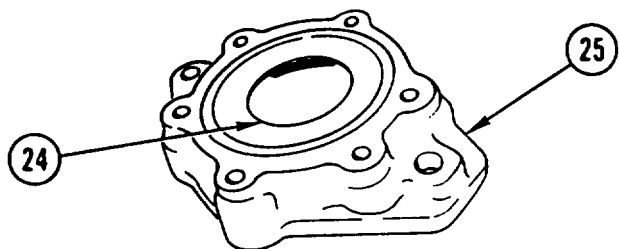
**NOTE**

Make sure pin in selector rod is positioned properly on gear.

10. INSTALL SHAFT (18), spring (19), ball (20), and pin (21) in housing (2).
11. USING alinement MARKS made during Disassembly, INSTALL LEVER (22) and socket head screw (23).



12. INSTALL new SEAL (24) in flange (25).



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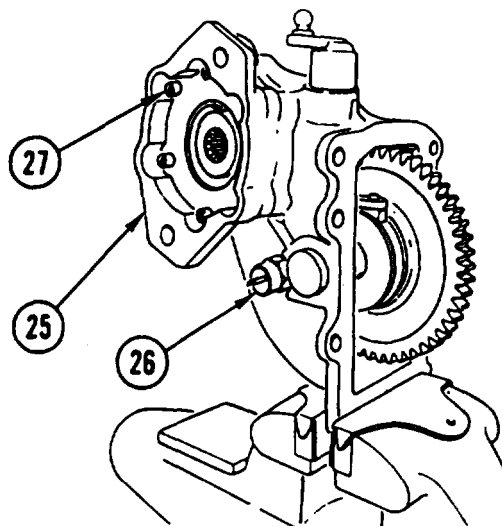
**POWER TAKE-OFF (PTO) REPAIR (CONT)**

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13. INSTALL push SWITCH (26).
14. INSTALL FLANGE (25) and six screws (27).

**NOTE**

Follow-on Maintenance:  
Install Power Take-Off (PTO)  
(page 3-79).





## CHAPTER 16 FRONT AND REAR AXLES REPAIR INSTRUCTIONS

### OVERVIEW

This chapter contains maintenance instructions for repair of the front and rear axles. A list of sections contained in this chapter is shown below.

	Page
Section I. Axle Repair .....	16-1
Section II. Steering Knuckle and Front Axle Drive Repair .....	16-25

### Section I. AXLE REPAIR

---

#### AXLE REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

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#### INITIAL SETUP

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Shop Equipment, SC 4910-95-CL-A63
- Adjusting Tool, P/N 425 589 00 21 00
- Holding Device, P/N 425 589 00 31 00
- Installation Tool, P/N 406 589 03 14 00
- Installing Tool, P/N 406 589 02 43 00
- Installing Tool, P/N 406 589 03 43 00
- Installing Tool, P/N 441 589 06 43 00
- Mandrel, P/N 406 589 04 15 00
- Puller, P/N 000 589 35 33 00
- Puller, P/N 000 589 68 33 00
- Test Device, P/N 401 589 01 25 00
- Wrench, P/N 000 589 64 03 00 or P/N W0-00640-300
- Wrench, P/N 001 589 80 21 00

- Compound, Sealing Appendix B, Item 16
- Oil, Lubricating Appendix B, Item 30
- Brass Bearing(s) ■

**Equipment Condition:**

Reference	Condition Description
	Axle Mounted on Stand

**General Safety Instructions:**

#### 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.

**Materials/Parts:**

- Packing
- Spacer, Tube
- Cord, Sealing
- Ring, Seal
- Shim(s) ■
- Packing (2)



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## AXLE REPAIR (CONT)

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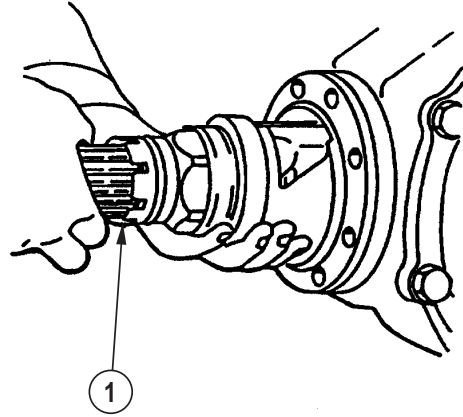
### DISASSEMBLY

1. REMOVE STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE or REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT (page 5-16 or 6-15).

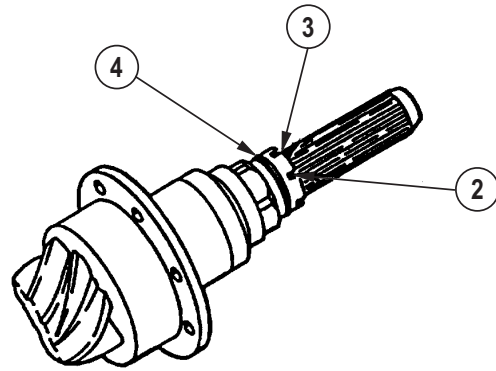
#### NOTE

Procedure is the same for both front and rear axles.

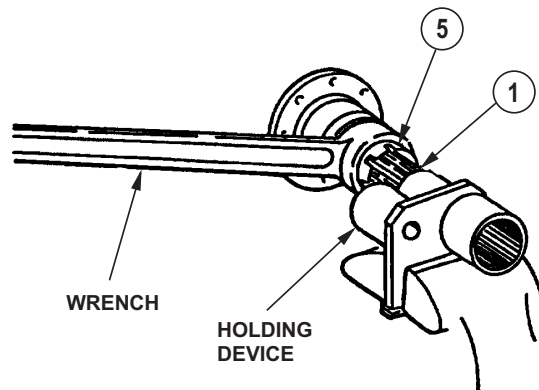
2. REMOVE pinion SHAFT (1).



3. REMOVE retaining ring (2), LOCK (3), and packing (4). DISCARD PACKING.



4. INSTALL pinion SHAFT (1) in holding device.
5. USING WRENCH, REMOVE NUT (5).



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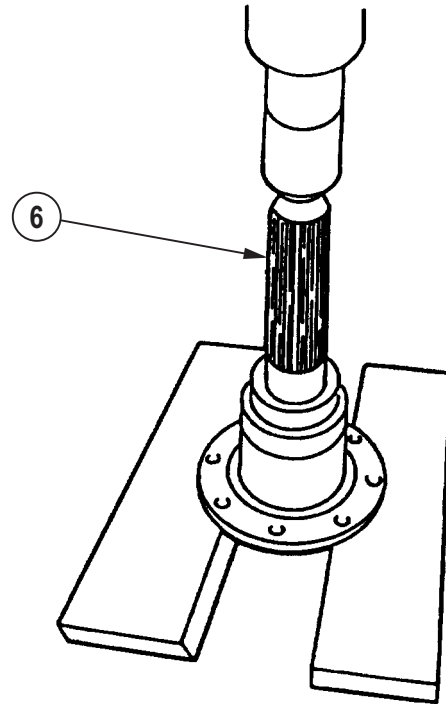
## AXLE REPAIR (CONT)

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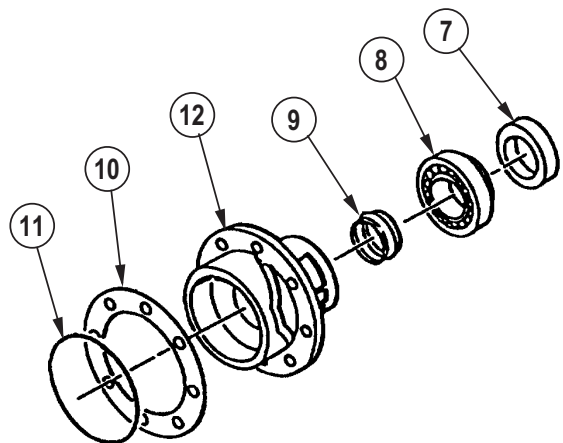
**CAUTION**

Support bevel gear under press to avoid dropping through and causing damage to equipment.

6. USING suitable PRESS, REMOVE bevel GEAR (6).



7. REMOVE ring spacer (7), bearing (8), tube SPACER (9), SHIM(S) (10), and sealing cord (11) from bearing body (12). DISCARD tube SPACER, sealing CORD, and SHIM(S).

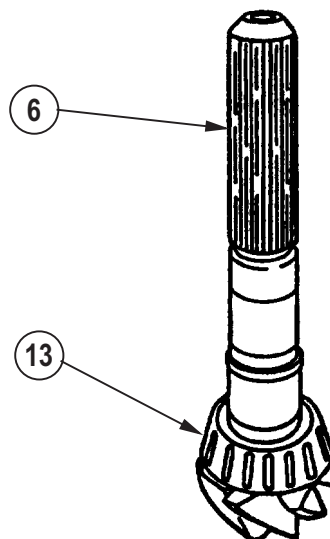


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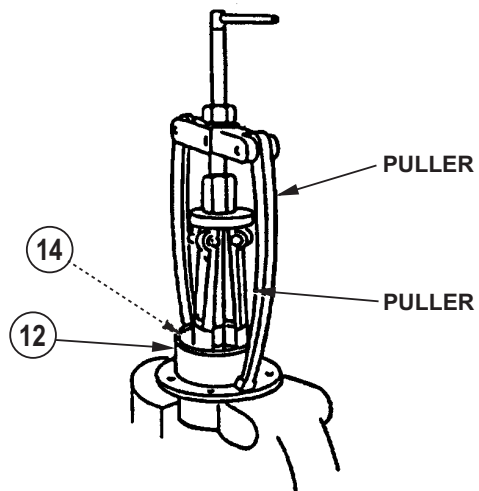
## AXLE REPAIR (CONT)

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8. USING PULLER, REMOVE BEARING (13) from bevel gear (6).

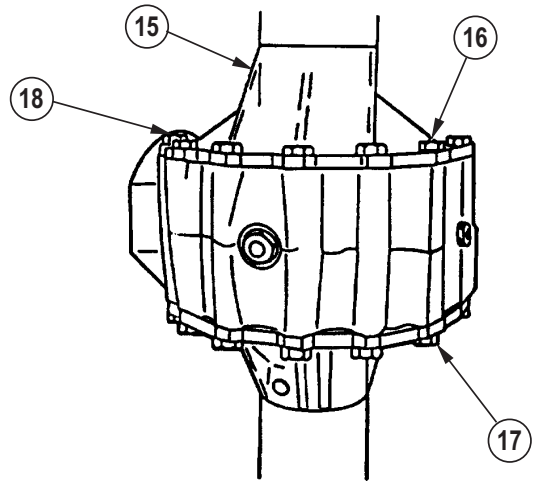


9. USING PULLERS, REMOVE bearing RACE (14) from bearing body (12).

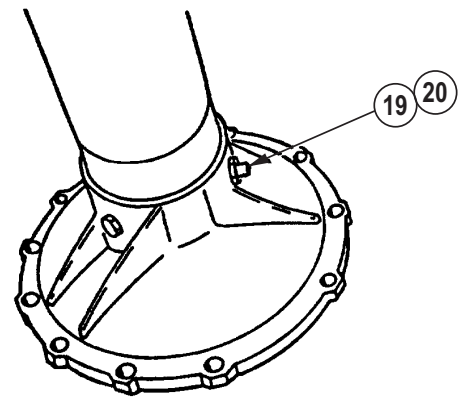


## AXLE REPAIR (CONT)

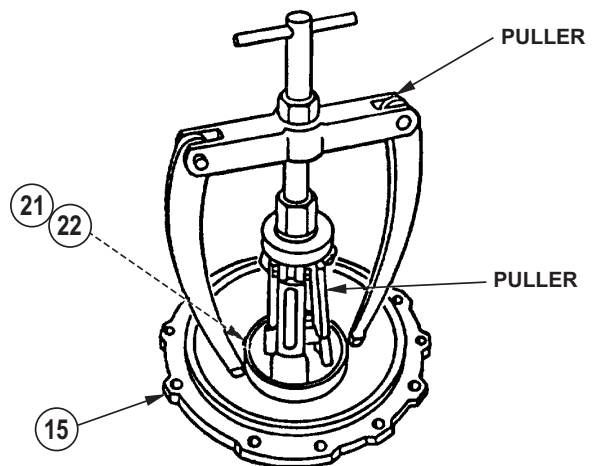
10. ROTATE AXLE 90 DEGREES to vertical, with long axle tube housing (15) up.
11. REMOVE nine bolts (16), nine nuts (17), two screws (18), and long axle tube HOUSING (15).



12. REMOVE FITTING (19) and seal RING (20). DISCARD seal RING.



13. USING PULLERS, REMOVE bearing RACE (21) and SHIM(S) (22) from long axle tube housing (15). DISCARD SHIM(S).

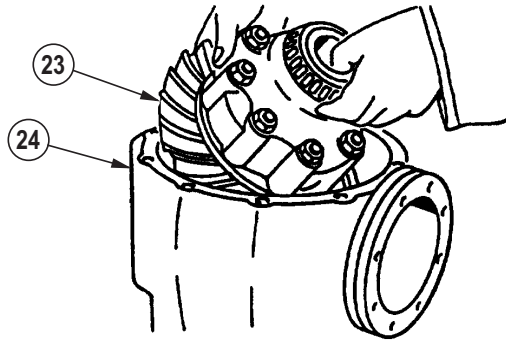


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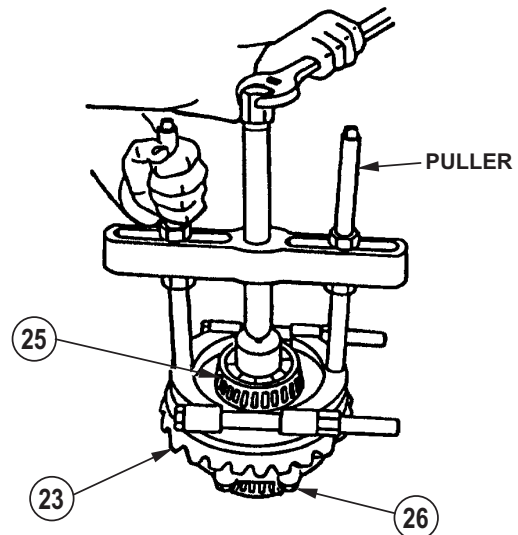
## AXLE REPAIR (CONT)

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14. REMOVE mechanical housing DIFFERENTIAL (23) from mechanical differential housing (24).



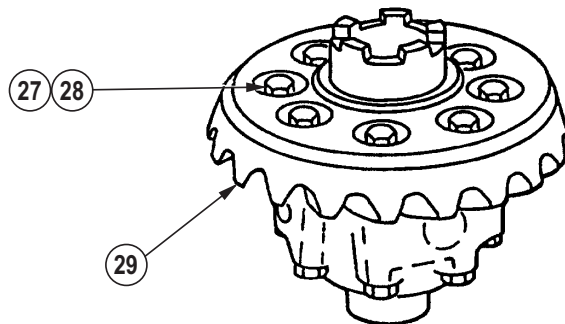
15. USING PULLER, REMOVE BEARING (25) from mechanical housing differential (23).
16. REPEAT STEP 15 for other bearing (26).



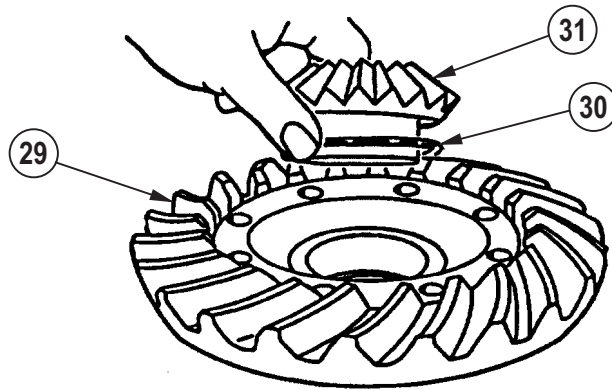
### NOTE

To aid in assembly, mark heads of screws to match white marks on housing.

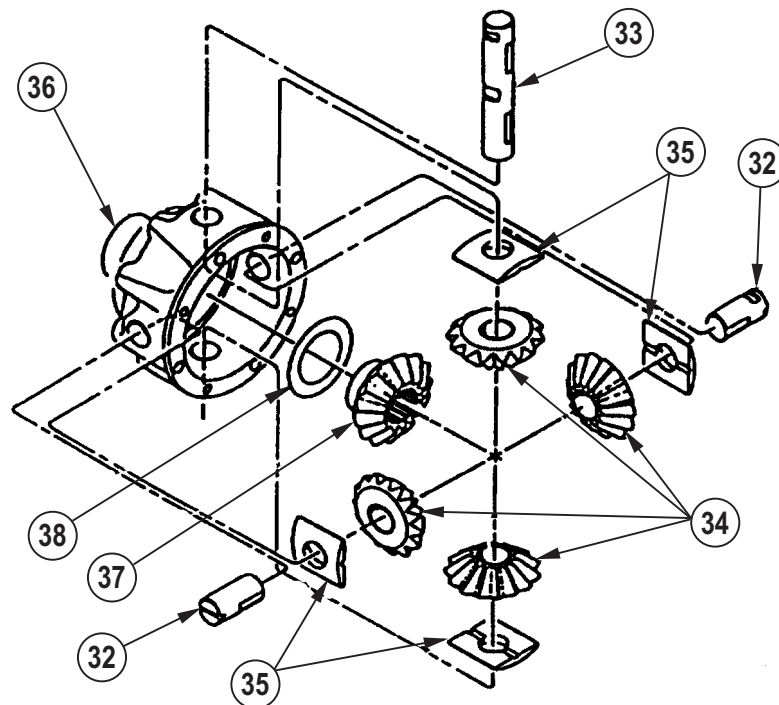
17. REMOVE eight screws (27) eight nuts (28), and bevel GEAR (29).



## AXLE REPAIR (CONT)



18. REMOVE disc (30) and WHEEL (31) from bevel gear (29).

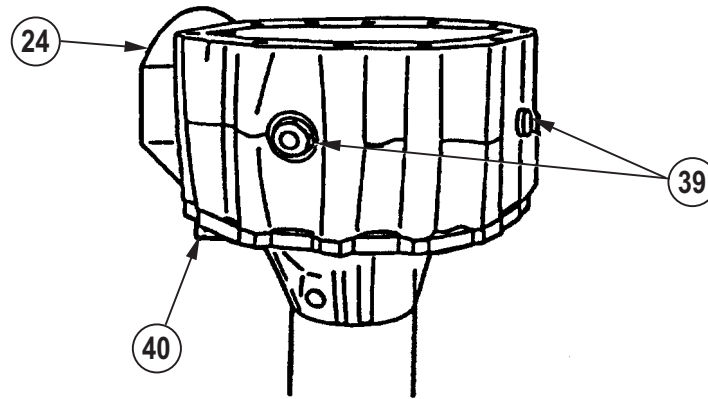


19. REMOVE two half-axes (32), axle (33), four GEARS (34), and four discs (35) from housing (36).
20. REMOVE WHEEL (37) and disc (38) from housing (36).

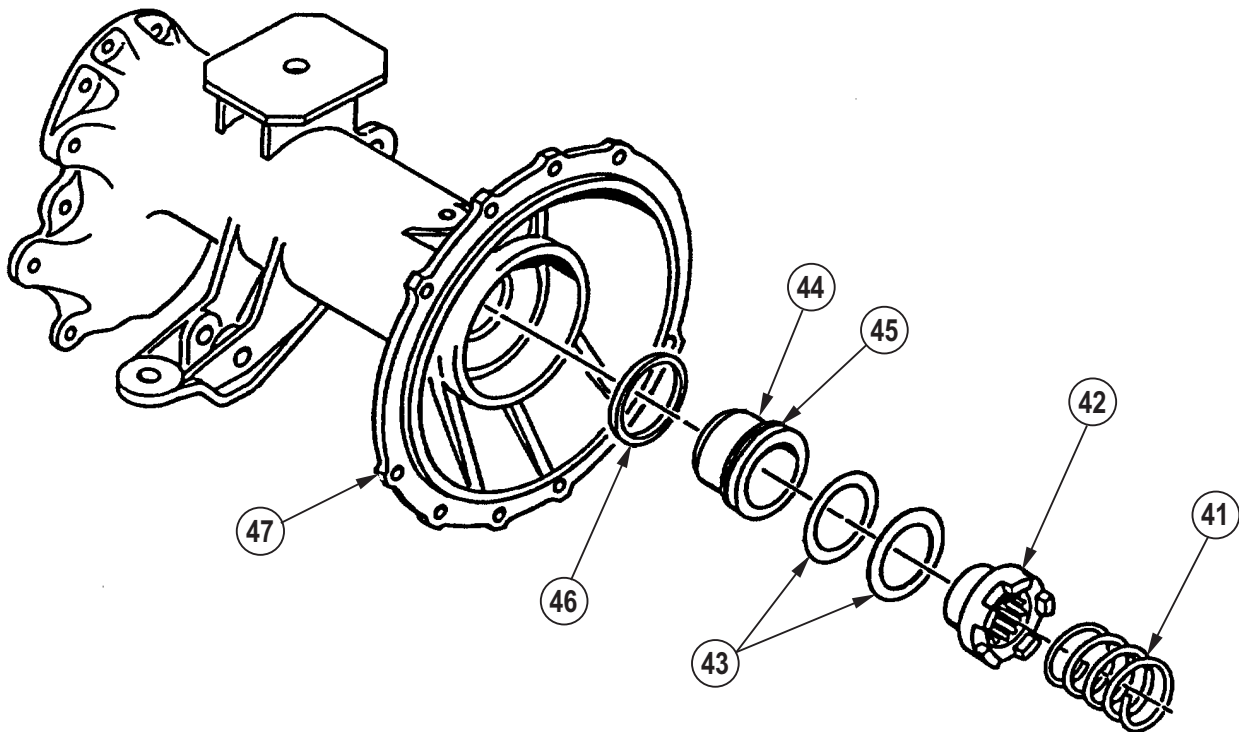
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## AXLE REPAIR (CONT)

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21. IF DAMAGED, REMOVE two PLUGS (39) from mechanical differential housing (24).
22. REMOVE two screws (40) and mechanical differential HOUSING (24).



23. REMOVE spring (41), follower (42), brass bearing(s) (43), PISTON (44), packing (45) from PISTON (44), and packing (46) from short axle tube housing (47). DISCARD PACKINGS and BRASS BEARING(S).

## AXLE REPAIR (CONT)

24. USING PULLERS, REMOVE bearing race (48) and SHIM(S) (49) from short axle tube housing (47). Discard shim(s).

### INSPECTION

#### NOTE

Install new ring gear, pinion, and differential housing when installing new differential gear repair kit.

1. Inspect housings for galling, cracks, or stripped threads.
2. Inspect gears for cracks or missing teeth.
3. Inspect pinion for damaged splines.
4. Inspect disc, wheel, half-axle, axle, four gears, and four discs for wear and damage.

### ASSEMBLY

#### NOTE

Procedure is the same for both front and rear axles.

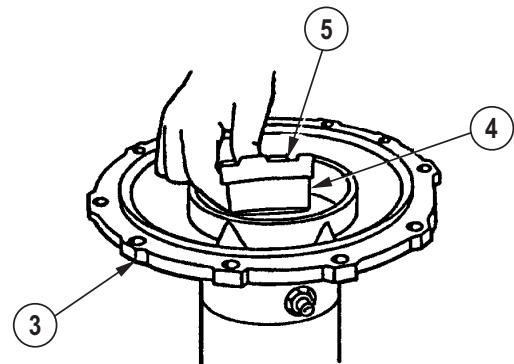
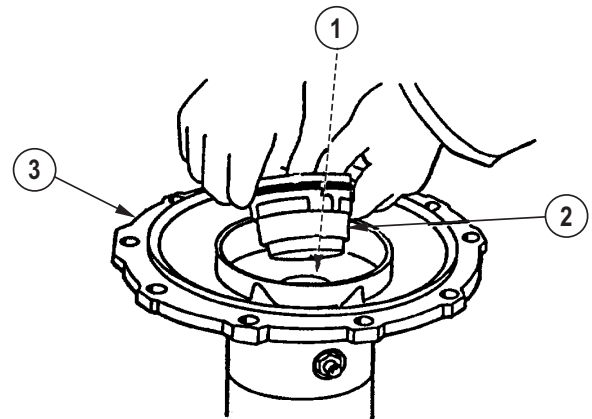
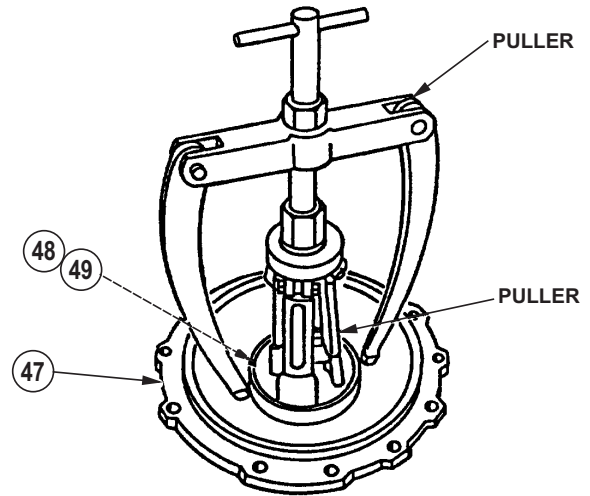
1. APPLY COAT of LUBRICATING OIL to new PACKING (1) and INSTALL PACKING (1) on piston (2).

#### CAUTION

Make sure slot on piston is aligned with dowel in short axle tube housing to prevent damage to equipment.

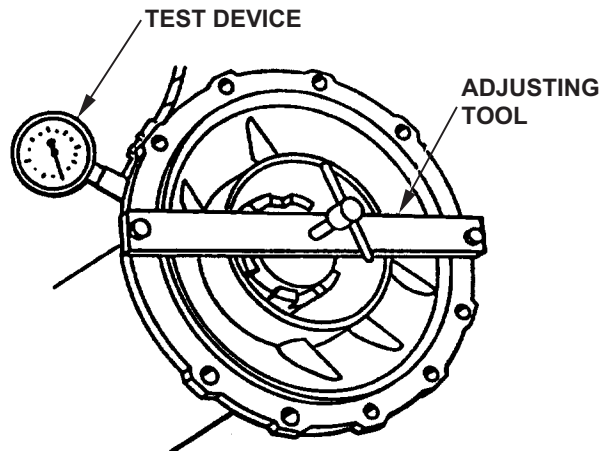
2. INSTALL PISTON (2) in short axle tube housing (3).

3. INSTALL brass bearing (4) and FOLLOWER (5) in short axle tube housing (3).

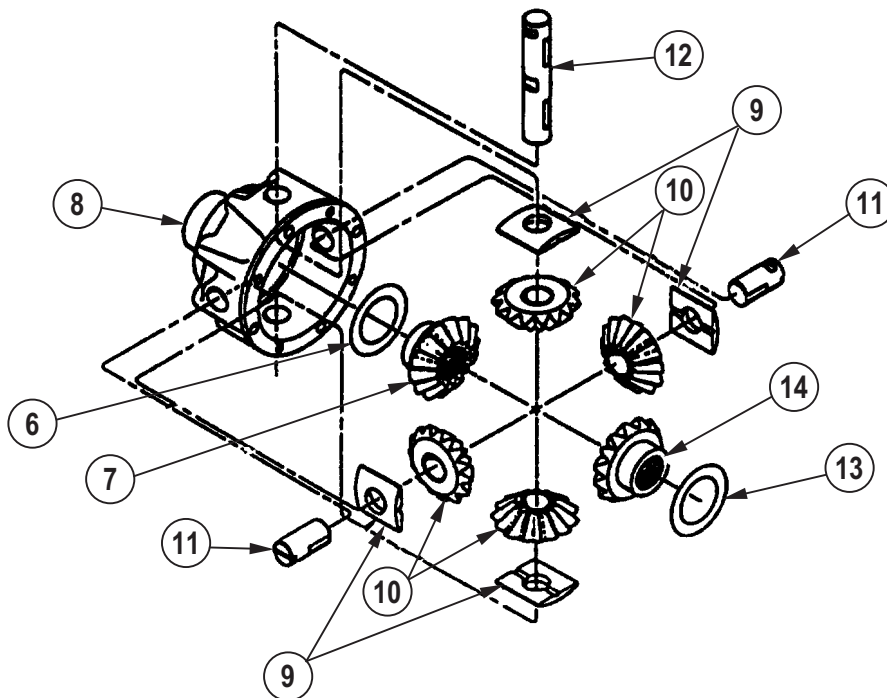




## AXLE REPAIR (CONT)



4. INSTALL ADJUSTING TOOL to short axle tube housing (3). UNSCREW T-HANDLE on ADJUSTING TOOL 0.4 in. (10 mm).
5. USING TEST DEVICE, CHECK differential LOCK for leaks. APPLY 42.5-70.8 psi (3-5 bar) of pressure and HOLD for a FEW minutes. IF PRESSURE DROPS off, REPAIR LEAK by REPEATING STEPS 1 thru 3 INSTALLING new PACKINGS.



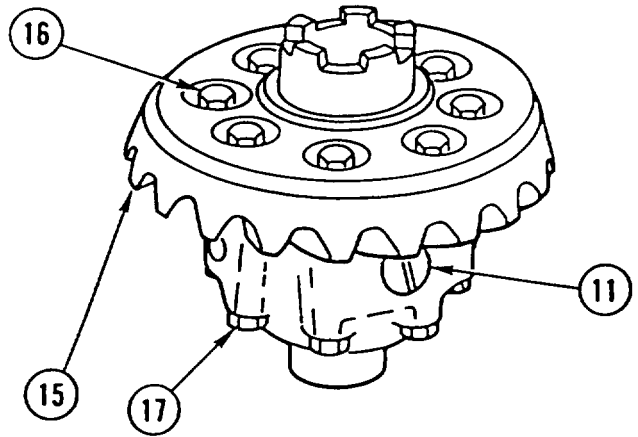
- 6. INSTALL disc (6) and WHEEL (7) in housing (8).
- 7. INSTALL four discs (9), four GEARS (10), two half-axes (11), and axle (12) in housing (8).
- 8. INSTALL disc (13) and WHEEL (14) in housing (8).

**AXLE REPAIR (CONT)**

**CAUTION**

If bevel gear is replaced, pinion shaft must also be replaced. Make sure serial numbers are the same to prevent damage to equipment.

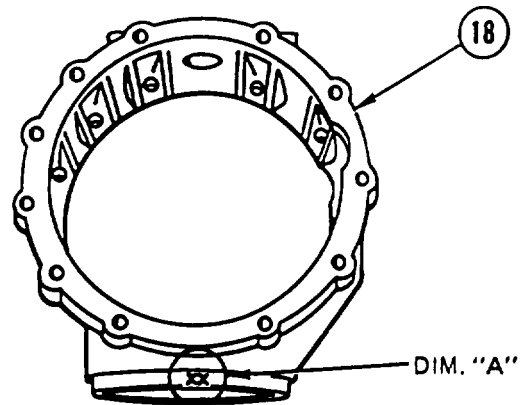
9. INSTALL bevel GEAR (15), eight screws (16), and eight nuts (17), observing marks on screws. TURN HALF-AXLES (11) to accept screws (16). TIGHTEN SCREWS to 88 lb-ft (120 NŹm).



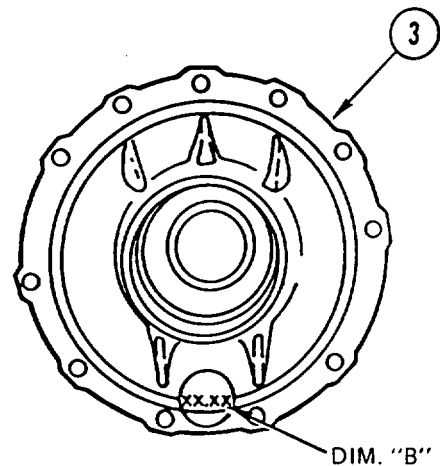
**NOTE**

- All measurements are in mm.
- If dimension amounts to two places, it will be necessary to prefix dimension "A" with the constant 74 ("A" = 74.XX).

10. CHECK DIMENSION etched on mechanical differential HOUSING (18) and RECORD in Table 2 (page 16-24) for A dimension.

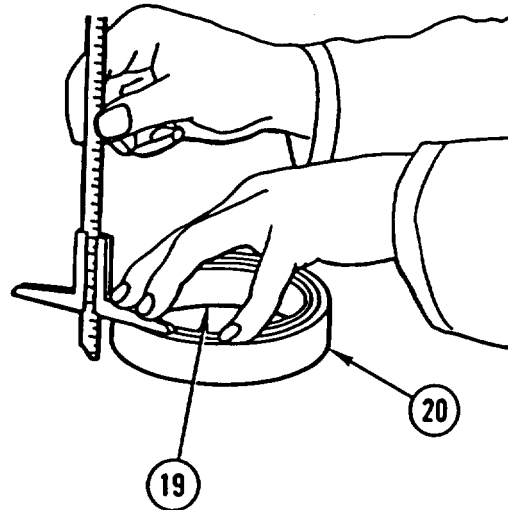


11. CHECK DIMENSION etched on short axle tube HOUSING (3) and RECORD in Table 2 (page 16-24) for B dimension.

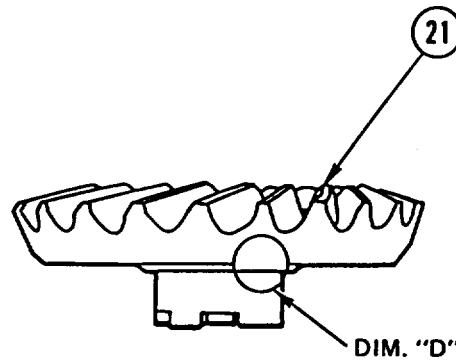


**AXLE REPAIR (CONT)**

12. MEASURE overall HEIGHT of large differential BEARING (19) and RACE (20) and RECORD in Table 2 (page 16-24) for C dimension.



13. CHECK DIMENSION etched on ring GEAR (21) and RECORD in Table 2 (page 16-24) for D dimension.

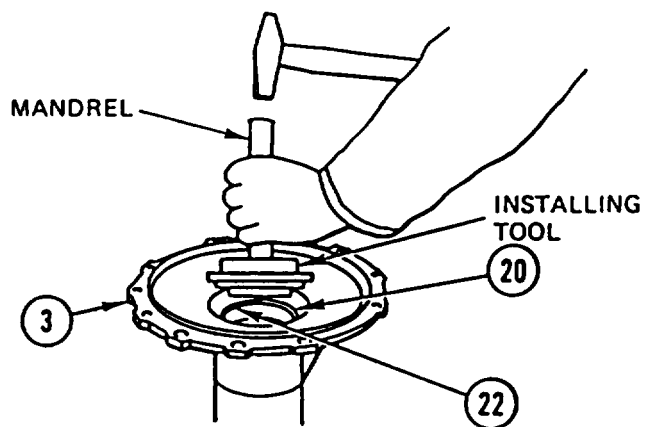


14. USING DIMENSIONS recorded in Table 2 (page 16-24), DETERMINE  $S_1$  (spacer thickness) and RECORD in Table 2 (page 16-24).

**NOTE**

Use original spacer(s) if dimensions are equal to original spacers. If not, discard and replace with new.

15. USING MANDREL and INSTALLING TOOL, INSTALL SPACER(S) (22) (thickness determined in step 14) and bearing race (20) in short axle tube housing (3).

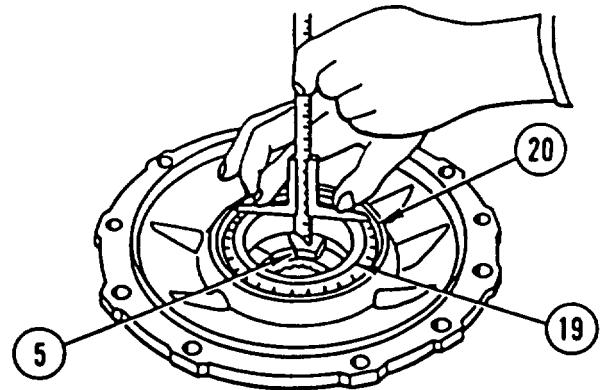


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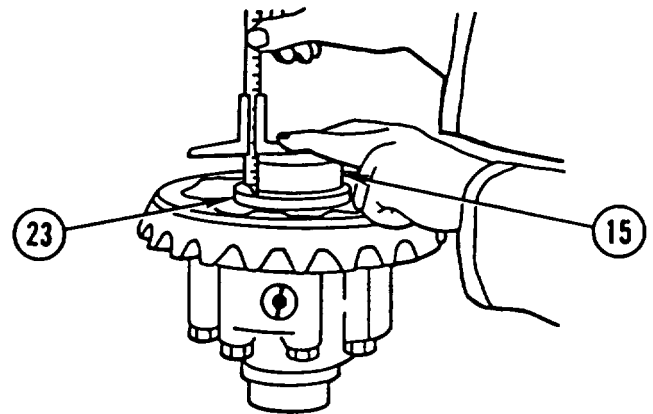
**AXLE REPAIR (CONT)**


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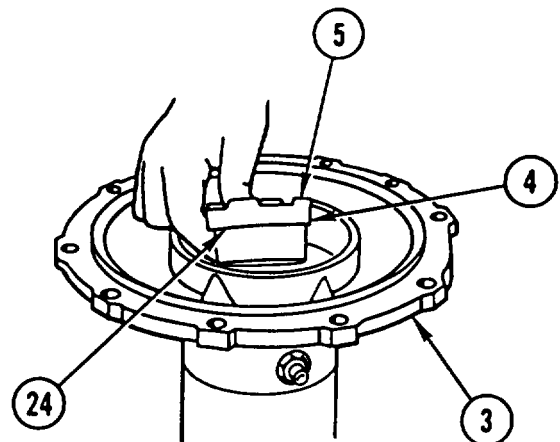
16. PLACE BEARING (19) in race (20).
17. MEASURE DISTANCE between top of BEARING (19) and top of FLANGES on follower (5) and RECORD in Table 2 (page 16-24) for E dimension.



18. MEASURE DISTANCE between top of bevel GEAR (15) and contact surface of bearing SEAT (23) and RECORD in Table 2 (page 16-24) for F dimension. ADD F and a DIMENSIONS.
19. SUBTRACT DIMENSION F + a from E to determine S<sub>2</sub> (bearing thickness).



20. REMOVE FOLLOWER (5) and brass bearing (4) from short axle tube housing (3). ADD BEARING(S) (24) determined in step 19 AND RE-INSTALL brass bearing (4) and FOLLOWER (5).

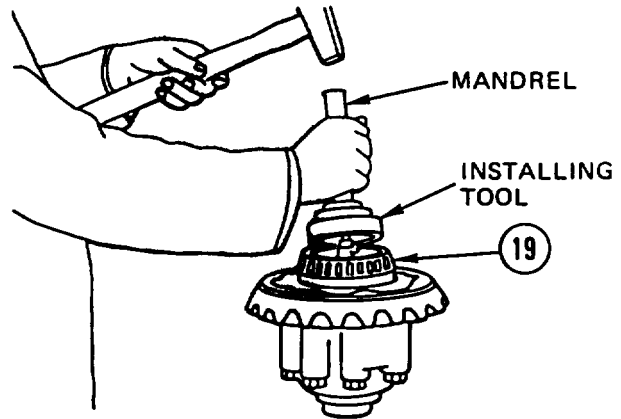


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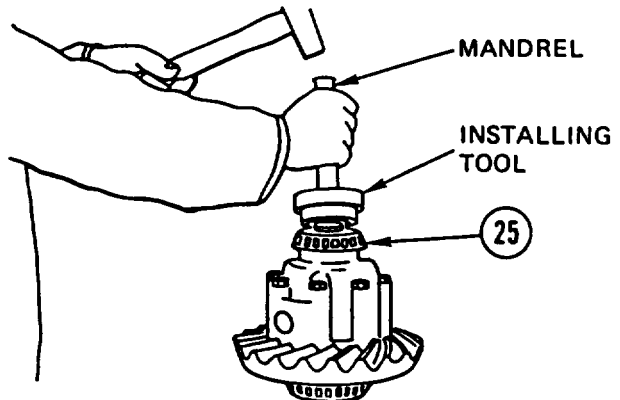
## AXLE REPAIR (CONT)

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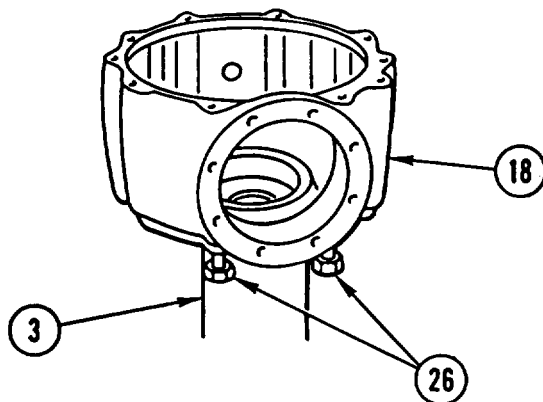
21. USING MANDREL and INSTALLING TOOL, INSTALL BEARING (19).



22. USING MANDREL and INSTALLING TOOL, INSTALL BEARING (25) half the bearing height.

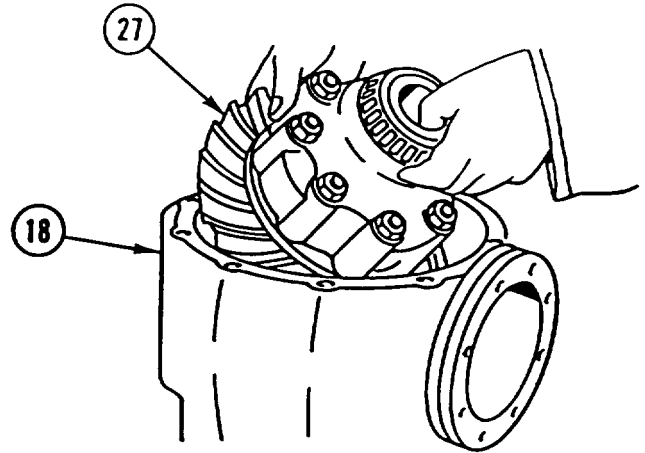


23. INSTALL mechanical differential HOUSING (18) on short axle tube housing (3). INSTALL two SCREWS (26), but DO NOT TIGHTEN.

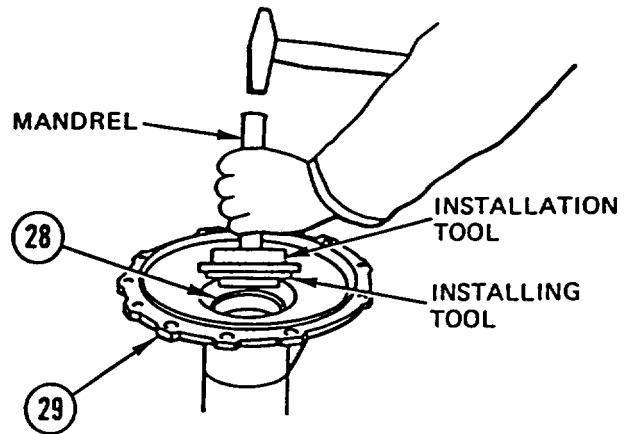


**AXLE REPAIR (CONT)**

24. CAREFULLY POSITION and INSTALL mechanical housing DIFFERENTIAL (27) in mechanical differential housing (18).



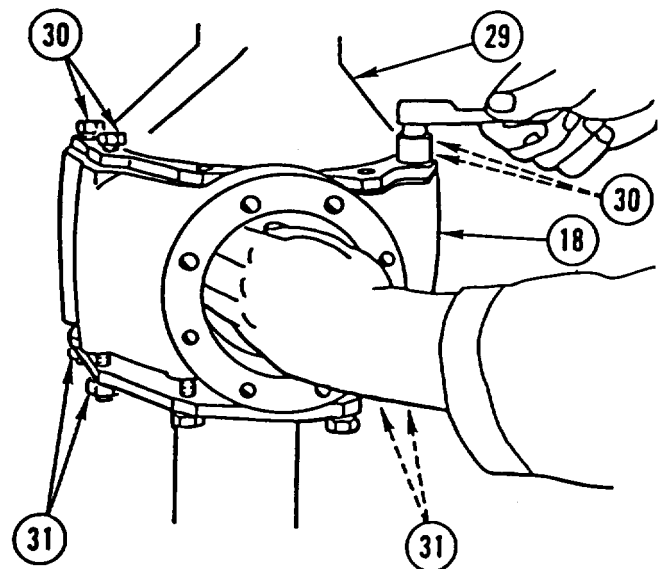
25. USING MANDREL, INSTALLATION TOOL, and INSTALLING TOOL, INSTALL bearing RACE (28) in long axle tube housing (29).



26. POSITION long axle tube HOUSING (29) on mechanical differential housing (18). INSTALL four diagonally opposite BOLTS (30) and four nuts (31) and SLOWLY TIGHTEN to 100 lb-ft (135 N·m), STEADILY TURNING ring GEAR to PULL axle tube HOUSING (29) and differential HOUSING (18) together.

27. AFTER TIGHTENING BOLTS (30), CONTINUE to TURN ring GEAR while TAPPING (with plastic-headed hammer) flange part of long axle tube housing (29) SEVERAL TIMES to RELIEVE any STRESSES.

28. REMOVE four bolts (30), four nuts (31), and long axle tube HOUSING (29).

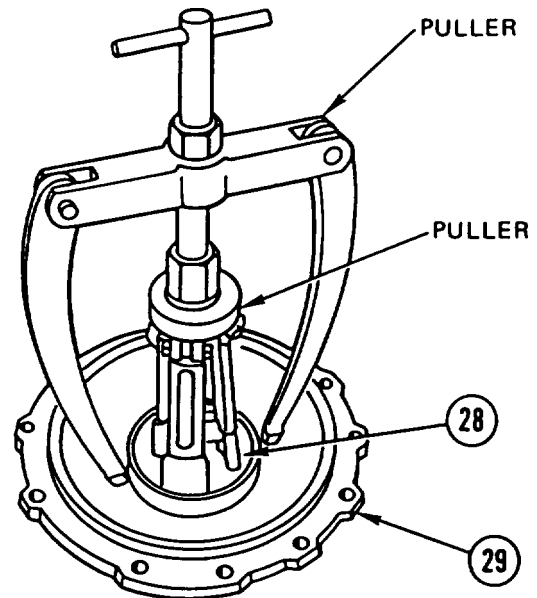


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**AXLE REPAIR (CONT)**

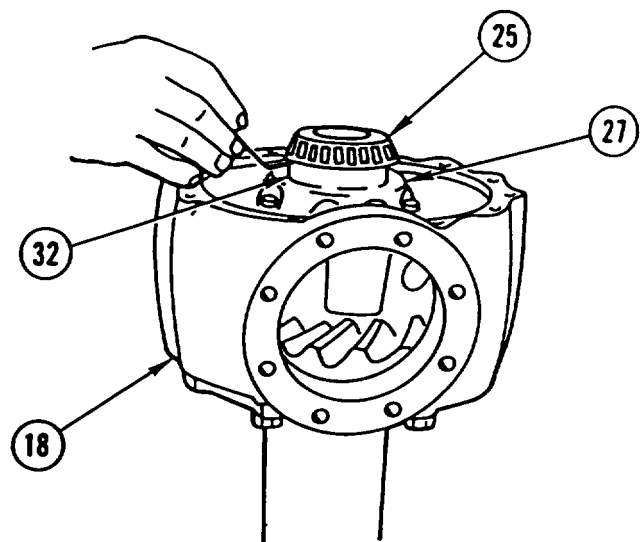
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29. USING PULLERS, REMOVE bearing RACE (28) from long axle tube housing (29).



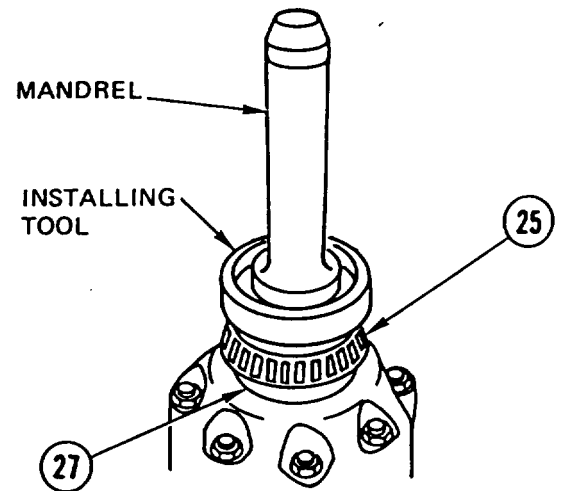
30. MEASURE DISTANCE between bottom of BEARING (25) and bearing surface SEAT (32). This measurement will be the S4 washer thickness for step 33.

31. REMOVE mechanical housing DIFFERENTIAL (27) from mechanical differential housing (18).

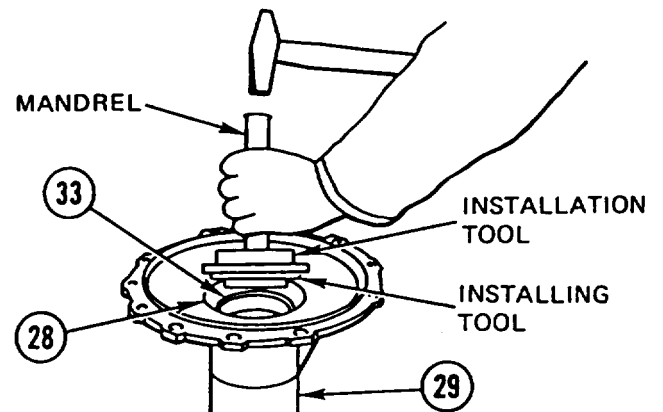


**AXLE REPAIR (CONT)**

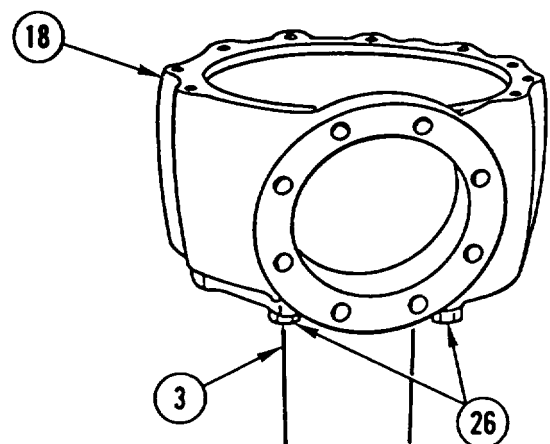
32. USING MANDREL and INSTALLING TOOL, SEAT BEARING (25) on mechanical housing differential (27).



33. USING MANDREL, INSTALLING TOOL, and INSTALLATION TOOL, INSTALL washer(s) (33) from step 30 and bearing RACE (28) in long axle tube housing (29).



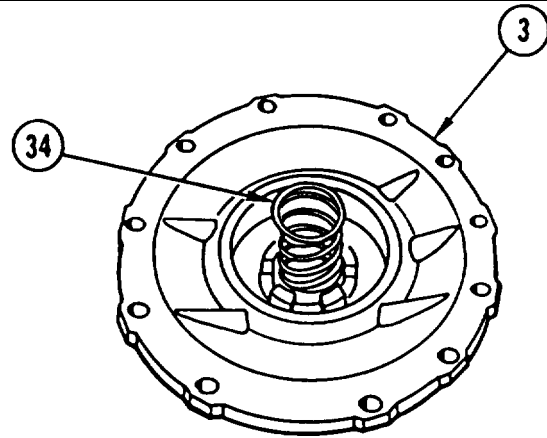
34. REMOVE two screws (26) and mechanical differential HOUSING (18) from short axle tube housing (3).



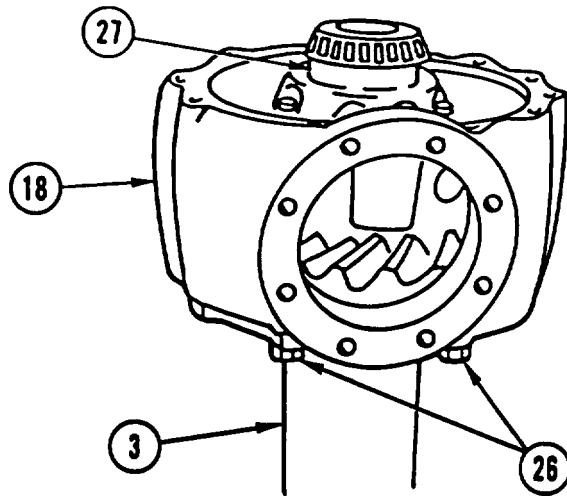


**AXLE REPAIR (CONT)**

35. INSTALL SPRING (34) in short axle tube housing (3). APPLY COAT of SEALING COMPOUND to outer mating SURFACE of axle tube housing.



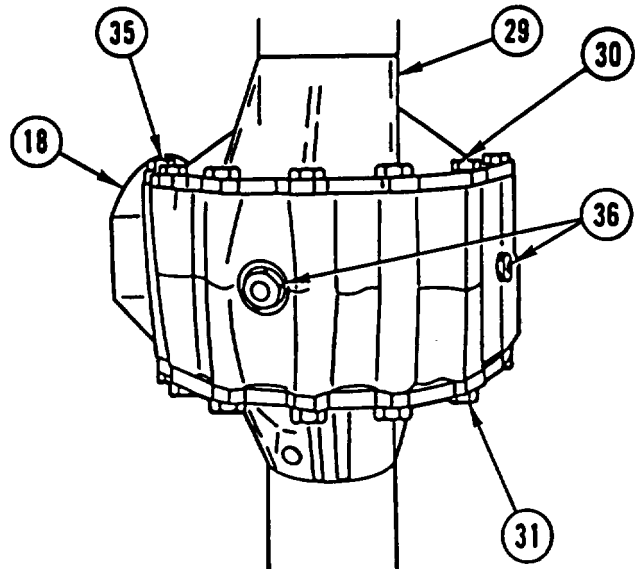
36. INSTALL mechanical differential HOUSING (18) and two screws (26) on short axle tube housing (3).



37. INSTALL mechanical housing DIFFERENTIAL (27) in mechanical differential housing (18).

38. APPLY COAT of SEALING COMPOUND to mating SURFACES of long axle tube housing (29) and mechanical differential housing (18).

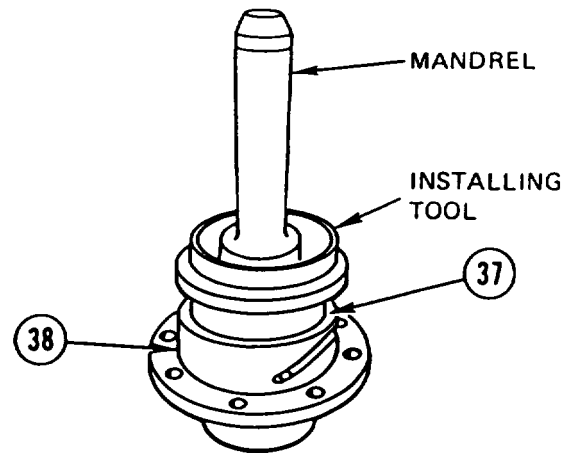
39. POSITION long axle tube HOUSING (29) on mechanical differential housing (18) and INSTALL two SCREWS (35), nine BOLTS (30), and nine NUTS (31). TIGHTEN SCREWS to 66 lb-ft (90 N•m) and BOLTS to 100 lb-ft (135 N•m).



40. IF REMOVED, INSTALL two new PLUGS (36) in mechanical differential housing (18).

**AXLE REPAIR (CONT)**

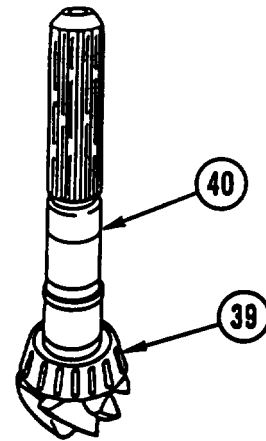
41. USING MANDREL and INSTALLING TOOL, INSTALL bearing RACE (37) in bearing body (38).



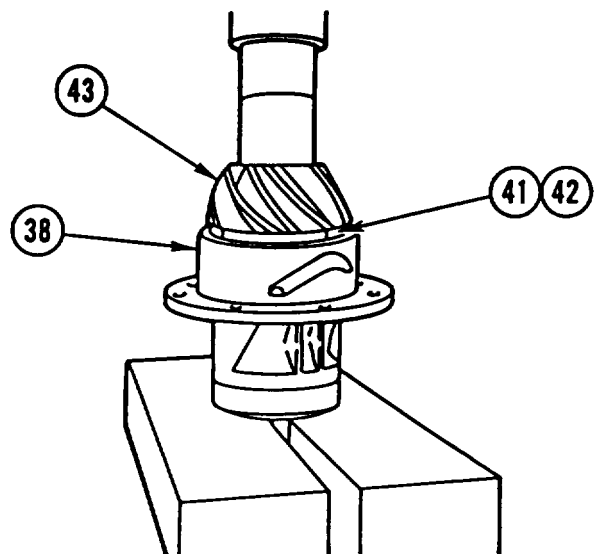
**CAUTION**

Pinion shaft must have same serial number as bevel gear to prevent damage to equipment.

42. USING suitable PRESS, INSTALL BEARING (39) on bevel gear (40).

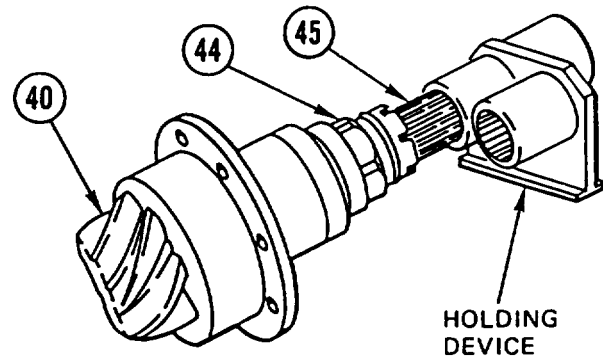


43. USING suitable PRESS, INSTALL ring spacer (41), new tube spacer (42), and bevel GEAR and bearing (43) in bearing body (38).

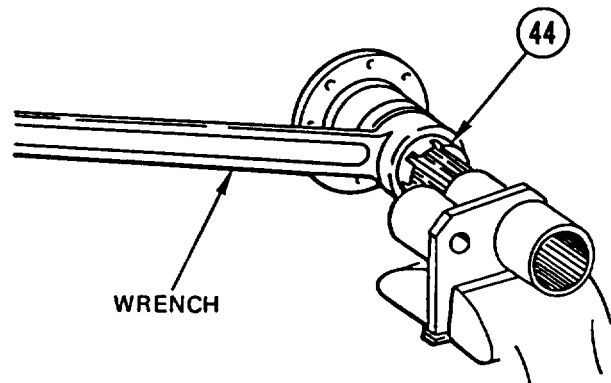


## AXLE REPAIR (CONT)

44. INSTALL NUT (44) on bevel gear (40).
45. INSTALL pinion SHAFT (45) in holding device.



46. USING WRENCH, TIGHTEN NUT (44) until there is no play.

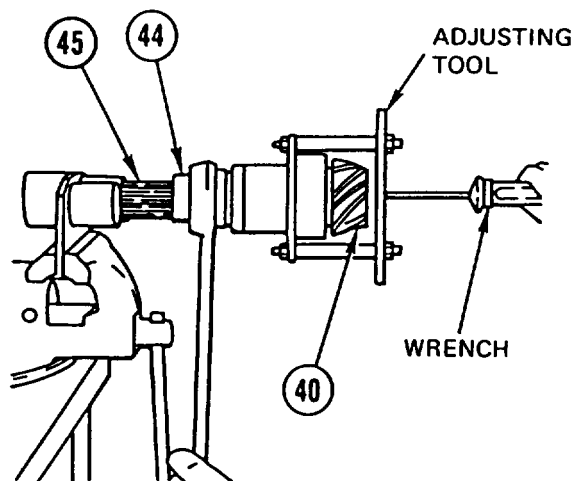


47. INSTALL ADJUSTING TOOL and WRENCH on pinion shaft (45).

**NOTE**

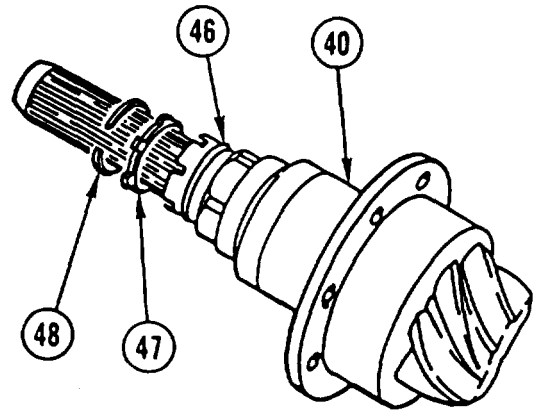
If specified breakaway force is exceeded, repeat steps 42 thru 47, installing new tube spacer.

48. TIGHTEN NUT (44) until breakaway force of 26-31 lb-in. (3.0-3.5 N•cm) is obtained.
49. REMOVE bevel GEAR (40) from holding device and adjusting tool.

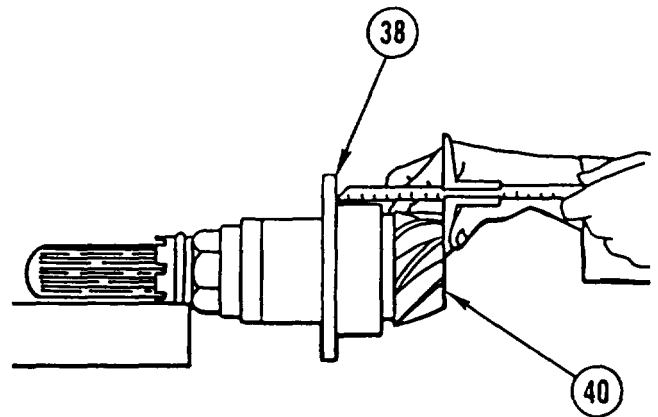


**AXLE REPAIR (CONT)**

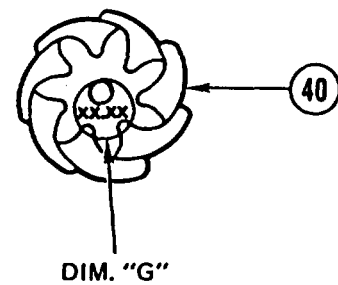
50. INSTALL new packing (46), LOCK (47), and retaining ring (48) on bevel gear (40).



51. USING suitable INDICATOR, MEASURE DISTANCE from base of bearing BODY (38) and end of bevel GEAR (40) and RECORD in Table 2 (page 16-24) for H dimension.



52. CHECK DIMENSION etched on end face of bevel GEAR (40) and RECORD in Table 2 (page 16-24) for G dimension. ADD G and H DIMENSIONS and RECORD in Table 2 (page 16-24).



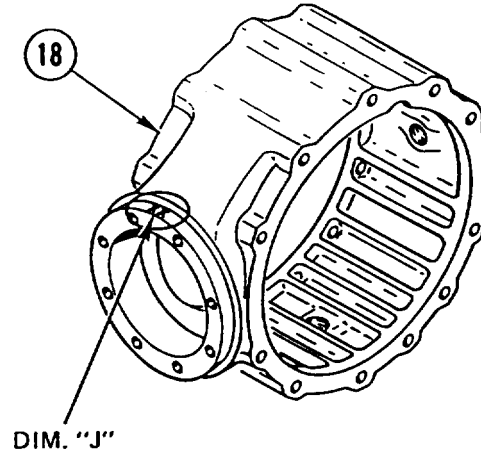
## AXLE REPAIR (CONT)

53. CHECK DIMENSION etched on top of mechanical differential HOUSING (18) and RECORD in Table 2 (page 16-24) for J dimension.

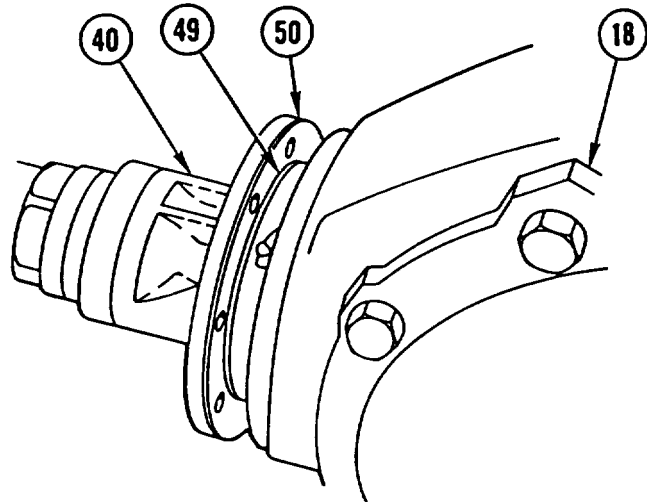
### NOTE

If dimension amounts to only two places (XX), it will be necessary to prefix this with the constant 176 ("J" = 176.XX). If dimension  $xx = 00$ , you will require the constant 177.

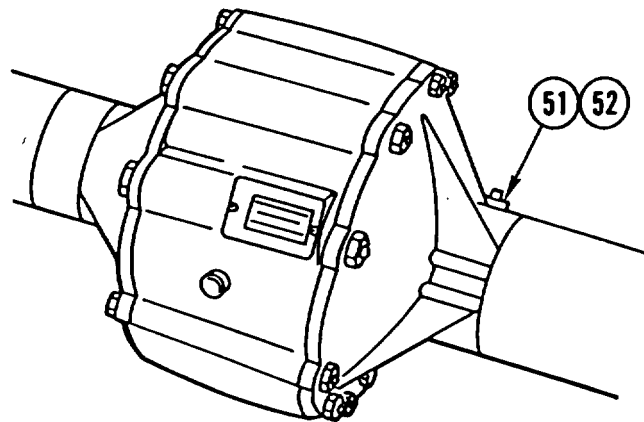
54. TO DETERMINE washer THICKNESS for bevel gear, SUBTRACT J DIMENSION from G + H DIMENSION in accordance with Table 2 (page 16-24).



55. INSTALL washer(s) (49) (determined in step 54), new sealing cord (50), and bevel GEAR (40) in mechanical differential housing (18) with oil ports to top of housing (18).



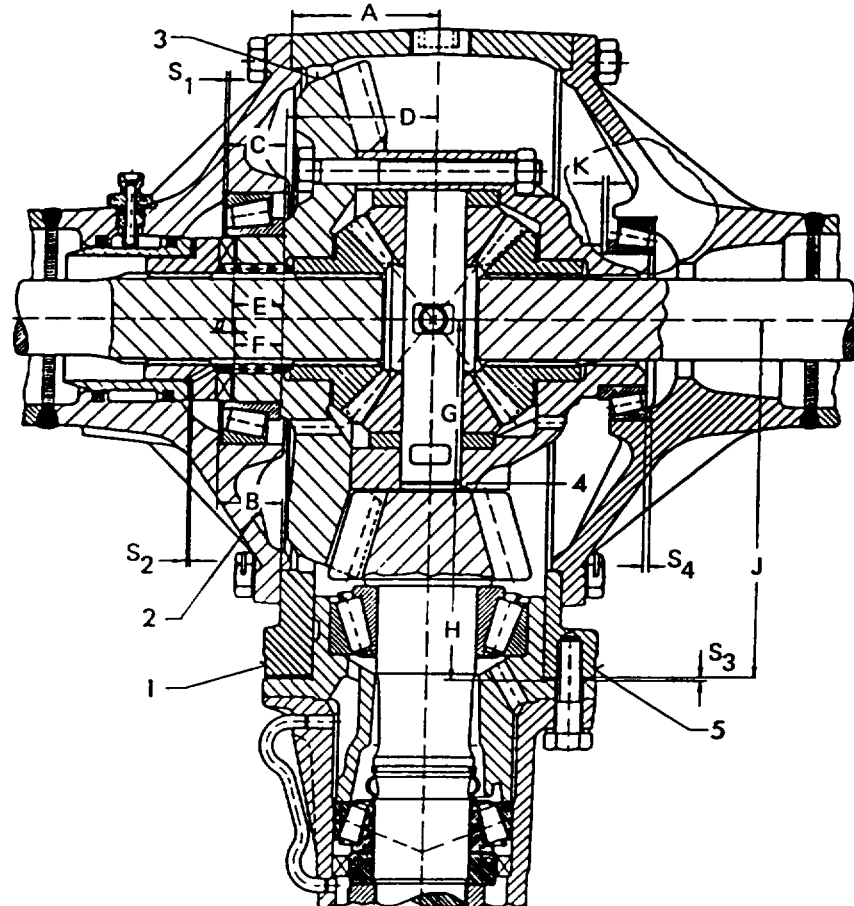
56. INSTALL new seal RING (51) and FITTING (52).
57. INSTALL STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE or REAR AXLE FINAL DRIVE HUB GEARS AND AXLE SHAFT (page 5-16 or 6-15).



**AXLE REPAIR (CONT)**

**Table 1. Worksheet for Spacer, Bearing, and Washer Thickness**

**EXPLANATIONS (dimensions in mm)**



- |   |  |                           |
|---|--|---------------------------|
| A | Etched in center axle housing (1)  | e.g., 0.35 in. (0.90 mm)  |
| B | Stamped in axle tube at lock side (2)  | e.g., 1.30 in. (33.15 mm) |
| C | Overall height of large taper roller bearing race, measured on a surface plate                             | e.g., 1.14 in. (29.00 mm) |
| D | Etched in ring gear (3)  | e.g. 3.02 in. (76.90 mm)  |
| E | Measurement from collar of inner bearing race to upper edge of follower, measured with depth gage          | e.g., 1.37 in. (34.80 mm) |
| F | Measurement from upper claw edge of ring gear to contact surface of bearing at ring gear                   | e.g., 1.31 in. (33.40 mm) |
| G | Measurement from end face of drive pinion to center of differential etched in end face of drive pinion (4) | e.g., 3.39 in. (86.15 mm) |

## AXLE REPAIR (CONT)

**Table 1. Worksheet for Spacer, Bearing, and Washer Thickness (Cont)**

H	Measurement from end face of drive pinion to pinion flange; measured with depth gage	e.g., 3.62 in. (92.15 mm)
J	Measurement from center of differential to flange is stamped in top side of axle at center of axle housing (5)*	e.g., 0.03 in. (0.77 mm)
K	Measurement from inner bearing race to contact surface of bearing at differential housing	

Important: All readings differ from axle to axle.

\* Insert the constant 176 before the measurement (e.g., 0.77 mm), and constant 177 for dimension 00.

**Table 2. Formula to Determine Spacer, Bearing, and Washer Thickness**

Note readings and calculate spacer, bearing, and washer thickness.

- Spacer thickness  $S_1$ , for large taper roller bearing at lock side determines backlash and contact pattern together with washer thickness  $S_3$ .

$$S_1 = (A + B) - (C + D)$$

$A =$	$C =$	$(A + B) =$
$+ B =$	$+ D =$	$-(C + D) =$
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>
$(A + B) =$	$(C + D) =$	<hr style="width: 50%; margin: 0 auto;"/> $S_1 =$

- Bearing thickness  $S_2$  between piston and differential lock determines claw play (a) of differential lock at off position.

$$S_2 = E - (F + a)$$

$E =$	$F =$	
$-(F + a) =$	$+ a =$	$(a = \text{claw play } 0.001 \text{ in.}$
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>	$\pm 0.007 \text{ in. } (0.5 \pm 0.2 \text{ mm}))$
<hr style="width: 50%; margin: 0 auto;"/> $S_2 =$	$F + a =$	

- Bearing thickness  $S_3$  at flange of drive pinion bearing determines amount by which drive pinion engages ring gear.

$$S_3 = (G + H) - J$$

$G =$	$(G + H) =$
$+ H =$	$- J =$
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>
$(G + H) =$	<hr style="width: 50%; margin: 0 auto;"/> $S_3 =$

- Washer thickness  $S_4$  at small taper roller bearing for front and rear axles  $S_4 = K$ .

## Section II. STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR

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### STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR

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This task covers: a. Disassembly b. Inspection c. Assembly

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#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A63  
 Installing Tool, P/N 387 589 01 15 00  
 Installation Tool, P/N 387 589 02 15 00  
 Installing Tool, P/N 424 589 01 43 00  
 Installing Tool, P/N 406 589 03 43 00  
 Mandrel, P/N 406 589 04 15 00

##### References:

TM 9-214

##### Equipment Condition:

Reference	Condition Description
Page 5-16	Steering Knuckle and Front Axle Final Drive Removed

##### Materials/Parts:

Seal  
 Ring, Spacer  
 Seal  
 Bearing  
 Compound, Sealing      Appendix B, Item 16  
 Shim(s)

##### General Safety Instructions:

#### 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.

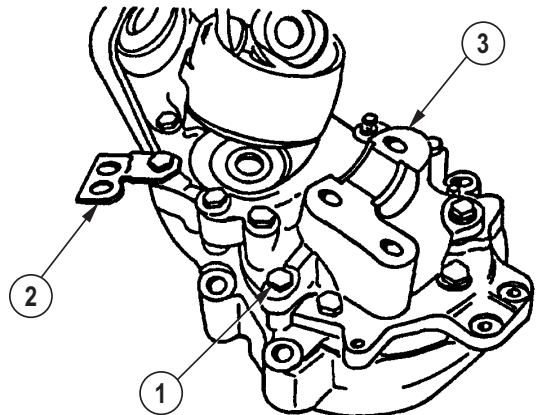
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#### DISASSEMBLY

##### NOTE

Procedure is the same for both sides of axles.

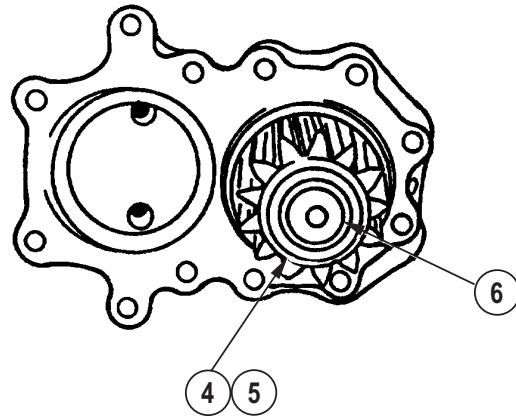
1. REMOVE 11 screws (1), bracket (2), and HOUSING (3).





## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

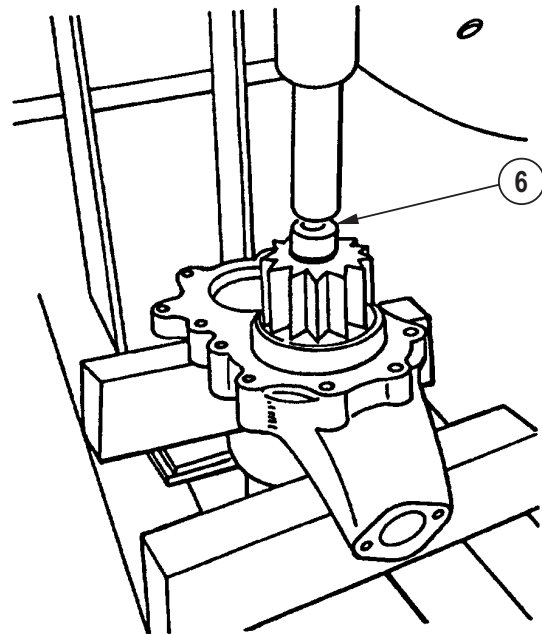
2. REMOVE retaining ring (4) and any WASHER(S) (5) from yoke (6). DISCARD WASHER(S), if present (no longer required).



### CAUTION

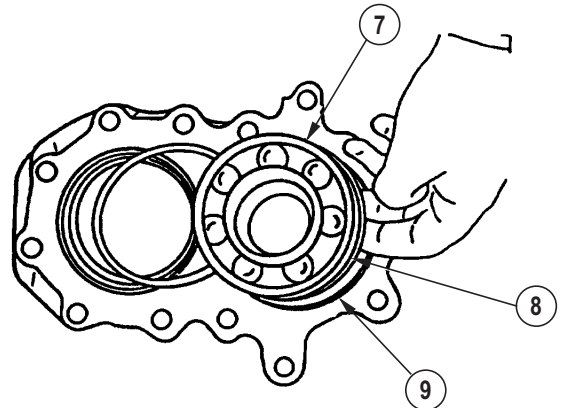
Support yoke to prevent dropping and causing damage to equipment.

3. USING suitable PRESS, REMOVE YOKE (6).



## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

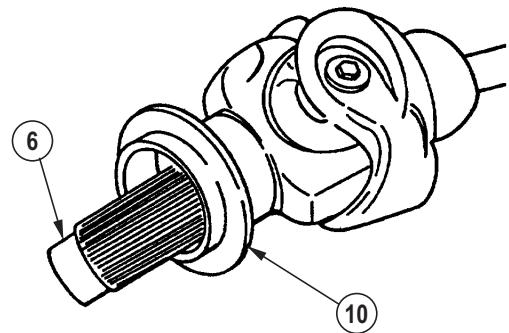
4. USING suitable PULLER, REMOVE bearing (7), SHIM(S) (8), and SEAL (9). DISCARD SEAL and SHIM(S).



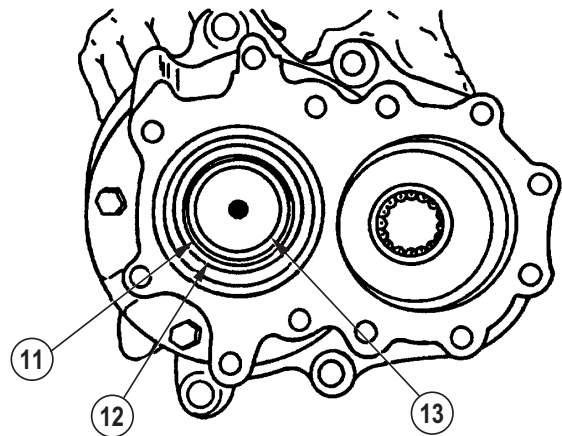
### CAUTION

Support yoke to prevent dropping and causing damage to equipment.

5. USING suitable PRESS, REMOVE spacer RING (10) from yoke (6). DISCARD spacer RING.

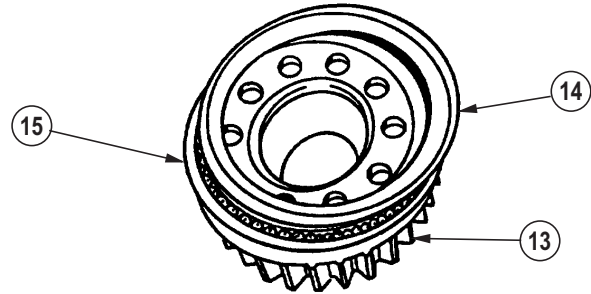


6. REMOVE retaining ring (11) and SPACER (12) from gear (13).

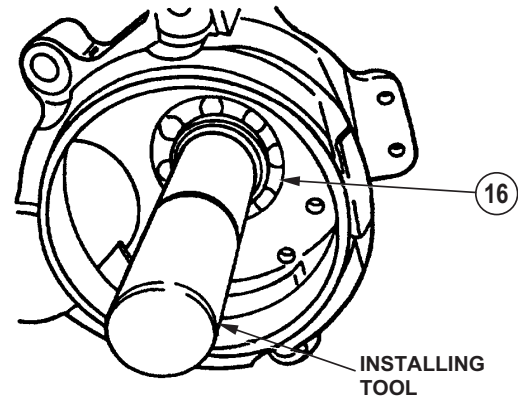


## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

7. USING suitable PRESS, REMOVE GEAR (13), seal (14), and bearing (15). DISCARD SEAL and BEARING.



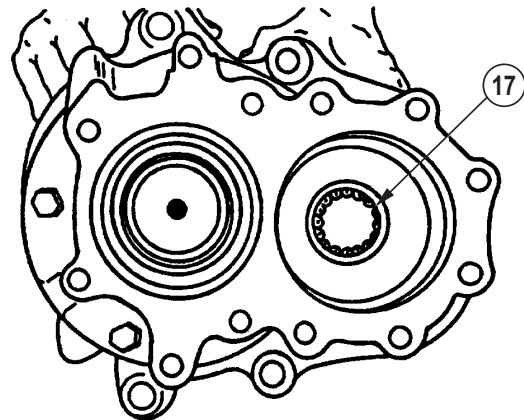
8. USING INSTALLING TOOL, REMOVE BEARING (16).



9. USING suitable PULLER, REMOVE BEARING (17).

### INSPECTION

1. Inspect housings for galling, cracks, or stripped threads.
2. Inspect gears for cracks or missing teeth.
3. Inspect bearings (TM 9-214).



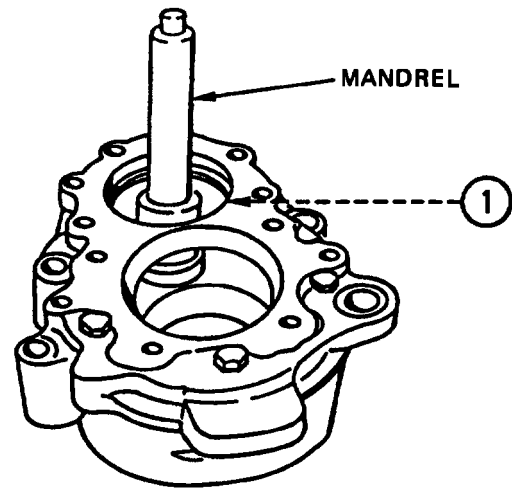
## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

### ASSEMBLY

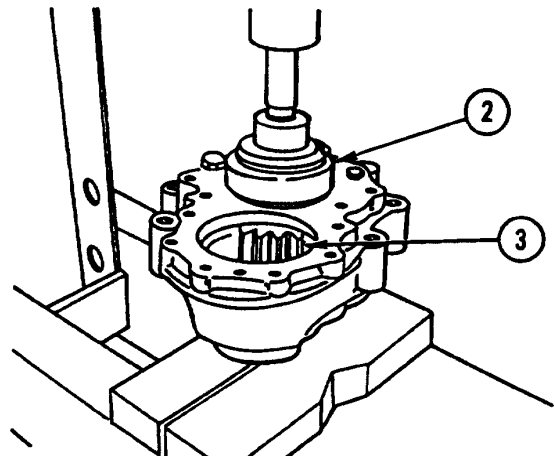
#### NOTE

Procedure is the same for both sides of axle.

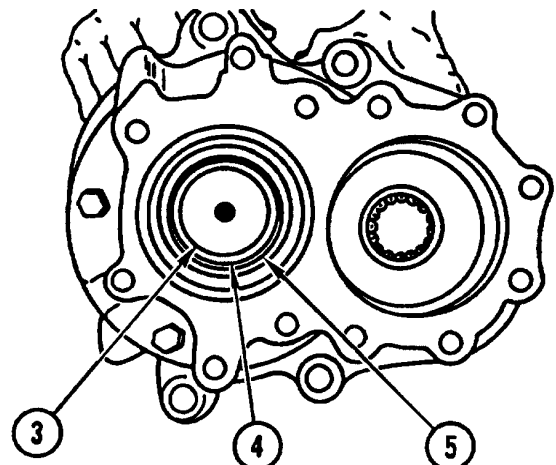
1. USING MANDREL, INSTALL BEARING (1).



2. USING suitable PRESS, INSTALL bearing (2) and GEAR (3).

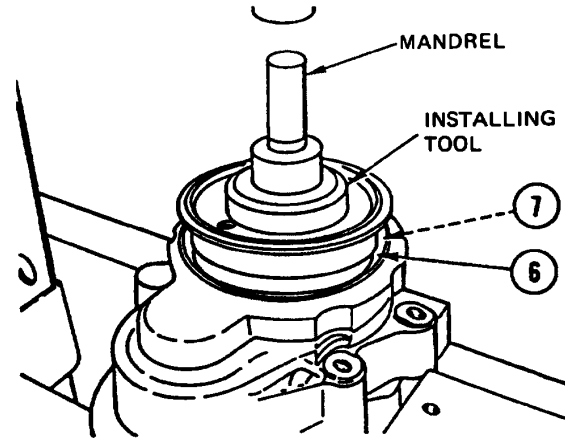


3. INSTALL SPACER (4) and retaining ring (5) on gear (3).
4. TURN ASSEMBLY OVER.

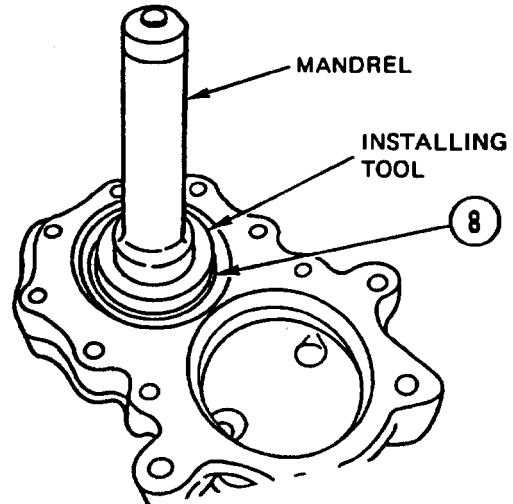


## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

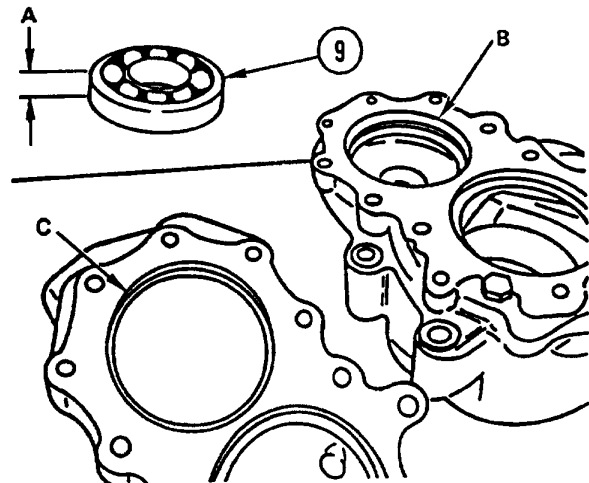
5. USING INSTALLING TOOL and MANDREL, INSTALL new BEARING (6). DISCARD plastic roller RETAINER.
6. USING INSTALLING TOOL and MANDREL in step 5, INSTALL new SEAL (7).



7. USING INSTALLING TOOL and MANDREL, INSTALL new SEAL (8).



8. MEASURE and RECORD DIMENSION A for bearing (9).
9. MEASURE and RECORD DIMENSIONS B and C.
10. ADD B and C.
11. SUBTRACT TOTAL of B and C in STEP 10 from dimension A in STEP 8 to determine shim thickness.

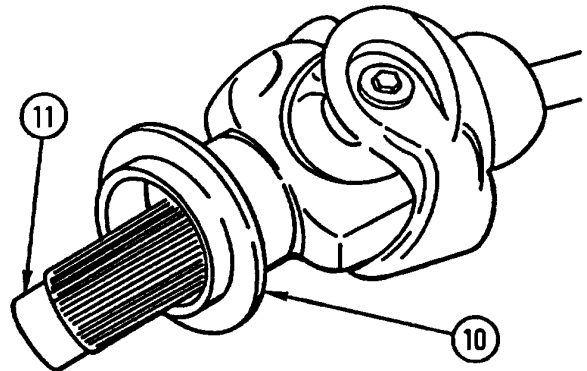


## STEERING KNUCKLE AND FRONT AXLE FINAL DRIVE REPAIR (CONT)

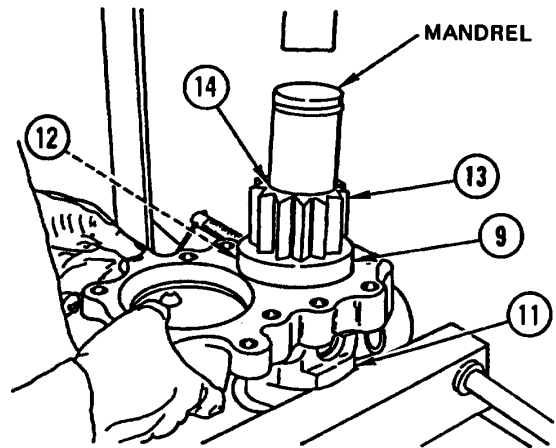
### WARNING

Spacer ring will be hot enough to burn you on contact. Wear heat resistant gloves when handling hot ring.

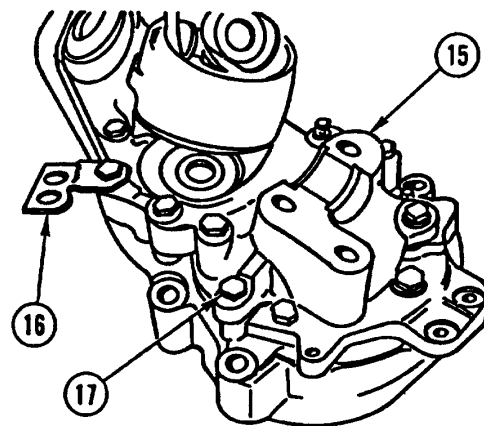
12. HEAT new spacer RING (10) to 195°F (90°C).
13. INSTALL spacer RING (10) on yoke (11).



14. INSTALL SHIM(S) (12) determined in step 11.
15. USING suitable PRESS and MANDREL, INSTALL BEARING (9), gear (13), and yoke (11).
16. INSTALL retaining RING (14).



17. APPLY COAT of SEALING COMPOUND to mating SURFACE of housing (15) and INSTALL HOUSING (15), bracket (16), and 11 screws (17). TIGHTEN SCREWS evenly to 66-73 lb-ft (90-100 N.m).



### NOTE

Follow-on Maintenance:  
Install steering knuckle and front axle final drive (page 5-16).



## CHAPTER 17 BRAKE SYSTEM AND TIRES REPAIR INSTRUCTIONS

### OVERVIEW

This chapter contains maintenance instructions for repair of the brake system and tires. A list of sections contained in this chapter is shown below.

		Page
Section I.	Brake Disc Repair . . . . .	17-1
Section II.	Front and Rear Brake Calipers Repair . . . . .	17-3
Section III.	Brake Master Cylinder Repair... . . . .	17-17
Section IV.	Brake Pressure Regulator (ALB Valve) Repair . . . . .	17-22
Section V.	Air Brake Booster Repair, . . . . .	17-24
Section VI.	Fluid Regulating Valve Repair... . . . .	17-28
Section VII.	Antifreeze Device Repair . . . . .	17-39
Section VIII.	Tandem Valve Repair . . . . .	17-44
Section IX.	Tire Repair . . . . .	17-48

### Section I. BRAKE DISC REPAIR

---

#### BRAKE DISC REPAIR

This task covers: Repair

---

#### INITIAL SETUP

**Tools**

Shop Equipment, SC 4910-95-CL-A31

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Brake Disc and Hub Removed



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## BRAKE DISC REPAIR (CON'T)

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### **REPAIR**

#### **NOTE**

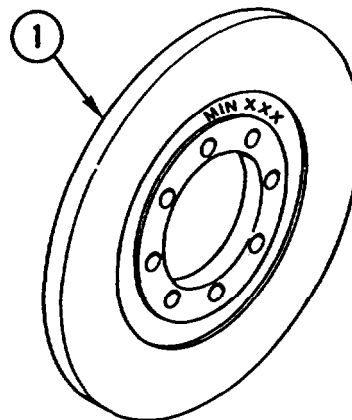
Procedure is the same for all brake discs.

1. Measure thickness of disc (1) at deepest groove on each side. If either of these measurements or combination of both is less than minimum allowable thickness, reject disc (1). Minimum allowable thickness is stamped on inside surface of disc (1).
2. If thickness of disc (1) is greater than minimum allowable, machine disc (1) evenly on both sides to minimum thickness allowed.

#### **NOTE**

Follow-on Maintenance:

Install brake disc and hub (TM 5-2420-224-20).



## Section II. FRONT AND REAR BRAKE CALIPERS REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the front and rear brake calipers. A list of tasks contained in this section is shown below.

	Page
Front Brake Caliper Repair . . . . .	17-3
Rear Brake Caliper Repair... . . . .	17-7

### FRONT BRAKE CALIPER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit; SC 5180-90-CL-N26
- Holder, P/N 406 589 04 31 00
- Installation Tool, P/N 406 589 09 43 00
- Installation Tool, P/N 000 589 00 40 00
- Installation Tool, P/N 406 589 09 43 00

**General Safety Instructions:**

**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.

**Materials/Parts:**

Kit

**References:**

TM 5-2420-224-20

**Equipment Condition:**

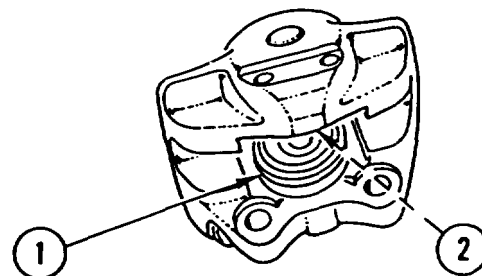
Reference	Condition Description
TM 5-2420-224-20	Front Brake Calipers Removed

#### DISASSEMBLY

**NOTE**

Procedure is the same for all four front brake calipers.

1. REMOVE and DISCARD two CAPS (1 and 2).



---

## FRONT BRAKE CALIPER REPAIR (CONT)

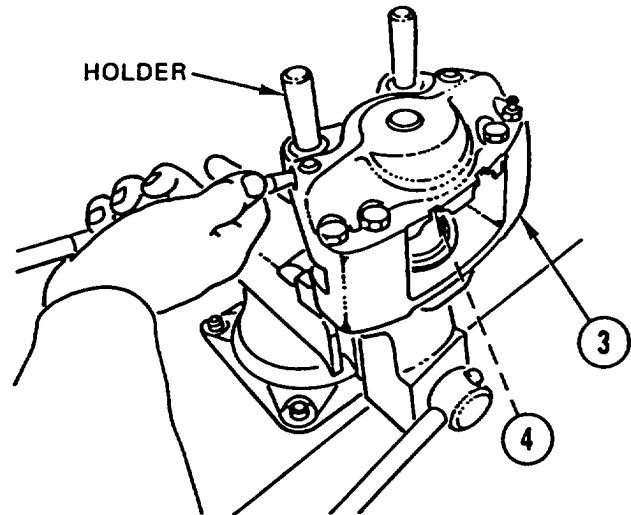
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2. INSTALL brake CALIPER (3) on holder.

**WARNING**

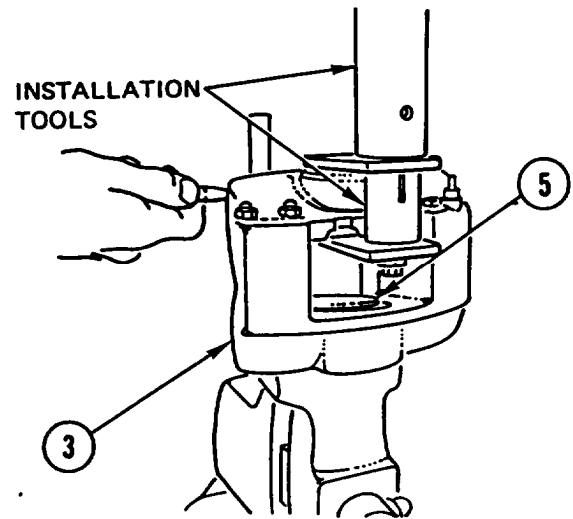
Place small block of wood between pistons during removal to prevent injury to personnel.

3. USING regulated AIR SUPPLY of 5 psi (34.5 kPa) APPLIED into brake LINE connecting point, REMOVE PISTON (4).



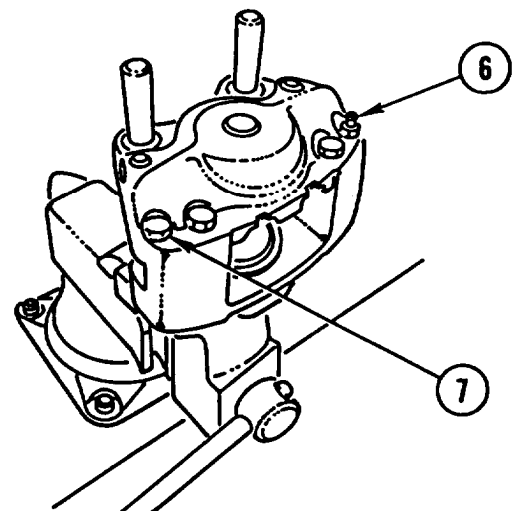
4. INSTALL INSTALLATION TOOLS over open side of brake caliper (3).

5. USING regulated AIR SUPPLY of 5 psi (34.5 kPa) APPLIED into brake LINE connecting point, REMOVE PISTON (5).



6. IF DAMAGED, REMOVE bleeder VALVE (6).

7. REMOVE four SCREWS (7).

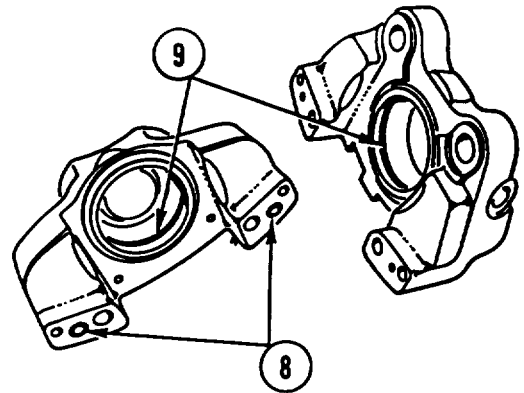


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**FRONT BRAKE CALIPER REPAIR (CONT)**

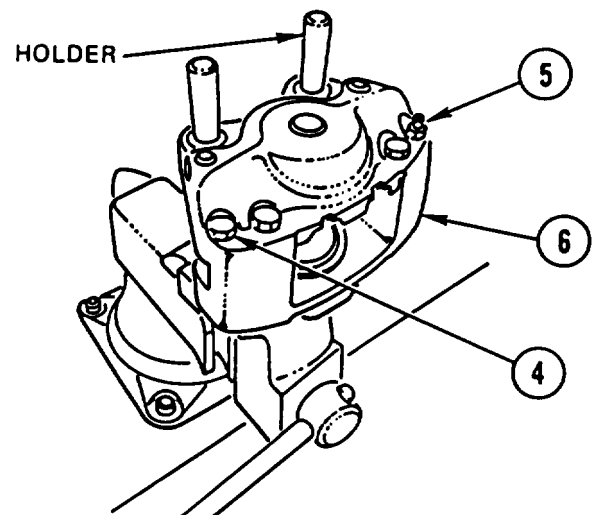
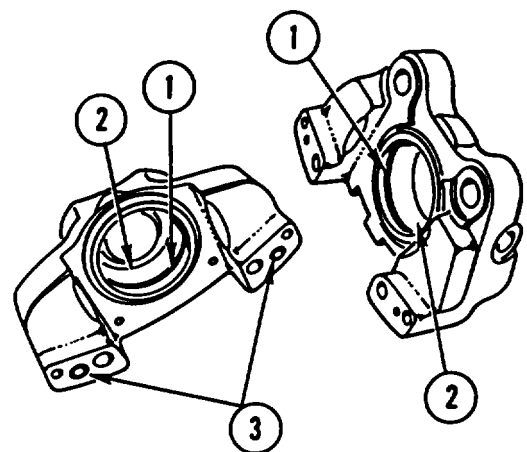

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8. REMOVE and DISCARD two PACKINGS (8).
9. REMOVE and DISCARD two PACKINGS (9).


**ASSEMBLY**
**NOTE**

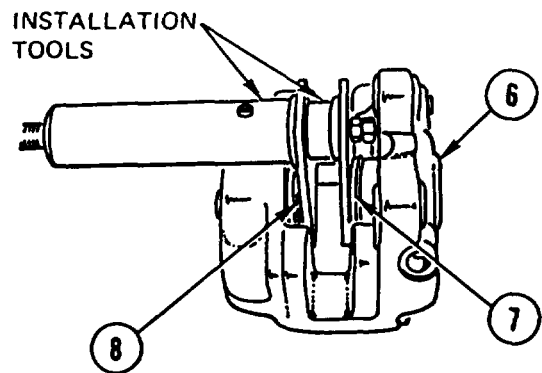
Procedure is the same for all four front brake calipers.

1. APPLY COAT of SILICONE (in Kit), to two new PACKINGS (1) and BORES (2) and INSTALL two PACKINGS (1).
2. INSTALL two new PACKINGS (3).
3. INSTALL four SCREWS (4) and TIGHTEN to 55-61 lb-ft (75-83 N•m).
4. IF REMOVED, INSTALL new bleeder VALVE (5),
5. INSTALL brake CALIPER (6) on holder.



## FRONT BRAKE CALIPER REPAIR (CONT)

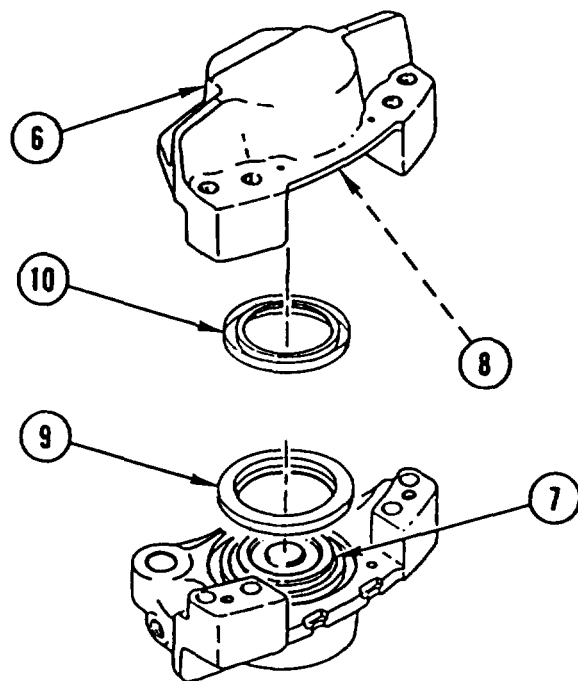
6. USING INSTALLATION TOOLS, INSTALL PISTON (7) in brake caliper (6) up to groove on piston (7).
7. REPEAT STEP 6 for piston (8).



8. APPLY COAT of SILICONE (in Kit) to two new CAPS (9 and 10) and INSTALL in brake caliper (6) and groove on pistons (7 and 8).

### NOTE

Follow-on Maintenance:  
 Install front brake calipers (TM 5-2420-224-20).  
 Bleed brake system (TM-5-2420-224-20).



---

## REAR BRAKE CALIPER REPAIR

---

This task covers: a. Disassembly b. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Bushing, P/N 406 589 04 14 00  
 Bushing P/N 406 589 13 43 00  
 Holder, P/N 406 589 04 31 00  
 Installation Tool, P/N 000 589 52 43 00  
 Installation Tool. P/N 000 589 00 40 00  
 Installation Tool; P/N 406 589 11 43 00  
 Installation Tool, P/N 406 589 08 43 00  
 Installing Tool, P/N 406 589 12 43 00  
 Wrench, P/N 001 589 70 09 00

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Rear Brake Calipers Removed

#### Materials/Parts:

Nut, Lock

Kit

Kit

Kit

Kit

Rags

Appendix B, Item 40

#### General Safety Instructions:

#### WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

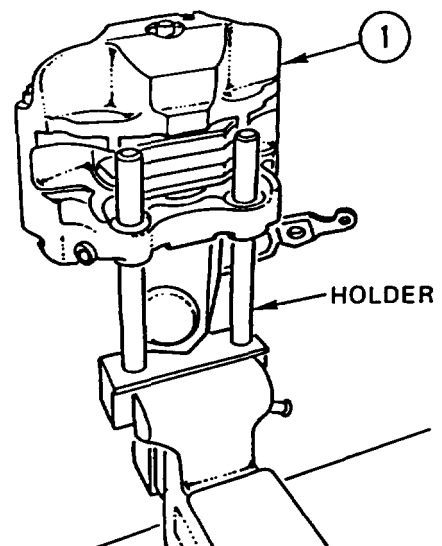
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### DISASSEMBLY

#### NOTE

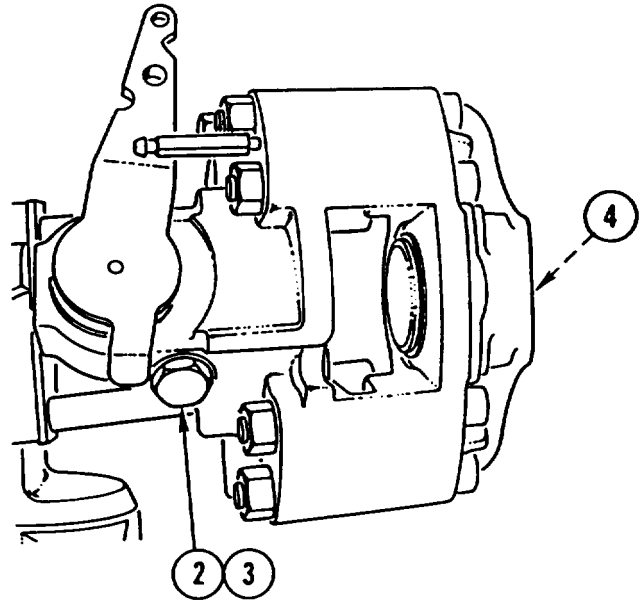
Procedure is the same for both rear brake calipers except as noted.

1. INSTALL brake CALIPER (1) on holder.

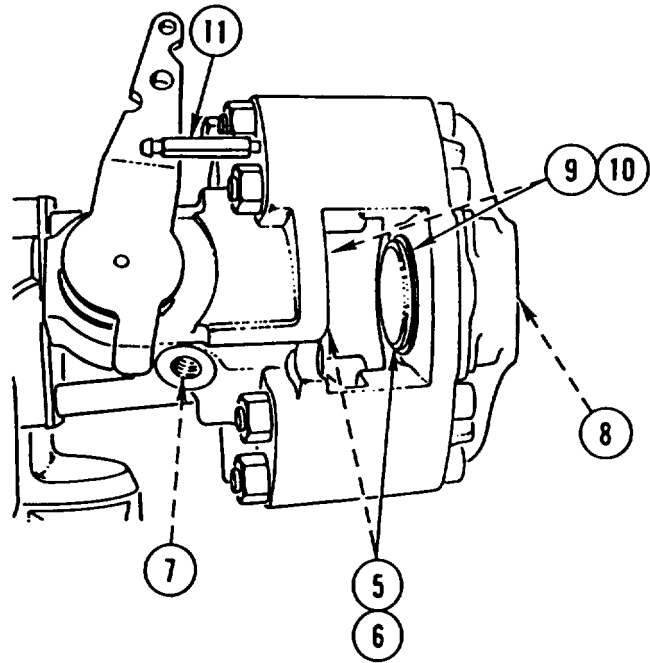


## REAR BRAKE CALIPER REPAIR (CONT)

2. REMOVE PLUG (2), seal ring (3), and lock nut (4). DISCARD seal RING and lock NUT.

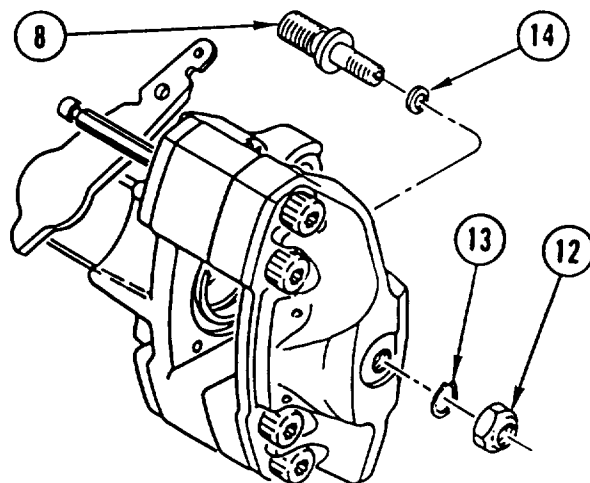


3. TO REMOVE two CAPS (5 and 6) on LEFT caliper, TURN adjusting SHAFT (7) and adjusting PIN (8) to LEFT until two pistons (9 and 10) are fully drawn in. REMOVE and DISCARD two CAPS (5 and 6).
4. TO REMOVE two CAPS (5 and 6) on RIGHT caliper, TURN adjusting SHAFT (7) and adjusting PIN (8) to RIGHT until two pistons (9 and 10) are fully drawn in. REMOVE and DISCARD two CAPS (5 and 6).
5. REMOVE two PISTONS (9 and 10) by REVERSING either STEP 3 or 4 depending on which caliper is being disassembled.
6. IF DAMAGED, REMOVE bleeder VALVE (11).

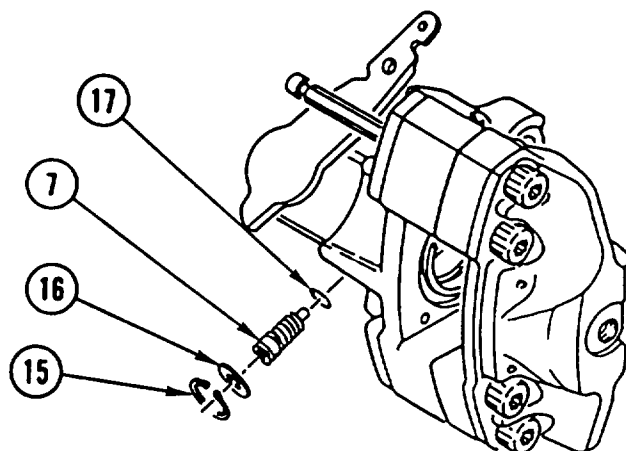


## REAR BRAKE CALIPER REPAIR (CONT)

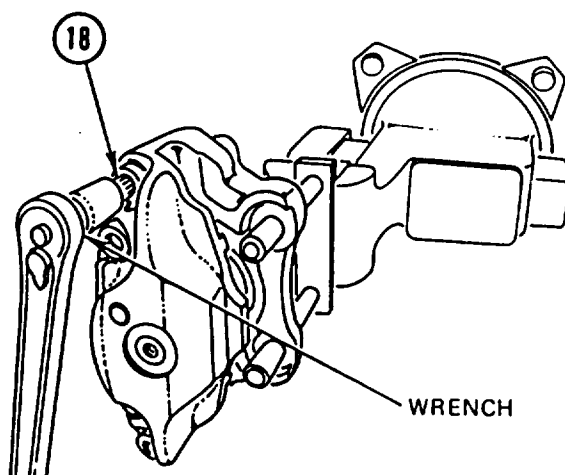
7. ON LEFT CALIPER, REMOVE nut (12), retaining ring (13), adjusting PIN (8), and packing (14). DISCARD PACKING.



8. REMOVE lock ring (15), shim (16), adjusting SHAFT (7), and packing (17). DISCARD PACKING.



9. USING WRENCH, REMOVE four SCREWS (18).

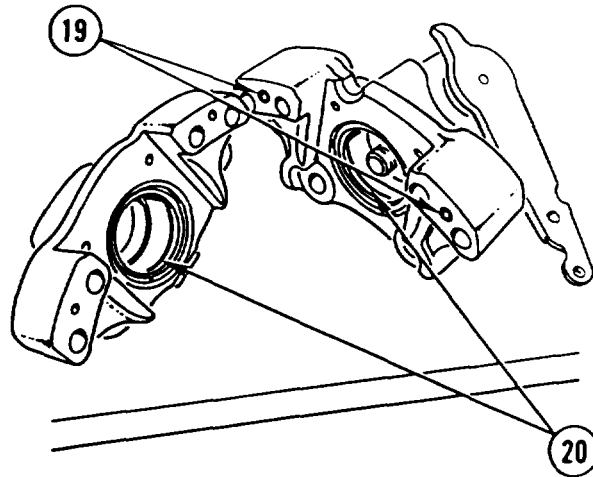




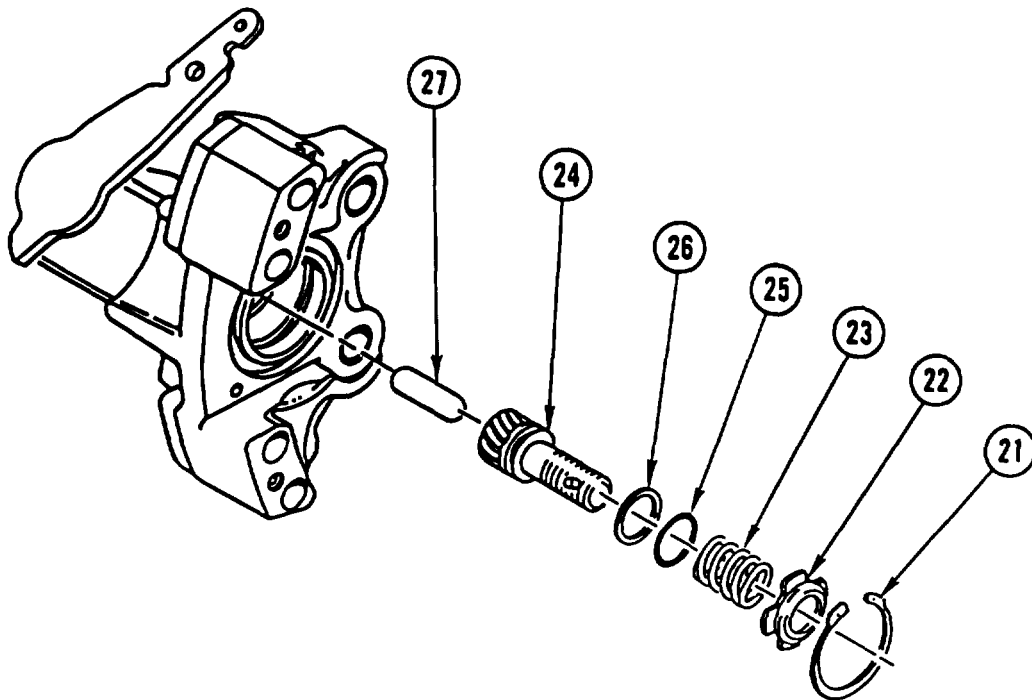
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**REAR BRAKE CALIPER REPAIR (CONT)**

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10. REMOVE and DISCARD four PACKINGS (19 and 20)



**WARNING**

Parts are under spring tension. Wear safety goggles and clear area of unnecessary personnel. Failure to do so could result in injury to personnel.

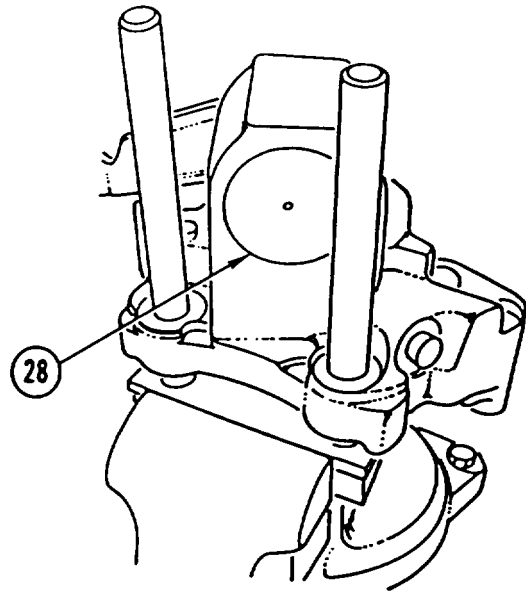
11. USING BUSHING, REMOVE retaining ring (21), spring seat (22), spring (23), adjusting gear (24), packing (25), seal (26), and ADJUSTER (27). DISCARD PACKING and SEAL.

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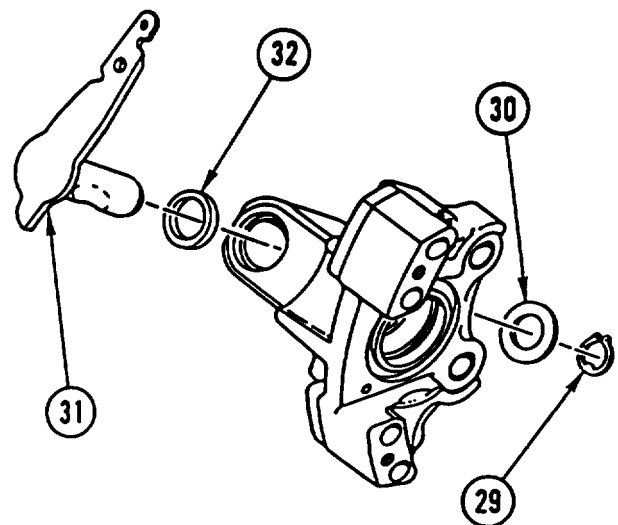
**REAR BRAKE CALIPER REPAIR (CONT)**

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12. USING 0.39-in. (10-mm) DRILL, DRILL HOLE into center of sealing washer (28). PRY sealing WASHER out USING PUNCH. DISCARD sealing WASHER.



13. REMOVE retaining ring (29), washer (30), and LEVER (31).
14. REMOVE and DISCARD SEAL (32).



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## REAR BRAKE CALIPER REPAIR (CONT)

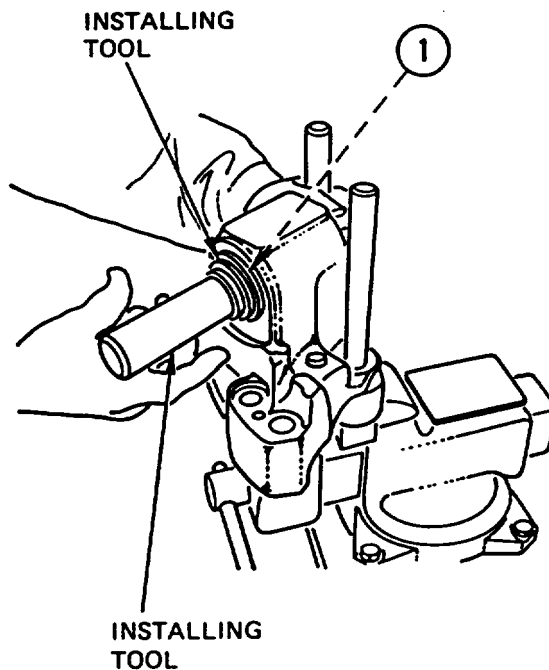
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### ASSEMBLY

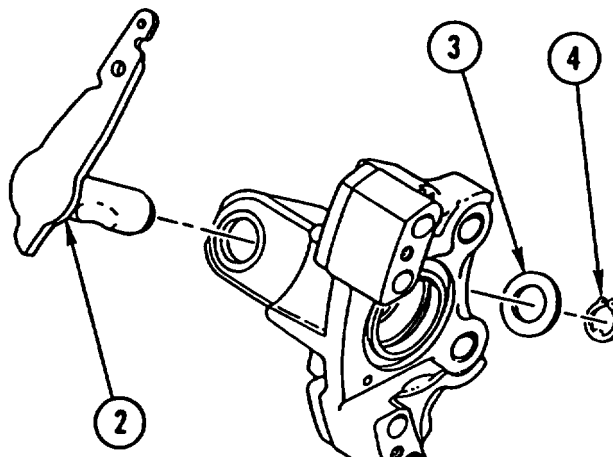
#### NOTE

Procedure is the same for both rear brake calipers except as noted.

1. USING INSTALLING TOOLS, INSTALL new SEAL (1).



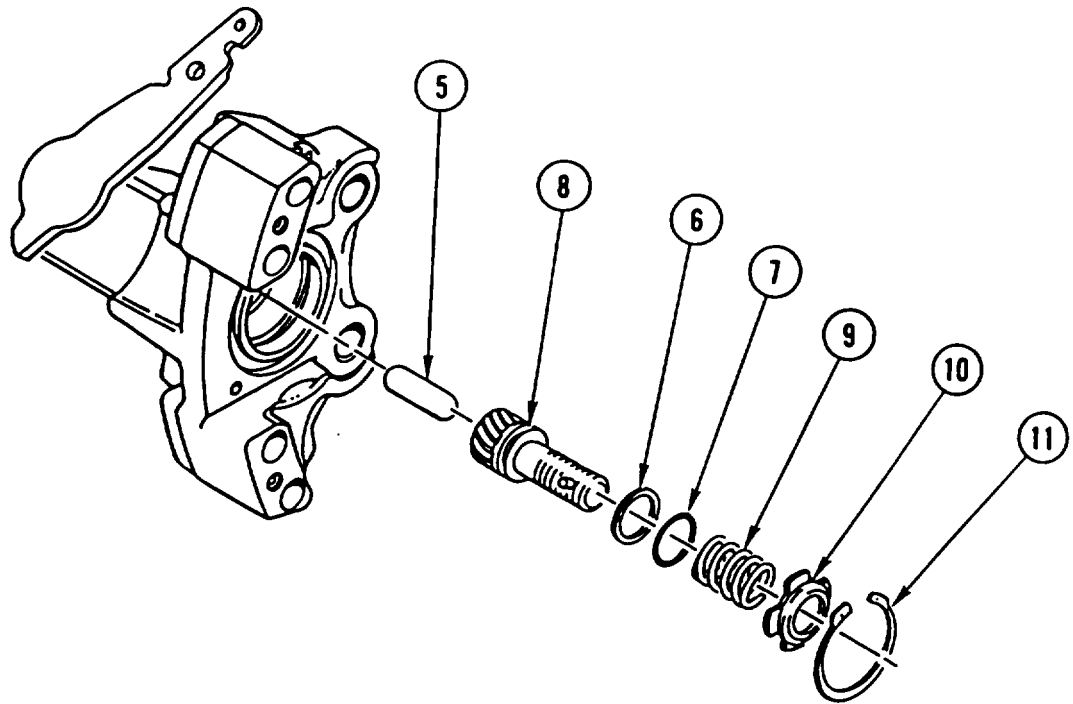
2. APPLY COAT of OIL (in Kit) to SHAFT of lever (2) and INSTALL LEVER (2), washer (3), and retaining ring (4).



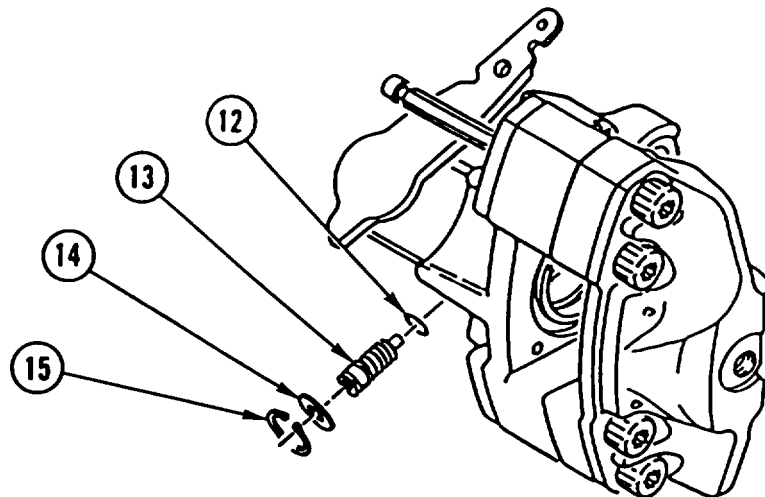
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**REAR BRAKE CALIPER REPAIR (CONT)**

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3. INSTALL ADJUSTER (5), new seal (6), new packing (7), adjusting gear (8), spring (9), spring seat (10), and retaining ring (11).



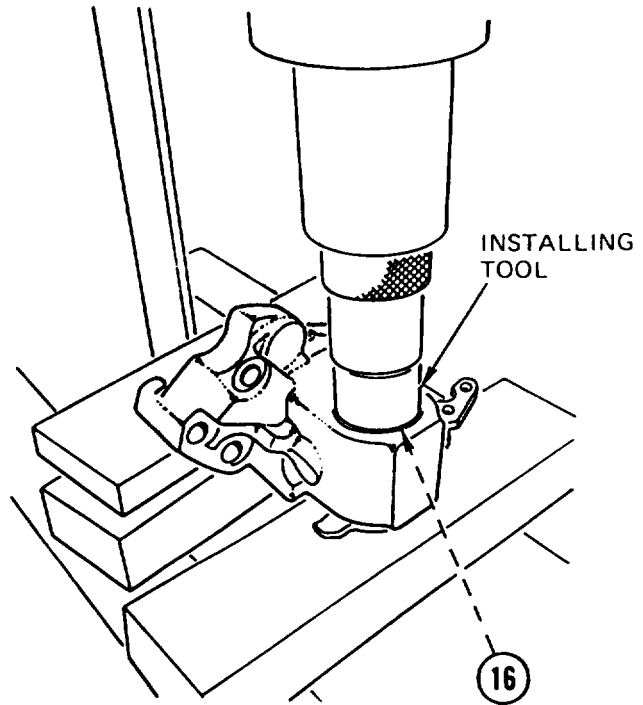
4. INSTALL new packing (12), adjusting SHAFT (13), shim (14), and lock ring (15).

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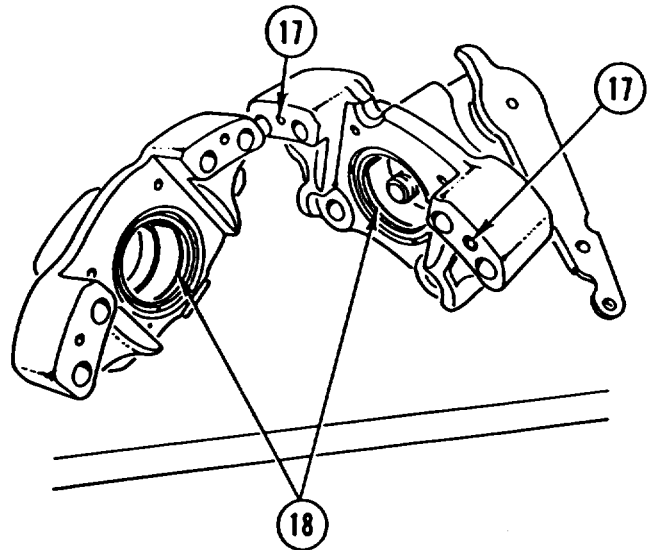
## REAR BRAKE CALIPER REPAIR (CONT)

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5. FILL CAVITY with oil (in Kit).
6. USING INSTALLING TOOL and hydraulic PRESS, INSTALL new sealing WASHER (16).



7. INSTALL four new PACKINGS (17 and 18).

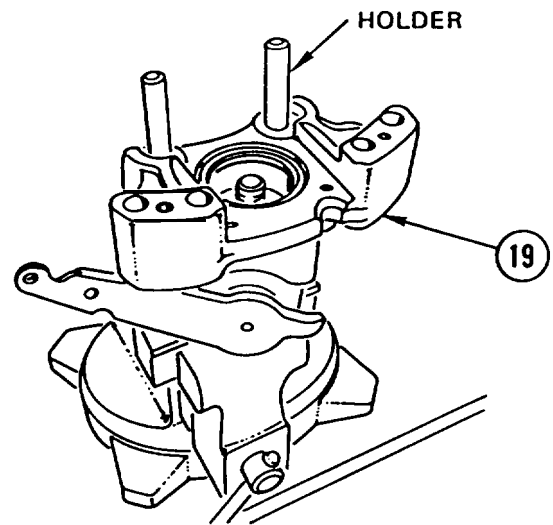


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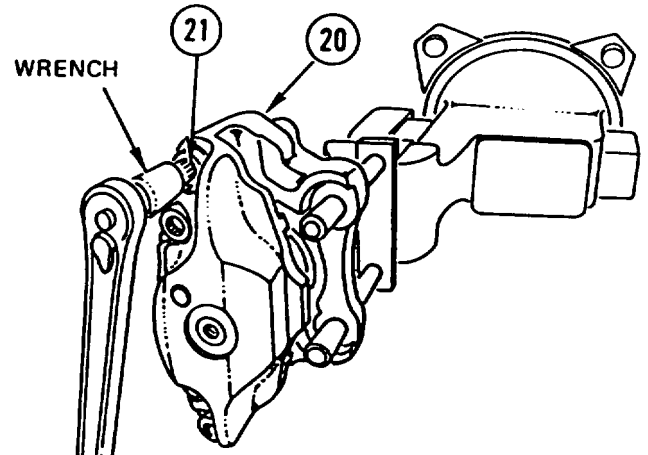
**REAR BRAKE CALIPER REPAIR (CONT)**


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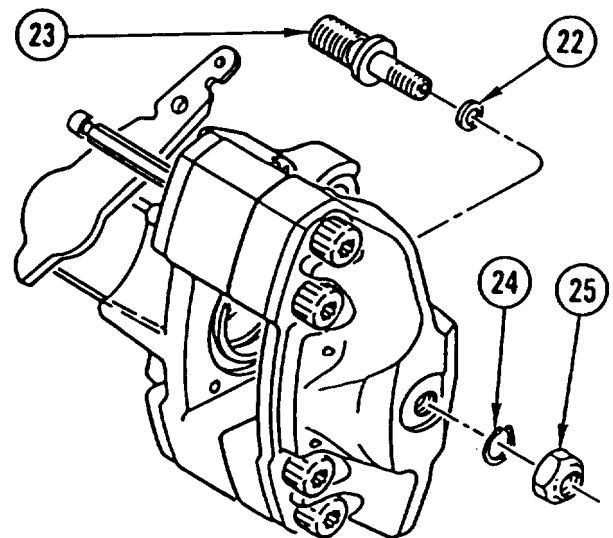
8. INSTALL brake caliper HALF (19) on holder.



9. INSTALL brake caliper HALF (20) and four screws (21). USING WRENCH, TIGHTEN SCREWS to 206 lb-ft (280 N•m).



10. ON LEFT CALIPER assembly, INSTALL new packing (22), adjusting PIN (23), retaining ring (24), and nut (25).

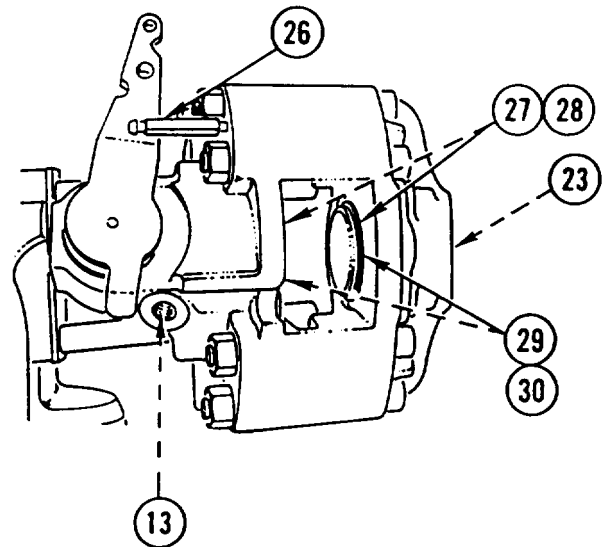


## REAR BRAKE CALIPER REPAIR (CONT)

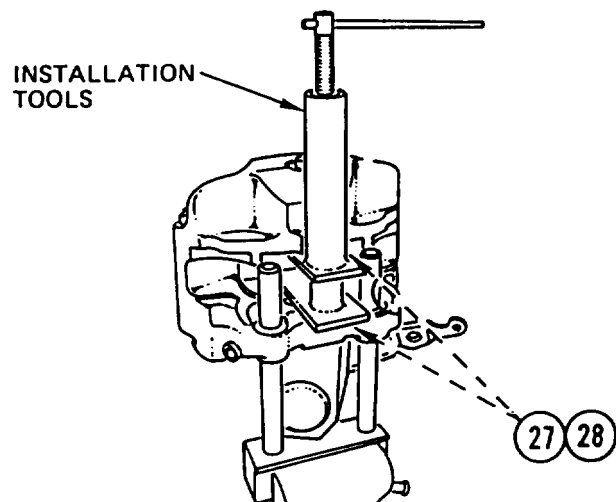
11. IF REMOVED, INSTALL new bleeder VALVE (26).

### 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.



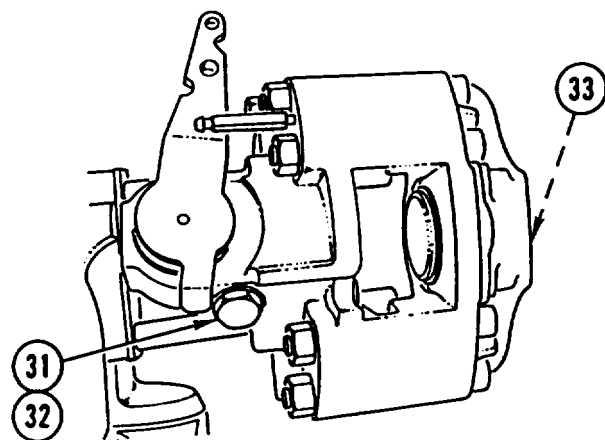
12. APPLY COAT of SILICONE (in Kit) to two PISTONS (27 and 28) and INSIDE of brake caliper.
13. INSTALL two PISTONS (27 and 28) on adjusting pin (23) and adjusting shaft (13) on left caliper assembly, or on right caliper assembly, and RETRACT two PISTONS (27 and 28) to groove on pistons.
14. INSTALL two new CAPS (29 and 30).
15. USING INSTALLATION TOOLS, PUSH two PISTONS (27 and 28) into caliper until flush.



16. INSTALL new seal ring (31), PLUG (32), and new lock nut (33).

### NOTE

Follow-on Maintenance:  
 Install rear brake calipers (TM 5-2420-224-20).  
 Adjust parking brakes (TM 5-2420-224-20).



## Section III. BRAKE MASTER CYLINDER REPAIR

### BRAKE MASTER CYLINDER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Kit, Parts Repair

##### References:

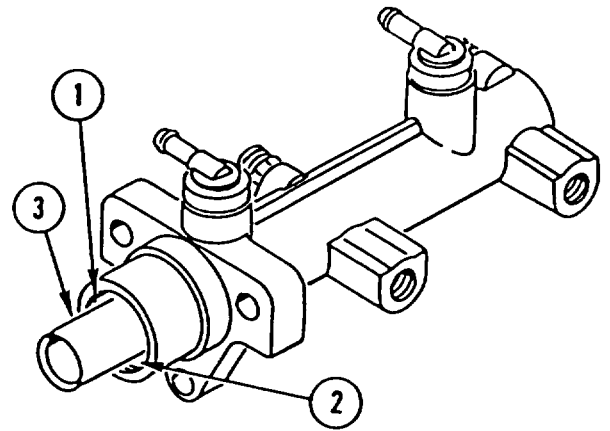
TM 5-2420-224-20

##### Equipment Condition:

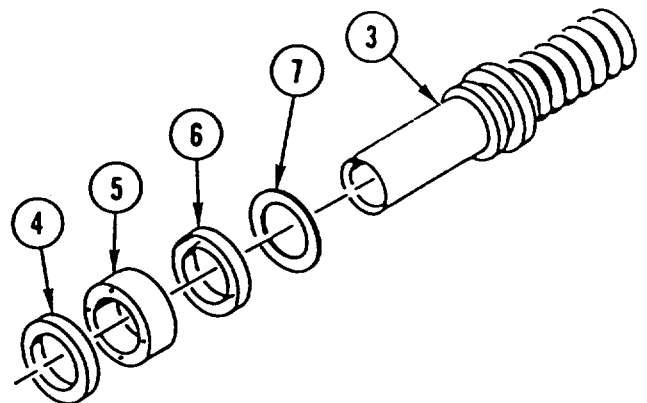
Reference	Condition Description
TM 5-2420-224-20	Brake Master Cylinder Removed

#### DISASSEMBLY

1. REMOVE and DISCARD lock RING (1) and stop RING (2).
2. REMOVE PISTON (3).



3. REMOVE wiper (4), sleeve (5), seal (6), and DISC (7) from piston (3). DISCARD WIPER, SLEEVE, SEAL, and DISC.



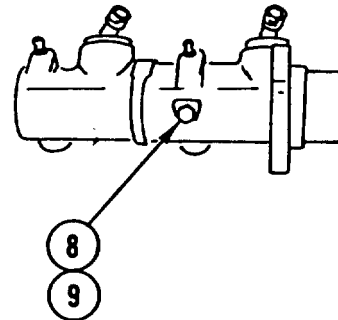


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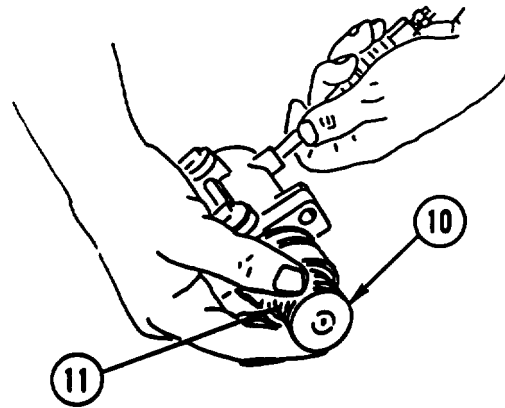
## BRAKE MASTER CYLINDER REPAIR (CONT)

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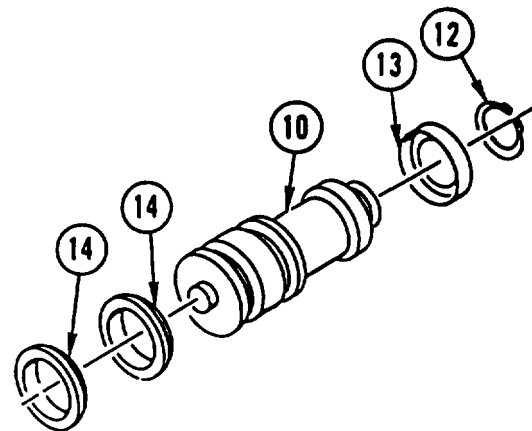
4. REMOVE BOLT (8) and seal ring (9).  
DISCARD seal RING.



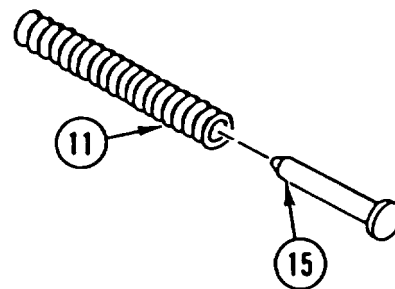
5. USING regulated AIR SUPPLY of 5 psi (34.5 kPa), REMOVE PISTON (10) and stop (11).



6. REMOVE backup ring (12), disc SEAL (13), and two seals (14) from piston (10).  
DISCARD backup RING, disc SEAL, and SEALS.

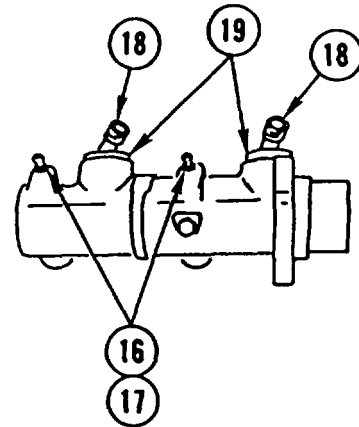


7. REMOVE stop ROD (15) from stop (11).



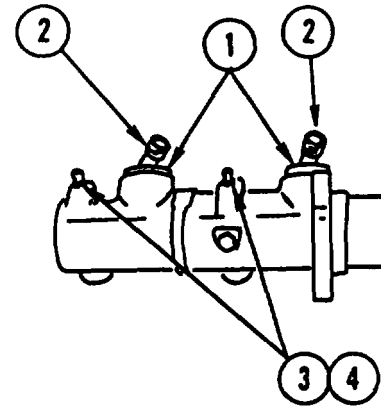
**BRAKE MASTER CYLINDER REPAIR (CONT)**

8. IF DAMAGED, REMOVE two bleeder VALVES (16) and two protective CAPS (17).
9. REMOVE two ELBOWS (18) and two bushings (19).

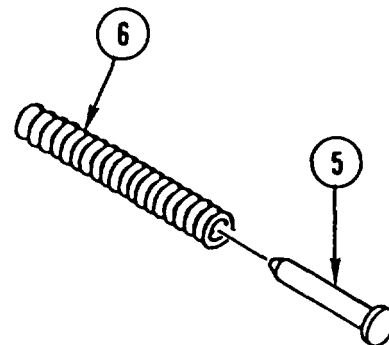


**ASSEMBLY**

1. INSTALL two bushings (1) and two ELBOWS (2).
2. IF REMOVED, INSTALL two new bleeder VALVES (3) and two new protective CAPS (4).



3. INSTALL stop ROD (5) in stop (6).

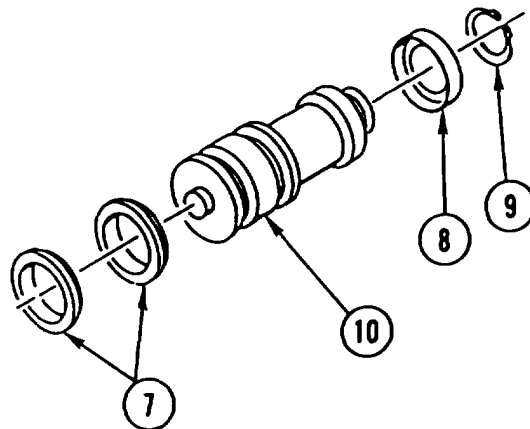


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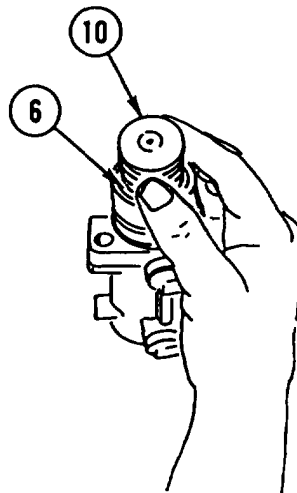
## BRAKE MASTER CYLINDER REPAIR (CONT)

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4. INSTALL two new seals (7), new disc SEAL (8), and new backup ring (9) on piston (10).



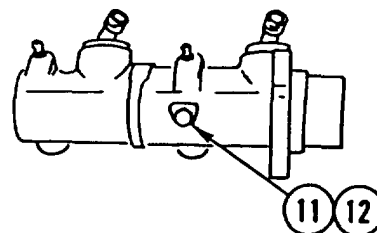
5. INSTALL stop (6) and PISTON (10).



### NOTE

Piston and stop must be all the way into master cylinder housing prior to performing step 6.

6. INSTALL new seal ring (11) and BOLT (12).

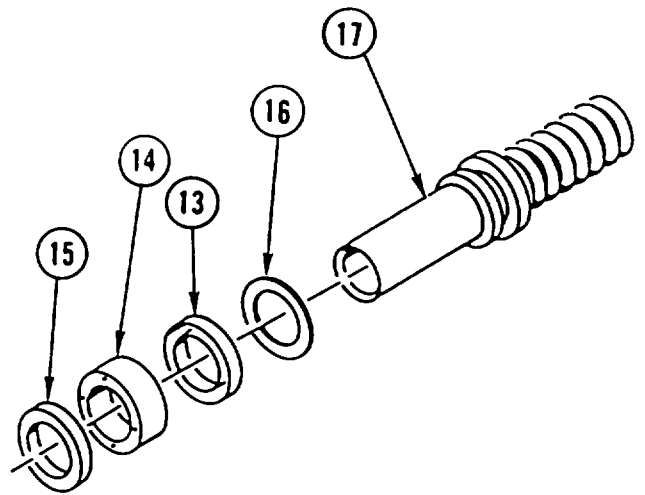


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**BRAKE MASTER CYLINDER REPAIR (CONT)**

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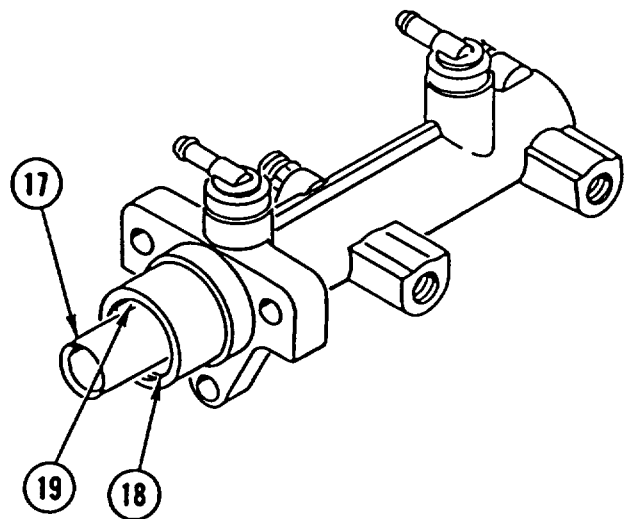
7. INSTALL new seal (13), new sleeve (14), new wiper (15), and new DISC (16) on piston (17).



8. INSTALL PISTON (17).
9. INSTALL new stop RING (18) and new lock RING (19).

**NOTE**

Follow-on Maintenance:  
Install brake master cylinder  
(TM 5-2420-224-20).



## Section IV. BRAKE PRESSURE REGULATOR (ALB VALVE) REPAIR

### BRAKE PRESSURE REGULATOR (ALB VALVE) REPAIR

This task covers: a. Disassembly b. Repair c. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Kit, Repair

##### References:

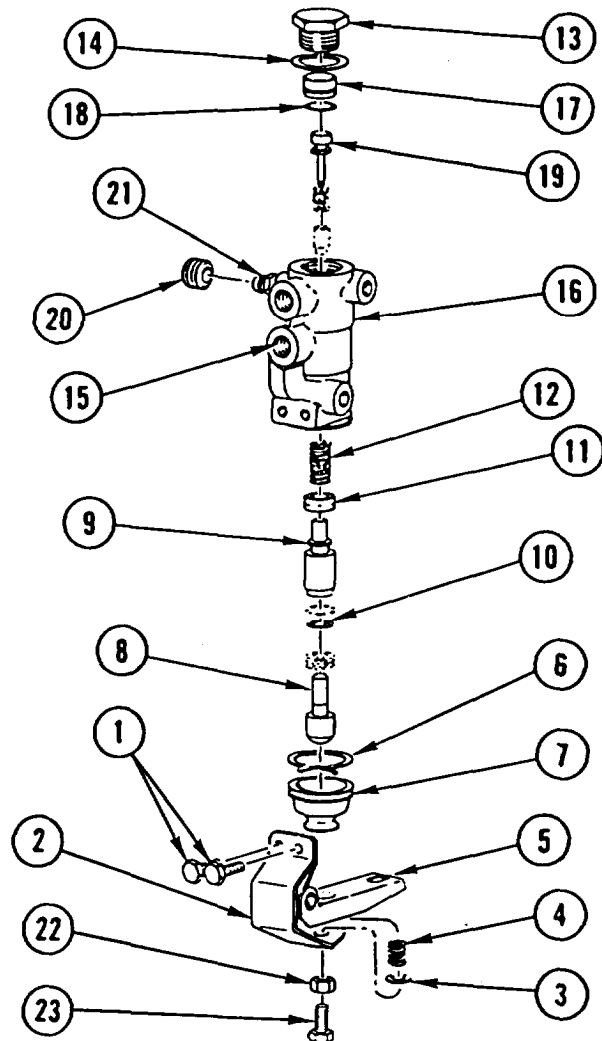
TM 5-2420-224-20

##### Equipment Condition:

Reference	Condition Description
Page 7-1	Brake Pressure Regulator (ALB Valve) Removed

#### DISASSEMBLY

1. REMOVE two capscrews (1), holder (2), washer (3), spring (4), and LEVER (5).
2. REMOVE retaining ring (6) and protective CAP (7).
3. REMOVE BOLT assembly (8).
4. PRESS down PISTON (9) and REMOVE CIRCLIP (10).
5. REMOVE PISTON (9), grooved ring (11), and spring (12).
6. REMOVE PLUG (13) and sealing ring (14). DISCARD sealing RING.
7. INSTALL air HOSE in lower hole (15) on ALB valve (16). APPLY APPROXIMATELY 5 psi (34.5 kPa) and REMOVE PISTON (17).
8. REMOVE PACKING (18) from piston (17). DISCARD PACKING.
9. REMOVE PISTON assembly (19) from ALB valve (16).
10. REMOVE protective CAP (20) from vent screw (21).
11. IF DAMAGED, REMOVE lock NUT (22) and adjusting SCREW (23).



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**BRAKE PRESSURE REGULATOR (ALB VALVE) REPAIR (CONT)**

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**REPAIR**

If any parts not found in Repair Kit are damaged or defective, replace ALB valve.

**ASSEMBLY**

1. INSTALL protective CAP (20) on vent screw (21).
2. INSTALL PISTON assembly (19).
3. INSTALL new packing (18) and PISTON (17).
4. INSTALL new sealing ring (14) and PLUG (13).
5. INSTALL spring (12), grooved ring (11), and PISTON (9).
6. PRESS down PISTON (9) and INSTALL CIRCLIP (10).
7. INSTALL BOLT assembly (8).
8. INSTALL protective CAP (7) and retaining ring (6).
9. INSTALL LEVER (5), spring (4), washer (3), holder (2), and two capscrews (1) on ALB valve (16).
10. IF REMOVED, INSTALL new adjusting SCREW (23) and new lock NUT (22).

**NOTE**

Follow-on Maintenance:

Install brake pressure regulator (ALB valve) (page 7-1).

Bleed brake system (TM 5-2420-224-20).

Adjust brake pressure regulator (ALB valve) (page 7-5).

## Section V. AIR BRAKE BOOSTER REPAIR

### AIR BRAKE BOOSTER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Kit, Parts

**References:**

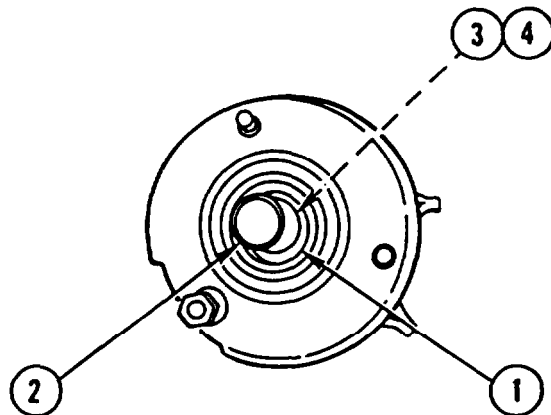
TM 5-2420-224-20

**Equipment Condition:**

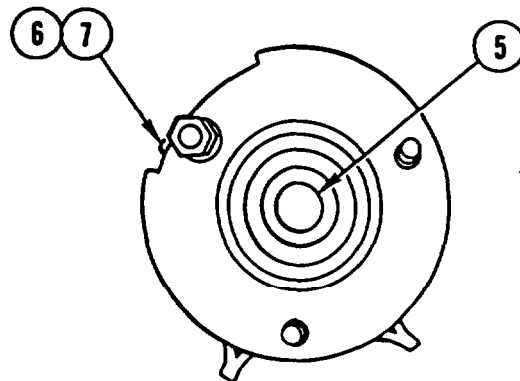
Reference	Condition Description
TM 5-2420-224-20	Air Brake Booster Removed

#### DISASSEMBLY

1. REMOVE retaining ring (1), thrust piece (2), packing (3), and SPRING (4). DISCARD retaining RING, PACKING, and SPRING.



2. REMOVE and DISCARD VALVE (5).
3. REMOVE SCREW (6) and washer (7).

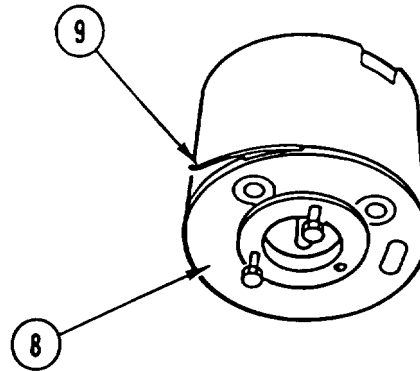


## AIR BRAKE BOOSTER REPAIR (CONT)

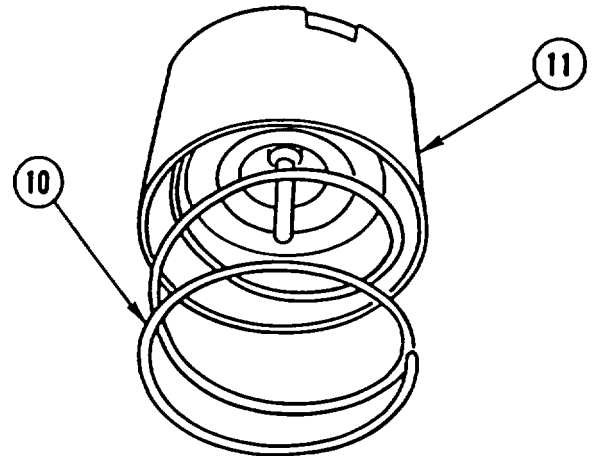
**WARNING**

To prevent personnel injury, use extreme care during removal of flange because of pressure of spring in case.

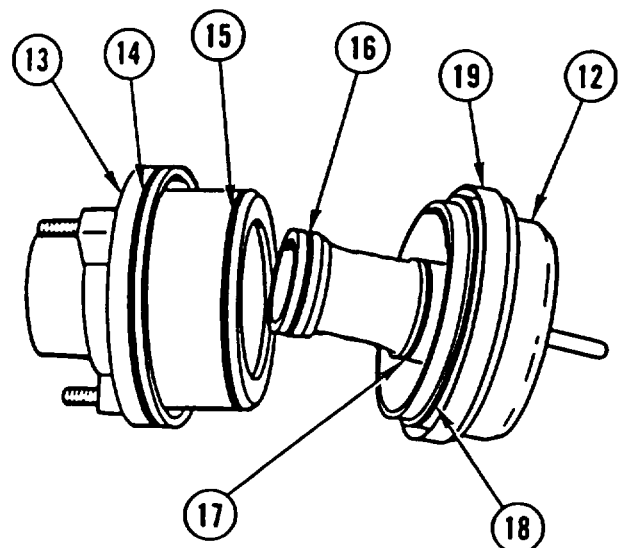
4. REMOVE FLANGE (8) and retaining wire (9) by turning flange (8) to left.



5. REMOVE spring (10) and CASE (11).



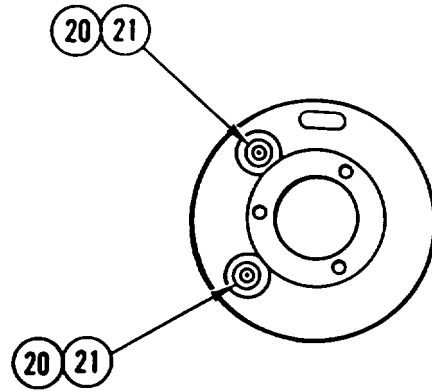
6. SEPARATE two HOUSINGS (12 and 13) by PULLING them apart.
7. REMOVE and DISCARD five PACKINGS (14, 15, 16, 17, and 18).
8. REMOVE and DISCARD RING (19).





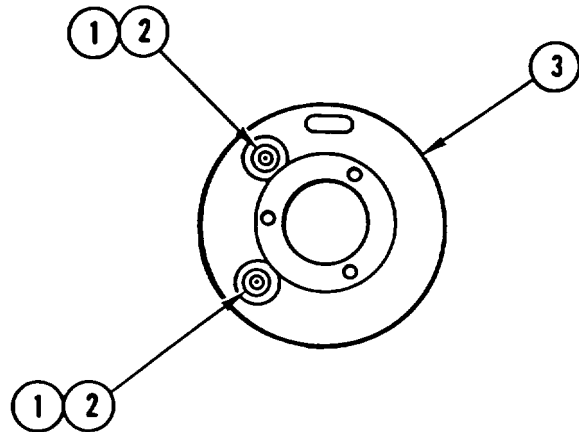
**AIR BRAKE BOOSTER REPAIR (CONT)**

- REMOVE two retaining rings (20) and two VALVES (21). DISCARD VALVES.

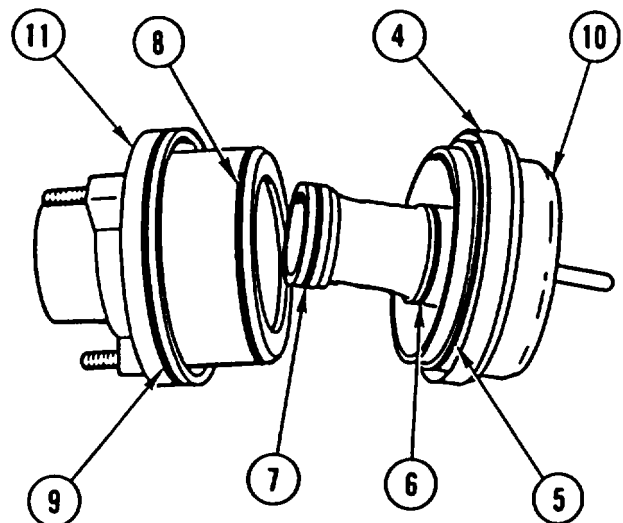


**ASSEMBLY**

- INSTALL two new VALVES (1) and two retaining rings (2) in flange (3).

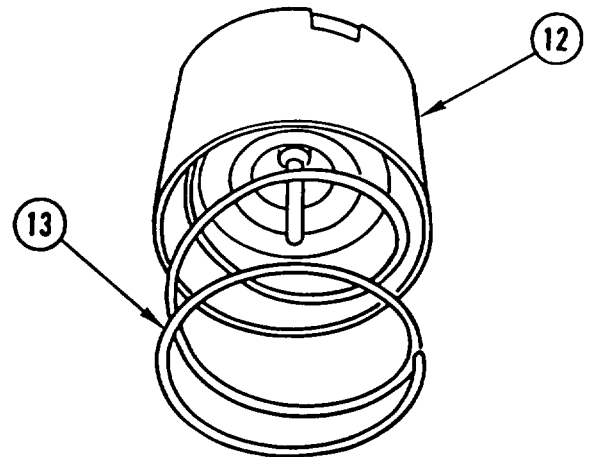


- INSTALL new RING (4).
- INSTALL five new PACKINGS (5, 6, 7, 8, and 9).
- INSTALL HOUSING (10) in housing (11).

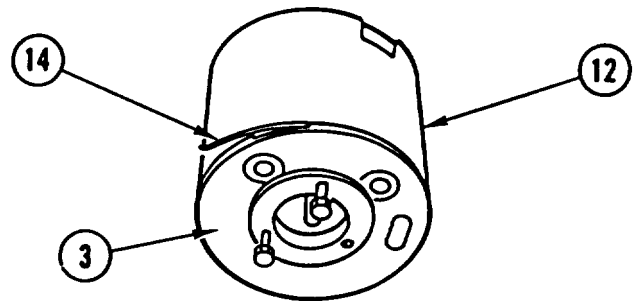


## AIR BRAKE BOOSTER REPAIR (CONT)

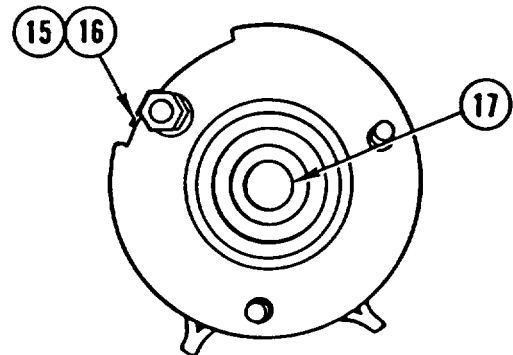
5. INSTALL CASE (12) and spring (13).



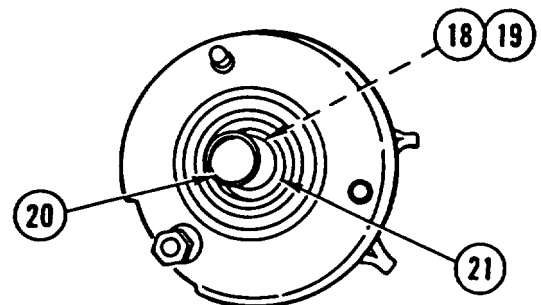
6. INSTALL FLANGE (3) in case (12) and line up hole in flange (3) with hole in case (12). INSTALL end of retaining WIRE (14) in hole of flange (3) and ROTATE FLANGE (3) to right until retaining wire (14) is completely installed.



7. INSTALL SCREW (15) and washer (16).
8. INSTALL new VALVE (17).



9. INSTALL new SPRING (18), new packing (19), thrust piece (20), and new retaining ring (21).



### NOTE

Follow-on Maintenance:  
Install air brake booster (TM 5-2420-224-20).

## Section VI. FLUID REGULATION VALVE REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the fluid regulating valve. A list of tasks contained in this section is shown below.

	Page
Fluid Regulating Valve Repair (P/N 0 481 039 202) . . . . .	17-28
Fluid Regulating Valve Repair (P/N 975 303 447 0) . . . . .	17-35

### FLUID REGULATING VALVE (P/N 0 481 039 202) REPAIR

This task covers: a. Disassemble b. Assembly

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90CL-N26

**Materials/Parts:**

Kit, Parts

**References:**

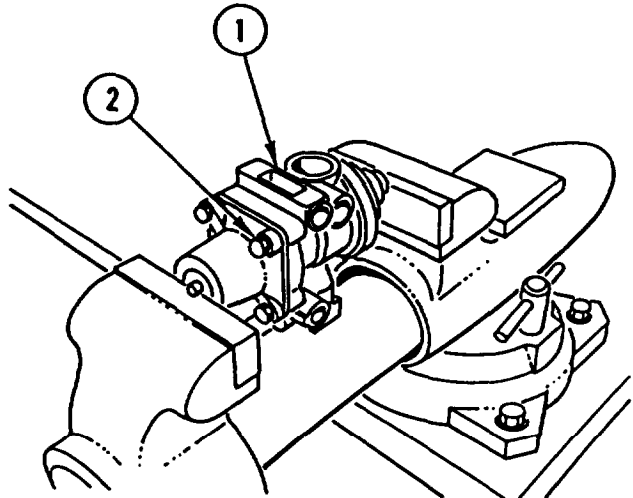
TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Fluid Regulating Valve Removed

### DISASSEMBLY

1. PLACE fluid regulating VALVE (1) in soft-jawed VISE, as shown, and REMOVE four SCREWS (2).

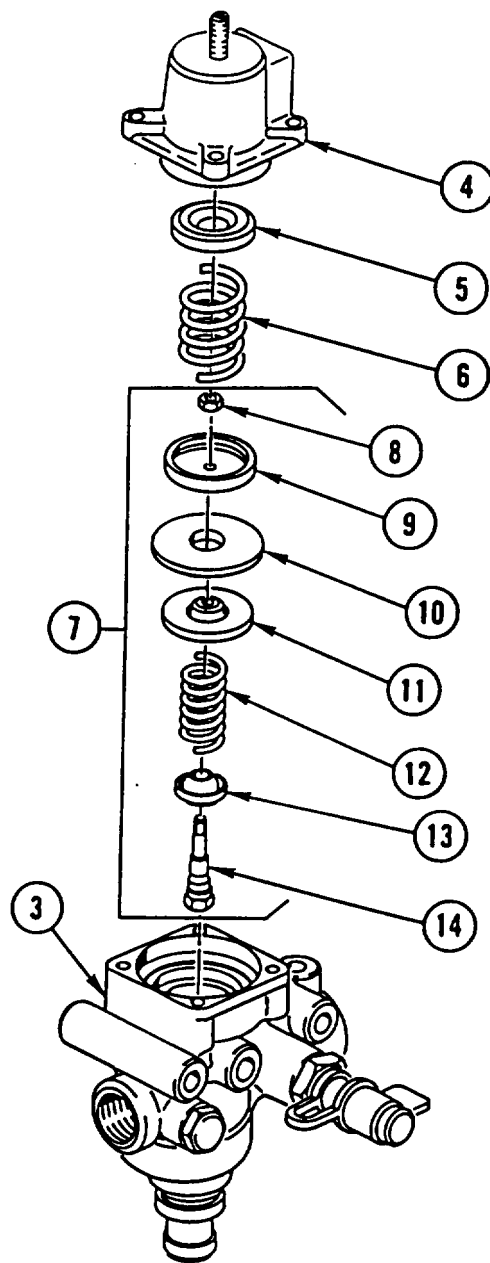


**FLUID REGULATING VALVE (P/N 0 481 039 202) REPAIR (CONT)**

**WARNING**

Cover is under spring pressure. Wear safety goggles. Pressure must be relieved slowly. Failure to do so could cause cover to fly off resulting in injury to personnel.

2. OPEN VISE SLOWLY and REMOVE regulating valve HOUSING (3) and cover (4) from vise.
3. REMOVE spring seat (5), spring (6), and DIAPHRAGM assembly (7) from regulating valve housing (3).
4. REMOVE nut (8), plate washer (9), DIAPHRAGM (10), plate washer (11), spring (12), and cup seal (13) from screw (14). DISCARD DIAPHRAGM and cup SEAL.

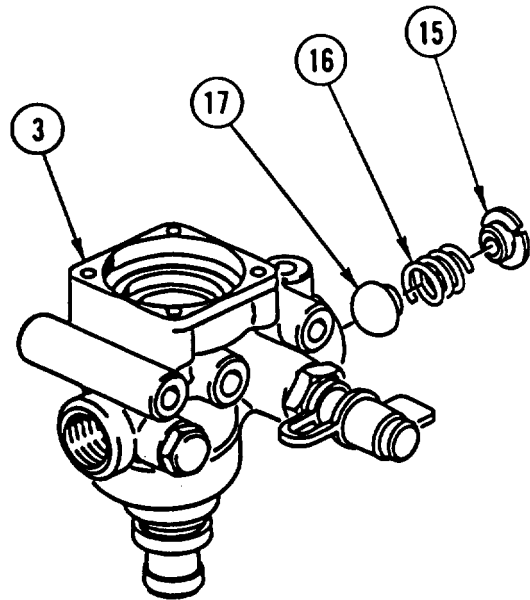


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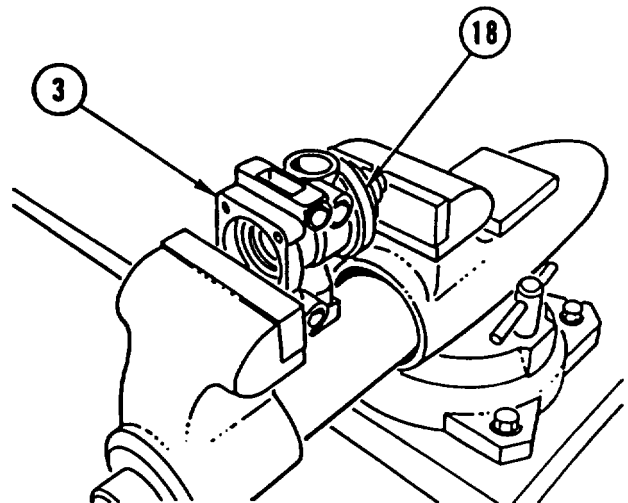
**FLUID REGULATING VALVE (P/N O 481 039 202) REPAIR (CONT)**

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5. REMOVE disc (15), spring (16), and valve CONE (17) from regulating valve housing (3). DISCARD valve CONE.



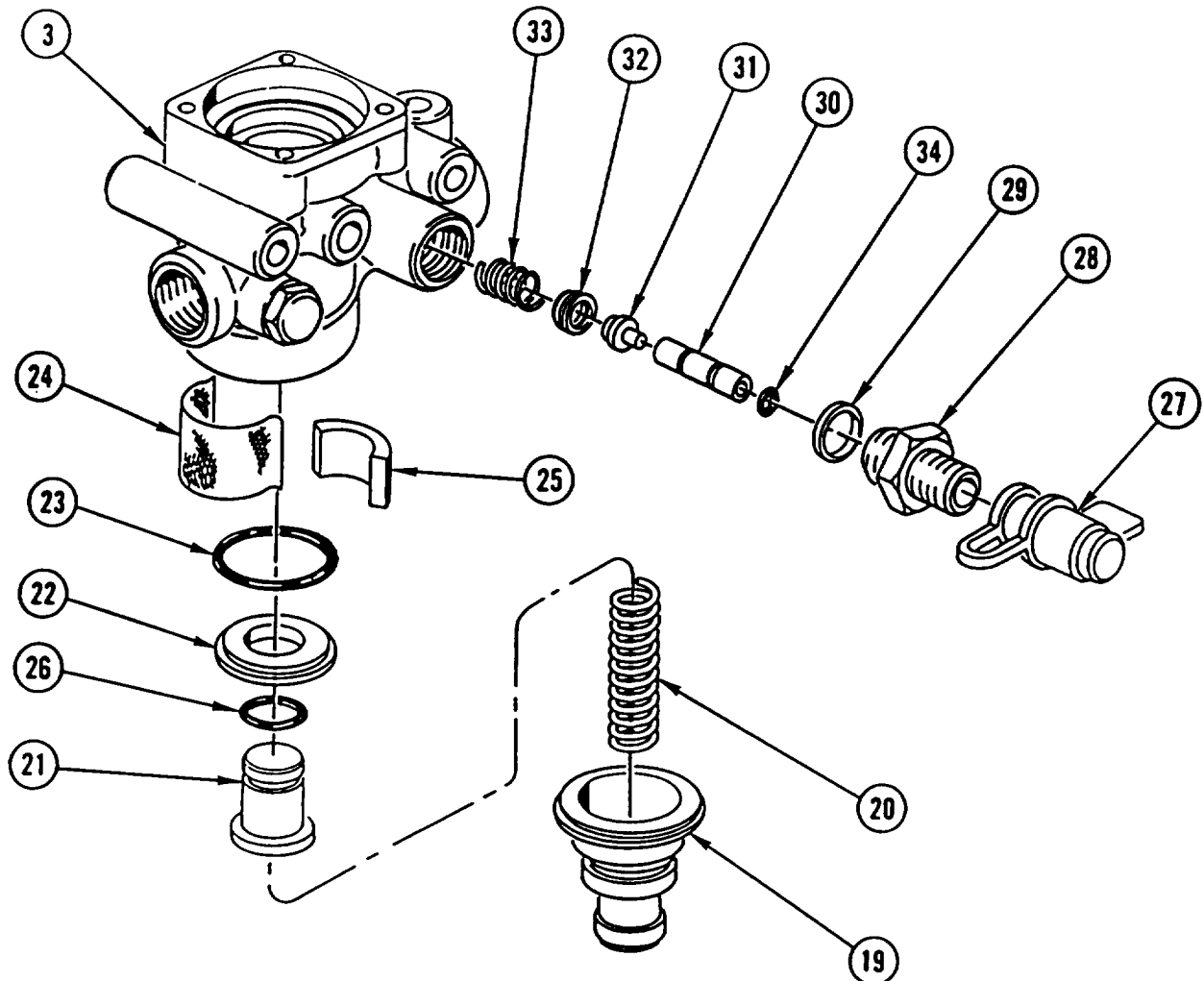
6. PLACE regulating valve HOUSING (3) in soft-jawed VISE, as shown, and REMOVE retaining RING (18).



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**FLUID REGULATING VALVE (P/N O 481 039 202) REPAIR (CONT)**


---

**WARNING**

Vent housing is under spring pressure. Wear safety goggles. Pressure must be relieved slowly. Failure to do so could cause housing to fly off resulting in injury to personnel.

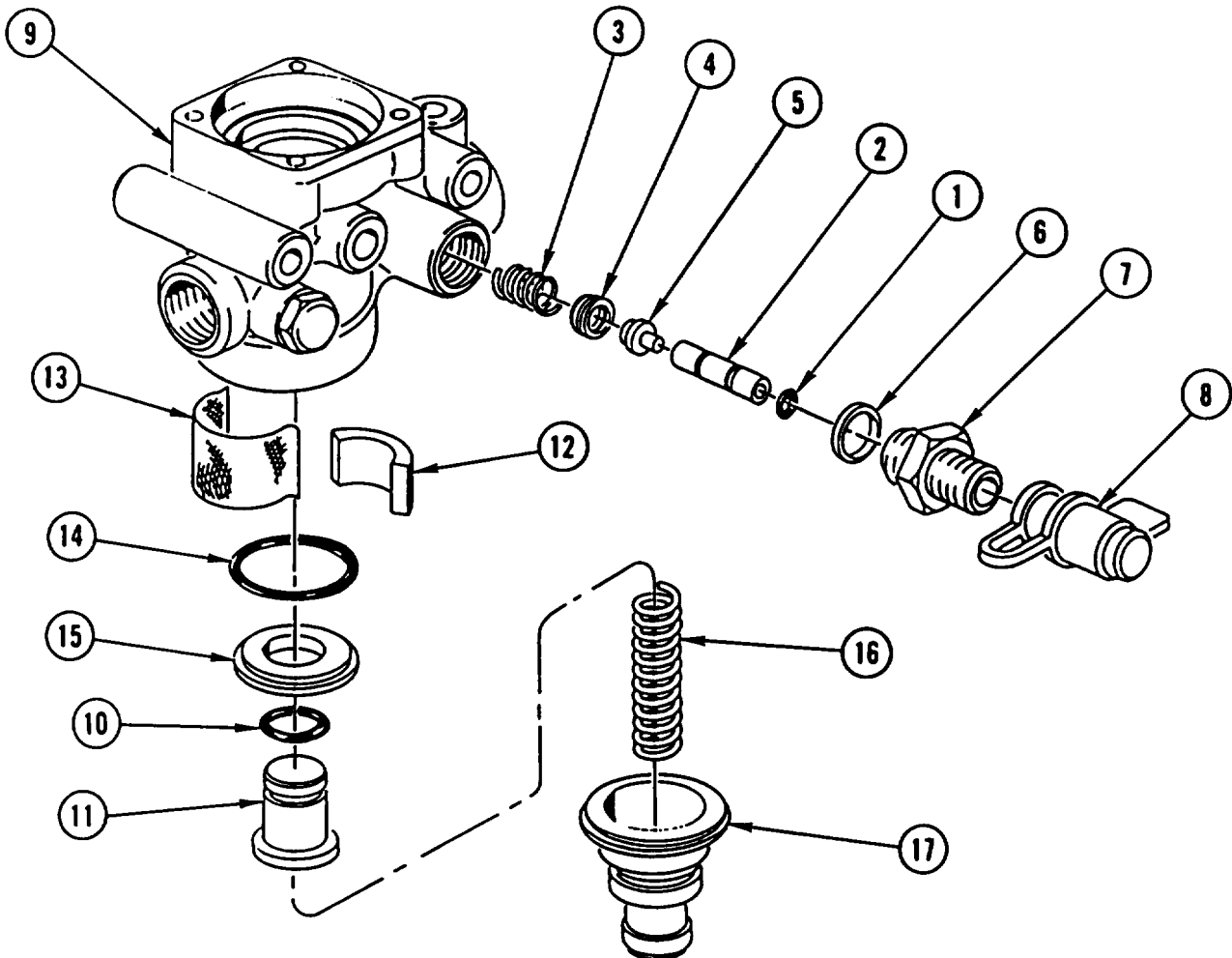
7. OPEN VISE SLOWLY and REMOVE regulating valve HOUSING (3), vent housing (19), spring (20), piston valve (21), ring (22), packing (23), filter screen (24), and filter (25). DISCARD PACKING.
8. REMOVE and DISCARD PACKING (26) from piston valve (21).
9. REMOVE cap (27), fitting (28), seal ring (29), tappet (30), PISTON (31), valve plate (32), and spring (33) from regulating valve housing (3). DISCARD seal RING and valve PLATE.
10. REMOVE and DISCARD PACKING (34) from tappet (30).

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**FLUID REGULATING VALVE (P/N O 481039 202) REPAIR (CONT)**

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**ASSEMBLY**



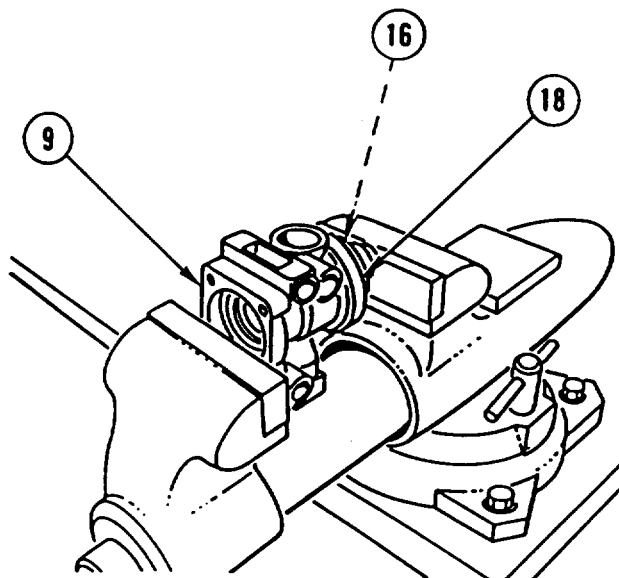
1. INSTALL new PACKING (1) on tappet (2).
2. INSTALL spring (3), new valve plate (4), PISTON (5), tappet (2), new seal ring (6), fitting (7), and cap (8) in regulating valve housing (9).
3. INSTALL new PACKING (10) on piston valve (11).
4. INSTALL filter (12), filter screen (13), new packing (14), ring (15), piston valve (11), spring (16), and vent HOUSING (17) in regulating valve housing (9).

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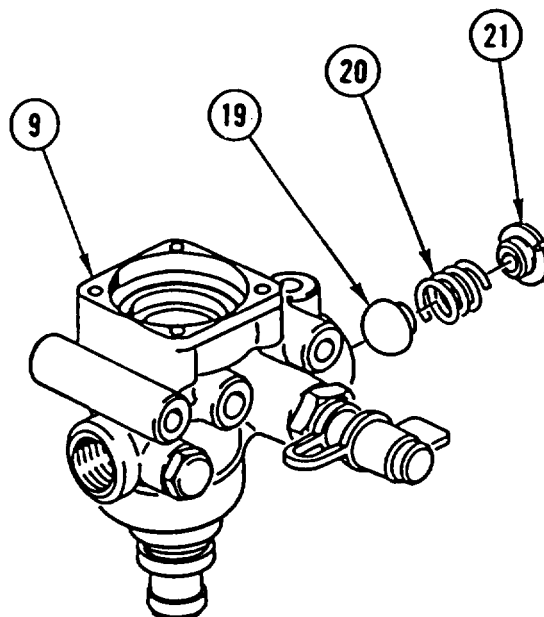
**FLUID REGULATING VALVE (P/N 0 481 039 202) REPAIR (CONT)**

---

5. PLACE regulating valve HOUSING (9) in soft-jawed VISE, as shown. COMPRESS SPRING (16) and INSTALL retaining RING (18).
6. OPEN VISE SLOWLY and REMOVE regulating valve HOUSING (9) from vise.



7. INSTALL new valve CONE (19), spring (20), and disc (21) in regulating valve housing (9).



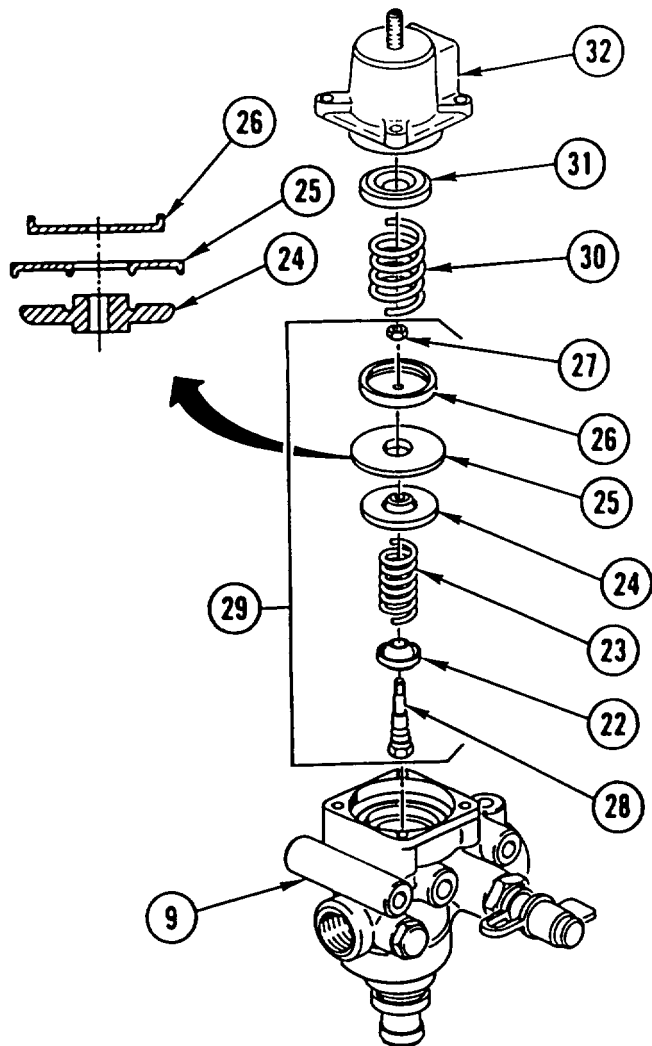


**FLUID REGULATING VALVE (P/N 0 481 039 202) REPAIR (CONT)**

**NOTE**

Plate washers should face diaphragm, as shown.

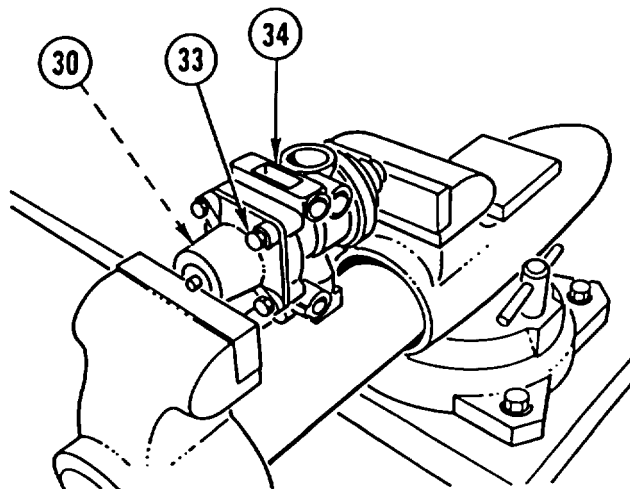
8. INSTALL new cup seal (22), spring (23), plate washer (24), new DIAPHRAGM (25), plate washer (26), and nut (27) on screw (28).
9. INSTALL DIAPHRAGM assembly (29), spring (30), spring seat (31), and cover (32) on regulating valve housing (9).



10. PLACE regulating valve HOUSING (9) in soft-jawed VISE, COMPRESS SPRING (30), and INSTALL four SCREWS (33).
11. REMOVE fluid regulating VALVE (34) from vise.

**NOTE**

Follow-on Maintenance:  
Install fluid regulating valve (TM 5-2420-224-20).



## FLUID REGULATING VALVE (P/N 975 303 447 0) REPAIR

This task covers: a. Disassembly b. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts

Kit, Parts

#### References:

TM 5-2420-224-20

#### Equipment Condition:

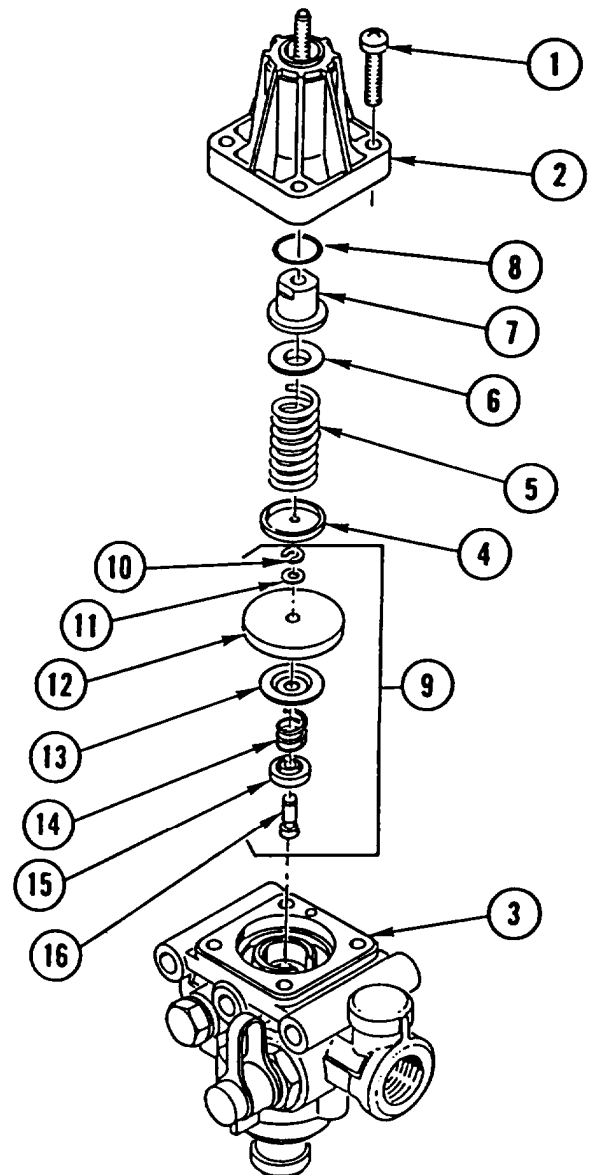
Reference	Condition	Description
TM 5-2420-224-20	Fluid Regulating Valve Removed	

### DISASSEMBLY

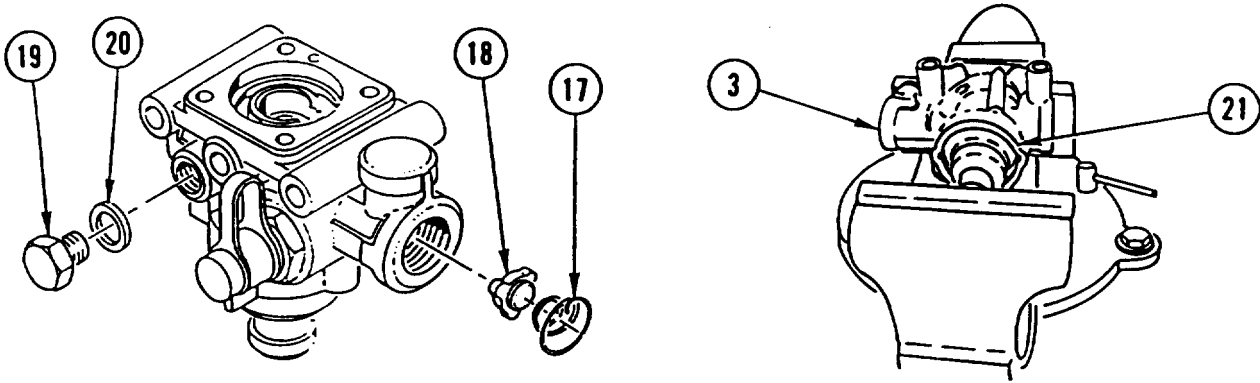
#### WARNING

Cover is under spring pressure. Wear safety goggles. Pressure must be relieved slowly. Failure to do so could cause cover to fly off resulting in injury to personnel.

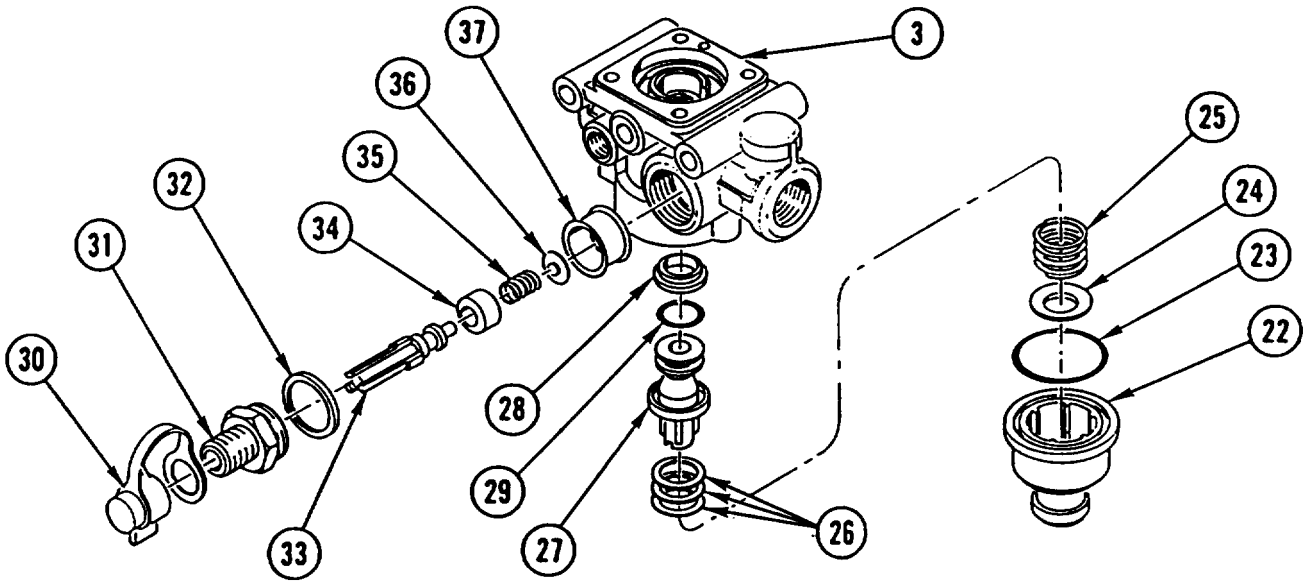
1. REMOVE four screws (1) and COVER (2) from regulating valve housing (3).
2. REMOVE cap (4), SPRING (5), cap (6), nut (7), and packing (8) from cover (2). DISCARD PACKING.
3. REMOVE DIAPHRAGM assembly (9) from regulating valve housing (3).
4. REMOVE circlip (10), cap (11), DIAPHRAGM (12), cap (13), spring (14), and valve CONE (15) from piston (16). DISCARD DIAPHRAGM and valve CONE.



**FLUID REGULATING VALVE (P/N 975 303 447 0) REPAIR (CONT)**



5. REMOVE and DISCARD SPRING (17) and VALVE (18).
6. IF DAMAGED, REMOVE PLUG (19) and GASKET (20).
7. PLACE regulating valve HOUSING (3) in soft-jawed VISE, as shown, and REMOVE retaining RING (21).



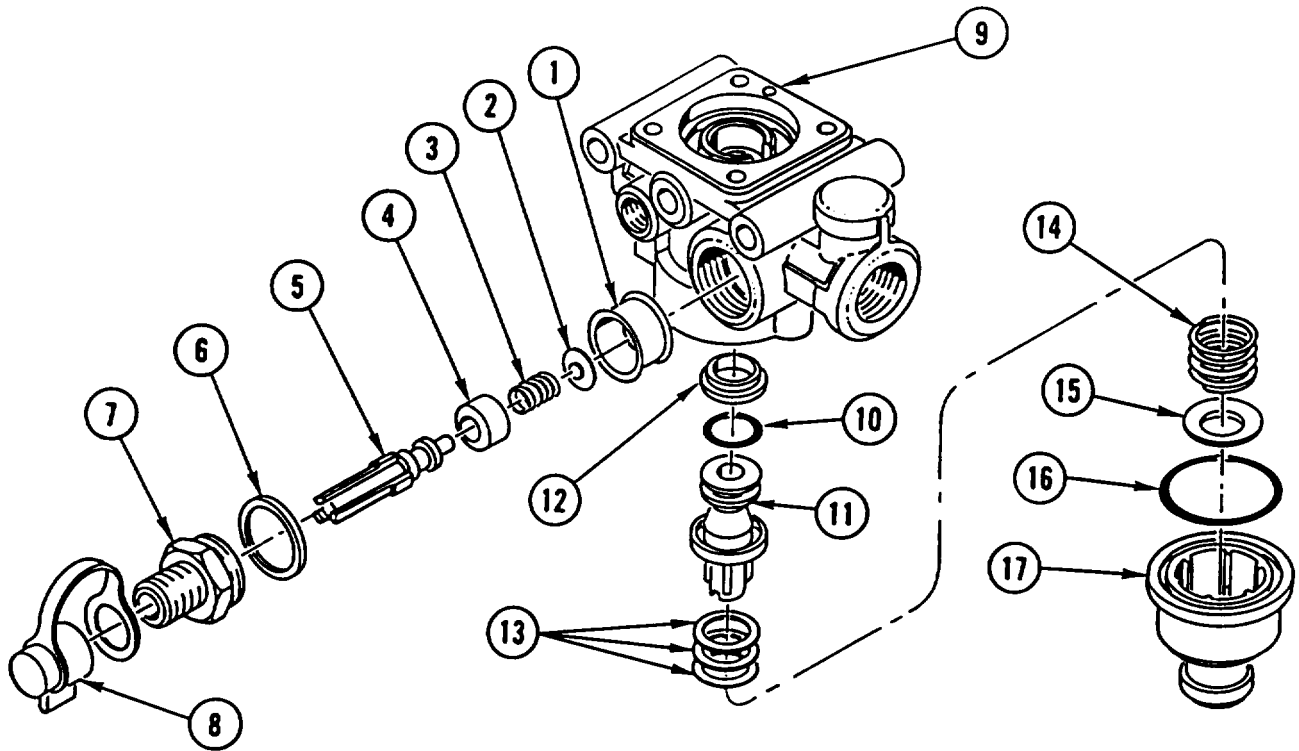
**WARNING**

Vent housing is under spring pressure. Wear safety goggles. Pressure must be relieved slowly. Failure to do so could cause housing to fly off resulting in injury to personnel.

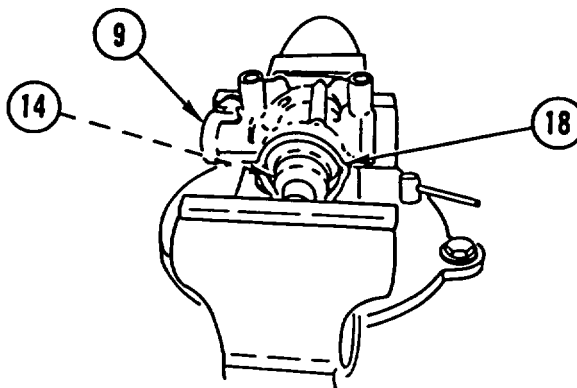
8. OPEN VISE SLOWLY and REMOVE regulating valve HOUSING (3), housing (22), packing (23), cap (24), spring (25), shims (26), piston (27), and valve (28). DISCARD PACKING and VALVE.
9. REMOVE and DISCARD PACKING (29) from piston (27).
10. REMOVE protective cap (30), adapter (31), gasket (32), PLUNGER (33), valve (34), spring (35), cap (36), and filter (37) from regulating valve housing (3). DISCARD VALVE and FILTER.

**FLUID REGULATING VALVE (P/N 975 303 447 0) REPAIR (CONT)**

**ASSEMBLY**



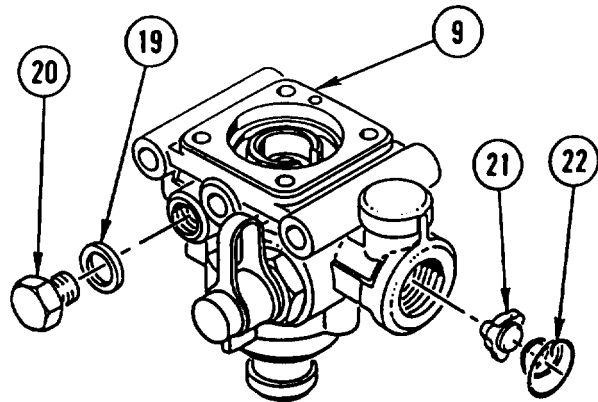
1. INSTALL new filter (1), cap (2), spring (3), new valve (4), PLUNGER (5), gasket (6), adapter (7), and protective cap (8) in regulating valve housing (9).
2. INSTALL new PACKING (10) on piston (11).
3. INSTALL new valve (12), piston (11), shims (13), spring (14), cap (15), new packing (16), and HOUSING (17) in regulating valve housing (9).



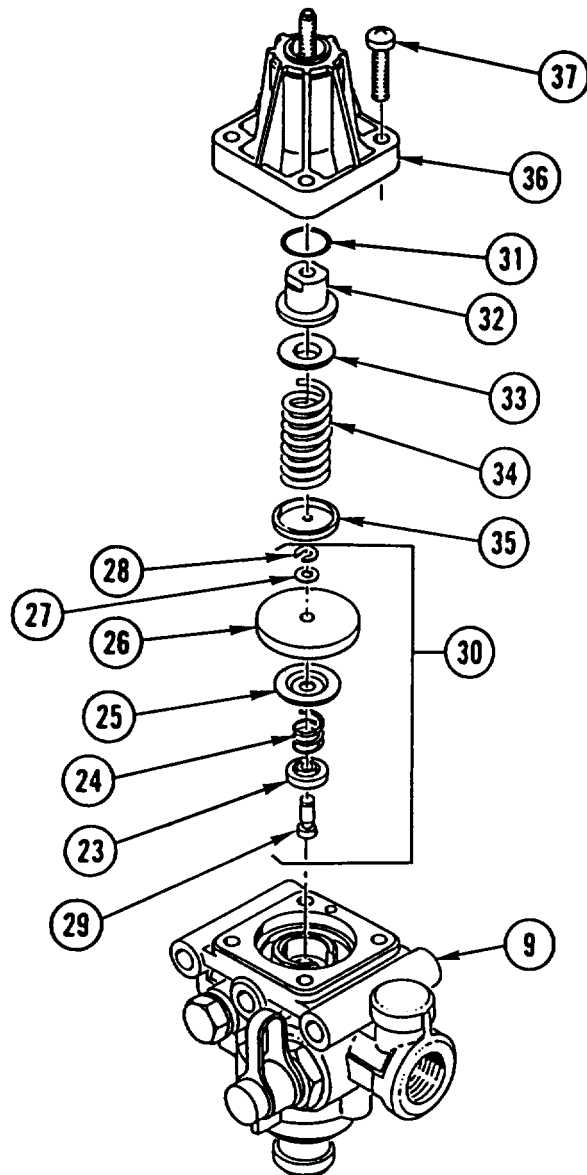
4. PLACE regulating valve HOUSING (9) in soft-jawed VISE, as shown. COMPRESS SPRING (14) and INSTALL retaining RING (18).

**FLUID REGULATING VALVE (P/N 975 303 447 0) REPAIR (CONT)**

5. OPEN VISE SLOWLY and REMOVE regulating valve HOUSING (9) from vise.
6. IF REMOVED, INSTALL new GASKET (19) and new PLUG (20) in regulating valve housing (9).
7. INSTALL new VALVE (21) and new spring (22) in regulating valve housing (9).



8. INSTALL new valve CONE (23), spring (24), cap (25), new DIAPHRAGM (26), cap (27), and circlip (28) on piston (29).
9. INSTALL DIAPHRAGM assembly (30) in regulating valve housing (9).
10. INSTALL new packing (31), nut (32), cap (33), SPRING (34), and cap (35) in cover (36).
11. INSTALL COVER (36) and four screws (37) on regulating valve housing (9).



**NOTE**

Follow-on Maintenance:  
Install fluid regulating valve (TM 5-2420-224-20).

## Section VII. ANTIFREEZE DEVICE REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the antifreeze device. A list of tasks contained in this section is shown below.

	Page
Antifreeze Device (P/N 000 431 57-15 Bl.1) Repair . . . . .	17-39
Antifreeze Device (P/N 932 002 000 0) Repair . . . . .	17-42

### ANTIFREEZE DEVICE (P/N 000 431 57 15 Bl.1) REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Kit, Repair  
 Compound, Sealing            Appendix B, Item 15  
 Oil, Lubricating                Appendix B, Item 30

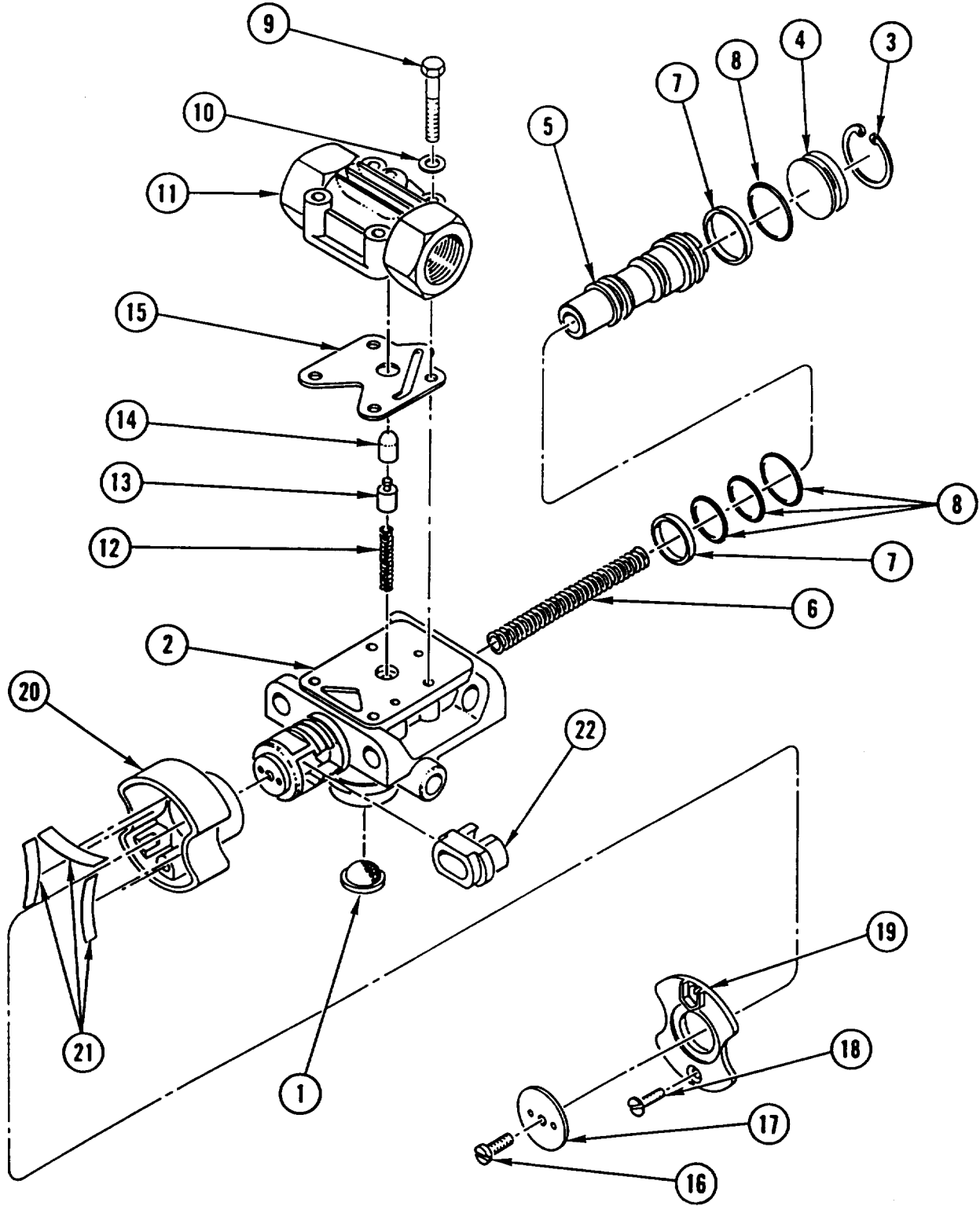
**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Antifreeze Device Removed

ANTIFREEZE DEVICE (P/N 000 431 57 15 BI.1) REPAIR (CONT)



---

**ANTIFREEZE DEVICE (P/N 000431 5715 BI.1) REPAIR (CONT)**

---

**DISASSEMBLY**

1. REMOVE and DISCARD SCREEN (1) from antifreeze pump (2).
2. REMOVE retaining ring (3), seat (4), PISTON (5), and spring (6). DISCARD retaining RING and SPRING.
3. REMOVE and DISCARD two backing RINGS (7) and four PACKINGS (8).
4. REMOVE four SCREWS (9) and four washers (10).
5. REMOVE HOUSING (11).
6. REMOVE spring (12), spring COVER (13), valve cone (14), and gasket (15). DISCARD SPRING, valve CONE, and GASKET.
7. REMOVE screw (16), PLATE (17), two screws (18), and COVER (19).
8. ROTATE KNOB (20) 1/4 turn and REMOVE.
9. REMOVE and DISCARD three KEEPERS (21).
10. REMOVE INSERT (22).

**ASSEMBLY**

1. INSTALL INSERT (22) in antifreeze pump (2).
2. INSTALL three new KEEPERS (21) in knob (20).
3. INSTALL KNOB (20) on antifreeze pump (2) and ROTATE KNOB (20) 1/4 turn.
4. INSTALL COVER (19), two screws (18), PLATE (17), and screw (16) on knob (20).
5. INSTALL new spring (12), spring COVER (13), and new valve cone (14).
6. INSTALL new gasket (15) and HOUSING (11).

**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 COAT of SEALING COMPOUND to four WASHERS (10) and four SCREWS (9) and INSTALL four washers (10) and four SCREWS (9).
8. INSTALL four new PACKINGS (8) and two new backing rings (7).
9. APPLY light COAT of LUBRICATING OIL to four PACKINGS (8) and two backing RINGS (7) to aid in piston installation.
10. INSTALL new spring (6), PISTON (5), seat (4), and new retaining ring (3).
11. INSTALL new SCREEN (1) on antifreeze pump (2).

**NOTE**

Follow-on Maintenance:  
Install antifreeze device (TM 5-2420-224-20).



## ANTIFREEZE DEVICE (P/N 932 002 000 0) REPAIR

This task covers: a. Disassembly b. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### References:

TM 5-2420-224-20

#### Equipment Condition:

#### Materials/Parts:

Kit, Repair

Compound, Sealing Appendix B, Item 15

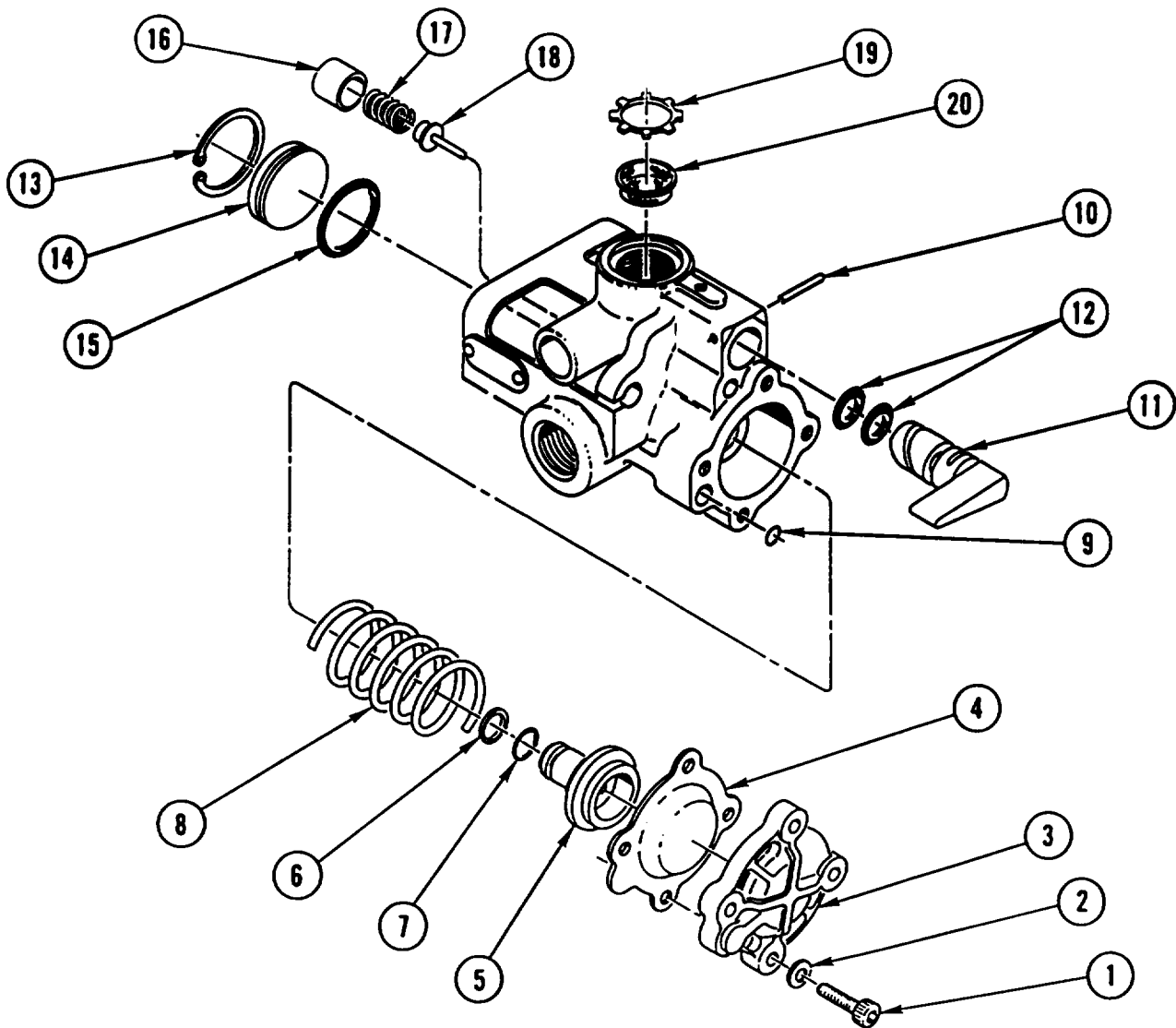
Oil, Lubricating Appendix B, Item 30

#### Reference

TM 5-2420-224-20

#### Condition Description

Antifreeze Device  
 Removed



---

**ANTIFREEZE DEVICE (P/N 932 002 000 0) REPAIR (CONT)**

---

**DISASSEMBLY****WARNING**

Membrane cover is under tension. Wear safety goggles. Remove cover carefully. Failure to do so could result in injury to personnel.

1. REMOVE four socket head screws (1), four washers (2), and membrane COVER (3). DISCARD WASHERS.
2. REMOVE membrane (4), POPPET (5), backing ring (6), packing (7), spring (8), and packing (9). DISCARD MEMBRANE, backing RING, PACKINGS, and SPRING.
3. REMOVE rollpin (10), KNOB (11), and two packings (12). DISCARD ROLLPIN and PACKINGS.
4. REMOVE retaining ring (13), COVER (14), and packing (15). DISCARD retaining RING and PACKING.
5. REMOVE spring cover (16), spring (17), and VALVE (18). DISCARD SPRING and VALVE.
6. REMOVE and DISCARD keeper (19) and SCREEN (20).

**ASSEMBLY**

1. INSTALL new SCREEN (20) and new keeper (19).
2. INSTALL new VALVE (18), new spring (17), and spring cover (16).
3. APPLY COAT of LUBRICATING OIL to new PACKING (15) and INSTALL packing (15), COVER (14), and new retaining ring (13).
4. APPLY COAT of LUBRICATING OIL to two new PACKINGS (12) and INSTALL two packings (12), KNOB (11), and new rollpin (10).
5. APPLY COAT of LUBRICATING OIL to new PACKING (9) and new PACKING (7) and INSTALL packing (9), new Spring (8), packing (7), new backing ring (6), POPPET (5), and new membrane (4).
6. INSTALL membrane COVER (3) and four new washers (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.

7. APPLY COAT of SEALING COMPOUND to THREADS of four socket head screws (1) and INSTALL four socket head SCREWS (1).

**NOTE**

Follow-on Maintenance:  
Install antifreeze device (TM 5-2420-224-20).

**Section VIII. TANDEM VALVE REPAIR**

**TANDEM VALVE REPAIR**

This task covers: a. Disassembly b. Repair c. Assembly

**INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**References:**

TM 5-2420-224-20

**Materials/Parts:**

Kit, Parts

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Tandem Valve Removed

**DISASSEMBLY**

**NOTE**

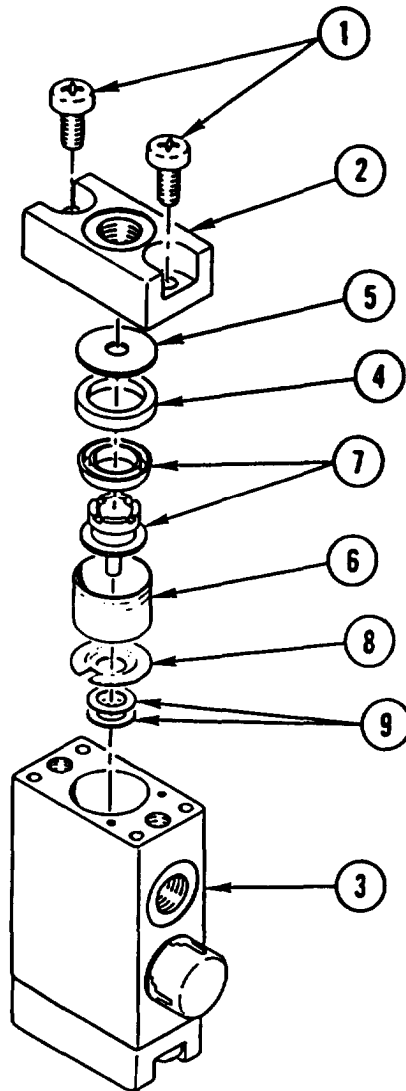
Matchmark cover and tandem valve housing prior to removal to ensure proper installation of cover on tandem valve housing.

1. REMOVE two screws (1) and COVER (2) from tandem valve housing (3).
2. REMOVE seal RiNG (4) and washer (5) from cover (2). DiSCARD seal RiNG and WAsHER.
3. REMOVE sleeve SPACER (6) from tandem valve housing (3).

**NOTE**

Note position of plunger assembly prior to removal to aid in installation.

4. REMOVE PLUNGER assembly (7) from sleeve spacer (6).
5. REMOVE slotted RiNG (8) and two seal rings (9) from tandem valve housing (3). DiSCARD slotted RiNG and seal RiNGS.



## TANDEM VALVE REPAIR (CONT)

### NOTE

Matchmark cover and tandem valve housing prior to removal to ensure proper installation of cover on tandem valve housing.

6. REMOVE two screws (10), COVER (11), and spring (12) from tandem valve housing (3).
7. REMOVE sleeve SPACER (13) and slotted ring (14) from tandem valve housing (3). DISCARD slotted RING.

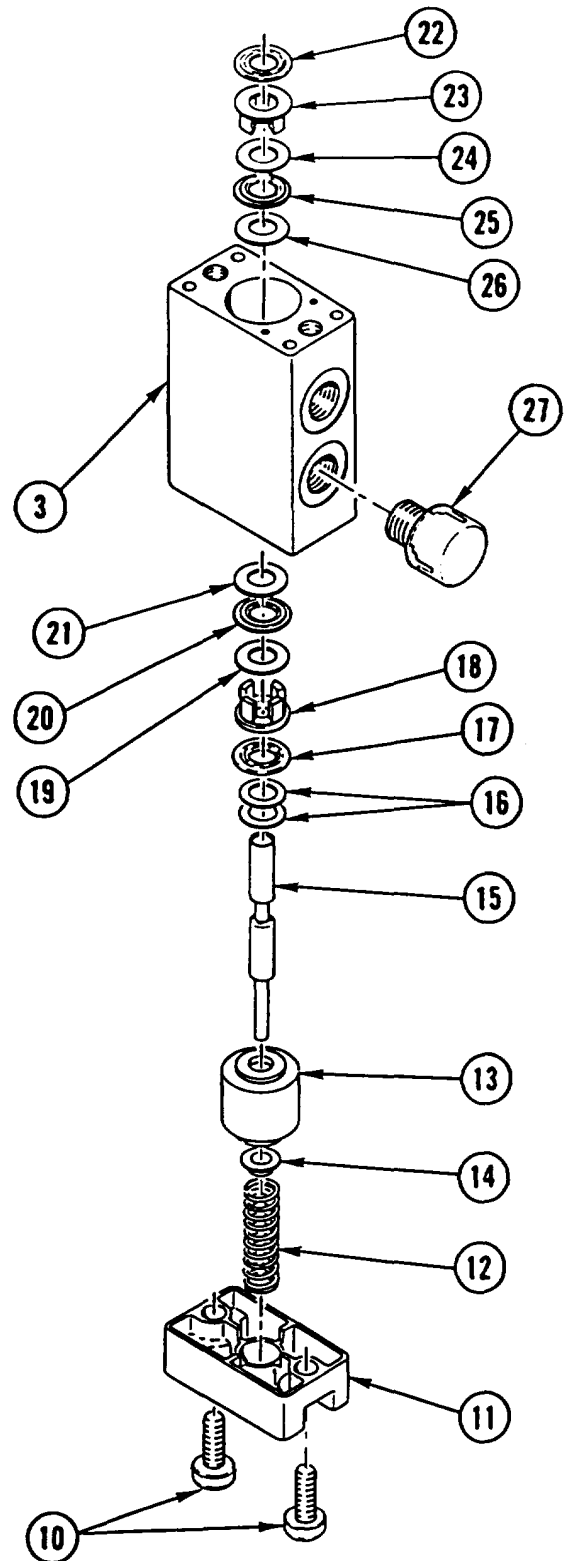
### NOTE

Note position of spool valve prior to removal to aid in installation.

8. REMOVE spool VALVE (15) and two seal rings (16) from tandem valve housing (3). DISCARD seal RINGS.
9. REMOVE and DISCARD seal RING (17) from tandem valve housing (3).
10. REMOVE SPACER (18) and three seal rings (19, 20, and 21) from tandem valve housing (3).
11. REMOVE and DISCARD seal RING (22) from tandem valve housing (3).
12. REMOVE SPACER (23) and three seal rings (24, 25, and 26) from tandem valve housing (3).
13. REMOVE breather CAP (27) from tandem valve housing (3).

## REPAIR

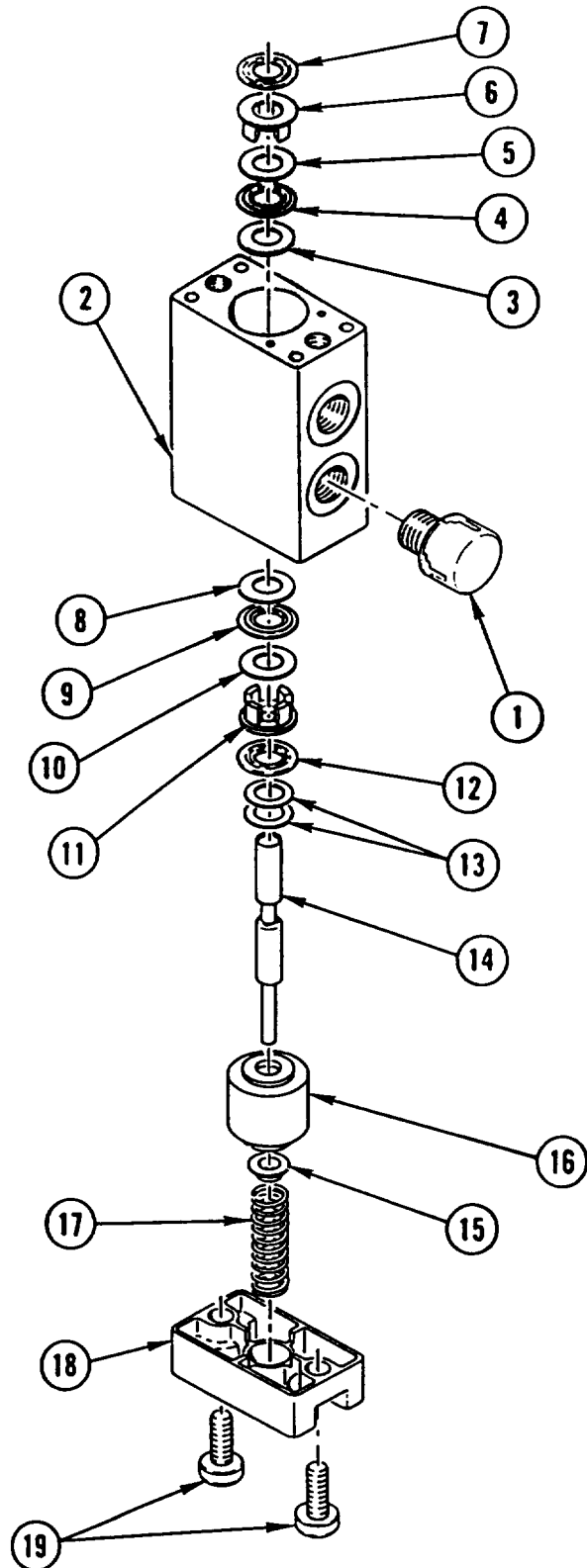
If any parts not found in Parts Kit are damaged, replace tandem valve.



## TANDEM VALVE REPAIR (CONT)

### ASSEMBLY

1. INSTALL breather CAP (1) in tandem valve housing (2).
2. INSTALL three seal rings (3, 4, and 5) and SPACER (6) in tandem valve housing (2).
3. INSTALL new seal RING (7) in tandem valve housing (2).
4. INSTALL three seal rings (8, 9, and 10) and SPACER (11) in tandem valve housing (2).
5. INSTALL new seal RING (12) in tandem valve housing (2).
6. INSTALL two new seal rings (13) and spool VALVE (14), in position noted during Removal, in tandem valve housing (2).
7. INSTALL new slotted ring (15) and sleeve SPACER (16) in tandem valve housing (2).
8. INSTALL spring (17), COVER (18), and two screws (19) on tandem valve housing (2).



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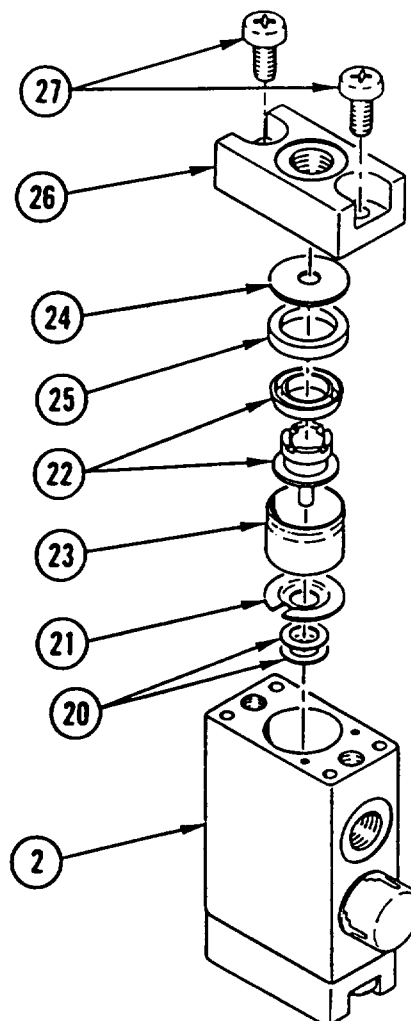
**TANDEM VALVE REPAIR (CONT)**

---

9. INSTALL two new seal rings (20) and new slotted RING (21) in tandem valve housing (2).
10. INSTALL PLUNGER assembly (22), in position noted during Removal, in sleeve spacer (23).
11. INSTALL sleeve SPACER (23) in tandem valve housing (2).
12. INSTALL new WASHER (24) and new seal ring (25) in cover (26).
13. INSTALL COVER (26) and two screws (27) on tandem valve housing (2).

**NOTE**

Follow-on Maintenance:  
Install tandem valve (TM 5-2420-224-20).



## Section IX. TIRE REPAIR

---

### TIRE REPAIR

---

This task covers: Repair

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Set, Tire Repair, SC 5180-95-CL-B14

**Personnel Required:** (2)

**References:**

TM 9-2610-200-24

**Equipment condition:**

**Reference**

TM 9-2610-200-24

**Condition Description**

Tire Removed from  
Wheel Rim

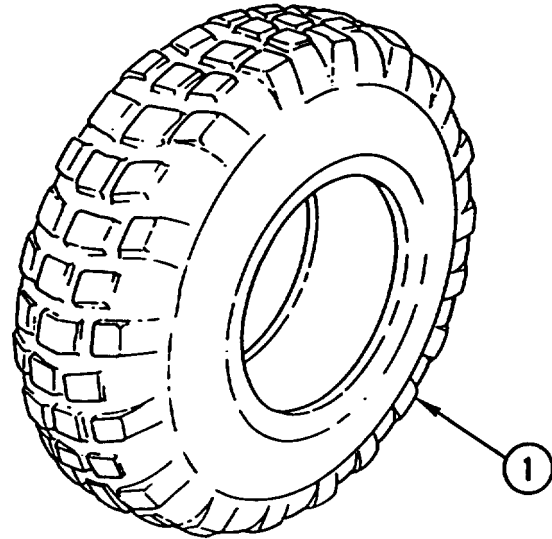
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#### REPAIR

Repair tire (1) (TM 9-2610-200-24).

**NOTE**

Follow-on Maintenance:  
Install tire on wheel rim (TM 9-2610-200-24).



## CHAPTER 18

### CAB REPAIR INSTRUCTIONS

#### OVERVIEW

This chapter contains maintenance instructions for repair of the cab.

---

#### CAB REPAIR

---

This task covers: a. Removal b. Repair c. Installation

---

#### **INITIAL SETUP**

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Shop Equipment, Welding, SC 4940-95-CL-B19  
Tool Kit, Body and Fender Repair,  
SC 5180-90-CL-N62

##### References:

FM 43-2  
TM 9-237

---

#### REMOVAL

##### NOTE

- If any metal panels are to be removed, removal must be performed in accordance with TM 9-237.
- Discard lock washer(s).

REMOVE cab COMPONENTS using illustration and legend as a guide.

#### REPAIR

If any body repair, other than removal of metal panels (i.e., dents), is to be performed, perform repair in accordance with FM 43-2.

#### INSTALLATION

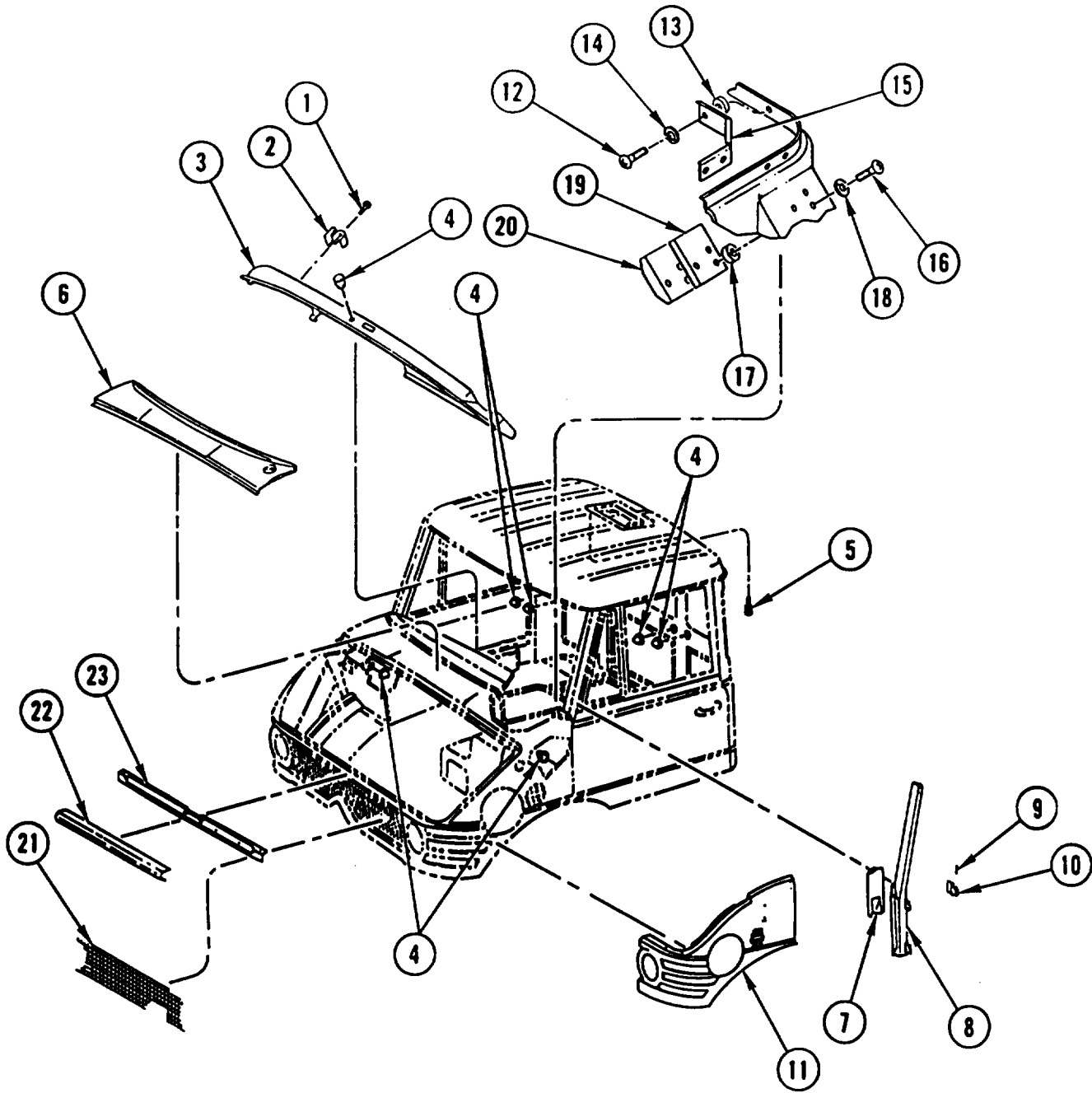
##### NOTE

- If any metal panels are to be installed, installation must be performed in accordance with TM 9-237.
- Install new lock washer(s).

INSTALL cab COMPONENTS using illustration and legend as a guide.



**CAB REPAIR (CONT)**



**LEGEND**

- |                          |                    |                      |
|--------------------------|--------------------|----------------------|
| 1 Capscrew (2)           | 9 Straight pin (2) | 17 Washer (3)        |
| 2 Cap (2)                | 10 Door hinge (2)  | 18 Lock washer (3)   |
| 3 Instrument panel cover | 11 Paneling        | 19 Pad               |
| 4 Bumper (8)             | 12 Screw (3)       | 20 Screening         |
| 5 Fastener               | 13 Washer (3)      | 21 Ventilation panel |
| 6 Structural panel       | 14 Lock washer (3) | 22 Structural panel  |
| 7 Structural post        | 15 Deflector       | 23 Reinforcement     |
| 8 Pillar                 | 16 Screw (3)       |                      |

## CHAPTER 19 ACCESSORY ITEMS REPAIR INSTRUCTIONS

---

### OVERVIEW

This chapter contains maintenance instructions for repair of accessory items.

---

### CAB HEATER REPAIR

---

This task covers: a. Disassemble b. Repair c. Assembly

---

#### **INITIAL SETUP**

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Washer, Lock (4)

Washer, Lock (3)

Washer, Spring  
Tension

Washer, Lock (2)

##### References:

TM 5-2420-224-20

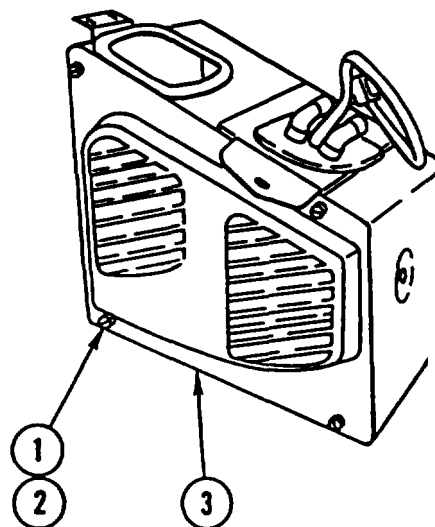
##### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Cab Heater Removed

---

#### **DISASSEMBLY**

1. REMOVE four screws (1), four lock washers (2), and COVER (3). DISCARD lock WASHERS.

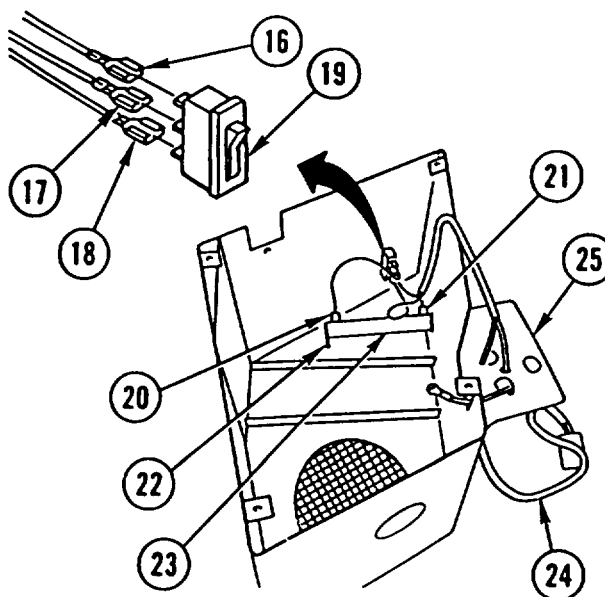
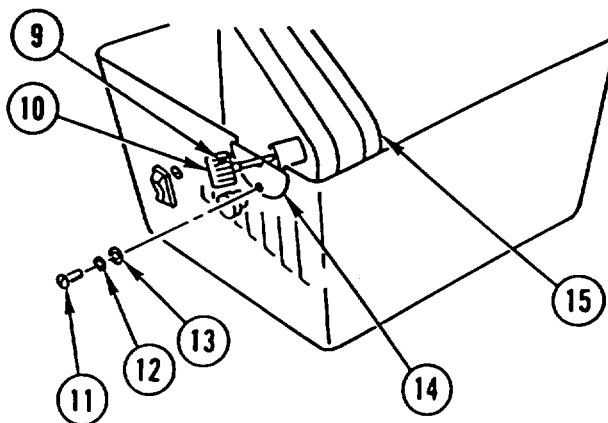
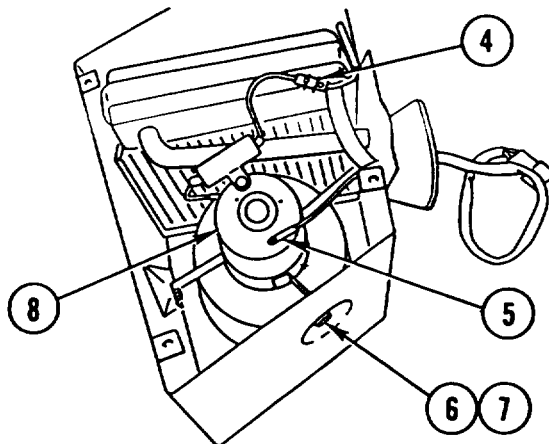


## CAB HEATER REPAIR (CONT)

### NOTE

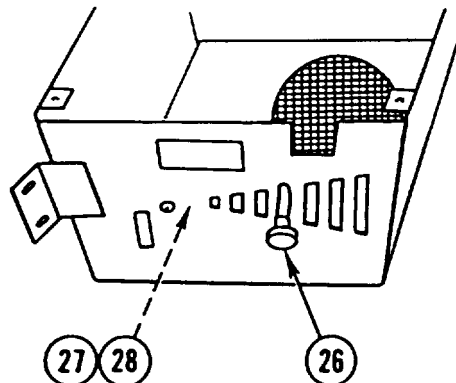
Tag all wires prior to disconnecting to aid in connecting.

2. DISCONNECT two WIRES (4 and 5).
3. REMOVE three screws (6), three lock washers (7), and MOTOR (8). DISCARD lock WASHERS.
4. LOOSEN SCREW (9) and REMOVE KNOB (10).
5. REMOVE screw (11), washer (12), spring tension washer (13), cover (14), and RADIATOR (15). DISCARD spring tension WASHER.
6. DISCONNECT three WIRES (16, 17, and 18) and REMOVE SWITCH (19).
7. DISCONNECT two WIRES (20 and 21).
8. BEND BRACKET (22) and REMOVE RESISTOR (23).
9. REMOVE wiring HARNESS (24) and flap (25).

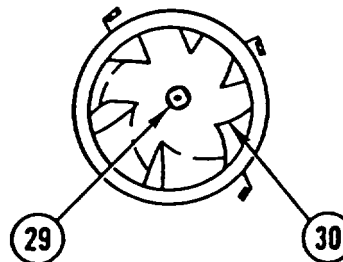


**CAB HEATER REPAIR (CONT)**

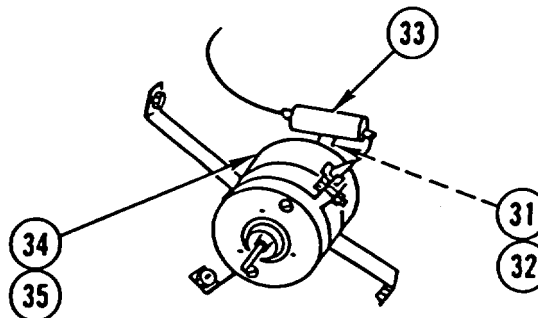
- 10. REMOVE KNOB (26).
- 11. REMOVE keeper (27) and SHUTTER (28).



- 12. REMOVE clip (29) and IMPELLER (30).



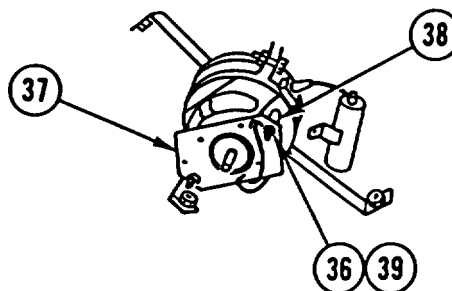
- 13. REMOVE two nuts (31), two lock washers (32), condenser (33), HOUSING (34), and washer (35). DISCARD lock WASHERS.



- 14. REMOVE two nuts (36), circuit BOARD (37), two spacers (38), and two screws (39).

**REPAIR**

Using low-heat soldering iron, replace brushes if worn and not making proper contact with motor armature.



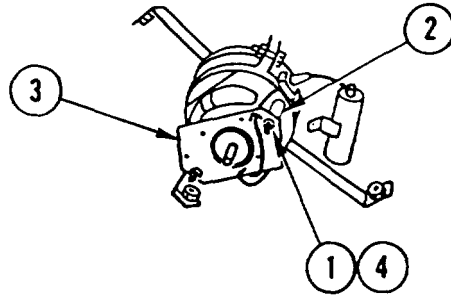
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## CAB HEATER REPAIR (CONT)

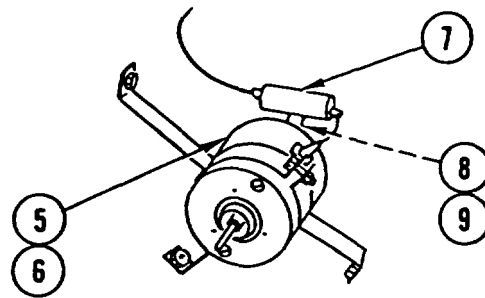
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### ASSEMBLY

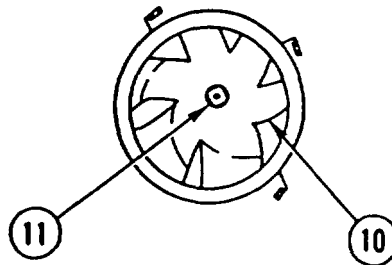
1. INSTALL two screws (1), two spacers (2), circuit BOARD (3), and two nuts (4).



2. INSTALL washer (5), HOUSING (6), condenser (7), two new lock washers (8), and two nuts (9).

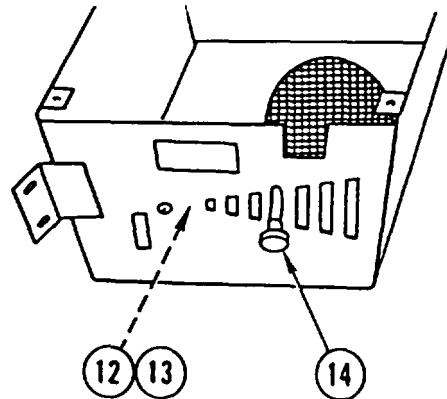


3. INSTALL IMPELLER (10) and clip (11).



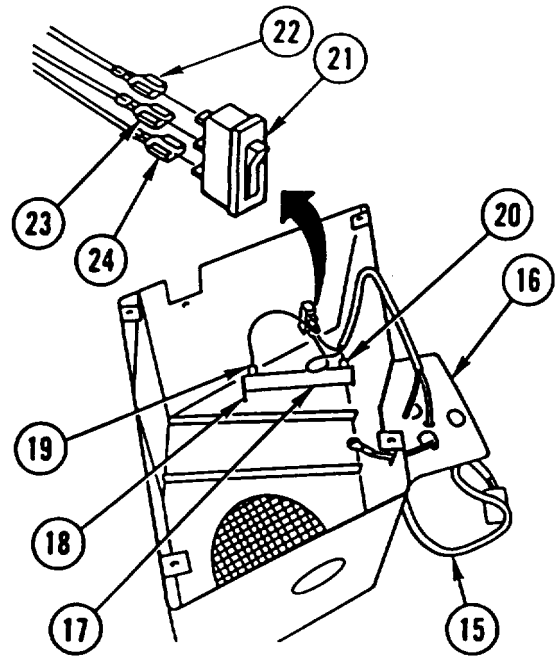
4. INSTALL SHUTTER (12) and keeper (13).

5. INSTALL KNOB (14).

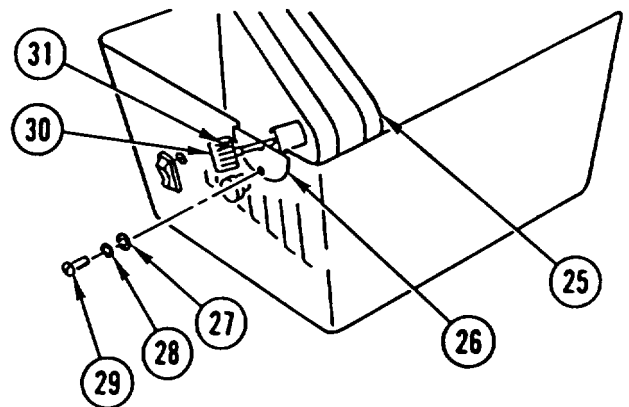


## CAB HEATER REPAIR (CONT)

6. INSTALL wiring HARNESS (15) and flap (16).
7. INSTALL RESISTOR (17). BEND BRACKET (18) down and CONNECT two WIRES (19 and 20).
8. INSTALL SWITCH (21) and CONNECT three WIRES (22, 23, and 24).



9. INSTALL RADIATOR (25), cover (26), new spring tension washer (27), washer (28), and screw (29).
10. INSTALL KNOB (30) and TIGHTEN SCREW (31).

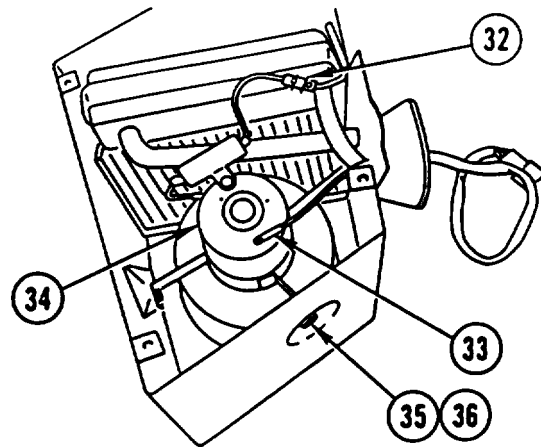


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## CAB HEATER REPAIR (CONT)

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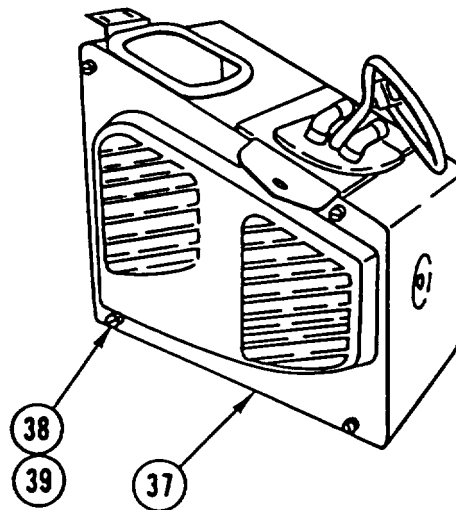
11. CONNECT two WIRES (32 and 33).
12. INSTALL MOTOR (34), three new lock washers (35), and three screws (36).



13. INSTALL COVER (37), four new lock washers (38), and four screws (39).

**NOTE**

Follow-on Maintenance:  
Install cab heater (TM 5-2420-224-20).



## CHAPTER 20

### HYDRAULIC SYSTEM REPAIR INSTRUCTIONS

---

#### OVERVIEW

This chapter contains maintenance instructions for repair of the hydraulic system. A list of sections contained in this chapter is shown below.

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Section IV.	Front Loader/Forklift Control Valve Repair . . . . .	20-14
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## Section I. FRONT HYDRAULIC PUMP REPAIR

### FRONT HYDRAULIC PUMP REPAIR

This task covers: a. Disassembly b. Repair c. Assembly

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Front Hydraulic Pump Removed

**Materials/Parts:**

Kit, Parts	
Kit, Parts	
Oil, Lubricating	Appendix B, Item 30
Rags	Appendix B, Item 40

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**References:**

TM 5-2420-224-20

## FRONT HYDRAULIC PUMP REPAIR (CONT)

### DISASSEMBLY

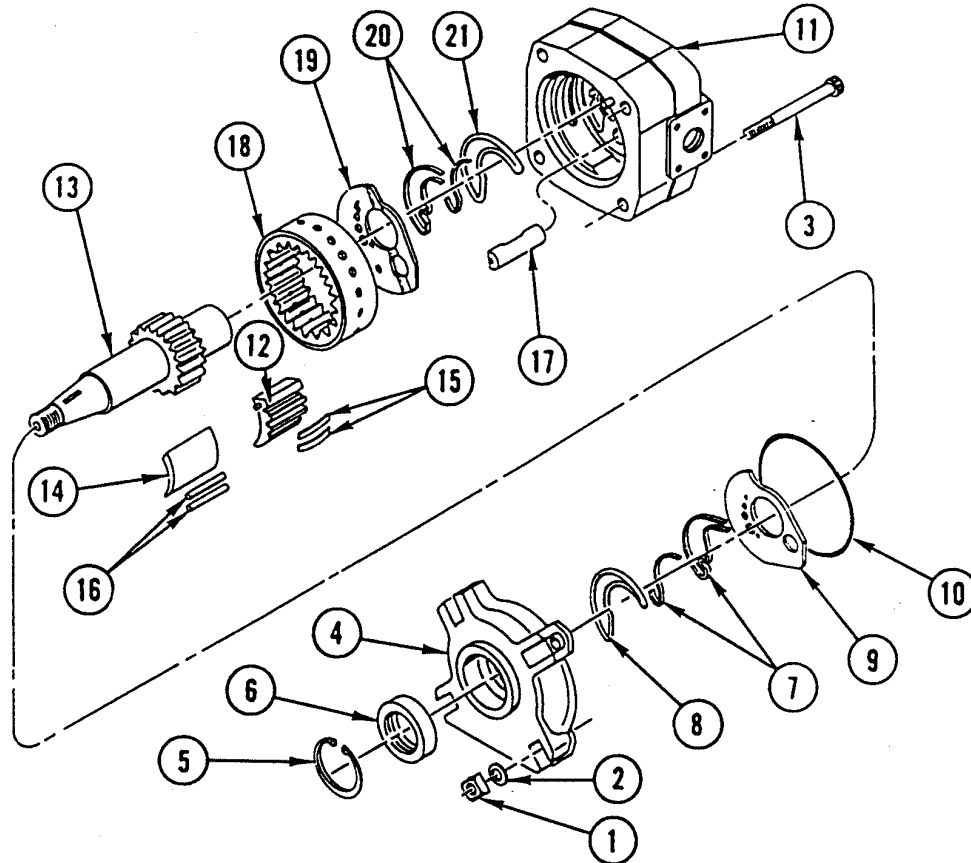
#### NOTE

New style pump does not have key-way on gear shaft.

1. REMOVE two nuts (1), two washers (2), two screws (3), and COVER (4).
2. REMOVE retaining ring (5), seal ring (6), two retainer springs (7), and SEAL (8) from COVER (4). DISCARD seal RING and SEAL.
3. REMOVE PLATE (9) and O-ring (10) from housing (11). DISCARD O-RING.
4. REMOVE segment CARRIER (12) from housing (11).
5. REMOVE GEAR (13), sealing segment (14), two segment springs (15), and two sealing rolls (16) from segment carrier (12). DISCARD sealing SEGMENT, segment SPRINGS, and sealing ROLLS.
6. REMOVE PIN (17) and gear ring (18).
7. REMOVE PLATE (19), two retainer springs (20), and seal (21) from housing (11). DISCARD SEAL.

### REPAIR

If any parts found in Parts Kits are damaged, replace pump.



---

**FRONT HYDRAULIC PUMP REPAIR (CONT)**

---

**ASSEMBLY****NOTE**

Apply coat of lubricating oil to O-ring and seals prior to assembly.

1. INSTALL new seal (21), two retainer springs (20), and PLATE (19) in housing (11).
2. INSTALL gear RING (18).
3. INSTALL PIN (17) with narrow chamfer toward outside of housing (11).
4. INSTALL two new sealing rolls (16), two new segment SPRINGS (15), and new sealing segment (14) on segment carrier (12).
5. INSTALL GEAR (13) and segment carrier (12) in housing (11).
6. INSTALL new O-ring (10) and PLATE (9) in housing (11).
7. INSTALL new SEAL (8), two retainer springs (7), new seal ring (6), and retaining ring (5) in cover (4).
8. INSTALL COVER (4), two screws (3), two washers (2), and two nuts (1).

**NOTE**

Follow-on Maintenance:

Install front hydraulic pump (TM 5-2420-224-20).

## Section II. REAR HYDRAULIC PUMP REPAIR

---

### REAR HYDRAULIC PUMP REPAIR

---

This task covers: a. Disassembly b. Assembly

---

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

##### Materials/Parts:

Washer, Lock (4)

Kit

Oil, Lubricating                      Appendix B, Item 30

Rags                                      Appendix B, Item 40

##### References:

TM 5-2420-224-20

##### Equipment Condition:

###### Reference

TM 5-2420-224-20

###### Condition Description

Rear Hydraulic Pump  
Removed

##### General Safety Instructions:

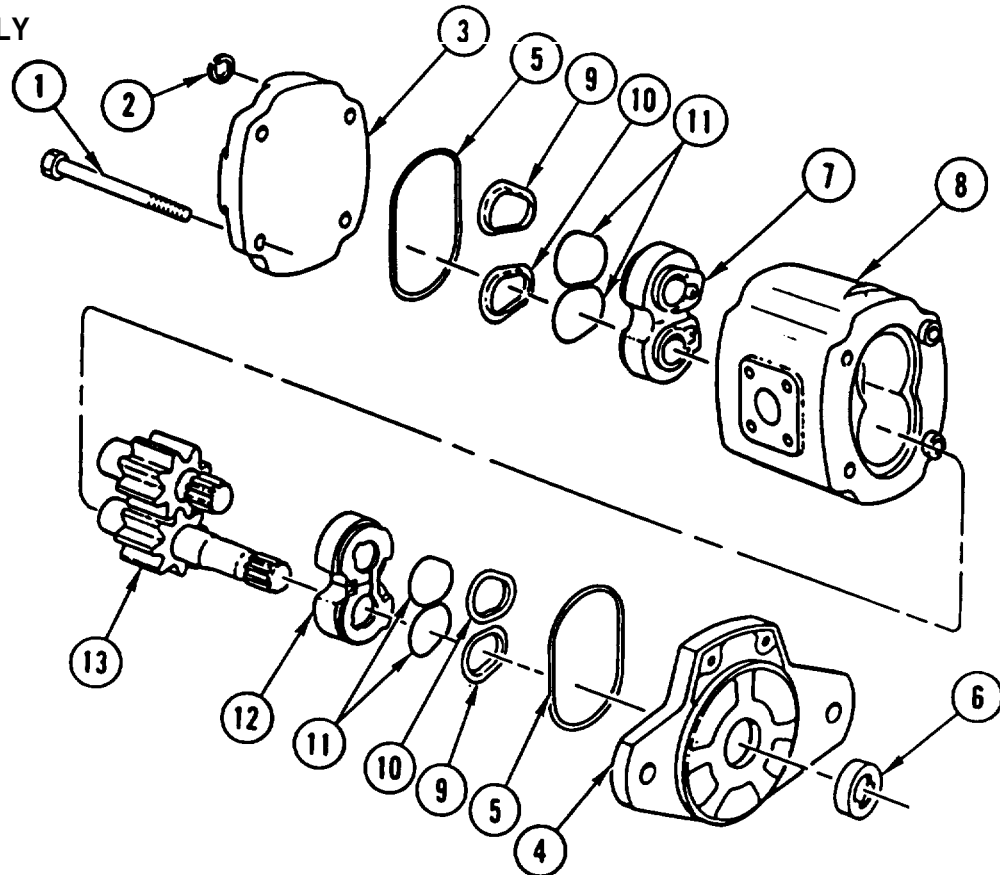
#### **WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**REAR HYDRAULIC PUMP REPAIR (CONT)**


---

**DISASSEMBLY**

1. REMOVE four bolts (1), four lock washers (2), COVER (3), flange (4), and two seals (5). DISCARD lock WASHERS and SEALS.
2. REMOVE and DISCARD SEAL (6) from flange (4).

**NOTE**

Tag each bush prior to removal to aid in installation.

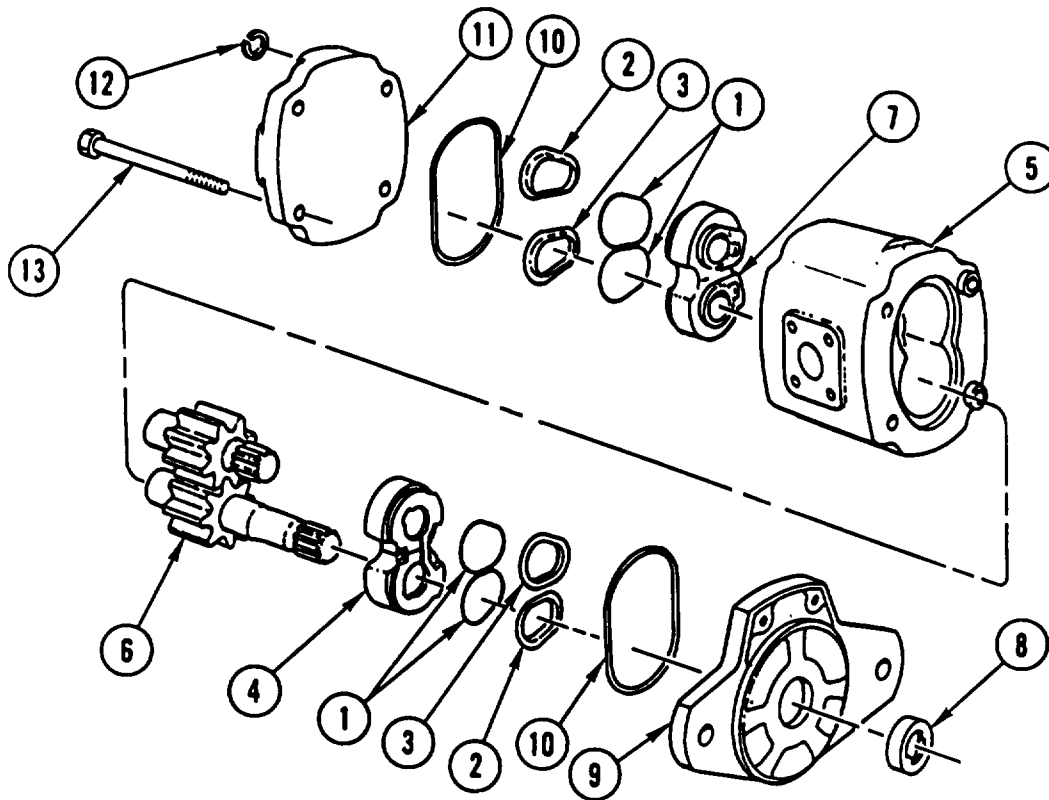
3. REMOVE BUSH (7) from rear of body (8).
4. REMOVE and DISCARD two backup WASHERS (9 and 10) and two lobe SEALS (11) from bush (7).
5. REMOVE bush (12) and gear PAIR (13) from body (8).
6. REMOVE BUSH (12) from gear pair (13).
7. REPEAT STEP 4 for bush (12).

---

**REAR HYDRAULIC PUMP REPAIR (CONT)**

---

**ASSEMBLY**



**NOTE**

- Apply coat of lubricating oil to seals prior to assembly.
- Make sure backup washers are flush after installation.

1. INSTALL two new lobe SEALS (1) and two new backup washers (2 and 3) on bush (4).
2. INSTALL BUSH (4) in body (5).
3. INSTALL gear PAIR (6) in body (5).
4. REPEAT STEP 1 for bush (7).
5. INSTALL BUSH (7).
6. INSTALL new SEAL (8) in flange (9).
7. INSTALL two new seals (10), flange (9), COVER (11), four new lock washers (12), and four bolts (13).
8. TIGHTEN BOLTS (13) in diagonal pattern to 34-36 lb-ft (46-49 N.m).

**NOTE**

Follow-on Maintenance:  
 Install rear hydraulic pump (TM 5-2420-224-20).

## Section III. HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR

---

### HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR

---

This task covers: a. Disassembly b. Assembly

---

#### INITIAL SETUP

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Packing, Preformed

Packing, Preformed

Packing, Preformed

Packing, Preformed

Washer, Lock (2)

Kit, Parts

Kit, Parts

Oil, Lubricating                      Appendix B, Item 30

Rags    Appendix B, Item 40

**References:**

TM 5-2420-224-20

LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Hydraulic Suspension Lockout Pump Removed

**General Safety Instructions:**

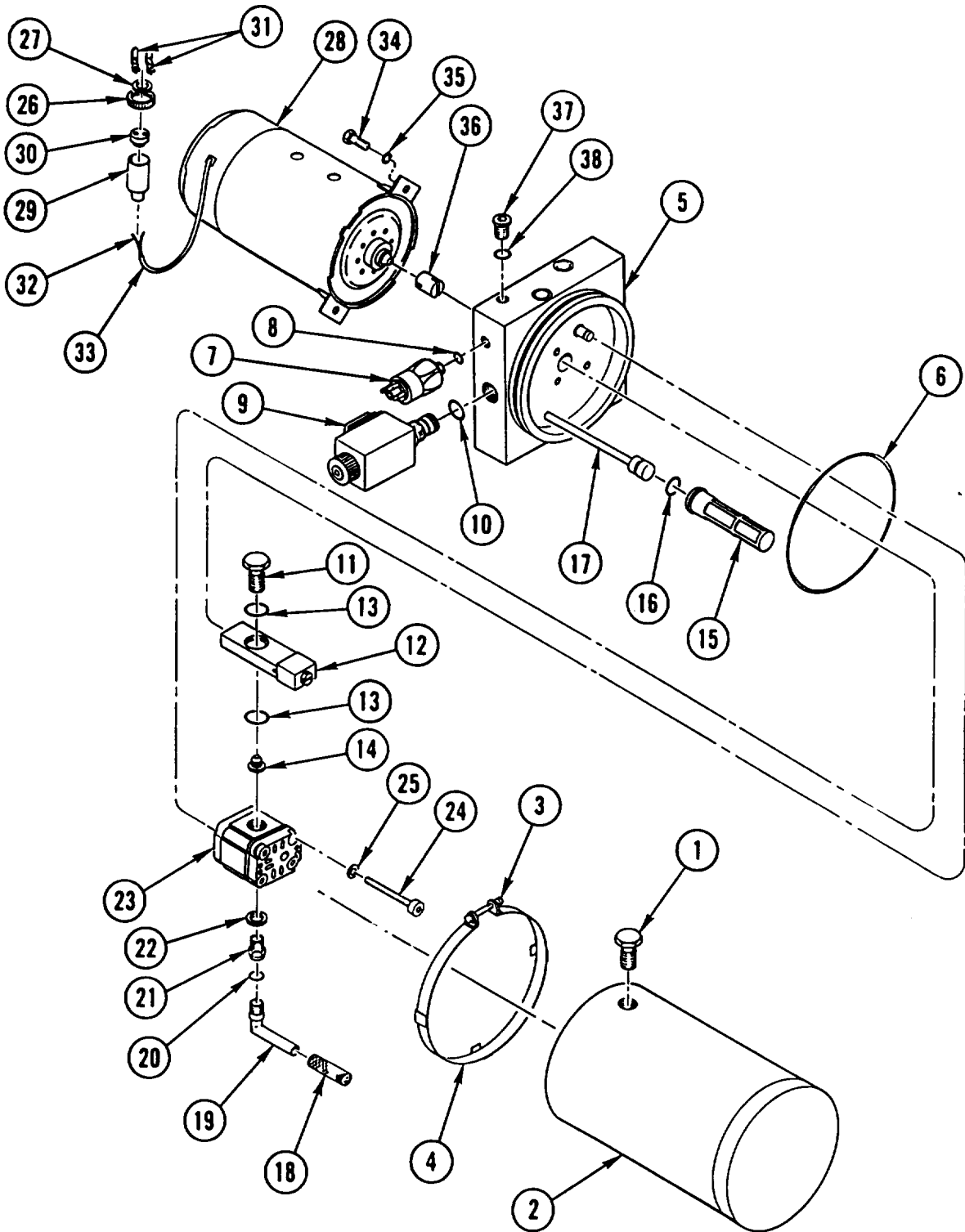
**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.



**HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR (CONT)**

**DISASSEMBLY**



---

## HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR (CONT)

---

1. REMOVE PLUG (1) and COMPLETELY DRAIN hydraulic OIL from oil pan (2) into suitable container.
2. REMOVE screw (3), clamp (4), and oil PAN (2) from manifold (5).
3. REMOVE and DISCARD PACKING (6) from manifold (5).
4. REMOVE pressure SWITCH (7) from manifold (5).
5. REMOVE and DISCARD PACKING (8) from pressure switch (7).
6. REMOVE VALVE (9) from manifold (5).
7. REMOVE and DISCARD PACKING (10) from valve (9).

### NOTE

Filter may remain inside either hollow screw or manifold.

8. REMOVE and DISCARD hollow SCREW (11) from pressure relief valve (12).
9. REMOVE and DISCARD pressure relief VALVE (12), two PACKINGS (13), and FILTER (14) from manifold (5).
10. REMOVE return FILTER (15) and packing (16) from return tube (17). DISCARD PACKING.
11. REMOVE and DISCARD intake FILTER (18). intake PIPE (19). and PACKING (20) from threaded bushing (21).
12. REMOVE threaded BUSHING (21) and washer (22) from hydraulic suspension lockout pump (23).

### NOTE

- If repairing hydraulic suspension lockout pump motor electrical plug, perform steps 13 thru 17.
- If replacing hydraulic suspension lockout pump motor, perform steps 18 and 19.

13. REMOVE four screws (24) and four washers (25) and hydraulic suspension lockout PUMP (23).
14. SLIDE union NUT (26) and washer (27) toward hydraulic suspension lockout pump motor (28).
15. CAREFULLY ROLL GROMMET (29) from plug housing (30).

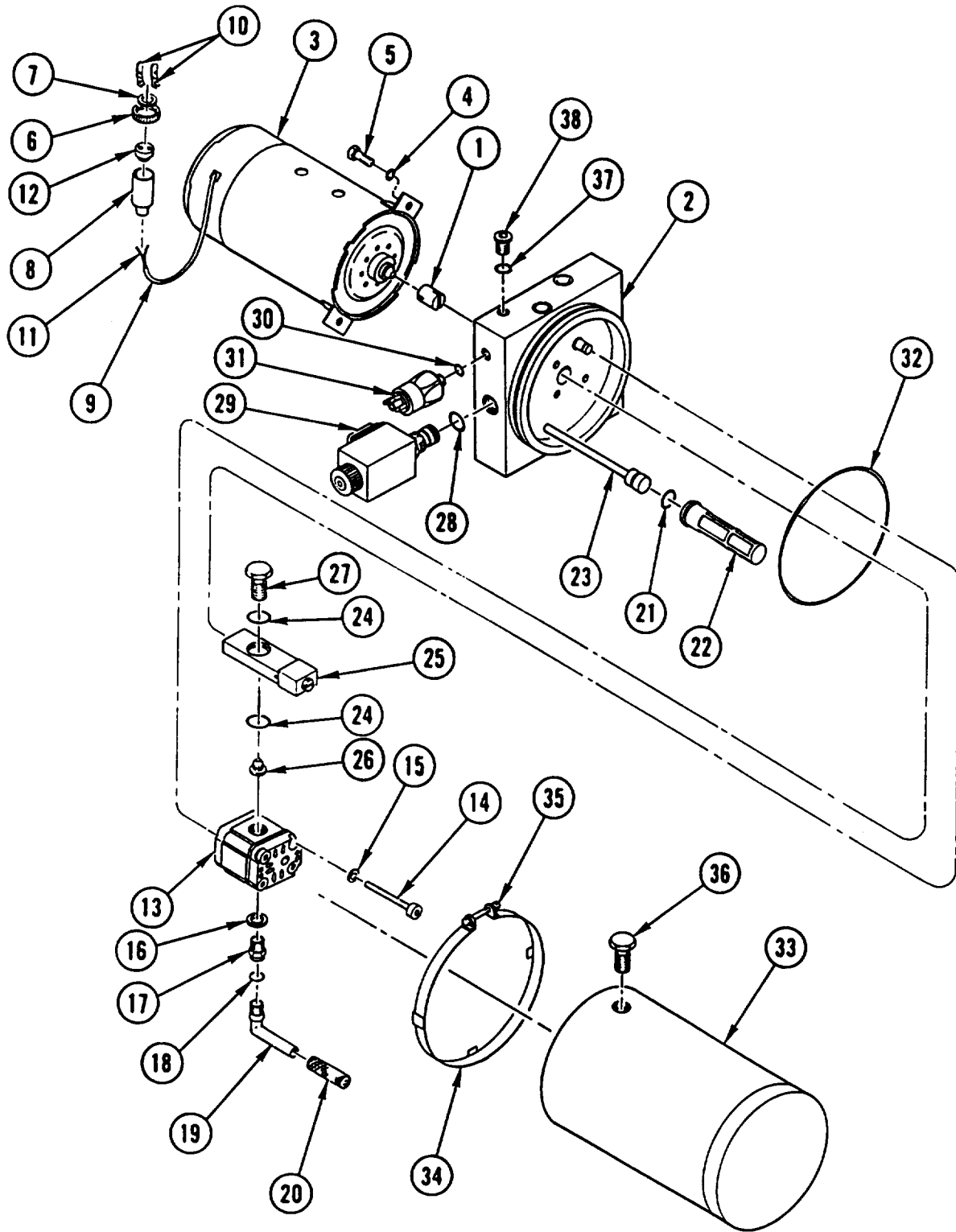
### NOTE

Note wire location in relation to locator pin on plug housing to aid in assembly.

16. REMOVE two electrical CONTACTS (31) from plug housing (30).
17. REMOVE two electrical CONTACTS (31) from two electrical wires (32).
18. REMOVE GROMMET (29), washer (27), and union nut (26) from cable assembly (33).
19. REMOVE two capscrews (34), two lock washers (35), and hydraulic suspension lockout pump MOTOR (28) from manifold (5). DISCARD lock WASHERS.
20. REMOVE drive COUPLER (36) from manifold (5).
21. REMOVE PLUG (37) and packing (38) from manifold (5). DISCARD PACKING.

HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR (CONT)

ASSEMBLY



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## HYDRAULIC SUSPENSION LOCKOUT MOTOR AND PUMP REPAIR (CONT)

---

### NOTE

- If replacing hydraulic suspension lockout pump motor, perform steps 1 and 2.
- If repairing hydraulic suspension lockout pump motor electrical plug, perform steps 3 thru 7.
- Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL drive COUPLER (1) in manifold (2).
2. INSTALL hydraulic suspension lockout pump MOTOR (3), two new lock washers (4), and two capscrews (5) in manifold (2).
3. INSTALL union nut (6), washer (7), and GROMMET (8) on cable assembly (9).
4. INSTALL two electrical CONTACTS (10) on two electrical wires (11).
5. INSTALL two electrical CONTACTS (10) in plug housing (12) in position noted during Disassembly.
6. CAREFULLY ROLL GROMMET (8) over plug housing (12).
7. SLIDE washer (7) and union NUT (6) over grommet (8).
8. INSTALL hydraulic suspension lockout PUMP (13), four screws (14), and four washers (15) in manifold (2).
9. INSTALL washer (16) and threaded BUSHING (17) in hydraulic suspension lockout pump (13).
10. INSTALL new PACKING (18) on new intake pipe (19).
11. INSTALL intake PIPE (19) in threaded bushing (17).
12. INSTALL new intake FILTER (20) on intake pipe (19).
13. INSTALL new packing (21) and return FILTER (22) on return tube (23).
14. INSTALL two new PACKINGS (24) in new pressure relief valve (25).
15. INSTALL pressure relief VALVE (25) on manifold (2).
16. INSTALL new FILTER (26) in pressure relief valve (25).
17. INSTALL new hollow SCREW (27) in pressure relief valve (25).
18. INSTALL new PACKING (28) on valve (29).
19. INSTALL VALVE (29) in manifold (2).
20. INSTALL new PACKING (30) on pressure switch (31).
21. INSTALL pressure SWITCH (31) in manifold (2).
22. INSTALL new PACKING (32) on manifold (2).
23. INSTALL oil PAN (33), clamp (34), and screw (35) on manifold (2).
24. FILL oil PAN (33) (LO 5-2420-224-12) and INSTALL PLUG (36).
25. INSTALL new packing (37) and PLUG (38) in manifold (2).

### NOTE

Follow-on Maintenance:

Install hydraulic suspension lockout pump (TM 5-2420-224-20).

**Section IV. FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR**

---

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR**

---

This task covers: a. Disassembly b. Assembly

---

**INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Washer, Lock (6)  
 Packing (8)  
 Packing (8)  
 Packing (2)  
 Packing (2)  
 Packing (3)  
 Washer, Lock (2)  
 Rod, Tie (3)  
 Set, Packing  
 Kit, Parts  
 Kit, Parts (3)  
 Kit, Parts (2)  
 Kit, Seal (2)  
 Kit, Seal (2)  
 Oil, Lubricating  
 Rags

Appendix B, Item 30  
 Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
Page 11-28	Front Loader Control Valve and Bracket (SEE) or Forklift Control Valve and Bracket (HMMH) Removed

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

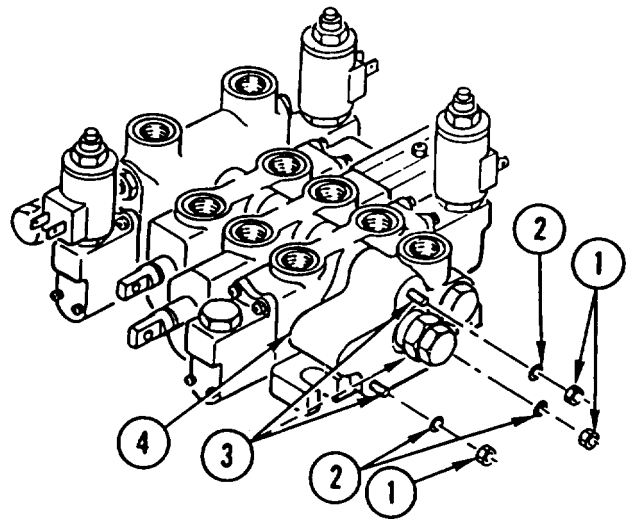

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**DISASSEMBLY**
**NOTE**

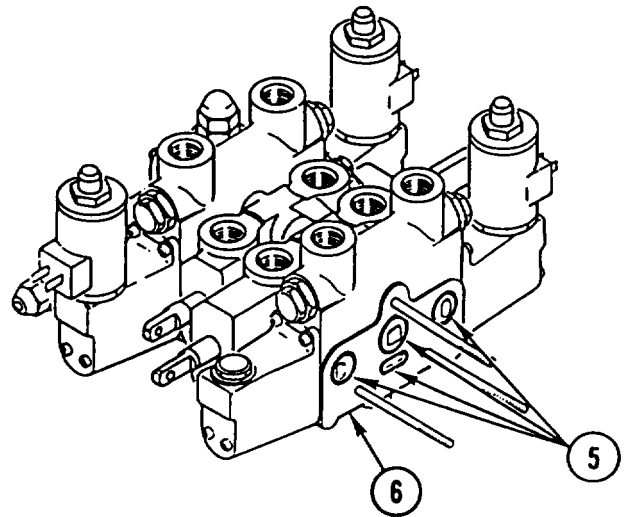
Procedure is the same for both vehicles.

**FRONT LOADER/FORKLIFT CONTROL VALVE**

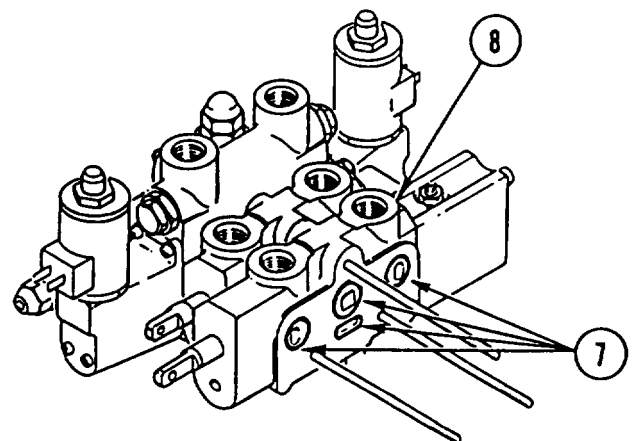
1. REMOVE three nuts (1) and three lock washers (2) from three tie RODS (3). DISCARD lock WASHERS.
2. REMOVE outlet BODY (4).



3. REMOVE four packings (5) and solenoid-operated hand tool valve BODY (6). DISCARD PACKINGS.



4. REMOVE four packings (7) and front loader/forklift control valve body SECTION (8). DISCARD PACKINGS.

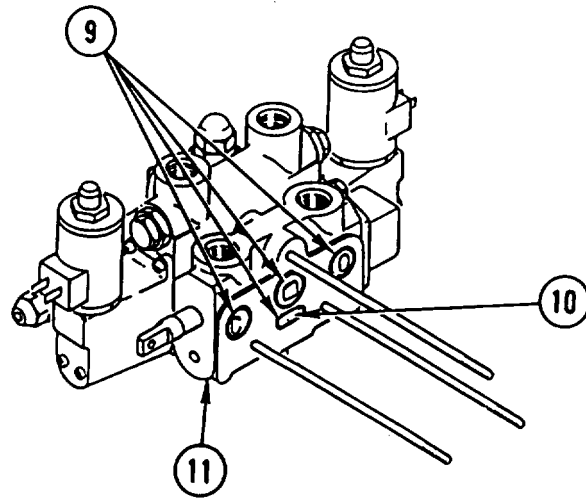


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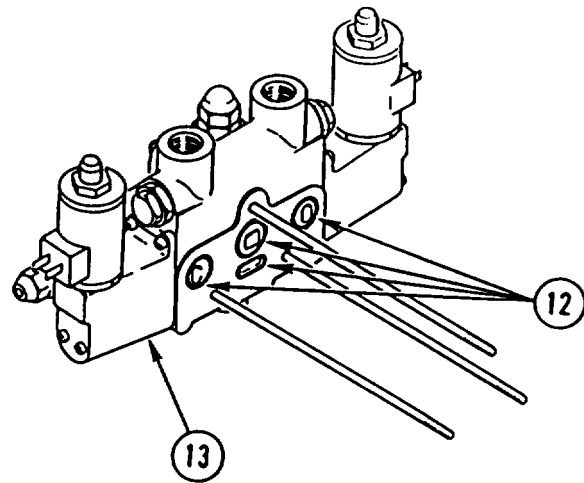
**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

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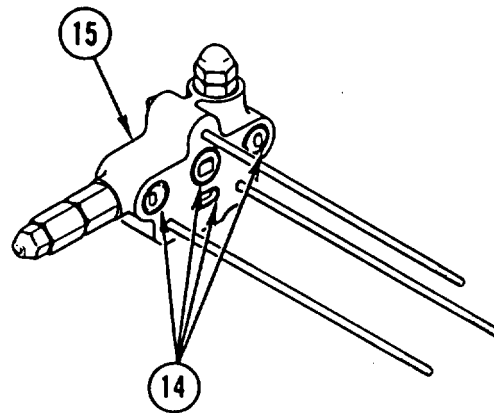
5. REMOVE four packings (9), blanking plate (10), and low body section valve BODY (11). DISCARD PACKINGS.



6. REMOVE four packings (12) and solenoid-operated front loader/forklift valve BODY (13). DISCARD PACKINGS.

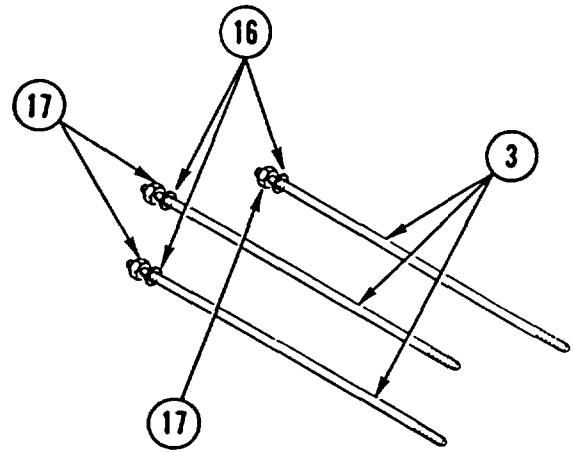


7. REMOVE four packings (14) and intake manifold BODY (15). DISCARD PACKINGS.



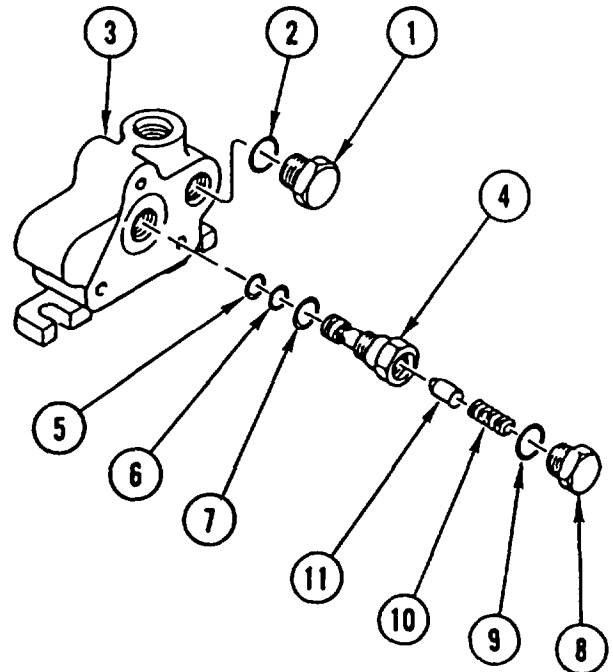
**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

- REMOVE three lock washers (16) and three nuts (17) from three tie RODS (3). DISCARD lock WASHERS and tie RODS.



**Outlet Body Disassembly**

- REMOVE PLUG (1) and packing (2) from outlet body (3). DISCARD PACKING.
- REMOVE CARTRIDGE assembly (4), packing (5), backup ring (6), and packing (7). DISCARD PACKINGS.
- REMOVE PLUG (8), packing (9), spring (10), and disc (11) from cartridge assembly (4). DISCARD PACKING.



**Outlet Body Assembly**

**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

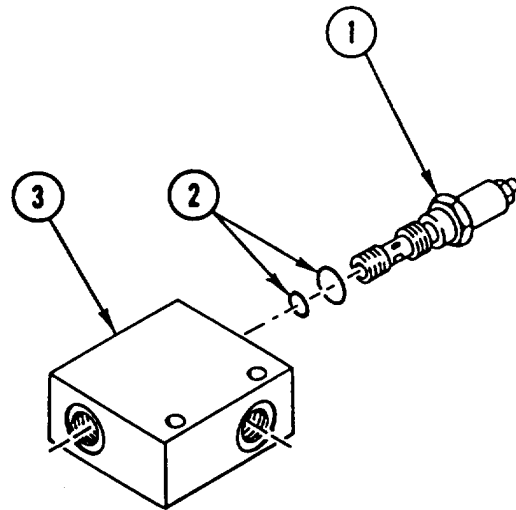
- INSTALL disc (11), spring (10), new packing (9), and PLUG (8) in cartridge assembly (4).
- INSTALL new packing (7), backup ring (6), new packing (5), and CARTRIDGE assembly (4) in outlet body (3).
- INSTALL new packing (2) and PLUG (1).



## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

### Front Loader/Forklift Relief Valve Disassembly

REMOVE front attachment relief VALVE (1) and two packings (2) from valve manifold (3). DISCARD PACKINGS.



### Front Loader/Forklift Relief Valve Assembly

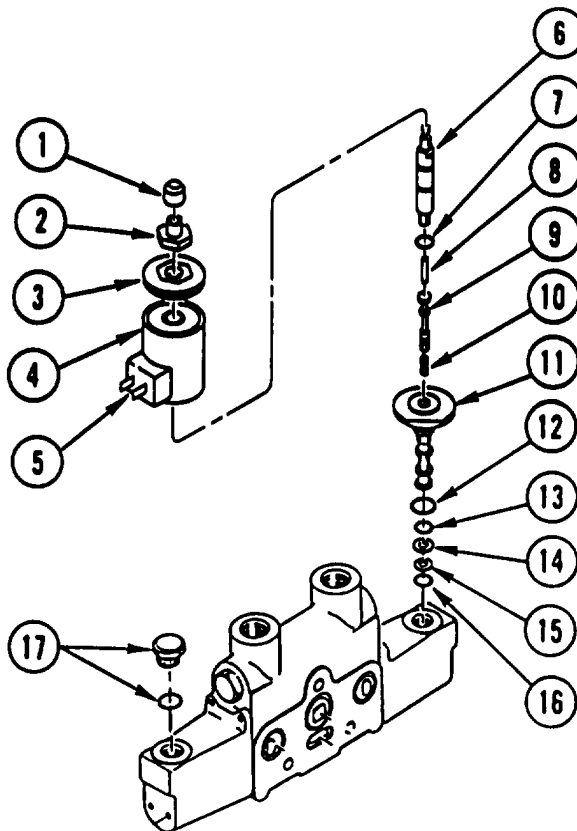
#### NOTE

Apply coat of lubricating oil to packings prior to assembly.

INSTALL two new packings (2) and front attachment relief VALVE (1) in valve manifold (3).

### Solenoid-Operated Hand Tool Valve Body Disassembly

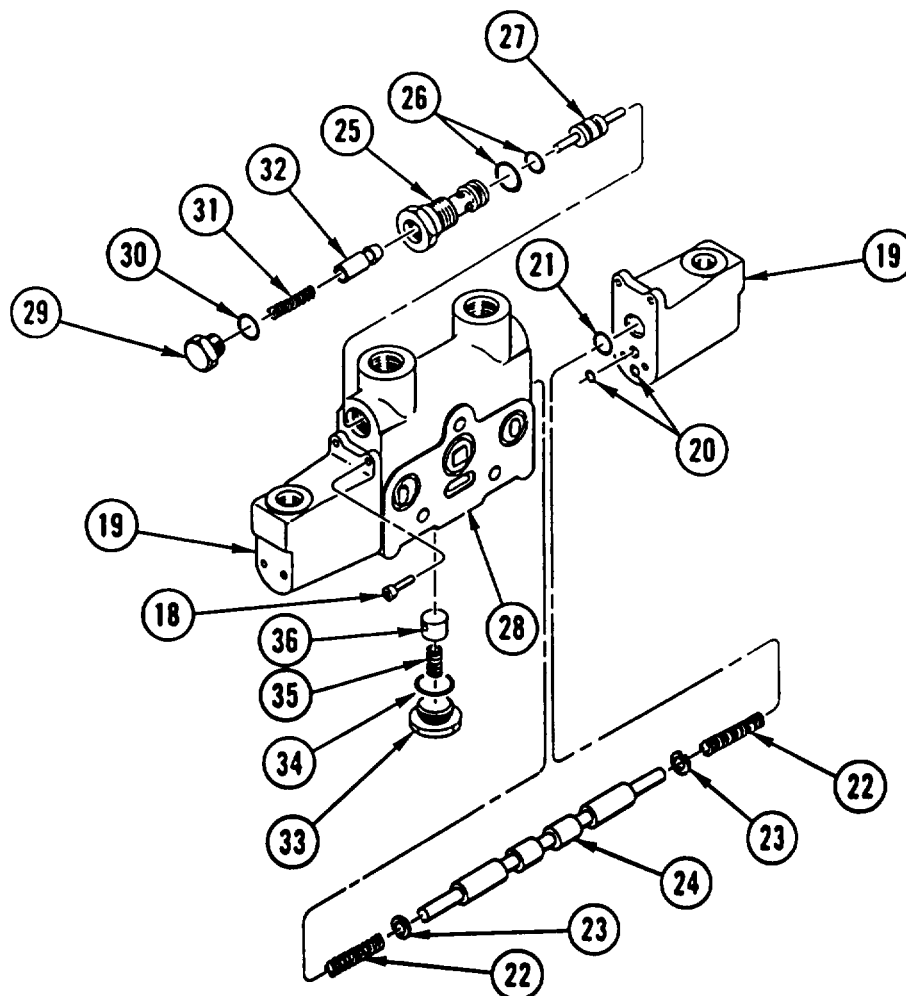
1. REMOVE button (1), retaining nut (2), cover (3), and solenoid CASE and SOLENOID (4 and 5).
2. REMOVE TUBE assembly (6), packing (7), push pin (8), spool (9), and spring (10). DISCARD PACKING.
3. REMOVE cartridge BODY (11), two packings (12 and 13), two backup rings (14 and 15), and packing (16). DISCARD PACKINGS and backup RINGS.
4. REMOVE PLUG (17).



---

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**


---



5. REMOVE eight capscrews (18), two HEADS (19), and six packings (20 and 21), DISCARD PACKINGS.
6. REMOVE two springs (22), two washers (23), and SPOOL (24).
7. REMOVE cylinder lock valve (25), two packings (26), and RAM (27) from valve body (28). DISCARD PACKINGS.
8. REMOVE cap (29), packing (30), spring (31), and POPPET (32) from valve (25). DISCARD PACKING.
9. TURN valve BODY (28) OVER and REMOVE load check plug (33), packing (34), spring (35), and PISTON (36). DISCARD PACKING.

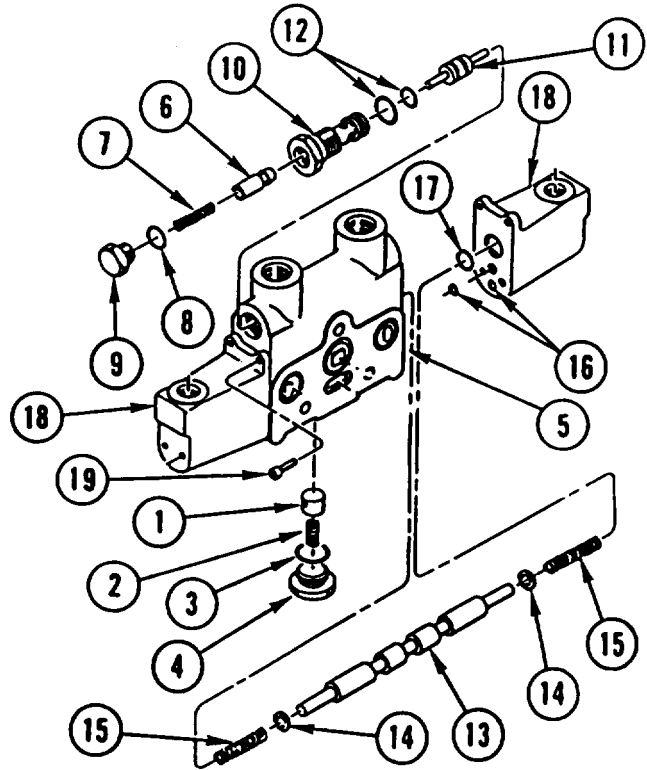
**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

**Solenoid-Operated Hand Tool Valve Body Assembly**

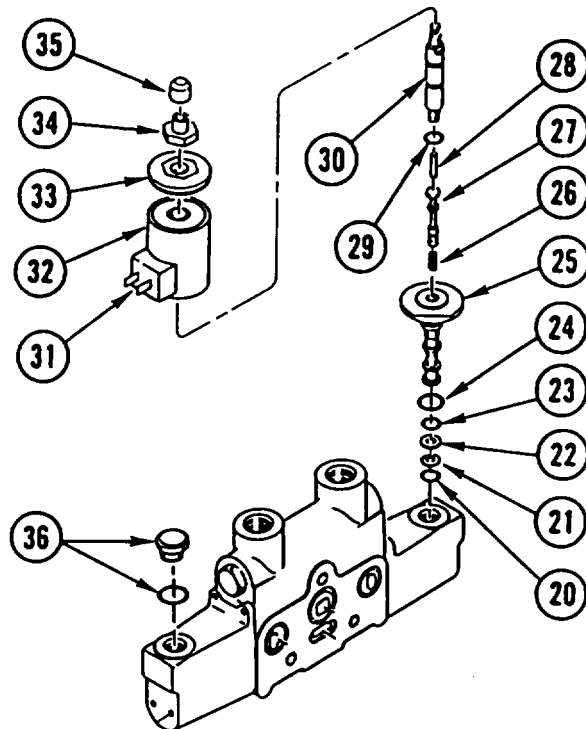
**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL PISTON (1), spring (2), new packing (3), and load check plug (4) in bottom of valve body (5).
2. INSTALL POPPET (6), spring (7), new packing (8), and cap (9) in cylinder lock valve (10).
3. INSTALL RAM (11), two new packings (12), and valve (10) in valve body (5).
4. INSTALL SPOOL (13), two washers (14), and two springs (15).
5. INSTALL six new packings (16 and 17), two HEADS (18), and eight capscrews (19).



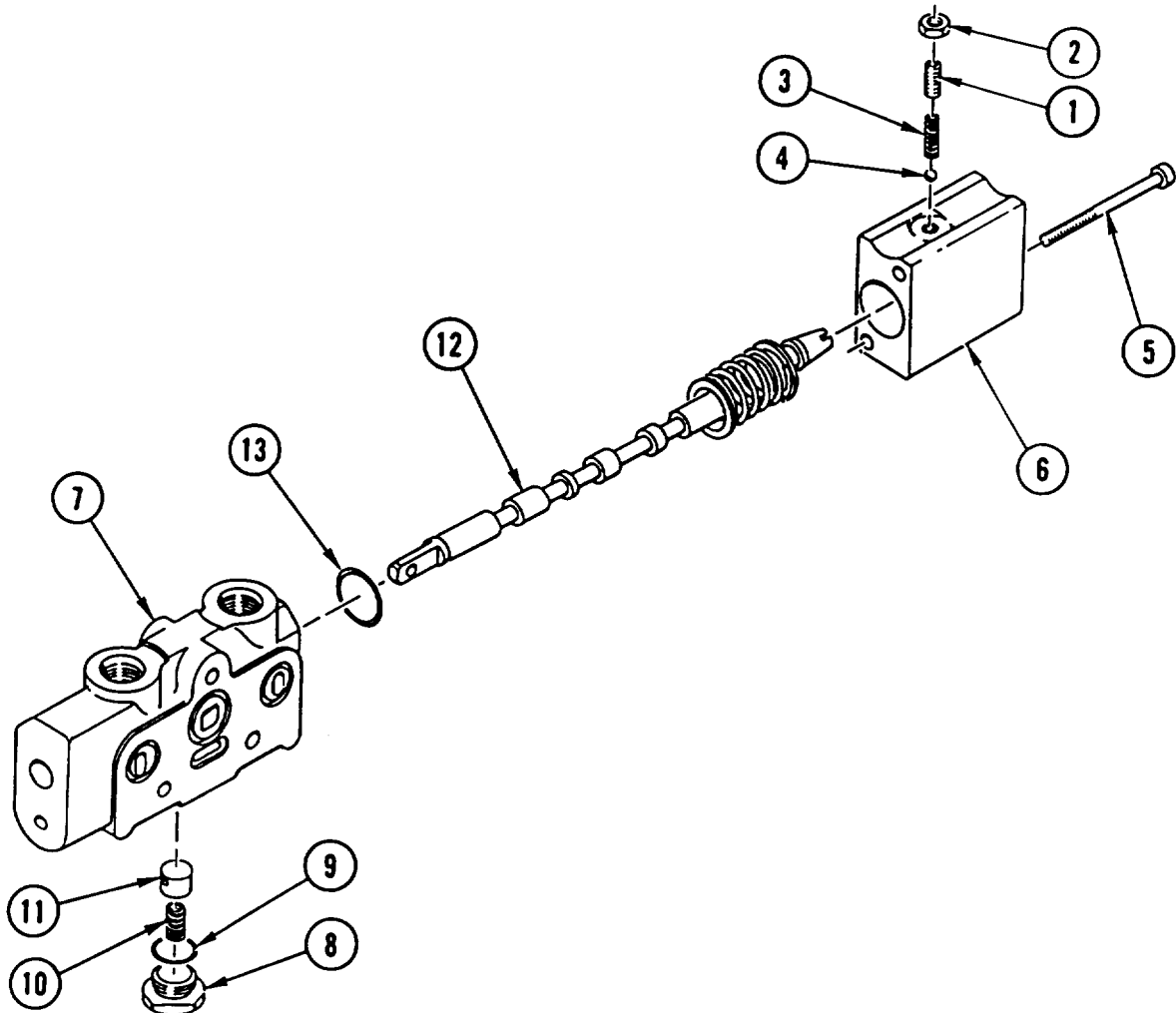
6. INSTALL new packing (20), two new backup rings (21 and 22), two new packings (23 and 24), and cartridge BODY (25).
7. INSTALL spring (26), spool (27), push pin (26), new packing (29), and TUBE assembly (30).
8. INSTALL SOLENOID and solenoid CASE (31 and 32), cover (33), retaining nut (34), and button (35).
9. INSTALL PLUG (36).



---

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**


---

**Front Loader/Forklift Control Valve Body Section Disassembly**


1. HOLD SCREW (1) and LOOSEN jam NUT (2).

**NOTE**

Note number of turns necessary to remove screw.

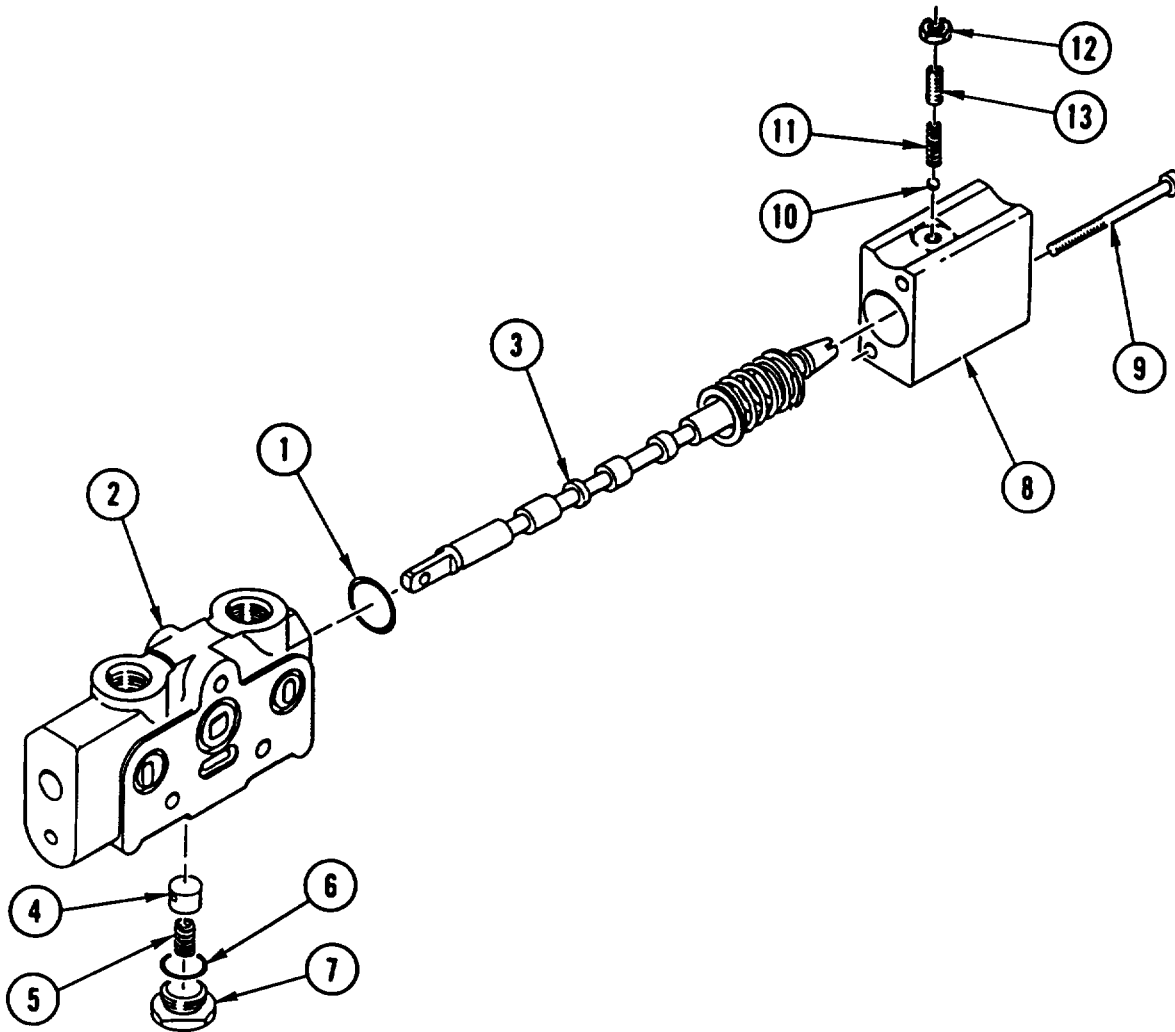
2. HOLD jam NUT (2) and REMOVE SCREW (1).
3. REMOVE spring (3) and BALL (4).
4. REMOVE two screws (5) and spring HOLDER (6).
5. TURN valve BODY (7) OVER and REMOVE plug (8), packing (9), spring (10), and PISTON (11). DISCARD PACKING.
6. REMOVE SPOOL (12) from valve body (7).
7. REMOVE and DISCARD PACKING (13) from valve body (7).

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**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

---

**Front Loader/Forklift Control Valve Body Section Assembly**



**NOTE**

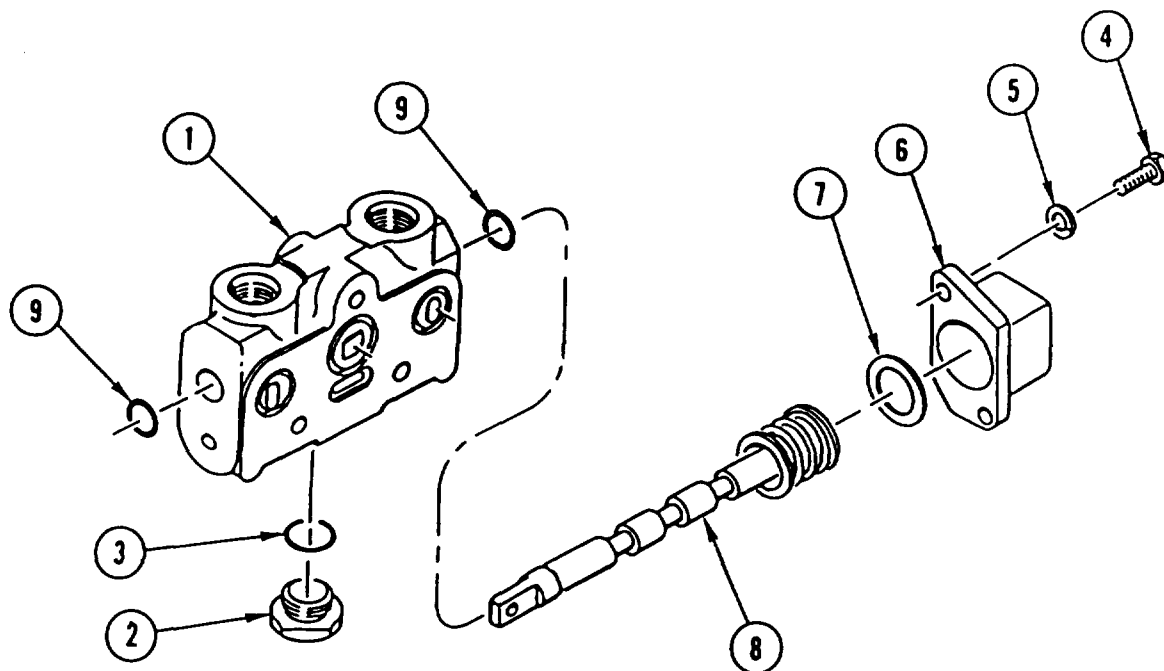
Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL new PACKING (1) in valve body (2).
2. INSTALL SPOOL (3) in valve body (2).
3. INSTALL PISTON (4), spring (5), new packing (6), and plug (7) in bottom of valve body (2).
4. INSTALL spring HOLDER (8) and two screws (9).
5. INSTALL BALL (10) and spring (11).
6. HOLD jam NUT (12) and INSTALLSCREW (13) number of turns noted.
7. HOLD SCREW (13) and TIGHTEN jam NUT (12).

---

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**


---


**Low Body Section Valve Body Disassembly**

1. TURN valve BODY (1) OVER and REMOVE PLUG (2) and packing (3). DISCARD PACKING.
2. REMOVE two screws (4), two lock washers (5), and COVER (6). DISCARD lock WASHERS.
3. REMOVE SPACER (7) from cover (6).
4. REMOVE valve SPOOL (8).
5. REMOVE and DISCARD two PACKINGS (9).

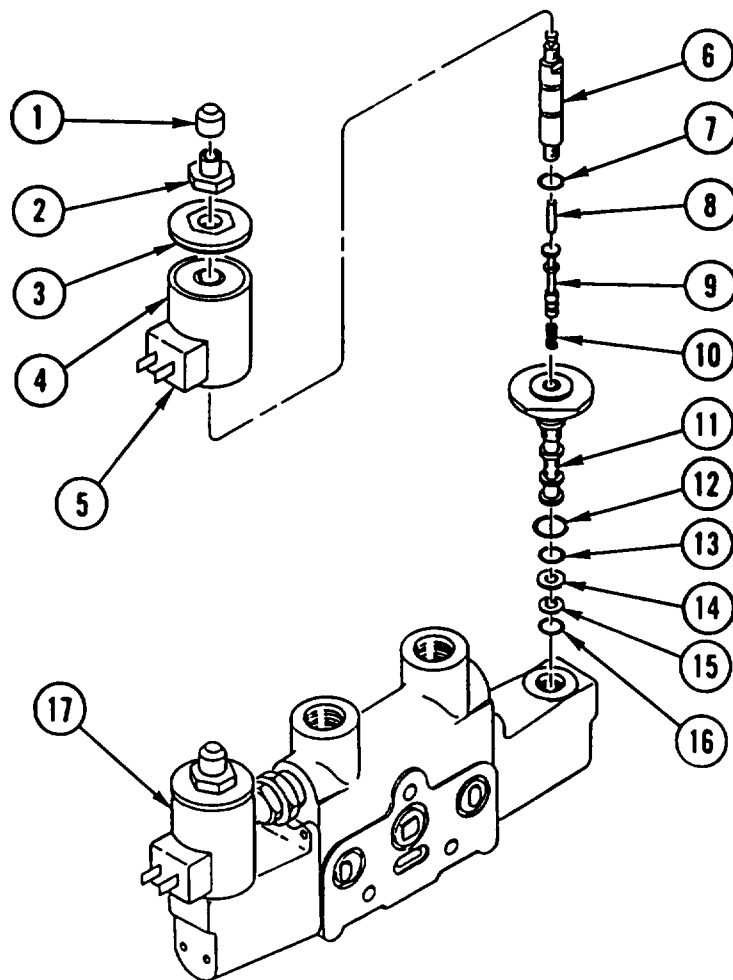
**Low Body Section Valve Body Assembly**
**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL two new PACKINGS (9).
2. INSTALL valve SPOOL (8).
3. INSTALL SPACER (7) in cover (6).
4. INSTALL COVER (6), two new lock washers (5), and two screws (4).
5. INSTALL new packing (3) and PLUG (2) in valve body (1).

## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

### Solenoid-Operated Front Loader/Forklift Valve Body Disassembly

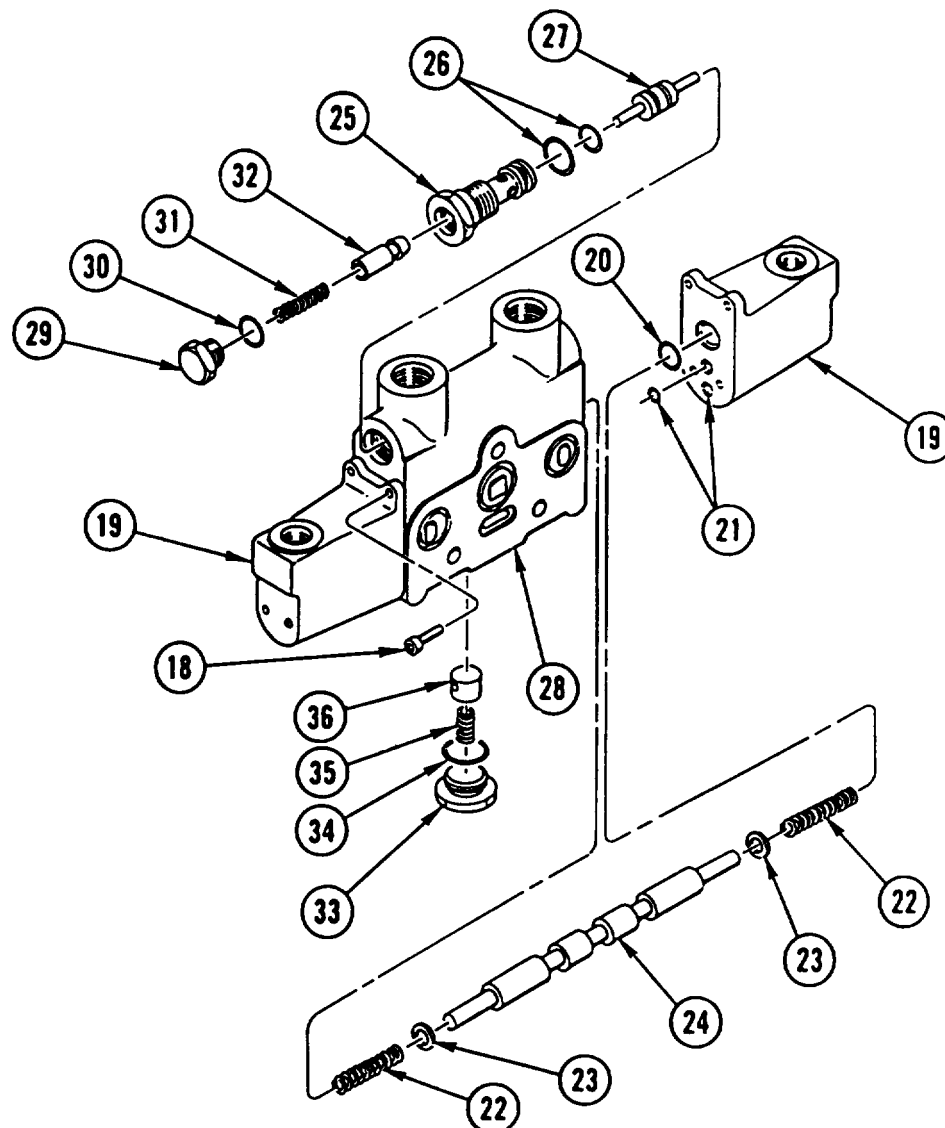


1. REMOVE button (1), retaining nut (2), cover (3), and solenoid CASE and SOLENOID (4 and 5).
2. REMOVE TUBE assembly (6), packing (7), push pin (8), spool (9), and spring (10). DISCARD PACKING.
3. REMOVE cartridge BODY (11), two packings (12 and 13), two backup rings (14 and 15), and packing (16). DISCARD PACKINGS and backup RINGS.
4. REPEAT STEPS 1 thru 3 for solenoid (17).

---

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**


---



REMOVE eight capscrews (18), two HEADS (19), and six packings (20 and 21). DISCARD PACKINGS.

REMOVE two springs (22), two washers (23), and SPOOL (24).

REMOVE cylinder lock valve (25), two packings (26), and RAM (27) from valve body (28). DISCARD PACKINGS.

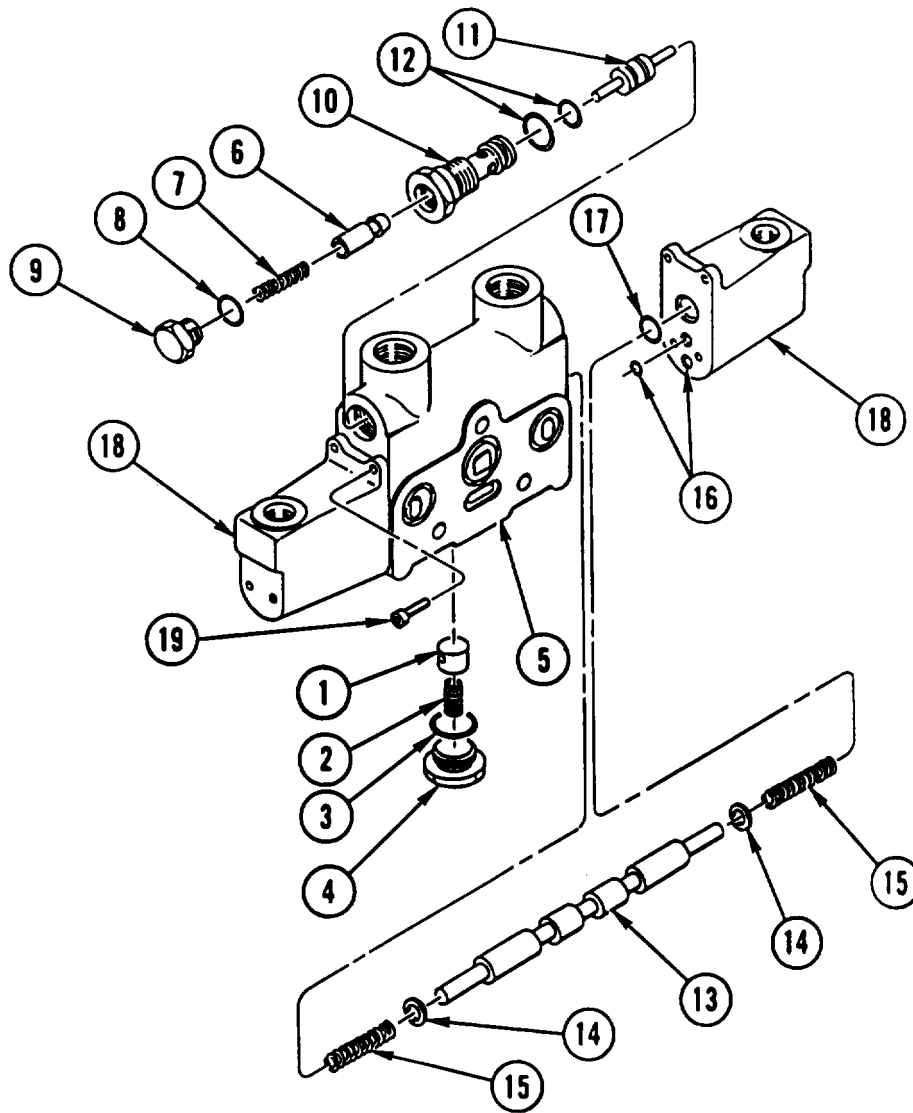
REMOVE cap (29), packing (30), spring (31), and POPPET (32) from valve (25). DISCARD PACKING.

TURN valve BODY (28) OVER and REMOVE load check plug (33), packing (34), spring (35), and PISTON (36). DISCARD PACKING.



## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

### Solenoid-Operated Front Loader/Forklift Valve Body Assembly

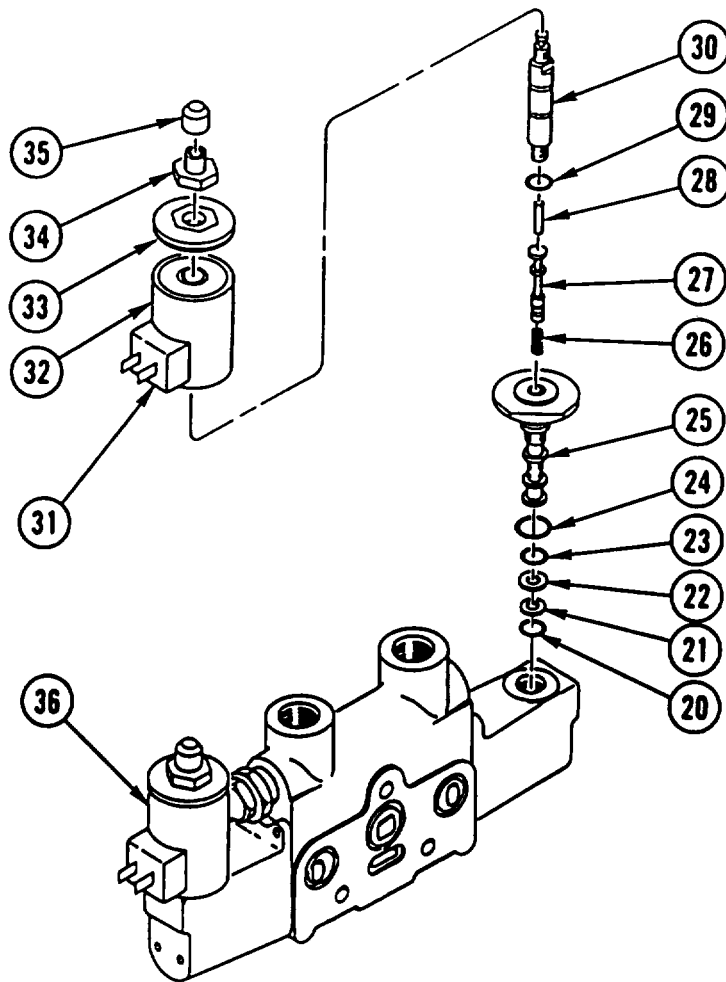


**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL PISTON (1), spring (2), new packing (3), and load check plug (4) in bottom of valve body (5).
2. INSTALL POPPET (6), spring (7), new packing (8), and cap (9) in cylinder lock valve (10).
3. INSTALL RAM (11), two new packings (12), and valve (10) in valve body (5).
4. INSTALL SPOOL (13), two washers (14), and two springs (15).
5. INSTALL six new packings (16 and 17), two HEADS (18), and eight cap screws (19).

**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**



6. INSTALL new packing (20), two new backup rings (21 and 22), two new packings (23 and 24), and cartridge BODY (25).
7. INSTALL spring (26), spool (27), push pin (28), new packing (29), and TUBE assembly (30).
8. INSTALL SOLENOID and solenoid CASE (31 and 32), cover (33), retaining nut (34), and button (35).
9. REPEAT STEPS 6 thru 8 for solenoid (36).

## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

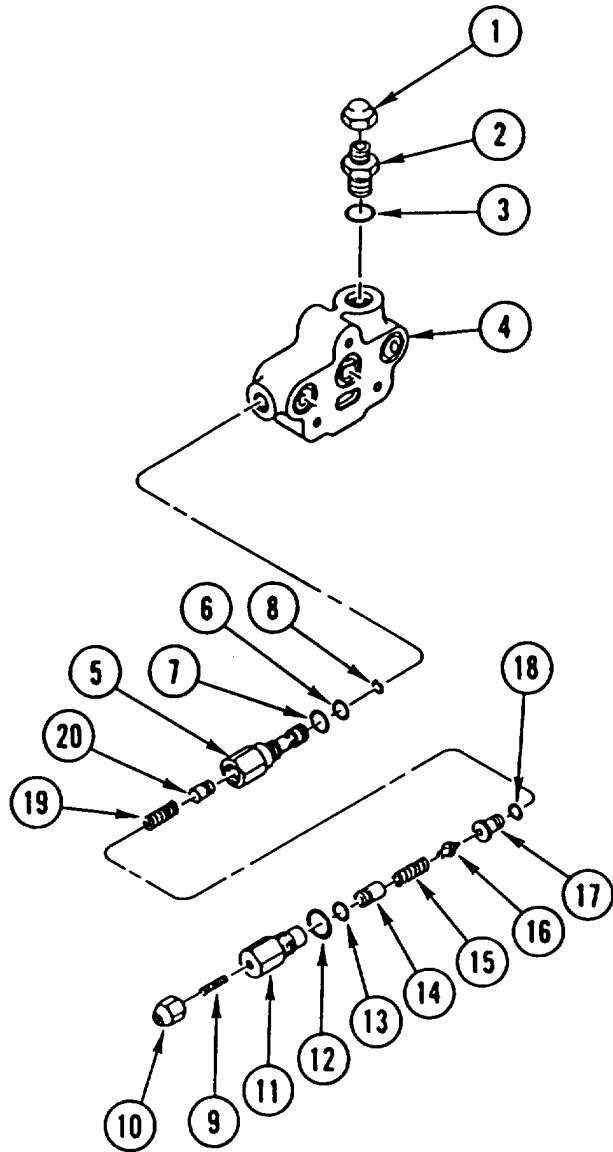
### Intake Manifold Body Disassembly

1. REMOVE capnut (1), ADAPTER (2), and packing (3) from intake manifold body (4). DISCARD PACKING.
2. REMOVE valve BODY (5), packing (6), and backup ring (7). DISCARD PACKING and backup RING.
3. REMOVE retaining RING (8) from valve body (5).
4. HOLD adjusting SCREW (9) and LOOSEN jam NUT (10).

**NOTE**

Note number of turns necessary to remove adjusting screw.

5. HOLD jam NUT (10) and REMOVE adjusting SCREW (9).
6. REMOVE valve BODY (11) from valve body (5).
7. REMOVE and DISCARD PACKING (12).
8. REMOVE packing (13), spring seat (14), spring (15), POPPET (16), seat (17), packing (18), spring (19), and piston (20). DISCARD PACKINGS.



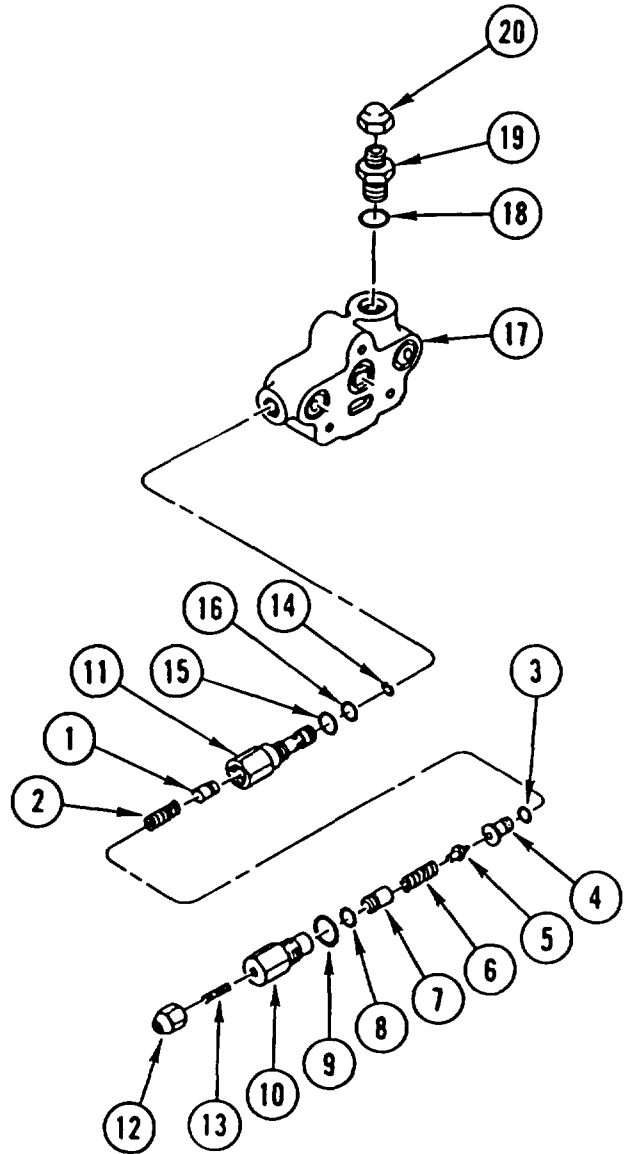
## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

### Intake Manifold Body Assembly

**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL piston (1), spring (2), new packing (3), seat (4), POPPET (5), spring (6), spring seat (7), and new packing (8).
2. INSTALL new PACKING (9) on valve body (10).
3. INSTALL valve BODY (11) in valve body (11).
4. HOLD jam NUT (12) and INSTALL adjusting SCREW (13) number of turns noted.
5. HOLD adjusting SCREW (13) and TIGHTEN jam NUT (12).
6. INSTALL retaining RING (14) in valve body (11).
7. INSTALL backup ring (15) and new PACKING (16) on valve body (11).
8. INSTALL valve BODY (11) in intake manifold body (17).
9. INSTALL new packing (18), ADAPTER (19), and capnut (20).



**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

**ASSEMBLY**

**FRONT LOADER/FORKLIFT CONTROL VALVE**

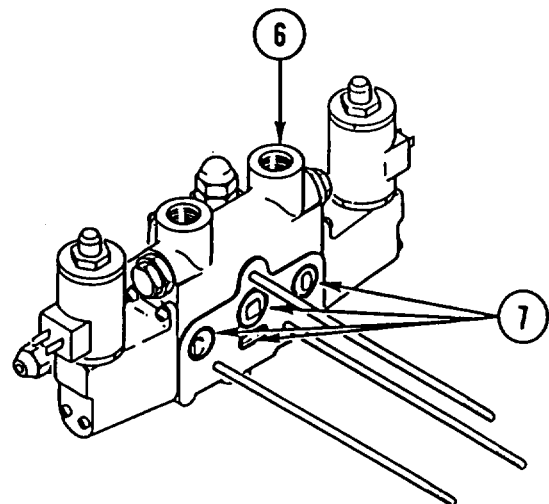
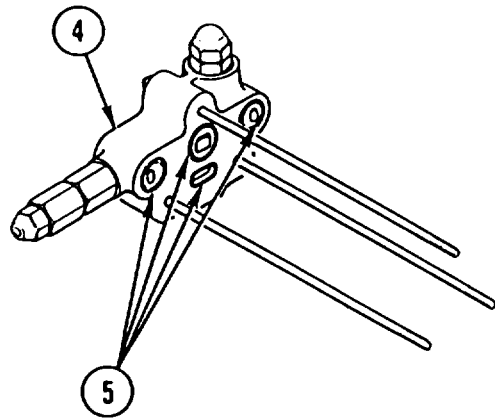
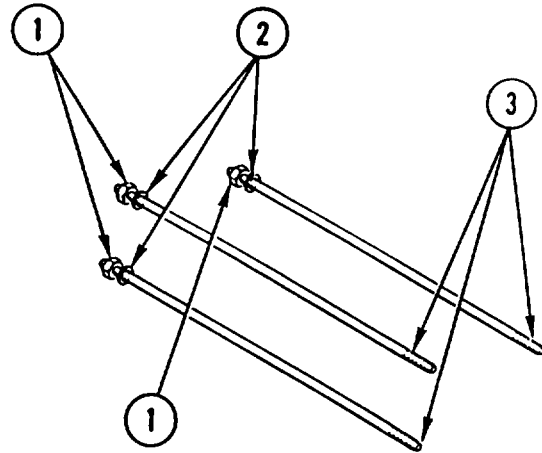
**CAUTION**

Make sure all packings between valve sections are replaced whenever nuts on tie rods are loosened for any reason. Failure to do so could result in leaks and possible damage to valve.

**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL three nuts (1) and three new lock washers (2) on three new tie RODS (3).
  
2. INSTALL intake manifold BODY (4) and four new packings (5).
  
3. INSTALL solenoid-operated front loader/forklift valve BODY (6) and four new packings (7).

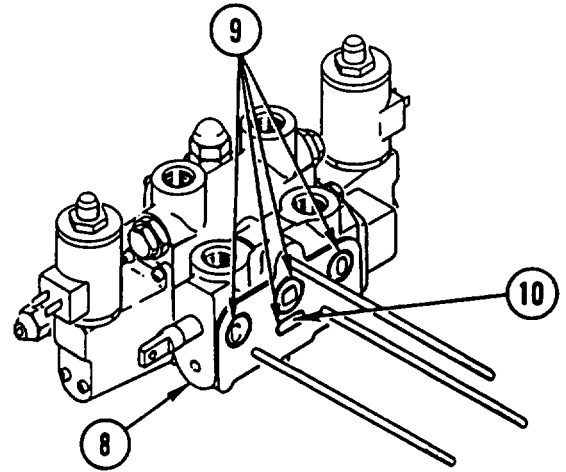


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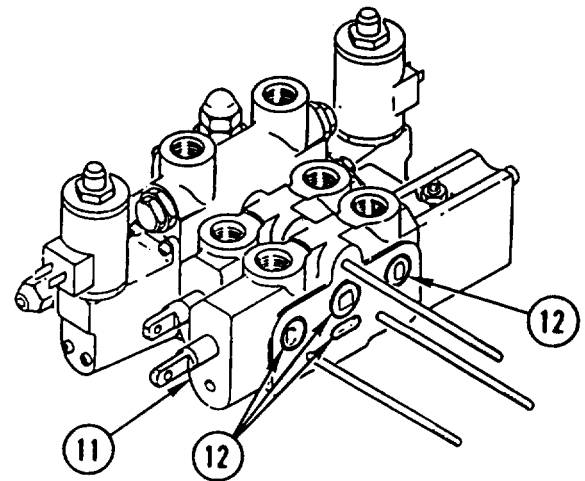
**FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)**

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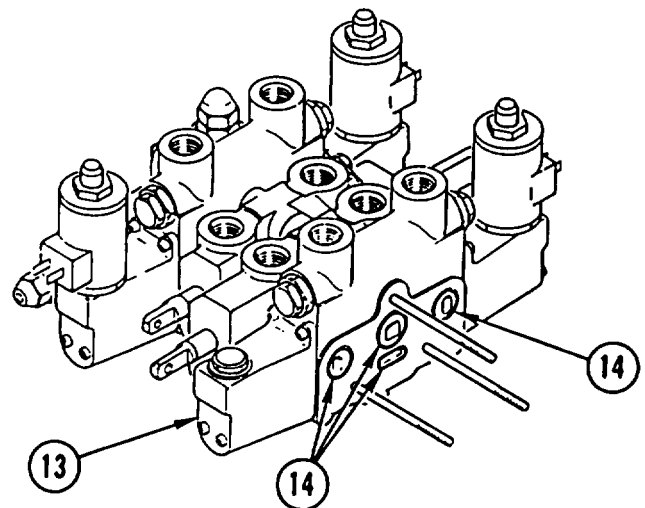
4. INSTALL low body section valve BODY (8), four new packings (9), and blanking plate (10).



5. INSTALL front loader/forklift control valve body SECTION (11) and four new packings (12).



6. INSTALL solenoid-operated hand tool valve BODY (13) and four new packings (14).



---

## FRONT LOADER/FORKLIFT CONTROL VALVE REPAIR (CONT)

---

7. INSTALL outlet BODY (15).

**NOTE**

Before tightening nuts, make sure equal amount of threads are exposed on each end of tie rods.

8. INSTALL three new lock washers (16) and three NUTS (17). TIGHTEN NUTS to 16 ±2 lb-ft (32.5 ±2.7 N•m).

**NOTE**

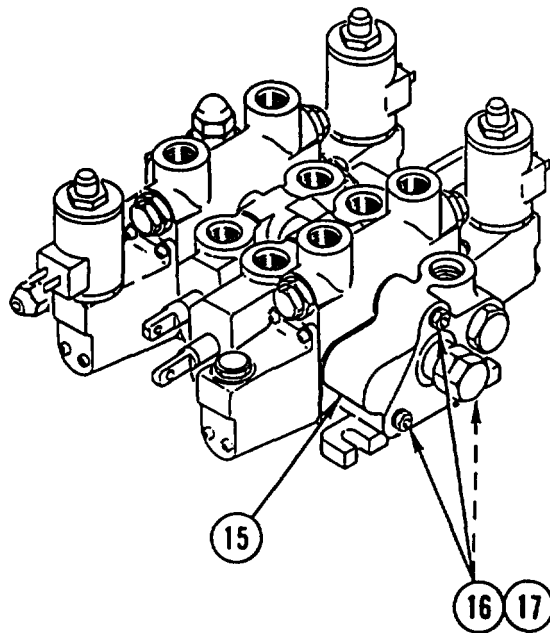
Follow-on Maintenance:

Install front loader control valve and bracket (SEE) or forklift control valve and bracket (HMMH) (page 11-28).

Adjust front loader control valve (SEE) or forklift control valve (HMMH) pressure settings (page 11-28).

Adjust front loader (SEE) or forklift (HMMH) linkage (TM5-2420-224-20).

Adjust front loader (SEE) or forklift (HMMH) float (TM 5-2420-224-20).



**Section V. TILT AND LATCH CONTROL VALVE REPAIR**

**TILT AND LATCH CONTROL VALVE REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Nut, Lock  
 Kit Parts  
 Kit Parts  
 Kit Parts  
 Kit Parts  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**Equipment Condition:**

Reference	Condition Description
Page 11-5	Tilt and Latch Control Valve Removed

**General Safety Instructions:**

**WARNING**

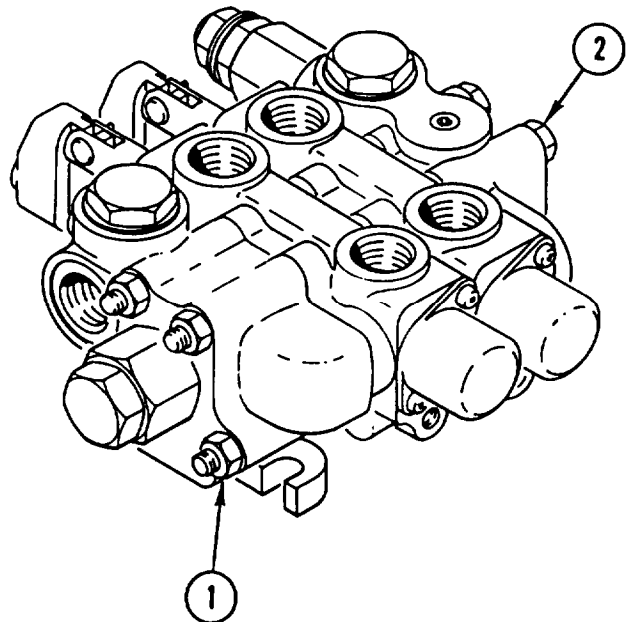
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

**CAUTION**

All packings between each valve must be replaced whenever valve tie rods are loosened. Failure to do so may result in hydraulic fluid leaks and/or equipment damage.

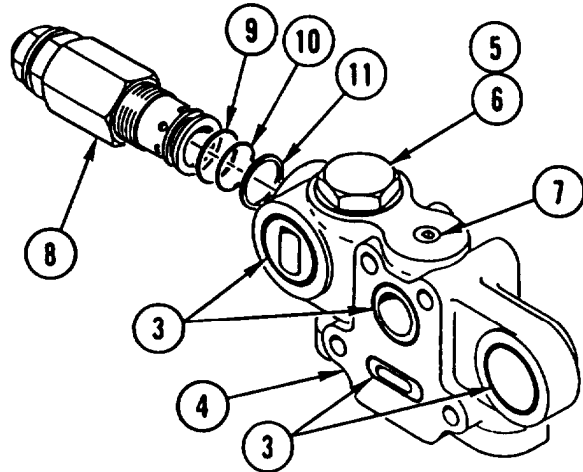
1. REMOVE four nuts (1) and four tie RODS (2). DISCARD NUTS.



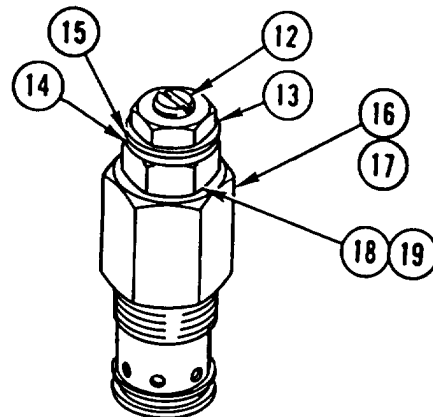


## TILT AND LATCH CONTROL VALVE REPAIR (CONT)

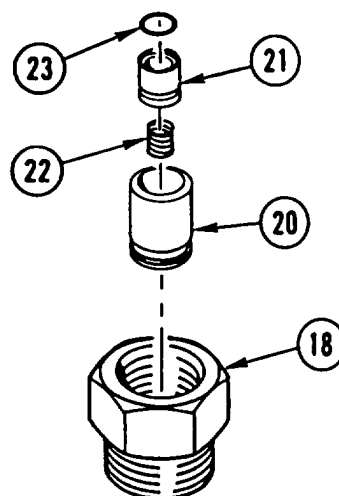
2. REMOVE four PACKINGS (3) from inlet section (4). DISCARD PACKINGS.
3. REMOVE plug COCK (5) and packing (6). DISCARD PACKING.
4. REMOVE PLUG (7).
5. REMOVE relief VALVE (8), two packings (9 and 10), and backup ring (11). DISCARD PACKINGS.



6. HOLD SCREW (12) and LOOSEN lock NUT (13).
7. REMOVE SCREW (12) and NOTE number of turns necessary for removal.
8. REMOVE thread SEAL (14), washer (15), and lock nut (13) from screw (12). DISCARD thread SEAL and lock NUT.
9. REMOVE spring (16) and POPPET (17).
10. REMOVE BODY (18) and packing (19). DISCARD PACKING.



11. REMOVE POPPET (20) from body (18).
12. REMOVE PISTON (21) from poppet (20).
13. REMOVE SPRING (22) and packing (23) from piston (21). DISCARD PACKING.

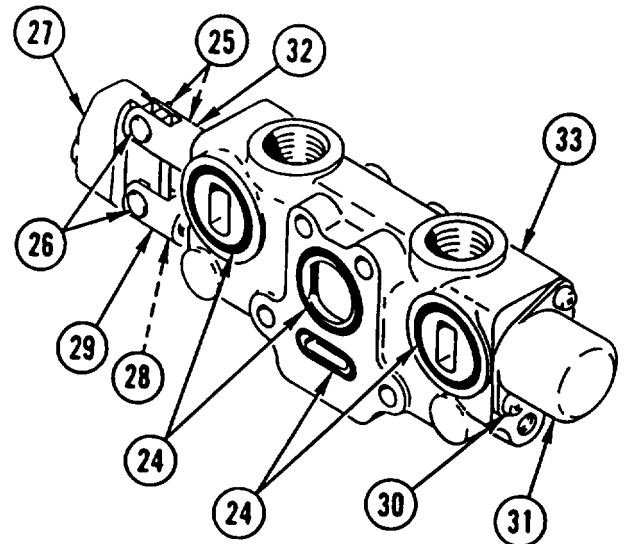


## TILT AND LATCH CONTROL VALVE REPAIR (CONT)

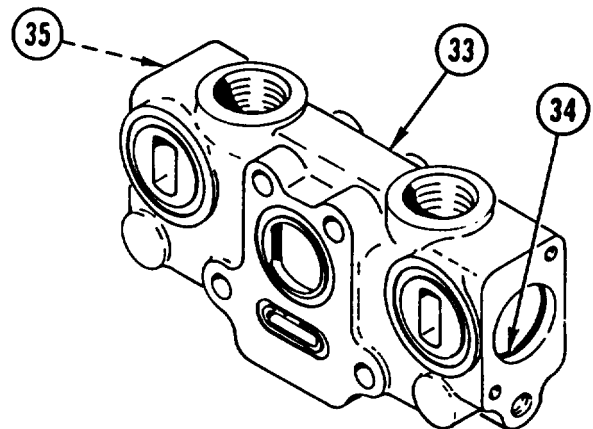
### NOTE

Procedure is the same for both tilt and latch control valve sections.

14. REMOVE and DISCARD four PACKINGS (24).
15. REMOVE two cotter pins (25), two pins (26), and BRACKET (27). DISCARD cotter PINS.
16. LOOSEN NUT (28) and REMOVE PIVOT (29).
17. REMOVE two screws (30) and RETAINER (31).
18. REMOVE SPOOL (32) from valve body (33).



19. REMOVE and DISCARD two PACKINGS (34 and 35) from valve body (33).

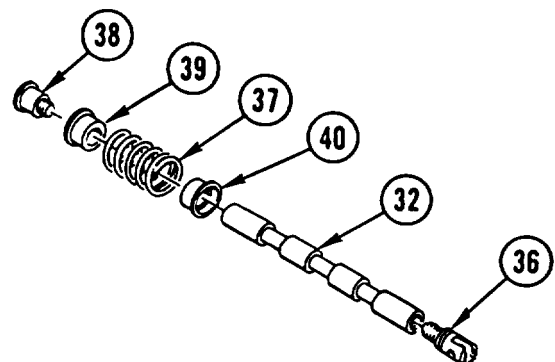


20. REMOVE spool END (36) from spool (32).

**WARNING**

Assembly is spring loaded. Wear safety goggles. Failure to do so could result in injury to personnel.

21. USING spring compression TOOL, completely COMPRESS SPRING (37) and REMOVE END (38).
22. CAREFULLY RELEASE TENSION on spring (37) and REMOVE spring compression TOOL.
23. REMOVE guide (39), SPRING (37), and guide (40).



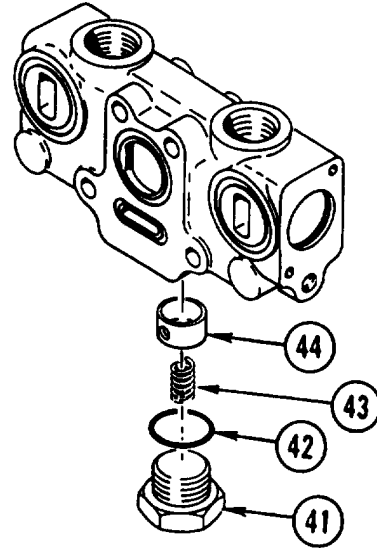
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**TILT AND LATCH CONTROL VALVE REPAIR (CONT)**

---

24. REMOVE plug COCK (41) and O-ring (42).  
DISCARD O-RING.

25. REMOVE spring (43) and POPPET (44).

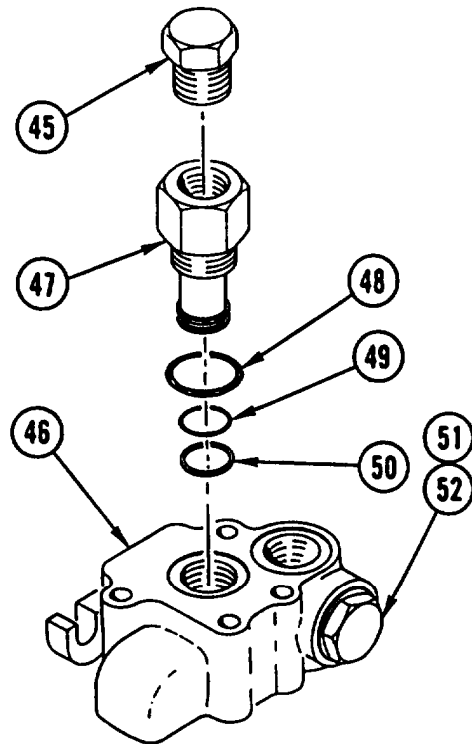


26. REMOVE PLUG (45) from outlet valve manifold (46).

27. REMOVE SLEEVE assembly (47).

28. REMOVE and DISCARD two PACKINGS (48 and 49) and backup RING (50).

29. REMOVE PLUG (51) and packing (52).  
DISCARD PACKING.

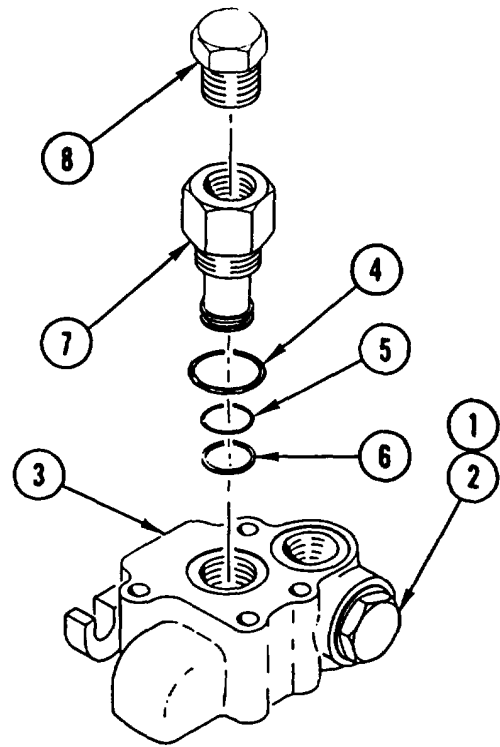


## TILT AND LATCH CONTROL VALVE REPAIR (CONT)

**NOTE**

Apply coat of lubricating oil to packings, O-ring, and seal prior to assembly.

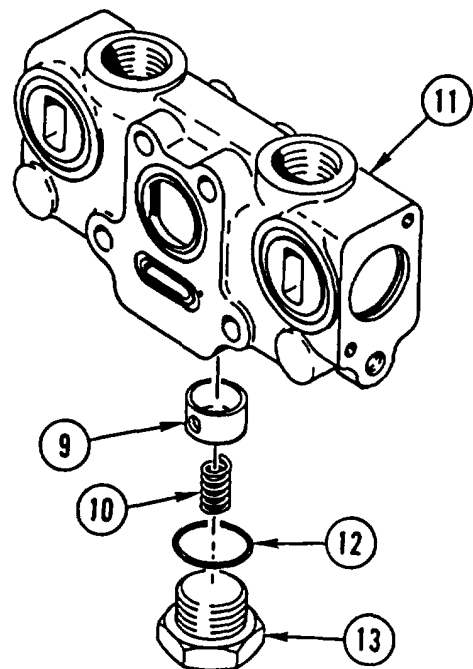
1. INSTALL new packing (1) and PLUG (2) in outlet valve manifold (3).
2. INSTALL two new PACKINGS (4 and 5) and new backup ring (6) on sleeve assembly (7).
3. INSTALL SLEEVE assembly (7).
4. INSTALL PLUG (8).



**NOTE**

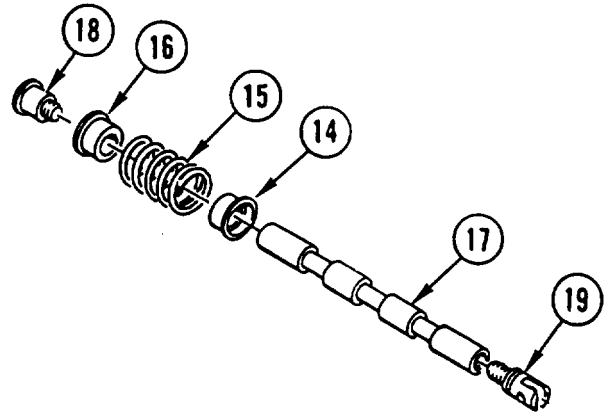
Procedure is the same for both tilt and latch control valve sections.

5. INSTALL POPPET (9) and spring (10) in valve body (11).
6. INSTALL new O-ring (12) and plug COCK (13).

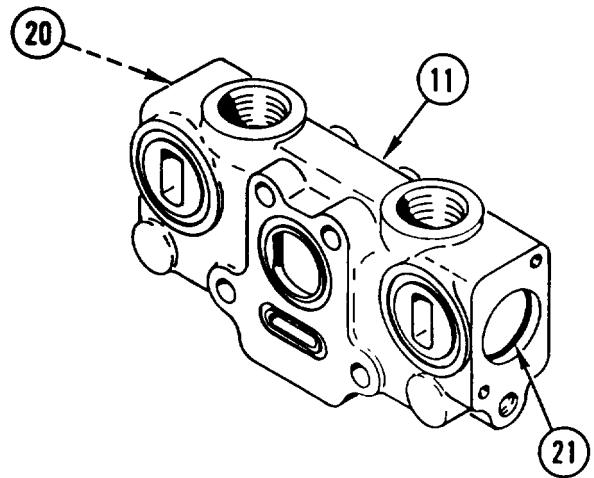


**TILT AND LATCH CONTROL VALVE REPAIR (CONT)**

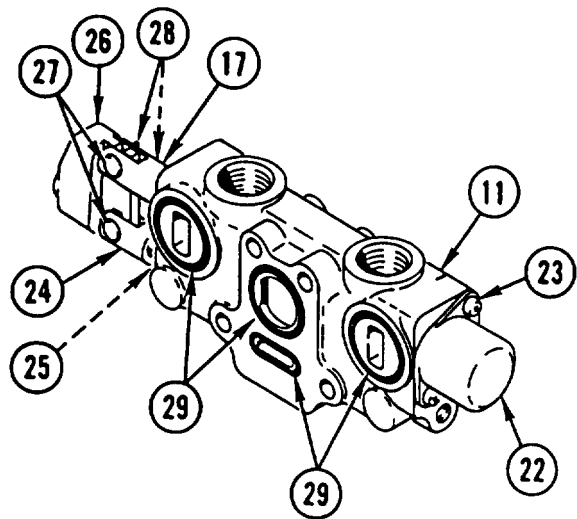
7. INSTALL guide (14), SPRING (15), and guide (16) on spool (17).
8. USING spring compression TOOL, completely COMPRESS SPRING (15).
9. INSTALL END (18) and REMOVE spring compression TOOL.
10. INSTALL spool END (19) on spool (17).



11. INSTALL two new PACKINGS (20 and 21) in valve body (11).

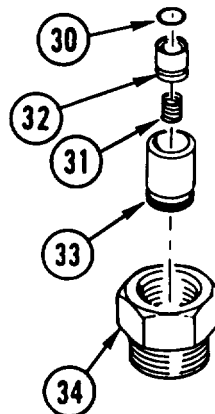


12. INSTALL SPOOL (17) in valve body (11).
13. INSTALL RETAINER (22) and two screws (23).
14. INSTALL PIVOT (24) and TIGHTEN NUT (25).
15. INSTALL BRACKET (26), two pins (27), and two new cotter pins (28).
16. INSTALL four new PACKINGS (29).

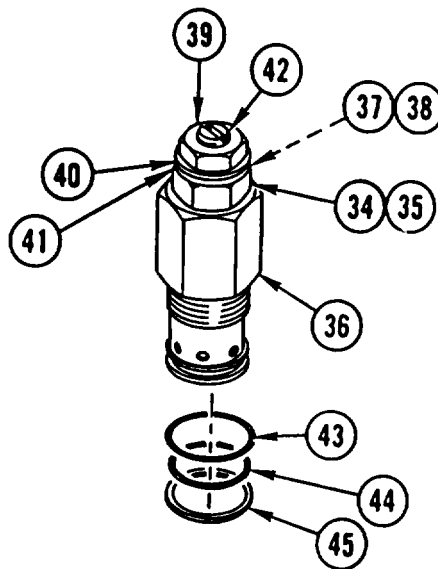


**TILT AND LATCH CONTROL VALVE REPAIR (CONT)**

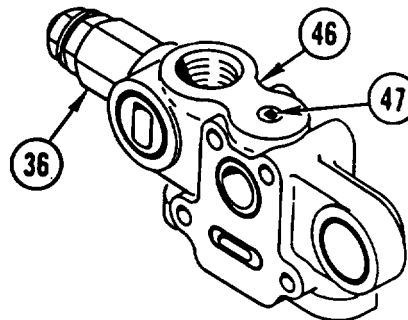
17. INSTALL new packing (30) and SPRING (31) in piston (32).
18. INSTALL PISTON (32) in poppet (33).
19. INSTALL POPPET (33) in body (34).



20. INSTALL new packing (35) and BODY (34) in relief valve (36).
21. INSTALL POPPET (37) and spring (38) in body (34).
22. INSTALL new lock nut (39), washer (40), and new thread SEAL (41) on screw (42).
23. INSTALL SCREW (42), and TIGHTEN number of turns noted during Disassembly.
24. HOLD SCREW (42) and TIGHTEN lock NUT (39).
25. INSTALL two new PACKINGS (43 and 44) and backup ring (45) on relief valve (36).



26. INSTALL relief VALVE (36) in inlet section (46).
27. INSTALL PLUG (47).

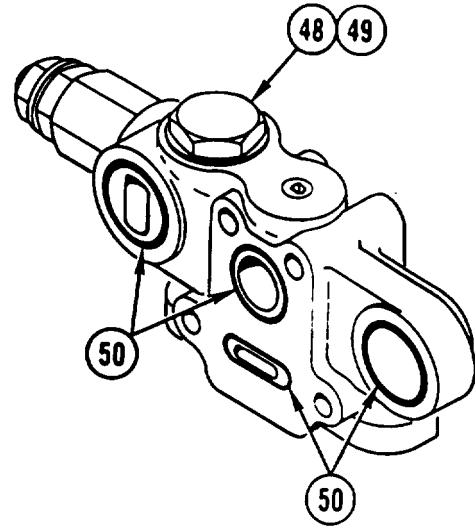


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## TILT AND LATCH CONTROL VALVE REPAIR (CONT)

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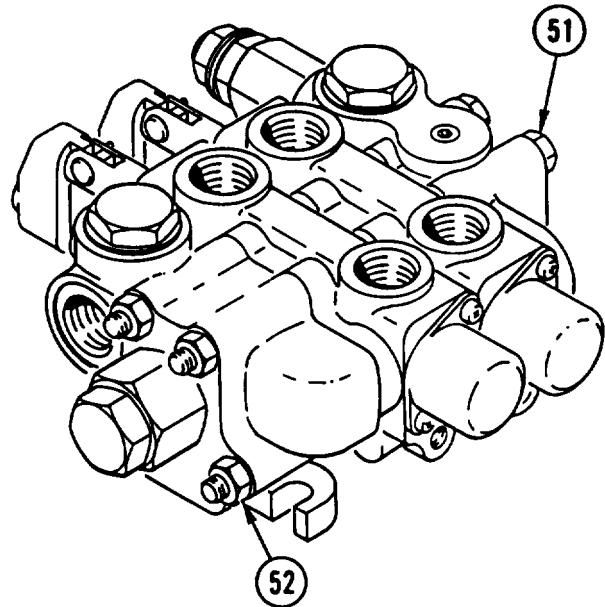
28. INSTALL new packing (48) and plug COCK (49).
29. INSTALL four new PACKINGS (50).



30. INSTALL four tie RODS (51) and four new nuts (52) through all four valve sections. TIGHTEN NUTS to 288 lb-in. (32.5 N•m).

### NOTE

Follow-on Maintenance:  
Install tilt and latch control valve  
(page 11-5).  
Adjust tilt and latch control valve  
pressure settings (page 11-5).



## Section VI. BACKHOE CONTROL VALVE REPAIR

### OVERVIEW

This section illustrates and describes procedures for repair of the backhoe control valve. A list of tasks contained in this section is shown below.

	Page
Backhoe Control Valve Repair . . . . .	20-41
Backhoe Control Valve, Intake Manifold Repair . . . . .	20-47
Backhoe Control Valve, Outlet Manifold Repair . . . . .	20-49
Backhoe Control Valve, Swing Section Valve Repair . . . . .	20-51
Backhoe Control Valve, Boom Section Valve Repair . . . . .	20-59
Backhoe Control Valve, Dipper and Bucket Section Valves Repair . . . . .	20-69

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### BACKHOE CONTROL VALVE REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

SEE

**Equipment Condition:**

**Reference**

Page 11-15

**Condition Description**

Backhoe Control Valve  
Removed

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Packing (15)

Packing (5)

Oil, Lubricating                      Appendix B, item 30



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## BACKHOE CONTROL VALVE REPAIR (CONT)

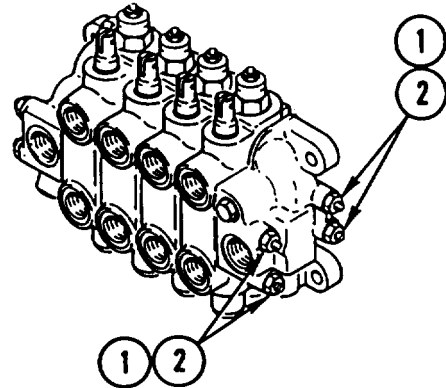
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### DISASSEMBLY

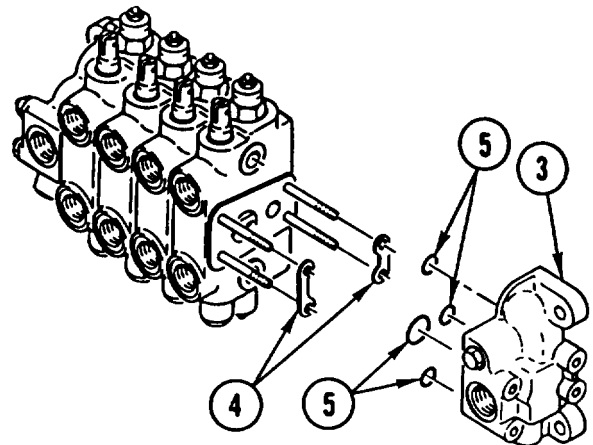
#### NOTE

Number each valve section prior to removal to aid in installation.

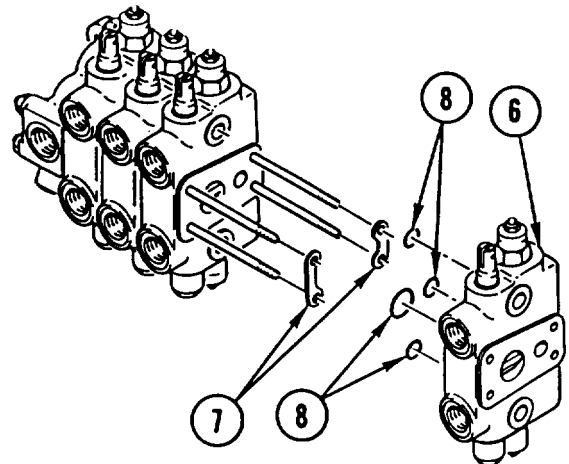
1. REMOVE four NUTS (1) from four rods (2).



2. REMOVE intake MANIFOLD (3), two shims (4), and four packings (5). DISCARD PACKINGS.

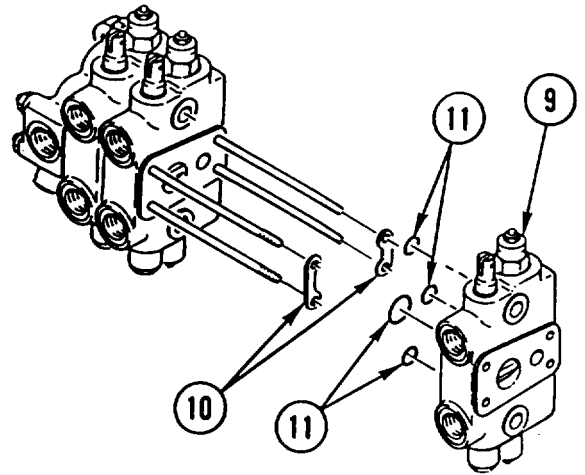


3. REMOVE swing section VALVE (6), two shims (7), and four packings (8). DISCARD PACKINGS.

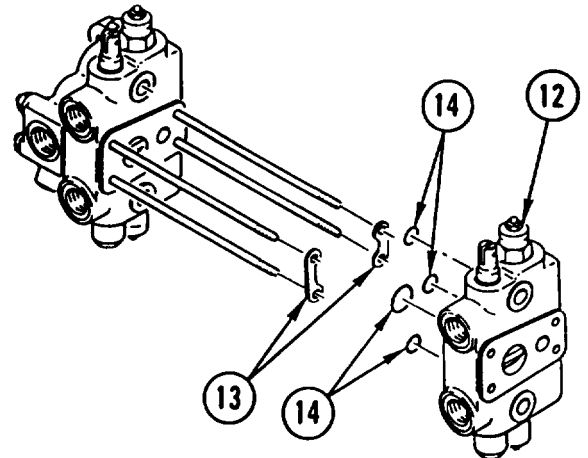


**BACKHOE CONTROL VALVE REPAIR (CONT)**

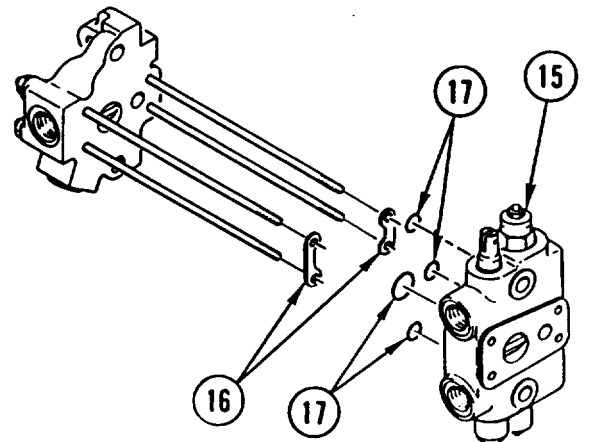
4. REMOVE bucket section VALVE (9), two shims (10), and four packings (11). DISCARD PACKINGS.



5. REMOVE dipper section VALVE (12), two shims (13), and four packings (14). DISCARD PACKINGS.



6. REMOVE boom section VALVE (15), two shims (16), and four packings (17). DISCARD PACKINGS.

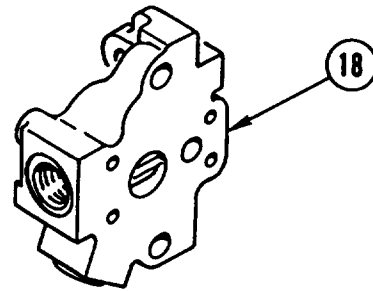


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## BACKHOE CONTROL VALVE REPAIR (CONT)

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7. REMOVE outlet MANIFOLD (18).



8. REMOVE four NUTS (19) from four rods (2).

### INSPECTION

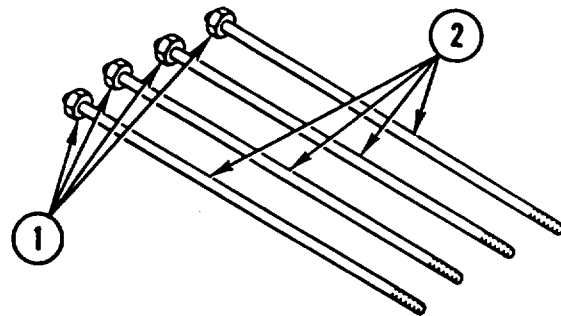
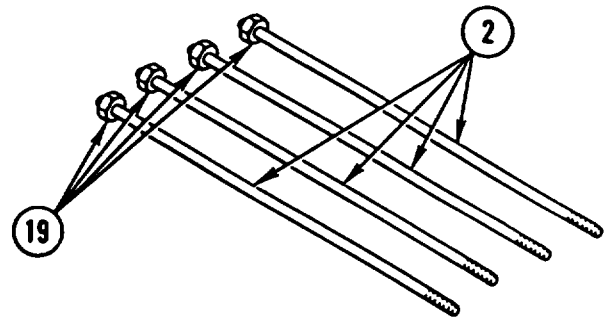
1. Inspect valves and manifolds for cracks or damage.
2. Inspect threads on rods for wear or damage.

### ASSEMBLY

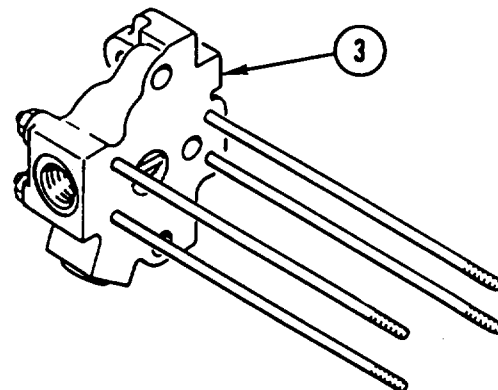
#### NOTE

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL four NUTS (1) on four rods (2).

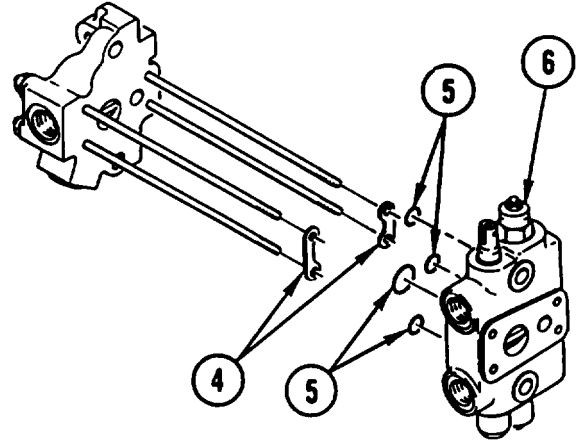


2. INSTALL outlet MANIFOLD (3).

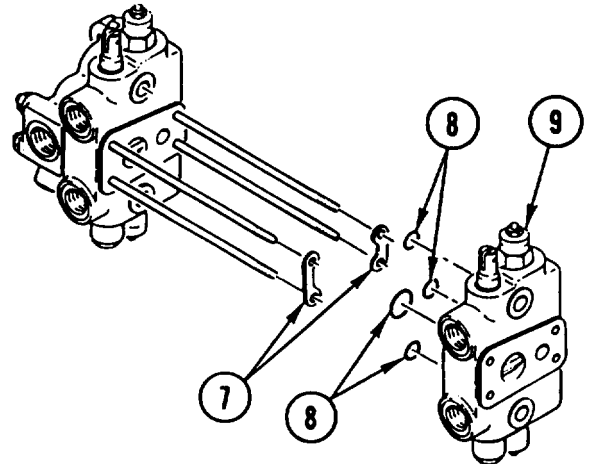


## BACKHOE CONTROL VALVE REPAIR (CONT)

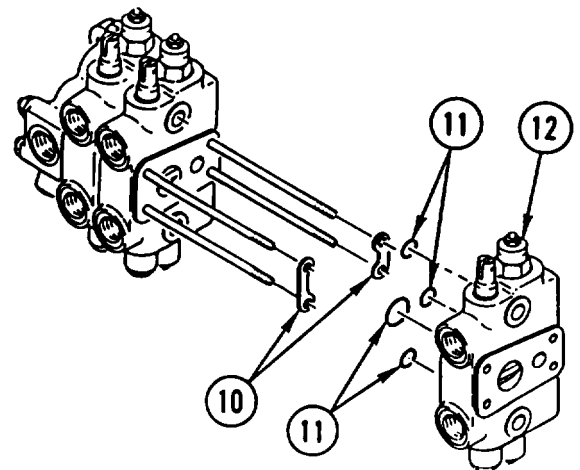
3. INSTALL two shims (4), four new packings (5), and boom section VALVE (6).



4. INSTALL two shims (7), four new packings (8), and dipper section VALVE (9).

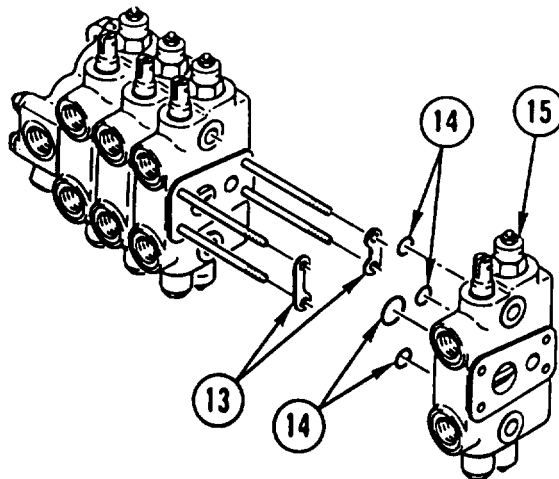


5. INSTALL two shims (10), four new packings (11), and bucket section VALVE (12).

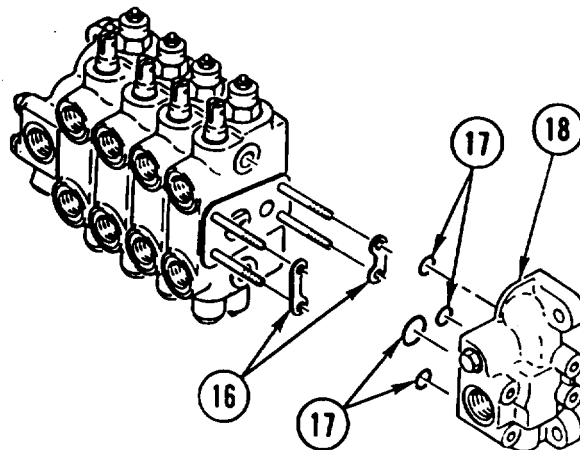


## BACKHOE CONTROL VALVE REPAIR (CONT)

6. INSTALL two shims (13), four new packings (14), and swing section VALVE (15).



7. INSTALL two shims (16), four new packings (17), and intake MANIFOLD (18).



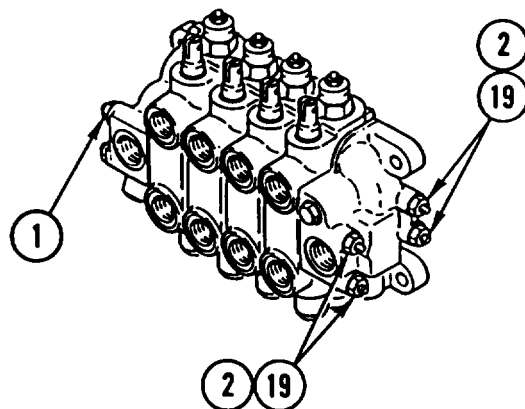
### NOTE

Before tightening nuts, be sure equal amount of threads are exposed on both ends of rods.

8. INSTALL four NUTS (19) on four rods (2). TIGHTEN eight NUTS (1 and 19) to 20-30 lb-ft (27-41 N•m).

### NOTE

Follow-on Maintenance:  
Install backhoe control valve (page 11-15).



---

## BACKHOE CONTROL VALVE, INTAKE MANIFOLD REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

SEE

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit, HSTRU) NSN 4940-01-036-5784

#### Materials/Parts:

Packing

Oil, Lubricating                      Appendix B, Item 30

---

#### Equipment Condition:

##### Reference

Page 20-41

##### Condition Description

Intake Manifold Removed  
 from Backhoe Control  
 Valve

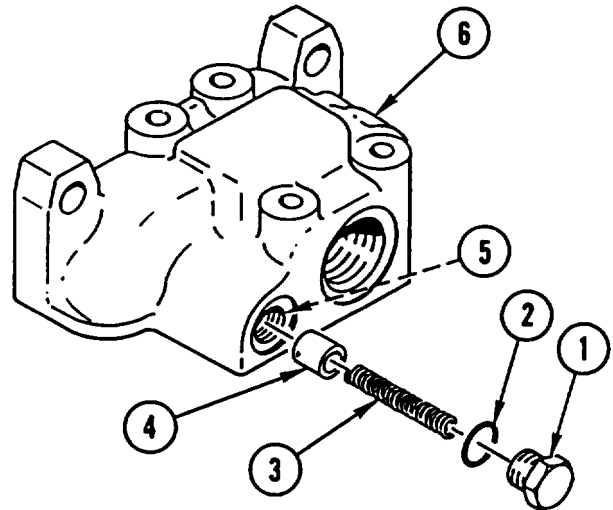
### DISASSEMBLY

1. REMOVE PLUG (1) and packing (2).  
DISCARD PACKING.
2. REMOVE SPRING (3).
3. REMOVE valve DISC (4).

#### NOTE

Remove seat only if damaged.

4. IF SEAT (5) is DAMAGED, INSTALL  
MANIFOLD (6) in drill PRESS. USING  
21/32-in. (17-mm) diameter DRILL, DRILL  
SEAT to depth of 11/32 in. (8.7 mm).
5. REMOVE remainder of SEAT (5).



### INSPECTION

Check spring length. Free length is 2.04 in. (51.8 mm); compressed length is 1.56 in. (39.6 mm) at 0.95 +1.1 lb (0.43 ±0.018 kg). If spring does not meet these length requirements, replace spring.

---

## BACKHOE CONTROL VALVE, INTAKE MANIFOLD REPAIR (CONT)

---

### ASSEMBLY

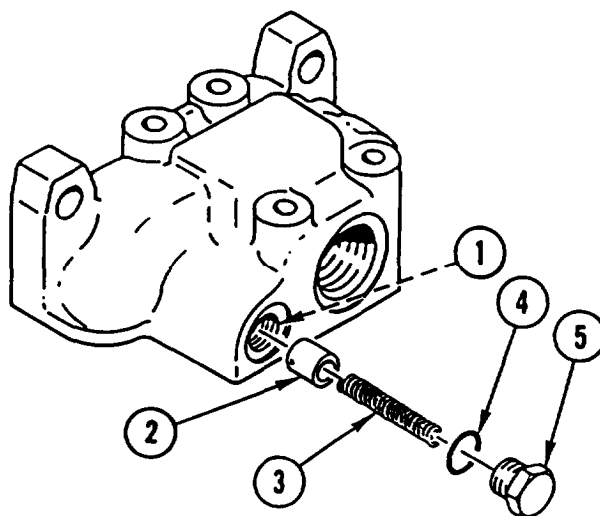
#### NOTE

Apply coat of lubricating oil to packing prior to assembly.

1. IF SEAT (1) was REMOVED, INSTALL new SEAT (1) with chamfer toward inside of bore.
2. INSTALL valve DISC (2).
3. INSTALL SPRING (3).
4. INSTALL new packing (4) and PLUG (5).

#### NOTE

Follow-on Maintenance:  
Install intake manifold in backhoe control valve (page 20-41).



---

## BACKHOE CONTROL VALVE, OUTLET MANIFOLD REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

SEE

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

#### Materials/Parts:

Packing

Packing

Oil, Lubricating                      Appendix B, Item 30

---

#### Equipment Condition:

##### Reference

Page 20-41

##### Condition Description

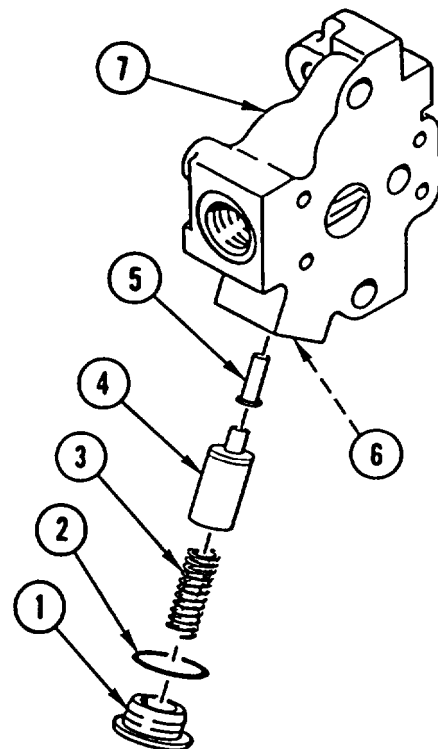
Outlet Manifold Removed  
 from Backhoe Control  
 Valve

### DISASSEMBLY

1. REMOVE PLUG (1) and packing (2). DISCARD PACKING.
2. REMOVE SPRING (3).
3. REMOVE SLIDE (4).
4. REMOVE PIN (5).
5. REMOVE PACKING (6) from bore of outlet manifold (7). DISCARD PACKING.

### INSPECTION

Check spring length. Free length is 2.097 in. (53.26 mm); compressed length is 1.61 in. (41 mm) at 62 ±4 lb (28 ±1.8 kg). If spring does not meet these length requirements, replace spring.





---

**BACKHOE CONTROL VALVE, OUTLET MANIFOLD REPAIR (CONT)**

---

**ASSEMBLY**

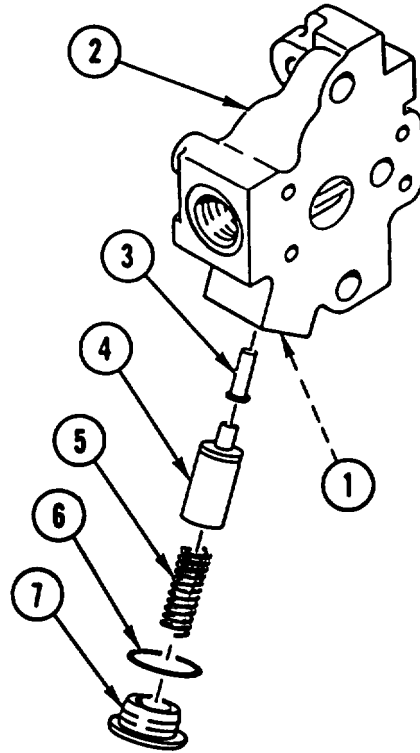
**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL new PACKING (1) in bore of outlet manifold (2).
2. INSTALL PIN (3).
3. APPLY COAT of LUBRICATING OIL to SLIDE (4) and INSTALL SLIDE (4) in outlet manifold (2).
4. INSTALL SPRING (5).
5. INSTALL new packing (6) and PLUG (7).

**NOTE**

Follow-on Maintenance:  
Install outlet manifold in backhoe control valve (page 20-41).



---

**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR**


---

This task covers: a. Disassembly b. Inspection c. Assembly

---

**INITIAL SETUP**
**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Fabricated Tool, Appendix C, Item 5

**Materials/Parts:**

Packing (2)

Packing (2)

Packing (2)

Seal

Kit, Repair

Oil, Lubricating

Appendix B, Item 30

**Equipment Condition:**
**Reference**

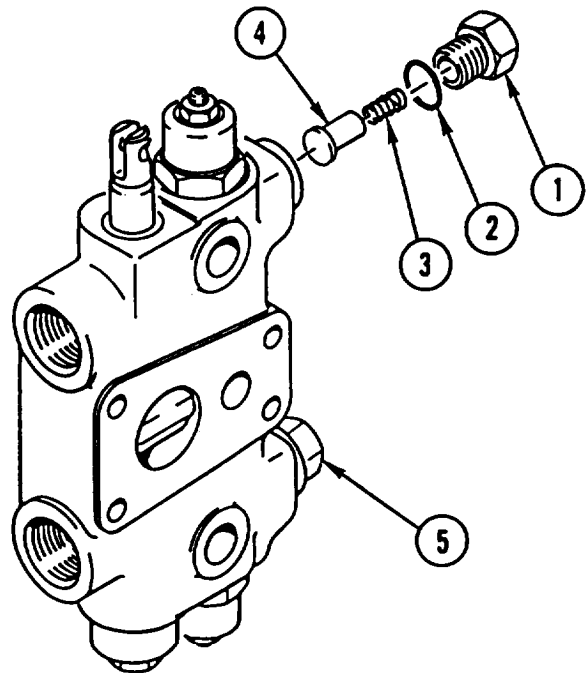
Page 20-41

**Condition Description**

Swing Section Valve  
 Removed from Backhoe  
 Control Valve

**DISASSEMBLY**

1. REMOVE PLUG (1) and packing (2). DISCARD PACKING.
2. REMOVE spring (3) and valve DISC (4).
3. TURN SPRING (3) and REMOVE SPRING (3) from valve disc (4).
4. REPEAT STEPS 1 thru 3 for plug (5).

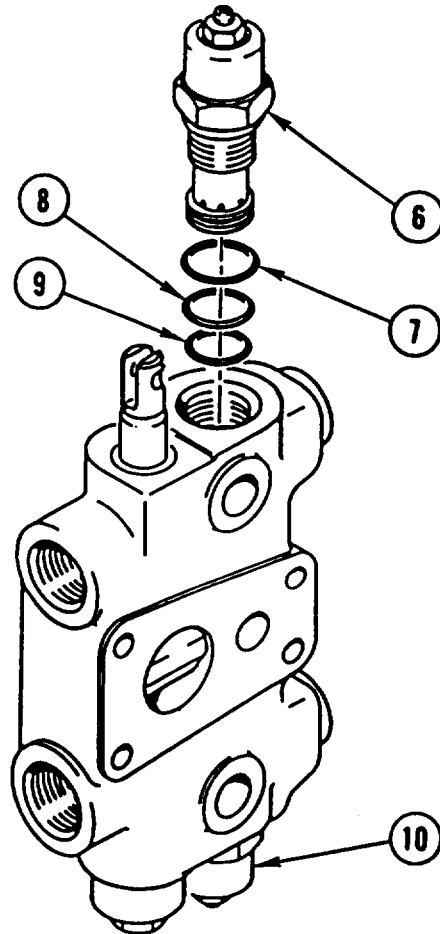


## BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)

### NOTE

Tag safety relief valves prior to removal to aid in installation.

5. REMOVE safety relief VALVE (6) and three packings (7, 8, and 9). DISCARD PACKINGS.
6. REPEAT STEP 5 for opposite safety relief valve (10).



### NOTE

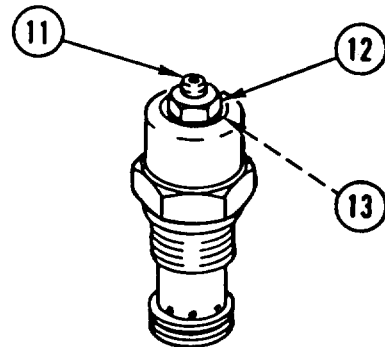
Steps 7 thru 10 are the same for both safety relief valves.

7. HOLD SETSCREW (11) and LOOSEN NUT (12).

### NOTE

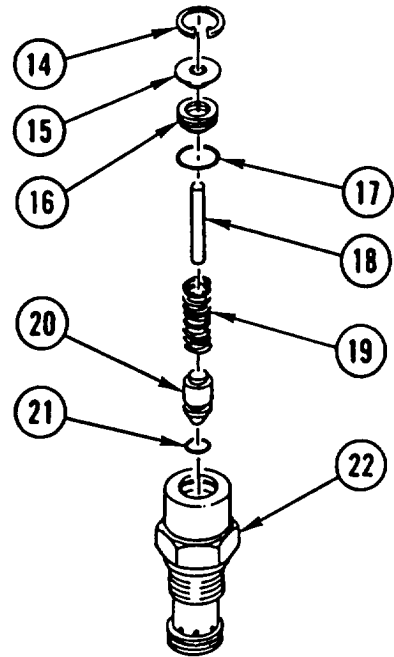
Note number of turns necessary to remove setscrew.

8. REMOVE SETSCREW (11) and washer (13).

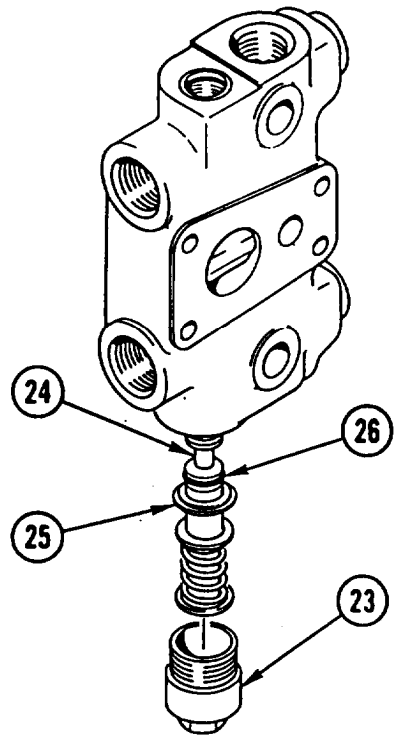


**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)**

9. REMOVE retaining RING (14).
10. REMOVE retainer (15), piston (16), packing (17), pin (18), spring (19), POPPET (20), and packing (21) from valve body (22). DISCARD PACKINGS.

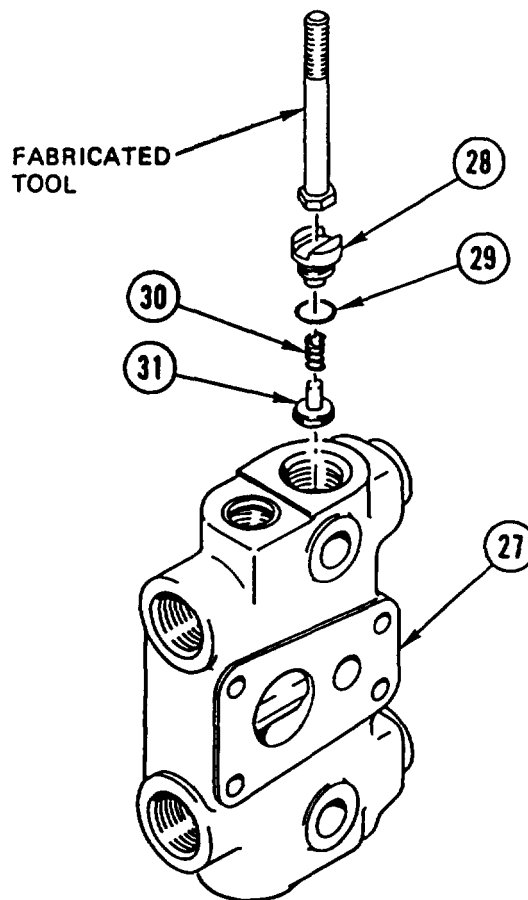


11. REMOVE PLUG (23).
12. REMOVE SPOOL (24), ring (25), and packing (26). DISCARD PACKING.

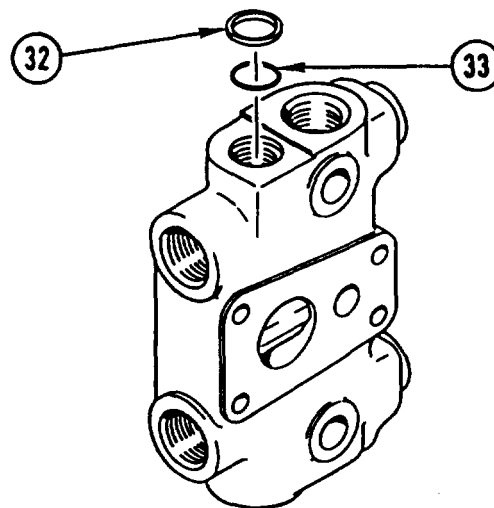


**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)**

13. INSTALL valve BODY (27) on end in soft-jawed VISE. USING FABRICATED TOOL, REMOVE load check PLUG (28) by INSERTING TOOL and TURNING it until it SLIPS into SLOTS on both sides of load check plug (28).
14. REMOVE and DISCARD PACKING (29).
15. REMOVE spring (30) and POPPET (31).
16. REPEAT STEPS 13 thru 15 for load check plug hole on other end of valve body (27).



17. REMOVE and DISCARD SEAL (32) and PACKING (33).



**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)**

18. COMPRESS SPRING (34) and REMOVE retaining RING (35).
19. SLOWLY RELEASE SPRING (34) and REMOVE retainer (36), SPRING (34), and retainer (37) from spool (24).

**INSPECTION**

1. Check secondary relief valve spring length. Free length is 1.785 in. (45.3 mm); compressed length is 1.51 in. (38.4 mm) at 137 ±16 lb (627.25 kg).
2. Check spool spring length. Free length is 2.27 in. (57.6 mm); compressed length is 0.87 in. (22 mm) at 35 ±2.1 lb (15.9 ±1 kg).
3. If either spring does not meet length requirements above, replace spring.

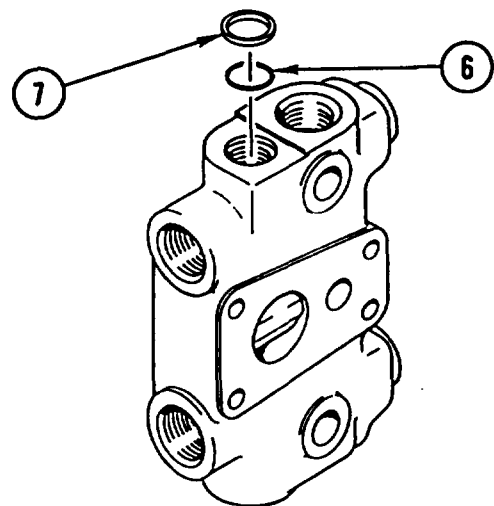
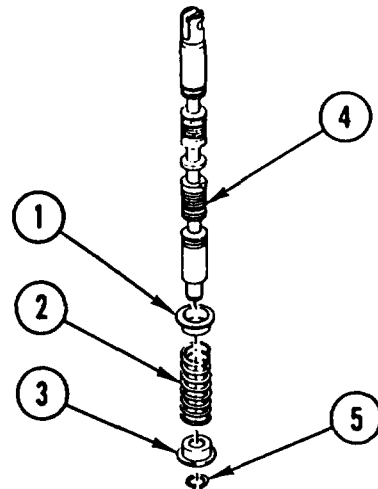
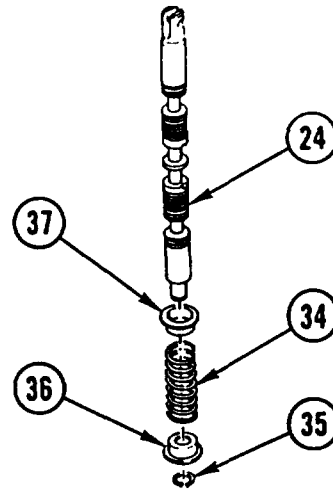
**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to packings and seal prior to assembly.

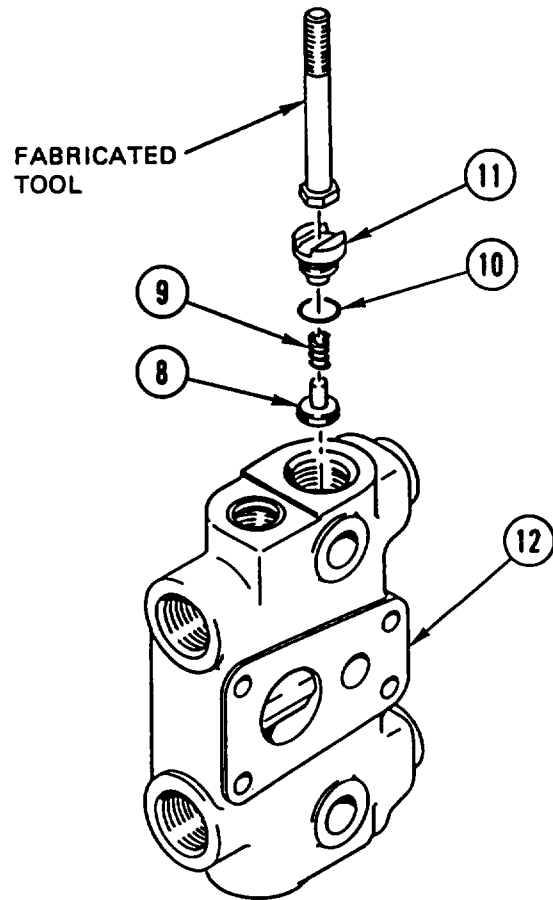
1. INSTALL retainer (1), SPRING (2), and retainer (3) on spool (4).
2. COMPRESS SPRING (2) and INSTALL retaining RING (5).

3. INSTALL new packing (6) and new SEAL (7). TAP SEAL with soft-faced hammer until it is even with the top.

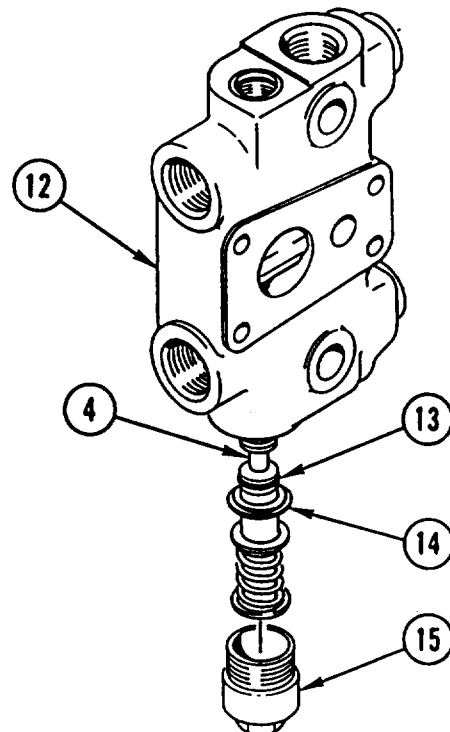


## BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)

4. INSTALL POPPET (8) and spring (9).
5. INSTALL new PACKING (10).
6. INSERT FABRICATED TOOL into both slots on load check plug (11) and INSTALL load check PLUG (11) in valve body (12).
7. TURN valve BODY (12) OVER and REPEAT STEPS 4 thru 6 for other load check plug hole.



8. INSTALL new packing (13) and RING (14) on spool (4).
9. INSTALL SPOOL (4) in valve body (12).
10. INSTALL PLUG (15) and TIGHTEN to 20-30 lb-ft (27-41 N.m).



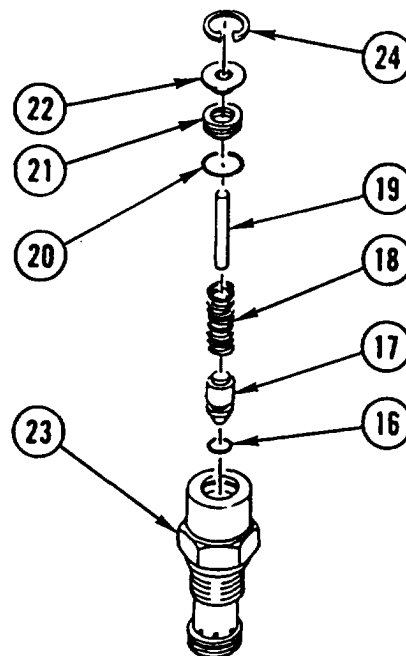
**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)**

**CAUTION**  
 Check tags to be sure correct safety relief valve is installed in correct place, otherwise valve section will not work properly.

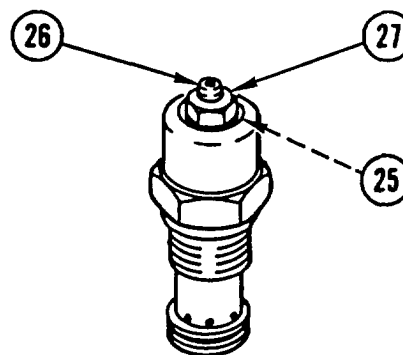
**NOTE**

Steps 11 thru 14 are the same for both safety relief valves.

11. INSTALL new packing (16). POPPET (17), spring (18), pin (19), new packing (20), piston (21), and retainer (22) in valve body (23).
12. INSTALL retaining RING (24).



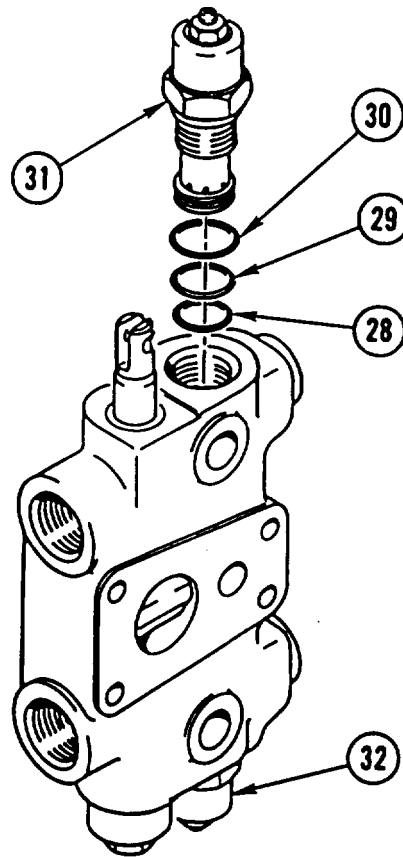
13. INSTALL washer (25) and SETSCREW (26). TIGHTEN SETSCREW number of turns noted during Disassembly.
14. HOLD SETSCREW (26) and TIGHTEN NUT (27) to 50-80 lb-in. (5.6-9.0 N.m).





**BACKHOE CONTROL VALVE, SWING SECTION VALVE REPAIR (CONT)**

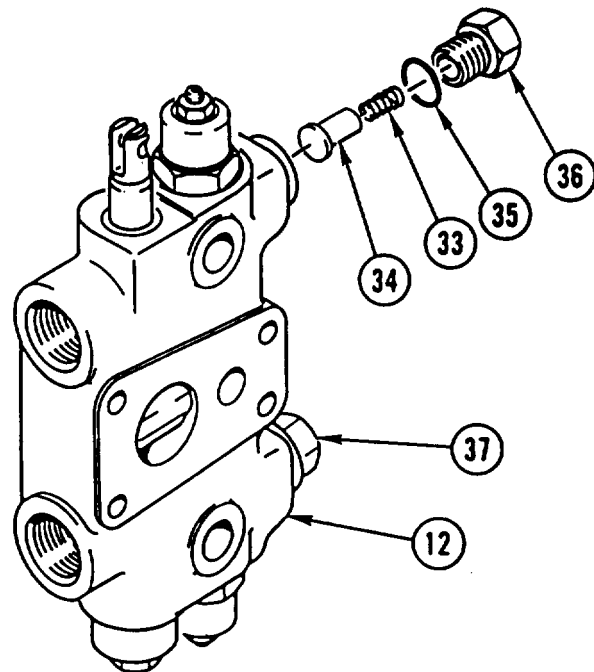
15. INSTALL three new packings (28, 29, and 30) and safety relief VALVE (31) and TIGHTEN to 65-85 lb-ft (85-115 N.m).
16. REPEAT STEP 15 for opposite safety relief valve (32).



17. INSTALL SPRING (33) In valve disc (34) by turning spring (33).
18. INSTALL spring (33) and valve DISC (34) in valve body (12).
19. INSTALL new packing (35) and PLUG (36).
20. REPEAT STEPS 17 thru 19 for plug (37).
21. PERFORM safety relief VALVE TESTING and ADJUSTMENT (page 20-69).

**NOTE**

Follow-on Maintenance:  
Install swing section valve in backhoe control valve (page 20-41).



---

## BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

SEE

**Equipment Condition:**

**Reference**

Page 20-41

**Condition Description**

Boom Section Valve  
Removed from Backhoe  
Control Valve

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784  
Fabricated Tool, Appendix C, Item 5

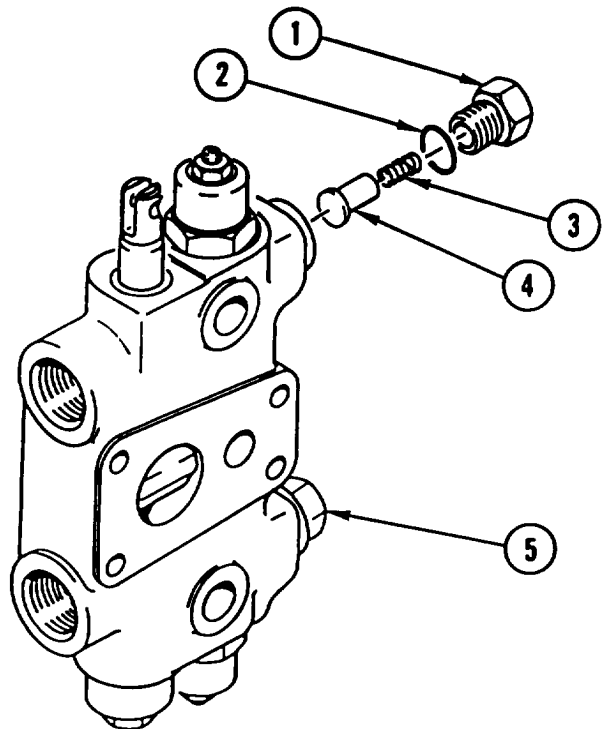
**Materials/Parts:**

- Packing (2)
- Packing (2)
- Packing (2)
- Seal
- Kit, Repair
- Kit, Repair
- Oil, Lubricating                      Appendix B, Item 30

---

### DISASSEMBLY

1. REMOVE PLUG (1) and packing (2). DISCARD PACKING.
2. REMOVE spring (3) and DISC (4).
3. TURN SPRING (3) and REMOVE SPRING (3) from disc (4).
4. REPEAT STEPS 1 thru 3 for plug (5).



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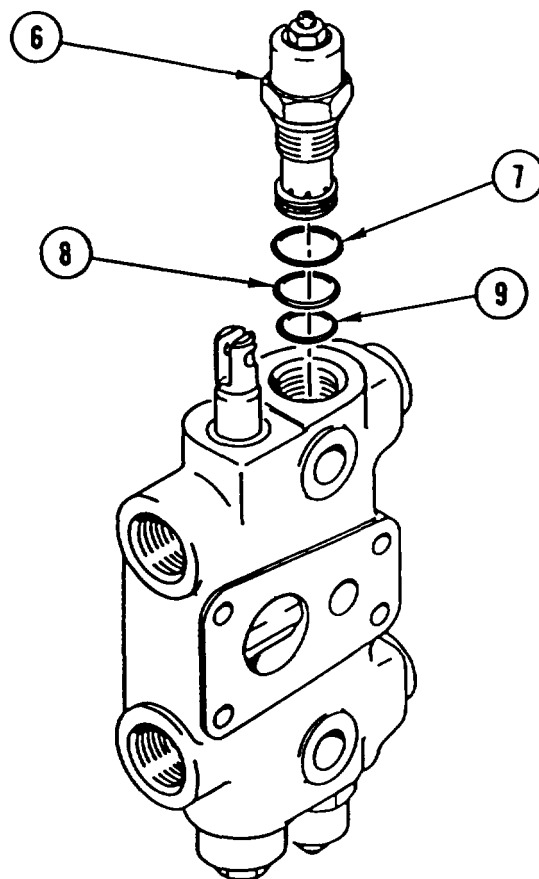
**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

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**NOTE**

Tag both relief valves prior to removal to aid in installation.

5. REMOVE safety relief VALVE (6) and three packings (7, 8, and 9). DISCARD PACKINGS.

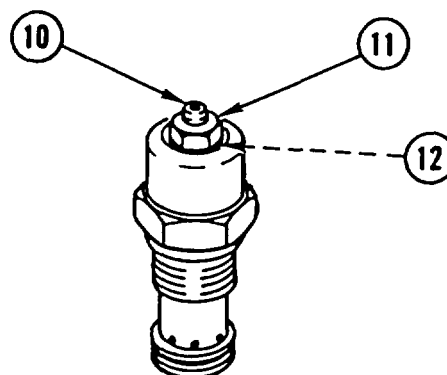


6. HOLD SETSCREW (10) and LOOSEN NUT (11).

**NOTE**

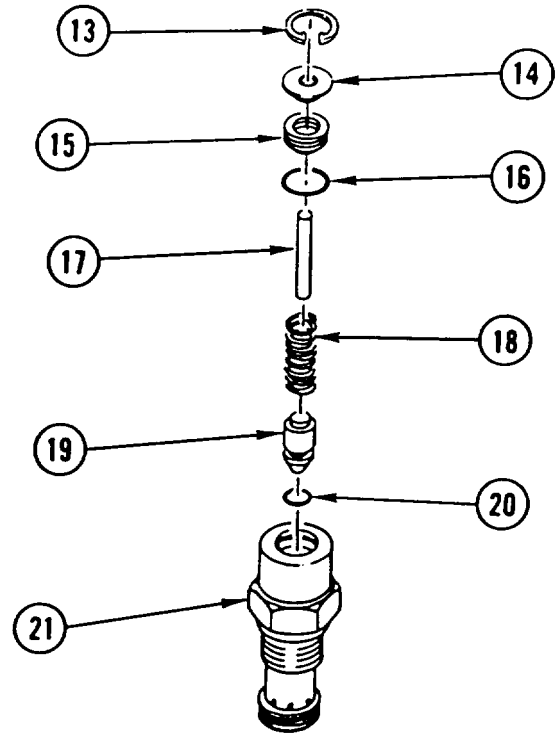
Note number of turns necessary to remove setscrew.

7. REMOVE SETSCREW (10) and washer (12).

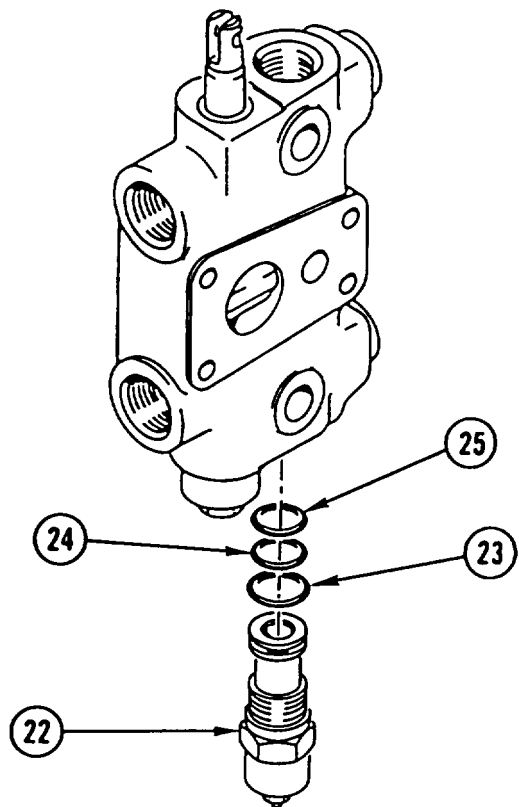


**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

8. REMOVE retaining RING (13).
9. REMOVE retainer (14), piston (15), packing (16), pin (17), spring (18), POPPET (19), and packing (20) from valve body (21). DISCARD PACKINGS.



10. REMOVE pressure relief VALVE (22) and three packings (23, 24, and 25). DISCARD PACKINGS.



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## BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)

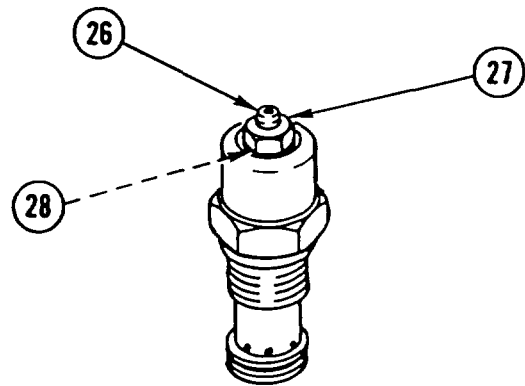
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11. HOLD SETSCREW (26) and LOOSEN NUT (27).

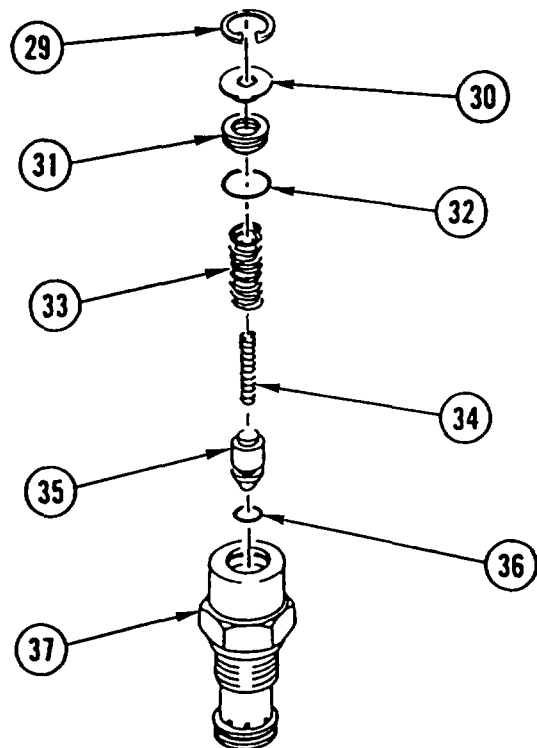
**NOTE**

Note number of turns necessary to remove setscrew.

12. REMOVE SETSCREW (26) and washer (28).

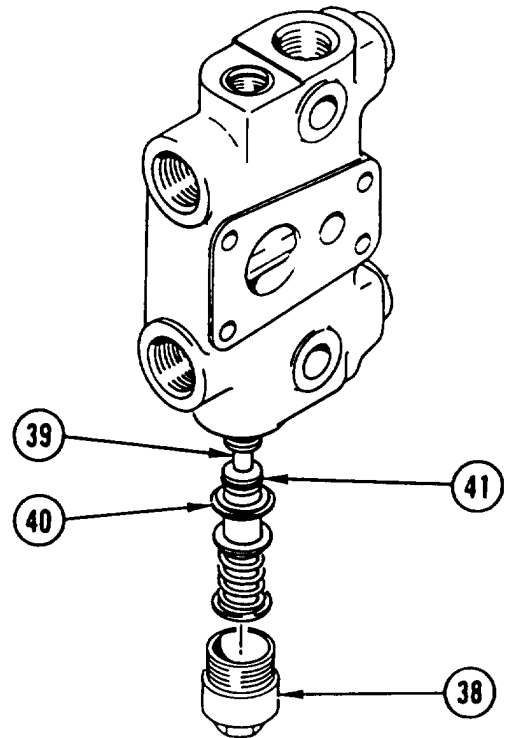


13. REMOVE retaining RING (29).
14. REMOVE retainer (30), piston (31), packing (32), spring (33), spring (34), POPPET (35), and packing (36) from valve body (37). DISCARD PACKINGS.

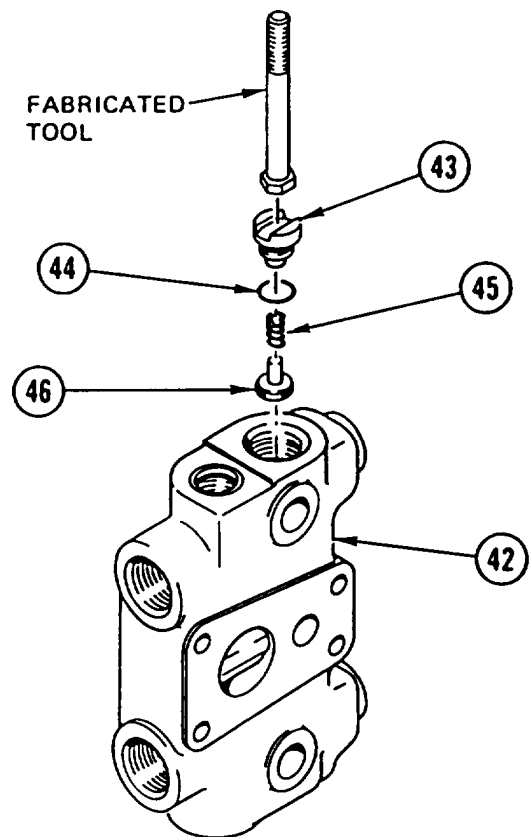


**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

15. REMOVE PLUG (36).
16. REMOVE SPOOL (39), washer (40), and packing (41). DISCARD PACKING.

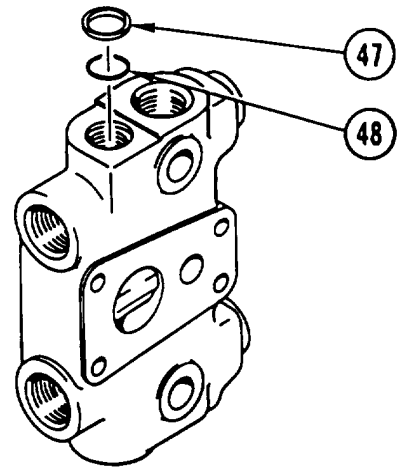


17. INSTALL valve BODY (42) on end in soft-jawed VISE. USING FABRICATED TOOL, REMOVE load check PLUG (43) by INSERTING TOOL and TURNING it until it SLIPS into slots on both sides of load check plug (43).
18. REMOVE and DISCARD PACKING (44).
19. REMOVE spring (45) and POPPET (46).
20. REPEAT STEPS 17 thru 19 for load check plug hole on other end of valve body (42).



**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

21. REMOVE and DISCARD SEAL (47) and PACKING (48).



22. COMPRESS SPRING (49) and REMOVE retaining RING (50).
23. SLOWLY RELEASE SPRING (49) and REMOVE retainer (51), SPRING (49), and retainer (52) from spool (39).

**INSPECTION**

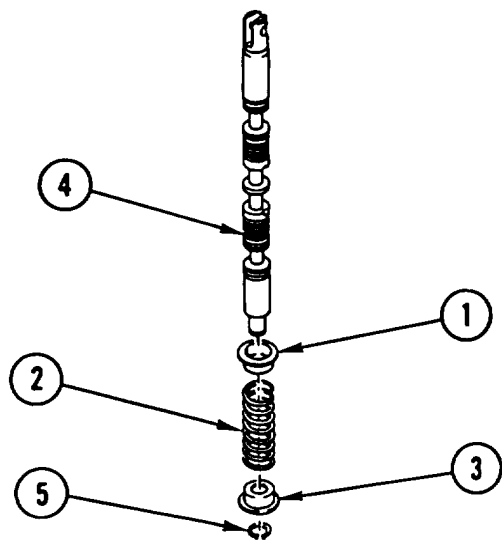
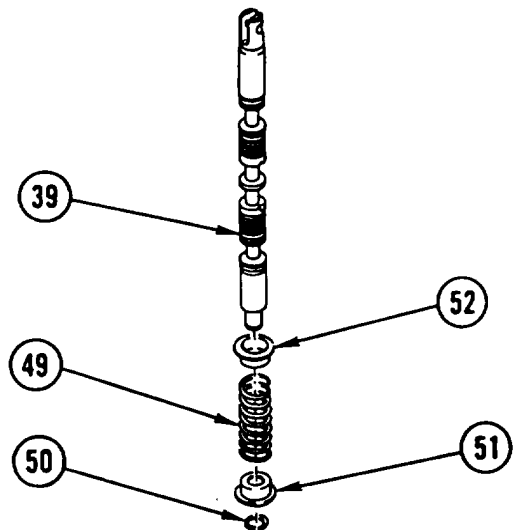
1. Check secondary relief valve spring length. Free length is 1.78 in. (45.3 mm); compressed length is 1.51 in. (38.4 mm) at 137 ±16 lb (627.25 kg).
2. Check spool spring length. Free length is 2.27 in. (57.6 mm); compressed length is 0.87 in. (22 mm) at 35 ±2.1 lb (15.9 ±1 kg).
3. If either spring does not meet length requirements above, replace spring.

**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to packings and seal prior to assembly.

1. INSTALL retainer (1), SPRING (2), and retainer (3) on spool (4).
2. COMPRESS SPRING (2) and INSTALL retaining RING (5).

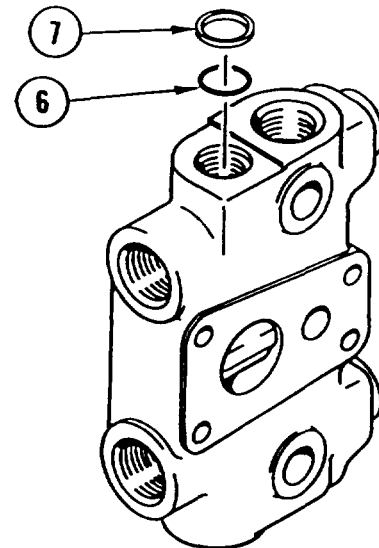


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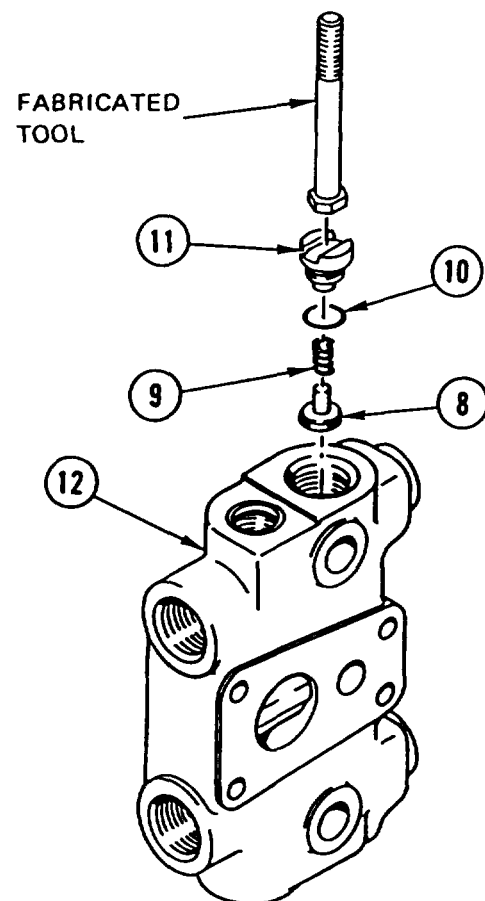
**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**


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3. INSTALL new packing (6) and new SEAL (7). TAP SEAL with soft-faced hammer until it is even with the top.



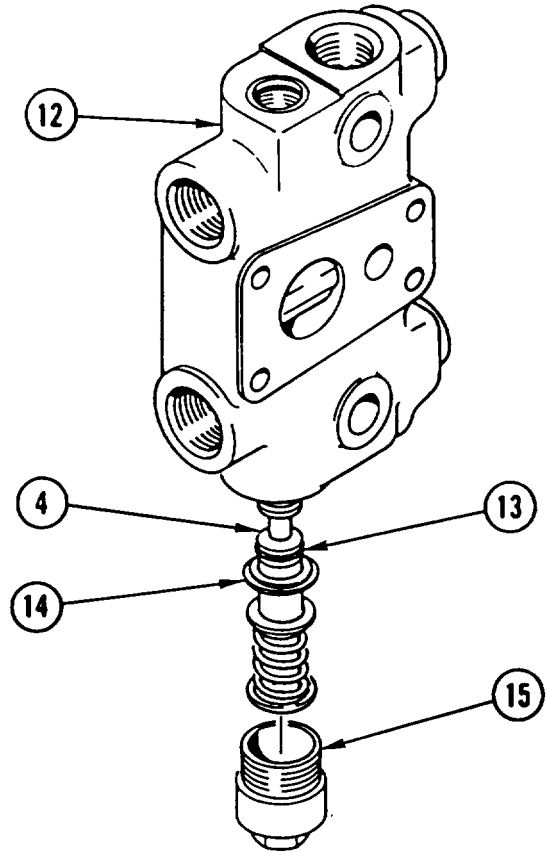
4. INSTALL POPPET (8) and spring (9).
5. INSTALL new PACKING (10).
6. INSERT FABRICATED TOOL into both slots on load check plug (11) and INSTALL load check PLUG (11) in valve body (12).
7. TURN valve BODY (12) over and REPEAT STEPS 4 thru 6 for other load check plug hole.



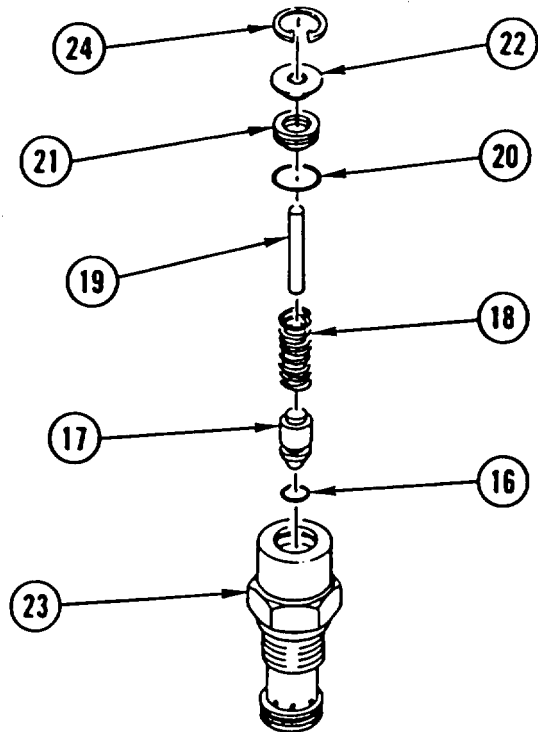


**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

8. INSTALL new PACKING (13) and washer (14) on spool (4).
9. INSTALL SPOOL (4) in valve body (12).
10. INSTALL PLUG (15) and TIGHTEN to 20-30 lb-ft (27-41 N.m).

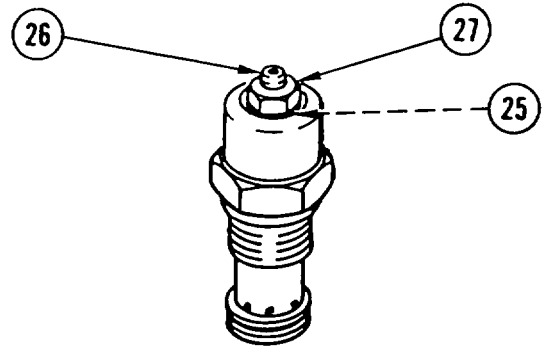


11. INSTALL new packing (16), POPPET (17), spring (18), pin (19), new packing (20), piston (21), and retainer (22) in valve body (23).
12. INSTALL retaining RING (24) in valve body (23).

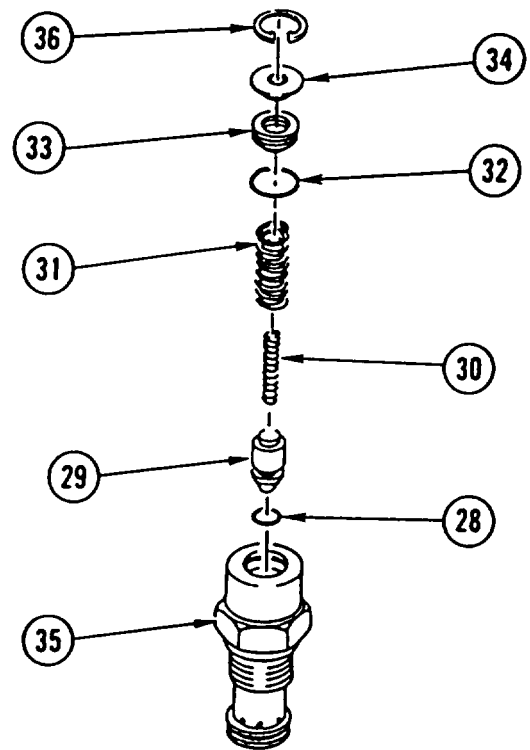


**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

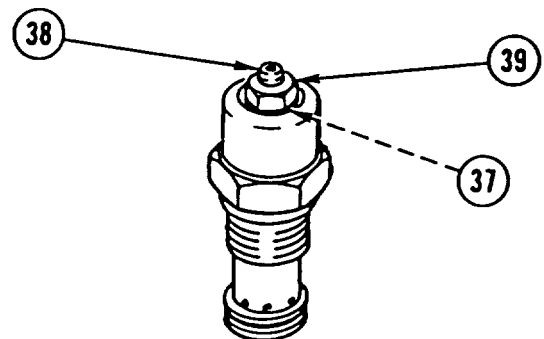
13. INSTALL washer (25) and SETSCREW (26). TIGHTEN SETSCREW number of turns noted during Disassembly.
14. HOLD SETSCREW (26) and TIGHTEN NUT (27) to 50-80 lb-in. (5.6-9.0 N.m).



15. INSTALL new packing (28), POPPET (29), Spring (30), spring (31), new packing (32), piston (33), and retainer (34) in valve body (35).
16. INSTALL retaining RING (36) in valve body (35).



17. INSTALL washer (37) and SETSCREW (38). TIGHTEN SETSCREW (38) number of turns noted during Disassembly.
18. HOLD SETSCREW (38) and TIGHTEN NUT (39) to 50-80 lb-in. (5.6-9.0 N.m).

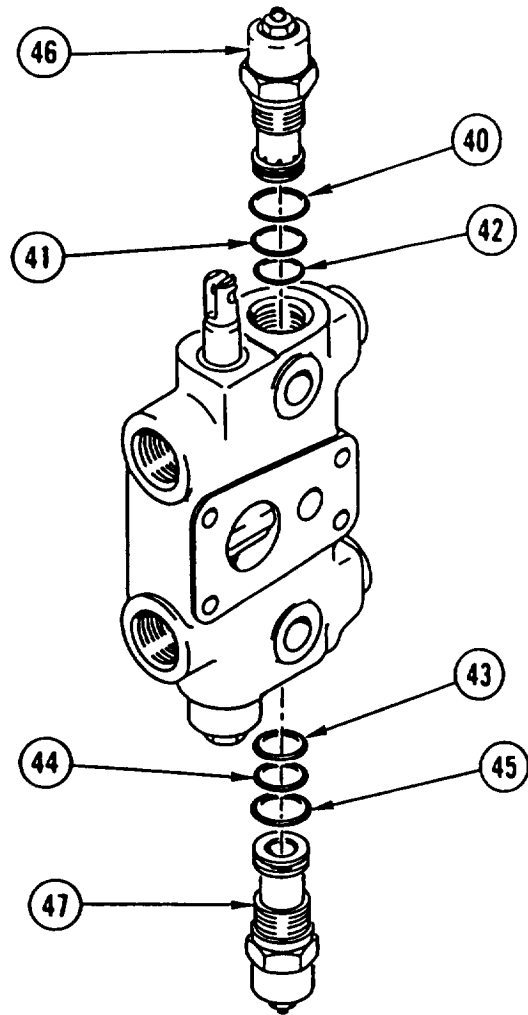


**BACKHOE CONTROL VALVE, BOOM SECTION VALVE REPAIR (CONT)**

**CAUTION**

Check tags to be sure correct relief valve is installed in correct place, otherwise valve section will not work properly.

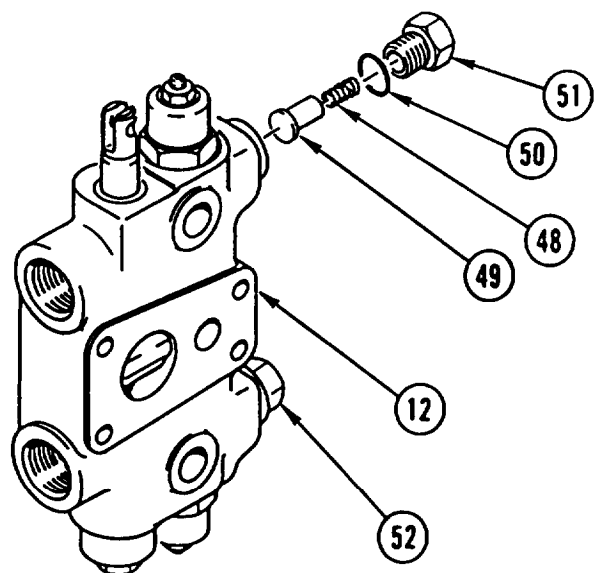
19. INSTALL six new packings (40, 41, 42, 43, 44, and 45), safety relief VALVE (46), and pressure relief valve (47). TIGHTEN to 65-85 lb-ft (85-115 N.m).



20. INSTALL SPRING (48) in disc (49) by turning spring (48).
21. INSTALL spring (48) and DISC (49) in valve body (12).
22. INSTALL new packing (50) and PLUG (51).
23. REPEAT STEPS 20 thru 22 for plug (52).

**NOTE**

Follow-on Maintenance:  
Install boom section valve in backhoe control valve (page 20-41 ).



# BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly d. Testing e. Adjustment

## INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Fabricated Tool, Appendix C, Item 5

**Materials/Parts:**

- Packing (2)
- Packing (2)
- Kit, Repair (4)
- Caps and Plugs                      Appendix B, Item 8
- Oil, Lubricating                      Appendix B, Item 30
- Rags                                      Appendix B, Item 40

**Equipment Condition:**

**Reference**

Page 20-41

**Condition Description**

Dipper Section Valve or  
 Bucket Section Valve  
 Removed from Backhoe  
 Control Valve

**General Safety Instructions:**

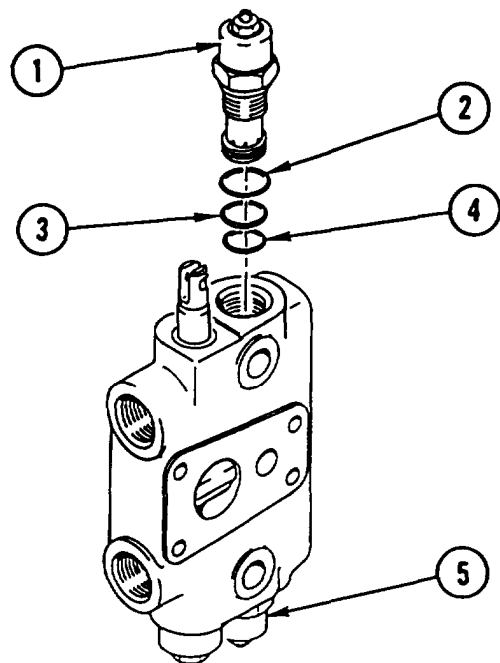
**WARNING**

- Wear safety goggles when performing leakage tests on valves. Failure to do so may result in serious eye injury due to high pressure oil.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

## DISASSEMBLY

**NOTE**

- Procedure is the same for both dipper section valve and bucket section valve.
  - Tag safety relief valves prior to removal to aid in installation.
1. REMOVE safety relief VALVE (1) and three packings (2, 3, and 4). DISCARD PACKINGS.
  2. REPEAT STEP 1 for opposite safety relief valve (5).



---

## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

---

**NOTE**

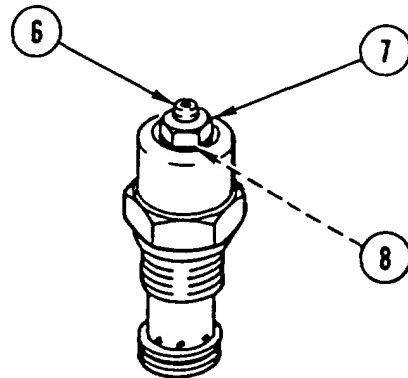
Steps 3 thru 6 are the same for both safety relief valves.

3. HOLD SETSCREW (6) and LOOSEN NUT (7).

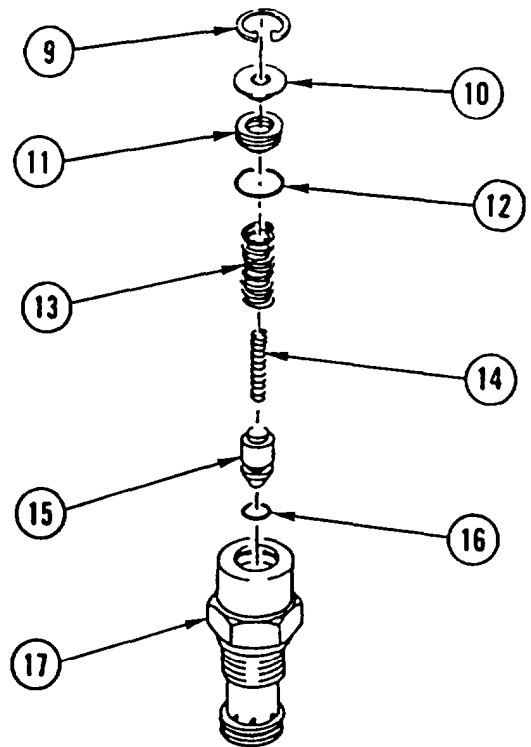
**NOTE**

Note number of turns necessary to remove setscrew.

4. REMOVE SETSCREW (6) and washer (8).

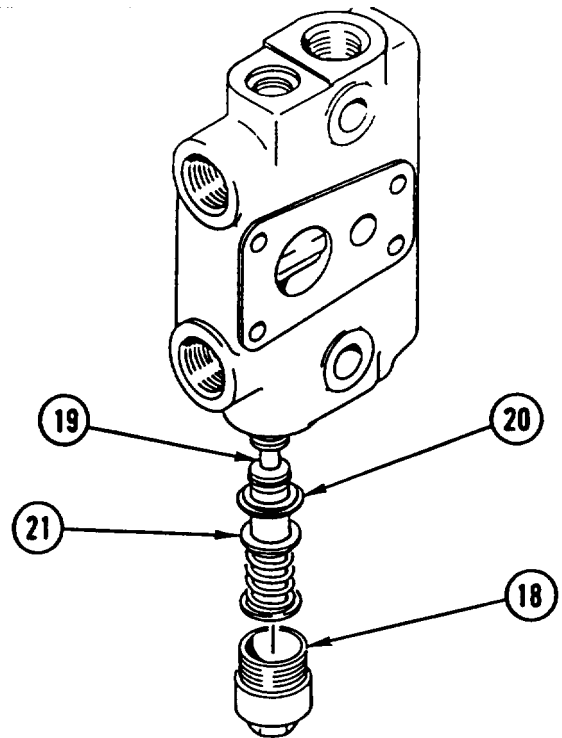


5. REMOVE retaining RING (9).
6. REMOVE retainer (10), piston (11), packing (12), spring (13), spring (14), POPPET (15), and packing (16) from valve body (17). DISCARD PACKINGS.

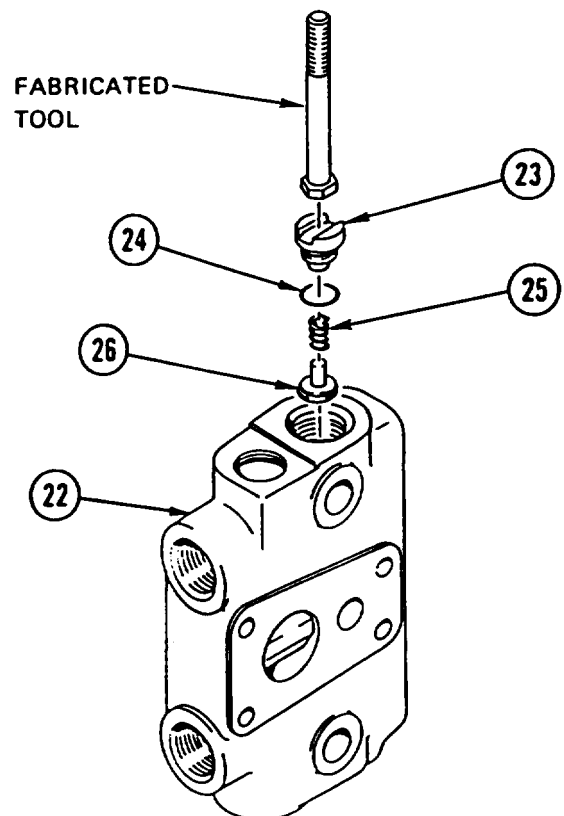


**BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES  
REPAIR (CONT)**

7. REMOVE PLUG (18).
8. REMOVE SPOOL (19), washer (20), and packing (21). DISCARD PACKING.



9. INSTALL valve BODY (22) on end in soft-jawed VISE. USING FABRICATED TOOL, REMOVE load check PLUG (23) by INSERTING TOOL and TURNING it until it SLIPS into slots on both sides of load check plug (23).
10. REMOVE and DISCARD PACKING (24).
11. REMOVE spring (25) and POPPET (26).
12. REPEAT STEPS 9 thru 11 for load check plug hole on other end of valve body (22).



## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

13. REMOVE and DISCARD SEAL (27) and PACKING (28).
14. COMPRESS SPRING (29) and REMOVE retaining RING (30).
15. SLOWLY RELEASE SPRING (29) and REMOVE retainer (31), SPRING (29), and retainer (32).

### INSPECTION

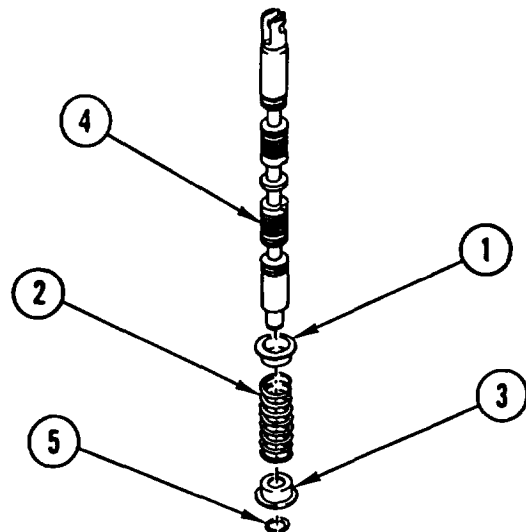
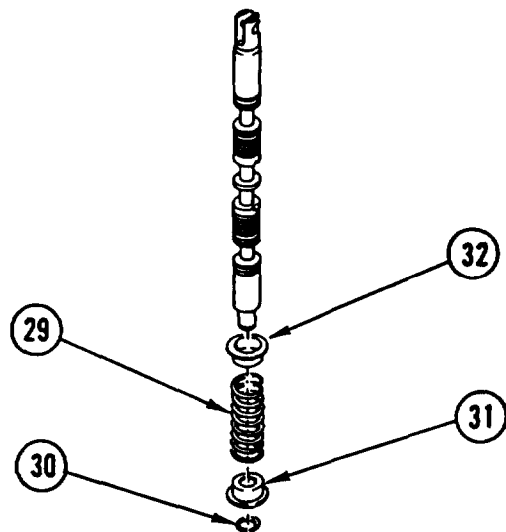
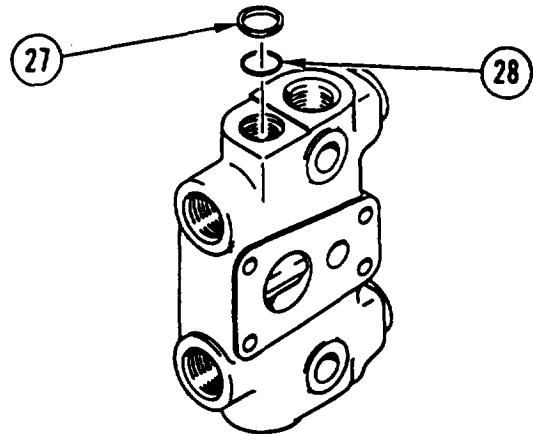
1. Check secondary relief valve spring length. Free length is 1.78 in. (45.3 mm); compressed length is 1.51 in. (38.4 mm) at 137 ±16 lb (627.25 kg).
2. Check spool spring length. Free length is 2.27 in. (57.6 mm); compressed length is 0.87 in. (22 mm) at 35 ±2.1 lb (15.9 ±1 kg).
3. If either spring does not meet length requirements above, replace spring.

### ASSEMBLY

#### NOTE

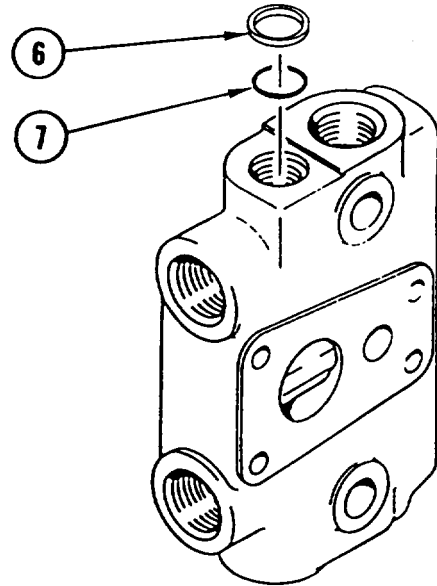
- Procedure is the same for both dipper section valve and bucket section valve.
- Apply coat of lubricating oil to packings and seal prior to assembly.

1. INSTALL retainer (1), SPRING (2), and retainer (3) on spool (4).
2. COMPRESS SPRING (2) and INSTALL retaining RING (5).

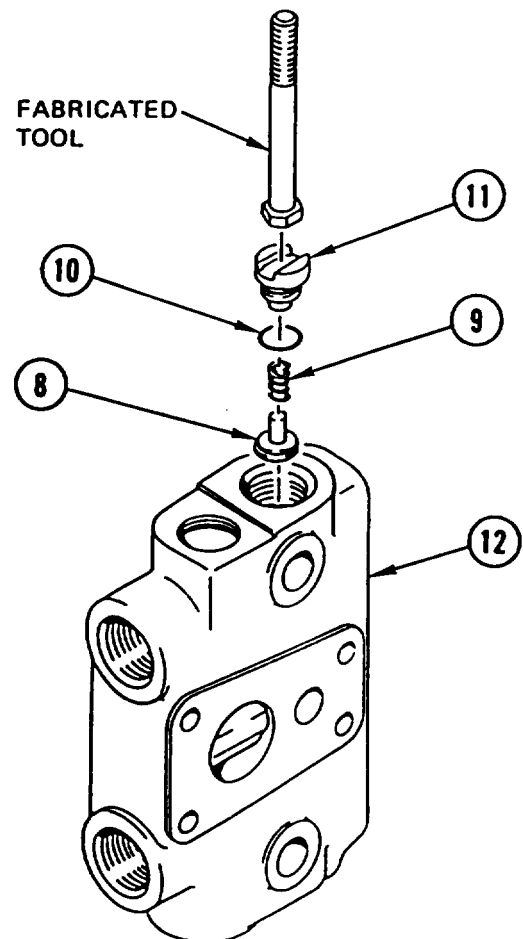


## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

3. INSTALL new packing (6) and new SEAL (7). TAP SEAL with soft-faced hammer until it is even with the top.



4. INSTALL POPPET (8) and spring (9).
5. INSTALL new PACKING (10).
6. INSERT FABRICATED TOOL into both SLOTS on bad check plug (11) and INSTALL bad check PLUG (11) in valve body (12).
7. TURN valve BODY (12) OVER and REPEAT STEPS 4 thru 6 for other load check plug hole.





## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

8. INSTALL new PACKING (13) and washer (14) on spool (4).
9. INSTALL SPOOL (4) in valve body (12).
10. INSTALL PLUG (15) and TIGHTEN to 20-30 lb-ft (27-41 N.m).

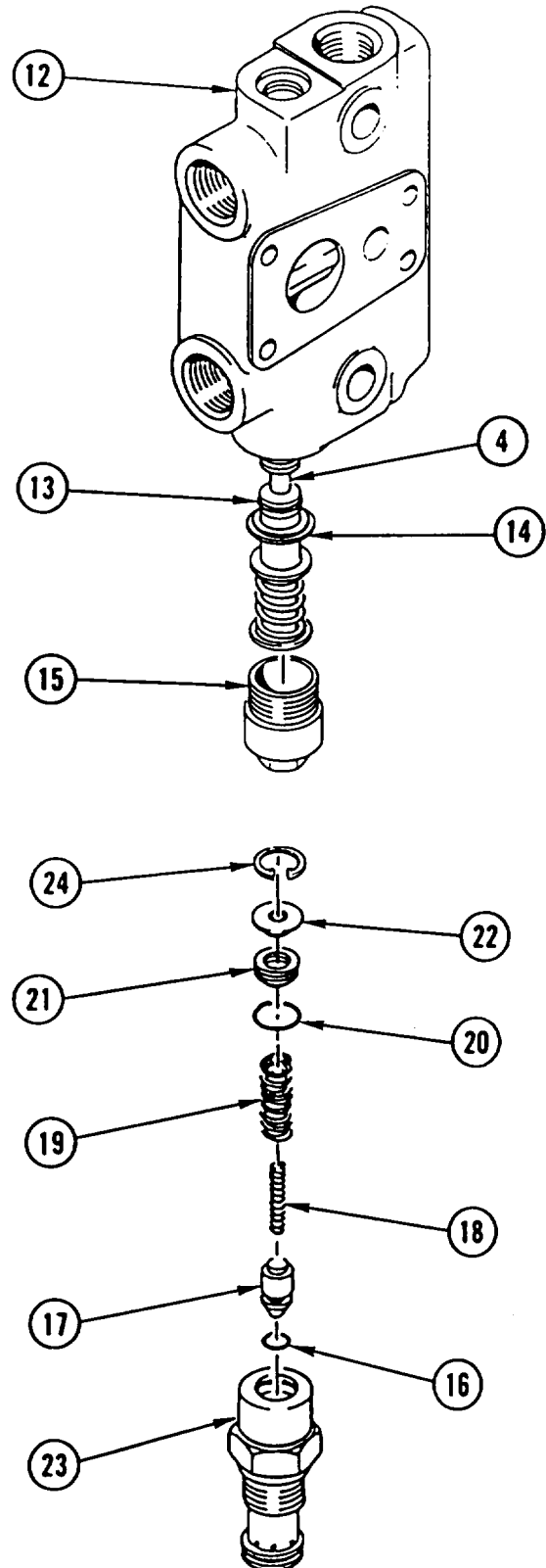
### CAUTION

Check tags to be sure correct safety relief valve is installed in correct place, otherwise valve section will not work properly.

### NOTE

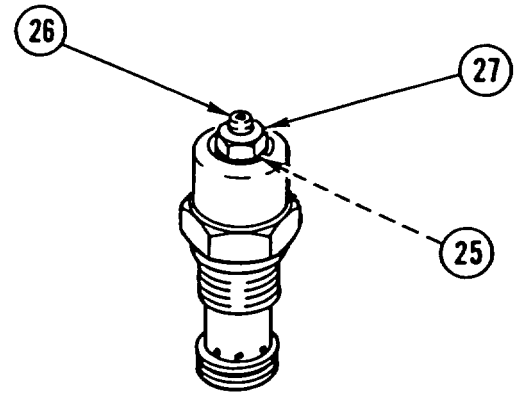
Steps 11 thru 14 are the same for both safety relief valves.

11. INSTALL new packing (16), POPPET (17), spring (18), spring (19), new packing (20), piston (21), and retainer (22) in valve body (23).
12. INSTALL retaining RING (24).

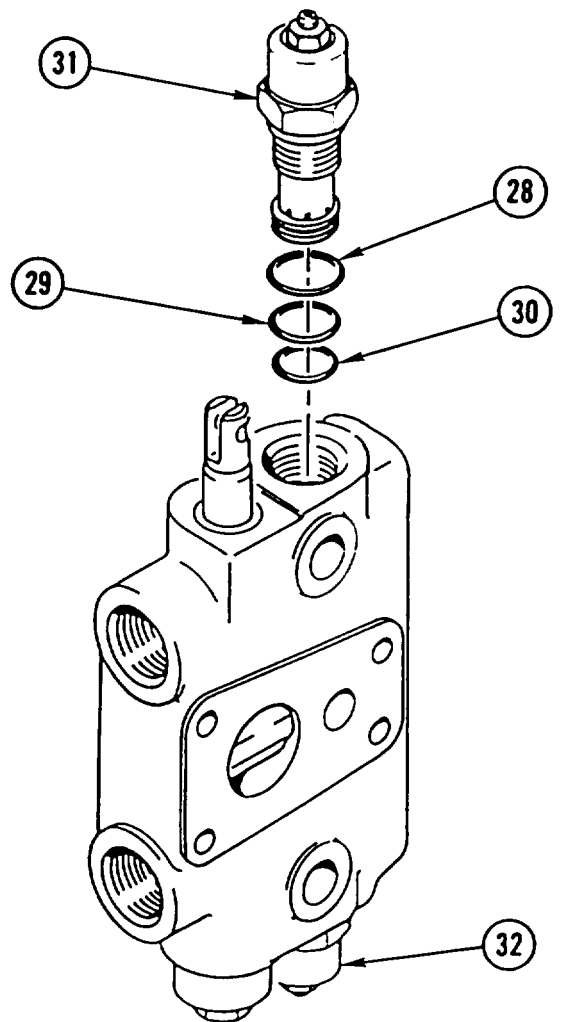


**BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES  
REPAIR (CONT)**

13. INSTALL washer (25) and SETSCREW (26). TIGHTEN SETSCREW number of turns noted during Disassembly.
14. HOLD SETSCREW (26) and TIGHTEN NUT (27) to 50-80 lb-in. (5.6-9.0 N.m).



15. INSTALL three new packings (28, 29, and 30) and safety relief VALVE (31) and TIGHTEN to 65-85 lb-ft (85-115 N.m).
16. REPEAT STEP 15 for opposite safety relief valve (32).

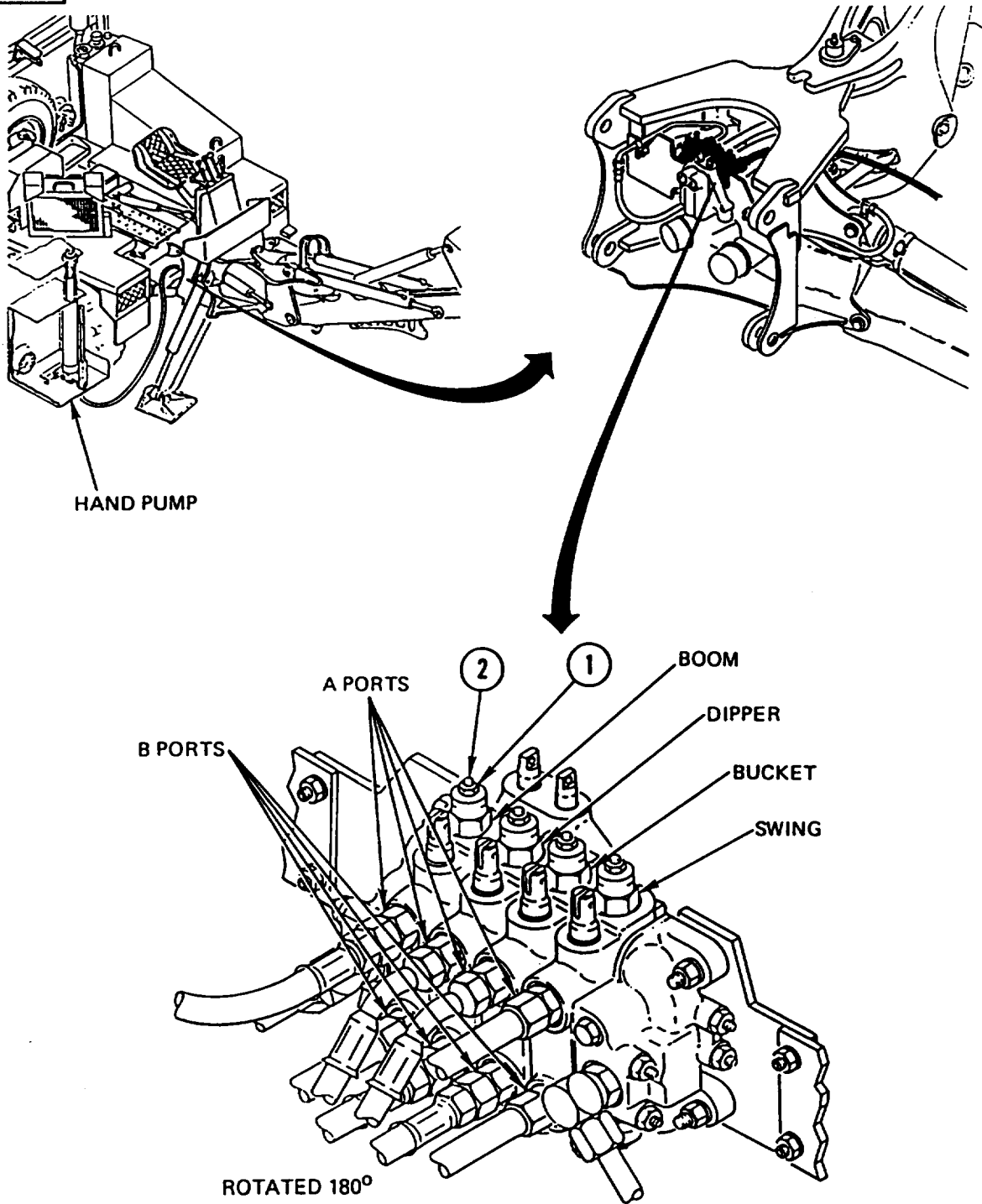


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## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

---

### TESTING



---

## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

---

### Safety Relief Valve

**CAUTION**

Caps or plugs must be installed in any ports not being tested to prevent hydraulic oil leakage.

1. Connect hand pump in port to be tested.
2. Stroke hand pump until sufficient pressure is built up in circuit to open safety relief valve.
3. Continue to stroke hand pump until all air has been pumped out of lines.
4. Record highest pressure and compare with acceptable ranges shown below:

Swing Section Valve	
A and B ports . . . . .	.1700-1900 psi (115.6-129.2 bar)
Boom Section Valve	
Abort . . . . .	.925-1075 psi (62.9-73.1 bar)
B port . . . . .	.2400-2650 psi (163.2-180.2 bar)
Dipper Section Valve	
A and B ports . . . . .	.2400-2650 psi (163.2-180.2 bar)
Bucket Section Valve	
A and B ports . . . . .	.2400-2650 psi (163.2 -180.2 bar)

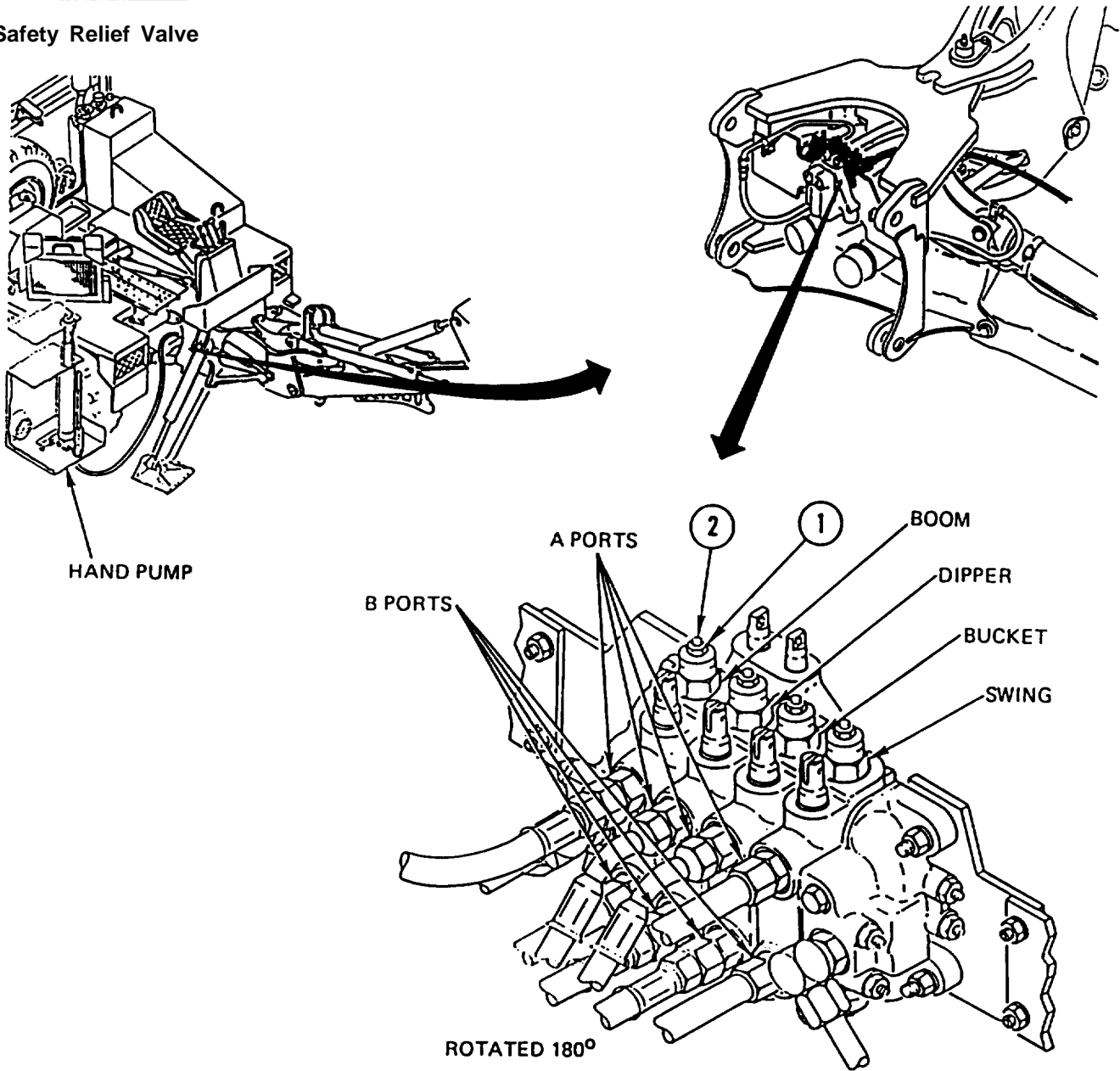
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## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

---

### ADJUSTMENT

#### Safety Relief Valve



1. Loosen lock nut (1).
2. Turn adjusting screw (2) in to increase pressure, or out to decrease pressure.
3. Repeat testing and adjustment until correct pressure is obtained.
4. If correct pressure cannot be obtained, replace safety relief valve.
5. When safety relief valve pressure is correct, perform leak test.

---

## BACKHOE CONTROL VALVE, DIPPER AND BUCKET SECTION VALVES REPAIR (CONT)

---

### Leak Test

#### NOTE

Perform steps 1 thru 3 to check high-pressure safety relief valves.

1. Stroke pump until pressure is built up to less than opening pressure of safety relief valve.

#### NOTE

It normally takes minimum of 15-30 seconds to bleed down to approximately 1000 psi (68 bar).

2. Allow pump to sit and monitor pressure for 30-45 seconds. Pressure should have dropped to approximately 500 psi (34 bar) and should not drop off to 0 for a few minutes.
3. If pressure drops off quicker, there is excessive leakage in circuit being tested. Check following:

Tube connections  
 Safety relief packings  
 Poppet seat in safety relief valve  
 Oil passing by valve spool  
 Valve spool not returning to neutral position  
 Possible cracks in backhoe control valve

#### NOTE

Perform steps 4 thru 6 to check low-pressure safety relief valves.

4. Stroke pump until pressure is built up to less than opening pressure of safety relief valve.

#### NOTE

It normally takes minimum of 15 seconds to bleed down to approximately 300 psi (20.4 bar).

5. Allow pump to sit and monitor pressure for 30-45 seconds. Pressure should not have dropped to, and should not drop off to, 0 for a few minutes.
6. If pressure drops off quicker, there is excessive leakage in circuit being tested. Check following:

Tube connections  
 Safety relief packings  
 Poppet seat in safety relief valve  
 Oil passing by valve spool  
 Valve spool not returning to neutral position  
 Possible cracks in backhoe control valve

#### NOTE

Follow-on Maintenance:

Install dipper section valve or bucket section valve in backhoe control valve (page 20-41 ).

**Section VII. BACKHOE SWING CYLINDER RELIEF VALVE REPAIR**

**BACKHOE SWING CYLINDER RELIEF VALVE REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Packing  
 Packing  
 Packing

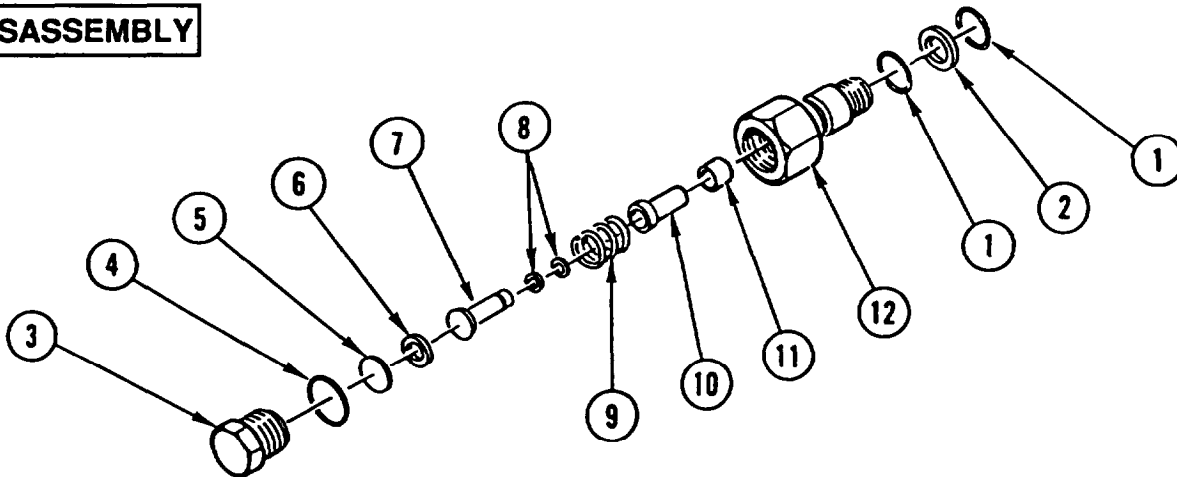
**Materials/Parts (Cont):**

Packing  
 Packing  
 Oil, Lubricating Appendix B, Item 30

**Equipment Condition:**

Reference	Condition Description
Page 11-10	Backhoe Swing Cylinder Relief Valve Removed

**DISASSEMBLY**



**NOTE**

Procedure is the same for both swing cylinder relief valves.

1. REMOVE two PACKINGS (1) and backup ring (2). DISCARD PACKINGS.
2. REMOVE PLUG (3) and packing (4). DISCARD PACKING.
3. IF PRESENT, REMOVE DISC(S) (5) and SHIM(S) (6).
4. REMOVE spring HOLDER (7), two packings (8), and spring (9). DISCARD PACKINGS.
5. REMOVE two valve SEATS (10 and 11) from valve body (12).

---

**BACKHOE SWING CYLINDER RELIEF VALVE REPAIR (CONT)**

---

**ASSEMBLY****NOTE**

- Procedure is the same for both swing cylinder relief valves.
  - Apply coat of lubricating oil to packings prior to assembly.
1. INSTALL two valve SEATS (10 and 11) in valve body (12).
  2. INSTALL spring (9), two new packings (8), and spring HOLDER (7).
  3. IF REMOVED, INSTALL same amount of SHIM(S) (6) and DISC(S) (5).
  4. INSTALL PLUG (3) and new packing (4).
  5. INSTALL backup ring (2) and two new PACKINGS (1).

**NOTE**

Follow-on Maintenance:  
Install backhoe swing cylinder relief valve (page 11-10).



## Section VIII. BACKHOE STABILIZER CONTROL VALVE REPAIR

### BACKHOE STABILIZER CONTROL VALVE REPAIR

This task covers: a. Disassembly b. Inspection c. Repair d. Assembly

#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Ring (2)

Packing (4)

Packing (2)

Packing (2)

Oil, Lubricating                      Appendix B, item 30

**Equipment Condition:**

**Reference**

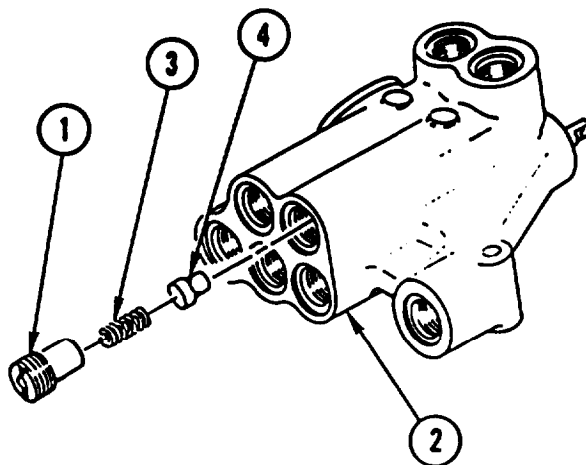
Page 11-12

**Condition Description**

Backhoe Stabilizer Control Valve Removed

#### DISASSEMBLY

1. REMOVE RING (1) from body (2). DISCARD RING.
2. REMOVE spring (3) and DISC (4).

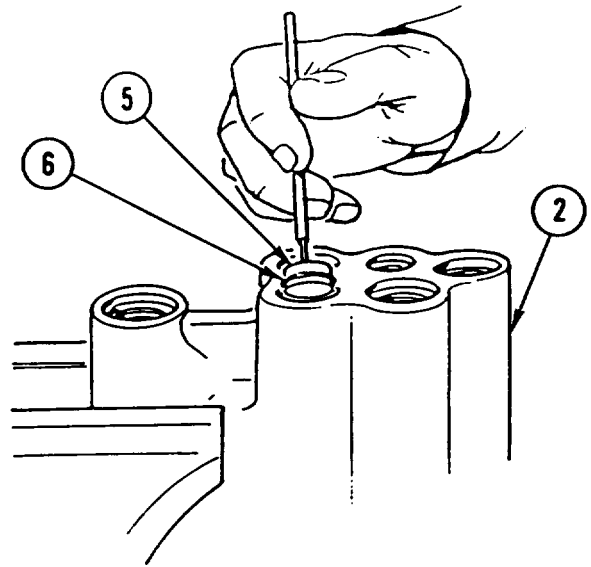


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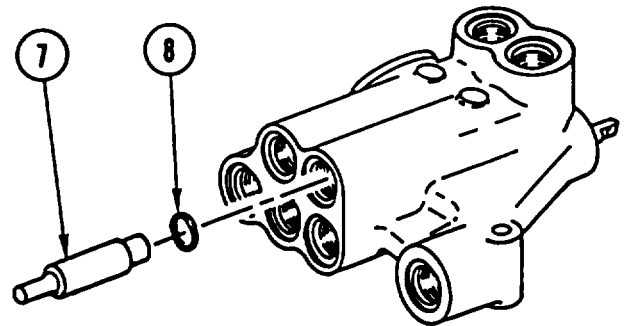
**BACKHOE STABILIZER CONTROL VALVE REPAIR (CONT)**

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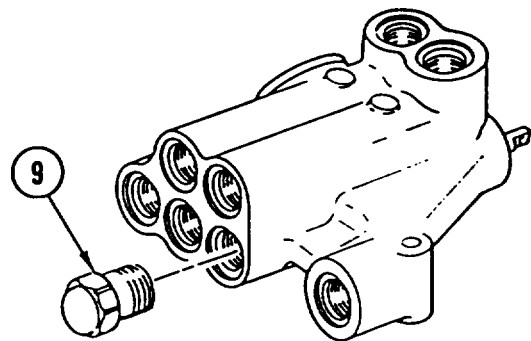
3. REMOVE SEAT (5) from bore of body (2).
4. REMOVE PACKING (6) from seat (5).  
DISCARD PACKING.



5. REMOVE DISC (7) and packing (8).  
DISCARD PACKING.



6. REMOVE CAP (9).

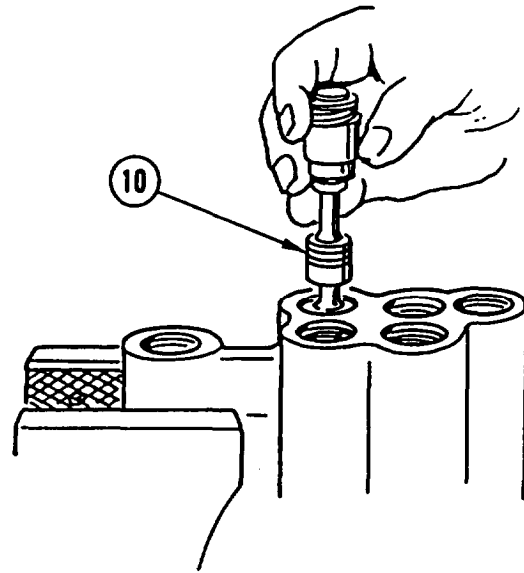


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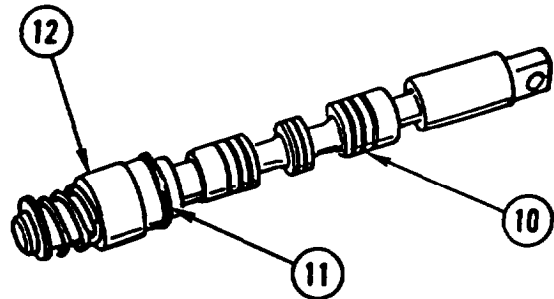
## BACKHOE STABILIZER CONTROL VALVE REPAIR (CONT)

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7. REMOVE SPOOL (10).



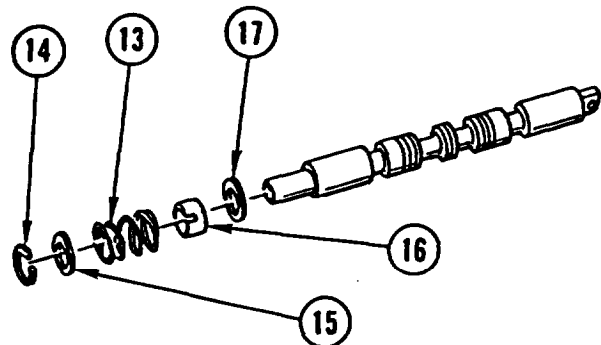
8. REMOVE packing (11) and BUSHING (12) from spool (10). DISCARD PACKING.



**WARNING**

Assembly is spring loaded. Wear safety goggles. Failure to do so could result in injury to personnel.

9. COMPRESS SPRING (13) and REMOVE retaining RING (14).
10. REMOVE flat washer (15), SPRING (13), spacer (16), and flat washer (17).



---

**BACKHOE STABILIZER CONTROL VALVE REPAIR (CONT)**


---

11. REMOVE and DISCARD PACKING (18).
12. REPEAT STEPS 1 thru 11 for removal of other spool and spool disc.

**INSPECTION**

1. Check spools and spool bores in body for damage. If a spool bore is damaged, replace backhoe stabilizer control valve.
2. Check discs and seats of check valves. If discs or seats are damaged, replace with new parts.
3. Check springs for distortion or damage.

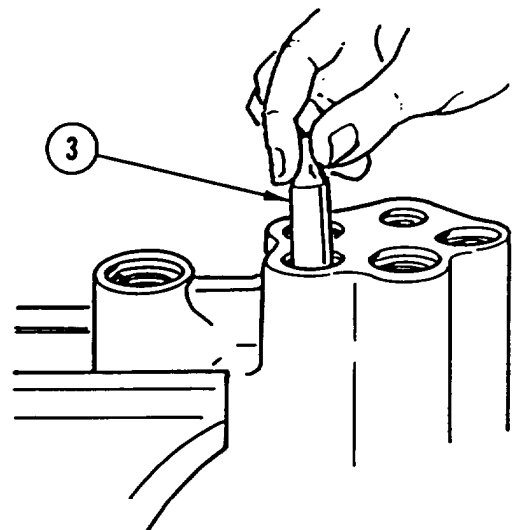
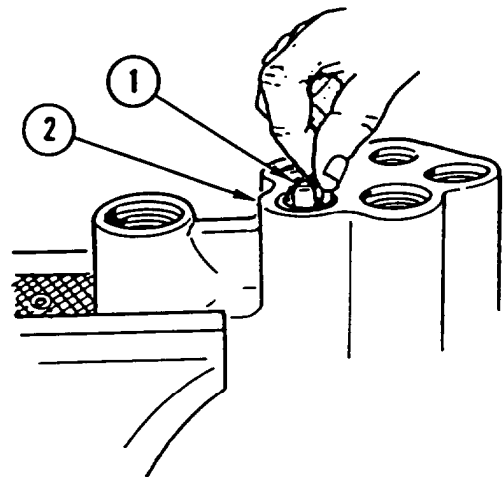
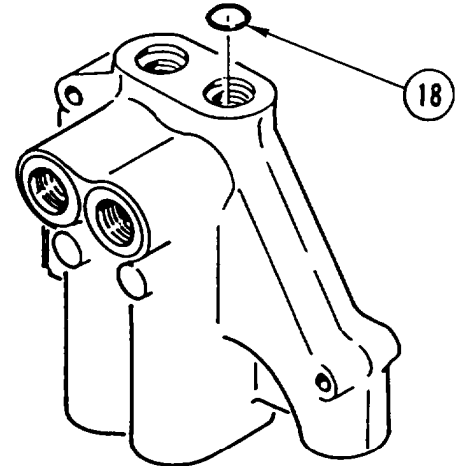
**REPAIR**

If spool or spool bore is damaged, replace spool or backhoe stabilizer control valve as needed.

**ASSEMBLY**
**NOTE**

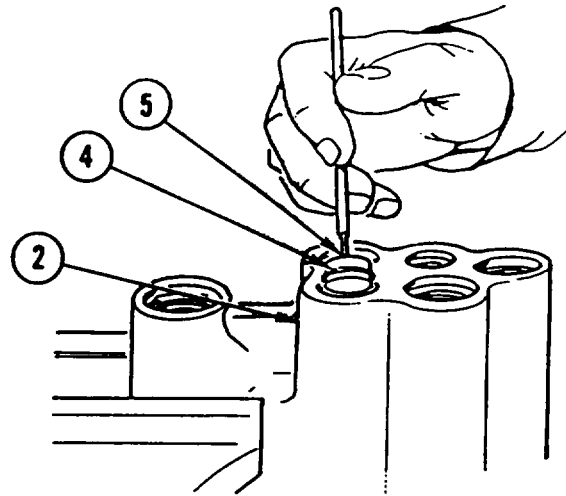
Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL new PACKING (1) in bore of body (2). Packing groove is half the distance down bore.
  
2. INSTALL DISC (3), large end first, in bore.

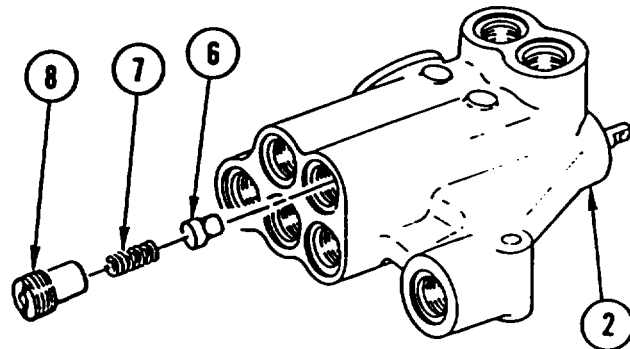


## BACKHOE STABILIZER CONTROL VALVE REPAIR (CONT)

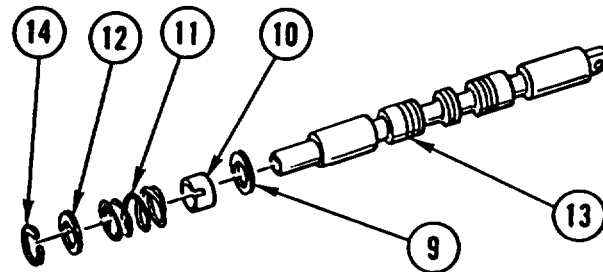
3. INSTALL new PACKING (4) on seat (5).
4. INSTALL SEAT (5), packing end first, in bore of body (2).



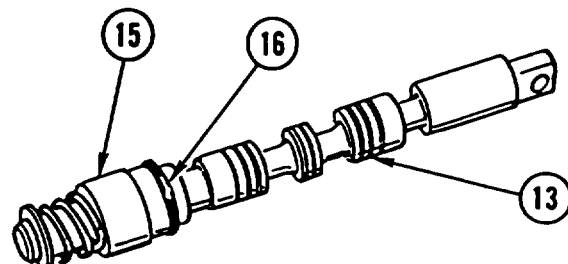
5. INSTALL DISC (6), small end first, in bore.
6. INSTALL SPRING (7) in body (2).
7. INSTALL new RING (8) and TIGHTEN to 35-40 lb-ft (47-54 N.m).



8. INSTALL flat washer (9), spacer (10), SPRING (11), and flat washer (12) on spool (13).
9. COMPRESS SPRING (11) on spool (13) and INSTALL retaining RING (14).

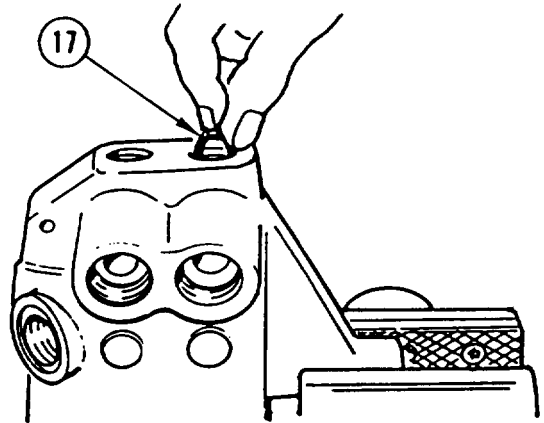


10. INSTALL BUSHING (15) on spool (13).
11. INSTALL new PACKING (16) on bushing (15).

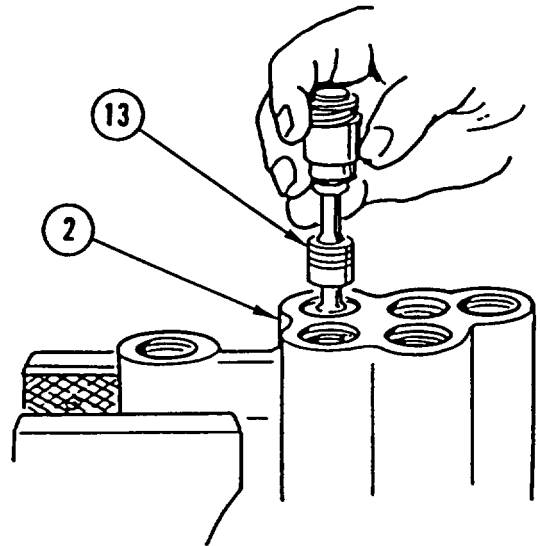


## BACKHOE STABILIZER CONTROL VALVE REPAIR (CONT)

12. INSTALL new PACKING (17) in spool bore.



13. INSTALL SPOOL (13) in body (2).

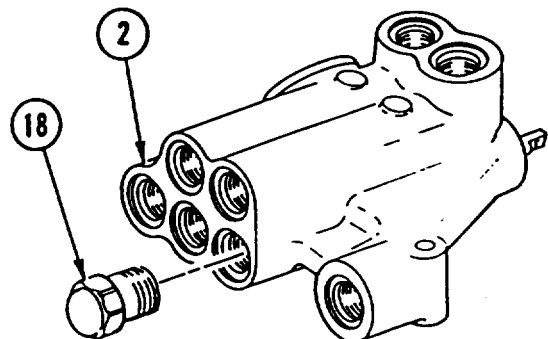


14. INSTALL CAP (18) in body (2) and TIGHTEN to 35-40 lb-ft (47-54 N.m).

15. REPEAT STEPS 1 thru 14 for installation of other spool and spool disc.

**NOTE**

Follow-on Maintenance:  
Install backhoe stabilizer control valve (page 11-12).



## Section IX. LOADER BOOM CYLINDER REPAIR

### LOADER BOOM CYLINDER REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Nut, Lock  
 Kit, Parts  
 Oil, Lubricating                      Appendix B, Item 30  
 Rags    Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Loader Boom Cylinder Removed

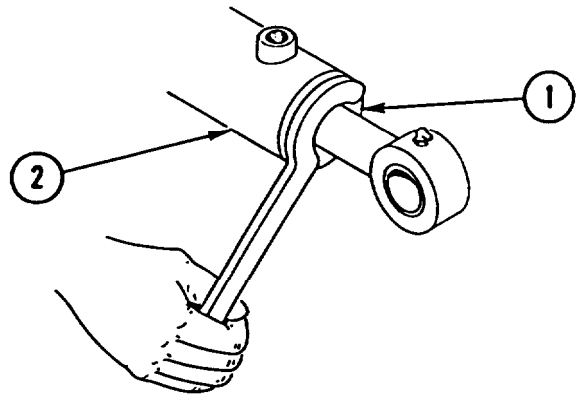
**General Safety Instructions:**

**WARNING**

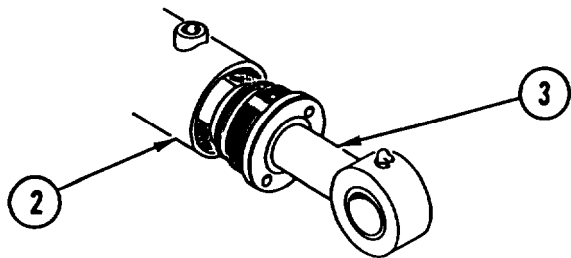
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

#### DISASSEMBLY

1. USING spanner WRENCH, REMOVE BEARING (1) from barrel (2).

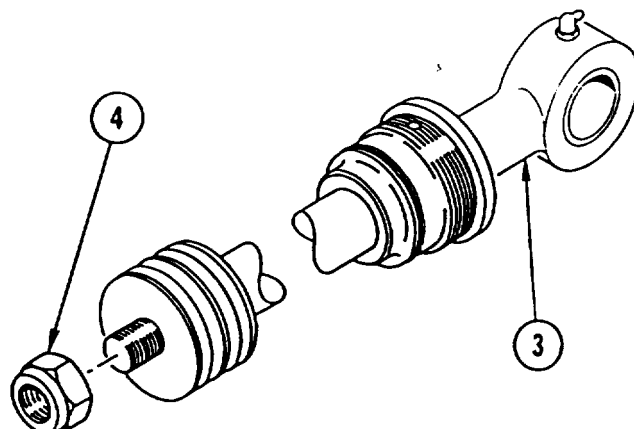


2. REMOVE rod end CONNECTOR (3) from barrel (2).

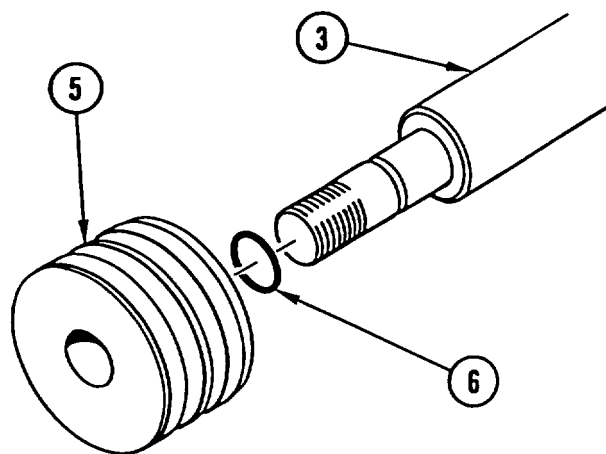


## LOADER BOOM CYLINDER REPAIR (CONT)

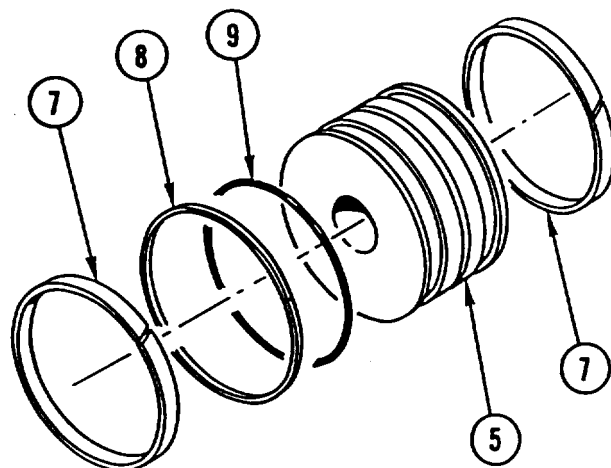
3. REMOVE lock NUT (4) from rod end connector (3). DISCARD lock NUT.



4. REMOVE PISTON (5) and seal (6) from rod end connector (3). DISCARD SEAL.



5. REMOVE and DISCARD two wear RINGS (7), SEAL (8), and PACKING (9) from piston (5).



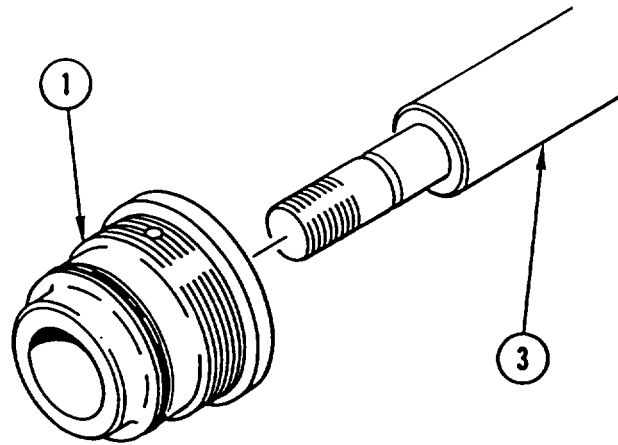


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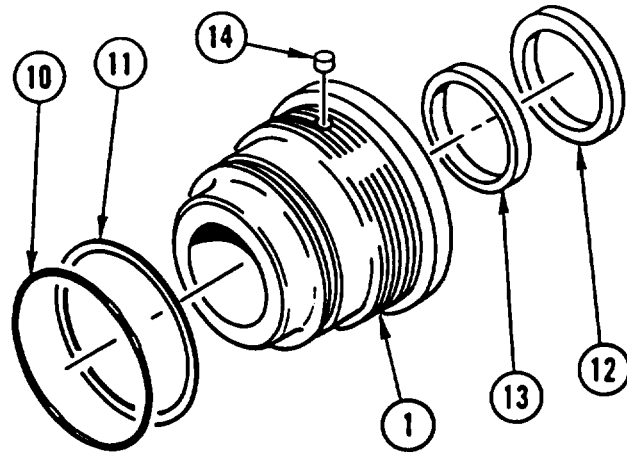
**LOADER BOOM CYLINDER REPAIR (CONT)**

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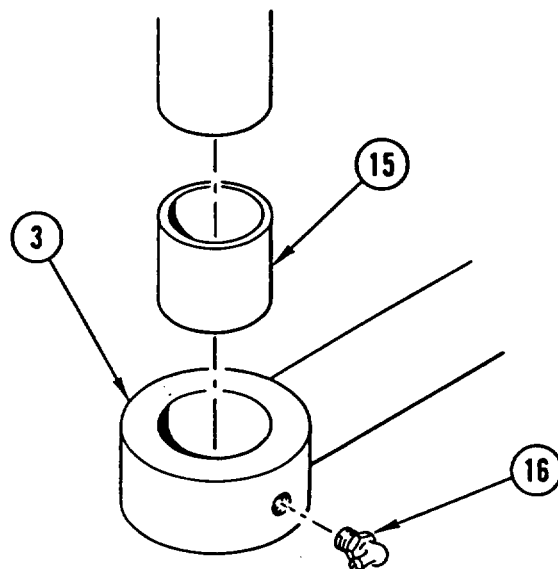
6. REMOVE BEARING (1) from rod end connector (3).



7. REMOVE and DISCARD PACKING (10), backup RING (11), WIPER (12), PACKING (13), and nylon PLUG (14) from bearing (1).



8. USING suitable PRESS, REMOVE BUSHING (15) from eye of rod end connector (3).
9. IF DAMAGED, REMOVE lubrication FITTING (16).



**LOADER BOOM CYLINDER REPAIR (CONT)**

10. USING suitable PRESS, REMOVE BUSHING (17) from barrel (2).
11. IF DAMAGED, REMOVE lubrication FITTING (18).

**INSPECTION**

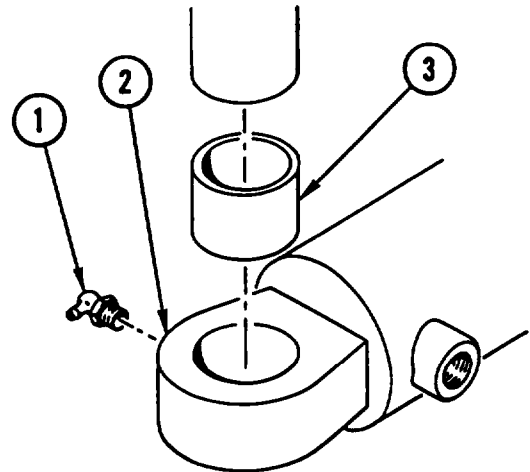
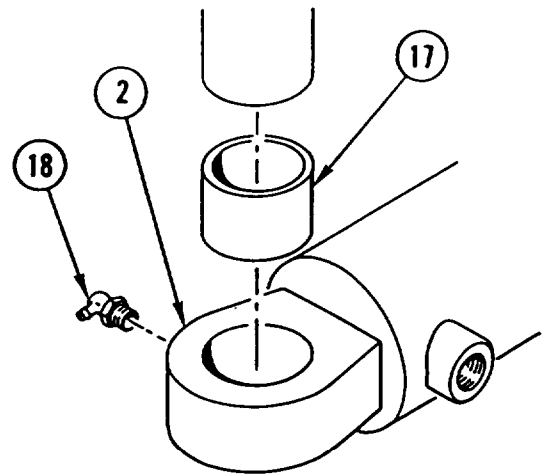
1. Inspect piston, rod end connector, and interior of barrel for scratches or scoring.
2. Inspect threads on rod end connector, barrel, and bearing for wear or damage.

**ASSEMBLY**

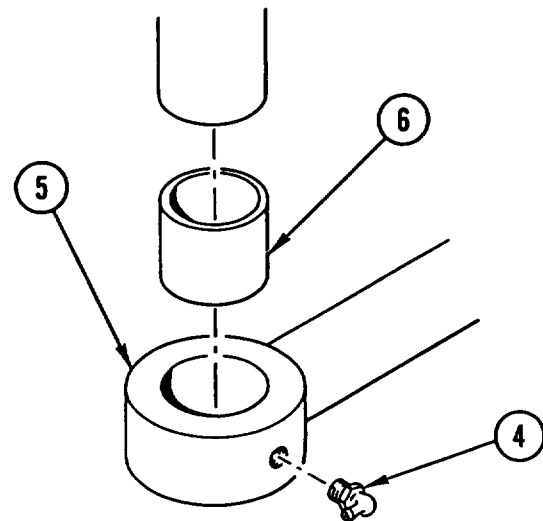
**NOTE**

Apply coat of lubricating oil to packings and seals prior to assembly.

1. IF REMOVED, INSTALL new lubrication FITTING (1) in eye of barrel (2).
2. USING suitable PRESS, INSTALL BUSHING (3) in eye of barrel (2).

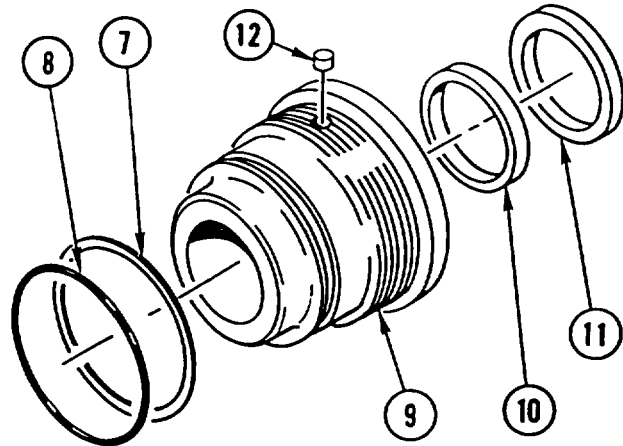


3. IF REMOVED, INSTALL new lubrication FITTING (4) in eye of rod end connector (5).
4. USING suitable PRESS, INSTALL BUSHING (6) in eye of rod end connector (5).

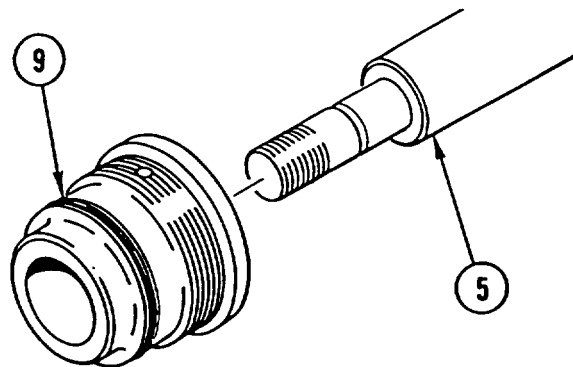


## LOADER BOOM CYLINDER REPAIR (CONT)

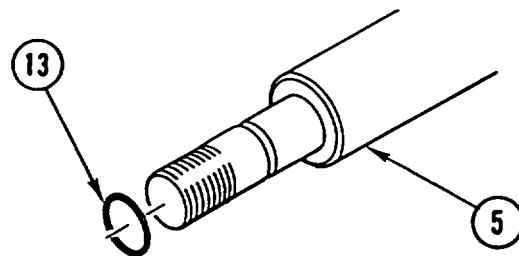
5. INSTALL new backup ring (7) and new PACKING (8) on bearing (9).
6. INSTALL new packing (10) and new WIPER (11) in bearing (9).
7. INSTALL new nylon PLUG (12) in bearing (9).



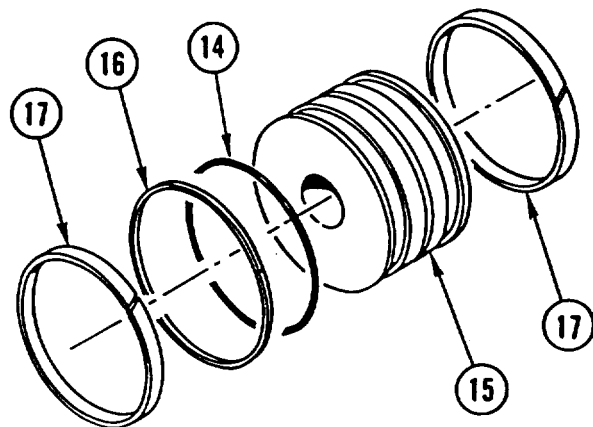
8. INSTALL BEARING (9) on rod end connector (5).



9. INSTALL new SEAL (13) on rod end connector (5).



10. INSTALL new PACKING (14) on piston (15).
11. INSTALL new SEAL (16) and two new wear rings (17) on piston (15).



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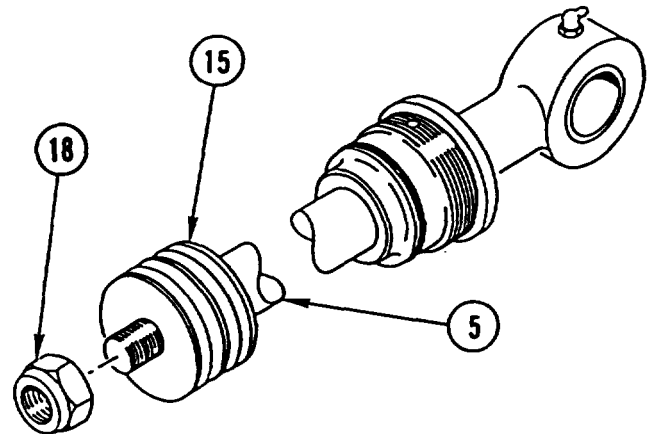
**LOADER BOOM CYLINDER REPAIR (CONT)**


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**CAUTION**

Ring compressor must be used to prevent damage to rings and packings.

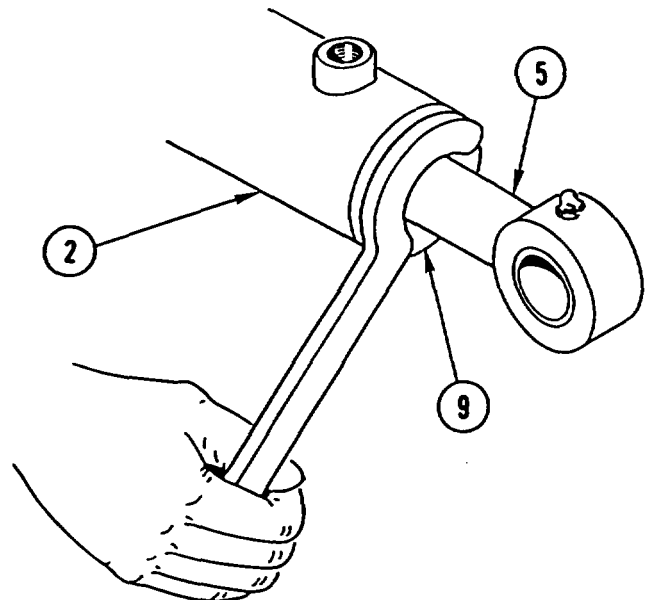
12. USING ring COMPRESSOR, INSTALL PISTON (15) on rod end connector (5).
13. INSTALL new lock NUT (18) on rod end connector (5). TIGHTEN lock NUT to 200-250 lb-ft (271.2-339.0 N.m).



14. INSTALL rod end CONNECTOR (5) in barrel (2).
15. INSTALL BEARING (9) in barrel (2). USING spanner WRENCH, TIGHTEN BEARING to 100-200 lb-ft (136-271 N.m).

**NOTE**

Follow-on Maintenance:  
install loader boom cylinder  
(TM 5-2420-224-20).



## Section X. LOADER BUCKET ROLLBACK CYLINDER REPAIR

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### LOADER BUCKET ROLLBACK CYLINDER REPAIR

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This task covers: a. Disassembly b. Inspection c. Assembly

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#### **INITIAL SETUP**

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Nut, Lock

Packing, Preformed

Kit, Parts

Oil, Lubricating                      Appendix B, Item 30

Rags    Appendix B, Item 40

**References:**

TM 5-2420-224-20  
TM 9-214

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Loader Bucket Rollback Cylinder Removed

**General Safety Instructions:**

<p style="text-align: center;"><b>W A R N I N G</b></p> <p>Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</p>
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#### **DISASSEMBLY**

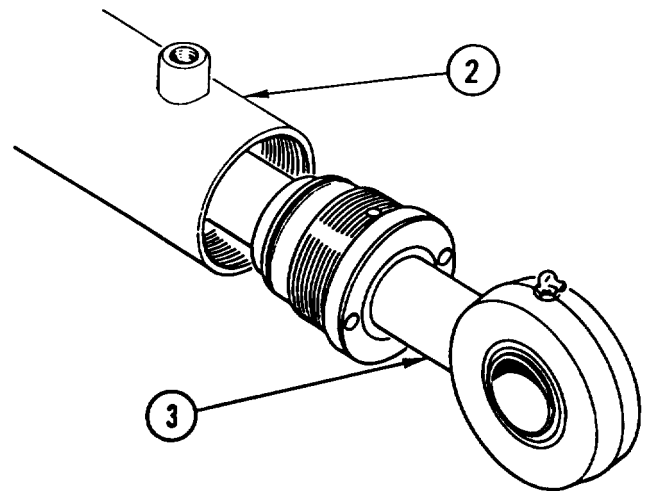
1. USING spanner WRENCH, REMOVE BEARING (1) from barrel (2).

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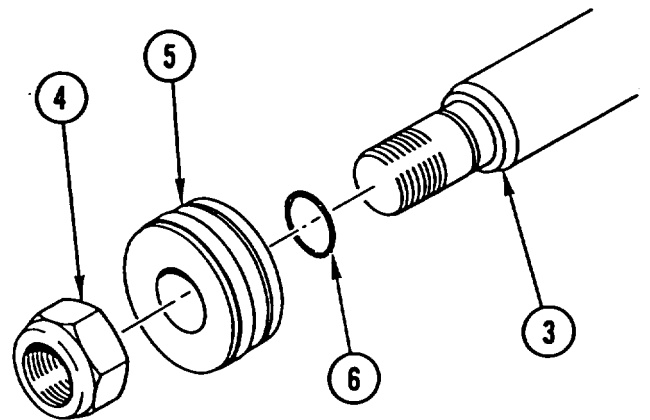
**LOADER BUCKET ROLLBACK CYLINDER REPAIR (CONT)**


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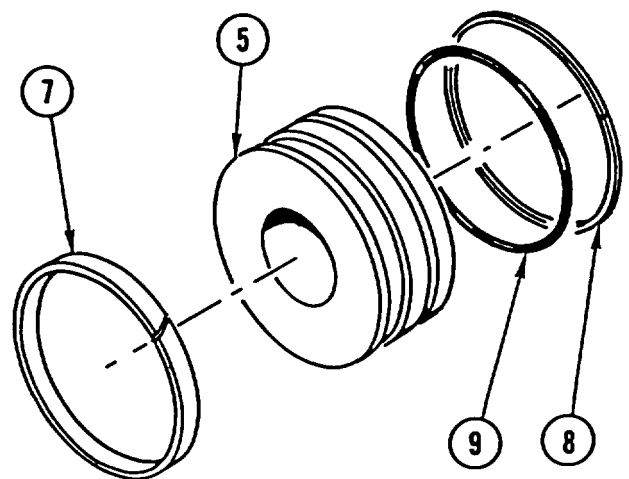
2. REMOVE rod end CONNECTOR (3) from barrel (2).



3. REMOVE lock NUT (4) from rod end connector (3). DISCARD lock NUT.
4. REMOVE PISTON (5) and seal (6) from rod end connector (3). DISCARD SEAL.



5. REMOVE and DISCARD wear RING (7), SEAL (8), and PACKING (9) from piston (5).

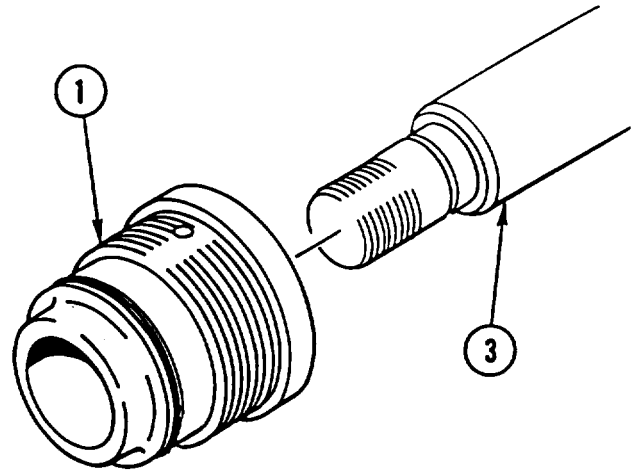


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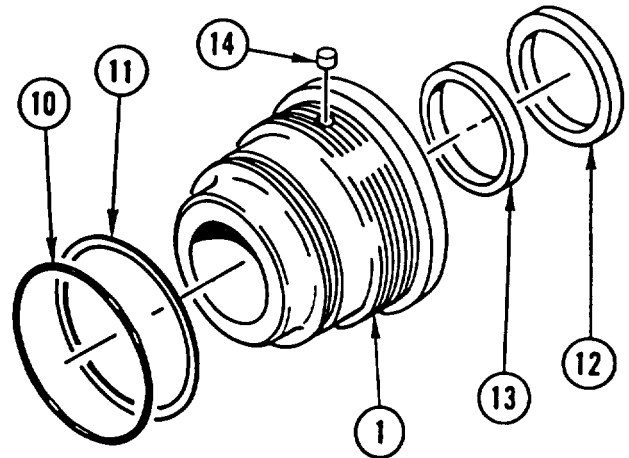
## LOADER BUCKET ROLLBACK CYLINDER REPAIR (CONT)

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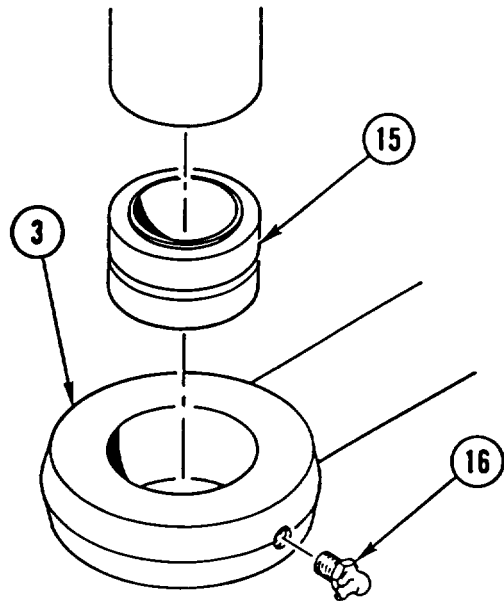
6. REMOVE BEARING (1) from rod end oonector (3).



7. REMOVE and DISCARD PACKING (10), backup RING (11), WIPER (12), PACKING (13), and nylon PLUG (14) from bearing (1).



8. USING suitable PRESS, REMOVE BEARING (15) from eye of rod end connector (3).
9. IF DAMAGED, REMOVE lubrication FITTING (16).



## LOADER BUCKET ROLLBACK CYLINDER REPAIR (CONT)

10. REMOVE retaining RING (17) from eye of barrel (2).
11. USING suitable PRESS, REMOVE BEARING (18) from barrel (2).
12. IF DAMAGED, REMOVE lubrication FITTING (19).

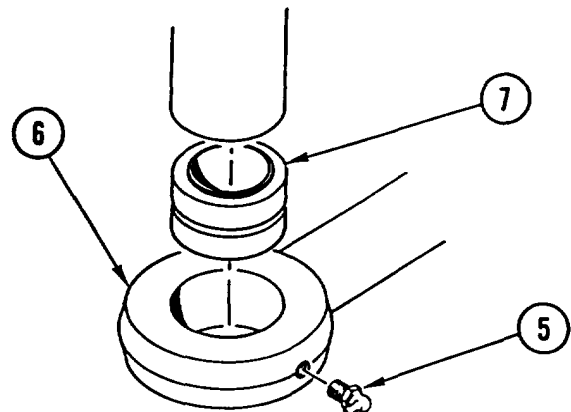
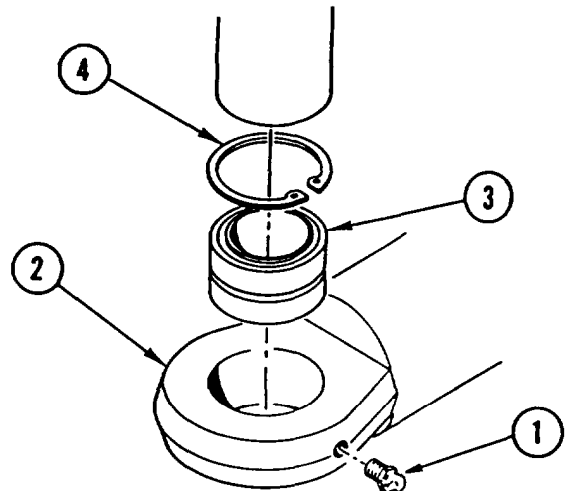
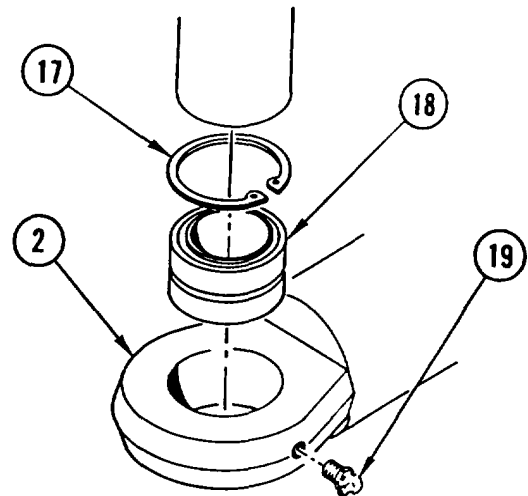
### INSPECTION

1. Inspect piston, rod end connector, and interior of barrel for scratches or scoring.
2. Inspect threads on rod end connector, barrel, and bearing for wear or damage.
3. Inspect bearings (TM 9-214).

### NOTE

Apply coat of lubricating oil to packings and seals prior to assembly.

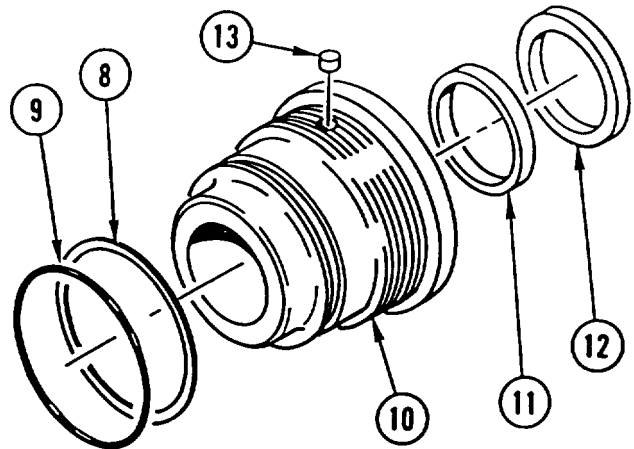
1. IF REMOVED, INSTALL new lubrication FITTING (1) in eye of barrel (2).
2. USING suitable PRESS, INSTALL BEARING (3) in eye of barrel (2).
3. INSTALL retaining RING (4) in eye of barrel (2).
4. IF REMOVED, INSTALL new lubrication FITTING (5) in eye of rod end connector (6).
5. USING suitable PRESS, INSTALL BEARING (7) in eye of rod end connector (6).



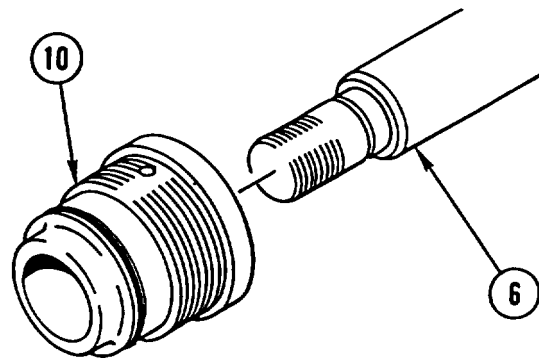


## LOADER BUCKET ROLLBACK CYLINDER REPAIR (CONT)

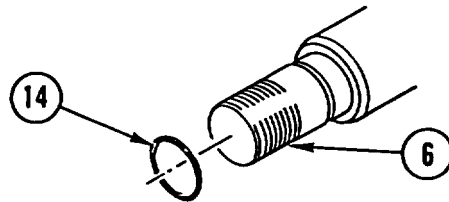
6. INSTALL new backup ring (8) and new PACKING (9) on bearing (10).
7. INSTALL new packing (11) and new WIPER (12) in bearing (10).
8. INSTALL new nylon PLUG (13) in bearing (10).



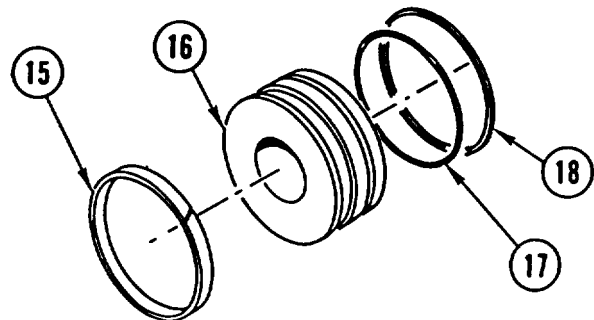
9. INSTALL BEARING (10) on rod end connector (6).



10. INSTALL new SEAL (14) on rod end connector (6).



11. INSTALL new wear RING (15) on piston (16).
12. INSTALL new packing (17) and new SEAL (18) on piston (16).

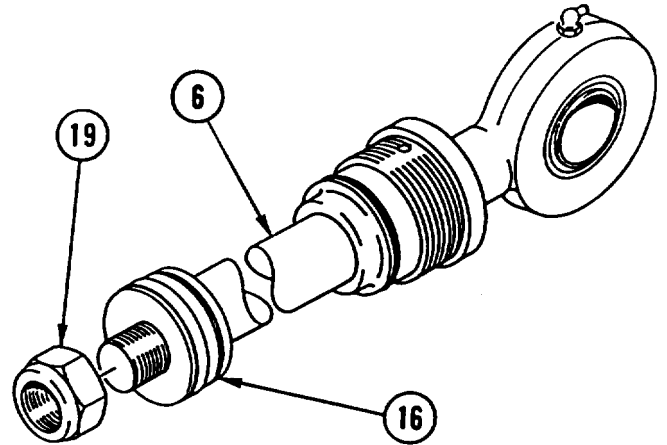


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**LOADER BUCKET ROLLBACK CYLINDER REPAIR (CONT)**


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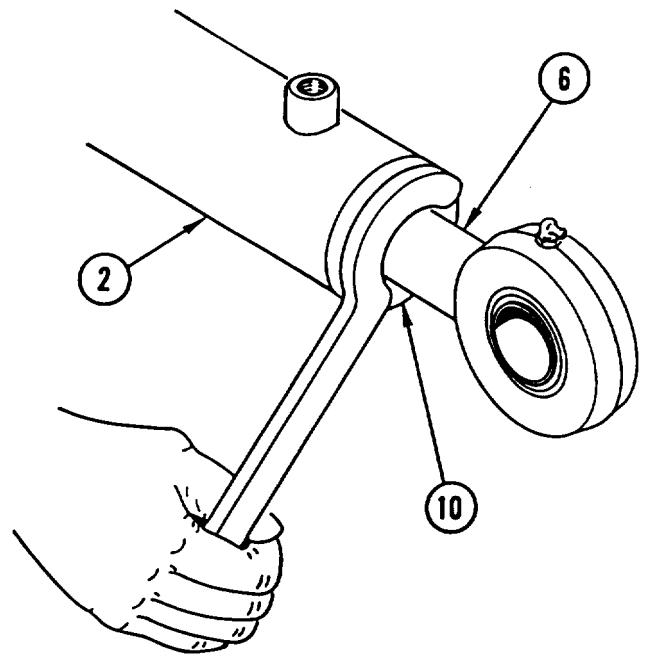
13. INSTALL PISTON (16) on rod end connector (6).
14. INSTALL new lock NUT (19) on rod end connector (6). TIGHTEN lock NUT to 200-250 lb-ft (271.2-339.0 N.m).



15. INSTALL rod end CONNECTOR (6) in barrel (2).
16. INSTALL BEARING (10) in barrel (2). USING spanner WRENCH, TIGHTEN BEARING to 100-200 lb-ft (136-271 N.m).

**NOTE**

Follow-on Maintenance:  
Install loader bucket rollback  
cylinder (TM 5-2420-224-20).



## Section XI. BACKHOE BOOM CYLINDER REPAIR

### BACKHOE BOOM CYLINDER REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Kit, Parts  
 Compound, Sealing            Appendix B, Item 15  
 Oil, Lubricating                Appendix B, item 30  
 Rags                                Appendix B, item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe Boom Cylinder Removed

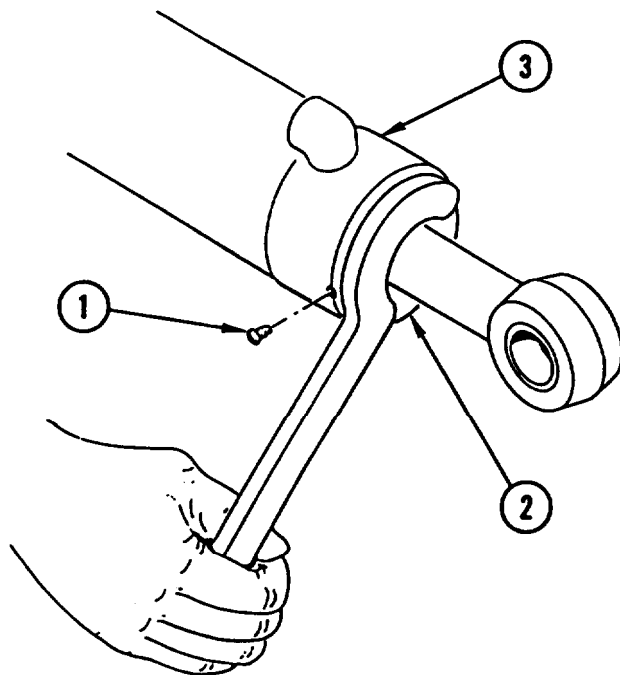
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

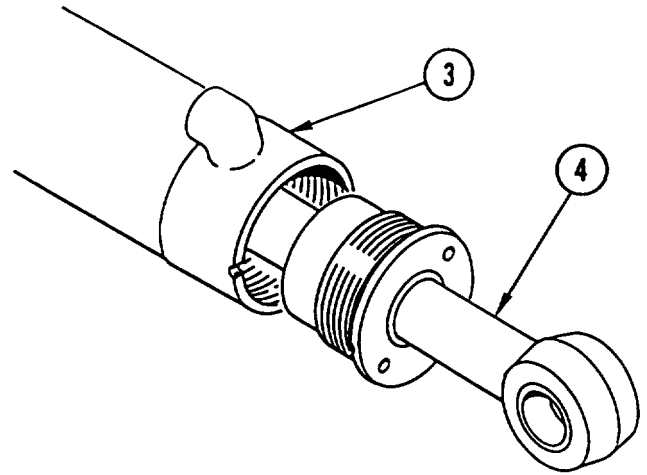
#### DISASSEMBLY

1. REMOVE self-tapping SCREW (1).
2. USING spanner WRENCH, REMOVE RETAINER (2) from tube (3).

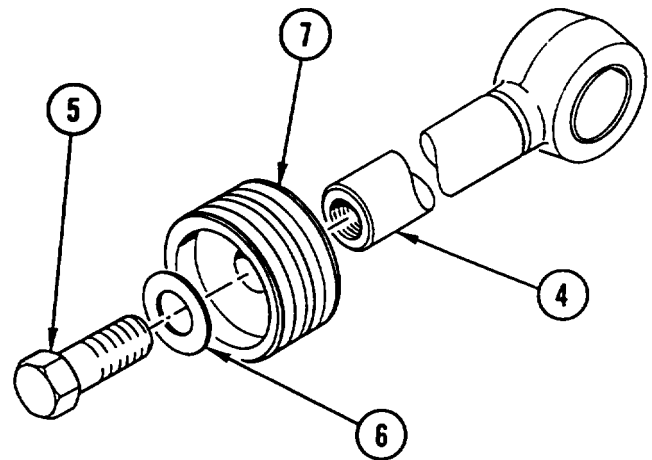


## BACKHOE BOOM CYLINDER REPAIR (CONT)

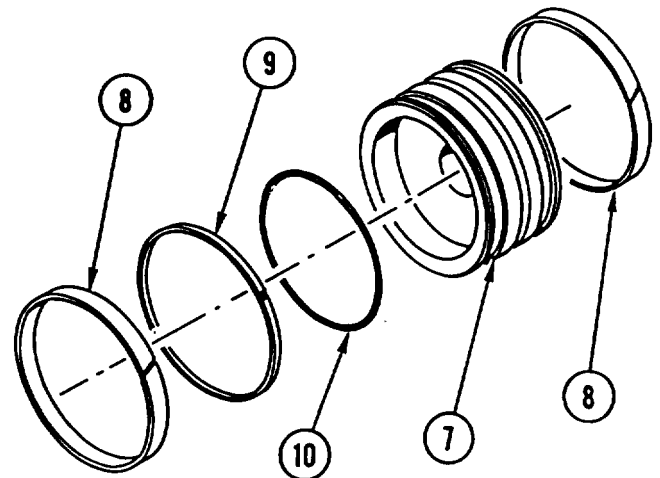
3. REMOVE piston ROD (4) from tube (3).



4. REMOVE SCREW (5) and washer (6) from piston rod (4).
5. REMOVE PISTON (7) from piston rod (4).



6. REMOVE and DISCARD two wear RINGS (8), RETAINER (9), and PACKING (10) from piston (7).

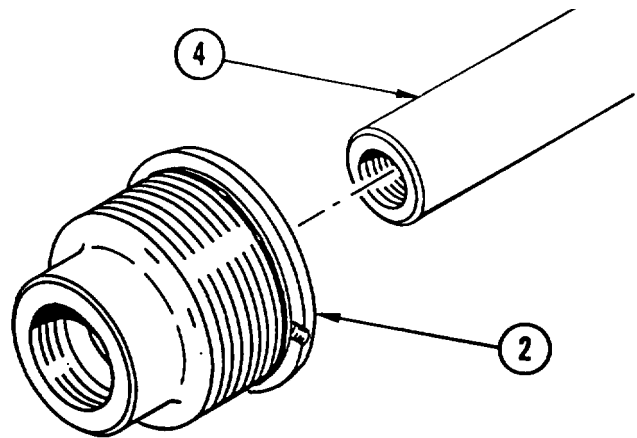


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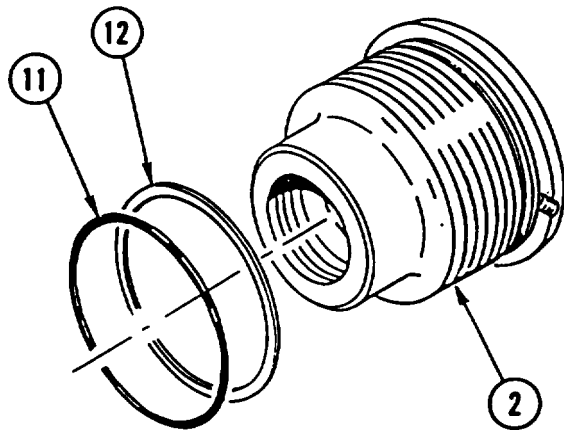
## BACKHOE BOOM CYLINDER REPAIR (CONT)

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7. REMOVE RETAINER (2) from piston rod (4).



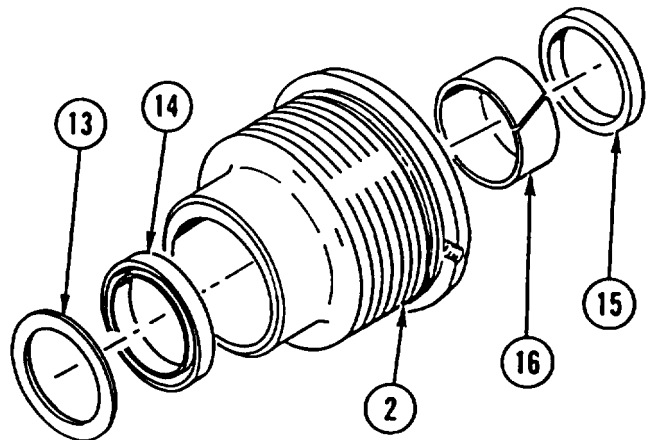
8. REMOVE and DISCARD PACKING (11) and backup RING (12) from retainer (2).



9. REMOVE and DISCARD SEAL (13), SEAL (14), WIPER (15), and BUSHING (16) from retainer (2).

### **INSPECTION**

1. Inspect piston, piston rod, and tube for scratches or scoring.
2. Inspect threads on piston rod, piston screw, tube, and retainer for wear or damage.



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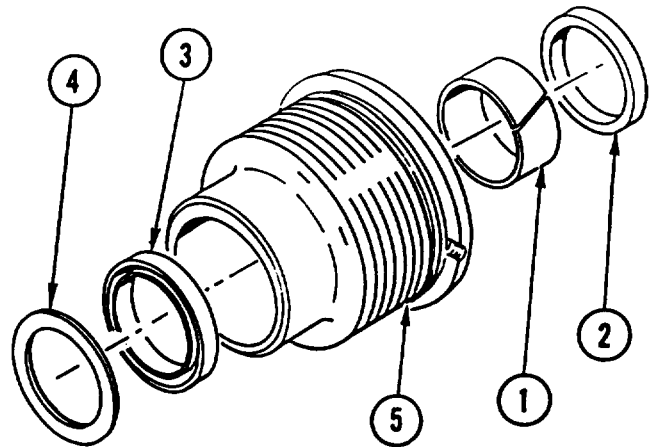
**BACKHOE BOOM CYLINDER REPAIR (CONT)**


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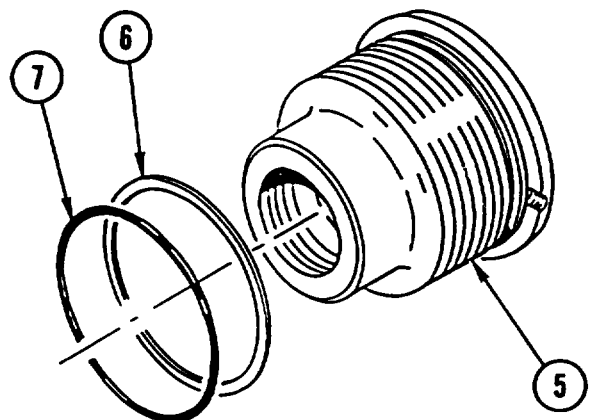
**ASSEMBLY****NOTE**

Apply coat of lubricating oil to packings and seals prior to assembly.

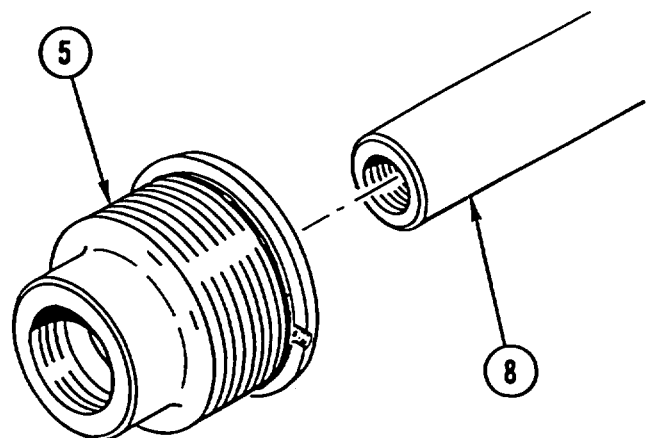
1. INSTALL new bushing (1), new WIPER (2), new seal (3), and new seal (4) in retainer (5).



2. INSTALL new backup ring (6) and new PACKING (7) on retainer (5).

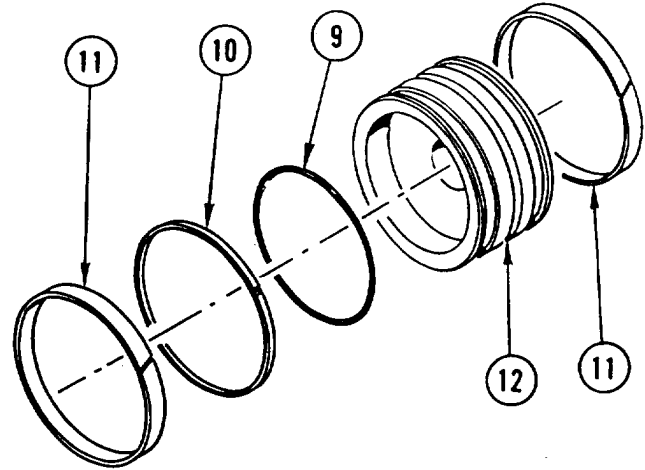


3. INSTALL RETAINER (5) on piston rod (8).



**BACKHOE BOOM CYLINDER REPAIR (CONT)**

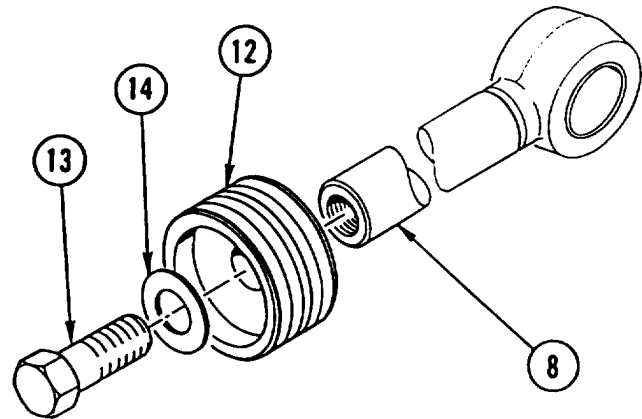
4. INSTALL new PACKING (9), new retainer (10), and two new wear rings (11) on piston (12).



5. INSTALL PISTON (12) on piston rod (8).

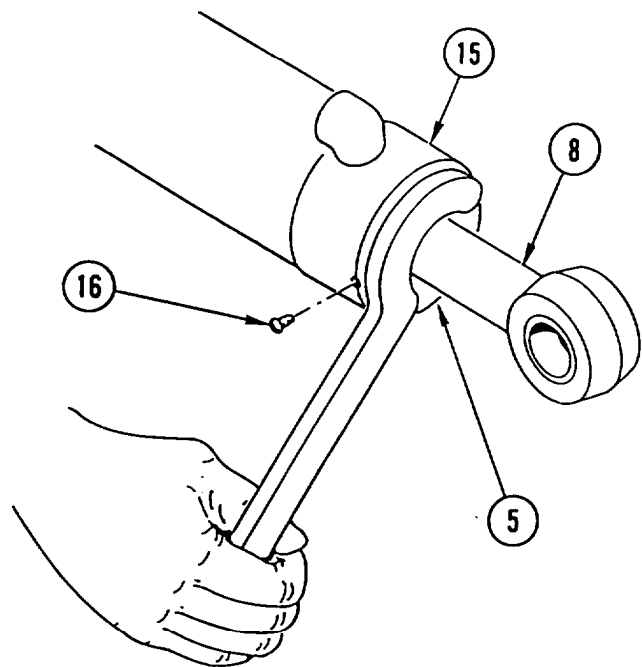
**WARNING**

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.



6. APPLY COAT of SEALING COMPOUND to THREADS of screw (13) and INSTALL SCREW (13) and washer (14) on piston rod (8). TIGHTEN SCREW to 475-525 lb-ft (644-712 N.m).

7. INSTALL piston ROD (8) in tube (15).
8. USING spanner WRENCH, THREAD RETAINER (5) into tube (15) and TIGHTEN to 100-200 lb-ft (135-271 N.m).
9. INSTALL self-tapping SCREW (16).



**NOTE**

Follow-on Maintenance:  
Install backhoe boom cylinder  
(TM 5-2420-224-20).

## Section XII. BACKHOE SWING CYLINDER REPAIR

### BACKHOE SWING CYLINDER REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Kit, Parts Repair  
 Compound, Sealing Appendix B, Item 15  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Backhoe Swing Cylinder  
 Removed

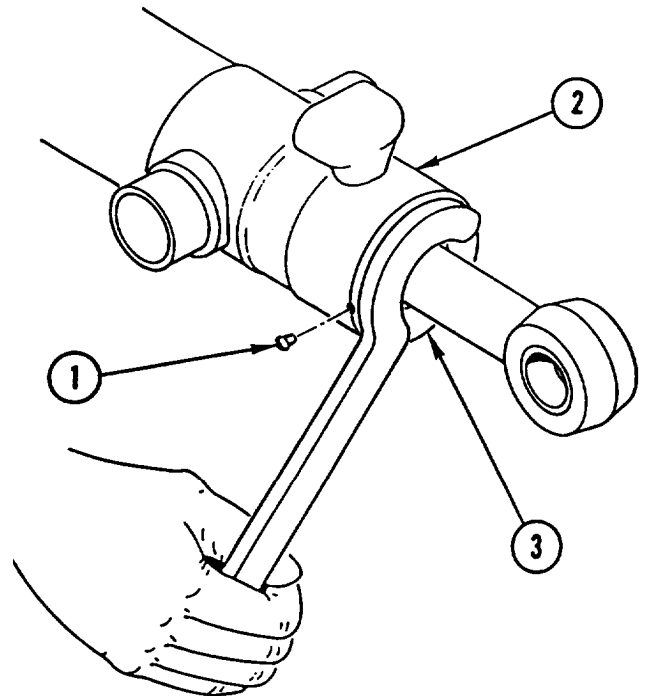
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

#### DISASSEMBLY

1. REMOVE self-tapping SCREW (1) from tube (2).
2. USING spanner WRENCH, REMOVE GLAND assembly (3).



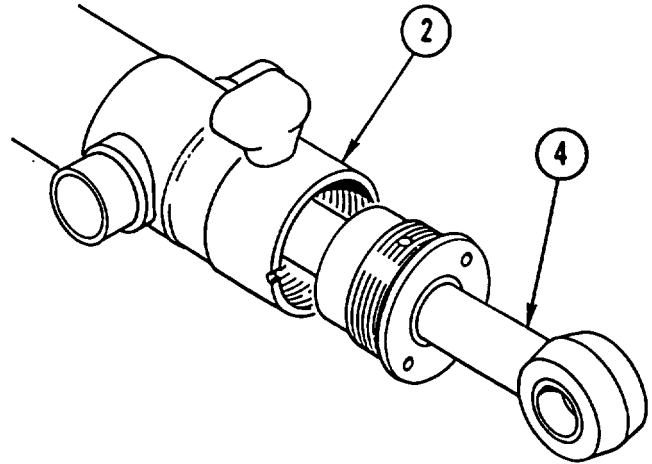


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## BACKHOE SWING CYLINDER REPAIR (CONT)

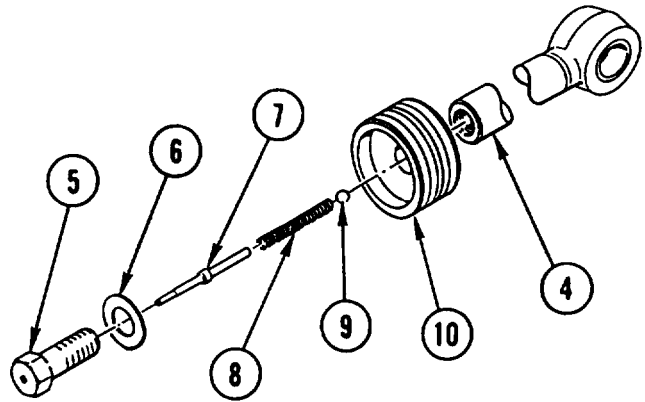
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3. REMOVE piston ROD (4) from tube (2).

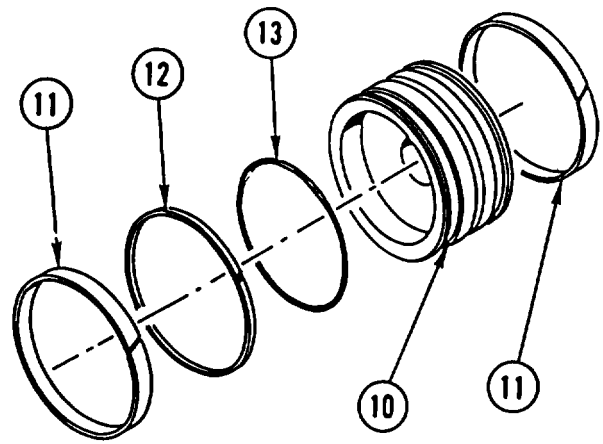


**WARNING**  
Pin is under spring pressure. Wear safety goggles. Remove bolt carefully to avoid possible injury.

4. REMOVE BOLT (5), washer (6), pin (7), spring (8), and ball (9) from piston rod (4).
5. REMOVE PISTON (10) from piston rod (4).

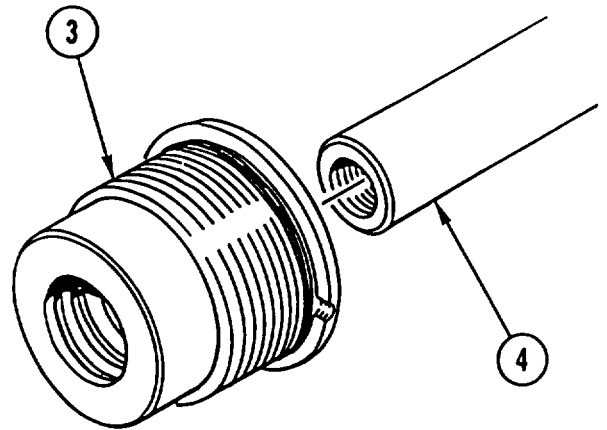


6. REMOVE and DISCARD two wear RINGS (11), RETAINER (12), and PACKING (13) from piston (10).

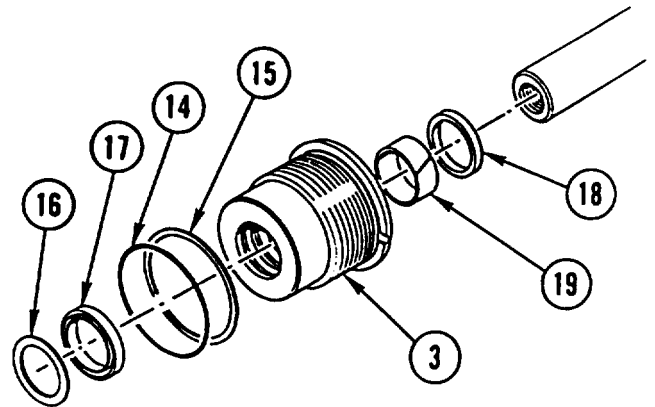


**BACKHOE SWING CYLINDER REPAIR (CONT)**

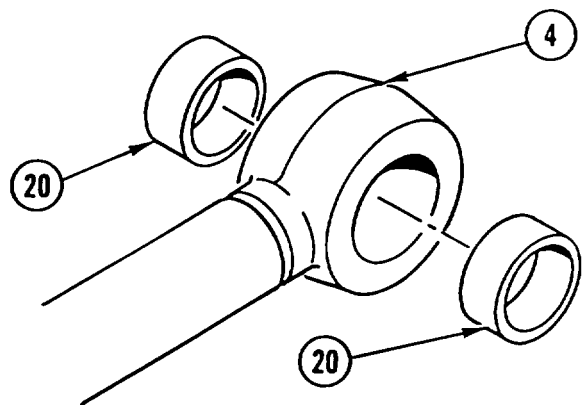
7. REMOVE GLAND (3) from piston rod (4).



8. REMOVE two packings (14 and 15), seal (16), packing (17), WIPER (18), and bearing (19) from gland (3). DISCARD PACKINGS, SEAL, WIPER, and BEARING.



9. USING suitable PRESS, REMOVE two BUSHINGS (20) from eye of piston rod (4).



## BACKHOE SWING CYLINDER REPAIR (CONT)

10. USING suitable PULLER, REMOVE two BUSHINGS (21) from tube (2).

11. IF DAMAGED, REMOVE three lubrication FITTINGS (22).

### INSPECTION

1. Inspect piston, piston rod, and tube for scratches or scoring.
2. Inspect threads on piston rod, bolt, tube, and gland for wear or damage.

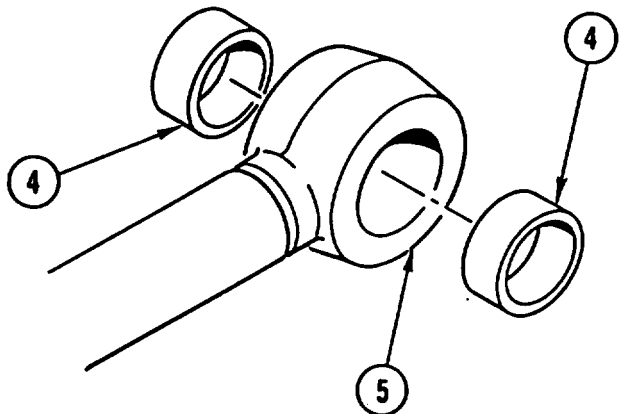
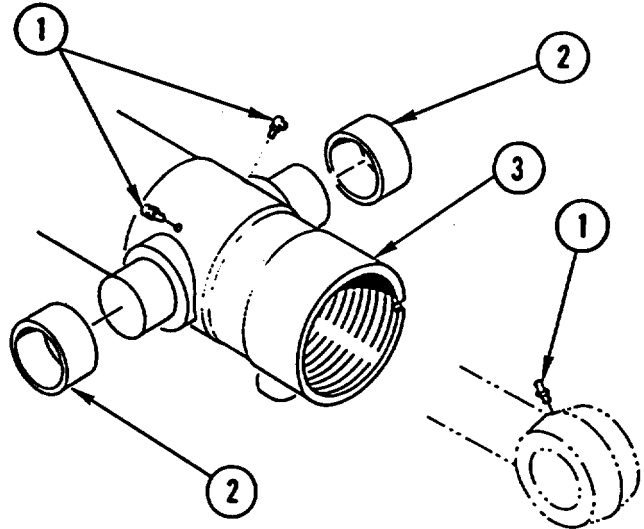
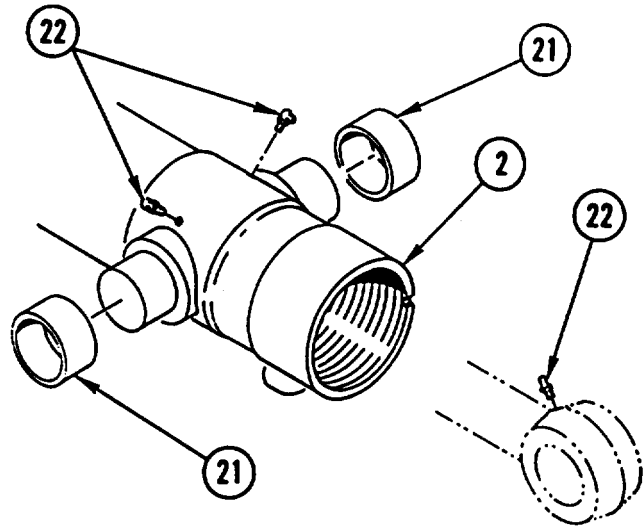
### ASSEMBLY

#### NOTE

Apply coat of lubricating oil to packings and seal prior to assembly.

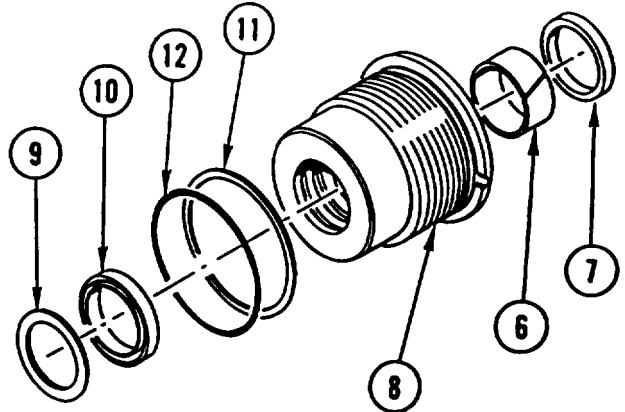
1. IF REMOVED. INSTALL three new fabrication FITTINGS (1).
2. USING suitable PRESS, INSTALL two BUSHINGS (2) on tube (3).

3. USING suitable PRESS, INSTALL two BUSHINGS (4) in eye of piston rod (5).

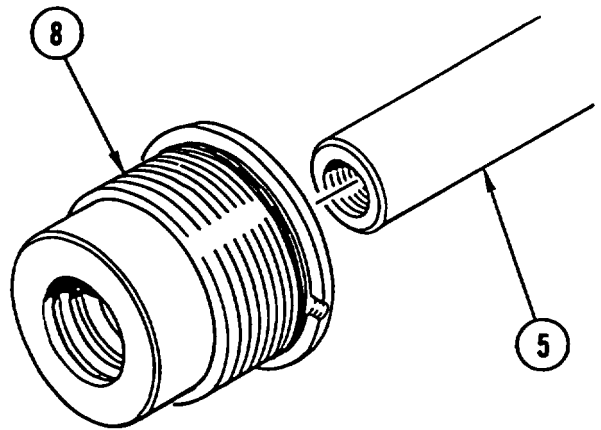


**BACKHOE SWING CYLINDER REPAIR (CONT)**

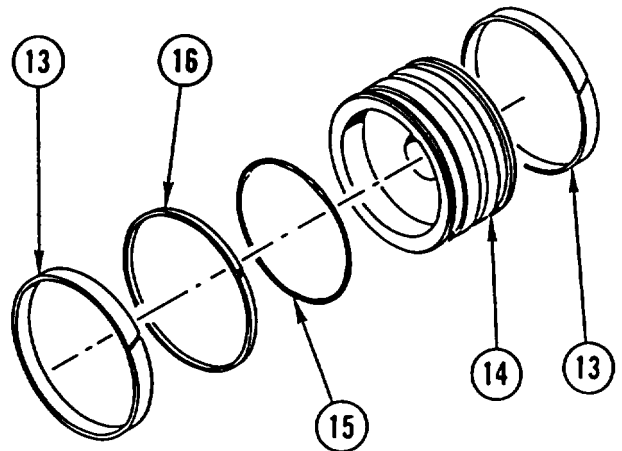
4. INSTALL new bearing (6) and new WIPER (7) in gland (8).
5. INSTALL new seal (9) and new PACKING (10) in gland (8).
6. INSTALL two new PACKINGS (11 and 12) in gland (8).



7. INSTALL GLAND (8) on piston rod (5).



8. INSTALL two new wear RINGS (13) on piston (14).
9. INSTALL new PACKING (15) and new retainer (16) on piston (14).

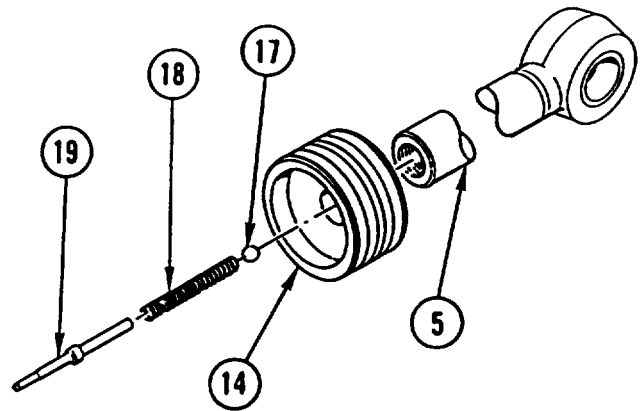


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## BACKHOE SWING CYLINDER REPAIR (CONT)

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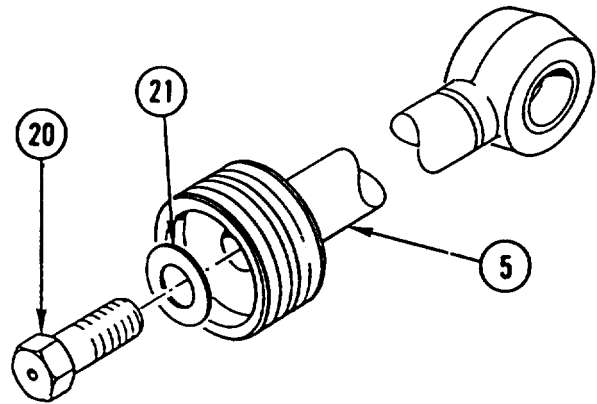
10. INSTALL PISTON (14) on piston rod (5).
11. INSTALL BALL (17), SPRING (18), and PIN (19), as an assembly, in piston rod (5).



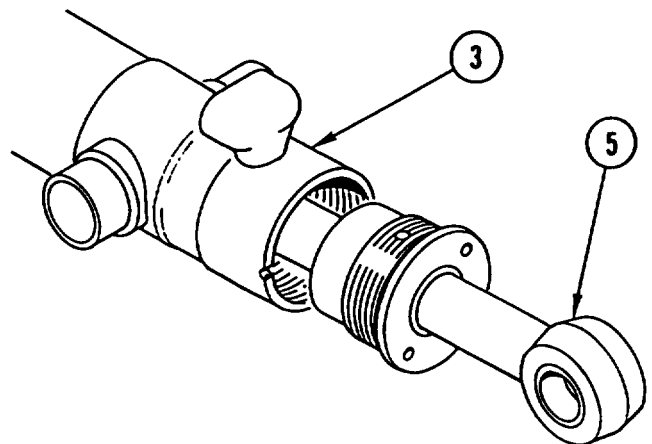
**WARNING**

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.

12. APPLY COAT of SEALING COMPOUND to THREADS of bolt (20) and INSTALL BOLT (20) and washer (21) in piston rod (5). TIGHTEN BOLT to 700-750 lb-ft (949-1017 N.m).



13. INSTALL piston ROD (5) in tube (3).



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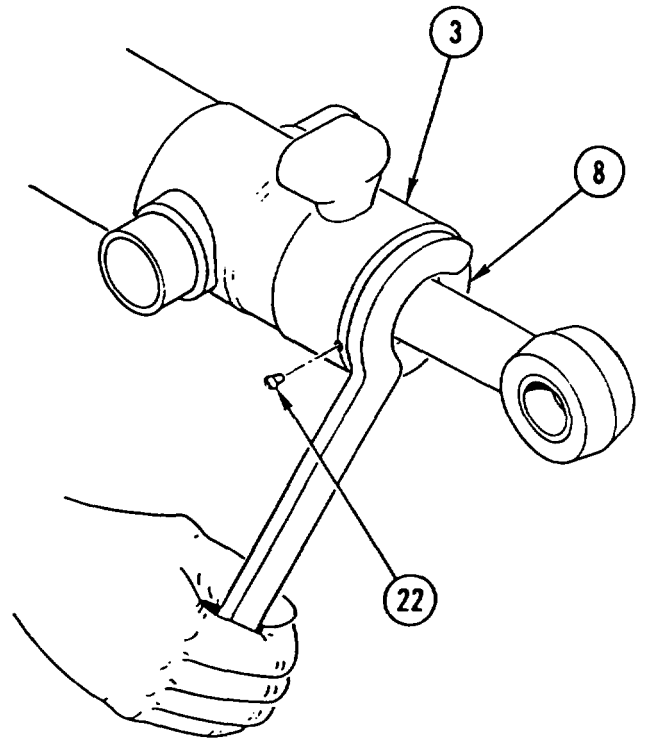
**BACKHOE SWING CYLINDER REPAIR (CONT)**

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14. USING spanner WRENCH, THREAD GLAND (8) into tube (3) and TIGHTEN to 100-200 lb-ft (135-271 N.m).
15. INSTALL self-tapping SCREW (22) in tube (3).

**NOTE**

Follow-on Maintenance:  
Install backhoe swing cylinder  
(TM 5-2420-224-20).



## Section XIII. BACKHOE BUCKET CYLINDER REPAIR

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### BACKHOE BUCKET CYLINDER REPAIR

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This task covers: a. Disassembly b. Inspection c. Assembly

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#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Kit, Parts

Compound, Sealing Appendix B, Item 15

Oil, Lubricating Appendix B, Item 30

Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Backhoe Bucket Cylinder  
Removed

**General Safety Instructions:**

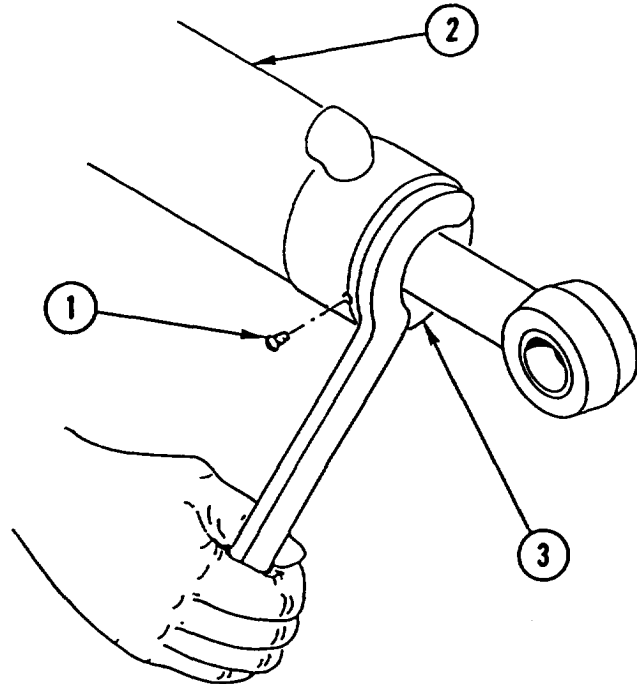
**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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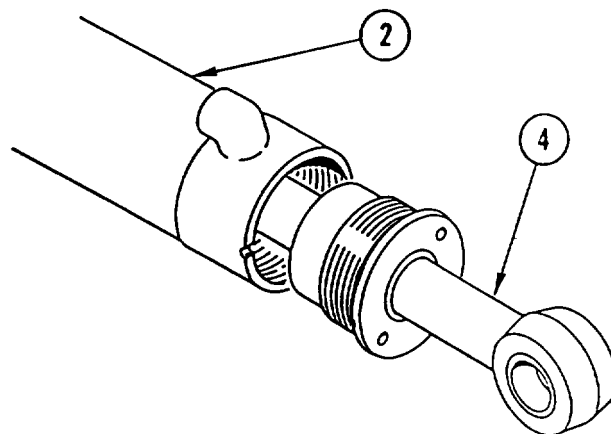
#### DISASSEMBLY

1. REMOVE self-tapping SCREW (1) from cylinder (2).
2. USING spanner WRENCH, REMOVE GLAND assembly (3).

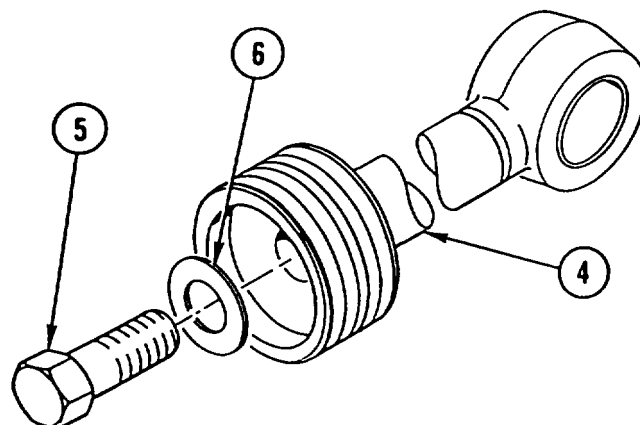


## BACKHOE BUCKET CYLINDER REPAIR (CONT)

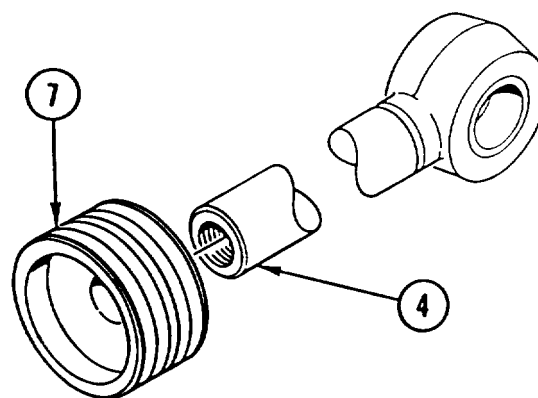
3. REMOVE piston ROD (4) from cylinder (2).



4. REMOVE SCREW (5) and washer (6) from piston rod (4).



5. REMOVE PISTON (7) from piston rod (4).



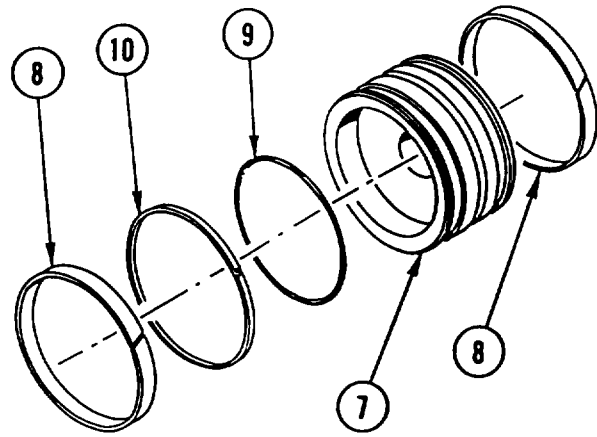


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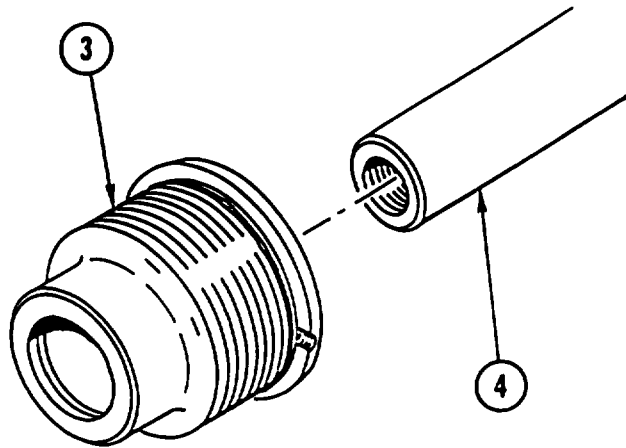
## BACKHOE BUCKET CYLINDER REPAIR (CONT)

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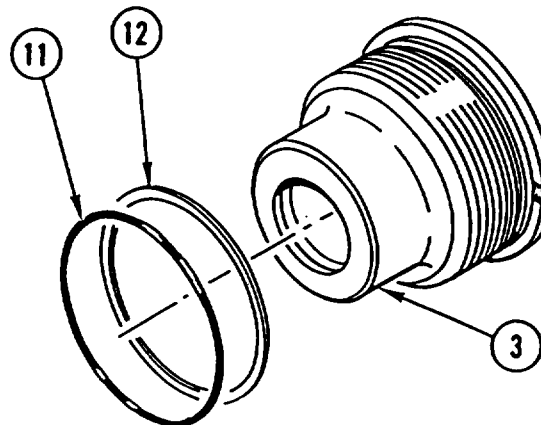
6. REMOVE and DISCARD two wear RINGS (8), PACKING (9), and backup RING (10) from piston (7).



7. REMOVE GLAND (3) from piston rod (4).

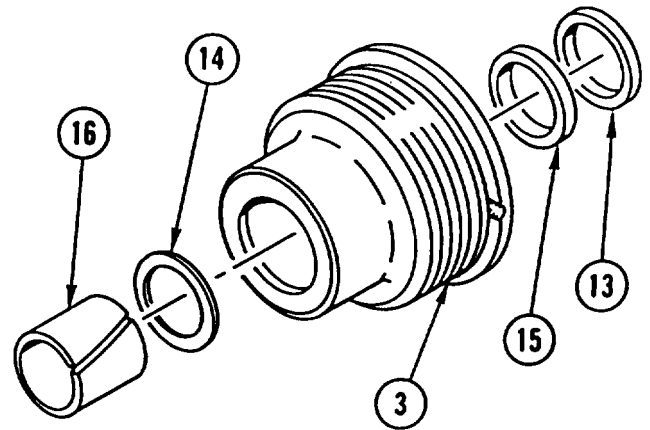


8. REMOVE and DISCARD PACKING (11) and backup RING (12) from gland (3).

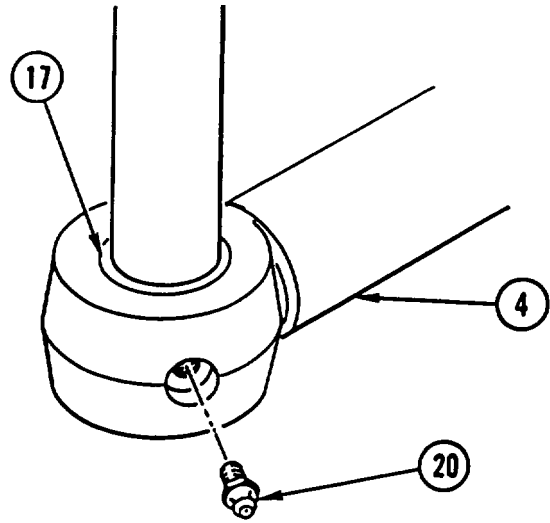


**BACKHOE BUCKET CYLINDER REPAIR (CONT)**

9. REMOVE and DISCARD SEAL (13), RING (14), SEAL (15), and BEARING (16) from gland (3).

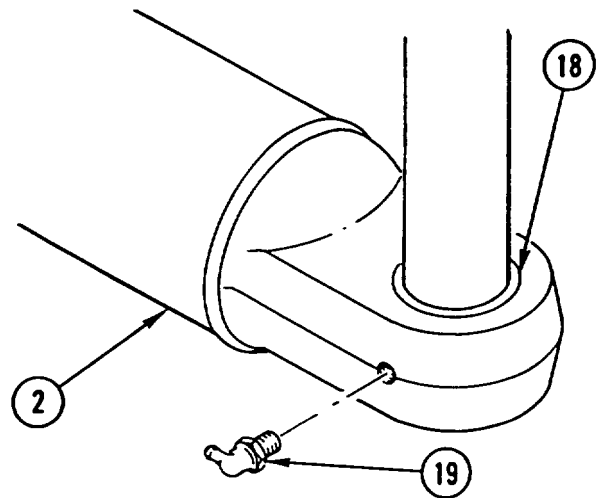


10. USING suitable PRESS, REMOVE two BUSHINGS (17) from piston rod (4) and two BUSHINGS (18) from cylinder (2).
11. IF DAMAGED, REMOVE lubrication FITTINGS (19 and 20).



**INSPECTION**

1. Inspect piston, piston rod, and cylinder for scratches or scoring.
2. Inspect threads on piston rod, piston screw, cylinder, and gland for wear or damage.



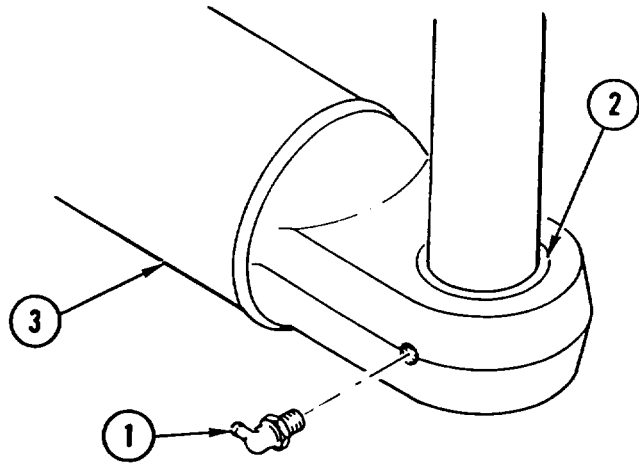
**BACKHOE BUCKET CYLINDER REPAIR (CONT)**

**ASSEMBLY**

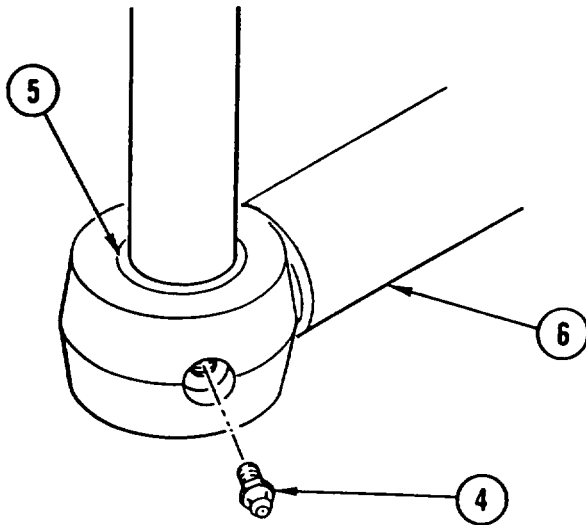
**NOTE**

Apply coat of lubricating oil to packing and seals prior to assembly.

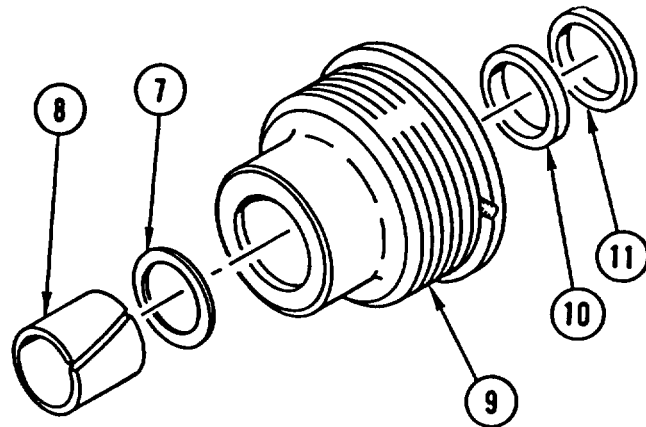
1. IF REMOVED, INSTALL new lubrication FITTING (1).
2. USING suitable PRESS, INSTALL two BUSHINGS (2) in cylinder (3).



3. IF REMOVED, INSTALL new lubrication FITTING (4).
4. USING suitable PRESS, INSTALL two BUSHINGS (5) in piston rod (6).



5. INSTALL new ring (7) and new BEARING (8) in gland (9).
6. INSTALL new SEAL (10) and new SEAL (11) in gland (9).

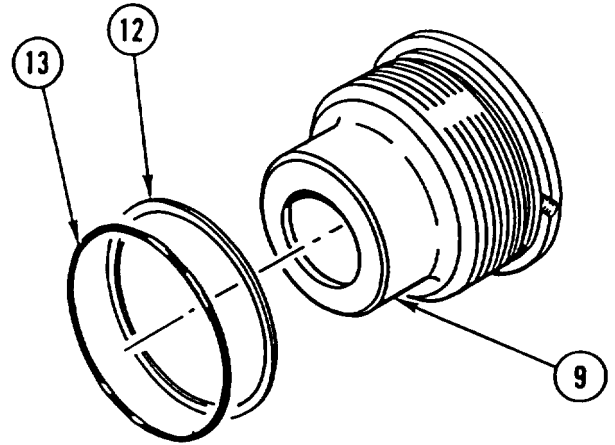


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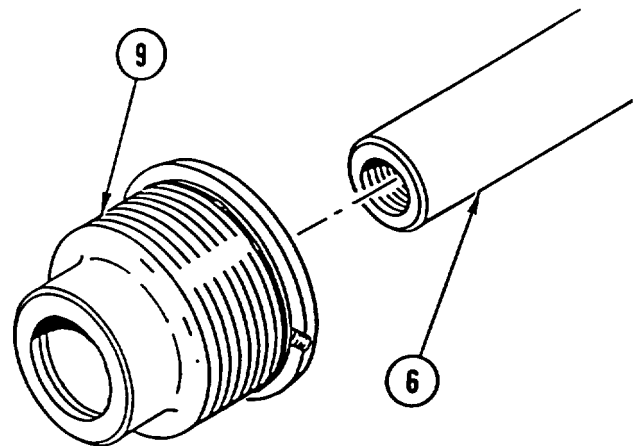
**BACKHOE BUCKET CYLINDER REPAIR (CONT)**

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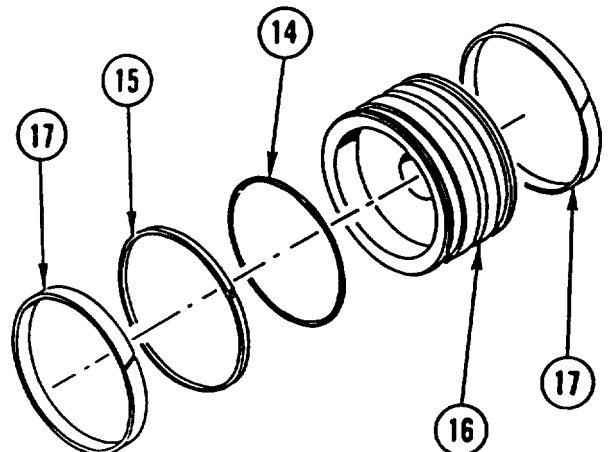
7. INSTALL new backup RING (12) and new packing (13) on gland (9).



8. INSTALL GLAND (9) on piston rod (6) with wiper ring toward piston rod eye.



9. INSTALL new packing (14) and new backup RING (15) on piston (16).
10. INSTALL two new wear RINGS (17) on piston (16).

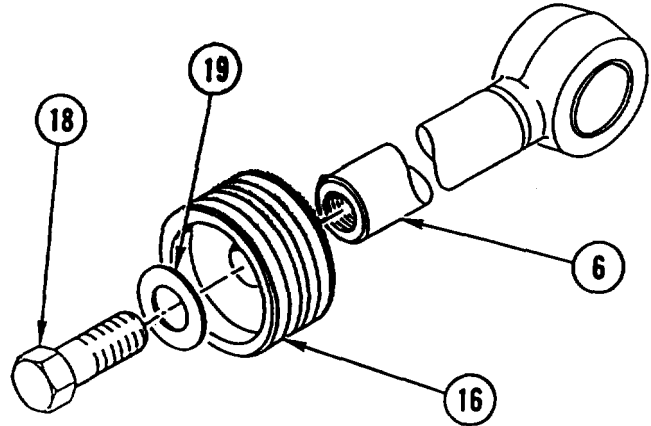


## BACKHOE BUCKET CYLINDER REPAIR (CONT)

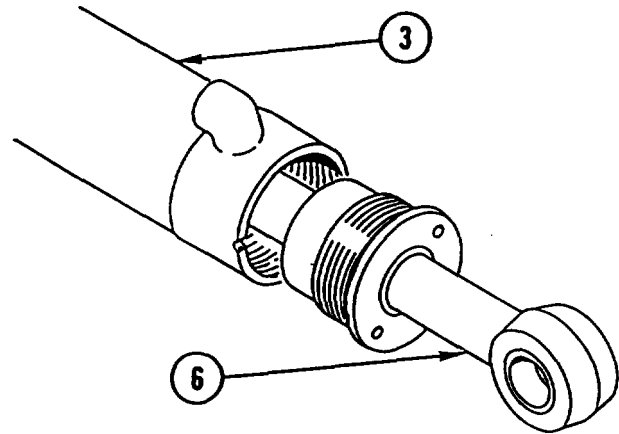
11. INSTALL PISTON (16) on piston rod (6).

**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.



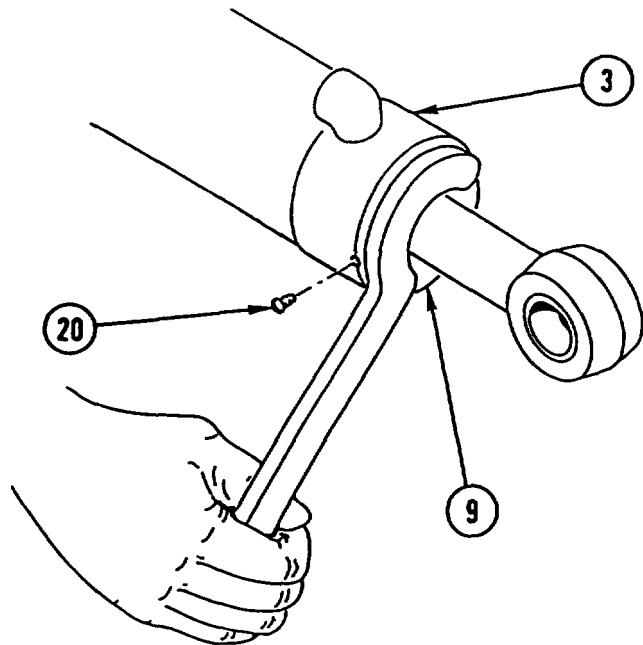
12. APPLY COAT of SEALING COMPOUND to THREADS of screw (18) and INSTALL SCREW (18) and washer (19) in piston rod (6). TIGHTEN SCREW to 475-525 lb-ft (644-712 N.m).



13. INSTALL piston ROD (6) in cylinder (3).

14. USING spanner WRENCH, THREAD GLAND (9) into cylinder (3) and TIGHTEN to 100-200 lb-ft (135-271 N.m). Each half of hole for self-tapping screw must now be in alinement.

15. INSTALL self-tapping SCREW (20) in cylinder (3).



**NOTE**

Follow-on Maintenance:  
Install backhoe bucket cylinder  
(TM 5-2420-224-20).

**Section XIV. BACKHOE DIPPER CYLINDER REPAIR**

**BACKHOE DIPPER CYLINDER REPAIR**

This task covers: a. Disassembly b. Inspection c. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Kit, Parts  
 Compound, Sealing Appendix B, Item 15  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Backhoe Dipper Cylinder  
 Removed

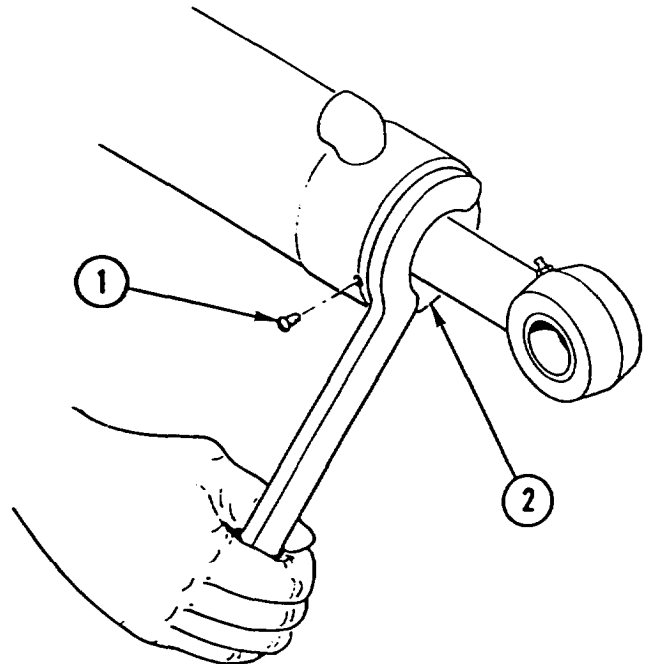
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

1. REMOVE self-tapping SCREW (1).
2. USING spanner WRENCH, REMOVE GLAND assembly (2).

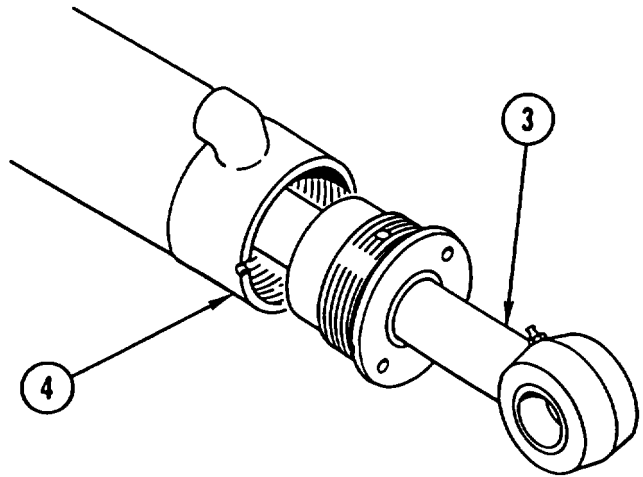


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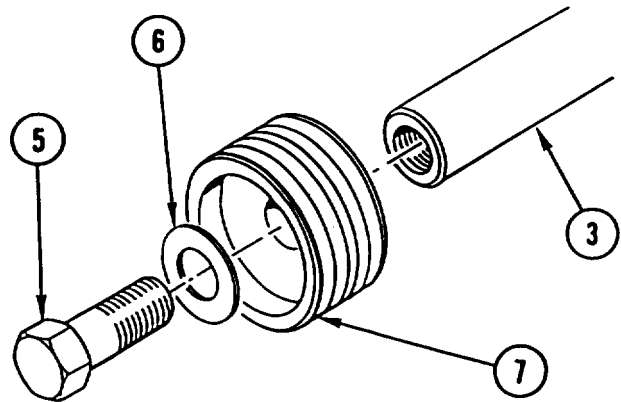
## BACKHOE DIPPER CYLINDER REPAIR (CONT)

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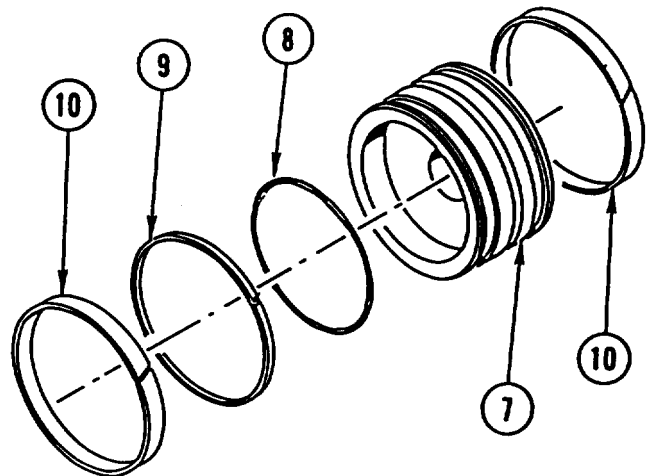
3. REMOVE piston ROD (3) from cylinder (4).



4. REMOVE bolt (5), washer (6), and PISTON (7) from piston rod (3).

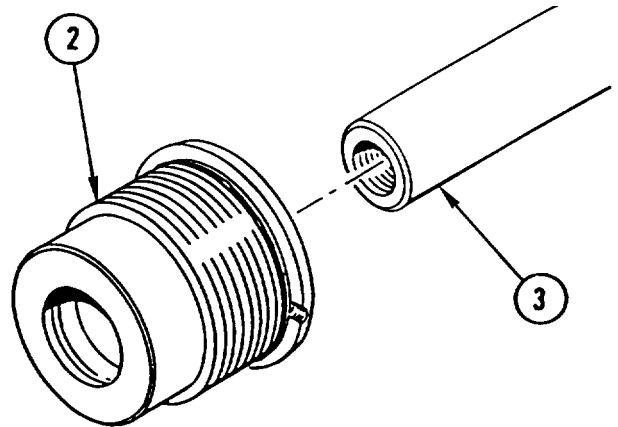


5. REMOVE and DISCARD PACKING (8), RETAINER (9), and two wear RINGS (10) from piston (7).



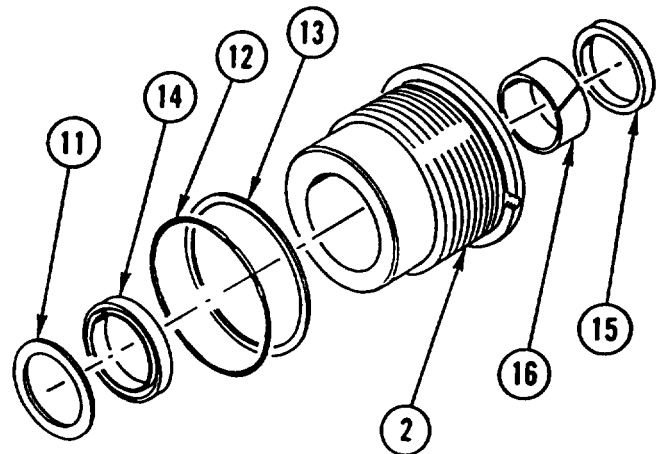
**BACKHOE DIPPER CYLINDER REPAIR (CONT)**

6. REMOVE GLAND (2) from piston rod (3).



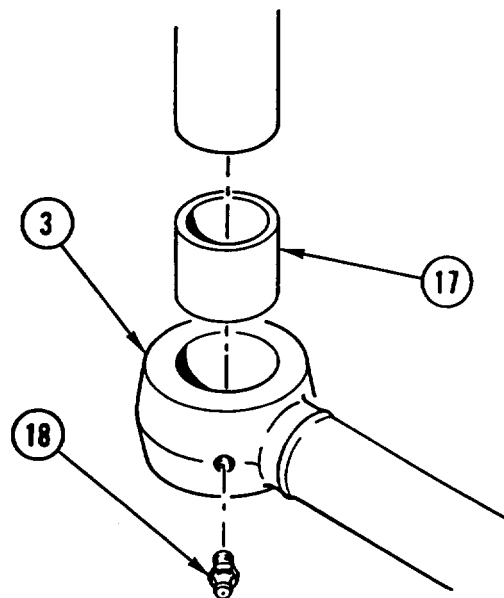
7. REMOVE and DISCARD three PACKINGS (11, 12, and 13) and SEAL (14) from gland (2).

8. REMOVE and DISCARD WIPER (15) and BEARING (16) from gland (2).



9. USING suitable PRESS, REMOVE BUSHING (17) from eye of piston rod (3).

10. IF DAMAGED, REMOVE lubrication FITTING (18).





**BACKHOE DIPPER CYLINDER REPAIR (CONT)**

11. USING suitable PRESS, REMOVE two BUSHINGS (19) from cylinder (4).
12. IF DAMAGED, REMOVE lubrication FITTING (20).

**INSPECTION**

1. Inspect piston, piston rod, and cylinder for scratches or scoring.
2. Inspect threads on piston rod, bolt, cylinder, and gland for wear or damage.

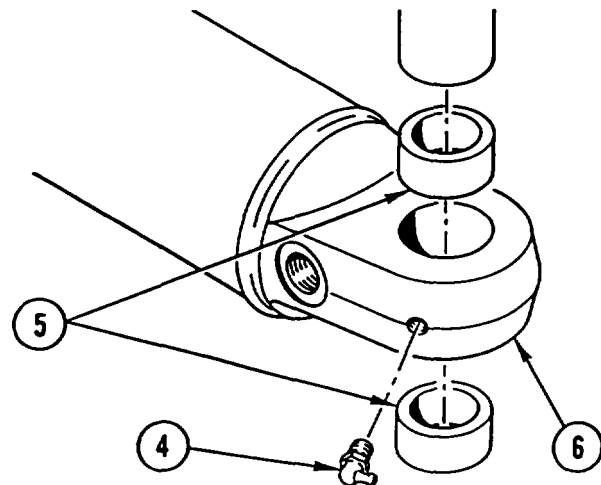
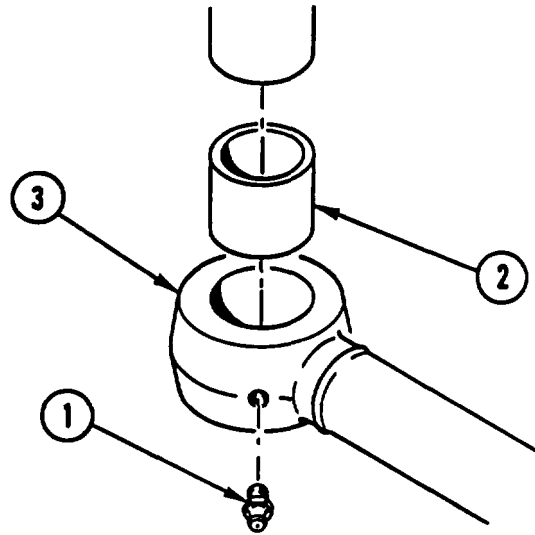
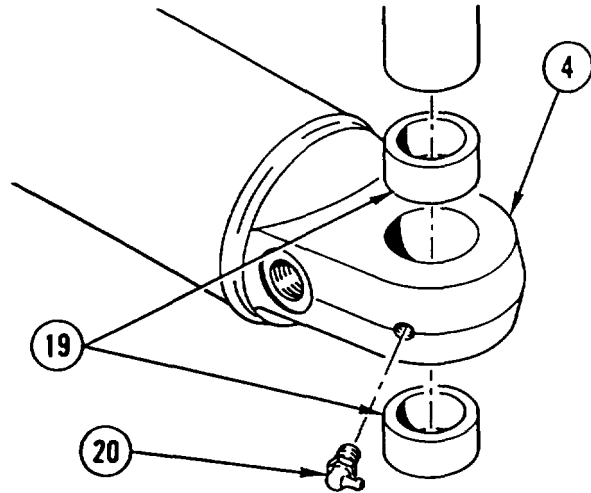
**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to packings and seal prior to assembly.

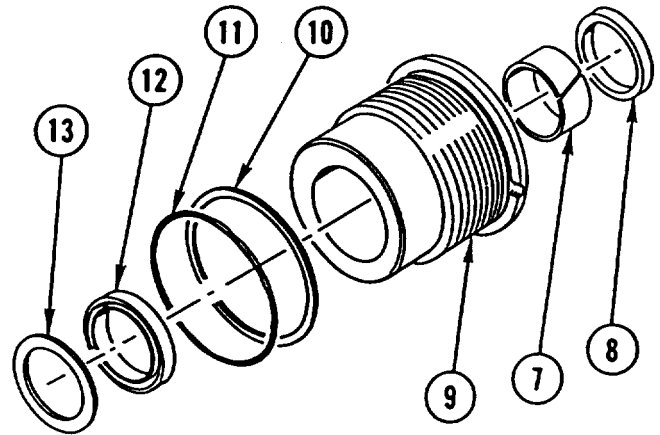
1. IF REMOVED, INSTALL new lubrication FITTING (1).
2. USING suitable PRESS, INSTALL BUSHING (2) in eye of piston rod (3).

3. IF REMOVED, INSTALL new lubrication FITTING (4).
4. USING suitable PRESS, INSTALL two BUSHINGS (5) in cylinder (6).

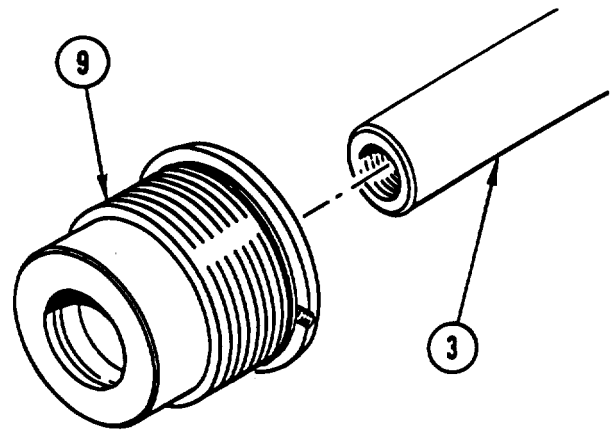


**BACKHOE DIPPER CYLINDER REPAIR (CONT)**

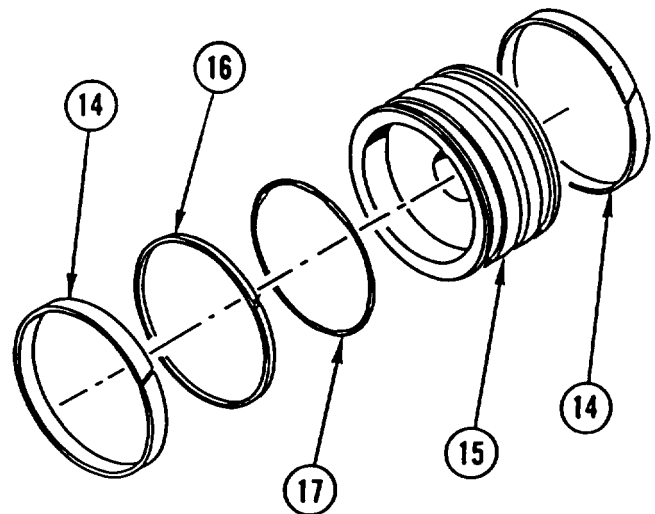
5. INSTALL new BEARING (7) and new wiper (8) in gland (9).
6. INSTALL new PACKING (10) and new PACKING (11) in gland (9).
7. INSTALL new seal (12) and new PACKING (13) in gland (9).



8. INSTALL GLAND (9) on piston rod (3).

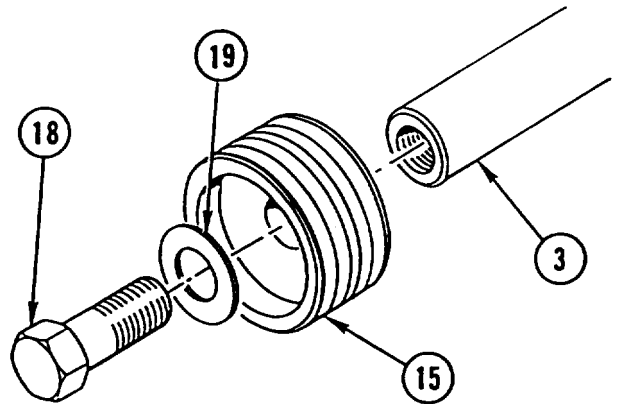


9. INSTALL two new wear RINGS (14) on piston (15).
10. INSTALL new retainer (16) and new PACKING (17) on piston (15).

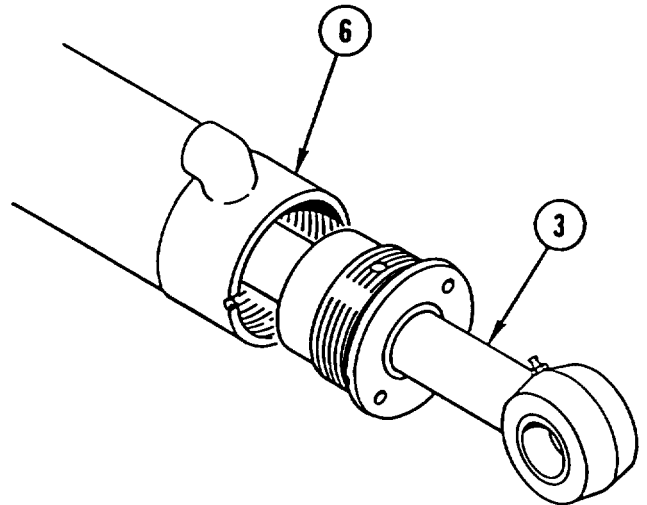


**BACKHOE DIPPER CYLINDER REPAIR (CONT)**

**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.

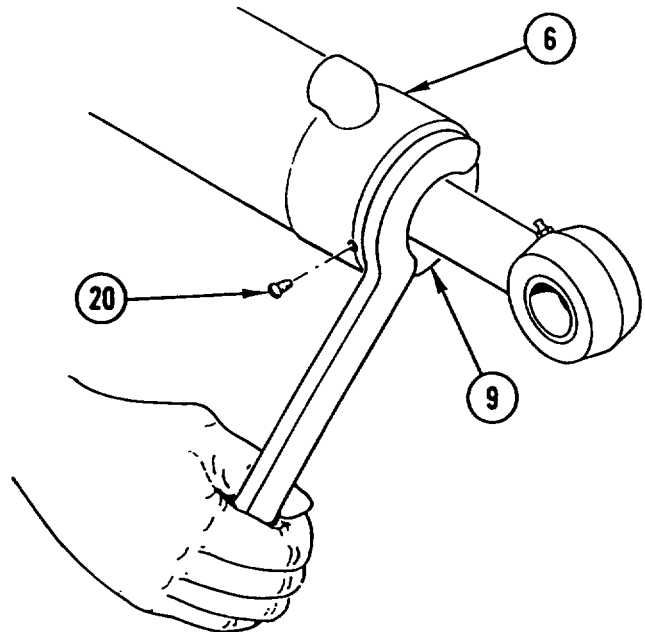


11. APPLY COAT of SEALING COMPOUND to THREADS of bolt (18) and INSTALL PISTON (15), washer (19), and bolt (18) on piston rod (3). TIGHTEN BOLT to 1000-1200 lb-ft (1356-1627 N•m).



12. INSTALL PISTON rod (3) in cylinder (6).

13. USING spanner WRENCH, THREAD GLAND (9) into cylinder (6) and TIGHTEN to 100-200 lb-ft (136-271 N•m).



14. INSTALL self-tapping SCREW (20).

**NOTE**  
 Follow-on Maintenance:  
 Install backhoe dipper cylinder (TM 5-2420-224-20).

**Section XV. BACKHOE STABILIZER CYLINDER REPAIR**

**BACKHOE STABILIZER CYLINDER REPAIR**

This task covers: a. Disassembly b. Inspection c. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Kit, Parts  
 Compound, Sealing Appendix B, Item 15  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe Stabilizer Cylinder Removed

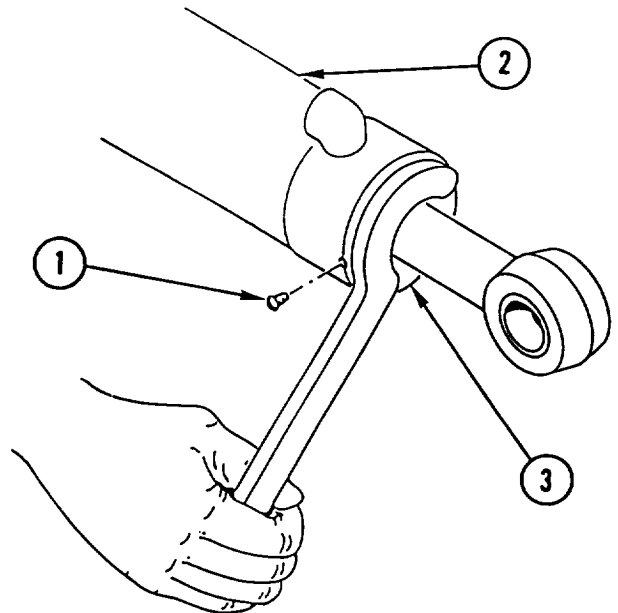
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

1. REMOVE self-tapping SCREW (1) from tube (2).
2. USING spanner WRENCH, REMOVE GLAND assembly (3).

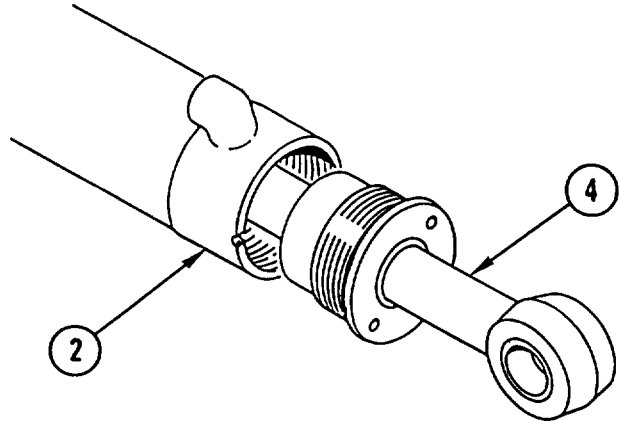


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## BACKHOE STABILIZER CYLINDER REPAIR (CONT)

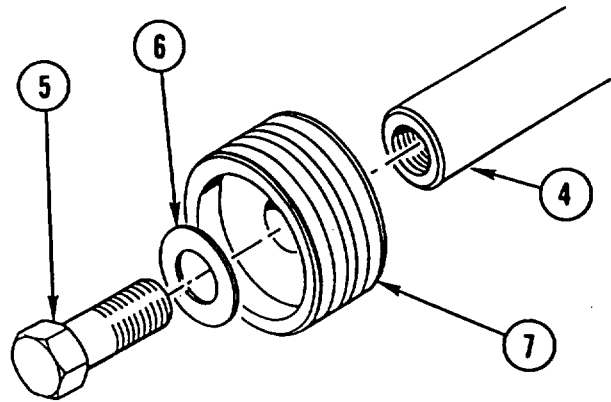
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3. REMOVE linear PISTON (4) from tube (2).

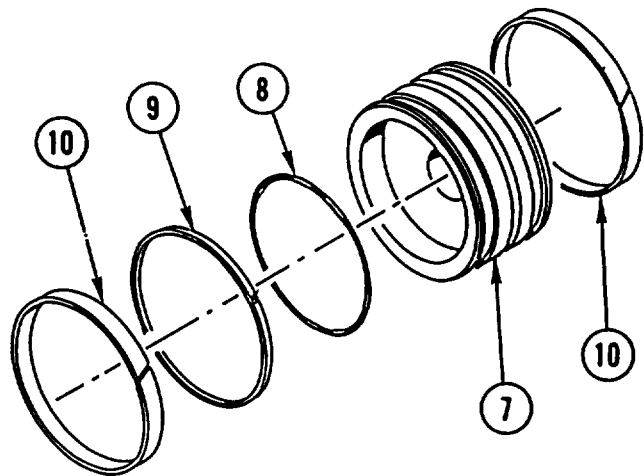


4. REMOVE SCREW (5) and washer (6) from linear piston (4).

5. REMOVE PISTON (7) from linear piston (4).

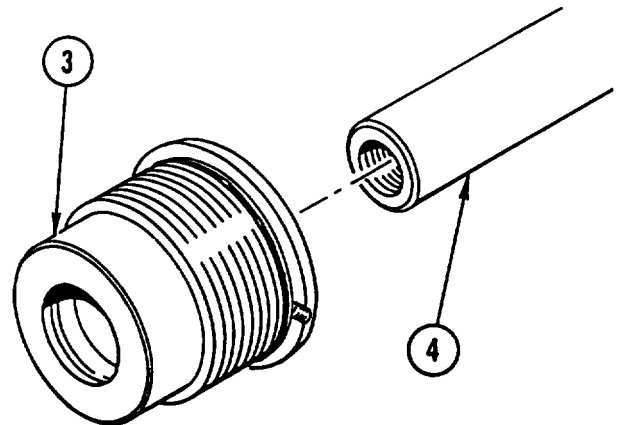


6. REMOVE and DISCARD SEAL (8), backup RING (9), and two wear RINGS (10) from piston (7).

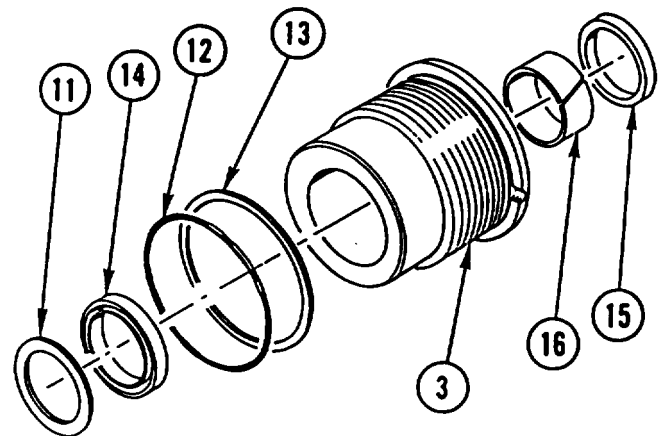


## BACKHOE STABILIZER CYLINDER REPAIR (CONT)

7. REMOVE GLAND (3) from linear piston (4).



8. REMOVE and DISCARD three PACKINGS (11, 12, and 13), SEAL (14), WIPER (15), and BEARING (16) from gland (3).

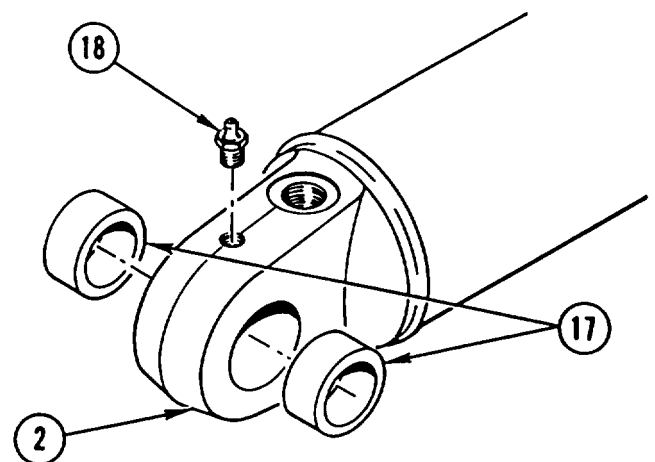


9. USING suitable PRESS, REMOVE two BUSHINGS (17) from tube (2).

10. IF DAMAGED, REMOVE lubrication FITTING (18).

### INSPECTION

1. Inspect piston, linear piston, and tube for scratches or scoring.
2. Inspect threads on linear piston, screw, tube, and gland for wear or damage.



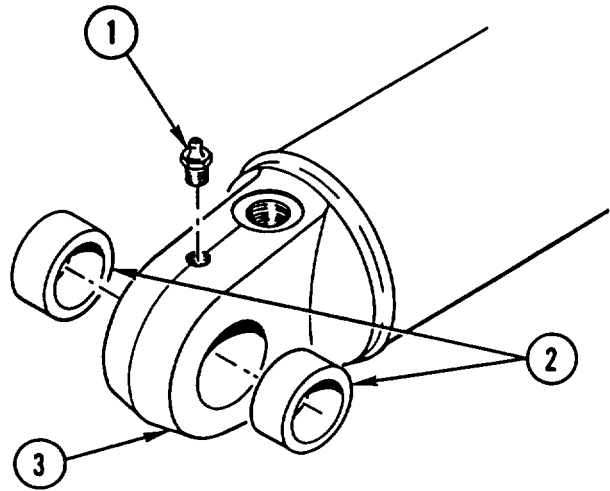
## BACKHOE STABILIZER CYLINDER REPAIR (CONT)

### ASSEMBLY

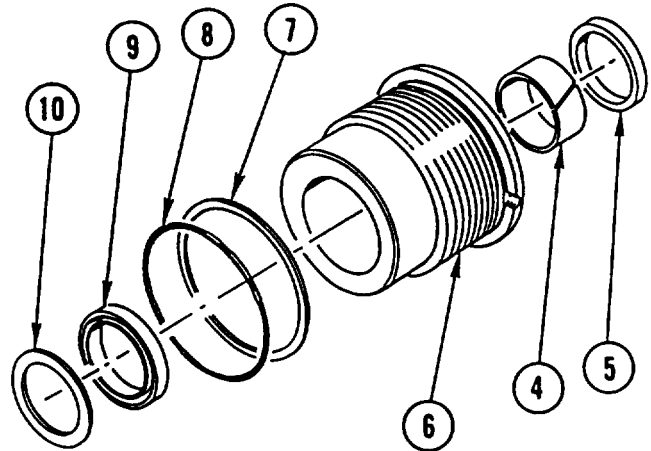
#### NOTE

Apply coat of lubricating oil to packings and seal prior to assembly.

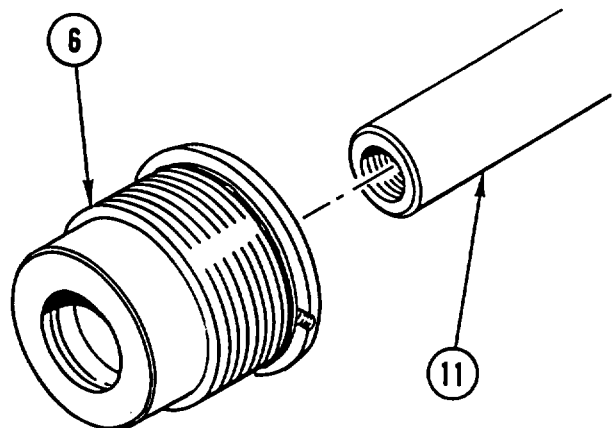
1. IF REMOVED, INSTALL new lubrication FITTING (1).
2. USING suitable PRESS, INSTALL two BUSHINGS (2) in tube (3).



3. INSTALL new BEARING (4) and new wiper (5) in gland (6).
4. INSTALL two new PACKINGS (7 and 8).
5. INSTALL new seal (9) and new PACKING (10).

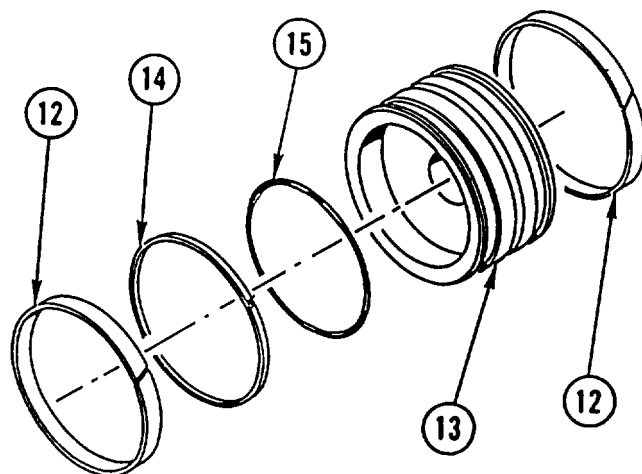


6. INSTALL GLAND (6) on linear piston (11).



## BACKHOE STABILIZER CYLINDER REPAIR (CONT)

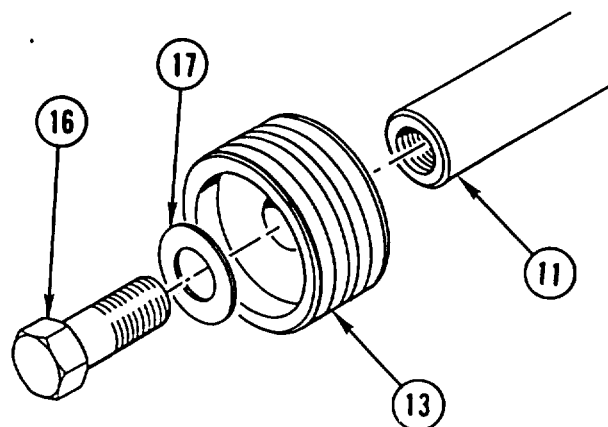
7. INSTALL two new wear RINGS (12) on piston (13).
8. INSTALL new backup RING (14) and new SEAL (15).



9. INSTALL PISTON (13) on linear piston (11).

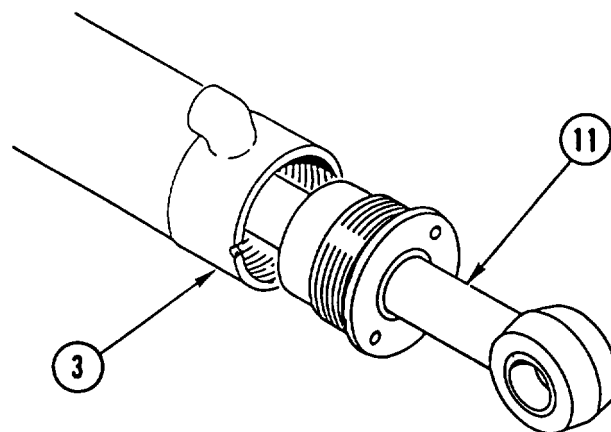
**WARNING**

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.



10. APPLY COAT of SEALING COMPOUND to THREADS of screw (16) and INSTALL washer (17) and SCREW (16) in linear piston (11).

11. INSTALL linear PISTON (11) in tube (3).





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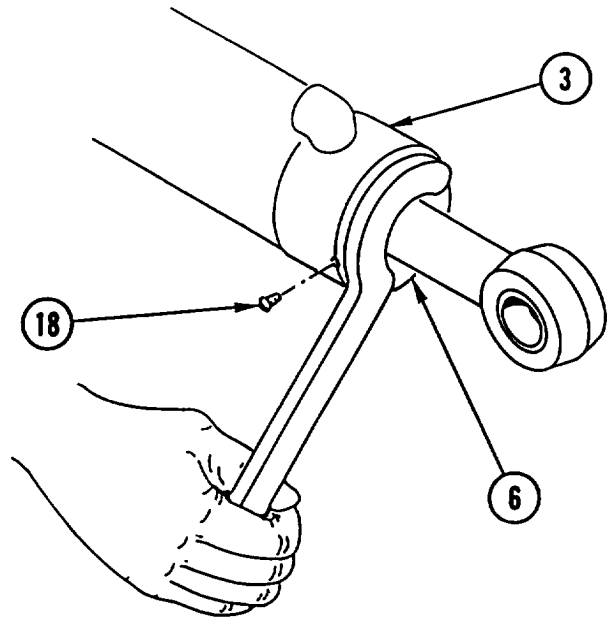
## BACKHOE STABILIZER CYLINDER REPAIR (CONT)

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12. USING spanner WRENCH, THREAD GLAND (6) in tube (3) and TIGHTEN to 100-200 lb-ft (135-271 N·m)
13. INSTALL self-tapping SCREW (18) in tube (3).

**NOTE**

Follow-on Maintenance:  
Install backhoe stabilizer cylinder  
(TM 5-2420-224-20).



**Section XVI. BACKHOE/CRANE TILT CYLINDER REPAIR**

**OVERVIEW**

This section illustrates and describes procedures for repair of the backhoe/crane tilt cylinder. A list of tasks contained in this section is shown below.

	Page
Backhoe/Crane Tilt Cylinder (J.I. Case) Repair . . . . .	20-131
Backhoe/Crane Tilt Cylinder (Aeroquip) Repair . . . . .	20-137

**BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR**

This task covers: a. Disassembly b. Inspection c. Assembly

**INITIAL SETUP**

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

- Kit, Parts
- Compound, Sealing            Appendix B, Item 15
- Oil, Lubricating                Appendix B, Item 30
- Rags                                Appendix B, Item 40

**References:**

- TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Backhoe Tilt Cylinder (SEE) or Crane Tilt Cylinder (HMMH) Removed

**General Safety Instructions:**

**WARNING**

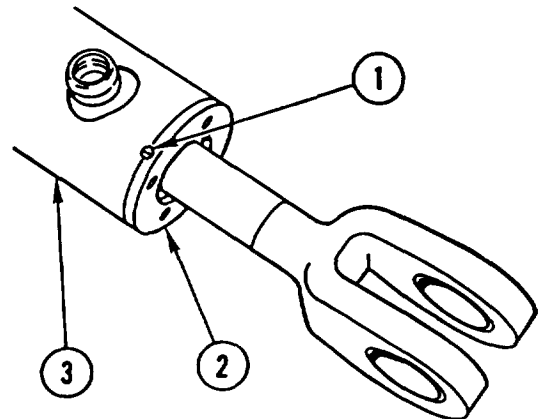
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

**NOTE**

Procedure the same for both vehicles.

1. REMOVE SCREW (1).
2. USING spanner WRENCH, REMOVE GLAND (2) from tube (3).

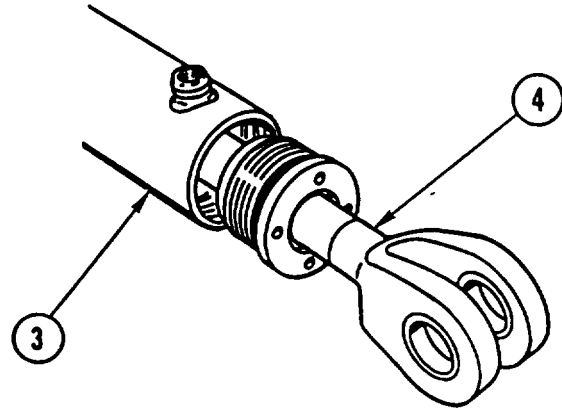


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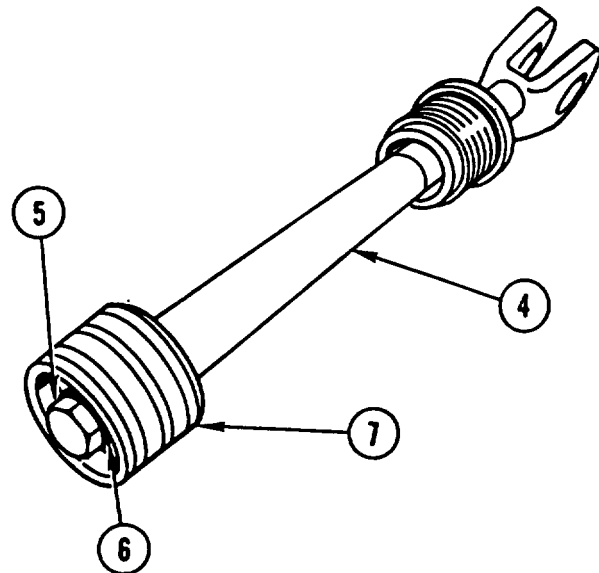
**BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR (CONT)**

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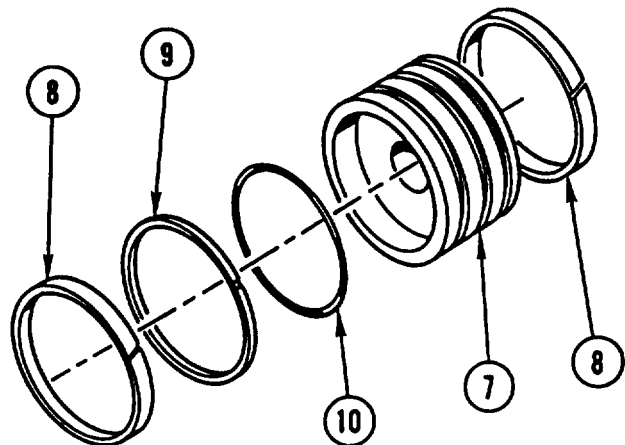
3. REMOVE connecting LINK (4) from tube (3).



4. REMOVE SCREW (5) and washer (6) from connecting link (4).
5. REMOVE PISTON (7) from connecting link (4).

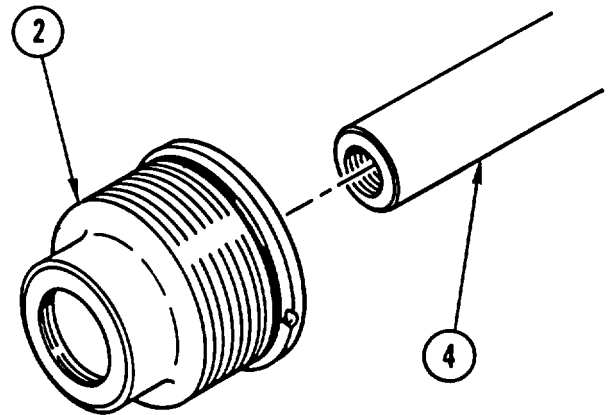


6. REMOVE two wear rings (8), gasket (9), and SEAL (10) from piston (7). DISCARD SEAL.

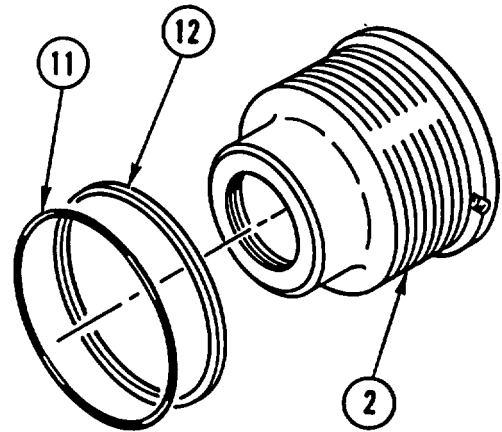


**BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR (CONT)**

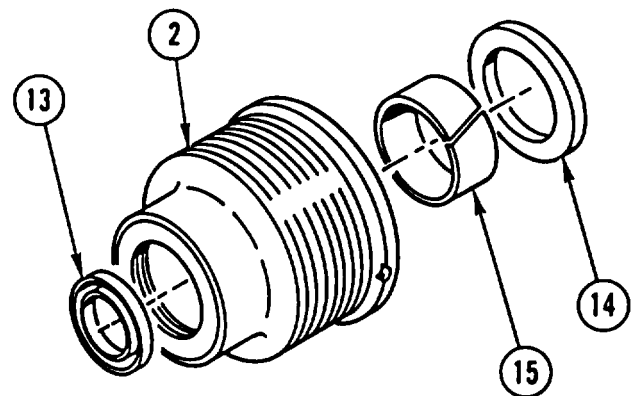
7. REMOVE GLAND (2) from connecting link (4).



8. REMOVE and DISCARD O-RING (11) and PACKING (12) from gland (2).



9. REMOVE and DISCARD SEAL (13), WIPER (14), and BEARING (15) from gland (2).



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## BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR (CONT)

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10. IF DAMAGED, REMOVE two lubrication FITTINGS (16).

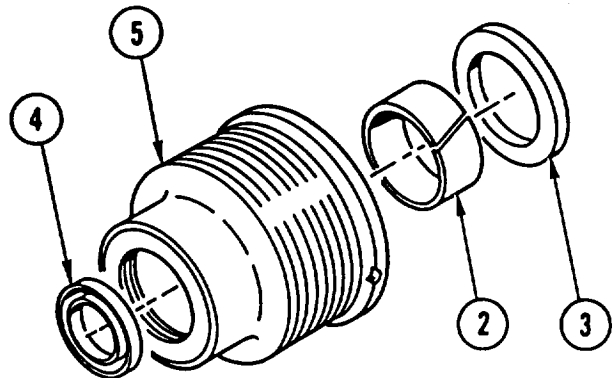
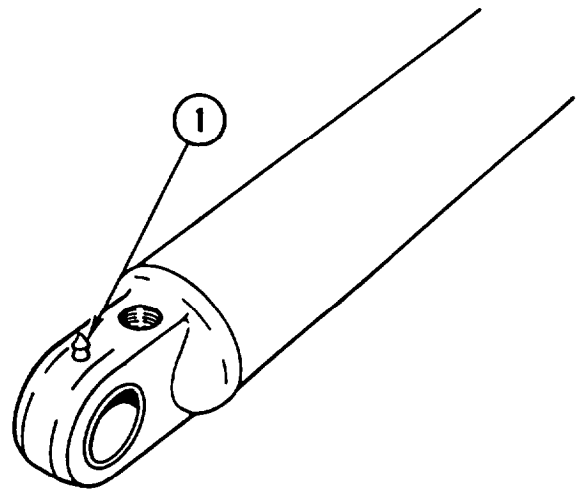
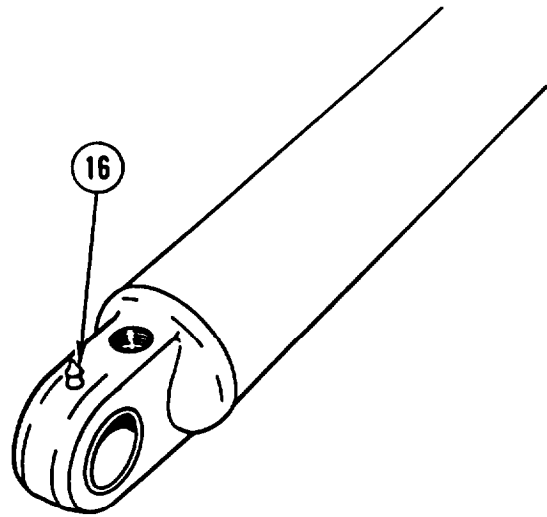
### INSPECTION

1. Inspect piston, connecting link, and tube for scratches or scoring.
2. Inspect threads on connecting link, piston screw, tube, and gland for wear or damage.

### ASSEMBLY

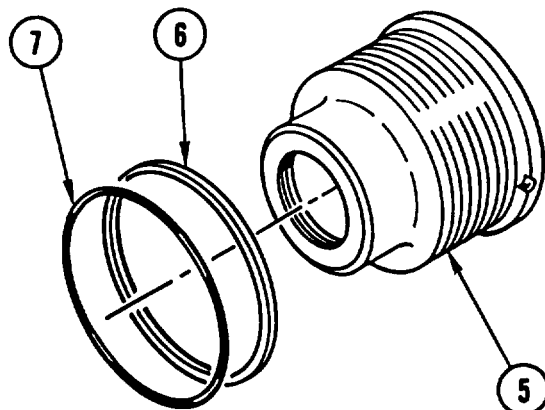
#### NOTE

- Procedure is the same for both vehicles.
  - Apply coat of lubricating oil to packing, O-ring, and seals prior to assembly.
1. IF REMOVED, INSTALL two new lubrication FITTINGS (1).
  2. INSTALL new BEARING (2), new wiper (3), and new seal (4) in gland (5).

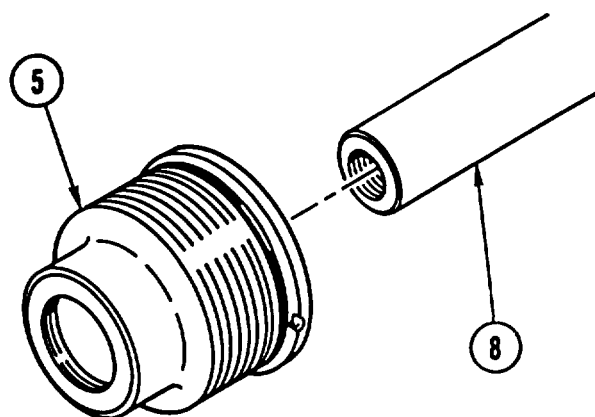


**BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR (CONT)**

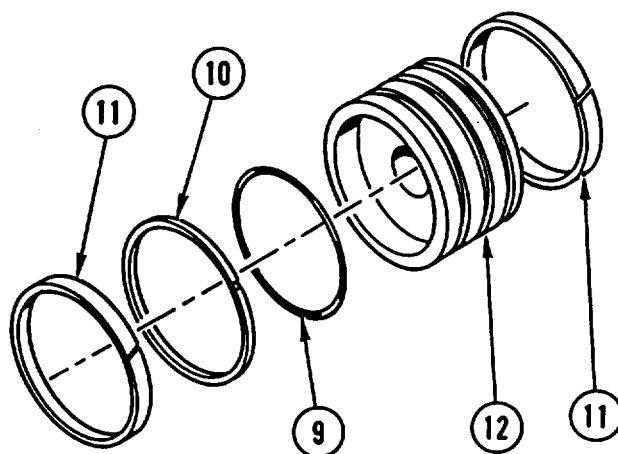
3. INSTALL new PACKING (6) and new O-RING (7) on gland (5).



4. INSTALL GLAND (5) on connecting link (8).



5. INSTALL new SEAL (9), gasket (10), and two wear rings (11) on piston (12).

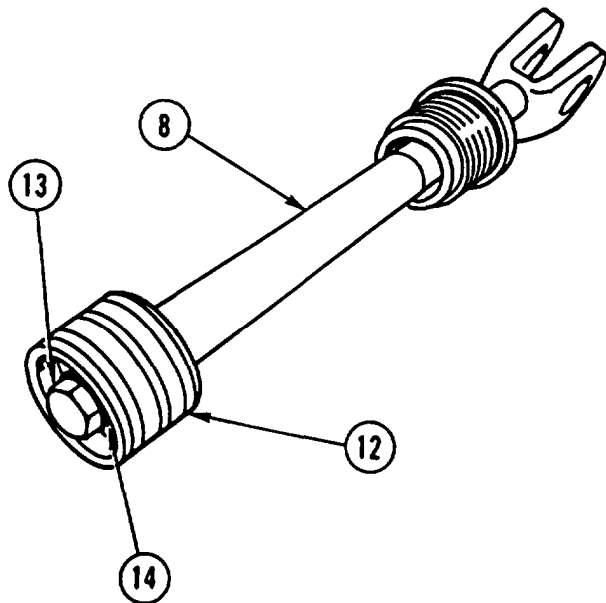


**BACKHOE/CRANE TILT CYLINDER (J.I. CASE) REPAIR (CONT)**

6. INSTALL PISTON (12) on connecting link (8).

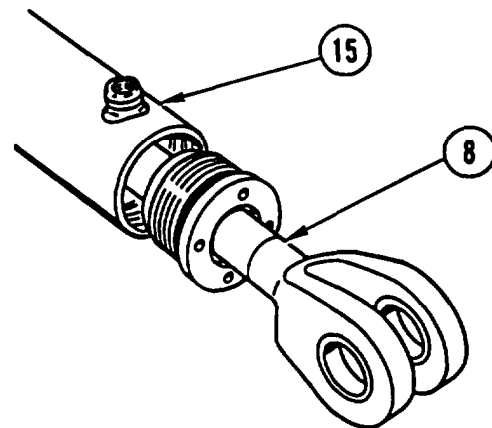
**WARNING**

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 COAT of SEALING COMPOUND to THREADS of screw (13) and INSTALL SCREW (13) and washer (14) in connecting link (8). TIGHTEN SCREW to 300-400 lb-ft (221-295 N.m).

8. INSTALL connecting LINK (8) in tube (15).

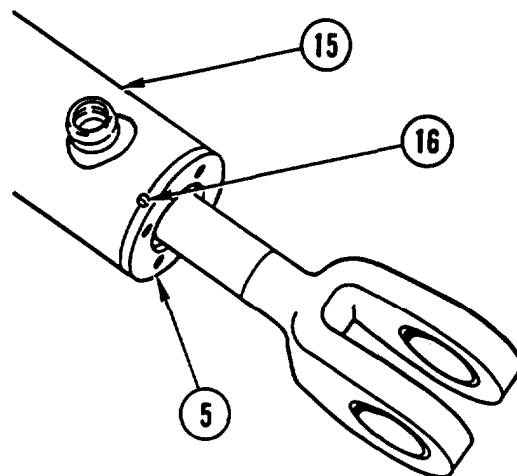


9. USING spanner WRENCH, INSTALL GLAND (5) in tube (15) and TIGHTEN to 100-200 lb-ft (136-271 N.m).

10. INSTALL SCREW (16).

**NOTE**

Follow-on Maintenance:  
Install backhoe tilt cylinder (SEE) or crane tilt cylinder (HMMH) (TM 5-2420-224-20).



## BACKHOE/CRANE TILT CYLINDER (Aeroquip) REPAR

This task covers: a. Disassembly b. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5984

#### Materials/Parts:

Kit  
 Compound, Sealing Appendix B, item 15  
 Oil, Lubricating Appendix B, item 30  
 Rags Appendix B, item 40

#### References:

TM 5-2420-224-20

#### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Backhoe Tilt Cylinder (SEE) or Crane Tilt Cylinder (HMMH) Removed

#### General Safety Instructions:

##### WARNING

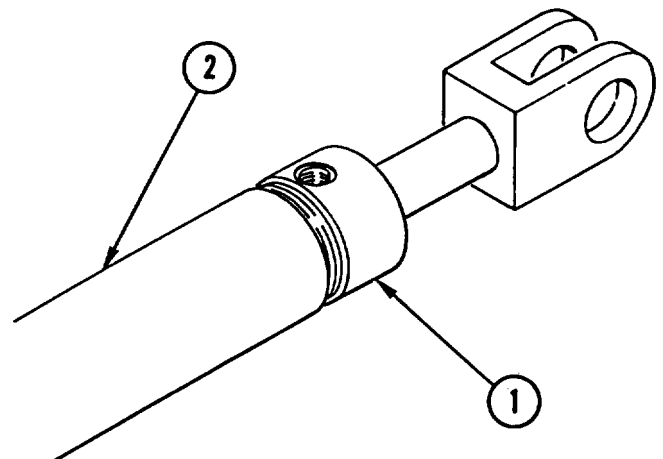
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- Adhesive causes immediate bonding on contact with eyes, skin, or clothing and also gives off harmful vapors. Wear protective goggles and use in well-ventilated area. If adhesive gets in eyes, try to keep eyes open; flush eyes with water for 15 minutes and get immediate medical attention.

### DISASSEMBLY

#### NOTE

Procedure is the same for both vehicles.

1. REMOVE HEAD (1) from cylinder tube (2).



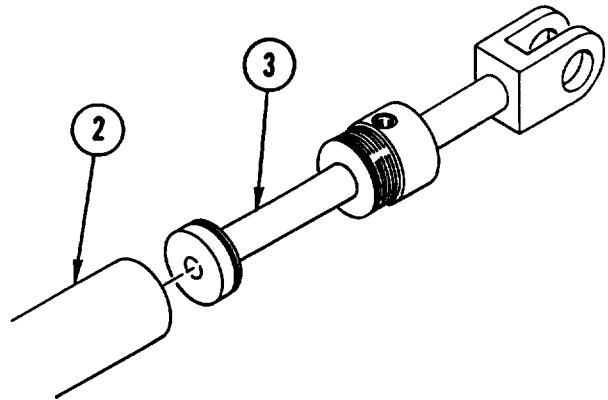


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**BACKHOE/CRANE TILT CYLINDER (AEROQUIP) REPAIR (CONT)**

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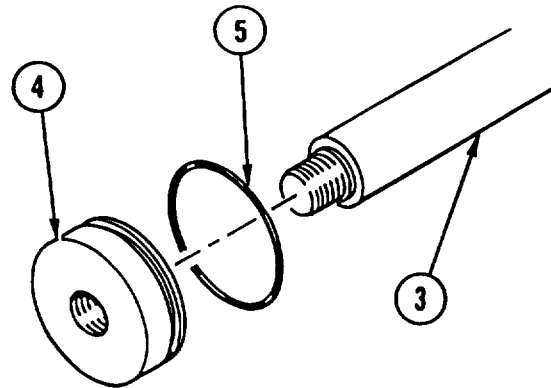
2. REMOVE piston ROD (3) from cylinder tube (2).



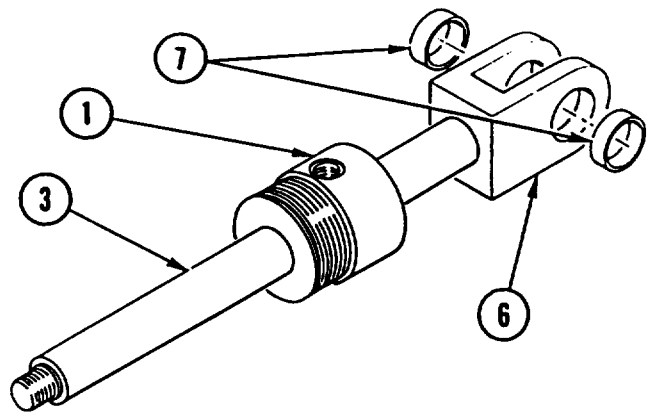
**NOTE**

It may be necessary to place piston rod in soft-jawed vise to perform steps 3 and 5.

3. IF DAMAGED, REMOVE PISTON (4) from piston rod (3).
4. REMOVE and DISCARD PACKING (5) from piston (4).

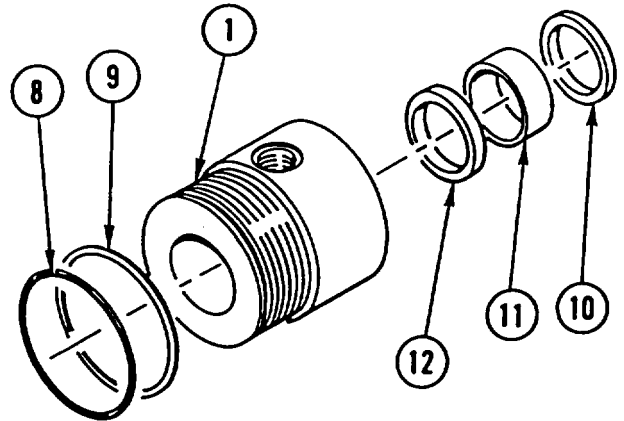


5. REMOVE rod clevis (6) and HEAD (1) from piston rod (3).
6. IF DAMAGED, REMOVE two sleeve BUSHINGS (7) from rod clevis (6).

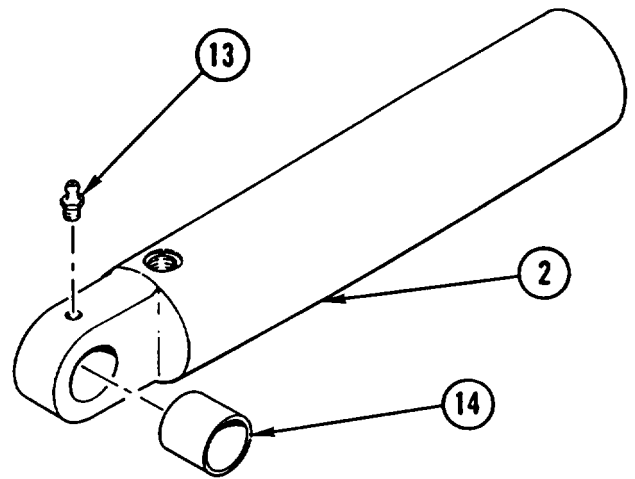


**BACKHOE/CRANE TILT CYLINDER (AEROQUIP) REPAIR (CONT)**

7. REMOVE and DISCARD O-RING (8), backup WASHER (9), rod WIPER (10), rod BEARING (11), and PACKING (12) from head (1).



8. IF DAMAGED, REMOVE lubrication FITTING (13) from cylinder tube (2).
9. IF DAMAGED, REMOVE sleeve BUSHING (14) from cylinder tube (2).

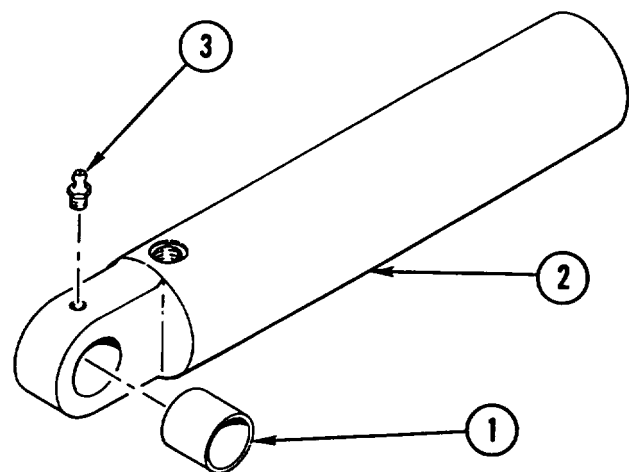


**ASSEMBLY**

**NOTE**

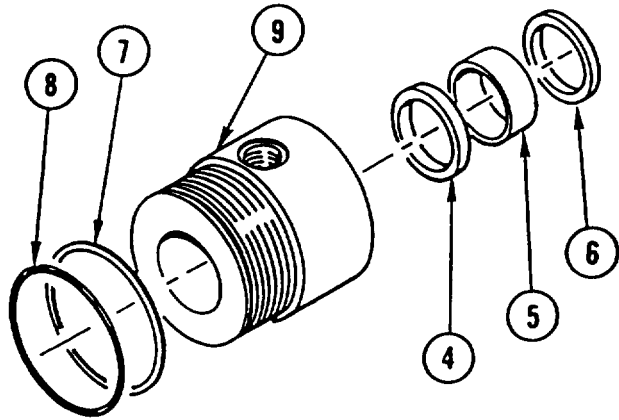
- Procedure is the same for both vehicles.
- Apply coat of lubricating oil to packings and O-ring prior to assembly.

1. IF REMOVED, INSTALL new sleeve BUSHING (1) in cylinder tube (2).
2. IF REMOVED, INSTALL new lubrication FITTING (3) in cylinder tube (2).



**BACKHOE/CRANE TILT CYLINDER (AEROQUIP) REPAIR (CONT)**

3. INSTALL new packing (4), new rod BEARING (5), new rod wiper (6), new backup washer (7), and new O-ring (8) in head (9).

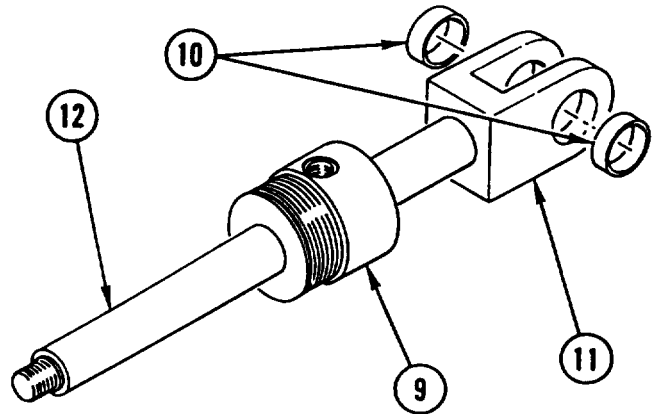


IF REMOVED, INSTALL two new sleeve BUSHINGS (10) in rod clevis (11).

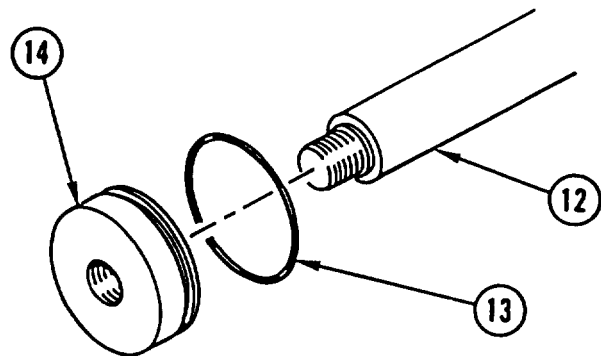
**NOTE**

It may be necessary to place piston rod in soft-jawed vise to perform steps 5 and 7.

5. INSTALL HEAD (9) and rod clevis (11) on piston rod (12).



6. INSTALL new PACKING (13) on piston (14).
7. IF REMOVED, apply COAT of SEALING COMPOUND to THREADS of piston rod (12) and INSTALL new PISTON (14) on piston rod (12).

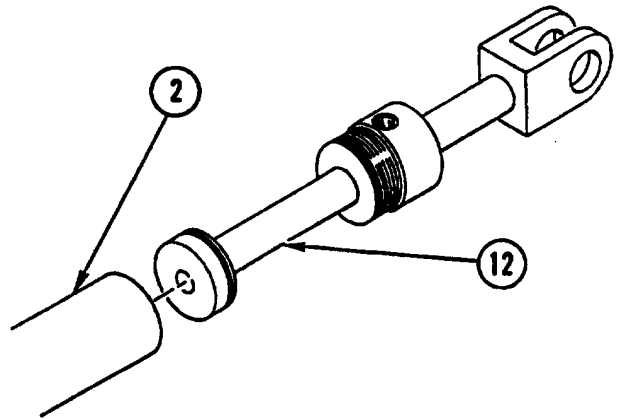


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**BACKHOE/CRANE TILT CYLINDER (AEROQUIP) REPAIR (CONT)**

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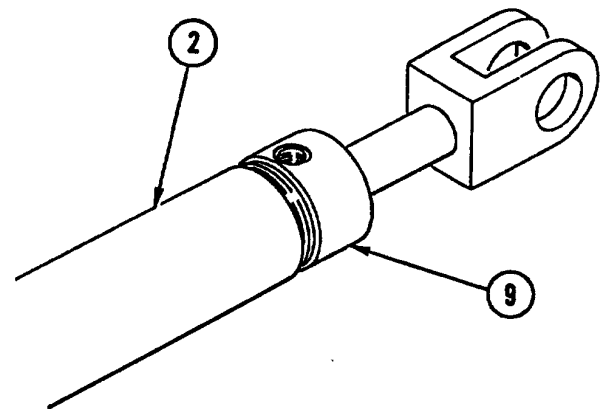
8. INSTALL piston ROD (12) in cylinder tube (2).



9. APPLY COAT of SEALING COMPOUND to THREADS of head (9) and INSTALL HEAD (9) in cylinder tube (2).

**NOTE**

Follow-on Maintenance:  
 Install backhoe tilt cylinder (SEE) or crane tilt cylinder (HMMH) (TM 5-2420-224-20).



## Section XVII. BACKHOE/CRANE LATCH CYLINDER REPAIR

### BACKHOE/CRANE LATCH CYLINDER REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784

##### Materials/Parts:

Kit, Parts  
Compound, Sealing Appendix B, Item 15  
Oil, Lubricating Appendix B, Item 30  
Rags Appendix B, Item 40

##### References:

TM 5-2420-224-20

##### Equipment Condition:

Reference	Condition Description
TM 5-2420-224-20	Backhoe Latch Cylinder (SEE) or Crane Latch Cylinder (HMMH) Removed

##### General Safety Instructions:

#### WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

#### DISASSEMBLY

##### NOTE

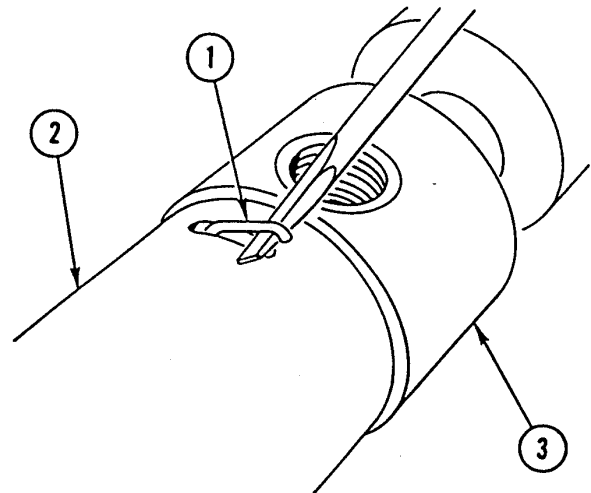
- Procedure is the same for both vehicles.
- Procedure is similar for both latch cylinders.

1. LIFT lock RING (1) clear of slot in latch cylinder (2).

##### NOTE

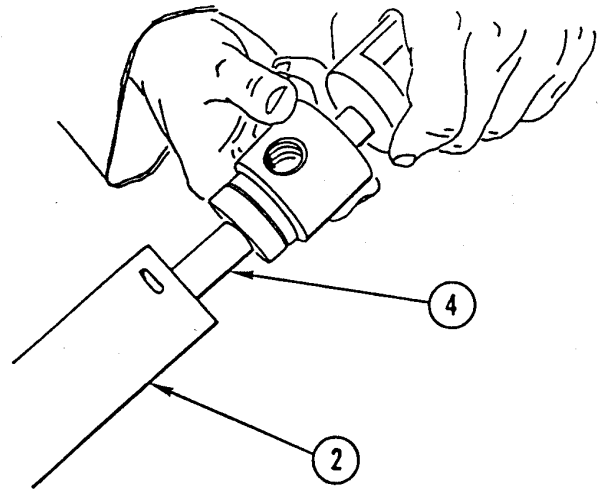
Lock ring will come out during gland removal.

2. REMOVE GLAND (3) and lock ring (1) from latch cylinder (2).

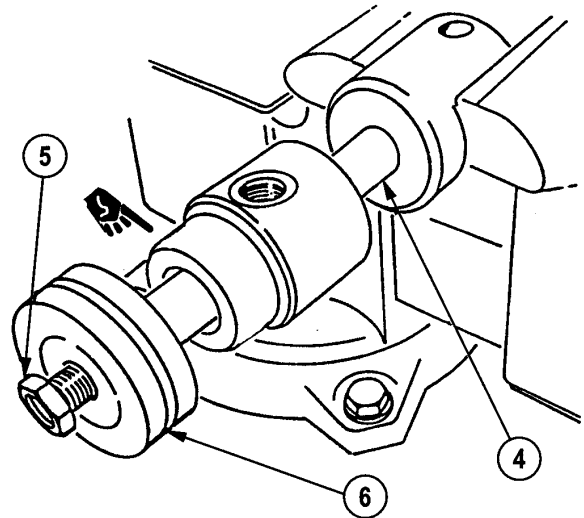


## BACKHOE/CRANE LATCH CYLINDER REPAIR

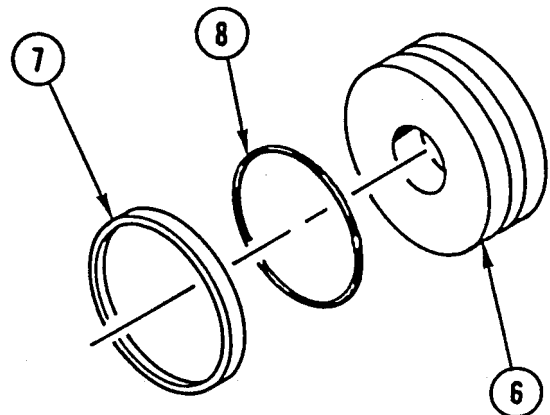
3. REMOVE piston ROD (4) from latch cylinder (2).



4. REMOVE nut (5) and PISTON (6) from piston rod (4).



5. REMOVE and DISCARD slipper RING (7) and PACKING (8) from piston (6).

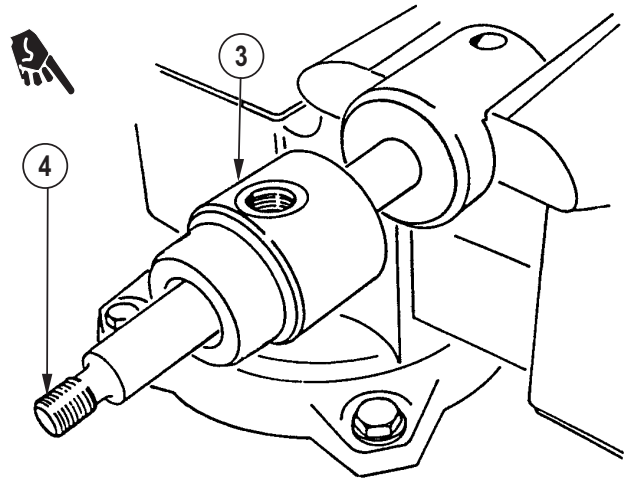


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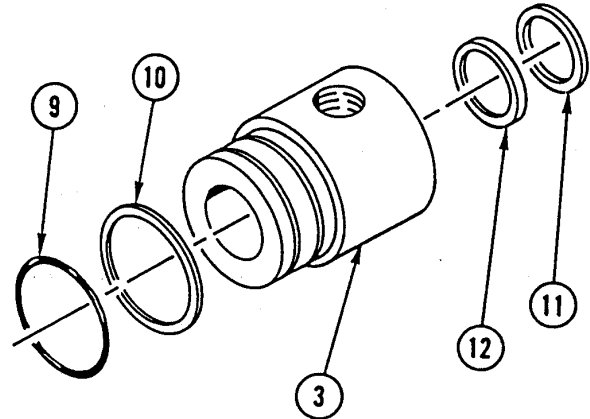
## BACKHOE/CRANE LATCH CYLINDER REPAIR (CONT)

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- REMOVE GLAND (3) from piston rod (4).



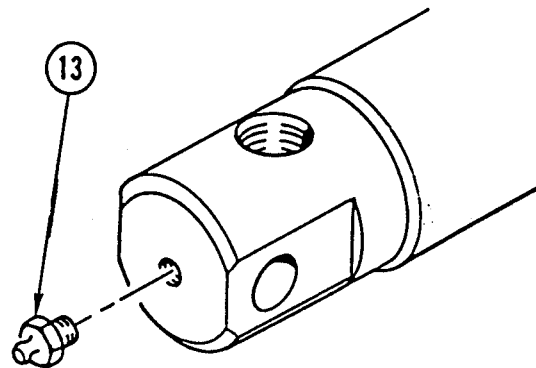
- REMOVE and DISCARD PACKING (9) and WASHER (10) from gland (3).
- REMOVE and DISCARD SEAL (11) and SEAL (12) from gland (3).



- IF DAMAGED, REMOVE FITTING (13).

### INSPECTION

- Inspect piston, piston rod, and cylinder for scratches or scoring.
- Inspect threads on piston rod, cylinder, and gland for wear or damage.



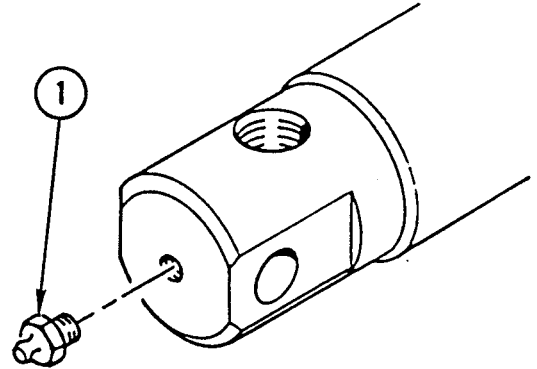
## BACKHOE/CRANE LATCH CYLINDER REPAIR (CONT)

### ASSEMBLY

#### NOTE

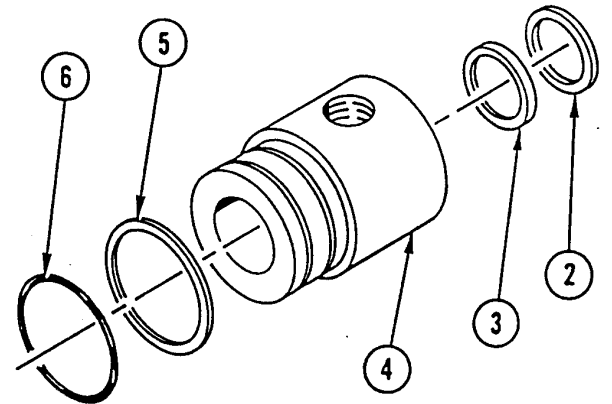
- Procedure is the same for both vehicles.
- Procedure is the same for both latch cylinders.
- Apply coat of lubricating oil to packings and seals prior to assembly.

1. IF REMOVED, INSTALL new FITTING (1).

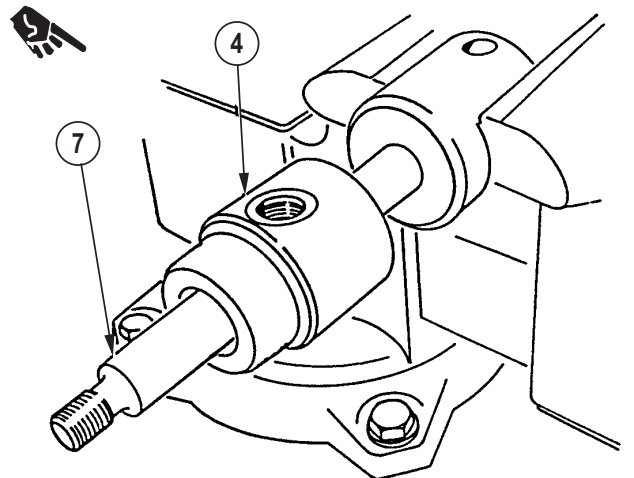


2. INSTALL new SEAL (2) and new SEAL (3) in gland (4).

3. INSTALL new washer (5) and new PACKING (6) on gland (4).



4. INSTALL GLAND (4) on piston rod (7).





## BACKHOE/CRANE LATCH CYLINDER REPAIR (CONT)

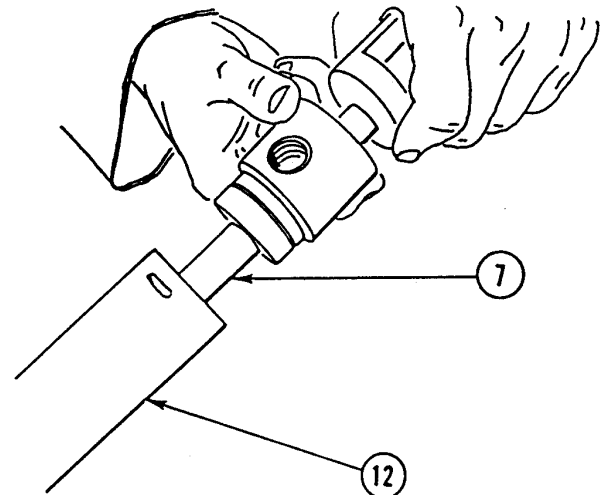
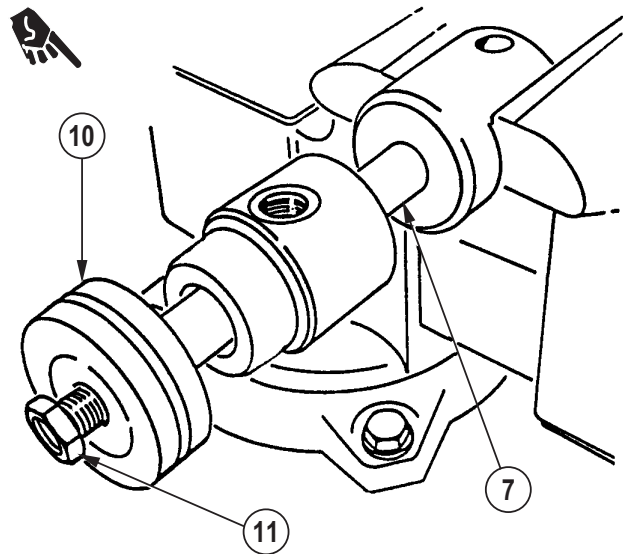
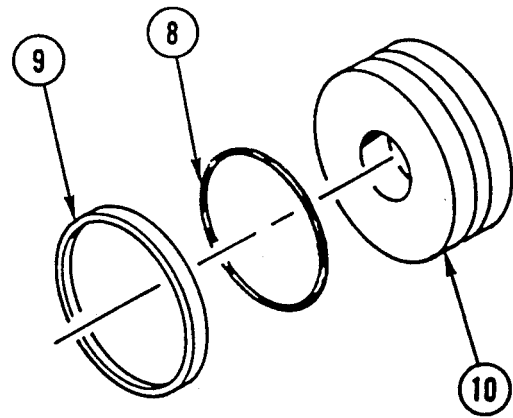
- INSTALL new PACKING (8) and new slipper ring (9) on piston (10).

### 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 with water for 15 minutes and get immediate medical attention.

- APPLY COAT of SEALING COMPOUND to THREADS of piston rod (7) and INSTALL PISTON (10) and nut (11) on piston rod (7). TIGHTEN NUT to 45-50 lb-ft (33-36 N.m).

- INSTALL piston ROD (7) in latch cylinder (12).



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**BACKHOE/CRANE LATCH CYLINDER REPAIR (CONT)**

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**NOTE**

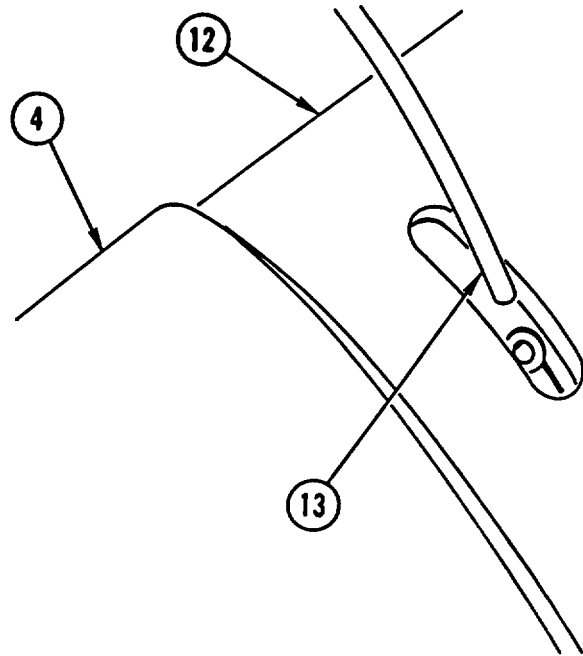
- Lock ring cannot be installed until gland is almost completely tightened.
- When completely tightened, both fitting holes must be in line with each other.

8. WHEN GLAND (4) is ALMOST completely tightened, INSTALL lock RING (13) in hole and COMPLETE TIGHTENING until lock ring (13) snaps into slot on latch cylinder (12).

**NOTE**

Follow-on Maintenance:

Install backhoe latch cylinder (SEE) or crane latch cylinder (HMMH) (TM 5-2420-224-20).



## Section XVIII. HYDRAULIC OIL COOLER REPAIR

### HYDRAULIC OIL COOLER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

##### Materials/Parts:

Washer, Lock (6)

Washer, Lock (6)

Washer, Lock (6)

##### References:

TM 5-2420-224-20

##### Equipment Condition:

##### Reference

TM 5-2420-224-20

TM 5-2420-224-20

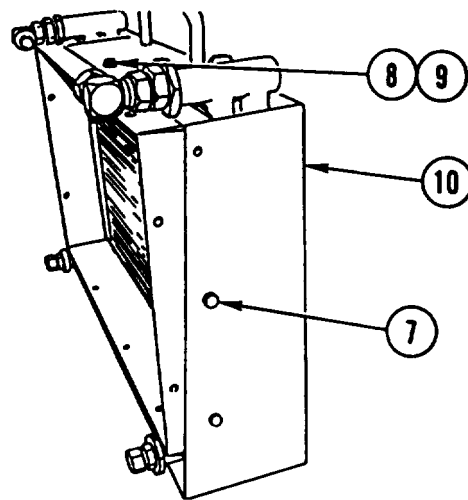
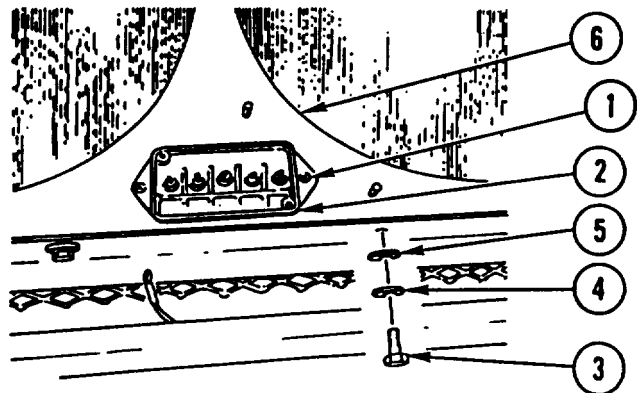
##### Condition Description

Hydraulic Oil Cooler  
Removed

Hydraulic Oil Cooler  
Thermal Switches  
Removed

#### DISASSEMBLY

1. REMOVE FAN IMPELLER (TM 5-2420-224-20).
2. REMOVE two screws (1) and TERMINAL (2).
3. REMOVE 12 screws (3), 12 lock washers (4), 12 washers (5), and PLATE (6). DISCARD lock WASHERS.
4. REMOVE four SCREWS (7).
5. REMOVE screw (8), washer (9), and HOUSING (10).



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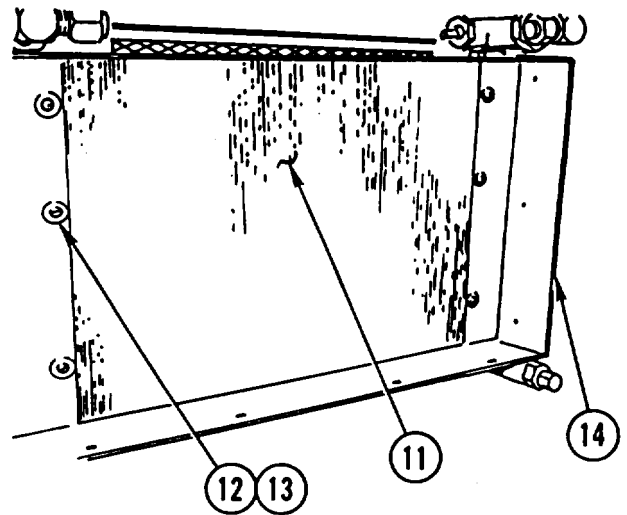
**HYDRAULIC OIL COOLER REPAIR (CONT)**


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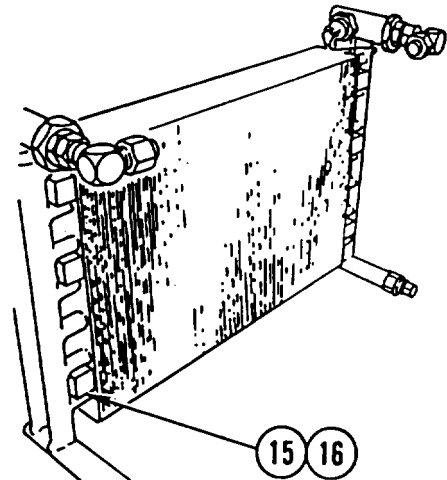
**CAUTION**

Support oil cooler (11) to prevent damage to fins.

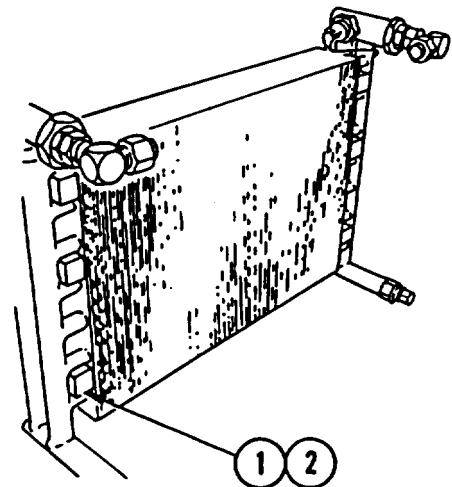
6. REMOVE six SCREWS (12) and six lock washers (13). DISCARD lock WASHERS.
7. REMOVE oil COOLER (11) from housing (14).



8. IF DAMAGED, REMOVE six PLUGS (15) and six tee nuts (16).

**ASSEMBLY**

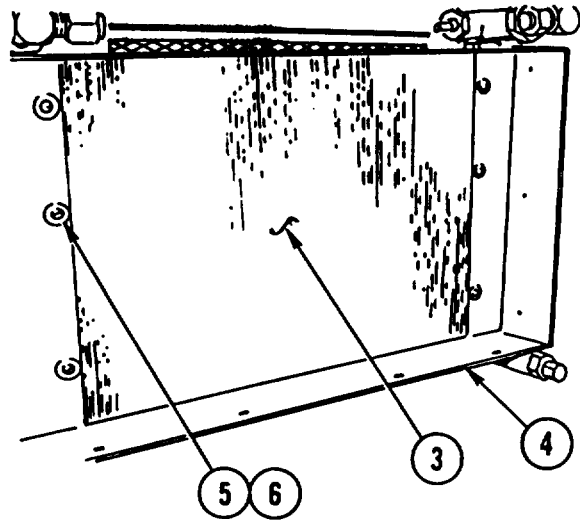
1. IF REMOVED, INSTALL six new tee nuts (1) and six new PLUGS (2).



## HYDRAULIC OIL COOLER REPAIR (CONT)

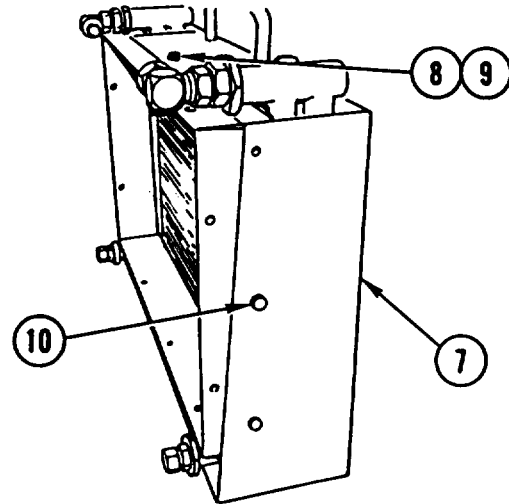
**CAUTION**

Support oil cooler to prevent damage to fins.

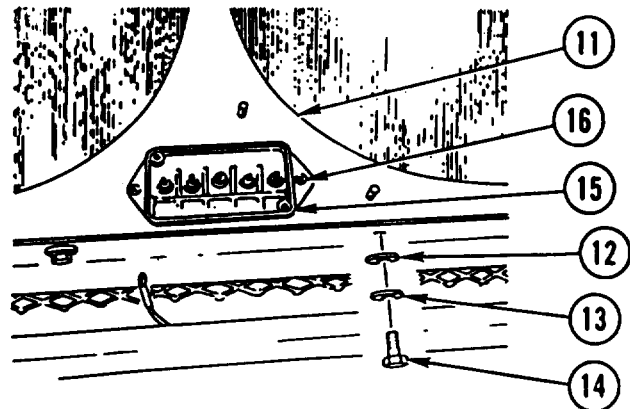


2. INSTALL oil COOLER (3) in housing (4).
3. INSTALL six SCREWS (5) and six new lock washers (6).

4. INSTALL HOUSING (7), screw (8), and washer (9).
5. INSTALL four SCREWS (10).



6. INSTALL PLATE (11), 12 washers (12), 12 new lock washers (13), and 12 screws (14).
7. INSTALL TERMINAL (15) and two screws (16).
8. INSTALL FAN IMPELLER (TM 5-2420-224-20).



**NOTE**

Follow-on Maintenance:

Install hydraulic oil cooler thermal switches (TM 5-2420-224-20).  
Install hydraulic oil cooler (TM 5-2420-224-20).

**Section XIX. CRANE VALVE BANK REPAIR**

**CRANE VALVE BANK REPAIR**

This task covers: a. Disassemble b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Washer, Lock (6)  
 Washer, Lock (2)  
 Kit  
 Kit  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**Equipment Condition:**

Reference	Condition Description
Page 11-24	Crane Valve Bank Removed

**General Safety Instructions:**

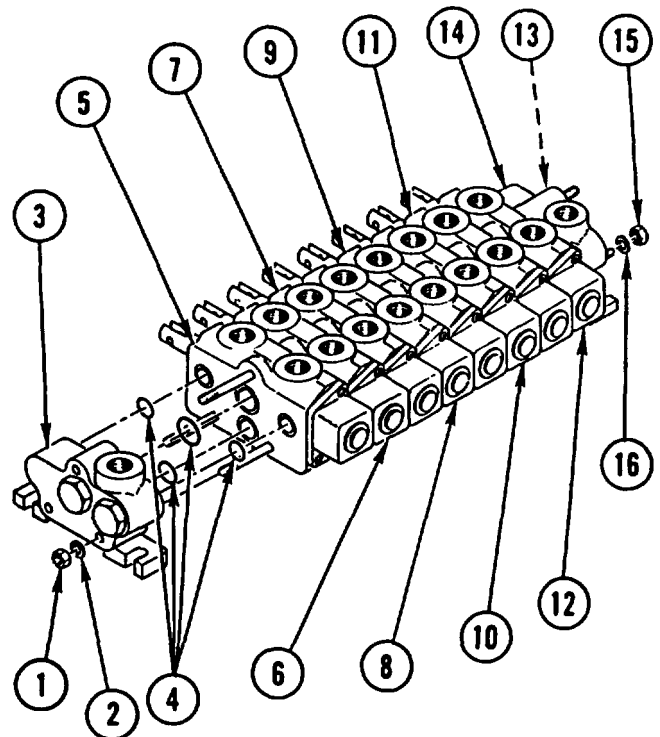
**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

**CRANE VALVE BANK**

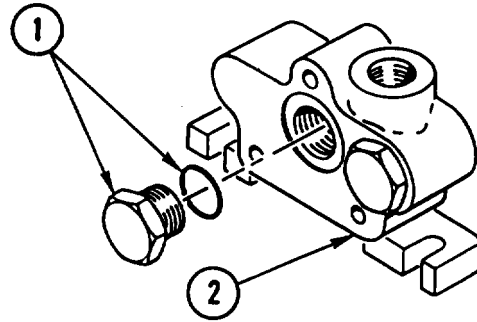
1. REMOVE three nuts (1), three lock washers (2), and outlet MANIFOLD (3). DISCARD lock WASHERS.
2. REMOVE four packings (4) and tilt valve SECTION (5). DISCARD PACKINGS.
3. REPEAT STEP 2 for these valve sections: right outrigger (6), left outrigger (7), horizontal (8), extension (9), outer boom (10), inner boom (11), and rotator (12).
4. REMOVE four packings (13) and inlet MANIFOLD (14). DISCARD PACKINGS.
5. REMOVE three NUTS (15) and three lock washers (16) from three tie rods (17). DISCARD lock WASHERS.



## CRANE VALVE BANK REPAIR (CONT)

### Outlet Manifold Disassembly

REMOVE and DISCARD two PLUG (1 and 2).



### Outlet Manifold Assembly

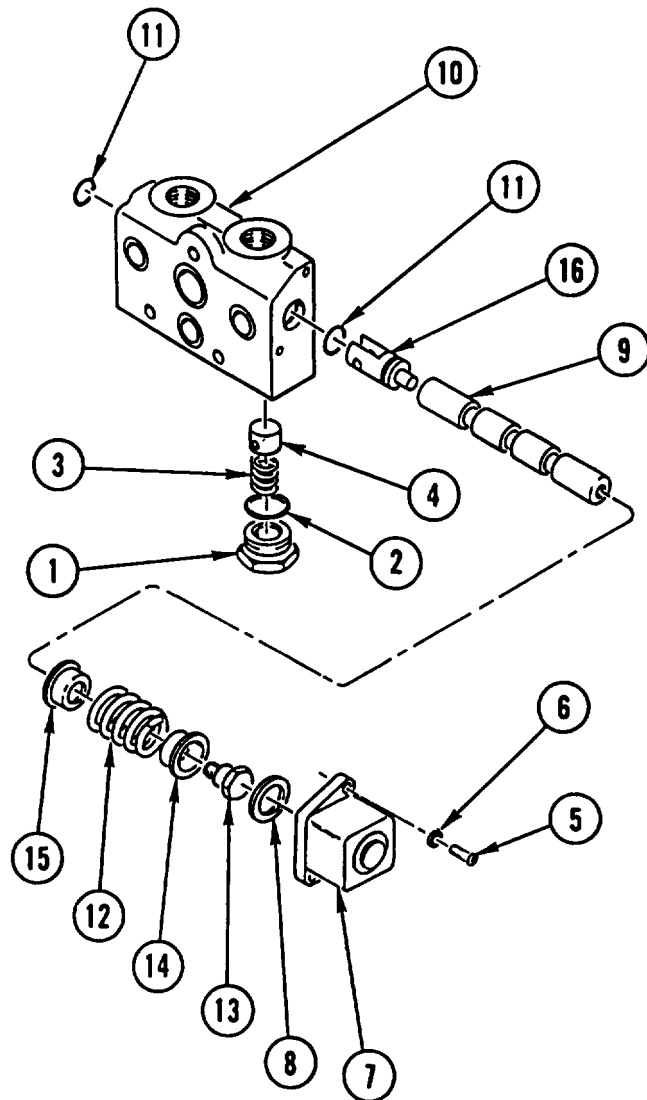
INSTALL two new PLUGS (1 and 2).

### Valve Section Disassembly

#### NOTE

Procedure is the same for all eight valve sections.

1. REMOVE plug (1), packing (2), spring (3), and PISTON (4). DISCARD PACKING.
2. REMOVE two screws (5), two lock washers (6), and RETAINER (7). DISCARD LOCK WASHERS.
3. REMOVE SPACER (8) from retainer (7).
4. REMOVE SPOOL (9) from body (10).
5. REMOVE and DISCARD two O-RINGS (11).
6. COMPRESS SPRING (12) and REMOVE SCREW (13).
7. CAREFULLY RELEASE SPRING (12) and REMOVE holder (14), SPRING (12), and holder (15).
8. REMOVE STEM (16).



## CRANE VALVE BANK REPAIR (CONT)

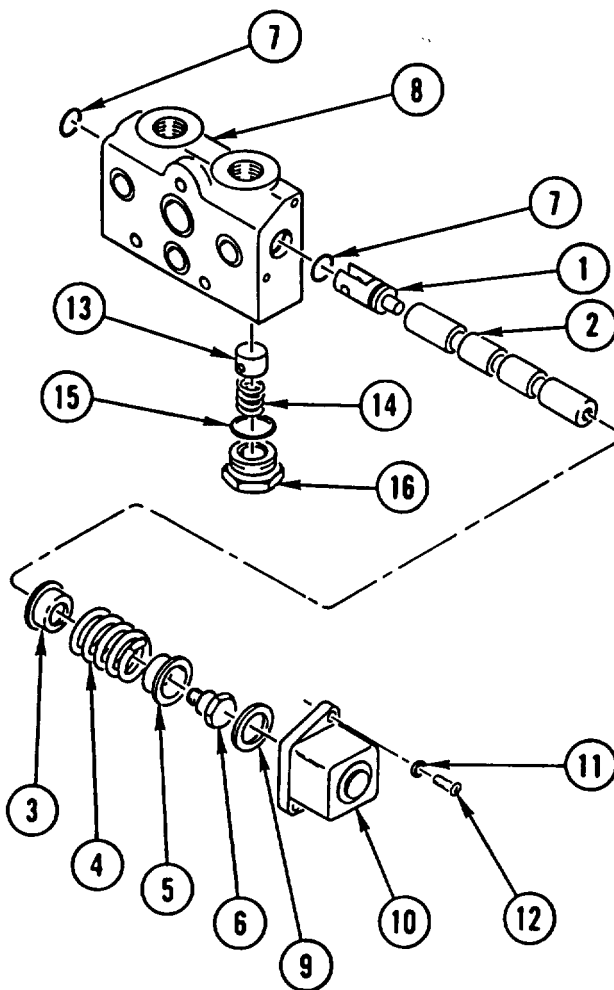
### Valve Section Assembly

**NOTE**

Procedure is the same for all eight valve sections.

Apply coat of lubricating oil to packing and O-rings prior to assembly.

1. INSTALL STEM (1) on spool (2).
2. INSTALL holder (3), SPRING (4), and holder (5).
3. COMPRESS SPRING (4) and INSTALL SCREW (6).
4. INSTALL two new O-RINGS (7) in body (8).
5. INSTALL SPOOL (2) in body (8).
6. INSTALL SPACER (9) in retainer (10).
7. INSTALL RETAINER (10), two new lock washers (11), and two screws (12).
8. INSTALL PISTON (13), Spring (14), new packing (15), and plug (16).



### Inlet Manifold Disassembly

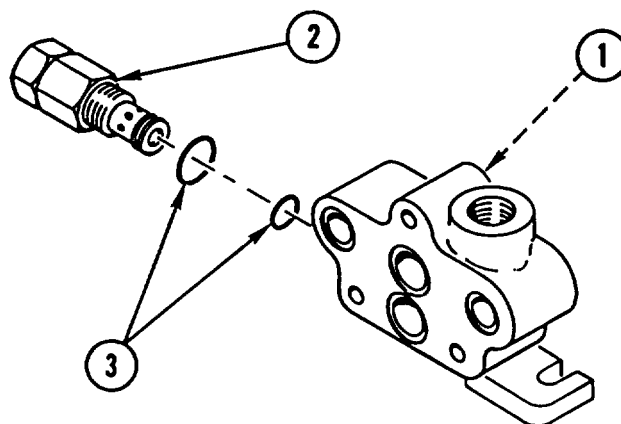
1. REMOVE PLUG (1).
2. REMOVE safety relief VALVE (2) and two packings (3). DISCARD PACKINGS.

### Inlet Manifold Assembly

**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL two new packings (3) and safety relief VALVE (2).
2. INSTALL PLUG (1).

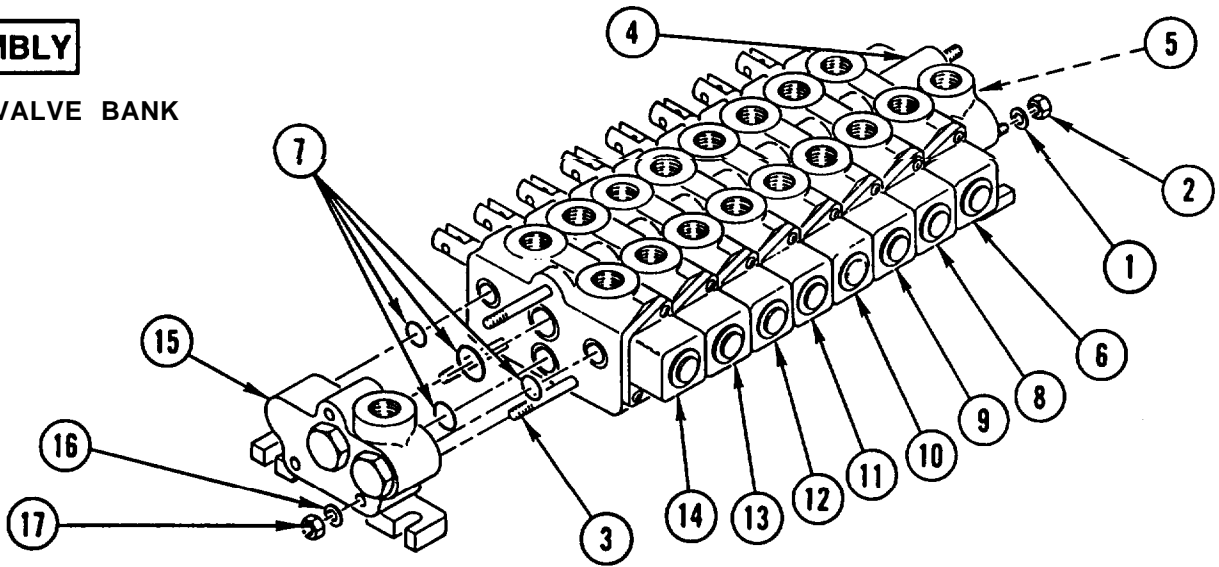




**CRANE VALVE BANK REPAIR (CONT)**

**ASSEMBLY**

**CRANE VALVE BANK**



**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL three new lock washers (1) and three NUTS (2) on three tie rods (3).

**CAUTION**

All packings between valve sections must be replaced any time the tie rod nuts are loosened or removed. Failure to do so may result in hydraulic fluid leaks and/or equipment damage.

2. INSTALL inlet MANIFOLD (4) and four new packings (5).

**NOTE**

Procedure is the same for all eight valve sections.

3. INSTALL rotator valve SECTION (6) and four new packings (7).
4. REPEAT STEP 3 for these valve sections: inner boom (8), outer boom (9), extension (10), horizontal (11), left outrigger (12), right outrigger (13), and tilt (14).
5. INSTALL outlet MANIFOLD (15).

**NOTE**

Before tightening nuts, make sure equal amount of threads are exposed on both ends of crane valve bank.

6. INSTALL three new lock washers (16) and three NUTS (17).

**NOTE**

Follow-on Maintenance:  
Install crane valve bank (page 11-24).

**Section XX. FORKLIFT MAST ASSEMBLY REPAIR**

---

**FORKLIFT MAST ASSEMBLY REPAIR**

---

This task covers: a. Disassembly b. Assembly

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Washer, Lock (2)

Nut, Lock

Washer, Lock (2)

Washer, Lock (2)

Washer, Lock (2)

Washer, Lock (6)

Washer, Lock (4)

Washer, Lock (2)

Washer, Lock (2)

Washer, Lock (4)

Washer, Lock (2)

Personnel Required: (2)

**Equipment Condition:**

**Reference**

Page 11-40

**Condition Description**

Forklift Mast Assembly  
 Removed

**General Safety Instructions:**

**WARNING**

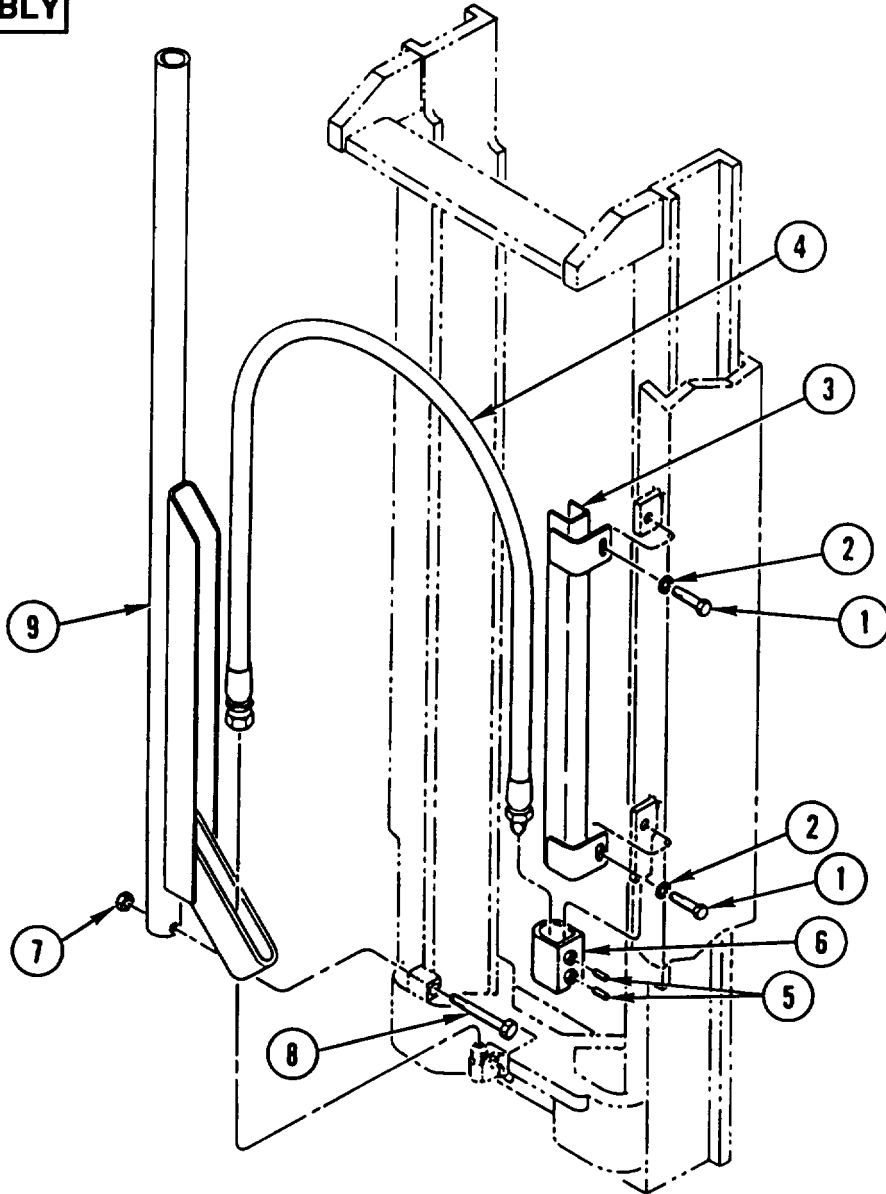
- Forklift rail upright weighs 172 pounds (78 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift rail upright.
- Forklift upright weighs 196 pounds (89 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift upright.
- Forklift mast assembly weighs 587 pounds (267 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forklift mast assembly.

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

---

**DISASSEMBLY**



1. REMOVE two cap screws (1), two lock washers (2), and GUIDE (3). DISCARD lock WASHERS.

**NOTE**

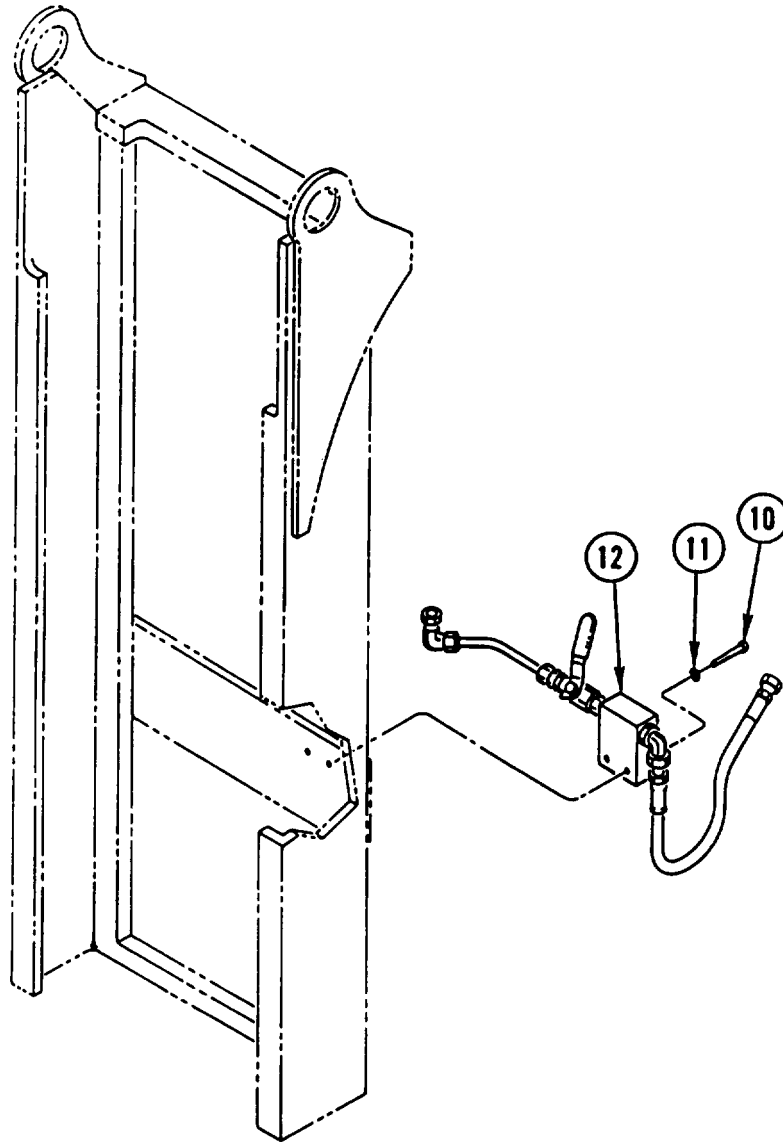
Tag all lines prior to disconnecting to aid in connecting.

2. DISCONNECT HOSE assembly (4).
3. REMOVE two setscrews (5) and CLAMP (6) from hose assembly (4).
4. REMOVE lock nut (7), cap screw (8), and GUIDE (9). DISCARD lock NUT.

---

**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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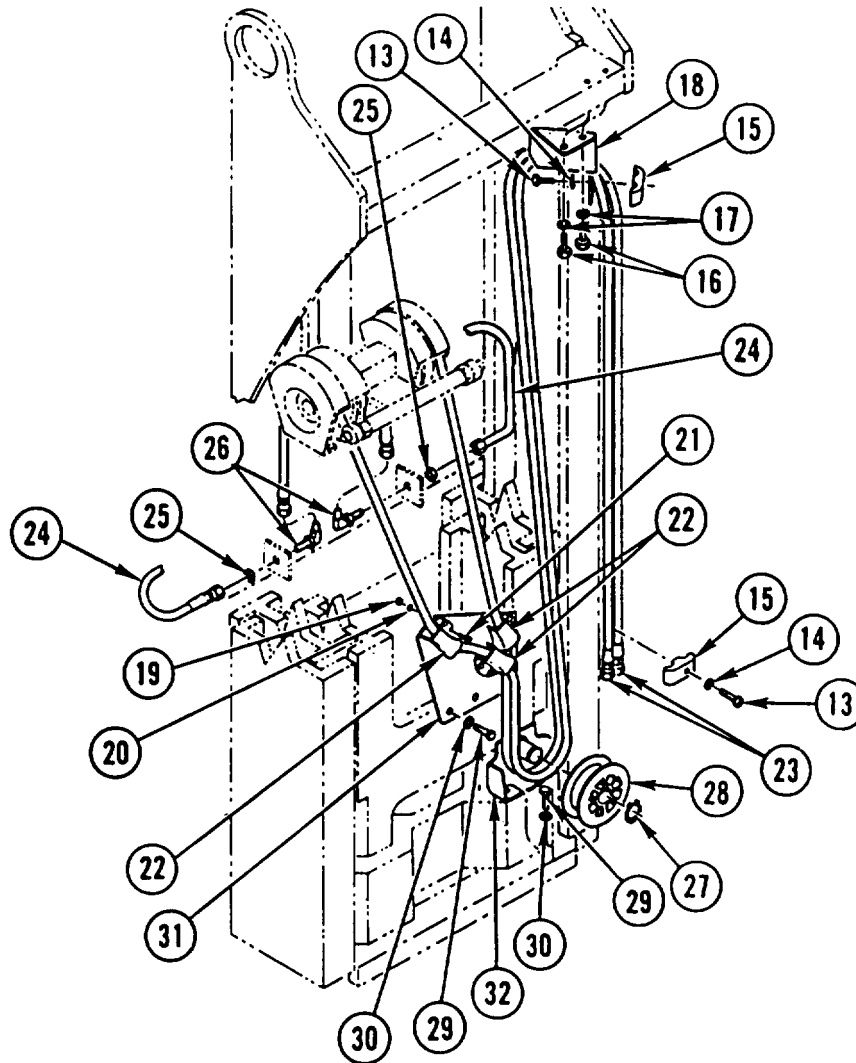


5. REMOVE two capscrews (10), two lock washers (11), and junction BLOCK (12). DISCARD lock WASHERS.

---

**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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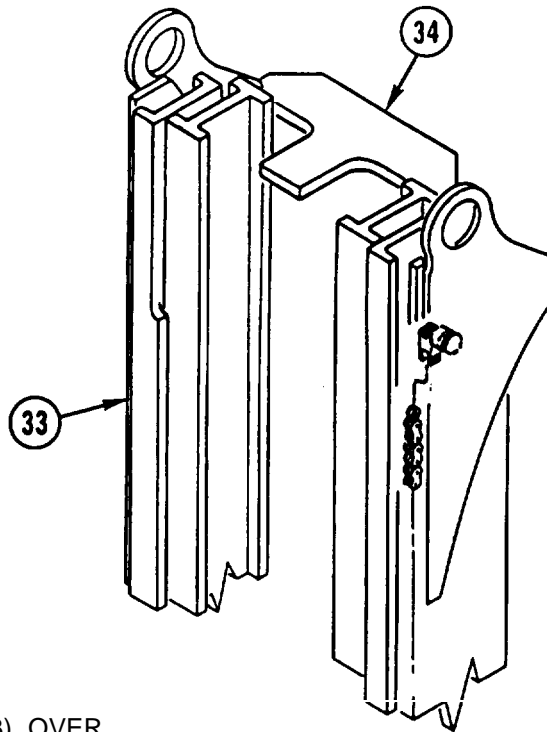


6. REMOVE two capscrews (13), two lock washers (14), and two CLAMPS (15). DISCARD lock WASHERS.
7. REMOVE two capscrews (16), two lock washers (17), and BRACKET (18). DISCARD lock WASHERS.
8. REMOVE six nuts (19), six lock washers (20), six capscrews (21), and three GUIDES (22). DISCARD lock WASHERS.
9. DISCONNECT and REMOVE two HOSES (23).
10. DISCONNECT and REMOVE two HOSES (24).
11. REMOVE two nuts (25) and two ELBOWS (26).
12. REMOVE retaining ring (27) and PULLEY (28).
13. REMOVE four capscrews (29), four lock washers (30), and two BRACKETS (31 and 32). DISCARD lock WASHERS.

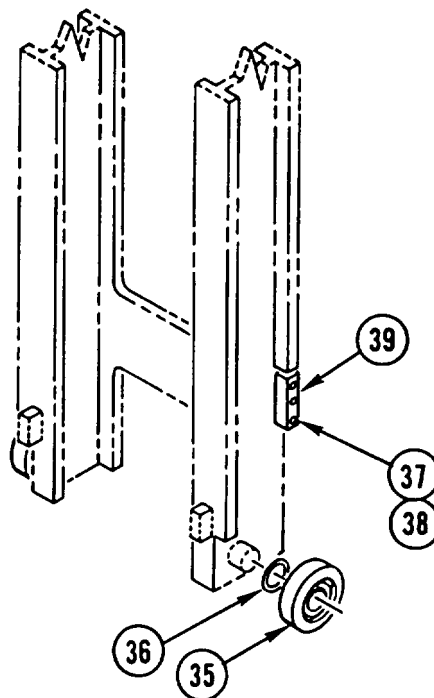
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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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14. TURN MAST assembly (33) OVER.
15. REMOVE rail UPRIGHT (34) from mast assembly (33).

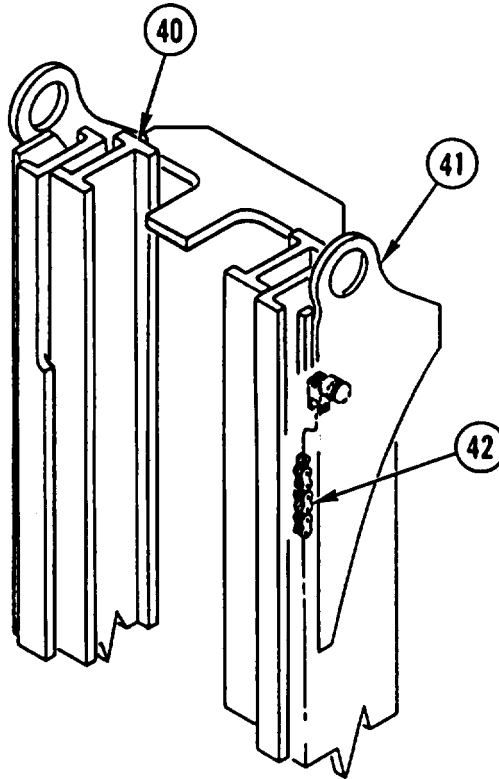


16. REMOVE two load BEARINGS (35) and spacer(s) (36).
17. REMOVE two cap screws (37), two lock washers (38), and BLOCK (39). DISCARD lock WASHERS.

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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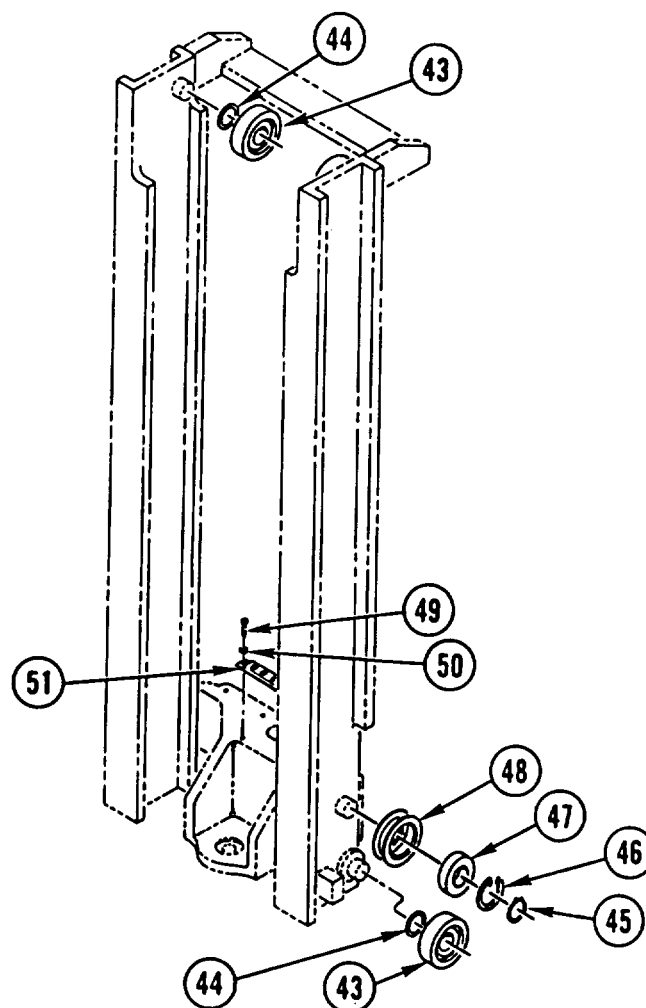


18. REMOVE UPRIGHT (40) from outer upright (41).
19. REMOVE FORKLIFT BOOTSTRAP CHAIN (42) (page 11-57).

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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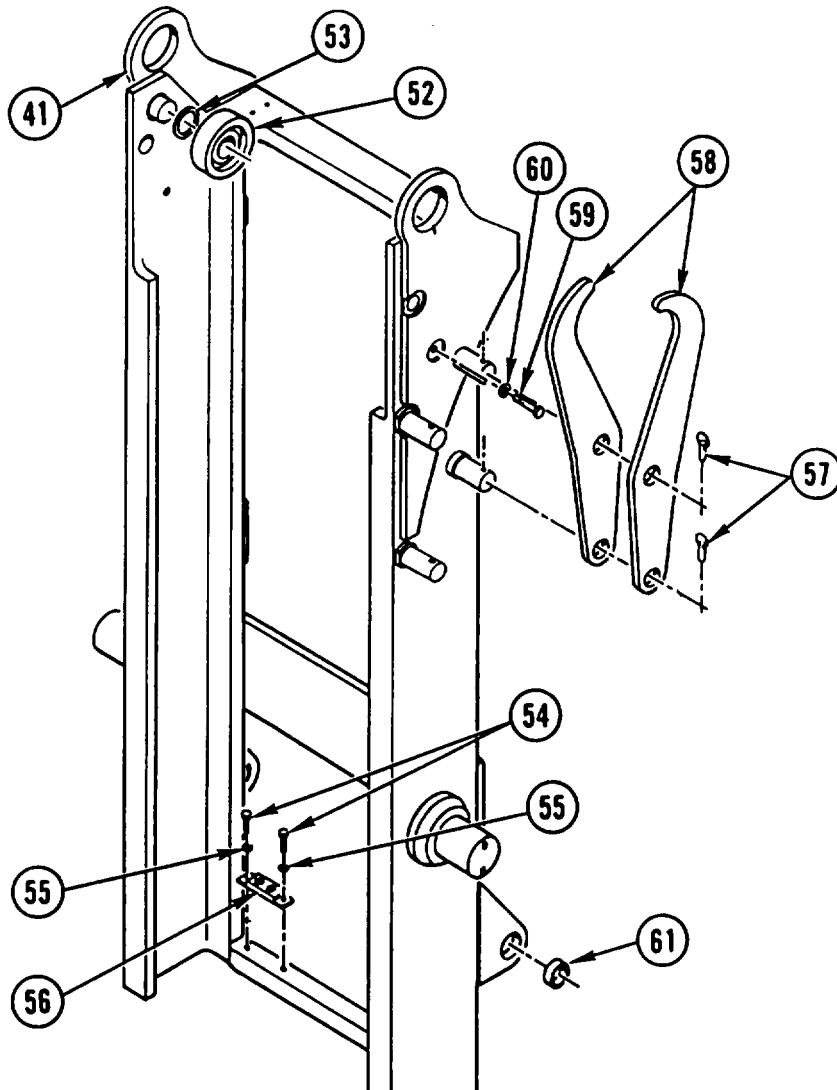
20. REMOVE four load BEARINGS (43) and spacer(s) (44).
21. REMOVE two retaining rings (45), two bearings (46), two outer TIRES (47), and two PULLEYS (48).
22. REMOVE two screws (49), two lock washers (50), and CUSHION (51). DISCARD lock WASHERS.



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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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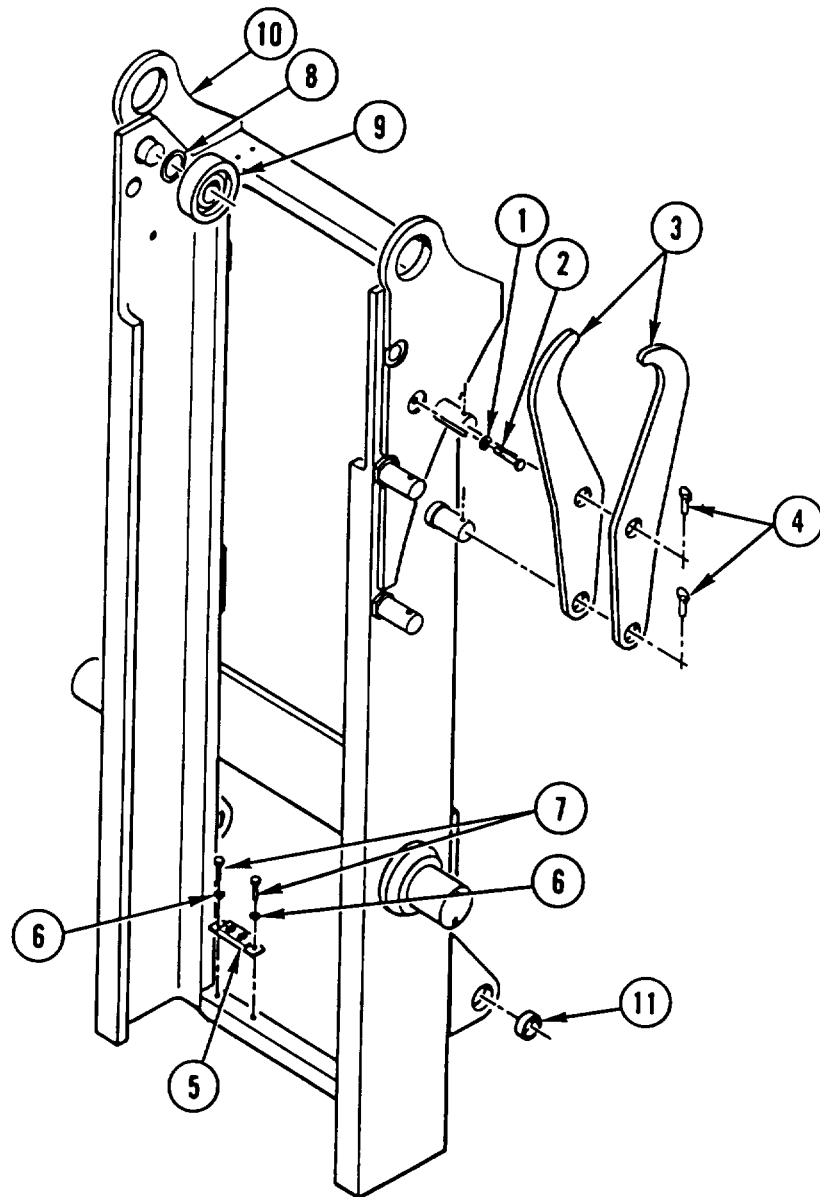


23. REMOVE two load ROLLER assemblies (52) and shim(s) (53) from outer upright (41).
24. REMOVE four screws (54), four lock washers (55), and two CUSHIONS (56). DISCARD lock WASHERS.
25. REMOVE two quick-release pins (57) and two PLATES (58).
26. REMOVE two CAPSCREWS (59) and two lock washers (60). DISCARD lock WASHERS.
27. REMOVE two BUSHINGS (61).

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**


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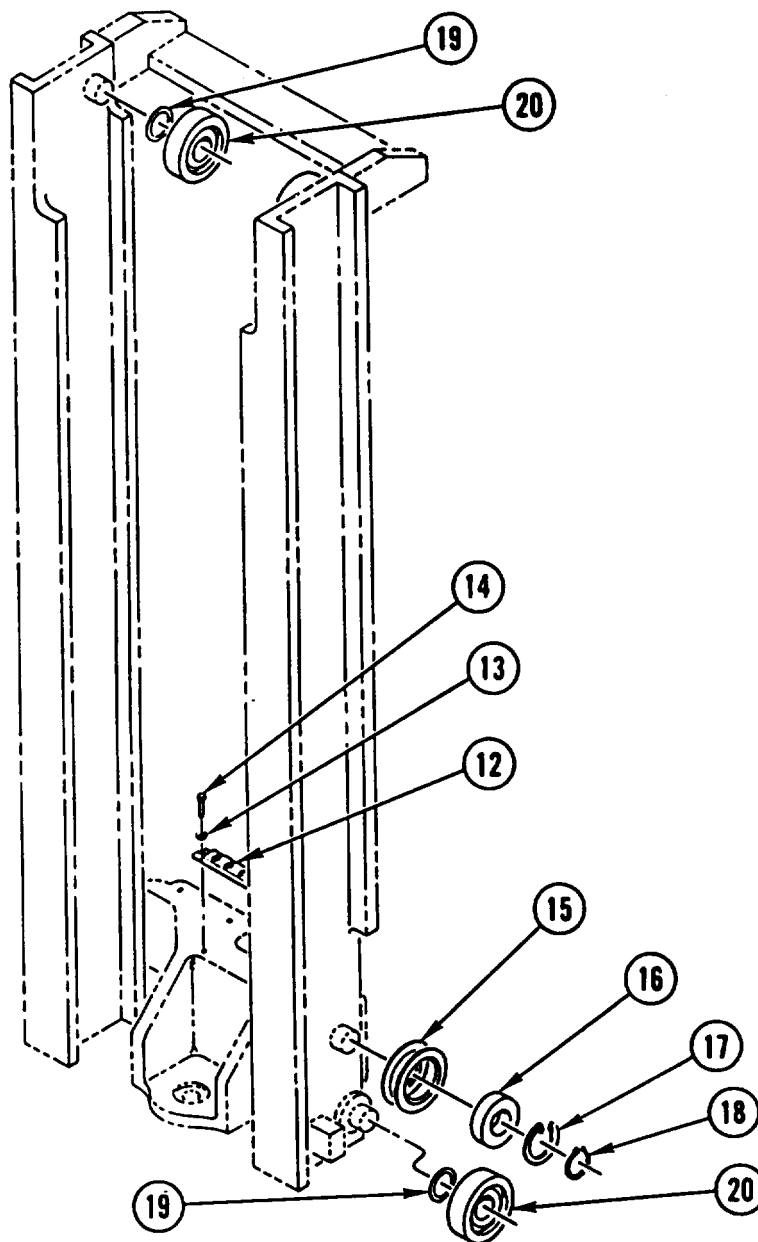
**ASSEMBLY**


1. INSTALL two new lock washers (1) and two CAPSCREWS (2).
2. INSTALL two PLATES (3) and two quick-release pins (4).
3. INSTALL two CUSHIONS (5), four new lock washers (6), and four screws (7).
4. INSTALL shim(s) (8) and two load ROLLER assemblies (9) on outer upright (10).
5. INSTALL two BUSHINGS (11).

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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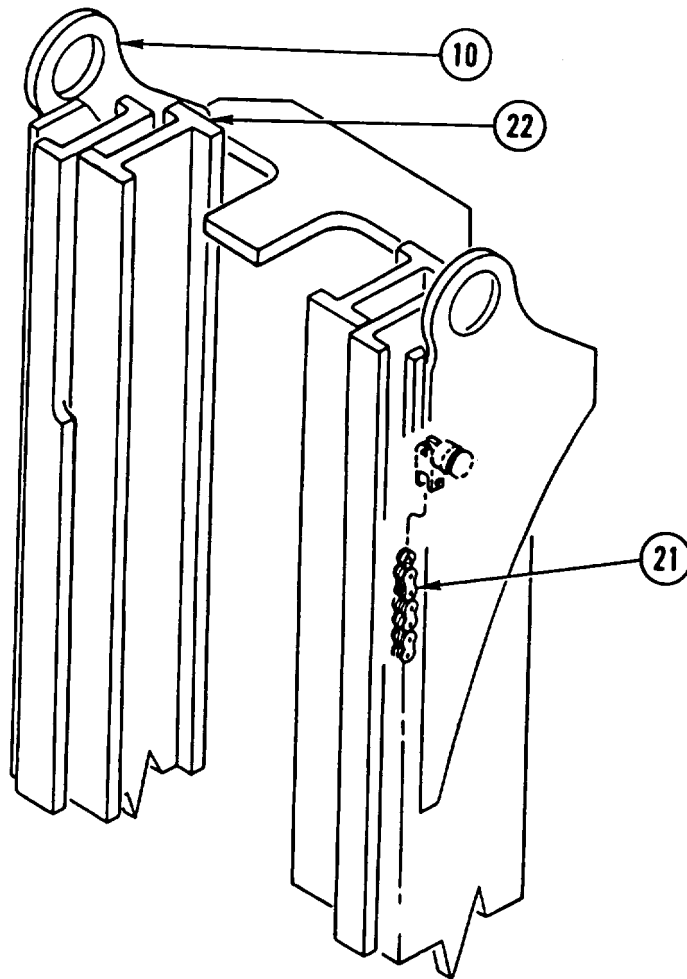


6. INSTALL CUSHION (12), two new lock washers (13), and two screws (14).
7. INSTALL two PULLEYS (15), two outer TIRES (16), two bearings (17), and two retaining rings (18).
8. INSTALL spacer(s) (19) and four load BEARINGS (20).

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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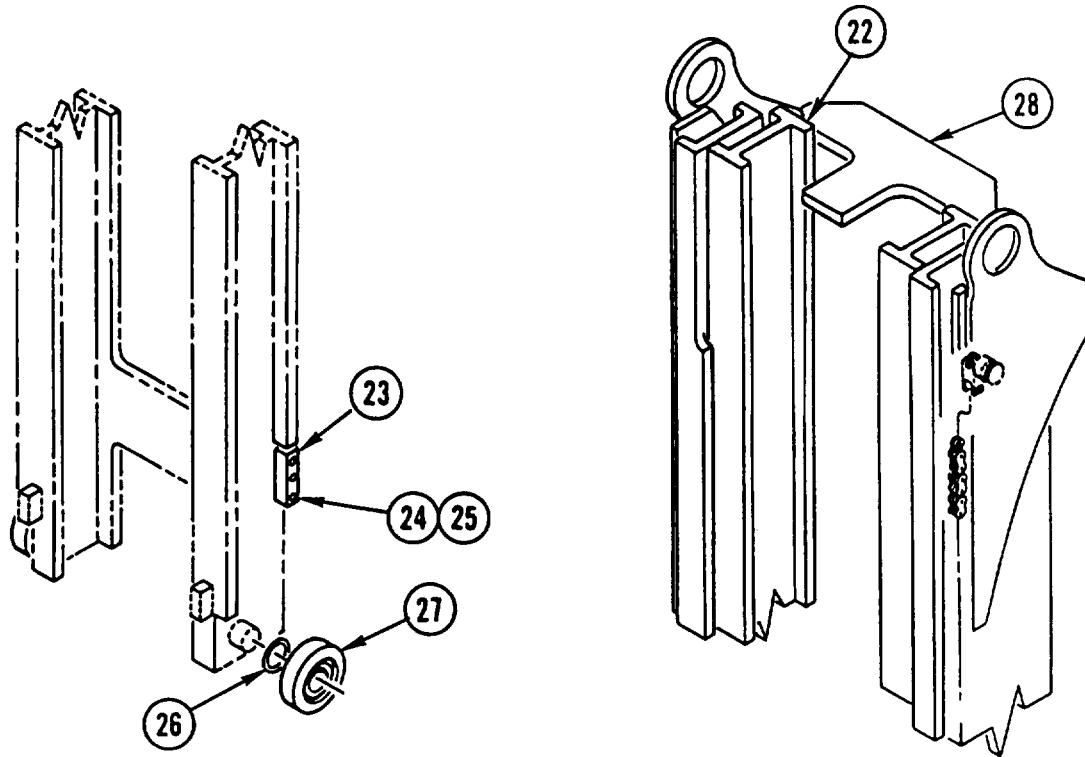


9. INSTALL FORKLIFT BOOTSTRAP CHAIN (21) (page 11-57).
10. INSTALL UPRIGHT (22) in outer upright (10).

---

**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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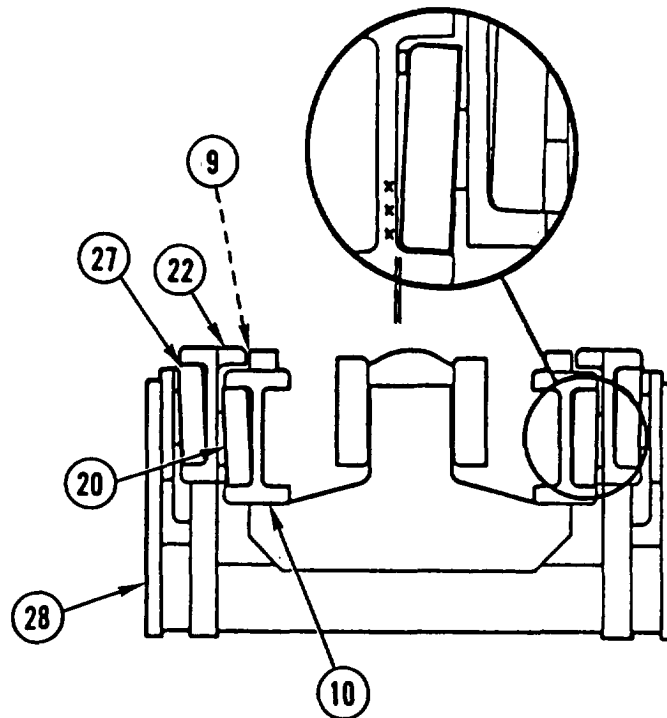


11. INSTALL BLOCK (23), two new lock washers (24), and two capscrews (25).
12. INSTALL spacer(s) (26) and two load BEARINGS (27).
13. INSTALL rail UPRIGHT (28) in upright (22).

---

**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**


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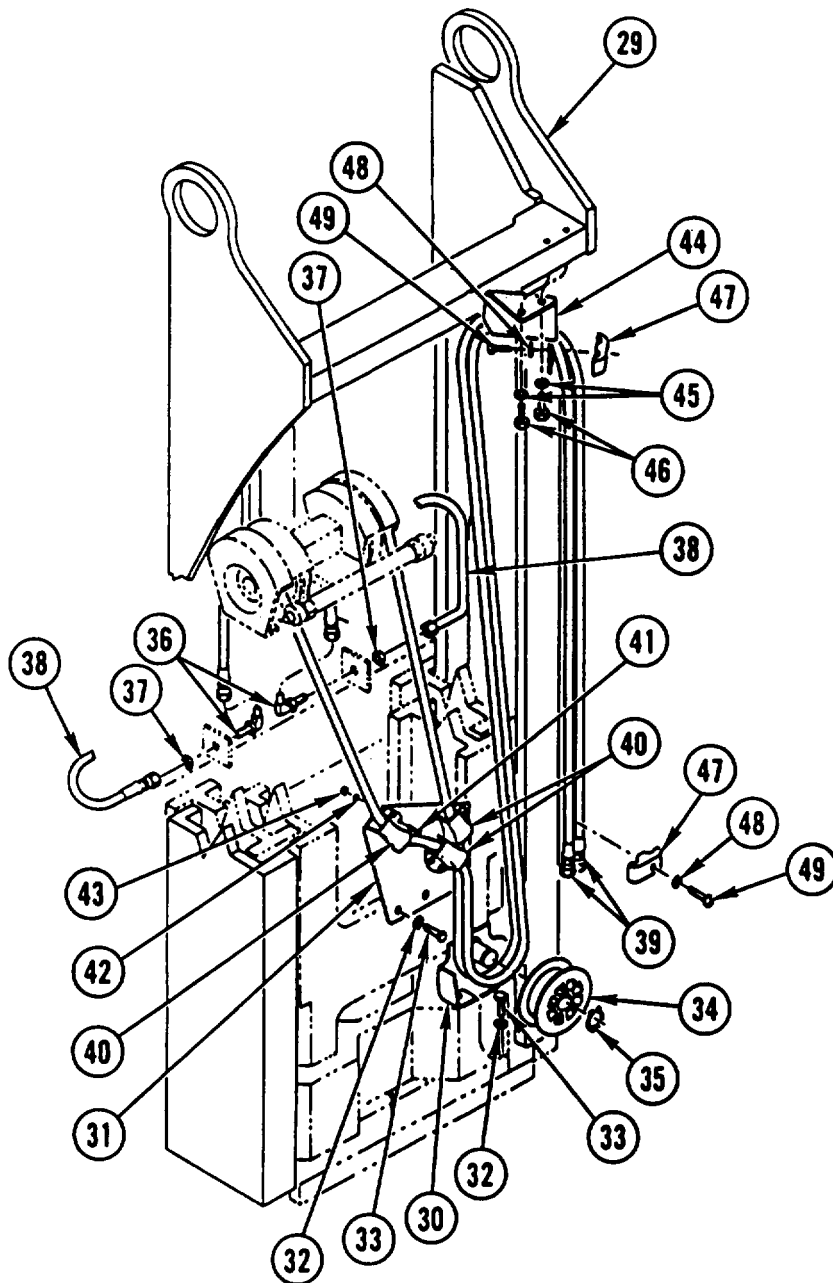


14. CHECK CLEARANCE between load roller (9), bearings (20 and 27), and channels of uprights (10, 22, and 28) by PRYING BETWEEN upright and load roller or bearing so that opposite load roller or bearing is tight against upright. MEASURE CLEARANCE between load roller or bearing and upright. Clearance should be 0.030 in. (0.076 cm).
15. IF CLEARANCE is GREATER than 0.030 in. (0.076 cm), REPEAT APPROPRIATE Disassembly steps for load roller or bearing being measured and ADD SHIM(S) or SPACER(S) as required to achieve 0.030 in. (0.076 cm) clearance; perform appropriate Assembly steps and repeat clearance check.
16. IF CLEARANCE is LESS than 0.030 in. (0.076 cm), REPEAT APPROPRIATE Disassembly steps for load roller or bearing being measured and REMOVE SHIM(S) or SPACER(S) as required to achieve 0.030 in. (0.076 cm) clearance; perform appropriate Assembly steps and repeat clearance check.
17. REPEAT STEPS 14 thru 16 for each load roller or bearing.

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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

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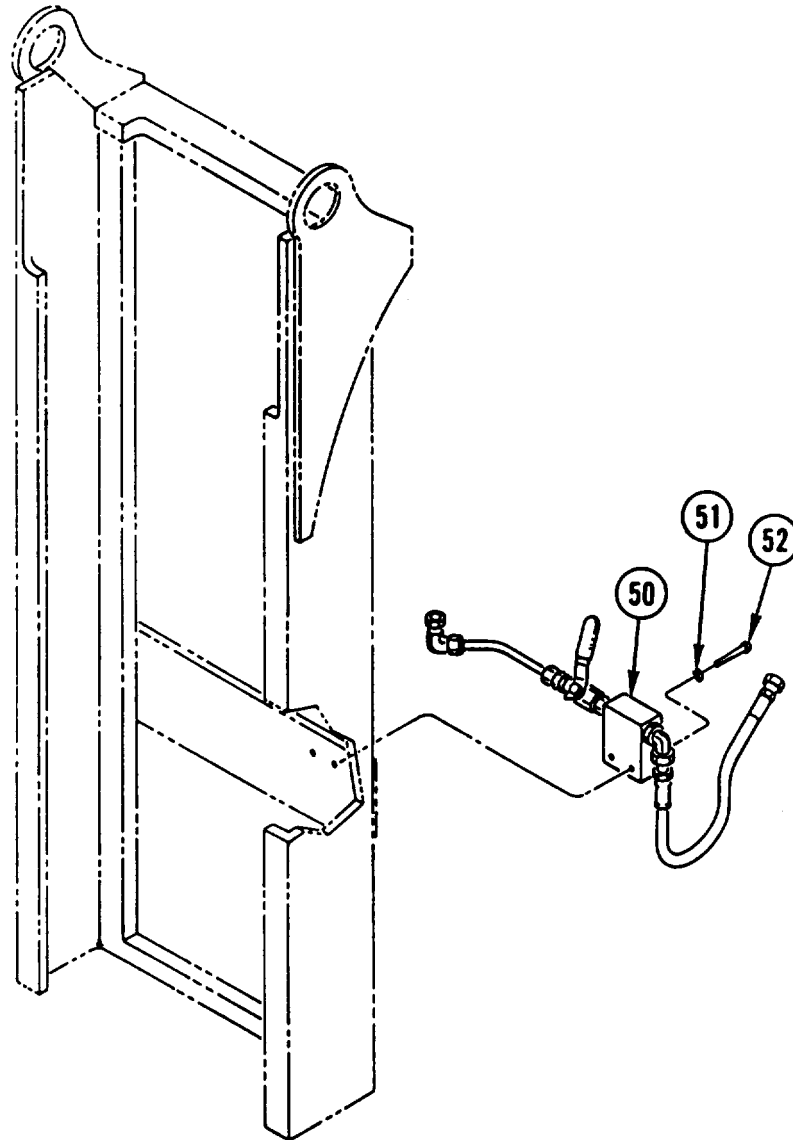
18. TURN MAST assembly (29) OVER.
19. INSTALL two BRACKETS (30 and 31), four new lock washers (32), and four capscrews (33).
20. INSTALL PULLEY (34) and retaining ring (35).
21. INSTALL two ELBOWS (36) and two nuts (37).
22. INSTALL and CONNECT two HOSES (38).
23. INSTALL and CONNECT two HOSES (39).

---

**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

---

24. INSTALL three GUIDES (40), six capscrews (41), six new lock washers (42), and six nuts (43).
25. INSTALL BRACKET (44), two new lock washers (45), and two capscrews (46).
26. INSTALL two CLAMPS (47), two new lock washers (46), and two capscrews (49).



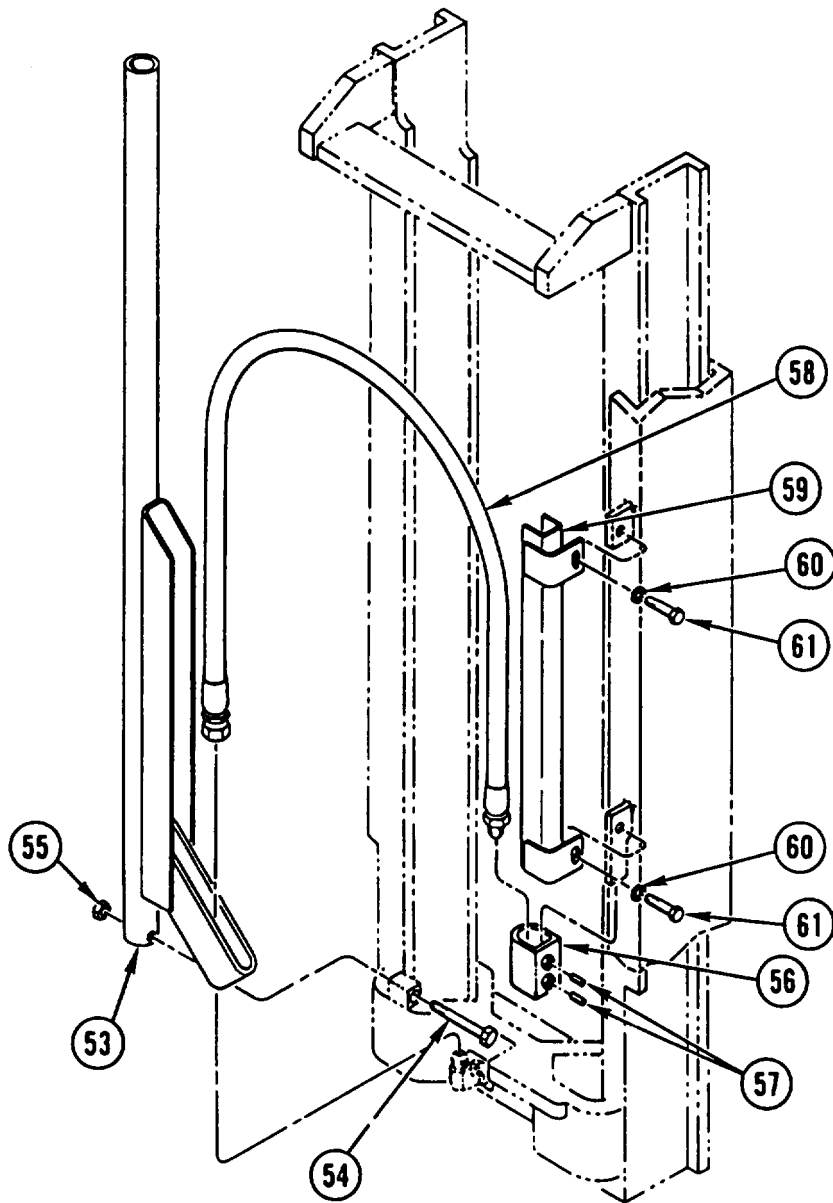
27. INSTALL junction BLOCK (50), two new lock washers (51), and two capscrews (52).



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**FORKLIFT MAST ASSEMBLY REPAIR (CONT)**

---



- 28. INSTALL GUIDE (53), capscrew (54), and new lock nut (55).
- 29. INSTALL CLAMP (56) and two setscrews (57) on hose assembly (58).
- 30. CONNECT HOSE assembly (58).
- 31. INSTALL GUIDE (59), two new lock washers (60), and two capscrews (61).

**NOTE**

Follow-on Maintenance:

- Install forklift mast assembly (page 11-40).
- Bleed forklift lift cylinder (page 11-51).
- Sequence forklift lift cylinder (page 11-51).

**Section XXI. FORKLIFT CARRIAGE ASSEMBLY REPAIR**

---

**FORKLIFT CARRIAGE ASSEMBLY REPAIR**

---

This task covers: a. Disassembly b. Inspection c. Assembly

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

- Screw, Lock (8)
- Pin, Cotter (2)
- Pin, Cotter (2)
- Seal (2)
- Adhesive, Rubber                      Appendix B, item 4
- Compound, Sealing                    Appendix B, Item 15
- Oil, Lubricating                        Appendix B, item 30

**Personnel Required:** (2)

References:

TM 5-2420-224-20  
 TM 9-214

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Forklift Rotator Removed
TM 5-2420-224-20	Forklift Rotator Cylinder Removed

**General Safety Instructions:**

**WARNING**

- Forklift rotator assembly weighs 356 pounds (162 kilograms). To avoid personal injury, use a hoist or suitable lifting device when lifting forkiift rotator assembly.
- 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.

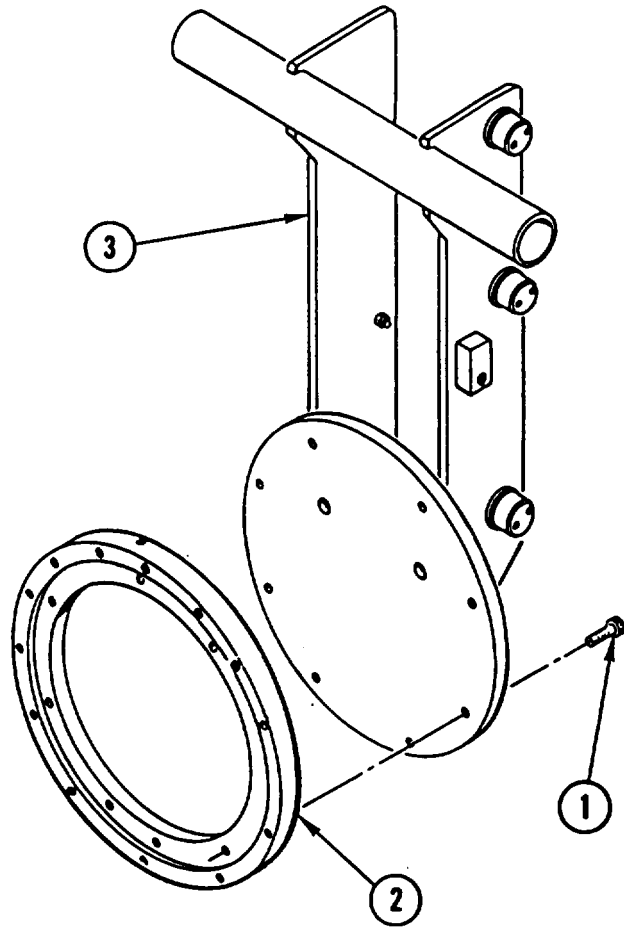
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**FORKLIFT CARRIAGE ASSEMBLY REPAIR (CONT)**

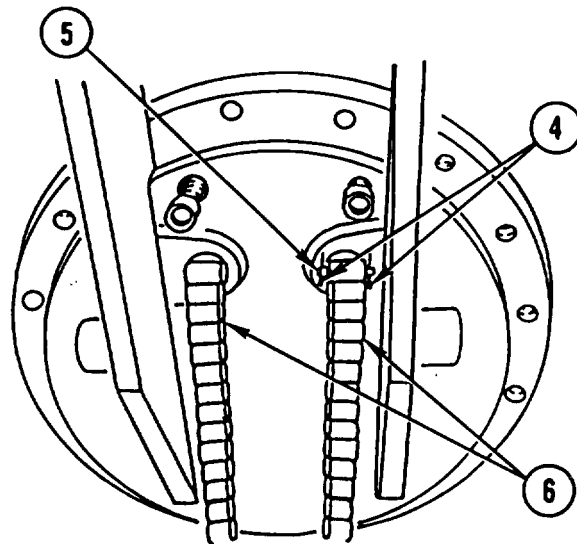
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**DISASSEMBLY**

1. REMOVE eight lock screws (1) and BEARING assembly (2) from carriage (3). DISCARD lock SCREWS.



2. REMOVE four cotter pins (4), two pins (5), and two CHAINS (6). DISCARD cotter PINS.



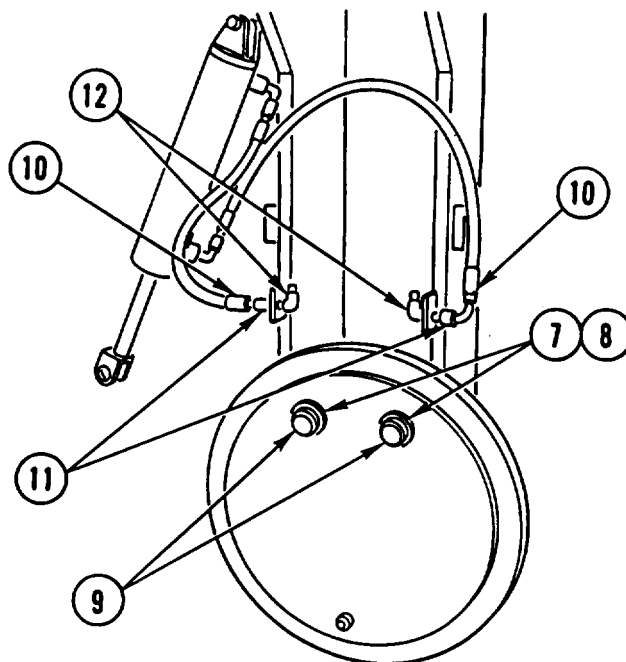
**FORKLIFT CARRIAGE ASSEMBLY REPAIR (CONT)**

3. REMOVE two retaining rings (7), two spacers (8), and two chain anchor STAKES (9).

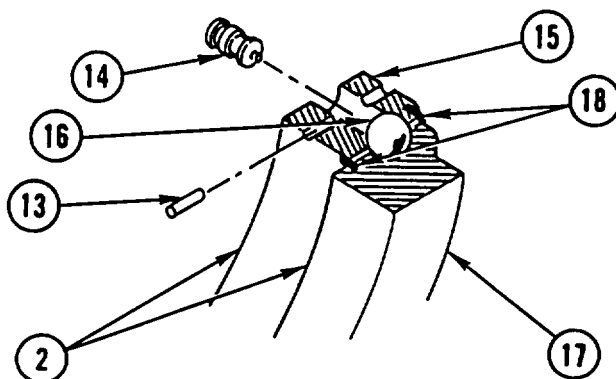
**NOTE**

Tag lines prior to removal to aid in installation.

4. REMOVE two HOSE assemblies (10).
5. REMOVE two nuts (11) and two ELBOWS (12).



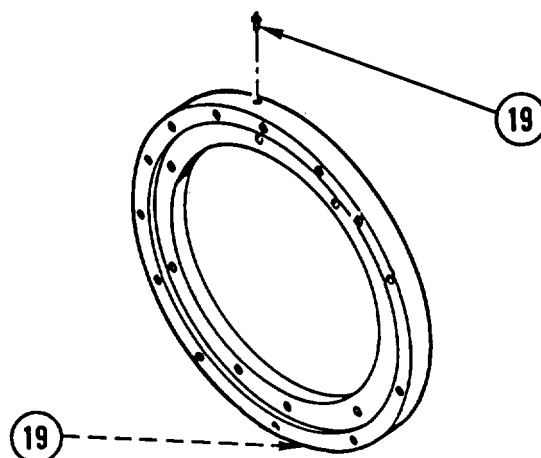
6. REMOVE pin (13) and PLUG (14).
7. HOLD BEARING assembly (2) on its SIDE with plug (14) hole on top, ROTATE inner RACE (15), and REMOVE 63 BALLS (16).
8. REMOVE inner RACE (15) from outer race (17).
9. REMOVE and DISCARD two SEALS (18).



10. IF DAMAGED, REMOVE two lubrication FITTINGS (19).

**INSPECTION**

Inspect bearings (TM 9-214).



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**FORKLIFT CARRIAGE ASSEMBLY REPAIR (CONT)**

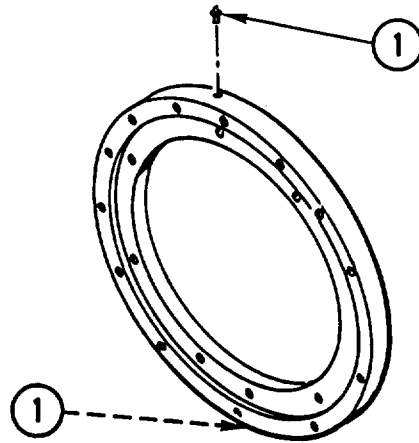
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**ASSEMBLY**

**NOTE**

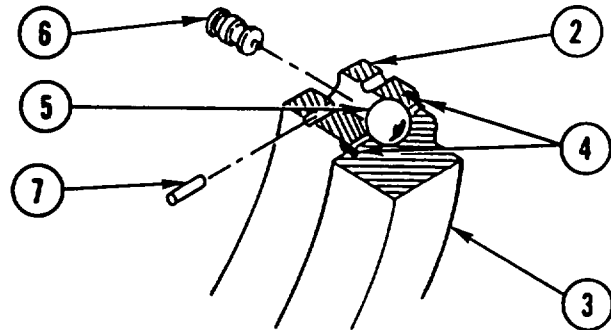
Apply coat of lubricating oil to seals prior to assembly.

1. IF REMOVED, INSTALL two new lubrication FITTINGS (1).
2. APPLY COAT of RUBBER ADHESIVE to GROOVES of inner race (2) and outer race (3).
3. INSTALL two new SEALS (4).

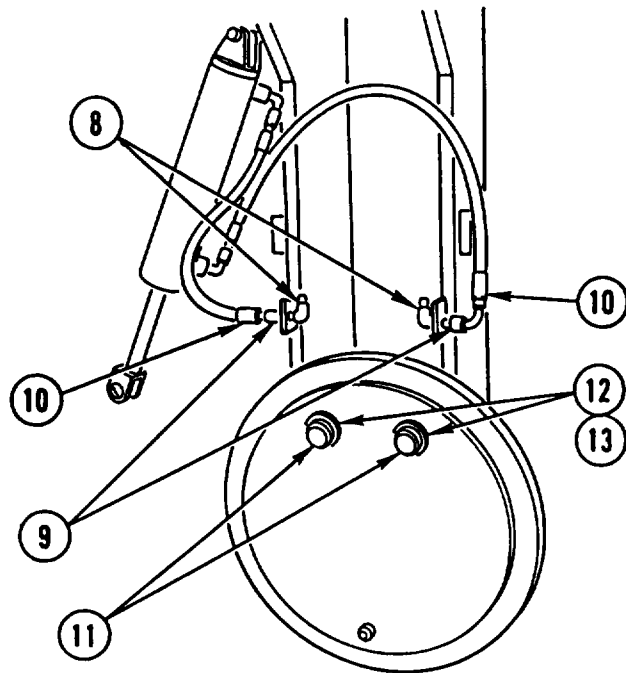


**CAUTION**  
 Allow adhesive to set up for 1 hour before assembling inner and outer races. Failure to do so may cause seals to fail.

4. INSTALL inner RACE (2) in outer race (3).
5. INSTALL 63 BALLS (5).
6. INSTALL PLUG (6) and pin (7).



7. INSTALL two ELBOWS (8) and two nuts (9).
8. INSTALL two HOSE assemblies (10).
9. INSTALL two chain anchor STAKES (11), two spacers (12), and two retaining rings (13).

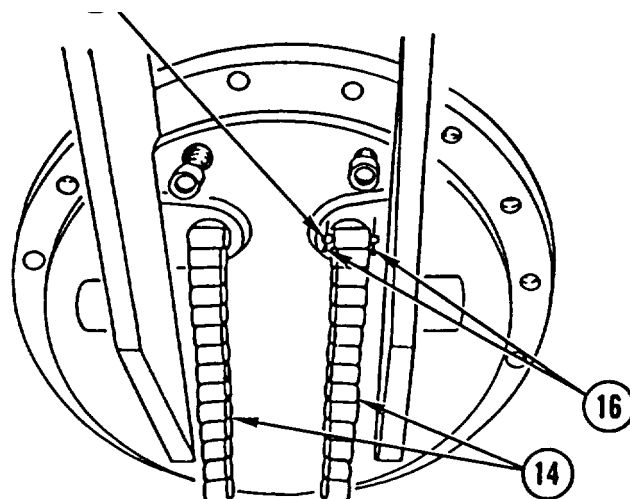


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**FORKLIFT CARRIAGE ASSEMBLY REPAIR (CONT)**


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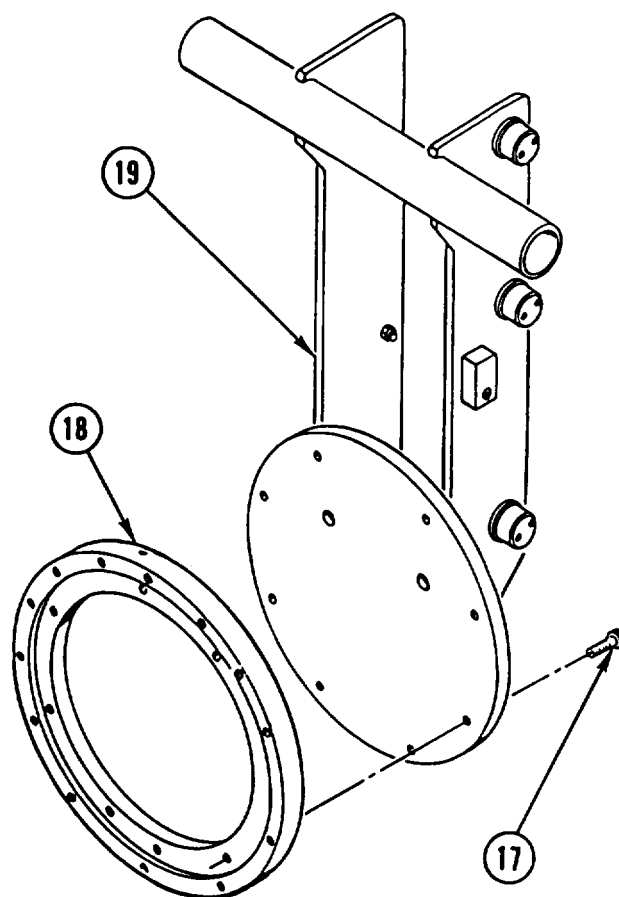
10. INSTALL two CHAINS (14), two pins (15), and four new cotter pins (16).



11. APPLY COAT of SEALING COMPOUND to THREADS of eight new lock screws (17). INSTALL BEARING assembly (18) and eight lock screws (17) on carriage (19). TIGHTEN lock SCREWS in crisscross pattern to 43-46 lb-ft (60-66 N.m).

**NOTE**

Follow-on Maintenance:  
 Install forklift rotator cylinder (TM 5-2420-224-20).  
 Install forklift rotator (TM 5-2420-224-20).



Section XXII. FORKLIFT VALVE REPAIR

---

**FORKLIFT VALVE REPAIR**

---

This task covers: a. Disassembly b. Assembly

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26

**Materials/Parts:**

Kit, Parts (2)

Kit, Parts

Kit, Parts (2)

Oil, Lubricating                      Appendix B, Item 30

Rags    Appendix B, Item 40

**References:**

LO 5-2420-224-12

**Equipment Condition:**

**Reference**

Page 11-37

**Condition Description**

Forklift Valve Removed

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

---

**DISASSEMBLY**

---

**CAUTION**

Note direction of diode prior to removal to aid in installation. Failure to do so could result in damage to equipment when diode is installed.

1. REMOVE DIODE assembly (1) from coil (2).

**NOTE**

Steps 2 thru 4 are the same for both solenoid valves.

2. REMOVE nut (3) and COIL (2).
3. REMOVE solenoid VALVE (4) from valve body (5).
4. REMOVE and DISCARD backup RING (6), O-RING (7), backup RING (8), backup RING (9), O-Ring (10), backup RING (11), and O-RING (12) from solenoid valve (4).

**NOTE**

Steps 5 and 6 are the same for both globe valves.

5. REMOVE globe VALVE (13) from valve body (5).

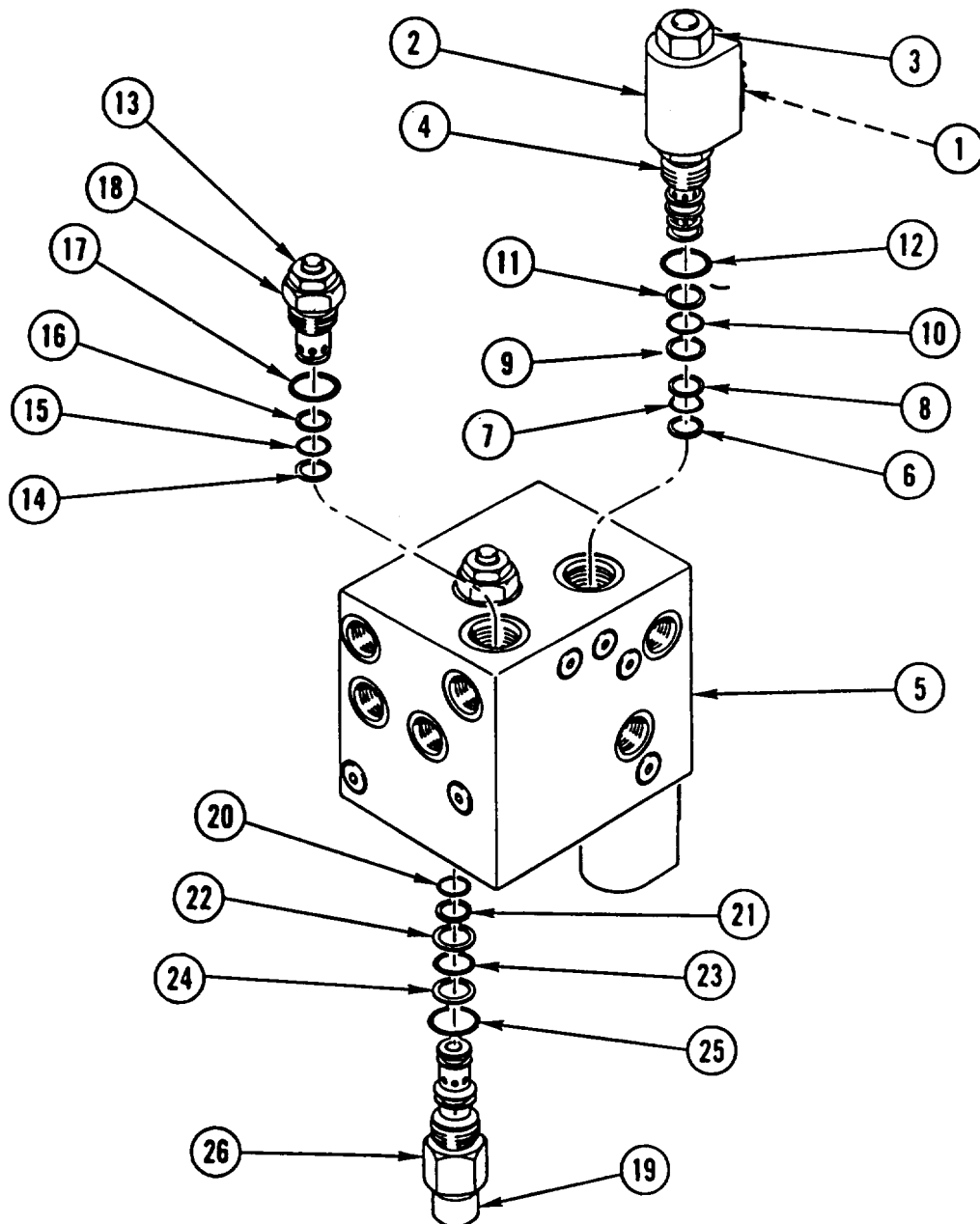
**FORKLIFT VALVE REPAIR (CONT)**

6. REMOVE and DISCARD backup RING (14), O-RING (15), backup RING (16), and O-RING (17) from globe valve body (18).

**NOTE**

Steps 7 and 8 are the same for all flow regulating valves.

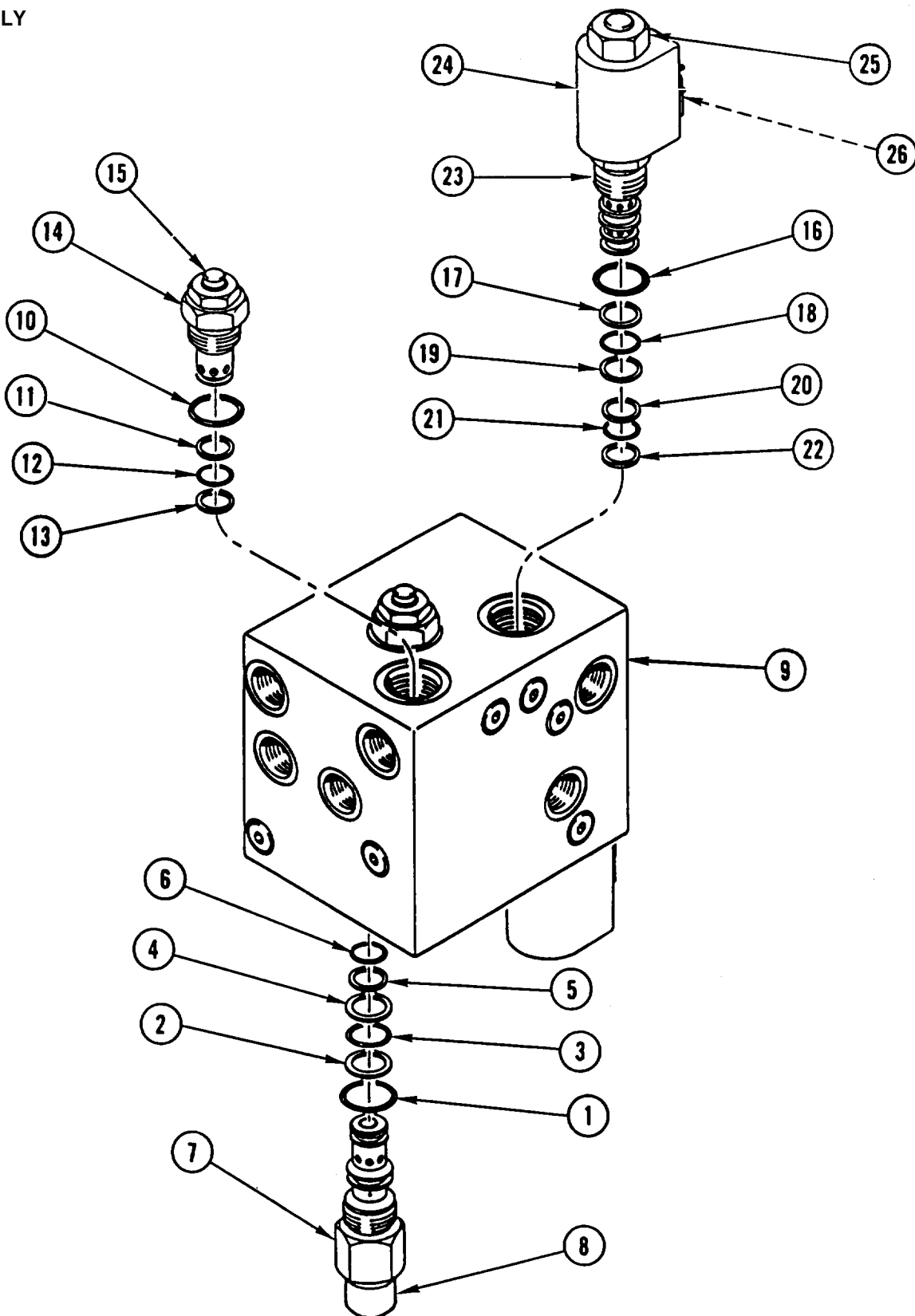
7. REMOVE flow regulating VALVE (19) from valve body (5).
8. REMOVE and DISCARD O-RING (20), backup RING (21), backup RING (22), O-RING (23), backup RING (24), and O-RING (25) from flow regulating valve body (26).





FORKLIFT VALVE REPAIR (CONT)

ASSEMBLY



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**FORKLIFT VALVE REPAIR (CONT)**

---

**NOTE**

- Steps 1 and 2 are the same for all flow regulating valves.
  - Apply coat of lubricating oil to O-rings prior to assembly.
1. INSTALL new O-RING (1), new backup RING (2), new O-RING (3), new backup RING (4), new backup RING (5), and new O-RING (6) on flow regulating valve body (7).
  2. INSTALL flow regulating VALVE (8) in valve body (9).

**NOTE**

Steps 3 and 4 are the same for both globe valves.

3. INSTALL new O-RING (10), new backup RING (11), new O-RING (12), and new backup RING (13) on globe valve body (14).
4. INSTALL globe VALVE (15) in valve body (9).

**NOTE**

Steps 5 thru 7 are the same for both solenoid valves.

5. INSTALL new O-RING (16), new backup RING (17), new O-RING (18), new backup RING (19), new backup RING (20), new O-RING (21), and new backup RING (22) on solenoid valve (23).
6. INSTALL solenoid VALVE (23) in valve body (9).
7. INSTALL COIL (24) and nut (25).
8. INSTALL DIODE assembly (26) on coil (24).

**NOTE**

Follow-on Maintenance:

Install forklift valve (page 11-37).

Bleed forklift lift cylinder (page 11-51).

Fill front and rear hydraulic tanks (LO 5-2420-224-12).

Section XXIII. FORKLIFT TILT CYLINDER REPAIR

**FORKLIFT TILT CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5764  
 Spanner Wrench, P/N 678602

**Materials/Parts:**

Nut, Lock  
 Kit  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Forklift Tilt Cylinder Removed

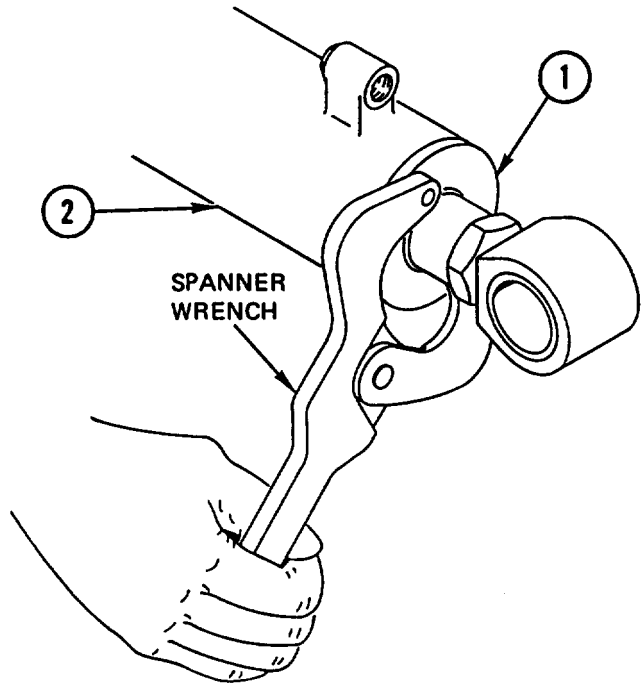
**General Safety instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

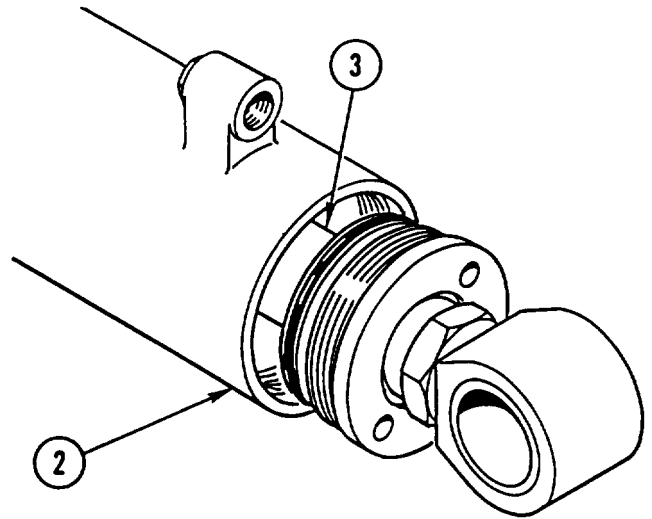
**DISASSEMBLY**

1. USING SPANNER WRENCH, REMOVE RETAINER (1) from housing (2).

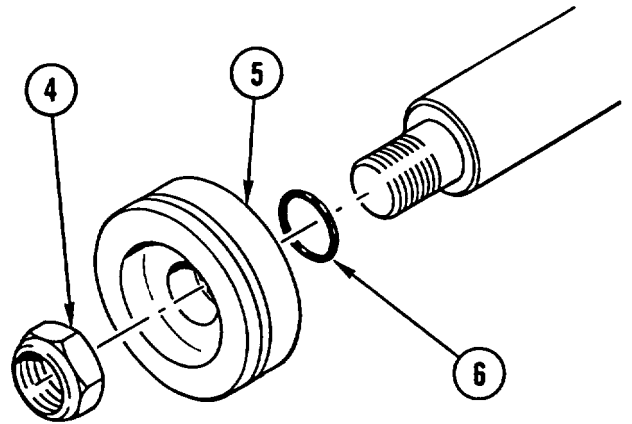


**FORKLIFT TILT CYLINDER REPAIR (CONT)**

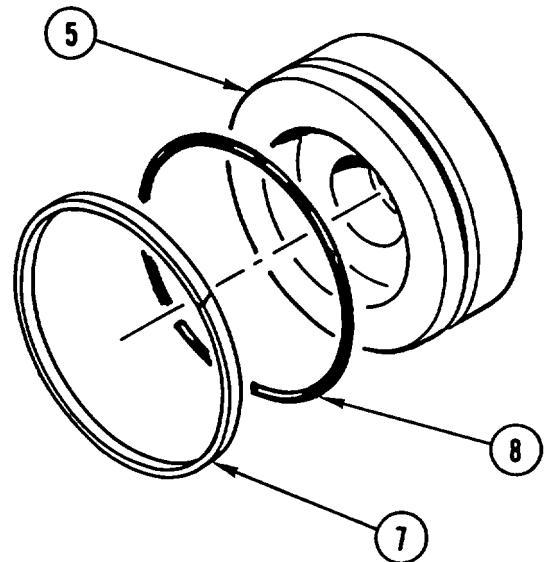
2. REMOVE ROD (3) from housing (2).



3. REMOVE lock nut (4), PISTON (5), and O-ring (6). DISCARD lock NUT and O-RING.



4. REMOVE and DISCARD SEAL (7) and O-RING (8) from piston (5).

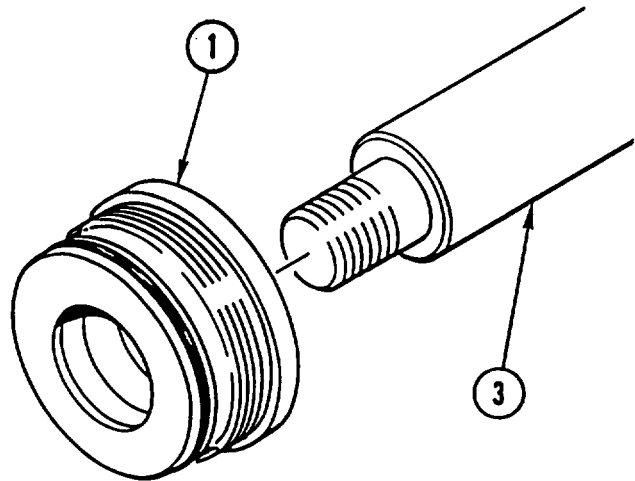


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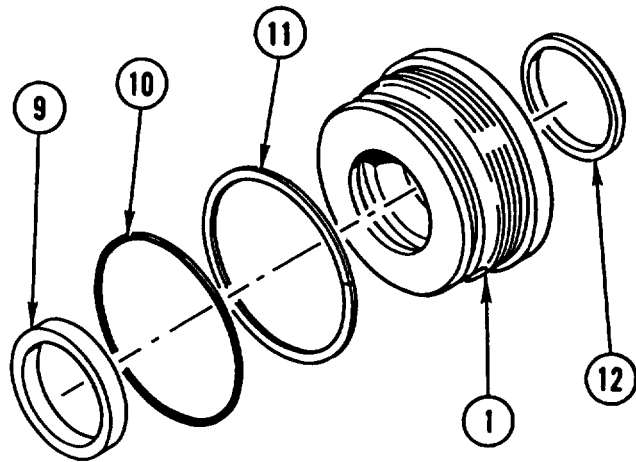
**FORKLIFT TILT CYLINDER REPAIR (CONT)**

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5. REMOVE RETAINER (1) from rod (3).



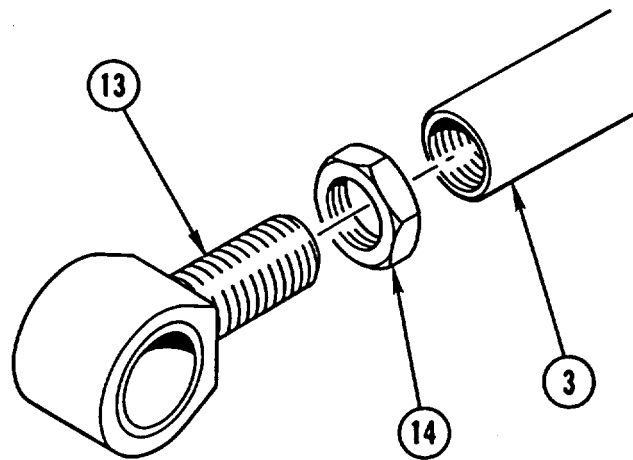
6. REMOVE and DISCARD SEAL (9), O-RING (10), backup RING (11), and WIPER (12) from retainer (1).



**NOTE**

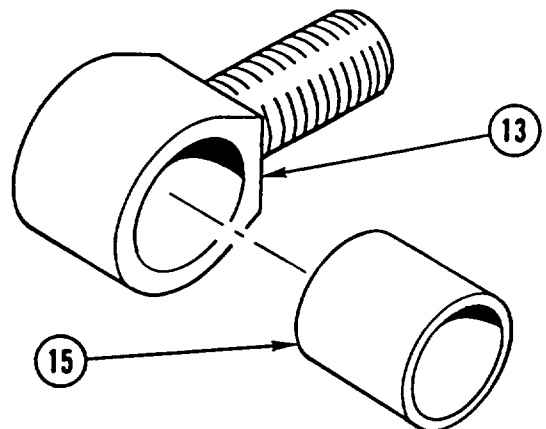
Note number of turns necessary to remove rod end connector.

7. REMOVE rod end CONNECTOR (13) and jam nut (14) from rod (3).

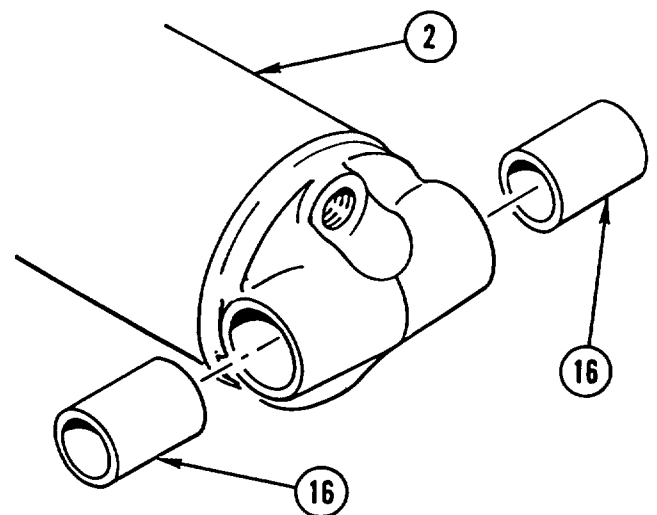


**FORKLIFT TILT CYLINDER REPAIR (CONT)**

8. USING suitable PRESS, REMOVE BUSHING (15) from rod end connector (13).



9. USING suitable PRESS, REMOVE two BUSHINGS (16) from housing (2).

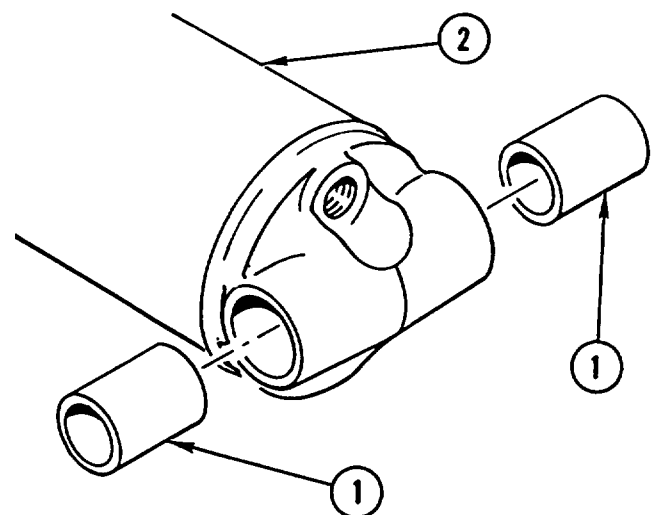


**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to O-rings and seals prior to assembly.

1. USING suitable PRESS, INSTALL two BUSHINGS (1) in housing (2).

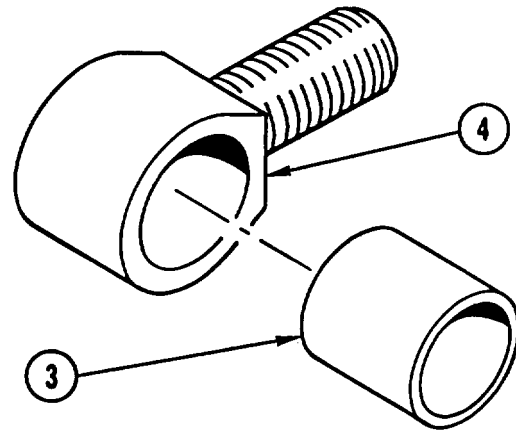


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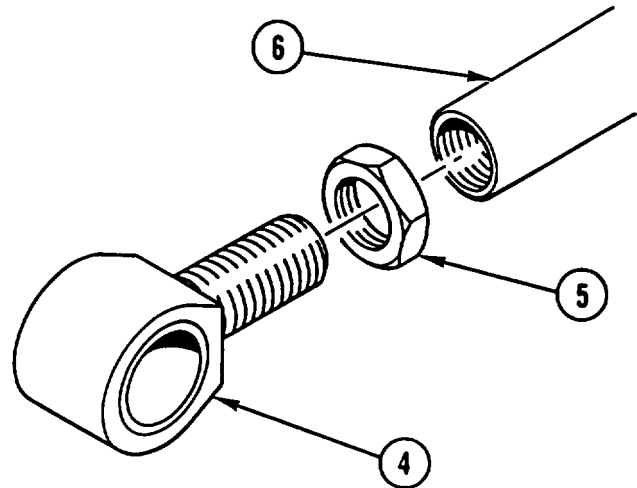
**FORKLIFT TILT CYLINDER REPAIR (CONT)**

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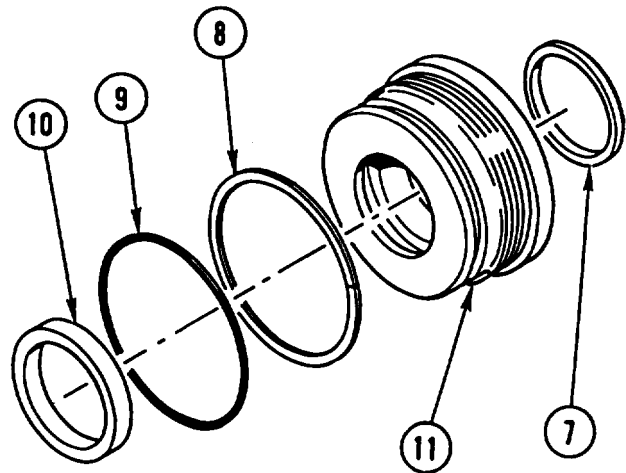
2. USING suitable PRESS, INSTALL BUSHING (3) in rod end connector (4).



3. INSTALL jam NUT (5) on rod end connector (4).
4. INSTALL rod end CONNECTOR (4) in rod (6) number of turns noted and TIGHTEN jam NUT (5) against rod (6).

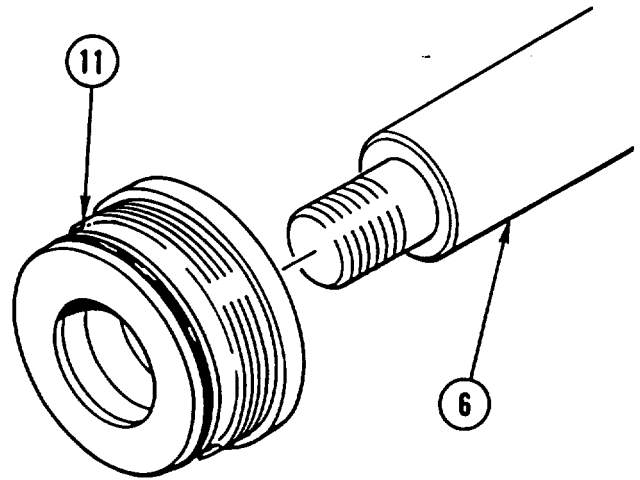


5. INSTALL new wiper (7), new backup ring (8), new O-ring (9), and new SEAL (10) on retainer (11).

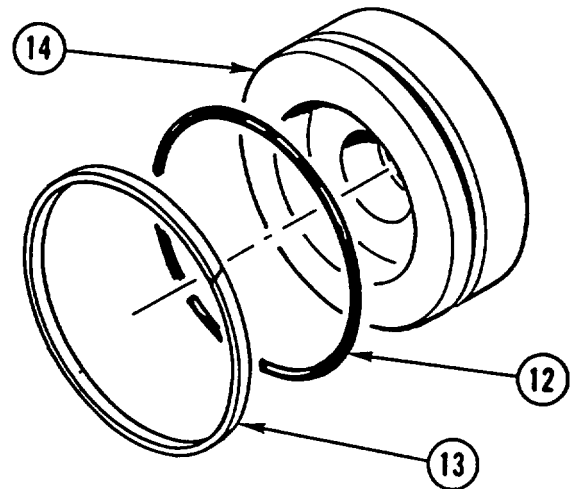


**FORKLIFT TILT CYLINDER REPAIR (CONT)**

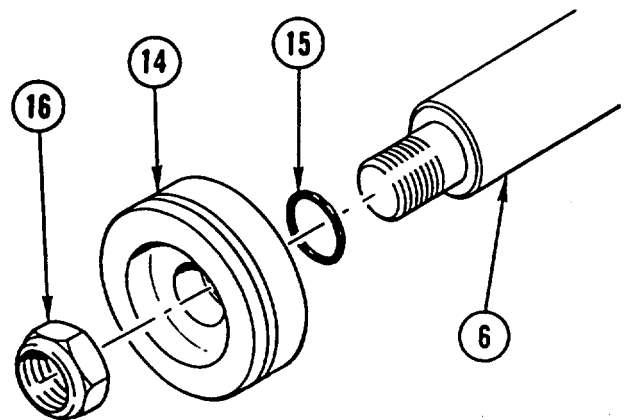
6. INSTALL RETAINER (11) on rod (6).



7. INSTALL new O-RING (12) and new seal (13) on piston (14).



8. INSTALL new O-ring (15), PISTON (14), new lock nut (16) on rod (6). TIGHTEN NUT to 200-225 lb-ft (271-305 N.m).





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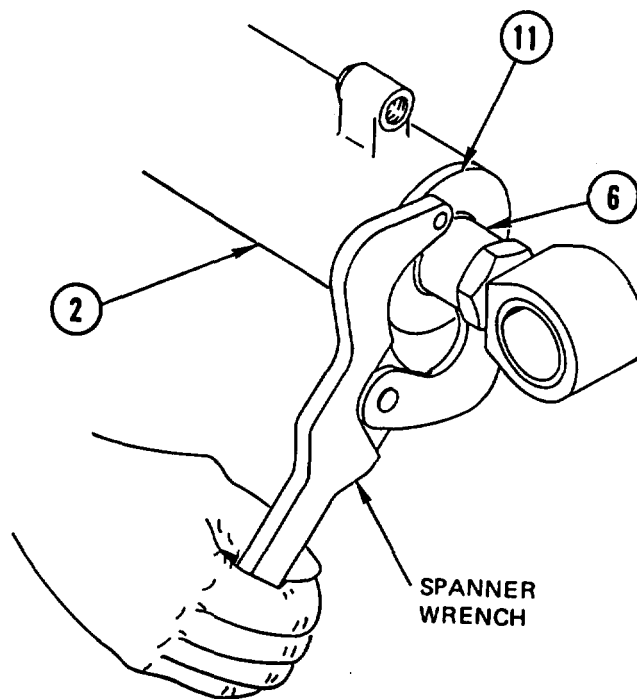
**FORKLIFT TILT CYLINDER REPAIR (CONT)**

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9. INSTALL ROD (6) in housing (2). USING SPANNER WRENCH, THREAD RETAINER (11) into housing (2) and TIGHTEN to 300-350 lb-ft (407-475 N.m).

**NOTE**

Follow-on Maintenance:  
Install forklift tilt cylinder (TM 5-2420-224-20).



Section XXIV. FORKLIFT ROTATOR CYLINDER

**FORKLIFT ROTATOR CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

Nut, Lock  
 Kit  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Forklift Rotator Cylinder Removed

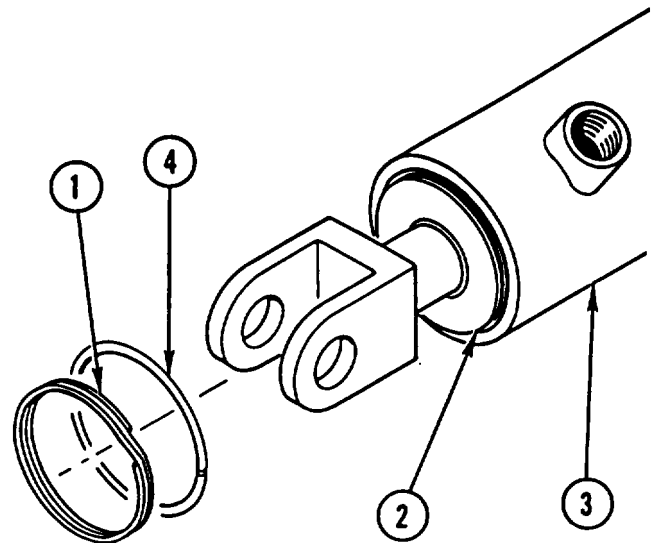
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

1. REMOVE retaining RING (1).
2. PUSH RETAINER (2) APPROXIMATELY 2 in. into shell (3) and REMOVE retaining RING (4).

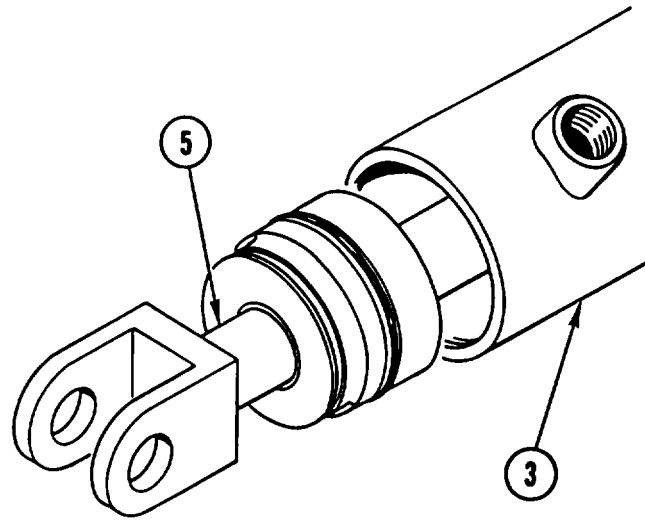


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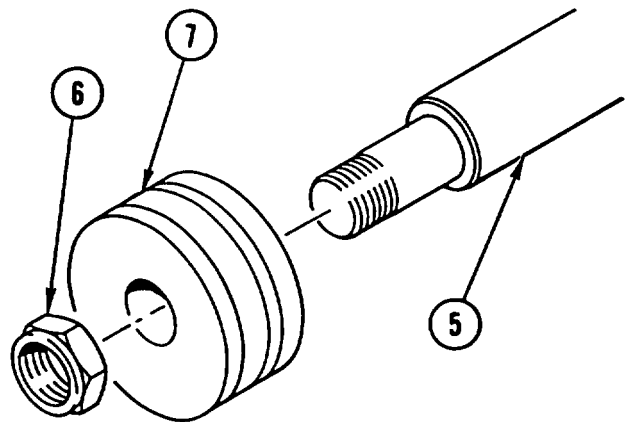
**FORKLIFT ROTATOR CYLINDER REPAIR (CONT)**

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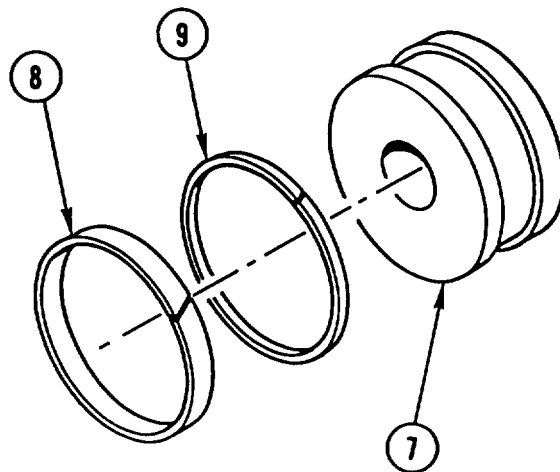
3. REMOVE ROD (5) from shell (3).



4. REMOVE lock nut (6) and PISTON (7) from rod (5). DISCARD lock NUT.

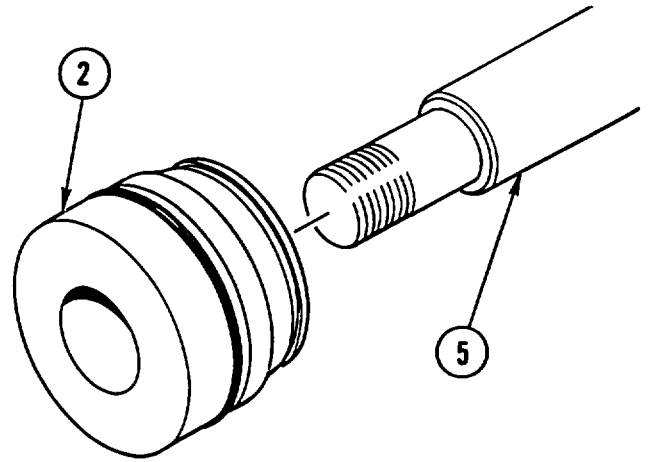


5. REMOVE and DISCARD SEAL (8) and backup RING (9) from piston (7).

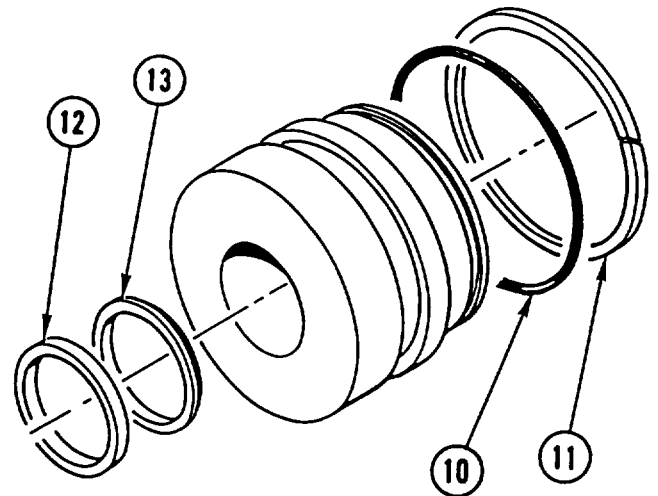


**FORKLIFT ROTATOR CYLINDER REPAIR (CONT)**

- REMOVE RETAINER (2) from rod (5).



- REMOVE and DISCARD O-RING (10), backup RING (11), WIPER (12), and SEAL (13).

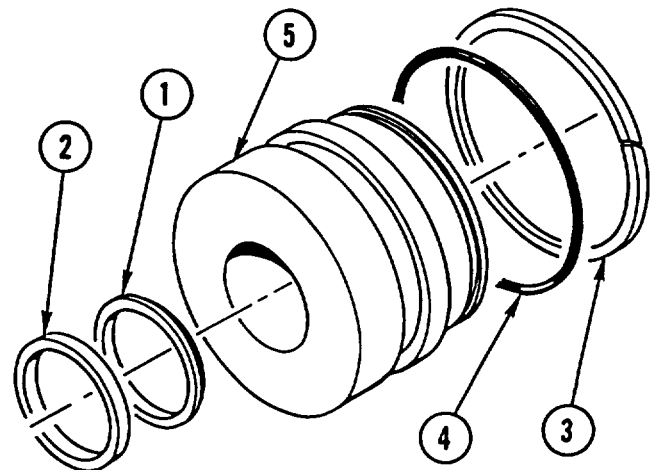


**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to O-ring and seals prior to assembly.

- INSTALL new SEAL (1), new WIPER (2), new backup RING (3), and new O-RING (4) on retainer (5).

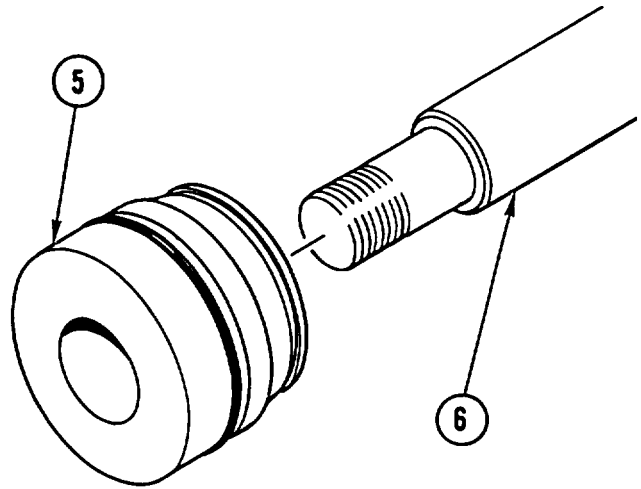


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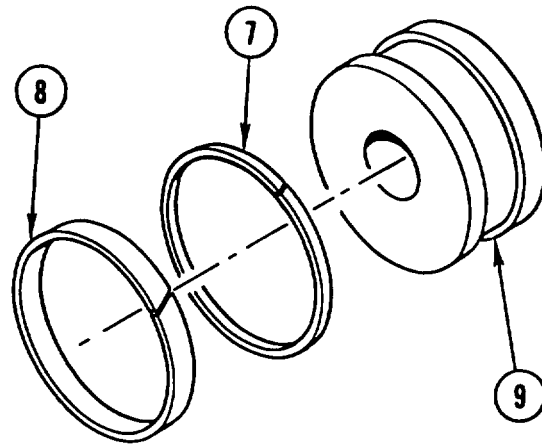
**FORKLIFT ROTATOR CYLINDER REPAIR (CONT)**

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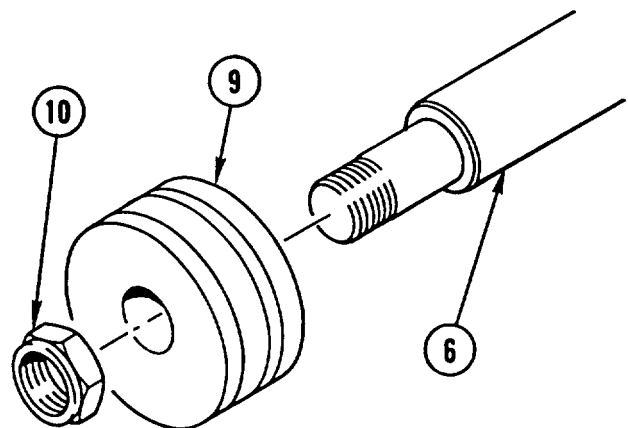
2. INSTALL RETAINER (5) on rod (6).



3. INSTALL new backup RING (7) and new SEAL (8) on piston (9).

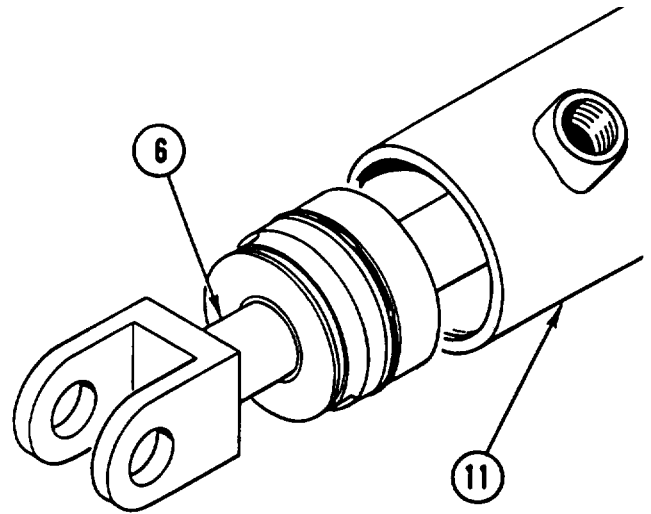


4. INSTALL PISTON (9) and new lock nut (10) on rod (6). TIGHTEN lock NUT to 70-75 lb-ft (95-102 N.m).

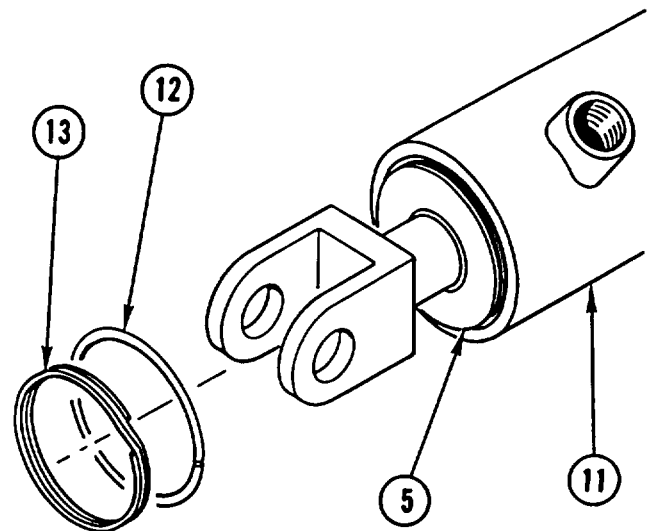


**FORKLIFT ROTATOR CYLINDER REPAIR (CONT)**

5. INSTALL ROD (6) in shell (11).



6. PUSH RETAINER (5) APPROXIMATELY 2 in. (50 mm) into shell (11) and INSTALL retaining RING (12).
7. INSTALL retaining RING (13).



**NOTE**

Follow-on Maintenance:  
Install forklift rotator cylinder  
(TM 5-2420-224-20).

Section XXV. FORKLIFT LIFT CYLINDER REPAIR

**FORKLIFT LIFT CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784

**Materials/Parts:**

- Nut, Lock
- Pin, Cotter
- Nut, Lock
- Kit
- Kit
- Caps and Plugs            Appendix B, Item 8
- Oil, Lubricating           Appendix B, Item 30
- Rags                            Appendix B, Item 40

**Personnel Required:** (2)

**References:**

LO 5-2420-224-12

**Equipment Condition:**

Reference	Condition Description
Page 11-51	Forklift Lift Cylinder Removed

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

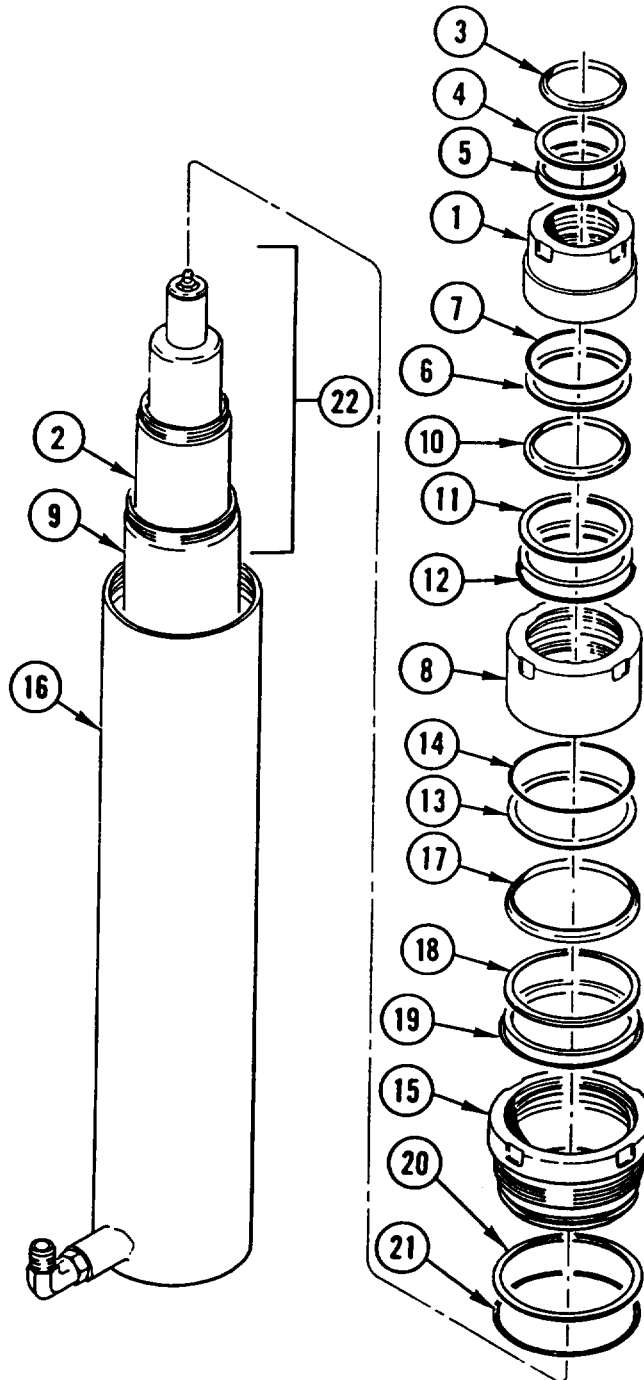
1. USING spanner WRENCH, REMOVE RETAINER (1) from tube (2).
2. REMOVE and DISCARD WIPER (3), RING (4), SEAL (5), backup RING (6), and O-RING (7) from retainer (1).
3. USING spanner WRENCH, REMOVE RETAINER (8) from tube (9).
4. REMOVE and DISCARD WIPER (10), RING (11), SEAL (12), backup RING (13), and O-RING (14) from retainer (8).
5. USING spanner WRENCH, REMOVE RETAINER (15) from housing (16).
6. REMOVE and DISCARD WIPER (17), RING (18), SEAL (19), backup RING (20), and O-RING (21) from retainer (15).

**NOTE**

All three tubes must be removed as an assembly.

7. REMOVE TUBE assembly (22) from housing (16).

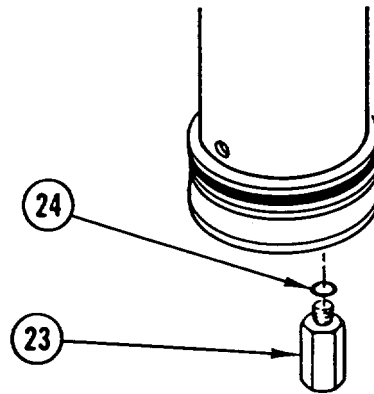
FORKLIFT LIFT CYLINDER REPAIR (CONT)



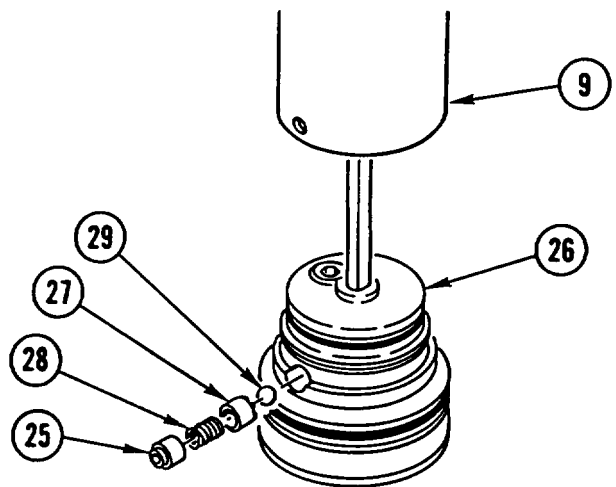


**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

8. REMOVE VALVE (23) and O-ring (24). DISCARD O-RING.

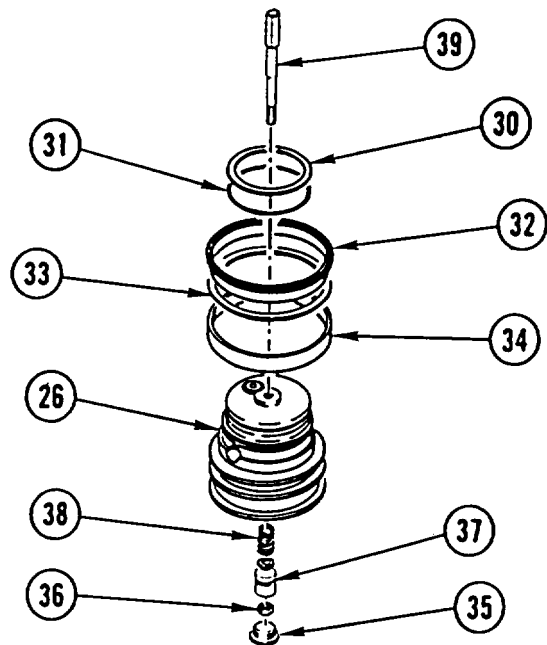


9. DEPRESS and HOLD WASHER (25) at bottom of tube (9). USING spanner WRENCH, REMOVE PISTON (26). When piston (26) clears tube (9), BE PREPARED to CATCH washer (25), spacer (27), spring (28), and ball (29).



10. REMOVE and DISCARD backup RING (30), O-RING (31), SEAL (32), RING (33), and BEARING (34) from piston (26).

11. REMOVE plug (35), lock nut (36), PLUNGER (37), and spring (38) from cap (39). DISCARD lock NUT, SPRING, and PLUNGER.

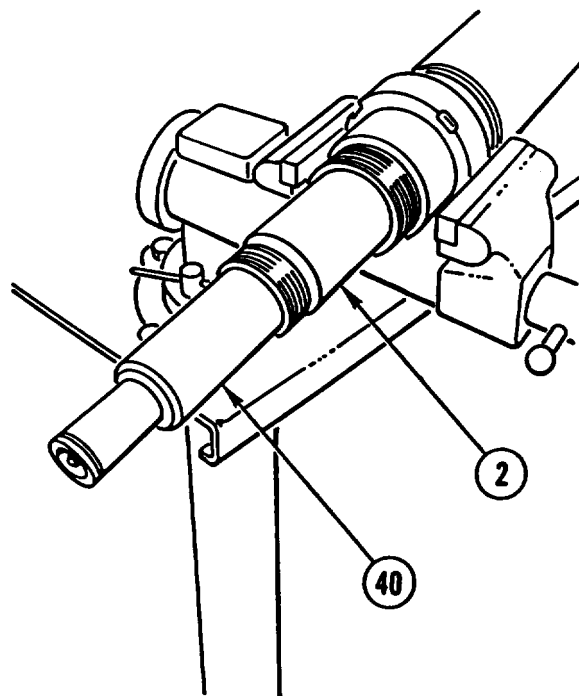


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**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

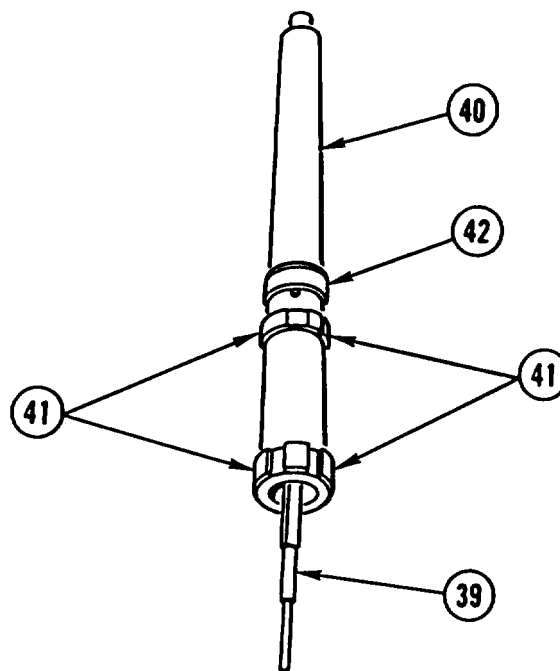
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12. REMOVE TUBE (40) from tube (2).



13. REMOVE four piston rings (41) and sleeve BUSHING (42) from tube (40).

14. REMOVE CAP (39) from tube (40).

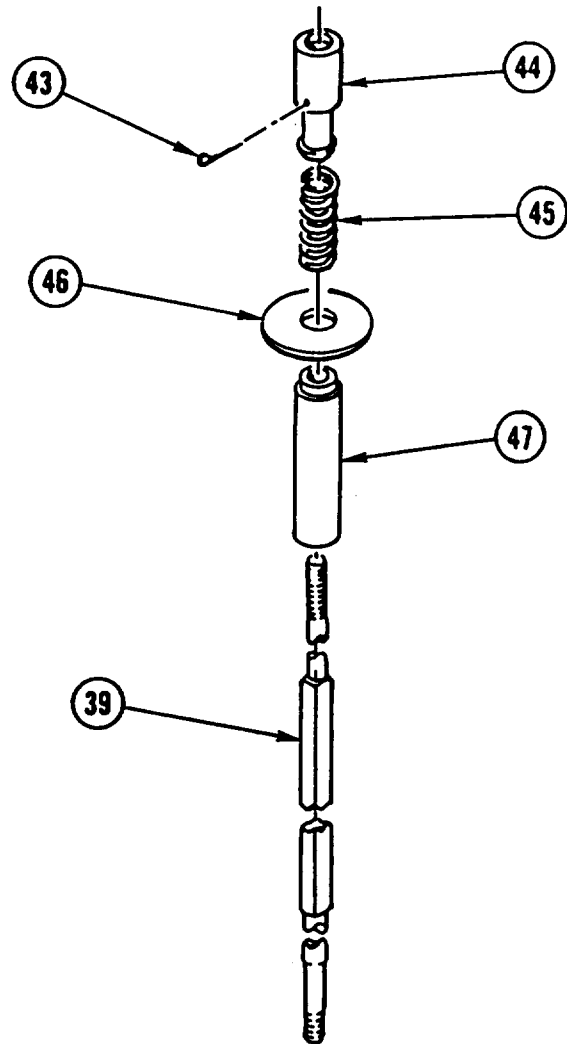


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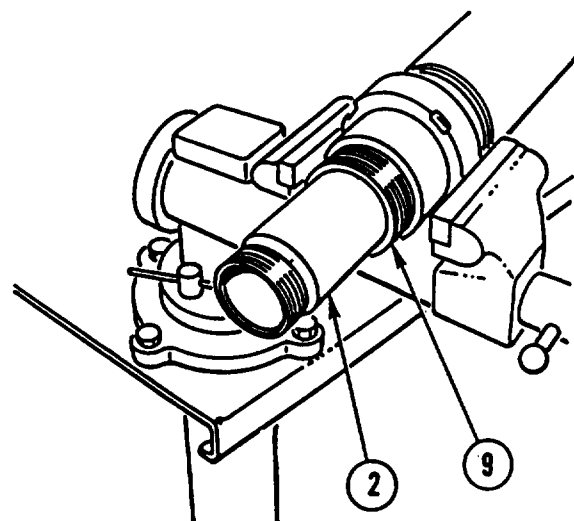
**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

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15. REMOVE cotter pin (43), adjustment lock nut (44), spring (45), PLATE (46), and spacer (47) from cap (39). DISCARD cotter PIN and adjustment lock NUT.

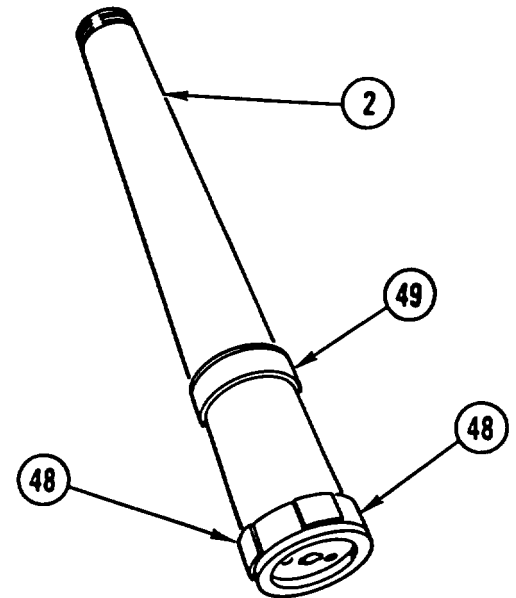


16. REMOVE TUBE (2) from tube (9).

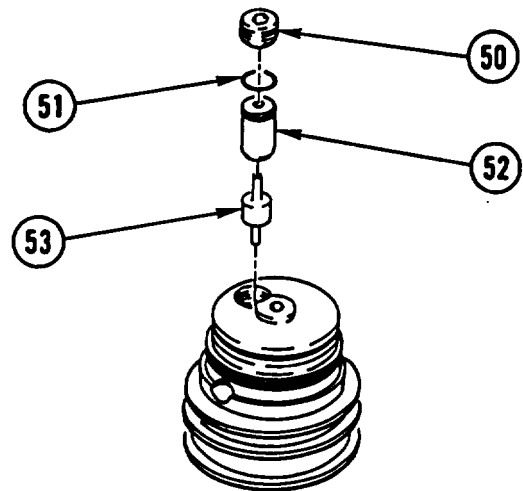


**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

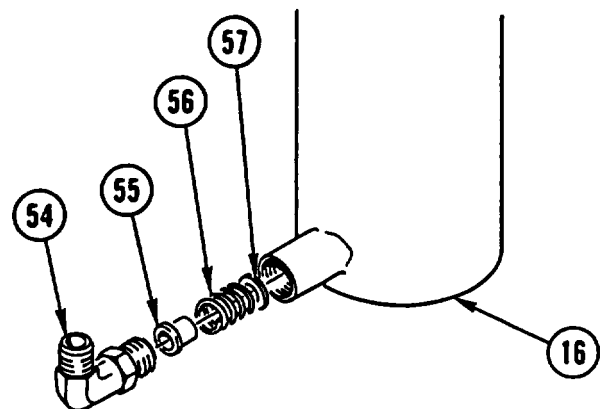
17. REMOVE two piston rings (48) and sleeve BUSHING (49) from tube (2).



18. REMOVE threaded bushing (50), O-ring (51), check VALVE (52), and disc (53). DISCARD O-RING.



19. REMOVE elbow fitting (54), spacer (55), SPRING (56), and washer (57) from housing (16).

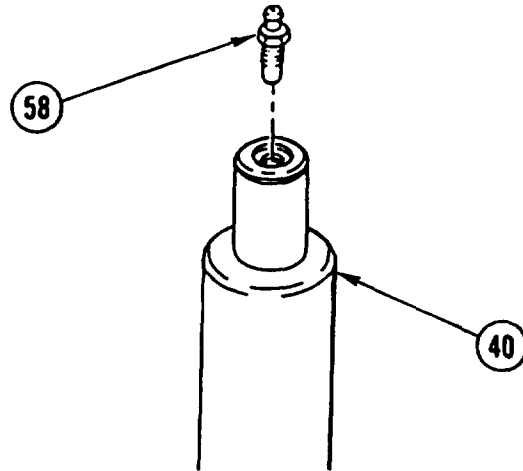


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**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

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20. IF DAMAGED, REMOVE bleeder VALVE (58) from tube (40).

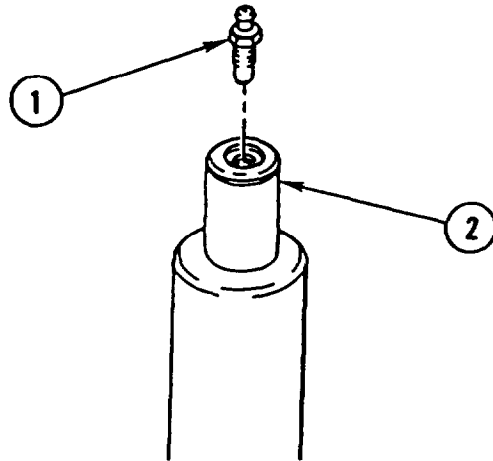


**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to O-rings and seals prior to assembly.

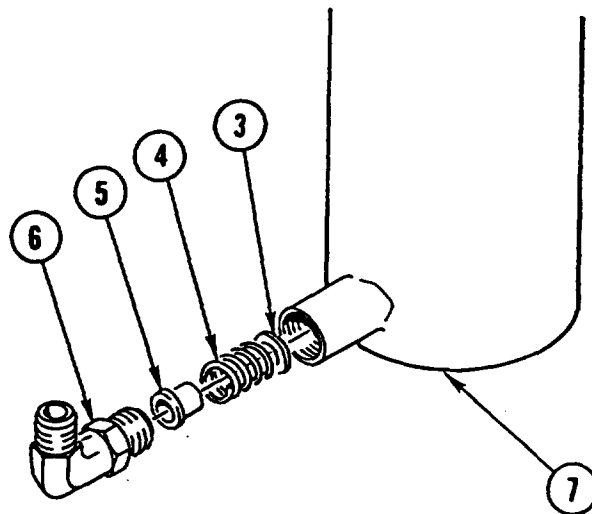
1. IF REMOVED, INSTALL new bleeder VALVE (1) in tube (2) and TIGHTEN to 25-27 lb-ft (34-37 N.m).



**CAUTION**

Cap or plug all ports and ends of hoses and tubes to prevent contamination of hydraulic oil. Failure to do so may result in damage to equipment.

2. INSTALL washer (3), SPRING (4), spacer (5), and elbow fitting (6) in housing (7). INSTALL CAP or PLUG on elbow fitting (6).

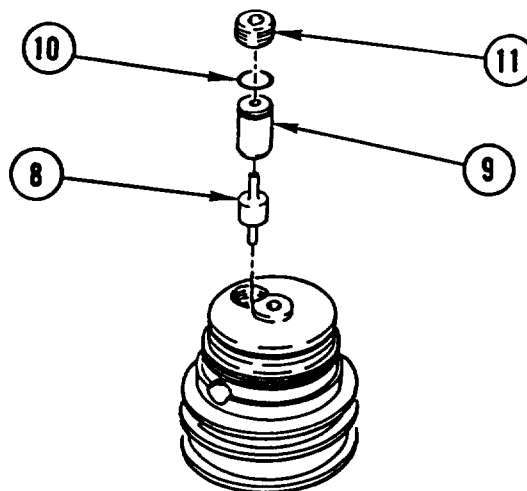


**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

**NOTE**

Disc is symmetrical and may be installed in either direction.

3. INSTALL disc (8), check VALVE (9), new O-ring (10), and threaded bushing (11). TIGHTEN threaded BUSHING to 40-50 lb-ft (54-68 N.m).

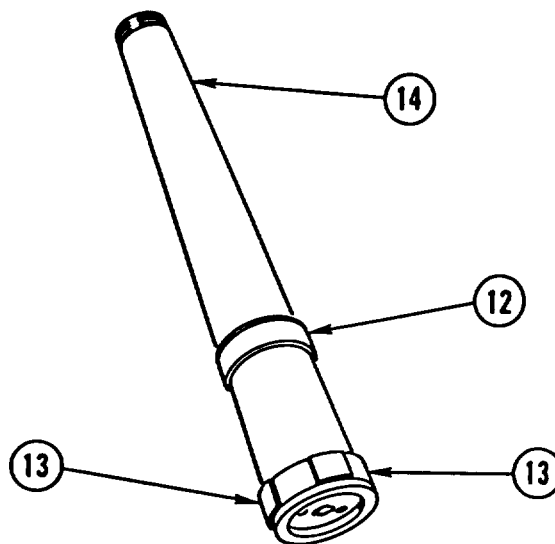


4. APPLY COAT of LUBRICATING OIL to INSIDE of sleeve bushing (12) and two piston RINGS (13).

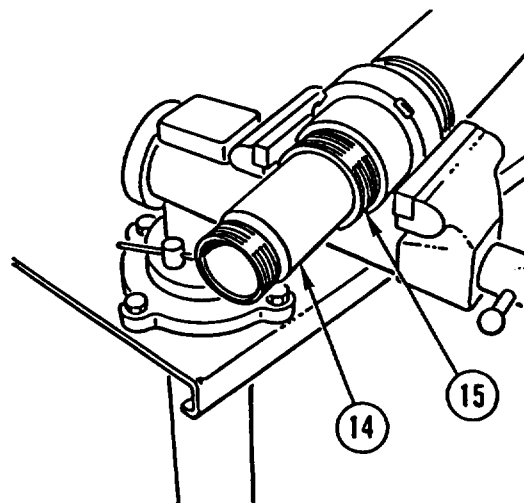
**NOTE**

Make sure lip of sleeve bushing is toward threaded end of tube.

5. INSTALL sleeve BUSHING (12) and two piston rings (13) on tube (14).



6. INSTALL TUBE (14) in tube (15).

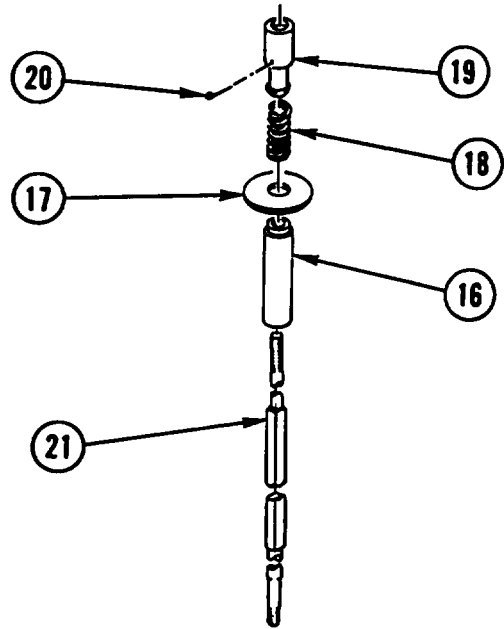


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**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

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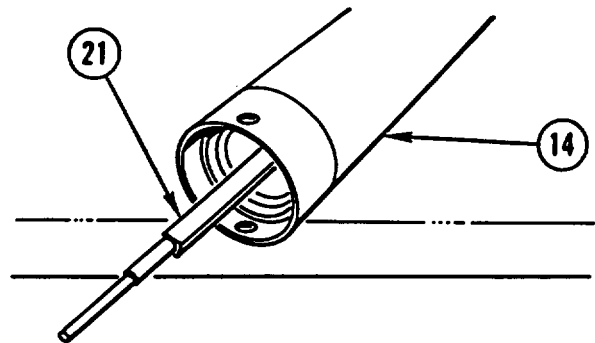
7. INSTALL spacer (16), PLATE (17), spring (18), new adjustment lock nut (19), and new cotter pin (20) on cap (21).



**NOTE**

Make sure square end of cap protrudes through plate at bottom of tube.

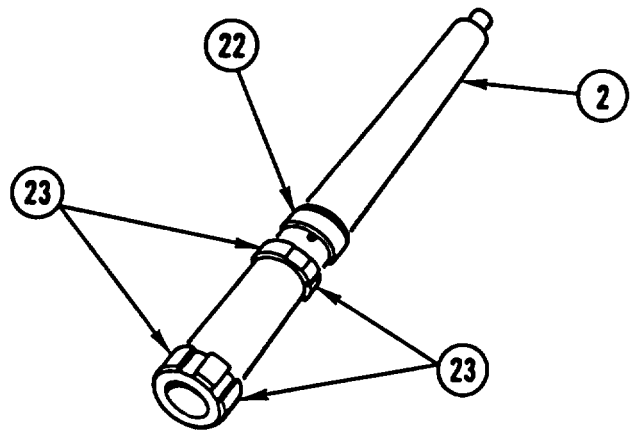
8. INSTALL CAP (21) in tube (14).



**NOTE**

Make sure lip of sleeve bushing is toward top of tube.

9. APPLY COAT of LUBRICATING OIL to INSIDE of sleeve bushing (22) and four piston RINGS (23).
10. INSTALL sleeve BUSHING (22) and four piston rings (23) on tube (2).

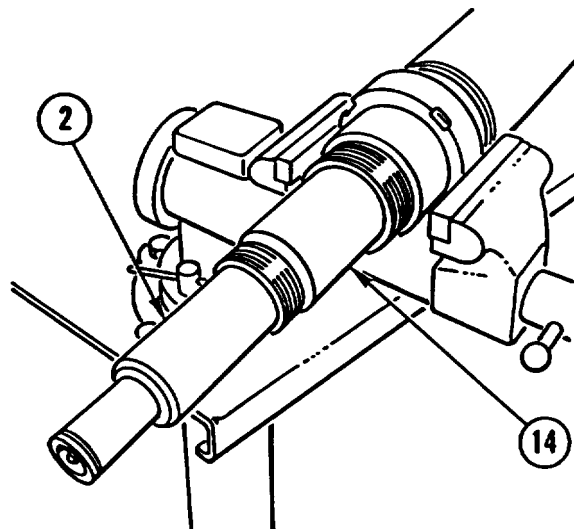


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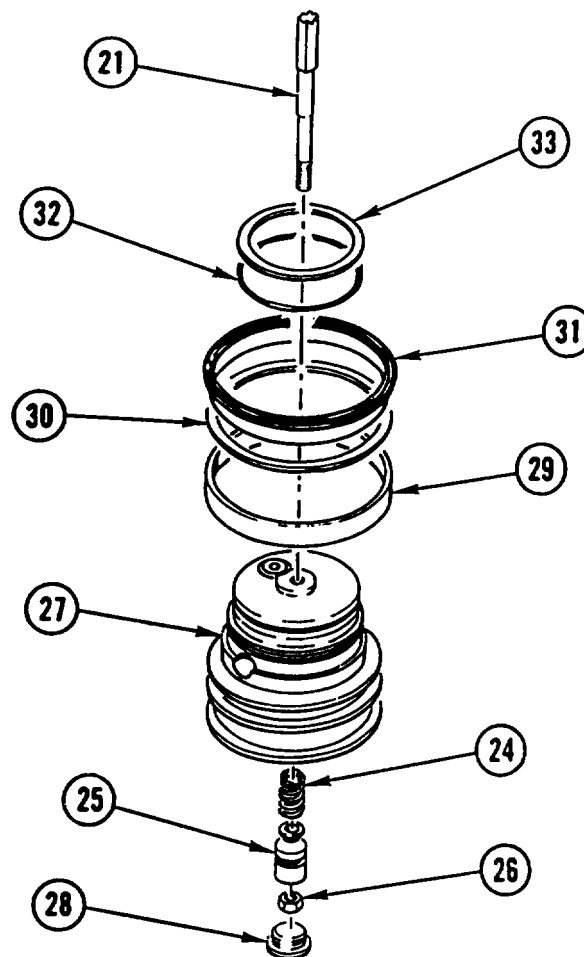
**FORKLIFT LIFT CYLINDER REPAIR (CONT)**


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11. INSTALL TUBE (2) in tube (14).



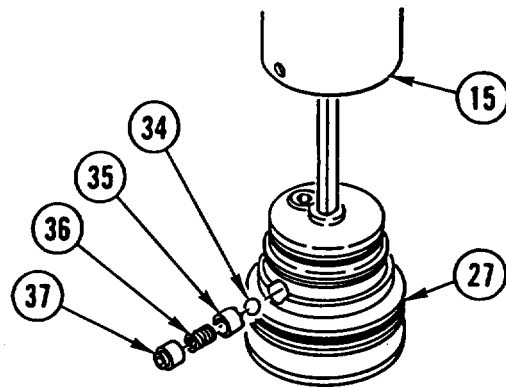
12. INSTALL cap (21), new spring (24), new PLUNGER (25), and new lock nut (26) in piston (27). TIGHTEN lock NUT to 7.5-9.0 lb-ft (10-12 N.m).
13. INSTALL PLUG (28) and TIGHTEN to 50-55 lb-ft (68-75 N.m).
14. INSTALL new BEARING (29), new ring (30), new seal (31), new O-ring (32), and new backup ring (33) on piston (27).



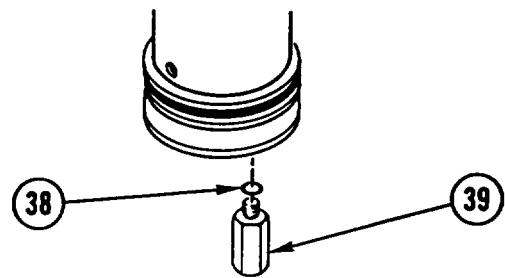


**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

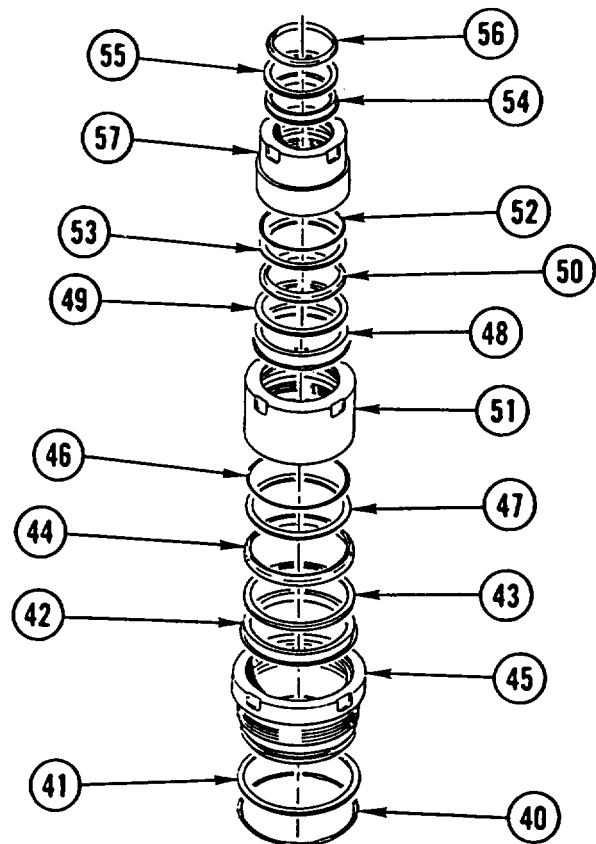
15. INSTALL BALL (34), spacer (35), spring (36), and washer (37). THREAD PISTON (27) into tube (15) until washer (37) pops into hole in tube (15). DEPRESS WASHER (37) and CONTINUE to THREAD PISTON (27) into tube (15) until it bottoms out. BACK PISTON (27) OUT until washer (37) POPS into hole.



16. INSTALL new O-ring (38) and VALVE (39) and TIGHTEN to 15-20 lb-ft (20-27 N.m).



17. INSTALL new O-RING (40), new backup RING (41), new SEAL (42), new RING (43), and new WIPER (44) on retainer (45).
18. INSTALL new O-RING (46), new backup RING (47), new SEAL (48), new RING (49), and new WIPER (50) on retainer (51).
19. INSTALL new O-RING (52), new backup RING (53), new SEAL (54), new RING (55), and new WIPER (56) on retainer (57).



**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

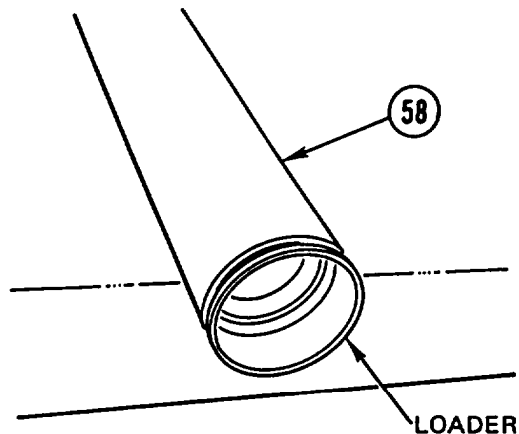
**CAUTION**

Kit comes with four loaders ranging in size from large to small. Loaders must be used during installation of retainers to prevent damage to seals, backup rings, etc.

**NOTE**

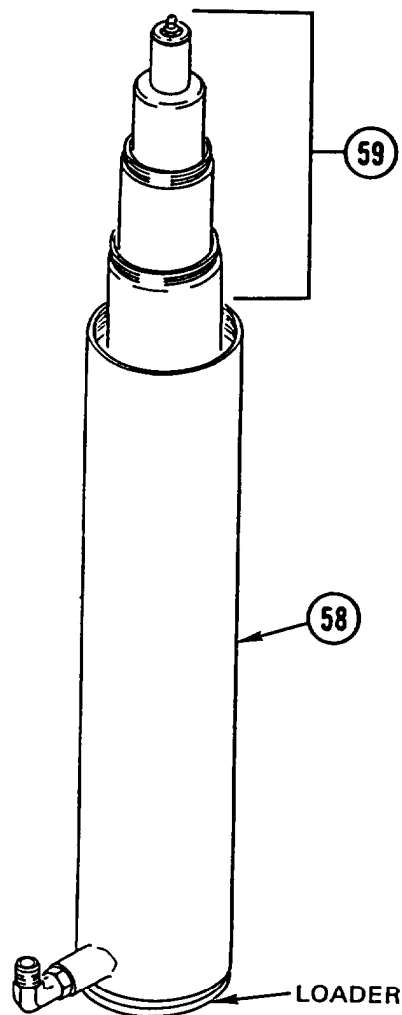
Apply coat of lubricating oil to all loaders and inside areas of all retainers prior to assembly.

20. INSTALL largest LOADER in housing (58).



21. INSTALL TUBE assembly (59) in housing (58).

22. REMOVE LOADER from housing (58).

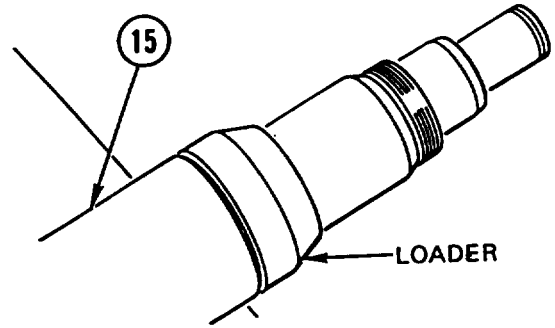


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**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

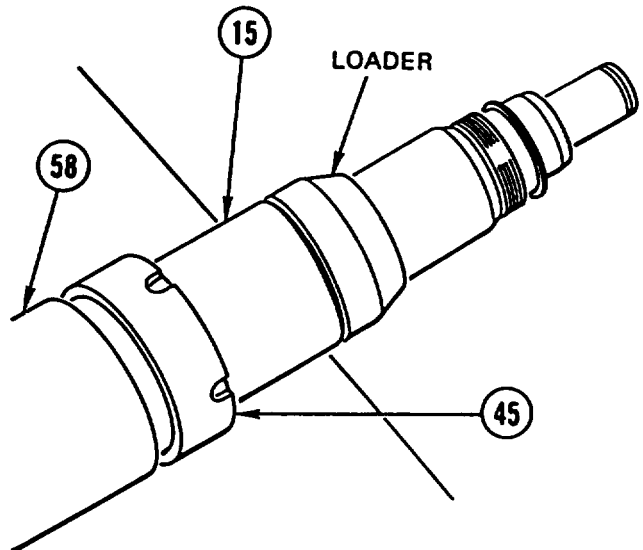
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23. INSTALL second largest LOADER over threads of tube (15).

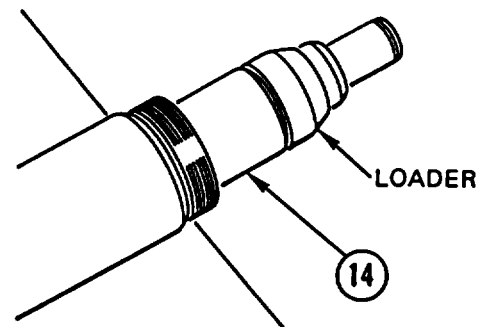


24. USING spanner WRENCH, INSTALL RETAINER (45) on housing (58) and TIGHTEN RETAINER to 200-250 lb-ft (271-339 N.m).

25. REMOVE LOADER from tube (15).



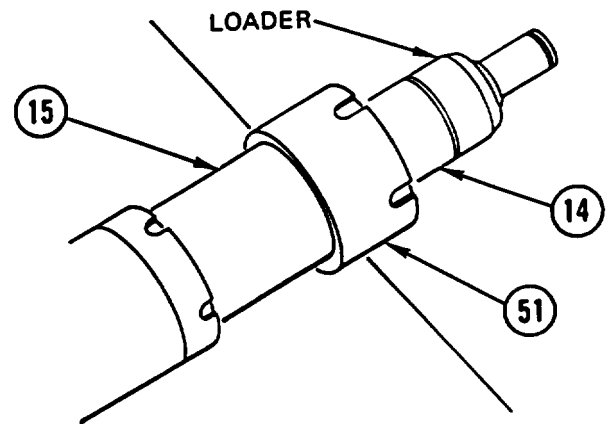
26. INSTALL third largest LOADER over threads of tube (14).



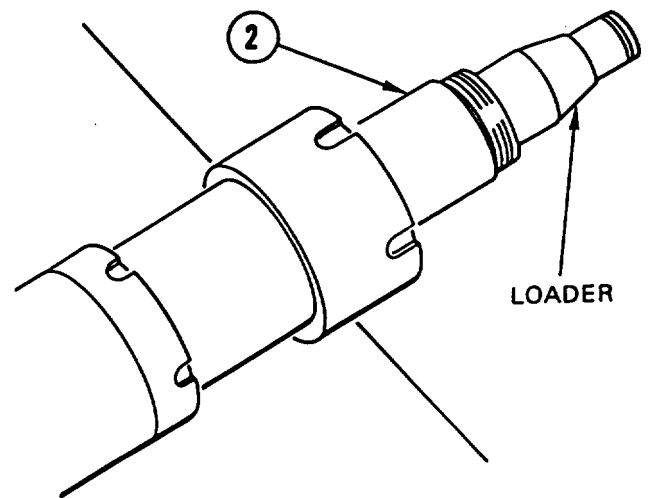
**FORKLIFT LIFT CYLINDER REPAIR (CONT)**

27. USING spanner WRENCH, INSTALL RETAINER (51) on tube (15) and TIGHTEN RETAINER to 100-150 lb-ft (136-203 N.m).

28. REMOVE LOADER from tube (14).



29. INSTALL smallest LOADER on tube (2).



30. USING spanner WRENCH, INSTALL RETAINER (57) on tube (14) and TIGHTEN RETAINER to 100-150 lb-ft (136-203 N.m).

31. REMOVE LOADER from tube (2).

**NOTE**

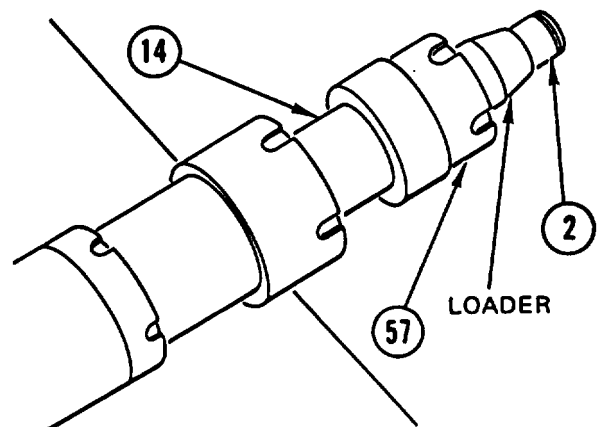
Follow-on Maintenance:

Install forklift lift cylinder (page 11-51).

Bleed forklift lift cylinder (page 11-51).

Sequence forklift cylinder (page 11-51).

Fill front and rear hydraulic tanks (LO 5-2420-224-12).



Section XXVI. CRANE EXTERNAL END EXTENSION CYLINDER REPAIR

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**CRANE EXTERNAL END EXTENSION CYLINDER REPAIR**

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This task covers: a. Disassemble b. Assembly

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784  
Spanner Wrench, P/N 3Y140510

**Materials/Parts:**

Kit  
Kit (2)  
Oil, Lubricating                      Appendix B, Item 30  
Rags    Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane External End Extension Cylinder Removed

**General Safety Instructions:**

**WARNING**

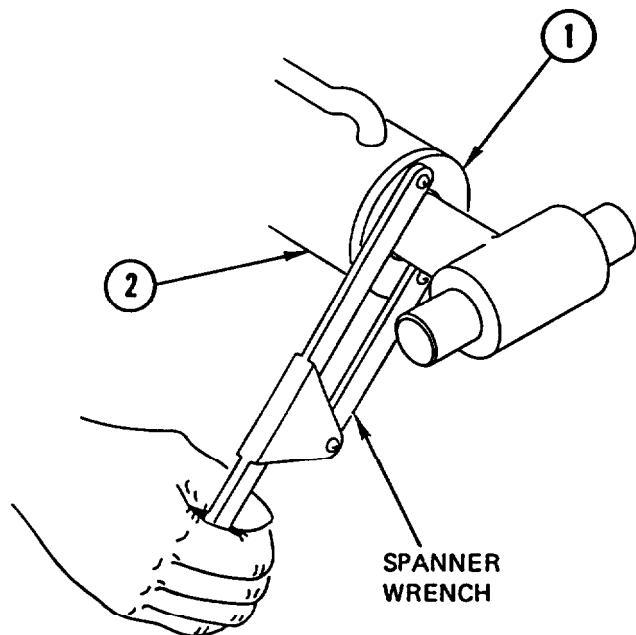
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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**DISASSEMBLY**

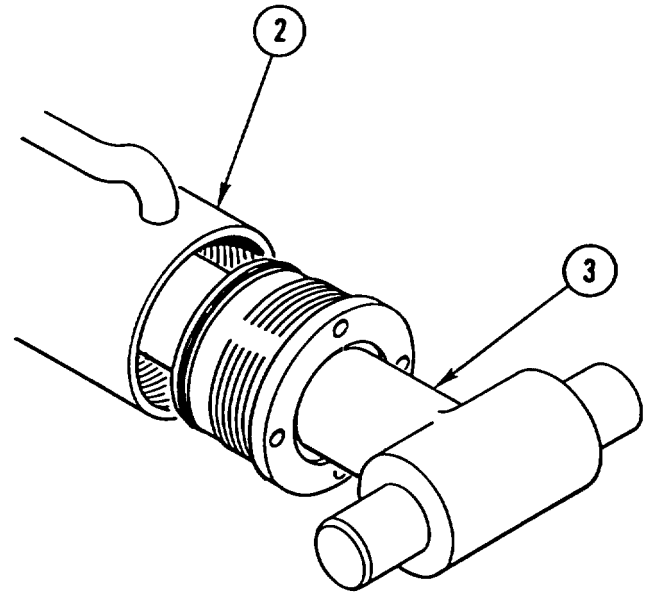
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1. USING SPANNER WRENCH, REMOVE HEAD (1) from housing (2).

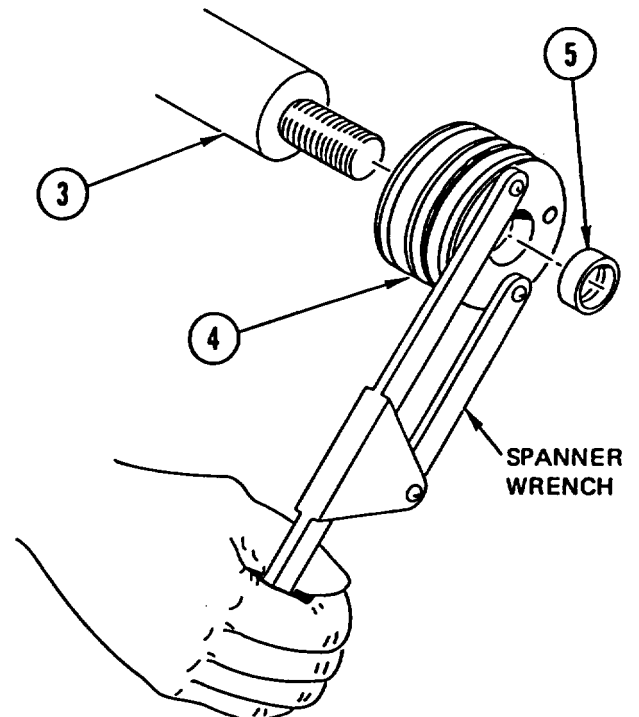


**CRANE EXTERNAL END EXTENSION CYLINDER REPAIR (CONT)**

2. REMOVE ROD assembly (3) from housing (2).

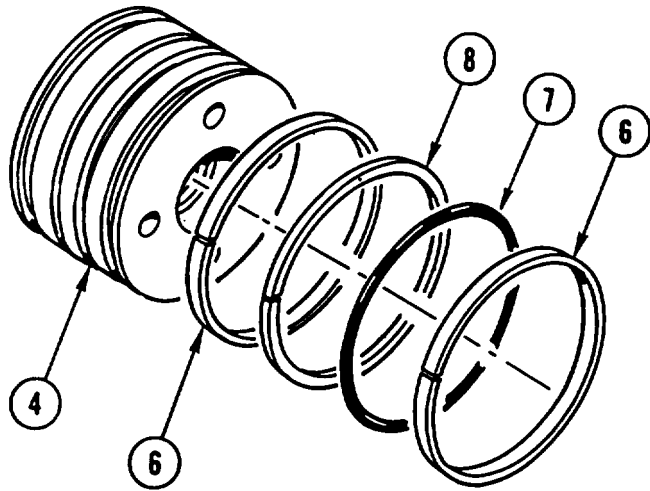


3. USING SPANNER WRENCH, REMOVE PISTON (4) and lock ring (5) from rod assembly (3). DISCARD bck RING.

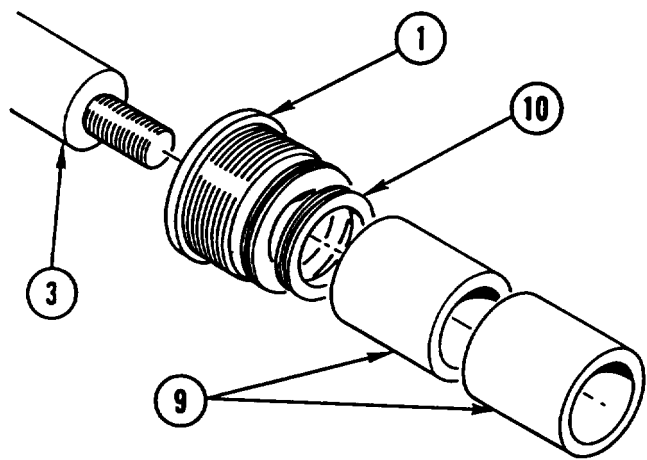


CRANE EXTERNAL END EXTENSION CYLINDER REPAIR (CONT)

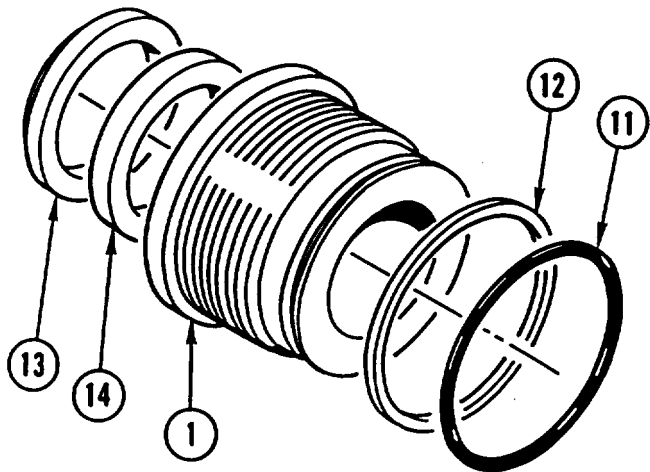
4. REMOVE and DISCARD two piston RINGS (6), O-RING (7), and SEAL (8) from piston (4).



5. REMOVE two cap tubes (9), wafer lock (10), and HEAD (1) from rod assembly (3). DISCARD wafer LOCK.

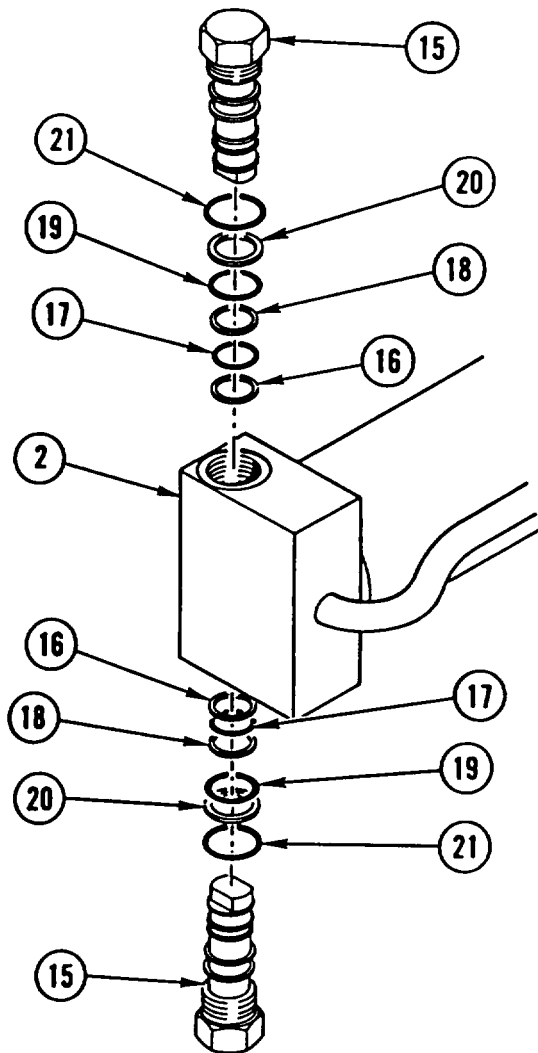


6. REMOVE and DISCARD O-RING (11), backup RING (12), WIPER (13), and SEAL (14) from head (1).



**CRANE EXTERNAL END EXTENSION CYLINDER REPAIR (CONT)**

7. REMOVE two counterbalance VALVES (15) from housing (2).
8. REMOVE and DISCARD backup RING (16), PACKING (17), backup RING (18), PACKING (19), backup RING (20), and PACKING (21) from each counterbalance valve (15).

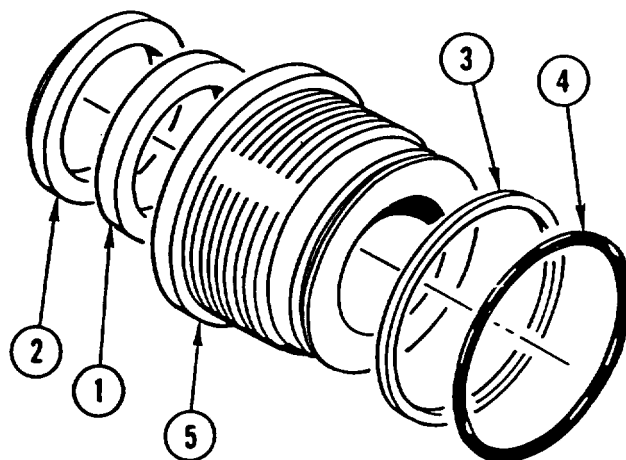


**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to packings, O-rings, and seals prior to assembly.

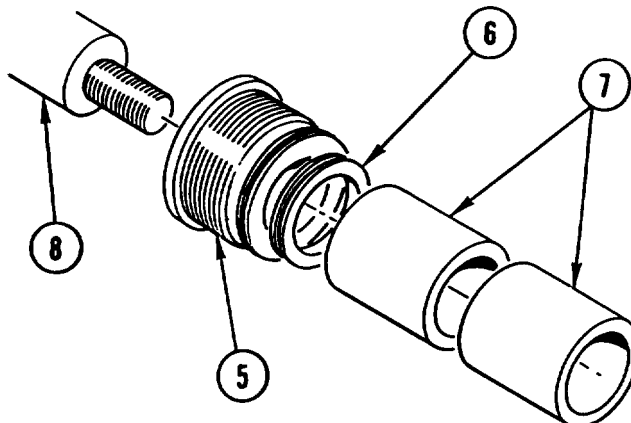
1. INSTALL new SEAL (1), new WIPER (2), new backup RING (3), and new O-RING (4) on head (5).



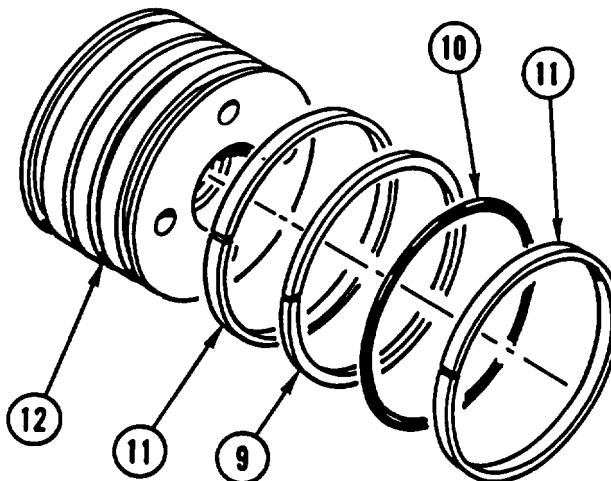


CRANE EXTERNAL END EXTENSION CYLINDER REPAIR (CONT)

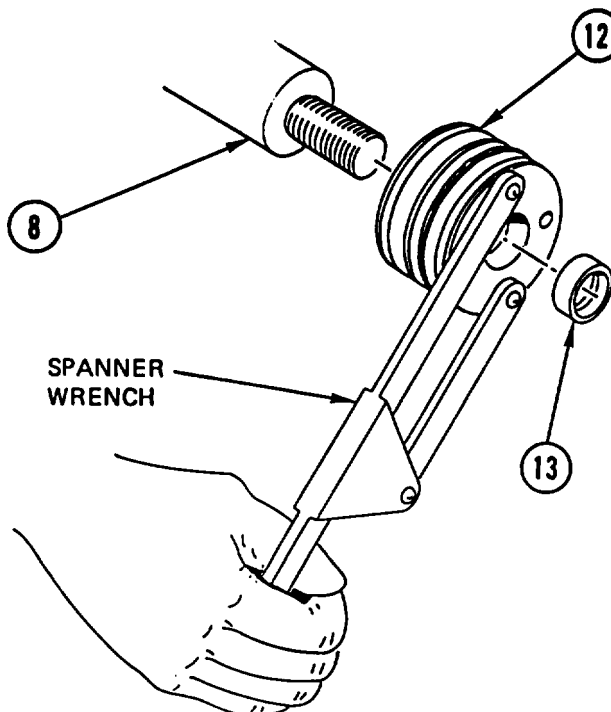
2. INSTALL HEAD (5), new wafer lock (6), and two cap tubes (7) on rod assembly (8).



3. INSTALL new SEAL (9), new O-RING (10), and two new piston RINGS (11) on piston (12).



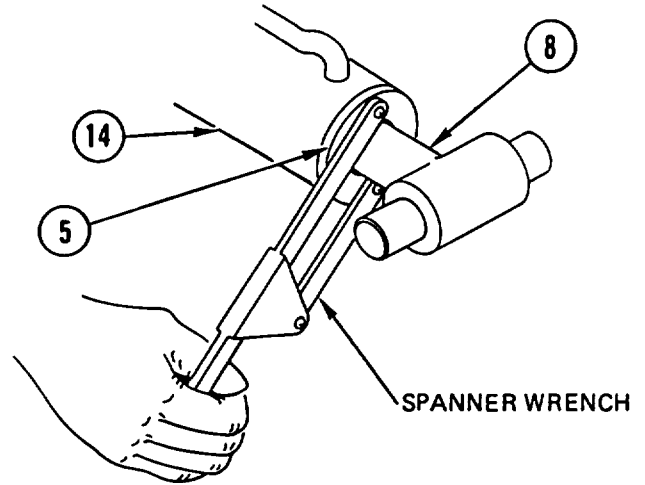
4. USING SPANNER WRENCH, INSTALL PISTON (12) on rod assembly (8) and TIGHTEN PISTON to 250 lb-ft (339 N.m).



5. INSTALL new lock RING (13) in piston (12).

**CRANE EXTERNAL END EXTENSION CYLINDER REPAIR (CONT)**

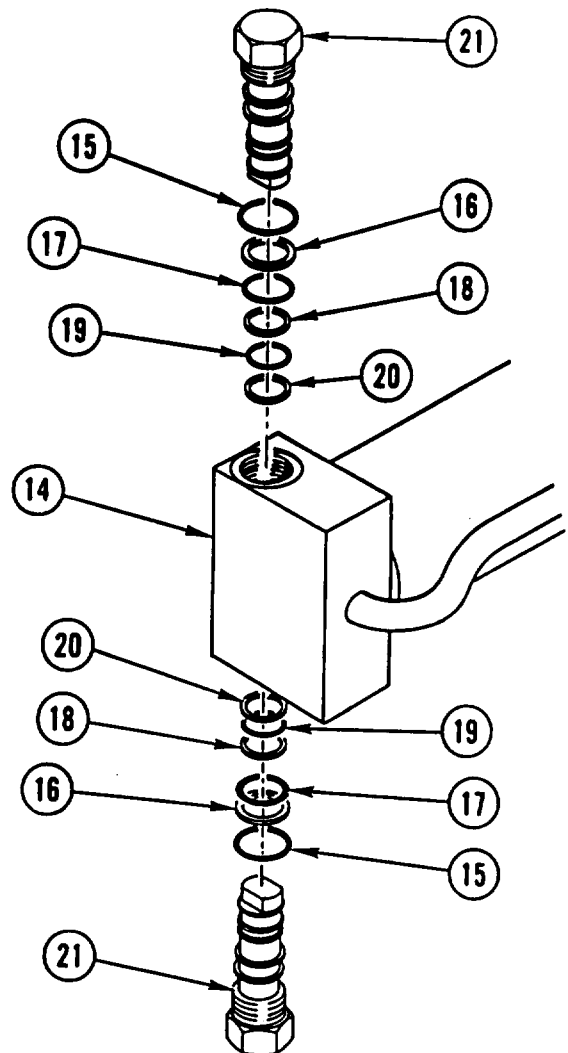
6. INSTALL ROD assembly (8) in housing (14).
7. USING SPANNER WRENCH, THREAD HEAD (5) into housing (14) and TIGHTEN to 250 lb-ft (339 N.m).



8. INSTALL new PACKING (15), new backup RING (16), new PACKING (17), new backup RING (18), new PACKING (19), and new backup RING (20) on each counterbalance valve (21).
9. INSTALL two counterbalance VALVES (21) in housing (14).

**NOTE**

Follow-on Maintenance:  
Install crane external end extension cylinder (TM 5-2420-224-20).



Section XXVII. CRANE INNER BOOM LIFT CYLINDER REPAIR

**CRANE INNER BOOM LIFT CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Spanner Wrench, P/N 3Y140510

**Materials/Parts:**

Kit  
 Kit  
 Oil, Lubricating                      Appendix B, item 30  
 Rags    Appendix B, item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane inner Boom Lift Cylinder Removed

**General Safety Instructions:**

**WARNING**

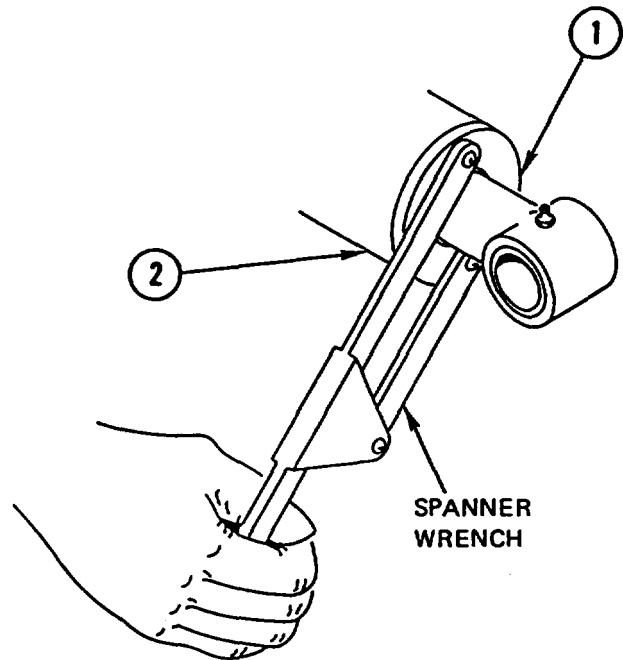
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

**NOTE**

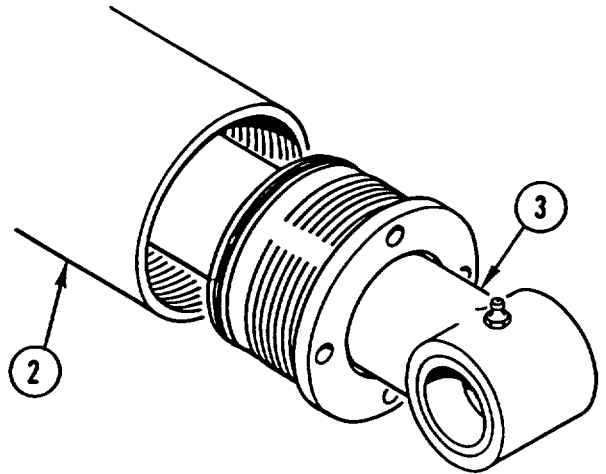
Procedure is the same for both inner boom lift cylinders.

1. USING SPANNER WRENCH, REMOVE HEAD (1) from crane inner boom lift cylinder (2).

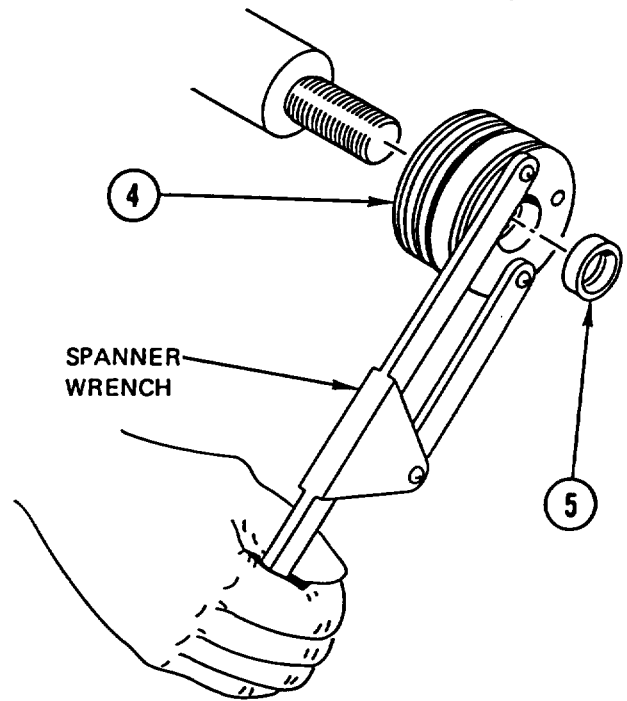


**CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)**

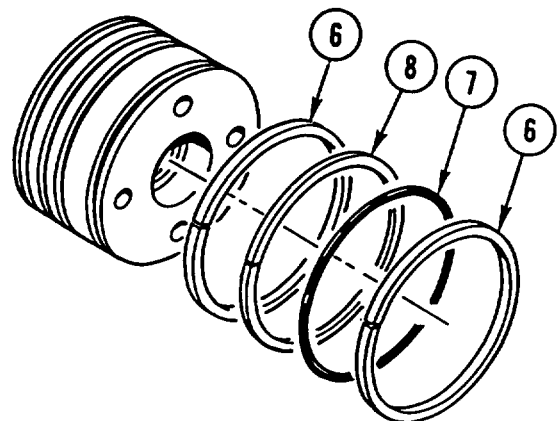
2. REMOVE ROD assembly (3) from crane inner boom lift cylinder (2).



3. USING SPANNER WRENCH, REMOVE PISTON (4).
4. IF DAMAGED, REMOVE lock RING (5) from piston (4).

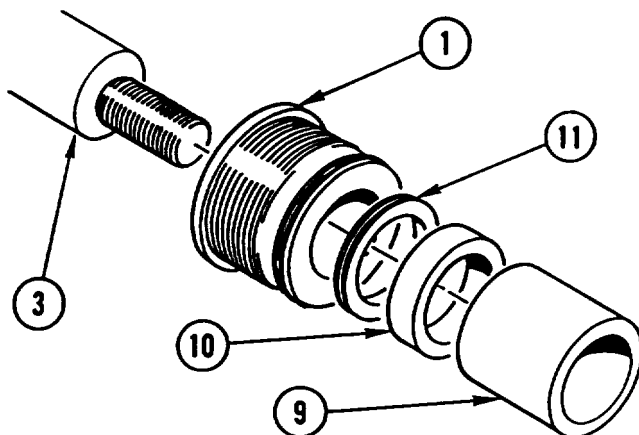


5. REMOVE and DISCARD two piston RINGS (6), O-RING (7), and SEAL (8).

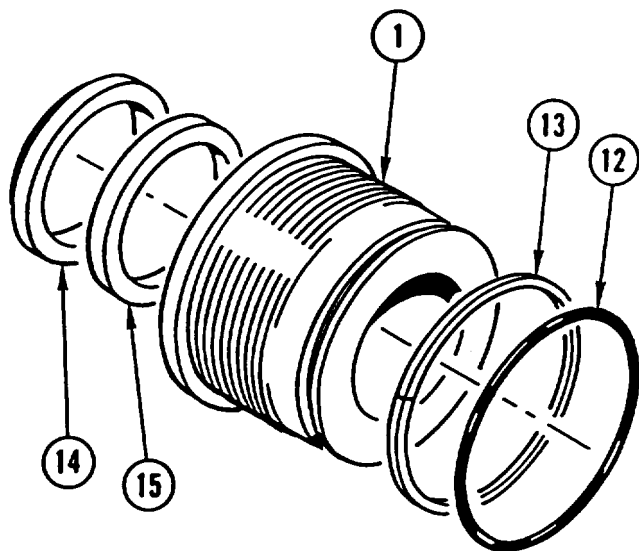


CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)

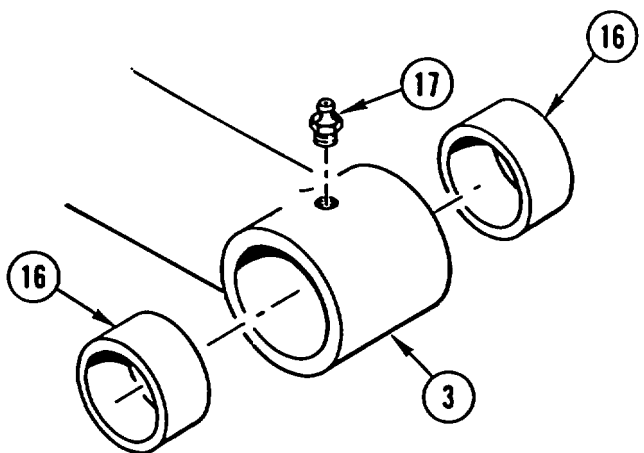
6. REMOVE two cap tubes (9 and 10), wafer lock (11), and HEAD (1) from rod assembly (3). DISCARD wafer LOCK.



7. REMOVE and DISCARD O-RING (12), backup RING (13), WIPER (14), and SEAL (15) from head (1).

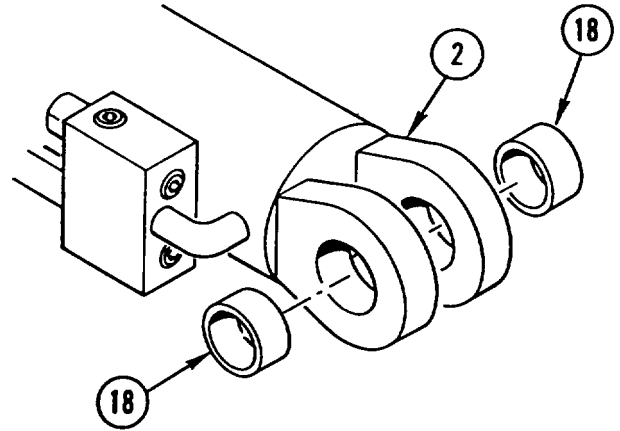


8. USING suitable PRESS, REMOVE two BUSHINGS (16) from rod assembly (3).
9. IF DAMAGED, REMOVE lubrication FITTING (17).

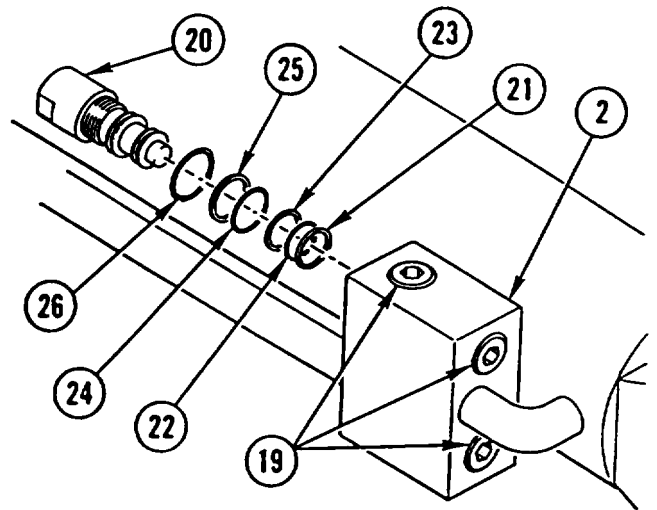


**CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)**

10. USING suitable PRESS, REMOVE two BUSHINGS (18) from crane inner boom lift cylinder (2).



11. REMOVE three PLUGS (19).
12. REMOVE counterbalance VALVE (20) from crane inner boom lift cylinder (2).
13. REMOVE and DISCARD backup RING (21), PACKING (22), backup RING (23), PACKING (24), backup RING (25), and PACKING (26) from counterbalance valve (20).

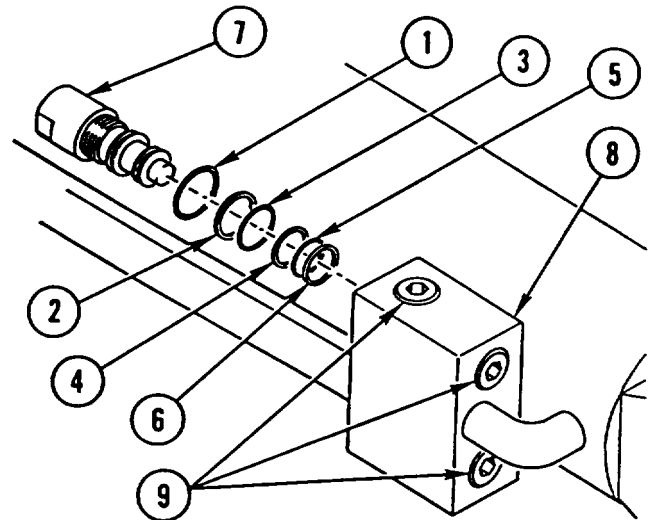


**ASSEMBLY**

**NOTE**

- Procedure is the same for both inner boom lift cylinders.
- Apply coat of lubricating oil to packings, O-rings, and seals prior to assembly.

1. INSTALL new PACKING (1), new backup RING (2), new PACKING (3), new backup RING (4), new PACKING (5), and new backup RING (6) on counterbalance valve (7).
2. INSTALL counterbalance VALVE (7) in crane inner boom lift cylinder (8).
3. INSTALL three PLUGS (9).

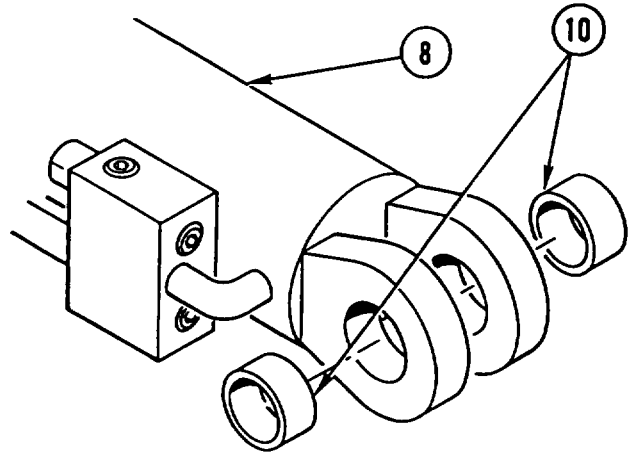


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**CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)**

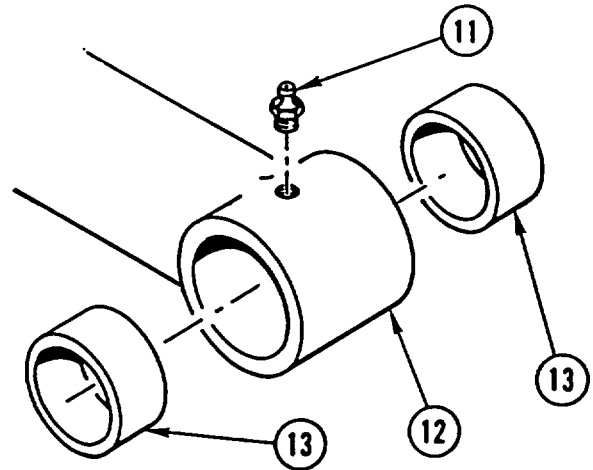
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4. USING suitable PRESS, INSTALL two BUSHINGS (10) in crane inner boom lift cylinder (8).

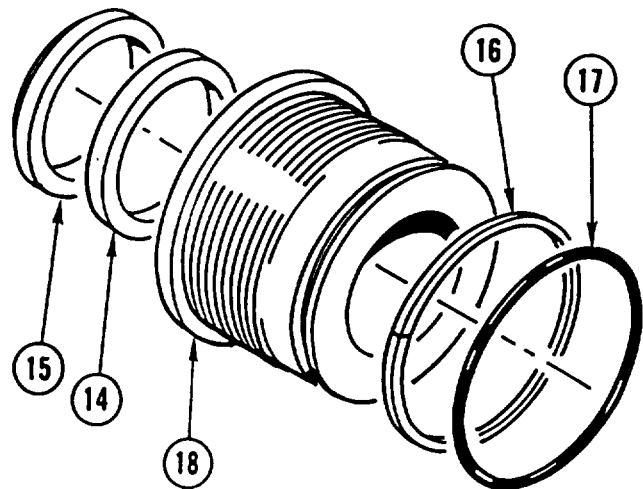


5. IF REMOVED, INSTALL new lubrication FITTING (11) in rod assembly (12).

6. USING suitable PRESS, INSTALL two BUSHINGS (13) in rod assembly (12).



7. INSTALL new SEAL (14), new WIPER (15), new backup RING (16), and new O-RING (17) on head (18).

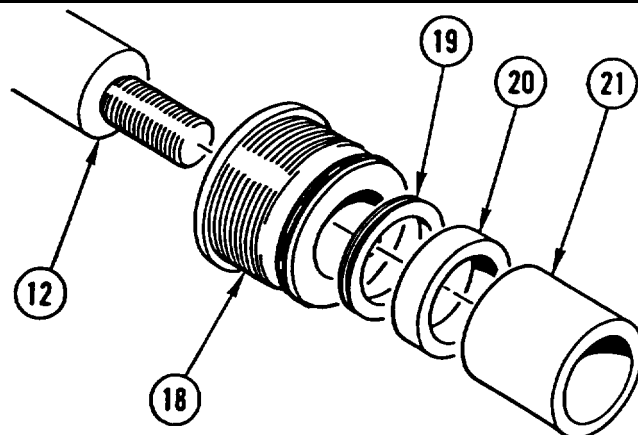


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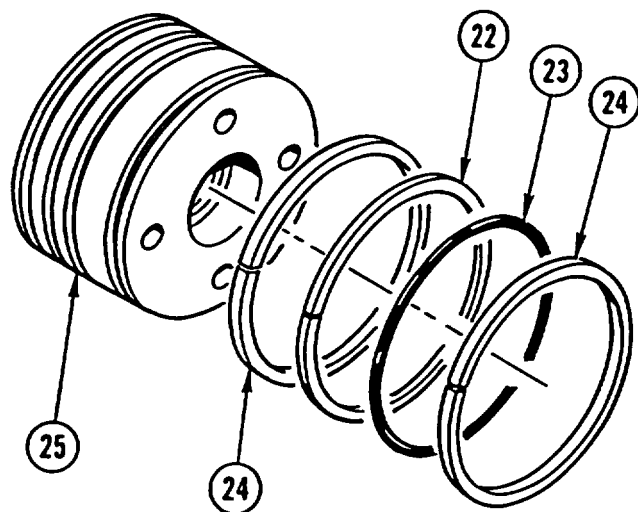
**CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)**


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8. INSTALL HEAD (18), new wafer lock (19), and two cap tubes (20 and 21) on rod assembly (12).

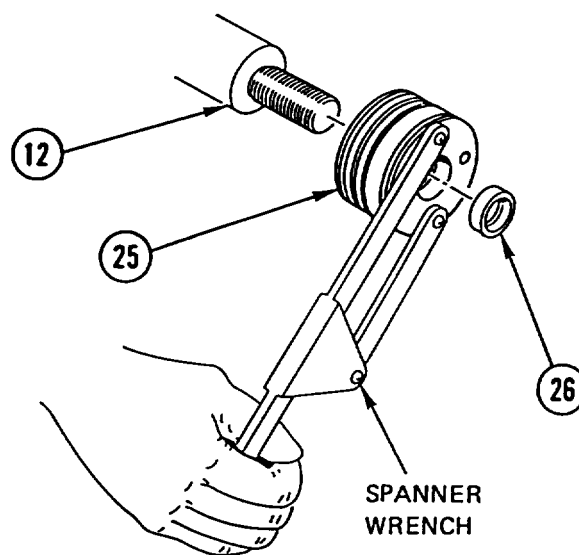


9. INSTALL new SEAL (22), new O-RING (23), and two new piston RINGS (24) on piston (25).



10. IF REMOVED, INSTALL new lock RING (26) in piston (25).

11. USING SPANNER WRENCH, INSTALL PISTON (25) on rod assembly (12) and TIGHTEN to 250 lb-ft (339 N.m).



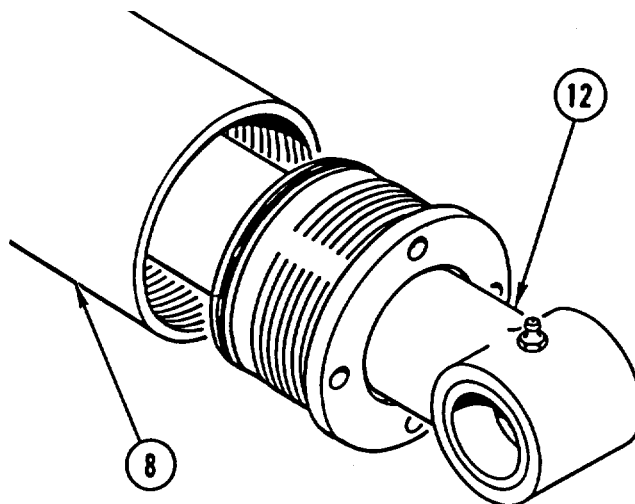


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CRANE INNER BOOM LIFT CYLINDER REPAIR (CONT)

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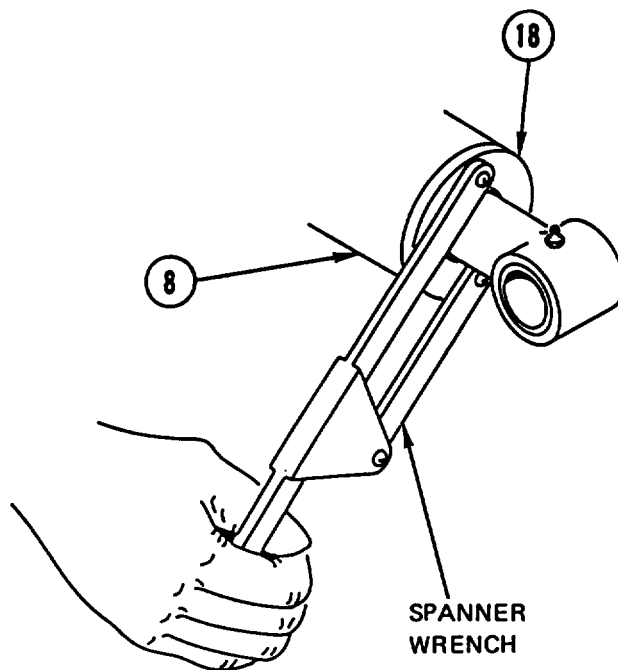
12. INSTALL ROD assembly (12) in crane inner boom lift cylinder (8).



13. USING SPANNER WRENCH, THREAD HEAD (18) into crane Inner boom lift cylinder (8) and TIGHTEN to 250 lb-ft (339 N.m).

**NOTE**

Follow-on Maintenance:  
Install crane inner boom lift  
cylinder (TM 5-2420-224-20).



Section XXVIII. CRANE MAST LOCKING CYLINDER REPAIR

**CRANE MAST LOCKING CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Spanner Wrench, P/N 3Y140510

**Materials/Parts:**

Kit  
 Oil, Lubricating Appendix B, Item 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane Mast Locking Cylinder Removed

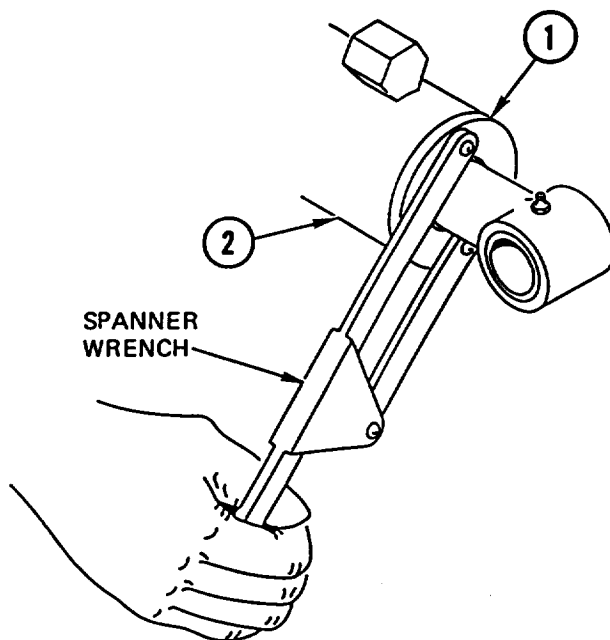
**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

1. USING SPANNER WRENCH, REMOVE HEAD (1) from housing (2).

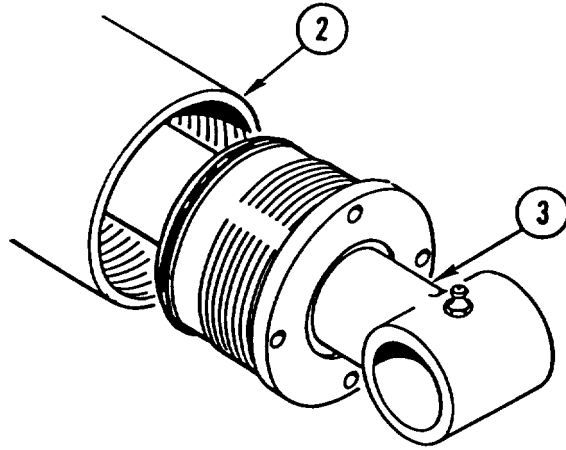


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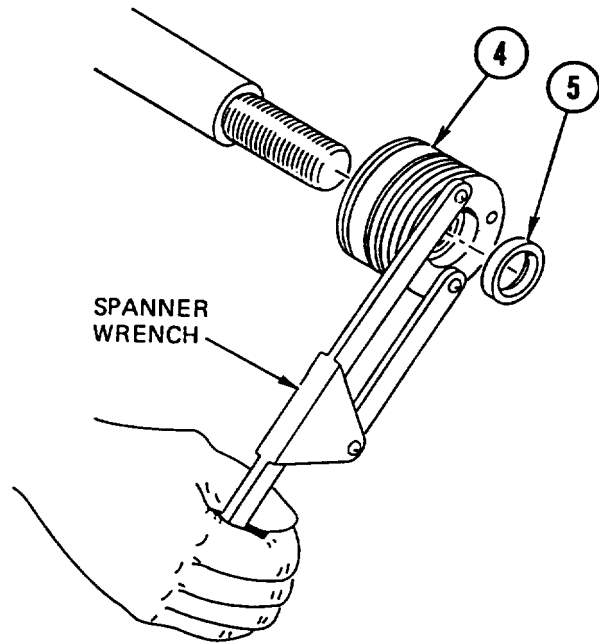
**CRANE MAST LOCKING CYLINDER REPAIR (CONT)**

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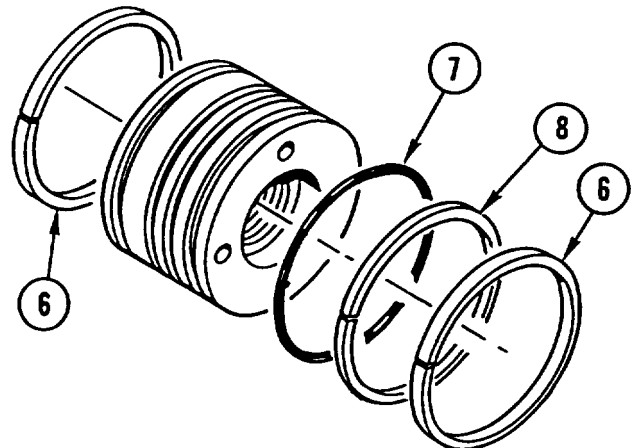
2. REMOVE ROD assembly (3) from housing (2).



3. USING SPANNER WRENCH, REMOVE PISTON (4).
4. REMOVE and DISCARD lock RING (5) from piston (4).

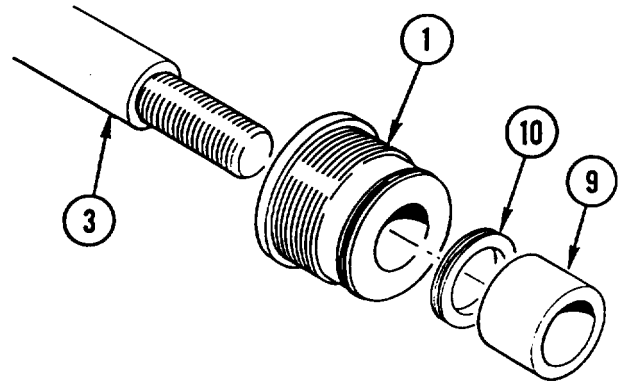


5. REMOVE and DISCARD two piston RINGS (6), O-RING (7), and SEAL (8).

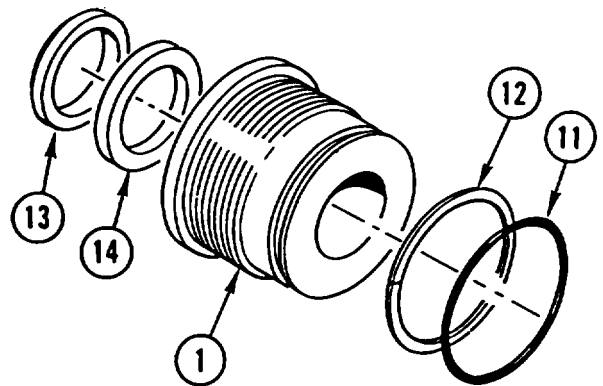


**CRANE MAST LOCKING CYLINDER REPAIR (CONT)**

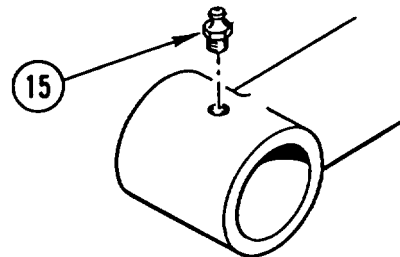
6. REMOVE bushing (9), wafer lock (10), and HEAD (1) from rod assembly (3). DISCARD wafer LOCK.



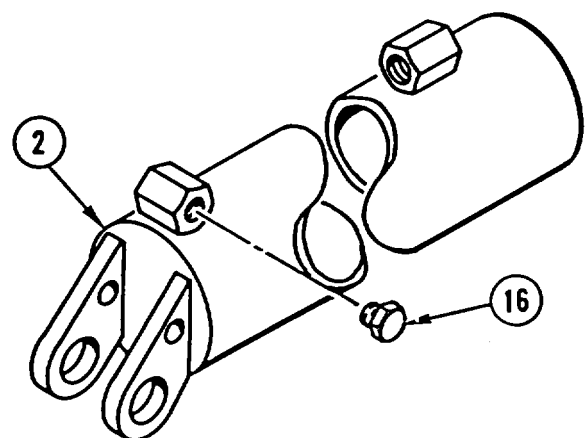
7. REMOVE and DISCARD O-RING (11), backup RING (12), WIPER (13), and SEAL (14) from head (1).



8. IF DAMAGED, REMOVE lubrication FITTING (15).



9. REMOVE PLUG (16) from housing (2).



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CRANE MAST LOCKING CYLINDER REPAIR (CONT)

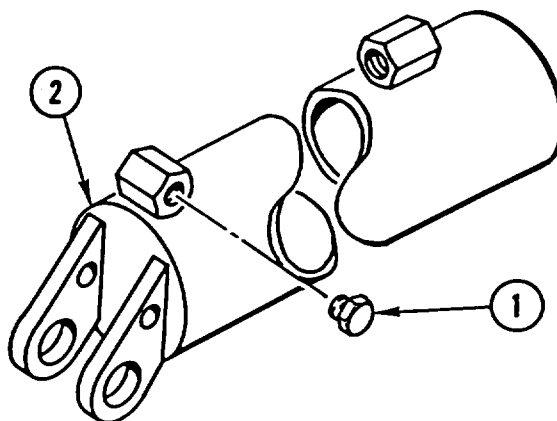
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**ASSEMBLY**

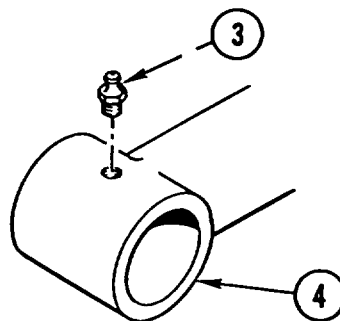
**NOTE**

Apply coat of lubricating oil to O-rings and seals prior to assembly.

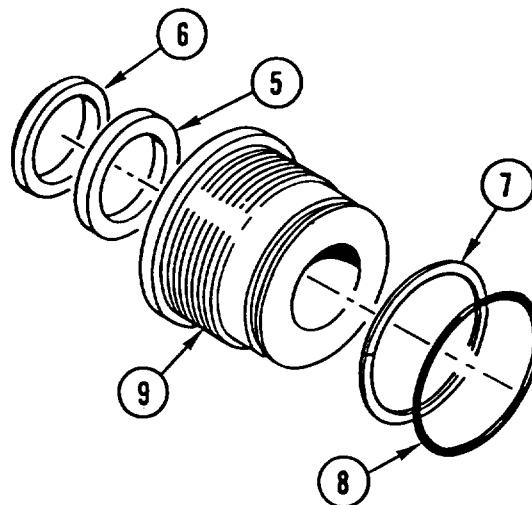
1. INSTALL PLUG (1) in housing (2).



2. IF REMOVED, INSTALL new lubrication FITTING (3) in rod assembly (4).



3. INSTALL new SEAL (5), new WIPER (6), new backup RING (7), and new O-RING (8) on head (9).

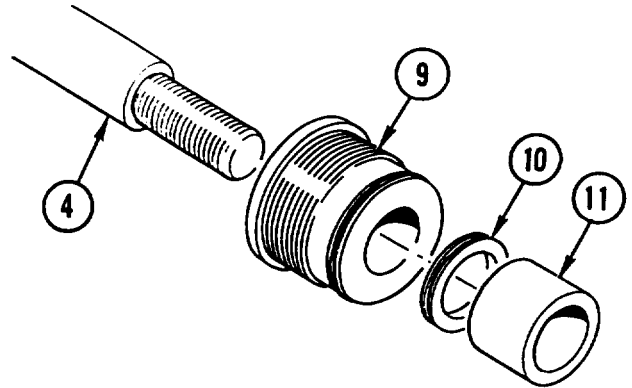


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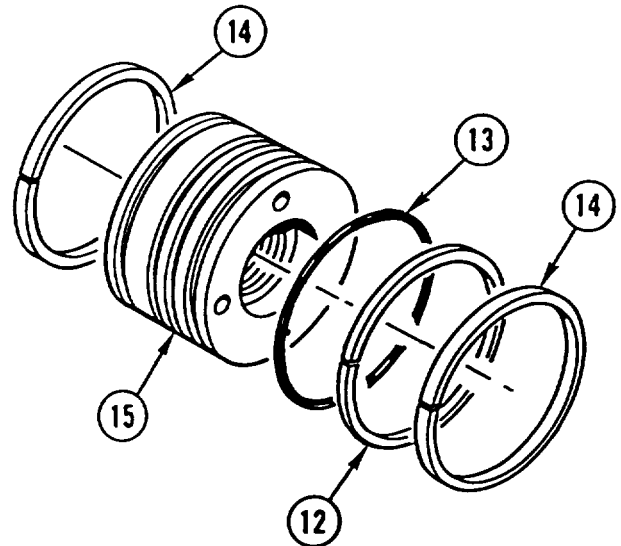
**CRANE MAST LOCKING CYLINDER REPAIR (CONT)**

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4. INSTALL HEAD (9), new wafer lock (10), and bushing (11) on rod assembly (4).



5. INSTALL new SEAL (12), new O-RING (13), and two new piston RINGS (14) on piston (15).

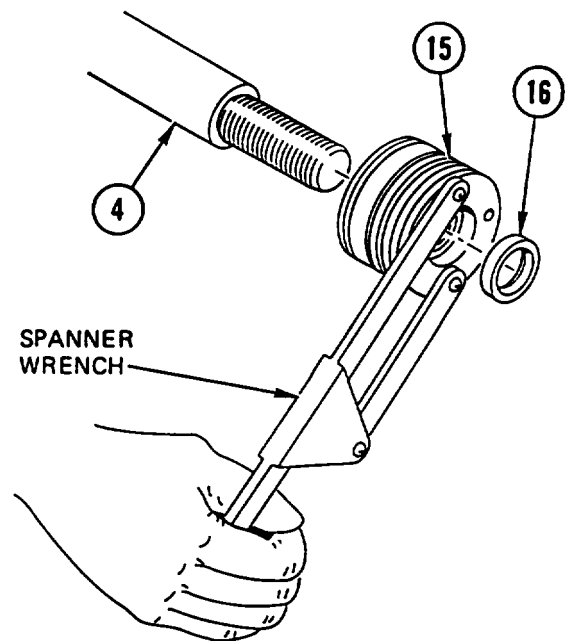


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## CRANE MAST LOCKING CYLINDER REPAIR (CONT)

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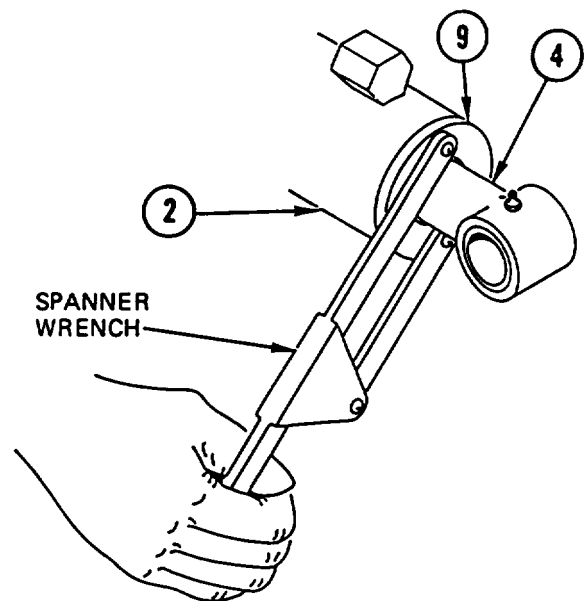
6. INSTALL new lock RING (16) in piston (15).
7. USING SPANNER WRENCH, INSTALL PISTON (15) on rod assembly (4) and TIGHTEN to 250 lb-ft (339 N.m).



8. INSTALL ROD assembly (4) in housing (2).
9. USING SPANNER WRENCH, THREAD HEAD (9) into housing (2) and TIGHTEN to 250 lb-ft (339 N.m).

**NOTE**

Follow-on Maintenance:  
Install crane mast locking cylinder  
(TM 5-2420-224-20).



**Section XXIX. CRANE OUTER BOOM CYLINDER REPAIR**

**CRANE OUTER BOOM CYLINDER REPAIR**

This task covers: a. Disassembly b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Spanner Wrench, P/N 3Y140510

**Materials/Parts:**

Kit  
 Kit  
 Oil, Lubricating                      Appendix B, Item 30  
 Rags    Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Condition Description
TM 5-2420-224-20	Crane Outer Boom Cylinder Removed

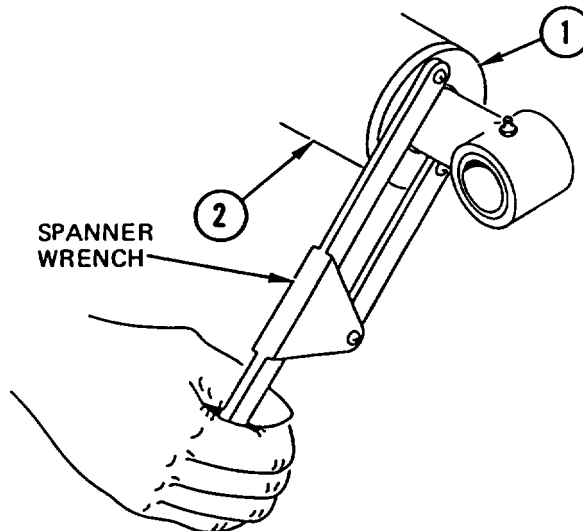
**General Safety instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

1. USING SPANNER WRENCH, REMOVE HEAD (1) from housing (2).



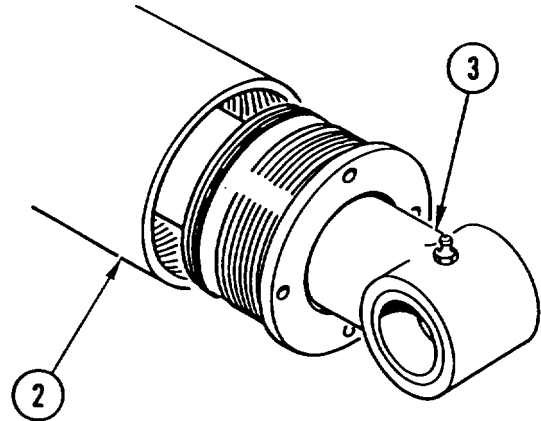


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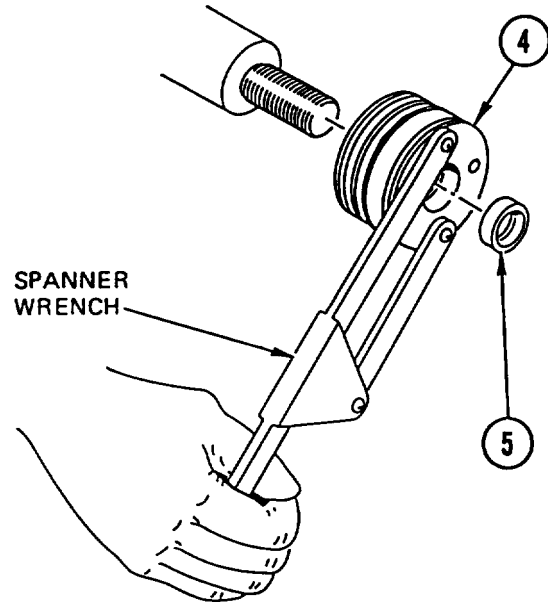
## CRANE OUTER BOOM CYLINDER REPAIR (CONT)

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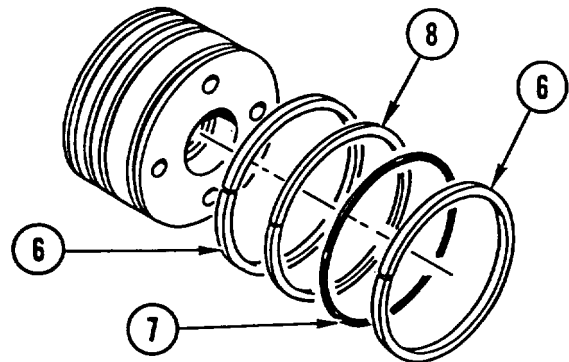
2. REMOVE ROD assembly (3) from housing (2).



3. USING SPANNER WRENCH, REMOVE PISTON (4).
4. REMOVE and DISCARD lock RING (5) from piston (4).

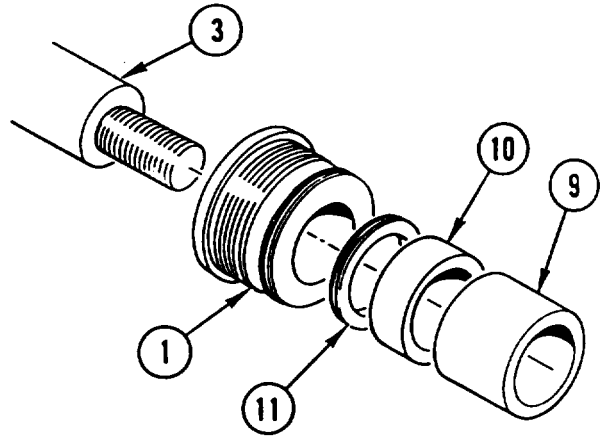


5. REMOVE and DISCARD two piston RINGS (6), O-RING (7), and SEAL (8).

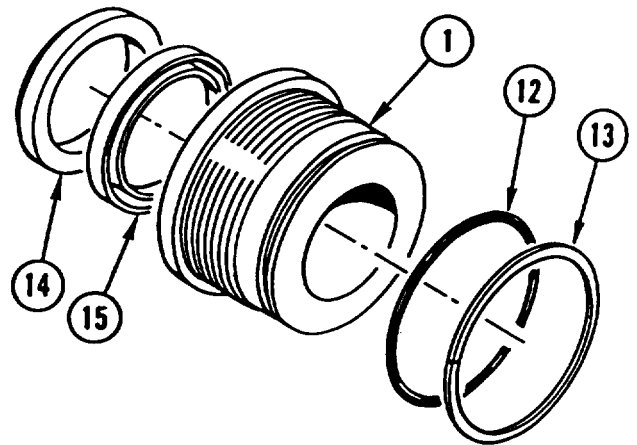


**CRANE OUTER BOOM CYLINDER REPAIR (CONT)**

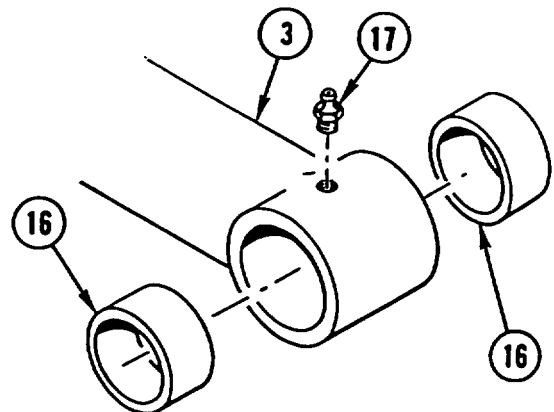
6. REMOVE two cap tubes (9 and 10), wafer lock (11), and HEAD (1) from rod assembly (3). DISCARD wafer LOCK.



7. REMOVE and DISCARD O-RING (12), backup RING (13), WIPER (14), and SEAL (15) from head (1).

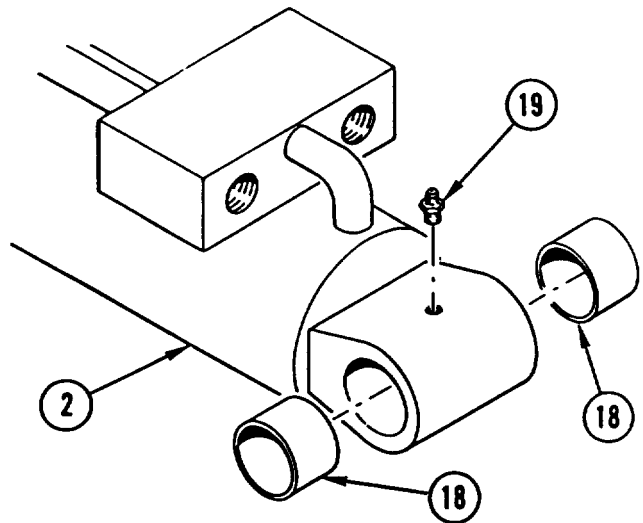


8. USING suitable PRESS, REMOVE two BUSHINGS (16) from rod assembly (3).
9. IF DAMAGED, REMOVE lubrication FITTING (17) from rod assembly (3).

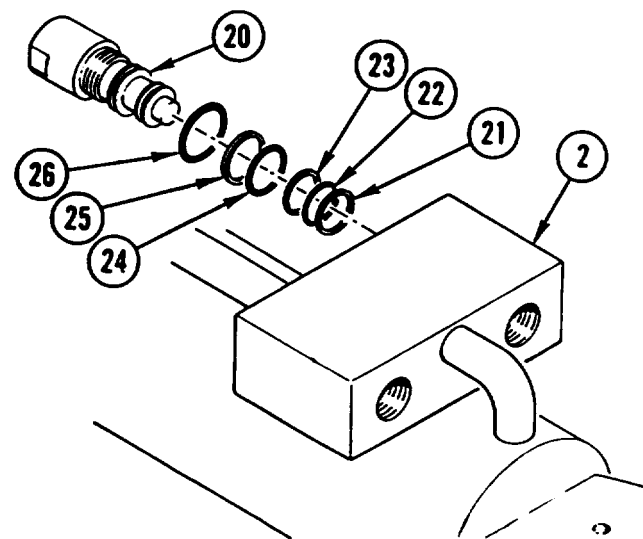


**CRANE OUTER BOOM CYLINDER REPAIR (CONT)**

10. USING suitable PRESS, REMOVE two BUSHINGS (18) from housing (2).
11. IF DAMAGED, REMOVE lubrication FITTING (19) from housing (2).



12. REMOVE counterbalance VALVE (20) from housing (2).
13. REMOVE and DISCARD backup RING (21), PACKING (22), backup RING (23), PACKING (24), backup RING (25), and PACKING (26) from counterbalance valve (20).

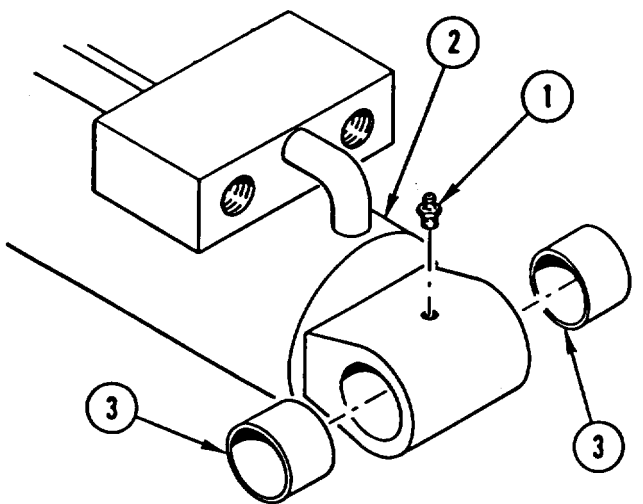


**ASSEMBLY**

**NOTE**

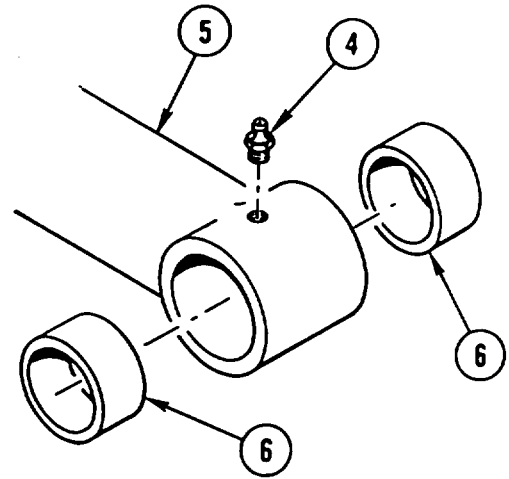
Apply coat of lubricating oil to packings, O-rings, and seals prior to assembly.

1. IF REMOVED, INSTALL new lubrication FITTING (1) in housing (2).
2. USING suitable PRESS, INSTALL two BUSHINGS (3) in housing (2).

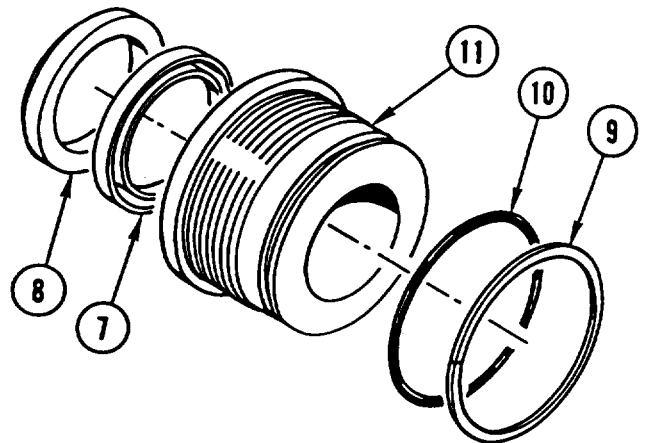


**CRANE OUTER BOOM CYLINDER REPAIR (CONT)**

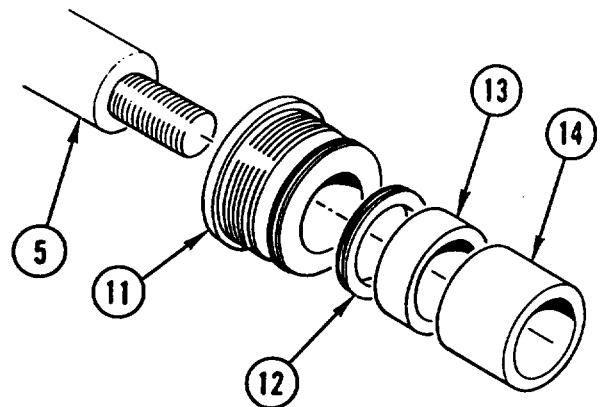
3. IF REMOVED, INSTALL new lubrication FITTING (4) in rod assembly (5).
4. USING suitable PRESS, INSTALL two BUSHINGS (6) in rod assembly (5).



5. INSTALL new SEAL (7), new WIPER (8), new backup RING (9), and new O-RING (10) on head (11).



6. INSTALL HEAD (11), new wafer lock (12), and two cap tubes (13 and 14) on rod assembly (5).

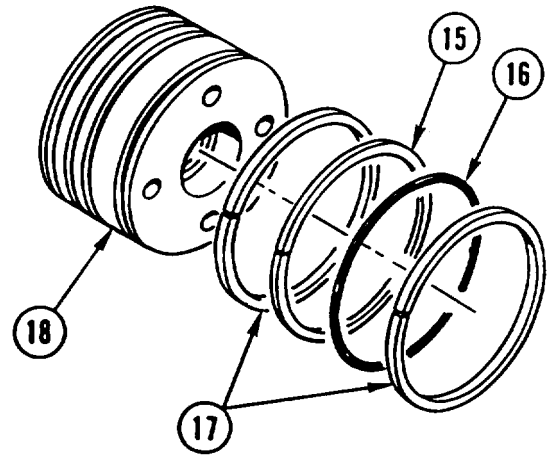


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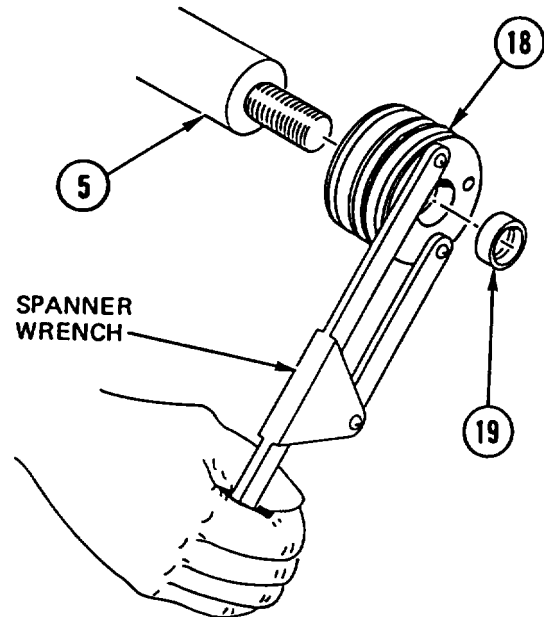
## CRANE OUTER BOOM CYLINDER REPAIR (CONT)

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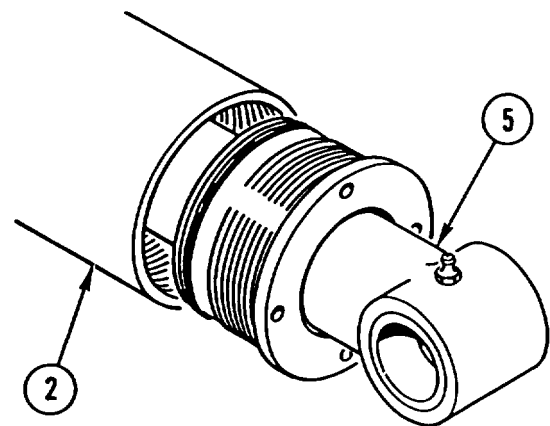
7. INSTALL new SEAL (15), new O-RING (16), and two new piston RINGS (17) on piston (18).



8. INSTALL new lock RING (19) in piston (18).
9. USING SPANNER WRENCH, INSTALL PISTON (18) on rod assembly (5) and TIGHTEN to 250 lb-ft (339 N.m).



10. INSTALL ROD assembly (5) in housing (2).

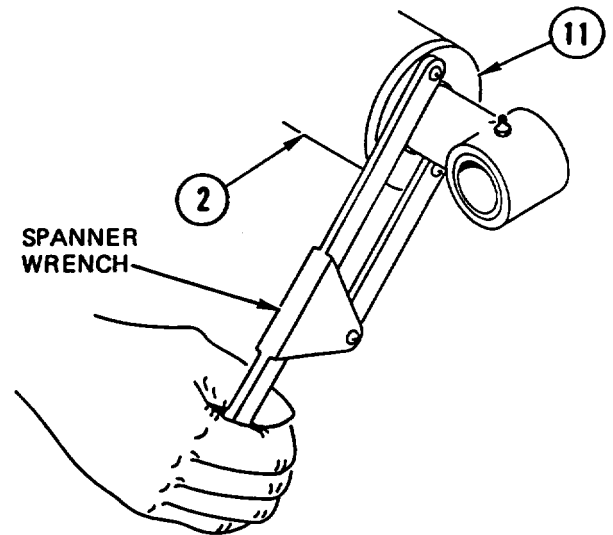


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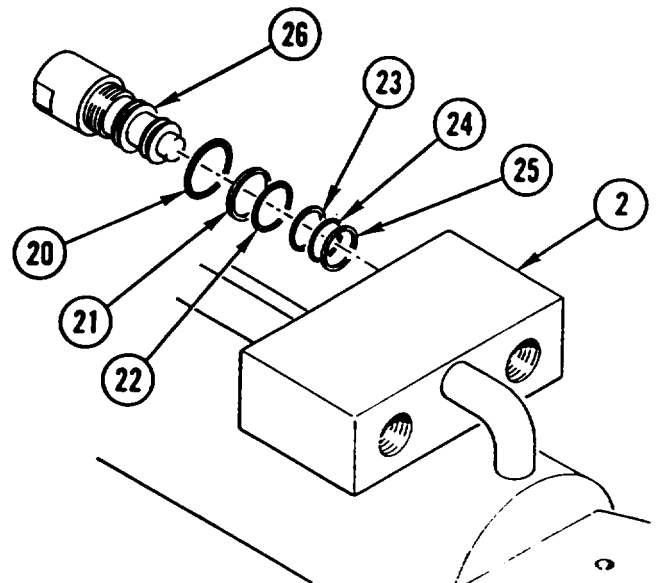
**CRANE OUTER BOOM CYLINDER REPAIR (CONT)**


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11. USING SPANNER WRENCH, THREAD HEAD (11) into housing (2) and TIGHTEN to 250 lb-ft (339 N.m).



12. INSTALL new PACKING (20), new backup RING (21), new PACKING (22), new backup RING (23), new PACKING (24), and new backup RING (25) on counterbalance valve (26).
13. INSTALL counterbalance VALVE (26) in housing (2).

**NOTE**

Follow-on Maintenance:  
Install crane outer boom cylinder  
(TM 5-2420-224-20).

## Section XXX. CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR

### CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR

This task covers: a. Disassembly b. Assembly

#### INITIAL SETUP

##### Applicable Configuration:

HMMH

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Tool Outfit (HSTRU), NSN 4940-01-036-5784  
Spanner Wrench, P/N 3Y140510

##### Materials/Parts:

Kit

Oil, Lubricating Appendix B, Item 30

Rags Appendix B, Item 40

##### References:

TM 5-2420-224-20

##### Equipment Condition:

##### Reference

TM 5-2420-224-20

##### Condition Description

Crane Horizontal Outrigger  
Cylinder Removed

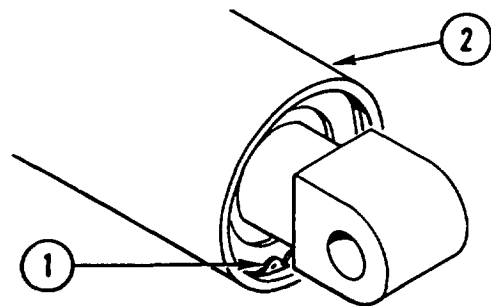
##### General Safety instructions:

#### WARNING

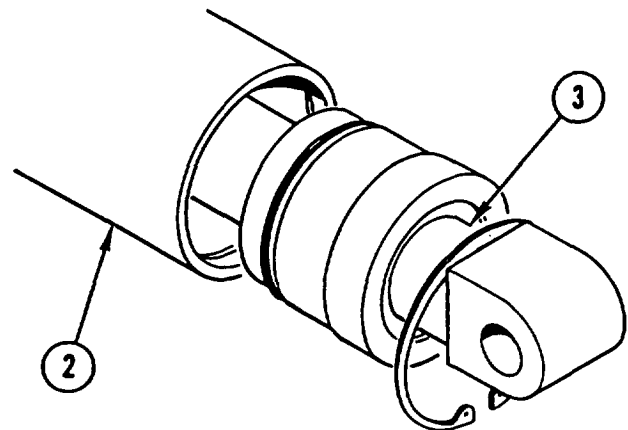
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

#### DISASSEMBLY

1. REMOVE retaining RING (1) from crane horizontal outrigger cylinder (2).

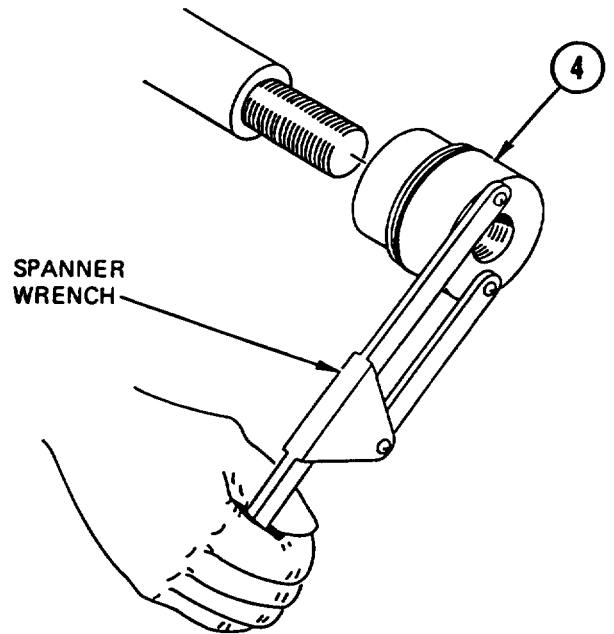


2. REMOVE ROD assembly (3) from crane horizontal outrigger cylinder (2).

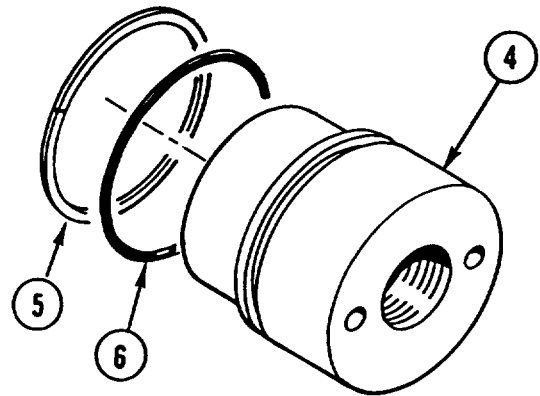


**CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR (CONT)**

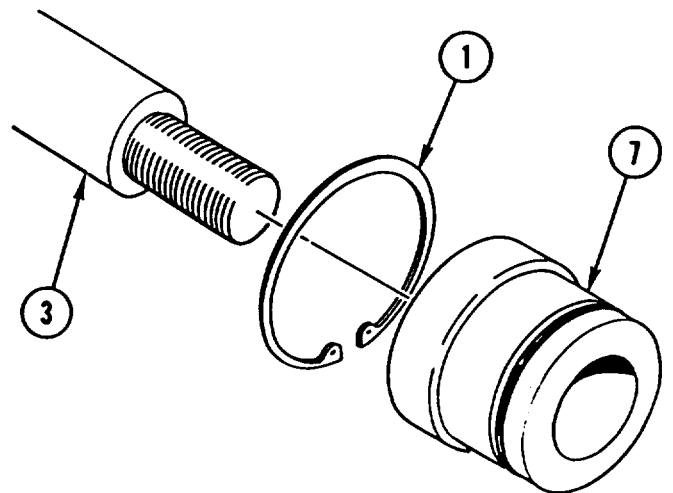
3. USING SPANNER WRENCH, REMOVE PISTON (4).



4. REMOVE and DISCARD SEAL (5) and O-RING (6) from piston (4).



5. REMOVE HEAD (7) and retaining ring (1) from rod assembly.



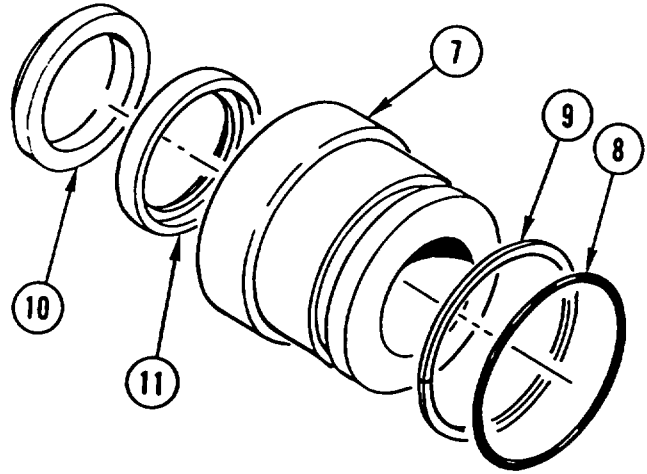


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**CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR (CONT)**

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6. REMOVE and DISCARD O-RING (8), backup RING (9), WIPER (10), and SEAL (11) from head (7).

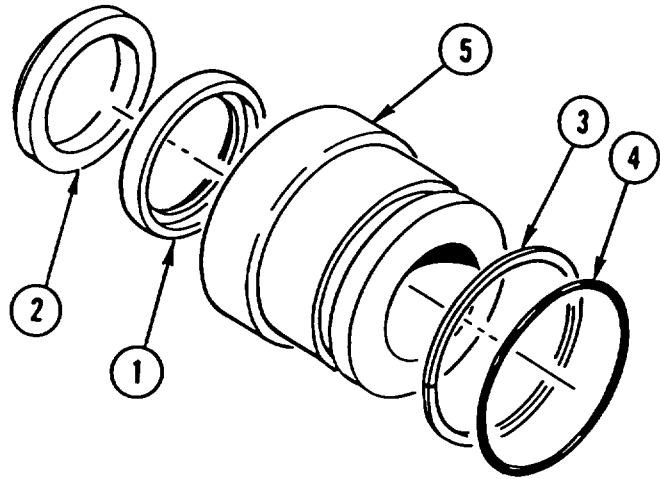


**ASSEMBLY**

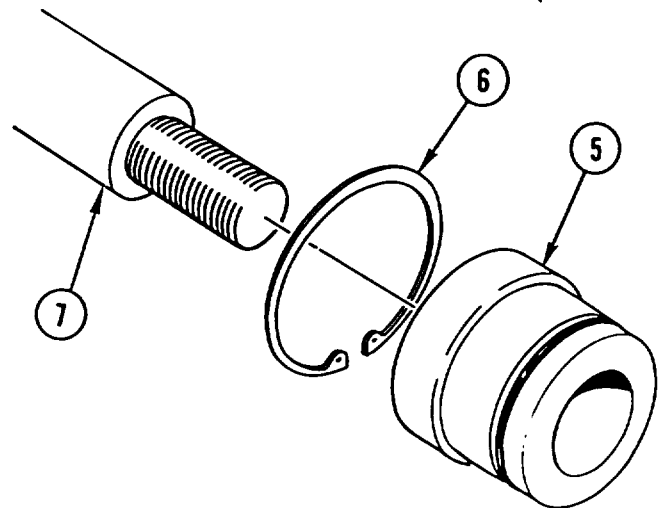
**NOTE**

Apply coat of lubricating oil to O-rings and seals prior to assembly.

1. INSTALL new SEAL (1), new WIPER (2), new backup RING (3), and new O-RING (4) on head (5).



2. INSTALL retaining ring (6) and HEAD (5) on rod assembly (7).

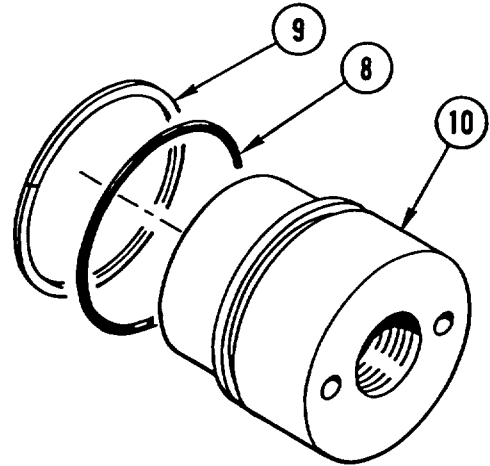


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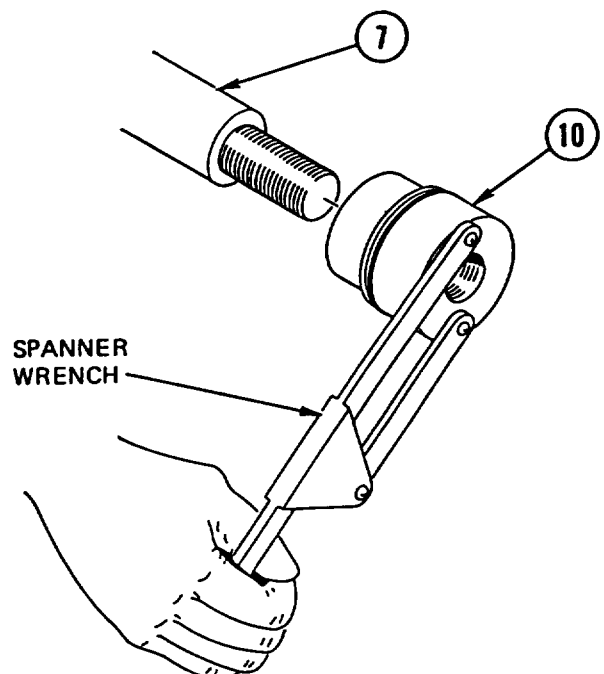
**CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR (CONT)**

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3. INSTALL new O-RING (8) and new SEAL (9) on piston (10).



4. USING SPANNER WRENCH, INSTALL PISTON (10) on rod assembly (7) and TIGHTEN to 35 lb-ft (47 N.m).

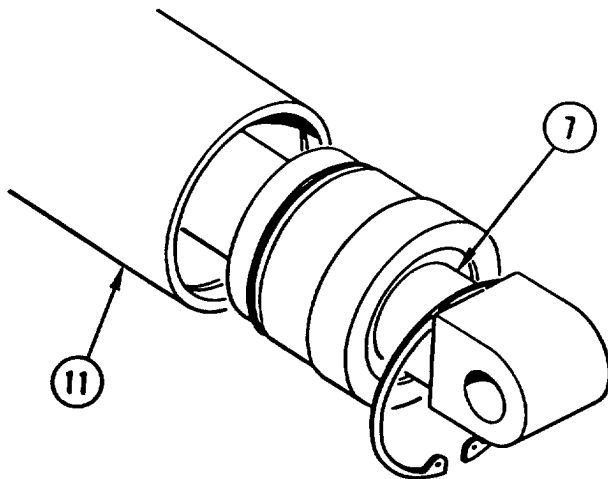


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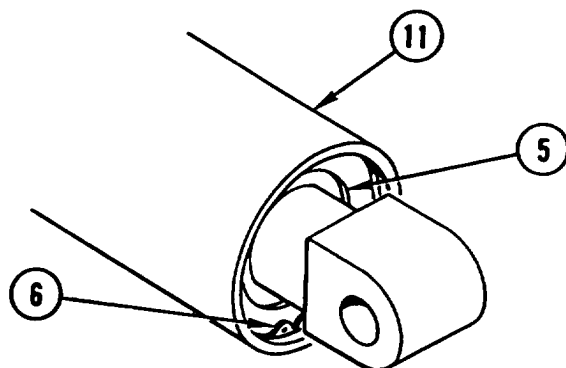
**CRANE HORIZONTAL OUTRIGGER CYLINDER REPAIR (CONT)**

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5. INSTALL ROD assembly (7) in crane horizontal outrigger cylinder (11).



6. INSTALL HEAD (5) in crane horizontal outrigger cylinder (11) and INSTALL retaining RING (6).



**NOTE**

Follow-on Maintenance:  
Install crane horizontal outrigger  
cylinder (TM 5-2420-224-20).

**Section XXXI. CRANE VERTICAL OUTRIGGER CYLINDER REPAIR**

**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR**

This task covers: a. Disassemble b. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Tool Outfit (HSTRU), NSN 4940-01-036-5784  
 Spanner Wrench, P/N 3Y140510

**Materials/Parts:**

Kit  
 Kit  
 Oil, Lubricating Appendix B, [tern 30  
 Rags Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

TM 5-2420-224-20

**Condition Description**

Crane Vertical Outrigger  
 Cylinder Removed

**General Safety Instructions:**

**WARNING**

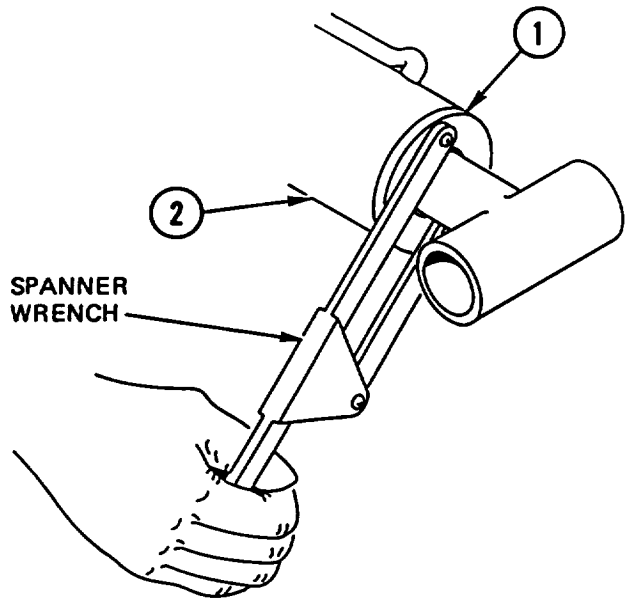
Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

**DISASSEMBLY**

**NOTE**

Procedure is the same for both vertical outrigger cylinders.

1. USING SPANNER WRENCH, REMOVE HEAD (1) from crane vertical outrigger cylinder (2).

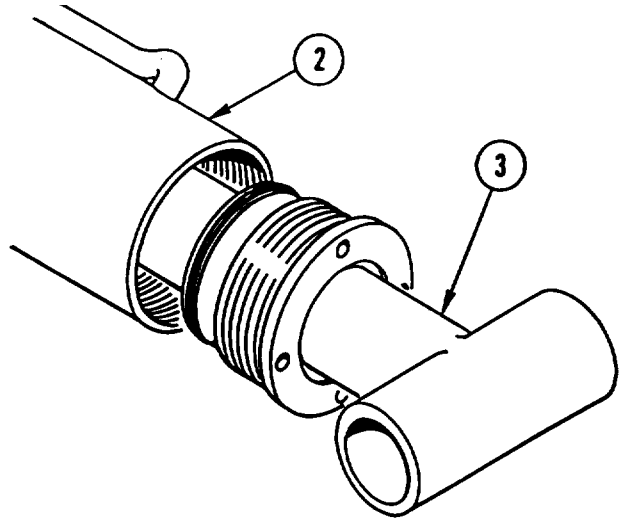


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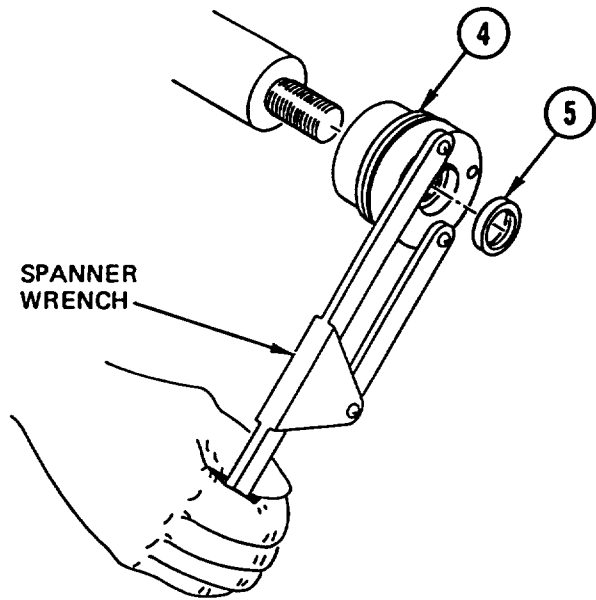
**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR (CONT)**

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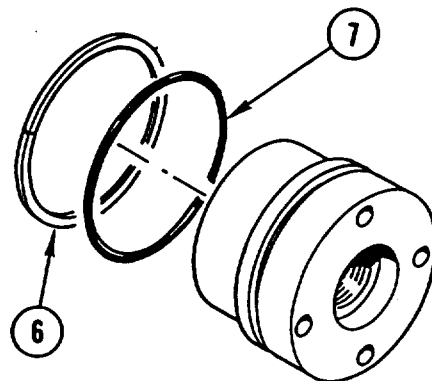
2. REMOVE ROD assembly (3) from crane vertical outrigger cylinder (2).



3. USING SPANNER WRENCH, REMOVE PISTON (4).
4. REMOVE and DISCARD lock RING (5) from piston (4).



5. REMOVE and DISCARD SEAL (6) and O-RING (7).

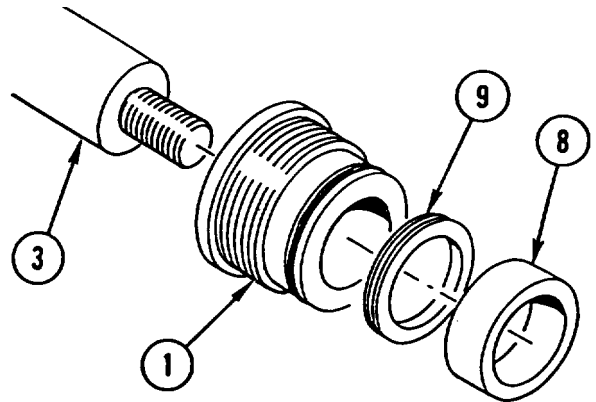


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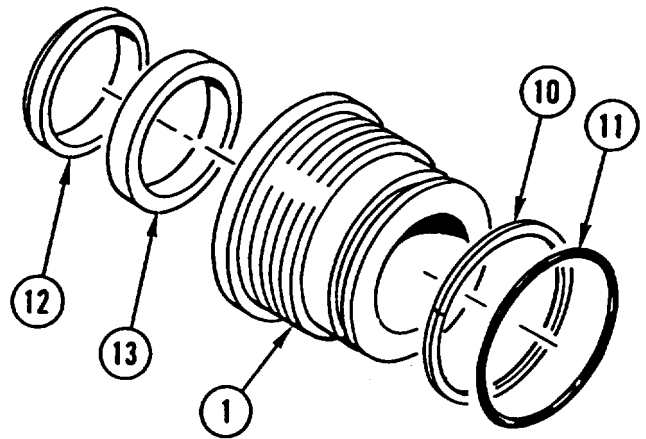
**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR (CONT)**


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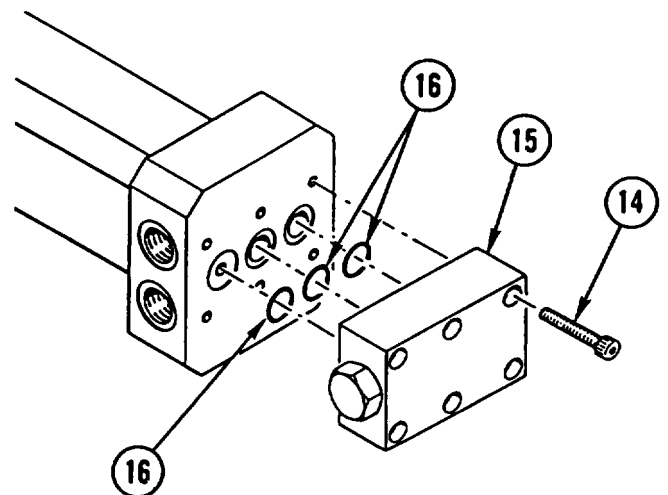
6. REMOVE stop tube (8), wafer lock (9), and HEAD (1) from rod assembly (3). DISCARD wafer LOCK.



7. REMOVE and DISCARD backup RING (10), O-RING (11), WIPER (12), and SEAL (13) from head (1).

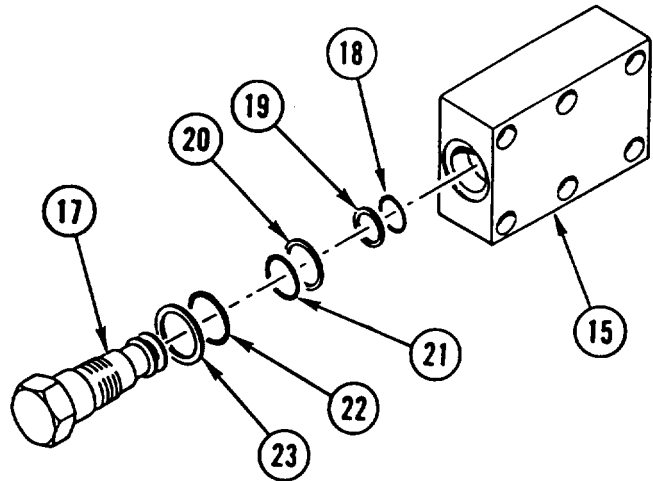


8. REMOVE six capscrews (14), valve BLOCK (15), and three packings (16). DISCARD PACKINGS.



**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR (CONT)**

9. REMOVE valve BODY (17) from valve block (15).
10. REMOVE and DISCARD PACKING (18), two backup RINGS (19 and 20), two PACKINGS (21 and 22), and backup RING (23) from valve body (17).

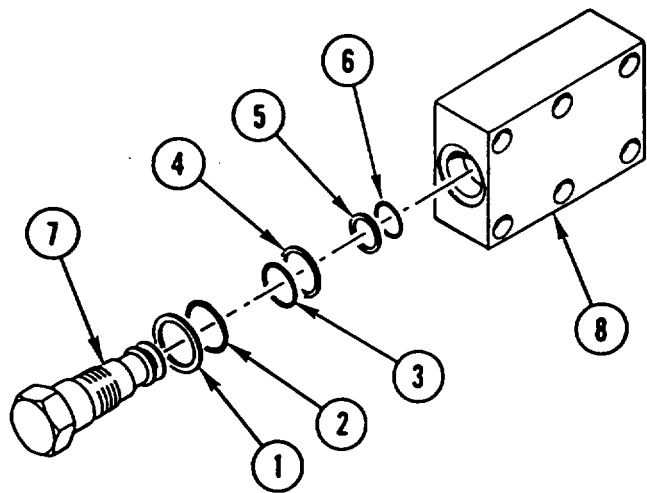


**ASSEMBLY**

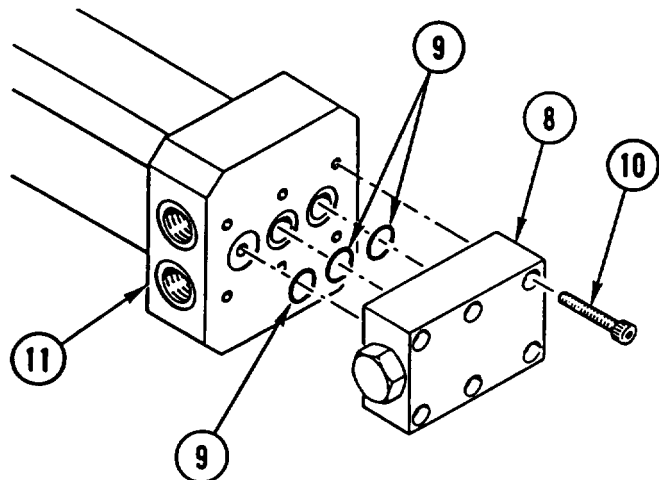
**NOTE**

- Procedure is the same for both vertical outrigger cylinders.
- Apply coat of lubricating oil to packings, O-rings, and seals prior to assembly.

1. INSTALL new backup RING (1), two new PACKINGS (2 and 3), two new backup RINGS (4 and 5), and new PACKING (6) on valve body (7).
2. INSTALL valve BODY (7) in valve block (8).

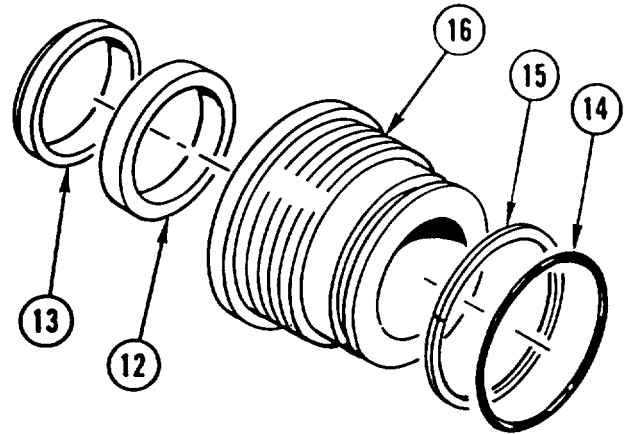


3. INSTALL three new packings (9), valve BLOCK (8), and six capscrews (10) on crane vertical outrigger cylinder (11).

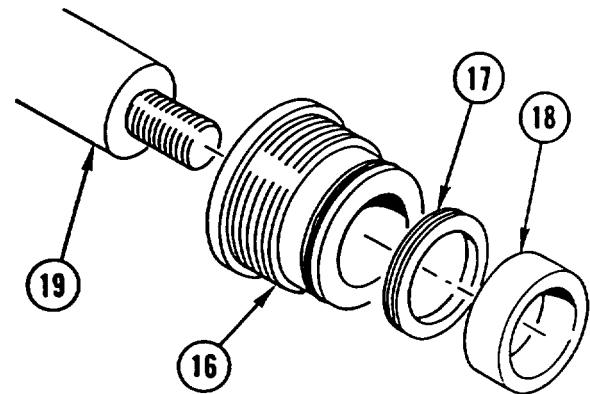


**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR (CONT)**

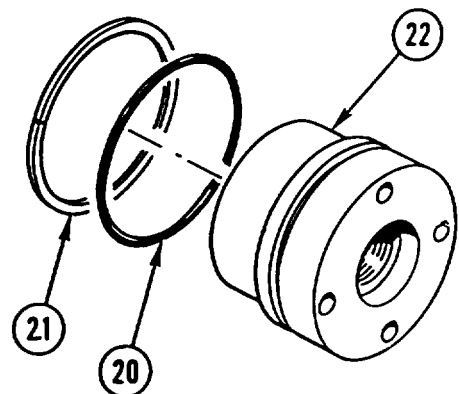
4. INSTALL new SEAL (12), new WIPER (13), new O-RING (14), and new backup RING (15) on head (16).



5. INSTALL HEAD (16), new wafer lock (17), and stop tube (18) on rod assembly (19).



6. INSTALL new O-RING (20) and new SEAL (21) on piston (22).



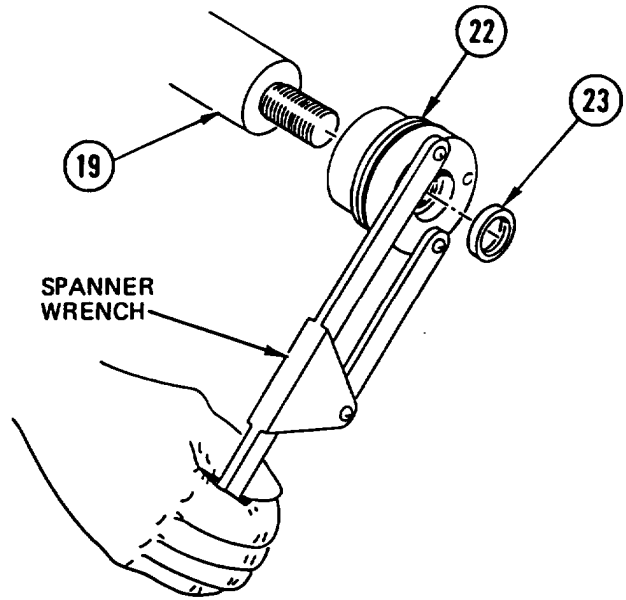


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**CRANE VERTICAL OUTRIGGER CYLINDER REPAIR (CONT)**

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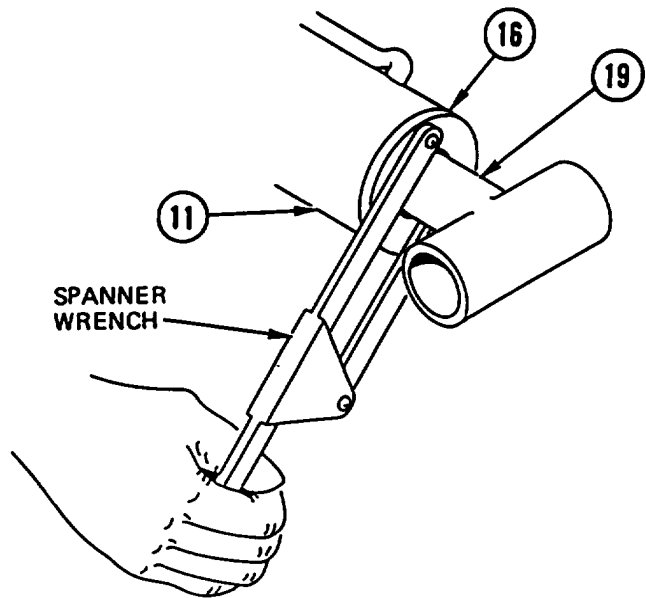
7. INSTALL new lock RING (23) in piston (22).
8. USING SPANNER WRENCH, INSTALL PISTON (22) on rod assembly (19) and TIGHTEN to 250 lb-ft (339 N.m).



9. INSTALL ROD assembly (19) in crane vertical outrigger cylinder (11).
10. USING SPANNER WRENCH, THREAD HEAD (16) into crane vertical outrigger cylinder (11) and TIGHTEN to 250 lb-ft (339 N.m).

**NOTE**

Follow-on Maintenance:  
Install crane vertical outrigger  
cylinder (TM 5-2420-224-20).



Section XXXII. CRANE HYDRAULIC MOTOR REPAIR

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**CRANE HYDRAULIC MOTOR REPAIR**

---

This task covers: a. Disassembly b. Assembly

---

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A74  
 Tool Kit, SC 5280-90-CL-A74  
 Socket, P/N 5422

**Materials/Parts:**

Kit, Parts

Caps and Plugs	Appendix B, Item 8
Cloth, Emery	Appendix B, Item 10
Compound, Sealing	Appendix B, Item 16
Oil, Lubricating	Appendix B, Item 30
Rags	Appendix B, Item 40

**References:**

TM 5-2420-224-20

**Equipment Condition:**

Reference	Equipment Condition
TM 5-2420-224-20	Crane Hydraulic Motor Removed

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

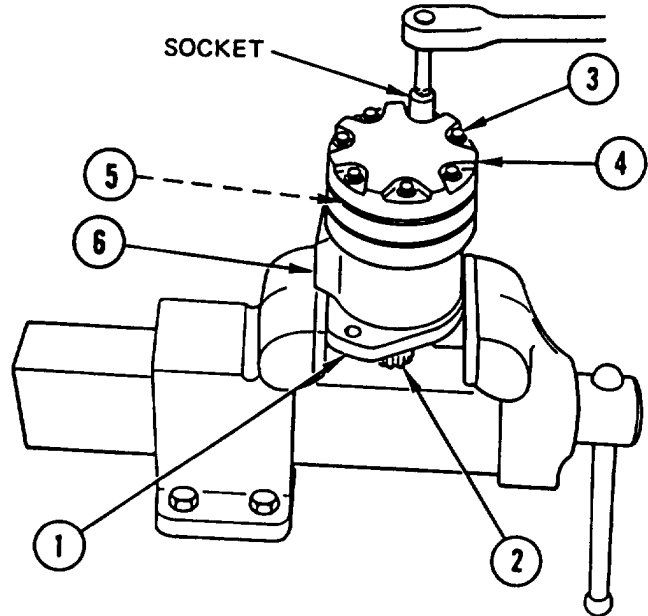
CRANE HYDRAULIC MOTOR REPAIR (CONT)

**DISASSEMBLY**

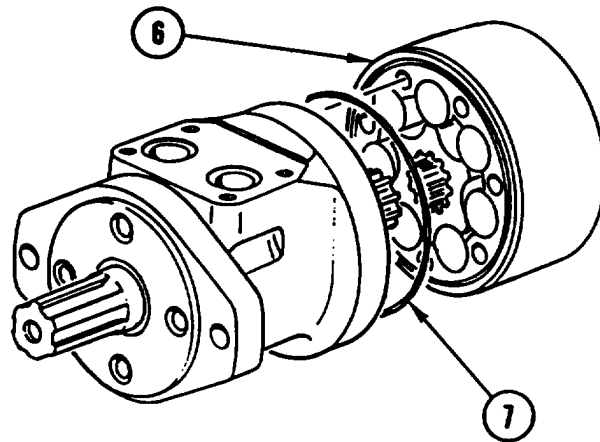
**CAUTION**

Cleanliness is extremely important when repairing crane hydraulic motor. Perform maintenance in a clean, dry area to prevent damage to equipment.

1. USING suitable CONTAINER, DRAIN OIL and INSTALL PLUGS in ports of crane hydraulic motor.
2. THOROUGHLY CLEAN outside of crane hydraulic motor.
3. PLACE crane hydraulic MOTOR in soft-jawed VISE by CLAMPING ACROSS mounting FLANGE (1) with output shaft (2) down.
4. USING SOCKET, REMOVE seven capscrews (3), end CAP (4), and seal (5) from gear rotor set (6). DISCARD SEAL.

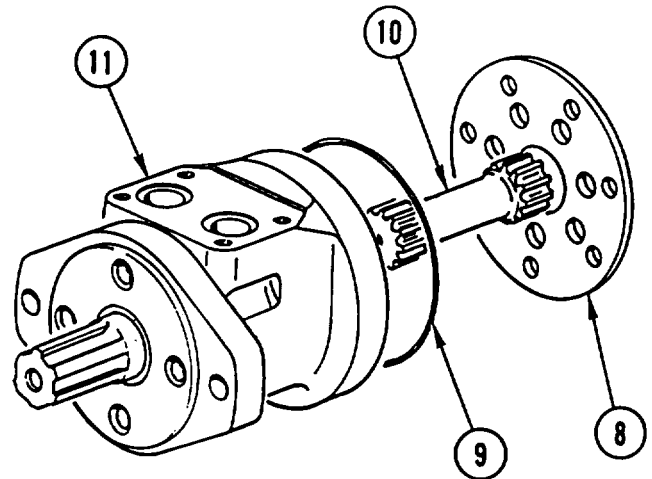


5. REMOVE GEAR ROTOR SET (6) and seal (7). RETAIN ROLLERS in outer gear rotor ring. DISCARD SEAL.



**CRANE HYDRAULIC MOTOR REPAIR (CONT)**

6. REMOVE spacer PLATE (8), seal (9), and drive shaft (10) from manifold housing (11). DISCARD SEAL.



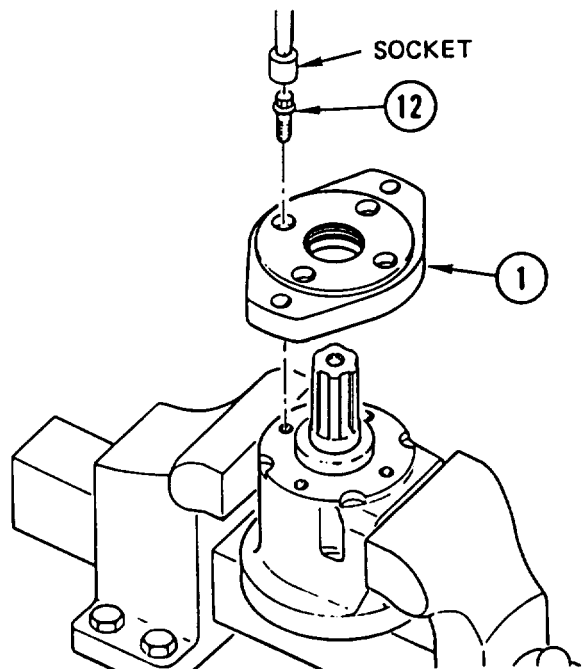
**CAUTION**

Do not overtighten vise jaws. Excessive clamping force may distort housing.

7. REPOSITION crane hydraulic MOTOR in soft-jawed vise by CLAMPING across PORTS.

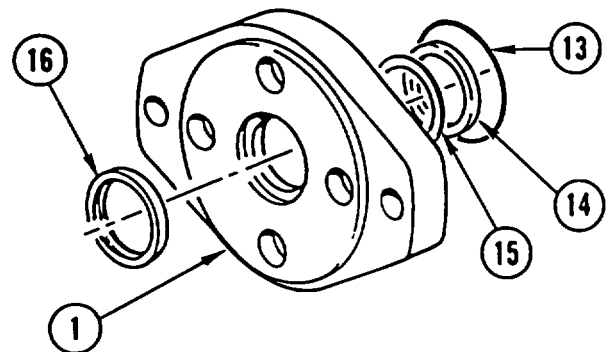
**CAUTION**

Do not use impact wrench on screws to break torque. This could result in rounded heads or broken sockets.



8. USING SOCKET, REMOVE four SCREWS (12).
9. REMOVE crane hydraulic MOTOR from soft-jawed vise and, using twisting motion, REMOVE mounting FLANGE (1).

10. REMOVE SEAL (13), seal (14), retaining ring (15), and seal (16) from mounting flange (1). DISCARD SEALS (13, 14, and 16).

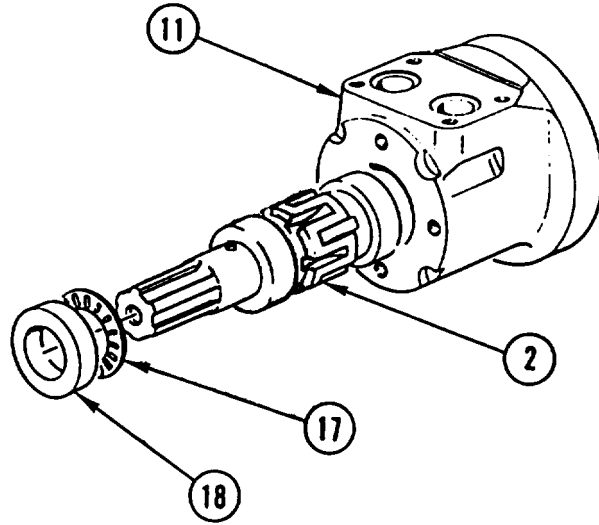


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**CRANE HYDRAULIC MOTOR REPAIR (CONT)**

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11. REMOVE output SHAFT (2) from manifold housing (11).
12. REMOVE retainer and roller (17) and PLATE (18) from output shaft (2).



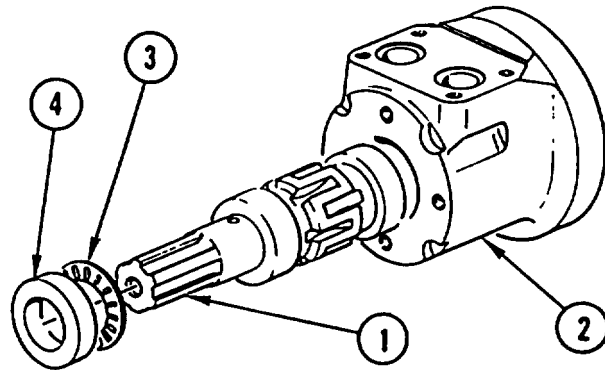
**ASSEMBLY**

**NOTE**

Coat all seals with lubricating oil prior to assembly.

1. APPLY coat of lubricating OIL to output shaft (1).

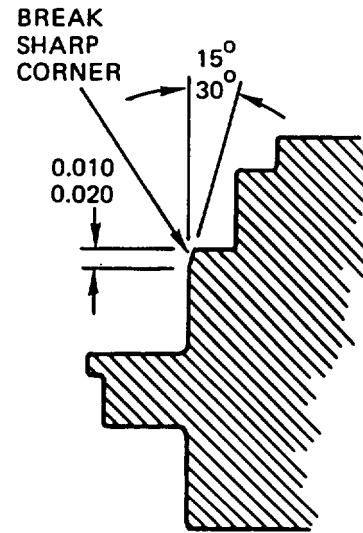
**CAUTION**  
Do not allow lubricating oil to enter tapped holes to prevent damage to equipment.



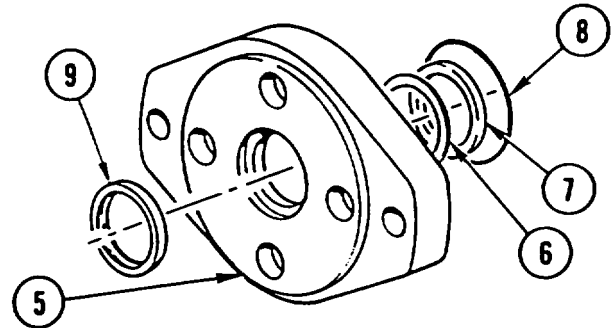
2. INSTALL output SHAFT (1) in manifold housing (2).
3. INSTALL retainer and roller (3) and PLATE (4) on output shaft (1). PULL output SHAFT (1) partially out of manifold housing (2) and PUSH retainer and roller (3), PLATE (4), and output SHAFT (1) into manifold housing (2) together.

**CRANE HYDRAULIC MOTOR REPAIR (CONT)**

4. IF INSTALLING new mounting FLANGE (5), BREAK seal seat CORNER with emery cloth.
5. INSTALL retaining ring (6), new SEAL (7), and new seal (8) in mounting flange (5).
6. INSTALL new SEAL (9) in mounting flange (5).



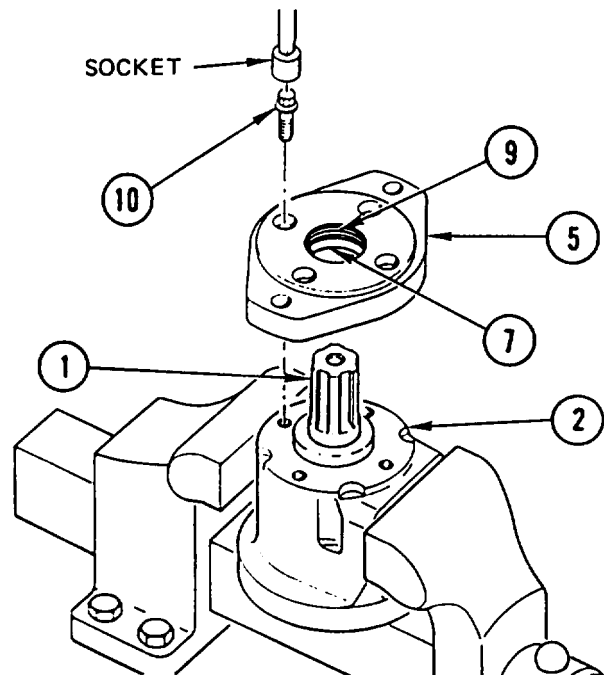
7. APPLY three or four drops of SEALING COMPOUND to threads of manifold HOUSING (2).
8. APPLY COAT of LUBRICATING OIL to output SHAFT (1), SEAL (7), and SEAL (9).



**CAUTION**  
Make sure seals are not inverted or damaged.

9. INSTALL mounting FLANGE (5), ROTATING SLOWLY while pushing down over output shaft (1).

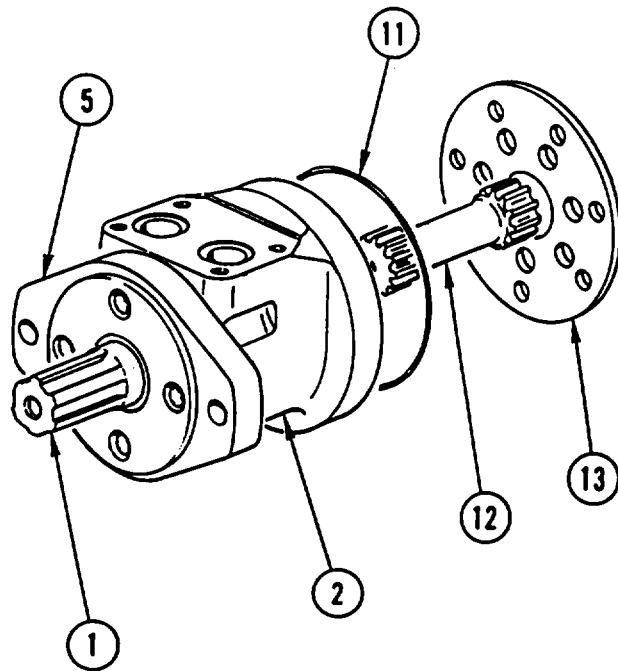
**CAUTION**  
Do not overtighten vise jaws. Excessive clamping force may distort housing.



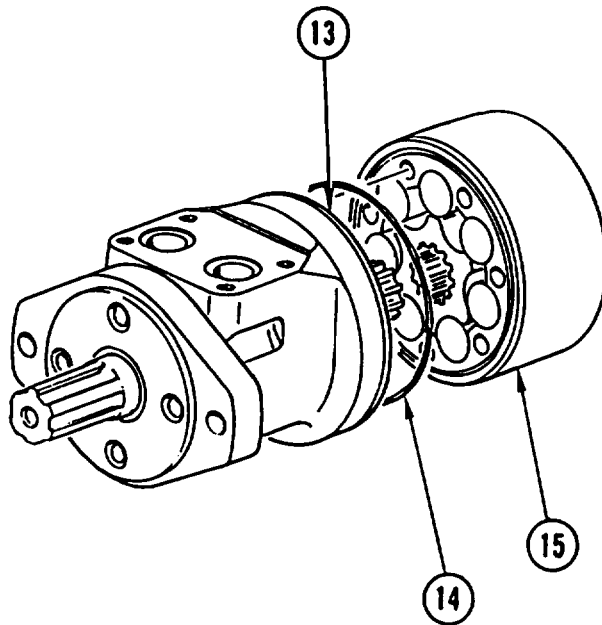
10. PLACE crane hydraulic MOTOR in soft-jawed vise by CLAMPING across PORTS.
11. USING SOCKET, INSTALL four SCREWS (10) and ALTERNATELY TIGHTEN to 250 lb-in. (28 N.m).

**CRANE HYDRAULIC MOTOR REPAIR (CONT)**

12. REPOSITION crane hydraulic MOTOR in soft-jawed vise by CLAMPING across mounting FLANGE (5) with output shaft (1) down.
13. POUR approximately 35 cc of lubricating OIL in output shaft (1) cavity.
14. INSTALL new seal (11), drive SHAFT (12), and spacer plate (13) to manifold housing (2) without twisting seal. ALINE screw HOLES so timing DOT on output shaft (1) is VISIBLE through one of the screw holes.

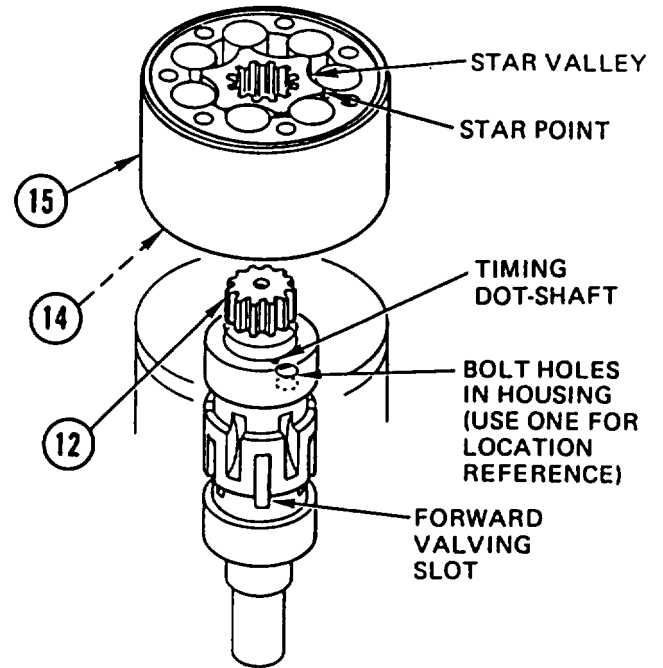


15. INSTALL new SEAL (14) on gear rotor set (15) without twisting seal.
16. INSTALL GEAR ROTOR SET (15) on spacer plate (13), POSITIONING any STAR POINT over screw HOLE aligned with timing DOT.



**CRANE HYDRAULIC MOTOR REPAIR (CONT)**

17. ROTATE GEAR ROTOR SET (15) to line up screw holes WITHOUT DISENGAGING star from drive shaft (12) or disturbing seal (14).

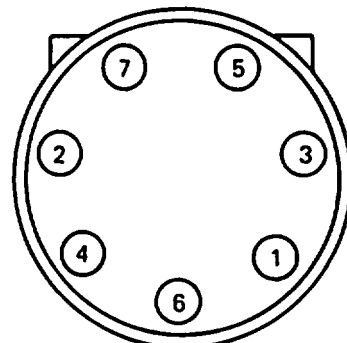
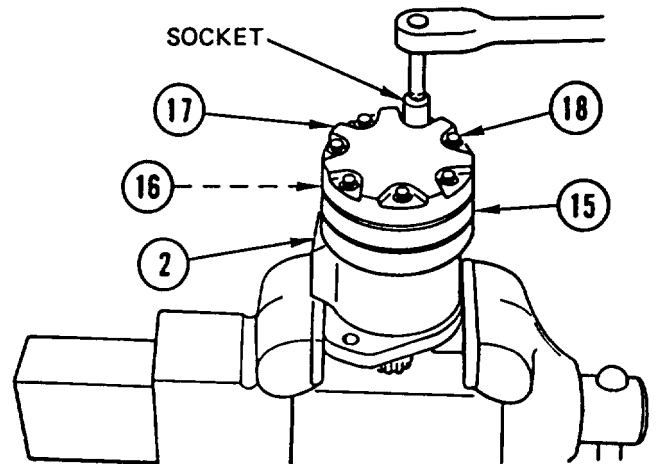


18. INSTALL new SEAL (16) on gear rotor set (15) without twisting seal.

**NOTE**

Make sure seals (14 and 16) are properly seated and not pinched.

19. USING SOCKET, INSTALL end CAP (17) and seven capscrews (18) on manifold housing (2). TIGHTEN CAPSCREWS to 15-40 lb-in. (2-5 N.m).
20. TIGHTEN CAPSCREWS (18) to 300 lb-in. (34 N.m) using sequence shown.



**CAPSCREW TIGHTENING SEQUENCE**





**CHAPTER 21  
MACHINE TOOLS REPAIR INSTRUCTIONS**

**OVERVIEW**

This chapter contains maintenance instructions for repair of the machine tools. A list of sections contained in this chapter is shown below.

	Page
Section I. Hammer Drill Repair . . . . .	21-1
Section II. Impact Wrench Repair . . . . .	21-15
Section III. Pavement Breaker Repair . . . . .	21-24
Section IV. Chain Saw Repair . . . . .	21-37

**Section I. HAMMER DRILL REPAIR**

---

**HAMMER DRILL REPAIR**

---

This task covers: a. Disassembly b. Assembly c. Charging d. Testing

---

**INITIAL SETUP**

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N26
- Bearing Installing Tool, P/N 05044
- Bearing Installing Tool, P/N 05061
- Installing and Removal Tool, P/N 04337
- Latch Installing Tool, P/N 05879
- Latch Installing Tool, P/N 05062
- Pipe, P/N 04910
- Removal Tool, P/N 05045
- Remover, P/N 04919
- Sleeve, P/N 01120
- Test Set, P/N 02835

**Materials/Parts:**

- Nut, Lock (2)
- Kit, Seal Pads
- Nitrogen Appendix B, Item 29
- Oil, Lubricating Appendix B, Item 30
- Rags Appendix B, Item 40

**General Safety Instructions:**

**WARNING**

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

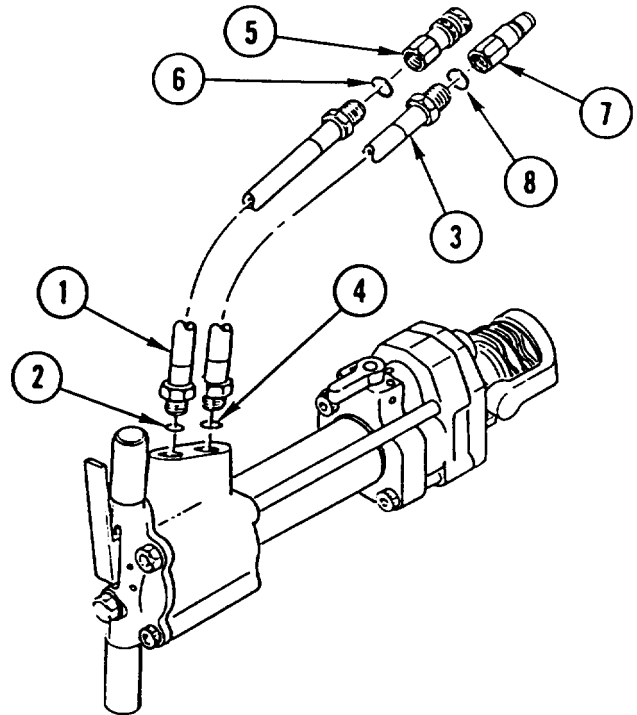
**HAMMER DRILL REPAIR (CONT)**

**DISASSEMBLY**

**NOTE**

Tag all lines prior to removal to aid in installation.

1. REMOVE HOSE assembly (1) and packing (2). DISCARD PACKING.
2. REMOVE HOSE assembly (3) and packing (4). DISCARD PACKING.
3. REMOVE quick-disconnect COUPLING (5) and packing (6). DISCARD PACKING.
4. REMOVE quick-disconnect COUPLING (7) and packing (8). DISCARD PACKING.

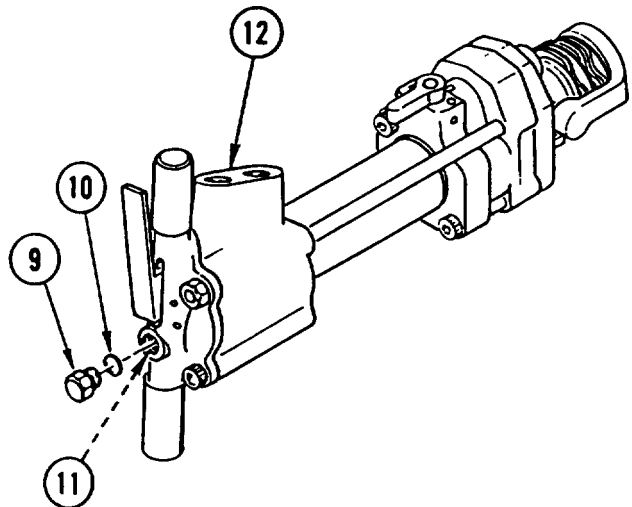


5. REMOVE PLUG (9) and packing (10), DISCARD PACKING.

**WARNING**

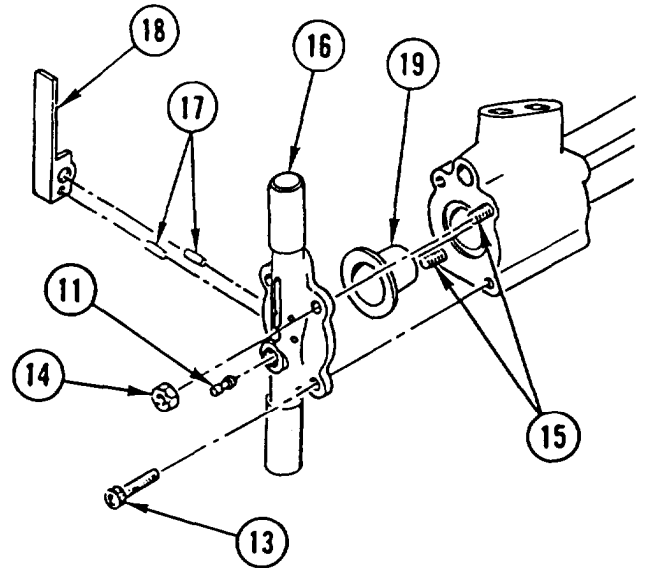
When discharging nitrogen from accumulator, stand to one side and keep face away from front of charging valve to prevent personal injury.

6. PRESS charging VALVE (11) and DISCHARGE all NITROGEN from housing (12).

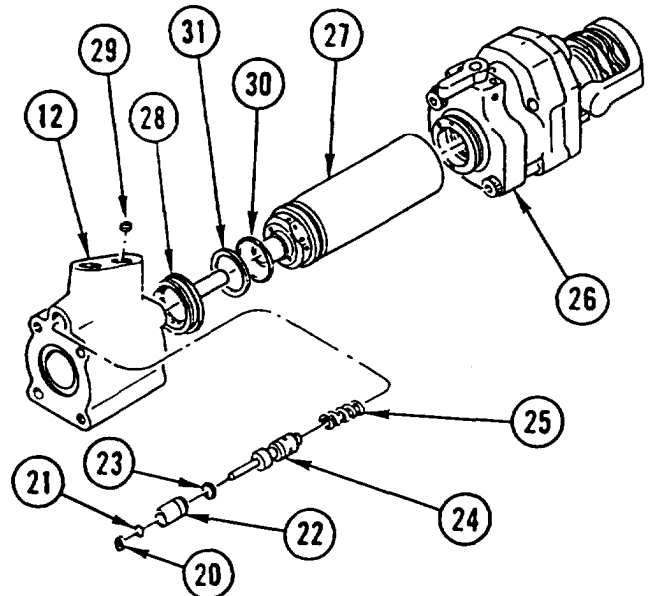


**HAMMER DRILL REPAIR (CONT)**

7. REMOVE two socket head capscrews (13), two lock nuts (14), two RODS (15), and handle grip (16). DISCARD lock NUTS.
8. REMOVE two spring pins (17) and TRIGGER (18).
9. REMOVE charging VALVE (11) from handle grip (16).
10. REMOVE DIAPHRAGM (19).

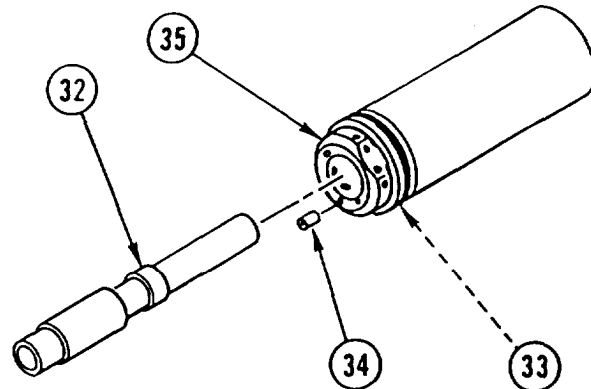


11. REMOVE wiper (20), packing (21), bushing (22), packing (23), valve SPOOL (24), and spring (25). DISCARD PACKINGS.
12. REMOVE HOUSING (26) from flow sleeve tube (27) by TAPPING GENTLY with PLASTIC or RUBBER hammer.
13. REMOVE HOUSING (12) from flow sleeve tube (27) by TAPPING GENTLY with PLASTIC or RUBBER hammer.
14. USING slide HAMMER and SLEEVE, REMOVE porting BLOCK (28) from housing (12).
15. REMOVE orifice PLUG (29) from housing (12).
16. REMOVE and DISCARD PACKING (30) and backup RING (31 ) from porting block (28).

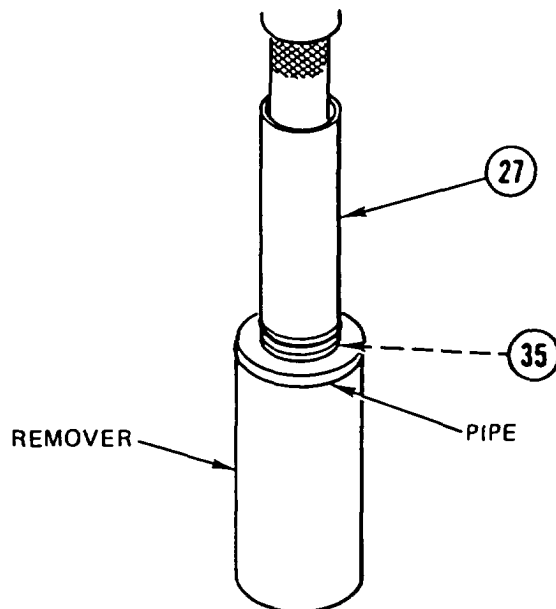


**HAMMER DRILL REPAIR (CONT)**

17. REMOVE PISTON (32) from flow sleeve (33).
18. REMOVE PIN (34) from valve body (35).



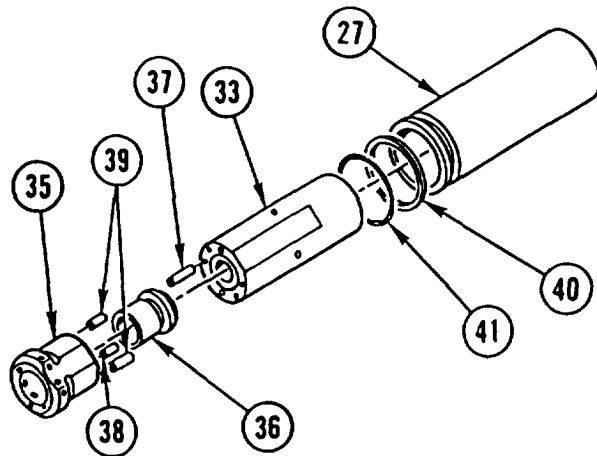
19. PLACE flow sleeve TUBE (27) with valve BODY (35) down onto PIPE and REMOVER.



**CAUTION**

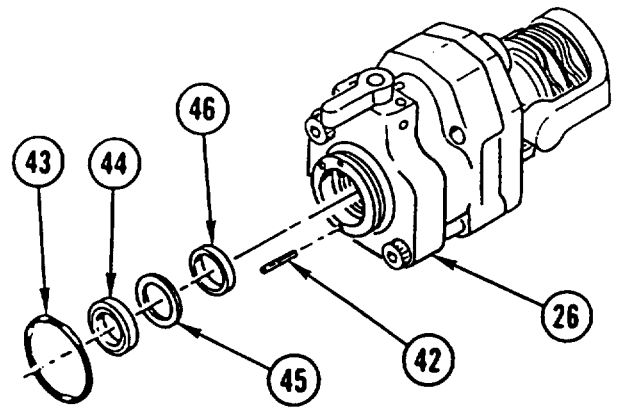
- During step 20, cover flow sleeve tube with suitable disc to prevent damage to flow sleeve tube.
- Insert rag into pipe to prevent damage to valve body.

20. USING suitable PRESS, REMOVE valve BODY (35), automatic valve (36), and flow sleeve (33).
21. REMOVE four PINS (37) from flow sleeve (33).
22. REMOVE PIN (38) and two PINS (39) from valve body (35).
23. REMOVE and DISCARD backup RING (40) and PACKING (41) from flow sleeve tube (27).

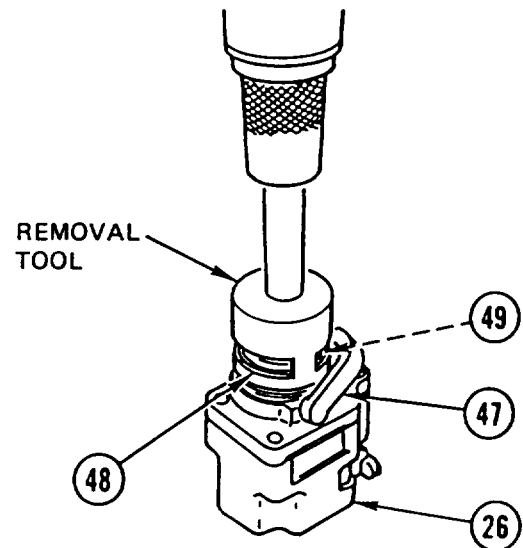


**HAMMER DRILL REPAIR (CONT)**

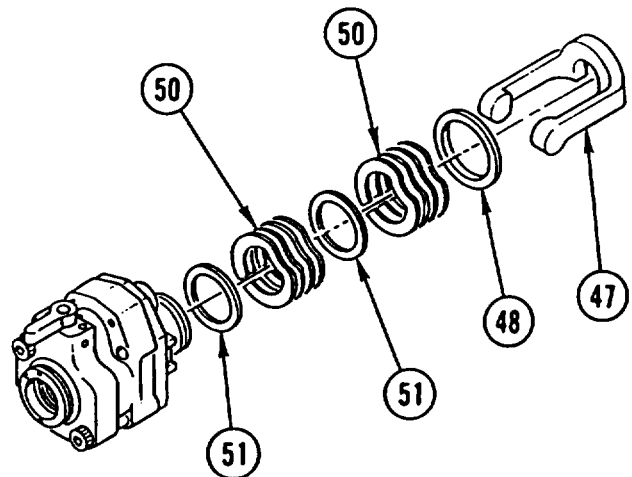
24. REMOVE pin (42), packing (43), cup SEAL (44), washer (45), and cup SEAL (46) from housing (26). DISCARD PACKING and cup SEALS.



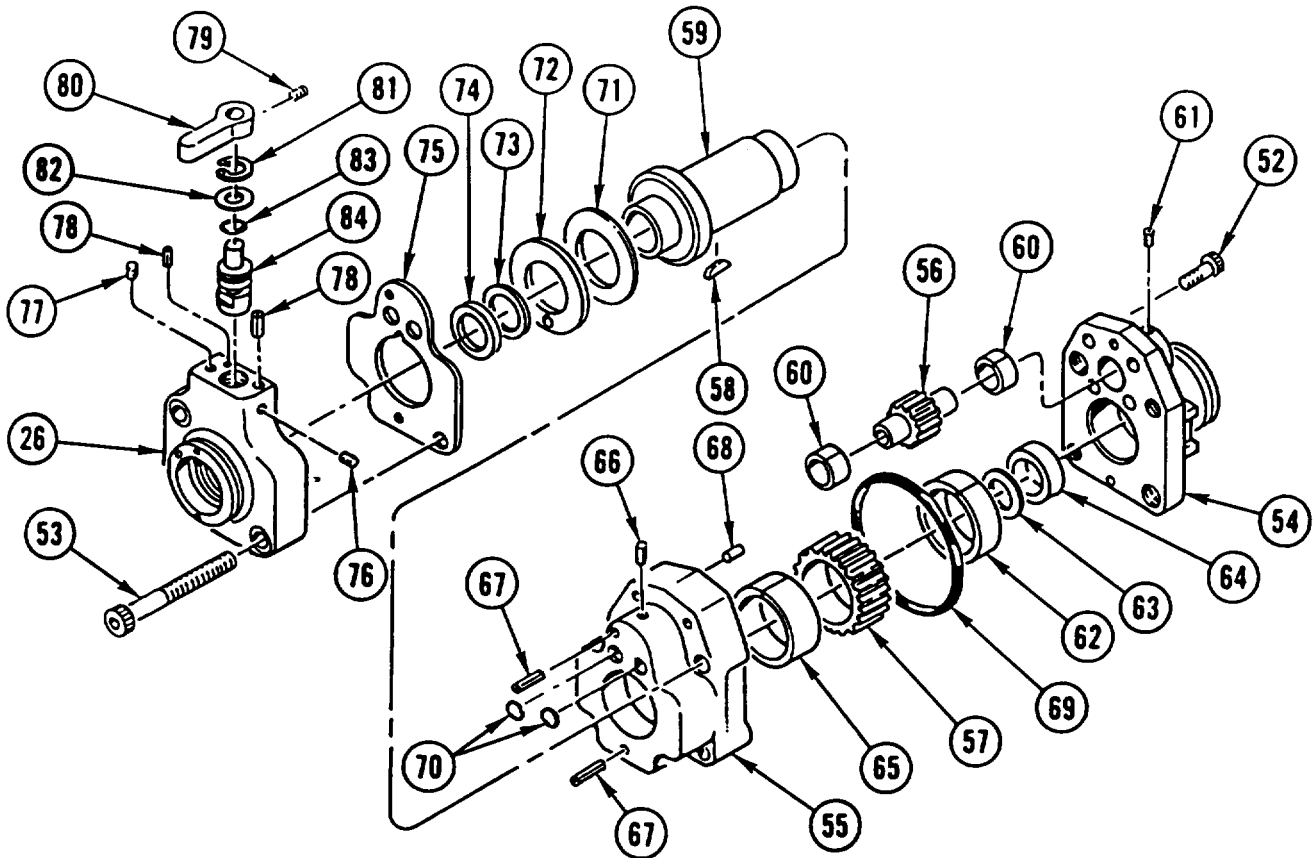
25. PLACE HOUSING (26) on metal plate in press with latch (47) UP.
26. ROTATE LATCH (47) to OPEN position. USING REMOVAL TOOL, PRESS DOWN on spring backup (48) and REMOVE retaining RING (49).



27. REMOVE spring backup (48), four wave springs (50), washer (51), four wave springs (50), washer (51), and LATCH (47).



HAMMER DRILL REPAIR (CONT)



**CAUTION**

During step 28, do not use any type of pry tool to prevent damage to equipment.

28. REMOVE four socket head CAPSCREWS (52 and 53).
29. REMOVE mounting FLANGE (54) from housing (55) and REMOVE HOUSING (55) from housing (26).
30. REMOVE idler gear (56), drive GEAR (57), woodruff key (58), and hex drive (59).
31. REMOVE two BEARINGS (60).
32. REMOVE plug (61), BEARING (62), quad ring (63), and backup ring (64) from mounting flange (54). DISCARD quad RING and backup RING.
33. REMOVE BEARING (65), setscrew (66), two pins (67), two pins (88), packing (69), and two packings (70) from housing (55). DISCARD PACKINGS.
34. REMOVE WASHER (71) and thrust washer (72) from hex drive (59).
35. REMOVE quad RING (73), backup RING (74), and GASKET (75) from housing (26). DISCARD quad RING, backup RING, and GASKET.
36. REMOVE setscrew (76), PLUG (77), and two pins (78).
37. REMOVE setscrew (79), LEVER (80), retaining ring (81), spacer ring (82), packing (83), and valve (84). DISCARD PACKING.

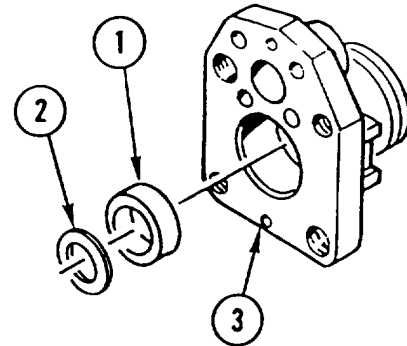
**HAMMER DRILL REPAIR (CONT)**

**ASSEMBLY**

**NOTE**

Apply coat of lubricating oil to packings prior to assembly.

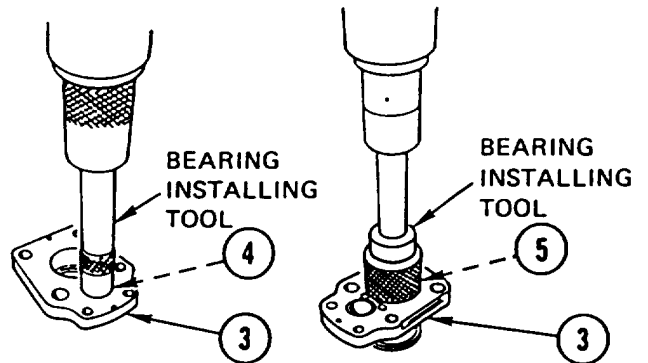
1. INSTALL new backup RING (1) and new quad RING (2) in mounting flange (3).



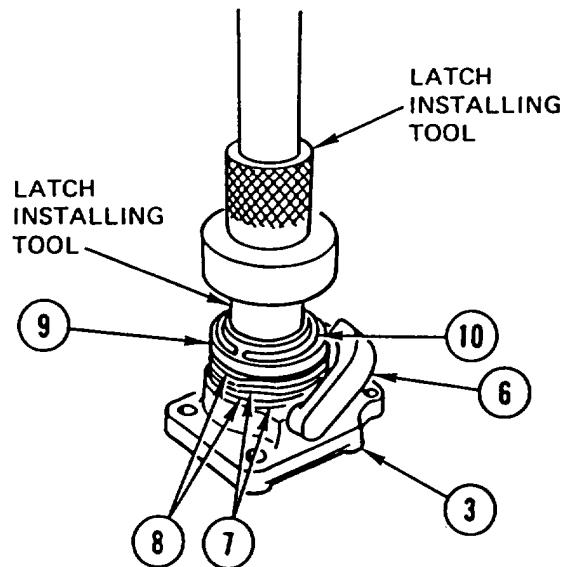
**NOTE**

Make sure mounting flange is level to ensure bearings are properly seated.

2. USING suitable PRESS and BEARING INSTALLING TOOLS, INSTALL two BEARINGS (4 and 5) in mounting flange (3) with split sides facing each other.



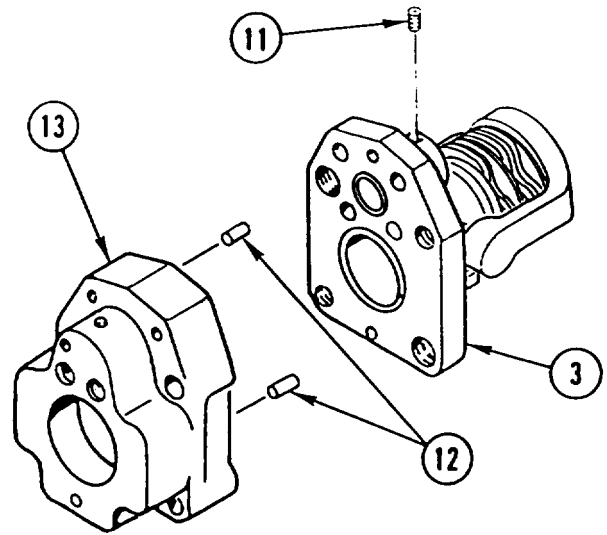
3. PLACE mounting FLANGE (3) on metal plate in PRESS, latch side UP, and INSTALL LATCH (6), washer (7), four wave springs (8), washer (7), four wave springs (8), spring backup (9), LATCH INSTALLING TOOLS, and retaining ring (10). PRESS with LATCH INSTALLING TOOLS until retaining ring (10) snaps into place. REMOVE LATCH INSTALLING TOOLS.



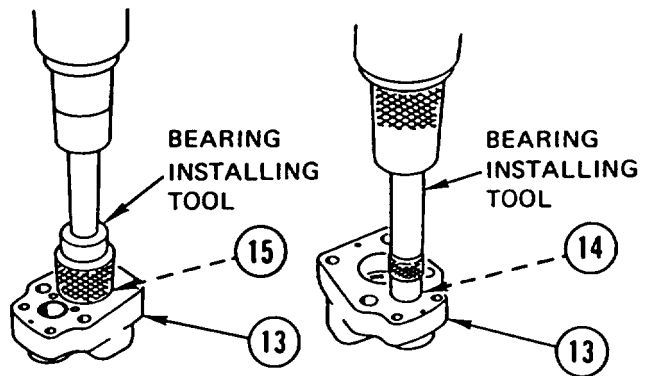


**HAMMER DRILL REPAIR (CONT)**

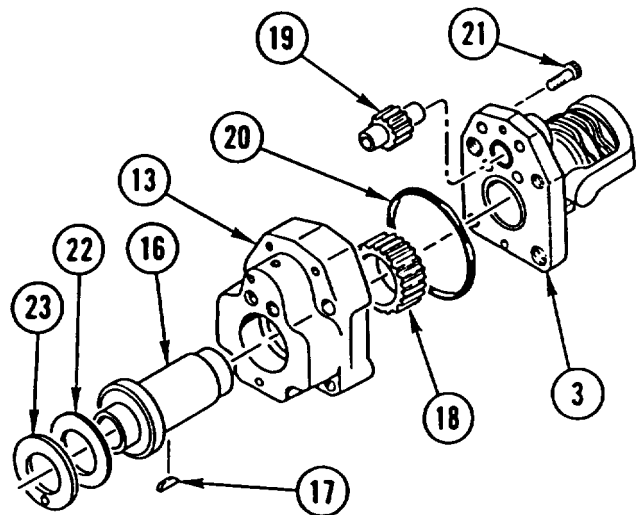
4. INSTALL PLUG (11) in mounting flange (3).
5. INSTALL two PINS (12) in housing (13).



6. USING suitable PRESS and BEARING INSTALLING TOOLS, INSTALL two BEARINGS (14 and 15) in housing (13) with split sides facing each other.



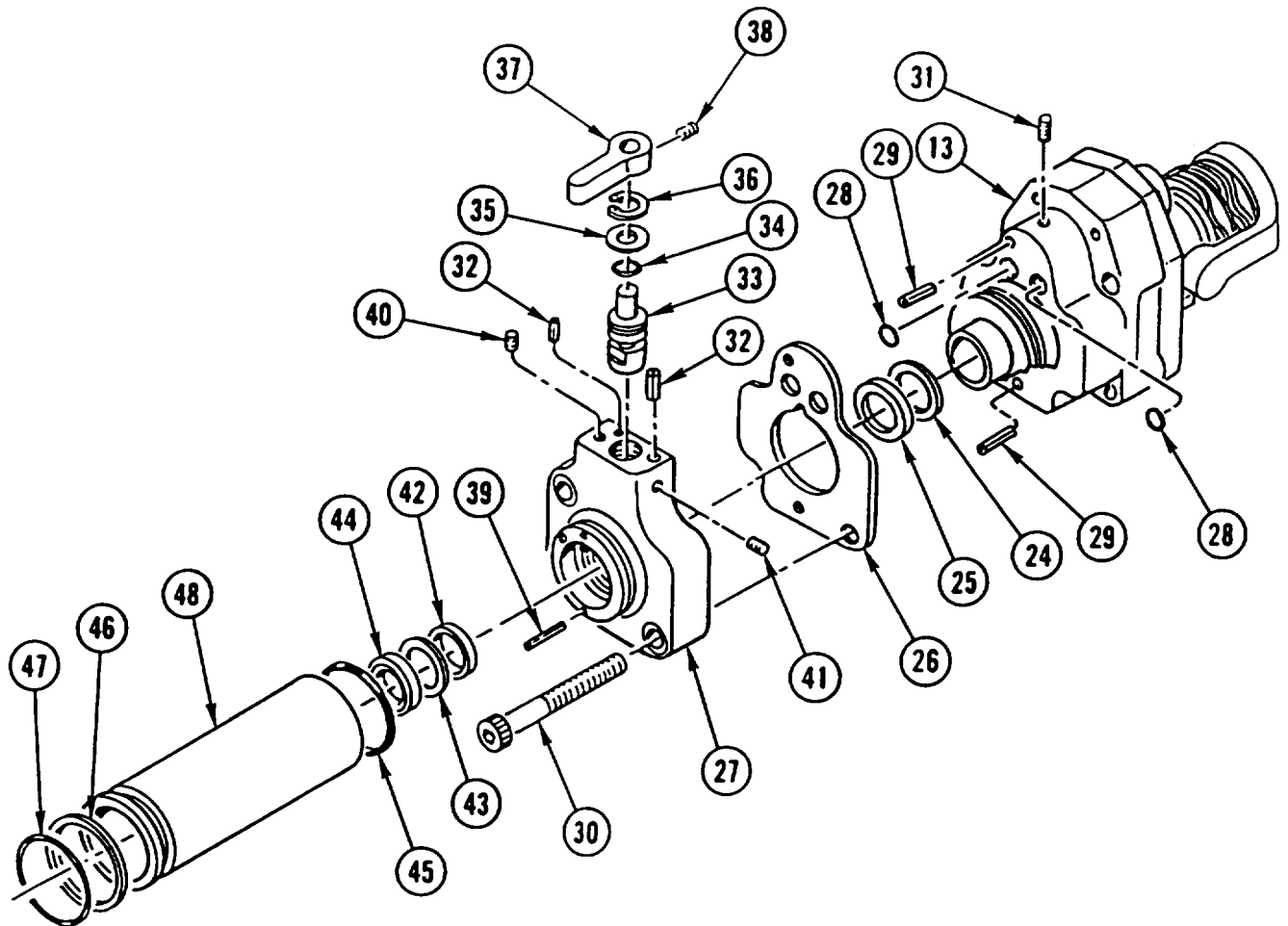
7. INSTALL hex drive (16), woodruff key (17), drive GEAR (18), idler gear (19), and new packing (20).
8. INSTALL mounting FLANGE (3) and two socket head capscrews (21) on housing (13). TIGHTEN CAPSCREWS to 25 lb-ft (34 N.m).
9. INSTALL washer (22) and thrust WASHER (23) on hex drive (16).



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**HAMMER DRILL REPAIR (CONT)**


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10. INSTALL new quad RING (24), new backup ring (25), and new GASKET (26) on housing (27).
11. INSTALL two new PACKINGS (28) and two pins (29) in housing (13).
12. INSTALL HOUSING (27), two socket head cap screws (30), and setscrew (31) on housing (13). TIGHTEN CAPSCREWS to 60 lb-ft (81 N.m).

**NOTE**

Lever must be installed with narrow portion toward handles, and setscrew must be seated in hole of valve.

13. INSTALL two pins (32), VALVE (33), new packing (34), spacer ring (35), retaining ring (36), lever (37), and setscrew (38).
14. INSTALL pin (39), PLUG (40), and setscrew (41).
15. INSTALL new cup SEAL (42) with lips facing inward, washer (43), new cup SEAL (44) with lips facing outward, and new packing (45).
16. INSTALL new backup RING (46) and new PACKING (47) on flow sleeve tube (48).

**HAMMER DRILL REPAIR (CONT)**

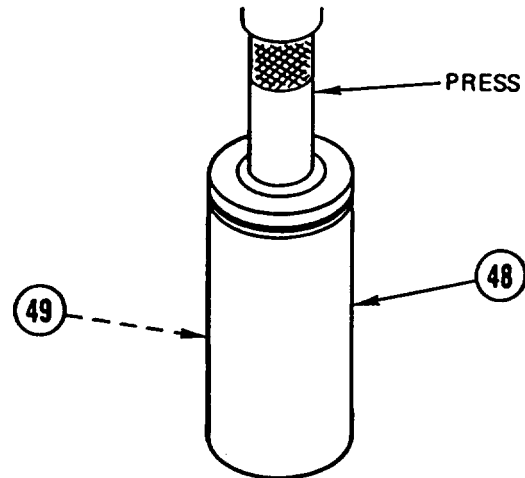
**CAUTION**

To prevent damage to flow sleeve, cover end with eight holes with piece of metal.

**NOTE**

Flow sleeve tube must be installed in press with packing end up.

17. USING suitable PRESS, INSTALL flow SLEEVE (49) in flow sleeve tube (48) from packing end until flow sleeve (49) is flush with flow sleeve tube (48).

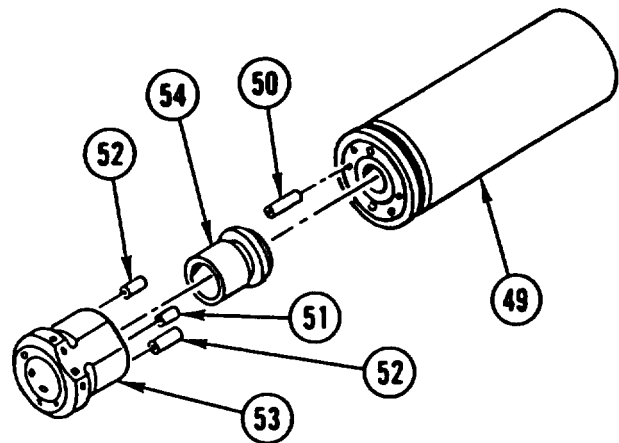


18. INSTALL four PINS (50) in flow sleeve (49).

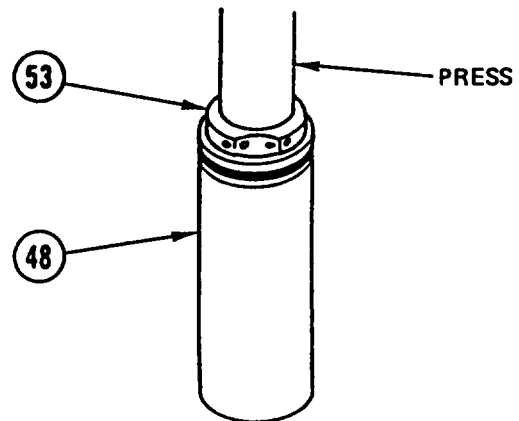
19. INSTALL PIN (51) and two PINS (52) in valve body (53).

20. INSTALL automatic VALVE (54) in valve body (53).

21. INSTALL valve BODY (53) on flow sleeve (49), alining pin (51) with pin holes.



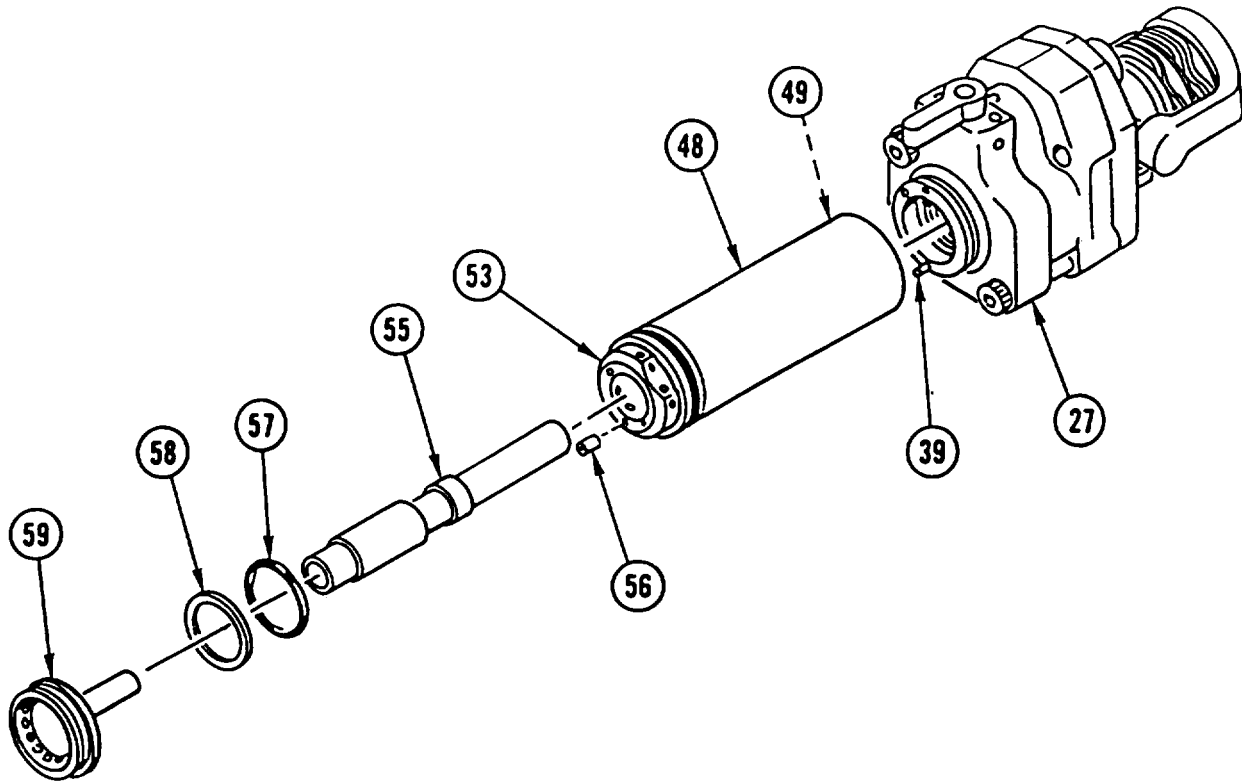
22. USING suitable PRESS, PRESS valve BODY (53) onto flow sleeve tube (48) until shoulder of valve body (53) is flush with flow sleeve tube (48).



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**HAMMER DRILL REPAIR (CONT)**


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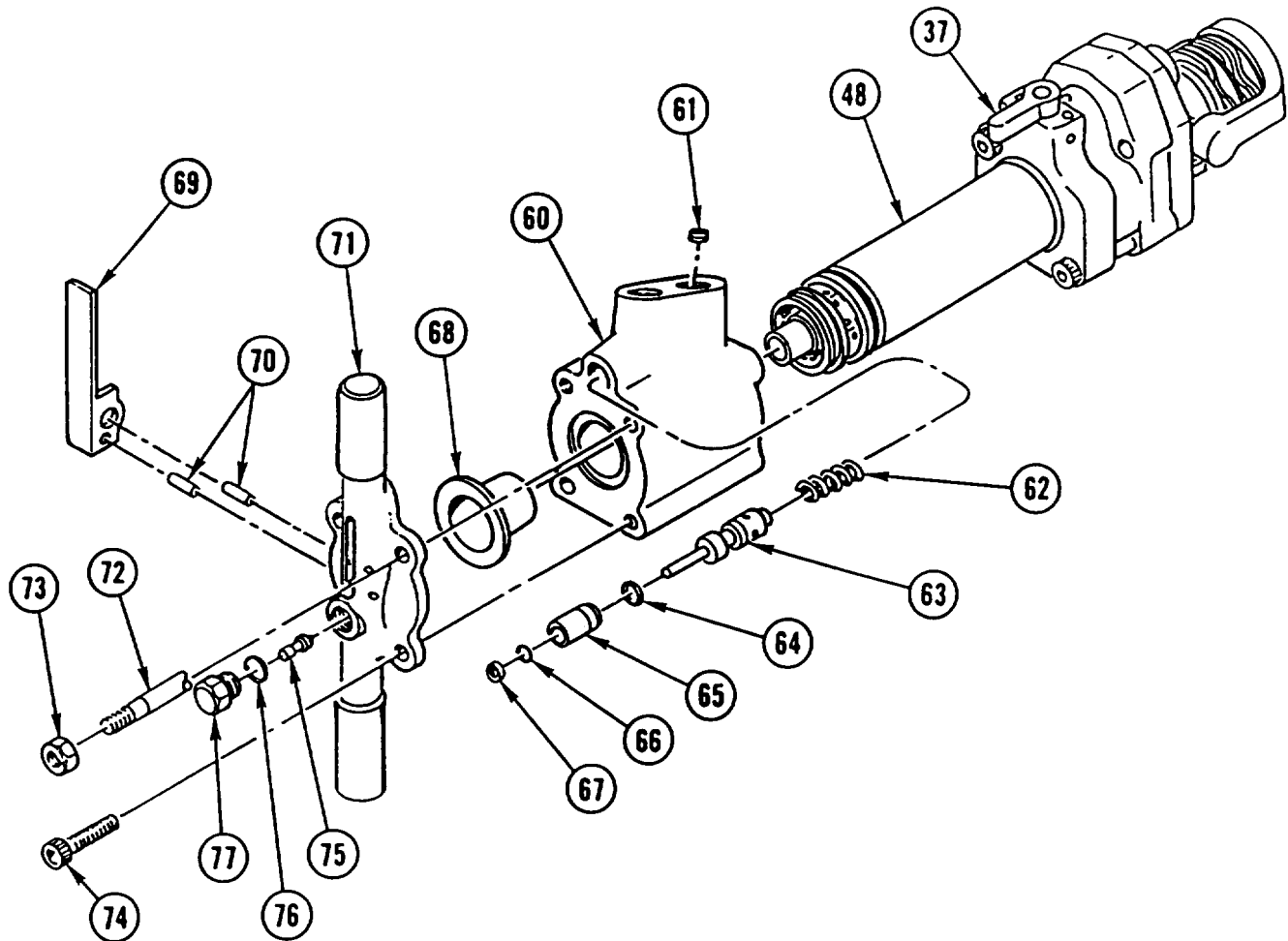
23. INSTALL PISTON (55), solid end first, in valve body (53).
24. INSTALL PIN (56) in valve body (53).
25. INSTALL new PACKING (57) and new backup RING (58) on porting block (59).
26. INSTALL porting BLOCK (59) in valve body (53).

**NOTE**

Make sure all three holes aline.

27. ALINE PIN (39) with hole in flow sleeve (49) and INSTALL flow sleeve TUBE (48) in housing (27).

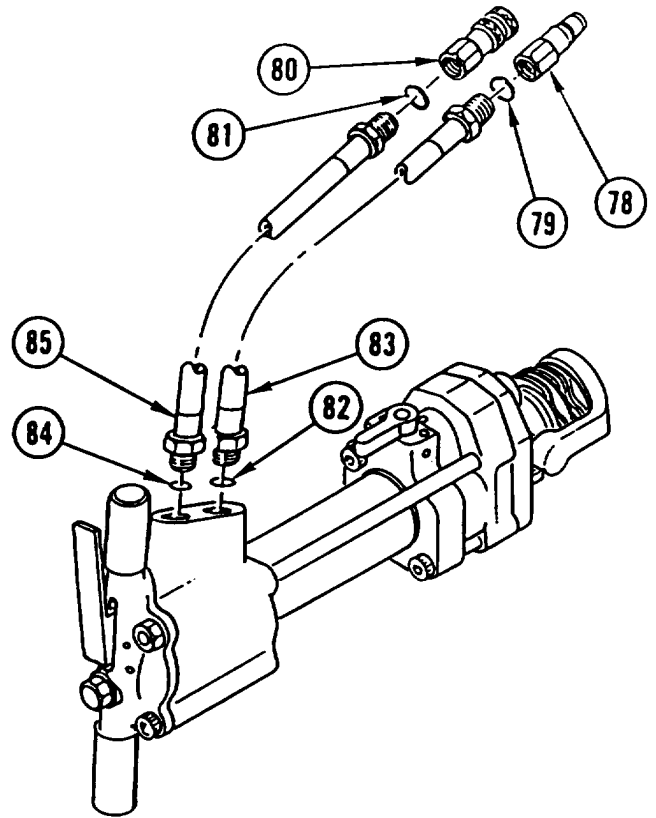
HAMMER DRILL REPAIR (CONT)



28. INSTALL HOUSING (60) on flow sleeve tube (46) so that oil ports are alined with lever (37).
29. INSTALL orifice plug (61), spring (62), valve SPOOL (63), new packing (64), bushing (65), new packing (66), and wiper (67) in housing (60). Bushing (65) should project approximately 0.200 in. (5 mm) from housing (60).
30. APPLY light COAT of LUBRICATING OIL to DIAPHRAGM (66) and INSTALL DIAPHRAGM in housing (60).
31. INSTALL TRIGGER (69) and two spring pins (70).
32. INSTALL handle GRIP (71), two rods (72), two new lock nuts (73), and two socket head cap screws (74). TIGHTEN lock NUTS alternately in 15 lb-ft (20 N.m) increments to 100 lb-ft (135 N.m). TIGHTEN socket head CAPSCREWS alternately in 15 lb-ft (20 N.m) increments to 75 lb-ft (100 N.m).
33. INSTALL charging VALVE (75).
34. INSTALL new packing (76) and PLUG (77).

**HAMMER DRILL REPAIR (CONT)**

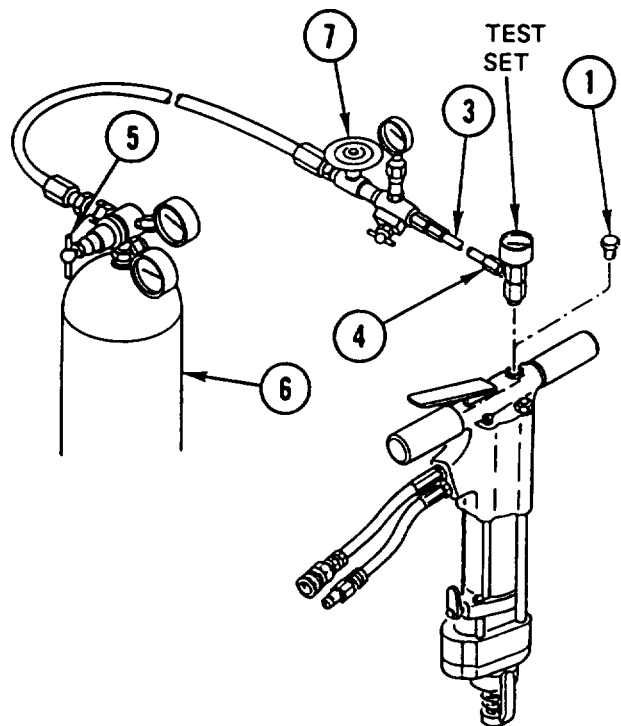
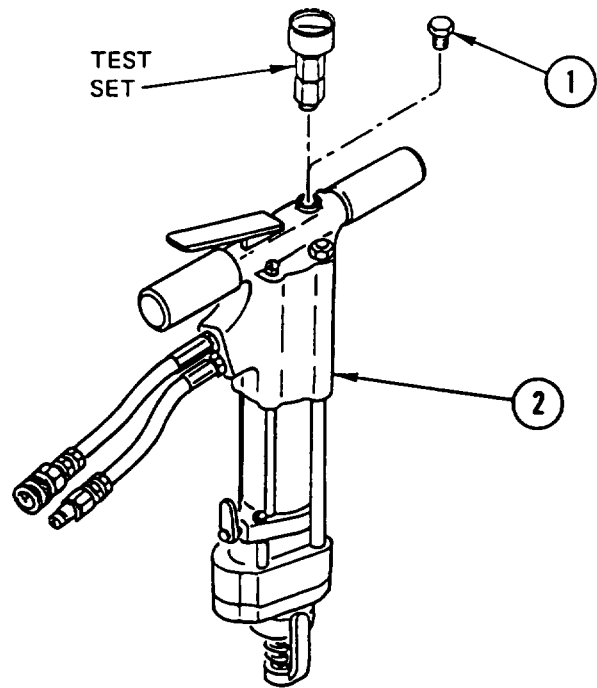
35. INSTALL quick-disconnect COUPLING (78) and new packing (79).
36. INSTALL quick-disconnect COUPLING (80) and new packing (81).
37. INSTALL new packing (82) and HOSE assembly (83).
38. INSTALL new packing (84) and HOSE assembly (85).
39. CHARGE hammer DRILL with nitrogen using Charging procedure.



**HAMMER DRILL REPAIR (CONT)**

**CHARGING**

1. Remove plug (1).
2. Rotate gage end of test set fully to left to make sure stem is fully retracted.
3. Install test set in handle of hammer drill (2) by rotating chuck end only.
4. Rotate gage end of test set slowly to right until pressure is indicated on gage. Pressure reading should be 500-700 psi (34-48 bar).
5. Connect nitrogen supply line (3) to charging valve (4) on test set.
6. Adjust regulator (5) on nitrogen bottle (6) to delivery pressure of 600 psi (42 bar).
7. Open valve (7) on nitrogen supply line (3).
8. When accumulator is fully charged, close valve (7) on nitrogen supply line (3) and disconnect from test set.
9. Rotate gage end of test set fully to left and remove tester at chuck end.
10. Install plug (1).



**TESTING**

1. Perform steps 1 thru 4 of Charging, above.
2. If pressure is low, charge accumulator using Charging procedure, above.
3. Rotate gage end of test set fully to left and remove tester at chuck end.
4. Install plug (1).

Section II. IMPACT WRENCH REPAIR

**IMPACT WRENCH REPAIR**

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

**INITIAL SETUP**

**Applicable Configuration:**

HMMH

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Installing and Removal Tool, P/N 04337

**Materials/Parts:**

Washer, Lock (4)

Washer, Lock (8)

Nut, Lock

**Materials/Parts (Cont):**

Kit, Parts

Cloth, Lint-Free Appendix B, Item 11

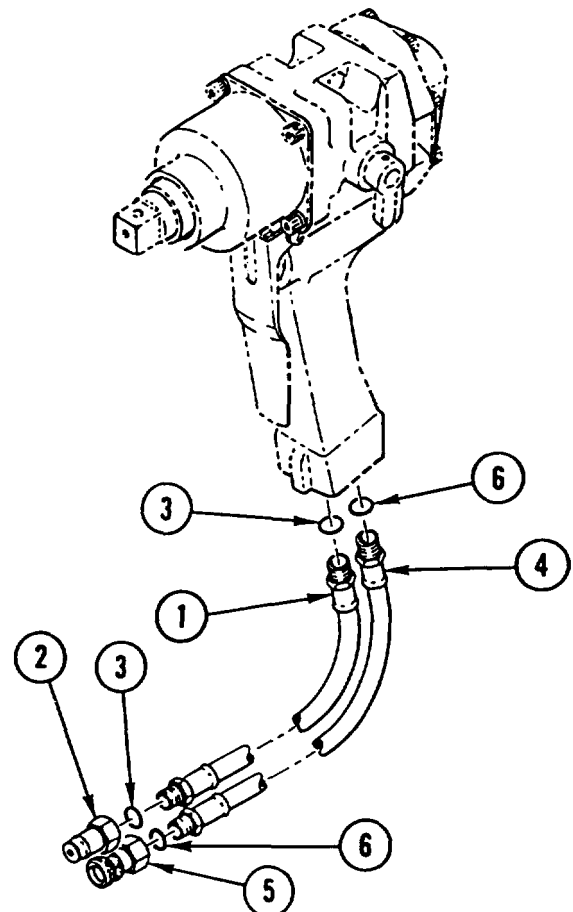
Grease, Automotive and Artillery (GAA) Appendix B, Item 23

Oil, Lubricating Appendix B, Item 30

Solvent, Drycleaning Appendix B, Item 42

**DISASSEMBLY**

1. REMOVE HOSE (1), coupling HALF (2), and two packings (3). DISCARD PACKINGS.
2. REMOVE HOSE (4), coupling half (5), and two packings (6). DISCARD PACKINGS.

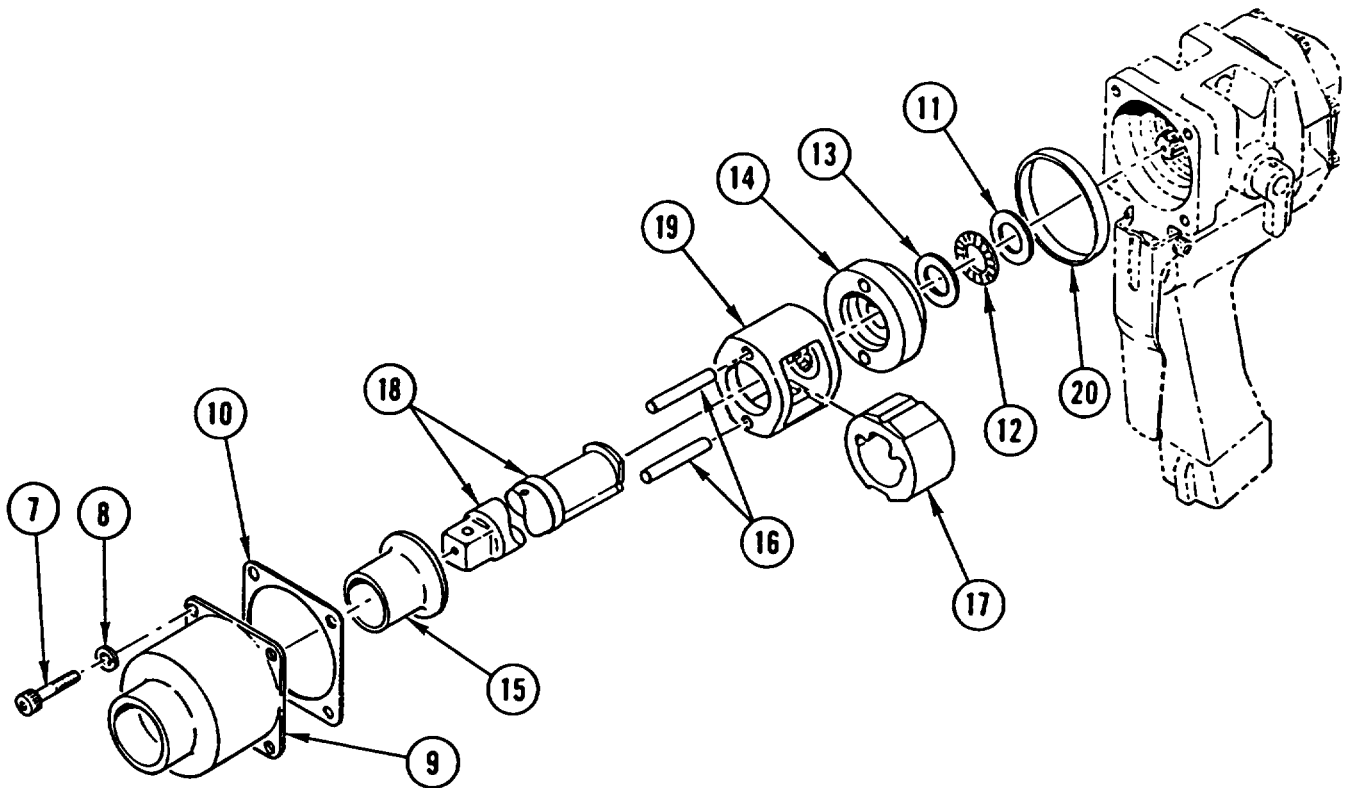




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**IMPACT WRENCH REPAIR (CONT)**

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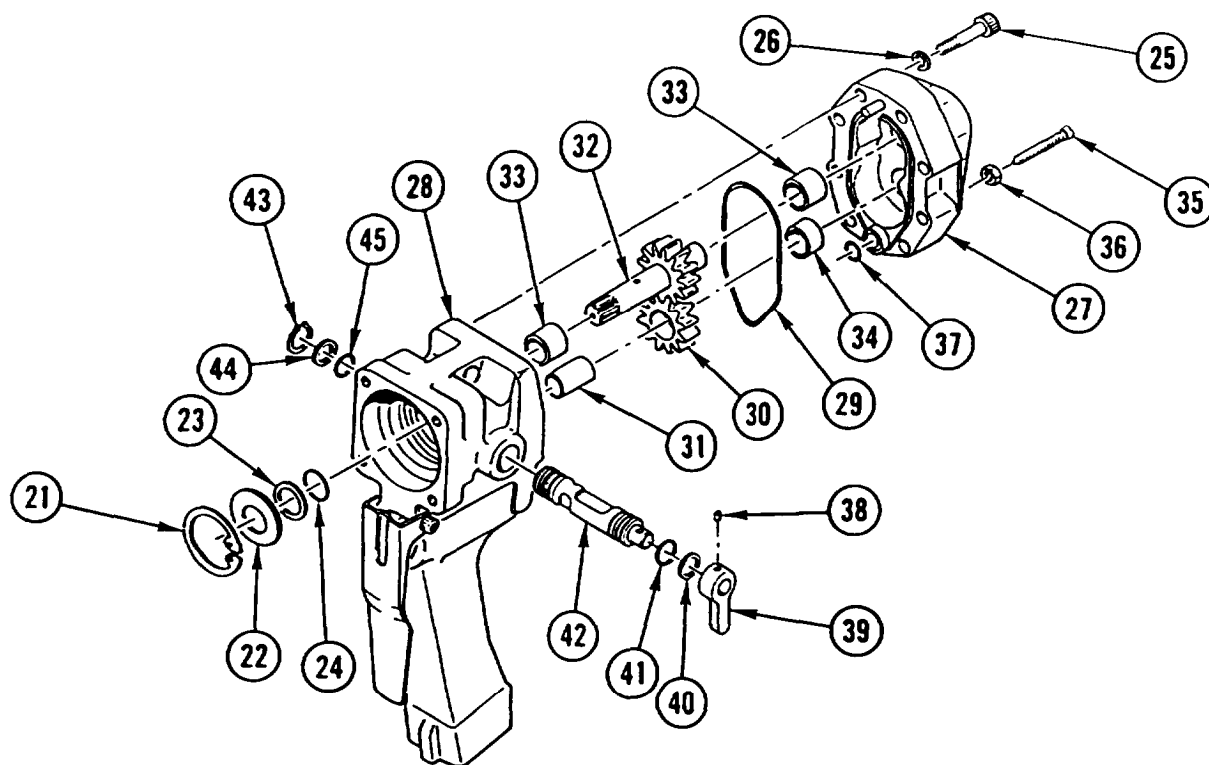


3. REMOVE four SCREWS (7) and four lock washers (8). DISCARD lock WASHERS.
4. HOLD impact WRENCH pointing DOWN. PULL on hammer CASE (9) and TRIGGER and REMOVE hammer CASE (9) and gasket (10). DISCARD GASKET.
5. REMOVE bearing (11), retainer and roller (12), bearing (13), and valve SEAT (14).
6. REMOVE hammer case BUSHING (15) from hammer case (9).
7. REMOVE two hammer pins (16), hammer (17), and ANVIL (18) from hammer frame (19).
8. REMOVE retaining RING (20).

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**IMPACT WRENCH REPAIR (CONT)**


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9. REMOVE retaining RING (21), flat washer (22), and two packings (23 and 24). DISCARD PACKINGS.
10. REMOVE eight socket head SCREWS (25) and eight lock washers (26). DISCARD lock WASHERS.
11. REMOVE motor CAP assembly (27) from main housing (28).

**CAUTION**

Do not pry or in any way force motor cap assembly off main housing to prevent damage to equipment.

12. REMOVE packing (29), idler gear (30), idler shaft (31), and worm SHAFT (32) from motor cap assembly (27). DISCARD PACKING.
13. REMOVE two BUSHINGS (33) and idler gear bushing (34).

**NOTE**

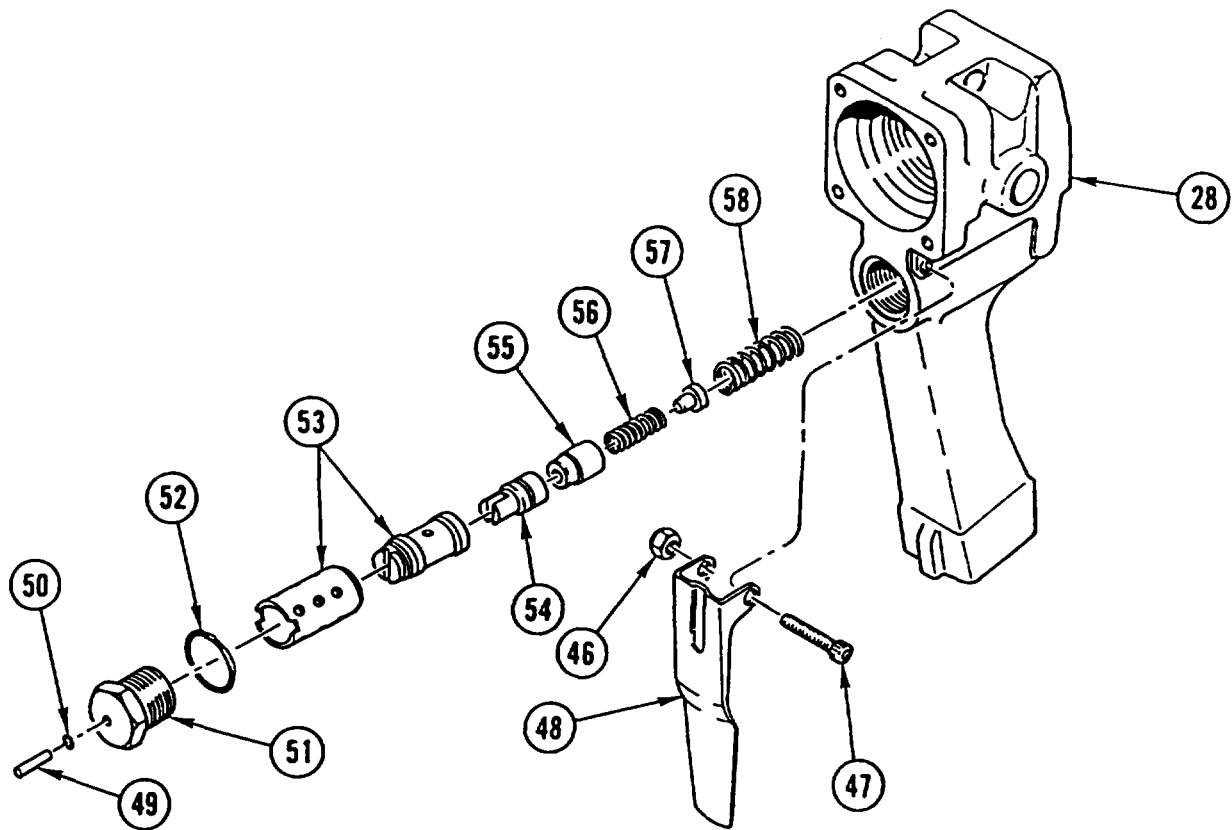
Note number of turns necessary to remove relief adjustment screw.

14. REMOVE relief adjustment SCREW (35), nut (36), and packing (37) from motor cap assembly (27). DISCARD PACKING.
15. REMOVE setscrew (38), lever (39), spacer ring (40), packing (41), and reversing SPOOL (42). DISCARD PACKING.
16. REMOVE retaining RING (43), spacer ring (44), and packing (45). DISCARD PACKING.

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**IMPACT WRENCH REPAIR (CONT)**

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17. REMOVE lock nut (46), screw (47), and TRIGGER (48). DISCARD lock NUT.

18. REMOVE roller BEARING (49), packing (50), spool cap (51), and packing (52). DISCARD PACKINGS.

**NOTE**

Valve sleeve is not removable and will remain in main housing. If valve sleeve is damaged, return main housing to depot maintenance.

19. REMOVE valve spool (53), seat valve (54), valve disc (55), spring (56), spring seat (57), and SPRING (58) from main housing (28).

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**IMPACT WRENCH REPAIR (CONT)**

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**CLEANING****WARNING**

- Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat, Flash point is 100°-138°F (38°-50°C). If you become dizzy while using drycleaning 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.
- To prevent injury, compressed air used for cleaning and drying purposes will not exceed 30 psi (207 kPa), Use only with effective chip guarding and personal protective equipment (goggles/ shield, gloves, etc.).

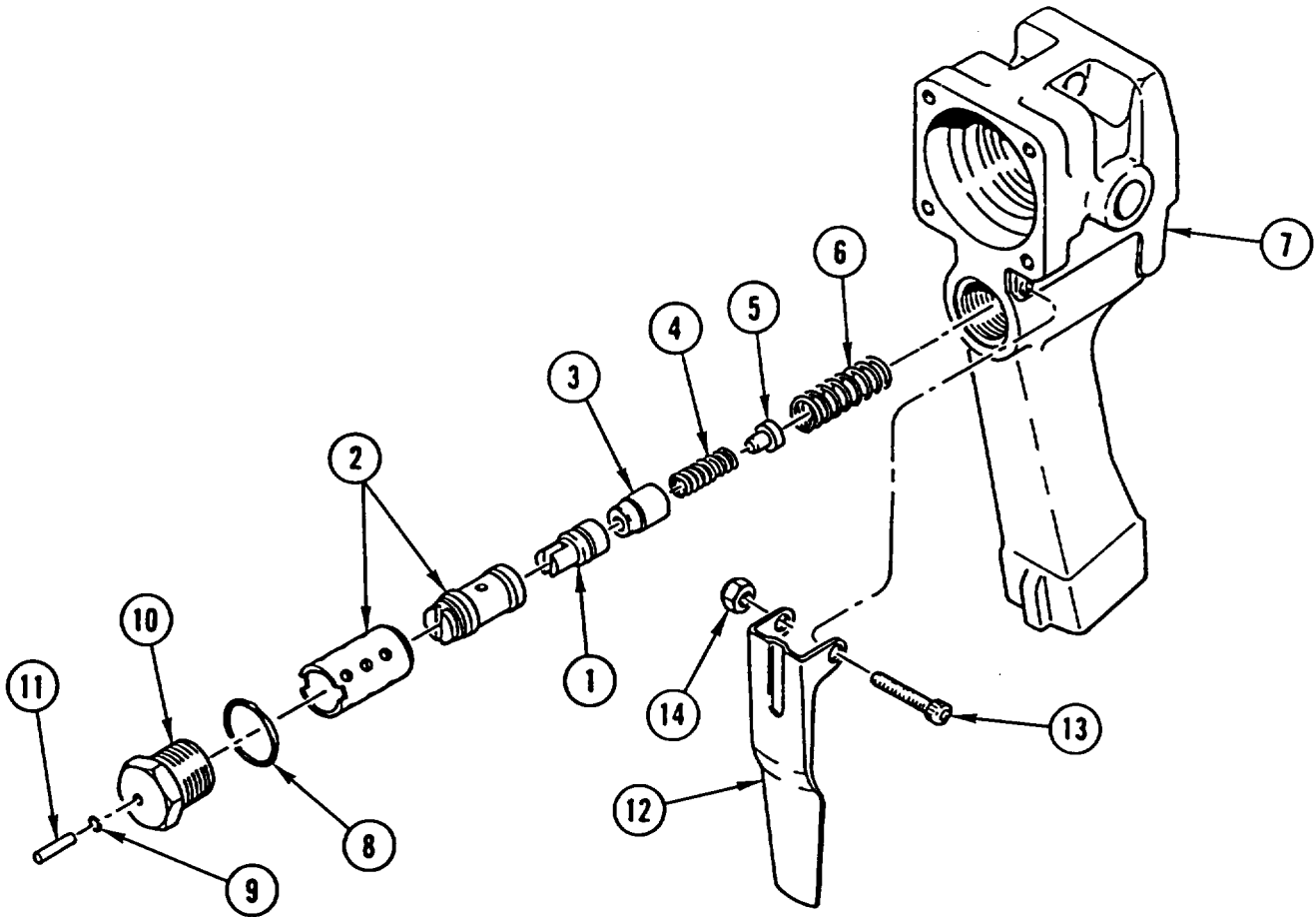
Clean all parts with drycleaning solvent. Dry with compressed air and wipe clean. Use only lint-free cloths.

**INSPECTION**

1. Inside of bushings should be grey. If color is mostly yellow-bronze, replace bushing.
2. Inspect shafts for wear and replace as required.
3. Motor cap gear chamber bores and end faces around bores should be polished, not rough or grooved.
4. Flat surfaces around chamber and bolt holes should be flat and free of nicks and burrs.
5. Gears should have flat, straight tips without nicks.
6. Gears should have smooth, even polish on teeth and end faces.
7. If cracks are present, discard gear.
8. Gear running surfaces of main housing should show two interconnecting polished circles without a step or roughness.
9. Main shaft diameter at bushing locations must be smooth.

IMPACT WRENCH REPAIR (CONT)

**ASSEMBLY**



**NOTE**

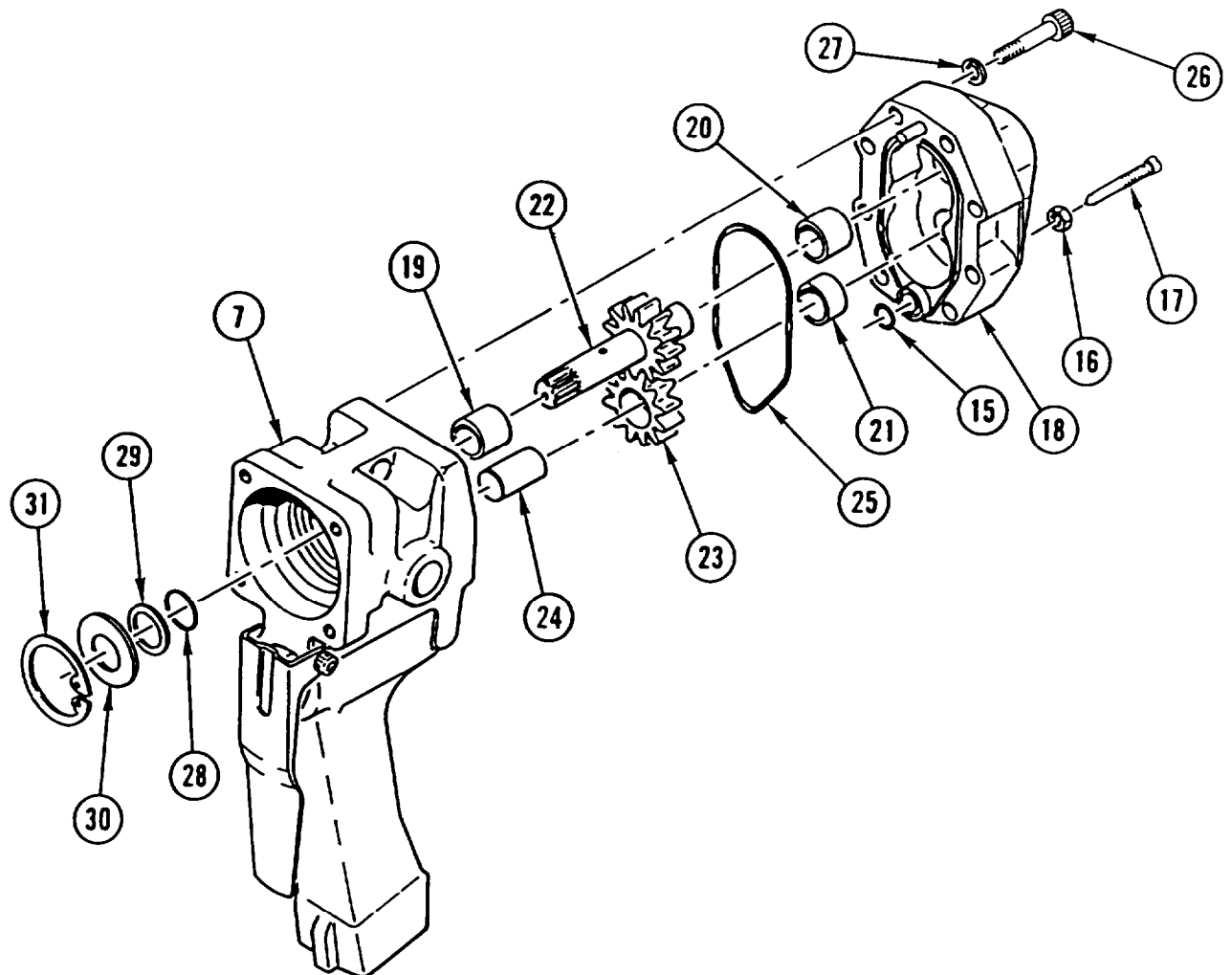
Apply coat of lubricating oil to packings prior to assembly.

1. APPLY COAT of GAA to seat VALVE (1) and INSTALL seat VALVE (1) in valve spool (2), notched end alined with strut.
2. INSTALL valve disc(3), SPRING (4), and spring seat (5).
3. INSTALL SPRING (6) on open end of spring seat (5).
4. INSTALL COMPONENTS assembled in STEPS 1 thru 3 in main housing (7).
5. INSTALL two new PACKINGS (8 and 9) on spool cap (10) and INSTALL spool CAP in main housing (7).
6. APPLY COAT of GAA to roller BEARING (11) and INSTALL roller BEARING (11) in spool cap (10).
7. INSTALL TRIGGER (12), screw (13), and new lock nut (14) in main housing (7).

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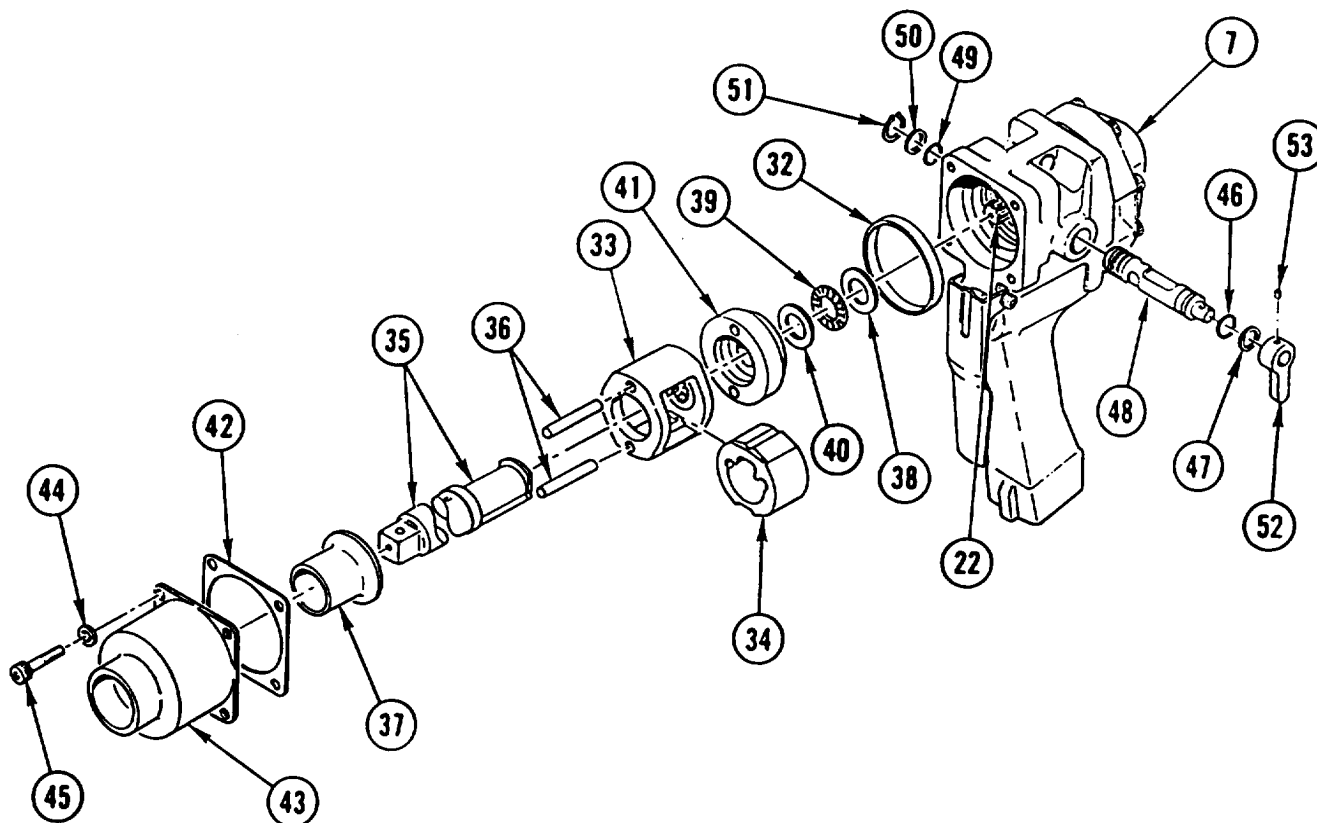
**IMPACT WRENCH REPAIR (CONT)**


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8. INSTALL new packing (15), nut (16), and relief adjustment SCREW (17) in motor cap (18). INSTALL relief adjustment SCREW (17) number of turns noted to maintain correct impact force. TIGHTEN NUT (16).
9. INSTALL BUSHING (19) in main housing (7).
10. INSTALL BUSHING (20) and idler gear BUSHING (21) in motor cap (18).
11. INSTALL worm shaft (22), idler GEAR assembly (23), and idler shaft (24).
12. INSTALL new PACKING (25) in groove of motor cap (18).
13. SLIDE main HOUSING (7) over worm shaft (22) until housing seats securely against motor cap (18).
14. APPLY COAT of GAA to eight socket head SCREWS (26) and INSTALL eight socket head SCREWS (26) and eight new lock washers (27). TIGHTEN socket head SCREWS to 22-25 lb-ft (29.8-33.9 N.m).
15. INSTALL two new PACKINGS (28 and 29), flat washer (30), and retaining ring (31).

**IMPACT WRENCH REPAIR (CONT)**



16. INSTALL retaining RING (32).

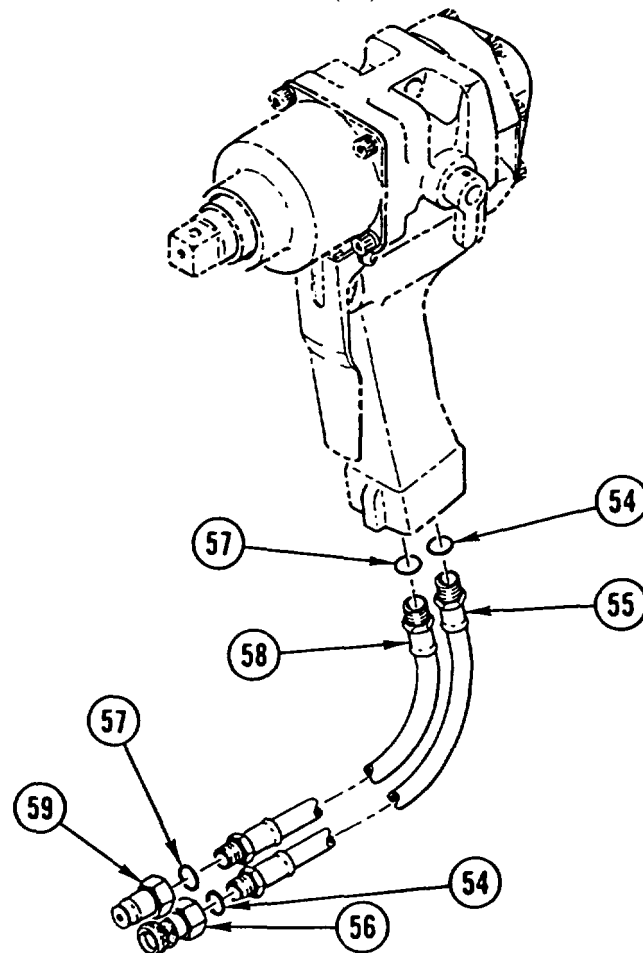
**NOTE**

Inside of hammer case should be free of grease to avoid overlubrication.

17. APPLY COAT of GAA to INSIDE of hammer frame (33) and INSTALL hammer (34), ANVIL (35), and two hammer pins (36).
18. APPLY COAT of GAA to hammer case BUSHING (37) and SLIDE onto anvil (35).
19. APPLY COAT of GAA to BEARING (38), RETAINER and ROLLER (39), and BEARING (40) and INSTALL on worm shaft (22) in that order.
20. INSTALL valve SEAT (41) in main housing assembly (7).
21. ALINE two hammer PINS (36) with valve seat (41) and INSTALL in worm shaft (22).
22. INSTALL new GASKET (42) in main housing (7).
23. SLIDE hammer CASE assembly (43) onto anvil (35) and INSTALL four new lock washers (44) and four SCREWS (45). TIGHTEN SCREWS to 13-15 lb-ft (47-54 N.m).
24. INSTALL new PACKING (46) and spacer ring (47) on reversing spool (48).

## IMPACT WRENCH REPAIR (CONT)

25. INSTALL reversing SPOOL (48) in main housing (7) far enough to INSTALL new PACKING (49) and spacer ring (50).
26. CENTER reversing SPOOL (46) and INSTALL retaining RING (51).
27. TURN reversing SPOOL (46) so hole is pointed UP. INSTALL LEVER (52) by alining hole in lever with hole in reversing spool. INSTALL SETSCREW (53).



28. INSTALL two new packings (54), HOSE (55), and coupling HALF (56).
29. INSTALL two new packings (57), HOSE (58) and coupling HALF (59).



### Section III. PAVEMENT BREAKER REPAIR

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## PAVEMENT BREAKER REPAIR

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This task covers: a. Disassembly b. Assembly c. Charging d. Testing

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### INITIAL SETUP

#### Applicable Configuration:

SEE

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N26  
Disassembly Tool, P/N 05508  
Installing and Removal Tool, P/N 04337  
Pipe, P/N 04910  
Puller Kit, P/N 11275  
Ring, P/N 04908  
Spacer, P/N 04909  
Test Set, P/N 02835

#### Materials/Parts:

Nut, Lock

Kit, Seal Parts

Grease, Automotive Appendix B, Item 23  
and Artillery (GAA)

#### Materials/Parts (Cont):

Nitrogen Appendix B, Item 29

Oil, Lubricating Appendix B, item 30

Rags Appendix B, Item 40

#### General Safety Instructions:

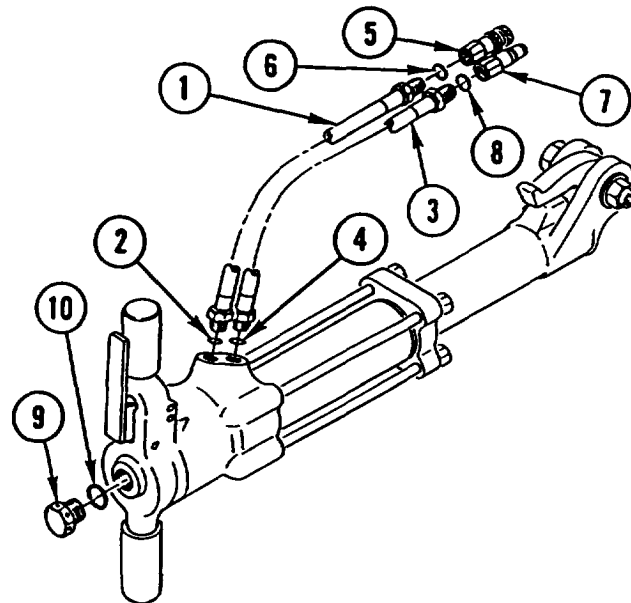
#### WARNING

Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.

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## DISASSEMBLY

1. REMOVE HOSE assembly (1) and packing (2). DISCARD PACKING.
2. REMOVE HOSE assembly (3) and packing (4). DISCARD PACKING.
3. REMOVE quick-disconnect coupling HALF (5) and packing (6). DISCARD PACKING.
4. REMOVE quick-disconnect coupling HALF (7) and packing (8). DISCARD PACKING.
5. REMOVE valve CAP (9) and packing (10). DISCARD PACKING.

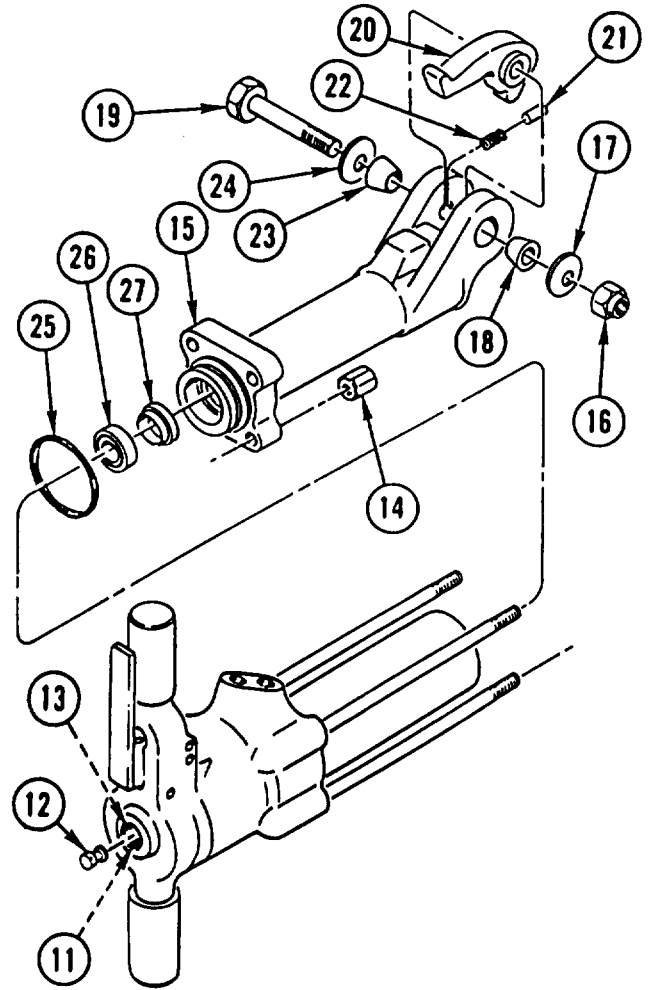


**PAVEMENT BREAKER REPAIR (CONT)**

**WARNING**

When discharging nitrogen from accumulator, stand to one side and keep face away from front of charging valve to prevent personal injury.

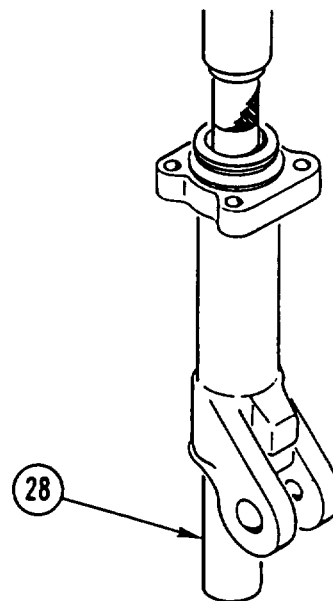
6. LOOSEN charging VALVE (11) 1-1/2 turns, REMOVE valve CAP (12), and DRAIN ACCUMULATOR assembly (13) to 20 psi (1.4 bar).
7. REMOVE four side rod NUTS (14).
8. REMOVE FOOT assembly (15) by TAPPING with RUBBER or PLASTIC hammer.
9. REMOVE lock nut (16), washer (17), bushing (18), bolt (19), latch (20), detent PLUNGER (21), spring (22), bushing (23), and washer (24).
10. REMOVE and DISCARD PACKING (25), cup SEAL (26), and WIPER (27).



**NOTE**

Hexagon bushing is tapered toward flange end of foot assembly.

11. USING 50-ton PRESS, REMOVE hexagon BUSHING (28).



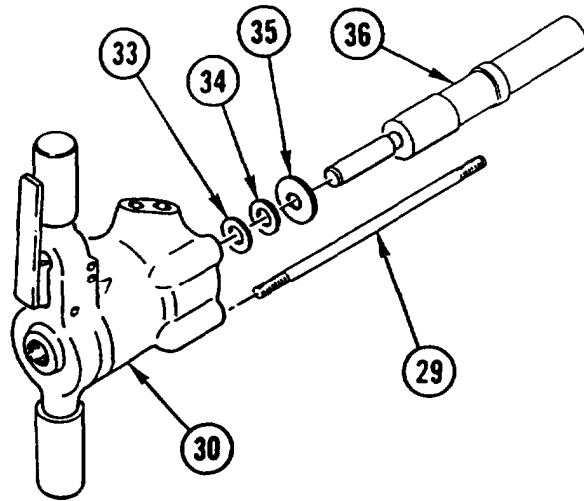
**PAVEMENT BREAKER REPAIR (CONT)**

- 12. REMOVE four side RODS (29).
- 13. REMOVE HANDLE assembly (30) by TAPPING with RUBBER or PLASTIC hammer.

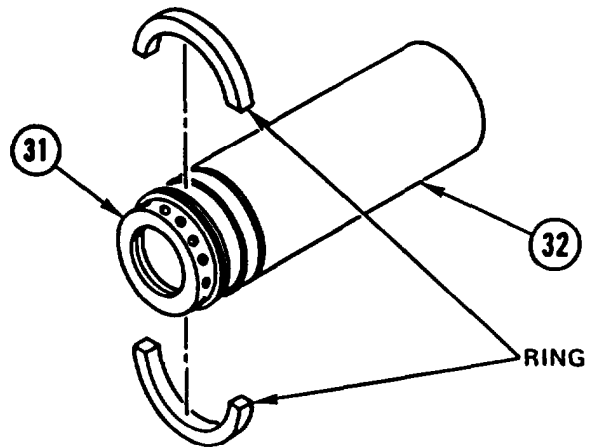
**NOTE**

If automatic body (31) remains in handle assembly, go to step 22. If automatic body remains in flow sleeve tube (32), go to step 14.

- 14. REMOVE backup washer (33), cup seal (34), washer (35), and PISTON (36). DISCARD backup WASHER and cup SEAL.



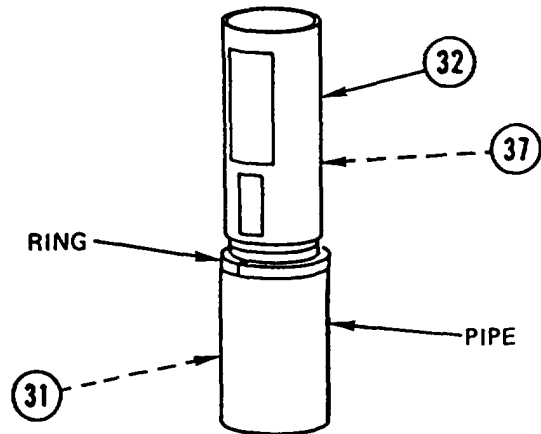
- 15. INSTALL RING between automatic body (31) and flow sleeve tube (32).



- 16. WITH RING in place, INSTALL flow sleeve TUBE (32) on PIPE with automatic body (31) DOWN.

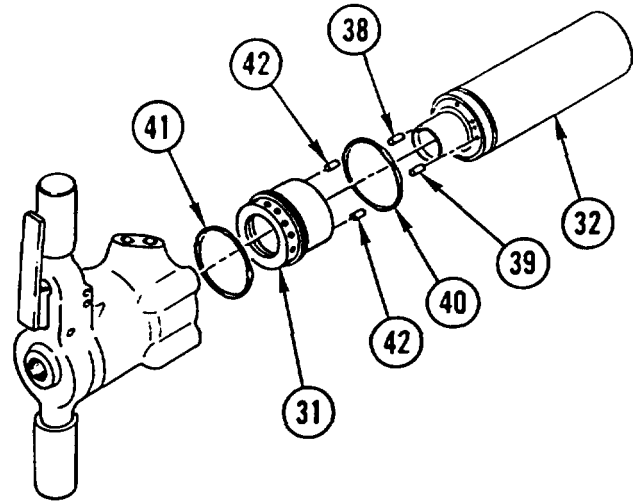
**CAUTION**  
To prevent possible damage to flow sleeve tube, place metal disc on top of flow sleeve tube before pressing flow sleeve.

- 17. USING suitable PRESS, PRESS flow SLEEVE (37) to REMOVE automatic BODY (31).

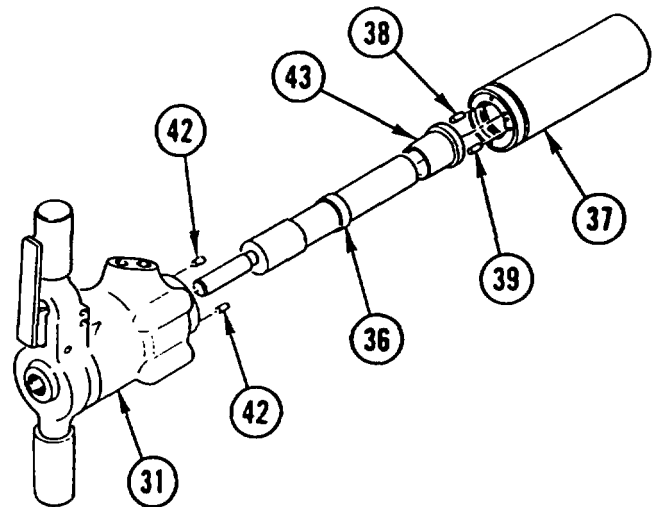


**PAVEMENT BREAKER REPAIR (CONT)**

18. REMOVE four pins (38) and PIN (39).
19. REMOVE and DISCARD PACKING (40) from flow sleeve tube (32).
20. REMOVE packing (41) and two PINS (42) from automatic body (31). DISCARD PACKING.
21. GO to STEP 30.



22. REMOVE piston (36) and automatic VALVE (43) from handle end of flow sleeve (37).
23. REMOVE four pins (38) and PIN (39) from flow sleeve (37).
24. REMOVE two PINS (42) from automatic body (31).

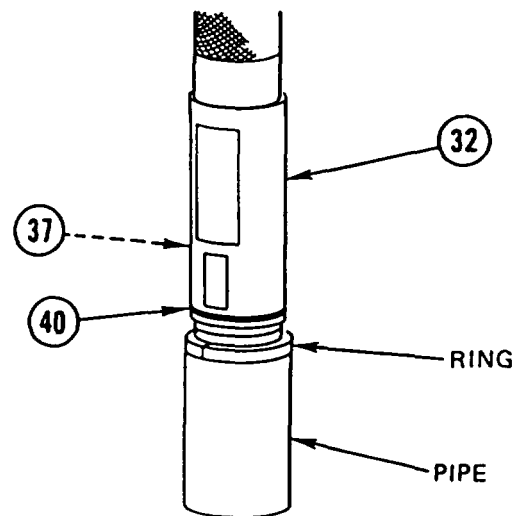


25. INSTALL RING on top of PIPE and PLACE flow sleeve TUBE (32) on top of RING.

**CAUTION**

To prevent possible damage to flow sleeve tube, place metal disc on top of flow sleeve tube before pressing flow sleeve.

26. USING suitable PRESS, PUSH flow SLEEVE (37) from flow sleeve tube (32).
27. REMOVE and DISCARD PACKING (40).

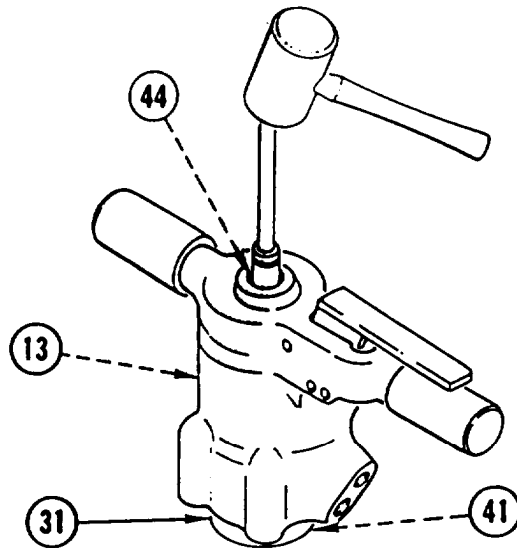


**PAVEMENT BREAKER REPAIR (CONT)**

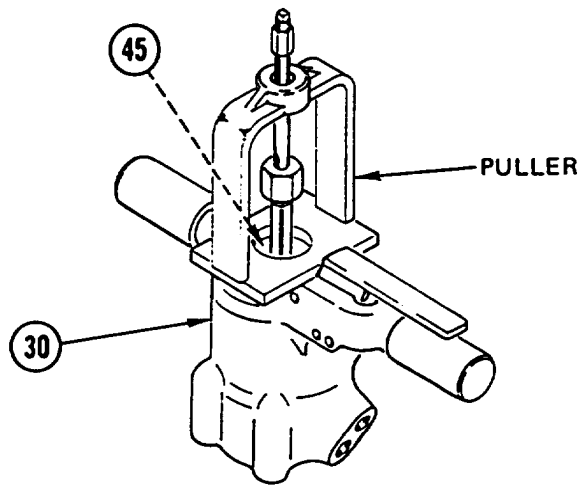
**NOTE**

Accumulator cylinder (45) may remain in handle if accumulator charge is below 20 psi (1.4 bar).

- 28. PLACE 3/4-hex deep socket with 6-in. (15-cm) EXTENSION over charging valve (44) and TAP EXTENSION with PLASTIC or RUBBER hammer to REMOVE ACCUMULATOR assembly (13) and automatic body (31).
- 29. REMOVE and DISCARD PACKING (41) from automatic body (31).



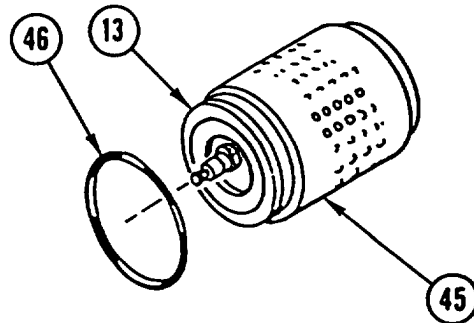
- 30. IF accumulator CYLINDER (45) is still in handle assembly (30), INSTALL PULLER KIT and remove accumulator CYLINDER (45).



- 31. REMOVE and DISCARD PACKING (46) from accumulator cylinder (45).

**WARNING**

When discharging nitrogen from accumulator, stand to one side and keep face away from front of charging valve to prevent personal injury.



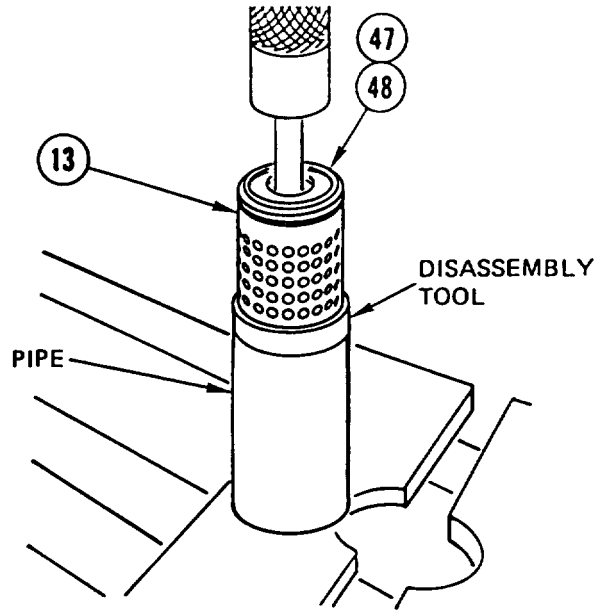
- 32. DISCHARGE remaining NITROGEN from accumulator assembly (13).

**PAVEMENT BREAKER REPAIR (CONT)**

33. ASSEMBLE DISASSEMBLY TOOL and PIPE and PLACE ACCUMULATOR assembly (13) on assembly.

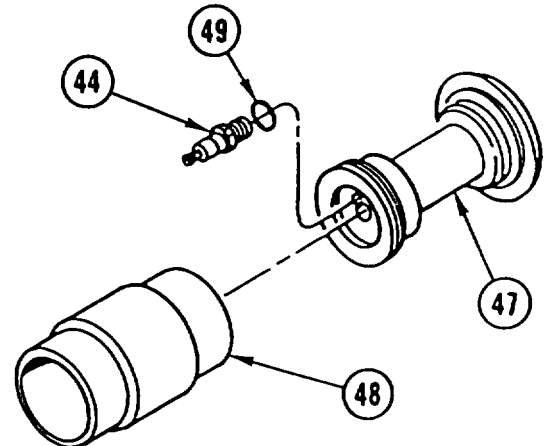
**CAUTION**  
To prevent damage to charging valve, cover with 3/4-hex deep socket.

34. USING suitable PRESS, REMOVE accumulator CHAMBER (47) and accumulator diaphragm valve (48).



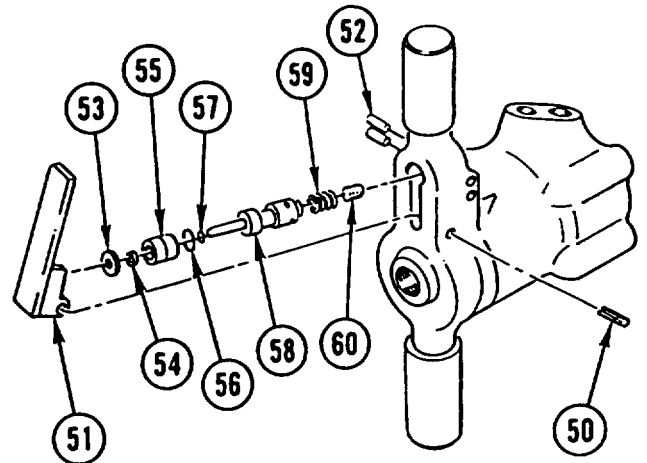
35. SQUEEZE diaphragm VALVE (48) and SLIDE off accumulator chamber (47).

36. REMOVE charging VALVE (44) and packing (49). DISCARD PACKING.



37. REMOVE pin (50) and LEVER (51).

38. REMOVE two pins (52), washer (53), wiper (54), bushing (55), packing (56), packing (57), valve SPOOL (58), spring (59), and plug (60). DISCARD PACKINGS.



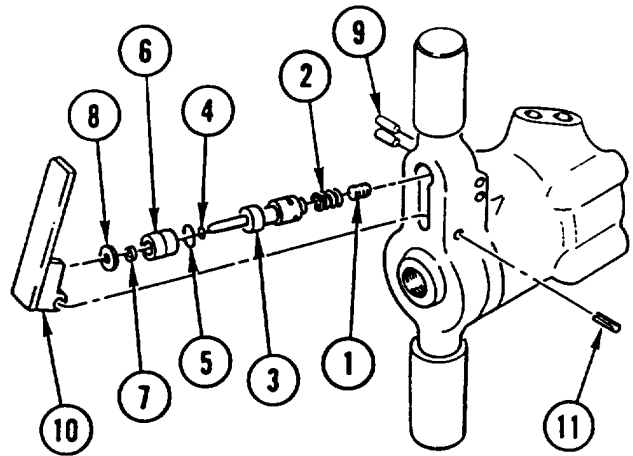
**PAVEMENT BREAKER REPAIR (CONT)**

**ASSEMBLY**

**NOTE**

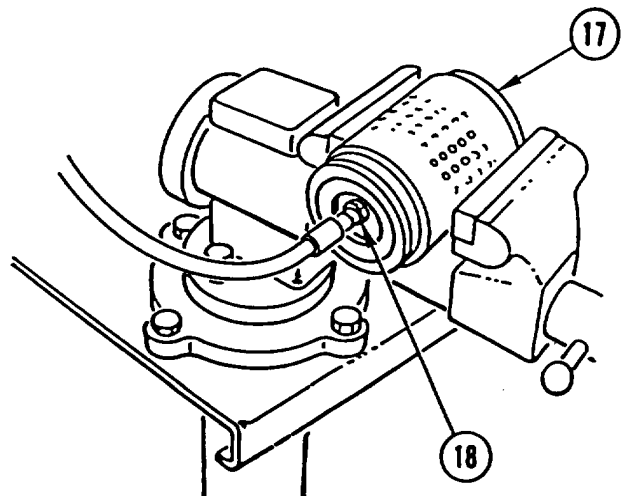
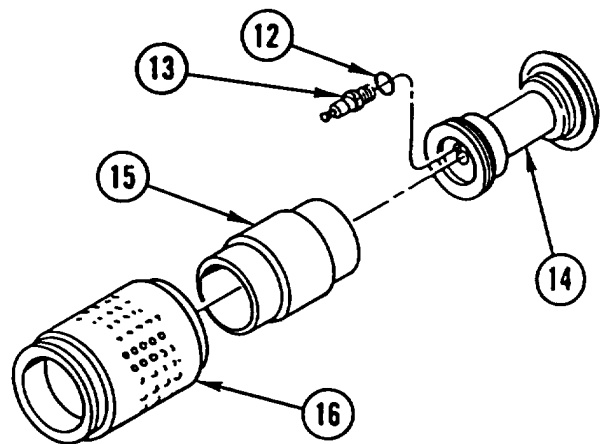
Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL plug (1), spring (2), valve SPOOL (3), new packing (4), new packing (5), bushing (6), wiper (7), and washer (8).
2. PRESS DOWN assembly from step 1 and INSTALL two PINS (9).
3. INSTALL LEVER (10) and pin (11).
4. INSTALL new packing (12) and charging VALVE (13) in accumulator chamber (14).
5. APPLY light COAT of LUBRICATING OIL on accumulator CHAMBER (14) and INSTALL accumulator diaphragm VALVE (15) over accumulator chamber (14) from charging valve (13) end.



**CAUTION**  
 If press is necessary to complete step 6, do not use powered press and use short strokes to prevent equipment damage.

6. APPLY light COAT of GAA to OUTSIDE of accumulator diaphragm valve (15) and INSIDE of accumulator cylinder (16). INSTALL ASSEMBLY from STEP 5 in accumulator cylinder (16) from chamfered end of accumulator cylinder (16).
7. TEST charge ACCUMULATOR assembly (17) from STEP-6 as follows:
  - a. Place accumulator assembly (17) in soft-jawed vise.
  - b. Loosen valve (18) 1-1/2 turns.
  - c. Charge accumulator assembly (17) with nitrogen to 600 psi (41 bar).
  - d. Check for leaks.



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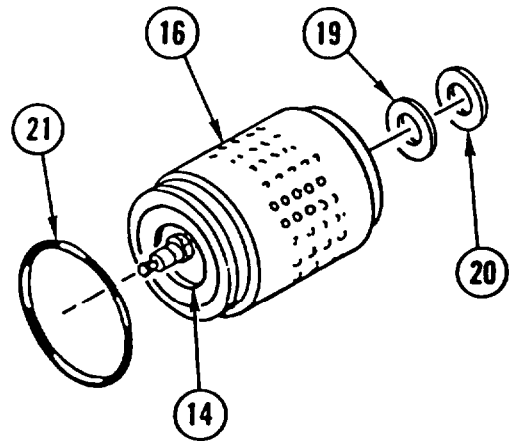
**PAVEMENT BREAKER REPAIR (CONT)**


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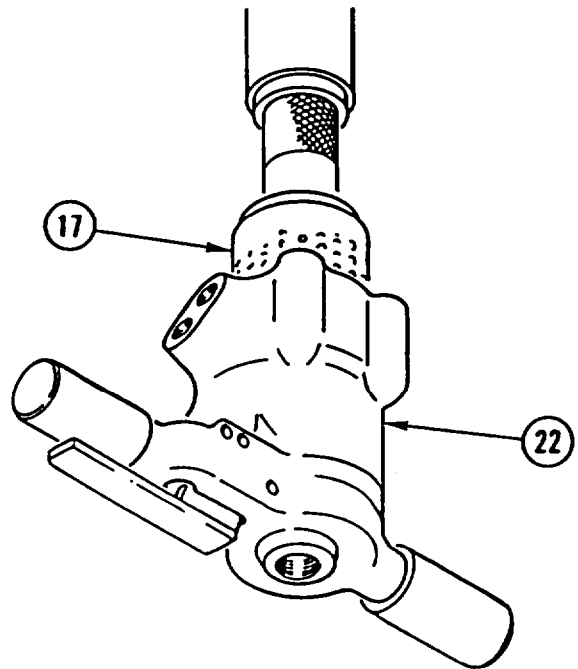
**WARNING**

When discharging nitrogen from accumulator, stand to one side and keep face away from front of charging valve to prevent personal injury.

- e. Discharge accumulator assembly (17) completely.
8. INSTALL new backup washer (19) and new cup SEAL (20), with lips facing out, in accumulator chamber (14).
9. INSTALL new PACKING (21) on accumulator cylinder (16).



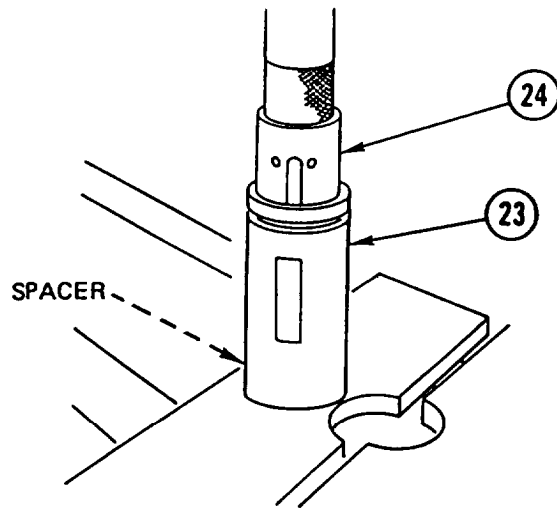
10. USING suitable PRESS, INSTALL ACCUMULATOR assembly (17) in handle (22).





**PAVEMENT BREAKER REPAIR (CONT)**

11. PLACE SPACER on base of press. APPLY COAT of GAA to entire BORE of flow sleeve TUBE (23) and PLACE on SPACER with packing groove facing up.
12. PRESS flow SLEEVE (24), wide groove end first, into flow sleeve tube (23) until top of flow sleeve (24) is FLUSH with top of flow sleeve tube (23).



13. INSTALL four PINS (25), tapered end first, in flow sleeve tube (23).

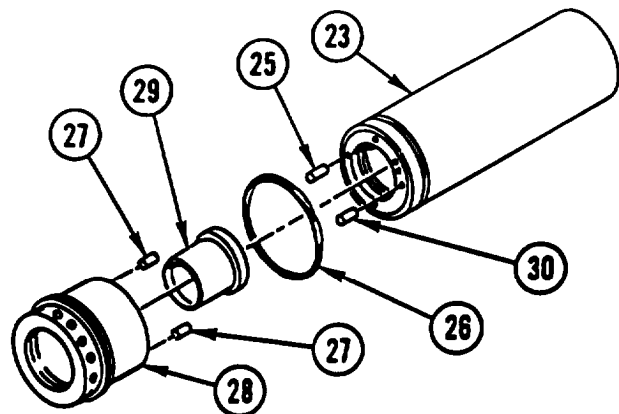
14. INSTALL new PACKING (26) on flow sleeve tube (23).

15. INSTALL two PINS (27), tapered end up, in automatic body (28).

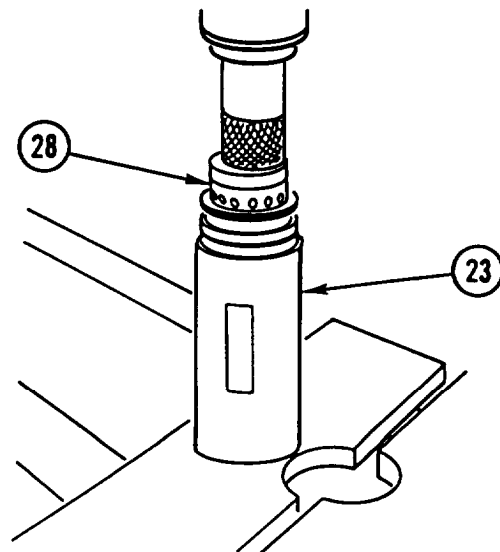
16. INSTALL automatic VALVE (28) In automatic body (28).

17. INSTALL PIN (30) In flow sleeve tube (23).

18. INSTALL automatic BODY (28) in flow sleeve tube (23), ALLOW automatic VALVE (28) to DROP and pilot Into bore of flow sleeve tube (23).

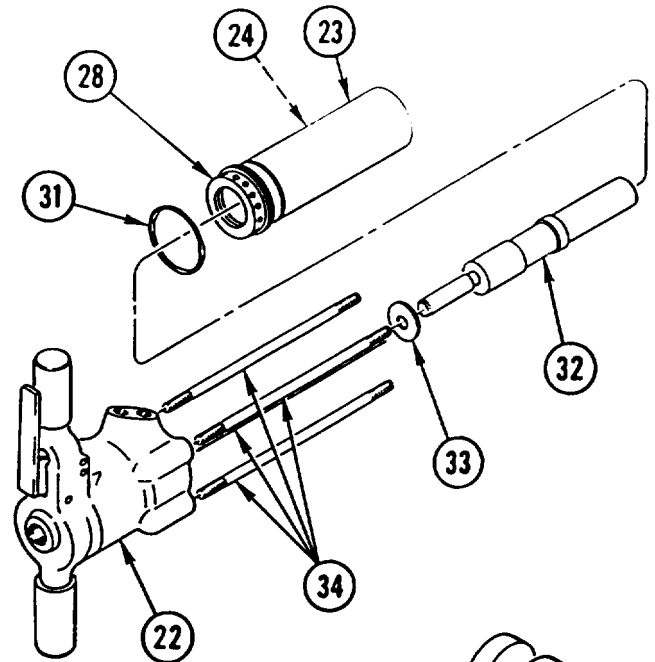


19. USING suitable PRESS, with metal plate on top of automatic body (28), INSTALL automatic BODY (28) in flow sleeve tube (23) until bottom edge of side holes in automatic body (28) are TOUCHING flow sleeve tube (23).

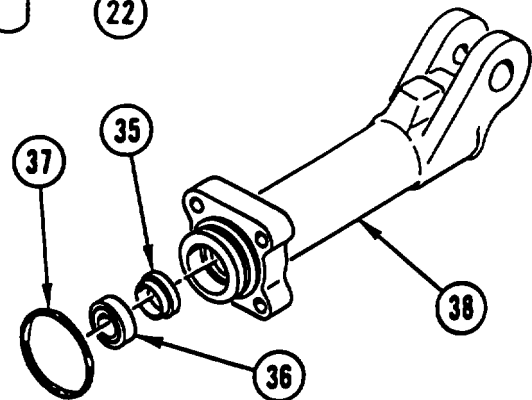


## PAVEMENT BREAKER REPAIR (CONT)

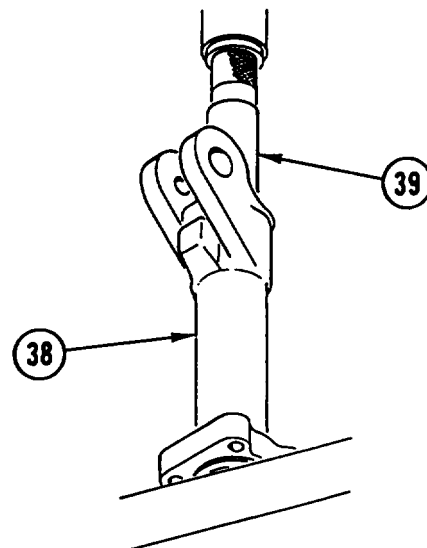
20. INSTALL new PACKING (31) on automatic body (28).
21. INSTALL PISTON (32), large end first, in flow sleeve (24) from automatic body (28).
22. APPLY heavy COAT of GAA to WASHER (33) and INSTALL on piston (32), small end first.
23. INSTALL four side RODS (34) in handle (22).
24. PLACE flow sleeve TUBE (23) in soft-jawed VISE and INSTALL HANDLE (22) on flow sleeve tube (23) by TAPPING with PLASTIC or RUBBER hammer.



25. INSTALL new WIPER (35), new cup SEAL (36), with lips facing out, and new PACKING (37) in foot (36).



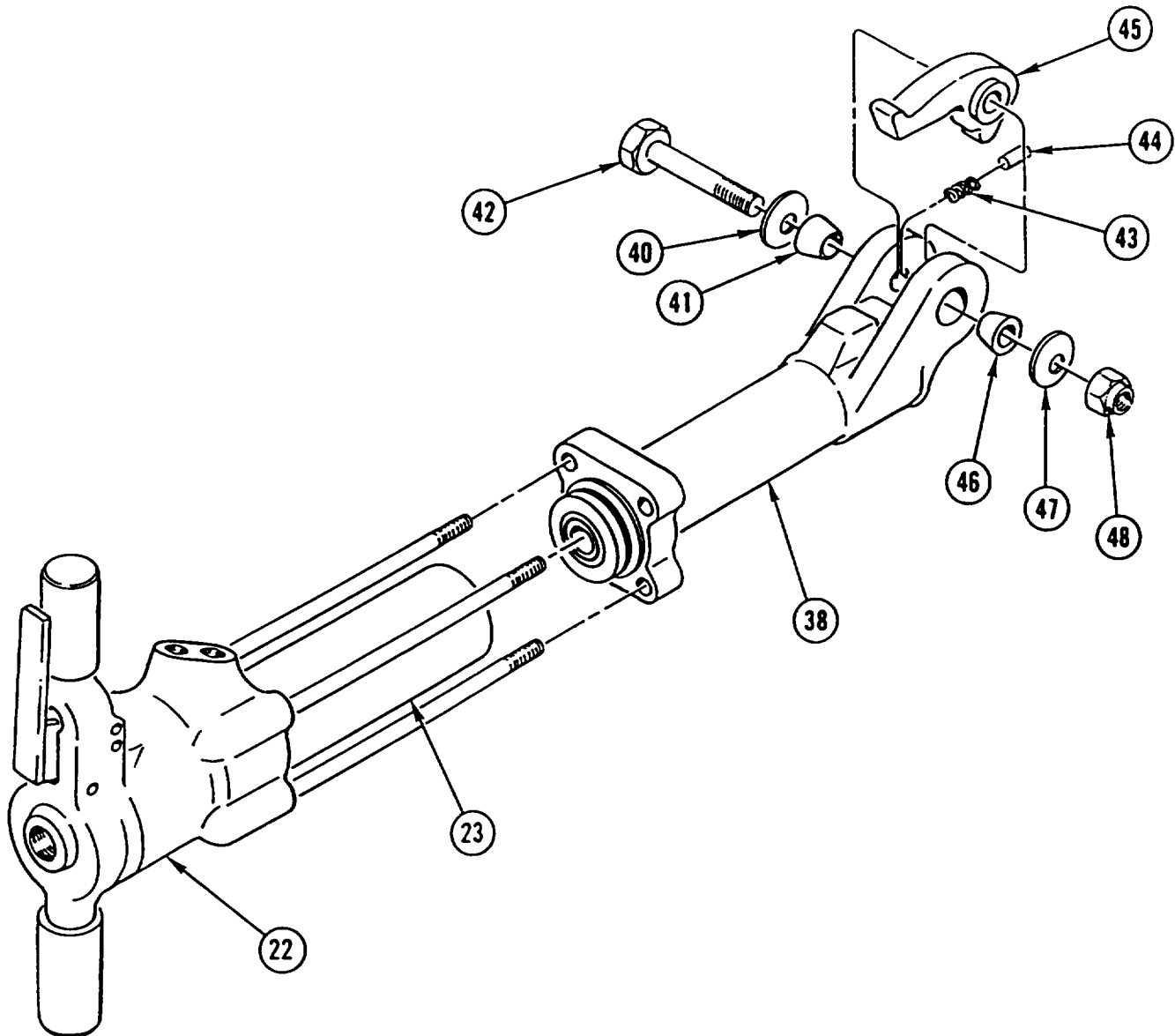
26. USING 50-ton PRESS, INSTALL hexagon BUSHING (39), tapered end first, in foot (38).



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**PAVEMENT BREAKER REPAIR (CONT')**

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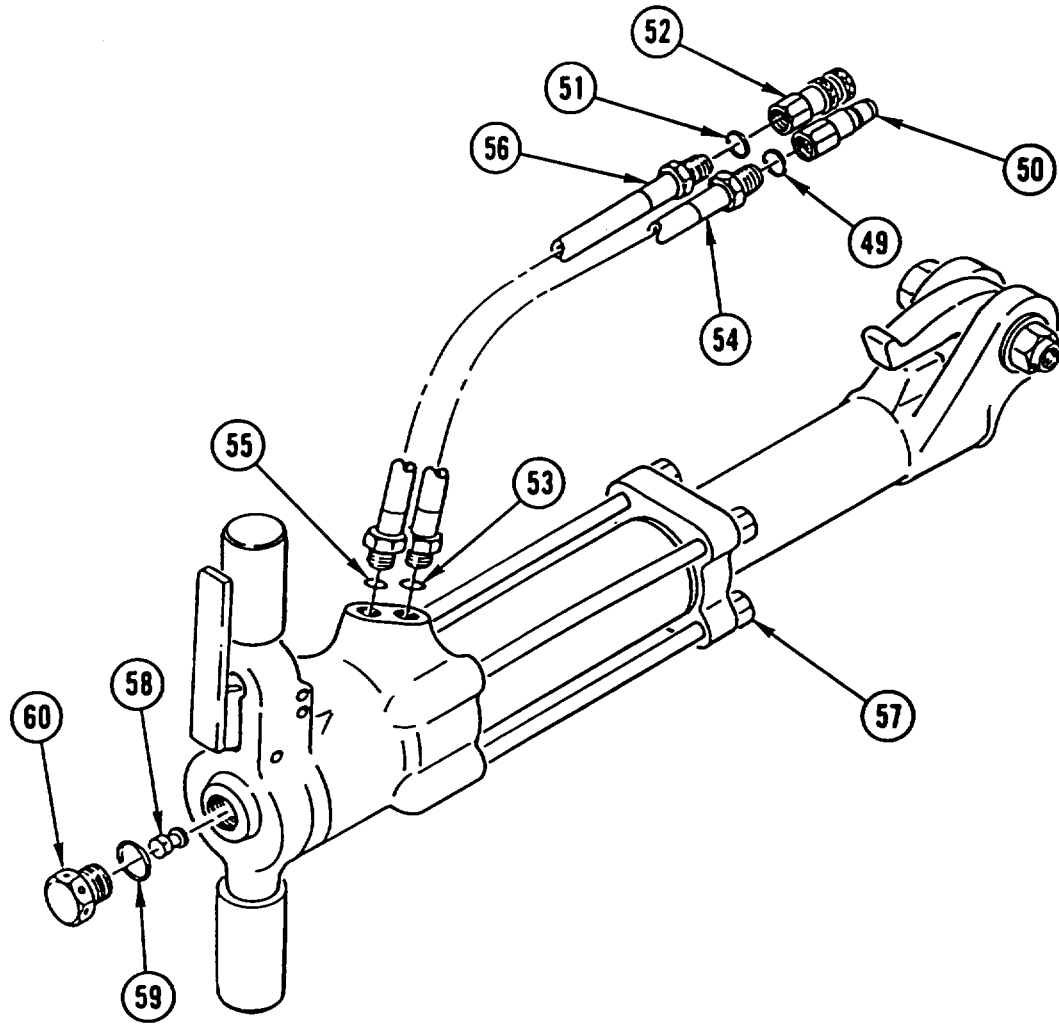
27. INSTALL washer (40), bushing (41), bolt (42), spring (43), detent plunger (44), LATCH (45), bushing (46), washer (47), and new lock nut (48).

28. INSTALL FOOT (38) on flow sleeve tube (23) with latch (45) in line with in and out ports on handle (22).

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**PAVEMENT BREAKER REPAIR (CONT)**


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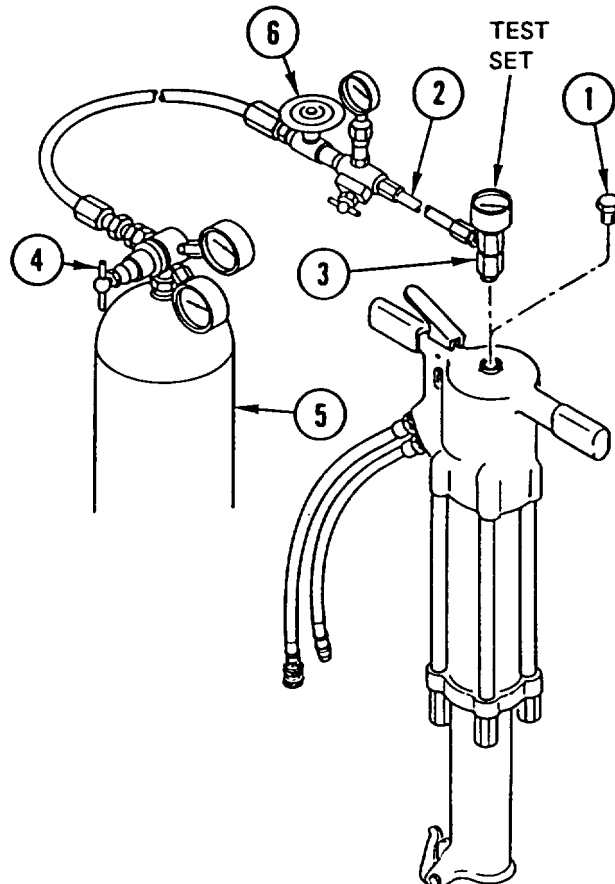
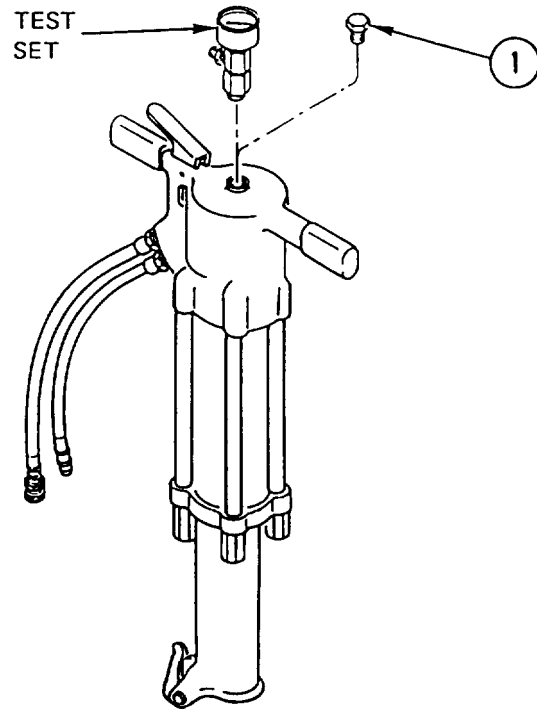


29. INSTALL new packing (49) and quick-disconnect coupling HALF (50).
30. INSTALL new packing (51) and quick-disconnect coupling HALF (52).
31. INSTALL new packing (53) and HOSE assembly (54).
32. INSTALL new packing (55) and HOSE assembly (56).
33. INSTALL four side rod NUTS (57) and TIGHTEN in 20 lb-ft (25 N.m) increments to 75 lb-ft (100 N.m).
34. CHARGE ACCUMULATOR using Charging procedure, below.
35. INSTALL valve CAP (58), new packing (59), and valve CAP (60).

## PAVEMENT BREAKER REPAIR (CONT)

### CHARGING

1. Remove valve cap (1).
2. Rotate gage end of test set fully to left to make sure stem is fully retracted.
3. Install test set in handle of pavement breaker by rotating chuck end only.
4. Rotate gage end of test set slowly to right until pressure is indicated on gage. Pressure reading should be 500-700 psi (34-46 bar).
5. Connect nitrogen supply line (2) to charging valve (3) on test set.
6. Adjust regulator (4) on nitrogen bottle (5) to delivery pressure of 600 psi (42 bar).
7. Open valve (6) on nitrogen supply line (2).
8. When accumulator is fully charged, close valve (6) on nitrogen supply line (2) and disconnect from test set.
9. Rotate gage end of test set fully to left and remove test set at chuck end.
10. Install valve cap (1).



### TESTING

1. Perform steps 1 thru 4 of Charging, above.
2. If pressure is low, charge accumulator using Charging procedure, above.
3. Rotate gage end of test set fully to left and remove test set at chuck end.
4. Install valve cap (1).

## Section IV. CHAIN SAW REPAIR

### CHAIN SAW REPAIR

This task covers: a. Disassembly b. Inspection c. Assembly

#### INITIAL SETUP

**Applicable Configuration:**

SEE

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26  
 Installing and Removal Tool, P/N 04337

**Materials/Parts:**

Kit, Parts

Kit, Seal

Grease, Automotive and Artillery (GAA)      Appendix B, Item 23

Oil, Lubricating      Appendix B, Item 30

**References:**

TM 5-2420-224-20

**Equipment Condition:**

**Reference**

**Condition Description**

TM 5-2420-224-20

Chain Saw Chain and Bar Removed

TM 5-2420-224-20

Chain Saw Hoses Removed

TM 5-2420-224-20

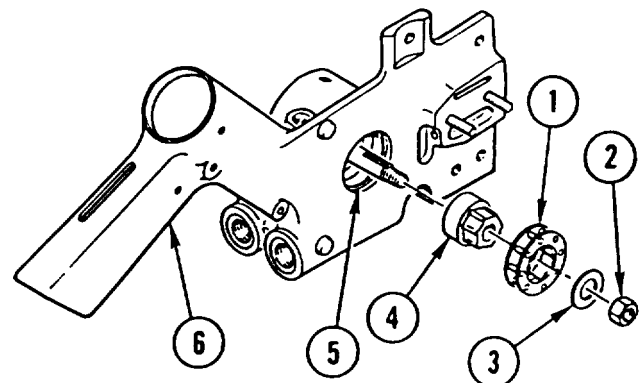
Chain Saw Trigger, Guard, and Handle Bar Removed

#### DISASSEMBLY

**NOTE**

Nut is left-hand thread.

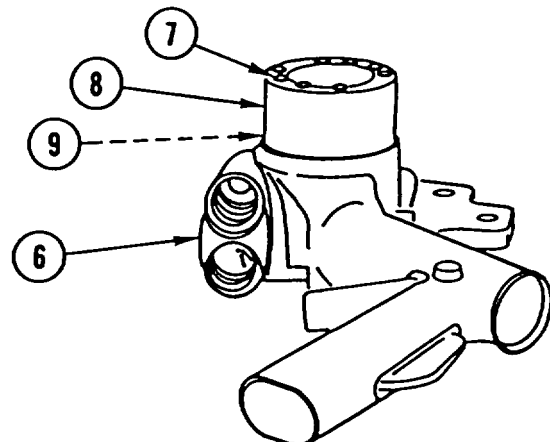
1. PREVENT SPROCKET (1) from TURNING and REMOVE nut (2), washer (3), SPROCKET (1), and adapter (4).
2. REMOVE retaining RING (5) from handle assembly (6).



**CAUTION**

Lift housing straight up. Do not tilt housing, or pry on flat surface inside surrounding groove, to avoid damage to sealing surface.

3. REMOVE eight screws (7), HOUSING (8), and packing (9) from handle assembly (6). DISCARD PACKING.

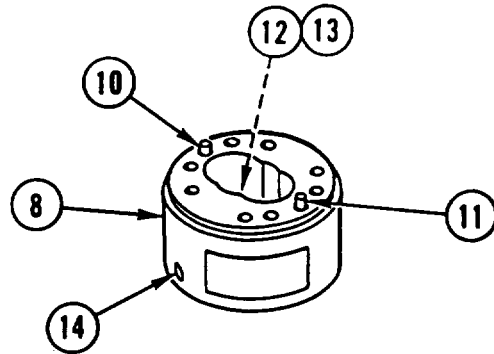


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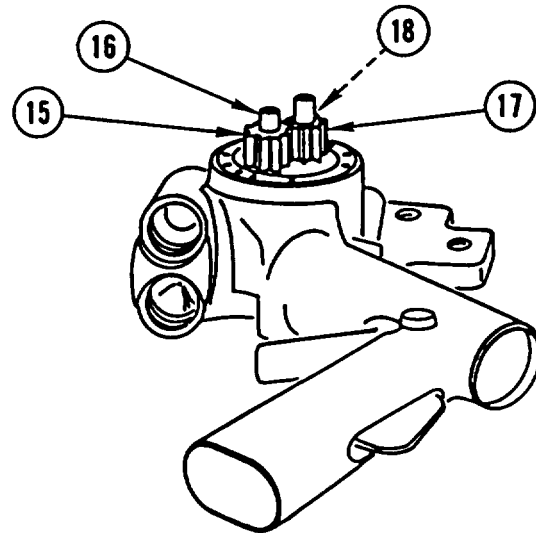
## CHAIN SAW REPAIR (CONTI)

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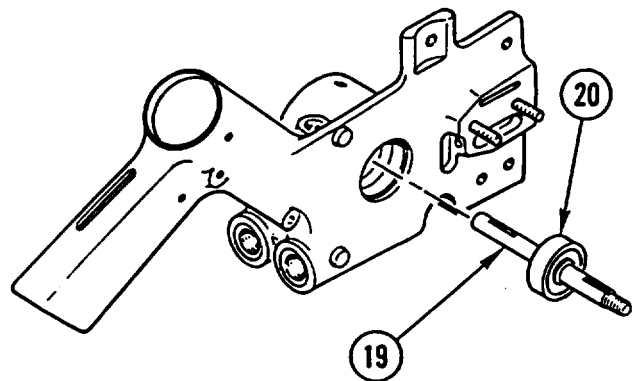
4. REMOVE two PINS (10 and 11) from housing (8).
5. IF WORN or DAMAGED, REMOVE two sleeve BEARINGS (12 and 13).
6. REMOVE screw PLUG (14).



7. REMOVE gear (15), pin (16), gear (17), and roller KEY (18).



8. REMOVE drive SHAFT (19) and BEARING (20) as an assembly.
9. REMOVE BEARING (20) from drive shaft (19).

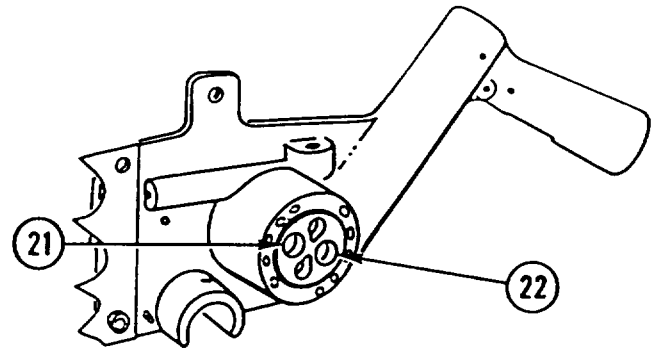


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**CHAIN SAW REPAIR (CONT)**

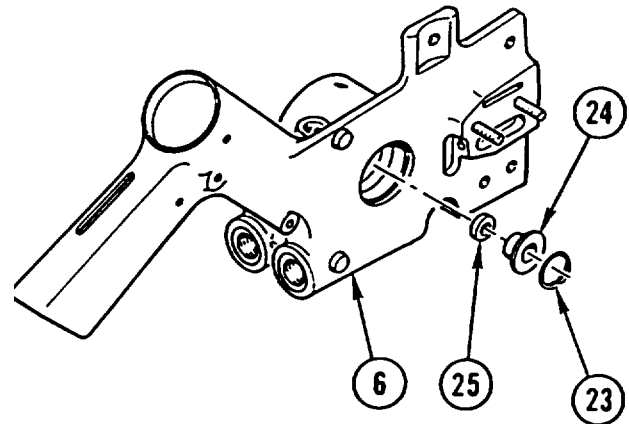

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10. IF WORN OR DAMAGED, REMOVE two sleeve BEARINGS (21 and 22).

**NOTE**

Note position of seal and seal backup washer prior to disassembly to aid in assembly.

11. REMOVE retaining ring (23), seal backup washer (24), and SEAL (25) from handle assembly (6). DISCARD SEAL.

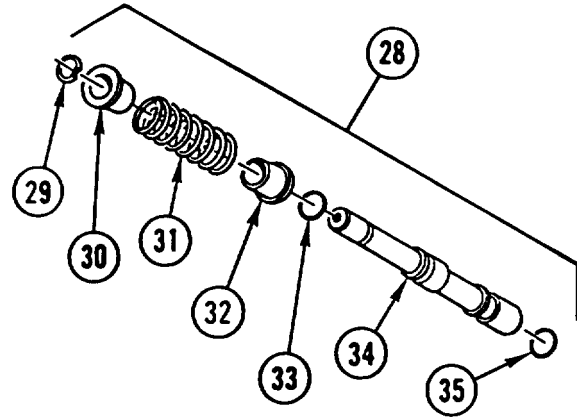


12. IF INSTALLED, REMOVE PLUG (26).
13. REMOVE spring PIN (27).
14. REMOVE assembled VALVE (28).



## CHAIN SAW REPAIR (CONT)

15. DISASSEMBLE assembled VALVE (28) by REMOVING retaining ring (29), spring washer (30), spring (31), spring washer (32), packing (33), VALVE (34), and packing (35). DISCARD PACKINGS.

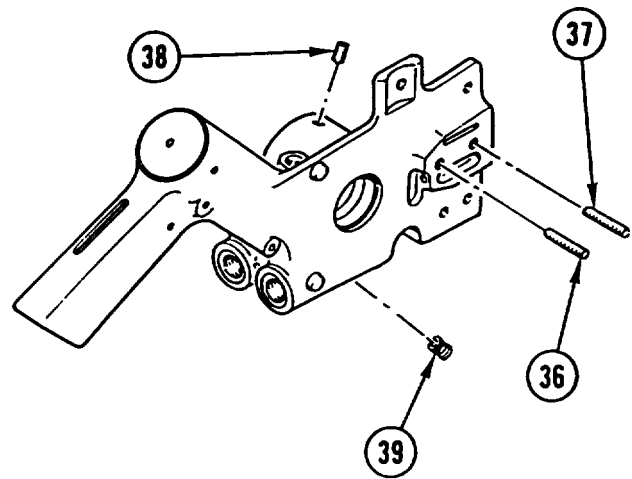


16. IF WORN or DAMAGED, REMOVE two sleeve BEARINGS (36 and 37).

17. REMOVE two screw PLUGS (38 and 39).

### INSPECTION

1. Gear chamber bores and bottoms around drive shaft sleeve bearings should be polished, not rough or grooved.
2. Sleeve bearings should be grey in color; replace if bores are yellow-bronze.
3. Flat surface around gear chamber and bolt holes should be flat and free of nicks.
4. Gears should have straight tips without nicks, square tooth ends, and smooth even polish on teeth and end surfaces. Check for cracks at groove in drive gear bore.



## CHAIN SAW REPAIR (CONT)

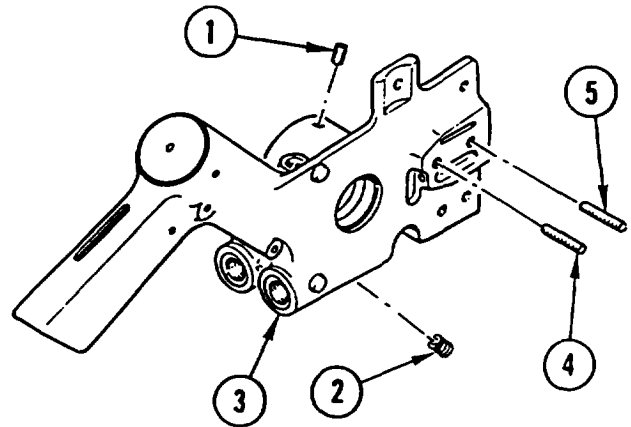
5. Surface on handle assembly near gears should show two interconnecting polished circles without a step; packing groove and surface should be smooth.
6. Handle assembly sleeve bearing bores should be grey in color; replace if bores are yellow-bronze.
7. Drive shaft diameter should be smooth on each side of V-groove keyway; signs of polishing are normal.
  - a. If drive shaft wear is in excess of normal polishing, or if drive shaft is grooved or rough, replace sleeve bearings, drive shaft, and seal.

### ASSEMBLY

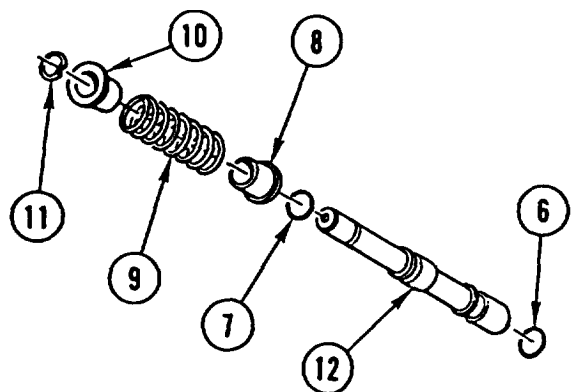
#### NOTE

Apply coat of lubricating oil to packings prior to assembly.

1. INSTALL two screw PLUGS (1 and 2) in handle assembly (3).
2. IF REMOVED, INSTALL two new sleeve BEARINGS (4 and 5).

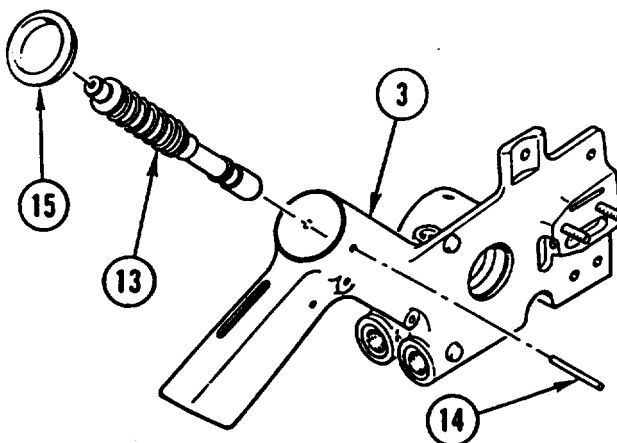


3. INSTALL two new packings (6 and 7), spring washer (8), SPRING (9), spring washer (10), and retaining ring (11) on valve (12).



**CHAIN SAW REPAIR (CONT)**

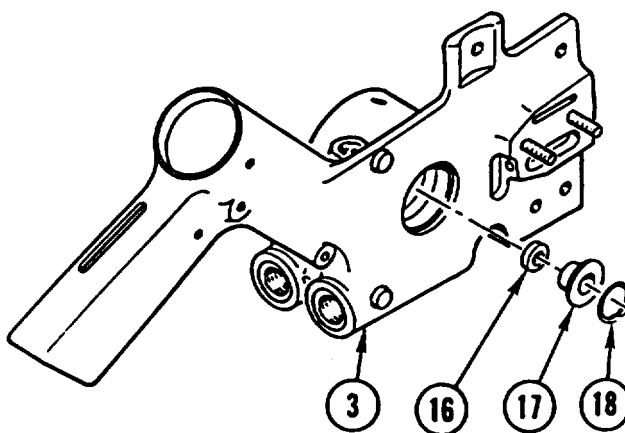
4. INSTALL assembled VALVE (13) in handle assembly (3).
5. INSTALL spring PIN (14).
6. IF REMOVED, INSTALL PLUG (15).



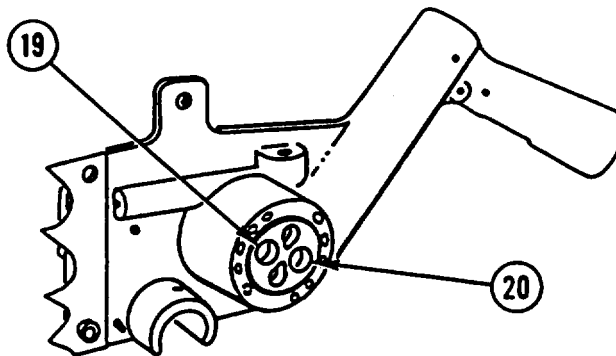
**CAUTION**

Make sure lips of seal face gear face to prevent damage to equipment.

7. INSTALL new SEAL (16), seal backup washer (17), and retaining ring (18) in handle assembly (3).



8. IF REMOVED, INSTALL two new sleeve BEARINGS (19 and 20).



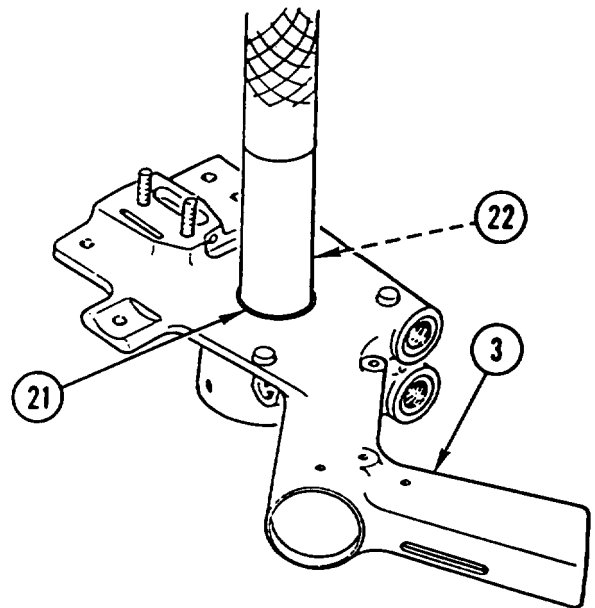
## CHAIN SAW REPAIR (CONT)

9. INSTALL BEARING (21) on drive shaft (22).

**CAUTION**

Do not press on drive shaft to seat bearing to prevent damage to equipment.

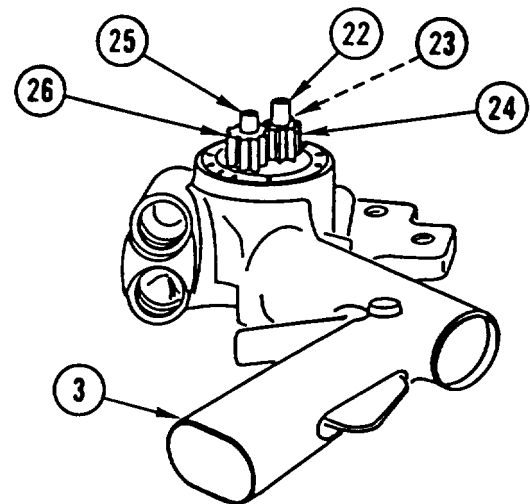
10. USING suitable SLEEVE and PRESS, INSTALL assembled BEARING (21) and drive SHAFT (22) in handle assembly (3).



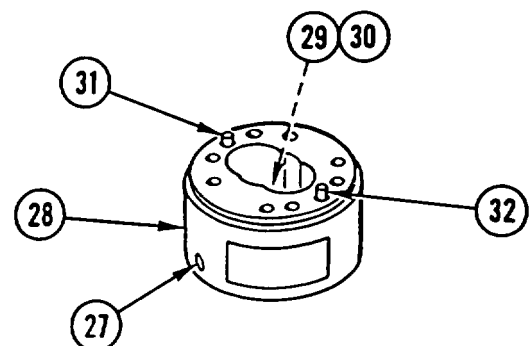
**NOTE**

Apply light coat of GAA on roller key for retention during assembly.

11. INSTALL roller key (23) and GEAR (24) on drive shaft (22).
12. INSTALL pin (25) and GEAR (26) in handle assembly (3).



13. INSTALL screw PLUG (27) in housing (28).
14. IF REMOVED, INSTALL two new sleeve BEARINGS (29 and 30).
15. INSTALL two PINS (31 and 32).



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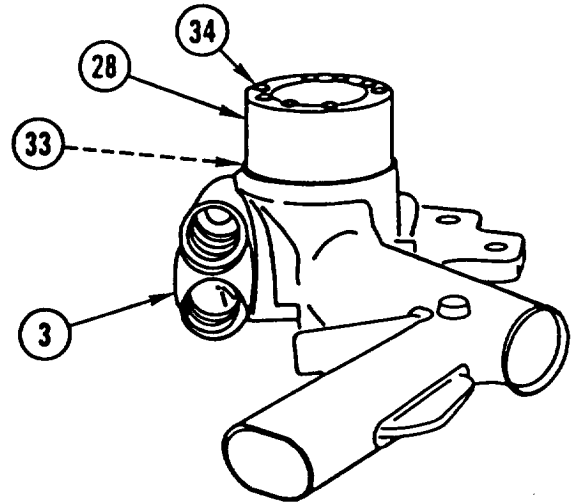
**CHAIN SAW REPAIR (CONT)**

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**CAUTION**

Turn shaft manually to check for free rotation before and after installing screws to prevent damage to equipment.

16. INSTALL new packing (33), HOUSING (28), and eight screws (34) on handle assembly (3).



17. INSTALL retaining RING (35) in handle assembly (3).

**NOTE**

Nut is left-hand thread.

18. INSTALL adapter (36), SPROCKET (37), washer (38), and nut (39). Do not tighten nut.

19. PREVENT SPROCKET (37) from TURNING and TIGHTEN NUT (39).

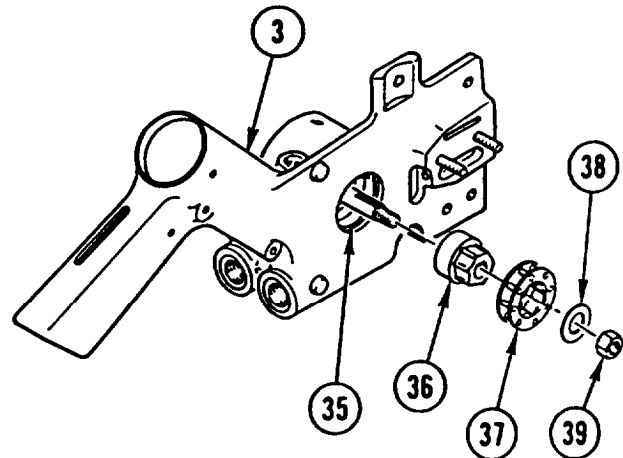
**NOTE**

Follow-on Maintenance:

Install chain saw trigger, guard, and handle bar (TM 5-2420-224-20).

Install chain saw hoses (TM 5-2420-224-20).

Install chain saw chain and bar (TM 5-2420-224-20).



## APPENDIX A REFERENCES

### **PUBLICATION INDEXES**

The following index should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual:

Consolidated Index of Army Publications and Blank Forms . . . . . DA Pam 25-30

### **FORMS**

The following forms pertain to this material. (Refer to DA Pam 25-30 for index of blank forms.)

DD Form 6, Packaging Improvement Report

SF Form 46, U.S. Government Motor Vehicle Operator's Identification Card

DA Form 91, Operator's Report of Motor Vehicle Accident

SF Form 368, Quality Deficiency Report

DD Form 1397, Processing and Reprocessing Records for Shipment, Storage, and Issue of Vehicles and Spare Engines

DA Form 2028, Recommended Changes to Publications and Blank Forms

DA Form 2028-2, Recommended Changes to Equipment Technical Manuals

DA Form 2404, Equipment Inspection and Maintenance Worksheet

DA Form 2408-9, Equipment Control Record

Refer to DA Pam 738-750, The Army Maintenance Management Systems (TAMMS), for instructions on the use of maintenance forms pertaining to this material.

### **OTHER PUBLICATIONS**

The following publications contain information pertinent to the major item material and associated equipment:

#### **Operating Vehicle**

Operator's Manual for SEE/HMMH Wheeled Tractors . . . . .	TM 5-2420-224-10
Driver Selection and Training (Wheeled Vehicles) . . . . .	FM 21-300
Army Motor Transport Units and Operation . . . . .	FM 55-30
Manual for the Wheeled Vehicle Driver . . . . .	FM 21-305
Prevention of Motor Vehicle Accidents . . . . .	AR 385-55
Accident Reporting and Records . . . . .	AR 385-40

**OTHER PUBLICATIONS (CONT)**

Rigging . . . . .	TM 5-725
Vehicle Recovery Operations . . . . .	FM 20-22
<b>Maintenance and Repair</b>	
Unit Maintenance for SEE/HMMH Wheeled Tractors . . . . .	TM 5-2420-224-20
Unit, Direct Support, and General Supped Maintenance Repair Parts and Special Tools List for SEE/HMMH Wheeled Tractors . . . . .	TM5-2420-224-24P
Lubrication Order for SEE/HMMH Wheeled Tractors . . . . .	LO 5-2420-224-12
Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Decontaminating Apparatus, Portable . . . . .	TM 3-4230-214-12&P
Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Lead-Acid Storage Batteries . . . . .	TM 9-6140-200-14
Organizational Care, Maintenance, and Repair of Pneumatic Tires and inner Tubes . . . . .	TM 9-2610-200-24
Description, Use, Bonding Techniques, and Properties of Adhesives . . . . .	TB ORD 1032
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials, including Chemicals . . . . .	TM 9-247
Metal Body Repair and Related Operations . . . . .	FM 43-2
Painting instructions for Field Use . . . . .	TM 43-0139
Inspection, Care, and Maintenance of Anti-Friction Bearings . . . . .	TM 9-214
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems. . . . .	TB 750-651
Rust Proofing Procedures for Truck, Utility . . . . .	TB 43-0213
Cooling Systems: Tactical Vehicles . . . . .	TM 750-254
Functional Grouping Codes . . . . .	TB 750-93-1
Solder and Soldering . . . . .	TB SIG 222
Operator's Manual for Welding Theory and Application . . . . .	TM 9-237
STE/ICE Technical Manual . . . . .	TM 9-4910-571-12&P
Safety inspection and Testing of Lifting Devices . . . . .	TB 43-0142

**OTHER PUBLICATIONS (CONT)**

Operator's Manual for Repair of Seat Cover and Pad . . . . .	FM 10-16
Fuel Tank Repair . . . . .	FM 43-2
<b>Cold Weather Operation and Maintenance</b>	
Basic Cold Weather Manual . . . . .	FM 31-70
Northern Operations . . . . .	FM 31-71
Personnel Heater and Winterization Kit Policy for Tank-Automotive Construction and Material Handling Equipment . . . . .	SB 9-16
Operation and Maintenance of Ordnance Material in Extreme Cold Weather (0°F to -65° F) . . . . .	FM 9-207
<b>Decontamination</b>	
Chemical, Biological, and Radiological (CBR) Decontamination . . . . .	TM 3-220
Chemical, Biological, Radiological, and Nuclear Defense . . . . .	FM 21-40
NBC Decontamination . . . . .	TM 3-5
<b>General</b>	
Artificial Respiration . . . . .	FM 21-11
Principles of Automotive Vehicles . . . . .	TM 9-8000
Camouflage . . . . .	FM 5-20
Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use. . . . .	TM 750-244-6
Administrative Storage of Equipment . . . . .	TM 740-90-1
Color and Marking of Army Material . . . . .	TB 43-0209
Preservation, Packaging, and Packing of Military Supplies and Equipment . . . . .	TM 38-230-1 &TM 38-230-2
Storage Serviceability Standard, Tracked Vehicles, Wheeled Vehicles, and Component Parts . . . . .	SB 740-98-1
Vehicle, Wheeled, Preparation for Shipment and Limited Storage of . . . . .	MIL-V-62038D
Warranty . . . . .	TB 5-2420-224-15
Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic items) . . . . .	CTA 50-970
Army Medical Department Expendable/Durable Items . . . . .	CTA 8-100





## APPENDIX B EXPENDABLE SUPPLIES AND MATERIALS LIST

### Section I. INTRODUCTION

#### SCOPE

This appendix lists expendable consumable maintenance supplies you will need to operate and maintain the SEE/HMMH. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970. Expendable/Durable Items (except Medical, Class V, Repair Parts, and Heraldic Items) or CTA 8-100, ARMY Medical Department Expendable/Durable Items.

#### EXPLANATION OF COLUMNS

Column (1) — Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use sealing compound, Appendix B, Item 14).

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

- C — Operator/Crew
- O — Unit Maintenance
- F — Direct Support Maintenance
- H — General Support Maintenance

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

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 Contractor and Government Entity (CAGE) Code in parentheses followed by the part number.

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 MATERIALS**

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	C	6850-01-246-6544	Additive, Diesel Fuel with Biocide (81349) MIL-S-53021  5 Gal Can	
2	F	8040-01-140-0954	Adhesive, Type 2, Class 3 (81349) MIL-A-46050	
3	O	8040-00-851-0211	Adhesive, Type 1, Black (81349) MIL-A-46106  100 ml Tube	ML
4	O	8040-00-455-5359	Adhesive, Rubber (04963) 8011	
5	O	6810-00-543-7415	Alcohol (81348) OE760  1 Gal Can	GAL
6	C	6850-00-181-7929 6850-00-181-7933 6850-00-181-7930	Antifreeze, Permanent, Glycol, Inhibited (81348) MIL-A-46153  1 Gal Can 5 Gal Can 55 Gal Drum	GAL GAL GAL
7	C		Antifreeze, Permanent, Glycol, Inhibited, Arctic (81349) MIL-A-11755	
8	O	5340-00-324-9158  5340-00-208-1989	Caps and Plugs, Protective, Dust  Caps 0.413 ID, 0.438 OD (96906) MS90376-8Y  0.480 ID, 0.540 OD (96906) MS90376-8R	EA  EA

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
		5340-00-449-4491	Caps (Cont) 0.530 ID, 0.595 OD (96906) MS90736-10Y	EA
		5340-00-211-8188	0.605 ID, 0.665 OD (96909) MS90376-10R	EA
		5340-00-213-8881	0.720 ID, 0.775 OD (96906) MS90376-12R	EA
		5340-00-481-8934	0.785 ID, 0.845 OD (96909) MS90376-14Y	EA
		5340-00-493-5835	0.850 ID, 0.905 OD (96906) MS91376-14R	EA
		5340-00-496-5832	0.893 ID, 0.963 OD (96906) MS90376-16Y	EA
		5340-00-200-5904	0.973 ID, 1.035 OD (96906) MS90376-16R	EA
		5340-00-171-2436	1.078 ID, 1.085 OD (96906) MS90376-18Y	EA
		5340-00-193-0783	1.093 ID, 1.155 OD (96906) MS90376-18R	EA
		5340-00-051-0029	1.150 ID, 1.215 OD (96906) MS90376-20Y	EA
		5340-00-213-8893	1.231 ID, 1.301 OD (96906) MS90376-20R	EA
		5340-00-191-4898	1.390 ID, 1.460 OD (96906) MS90376-24Y	EA
		5340-00-889-8677	1.463 ID, 1.563 OD (96906) MS90376-24R	EA
		5340-00-804-1228	Plugs 0.500-20 THD, 0.483 DIA (81349) M5501/1-5	EA
		5340-00-292-3292	0.5625-18 THD, 0.500 DIA (81349) M5501/1-6	EA

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
		5340-00-828-8802	Plugs (Cont) 0.750-16 THD, 0.675 DIA (81349) M5501/1-8	EA
		5340-00-804-1245	1.3125-12 THD, 1.219 DIA (81349) M5501/1-16	EA
		5340-00-804-1238	0.4375-20 THD, 0.660 DIA (81349) M5501/2-4	EA
		5340-00-804-1243	0.5625-18 THD, 0.800 DIA (81349) M5501/2-6	EA
		5340-00-804-1241	0.750-16 THD, 1.00 DIA (81349) M5501/2-8	EA
		5340-01-138-2169	1.0625-12 THD, 1.28 DIA (81349) M5501/2-12	EA
		5340-00-804-1222	1.3125-12 THD, 1.53 DIA (81349) M5501/2-16	EA
		5340-01-120-9526	1.875-12 THD, 2.33 DIA (81349) M5501/2-24	EA
9	O	7930-00-643-3935	Chips, Soap (81348) P-S-1792	
10	O		Cloth, Emery (81348) P-C-1673	
		5350-00-584-4654	50-Sheet Pack	EA
11	O		Cloth, Lint-Free	
12	O	8030-00-597-5367	Compound, Antiseize (81349) MIL-A-907A	EA
13	O		Compound, Flight Deck, Non-Slip, Type 3 (81349) MIL-D-23003	
14	O		Compound, Sealing, Grade N, Type 2 (81349) MIL-S-46163	
		8030-01-014-5968	50 cc bottle	CC

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
15	F	8030-00-148-9833 8030-01-158-6070	Compound, Sealing Grade K, Type 1 (81349) MIL-S-46163 10 cc Bottle (Box, 10 EA.) 50 cc Bottle	CC CC
16	F	8030-01-137-6964	Compound, Sealing (05972) 515-31 50 ml Tube	ML
17	F	8030-01-166-0675	Compound, Sealing (05972) 567-47 50 ml Tube	ML
18	C	6850-01-160-3868	Extender, Antifreeze (81349) MIL-A-53009	
19	O	9150-01-102-9455 9150-01-123-3152	Fluid, Brake, Silicone (81349) MIL-B-46176 1 Gal CAN 5 Gal CAN	GAL GAL
20	C	6850-00-926-2275	Fluid, Windshield Washing (81348) O-C-1901 1 Gal Bottle	GAL
21	C	9140-00-286-5286 9140-00-286-5287 9140-00-286-5288 9140-00-286-5289	Fuel, Diesel, Winter (81348) VV-F-800 Bulk 5 Gal Can 55 Gal Drum, 16 GAGE 55 Gal Drum, 18 GAGE	GAL GAL GAL GAL
22	C	9140-00-286-5294 9140-00-286-5295 9140-00-286-5296 9140-00-286-5297	Fuel, Diesel, Regular (81348) VV-F-800 Bulk 5 Gal Can 55 Gal Drum, 16 GAGE 55 Gal Drum, 18 GAGE	GAL GAL GAL GAL

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
23	C	9150-01-197-7788 9150-01-197-7693 9150-01-197-7690 9150-01-197-7652 9150-01-197-7692 9150-01-197-7691	Grease, Automotive and Artillery (GAA) (81349) MIL-G-10924  2.5 Oz Tube 14 Oz Cartridge 1 Lb Can 5 Lb Can 35 Lb Can 120 Lb Drum	   OZ OZ LB LB LB LB
24	F	9150-00-935-4018 9150-00-965-2003	Grease, Molybdenum Disulfide (81349) MIL-G-21164  14 Oz Tube 35 Lb Can	  OZ LB
25	F	6850-00-664-4959	Grease, Silicone (81349) MIL-C-21567	
26	F	6685-00-269-4892	Indicator, Temperature (82682) Tempilstik	EA
27	C	6850-00-753-4967 6850-00-584-2707 6850-01-076-8810	Inhibitor, Corrosion, Cooling System (81348) 0-1-490  6 Oz Can 8.5 Oz Can 12 Oz Can	   OZ OZ OZ
28	O	9150-00-948-6912 9150-00-948-7025	Lubricant, Solid (81349) MIL-L-46010	
29	F	6830-00-764-8964	Nitrogen, Technical BB-N-411  380 Cu Ft	EA
30	C	9150-20-189-6727 9150-00-186-6668 9150-00-191-2772	Oil, Lubricating, OE/HDO 10 (81349) MIL-L-2104  1 Qt Can 5 Gal Can 55 Gal Drum, 18 GAGE	   QT GAL GAL

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
31	C	9150-00-265-9433 9150-00-265-9435 9150-00-265-9436 9150-00-265-9437	Oil, Lubricating, OE/HDO 30 (81 349) MIL-L-2104  1 Qt Can 5 Gal Can 55 Gal Drum, 16 GAGE 55 Gal Drum, 18 GAGE	QT GAL GAL GAL
32	C	9150-00-265-9864 9150-00-265-9865 9150-00-265-9866	Oil, Lubricating, OE/HDO 50 (81 349) MIL-L-2104  1 Qt Can 5 Gal Can 55 Gal Drum, 16 GAGE	QT GAL GAL
33	C	9150-01-152-4117 9150-01-152-4118 9150-01-152-4119	Oil, Lubricating, OE/HDO 15/40 (81349) MIL-L-2104  1 Qt Can 5 Gal Can 55 Gal Drum	QT GAL GAL
34	C	9150-00-035-5390 9150-00-035-5391 9150-00-035-5392	Oil, Lubricating, GO 75 (81 349) MIL-L-2105  1 Qt Can 5 Gal Can 55 Gal Drum	QT GAL GAL
35	C	9150-01-035-5392 9150-01-035-5393 9150-01-035-5394	Oil, Lubricating, GO 80/90 (81349) MIL-L-2105  1 Qt Can 5 Gal Can 55 Gal Drum	QT GAL GAL
36	C	9150-01-048-4581 9150-01-035-5345 9150-01-035-5396	Oil, Lubricating, GO 85/140 (81349) MIL-L-2105  1 Qt Can 5 Gal Can 55 Gal Drum	QT GAL GAL



(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
37	O	9150-00-261-7904 9150-00-257-5440 9150-00-257-5443	Oil, Lubricating, Gear, Subzero, GOS (81349) MIL-L-10324  1 Qt Can 5 Gal Can 55 Gal Drum	QT GAL GAL
38	O	9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	Oil, Lubricating, ICE, Subzero (OEA) (81349) MIL-L-46167  1 Qt Can 5 Gal Can 55 Gal Drum, 16 GAGE	QT GAL GAL
39	O		Preventive, Corrosion (81349) MIL-C-16173	
40	O	7920-00-205-1711	Rags (81348) DDD-R-30  Bundle	BDL
41	O	6810-00-264-6618	Sodium Bicarbonate (Technical) (Baking Soda) (81348) O-5-576  1 Lb Container	LB
42	C	6850-00-664-5685 6850-00-281-1985 6850-00-285-8011	Solvent, Drycleaning (SD), Type II (81348) P-D-680  1 Qt Can 1 Gal Can 55 Gal Drum	QT GAL GAL
43	O	5975-00-984-6582	Strap, Tiedown, Electrical (81349) MIL-S-23190	EA
44	O	5975-00-074-2072	Strap, Tiedown, Electrical (96906) MS3367-1-9  Bundle	BDL

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
45	O	5975-00-451-5001	Strap, Tiedown, Electrical (96906) MS3367-3-9  Bundle	BDL
46	O	9905-00-537-8954	Tag, Identification (81349) MIL-T-12755  Bundle of 50	EA
47	O	5970-00-543-1154	Tape, Insulation, Electrical (81349) MIL-L-15126  Roll	RL
48	O		Towel, Shop (58536) A-A-531	
49	F		Twine, Cotton, 1/8-in. Diameter	
50	O	6610-00-682-6867 8810-00-356-4936	Water, Distilled (96906) MI L-STD-1444  1 Gal 5 Gal	GAL GAL
51	O	9505-00-191-3680	Wire, Nonelectrical	



## APPENDIX C ILLUSTRATED LIST OF MANUFACTURED ITEMS

### INTRODUCTION

This appendix includes complete instructions for making items authorized to be manufactured at unit maintenance.

A Part No. Index in numeric order is provided for cross-referencing the part number of the item to be manufactured to the table which covers fabrication criteria.

All bulk materials needed for manufacture of an item are listed by part number or specification number.

PART NO.	NAME	TABLE NO.
008 977 54 82X270	HOSE	C-1
48-02223-169X9.5	WIRE	C-1
68236R-2240	CONDUIT	C-1
68238R-1220	CONDUIT	C-1
68240R-400	CONDUIT	C-1
008 997 60 82X240	HOSE	C-1
008 997 60 82X290	HOSE	C-1
008 997 60 82X360	HOSE	C-1
008 997 60 82X250	HOSE	C-1
008 997 60 82X460	HOSE	C-1
000 429 23 01X1300	LINE	C-1
48-02461-012X0.13	INSULATION	C-1
48-02217-025X10.53	CONDUIT	C-1
48-02461-025X0.131	INSULATION	C-1
48-02223-160X32.4	WIRE	C-1
68237R-1850	CONDUIT	C-1
68238R-1340	CONDUIT	C-1
68240R-1920	CONDUIT	C-1
419 546 70 31X12.5	CONDUIT	C-1
419 546 71 31X26.2	CONDUIT	C-1
48-00102-003X18.49	LOOM	C-1
48-00102-005X20.49	LOOM	C-1
48-00102-007X11.48	LOOM	C-1
48-00102-013X1.48	LOOM	C-1
48-02461-012X1.64	TUBE	C-1
48-02461-050X0.49	TUBE	C-1
48-02461-100X0.49	TUBE	C-1
48-00102-004X8.5	LOOM	C-1
48-00102-004X6.0	LOOM	C-1
48-02223-160X9.5	WIRE	C-1

Table C-1. Manufactured Items

PART NO.	NAME	MFG FROM	DESCRIPTION
008 977 54 82x270	HOSE	008 997 54 82	207 MM LONG
48-02223-169X9.5	WIRE	48-02223-169	9.5 FT LONG
68236R-2240	CONDUIT	68236R	2240 MM LONG
68238R-1220	CONDUIT	68238R	1220 MM LONG
68240R-400	CONDUIT	68240R	400 MM LONG
008 997 60 82X240	HOSE	008 997 60 82	240 MM LONG
008 997 60 82X290	HOSE	008 997 60 82	290 MM LONG
008 997 60 82X360	HOSE	008 997 60 82	360 MM LONG
008 997 60 82X250	HOSE	008 997 60 82	250 MM LONG
008 997 60 82X460	HOSE	008 997 60 82	460 MM LONG
000 429 23 01X1300	LINE	000 429 23 01	1300 MM LONG
48-02461-012X0.13	INSULATION	48-02461-012	0.13 FT LONG
48-02217-025X10.53	CONDUIT	48-02217-025	10.53 FT LONG
48-02461-025X0.131	INSULATION	M23053/4-130-0	0.131 FT LONG
48-02223-160X32.4	WIRE	48-02223-160	32.4 FT LONG
68237R-1850	CONDUIT	68237R	1850 MM LONG
68238R-1340	CONDUIT	68238R	1340 MM LONG
68240R-1920	CONDUIT	68240R	1920 MM LONG
419 546 70 31X12.5	CONDUIT	92171	12.5 FT LONG
419 546 71 31X26.2	CONDUIT	92171	26.2 FT LONG
48-00102-003X18.49	LOOM	48-00102-003	18.49 FT LONG
48-00102-005X20.49	LOOM	48-00102-005	20.49 FT LONG
48-00102-007X11.48	LOOM	48-00102-007	11.48 FT LONG
48-00102-013X1.48	LOOM	48-00102-013	1.48 FT LONG
48-02461-012X1.64	TUBE	M23053/4-101-0	1.64 FT LONG
48-02461-050X0.49	TUBE	TAT-125 1/2 IN	0.49 FT LONG
48-02461-100X0.49	TUBE	TAT-125-1	0.49 FT LONG
48-00102-004X8.5	LOOM	48-00102-004	8.5 FT LONG
48-00102-004X6.0	LOOM	48-00102-004	6.0 FT LONG
48-02223-160X9.5	WIRE	48-02223-160	9.5 FT LONG

Table C-1. Manufactured Items

PART NUMBER	NAME	MFG FROM	DESCRIPTION
000 429 07 01X580	LINE	000 429 07 01	580 mm LONG
000 429 23 01X170	LINE	000 429 23 01	170 mm LONG
000 429 23 01X250	LINE	000 429 23 01	250 mm LONG
000 429 23 01X300	LINE	000 429 23 01	300 mm LONG
000 429 23 01X350	LINE	000 429 23 01	350 mm LONG
000 429 23 01X450	HOSE	000 429 23 01	450 mm LONG
000 429 23 01X520	HOSE	000 429 23 01	520 mm LONG
000 429 23 01X850	LINE	000 429 23 01	850 mm LONG
000 429 23 01X1250	LINE	000 429 23 01	1250 mm LONG
000 429 23 01X1300	LINE	000 429 23 01	1300 mm LONG
000 429 23 01X1311	TUBE, METALLIC	000 429 23 01	1311 mm LONG
000 429 62 01X0.7	HOSE, NONMETALLIC	000 429 62 01	0.7 mm LONG
000 429 62 01X460	LINE, HYDRAULIC	000 429 62 01	460 mm LONG
000 429 62 01X580	HOSE, NONMETALLIC	000 429 62 01	580 mm LONG
000 429 62 01X700	HOSE, NONMETALLIC	000 429 62 01	700 mm LONG
000 435 20 82X60	HOSE, NONMETALLIC	000 435 20 82	60 mm LONG
000 551 40 56X430	TUBING, NONMETALLIC	000 551 40 56	430 mm LONG
000 551 62 56X2000	TUBE	000 551 62 56	2000 mm LONG
000 985 45 30X94	SEAL, NONMETALLIC	000 985 45 30	94 mm RIGHT
000 985 45 30X530	SEAL, NONMETALLIC	000 985 45 30	530 mm LEFT
001 987 06 52X512	SEAL, RUBBER CHANNEL	001 987 06 52	512 mm LONG
000 987 07 72X220	GUARD, EDGE SECTION	000 987 07 72	220 mm LONG
001 987 22 72X320	GUARD, EDGE	001 987 22 72	320 mm LONG
001 987 36 25	CHANNEL, NONMETALLIC	001 987 36 25	
001 987 42 57X365	SEAL, RUBBER STRIP	001 987 42 57	365 mm LONG
001 989 95 85X440	TAPE, RUBBER ADHESIVE	001 989 95 85	440 mm LONG
008 997 54 82X207	HOSE	008 997 54 82	207 mm LONG
008 997 54 82X522	HOSE	008 997 54 82	522 mm LONG

Table C-1. Manufactured Items (Cont)

PART NUMBER	NAME	MFG FROM	DESCRIPTION
008 997 60 82X24	HOSE	008 997 60 82	24 mm LONG
008 997 60 82X25	HOSE	008 997 60 82	25 mm LONG
008 997 60 82X29	HOSE	008 997 60 82	29 mm LONG
008 997 60 82X36	HOSE	008 997 60 82	36 mm LONG
008 997 60 82X46	HOSE	008 997 60 82	46 mm LONG
008 997 60 82X190	HOSE	008 997 60 82	190 mm LONG
008 997 60 82X310	HOSE	008 997 60 82	310 mm LONG
008 997 60 82X490	HOSE	008 997 60 82	490 mm LONG
008 997 60 82X500	HOSE	008 997 60 82	500 mm LONG
008 997 60 82X890	HOSE	008 997 60 82	890 mm LONG
008 997 60 82X940	HOSE	008 997 60 82	940 mm LONG
008 997 60 82X1480	HOSE	008 997 60 82	1480 mm LONG
008 997 60 82X1524	HOSE	008 997 60 82	1524 mm LONG
008 997 60 82X2500	HOSE	008 997 60 82	2500 mm LONG
008 997 90 82X700	HOSE, NONMETALLIC	008 997 90 82	700 mm LONG
009 997 93 82X262	HOSE	009 997 93 82	262 mm LONG
376 987 01 27X500	PIPE, NONMETALLIC	376 987 01 27	500 mm LONG
376 987 01 27X860	TUBE, NONMETALLIC	376 987 01 27	860 mm LONG
376 987 01 27X920	TUBE, NONMETALLIC	376 987 01 27	920 mm LONG
376 987 01 27X960	TUBE, NONMETALLIC	376 987 01 27	960 mm LONG
376 987 74 27	PIPE, PLASTIC	376 987 74 27	
376 987 74 27X350	LINE	376 987 74 27	350 mm LONG
419 546 70 31X12.5	CONDUIT, SHIELDED	419 546 70 31	12.5 FT LONG
419 546 71 31X26.2	CONDUIT, SHIELDED	419 546 71 31	26.2 FT LONG
442 967 11 43X500 MM	SLEEVE, RUBBER	442 987 11 43	500 mm LONG
47-02188-001X1960	MOLDING, PLASTIC	47-02188-001	1960 mm LONG
47-02188-001X3250	MOLDING, PLASTIC	47-02188-001	3250 mm LONG
48-00100-010X1300	TUBE, NONMETALLIC	48-00100-010	1300 mm LONG

Table C-1. Manufactured Items (Cont)

PART NUMBER	NAME	MFG FROM	DESCRIPTION
48-00100-010X1700	TUBING, NONMETALLIC	48-00100-010	1700 mm LONG
48-00101-020X1725	HOSE, NONMETALLIC	48-00101-020	1725 mm LONG
48-00102-003X18.49	LOOM, NONMETALLIC	48-00102-003	18.49 FT LONG
48-00102-004X6.0	LOOM, NONMETALLIC	48-00102-004	6.0 FT LONG
48-00102-004X8.5	LOOM, NONMETALLIC	48-00102-004	8.5 FT LONG
48-00102-005X20.49	LOOM, NONMETALLIC	48-00102-005	20.49 FT LONG
48-00102-007X11.48	LOOM, NON METALLIC	48-00102-007	11.48 FT LONG
48-00102-013X1.48	LOOM, NON METALLIC	48-00102-013	1.48 FT LONG
48-02223-160X9.5	LOOM, NONMETALLIC	48-02223-160	9.5 FT LONG
46-02223-169X9.5	LOOM, NONMETALLIC	48-02223-169	9.5 FT LONG
48-02461-012X0.13	INSULATION, SLEEVING	48-02461-012	0.13 FT LONG
48-02461-012X1.64	TUBE	48-02461-012	1.64 FT LONG
48-02461-050X0.49	TUBE	48-02461-050	0.49 FT LONG
48-02461-100X0.49	TUBE	48-02461-100	0.49 FT LONG



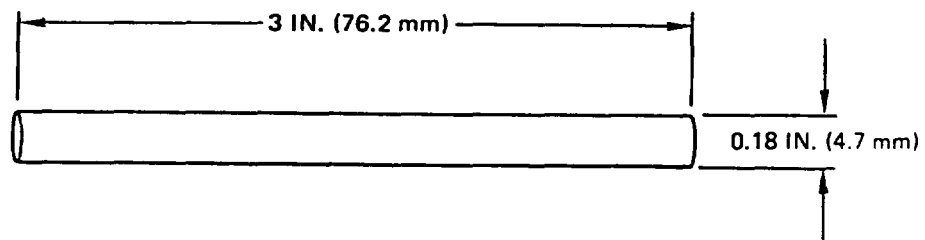
FABRICATED TOOLS

ITEM 1

MATERIALS:

WOOD DOWEL (4)

3 IN. (76.2 mm) X 0.18 IN. (4.7 mm)



NOTE:

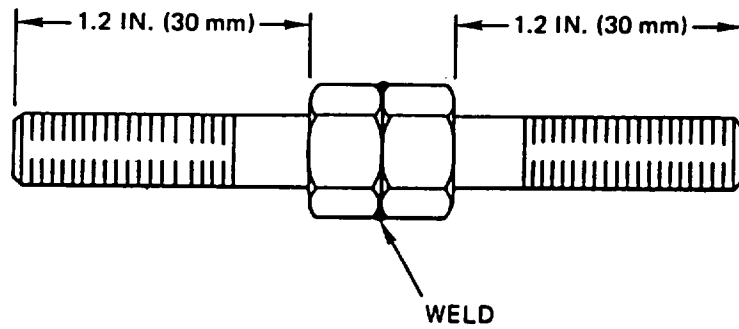
CUT 0.18-IN. (4.7-mm) DOWEL TO 3-IN. (76.2-mm) LENGTH.

FABRICATED TOOLS (CONT)

ITEM 2

MATERIALS:

BOLT, HEXAGON (2)  
M10X1,5 8.8 GR



NOTE:  
WELD TWO BOLTS TOGETHER PER TM 9-237.

FABRICATED TOOLS (CONT)

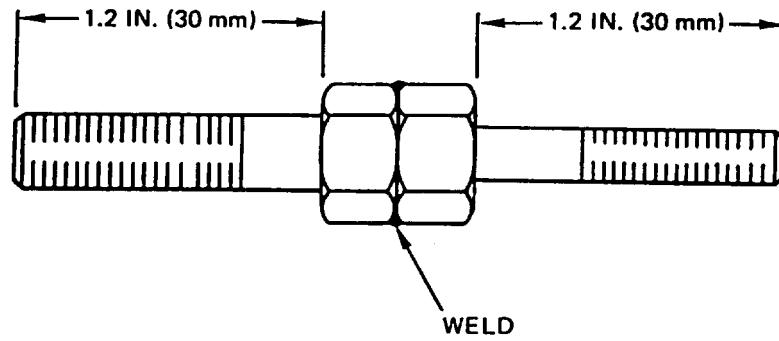
ITEM 3

MATERIALS:

BOLT, HEXAGON

M12X1,5 8.8 GR (1)

M14X1,5 8.8 GR (1)



NOTE :

WELD TWO BOLTS TOGETHER PER TM 9-237.

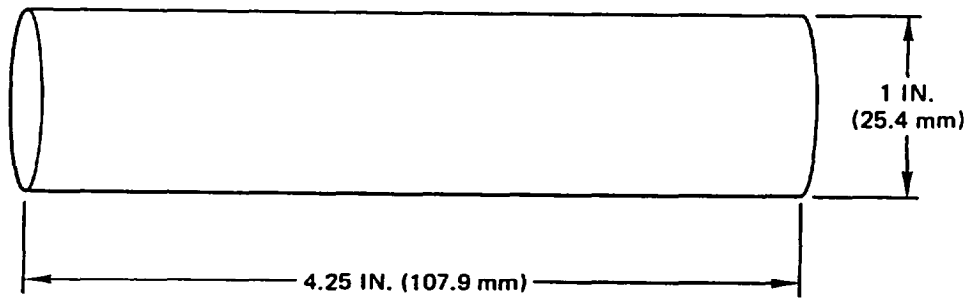
FABRICATED TOOLS (CONT)

ITEM 4

MATERIALS:

WOOD DOWEL

4.25 IN. (107.9 mm) X 1 IN. (25.4 mm)



NOTE:

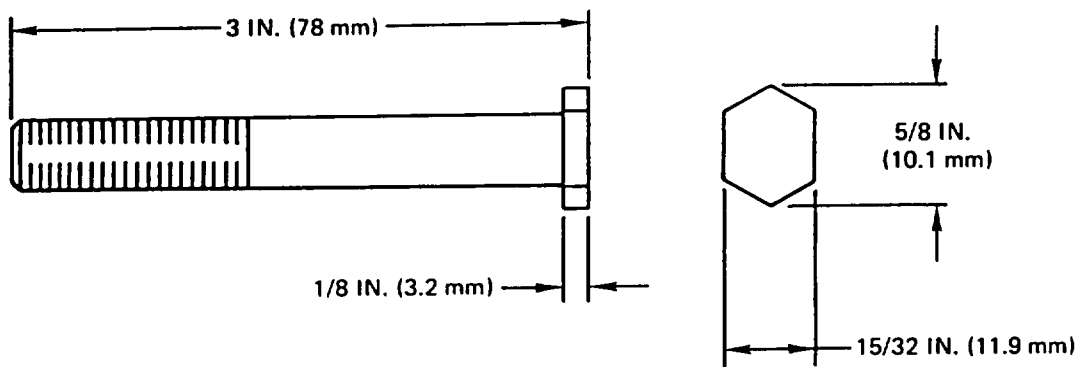
CUT 1-IN. (25.4-mm) DOWEL TO 4.25-IN. (107.9-mm) LENGTH.

FABRICATED TOOLS (CONT)

ITEM 5

MATERIALS:

BOLT, HEXAGON  
3/8-16 X 3 NC



NOTE:

1. GRIND TWO SIDES OF HEAD EVENLY TO 15/32 IN. (11.9 mm).
2. GRIND HEAD TO 1/8 IN. (3.2 mm).

## APPENDIX D TORQUE LIMITS

Use the torque values listed in the maintenance procedures, if they are given. When no torque values are given in the maintenance procedures, use the following guides.

**Table D-1. Torque Value Guide (Pound-Feet)**

Screw Diameter	Torque Lb-Ft No Dashes (SAE Grade 2)	Torque Lb-Ft 3 Dashes (SAE Grade 5)	Torque Lb-Ft 6 Dashes (SAE Grade 8)	Socket Size
1/4-20 UNC	3-5	6-8	10-12	7/16
1/4-28 UNF	4-6	8-10	9-14	7/16
4/16-18 UNC	7-11	13-17	19-24	1/2
5/16-24 UNF	7-11	14-19	23-28	1/2
3/8-16 UNC	14-18	26-31	39-44	9/16
3/8-24 UNF	15-19	30-35	46-51	9/16
7/16-14 UNC	23-28	44-49	65-70	5/8
7/16-20 UNF	23-28	44-54	69-79	5/8
1/2-13 UNC	32-37	65-75	95-105	3/4
1/2-20 UNF	34-41	73-83	113-123	3/4
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1-8 UNC	251-261	580-590	900-910	1-1/2
1-14 UNF	255-265	585-634	943-993	1-1/2
1-1/4-7 UNC	441-461	1070-1120	1767-1817	1-7/8
1-1/4-12 UNF	488-498	1211-1261	1963-2013	1-7/8
1-1/2-6 UNC	727-737	1899-1949	3111-3161	2-1/4
1-1/2-12 UNF	816-826	2144-2194	3506-3556	2-1/4

Table D-2. Torque Value Guide (Newton-Meters)

Screw Diameter	Torque N.m No Dashes (SAE Grade 2)	Torque N.m 3 Dashes (SAE Grade 5)	Torque N.m 6 Dashes (SAE Grade 8)	Socket Size
1/4-20 UNC	4-7	8-11	14-16	7/16
1/4-28 UNF	5-8	11-14	12-19	7/16
5/16-18 UNC	9-15	18-23	26-33	1/2
5/16-24 UNF	9-15	19-26	31-38	1/2
3/8-16 UNC	19-24	35-42	53-60	9/16
3/8-24 UNF	20-26	41-47	62-69	9/16
7/16-14 UNC	31-38	60-66	88-95	5/8
7/16-20 UNF	31-38	60-73	94-107	5/8
1/2-13 UNC	43-50	88-102	129-142	3/4
1/2-20 UNF	46-56	99-113	153-167	3/4
9/16-12 UNC	62-76	136-149	197-210	13/16
9/16-18 UNF	64-77	145-159	224-237	13/16
5/8-11 UNC	84-98	190-203	271-285	15/16
5/8-18 UNF	91-104	207-221	319-332	15/16
3/4-10 UNC	144-157	353-366	495-508	1-1/4
3/4-16 UNF	156-169	363-377	565-579	1-1/4
7/8-9 UNC	224-237	522-536	807-820	1-5/16
7/8-14 UNF	241-255	575-588	899-912	1-5/16
1-8 UNC	340-354	786-800	1220-1234	1-1/2
1-14 UNF	346-359	793-860	1279-1346	1-1/2
1-1/4-7 UNC	611-625	1451-1518	2396-2463	1-7/8
1-1/4-12 UNF	662-675	1642-1710	2661-2729	1-7/8
1-1/2-6 UNC	986-999	2575-2642	4218-4286	2-1/4
1-1/2-12 UNF	1106-1120	2907-2975	4753-4821	2-1/4

**Table D-3. Torque Value Guide (Pound-Feet)**

<b>Screw Diameter</b>	<b>Torque Lb-Ft * Class 8.8</b>	<b>Torque Lb-Ft * Class 10.9</b>	<b>Socket Size</b>
M6-1	3	4	10 mm
M8-1.25	8	8	13 mm
M10-1.5	30	40	16 mm
M12-1.75	55	75	18 mm
M14-2	85	115	21 mm
M16-2	130	180	24 mm
M20-2.5	250	350	30 mm
M24-3	435	615	36 mm
M30-3.5	900	1250	46 mm

**Table D-4. Torque Value Guide (Newton-Meters)**

<b>Screw Diameter</b>	<b>Torque N.m * Class 8.8</b>	<b>Torque N.m * Class 10.9</b>	<b>Socket Size</b>
M6-1	8	11	10 mm
M8-1.25	20	28	13 mm
M10-1.5	41	54	16 mm
M12-1.75	75	102	18 mm
M14-2	115	156	21 mm
M16-2	176	244	24 mm
M20-2.5	339	475	30 mm
M24-3	590	834	36 mm
M30-3.5	1220	1695	46 mm

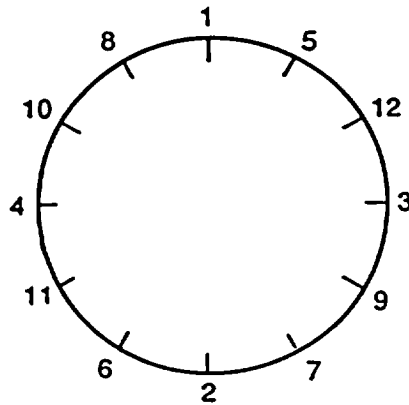
\* Grade class is stamped on bolt head.



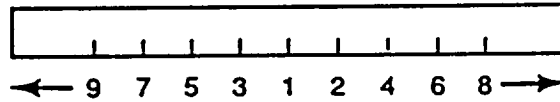
## TORQUE SEQUENCE

If the maintenance procedures do not specify a tightening order, use the following guides:

- Unless otherwise specified, lubricate threads of fasteners with oil (OE/HDO-10 or OEA).
- When tightening fasteners above 30 lb-ft (41 N.m), use the torque pattern but only tighten to 70 percent of final value (multiply final value by 0.7); then repeat the pattern until final value is reached.
- Tighten circular patterns using the circular torque pattern, and straight patterns using the straight torque pattern.



CIRCULAR TORQUE PATTERN



STRAIGHT TORQUE PATTERN

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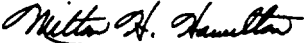
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By Order of the Secretary of the Army:

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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To be distributed in accordance with DA Form 12-38-E (Block 0974) requirements for TM5-2420-224-34.

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<b>RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS</b>						Use Part II ( <i>reverse</i> ) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE Date you filled out this form.
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TO: ( <i>Forward to proponent of publication or form</i> ) ( <i>Include ZIP Code</i> ) AMSTA-LC-CI/TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630						FROM: ( <i>Activity and location</i> ) ( <i>Include ZIP Code</i> )  Your mailing address	
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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON ( <i>Provide exact wording of recommended changes, if possible.</i> )	
	7-4	3				FOUR SPACERS ARE REQUIRED. CHANGE TEXT AND ILLUSTRATIONS.	
							
<i>*Reference to line numbers within the paragraph or subparagraph.</i>							
TYPED NAME, GRADE OR TITLE  Your Name				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE  Your Signature	

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## THE METRIC SYSTEM AND EQUIVALENTS

### LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches  
 1 Meter = 100 Centimeters = 1,000 Millimeters = 39.37 Inches  
 1 Kilometer = 1,000 Meters = 0.621 Miles

### WEIGHTS

1 Gram = 0.001 Kilograms = 1,000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1,000 Grams = 2.2 Lb  
 1 Metric Ton = 1,000 Kilograms = 1 Megagram = 1.1 Short Tons

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1,000 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 = 1,000 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  
 $9/5 \text{ C} + 32 = \text{F}$

## 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
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds Per Square Inch	Kilopascals	6.895
Miles Per Gallon	Kilometers Per Liter	0.425
Miles Per Hour	Kilometers Per Hour	1.609
TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds Per Square Inch	0.145
Kilometers Per Liter	Miles Per Gallon	2.354
Kilometers Per Hour	Miles Per Hour	0.621

