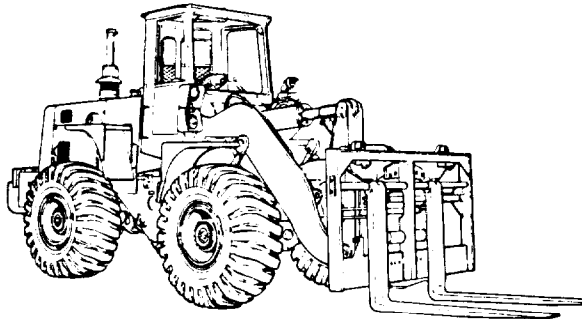
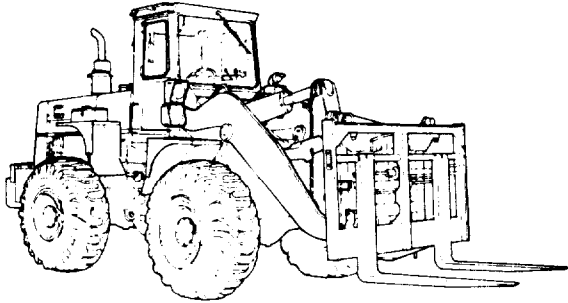


**DIRECT SUPPORT AND GENERAL  
SUPPORT MAINTENANCE**



S/N 2000 AND BELOW



S/N 2001 AND ABOVE

**TRUCK, FORKLIFT, DED  
PNEUMATIC TIRE,  
10,000 LB. CAPACITY  
ROUGH TERRAIN,  
ARTICULATED FRAME STEER  
(DRESSER INDUSTRIES  
MODEL M10A, MHE 236)  
(NSN 3930-01-054-3833)**

<b>CHAPTER 1</b>	
Introduction .....	Page 1-1
<b>Chapter 2.....</b>	<b>Page 1-1</b>
General Maintenance Procedures .....	Page 2-1
<b>DIRECT SUPPORT MAINTENANCE</b>	
<b>CHAPTER 3</b>	
Troubleshooting Symptom Index .....	Page 3-1
<b>CHAPTER 4</b>	
Troubleshooting .....	Page 4-1
<b>CHAPTER 5</b>	
Electrical System Maintenance .....	Page 5-1
<b>CHAPTER 6</b>	
Transmission Troubleshooting and Maintenance.....	Page 6-1
<b>CHAPTER 7</b>	
Axle Troubleshooting and Maintenance.....	Page 7-1
<b>CHAPTER 8</b>	
Brake Troubleshooting and Maint- enance.....	Page 8-1
<b>CHAPTER 9</b>	
Steering Troubleshooting and Maintenance.....	Page 9-1
<b>CHAPTER 10</b>	
Frame and Towing Attachment Maintenance.....	Page 10-1
<b>CHAPTER 11</b>	
Body, Chassis and Hull Accessory Items Maintenance.....	Page 11-1
<b>CHAPTER 12</b>	
Hydraulic System Troubleshooting and Maintenance.....	Page 12-1
<b>GENERAL SUPPORT MAINTENANCE</b>	
<b>CHAPTER 13</b>	
Engine, Fuel, Exhaust and Cooling Maintenance.....	Page 13-1
<b>CHAPTER 14</b>	
Electrical System Maintenance .....	Page 14-1
<b>CHAPTER 15</b>	
Transmission Maintenance .....	Page 15-1
<b>CHAPTER 16</b>	
Propeller and Propeller Shaft Maintenance.....	Page 16-1
<b>CHAPTER 17</b>	
Brake Maintenance.....	Page 17-1
<b>APPENDICES A, C, D, E</b>	
<b>GLOSSARY</b>	
<b>ALPHABETICAL INDEX.....</b>	<b>Index-1</b>

\*This TM supersedes the Direct and General Support Maintenance portion of TM 10-3930-643-14&P, dated 30 November 1981, and the Direct and General Support Maintenance portions of all changes.

APPROVED FOR PUBLIC RELEASE, DISTRIBUTION IS UNLIMITED.



**WARNING**

Diesel fuel used in this equipment is highly flammable. Make sure open flames or sparks cannot ignite diesel fuel when working on or near the vehicle. Do not smoke when working on the fuel system. Failure to follow this procedure could result in SEVERE INJURY or DEATH. If injured, obtain medical aid immediately.

**WARNING**

## OIL UNDER 2500 PSI PRESSURE

High pressure hydraulics operate this equipment. NEVER disconnect any hydraulic lines or fittings without checking manual to see how to drop the pressure to zero. Failure to follow this procedure could cause SEVERE INJURY. If you are struck by a high pressure oil stream, seek medical aid immediately.

**WARNING**

## ELECTRICAL SHOCK HAZARD

Always disconnect the battery ground cable before working on electrical components of this equipment.

DEATH

or SEVERE INJURY may result if you fail to observe this procedure. If you receive an electrical shock, seek medical aid immediately.

**WARNING**

## FALLING EQUIPMENT HAZARD

Never crawl under equipment when performing maintenance unless equipment is securely blocked. Keep clear of equipment when it is being raised or lowered. Do not allow heavy components to swing while suspended by lifting device. Exercise extreme caution when working near a cable or chain under tension.

**WARNING**

TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes and clothes. Do not breathe vapors. Do not use near open flame or excessive heat. Do not smoke when using it. Failure to do so could cause SEVERE INJURY. If you become dizzy while using cleaning solvent, get fresh air immediately, if necessary, seek medical attention. If contact with skin or clothes is made, flush thoroughly with water. If the solvent contacts your eyes, wash eyes with water immediately, and obtain medical aid.

**WARNING**

EXHAUST GASES CAN BE DEADLY

Exhaust gases can produce symptoms of headache, dizziness, loss of muscular control or coma. Permanent brain damage or DEATH can result from severe exposure. You can insure your safety by following these rules:

- . Do not operate the engine in an enclosed area unless properly ventilated.
- . Do not drive with any inspection plates, cover plates or hoods off unless for maintenance.
- . If you notice exhaust odors or exposure symptoms, IMMEDIATELY VENTILATE the area. If symptoms persist, remove and treat the affected personnel:
  - . Expose them to fresh air.
  - . If necessary, give artificial respiration.
  - . Keep them warm.
  - . Do not permit physical exercise.

Refer to FM 21-11, First Aid for Soldiers, for first aid treatment of injured personnel.

**WARNING**

SEAT BELT

Be sure your seat belt is fastened before operating the vehicle. Avoid sudden stops and operate at a safe speed.



**WARNING**

## NOISE HAZARD

Excessive noise levels are present any time the equipment is operating. Wear hearing protection while operating or working around equipment while it is running. Failure to do so could result in damage to your hearing. Seek medical aid should you suspect a hearing problem.

**WARNING**

## STEAM UNDER PRESSURE

Remove radiator cap slowly to relieve pressure before completely removing it when the engine is hot. Failure to follow this procedure could cause SEVERE INJURY. If you are scalded by steam, seek medical aid immediately.

**WARNING**

## OIL UNDER PRESSURE

Keep hands and feet clear of steering cylinder assemblies while checking for hydraulic leakage when engine is running. SEVERE INJURY may result if you fail to follow this procedure.

**WARNING**

## OIL UNDER PRESSURE

When bleeding air from hydraulic cylinder assemblies, do not look directly at bleed fitting. Hydraulic oil is under high pressure. SEVERE INJURY may result if you fail to follow this procedure.

**WARNING**

## FUEL UNDER PRESSURE

When testing fuel injectors, always direct fuel injector tip away from you. Fuel from orifices can penetrate clothing and skin. This can cause SERIOUS INFECTION. Be sure fuel injector tip is enclosed in a receptacle to contain the spray. If skin is broken by fuel injector spray, seek medical aid.

**WARNING**

BURN HAZARD

Batteries contain sulfuric acid which can cause severe burns. Avoid contact with skin, eyes or clothing. Wear safety goggles and gloves. If battery electrolyte is spilled, take immediate action to stop its burning effects:

- . EXTERNAL: Flush with cold water to remove all acid.
- . EYES: Flush with cold water for 15 minutes. Get medical attention at once.
- . INTERNAL: Drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Get medical attention at once.
- . CLOTHING OR VEHICLE: Wash at once with cold water. Neutralize with baking soda or household ammonia solution.

**WARNING**

HIGH VELOCITY AIR

Compressed air, used for cleaning purposes, must not exceed 30 psi. Safety glasses must be used when cleaning parts with compressed air. Failure to protect your eyes could cause SEVERE INJURY and possible blindness. If you injure your eyes or if a foreign object is blown into your eyes, seek medical attention immediately.

**WARNING**

TOXIC/FLAMMABLE

Starting fluid is toxic and highly flammable. Container is pressurized to act as an expellent. Do not heat container and do not discharge starting fluid in confined areas or near an open flame. SEVERE INJURY may result if you fail to follow this procedure.

**WARNING**

BURN HAZARD

Allow engine to cool off before you perform maintenance on the muffler, exhaust pipe, exhaust manifold or turbocharger. If necessary, use insulated pads and gloves. If you are burned, seek medical aid immediately.

**WARNING**

Hot coolant and alkali conditioner can burn severely. Cooling system conditioner contains alkali. Contact with skin or eyes could result in SEVERE INJURY and/or skin rash. If alkali is splashed on skin or clothes, flush with large amounts of water and seek medical attention. Hot coolant and a hot radiator can cause severe burns. Even when the system is drained, some coolant remains in the lines and fittings.

1. Wear protective goggles and clothing when handling cooling system components.
2. Remove the radiator fill cap slowly to release pressure. Release all pressure before removing cap.
3. Drain engine coolant only when the engine is stopped and the radiator and fill cap are cool enough to touch.

**WARNING**

## JACKING VEHICLE

Make sure that vehicle will not roll or shift. Secure with wood blocks. DEATH or SEVERE INJURY may result by your failure to follow this procedure due to vehicle turning and slipping off jack or jack stands.

**WARNING**

## FLAMMABLE

Battery gases can explode. Do not smoke, have open flames or make sparks around a battery, especially if the caps are off. SEVERE INJURY may result if you fail to follow this procedure.

**WARNING**

## PARTS UNDER SPRING TENSION

Exercise care when removing parts under spring tension. SEVERE INJURY may result by the part striking your eye if you do not observe this caution. If your eye is struck by a foreign object, seek medical help immediately.

**WARNING**

Do not let fuel spill or leak onto hot surfaces or electrical parts. Failure to follow this procedure may cause fire and injury. If you are injured or burned, get medical help.

**WARNING**

Wear gloves and safety goggles when loosening fuel line nut. Fuel under pressure can penetrate eyes and skin. If injured, seek medical aid immediately.

TECHNICAL MANUAL

HEADQUARTERS  
 DEPARTMENT OF THE ARMY  
 Washington D.C., 30 January 1990

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

TRUCK, FORKLIFT, DED  
 PNEUMATIC TIRE, 10,000 LB. CAPACITY  
 ROUGH TERRAIN, ARTICULATED FRAME STEER  
 (DRESSER INDUSTRIES MODEL M10A, MHE 236)  
 (NSN 3930-01-054-3833)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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

TABLE OF CONTENTS

	<u>Page</u>
HOW TO USE THIS MANUAL	iii
CHAPTER 1 INTRODUCTION	1-1
CHAPTER 2 GENERAL MAINTENANCE PROCEDURES	2-1
CHAPTER 3 TROUBLESHOOTING SYMPTOM INDEX	3-1
CHAPTER 4 ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE	4-1
CHAPTER 5 ELECTRICAL SYSTEM MAINTENANCE	5-1
CHAPTER 6 TRANSMISSION TROUBLESHOOTING AND MAINTENANCE	6-1
CHAPTER 7 FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE	7-1

\*This TM supersedes the Direct and General Support Maintenance portion of TM 10-3930-643-14&pi dated 30 November 1981, and the Direct and General Support Maintenance portions of all changes.

APPROVED FOR PUBLIC RELEASE. DISTRIBUTION IS UNLIMITED.

TABLE OF CONTENTS (cont)

	<u>Page</u>
CHAPTER 8	8-1
CHAPTER 9	9-1
CHAPTER 10	10-1
CHAPTER 11	11-1
CHAPTER 12	12-1
CHAPTER 13	13-1
CHAPTER 14	14-1
CHAPTER 15	15-1
CHAPTER 16	16-1
CHAPTER 17	17-1
APPENDIX A	A-1
APPENDIX B	NOT APPLICABLE TO THIS MANUAL
APPENDIX C	C-1
APPENDIX D	D-1
APPENDIX E	E-1
	INDEX-1

## HOW TO USE THIS MANUAL

This manual is designed to help you maintain the M10A Forklift. It is divided into chapters, sections and appendices. Chapter 1 contains information concerning the vehicle, its characteristics, systems and components. Chapter 2 provides useful general maintenance information. Chapters 3 through 15 contain procedures necessary for troubleshooting, maintenance and general upkeep. The maintenance procedures contained in these chapters tell you several things:

- .....what tools you need to do the job
- .....materials or parts required
- .....what condition the vehicle is to be in before work is started.

The appendices contain supplemental information which assist you in the performance of the maintenance procedures.

In addition to the text, you'll have either an assembled or an exploded view illustration of the associated parts. Sometimes the illustration will be keyed by an arrow to an overall view of the vehicle to help you determine the approximate location of the parts. The illustration is keyed to the text by numbers and shows you how to take the part off and put it on. The following example will show some of the features of this manual.

EXAMPLE

An operator brings his M10A Forklift into the shop with an engine cooling problem: the engine stalls frequently or does not develop full power. The best way to solve his problem is by using your manual. This is what you do:

1. How do you start?

Look at the cover of the manual. On the cover you'll find a listing for TROUBLESHOOTING SYMPTOM INDEX. To find the page fast, open the manual by using the black tab that lines up with the listing on the cover.

2. What kind of problem do you have?

Find it in the symptom index. The symptom index is a list of problems covered by a chapter. It tells you that your problem, "Engine stalls or lacks power" is covered in paragraph 4-1, malfunction entry D.

3. How do you determine what is causing the problem?

Go to paragraph 4-1, malfunction entry number D. There you will find the troubleshooting procedures you will need. The procedure has columns with the headings: MALFUNCTION, TEST OR INSPECTION, and CORRECTIVE ACTION. Starting at step 1, read the procedure. Each step tells you what to do and what to look for. Follow the steps, in order, until you find your problem. The corrective action column will tell you what to do next.

4. Let's assume that the troubleshooting procedures lead you to a faulty fuel injector nozzle. The replacement procedure is in paragraph 4-13. The procedure contains all the information you will need to repair or replace the fuel injector nozzle. First, check the introductory material. It tells you what you will need before you start the job. Below the introductory material is an assembled view of the vehicle showing the approximate location of the fuel injector nozzles and an illustration which shows you how to do the job.

5. If on the other hand, you know the cause of the problem, refer to the alphabetical index located at the rear of this manual. Find the name of the part to be replaced and the paragraph number for the maintenance procedure. For example, you notice a leak in the fuel pump. You know the fuel pump must be replaced or repaired. Refer to the alphabetical index under the listing "Fuel pump." Turn to the page referenced for replacement and repair procedures.



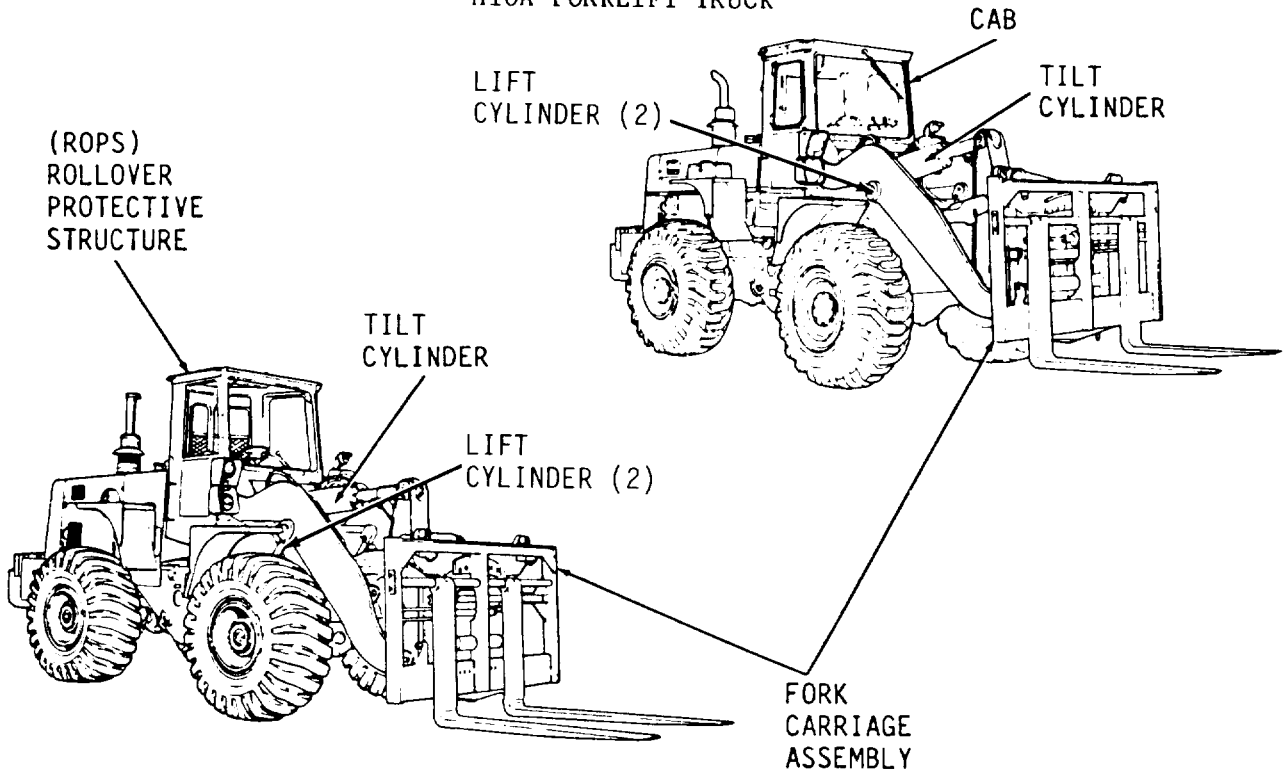
## CHAPTER 1

## INTRODUCTION

## INDEX

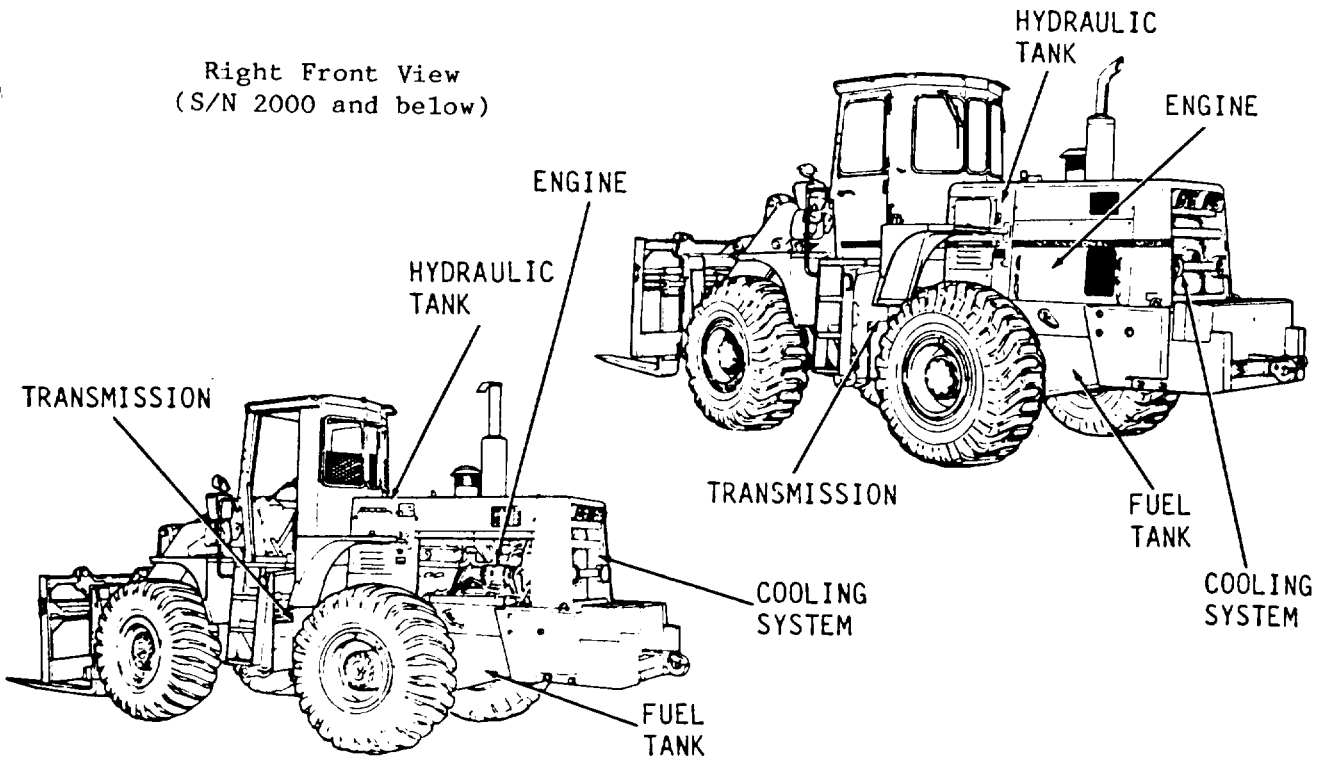
<u>Section</u>	<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
I	GENERAL INFORMATION		
	Scope	1-1	1-3
	Maintenance Forms, Records and Reports	1-2	1-3
	Destruction of Army Material to Prevent Enemy Use	1-3	1-3
	Quality Assurance/Quality Control (QA/QC)	1-4	1-3
	Nomenclature Cross Reference	1-5	1-4
	Reporting Equipment Improvement Recommendations (EIR)	1-6	1-4
	Warranty Information	1-7	1-4
II	EQUIPMENT DESCRIPTION AND DATA		
	Differences in Models	1-8	1-5

M10A FORKLIFT TRUCK



Right Front View  
(S/N 2001 and above)

Right Front View  
(S/N 2000 and below)



Left Rear View  
(S/N 2000 and below)

Left Rear View  
(S/N 2001 and above)

## CHAPTER 1

## INTRODUCTION

## Section I. GENERAL INFORMATION.

1-1. Scope. This chapter provides general descriptive data to aid the maintenance specialist in understanding the various mechanical functions of the M10A Forklift.

- a. Type of Manual. Direct Support and General Support Maintenance Manual.
- b. Model Number and Equipment Name. MHE 236, (NSN 3930-01-054-3833) Rough Terrain 10,000 Pound Capacity, Articulated Frame Steer, Pneumatic Tire, DED, M10A Forklift.
- c. Purpose of Equipment. Handle, transport, and stock materials on various types of terrain. The vehicle has a capacity of 10,000 pounds, 48 inch load center and can lift the load to a maximum of 121.6 inches.
- d. Metric Dimensions. The equipment described herein is non-metric and does not require metric common or special tools. Therefore, metric units are not supplied.

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

1-3. Destruction of Army Material to Prevent Enemy Use. TM 750-244-6, "Procedures for Destruction of Equipment to Prevent Enemy Use."

1-4. Quality Assurance/Quality Control (QA/QC).

- a. No particular quality assurance or quality control technical manuals pertain specifically to the M10A Forklift. Use standard QA/QC procedures.
- b. Defective material received through the supply system should be reported on a Quality Deficiency Report (QDR), SF368. QDR's should be mailed directly to: Commander, U.S. Army Tank Automotive Command, ATTN: AMSTA-QRT, Warren, MI 48397-5000. A reply will be furnished directly to you.

INTRODUCTION. (cont)

1-5. Nomenclature Cross Reference. This listing includes nomenclature cross-references used in this manual.

<u>Official Nomenclature</u>	<u>Common Name</u>
Truck, Forklift, DED	Forklift
Pneumatic Tire, 10,000 Lbs. Capacity, Rough Terrain, Articulated Frame Steer	
Technical Manual	TM
Lubrication Order	LO, Lube Order
Level Indicator	Sight Gage, Dipstick
Capscrew	Bolt
Safety Wire	Lockwire
Gauge	Gage
Water Temperature Regulator	Thermostat
Servicemeter	Hourmeter
O-Ring	Preformed Packing
XMSN	Transmission
Hydraulic Tank	Hydraulic Reservoir
Air Reservoir	Air Tank
Self-Locking Nut	Locknut
Drive Shaft	Propeller Shaft
Fork Carriage	Boom
Final Filter	Secondary Filter

1-6. Reporting Equipment Improvement Recommendations (EIR). If your M10A Forklift needs improvement, let us know. Send an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on a SF 368. EIR's should be mailed directly to: Commander, U. S. Army Tank Automotive Command, ATTN: AMSTA-QRT, Warren, MI 48397-5000. A reply will be furnished directly to you.

1-7. Warranty Information. The model, MHE Forklift is warranted by Dresser Industries for 15 months or 1500 hours of operation, whichever occurs first. The warranty starts on the date found on DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor. He will take appropriate action through your direct support and general support maintenance shop.

For warranty processing information see DA PAM 738-750.

## INTRODUCTION.

## Section II. EQUIPMENT DESCRIPTION AND DATA

1-8. Differences in Models. Read Operator's Manual (TM 10-3930-643-10) paragraph 1-9 and Organizational Maintenance Manual (TM 10-3930-643-20) paragraph 1-8 for differences in models. In addition, note the following differences as they affect maintenance tasks.

a. Front Axle Assembly.

- (1) S/N 2000 and below. Three piece axle assembly.
- (2) S/N 2001 and above. One piece axle assembly.

b. Rear Axle Assembly.

- (1) S/N 2000 and below. Three piece axle assembly.
- (2) S/N 2001 and above. One piece axle assembly.

c. Power Cluster/Pressure Converter and Reservoir. Nomenclature difference. Power cluster is on S/N 2000 and below and pressure converter is on S/N 2001 and above.

d. Two-Way Valves/Check Valves-Treadle. Nomenclature difference. Two-way valves are on S/N 2000 and below and check valves are on S/N 2001 and above.

e. Treadle Valve. Internal design difference.

f. Ground Driven Steering Pump. Internal design differences.

g. ROPS/Cab.

- (1) S/N 2000 and below. Equipped with ROPS.
- (2) S/N 2001 and above. Equipped with cab.

h. Heater Assembly.

- (1) S/N 2000 and below. No heater assembly.
- (2) S/N 2001 and above. Equipped with heater assembly.



## CHAPTER 2

## GENERAL MAINTENANCE PROCEDURES

## INTRODUCTION.

This chapter describes the general maintenance procedures that should be applied during performance of all maintenance tasks.

## INDEX

<u>Section</u>	<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
I	SAFETY PROCEDURES		
	Remedies of Injuries	2-1	2-2
	Personnel Precautions	2-2	2-2
	Vehicle Precautions	2-3	2-3
II	STANDARD TOOL REQUIREMENTS		
	Tool Kits	2-4	2-4
III	DISASSEMBLY AND ASSEMBLY PROCEDURES		
	Condition OF Vehicle	2-5	2-5
	Disassembly and Assembly Procedures	2-6	2-5
IV	GENERAL REPAIR PRACTICES		
	Replacement of Parts	2-7	2-6
	Cleaning	2-8	2-6
	Inspection Criteria	2-9	2-6
	General Repair Practices	2-10	2-6
	Lubrication	2-11	2-7
	Application of Adhesives	2-12	2-7
	Electrical Repair	2-13	2-10
	Bearing Procedures	2-14	2-26

GENERAL MAINTENANCE PROCEDURES. (cont)

Section I. SAFETY PROCEDURES

2-1. Remedies of Injuries. Refer to FM 21-11, First Aid for Soldiers, for first aid treatments of injured personnel. For any injury, always seek medical attention immediately. The following first aid procedure should be done to prevent further injury until medical attention is available.

a. Overcome by Exhaust Gases or Toxic Fumes. Expose victim to fresh air. If necessary, administer artificial respiration. Keep victim warm. Do not permit physical exertion. Seek medical attention immediately.

b. Chemical Burns.

(1) Eyes. Flush with cold water for 15 minutes. Seek medical attention immediately.

(2) Internal. Drink large amounts of milk or water. Follow with milk of magnesia, beaten egg, or vegetable oil.

(3) External. Flush with cold water until all acid has been removed.

(4) Clothing or Vehicle. Wash with cold water at once. Neutralize acid with baking soda or household ammonia, refer to TM 9-6140-200-14.

c. Foreign Object in Eye. Do not attempt to remove object. Object may cause cuts and abrasions. Close eye and seek medical attention immediately.

2-2. Personnel Precautions. Observe all warnings listed in this manual. Basic safety precautions are listed before the procedures to which they apply. WARNING labels have also been put on the vehicle to provide instructions and identify specific hazards which could cause bodily injury or death. The word WARNING appears in this technical manual to alert you to situations that could cause you injury. Other general safety precautions to follow are:

a. Use Personal Protective Equipment. Protect your eyes against acid burns and Foreign objects. Operate vehicle only when necessary to keep sound levels down and prevent hearing loss. Guard your skin from burns, rashes and toxic substances that are absorbed through the skin.

b. Stay Clear of Moving parts. Remove watches, rings and other jewelry that could catch in moving parts and cause injury. Keep your hand, feet and clothing away from all machinery in motion.

c. Use Care in the Handling of Flammable Materials. Notify others in the area that you are handling flammables. Know emergency procedures in case of accident or fire.



## GENERAL MAINTENANCE PROCEDURES.

## 2-2. Personnel Precautions.

d. Ventilate. Do not operate engine or heater in a closed area unless area is properly ventilated. If you notice exhaust odors or exposure symptoms, immediately ventilate the area.

e. Handling Heavy Items. Properly support heavy items before removing. Keep clear of suspended items. Use sufficient number of personnel to maintain control of item. If item begins to fall; let it fall. Ensure that hoist or hydraulic floor jack has sufficient capacity to do the job and provide an ample safety margin.

f. Prevent Accidental Movement. Never leave vehicle unattended while the engine is running. Observe all pre-conditions before performing maintenance.

g. Use Sturdy Supports. Do not climb on tires. Use mounted steps and ladders when climbing onto vehicle. If needed, use a sturdy step ladder to perform maintenance on equipment not safely within reach.

2-3. Vehicle Precautions. Observe all cautions listed in this manual. The word CAUTION appears in this manual to alert you to conditions that could cause damage to the vehicle and its components. Cautions are listed before the procedure to which they apply. Other general vehicle precautions include:

a. During service maintenance turn master disconnect switch off to prevent damage to the electrical system.

b. Disconnect battery ground when required.

c. Use a hoist or hydraulic floor jack of sufficient capacity to remove and support heavy items.

Section II. STANDARD TOOL REQUIREMENTS

2-4. Tool Kits. The following are general practices regarding the use of tools.

a. To prevent personal injury and damage to tools always use the proper tool for the task being performed.

b. Be sure to keep tools clean and lubricated. Following this practice will reduce wear and prevent rust.

c. Keep track of your tools. Do not be careless with them.

d. Return tools to tool box when you are finished with repair or maintenance.

e. Return tool boxes to tool storage when not in use.

f. Inventory tools before and after each use.

g. Use the tool kit specified in the procedure. It contains the tools you will need to complete the maintenance task. The three authorized tool kits used to perform maintenance on this vehicle are:

(1) Shop Equipment, Automotive Maintenance and Repair: Organizational Maintenance, Common No. 1, Less Power (NSN 4910-00-754-0654).

(2) Shop Equipment, Automotive Maintenance and Repair: Organizational Maintenance, Common No. 2, Less Power (NSN 4910-00-754-0650).

(3) Tool Kit, General Mechanic's Automotive (NSN 5180-00-177-7033).

h. Some maintenance tasks require special or fabricated tools. The initial page of the task will name any special or fabricated tool needed for that procedure. Use these special tools only for the maintenance tasks for which they are designed or called out. Personnel should be carefully instructed in the use of these tools.

## GENERAL MAINTENANCE PROCEDURES.

## Section III. DISASSEMBLY AND ASSEMBLY PROCEDURES

2-5. Condition of Vehicle. Before performing any maintenance task ensure that the following conditions have been observed, unless otherwise specified.

- a. Forks must be lowered to the ground.
- b. Vehicle must be parked on level ground.
- c. Parking brake must be applied.
- d. Transmission must be in neutral and locked.
- e. Engine must be shut off.
- f. Master disconnect switch must be off.
- g. Components must be at operating temperature to be tested.
- h. Air system must be vented.

2-6. Disassembly and Assembly Procedures. Follow these general practices when performing disassembly and assembly procedures:

- a. Read the procedure and thoroughly understand it before performing maintenance or repair. Be alert during procedure.
- b. Keep major components and assemblies together whenever possible and practical.
- c. Tag hoses, electrical wires, cables and harnesses to identify them and aid in installation.
- d. Have all the necessary parts, tools, material and personnel before starting procedure.
- e. Keep related parts together for identification purposes.
- f. To prevent loss, temporarily reinstall attaching hardware such as screws, bolts, washers and nuts.
- g. Only disassemble to point of problem.
- h. Make sure parts are clean and lubricated" before assembly.

Section IV. GENERAL REPAIR PRACTICES

2-7. Replacement of Parts. Only replace unserviceable or discarded parts. Always discard the following: cotter pins, lockwire, preformed packings, rubber seals and gaskets.

2-8. Cleaning. Cleaning is a necessary part of most tasks. Use the following guidelines when cleaning:

- a. Use cleaning solvent P-D-680 for cleaning metal parts only.
- b. Use a mild detergent solution For rubber, plastic and nylon parts.
- c. Always clean parts before inspecting them.
- d. Dry parts with lint free cloths. Use compressed air when specified.
- e. Use a wire brush, tap or die to clean rust, accumulated dirt, sealant and paint from bolts, screws, nuts and threaded holes.
- f. After cleaning, protect all parts from dust and dirt.
- g. Keep work area floors and workbenches clean and dry. Clean as you go to prevent accidents.
- h. Dispose of oily rags in specified containers to prevent fire hazard.
- i. Keep the vehicle clean. Oil, grease and debris may hide a serious problem.
- j. Clean all new parts before installation.

2-9. Inspection Criteria. Proper inspection of parts and operating equipment prevents small problems from becoming major problems. Visually check for any of the following problems: broken welds, loose fasteners, damaged threads, bending, cracking, deformity, nicks, cuts, scratches, gouges, distortion, blockage or inoperability. Equipment defects can be discovered by performing PMCS at both crew and organizational levels. Inspect disassembled, clean parts for damage listed above. Check for wear. Inspect all new parts for defects before installation.

2-10. General Repair Practices. The following are additional general repair practices. Discard broken and non-reusable parts. Paint exposed metal to protect from rust. Do not paint electrical harnesses, wiring, hoses or finished machine parts. Routinely check hoses, lines and fittings for leaks. Perform all lubrication and PMCS on schedule. To prevent further damage to components, take corrective action promptly when indicated. Be sure to follow all warnings, cautions and notes. Remove burrs, scratches or raised metal. Use a fine file, stone or crocus cloth dipped in oil.

## GENERAL MAINTENANCE PROCEDURES.

2-11. Lubrication. Refer to LO 10-3930-643-12 for detailed, illustrated instructions on proper lubrication. Some general practices to remember include:

- a. Use the correct lubricant.
- b. Keep lubricants clean.
- c. Clean all fittings prior to lubrication.
- d. Lubricate clean disassembled and new parts to prevent rust.

2-12. Application of Adhesives. Liquid gasket, silicone rubber adhesive and Loctite retaining and sealing compounds are recommended in some tasks to ensure and strengthen seals. The following procedures describe their correct use and application:

a. Liquid Gasket. Can be used on machined surfaces (where no gasket is specified), ground joints and threaded connections. It can also be used with all types of gaskets. Liquid gasket is heat and cold resistant, unaffected by low pressure gases, gasoline, oil or other liquids, and prevents seizure.

**WARNING**

TOXIC/FLAMMABLE

Liquid gasket is toxic and flammable. Use only in well ventilated areas. Avoid contact with eyes or skin. If injured, seek medical attention immediately. Do not allow near open flame, heat or sparks. Do not smoke when working with liquid gasket.

Liquid gasket is applied as follows:

- (1) Thoroughly clean the mating surfaces. Surfaces must be free of grease, paint, rust or any other foreign substance.
- (2) Brush each mating surface with a thin, even coat of liquid gasket.
- (3) Allow 10-20 minutes to dry until tacky. Temperature and humidity will affect drying time. Adhesive is right consistency when it will not transfer to finger when touched.
- (4) Press surfaces together. Ensure full contact between surfaces. Do not pull or pry either surface after mating.

GENERAL MAINTENANCE PROCEDURES. (cont)

2-12. Application of Adhesives. (cont)

b. Silicone Rubber Adhesive. Except for the instrument panel which is sprayed with anti-corrosive varnish, all electrical connections are sealed against moisture with a room temperature vulcanizing silicone rubber sealant, MIL-A-46146A, Type 1. If you must break into this seal for repair work you must remove the switch involved completely from the machine and thoroughly clean all existing sealant and dirt that may remain on switch. Replace the switch if corroded. The sealant must have a clean surface to adhere to or there will not be an effective seal. After switch is cleaned and reassembled or replaced apply sealant. Cover the switch and terminals completely with sealant. Press sealant into and around the terminals to ensure complete coverage. Sealant will set in 15-30 minutes depending on temperature and humidity.

c. Loctite Retaining and Sealing Compounds. These compounds will resist solvents, heat, shock and vibration. They provide a positive seal against leakage and shear strength resistance to loosening when used in the assembly of threaded, slipfit or press fitted parts. Use the grade of Loctite specified. Once cured these compounds have an operating temperature range of -65 to 300 degrees F (-54 to 149 degrees C), and will resist attack by oils, chemicals, hydraulic fluids and solvents. Do not use Loctite where other retaining means are provided, such as lock wires, lock washers, lockplates and fasteners. Do not substitute grades or usage unless specified. Do not use Loctite on items that need frequent servicing, or on brass fittings or plugs, or when operating temperatures exceed 300 degrees F (149 degrees C) (Example: Engine exhaust systems). Loctite is applied as follows:

(1) Threadlock adhesives. Loctite MIL-S-46163, Type II, Grade O, a high strength adhesive for fasteners and Loctite MIL-S-46163, Type I, Grade L, a high viscosity, high strength adhesive for large bolts and studs, are recommended for use on this vehicle. Primers are not required with threadlock adhesives, but if used will speed up the cure and act as a cleaner. Surface preparation depends on type of metal and purpose of application. In general, most surfaces must be cleaned thoroughly. Apply Loctite to bolts and studs by filling full length of thread with one strip in diameters up to 1 inch, two strips 180 degrees apart, on diameters up to 2 inches, and three strips 120 degrees apart, on diameters over 2 inches. Apply one strip into tapped holes. For blind hole applications, apply enough Loctite to fill the bottom 2 to 3 threads of engagement, then insert stud. If engagement length exceeds one diameter use proportionally more Loctite. For non-seated studs (studs that go deeper in hole than required) turn stud one turn deeper than required. After bubbling stops, apply a ring of Loctite around stud at top of hole, then back stud to required height. Loctite will set in 10 minutes to 2 hours. Temperature and humidity affect drying time.

## GENERAL MAINTENANCE PROCEDURES.

## 2-12. Application of Adhesives.

(2) Plastic gasket. Plastic gasket is used as a seal on large close fitting metal parts. Mating surfaces must be clean and degreased. Spread an even coat (0.061 cubic inch per 40 square inches) on one of the mating surfaces. Assemble and tighten bolts. Plastic gasket will dry in approximately 12-24 hours. Temperature and humidity affect drying time.

(3) Unfilled pipe sealant. Pipe sealant MIL-S-22473D, Product CW, seals against moderate pressures instantly and working pressures when completely dry. Before application, clean threads to remove oil, grease and metal chips. Fill the second and third threads completely for 360 degrees. For system cleanliness, do not fill leading thread. Pipe sealant will dry in 6-24 hours at room temperature. Adjustments for elbows, gages and valves can be made up to 24 hours after application without affecting seal.

GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repair. Specific electrical system maintenance tasks are covered in Chapter 5 of this manual. The following are general electrical repair practices and procedures:

- a. Clean electrical ground contacts with crocus cloth or emery cloth.
- b. Make sure that all connections are tight.
- c. Electrical wires, cables and connections should be checked for cracks due to aging and for exposed wires which could cause an electrical short.
- d. Use distilled water for batteries. If unavailable, use clean water.
- e. Use of multimeter. Maintenance functions authorized for performance at the organizational level require the use of the multimeter. Wire, harness and cable repairs may be indicated as a result of tests performed with the multimeter. Procedures for repairing these electrical components can be found in Chapter 5. After any repairs or replacements are done, test again. The following procedures outline the uses of the multimeter for electrical testing:

(1) Using the ohms scale. The ohms scale is used to make tests for continuity, shorts and resistance.

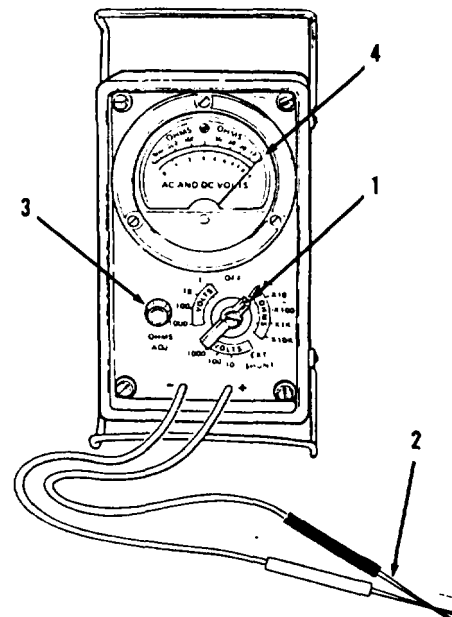
NOTE

Proper operation of electrical components depends upon proper grounding. In all troubleshooting procedures of devices which depend on screws or physical contact for their electrical ground (lamp sockets, transmitters, batteries, etc.) use a jumper wire from the device to the hull to check grounding.

The multimeter must be set up and zeroed before making these tests. Perform the following steps for the multimeter you are using:

(a) AN/URM-105.

- 1 Set selector switch (1) to X1 ohms position.
- 2 Now zero the meter. Touch the two probes (2) together while turning OHMS ADJ knob (3) until needle (4) is over 0 on the top scale.
- 3 If needle will not zero, replace the batteries. If needle still will not zero after replacing the batteries, turn in the multimeter for repair.



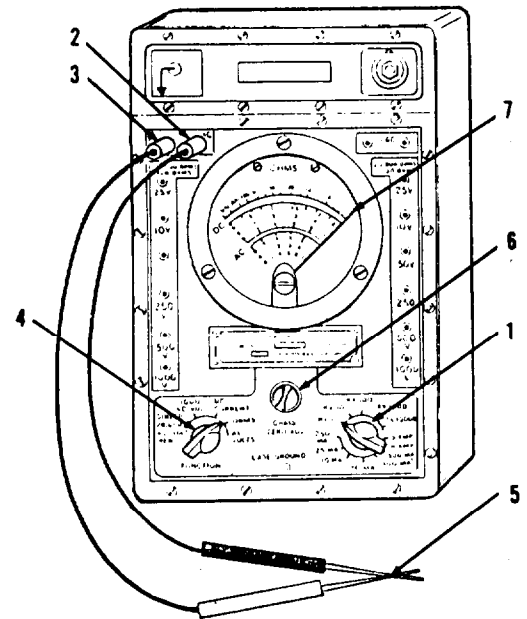


## GENERAL MAINTENANCE PROCEDURES.

## 2-13. Electrical Repair.

(b) TS-352 B/U.

- 1 Set RANGE switch (1) on RX1.
- 2 Put black (-) lead (2) into the OHMS -DC  $\pm$  AC jack.
- 3 Put red (+) lead (3) in the upper left OHMS jack.
- 4 Turn FUNCTION switch (4) to OHMS.
- 5 Touch the two probes (5) together.
- 6 Zero meter by turning the OHMS ZERO ADJ (6) knob until needle (7) is over 0 on top scale. If needle will not zero, replace batteries. If needle still will not zero after replacing the batteries, turn in the multimeter for repair.



(2) Testing for continuity. Continuity tests check for breaks in a circuit, such as the switch, light bulb, or electrical cable, as shown. To make a continuity check, do the following steps:

(a) Set up and zero the multimeter.

**CAUTION**

- Do not touch terminal caps with probes. This will give false reading.
- Failure to do the following step can damage the multimeter.

(b) Disconnect the circuit being tested from the power source. To be safe, disconnect the battery ground strap.

(c) Connect the meter probes to both terminals of the circuit being tested.

(d) Observe needle movement. If the needle swings to the far right over the 0 on the top scale, the circuit has continuity. If the needle doesn't move, the circuit is open (broken). If the needle jumps or flickers, there is a loose connection in the circuit being tested.

(3) Testing for short circuit. A short circuit occurs when two circuits that should not be connected, have contact with each other. A short also occurs when a circuit that should not touch ground, has contact with ground. To check for shorts, do the following steps:

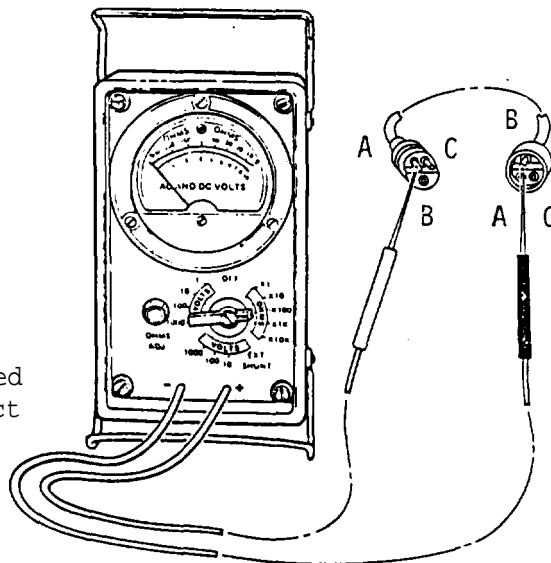
2-13. Electrical Repair. (cont)

(a) Set up and zero the multimeter.

**CAUTION**

Failure to do the following steps can damage the multimeter.

(b) Disconnect the circuit being tested from the power source. To be safe, disconnect the battery ground strap.



(c) Connect one probe to one circuit and the other probe to the other circuit or ground (if checking for a short to ground). The example shows a check to see if wire A is shorted to wire B in the wiring harness.

(d) Observe needle movement. If the needle swings to the far right over the 0 on the top scale, the circuits are short circuited.

If the needle doesn't move, the circuits are not short circuited. If needle jumps or flickers, the circuits are intermittently short circuited.

(4) Measuring resistance. To measure resistance, do the following steps:

(a) Set up and zero the multimeter.

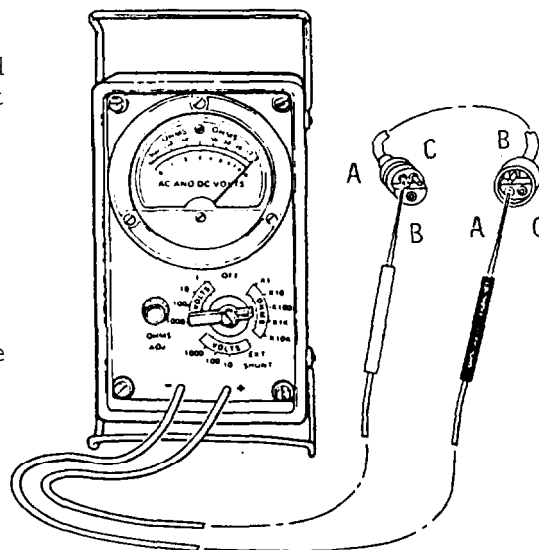
(b) Disconnect the circuit being tested from the power source. To be safe, disconnect the battery ground strap.

**CAUTION**

Failure to do the following step can damage the multimeter.

(c) If the test calls for an ohms range different than RX1 or X1, set the selector switch to that range (RX10 or X10). Zero the meter every time you change ranges.

(d) Connect the probes across the circuit or item to be measured. The example shows measuring the resistance of one wire in a three-wire cable.



GENERAL MAINTENANCE PROCEDURES.

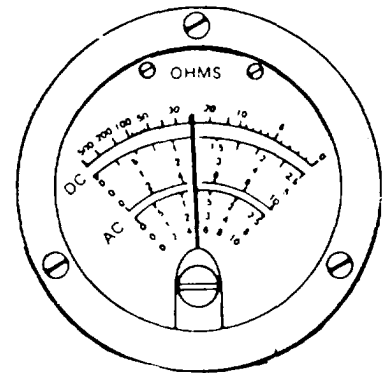
2-13. Electrical Repair.

(e) Read the meter. If the meter switch is on the RX1 or X1 range, the reading is taken directly from the top scale. If the meter switch is on a different range, multiply the reading on the scale according to the table below.

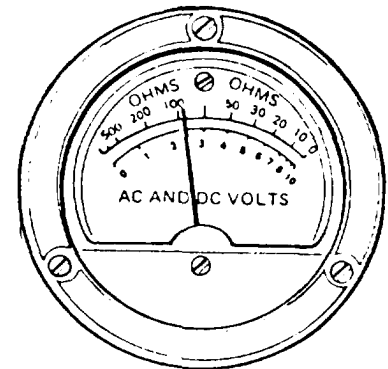
OHMS SWITCH SETTING	SCALE
X1 or RX1	Read number on scale
X10 or RX10	Multiply reading by 10
X100 or RX100	Multiply reading by 100
X1K or RX1K	Multiply reading by 1000
X10K or RX10K	Multiply reading by 10,000

For example, the meters show the following readings:

OHMS SWITCH SETTING	READING
X1 or RX1	40 ohms
X10 or RX10	400 ohms



TS-352 B/U



AN/URM-105

(5) Using the DC volts scale. Setting up the meter. Before using the multimeter to measure DC voltage, do the following steps pertaining to the multimeter you have.

**CAUTION**

Multimeter must be set to a voltage range higher than that being measured or multimeter could be damaged.

NOTE

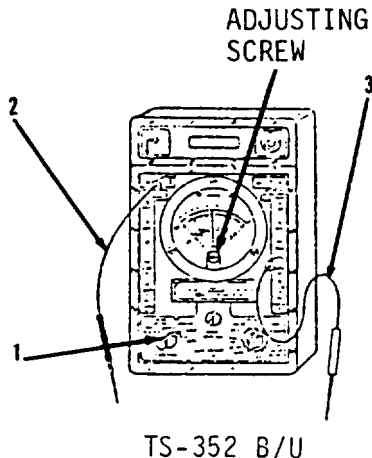
Before using multimeter, check the mechanical zero of the meter. If the meter pointer is not exactly over the zero line, reset by using the proper size screwdriver to adjust the small screw.

(a) AN/URM-105. Set meter switch to DC volts range. (To measure 24 volts DC, set switch on 100 DC volts range).

2-13. Electrical Repair. (cont)

(b) TS-352 B/U.

- 1 Set FUNCTION switch (1) to DIRECT.
- 2 Put black lead (2) in LHMS-DC/± AC jack.
- 3 To measure 24 volts DC, plug red lead (3) into 50V jack on left side of meter. (If measuring less than 10 volts DC, use 10V jack. If measuring less than 2.5 volts DC, use 2.5V jack).



(6) Measuring DC voltage. To measure DC voltage, do the following steps:

(a) Set up and zero multimeter.



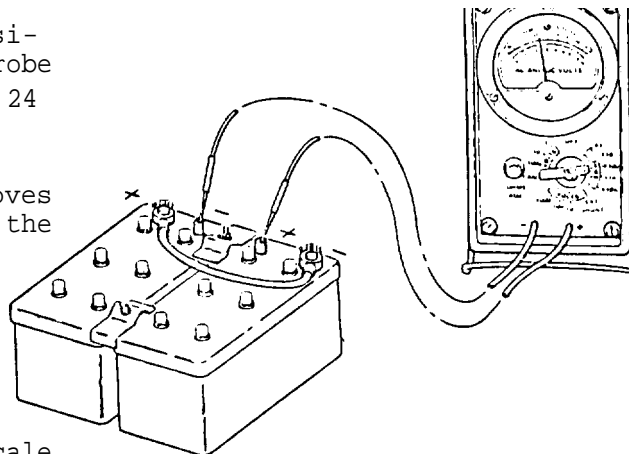
If you are unsure of the voltage to be measured on the vehicle, always start on the highest range. This will protect the meter.

(b) Connect the red probe to the positive (+) side of the circuit and the black probe to the negative (-) side. The example shows 24 volts DC being measured across the batteries.

(c) Read the meter. If the needle moves off scale to the left, reverse the probes on the circuit.

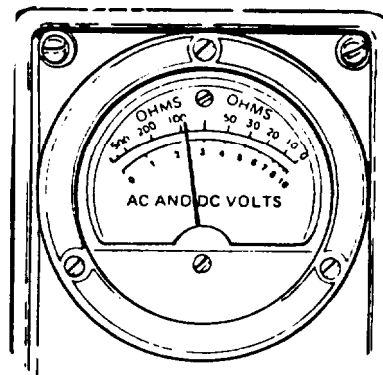
NOTE

The following examples show how to read both multimeters.



- 1 AN/URM-105. Read the DC volts scale for the range at which the selector switch is set.

SWITCH SETTING	SCALE
1000 DC Volts	0-10 (and multiply by 100)
100 DC Volts	0-10 (and multiply by 10)
10 DC Volts	0-10 (read the number of scale)
1 DC Volts 0-10	(and divide by 10)
2-14	



AN/URM-105

GENERAL MAINTENANCE PROCEDURES.

2-13. Electrical Repair.

Thus the meter illustrated is showing the following readings:

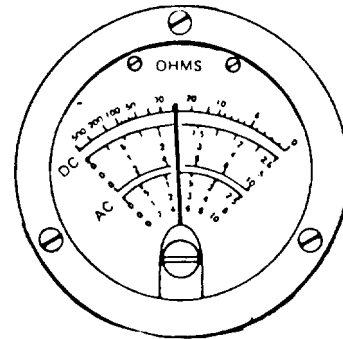
SWITCH SETTING	READING
1000 DC Volts	200 Volts DC
100 DC Volts	20 Volts DC
10 DC Volts	2 Volts DC
1 DC Volts	0.2 Volts DC

2 TS-352 B/U. Read the DC volts scale for the range at which the red lead is plugged.

RANGE	SCALE
50V	0-5 (and multiply by 10)
10V	0-10 (read the number on the scale)
2.5V	0-2.5 (read the number on the scale)

Thus the meter illustrated is showing the following readings:

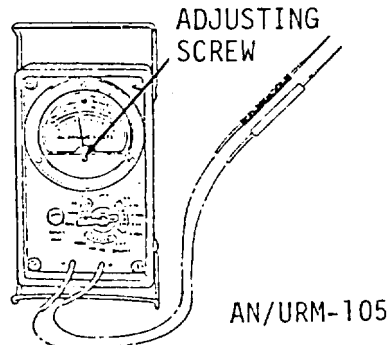
RANGE	READING
50V	20 volts DC
10V	4 volts DC
2.5V	1 volt DC



TS-352 B/U

(7) Using the AC Volts scale. The AC Volts scale on the multimeter is used to measure the voltage in the alternator-to-rectifier circuit.

Before using the multimeter to measure AC volts, do the following steps for the multimeter you have:



GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repair. (cont)

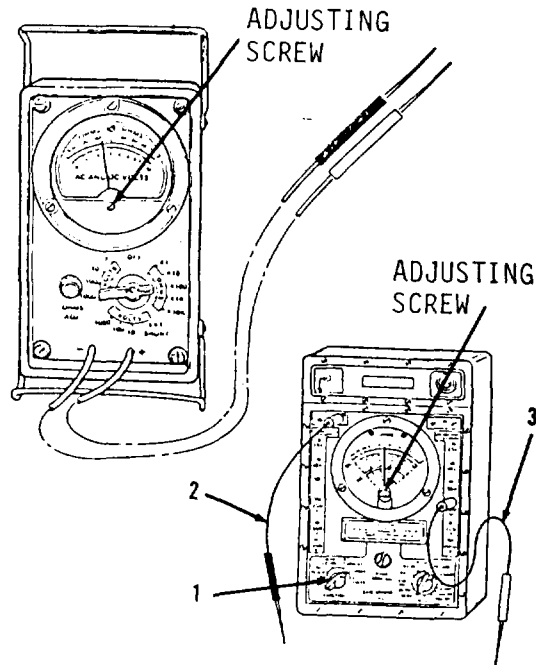
NOTE

Before using the multimeter, check the mechanical zero of the meter. If the meter pointer is not exactly over the zero line, reset by using proper size screwdriver to adjust the small screw.

(a) AN/URM-105. Set meter switch to 1000 AC volts.

(b) TS-352 B/U.

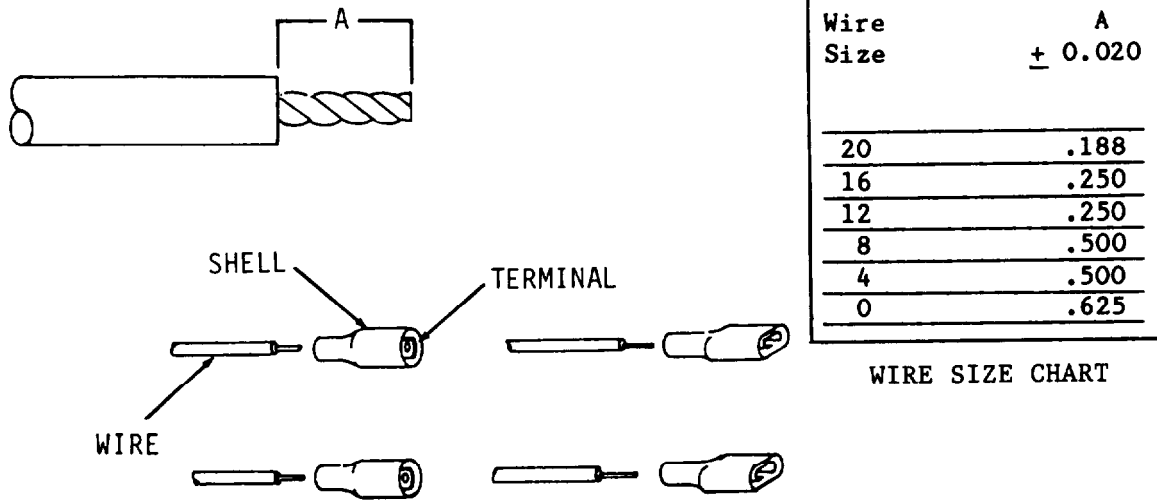
- 1 Set FUNCTION switch (1) to AC.
- 2 Put black lead (2) in OHMS-DC/± AC jack.
- 3 Put red lead (3) in 250V jack on right side of meter.



f. Repairing of wiring harnesses and cables consist of replacement of defective connectors, shells and terminals or taping cut or worn insulation and exposed wire conductors. The following disassembly and assembly procedures are to help you make replacement and repairs to electrical wires and cables.

GENERAL MAINTENANCE PROCEDURES.

2-13. Electrical Repair.



(1) Terminal-type connector, with shell.

DISASSEMBLY

Cut wire close to shell. Remove and discard shell.

ASSEMBLY

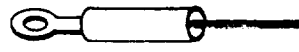
1. Strip wire, refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Strip new wire, refer to Wire Size Chart. Do not nick or cut strands.
4. Tin bare wires. Use resin-core solder to coat bare wires. If using solid-core solder, clean wires with flux before tinning.
5. Slide shrink tubing on wire before splicing.
6. Splice wires. Twist together tightly.
7. Secure wires to prevent movement and solder.
8. Position shrink tubing over spliced wire.
9. Apply heat to shrink tubing. Shrink until tubing fits snugly.

GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repairs. (cont)



SOLDERED, WITHOUT  
INSULATOR



CRIMPED, WITHOUT  
INSULATOR

(2) Connector with ring-type terminals.

DISASSEMBLY

Cut wire close to terminal. Remove and discard terminal.

ASSEMBLY

NOTE

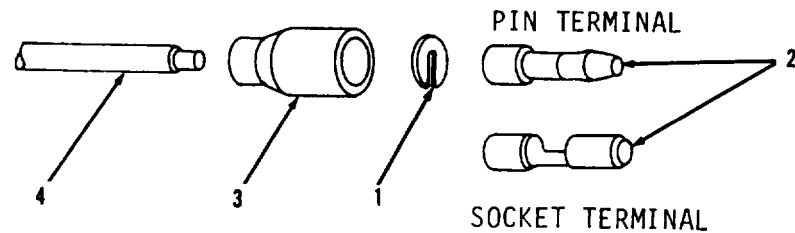
New terminal must be selected to match the ring size of the terminal with the mounting screw at the connection. New terminal must also match crimp tabs with the thickness of the wire.

1. Strip wire, refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Insert wire into new terminal.
4. Crimp new terminal. Securely fasten wire to new crimp-type, insulated new terminal.
5. Secure wire to prevent movement and solder new solder-type terminal. Use solder sparingly.



## GENERAL MAINTENANCE PROCEDURES.

## 2-13. Electrical Repairs.



(3) Terminal-type connector, pin and socket.

## DISASSEMBLY

1. Slide shell (3) back on the wire (4) to expose metal parts.
2. Remove C-washer (1).
3. Cut wire (4) close to terminal (2). Remove and discard terminal (2).
4. Remove shell (3).

## ASSEMBLY

1. Strip wire (4), refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Slide shell (3) onto wire (4).

## NOTE

New terminal must be selected to match the size of the mating contact at the terminal connection. New terminal must also match the crimping area with the thickness of the wire.

4. Insert wire (4) into new terminal (2).
5. Crimp terminal (2). Securely fasten wire (4) to terminal (2).
6. Install C-washer (1).

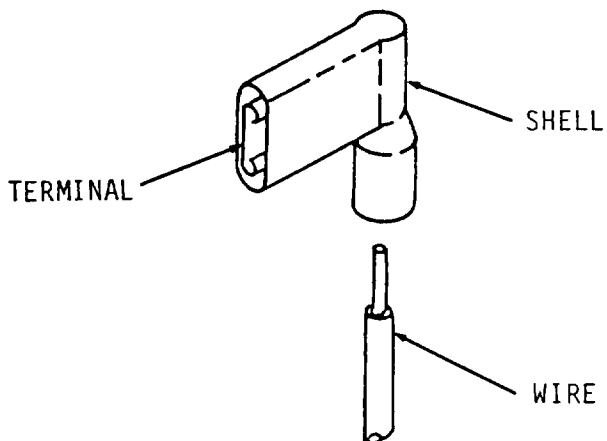
## NOTE

Shell is held in position over terminal by the C-washer. Make sure the C-washer is firmly seated in shell.

7. Slide shell (3) up over new terminal (2) and C-washer (1).

GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repairs. (cont)



(4) Flag-type connector, terminal with shell.

DISASSEMBLY

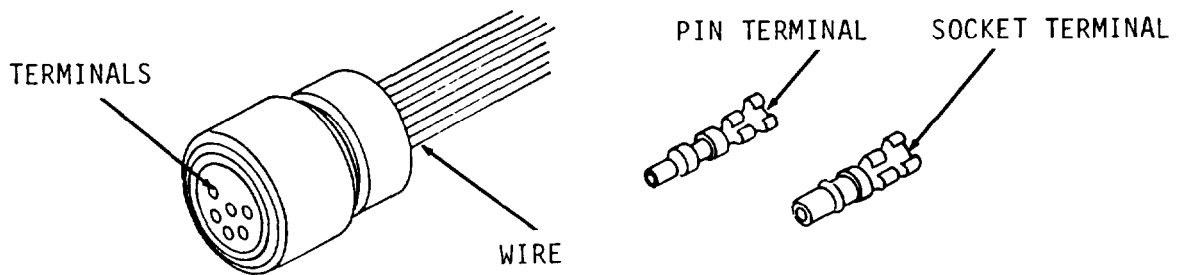
Cut wire close to terminal. Remove and discard terminal.

ASSEMBLY

1. Strip wire, refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Roll back insulation on new terminal to expose crimping area.
4. Insert new wire in terminal.
5. Crimp new terminal. Securely fasten wires to new terminal.
6. Unroll insulation on new terminal to cover parts.

## GENERAL MAINTENANCE PROCEDURES.

## 2-13. Electrical Repairs.



(5) Polarized connector, multi-wire.

## DISASSEMBLY

## NOTE

All wires must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type terminal, refer to illustration.

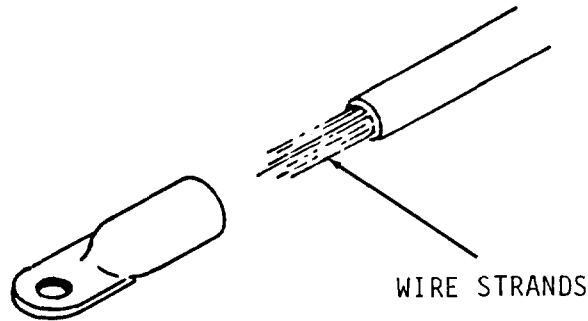
1. Using pin removal tools, push connector terminals out of connector.
2. Record location of terminal.
3. Remove and discard terminals.

## ASSEMBLY

1. Strip wires, refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Insert wires into new terminals. Make sure pin-type and socket-type terminals are used as required.
4. Crimp new terminals. Securely fasten new terminals to wires.
5. Using pin insertion tools, install new terminals in holes of connector as required.

GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repairs. (cont)



(6) Ring-type connector, soldered.

DISASSEMBLY

Cut wire close to terminal. Remove and discard terminal.

ASSEMBLY

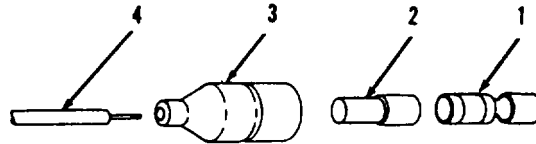
NOTE

New terminal must be selected to match the ring size of the terminal with the mounting screw at the connection. New terminal must also match the wire solder area with the size of the wire.

1. Strip wire, refer to Wire Size Chart. Do not cut or nick strands.
2. Tin bare wires. Use resin-core solder to coat bar wires. If using solid core solder, clean wires with flux before tinning.
3. Insert wires in new terminal.
4. Secure wires to new terminal.
5. Fill wire cavity with melted solder. Allow to cool several minutes before moving wires or new terminal.

## GENERAL MAINTENANCE PROCEDURES.

## 2-13. Electrical Repairs.



(7) Connector, terminal-type, weather-proof.

## DISASSEMBLY

1. Slide shell (3) back to expose sleeve (2).
2. Slide sleeve (2) back to expose terminal (1).
3. Remove and discard terminal (1).
4. Remove sleeve (2) and shell (3).

## ASSEMBLY

1. Strip wire (4), refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Slide shell (3) and sleeve (2) onto wire (4).

## NOTE

New terminal must be selected to match the size of the mating contact at the terminal connection. New terminal must also match the crimping area with the thickness of the wire.

4. Strip wire (4), refer to Wire Size Chart. Do not nick or cut strands.
5. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
6. Insert wire (4) into new terminal (1).

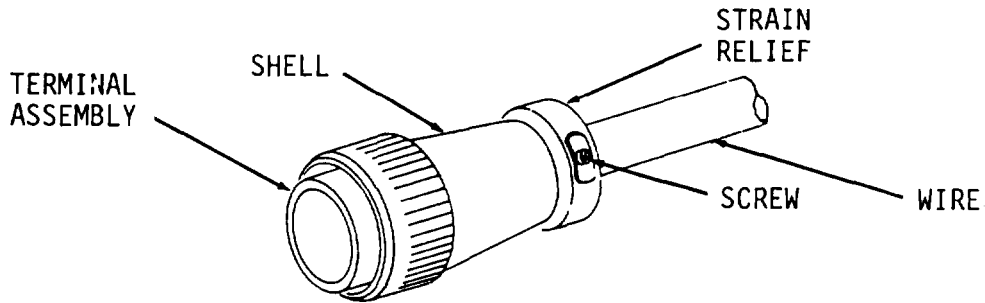
## NOTE

Connector sleeve and shell are held in position over terminal by compression. Sleeve must be firmly seated on terminal and shell must be firmly seated over sleeve.

7. Slide shell (3) over sleeve (2) and terminal (1).

GENERAL MAINTENANCE PROCEDURES. (cont)

2-13. Electrical Repairs. (cont)



(8) Multi-wire connector, hard shell.

DISASSEMBLY

1. Loosen two screws until wire is free to rotate.
2. Remove terminal assembly from shell.

NOTE

All wires must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type terminal.

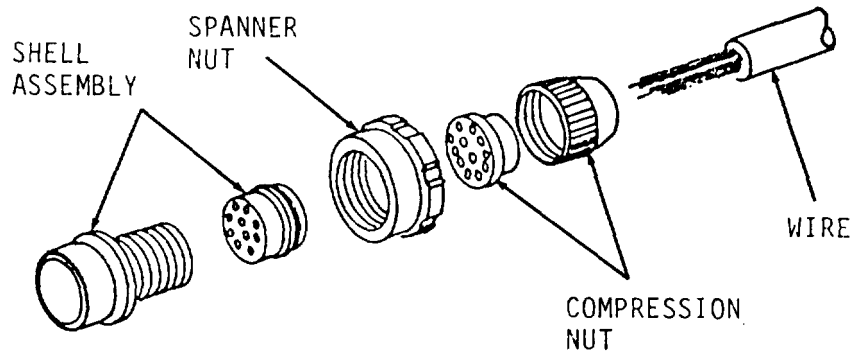
3. Cut wires close to terminals. Discard terminals.
4. Record location of terminals.
5. Remove and discard shell.

ASSEMBLY

1. Strip wires, refer to Wire Size Chart. Do not nick or cut strands.
2. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
3. Slide new shell onto wires.
4. Insert wires into connector pins or socket wells as indicated on tags.
5. Crimp wires. Securely fasten wires to new terminals.
6. Secure wires and new terminal to prevent movement and solder. Use solder sparingly.

## GENERAL MAINTENANCE PROCEDURES.

## 2-13. Electrical Repairs.



(9) Multi-wire connector, compression type.

## DISASSEMBLY

1. Loosen compression nut from shell assembly.
2. Slide compression nut and spanner nut up on wire to expose pin and socket terminals.

## NOTE

All wires must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

3. Cut wire close to terminals. Remove and discard terminals.
4. Remove and discard shell assembly, spanner nut and compression nut.

## ASSEMBLY

1. Slide new compression nut and new spanner nut onto wire.
2. Strip wires, refer to Wire Size Chart. Do not cut or nick strands.
3. Tin bare wires. Use resin-core solder to coat bare wires. If using solid core solder, clean wires with flux before tinning.
4. Insert wires into connector pins or socket wells as indicated on tags.
5. Secure wires and new terminals to prevent movement and solder. Use solder sparingly.

GENERAL MAINTENANCE PROCEDURES. (cont)

2-14. Bearing Procedures. Special care should be taken when removing, cleaning, inspecting and installing bearings. The following procedures are recommended to avoid problems that could occur from improper handling of bearings:

a. Bearing Removal.

(1) Keep area around bearings clean. Prevent loose dirt from entering bearings. Study the assembly before removing bearing and handle carefully.

(2) The best tool for removing a bearing is an arbor press. Press only on the race that is tight. Press evenly to prevent the race from cocking and scoring the shaft or damaging the bearing. Keep press table and support blocks clean and square. Prevent the shaft from falling on the floor. Protect the end of the shaft with a pad of lead, copper, or hardwood.

(3) If an arbor press is not available, use a bearing puller. Install bearing pullers to pull or push bearings straight and square. Do not damage threads, keyways, and shoulders.

(4) With proper care, bearings may be removed safely with other methods if the proper tools are not available. A vise and drift may be used in place of an arbor press and press ram. If the shaft is to be held in a vise, protect its surface with a copper sheet or hardwood blocks. A hardwood block may be used to permit hammer blows to be struck dead center and prevent bearing from cocking.

(5) If the bearing fit does not permit the use of a bearing puller or arbor press, grind off or cut off with an acetylene torch. Cut the outer race and ball retainer and burn the inner race part way through to avoid damaging the shaft. Crack the race the rest of the way using a hammer and chisel. Use caution to avoid personal injury from flying parts.

b. Cleaning Bearings.

(1) Clean all bearings before installation. An accurate judgement about the condition of a bearing cannot be made unless it is thoroughly free from dirt. Do not spin dirty bearings. Rotate them slowly while cleaning in cleaning solvent P-D-680. Bearings with a shield or seal on one side only should be cleaned and inspected in the same way as other bearings. Bearings with shields or seals on both sides should not be cleaned in cleaning solvent P-D-680. Wipe with a clean cloth to prevent dirt or other contamination.

(2) Dry bearings thoroughly with compressed air. When drying bearing, rotate to expose all parts of the bearing.



## GENERAL MAINTENANCE PROCEDURES.

## 2-14. Bearing Procedures.

c. Inspection. Bearings are inspected by holding the inner race so that the axis is vertical (bearing horizontal). Turn the outer race slowly. Bearing may have a small amount of tarnish, stain, or corrosion on the outside surfaces of the races. Operation of the bearing is not affected and they need not be rejected. If bearings feel slightly rough or have a tendency to stick at certain points when rotated, reclean. Determine cause of sticking and reject if necessary. Reject bearings with the following defects: broken or cracked races, dented shields or seals, cracked or broken separators, balls or rollers, flaked areas on balls, rollers or raceways, bearings with signs of heating (darkened to brownish blue or blue black), and indentations from ball or roller impressions. An anti-friction bearing, properly lubricated, should not wear unless dirt or abrasive foreign matter gets into it. Dirt mixed with grease or oil will lap down balls and rollers. Load carrying surfaces of anti-friction bearings are finished with extreme care and will sustain very heavy loads unless the surfaces are damaged by abusive handling or by foreign matter.

d. Bearing Installation.

(1) Before installing bearings, clean shafts and bearing housings thoroughly. Remove all dirt from keyways, splines, and grooves. Remove burrs and slivers. If new bearings are to be used, keep them in their original cartons or wrappings until ready for use. New bearings are shipped with a protective lubricant. Do not clean the oil or grease from a new bearing. Handle the bearing with clean hands and use clean tools to install. Before installing bearings, make sure bearing seats are cleaned and oiled.

(2) Press bearings only on the tight fitting race and press straight and square. The same protective measures for shafts and bearings used during removal should be applied during installation.

(3) In some applications, bearings must be heated to ensure proper fit. A bearing may be heated in a temperature controlled oven or in clean oil at a temperature of 200 to 250 degrees F. The high temperature expands the inner race enough to allow it to slip over the shaft to the bearing seat. Do not overheat bearing. Overheating will cause bearing to lose hardness. If expanding race will not allow installation of the bearing, freeze shaft in dry ice for approximately 30 minutes. Chilling will cause shaft to shrink enough to allow bearing installation.



CHAPTER 3

TROUBLESHOOTING SYMPTOM INDEX

CHAPTER OVERVIEW

This Chapter is to provide the troubleshooting symptom index.

INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
TROUBLESHOOTING SYMPTOM INDEX		
Troubleshooting Symptom Index	3-1	3-2

TROUBLESHOOTING SYMPTOM INDEX. (cont)

3-1. Troubleshooting Index. (cont)

This paragraph contains an index of the troubleshooting data located within the manual. Included in the index are the paragraph/malfunction and page where the detailed procedure will be found. The list of MALFUNCTIONS will give you an indication of where a possible problem might be found. To use the index effectively, follow this procedure:

- FIRST: Locate the appropriate MALFUNCTION from this index and go to the troubleshooting procedure paragraph designated . . . locate the MALFUNCTION.
- SECOND: Do the TEST OR INSPECTION until you verify where the problem originates.
- THIRD: Do the CORRECTIVE ACTION procedure to correct your problem.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION

<u>Component/System</u>	<u>Paragraph/ Malfunction</u>	<u>Page</u>
ENGINE, FUEL, EXHAUST AND COOLING		
Engine cranks but will not start	4-1a	4-2
Engine starts but will not run	4-1b	4-3
Engine misfires, is erratic or visual smoke from exhaust	4-1c	4-4
Engine stalls or lacks power	4-1d	4-5
Excessive crankcase pressure	4-1e	4-8
Engine knocks	4-1f	4-9
High intake manifold pressure	4-1g	4-9
Low intake manifold pressure	4-1h	4-9
Engine cylinder compression test	4-1i	4-10
Intake manifold pressure boost test	4-1j	4-11
Crankcase pressure test	4-1k	4-13

## TROUBLESHOOTING SYMPTOM INDEX.

## 3-1. Troubleshooting Index.

	<u>Paragraph/ Malfunction</u>	<u>Page</u>
TORQUE CONVERTER		
High torque converter oil temperature	6-1a	6-2
High torque converter "in" pressure	6-1b	6-3
Low torque converter "in" pressure	6-1c	6-3
Loss of power	6-1d	6-4
High engine speed at torque converter stall	6-1e	6-4
Low engine speed at torque converter stall	6-1f	6-5
TRANSMISSION		
High oil temperature	6-2a	6-6
Slow or erratic clutch engagement	6-2b	6-6
High clutch pressure	6-2c	6-6
Low clutch pressure	6-2d	6-7
High or low torque converter "in" pressure	6-2e	6-7
Loss of power	6-2f	6-7
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction	6-2g	6-8
Vehicle drives in one range but stalls when shifted to another range	6-2h	6-8
All range pressures normal in one direction but all low in opposite direction	6-2i	6-8
Low clutch pressure in one range (clutch in either direction)	6-2j	6-8
Clutch pressure check at full power stall	6-2k	6-9
AXLE		
Noise when driving	7-1a	7-2
Noise on turns	7-1b	7-3
Noise while vehicle is coasting	7-1c	7-3
Differential overheats	7-1d	7-3
Loss of lubricant	7-1e	7-3
Differential oil level rises	7-1f	7-4

## TROUBLESHOOTING SYMPTOM INDEX. (cont)

## 3-1. Troubleshooting Index. (cont)

	<u>Paragraph/ Malfunction</u>	<u>Page</u>
SERVICE BRAKE		
Brakes do not engage	8-1a	8-2
Brakes do not release	8-1b	8-2
Brakes squeal or scrape	8-1c	8-2
Low air pressure	8-1d	8-3
High air pressure	8-1e	8-4
Noisy compressor	8-1f	8-4
PARKING BRAKE		
Parking brake drags	8-2a	8-5
Parking brake slips	8-2b	8-5
STEERING		
Slow steering at low engine RPM and slow boom hydraulics at high engine RPM	9-1a	9-2
Slow steering	9-1b	9-2
Noisy operation	9-1c	9-3
Hydraulic oil heating up	9-1d	9-3
Insufficient steering pressure	9-1e	9-3
Sticking control valve plunger	9-1f	9-4
Play in steering gear	9-1g	9-4
Hard steering while driving	9-1h	9-5
HYDRAULIC SYSTEM		
All implements fail to operate	12-1a	12-2
All cylinder assemblies operate slowly	12-1b	12-2
A particular cylinder assembly operates slowly	12-1c	12-3
Loss of cylinder motion during operation	12-1d	12-4
Load slowly drops with lift control lever in "hold"	12-1e	12-5
Momentary drop of load when lift control lever is moved from "hold" to "raise" or "raise" to "hold"	12-1f	12-5
Noisy operation	12-1g	12-6
Hydraulic oil heating up	12-1h	12-6
Insufficient pump pressure build-up	12-1i	12-6
Sticking loader control valve spool(s)	12-1j	12-7
Hydraulic pump not delivering oil	12-1k	12-8
Oil leakage at hydraulic pump	12-1l	12-8

## CHAPTER 4

ENGINE, FUEL, EXHAUST AND COOLING  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Engine, Fuel, Exhaust and Cooling Troubleshooting	4-1	4-2
Engine Assembly	4-2	4-15
Engine Mounts	4-3	4-25
Cylinder Head Assembly with Valves	4-4	4-29
Vibration Damper	4-5	4-47
Rocker Arm Assembly and Valve Cover	4-6	4-51
Oil Pan	4-7	4-60
Oil Filter Base	4-8	4-64
Oil Cooler	4-9	4-68
Oil Pressure Regulator Valve	4-10	4-73
Intake and Exhaust Manifolds	4-11	4-76
Fuel Injectors	4-12	4-83
Fuel Injector Lines	4-13	4-88
Fuel Injection Pump, Cover Plate, Adapter and Drive Gears	4-14	4-93
Turbocharger and Piping	4-15	4-101
Fuel Tank	4-16	4-107
Radiator Assembly	4-17	4-110
Water Pump Assembly	4-18	4-112
Fan and Clutch	4-19	4-117

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

---

MALFUNCTION

TEST OR INSPECTION

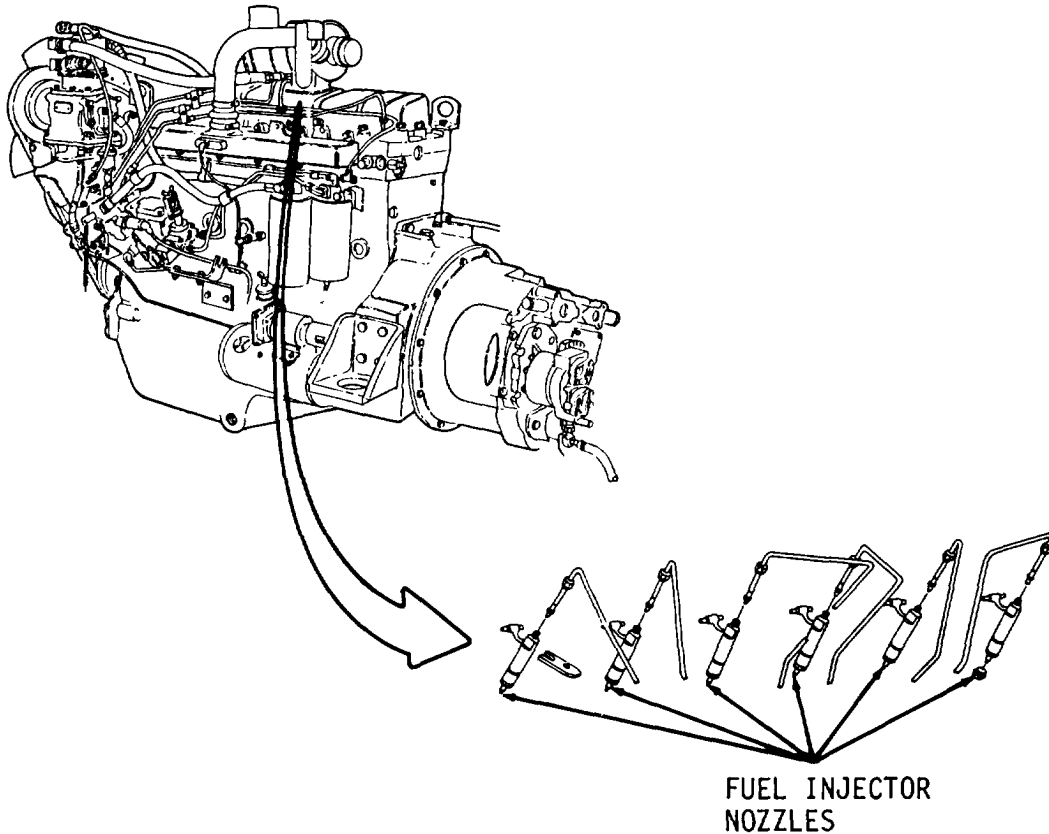
CORRECTIVE ACTION

---

a. ENGINE CRANKS BUT WILL NOT START.

Step 1. Test for worn or plugged fuel injection nozzles, refer to paragraph 4-13.

If fuel injection nozzles are satisfactory, proceed to step 2.



Step 2. Check for faulty solenoid.

If fuel solenoid is not functioning properly, notify General Support.

Step 3. Check for broken timing gear, camshaft or sheared keyway in camshaft drive gear, notify General Support.



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

b. ENGINE STARTS BUT WILL NOT RUN.

Step 1. Test fuel injector nozzle opening pressure, refer to paragraph 4-12.

If fuel injectors are satisfactory, refer to step 2.

Step 2. Check for bent push rods and proper valve adjustment.

If push rods are bent, inspect rocker arm assembly and replace push rods. Adjust valves, refer to paragraph 4-6.

Contact General Support.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

c. ENGINE MISFIRES, IS ERRATIC OR VISUAL SMOKE FROM EXHAUST.

Step 1. Test for damaged fuel injector nozzles or low nozzle valve opening pressure, refer to paragraph 4-12.

If fuel injectors are satisfactory, proceed to step 2.

Step 2. Check for proper fuel injection pump timing, refer to paragraph 4-14.

If timing is correct, proceed to step 3.

Step 3. Check for proper valve lash adjustment, refer to paragraph 4-6.

If valve lash adjustment and fuel injection pump timing are correct, proceed to step 4.

Step 4. Test for proper engine cylinder compression (335-365 psi), refer to paragraph 4-1.i.

If compression does not meet specifications, check for proper valve adjustment, refer to paragraph 4-6.

If valves are properly adjusted, check for worn valves and/or valve seats or a blown cylinder head gasket, refer to paragraph 4-4.

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

d. ENGINE STALLS OR LACKS POWER.

Step 1. Perform engine stall test to isolate engine, refer to paragraph 6-3.

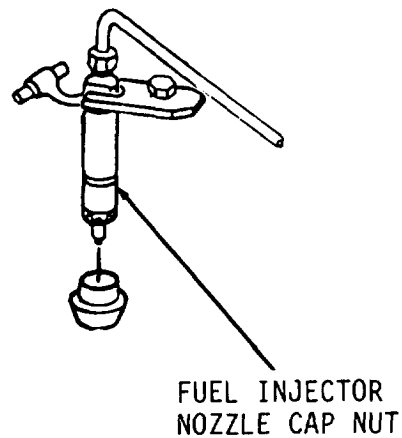
Step 2. Perform engine cylinder compression test, refer to paragraph 4-1.i.

Step 3. Check for dirty or leaking fuel injection nozzles, refer to paragraph 4-12.

If repair is necessary, contact General Support.

Step 4. Check for loose fuel injection nozzle cap nut.

If loose, tighten.



Step 5. Check for sticking fuel injection nozzle valve.

If repair is necessary, contact General Support.

Step 6. Check for blockage in fuel injection nozzle spray holes.

If repair is necessary, contact General Support.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

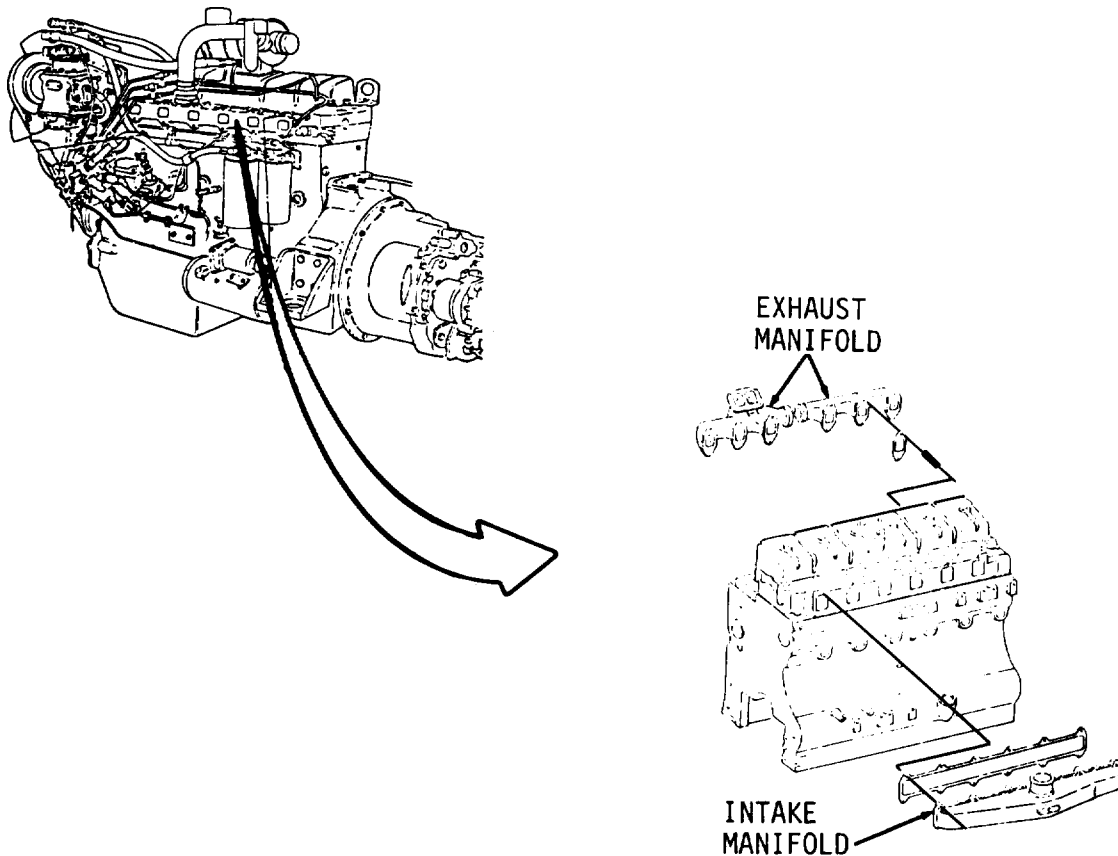
---

d. ENGINE STALLS OR LACKS POWER. (cont)

Step 7. Check turbocharger operation. Check boost pressure, refer to paragraph 4-1.j.

If repair is necessary, contact General Support.

Step 8. Check for leaks at intake and exhaust manifolds.



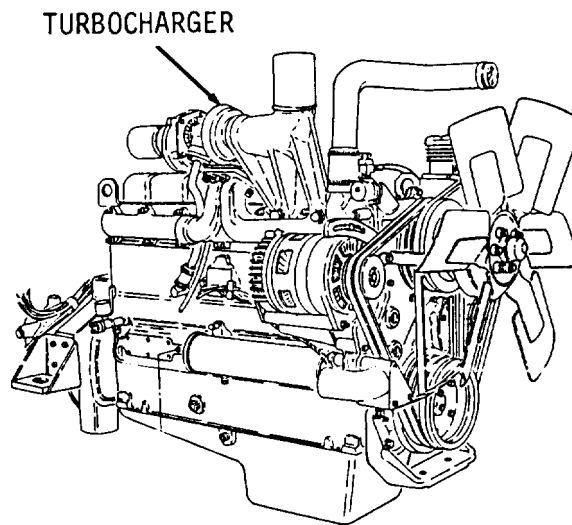
ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION

d. ENGINE STALLS OR LACKS POWER.

Step 9. Check for leakage at turbocharger.



If no leakage exists, proceed to step 10.

Step 10. Check for proper fuel injection pump timing, refer to paragraph 4-14.

If timing is correct, proceed to step 11.

Step 11. Check for proper valve lash adjustment, refer to paragraph 4-6.

If valve lash adjustment is correct, proceed to step 12.

Step 12. Test for proper crankcase pressure, refer to paragraph 4-1.k.

If crankcase pressure is in excess, contact General Support.

If crankcase pressure meets specifications, proceed to step 13.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

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

---

d. ENGINE STALLS OR LACKS POWER. (cont)

Step 13. Test for proper engine cylinder compression (335-365 psi), refer to paragraph 4-1.i.

If compression test does not meet specifications, remove cylinder head and inspect for worn valves and/or valve seats or worn rings, refer to paragraph 4-4.

If compression test meets specifications, proceed to step 14.

Step 14. Check for malfunctions in the transmission, refer to Transmission Troubleshooting.

Step 15. Perform Stall Test, refer to paragraph 6-3.

If transmission is operating properly, proceed to step 16.

Step 16. Test for excessive hydraulic pressure, refer to Hydraulic System Troubleshooting.

e. EXCESSIVE CRANKCASE PRESSURE.

Step 1. Perform crankcase pressure test, refer to paragraph 4-1.k.

Step 2. Test for proper engine cylinder compression (335-365 psi), refer to paragraph 4-1.i.

If compression test does not meet specifications, check cylinder head gasket for cracking, nicks, cuts and distortion, refer to paragraph 4-4 for replacement.

If cylinder head gasket is satisfactory, check for worn, stuck, broken piston rings or cracked pistons or cylinder liners.

If any of these conditions exist, contact General Support.

## E4ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

## f. ENGINE KNOCKS.

Step 1. Check for bad gaskets or crack in manifolds, replace as necessary, refer to paragraph 4-11.

Step 2. Perform Intake Manifold Pressure Boost Test, refer to paragraph 4-1.j.

Step 3. Check low intake manifold pressure, refer to paragraph 4-1.h.

If any knocks or sound of metal to metal contact exists, and if manifolds do not leak and boost pressure meets specifications, shut engine off immediately and contact General Support.

## g. HIGH INTAKE MANIFOLD PRESSURE.

Check for defective or incorrectly adjusted fuel injection pump, refer to paragraph 4-14.

If repair is necessary, contact General Support.

## h. LOW INTAKE MANIFOLD PRESSURE.

Step 1. Check for defective or incorrectly adjusted fuel injection pump, refer to paragraph 4-14.

Step 2. Check for defective intake or exhaust manifolds or gaskets, refer to paragraph 4-11.

If manifolds and gaskets are satisfactory, proceed to step 3.

Step 3. Check fuel injectors, refer to paragraph 4-12.

If repair is necessary, contact General Support.

Step 4. Check turbocharger, refer to paragraph 4-15.

If repair is necessary, contact General Support.

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

h. LOW INTAKE MANIFOLD PRESSURE. (cont)

Step 5. Test crankcase pressure and engine cylinder compression, refer to paragraphs 4-1.k and 4-1.i.

If crankcase pressure test does not meet specifications, refer to General Support.

If crankcase pressure is satisfactory and engine compression does not meet specifications, check for blown head gasket or cylinder head repair, refer to paragraph 4-4.

i. ENGINE CYLINDER COMPRESSION TEST.

1. Start and run engine until normal operating temperature is obtained, refer to TM 10-3930-643-10.
2. Stop engine and remove fuel injectors, refer to paragraph 4-12.
3. Clean and remove foreign material from cylinder head fuel injector sealing surfaces.
4. Install compression test adapter, DR02-3031-10, to fuel injector port on number one cylinder.
5. Connect adequate cylinder compression gage to adapter.



## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

---

MALFUNCTION

## TEST OR INSPECTION

CORRECTIVE ACTION

---

## i. ENGINE CYLINDER COMPRESSION TEST.

## NOTE

Batteries must be fully charged to provide correct cranking speed for compression test.

6. Turn engine through four intake strokes using starter.

7. Read gage and record results.

## NOTE

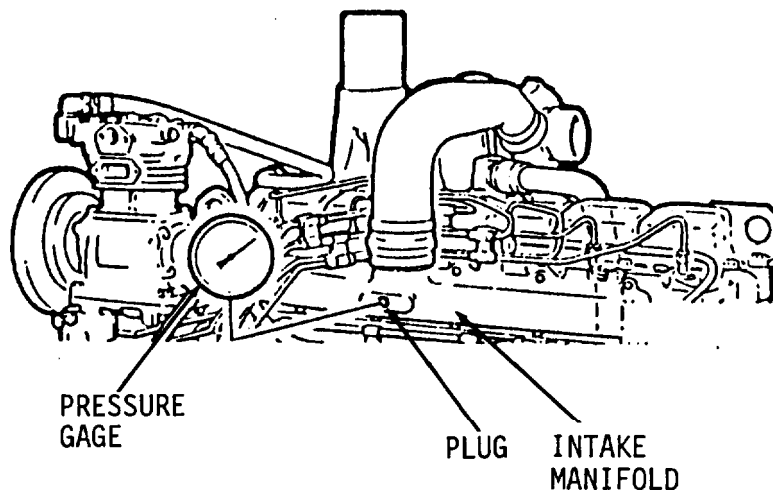
Increase in altitude above sea level will lower compression on test results. Compression test results should read 335-365 PSI.

8. Release pressure from cylinder through gage and perform the same test to remaining cylinders.

## j. INTAKE MANIFOLD PRESSURE BOOST TEST.

1. Start and run engine until normal operating temperature is obtained, refer to TM 10-3930-643-10.

2. Stop engine. Remove plug from center of intake manifold on left side of engine and install pressure gage.



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION

---

j. INTAKE MANIFOLD PRESSURE BOOST TEST. (cont)

**WARNING**

When performing test with vehicle at full stall, apply brakes before engaging transmission and clear all personnel from the immediate area. Failure to follow this procedure could result in SEVERE INJURY or DEATH.

**CAUTION**

During full stall, do not engage steering system; to prevent overheating, do not exceed 15 seconds per stall check; do not allow torque converter to exceed normal operating temperature.

NOTE

Full stall is the speed of engine with throttle at maximum, vehicle in highest gear with brakes applied and hydraulic control valve activated to demand maximum hydraulic relief pressure.

3. Start engine and operate vehicle under full stall conditions. Read pressure gage. Pressure of intake manifold should be 13-17 psi.
4. Stop engine. Remove pressure gage. Install plug in intake manifold.

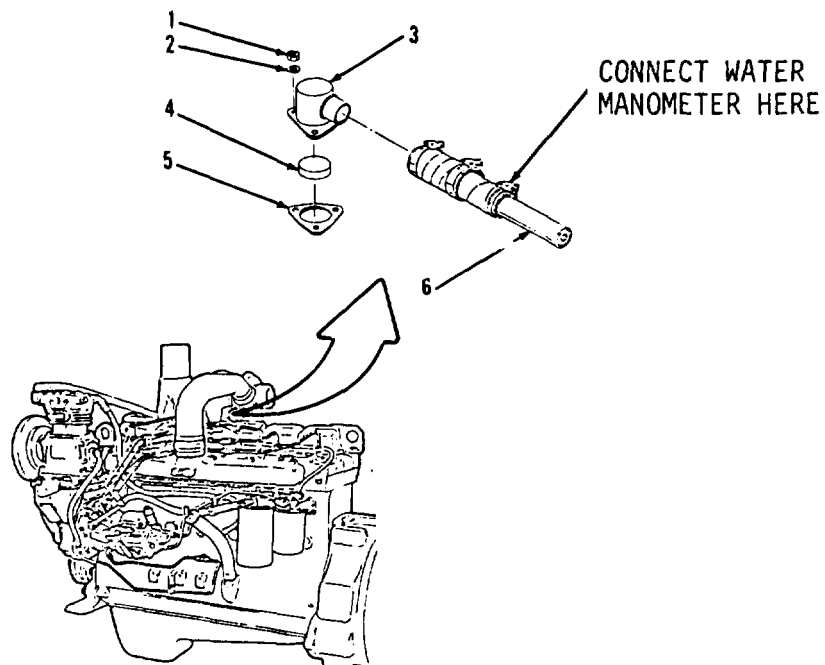
ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION

k. CRANKCASE PRESSURE TEST.

1. Remove crankcase ventilation breather tube and thoroughly clean breather element, refer to TM 10-3930-643-20.



2. Install new gasket (5), clean breather element (4), housing (3), three washers (2) and nuts (1) on valve cover in place of standard breather tube.
3. Connect orificed restrictor (6) to housing (3) and secure with hose clamp.

4-1. Engine, Fuel, Exhaust and Cooling Troubleshooting. (cont)

---

MALFUNCTION

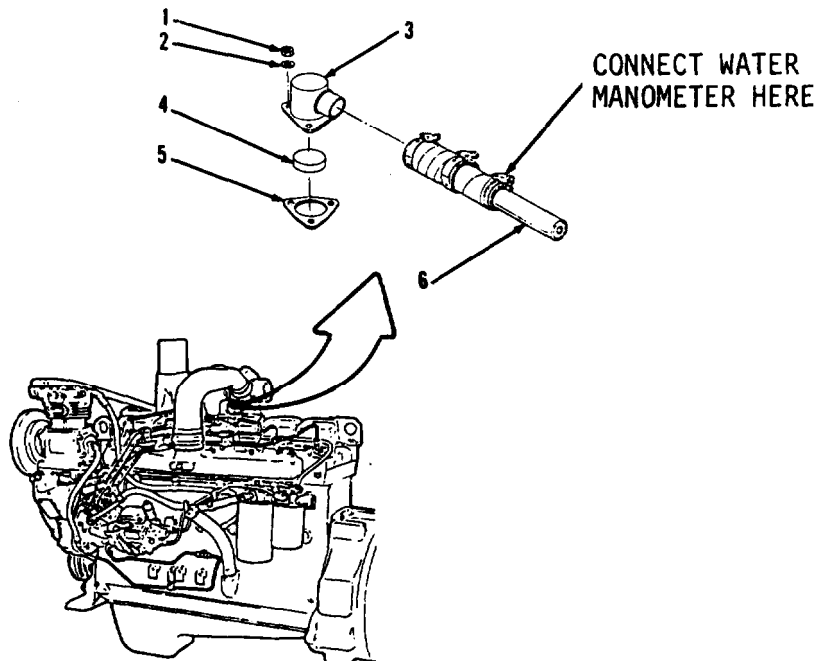
TEST OR INSPECTION

CORRECTIVE ACTION

---

k. CRANKCASE PRESSURE TEST. (cont)

4. Check oil in crankcase for proper level.
5. Connect water manometer to orifice connector, as shown.
6. Run engine until correct operating temperature is obtained, refer to TM 10-3930-643-10.
7. Run engine at high idle, observe manometer for two minutes and record average reading, refer to Engine Troubleshooting if there is an average reading of above 5.5 inches of water.
8. Remove orificed restrictor (6), three nuts (1), washers (2) and housing (3).



9. Install crankcase ventilation breather tube, refer to TM 3930-643-20.

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-2. Engine Assembly. (Sheet 1 of 10)

This task covers:        a. Removal                                b. Installation

#### INITIAL SETUP

##### Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

##### Materials/Parts

Liquid gasket, Type I  
(App. C, Item 14)  
Small tag (App. C, Item 28)  
Tie strap (2)

##### Torques

Bolts (28) to 80 lb-ft.  
Nuts (30) to 160 lb-ft.  
Clamp to 25 in-lb.

#### EQUIPMENT CONDITION

##### References

TM 10-3930-643-10

LO 10-3930-643-12

TM 10-3930-643-20

Paragraph 4-17

Paragraph 12-2

##### Condition Description

Air pressure vented.  
Coolant drained.

Engine oil drained.

Battery cables disconnected.  
Engine top access cover removed.  
Air cleaner connections removed.  
Air cleaner assembly and mounting  
removed.  
Hydraulic oil drained.  
Transmission oil drained.

Radiator removed.

Hydraulic pump removed.

Go to sheet 2

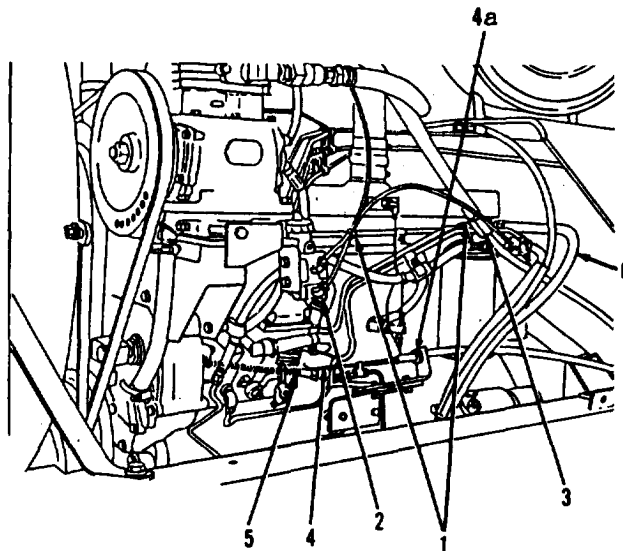
4-2. Engine Assembly. (Sheet 2 of 10)

REMOVAL

NOTE

- Tag all hose and tube assemblies before disconnecting to aid in installation.
- All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

1. Cut and discard two tie straps (1) from right side of engine (38).
2. Using a 7/16" open end wrench, disconnect hose assembly (2) from air governor and move to one side, away from engine assembly.
3. Using 1" and 3/4" open end wrenches, disconnect hose assembly (3) at adapter and move to one side, away from engine assembly.
4. Using long round nose pliers, disconnect spring (5) from bracket on fuel pump cover.
5. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, disconnect cable (4) from injection pump arm and mounting bracket.
6. Using a 15/16" open end wrench, loosen two nuts (4a) and remove cable (4) from mounting bracket and lay away from engine.
7. Using an 11/16" open end wrench, disconnect tube assembly (6) from rear of engine assembly.



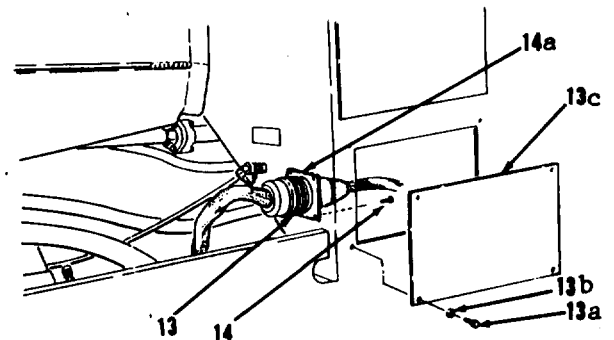
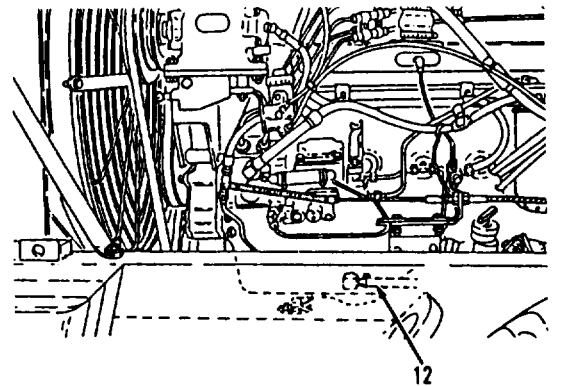
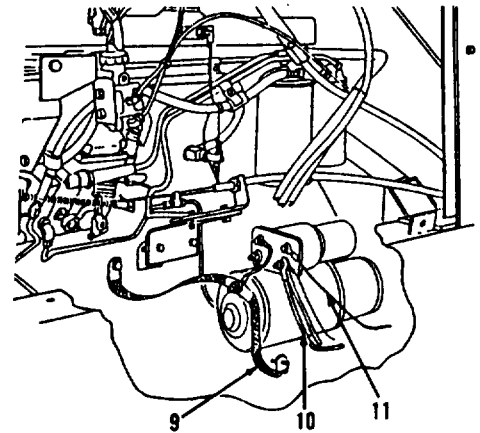
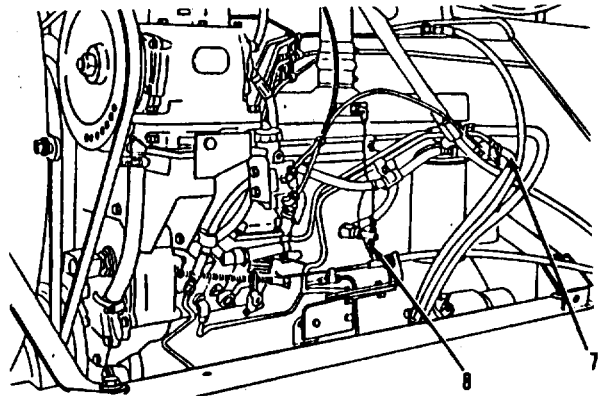
Go to sheet 3

ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE AND TROUBLESHOOTING.

4-2. Engine Assembly. (Sheet 3 of 10)

REMOVAL

8. Using an 11/16" open end wrench, disconnect tube assembly (7) from filter.
9. Using a 3/8" open end wrench, disconnect tube assembly (8) from ether temperature switch.
10. Using a 9/16" socket and socket wrench handle, disconnect ground strap (9) from frame stud at right side of engine and starter motor.
11. Using a 3/4" open and box end wrench, disconnect wire assembly (10) at solenoid connector.
12. Using a 3/8" open end wrench, disconnect wire assembly (11) from solenoid.
13. Using flat tip screwdriver, loosen hose clamp and disconnect hose assembly (12) from oil pan.
14. Disconnect wire assembly connector (13) from hydraulic reservoir, beneath battery compartment.
15. Using a 9/16" open and box end wrench, remove four bolts (13a), washers (13b) and plate (13c).
16. Using a cross tip screwdriver, remove four screws (14) and connector (14a) from hydraulic reservoir bulkhead.



Go to sheet 4

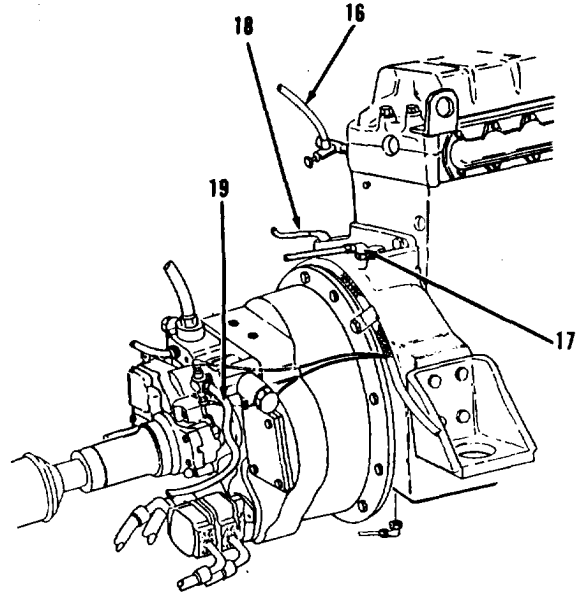
4-2. Engine Assembly. (Sheet 4 of 10)

REMOVAL (cont)

NOTE

The following are differences between M10A Forklift models. The removal/installation procedures are identical.

17. Using a flat tip screwdriver, loosen heater hose clamp and disconnect hose assembly (16), from front, right side of engine on vehicles S/N 2001 and above.
18. Using a 5/8" open end wrench, disconnect hose assembly (17) from flywheel housing on torque converter at front of engine assembly.
19. Disconnect ground cable (18).
20. Using a 1-1/2" open end wrench, disconnect hose assembly (19) from regulator valve.



Go to sheet 5

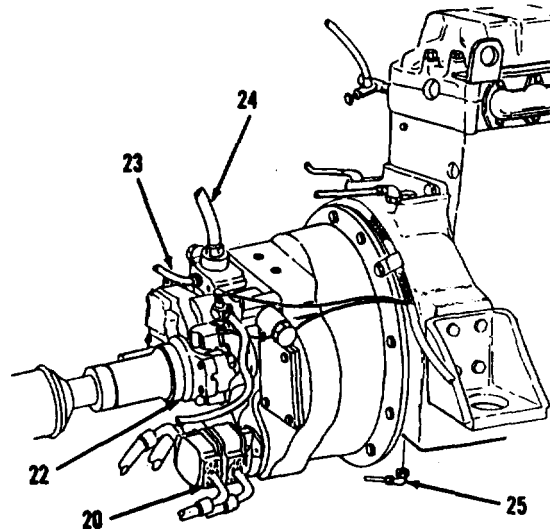


## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-2. Engine Assembly. (Sheet 5 of 10)

REMOVAL

21. Using a 9/16" open and box end wrench, remove charging pump (20). Leave hoses attached.
22. Using a 1/2" open end wrench, disconnect drive shaft (22) and slide forward, away from torque converter.
23. Using 15/16" and 1-1/2" wrenches, disconnect hose assemblies (23 and 24).
24. Using a flat tip screwdriver, disconnect hose assembly (25) from flywheel housing.



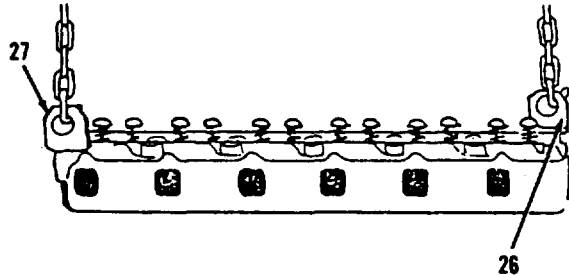
Go to sheet 6

4-2. Engine Assembly. (Sheet 6 of 10)

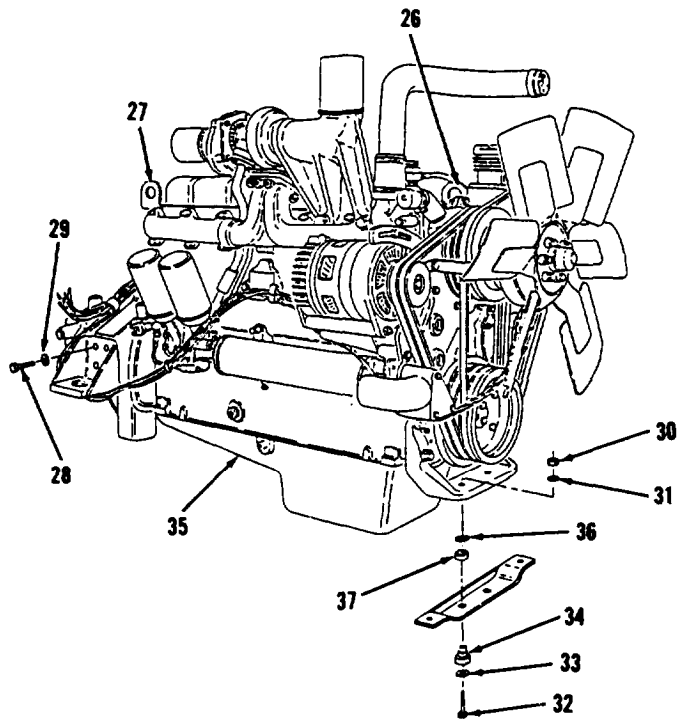
REMOVAL (cont)

**WARNING**

Weight of engine is approximately 1555 lbs. Use adequate hoist and chains for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.



- 25. Attach hoist and chains to lifting eyes (26 and 27) on top of engine (35). Take up slack in chains.
- 26. Using a 3/4" open and box end wrench, remove eight bolts (28) and washers (29) from bottom, front of engine (35).
- 27. Using a 15/16" socket, socket wrench handle and a 15/16" open end wrench, remove two nuts (30), washers (31), bolts (32), washers (33) and mounts (34) from bottom, rear of engine (35).
- 28. Using hoist and chains, remove engine (35) from engine compartment. Place engine (35) on solid surface.
- 29. Remove hoist and chains from lifting eyes (26 and 27).
- 30. Remove two washers (36) and mounts (37).



## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-2. Engine Assembly. (Sheet 7 of 10)

INSTALLATION

31. Position two mounts (37), washers (36) and mounts (34) in engine compartment.



Use care when attaching hoist and chains to prevent any damage to engine or vehicle.

32. Attach hoist and chains to lifting eyes (27 and 26). Lower engine (35) slowly into position.
33. Using a 15/16" socket, socket wrench handle, a 15/16" open end wrench and a 1/2" torque wrench, install two washers (33), bolts (32), washers (31) and nuts (30) on bottom, rear of engine (35). Tighten nuts (30) to 160 lb-ft.
34. Using a 3/4" open and box end wrench, install eight washers (29) and bolts (28) in bottom, rear side of engine (35). Tighten bolts (28) to 80 lb-ft.
35. Remove hoist and chains from lifting eyes (27 and 26) at top of engine (35).

Go to sheet 8

4-2. Engine Assembly. (Sheet 8 of 10)

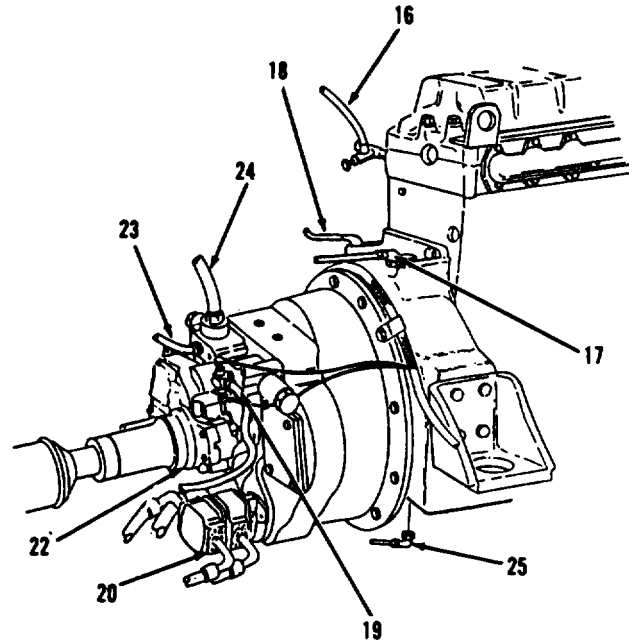
INSTALLATION (cont)

36. Using a flat tip screwdriver, connect hose assembly (25) to flywheel housing in front of engine assembly.
37. Using 15/16" and 1-1/2" open end wrenches, connect hose assemblies (24 and 23).
38. Using a 1/2" open end wrench, connect drive shaft (22).

NOTE

It may be necessary to disconnect lines of charging pump to install charging pump on engine.

39. Using a 9/16" open and box end wrench, install charging pump (20).
40. Using a 1-1/2" open end wrench, connect hose assembly (19) to regulator valve.
41. Using a 5/8" open end wrench, connect ground cable (18).
42. Connect hose assembly (17) to flywheel housing in front of engine assembly.
43. Using a flat tip screwdriver, connect heater hose assembly (16) and tighten hose clamp to front, right side of engine on vehicles S/N 2001 and above.

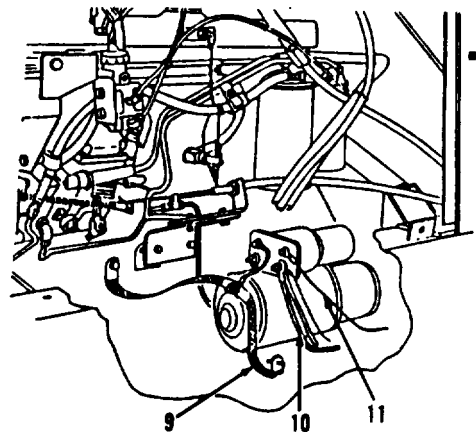
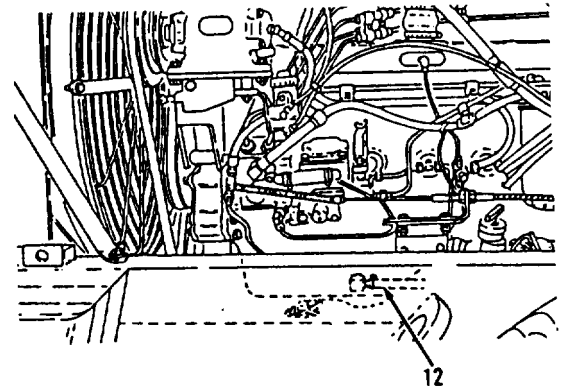
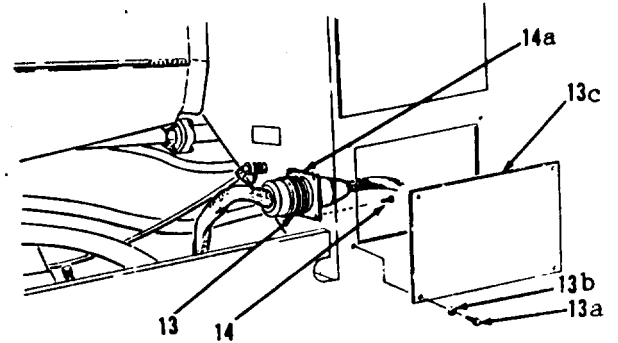


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-2. Engine Assembly. (Sheet 9 of 10)

INSTALLATION

44. Using a cross tip screwdriver, install connector (14a) and four screws (14) on hydraulic reservoir bulkhead in hydraulic reservoir, beneath battery compartment.
45. Using a 9/16" open and box wrench, install plate (13c), four washers (13b) and bolts (13a).
46. Connect wire assembly connector (13).
47. Using a flat tip screwdriver, connect hose assembly (12) oil pan and tighten hose clamp.
48. Using a 3/8" open end wrench, connect wire assembly (11) to solenoid.



Go to sheet 10

4-2. Engine Assembly. (Sheet 10 of 10)

INSTALLATION (cont)

49. Using a 3/4" open and box end wrench, connect wire assembly (10) at connector to solenoid on starter motor.

50. Using 9/16" socket and socket wrench handle, connect ground strap (9) to frame stud and starter motor.

51. Using a 3/8" open end wrench, connect tube assembly (8) to ether temperature switch at right side of engine assembly.

52. Using an 11/16" open end wrench, connect tube assembly (7) to filter.

53. Connect tube assembly (6) to front of engine assembly.

54. Install cable (4) in mounting bracket and using a 15/16" open end wrench, tighten two nuts (4a).

55. Using a 7/16" socket, socket wrench handle-and a 7/16" open end wrench, connect cable (4) to injection pump arm and mounting bracket.

56. Using long round nose pliers, connect spring (5) to bracket on fuel pump cover.

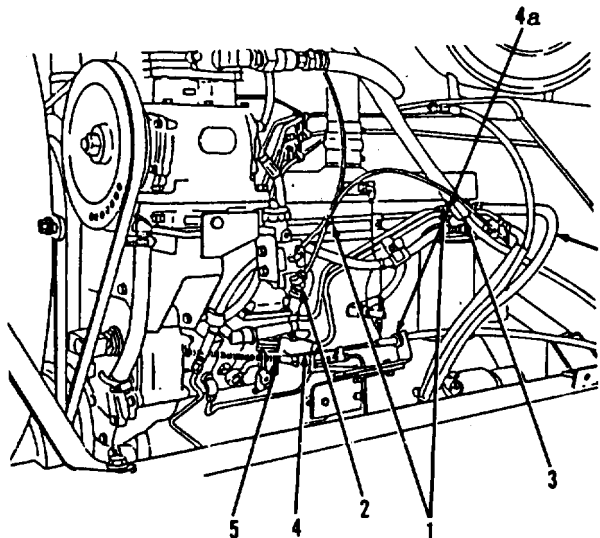
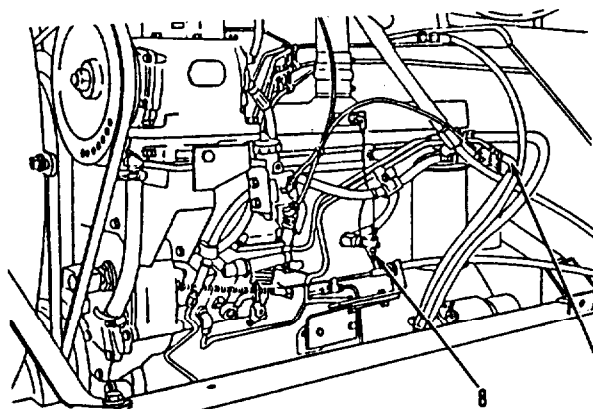
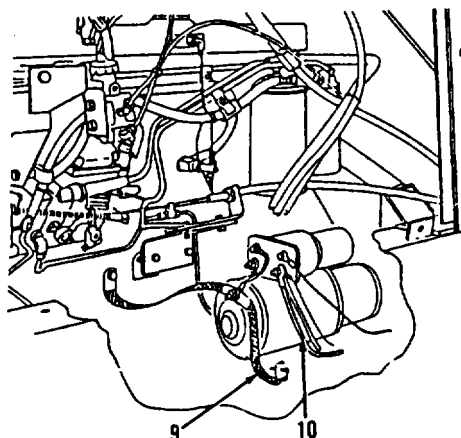
57. Using 1" and 3/4" open end wrenches, connect hose assembly (3) at adapter.

58. Using a 7/16" open end wrench, connect hose assembly (2) to governor.

59. Install two new tie straps (1).

NOTE

Return M10A Forklift to original equipment condition.



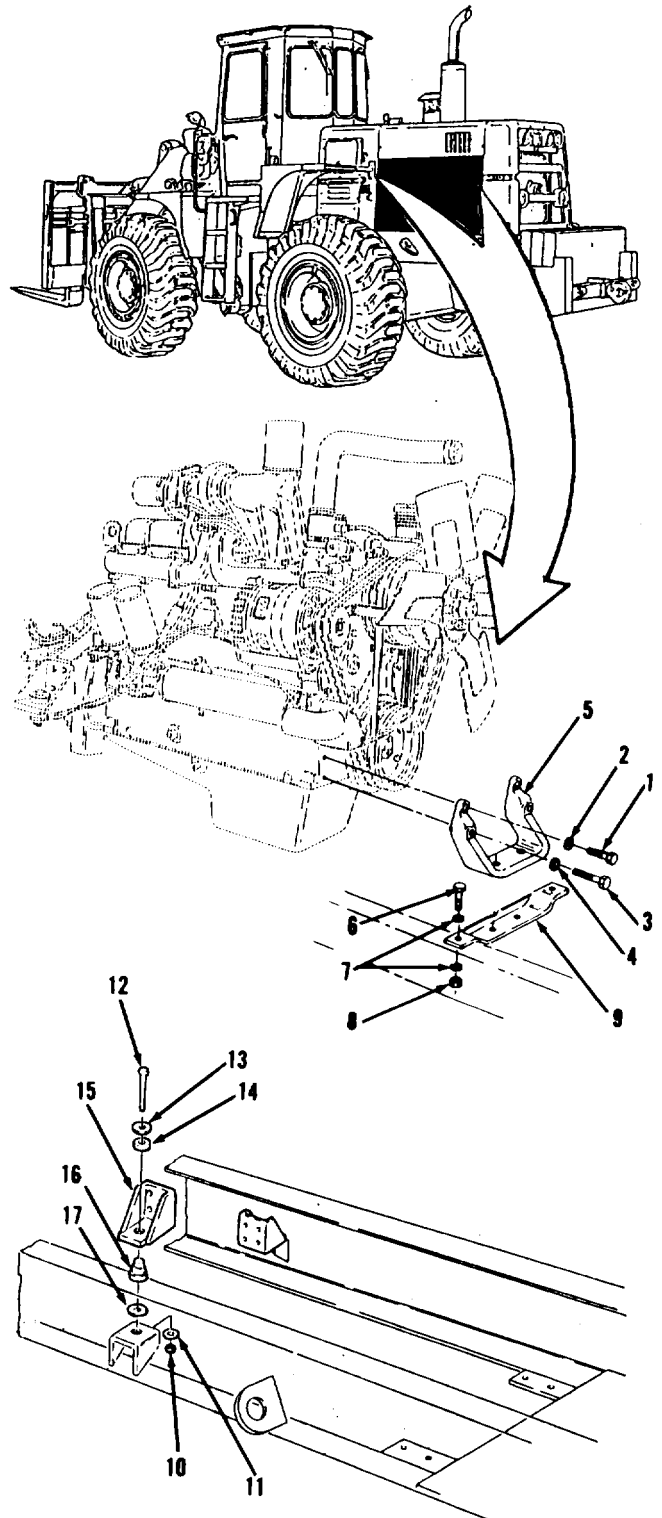
END OF TASK



4-3. Engine Mounts. (Sheet 2 of 4)

REMOVAL

1. Using a 15/16" socket and socket wrench handle, remove two bolts (1), washers (2), bolts (3), washers (4) and front mount (5) from bottom of engine.
2. Remove two bolts (6), four washers (7), two nuts (8) and support (9) from frame.
3. Using a 1-5/16" socket and socket wrench handle, remove nut (10), washer (11), bolt (12), washer (13), mount (14), support (15), mount (16) and washer (17) from frame in rear, left engine compartment.
4. Repeat step 3 for rear, right engine mount assembly.



Go to sheet 3



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-3. Engine Mounts. (Sheet 3 of 4)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

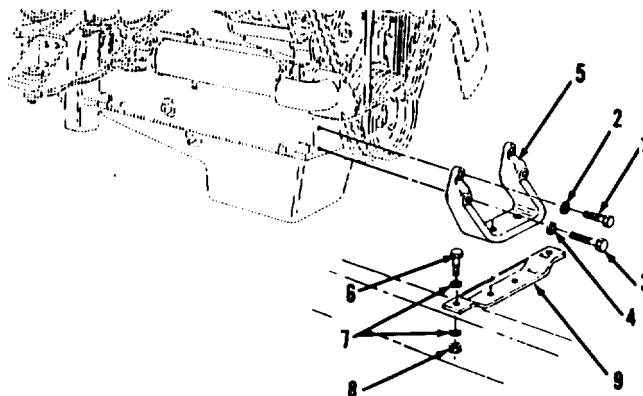
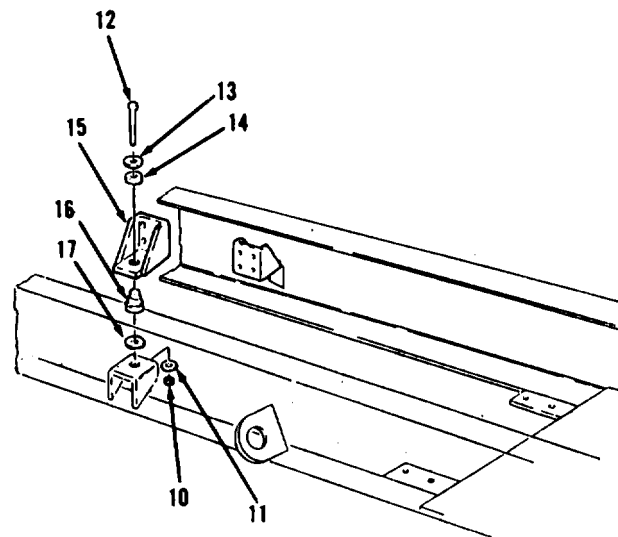
5. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
6. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

4-3. Engine Mounts. (Sheet 4 of 4)

INSTALLATION

7. Using a 1-5/16" socket and socket wrench handle, install washer (17), mount (16), support (15), mount (14), washer (13), bolt (12), washer (11) and nut (10) in frame of rear left engine compartment. Tighten bolt (12) to 320 lb-ft.
8. Repeat step 7 for rear right engine mount assembly.
9. Using a 15/16" socket and socket wrench handle, install support (9), two nuts (8), four washers (7) and two bolts (6) on frame at front of engine compartment. Tighten bolt (6) to 160 lb-ft.
10. Install front mount (5), two washers (4), bolts (3), washers (2) and bolts (1) on bottom front of engine. Tighten bolts (3 and 1) to 160 lb-ft.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-4. Cylinder Head Assembly with Valves. (Sheet 1 of 18)

This task covers:

a. Removal	b. Disassembly/Cleaning/Inspection
c. Assembly	d. Installation
e. Adjustment	

## INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Detergent (App. C, Item 33)  
Engine oil SAE 50  
(App. C, Item 19)  
Emery paper (App. C, Item 4)  
Loctite 262 (App. C, Item 15)  
Prussian blue (App. C, Item 23)  
Clean cloth (App. C, Item 24)  
Silicone sealant (App. C, Item 27)  
Anti-seize compound  
(App. C, Item 1)  
Thermostat housing pressure plate  
(App. D, Item D-1)  
Thermostat housing gasket  
(App. D, Item D-2)  
Bottom pressure plate  
(App. D, Item D-3)  
Gasket  
Wood block (4)  
Sleeve (6)

Test Equipment

Spring Resiliency Tester  
NSN 6635-00-641-7346

Torques

Bolts (4) to 110 lb-ft., 155 lb-ft.  
and 165 lb-ft.

Go to sheet 2

TM 10-3930-643-34

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-4. Cylinder Head Assembly with Valves. (Sheet 2 of 18)

---

EQUIPMENT CONDITION

References

Condition Description

TM 10-3930-643-20

Thermostat, housing and by-pass valve removed.  
Engine water temperature sender removed.  
Engine water temperature switch removed.

Paragraph 4-6

Valve cover and rocker arm assembly removed.

Paragraph 4-11

Manifolds removed.

Paragraph 4-12

Fuel injectors removed.

Paragraph 4-15

Turbocharger removed.

---

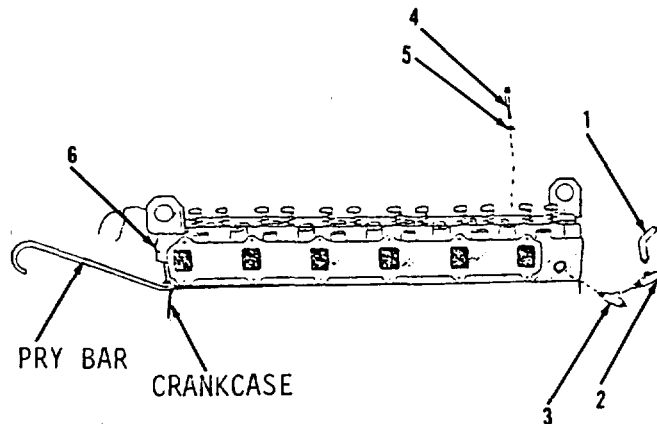
Go to sheet 3

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 3 of 18)

REMOVAL

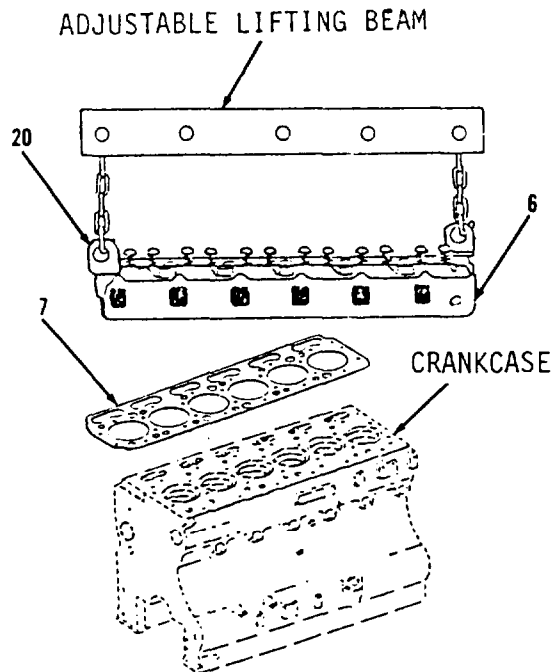
1. Using a flat tip screwdriver, disconnect hose (1) in top, right front of engine.
2. Using a standard pipe wrench or slip joint pliers, remove valve (2) and tee (3).
3. Using a 13/16" socket and socket wrench handle, remove 20 bolts (4) and washers (5) in top of engine.
4. Insert a pry bar at front, left side of cylinder head (6) between indentation and crankcase. Pry with rolling motion to break seal formed by head gasket sealant.



**WARNING**

Weight of cylinder head assembly with valves is 200 lbs. Use adequate hoist and adjustable lifting beam for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

5. Attach hoist and adjustable lifting beam to two lifting brackets (20) and remove cylinder head (6). Supporting cables or chains should be parallel to each other and as near perpendicular to cylinder head (6) as possible. Cylinder head (6) must be placed on wood blocks to protect valves and deck.
6. Using a gasket scraper or putty knife, remove and discard gasket (7).



Go to sheet 4

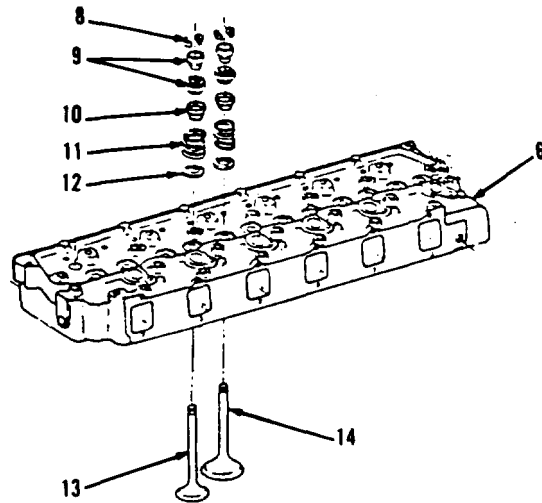
4-4. Cylinder Head Assembly with Valves. (Sheet 4 of 18)

DISASSEMBLY/CLEANING/INSPECTION

NOTE

Identify valves (exhaust valves-small head or intake valves-large head) and their locations. All valves are to be installed in the same location from which they were removed.

7. Using a valve spring lifter tool, compress springs (11) and remove 24 keys (8), 12 rotors (9), shields (10), springs (11) and spring seats (12).
8. Remove 12 rotors (9), shields (10), springs (11) and spring seats (12).
9. Remove six exhaust valves-small head (13) and intake valves-large head (14) from bottom of cylinder head (6).



NOTE

If valve cannot be removed easily, inspect for burrs. If burr exists, remove with a hone to prevent valve guide damage.

Go to sheet 5

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 5 of 18)

DISASSEMBLY/CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

**CAUTION**

After any machining operation or inspection such as Magnaflux, clean parts with P-D-680 and dry with compressed air. Failure to do so will result in premature engine failure.

10. Remove deposits from upper and lower deck of cylinder head (6) using cleaning solvent P-D-680. Refer to paragraph 2-8.

Go to sheet 6

4-4. Cylinder Head Assembly with Valves. (Sheet 6 of 18)

DISASSEMBLY/CLEANING/INSPECTION (cont)

11. Using cleaning solvent P-D-680 and brass wire brush, clean bores. Do not clean valve guides with a brass wire brush. Blow out carbon deposits with compressed air.
12. Clean valve guides with cleaning solvent P-D-680 and a nylon brush that has a slightly larger diameter than guide I.D. Insert brush into guide and with a turning motion, run brush through to insure removal of gum, carbon deposits and rust preventive.
13. Clean six exhaust valves-small head (13) and intake valves-large head (14) with cleaning solvent P-D-680 and a brass wire brush. Remove any burrs from stem and grooves with crocus cloth.
14. Dry all parts with compressed air.
15. Inspect cylinder head (6) for cracks using Magnaflux or dye penetrant method.

NOTE

If cracks are found, cylinder head must be replaced.

16. Using a 9/16" socket and socket wrench handle, install injector nozzles, thermostat housing plate, bottom pressure plate and new gasket (7). Plug ports for water temperature and sending switches.

Go to sheet 7



## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-4. Cylinder Head Assembly with Valves. (Sheet 7 of 18)

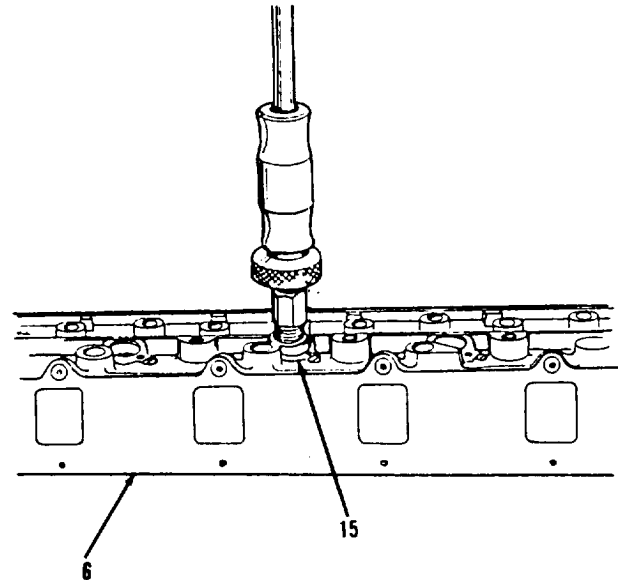
DISASSEMBLY/CLEANING/INSPECTION

17. Attach fitting, pressure gage and hose to thermostat housing plate. Run hot water into cylinder head (6) at 25 psi.
18. Observe cylinder head (6) for leakage at injection nozzle sleeve flanges, upper deck, lower deck, ports and seat insert areas.
19. Inspect lower deck for flatness. Use a straight edge long enough to span both length and width of cylinder head (6). Follow checking pattern shown. Insert feeler gage under each point shown.

## NOTE

Cylinder head must be replaced if 0.003 inch feeler gage can be inserted under straight edge across length or width. Sudden changes in contour such as scratches, gouges, etc., must not exceed 0.002 inches in depth.

20. Remove and discard six sleeves (15) with slide hammer and nozzle sleeve puller adapter.



Go to sheet 8

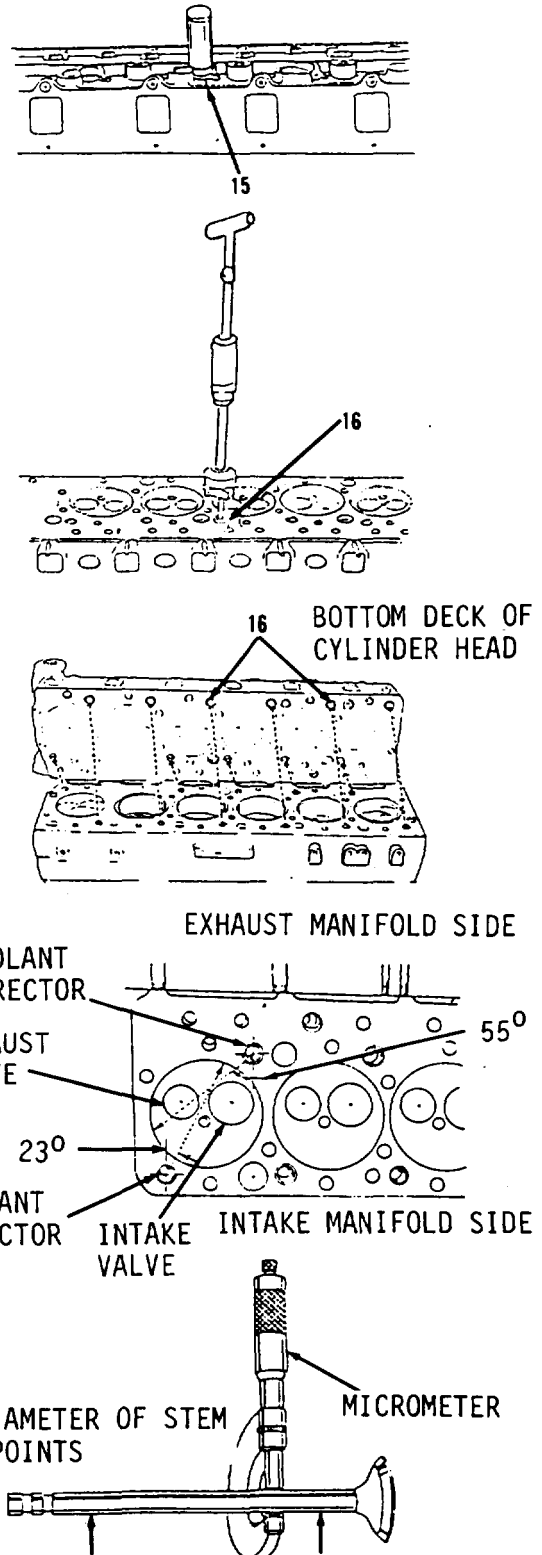
4-4. Cylinder Head Assembly with Valves. (Sheet 8 of 18)

DISASSEMBLY/CLEANING/INSPECTION (cont)

21. Place six new sleeves (15) in cylinder bores and position installing tool. Keep tool centered and tap squarely with brass hammer until six sleeves (15) are bottomed in bores.
22. Inspect 12 coolant directors (16). Replace if loose or restricted. If required, coolant directors (16) may be removed using a slide hammer with a small enough jaw to hook under coolant directors (16) opening.
23. Install new coolant directors (16), as shown, if removed, by tapping into place with a small hammer and block. Recess 0.06 inches below bottom deck of cylinder head (6).
24. Aim 12 new coolant directors (16), as shown.
25. Inspect six exhaust valves-small head (13) and intake valves-large head (14) for excessive wear, burn marks, warpage, pitting or scuffing at valve stem grooves, valve stems and heads. Replace if bent, worn, burned, warped, pitted or scuffed.
26. Measure valve stem diameter in two places, as shown. Valve stem should be 0.3718 inches.

NOTE

If stem is more than 0.001 inches undersize, replace valve.



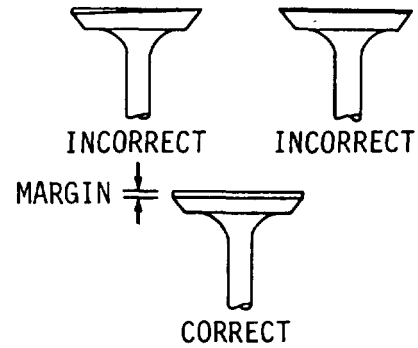
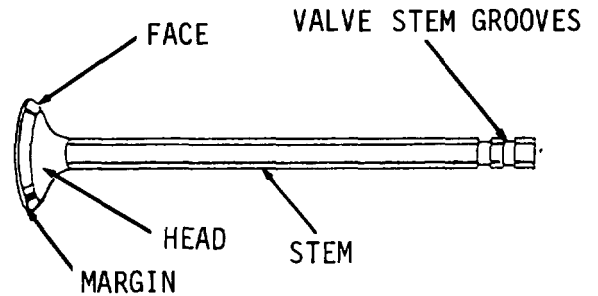
Go to sheet 9

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 9 of 18)

DISASSEMBLY/CLEANING/INSPECTION

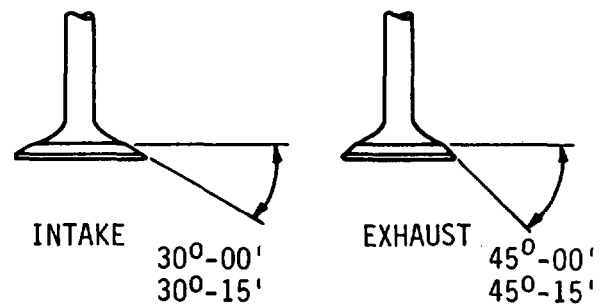
27. Check valve stem ends. If worn, grind ends square.
28. Resurface valve face angle, if necessary. Maintain valve face margin, as shown. A minimum margin must be maintained of 0.088 inches for intake valves-large head (14) and 0.045 inches for exhaust valves-small head (13).
29. Maintain valve face angles, as shown. Valve must be replaced if more than 0.008 inches of stock is removed or margin falls below minimum specification in Step 31.
30. After resurfacing, check valve face runout with dial indicator.



NOTE

Valve must be replaced if total indicator reading is greater than 0.002 inches.

31. Check valve face contact with Prussian blue. Bluing should appear around entire contact surface of valve face and valve seat. If bluing does not appear around entire contact surface, angles do not match. Valve seats must be resurfaced.



Go to sheet 10

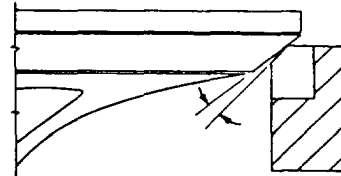
4-4. Cylinder Head Assembly with Valves. (Sheet 10 of 18)

DISASSEMBLY/CLEANING/INSPECTION (cont)

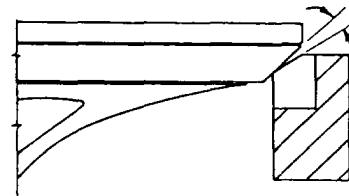
- 32. Recheck valve face contact with Prussian blue if valve seats are resurfaced.
- 33. Place valves in proper guides and position dial indicator against stem. Raise valve approximately 0.5 inches. Move valve against and away from dial indicator parallel to cylinder head (6).

NOTE

If total indicator reading is more than 0.004 inches, send cylinder head to General Support.



CORRECT

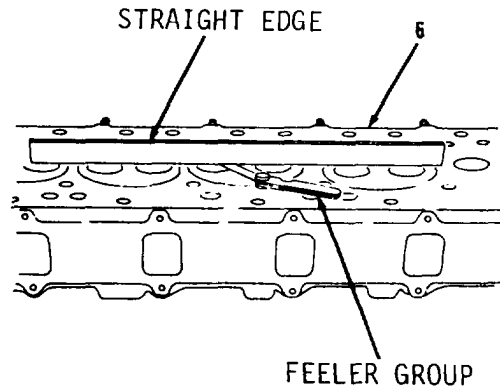


INCORRECT

- 34. Check valve seat for correct width, as shown. If necessary, correct width by grinding top edge of valve seat with a stone of smaller angle (preferably 15 degrees) than valve seat.

NOTE

If valve does not seat properly after resurfacing valve seats, cylinder head must be sent to General Support.



- 35. Insert valves in cylinder head (6). Invert cylinder head (6). Place straight edge across valves. Measure distance from valves to straight edge. Distance should be 0.000 to 0.014 inches. If necessary, grind seat to different angle to obtain correct distance.

Go to sheet 11

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

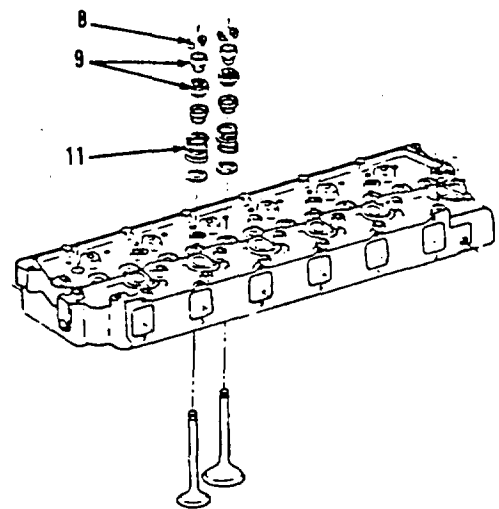
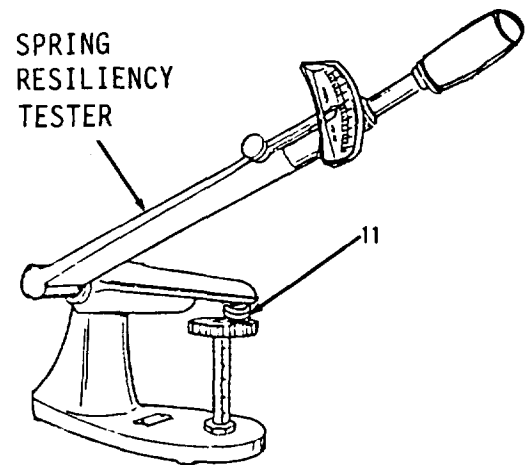
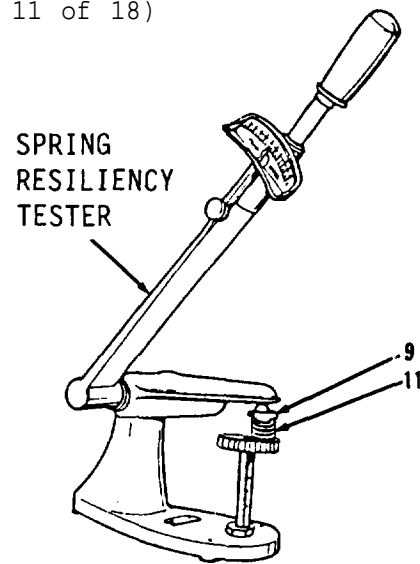
4-4. Cylinder Head Assembly with Valves. (Sheet 11 of 18)

DISASSEMBLY/CLEANING/INSPECTION

NOTE

Valve springs are tested on spring tester.

36. Check 12 springs (11) and spring seats (12) for rust, pitting and cracks. Replace if rusted, pitted or cracked.
37. Measure free length of springs (11). Free length should be 2.34 inches.
38. Apply 66 to 70 lbs. pressure to springs (11) in spring resiliency tester and measure length (maximum length with valve open). Spring (11) length should be 2.007 inches.
39. Apply 156 to 164 lbs. pressure to springs (11) in spring resiliency tester and measure length (minimum length with valve open). Spring length should be 1.552 inches.
40. Inspect 24 keys (8) inside rib and outside of 24 keys (8). Replace if worn.
41. Inspect 12 rotors (9). Place springs (11) with rotor (9) in spring tester.
42. Place ball bearing between rotor and ram of spring tester.
43. Compress valve spring (11) and observe motion of rotor. Rotor should turn counterclockwise. Replace rotors which do not turn.
44. Check oil seal on rotor for wear. Replace rotor with worn seal.



Go to sheet 12

4-4. Cylinder Head Assembly with Valves. (Sheet 12 of 18)

DISASSEMBLY/CLEANING/INSPECTION (cont)

45. Using a ball peen hammer and flat punch, a 13/16" socket, a socket wrench handle, 2-7/16" nuts and two 5/8" open end wrenches, remove six plugs (17 and 18), sleeves (19), and 12 studs (20).
46. Using a 13/16" socket and socket wrench handle, remove two bolts (21) and brackets (21a).

**WARNING**

- TOXIC/FLAMMABLE

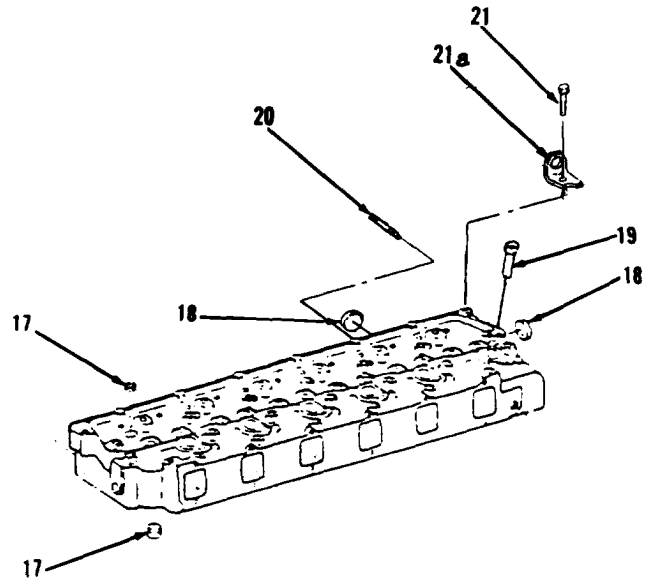
Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

- COMPRESSED AIR HAZARD

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

47. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
48. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 13

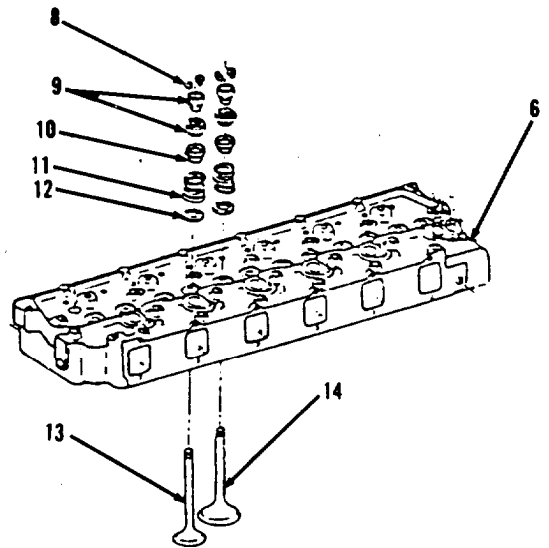


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 13 of 18)

ASSEMBLY

49. Using a 13/16" socket and socket wrench handle, install two brackets (21a) and bolts (21).
50. Coat 12 studs (20) with anti-seize compound.
51. Coat back and sides of plugs (18 and 17) with silicone sealant.
52. Using two 7/16" nuts and two 5/8" open end wrenches, a 13/16" socket, socket wrench handle and ball peen hammer, install 12 studs (20), six sleeves (19) and plugs (18 and 17).
53. Coat six intake valves-large head (14) and exhaust valves-small head (13) with clean engine oil.



NOTE

Valves must be installed in same location from which they were removed.

54. Install valves from bottom of cylinder head (6).
55. Using a valve spring lifter tool, install 12 spring seats (12), springs (11), shields (10) and rotors (9) on valve stems.
56. Compress valve springs (11) with valve spring lifter and install 24 keys (8). If necessary, tap top of valves with rubber or plastic mallet to seat keys (8).

Go to sheet 14

4-4. Cylinder Head Assembly with Valves. (Sheet 14 of 18)

INSTALLATION

NOTE

Before installing cylinder head, check cylinder sleeve protrusion on crankcase, refer to paragraph 13-3. If protrusion above crankcase is less than 0.002 to 0.005 inches, return crankcase to General Support.

- 57. Install new gasket (7) in top of engine. New gasket (7) is provided with premeasured sealant. Do not use gasket cement. Cylinder head (6) transfer may be adversely affected.
- 58. Insure that gasket (7) surfaces on cylinder head (6) are clean and dry.

**WARNING**

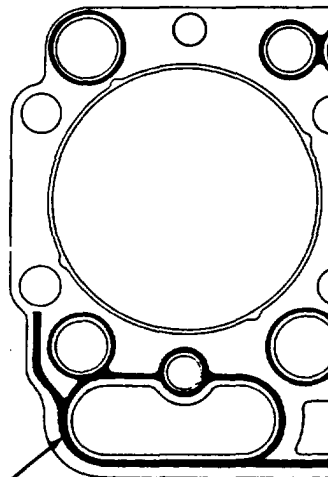
COMPRESSED AIR HAZARD

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

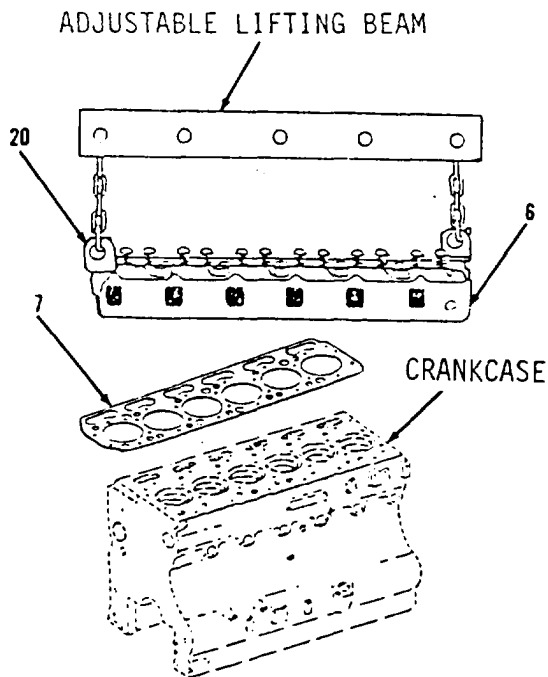
- 59. Blow out holes in cylinder head (6) and crankcase with compressed air.

NOTE

Bolt holes must be free of foreign matter to prevent hydrostatic lock and possible block cracking when bolts are tightened.



PREMEASURED SEALANT



Go to sheet 15

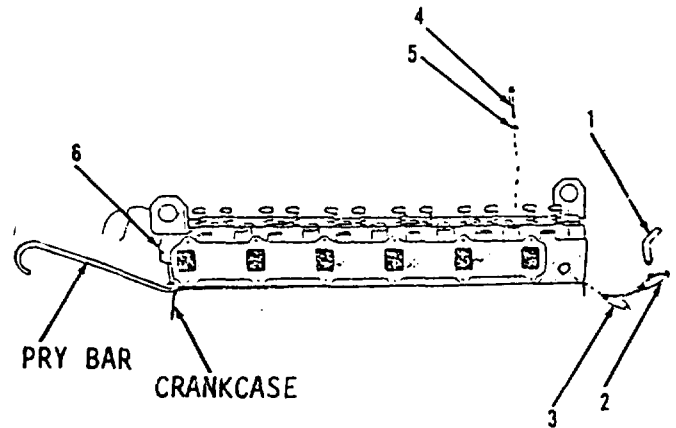


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 15 of 18)

INSTALLATION

60. Attach adjustable lifting beam and hoist to two lifting brackets (20). Supporting cables or chains should be parallel to each other and as near perpendicular to cylinder head (6) as possible.
61. Install cylinder head (6). Be sure to maintain gasket (7) alignment during installation.
62. Lubricate bolt threads and head seating areas with clean engine oil.
63. Install 20 washers (5) and bolts (4). Do not tighten.
64. Using a standard pipe wrench or slip joint pliers, install tee (3) and valve (2) in top, right front of engine.
65. Using a flat tip screwdriver, connect hose (1).
66. Install rocker arm assembly on cylinder head (6), refer to paragraph 4-6.



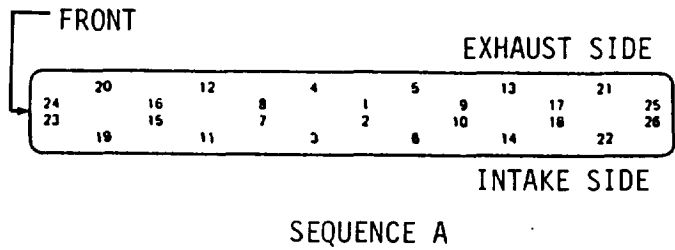
NOTE

Rocker arm mounting bolts are included in tightening sequence with 20 cylinder head mounting bolts.

4-4. Cylinder Head Assembly with Valves. (Sheet 16 of 18)

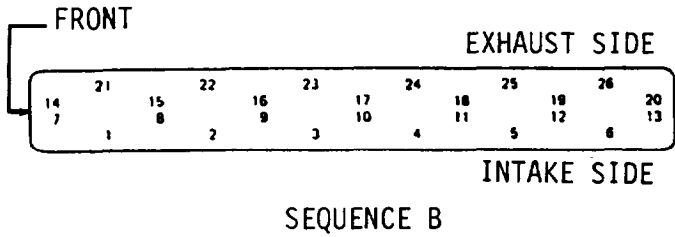
INSTALLATION (cont)

- 67. Using a 1/2" drive torque wrench, tighten bolts (4) to 110 lb-ft following sequence A.
- 68. Check two end rocker arms for freedom of motion.
- 69. Tighten bolts (4) to 155 lb-ft following sequence A.
- 70. Tighten bolts (4) in rows to 165 lb-ft following sequence B.



NOTE

Return vehicle to original equipment condition.



- 71. Operate engine under load for at least one hour, refer to TM 10-3930-643-10.
- 72. Retighten cylinder head bolts according to procedure given in step 69.

Go to sheet 17

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-4. Cylinder Head Assembly with Valves. (Sheet 17 of 18)

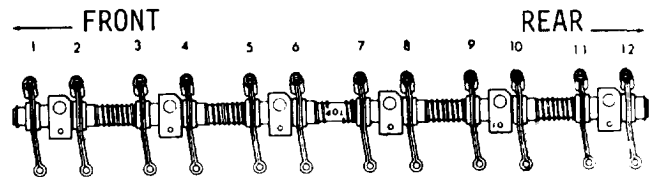
ADJUSTMENT

NOTE

- Adjustment is to be made on a warm engine.
- All valves are adjusted by only cranking the engine twice.

73. Remove valve cover, refer to paragraph 4-6.
74. Turn crankshaft until number one piston is on the compression stroke and timing pointer on front cover is in line with the TDC mark (pin) on vibration damper.

WITH	ADJUST VALVES												
No. 1 Piston at T.C.C. (Compression)	1	2	3			6	7		10				
No. 6 Piston at T.D.C. (Compression)				4	5			8	9		11	12	



VALVE ARRANGEMENT

**CAUTION**

Do not adjust valves with engine running. Severe damage can result if feeler gage is inserted between valve and valve lever due to close clearance of valve to piston.

NOTE

- Be sure that the number one piston is on the compression stroke.
75. Turn both push rods by hand until both valves are closed. Valves are closed when push rods are loose and can be turned easily.

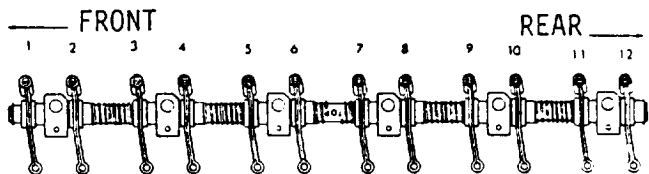
Go to sheet 18

4-4. Cylinder Head Assembly with Valves. (Sheet 18 of 18)

ADJUSTMENT (cont)

- 76. Adjust valves. Six valves are adjusted when No. 1 piston is at TDC (compression) and remaining six are adjusted when No. 6 piston is at TDC (compression). Refer to Valve Arrangement illustration for numbering sequence of valves which correspond to the chart. Numbers 1, 3, 5, 7, 9 and 11 are intake valves and numbers 2, 4, 6, 8, 10 and 12 are
- 77. Tighten adjusting screw nuts to 20 lb-ft.
- 78. Install valve cover, refer to paragraph 4-6.

WITH	ADJUST VALVES												
No 1 Piston at TDC (Compression)	1	2	3			6	7			10			
No 6 Piston at TDC (Compression)				4	5			8	9		11	12	



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-5. Vibration Damper. (Sheet 1 of 4)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Machine  
Shop : Field Maintenance,  
Basic, Less Power  
NSN 3470-00-754-0708

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
No. 2 Permatex sealant  
(App. C, Item 26)

Torques

Bolt (4) to 125 lb-ft.

Test Equipment

Dial indicator

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Drive belts removed.

Go to sheet 2

4-5. Vibration Damper. (Sheet 2 of 4)

REMOVAL

NOTE

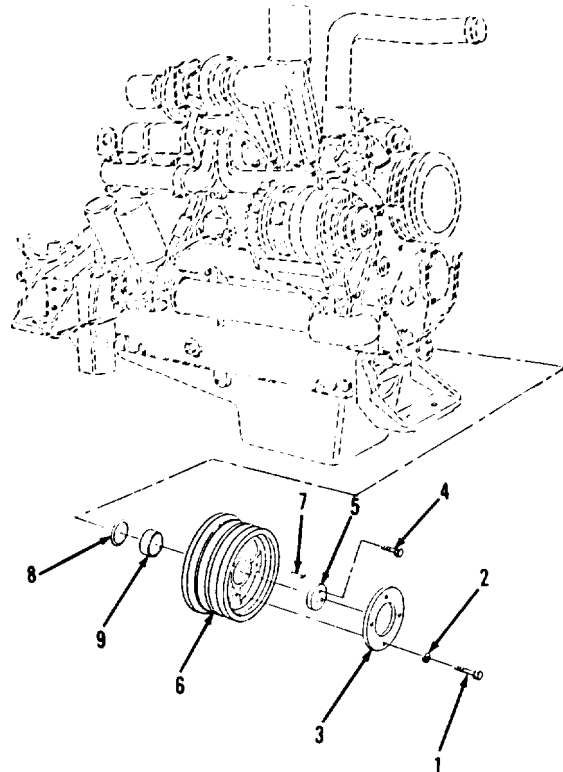
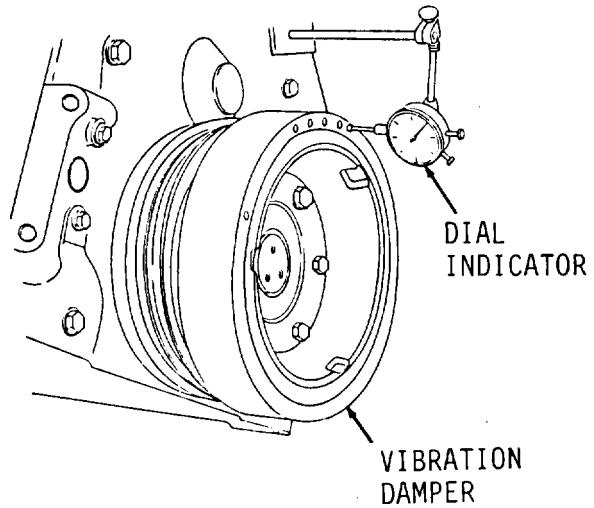
Before removing vibration damper, check for wobble using dial indicator. If wobble exceeds 0.06 inch total indicator reading, replace vibration damper.

1. Using a 9/16" socket and socket wrench handle, remove four bolts (1), washers (2) and plate (3) in front, bottom of engine.
2. Using a 3/4" socket and socket wrench handle, remove three bolts (4) and plate (5).
3. Pull vibration damper (6) and key (7) off crankshaft using puller.
4. Remove spring washer (8).

**CAUTION**

Use care during removal to avoid damaging the vibration damper hub.

5. Remove wear sleeve (9) from vibration damper (6) using chisel to split wear sleeve (9). Remove wear sleeve (9) only if it is worn, scratched or nicked.



Go to sheet 3

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-5. Vibration Damper. (Sheet 3 of 4)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

6. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
7. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

4-5. Vibration Damper. (Sheet 4 of 4)

INSTALLATION

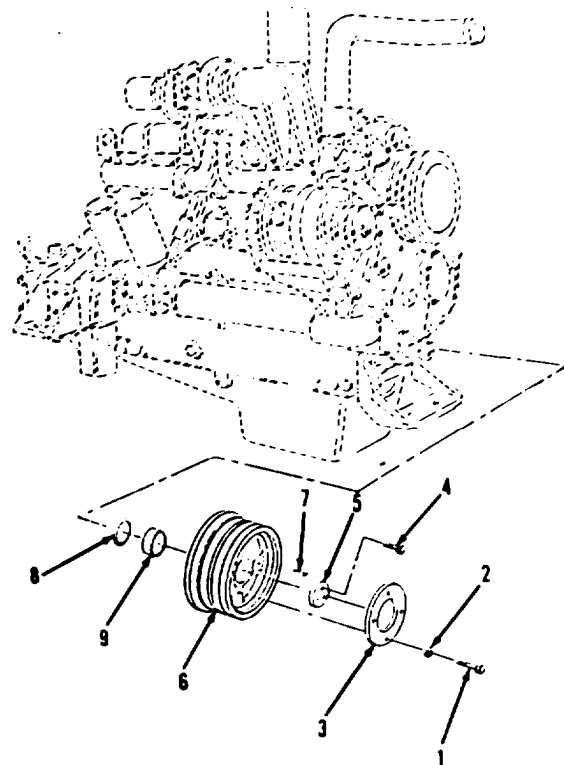
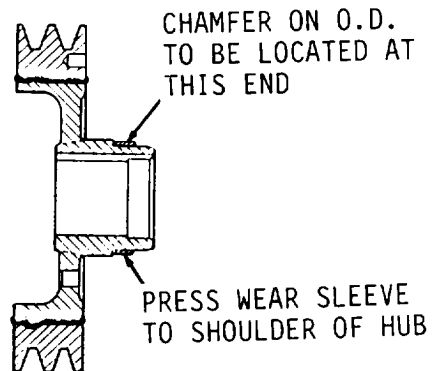
8. Using sleeve installer, press wear sleeve (9) on vibration damper (6).
9. Install spring washer (8) in bottom, front of engine.

**CAUTION**

- Do not attempt to install vibration damper cold.
  - Do not heat vibration damper for more than one hour to avoid damage to the elastic member.
10. Heat vibration damper (6) in boiling water.
  11. Lightly coat key (7) and keyway area with No. 2 Permatex sealant.
  12. Using a ball peen hammer, install key (7) and vibration damper (6).
  13. After installing vibration damper (6), remove excess No. 2 Permatex sealant from mounting surfaces.
  14. Using a 3/4" socket and socket wrench handle, install plate (5) and three bolts (4). Tighten three bolts (4) to 125 lb-ft.
  15. Using a 9/16" socket and socket wrench handle, install plate (3), four washers (2) and bolts (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-6. Rocker Arm Assembly and Valve Cover. (Sheet 1 of 9)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Liquid gasket, Type I  
(App. C, Item 14)  
Gasket  
Preformed packing (6)

Torques

Bolt (7) to 26 in-lb.  
Stud (9) to 26 in-lb.  
Bolt (13) to 110 lb-ft. and  
165 lb-ft.  
Nut (24) to 20 lb-ft.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Engine top access cover removed.  
Crankcase ventilation and mounting  
removed.

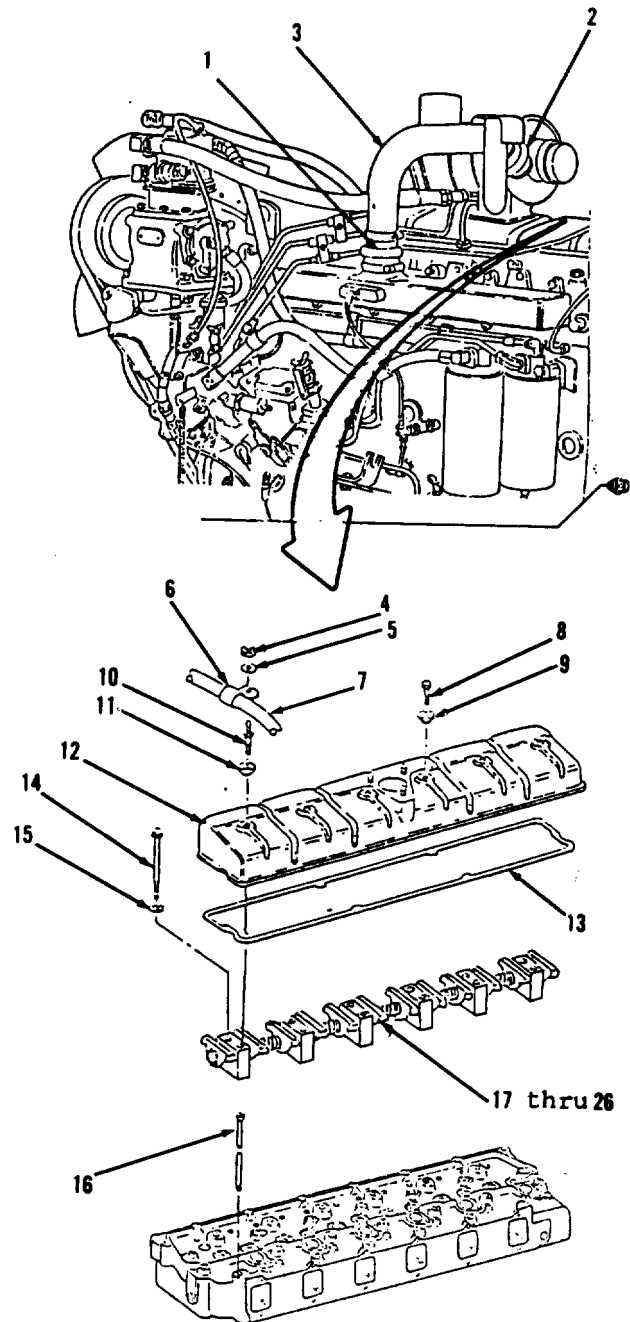
4-6. Rocker Arm Assembly and Valve Cover. (Sheet 2 of 9)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a flat tip screwdriver, loosen clamps (1 and 2) on top of engine.
2. Remove tube assembly (3).
3. Using a 1/2" socket and socket wrench handle, remove nut (4), washer (5) and clamp (6). push hose assembly (7) to side of engine.
4. Remove five bolts (8), preformed packings (9), stud (10), preformed packing (11), access cover (12) and gasket (13). Discard five preformed packings (9), preformed packing (11) and gasket (13). Remove all gasket material from mounting surfaces.
5. Using a 9/16" socket and socket wrench handle, remove six bolts (14), washers (15) and items 17 through 26 as an assembly.
6. Remove 12 push rods (16) from cylinder head.



## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

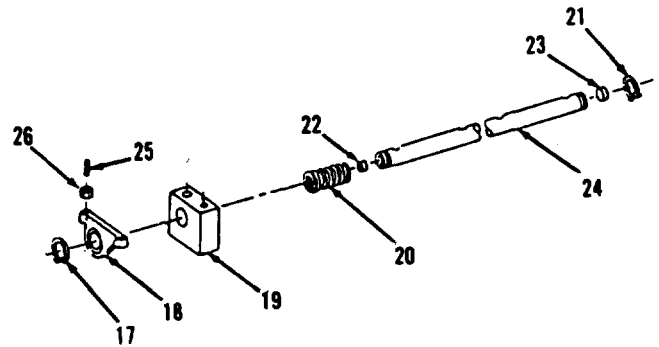
## 4-6. Rocker Arm Assembly and Valve Cover. (Sheet 3 of 9)

DISASSEMBLY

## NOTE

Take note of the position of the rocker arms to aid in installation.

7. Using internal snap ring pliers or small flat tip screwdriver, remove retaining ring (17), 12 rocker arms (18), six brackets (19), five springs (20) and retaining ring (21).
8. Using a small flat drift punch and hammer, remove plugs (22 and 23) from shaft (24).
9. Using a flat tip screwdriver and 9/16" open end wrench, remove setscrew (25) and nut (26) from rocker arm (18).



Go to sheet 4

4-6. Rocker Arm Assembly and Valve Cover. (Sheet 4 of 9)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

10. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
11. Inspect shaft (22) for rocker arm wear and on flat surface for straightness. Replace shaft (22) if worn or bent.

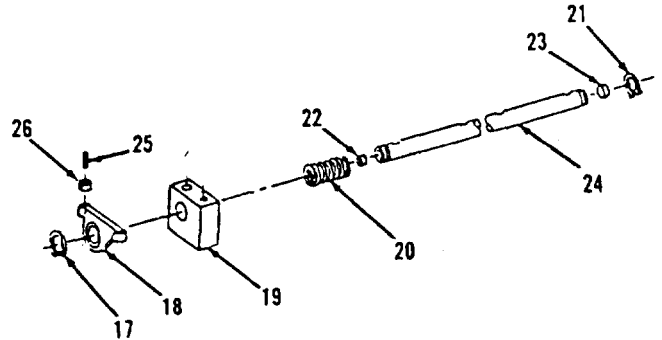
Go to sheet 5

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-6. Rocker Arm Assembly and Valve Cover. (Sheet 5 of 9)

CLEANING/INSPECTION

12. Inspect setscrew (25) for wear at contact surface and for thread wear. Replace worn setscrew (25).
13. Inspect valve stem contact surface on 12 rocker arms (18). Replace rocker arms (18) if severely worn.
14. Measure outside diameter of five springs (20). Outside diameter should be 1.02 inches.
15. Measure free length of five springs (20). Length should be 4.06 inches.
16. Using a spring resiliency tester, apply 7 lb. compression load to five springs (20) and measure test length. Length of five springs (20) should be 2.07 inches.
17. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

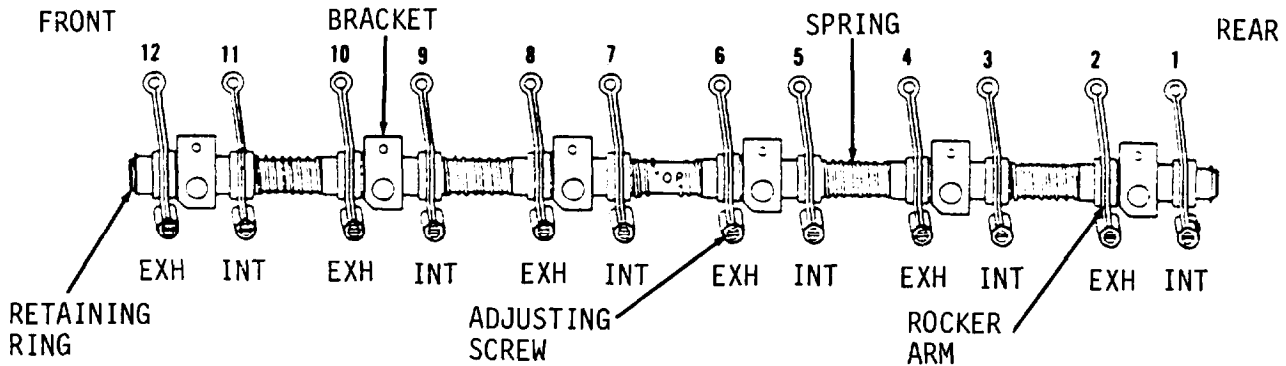
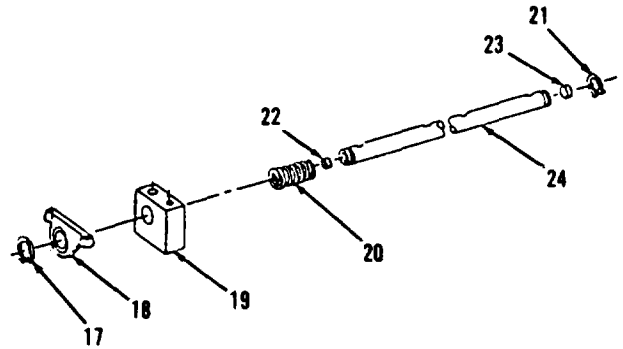
18. Using a flat tip screwdriver and 9/16" open end wrench, install nut (26) and setscrew (25) on rocker arm (18).
19. Apply liquid gasket to threads on plugs (23 and 22) and in shaft (24) and install plugs (23 and 22) in shaft (24).

Go to sheet 6

4-6. Rocker Arm Assembly and Valve Cover. (Sheet 6 of 9)

INSTALLATION

20. Slide spring (20) to center of shaft (24). Position shaft (24) with side marked TOP up, as shown.
21. Install two rocker arms (18) on each side of spring (20). Adjusting screw must be toward assembler, as shown.
22. Install two brackets (19) on each end of spring (20) next to two rocker arms (18). Tapped hole must be away from assembler and the bolt holes must align with notches in shaft (24).
23. Install four springs (20), ten rocker arms (18) and four brackets (19). Observe order of assembly, as shown.



24. Using internal snap ring pliers, install retaining rings (21 and 17).

Go to sheet 7

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-6. Rocker Arm Assembly and Valve Cover. (Sheet 7 of 9)

INSTALLATION

25. Install 12 push rods (16) in cylinder head.

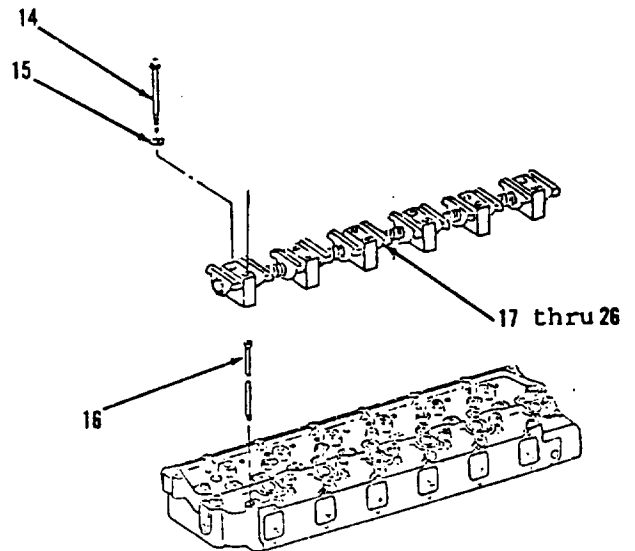
**CAUTION**

Bolts must be tighten evenly to avoid bending shaft,

26. Using a 9/16" socket and socket wrench handle, install items (26 through 17) as an assembly, six washers (15) and bolts (14). Tighten six bolts (14) in two stages to 110 lb-ft and 165 lb-ft.

## NOTE

It is necessary to adjust the rocker arm assembly before completing the installation procedure.



Go to sheet 8

4-6. Rocker Arm Assembly and Valve Cover. (Sheet 8 of 9)

ADJUSTMENT



Do not adjust valves with engine running. Severe damage can result from inserting feeler gage between valve and rocker arm because of limited clearance.

NOTE

All valves are adjusted by cranking the engine twice. Perform valve lash adjustment with the engine at any temperature above freezing.

27. Turn crankshaft on bottom, front of engine until exhaust valve closes on No. 1 cylinder. Continue turning until TDC mark (pin) on vibration damper is in line with timing pointer on front cover. No. 1 piston will be on compression stroke.

---

VALVE LASH ADJUSTMENT CHART

ENGINE	ENGINE Serial No.	INTAKE In.	EXHAUST In.
DT 466B	110913 and below	0.020	0.025
DT-466B	110914 and above	0.025	0.025

---

Go to sheet 9

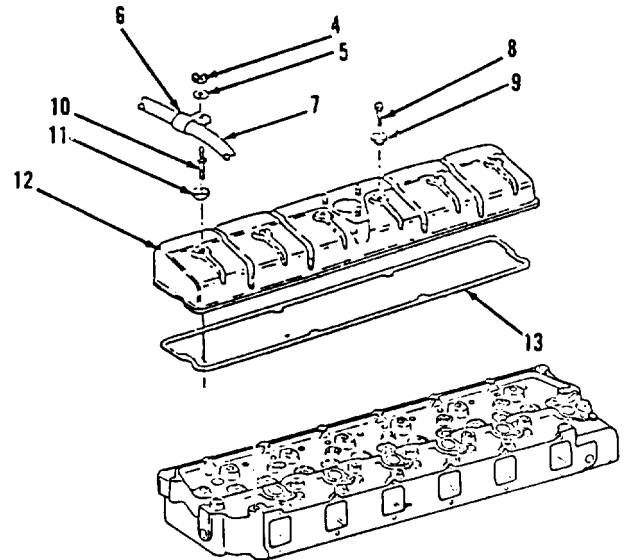


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-6. Rocker Arm Assembly and Valve Cover. (Sheet 9 of 9)

ADJUSTMENT

28. Using a flat tip screwdriver, a 9/16" open end wrench and a feeler gage, adjust rocker arm numbers 1, 2, 3, 6, 7 and 10 in top of engine, refer to Valve Lash Adjustment Chart.
29. Turn crankshaft on bottom, rear of engine until No. 6 piston is at TDC (compression) which is one complete revolution of vibration damper,
30. Adjust rocker arm numbers 4, 5, 8, 9, 11 and 12, refer to Valve Lash Adjustment Chart.
31. Using a flat tip screwdriver, a 9/16" open end wrench and a feeler gage, tighten 12 nuts (26) to 20 lb-ft.

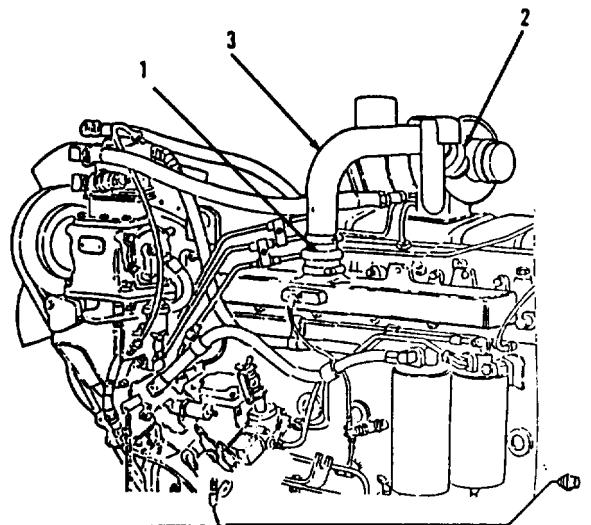


NOTE

If valve are in correct adjustment, proceed to installation.

INSTALLATION

32. Using a 1/2" socket and socket wrench handle, install new gasket (13), access cover (12), new preformed packing (11), stud (10), five new preformed packing (9) and bolts (8). Tighten bolts (8) and stud (10) to 26 lb-ft.
33. Position hose assembly (7) and using a 1/2" socket and socket wrench handle, install clamp (6), washer (5) and nut (4).
34. Install tube assembly (3).
35. Using a flat tip screwdriver, tighten clamps (2 and 1).



NOTE

Return M10A Forklift to original END OF TASK equipment condition.

TM 10-3930-643-34

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-7. Oil Pan (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Gasket

Torques

Bolts (1) to 20 lb-ft.  
Drain plug (4) to 33 lb-ft.

---

EQUIPMENT CONDITION

References

LO 10-3930-643-12  
TM 10-3930-643-20  
Paragraph 4-16

Condition Description

Oil drained.  
Oil drain line and fittings removed.  
Fuel tank removed.

---

Go to sheet 2

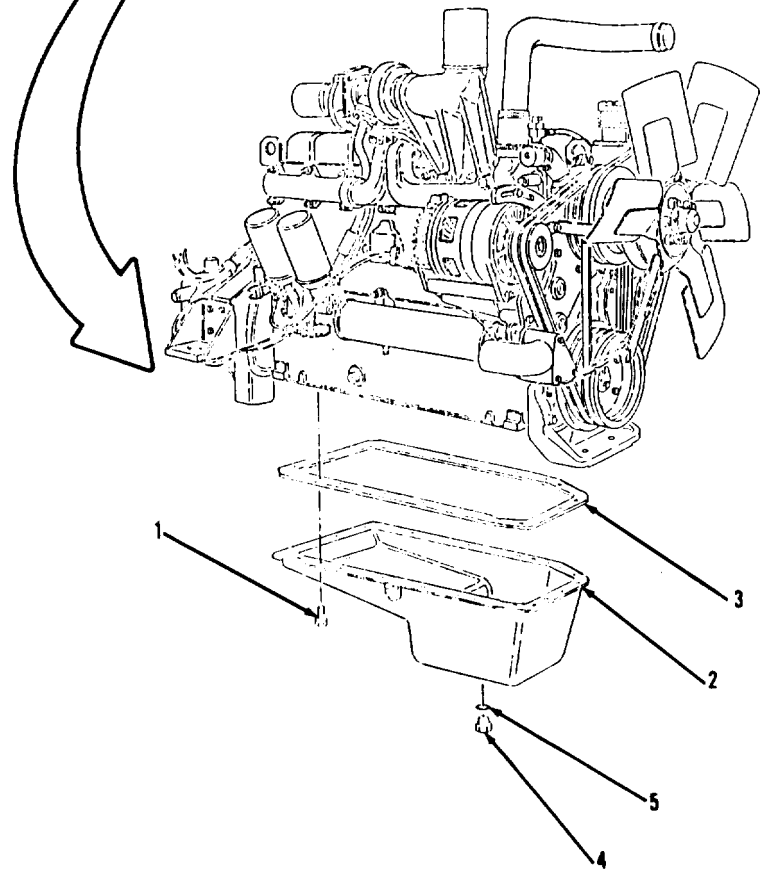
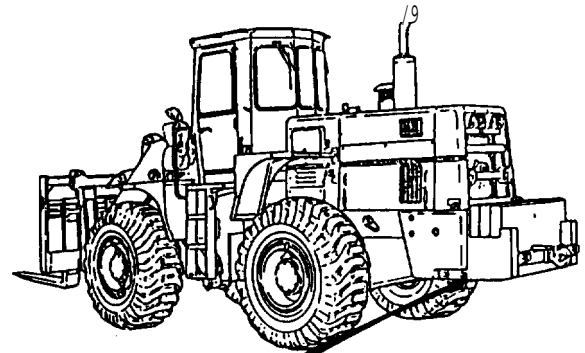
4-60

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-7. Oil Pan. (Sheet 2 of 4)

REMOVAL

1. Using a 1/2" socket, socket wrench handle and a putty knife, remove 34 bolts (1), oil pan (2) and gasket (3) from bottom of engine. Discard gasket (3). Remove all gasket material from mounting surfaces.
2. Using a 1-1/4" socket and socket wrench handle, remove drain plug (4) and washer (5) from oil pan (2).



Go to sheet 3

4-7. Oil Pan. (Sheet 3 of 4)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

3. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
4. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

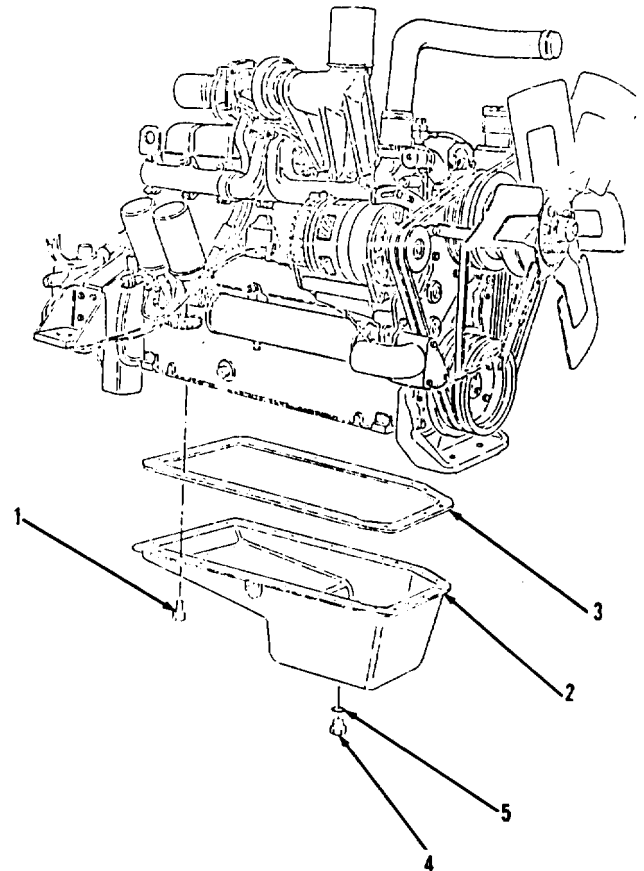
## 4-7. Oil Pan. (Sheet 4 of 4)

INSTALLATION

5. Using a 1-1/8" socket and socket wrench handle, install washer (5) and drain plug (4) in oil pan (2). Tighten drain plug (4) to 33 lb-ft.
6. Using a 1/2" socket and socket wrench handle, install new gasket (3), oil pan (2) and 34 bolts (1) in bottom of engine. Tighten bolts (1) to 20 lb-ft.

## NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TM 10-3930-643-34

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-8. Oil Filter Base. (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Test Equipment

Spring Resiliency Tester  
NSN 6635-00-641-7346

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Teflon thread sealant  
(App. C, Item 31)  
Gasket (2)

Torques

Plug (7) to 50 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Oil filter elements removed.

---

Go to sheet 2

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

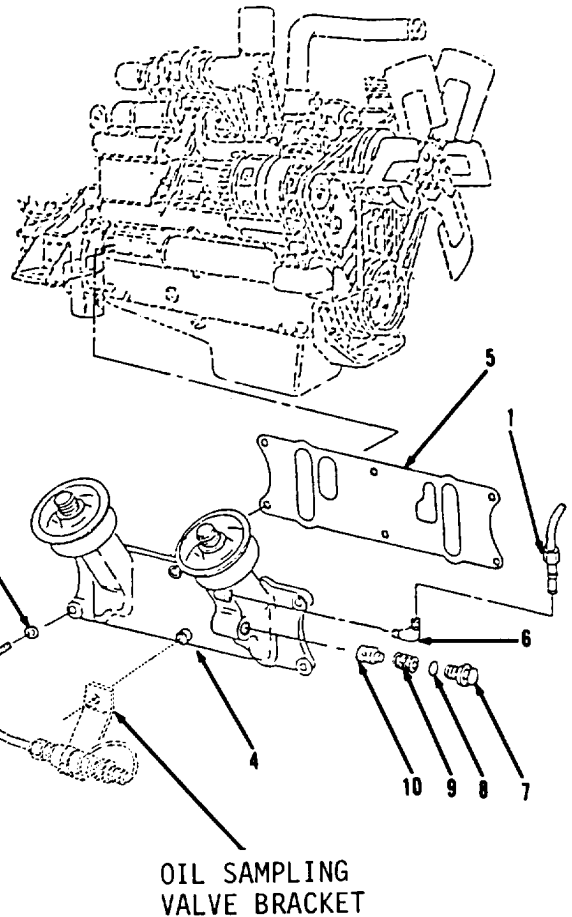
4-8. Oil Filter Base. (Sheet 2 of 4)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 3/4" open end wrench, disconnect turbocharger oil line (1) on front, left side of engine.
2. Using a 9/16" socket and socket wrench handle, remove six bolts (2), washers (3), oil filter base (4) and gasket (5). Discard gasket (5). Remove all gasket material from mounting surfaces.



NOTE

- On vehicles S/N 2001 and above, slide oil filter base and gasket out from behind oil sampling valve bracket.
- Do not mix bolts with any other hardware. One bolt hole connects oil pressure gallery and requires special bolts to prevent leaks.

3. Using a 3/4" open end wrench, remove elbow (6).
4. Using a 5/8" socket and socket wrench handle, remove plug (7), gasket (8), spring (9) and check valve (10). Discard gasket (8). Remove all gasket material from mounting surfaces.

4-8. Oil Filter Base. (Sheet 3 of 4)

CLEANING/INSPECTION

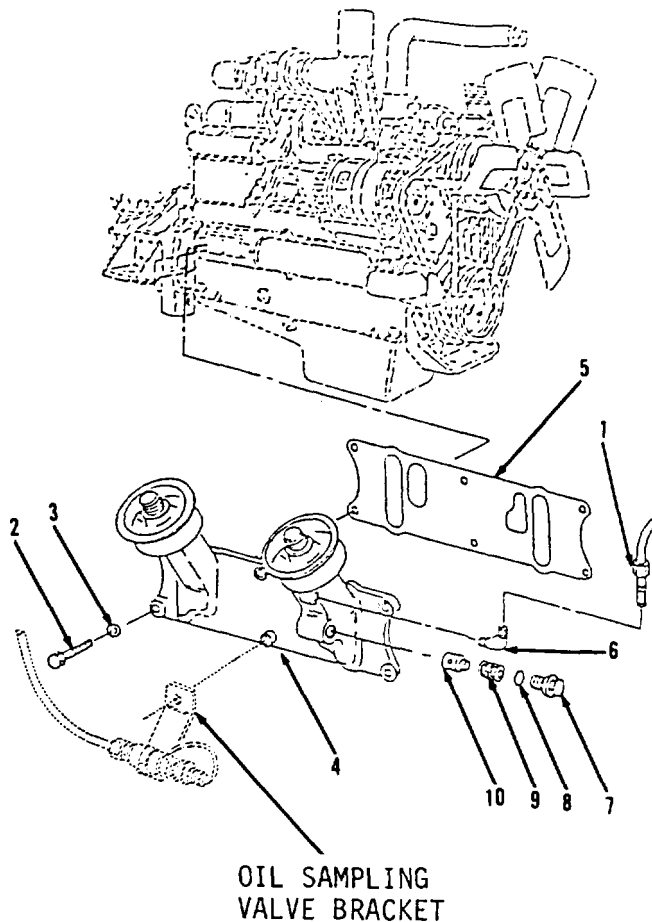
**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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



5. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
6. Inspect oil filter base (4). Replace if cracked, warped, distorted or damaged. Check inlet and outlet passages for dirt or blockage. Remove blockage or replace.
7. Inspect check valve (10). Replace if worn or damaged.
8. Using a spring resiliency tester, measure free length of spring (9). Free length should be 2.075 inches.

Go to sheet 4



## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-8. Oil Filter Base. (Sheet 4 of 4)

CLEANING/INSPECTION

9. Apply test load of 6.12 lb-ft to spring (9).
10. Measure test length of spring (9). Test length should be 0.927 inches.
11. Replace spring (9) if free or test length does not meet specifications.
12. Inspect all other parts. Refer to paragraph 2-9.

INSTALLATION

13. Using a 5/8" socket, socket wrench handle and torque wrench, install check valve (10), spring (9), new gasket (8) and plug (7). Tighten plug (7) to 50 lb-ft.
14. Using a 3/4" open end wrench, coat threads of elbow (6) with sealant and install elbow (6).

## NOTE

On vehicles S/N 2001 and above,  
slide gasket and oil filter behind  
oil sampling valve.

15. Using a 9/16" socket and socket wrench handle, install new gasket (5), oil filter base (4), six washers (3) and bolts (2) on front, left side of engine.
16. Using a 3/4" open end wrench, connect turbocharger oil line (1).

## NOTE

Return M10A Forklift to original  
equipment condition.

END OF TASK

4-9. Oil Cooler. (Sheet 1 of 5)

This task covers:      a. Removal                                  b. Cleaning/Inspection  
                                c. Testing    d. Installation

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Oil cooler pressure plate (2)  
(App. D, Item D-5)  
Seal (4)  
Preformed packing (4)  
Nut (4)

Torques

Except for special torques shown,  
all fasteners are tightened to  
standard torques. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

LO 10-3930-643-12  
  
TM 10-3930-643-20

Condition Description

Oil drained.  
  
Coolant drained.  
Left side engine access cover removed.

---

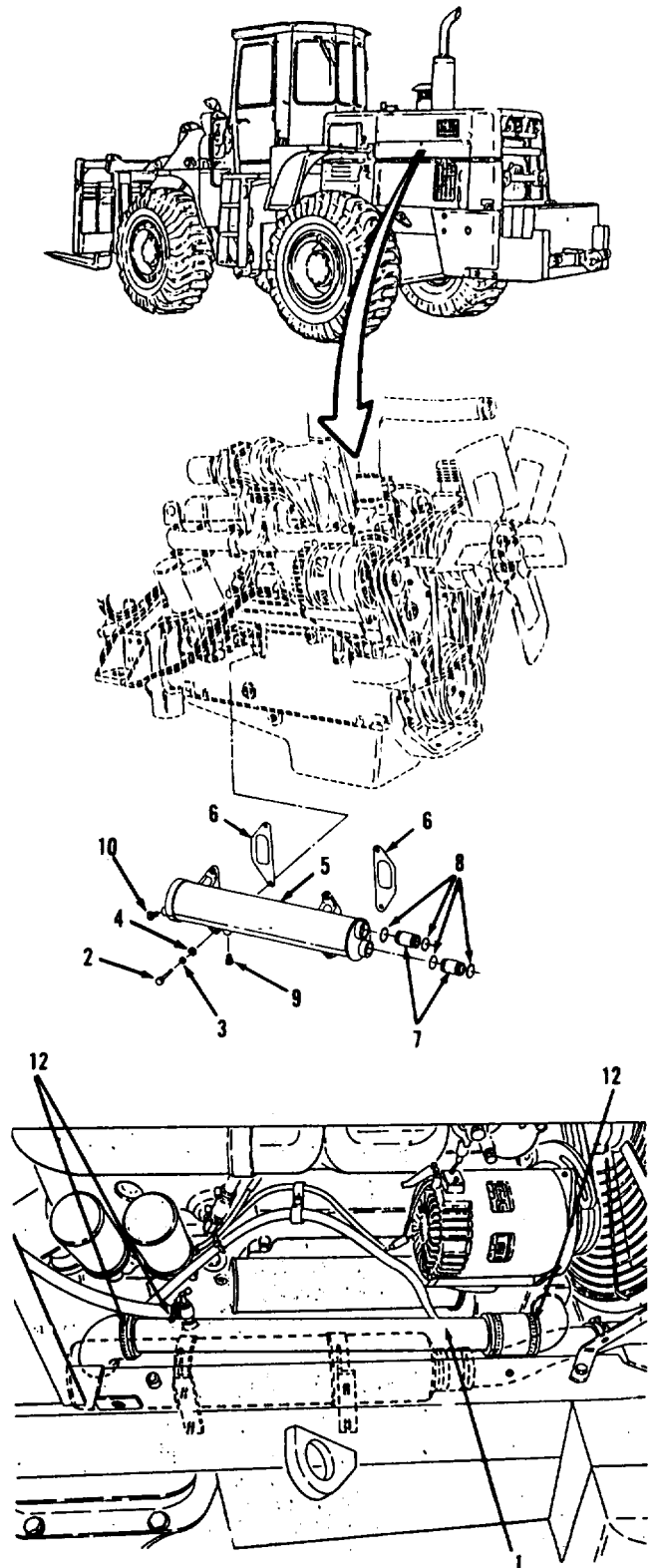
Go to sheet 2

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-9. Oil Cooler. (Sheet 2 of 5)

REMOVAL

1. Using a flat tip screwdriver, loosen four clamps (12) and remove hose assembly (1).
2. Using a 9/16" socket and socket wrench handle, remove four bolts (2), lock washers (3), washers (4) and oil cooler (5) from left side of engine.
3. Using a gasket scraper or putty knife, remove and discard two seals (6).
4. Remove two connectors (7) and four preformed packings (8). Discard preformed packings (8).
5. Using a 9/16" socket and socket wrench handle, remove plugs (9 and 10) from oil cooler (5).



Go to sheet 3

4-9. Oil Cooler. (Sheet 3 of 5)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

6. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
7. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

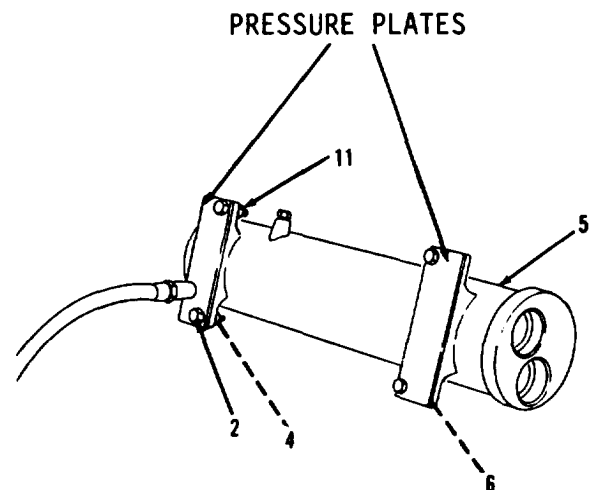
4-9. Oil Cooler. (Sheet 4 of 5)

TESTING

NOTE

Plugs must be installed in oil cooler for testing.

8. Install two new seals (6) and two pressure plates to inlet and outlet flange of oil cooler (5), refer to Appendix D, Part D-5 for fabrication of pressure plates.
9. Using a 9/16" socket and socket wrench handle, install four washers (4), bolts (2) and nuts (11).
10. Attach air hose and immerse oil cooler (5) in water. Water should be at 120 degrees F.



**WARNING**

COMPRESSED AIR HAZARD

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

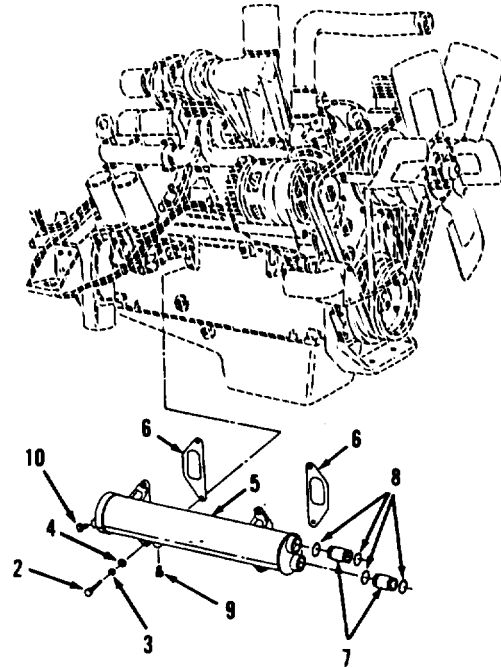
11. Using an air hose, apply 15 psi pressure. No moving or growing bubbles should be visible for about one minute. If moving or growing bubbles are present after one minute, replace cooler.
12. Remove oil cooler (5) from water and disconnect air hose.

Go to sheet 5

4-9. Oil Cooler. (Sheet 5 of 5)

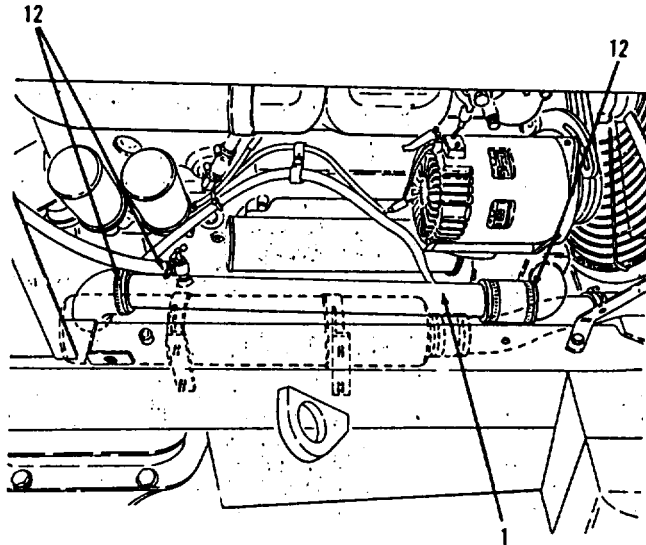
INSTALLATION

13. Using a 9/16" socket and socket wrench handle, remove four nuts (11), washers (4) and bolts (2).
14. Remove two pressure plates and seals (6). Discard seals (6).
15. Install plugs (10 and 9) in oil cooler (5).
16. Install four new preformed packings (8) and two connectors (7) in left side of engine.
17. Position and install two new seals (6).
18. Install oil cooler (5), four washers (4), lock washers (3) and bolts (2).
19. Using a flat tip screwdriver, install hose assembly (1) and tighten four clamps (12).



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-10. oil Pressure Regulator Valve. (Sheet 1 of 3)

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

#### INITIAL SETUP

##### Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
Torque Wrench  
NSN 5120-00-643-6364

##### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Preformed packing  
Gasket

##### Torques

Valve cap (1) to 170 lb-ft.

#### EQUIPMENT CONDITION

##### References

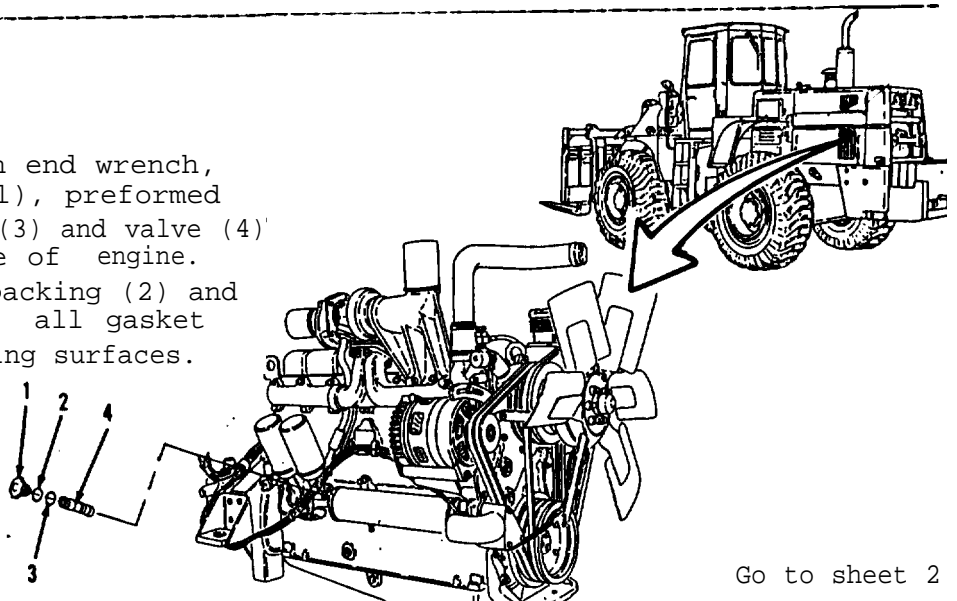
TM 10-3930-643-20

##### Condition Description

Left side engine access cover removed.

#### REMOVAL

- Using a 1-3/4" open end wrench, remove valve cap (1), preformed packing (2), gasket (3) and valve (4) in front, left side of engine. Discard preformed packing (2) and gasket (3). Remove all gasket material from mounting surfaces.



Go to sheet 2

4-10 . Oil Pressure Regulator Valve. (Sheet 2 of 3)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

2. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
3. Inspect all parts. Refer to paragraph 2-9.



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

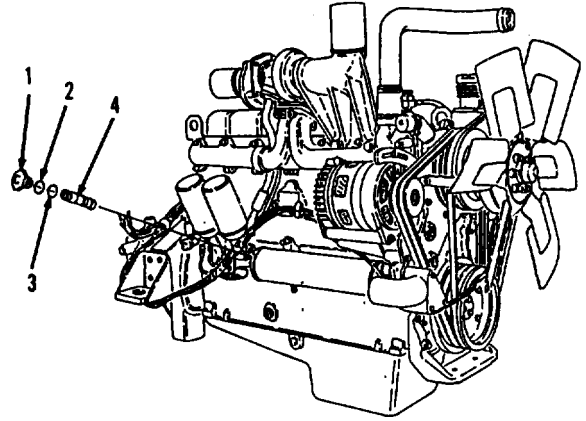
4-10. Oil Pressure Regulator Valve. (Sheet 3 of 3)

### INSTALLATION

4. Using a 1-3/4" socket and torque wrench, install valve (4), new gasket (3), new preformed packing (2) and valve cap (1) in front, left side of engine. Tighten valve cap (1) to 170 lb-ft.

#### NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-11. Intake and Exhaust Manifolds. (Sheet 1 of 7)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
Feeler Gage  
NSN 5210-00-221-1999

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Anti-seize compound  
(App. C, Item 1)  
Gasket (8)

Torques

Bolts (7) to 20 lb-ft.  
Bolts (14) to 35 lb-ft.  
Nuts (16) to 60 lb-ft. and 57 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Engine side access covers removed.

---

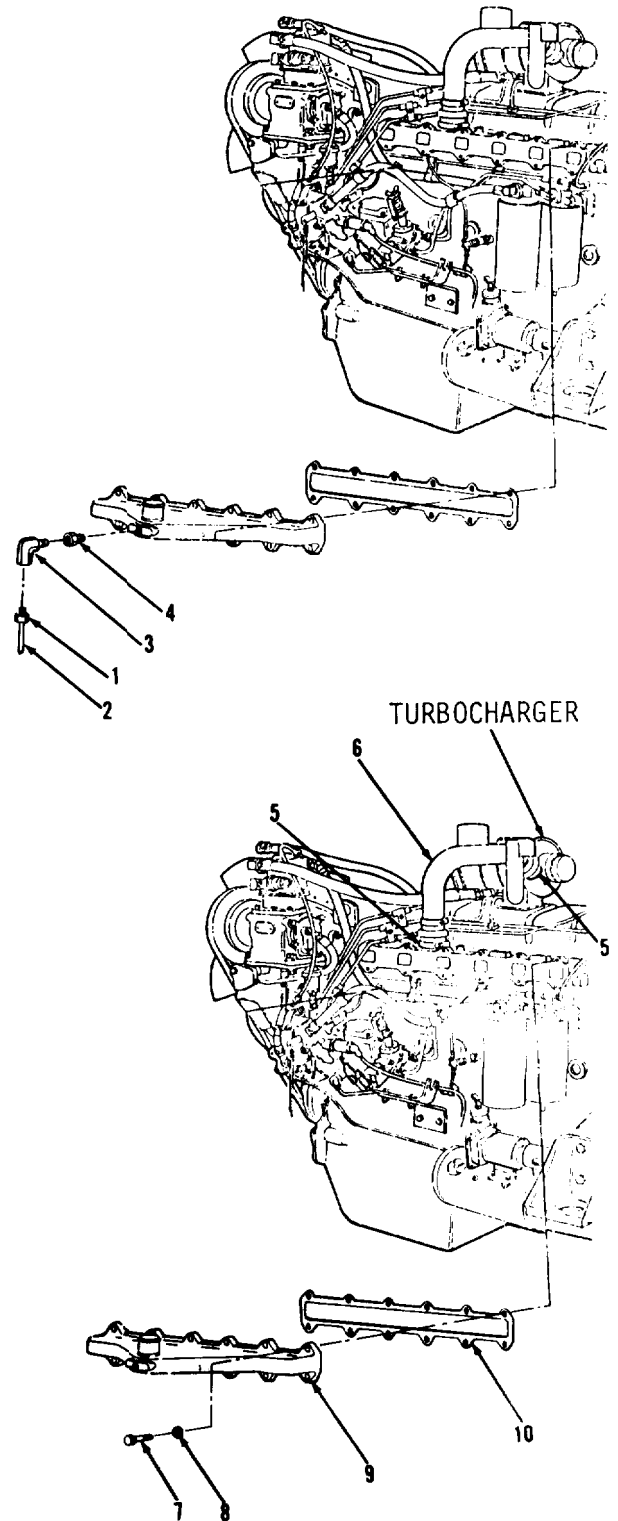
Go to sheet 2

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-11. Intake and Exhaust Manifolds. (Sheet 2 of 7)

REMOVAL

1. Using a 3/8" open end wrench, loosen nut (1) and disconnect tube assembly (2).
2. Remove elbow (3) and ether nozzle (4).
3. Using a flat tip screwdriver, loosen clamps (5), disconnect and remove pipe (6) at turbocharger and intake manifold (9).
4. Using a 1/2" socket and socket wrench handle, remove 12 bolts (7), washers (8), intake manifold (9) and gasket (10). Discard gasket (10). Remove all gasket material from mounting surfaces.



Go to sheet 3

4-11. Intake and Exhaust Manifolds. (Sheet 3 of 7)

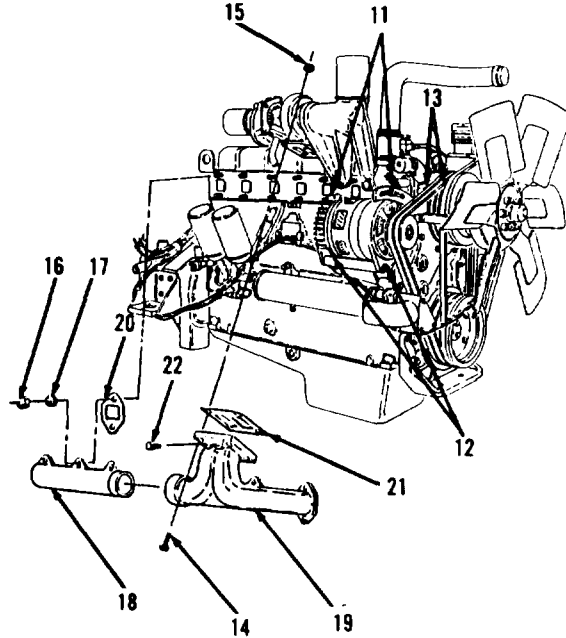
REMOVAL (cont)

5. Using 3/8" and 3/4" open end wrenches, loosen two bolts (11) and nuts (12).
6. Remove two drive belts (13) from alternator pulley. Rotate alternator away from engine as far as possible.
7. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove four bolts (14) and locknuts (15).

NOTE

Front and rear exhaust manifolds are removed together as a unit.

8. Using a 5/8" socket and socket wrench handle, remove 12 nuts (16), washers (17), front exhaust manifold (18), rear exhaust manifold (19), six gaskets (20) and gasket (21). Discard gaskets (20 and 21). Remove all gasket material from mounting surfaces.
9. Using a 7/16" socket and socket wrench handle, remove two pipe plugs (22) from rear exhaust manifold (19).



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-11. Intake and Exhaust Manifolds. (Sheet 4 of 7)

CLEANING/INSPECTION

**WARNING**

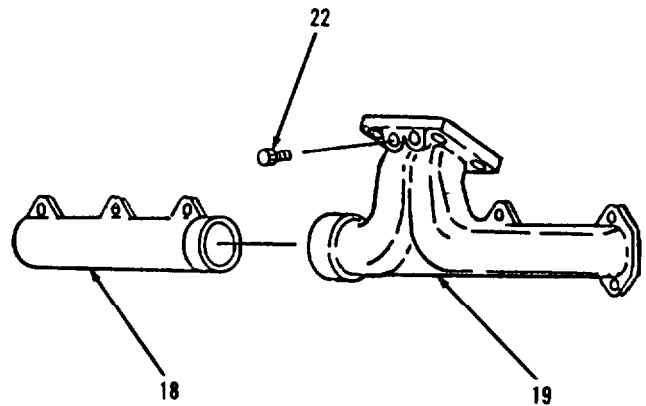
● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

10. Using hot water and compressed air, steam clean intake manifold (9), front exhaust manifold (18) and rear exhaust manifold (19). Remove all dirt and carbon accumulation.
11. Wipe drive belts (13) with clean cloth.
12. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

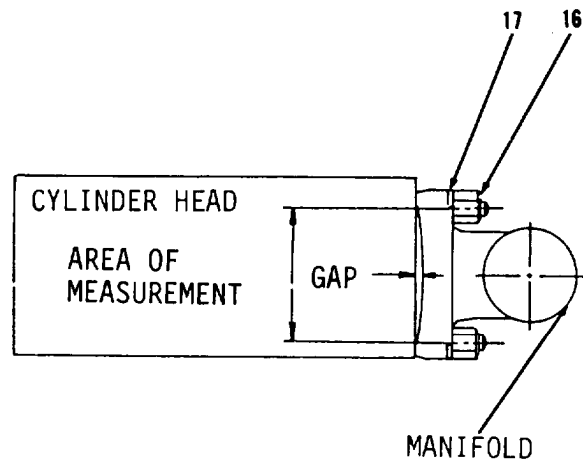


Go to sheet 5

4-11. Intake and Exhaust Manifolds. (Sheet 5 of 7)

CLEANING/INSPECTION (cont)

- 13. Inspect intake manifold (9), front exhaust manifold (18) and rear exhaust manifold (19). Replace if cracked or distorted.
- 14. Inspect all other parts. Refer to paragraph 2-9.

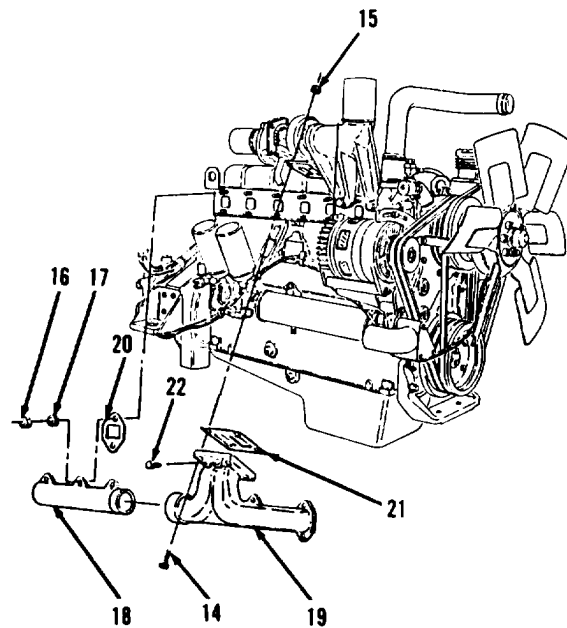


INSTALLATION

- 15. Using a 7/16" socket and socket wrench handle, install two pipe plugs (22) on rear exhaust manifold (19).
- 16. Install rear exhaust manifold (19) and front exhaust manifold (18).

NOTE

Install exhaust manifold sections as a unit on cylinder head without gasket.



- 17. Using a 5/8" socket and socket wrench handle, install 12 washers (17) and nuts (16). Tighten nuts (16) to 60 lb-ft.
- 18. Use a 0.015 inch feeler gage to measure gap between cylinder head and manifold flange face. If feeler gage will pass through area of measurement, as shown, replace manifold.
- 19. Using a 5/8" socket and socket wrench handle, remove 12 nuts (16), washers (17), front exhaust manifold (18) and rear exhaust manifold (19).

Go to sheet 6

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

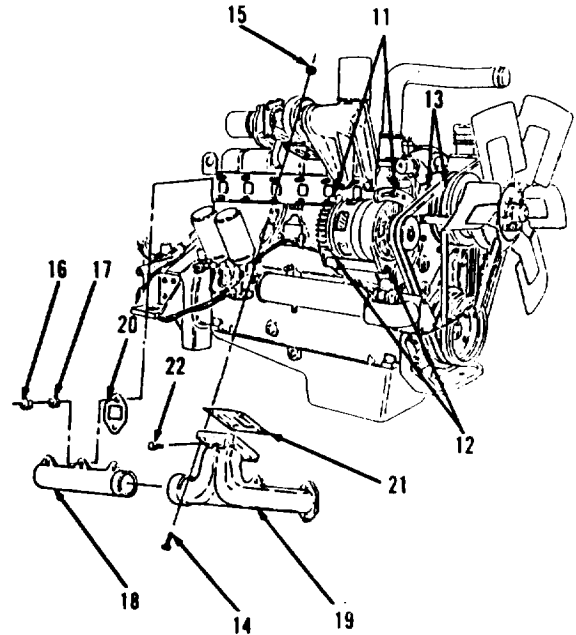
## 4-11. Intake and Exhaust Manifolds. (Sheet 6 of 7)

INSTALLATION

## NOTE

Front and rear exhaust manifolds are installed together as a unit.

20. Using a 5/8" socket and socket wrench handle, install new gasket (21), six new gaskets (20), rear exhaust manifold (19), front exhaust manifold (18), 12 washers (17) and nuts (16) on left side of engine. Tighten nuts (16) to 57 lb-ft.
21. Apply anti-seize compound to bolts (14) before installation.
22. Using a 9/16" socket, socket wrench handle, and a 9/16" open box wrench, install four locknuts (15) and bolts (14). Tighten bolts (14) to 35 lb-ft.
23. Install two drive belts (13) on alternator pulleys.
24. Using a 9/16" socket and socket wrench handle, tighten two nuts (12) and bolts (11). Refer to TM 10-3930-643-20 for alternator drive belt adjustment.



Go to sheet 7

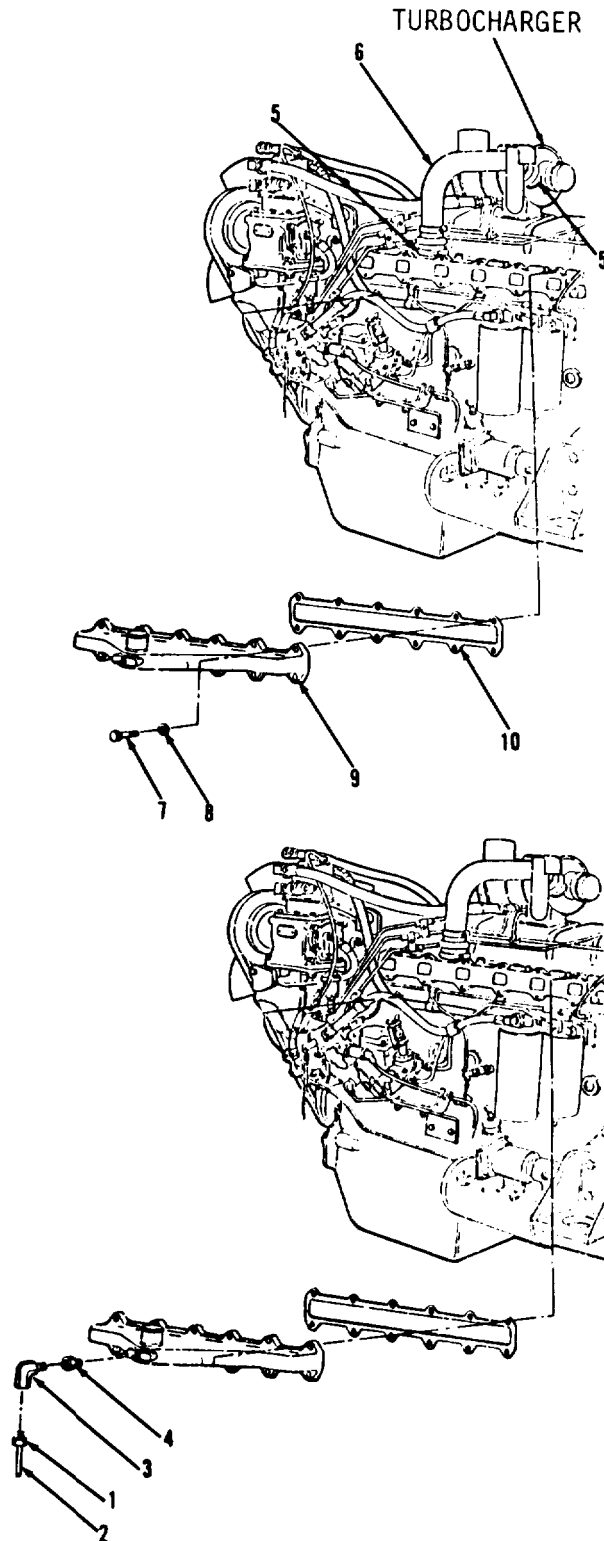
4-11. Intake and Exhaust Manifolds. (Sheet 7 of 7)

INSTALLATION (cont)

25. Using a 1/2" socket and socket wrench handle, install new gasket (10), intake manifold (9), 12 washers (8) and bolts (7) in right side of engine. Tighten bolts (7) to 20 lb-ft.
26. Position pipe (6), clamps (5) and using a flat tip screwdriver, tighten clamps (5) at intake manifold (9) and turbocharger.
27. Using a 3/8" open end wrench, install ether nozzle (4) and elbow (3).
28. Connect tube assembly (2) and tighten nut (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-12. Fuel Injectors. (Sheet 1 of 5)

- This task covers:
- a. Removal
  - b. Testing/Cleaning/Inspection
  - c. Installation

INITIAL SETUP

Tools

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, Less Power  
 NSN 4910-00-754-0714

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, MAP only  
 NSN 4910-00-919-0083

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

Torque Wrench  
 NSN 5120-00-247-2536

Materials/Parts

Cleaning solvent P-D-680 (App. C, Item 5)  
 Clean cloth (App. C, Item 24)  
 Detergent (App. C, Item 33)

Torques

Bolts (1) to 20 lb-ft.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Paragraph 4-13

Condition Description

Right side engine access cover removed.

Fuel injector lines removed.

4-12. Fuel Injectors. (Sheet 2 of 5)

REMOVAL

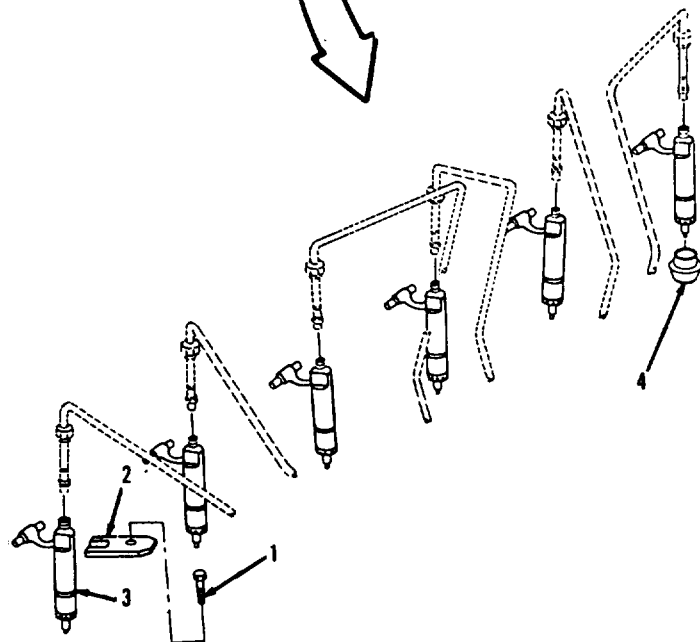
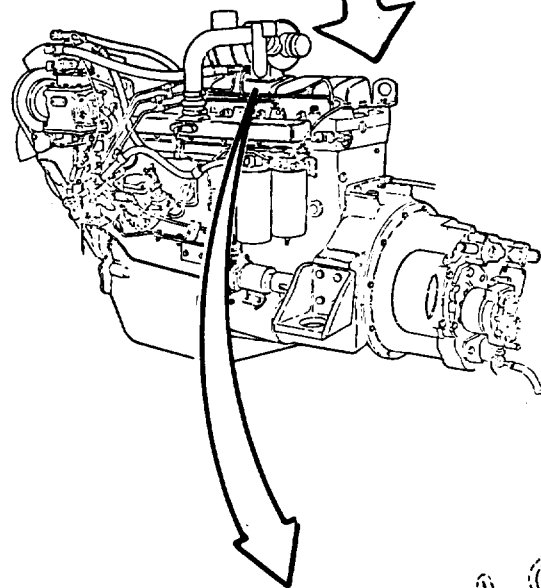
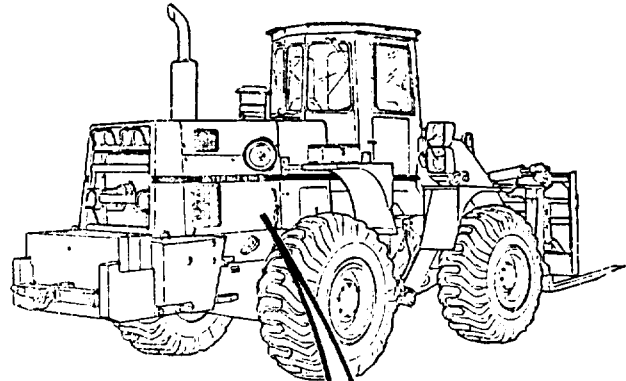
1. Using a 9/16" socket and socket wrench handle, remove six bolts (1), injector crabs (2), fuel injectors (3) and grommets (4) from top, right side of engine.

TESTING/CLEANING/INSPECTION

**WARNING**

Keep hands away from nozzle spray. At opening pressure, velocity of spray could puncture skin. Wear safety glasses during test.

2. Using a 3/4" open end wrench, connect six fuel injectors (3) loosely to test pump. Pump handle several times to flush out fittings. Tighten connections.



Go to sheet 3

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-12. Fuel Injectors. (Sheet 3 of 5)

TESTING/CLEANING/INSPECTION

3. Operate test pump until nozzle opening pressure is reached. All orifices in nozzle tip should be clear. Fuel should spray in atomized mist. Nozzle should emit a sharp high-pitched chatter. If chattering does not occur, flush with pump in rapid complete strokes. Spray pattern should be uniform and equal in all directions.
4. Operate test pump a few strokes to clear air from nozzle. Raise pressure steadily. Observe pressure at which nozzle opens. Opening pressure for new nozzles is 3600 to 3750 psi. Minimum opening pressure for used nozzles is 2900 psi.
5. Wipe nozzle tip dry. Bring pressure slowly to 500 psi below nozzle opening pressure. Maintain this pressure for 5 seconds. Wetting of nozzle is permissible without formation of a droplet. Do not wipe the tip with fingers. This will draw fuel present in sac hole through orifices and give false leak indication. Hold wiper lightly against tip of nozzle.
6. Bring pressure on nozzle to 1500 psi. Collect any leakage from fuel return stem. Maximum allowable leakage is 1.5 cubic inch in one minute.
7. Wipe retainers (4) with a damp clean cloth using a mild detergent and water solution.

Go to sheet 4

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-12. Fuel Injectors. (Sheet 4 of 5)

TESTING/CLEANING/INSPECTION (cont)

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

8. Clean all other parts using cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
9. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

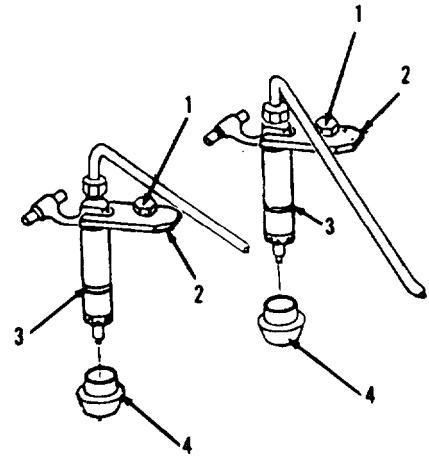
4-12. Fuel Injectors. (Sheet 5 of 5)

INSTALLATION

10. Using a 9/16" socket and socket wrench handle, install six retainers (4), fuel injectors (3), injector crabs (2) and bolts (1) in top, right side of engine. Tighten six bolts (1) to 20 lb-ft.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-13. Fuel Injector Lines. (Sheet 1 of 5)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, Less Power  
NSN 4910-00-754-0714  
Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, MAP only  
NSN 4910-00-919-0083  
Tool Kit, General Mechanic's Automotive  
NSN 5180-00-177-7033  
Torque Wrench  
NSN 5120-00-247-2536

Materials/Parts

Cleaning solvent P-D-680 (App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Detergent (App. C, Item 33)  
Suitable container

Torques

Injection pipes (19, 18, 17, 16, 15 and 14) to 30 lb-ft.  
Fittings to 30 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Right side engine access cover removed.

---

Go to sheet 2

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-13. Fuel Injector Lines. (Sheet 2 of 5)

REMOVAL

**WARNING**

FIRE HAZARD

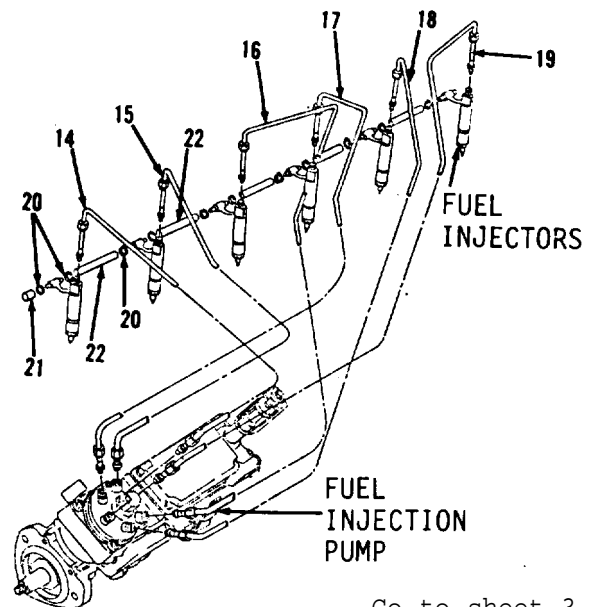
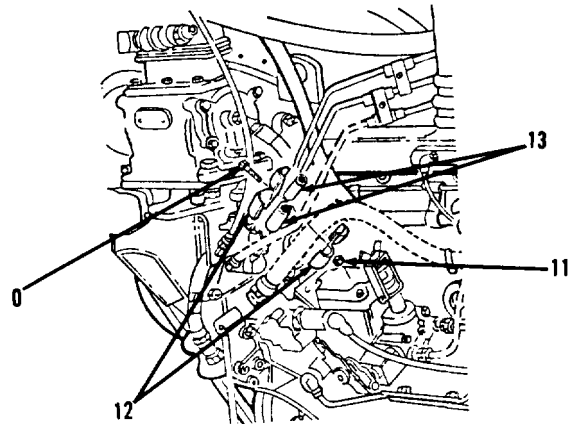
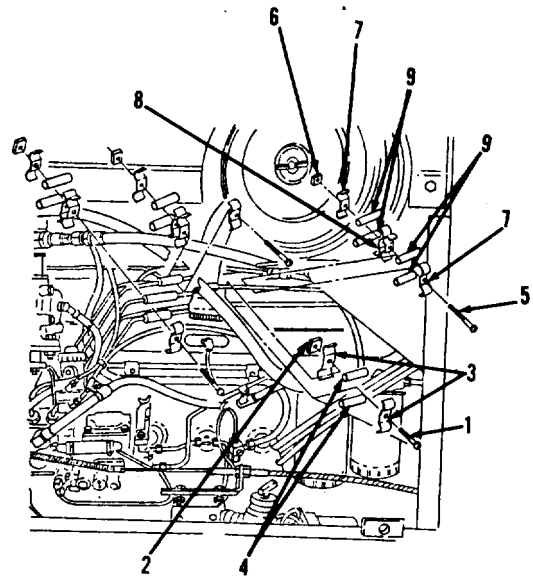
Diesel fuel and combustible materials are used in operation and maintenance of this equipment. Do not smoke or allow open flames or sparks in areas where diesel fuel and combustible materials are used or stored. DEATH or injury may result if personnel fail to observe this precaution. If you are burned, seek medical help immediately.

1. Using a flat tip screwdriver, remove screw (1), retaining clip (2), two clamps (3) and spacers (4) from right side of engine.
2. Remove three screws (5), retaining clips (6), six clamps (7), three clips (8) and twelve spacers (9).
3. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove bolt (10), nut (11), two clamps (12) and spacers (13).

NOTE

Use a suitable container to catch any draining fuel.

4. Using a 3/4" open end wrench, disconnect injection pipes (14, 15, 16, 17, 18 and 19) from fuel injectors.
5. Disconnect injection pipes (14, 15, 16, 17, 18 and 19) from fuel injection pump and remove from vehicle.
6. Using long round nose pliers, remove eleven hose clamps (20), cap (21) and five hoses (22).



Go to sheet 3

4-13. Fuel Injector Lines. (Sheet 3 of 5)

CLEANING/INSPECTION

7. Clean two spacers (4), 12 spacers (9), spacer (13), cap (21) and five hoses (22) with warm water and detergent.

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

8. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 4



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

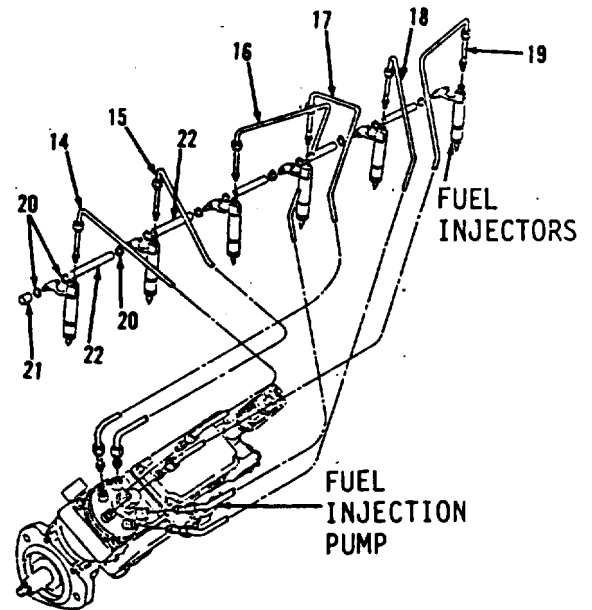
4-13. Fuel Injector Lines. (Sheet 4 of 5)

CLEANING/INSPECTION

9. Inspect injection pipes (14, 15, 16, 17, 18 and 19). Replace if cracked, twisted or if inside diameter is blocked with dirt or foreign material.
10. Inspect all parts. Refer to paragraph 2-9.

INSTALLATION

11. Using round nose pliers, install five hoses (22), cap (21) and eleven hose clamps (20) in right side of engine.
12. Using a 3/4" open end wrench, position and connect injection pipes (19, 18, 17, 16, 15 and 14) to injection pump. Tighten to 30 lb-ft.
13. Connect injection pipes (19, 18, 17, 16, 15 and 14) to fuel injectors. Tighten fittings to 30 lb-ft.



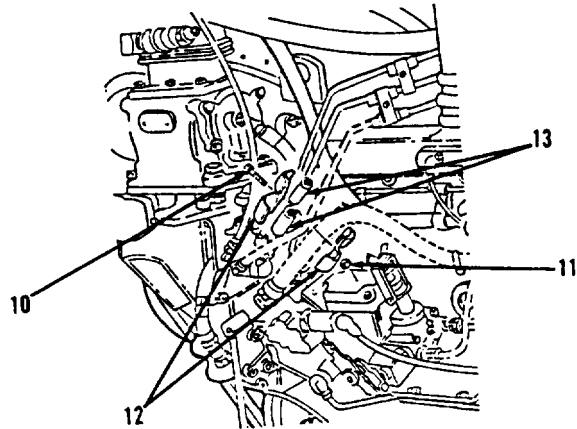
Go to sheet 5

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-13. Fuel Injector Lines. (Sheet 5 of 5)

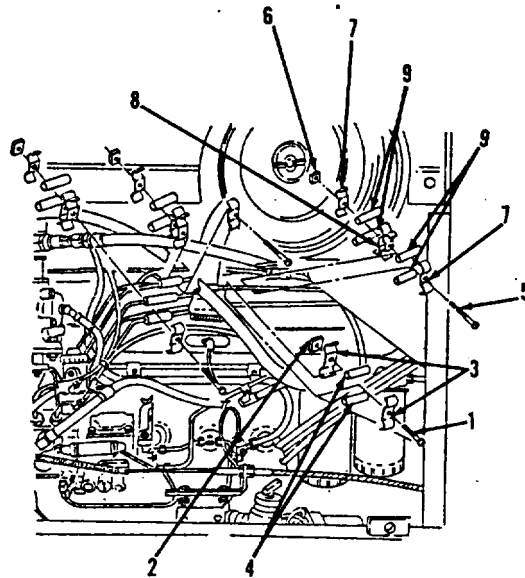
INSTALLATION (cont)

14. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, install two spacers (13), clamps (12), nut (11) and bolt (10).
15. Using a flat tip screwdriver, install twelve spacers (9), three clips (8), six clamps (7), three retaining clips (6) and screws (5).
16. Install two spacers (4), clamps (3), retaining clip (2) and screw (1).



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 1 of 9)

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

INITIAL SETUP

Tools

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, Less Power  
 NSN 4910-00-754-0714

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, MAP only  
 NSN 4910-00-919-0083

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

Torque Wrench  
 NSN 5120-00-247-2536

Wrench, Open End 2-1/2"  
 NSN 5120-00-277-3022

Materials/Parts

Cleaning solvent P-D-680  
 (App. C, Item 5)  
 Silicone sealant (App. C, Item 27)  
 Small tag (App. C, Item 28)  
 Gasket (2)

Torques

Except for special torques shown, all fasteners are tightened to standard torques. Refer to Appendix E.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Right side engine access cover removed.

REMOVAL

**CAUTION**

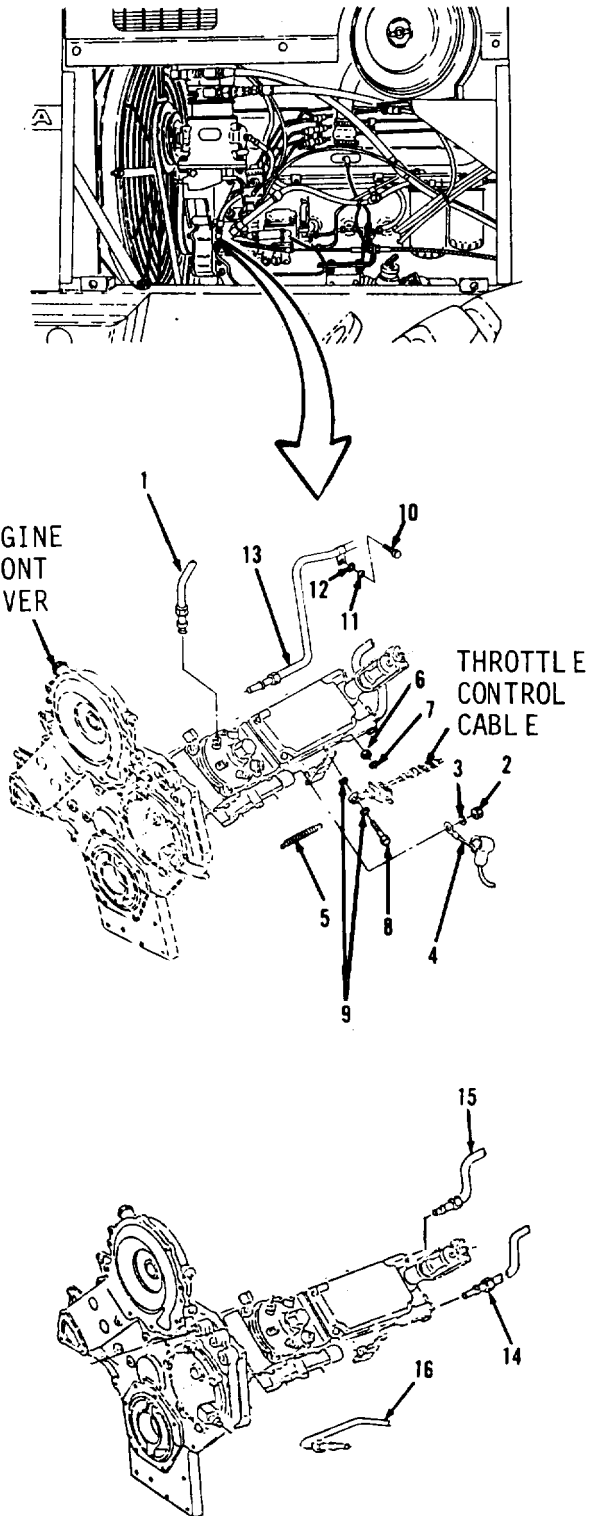
- Before performing injection pump removal procedure, rotate engine clockwise until the No. 1 piston is on compression stroke and timing pointer is at 15 degrees BTDC plus or minus 1 degree.
- If the pump is to be reinstalled, DO NOT rotate the pump drive shaft after the pump has been removed.
- Thoroughly clean left side of engine to prevent dirt from entering pump. Be sure to plug all openings of pump and lines to prevent entry of dirt.
- Failure to observe the preceding can result in severe damage to engine or fuel injection pump.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 3/4" open end wrench, disconnect six fuel injector lines (1) from right side of engine.
- 3\* Using a flat tip screwdriver, remove nut (2), washer (3) and terminal (4).
3. Using long round nose pliers, a 7/16" socket and a 7/16" open end wrench, remove spring (5), nut (6), washer (7), bolt (8) and two washers (9).
4. Using a 9/16" socket and socket wrench handle, remove bolt (10), lock washer (11) and washer (12). Leave clip attached to tube assembly (13).
5. Using a 3/4" open end wrench, disconnect tube assemblies (13, 14, 15 and 16).

Go to sheet 3

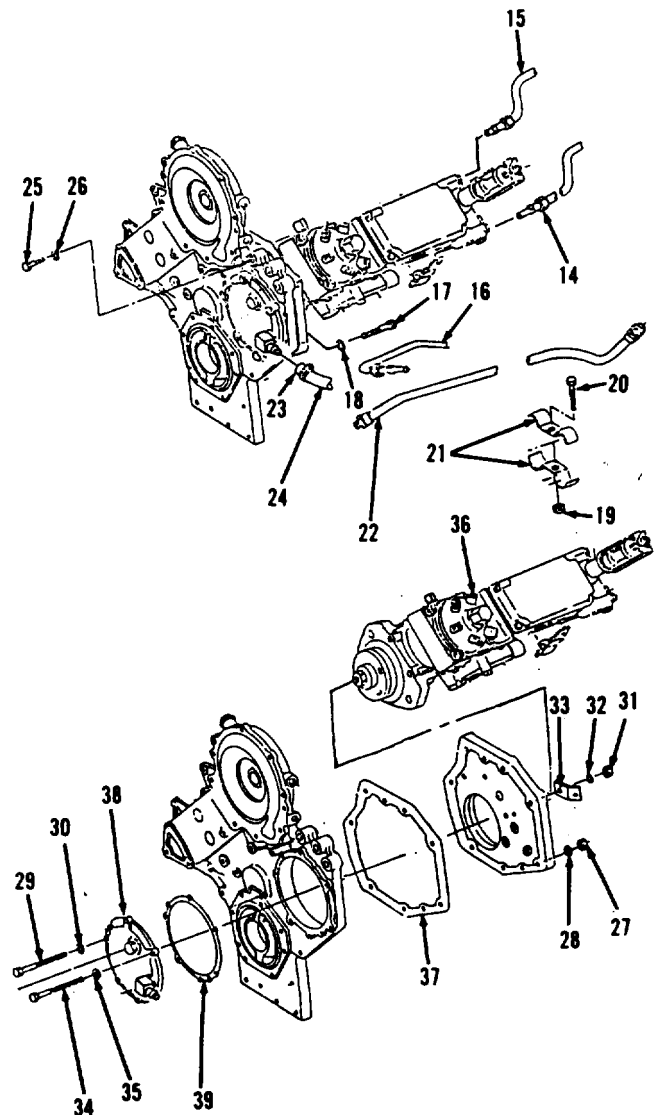


## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 3 of 9)

REMOVAL

6. Using a 1/2" open end wrench, remove bolt (17) and washer (18).
7. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove nut (19), bolt (20) and two straps (21).
8. Using 3/4" open end wrench, remove hose assembly (22). Cap port on fuel injection pump (36).
9. Using a flat tip screwdriver, loosen clamp (23).
10. Disconnect hose (24).
11. Using a 1/2" socket and socket wrench handle, remove five bolts (25) and washers (26).
12. Remove three nuts (27), washers (28), bolts (29) and washers (30).
13. Support fuel injection pump (36) and using a 1/2" socket, socket wrench handle and a 1/2" open end wrench, remove nut (31), washer (32), bracket (33), bolt (34) and washer (35).
14. Remove fuel injection pump (36), then using a gasket scraper or putty knife, remove gasket (37), cover (38) and gasket (39). Discard gaskets (37 and 39). Remove all gasket material from mounting surfaces.

**CAUTION**

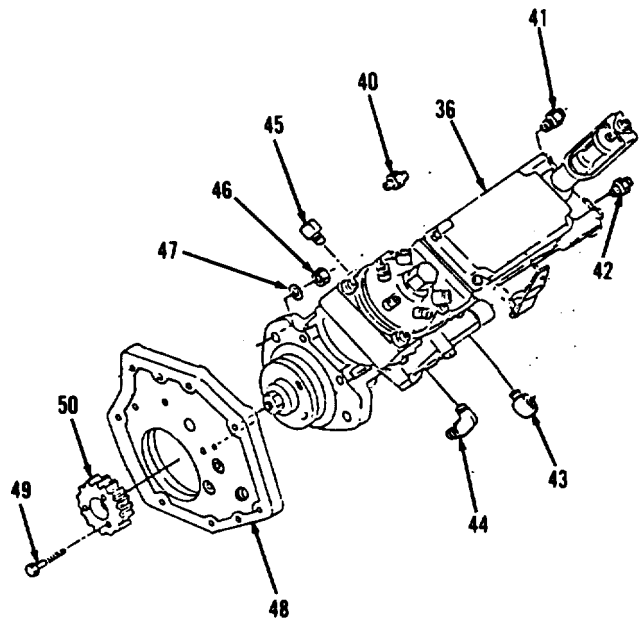
If the same fuel injection pump is to be installed, DO NOT rotate the pump drive shaft after the pump has been removed. Failure to follow this procedure will damage the fuel injection pump timing.

Go to sheet 4

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 4 of 9)

DISASSEMBLY

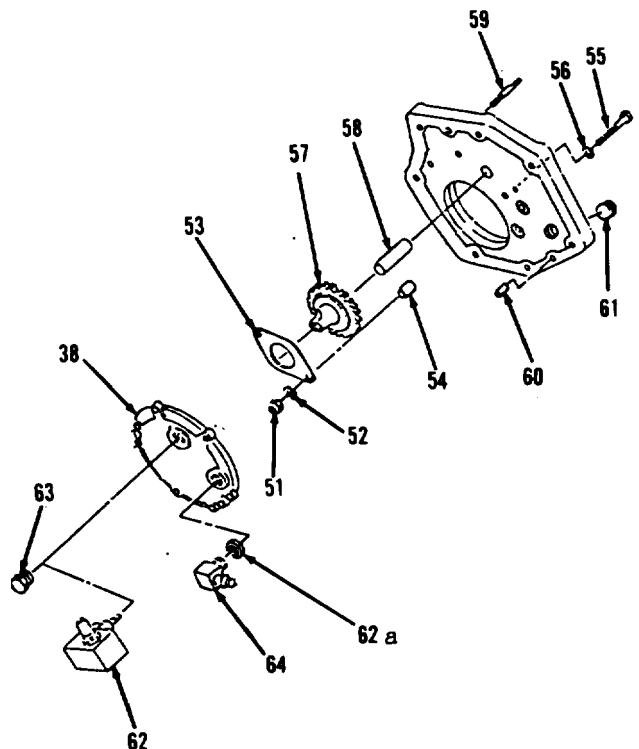
15. Using an 11/16" open end wrench, remove adapters (40, 41 and 42) and elbows (43, 44 and 45) from fuel injection pump (36).
16. Using a 9/16" socket and socket wrench handle, remove two nuts (46), washers (47) and adapter (48).
17. Remove three bolts (49) and gear (50).
18. Using a 1/2" socket, socket wrench handle and a 1/2" open box wrench, remove two locknuts (51), washers (52), plate (53), two spacers (54), bolts (55), washers (56), gear (57) and pin (58) from adapter (48).
19. Using a 1/2" open end wrench and vise grip, remove two studs (59) and pins (60)
20. Remove plug (61).



NOTE

The following are differences between M10A Forklift models. The disassembly/assembly procedure is identical.

21. Using 1-5/16" and 1-1/4" open end wrenches, remove tachometer drive (62) and locknut (62a) from cover (38), from vehicles S/N 2001 and above, or remove plug (63) from cover (38), from vehicles S/N 2000 and below.
22. Using a 3/4" open end wrench, remove elbow (64) from cover (38).



Go to sheet 5

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 5 of 9)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

23. Clean all parts, except fuel injection pump (36), with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
24. Inspect all parts. Refer to paragraph 2-9.

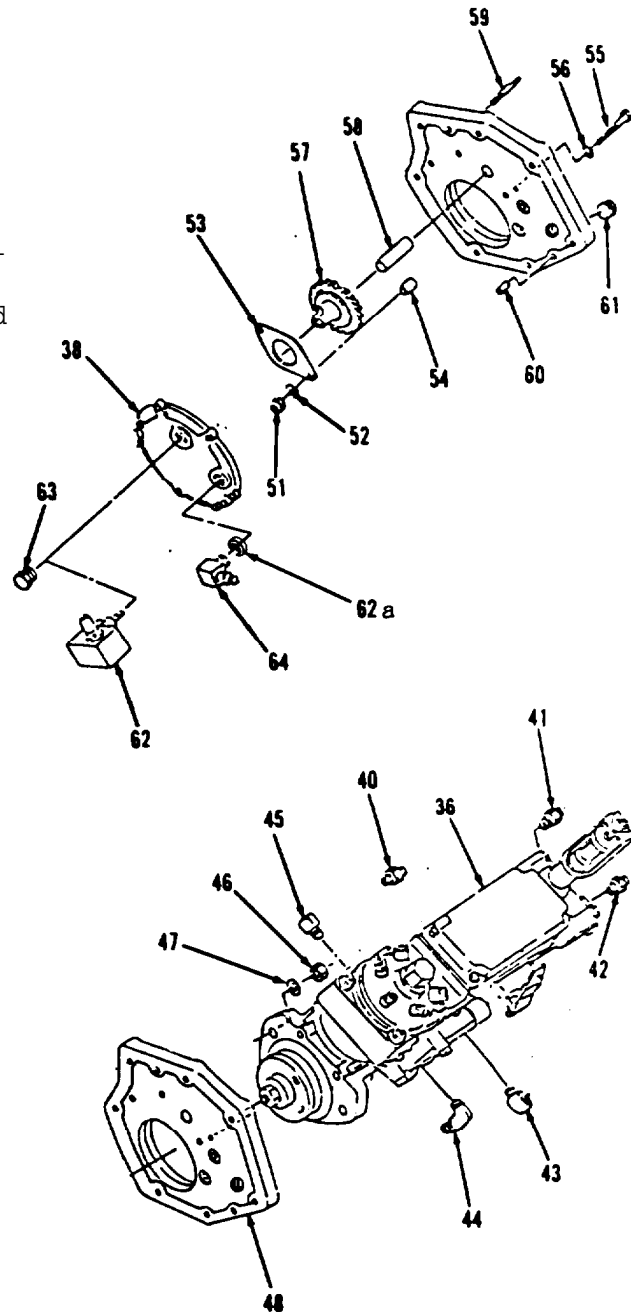
Go to sheet 6

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 6 of 9)

ASSEMBLY

- 25. Using a 3/4" open end wrench, install elbow (64).
- 26. Using 1-5/16" and 1-1/4" open end wrenches, install plug (63) in cover (38) in vehicles S/N 2000 and below or using a 1-1/8" open end wrench, install tachometer drive (62) and locknut (62a) in cover (38), in vehicles S/N 2001 and above. Refer to TM 10-3930-643-20.
- 27. Using a 1/2" open end wrench, install plug (61) in adapter (48).
- 28. Using a small hammer, 2-5/16" nuts and 2-1/2" open end wrench, install two pins (60) and studs (59).
- 29. Using a small hammer, a 1/2" socket, socket wrench handle and 1/2" open end wrench, install pin (58), gear (57), two washers (56), bolts (55), spacers (54), plate (53), two washers (52) and locknuts (51).
- 30. Using a 9/16" socket and socket wrench handle, install adapter (48), two washers (47) and nuts (46) in fuel injection pump (36).
- 31. Using an 11/16" open end wrench, install elbows (45, 44 and 43) and adapters (42, 41 and 40).



Go to sheet 7

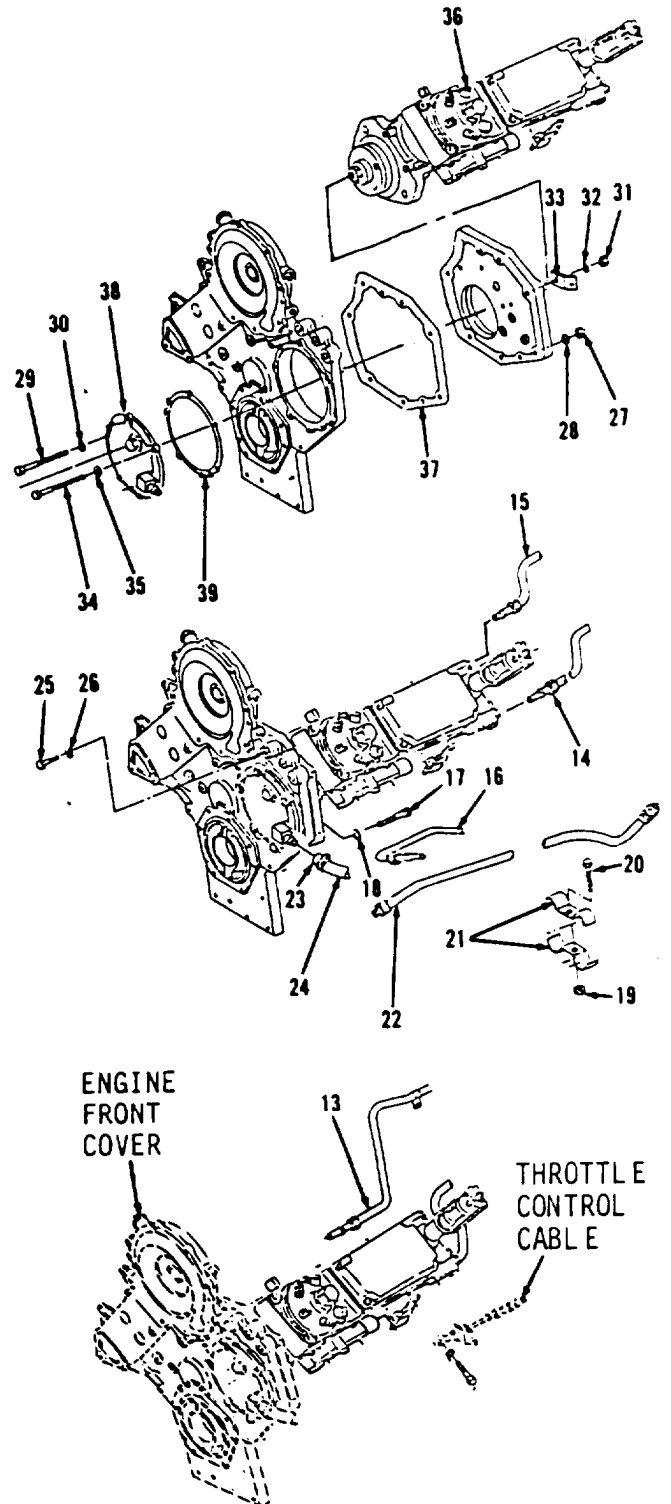


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 7 of 9)

INSTALLATION

32. Position new gaskets (37 and 39), fuel injection pump (36) and cover (38), in right, rear side of engine.
33. Support fuel injection pump (36) and using a 1/2" socket., socket wrench handle and a 1/2" open end wrench, install washer (35), bolt (34), bracket (33), washer (32) and nut (31).
34. Install two washers (30), bolts (29), washers (28) and nuts (27).
35. Using a 1/2" socket and socket wrench handle, install two washers (26), bolts (25), washer (18) and bolt (17).
36. Using a flat tip screwdriver, tighten clamp (23) to connect hose (24).
37. Using a 3/4" open end wrench, connect hose assembly (22).
38. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, install two straps (21), bolt (20) and nut (19).
39. Using a 3/4" open end wrench, connect tube assemblies (16, 15, 14 and 13). Tighten fittings to 35 lb-ft.



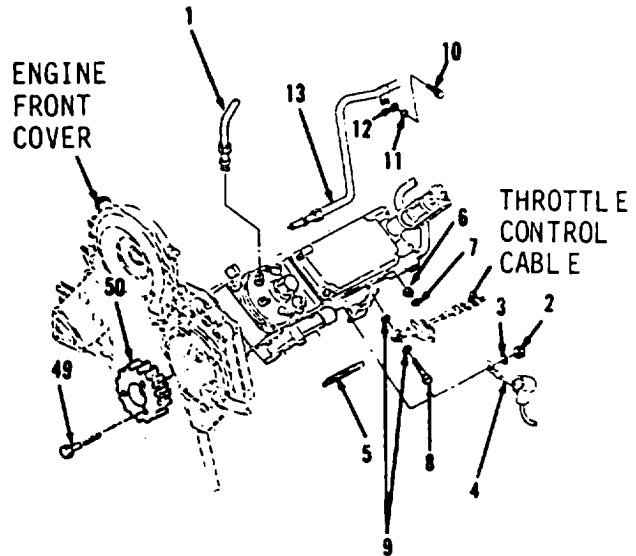
Go to sheet 8

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 8 of 9)

INSTALLATION (cont)

- 40. Using a 9/16" socket and socket wrench handle, install washer (12), lock washer (11) and bolt (10).
- 41. Position throttle control cable. Using a 7/16" socket, socket wrench handle, a 7/16" open end wrench and long round nose pliers, install two washers (9), bolt (8), washer (7), nut (6) and spring (5).
- 42. Using a flat tip screwdriver, install terminal (4), washer (3) and nut (2). Apply silicone sealant over entire connection.
- 43. Using a 3/4" open end wrench, install six fuel injector lines (1). Tighten fittings to 35 lb-ft.



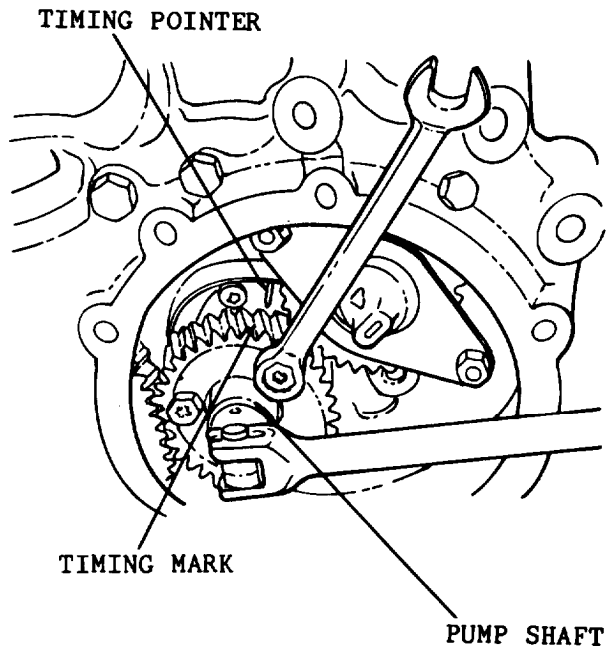
TIMING

- 44. Rotate engine clockwise till number 1 piston is on compression stroke and timing pointer is at 15 % BTDC plus or minus one percent.
- 45. Using a 7/8 socket and socket wrench handle, rotate pump shaft until timing mark on shaft lines up with timing pointer.

**CAUTION**

Make sure timing marks on drive gear and idler gear are in alignment.

- 46. Install drive gear (50), aligning the timing marks with the idler gear.



Go to Sheet 9

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-14. Fuel Injection Pump, Cover Plate, Adapter and Drive Gears. (Sheet 9 of 9)

**TIMING**

47. Using a 7/8 socket and socket wrench handle, hold pump shaft in position while installing install three bolts (49) using a 1/2" open end wrench. Tighten three bolts (49) to 30 lb-ft.
48. Perform fuel system hand priming procedure, refer to Fuel System Vent Procedure, in TM 10-3930-643-20.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-15. Turbocharger and Piping. (Sheet 1 of 6)

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

INITIAL SETUP

Tools

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

Materials/Parts

Cleaning solvent P-D-680  
     (App. C, Item 5)  
 Clean cloth (App. C, Item 24)  
 Detergent (App. C, Item 33)  
 Lubricating oil (App. C, Item 19)  
 Liquid gasket (App. C, Item 14)  
 Anti-seize compound (App. C, Item 1)  
 Small tag (App. C, Item 28)  
 Gasket (2)

Torques

Except for special torques shown,  
 all fasteners are tightened to  
 special torques. Refer to  
 Appendix E.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Top access cover removed.

Go to sheet 2

4-15. Turbocharger and Piping. (Sheet 2 of 6)

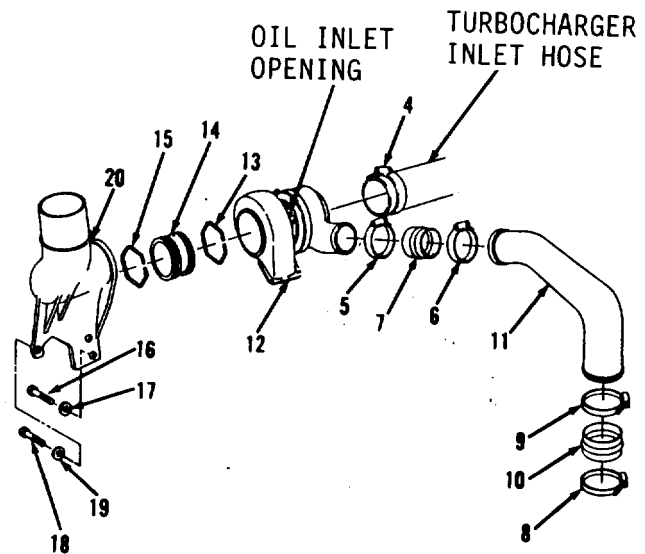
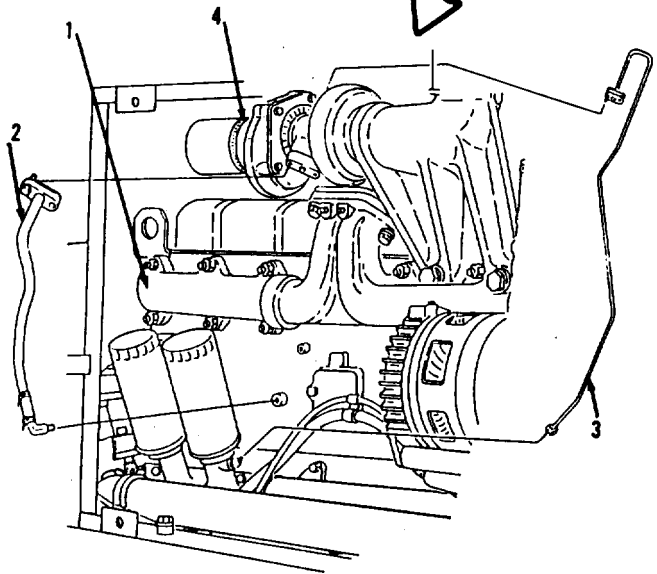
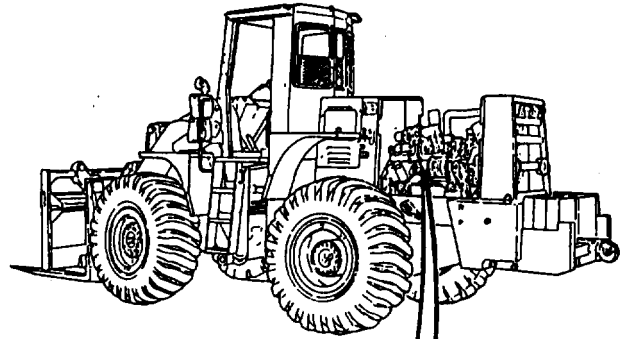
REMOVAL

1. Using a 9/16 socket and socket wrench handle, remove exhaust manifold (1) from top, left side of engine, refer to paragraph 4-11.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Using 1/2" and 9/16" sockets and a socket wrench handle, remove turbocharger oil lines (2 and 3) from left side of engine, refer to TM 10-3930-643-20.
3. Using a flat tip screwdriver, loosen clamp (4) and disconnect turbocharger inlet hose.
4. Remove clamps (5 and 6), hose (7), clamps (8 and 9), hose (10) and pipe (11).
5. Remove turbocharger (12), seal (13), bushing (14) and seal (15).
6. Using a 15/16" socket and socket wrench handle, remove bolt (16), washer (17), two bolts (18), washers (19) and elbow (20).



Go to sheet 3

## ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

## 4-15. Turbocharger and Piping. (Sheet 3 of 6)

CLEANING/INSPECTION

7. Clean hoses (7 and 10) with cloth moistened with detergent.

**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

8. Clean exterior of turbocharger (12) with cloth moistened with cleaning solvent P-D-680. Allow to air dry.
9. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
10. If turbocharger fails, check for small parts dropped into exhaust manifold.
11. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 4

4-15. Turbocharger and Piping. (Sheet 4 of 6)

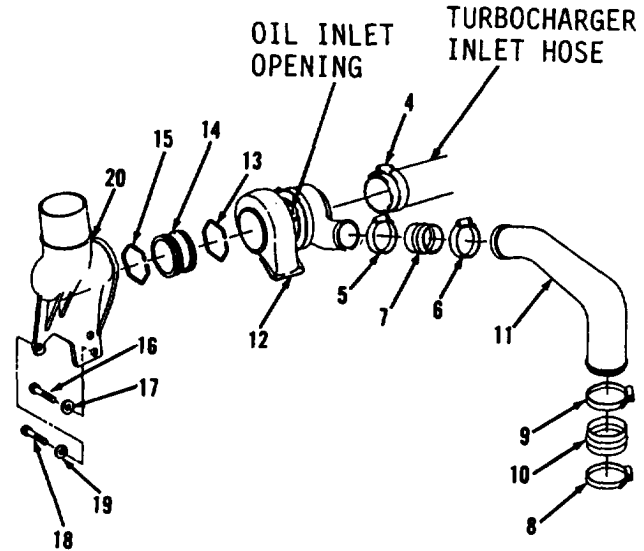
INSTALLATION

12. Using a 15/16" socket and socket wrench handle, install elbow (20), two washers (19), bolts (18), washer (17) and bolt (16) in top, left side of engine.
13. Apply anti-seize compound to seals (15 and 13).
14. Apply liquid gasket to hose at inlet connection of turbocharger.
15. Install seal (15), bushing (14), seal (13) and turbocharger (12).
16. Using a flat tip screwdriver, install hose (10), pipe (11), clamps (9 and 8), hose (7) and clamps (6 and 5).
17. Connect turbocharger inlet hose, position and tighten clamp (4).

**CAUTION**

Turbocharger must be primed prior to starting the engine. Failure to follow this procedure could result in damage to turbocharger and/or engine.

18. Apply four or five ounces of clean lubricating oil into the oil inlet opening of the turbocharger to lubricate the turbocharger bearings during initial start up.



Go to sheet 5

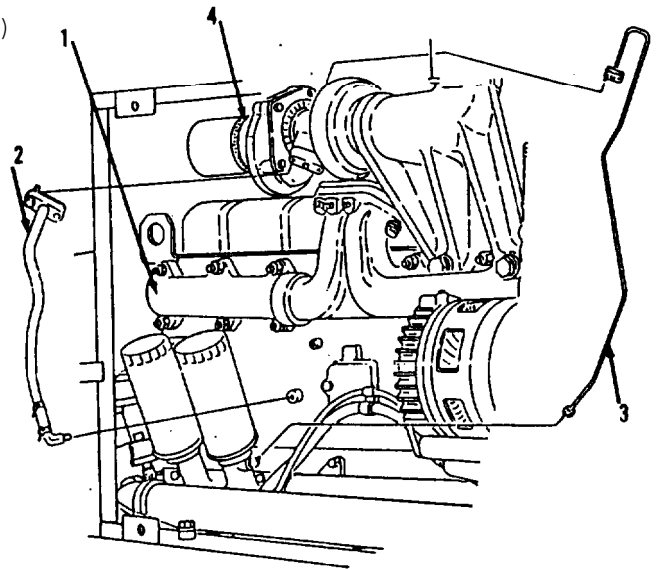


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-15. Turbocharger and Piping. (Sheet 5 of 6)

INSTALLATION

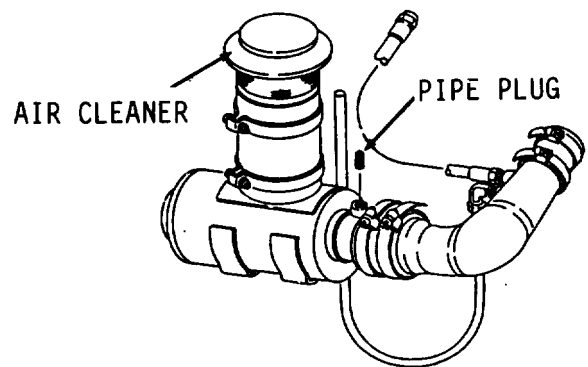
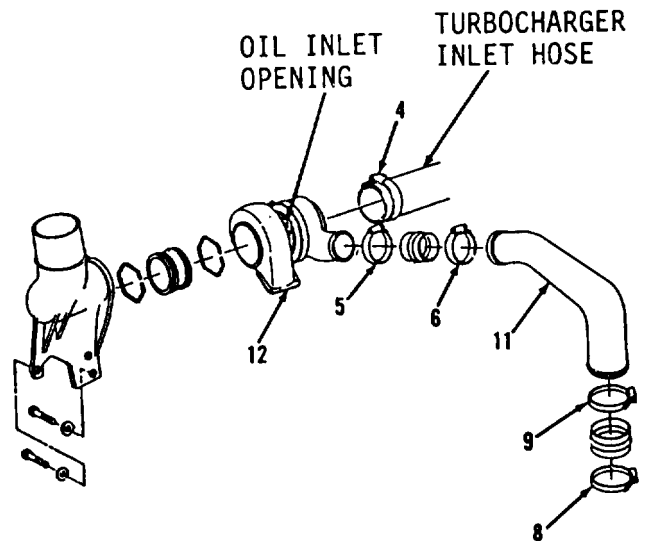
19. Using a 1/2" socket and socket wrench handle, install turbocharger oil lines (2 and 3) at left side of engine, refer to TM 10-3930-643-20.
20. Using a 9/16 socket and socket wrench handle, install exhaust manifold (1), refer to paragraph 4-11.
21. Check that all piping is alined and mounting bolts are tightened in turbocharger (12).
22. Using a flat tip screwdriver, tighten clamps (4,5,6,8 and 9).



NOTE

Air induction system and turbo-charger assembly must be tested following installation.

23. Using a 9/32" open end wrench, remove pipe plug and apply compressed air at 5 psi to pipe plug opening in air cleaner. Air intake pipe must be blocked off completely.
24. Apply detergent and water solution and check for leaks in all connections in air induction system. Air bubbles indicate leaks. Tighten any loose connections.

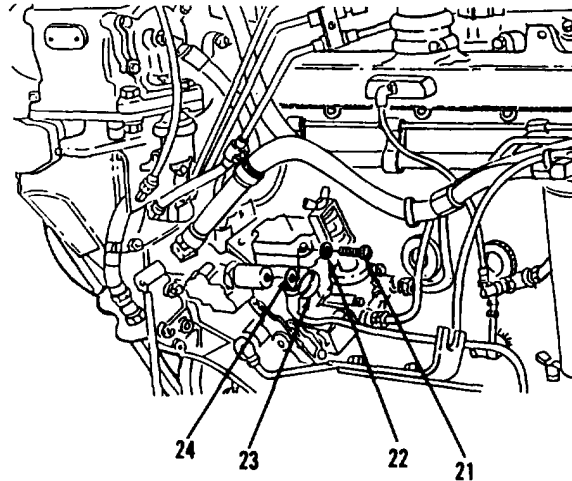


Go to sheet 6

4-15. Turbocharger and Piping. (Sheet 6 of 6)

INSTALLATION (cont)

25. Using a flat tip screwdriver, disconnect protective boot (23) and remove screw (21) and washer (22).
26. Disconnect wire assembly (24) from fuel injection pump.
27. Crank the engine, without starting, until oil pressure is indicated on the oil pressure gage, to provide an adequate amount of oil to lubricate the turbocharger (12).
28. Connect wire assembly (24) to the fuel injection pump.
29. Using a flat tip screwdriver, install washer (22), screw (21) and connect protective boot (23).



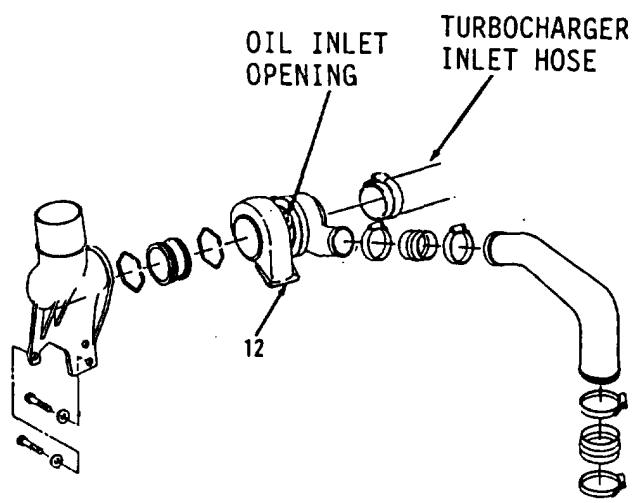
**CAUTION**

Shut engine down and immediately correct the following conditions: unusual noises, lubrication leaks, insecure mounting, excessive vibration or smoke,

30. Operate engine and observe turbocharger (12).
31. Using 9/16" and 1/2" sockets and socket wrench handle, tighten all bolts, nuts, clamps and oil connections.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-16. Fuel Tank. (Sheet 1 of 3)

This task covers: a. Removal b. Installation

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Wood block (4)

Torques

Except for special torques shown,  
all fasteners are tightened to  
standard torques. Refer to  
Appendix E.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Step removed.  
Fuel tank drained.  
Filler cap assemblies removed.  
Fuel strainer removed.  
Fuel level sending unit removed.  
Fuel tank lines and fittings removed.

Paragraph 4-9

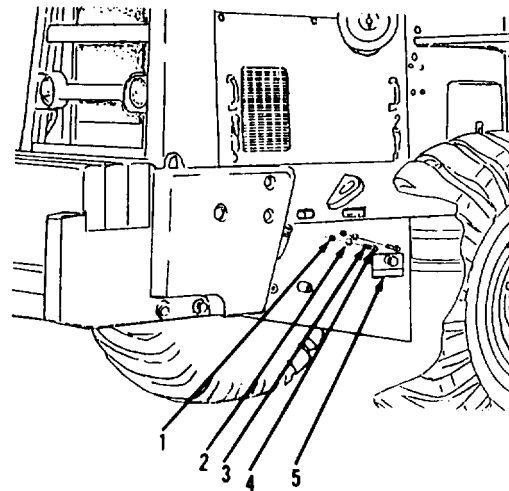
Transmission oil cooler removed.

Go to sheet 2

4-16. Fuel Tank. (Sheet 2 of 3)

REMOVAL

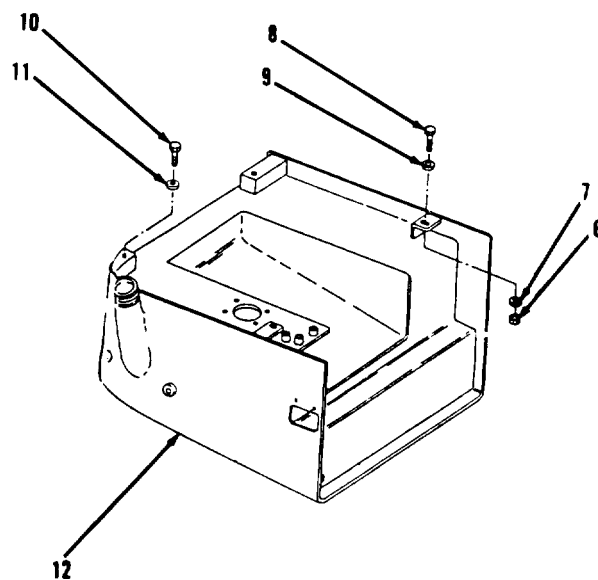
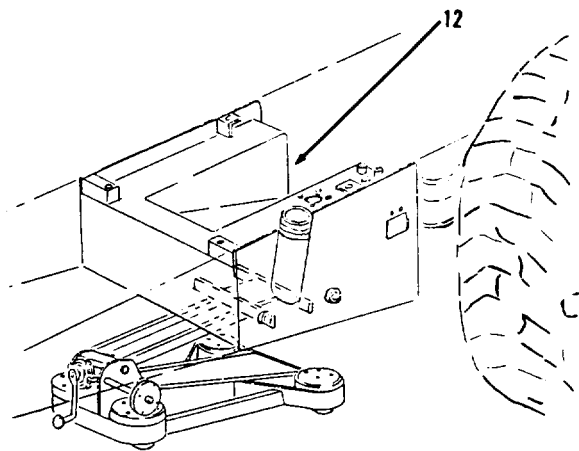
1. Using 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove two nuts (1), washers (2), bolts (3), washers (4) and oil drain adapter (5) from bottom, rear of vehicle. Move oil drain adapter (5) and hose to one side.



**WARNING**  
**WEIGHT HAZARD**

Weight of fuel tank is approximately 500 lbs. Use transmission and differential lift for removal and installation. Fuel tank must be centered and balanced on lift. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

2. Position transmission and differential lift under fuel tank (12).
3. Using a 15/16" socket, socket wrench handle and a 15/16" open end wrench, remove two nuts (6), washers (7), bolts (8) and washers (9).
4. Using a 15/16" socket and socket wrench handle, remove two bolts (10) and washers (11).
5. Using transmission and differential lift, remove fuel tank (12) and place on wood blocks.



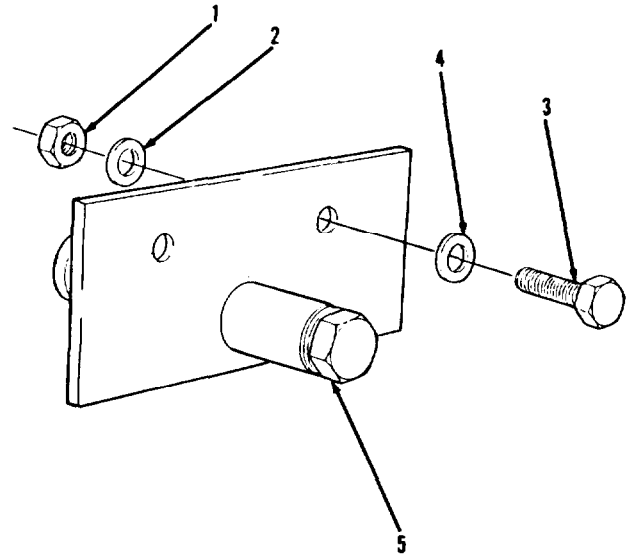
Go to sheet 3

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-16. Fuel Tank. (Sheet 3 of 3)

INSTALLATION

6. Using transmission and differential lift, position fuel tank (12) at bottom, rear of vehicle.
7. Using a 15/16" socket and socket wrench handle, install two washers (11) and bolts (10).
8. Using a 15/16" socket, socket wrench handle and a 15/16" open end wrench, install two washers (9), bolts (8), washers (7) and nuts (6).
9. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install oil drain adapter (5), two washers (4), bolts (3), washers (2) and nuts (1).
10. Remove transmission and differential lift from fuel tank (12).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

TM 10-3930-643-34

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-17. Radiator Assembly. (Sheet 1 of 2)

This task covers:       a. Removal                               b. Installation

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Hoist and lifting strap,  
capacity of 216 lbs.  
3/8-16 eyebolt (2)

Materials/Parts

Wood block (2)

Torques

Except for special torques shown,  
all fasteners are tightened to  
standard torques. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Radiator drained.  
Engine top access cover removed.  
Fan, guard, housing and supports  
removed.  
Grille and supports removed.  
Radiator piping and mounting removed.

---

Go to sheet 2

4-110

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-17. Radiator Assembly. (Sheet 2 of 2)

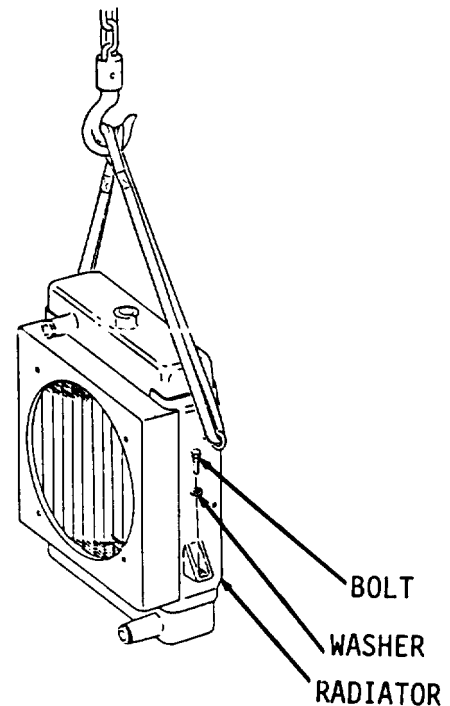
REMOVAL

1. Attach two 3/8-16 eyebolts in support-to-radiator mounting holes in rear of vehicle.

**WARNING**  
**WEIGHT HAZARD**

Weight of radiator assembly is approximately 216 lbs. Use adequate hoist and lifting strap for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

2. Attach hoist and lifting strap to eyebolts.
3. Using a 3/4" socket and socket wrench handle, remove two bolts and washers.
4. Using hoist and lifting strap, remove radiator assembly. Place securely on wood blocks on floor.

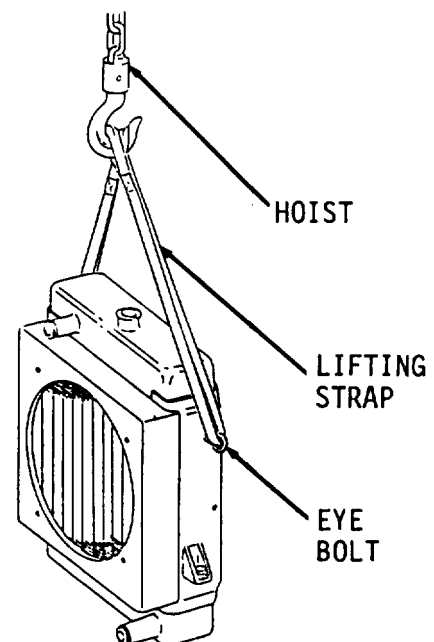


INSTALLATION

5. Using hoist and lifting strap, install radiator assembly.
6. Using a 3/4" socket and socket wrench handle, install two washers and bolts.
7. Remove hoist and lifting strap.
8. Remove two 3/8-16 eyebolts from mounting holes.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-18. Water Pump Assembly. (Sheet 1 of 5)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754'0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubrication oil (App. C, Item 19)  
Grease (App. C, Item 9)  
Seal and boot  
Water pump seal assembly  
Front bearing grease seal  
Rear bearing grease seal

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT DESCRIPTION

References

TM 10-3930-643-20

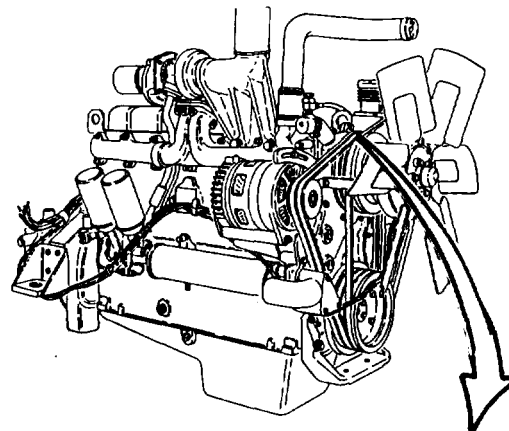
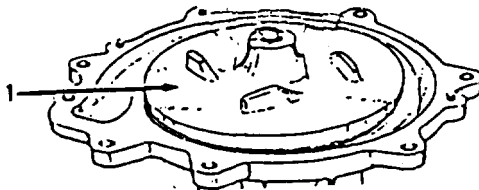
Condition Description

Water pump assembly removed.

---

DISASSEMBLY

1. Use puller to engage two 1/2 inch holes in impeller (1). If impeller (1) is equipped with 1/4 inch holes, enlarge them to accept puller, then remove impeller (1).



Go to sheet 2

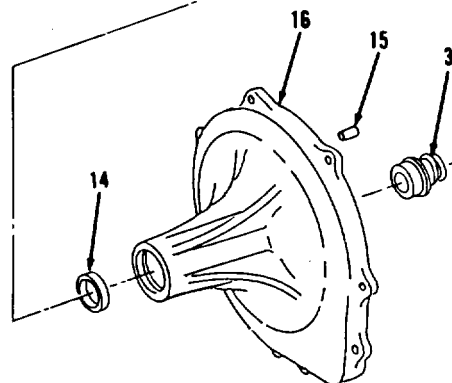
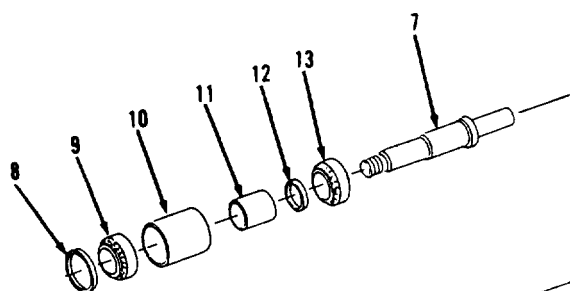
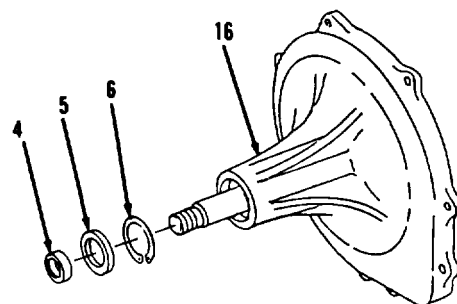
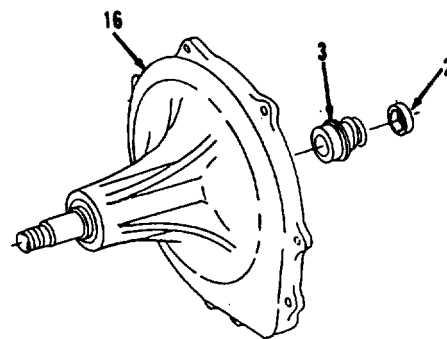


ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-18. Water Pump Assembly. (Sheet 2 of 5)

DISASSEMBLY

2. Using a flat tip screwdriver, pry out and discard seal and boot (2).
3. Remove seal assembly (3) and discard. Metal part of seal assembly (3) will remain in water pump housing (16).
4. Remove sleeve (4).
5. Remove and discard grease seal (5).
6. Using internal snap ring pliers or a small flat tip screwdriver, remove retainer ring (6).
7. From rear of water pump housing (16), press out shaft (7), spacer (8), bearing (9), spacer (10), spacer (11), spacer (12) and bearing (13). Spacers (8, 10, 11 and 12) and bearings (9 and 13) will come out with shaft (7).
8. Using a drive pin punch and small hammer, drive out metal part of seal assembly (3) and discard.
9. Using a flat tip screwdriver, remove and discard grease seal (14).
10. Using vise grip pliers, remove two pins (15).



Go to sheet 3

4-18. Water Pump Assembly. (Sheet 3 of 5)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

11. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
12. Inspect all parts. Refer to paragraph 2-9.

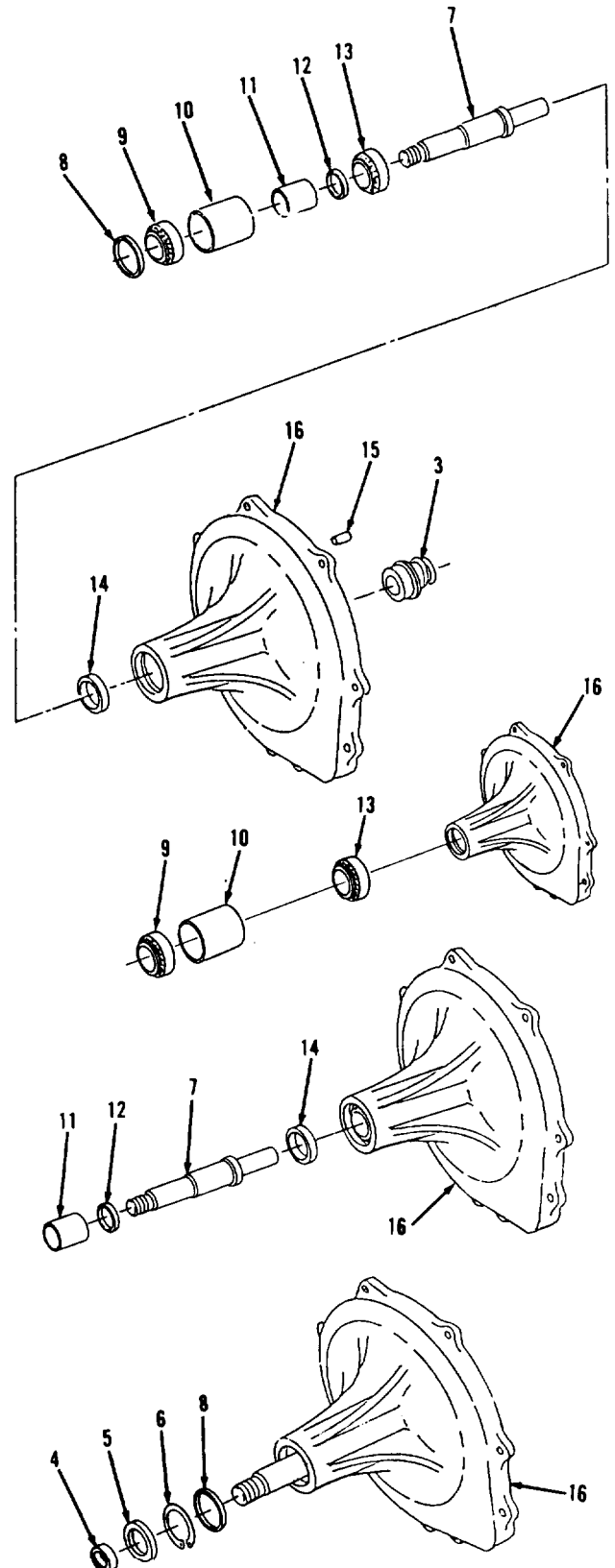
Go to sheet 4

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-18. Water Pump Assembly. (Sheet 4 of 5)

ASSEMBLY

13. Using a small hammer, install two pins (15).
14. Grease and position new grease seal (14) so open end faces bearing (13).
15. Pack bearing (13) with grease and install. Inner and outer race must be pressed together into water pump housing (16) against shoulder.
16. Install spacer (10).
17. Press outer race of bearing (9) into water pump housing (16) insuring that the outer races of bearings (9 and 13) and spacer (10) are bottomed.
18. Lubricate new grease seal (14) with engine oil and install.
19. Press shaft (7) into rear of water pump housing (16) until rear inner race stops shaft (7).
20. Install spacers (12 and 11). Fill cavity between spacers (12 and 11) with 0.6 oz. of grease.
21. Pack inner race of bearing (9) with grease. Press inner race into water pump housing (16) until it bottoms on shaft (7). Shaft (7) must be supported at rear.
22. Using internal snap ring pliers, install spacer (8) and retainer ring (6).
23. Position new grease seal (5) against retainer ring (6) so open end faces bearing (9).
24. Install sleeve (4).

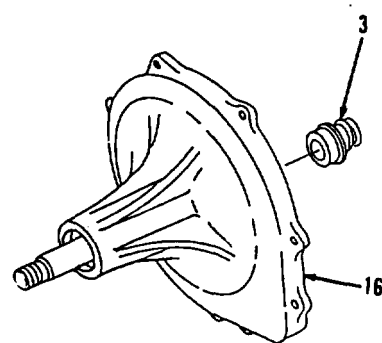


Go to sheet 5

4-18. Water Pump Assembly. (Sheet 5 of 5)

ASSEMBLY (cont)

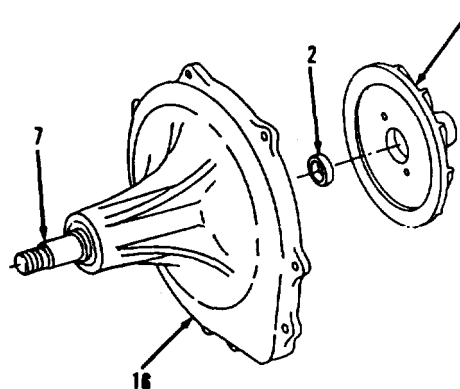
25. Press new seal assembly (3) into water pump housing (16).
26. Moisten new rubber boot with water and install new ceramic seal into boot. Identification mark on ceramic seal must be down.
27. press new seal and boot (2) into impeller (1) until seal and boot (2) bottoms in counterbore.
28. Support front end of shaft (7) and push down on water pump housing (16) to take bearing end plate toward the rear of water pump assembly.



NOTE

Since shaft will protrude slightly from impeller, use care not to damage shaft during installation.

29. Place two 0.030 inch feeler gages on opposite sides of water pump housing (16) and press impeller (1) on shaft (7) until feeler gages are snug.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-19. Fan and Clutch. (Sheet 1 of 4)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                                  c. Assembly

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Loctite 262 (App. C, Item 15)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

EQUIPMENT CONDITION

References

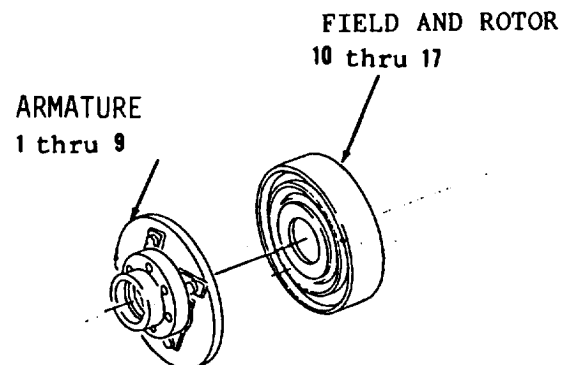
TM 10-3930-643-20

Condition Description

Fan, guard, housing and supports  
removed.  
Fan and clutch removed.

DISASSEMBLY

1. Separate armature, items 1 thru 9 as an assembly from field and rotor, items 10 thru 17 as an assembly.

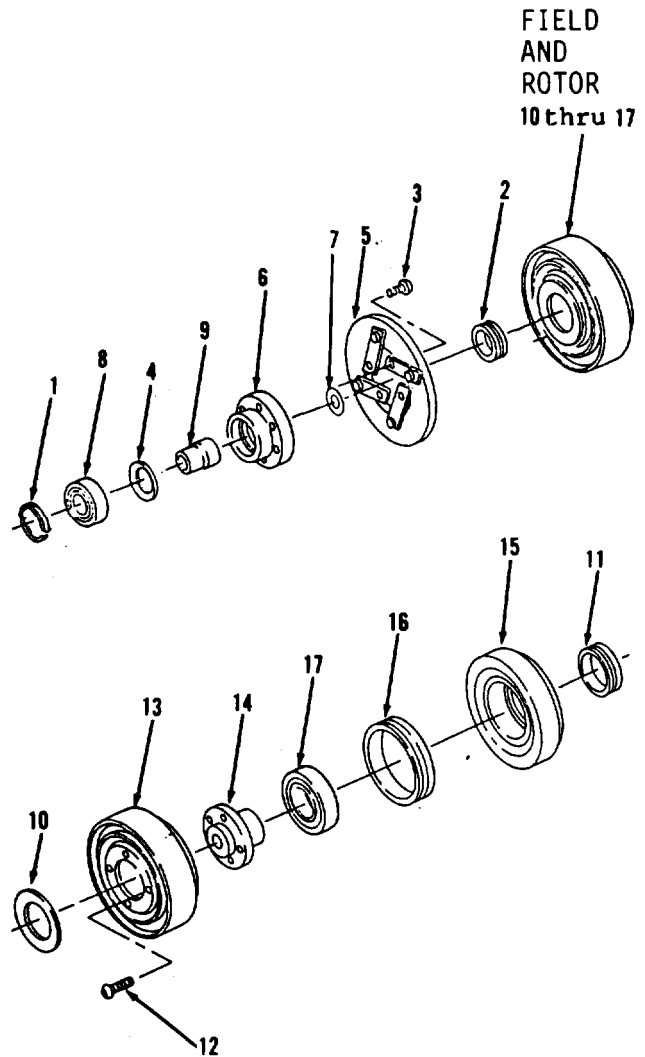


Go to sheet 2

4-19. Fan and Clutch. (Sheet 2 of 4)

DISASSEMBLY (cont)

2. Using internal snap ring pliers, remove rings (1 and 2) on armature.
3. Using a 3/8" open end wrench, remove four bolts (3), disk (4) from housing (5).
4. Press sleeve (6) from bearing (8).
5. Press bearing (8) from housing (5).
6. Remove bearing sleeve (9).
7. Remove shim (7).
8. Remove two spacers (10) from field and rotor.
9. Remove ring (11).
10. Using a 3/8" open end wrench, remove four bolts (12), clutch (13), hub (14) and disk (15).
11. Remove ring (16).
12. Press hub (14) from bearing (17).
13. Press bearing (17) from disk (15).



ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE.

4-19. Fan and Clutch. (Sheet 3 of 4)

CLEANING/Inspection

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

14. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
15. Inspect all parts. Refer to paragraph 2-9.

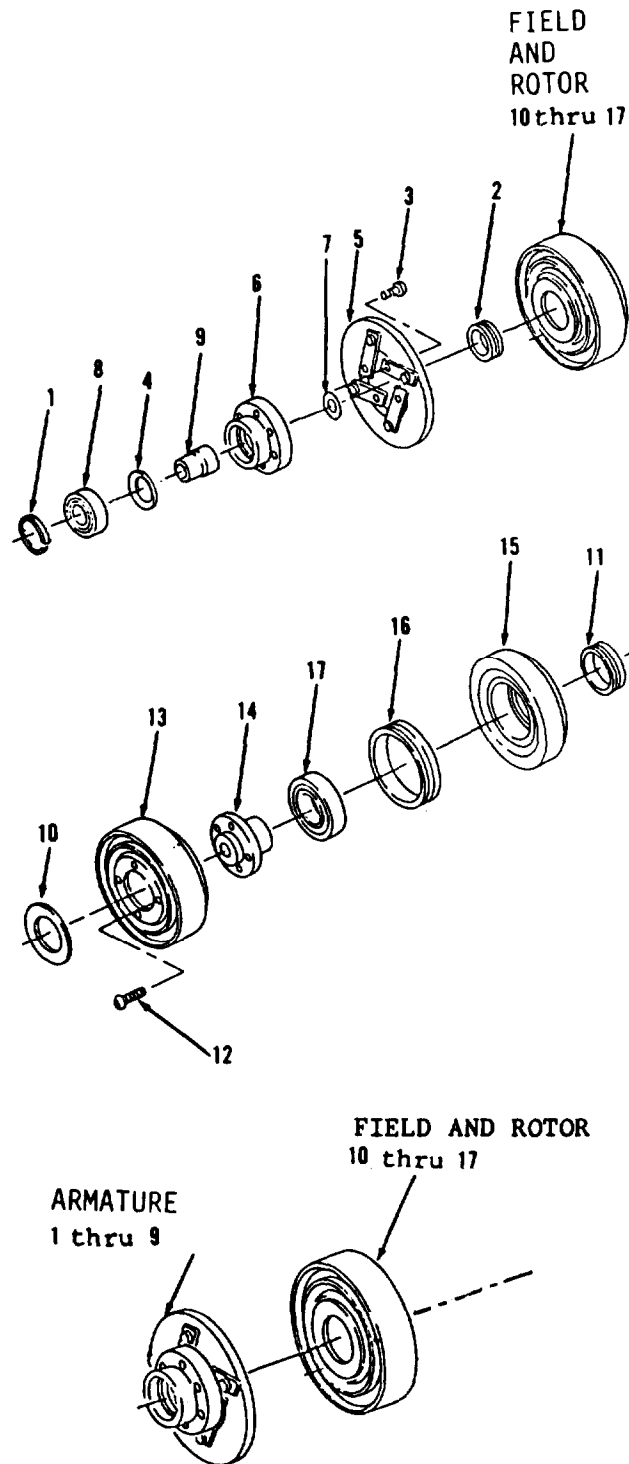
Go to sheet 4

ENGINE, FUEL, EXHAUST AND COOLING TROUBLESHOOTING AND MAINTENANCE. (cont)

4-19. Fan and Clutch. (Sheet 4 of 4)

ASSEMBLY

16. Press bearing (17) into disk (15).
17. Press hub (14) into bearing (17).
18. Install ring (16).
19. Apply Loctite 262 to four bolts (12).
20. Using a 3/8" open end wrench, install disk (15), hub (14), clutch (13) and four bolts (12).
21. Install ring (11).
22. Install two spacers (10).
23. Install shim (7) in armature.
24. Install bearing sleeve (9).
25. Press bearing (8) into housing (5).
26. Press sleeve (6) into bearing (8).
27. Apply Loctite 262 to four bolts (3).
28. Using a 3/8" open end wrench and internal snap ring pliers, install housing (5), disk (4), four bolts (3) and rings (2 and 1).
29. Assemble field and rotor, items 17 thru 10 as an assembly and armature, items 9 thru 1 as an assembly in fan clutch. Use 0.0179 inch spacers (10) as required to obtain 0.035 to 0.055 inch gap between clutch (13) and clutch disk (4).



END OF TASK



## CHAPTER 5

ELECTRICAL SYSTEM  
MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Starting Motor	5-1	5-2
Instrument Panel Wiring Harness	5-2	5-17
Main Wiring Harness	5-3	5-26
Intermediate Wiring Harness (S/N 2001 and above)	5-4	5-41
Intermediate Wiring Harness (S/N 2000 and below)	5-5	5-45
Fork Control Wiring Harness	5-6	5-49
Front Lights Wiring Harness	5-7	5-53

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 1 of 15)

- This task covers:
- |                |                        |
|----------------|------------------------|
| a. Disassembly | b. Cleaning/Inspection |
| c. Assembly    | d. Adjustment          |

---

INITIAL SETUP

Tools

Shop Equipment, Fuel & Electrical  
System, Engine: Field Maintenance,  
Basic, Less Power  
NSN 4910-00-754-0714  
Shop Equipment, Fuel & Electrical  
System, Engine: Field Maintenance,  
Basic, MAP only  
NSN 4910-00-919-0083  
Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Torque Wrench  
NSN 5120-00-247-2536

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Oil, Grade 3 (App. C, Item 13)  
Insulating tape (App. C, Item 29)  
Locknut  
Preformed packing (5)  
Casket (3)  
Cap (3)  
Wick (3)  
Seal  
Plug  
No. 00 grit sandpaper

Torques

Bolts (35 and 36) to 13-17 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Right side engine cover removed.  
Solenoid removed.

---

ELECTRICAL SYSTEM MAINTENANCE.

5-1. Starting Motor. (Sheet 2 of 15)

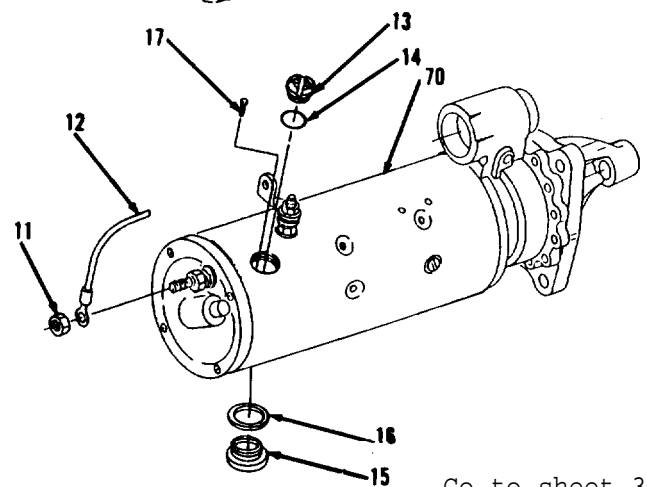
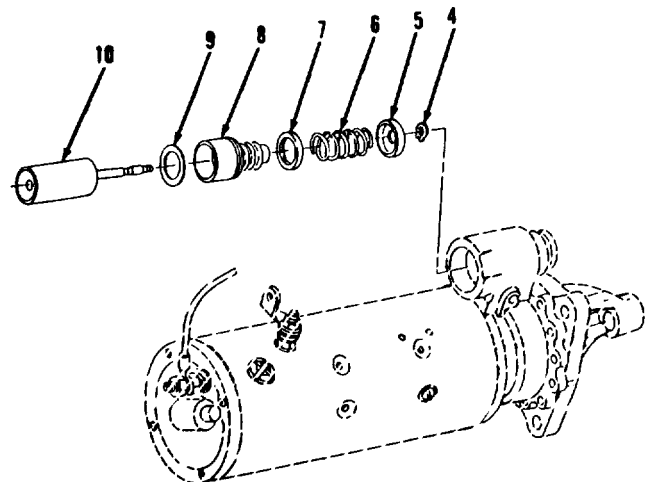
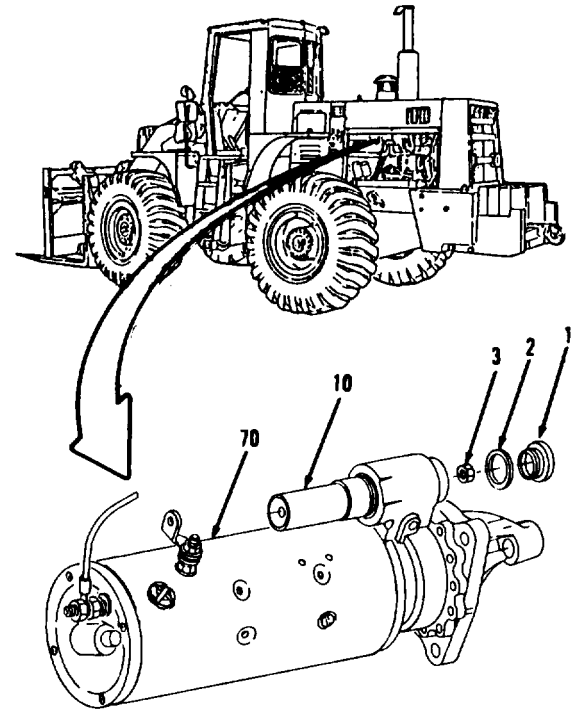
DISASSEMBLY

1. Using a flat tip screwdriver, remove plug (1), gasket (2) and locknut (3) from starting motor housing (70). Discard gasket (2) and locknut (3). Hold plunger (10) when turning locknut (3).
2. Using slip joint pliers, remove items 4 thru 10 as an assembly.
3. Compress spring (6) and remove retaining ring (4), recessed washer (5), spring (6), recessed washer (7), bellows (8) and washer (9) from plunger (10).

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

4. Using a 3/4" open end wrench, remove nut (11) and lead assembly (12) from starting motor housing (70).
5. Using a flat tip screwdriver, remove plug (13), gasket (14), plug (15) and gasket (16). Discard gaskets (14 and 16).
6. Remove two screws (17). Screws (17) may be reached through ports of plugs (13 and 15).



Go to sheet 3

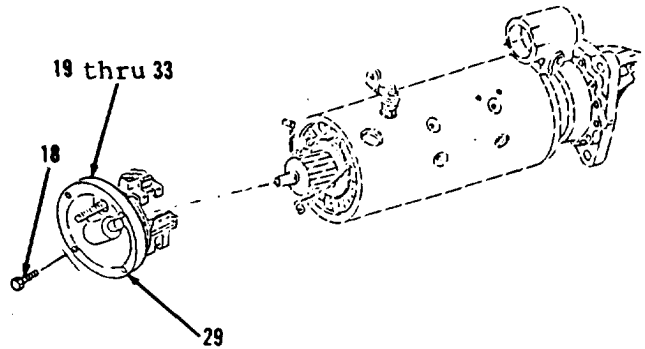
ELECTRICAL SYSTEM MAINTENANCE, (cont)

5-1. Starting Motor. (Sheet 3 of 15)

DISASSEMBLY (cont)

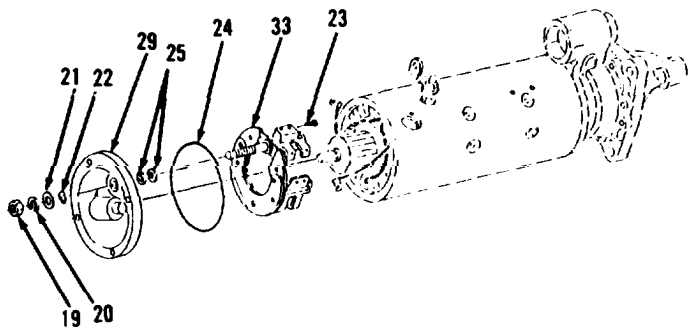
NOTE

Starting motor frame and housings must be match marked before disassembly.



7. Using a 7/16" socket and socket wrench handle, remove four bolts (18).

8. Remove items 19 thru 33 as an assembly. Use suitable driver and hammer to tap around circumference of frame (29).



9. Using a 3/4" open end wrench, remove nut (19), lock-washer (20), washer (21) and bushing (22).

10. Using a flat tip screwdriver, remove three screws (23).

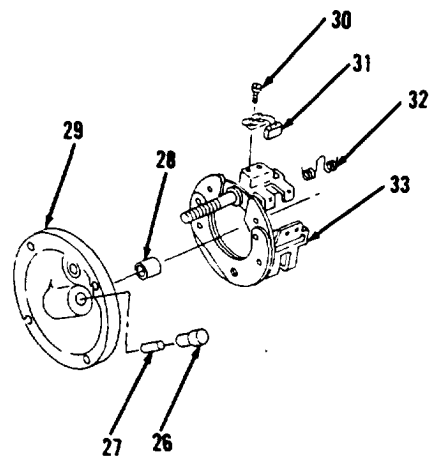
11. Separate frame (29), element holder (33) and preformed packing (24). Discard preformed packing (24).

12. Remove two insulators (25) from element holder (33).

13. Using an electric drill, drill hole to pry out cap (26) and wick (27) from frame (29). Discard cap (26) and wick (27).

**CAUTION**

Removal of bearing from frame will cause destruction of bearing. Remove only if inspection indicates removal is necessary.



14. Inspect bearing (28). Replace if cracked, broken, grooved or scored.

Go to sheet 4

## ELECTRICAL SYSTEM MAINTENANCE.

## 5-1. Starting Motor. (Sheet 4 of 15)

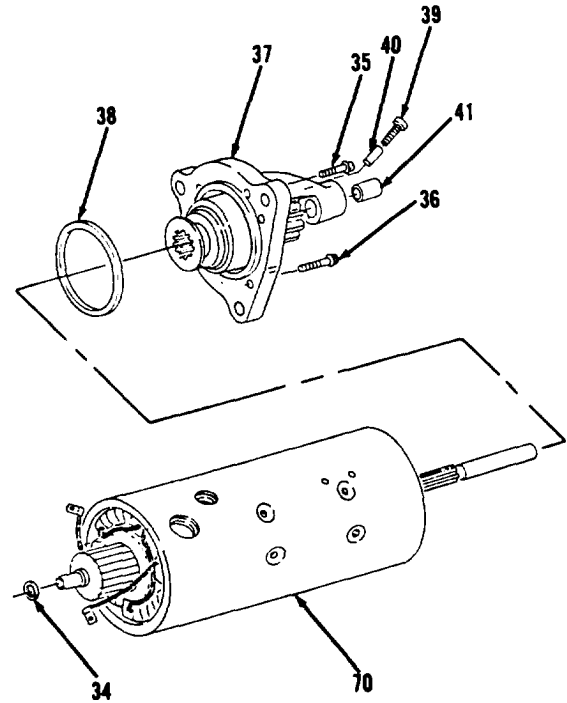
DISASSEMBLY

15. If necessary, press out bearing (28) using a suitable driver and press.
16. Using a flat tip screwdriver, remove four screws (30) and brushes (31) from element holder (33).
17. Remove four springs (32).
18. Remove washer (34) from starting motor housing (70).
19. Using a 1/4" socket head screw key, remove bolt (35), five bolts (36) and housing (37).
20. Remove and discard preformed packing (38) from housing (37).
21. Using an electric drill, drill hole to pry out cap (39) and wick (40) from housing (37). Discard cap (39) and wick (40).

**CAUTION**

Removal of bushing from housing will cause destruction of bushing. Remove only if inspection indicates removal is necessary.

22. Inspect bushing (41). Replace if cracked, broken, grooved or scored.
23. If necessary, press out bushing (41) using suitable driver and press.



Go to sheet 5

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 5 of 15)

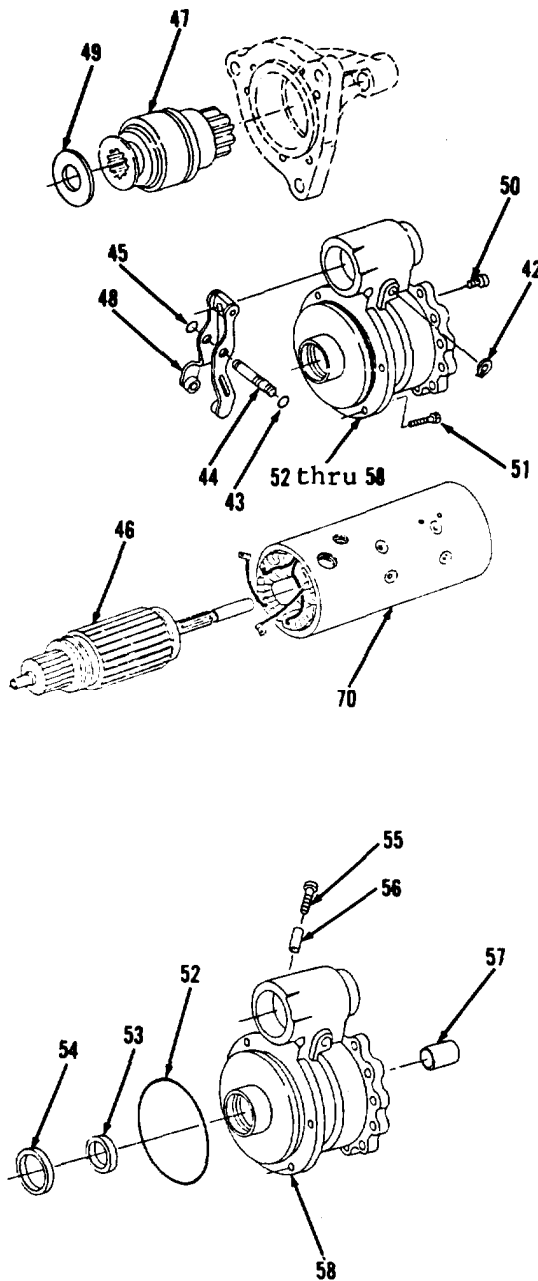
DISASSEMBLY (cont)

24. Using snap ring pliers, remove retaining ring (42), preformed packing (43), shaft (44) and preformed packing (45) from starting motor housing (70). Discard preformed packings (43 and 45).
25. Remove armature (46).
26. Remove drive (47), lever (48) and washer (49).
27. Using long round nose pliers, remove plug (50).
28. Using a 7/16" open end wrench, remove five bolts (51).
29. Separate items 52 thru 58 as an assembly.
30. Using a flat tip screwdriver, remove preformed packing (52), seal (53) and washer (54) from lever housing (58). Discard preformed packing (52) and seal (53).
31. Using an electric drill, drill hole to pry out cap (55) and wick (56). Discard cap (55) and wick (56).

**CAUTION**

Removal of bearing from lever housing will cause destruction of bearing. Remove only if inspection indicates removal is necessary.

32. Inspect bearing (57). Replace if cracked, broken, grooved or scored.
33. If necessary, press out bearing (57) using suitable driver and press.



Go to sheet 6

## ELECTRICAL SYSTEM MAINTENANCE.

## 5-1. Starting Motor. (Sheet 6 of 15)

DISASSEMBLY

## NOTE

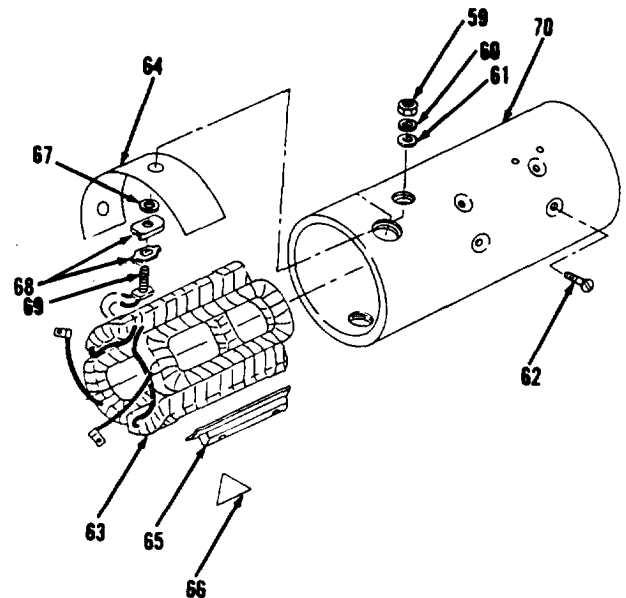
Remove coil only if testing and inspection indicate replacement is necessary.

34. Using a 3/4" open end wrench, remove nut (59), washer (60) and washer (61) from starting motor housing (70).

## NOTE

In steps 35 thru 37, support coil by hand or use pole spreader to prevent distortion.

35. Using cross tip screwdriver, remove eight screws (62).
36. Bend up three tabs on commutator end of coil (63) and pull lead assembly of coil (63) through starting motor housing (70).
37. If necessary, remove coil (63), insulator (64), four shoes (65) and two plates (66).
38. Remove washer (67) and insulator bushing (68) from coil (63).
39. Using diagonal cutting pliers, cut leads and remove terminal stud (69). Remove only if stud is bent or threads are damaged.



Go to sheet 7

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 7 of 15)

CLEANING/INSPECTION

40. Wipe bellows (8). insulator (68), four brushes (31), drive (47) and two plates (66) with a clean, lint-free cloth. Do not use cleaning solvent.
41. Clean coil (63) and starting motor housing (70) with mineral spirits and brush. Dry with clean cloth.

**WARNING**

**COMPRESSED AIR HAZARD**

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

42. Clean armature (46) with mineral spirits and brush. Dry with compressed air. Commutator can be cleaned with No. 00 grit sandpaper. Wipe commutator with a clean, lint-free cloth to remove all particles from between commutator bars. Do not use emery cloth.

Go to sheet 8



## ELECTRICAL SYSTEM MAINTENANCE.

5-1. Starting Motor. (Sheet 8 of 15)

CLEANING/INSPECTION

**WARNING**  
TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

43. Wipe frame (29) and housings (37 and 58) with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air.
44. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
45. Inspect all parts. Refer to paragraph 2-9.

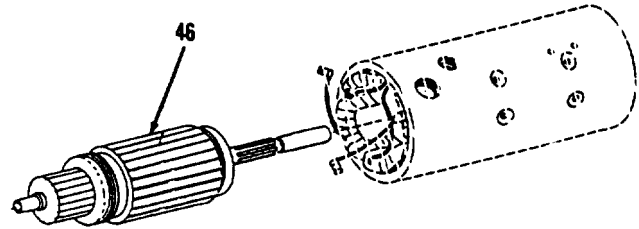
Go to sheet 9

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 9 of 15)

TESTING

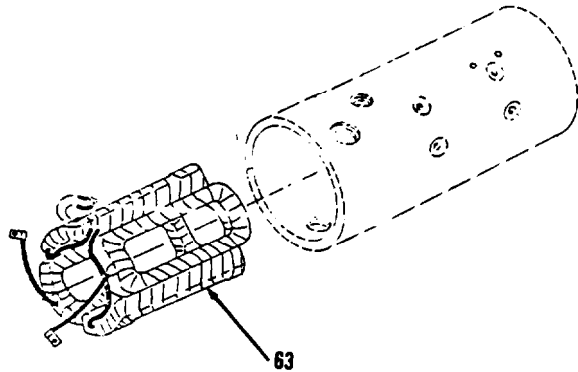
- 46. Use growler and steel blade to test for shorted windings in armature (46). Replace if steel blade vibrates.
- 47. Test to check for accumulation of brush material between commutator bars in armature (46). Replace armature (46) if brush material has been cleaned out from in between commutator bars and if testing device shows short circuit between two commutator bars.



NOTE

Coil must be installed in starting housing and grounds must be disconnected for grounds and opens test.

- 48. Test coil (63) for grounds with multimeter. Replace if grounds are indicated.
- 49. Test coil (63) for opens with multimeter. Replace if opens are indicated.



ELECTRICAL SYSTEM MAINTENANCE.

5-1. Starting Motor. (Sheet 10 of 15)

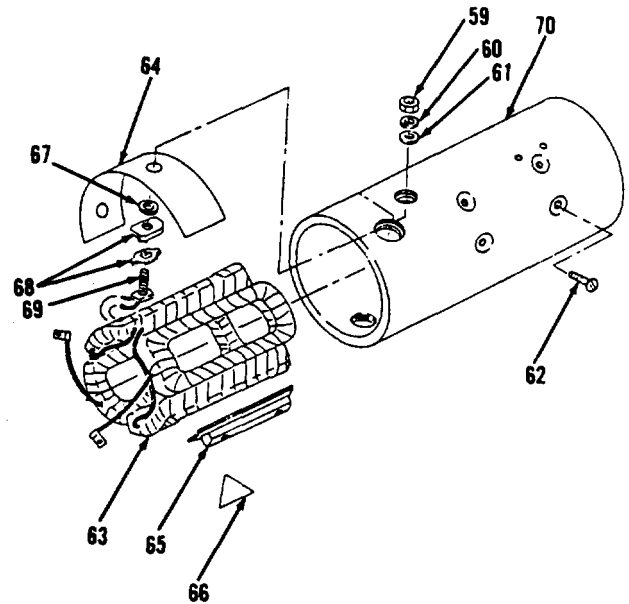
ASSEMBLY

50. Install terminal stud (69), if removed, in coil (63). Use soldering gun and insulating tape.
51. Install insulator bushing (68) and washer (67).
52. Using a cross tip screwdriver, position two plates (66) and four shoes (65). Shoes (65) must be assembled on coil (63) with long lip in the direction of armature rotation. Long lip must be the trailing edge of the shoe, not the leading edge.
53. Wrap insulator (64) around coil (63).
54. Install coil (63) in starting motor housing (70). Support coil (63) by hand or use pole shoe spreader.



Do not tear insulator. Careful installation of coil is necessary to prevent shorting or grounding of the coil as shoes are tightened into place.

55. Using a cross tip screwdriver, install eight screws (62) through starting motor housing (70) into shoes (65) to secure coil (63). Tighten screws (62) evenly.
56. Using a 3/4" open end wrench, install washers (61 and 60) and nut (59).

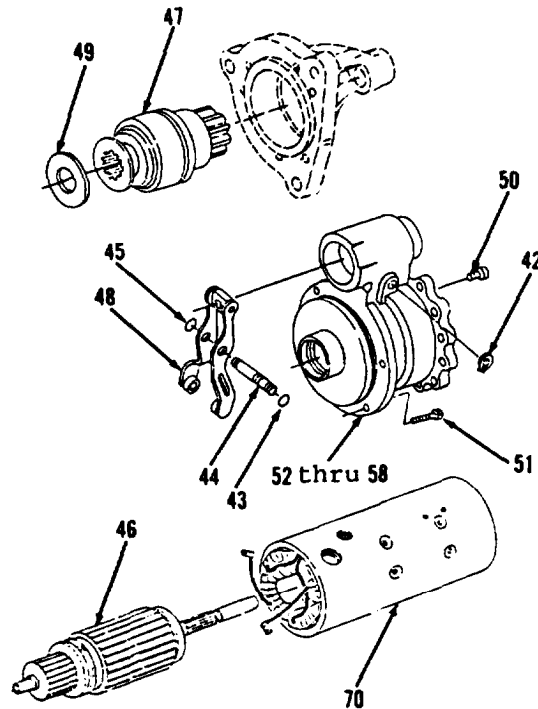
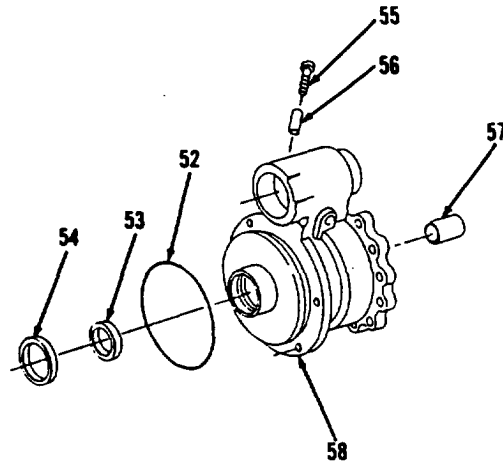


ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 11 of 15)

ASSEMBLY (cont)

57. If removed, press new bearing (57) into lever housing (58). Prior to installation, soak bearing in oil, Grade 3.
58. Soak wick (56) in oil, Grade 3. Then install new wick (56) and new cap (55).
59. Lubricate bore of seal (53) lightly with oil, Grade 3, then install washer (54), new seal (53) and new preformed packing (52).
60. Position items 58 thru 52 as an assembly in starting motor housing (70). Aline match marks on lever housing (58) and starting motor housing (70).
61. Using a 7/16" open end wrench, install five bolts (51).
62. Using long round nose pliers, install plug (50).
63. Install washer (49), lever (48) and drive (47).
64. Install armature (46).
65. Install new preformed packing (45), shaft (44), new preformed packing (43) and retaining ring (42).



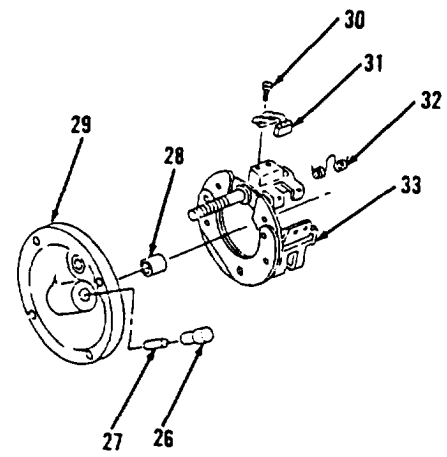
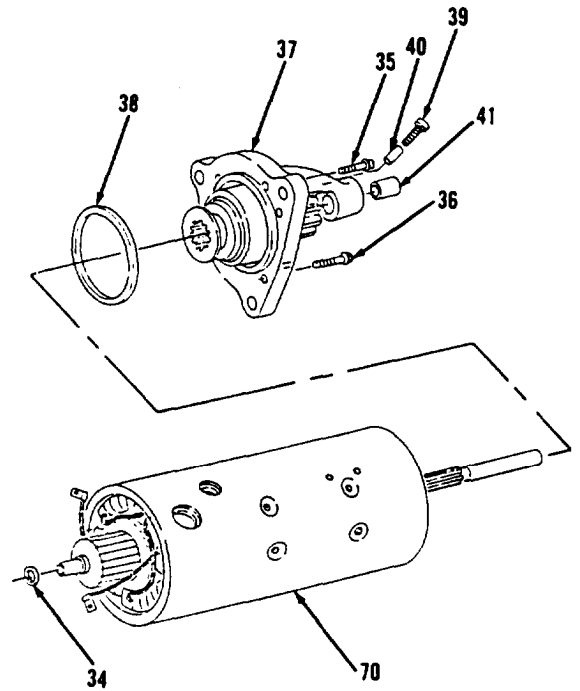
Go to sheet 12

ELECTRICAL SYSTEM MAINTENANCE.

5-1. Starting Motor. (Sheet 12 of 15)

ASSEMBLY

66. If removed, press new bushing (41) into housing (37). Prior to installation, soak bushing in oil, Grade 3.
67. Soak new wick (40) and new cap (39) in oil, Grade 3, then install.
68. Lubricate new preformed packing (38) lightly with oil, Grade 3, then install.
69. Using a 1/4" socket head screw key, install housing (37), five bolts (36) and bolt (35) in starting motor housing (70). Tighten bolts to 13 to 17 lb-ft.
70. Install washer (34).
71. Install four springs (32) in element holder (33).
72. Using a flat tip screwdriver, install four brushes (31) and screws (30). Check that brushes (31) ride freely in holder.
73. Soak new bearing (28) in oil, Grade 3.
74. If removed, press new bearing (28) into frame (29) with suitable driver and press.
75. Soak new wick (27) and new cap (26) in oil, Grade 3, then install.



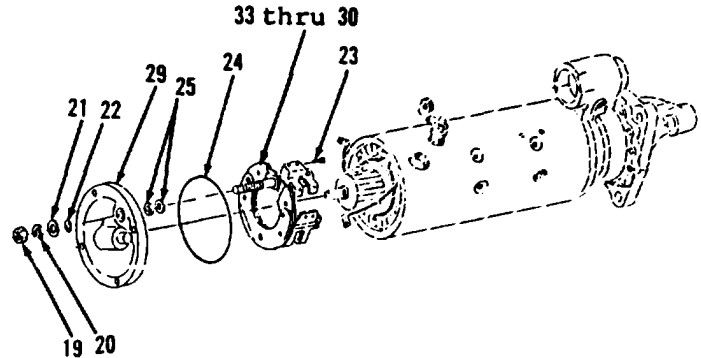
Go to sheet 13

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-1. Starting Motor. (Sheet 13 of 15)

ASSEMBLY (cont)

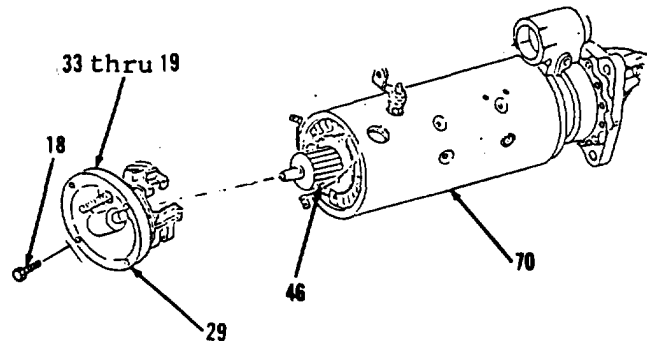
76. Install two insulators (25) in element holder (33).
77. Install new preformed packing (24) in frame (29).
78. Position items 33 thru 30 as an assembly.
79. Using a flat tip screwdriver, install three screws (23).
80. Using a 3/4" open end wrench, install bushing (22), washer (21), lock washer (20) and nut (19).



NOTE

Terminals of two brush leads connected to coil must be in alignment with ports of plugs in starting motor housing.

81. Install items 33 thru 19 as an assembly in starting motor housing (70). Aline match marks on frame (29) and starting motor housing (70). Pull armature (46) out just far enough to compress brushes for installation on commutator. Slide assembly back into position.
82. Using a 7/16" socket and socket wrench handle, install four bolts (18).



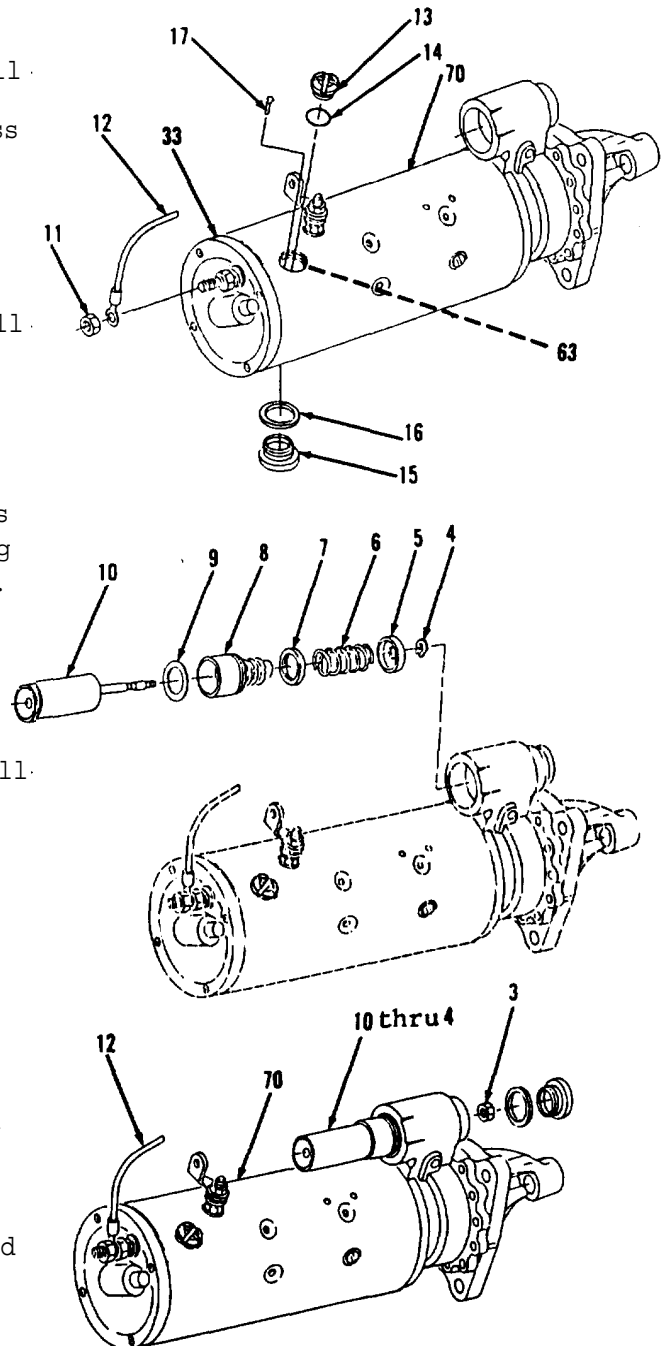
Go to sheet 14

ELECTRICAL SYSTEM MAINTENANCE.

5-1. Starting Motor. (Sheet 14 of 15)

ASSEMBLY

83. Using a flat tip screwdriver, install two screws (17). Secure coil (63) leads to element holder (33). Access through ports of plugs (13 and 15).
84. Install new gasket (16), plug (15), new gasket (14) and plug (13).
85. Using a 3/4" open end wrench, install lead assembly (12) and nut (11).
86. Install washer (9), bellows (8), recessed washer (7), spring (6), recessed washer (5) and retaining ring (4) in plunger (10). Compress spring (6) to install retaining ring (4) on groove of plunger (10) shaft.
87. Install items 10 thru 4 as assembly in starting motor (70).
88. Using a 1/2" open end wrench, install new locknut (3). Do not tighten.



NOTE

Following this assembly procedure for starting motor, install solenoid on starting motor housing, refer to TM 10-3930-643-20.

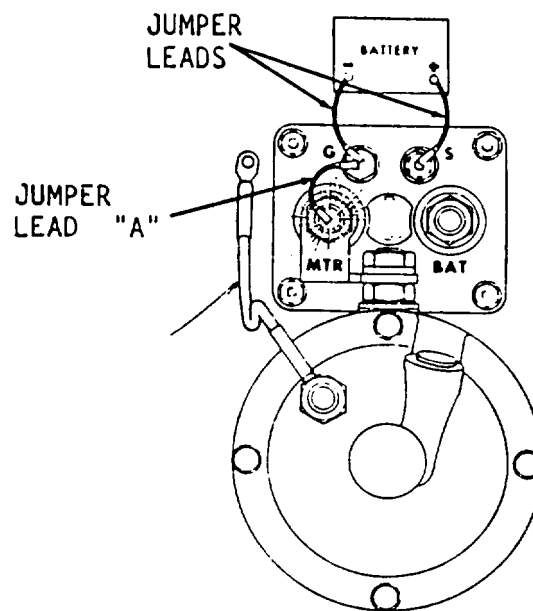
89. Disconnect lead assembly (12) from solenoid mounted on starting motor housing (70).
90. Position starting motor and solenoid assembly in soft-jawed vise.
91. Connect starting motor to 24 volt battery as shown, using two jumper leads. Do not connect battery negative to MTR terminal at this time.
92. Connect jumper lead A to battery negative or terminal G, as shown.

Go to sheet 15

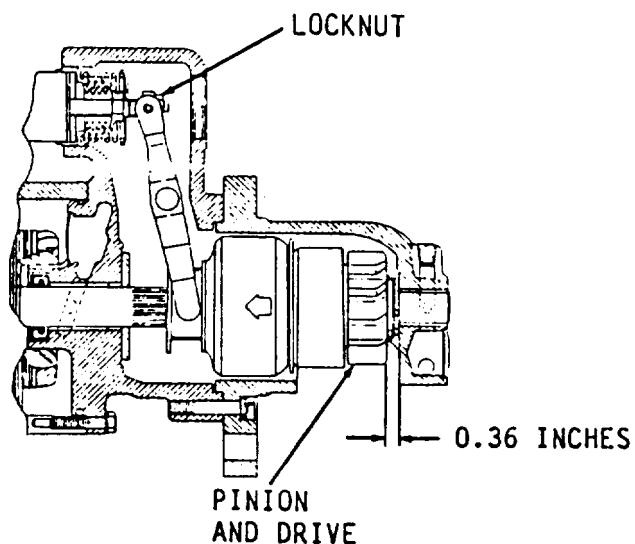
ADJUSTMENT

**WARNING**

Only personnel with training and experience in handling potentially hazardous electrical testing procedures may perform the next procedure. An insulating glove and/or insulated tool should be used.

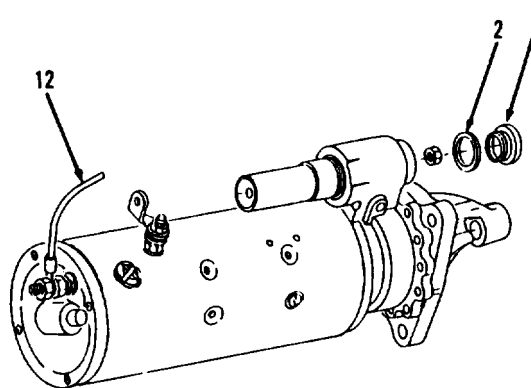


93. Momentarily touch jumper lead A from battery negative to MTR terminal. Drive will shift into cranking position.
94. Push on drive to take up movement.
95. Measure pinion clearance. It should be 0.36 inches.
96. Adjust pinion clearance, if required, by turning locknut.
97. Remove three jumper leads.
98. Connect lead assembly (12) to starting motor solenoid.
99. Install new gasket (2) and plug (1).



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 1 of 9)

This task covers: a. Removal b. Installation

---

  
INITIAL SETUPToolsTool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033Materials/PartsSmall tag (App. C, Item 28)  
Anti-corrosive varnish  
(App. C, Item 30)  
Tie strapTorquesExcept for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

  
EQUIPMENT CONDITIONReferences

TM 10-3930-643-20

Condition Description

Battery negative disconnected.

Go to sheet 2

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 2 of 9)

REMOVAL

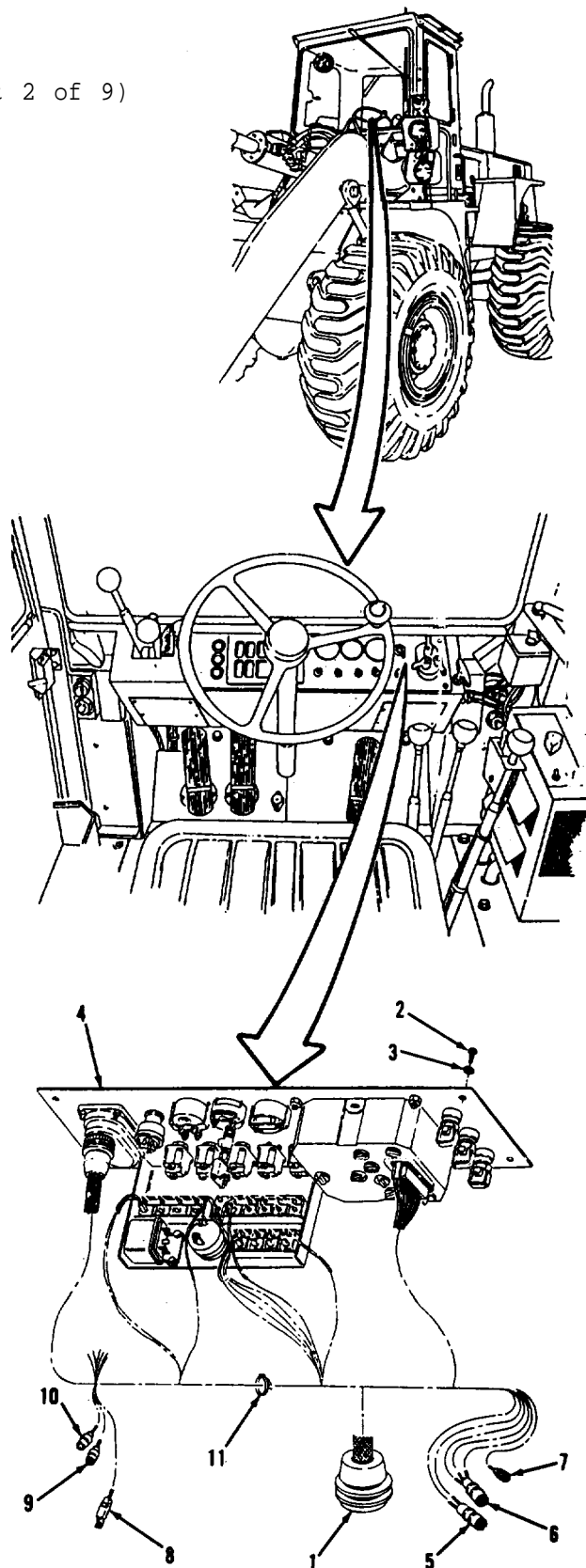
NOTE

● For the following procedure, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.

● All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

● Quantity of tie straps used to secure harness is variable.

1. Disconnect harness assembly (1) at connector from intermediate harness in operator's compartment.
2. Using a flat tip screwdriver, remove four screws (2) and washers (3).
3. Lift instrument panel assembly (4) out of housing.
4. Disconnect wire assemblies (5 thru 7) at connectors from front lights harness.
5. Disconnect wire assembly (8) at connector from heater harness.
6. Disconnect wire assemblies (9 and 10) at connectors from front lights cable assembly.
7. Using diagonal cutting pliers, cut and discard tie straps (11).



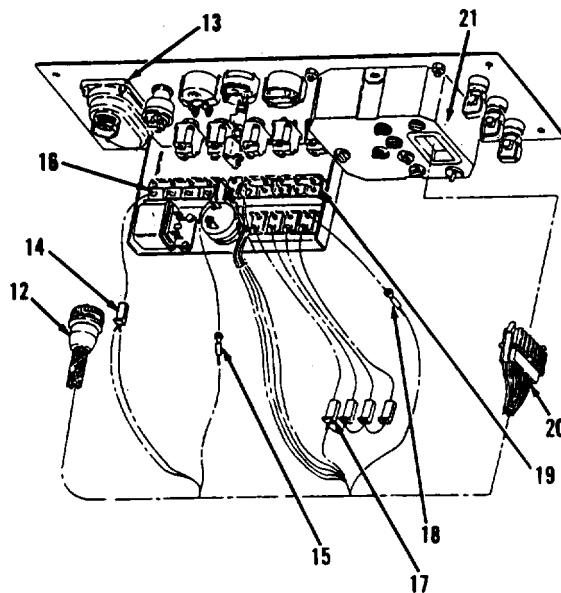
Go to sheet 3

ELECTRICAL SYSTEM MAINTENANCE.

5-2. Instrument Panel Wiring Harness. (Sheet 3 of 9)

REMOVAL

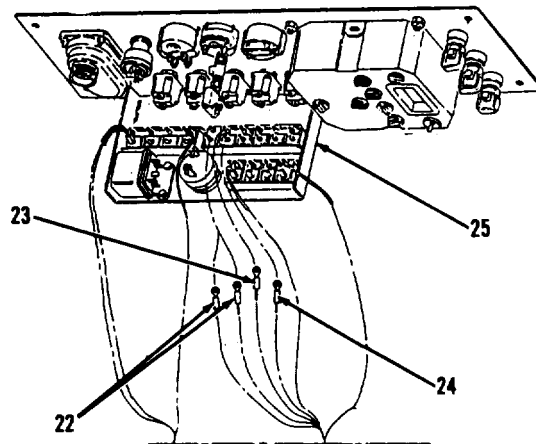
8. Disconnect harness assembly (12) at connector from blackout switch (13).
9. Disconnect four wire assemblies (14) at connectors and lead assemblies (15) from diode assembly (16).
10. Using a flat tip screwdriver, disconnect four wire assemblies (17) at connector and lead assembly (18) from diode assembly (19).
11. Disconnect wire assembly (20) at connector from instrument panel (21).



NOTE

The following are differences between M10A Forklift models. The removal/installation procedures are identical.

12. Disconnect two lead assemblies (22) and lead assembly (23) from circuit breaker assembly (25), from vehicles S/N 2001 and above or disconnect seven lead assemblies (24) from circuit breaker assembly (25), from vehicles S/N 2000 and below.



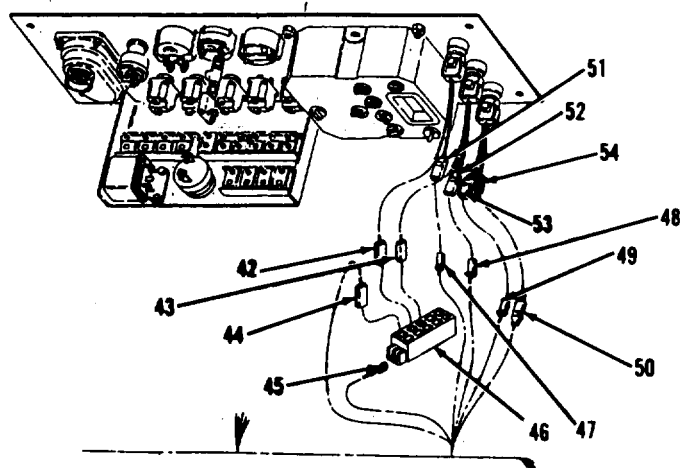
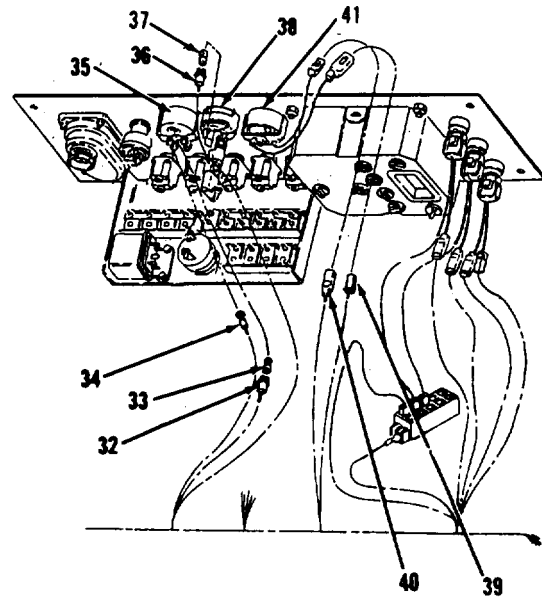
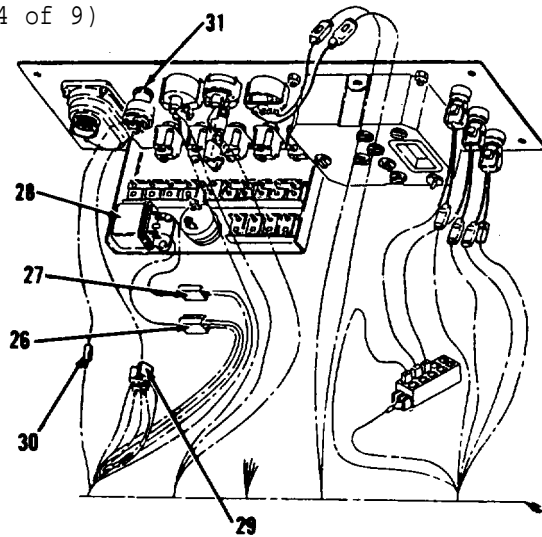
Go to sheet 4

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 4 of 9)

REMOVAL (cont)

13. Disconnect wire assemblies (26 and 27) at connectors from fan clutch relay (28).
14. Disconnect seven wire assemblies (29) and wire assembly (30) at connectors from start switch (31).
15. Remove socket (32) and lamp (33) from oil pressure gage (35).
16. Disconnect two lead assemblies (34) from oil pressure gage (35).
17. Remove socket (36) and lamp (37) from air pressure gage (38).
18. Disconnect lead assemblies (39 and 40) from hourmeter (41).
19. Disconnect two lead assemblies (42, 43, 44 and 45), from connector (46).
20. Disconnect lead assemblies (47 thru 50) from lead assemblies (51 thru 54).



Go to sheet 5

ELECTRICAL SYSTEM MAINTENANCE. (cont)

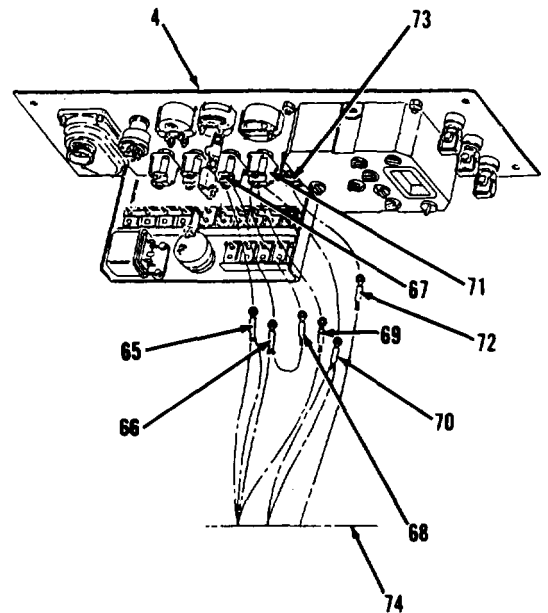
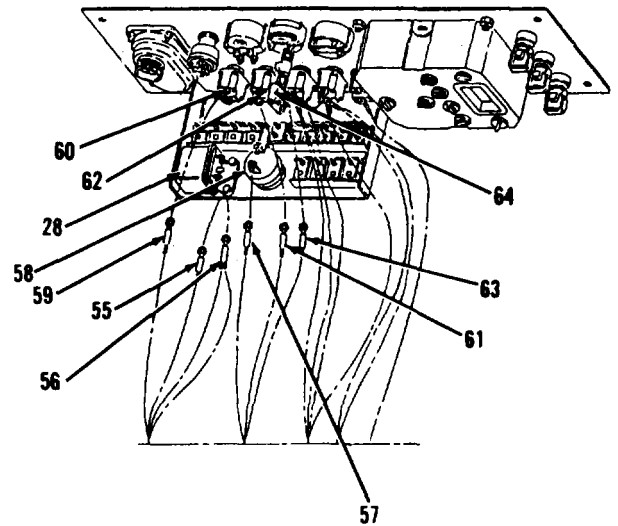
5-2. Instrument Panel Wiring Harness. (Sheet 5 of 9)

REMOVAL (cont)

21. Disconnect lead assemblies (55 and 56) from fan clutch relay (28).
22. Disconnect two lead assemblies (57) from alarm signal (58).
23. Disconnect two lead assemblies (59) from bulb check switch (60).
24. Disconnect two lead assemblies (61) from ether start switch (62).
25. Disconnect lead assembly (63) from air pressure switch (64).
26. Disconnect lead assemblies (65 and 66) from front light switch (67).
27. Disconnect lead assemblies (68 thru 70) from rear light switch (71).
28. Disconnect two lead assemblies (72) from fan switch (73).
29. Remove harness assembly (74) from instrument panel assembly (4).

NOTE

Refer to paragraph 2-13 for electrical repair procedures for terminals and connectors.



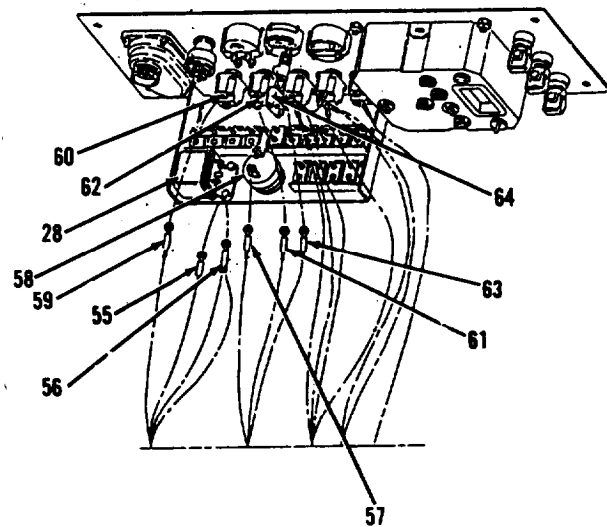
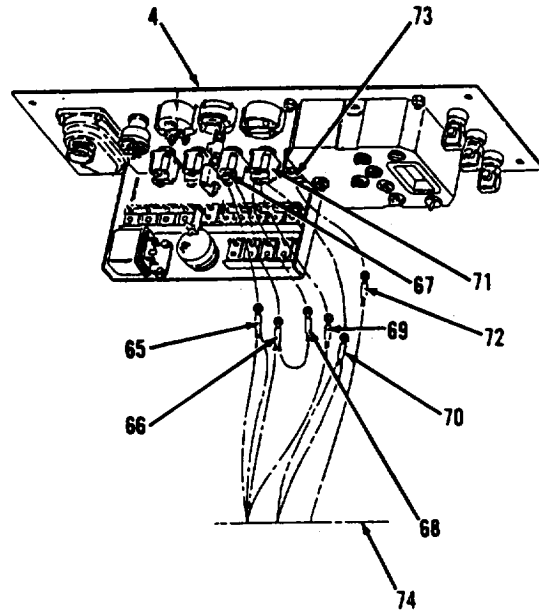
Go to sheet 6

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 6 of 9)

**INSTALLATION**

30. Position harness assembly (74) on instrument panel (4).
31. Using a flat tip screwdriver, connect two lead assemblies (72) to fan switch (73).
32. Connect lead assemblies (70 thru 68) to rear light switch (71).
33. Connect lead assemblies (66 and 65) to front light switch (67).
34. Connect lead assembly (63) to air pressure switch (64).
35. Connect two lead assemblies (61) to ether start switch (62).
36. Connect two lead assemblies (59) to bulb check switch (60).
37. Connect two lead assemblies (57) to alarm signal (58).
38. Connect lead assemblies (56 and 55) to neutral start relay (28).



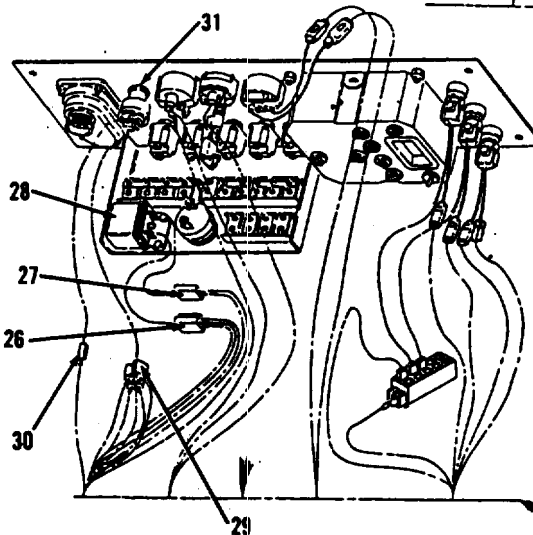
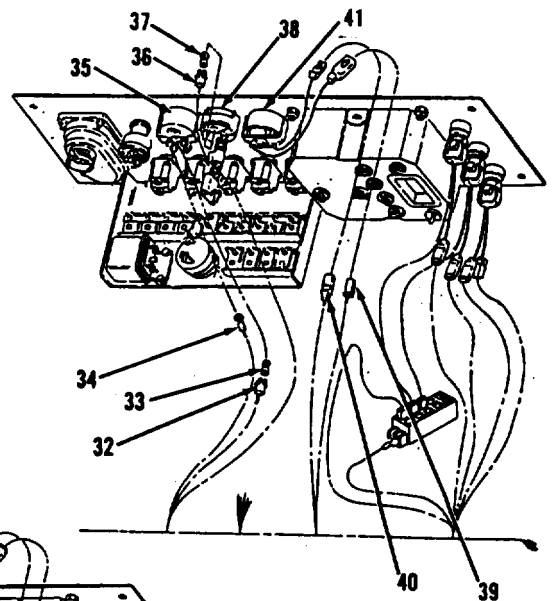
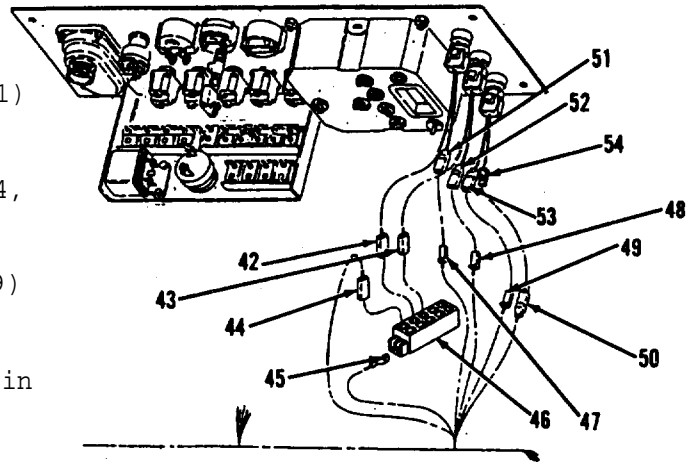
Go to sheet 7

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 7 of 9)

INSTALLATION (cont)

39. Connect lead assemblies (54 thru 51) to lead assemblies (50 thru 47).
40. Connect two lead assemblies (45, 44, 43 and 42) to connector (46).
41. Connect lead assemblies (40 and 39) to hourmeter (41).
42. Install lamp (37) and socket (36) in air pressure gage (38).
43. Connect two lead assemblies (34) to oil pressure gage (35).
44. Install lamp (33) and socket (32) in oil pressure gage (35).
45. Connect wire assembly (30) and seven wire assembly (29) at connectors to start switch (31).
46. Connect wire assemblies (27 and 26) at connectors to fan clutch relay (28).



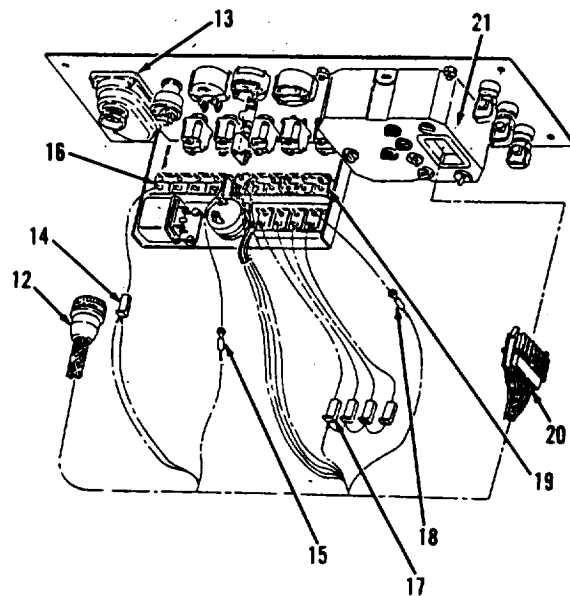
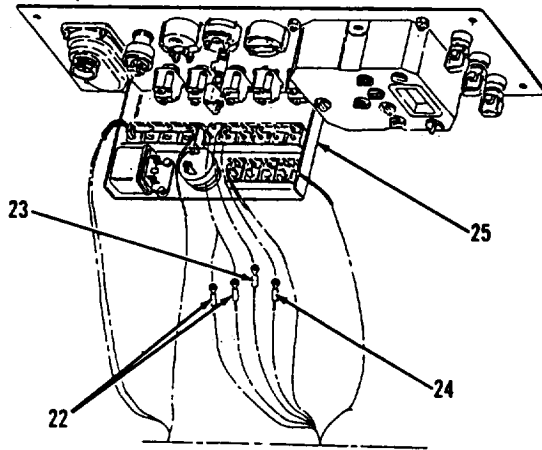
Go to sheet 8

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-2. Instrument Panel Wiring Harness. (Sheet 8 of 9)

INSTALLATION (cont)

- 47. Connect seven lead assemblies (24) to circuit assembly (25), from vehicles S/N 2000 and below or connect lead assembly (23) and two assemblies (22) to circuit breaker assembly (25), from vehicles S/N 2001 and above.
- 48. Connect wire assembly (20) at connector to instrument panel (21).
- 49. Connect lead assembly (18) and four wire assemblies (17) at connector to diode assembly (19).
- 50. Connect four lead assemblies (15) and wire assemblies (14) at connectors to diode assembly (16).
- 51. Connect harness assembly (12) at connector to blackout switch (13).



Go to sheet 9

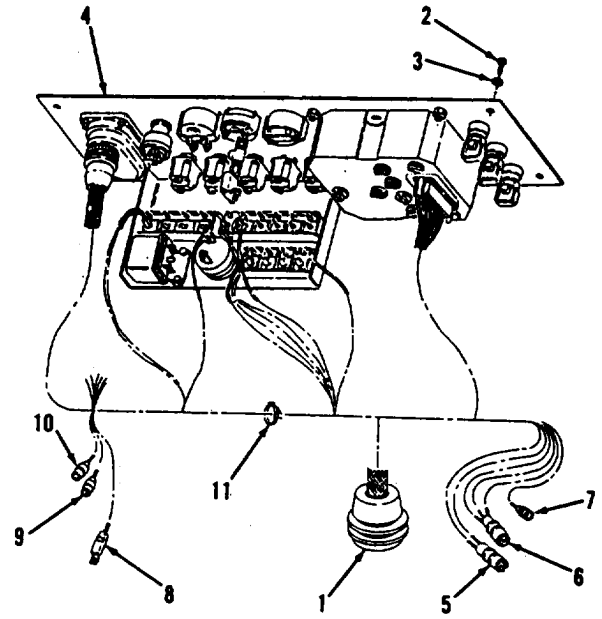


## ELECTRICAL SYSTEM MAINTENANCE.

## 5-2. Instrument Panel Wiring Harness. (Sheet 9 of 9)

INSTALLATION

52. Install a suitable number of new tie straps (11) to secure harness leads together.
53. Position instrument panel assembly (4) in operator's compartment; do not install in housing.
54. Connect wire assemblies (10 and 9) at connectors to front lights cable assembly.
55. Connect wire assembly (8) at connector to heater harness.
56. Connect wire assemblies (7 thru 5) at connectors to front lights harness.
57. Spray all instrument panel electrical connections with anti-corrosive varnish.
58. Position instrument panel assembly (4) in housing.
59. Install four washers (3) and screws (2).
60. Connect harness assembly (1) at connector to intermediate harness.



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

TM 10-3930-643-34

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 1 of 15)

This task covers:        a. Removal                                b. Installation

---

INITIAL SETUP

Tools

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

Materials/Parts

Silicone sealant (App. C, Item 27)  
Small tag (App. C, Item 28)  
Tie strap

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Engine side access covers removed.  
Battery negative disconnected.

---

Go to sheet 2

5-26

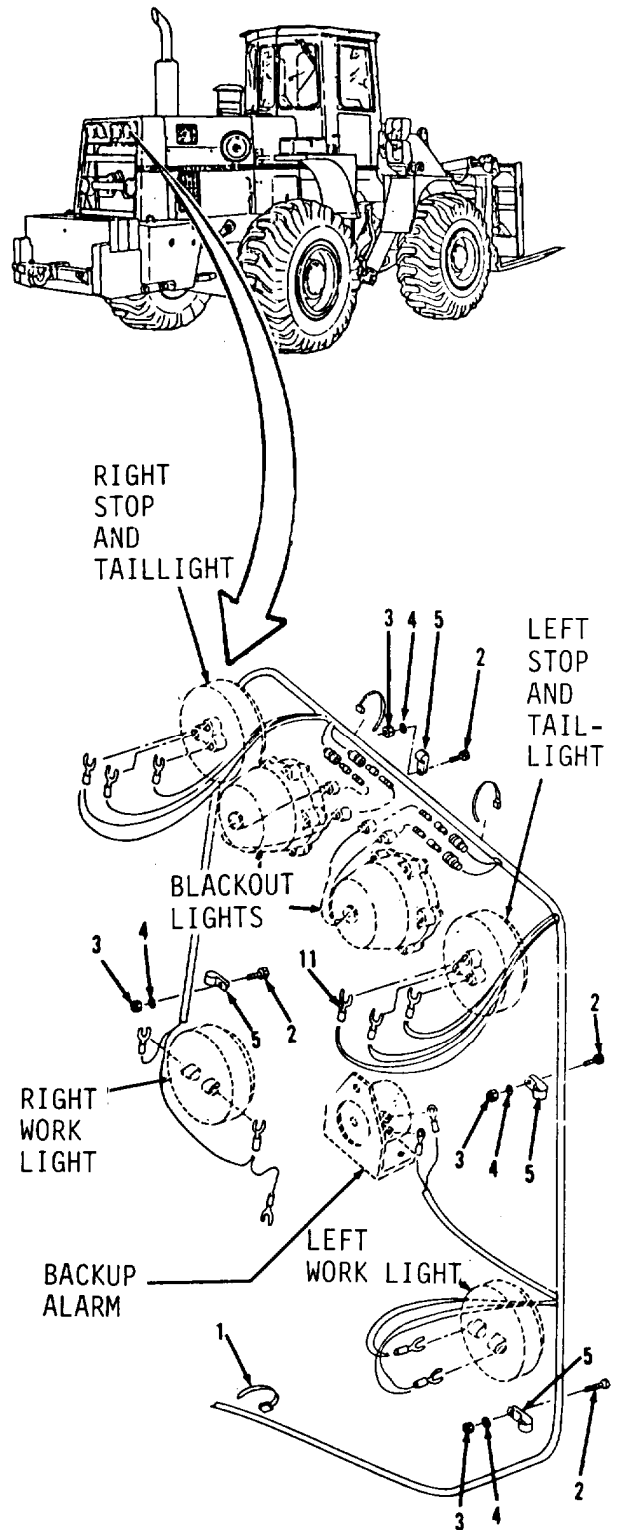
ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 2 of 15)

REMOVAL

NOTE

- For the following procedure, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.
  - All electrical connections, except those on the instrument panel are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
  - All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.
  - Quantity of tie straps used to secure harness is variable.
1. Using diagonal cutting pliers, cut and discard tie strap (1).
  2. Using a 9/16" socket and socket wrench handle, remove four bolts (2), nuts (3), washers (4) and clamps (5) from rear of vehicle.



Go to sheet 3

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 3 of 15)

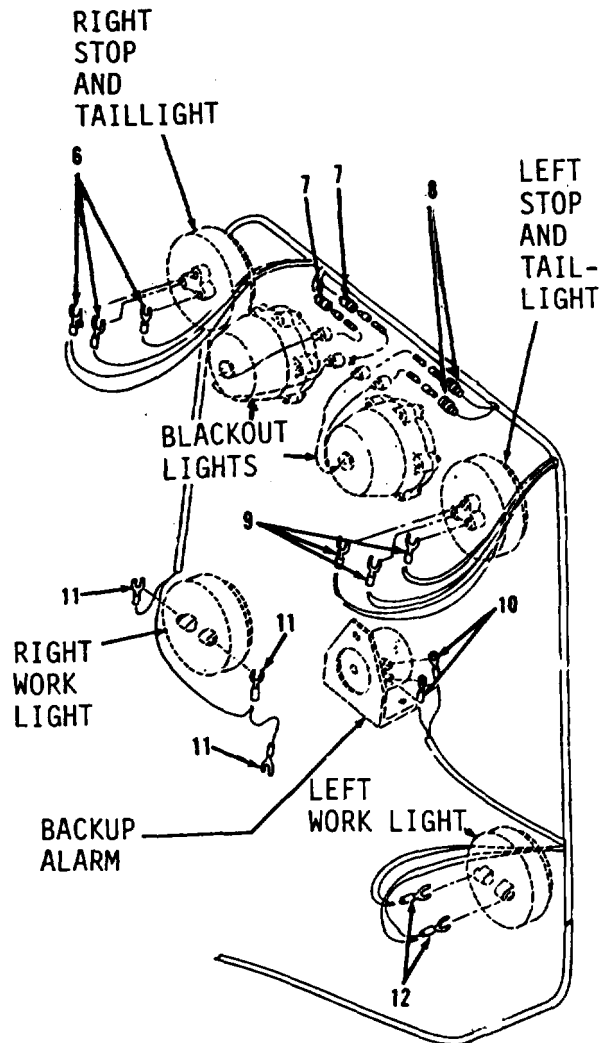
REMOVAL (cont)

3. Using a flat tip screwdriver, disconnect three wire assemblies (6) at terminals from right stop light and taillight.
4. Disconnect two wire assemblies (7 and 8) at connectors from blackout lights.
5. Disconnect three wire assemblies (9) at terminals from left stop light and taillight.

NOTE

The following is a difference between M10A Forklift models.

6. Disconnect two wire assemblies (10) at terminals, from vehicles S/N 2001 and above, from backup alarm.
7. Disconnect three wire assemblies (11) at terminals from right work light and frame.
8. Disconnect two wire assemblies (12) at terminals from left work light.



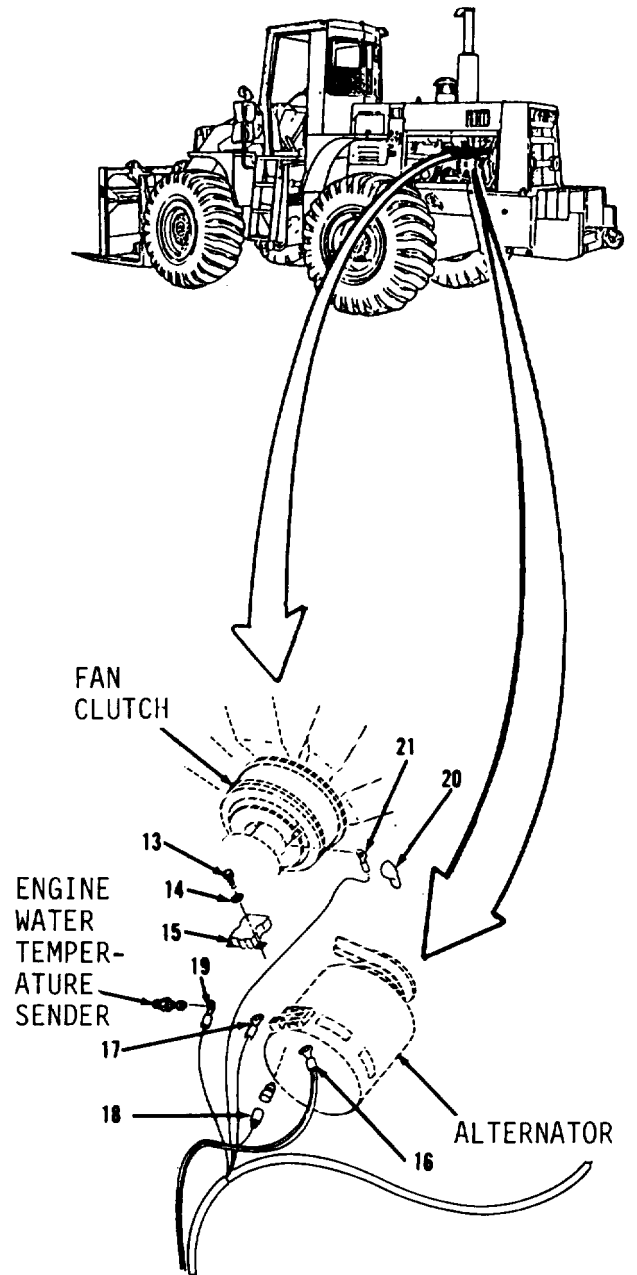
Go to sheet 4

ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 4 of 15)

REMOVAL

9. Remove two screws (13), washers (14) and cover (15) from left side of engine.
10. Using a 1/2" open end wrench and a flat tip screwdriver, disconnect wire assemblies (16 and 17) at terminals and wire assembly (18) at connector from alternator.
11. Using a 3/8" open end wrench, disconnect wire assembly (19) at terminal from engine water temperature sender.
12. Pull back boot (20).
13. Using a flat tip screwdriver, disconnect wire assembly (21) at terminal from fan clutch.



Go to sheet 5

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 5 of 15)

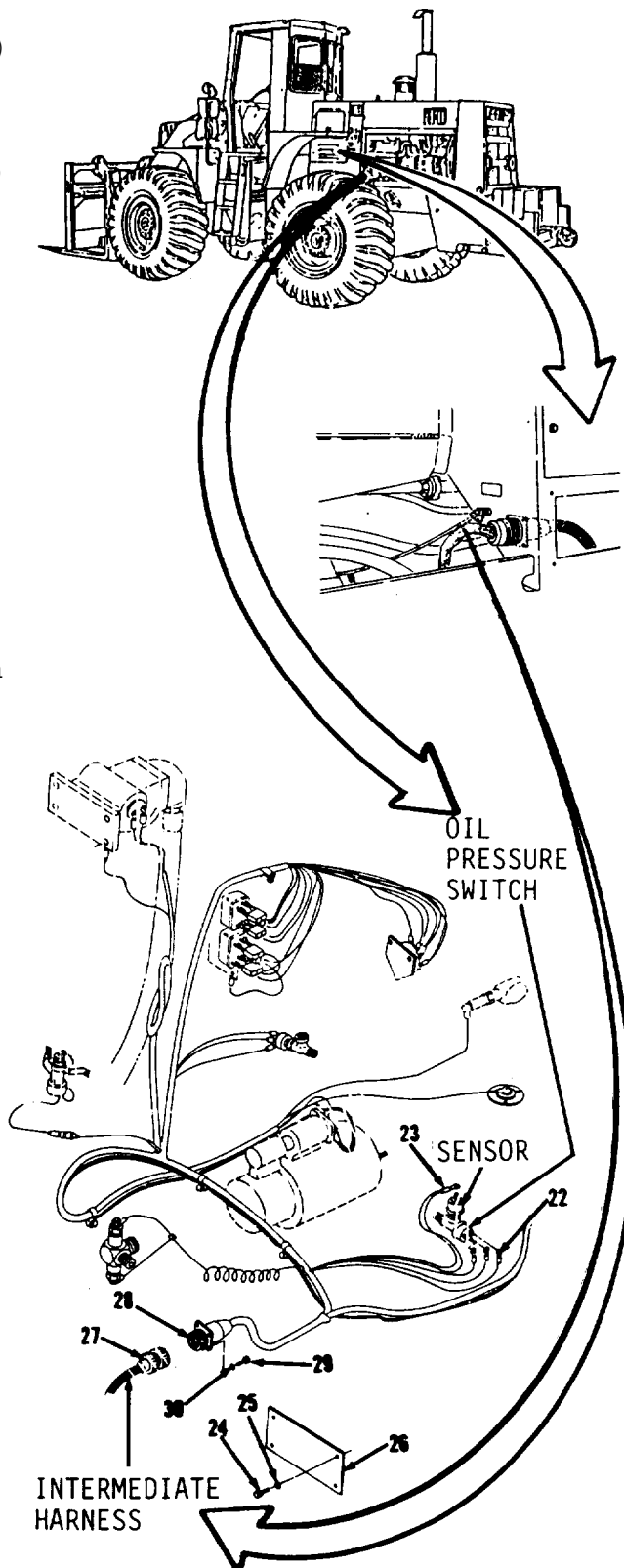
REMOVAL (cont)

14. Disconnect three wire assemblies (22) at terminal from oil pressure switch in left side of engine.
15. Using a 3/8" open end wrench, disconnect terminal (23) from sensor.

NOTE

The following is a difference between M10A Forklift models.

16. Using a 9/16" socket and socket wrench handle, remove four bolts (24), washers (25) and plate (26), from vehicles S/N 2001 and above, from left side of vehicle, underneath battery compartment.
17. Disconnect wire assembly (27) at connector (28) in front, left side of hydraulic tank.
18. Using a cross tip screwdriver, remove four screws (29) and washers (30).

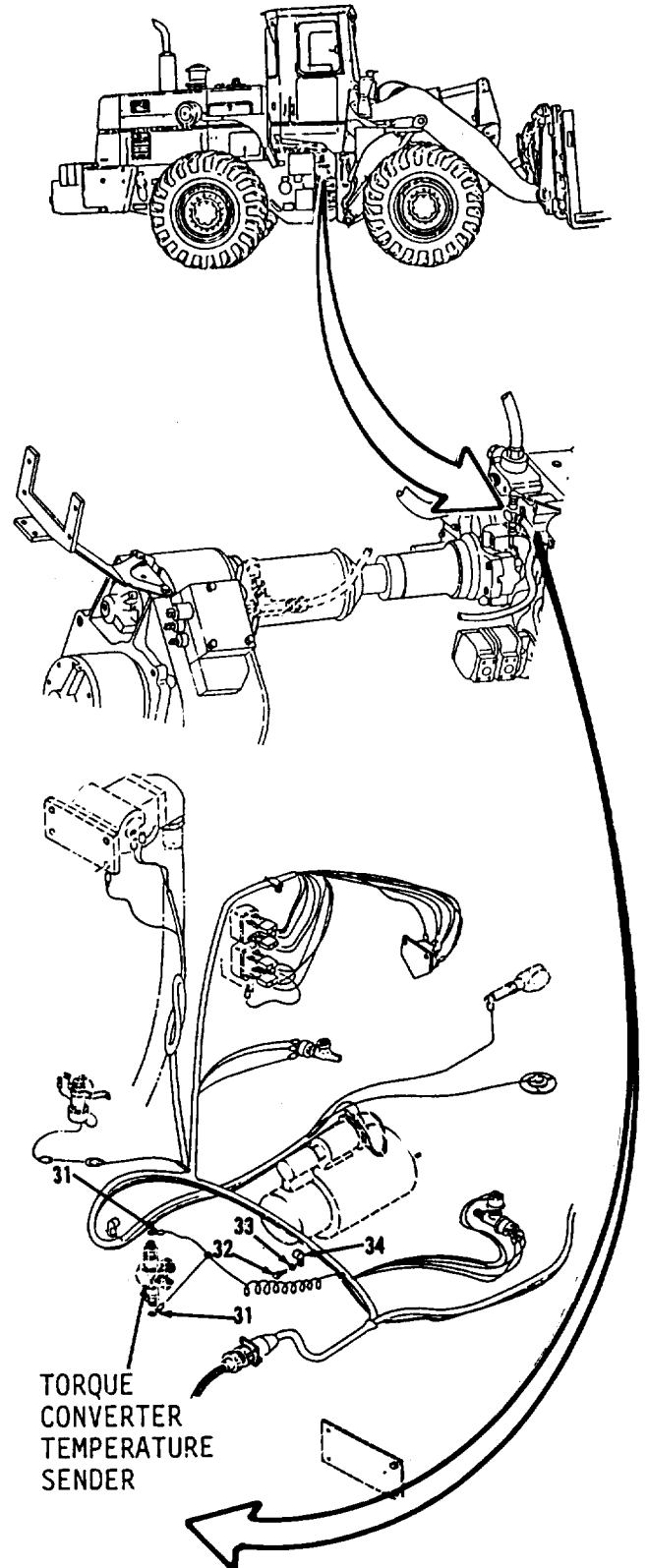


ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 6 of 15)

REMOVAL

19. Using a 3/8" open end wrench, disconnect two wire assemblies (31) at terminal from torque converter temperature sender in rear, left side of engine.
20. Using a 9/16" socket and socket wrench handle, remove bolt (32), washer (33) and clamp (34) from rear, left side of engine compartment at torque converter.



Go to sheet 7

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 7 of 15)

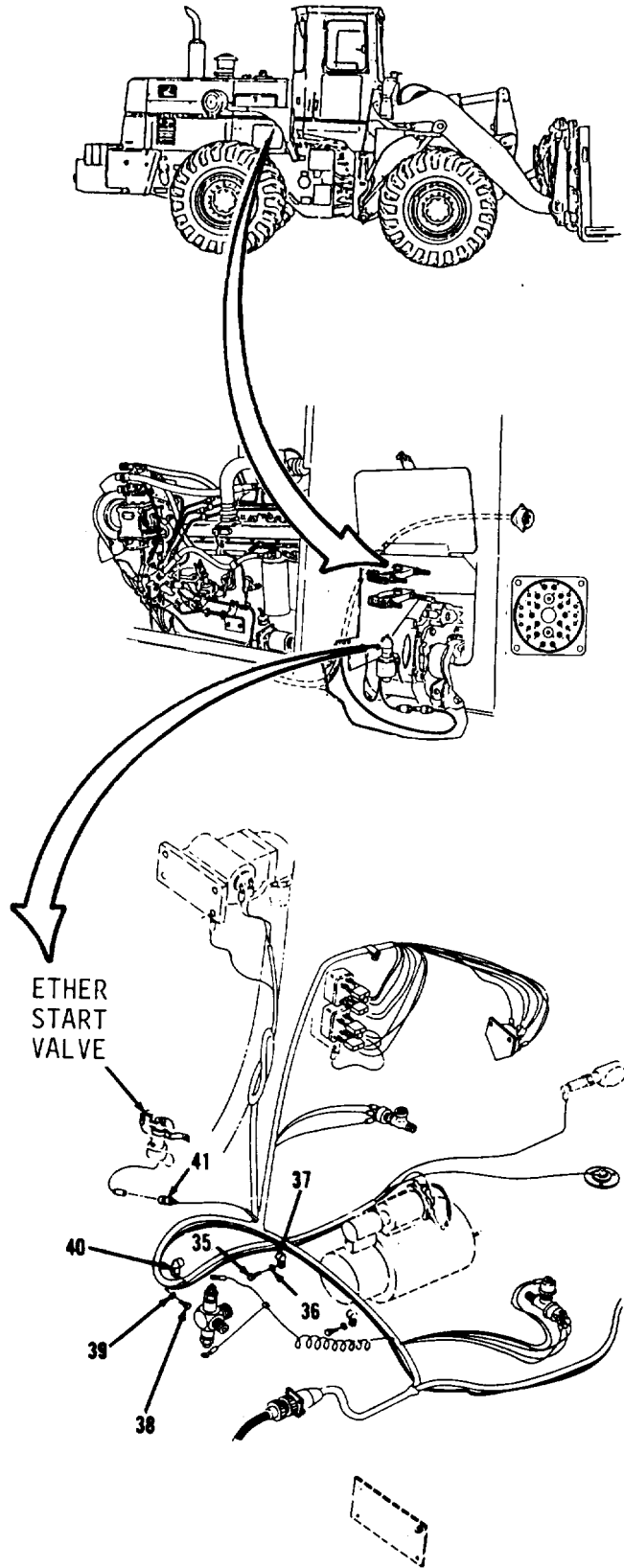
REMOVAL (cont)

21. Remove bolt (35), washer (36) and clamp (37) from right side of engine compartment at torque converter.

NOTE

The following is a difference between M10A Forklift models.

22. Using a 9/16" open end wrench, remove bolt (38), washer (39) and clamp (40), from vehicles S/N 2000 and below
23. Disconnect wire assembly (41) at connector from ether start valve.



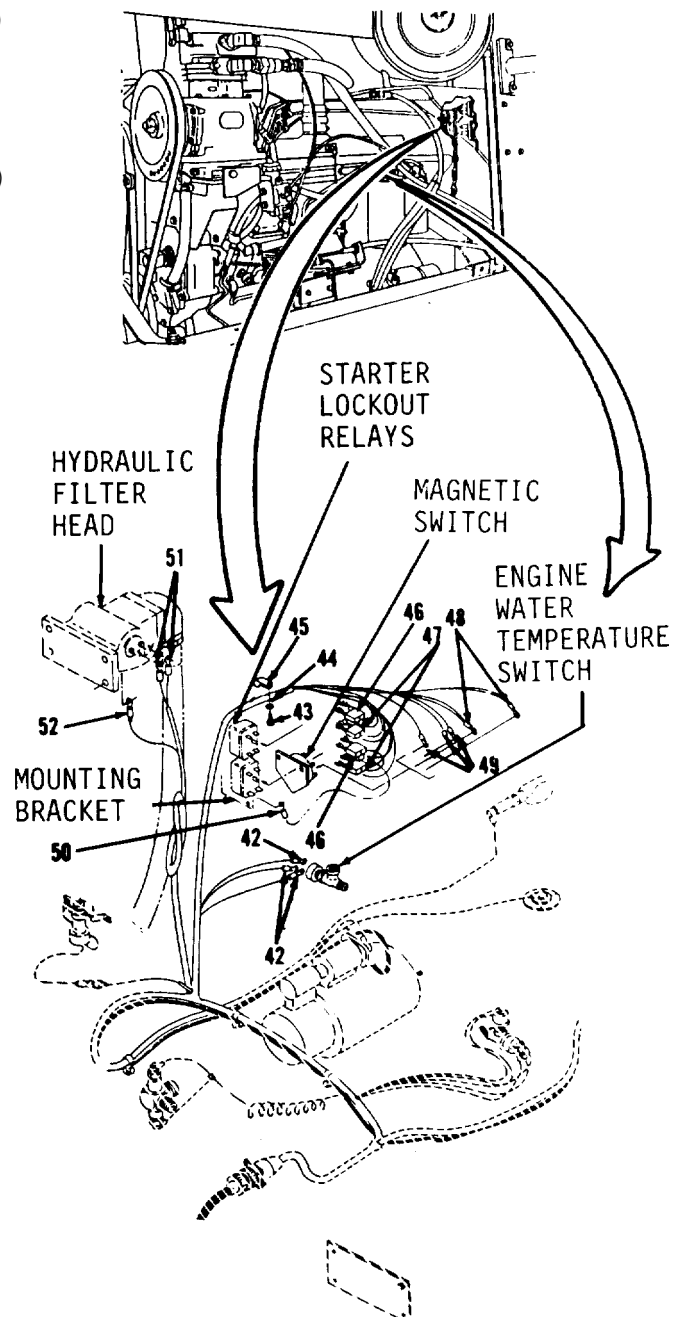


ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 8 of 15)

REMOVAL

24. Using a flat tip screwdriver, disconnect three wire assemblies (42) at terminals from engine water temperature switch.
25. Using a 9/16" socket and socket wrench handle, remove bolt (43), washer (44) and clamp (45).
26. Disconnect two wire assemblies (46 and 47) at connectors from starter lockout relays.
27. Using 1/2" and 3/8" open end wrenches, disconnect two wire assemblies (48) at terminals and three wire assemblies (49) at terminals from magnetic switch.
28. Using a 7/16" open end wrench, disconnect wire assembly (50) at terminal from mounting bracket.
29. Using a flat tip screwdriver, disconnect two wire assemblies (51) at terminals and wire assembly (52) at terminal from hydraulic filter head.



Go to sheet 9

ELECTRICAL SYSTEM MAINTENANCE. (cont)

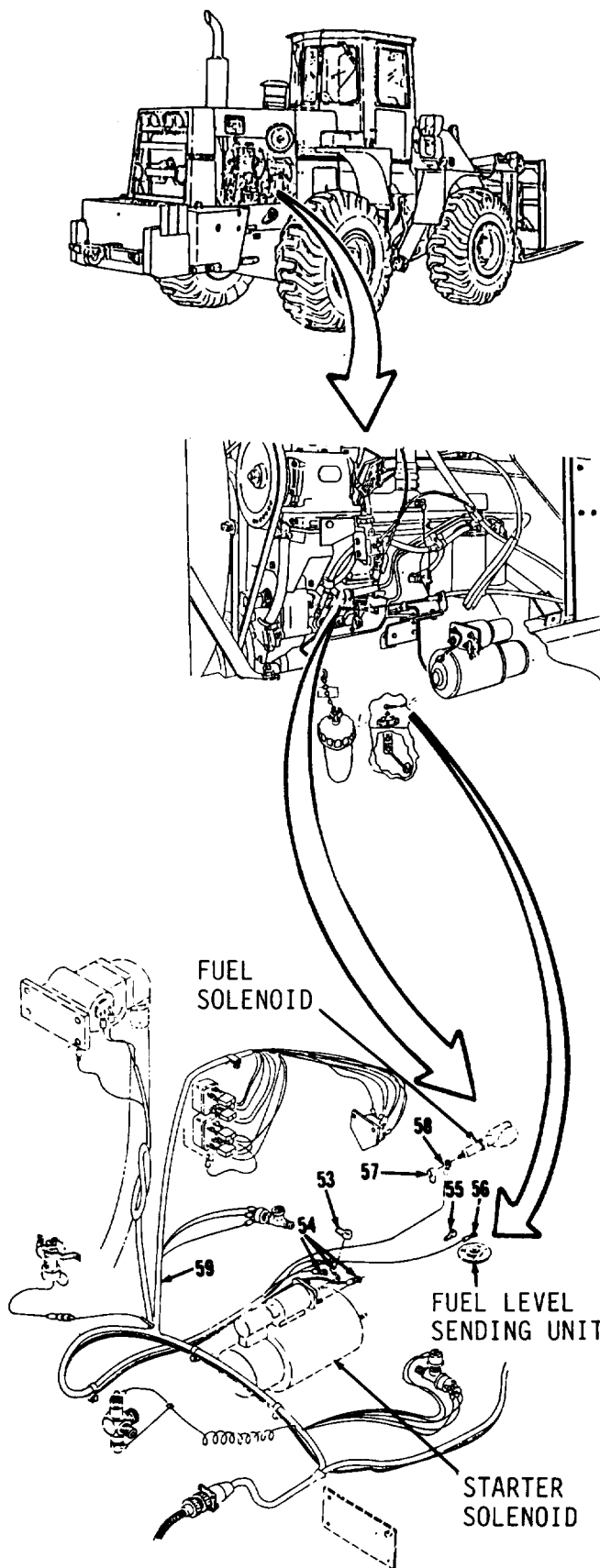
5-3. Main Wiring Harness. (Sheet 9 of 15)

REMOVAL (cont)

- 30. Pull back boot (53).
- 31. Using a 3/4" open end wrench, disconnect three wire assemblies (54) at terminals from starter solenoid.
- 32. Pull back boot (55).
- 33. Using a 3/8" open end wrench, disconnect wire assembly (56) at terminal from top of fuel level sending unit.
- 34. Pull back boot (57).
- 35. Using a flat tip screwdriver, disconnect wire assembly (58) at terminal from fuel solenoid.
- 36. Remove harness (59) from vehicle.

NOTE

Refer to paragraph 2-13 for electrical repair procedures for terminals and connectors.



## ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 10 of 15)

INSTALLATION

37. Position harness (59) throughout vehicle.
38. Using a flat tip screwdriver, connect wire assembly (58) at terminal to fuel solenoid.
39. Position boot (57).
40. Apply silicone sealant over entire connection.
41. Using a 3/8" open end wrench, connect wire assembly (56) at terminal to top of fuel level sending unit.
42. Position boot (55).
43. Apply silicone sealant over entire connection.
44. Using a 3/4" open end wrench, connect three wire assemblies (54) at terminals to starter solenoid.
45. Position boot (53).
46. Apply silicone sealant over entire connection.

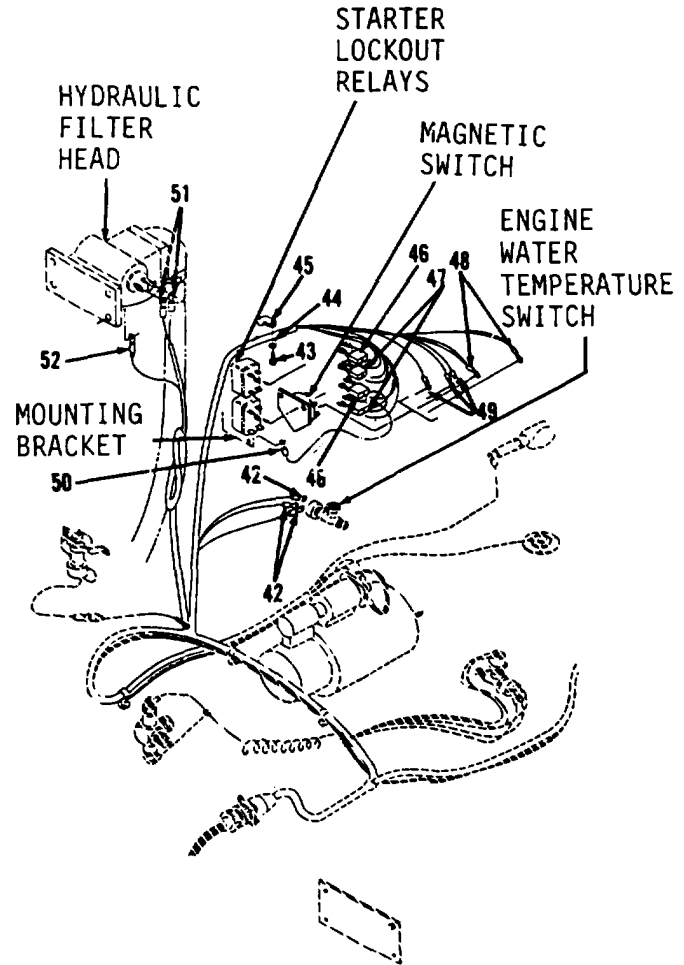
Go to sheet 11

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 11 of 15)

INSTALLATION (cont)

- 47. Using a flat tip screwdriver, connect wire assembly (52) at terminal and two wire assemblies (51) at terminals to hydraulic filter head.
- 48. Apply silicone sealant over entire connection.
- 49. Using a 7/16" open end wrench, connect wire assembly (50) at terminal to mounting bracket.
- 50. Apply silicone sealant over entire connection.
- 51. Using 1/2" and 3/8" open end wrenches, connect three wire assemblies (49) at terminals and two wire assemblies (48) at terminals to magnetic switch.
- 52. Apply silicone sealant over entire connection.
- 53. Connect two wire assemblies (47 and 46) at connectors to starter lockout relays.
- 54. Apply silicone sealant over entire connection.
- 55. Using a 9/16" socket and socket wrench handle, install clamp (45), washer (44) and bolt (43).
- 56. Using a flat tip screwdriver, connect three wire assemblies (42) at terminals to engine water temperature switch.
- 57. Apply silicone sealant over entire connection.



Go to sheet 12

ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 12 of 15)

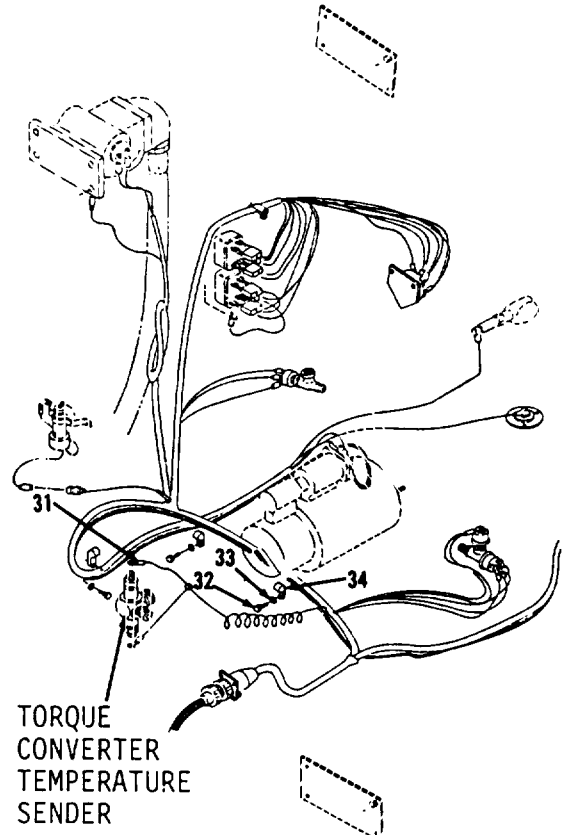
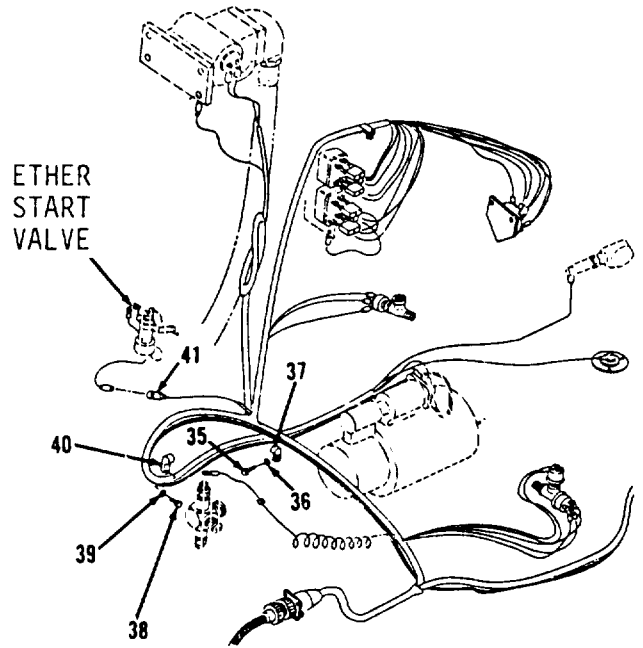
INSTALLATION

- 58. Connect wire assembly (41) at connector to ether start valve.
- 59. Apply silicone sealant over entire connection.

NOTE

The following is a difference between M10A Forklift models.

- 60. Using a 9/16" open end wrench, install clamp (40), washer (39) and bolt (38), from vehicles S/N 2000 and below.
- 61. Install clamp (37), washer (36) and bolt (35).
- 62. Install clamp (34), washer (33) and bolt (32) in front, left side of engine.
- 63. Using a 3/8" open end wrench, connect two wire assemblies (31) at terminals to torque converter temperature sender.
- 64. Apply silicone sealant over entire connection.



Go to sheet 13

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 13 of 15)

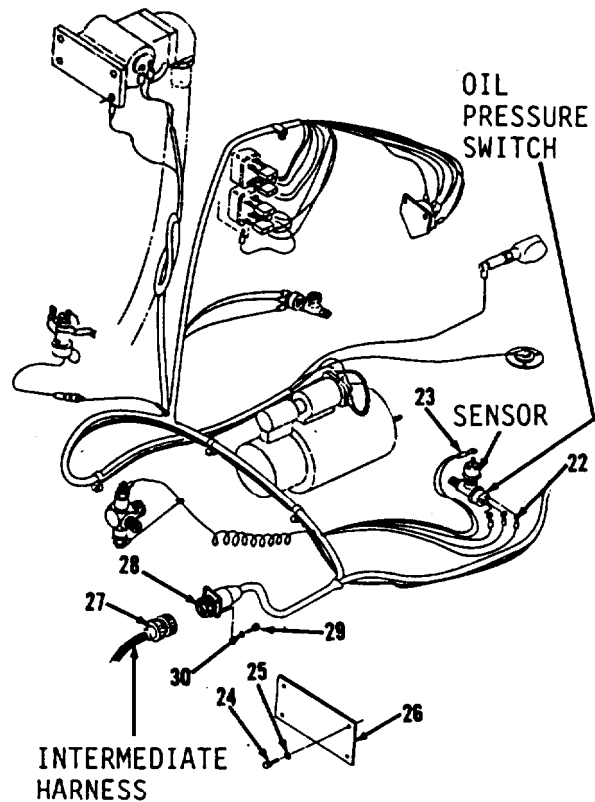
INSTALLATION (cont)

- 65. Position wire assembly (28) in front, left side of hydraulic tank,
- 66. Using a flat tip screwdriver, install four washers (30) and screws (29).
- 67. Connect wire assemblies (27) at connectors.
- 68. Apply silicone sealant over entire connection.

NOTE

The following is a difference between M10A Forklift models.

- 69. Using a 9/16" socket and socket wrench handle, install plate (26), four washers (25) and bolts (24), from vehicles S/N 2001 and above, in left side of vehicle, underneath battery compartment.
- 70. Using a flat tip screwdriver, connect wire assembly (23) at terminal to sensor in left side of engine.
- 71. Apply silicone sealant over entire connection.
- 72. Connect three wire assemblies (22) at terminals to oil pressure switch.
- 73. Apply silicone sealant over entire connection.

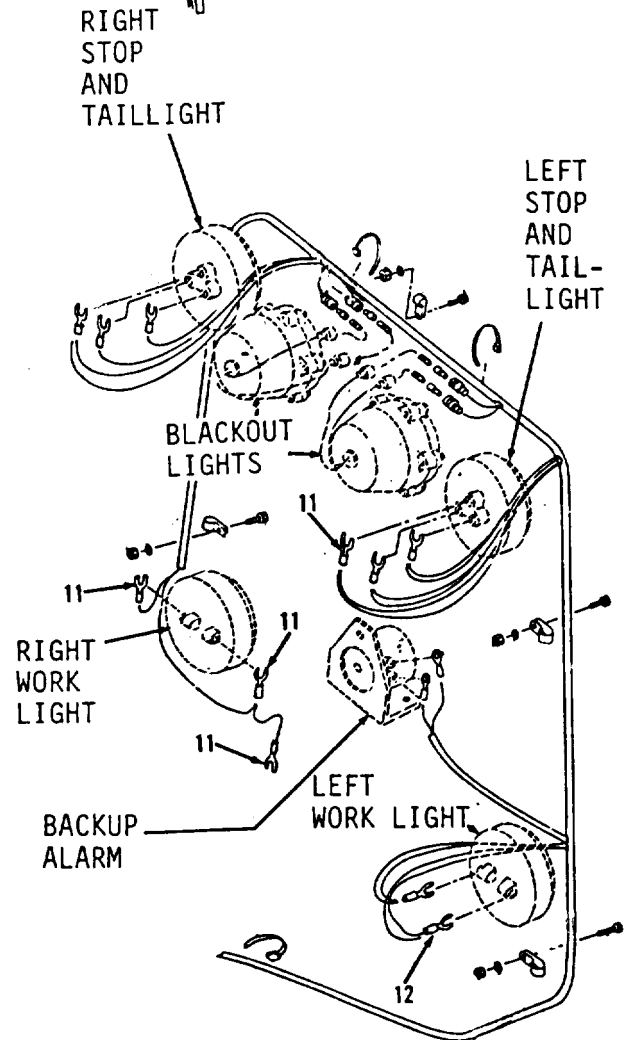
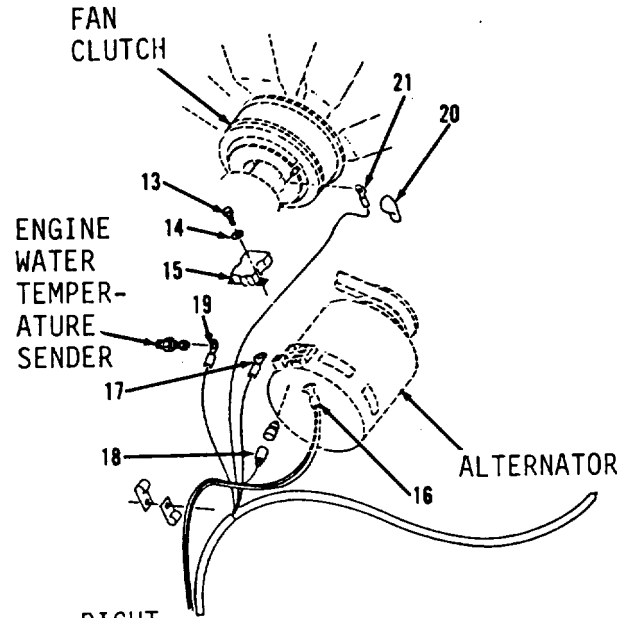


ELECTRICAL SYSTEM MAINTENANCE.

5-3. Main Wiring Harness. (Sheet 14 of 15)

INSTALLATION

74. Connect terminal (21) to fan clutch.
75. Position boot (20).
76. Apply silicone sealant over entire connection.
77. Using a 3/8" open end wrench, connect wire assembly (19) at terminal to engine water temperature sender.
78. Apply silicone sealant over entire connection.
79. Using a 1/2" open end wrench, connect wire assemblies (18,17 and 16) at terminals to alternator.
80. Apply silicone sealant over entire connection.
81. Using a flat tip screwdriver, install cover (15), two washers (14) and screws (13).
82. Connect two wire assemblies (12) at terminals to left work light.
83. Apply silicone sealant over entire connection.
84. Connect three wire assemblies (11) at terminals to right work light and frame.
85. Apply silicone sealant over entire connection.



Go to sheet 15

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-3. Main Wiring Harness. (Sheet 15 of 15)

INSTALLATION (cont)

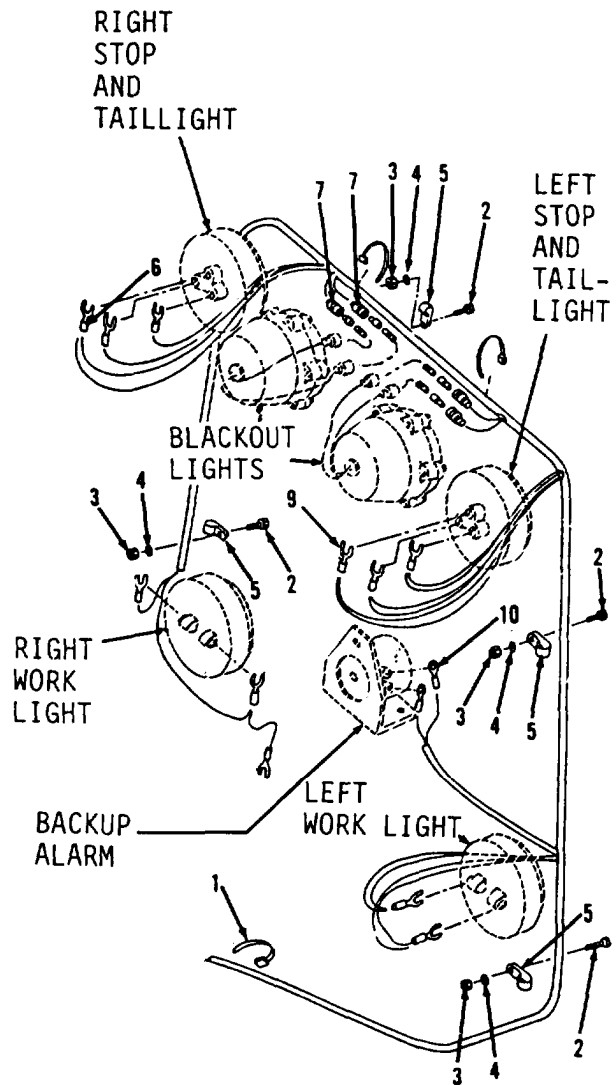
NOTE

The following is a difference between M10A Forklift models.

- 86. Connect two wire assemblies (10) at terminals to backup alarm, from vehicles S/N 2001 and above.
- 87. Apply silicone sealant over entire connection.
- 88. Connect three wire assemblies (9) at terminals to left stop light and taillight.
- 89. Apply silicone sealant over entire connection.
- 90. Connect two wire assemblies (8 and 7) at connectors to blackout lights.
- 91. Apply silicone sealant over entire connection.
- 92. Connect three wire assemblies (6) at terminals to right stop light and taillight.
- 93. Apply silicone sealant over entire connection.
- 94. Using a 9/16" socket and socket wrench handle, install four clamps (5), washers (4), nuts (3) and bolts (2).
- 95. Install a suitable number of tie straps (1) to secure harness to vehicle.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



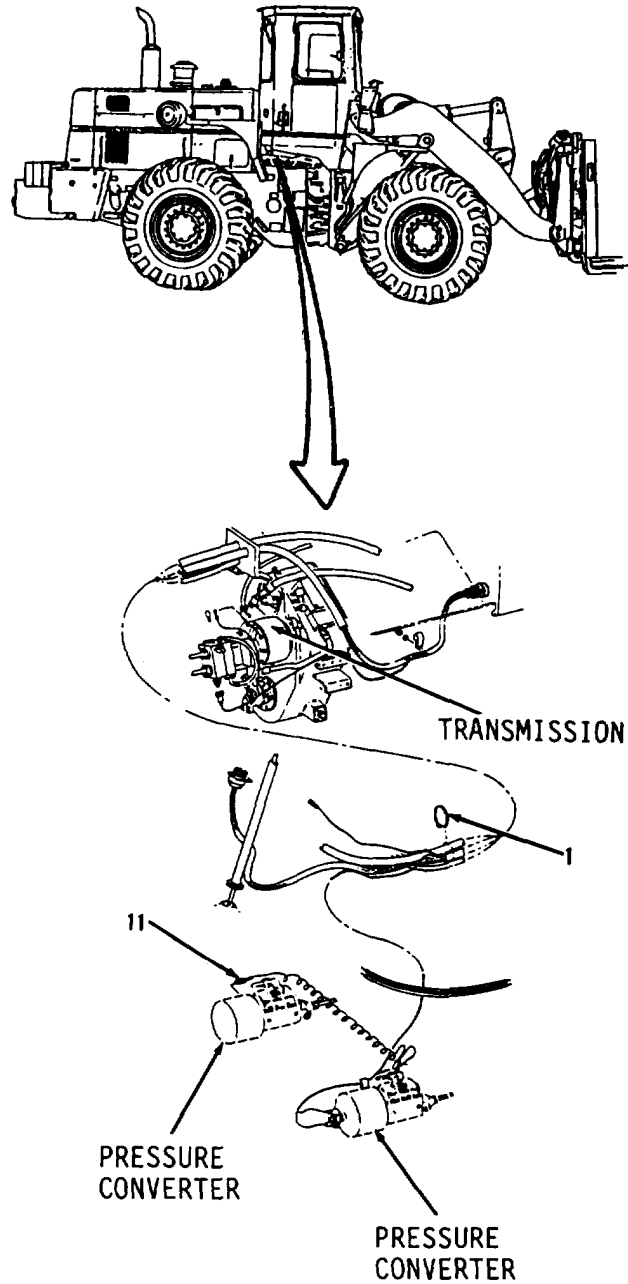


REMOVAL

NOTE

- For the following procedures, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.
- All electrical connections, except those on the instrument panel are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
- All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.
- Quantity of tie straps used to secure harness is variable.

1. Cut and discard tie straps (1).
2. Disconnect lead assembly (11) from pressure converter under right side of cab.



Go to sheet 3

ELECTRICAL SYSTEM MAINTENANCE.

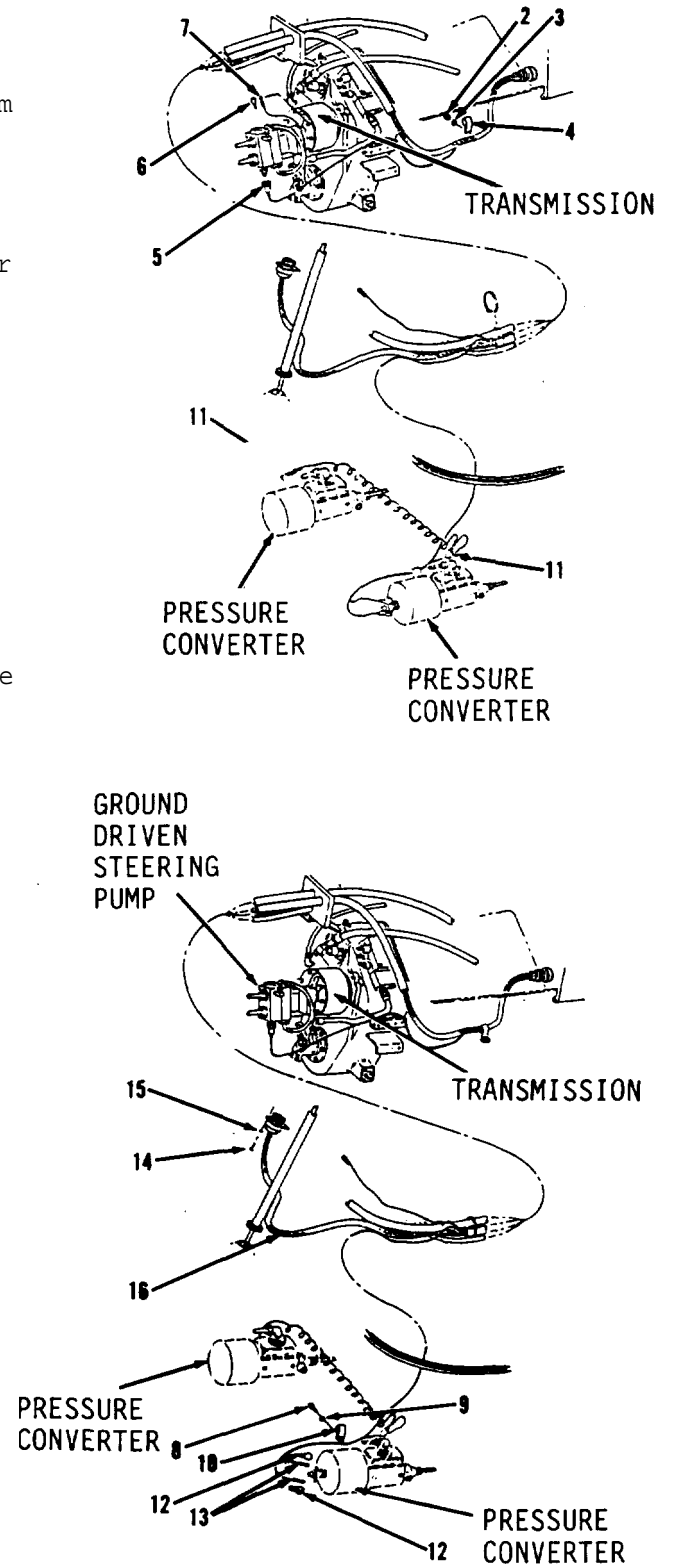
5-4. Intermediate Wiring Harness (S/N 2001 and above). (Sheet 3 of 4)

REMOVAL

3. Disconnect harness assembly (16) from main harness in left, front of hydraulic tank.
40. Using a 9/16" socket and socket wrench handle, remove nut (2), washer (3) and clamp (4) under left side of cab.
5. Disconnect lead assembly (5) from ground driven steering pump switch.
6. Pull back boot (6).
7. Using a 9/16" open end wrench, disconnect lead assembly (7) from transmission.
8. Using a 10" adjustable wrench, remove nut (8), washer (9) and clamp (10).
9. Disconnect lead assembly (11) from pressure converter.
10. Pull back two boots (12).
11. Using a 3/8" open end wrench, disconnect two lead assemblies (13) from pressure converter.
12. Using a flat tip screwdriver, remove four screws (14) and washers (15) from operator's compartment.
13. Remove harness assembly (16) from vehicle.

NOTE

Refer to paragraph 2-13 for electrical repair procedures to terminals and connectors.



Go to sheet 4

ELECTRICAL SYSTEM MAINTENANCE. (cont)

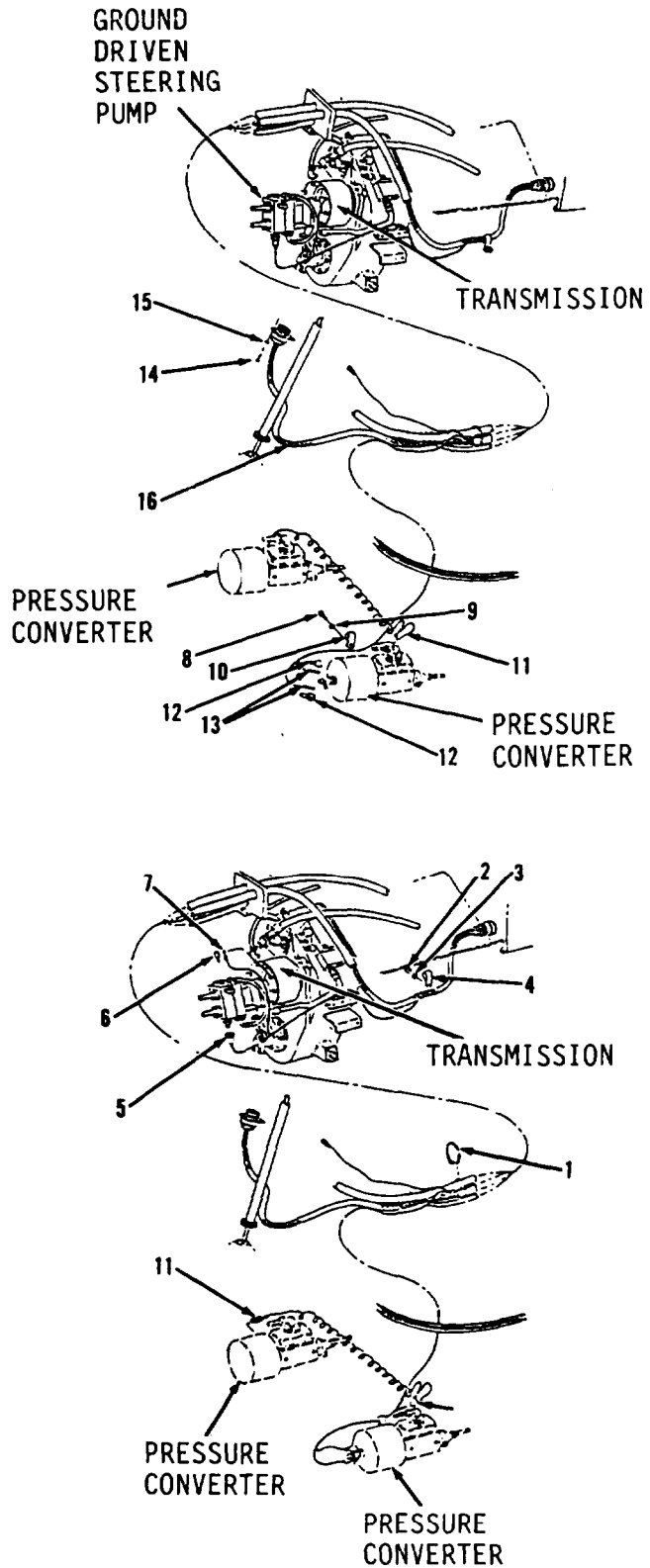
5-4. Intermediate Wiring Harness (S/N 2001 and above). (Sheet 4 of 4)

INSTALLATION

14. Position harness assembly (16) throughout vehicle.
15. Using a flat tip screwdriver, install four washers (15) and screws (14) in operator's compartment.
16. Connect two lead assemblies (13) to pressure converter under left side of cab. Apply silicone sealant over entire connection.
17. Pull two boots (12) over terminals.
18. Connect lead assembly (11) to pressure converter.
19. Using a 10" adjustable wrench, install clamp (10), washer (9) and nut (8).
20. Using a flat tip screwdriver, connect lead assembly (7) to transmission. Apply silicone sealant over entire connection.
21. Pull boot (6) over terminal.
22. Connect lead assembly (5) to ground driven steering pump switch.
23. Using a 9/16" socket and socket wrench handle, install clamp (4), washer (3) and nut (2).
24. Connect harness assembly (16) to main harness in left, front of hydraulic tank.
25. Connect lead assembly (11) to pressure converter under right side of cab.
26. Install a suitable number of new tie straps (1) to secure harness to vehicle.

NOTE

Return M10A Forklift to original equipment condition.



## ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-5. Intermediate Wiring Harness (S/N 2000 and below). (Sheet 1 of 4)

This task covers:           a. Removal                                       b. Installation

## INITIAL SETUP

Tools

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

Materials/Parts

Silicone sealant (App. C, Item 27)  
Small tag (App. C, Item 28)  
Tie strap

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

## EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Battery negative disconnected.

## REMOVAL

## NOTE

- For the following procedures, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.
- All electrical connections, except those on the instrument panel are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
- Quantity of tie straps used to secure harness is variable.

Go to sheet 2

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-5. Intermediate Wiring Harness (S/N 2000 and below). (Sheet 2 of 4)

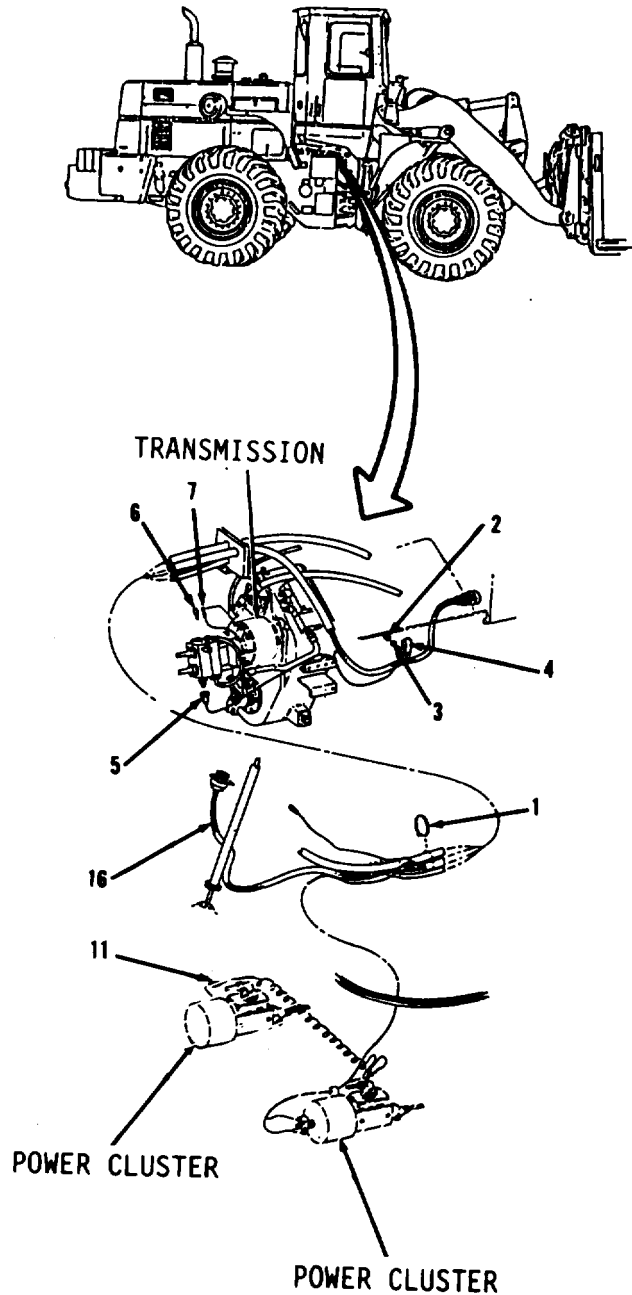
REMOVAL (cont)

1. Using diagonal cutting pliers, cut and discard tie straps (1).

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

2. Disconnect lead assembly (11) from power cluster under right side of cab.
3. Disconnect harness assembly (16) from main harness in left, front of hydraulic tank.
4. Using a 9/16" open end wrench, remove nut (2), washer (3) and clamp (4) under left side of cab.
5. Using a 3/8" open end wrench, disconnect lead assembly (5) from ground driven steering pump switch.
6. Pull back boot (6).
7. Using a flat tip screwdriver, disconnect lead assembly (7) from transmission.



Go to sheet 3

ELECTRICAL SYSTEM MAINTENANCE.

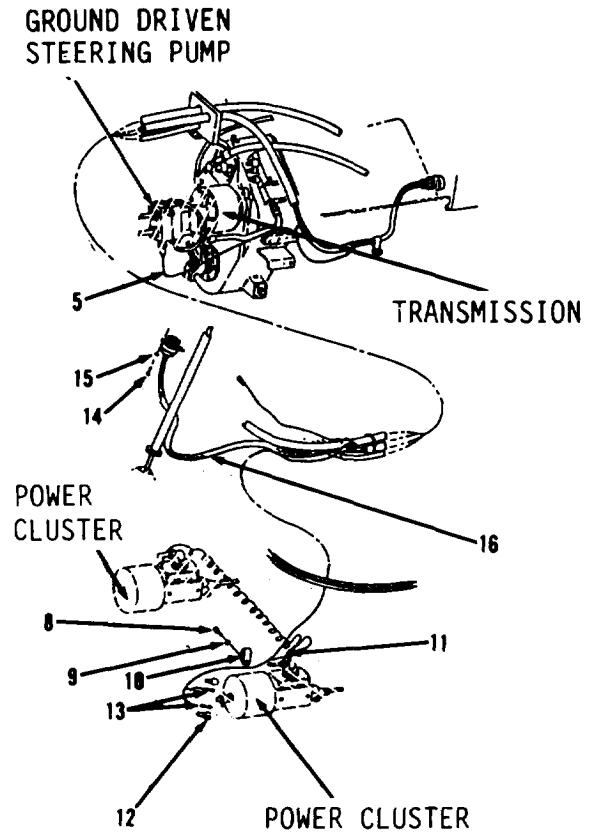
5-5. Intermediate Wiring Harness (S/N 2000 and below). (Sheet 3 of 4)

REMOVAL

8. Using a 9/16" open end wrench, remove nut (8), washer (9) and clamp (10).
9. Disconnect lead assembly (11) from power cluster.
10. Pull back two boots (12).
11. Using a 3/8" open end wrench, disconnect two lead assemblies (13) from power cluster.
12. Using a flat tip screwdriver, remove four screws (14) and washers (15) from operator's compartment.
13. Remove harness assembly (16) from vehicle.

NOTE

Refer to paragraph 2-13 for electrical repair procedures to terminals and connectors.



INSTALLATION

14. Position harness assembly (16) throughout vehicle.
15. Using a flat tip screwdriver, install four washers (15) and screws (14) in operator's compartment.
16. Connect two lead assemblies (13) to power cluster under left side of cab. Apply silicone sealant over entire connection.
17. Pull two boots (12) over terminals.
18. Connect lead assembly (11) to power cluster.
19. Using 9/16" open end wrench, install clamp (10), washer (9) and nut (8).

Go to sheet 4

ELECTRICAL SYSTEM MAINTENANCE. (cont)

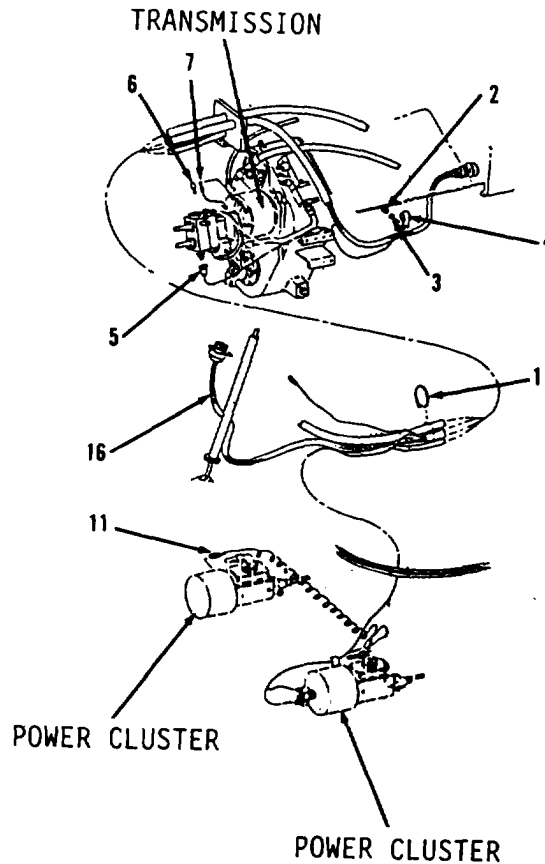
5-5. Intermediate Wiring Harness (S/N 2000 and below). (Sheet 4 of 4)

INSTALLATION (cont)

20. Using a flat tip screwdriver, connect lead assembly (7) to transmission. Apply silicone sealant over entire connection.
21. Pull boot (6) over terminal.
22. Using a 3/8" open end wrench, connect lead assembly (5) to ground driven steering pump switch.
23. Using a 9/16" open end wrench, install clamp (4), washer (3) and nut (2).
24. Connect harness assembly (16) to main harness in left, front hydraulic tank.
25. Connect lead assembly (11) to power cluster under right side of cab.
26. Install a suitable number of new tie straps (1) to secure harness assembly (16) to vehicle.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## ELECTRICAL SYSTEM MAINTENANCE.

## 5-6. Fork Control Wiring Harness. (Sheet 1 of 4)

This task covers:           a. Removal   b. Installation

## INITIAL SETUP

Tools

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

Materials/Parts

Silicone sealant (App. C, Item 27)  
Small tag (App. C, Item 28)  
Tie strap

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

## EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Fork control switch removed.

Go to sheet 2

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-6. Fork Control Wiring Harness. (Sheet 2 of 4)

REMOVAL

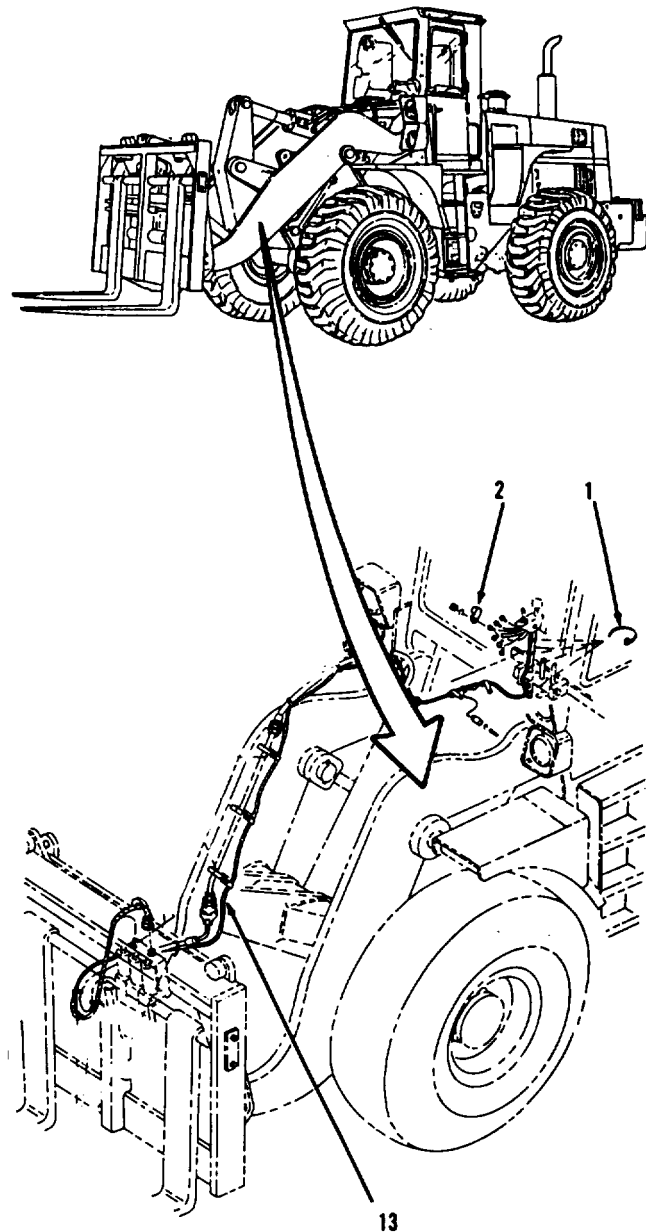
NOTE

- For the following procedures, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.
  - All electrical connections, except those on the instrument panel are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
  - The quantity of tie straps used to secure harness is variable.
1. Using diagonal cutting pliers, cut and discard tie straps (1) in operator's compartment.

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

- 2\* Using a 1/2" socket and socket wrench handle, remove clamp (2) from harness assembly (13) in left side of operator's compartment.

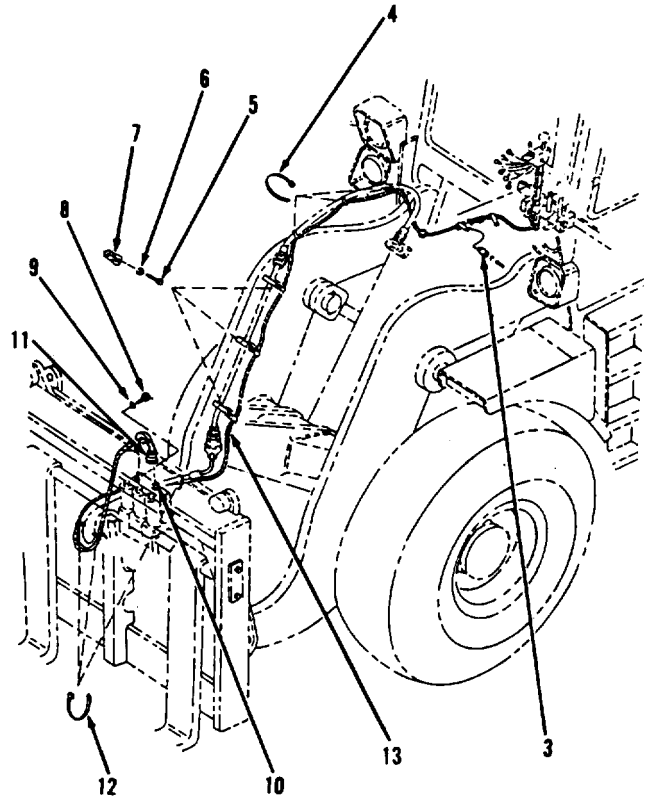


## ELECTRICAL SYSTEM MAINTENANCE.

5-6. Fork Control Wiring Harness. (Sheet 3 of 4)

REMOVAL

3. Disconnect lead assembly (3) from intermediate harness right side of cab.
4. Using diagonal cutting pliers, cut and discard tie straps (4) from right, front of vehicle.
5. Using a 1/2" socket and socket wrench handle, remove three bolts (5), washers (6) and clamps (7).
6. Using a 9/16" open end wrench, remove bolt (8) and washer (9).
7. Using a flat blade screwdriver, disconnect lead assembly (10) from fork control valve.
8. Remove wire assembly (11) at connector.
9. Using diagonal cutting pliers, cut and discard tie straps (12).
10. Remove harness assembly (13).



## NOTE

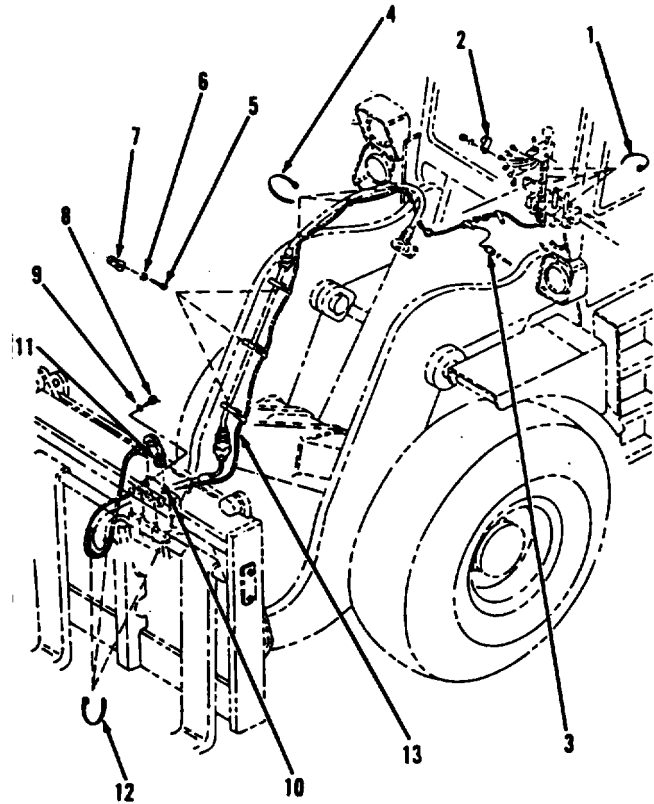
Refer to paragraph 2-13 for electrical repair procedures for harness terminals and connectors.

Go to sheet 4

5-6. Fork Control Wiring Harness. (Sheet 4 of 4)

INSTALLATION

11. Position harness assembly (13) on right, front of vehicle.
12. Install new tie straps (12).
13. Connect wire assembly (11) at connector to fork control valve.
14. Position lead assembly (10) on fork control valve.
15. Using a 9/16" open end wrench, install washer (9) and bolt (8).
16. Apply silicone sealant over entire connection.
17. Using a 1/2" socket and socket wrench handle, install three clamps (7), washers (6) and bolts (5).
18. Install new tie straps (4).
19. Connect lead assembly (3) to intermediate harness under right side of cab.
20. Install clamp (2) on harness assembly (13) in left side of operator's compartment.
21. Install new tie straps (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-7. Front Lights Wiring Harness. (Sheet 1 of 7)

This task covers: a. Removal b. Installation

INITIAL SETUP

Tools

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

Materials/Parts

Silicone sealant (App. C, Item 27)  
Small tag (App. C, Item 28)  
Tie strap

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Battery negative disconnected.

5-7. Front Lights Wiring Harness. (Sheet 2 of 7)

REMOVAL

1. Remove two access covers (1) from instrument panel housing, refer to TM 10-3930-643-20.

NOTE

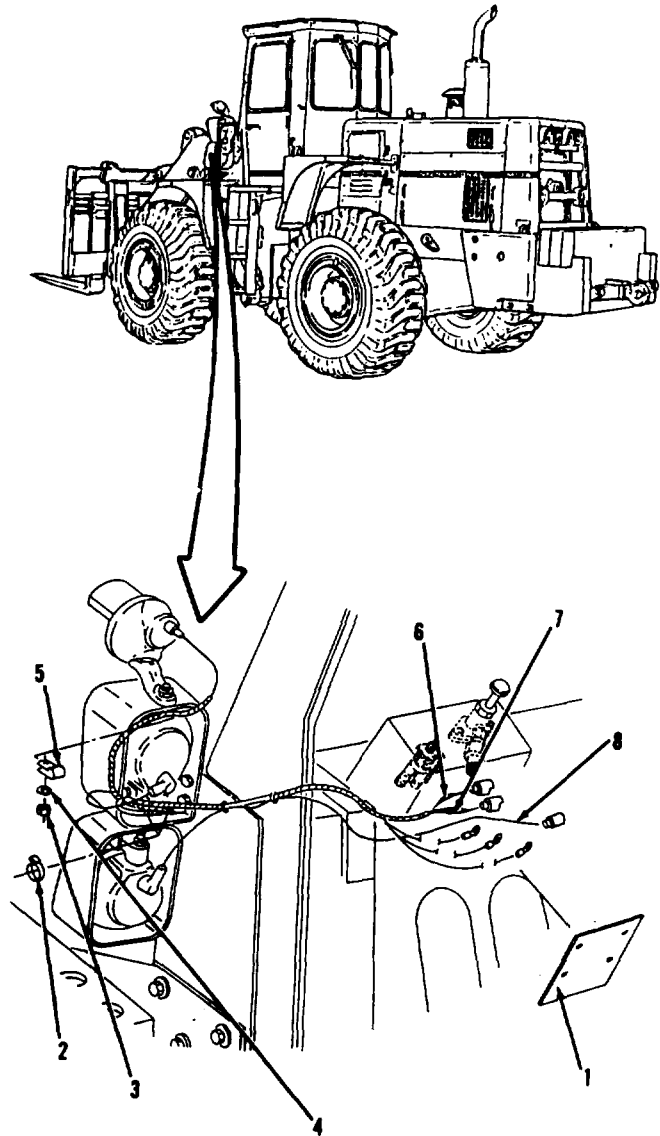
- For the following procedure, disconnect is used to indicate the separation of plugs, connectors or terminals and the removal of all attaching hardware. To prevent loss, reinstall attaching hardware in its original position.
- All electrical connections, except those on the instrument panel are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
- Quantity of tie straps used to secure harness is variable.

2. Using diagonal cutting pliers, cut and discard four tie straps (2) from front, left side of vehicle.
3. Using a 9/16" socket and socket wrench handle, remove nut (3), washer (4) and clamp (5).

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

4. Disconnect wire assemblies 6, 7 and 8) at connectors.



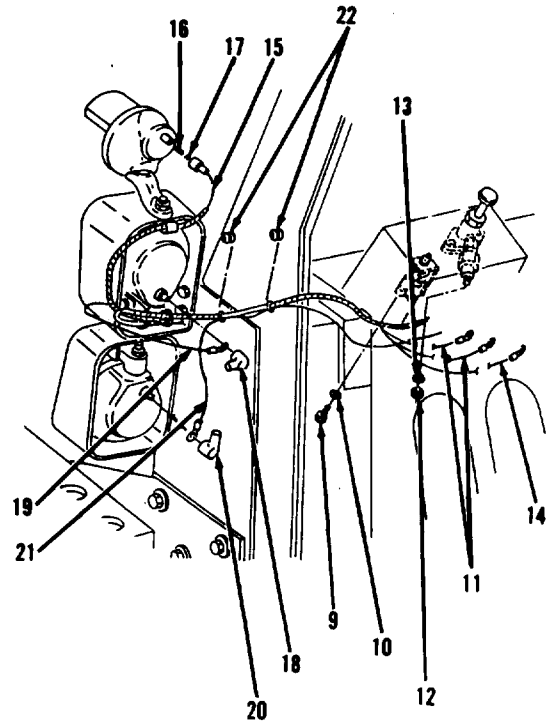
Go to sheet 3

## ELECTRICAL SYSTEM MAINTENANCE.

## 5-7. Front Lights Wiring Harness. (Sheet 3 of 7)

REMOVAL

5. Using a 3/8" open end wrench, remove two screws (9) and washers (10).
6. Disconnect wire assemblies (11) at terminals.
7. Remove nut (12) and washer (13).
8. Disconnect wire assemblies (14 and 15) at terminal and shell.
9. Remove terminal (16) and washer (17).
10. Remove insulator (18).
11. Disconnect wiring harness (19) at terminal.
12. Remove insulator (20).
13. Disconnect wire assembly (21) at terminal.
14. Remove two plugs (22).



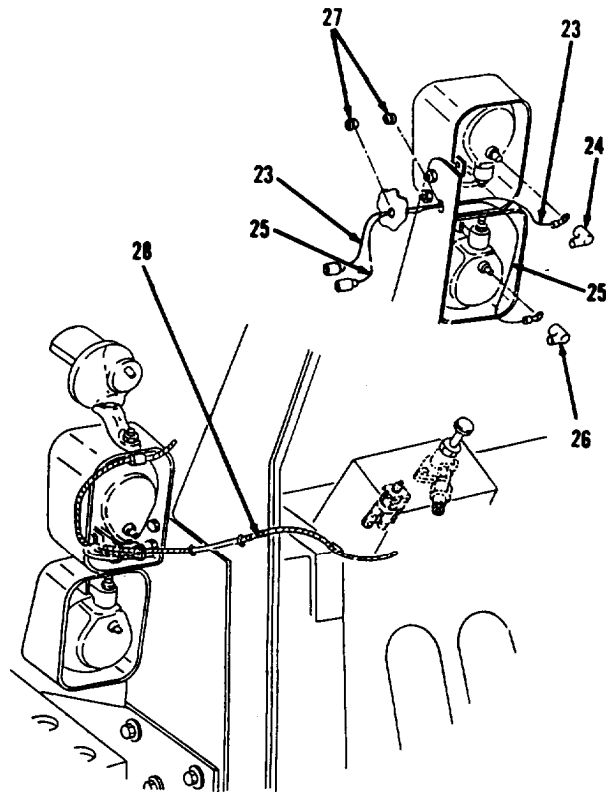
Go to sheet 4

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-7. Front Lights Wiring Harness. (Sheet 4 of 7)

REMOVAL (cont)

15. Disconnect wire assembly (23) at connector in front, right side of vehicle.
16. Remove insulator (24).
17. Disconnect wire assembly (23) at terminal and remove.
18. Disconnect cable assembly (25) at connector.
19. Remove insulator (26).
20. Disconnect wire assembly (25) at terminal and remove.
- 21\* Using a flat tip screwdriver, remove two plugs (27).
22. Remove harness (28) from vehicle.



NOTE

Refer to paragraph 2-13 for electrical repair procedures for terminals and connectors.

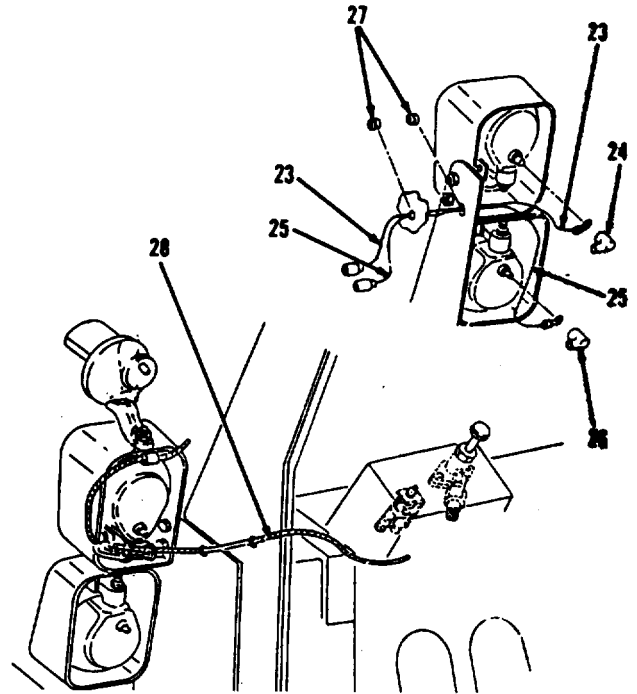


ELECTRICAL SYSTEM MAINTENANCE.

5-7. Front Lights Wiring Harness. (Sheet 5 of 7)

INSTALLATION

23. Position harness (28) throughout vehicle.
24. Install two plugs (27).
25. Connect wire assembly (25) at terminal.
26. Apply silicone sealant over entire connection.
27. Install insulator (26).
28. Connect wire assembly (25) at connector.
29. Apply silicone sealant over entire connection.
30. Connect wire assembly (23) at terminal.
31. Apply silicone sealant over entire connection.
32. Install insulator (24).
33. Connect wire assembly (23) at connector.
34. Apply silicone sealant over entire connection.



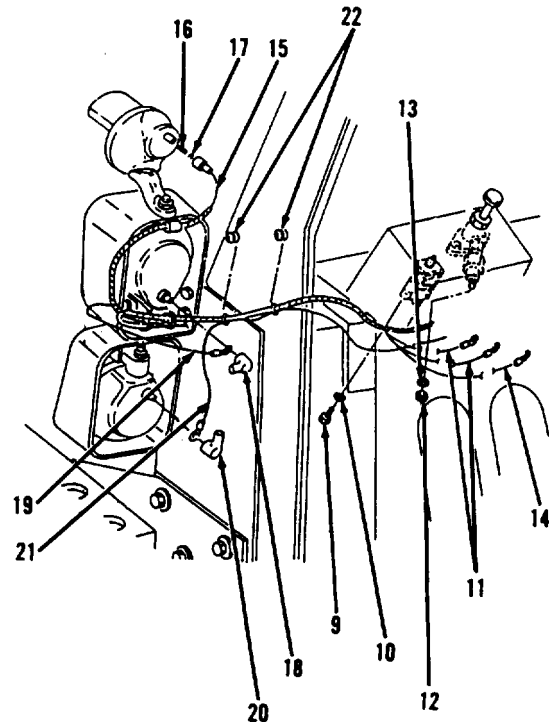
Go to sheet 6

ELECTRICAL SYSTEM MAINTENANCE. (cont)

5-7. Front Lights Wiring Harness. (Sheet 6 of 7)

INSTALLATION (cont)

35. Install two plugs (22) in front, left side of vehicle.
36. Connect wire assembly (21) at terminal.
37. Apply silicone sealant over entire connection.
38. Install insulator (20).
39. Connect wire assembly (19) at terminal.
40. Apply silicone sealant over entire connection.
41. Install insulator (18).
42. Using slip joint pliers, install washer (17) and terminal (16).
43. Connect wire assemblies (15 and 14) at shell and terminal.
44. Apply silicone sealant over entire connection.
45. Using a 3/8" open end wrench, install washer (13) and nut (12).
46. Connect wire assemblies (11) at terminals.
47. Apply silicone sealant over entire connection.
48. Install two washers (10) and screws (9).



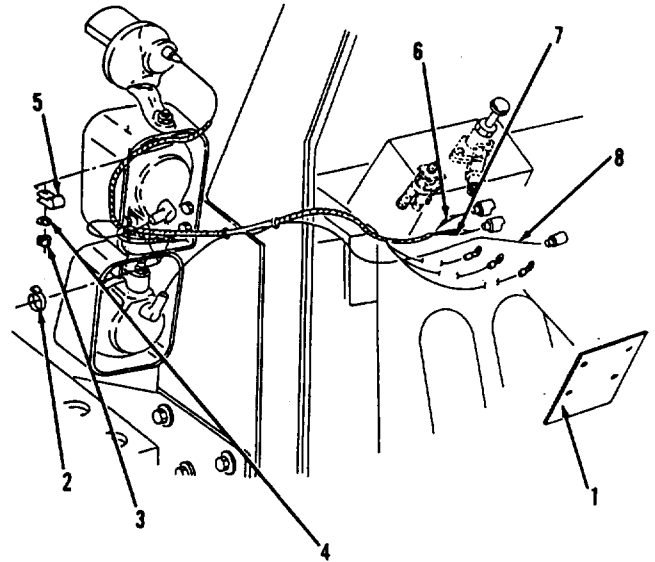
Go to sheet 7

ELECTRICAL SYSTEM MAINTENANCE.

5-7. Front Lights Wiring Harness. (Sheet 7 of 7)

INSTALLATION

49. Connect wire assemblies (8, 7 and 6) at connectors.
50. Apply silicone sealant over entire connection.
51. Using a 9/16" socket and socket wrench handle, install clamp (5), washer (4) and nut (3).
52. Using slip joint pliers, install four new tie straps (2).
53. Install two access covers (1) in instrument panel housing, refer to TM 10-3930-643-20.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



## CHAPTER 6

TRANSMISSION  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift transmission system.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Torque Converter Troubleshooting	6-1	6-2
Transmission Troubleshooting	6-2	6-6
Torque Converter	6-3	6-11
Torque Converter Charging Pump	6-4	6-20
Torque Converter and Transmission Hoses, Lines and Fittings	6-5	6-26
Transmission Assembly	6-6	6-36
Transmission Oil Filter Base	6-7	6-48
Scheduling Valve and Control Valve	6-8	6-54
Transmission Oil Cooler	6-9	6-58

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-1. Torque Converter Troubleshooting.

---

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

---

a. HIGH TORQUE CONVERTER OIL TEMPERATURE.

Step 1. Transmission sump oil level too high or too low.

Add or drain to proper level, refer to LO 10-3930-643-12.

If oil level is correct, proceed to Step 2.

Step 2. Check for foam in oil. If there is evidence of foam, check for leaks in torque converter lines, refer to paragraph 6-5.

If there is no leakage in lines, proceed to Step 3.

Step 3. Test for torque converter pressure.

If pressure is low, check pump for wear.

If torque converter pressure is accurate, proceed to Step 4.

Step 4. Check for low oil flow through torque converter.

Replace torque converter charging pump, refer to paragraph 6-4.

Step 5. Check regulating valve for operation.

If not operating properly, refer to paragraph 4-10.

Step 6. Check for clogged transmission oil cooler.

Remove and clean, refer to paragraph 6-9.

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

## 6-1. Torque Converter Troubleshooting.

---

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

---

## b. HIGH TORQUE CONVERTER "IN" PRESSURE.

Step 1. Check for stuck torque converter or lubrication pressure regulator valve.

Clean, replace or repair as necessary, refer to paragraph 6-3.

Step 2. Check for clogged transmission oil cooler.

Remove and clean, if necessary, refer to paragraph 6-9.

## c. LOW TORQUE CONVERTER "IN" PRESSURE.

Step 1. Check for low transmission sump oil level.

Add oil to proper level, refer to LO 10-3930-643-12.

If oil level is correct, proceed to Step 2.

Step 2. Low clutch pressure, refer to Transmission Troubleshooting,

If clutch pressure is correct, proceed to Step 3.

Step 3. Check external transmission and torque converter oil lines for leaks.

Replace as necessary, refer to paragraph 6-5.

If there is no sign of leakage, proceed to Step 4.

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-1. Torque Converter Troubleshooting. (cont)

---

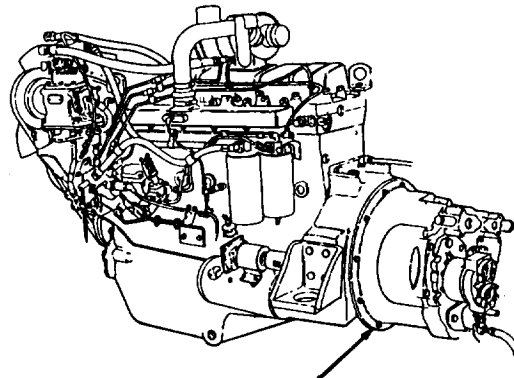
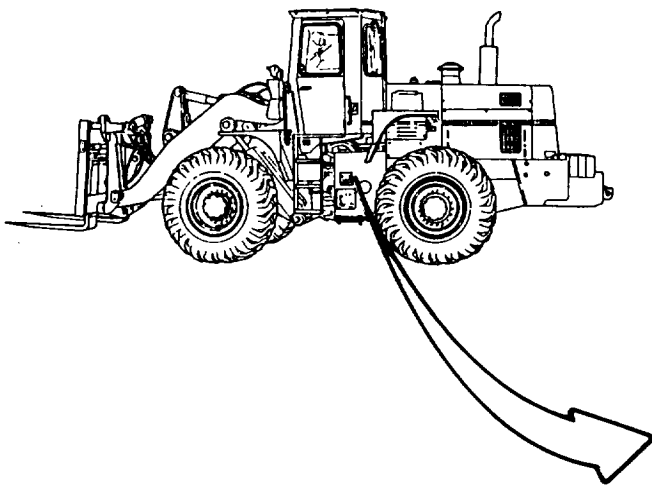
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

---

c. LOW TORQUE CONVERTER "IN" PRESSURE. (cont)

Step 4. Check for internal leakage in torque converter.

If leakage is suspected, contact General Support.



TORQUE  
CONVERTER

d. LOSS OF POWER.

Check for low engine output, refer to Engine Troubleshooting.

e. HIGH ENGINE SPEED AT TORQUE CONVERTER STALL.

Step 1. Check for low transmission sump oil level.

Add or drain oil as necessary, refer to LO 10-3930-643-12.

If oil level is correct, proceed to Step 2.

Step 2. Check for foam in oil,

If foam is present, check connections on inlet side of charging pump, refer to paragraph 6-4.

If no foam is present, proceed to Step 3.



TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-1. Torque Converter Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

e. HIGH ENGINE SPEED AT TORQUE CONVERTER STALL.

Step 3. Check for defective torque converter.

Replace, refer to paragraph 6-3.

f. LOW ENGINE SPEED AT TORQUE CONVERTER STALL.

Check for low engine output, refer to Engine Troubleshooting.

6-2. Transmission Troubleshooting.

---

MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION

---

a. HIGH OIL TEMPERATURE.

Refer to Torque Converter Troubleshooting.

b. SLOW OR ERRATIC CLUTCH ENGAGEMENT.

Step 1. Check for clogged oil filter or oil filter screens, refer to LO 10-3930-643-12.

If transmission continues to shift roughly or erratically, proceed to Step 2.

Step 2. Test for low clutch pressure. Refer to "low clutch pressure" in this section.

If clutch pressure is correct, proceed to Step 3.

Step 3. Check to see if neutral knock down valve or clutch pressure regulator valve sticking.

Replace control and scheduling valve assembly, refer to paragraph 6-8.

If shifting is still erratic, proceed to Step 4.

Step 4. Internal oil leaks. Shift through all gears to determine if one or all clutches are malfunctioning.

Replace transmission, refer to paragraph 6-6.

c. HIGH CLUTCH PRESSURE.

Check for improper main pressure regulator valve operation.

Replace or repair as necessary, refer to paragraph 6-8.

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-2. Transmission Troubleshooting.

---

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

---

## d. LOW CLUTCH PRESSURE.

Step 1. Check for clogged oil filter or transmission screens.

Clean or replace as necessary, refer to LO 10-3930-643-12.

If filter and screens are operating, proceed to Step 2.

Step 2. Check for foamed oil.

Tighten, replace or repair any external leaks in gaskets, lines or fittings.

If no leaks are found, proceed to Step 3.

Step 3. Improper clutch pressure regulator valve or neutral knock down valve operation.

Replace control and scheduling valve assembly, refer to paragraph 6-8.

If clutch pressure is still low, proceed to Step 4.

Step 4. Pressure test while shifting transmission to determine internal leakage.

Replace transmission if internal leakage is determined, refer to paragraph 6-6.

## e. HIGH OR LOW TORQUE CONVERTER "IN" PRESSURE.

Refer to Torque Converter Troubleshooting.

## f. LOSS OF POWER.

Step 1. Check engine, refer to Engine Troubleshooting.

If engine is running properly, proceed to Step 2.

Step 2. Check torque converter, refer to Torque Converter Troubleshooting.

If torque converter is operating, proceed to Step 3.

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-2. Transmission Troubleshooting. (cont)

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

f. LOSS OF POWER. (cont)

Step 3. Check for improper control of scheduling valve operation.

Replace, refer to paragraph 6-8.

If valve is functioning, proceed to Step 4.

Step 4. Check for slipping clutches. Refer to "Low Clutch Pressure" in this section.

If transmission is fully operational, and loss of power continues, check parking and vehicle brakes.

g. VEHICLE DRIVES IN ONE DIRECTION AND CREEPS IN THAT DIRECTION IN NEUTRAL BUT STALLS WHEN SHIFTED TO THE OPPOSITE DIRECTION.

Failed range clutch.

Replace transmission, refer to paragraph 6-6.

h. VEHICLE DRIVES IN ONE RANGE, BUT STALLS WHEN SHIFTED TO ANOTHER RANGE.

Failed range clutch.

Replace transmission, refer to paragraph 6-6.

i. ALL RANGE PRESSURES NORMAL IN ONE DIRECTION BUT ALL LOW IN OPPOSITE DIRECTION.

Internal oil leaks in forward or reverse clutch.

Replace transmission, refer to paragraph 6-6.

j. LOW CLUTCH PRESSURE IN ONE RANGE (CLUTCH IN EITHER DIRECTION).

Internal oil leaks in clutch.

Replace transmission, refer to paragraph 6-6.

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-2. Transmission Troubleshooting.

MALFUNCTION  
 TEST OR INSPECTION  
 CORRECTIVE ACTION

k. CLUTCH PRESSURE CHECK AT FULL POWER STALL.



When performing test with vehicle at full power stall, apply brakes before engaging transmission and clear all personnel from the immediate area. Failure to follow this procedure could result in SEVERE INJURY and DEATH.



During full power stall, do not engage steering system, do not exceed 15 seconds per stall check and do not allow torque converter to exceed normal operating temperature.

NOTE

Full stall is the speed of engine with throttle at maximum, vehicle in highest gear with brakes applied and hydraulic control valve activated to demand maximum hydraulic relief pressure.

- Step 1. Locate pressure tap at right side center of vehicle, under operator's compartment.

6-2. Transmission Troubleshooting. (cont)

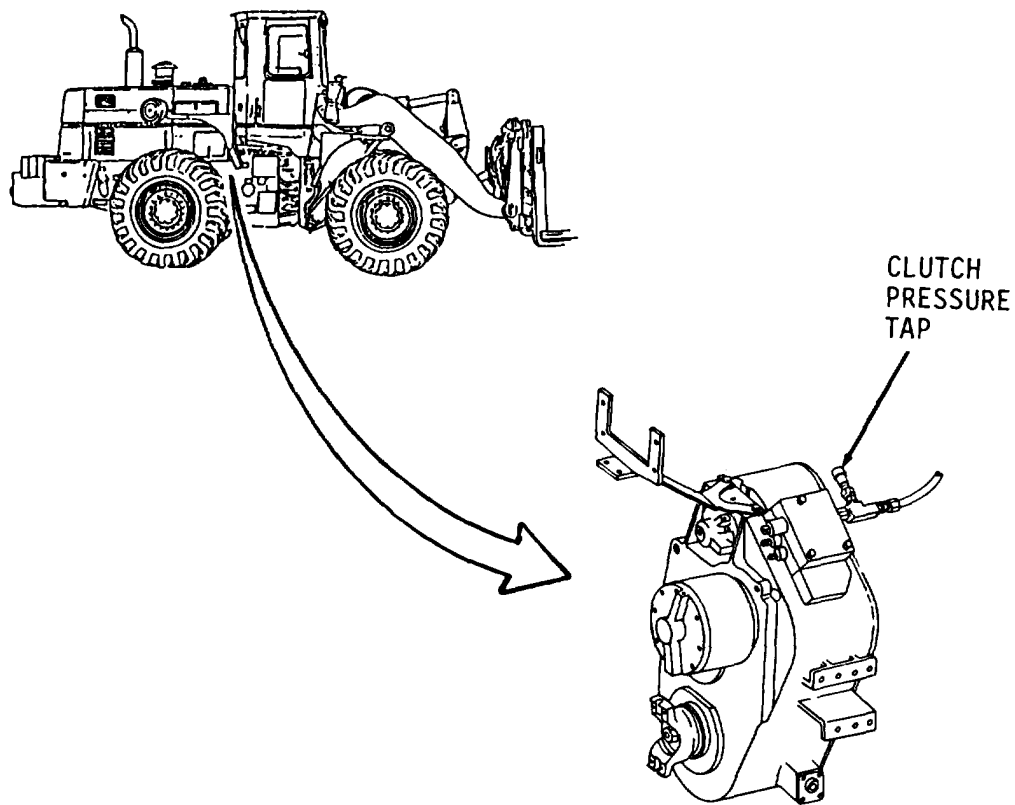
---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

k. CLUTCH PRESSURE CHECK AT FULL POWER STALL. (cont)

Step 2. Remove cap from pressure tap and attach pressure gage, as shown.



Step 3. Run engine and transmission until normal operating temperatures are obtained, refer to TM 10-3930-643-10.

Step 4. Operate vehicle under full power stall. Read pressure gage. Clutch pressure should be 270-310 psi.

Step 5. Place vehicle in park, apply parking brake and shut engine off.

Step 6. Remove pressure gage and install cap on pressure tap.



6-3. Torque Converter. (Sheet 2 of 9)

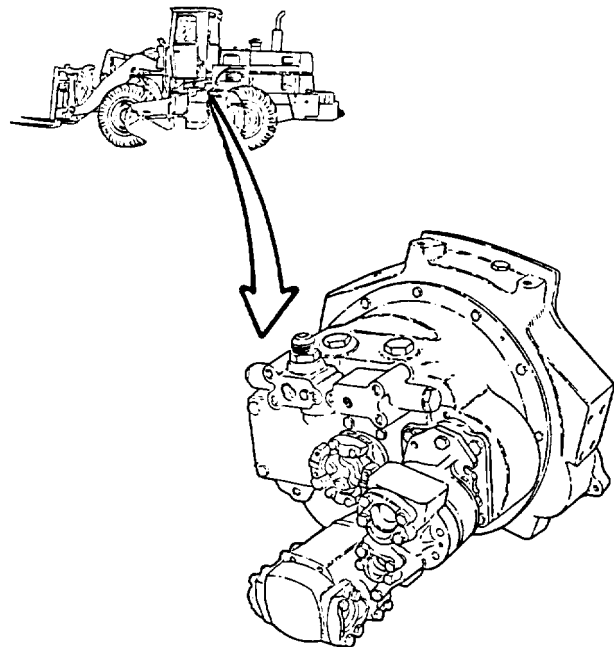
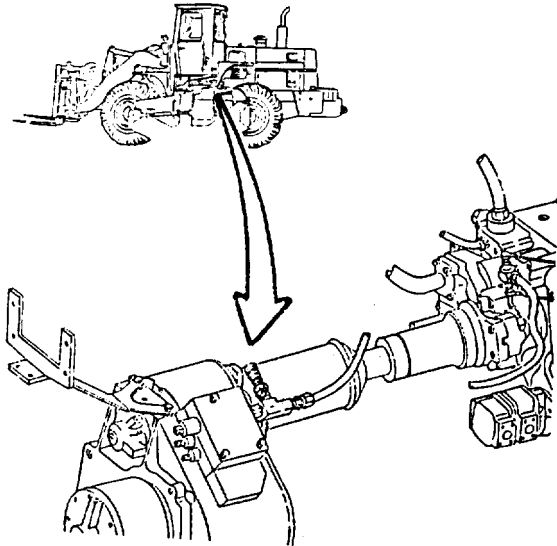
TESTING

1. Using an 11/16" open end wrench, install pressure gage at clutch pressure tap in transmission and torque converter.
2. Using a 3/4" open end wrench, install pressure gage at torque converter charge pressure tap.
3. Operate engine.

NOTE

Engine, torque converter and transmission should be at normal operating temperature.

4. Accelerate engine to 1000 to 1200 rpm with transmission in neutral for not longer than three minutes. Do not exceed 1200 rpm.
5. Using a pressure gage, check clutch pressure. Clutch pressure should be 270 to 310 psi. If a minimum clutch pressure of 160 psi is not reached within 30 seconds after engine is operating at low idle (675 to 700 rpm), shut down engine. Do not perform stall check test.
6. Using a pressure gage, check torque converter charge pressure. Charge pressure should be 25 to 35 psi.





## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-3. Torque Converter. (Sheet 3 of 9)

TESTING

## 7. Perform stall check:

## NOTE

Perform stall check using tachometer transducer tester for vehicles 2001 and above. Use electronic tachometer for vehicles 2000 and below.

- a. Apply parking brake.
- b. Install tachometer transducer tester, refer to VTM-General Setup and Checkout Instructions in TM 9-4910-571-12&P.
- c. Increase engine speed to be sure it will operate at high idle (2650 to 2750 rpm).
- d. Shift transmission to forward and third gear.
- e. Depress accelerator to its maximum position and record engine rpm. Engine rpm should be 2300 to 2550 rpm.

**CAUTION**

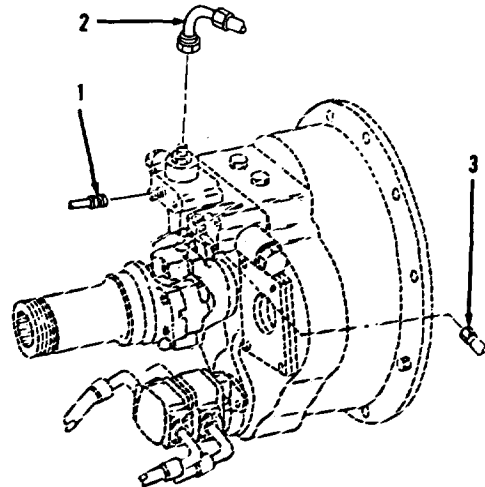
Do not exceed 15 seconds per stall check. Do not allow torque converter to exceed normal operating temperature.

REMOVAL

## NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

8. Using 1-1/2" and 7/8" open end wrenches, disconnect hose assemblies (1, 2 and 3) in front of engine.



Go to sheet 4

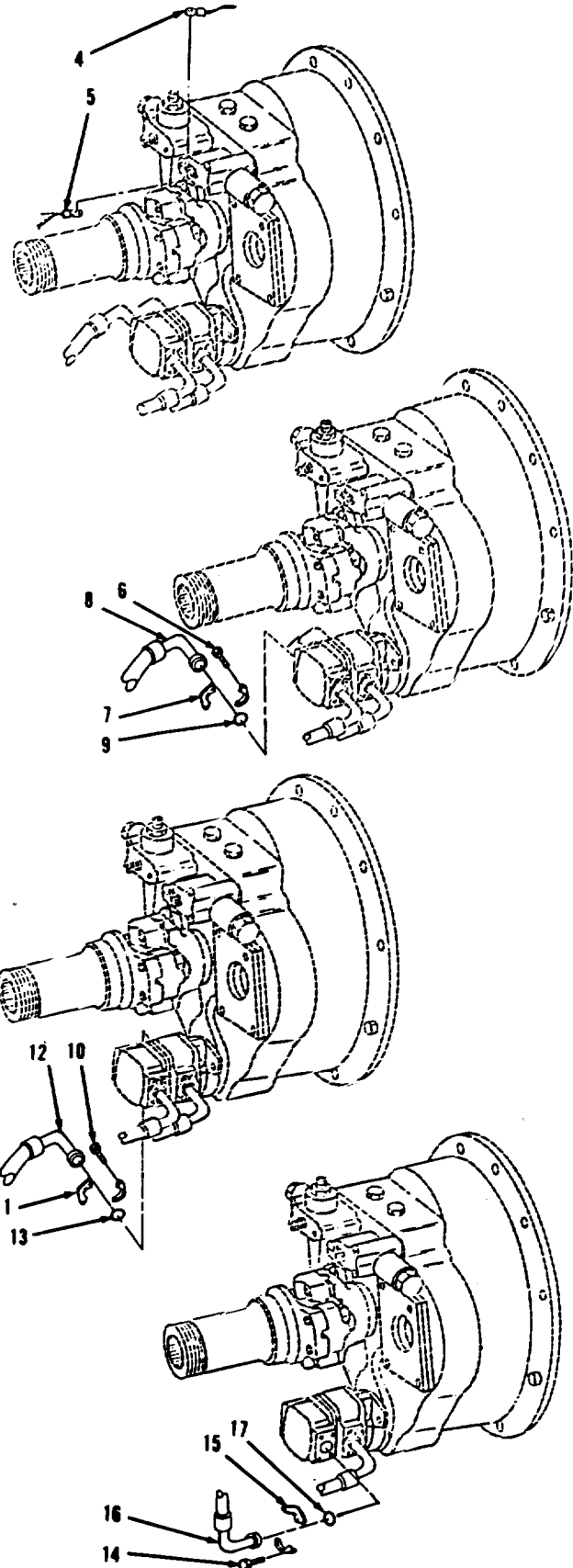
6-3. Torque Converter. (Sheet 4 of 9)

REMOVAL (cont)

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

9. Using a flat tip screwdriver and a 3/8" open end wrench, disconnect wire assemblies (4 and 5) at terminals.
10. Using a 9/16" socket and socket wrench handle, remove four bolts (6) and two flange halves (7).
11. Disconnect hose assembly (8).
12. Using long round nose pliers, remove and discard preformed packing (9).
13. Using a 9/16" socket and socket wrench handle, remove four bolts (10) and two flange halves (11).
14. Disconnect hose assembly (12).
15. Using long round nose pliers, remove and discard preformed packing (13).
16. Using a 9/16" socket and socket wrench handle, remove four bolts (14) and two flange halves (15).
17. Disconnect hose assembly (16).
18. Using long round nose pliers, remove and discard preformed packing (17).



Go to sheet 5

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-3. Torque Converter. (Sheet 5 of 9)

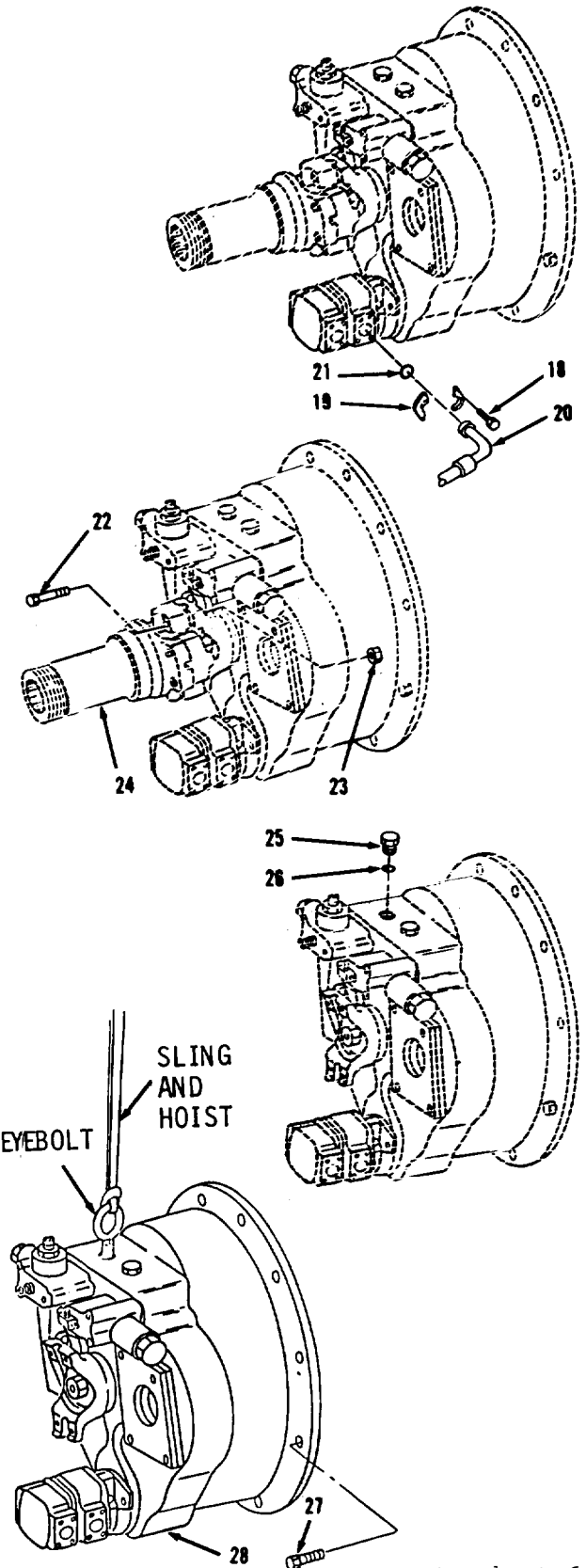
REMOVAL

19. Using a 9/16" socket and socket wrench handle, remove four bolts (18) and two flange halves (19).
20. Disconnect hose assembly (20).
21. Using long round nose pliers, remove and discard preformed packing (21).
22. Using a 1/2" open end wrench, remove four bolts (22) and locknuts (23).
23. Using a flat blade screwdriver or pry bar, disconnect drive shaft (24).
24. Using a 1-1/2" open end wrench, remove plug (25) and preformed packing (26). Discard preformed packing (26).
25. Using side cutting pliers, cut and discard two tie straps and separate hoses for easier access to torque converter (28).

**WARNING**

Weight of torque converter is approximately 180 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

26. Install one inch eyebolt in plug mounting hole; attach hoist and sling.
27. Using a 9/16" socket and socket wrench handle, remove 12 bolts (27) and torque converter (28). Use two bolts (27) as pusher bolts near top and bottom.



to sheet 6

6-3. Torque Converter. (Sheet 6 of 9)

CLEANING/INSPECTION

28. Wipe hose assemblies (1, 2, 3, 8, 12, 16 and 20) with clean cloth moistened with detergent and water solution.

**WARNING**

- TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

- COMPRESSED AIR HAZARD

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

29. Wipe outer surface of torque converter (28) with clean cloth dampened with cleaning solvent P-D-680. Allow to air dry.
30. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
31. Inspect all parts. Refer to paragraph 2-9.

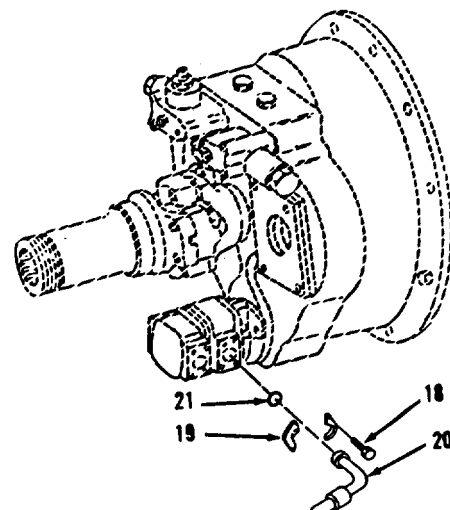
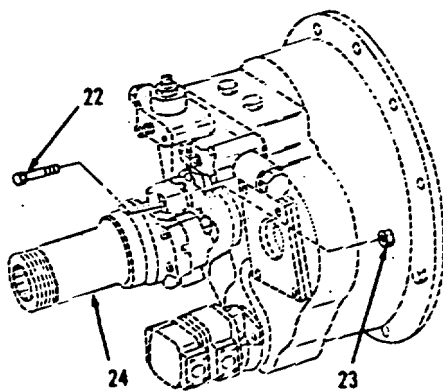
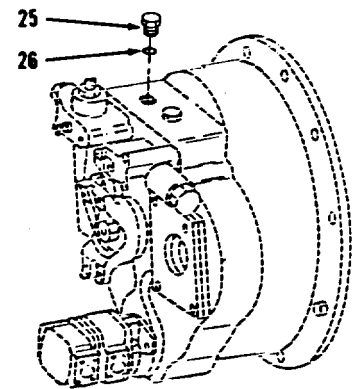
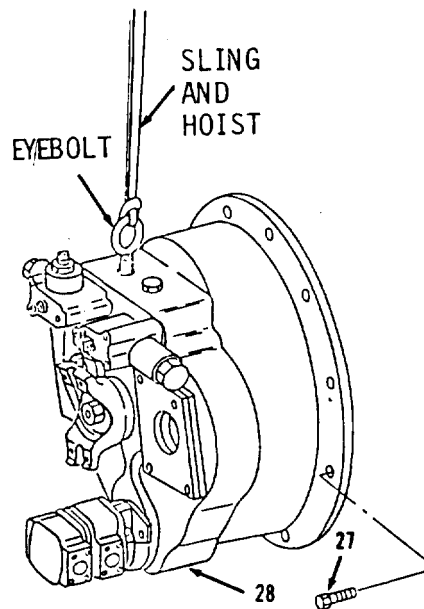
Go to sheet 7

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-3. Torque Converter. (Sheet 7 of 9)

INSTALLATION

32. Position torque converter (28) on flywheel housing.
33. Using a 9/16" socket, socket wrench handle, and 1/2" torque wrench, install torque converter (28) and 12 bolts (27). Tighten bolts (27) to 33 then to 37 lb-ft.
34. Install two new tie straps on hoses, removed to gain easier access to torque converter (28).
35. Using a 1-1/2" open end wrench, install new preformed packing (26) and plug (25).
36. Position drive shaft (24).
37. Using a 1/2" socket, socket wrench handle and 1/2" torque wrench, install four locknuts (23) and bolts (22). Tighten bolts (22) to 20 lb-ft.
38. Install new preformed packing (21).
39. Position hose assembly (20).
40. Using a 9/16" socket and socket wrench handle, install two flange halves (19) and four bolts (18).

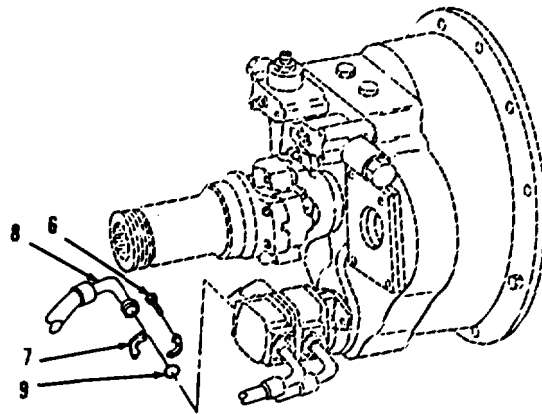
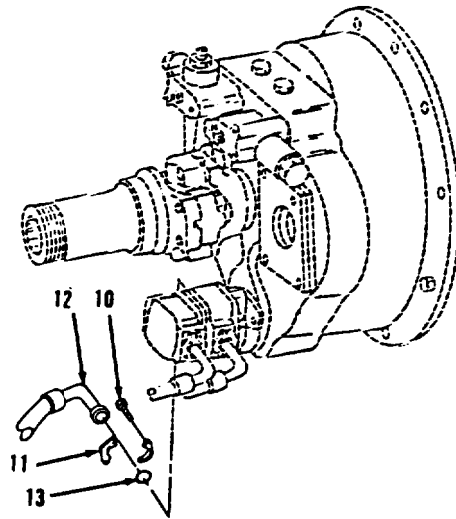
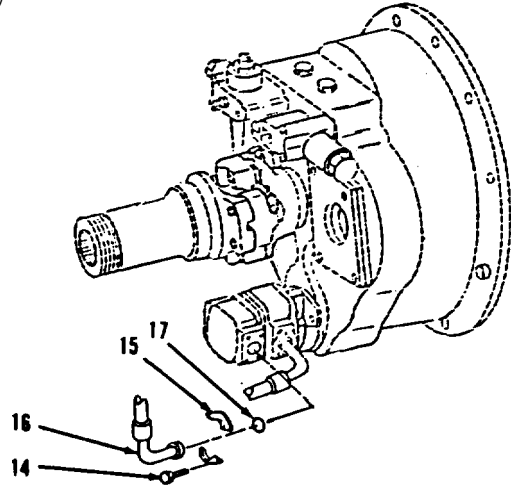


Go to sheet 8

6-3. Torque Converter. (Sheet 8 of 9)

INSTALLATION (cont)

41. Install new preformed packing (17).
42. Position hose assembly (16).
43. Using a 9/16" socket and socket wrench handle, install two flange halves (15) and four bolts (14).
44. Install new preformed packing (13).
45. Position hose assembly (12).
46. Install two flange halves (11) and four bolts (10).
47. Install new preformed packing (9).
48. Position hose assembly (8).
49. Install two flange halves (7) and four bolts (6).



TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

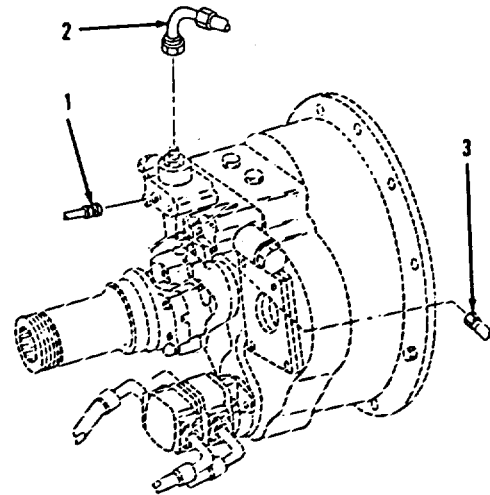
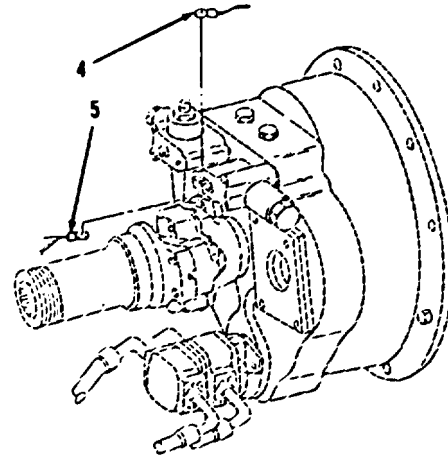
6-3. Torque Converter. (Sheet 9 of 9)

INSTALLATION

50. Using a flat tip screwdriver and a 3/8" open end wrench, connect wire assemblies (5 and 4) at terminals.
51. Using 1-1/2" and 7/8" open end wrenches, connect hose assemblies (3, 2 and 1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-4. Torque Converter Charging Pump. (Sheet 1 of 6)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Detergent (App. C, Item 33)  
Small tag (App. C, Item 28)  
Preformed packing (5)

Torques

Bolts (17) to 33 to 37 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Engine top and side access covers  
removed.

---



TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-4. Torque Converter Charging Pump. (Sheet 2 of 6)

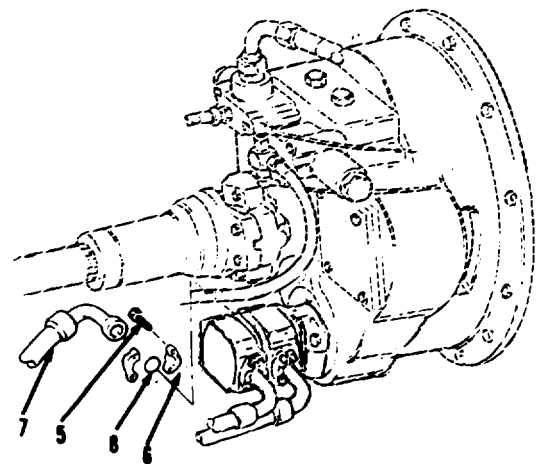
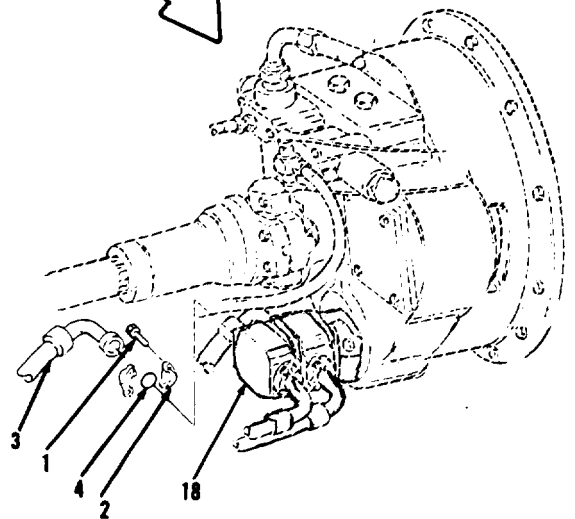
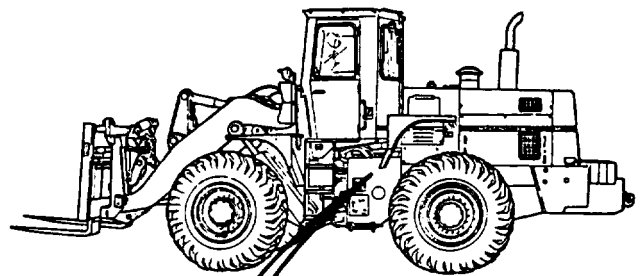
REMOVAL

1. Using a 9/16" socket and socket wrench handle, remove four bolts (1) and two flange halves (2) from charging pump (18).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Disconnect hose assembly (3).
3. Using long round nose pliers, remove and discard preformed packing (4).
- 4\* Using a 9/16" socket and socket wrench handle, remove four bolts (5) and two flange halves (6).
5. Disconnect hose assembly (7).
6. Using long round nose pliers, remove and discard preformed packing (8).



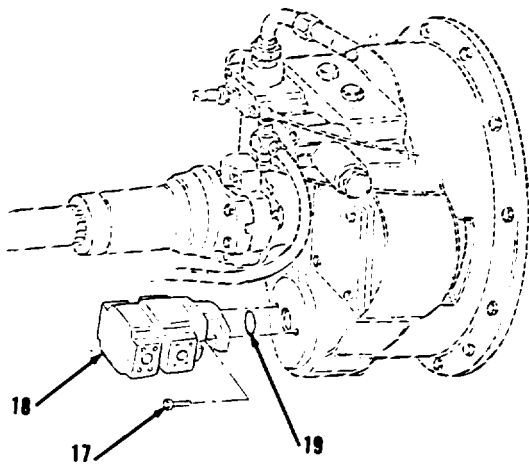
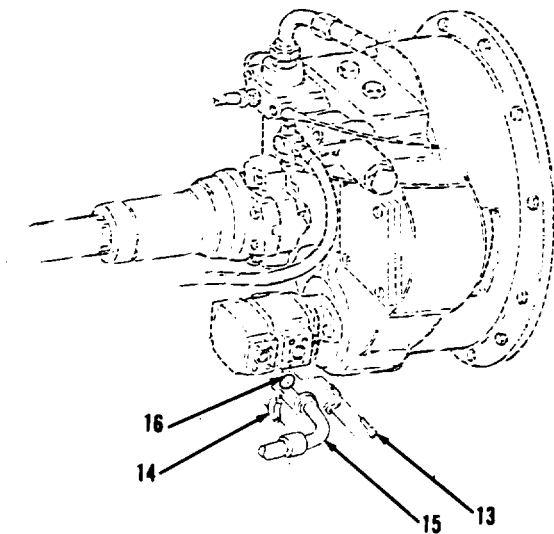
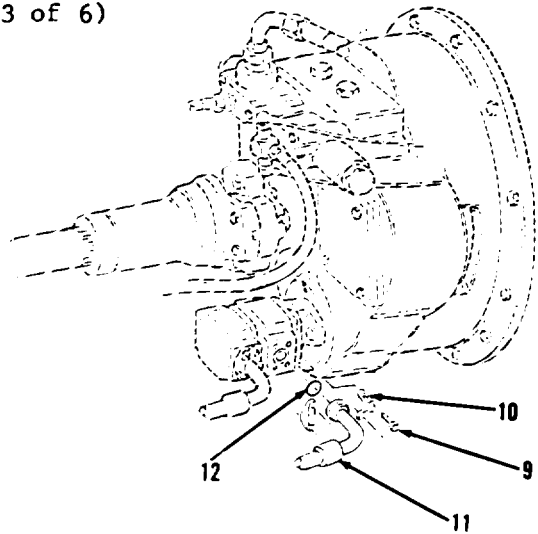
Go to sheet 3

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-4. Torque Converter Charging Pump. (Sheet 3 of 6)

REMOVAL (cont)

7. Using a 9/16" socket and socket wrench handle, remove four bolts (9) and two flange halves (10).
8. Disconnect hose assembly (11).
9. Using long round nose pliers, remove and discard preformed packing (12).
10. Using a 9/16" socket and socket wrench handle, remove four bolts (13) and two flange halves (14).
11. Disconnect hose assembly (15).
12. Using long round nose pliers, remove and discard preformed packing (16).
13. Using a 9/16" socket and socket wrench handle, remove two bolts (17), charging pump (18) and preformed packing (19). Discard preformed packing (19).



Go to sheet 4

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-4. Torque Converter Charging Pump. (Sheet 4 of 6)

CLEANING/INSPECTION

14. Wipe hose assemblies (3, 7, 11 and 15) with clean cloth moistened with detergent and water solution.

**WARNING**

- TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

**● COMPRESSED AIR HAZARD**

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

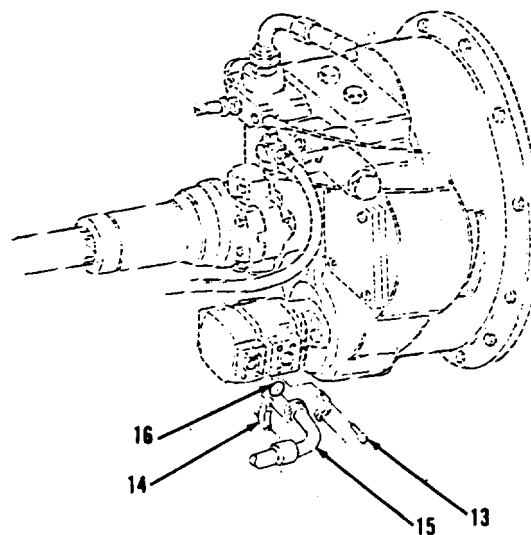
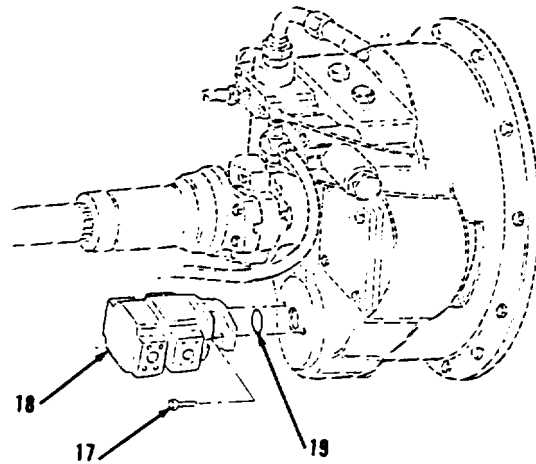
15. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
16. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

6-4. Torque Converter Charging Pump. (Sheet 5 of 6)

INSTALLATION

17. Using a 9/16" socket, socket wrench handle and 1/2" torque wrench, install new preformed packing (19), charging pump (18) and two bolts (17) in torque converter. Tighten bolts (17) to 33 to 37 lb-ft.
18. Install new preformed packing (16).
19. Connect hose assembly (15).
20. Using a 9/16" socket and socket wrench handle, install two flange halves (14) and four bolts (13).



TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

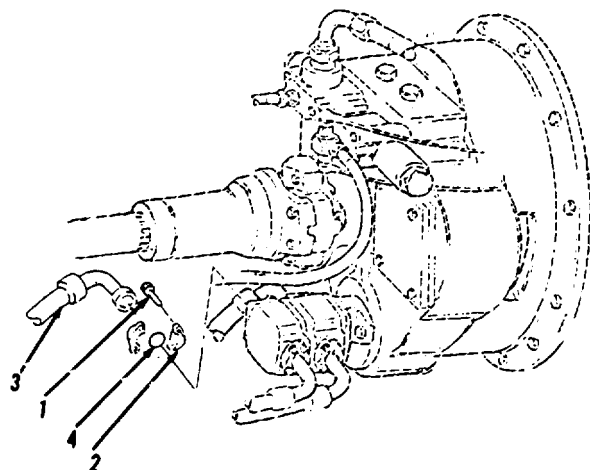
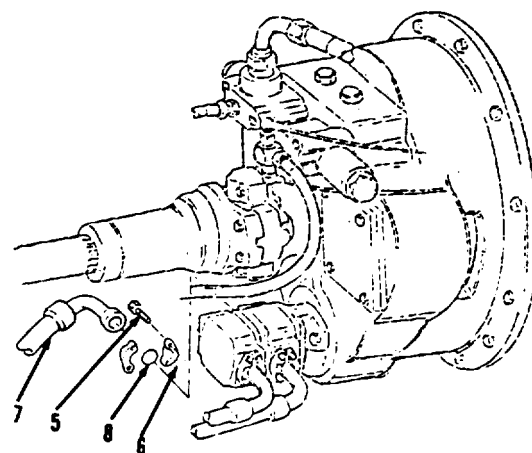
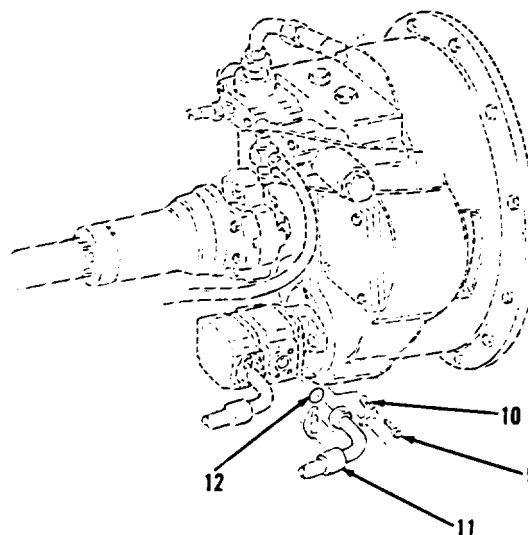
6-4. Torque Converter Charging Pump. (Sheet 6 of 6)

INSTALLATION

21. Install new preformed packing (12).
22. Connect hose assembly (11).
23. Using a 9/16" socket and socket wrench handle, install two flange halves (10) and four bolts (9).
24. Install new preformed packing (8).
25. Connect hose assembly (7).
26. Install two flange halves (6) and four bolts (5).
27. Install new preformed packing (4).
28. Connect hose assembly (3).
29. Install two flange halves (2) and four bolts (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 1 of 10)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Detergent (App. C, Item 33)  
Small tag (App. C, Item 28)  
Preformed packing (11)  
Tie strap (3)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Transmission oil drained.

---

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

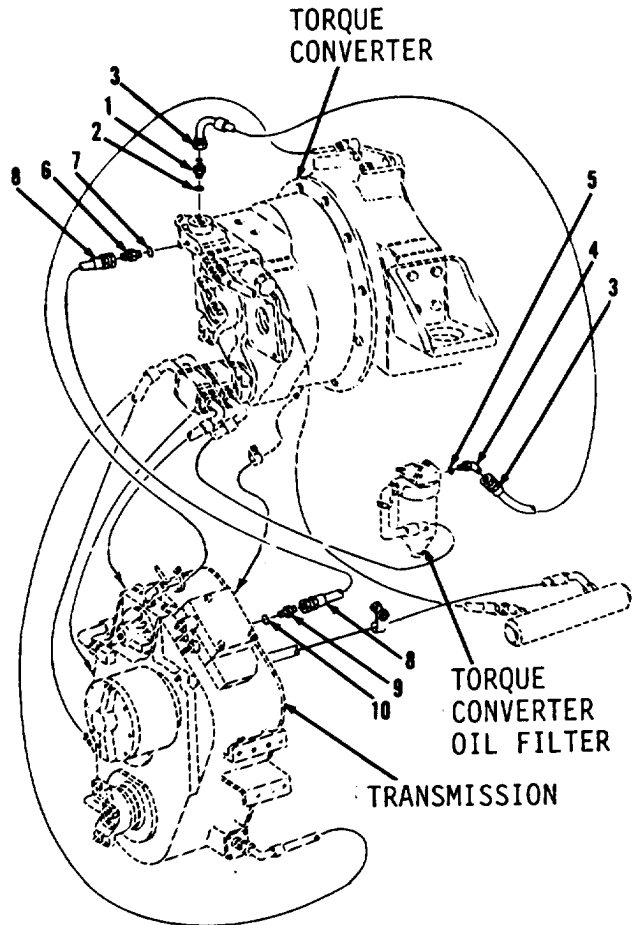
6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 2 of 10)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 1-1/2" open end wrench, disconnect hose assembly (3) from torque converter.
2. Remove union (1) and preformed packing (2). Discard preformed packing (2).
3. Remove hose assembly (3), elbow (4) and preformed packing (5) from torque converter oil filter. Discard preformed packing (5).
4. Using a 5/8" open end wrench, disconnect hose assembly (8) from torque converter.
5. Remove union (6) and preformed packing (7). Discard preformed packing (7).
6. Remove hose assembly (8), union (9) and preformed packing (10) from transmission. Discard preformed packing (10).

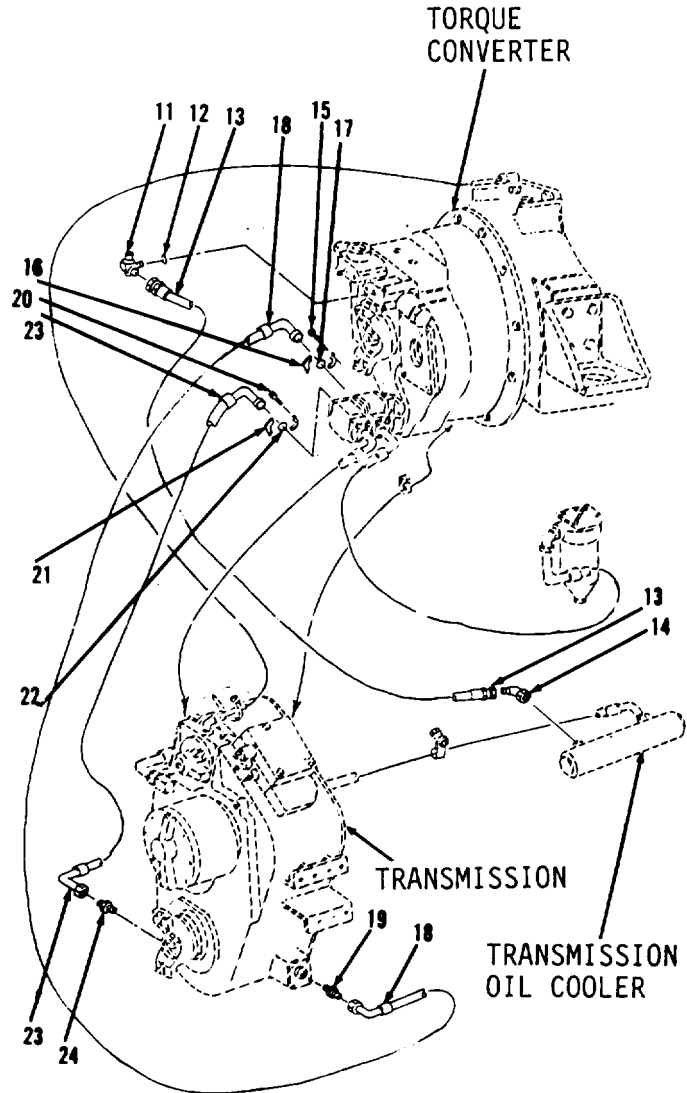


Go to sheet 3

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 3 of 10)

REMOVAL (cont)

7. Using a 1-1/2" open end wrench, disconnect hose assembly (13) from torque converter.
8. Using slip joint pliers, remove elbow (11) and preformed packing (12). Discard preformed packing (12).
9. Using a 1-1/2" open end wrench, remove hose assembly (13) and elbow (14) from transmission oil cooler.
10. Using a 9/16" socket and socket wrench handle, remove four bolts (15), two flange halves (16) and preformed packing (17) from torque converter. Discard preformed packing (17).
11. Disconnect hose assembly (18).
12. Using 1-3/8" and 1-1/2" open end wrenches, remove hose assembly (18) and adapter (19) from transmission.
13. Using a 9/16" socket and socket wrench handle, remove four bolts (20), two flange halves (21) and preformed packing (22) from torque converter. Discard preformed packing (22).
14. Disconnect hose assembly (23).
15. Using 1-3/8" and 1-1/2" open end wrenches, remove hose assembly (23) and adapter (24) from transmission.



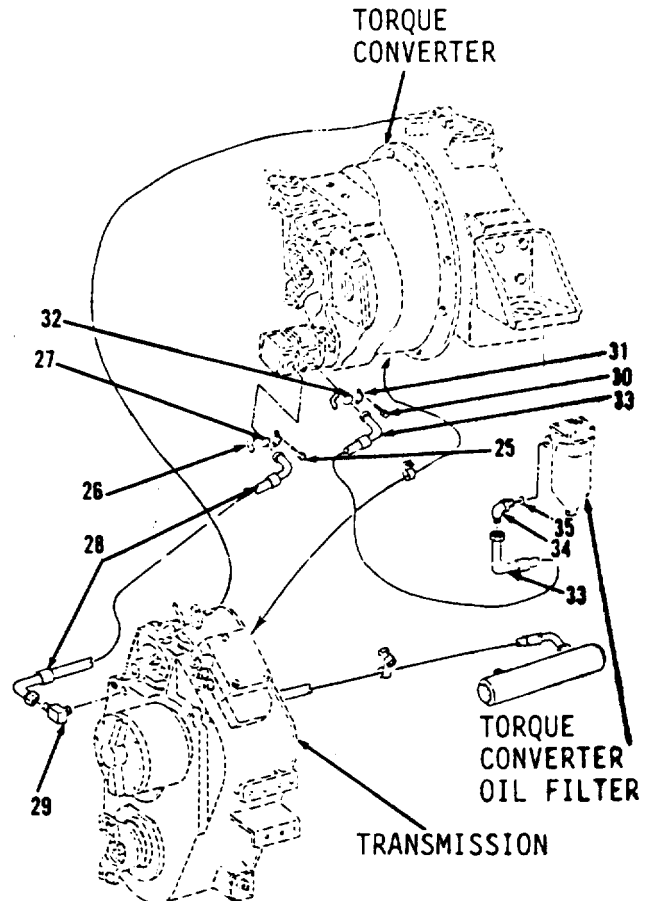


TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 4 of 10)

REMOVAL

16. Using a 9/16" socket and socket wrench handle, remove four bolts (25), two flange halves (26) and preformed packing (27) from torque converter. Discard preformed packing (27).
17. Disconnect hose assembly (28).
18. Using a 1-1/2" open end wrench, remove hose assembly (28) and elbow (29) from transmission.
19. Using a 9/16" socket and socket wrench handle, remove four bolts (30), two flange halves (31) and preformed packing (32) from torque converter. Discard preformed packing (32).
20. Disconnect hose assembly (33).
21. Using 1-1/2" and 3/4" open end wrenches, remove hose assembly (33), elbow (34) and preformed packing (35) from torque converter oil filter. Discard preformed packing (35).



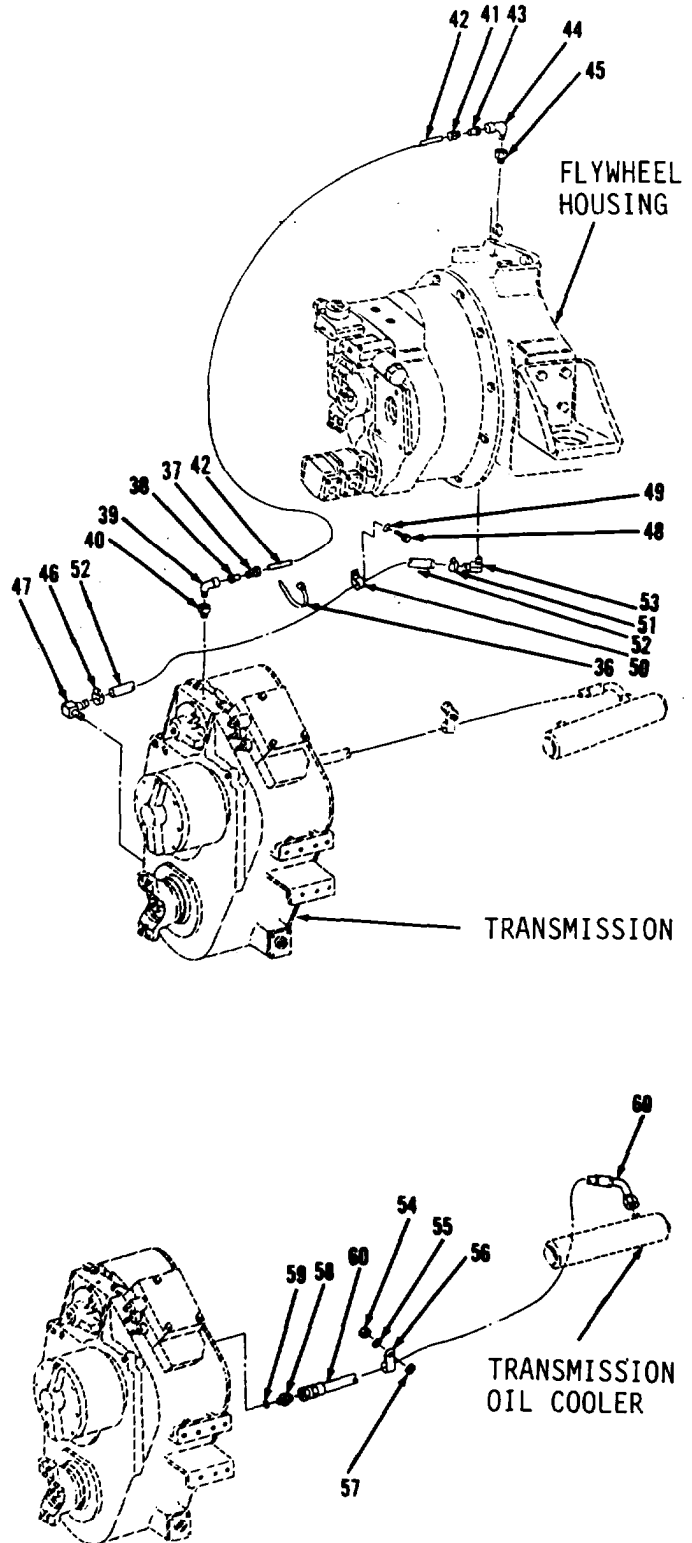
Go to sheet 5

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 5 of 10)

REMOVAL (cont)

22. Using side cutting pliers, cut and discard three tie straps (36).
23. Using 9/16" and 3/4" open end wrenches, remove nut (37), insert (38), elbow (39) and reducer (40).
24. Disconnect tube assembly (42).
25. Remove nut (41), tube (42), insert (43), elbow (44) and adapter (45) from flywheel housing.
26. Using a flat tip screwdriver and 1-3/8" open end wrench, remove clamp (46) and elbow transmission.
27. Disconnect hose assembly (52)
28. Using a 3/4" socket and socket wrench handle, remove bolt (48), washer (49) and clamp (50) from frame under cradle.
29. Using a flat tip screwdriver and 1-3/8" open end wrench, remove clamp (51), hose (52) and nipple (53).
30. Using a 9/16" socket and socket wrench handle, remove locknut (54), washer (55), clamp (56) and washer (57) from frame under converter.
31. Disconnect hose assembly (60).
32. Using a 1-1/2" open end wrench, remove union (58) and preformed packing (59). Discard preformed packing (59).
33. Remove hose assembly (60) from transmission oil cooler.



Go to sheet 6

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 6 of 10)

CLEANING/INSPECTION

34. Wipe hose assemblies (3, 8, 13, 18, 23, 28, 33, 52 and 60) with clean cloth moistened with detergent and water solution.

**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

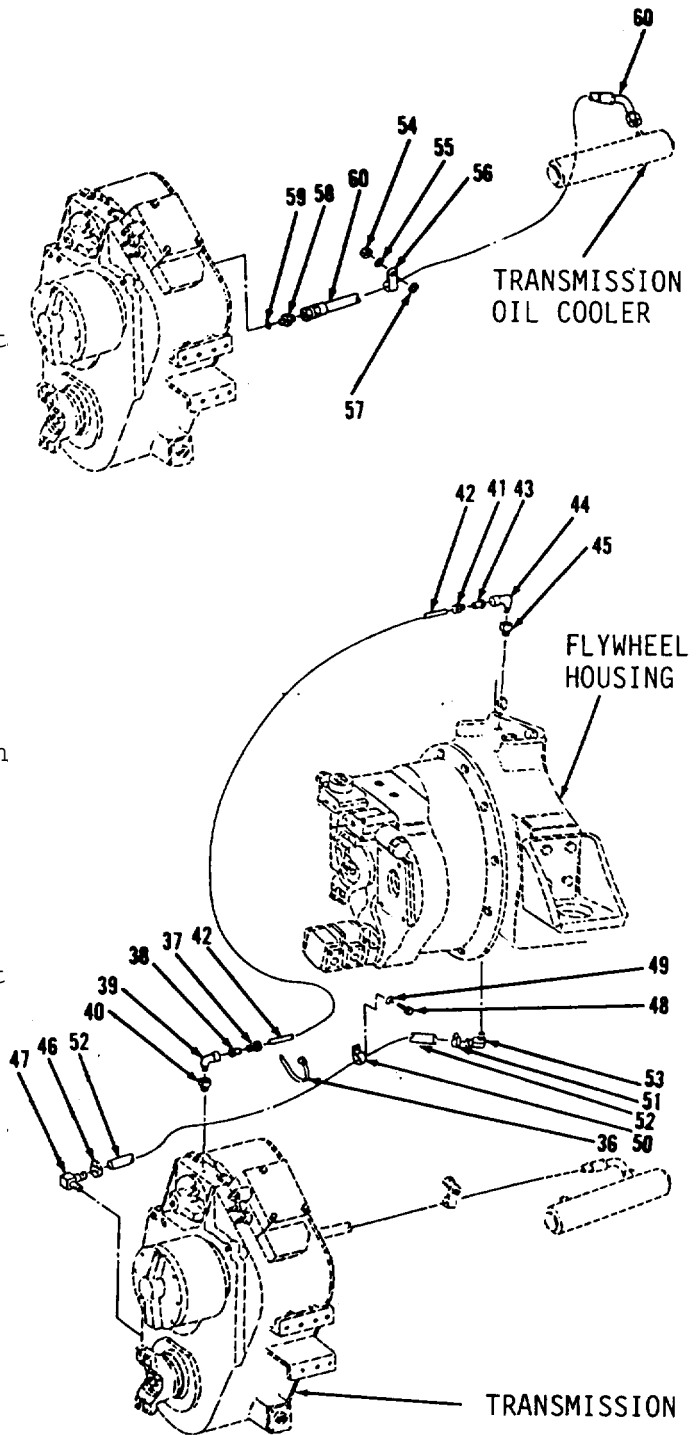
35. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
36. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 7

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 7 of 10)

INSTALLATION

- 37. Using a 1-1/2" open end wrench, install hose assembly (60) in transmission oil cooler.
- 38. Install new preformed packing (59) and union (58) in transmission.
- 39. Using a 7/8" open end wrench, connect hose assembly (60).
- 40. Using a 9/16" socket and socket wrench handle, install washer (57), clamp (56), washer (55) and locknut (54).
- 41. Using a 1-3/8" open end wrench and a flat tip screwdriver, install nipple (53), hose (52) and clamp (51) on frame.
- 42. Using a 3/4" socket and socket wrench handle, install clamp (50), washer (49) and bolt (48).
- 43. Connect hose assembly (52) in transmission.
- 44. Using a 3/8" open end wrench and flat tip screwdriver, install elbow (47) and clamp (46).
- 45\* Using 9/16" and 3/4" open end wrenches, install adapter (45), elbow (44), insert (43), tube (42) and nut (41) in flywheel housing.
- 46. Connect tube (42) in transmission.
- 47. Install reducer (40), elbow (39), insert (38) and nut (37).
- 48. Install three new tie straps (36).



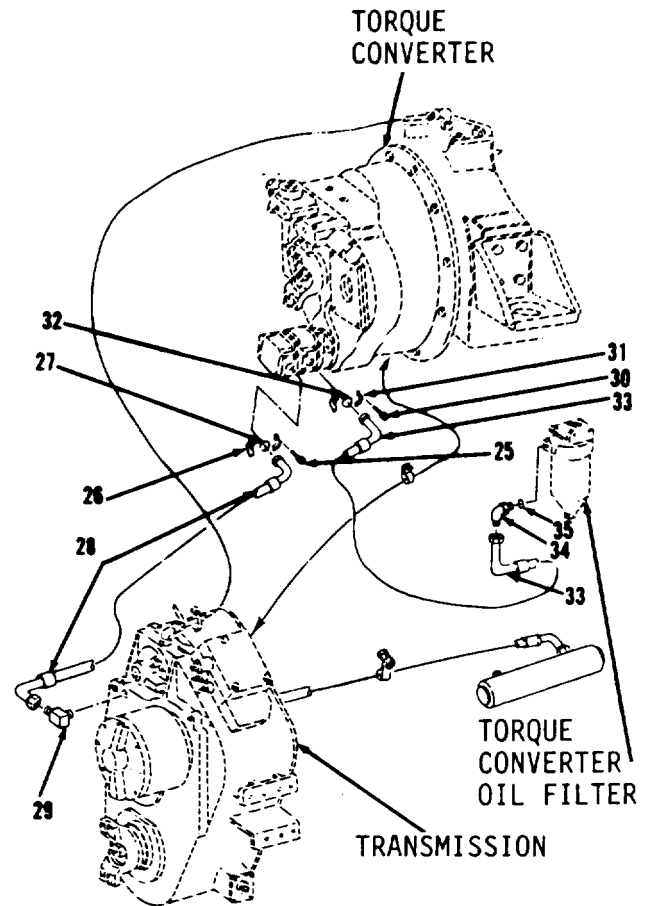
Go to sheet 8

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 8 of 10)

INSTALLATION

49. Using 1-1/2" and 1-3/4" open end wrenches, install new preformed packing (35), elbow (34) and hose assembly (33) in torque converter oil filter.
50. Connect hose assembly (33) to torque converter.
51. Using a 9/16" socket and socket wrench handle, install new preformed packing (32), two flange halves (31) and four bolts (30).
52. Using a 1-1/2" open end wrench, install elbow (29) and hose assembly (28) in transmission.
53. Connect hose assembly (28) in torque converter.
54. Using a 9/16" socket and socket wrench handle, install new preformed packing (27), two flange halves (26) and four bolts (25).



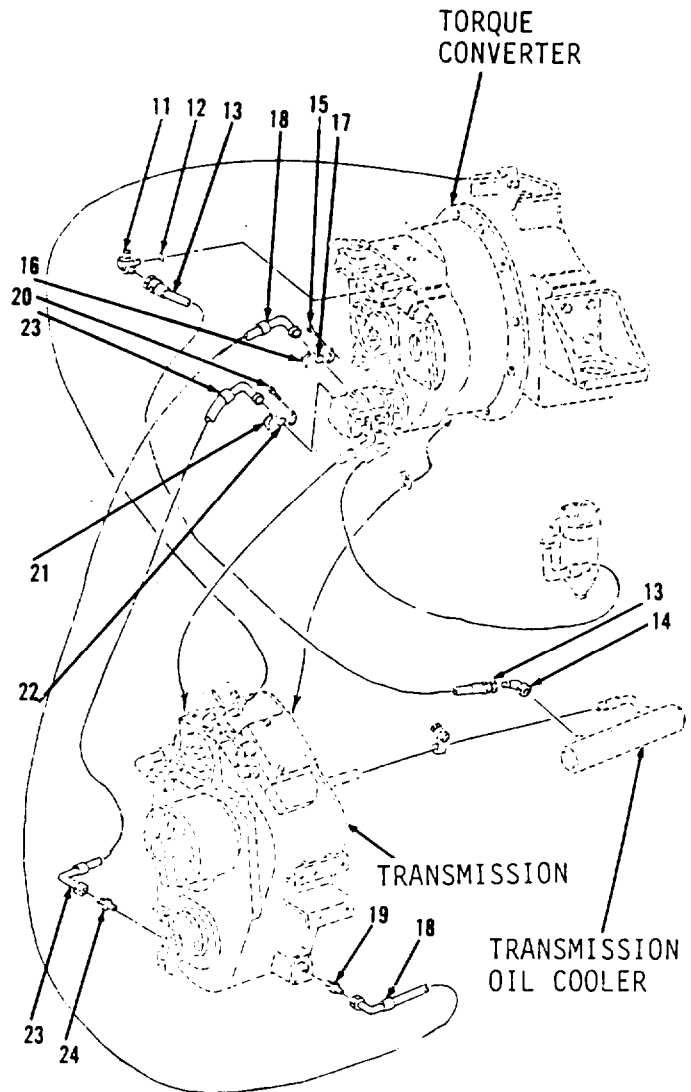
Go to sheet 9

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 9 of 10)

INSTALLATION (cont)

55. Using 1-3/8" and 1-1/2" open end wrenches, install adapter (24) and hose assembly (23) in transmission.
56. Connect hose assembly (23) in torque converter.
57. Using a 9/16" socket and socket wrench handle, install new preformed packing (22), two flange halves (21) and four bolts (20).
58. Using 1-3/8" and 1-1/2" open end wrenches, install adapter (19) and hose assembly (18) in transmission.
59. Connect hose assembly (18) in torque converter.
- 600 Using a 9/16" socket and socket wrench handle, install new preformed packing (17), two flange halves (16) and four bolts (15).
61. Using a 1-1/2" open end wrench, install elbow (14) and hose assembly (13) in transmission oil cooler.
62. Using slip joint pliers, install new preformed packing (12) and elbow (11) in torque converter.
63. Using a 1-1/2" open end wrench, connect hose assembly (13).



Go to sheet 10

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

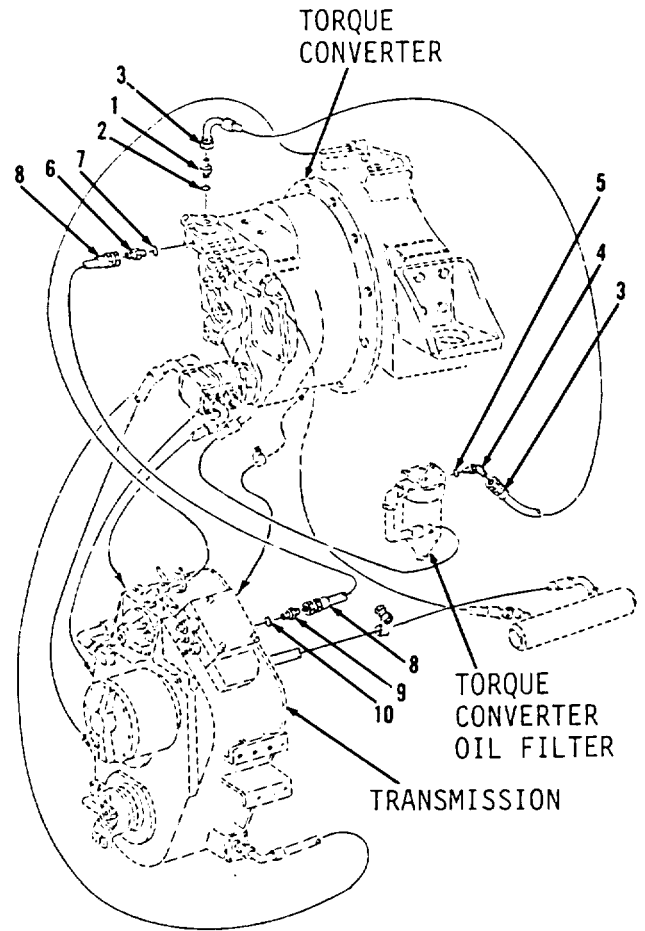
6-5. Torque Converter and Transmission Hoses, Lines and Fittings. (Sheet 10 of 10)

INSTALLATION

64. Using a 5/8" open end wrench, install new preformed packing (10), union (9) and hose assembly (8) in transmission.
65. Install new preformed packing (7) and union (6) in torque converter.
66. Connect hose assembly (8).
67. Using 1-1/2" and 1-5/16" open end wrenches, install new preformed packing (5), elbow (4) and hose assembly (3) in torque converter oil filter.
68. Install new preformed packing (2) and union (1) in torque converter.
69. Connect hose assembly (3).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-6. Transmission Assembly. (Sheet 1 of 12)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
Lifting eye, capacity of 730 lbs.  
Hoist and cable, capacity of  
730 lbs.  
1-1/2" open end off set wrench (45)  
NSN

Personnel Required

Three

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Detergent (App. C, Item 33)  
Small tag (App. C, Item 28)  
Lifting eye (App. D, Item D-9)  
Hexnut and washer  
Preformed packing (2)  
Cotter pin (2)  
Gasket

Torques

Bolts (7 and 10) to 80 lb-ft.  
Bolts (3 and 2) to 34 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-10

TM 10-3930-643-20

Condition Description

Vehicle frames locked in straight-ahead position.

Ground driven steering pump removed.  
Propeller shaft-torque converter to transmission removed.  
Seat assembly removed.  
Transmission fluid drained.

---

Go to sheet 2

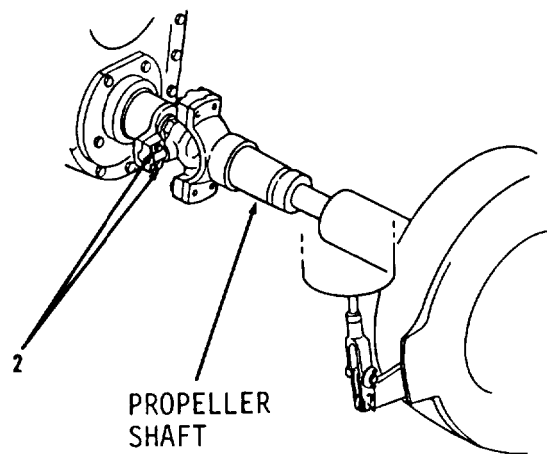
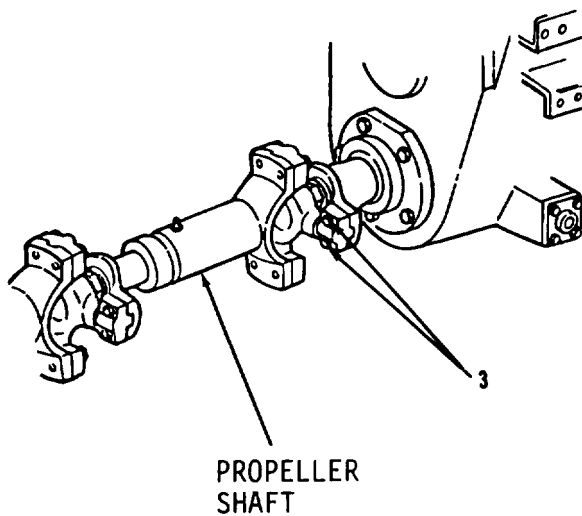
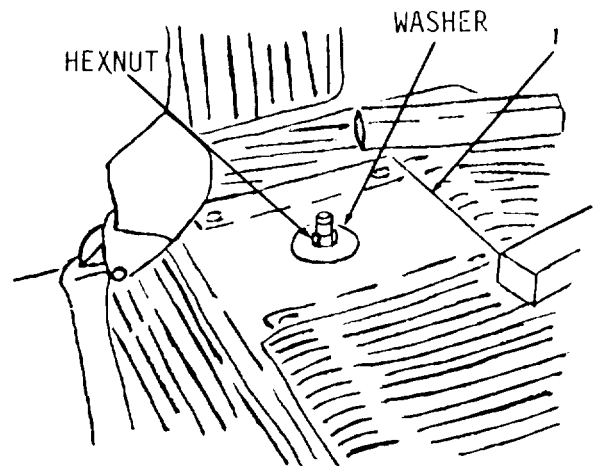
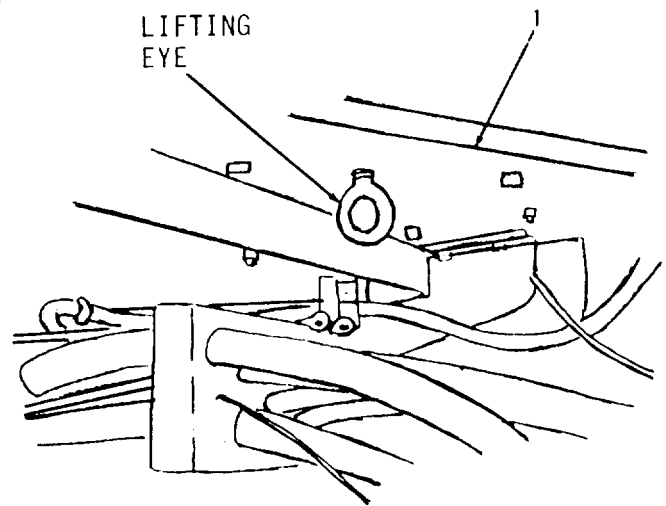


TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-6. Transmission Assembly. (Sheet 2 of 12)

REMOVAL

1. Using floor jack, raise vehicle 16" inches off floor and support with four jack stands.
2. Drill a hole through floor plate (1) of cab directly above tapped hole in top of transmission. Make hole large enough for a lifting eye capable of supporting at least 4,000 lbs.
3. Install lifting eye in hole in floor of cab and secure with washer and hexnut.
4. Using a 9/16" open and box end wrench, remove eight bolts (2) disconnecting propeller shaft from transmission rear output yoke to rear axle.
5. Using a 9/16" socket and socket wrench handle, remove four bolts (3) disconnecting transmission to hanger bearing propeller shaft from transmission front output yoke.



Go to sheet 3

6-6. Transmission Assembly. (Sheet 3 of 12)

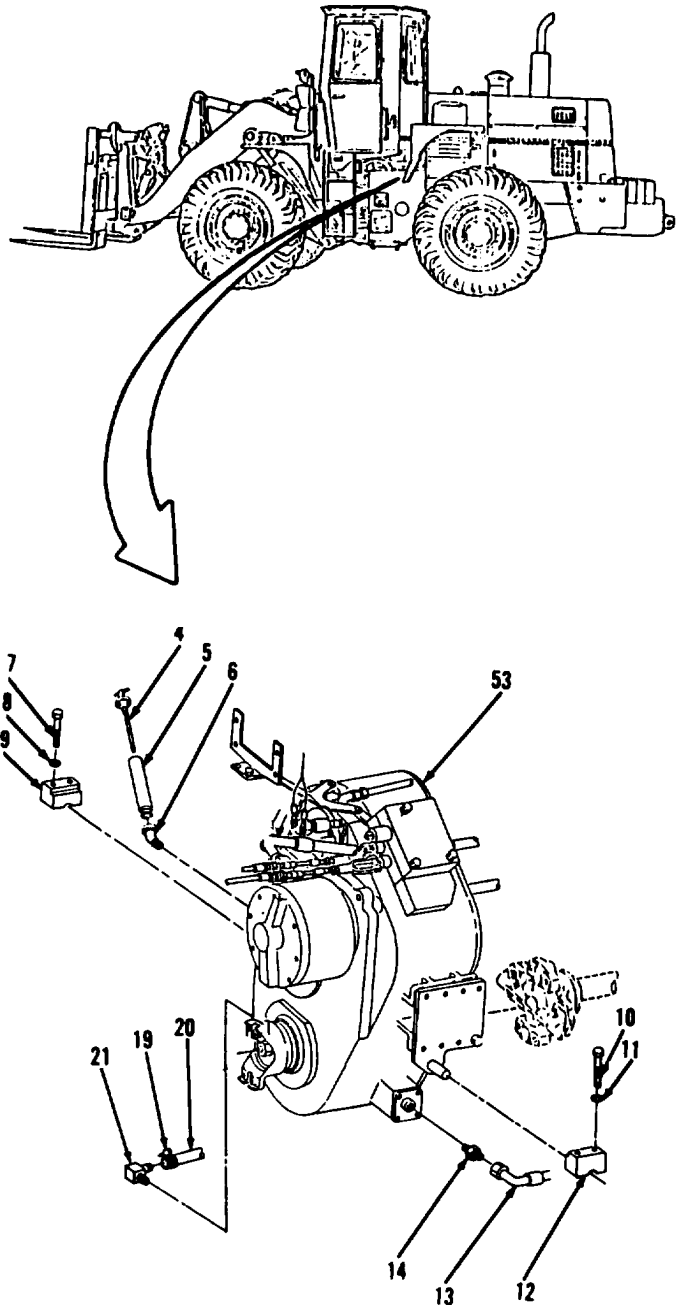
REMOVAL (cont)

6. Using a flat tip screwdriver, loosen clamp (19).
7. Disconnect hose assembly (20).
8. Using a 1-3/8" open end wrench, remove elbow (21).
9. Using a pipe wrench, remove gage (4), nipple (5) and elbow (6) from right side of transmission (53).
10. Using a 3/4" socket and socket wrench handle, remove two bolts (7), washers (8) and plate (9) from right side of transmission (53).
11. Remove two bolts (10), washers (11) and plate (12) from left side of transmission (53).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

12. Using a 1-1/2" open end wrench, disconnect hose assembly (13) from underneath transmission (53).
13. Using a 1-3/8" open end wrench, remove adapter (14).



## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-6. Transmission Assembly. (Sheet 4 of 12)

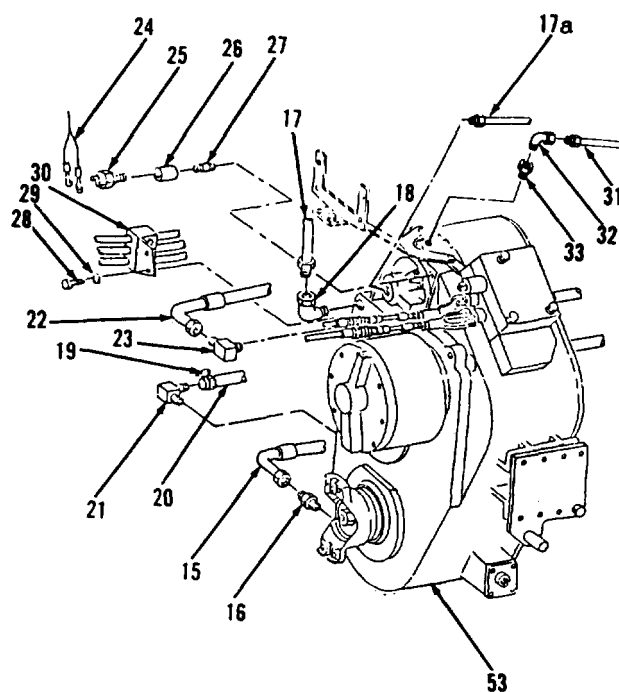
REMOVAL

14. Using a 1-1/2" open end wrench, disconnect hose assembly (15).
15. Using a 1-3/8" open end wrench, remove adapter (16).
16. Using a 1-1/2" open end wrench, disconnect hose assembly (17) from front, right side of transmission (53).
17. Using a 5/8" open end wrench, disconnect hose assembly (17a).
18. Using a pipe wrench, remove elbow (18).
19. Using a 1-1/4" open end wrench, disconnect hose assembly (22).
20. Using a 1-1/16" open end wrench, remove elbow (23).

## NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

21. Disconnect two wire assemblies (24) at terminals.
22. Using a 1" open and box end wrench, remove switch (25), coupling (26) and nipple (27).
23. Using a 9/16" socket and socket wrench handle, remove two bolts (28), washers (29) and bracket (30).
24. Using a 5/8" open end wrench, disconnect tube assembly (31).
25. Using 3/4" and 9/16" open end wrenches, remove elbow (32) and reducer (33).

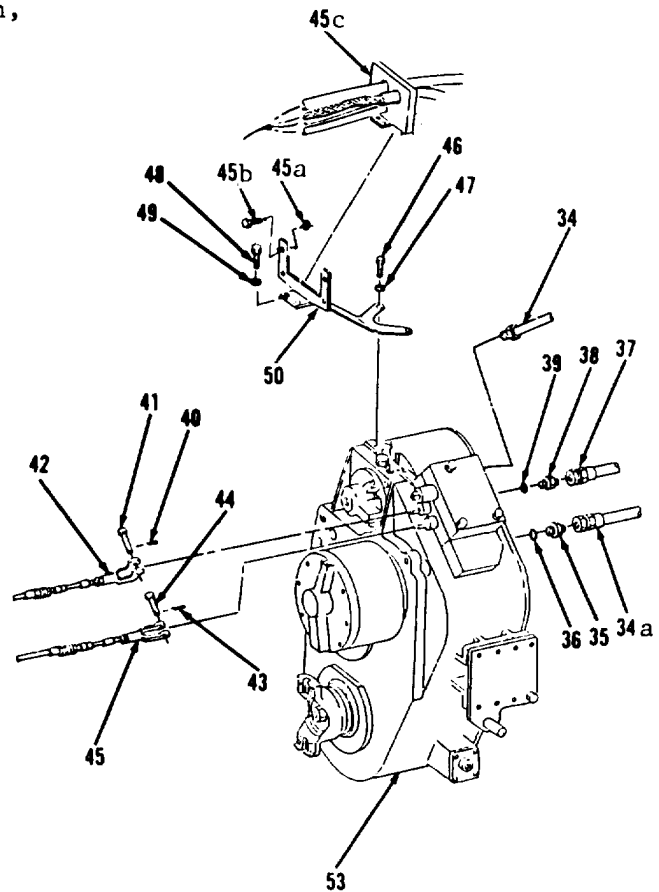


Go to sheet 5

6-6. Transmission Assembly. (Sheet 5 of 12)

REMOVAL (cont)

26. Using a 7/16" open end wrench, disconnect hose assembly (34) from transmission (53).
27. Using a 1-1/2" open end off set wrench, disconnect hose assembly (34a).
28. Remove union (35) and preformed packing (36). Discard preformed packing (36).
29. Using a 7/8" open end wrench, disconnect hose assembly (37) from control and scheduling valve on transmission (53).
30. Using a 13/16" open end wrench, remove union (38) and preformed packing (39). Discard preformed packing (39).
31. Using long round nose pliers, remove cotter pin (40) and pin (41). Discard cotter pin (40).
32. Disconnect clevis (42).
33. Using a 9/16" socket and socket wrench handle, remove four nuts (45a) and bolts (45b). Slide grommet (45c) forward, away from bracket (50).
34. Remove cotter pin (43) and pin (44). Discard cotter pin (43).
35. Disconnect clevis (45).
36. Using a 3/4" socket and socket wrench handle, remove two bolts (46), washers (47), bolts (48) and washers (49) from top of transmission (53).
37. Remove bracket (50).



Go to sheet 6

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-6. Transmission Assembly. (Sheet 6 of 12)

REMOVAL

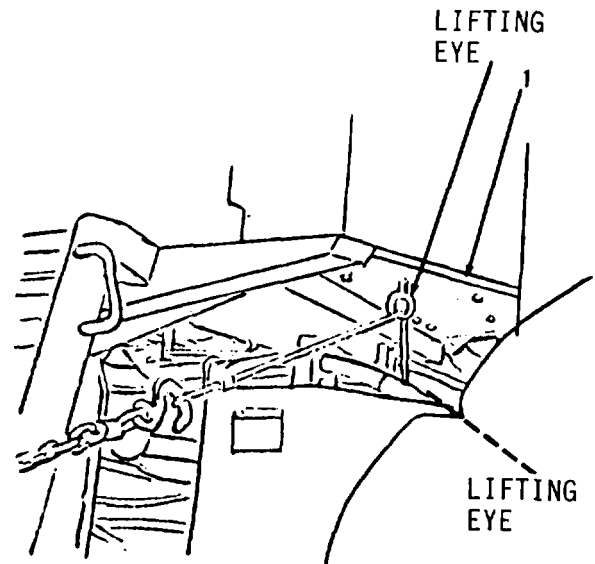
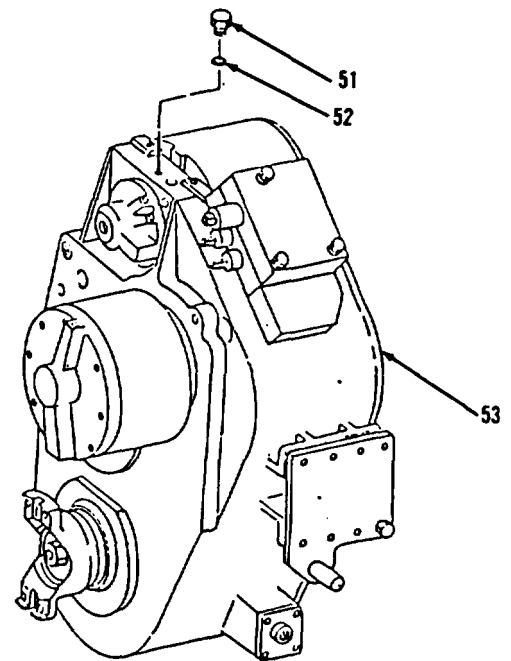
38. Using a 1-1/8" socket and socket wrench handle, remove plug (51) and gasket (52). Discard gasket (52). Remove all gasket material from mounting surfaces.

**WARNING**

## WEIGHT HAZARD

Weight of transmission assembly is approximately 730 lbs. Use adequate hoist and cable for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

39. Attach lifting eye to top of transmission (53) at mounting bore for plug (51), refer to Appendix D, part D-9 for fabrication of lifting eye.
40. Attach a cable to lifting eye installed in transmission (53) and run cable through lifting eye installed in floor plate (1) of cab to a winch mounted to the side of the vehicle.
41. Raise transmission (53) high enough to clear pin supports in rear vehicle frame.
42. Tip transmission (53) to rear of vehicle and lower.
43. Using a 3/4" socket and socket wrench handle, remove eight bolts (54), washers (55) and bracket (56) from transmission (53).
44. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, remove seven nuts (57), washers (58), bolts (59), washers (60) and bracket (61).



Go to sheet 7

6-6. Transmission Assembly. (Sheet 7 of 12)

CLEANING/INSPECTION

45. Wipe hose and tube assemblies (13, 15, 17, 20, 22, 31, 34 and 37) with clean cloth moistened with detergent and water solution. Wipe dry with clean cloth.

**WARNING**

TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

46. Wipe gage (4) with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**

COMPRESSED AIR HAZARD

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

47. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
48. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 8

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-6. Transmission Assembly. (Sheet 8 of 12)

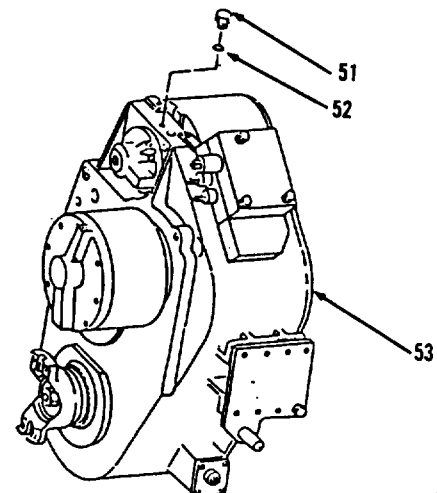
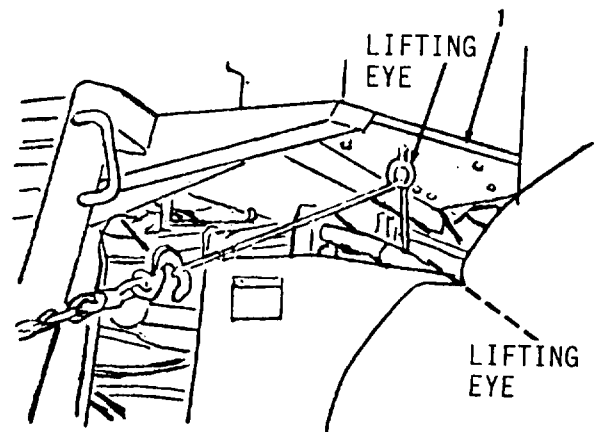
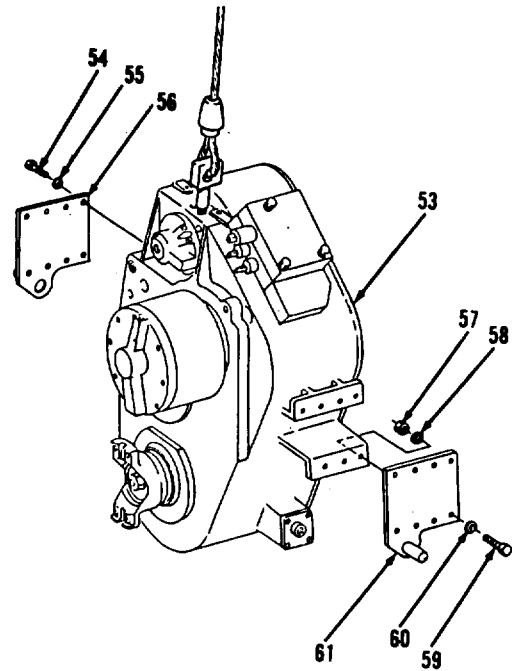
INSTALLATION

49. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, install bracket (61), seven washers (60) 9 bolts (59), washers (58) and nuts (57) in transmission (53).
50. Using a 3/4" socket and socket wrench handle, install bracket (56), eight washers (55) and bolts (54) in transmission (53).

**WARNING**  
WEIGHT HAZARD

Weight of transmission assembly is approximately 730 lbs. Use adequate hoist and cable for installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

51. Position transmission (53) underneath vehicle.
52. Attach cable to lifting eye on top of transmission (53) and lifting eye installed in floor plate (1) of cab.
53. Using hoist and chain, raise transmission (53) up, pushing it to rear of vehicle, clearing the left side. Position pins on brackets (56 and 61) into pin supports in vehicle rear frame.
54. Remove hoist, cable and lifting eye from top of transmission (53).
55. Using a 1-1/8" socket and socket wrench handle, install new gasket (52) and plug (51) in top of transmission (53).

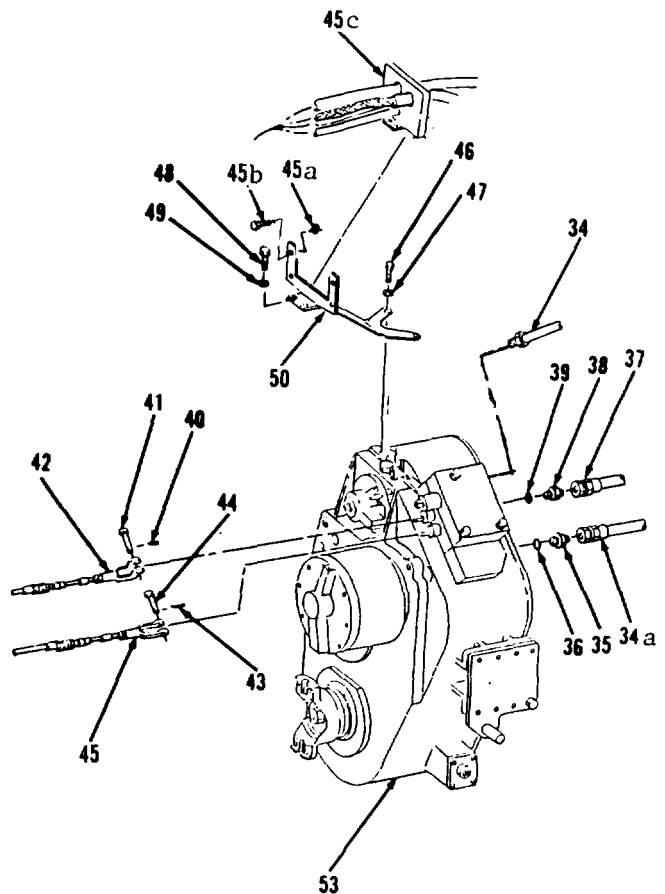


Go to sheet 9

6-6. Transmission Assembly. (Sheet 9 of 12)

INSTALLATION (cont)

56. Install bracket (50).
57. Using a 3/4" socket and socket wrench handle, install two washers (49), bolts (48), washers (47) and bolts (46).
58. Connect clevis (45) to control and scheduling valve on transmission (53).
59. Using long round nose pliers, install pin (44) and new cotter pin (43).
60. Slide grommet (45c) back toward bracket (50) and using a 9/16" socket and socket wrench handle, install four bolts (45b) and nuts (45a).
61. Connect clevis (42).
62. Using long round nose pliers, install pin (41) and new cotter pin (40).
63. Using a 13/16" open end wrench, install new preformed packing (39) and union (38).
64. Using a 7/8" open end wrench, connect hose assembly (37).
65. Using a 1-1/2" open end off set wrench, install new preformed packing (36) and union (35) in rear of transmission (53).
66. Connect hose assembly (34a).
67. Using a 7/16" open end wrench, connect hose assembly (34).



Go to sheet 10

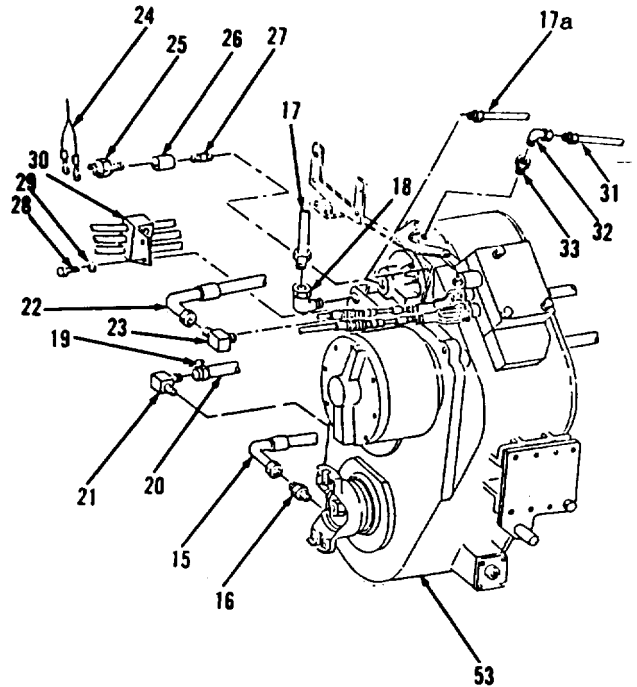


## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-6. Transmission Assembly. (Sheet 10 of 12)

INSTALLATION

68. Using 3/4" and 9/16" open end wrenches, install reducer (33) and elbow (32) in right side of transmission (53).
69. Using a 5/8" open end wrench, connect tube assembly (31).
70. Using a 9/16" socket and socket wrench handle, install bracket (30), two washers (29) and bolts (28).
71. Using a 1" open and box end wrench, install nipple (27), coupling (26) and switch (25).
72. Connect two wire assemblies (24) at terminals.
73. Using a 1-1/16" open end wrench, install elbow (23).
74. Using a 1-1/4" open end wrench, connect hose assembly (22).
75. Using a pipe wrench, install elbow (18).
76. Using a 5/8" open end wrench, connect hose assembly (17a).
77. Using a 1-1/2" open end wrench, connect hose assembly (17) under transmission (53).
78. Using a 1-3/8" open end wrench, install adapter (16).
79. Using a 1-1/2" open end wrench, install hose assembly (15).



Go to sheet 11

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-6. Transmission Assembly. (Sheet 11 of 12)

INSTALLATION (cont)

80. Using a 1-3/8" open end wrench, install adapter (14).

81. Using a 1-1/2" open end wrench, connect hose assembly (13) under transmission (53).

NOTE

Tighten bolts finger tight only.

82. Using a 3/4" socket and socket wrench handle, install plate (12), two washers (11) and bolts (10).

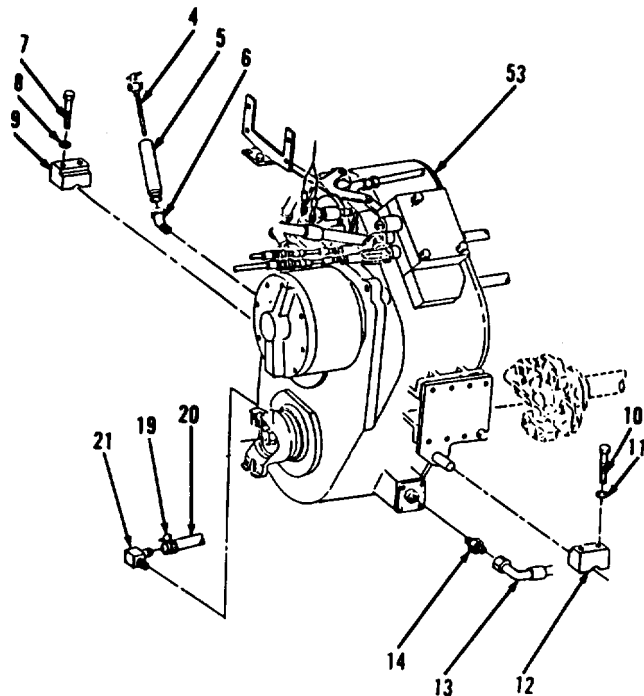
NOTE

Tighten bolts finger tight only.

83. Install plate (9), two washers (8) and bolts (7).

NOTE

Clearance should be 1/16 inch. If clearance is less, plate must be replaced. If clearance is 1/16 inch, torque bolts to 80 lb-ft .



84. Using a feeler gage, measure clearance between plates (9 and 12) and support block.

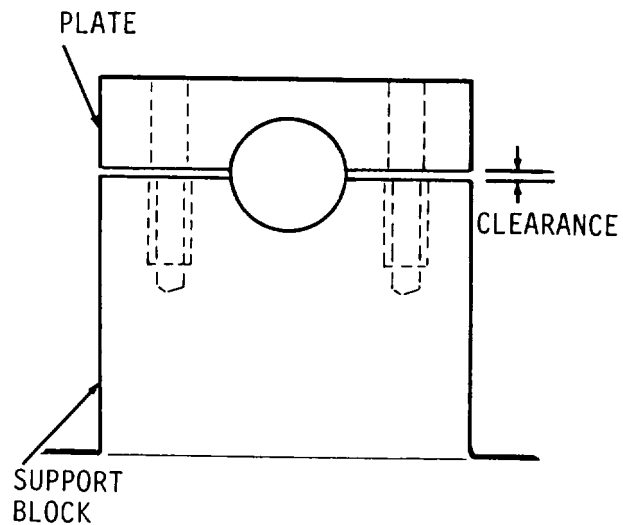
85. Using pipe wrench, install elbow (6), nipple (5) and gage (4) at right side of transmission (53).

86. Using a 1-3/8" open end wrench, install elbow (21).

87. Connect hose assembly (20).

88. Using a flat tip screwdriver, tighten clamp (19).

89. Position hanger bearing propeller shaft from transmission front output yoke to rear of transmission (53).



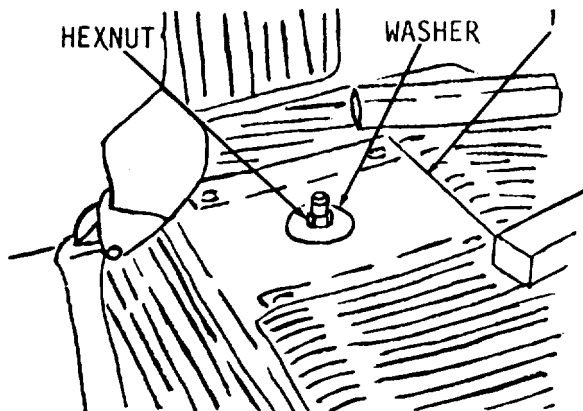
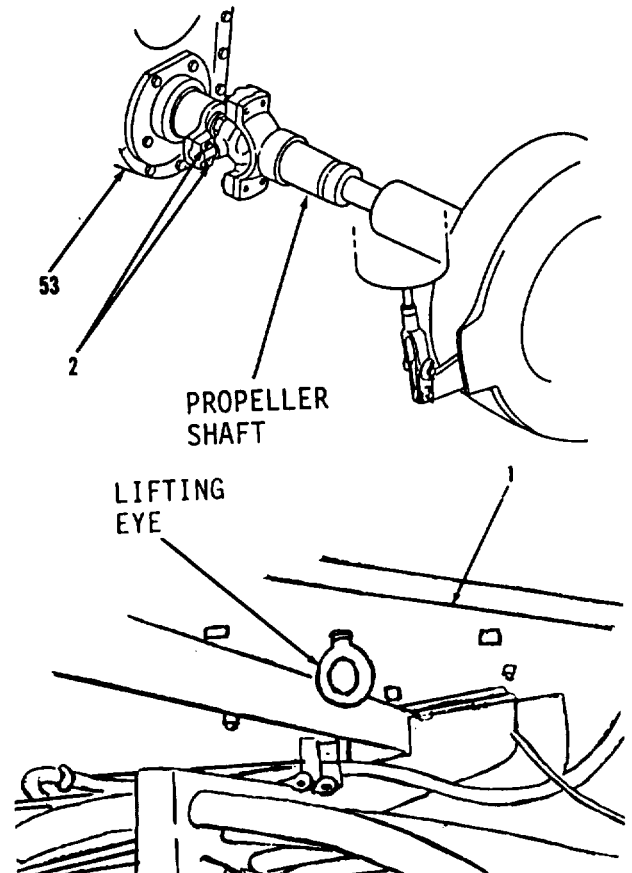
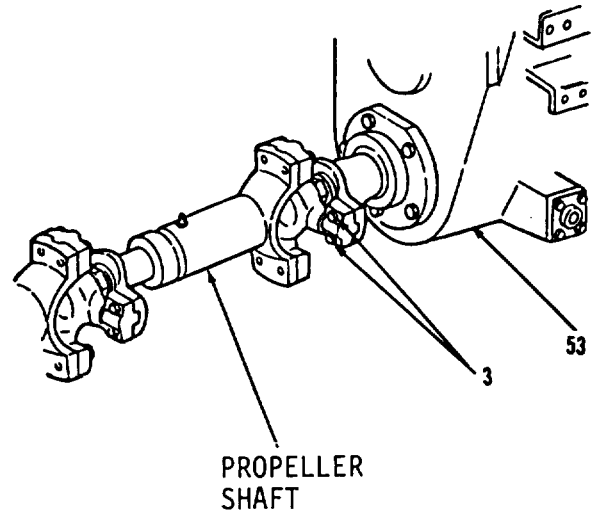
Go to sheet 12

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-6. Transmission Assembly. (Sheet 6 of 12)

INSTALLATION

90. Using a 9/16" socket, socket wrench handle and torque wrench, install four bolts (3) connecting propeller shaft to transmission (53). Tighten bolts (3) to 34 lb-ft.
91. Position propeller shaft from rear output yoke to rear axle.
92. Using a 9/16" open and box end wrench, install four bolts (2) connecting propeller shaft to transmission (53). Tighten bolts (2) to 34 lb-ft.
93. Remove hexnut, washer and lifting eye from floor plate (1) of cab.
94. Using floor jack, remove four jack stands and lower vehicle to the ground.



END OF TASK

**TM 10-3930-643-34**

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-7. Transmission Oil Filter Base. (Sheet 1 of 6)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Preformed packing (2)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Transmission oil filter  
element removed.

---

Go to sheet 2

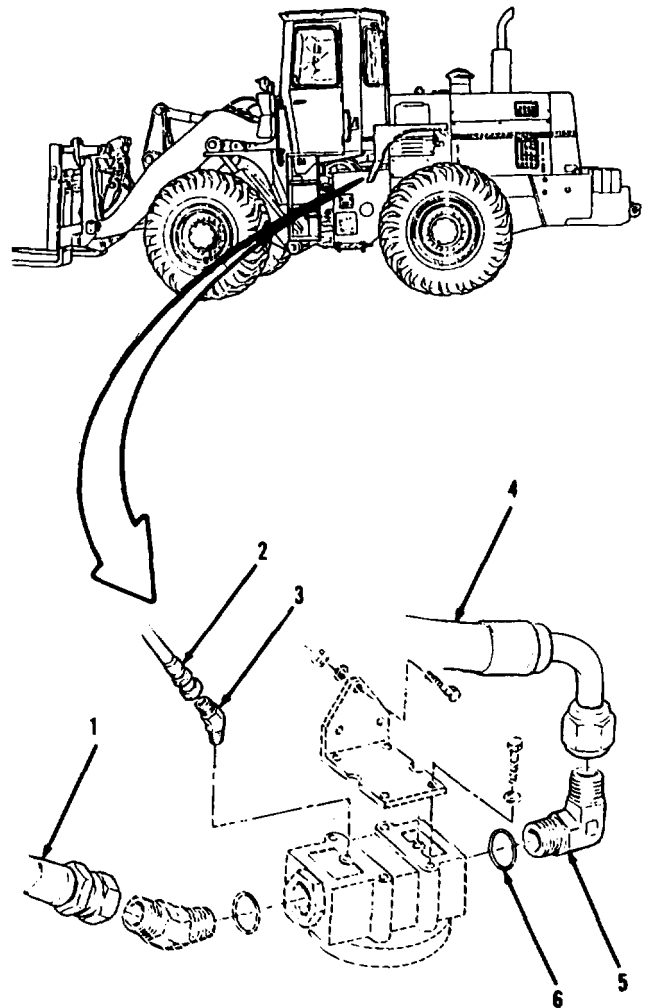
## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-7. Transmission Oil Filter Base. (Sheet 2 of 6)

REMOVAL

## NOTE

- Tag all hose and tube assemblies before disconnecting to aid in installation.
  - The following are differences between M10A Forklift models. The removal/installation procedures are identical.
1. Using a 1-1/2" open end wrench, disconnect hose assembly (1).
  2. Using a 9/16" open end wrench, disconnect hose assembly (2) on inside, left of frame, from vehicles S/N 2001 and above.
  3. Remove elbow (3) from vehicles S/N 2001 and above.
  4. Using a 1-1/2" open end wrench, disconnect hose assembly (4).
  5. Remove elbow (5) and preformed packing (6). Discard preformed packing (6).



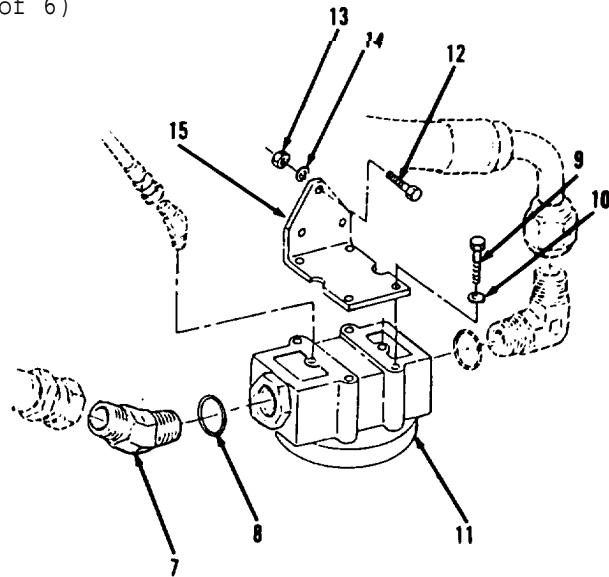
Go to sheet 3

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-7. Transmission Oil Filter Base. (Sheet 3 of 6)

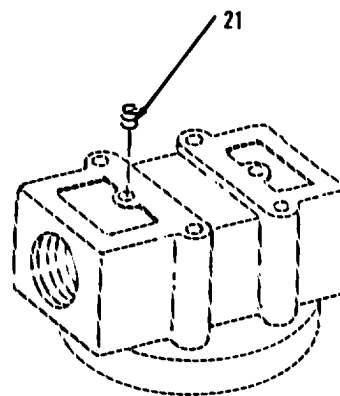
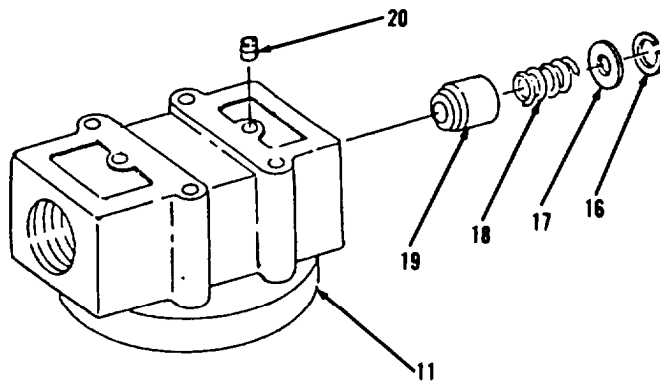
REMOVAL (cont)

6. Using a 1-1/2" open end wrench, remove elbow (7) and preformed packing (8). Discard preformed packing (8).
7. using a 9/16" socket and socket wrench handle, remove four bolts (9), washers (10) and base (11).
8. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, remove three bolts (12), nuts (13), washers (14) and bracket (15).



DISASSEMBLY

9. Using internal snap ring pliers, remove retaining ring (16), washer (17), spring (18) and valve (19) from base (11).
10. Using a 1/4" socket head screw key, remove plug (20) from base (11).
11. Remove plug (21) from vehicles S/N 2000 and below.



Go to sheet 4

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-7. Transmission Oil Filter Base. (Sheet 4 of 6)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

12. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
13. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

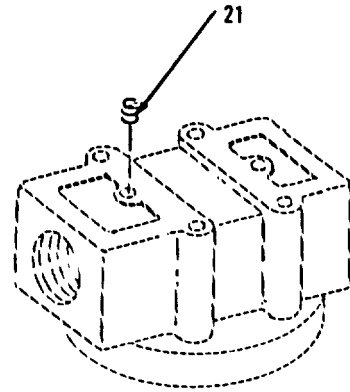
6-51

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-7. Transmission Oil Filter Base. (Sheet 5 of 6)

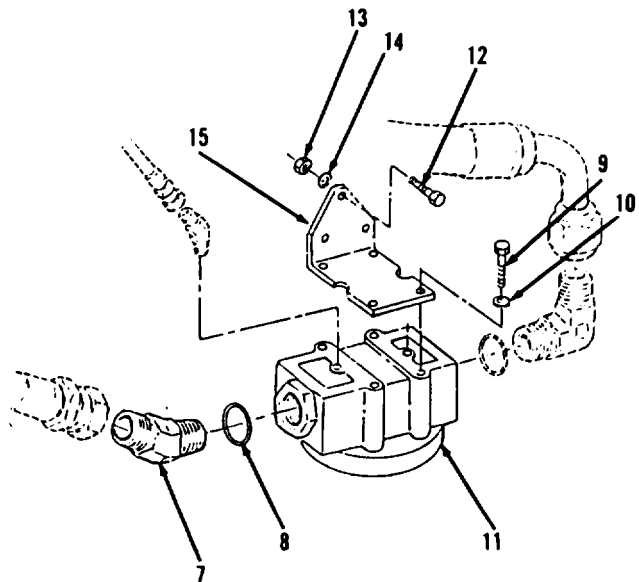
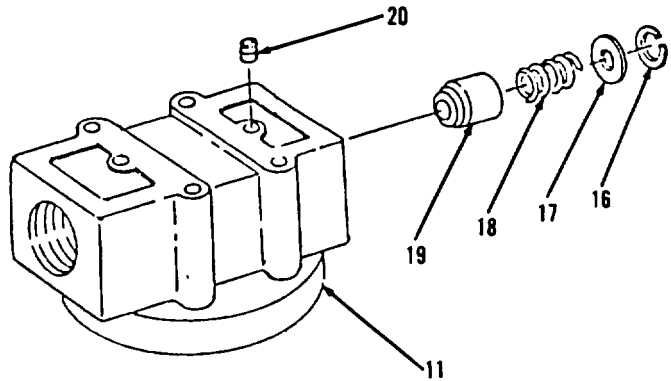
ASSEMBLY

- 14. Using a 1/4" socket head screw key, install plug (21) on vehicles S/N 2000 and below.
- 15. Install plug (20).
- 16. Using internal snap ring pliers, install valve (19), spring (18), washer (17) and retaining ring (16).



INSTALLATION

- 17. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, install bracket (15), three washers (14), nuts (13) and bolts (12) on inside, left of frame.
- 18. Using a 9/16" socket and socket wrench handle, install base (11), four washers (10) and bolts (9).
- 19. Using a 1-1/2" open end wrench, install new preformed packing (8) and elbow (7).



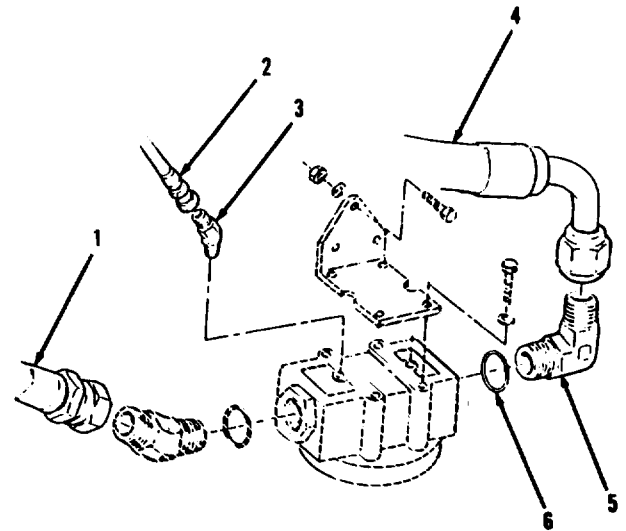


## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-7. Transmission Oil Filter Base. (Sheet 6 of 6)

INSTALLATION

20. Using a 1-1/2" open end wrench, install new preformed packing (6) and elbow (5).
21. Connect hose assembly (4).
22. Using a 9/16" open end wrench, install elbow (3) on vehicles S/N 2001 and above.
23. Connect hose assembly (2) on vehicles S/N 2001 and above.
24. Using a 1-1/2" open end wrench, connect hose assembly (1).



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-8. Scheduling Valve and Control Valve. (Sheet 1 of 4)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

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

Materials/Parts

Detergent (App. C, Item 33)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Preformed packing (13)  
Cotter pin (2)  
Plug (2)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-10

Condition Description

Vehicle frames locked in straight ahead  
position.

TM 10-3930-643-20

Transmission fluid drained.

---

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

6-8. Scheduling Valve and Control Valve. (Sheet 2 of 4)

REMOVAL

1. Using long round nose pliers, remove cotter pin (1), pin (2), cotter pin (3) and pin (4) from transmission. Discard cotter pins (1 and 3).

## NOTE

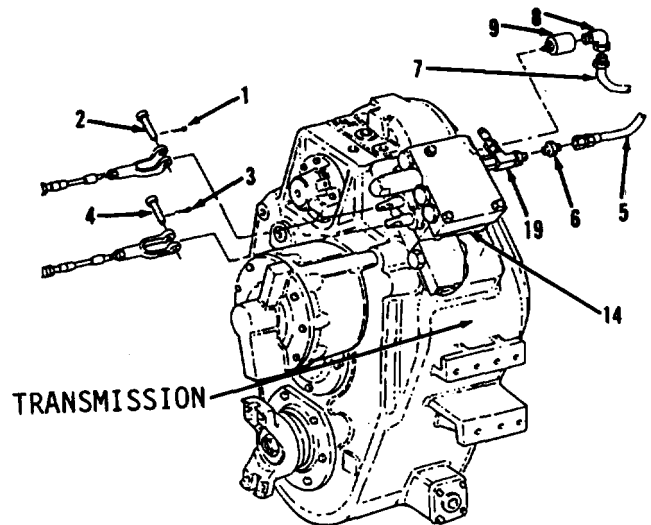
Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Using a 7/8" open end wrench, disconnect tube (5).
3. Remove union (6) from tee (19).
4. Using a 7/16" open end wrench, disconnect tube (7).

## NOTE

Plug all ports in valves to prevent entry of foreign material or dirt.

- 5\* Using 1/2" and 5/8" open end wrenches, remove elbow (8) and air cylinder (9) from control valve (14).

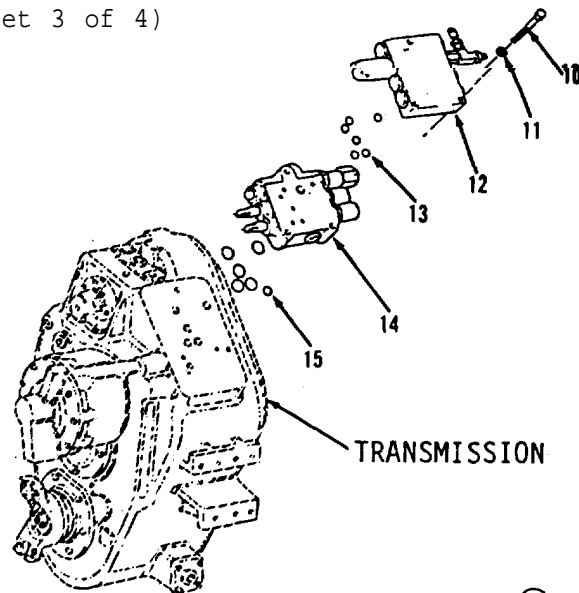


Go to sheet 3

6-8. Scheduling Valve and Control Valve. (Sheet 3 of 4)

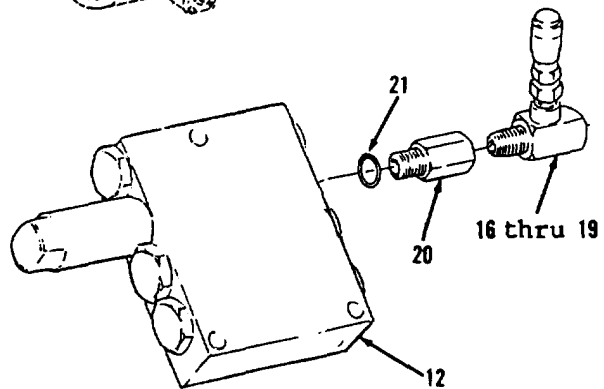
REMOVAL (cont)

6. Using a 9/16" socket and socket wrench handle, remove three bolts (10), washers (11), scheduling valve (12), six preformed packings (13), control valve (14) and six preformed packings (15). Discard six preformed packings (13 and 15).
7. Using a 1" open end wrench, remove items 16 thru 19 as an assembly, coupling (20) and preformed packing (21) from scheduling valve (12). Discard preformed packing (21).
8. Using 9/16" and 11/16" open end wrenches, remove cap (16), coupling (17) and adapter (18) from tee (19).



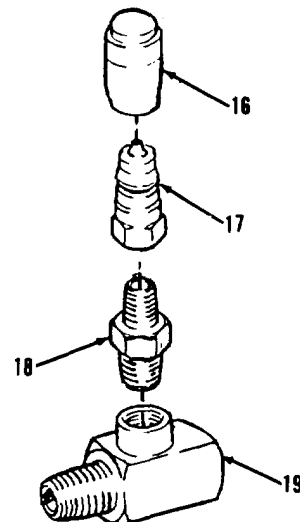
CLEANING/INSPECTION

9. Clean all parts with mild detergent and wipe dry with clean cloth. Refer to paragraph 2-8.
10. Inspect all parts. Refer to paragraph 2-9.



INSTALLATION

11. Using 9/16" and 11/16" open end wrenches, install adapter (18), coupling (17) and cap (16) to tee (19).
12. Using a 1" open end wrench, install new preformed packing (21), coupling (20) and items 16 thru 19 as an assembly to scheduling valve (12).



Go to sheet 4

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

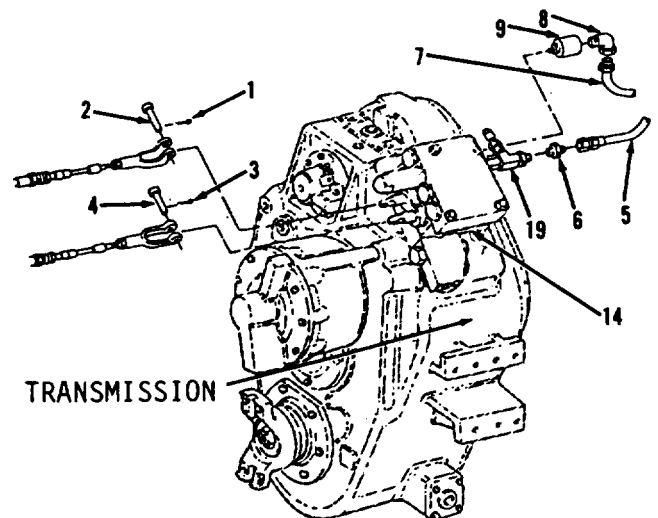
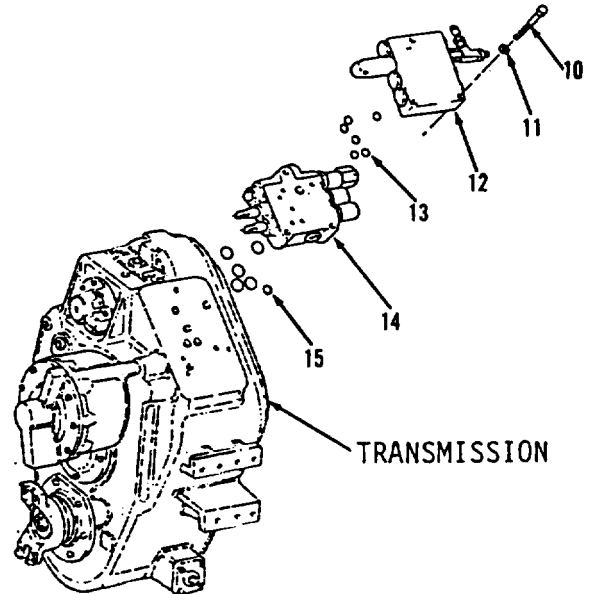
6-8. Scheduling Valve and Control Valve. (Sheet 4 of 4)

INSTALLATION

13. Using a 9/16" socket and socket wrench handle, install six new preformed packings (15), control valve (14), six new preformed packings (13), scheduling valve (12), three washers (11) and bolts (10).
14. Using 1/2" and 5/8" open end wrenches, install air cylinder (9) and elbow (8) into control valve (14).
15. Using a 7/16" open end wrench, connect tube (7) to elbow (8).
16. Using a 7/8" open end wrench, install union (6) to tee (19).
17. Connect tube (5) to union (6).
18. Using long round nose pliers, install pin (4), new cotter pin (3), pin (2) and new cotter pin (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TRANSMISSION TROUBLESHOOTING AND MAINTENANCE. (cont)

6-9. Transmission Oil Cooler. (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
1-1/2" Open end wrench  
NSN 5120-00-184-8438

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Detergent (App. C, Item 33)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Left engine side access cover  
removed.

Paragraph 4-9

Engine oil cooler removed.

---

Go to sheet 2

## TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

## 6-9. Transmission Oil Cooler. (Sheet 2 of 4)

REMOVAL

## NOTE

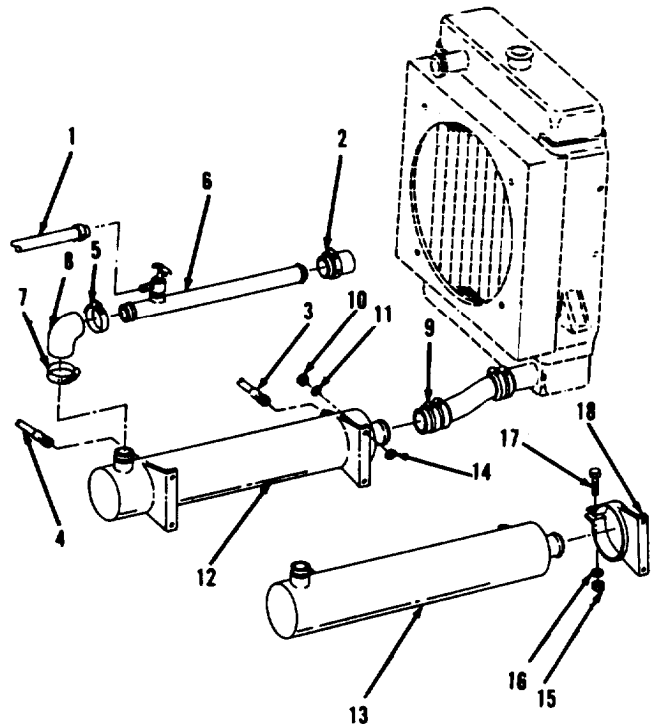
Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a flat tip screwdriver, disconnect hose assemblies (1 and 2) from left side of engine.
2. Using a 1-1/2" open end wrench, disconnect hose assemblies (3 and 4).
3. Using a flat tip screwdriver, remove clamp (5), tube (6), clamp (7) and hose (8).
4. Disconnect hose assembly (9).

## NOTE

The difference between oil cooler (12) and oil cooler assembly (13) is removable clamps on the oil cooler assembly (13).

5. Using a 1/2" socket and socket wrench handle, remove four nuts (10), washers (11), oil cooler (12) or oil cooler assembly (13) and four washers (14).
6. Using two 3/4" open end wrenches, remove two nuts (15), washers (16), bolts (17) and clamps (18) from oil cooler assembly (13), if removed.



Go to sheet 3

6-9. Transmission Oil Cooler. (Sheet 3 of 4)

CLEANING/INSPECTION

7. Wipe hoses (1, 2, 3, 4, 8 and 10) with clean cloth moistened with detergent and water solution. Dry with clean cloths.

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

8. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
9. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4



TRANSMISSION TROUBLESHOOTING AND MAINTENANCE.

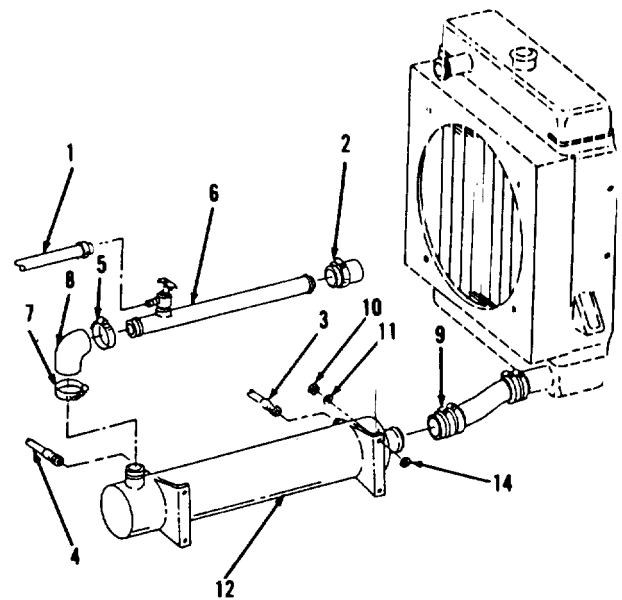
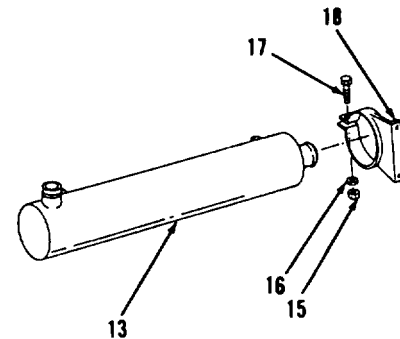
6-9. Transmission Oil Cooler. (Sheet 4 of 4)

INSTALLATION

10. Using two 3/4" open end wrenches, install two clamps (18), bolts (17), washers (16) and nuts (15) on oil cooler assembly (13), if removed.
11. Using a 1/2" socket and socket wrench handle, install four washers (14), oil cooler assembly (13) or oil cooler (12), four washers (11) and nuts (10).
12. Using a flat tip screwdriver, connect hose assembly (9).
13. Install hose (8), clamp (7), tube (6) and clamp (5).
14. Using a 1-1/2" open end wrench, connect hose assemblies (4 and 3).
15. Using a flat tip screwdriver, connect hose assemblies (2 and 1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## CHAPTER 7

FRONT AND REAR AXLES  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift front and rear axles.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Front and Rear Axles Troubleshooting	7-1	7-2
Front Axle Assembly (S/N 2001 to 2903)	7-2	7-5
Front Axle Assembly (S/N 2000 and below/and S/N 2904 and above)	7-3	7-11
Front Differential Carrier Assembly	7-4	7-20
Front and Rear Planetary	7-5	7-24
Rear Drive Axle (S/N 2001 and above)	7-6	7-32
Rear Axle Assembly (S/N 2000 and below)	7-7	7-39
Rear Differential Carrier Assembly	7-8	7-46

7-1. Front and Rear Axles Troubleshooting.

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

a. NOISE WHEN DRIVING.

Step 1. Check lubricant level.

If level is low, inspect for leaks.

If leak exists, take necessary corrective action.

If level is low and no leaks exist, refill lubricant to proper level, refer to LO 10-3930-643-12.

Step 2. Inspect for scored or damaged wheel bearings.

If wheel bearings are satisfactory, install and check for possibility of improper adjustment of wheel bearing, refer to paragraph 7-5 for wheel bearing inspection, replacement or adjustment.

If wheel bearings are operating, proceed to Step 3.

Step 3. Check for bent shaft or worn or damaged gear teeth on axle shaft.

Replace, refer to paragraph 7-2 or 7-3 for front axle and 7-6 or 7-7 for rear axle.

If axles are satisfactory, proceed to Step 4.

Step 4. Inspect ring gear and bearings in planetary.

If damaged, replace, refer to paragraph 7-5.

If damage is to planetary carrier assembly, contact General Support.

If planetary is functioning, proceed to Step 5.

Step 5. Differential pinion and ring gear adjustment too tight.

Contact General Support.

## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

## 7-1. Front and Rear Axles Troubleshooting.

---

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

---

## b. NOISE ON TURNS.

Differential side gears or pinion gears defective.

Contact General Support.

## c. NOISE WHILE VEHICLE IS COASTING.

Defective or misadjusted differential.

Contact General Support.

## d. DIFFERENTIAL OVERHEATS.

Step 1. Check for correct lubricant level, refer to LO 10-3930-643-12.

Step 2. Defective differential, refer to paragraph 7-4 for front and paragraph 7-8 for rear differential replacement.

## e. LOSS OF LUBRICANT.

Step 1. Check for correct level of lubricant, refer to LO 10-3930-643-12.

If lubricant level is correct, proceed to Step 2.

Step 2. Check for leaks.

Leak at planetary cover gasket, refer to paragraph 7-5.

Leak at differential, refer to paragraph 7-4 for front and paragraph 7-8 for rear.

7-1. Front and Rear Axles Troubleshooting. (cont)

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

e. LOSS OF LUBRICANT. (cont)

If leak is at differential drive yoke, contact General Support.

If no external leaks exist, proceed to Step 3.

Step 3. Check for oil behind wheel in brake compartments.

If oil is leaking into brake compartment, replace axle spindle housing oil seal, refer to paragraph 7-5.

f. DIFFERENTIAL OIL LEVEL RISES.

Replace drive axle oil seal, refer to paragraph 7-5.



7-2. Front Axle Assembly (S/N 2001 to 2903). (Sheet 2 of 6)

REMOVAL

NOTE

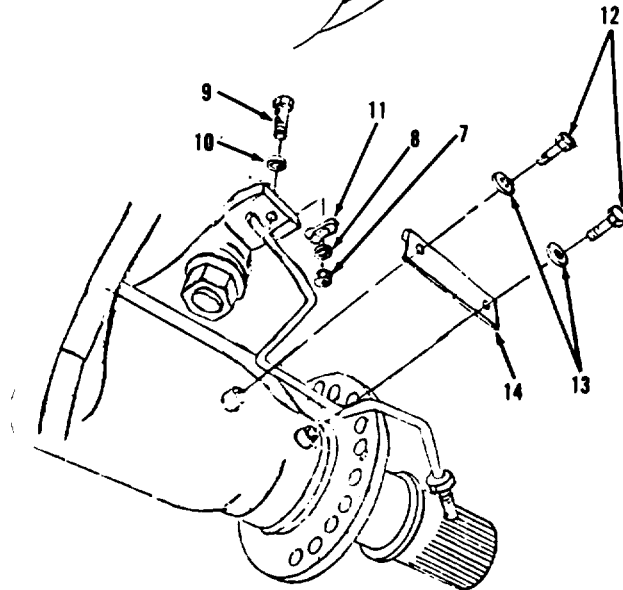
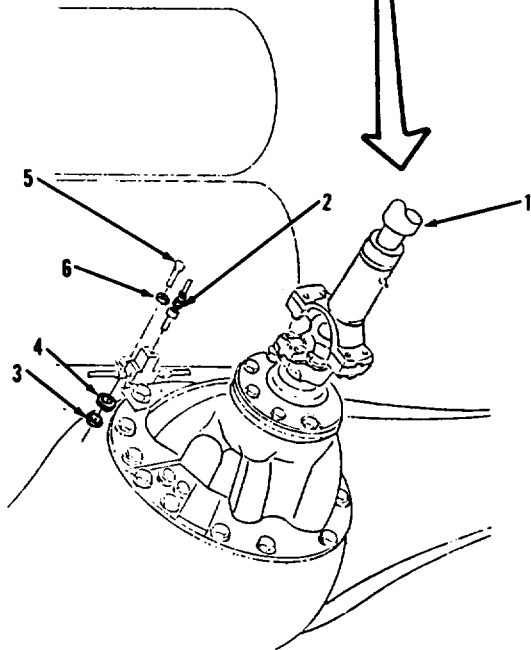
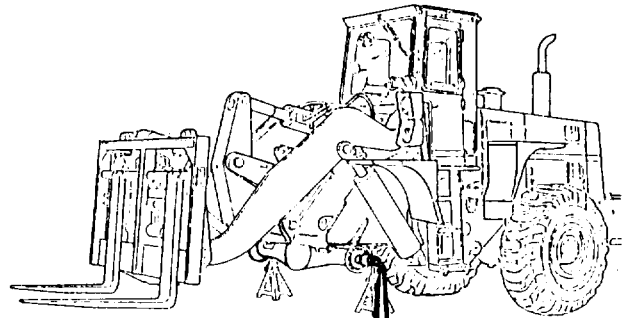
Vehicle must be raised off the ground and supported with jack stands under the frame for the following procedure.

1. Using a 9/16" socket and socket wrench handle, disconnect propeller shaft (1) from under front of vehicle, refer to TM 10-3930-643-20.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Using a 1/2" box and open end wrench, disconnect tube assembly (2).
3. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove nut (3), washer (4), bolt (5) and washer (6).
4. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove nut (7), washer (8), bolt (9), washer (10) and clamp (11) from right side of axle assembly.
5. Using a 9/16" socket and socket wrench handle, remove two bolts (12), washers (13) and access cover (14).



Go to sheet 3



FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-2. Front Axle Assembly (S/N 2001 to 2903). (Sheet 3 of 6)

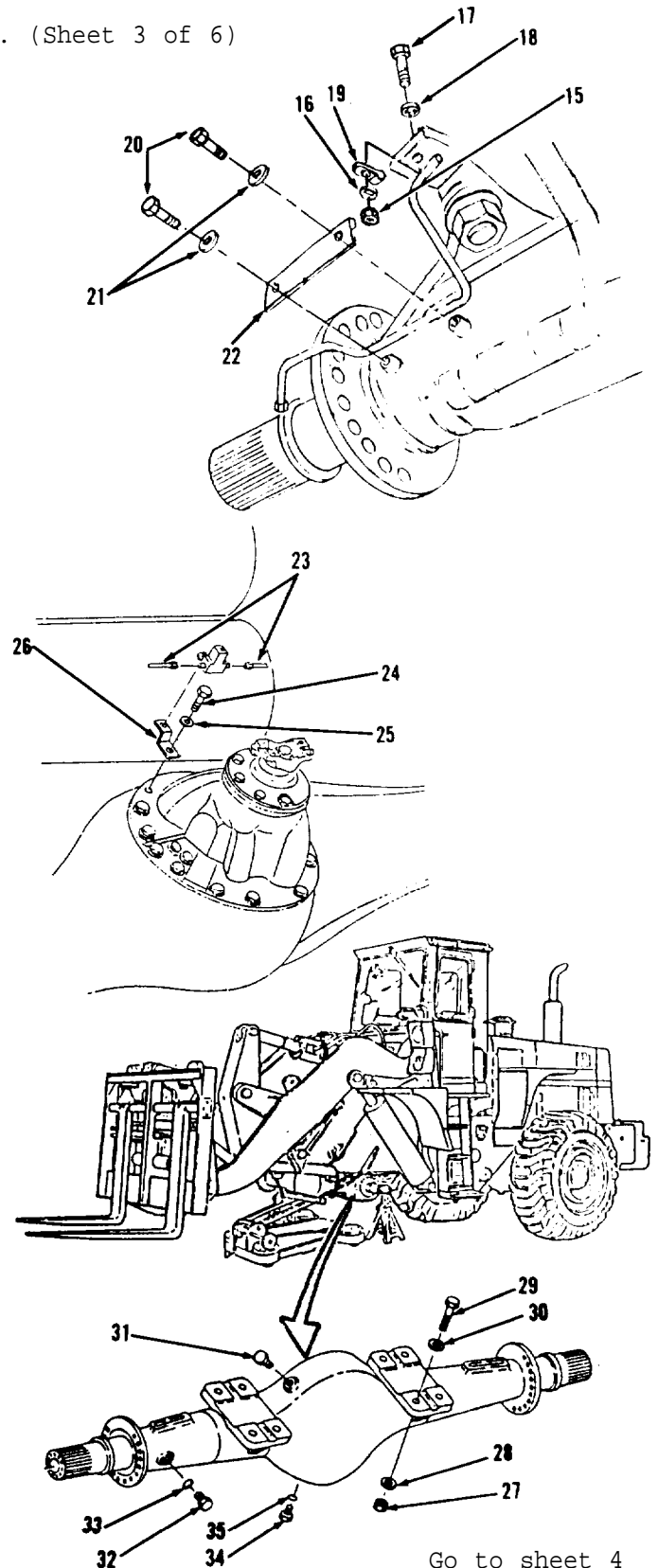
REMOVAL

6. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove nut (15), washer (16), bolt (17), washer (18) and clamp (19).
7. Using a 9/16" socket and socket wrench handle, remove two bolts (20), washers (21) and access cover (22).
8. Using two 7/16" box and open end wrenches, remove tube assemblies (23).
9. Using a 3/4" socket and socket wrench handle, remove bolt (24), washer (25) and clamp (26).

**WARNING**  
WEIGHT HAZARD

Use transmission and differential lift for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

10. Position transmission and differential lift under front axle assembly.
11. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, remove eight nuts (27), washers (28), bolts (29), washers (30) and front axle assembly.
12. Place front axle assembly on wood blocks and remove transmission and differential lift.
13. Using a 7/16" socket and socket wrench, remove plug (31).
14. Using a 1-1/4" socket and socket wrench handle, remove plug (32), preformed packing (33), plug (34) and preformed packing (35). Discard preformed packings (33 and 35).



Go to sheet 4

CLEANING/INSPECTION

**WARNING**

**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

15. Wipe front axle assembly with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**

**COMPRESSED AIR HAZARD**

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

16. Clean all other parts with clean cloths moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
17. Inspect all parts. Refer to paragraph 2-9.

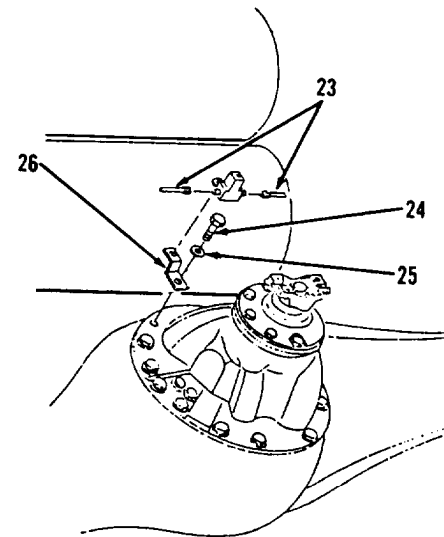
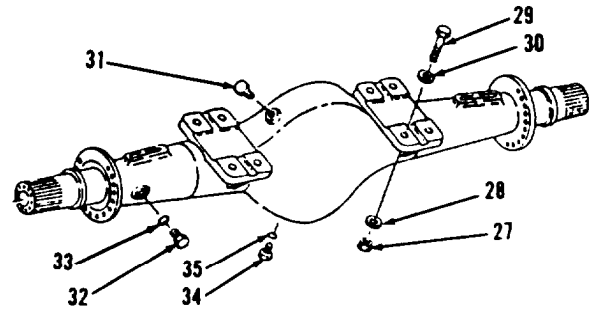
Go to sheet 5

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-2. Front Axle Assembly (S/N 2001 to 2903). (Sheet 5 of 6)

INSTALLATION

18. Using a 1-1/4" socket and socket wrench handle, install new preformed packing (35), plug (34), new preformed packing (33) and plug (32).
19. Using an 11/16" socket and socket wrench handle, install plug (31).
20. Using a transmission and differential lift, position front axle assembly under front of vehicle.
21. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, install eight washers (30), bolts (29), washers (28) and nuts (27). Using a 3/4" torque wrench, tighten bolts (29) to 680 lb-ft.
22. Using a 3/4" socket and socket wrench handle, install clamp (26), washer (25) and bolt (24).
23. Using two 7/16" box and open end wrenches, position and install tube assemblies (23).



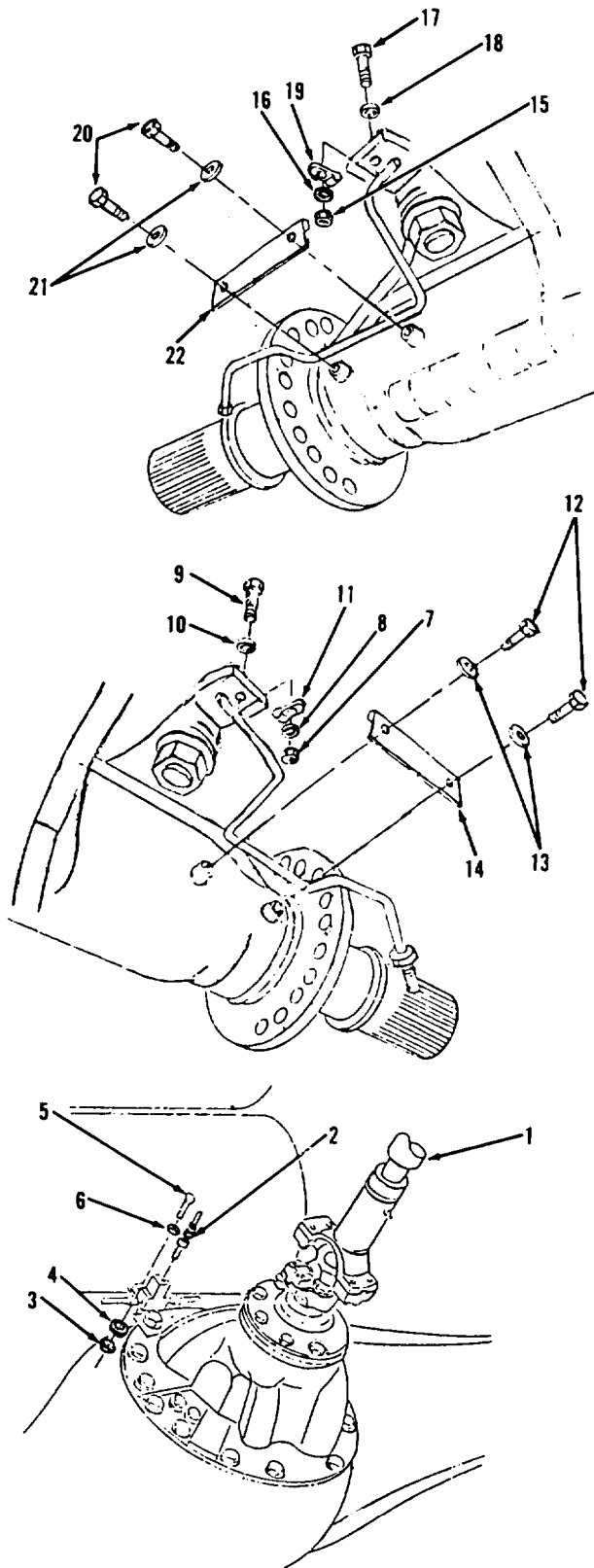
Go to sheet 6

INSTALLATION (cont)

24. Using a 9/16" socket and socket wrench handle, and install access cover (22), two washers (21) and bolts (20).
25. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install clamp (19), washer (18), bolt (17), washer (16) and nut (15).
26. Using a 9/16" socket and socket wrench handle, install access cover (14), two washers (13) and bolts (12).
27. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install clamp (11), washer (10), bolt (9), washer (8) and nut (7).
28. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, install washer (6), bolt (5), washer (4) and nut (3).
29. Using 3/4" and 13/16" box and open end wrenches, connect tube assembly (2).
30. Using a 1/2" socket, socket wrench handle and a 1/2" open end wrench, connect propeller shaft (1), refer to TM 10-3930-643-20.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



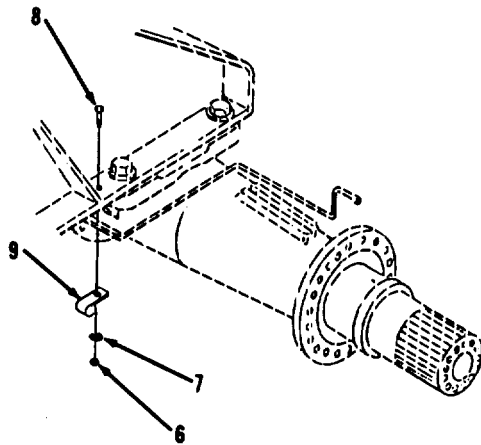
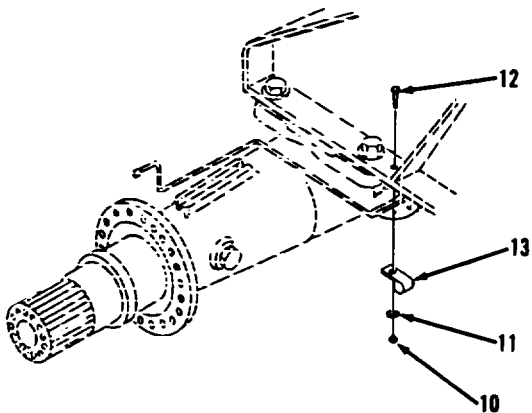
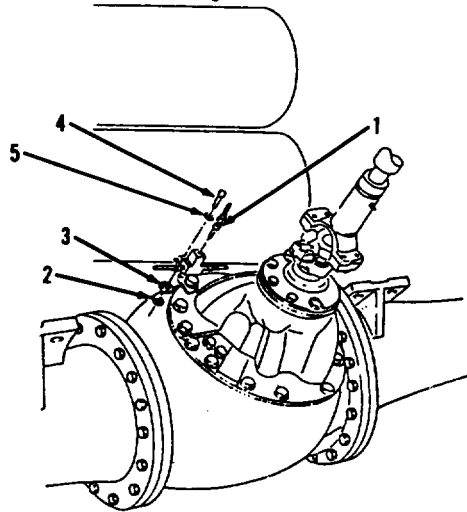
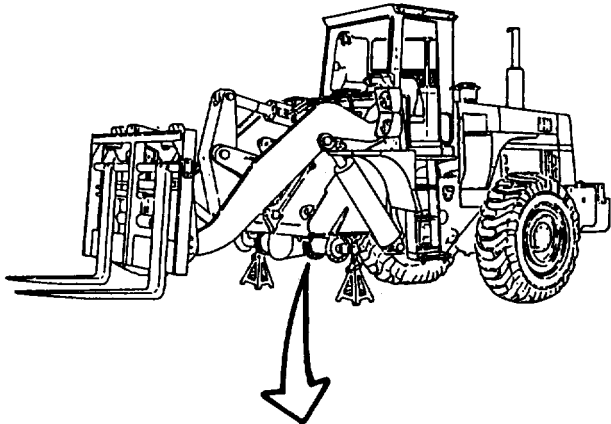
7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 2 of 9)

REMOVAL



Vehicle must be raised off the ground and supported with jack stands under the frame for the following procedure.

1. Using 7/16" and 1/2" open end wrenches, disconnect tube assembly (1) from front, underside of vehicle.
2. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove nut (2), washer (3), bolt (4) and washer (5).
3. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove nut (6), washer (7), bolt (8) and clamp (9) from right side of axle assembly.
4. Remove nut (10), washer (11), bolt (12) and clamp (13) from left side of axle assembly.



Go to sheet 3

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

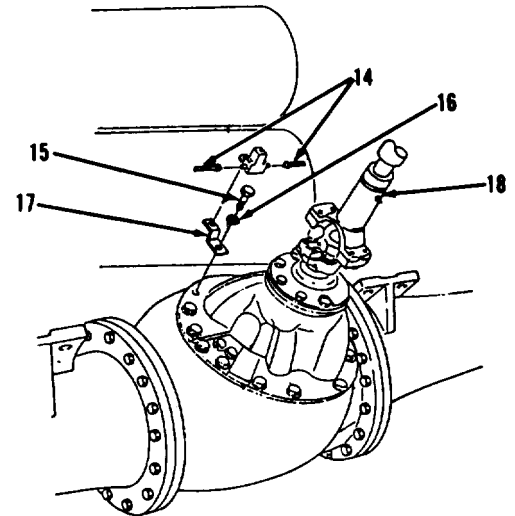
7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 3 of 9)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

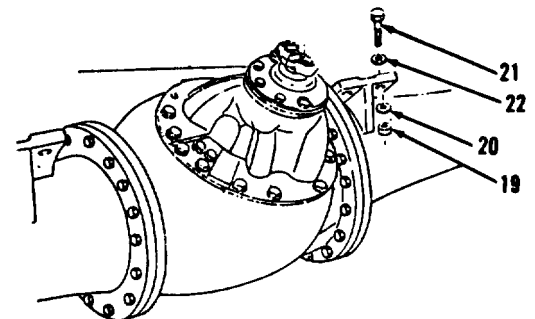
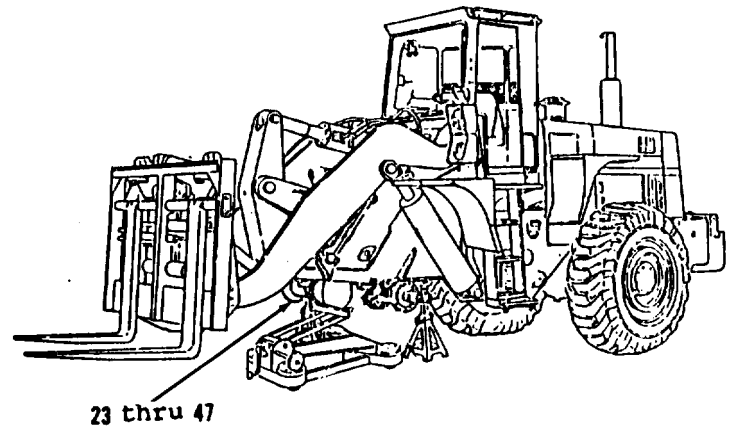
5. Using 7/16" and 13/16" box and open end wrenches, remove tube assemblies (14).
6. Using a 3/4" socket and socket wrench handle, remove bolt (15), washer (16) and clamp (17).
7. Disconnect propeller shaft (18), refer to TM 10-3930-643-20.



**WARNING**  
WEIGHT HAZARD

Use transmission and differential lift for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

8. Position transmission and differential lift under front of vehicle to remove axle items 23 thru 47 as an assembly.
9. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, remove eight nuts (19), washers (20), bolts (21) and washers (22).



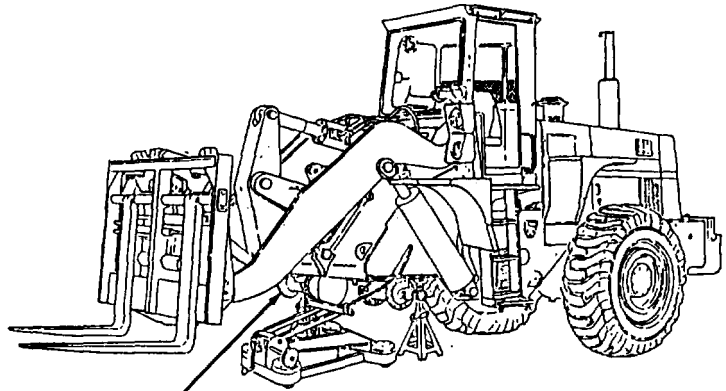
Go to sheet 4

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

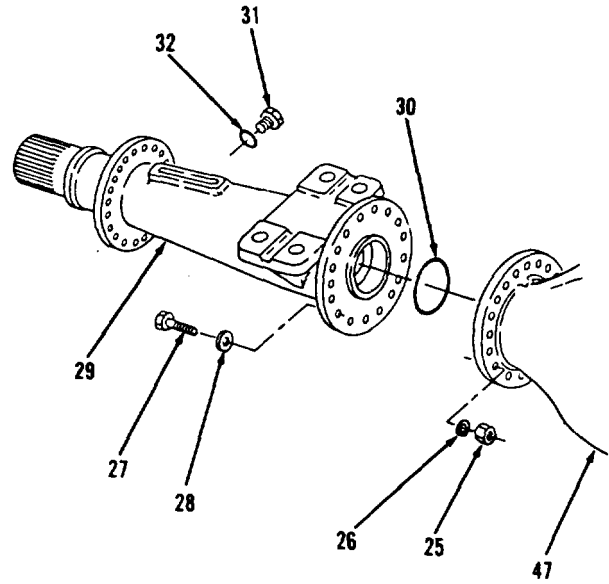
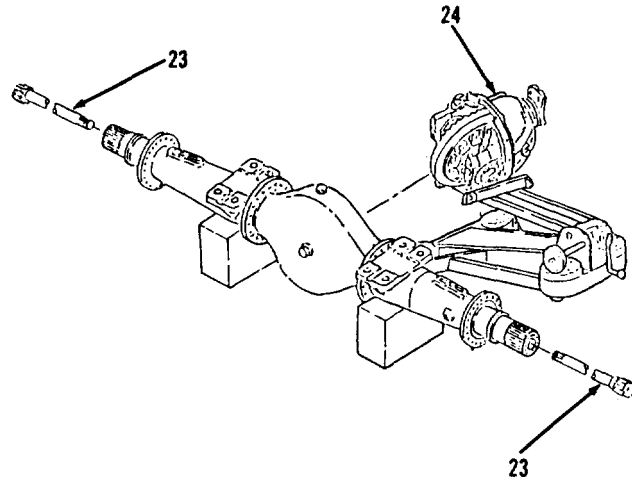
7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 4 of 9)

REMOVAL (cont)

10. Using a transmission and differential lift, remove axle items 23 thru 47 as an assembly.
11. Place front axle assembly on wood blocks and remove transmission and differential lift.
12. Remove two shafts (23).
13. Using a 3/4" socket, socket wrench handle and transmission and differential lift, remove differential (24), refer to paragraph 7-4.
14. Using a 1-1/8" socket, socket wrench handle and a 1-1/8" open end wrench, remove 16 nuts (25), washers (26), bolts (27), washers (28), spindle (29) and preformed packing (30) from bowl (47) on right side. Discard preformed packing (30).
15. Using a 1-1/4" socket and socket wrench handle, remove plug (31) and preformed packing (32) from spindle (29). Discard preformed packing (32).



23 thru 47



Go to sheet 5

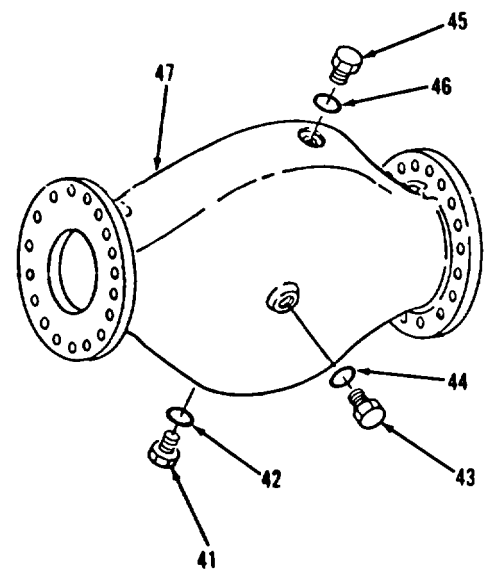
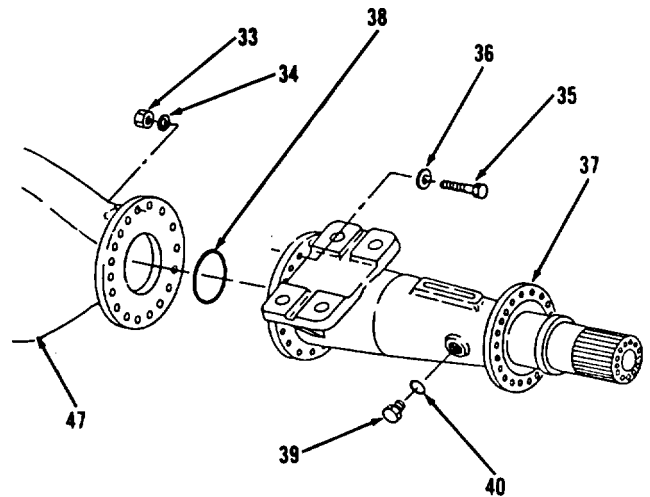


FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 5 of 9)

REMOVAL

16. Using a 1-1/8" socket, socket wrench handle and 1-1/8" open end wrench, remove 16 nuts (33), washers (34), bolts (35), washers (36), spindle (37) and preformed packing (38) from bowl (47) on left side. Discard preformed packing (38).
17. Using a 1-1/4" socket and socket wrench handle, remove plug (39) and preformed packing (40) from spindle (37). Discard preformed packing (40).
18. Remove plug (41), preformed packing (42), plug (43), preformed Packing (44), plug (45) and preformed packing (46) from bowl (47). Discard preformed packings (42,44 and 46).



Go to sheet 6

7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 6 of 9)

CLEANING/INSPECTION

**WARNING**

**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

19. Wipe differential (24) and front axle assembly with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**

**COMPRESSED AIR HAZARD**

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

20. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
21. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 7

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

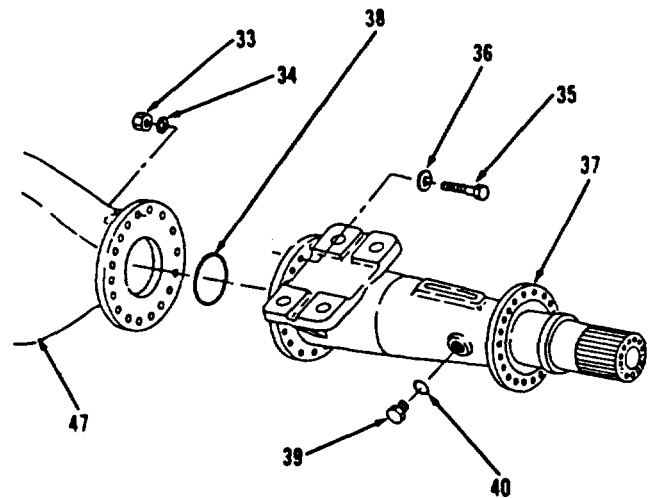
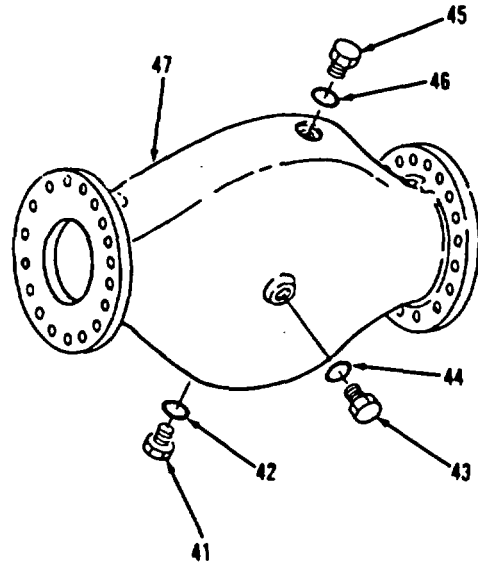
7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 7 of 9)

INSTALLATION

NOTE

One-piece axle assembly is no longer available.

22. Using a 1-1/4" socket and socket wrench handle, install new preformed packing (46), plug (45), new preformed packing (44), plug (43), new preformed packing (42) and plug (41) in bowl (47).
23. Install new preformed packing (40) and plug (39) in spindle (37).
24. Using a 1-1/8" socket, socket wrench handle and a 1/2" torque wrench, install new preformed packing (38), spindle (37), 16 washers (36), bolts (35), washers (34) and nuts (33) in bowl (47). Tighten nuts (33) to 270 to 300 lb-ft.



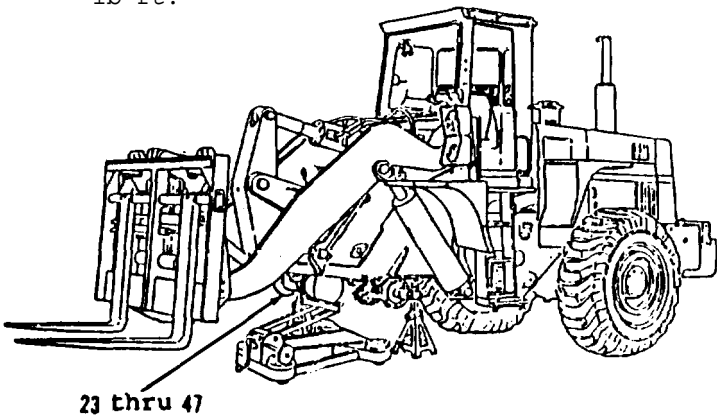
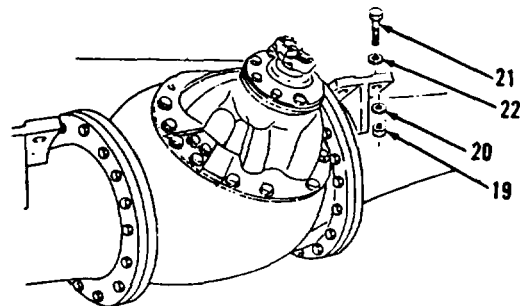
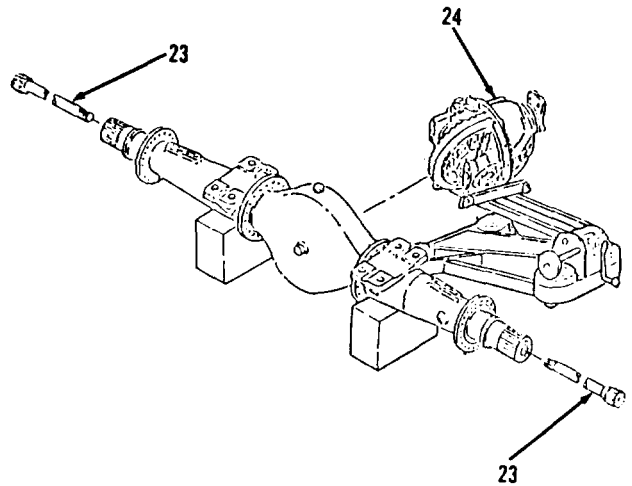
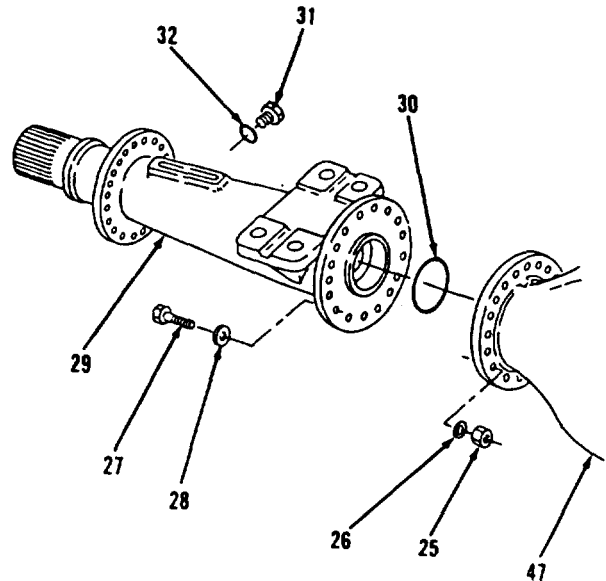
Go to sheet 6

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 8 of 9)

INSTALLATION (cont)

25. Using a 1-1/4" socket and socket wrench handle, install new preformed packing (32) and plug (31) in spindle (29).
26. Using a 1-1/8" socket, socket wrench handle, 1-1/8" open end wrench and torque wrench, install new preformed packing (30), spindle (29), 16 washers (28), bolts (27), washers (26) and nuts (25) in bowl (47). Tighten nuts (25) to 270 to 300 lb-ft.
27. Using a 9/16" socket, socket wrench handle and transmission and differential lift, install differential (24), refer to paragraph 7-4.
28. Install two shafts (23).
29. Using a transmission and differential lift, position axle under front of vehicle to install front axle assembly items 47 through 23 as an assembly.
30. Using a 1-1/2" socket, socket wrench handle, 1-1/2" open end wrench and torque wrench, install eight washers (22), bolts (21), washers (20) and nuts (19). Tighten nuts (19) to 680 lb-ft.



23 thru 47

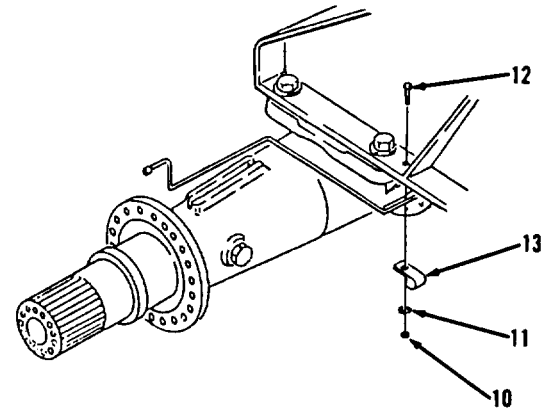
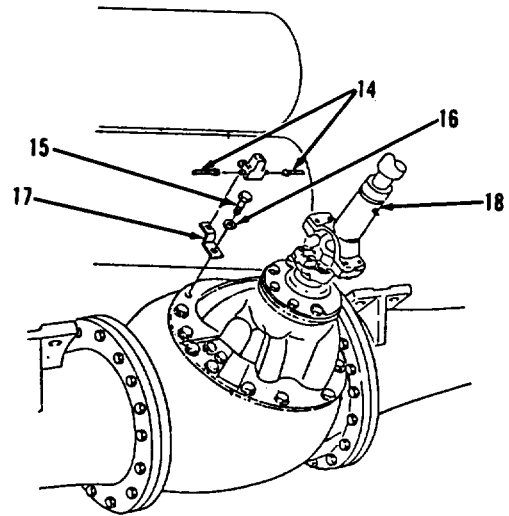
Go to sheet 9

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-3. Front Axle Assembly (S/N 2000 and below and S/N 2904 and above). (Sheet 9 of 9)

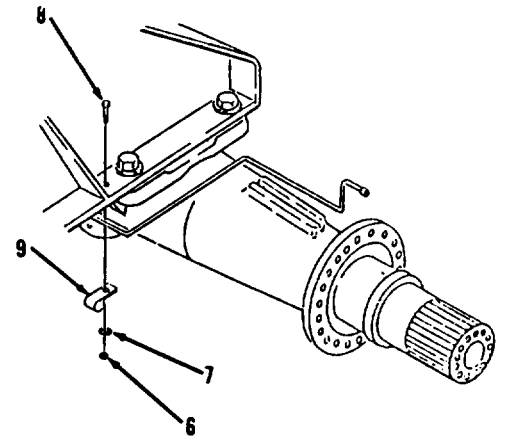
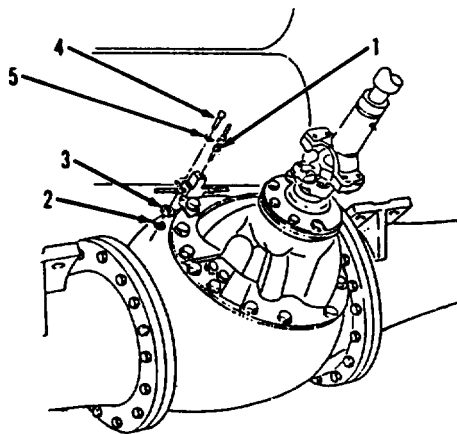
INSTALLATION

31. Connect propeller shaft (18), refer to TM 10-3930-643-20.
32. Using a 9/16" socket and socket wrench handle, install clamp (17), washer (16) and bolt (15).
33. Using 3/4" and 13/16" box and open end wrenches, install tube assemblies (14).
34. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install clamp (13), bolt (12), washer (11) and nut (10).
35. Install clamp (9), bolt (8), washer (7) and nut (6).
36. Install washer (5), bolt (4), washer (3) and nut (2).
37. Using 3/4" and 13/16" box and open end wrenches, connect tube assembly (1).



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-4. Front Differential Carrier Assembly. (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(APP. C, Item 5)  
Clean cloth (App. C, Item 24)  
Loctite 262 (App. C, Item IS)  
Wood block (2)

Torques

Bolts (5) to 75 to 85 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Front wheels and tires removed.  
Propeller shaft - hanger bearing to  
front axle removed.

LO 10-3930-643-12

Planetary lubricant drained.  
Axle lubricant drained.

Paragraph 7-5

Front planetaries removed.

---

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-4. Front Differential Carrier Assembly. (Sheet 2 of 4)

REMOVAL

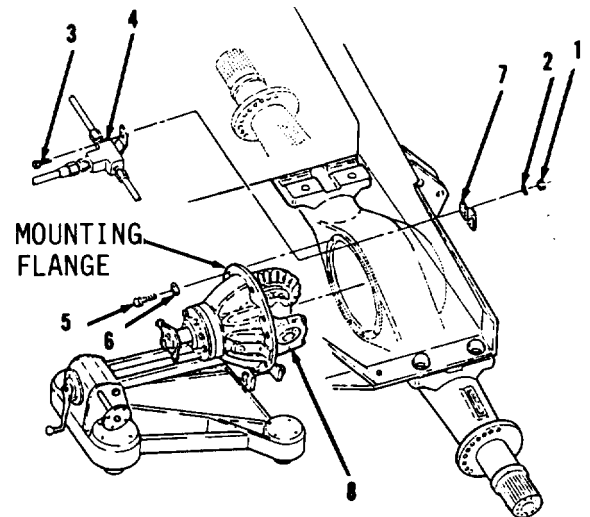
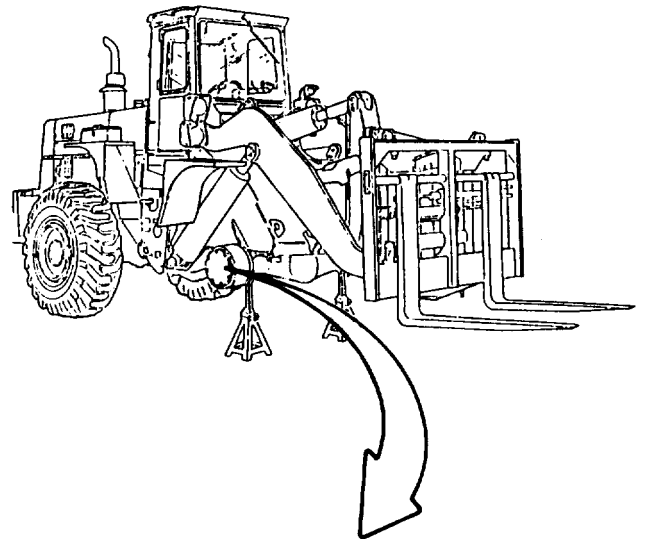
**WARNING**  
**WEIGHT HAZARD**

Use transmission and differential lift for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

NOTE

The procedures for the left and right side axles are identical.

1. Support and secure differential (8) in rear, center, front axle with transmission and differential lift.
2. Using 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove nut (1), washer (2), bolt (3) and block (4) and move brake lines to one side.
3. Using a 3/4" socket and socket wrench handle, remove 14 bolts (5), washers (6), bracket (7) and differential (8).
4. Using transmission and differential lift, remove differential (8) from front axle assembly.
5. Remove differential (8) from transmission and differential lift and support between two wood blocks.



7-4. Front Differential Carrier Assembly. (Sheet 3 of 4)

CLEANING/INSPECTION

**WARNING**

**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

6. Wipe differential with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**

**COMPRESSED AIR HAZARD**

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

7. Clean all other parts with clean cloths moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
8. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

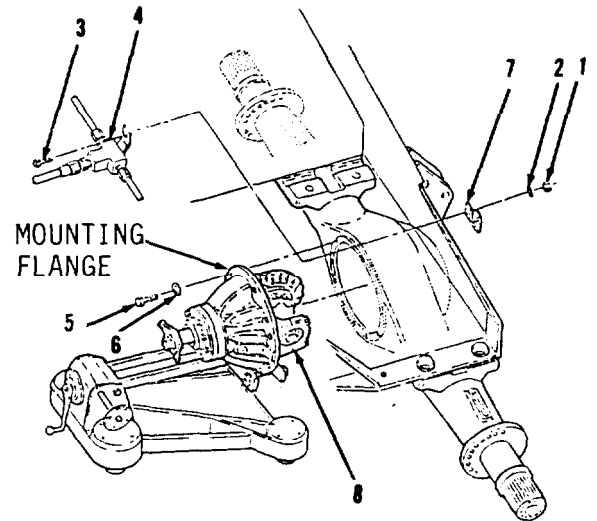


## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

## 7-4. Front Differential Carrier Assembly. (Sheet 4 of 4)

INSTALLATION

9. Apply Loctite 262 to mounting flange in differential (8) in rear, center, front axle. Position and secure differential (8) on transmission and differential lift and install into front axle assembly.
10. Using a 5/8" socket, socket wrench handle and torque wrench, install bracket (7), 14 washers (6) and bolts (5). Tighten bolts (5) to 75 to 85 lb-ft.
11. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install block (4), bolt (3), washer (2) and nut (1).



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-5. Front and Rear Planetary. (Sheet 1 of 8)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Hoist and sling, capacity of  
216 lbs.

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Loctite 262 (App. C, Item IS)  
Shim (2)  
Seal  
Ring  
Gasket

Torques

Bolts (1) to 24 to 26 lb-ft.  
Bolts (2) to 34 to 37 lb-ft.  
Bolts (8) to 30 lb-ft. and 40 to  
45 lb-ft.  
Bolts (12) to 20 to 23 lb-ft.

---

EQUIPMENT CONDITION

References

LO 10-3930-643-12

TM 10-3930-643-20

Paragraph 8-4

Condition Description

Planetary lubricant drained.

Wheel removed.

Service brakes removed.

---

Go to sheet 2

## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-5. Front and Rear Planetary. (Sheet 2 of 8)

REMOVAL

## NOTE

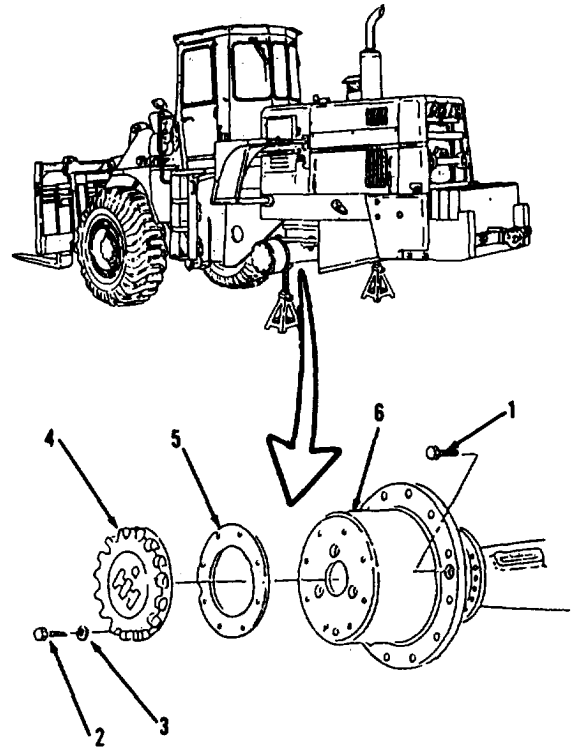
The following is a procedure for removal/installation of left side rear planetary carrier assembly. The procedure for right rear and front left and right planetary assemblies is identical.

1. Using a 9/16" open and box end wrench, remove two bolts (1) from rear, left side of axle assembly.
2. Using a 9/16" socket, socket wrench handle and a putty knife, remove eight bolts (2), washers (3), cover (4) and gasket (5). Discard gasket (5). Remove all gasket material from mounting surfaces.

**WARNING**  
**WEIGHT HAZARD**

Weight of planetary carrier assembly is approximately 180 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

3. Attach hoist and sling to planetary carrier assembly (6) and remove. Place securely on ground.



Go to sheet 3

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-5. Front and Rear Planetary. (Sheet 3 of 8)

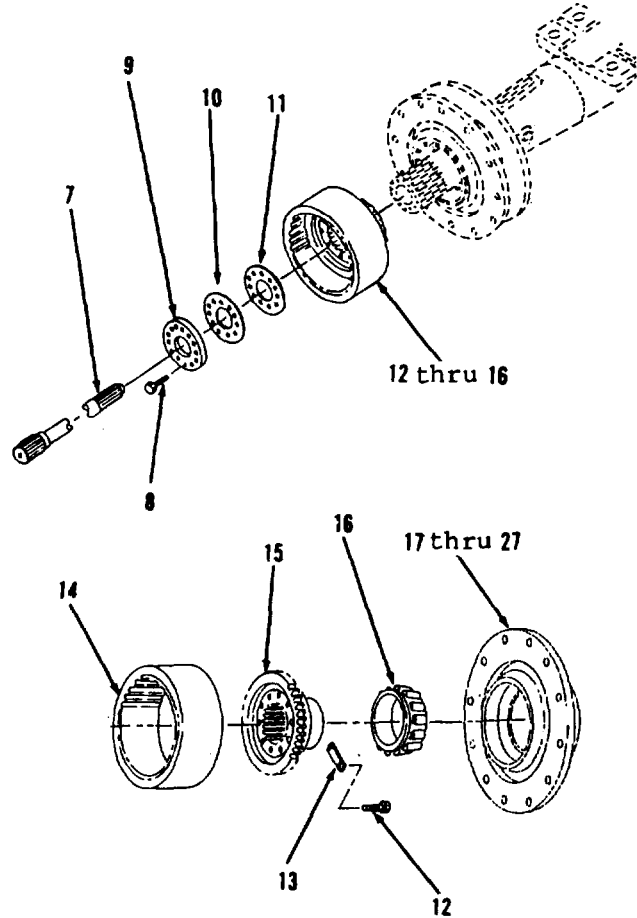
REMOVAL (cont)

4. Remove hoist and sling.
5. Remove axle shaft (7).
6. Using a 9/16" socket and socket wrench handle, remove 12 bolts (8), retainer (9), shims (10 and 11) and items 12 thru 16 as an assembly. Discard shims (10 and 11).

NOTE

Weight of ring and hub assembly is approximately 60 lbs.

7. Using a 1/2" socket and socket wrench handle, remove eight bolts (12), four bars (13) and ring (14) from hub (15).
8. Using an arbor press and bearing adapter, remove bearing (16).
9. Using a ball peen hammer and a flat tip screwdriver, remove items 17 thru 27 as an assembly from left side of rear axle assembly.



FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

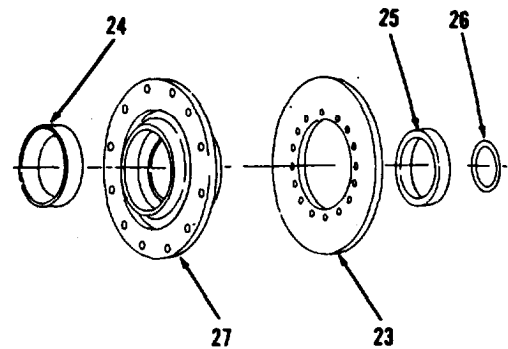
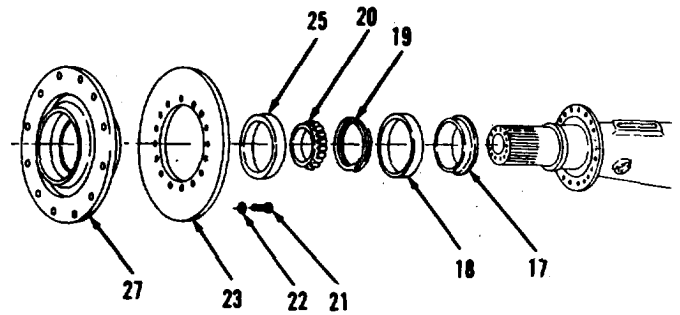
7-5. Front and Rear Planetary. (Sheet 4 of 8)

REMOVAL

NOTE

The following is a difference between M10A Forklift models.

10. Remove retainer (17), seal (18) and bearing (20) from wheel hub (27), from vehicles S/N 2001 and above or remove retainer (17), seal (18), ring (19) and bearing (20) from wheel hub (27), from vehicles S/N 2000 and below. Discard seal (18).
11. Mark position of disc (23) and wheel hub (27). Then using a 1-1/8" socket and socket wrench handle, remove 18 bolts (21), washers (22) and disc (23).
12. Remove cups (24 and 25).
13. Using a putty knife, remove and discard ring (26).



Go to sheet 5

7-5. Front and Rear Planetary. (Sheet 5 of 8)

CLEANING/INSPECTION

**WARNING**  
**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

14. Wipe planetary carrier assembly (6) with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**  
**COMPRESSED AIR HAZARD**

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

15. Clean all parts except bearing (20) with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
16. Inspect all parts. Refer to paragraph 2-9.

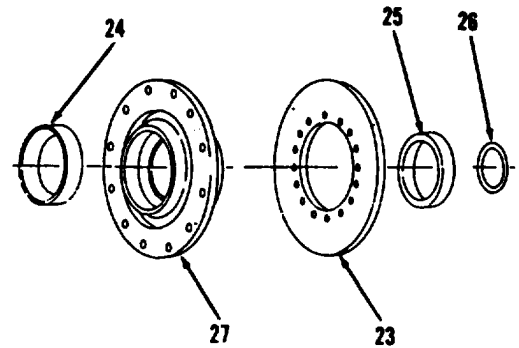
Go to sheet 6

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-5. Front and Rear Planetary. (Sheet 6 of 8)

INSTALLATION

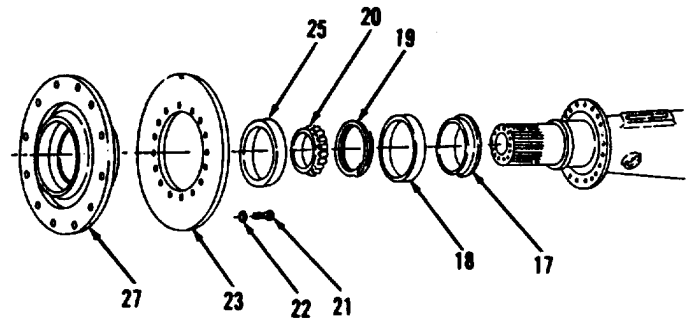
17. Lubricate new ring (26) with clean oil and install in wheel hub (27).
18. Install cups (25 and 24).
19. Using a 1-1/8" socket and socket wrench handle, install disc (23), 18 washers (22) and bolts (21). Aline location marks with wheel hub (27) during installation.



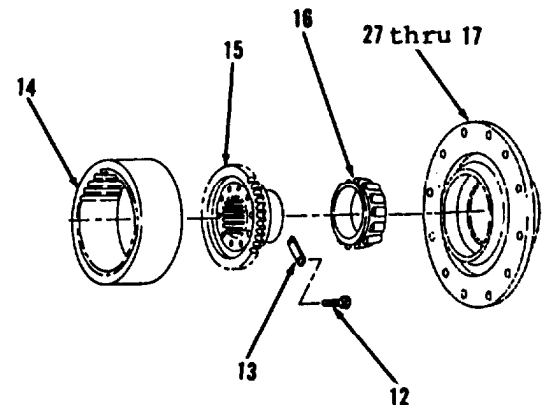
NOTE

The following is a difference between M10A Forklift models.

20. Install bearing (20), new seal (18) and retainer (17) on vehicles S/N 2001 and above or install bearing (21), ring (19), new seal (18) and retainer (17) in vehicles S/N 2000 and below.



21. Apply Loctite 290 to lips of new seal (18) before installation, then install items 27 thru 17 as an assembly on left side of rear axle assembly.
22. Install bearing (16).
23. Apply Loctite 262 to threads on eight bolts (12). Using a 1/2" socket and a torque wrench, install ring (14), four bars (13) and eight bolts (12) to hub (15). Tighten eight bolts (12) to 20 to 23 lb-ft.

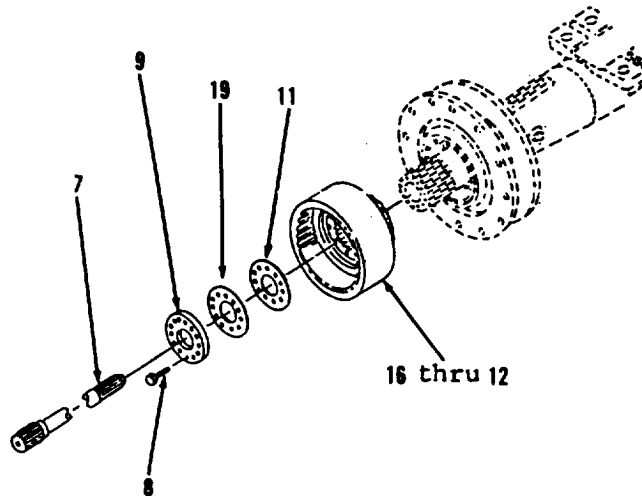


Go to sheet 7

7-5. Front and Rear Planetary. (Sheet 7 of 8)

INSTALLATION (cont)

- 24. Install items 16 thru 12 as an assembly in rear left side of rear axle assembly.
- 25. Using a 9/16" socket, socket wrench handle and torque wrench, install retainer (9) and four of 12 bolts (8). Tighten four of 12 bolts (8) to 30 lb-ft while rotating wheel assembly.
- 26. Using a feeler gage, measure gap between retainer (9) and end of spindle at two points and install. Average two measurements to determine shim pack thickness. Use shim pack equal to, but not less than, average gap dimension.
- 27. Using a 9/16" socket, socket wrench handle and torque wrench, remove four bolts (8) and retainer (9).
- 28. Apply Loctite 262 to threads on 12 bolts (8). Using a 1/2" socket and torque wrench, install new shims (11 and 10), retainer (9) and bolts (8). Tighten bolts (8) to 40 to 45 lb-ft while rotating wheel assembly.
- 29. Install axle shaft (7).



Go to sheet 8

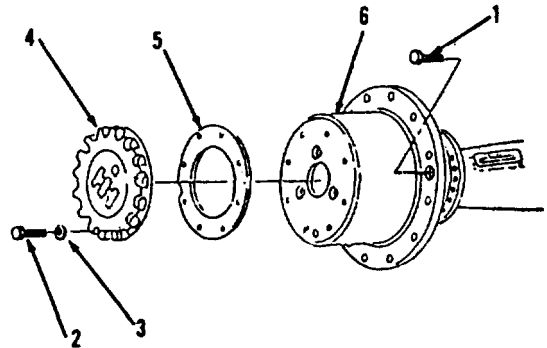


## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

## 7-5. Front and Rear Planetary. (Sheet 8 of 8)

INSTALLATION

30. Attach hoist and sling to planetary carrier assembly (6) and install.
31. Remove hoist and sling.
32. Apply Loctite 262 to threads of eight bolts (2). Using a 9/16" socket and torque wrench, install new gasket (5), cover (4), eight washers (3) and bolts (2). Tighten eight bolts (2) to 34 to 37 lb-ft.
33. Using 9/16" open end wrench, install two bolts (1) to left side of axle assembly. Tighten two bolts (1) to 24 to 26 lb-ft.



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 1 of 7)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489  
Jack stand (2)

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Preformed packing (3)  
Wood block (2)

Torques

Bolts (28) to 680 lb-ft.

---

EQUIPMENT CONDITION

References

LO 10-3930-643-12  
  
TM 10 3930-643-20  
  
Paragraph 7-5  
  
Paragraph 8-16  
  
Paragraph 8-4

Condition Description

Rear axle drained.  
  
Rear wheels removed.  
  
Rear planetaries removed.  
  
Parking brake removed.  
  
Rear service brakes removed.

---

Go to sheet 2

## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

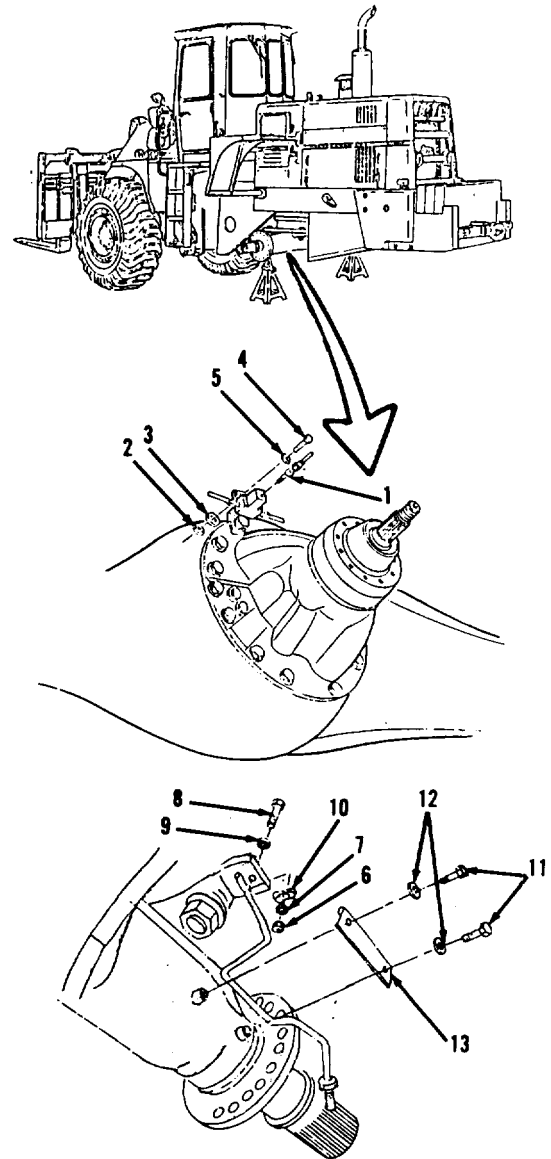
## 7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 2 of 7)

REMOVAL

## NOTE

Vehicle must be raised off the ground and supported with jack stands under the frame for the following procedure.

1. Using a 1/2" box and open end wrench, disconnect, tube assembly (1) from under rear of vehicle.
2. Using a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove nut (2), washer (3), bolt (4) and washer (5).
3. Remove nut (6), washer (7), bolt (8), washer (9) and clamp (10) from left side of rear axle assembly.
4. Using a 9/16" socket and socket wrench handle, remove two bolts (11), washers (12) and access cover (13).



Go to sheet 3

7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 3 of 7)

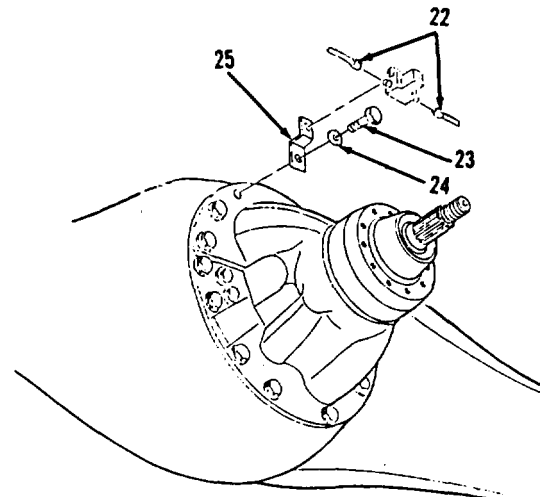
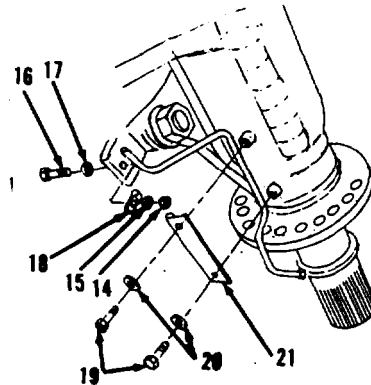
REMOVAL (cont)

5. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove nut (14), washer (15), bolt (16), washer (17) and clamp (18) from right side of rear axle assembly.
6. Using a 9/16" socket and socket wrench handle, remove two bolts (19), washers (20) and access cover (21).
7. Using a 7/16" box and open end wrench, remove tube assemblies (22).
8. Using a 3/4" socket and socket wrench handle, remove bolt (23), washer (24) and clamp (25).

**WARNING**  
WEIGHT HAZARD

Use transmission and differential lift for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

9. Position transmission and differential lift under rear of vehicle to remove rear axle, items 30 thru 37 as an assembly.



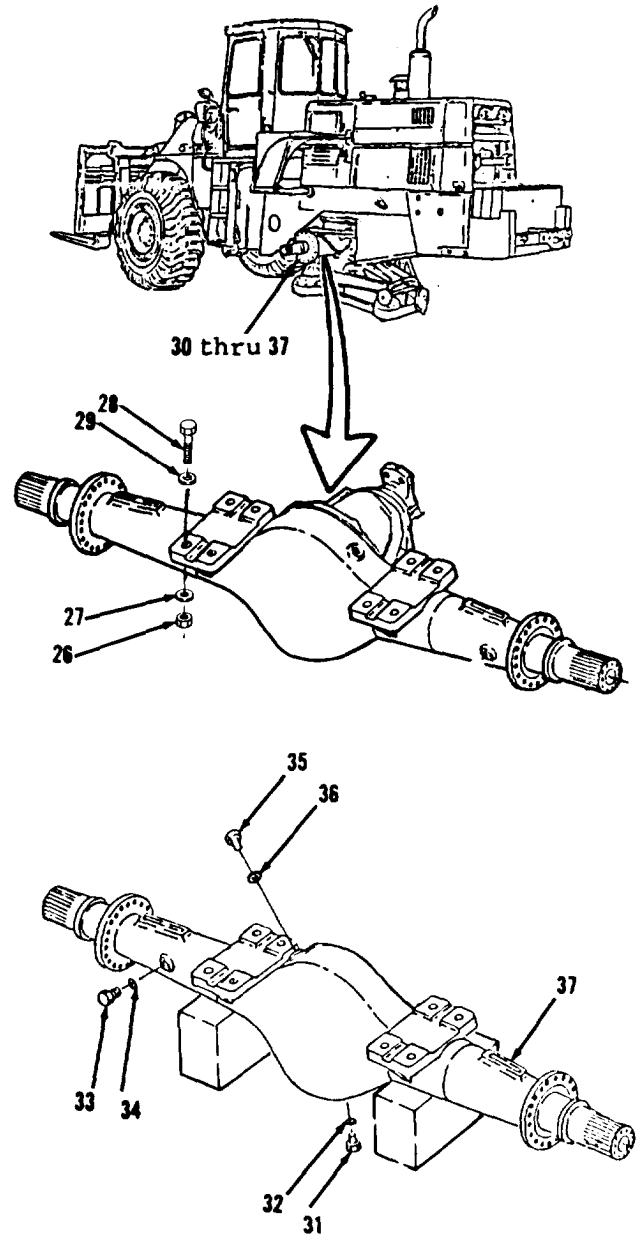
Go to sheet 4

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 4 of 7)

REMOVAL

10. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, remove eight nuts (26), washers (27), bolts (28) and washers (29).
11. Using a transmission and differential lift, remove rear axle, items 30 thru 37 as an assembly.
12. Place rear axle, items 30 thru 37 as an assembly, on wood blocks and remove transmission and differential lift.
13. Remove differential (30), refer to paragraph 7-9.
14. Using a 1-1/4" socket and socket wrench handle, remove plug (31), preformed packing (32), plug (33), preformed packing (34), plug (35) and preformed packing (36). Discard preformed packings (32, 34 and 36).



Go to sheet 5

7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 5 of 7)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

15. Wipe rear axle (37) and differential (30) with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING**

**COMPRESSED AIR HAZARD**

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

16. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
17. Inspect all parts. Refer to paragraph 2-9.

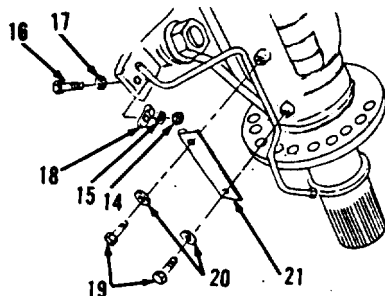
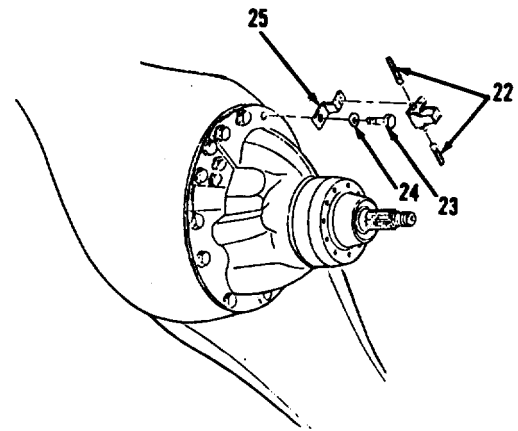
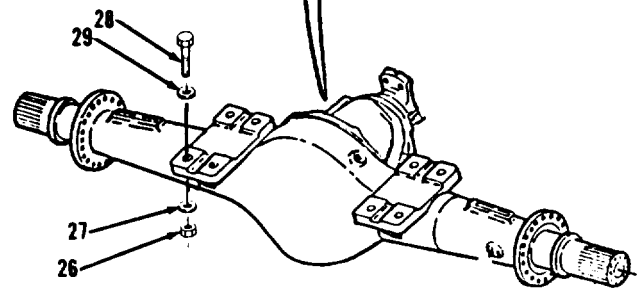
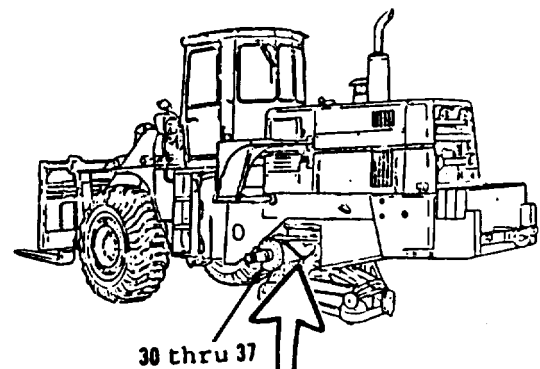
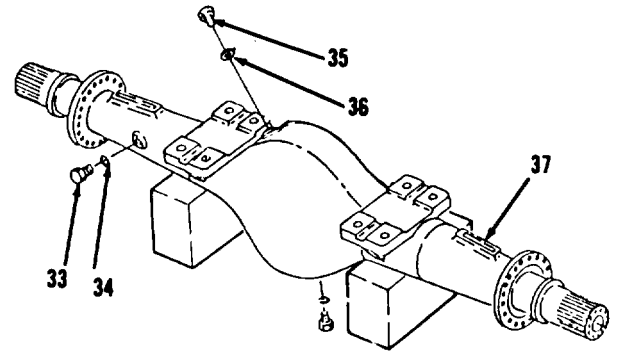
Go to sheet 6

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 6 of 7)

INSTALLATION

18. Using a 1-1/4" socket and socket wrench handle, install new preformed packing (36), plug (35), new preformed packing (34), plug (33), new preformed packing (32) and plug (31) in axle (37).
19. Install differential (30), refer to paragraph 7-9.
20. Using a transmission and differential lift, position rear axle assembly items 37 thru 30 under rear of vehicle and install.
- 21\* Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, install eight washers (29), bolts (28), washers (27) and nuts (26). Tighten eight bolts (28) to 680 lb-ft.
22. Using a 9/16" socket and socket wrench handle, install clamp (25), washer (24) and bolt (23).
23. Using a 7/16" box and open end wrench, position and install tube assemblies (22).
24. Using a 9/16" socket and socket wrench handle, install access cover (21), two washers (20) and bolts (19) to right side of rear axle assembly.
25. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install clamp (18), washer (17), bolt (16), washer (15) and nut (14).



Go to sheet 7

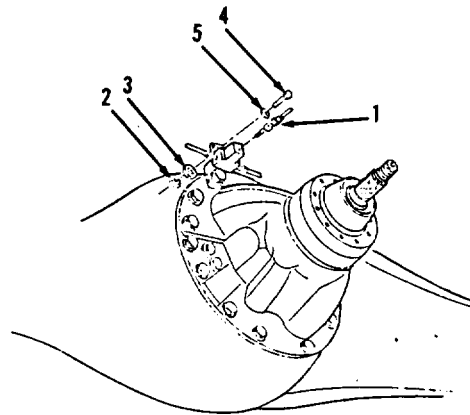
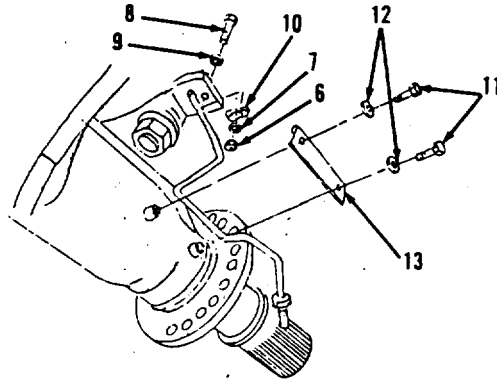
7-6. Rear Drive Axle (S/N 2001 and above). (Sheet 7 of 7)

INSTALLATION (cont)

26. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install access cover (13), two washers (12) and bolts (11) to left side of rear axle assembly.
27. Install clamp (10), washer (9), bolt (8), washer (7) and nut (6).
28. Using a 7/16" socket, socket wrench handle and a 9/16" open end wrench, install washer (5), bolt (4), washer (3) and nut (2).
29. Using 1/2" and 13/16" box and open end wrenches, connect tube assembly (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK





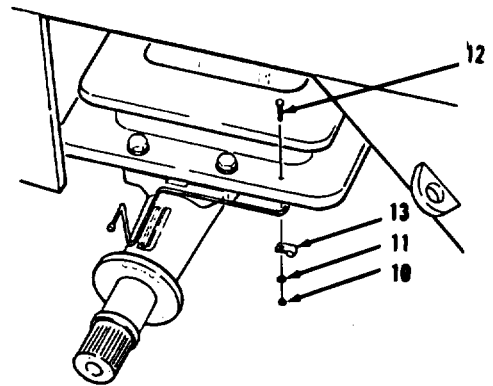
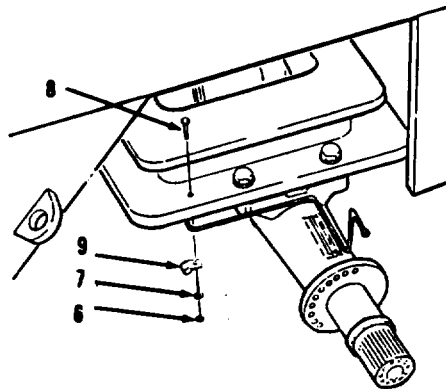
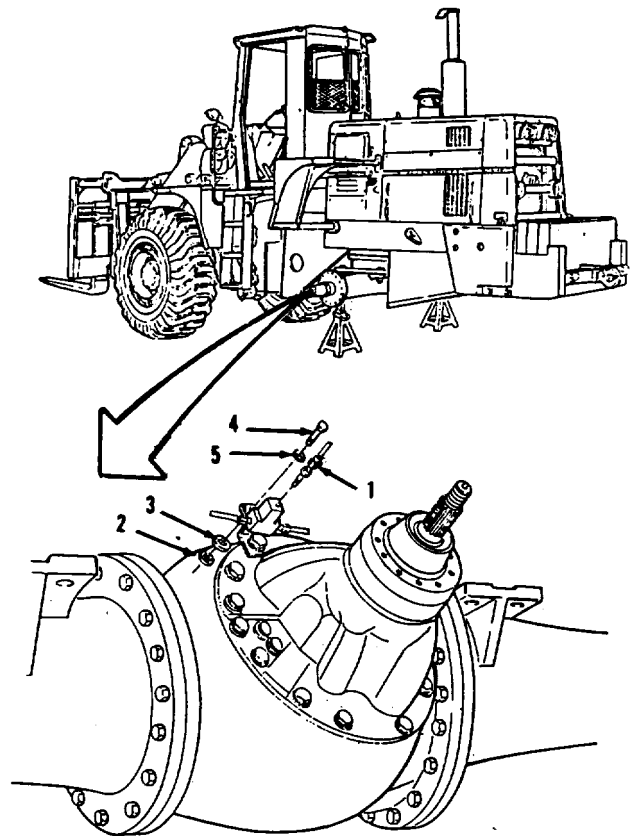
7-7. Rear Axle Assembly (S/N 2000 and below). (Sheet 2 of 7)

REMOVAL

NOTE

Vehicle must be raised off the ground and supported with jack stands under the frame for the following procedure.

1. Using a 1/2" open end wrench, disconnect tube assembly (1) from under rear of vehicle.
2. Using a 7/16" open end wrench, 7/16" socket and socket wrench handle, remove nut (2), washer (3), bolt (4) and washer (5).
3. Using a 9/16" open end wrench, 9/16" socket and socket wrench handle, remove nut (6), washer (7), bolt (8) and clamp (9) from left side of axle assembly.
4. Remove nut (10), washer (11), bolt (12) and clamp (13) from right side of axle assembly.



Go to sheet 3

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

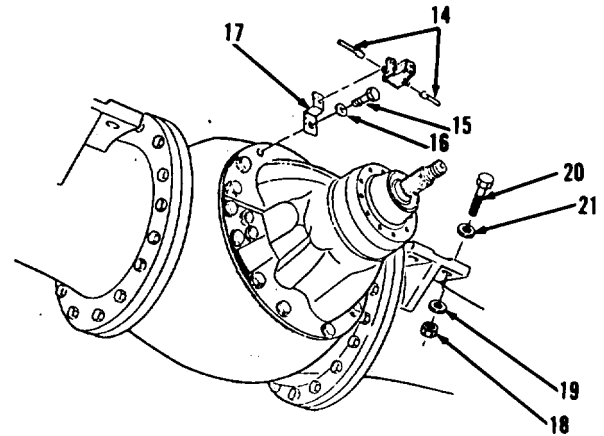
7-7. Rear Axle Assembly (S/N 2000 and below). (Sheet 3 of 7)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

5. Using a 7/16" open end wrench, remove tube assemblies (14).
6. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, remove bolt (15), washer (16) and clamp (17).

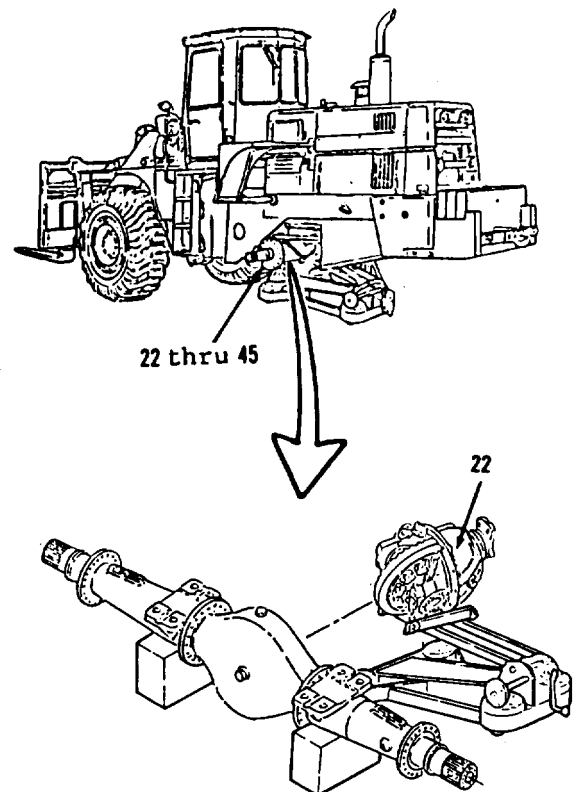


**WARNING**

**WEIGHT HAZARD**

Use transmission and differential lift for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

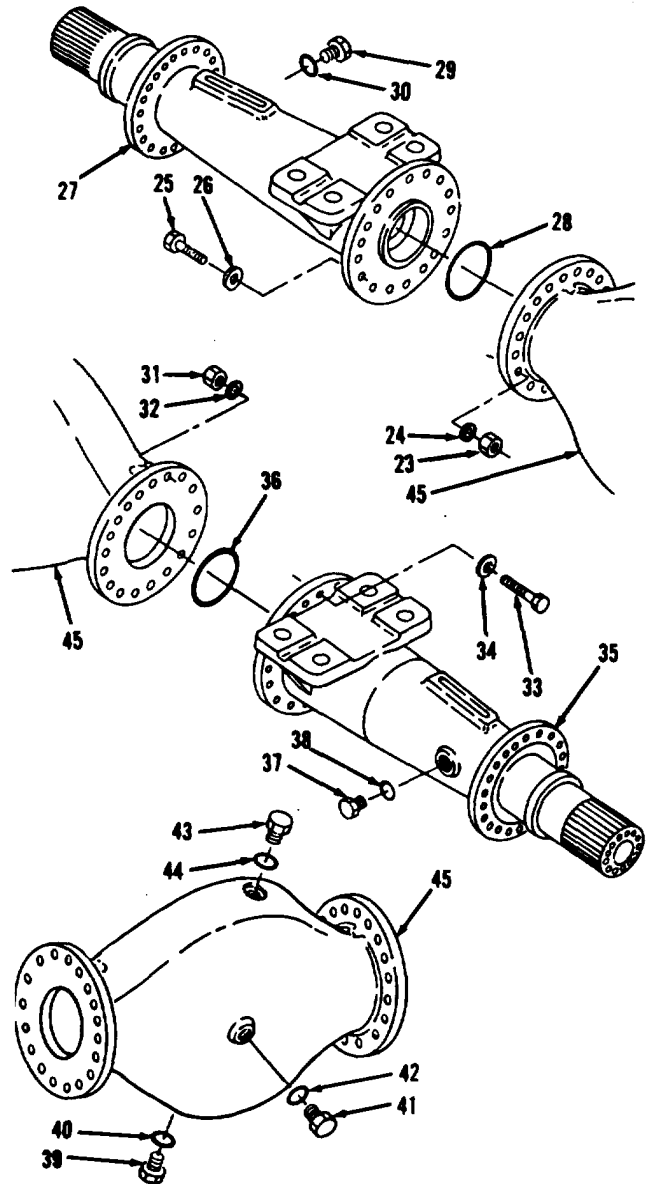
7. Position transmission and differential lift under rear axle assembly items 22 thru 45.
8. Using a 1-1/2" open end wrench, 1-1/2" socket and socket wrench handle, remove eight nuts (18), washers (19), bolts (20) and washers (21).
9. Using a transmission and differential lift, a hammer and flat tip screwdriver, remove rear axle assembly items 22 thru 45.
10. Place rear axle assembly items 22 thru 45 on wood blocks and remove transmission and differential lift.
11. Remove differential (22), refer to paragraph 7-9.



Go to sheet 4

REMOVAL (cont)

12. Using a 1-1/8" open end wrench, 1-1/4" socket and socket wrench handle, remove 16 nuts (23), washers (24), bolts (25), washers (26), spindle (27) and preformed packing (28) from bowl (45). Discard preformed packing (28).
13. Using a 1-1/4" open end wrench, remove plug (29) and preformed packing (30) from spindle. Discard preformed packing (30).
14. Using a 1-1/8" open end wrench, 1-1/8" socket and socket wrench handle, remove 16 nuts (31), washers (32), bolts (33), washers (34), spindle (35) and preformed packing (36) from bowl (45). Discard preformed packing (36).
15. Using a 1-1/4" open end wrench, remove plug (37) and preformed packing (38) from spindle (35). Discard preformed packing (38).
16. Remove plug (39), preformed packing (40), plug (41), preformed packing (42), plug (43) and preformed packing (44) from bowl (45). Discard preformed packings (40, 42 and 44).



## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-7. Rear Axle Assembly (S/N 2000 and below). (Sheet 5 of 7)

CLEANING/INSPECTION**WARNING****TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

17. Wipe spindles (27 and 35) and bowl (45) with clean cloth moistened with cleaning solvent P-D-680. Allow to air dry.

**WARNING****COMPRESSED AIR HAZARD**

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

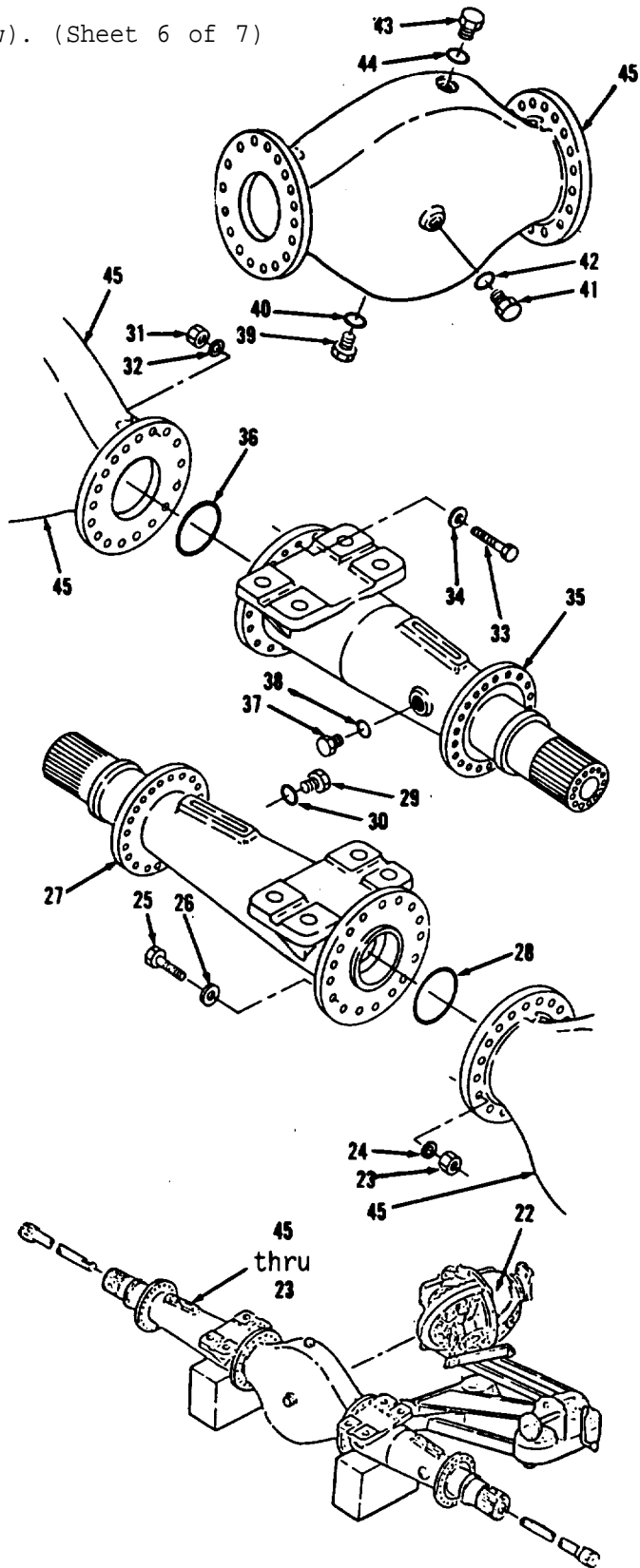
18. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
19. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 6

7-7. Rear Axle Assembly (S/N 2000 and below). (Sheet 6 of 7)

INSTALLATION

20. Using a 1-1/4 open end wrench, install new preformed packing (44), plug (43), new preformed packing (42), plug (41), new preformed packing (40) and plug (39) from bowl (45)\*
21. Install new preformed packing (38) and plug (37) in spindle (35).
22. Using 1-1/8" open end wrench, 1/8" socket, socket wrench handle and torque wrench, install new preformed packing (36), spindle (35), 16 washers (34), bolts (33), washers (32) and nuts (31) in bowl (45). Tighten 16 nuts (31) to 270 to 300 lb-ft.
23. Using a 1-1/4" open end wrench, install new preformed packing (30) and plug (29) in spindle (27).
24. Using a 1-1/8" open end wrench, 1-1/8" socket, socket wrench handle and torque wrench, install new preformed packing (28), spindle (27), 16 washers (26), bolts (25), washers (24) and nuts (23) in bowl (45). Tighten 16 nuts (23) to 270 to 300 lb-ft.
25. Using a transmission and differential lift, install differential (22) in items 45 thru 23 as an assembly, refer to paragraph 7-9.
26. Position rear axle assembly items 45 through 22 under rear of vehicle.



Go to sheet 7

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

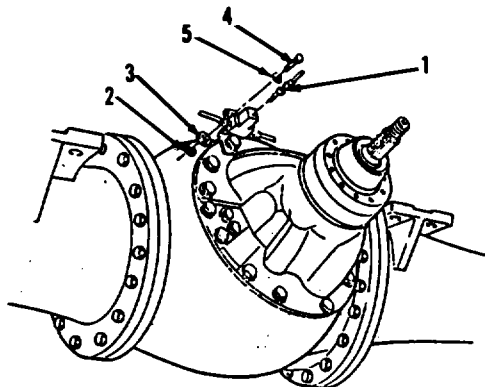
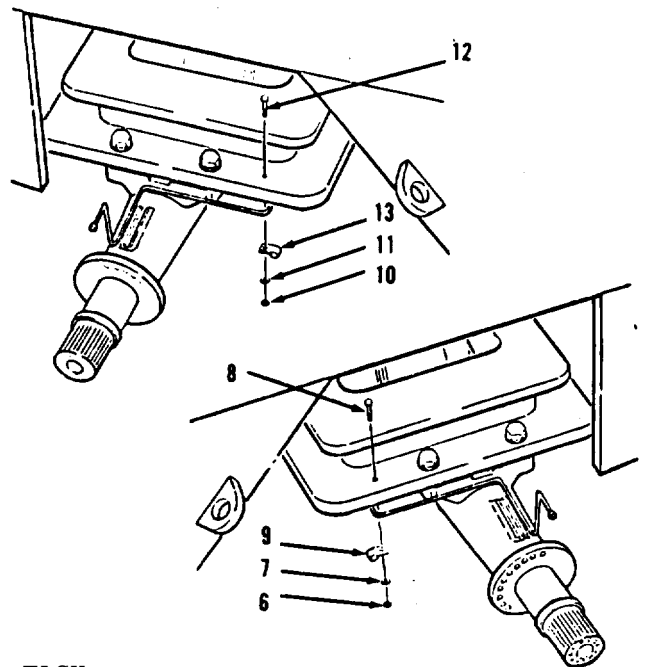
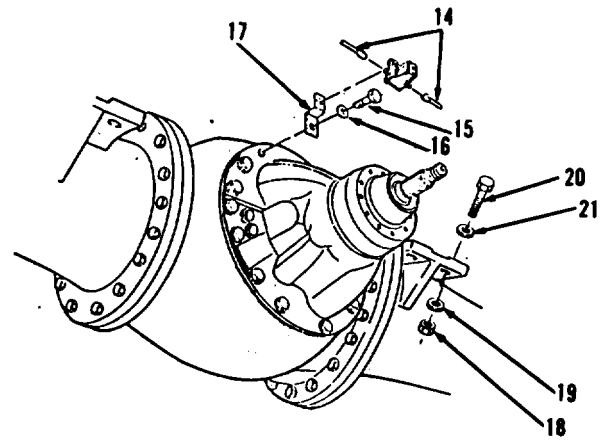
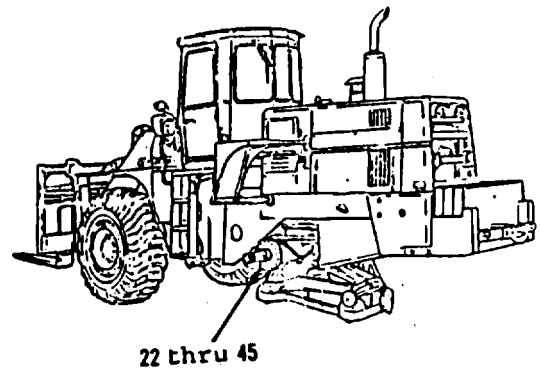
7-7. Rear Axle Assembly (S/N 2000 and below). (Sheet 7 of 7)

INSTALLATION

27. Using a 1-1/2" open end wrench, 1-1/2" socket, socket wrench handle and torque wrench, install eight washers (21), bolts (20), washers (19) and nuts (18). Tighten eight nuts (18) to 680 lb-ft.
28. Using a 1-1/2" adjustable wrench, install clamp (17), washer (16) and bolt (15)
29. Using a 1-1/8" socket and socket wrench handle, connect tube assemblies (24).
30. Using a 9/16" open end wrench, 9/16" socket and socket wrench handle, install clamp (13), bolt (12), washer (11) and nut (10).
31. Install clamp (9), bolt (8), washer (7) and nut (6).
32. Using a 7/16" open end wrench, 7/16" socket and socket wrench handle, install washer (5), bolt (4), washer (3) and nut (2).
33. Using 1-1/2" open end wrench, connect tube assembly (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE. (cont)

7-8. Rear Differential Carrier Assembly. (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Loctite 262, Grade N  
(App. C, Item 15)  
Gasket  
Seal  
Wood block (2)

Torques

Bolts (5) to 75 to 85 lb-ft.

---

EQUIPMENT CONDITION

References

LO 10-3930-643-12

TM 10-3930-643-20

Paragraph 7-5

Paragraph 8-16

Condition Description

Planetary lubricant drained.  
Axle lubricant drained.

Rear wheels and tires removed.

Rear planetaries removed.

Parking brake removed.

---

Go to sheet 2

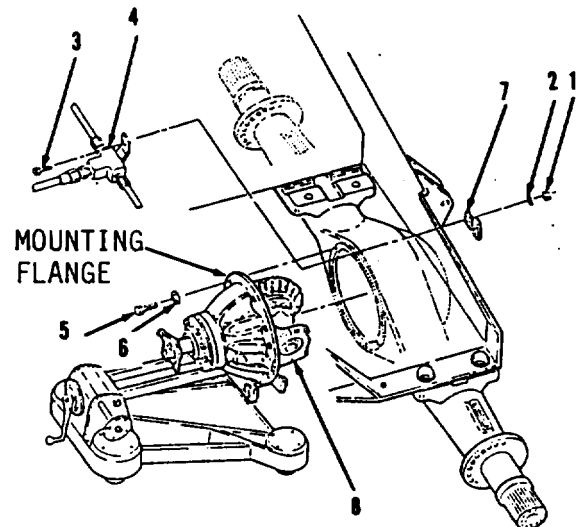


## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-8. Rear Differential Carrier Assembly. (Sheet 2 of 4)

REMOVAL

1. Using a transmission and differential lift, support and secure differential (8) in front, center of rear axle.
2. Using a 7/16" open and box end wrench, remove nut (1), washer (2), bolt (3) and block (4). Move brake lines to one side.
3. Using a 3/4" socket and socket wrench handle, remove 14 bolts (5), washers (6) and bracket (7).
4. Using a transmission and differential lift, remove differential (8).
5. Remove differential (8) from transmission and differential lift and support between two wood blocks.



Go to sheet 3

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

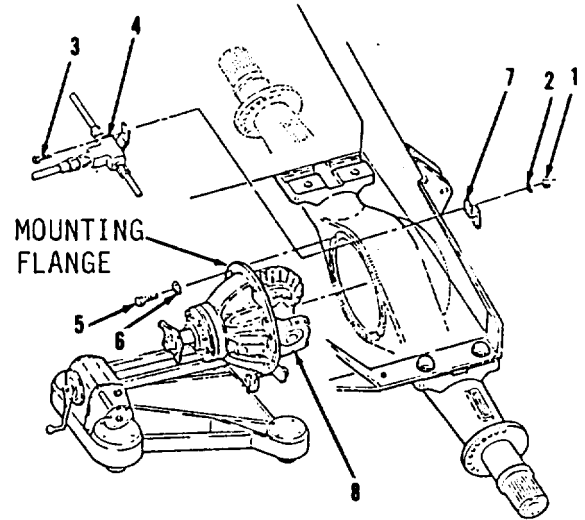
6. Clean all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
7. Inspect all parts. Refer to paragraph 2-9.

## FRONT AND REAR AXLES TROUBLESHOOTING AND MAINTENANCE.

7-8. Rear Differential Carrier Assembly. (Sheet 4 of 4)

INSTALLATION

8. Apply Loctite 262 to mounting flange in differential (8).
9. Using a transmission and differential lift, position differential (8) and install into axle on rear of vehicle.
10. Using a 3/4" socket, socket wrench handle and torque wrench, install bracket (7), 14 washers (6) and bolts (5). Tighten bolts (5) to 75 to 85 lb-ft.
11. Using a 7/16" open and box end wrench, install block (4), bolt (3), washer (2) and nut (1).



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

7-49 (7-50 blank)



## CHAPTER 8

BRAKE  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift brake system.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Service Brake Troubleshooting	8-1	8-2
Parking Brake Troubleshooting	8-2	8-5
Parking Brake Air Cylinder	8-3	8-6
Service Brake Assembly	8-4	8-11
Power Cluster (S/N 2000 and below)	8-5	8-17
Power Cluster Reservoir (S/N 2000 and below)	8-6	8-21
Pressure Converter (S/N 2001 and above)	8-7	8-26
Pressure Converter Reservoir (S/N 2001 and above)	8-8	8-31
Treadle Two Way Valve (S/N 2000 and below)	8-9	8-37
Treadle Check Valve (S/N 2001 and above)	8-10	8-40
Parking Brake Control Valve	8-11	8-43
Treadle Valve (S/N 2000 and below)	8-12	8-47
Treadle Valve (S/N 2001 and above)	8-13	8-54
Air Compressor	8-14	8-62
Governor Assembly	8-15	8-75
Parking Brake Assembly	8-16	8-80

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-1. Service Brake Troubleshooting.

---

MALFUNCTION

TEST OR INSPECTION

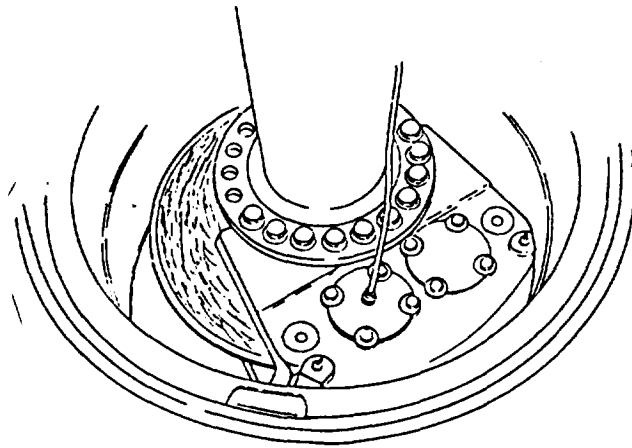
CORRECTIVE ACTION

---

a. BRAKES DO NOT ENGAGE.

Check brake calipers for evidence of oil leakage.

Leakage indicates a faulty seal, refer to paragraph 8-4 for repair procedures.



b. BRAKES DO NOT RELEASE.

Check treadle and treadle valves for proper operation.

If repair is necessary, refer to paragraphs 8-9, 8-10, 8-12 and 8-13.

c. BRAKES SQUEAL OR SCRAPE.

Check for wear of brake liners.

To repair service brakes, refer to paragraph 8-4.

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

## 8-1. Service Brake Troubleshooting.

---

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

---

## d. LOW AIR PRESSURE.

Step 1. Check air compressor belt.

Adjust or replace if necessary, refer to paragraph 8-14.

If belt is good, go to Step 2.

Step 2. Inspect governor.

Repair or replace governor, refer to paragraph 8-15.

If governor is good, go to step 3.

Step 3. Inspect air compressor discharge valves to determine if valves are leaking.

If valves are faulty, repair or replace, refer to paragraph 8-14.

If valves are good, go to Step 4.

Step 4. Inspect for a restriction in discharge line or in discharge cavity of air compressor.

Remove and clean cylinder head, refer to paragraph 8-14.

If no restriction is found, go to Step 5.

Step 5. Inspect for restriction in inlet valves.

Remove cylinder head and clean inlet valves, guides, springs and inlet ports, refer to paragraph 8-14.

If no restriction is found, go to Step 6.

Step 6. Inspect air compressor inlet valves for faulty operation or worn parts.

Repair or replace inlet valve if necessary, refer to paragraph 8-14.

If valve is good, go to Step 7.

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-1. Service Brake Troubleshooting. (cont)

---

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

---

d. LOW AIR PRESSURE. (cont)

Step 7. Inspect air compressor parts for wear.

Repair compressor, refer to paragraph 8-14.

e. HIGH AIR PRESSURE.

Inspect governor for proper operation.

If necessary, repair, refer to paragraph 8-15.

f. NOISY COMPRESSOR.

Check oil supply line for restriction.

If restriction is found, check for damage. Repair or replace if necessary.

Inspect crankshaft and connecting rod bearings for burns or wear. Replace if necessary, refer to paragraph 8-14.



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

## 8-2. Parking Brake Troubleshooting.

---

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

---

## a. PARKING BRAKE DRAGS.

Step 1. Check for low air pressure and check lines for restrictions.

If restriction is found, check for damage.

Repair or replace, if necessary.

Step 2. If parking brakes do not apply, check linkage.

Adjust linkage, refer to TM 10-3930-643-20.

Step 3. Replace return springs, refer to paragraph 8-16.

## b. PARKING BRAKE SLIPS.

Apply parking brake. With engine running and transmission in the forward third gear position, fully accelerate engine. If vehicle moves and parking brake is properly adjusted, check for oil on linings or worn linings. If linings are worn below 1/8", replace brake shoe assembly, refer to paragraph 8-16.



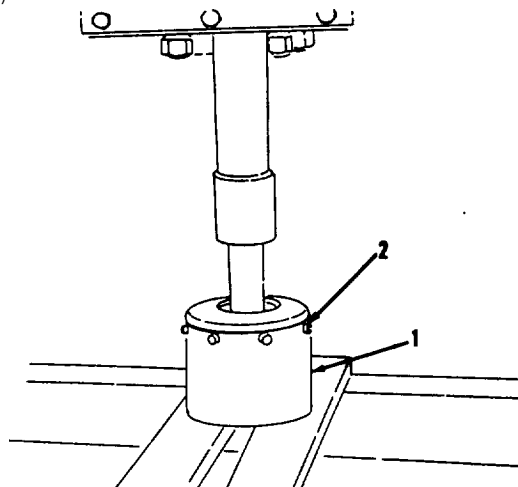
## BRAKE TROUBLESHOOTING AND MAINTENANCE.

## 8-3. Parking Brake Air Cylinder. (Sheet 2 of 5)

DISASSEMBLY**WARNING**

Spring is under pressure from plate. Use suitable press to release spring. Failure to follow this procedure could result in SEVERE INJURY. If you are injured, seek medical aid immediately.

- 10 Position air cylinder (1) securely in press.
2. Using a 1/2" socket and socket wrench handle, remove eight screws (2).
3. Release press slowly to relieve pressure on spring (3).
4. Remove air cylinder (1).
5. Remove spring (3) and plate (4).
6. Using a flat tip screwdriver, remove four screws (5) and plate (6).
7. Using a 7/8" open end wrench, remove nuts (7 and 8).
8. Remove shaft (9).



Go to sheet 3

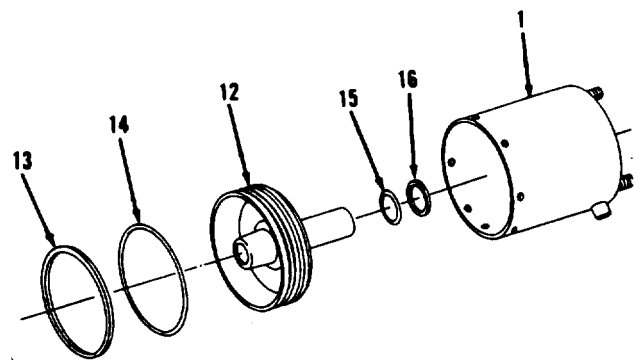
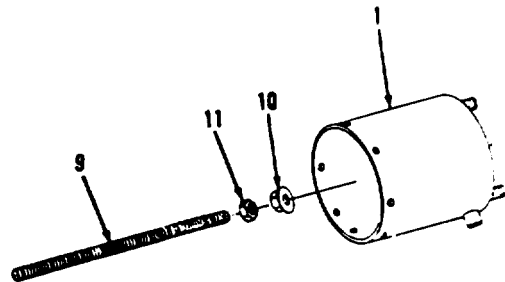
8-3. Parking Brake Air Cylinder. (Sheet 3 of 5)

DISASSEMBLY (cont)

NOTE

Remove nuts from shaft only if inspection proves replacement of nuts or shaft is necessary.

9. Remove nuts (10 and 11) from shaft (9).
10. Remove piston (12).
11. Remove and discard felt (13) and ring (14).
12. Remove and discard ring (15) and bushing (16).



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

## 8-3. Parking Brake Air Cylinder. (Sheet 4 of 5)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and Flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

13. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
14. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

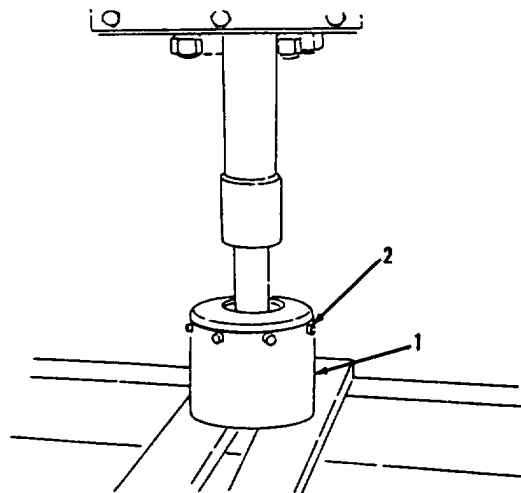
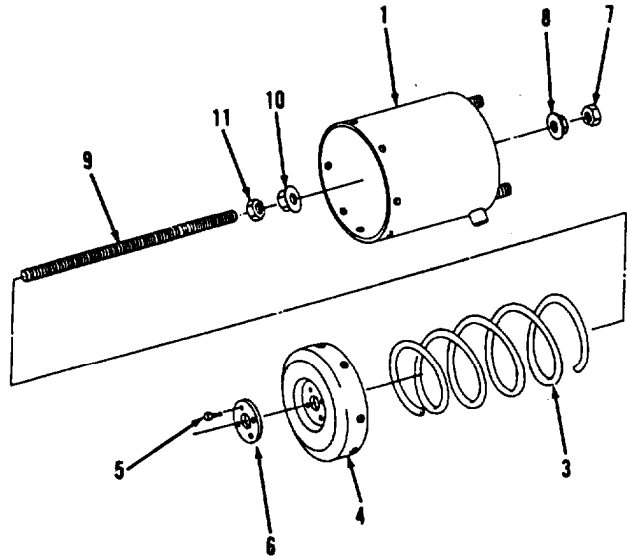
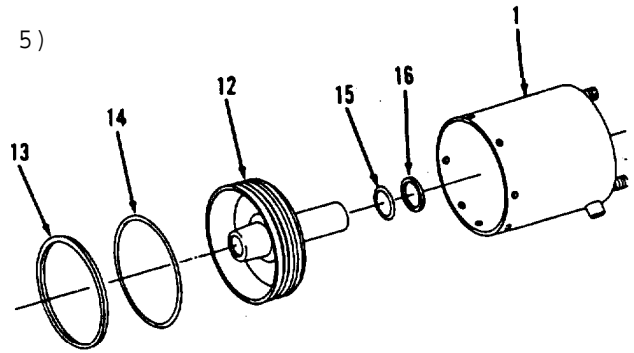
8-3. Parking Brake Air Cylinder. (Sheet 5 of 5)

ASSEMBLY

15. Lubricate inner diameters of new bushing (16) and new ring (15) with clean grease and install.
16. Lubricate inner diameter of air cylinder (1) with clean grease.
17. Install new ring (14) and new felt (13) in piston (12).
18. Using a 7/8" open end wrench, install shaft (9) with nuts (11 and 10) in piston (12).
19. Install piston (12) to air cylinder (1).
20. Using a 7/8" open end wrench, install nuts (8 and 7).
21. Using a flat tip screwdriver, install plate (6) and four screws (5) to plate (4).
22. Position plate (4) and spring (3) on air cylinder (1).
23. Position air cylinder (1) in press and compress spring (3).
24. Using a 1/2" socket and socket wrench handle, install eight screws (2).
25. Remove air cylinder (1) from press.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-4. Service Brake Assembly. (Sheet 1 of 6)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Brake fluid (App. C, Item 2)  
Clean cloth (App. C, Item 24)  
Small tags (App. C, Item 28)  
Preformed packing (12)  
Boot (4)  
Backup packing (4)  
  
Bolt (1) to 7 lb-ft.  
Bolts (5) to 290 lb-ft.  
Bolts (7) to 285 lb-ft.  
Bolts (16) to 40 lb-ft.

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Tire and wheel assembly removed.

REMOVAL

NOTE

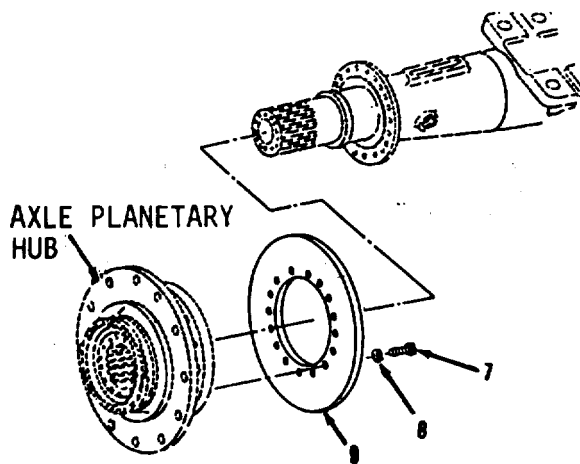
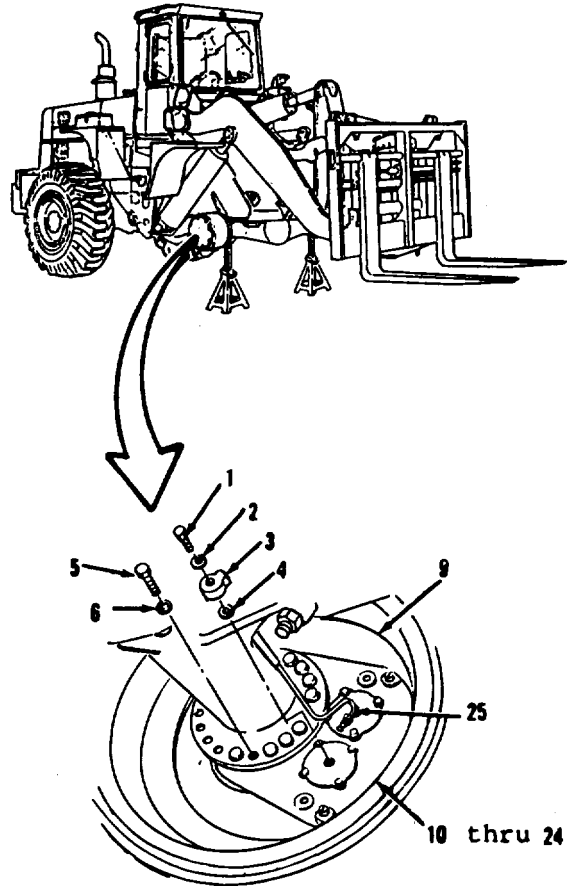
The following is a maintenance procedure for one service brake assembly. The maintenance procedure for the remaining service brake assemblies is identical.

1. Disconnect tube assembly (25) from tee pipe (3).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Using a 3/4" socket and socket wrench handle, remove bolt (1) and washer (2).
3. Remove tee pipe (3) and washer (4).
4. Remove ten bolts (5) and washers (6).
5. Remove items 10 thru 24 as an assembly from disc (9).
6. Remove axle planetary hub, refer to paragraph 7-5.
7. Using a 1-1/8" socket and socket wrench handle, remove 18 bolts (7), washers (8) and disc (9) from axle planetary hub.



Go to sheet 3



BRAKE TROUBLESHOOTING AND MAINTENANCE.

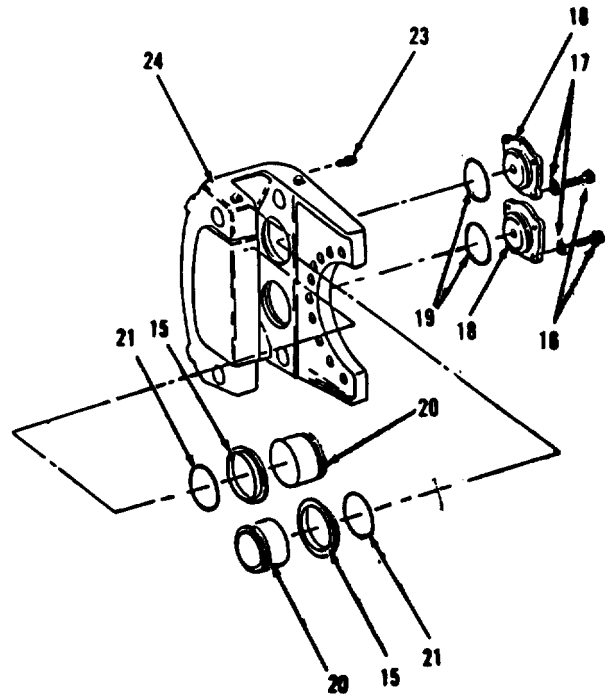
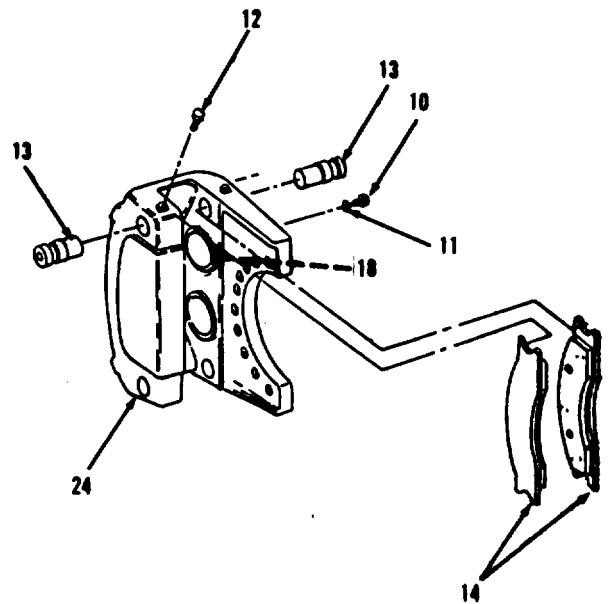
8-4. Service Brake Assembly. (Sheet 3 of 6)

REMOVAL

8. Using a 9/16" socket and socket wrench handle, remove plug (10) and preformed packing (11) from cap (18). Discard preformed packing (11).

DISASSEMBLY

9. Remove four bolts (12).
10. Remove four pins (13).
11. Remove two linings (14).
12. Install plug (10).
13. Force four pistons (20) out of housing (24) with compressed air. Apply air to port of cap (18) (without plug).
14. Remove plug (10).
15. Remove and discard four boots (15).
16. Remove eight bolts (16), washers (17), two caps (18) and preformed packings (19). Discard two preformed packings (19).
17. Remove and discard four preformed packings (21) from pistons (20).
18. Using a 3/8" open end wrench, remove two bleeder screws (23) from housing (24).



Go to sheet 4

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-4. Service Brake Assembly. (Sheet 4 of 6)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

19. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
20. Inspect disc (9) for cracks, scoring, grooves, glazing or wear less than 0.4375 inches thick.
21. Inspect two linings (14) for cracks, scoring, grooves or wear less than 0.125 inch thick.
22. Inspect four pistons (20) for cracks, breaks, burrs, scoring or grooves.
23. Inspect housing (24) for cracks, breaks, grooves or scoring in piston bores, bores blocked or threads damaged.
24. Inspect all other parts. Refer to paragraph 2-9.

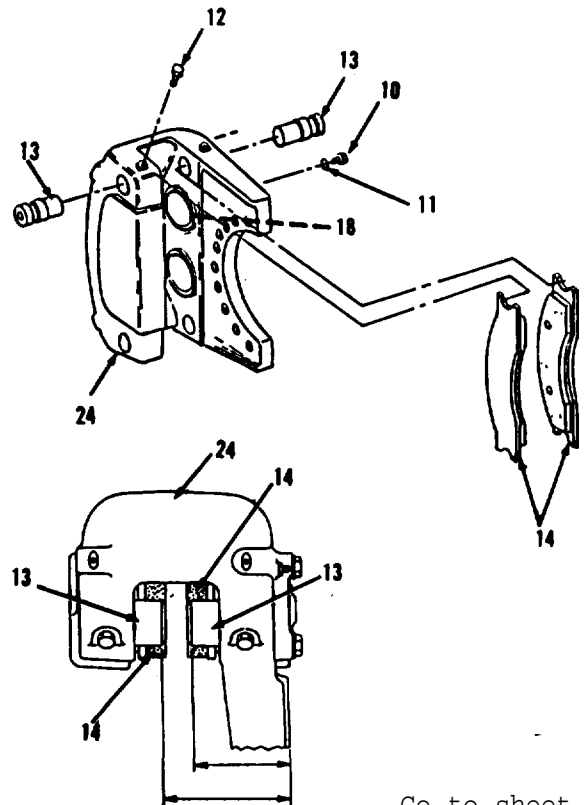
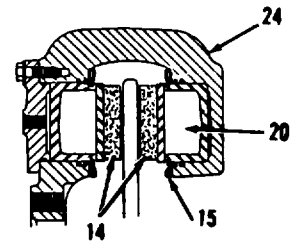
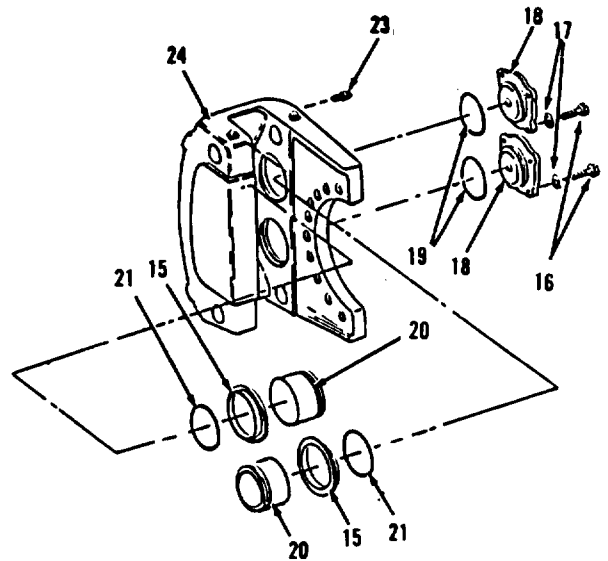
Go to sheet 5

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-4. Service Brake Assembly. (Sheet 5 of 6)

ASSEMBLY

25. Using a 3/8" open end wrench, install two bleeder screws (23) in housing (24).
26. Lubricate with clean brake fluid and install new preformed packings (21) in grooves of bores in housing (24).
27. Install four new boots (15) in bores of housing (24).
28. Lubricate four pistons (20) with clean brake fluid and install partially into housing (24). Position lips of four new boots (15) in groove of four pistons (20), as shown.
29. Check four new boots (15) and pistons (20) to make sure proper seating has been obtained and install four new boots (15) using a dust boot installing tool.
30. Using a 9/16" socket and torque wrench, install two new preformed packings (19), caps (18), eight washers (17) and bolts (16). Tighten eight bolts (16) to 40 lb-ft.
31. Install four pins (13).
32. Install four bolts (12) loosely.
33. Position two linings (14).
34. Adjust four pins (13) with two linings (14), as shown.
35. Tighten four bolts (12), securing pins (13) in housing (24).



Go to sheet 6

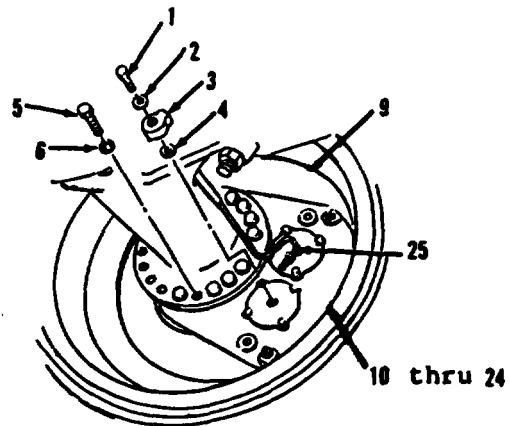
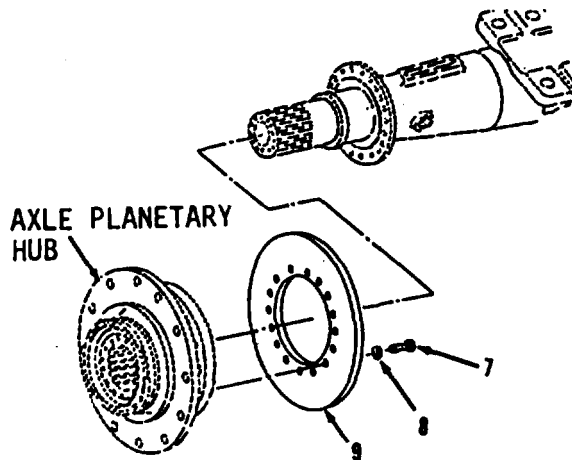
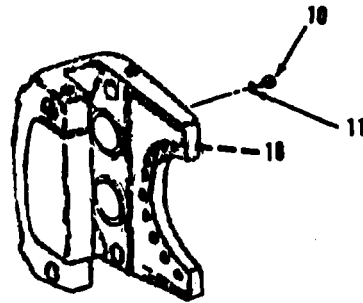
8-4. Service Brake Assembly. (Sheet 6 of 6)

INSTALLATION

- 36. Using a 9/16" socket and socket wrench handle, install new preformed packing (11) and plug (10) in two caps (18).
- 37. Position disc (9) on axle planetary hub .
- 38. Using a 1-1/8" socket and torque wrench, install 18 washers (8) and bolts (7). Tighten 18 bolts (7) to 285 lb-ft.
- 39. Install axle planetary hub, refer to paragraph 7-5.
- 40. Position items 24 thru 10 as an assembly on disc (9).
- 41. Using a 3/4" socket and socket wrench handle, install ten washers (6) and bolts (5). Tighten ten bolts (5) to 290 lb-ft.
- 42. Position washer (4) and tee pipe (3).
- 43. Using a 3/4" socket and torque wrench, install washer (2) and bolt (1). Tighten bolt (1) to 7 lb-ft.
- 44. Using a 10" adjustable wrench, connect tube assembly (25) to tee pipe (3).
- 45. Install tire and wheel assembly, refer to TM 10-3930-643-20.
- 46. Bleed air in brake hydraulic system, refer to TM 10-3930-643-20.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



REMOVAL

**WARNING**

Make sure that vehicle will not roll or shift. Secure with wood blocks .

DEATH

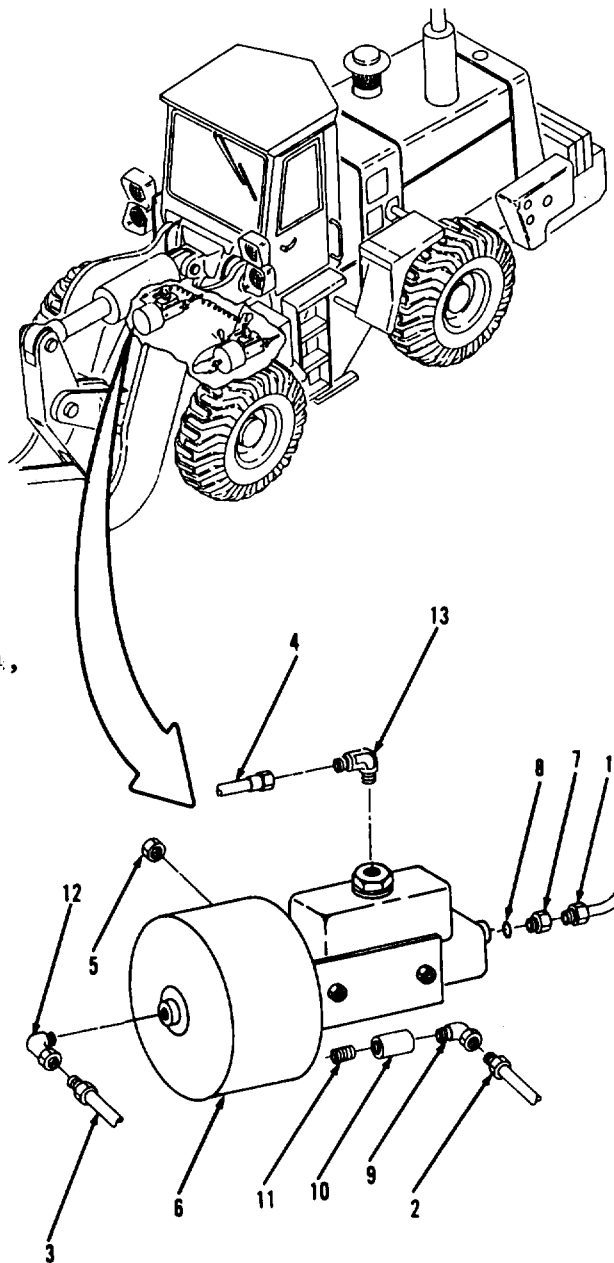
or serious injury may result by your failure to follow this procedure.

NOTE

The following is a maintenance procedure for the right side power cluster. The maintenance procedure for the left side power cluster is identical.

- Tag all tube assemblies before disconnecting to aid in installation.

1. Using a 3/4" or a 1/2" open end wrench, disconnect tube assembly (1) from power cluster at front, underside of vehicle.
2. Using 5/8" and 11/16" open end wrenches, disconnect tube assemblies (2, 3 and 4).
3. Using a 1/2" socket and socket wrench handle, remove four locknuts (5) and power cluster (6).
4. Using an 11/16" open end wrench, remove fitting (7) and gasket (8). Discard gasket (8). Remove all gasket material from mounting surfaces.
5. Using a 9/16" open end wrench, remove elbow (9).
6. Using an 8" pipe wrench, remove coupling (10) and nipple (11).
7. Using 9/16" and 11/16" open end wrenches, remove elbows (12 and 13).



Go to sheet 3

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-5. Power Cluster (S/N 2000 and below). (Sheet 3 of 4)

CLEANING/INSPECTION**WARNING**

## ● TOXIC\FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves, Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

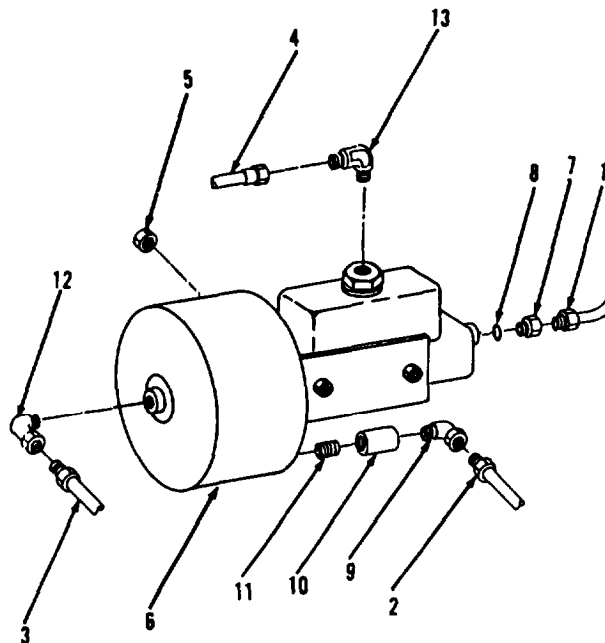
8. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
9. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

8-5. Power Cluster (S/N 2000 and below). (Sheet 4 of 4)

INSTALLATION

10. Using 9/16" and 11/16" open end wrenches, install elbows (13 and 12) on power cluster (6).
11. Using an 8" pipe wrench, install nipple (11) and coupling (10).
12. Using a 9/16" open end wrench, install elbow (9).
13. Using an 11/16" open end wrench, install new gasket (8) and fitting (7).
14. Using a 1/2" socket and socket wrench handle, install power cluster and four locknuts.
15. Using 5/8" and 11/16" open end wrenches, connect tube assemblies (4, 3 and 2) to power cluster (6).
16. Using a 3/4" or a 1/2" open end wrench, connect tube assembly (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



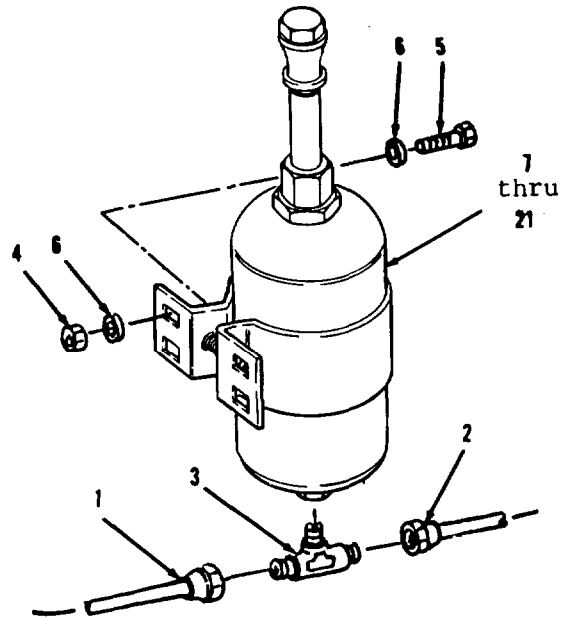


REMOVAL

NOTE

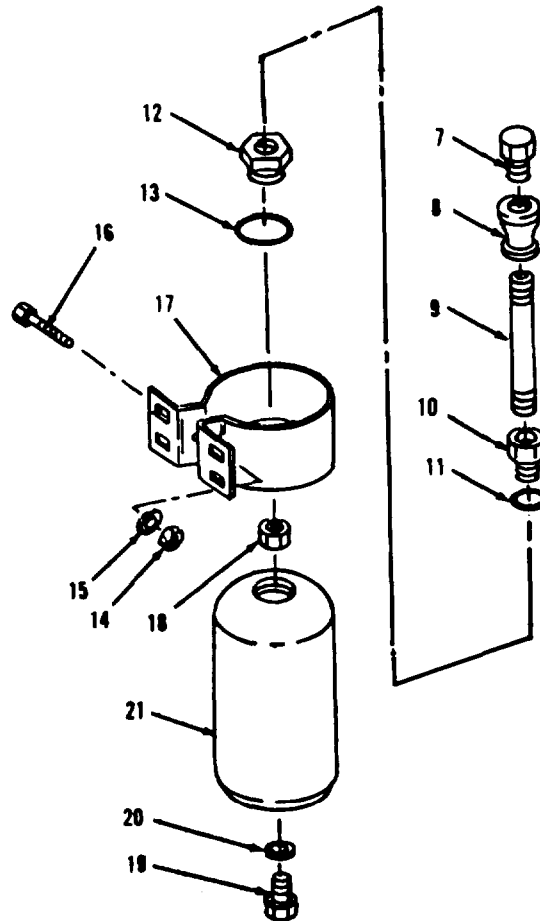
Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 3/4" open end wrench, disconnect tube assemblies (1 and 2) from inner, left side of front frame.
2. Using a 5/8" socket and socket wrench handle, remove tee (3).
3. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove four nuts (4), bolts (5), eight washers (6) and items 7 thru 21 as an assembly.



DISASSEMBLY

4. Using a 5/8" socket, socket wrench handle and vise grips, remove plug (7), coupling (8), nipple (9), adapter (10), gasket (11), cap (12) and gasket (13). Discard gaskets (11 and 13). Remove all gasket material from mounting surfaces.
5. Using a 1/2" socket, socket wrench handle, and a 1/2" open end wrench, remove nut (14), lock washer (15) and bolt (16).
6. Separate clamp (17) and tank (21).
7. Using a 3/4" open end wrench, hold nut (18) on inside of tank (21).
8. Remove adapter (19) and gasket (20). Discard gasket (20). Remove all gasket material from mounting surfaces.
9. Remove and discard nut (18).



go to sheet 3

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-6. Power Cluster Reservoir (S/N 2000 and below). (Sheet 3 of 5)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

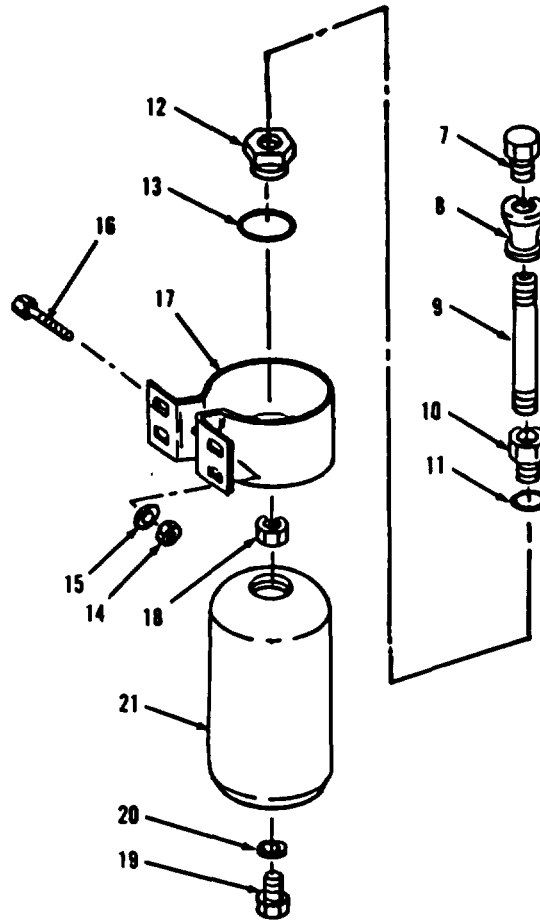
10. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
11. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

8-6. Power Cluster Reservoir (S/N 2000 and below). (Sheet 4 of 5)

ASSEMBLY

12. Install new gasket (20) on adapter (19) .
13. Using a 3/4" open end wrench, position and hold new nut (18) in tank (21).
14. Install adapter (19).
15. Position clamp (17) on tank (21).
16. Using a 1/2" socket, socket wrench handle and a 1/2" open end wrench, install bolt (16), lock washer (15) and nut (14).
17. Using a 5/8" socket, socket wrench handle and vise grips, install new gasket (13), cap (12), new gasket (11), adapter (10), nipple (9), coupling (8) and plug (7).



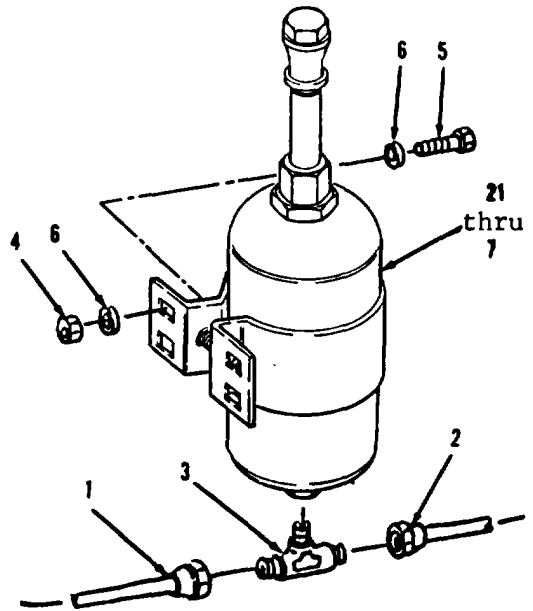
Go to sheet 5

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-6. Power Cluster Reservoir (S/N 2000 and below). (Sheet 5 of 5)

INSTALLATION

18. Using a 9/16" socket, socket wrench handle, and a 9/16" open end wrench, install items 21 thru 7 as an assembly with eight washers (6), four bolts (5) and four nuts (4).
19. Using a 5/8" socket and socket wrench handle, install tee (3).
20. Using a 3/4" open end wrench, connect tube assemblies (2 and 1).
21. Using a 5/8" socket and socket wrench handle, remove plug (7).
22. Refill tank (21) to proper level, refer to LO 10-3930-643-12.
23. Install plug (7).
24. Bleed air in brake hydraulic system, refer to TM 10-3930-643-20.



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

TM 10-3930-643-34

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-7. Pressure Converter (S/N 2001 and above). (Sheet 1 of 5)

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

---

#### INITIAL SETUP

##### Tools

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

##### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Detergent (App. C, Item 33)  
Silicone sealant (App. C, Item 27)  
Wood block (4)

##### **Torques**

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

Go to sheet 2

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

## 8-7. Pressure Converter (S/N 2001 and above). (Sheet 2 of 5)

REMOVAL**WARNING**

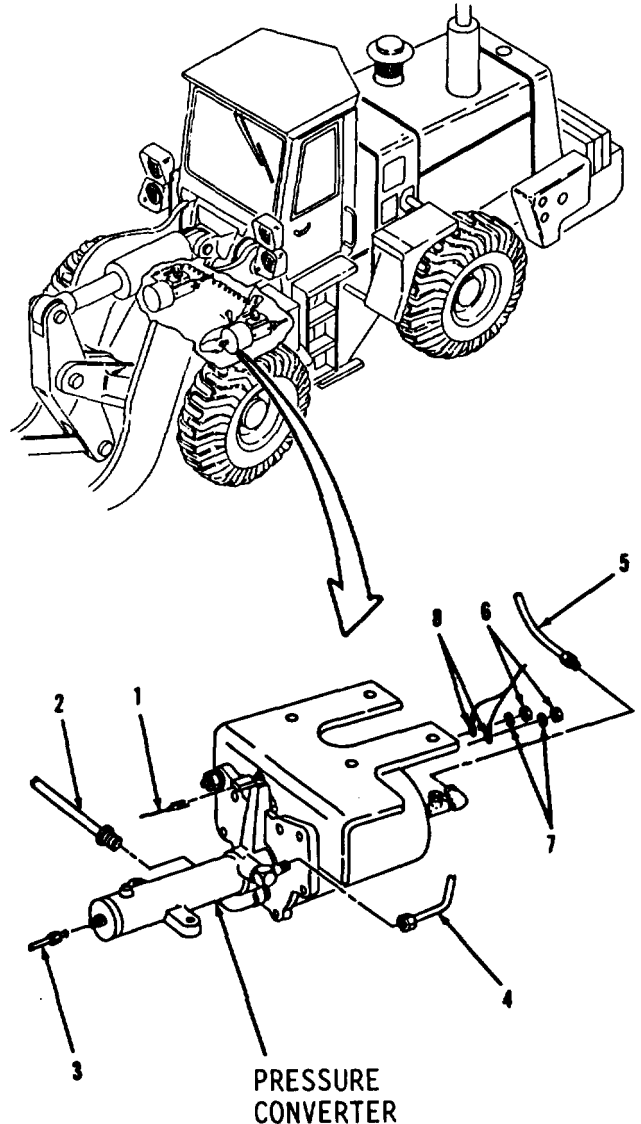
Make sure that vehicle will not roll or shift. Secure with wood blocks .

## DEATH

or serious injury may result by your failure to follow this procedure.

## NOTE

- The following is a maintenance procedure for the rear brake (left hand) pressure converter. The maintenance procedure for the front brake (right hand) pressure converter is identical, except as noted.
  - All electrical connections, except those on the instrument panel, are sealed against moisture with silicone sealant. Remove all silicone sealant before performing maintenance on electrical connections.
  - . Tag all hose and tube assemblies before disconnecting to aid in installation.
1. Disconnect wire assembly (1) at terminal and using 1/2", 7/8" and 5/8" open end wrenches, disconnect hose assemblies (2 and 3) and tube assemblies (4 and 5) from pressure converter on front of vehicle.
  2. Using a 3/8" open end wrench, remove two nuts (6), washers (7) and wire assemblies (8) from left side of pressure converter (13) only.



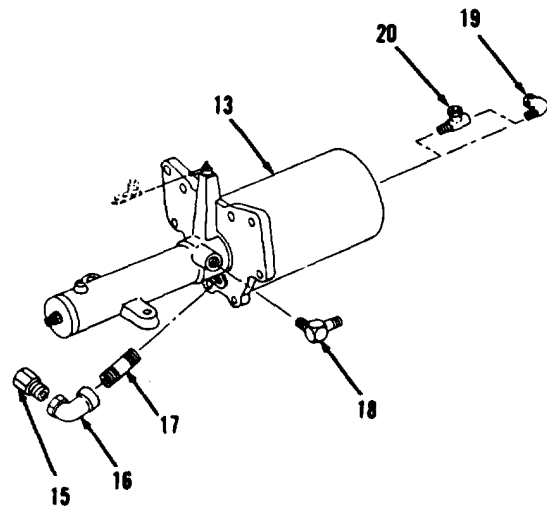
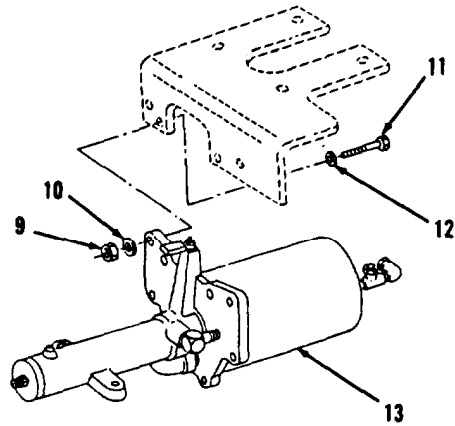
Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-7. Pressure Converter (S/N 2001 and above). (Sheet 3 of 5)

REMOVAL (cont)

3. Using a 3/4" socket, socket wrench handle and a 3/4" box end wrench, remove two nuts (9), washers (10), bolts (11), washers (12) and pressure converter (13).
4. Using a 5/8" open end wrench, remove adapter (15), elbow (16) and nipple (17).
5. Using a 9/16" and 7/8" open end wrench, remove elbows (18 and 19).
6. Using a 13/16" open end wrench, remove tee (20) from left side pressure converter (13) only.



Go to sheet 4



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-7. Pressure Converter (S/N 2001 and above). (Sheet 4 of 5)

CLEANING/INSPECTION

8. Wipe all hose assemblies (2 and 3), tube assemblies (4 and 5) and wire assemblies (1 and 6) with detergent and water solution.

**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

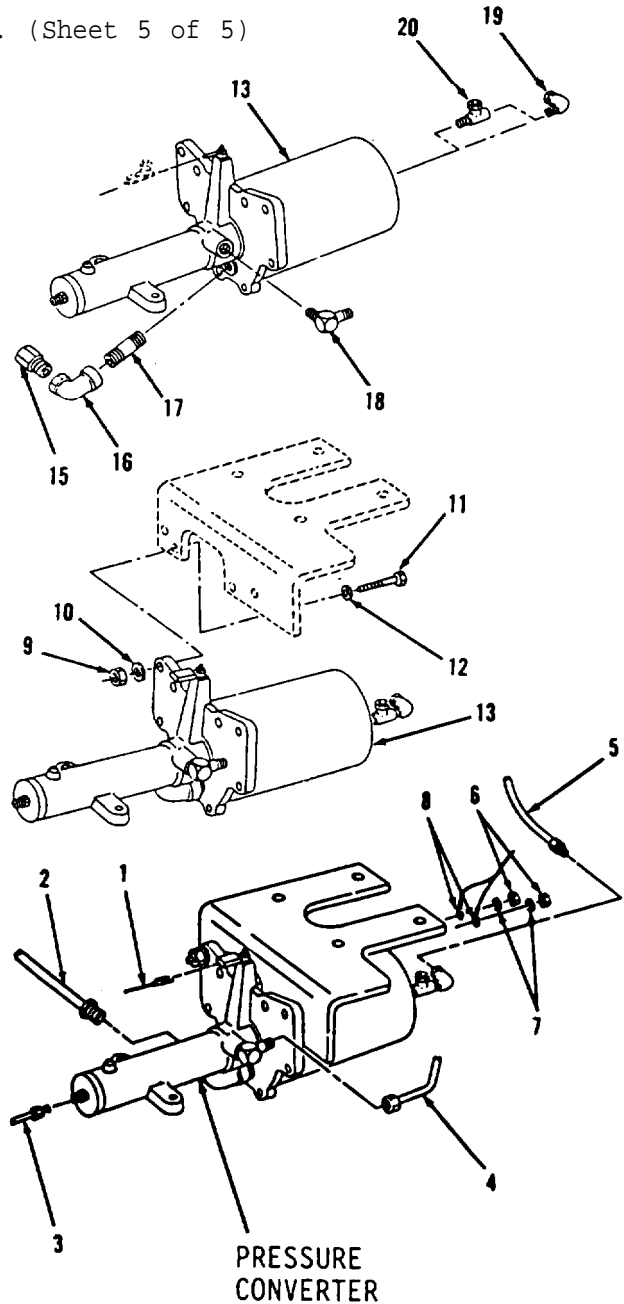
Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

9. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
10. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

INSTALLATION

11. Using a 13/16" open end wrench install tee (20) on left side pressure converter (13) only.
12. Using a 9/16" and 7/8" open end wrenches , install elbows (19 and 18).
13. Using a 5/8" open end wrench, install nipple (17), elbow (16) and adapter (15).
14. Using a 3/4" socket, socket wrench handle, and a 3/4" box end wrench, install pressure converter (13), two washers (12), bolts (11), washers (10), nuts (9) under front of vehicle.
15. Connect two wire assemblies (8) at terminals on left side pressure converter (13) only. Apply silicone sealant over entire connection.
16. Using a 3/8" open end wrench, install two washers (7) and nuts (6) on terminals of left side pressure converter (13) only.
17. Using 5/8", 1/2" and 7/8" open end wrenches, connect tube assemblies (5 and 4) and hose assemblies (3 and 2).
18. Connect **wire** assembly (1) at terminal. Apply silicone sealant over entire connection.

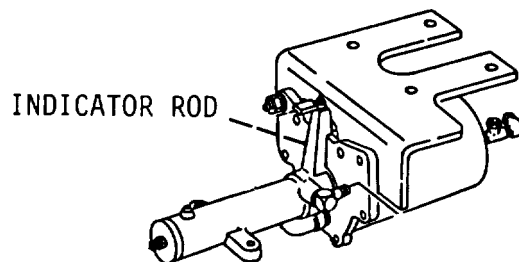


SERVICE

19. If after servicing brake system the brake warning light goes on and stays on, reset indicator rod back in place with a length of wire. Indicator rod has no resistance and light will go off.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



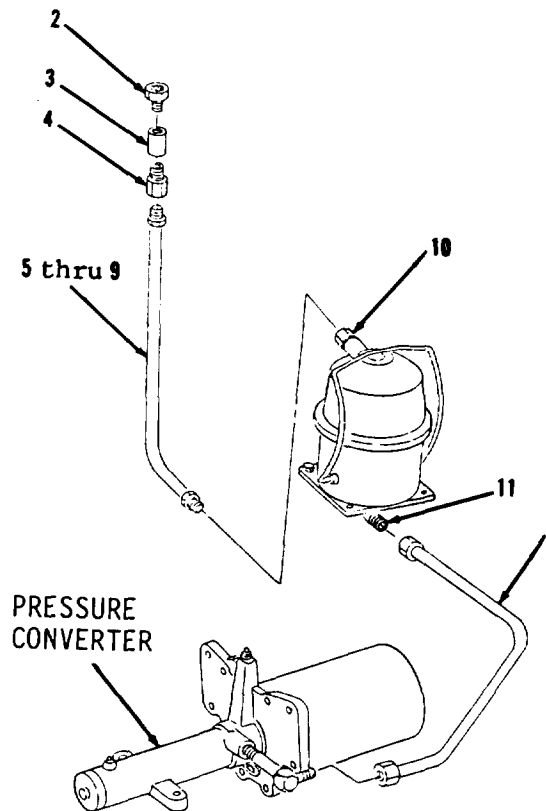
BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-8. Pressure Converter Reservoir (S/N 2001 and above). (Sheet 2 of 6)

REMOVAL

NOTE

- The following is a maintenance procedure for the left pressure converter reservoir. The maintenance procedure for the right pressure converter reservoir is identical.
  - Tag all hose and tube assemblies before disconnecting to aid in installation.
1. Using a 7/8" open end wrench, loosen tube assembly (1) at elbow (11) on left side of front frame.
  2. Position suitable container at end of tube assembly (1).
  3. Using a 7/8" open end wrench, disconnect tube assembly (1) from pressure converter.
  4. Using a 3/4" open end wrench, remove breather (2).
  5. Drain pressure converter.
  6. Using a 7/8" open end wrench, remove tube assembly (1).
  - 7\* Using a 5/8" open end wrench, remove connectors (3 and 4).
  8. Disconnect items 5 thru 9 as an assembly from connector (10).



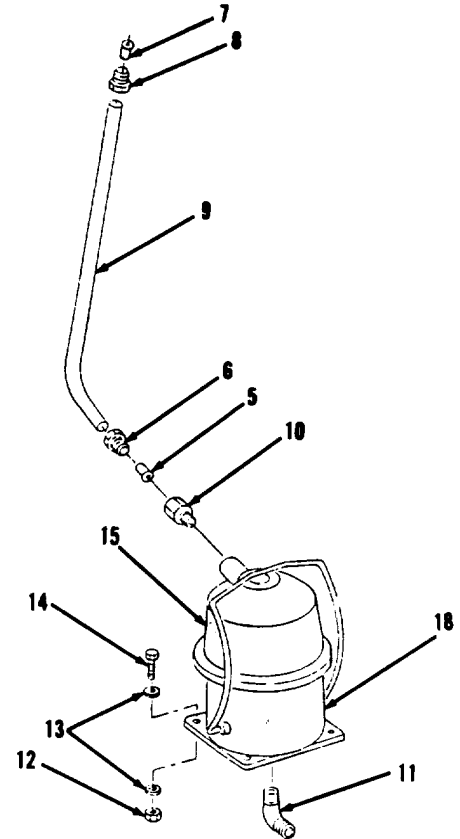
Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-8. Pressure Converter Reservoir (S/N 2001 and above). (Sheet 3 of 6)

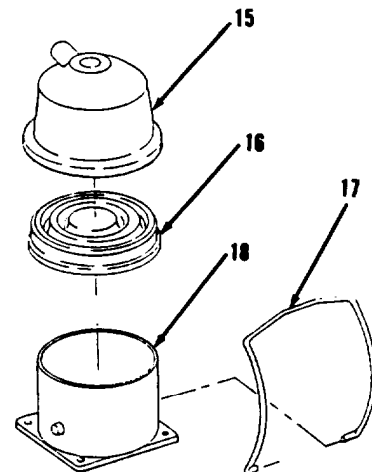
REMOVAL

9. Using a 5/8" open end wrench, remove ferrule (5), nut (6), ferrule (7) and nut (8) from tube (9).
10. Remove connector (10) from cover (15).
11. Using a 5/8" open end wrench, remove elbow (11) from reservoir (18).
12. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, remove four nuts (12), eight washers (13) and four bolts (14).
13. Remove items 15 thru 18 as an assembly from frame weldment.



DISASSEMBLY

14. Using a flat tip screwdriver, pry off retainer (17) from cover (15).
15. Remove cover (15).
16. Using a flat tip screwdriver, separate diaphragm (16) from cover (15).
17. Remove retainer (17) from reservoir (18).



Go to sheet 4

CLEANING/INSPECTION

18. Wipe diaphragm (16) with dry, clean cloth .

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

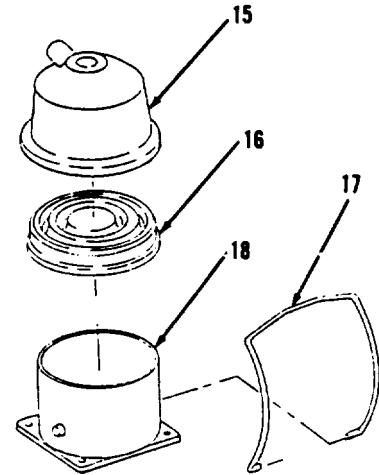
19. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
20. Inspect all parts. Refer to paragraph 2-9.

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-8 . Pressure Converter Reservoir (S/N 2001 and above). (Sheet 5 of 6)

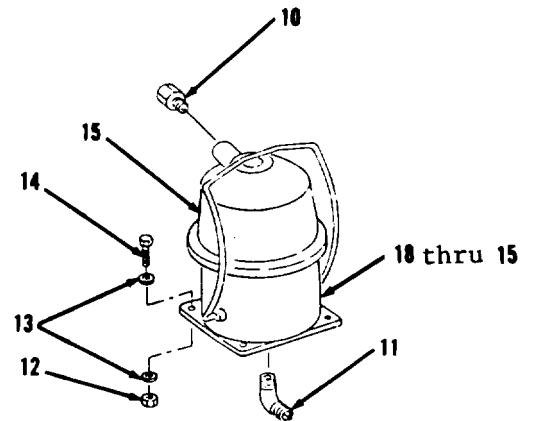
ASSEMBLY

21. Using a flat tip screwdriver, install retainer (17) on reservoir (18).
22. Install diaphragm (16) in cover (15).
23. Install items 16 and 15 as an assembly on reservoir (18) and secure in place with retainer (17).



INSTALLATION

24. Position items 18 thru 15 as an assembly on frame weldment on left side of front frame.
25. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench, install four bolts (14), eight washers (13) and four nuts (12).
26. Using 5/8" open end wrench, install elbow (11).
27. Install connector (10) in cover (15).



Go to sheet 6

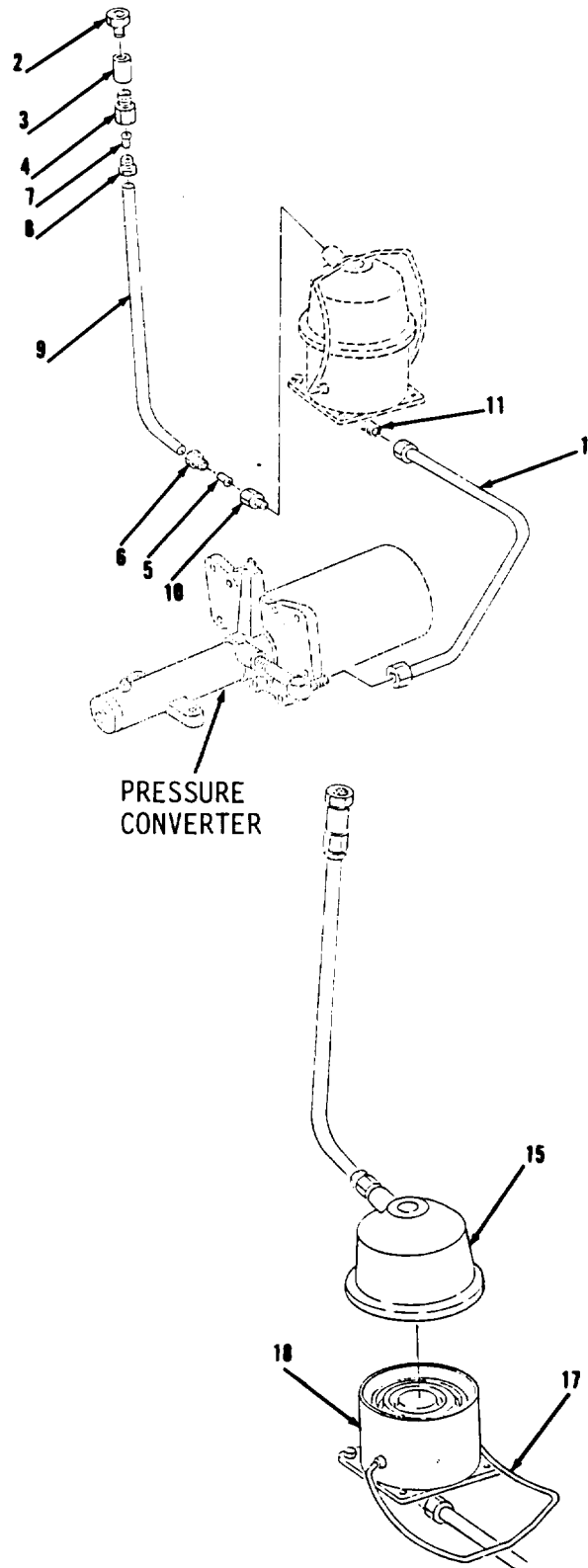
8-8. Pressure Converter Reservoir (S/N 2001 and above). (Sheet 6 of 6)

INSTALLATION (cont)

28. Position nuts (6 and 8) on tube (9).
29. Install ferrules (7 and 5) in nuts (8 and 6). Ferrules (7 and 5) must fit tightly in tube (9).
30. Connect items 9 thru 5 as an assembly to connector (10). Tube (9) must point straight up.
31. Using 5/8" and 3/4" open end wrenches, install connectors (4 and 3) and breather (2).
32. Using a 7/8" open end wrench, connect tube assembly (1) to elbow (11) and install on pressure converter.
33. Using a flat tip screwdriver, pry retainer (17) off cover (15).
34. Remove cover (15).
35. Refill pressure converter to proper level, refer to LO 10-3930-643-12.
36. Install and secure cover (15) with retainer (17).
37. Bleed air from brake hydraulic system, refer to TM 10-3930-643-20.

NOTE

Return M10A Forklift to original equipment condition.







CLEANING/INSPECTION

**WARNING**

TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

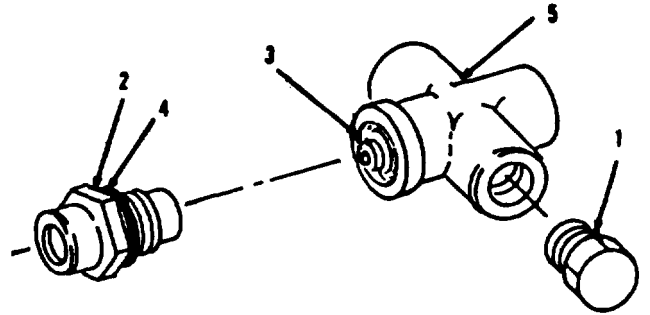
- 5\* Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
6. Inspect all parts. Refer to paragraph 2-9.

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-9. Treadle Two-Way Valve (S/N 2000 and below). (Sheet 3 of 3)

ASSEMBLY

7. Install new gasket (4) on cap (2).
8. Install retainer and seat assembly (3) in body (5).
9. Using a 3/4" socket, socket wrench handle and torque wrench, install cap (2). Tighten cap (2) to 45 lb-ft.
10. Using a 3/4" socket and socket wrench handle, install plug (1).



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-10. Treadle Check Valve (S/N 2001 and above). (Sheet 1 of 3)

- This task covers:
- a. Disassembly
  - b. Cleaning/Inspection
  - c. Assembly

---

INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)

Torques

Seat (1) to 45 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

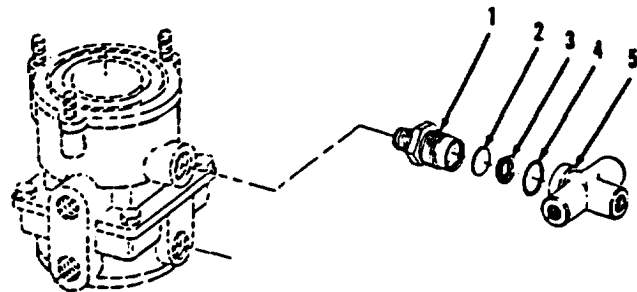
Condition Description

Check valve removed from  
treadle valve.

---

DISASSEMBLY

1. Using a 1-1/8" open end wrench,  
remove seat (1).
2. Remove and discard diaphragm (2) and  
ring (3) from body (5).
3. Remove and discard preformed packing  
(4).



Go to sheet 2

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-10. Treadle Check Valve (S/N 2001 and above). (Sheet 2 of 3)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

4. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
5. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

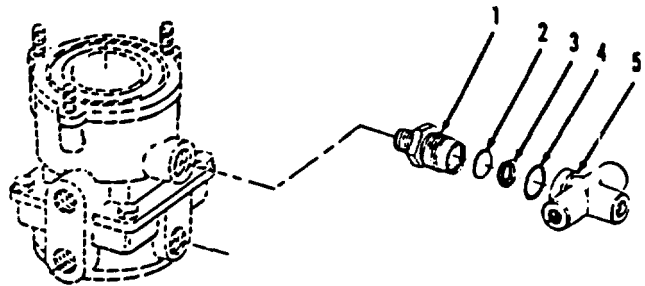
8-10. Treadle Check Valve (S/N 2001 and above). (Sheet 3 of 3)

ASSEMBLY

6. Install new preformed packing (4) on seat (1).
7. Install new ring (3) and new diaphragm (2) on body (5).
8. Using a 1-1/8" socket, socket wrench handle and torque wrench, install seat (1). Tighten seat (1) to 45 lb-ft .

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

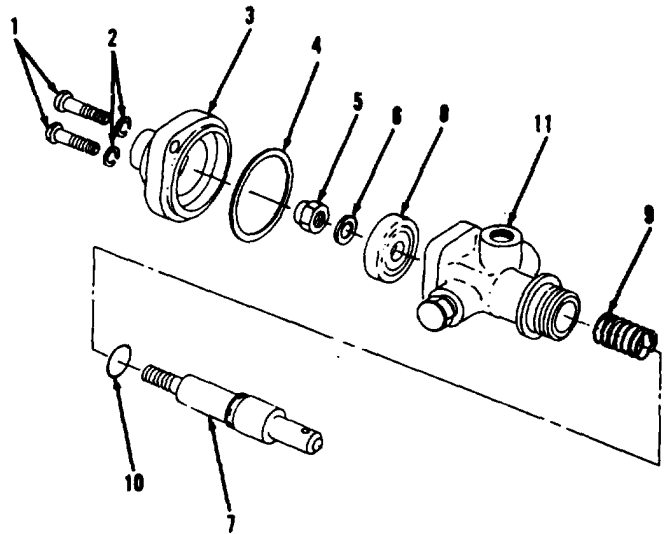


BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-11. Parking Brake Control Valve. (Sheet 2 of 4)

DISASSEMBLY

1. Using a 7/16" socket and socket wrench handle, remove two screws (1) and lock washers (2).
2. Using a flat brass punch, separate cover (3) and seal ring (4) from body (11). Discard seal ring (4).
3. Hold plunger (7).
4. Using a 9/16" socket and socket wrench handle, remove and discard locknut (5) and washer (6)
5. Remove plunger (7), valve (8) and spring (9) from body (11). Discard valve (8).
6. Remove and discard preformed packing (10).



Go to sheet 3



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-11. Parking Brake Control Valve. (Sheet 3 of 4)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

7. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
8. Inspect all parts. Refer to paragraph 2-9.

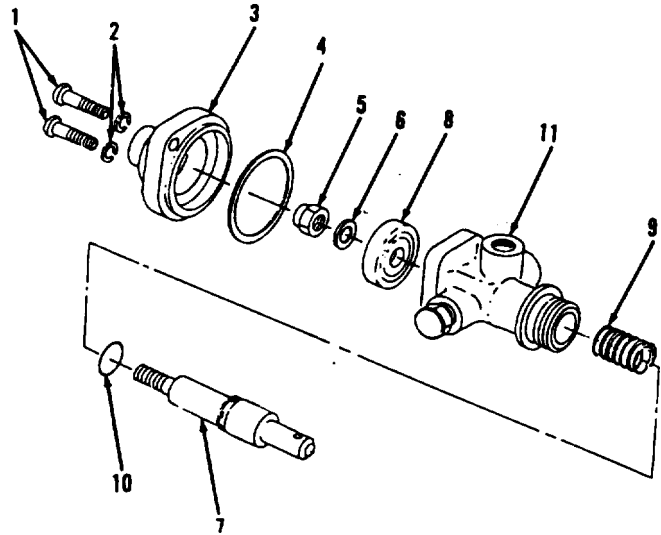
Go to sheet 4

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-11. Parking Brake Control Valve. (Sheet 4 of 4)

ASSEMBLY

9. Install new preformed packing (10) and spring (9) on plunger (7).
10. Install plunger (7) in body (11).
11. Install new valve (8).
12. Using a 5/8" socket, socket wrench handle and torque wrench, install new washer (6) and locknut (5). Tighten locknut (5) to 35 in-lb.
13. Position new seal ring (4) and **cover** (3)
14. Using a 9/16" socket and socket wrench handle, install two lock washers (2) and screws (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-12. Treadle Valve (S/N 2000 and below). (Sheet 1 of 7)

This task covers:        a. Disassembly                                b. Cleaning/Inspection  
                                       c. Assembly

## INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
 Automotive  
 NSN 5180-00-177-7033  
 Shop Equipment, Automotive  
 Maintenance and Repair:  
 Field Maintenance, Basic,  
 Less Power  
 NSN 4910-00-754-0705  
 Shop Equipment, Automotive  
 Maintenance and Repair:  
 Field Maintenance  
 NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
 (App. C, Item 5)  
 Clean cloth (App. C, Item 24)  
 Detergent ( App. C, Item 33)  
 Grease (App. C, Item 11)  
 Valve (2)  
 Preformed packing (3)

Torques

Except for special torques shown,  
 all fasteners are tightened to a  
 standard torque. Refer to  
 Appendix E.

## EQUIPMENT CONDITION

References

TM 10-3930-643-20

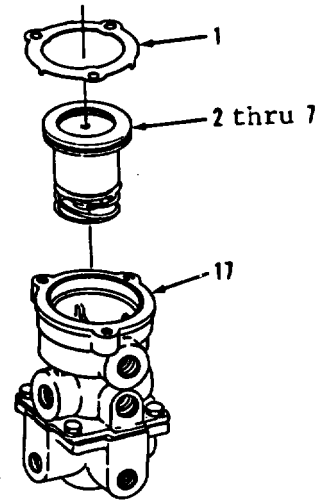
Condition Description

Treadle valve removed.

Go to sheet 2

DISASSEMBLY

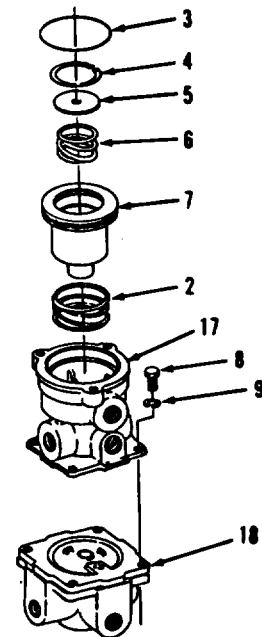
1. Using a flat brass punch, depress piston (7) to compress spring (2).
2. Remove retainer (1).
3. Remove items 2 thru 7 as an assembly from body (17).
4. Remove spring (2) from piston (7).
5. Remove and discard preformed packing (3) from piston (7).
6. Using a flat brass punch, depress retainer (5) in piston (7).
7. Using snap ring pliers, remove ring (4).
8. Remove retainer (5) and spring (6) from piston (7).



NOTE

Use scribe or punch to aid in assembly.

9. Matchmark body (17), cover (18) and body (33).
10. Using a 9/16" socket and socket wrench handle, remove four bolts (8) and lock washers (9).
11. Using a flat tip screwdriver, separate body (17) and cover (18).



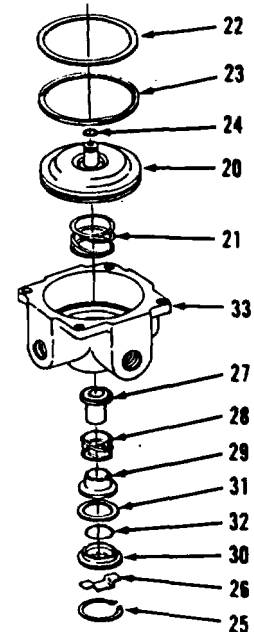
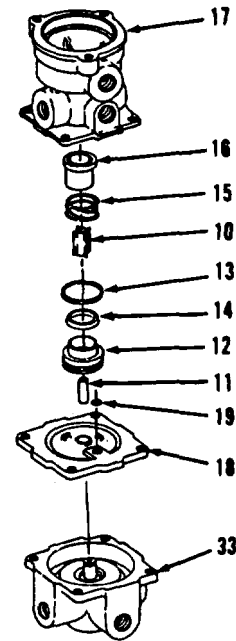
Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-12. Treadle Valve (S/N 2000 and below). (Sheet 3 of 7)

DISASSEMBLY

12. Remove and separate guide (10) and push rod (11).
13. Remove valve guide (12).
14. Using a small flat tip screwdriver, remove and discard seals (13 and 14) from valve guide (12).
15. Remove and separate spring (15) and valve (16) from body (17). Discard valve (16).
16. Separate cover (18) and body (33).
17. Remove and discard preformed packing (19).
18. Remove items 20 thru 24 as an assembly from body (33).
19. Remove spring (21), seals (22 and 23) and preformed packing (24) from piston (20). Discard seals (22 and 23) and preformed packing (24).
20. Using snap ring pliers, remove ring (25) and shield (26).
21. Remove items 27 thru 32 as an assembly from body (33).
22. Remove valve (27), spring (28), valve guide (29) and items 30 thru 32 as an assembly. Discard valve (27).
23. Remove and discard seals (31 and 32) from retainer (30).



Go to sheet 4

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-12. Treadle Valve (S/N 2000 and below). (Sheet 4 of 7)

CLEANING/INSPECTION

24. Wipe all rubber and plastic parts with a clean cloth moistened with mild detergent and water solution.

**WARNING**

● TOXICIFLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If **you** become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

25. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
26. Inspect all parts. Refer to paragraph 2-9.

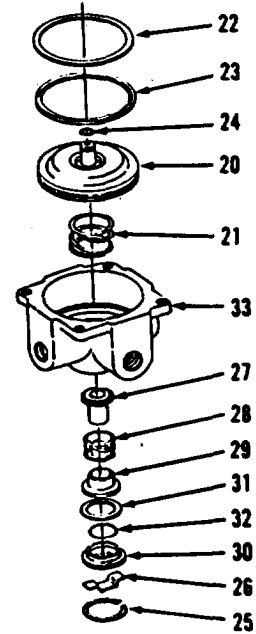
Go to sheet 5

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-12. Treadle Valve (S/N 2000 and below). (Sheet 5 of 7)

ASSEMBLY

27. Lubricate new seals (32 and 31) with clean grease.
28. Install new seals (32 and 31) in retainer (30).
29. Install valve guide (29).
30. Install spring (28) and new valve (27).
31. Lubricate center bore of body (33) with clean grease.
32. Using internal snap ring pliers, install items 32 thru 27 as an assembly, shield (26) and ring (25).
33. Install new preformed packing (24) and new seals (23 and 22) on piston (20).
34. Lubricate piston (20) with clean grease.
35. Install spring (21) and piston (20) in body (33).



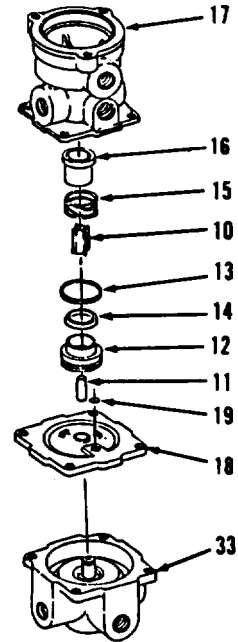
Go to sheet 6

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-12. Treadle Valve (S/N 2000 and below). (Sheet 6 of 7)

ASSEMBLY (cont)

- 36. Install new preformed packing (19) in cover (18).
- 37. Position cover (18) with atchmarks on body (33).
- 38. Lubricate center bore of body (17) with clean grease.
- 39. Install new valve (16) in spring (15).
- 40. Lubricate new seals (14 and 13) with clean grease and install.
- 41. Install new seal (14) in valve guide (12).
- 42. Install new seal (13) on valve guide (12).
- 43. Install new valve (16) in valve guide (12).
- 44. Install items 16 thru 12 as an assembly in body (17).
- 45. Install push rod (11) in guide (10).



Go to sheet 7

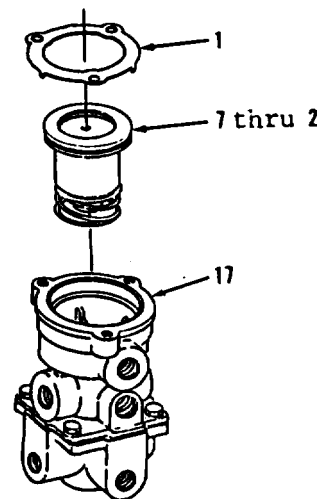
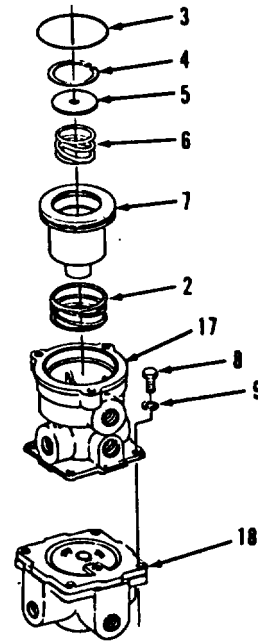


BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-12. Treadle Valve (S/N 2000 and below). (Sheet 7 of 7)

ASSEMBLY

46. Install guide (10) in new valve (16).
47. Position body (17) with matchmarks on cover (18).
48. Using a 9/16" socket and socket wrench handle, install four lock washers (9) and bolts (8).
49. Lubricate bore of piston (7) with clean grease.
50. Using a flat brass punch, position spring (6) and retainer (5) in piston (7). Depress retainer (5).
51. Using internal snap ring pliers, install ring (4).
52. Lubricate outer diameter of new preformed packing (3) with clean grease and install.
53. Install spring (2) on piston (7).
54. Install items 7 thru 2 as an assembly in body (17). Depress to compress spring (2).
55. Install retainer (1).



**NOTE**

Return M10A Forklift to original equipment condition.

END OF TASK

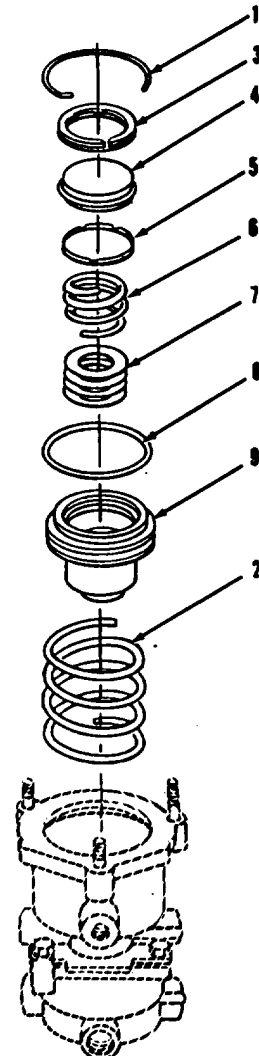


BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-13. Treadle Valve (S/N 2001 and above). (Sheet 2 of 8)

DISASSEMBLY

1. Using a flat brass punch, depress piston (9) to compress spring (2).
2. Using internal snap ring pliers, remove ring (1).
3. Remove spring (2) and items 3 thru 9 as an assembly. Discard spring (2).
4. Using a flat brass punch, depress retainer (4).
5. Using internal snap ring pliers, remove ring (3).
6. Remove retainer (4), ring (5), spring (6), shims (7) and preformed packing (8) from piston (9). Discard preformed packing (8).



Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-13. Treadle Valve (S/N 2001 and above). (Sheet 3 of 8)

DISASSEMBLY (cont)

NOTE

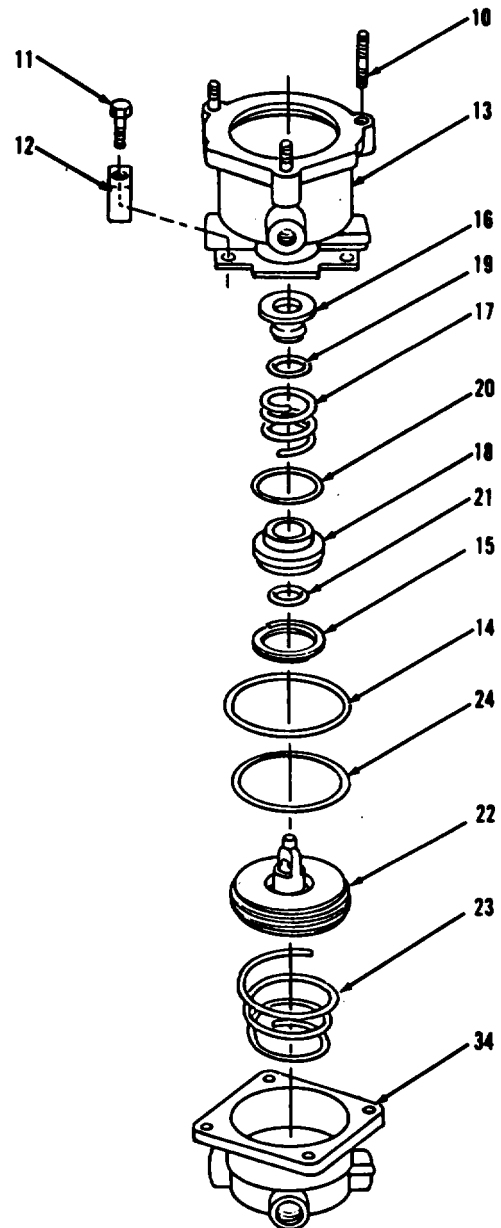
Remove studs from body only if inspection indicates replacement is necessary.

- 7. Using a vise grip, remove three studs (10), if necessary.

NOTE

Use scribe or punch to aid in assembly.

- 8. Matchmark bodies (13 and 34).
- 9. Using a 7/16" socket and socket wrench handle, remove four screws (11) and tag (12).
- 10. Separate bodies (13 and 34).
- 11. Remove and discard preformed packing (14).
- 12. Using a flat brass punch, depress body (18).
- 13. Remove ring (15).
- 14. Separate valve (16), spring (17), body (18) and preformed packing (19). Discard valve (16), spring (17) and preformed packing (19).
- 15. Remove and discard preformed packings (20 and 21).
- 16. Remove disk (22) and spring (23). Discard spring (23).



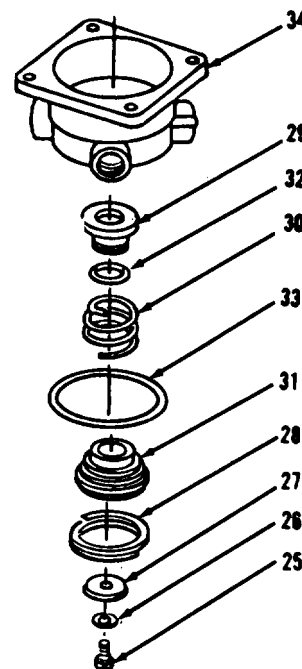
Go to sheet 4

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-13. Treadle Valve (S/N 2001 and ab+ove). (Sheet 4 of 8)

DISASSEMBLY

17. Using a small flat tip screwdriver, remove and discard preformed packing (24).
18. Remove screw (25), washer (26) and diaphragm (27).
19. Using a flat brass punch, depress body (31).
20. Remove ring (28).
21. Remove items 29 thru 33 as an assembly from body (34).
22. Separate valve (29), spring (30), body (31) and preformed packing (32). Discard valve (29), spring (30) and preformed packing (32).
23. Remove and discard preformed packing (33).



Go to sheet 5

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-13. Treadle Valve (S/N 2001 and above). (Sheet 5 of 8)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

1 COMPRESSED AIR HAZARD

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

24. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
25. Inspect all parts. Refer to paragraph 2-9.

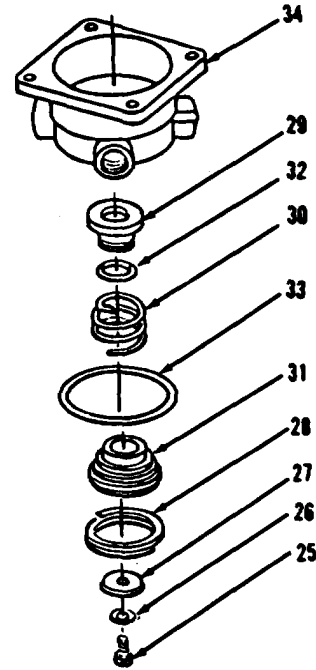
Go to sheet 6

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-13. Treadle Valve (S/N 2001 and above). (Sheet 6 of 8)

ASSEMBLY

26. Lubricate new preformed packings (33 and 32) with clean grease and install.
27. Install new spring (30) and new valve (29) in valve body (31).
28. Lubricate center bore of body (34) with clean grease and install.
29. Install items 33 thru 29 as an assembly and ring (28) in body (34).
30. Using flat tip screwdriver, install diaphragm (27), washer (26) and screw (25). Tighten screw (25) to 7 in-lb.

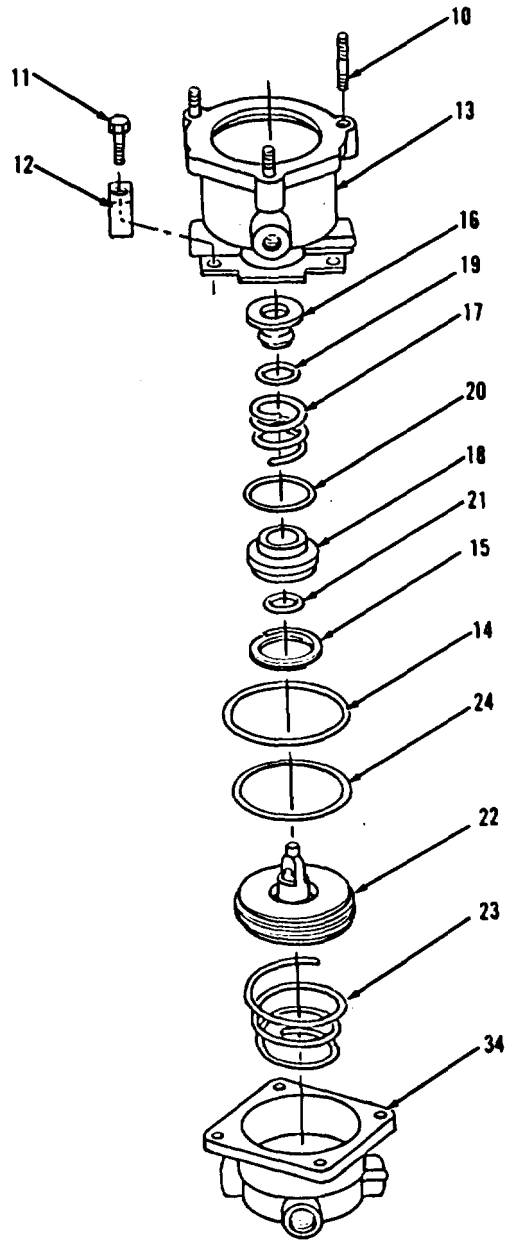


Go to sheet 7

8-13. Treadle Valve (S/N 2001 and above). (Sheet 7 of 8)

ASSEMBLY (cont)

- 31. Lubricate new preformed packing (24) and install.
- 32. Install new spring (23) and disc (22) in body (34).
- 33. Lubricate new preformed packing (21 and 20) with clean grease and install.
- 34. Lubricate new preformed packing (19) with clean grease and install with new spring (17).
- 35. Install new valve (16), ring (15) and new preformed packing (14) in body (18).
- 36. Lubricate center bore of body (13) with clean grease.
- 37. Install items 21 thru 16 as an assembly in body (13).
- 38. Position body (13) with matchmark on body (34).
- 39. Using a 7/16" socket, socket wrench handle and torque wrench, install tag (12) and four screws (11). Tighten four screws (11) to 55 in-lb.
- 40. Coat threads of three studs (10) with thread sealant and install, if removed. Tighten three studs (10) to 25 in-lb.



Go to sheet 8



BRAKE TROUBLESHOOTING AND MAINTENANCE.

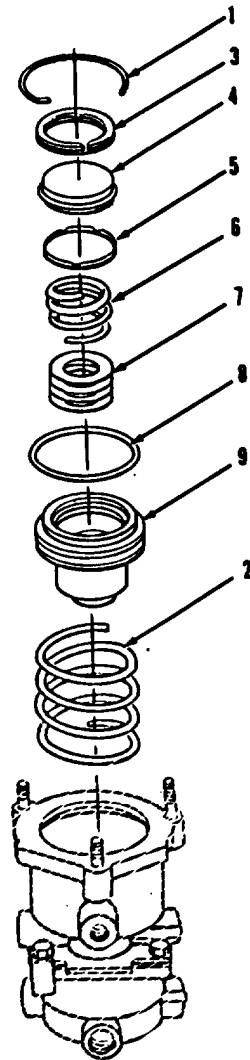
8-13. Treadle Valve (S/N 2001 and above). (Sheet 8 of 8)

ASSEMBLY

41. Lubricate center bore of piston (9) with clean grease.
42. Lubricate new preformed packing (8) with clean grease and install.
43. Position shims (7), spring (6), ring (5) and retainer (4) in piston (9).
44. Using a flat brass punch, depress retainer (4).
45. Using internal snap ring pliers, install ring (3).
46. Install new spring (2) on piston (9).
47. Install items 9 thru 2 as an assembly in body (13).
48. Using internal snap ring pliers, install ring (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-14. Air Compressor. (Sheet 1 of 13)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Shop Equipment, Machine Shop:  
  Field Maintenance,  
  Basic, Less Power  
  NSN 3470-00-754-0708  
Shop Equipment, Machine Shop:  
  Field Maintenance,  
  Basic, MAP only  
  NSN 3470-00-919-0068  
Tool Kit, General Mechanic's  
  Automotive  
  NSN 5180-00-177-7033  
Micrometer  
Feeler gage  
Piston ring compressor

Materials/Parts

Cleaning solvent P-D-680  
  (App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Plastigage (App. C, Item 22)  
Quick drying paint  
  (App. C, Item 6)  
Casket (4)  
Preformed packing  
Seal (2)  
Bushing  
Bushing (2)

Torques

Bolts (1) to 18 lb-ft.  
Bolts (4 and 14) to 15 lb-ft,  
Two bolts (20) to 8 lb-ft. and  
  9 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Air Compressor removed.

---

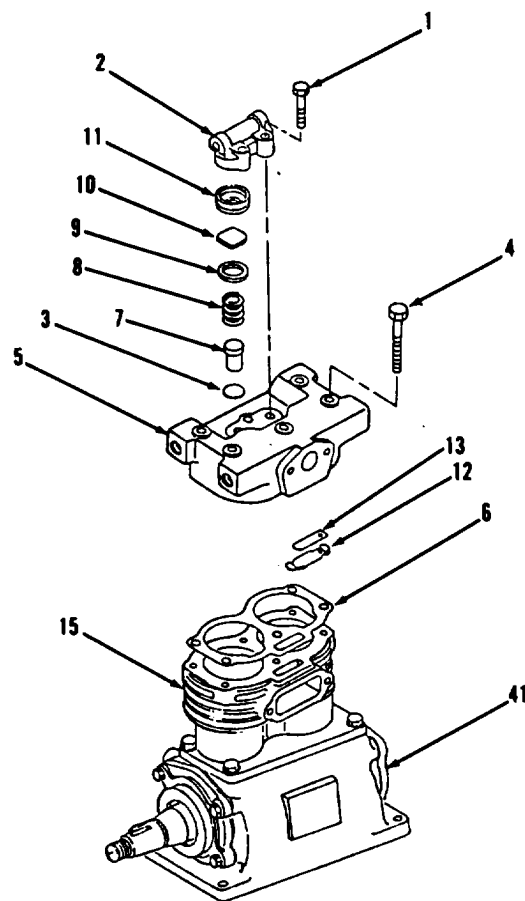
Go to sheet 2

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-14. Air Compressor. (Sheet 2 of 13)

DISASSEMBLY

1. Using a 7/16" socket and socket wrench handle, remove two bolts (1), valve (2) and two cups (3) from cylinder head (5).
2. Using snap ring pliers, remove two cages (7), springs (8), washers (9), valves (10) and seats (11) from valve (2).
3. Using a drift punch and hammer, matchmark cylinder head (5) and cylinder block (15) with punch in crankcase (41).
4. Using a 1/2" socket and socket wrench handle, remove five bolts (4), cylinder head (5) and gasket (6). Discard gasket (6).
5. Using a gasket scraper, scrape carbon accumulations from under cylinder head (5).
6. Using a small flat tip screwdriver, pry off two guards (12) and valves (13) on cylinder head (5).



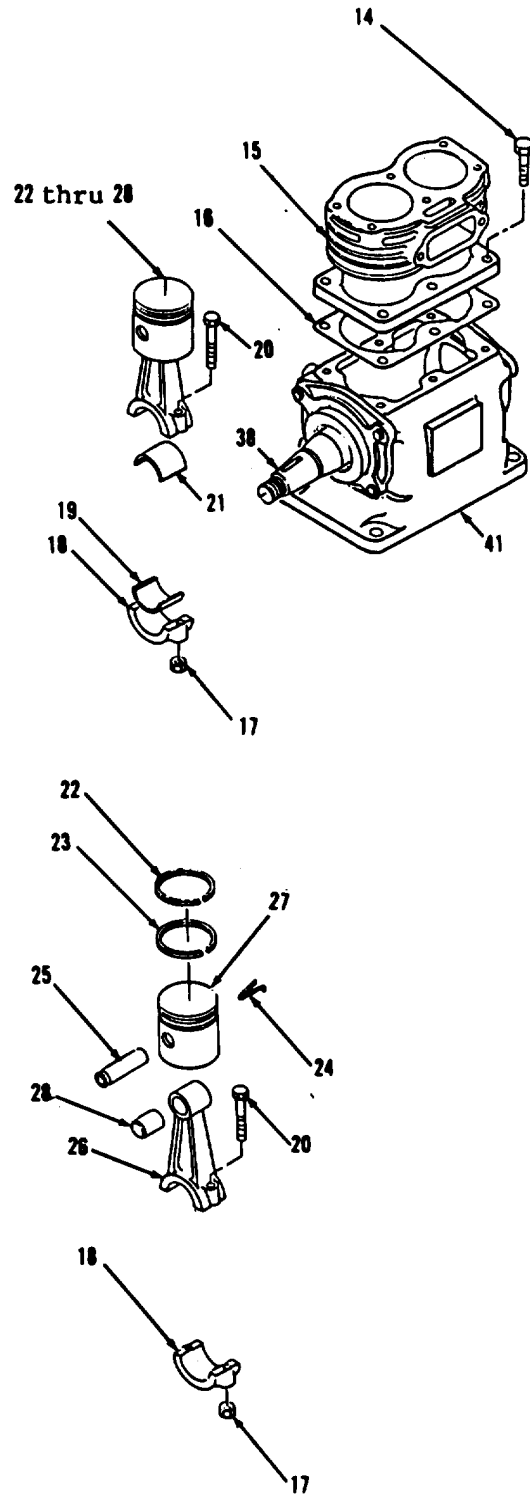
go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-14. Air Compressor. (Sheet 3 of 13)

DISASSEMBLY (cont)

7. Using a drift punch and hammer, matchmark cylinder block (15) and crankcase (41) with punch.
8. Using a 1/2" open end wrench, remove six lock bolts (14), cylinder block (15) and gasket (16) from crankcase (41). Discard gasket (16).
9. Lift cylinder block (15) straight up until clear of pistons.
10. Position crankcase (41) on one side.
11. Rotate crankshaft (38) to bring one connecting rod (26) to bottom of stroke.
12. Using a 1/4" socket, socket wrench handle and an open end wrench, remove two locknuts ((17), rod cap (18), bearing half (19), two bolts (20), items 22 thru 28 as an assembly and bearing half (21). Discard bearing halves (19 and 21).
13. Repeat procedure for second connecting rod and piston assembly.
14. Replace two rod caps (18) on connecting rods (26).
15. Using a 1/4" socket and socket wrench handle, install four bolts (20) and locknuts (17).
16. Identify connecting rods (26) as matched assemblies by marking with quick dry paint.
17. Using a small flat tip screwdriver, remove ring sets (22 and 23) from connecting rod and piston assembly.



Go to sheet 4

BRAKE TROUBLESHOOTING AND MAINTENANCE.

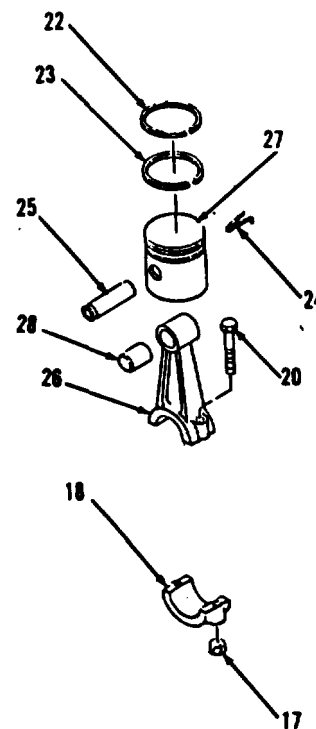
8-14. Air Compressor. (Sheet 4 of 13)

DISASSEMBLY

18. Clamp piston (27) bottom side up in soft-jawed vise.
19. Insert pointed tool in hole on bottom side of pin (25).
20. Press downward to force end of lockwire (24) out of hole.
21. Using long round nose pliers, remove lockwire (24) through bore of piston (27).
22. Using a flat punch and hammer, remove pin (25) and connecting rod (26).
23. Using a flat punch and hammer, remove and discard bushing (28) from connecting rod (26).

NOTE

Disassembly procedure for second connecting rod and piston assembly is identical.



Go to sheet 5

DISASSEMBLY (cont)

24. Using a 1/2" socket and socket wrench handle, remove four lock bolts (29) and bearing cap (33).

25. Remove and discard seal (30), preformed packing (31) and gasket (32) from bearing cap (33). Remove all gasket material from mounting surfaces.

26. Remove four lock bolts (34), bearing cap (35) and gasket (36) from crankcase (41). Discard gasket (36).

27. Using a small flat tip screwdriver, remove and discard seal (37) in bearing cap (35).

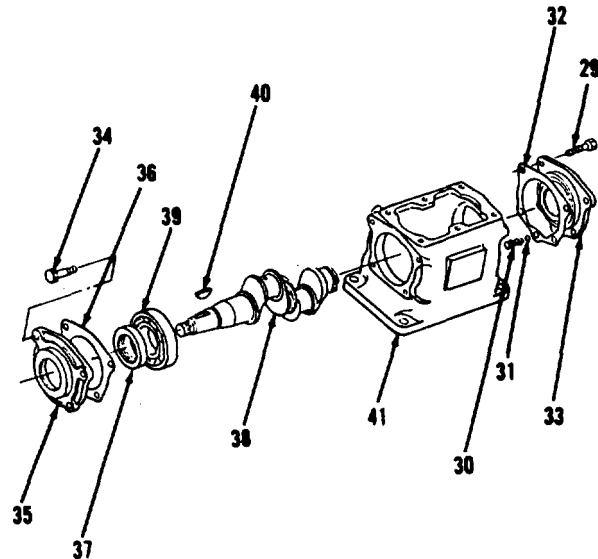
28. Align front connecting rod bearing journal of crankshaft (38) in crankcase (41) with cut-out portion of crankshaft (38) bearing bore in front end of crankcase (41).

29. Using a soft faced hammer against rear end of crankshaft (38), drive bearing (39) free from supporting bore of crankshaft (38) in crankcase (41)\*

30. Remove crankshaft (38) from crankcase (41).

31. Using a press, remove bearing (39) from crankshaft (38).

32. Using a small flat tip screwdriver, remove key (40).



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-14. Air Compressor. (Sheet 6 of 13)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

33. Clean all parts with cleaning solvent P-D-680. If necessary, run wire or wire brush through oil passages in crankshaft (38) to remove oil deposits. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 7

8-67

8-14. Air Compressor. (Sheet 7 of 13)

CLEANING/INSPECTION (cont)

34. Using a micrometer, measure front bearing journal (threaded end) of crankshaft (38). Dimension must be 1.3779 to 1.3784 inches.

35. Using a micrometer, measure rear bearing journal of crankshaft (38).

Standard dimension: 1.3779 to 1.3784 inches .

0.010 U/S dimension: 1.3684 to 1.3689 inches.

0.020 U/S dimension: 1.3584 to 1.3589 inches .

0.030 U/S dimension: 1.3484 to 1.3489 inches .

NOTE

If necessary, grind rear bearing journal to next lower undersize dimension and replace bearing cap with appropriate undersize bearing cap.

36. Using a micrometer, measure two connecting rod bearing journals.

Standard dimension: 1.1230 to 1.1235 inches.

0.020 U/S dimension: 1.1040 to 1.1035 inches.

0.030 U/S dimension: 1.0940 to 1.0935 inches.

Go to sheet 8



## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-14. Air Compressor. (Sheet 8 of 13)

CLEANING/INSPECTION

## NOTE

If necessary, grind connecting rod bearing journals to next lower undersize dimension and replace bearings with appropriate undersize bearings.

37. Inspect threads and keyway of crankshaft (38). Replace if keyway is chipped or misshaped or threads are stripped.
38. Using a micrometer, measure cylinder diameter of cylinder block (15). Cylinder diameter should be 1.995 to 2.000 inches.
39. Inspect cylinder block (15) for cracks, scoring, pitting or damage. If severe scoring or pitting of cylinder walls is evident, cylinders may be bored to 2.015 to 2.020 inches and pistons (27) replaced with oversize pistons.
40. Inspect piston (27) for cracks. Light scoring or abrasion marks can be removed with a stone.
41. Install ring sets (22 and 23).
42. Using a feeler gage, measure clearance of rings in grooves. Clearance should be 0.005 to 0.0025 inches.

Go to sheet 9

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-14. Air Compressor. (Sheet 9 of 13)

CLEANING/INSPECTION (cont)

43. Using a feeler gage, measure ring gap. Gap should be 0.003 to 0.010 inches.
44. Using a feeler gage, check clearance of pin (25) in bushing (28). Clearance should be 0.0002 to 0.0006 inches .

NOTE

Ensure that all match marks on connecting rods and rod caps are alined and connecting rods are installed on journal from which they were removed.

45. Using a 1/2" socket, socket wrench handle, torque wrench, install connecting rod (26), new bearing halves (19 and 21), two rod caps (18), bolts (20) and locknuts (17) on crankshaft (38) with Plastigage. Tighten four bolts (20) to 9 lb-ft.
46. Remove Plastigage and measure bearing clearance. Bearing clearance must be 0.0005 to 0.0020 inches.
47. Using a feeler gage, measure connecting rod (26) to crankshaft side clearance. Clearance must be 0.003 to 0.008 inches.

Go to sheet 10

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-14. Air Compressor. (Sheet 10 of 13)

CLEANING/INSPECTION

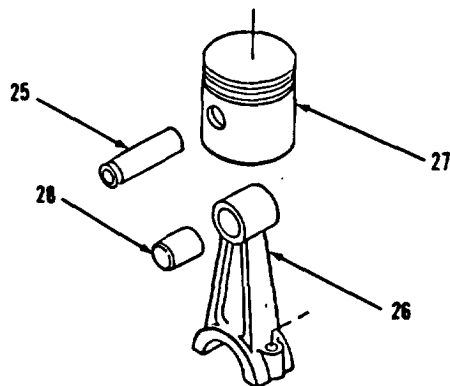
48. Inspect bearing cap (35) for cracks or damage. Replace if cracked or damaged.
49. Inspect cylinder head (5) for deposits or foreign matter. Carbon deposits in air inlet and exhaust cavities must be removed. Heavy accumulations of rust or foreign matter in water passage must be removed. A light coating of rust is acceptable.
50. Inspect valve seat surfaces for scratches, burrs or imperfections. Slight imperfections may be removed with a stone.
51. Inspect valves (2,8 and 13), two guards (12) cages (11) and seats (7) for nicks, burrs, pitting or roughness. Minor defects may be removed with lapping equipment. Pin in two guards (12) must be a tight fit in pin hole.
52. Using a micrometer, measure free length of two springs (10). Free length should be 0.97 inch. Apply load of 3.5 lbs to two springs (10). Using hydraulic pliers, measure test length. Test length should be 0.73 inches.

Go to sheet 11

8-14. Air Compressor. (Sheet 11 of 13)

ASSEMBLY

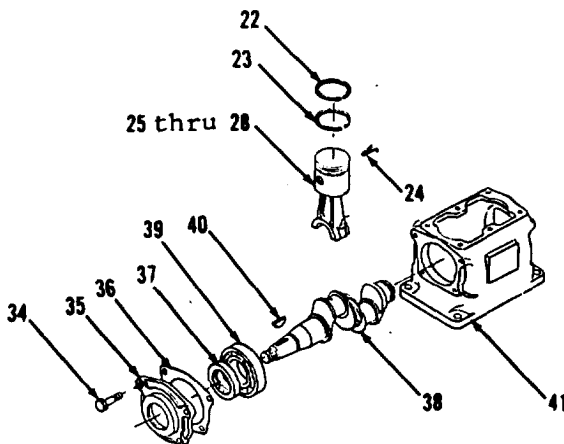
- 53. Using a hydraulic press or soft jawed vise, install new bushing (28) on connecting rod (26).
- 54. Using a soft jawed vise, install connecting rod (26) and pin (25) in piston (27).



NOTE

Ensure that lockwire holes in pistons and pin are alined during installation.

- 55. Using long round nose pliers, install lockwire (24).
- 56. Install ring sets (23 and 22). Position gap in rings 180 degrees apart.
- 57. Using a small hammer, install key (40) in crankshaft (38).
- 58. Press bearing (39) onto crankshaft (38).
- 59. Position crankshaft (38) in crankcase (41). Press bearing (39) in bore into crankcase (41).



- 60. Using a soft jawed vise, install new seal (37) in bearing cap (35).
- 61. Using a 1/2" socket and socket wrench handle, install new gasket (36), bearing cap (35) and four lock bolts (34) in crankcase (41).

Go to sheet 12

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-14. Air Compressor. (Sheet 12 of 13)

ASSEMBLY

Install new preformed packing (31) and new seal (30) in bearing cap (33).

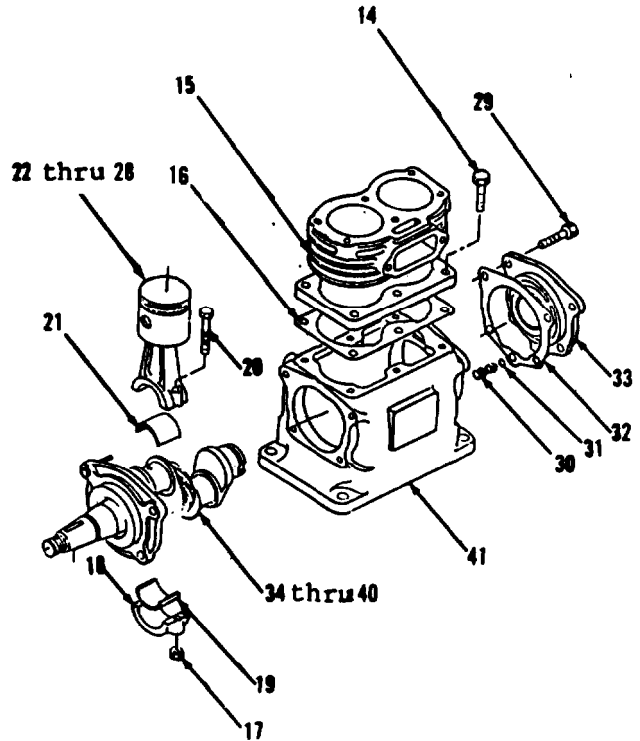
Using a 1/2" socket and socket wrench handle, install new gasket (32), new preformed packing (31), new seal (30), bearing cap (33) and four lock bolts (29) in crankcase (41).

64. Using a piston ring compressor, install items 28 thru 22 as an assembly in cylinder block (15).

65. Install new gasket (16) and cylinder block (15) with items 28 thru 22 as an assembly in crankcase (41). Guide lower ends of connecting rods onto journals on crankshaft.

66. Using a torque wrench and square drive to hex adapter, install six lock bolts (14). Tighten six lock bolts (14) to 15 lb-ft.

67. Using a 1/4" socket, socket wrench handle, torque wrench and a open end wrench, install new bearing halves (21 and 19), rod cap (18), two bolts (20) and locknuts (17). Tighten two bolts (20) to 8 lb-ft.



NOTE

Ensure match marks on connecting rod and rod cap are aligned.

68. Repeat procedure for second connecting rod and piston assembly.

Go to sheet 13

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

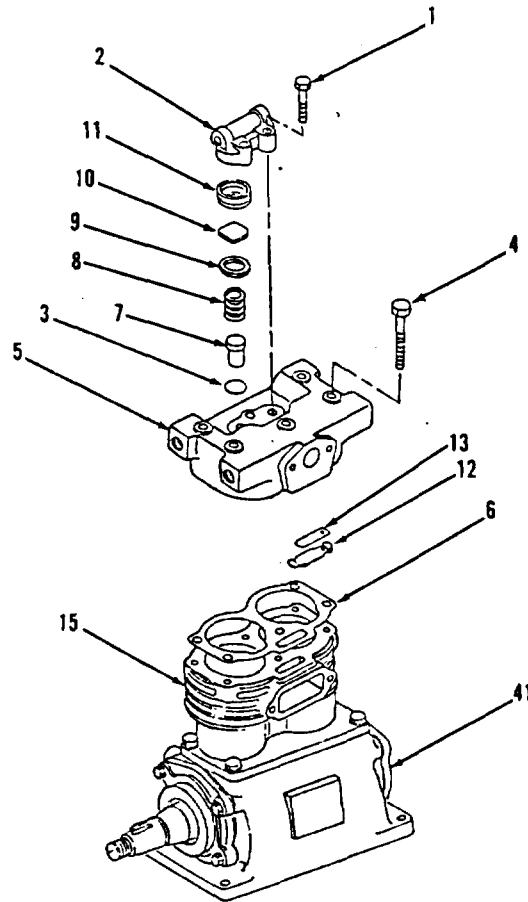
8-14. Air Compressor. (Sheet 13 of 13)

ASSEMBLY (cont)

69. Install two valves (13) and guards (12) in cylinder head (5). Guards must be staked and flush with cylinder head (5).
70. Using a 1/2" socket, socket wrench handle and torque wrench, install new gasket (6) , cylinder head (5) and five bolts (4) in crankcase (41). Tighten five bolts (4) to 15 lb-ft.
71. Using snap ring pliers, install two seats (11), valves (10), washers (9), springs (8) and cages (7) in valve (2).
72. Using a 7/16" socket, socket wrench handle and torque wrench, install two cups (3), valve (2) and two bolts (1) in cylinder head (5). Tighten two bolts (1) to 18 lb-ft.

NOTE

Return M10A Forklift to original equipment condition.



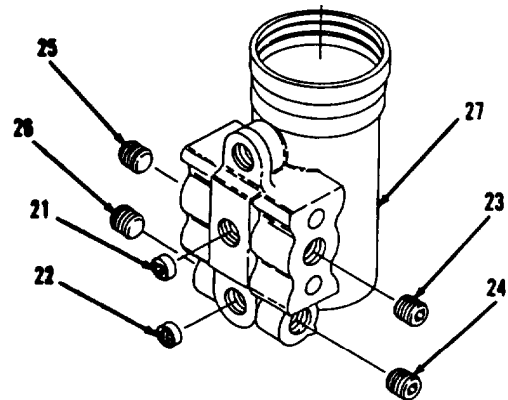
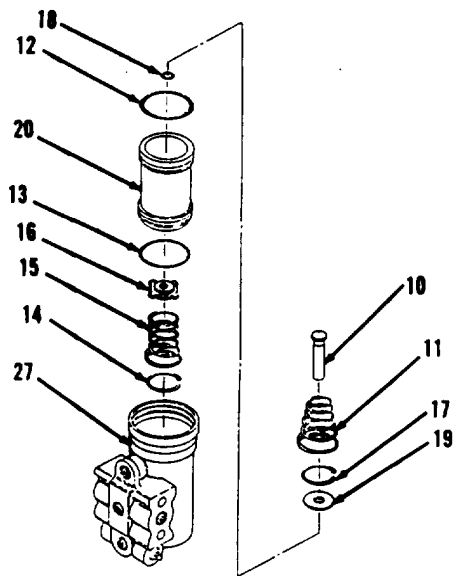
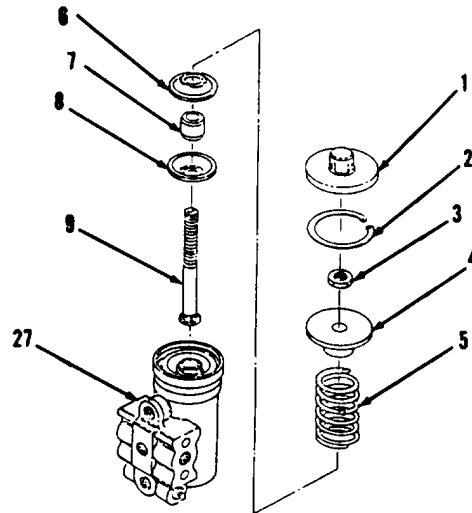
END OF TASK



8-15. Governor Assembly. (Sheet 2 of 5)

DISASSEMBLY

1. Using internal snap ring pliers, remove cover (1), retaining ring (2) and items 3 thru 9 as an assembly from body (27).
2. Using a 1/2" socket, socket wrench handle and flat tip screwdriver, remove nut (3), spring seat (4), spring (5), spring seat (6), guide (7) and spring seat (8) from screw (9).
3. Remove exhaust stem (10) and spring (11) from body (27).
4. Remove items 12 thru 20 as an assembly from body (27).
5. Using a small flat tip screwdriver, remove and discard preformed packings (12 and 13) from piston (20).
6. Using internal snap ring pliers, remove retaining ring (14), spring (15) and valve (16).
7. Remove retaining ring (17), washer (18) and grommet (19). Discard grommet (19).
8. Using long round nose pliers, remove filters (21 and 22) in body (27).
9. Using a socket head screw key, remove plugs (23 thru 26).



Go to sheet 3



BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-15. Governor Assembly. (Sheet 3 of 5)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

10. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
11. Inspect all parts. Refer to paragraph 2-9.

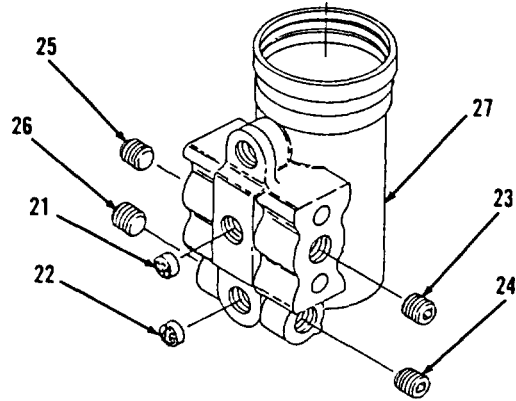
Go to sheet 4

ASSEMBLY

NOTE

Apply thread sealant before installation.

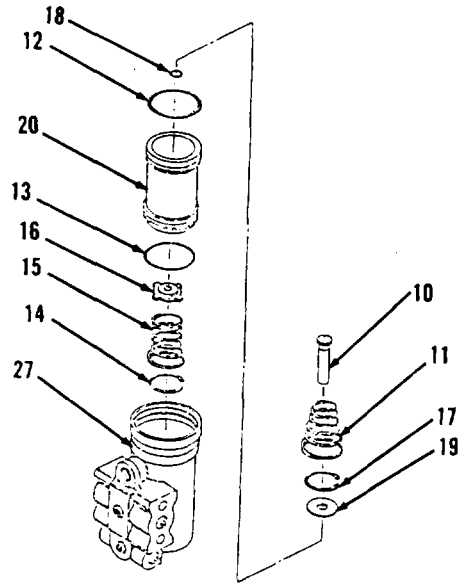
12. Using a socket head screw key, install plugs (26 thru 23).
13. Using long round nose pliers, install filters (22 and 21) in body (27).



NOTE

Before further assembly, lubricate lower bore of body, top of piston, piston grooves, preformed packings, guide, grommet and screw with grease.

14. Using internal snap ring pliers, install new grommet (19) in piston (20).
15. Using internal snap ring pliers, install washer (18) and retaining ring (17).
16. Using internal snap ring pliers, install valve (16), spring (15) and retaining ring (14). Small end of spring must be toward valve (16).
17. Install new preformed packings (13 and 12).
18. Install spring (11) and exhaust stem (10) in piston (20).
19. Install items 12 thru 20 as an assembly in body (27).

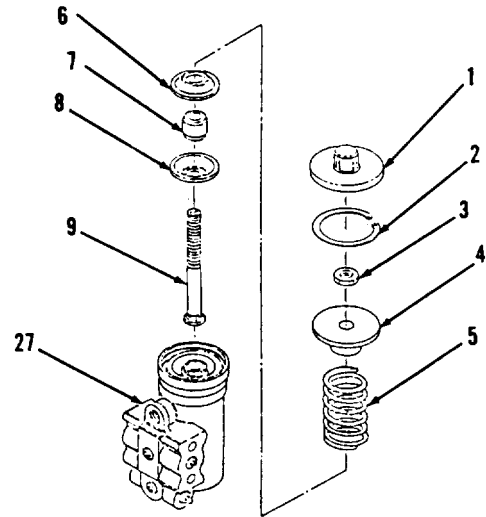


BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-15. Governor Assembly. (Sheet 5 of 5)

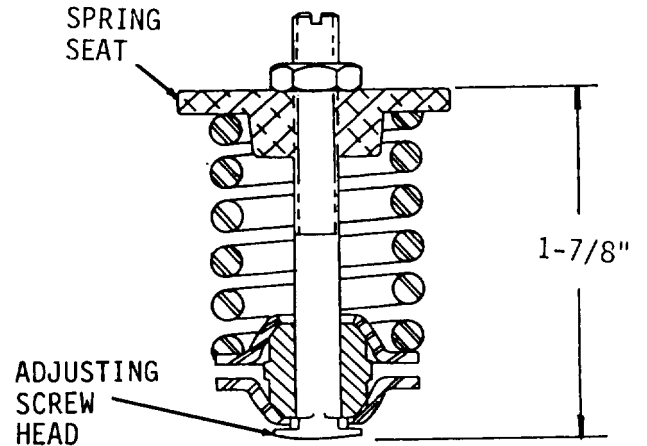
ASSEMBLY

20. Using a 1/2" socket and socket wrench handle, install spring seat (8), guide (7), spring seat (6), spring (5), spring seat (4) and nut (3). Tighten spring seat (4) until dimension between head of screw (9) and spring seat (4) is as shown.
21. Using internal snap ring pliers, install items 3 thru 9 as an assembly, retaining ring (2) and cover (1) in body (27).



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

8-16. Parking Brake Assembly. (Sheet 1 of 6)

- This task covers:
- a. Removal
  - b. Cleaning/Inspection
  - c. Installation

---

INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Cotter pin

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Parking brake linkage removed.  
Propeller shaft (transmission to rear  
axle) removed.

---

Go to sheet 2

BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-16. Parking Brake Assembly . (Sheet 2 of 6)

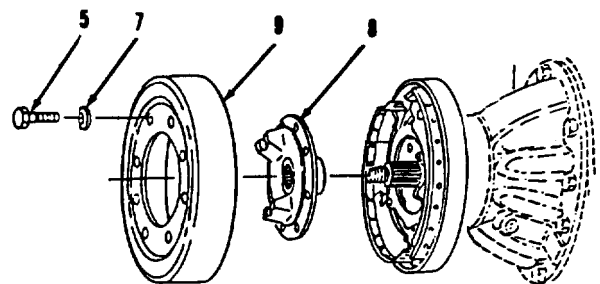
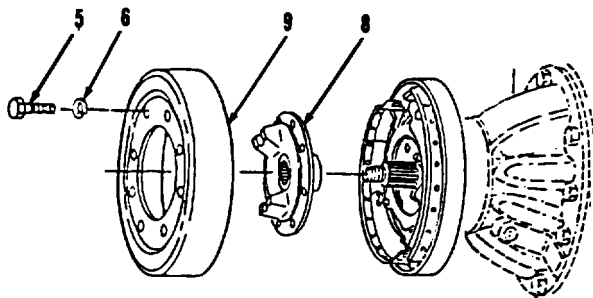
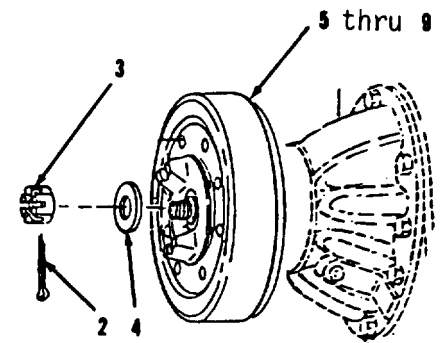
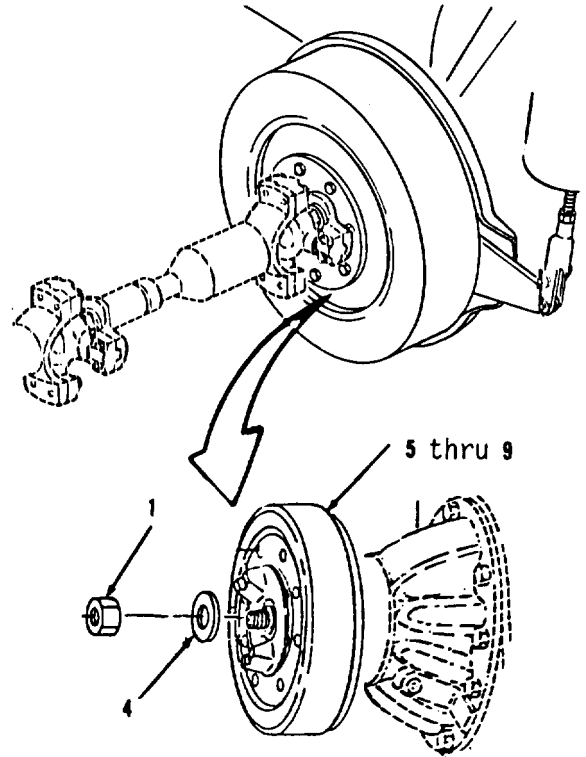
REMOVAL

NOTE

1 Hold flange yoke while removing nut from vehicle S/N 2000 and below.

1 The following are differences between M10A Forklift models. The removal/installation procedures are identical.

1. Using a 1-5/16" socket and socket wrench handle, remove nut (1) and washer (4) from vehicles S/N 2000 and below or remove cotter pin (2), locknut (3) and washer (4) from vehicles S/N 2001 and above from rear axle under vehicle.
2. Using a suitable puller, remove items 5 thru 9 as an assembly.
3. Using a 9/16" socket and socket wrench handle, remove eight bolts (5), lock washers (6) and flange yoke (8) from brake drum (9) on vehicles S/N 2000 and below or washers (7) and flange yoke (8) on vehicles S/N 2001 and above from brake drum (9).



Go to sheet 3

BRAKE TROUBLESHOOTING AND MAINTENANCE. (cont)

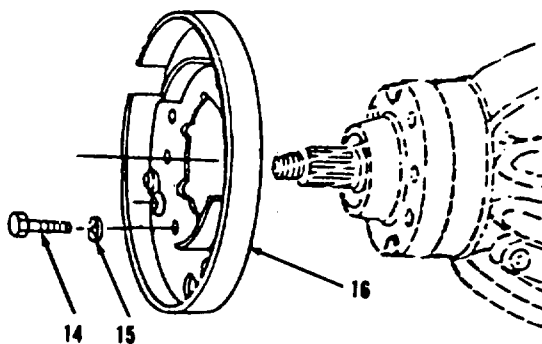
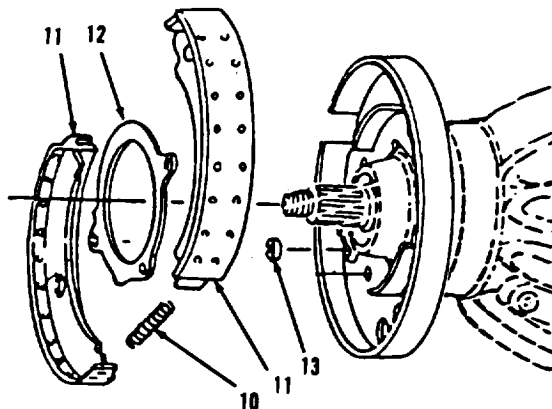
8-16. Parking Brake Assembly. (Sheet 3 of 6)

REMOVAL (cont)

4. Using brake spring pliers, remove two springs (10), shoe assemblies (11), lever (12) and roller (13) from rear axle, under vehicle.
5. Using a 3/4" socket and socket wrench handle, remove six bolts (14), washers (15) and plate (16).

NOTE

- Inspect shoe assemblies for wear of linings. If worn below 1/8", replace brake shoe assembly.
- Brake shoe assemblies must be replaced in pairs.



Go to sheet 4

## BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-16. Parking Brake Assembly. (Sheet 4 of 6)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

6. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

## NOTE

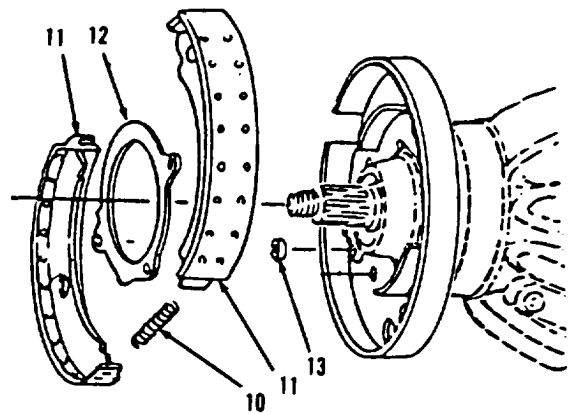
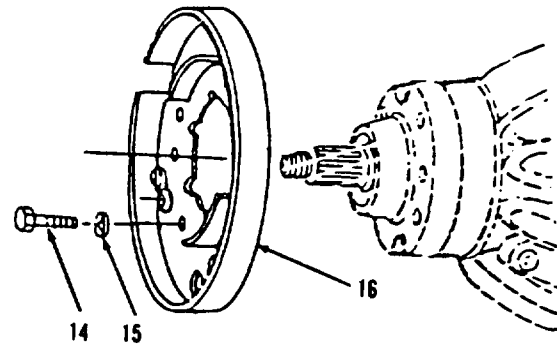
If necessary, resurface brake drum.

7. Measure inside diameter of brake drum (9). If measurement exceeds 13.410 inches, replace drum.
8. Inspect brake drum (9) for scoring or cracks. Replace if necessary.
9. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

INSTALLATION

10. Using a 13/16" socket and socket wrench handle, install plate (16), six washers (15) and bolts (14) in rear axle under vehicle.
11. Lubricate and install roller (13), contact points and lever (12). Lever (12) must be positioned on left hand brake pawl. Roller (13) on right hand brake pawl must ride on upper edge of lever (12).
12. Lubricate shoe (17) to bracket contact point. Install two shoe assemblies (11). Web of shoe assemblies (11) must be positioned under guide brackets on plate (16).
13. Using brake spring pliers, install two springs (10). Springs (10) must be installed in holes near-est plate (16).





BRAKE TROUBLESHOOTING AND MAINTENANCE.

8-16. Parking Brake Assembly. (Sheet 6 of 6)

INSTALLATION

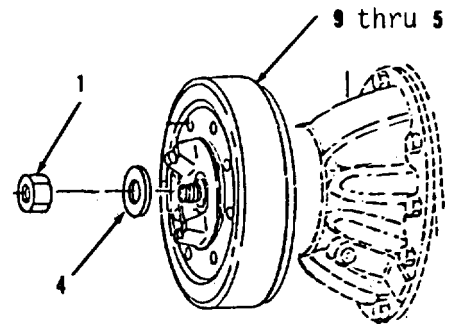
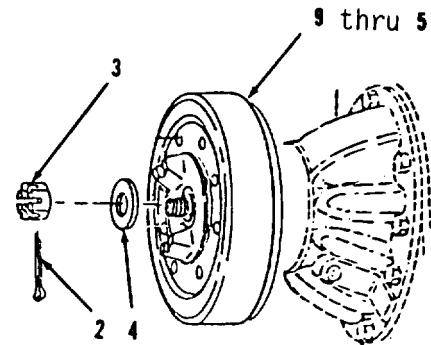
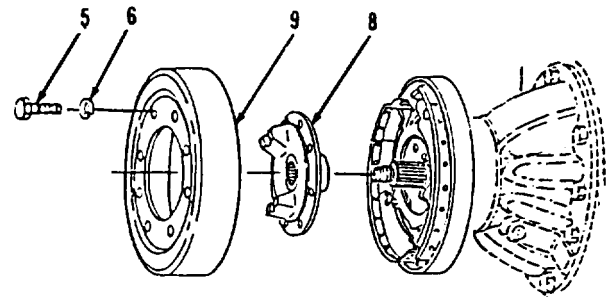
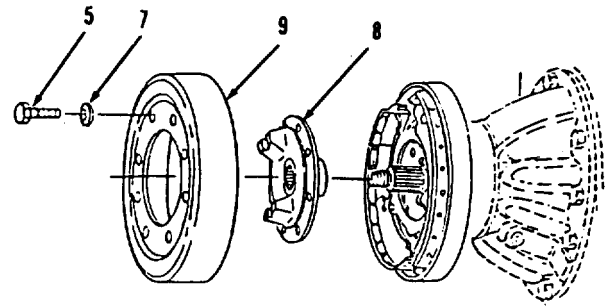
NOTE

The following are differences between M10A Forklift models.

14. Using a 9/16" socket and a socket wrench, install flange yoke (8), eight washers (7) and bolts (5) in vehicles S/N 2001 in brake drum (9) and above or flange yoke (8), eight lock washers (6) and bolts (5) in vehicles S/N 2000 and below in brake drum (9).
15. Install items 9 thru 5 as an assembly in rear axle, under vehicle.
16. Using a 1-5/16" socket and socket wrench handle, install washer (4), locknut (3) and new cotter pin (2) in vehicles S/N 2001 and above or washer (4) and nut (1) in vehicles S/N 2000 and below. Tighten locknut (1) to 300-400 lb-ft.
17. Using an adjustable wrench, adjust parking brake linkage, refer to TM 10-3930-643-20.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## CHAPTER 9

STEERING  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift steering system.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Steering Troubleshooting	9-1	9-2
Steering Gear Assembly	9-2	9-6
Ground Driven Steering Pump (S/N 2000 and below)	9-3	9-14
Ground Driven Steering Pump (S/N 2001 and above)	9-4	9-24
Steering Cylinder	9-5	9-32
Control Valve and Check Valve	9-6	9-37
Steering Circuit Relief Valve	9-7	9-52

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-1. Steering Troubleshooting.

---

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

---

a. SLOW STEERING AT LOW ENGINE RPM AND SLOW BOOM HYDRAULICS AT HIGH ENGINE RPM .

Step 1. Check operation of hydraulic pump for malfunction or worn parts.

Replace hydraulic pump, refer to paragraph 12-2.

Step 2. Check steering circuit relief valve pressure, refer to paragraph 9-7.

Adjust to correct pressure setting.

Step 3. Check steering circuit relief valve for leaks or defective operation.

Repair steering circuit relief valve, refer to paragraph 9-7.

b. SLOW STEERING.

Step 1. Check steering cylinder assembly for worn or scored piston rings or seals, refer to paragraph 9-5.

Step 2. Check inside diameter of steering cylinder for nicks and grooves too deep to be polished out.

Replace defective parts. Install repair kit.

For disassembly and inside inspection of cylinder assembly, refer to paragraph 9-5.

For replacement of cylinder assembly, refer to TM 10-3930-643-20.

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-1. Steering Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

c. NOISY OPERATION.

Step 1. Check steering circuit relief valve for possible chattering, refer to paragraph 9-7.

Repair as necessary.

Step 2. Refer to TM 10-3930-643-20 for other malfunctions (steering gear noise). Also, refer to paragraph 12-1.

d. HYDRAULIC OIL HEATING UP.

Step 1. Check steering circuit relief valve for insufficient valve pressure or pressure too high, refer to paragraph 9-7.

Adjust to correct pressure setting.

Step 2. Check steering circuit relief valve to determine if defective, refer to paragraph 9-7.

Repair steering circuit relief valve.

e. INSUFFICIENT STEERING PRESSURE.

Check steering circuit relief valve pressure, refer to paragraph 9-7.

Adjust to correct pressure setting.

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-1. Steering Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

f. STICKING CONTROL VALVE PLUNGER.

Step 1. Check control valve plunger bore for burrs or scoring, refer to paragraph 9-6.

Replace control valve.

Step 2. Check valve plunger in steering control valve to see if it is warped. Also, check for dirt or foreign matter, refer to paragraph 9-6.

Clean steering control valve. Replace plunger if necessary.

Step 3. Check control valve for damaged, broken or distorted springs, refer to paragraph 9-6.

Replace springs if damaged, broken or distorted.

g. PLAY IN STEERING GEAR.

Check for worn gear teeth in steering gear housing, refer to paragraph 9-2.

Repair steering gear.

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-1. Steering Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

h. HARD STEERING WHILE DRIVING.

Check oil pressure, if pressure is low, adjust to correct pressure setting, refer to paragraph 9-6.

Check frame hinge pins for frozen bushings, refer to paragraph 10-2.

Replace frame hinge pin bushings.

NOTE

Since the procedure for replacing frame hinge pin bushings requires so much time, other causes for malfunctions "h." should be thoroughly investigated, refer to TM 10-3930-643-20.

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-2. Steering Gear Assembly. (Sheet 1 of 8)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                              c. Assembly

---

INITIAL SETUP

Tool S

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Leas Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
Feeler gage

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean-cloth (App. C, Item 24)  
Multi-purpose gear grease  
(App; C; Item 10)  
Gasket  
Seal (2)

Torques

Nut (3) to 22 lb-ft.  
Locknut (4) to 90 lb-ft.  
Bolts (9) to 30 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Steering gear removed.

---



STEERING TROUBLESHOOTING AND MAINTENANCE.

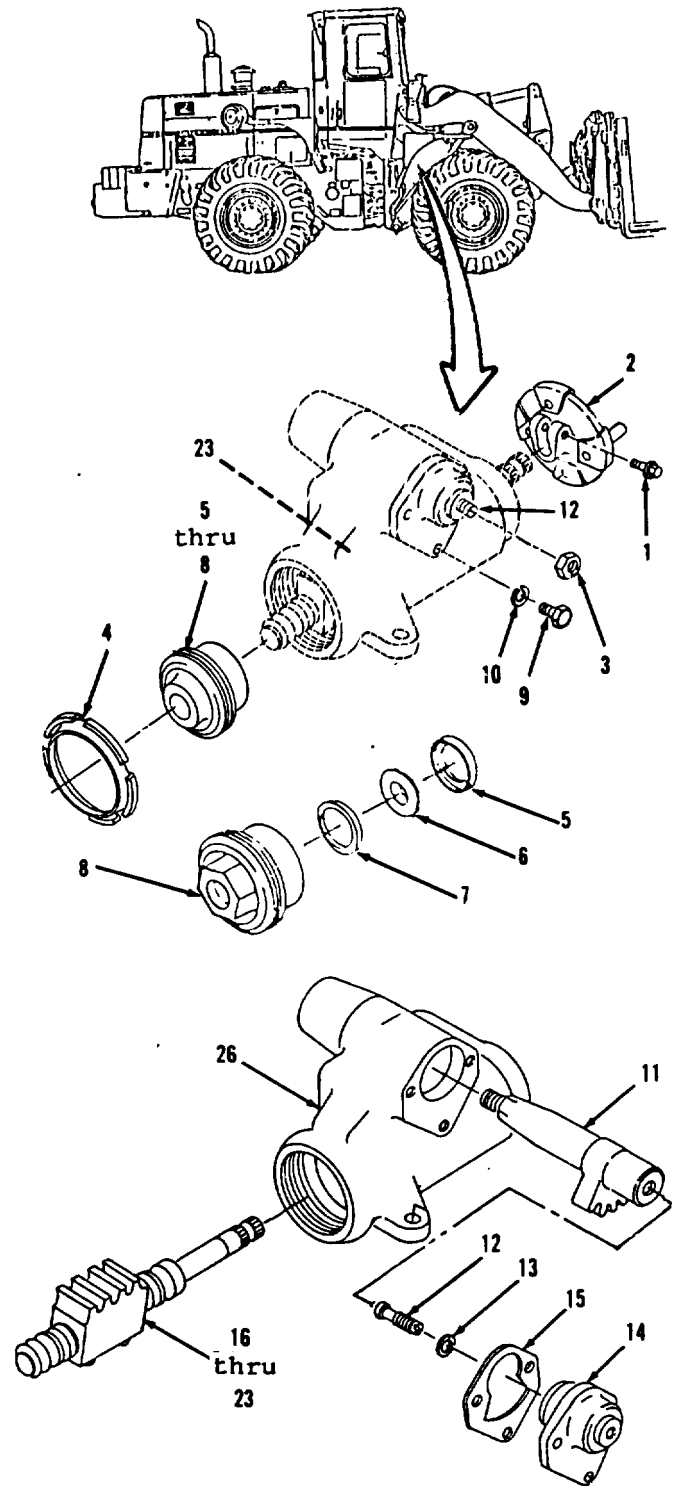
9-2. Steering Gear Assembly. (Sheet 2 of 8)

DISASSEMBLY

NOTE

Scribe a mark on flange and shaft of ballnut and worm assembly to aid in installation.

1. Using a 9/16" open end wrench, remove bolt (1) and flange (2).
2. Using a 3/4" socket and socket wrench handle, remove nut (3).
3. Turn setscrew (12) counterclockwise several times to relieve load from bearings (6 and 23).
4. Using a spanner wrench, remove locknut (4) and items 5 thru 8 as an assembly.
5. Using a cotter pin extractor, remove seat (5), bearing (6) and ring (7) from adjuster (8).
6. Using a 9/16" socket and socket wrench handle, remove three bolts (9), washers (10) and items 11 thru 15 as an assembly.
7. Using a large rubber mallet, remove gearshaft (11).
8. Using a flat tip screwdriver, remove setscrew (12), shim (13) and gasket (15) from cover (14). Discard gasket (15).
9. Using a large rubber mallet, remove items 16 thru 23 as an assembly from housing (26).

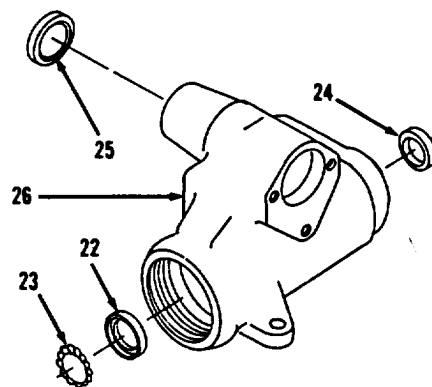
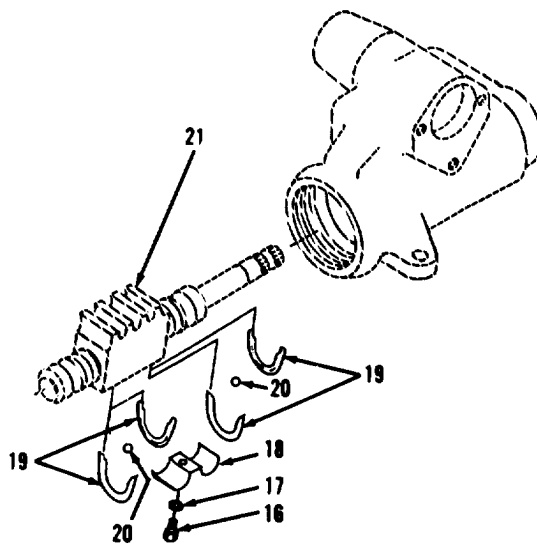


Go to sheet 3

9-2. Steering Gear Assembly. (Sheet 3 of 8)

DISASSEMBLY (cont)

10. Using a 3/8" socket and socket wrench handle, remove bolt (16), washer (17) and clamp (18).
11. Using long round nose pliers, remove four guides (19) and 54 balls (20) from ballnut and worm assembly (21), ring (22) and bearing (23).
12. Using a cotter pin extractor, remove and discard seals (24 and 25).



## STEERING TROUBLESHOOTING AND MAINTENANCE.

9-2. Steering Gear Assembly. (Sheet 4 of 8)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

13. Soak bearings (6 and 23) in cleaning solvent P-D-680 to loosen dirt then rinse in clean cleaning solvent P-D-680. Wipe dry.
14. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 5

9-2. Steering Gear Assembly. (Sheet 5 of 8)

CLEANING/INSPECTION (cont)

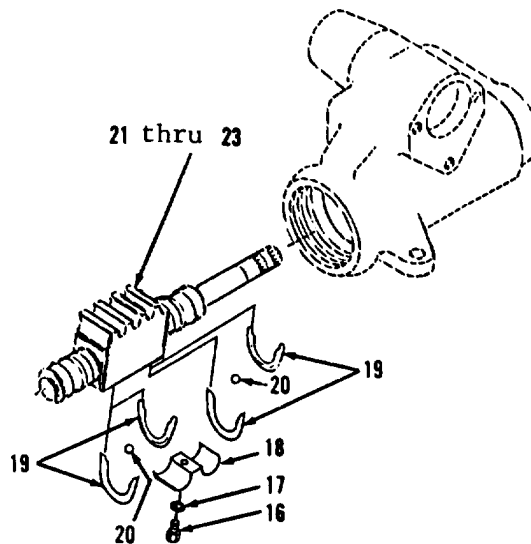
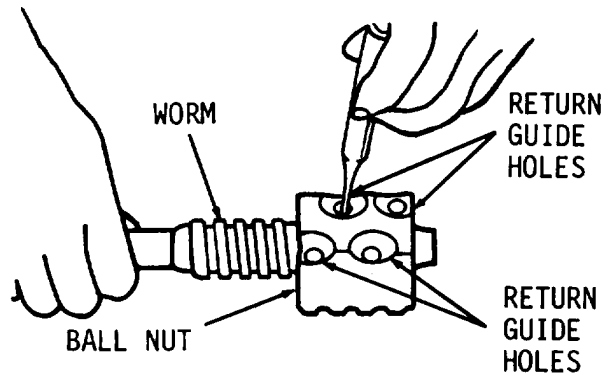
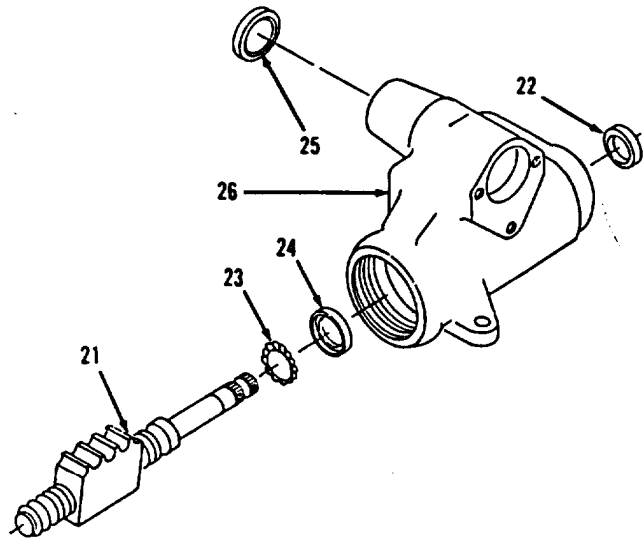
15. Inspect 54 balls (20) for flat spots or wear. Balls (20) should be same size within 0.0001 inch.
16. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

NOTE

All parts must be clean and free of abrasive dirt. All moving parts must be lubricated with multi-purpose gear grease.

17. Using a wooden dowel and hammer, install new seals (25 and 24), bearing (23) and ring (22).
18. Position ballnut and worm assembly (21) with return guide holes facing up.
19. Aline grooves in ballnut and worm assembly (21).
20. Using pliers, insert 27 balls (20) into any return guide hole.
21. Slowly rotate worm away from guide holes while inserting balls (20).
22. Continue inserting balls (20) until circuit is filled from the bottom of one hole to the bottom of the other or until stopped by reaching end of worm.



Go to sheet 6

STEERING TROUBLESHOOTING AND MAINTENANCE.

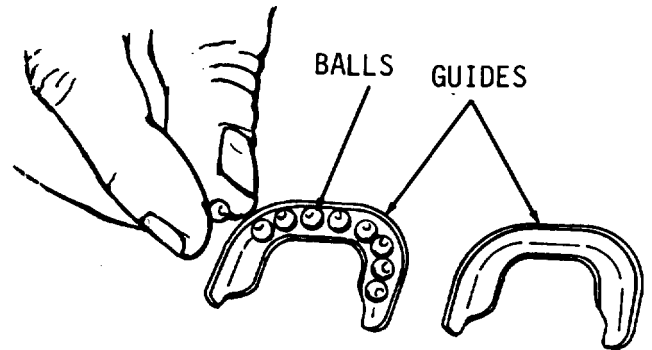
9-2. Steering Gear Assembly. (Sheet 6 of 8)

ASSEMBLY

NOTE

If balls are stopped by reaching end of worm, hold down balls already installed with rod or punch. Rotate shaft in a reverse direction a few turns. Filling of circuit may then be continued.

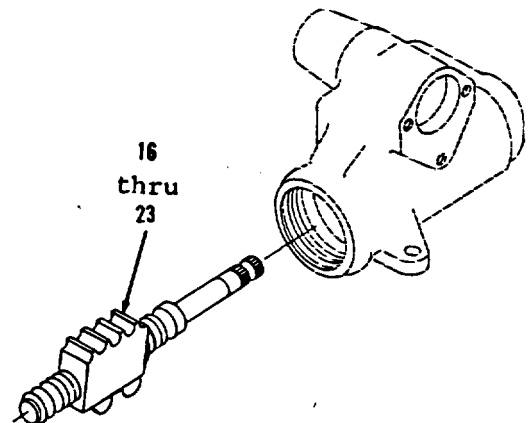
23. Place remaining balls (20) in groove of one guide (19). Then cover with another guide (19).
24. Plug both ends of guides (19) with multi-purpose grease to prevent balls (20) from falling out when installing.
25. Using long round nose pliers, install items 20 and 19 as an assembly in ballnut and worm assembly (21).



NOTE

Install remainder of balls by repeating steps 18 thru 25.

26. Install 27 of 54 balls (20) in ballnut and worm assembly (21).
27. Using a 3/8" socket and socket wrench handle, install clamp (18), washer (17) and bolt (16).



NOTE

Do not allow ballnut to rotate to end of worm threads. Temporarily tape exposed threads until ready for assembly.

28. Test items 23 thru 16 as an assembly by rotating ballnut on worm. Ballnut and worm assembly (21) must move freely.

Go to sheet 7

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-2. Steering Gear Assembly. (Sheet 7 of 8)

ASSEMBLY (cont)

29. Using a large rubber mallet, install items 23 thru 16 as an assembly in housing (26).

30. Position new gasket (15) on cover (14).

31. Using long round nose pliers, install shim (13) on setscrew (12).

32. Using a flat tip screwdriver, install items 13 and 12 as an assembly in gearshaft (11).

33. Using a feeler gage, measure clearance between head of setscrew (12) and gearshaft (11). If clearance exceeds 0.002 inch, install thicker shim (13).

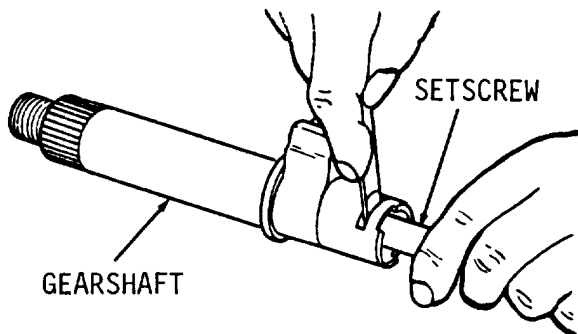
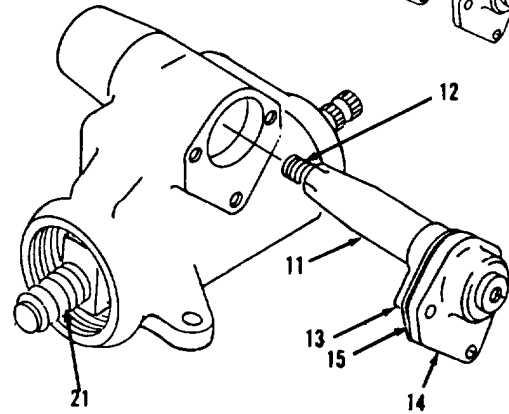
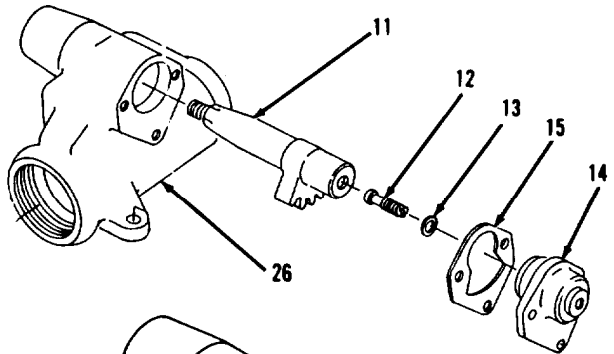
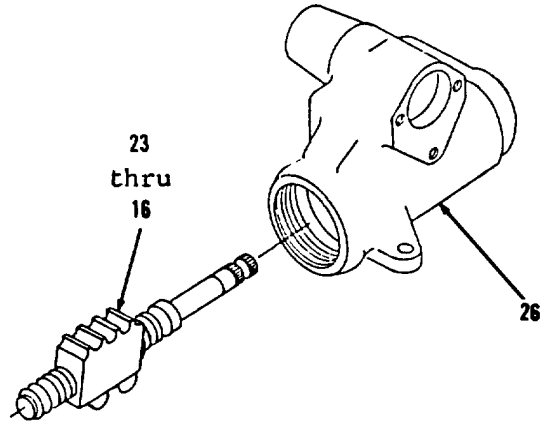
34. Thread cover (14) onto setscrew (12).

35. Rotate worm until ballnut is in center of worm assembly (21).

36. Using a large rubber mallet, install items 14 thru 11 as an assembly in housing (26). Center tooth of gearshaft (11) must enter center tooth space of ballnut on ballnut and worm assembly (21).

37. Rotate setscrew (12) to pull cover (14) over end of gearshaft (11).

38. Back off to permit clearance between gear on gearshaft (11) and ballnut and worm assembly (21).



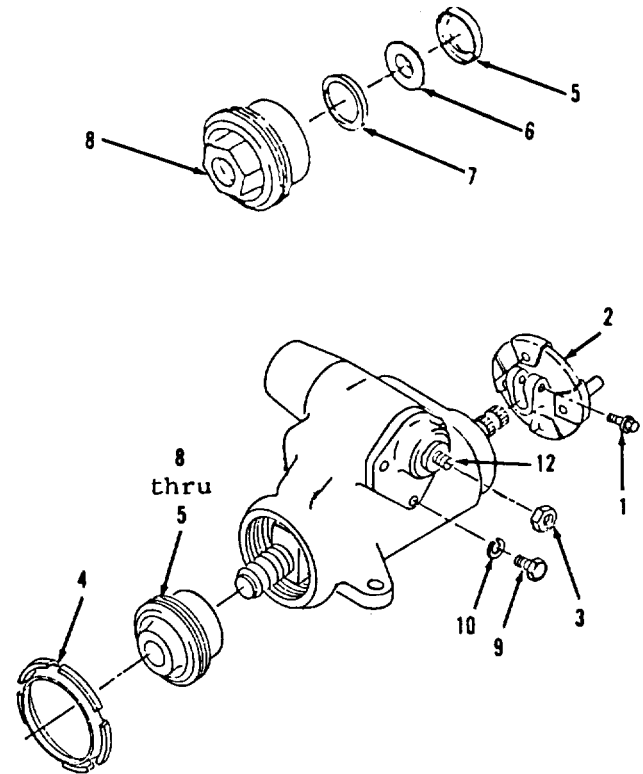
Go to sheet 8

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-2. Steering Gear Assembly. (Sheet 8 of 8)

ASSEMBLY

39. Using a 9/16" socket and socket wrench handle, install three washers (10) and bolts (9). Tighten bolts (9) to 30 lb-ft.
40. Using a wooden dowel and hammer, install ring (7), bearing (6) and seat (5) in adjuster (8).
41. Using a spanner wrench, install items 8 thru 5 as an assembly and locknut (4). Tighten locknut (4) to 90 lb-ft.
42. Using a 3/4" socket and socket wrench handle, install nut (3). Tighten nut (3) to 22 lb-ft.
43. Using a 9/16" open-end wrench, install flange (2) and bolt (1). Use matchmarks made before step 1.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 1 of 10)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tags (App. C, Item 28)  
Loctite 262, Grade N  
(App. C, Item 15)  
Lubricating oil (App. C, Item 19)  
Preformed packing (17)  
Seal (2)

Torques

Bolts (1) to 24 lb-ft.  
Bolts (9 and 10) to 34 lb-ft.  
Bolts (32 and 33) to 18 lb-ft.  
Bolts (45) to 20 lb-ft.  
Plug (49) to 30 lb-ft.  
Plugs (51) to 60 lb-ft.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Ground driven steering pump removed.

---

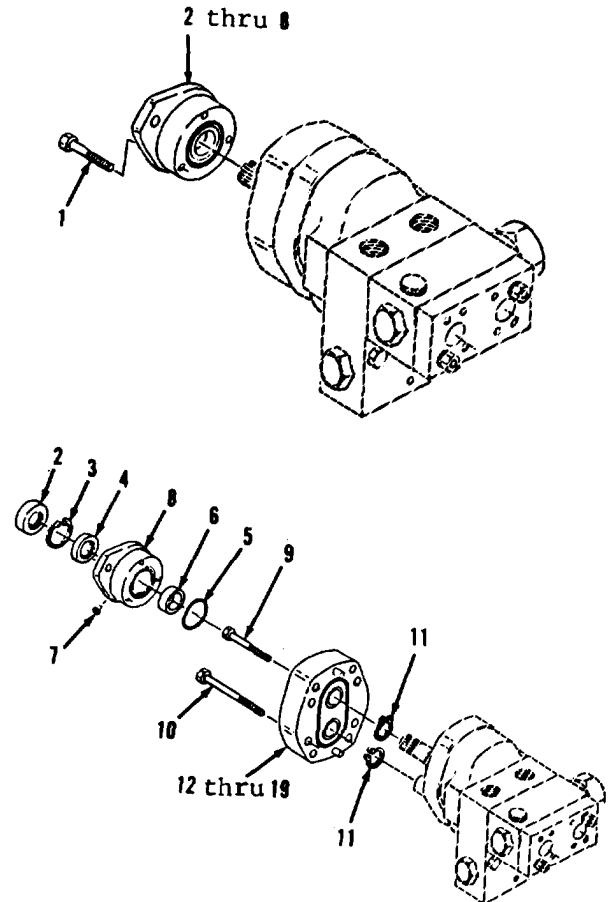


STEERING TROUBLESHOOTING AND MAINTENANCE.

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 2 of 10)

DISASSEMBLY

1. Using a 7/16" socket and socket wrench handle, remove three bolts (1) and items 2 thru 8 as an assembly.
2. Using retaining ring pliers, remove seal (2), ring (3) and seal (4). Discard seals (2 and 4).
3. Using a scribe, remove preformed packing (5) and locating ring (6). Discard preformed packing (5).
4. Using a flat tip screwdriver, remove plug (7) from adapter (8).
5. Using a 9/16" socket and socket wrench handle, remove four bolts (9 and 10).
6. Using retaining ring pliers, remove two rings (11).
7. Using a plastic mallet, separate items 12 thru 19 as an assembly.



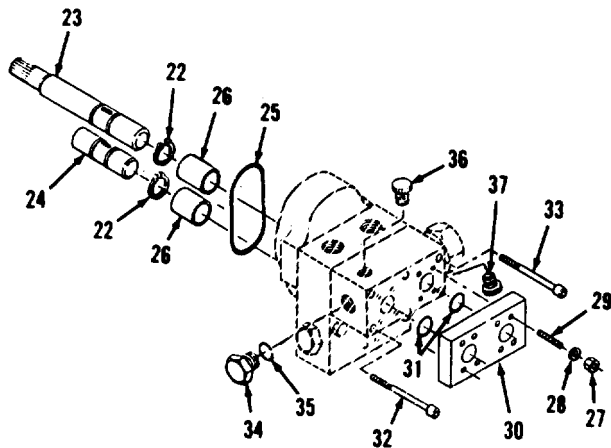
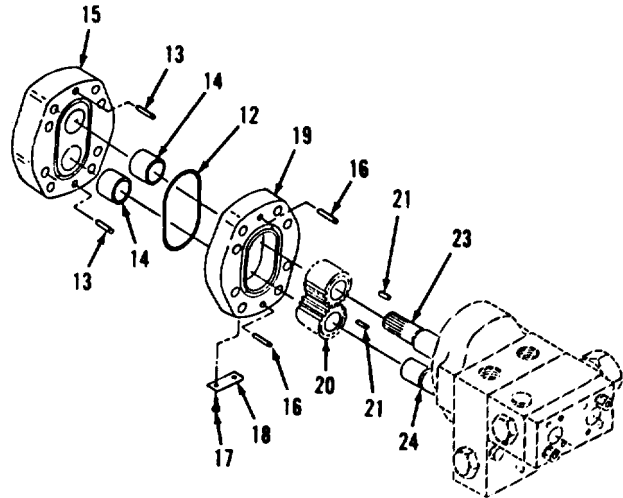
Go to sheet 3

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 3 of 10)

DISASSEMBLY (cont)

8. Using a scribe, remove and discard preformed packing (12).
- 9\* Using a small punch, remove two pins (13), bearings (14) and body (15).
10. Using a small punch and flat blade screwdriver, remove two pins (16), screws (17), plate (18) and body (19).
11. Using a plastic mallet, remove two gears (20) and pins (21) from shafts (23 and 24).
12. Using retaining ring pliers, remove two rings (22).
13. Using a plastic mallet, remove shafts (23 and 24).
14. Using a scribe, remove preformed packing (25) and two bearings (26). Discard preformed packing (25).
15. Using a 9/16" socket and socket wrench handle, remove two nuts (27) and washers (28).
16. Using slip joint pliers, remove two studs (29) and block (30).
17. Using a scribe, remove and discard two preformed packings (31).
18. Using a 1/4" socket head screw key, remove two bolts (32) and four bolts (33).
19. Using a 1-1/4" open end wrench, remove plug (34), preformed packing (35) and plug (36). Discard preformed packing (35).
20. Using slip joint pliers, remove plug (37).



Go to sheet 4

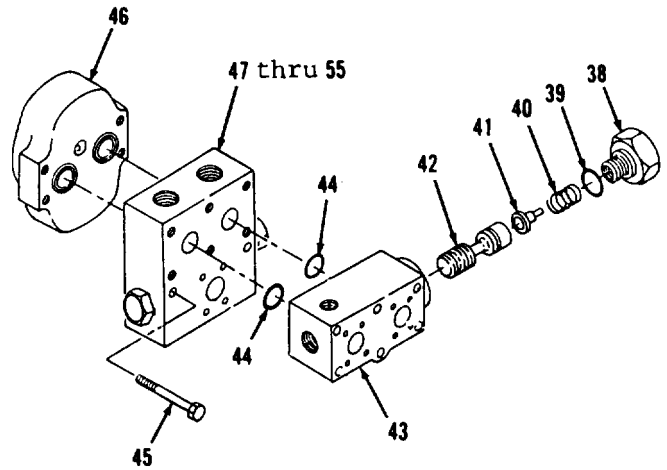
## STEERING TROUBLESHOOTING AND MAINTENANCE.

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 4 of 10)

DISASSEMBLY**WARNING**

Exercise care when removing retainer. Retainer is under spring pressure. Failure to follow this procedure could result in SEVERE INJURY.

21. Using a 1-1/8" open end wrench, remove retainer (38) and preformed packing (39). Discard preformed packing (39).
22. Using a wooden dowel, remove spring (40), seat (41), spool (42) and valve (43).
23. Using a scribe, remove and discard two preformed packings (44).
24. Using a 1/2" socket and socket wrench handle, remove two bolts (45).
25. Using a plastic mallet, separate body (46) from items 47 thru 55 as an assembly.



Go to sheet 5

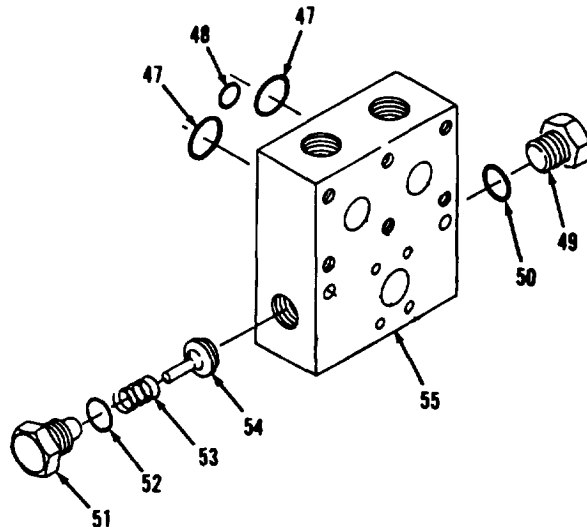
DISASSEMBLY (cont)

26. Using a scribe, remove and discard two preformed packings (47) and preformed packing (48).
27. Using a 1/4" open end wrench, remove plug (49) and preformed packing (50). Discard preformed packing (50).

**WARNING**

Exercise care when removing plugs. Plugs are under spring pressure. Failure to follow this procedure could result in SEVERE INJURY.

28. Using a 1-1/4" open end wrench, remove four plugs (51) and preformed packings (52). Discard four preformed packings (52).



NOTE

Tag location of pistons in body to aid in installation.

29. Remove four springs (53) and pistons (54) from body (55).

## STEERING TROUBLESHOOTING AND MAINTENANCE.

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 6 of 10)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

30. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 7

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 7 of 10)

CLEANING/INSPECTION (cont)

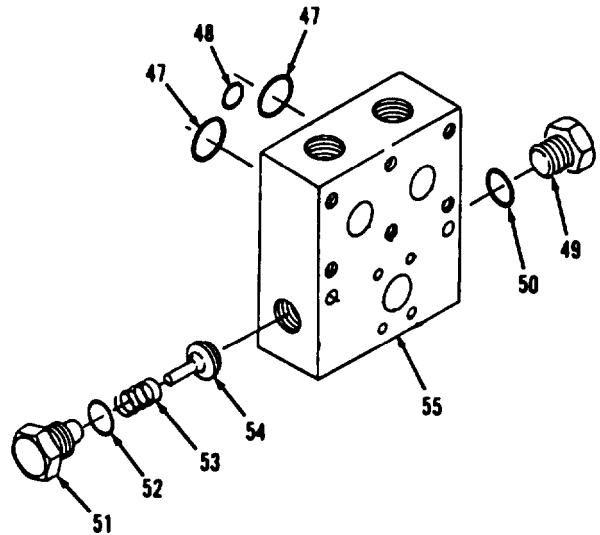
- 31. Inspect two bearings (14 and 26). Check inside diameter for scoring. Replace if scored, grooved or badly pitted.
- 32. Inspect two gears (20). Replace if teeth are worn or gears are pitted or scored.
- 33. Inspect shafts (23 and 24). Replace if splines are worn or shafts are pitted or scored.
- 34. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

NOTE

All moving parts, seals and pre-formed packings must be lubricated before installation.

- 35. Install four pistons (54) and springs (53) in body (55).
- 36. Using a 1-1/4" socket, socket wrench handle and torque wrench, install four new preformed packings (52) and four plugs (51). Tighten plugs (51) to 60 lb-ft.
- 37. Install new preformed packing (50) and plug (49). Tighten plug (49) to 30 lb-ft.
- 38. Install new preformed packing (48) and two new preformed packings (47).



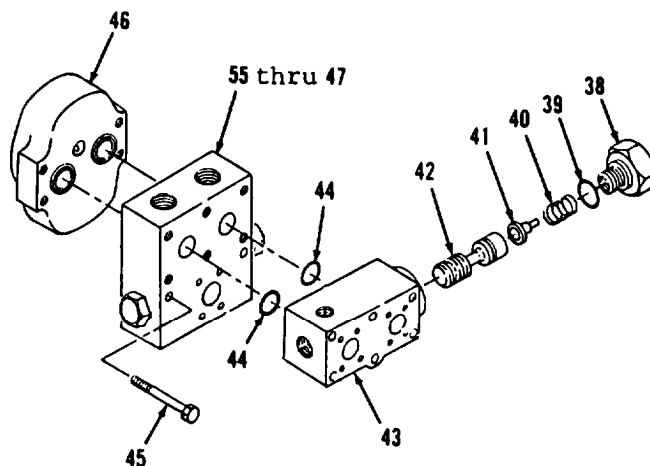
Go to sheet 8

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 8 of 10)

ASSEMBLY

39. Position body (46) against items 55 thru 47 as an assembly.
40. Using a 1/2" socket, socket wrench handle and torque wrench, install two bolts (45). Tighten to 20 lb-ft.
41. Install two new preformed packings (44).
42. Using a wooden dowel, install spool (42), seat (41) and spring (40) in valve (43).
43. Using a 12" adjustable wrench, install new preformed packing (39) and retainer (38).



Go to sheet 9

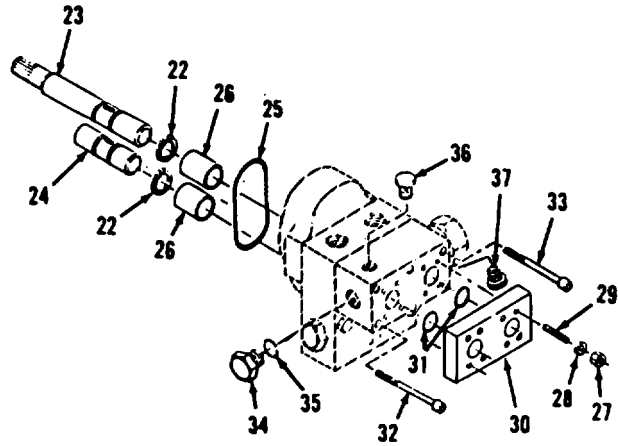
## TM 10-3930-643-34

### STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 9 of 10)

#### ASSEMBLY (cont)

44. Using slip joint pliers, install plug (37) in retainer (38).
45. Using a 1/4" socket and socket wrench handle, install plug (36), new preformed packing (35) and plug (34).
46. Using a 1/4" socket head screw key, 1/4" socket, socket wrench handle and torque wrench, install four bolts (33), two bolts (32) and block (30). Tighten bolts (33 and 32) to 18 lb-ft.
47. Install two new preformed packings (31) in block (30).
48. Using slip joint pliers, install two studs (29).
49. Using a 9/16" socket and socket wrench handle, install two washers (28) and nuts (27).
50. Install two bearings (26) and new preformed packing (25).
51. Install shafts (24 and 23).
52. Using retaining ring pliers, install two rings (22).



Go to sheet 10

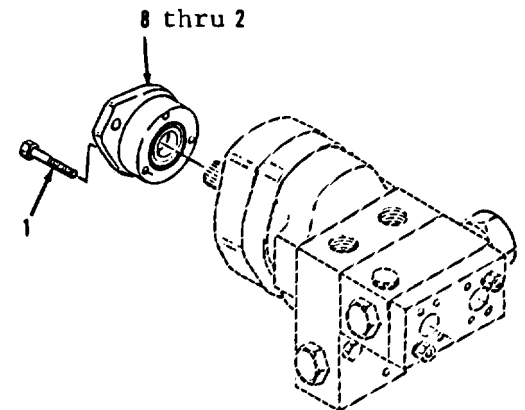
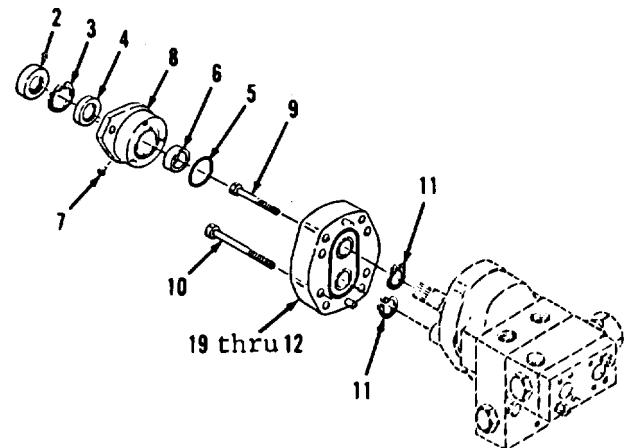
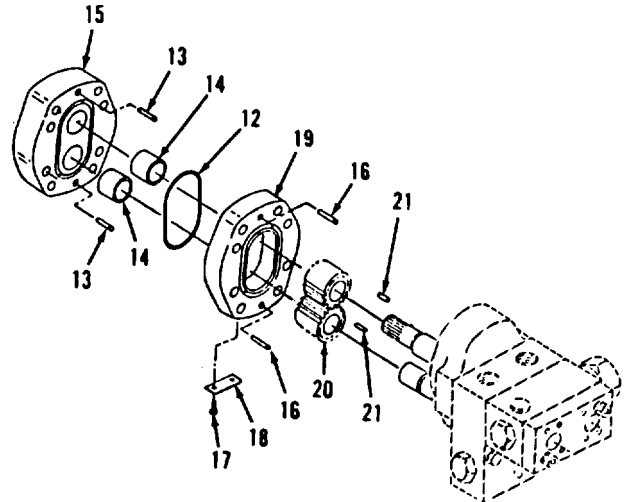


STEERING TROUBLESHOOTING AND MAINTENANCE.

9-3. Ground Driven Steering Pump (S/N 2000 and below). (Sheet 10 of 10)

ASSEMBLY

53. Using a hammer and small punch, install two pins (21) and gears (20).
54. Using a flat tip screwdriver and small punch, install plate (18), two screws (17), pins (16) and body (15).
55. Using a hammer and small punch, install two bearings (14) and pins (13).
56. Using retaining ring pliers, install two rings (11).
57. Install new preformed packing (12).
58. Position items 19 thru 12 as an assembly.
59. Apply Loctite 262 under bolt heads only. Using a 9/16" socket, socket wrench handle and torque wrench, install four bolts (10 and 9). Tighten bolts (10 and 9) to 34 lb-ft.
60. Using a flat tip screwdriver, install adapter (8) and plug (7).
61. Install locating ring (6) and new preformed packing (5).
62. Using retaining ring pliers, install new seal (4), ring (3) and new seal (2).
63. Position items 8 thru 2 as an assembly.
64. Apply Loctite 262 under bolt heads only. Using a 7/16" socket, socket wrench handle and torque wrench, install three bolts (1). Tighten three bolts (1) to 24 lb-ft.



NOTE

Return M10A Forklift to original equipment condition. END OF TASK

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 1 of 8)

This task covers:

a. Disassembly	b. Cleaning/Inspection
c. Assembly	

---

### INITIAL SETUP

#### Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

#### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Small tag (App. C, Item 28)  
Preformed packing (19)  
Seal (2)

#### Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

### EQUIPMENT CONDITION

#### References

TM 10-3930-643-20

#### Condition Description

Ground driven steering pump removed.

---

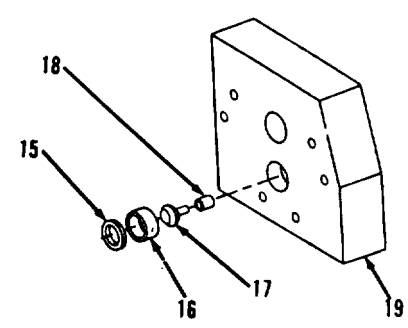
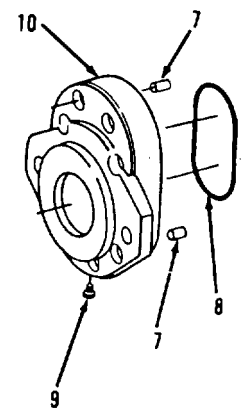
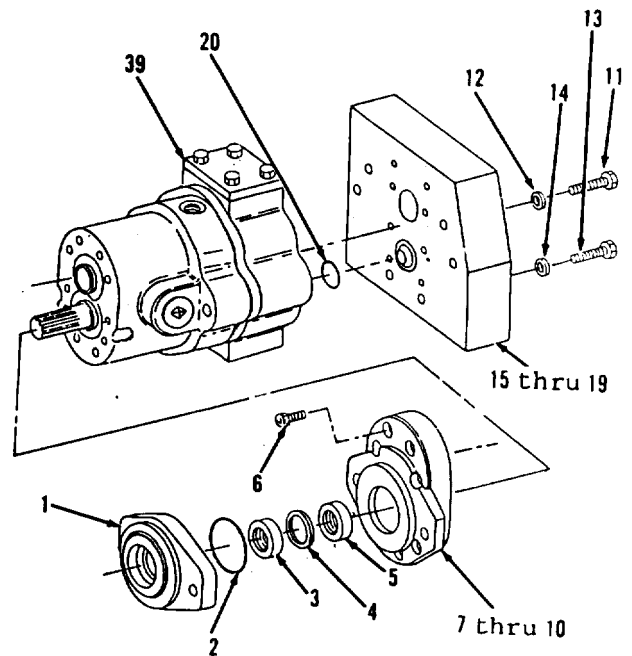
Go to sheet 2

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 2 of 8)

DISASSEMBLY

1. Using a plastic mallet, separate plate (1) from flange (10).
2. Using a scribe, remove and discard preformed packing (2).
3. Using a cotter pin extractor, remove seal (3), snap ring (4) and seal (5). Discard seals (3 and 5).
4. Using a 1/4" socket head screw key, remove eight bolts (6) and items 7 thru 10 as an assembly.
5. Using a drift pin and scribe, remove two dowels (7), preformed packing (8) and plug (9) from flange (10). Discard preformed packing (8).
6. Using a 9/16" socket and socket wrench handle, remove two bolts (11), washers (12), four bolts (13) and washers (14).
7. Using a plastic mallet, remove items 15 thru 19 as an assembly.
8. Using a scribe, remove preformed packing (15), seat (16), piston (17) and retainer (18) from plate (19). Discard preformed packing (15).
9. Using a scribe, remove and discard preformed packing (20) from valve body (39).



Go to sheet 3

# TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 3 of 8)

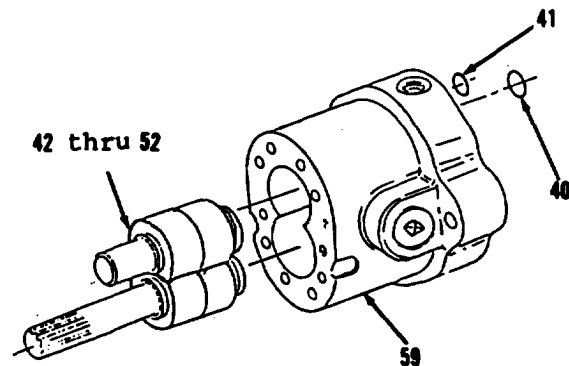
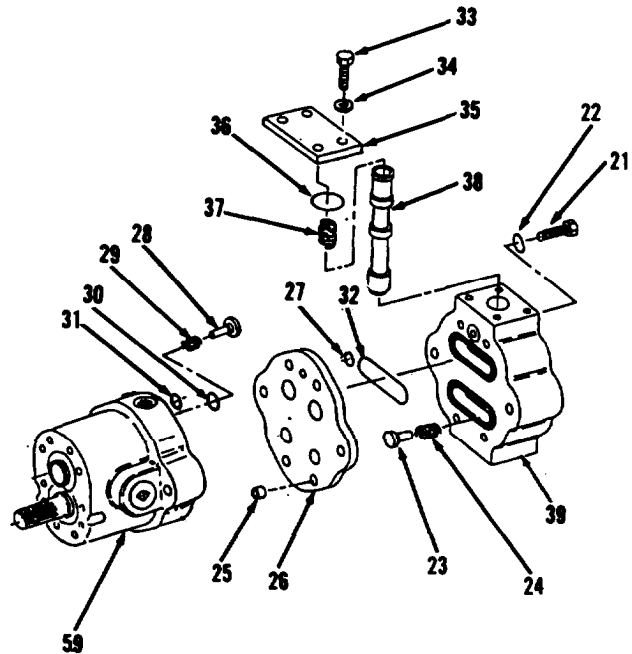
## DISASSEMBLY (cont)

10. Using a 1/4" socket head screw key, remove two bolts (21) and washers (22).
11. Using a plastic mallet, separate plate (26) and valve body (39) from body (59).

### NOTE

Tag all pistons to aid in installation.

12. Remove two pistons (23) and springs (24) from valve body (39).
13. Using a plastic mallet, remove two spacers (25), plate (26) and preformed packing (27). Discard preformed packing (27).
14. Remove two pistons (28), springs (29), preformed packings (30) and preformed packing (31) from body (59). Discard two preformed packings (30) and preformed packing (31).
15. Using a scribe, remove and discard two preformed packings (32) from valve body (39).
16. Using a 9/16" socket and socket wrench handle, remove four bolts (33), washers (34), plate (35) and preformed packing (36). Discard preformed packing (36).
17. Using a plastic mallet, remove spring (37) and sleeve (38) from valve body (39).
18. Using a scribe, remove two preformed packings (40) and preformed packing (41) from body (59). Discard preformed packings (40 and 41).
19. Using a plastic mallet, remove items 42 thru 52 as an assembly from body (59).



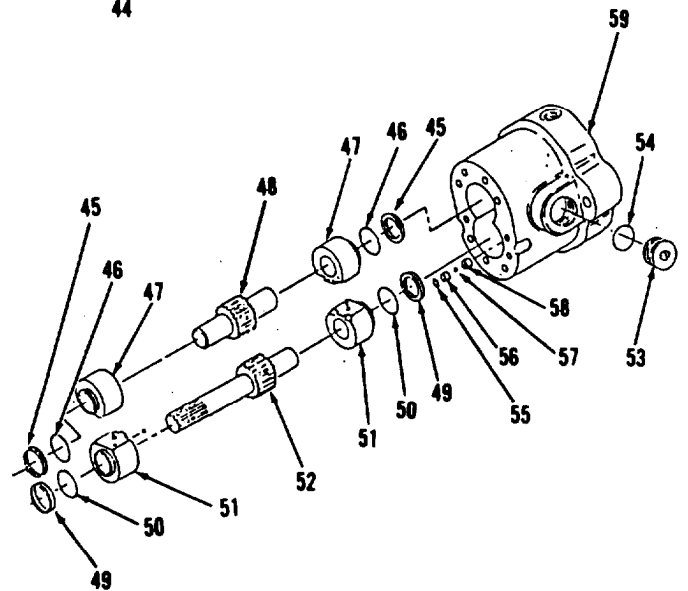
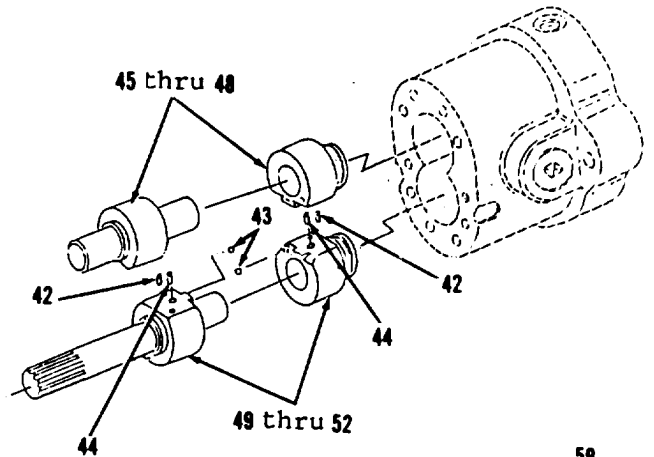
Go to sheet 4

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 4 of 8)

DISASSEMBLY

20. Separate items 45 thru 48 as an assembly from items 49 thru 52 as an assembly.
21. Using long round nose pliers, remove four pins (42) and balls (43).
22. Remove two pins (44).
23. Using a scribe, remove two rings (45), preformed packings (46) and bushings (47) from gear (48). Discard two preformed packings (46).
24. Using a scribe, remove two rings (49), preformed packings (50) and bushing (51) from gear (52). Discard two preformed packings (50).
25. Remove plug (53) and preformed packing (54). Discard preformed packing (54).
26. Using a scribe, remove two preformed packings (55), seats (56), balls (57) and retainers (58) from body (59). Discard two preformed packings (55).



Go to sheet 5

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 5 of 8)

### CLEANING/INSPECTION

#### **WARNING**

##### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

##### ● COMPRESSED AIR HAZARD

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

27. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
28. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 6

STEERING TROUBLESHOOTING AND MAINTENANCE.

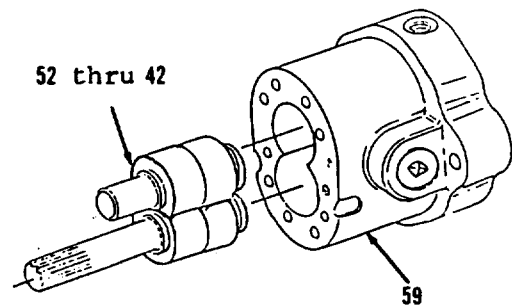
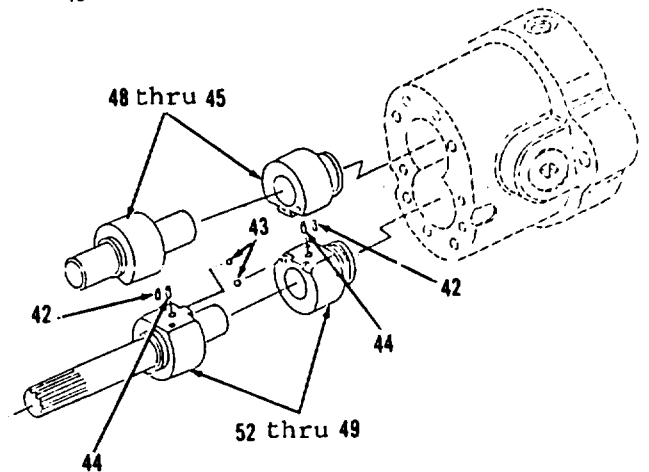
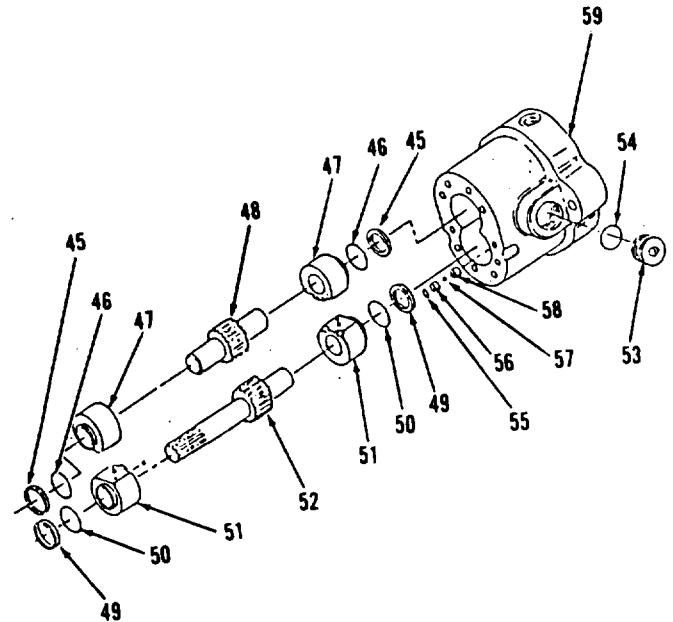
9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 6 of 8)

ASSEMBLY

NOTE

All moving parts, seals and pre-formed packings must be lubricated before installing.

29. Install two retainers (58), balls (57), seats (56) and new preformed packings (55) in body (59). Seats (56) must be flush with face of body (59).
30. Install new preformed packing (54) and plug (53).
31. Install two bushings (51), new preformed packings (50) and rings (49) on gear (52).
32. Install two bushings (47), new preformed packings (46) and rings (45) on gear (48).
33. Install two pins (44).
34. Install four balls (43) and pins (42).
35. Position items 48 thru 45 as an assembly on items 52 thru 49 as an assembly.
36. Install items 52 thru 42 as an assembly in body (59).



Go to sheet 7

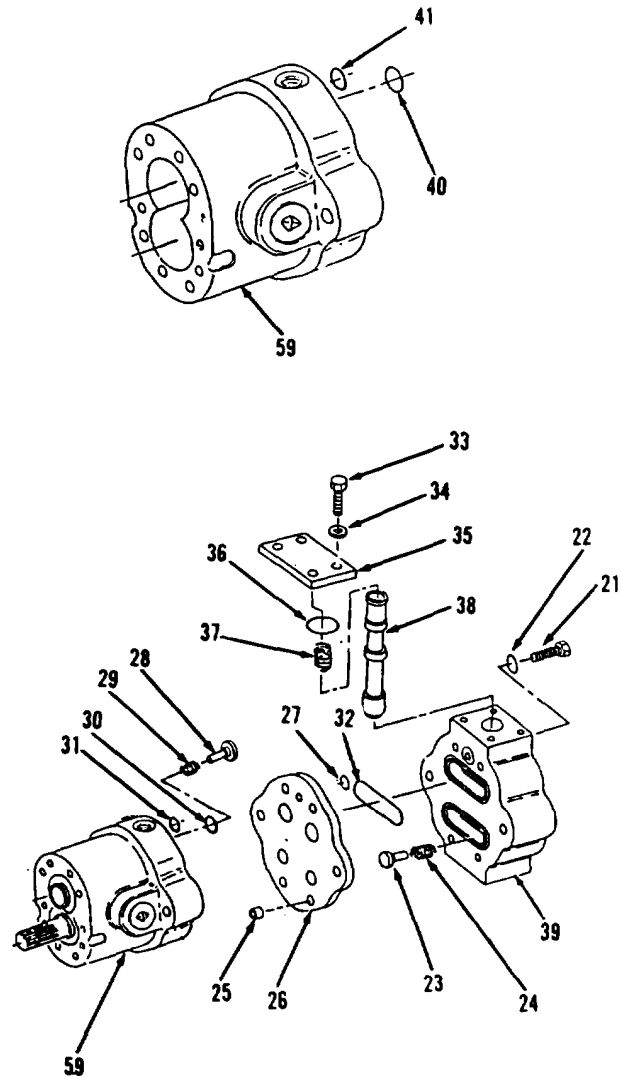
# TM 10-3930-643-34

## STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 7 of 8)

### ASSEMBLY (cont)

37. Install new preformed packing (41) and two new preformed packings (40) in body (59).
38. Install sleeve (38) and spring (37) in valve body (39).
39. Install new preformed packing (36), plate (35), four washers (34) and bolts (33).
40. Install two new preformed packings (32) in valve body (39).
41. Install new preformed packing (31), two new preformed packings (30), springs (29) and pistons (28) in body (59).
42. Install new preformed packing (27), plate (26) and two spacers (25).
43. Install two springs (24) and pistons (23).
44. Position valve body (37) and plate (26) against body (57).
45. Using an socket head screw key, install two washers (22) and bolts (21).



Go to sheet 8



STEERING TROUBLESHOOTING AND MAINTENANCE.

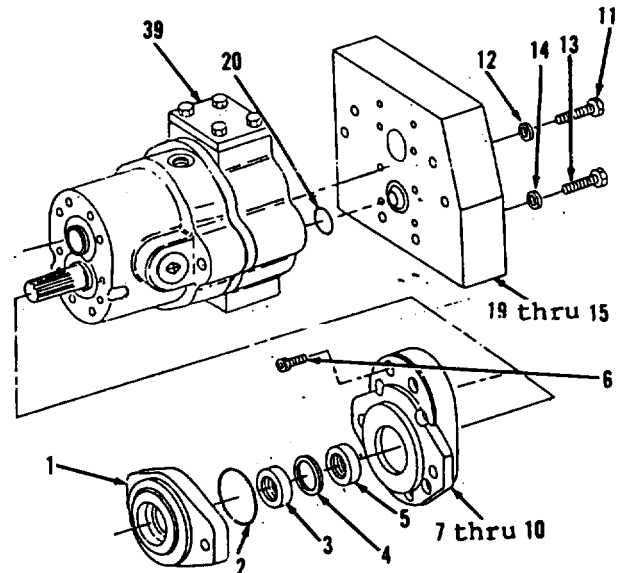
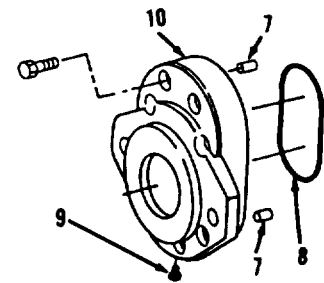
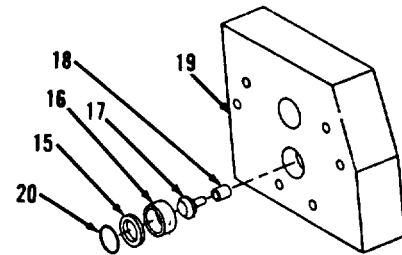
9-4. Ground Driven Steering Pump (S/N 2001 and above). (Sheet 8 of 8)

ASSEMBLY

46. Install new preformed packing (20) in valve body (39).
47. Install retainer (18), piston (17), seat (16) and new preformed packing (15) in plate (19).
48. Position items 19 thru 15 as an assembly.
49. Using a 9/16" socket and socket wrench handle, install four washers (14), bolts (13), two washers (12) and bolts (11).
50. Using a flat tip screwdriver, install plug (9) and new preformed packing (8) and two dowels (7) in flange (10).
51. Using 1/4" socket head screw key and plastic mallet, install items 10 thru 7 as an assembly and eight bolts (6).
52. Install new seal (5), snap ring (4) and new seal (3).
53. Install new preformed packing (2).
54. Position plate (1) on flange (10).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-5. Steering Cylinder. (Sheet 1 of 5)

This task covers:      a. Disassembly                              b. Cleaning/Inspection  
                                 c. Assembly

---

### INITIAL SETUP

#### Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

#### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Emery cloth (App. C, Item 4)  
Lubricating oil (App. C, Item 19)  
Loctite 592 (App. C, Item 17)  
Preformed packing (3)  
Seal (3)  
Washer  
Ring (2)

#### Torques

Nut (1) to 370 lb-ft.  
Cap (12) to 950 lb-ft.

---

### EQUIPMENT CONDITION

#### References

TM 10-3930-643-20

#### Condition Description

Steering cylinder removed.

---

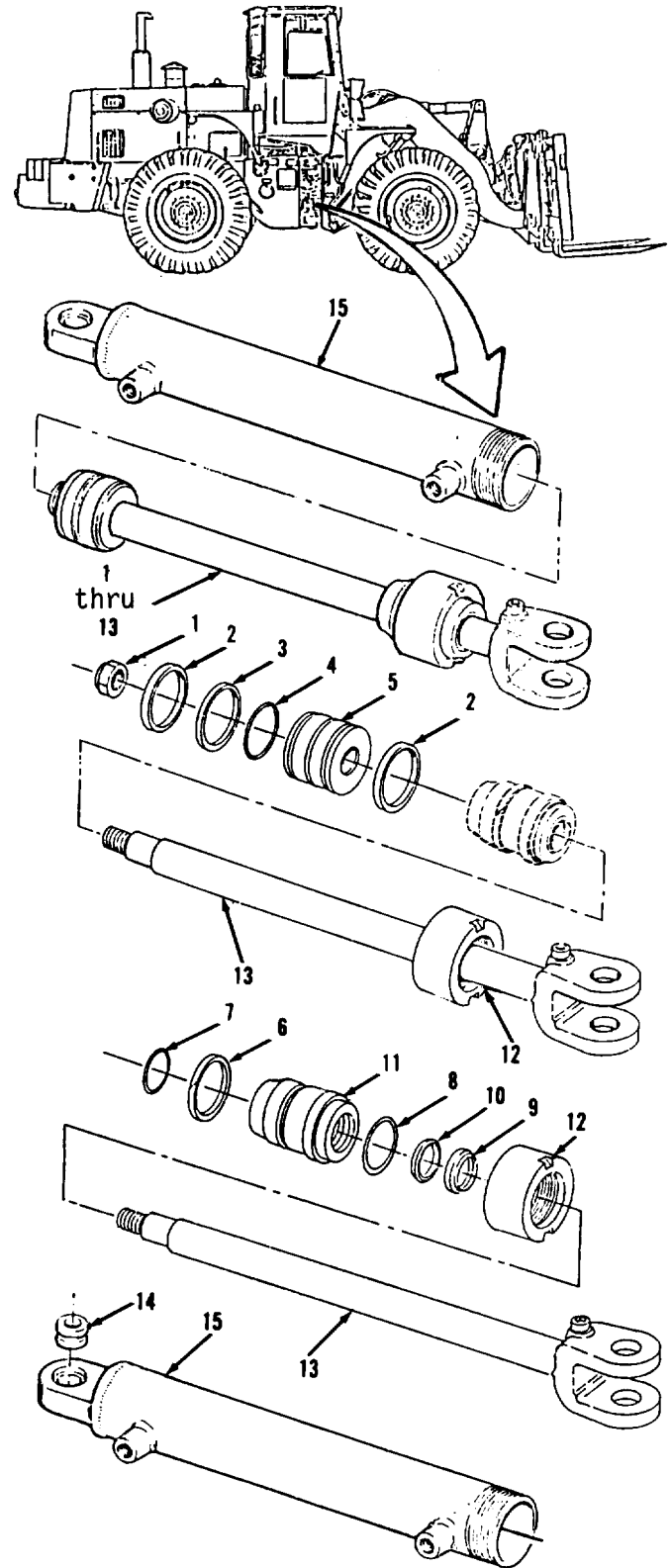
Go to sheet 2

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-5. Steering Cylinder. (Sheet 2 of 5)

DISASSEMBLY

1. Using a cylinder cap tool, unscrew cap (13).
2. Using a large rubber mallet, remove items 1 thru 13 as an assembly from cylinder (15).
3. Using a 1-13/16" socket and socket wrench handle, remove nut (1). Hold rod (13) eye in suitable holding device when removing nut (1).
4. Remove 2 thru 5 as an assembly from rod (13).
5. Remove two rings (2) from piston (5).
6. Using a scribe, remove and discard seal (3) and preformed packing (4).
7. Using a large rubber mallet, remove items 6 thru 11 as an assembly.
8. Using a scribe, remove washer (6) from gland (11).
9. Remove and discard preformed packings (7 and 8).
10. Remove and discard seals (9 and 10) from gland (11).
11. Remove cap (12) from rod (13).
12. Using a hammer and punch, remove bushing (14) from cylinder (15).



Go to sheet 3

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-5. Steering Cylinder. (Sheet 3 of 5)

CLEANING/INSPECTION

### **WARNING**

#### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

#### ● COMPRESSED AIR HAZARD

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

13. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
14. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

STEERING TROUBLESHOOTING AND MAINTENANCE.

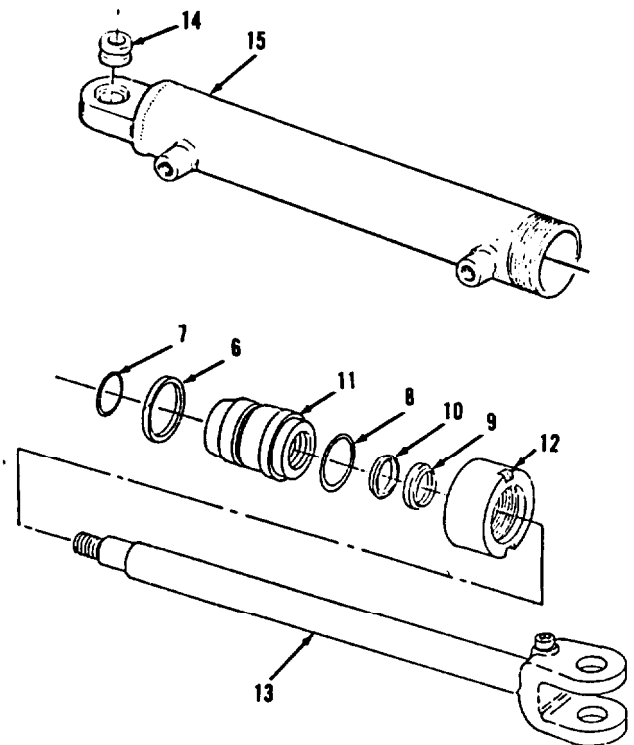
9-5. Steering Cylinder. (Sheet 4 of 5)

ASSEMBLY

NOTE

All moving parts, seals and pre-formed packings must be lubricated with hydraulic fluid before installing.

15. Using a rubber mallet, install bushing (14) on cylinder (15).
16. Install cap (12) on rod (13).
17. Install new seal (10) in gland (11) with larger end of seal (10) facing inward.
18. Install new seal (9) in gland (11) with open end of seal (9) facing outward.
19. Install new preformed packings (8 and 7) and washer (6) on gland (11).
20. Lubricate rod (13).
21. Using a large rubber mallet, install items 11 thru 6 as an assembly on rod (13).



Go to sheet 5

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

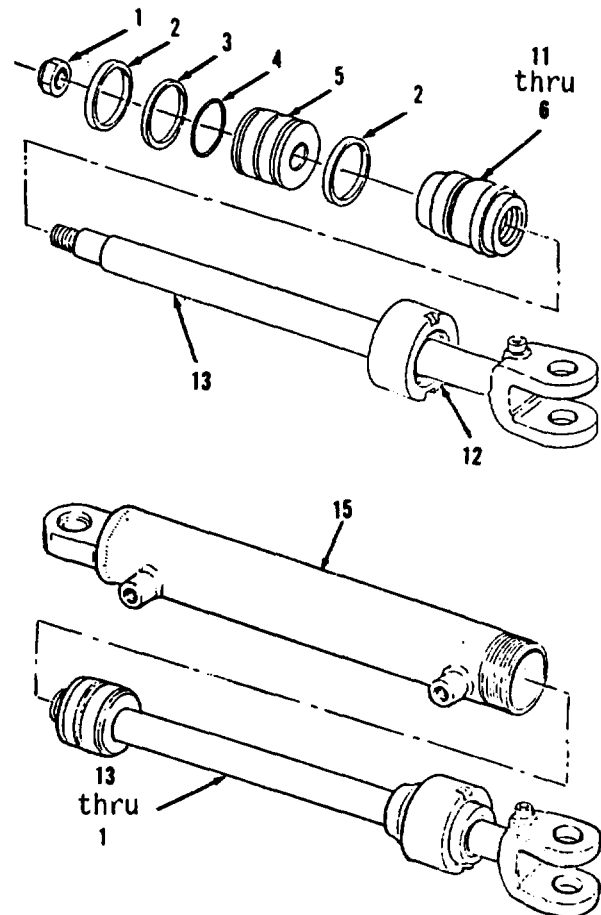
9-5. Steering Cylinder. (Sheet 5 of 5)

### ASSEMBLY (cont)

22. Install new preformed packing (4) on piston (5).
23. Install one of two rings (2), closest to gland (11) on piston (5).
24. Place seal (3) in hot water 180-200 degrees F to soften and install over preformed packing (4).
25. Using a ring compressor, compress seal (3) and ring (2) onto piston (5).
26. Using a rubber mallet, install items 5 thru 2 as an assembly on rod (13), keeping items 3 and 2 compressed.
27. Apply Loctite 592 to threads of rod (13) and using a 1-13/16" socket, socket wrench handle and torque wrench, install nut (1). Tighten nut (1) to 370 lb-ft.
28. Using a lint free cloth, lubricate items 11 thru 6 as an assembly and items 5 thru 2 as an assembly.
29. Tap items 13 thru 2 as an assembly into cylinder (15), until seal (3) is inserted in barrel.
30. Apply Loctite 592 across width of cylinder (15) housing threads.
31. Using a cylinder cap tool and torque wrench, tighten cap (12) to 950 lb-ft.

#### NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 1 of 15)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
Hoist and sling, capacity of  
100 lbs.

Personnel Required

Two (Adjustment only)

Torques

Plug (45) to 100 lb-ft.  
Plug (47) to 45 lb-ft.  
Plug (48) to 30 lb-ft.  
Nut (50) to 50 lb-ft.  
Plug (55) to 110 lb-ft.  
Bolts (56) to 15 lb-ft.  
Screws (60) to 25 lb-ft.  
Screw (64) to 7.5 lb-ft.  
Plug (76) to 7.5 lb-ft.  
Nut (82) to 10 lb-ft.  
Locknut (84) to 10 lb-ft.

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Small tag (App. C, Item 28)  
Crocus cloth (App. C, Item 3)  
Lubricating oil (App. C, Item 19)  
Preformed packing (22)  
Seal (3)  
Wiper (2)  
Tie strap

EQUIPMENT CONDITION

References

Paragraph 9-7

Condition Description

Steering circuit relief valves removed.

Go to sheet 2

# TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 2 of 15)

## REMOVAL

### NOTE

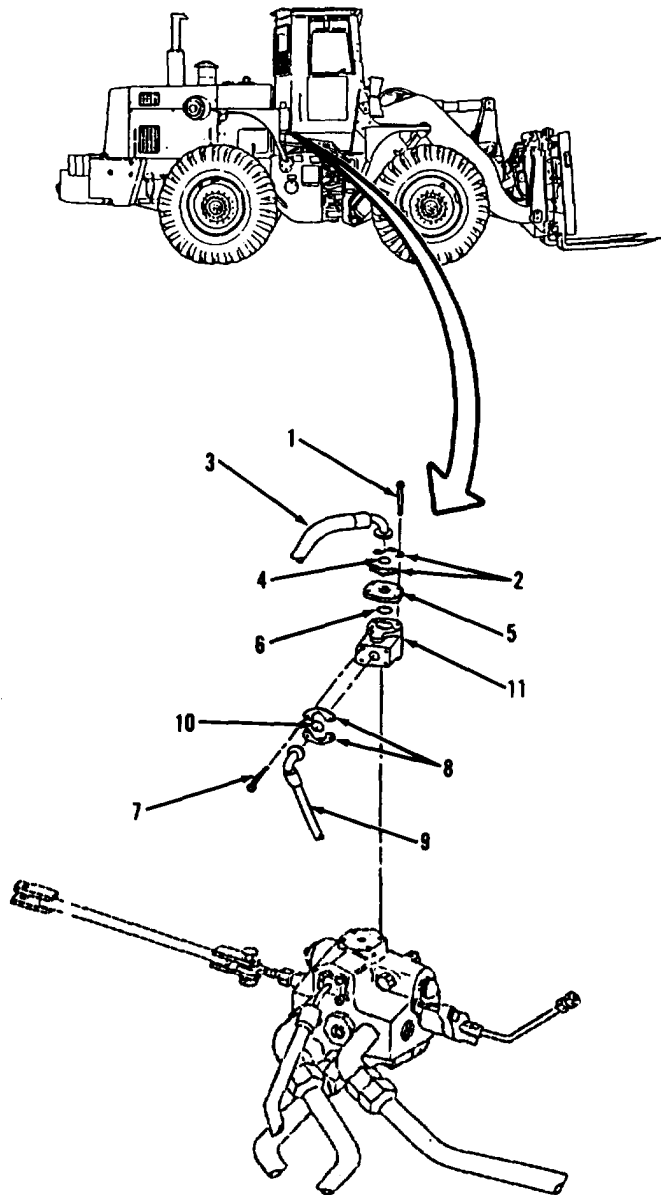
Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 9/16" socket and socket wrench handle, remove two bolts (1) and two flange halves (2) from under right side of cab.
2. Disconnect hose assembly (3) from check valve (11).

### NOTE

The following is a difference between M10A Forklift models.

3. Using a scribe, remove preformed packing (4) and plate (5) from vehicles S/N 2001 and above. Discard preformed packing (4).
4. Remove and discard preformed packing (6).
5. Using a 9/16" socket and socket wrench handle, remove four bolts (7) and two flange halves (8).
6. Disconnect hose assembly (9).
7. Remove preformed packing (10) and check valve (11). Discard preformed packing (10).



Go to sheet 3

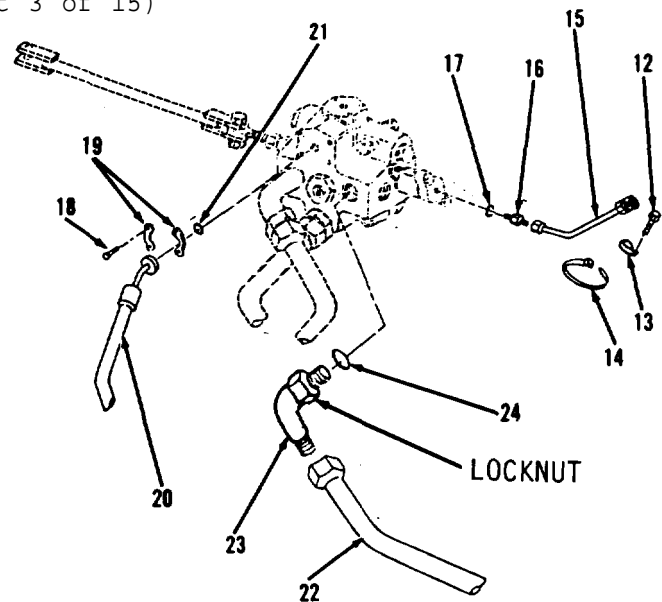


STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 3 of 15)

REMOVAL

8. Using a 1/2" socket and socket wrench handle, remove bolt (12) and strap (13) from right front of engine compartment.
9. Using diagonal cutting pliers, cut and discard tie strap (14) from under right side of cab.
10. Using a 9/16" open end wrench, disconnect hose assembly (15) from connector (16).
11. Using a 3/4" open end wrench and a scribe, remove connector (16) and preformed packing (17). Discard preformed packing (17).
12. Using a 9/16" socket and socket wrench handle, remove four bolts (18) and two flange halves (19).
13. Disconnect hose assembly (20).
14. Using a scribe, remove and discard preformed packing (21).
15. Using a 1" open end wrench, disconnect hose assembly (22).
16. Using a 1-1/4" open end wrench, loosen locknut on elbow (23).
17. Using a 1-1/8" open end wrench, remove elbow (23) and preformed packing (24). Discard preformed packing (24).



Go to sheet 4

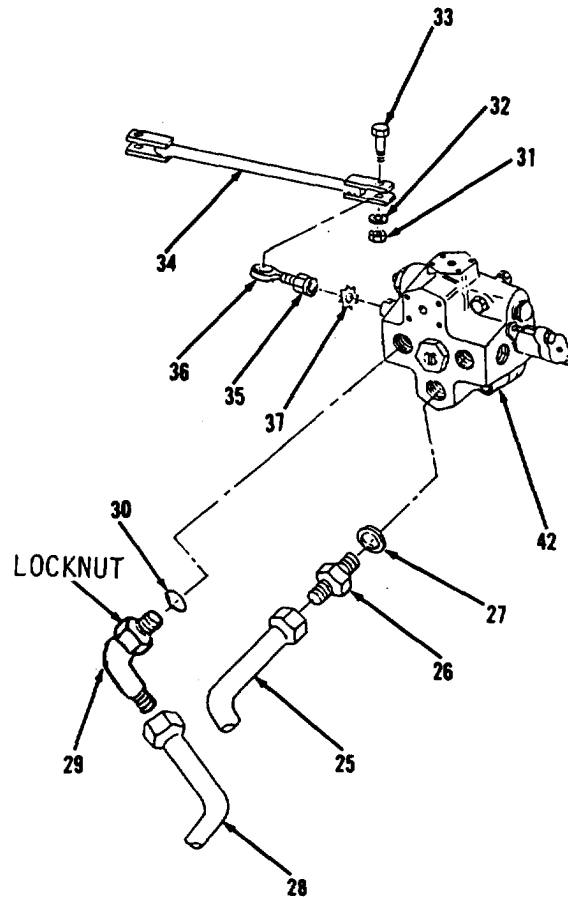
## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 4 of 15)

### REMOVAL (cont)

18. Using a 15/16" open end wrench, disconnect hose assembly (25).
19. Using a 1-1/8" open end wrench, remove connector (26) and preformed packing (27). Discard preformed packing (27).
20. Using a 15/16" open end wrench, disconnect hose assembly (28).
21. Using a 1-1/4" open end wrench, loosen locknut on elbow (29).
22. Using a 1-1/8" open end wrench, remove elbow (29) and preformed packing (30). Discard preformed packing (30).
23. Using a 15/16" socket, socket wrench handle and a 1-1/8" open end wrench, remove nut (31), washer (32) and bolt (33).
24. Move pin (34) aside.
25. Using a 1-1/8" open end wrench, loosen locknut (35).
26. Using a 10" adjustable wrench, remove link assembly (36). Unscrew from plunger on valve assembly (42).
27. Remove washer (37).



Go to sheet 5

## STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 5 of 15)

REMOVAL**WARNING**

## WEIGHT HAZARD

Weight of valve assembly is approximately 95 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY .

28. Attach hoist and sling to valve assembly (42) on right side, under cab.
29. Using a 3/4" socket and socket wrench handle, remove three nuts (38), washers (39), bolts (40), washers (41) and valve assembly (42).
30. Remove hoist and sling.

DISASSEMBLY

31. Using a 1-3/8" socket and socket wrench handle, remove plug (43), preformed packing (44), plug (45), preformed packing (46) and plug (47). Discard preformed packings (44 and 46) .
32. Using a 5/8" socket and socket wrench handle, remove three plugs (48) and preformed packings (49). Discard three preformed packings (49).
33. Using a 1-1/2" socket and socket wrench handle, remove nut (50).
34. Using a scribe, remove items 51 thru 55 as an assembly.

Go to sheet 6

# TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 6 of 15)

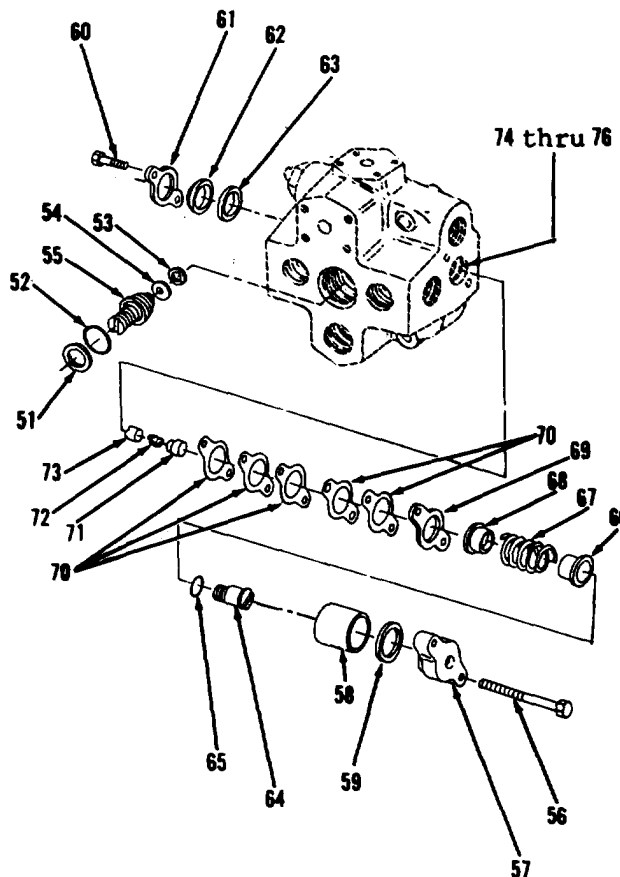
## DISASSEMBLY (cont)

- 35. Remove washer (51), preformed packing (52) and rings (53 and 54) from plug (55). Discard preformed packing (52).
- 36. Using a 9/16" socket and socket wrench handle, remove two bolts (56), cap (57), body (58) and seal (59). Discard seal (59).
- 37. Using a flat tip screwdriver, remove two screws (60), plate (61), wiper (62) and seal (63). Discard wiper (62) and seal (63).
- 38. Remove screw (64), preformed packing (65), seat (66), spring (67) and seat (68). Discard preformed packing (65).

### NOTE

Same quantity and size of shims must be installed during assembly.

- 39. Using a scribe, remove plate (69) and shims (70).
- 40. Remove spacer (71), spring (72) and poppet (73).
- 41. Remove items 74 thru 76 as an assembly.



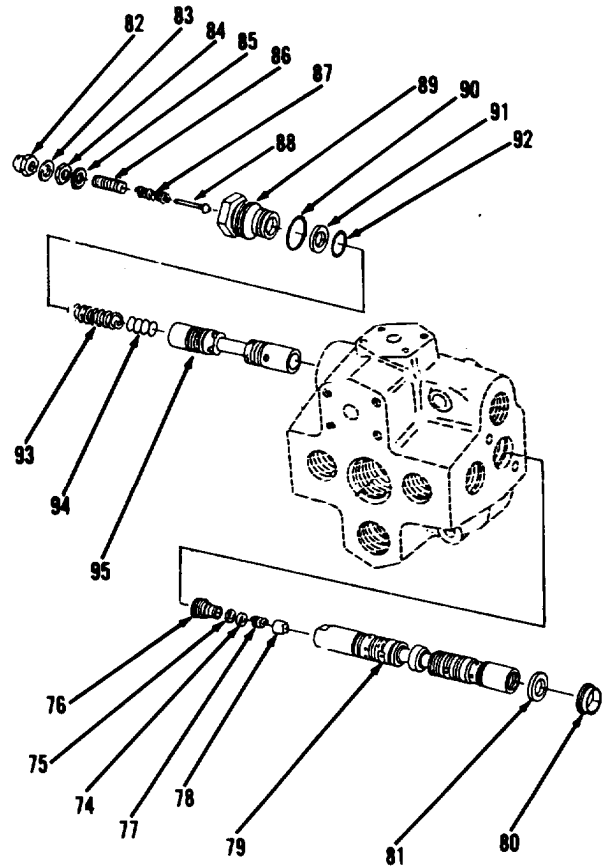
Go to sheet 7

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 7 of 15)

DISASSEMBLY

42. Using a scribe, remove retainer (74) and preformed packing (75) from plug (76). Discard preformed packing (75).
43. Remove spring (77) and poppet (78).
44. Remove plunger (79).
45. Remove and discard wiper (80) and seal (81).
46. Using an 11/16" open end wrench, remove nut (82) and preformed packing (83). Discard preformed packing (83).
47. Using an 11/16" open end wrench, remove locknut (84), preformed packing (85), adjusting screw (86), spring (87) and poppet (88). Discard preformed packing (85).
48. Using a 1-3/8" open end wrench, remove plug (89), preformed packing (90), retainer (91) and Preformed packing (92). Discard preformed packings (90 and 92).
49. Remove spring (93), shims (94) and plunger (95) from valve (96).



Go to sheet 8

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 8 of 15)

### CLEANING/INSPECTION

#### **WARNING**

##### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

##### ● COMPRESSED AIR HAZARD

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

50. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
51. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 9

STEERING TROUBLESHOOTING AND MAINTENANCE.

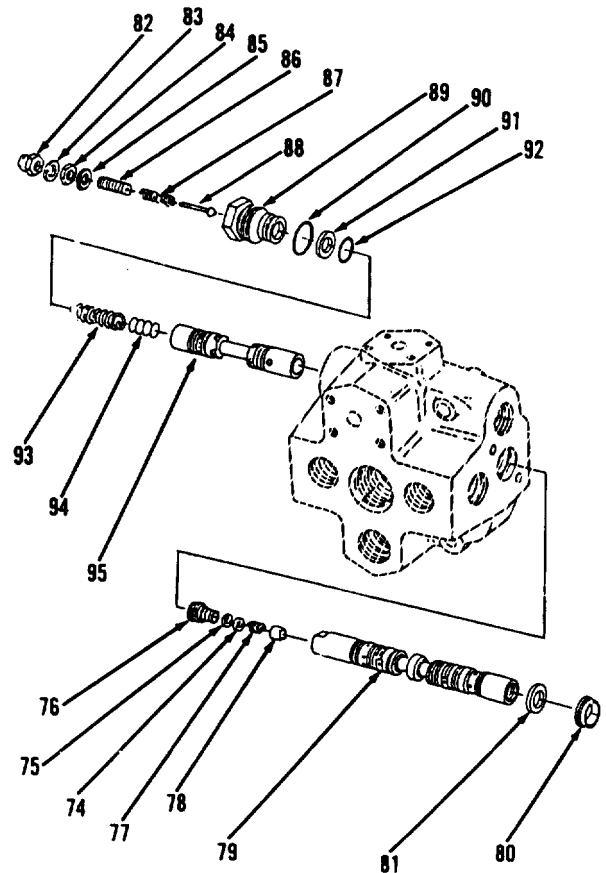
9-6. Control Valve and Check Valve. (Sheet 9 of 15)

ASSEMBLY

NOTE

All moving parts, preformed packings, plungers and seal counterbores in valve must be lubricated before assembling.

52. Install plunger (95), shims (94) and spring (93) in valve (96).
53. Install new preformed packing (92), retainer (91), new preformed packing (90) and plug (89).
54. Using an 11/16" socket, socket wrench handle and torque wrench, install poppet (88), spring (87), adjusting screw (86), new preformed packing (85) and locknut (84). Tighten locknut (84) to 10 lb-ft.
55. Install new preformed packing (83) and nut (82). Tighten nut (82) to 10 lb-ft.
56. Install new seal (81) and new wiper (80).
57. Install plunger (79).
58. Install poppet (78) and spring (77).
59. Install new preformed packing (75) and retainer (74) on plug (76).
60. Using a flat tip bit in adapter socket and torque wrench, install items 76 thru 74 as an assembly. Tighten plug (76) to 7.5 lb-ft.



Go to sheet 10

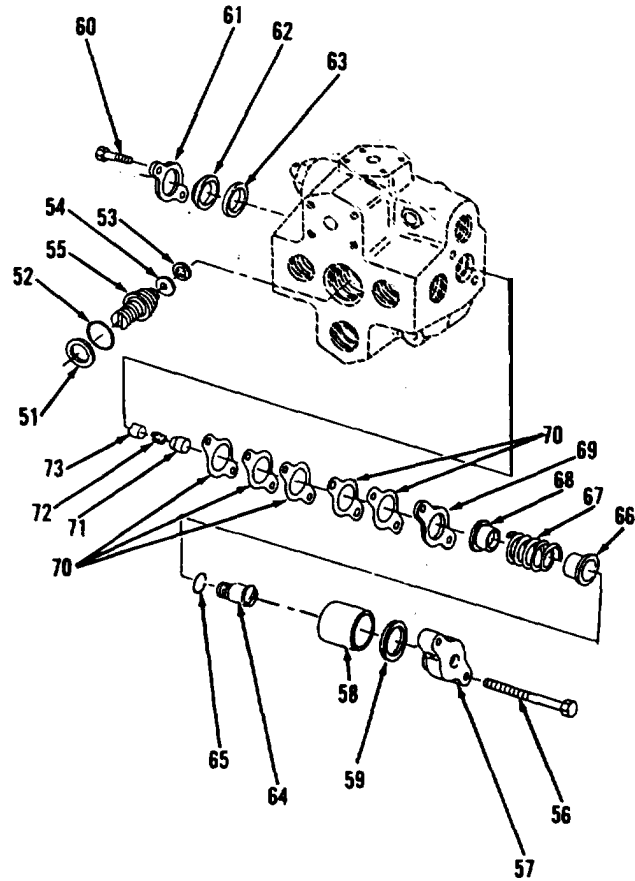
**TM 10-3930-643-34**

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 10 of 15)

ASSEMBLY (cont)

- 61. Install poppet (73), spring (72) and spacer (71).
- 62. Install shims (70) and plate (69).
- 63. Using a flat tip bit in adapter socket and torque wrench, install seat (68), spring (67), seat (66), new preformed packing (65) and screw (64). Tighten screw (64) to 7.5 lb-ft .
- 64. Install new seal (63), new wiper (62), plate (61) and two screws (60). Tighten screws (60) to 25 lb-ft.
- 65. Using a 9/16" socket, socket wrench handle and torque wrench, install new seal (59), body (58), cap (57) and two bolts (56). Tighten bolts (56) to 15 lb-ft.
- 66. Using a flat tip screwdriver, install rings (54 and 53), new preformed packing (52) and washer (51) on plug (55).



Go to sheet 11

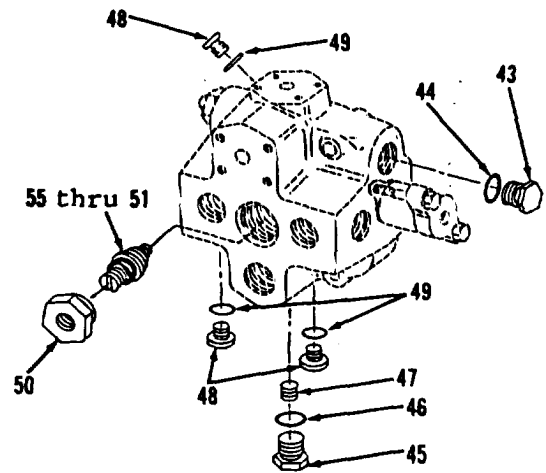


STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 11 of 15)

ASSEMBLY

67. Using a flat tip bit in adapter socket and torque wrench, install items 55 thru 51 as an assembly. Tighten plug (55) to 110 lb-ft.
68. Using a 1-1/2" socket, socket wrench handle and torque wrench, install nut (50). Tighten nut (50) to 50 lb-ft.
69. Using a 5/8" socket, socket wrench handle and torque wrench, install three new preformed packings (49) and plugs (48). Tighten plugs (48) to 30 lb-ft.
70. Using a 1-3/8" socket, socket wrench handle and torque wrench, install plug (47), new preformed packing (46), plug (45), new preformed packing (44) and plug (43). Tighten plug (47) to 45 lb-ft and plug (45) to 100 lb-ft.



Go to sheet 12

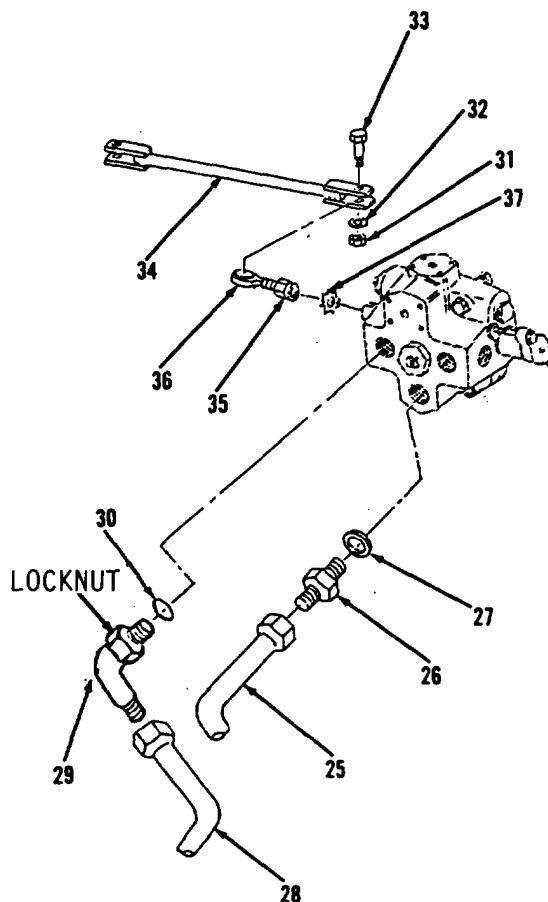
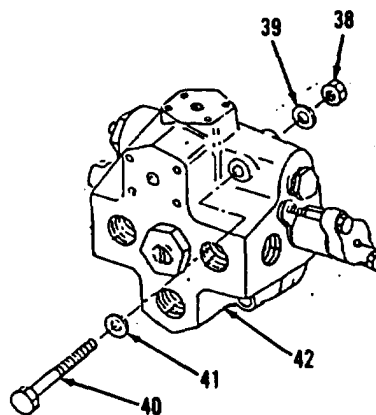
## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-6. Control Valve and Check Valve. (Sheet 12 of 15)

### INSTALLATION

71. Attach hoist and sling to valve assembly (42) and install under right side of cab.
72. Using a 3/4" socket, socket wrench handle and a 3/4" open end wrench, install three washers (41), bolts (40), washers (39) and nuts (38).
73. Remove hoist and sling.
74. Using a 10" adjustable wrench, install washer (37) and link assembly (36).
75. Using a 1-1/8" open end wrench, tighten locknut (35).
76. Position pin (34).
77. Using a 15/16" socket, socket wrench handle and a 1-1/8" open end wrench, install bolt (33), washer (32) and nut (31).
78. Using a 1-1/8" open end wrench, install new preformed packing (30) and elbow (29).
79. Using a 1-1/4" open end wrench, tighten locknut on elbow (29).
80. Using a 15/16" open end wrench, connect hose assembly (28) to elbow (29).
81. Using a 1-1/8" open end wrench, install new preformed packing (27) and connector (26).
82. Using a 15/16" open end wrench, connect hose assembly (25).



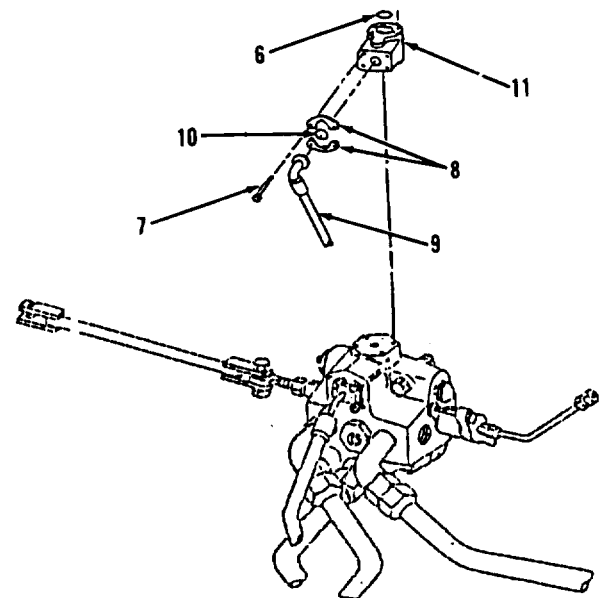
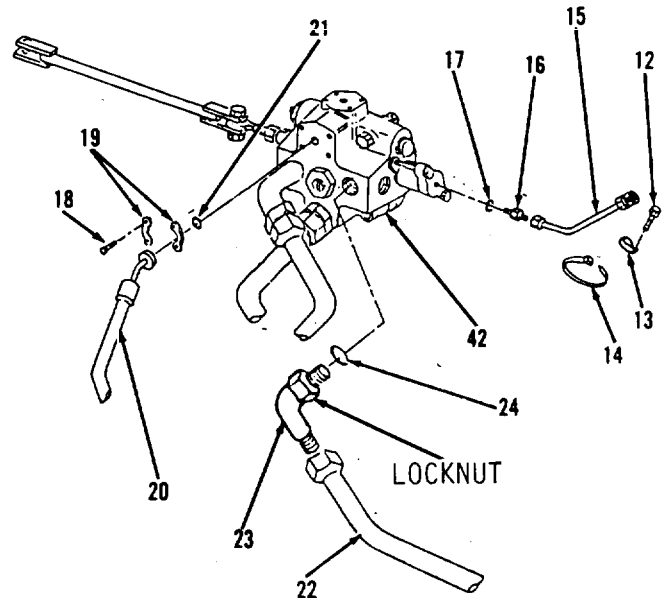
Go to sheet 13

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 13 of 15)

INSTALLATION

83. Using a 1-1/8" open end wrench, install new preformed packing (24) and elbow (23).
84. Using a 1-1/4" open end wrench, tighten locknut on elbow (23).
85. Using a 1" open end wrench, connect hose assembly (22).
86. Using a 9/16" socket and socket wrench handle, install new preformed packing (21), hose assembly (20), two flange halves (19) and four bolts (18).
87. Using a 3/4" open end wrench, install new preformed packing (17) and connector (16).
88. Using a 9/16" open end wrench, connect hose assembly (15).
89. Install new tie strap (14).
90. Using a 1/2" socket and socket wrench handle, install strap (13) and bolt (12) on right front of engine compartment.
91. Position check valve (11) on valve assembly (42) under right side of cab.
92. Position new preformed packing (10) and hose assembly (9) on check valve (11).
93. using a 9/16" socket and socket wrench handle, install two flange halves (8) and four bolts (7).
94. Install new preformed packing (6).



Go to sheet 14

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

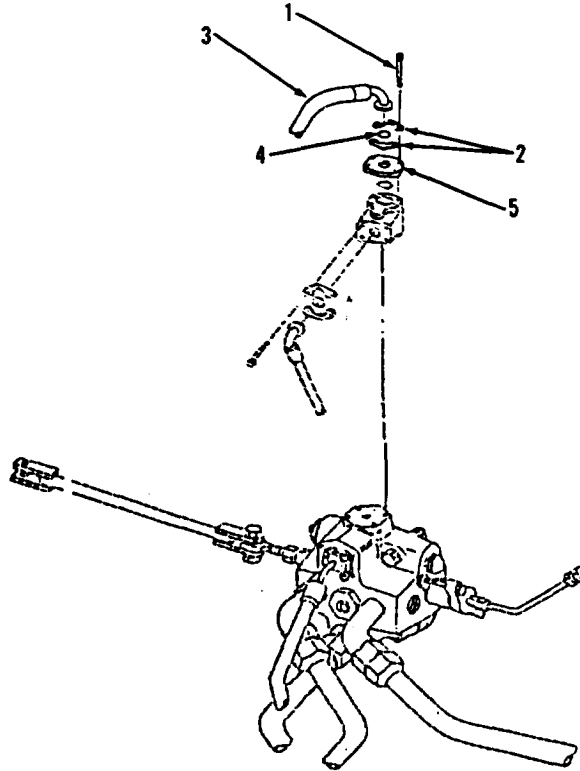
9-6. Control Valve and Check Valve. (Sheet 14 of 15)

### INSTALLATION (cont)

#### NOTE

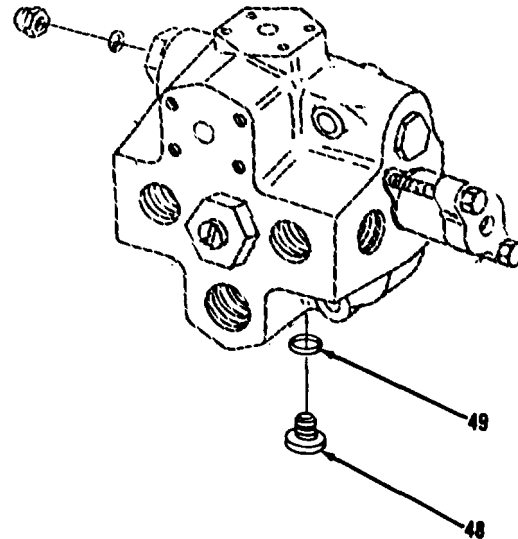
The following is a difference between M10A Forklift models.

95. Install plate (5) and new preformed packing (4) on vehicles S/N 2001 and above.
96. Position hose assembly (3) and two flange halves (2).
97. Using a 9/16" socket and socket wrench handle, install four bolts (1).



### ADJUSTMENT

98. Check fluid level of hydraulic fluid reservoir, refer to LO 10-3930-643-12. Fill to proper level.
99. Check fluid filter, refer to TM 10-3930-643-20. Clean or replace as necessary.
100. Using a 10" adjustable wrench, install relief valves, refer to TM 10-3930-643-20.
101. Using a 5/8" socket and socket wrench handle, remove one plug (48) and preformed packing (49). Discard preformed packing (49).
102. Using a 10" adjustable wrench, install hydraulic pressure gage (0-3000 psi).



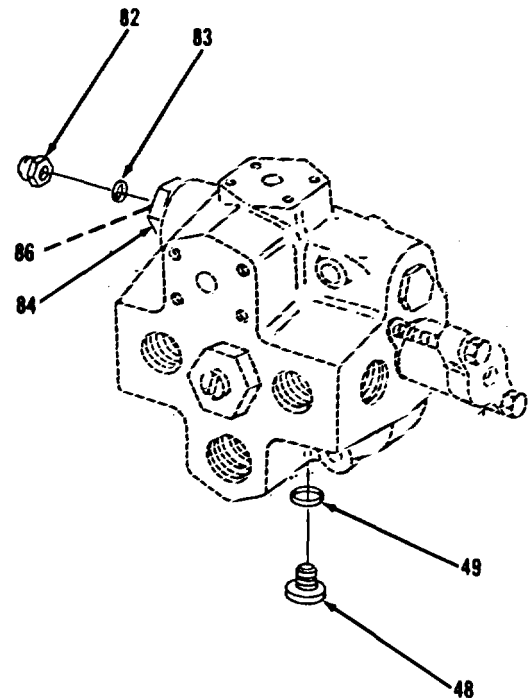
Go to sheet 15

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-6. Control Valve and Check Valve. (Sheet 15 of 15)

ADJUSTMENT

103. Using an 11/16" socket and socket wrench handle, remove nut (82) and preformed packing (83). Discard preformed packing (83).
104. Loosen locknut (84).
105. Using a flat tip screwdriver, back off adjusting screw (86) until no tension is felt.
106. Start engine and run at high idle. Turn steering wheel fully right or left. Hydraulic fluid must be at normal operating temperature. Pressure gage should read 2000 psi.
107. Using a flat tip screwdriver, turn adjusting screw (86) clockwise to increase pressure, counterclockwise to decrease pressure, as necessary.
108. Using an 11/16" socket, socket wrench handle and torque wrench, tighten locknut (84) to 10 lb-ft.
109. Stop engine.
110. Install new preformed packing (83) and nut (82).
111. Remove hydraulic pressure gage.
112. Using a 5/8" socket, socket wrench handle and torque wrench, install new preformed packing (49) and one plug (48). Tighten plug (48) to 30 lb-ft.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-7. Steering Circuit Relief Valve. (Sheet 1 of 7)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Adjustment

---

### INITIAL SETUP

#### Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

#### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Preformed packing (7)

#### Torques

Nuts (2 and 4) to 10 lb-ft.  
Body (13) to 75 lb-ft.

---

### EQUIPMENT CONDITION

#### References

TM 10-3930-643-20

#### Condition Description

Hydraulic system vented.  
Vehicle turned left.

---

Go to sheet 2

STEERING TROUBLESHOOTING AND MAINTENANCE.

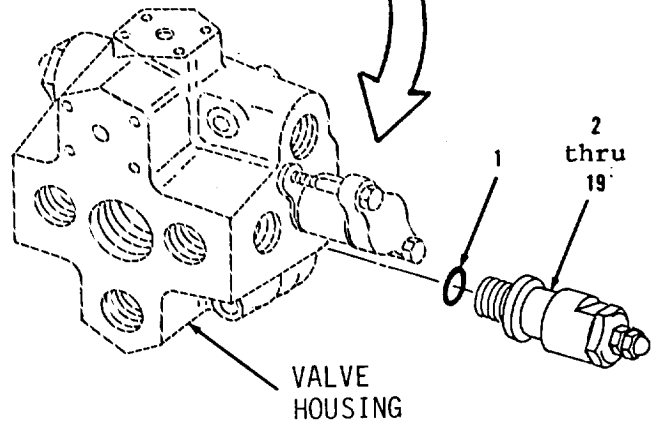
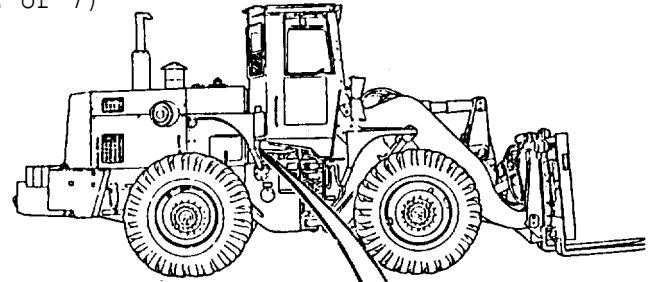
9-7. Steering Circuit Relief Valve. (Sheet 2 of 7)

REMOVAL

NOTE

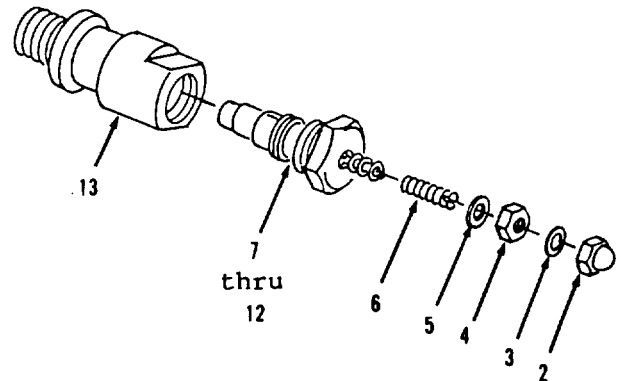
This task is for maintenance of the left steering relief valve. Procedure for maintenance of the right steering relief valve is identical.

1. Using a 1-1/4" open end wrench, remove items 2 thru 19 as an assembly from steering control valve under cab, on right side of vehicle.
- 2\* Using a scribe, remove and discard preformed packing (1).
3. Plug valve port on items 2 thru 19 as an assembly to prevent contamination from entering hydraulic system.



DISASSEMBLY

4. Using a 1-1/16" socket, socket wrench handle, machinist scribe and flat tip screwdriver, remove nut (2), preformed packing (3), nut (4), preformed packing (5) and screw (6). Discard preformed packings (3 and 5).
5. Using a 1-1/4" open end wrench, remove items 7 thru 12 as an assembly from body (13).



Go to sheet 3

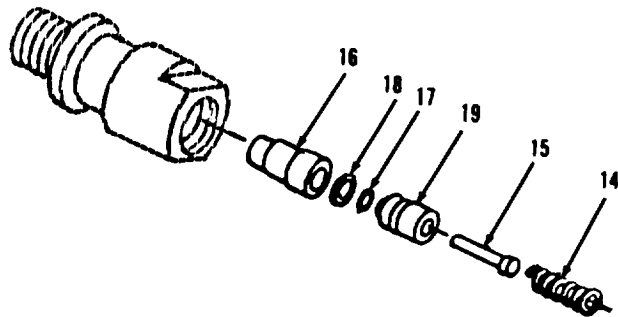
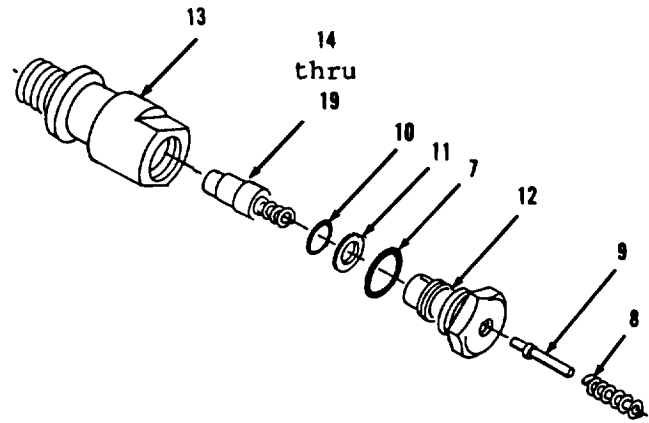
## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-7. Steering Circuit Relief Valve. (Sheet 3 of 7)

### DISASSEMBLY (cont)

6. Using a scribe, remove and discard preformed packing (7).
7. Remove spring (8), poppet (9), preformed packing (10) and retainer (11) from plug (12). Discard preformed packing (10).
8. Remove items 14 thru 19 as an assembly from body (13).
9. Remove spring (14), piston (15) and items 17 thru 19 as an assembly from poppet (16).
10. Using a scribe, remove ring (17) and preformed packing (18) from poppet (19). Discard preformed packing (18).



Go to sheet 4



STEERING TROUBLESHOOTING AND MAINTENANCE.

9-7. Steering Circuit Relief Valve. (Sheet 4 of 7)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

11. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
12. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

# TM 10-3930-643-34

## STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

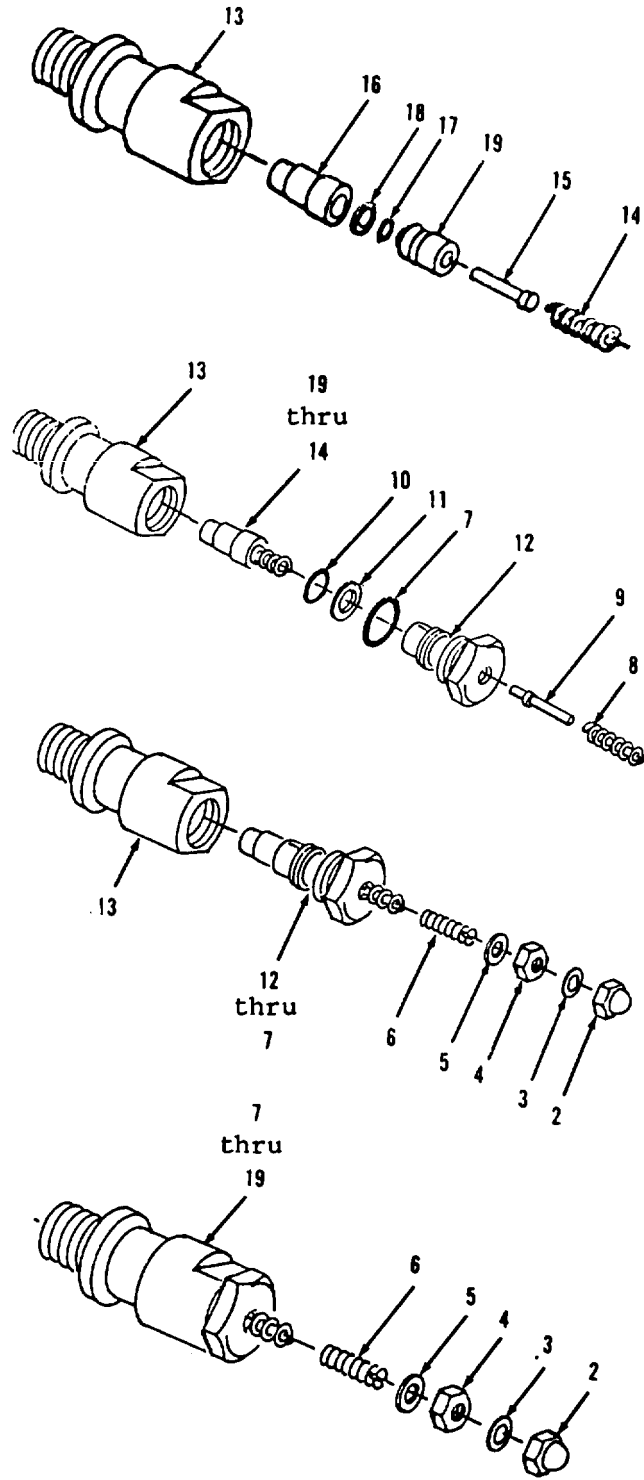
### 9-7. Steering Circuit Relief Valve. (Sheet 5 of 7)

#### ASSEMBLY

##### NOTE

All preformed packings must be lubricated with hydraulic fluid before installing.

13. Install new preformed packing (18) and ring (17) on poppet (19).
14. Install items 19 thru 17 as an assembly, piston (15) and spring (14) in poppet (16).
15. Install items 19 thru 14 as an assembly in body (13).
16. Install retainer (11), new preformed packing (10), poppet (9) and spring (8) in plug (12).
17. Install new preformed packing (7).
18. Using a 1-1/4" socket and socket wrench handle, install items 12 thru 7 as an assembly in body (13).
19. Using a flat tip screwdriver, 11/16" socket, socket wrench handle and torque wrench, install screw (6), new preformed packing (5), nut (4), new preformed packing (3) and nut (2). Tighten nut (4) to 10 lb-ft while holding screw (6). Tighten nut (2) to 10 lb-ft.



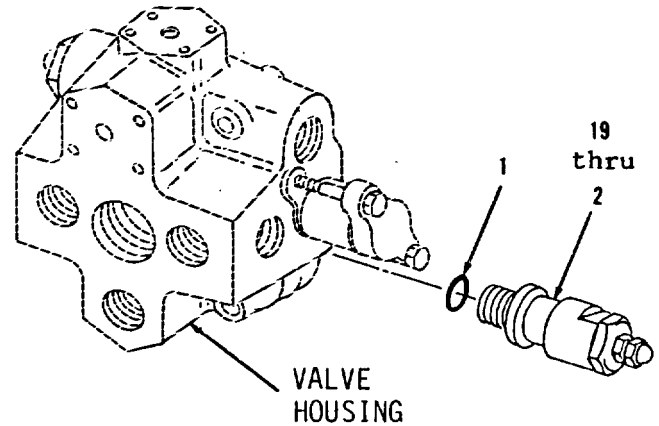
Go to sheet 6

STEERING TROUBLESHOOTING AND MAINTENANCE.

9-7. Steering Circuit Relief Valve. (Sheet 6 of 7)

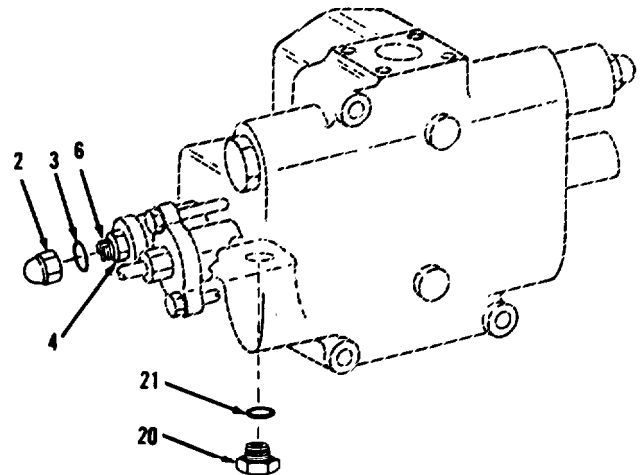
INSTALLATION

20. Using 15/16" socket, socket wrench handle and torque wrench, install items 19 thru 2 as an assembly and new preformed packing (1) in steering control valve. Tighten items 19 thru 2 to 75 lb-ft.



ADJUSTMENT

21. Using a 5/8" socket and socket wrench handle, remove plug (20) and preformed packing (21). Discard preformed packing (21).
22. Install pressure gage.
23. Operate and observe at what pressure valve releases. Valve should open at 3500 psi.
24. Using an 11/16" socket and socket wrench handle, remove nut (2) and new preformed packing (3), if necessary.
25. Using an 11/16" open end wrench and flat tip screwdriver, loosen nut (4) while holding screw (6).



Go to sheet 7

## TM 10-3930-643-34

STEERING TROUBLESHOOTING AND MAINTENANCE. (cont)

9-7. Steering Circuit Relief Valve. (Sheet 7 of 7)

### ADJUSTMENT (cont)

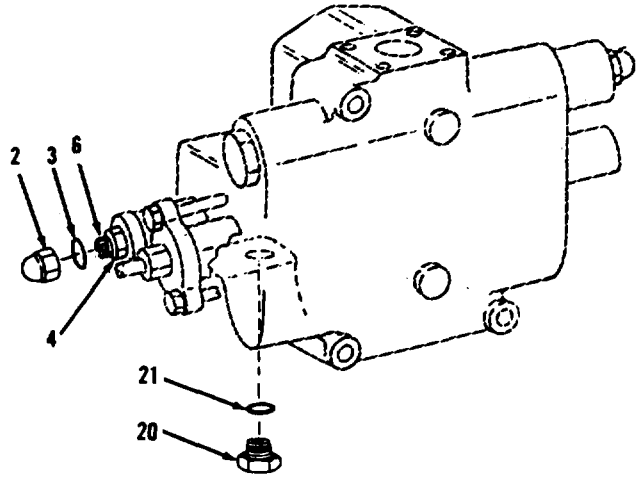
#### NOTE

Turn screw clockwise to increase pressure: counterclockwise to decrease as necessary.

26. Using an 11/16" socket, socket wrench handle, torque wrench and flat tip screwdriver, tighten nut (4) to 10 lb-ft while holding screw (6), after obtaining proper pressure setting.
27. Using an 11/16" open end wrench, install new preformed packing (3) and nut (2).
28. Remove pressure gage.
29. Using a 5/8" socket and socket wrench handle, install new preformed packing (21) and plug (20).

#### NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

## CHAPTER 10

FRAME AND TOWING ATTACHMENTS  
MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift frame.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Bolster	10-1	10-2
Frame Hinge Pin and Frame Assembly	10-2	10-6
Counterweights	10-3	10-19
Roll Over Protective Structure (S/N) 2000 and below)	10-4	10-23



FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-1. Bolster. (Sheet 2 of 4)

REMOVAL

**WARNING**

WEIGHT HAZARD

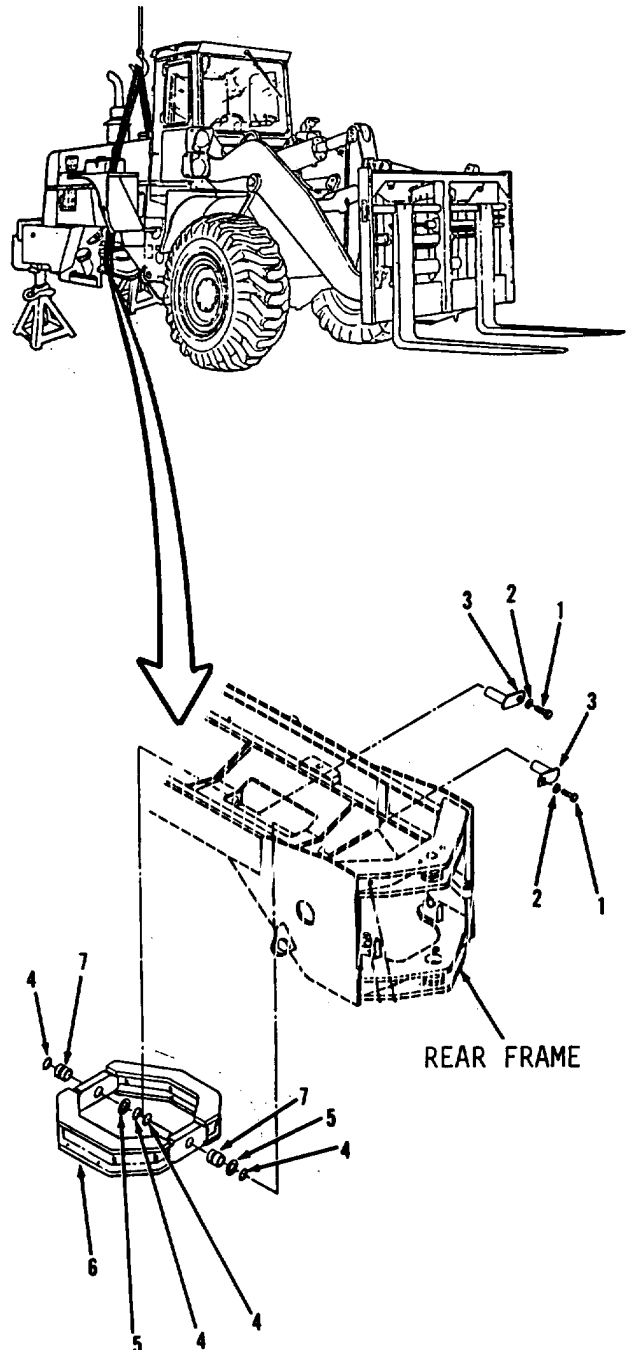
Weight of bolster is approximately 350 lbs. Use adequate hoist and two slings for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

1. Attach two slings to bolster (6) in rear of frame. With hoist suspended above center, rear of vehicle, take up slack in slings.
2. Using a 3/4" socket and socket wrench handle, remove two bolts (1) and washers (2).

**CAUTION**

Bolster will be suspended by slings when pins are removed. Keep even tension on slings after one pin has been removed to keep other pin from binding.

3. Using a flat brass punch and hammer, remove two pins (3), four preformed packings (4) and spacers (5). Discard preformed packings (4).
4. Lower bolster (6) onto dollies to make removing from under vehicle easier. Remove slings.
5. Using a flat brass punch and hammer, remove two bushings (7).



Go to sheet 3

## TM 10-3930-643-34

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-1. Bolster. (Sheet 3 of 4)

### CLEANING/INSPECTION

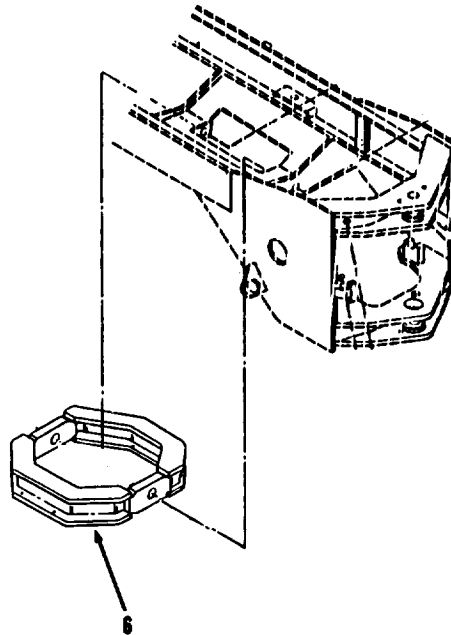
#### **WARNING**

##### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

##### ● COMPRESSED AIR HAZARD

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



6. Wipe bolster (6) clean with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly.
7. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
8. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

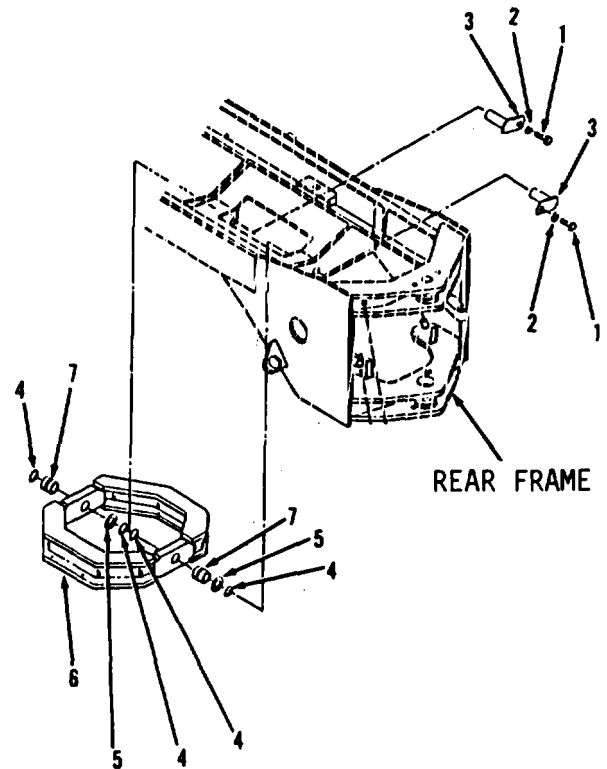


FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-1. Bolster. (Sheet 4 of 4)

INSTALLATION

9. Lubricate bushings (7) with clean grease. Using a flat brass punch and hammer, install bushings (7) in bolster (6). Groove in bushing (7) must be in alignment with bore in bolster (6).
10. Using dollies, position bolster (6) under vehicle.
11. Attach slings to bolster (6).
12. Using a hoist and sling, position bolster (6) to frame.
13. Lubricate spacers (5) and four new preformed packings (4) with clean grease and install on bolster (6).
14. Lubricate two pins (3) with clean grease and using a flat brass punch and hammer, install.
15. Measure clearance between spacers (5) and frame. Clearance must be 0.0625 inch. Remove pins (3) and add spacers as necessary if clearance exceeds requirements.
16. Using a 3/4" socket and socket wrench handle, install two washers (2) and bolts (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 2 of 13)

CHECKING HINGE PIN WEAR

1. Position vehicle on level ground.

NOTE

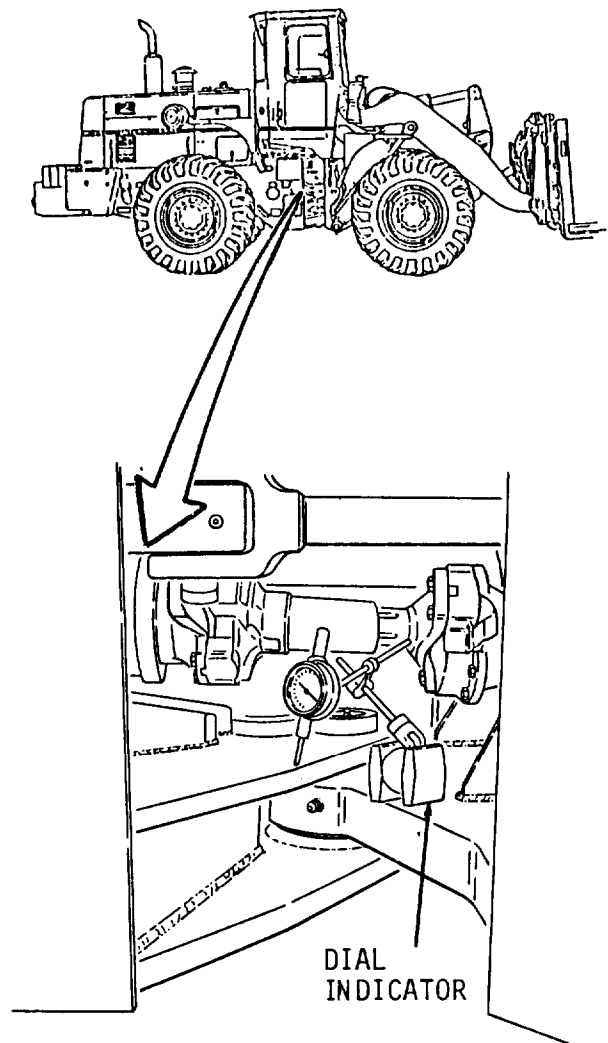
Place the dial indicator in a position that will allow another person to observe the readings from the side of the vehicle at a safe distance.

2. Position dial indicator as close as possible to the hitch pin at the lower frame hitch and zero dial indicator.

**WARNING**

Only a qualified operator may perform the next step. All other personnel, with the exception of an observer for reading the dial indicator, must clear the immediate area. Failure to follow this procedure could result in SEVERE INJURY or DEATH.

3. Power forklift down until front wheels are off ground.
4. Read dial indicator.
5. Raise forklift to full height.
6. Read dial indicator. If readings indicate an up and down movement of more than 0.010 inch, adjustment or replacement is necessary.
7. Install safety lock bar, refer to TM 10-3930-643-10.
8. Lower forklift to ground.
9. Stop engine.



## TM 10-3930-643-34

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 3 of 13)

### ADJUSTMENT

#### NOTE

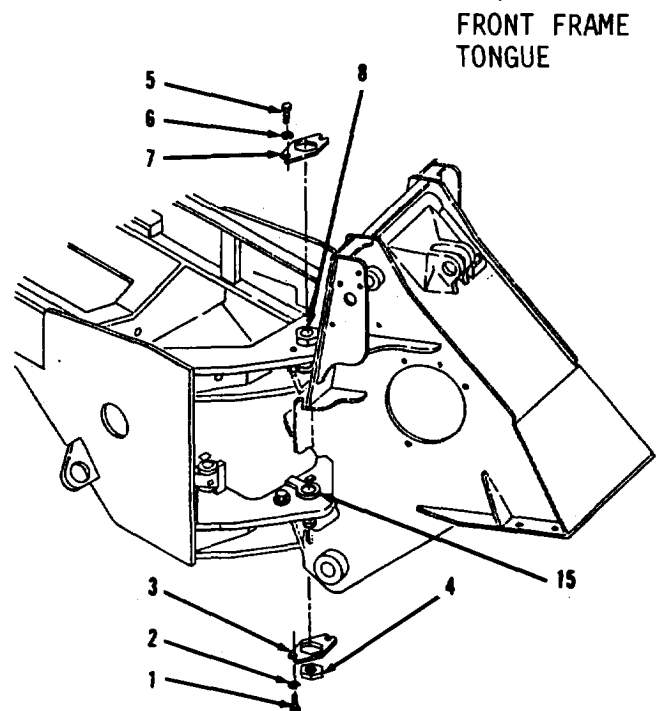
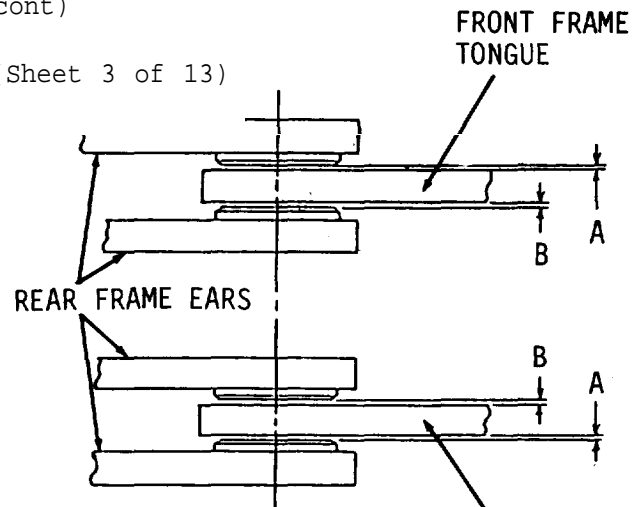
During adjustment, lock plates on shafts must be kept from moving by frame stop blocks and spacers.

10. Center hinge alignment. Using feeler gage, measure at points A. The front frame tongues should be centered between rear frame ears so that the dimensions at points A are the same.
11. Using feeler gage, measure at points B. The dimensions at points B must be the same. Dimensions will not necessarily be the same as the point A measurements.

#### NOTE

Dimensions at points A and B must be spaced so that no part of the front frame tongues comes in contact with the rear frame ears.

12. Using a 15/16" socket and socket wrench handle, remove two bolts (1), washers (2) and retainer plate (3) from lower hitch.
13. Using a 3-1/16" socket and socket wrench handle, remove nut (4).
14. Using a 15/16" socket and socket wrench handle, remove two bolts (5), washers (6) and retainer plate (7) from upper hitch.
15. Using a 3-1/16" socket and socket wrench handle, adjust points A and B clearance of front and rear frame. If front frame tongues are too high, loosen nut (8). If front frame tongues are too low, tighten nut (8), refer to step (10 and 11) for proper dimensions.



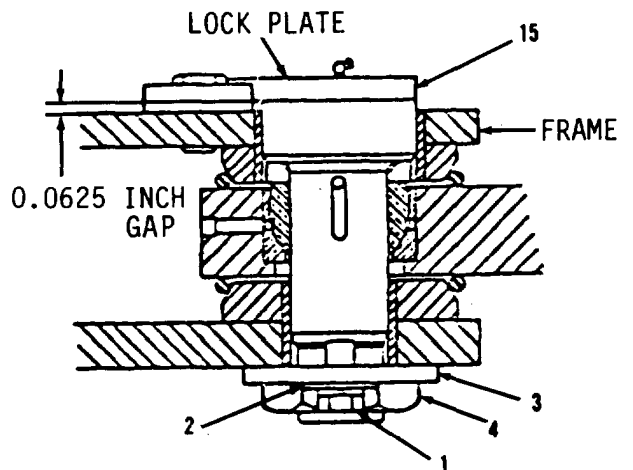
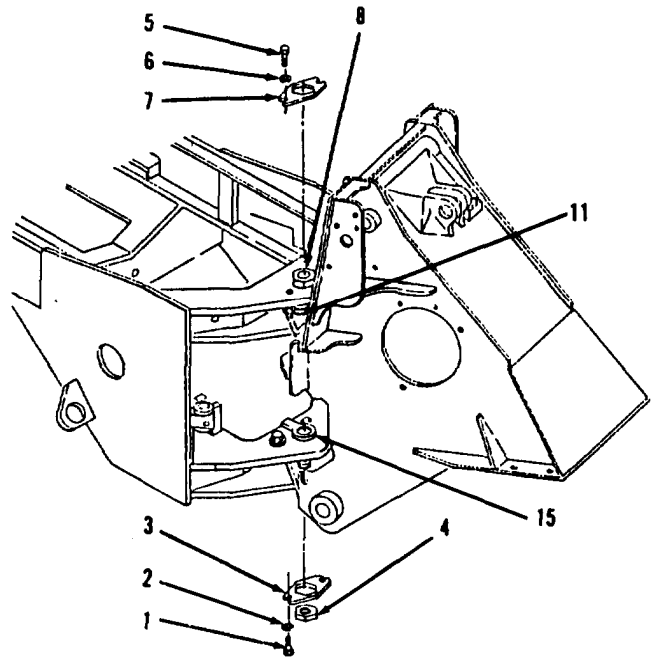
Go to sheet 4

FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 4 of 13)

ADJUSTMENT

16. Using a feeler gage, measure clearance between lock plates and frame ears. Shafts (11 and 15) and their lock plates must not make contact with frame ears. A minimum of 0.0625 inch must exist between lock plate and frame. If clearance is incorrect, refer to step 29 for shim installation.
17. Using a 15/16" socket and socket wrench handle, install retainer plate (7), two washers (6) and bolts (5). Retainer plate (7) can be turned over if it does not aline with nut (8). If retainer plate (7) still does not aline with nut (8), loosen or tighten nut (8). Do not turn nut more than 30 degrees.
18. Using a 3-1/16" socket, socket wrench handle and torque wrench, install nut (4) and tighten to 190 lb-ft. Tap head of shaft (15) solidly with hammer while tightening nut (4) to seat shaft (15).
19. Loosen nut (4).
20. Tighten nut (4) by hand with retainer plate (3).
21. Raise forklift to maximum height and lower in jerky increments. This will help to seat mating components.
22. Recheck vertical frame movement with dial indicator, refer to step 6. If dial indicator reading still exceeds 0.010 inch, determine if movement is all up and down. If movement is anything but vertical, replacement of worn parts is necessary. If measure exceeds 0.010 inch and is all up and down, repeat steps 18 and 19. Increase tightening of nut (4) to 220 lb-ft.



Go to sheet 5

# TM 10-3930-643-34

## FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

### 10-2. Frame Hinge Pin and Frame Assembly.

#### ADJUSTMENT (cont)

(Sheet 5 of 13)

23. Using a 15/16" socket and socket wrench handle, install retainer plate (3), two washers (2) and bolts (1). Retainer plate (3) can be turned over if it does not align with nut (4). If retainer plate (3) still does not align with nut (4), do not turn more than 30 degrees.

#### NOTE

The following step is the procedure used to acquire 0.0625 inch gap between shafts lock plates and frame ears.

24. Using bottle jacks, support frames to allow removal of shaft (15) or shaft (11).

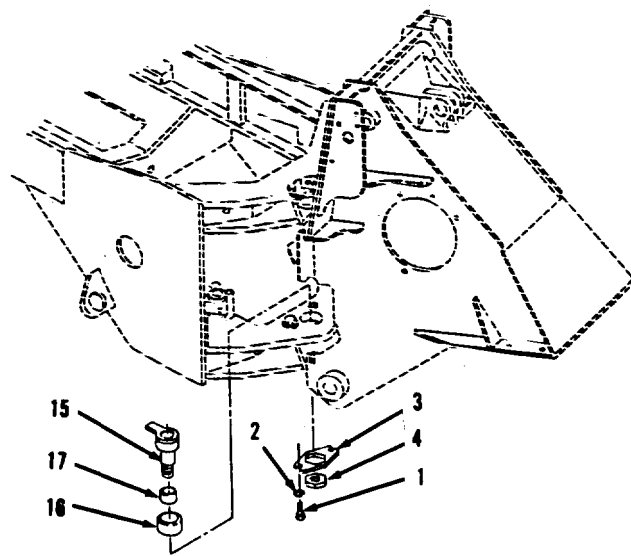
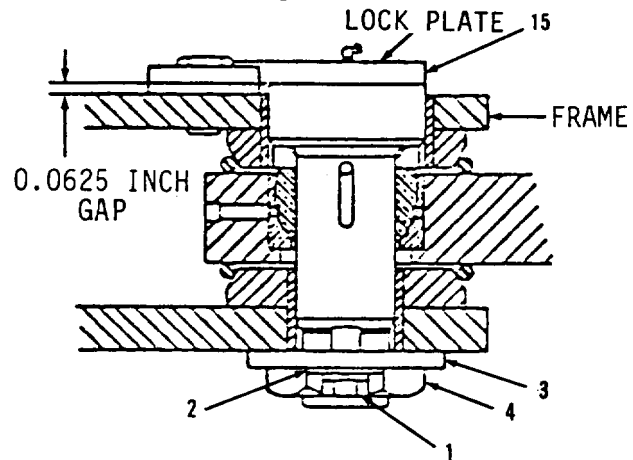
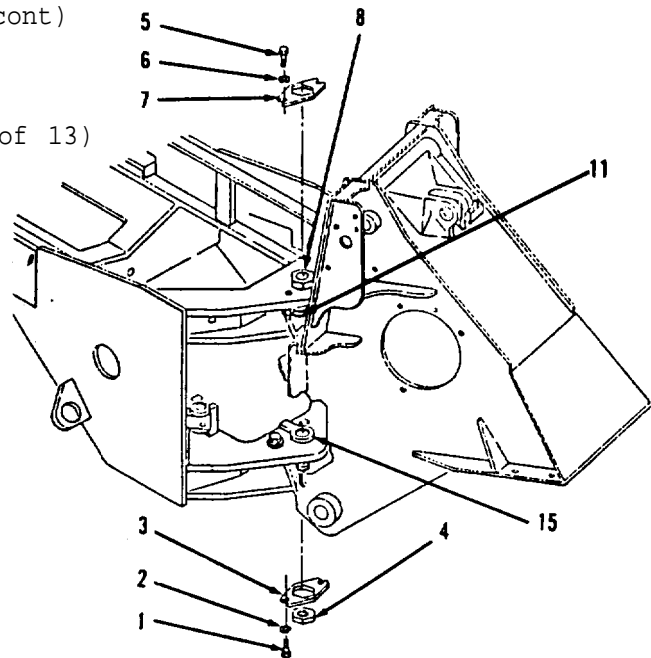


Do not remove both shafts from frame at the same time. If both shafts need adjustment, remove one at a time.

#### NOTE

The following steps are for adjusting lower hitch shaft. Adjustment of upper hitch shaft is identical, except as noted.

25. Remove steering linkage before removal of upper hitch shaft, refer to TM 10-3930-643-20.
26. Using a 15/16" socket and socket wrench handle, remove two bolts (1), washers (2) and retainer plate (3).
27. Using a 3-1/16" socket and socket wrench handle, remove nut (4).



Go to sheet 6

FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 6 of 13)

ADJUSTMENT

29. Using a flat brass punch and hammer, remove spacer (16) from shaft (15).
30. Install shims (17) and spacer (16) on shaft (15). Each shim is 0.010 inch thick.
31. Lubricate shaft (15) with clean grease, using a flat punch and hammer, install shaft (15).
32. Using a 3-1/16" socket and socket wrench handle, install nut (4) and adjust, refer to Adjustment procedures.
33. Using a 15/16" socket and socket wrench handle, install retainer plate (3), two washers (2) and bolts (1).

REMOVAL

34. Remove transmission to bearing hanger propeller shaft, refer to TM 10-3930-643-20.
35. Remove steering linkage, refer to TM 10-3930-643-20.
36. Use four ten-ton bottle jacks to support front and rear frames.

Go to sheet 7

# TM 10-3930-643-34

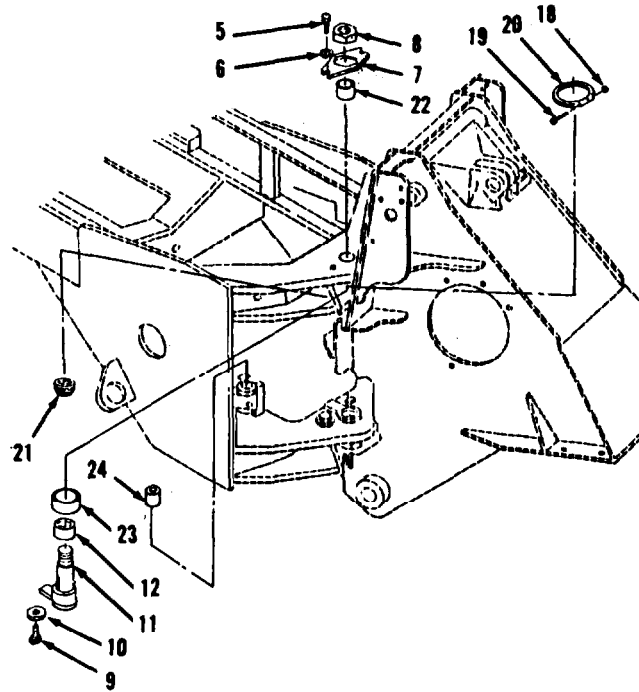
FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 7 of 13)

## REMOVAL (cont)

### NOTE

- The following procedure is for removal of the top hitch shaft and bushings. Removal of lower hitch shaft and bushings is identical, except for positioning of a suitable puller or ports-power.
  - Nut and bolt are provided for replacing seal, without removing shafts.
37. Using a 1/2" socket, socket wrench handle and a 1/2" open end wrench, remove two nuts (18), bolts (19) and seals (20). Discard two seals (20).
  38. Using a 15/16" socket and socket wrench handle, remove two bolts (5), washers (6) and retainer plate (7).
  39. Using a 3-1/16" socket and socket wrench handle, remove nut (8).
  40. Using a 1-1/8" socket and socket wrench handle, remove bolt (9) and spacer (10).
  41. Using a large rubber mallet, remove shaft (11). If necessary, drive shaft (11) from frame with hammer and drift.
  42. Using a hammer and drift punch, remove spacer (12).
  43. Remove bushing (23).



Go to sheet 8



## FRAME AND TOWING ATTACHMENTS MAINTENANCE.

## 10-2. Frame Hinge Pin and Frame Assembly. (Sheet 8 of 13)

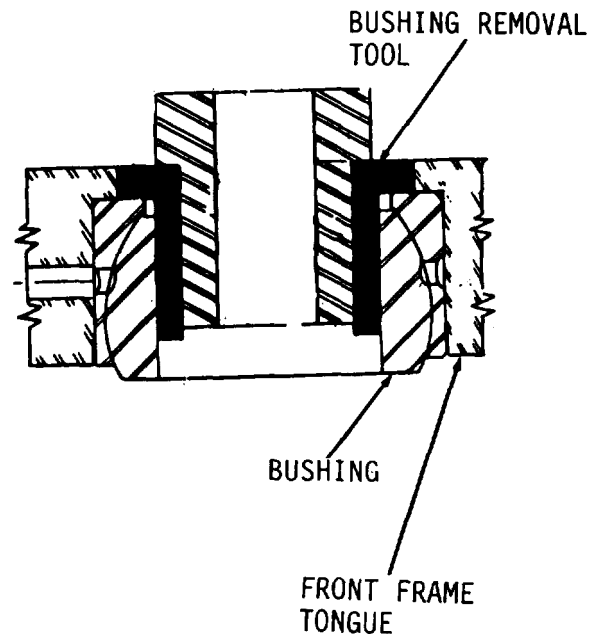
REMOVAL**CAUTION**

Do not remove both upper and lower shafts at the same time. Do one at a time, only.

## NOTE

Repositioning of surrounding lines, cables or hoses may be necessary to accommodate use of equipment.

44. Using a bushing removal tool, a 7/16" socket, socket wrench handle and a 7/16" open end wrench, remove bushing (21). Install two side pieces of bushing removal tool in bushing (21) so the lips of the tool grasp the lower edge of the bushing (21).
45. Install the center piece of the bushing removal tool over the shaft of the ports-power and between the two side pieces of the bushing removal tool.
46. Install a nut to lock the assembly together on the ports-power shaft. Activate the ports-power and push out bearing (21).
47. Using a hammer and drift punch, remove bushing (22).
48. Remove two bushings (24) from left and right side of rear frame.



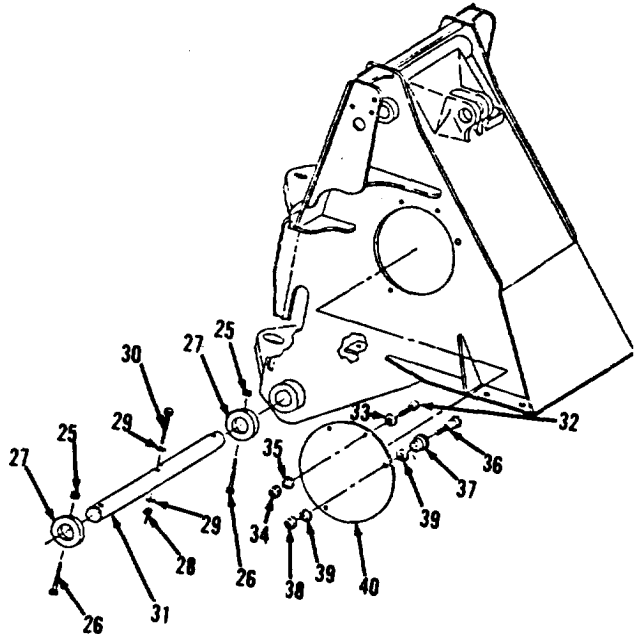
Go to sheet 9

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 9 of 13)

REMOVAL

49. Using 3/4" socket, socket wrench handle and an open end wrench, remove two nuts (25), bolts (26) and fittings (27) from lift cylinders on each side of vehicle. Refer to paragraph 12-12.
50. Using a hoist and slings, disconnect two lift cylinders assemblies and secure on boom assembly.
51. Using a 3/4 socket, socket wrench handle and an open end wrench, remove nut (28) two washers (29) and bolt (30) from rod (31) under rear front frame assembly.
52. Using a hammer and drift punch, remove rod (31). Drive rod (31) through the front frame assembly and remove from the other side of vehicle.
53. Using a 9/16" socket, socket wrench handle and a open end wrench, remove two bolts (32), spacers (33), nuts (34) and washers (35) from access cover (40).
54. Remove six bolts (36), rollers (37), nuts (38), washers (39) and access cover (40).



Go to sheet 10

## FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 10 of 13)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

55. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
56. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 11

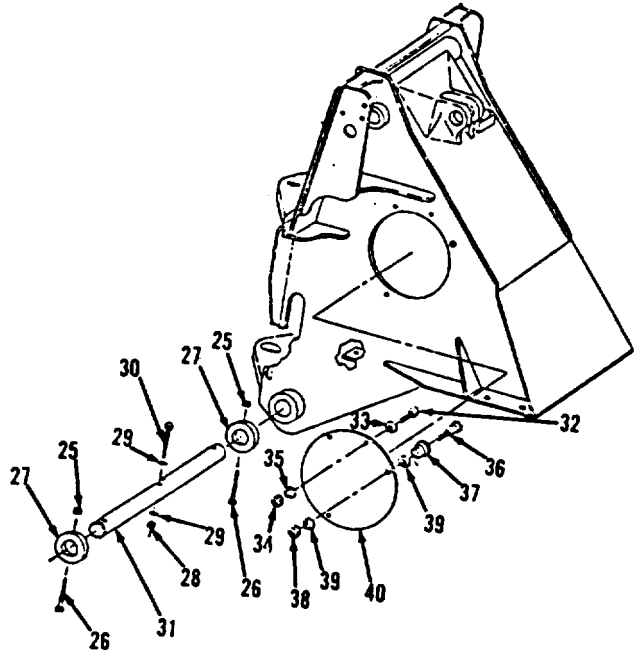
10-15

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-2. Frame Hinge Pin and Frame Assembly. (Sheet 11 of 13)

INSTALLATION

57. Using a 9/16" socket, socket wrench handle and a open end wrench, install access cover (40), six washers (39), nuts (38), rollers (37) and bolts (36) to front frame assembly.
58. Install two washers (35), nuts (34), spacers (33) and bolts (32) to access cover (40).
59. Using a hammer and drift punch, install rod (31).
60. Using a 3/4 socket, socket wrench handle and an open end wrench, install bolt (30), two washers (29), and nut (28) to rod (31) under rear front frame assembly.
61. Using a hoist and slings, connect two lift cylinders assemblies. Refer to paragraph 12-12.
62. Using 3/4" socket, socket wrench handle and an open end wrench, install two fittings (27), bolts (26) and nuts (25) to lift cylinders on each side of vehicle.

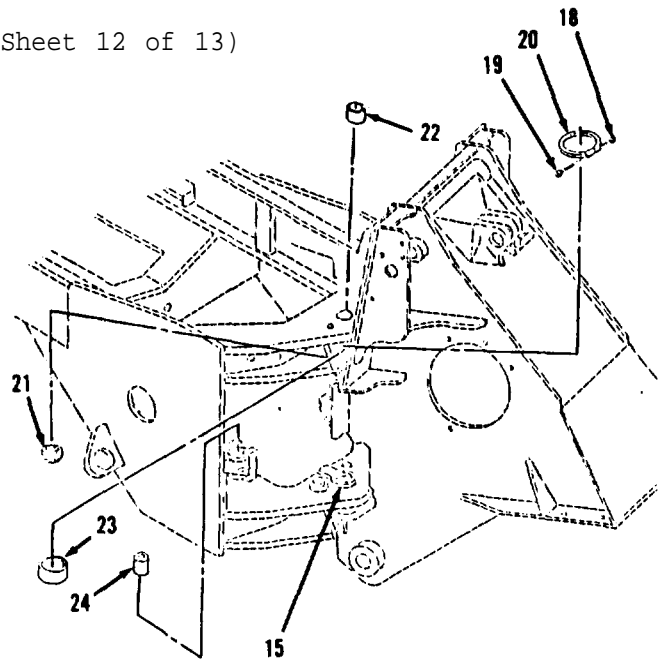


## FRAME AND TOWING ATTACHMENTS MAINTENANCE.

## 10-2. Frame Hinge Pin and Frame Assembly. (Sheet 12 of 13)

INSTALLATION

63. Lubricate bores with clean grease. Using a hammer and drift punch, install two bushings (24) on left and rights sides of rear frame.
64. Lubricate bore with clean grease. Install bushing (21), refer to step 44. Use ports-power or equivalent to push bushing (21) into front frame tongue until bushing seats against counterbore of tongue.
65. Lubricate bore with clean grease. Install bushing (23) until flush with frame ear surfaces.
66. Lubricate bore with clean grease. Install bushing (22) until flush with frame ear surfaces.
67. Using a 1/2" socket, socket wrench handle and a 1/2" open end wrench, position two new seals (20). One seal goes on top of upper front frame tongue and one goes below tongue. Cutting of new seals is not necessary if shafts (15 or 11) have been removed. If shafts are already in place, then cut new seals and use bolts (19) and nuts (18) to secure seals (20).



Go to Sheet 13

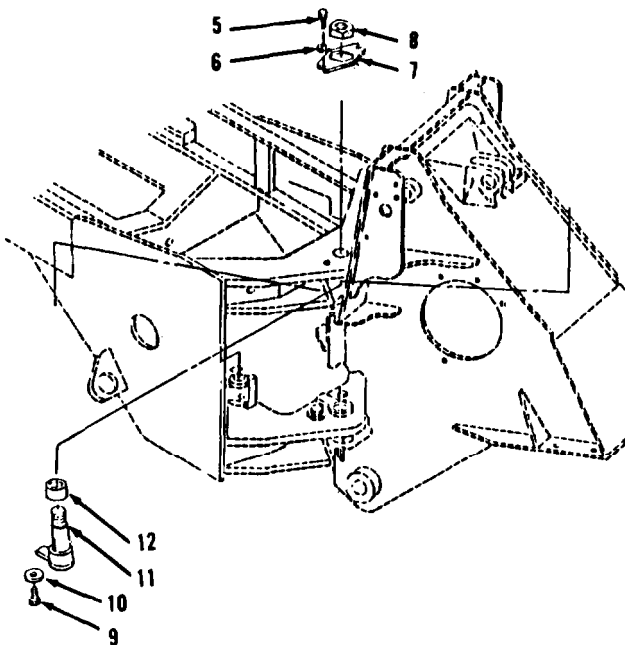
10-2. Frame Hinge Pin and Frame Assembly. (Sheet 13 of 13)

INSTALLATION (cont)

68. Using a hammer and drift, install spacer (12).
69. Using a large rubber mallet, install shaft (11). If necessary, drive shaft (11) into frame with hammer and drift.
70. Using a 1-1/8" socket and socket wrench handle, install spacer (10) and bolt (9).
71. Using a 3-1/16" socket and socket wrench handle, install nut (8).
72. Using a 15/16" socket and socket wrench handle, install retainer plate (7), two washers (6) and bolts (5).

NOTE

The following step must be done after upper and lower hitch bearings have been replaced.



73. Adjust front and rear frames, refer to Adjustment procedure.
74. Install steering linkage, refer to TM 10-3930-643-20.
75. Install transmission to bearing hanger propeller shaft, refer to TM 10-3930-643-20.
76. Lubricate with clean grease. Install lubrication lines and fittings.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-3. Counterweights. (Sheet 2 of 4)

REMOVAL

**WARNING**

WEIGHT HAZARD

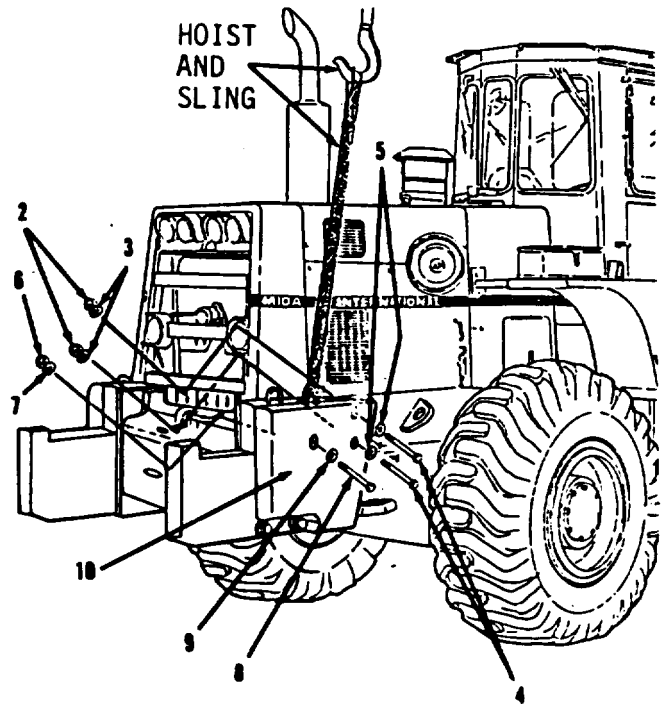
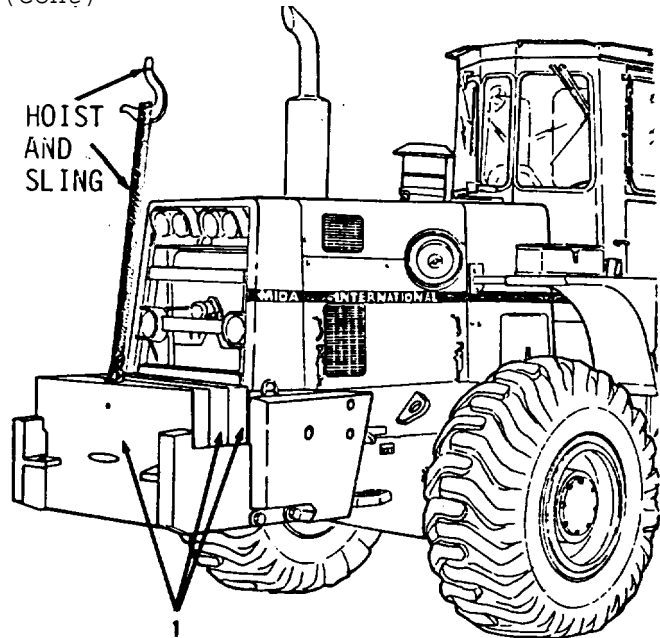
The weight of the heaviest counterweight is 2135 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

1. Attach hoist and sling to one weight (1) in rear of vehicle.
2. Using a hoist and sling, remove three weights (1), one at a time, from vehicle.
3. Remove hoist and sling.

NOTE

The following step is for removal of side weights on the right side. Removal and installation of left side weights is identical.

4. Attach hoist and sling to weight (10) on right side of rear frame.
5. Using a 1-1/8" socket, socket wrench handle and 1-1/8" open end wrench, remove two nuts (2), washers (3), bolts (4), washers (5), nut (6), washer (7), bolt (8), washer (9) and weight (10). Bolts (4) may have to be driven from frame and weights (10 and 15) with a hammer and drift.



Go to sheet 3

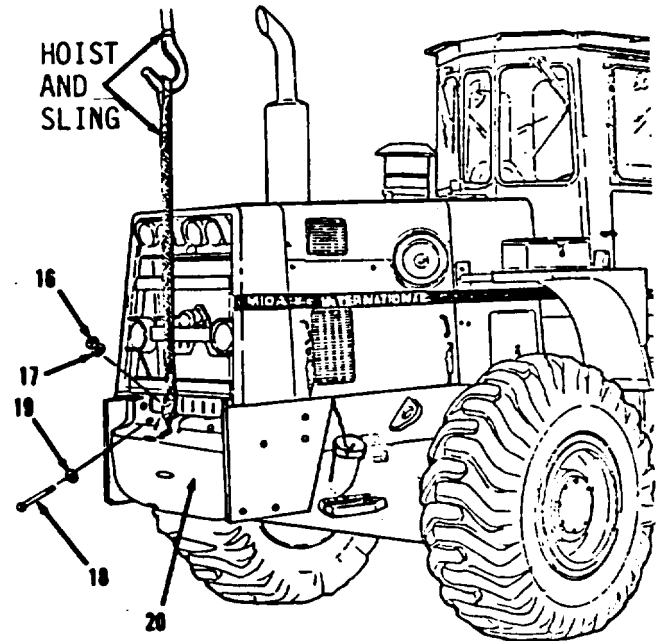


FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-3. Counterweights. (Sheet 3 of 4)

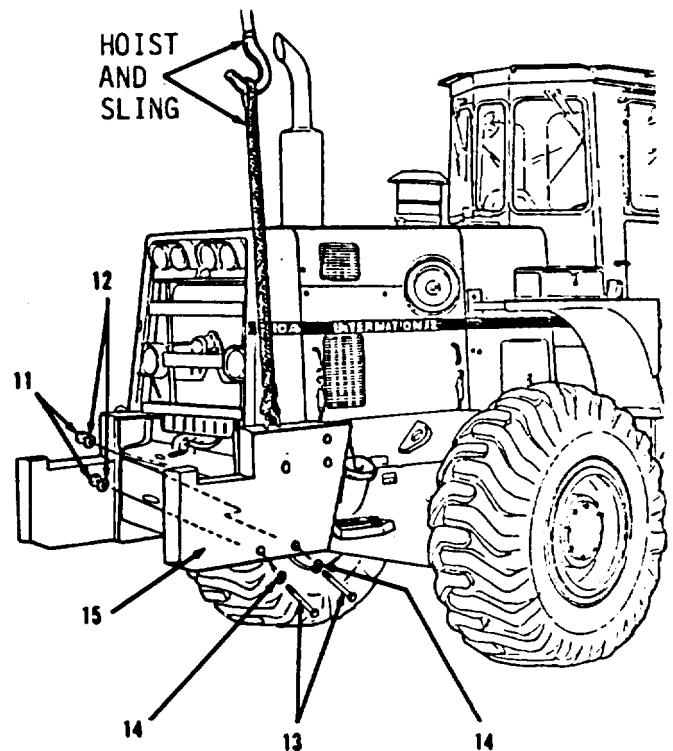
REMOVAL

6. Attach hoist and sling to weight (15).
7. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, remove two nuts (11), washers (12), bolts (13), washers (14) and weight (15).
8. Remove hoist and sling from weight (15).
9. Attach hoist and sling to weight (20).
10. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, remove four nuts (16), washers (17), bolts (18), washers (19) and weight (20).



INSTALLATION

11. Position weight (20) on frame.
12. Using a 1-1/8" socket, socket wrench handle and a 1-1/8" open end wrench, install four washers (19), bolts (18), washers (17) and nuts (16). Tighten bolts (18) to 280 lb-ft.
13. Remove hoist and sling from weight (20).
14. Attach hoist and sling to weight (15).
15. Position weight (15) on rear of frame.
16. Using a 1-1/2" socket, socket wrench handle and a 1-1/2" open end wrench, install two washers (14), bolts (13), washers (12) and nuts (11).
17. Remove hoist and sling from weight (15).



Go to sheet 4

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

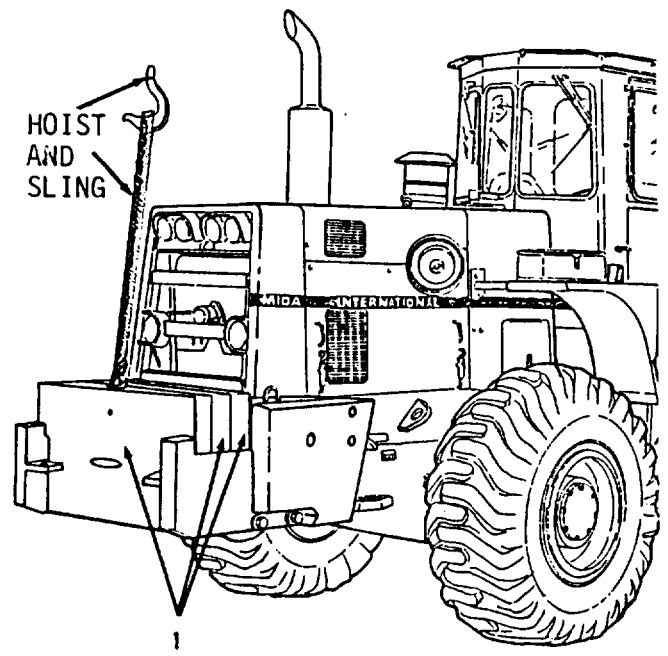
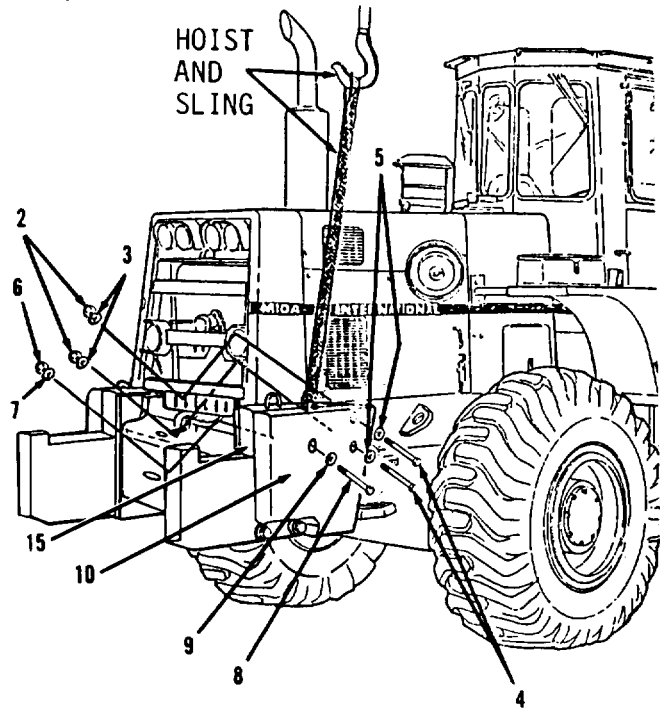
10-3. Counterweights. (Sheet 4 of 4)

INSTALLATION (cont)

18. Attach hoist and sling to weight (10).
19. Using a 1-1/8" socket, socket wrench handle and 1-1/8" open-box wrench, position weight (10) on weight (15).
20. Install washer (9), bolt (8), washer (7) and nut (6). Tighten bolt (8) to 680 lb-ft.
21. Install two washers (5), bolts (4), washers (3) and nuts (2). Tighten two bolts (4) to 280 lb-ft.
22. Remove hoist and sling from weight (10).
23. Attach hoist and sling to three weights (1), one at a time.
24. Install three weights (1) on rear of vehicle.
25. Remove hoist and sling from weight (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-4. Roll Over Protective Structure. (S/N 2000 and below). (Sheet 1 of 6)

- This task covers:
- a. Disassembly
  - b. Cleaning/Inspection
  - c. Assembly

INITIAL SETUP

Tools

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

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Strips (3)  
Channel (4)

Torques

Except for special torques shown, all fasteners are tightened to a standard torque. Refer to Appendix E.

EQUIPMENT CONDITION

References

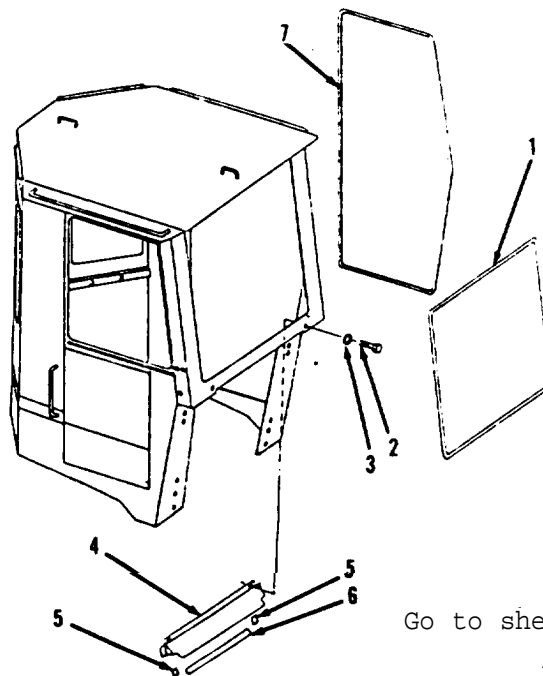
TM 10-3930-643-20

Condition Description

Roll over protective structure removed.

DISASSEMBLY

1. Using a putty knife, remove seal (1) from front window frame in cab.
2. Using a 9/16" socket and socket wrench handle, remove two bolts (2), washers (3), support (4), two strips (5) and strip (6) in front of cab. Discard strips (5 and 6).
3. Using a putty knife, remove seal (7) from left side of door frame in cab.



Go to sheet 2

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

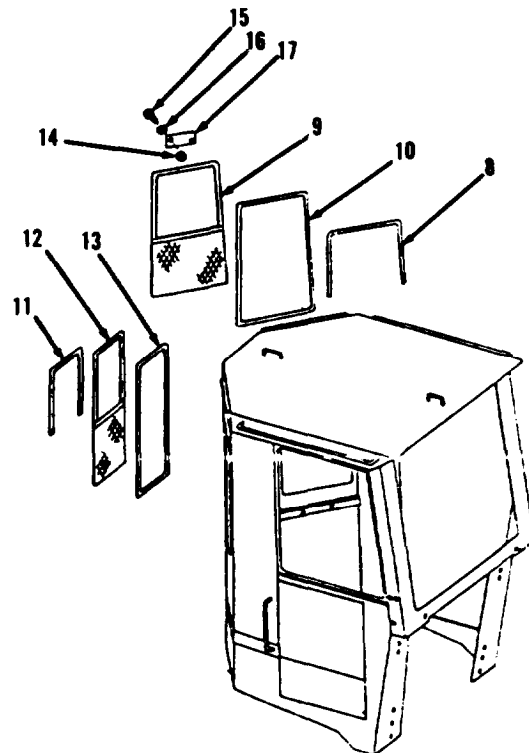
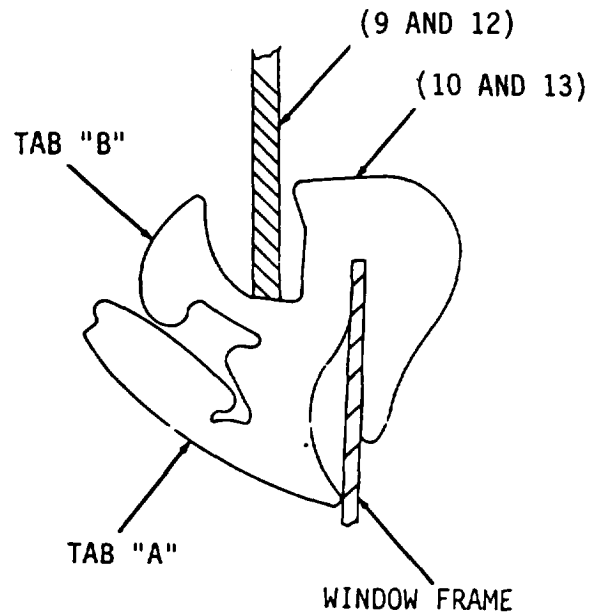
10-4. Roll over protective Structure. (S/N 200 and below). (Sheet 2 of 6)

DISASSEMBLY (cont)

NOTE

The following steps cover removal of items from the rear left window. Removal of these items from the right rear is identical.

4. Using a putty knife, remove seal (8) from inner lip of protector (9) from left rear window of cab.
5. Locate break in seal and pry tab "A" free of tab "B" in seal (10).
6. Remove protector (9) from seal (10).
7. Remove seal (10) from window frame.
8. Remove seal (11) from protector (12) from rear center window of cab.
9. Locate break in seal (13) and pry tab "A" free of tab "B".
10. Remove protector (12) from seal (13).
11. Remove seal (13) from window frame.
12. Using a 7/16" box and open end wrench, remove six nuts (14) from upper left and right sides of inside, rear of cab.



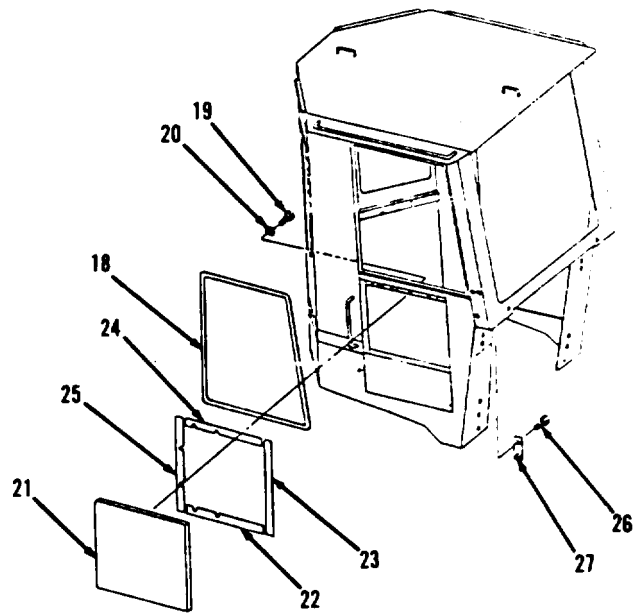
Go to sheet 3

FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-4. Roll Over Protective Structure. (S/N 2000 and below). (Sheet 3 of 6)

DISASSEMBLY

13. Using a 7/16" socket and socket wrench handle, remove six bolts (15), washers (16) and two bars (17) from outer cab.
14. Using a putty knife, remove seal (18) from right side of window frame on right side of cab.
15. Using a 9/16" socket and socket wrench handle, remove eight bolts (19), washers (20), panel (21) and channels (22 thru 25) on right side of cab.
16. Remove two screws (26) and plate (27) from lower front, inner right side of cab.



Go to sheet 4

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-4. Roll Over Protective Structure. (S/N 2000 and below). (Sheet 4 of 6)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

17. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
18. Inspect all parts. Refer to paragraph 2-9.

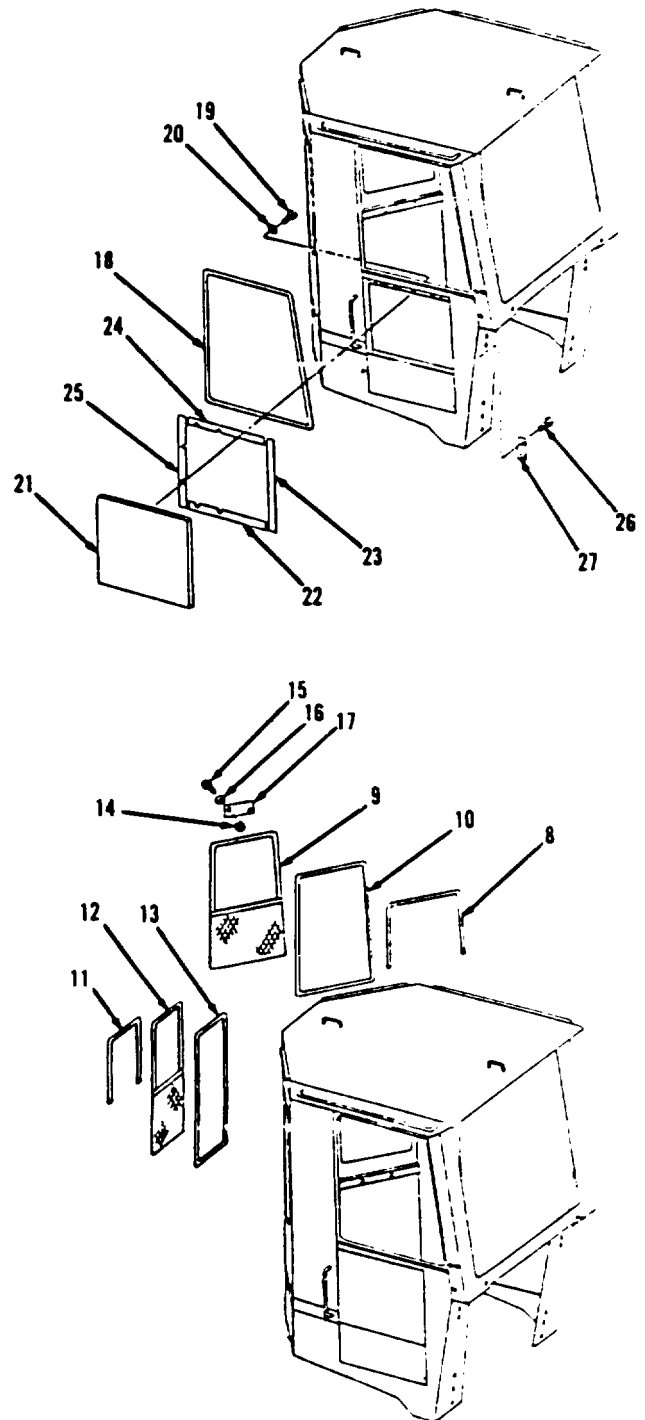
Go to sheet 5

FRAME AND TOWING ATTACHMENTS MAINTENANCE.

10-4. Roll Over Protective Structure. (S/N 2000 and below). (Sheet 5 of 6)

ASSEMBLY

19. Using a 9/16" socket and socket wrench handle, install plate (27) and two screws (26) on front, right side, inside of cab.
20. Install new channels (25 thru 22) in right side of cab. Apply adhesive backing of channels (25 thru 22) to clean, dry surface.
21. Install panel (21), eight washers (20) and bolts (19).
22. Install seal (18) on right side window frame in cab.
23. Using a 7/16" socket and socket wrench handle, install two bars (17), six washers (16), bolts (15) and nuts (14) in rear, upper left and right sides of cab.
24. Install seal (13) on window frame in rear center window in cab.
25. Install protector (12) in seal (13).
26. Press seal (13) in tab "A" into tab "B". A mild soap solution on tab "A" will help to make installation easier.
27. Install seal (11) on protector (12).



Go to sheet 6

FRAME AND TOWING ATTACHMENTS MAINTENANCE. (cont)

10-4. Roll Over Protective Structure. (S/N 2000 and below). (Sheet 6 of 6)

ASSEMBLY (cont)

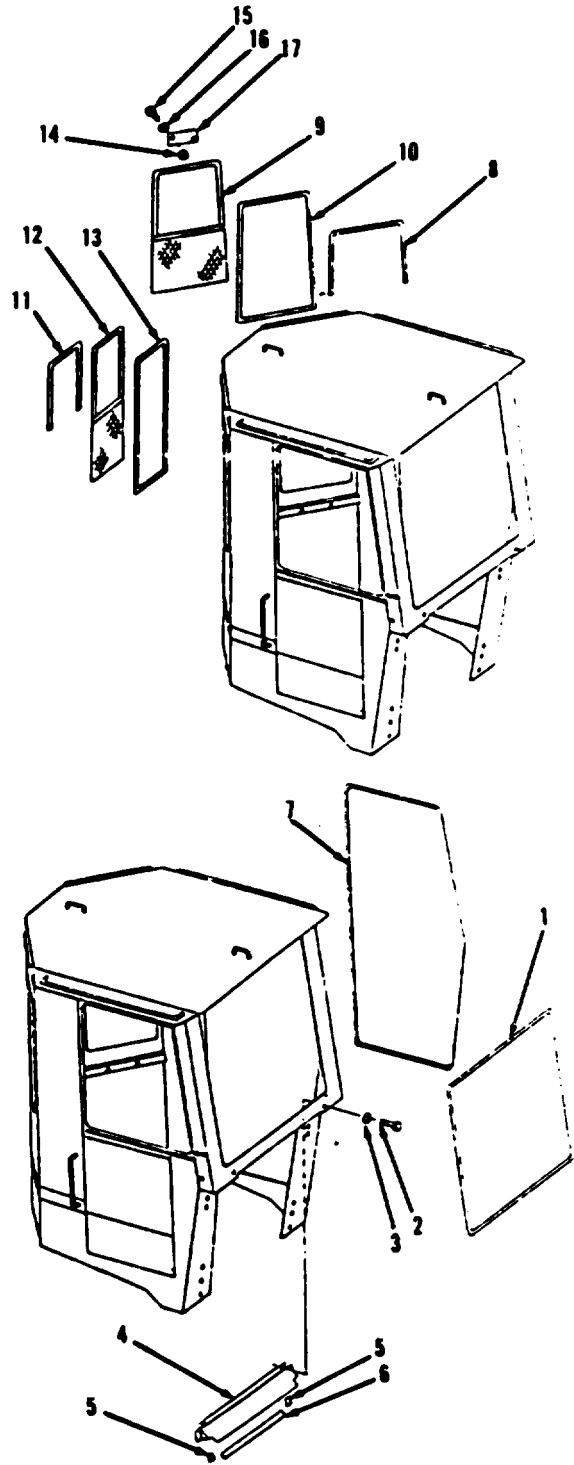
NOTE

The following step covers installation of items from the rear left side window. Installation of these items in the right side is identical.

- 28. Install seal (10) on window frame in left rear window of cab.
- 29. Install protector (9) in seal (10).
- 30. Press tab "A" into tab "B" in seal (10). A mild soap solution on tab "A" will help to make installation easier.
- 31. Install seal (8) on protector (9).
- 32. Install seal (7) in left side door frame of cab.
- 33. Install new strip (6) and two new strips (5) on support (4) in front of cab.
- 34. Install support (4), two washers (3) and bolts (2).
- 35. Install seal (1) in front window frame of cab.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## CHAPTER 11

BODY, CHASSIS AND HULL ACCESSORY ITEMS  
MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift body, chassis cab and hull accessory items.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Heater (S/N 2001 and above)	11-1	11-2

TM 10-3930-643-34

BODY, CHASSIS AND HULL ACCESSORY ITEMS. (cont)

11-1. Heater Assembly (S/N 2001 and above). (Sheet 1 of 6)

This task covers:       a. Disassembly                               c. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

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

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Heater assembly removed.

---

Go to sheet 2

11-2

BODY, CHASSIS AND HULL ACCESSORY ITEMS.

11-1 . Heater Assembly (S/N 2001 and above). (Sheet 2 of 6)

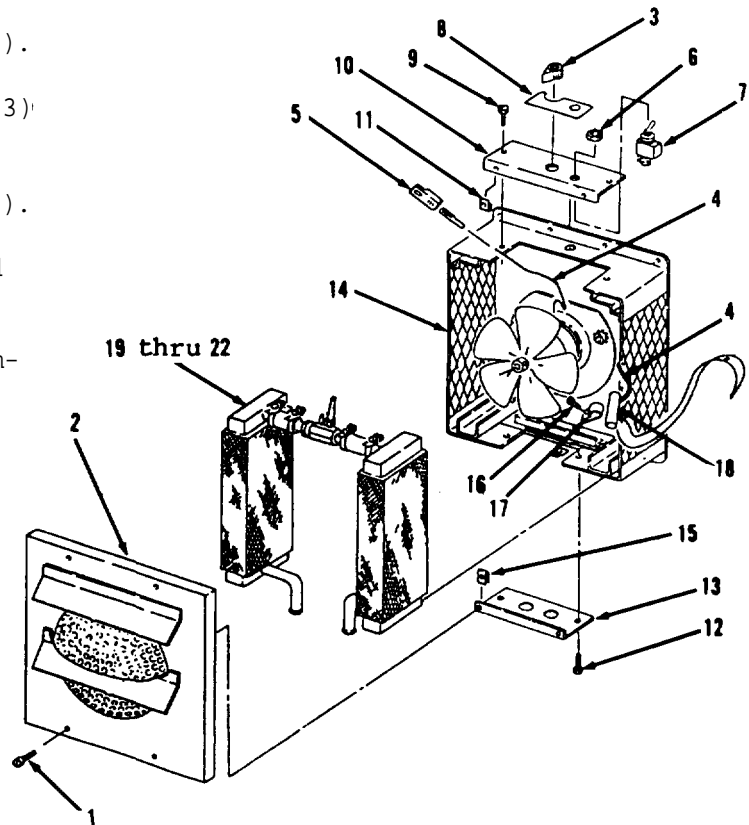
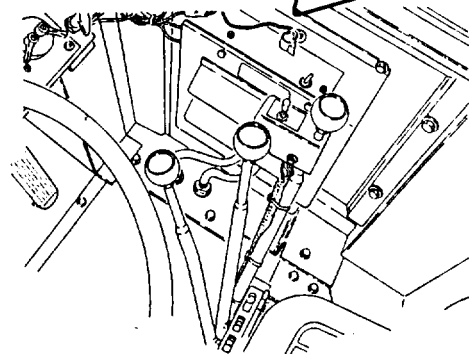
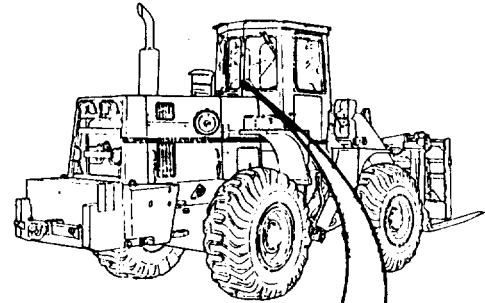
DISASSEMBLY

1. Using a flat tip screwdriver, remove four screws (1) and cover (2).
2. Remove knob (3).

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

3. Disconnect four wire assemblies (4) at connector (5) and switch (7).
4. Using a 9/16" open end wrench, remove nut (6) and switch (7).
5. Using a flat tip screwdriver, remove plate (8), two screws (9) and plate (10).
6. Remove two cups (11) from plate (10).
7. Remove two screws (12) and plate (13) from heater (14).
8. Remove two cups (15) from plate (13).
9. Remove screw (16), clamp (17) and resistor (18) from heater (14).
10. Remove items 19 thru 22 as an assembly from heater (14).



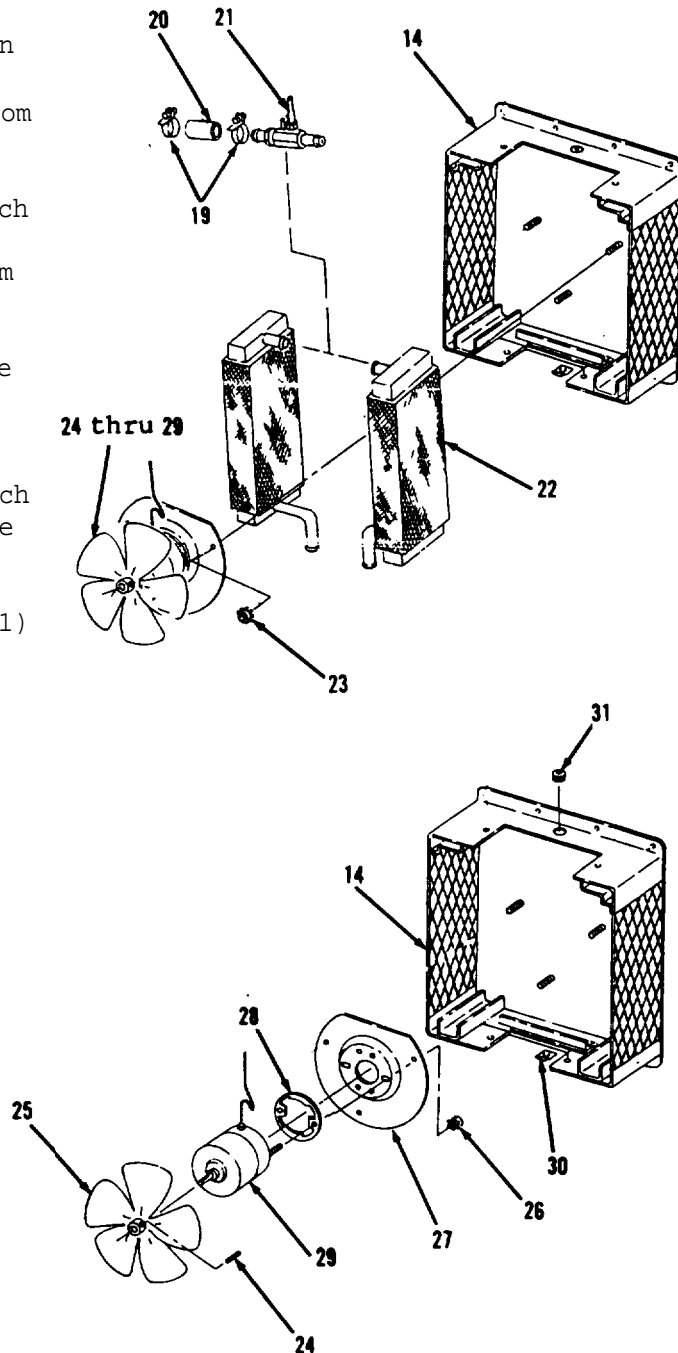
Go to sheet 3

BODY, CHASSIS AND HULL ACCESSORY ITEMS. (cont)

11-1. Heater Assembly (S/N 2001 and above). (Sheet 3 of 6)

DISASSEMBLY (cont)

11. Using a flat tip screwdriver, loosen four clamps (19), remove two hoses (20), clamps (19) and valve (21) from two cores (22).
12. Using a 1/2" socket and socket wrench handle, remove three nuts (23) and items 24 thru 29 as an assembly from heater (14).
13. Using a flat tip screwdriver, remove screw (24) and fan (25) from motor (29).
14. Using a 1/2" socket and socket wrench handle, remove two nuts (26), plate (27) and spacer (28).
15. Remove two nuts (30) and grommet (31) from heater (14).



Go to sheet 4

BODY, CHASSIS AND HULL ACCESSORY ITEMS.

11-1. Heater Assembly (S/N 2001 and above). (Sheet 4 of 6)

CLEANING/INSPECTION

**WARNING**

TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

16. Wipe all parts except two hoses (17) and connector (5) with clean cloth moistened with cleaning solvent P-D-680. Do not apply cleaning solvent to wire lead on motor (26).
17. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

BODY, CHASSIS AND HULL ACCESSORY ITEMS .(cont)

11-1. Heater Assembly (S/N 2001 and above). (Sheet 5 of 6)

ASSEMBLY (cont)

18. Using a 1/2" socket and socket wrench handle, install grommet (31) and two nuts (30) in heater (14).

19. Install spacer (28), plate (27) and two nuts (26) on motor (29).

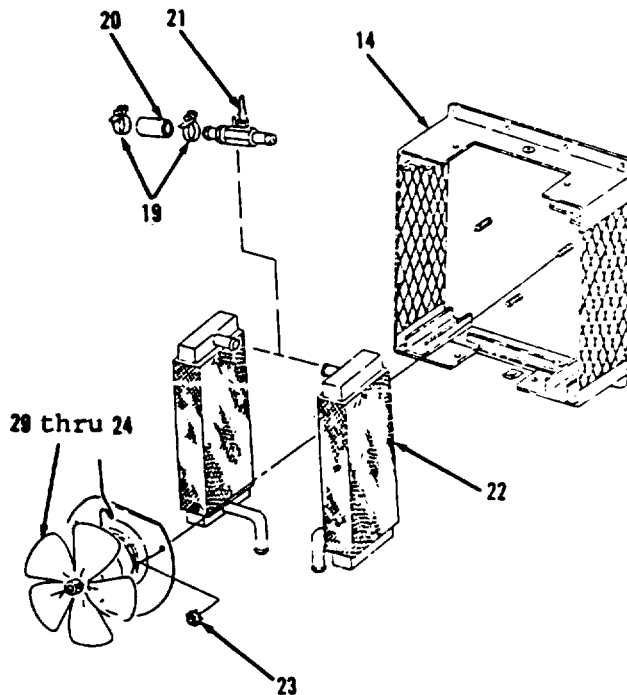
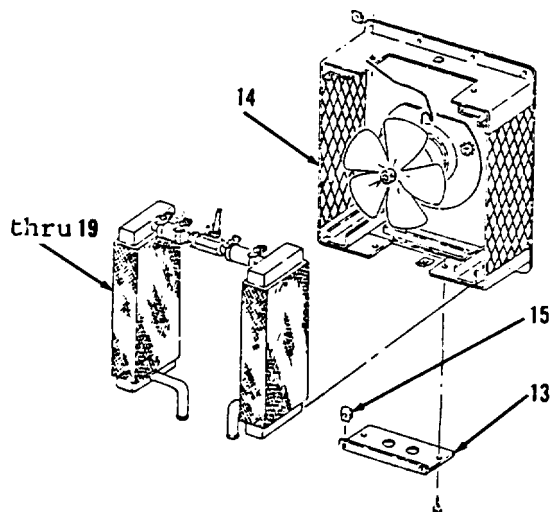
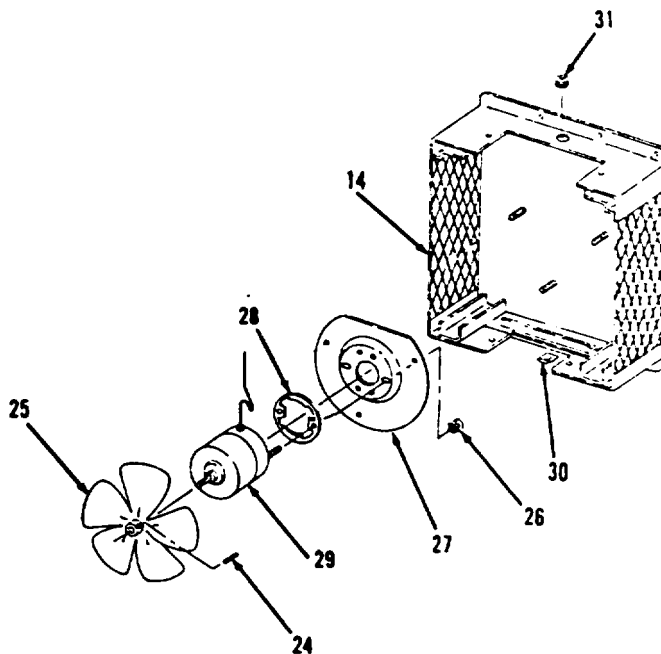
20. Using a flat tip screwdriver, install fan (25) and screw (24).

21. Using a 1/2" socket and socket wrench handle, install items 29 thru 24 as an assembly and three nuts (23) in heater (14).

22. Using a flat tip screwdriver, install valve (21), two-hoses (20) and four clamps (19) in two cores (22).

23. Install items 22 thru 19 as an assembly in heater (14).

24. Install two cups (15) in plate (13).



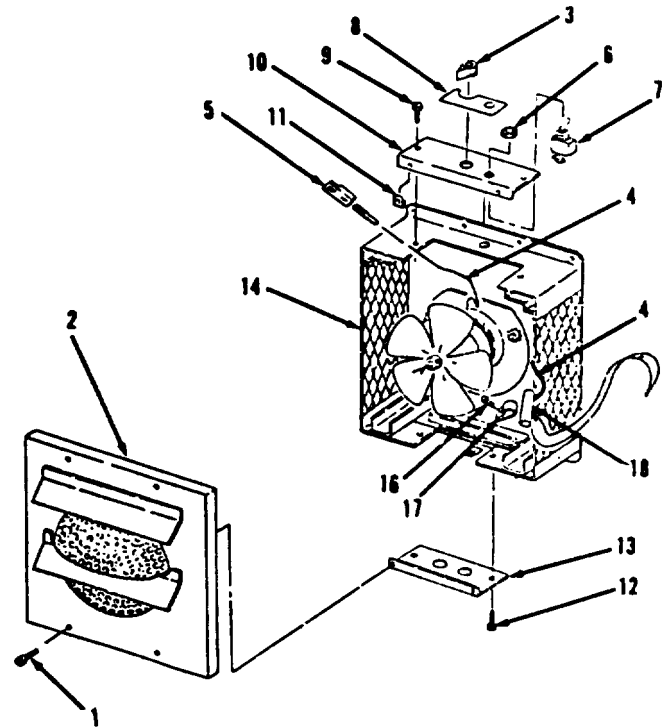
Go to sheet 6

BODY, CHASSIS AND HULL ACCESSORY ITEMS.

11-1. Heater Assembly (S/N 2001 and above). (Sheet 6 of 6)

ASSEMBLY

25. Using a flat tip screwdriver, install resistor (18), clamp (17) and screw (16) to heater (14).
26. Install plate (13) and two screws (12) in heater (14).
27. Install two cups (11) in plate (10).
28. Install plate (10), two screws (9) and plate (8) in heater (14).
29. Using a 1/2" socket and socket wrench handle, install switch (7) and nut (6).
30. Connect four wire assemblies (4) to connector (5) and switch (7).
31. Using a flat tip screwdriver, install knob (3).
32. Using a 5/16" socket and socket wrench handle, install cover (2) and four screws (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK





## CHAPTER 12

HYDRAULIC SYSTEM  
TROUBLESHOOTING AND MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently troubleshoot and repair malfunctioning equipment and to perform authorized direct support level maintenance procedures on the M10A Forklift hydraulic system.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Hydraulic System Troubleshooting	12-1	12-2
Hydraulic Pump	12-2	12-9
Loader Control Valve	12-3	12-13
Inlet Valve Assembly	12-4	12-27
Fork Valve Assembly	12-5	12-33
Tilt Valve Assembly	12-6	12-42
Boom Assembly Valve	12-7	12-50
Fork Control Valve	12-8	12-56
Tilt Cylinder	12-9	12-65
Boom Assembly	12-10	12-75
Lifting Forks and Carriage Assembly	12-11	12-86
Lift Cylinder	12-12	12-101
Sideshift Cylinder (S/N 2000 and below)	12-13	12-111
Sideshift Cylinder (S/N 2001 and above)	12-14	12-121
Fork Position Cylinders (S/N 2000 and below)	12-15	12-132
Fork Position Cylinders (S/N 2001 and above)	12-16	12-142
Oscillation Cylinder (S/N 2000 and below)	12-17	12-152
Oscillation Cylinder (S/N 2001 and above)	12-18	12-160
Hydraulic Reservoir and Filter	12-19	12-170

12-1. Hydraulic System Troubleshooting.

---

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

---

NOTE

Before using this procedure, check all hydraulic connections and lines for damage or external leakage and correct where necessary.

Check the hydraulic hoses for leaks and loose fittings. Apply soap and water solution over length of hoses and observe. If a hydraulic hose fitting is loose, tighten it. If a hose is damaged or defective, replace it.

Also check the hydraulic fluid level as described in the Operator's Manual TM 10-3930-643-10.

a. ALL IMPLEMENTS FAIL TO OPERATE.

Check hydraulic pump to determine if it is malfunctioning or worn out.

Replace hydraulic pump, refer to paragraph 12-2.

b. ALL CYLINDER ASSEMBLIES OPERATE SLOWLY.

Step 1. Check hydraulic pump to determine if it is malfunctioning or worn.

Replace hydraulic pump, refer to paragraph 12-2.

Step 2. Check loader control valve spools to determine if they are stuck between galleries, blocking passages, refer to paragraph 12-3.

Test loader control valve per paragraph 12-3. Repair loader control valve, refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

NOTE

This procedure refers to cylinders which are not involved in steering. For steering system malfunctions, refer to paragraph 9-1.

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

## 12-1. Hydraulic System Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

## b. ALL CYLINDER ASSEMBLIES OPERATE SLOWLY.

Step 3. Check loader control valve to determine if relief valves are stuck or if valve spring(s) are broken, allowing hydraulic fluid under pressure to dump back to reservoir, refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

Repair system relief valve and/or circuit relief valve and adjust to correct pressure setting.

## c. A PARTICULAR CYLINDER ASSEMBLY OPERATES SLOWLY.

Step 1. Check for worn or scored cylinder piston rings and/or seals. Refer to the paragraph covering the cylinder malfunctioning. Non-steering cylinders have disassembly procedures in Chapter 12.

Step 2. Check inside diameter of cylinder housings to determine if badly scored or nicked. Refer to the paragraph covering the cylinder malfunctioning. Non-steering cylinders have disassembly procedures in Chapter 12.

Replace cylinders which have nicks and/or scoring which cannot be removed with fine emery cloth.

Replace seals and piston rings prior to assembly.

12-1. Hydraulic System Troubleshooting. (cont)

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

d. LOSS OF CYLINDER MOTION DURING OPERATION.

Step 1. Check hydraulic pressure.

If pressure is low, go to step 2.

Step 2. Check hydraulic pump outlet to determine if it is operating correctly, refer to paragraph 12-2.

If necessary, clean the hydraulic line, refer to TM 10-3930-643-20.

Step 3. Check loader control valve relief valve(s) to determine if any are leaking and/or defective, refer to paragraph 12-3 for tests and adjustments.

If necessary, replace hydraulic pump, refer to paragraph 12-2.

Step 4. Check loader control valve relief valve(s) to determine if any are leaking and/or defective, refer to paragraph 12-3 for tests and adjustments.

If necessary to repair system relief valve, refer to paragraph 12-3.

If necessary to repair or replace circuit relief valve(s), refer to paragraphs 12-4, 12-5 and 12-6.

Step 5. Check loader control valve system relief valve for broken spring, refer to paragraph 12-3.

Replace spring, refer to paragraph 12-3.

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-1. Hydraulic System Troubleshooting.

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

e. LOAD SLOWLY DROPS WITH LIFT CONTROL LEVER IN "HOLD".

Step 1. Check loader control valve spool to determine if hydraulic fluid is leaking past it, refer to paragraph 12-3.

Repair or replace loader control valve, refer to paragraph 12-3.

If hydraulic fluid is leaking by the valve spool in the fork valve assembly, refer to paragraph 12-5.

If hydraulic fluid is leaking by the valve spool in boom assembly valve, refer to paragraph 12-7.

Step 2. Check to determine if hydraulic fluid is passing from hold side to opposite side of hydraulic lift cylinder piston, refer to paragraph 12-12.

Repair hydraulic lift cylinder, refer to paragraph 12-12.

f. MOMENTARY DROP OF LOAD WHEN LIFT CONTROL LEVER IS MOVED FROM "HOLD" TO "RAISE" OR "RAISE" TO "HOLD".

Step 1. Check for scored or worn check valve poppet or seat in loader control valve, refer to paragraphs 12-3, 12-5 and 12-7.

Replace appropriate valves.

Step 2. Check for valve poppet held off its seat in loader control valve, refer to paragraphs 12-3, 12-4, 12-5 and 12-6.

Clean system. Check for foreign matter after cleaning.

Step 3. Inspect for broken check valve spring, refer to paragraphs 12-3, 12-4, 12-5 and 12-7.

Replace any broken or defective spring.

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-1. Hydraulic System Troubleshooting. (cont)

---

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

---

g. NOISY OPERATION.

Step 1. Check hydraulic pump to determine if it is worn out or malfunctioning.

Replace hydraulic pump, refer to paragraph 12-2.

Step 2. Check system relief valve spring or circuit relief valve spring(s) for possible chattering in loader control valve, refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

Replace spring(s).

h. HYDRAULIC OIL HEATING UP,

Step 1. Check loader control valve relief valve(s) for insufficient valve pressure or pressure too high, refer to paragraph 12-3.

Adjust to correct pressure setting.

Step 2. Check loader control valve system relief valve to determine if defective, refer to paragraphs 12-3, 12-4, 12-5 and 12-6.

Repair loader control valve and/or relief valve(s).

Step 3. Check hydraulic pump to determine if it is worn out or malfunctioning.

Replace hydraulic pump, refer to paragraph 12-2.

i. INSUFFICIENT PUMP PRESSURE BUILD-UP.

Step 1. Check hydraulic pump to determine if it is malfunctioning or worn out.

Replace pump, refer to paragraph 12-2.

Step 2. Check valve pressure on loader control valve and relief valve(s), refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

Adjust to correct pressure setting.

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

## 12-1. Hydraulic System Troubleshooting.

---

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

---

## j. STICKING LOADER CONTROL VALVE SPOOL(S).

## NOTE

Steps below should be taken after system is heated to proper temperature.

Step 1. Check loader control valve to determine if housing has been distorted by improperly tightened mounting bolts, refer to paragraph 12-3.

Loosen and retighten mounting bolts to proper torque.

Step 2. Check individual circuit valves to determine if there is distortion of valve housing by improperly tightened bolts, refer to paragraphs 12-4, 12-5, 12-6 and 12-7.

Loosen and retighten bolts to proper torque.

Step 3. Check control valve plunger bore(s) for burrs or scoring, refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

Replace loader control valve.

Step 4. Check valve spools in loader control valve to see if any are warped. Also check for dirt or foreign matter, refer to paragraphs 12-3, 12-4, 12-5, 12-6 and 12-7.

Clean loader control valve. Replace spool(s) if necessary.

Step 5. Check loader control valve for damaged, broken or distorted springs, refer to paragraph 12-3. Also refer to paragraphs 12-4, 12-5, 12-6 and 12-7 as applicable.

Replace springs if damaged, broken or distorted.

12-1. Hydraulic System Troubleshooting. (cont)

---

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

k. HYDRAULIC PUMP NOT DELIVERING OIL.

Step 1. Check hydraulic pump to determine if it is rotating.

If necessary, replace hydraulic pump, refer to paragraph 12-2.

Step 2. Check hydraulic pump to determine if it is malfunctioning or worn out.

Replace pump, refer to paragraph 12-2.

l. OIL LEAKAGE AT HYDRAULIC PUMP.

Step 1. Check for worn or damaged oil seals or preformed packing(s), refer to paragraph 12-2.

Replace seals and preformed packings prior to installation of pump.

Step 2. Check for defective mounting of preformed packing(s), refer to paragraph 12-2.

Replace preformed packings prior to reinstallation of pump.





HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

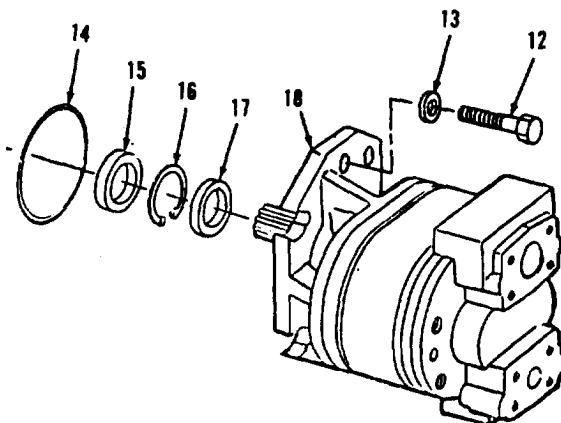
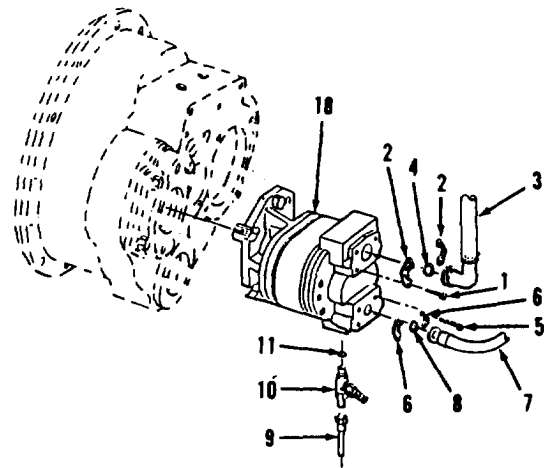
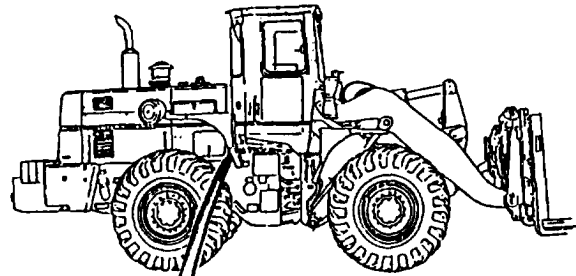
12-2. Hydraulic Pump. (Sheet 2 of 4)

REMOVAL (cont)

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

2. Disconnect hose assembly (3).
3. Using a machinist's scribe, remove and discard preformed packing (4).
4. Using a 9/16" socket and socket wrench handle, remove four bolts (5) and two flange halves (6).
5. Using a 10" adjustable wrench, disconnect hose assembly (7).
6. Using a machinist's scribe, remove and discard preformed packing (8).
7. Using a 5/8" open end wrench, disconnect hose assembly (9) from tee assembly (10).
8. Cap tee assembly (10).
9. Using an 11/16" open end wrench, remove tee assembly (10) from hydraulic pump (18).
10. Using a machinist's scribe, remove and discard preformed packing (11).
11. Using a 3/4" socket and socket wrench handle, remove two bolts (12), lock washers (13) and pump (18) from torque converter.
12. Using a machinist's scribe, remove and discard preformed packing (14).
13. Using snap ring pliers, remove seal (15), snap ring (16) and seal (17) from hydraulic pump (18). Discard seals (15 and 17).



Go to sheet 3

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-2. Hydraulic Pump. (Sheet 3 of 4)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

14. Wipe pump (18) and hose assemblies (3 and 7) with clean cloth moistened with detergent. Dry with compressed air.
15. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
16. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

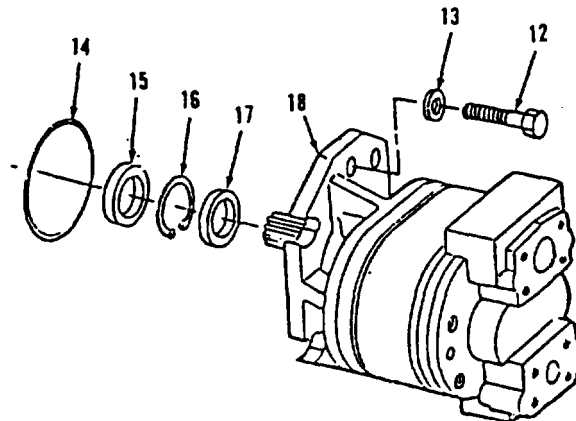
12-2. Hydraulic Pump. (Sheet 4 of 4)

INSTALLATION

17. Using snap ring pliers, install new seal (17), snap ring (16) and new seal (15) in hydraulic pump (18).

18. Install new preformed packing (14).

19. Using a 3/4" socket and torque wrench, install items 18 thru 14 as an assembly, two lock washers (13) and bolts (12). Tighten two bolts (12) to 55 lb-ft.



20. Using an 11/16" adjustable wrench, install new preformed packing (11) and tee assembly (10) to hydraulic pump (18).

21. Using a 5/8" open end wrench, connect hose assembly (9) to tee assembly (10).

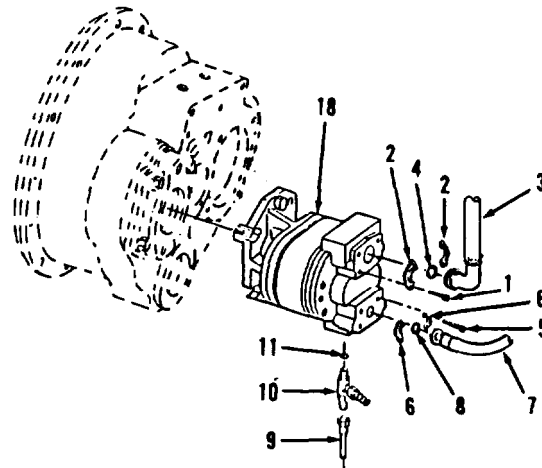
22. Position new preformed packing (8) and hose assembly (7).

23. Using a 9/16" socket and socket wrench handle, install two flange halves (6) and four bolts (5).

24. Position new preformed packing (4) and hose assembly (3).

25. Install two flange halves (2) and four bolts (1).

26. Fill hydraulic reservoir to proper level, refer to LO 10-3930-643-12.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 1 of 14)

- This task covers:
- |                        |                      |
|------------------------|----------------------|
| a. Removal             | b. Disassembly       |
| c. Cleaning/Inspection | d. Assembly          |
| e. Installation        | f. Testing/Adjusting |

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
 Automotive  
 NSN 5180-00-177-7033  
 Shop Equipment, Automotive  
 Maintenance and Repair:  
 Field Maintenance, Basic,  
 Less Power  
 NSN 4910-00-754-0705  
 Shop Equipment, Automotive  
 Maintenance and Repair:  
 Field Maintenance  
 NSN 4910-00-919-0076  
 1-1/2" Open end wrench  
 NSN 5120-00-184-8489  
 Pressure tester hand pump  
 NSN 4940-01-036-5784

Materials/Parts

Cleaning solvent P-D-680  
 (App. C, Item 5)  
 Clean cloth (App. C, Item 24)  
 Detergent (App. C, Item 33)  
 Small tag (App. C, Item 28)  
 Sandwich test block (App. D, Item 13)  
 Preformed packing (16)  
 Y bolt (4)

Torques

Nuts (39) to 74 lb-ft.  
 Nuts (41) to 48 lb-ft.  
 Acorn nut (51 and 61) to 10 lb-ft.  
 Jam nut (52 and 62) to 10 lb-ft.

EQUIPMENT CONDITION

References

TM 10-3930-643-10  
 TM 10-3930-643-20

Condition Description

Hydraulic pressure vented.  
 Right frame access cover removed.

12-3. Loader Control Valve. (Sheet 2 of 14)

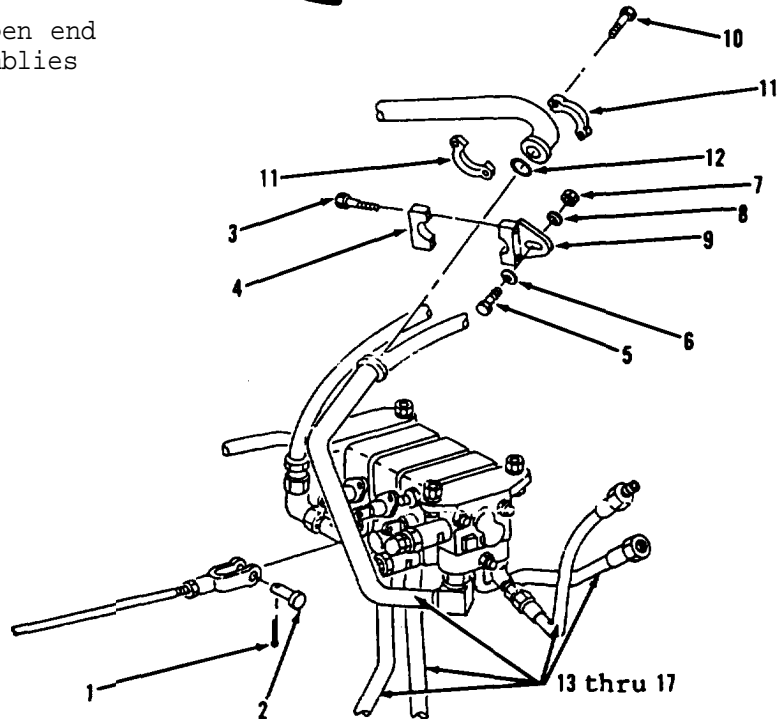
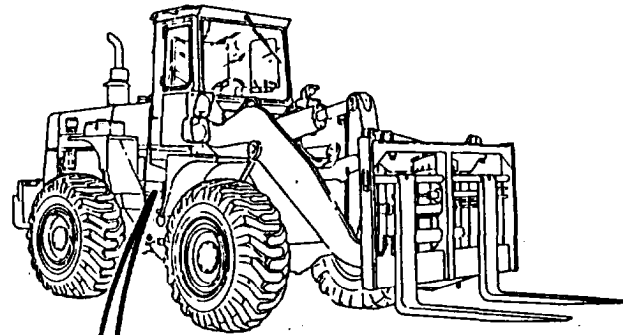
REMOVAL

1. Using pliers, remove three cotter pins (1) and pins (2) from under right side of cab. Discard cotter pins (2).
2. Using a 9/16" socket and socket wrench handle, remove two bolts (3) and clamp (4).
3. Using a 9/16" socket, socket wrench handle and a 9/16" open end wrench. remove bolt (5), washer (6), nut (7), washer (8) and clamp (9).
4. Using a 9/16" socket and socket wrench handle, remove four bolts (10), two flange halves (11) and preformed packing (12). Discard preformed packing (12).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

5. Using 1-3/8", 1-9/16" and 1" open end wrenches, disconnect tube assemblies (13 thru 17).



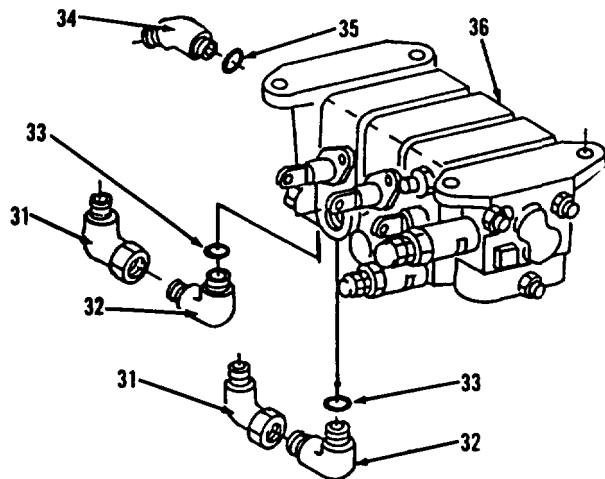
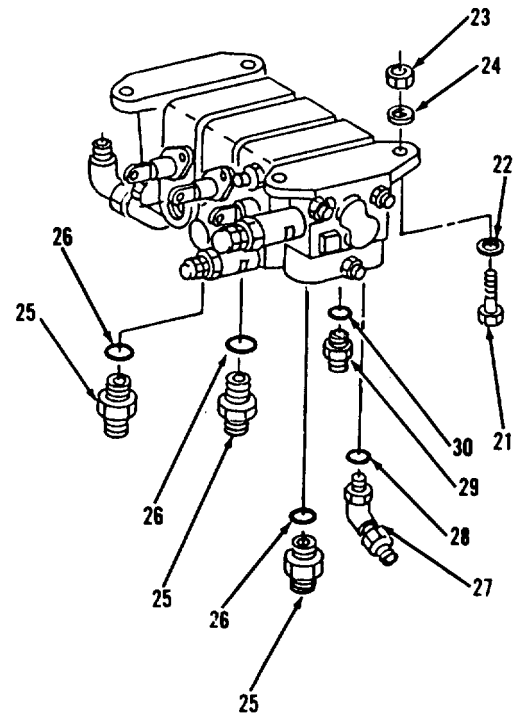
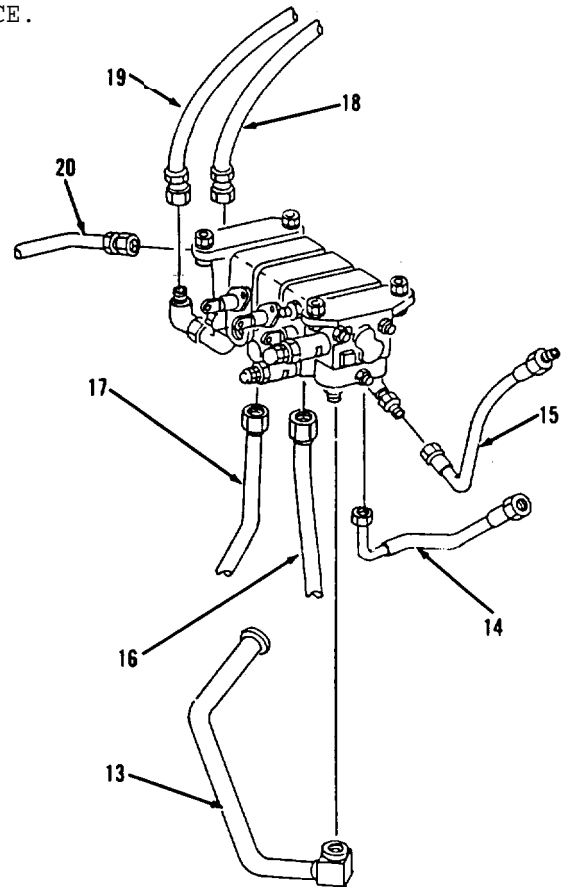
Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 3 of 14)

REMOVAL

6. Using a 1-1/2" open end wrench, disconnect hose assemblies (18 thru 20).
7. Using a 3/4" socket, socket wrench handle and an open end wrench, remove three bolts (21), washers (22), nuts (23), washers (24) and items 25 thru 36 as an assembly from vehicle.
8. Using a 1-3/8" open end wrench, remove three connectors (25) and preformed packings (26). Discard three preformed packings (26).
9. Using a 1" open end wrench, remove elbow (27), preformed packing (28), connector (29) and preformed Packing (30). Discard preformed packings (28 and 30).
10. Using a 1-9/16" open end wrench, remove two elbows (31 and 32) and preformed packings (33). Discard two preformed packings (33).
11. Using a 10" adjustable wrench, remove elbow (34) and preformed packing (35) from loader control valve (36). Discard preformed packing (35).



Go to sheet 4

12-3. Loader Control Valve. (Sheet 4 of 14)

DISASSEMBLY

- 12. Using a 1-1/2" socket and socket wrench handle, remove plug (37) and preformed packing (38) from outlet housing (43). Discard preformed packing (38).
- 13. Using a 3/4" socket and socket wrench handle, remove two nuts (39), rod (40), four nuts (41) and two rods (42).

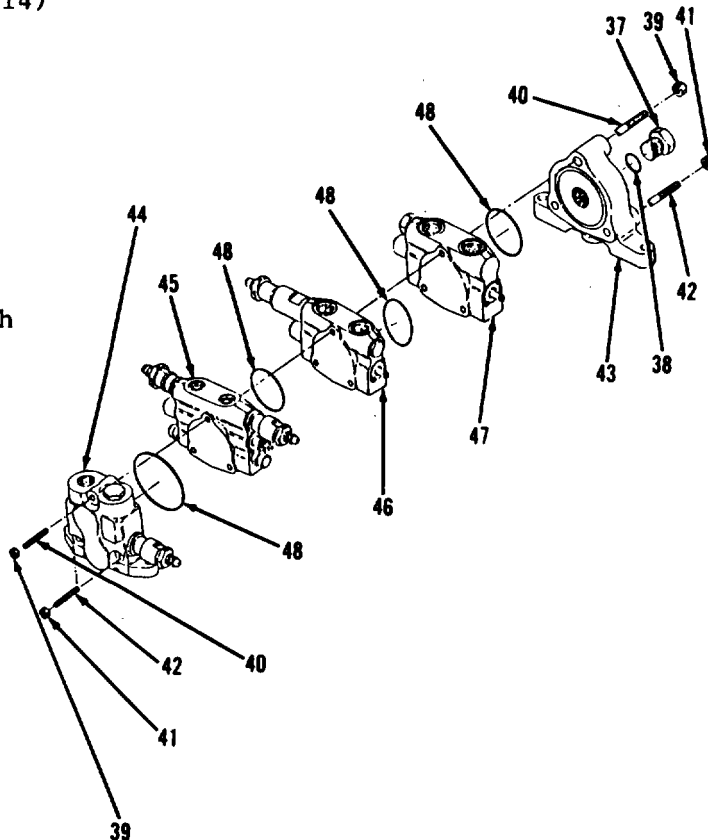
NOTE

When separating outlet housing and valve assemblies be extremely careful not to damage sealing surfaces.

- 14. Separate outlet housing (43), inlet valve assembly (44), fork valve assembly (45), tilt valve assembly (46) and boom valve assembly (47).
- 15. Using a scribe, remove and discard four preformed packings (48).

NOTE

For repair of valve assemblies, refer to paragraphs 12-4 thru 12-7.





## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 5 of 14)

CLEANING/INSPECTION

16. Wipe hose assemblies (18 thru 20) with clean cloth moistened with detergent. Wipe dry with clean cloth.

**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

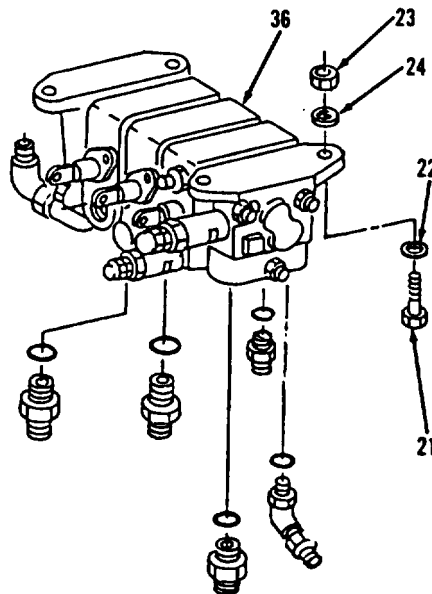
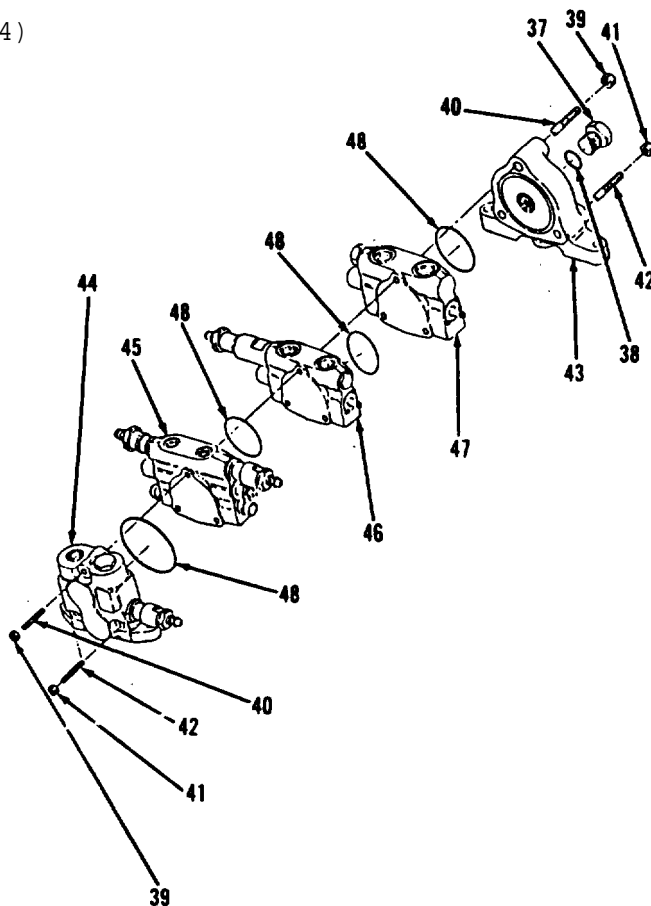
17. Clean all other parts except valve assemblies (44 thru 47) with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
18. Inspect all parts except valve assemblies (44 thru 47). Refer to paragraph 2-9.

Go to sheet 6

12-3. Loader Control Valve. (Sheet 6 of 14)

ASSEMBLY

19. Install four new preformed packings (48).
20. Position boom valve assembly (47), tilt valve assembly (46), fork valve assembly (45), inlet valve assembly (44) and outlet housing (43).
21. Using a 3/4" socket and torque wrench, install two rods (42), four nuts (41), rod (40) and two nuts (39). Tighten nuts (41) to 48 lb-ft and nuts (39) to 74 lb-ft.
22. Using a 1-1/2" socket and socket wrench handle, install new preformed packing (38) and plug (37) in outlet housing (43).
23. Using a 3/4" socket, socket wrench handle and an open end wrench, install loader control valve (36), three washers (24), nuts (23), washers (22) and bolts (21).



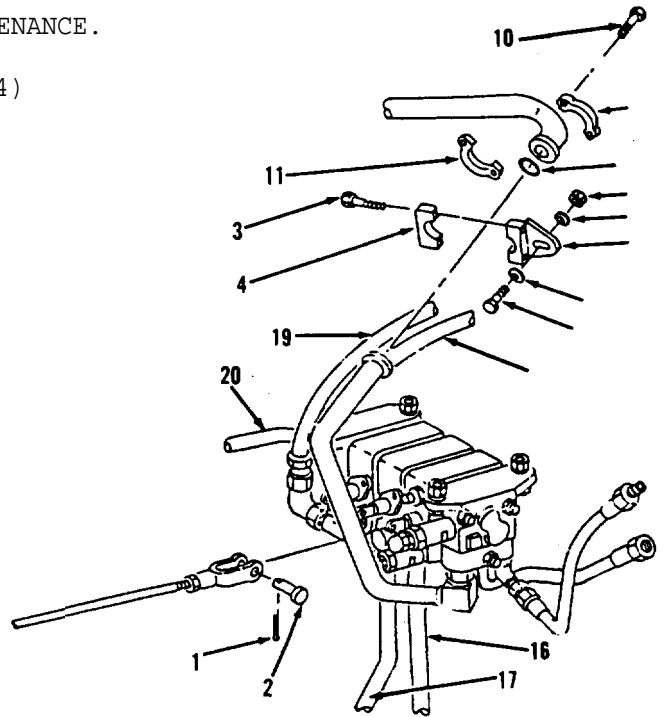
Go to sheet 7

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 7 of 14)

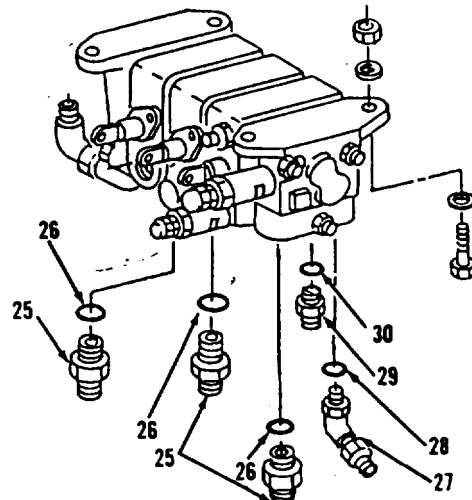
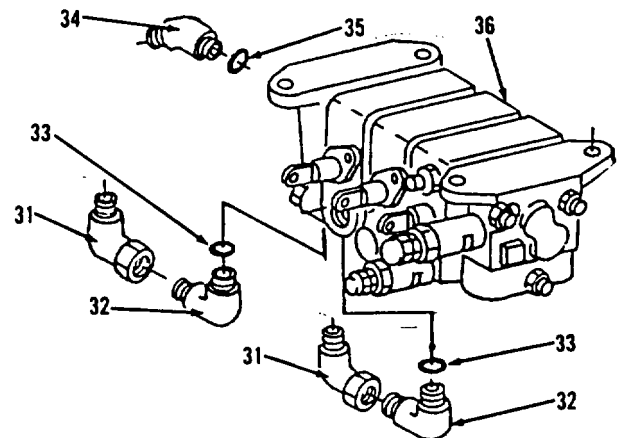
ASSEMBLY

24. Using a 1-1/2" open end wrench, connect hose assemblies (20 thru 18).
25. Using a 1-9/16" open end wrench, connect tube assemblies (17 and 16).
26. Using a 9/16" socket and socket wrench handle, install new preformed packing (12), two flange halves (11) and four bolts (10).
27. Using a 3/4" socket, socket wrench handle and a open end wrench, install clamp (9), washer (8), nut (7), washer (6) and bolt (5).
28. Using a 9/16" socket and socket wrench handle, install clamp (4) and two bolts (3).
29. Using long round nose pliers, install three pins (2) and new cotter pins (1).



INSTALLATION

30. Using a 10" adjustable wrench, install new preformed packing (35) and elbow (34) on loader control valve (36).
31. Using a 1-9/16" open end wrench, install two new preformed packings (33) and two elbows (32 and 31).
32. Using a 1" open end wrench, install new preformed packing (30), connector (29), new preformed packing (28) and elbow (27).
33. Using a 1-3/8" open end wrench, install three new preformed packings (26) and connectors (25).



Go to sheet 8

12-3. Loader Control Valve. (Sheet 8 of 14)

TESTING/ADJUSTING - RELIEF VALVES

34. Vent hydraulic system, refer to TM 10-3930-643-10.

35. Using a 11/16" socket and socket wrench handle, remove plug (49) and preformed packing (50) from loader control valve (36) and inlet valve assembly (44). Discard preformed packing (50).

36. Using a 10" adjustable wrench, install 3000 psi hydraulic pressure gage in plug (49) port.

37. Start engine in operator's compartment.

38. Operate tilt and fork controls through four loading cycles, refer to TM 10-3930-643-10.

39. Position forks in forks together position and hold, refer to TM 10-3930-643-10.

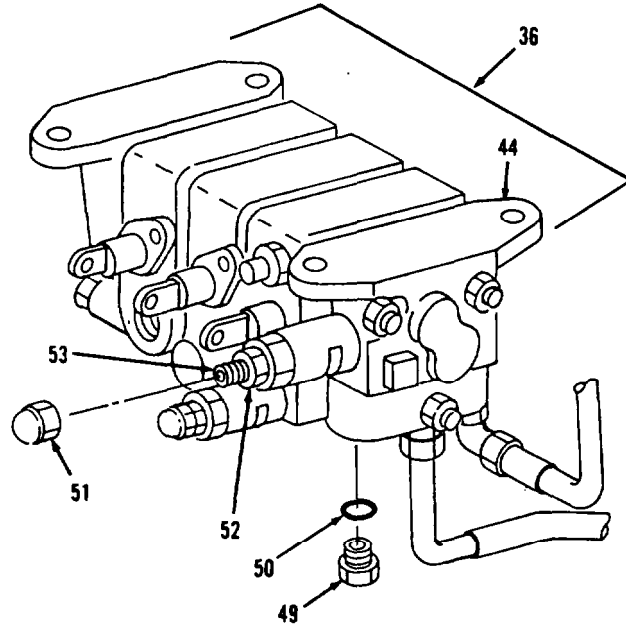
40. Accelerate engine to full throttle.

41. Read hydraulic pressure gage. If system does not relieve at 2755 psi, adjust system relief valve.

42. Using a 1-1/4" and 11/16" open end wrenches, remove system relief valve and acorn nut (51) from loader control valve (36) and inlet valve assembly (44).

43. Using a 3/4" open end wrench, loosen jam nut (52).

44. Using a flat tip screwdriver, adjust screw (53), turning clockwise to increase the pressure and counterclockwise to decrease pressure.



Go to sheet 9

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 9 of 14)

TESTING/ADJUSTING RELIEF VALVES

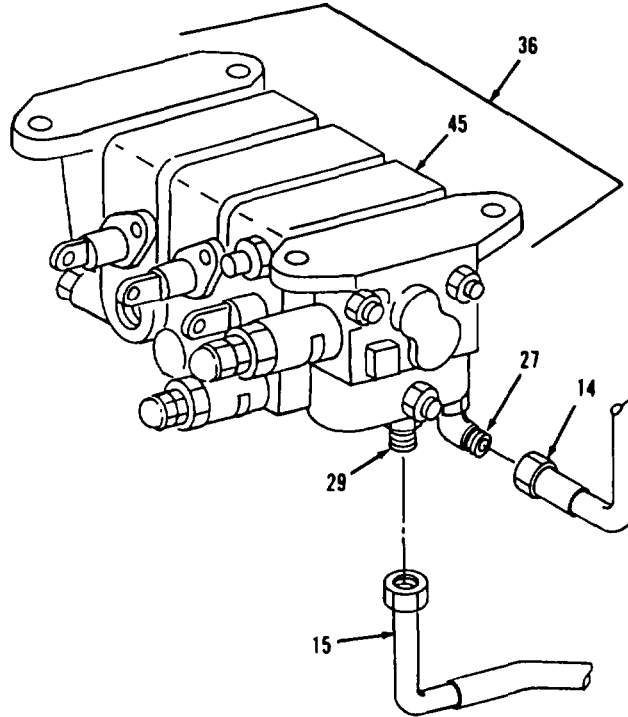
45. Hold adjustment screw when correct pressure is obtained. If correct pressure cannot be obtained with adjustment, replace or repair relief valve as necessary, refer to paragraph 12-5.
46. Using a 3/4" socket and torque wrench, tighten jam nut (52) to 10 lb-ft .
47. Using an 11/16" socket and torque wrench, install acorn nut (51) and tighten to 10 lb-ft.
48. Stop engine.
49. Vent hydraulic system pressure, refer to TM 10-3930-643-10.
50. Using a 10" adjustable wrench, disconnect hydraulic pressure gage from loader control valve (36) and inlet valve assembly (44).
51. Using an 11/16" socket and socket wrench handle, install new preformed packing (50) and plug (49).

Go to sheet 10

12-3. Loader Control Valve. (Sheet 10 of 14)

TESTING/ADJUSTING - FORK CIRCUIT RELIEF VALVES

52. Vent hydraulic system pressure, refer to TM 10-3930-643-10.
53. Using a 1" open end wrench disconnect tube assembly (14) from elbow (27) on loader control valve (36) and fork valve assembly (45).
54. Disconnect tube assembly (15) from connector (29).
55. Connect two tees to connector (29) and elbow (27). Tees will have to fit on connector (29) and elbow (27), as well as tube assemblies (14 and 15) and hydraulic pressure gage.
56. Using a 1" open end wrench and a 10" adjustable wrench, connect tube assemblies (15 and 14) to two tees.
57. Using a 10" adjustable wrench, connect two hydraulic pressure gages to two tees.
58. Start engine in operator's compartment.
59. Operate tilt and fork controls through four loading cycles, refer to TM 10-3930-643-10. This will bring hydraulic fluid to normal operating temperature.



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 11 of 14)

TESTING/ADJUSTING - FORK CIRCUIT RELIEF VALVES

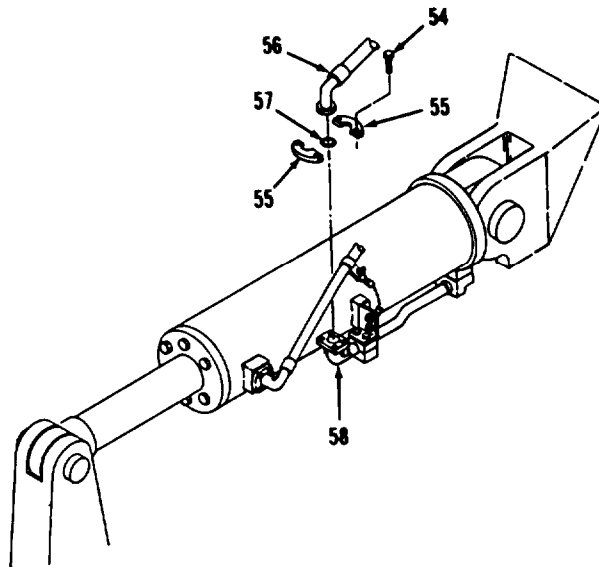
60. Position forks in forks together position and hold, refer to TM 10-3930-643-10.
61. Read hydraulic pressure gages. Front gage should read 1930 psi and rear gage 30 psi.
62. Position forks in forks apart position and hold.
63. Read hydraulic pressure gages. Rear gage should read 1930 psi and front gage 30 psi.
64. Using a 1-9/16" open end wrench, adjust two circuit relief valves on loader control valve (36) and fork valve assembly (45), front and rear. Except for pressure, adjustment of fork circuit relief valves is same as main system relief valve adjustment, step 10.
65. Stop engine.
66. Vent hydraulic system pressure, refer to TM 10-3930-643-10.
67. Using a 10" adjustable wrench, disconnect two hydraulic gages from fork valve assembly (45).
68. Using a 1" open end wrench and a 10" adjustable wrench, disconnect tube assemblies (15 and 14).
69. Using a 10" adjustable wrench, remove two tees.
70. Using a 1" open end wrench, connect tube assembly (15) to connector (29).
71. Connect tube assembly (14) to elbow (27).

Go to sheet 12

12-3. Loader Control Valve. (Sheet 12 of 14)

TESTING/ADJUSTING - TILT BACK CIRCUIT RELIEF VALVE

- 72. Vent hydraulic system pressure, refer to TM 10-3930-643-10.
- 73. Using a 9/16" socket and socket wrench handle, remove four bolts (54) and two flange halves (55) from tilt cylinder, left side.
- 74. Disconnect hose assembly (56) from tube assembly (58).
- 75. Using a scribe, remove and discard preformed packing (57).
- 76. Position new preformed packing (57) and sandwich test block on tube assembly (58), refer to Appendix D for fabrication instruction for sandwich test block.
- 77. Install new preformed packing (57) on hose assembly (56).
- 78. Connect hose assembly (56) to sandwich test block.
- 79. Using a 9/16" socket and socket wrench handle, install two flange halves (55) and four Y bolts.
- 80. Using a 10" adjustable wrench, install pressure tester hand pump in sandwich test block.
- 81. Start engine in operator's compartment.



Go to sheet 13

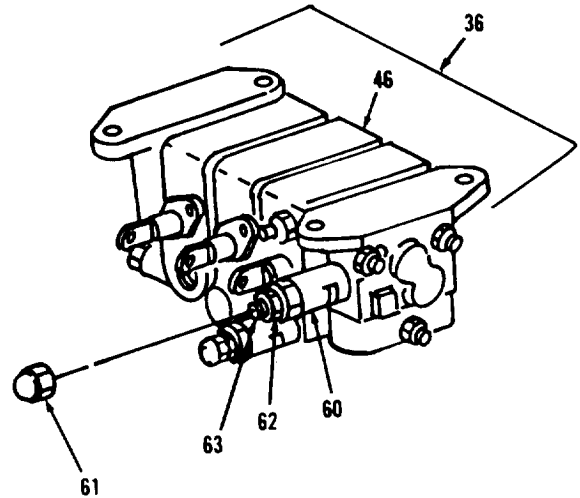


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-3. Loader Control Valve. (Sheet 13 of 14)

TESTING/ADJUSTING - TILT BACK CIRCUIT RELIEF VALVE

82. Operate hydraulic controls through three full movements of travel to warm hydraulic fluid.
83. Position fork tilt control in full tilt back position, refer to TM 10-3930-643-10.
84. Position in hold (NEUTRAL) position.
85. Stop engine.
86. Pump pressure tester hand pump pressure to 3000 psi on tilt cylinder.
87. Read gage. If pump pressure exceeds or does not produce 3000 psi, relief valve (60) must be adjusted.
88. Using an 11/16" socket and socket wrench handle, remove acorn nut (61) from loader control valve (36) and tilt valve assembly (46). Tilt back relief valve (60).
89. Using a 1" open end wrench, loosen jam nut (62).
90. Using a flat tip screwdriver, adjust screw (63), turning clockwise to increase pressure, counterclockwise to decrease pressure.
91. Hold when 3000 psi adjustment is made.
92. Using an 11/16" socket and torque wrench, tighten jam nut (62) to 10 lb-ft .



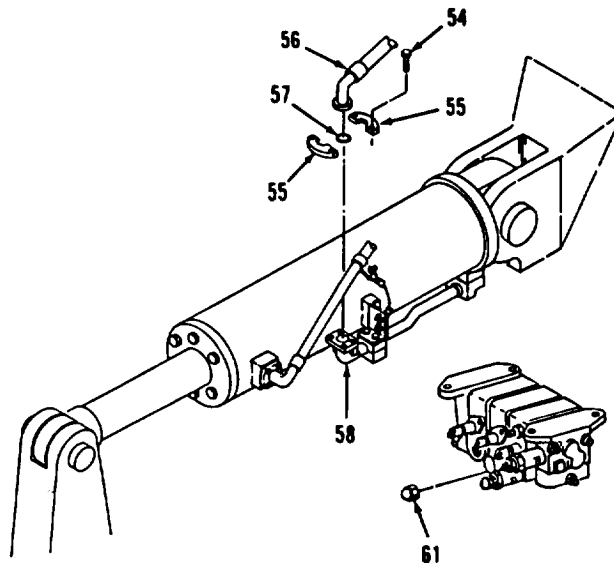
Go to sheet 14

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-3. Loader Control Valve. (Sheet 14 of 14)

TESTING/ADJUSTING - TILT BACK CIRCUIT RELIEF VALVE (cont)

93. Using a 11/16" socket and socket wrench handle, install and tighten acorn nut (61) to 10 lb-ft.
94. Vent pressure tester hand pump, pressure on tilt cylinder, left side.
95. Using a 10" adjustable wrench, disconnect pressure tester hand pump from sandwich test block.
96. Using a 9/16" socket and socket wrench handle, remove four bolts (54) and two flange halves (55).
97. Disconnect hose assembly (56) from sandwich test block.
98. Inspect new preformed packing (57), replace with new, if damaged during test.
99. Remove sandwich test block and preformed packing (57). Keep second preformed packing (57) with sandwich test block for future testing.
100. Install new preformed packing (57), hose assembly (56), two flange halves (55) and four bolts (54) to tube assembly (58).



NOTE

Return M10A Forklift to original equipment condition.

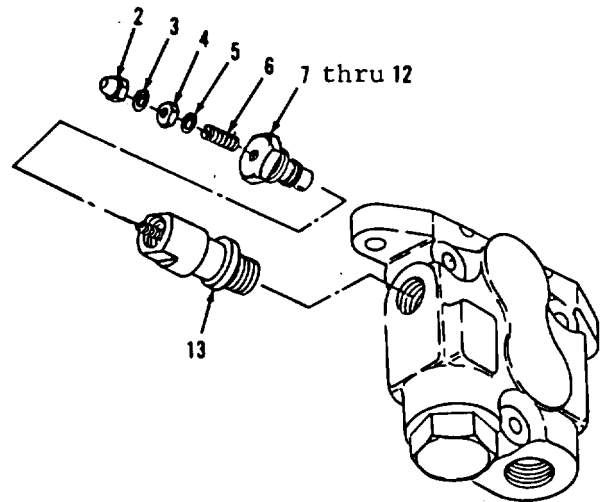
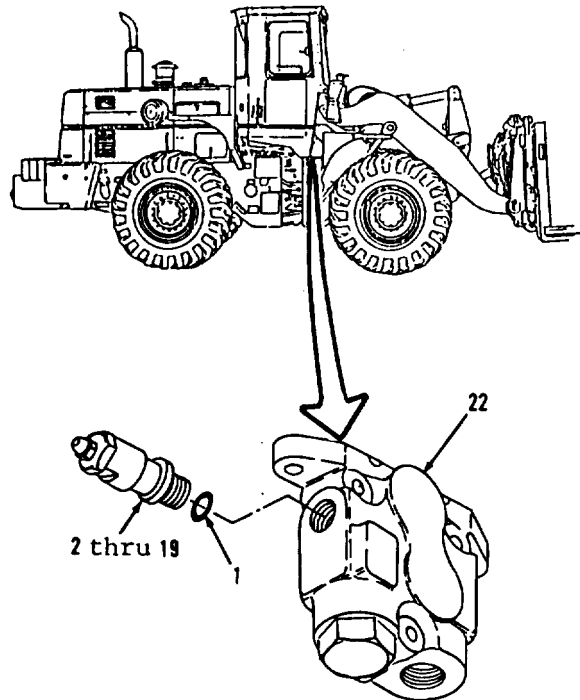
END OF TASK



12-4. Inlet Valve Assembly. (Sheet 2 of 6)

DISASSEMBLY

1. Using a 1-1/4" open end wrench, remove relief valve items 2 thru 19 as an assembly from housing (22).
2. Using a scribe, remove and discard preformed packing (1).
3. Using an 11/16" socket and socket wrench handle, remove nut (2) and preformed packing (3). Discard preformed packing (3).
4. Using an 11/16" socket, socket wrench handle and a flat tip screwdriver, remove nut (4), preformed packing (5) and adjusting screw (6). Discard preformed packing (5).
5. Using a 1-1/4" socket, socket wrench handle and a open end wrench. remove items 7 thru 12 as an assembly from body (13).



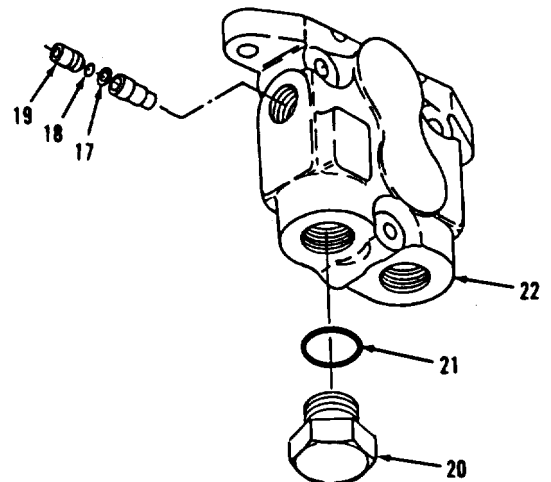
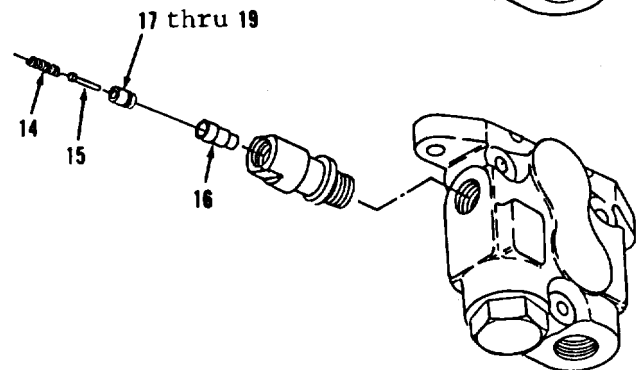
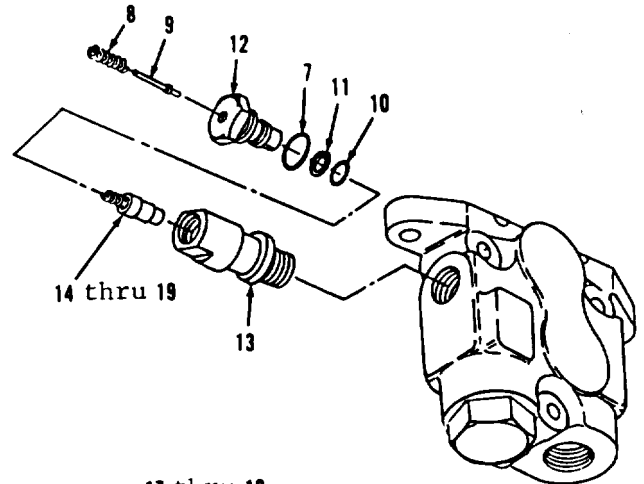
Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-4. Inlet Valve Assembly. (Sheet 3 of 6)

DISASSEMBLY

6. Using a scribe, remove and discard preformed packing (7).
7. Remove spring (8), poppet (9), preformed packing (10) and ring (11) from plug (12). Discard preformed packing (10).
8. Remove items 14 thru 19 as an assembly from body (13).
9. Remove spring (14), piston (15) and items 17 thru 19 as an assembly from poppet (16).
10. Remove ring (17) and preformed packing (18) from poppet (19). Discard preformed packing (18).
11. Using a 1-1/2" open end wrench, remove plug (20) and preformed packing (21) from housing (22). Discard preformed packing (21).



Go to sheet 4

12-4. Inlet Valve Assembly. (Sheet 4 of 6)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

12. Wipe all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. All grooves and passages in housing (22) must be free of foreign matter.
13. Inspect housing (22) surfaces for burrs, scratches, nicks or scores. Stone or lap all burrs. Use crocus cloth on small scores.
14. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 5

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

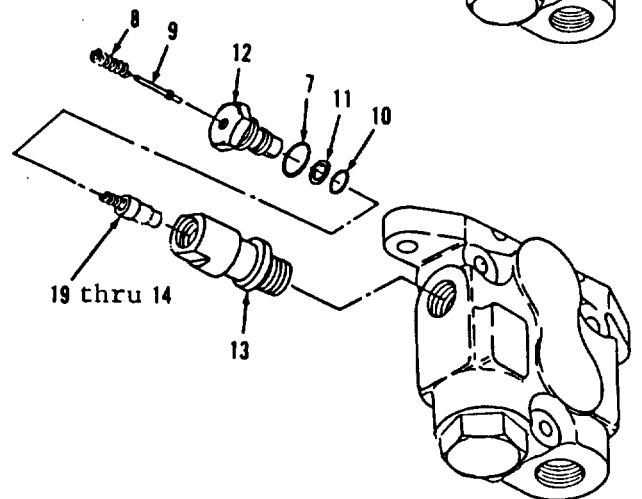
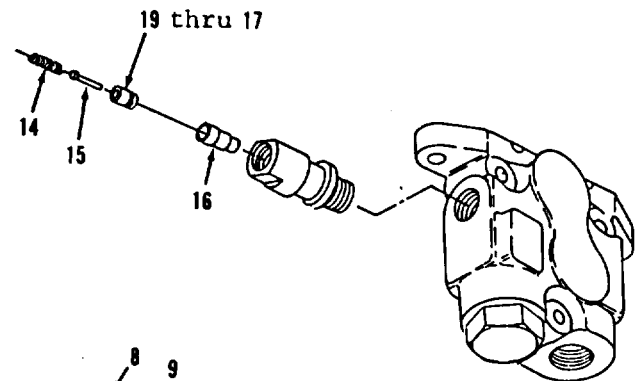
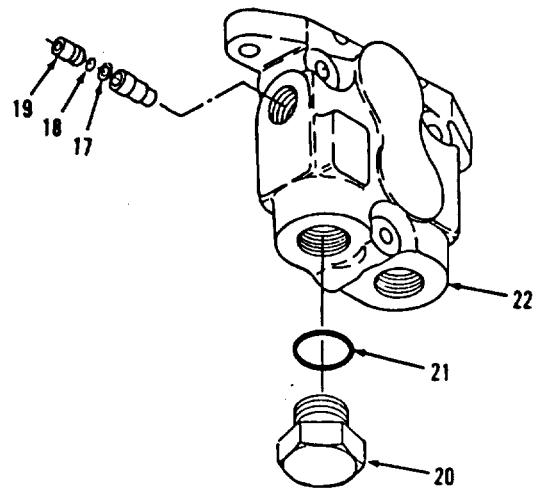
12-4. Inlet Valve Assembly. (Sheet 5 of 6)

ASSEMBLY

NOTE

Lubricate all preformed packings, and housing before installing.

15. Using a 1-1/2" open end wrench, install new preformed packing (21) and plug (20) in housing (22).
16. Install new preformed packing (18) and ring (17) on poppet (19).
17. Install items 19 thru 17 as an assembly, piston (15) and spring (14) on poppet (16).
18. Install items 19 thru 14 as an assembly in body (13).
19. Install ring (11), new preformed packing (10), poppet (9) and spring (8) in plug (12).
20. Install new preformed packing (7) on plug (12).

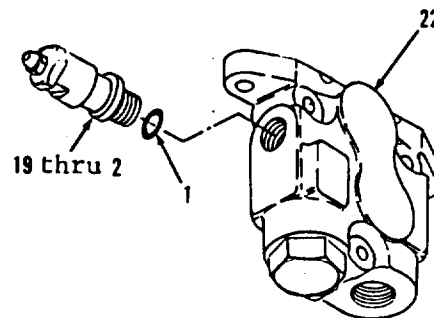
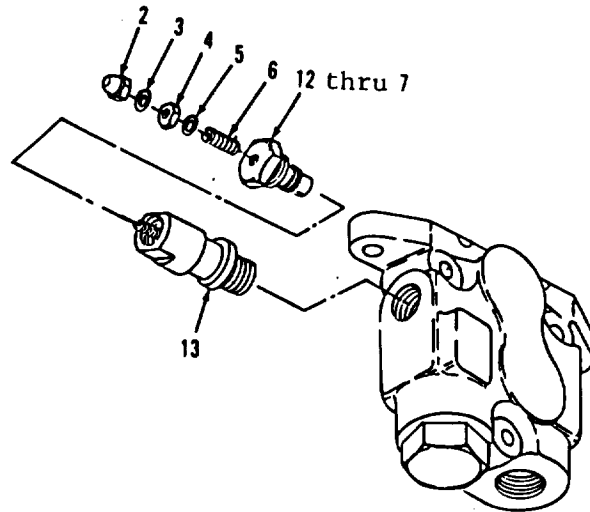


Go to sheet 6

12-4. Inlet Valve Assembly. (Sheet 6 of 6)

ASSEMBLY (cont)

21. Using a 1-1/4" socket and socket wrench handle, install items 12 thru 7 as an assembly in body (13).
22. Using a flat tip screwdriver, 11/16" socket and torque wrench, install adjusting screw (6), new preformed packing (5) and nut (4). Tighten nut (4) to 10 lb-ft.
23. Using an 11/16" socket and torque wrench, install new preformed packing (3) and nut (2). Tighten nut (2) to 10 lb-ft.
24. Install new preformed packing (1).
25. Using a 1-1/4" socket and socket wrench handle, install relief valve items 19 thru 2 as an assembly.



TESTING/ADJUSTING

26. Adjust relief valve items 19 thru 2 as an assembly, refer to paragraph 12-3.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



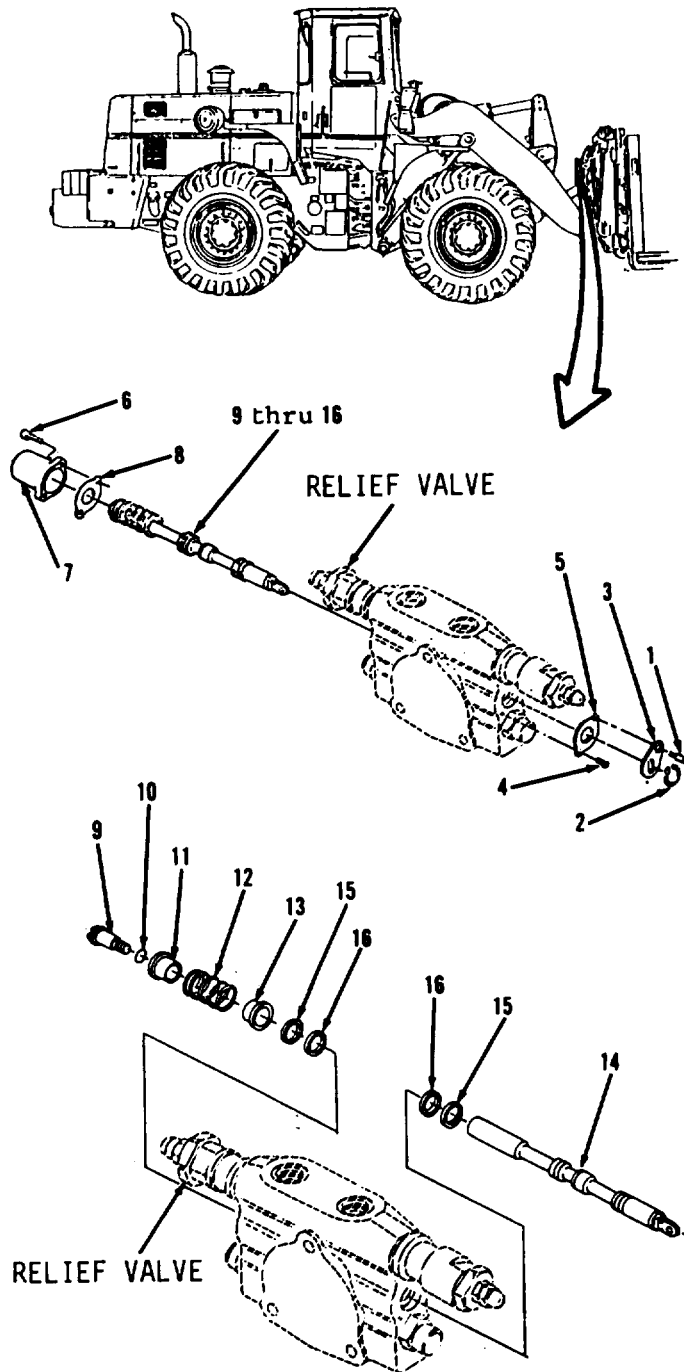


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-5. Fork Valve Assembly. (Sheet 2 of 9)

DISASSEMBLY

1. Using a flat tip screwdriver and snap ring pliers, remove guide screw (1), retaining ring (2) and plate (3).
2. Using a flat tip screwdriver, remove screw (4) and plate (5).
3. Using a 1/4" socket head screw key, remove two bolts (6), cap (7) and plate (8).
4. Remove items 9 thru 16 as an assembly.
5. Using a flat tip screwdriver and scribe, remove screw (9) and preformed packing (10). Discard preformed packing (10).
6. Remove seat (11), spring (12) and seat (13) from spool (14). Note position of spool to aid in installation.
7. Using a scribe, remove and discard two wipers (15) and seals (16).



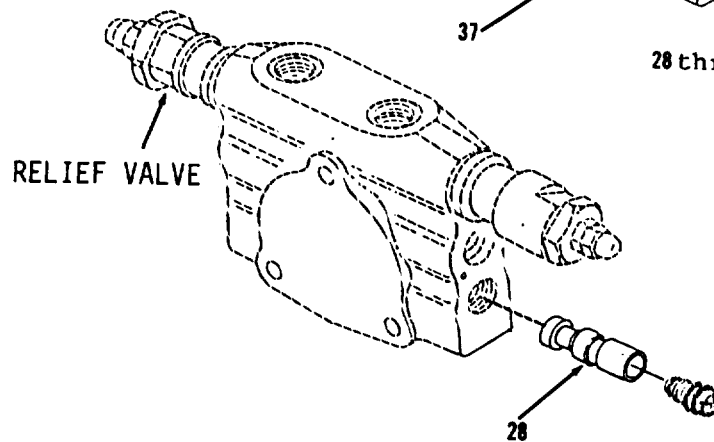
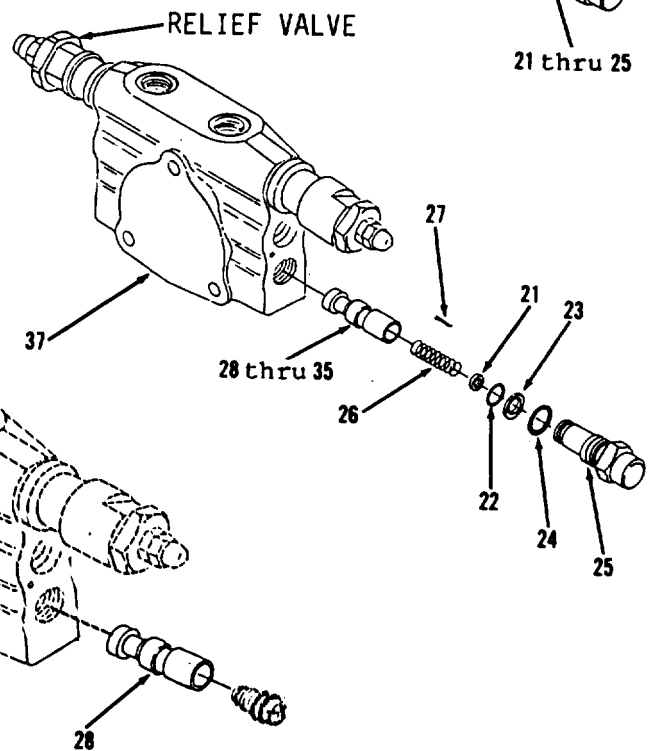
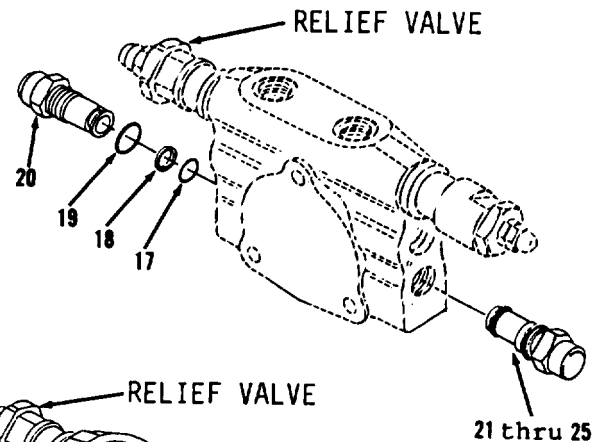
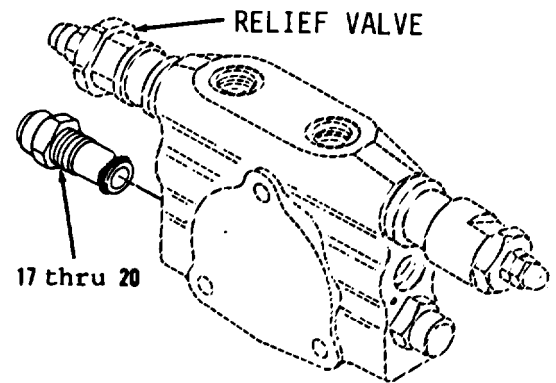
Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-5. Fork Valve Assembly. (Sheet 3 of 9)

DISASSEMBLY

8. Using an 11/16" socket and socket wrench handle, remove items 17 thru 20 as an assembly.
9. Using a scribe, remove preformed packing (17), ring (18) and preformed packing (19) from plug (20). Discard preformed packings (17 and 19).
10. Using an 11/16" socket and socket wrench handle, remove items 21 thru 25 as an assembly.
11. Using a scribe, remove washer (21), preformed packing (22), ring (23) and preformed packing (24) from plug (25). Discard preformed packings (22 and 24).
12. Remove spring (26) from housing (37).
13. Using long round nose pliers, remove retainer (27) from plug (31). Rotate plug (31) counterclockwise to remove.
14. Remove items 28 thru 35 as an assembly from housing (37). Note position of spool (28) to aid in installation.



Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-5. Fork Valve Assembly. (Sheet 4 of 9)

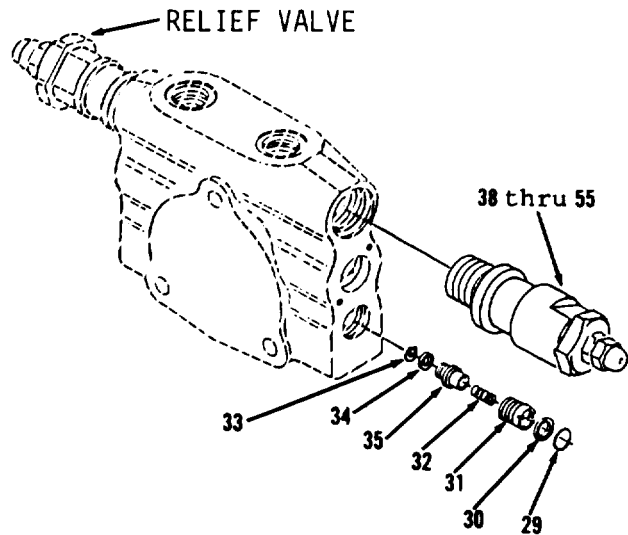
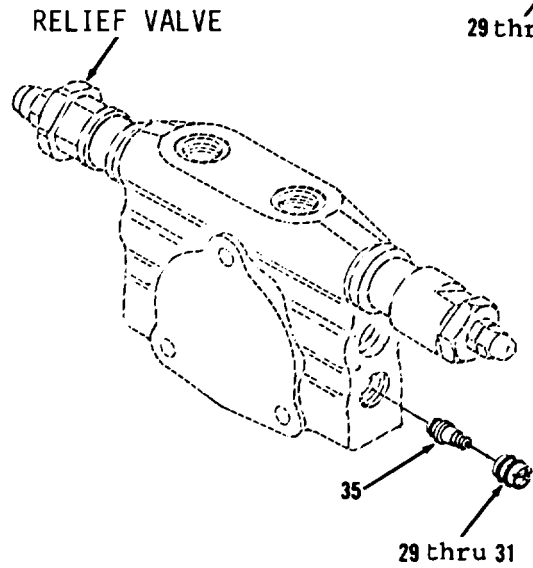
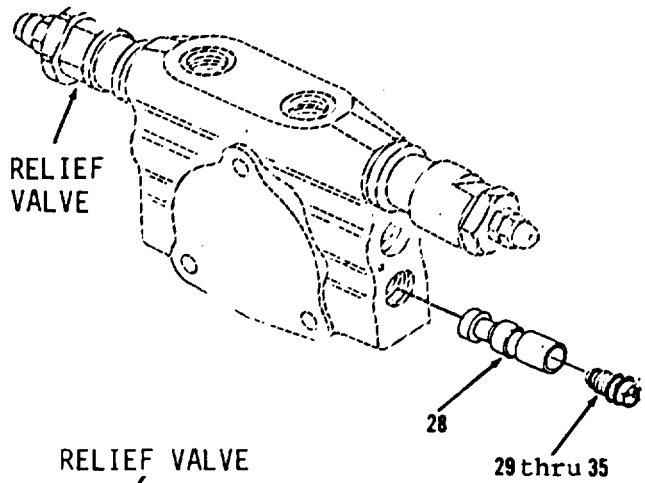
DISASSEMBLY (cont)

- 15. Remove items 29 thru 35 as an assembly from spool (28).
- 16. Using a flat tip screwdriver, remove items 29 thru 31 as an assembly from poppet (35).
- 17. Using a scribe, remove preformed packing (29) and ring (30) from plug (31). Discard preformed packing (29).
- 18. Remove spring (32).
- 19. Using snap ring pliers, remove retaining-ring (33) and washer (34) from poppet (35).

NOTE

There are two relief valves in the fork valve assembly. The maintenance procedure for both relief valves is identical.

- 20. Using a 1-1/4" open end wrench, remove relief valve items 38 thru 55 as an assembly.



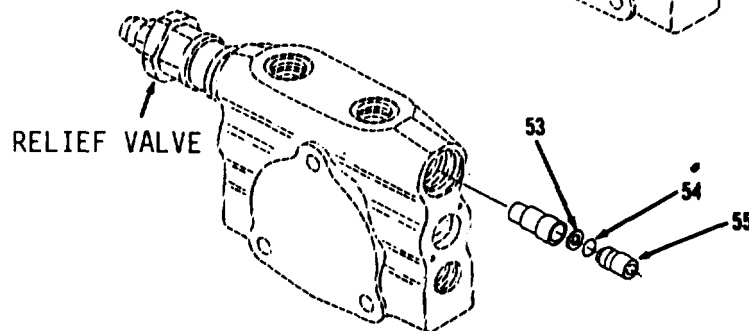
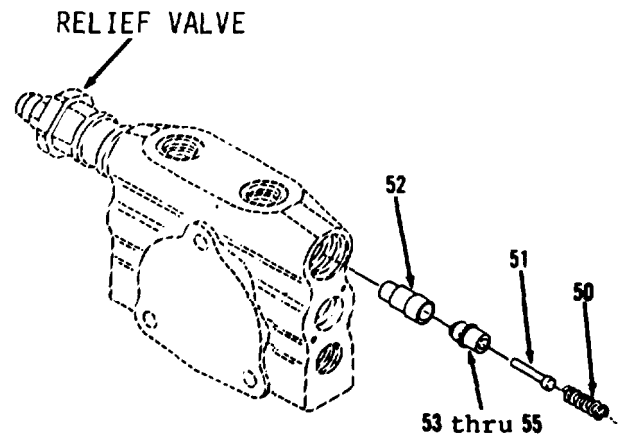
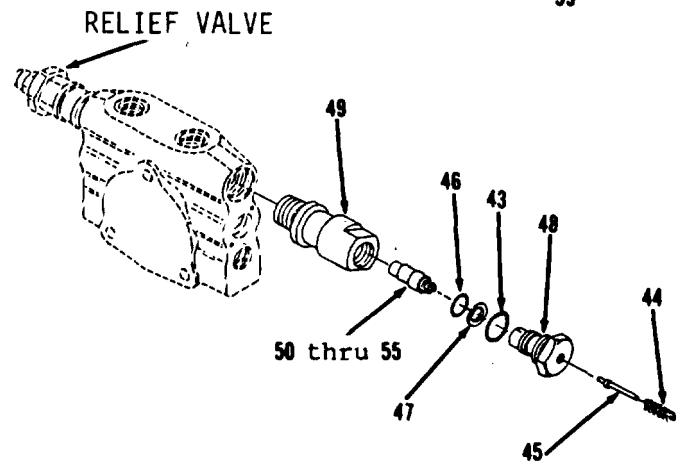
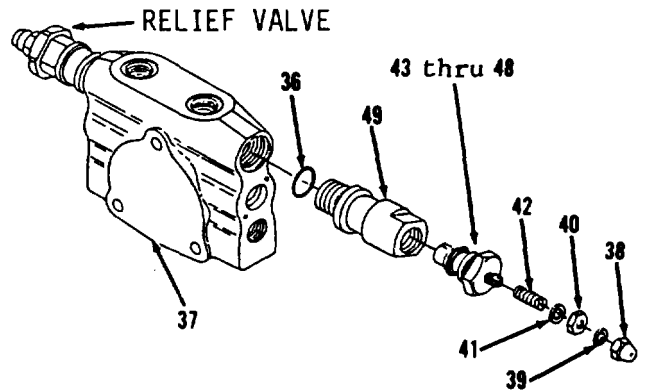
Go to sheet 5

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-5. Fork Valve Assembly. (Sheet 5 of 9)

DISASSEMBLY

21. Using a scribe, remove and discard preformed packing (36) from housing (37).
22. Using an 11/16" socket and socket wrench handle, remove nut (38) and preformed packing (39). Discard preformed packing (39).
23. Using a flat tip screwdriver, remove nut (40), preformed packing (41) and adjusting screw (42). Discard preformed packing (41).
24. Remove items 43 thru 48 as an assembly from body (49).
25. Using a scribe, remove and discard preformed packing (43).
26. Remove spring (44), poppet (45), preformed packing (46) and ring (47) from plug (48). Discard preformed packing (46).
27. Remove items 50 thru 55 as an assembly from body (49).
28. Remove spring (50), piston (51) and items 53 thru 55 as an assembly from poppet (52).
29. Remove ring (53) and preformed packing (54) from poppet (55). Discard preformed packing (54).



Go to sheet 6

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-5. Fork Valve Assembly. (Sheet 6 of 9)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

30. Wipe all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8. All grooves and passages in housing (37) must be free of foreign matter.
31. Inspect housing (37) surfaces for burrs, scratches, nicks or scores. Stone or lap all burrs. Use crocus cloth on small scores.
32. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 7

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

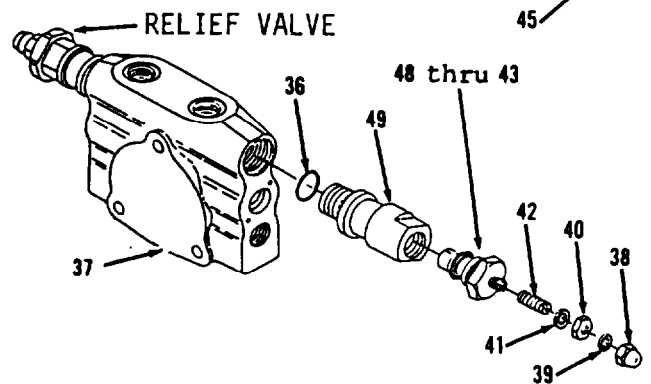
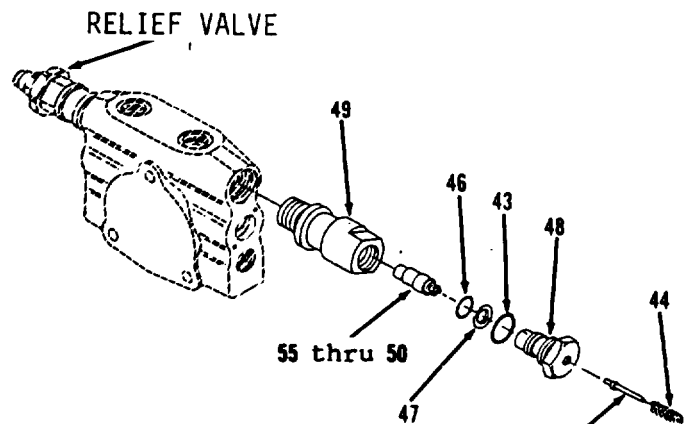
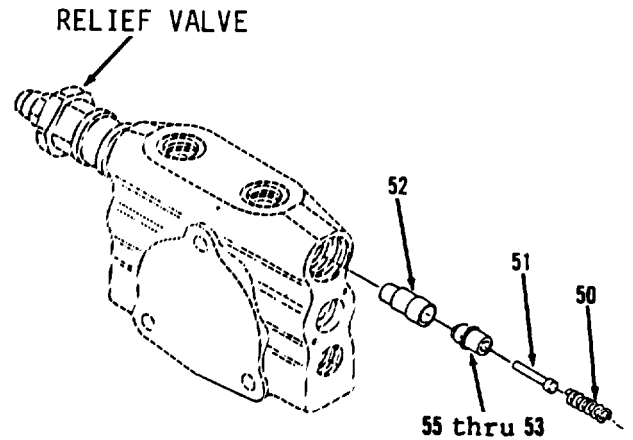
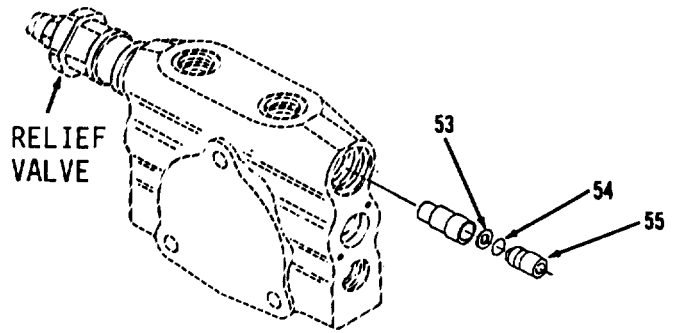
12-5. Fork Valve Assembly. (Sheet 7 of 9)

ASSEMBLY

NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

33. Install new preformed packing (54) and ring (53) on poppet (55).
34. Install items 55 thru 53 as an assembly, piston (51) and spring (50) on poppet (52).
35. Install items 55 thru 50 as an assembly in body (49).
36. Install ring (47), new preformed packing (46), poppet (45) and spring (44) in plug (48).
37. Install new preformed packing (43).
38. Using a 1-1/4" socket and socket wrench handle, install items 48 thru 43 as an assembly in body (49).
39. Using a flat tip screwdriver, install adjusting screw (42), new preformed packing (41) and nut (40). Tighten nut (40) to 10 lb-ft.
40. Using an 11/16" socket and torque wrench, install new preformed packing (39) and nut (38). Tighten nut (38) to 10 lb-ft.
41. Install new preformed packing (36) in housing (37).



Go to sheet 8

12-5. Fork Valve Assembly. (Sheet 8 of 9)

ASSEMBLY (cont)

42. Using a 1-1/4" socket and torque wrench, install relief valve items 55 thru 38 as an assembly. Tighten body (49) to 75 lb-ft.

43. Using snap ring pliers, install washer (34) and retaining ring (33) in poppet (35).

44. Install spring (32).

45. Install ring (30) and new preformed packing (29) on plug (31).

46. Using a flat tip screwdriver, install items 31 thru 29 as an assembly on poppet (35).

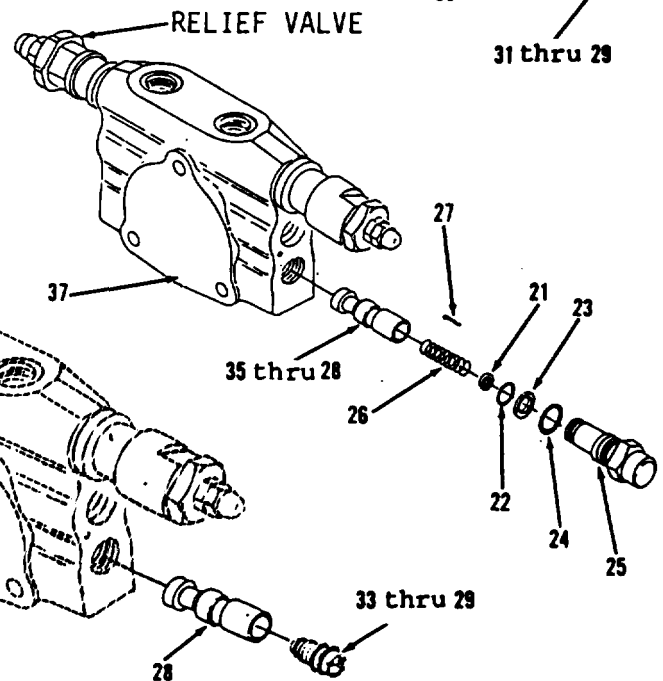
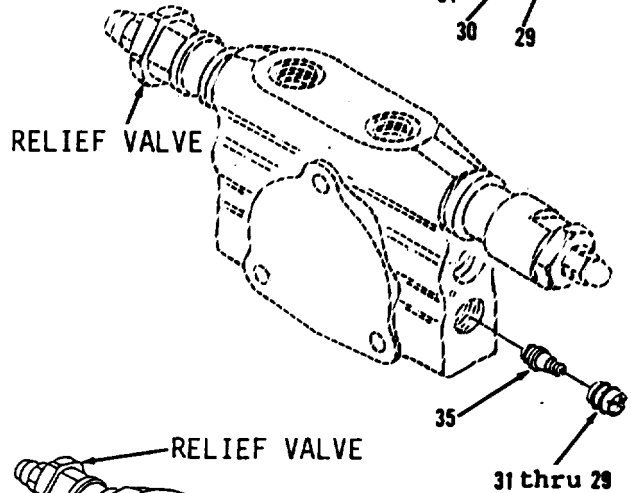
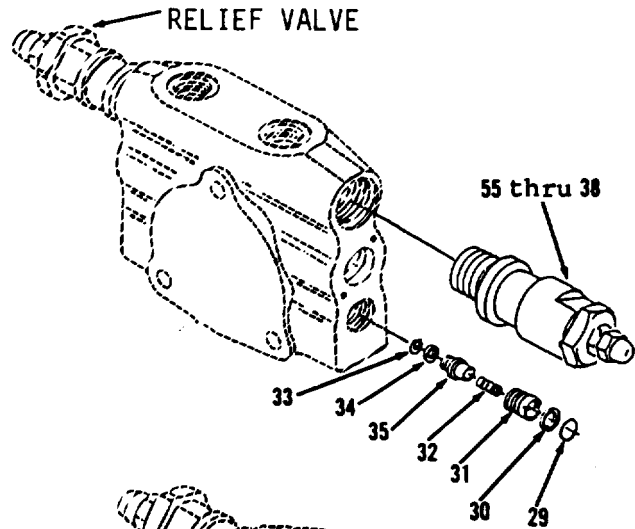
47. Install items 33 thru 29 as an assembly in spool (28).

48. Install items 35 thru 28 as an assembly in housing (37).

49. Using long round nose pliers, install retainer (27) in plug (31). Rotate plug (31) clockwise to install.

50. Install spring (26).

51. Install new preformed packing (24), ring (23), new preformed packing (22) and washer (21) in plug (25).



Go to sheet 9



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

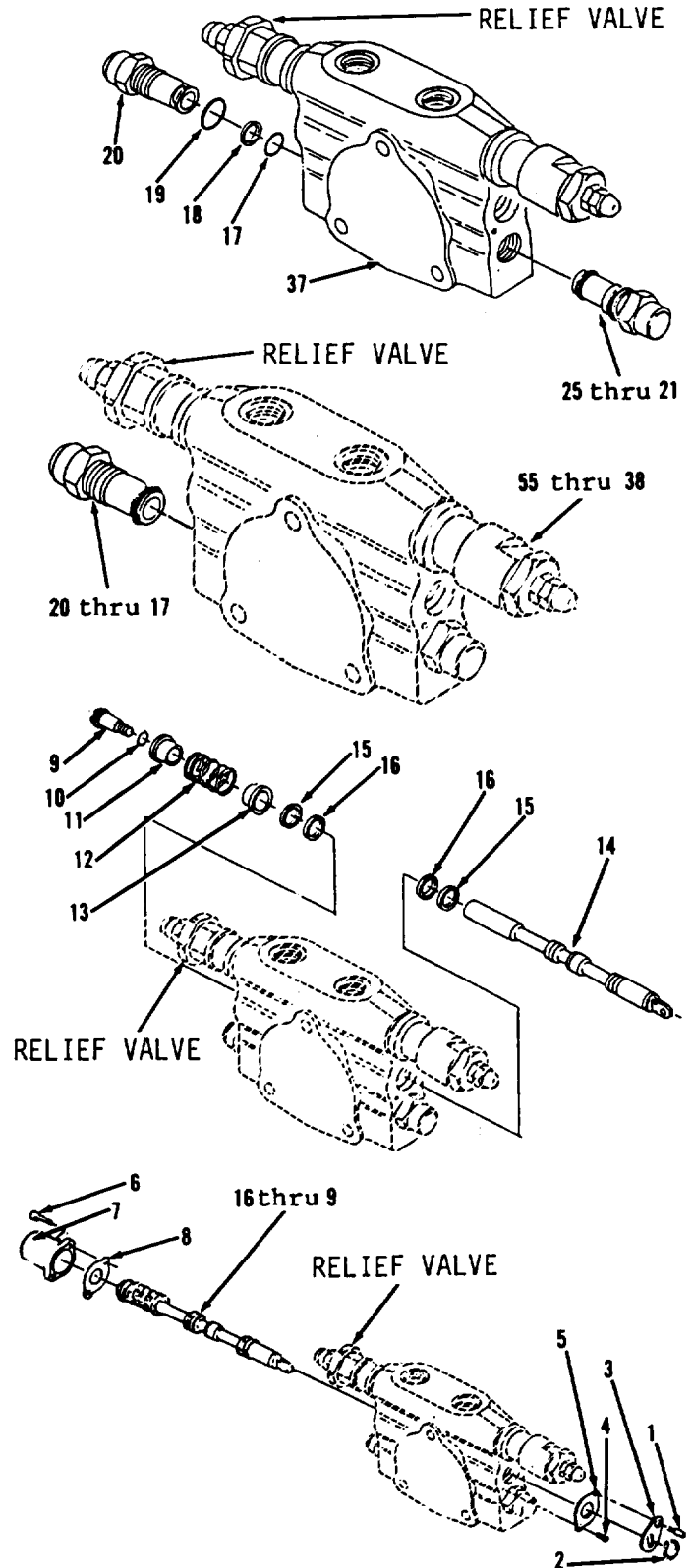
12-5. Fork Valve Assembly. (Sheet 9 of 9)

ASSEMBLY

52. Using an 11/16" socket and torque wrench, install items 25 thru 21 as an assembly in housing (37). Tighten plug (25) to 75 lb-ft.
53. Install new preformed packing (19), ring (18) and new preformed packing (17) in plug (20).
54. Install items 20 thru 17 as an assembly in housing (37).
55. Install two new seals (16) and new wipers (15) on spool (14).
56. Position seat (13), spring (12) and seat (11) on spool (14).
57. Install new preformed packing (10) on screw (9).
58. Using a flat tip screwdriver, install items 16 thru 9 as an assembly. Tighten screw (9) to 4 lb-ft.
59. Using a 1/4" socket and torque wrench, install plate (8), cap (7) and two bolts (6). Tighten two bolts (6) to 5 lb-ft.
60. Using a flat tip screwdriver, install plate (5) and screw (4).
60. Using a flat tip screwdriver and a snap ring pliers, install plate (5), screw (4), plate (3), retaining ring (2) and guide screw (1).
61. Adjust relief valve items 55 thru 38 as an assembly, refer to paragraph 12-3.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cent)

12-6. Tilt Valve Assembly. (Sheet 1 of 8)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Crocus cloth (App. C, Item 3)  
Preformed packing (10)  
Seal (2)  
Wiper (2)

Torques

**Bolts (5) to 5 lb-ft**  
Screw (8) to 4 lb-ft  
Plug (17) and nut (26) to 75

---

EQUIPMENT CONDITION

References

Paragraph 12-3

Condition Description

Loader control valve disassembled.

---

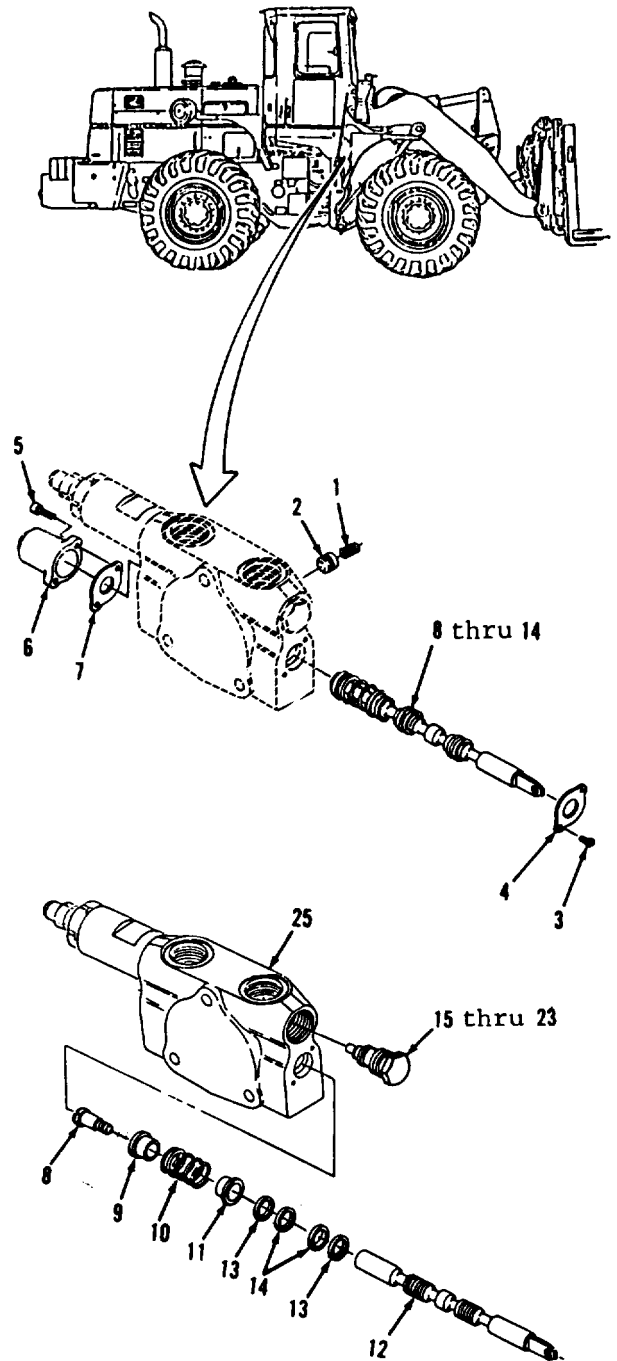
Go to sheet 2

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-6. Tilt Valve Assembly. (Sheet 2 of 8)

DISASSEMBLY

1. Remove spring (1) and poppet (2).
2. Using a flat tip screwdriver, remove two screws (3) and plate (4).
3. Using a 1/4" socket head screw key, remove two bolts (5), cap (6) and plate (7).
4. Remove items 8 thru 15 as an assembly. Note position of spool (13) to aid in installation.
5. Using a flat tip screwdriver, remove screw (8).
6. Remove seat (9), spring (10) and seat (11) from spool (12).
7. Using a machinists scribe, remove and discard two wipers (13) and seals (14).
8. Using a 1-1/4" socket and socket wrench handle, remove items 15 thru 23 as an assembly from housing (25).

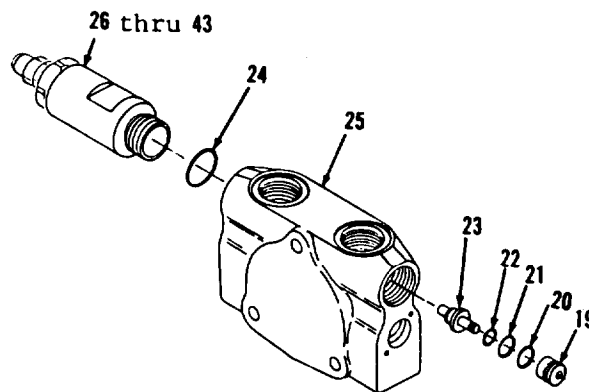
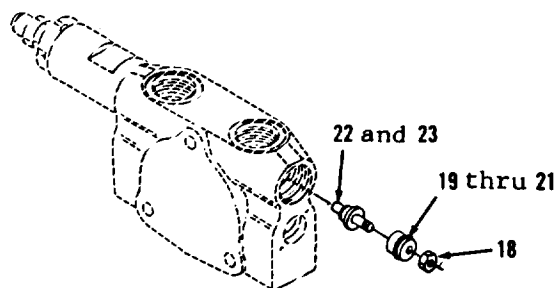
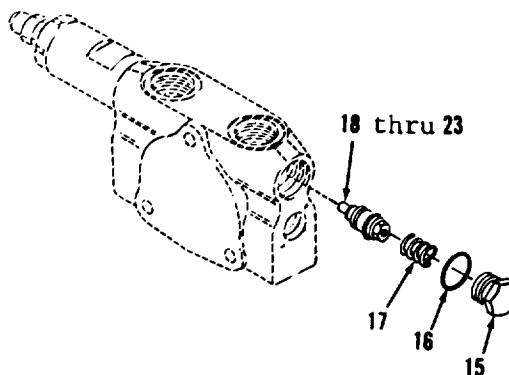


Go to sheet 3

12-6. Tilt Valve Assembly. (Sheet 3 of 8)

DISASSEMBLY (cont)

9. Using a machinists scribe, remove plug (15) and preformed packing (16). Discard preformed packing (16).
10. Remove spring (17) from items 18 thru 23 as an assembly.
11. Using a 7/8" socket and socket wrench handle, remove nut (18) and items 19 thru 21 as an assembly from poppet (23).
12. Using a machinists scribe, remove spacer (19), preformed packing (20) and ring (21). Discard preformed packing.
13. Remove preformed packing (22) from poppet (23). Discard preformed packing (22).
14. Using a 1-1/4" open end wrench, remove relief valve items 26 thru 43 as an assembly.
15. Using a machinists scribe, remove preformed packing (24) from housing (25). Discard preformed packing (24).

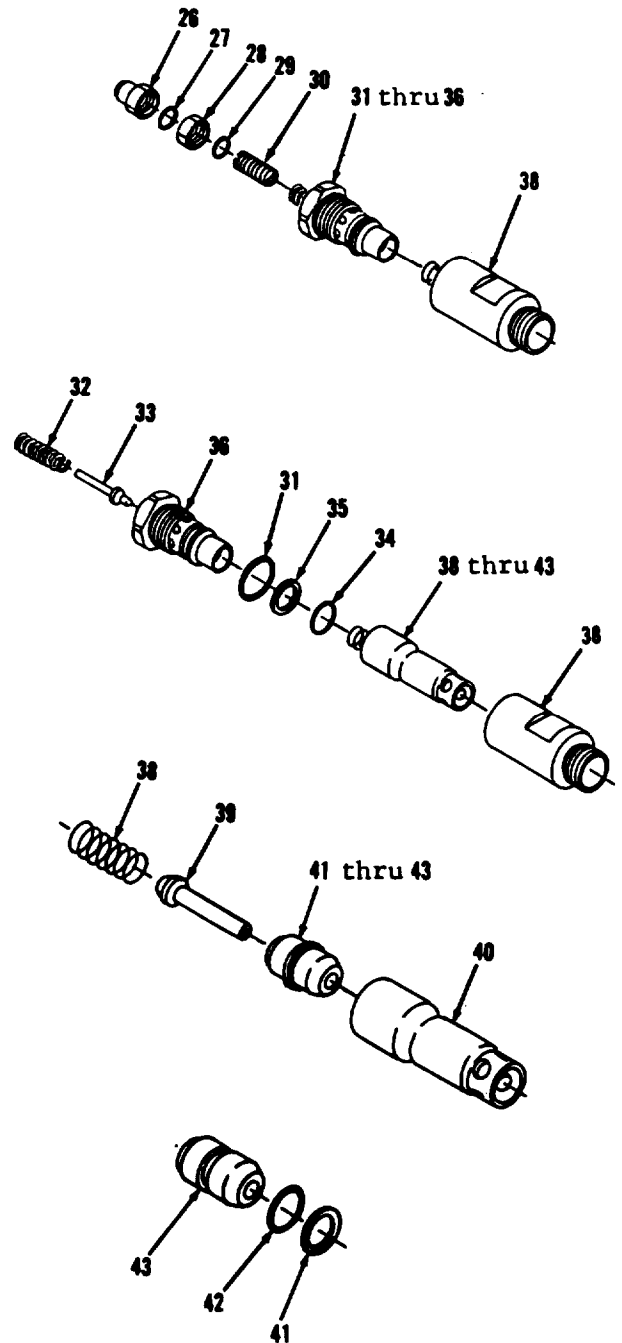


## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

## 12-6. Tilt Valve Assembly. (Sheet 4 of 8)

DISASSEMBLY

16. Using an 11/16" socket and socket wrench handle, remove nut (26) and preformed packing (27). Discard preformed packing (27).
17. Using an 11/16" open end wrench and a flat tip screwdriver, remove nut (28), preformed packing (29) and adjusting screw (30). Discard preformed packing (29).
18. Using a 1-1/4" socket, socket wrench handle and vise, remove items 31 thru 36 as an assembly from body (37).
19. Using a scribe, remove and discard preformed packing (31).
20. Remove spring (32), poppet (33), preformed packing (34) and ring (35) from plug (36). Discard preformed packing (34).
21. Remove items 38 thru 43 as an assembly from body (37).
22. Remove spring (38), piston (39) and items 41 thru 43 as an assembly from poppet (40).
23. Remove ring (41) and preformed packing (42) from poppet (43). Discard preformed packing (42).



Go to sheet 5

12-6. Tilt Valve Assembly. (Sheet 5 of 8)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

24. Wipe all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8. All grooves and passages in housing (25) must be free of foreign matter.

Go to sheet 6

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-6. Tilt Valve Assembly. (Sheet 6 of 8)

CLEANING/INSPECTION

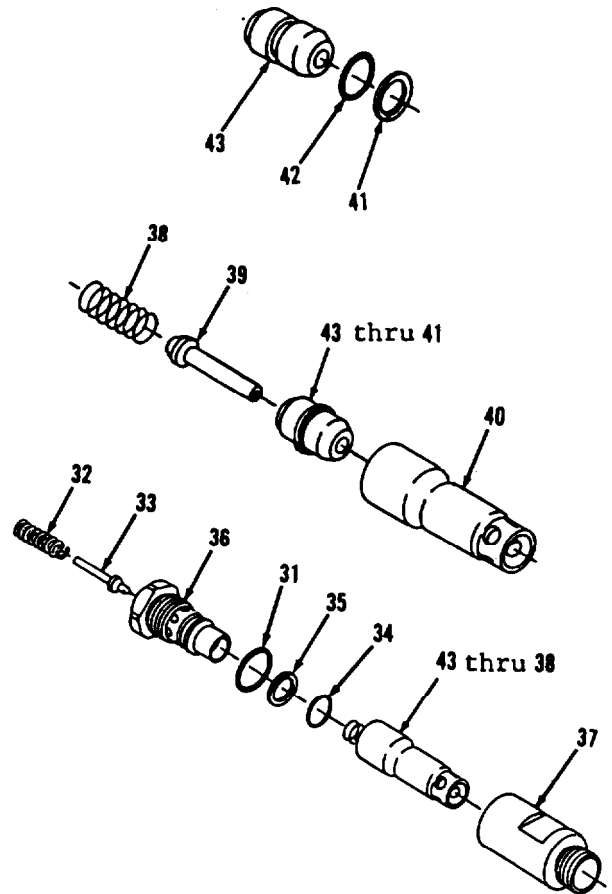
25. Inspect housing (25) surfaces for burrs, scratches and nicks or scores. Stone or lap all burrs. Use crocus cloth on small burrs.
26. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

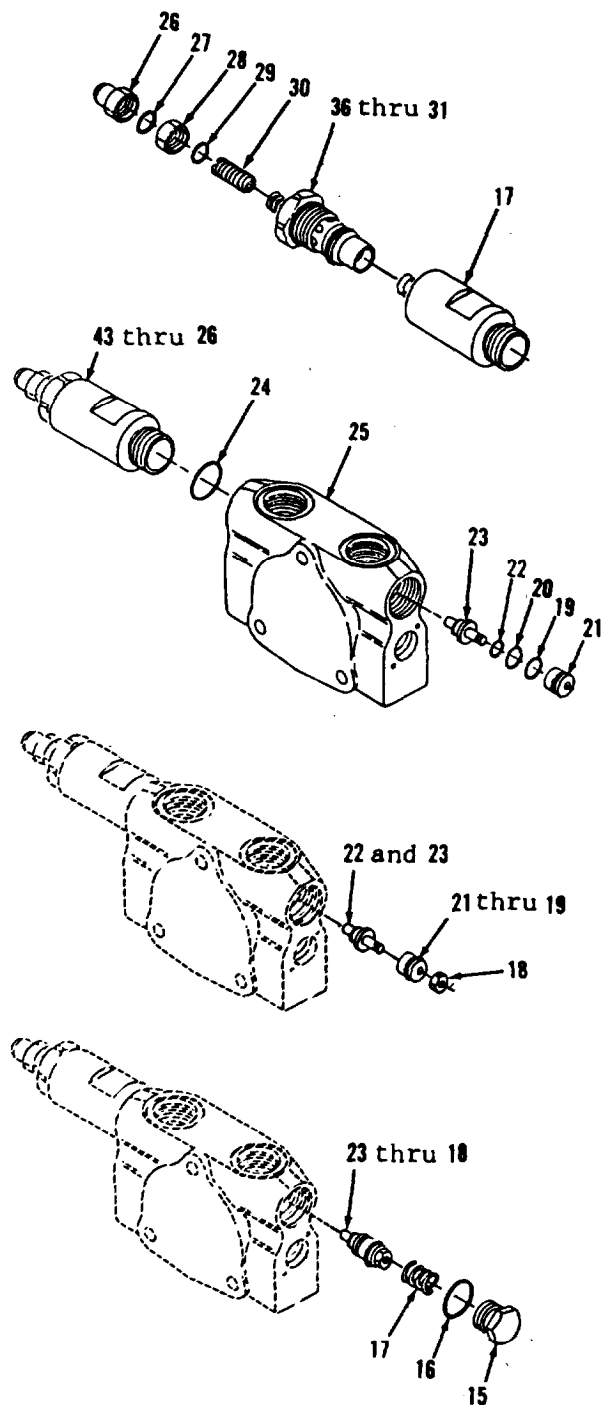
27. Install new preformed packing (42) and ring (41) on poppet (43).
28. Install items 43 thru 41 as an assembly, piston (39) and spring (38) in poppet (40).
29. Install items 43 thru 38 as an assembly in body (37).
30. Install ring (35), new preformed packing ((34), poppet (33) and spring (32) in plug (36).
31. Install new preformed packing (31).



12-6. Tilt Valve Assembly. (Sheet 7 of 8)

ASSEMBLY (cont)

32. Using a 1-1/4" socket and socket wrench handle, install items 36 thru 31 as an assembly in body (37).
33. Using an 11/16" socket, socket wrench handle and flat tip screwdriver, install adjusting screw (30), new preformed packing (29) and nut (28).
34. Using an 11/16" socket and torque wrench, install new preformed packing ((27) and nut (26). Tighten nut (26) to 10 lb-ft.
35. Install new preformed packing (24) in housing (25).
36. Using a 1-1/4" socket and torque wrench, install relief valve items 43 thru 26 as an assembly. Tighten nut (26) to 75 lb-ft.
37. Install new preformed packing (22) on poppet (23).
38. Install ring (20) and new preformed packing (19) on spacer (21).
39. Install items 21 thru 19 as an assembly and nut (18) in poppet (23).
40. Using a 7/8" socket and socket wrench handle, install spring (17) and items 23 thru 18 as an assembly in plug (17).
41. Install new preformed packing (16) in plug (15).



Go to sheet 8

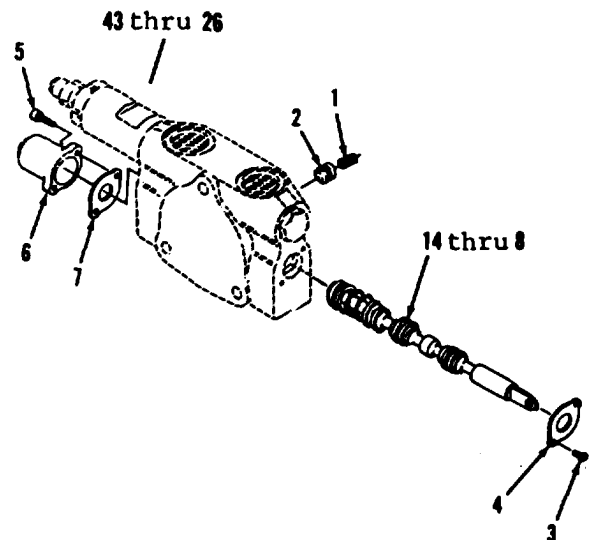
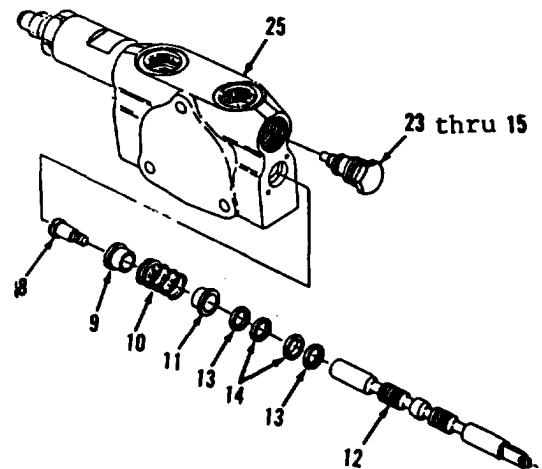


## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

## 12-6. Tilt Valve Assembly. (Sheet 8 of 8)

ASSEMBLY

42. Using a 1-1/4" socket and torque wrench, install items 23 thru 15 as an assembly in housing (25).
43. Install two seals (14) and new wipers (13).
44. Position seat (11), spring (10) and seat (9) on spool (12).
45. Using a flat tip screwdriver, install screw (8). Tighten screw (8) to 4 lb-ft .
46. Install items 14 thru 8 as an assembly.
47. Using a 1/4" socket head screw key and torque wrench, install plate (7), cap (6) and two bolts (5). Tighten bolts (5) to 5 lb-ft.
48. Using a flat tip screwdriver, install plate (4) and two screws (3).
49. Install poppet (2) and spring (1).
50. Adjust relief valve items 43 thru 26 as an assembly, refer to paragraph 12-3.



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

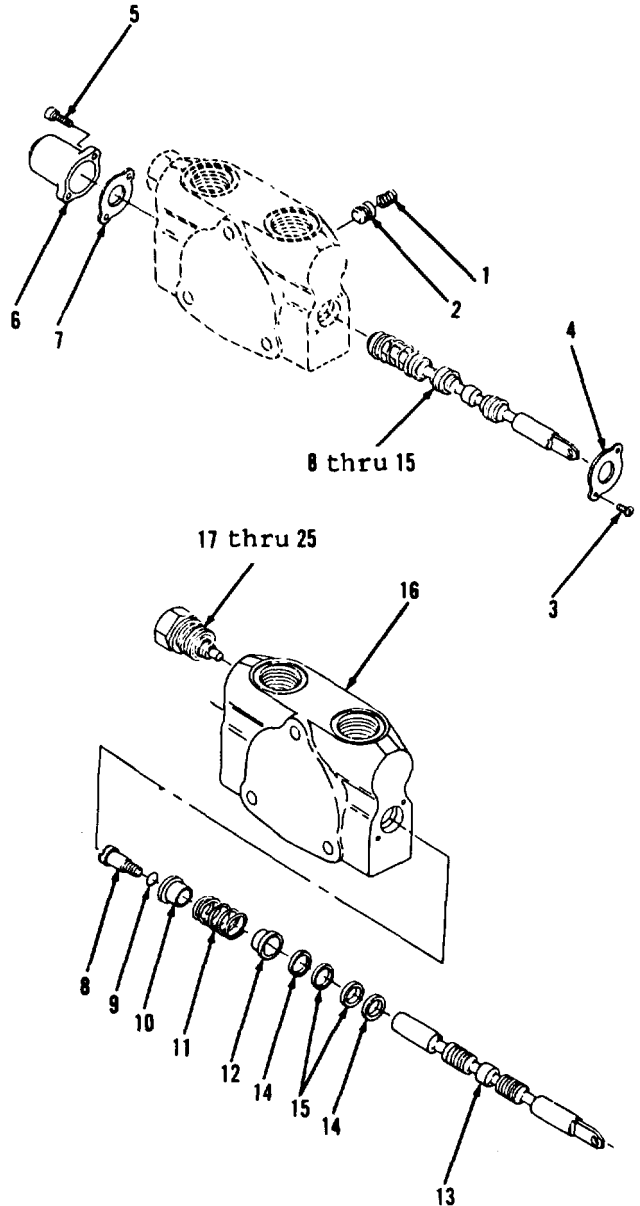


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-7. Boom Assembly Valve. (Sheet 2 of 6)

DISASSEMBLY

1. Remove spring (1) and poppet (2).
2. Using a flat tip screwdriver, remove two screws (3) and plate (4).
3. Using a 1/4" socket head screw key, remove two bolts (5), cap (6) and plate (7).
4. Remove items 8 thru 15 as an assembly from housing (16). Note position of spool (13) to aid in installation.
5. Using a flat tip screwdriver, remove screw (8) and preformed packing (9). Discard preformed packing (9).
6. Remove seat (10), spring (11) and seat (12) from spool (13).
7. Remove and discard two wipers (14) and seals (15) from housing (16).
8. Using a 1-1/4" socket and socket wrench handle, remove items 17 thru 25 as an assembly from housing (16).

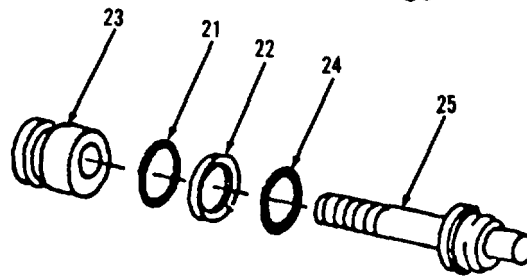
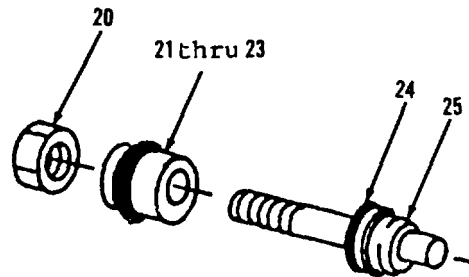
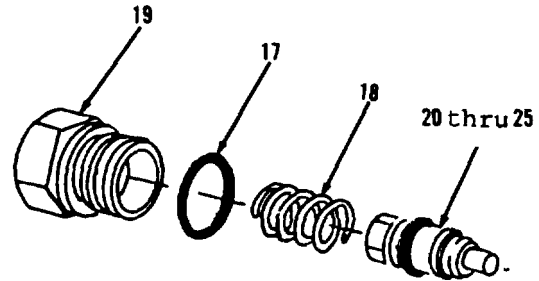


Go to sheet 3

12-7. Boom Assembly Valve. (Sheet 3 of 6)

DISASSEMBLY (cont)

9. Using a scribe, remove preformed packing (17) from plug (19). Discard preformed packing (17).
10. Remove items 20 thru 25 as an assembly and spring (18) from plug (19).
11. Using an 11/16" box and open end wrench, remove nut (20) and items 21 thru 23 as an assembly from poppet (25).
12. Using a scribe, remove preformed packing (21) and ring (22) from spacer (23). Discard preformed packing (21).
13. Remove preformed packing (24) from poppet (25). Discard preformed packing (24).



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-7. Boom Assembly Valve. (Sheet 4 of 6)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

14. Wipe all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 5

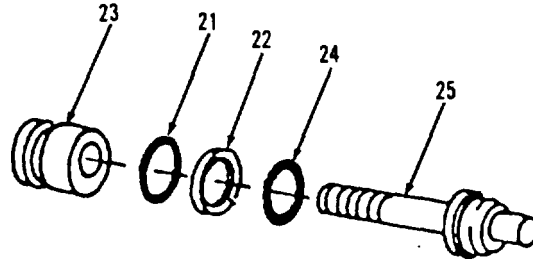
12-7. Boom Assembly Valve. (Sheet 5 of 6)

CLEANING/INSPECTION (cont)

NOTE

All grooves and passages in housing must be free of foreign matter.

15. Inspect all parts. Refer to paragraph 2-9.

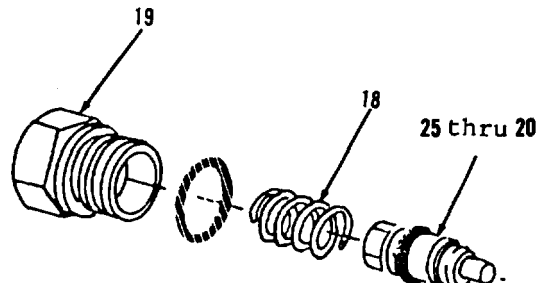
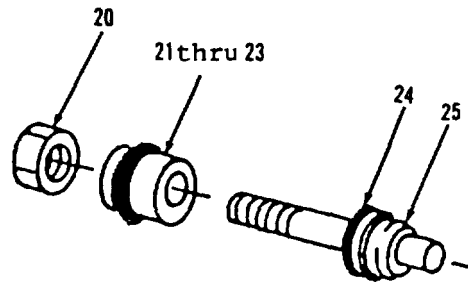


ASSEMBLY

NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

16. Install new preformed packing (24) on poppet (25).
17. Install ring (22) and new preformed packing (21) on spacer (23).
18. Using an 11/16" box and open end wrench, install items 23 thru 21 as an assembly and nut (20) on poppet (25).
19. Install spring (18) and items 25 thru 20 as an assembly in plug (19).

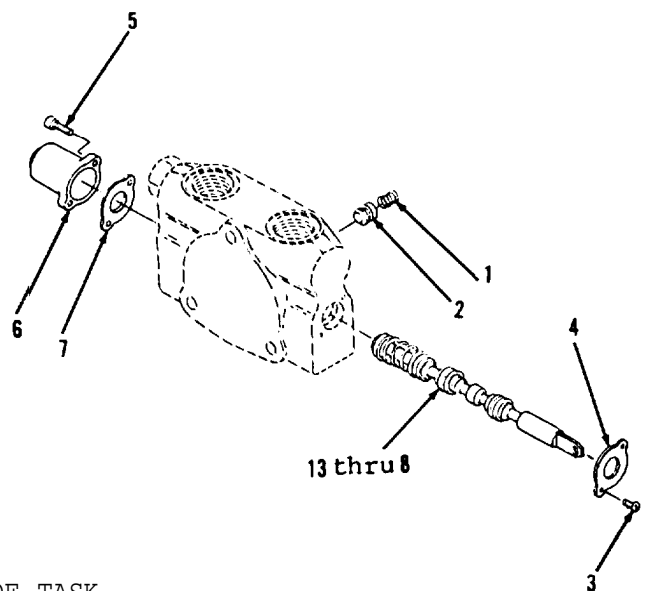
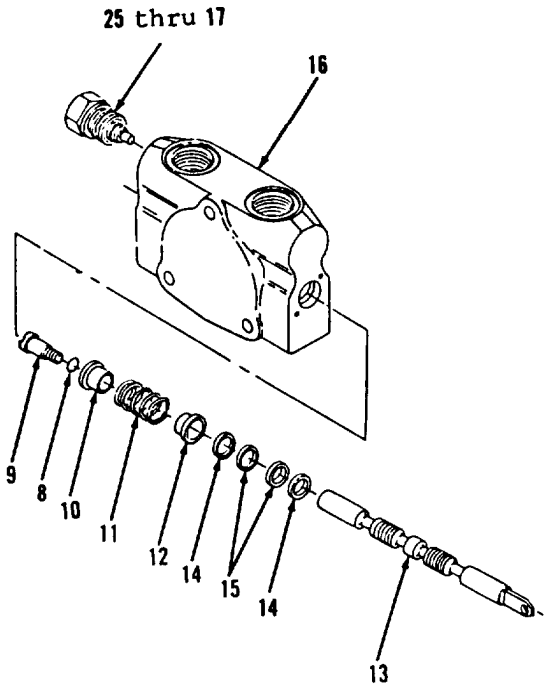
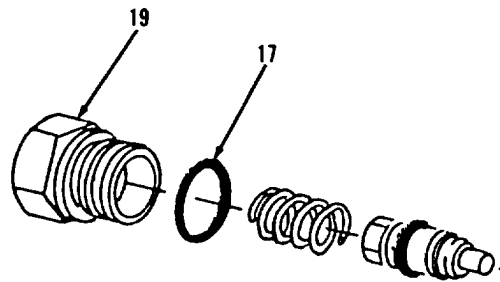


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-7. Boom Assembly Valve. (Sheet 6 of 6)

ASSEMBLY

20. Install new preformed packing (17) on plug (19).
21. Using a 1-1/4" socket and torque wrench, install items 25 thru 17 as an assembly in housing (16). Tighten plug (19) to 75 lb-ft.
22. Install two new seals (15) and new wipers (14) in housing (16).
23. Position seat (12), spring (11) and seat (10) on spool (13).
24. Using a flat tip screwdriver, install new preformed packing (9) and screw (8). Tighten screw (8) to 4 lb-ft.
25. Install items 13 thru 8 as an assembly.
26. Using a 1/4" hex head adapter and torque wrench, install plate (7), cap (6) and two bolts (5). Tighten two bolts (5) to 5 lb-ft.
27. Using a flat tip screwdriver, install plate (4) and two screws (3).
28. Install poppet (2) and spring (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-8. Fork Control Valve. (Sheet 1 of 9)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Detergent (App. C, Item 33)  
Small tag (App. C, Item 28)  
Preformed packing (10)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Hydraulic pressure vented.

---



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-8. Fork Control Valve. (Sheet 2 of 9)

REMOVAL

NOTE

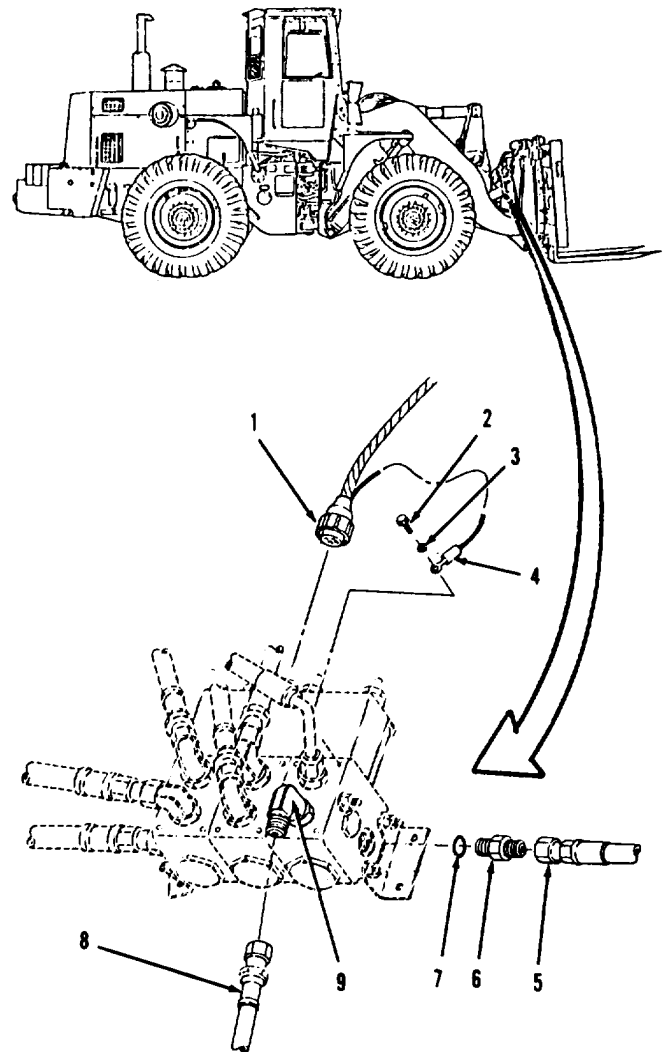
All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

1. Using slip joint pliers, disconnect cable assembly (1) at connector from front of vehicle.
2. Using a 1/2" socket and socket wrench handle, remove bolt (2) and washer (3).
3. Disconnect wire assembly (4).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

4. Using a 7/8" open end wrench, disconnect hose assembly (5) at connector (6).
5. Remove connector (6) and preformed packing (7). Discard preformed packing (7).
6. Disconnect hose assembly (8) a elbow (9).

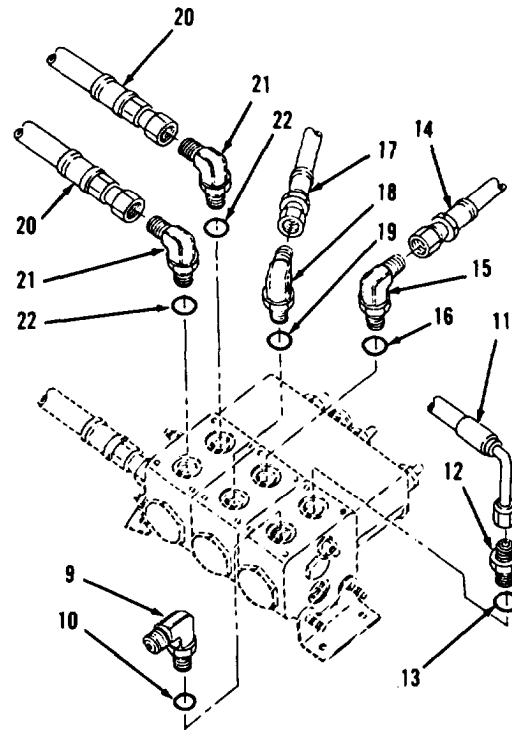


Go to sheet 3

12-8. Fork Control Valve. (Sheet 3 of 9)

REMOVAL (cont)

7. Using a 7/8" open end wrench, remove elbow (9) and preformed packing (10). Discard preformed packing (10).
8. Disconnect hose assembly (11) at connector (12).
9. Remove connector (12) and preformed packing (13). Discard preformed packing (13).
10. Disconnect hose assembly (14) at elbow (15).
11. Remove elbow (15) and preformed packing (16). Discard preformed packing (16).
12. Disconnect hose assembly (17) at elbow (18).
13. Remove elbow (18) and preformed packing (19). Discard preformed packing (19).
14. Disconnect two hose assemblies (20) at two elbows (21).
15. Remove two elbows (21) and preformed packings (22). Discard two preformed packings (22).



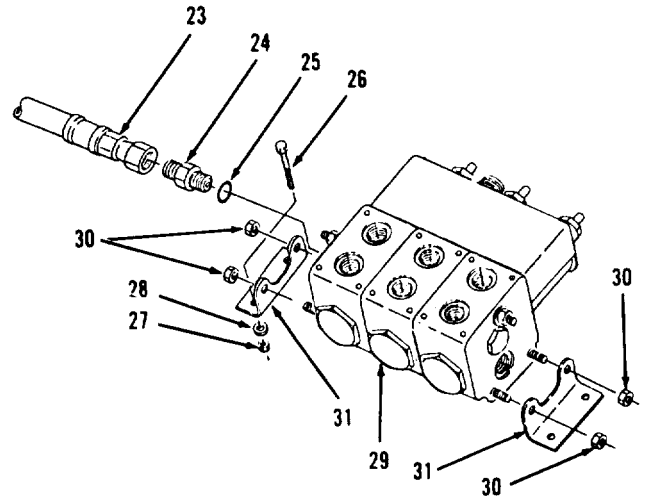
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-8. Fork Control Valve. (Sheet 4 of 9)

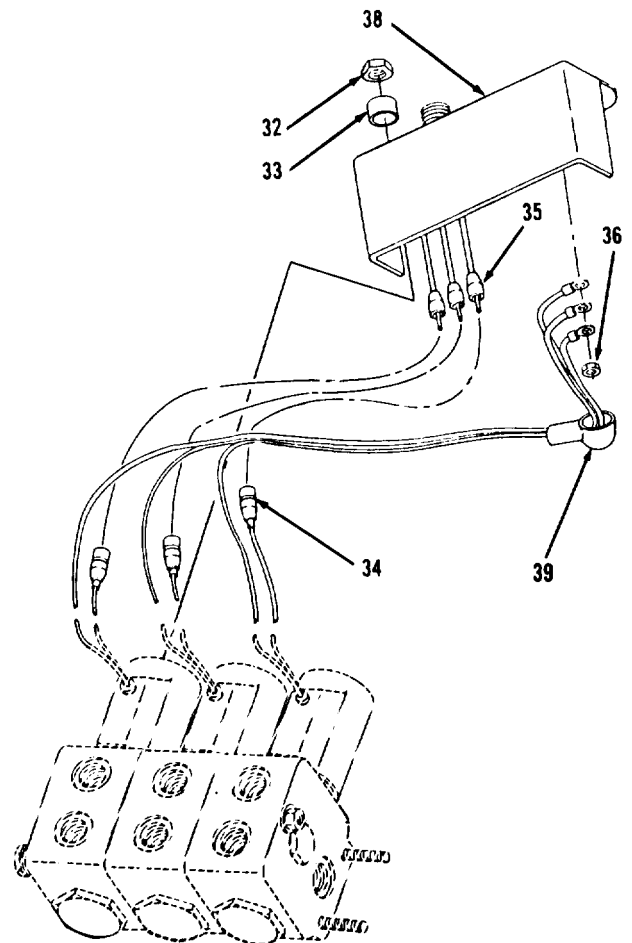
REMOVAL

16. Using a 7/8" open end wrench, disconnect hose assembly (23) at connector (24).
17. Remove connector (24) and preformed packing (25). Discard preformed packing (25).
18. Using a 1/2" socket, socket wrench handle and a 1/2" box and open end wrench, remove four bolts (26) , nuts (27), washers (28) and fork control valve assembly (29).
19. Remove four nuts (30) and two brackets (31).



DISASSEMBLY

20. Using a 7/8" open end wrench, remove three nuts (32) and sleeves (33).
21. Disconnect three wire assemblies (34) from wire assemblies (35) lifting up connector assembly (38) for access.
22. Using a 3/8" open end wrench, remove nut (36) pulling back boot (39) for access.

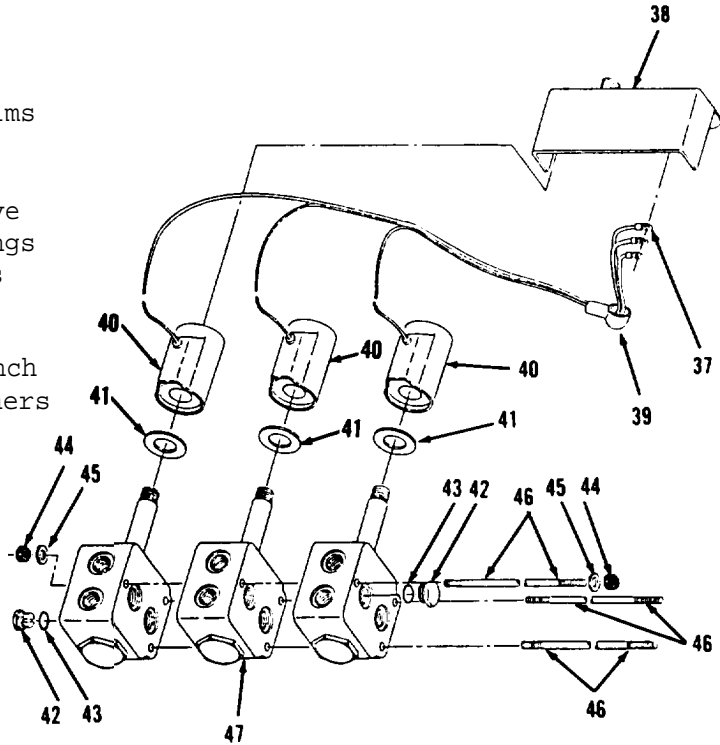


Go to sheet 5

12-8. Fork Control Valve. (Sheet 5 of 9)

DISASSEMBLY (cont)

23. Disconnect three wire assemblies (37) at terminals.
24. Remove connector assembly (38).
25. Remove boot (39).
26. Remove three coils (40) and six shims (41).
27. Using a 7/8" open end wrench, remove two plugs (42) and preformed packings (43). Discard preformed packings (43).
28. Using a 1/2" socket and socket wrench handle, remove two nuts (44), washers (45) and three studs (46).
29. Separate three valves (47).



Go to sheet 6

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-8. Fork Control Valve. (Sheet 6 of 9)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

30. Wipe cable assembly (1), wire assemblies (4, 34, 35 and 37), connector assembly (38), coils (40) and shims (41) with clean dry cloth.

Go to sheet 7

12-61

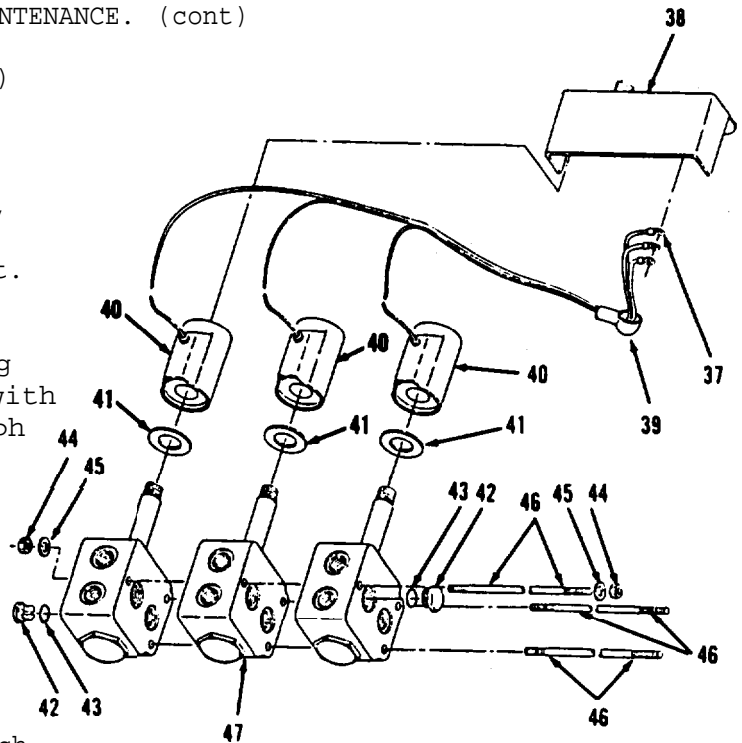
12-8. Fork Control Valve. (Sheet 7 of 9)

CLEANING/INSPECTION (cont)

31. Wipe hose assemblies (5, 8, 11, 14, 17, 20 and 23) and boot (39) with clean cloth moistened with detergent. Dry with compressed air.
32. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
33. Inspect all parts. Refer to paragraph 2-9.

ASSEMBLY

34. Position three valves (47).
35. Using a 1/2" socket and socket wrench handle, install three studs (46), two washers (45) and nuts (44).
36. Using a 7/8" open end wrench, install two new preformed packings (43) and plugs (42).
37. Install six shims (41) and three coils (40).
38. Install boot (39).
39. Install connector assembly (38).
40. Position three wire assemblies (37).



Go to sheet 8

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

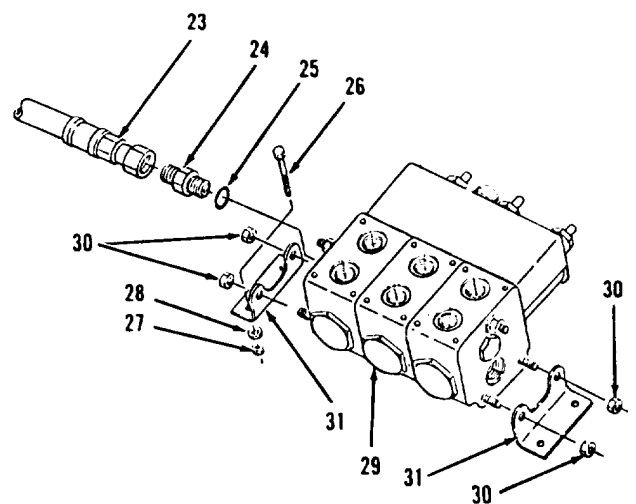
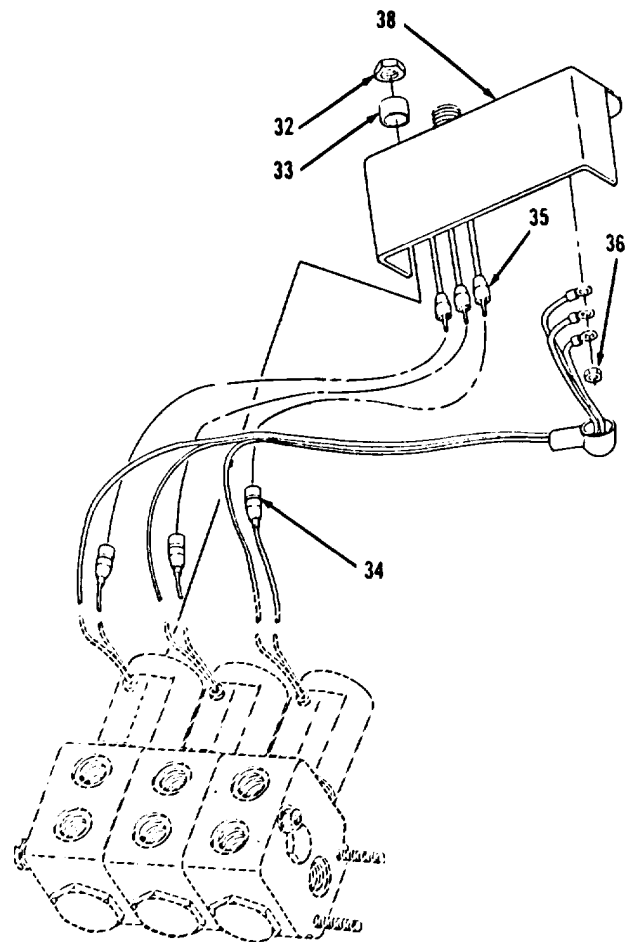
12-8. Fork Control Valve. (Sheet 8 of 9)

ASSEMBLY

41. Using a 3/8" open end wrench, install nut (36).
42. Connect three wire assemblies (35) to wire assemblies (34).
43. Using a 7/8" open end wrench, install three sleeves (33) and nuts (32).

INSTALLATION

44. Using a 1/2" socket, socket wrench handle and a box and open end wrench, install two brackets (31) and four nuts (30) to front of vehicle.
45. Install fork control valve assembly (29), four washers (28), nuts (27) and bolts (26).
46. Using a 7/8" open end wrench, install new preformed packing (25) and connector (24).
47. Connect hose assembly (23).



Go to sheet 9

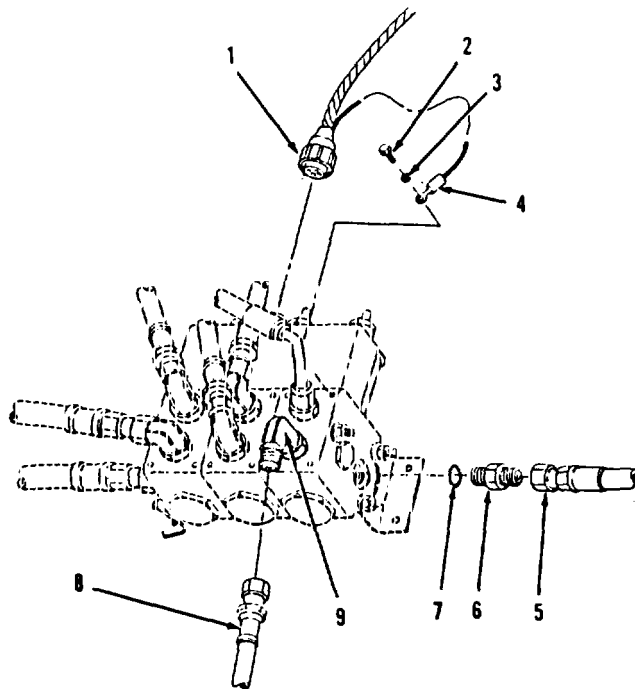
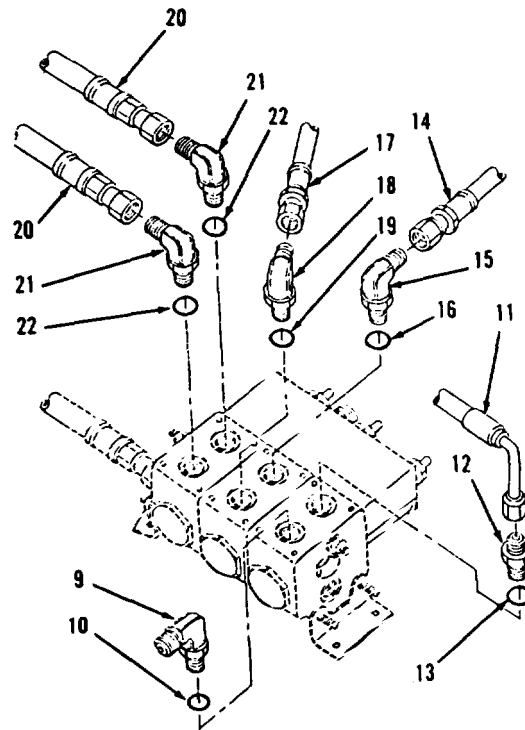
12-8. Fork Control Valve. (Sheet 9 of 9)

INSTALLATION (cont)

- 48. Using a 7/8" open end wrench, install two new preformed packings (22) and elbows (21).
- 49. Connect two hose assemblies (20).
- 50. Install new preformed packing (19) and elbow (18).
- 51. Connect hose assembly (17).
- 52. Install new preformed packing (16) and elbow (15).
- 53. Connect hose assembly (14).
- 54. Install new preformed packing (13) and connector (12).
- 55. Connect hose assembly (11).
- 56. Install new preformed packing (10) and elbow (9).
- 57. Connect hose assembly (8).
- 58. Install new preformed packing (7) and connector (6).
- 59. Connect hose assembly (5).
- 60. Position wire assembly (4).
- 61. Using a 3/8" socket and socket wrench handle, install washer (3) and bolt (2).
- 62. Using slip joint pliers, connect cable assembly (1) at connector in front of vehicle.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-9. Tilt Cylinder. (Sheet 1 of 10)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

## INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Hoist and sling, capacity of  
450 lbs.

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)

Clean cloth (App. C, Item 24)

Small tag (App. C, Item 28)

Grease (App. C, Item 11)

Loctite 262 (App. C, Item 15)

Lubricating oil (App. C, Item 19)

Preformed packing (8)

Ring cord

Ring

Wiper

Seal (3)

Bushing (2)

Torques

Bolts (21) to 80 lb-ft

12-9. Tilt Cylinder. (Sheet 2 of 10)

REMOVAL

1. Lower forks to the ground and shut down engine.
2. Operate tilt control lever several times to relieve pressure in cylinder.

**WARNING**

WEIGHT HAZARD

Weight of cylinder assembly is approximately 450 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

3. Attach hoist and sling to cylinder assembly (20).
4. Using a 3/4" socket and socket wrench handle, remove two bolts (1), washers (2) and bracket assembly (3) from cylinder assembly (20).
5. Using a 5/16" socket and head screw key, remove two bolts (4 and 5).

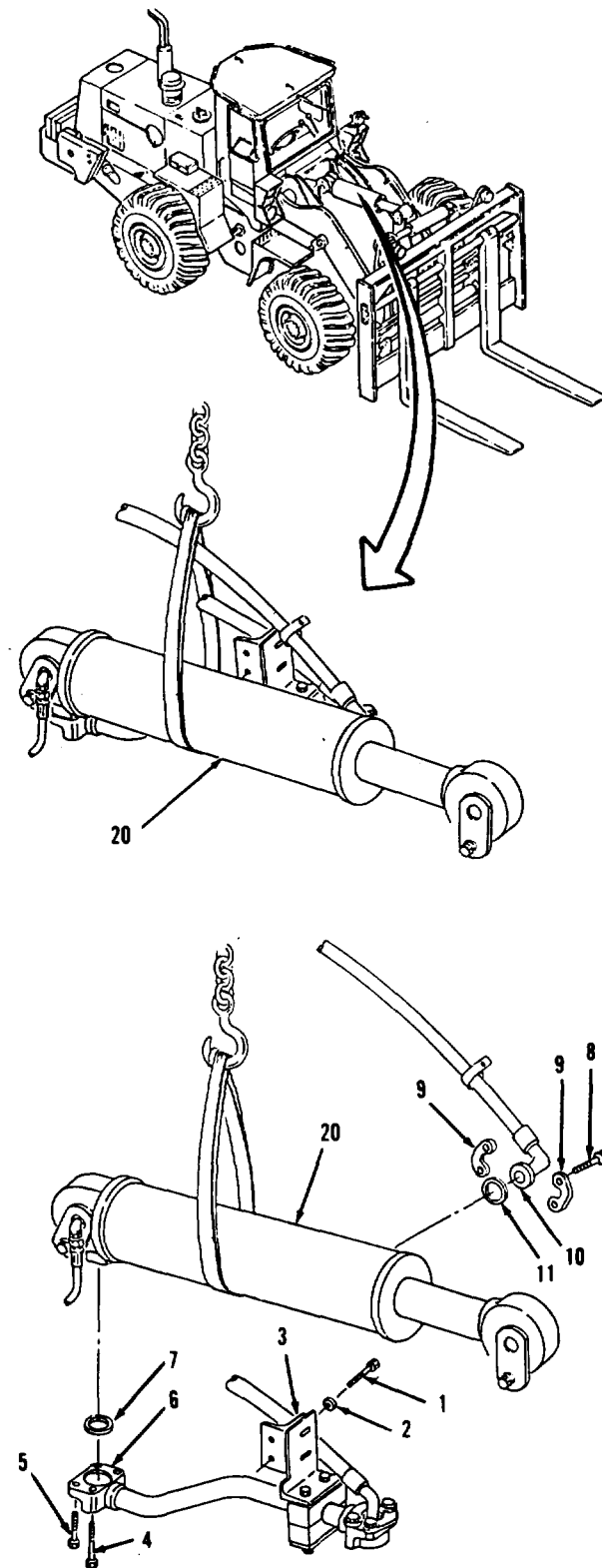
**CAUTION**

There might be some hydraulic pressure still remaining in the cylinder. Use caution when disconnecting tube assemblies.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

6. Disconnect tube assembly (6).



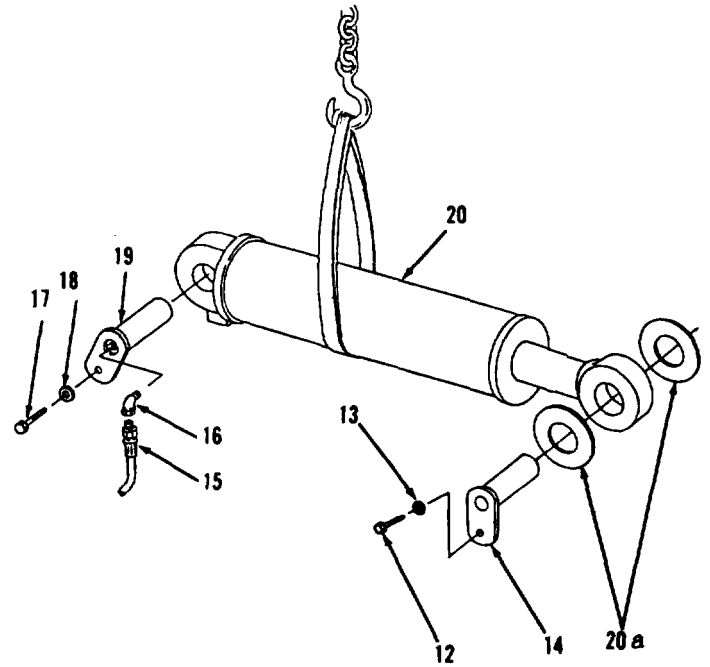
Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-9. Tilt Cylinder. (Sheet 3 of 10)

REMOVAL

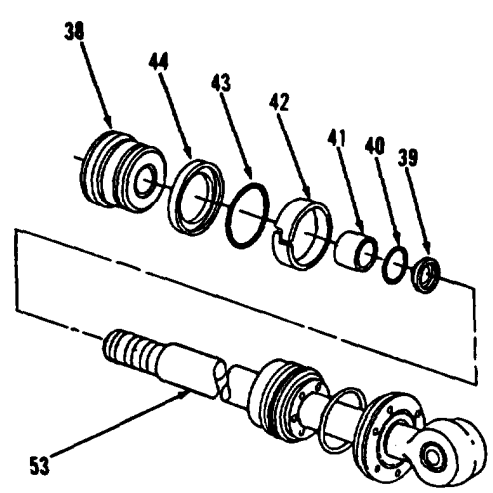
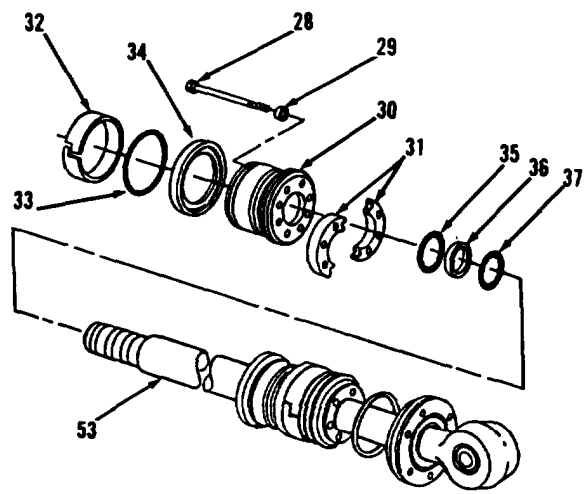
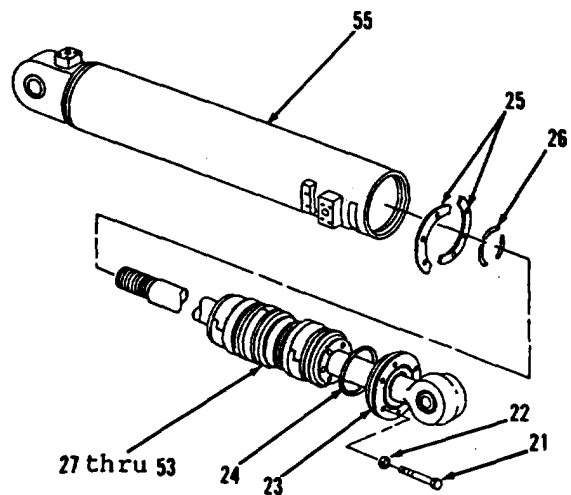
7. Remove and discard preformed packing (7).
8. Using a 9/16" socket and socket wrench handle, remove four bolts (8) and two flange halves (9).
9. Disconnect hose assembly (10).
10. Remove and discard preformed packing (11).
11. Using a 1-1/8" socket and socket wrench handle, remove bolt (12), washer (13) and pin (14).
12. Using a 9/16" open end wrench, disconnect hose assembly (15).
13. Using a 1/2" open and box end wrench, remove adapter (16) from vehicles S/N 2000 and below, only.
14. Using a 1-1/8" socket and socket wrench handle, remove bolt (17), washer (18) and pin (19).
15. Using hoist and sling, remove cylinder assembly (20) and shims (20a) from vehicle.
16. Place cylinder assembly (20) on a suitable work bench and remove hoist and sling.



12-9. Tilt Cylinder. (Sheet 4 of 10)

DISASSEMBLY

17. Extend rod (53) half way and drain remaining hydraulic fluid.
18. Using a 1/2" socket and socket wrench handle, remove six bolts (21), and washers (22) from retainer (23).
19. Loosen retainer (23), and ring cord (24) from cylinder (55). The retainer (23) and ring cord (24) will stay loosely on upper portion of rod (53) for removal later.
20. Using a brass punch, drive items 25 thru 52 into cylinder (55) to loosen three lock rings (26).
21. Using a pick, remove shim (25) and three lock rings (26). Discard lock rings (26).
22. Using hoist and sling, remove items 27 thru 53 as an assembly from cylinder (55).
23. Using a 15/16" socket and socket wrench handle, remove eight bolts (28), washers (29), piston (30) and two hubs (31) from rod (53).
24. Remove ring (32) seal (33), and preformed packing (34) from piston (30). Discard seal (33) and preformed packing (34).
25. Using a scribe, remove ring (35), preformed packing (36), and ring (37) from rod (53). Discard preformed packing (36).
26. Remove piston (38).
27. Remove ring buffer (39), preformed packing (40), back up ring (41), ring (42), seal (43) and preformed packing (44) from piston (38). Discard preformed packings (40 and 44).



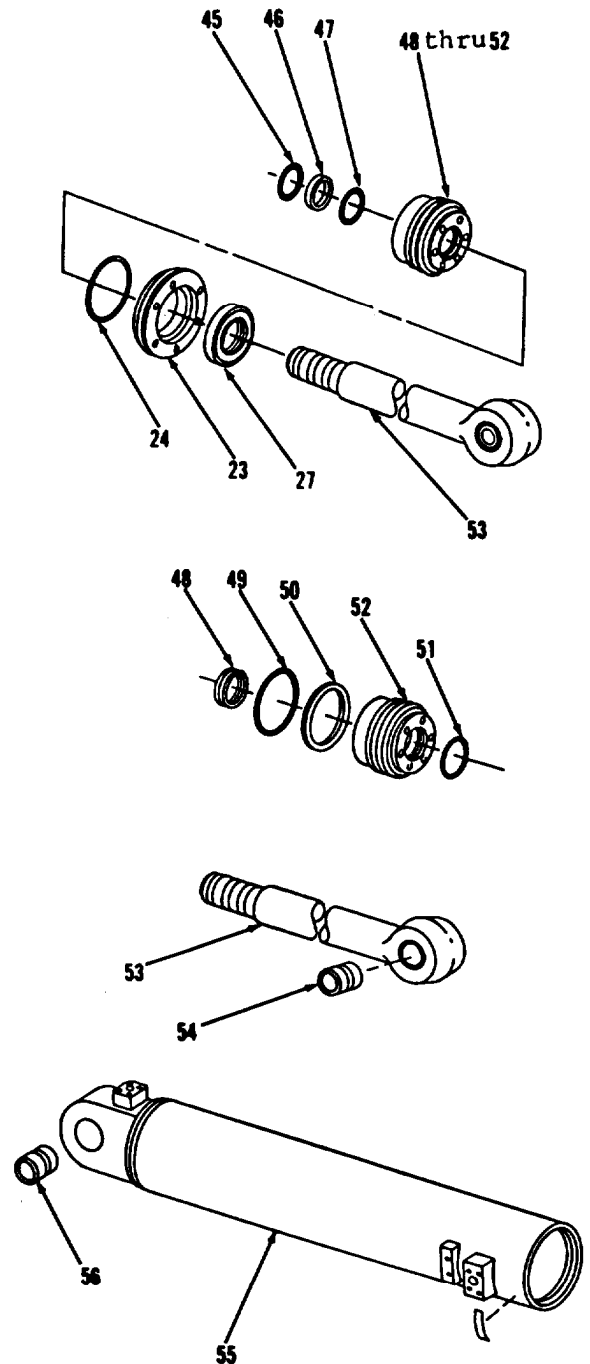
Go to sheet 5

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-9. Tilt Cylinder. (Sheet 5 of 10)

DISASSEMBLY

28. Remove ring (45), preformed packing (46), ring (47), from rod (53). Discard preformed packing (46).
29. Remove items 48 thru 52 as an assembly, ring cord (24) and retainer (23) from rod (53). Discard ring cord (24).
30. Remove and discard wiper (27) from retainer (23).
31. Using a scribe, remove seal (48), preformed packing (49), washer (50) and wear ring (51) from piston (52). Discard seal (48) preformed packing (49).
32. Using an arbor press, remove and discard bushing (54) from rod (53).
33. Remove and discard bushing (56) from cylinder (55).



Go to sheet 6

12-9. Tilt Cylinder. (Sheet 6 of 10)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

34. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
35. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 7

12-70

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

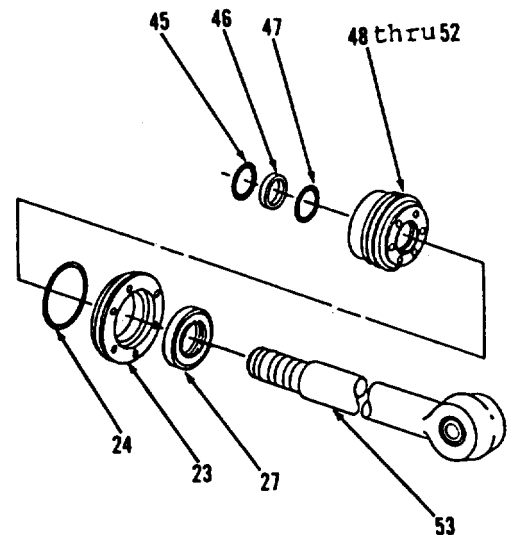
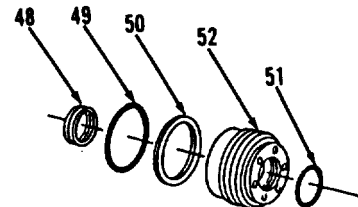
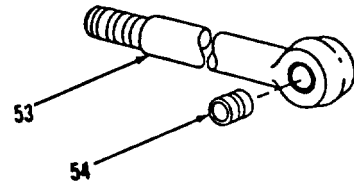
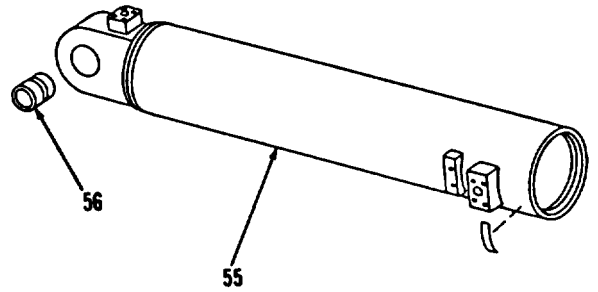
12-9. Tilt Cylinder. (Sheet 7 of 10)

ASSEMBLY

NOTE

Lubricate all preformed packings, wipers, seals, rod and cylinder before installing.

36. Using an arbor press, install new bushing (56) on cylinder (55).
37. Install new bushing (54) on rod (53).
38. Install wear ring (51), washer (50), new preformed packing (49) and new seal (48) on piston (52).
39. Install new wiper (27) on retainer (23).
40. Install retainer (23), new ring cord (24) and items 52 thru 48 as an assembly on rod (53).
41. Install ring (47), new preformed packing (46) and ring (45) on rod (53).
42. Install new preformed packing (44), seal (43), ring (42), back up ring (41), new preformed packing (40), and ring buffer (39) on piston (38).
43. Install piston (38) on rod (53).

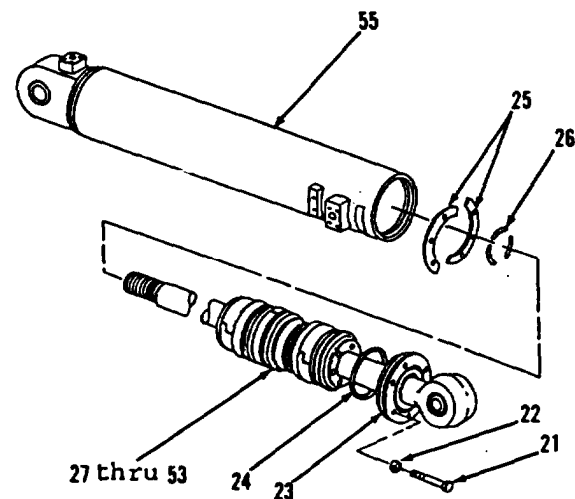
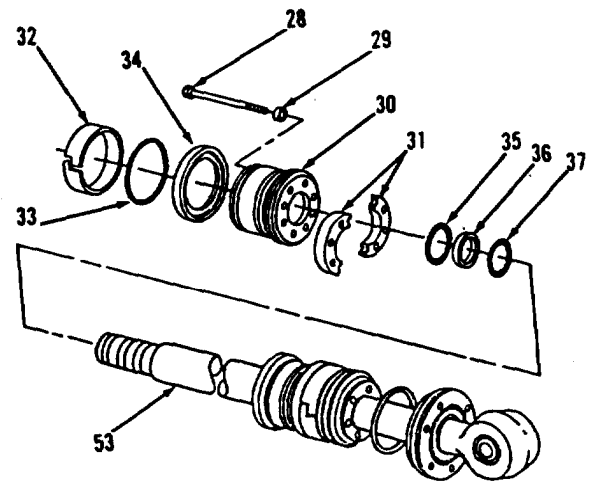


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-9. Tilt Cylinder. (Sheet 8 of 10)

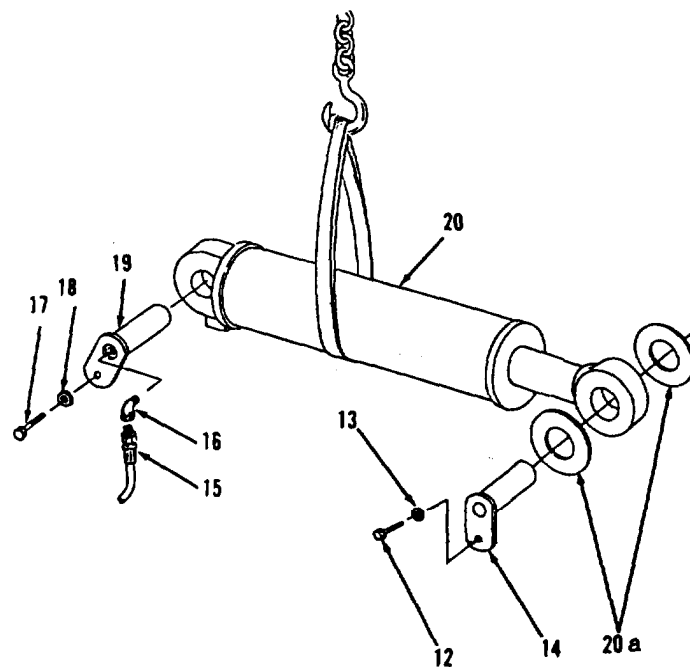
ASSEMBLY (cont)

44. Install ring (37), new preformed packing (36) and ring (35) on rod (53).
45. Install new preformed packing (34), new seal (33) and ring (32) on piston (30).
46. Using a 15/16" socket and socket wrench handle, install two hubs (31), piston (30), eight washers (29) and bolts (28).
47. Using hoist and sling, install items 53 thru 27 as an assembly half way into cylinder (55).
48. Install three new lock rings (26) and shim (25).
49. Slide ring cord (24) and retainer (23) down and position on cylinder (55).
50. Using a 1/2" socket and torque wrench, install six washers (22) and bolts (21). Tighten six bolts (21) to 80 lb-ft.



INSTALLATION

51. Attach hoist and sling to cylinder assembly (20) on top of boom assembly.
52. Position cylinder assembly (20),
53. Coat pin (19), washer (18) and bolt (17) with grease.
54. Using a 1/2" open and box end wrench, install adapter (16) on vehicles S/N 2000 and below, only.
55. Using a 9/16" open end wrench, connect hose assembly (15).



Go to sheet 9

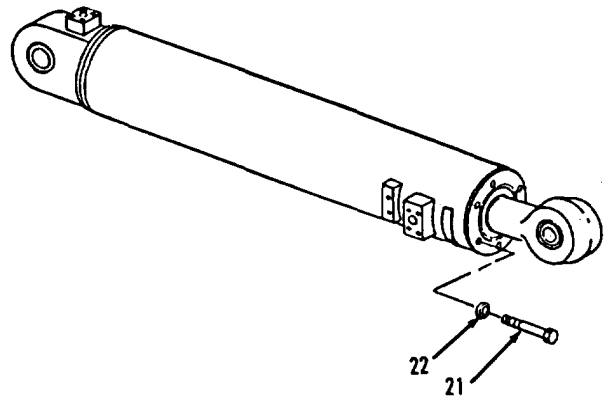
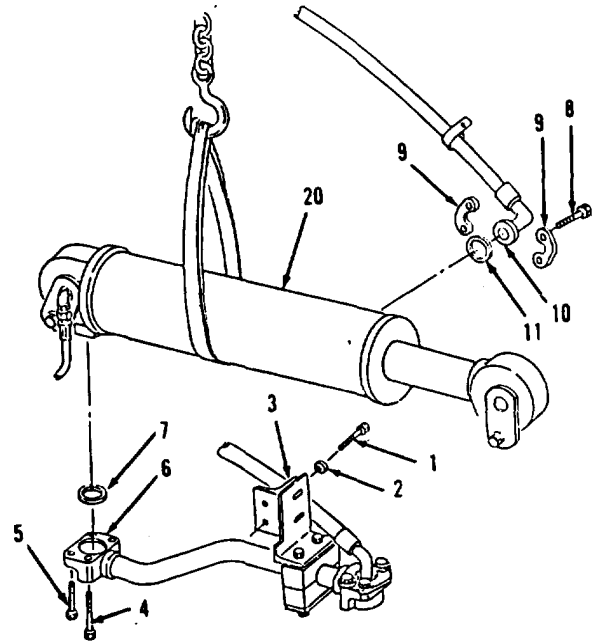


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-9. Tilt Cylinder. (Sheet 9 of 10)

INSTALLATION

56. Coat pin (14), washer (13) and bolt (12) with grease.
57. Using a 1-1/8" socket and socket wrench handle, install pin (14), washer (13) and bolt (12).
58. Install new preformed packing (11).
59. Connect hose assembly (10).
60. Using a 9/16" socket and socket wrench handle, install two flange halves (9) and four bolts (8).
61. Install new preformed packing (7).
62. Connect tube assembly (6).
63. Using a 5/16" socket head screw key, install two bolts (5 and 4).
64. Using a 3/4" socket and socket wrench handle, install bracket assembly (3), two washers (2) and bolts (1).
65. Remove hoist and sling from cylinder assembly (20).
66. Operate engine until hydraulic fluid is at normal operating temperature.
67. Move tilt control lever to tilt back position until rod is fully extended.
68. Apply Loctite 262 to three washers (22) and bolts (21).



12-9. Tilt Cylinder. (Sheet 10 of 10)

TESTING

69. Using a 1-1/8" socket and socket wrench handle, disconnect rod end of cylinder from vehicle.
70. Start engine and move tilt control lever to tilt forward position until rod is fully retracted.
71. Using a 9/16" open end wrench, disconnect rear hose from cylinder. and cap hose.
72. Operate engine at 2625 to 2750 rpm and move tilt control lever to tilt forward position.
73. Observe rear port. Continuous fluid flow from port indicates defective packing or deformed cylinder.
74. Connect rear hose.
75. Using a 1-1/8" socket and socket wrench handle, connect rod end to vehicle.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-10. Boom Assembly. (Sheet 2 of 11)

REMOVAL (cont)

NOTE

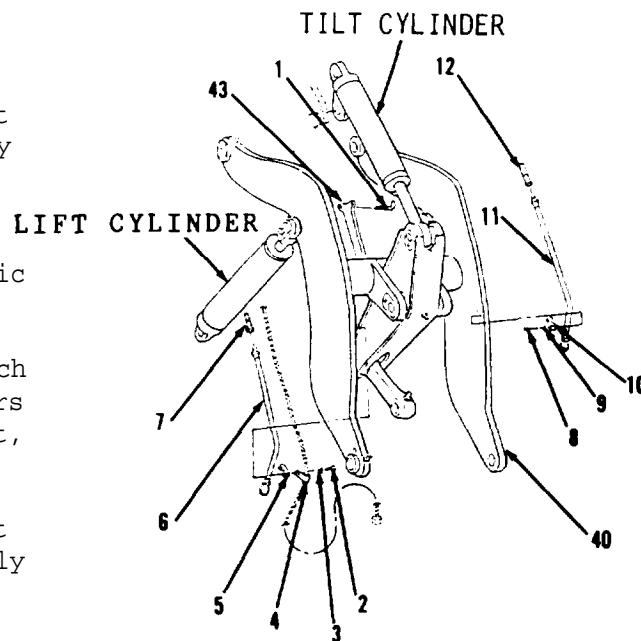
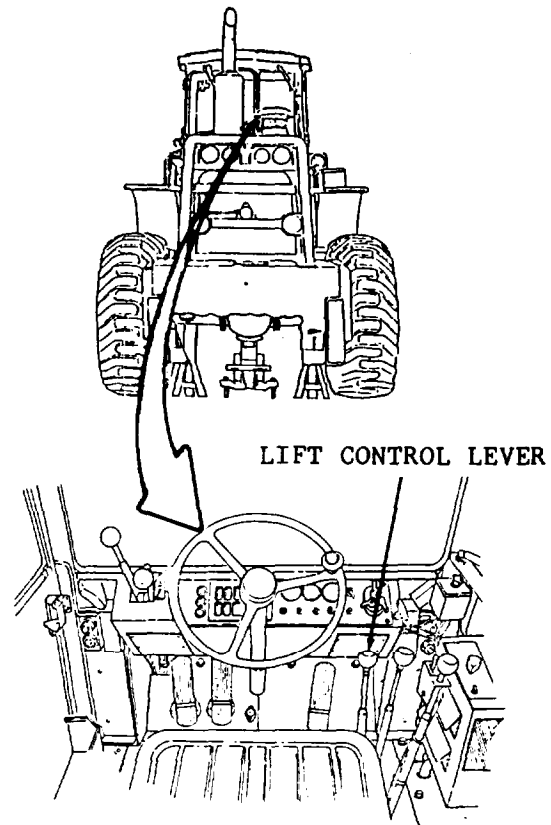
The following are differences between M10A Forklift models.

2. Operate boom control lever in operator's compartment to raise boom on vehicles S/N 2001 and above only.
3. Remove pin (1) from front on vehicles S/N 2001 and above only.
4. Position boom support (43) under boom assembly (40) on vehicles S/N 2001 and above only.
5. Using a 1/2" socket and socket wrench handle, remove six bolts (2), washers (3), clips (4) and three clamps (5) from front, right side of vehicle.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

6. Uncouple quick-coupler to disconnect tube assembly (6) from hose assembly (7).
7. Cap hose assembly (7) to prevent contamination from entering hydraulic system.
8. Using a 1/2" socket and socket wrench handle, remove six bolts (8), washers (9) and three clamps (10) from front, left side of vehicle.
9. Uncouple quick-coupler to disconnect tube assembly (11) from hose assembly (12).
10. Using a plug, cap hose assembly (12).



Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-10. Boom Assembly. (Sheet 3 of 11)

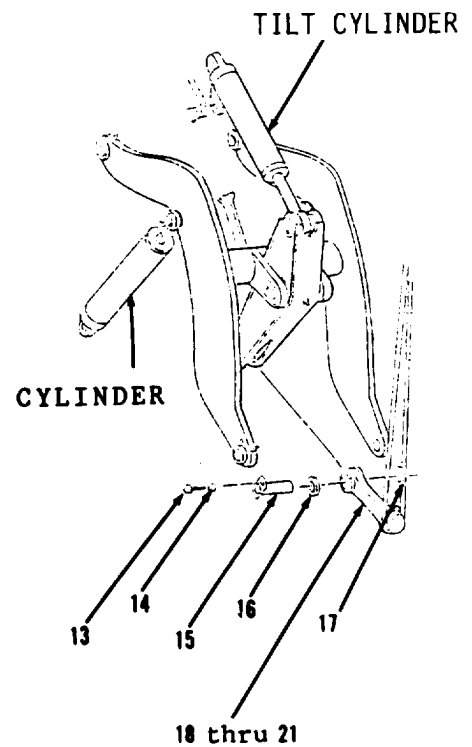
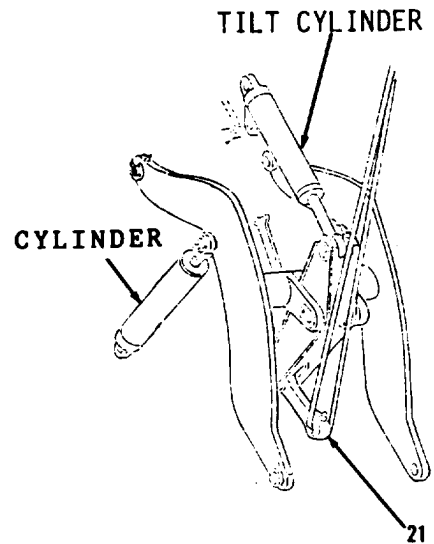
REMOVAL

**WARNING**

WEIGHT HAZARD

Weight of boom assembly is approximately 2100 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

11. Attach hoist and sling to rod (21) at front of vehicle.
12. Using a 1-1/8" socket and socket wrench handle, remove bolt (13), washer (14) and pin (15).
13. Using a rubber mallet, remove washers (16 and 17) and items 18 thru 21 as an assembly. Rod weights approximately 103 lbs. Washers (16 and 17) are used as shims: their quantity is variable.
14. Remove hoist and sling.



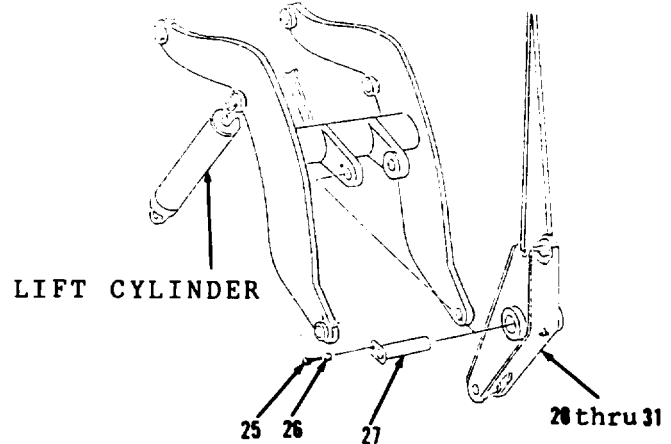
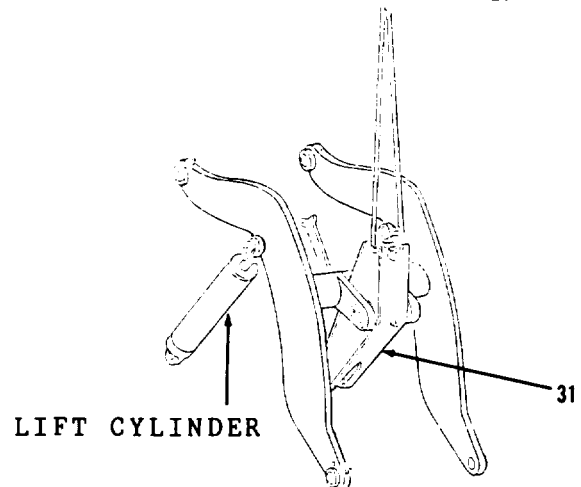
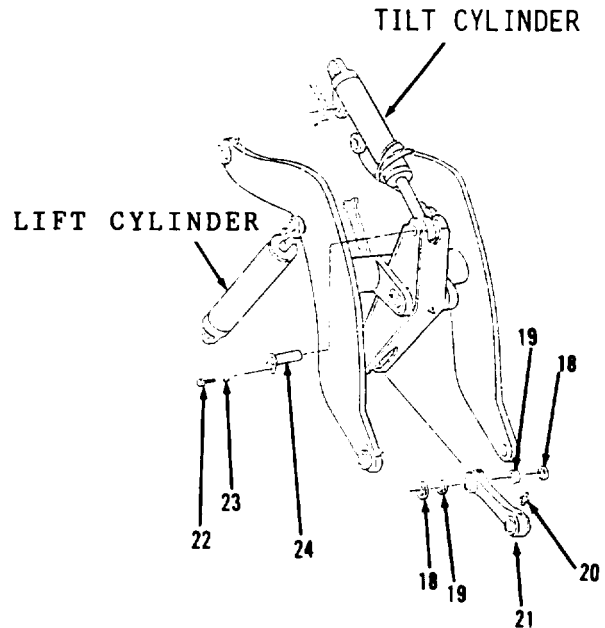
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-10. Boom Assembly. (Sheet 4 of 11)

REMOVAL (cont)

15. Using a hammer and punch, a 7/16" socket and socket wrench handle, remove two seals (18), two bushings (19) and lubrication fittings (20) from rod (21). Discard seals (18).
16. Using a safety rope, fasten tilt cylinder to vehicle to prevent cylinder rod end from dropping when pin (24) is removed.
17. Using a 1-1/8" socket and socket wrench handle, remove bolt (22), washer (23) and pin (24).
18. Using a 10" long bar, attach hoist and sling to lever (31).
19. Using a 1-1/8" socket and socket wrench handle, remove bolt (25), washer (26) and pin (27).
20. Using a hoist and sling, remove items 28 thru 31 as an assembly. Lever (31) weighs approximately 382 lbs.
21. Remove hoist and sling.



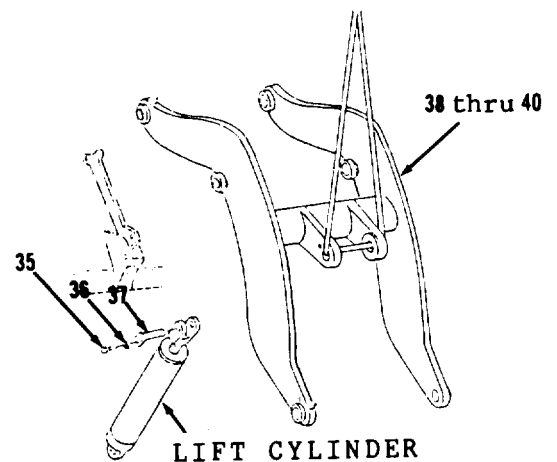
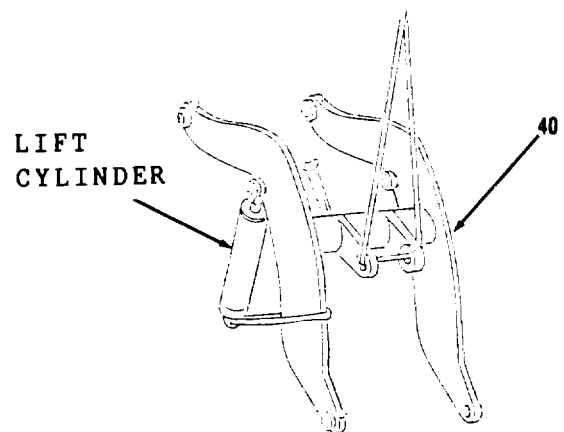
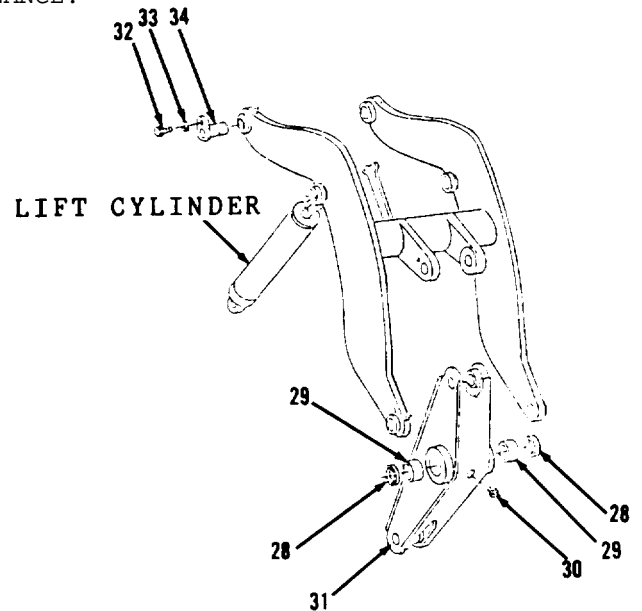
Go to sheet 5

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-10. Boom Assembly. (Sheet 5 of 11)

REMOVAL

22. Using a hammer and punch, a 7/16" socket and socket wrench handle, remove two seals (28), bushings (29) and lubrication fitting (30) from lever (31). Discard seals (28).
23. Attach hoist and sling to boom assembly (40) and take up slack.
24. Using a 1-1/8" socket and socket wrench handle, remove two bolts (32), washers (33) and pins (34).
25. Using a safety rope, fasten lift cylinders to vehicle to prevent cylinder rod ends from dropping when boom assembly (40) is removed.
26. Remove two bolts (35), washers (36) and pins (37).
27. Using a hoist and sling, remove items 38 thru 40 as an assembly and place on suitable work bench. Boom assembly (40) weighs approximately 2100 lbs.
28. Remove hoist and sling.

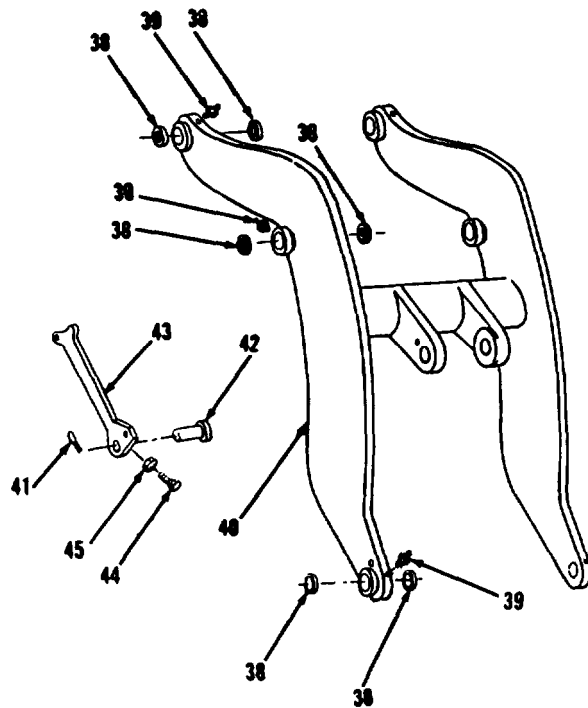


Go to sheet 6

12-10. Boom Assembly. (Sheet 6 of 11)

DISASSEMBLY

29. Using a 7/16" socket and socket wrench handle, remove 12 seals (38) and six lubrication fittings (39) from boom assembly (40). Discard seals (38).
30. Using a cotter pin extractor, remove cotter pin (41), pin (42) and boom support (43) from front of vehicles S/N 2001 and above. Discard cotter pin (41).
31. Using a 3/4" socket, socket wrench handle and 3/4" open end wrench, remove bolt (44) and nut (45) from vehicles S/N 2001 and above.



Go to sheet 7



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-10. Boom Assembly. (Sheet 7 of 11)

CLEANING/INSPECTION

## ● COMPRESSED AIR HAZARD

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

32. Wipe hose assemblies (7 and 12) with clean cloth moistened with detergent. Dry with compressed air.

**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

33. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 8

12-81

12-10. Boom Assembly. (Sheet 8 of 11)

CLEANING/INSPECTION (cont)

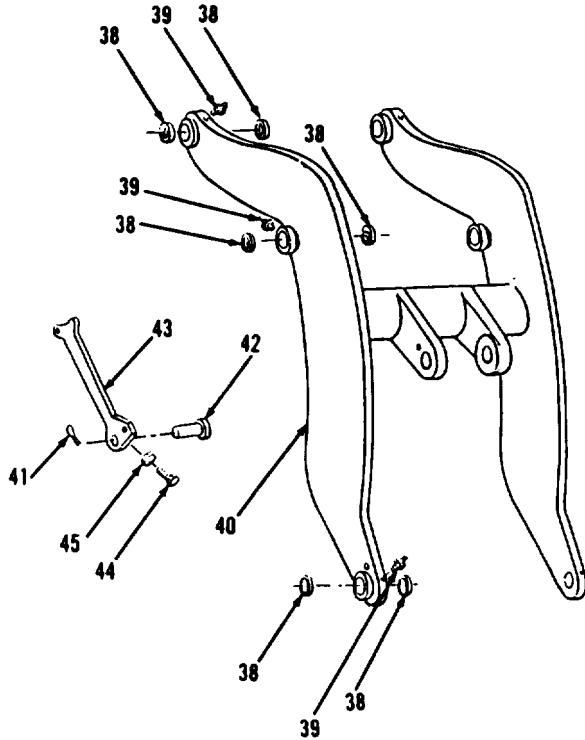
- 34. Inspect boom assembly (40). If bushings are worn, boom assembly (40) must be replaced.
- 35. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

NOTE

The following are differences between M10A Forklift models.

- 36. Using a 3/4" socket, socket wrench handle and open end wrench, install t nut (45) and bolt (44) in vehicles S/N 2001 and above.
- 37. Using a rubber mallet and slip joint pliers, install boom support (43), pin (42) and new cotter pin (41), in vehicles S/N 2001 and above.
- 38. Using a 7/16" socket, socket wrench handle and rubber mallet, install six lubrication fittings (39) and 12 new seals (38) on boom assembly (40), seal lips face outward.

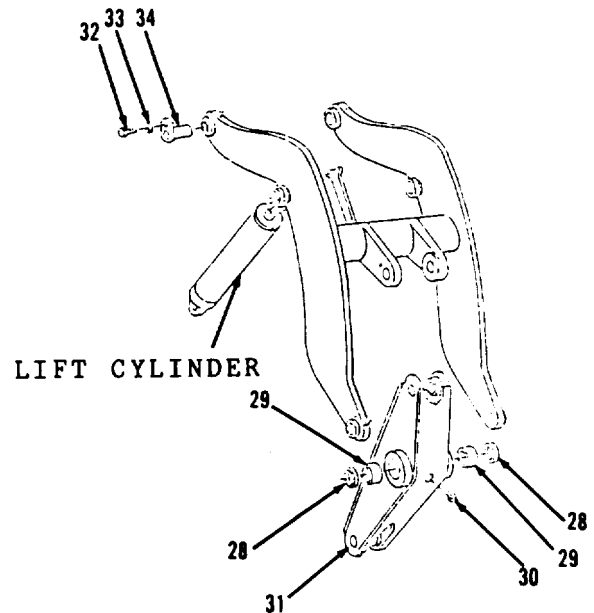
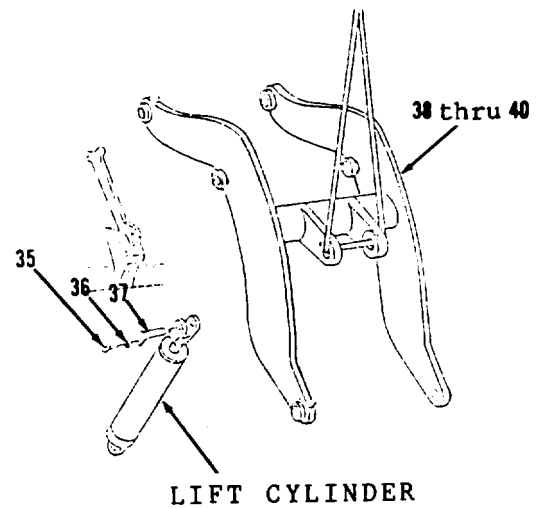
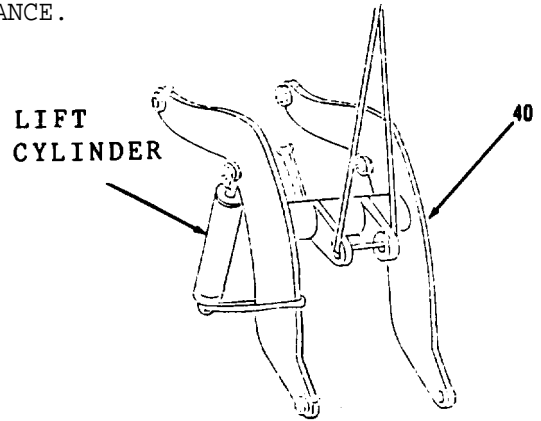


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-10. Boom Assembly. (Sheet 9 of 11)

INSTALLATION

39. Attach hoist and sling to boom assembly (40).
40. Position items 40 thru 38 as an assembly on vehicle.
41. Position boom support (43) under boom in vehicles S/N 2001 and above.
42. Using a 1-1/8" socket and socket wrench handle, install two pins (37), washers (36) and bolts (35).
43. Remove hoist and sling.
44. Install two pins (34), washers (33) and bolts (32).
45. Using a 7/16" socket, socket wrench handle and rubber mallet, install lubrication fitting (30), two bushings (29) and new seals (28) in lever (31), seal lips face outward.



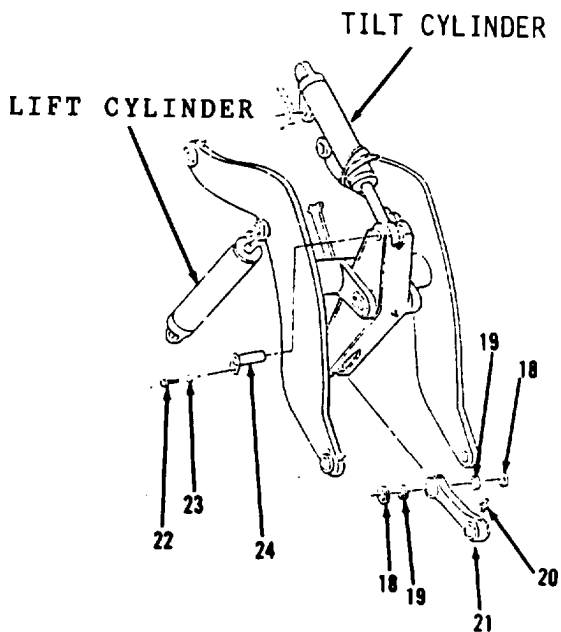
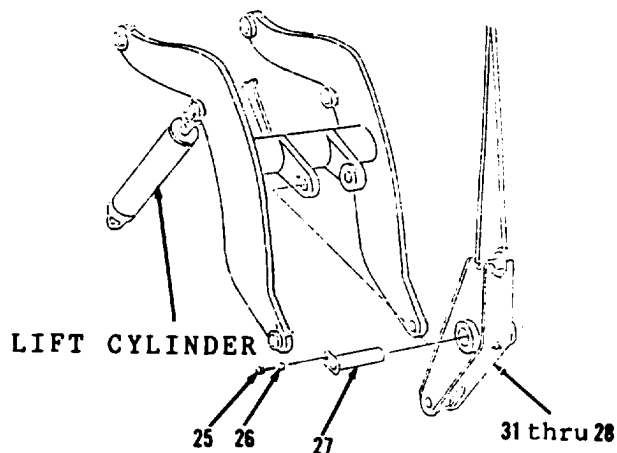
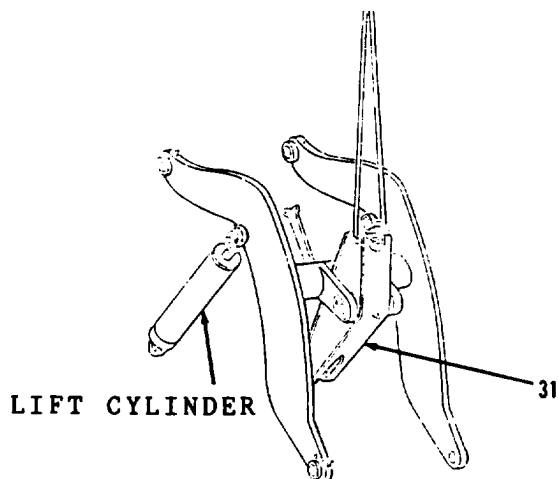
Go to sheet 10

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-10. Boom Assembly. (Sheet 10 of 11)

INSTALLATION (cont)

46. Using a 10" long bar, attach hoist and sling to lever (31).
47. Position items 31 thru 28 as an assembly on vehicle. Lever (31) weighs approximately 382 lbs.
48. Using a 1-1/8" socket and socket wrench handle, install pin (27), washer (26) and bolt (25).
49. Remove hoist and sling.
50. Using a 1-1/8" socket, socket wrench handle and a rubber mallet, install pin (24), washer (23) and bolt (22).
51. Using a 7/16" socket, socket wrench handle and a rubber mallet, install two lubrication fittings (20), bushings (19) and new seals (18) in rod (21), seal lips face outward.
52. Attach hoist and sling to rod (21).



Go to sheet 11

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

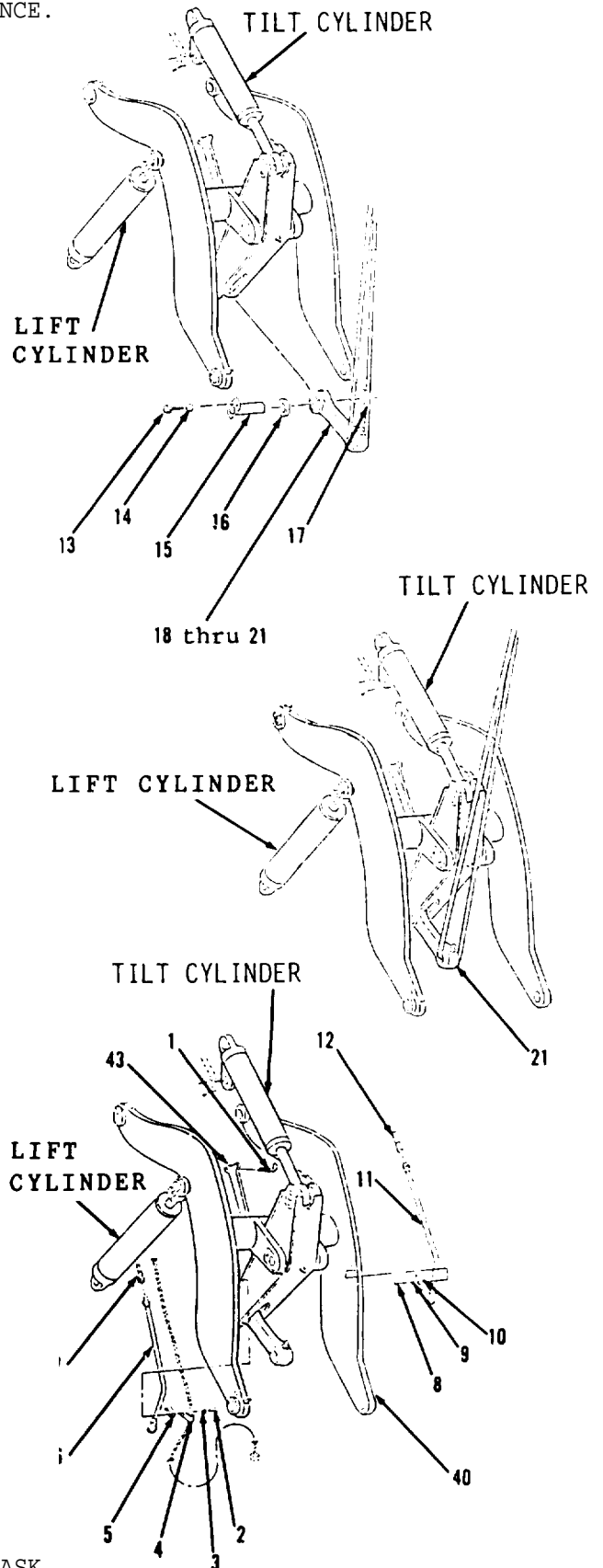
12-10. Boom Assembly. (Sheet 11 of 11)

INSTALLATION

53. Using a 1-1/4" socket and socket wrench handle, install items 21 thru 18 as an assembly, washers (17 and 16), pin (15), washer (14) and bolt (13)\* Use washers (17 and 16) as shims to maintain a maximum gap of 0.031 inch between sides of rod (21) and lever (31) and between rod (21) and vehicle frame.
54. Remove hoist and sling.
55. Using a 15/16" open end wrench, connect hose assembly (12) to tube assembly (11).
56. Using a 1/2" socket and socket wrench handle, install three clamps (10), six washers (9) and bolts (8).
57. Using a 15/16" open end wrench, connect hose assembly (7) to tube assembly (6) to front, right side of vehicle.
58. Using a 1/2" socket and socket wrench handle, install three clamps (5), clips (4), six washers (3) and bolts (2).
59. Install pin (1) to lock boom support (43) in place, for vehicles S/N 2001 and above.
60. Lubricate all lubrication fittings, refer LO 10-3930-643-12.
61. Remove two jack stands and hydraulic jack from rear of vehicle.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-11. Lifting Forks and Carriage Assembly. (Sheet 1 of 15)

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

---

INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

1-1/2" Open end wrench  
NSN 5120-00-184-8489

Two hoist and slings, capacity  
of 4600 lbs.  
2-9/16" socket and socket  
wrench handle  
NSN 5189-00-177-7033

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)

Detergent (App. C, Item 33)

Clean cloth (App. C, Item 24)

Small tag (App. C, Item 28)

Preformed packing (16)

3/4 inch flat washer (7)

Tie strap (6)

Wooden block (2)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

Paragraph 12-13 or 12-14

Paragraph 12-8

Paragraph 12-15 or 12-16

Paragraph 12-17 or 12-18

Condition Description

Sideshift cylinder removed.

Fork control valve removed.

Fork position cylinders removed.

Oscillation cylinder removed.

---

Go to sheet 2

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-11. Lifting Forks and Carriage Assembly. (Sheet 2 of 10)

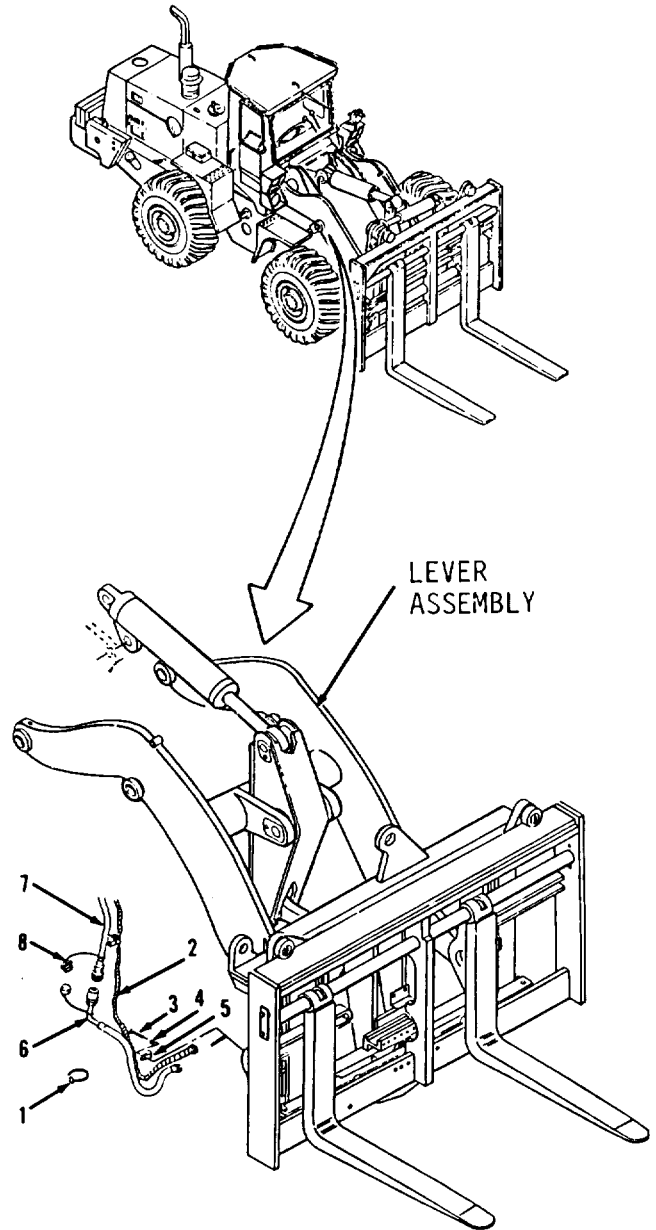
REMOVAL

1. Using diagonal cutters, cut six tie straps (1) from harness assembly (2) and two hose assemblies (6) in vehicle, front right. Discard six tie straps (1).
2. Using a 9/16" socket and socket wrench handle, remove bolt (3), washer (4) and clip (5).

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

3. Uncouple quick-couplers to disconnect two hose assemblies (6) from vehicle, front right and left sides.
4. Install two plugs (8) in ends of two hose assemblies (7).



Go to sheet 3

REMOVAL (cont)

- Using a safety rope, secure rod assembly (9) to boom assembly to prevent movement when pin (12) is removed.

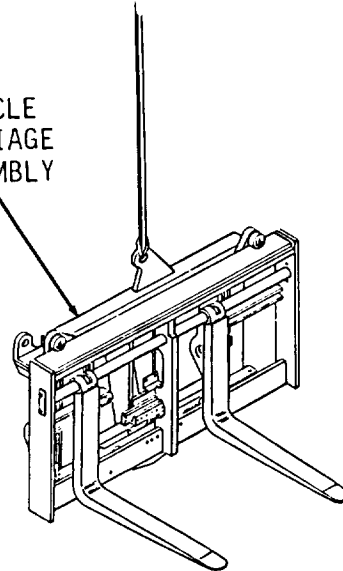
**WARNING**

WEIGHT HAZARD

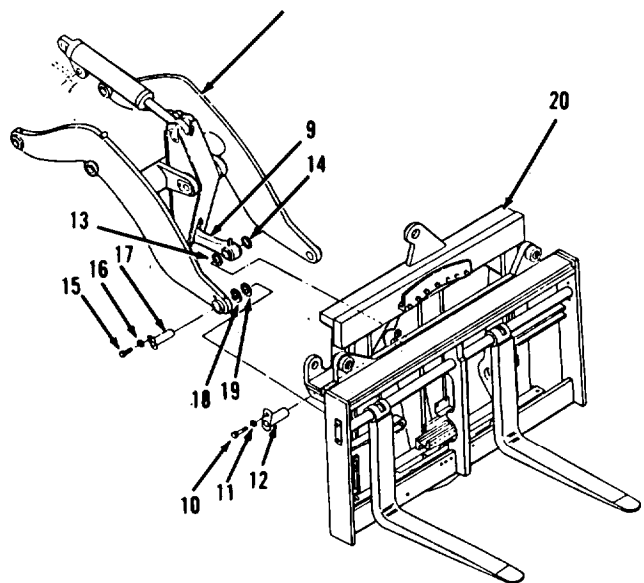
Weight of lifting forks and carriage assembly is approximately 4600 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

- Attach hoist and sling to carriage assembly (20).
- Using a hammer and punch, a 1-1/8" socket, socket wrench handle, remove bolt (10), washer (11), pin (12) and washers (13 and 14). Washers (13 and 14) are used as shims; their quantity is variable.
- Remove two bolts (15), washer (16), pin (17) and washers (18 and 19). Washers (18 and 19) are used as shims; their quantity is variable.
- Drive vehicle straight back from carriage assembly (20) without bumping assembly with boom arms. Lower carriage assembly (20) to ground and secure with wooden blocks.
- Remove hoist and sling.

VEHICLE  
CARRIAGE  
ASSEMBLY



BOOM  
ASSEMBLY



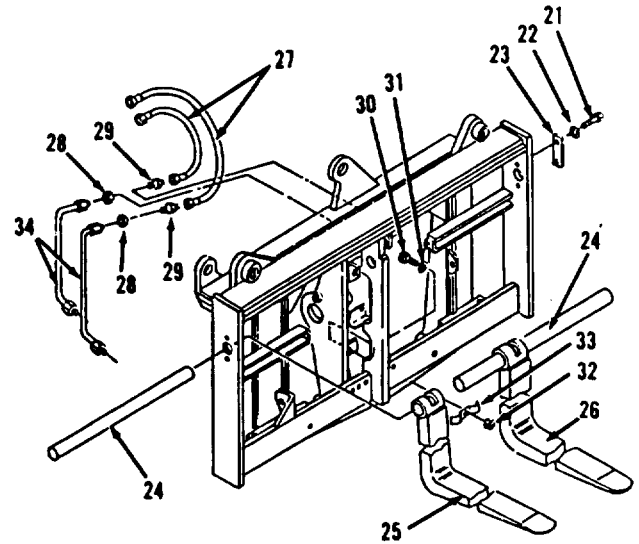


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-11. Lifting Forks and Carriage Assembly. (Sheet 4 of 15)

DISASSEMBLY

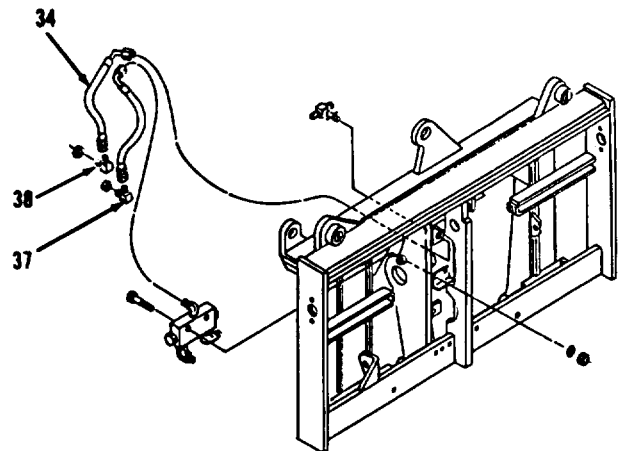
11. Using a 3/4" socket and socket wrench handle, remove four bolts (21), washers (22) and two plates (23).
12. Attach hoists and slings to forks (25 and 26) and take up slack.
13. Using hoists and slings, rubber mallet and a brass bar, remove two pins (24) and forks (25 and 26). Mark left and right forks to aid in installation.
14. Using an 11/16" open end wrench, disconnect two hose assemblies (27) from adapters (29).
15. Using a 13/16" open end wrench, remove two nuts (28) and adapters (29).



NOTE

The following is a difference between M10A Forklift models.

16. Using a 1-1/8" socket, socket wrench handle and a 1-1/8" box and open end wrench, remove bolt (30), washer (31), nut (32) and clamp (33) from vehicles S/N 2001 and above.
17. Using an 11/16" open end wrench, disconnect tube assembly (34) from elbow (37), from vehicles S/N 2001 and above.
18. Disconnect tube assembly (34) from elbow (38).

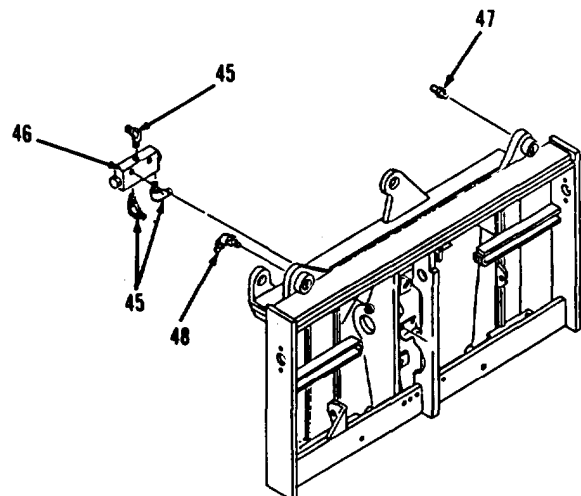
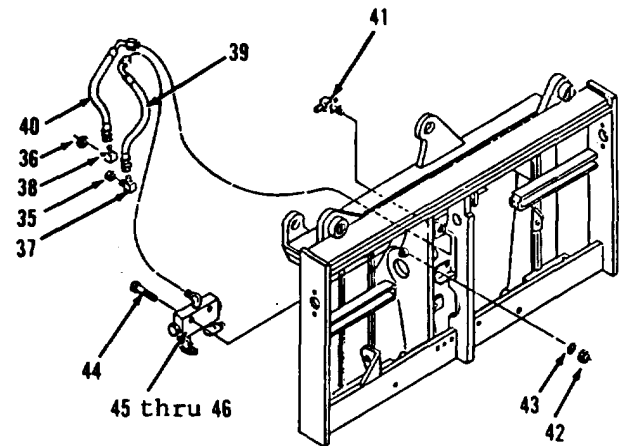
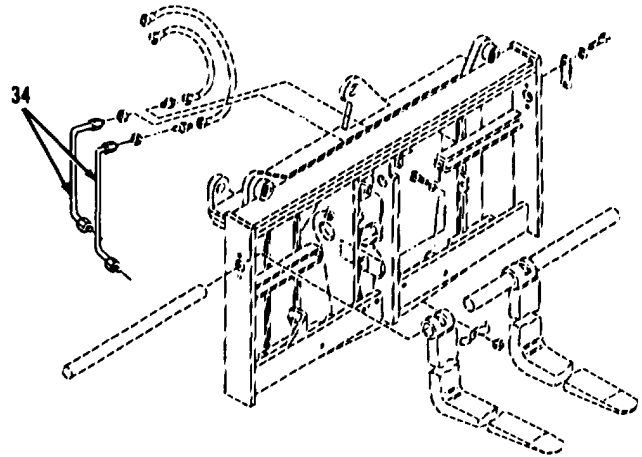


Go to sheet 5

12-11. Lifting Forks and Carriage Assembly. (Sheet 5 of 15)

DISASSEMBLY (cont)

- 19. Using an 11/16" open end wrench, disconnect tube assembly (34) from elbow (45), from vehicles S/N 2000 and below.
- 20. Using a 13/16" open end wrench, remove nuts (35 and 36) and elbow (37) from vehicles S/N 2001 and above.
- 21. Using an 11/16" open end wrench, remove elbow (38).
- 22. Disconnect hose assemblies (39 and 40) from vehicles S/N 2001 and above.
- 23. Using a 13/16" open end wrench, remove tee (41).
- 24. Using a 7/16" socket and socket head screw key, remove two nuts (42), washers (43), bolts (44) and items 45 and 46 as an assembly.
- 25. Using a 13/16" open end wrench, remove three elbows (45) from flow divider (46).
- 26. Using a socket and socket wrench handle, remove lubrication fittings (47 and 48).



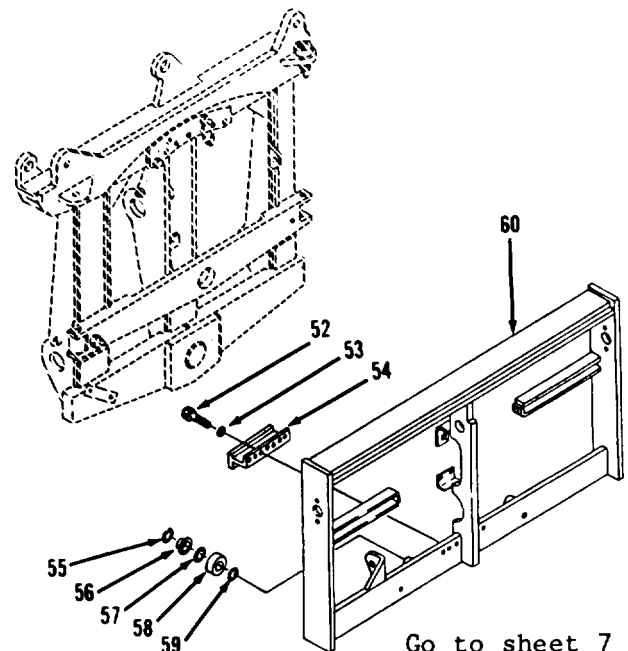
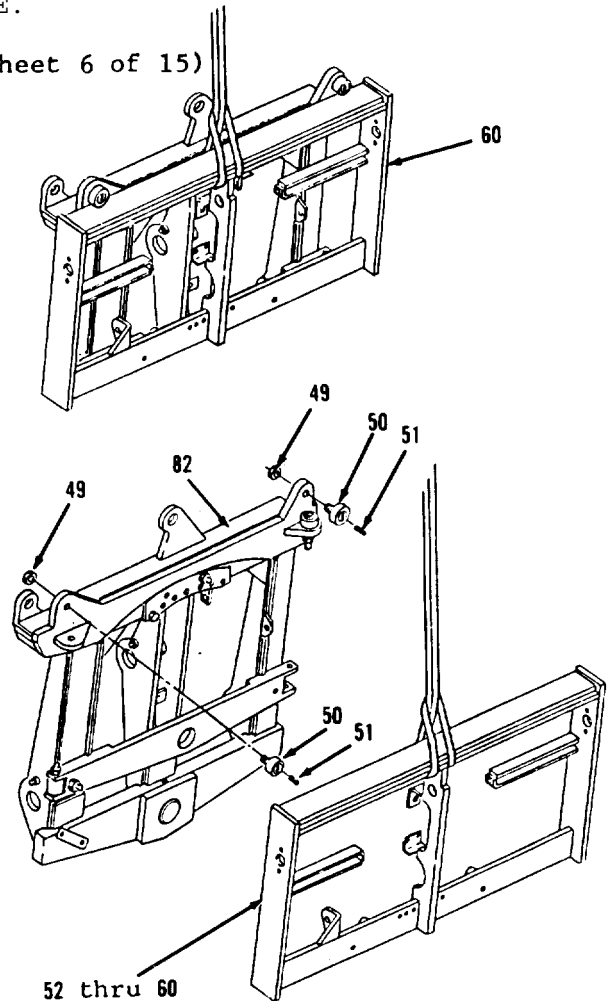
Go to sheet 6

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-11. Lifting Forks and Carriage Assembly. (Sheet 6 of 15)

DISASSEMBLY

27. Attach two hoists and slings, one to apron (60) and the other to frame (89).
28. Using a 2-9/16" socket and socket wrench handle, remove two nuts (49), cam followers (50) and pins (51).
29. Using a hoist and sling, remove items 52 thru 60 as an assembly from frame (82), and place securely on floor.
30. Remove hoist and sling.
31. Using a 1-1/8" socket and socket wrench handle, remove seven bolts (52), washers (53) and claw (54).
32. Using snap ring pliers, remove two retaining rings (55), covers (56), retaining rings (57), rollers (58) and retaining rings (59) from apron.

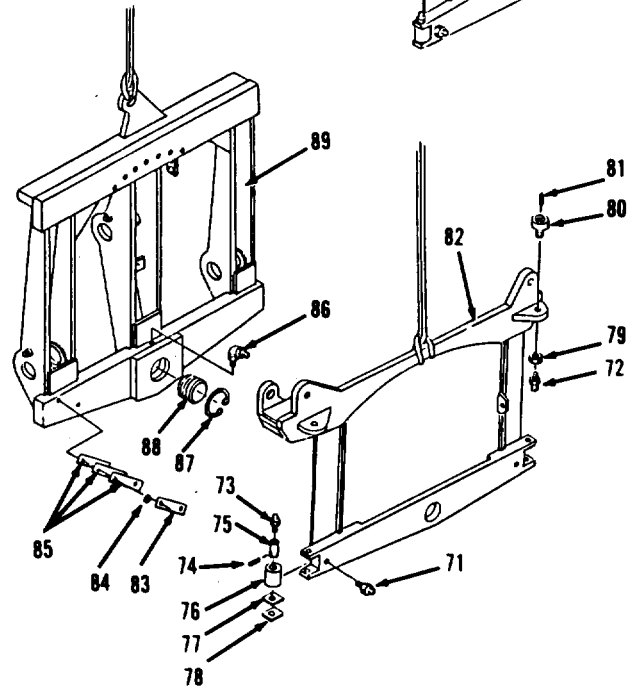
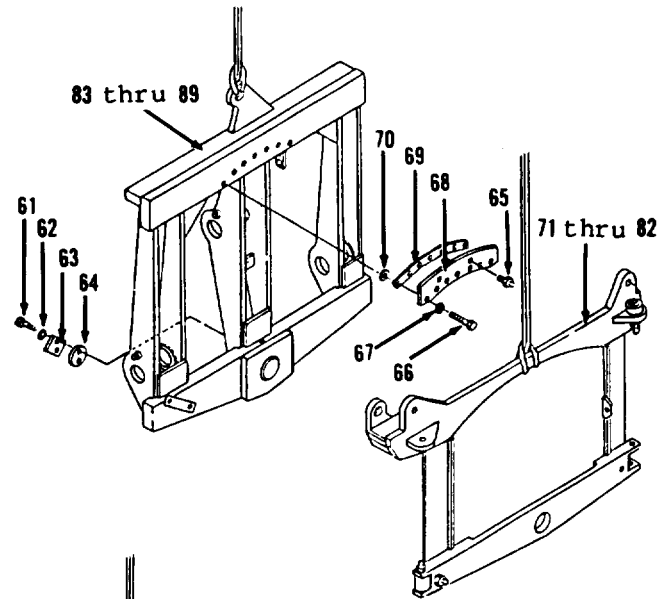
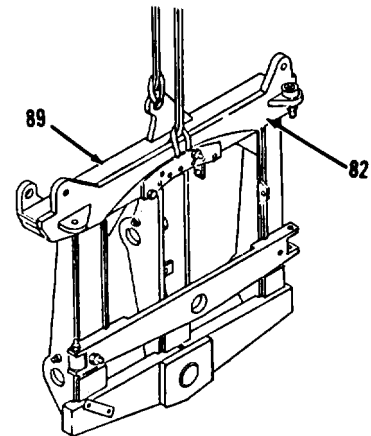


Go to sheet 7

12-11. Lifting Forks and Carriage Assembly. (Sheet 7 of 15)

DISASSEMBLY (cont)

33. Attach hoists and slings to frames (82 and 89).
34. Using a 1-1/8" socket and socket wrench handle, remove two bolts (61), washers (62), plate (63) and shim (64).
35. Using a 3/8" socket and socket wrench handle, remove two lubrication fittings (65).
36. Using a 1-1/8" socket and socket wrench handle, remove seven bolts (66), washers (67), plate (68) and plate (69) and seven washers (70).
37. Separate items 71 thru 82 and items 83 thru 89 as assemblies.



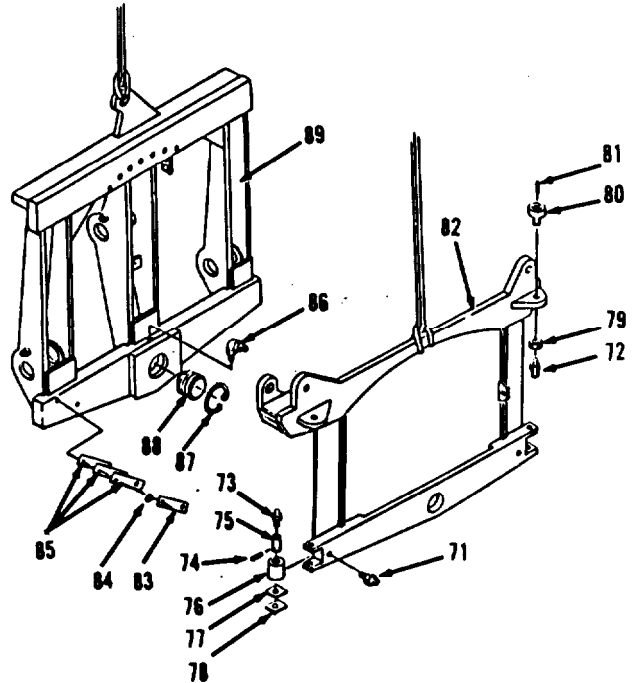
Go to sheet 8

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-11. Lifting Forks and Carriage Assembly. (Sheet 8 of 15)

DISASSEMBLY

38. Using a 3/8" socket and socket wrench handle, remove three lubrication fittings (71 thru 73).
39. Using a drift pin and hammer, remove two pins (74), shafts (75) and rollers (76).
40. Remove two washers (77) from vehicles S/N 2001 and above.
41. Remove four washers (78) from vehicles S/N 2000 and below.
42. Using a 2-9/16" socket and socket wrench handle, remove two nuts (79) and cam followers (80) from frame (82).
43. Using drift pin, remove two pins (81) from cam followers (80).
44. Remove hoists and slings.
45. Remove eight strips (83), 16 pre-formed packings (84) and shim (85). Discard 16 preformed packings (84).
46. Using a 7/16" socket, socket wrench handle and snap ring pliers, remove lubrication fitting (86), retaining ring (87) and bearing (88) from frame (89).



Go to sheet 9

CLEANING/INSPECTION

47. Wipe hose assemblies (6, 7, 27, 39 and 40) and two plugs (8) with clean cloth moistened with detergent. Wipe dry.

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

48. Wipe bearing (88) with cleaning solvent P-D-680). Air dry.

Go to sheet 10

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

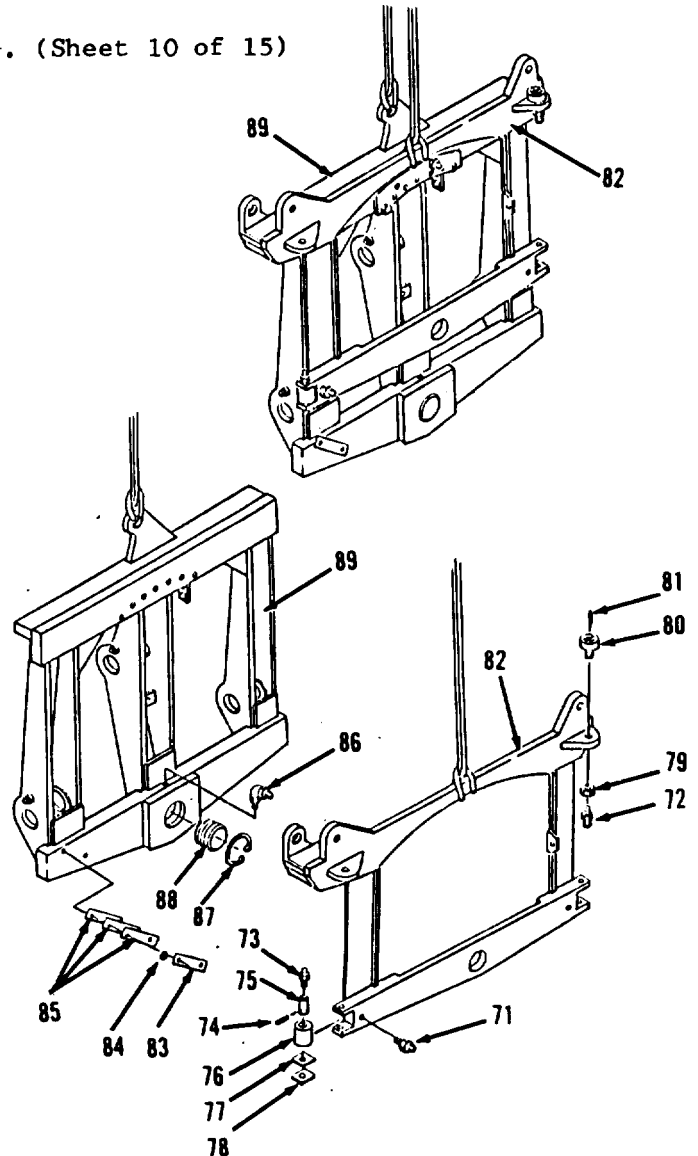
12-11. Lifting Forks and Carriage Assembly. (Sheet 10 of 15)

CLEANING/INSPECTION

49. Clean all other parts with cleaning solvent P-D-680. Dry with compressed air. Refer to paragraph 2-8.
50. Inspect all parts. Refer to paragraph 2-9.

ASSEMBLY

51. Attach hoists and slings to frames (89 and 82).
52. Using a 5/16" socket, socket wrench handle and snap ring pliers, install bearing (88), retaining ring (87) and lubrication fitting (86).
53. Install shim (85), 16 new preformed packings (84) and eight strips (83).
54. Using a plastic hammer, install two pins (81) in cam followers (80).
55. Using a 2-9/16" socket and socket wrench handle, install two nuts (79) on cam followers (80).



Go to sheet 11

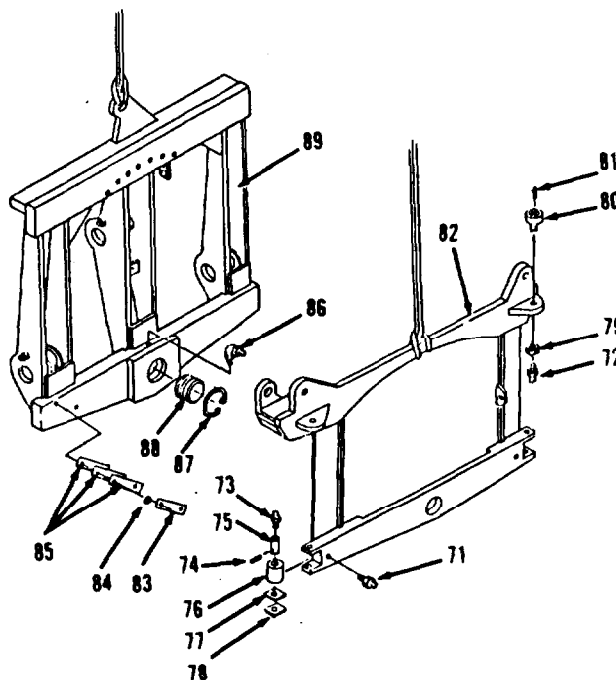
12-11. Lifting Forks and Carriage Assembly. (Sheet 11 of 15)

ASSEMBLY (cont)

NOTE

The following are differences between M10A Forklift models. The removal/installation procedure is identical.

56. Position four washers (78) in vehicles S/N 2000 and below.
57. Position two washers (77) in vehicles S/N 2001 and above.
58. Using a hammer and punch, install two rollers (76), shafts (75) and pins (74).
59. Using a 3/8" socket and socket wrench handle, install two lubrication fittings (73 thru 71).
60. Using hoists and slings, position items 89 thru 83 on items 82 thru 71 as assemblies.



Go to sheet 12

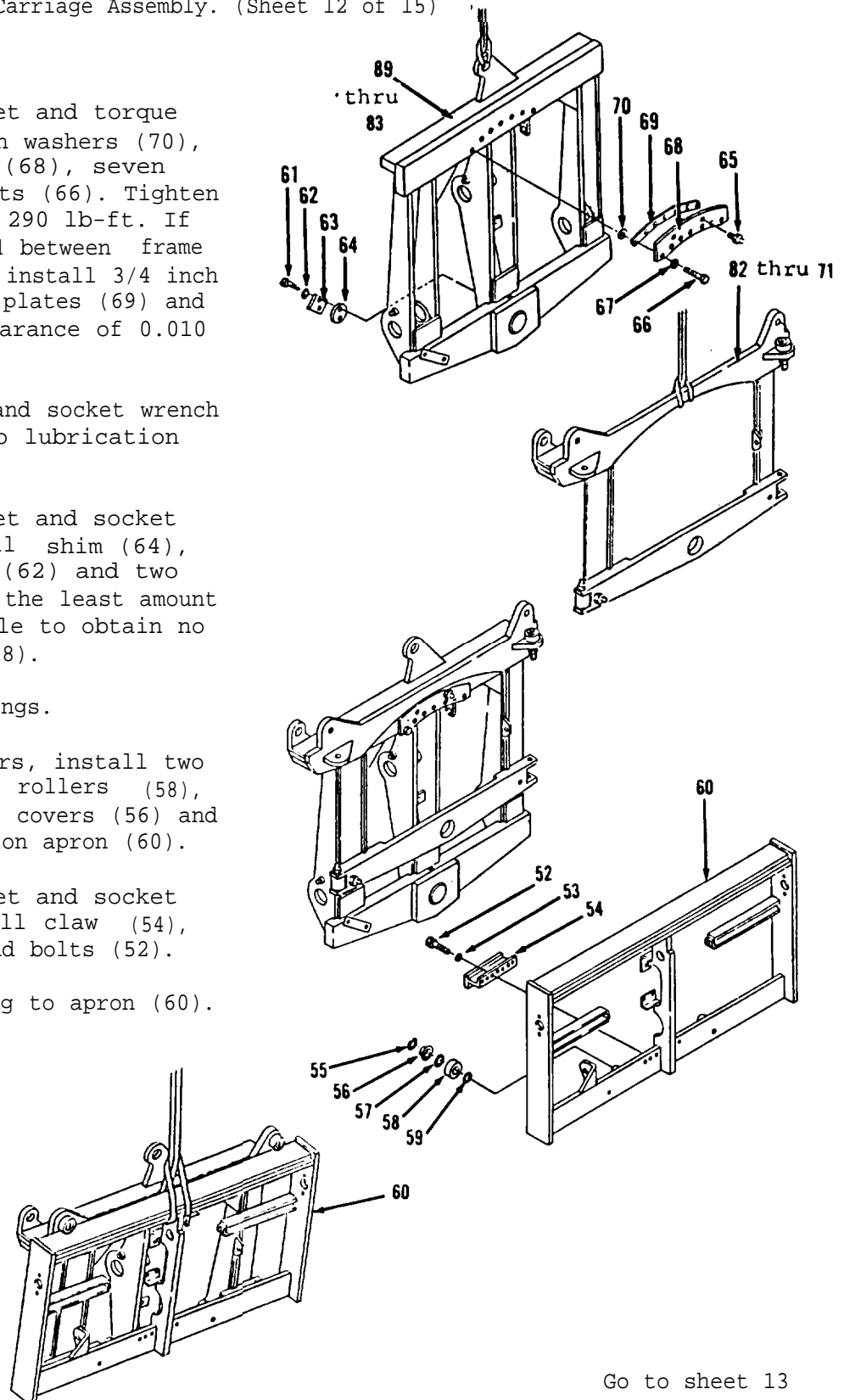


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-11. Lifting Forks and Carriage Assembly. (Sheet 12 of 15)

ASSEMBLY

61. Using a 1-1/8" socket and torque wrench, install seven washers (70), plate (69), plates (68), seven washers (67) and bolts (66). Tighten seven bolts (66) to 290 lb-ft. If interference is found between frame (82) and plate (68), install 3/4 inch flat washers between plates (69) and (68). Shim to a clearance of 0.010 inch with shim (85).
62. Using a 3/8" socket and socket wrench handle, install two lubrication fittings (65).
63. Using a 1-1/8" socket and socket wrench handle, install shim (64), plate (63), washers (62) and two bolts (61). Install the least amount of shims (64) possible to obtain no preload on bearing (68).
64. Remove hoists and slings.
65. Using snap ring pliers, install two retaining rings (59), rollers (58), retaining rings (57), covers (56) and retaining rings (55) on apron (60).
66. Using a 1-1/8" socket and socket wrench handle, install claw (54), seven washers (53) and bolts (52).
67. Attach hoist and sling to apron (60).



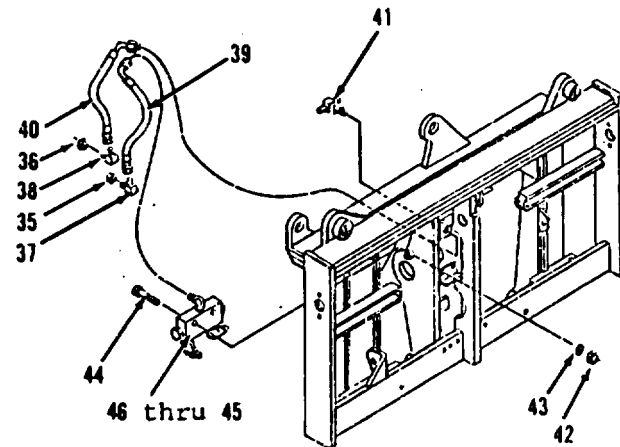
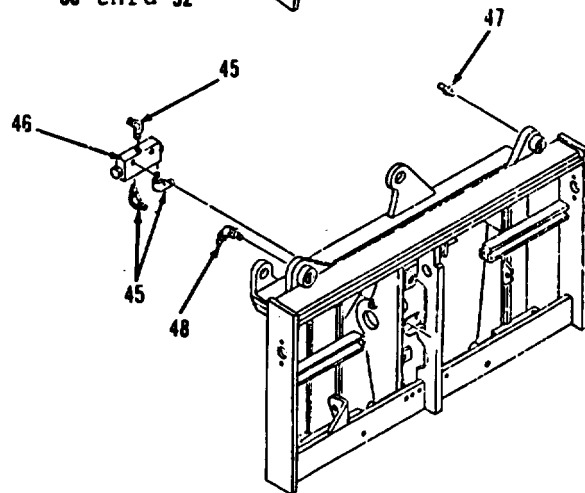
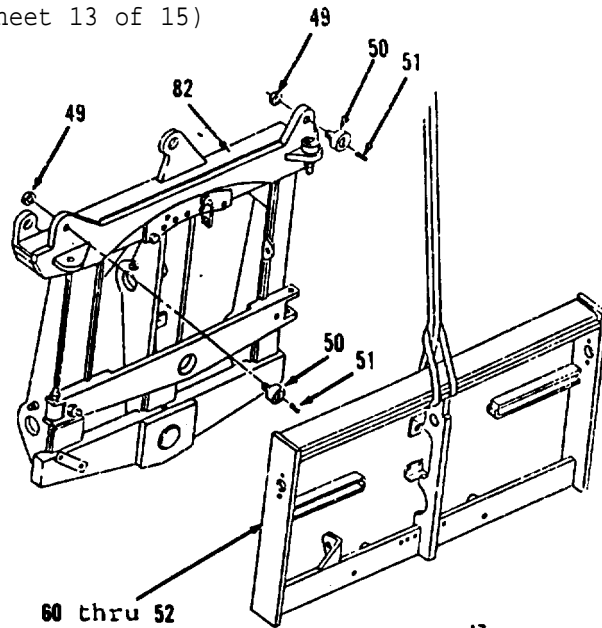
Go to sheet 13

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-11. Lifting Forks and Carriage Assembly. (Sheet 13 of 15)

ASSEMBLY (cont)

- 67. Position items 60 thru 52 as an assembly on frame (82).
- 68. Using hoist and sling, position items 60 thru 52 as an assembly on frame (82).
- 69. Using a 2-9/16" socket and socket wrench handle, install two pins (51), cam followers (50) and two nuts (49).
- 70. Remove hoist and sling.
- 71. Using a 3/8" socket and socket wrench handle, install lubrication fittings (48 and 47).
- 72. Using a 13/16" open end wrench, install three elbows (45) on flow divider (46).
- 73. Using a 7/16" socket and 1/4" socket head screw key, install items 46 and 45 as an assembly, two bolts (44), washers (43) and nuts (42).
- 74. Position tee (41).
- 75. Using an 11/16" open end wrench, connect hose assemblies (40 and 39) in vehicles S/N 2001 and above.
- 76. Install elbow (38).
- 77. Using a 13/16" open end wrench, install elbow (37) and nuts (36 and 35) in vehicles S/N 2001 and above.



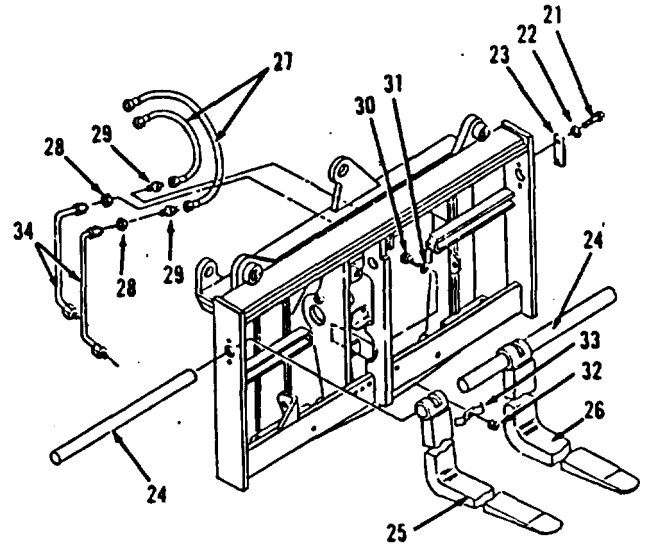
Go to sheet 14

HYDRAULIC SYSTEM MAINTENANCE.

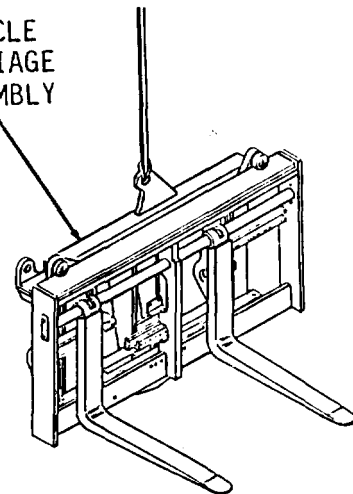
12-11. Lifting Forks and Carriage Assembly. (Sheet 14 of 15)

ASSEMBLY

78. Using an 11/16" open end wrench, connect tube assembly (34) to elbow (45) in vehicles S/N 2000 and below.
79. Connect tube assembly (34) to elbow (38).
80. Connect tube assembly (34) to elbow (37) in vehicles S/N 2001 and above.
81. Using a 1-1/8" socket and socket wrench handle, install clamp (33), nut (32), washer (31) and bolt (30) in vehicles S/N 2001 and above.
82. Using a 13/16" open end wrench, install two adapters (29) and nuts (28).
83. Using an 11/16" open end wrench, connect two hose assemblies (27) to adapters (29).
84. Attach hoist and slings to forks (26 and 25).
85. Using hoists and slings and a rubber mallet, install forks (26 and 25) and two pins (24).
86. Remove hoist and slings.
87. Using a 3/4" socket and socket wrench handle, install two plates (23), washers (22) and four bolts (21).



VEHICLE  
CARRIAGE  
ASSEMBLY



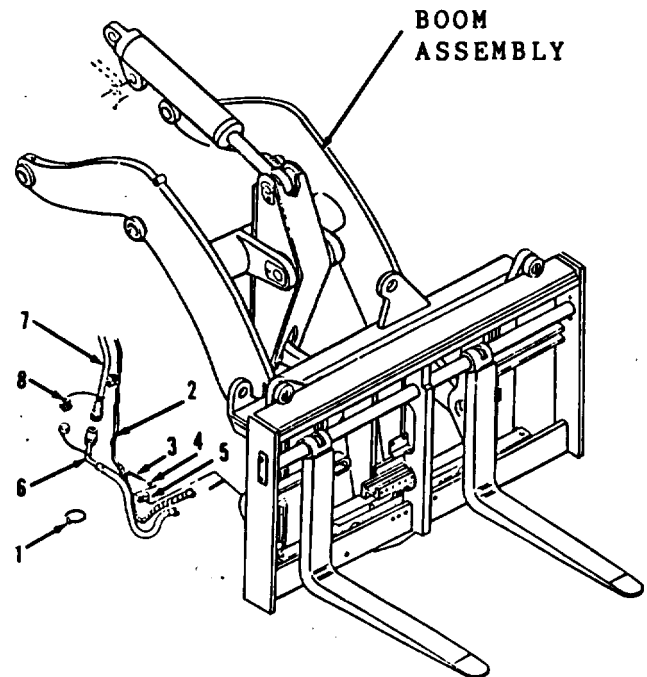
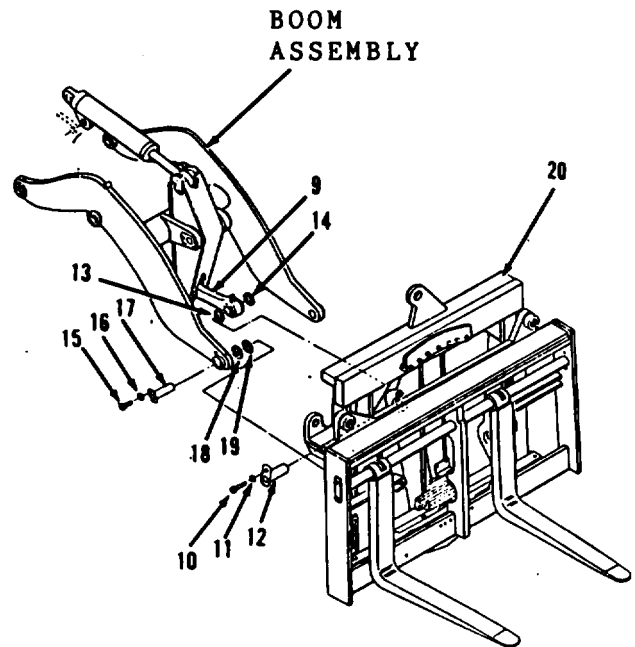
Go to sheet 15

INSTALLATION

88. Using a hoist and sling, position carriage assembly (20).
89. Using a 1-1/8" socket and socket wrench handle, install washers (19 and 18), pin (17), washer (16) and two bolts (15). Use washers (19 and 18) as shims to provide a maximum gap of 0.031 inch between boom arms and carriage frame.
90. Install washers (14 and 13), pin (12), washer (11) and bolt (10). Install pin (12) through rod assembly (9). Use washers (14 and 13) as shims to provide a gap of 0.031 inch between lever (9) and carriage frame.
91. Remove hoist and sling.
92. Remove two plugs (8) from ends of two hose assemblies (7).
93. Using quick-couplers, connect two hose assemblies (7) to two hose assemblies (6).
94. Using a 9/16" socket and socket wrench handle, install clip (5), washer (4) and bolt (3).
95. Install six new tie straps (1) to secure harness assembly (2).

NOTE

Return M10A Forklift to original equipment condition.





12-12. Lift Cylinder. (Sheet 2 of 10)

REMOVAL

NOTE

The following is a procedure for removal/installation of right side lift cylinder. The procedure for left side lift cylinder is identical.

1. Remove fender (1) from front, right side of vehicle, refer to TM 10-3930-643-20. Remove fender and ladder for left side lift cylinder.
2. Position forks so boom ends are approximately two feet off ground.
3. Block securely in place.

**WARNING**

Weight of lift cylinder is approximately 260 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

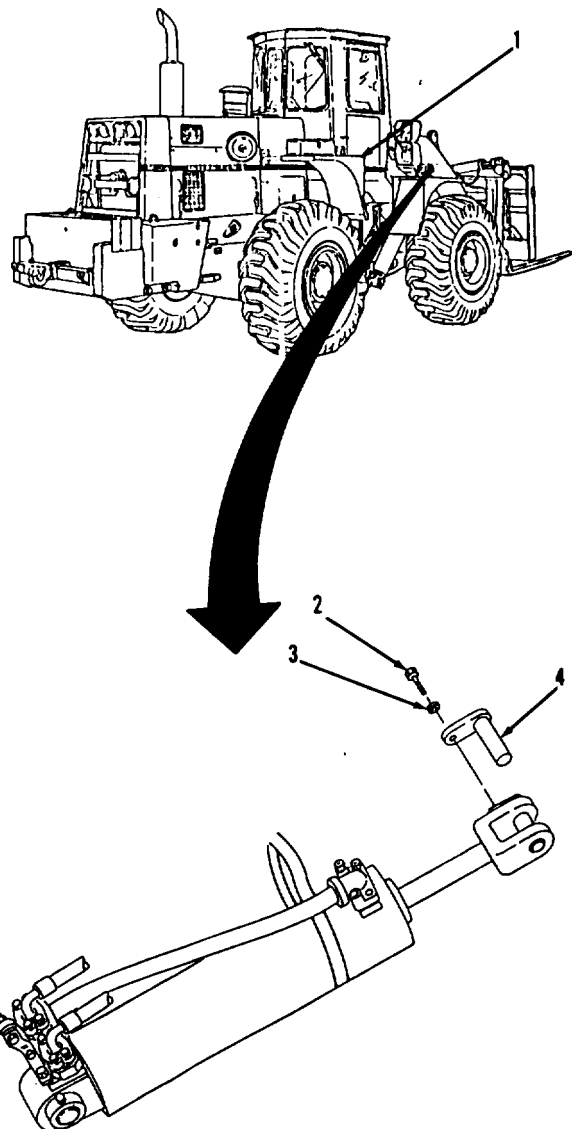
4. Position hoist and sling on cylinder assembly (48), making sure the sling is rapped under tube assembly (19), and take up slack.
5. Using a 1-1/8" socket and socket wrench handle, remove bolt (2), washer (3) and pin (4) from top of lift cylinder.

**CAUTION**

Do not attempt to retract rod if it is bent.

6. Start engine and move lift control lever to LOWER position to retract rod. Turn engine off and vent hydraulic pressure, refer to TM 10-3930-643-10.

Go to sheet 3



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

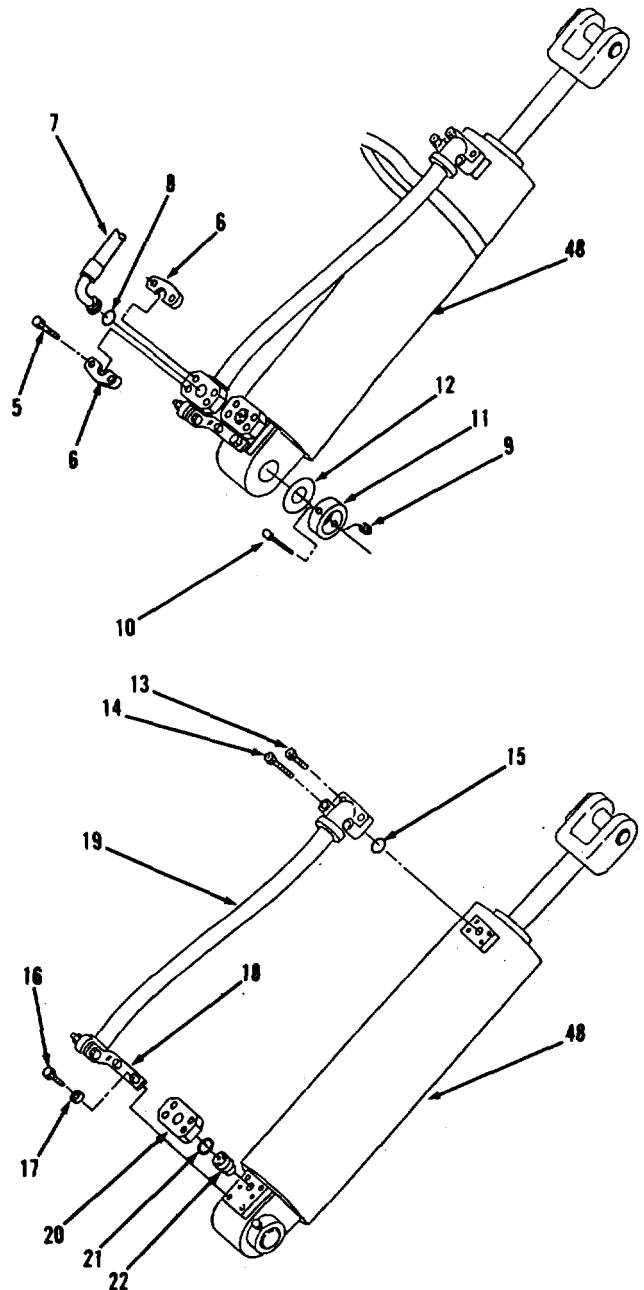
## 12-12. Lift Cylinder. (Sheet 3 of 10)

REMOVAL

## NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

7. Using a 9/16" socket and socket wrench handle, remove eight bolts (5) and four flanges (6) from bottom of cylinder assembly (48).
8. Disconnect two hose assemblies (7).
9. Remove and discard two preformed packings (8).
10. Using a 3/4" socket, socket wrench handle and an open end wrench, remove nut (9), bolt (10), fitting (11) and shim (12) from bottom of cylinder assembly (48).
11. Using hoist and sling, remove cylinder assembly (48) from vehicle and place on suitable work bench.
12. Remove hoist and sling.
13. Using a 5/16" socket head screw key, remove two bolts (13 and 14).
14. Disconnect tube assembly (19).
15. Remove and discard preformed packing (15).
16. Using a 9/16" socket and socket wrench handle, remove two bolts (16), washers (17), support assembly (18) and tube assembly (19).
17. Remove spacer (20), preformed packing (21) and valve (22) from cylinder (48). Discard preformed packing (21).



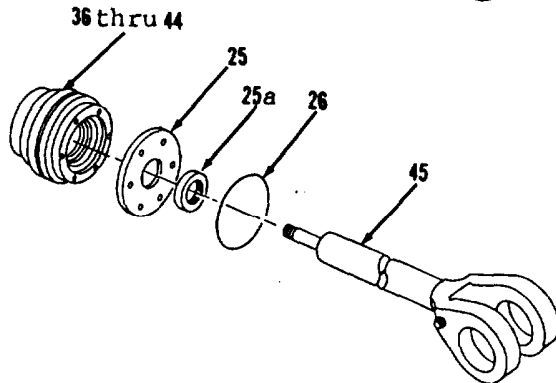
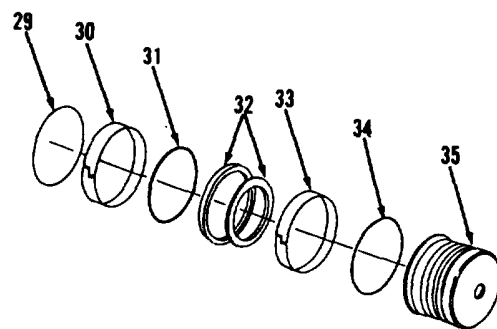
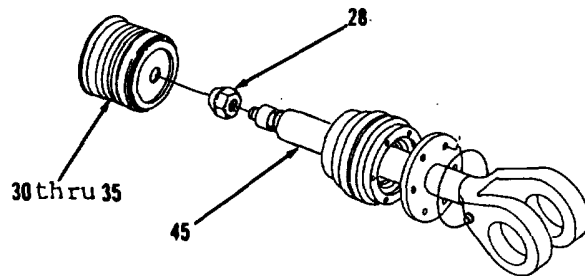
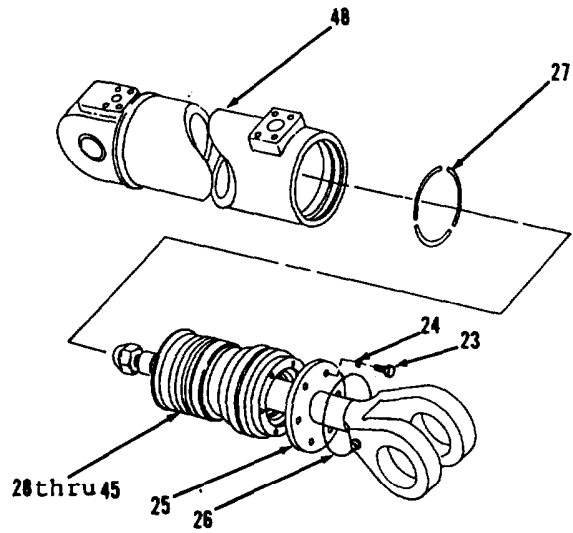
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-12. Lift Cylinder. (Sheet 4 of 10)

DISASSEMBLY

18. Using hoist and sling, extend rod (45) half way out of cylinder assembly and drain remaining fluid.
19. Using a 9/16" socket and socket wrench handle, remove six bolts (23) washers (24) from retainer (25).
20. Loosen retainer (25) and ring (26) from cylinder and slide up on rod (45).
21. Using a brass punch, drive items 29 thru 44 down into cylinder (48) to loosen three lock rings (27).
22. Using a pick, remove and discard three lock rings (27).
23. Using hoist and sling, remove items 28 thru 45 as an assembly from cylinder (48).
24. Using a 2-3/4" socket and socket wrench handle, remove lock nut (28) and items 30 thru 35 as an assembly from rod (45).
25. Using a scribe, remove preformed packing (29) , wear ring (30), preformed packing (31), seal (32), wear ring (33) and preformed packing (34) from piston (35). Discard seal (32) and preformed packings (31 and 34).
26. Remove items 36 thru 44 as an assembly, retainer (25) and ring (26) from rod (45). Discard preformed packing (26).
27. Remove and discard wiper seal (25a) from retainer (25).



Go to sheet 5

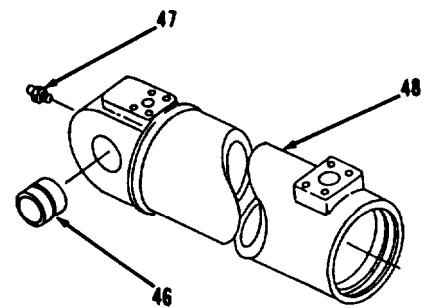
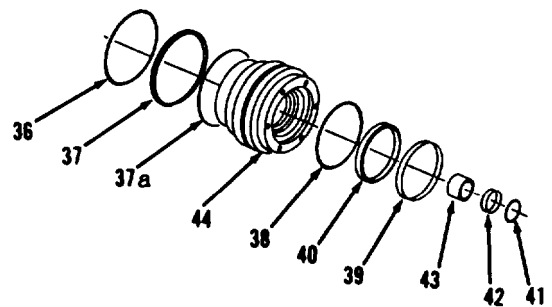


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-12. Lift Cylinder. (Sheet 5 of 10)

DISASSEMBLY

28. Using a scribe, remove preformed packing (36), ring (37) and rod seal (37a) from piston (44).
29. Remove and discard preformed packing (38) and seals (39 and 40).
30. Remove preformed packing (41) and rings (42 and 43). Discard preformed packing (41).
31. Using an arbor press, a 7/16" socket and socket wrench handle, remove bushing (46) and fitting (47) from cylinder (48). Discard bushing (46).



12-12. Lift Cylinder. (Sheet 6 of 10)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

32. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
33. Inspect piston (35) and retainer (44), rod (45) and cylinder (48) for burrs, scratches or other damage. A small stone may be used to remove burrs or small scratches. Replace parts showing damage or excessive wear.
34. Inspect all other parts. Refer to paragraph 2-9.

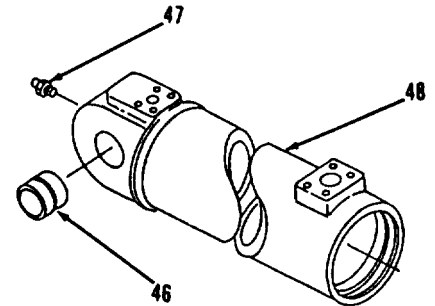
Go to sheet 7

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-12. Lift Cylinder. (Sheet 7 of 10)

ASSEMBLY

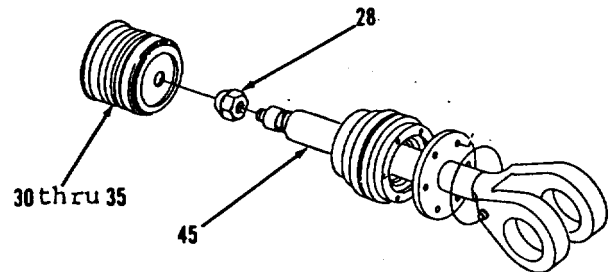
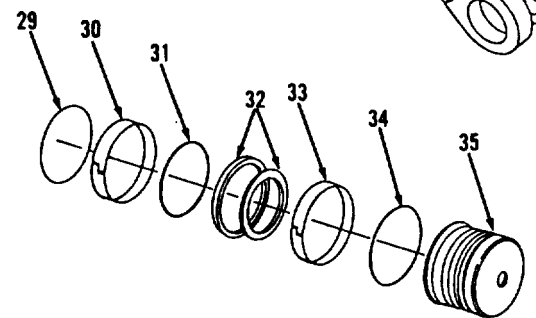
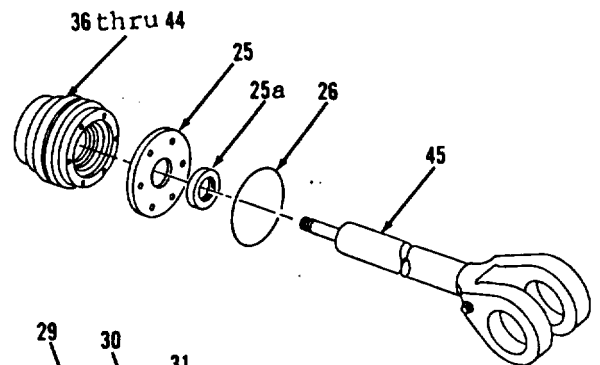
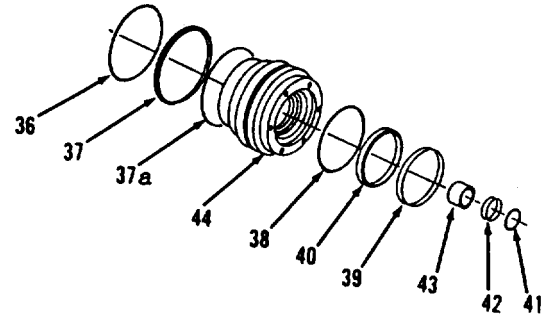
35. Using an arbor press, a 7/16" socket and socket wrench handle, install fitting (47) and new bushing (46) in cylinder (48).



NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

36. Install rings (43 and 42) and new preformed packing (41) on piston (44).
37. Install new seals (40 and 39) and new preformed packing (38) on piston (44).
38. Install rod seal (37a), ring (37) and new preformed packing (36) on piston (44).
39. Install new wiper seal (25a) on retainer (25).
40. Install new ring (26), retainer (25) and items 44 thru 36 as an assembly on rod (45).
41. Install new preformed packing (34), wear ring (33), new seal (32), new preformed packing (31), wear ring (30) and new preformed packing (29) on piston (35). To install outer seal ring (32) soak in hot water until pliable.
42. Using a 2-3/4" socket and torque wrench, install items 35 thru 30 as an assembly and lock nut (28) on rod (45). Tighten lock nut (28) to 1900 to 200 lb-ft.

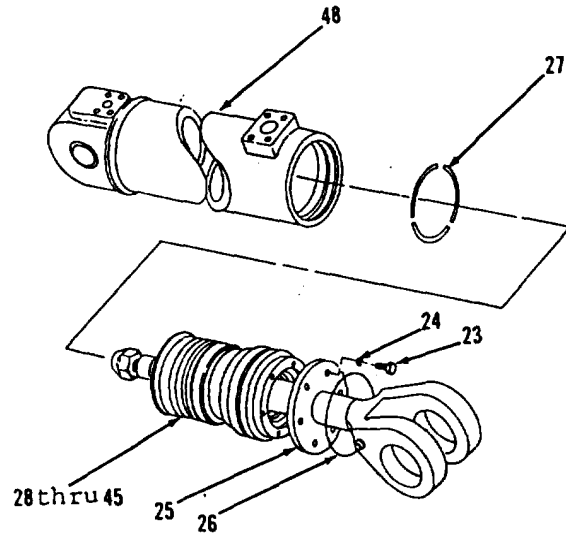


Go to sheet 8

12-12. Lift Cylinder. (Sheet 8 of 10)

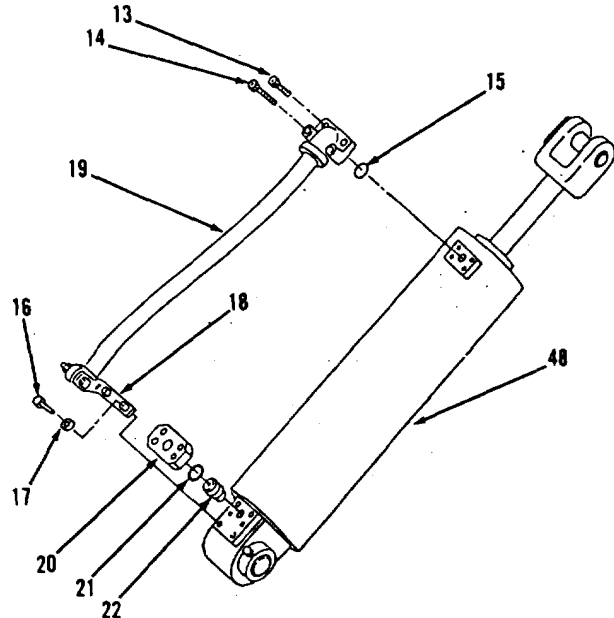
ASSEMBLY

43. Using a hoist and sling, Install items 45 thru 28 as an assembly into cylinder (48).
44. Install three new lock rings (27).
45. Slide new ring (26) and retainer (25) down and position on cylinder (48).
46. Apply loctite 262 on six bolts (23).
47. Using a 9/16" socket and socket wrench handle, install six washers (24) and bolts (23) on retainer (25). Tighten six bolts (23) to 34 lb-ft.



INSTALLATION

48. Install valve (22), new preformed packing (21) and spacer (20) in cylinder assembly (48).
49. Using a 9/16" socket and socket wrench handle, install tube assembly (19), support assembly (18), two washers (17) and bolts (16) on lower part of cylinder assembly (48).
50. Install new preformed packing (15) on upper part of cylinder assembly (48).
51. Connect tube assembly (19).
52. Using a 5/16" socket head screw key, install two bolts (14 and 13).



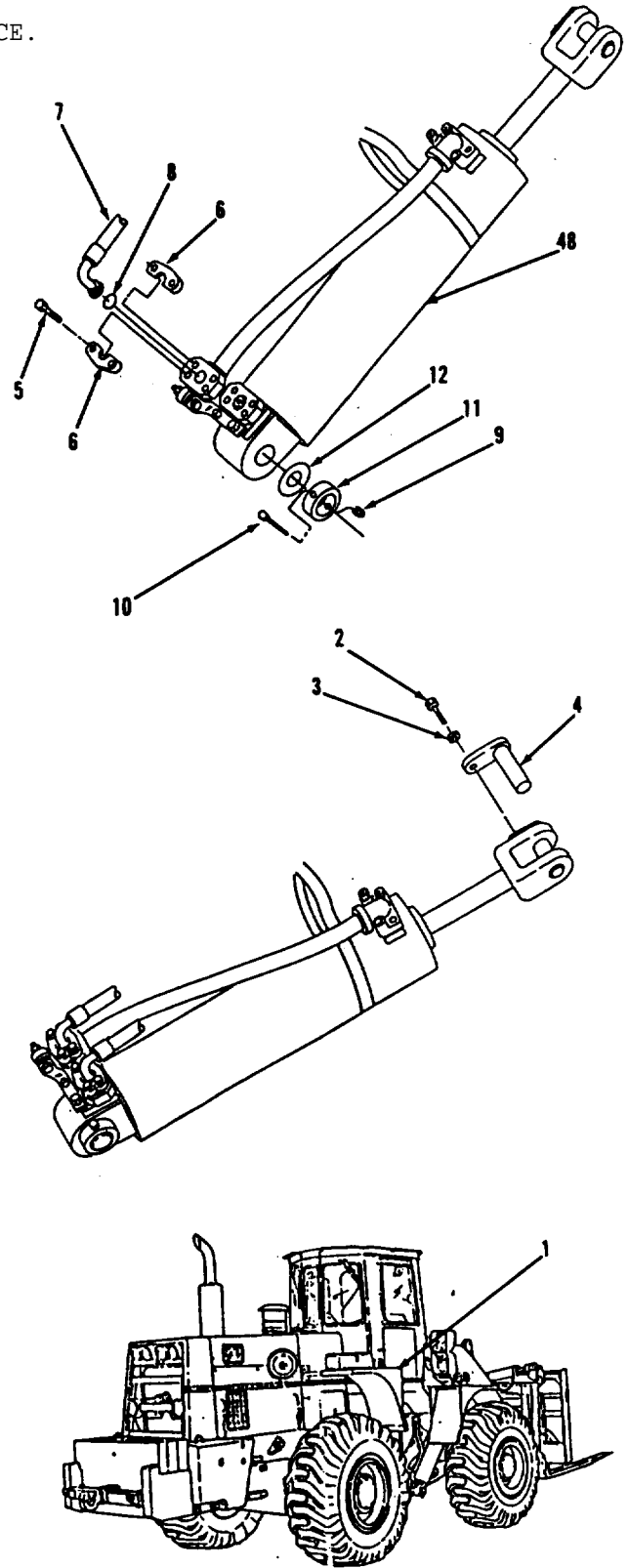
Go to sheet 9

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-12. Lift Cylinder. (Sheet 9 of 10)

INSTALLATION

53. Position hoist and sling on cylinder assembly (48), making sure the sling is rapped under tube assembly (19) and take up slack.
54. Coat mounting rod on lower frame of vehicle with grease.
55. Using a hoist and sling, install cylinder assembly (48) on vehicle.
56. Using a 3/4" socket, socket wrench handle and open end wrench, install shim (12), fitting (11), bolt (10) and nut (9) to lower end of cylinder assembly (48).
57. Install two new preformed packings (8).
58. Connect two hose assemblies (7).
59. Using a 9/16" socket and socket wrench handle, install four flanges (6) and eight bolts (5) on hose assemblies (7).
60. Start engine and move lift control lever to RAISED position to aline rod (45) with boom assembly.
61. Using a 1-1/8" socket and socket wrench handle, install pin (4), washer (3) and bolt (2) in rod end of cylinder assembly (48).
62. Remove hoist and sling.
63. Install fender (1) to front, right side of vehicle, refer to TM 10-3930-643-12.
64. Lubricate grease fittings, refer to TM 10-3930-643-12.



Go to sheet 10

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-12. Lift Cylinder. (Sheet 10 of 10)

INSTALLATION

65. Check and refill hydraulic reservoir, refer to TM 10-3930-643-12.
66. Operate engine until hydraulic fluid is at normal operating temperature.
67. Move lift cylinder through at least five full movements of travel to bleed air from system.
68. Check for binding in lift cylinder operation.
69. Stop engine.
70. Inspect hydraulic hoses, fittings and cylinder assemblies for leaks.

TESTING

71. Lower forks to the ground.
72. Using a 9/16" socket and socket wrench handle, disconnect hoses from left side lift cylinder and cap hoses.
73. Disconnect hose from lower end of right side lift cylinder and cap hoses.
74. Operate engine at 2625 to 2750 rpm and move lift control lever to maximum LOWER position.
75. Observe lower port. Continuous fluid flow from port indicates defective packing. Replace packing if defective.
76. Connect hoses.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 1 of 10)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

## INITIAL SETUP

Tools

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

shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Hoist and sling

1-13/16" socket and socket  
wrench handle  
NSN 5120-00-199-7768

Material/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)

Clean cloth (App. C, Item 24)

Small tag (App. C, Item 28)

Fine emery cloth (App. C, Item 4)

Hydraulic fluid (App. C, Item 19)

Preformed packing (3)

Rod packing

Packing (2)

Wiper ring

Plug (2)

Wood block

Suitable container

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

Go to sheet 2

12-111

REMOVAL

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

NOTE

Do not disconnect battery negative ground for steps 1, 2 and 3. The electrical system must be operating for the engine and hydraulic cylinders to-function.

1. Start engine, refer to TM 10-3930-643-10.
2. Spread forks apart as far as possible, refer to TM 10-3930-643-10.
3. Shift vehicle carriage assembly to extreme right, using side shift lever, refer to TM 10-3930-643-10.
4. Stop engine, refer to TM 10-3930-643-10.
5. Turn master disconnect switch OFF.

Go to sheet 3

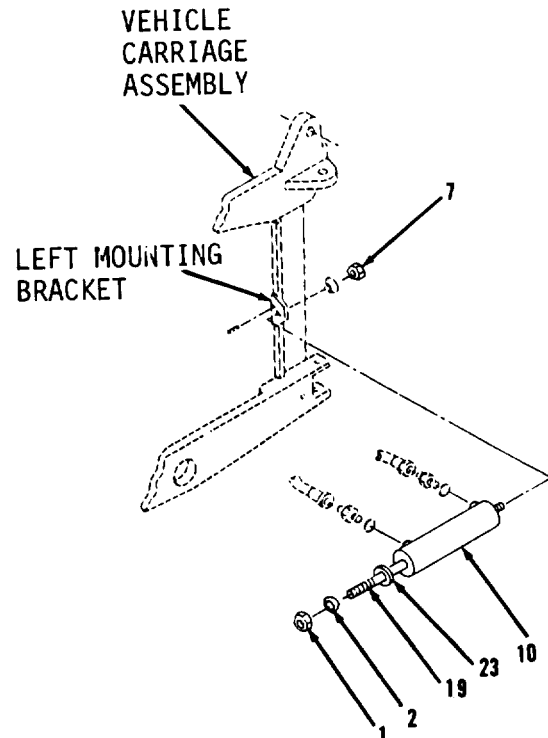
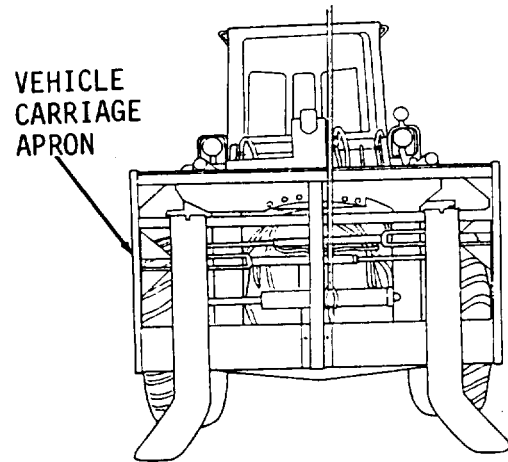


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 3 of 10)

REMOVAL

6. Attach hoist and sling to cylinder on vehicle carriage assembly. Remove slack from sling.
7. Using a 1-13/16" socket and socket wrench handle, remove nut (1) and washer (2).
8. Loosen nut (7) slightly, approximately 1/2 turn.
- 9\* Retract rod (19) to stop. Be sure vehicle carriage apron is not pulled along with rod (19). Do not damage bushing (23) unless it is being replaced.
10. Secure cylinder assembly (10) to vehicle carriage assembly. In addition, cylinder assembly (10) must remain securely held by hoist and sling.
11. Vent all hydraulic pressure, refer to TM 10-3930-643-10.



Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 4 of 10)

REMOVAL (cont)

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

12. Using a 7/8" open end wrench, disconnect hose assemblies (3 and 4) from cylinder assembly (10).
13. Remove two unions (5) and preformed packings (6). Discard two preformed packings (6).
14. Using a 1-13/16" socket and socket wrench handle, loosen nut (7) enough to show a small gap between nut (7) and left mounting bracket.
15. Using a rubber mallet, drive cylinder assembly (10) free of pin (9). Use soft hammer and protect cylinder assembly (10) with wood block.
16. Using a 1-13/16" socket and socket wrench handle and long round nose pliers, remove nut (7), washer (8) and pin (9). Observe position of washer (8) to aid in installation.

NOTE

Place cylinder assembly in on repair stand with oil ports down to avoid contamination.

17. Remove cylinder assembly (10) from mounting brackets and place on a suitable work bench with oil ports facing down.
18. Using a suitable container, drain all hydraulic fluid from cylinder assembly (10). There should be approximately two quarts.
19. Remove hoist and sling.

Go to sheet 5

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 5 of 10)

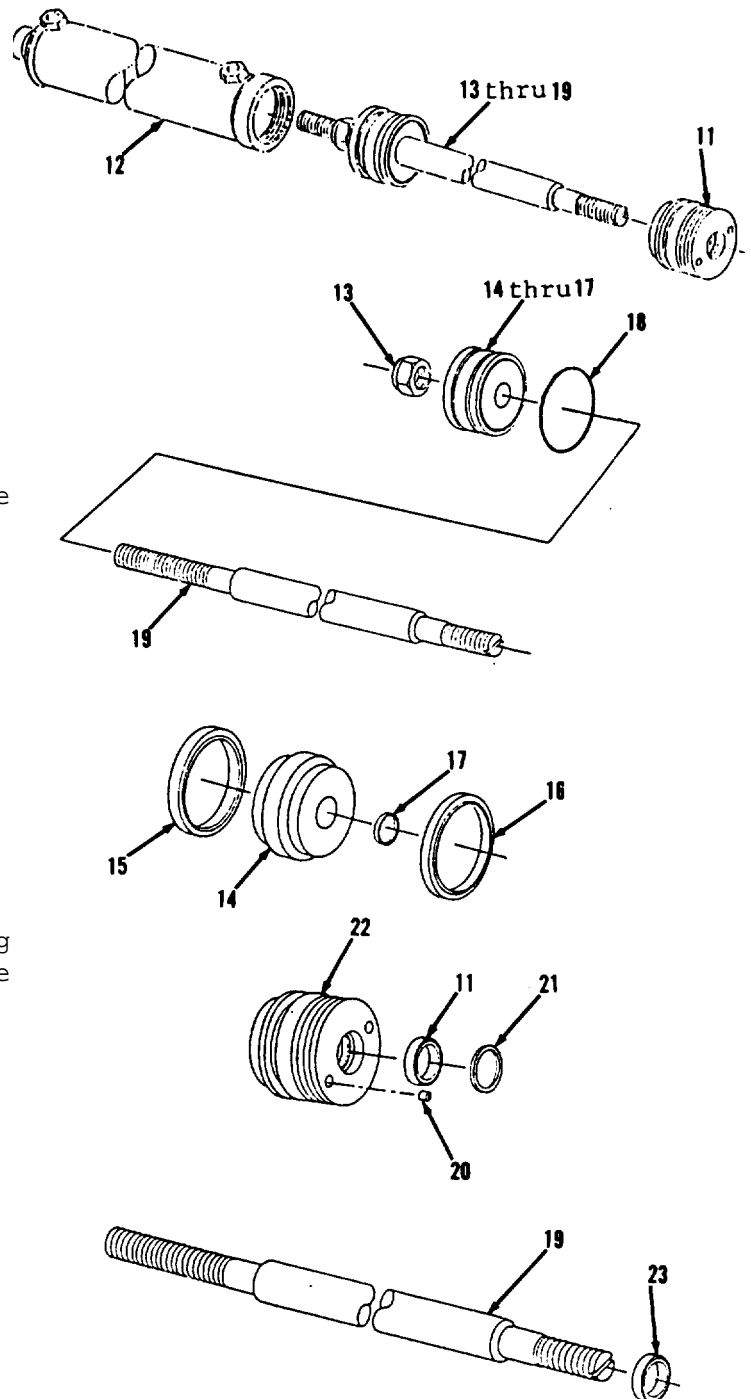
DISASSEMBLY

20. Using a spanner wrench, remove retainer (11) from cylinder shell (12).

NOTE

Observe positioning of seals, wipers and packings when removing them. Record positioning, as necessary, for proper assembly.

21. Remove items 13 thru 19 as an assembly from cylinder shell (12).
22. Using a 14" adjustable wrench, remove nut (13) from rod (19).
23. Using a rubber mallet, remove items 14 thru 18 as an assembly from rod (19).
24. Remove and discard packings (15 and 16) from piston (14).
25. Remove and discard seal (17) from piston (14).
26. Remove and discard preformed packing (18), wiper ring (20) and rod packing (21) from retainer (11). One or more spacer rings will be removed with these items.
27. Remove and discard two plugs (22) from retainer (11).
28. Using an arbor press, remove bushing (23) from rod (19).



Go to sheet 6

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 6 of 10)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

30. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 7 of 10)

CLEANING/INSPECTION

29. Inspect rod (19) and inside of cylinder shell (12) for scratches, grooves, burrs or other damage which might cause a malfunction. Small burrs and shallow scratches can be polished out with fine emery cloth and oil. Replace what cannot be repaired. Threads on cylinder shell (12) and rod (19) must not be damaged. Be sure residues of abrasives and foreign matter have been cleaned away prior to assembly.
30. Inspect bushing (23). Replace if it is cracked or worn enough to allow excessive movement of rod (19).
31. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 8

12-117

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 8 of 10)

ASSEMBLY

32. Using an arbor press, install bushing (23) on rod (19).
33. Install two new plugs (22) in retainer (11).

NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

34. Using a flat tip screwdriver, install one spacer ring in new rod packing (21). One more spacer ring will be used as a shim in the slots in retainer (11).
35. Install new rod packing (21), new wiper ring (20) and new preformed packing (18) on retainer (11). Make sure the lips of new rod packing (21) face the opposite direction from lip of new wiper ring (20). Lip of new wiper ring (20) should point toward the out side of retainer (11).

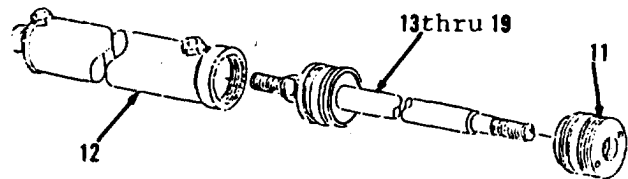
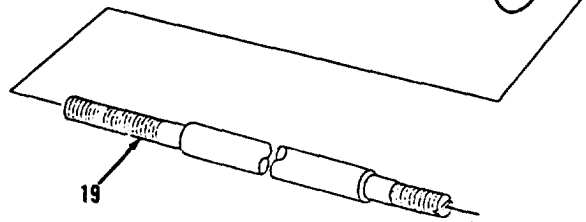
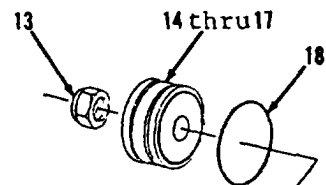
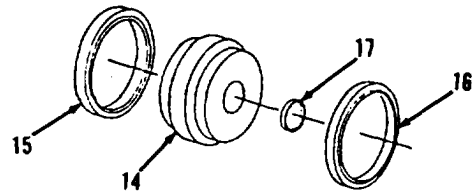
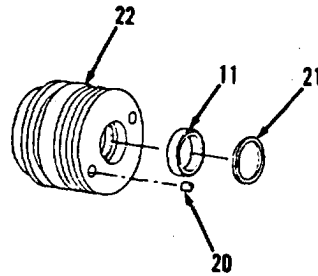
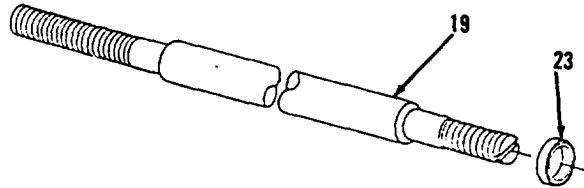
36. Install new seal (17), and new packings (16 and 15) on piston (14).

37. Using a 14" adjustable wrench, install items 18 thru 14 as an assembly and nut (13) on rod (19).

38. Install items 19 thru 13 as an assembly in cylinder shell (12).

39. Install retainer (11) on rod (19).

40. Using a spanner wrench, tighten retainer (11) and items 19 thru 13 as an assembly in cylinder shell (12).



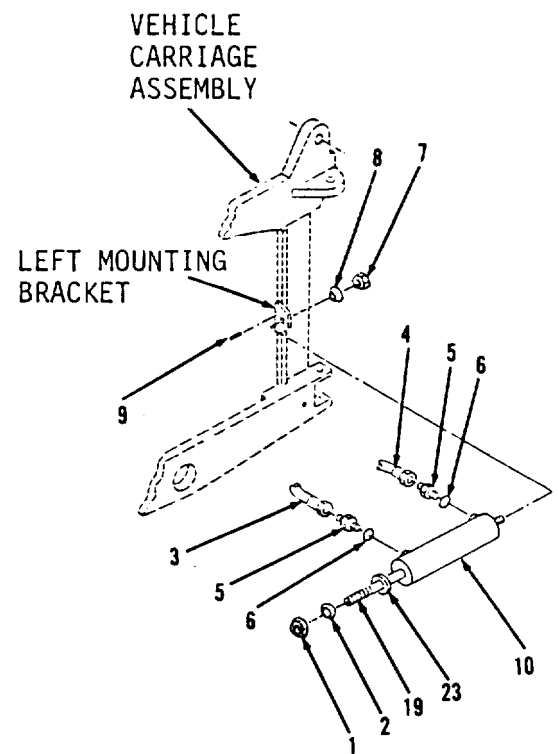
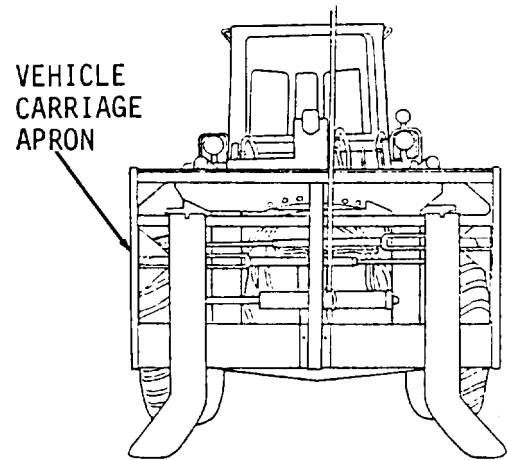
Go to sheet 9

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 9 of 10)

INSTALLATION

41. Fill cylinder assembly (10) with approximately two quarts of hydraulic fluid.
42. Attach hoist and sling to cylinder assembly (10) and position on mounting brackets.
43. Using a plastic hammer and 1-13/16" socket and socket wrench handle, install pin (9), washer (8) and nut (7). Tighten nut (7) to a snug fit, then back off 1/8 turn. This procedure is necessary to allow cylinder end movement between mountings and cylinder assembly (10).
44. Install two new preformed packing (6) and two unions (5).
45. Using a 7/8" open end wrench, connect hose assemblies (4 and 3).
46. Using a 1-13/16" socket and socket wrench handle, install washer (2) and nut (1) to cylinder assembly (10)
47. Remove hoist and sling.
48. Check hydraulic fluid level. Add hydraulic fluid, refer to TM 10-3930-643-12.



Go to sheet 10

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-13. Sideshift Cylinder (S/N 2000 and below). (Sheet 10 of 10)

TESTING

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

49. Turn master disconnect switch ON.
50. Start engine.
51. Slowly move sideshift cylinder through at five full movements of travel to bleed air from system.
52. Check for binding of cylinder assembly during operation.
53. Stop engine.
54. Inspect hydraulic hoses, fittings and cylinder assemblies for leaks.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 1 of 11)

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

INITIAL SETUP

Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Hoist and sling  
1-13/16" socket and socket  
wrench handle  
NSN 5120-00-199-7768

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)

Clean cloth (App. C, Item 24)

Small tag (App. C, Item 28)

Hydraulic fluid (App. C, Item 19)

Fine emery cloth (App. C, Item 4)

Seal (4)

Preformed packing (2)

Wire

Wiper

Ring

Wood block

Suitable container

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 2 of 11)

REMOVAL

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

NOTE

Do not disconnect battery negative ground for steps 1, 2 and 3. The electrical system must be operating for the engine and hydraulic cylinders to function.

1. Start engine, refer to TM 10-3930-643-10.
2. Spread forks apart as far as possible, refer to TM 10-3930-643-10.
3. Shift vehicle carriage assembly to extreme right, using side shift lever, refer to TM 10-3930-643-10.
4. Stop engine, refer to TM 10-3930-643-10.
5. Turn master disconnect switch OFF.

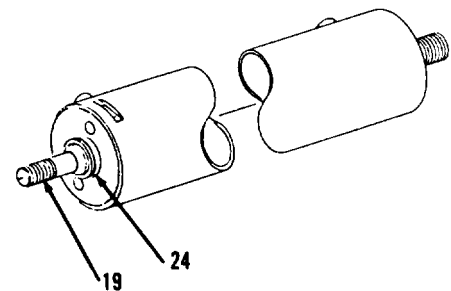
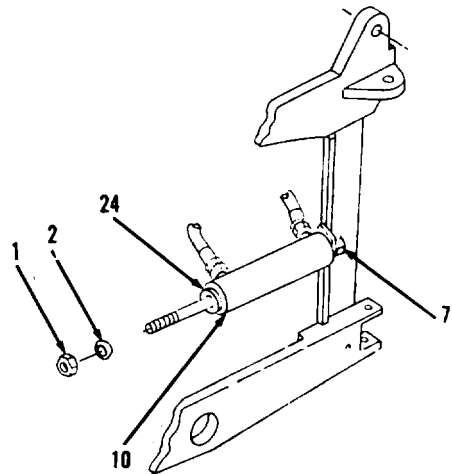
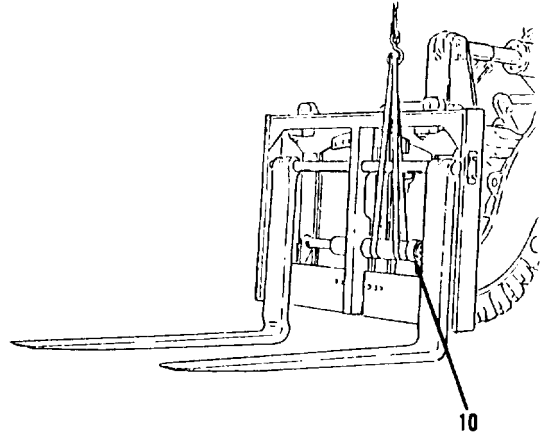
Go to sheet 3

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 3 of 11)

REMOVAL (cont)

6. Attach hoist and sling to cylinder assembly (10). Remove slack from sling.
7. Using a 1-13/16" socket and socket wrench handle, remove nut (1) and washer (2).
8. Loosen nut (7) slightly, approximately 1/2 turn.
9. Retract rod (19) to stop. Be sure vehicle carriage apron is not pulled along with rod (19). Do not damage bushing (24) unless it is being replaced.
10. Vent all hydraulic pressure, refer to TM 10-3930-643-10.



Go to sheet 4

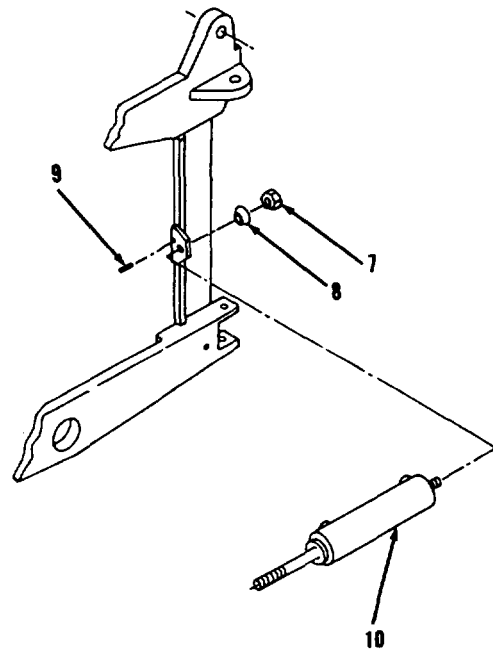
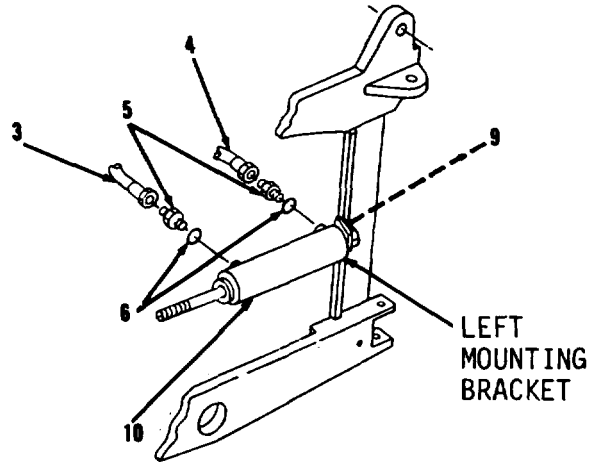
12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 4 of 11)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

11. Using a 7/8" open end wrench, disconnect hose assemblies (3 and 4) from cylinder assembly (10) of vehicle carriage assembly.
12. Using a 7/8" open end wrench, remove two unions (5) and preformed packings (6). Discard preformed packings (6).
13. Using a 1-13/16" socket and socket wrench handle, loosen nut (7) enough to show a small gap between nut (7) and left mounting bracket.
14. Using a rubber mallet, drive cylinder assembly (10) free of pin (9). Use soft hammer and protect cylinder assembly with wood block.
15. Using a 1-13/16" socket and socket wrench handle and long round nose pliers, remove nut (7), washer (8) and pin (9). Observe position of washer (8) to aid in installation.



Go to sheet 5

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 5 of 11)

REMOVAL (Cont)

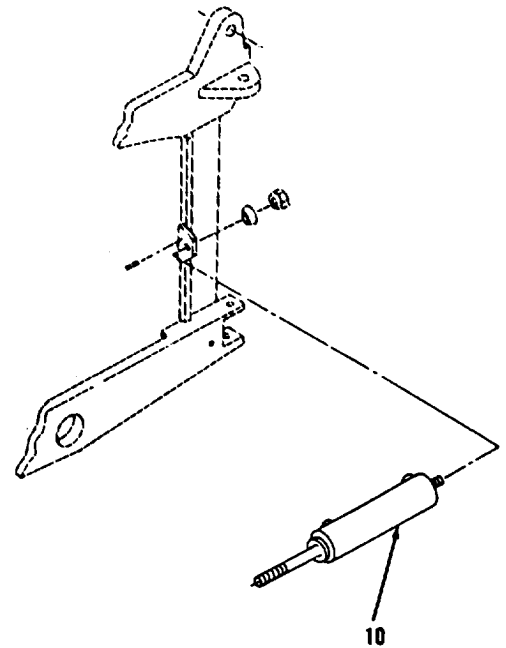
## NOTE

Place cylinder assembly in on repair stand with oil ports down to avoid contamination.

16. Remove cylinder assembly (10) from mounting brackets and place on a suitable work bench with oil ports facing down.
17. Using a suitable container, drain all hydraulic fluid from cylinder assembly (10). There should be approximately two quarts.
18. Remove hoist and sling.

DISASSEMBLY

19. Remove wire (11).



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 6 of 11)

DISASSEMBLY

NOTE

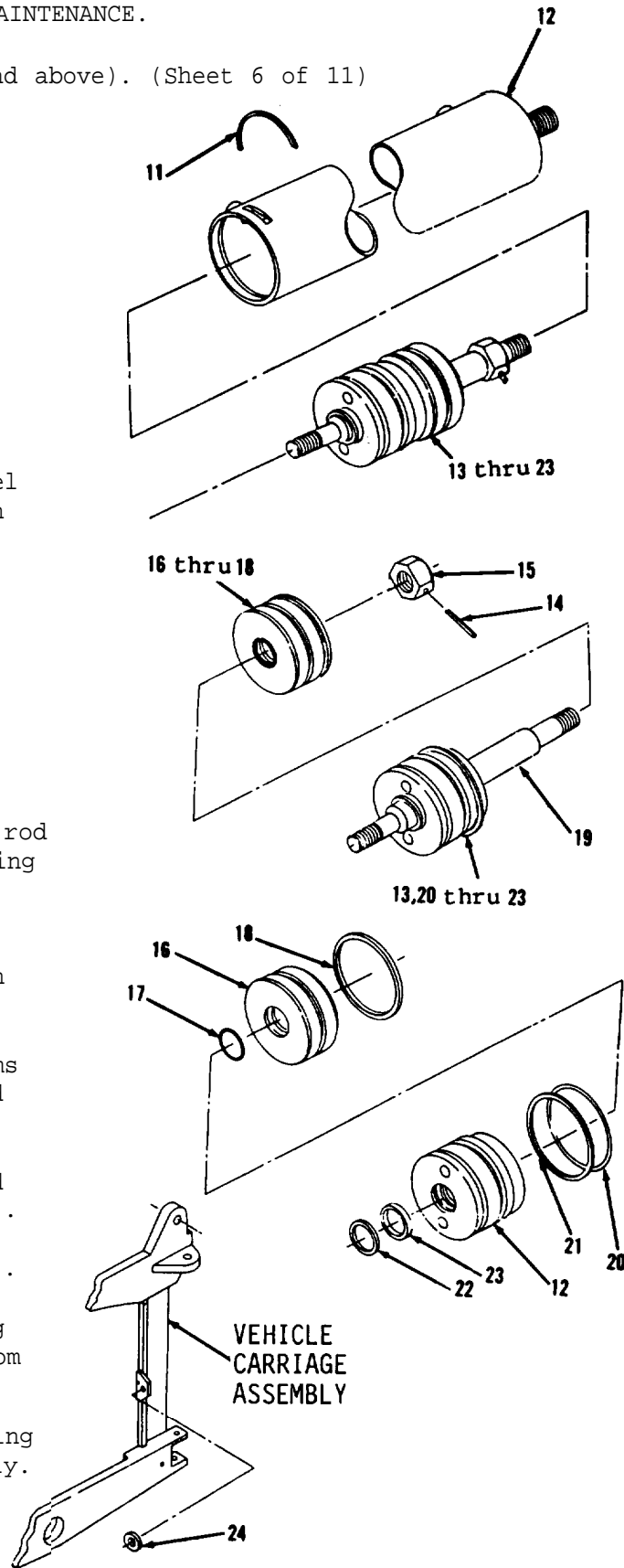
Observe positioning of seals, wipers and ring when removing them. Record positioning, as necessary, for proper assembly.

- 20. Using a spanner wrench, loosen retainer (13) from barrel (12).
- 21. Remove items 14 thru 19 from barrel (12). Pull items 14 thru 19 as an assembly straight out to prevent damage to barrel (12).

NOTE

Observe positioning of seals, wipers and packings when removing them. Record positioning, as necessary, for proper assembly.

- 22. Secure rod (19) in vice. Protect rod (19) with shop cloths and/or padding and metal protector.
- 23. Using a 14" adjustable wrench and long round nose pliers, remove pin (14) and nut (15) from rod (19).
- 24. Using a rubber mallet, remove items 16 thru 18 as an assembly from rod (19).
- 25. Using a scribe, remove and discard seals (17 and 18) from piston (16).
- 26. Remove retainer (13) from rod (19).
- 27. Remove and discard seal (20), ring (21), wiper (22) and seal (23) from retainer (13).
- 28. Using an arbor press, remove bushing (24) from vehicle carriage assembly.



Go to sheet 7

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 7 of 11)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

28. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 8

## **TM 10-3930-643-34**

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 8 of 11)

### CLEANING/INSPECTION

29. Inspect rod (19) and inside of barrel (13) for scratches, grooves, burrs or other damage which might cause a malfunction. Small burrs and shallow scratches can be polished out with fine emery cloth and oil. Replace what cannot be repaired. Threads on barrel (13) and rod (19) must not be damaged. Be sure residues of abrasives and foreign matter have been cleaned away prior to assembly.
30. Inspect piston (16). Replace if it has scratches, grooves, burrs or other damage which might cause a malfunction.
31. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 9



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 9 of 11)

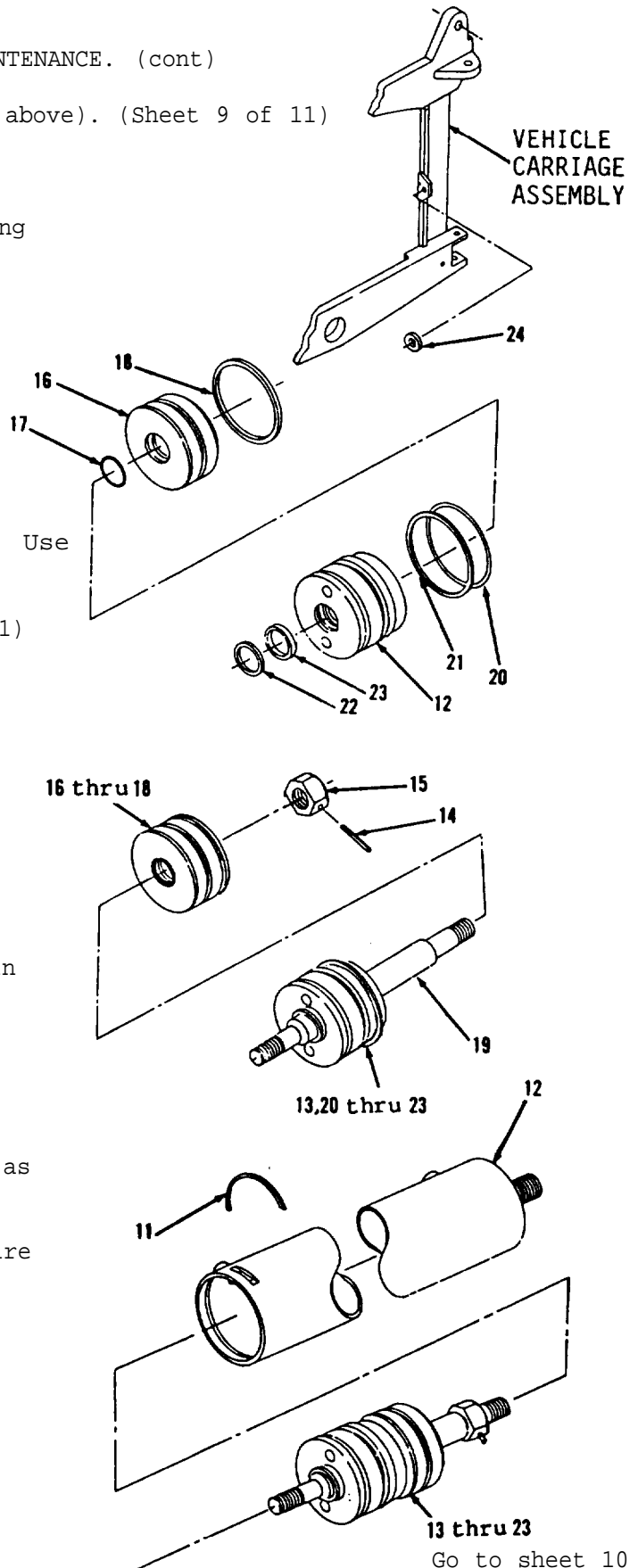
ASSEMBLY

32. Using an arbor press, install bushing (24) on vehicle carriage assembly.

NOTE

Lubricate all preformed packings, wipers, seals. sliding parts and housing before installing.

33. Install new seal (23), in retainer (13). Make sure the lips of seal (23) face inside barrel (12). Use seal installer tool if necessary.
34. Install new wiper (22) , new ring (21) and new seal (20 on retainer (13).
35. Install retainer (13) on rod (19).
36. Install new seal (18 and 17) on piston (16) .
37. Using a 14" adjustable wrench, install items 18 thru 16 as an assembly and nut (15) on rod.
38. Aline holes in nut (15) with hole in rod (19) and install pin (14).
39. Install items 19 thru 13 as an assembly in barrel (12).
40. Using a spanner wrench, tighten retainer (13) and items 19 thru 14 as an assembly in barrel (12).
41. Using slip joint pliers , install wire (11).



Go to sheet 10

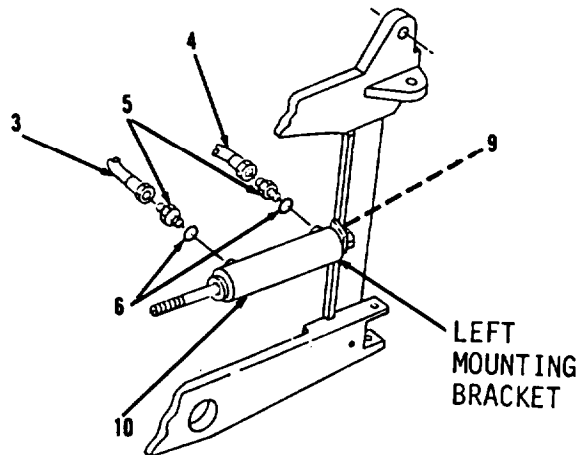
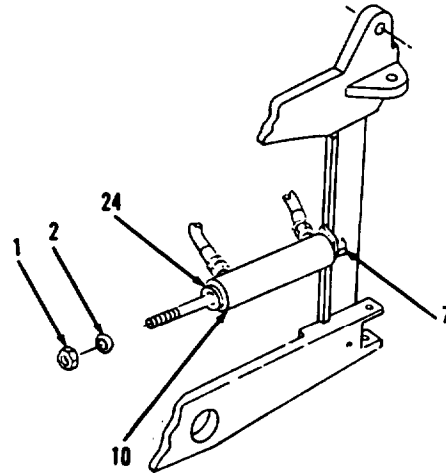
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 10 of 11)

#### INSTALLATION

42. Fill cylinder assembly (10) with approximately two quarts of hydraulic fluid.
43. Attach hoist and sling to cylinder assembly (10) and position on mounting brackets.
44. Using a plastic hammer and 1-13/16" socket and socket wrench handle, install pin (9), washer (8) and nut (7). Tighten nut (7) to a snug fit, then back off 1/8 turn. This procedure is necessary to allow cylinder end movement between mountings and cylinder assembly (10).
45. Install two new preformed packing (6) and two unions (5).
46. Using a 7/8" open end wrench, connect hose assemblies (4 and 3).
47. Using a 1-13/16" socket and socket wrench handle, install washer (2) and nut (1) to cylinder assembly (10).
48. Remove hoist and sling.
49. Check hydraulic fluid level. Add hydraulic fluid, refer to TM 10-3930-643-12.



Go to sheet 11

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-14. Sideshift Cylinder (S/N 2001 and above). (Sheet 11 of 11)

TESTING

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

50. Turn master disconnect switch ON.
51. Start engine.
52. Slowly move sideshift cylinder through at five full movements of travel to bleed air from system.
53. Check for binding of cylinder assembly during operation.
54. Stop engine.
55. Inspect hydraulic hoses, fittings and cylinder assemblies for leaks.

NOTE

Return M10A Forklift to original equipment condition.

Return M10A Forklift to original equipment condition.

END OF TASK

# TM 10-3930-643-34

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 1 of 10)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

---

### INITIAL SETUP

#### Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

#### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Hydraulic fluid (App. C, Item 19)  
Emery cloth (App. C, Item 4)  
Preformed packing (8)  
Wiper (2)  
Nylon rider (2)  
Cotter pin (2)  
Ring

Nuts (15 and 16) to 90 lb-ft.

---

### EQUIPMENT CONDITION

#### References

TM 10-3930-643-10

#### Condition Description

Hydraulic pressure vented.

---

Go to sheet 2

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

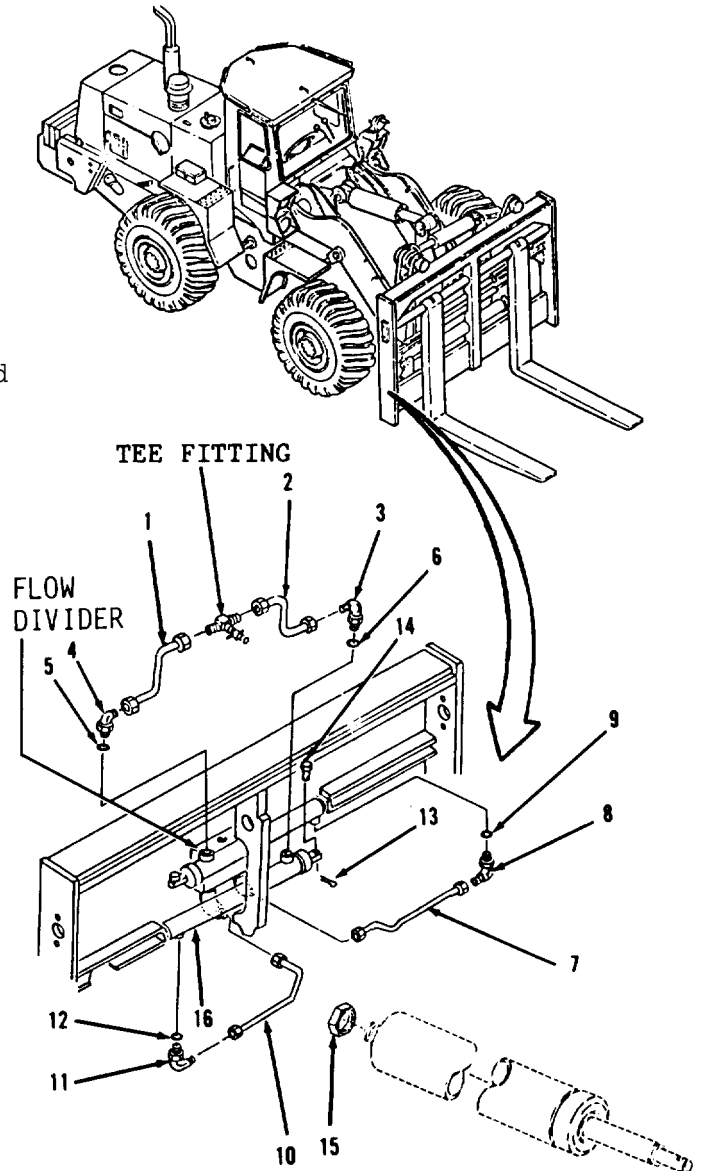
12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 2 of 10)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using an 11/16" open end wrench, disconnect tube assemblies (1 and 2) from tee fitting and elbows (3 and 4) on vehicle carriage assembly.
2. Remove elbows (3 and 4) and preformed packings (5 and 6). Discard preformed packings (5 and 6).
3. Disconnect tube assembly (7) from elbow (8) and flow divider.
4. Remove elbow (8) and preformed packing (9). Discard preformed packing (9).
5. Disconnect tube assembly (10) from elbow (11) and from flow divider.
6. Remove elbow (11) and preformed packing (12). Discard preformed packing (12).
7. Using slip joint pliers, remove cotter pin (13) and pin (14) from cylinder assembly (16) and mounting bracket. Discard cotter pin (13).
8. Using a 1-1/8" socket and socket wrench handle, remove nut (15).



Go to sheet 3

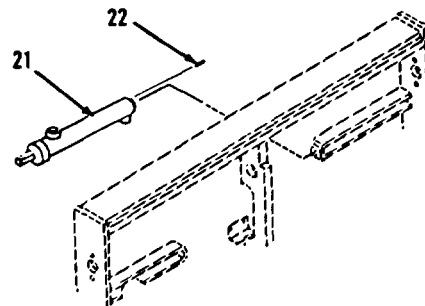
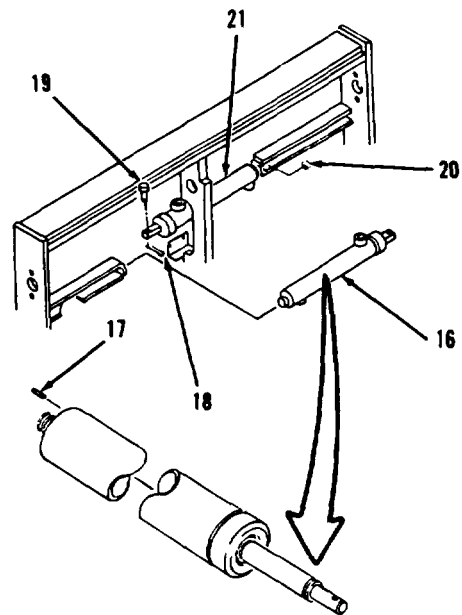
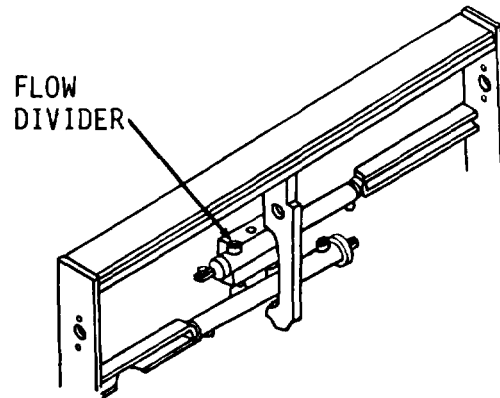
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 3 of 10)

#### REMOVAL

9. Using a rubber mallet, remove cylinder assembly (16) from mounting brackets.
10. Using slip joint pliers, remove pin (17).
11. Using slip joint pliers, remove cotter pin (18) and pin (19) from cylinder assembly (21) and mounting bracket. Discard cotter pin (18).
12. Using a 1-1/8" socket and socket wrench handle, remove nut (20).
13. Using a rubber mallet, remove cylinder assembly (21) from mounting brackets.
14. Using slip joint pliers, remove pin (22).



Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 4 of 10)

DISASSEMBLY

NOTE

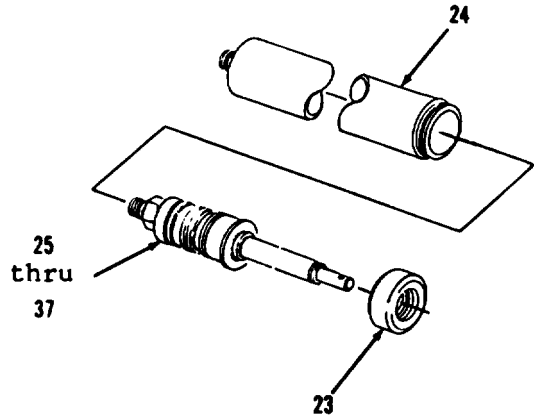
This procedure is for maintenance of the lower fork position cylinder. Procedure for the upper fork position cylinder is identical.

15. Using a strap wrench, remove cap (23) from cylinder shell (24).

NOTE

Observe positioning of wipers, packings, rings and riders when removing them. Record positioning, as necessary, for proper assembly.

16. Remove items 25 thru 37 as an assembly from cylinder shell (24).



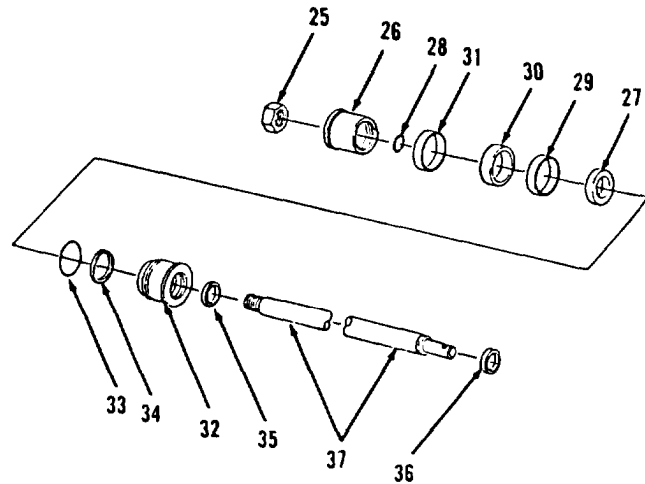
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 5 of 10)

#### DISASSEMBLY

17. Using a 14" adjustable wrench, remove nut (25) from rod (37).
18. Using a plastic hammer, remove piston half (26) with attached parts.
19. Remove piston half (27) and preformed packing (28). Discard preformed packing (28).
20. Remove and discard nylon rider (29), preformed packing (30) and nylon rider (31) from piston half (26).
21. Remove bushing (32) from rod (37).
22. Remove and discard preformed packing (33), ring (34) and preformed packing (35) from bushing (32).
23. Remove and discard wiper (36) from rod (37).



Go to sheet 6



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 6 of 10)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

24. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
25. Inspect rod (37) and inside of cylinder shell (24) for scratches, grooves, or burrs. Small burrs and shallow scratches can be polished out with fine emery cloth and oil.
26. Inspect piston half (26), piston half (27), rod (37) and cylinder shell (24). Replace items which cannot be repaired and items with scoring, scratches or burrs.

Go to sheet 7

## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

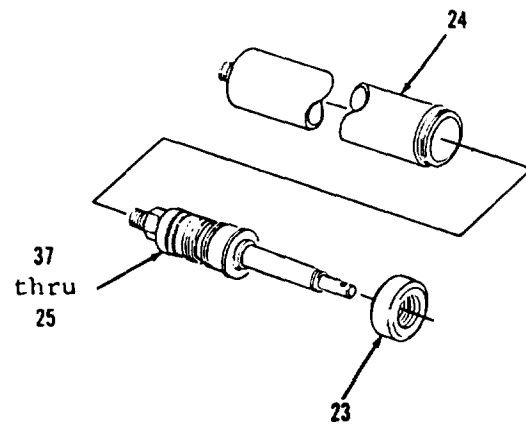
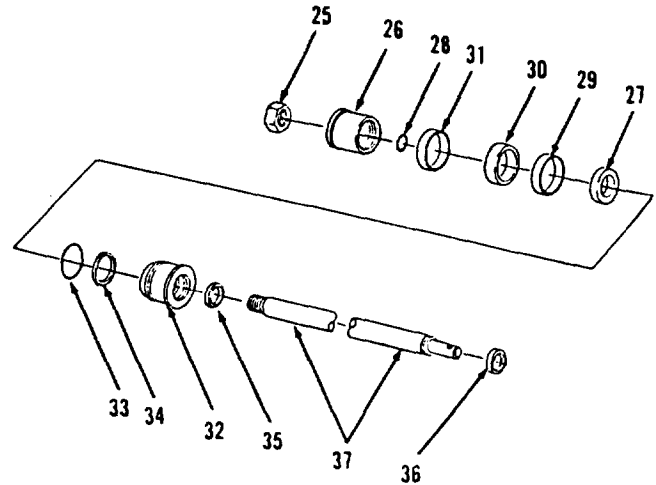
12-15. Fork Position Cylinders (S/N 2000 and below). (sheet 7 of 10)

#### CLEANING/INSPECTION

27. Inspect all other parts. Refer to paragraph 2-9.

#### ASSEMBLY

28. Coat bushing (32), rod (37) and inside of cylinder shell (24) with clean hydraulic fluid,
29. Coat new wiper (36) with clean hydraulic fluid and using seal installer, install on rod (37).
30. Coat new preformed packing (35), new ring (34) and new preformed packing (33) with clean hydraulic fluid and install on bushing (32).
31. Install bushing (32) on rod (37).
32. Coat new preformed packing (28), new nylon rider (31), new preformed packing (30), and new nylon rider (29) with clean hydraulic fluid and install on piston half (26).
33. Coat piston half (27) and piston half (26) with clean hydraulic fluid.
34. Install piston half (27) and piston half (26) with attached parts on rod (37).
35. Using a 14" adjustable wrench, install nut (25).
36. Install items 37 thru 25 as an assembly in cylinder shell (24).
37. Using a strap wrench, install cap (23) on cylinder shell (24).



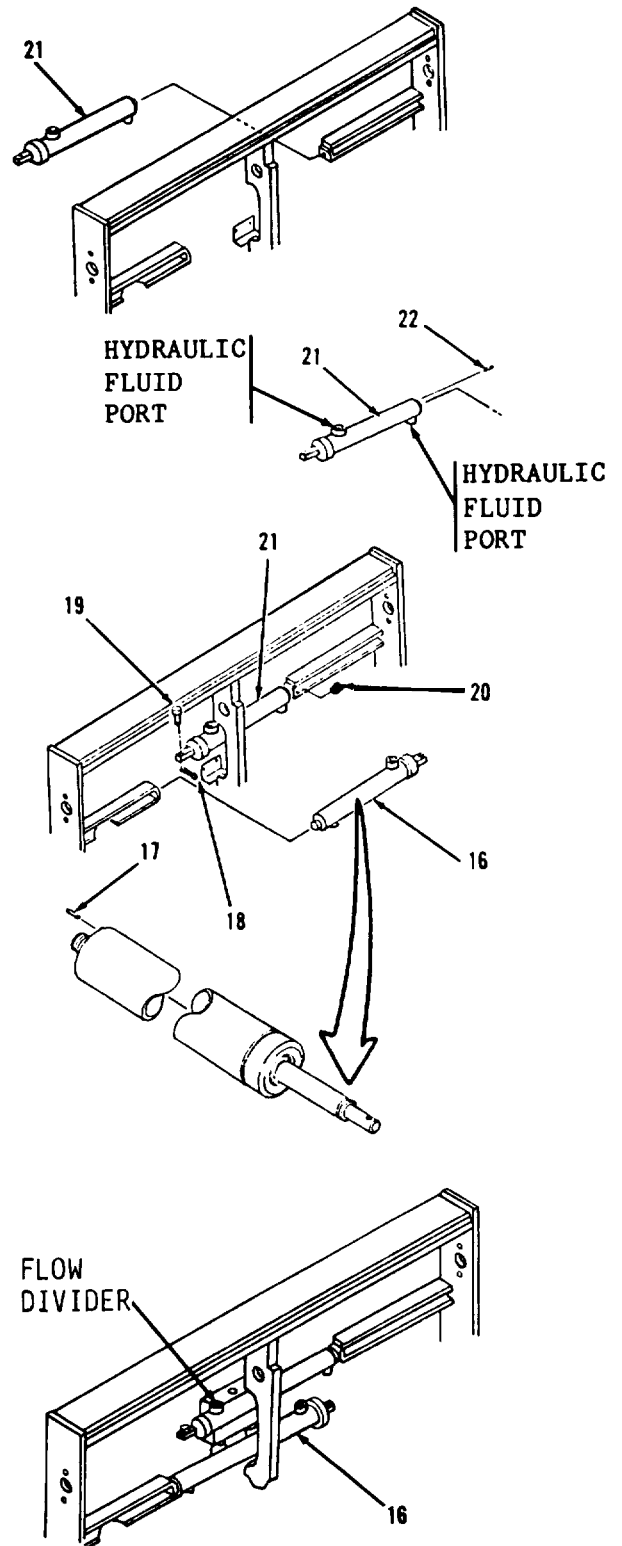
Go to sheet 8

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 8 of 10)

INSTALLATION

38. Install cylinder assembly (21) in mounting bracket. Hydraulic fluid ports are to be positioned as shown.
39. Using a plastic mallet, install pin (22).
40. Using a 1-1/8" socket and torque wrench, install nut (20) and tighten to 90 lb-ft, then back off 1/4 turn. This is necessary to allow cylinder end movement between the bracket and cylinder assembly.
41. Using a plastic hammer and slip joint pliers, install pin (19) and new cotter pin (18).
42. Install cylinder assembly (16) in mounting bracket. Hydraulic fluid ports are to be positioned as shown.
43. Using a plastic hammer, install pin (17).



Go to sheet 9

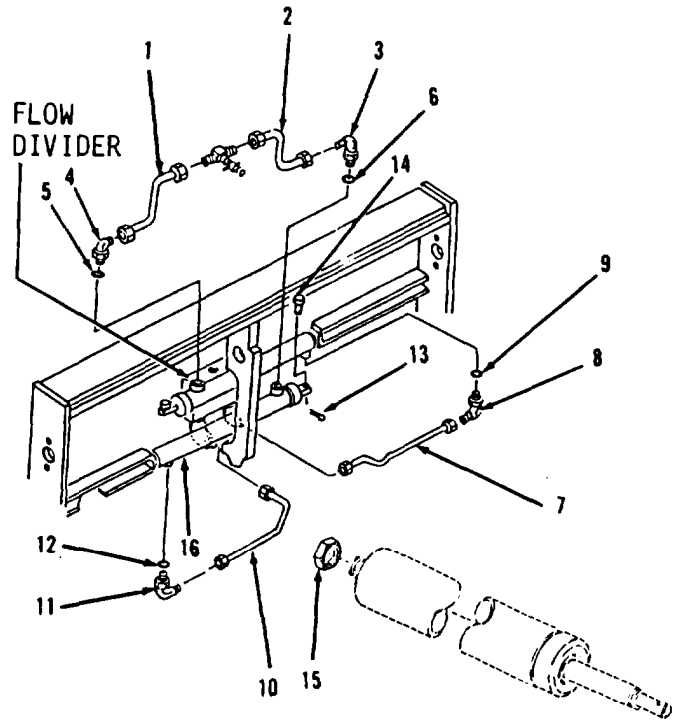
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 9 of 10)

#### INSTALLATION

44. Using a 1-1/8" socket and torque wrench, install nut (15) and tighten to 90 lb-ft, then back off 1/4 turn. This is necessary to allow cylinder end movement between the bracket and cylinder assembly,
45. Using a plastic hammer and slip joint pliers, install pin (14) and new cotter pin (13).
46. Using an 11/16" open end wrench, install new preformed packing (12) and elbow (11) .
47. Install tube assembly (10) at elbow (11) and flow divider. Tighten both ends.
48. Install new preformed packing (9) and elbow (8).
49. Install tube assembly (7) at elbow (8) and flow divider. Tighten both ends.
50. Install new preformed packings (6 and 5) and elbows (4 and 3).
51. Connect tube assemblies (2 and 1) to tee fitting and to elbows (4 and 3).
52. Check hydraulic fluid level. Add hydraulic fluid if necessary, refer to LO 10-3910-643-12.



Go to sheet 11

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-15. Fork Position Cylinders (S/N 2000 and below). (Sheet 10 of 10)

TESTING

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

53. Start engine.
54. Operate fork position cylinder slowly.
55. Move fork position cylinder through at least five full movements of travel to bleed air from system.
56. Check for binding in operation of hydraulic cylinders and vehicle.
57. Stop engine.
58. Inspect hydraulic fluid tubes, fittings and cylinder assemblies for leaks.
59. Check hydraulic fluid level again. Add hydraulic fluid, if necessary, refer to LO 10-3930-643-12.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

# TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 1 of 10)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

---

## INITIAL SETUP

### Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Hydraulic fluid (App. C, Item 19)  
Small tag (App. C, Item 28)  
Fine emery cloth (App. C, Item 4)  
Seal (4)  
Preformed packing (5)  
Cotter pin (2)  
Strip  
Wiper

### Torques

Nuts (15 and 20) to 90 lb-ft.

---

## EQUIPMENT CONDITION

### References

TM 10-3930-643-10

### Condition Description

Hydraulic pressure vented.

---

Go to sheet 2

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

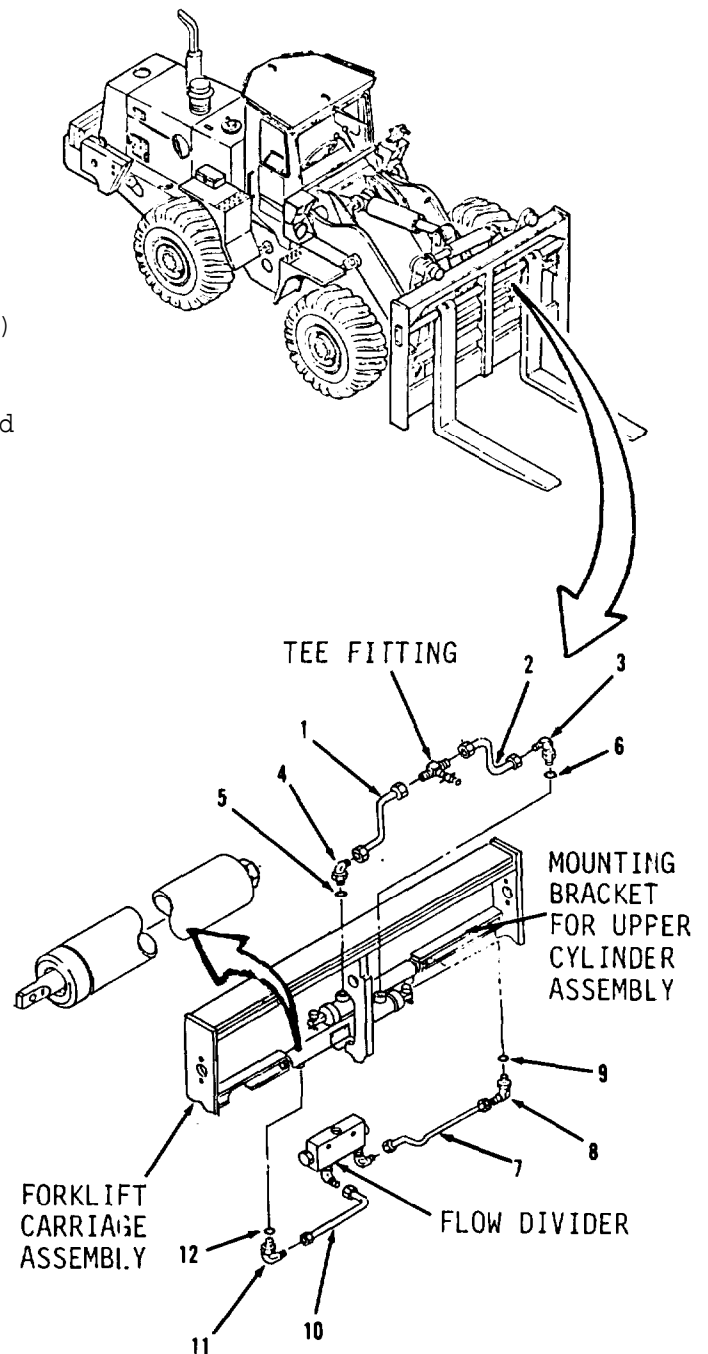
12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 2 of 10)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using an 11/16" open end wrench, disconnect tube assemblies (1 and 2) from tee fitting and elbows (3 and 4) on vehicle carriage assembly.
2. Remove elbows (3 and 4) and preformed packings (5 and 6). Discard preformed packings (5 and 6).
3. Disconnect tube assembly (7) from elbow (8) and flow divider.
4. Remove elbow (8).
5. Remove and discard preformed packing (9).
6. Disconnect tube assembly (10) from elbow (11) and flow divider.
7. Remove elbow (11) and preformed packing (12). Discard preformed packing (12).



Go to sheet 3

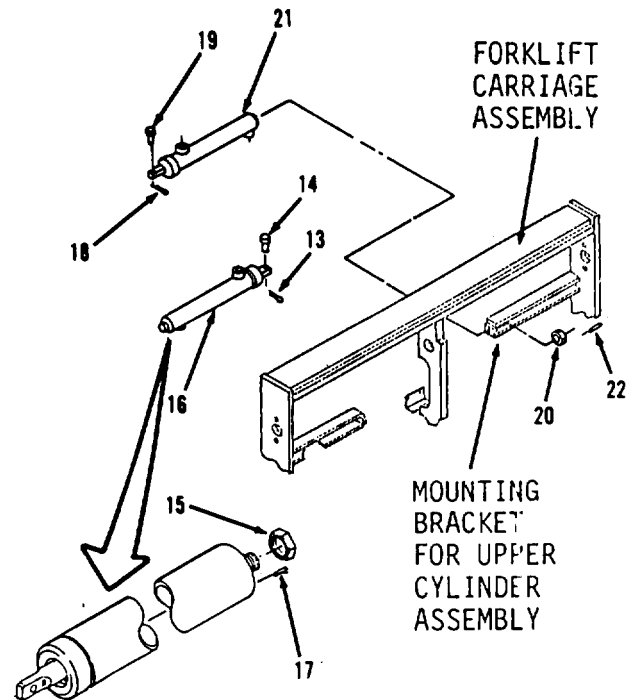
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 3 of 10)

#### REMOVAL

8. Using slip joint pliers, remove cotter pin (13) and pin (14) from cylinder assembly (16) and mounting bracket.
9. Using a 1-1/8" socket and socket wrench handle, remove nut (15).
10. Remove cylinder assembly (16) from mounting brackets.
11. Using slip joint pliers, remove pin (17).
12. Using slip joint pliers, remove cotter pin (18) and pin (19) from cylinder assembly (21) and mounting bracket. Discard cotter pin (18).
13. Using a 1-1/8" socket and socket wrench handle, remove nut (20).
14. Remove cylinder assembly (21) from mounting brackets.
15. Using slip joint pliers, Remove pin (22).



Go to sheet 4

**12-144**



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 4 of 10)

DISASSEMBLY

NOTE

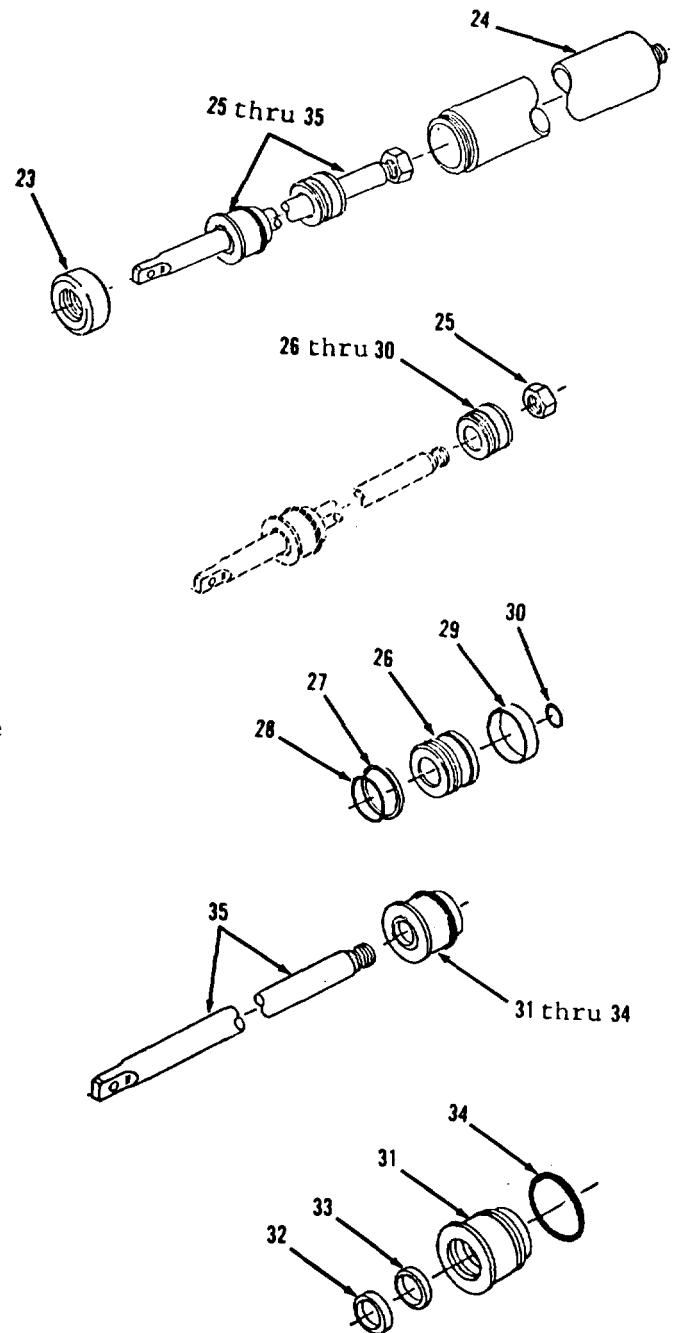
This procedure is for maintenance of the lower fork position cylinder. Procedure for the upper fork position cylinder is identical.

16. Using a strap wrench, remove collar (23) from barrel (24).

NOTE

Observe positioning of seals, wipers, strip and packings when removing them. Record positioning, as necessary, for proper assembly.

17. Remove items 25 thru 35 as an assembly from barrel (24).
18. Using a 14" adjustable wrench, remove nut (25).
19. Remove items 26 thru 30 as an assembly.
20. Remove and discard seal (27) and preformed packing (28) from piston (26).
21. Remove and discard strip (29) and seal (30).
22. Remove items 31 thru 34 as an assembly from shaft (35).
23. Remove and discard wiper (32) and seals (33 and 34) from retainer (31).



Go to sheet 5

## TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 5 of 10)

### CLEANING/INSPECTION

#### **WARNING**

##### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

##### ● COMPRESSED AIR HAZARD

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

24. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 6

**12-146**

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 6 of 10)

CLEANING/INSPECTION (cont)

25. Inspect shaft (35) and inside of barrel (24) for scratches, grooves, burrs or other damage which could cause a malfunction. Use fine emery cloth and oil to remove small burrs and shallow scratches.
26. Inspect piston (26), retainer (31), barrel (24) and shaft (35) and replace items which cannot be repaired or have scoring, scratches or burrs. Replace items with damage which might cause a malfunction; this may include indentations, flat sides and such distortions as bent shafts. Threads on barrel (24) and shaft (35) must not be damaged. Be sure residues of abrasives and foreign matter have been cleaned away prior to assembly.
27. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 7

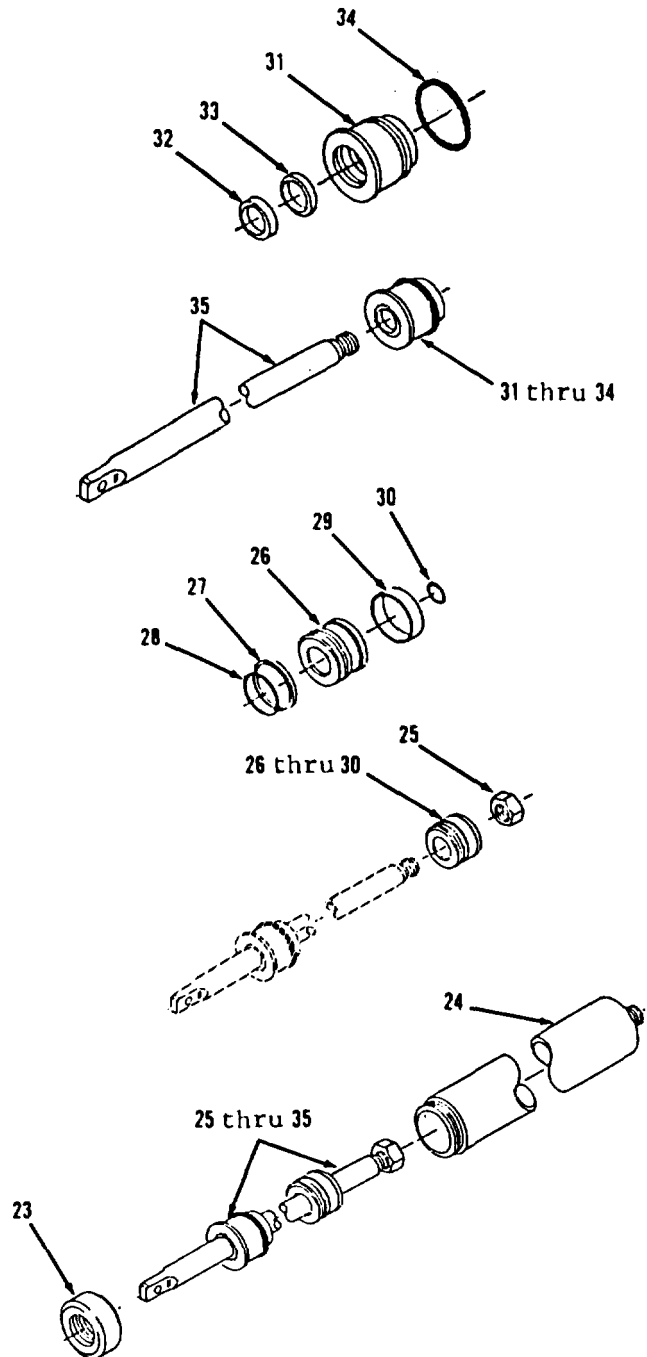
# TM 10-3930-643-34

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 7 of 10)

### ASSEMBLY

28. Coat retainer (31), shaft (35) and new seal (30) with clean hydraulic fluid.
29. Coat new seals (34 and 33) and new wiper (32) with clean hydraulic fluid.
30. Install seals (34 and 33) on retainer (31). Use suitable seal installer, if necessary. Lip on seal (33) is to face inside cylinder.
31. Install new wiper seal (32) on retainer (31).
32. Install items (34 thru 31) on shaft (35).
33. Coat new seal (30), new strip (29), new preformed packing (28) and new seal (27) with clean hydraulic fluid.
34. Install new seal (30), new strip (29), new preformed packing (28) and new seal (27) on piston (26). Use suitable seal expander, if necessary.
35. Coat piston (26) with clean hydraulic fluid.
36. Install items (30 thru 26) on shaft (35).
37. Using a 14" adjustable wrench, install nut (25).
38. Coat inside of barrel (24) liberally with clean hydraulic fluid.



Co to sheet 8

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

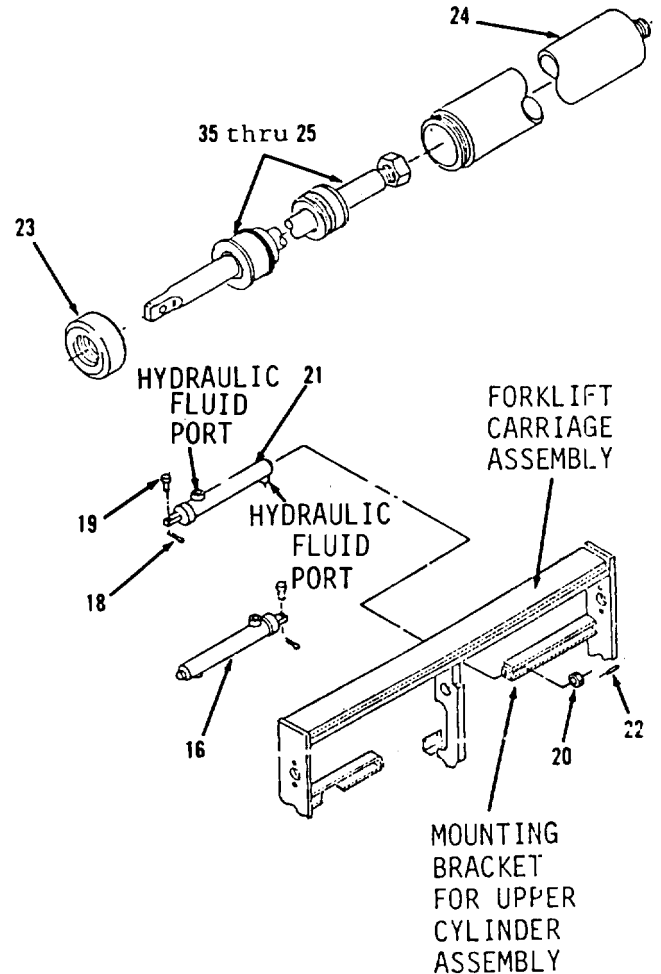
12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 8 of 10)

ASSEMBLY (cont)

- 39. Install items 35 thru 25 as an assembly in barrel (24).
- 40. Using a strap wrench, install collar (23) on barrel (24). Tighten until snug.

INSTALLATION

- 41. Install cylinder assembly (21) in mounting bracket. Hydraulic fluid ports are to be positioned as shown.
- 42. Using a plastic mallet, install pin (22).
- 43. Using a 1-1/8" socket and torque wrench, install nut (20) and tighten to 90 lb-ft, then back off 1/4 turn. This is necessary to allow cylinder end movement between the bracket and cylinder assembly.
- 44. Using a plastic hammer and slip joint pliers, install pin (19) and new cotter pin (18).
- 45. Install cylinder assembly (16) in mounting bracket. Hydraulic fluid ports are to be positioned as shown.



Go to sheet 9

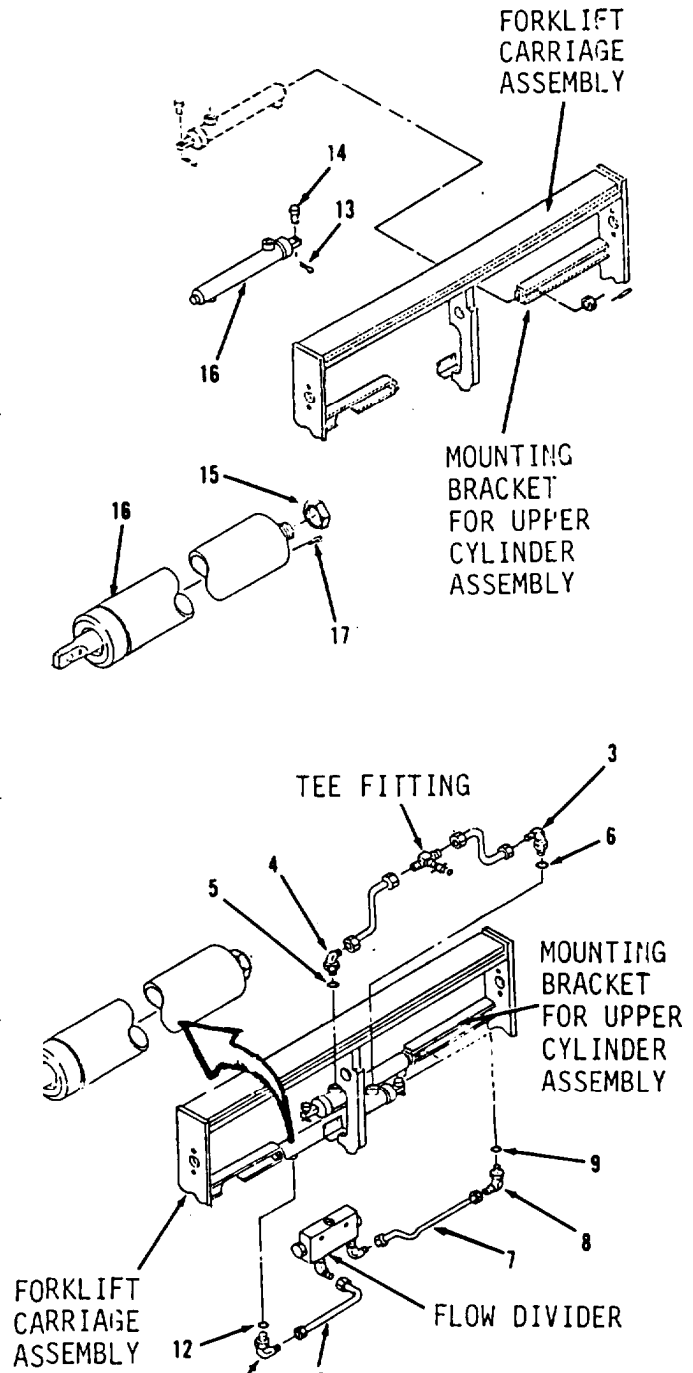
# TM 10-3930-643-34

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 9 of 10)

### INSTALLATION

46. Using a plastic hammer, install pin (17).
47. Using a 1-1/8" socket and torque wrench, install nut (15) and tighten to 90 lb-ft, then back off 1/4 turn. This is necessary to allow cylinder end movement between the bracket and cylinder assembly.
48. Using a plastic hammer and slip joint pliers, install pin (14) and new cotter pin (13).
49. Using an 11/16" open end wrench, install new preformed packing (12) and elbow (11).
50. Install tube assembly (10) at elbow (11) and flow divider. Tighten both ends.
51. Install new preformed packing (9) and elbow (8).
52. Install tube assembly (7) at elbow (8) and flow divider. Tighten both ends.
53. Install new preformed packings (6 and 5) and elbows (4 and 3).



Go to sheet 10

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-16. Fork Position Cylinders (S/N 2001 and above). (Sheet 10 of 10)

INSTALLATION (cont)

54. Connect tube assemblies (2 and 1) to tee fitting and to elbows (4 and 3).
55. Check hydraulic fluid level. Add hydraulic fluid if necessary, refer to LO 10-3910-643-12.

TESTING

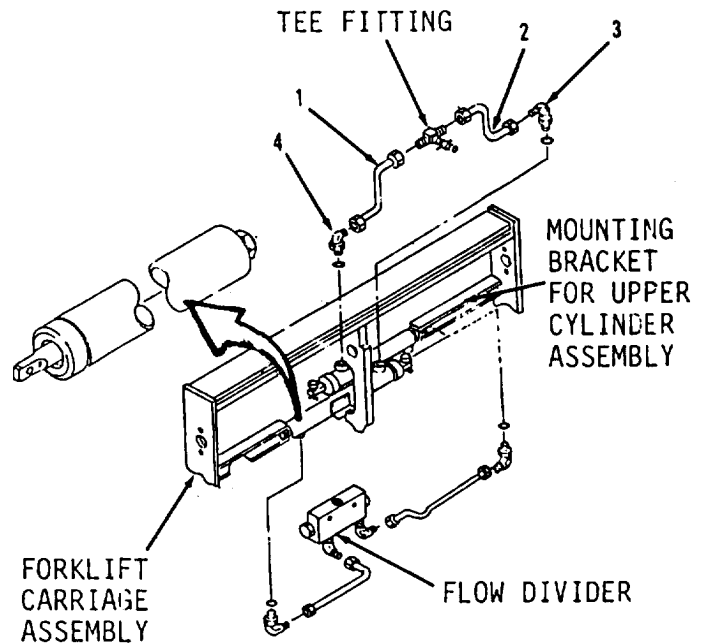
**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

56. Start engine.
57. Operate fork position cylinder slowly.
58. Move fork position cylinder through at least five full movements of travel to bleed air from system.
59. Check for binding in operation of hydraulic cylinders and vehicle.
60. Stop engine.
61. Inspect hydraulic fluid tubes, fittings and cylinder assemblies for leaks.
62. Check hydraulic fluid level again. Add hydraulic fluid, if necessary, refer to LO 10-3930-643-12.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

## TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 1 of 8)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

---

### INITIAL SETUP

#### Tools

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

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705

Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Hoist and sling

#### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)

Clean cloth (App. C, Item 24)

Small tag (App. C, Item 28)

Hydraulic fluid (App. C, Item 19)

Multi-purpose grease  
(App. C, Item 12)

Seal (4)

Ring (4)

Preformed packing (4)

Wiper

Bearing

Retainer bearing

#### Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

### EQUIPMENT CONDITION

#### References

TM 10-3930-643-10

#### Condition Description

Hydraulic pressure vented.

---

Go to sheet 2



## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

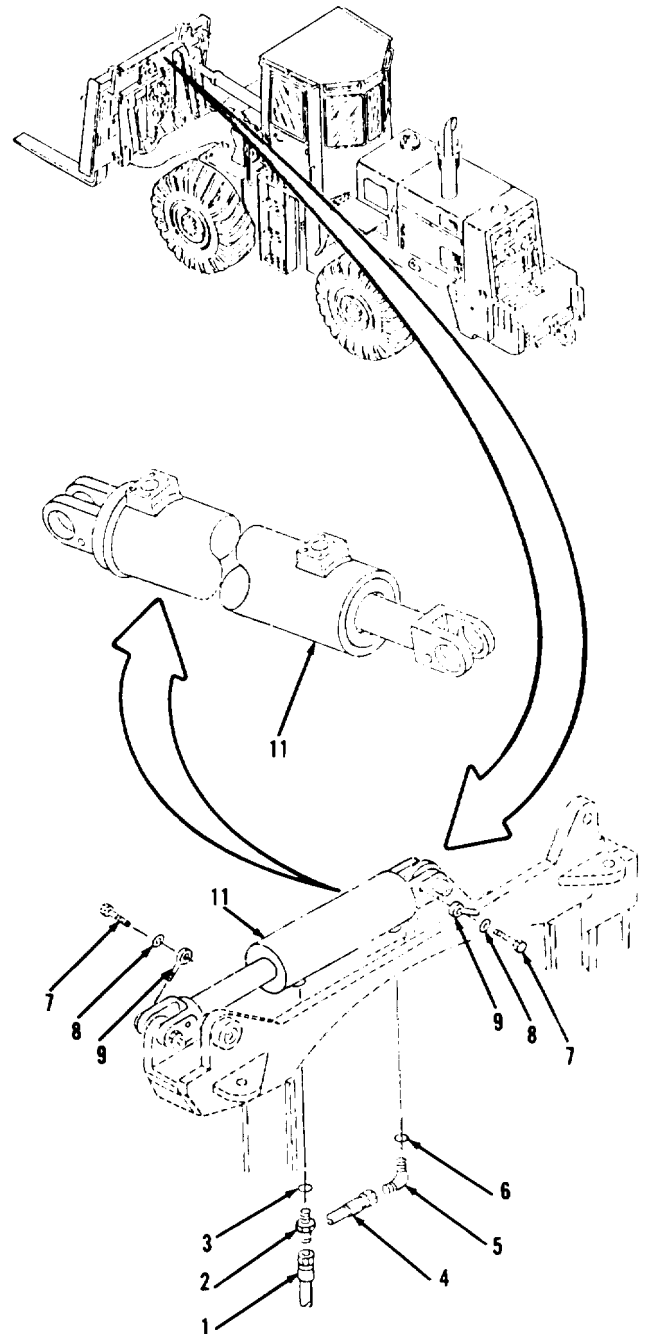
12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 2 of 8)

REMOVAL

## NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 7/8" open end wrench, disconnect hose assembly (1) and union (2) from cylinder assembly (11) from vehicle carriage assembly.
2. Using a scribe, remove and discard preformed packing (3).
3. Using a 7/8" open end wrench, disconnect hose assembly (4) and elbow (5) from cylinder assembly (11).
4. Using a scribe, remove and discard preformed packing (6).
5. Using a 3/4" socket and socket wrench handle, remove two screws (7), washers (8) and anchors (9).



Go to sheet 3

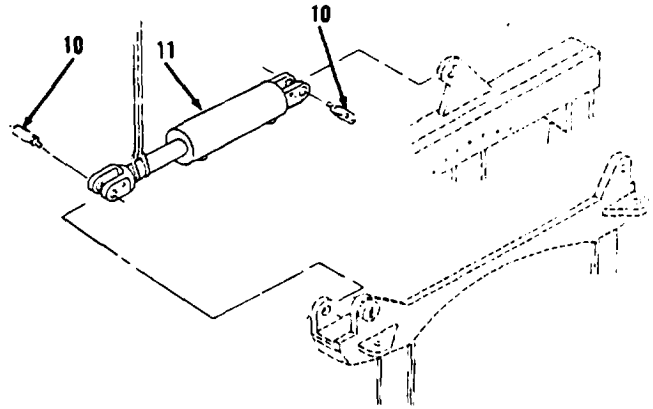
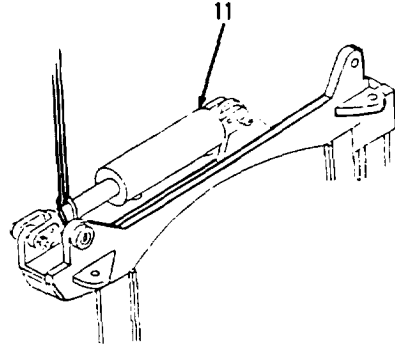
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 3 of 8)

#### REMOVAL

6. Attach hoist and sling to cylinder assembly (11).
7. Using a hammer and wooden dowel, remove two pins (10). Drive pins (10) out using care not to damage pins (10).
8. Using a hoist and sling, remove cylinder assembly (11) from mounting brackets and place on a suitable work bench.
9. Remove hoist and sling.



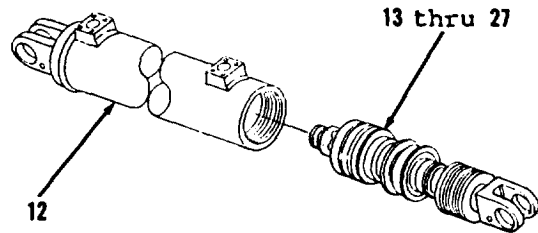
#### DISASSEMBLY

10. Using a spanner wrench, loosen retainer (13) from cylinder assembly (11).

#### NOTE

Observe positioning of seals, wipers and packings when removing them. Record positioning, as necessary, for proper assembly.

11. Remove items 13 thru 27 as an assembly from cylinder shell (12).



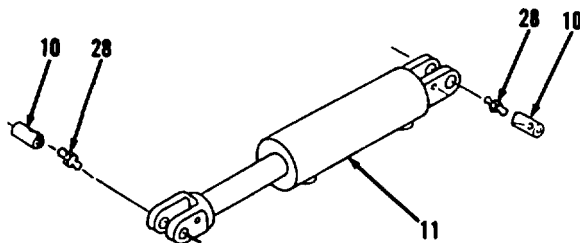
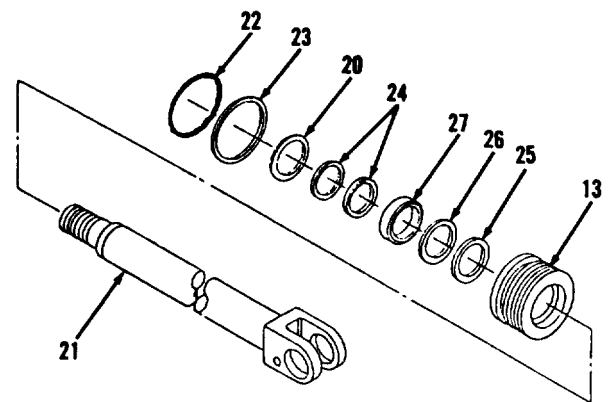
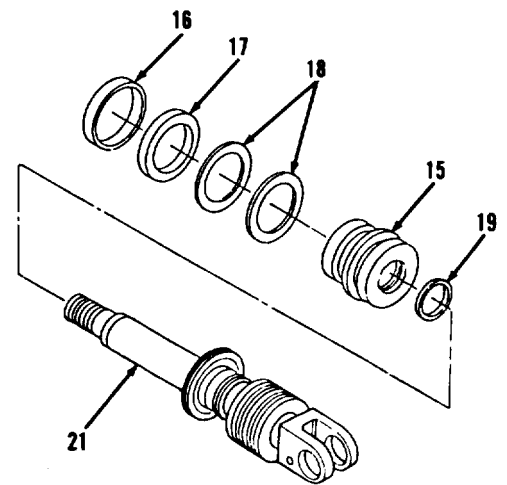
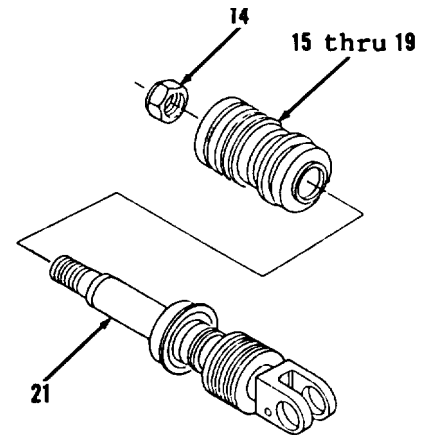
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 4 of 8)

DISASSEMBLY (cont)

12. Using a 14" adjustable wrench, remove nut (14).
13. Remove items 15 thru 19 as an assembly from rod (21).
14. Using a scribe, remove and discard bearing (16), seal (17), two rings (18) and preformed packing (19) from piston (15).
15. Pull rod (21) through parts remaining on rod (21) to facilitate removal of retainer bearing (20).
16. Remove and discard retainer bearing (20).
17. Remove and discard preformed packing (22), ring (23), two seals (24), wiper ring (25), ring (26) and seal (27).
18. Remove retainer (13).
19. Using a 5/16" socket and socket wrench handle, remove two fittings (28) from pins (10).



## TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 5 of 8)

### CLEANING/INSPECTION

#### **WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

20. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
21. Inspect piston (15), rod (21) and inner and outer surfaces of cylinder shell (12). Replace items which cannot be repaired and items which have burrs, scoring, scratches, or grooves.
22. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 6

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 6 of 8)

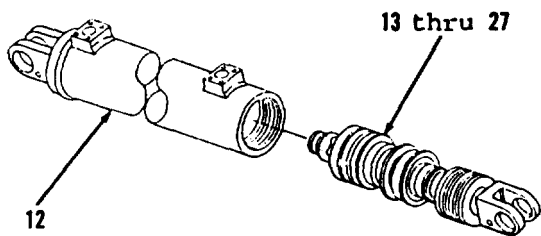
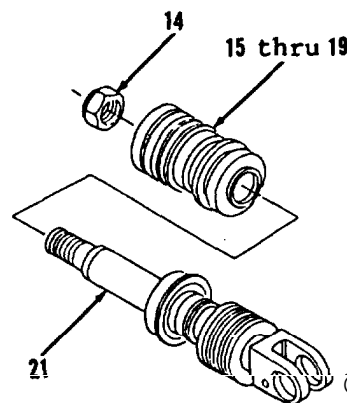
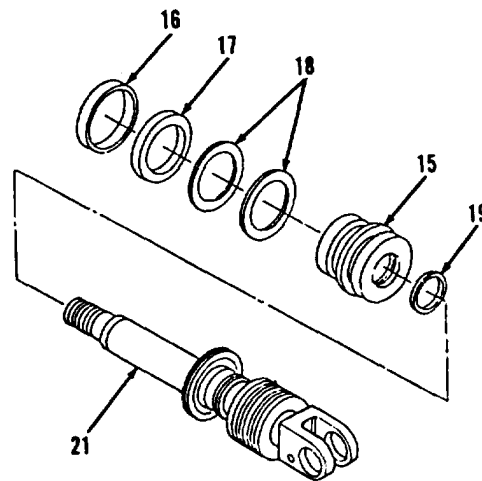
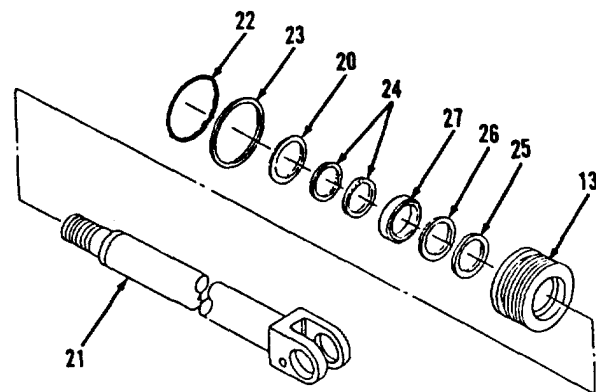
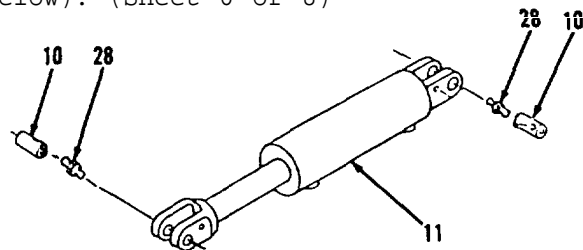
ASSEMBLY

23. Using a 5/16" socket and socket wrench handle, install two fittings (28) on two pins (10).
24. Coat retainer (13), rod (21) and inside of cylinder shell (12) with clean hydraulic fluid.
25. Install retainer (13) on rod (21).

NOTE

Lubricate all preformed packings, wipers, seals, sliding parts and housing before installing.

26. Install new retainer bearing (20) on rod (21).
27. Install new preformed packing (19), two rings (18), new bearing (16) and new seal (17) on piston (15). Lip on seal (17) is to face inside cylinder.
28. Install items 19 thru 15 as an assembly on rod (21).
29. Using an adjustable wrench, install nut (14) on rod (21).
30. Install items 27 thru 14 as an assembly in cylinder shell (12).
31. Using a spanner wrench, tighten retainer (13) on cylinder assembly (11).



Go to sheet 7

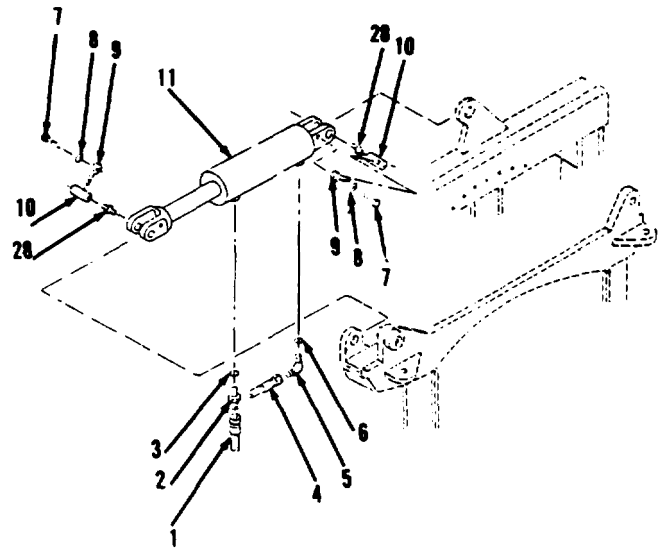
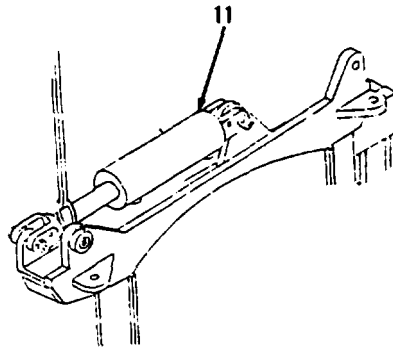
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 7 of 8)

#### INSTALLATION

32. Attach hoist and sling on cylinder assembly (11).
33. Position cylinder assembly (11) on vehicle carriage assembly.
34. Using a rubber mallet, install two pins (10).
35. Remove hoist and sling.
36. Using a 3/4" socket and socket wrench handle, install two anchors (9), washers (8) and screws (7).
37. Using a 5/16" socket and socket wrench handle, install two fittings (28).
38. Install new preformed packing (6).
39. Using a 7/8" open end wrench, connect elbow (5) and hose assembly (4) on cylinder assembly (11).
40. Install new preformed packing (3).
41. Connect union (2) and hose assembly (1) on cylinder assembly (11).
42. Lubricate two fittings (28) until clean grease appears. Use multi-purpose grease where temperature allows. If necessary, refer to LO 10-3930-643-12.
43. Check hydraulic fluid level. Add hydraulic fluid, if necessary, refer to LO 10-3930-643-12.



Go to sheet 8

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-17. Oscillation Cylinder (S/N 2000 and below). (Sheet 8 of 8)

TESTING

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

44. Start engine.
45. Operate oscillation cylinder slowly.
46. Move oscillation cylinder through at least five full movements of travel to bleed air from system.
47. Check for binding in hydraulic cylinder operation.
48. Stop engine.
49. Inspect hydraulic fluid hoses, fittings and cylinder assemblies for leaks.
50. Check hydraulic fluid level again. Add fluid, if necessary, refer to LO 10-3930-643-12.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

## TM 10-3930-643-34

### HYDRAULIC TROUBLESHOOTING AND MAINTENANCE.

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 1 of 10)

This task covers:

a. Removal	b. Disassembly
c. Cleaning/Inspection	d. Assembly
e. Installation	f. Testing

---

#### INITIAL SETUP

##### Tools

Shop Equipment, Automotive  
Maintenance and Repair:  
Organizational Maintenance,  
Common No. 1, Less Power  
NSN 4910-00-754-0654  
Shop Equipment, Automotive  
Maintenance and Repair:  
Organizational Maintenance,  
Common No. 2, Less Power  
NSN 4910-00-754-0650  
Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Hoist and sling  
1-7/8" socket and socket  
wrench handle  
NSN 5120-00-169-2990

##### Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Hydraulic fluid (App. C, Item 19)  
Fine emery cloth (App. C, Item 4)  
Preformed packing (4)  
Seal (3)  
Wiper  
Strip

##### Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

#### EQUIPMENT CONDITION

##### References

TM 10-3930-643-10

##### Condition Description

Hydraulic pressure vented.

---

Go to sheet 2

**12-160**



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

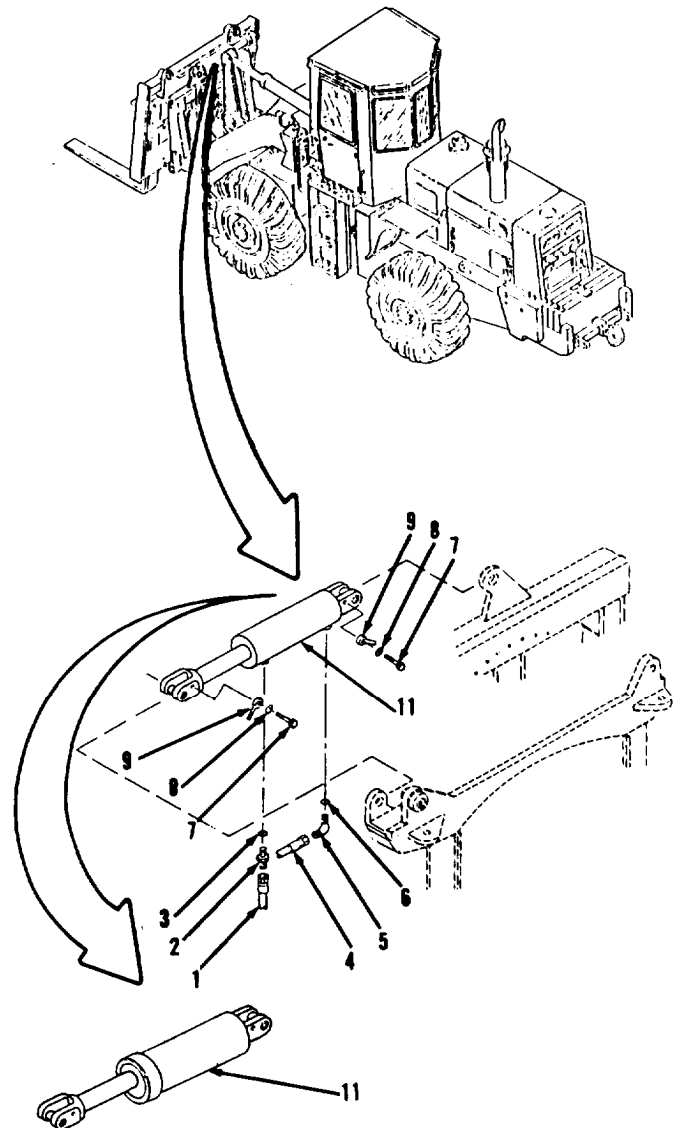
12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 2 of 10)

REMOVAL

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation. Cap all hose ends to prevent contamination.

1. Using a 7/8" open end wrench, disconnect hose assembly (1) and union (2) from cylinder assembly (11) from vehicle carriage assembly.
2. Using a scribe, remove and discard preformed packing (3).
3. Using a 7/8" open end wrench, disconnect hose assembly (4) and elbow (5) from cylinder assembly (11).
4. Using a scribe, remove and discard preformed packing (6).
5. Using a hammer, 3/4" socket and socket wrench handle, remove two bolts (7), washers (8) and anchors (9).



Go to sheet 3

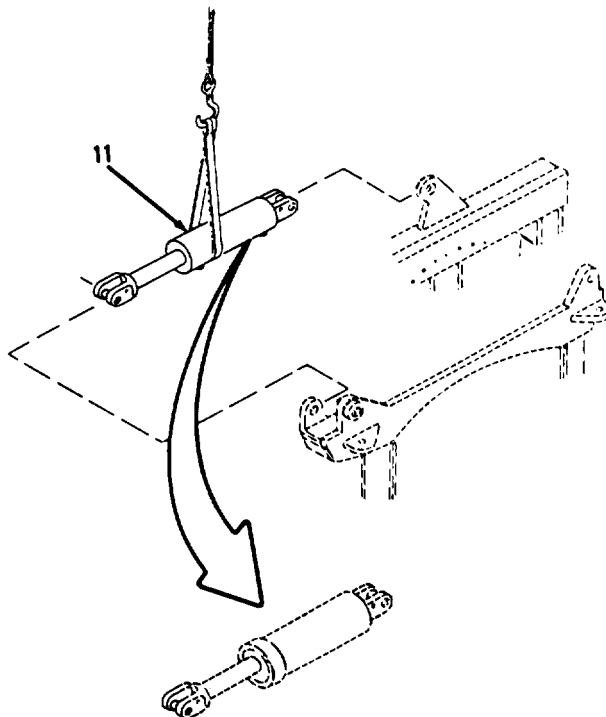
## TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 3 of 10)

### REMOVAL

6. Attach hoist and sling to barrel (13) on cylinder assembly (11). Remove slack from sling.
7. Using a hammer and wooden dowel, remove two pins (10). Drive pins (10) out, using care not to damage pins (10) or fittings (25).
8. Using a hoist and sling, remove cylinder assembly (11) from mounting brackets. For convenience, lower cylinder assembly (11) onto suitable repair stand or work bench with padding.
9. Remove hoist and sling.



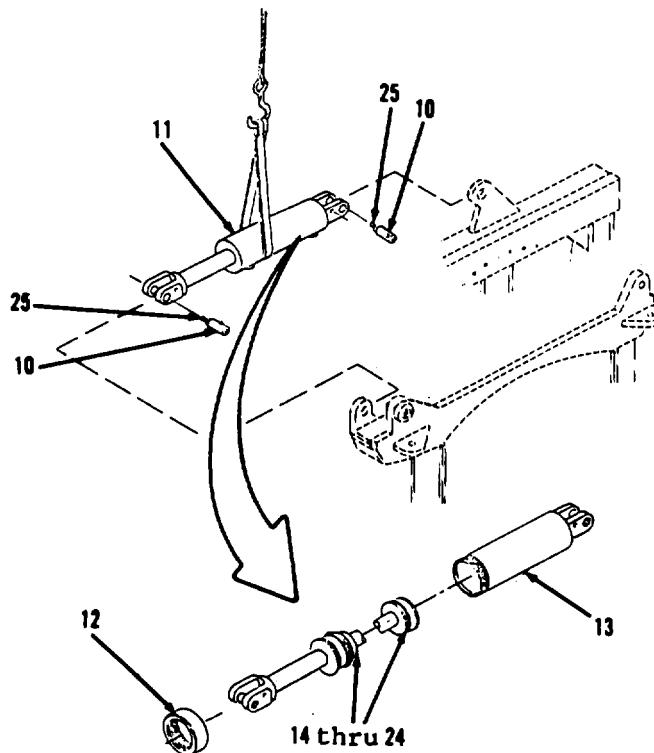
### DISASSEMBLY

10. Using a strap wrench, remove collar (12) from barrel (13) from cylinder assembly (11).

### NOTE

Observe positioning of seals, wipers and packings when removing them. Record positioning, as necessary, for proper assembly.

11. Using a rubber mallet, remove items 14 thru 24 as an assembly from barrel (13).



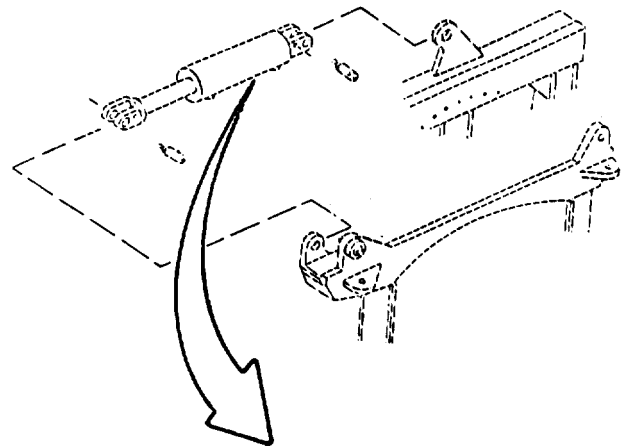
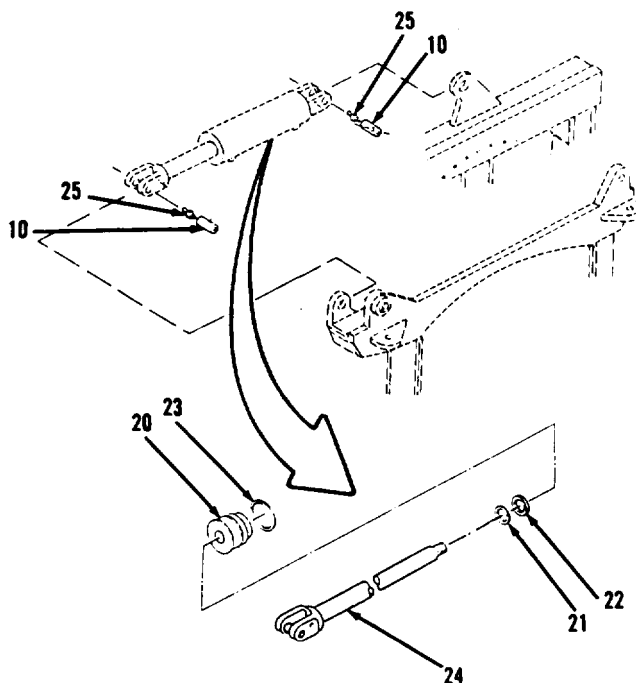
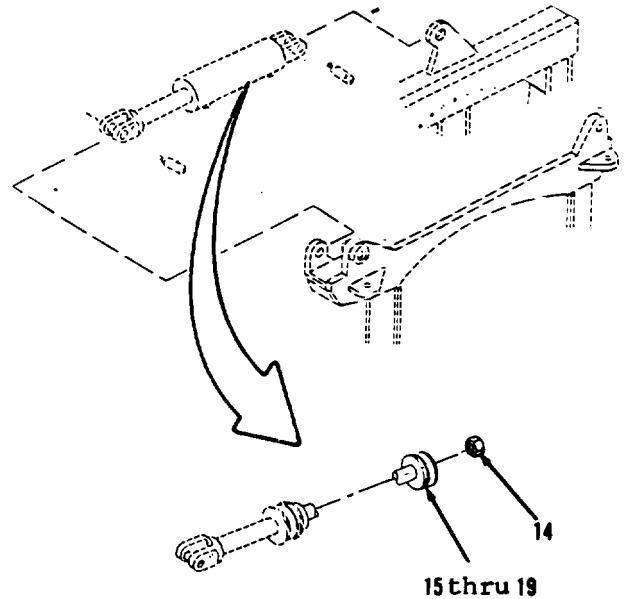
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 4 of 10)

DISASSEMBLY (cont)

12. Using a 1-7/8" socket, socket wrench handle and vise, remove nut (14).
13. Remove items 15 thru 19 as an assembly.
14. Using a scribe, remove and discard seal (16) and preformed packing (17).
15. Remove and discard strip (18) and preformed packing (19).
16. Remove items 20 thru 23 as an assembly.
17. Remove gland (20) from rod (24).
18. Remove and discard wiper (21) and seals (22 and 23).
19. Using a 5/16" box and open end wrench, remove two fittings (25) from pin (10).



Go to sheet 5

## TM 10-3930-643-34

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 5 of 10)

### CLEANING/INSPECTION

#### **WARNING**

##### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

##### ● COMPRESSED AIR HAZARD

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

20. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

go to sheet 6

12-164

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 6 of 10)

CLEANING/INSPECTION (cont)

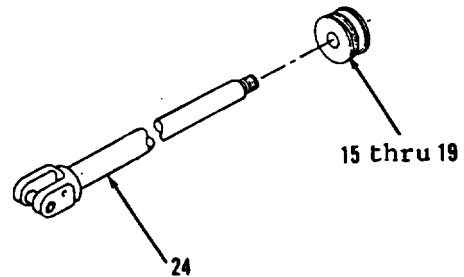
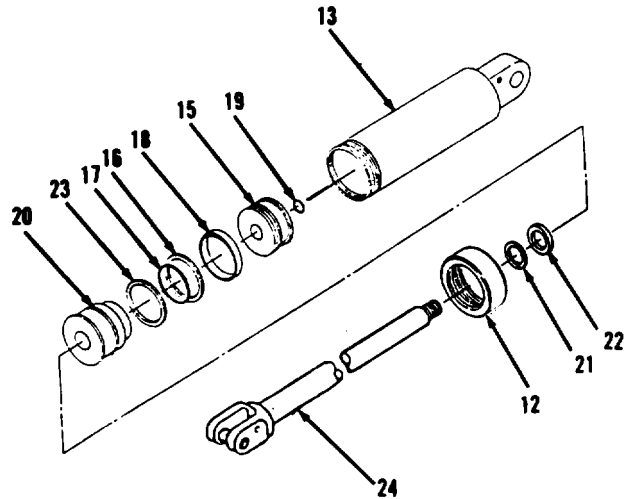
21. Inspect rod (24) and inside of barrel (13) for scratches, grooves, burrs, or other damage which might cause a malfunction. Small burrs and shallow scratches can be polished out with fine emery cloth and oil.
22. Inspect piston (15), gland (20), rod (24) and barrel (13) and replace items which cannot be repaired and items which have scoring, scratches, burrs, or other damage which might cause a malfunction. Threads on barrel (13) and rod (24) must not be damaged. Be sure residues of abrasives and foreign matter have been cleaned away prior to assembly.
23. Inspect all other parts. Refer to paragraph 2-9.

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 7 of 10)

ASSEMBLY

24. Coat rod (24) and inside of barrel (13) with clean hydraulic fluid.
25. Coat new seals (23 and 22) and new wiper (21) with clean hydraulic fluid.
26. Install new seals (23 and 22) on gland (20) using suitable seal installer, if necessary. Lip on properly installed seal (22) faces inside cylinder assembly (11). Wiper (21) will be placed, as shown.
27. Dip gland (20) in clean hydraulic fluid.
28. Install gland (20) on rod (24).
29. Coat new preformed packing (17), new seal (16), new preformed packing (19) and new strip (18) with clean hydraulic fluid.
30. Install new preformed packing (17), new seal (16), new preformed packing (19) and new strip (18) on piston (15), using suitable seal expander, if necessary.
31. Dip items 15 thru 19 as an assembly in clean hydraulic fluid and install on rod (24).



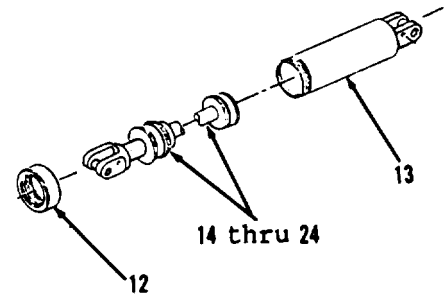
Go to sheet 8

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 8 of 10)

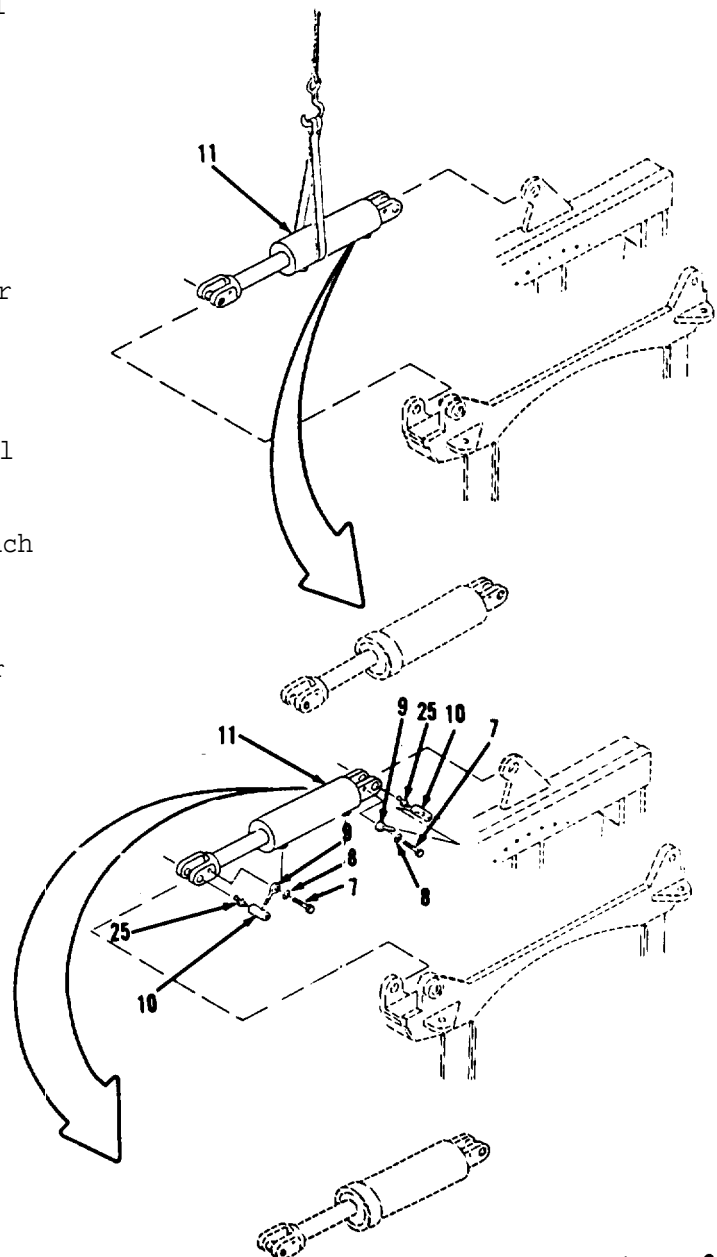
ASSEMBLY (cont)

32. Dip items 12 and 14 thru 24 as an assembly in clean hydraulic fluid.
33. Install items 14 thru 24 as an assembly in barrel (13).
34. Using a strap wrench, install collar (12) on barrel (13). Tighten until snug.



INSTALLATION

35. Attach hoist and sling to cylinder assembly (11). Remove slack from sling.
36. Position cylinder assembly (11) for installation. position hydraulic fluid ports as observed during REMOVAL.
37. Using a large rubber mallet, install two pins (10).
38. Using a 3/4" socket and socket wrench handle, install two anchors (9), washers (8) and bolts (7).
39. Remove hoist and sling from cylinder assembly (11).



**Go to sheet 9  
12-167**

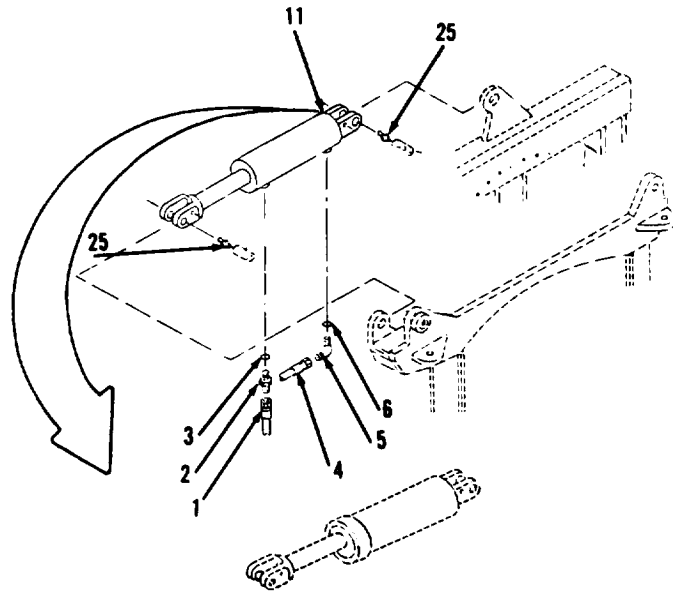
## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 9 of 10)

#### INSTALLATION

40. Using a 7/16" box and open end wrench, install two fittings (25).
41. Install new preformed packing (6).
42. Using a 7/8" open end wrench, install elbow (5) and hose assembly (4) to cylinder assembly (11).
43. Install new preformed packing (3).
44. Install union (2) and hose assembly (1) to cylinder assembly (11).
45. Lubricate two fittings (25) until clean grease appears. Use multi-purpose grease where temperature allows, if necessary, refer to LO 10-3930-643-12.
46. Check hydraulic fluid level. Add hydraulic fluid, if necessary, refer to LO 10-3930-643-12.



Go to sheet 10



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-18. Oscillation Cylinder (S/N 2001 and above). (Sheet 10 of 10)

TESTING

**WARNING**

Only a qualified operator may perform the next procedure. All other personnel must clear the immediate area. Failure to follow this procedure could result in SERIOUS INJURY or DEATH. If injured, obtain medical aid immediately.

47. Start engine.
48. Operate oscillation cylinder slowly.
49. Move oscillation cylinder through at least five full movements of travel to bleed air from system.
50. Check for binding in hydraulic cylinder operation.
51. Stop engine.
52. Inspect hydraulic fluid hoses, fittings and cylinder assemblies for leaks.
53. Check hydraulic fluid level again. Add fluid, if necessary, refer to LO 10-3930-643-12.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-19. Hydraulic Reservoir and Filter. (Sheet 2 of 11)

REMOVAL

NOTE

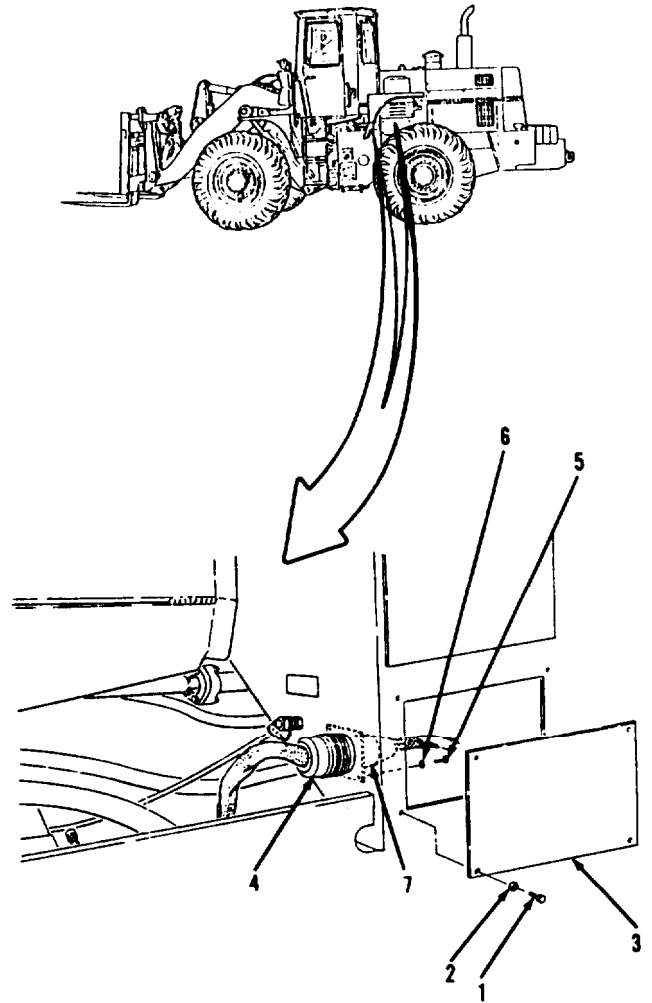
The following is a difference between M10A Forklift models. The removal/installation procedure is identical.

1. Using a 9/16" socket and socket wrench handle, remove four bolts (1), washers (2) and plate (3) from left side of hydraulic reservoir (35) on vehicles S/N 2001 and above.

NOTE

All wire must be tagged when removed from connector. Indicate whether wire is connected to pin-type or socket-type connector.

2. Using slip joint pliers, disconnect harness assembly (4) at connector.
3. Using a cross tip screwdriver, remove four screws (5) and lock washers (6).
4. Disconnect harness assembly (7) at connector.



Go to sheet 3

# TM 10-3930-643-34

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-19. Hydraulic Reservoir and Filter. (Sheet 3 of 11)

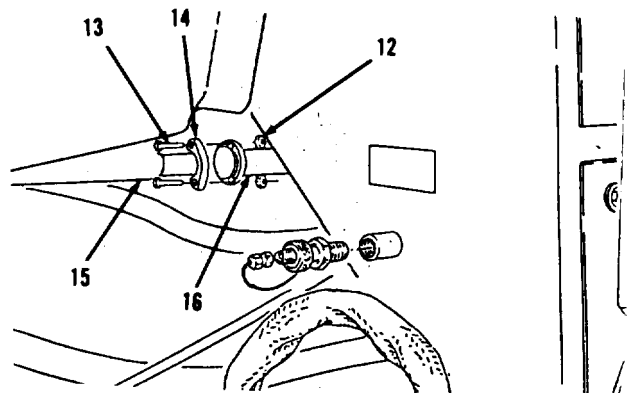
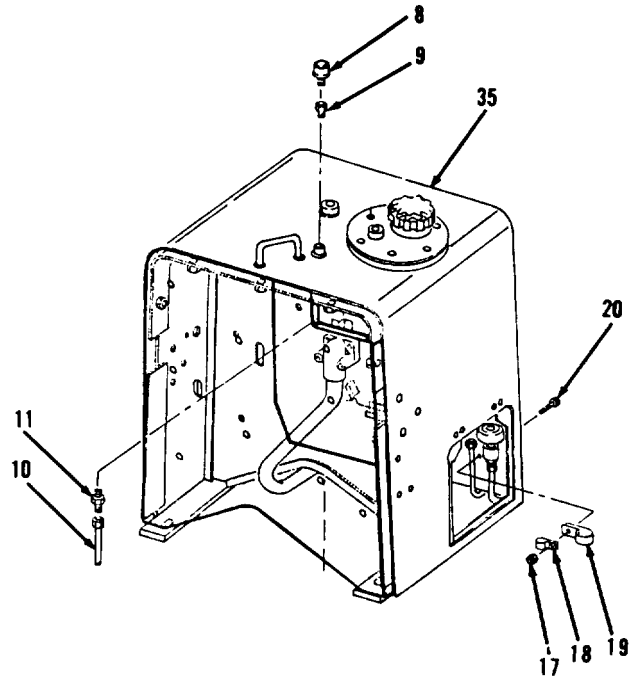
### REMOVAL

- Using a 1-1/4" open end wrench, remove indicator (8) and adapter (9) from rear of hydraulic reservoir (35).

#### NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

- Using a 9/16" open end wrench, disconnect tube assembly (10).
- Remove adapter (11).
- Using a 3/4" socket and socket wrench handle, remove four locknuts (12), bolts (13), two flanges (14) and disconnect tube assemblies (15 and 16) from front bottom of hydraulic reservoir (35).
- Using a 9/16" socket, socket wrench handle and open end wrench, remove nut (17), clamps (18 and 19) and bolt (20) from right side of hydraulic reservoir (35). Move breather tubes to one side.



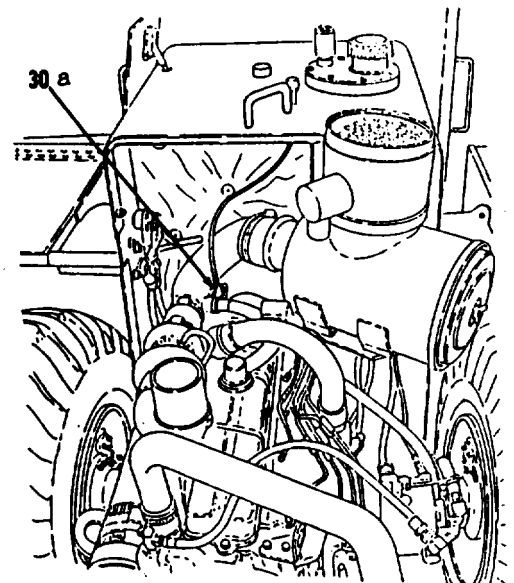
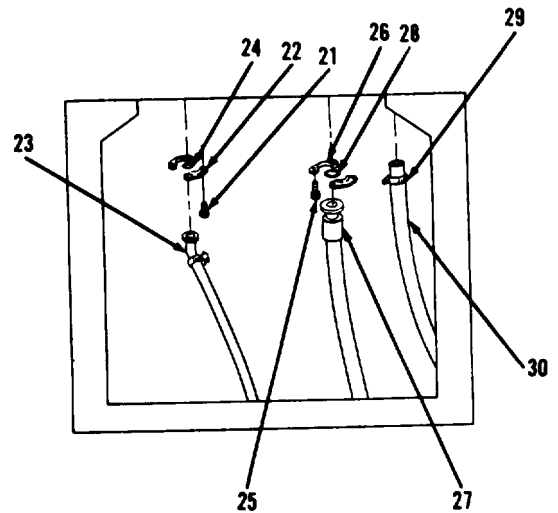
Go to sheet 4

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-19. Hydraulic Reservoir and Filter. (Sheet 4 of 11)

REMOVAL (cont)

10. Using a 9/16" socket and socket wrench handle or 1/2" open end wrench, remove four bolts (21) and two flange halves (22) from right side of hydraulic reservoir (35)
11. Disconnect hose assembly (23)
12. Remove and discard preformed packing (24).
13. Using a 5/8" socket and socket wrench handle, remove four bolts (25) and two flange halves (26).
14. Disconnect hose assembly (27) and remove and discard preformed packing (28).
15. Using a 5/8" socket and socket wrench handle, remove four bolts (29) from hose assembly (30) on top of hydraulic pump.
16. Disconnect hose assembly (30).
17. Disconnect hose assembly from hydraulic control valve, refer to TM 20-3930-643-20.
18. Disconnect hose assembly (30a) from shut off valve on rear of engine.



Go to sheet 5

## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

#### 12-19. Hydraulic Reservoir and Filter. (Sheet 5 of 11)

##### REMOVAL

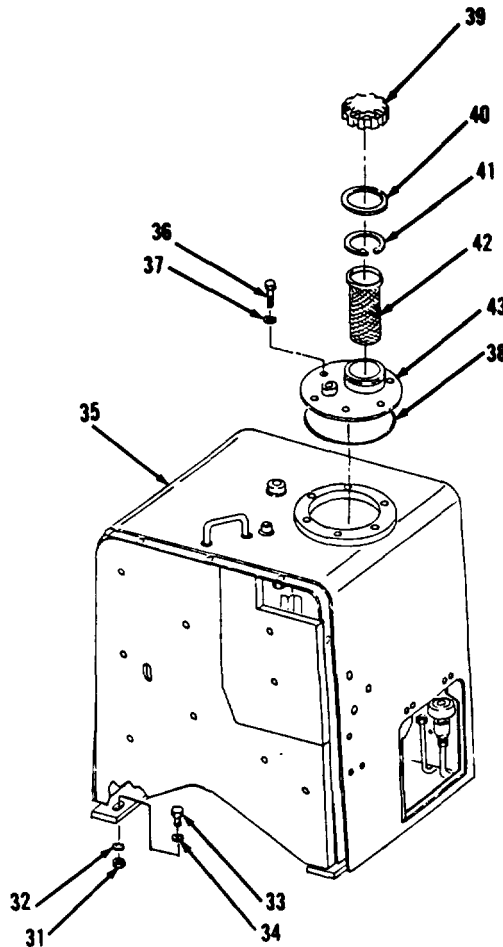
### WARNING

Weight of hydraulic reservoir is approximately 300 pounds. Use adequate hoist and sling for lifting. Failure to follow this procedure may cause damage to equipment or INJURY. If you are injured, seek medical aid immediately.

19. Using a 14" adjustable wrench, install 3/4-10 NC eyebolt in boss on top of hydraulic reservoir (35). Attach hoist and sling.
20. Using a 3/4" socket, socket wrench handle and a 3/4" box and open end wrench, remove four nuts (31), washers (32), bolts (33), washers (34) and hydraulic reservoir (35).
21. Remove hoist and sling.

##### DISASSEMBLY

22. Using a 9/16" socket and socket wrench handle, remove six bolts (36), washers (37), items 39 thru 43 as an assembly and preformed packing (38) from hydraulic reservoir (35). Discard preformed packing (38).
23. Using snap ring pliers, remove cap (39), gasket (40), retaining ring (41) and filter (42) from filler neck (43). Discard gasket (40).



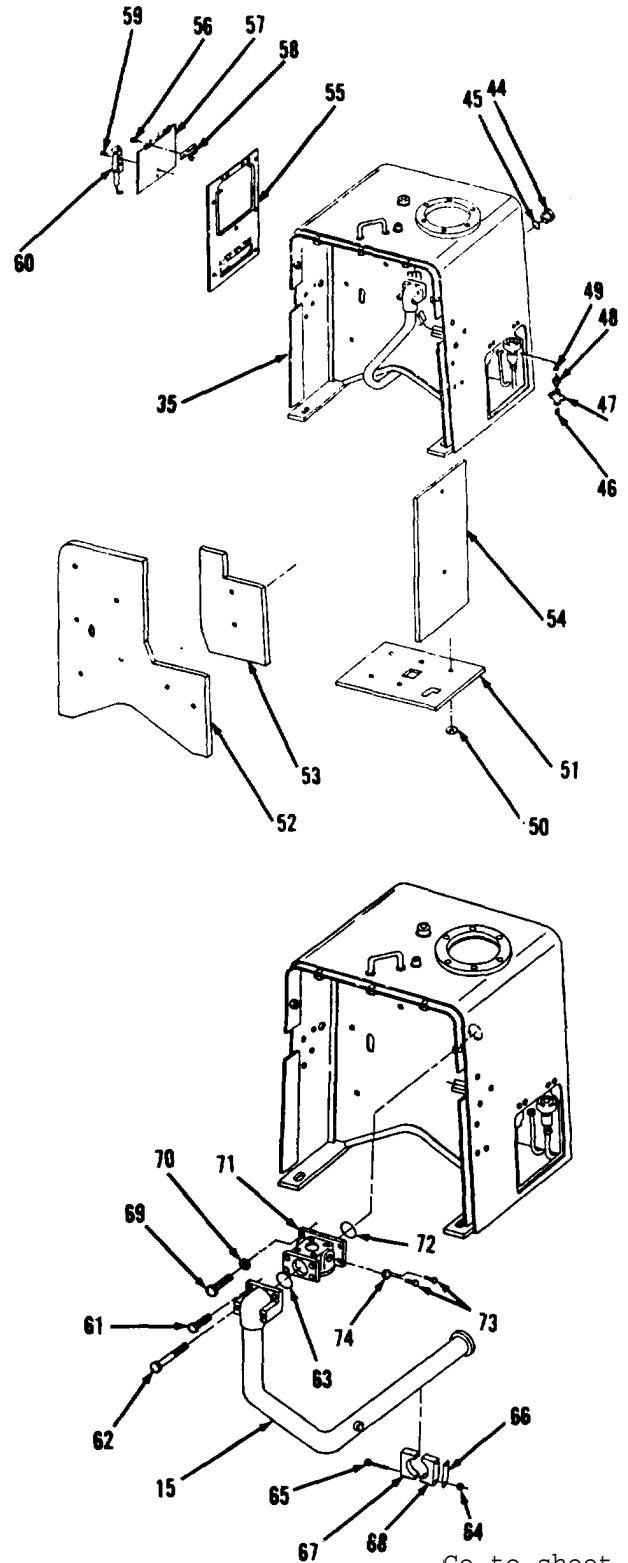
Go to sheet 6

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

12-19. Hydraulic Reservoir and Filter. (Sheet 6 of 11)

DISASSEMBLY (cont)

24. Using a 14" adjustable wrench, remove indicator (44) and preformed packing (45) from hydraulic reservoir (35). Discard preformed packing (45).
25. Remove plug (46), plug cock (47), adapter (48) and preformed packing (49). Discard preformed packing (49).
26. Remove 16 key washers (50) and plates (51 thru 54).
27. Using a drill, remove four rivets (56), panel (57) and spring (58) from panel (55). Discard four rivets (56). Panel (55) is removed during battery removal procedure.
28. Remove two rivets (59) and latch (60) from panel (57). Discard two rivets (59).
29. Using a 5/8" and 1/2" socket and socket wrench, remove bolts (61 and 62), tube assembly (15) and preformed packing (63) from filter head assembly (71). Discard preformed packing (63).
30. Using an 11/16" socket, socket wrench handle and an open end wrench, remove two locknuts (64), bolts (65), link (66) and couplings (67 and 68) from tube assembly (15).
31. Using a 1/2" socket and socket wrench handle, remove four bolts (69), washers (70), filter head assembly (71) and preformed packing (72) from hydraulic reservoir (35). Discard preformed packing (72).
32. Using a 1/4" socket and socket wrench handle, remove two screws (73) and filter indicator (74) from filter head assembly (71).



## TM 10-3930-643-34

### HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-19. Hydraulic Reservoir and Filter. (Sheet 7 of 11)

#### CLEANING/INSPECTION

33. Purge and clean hydraulic reservoir (35). If welding is required, use steel. Purging and cleaning must be performed according to purge section of TB 43-0212.

#### **WARNING**

- TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

- COMPRESSED AIR HAZARD

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

34. Clean all other parts except plates (51 thru 54) with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
35. Inspect hydraulic reservoir (35). If leaks are evident and welding is required, refer to TM 9-237, Welding Theory and Application.
36. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 8

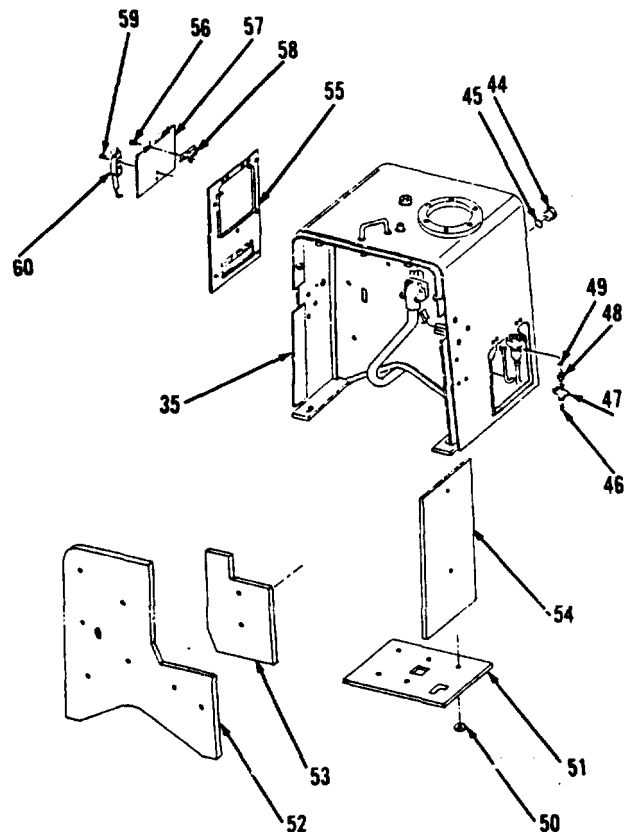
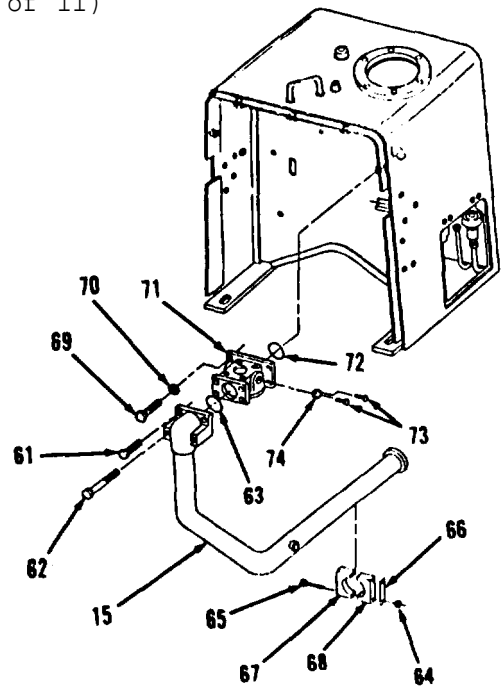


HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (Cont)

12-19. Hydraulic Reservoir and Filter. (Sheet 8 of 11)

ASSEMBLY (Cont)

37. Using a 1/4" socket and socket wrench handle, install filter indicator (74) and two screws (73) on filter head assembly (71).
38. Using a 1/2" socket and socket wrench handle, install new preformed packing (72), filter head assembly (71), four washers (70) and bolts (69) on hydraulic reservoir.
39. Using an 11/16" socket, socket wrench handle and an open end wrench, install couplings (68 and 67), link (66), two bolts (65) and locknuts (64) on tube assembly (15).
40. Using a 5/8" and 1/2" socket and socket wrench handle, install new preformed packing (63), tube assembly (15) bolts (62 and 61) on filter head assembly (71).
41. Using an air hammer and backing bar, install latch (60) and two new rivets (59 to panel).
42. Install spring (58), panel (57) and four new rivets (56) to panel (55).
43. Install plates (54 thru 51) and 16 key washers (50 to hydraulic reservoir (35).
44. Using a 14" adjustable wrench, install new preformed packing (49), adapter (48), plug cock (47) and plug (46).
45. Using a 1-1/4" socket and torque wrench, install new preformed packing (450) and indicator (44). Tighten indicator (44) to 250 to 300 lb-ft.



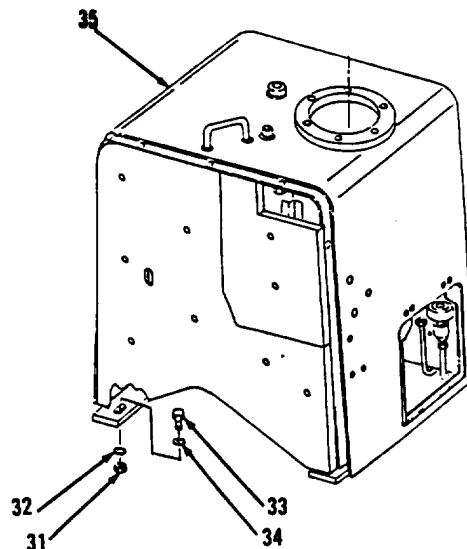
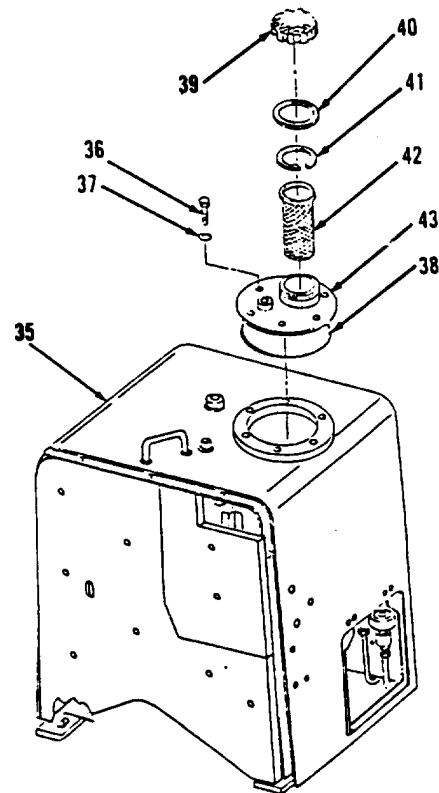
Go to sheet 9  
12-177

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-19. Hydraulic Reservoir and Filter. (Sheet 9 of 11)

INSTALLATION

46. Using snap ring pliers, install filter (42), retaining ring (41), new gasket (40) and cap (39) to filter neck (43).
47. Using a 9/16" socket and torque wrench, install new preformed packing (38), items 43 thru 39 as an assembly, six washers (37) and bolts (36) on hydraulic reservoir (35). Tighten bolts (36) to 15 to 20 lb-ft.
48. Using a 14" adjustable wrench, install 3/4-10 NC eyebolt in boss on top of hydraulic reservoir (35). Attach hoist and sling.
49. Position on vehicle.
50. Using a 3/4" socket, socket wrench handle and a 3/4" box and open end wrench, install hydraulic reservoir (35), four washers (34), bolts (33), washers (32) and nuts (31). Do not tighten bolts (33).
51. Using a hoist and sling, position engine top access cover on vehicle.
52. Aline mounting bolt holes on hydraulic reservoir (35) and engine top access cover.
53. Tighten bolts (33) to 80 lb-ft.
54. Remove access cover and hoist and sling.



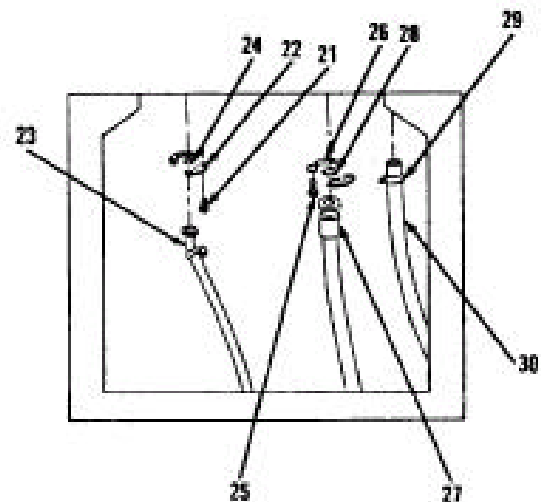
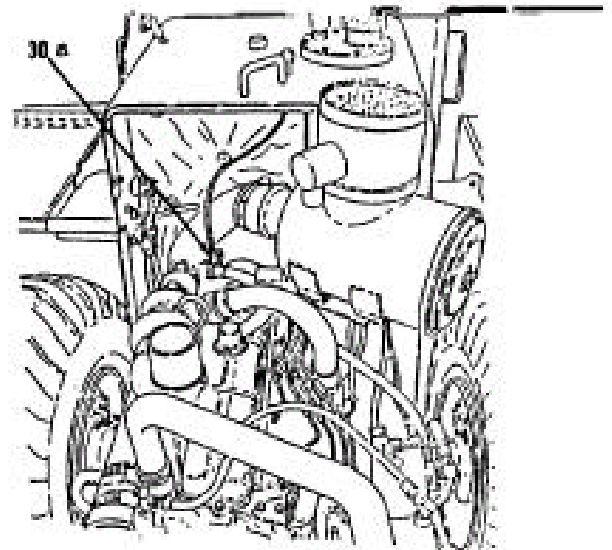
Go to sheet 10

## HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE. (cont)

## 12-19. Hydraulic Reservoir and Filter. (Sheet 10 of 11)

INSTALLATION (cont)

55. Connect hose assembly (30a) to shut off valve on rear of engine.
56. Connect hose assembly to hydraulic control valve, refer to TM 10-3930-643-20.
57. Connect hose assembly (30) on hydraulic pump.
58. Install four bolts (29) on hose assembly (30).
59. Install new preformed packing (28) and connect hose assembly (27) on right side of hydraulic reservoir (35).
60. Using a  $5/8$ " socket and socket wrench handle, install two flange halves (26) and four bolts (25) on hose assembly (27).
61. Install new preformed packing (24) and connect hose assembly (23).
62. Using a  $9/16$ " socket and socket wrench handle, install two flange halves (22) and four bolts (21) on hose assembly (23).



Go to sheet 11

HYDRAULIC SYSTEM TROUBLESHOOTING AND MAINTENANCE.

12-19. Hydraulic Reservoir and Filter. (Sheet 11 of 11)

INSTALLATION

63. Using a 9/16" socket, socket wrench handle and a 9/16" box and open end wrench, install bolt (20), clamps (19 and 18) and nut (17) to right side of hydraulic reservoir (35).

64. Using a 3/4" socket and socket wrench handle, connect tube assemblies (16 and 15), and install two flanges (14), four bolts (13) and locknuts (12) to front bottom of hydraulic reservoir.

65. Using a 9/16" open end wrench, install adapter (11) to rear of hydraulic reservoir (35).

66. Connect tube assembly (10).

67. Using a 1-1/4" open end wrench, install adapter (9) and indicator (8).

68. Connect harness assembly (7) at connector.

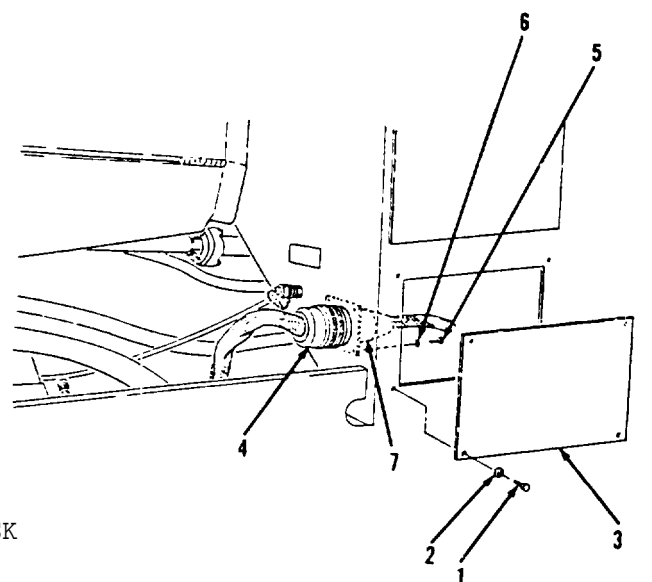
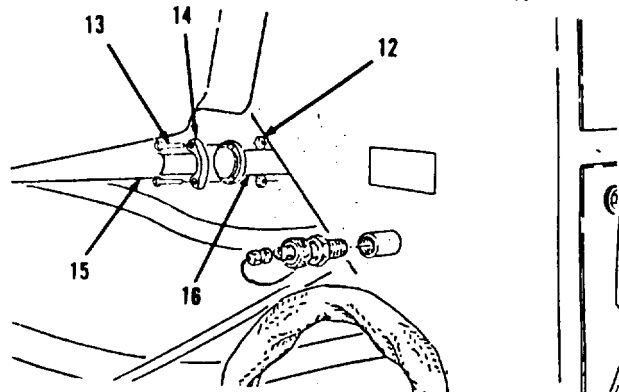
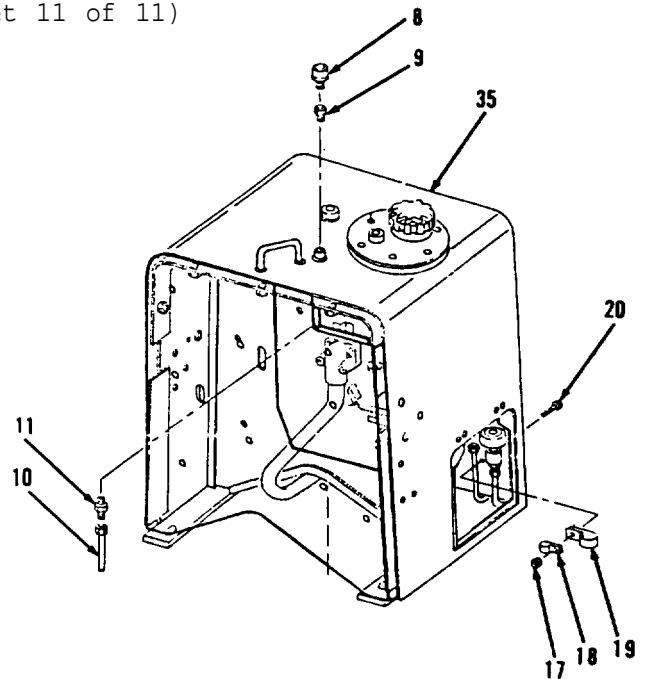
69. Using a cross tip screwdriver, install four lock washers (6) and screws (5) to left side of hydraulic reservoir (35).

70. Using slip joint pliers, connect harness assembly (4) at connector.

71. Using a 9/16" socket and socket wrench handle, install plate (3), four washers (2) and bolts (1) in vehicles S/N 2001 and above.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

## CHAPTER 13

GENERAL SUPPORT ENGINE, FUEL, EXHAUST  
AND COOLING MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized general support level maintenance procedures on the M10A Forklift engine.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Front Cover	13-1	13-2
Cylinder Head Assembly with Valves	13-2	13-8
Crankcase and Cylinder Sleeves	13-3	13-14
Crankshaft	13-4	13-25
Crankshaft Main Bearings	13-5	13-34
Rear Oil Seal	13-6	13-38
Flywheel and Housing	13-7	13-44
Pistons, Connecting Rods and Connecting Rod Bearings	13-8	13-49
Camshaft and Timing Gears	13-9	13-61
Oil Pump Inlet Tube	13-10	13-69
Engine Oil Pump	13-11	13-72
Fuel Injectors	13-12	13-77
Fuel Solenoid	13-13	13-81
Turbocharger	13-14	13-86
Fuel Tank	13-15	13-96
Radiator	13-16	13-97

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-1. Front Cover. (Sheet 1 of 6)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
  
5/16-18 bolt with heads  
removed (2)

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Small tag (App. C, Item 28)  
Gasket (4)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Alternator and mounting removed.  
Water pump removed.  
Air compressor base and mounting  
removed.  
  
Fuel injection pump, cover plate,  
adapter and drive gears removed.  
  
Engine oil pump removed.

---

Paragraph 4-14

Paragraph 13-11

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-1. Front Cover. (Sheet 2 of 6)

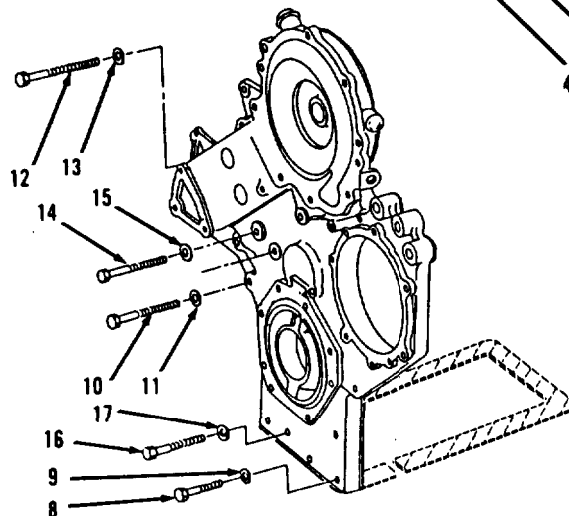
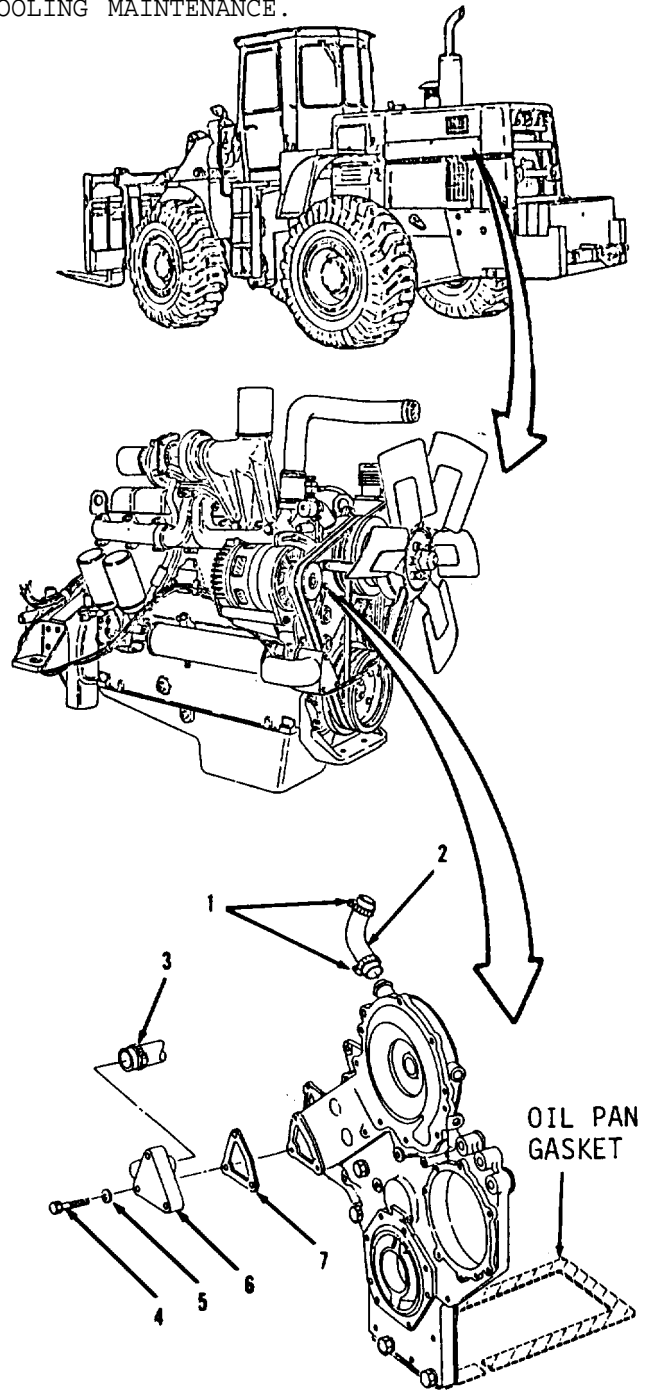
REMOVAL

1. Remove crankshaft pulley. Refer to paragraph 13-4.
2. Using a flat tip screwdriver, loosen two clamps (1) at front of engine.

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

- 3\* Remove hose (2).
4. Using a flat tip screwdriver, loosen clamp (3).
5. Using 9/16" socket and socket wrench handle, remove three bolts (4), washers (5), elbow (6) and gasket (7). Discard gasket (7). Remove all gasket material from mounting surfaces.
6. Using 1/2" socket and socket wrench handle, remove six bolts (8), washers (9), two bolts (10), washers (11), bolts (12), washers (13), four bolts (14) and washers (15).
7. Using 3/4" socket and socket wrench handle, remove two bolts (16) and washers (17) from bottom, rear of engine.



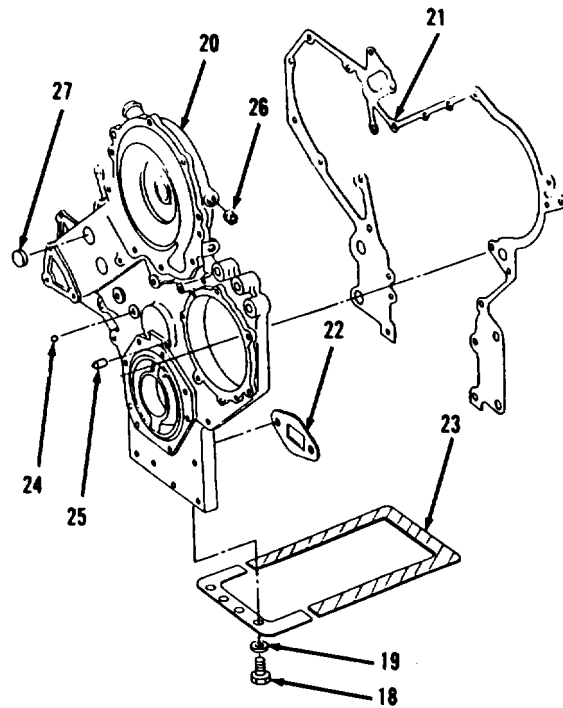
Go to sheet 3

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-1. Front Cover. (Sheet 3 of 6)

REMOVAL (cont)

8. Using 9/16" socket and socket wrench handle, remove four bolts (18) and washers (19).
9. Using a gasket scraper, remove cover (20) and gaskets (21,22 and 23) from front of engine. Discard gaskets (21,22 and 23).
10. Using a magnet, remove two balls (24) from cover (20).
11. Using slip joint pliers, remove indicator (25).
12. Using a 3/8" box and open end wrench, remove two plugs (26).
13. Using a flat brass punch and hammer, remove three cups (27).



Go to sheet 4



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-1. Front Cover. (Sheet 4 of 6)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

14. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
15. Inspect all parts. Refer to paragraph 2-9.

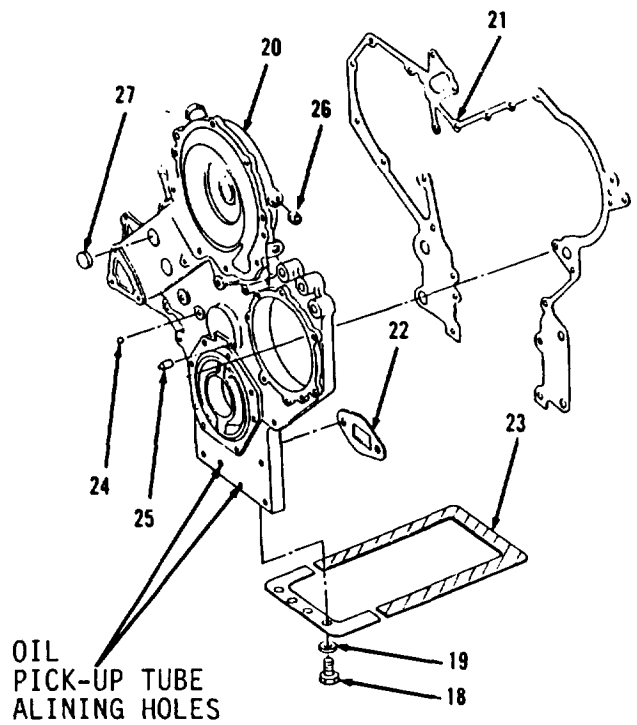
Go to sheet 5

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-1. Front Cover. (Sheet 5 of 6)

INSTALLATION

- 16. Using a flat brass punch and hammer, install three cups (27) in cover (20).
- 17. Using a 3/8" box and open end wrench, install two plugs (26).
- 18. Using flat brass punch and hammer, install indicator (25).
- 19. Install two balls (24).
- 20. Position new gasket (23) in rear of engine.
- 21. Using 1/2" socket and socket wrench handle, install two 5/16-18" bolts with heads removed on oil pick-up tube and position new gasket (23) on bolts. New gasket (23) must be cut to fit section of oil pan.
- 22. Position new gaskets (22 and 21) and cover (20).
- 23. Position guide bolts in oil pick-up tube alining holes in cover (20).
- 24. Using a 9/16" socket and socket wrench handle, install four washers (19) and bolts (18) in bottom, rear of engine.



Go to sheet 6

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

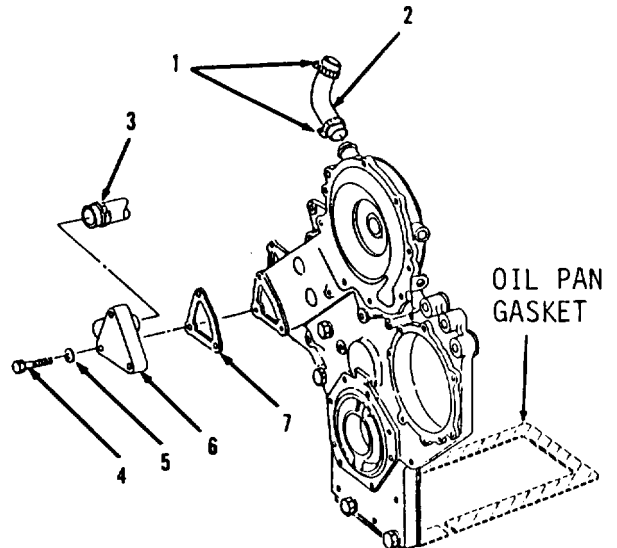
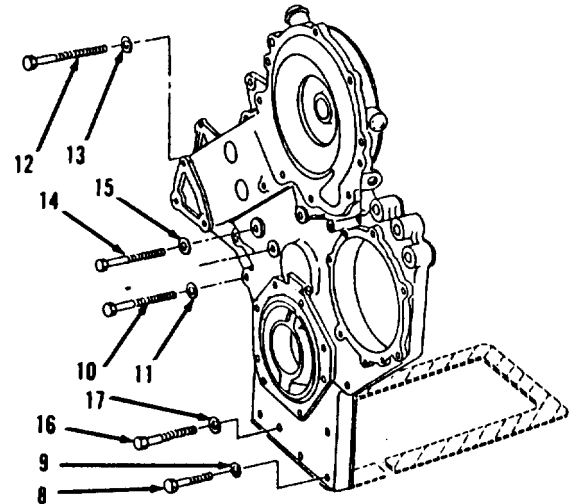
## 13-1. Front Cover. (Sheet 6 of 6)

INSTALLATION

25. Using a 1/2" socket and socket wrench handle, remove guide bolts.
26. Install two washers (17) and bolts (16).
27. Install four washers (15). bolts (14), two washers (13), bolts (12), washers (11), bolts (10), six washers (9) and bolts (8) in rear of engine.
28. Using a 9/16" socket and socket wrench handle, install new gasket (7), elbow (6), three washers (5) and bolts (4).
29. Using a flat tip screwdriver, tighten clamp (3).
30. Install hose (2).
31. Using a flat tip screwdriver, tighten two clamps (1).

## NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-2. Cylinder Head Assembly with Valves. (Sheet 1 of 6)

This task covers:        a. Disassembly                b. Cleaning/Inspection/Assembly

---

INITIAL SETUP

Tools

Shop Equipment, Machine Shop:  
Field Maintenance,  
Basic, Less Power  
NSN 3470-00-754-0708

Shop Equipment, Machine Shop:  
Field Maintenance,  
Basic, MAP only  
NSN 3470-00-919-0068

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

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Loctite 277 (App. C, Item 16)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

Paragraph 4-4

Condition Description

Cylinder head and valve assemblies  
removed.

---

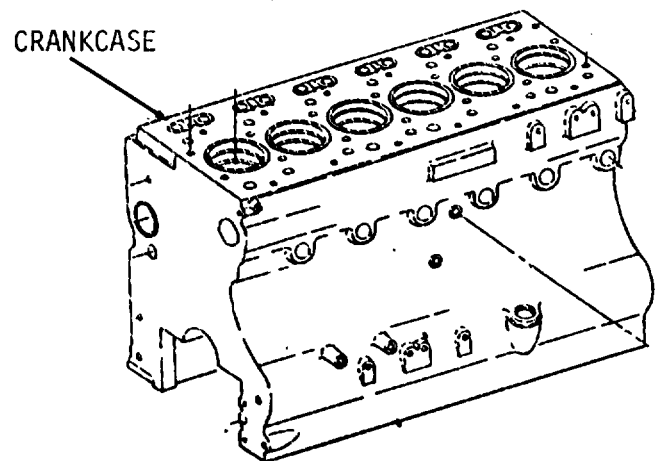
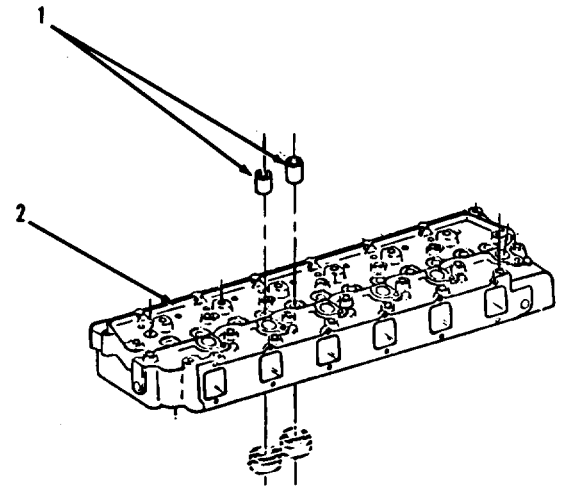
Go to sheet 2

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-2. Cylinder Head Assembly with Valves. (Sheet 2 of 6)

DISASSEMBLY

1. Inspect 12 guides (1) in cylinder head (2). Replace if burned, cracked or excessively worn. Ream guides with a .374 reamer to remove burrs or correct mushrooming. I.D. of valve guides must not be more than 0.3750 inches.
2. Measure I.D. of 12 valve guides (1) at top, middle and bottom with a ball gage. Replace valve guides only if worn beyond limits.
3. Using valve guide remover tool, remove any worn valve guides (1).



Go to sheet 3

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-2. Cylinder Head Assembly with Valves. (Sheet 3 of 6)

CLEANING/INSPECTION/ASSEMBLY

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

4. Clean counterbore with cleaning solvent P-D-680 and nylon brush. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 4

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-2. Cylinder Head Assembly with Valves. (Sheet 4 of 6)

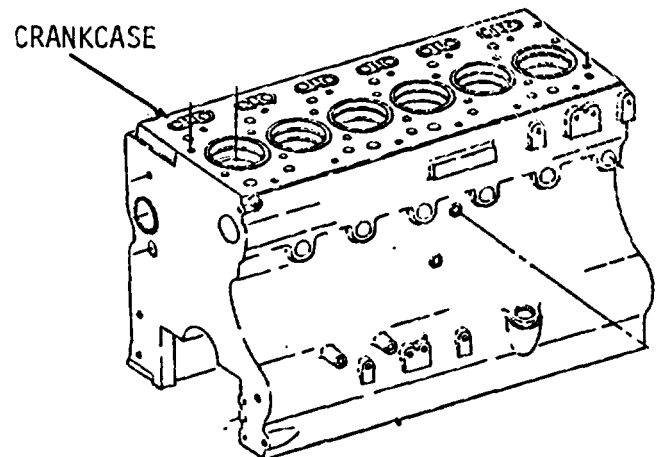
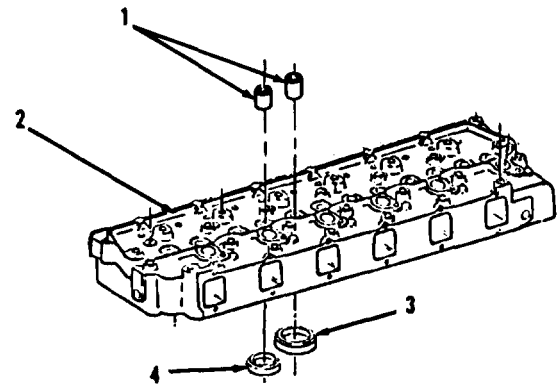
CLEANING/INSPECTION/ASSEMBLY

5. Lubricate outside diameter of new valve guides (1) with lubricating oil.

NOTE

The 30 degree chamfer at the top of the valve guide is intended to allow excess oil to drain away from the top. Inverting the valve guides can lead to excessive oil consumption.

6. Using valve guide installer tool, install new valve guides (1) with threaded portions down.
7. Using a dial indicator, measure height from top deck of cylinder head (2) to top of valve guide (1). Clearance for valve guides (1) must be between 1.207 and 1.227 inches for intake and valve guides (1) must be between 1.287 and 1.307 inches for exhaust.
8. Inspect six seats (3) and inserts (4), refer to paragraph 4-4. Replace if valve guide (1) does not seat properly after being resurfaced.
9. Using a slide hammer and expanding screw, with pre-cup puller (exhaust), remove damaged seats (3) or inserts (4).



Go to sheet 5

13-2. Cylinder Head Assembly with Valves. (Sheet 5 of 6)

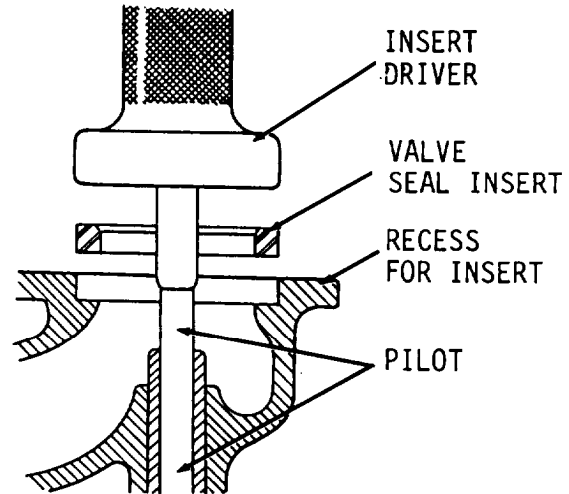
CLEANING/INSPECTION/ASSEMBLY (cont)

10. Using a feeler gage, install six new standard size seats (3) and inserts (4) with insert driver tool and an arbor press. Exert an even pressure of 500 lb-ft for five seconds. Proper depth of seat (3) and insert (4) counterbore is between 0.509 and 0.511 inches for intake and 0.455 and 0.459 inches for exhaust.
11. Inspect for proper valve seat (3) mating. If surfaces do not mate correctly, oversize inserts (4) and seats (3) must be installed.

NOTE

The following procedure must be followed before installing 0.15 in oversize seats and inserts.

12. Measure bore of valve seat and insert counterbores to determine if cylinder head (2) must be machined. If machining is necessary, send cylinder head (2) to depot maintenance. Bores must be within 2.011 and 2.012 inches for intake valves and 1.639 and 1.640 inches for exhaust valves.





GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

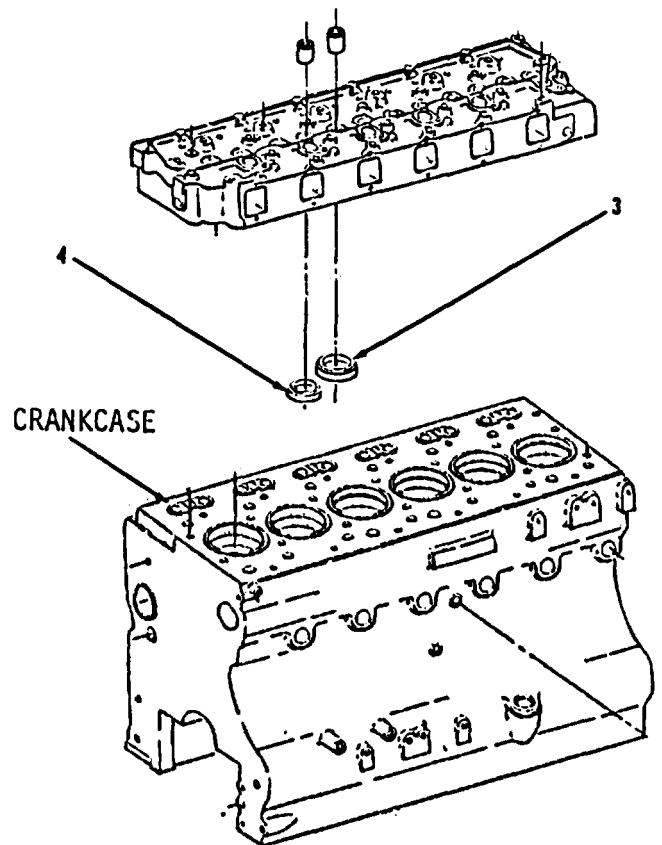
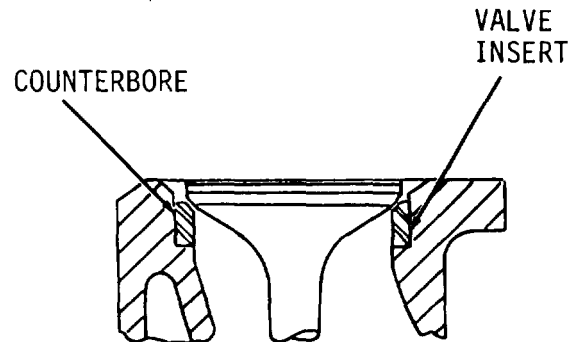
13-2. Cylinder Head Assembly with Valves. (Sheet 6 of 6)

CLEANING/INSPECTION/ASSEMBLY

13. Chill new 0.15 inch oversize inserts (4) and seats (3) and insert driver tool in dry ice for 30 minutes before installing. Chilling will prevent metal scraping of counter-bore. This will ensure maximum mating of surfaces.
14. Coat six inserts (4) and seat (3) with Loctite 277.
15. Aline six inserts (4) and seats (3) to avoid cocking.
16. Using a insert driver tool and arbor press, install new inserts (4) and seats (3). Exert an even pressure of 500 lb-ft for five seconds.
17. Inspect all six inserts (4) and seats (3) to ensure that they are properly seated.
18. Inspect all other parts. Refer to paragraph 2-9.

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-3. Crankcase and Cylinder Sleeves. (Sheet 1 of 11)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                              c. Assembly

---

INITIAL SETUP

Tools

Shop Equipment, Machine Shop:  
  Field Maintenance,  
  Basic, Less Power  
  NSN 3470-00-754-0708  
Shop Equipment, Machine Shop:  
  Field Maintenance,  
  Basic, MAP only  
  NSN 3470-00-919-0068  
Tool Kit, General Mechanic's  
  Automotive  
  NSN 5180-00-177-7033

Materials/Parts

Cleaning solvent P-D-680  
  (App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Engine oil SAE 30 (App. C, Item 19)  
Permatex #2 (App. C, Item 26)  
Preformed packing (18)  
Gasket  
Shim (6)  
Plug (9)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

Paragraph 4-7

Paragraph 13-4

Paragraph 13-6

Paragraph 13-8

Paragraph 13-9

Condition Description

Oil pan removed.

Crankshaft removed.

Rear oil seal removed.

Pistons, connecting rods and connecting  
rod bearings removed.

Camshaft and timing gears removed.

---

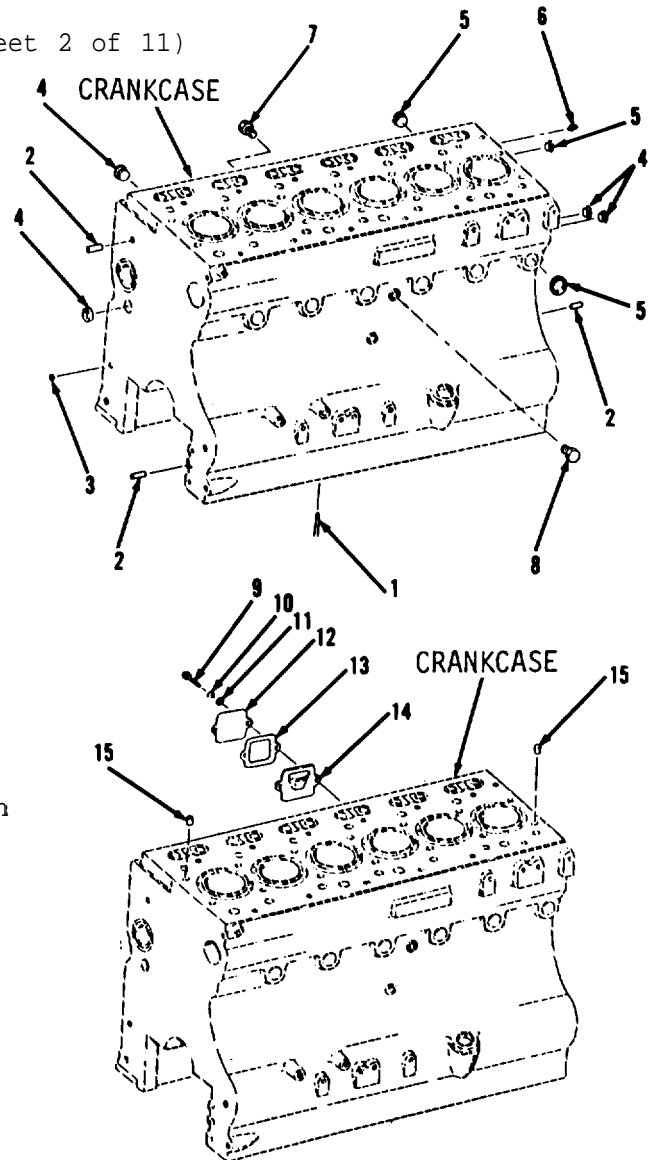
Go to sheet 2

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-3. Crankcase and Cylinder Sleeves. (Sheet 2 of 11)

DISASSEMBLY

1. Using slip joint pliers, remove restrictor (1).
2. Remove four pins (2).
3. Using a magnet, remove ball bearing (3).
4. Using a punch and hammer, punch hole in three plugs (4) and remove.
5. Remove and discard nine plugs (5).
6. Using a 3/16" socket and socket wrench handle, remove five plugs (6).
7. Using a 9/16" socket and socket wrench handle, remove plugs (7 and 8).
8. Using a 1/2" socket and socket wrench handle, remove two bolts (9), lock washers (10), washers (11), cover (12), gasket (13) and baffle (14). Discard gasket (13).
9. Using slip joint pliers, remove two. dowels (15).



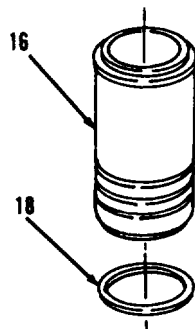
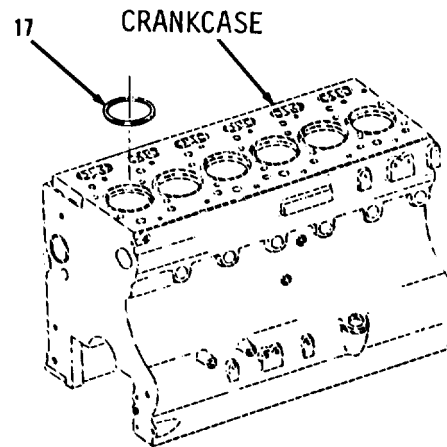
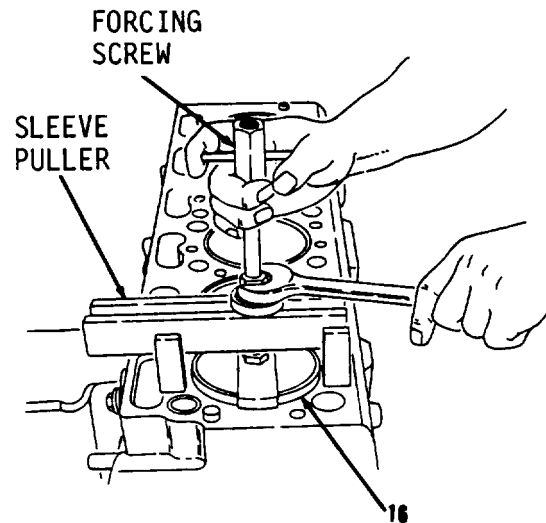
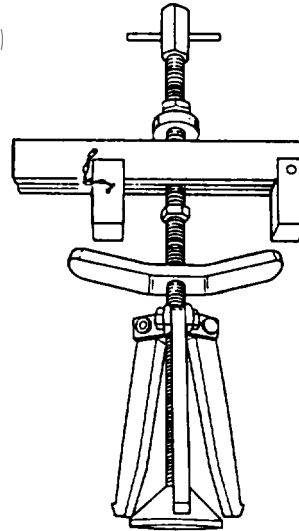
13-3. Crankcase and Cylinder Sleeves. (Sheet 3 of 11)

DISASSEMBLY (cont)

NOTE

Make sure that each sleeve is marked with the number of the cylinder from which it was removed. Sleeves must be installed into their original cylinders.

10. Using a universal wet sleeve puller, remove six sleeves (16). If necessary, thread a slide hammer into the forcing screw to aid removal.
11. Using a flat brass punch and hammer, remove and discard six shims (17).
12. Using a small flat tip screwdriver, remove and discard 18 preformed packings (18) from six sleeves (16).



Go to sheet 4

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-3. Crankcase and Cylinder Sleeves. (Sheet 4 of 11)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

13. Clean six sleeves (16) with a clean cloth moistened with mild detergent and water solution and a non - abrasive brush. Make sure that grooves are clean. Dry thoroughly with compressed air.

Go to sheet 5

13-3 1 Crankcase and Cylinder Sleeves. (Sheet 5 of 11)

CLEANING/INSPECTION (cont)

14. Clean crankcase and seven caps (3) with cleaning solvent P-D-680. Remove all carbon and mineral deposits. Clean all passages, ports and holes. Dry thoroughly with compressed air. If cleaning solvent P-D-680 fails to remove scale, send crankcase to Depot Maintenance.
15. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.



Do not resurface the crankcase. Damage and defects not correctable by light filing indicates replacement is needed. Damaged crankcase must be sent to Depot Maintenance to determine salvageability.

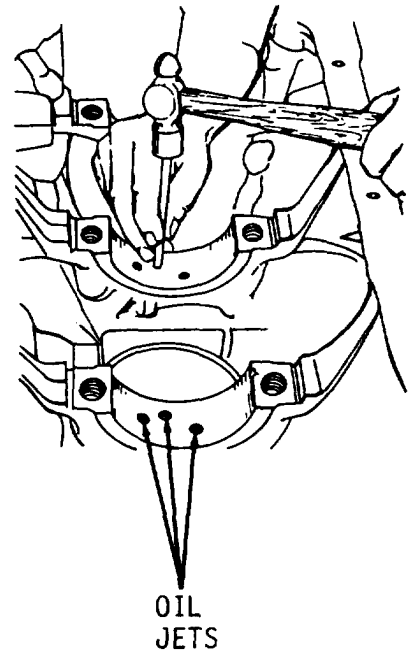
16. Check deck of crankcase for "pulled" thread holes. Lightly file area to restore flatness.
17. Inspect threaded holes. Threads may be retapped or repaired with heli-coils, if necessary.

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-3. Crankcase and Cylinder Sleeves. (Sheet 6 of 11)

CLEANING/INSPECTION

18. Inspect lower cylinder sleeve pilot bore for erosion. If water leakage is evident, replace crankcase. Send damaged crankcase to Depot Maintenance.
19. Inspect for coolant or oil leaks in crankcase. If leaks are found, notify Depot Maintenance.
20. Inspect sleeve counterbore for burrs or fractures. If repair is indicated, notify Depot Maintenance.
21. Inspect twelve oil jets for dirt and blockage. Clean and open, if necessary.
22. Inspect jets for cracks and chips. Replace damaged jets.
23. Remove only if jets are damaged using pilot driver.
24. Install new jets with pilot driver.
25. Check surface recess of jets. Jets must be recessed 1/8 inch below surface.



Go to sheet 7

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-3. Crankcase and Cylinder Sleeves. (Sheet 7 of 11)

CLEANING/INSPECTION (cont)

NOTE

Do not hone cylinder sleeves. If excessively damaged, they must be replaced.

26. Inspect six sleeves (16) for scuffing, scoring, scratches and gouges. Replace if necessary.
27. Using an inside micrometer or a bore gage, measure I.D. of sleeve from the top to bottom of piston travel. Measure the preformed packing area. Take all measurements at right angles. Replace sleeve if out of round or does not meet specifications. Maximum permissible diameter of sleeve wear at top of ring travel is 0.004 inch.

NOTE

The following procedure is for deglazing cylinder sleeve. Use the procedure if new piston rings are being used with new cylinder sleeves. Do not deglaze new sleeves.

28. Using a deglazing tool and drill, deglaze sleeve to provide a good seating surface for rings.
29. Inspect all other parts. Refer to paragraph 2-9.



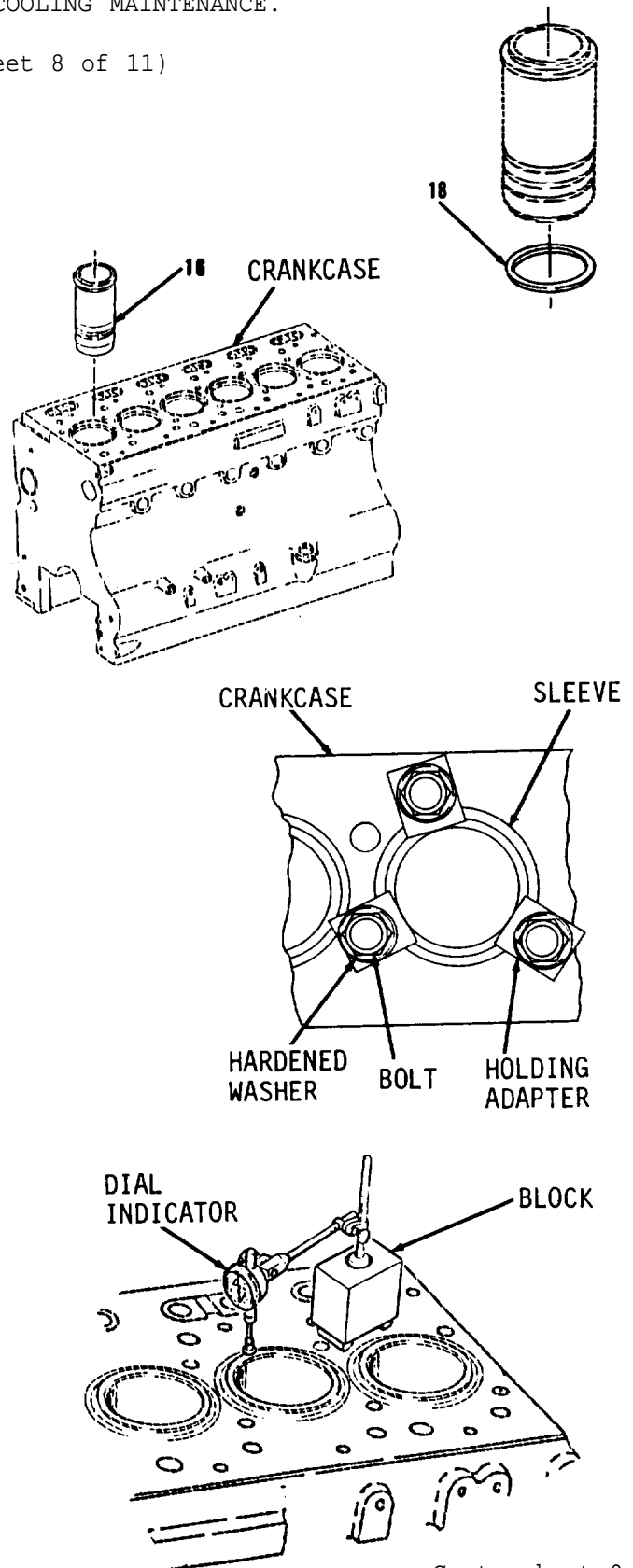


GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-3. Crankcase and Cylinder Sleeves. (Sheet 8 of 11)

ASSEMBLY

30. Install six sleeves (16) in engine crankcase without 18 new packings (18).
310. Clamp down one sleeve (16) using three holding adapters, bolts and hardened washers. Space the bolts to obtain uniform pressure on sleeve.
32. Place a dial indicator with block across cylinder sleeve.
33. With dial indicator set on the flange of the sleeve, adjust indicator to zero.
34. Move indicator block until pointer drops to crankcase deck. Record reading.
35. If sleeve is below deck, rest indicator pointer on deck and set indicator on zero.
36. Move the indicator block until the pointer drops to the sleeve flange. Take a reading.



Go to sheet 9

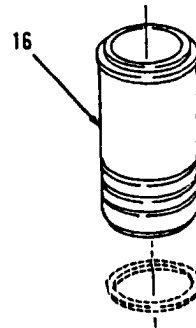
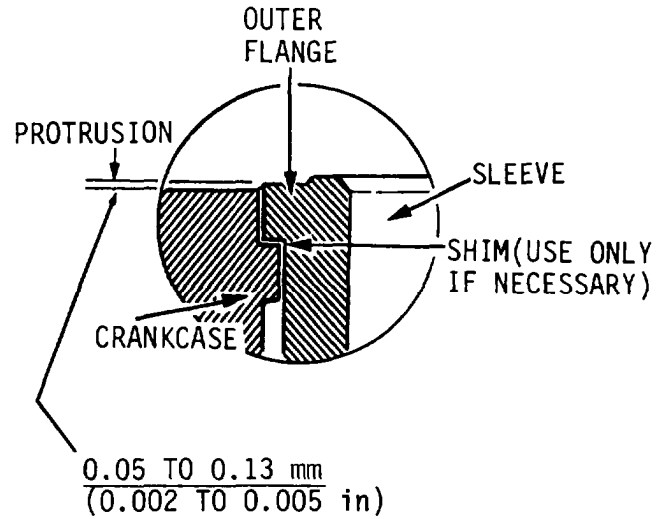
13-3. Crankcase and Cylinder Sleeves. (Sheet 9 of 11)

ASSEMBLY (cont)

NOTE

Shims are available in 0.002 inch, 0.004 inch, 0.010 inch, 0.020 inch and 0.032 inch thickness.

37. Take readings at three or four points around the sleeve. Use an average to determine which shims, if any, are needed. Protrusion must be within 0.002 to 0.005 inch.
38. Remove three bolts, hardened washers and holding adapters.
39. Remove one sleeve (16).
40. Repeat previous steps for each of six sleeves (16).



Go to sheet 10

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

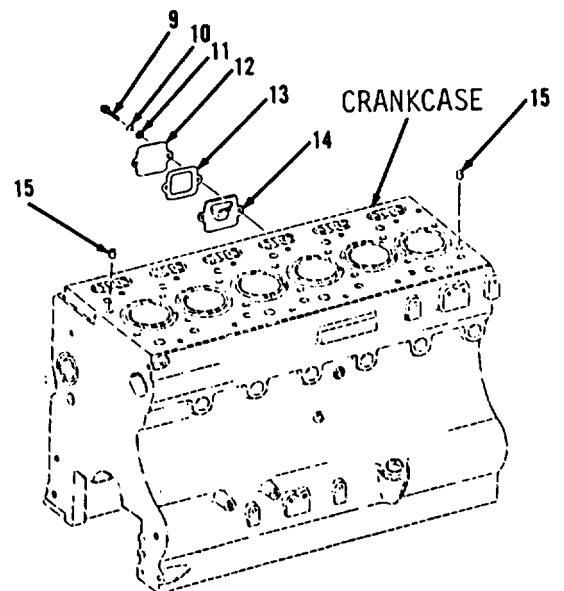
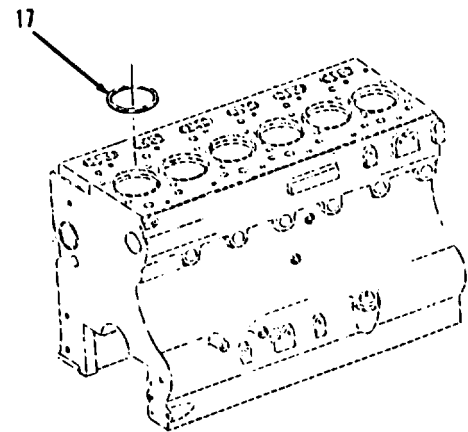
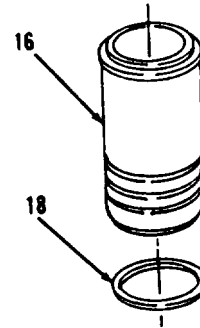
13-3. Crankcase and Cylinder Sleeves. (Sheet 10 of 11)

ASSEMBLY

NOTE

Preformed packings must be installed in the following order: bottom, center and top.

41. Coat 18 new preformed packings (18) in engine crankcase with clean engine oil and install 18 new preformed packings (18) on six sleeves (16).
42. Install new shims (17) in cylinder counterbores.
43. Coat sealing surfaces with clean engine oil. Using a hydraulic press, install six sleeves (16) into bores. Make sure that sleeves are installed into same cylinders from which they were removed.
44. Check sleeve protrusion again. Make additional adjustments, if necessary.
45. Using a flat brass pump, install two dowels (15).
46. Coat threads of two bolts (9) with permatex #2. Using a 1/2" socket and socket wrench handle, install baffle (14), new gasket (13), cover (12), two washers (11), lock washers (10) and bolts (9).



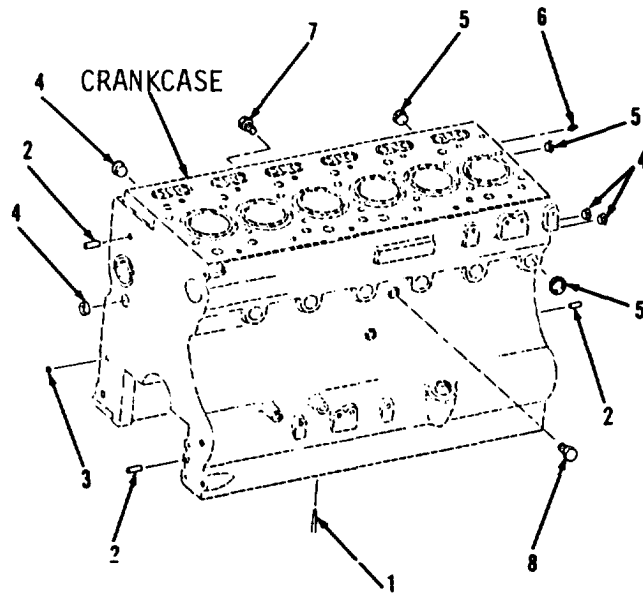
Go to sheet 11

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-3. Crankcase and Cylinder Sleeves. (Sheet 11 of 11)

ASSEMBLY (cont)

47. Coat threads of plugs (8, 7 and 6) with Permatex #2. Using 7/16" and 3/16" sockets and socket wrench handle, install plugs (8 and 7) and five plugs (6).
48. Using a flat brass punch and hammer, install nine new plugs (5).
49. Using a flat brass punch and hammer, install three plugs (4).
50. Install ball bearing (3).
51. Using a flat brass punch and hammer, install four pins (2).
52. Using a flat brass punch and hammer, install restrictor (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

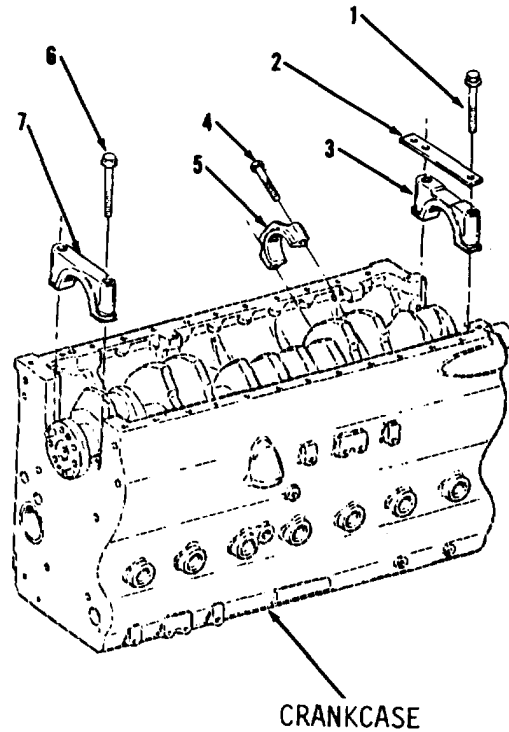
13-4. Crankshaft. (Sheet 2 of 9)

REMOVAL

NOTE

- Bearing caps are not interchangeable within the crankcase or with other crankcases.
- If a bearing has spun, the entire engine must be disassembled and cleaned.
- Immediately tag all bearing caps upon removal to aid in installation.

1. Using a 13/16" socket and socket wrench handle, remove 12 bolts (1), link (2) and six bearing caps (3) from bottom of engine crankcase.
2. Using a 5/8" socket and socket wrench handle, remove 12 bolts (4) and six connecting bearing caps (5), refer to paragraph 13-8.
3. Using a 13/16" socket and socket wrench handle, remove two bolts (6) and thrust bearing cap (7).



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-4. Crankshaft. (Sheet 3 of 9)

### REMOVAL

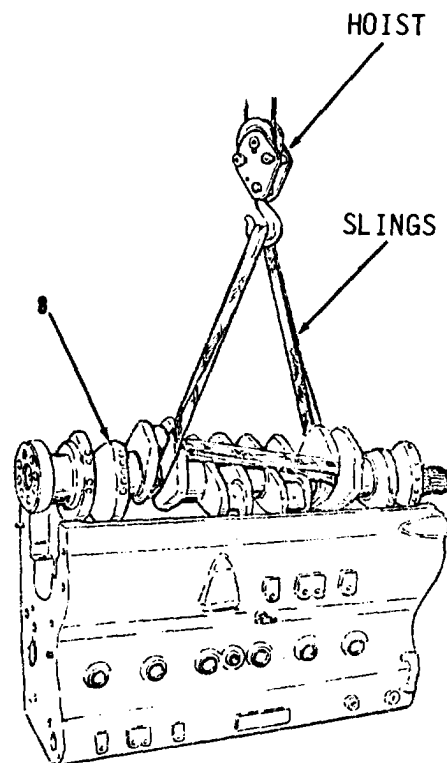
#### **WARNING**

Weight of crankshaft is approximately 375 pounds. Use adequate hoist and sling to lift crankshaft. Failure to follow this procedure could result in SEVERE INJURY.

#### **CAUTION**

Two five foot nylon slings, attached around two journals at equal distances from the end of the crankshaft is the preferred method of lifting. If another method is used, protect crankshaft surface from lifting device with plastic tubing or soft brass. Failure to follow this procedure could result in damage to crankshaft.

4. Attach hoist and slings around journals of crankshaft (8) and remove.

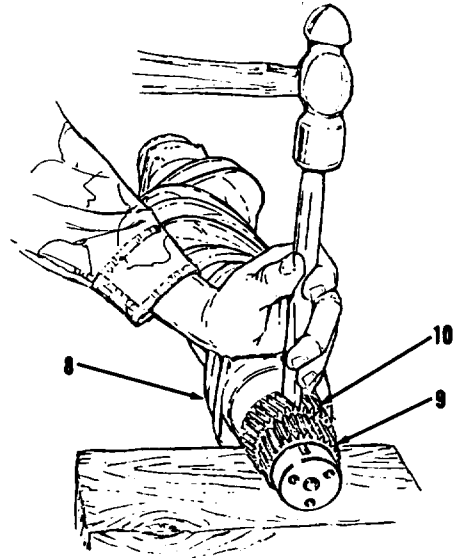


Go to sheet 4

13-4. Crankshaft. (Sheet 4 of 9)

REMOVAL (cont)

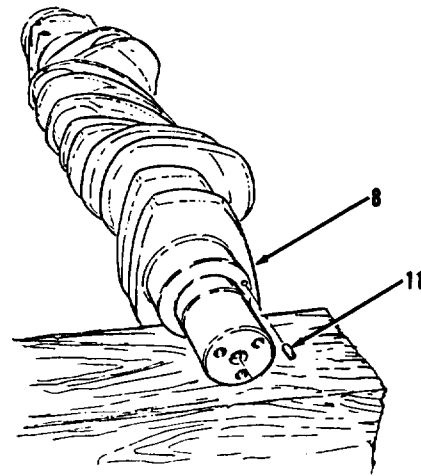
5. Place crankshaft (8) on wood blocks to prevent damage to journals.
6. Remove hoist and sling.
7. Support nose of crankshaft (8) with wood blocks.
8. Using a chisel and hammer, separate and remove gears (9 and 10). Discard gears (9 and 10).
9. Using a flat brass punch and hammer, remove pin (11) from crankshaft (8). Discard pin (11).



**CAUTION**

Exercise care when removing wear sleeve. Do not damage crankshaft surface.

10. Using a muller tool, remove wear sleeve (12) from crankshaft (8). Discard wear sleeve (12).





## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-4. Crankshaft. (Sheet 5 of 9)

CLEANING/INSPECTION**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

11. Wash crankshaft (8) with cleaning solvent P-D-680. Use nylon brush to remove deposits and sludge from internal oil passages.
12. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 6

13-4. Crankshaft. (Sheet 6 of 9)

CLEANING/INSPECTION (cont)

NOTE

If crankshaft or connecting rod journals have been overheated or a bearing has spun, crankshaft must be magnafluxed.

13. Inspect main journals of crankshaft (8) for scoring.
14. Using a micrometer, measure diameter of each crankshaft (8) journal in two or three places. Journal diameter should be 3.3742 to 3.3755 inches.
15. Using a micrometer, measure diameter of each connecting rod journal in two or three places with micrometer. Journal diameter should be 2.9977 to 2.9990 inches.
16. Using a sclerometer, measure hardness in at least three locations on each crankshaft (8) and connecting rod journal. Minimum hardness is -45 Rc.
17. Replace crankshaft (8) if journals are scored or if test results are outside acceptable limits.
18. Inspect crankshaft (8) for sludge deposits or other obstructions in oil jet holes in each journal.
19. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 7

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

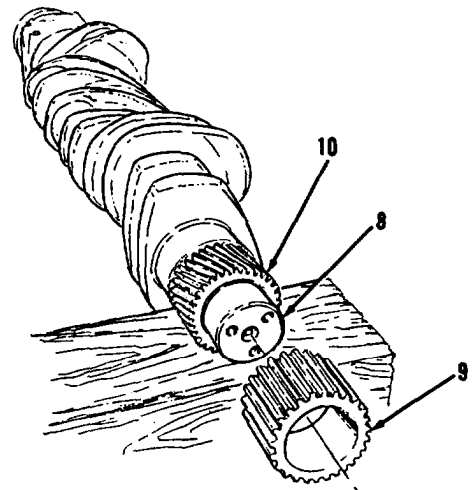
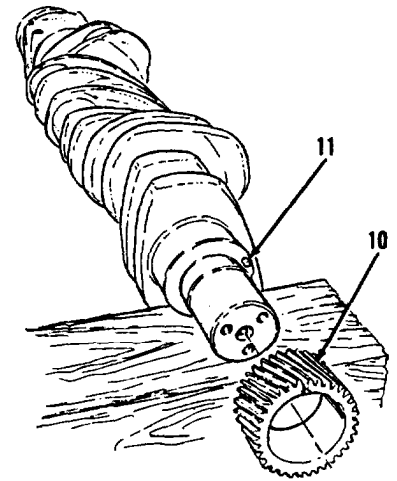
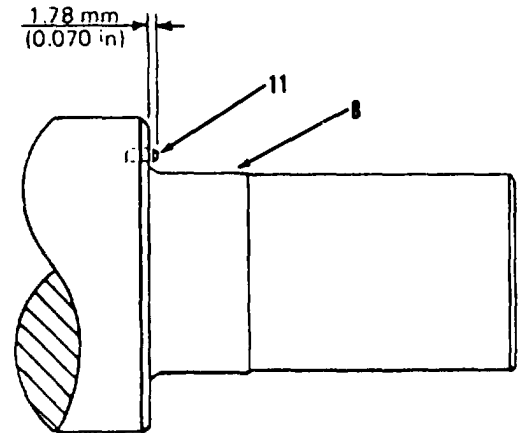
13-4. Crankshaft. (Sheet 7 of 9)

INSTALLATION

NOTE

Pin must protrude not more than 0.070 inch (1.78 mm) from crankshaft, as shown.

20. Press a new pin (11) into crankshaft (8).
21. Heat new gears (10 and 9) in an oil bath to 400 degrees F.
22. Using heat resistant gloves to handle the gear, remove drive spline gear (10) from oil bath, aline notch on rear of gear (10) with pin (11) in crankshaft (8) and slide gear (10) onto crankshaft (8) until it seats against crankshaft (8) shoulder.
23. Using heat resistant gloves to handle gear (9), remove sector gear (9) from oil bath and install onto crankshaft (8) until it contacts gear (10).
24. Allow gears (10 and 9) to cool until they are securely fitted to crankshaft (8).
25. Attach hoist and sling around journals of crankshaft (8).



Go to sheet 8

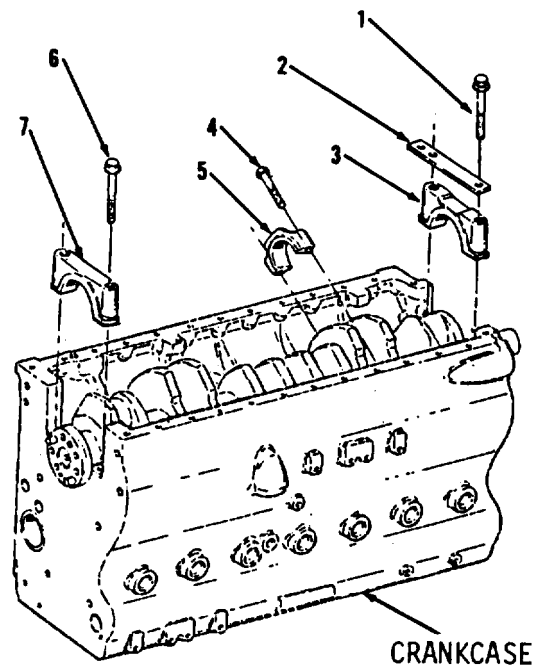
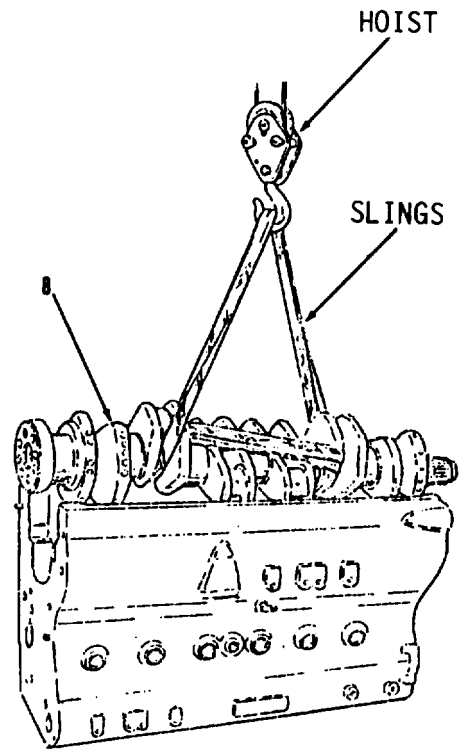
13-4. Crankshaft. (Sheet 8 of 9)

INSTALLATION (cont)

NOTE

If bearings have been removed, insure that new bearings have been installed before installing crankshaft, refer to paragraphs 13-5 and 13-9. Lubricate bearing with Fel-Pro C-670.

26. Place crankshaft (8) into crankcase.
27. Remove hoist and sling.
28. Lubricate threads of two bolts (6), twelve bolts (4 and 1) with clean engine oil.
29. Install thrust bearing cap (7), two bolts (6), six bearing caps (3), link (2) and twelve bolts (1).
30. After all six bearing caps (3) are installed, tighten 12 bolts (1) and two bolts (6) to 115 lb-ft.
31. Install six connecting rod bearing caps (5) and 12 bolts (4), refer to paragraph 13-8.



## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-4. Crankshaft. (Sheet 9 of 9)

INSTALLATION

32. Position contact pin of dial indicator against end of crankshaft (8).

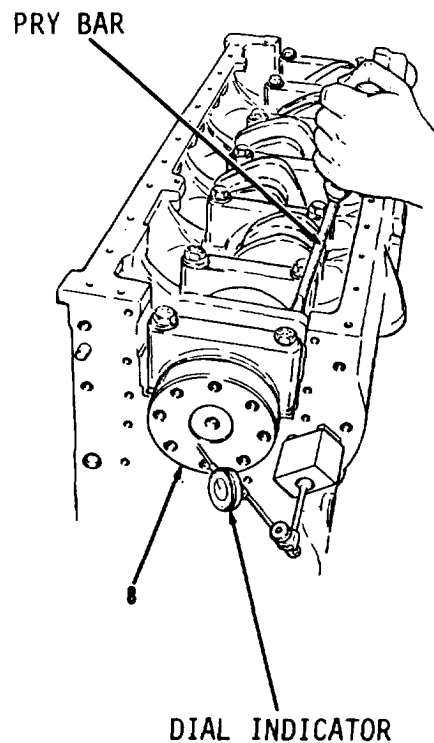
**WARNING**

Do not use a metal hammer to move crankshaft. Do not contact machined surfaces of crankshaft with a metal prybar. Failure to follow this procedure could result in damage to crankshaft.

33. Using a pry bar, move crankshaft (8) forward, then backward.
34. Measure end play of crankshaft (8). Maximum end play is 0.020 inch.
35. For installation of new wear sleeve (12), refer to paragraph 13-7.

## NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-5. Crankshaft Main Bearings. (Sheet 1 of 4)

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

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076  
1-1/2" Open end wrench  
NSN 5120-00-184-8489  
Micrometer  
Torque wrench

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubriplate C-670 (App. C, Item 7)  
Plastigage  
Wire (0.040 diameter)  
Bearing half (12)  
Thrust bearing half (2)

Torques

Bolts of Crankshaft (5) to  
115 lb-ft.

---

EQUIPMENT CONDITION

References

Paragraph 13-4

Condition Description

Crankshaft removed.

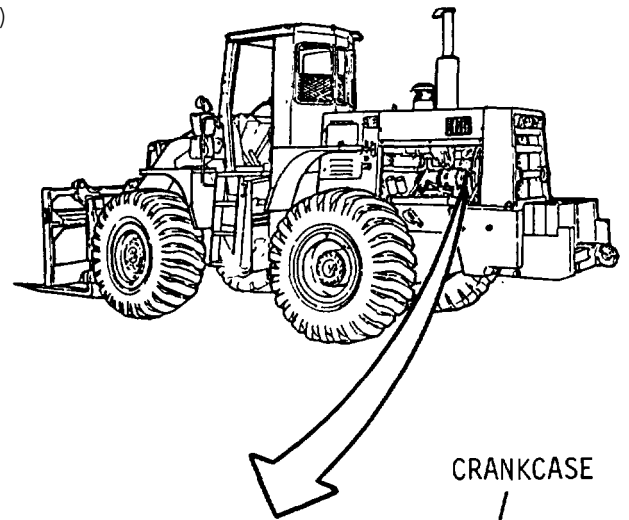
---

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-5. Crankshaft Main Bearings. (Sheet 2 of 4)

REMOVAL

1. Remove and discard six bearing halves (1) from crankcase.
2. Remove and discard thrust bearing half (2).
3. Remove and discard six bearing halves (3) from six saddle caps.
4. Remove and discard thrust bearing half (4) from thrust bearing saddle cap.

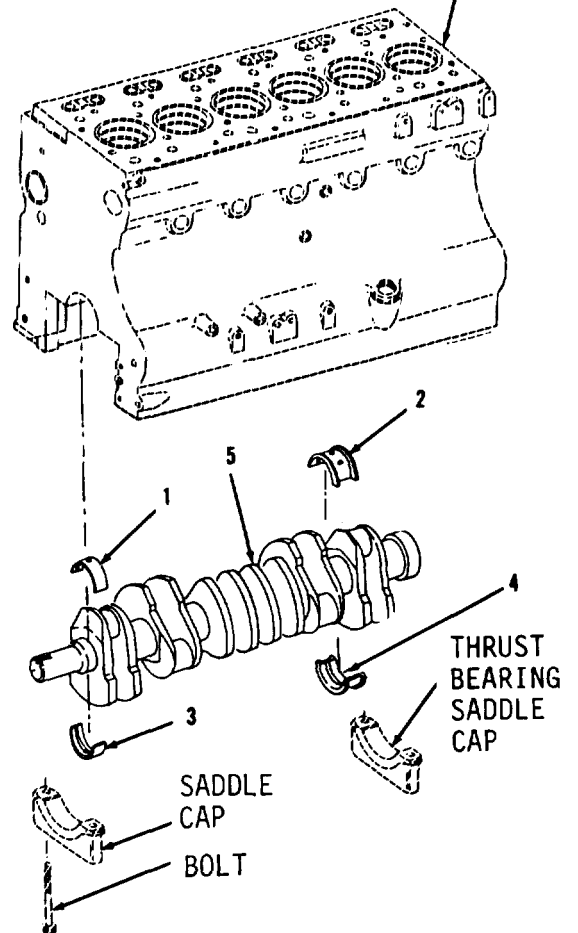


CLEANING/INSPECTION

**WARNING**  
**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

5. Clean crankshaft (5) with cleaning solvent P-D-680.
6. Inspect crankshaft (5), crankcase saddles and saddle caps, refer to paragraph 13-4.

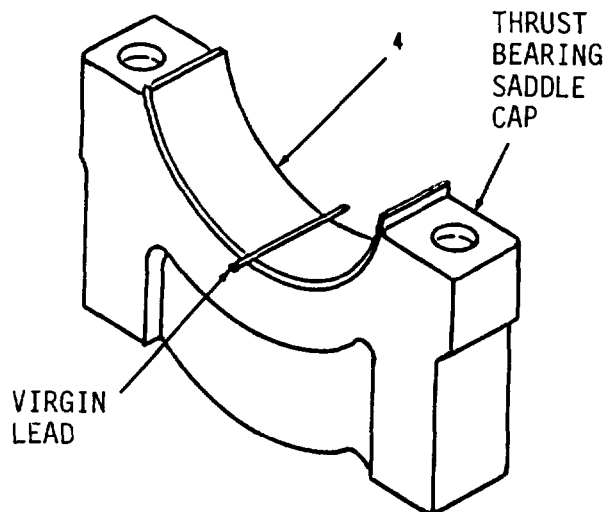


Go to sheet 3

13-5. Crankshaft Main Bearings. (Sheet 3 of 4)

INSTALLATION

7. Coat six new bearing halves (1) with lubriplate. Install six new bearing halves (1) in crankcase.
8. Coat new thrust bearing half (2) with lubricate and install in crankcase.
- 9\* Using a hoist and sling, install crankshaft (5), refer to paragraph 13-4.
10. Install six new bearing halves (3 in six saddle caps.
11. Install thrust bearing half (4) in thrust bearing saddle cap.
12. Position 0.010 inch thick by 1-1/2 inch long virgin lead on top of thrust bearing journal.
13. Install thrust bearing saddle cap and two bolts in crankshaft (5).
14. Using a 13/16" socket and torque wrench, tighten bolts in crankshaft (5) to 115 lb-ft.
15. Using a 13/16" socket and socket wrench handle, remove bolts.
16. Remove thrust bearing saddle cap.
17. Using a micrometer, measure thickness of lead (bearing clearance). Lead thickness should be 0.002 to .005 inch.





GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-5. Crankshaft Main Bearings. (Sheet 4 of 4)

INSTALLATION

18. Using a micrometer, check six main bearing clearance.

NOTE

- If clearances are not within specifications, check crankshaft, saddle caps or for foreign matter behind bearings. Refer to paragraph 13-4.
- Return M10A Forklift to original equipment condition.

END OF TASK



## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

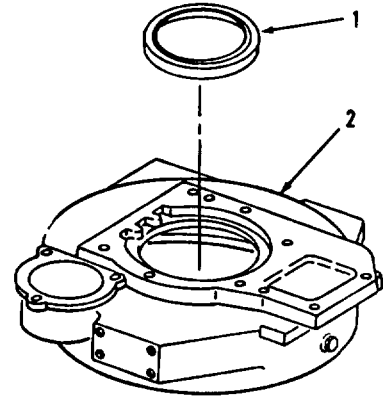
## 13-6. Rear Oil Seal. (Sheet 2 of 6)

REMOVAL

## NOTE

Be careful not to damage the seal bore in the flywheel housing.

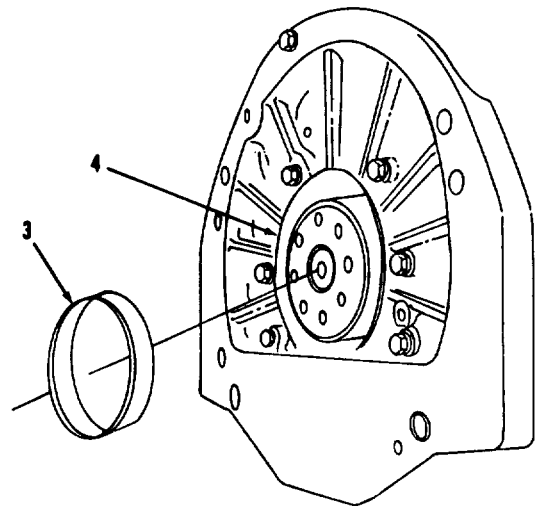
1. Using a brass and hammer, split oil seal (1) and remove from flywheel housing (2). Discard oil seal (1).



## NOTE

Be careful not to damage the crankshaft flange when removing the wear sleeve.

2. Using a muffler tool and hammer, cut wear sleeve (3) and remove from flange of crankshaft (4). Discard wear sleeve (3).



Go to sheet 3

13-6. Rear Oil Seal. (Sheet 3 of 6)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

3. Clean rear of crankshaft and surrounding area with cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
4. Inspect for burrs or foreign material in rear of crankshaft.
5. Inspect all other parts. Refer to paragraph 2-9.

Go to sheet 4

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-6. Rear Oil Seal. (Sheet 4 of 6)

INSTALLATION**CAUTION**

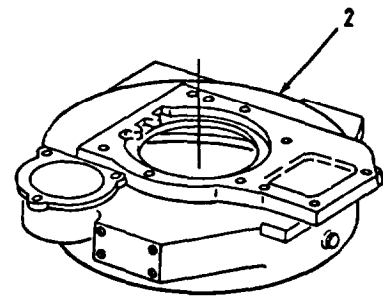
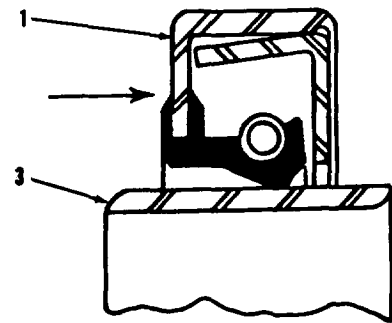
Before installing sleeve and seal, check the seal bore for chamfer. If no chamfer is found, use a file to break the edge of the bore. Failure to follow this procedure could result in damage to casing when sleeve and seal are installed. Be careful not to damage the bore while filing the chamfer edge.

6. Lubricate lip of new oil seal (1) with grease.

## NOTE

Seal must be installed onto side of sleeve with chamfer on O.D. to avoid damage to seal lip, as shown.

7. Assemble new oil seal (1) onto new wear sleeve (3) by pushing new oil seal (1) in the direction of the arrow.
8. Install flywheel housing (2) to crankcase, refer to paragraph 13-7.



Go to sheet 5

13-6. Rear Oil Seal. (Sheet 5 of 6)

INSTALLATION (cont)

NOTE

Only four bolt holes in the crankshaft will line up with the holes in the centering plate.

9. Attach the centering plate to the flange of crankshaft (4) using the four allen head screws. DO NOT tighten the screws at this time.

NOTE

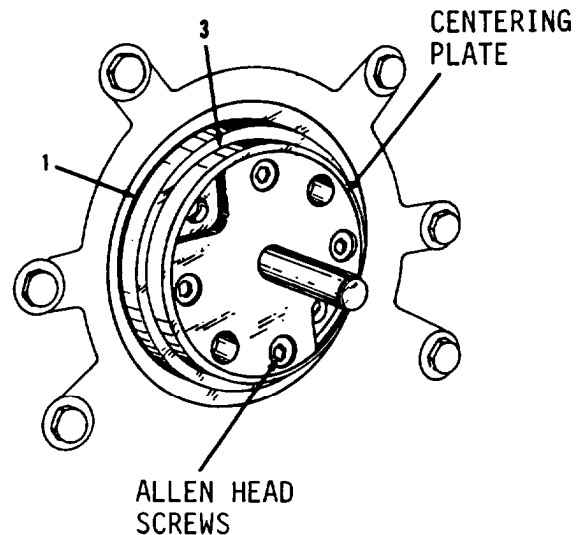
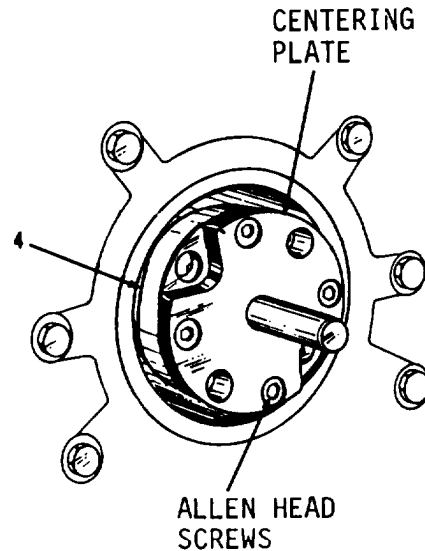
Never remove the oil seal from the wear sleeve during assembly.

10. Position new wear sleeve (3) with new oil seal (1) on centering plate and crankshaft (4), as shown. Tighten the four allen head screws.

NOTE

Do not allow liquid gasket material to come into contact with lip of seal or O.D. of wear sleeve.

11. Coat I.D. of new wear sleeve (3) and O.D. of new oil seal (1) with a thin film of liquid gasket material.
- 12\* Center new wear sleeve (3) and new oil seal (1) on crankshaft (4).



Go to sheet 6

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

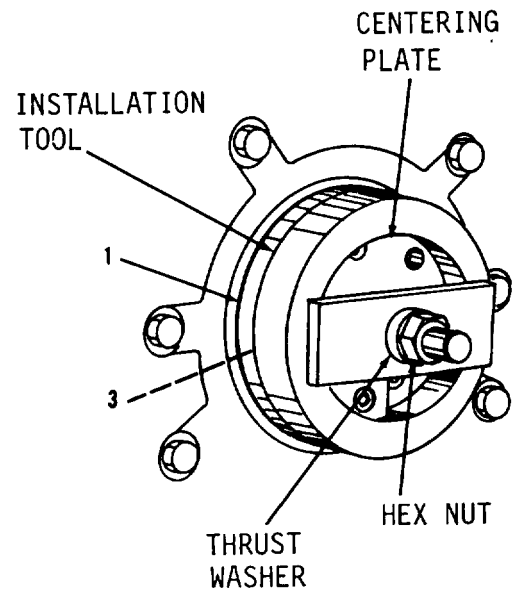
## 13-6. Rear Oil Seal. (Sheet 6 of 6)

INSTALLATION

13. Position rear crankshaft wear sleeve and seal installing tool onto the centering plate, then tighten thrust washer by turning hex nut, as shown. Tighten hex nut until it reaches the end of its travel, at which point new oil seal (1) and new wear sleeve (3) are correctly installed.
14. Remove hex nut, thrust washer, rear crankshaft wear sleeve and seal installing tool, four allen head screws and centering plate.

## NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



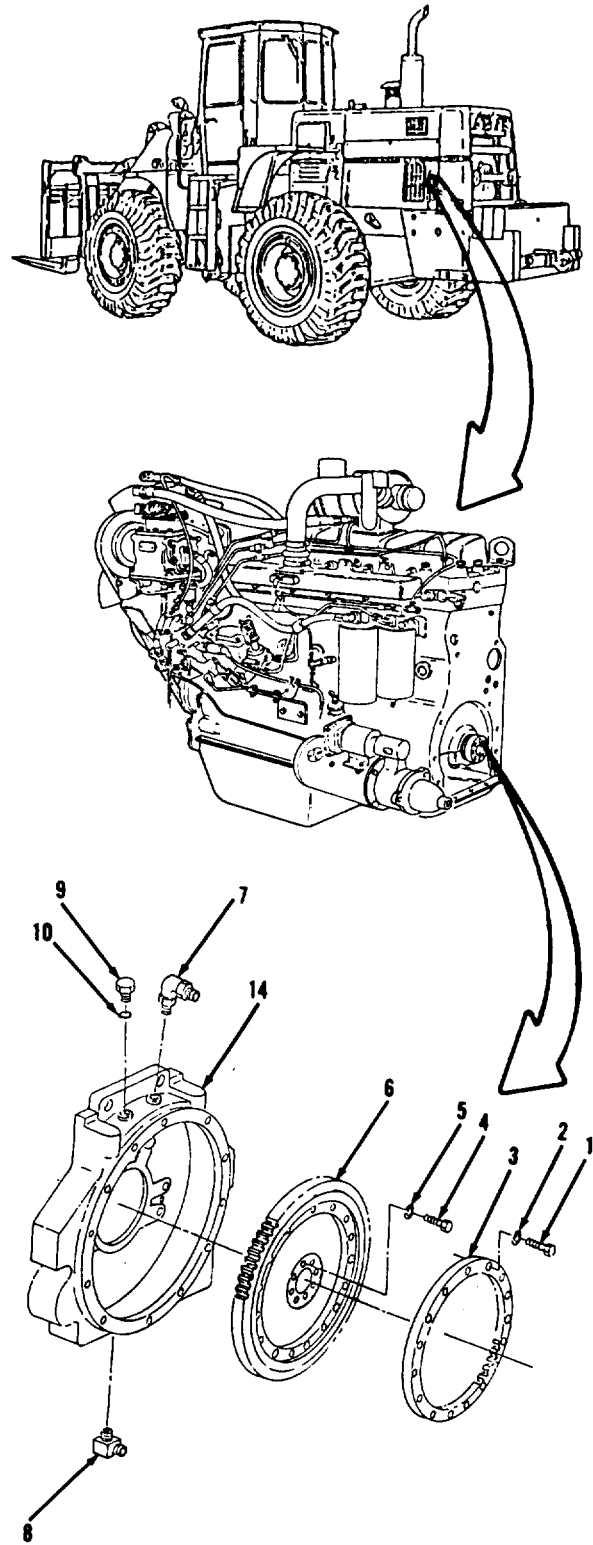


GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-7. Flywheel and Housing. (Sheet 2 of 5)

REMOVAL

1. Using a 3/4" socket and socket wrench handle, remove 16 bolts (1), washers (2) and gear (3) in flywheel (6).
2. Using a 3/4" socket and socket wrench handle, remove eight bolts (4), washers (5) and flywheel (6) in flywheel housing (14).
3. Using a 1" box and open end wrench, remove elbows (7 and 8), plug (9) and gasket (10). Discard gasket (10).



Go to sheet 3

13-7. Flywheel and Housing. (Sheet 3 of 5)

REMOVAL (cont)

4. Attach hoist and sling to flywheel housing (14) in front of crankcase.

**WARNING**  
**WEIGHT HAZARD**

Weight of flywheel and housing is approximately 300 lbs. Use adequate hoist and sling for removal and installation. Keep area clear of unnecessary personnel. Failure to follow this procedure could result in SEVERE INJURY.

5. Using a 9/16" open end wrench, remove four bolts (11).

NOTE

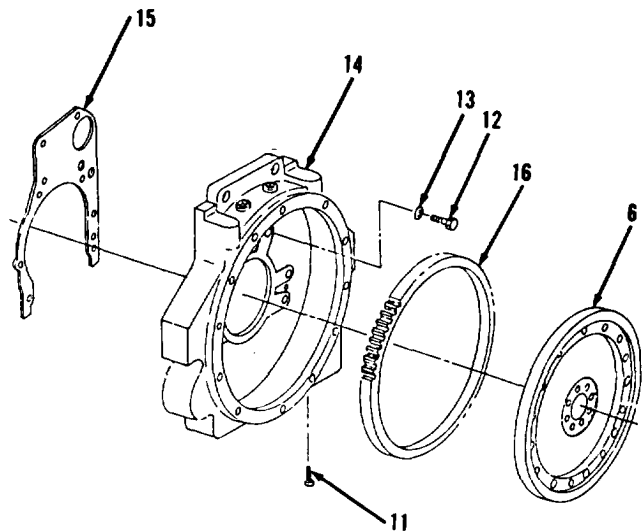
Remove oil seal and wear sleeve, paragraph 13-6.

6. Using a 3/4" socket and socket wrench handle, remove eight bolts (12), washers (13), flywheel housing (14) and gasket (15). Discard gasket (15).

NOTE

Before removal, inspect gear. Replace if gear is cracked, warped, chipped or has broken teeth.

7. Using a flat punch and hammer, remove gear (16) from flywheel (6).



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-7. Flywheel and Housing. (Sheet 4 of 5)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

8. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
9. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5

13-7. Flywheel and Housing. (Sheet 5 of 5)

INSTALLATION

10. Heat gear (16) to 500-550 degrees F and place on flywheel (6) while hot.

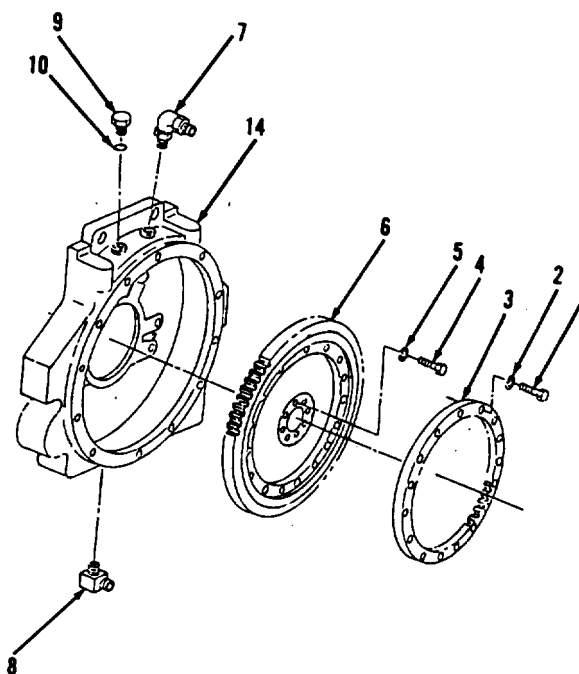
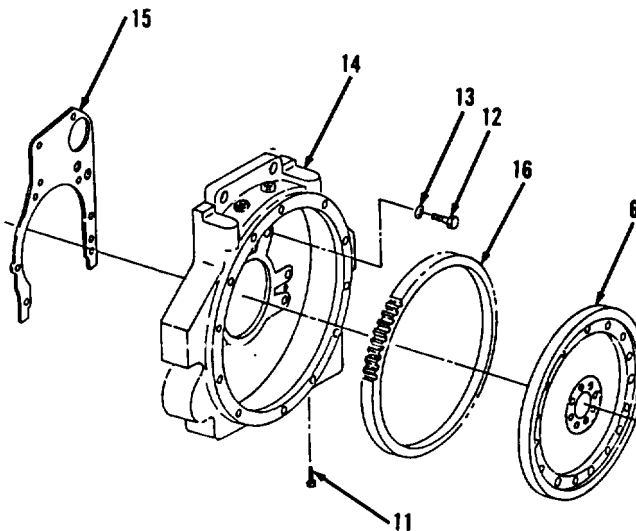
NOTE

Install wear sleeve and oil seal, paragraph 13-6.

11. Position new gasket (15) and flywheel housing (14) in front of crankcase with hoist and sling.
12. Using a 3/4" socket and torque wrench, install new gasket (15), flywheel housing (14), eight washers (13) and bolts (12). Tighten eight bolts (12) to 105 lb-ft.
13. Install four bolts (11).
14. Install new gasket (10), plug (9) and elbows (8 and 7) in flywheel housing (14).
15. Install flywheel (6), eight washers (5) and bolts (4). Tighten eight bolts (4) to 125 lb-ft. Eight bolts (4) must be tightened evenly to draw flywheel (6) onto crankshaft evenly. Remove hoist and sling.
16. Using a 3/4" socket and socket wrench handle, install gear (3), 16 washers (2) and bolts (1) on flywheel (6).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 1 of 12)

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

INITIAL SETUP

Tools

Shop Equipment, Machine Shop :  
 Field Maintenance,  
 Basic, Less Power  
 NSN 3470-00-754-0708

Shop Equipment, Machine Shop :  
 Field Maintenance,  
 Basic, MAP only  
 NSN 3470-00-919-0068

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

Materials/Parts

Cleaning solvent P-D-680  
 (App. C, Item 5)  
 Clean-cloth (App. C, Item 24)  
 Fine crocus cloth  
 (App. C, Item 3)  
 Engine oil SAE 30  
 (App. C, Item 19)  
 Virgin lead wire  
 Rings (3)

Torques

Bolts (1) to 60 lb-ft., 130 lb-ft.  
 and 115 lb-ft.

EQUIPMENT CONDITION

References

Paragraph 4-4

Paragraph 4-7

Condition Description

Cylinder head removed.

Oil pan removed.

Go to sheet 2

REMOVAL

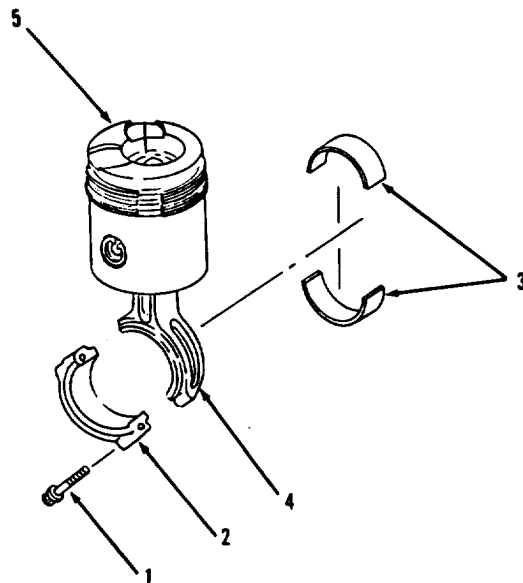
**CAUTION**

Before removing piston and connecting rod inspect the upper edge of the cylinder sleeve for a ridge. If a ridge is found it must be removed with a fine crocus cloth and a carbon scraper or ridge reamer before the piston is removed. Failure to follow this procedure could result in damage to piston ring lands during removal and installation.

NOTE

- Keep parts in order and observe markings to prevent possible mismatching during assembly and installation. Keep rod caps and bearings bolted to their original connecting rod.
- The following procedure is for one piston and connecting rod assembly. The procedure for the other five piston and connecting rod assemblies is identical.

1. Using a 5/8" socket and socket wrench handle, remove two bolts (1), cap (2) and two bearing halves (3) from connecting rod (4) in lower crankcase.



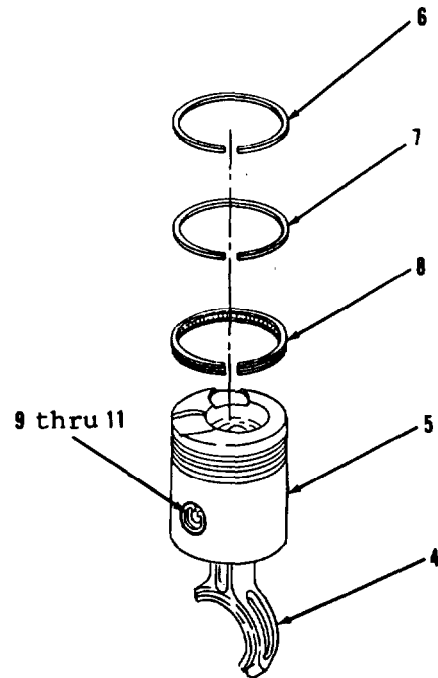
## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 3 of 12)

DISASSEMBLY**CAUTION**

Use extreme care when removing piston and connecting rod assembly. Failure to follow this procedure could result in damage to cylinder sleeves or crankshaft journals.

2. Using a plastic mallet, remove items 4 thru 11 as an assembly through top of crankcase by using a wood punch to push connecting rod (4) and piston (5) to top of cylinder from lower crankcase.
3. Wrap an oil soaked cloth around crankshaft connecting rod journals in lower crankcase to protect it until installation.
4. Using a ring expander tool, remove rings (6, 7 and 8) in order and discard.



Go to sheet 4

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 4 of 12)

DISASSEMBLY (cont)

NOTE

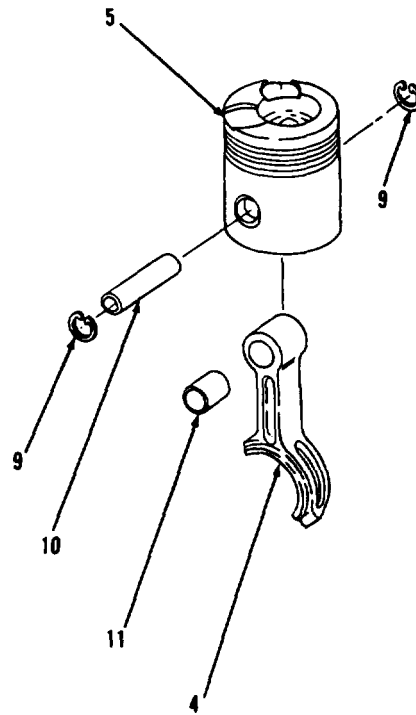
Do not force pin. If pin cannot be removed when cold, heat the piston in water 160-180 degrees F.

5. Using retaining ring pliers, remove two retainers (9) and pin (10) by hand,

NOTE

Before removal, note the direction of valve depressions in relation to the connecting rod for proper assembly.

6. Separate connecting rod (4) and piston (5).
7. Using a dial indicator, measure pin (10) in pin bushing. If reading is not between .0006-.003 inches, replace pin (10). If reading is not accurate due to gumming on piston (5) and pin (10), repeat measurement after cleaning.
8. Inspect bushing (11) for wear. Using an arbor press, remove bushing (11) and discard. only if worn.





## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 5 of 12)

CLEANING/INSPECTION

9. Soak piston (5) in mild detergent solution until carbon deposits are soft.
10. Using a carbon scraper, remove carbon on piston (5).
11. Using a non-metallic brush, clean piston (5) ring grooves and oil holes.
12. Clean carbon deposits in connecting rod (4) and cap (2) with mild detergent solution and non-metallic brush. Clean mating surfaces between connecting rod (4) and cap (2).

Go to sheet 6

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 6 of 12)

CLEANING/INSPECTION (cont)

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

13. Clean threads of two bolts (1) with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 7 of 12)

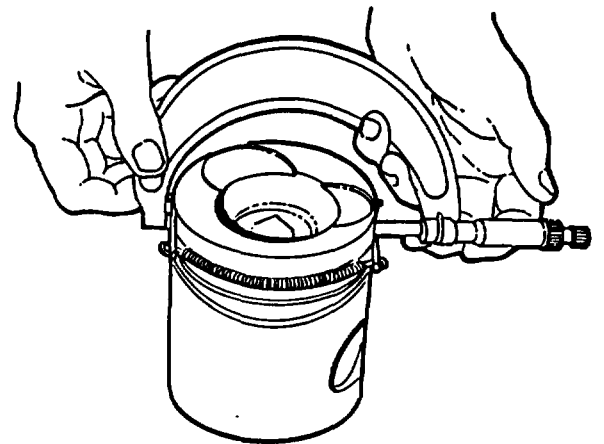
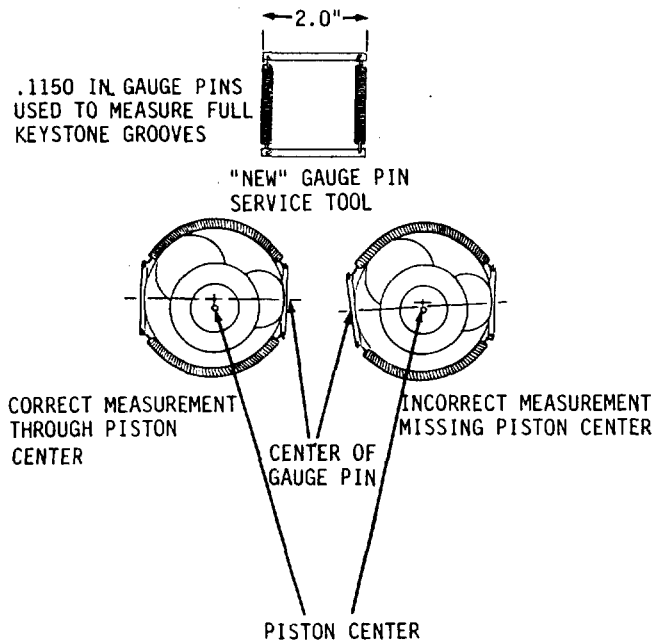
CLEANING/INSPECTION

- 14. Inspect piston (5) for scuffed or scored skirts, cracked or worn piston lands. Check pin bore for wear and cracks, replace if necessary.
- 15. Using a feeler gage, measure running clearance between piston (5) and cylinder sleeve, replace piston (5) if necessary. Measure piston (5) at a 90 degree angle from the piston pin (10). Clearance should be between 0.0045 and 0.0075 inches, refer to paragraph 13-3.

NOTE

Full keystone grooves use the 0.1150 inch gage pins to determine piston ring groove wear. Be sure that the center of the gage pins align with the center of the piston so that gage pins are parallel. Rectangular grooves do not use gage pins. Use side clearance and ring gap to determine piston ring groove wear.

- 16. Install tool 3020 in the top of piston (5) ring groove.
- 17. Using 4-5 inch micrometer, measure piston (5) over gage pins, if necessary.
- 18. Repeat steps 16 and 17 for intermediate ring (7) and ring (8). For ring (7), upper limit is 4.3168 inches and replacement limit is 4.2844 inches. For ring (8), side clearance must be between 0.002 and 0.004 inches.
- 19. Remove tool 3020 from piston (5) ring groove.



Go to sheet 8

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 8 of 12)

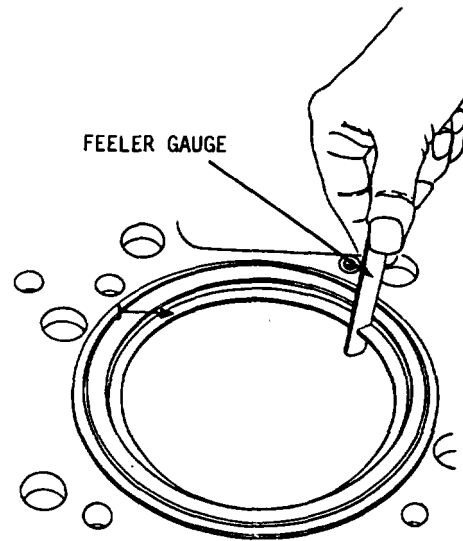
CLEANING/INSPECTION (cont)

20. Push new rings (6 and 7) down into cylinder sleeve with the top of a piston positioning ring squarely in the sleeve.
21. Using a feeler gage, measure ring gap. Replace ring if gap is too wide. File ring to specification. Ring (6) gap should be between 0.010 and 0.029 inches. Ring (7) gap should be between 0.020 and 0.033 inches for narrow gap and between 0.065 and 0.078 inches for wide gap.
22. Inspect pin (10) and replace if worn, etched or corroded.
23. Inspect two bolts (1) for nicks or thread damage, replace if necessary.

NOTE

Rods have a special rolled thread.  
Do no retap rods.

24. Lubricate thread of two bolts (1) with SAE 30 engine oil. Screw two bolts (1) into connecting rod (4) face by hand. If two bolts (1) does not screw into connecting rod (4) freely, replace connecting rod (4).
25. Using a micrometer, measure and record the three inside diameters of each rod at points "A", "B" and "C".
26. Inspect two bearing halves (3) for deep scratches, wear or burned areas.
27. Insert two bearing halves (3) into connecting rod (4) and cap (2).
28. Check crank pin diameter of crankshaft, refer to paragraph 13-4.



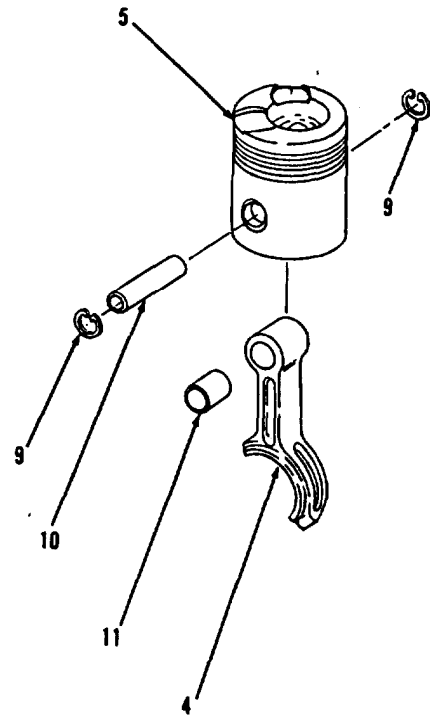
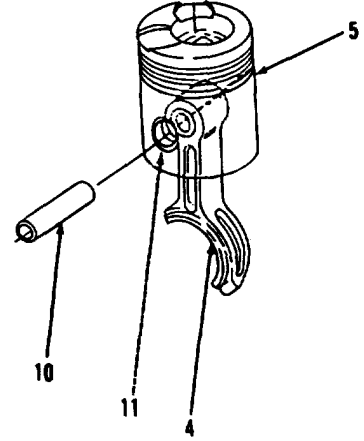
Go to sheet 9

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 9 of 12)

ASSEMBLY

29. Using an arbor press, install new bushing (11), if worn, in piston (5) and connecting rod (4) with parting line 60 degrees to left of oil hole in top of rod.
30. Bore bushing (11) to 1.6256 to 1.6258 inches.
31. Coat piston (5) bore and pin (10) with moly lube.
32. Insert pin (10) end into piston of connecting rod (4). Aline bore holes of connecting rod (4) and piston (5). Aline bushing (11) with pin (10) hole.
33. Install pin (10). Pin is loose fit at 70 degrees F.
34. Using internal snap ring pliers, install two retainers (9).



Go to sheet 10

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 10 of 12)

ASSEMBLY (cont)

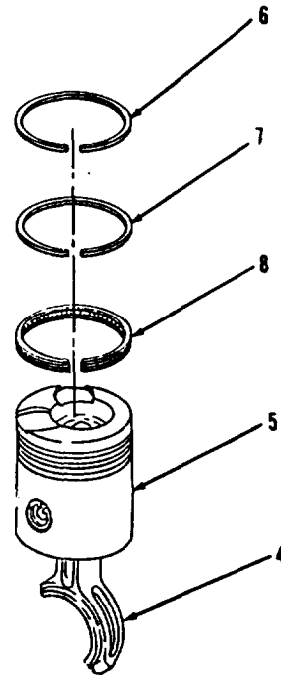
**CAUTION**

A piston ring expander must be used to install rings. Use of any other tool may cause damage to piston lands.

NOTE

During installation of rings, make sure the proper order is followed. Bottom ring first, then consecutively upwards. Shiny face of ring should be up.

35. Using a ring expander tool, install new rings (8, 7 and 6).
36. Position ring (8) 90 degrees from intermediate ring. Position ring (7) 180 degrees from top ring. Position split of ring (6) 30 degrees from pin bore.
37. Coat cylinder sleeve in upper crankcase with thick lubricating oil.
38. Coat piston (5) and rings (8,7 and 6) with clean lubricating oil, working oil into ring grooves.



Go to sheet 11

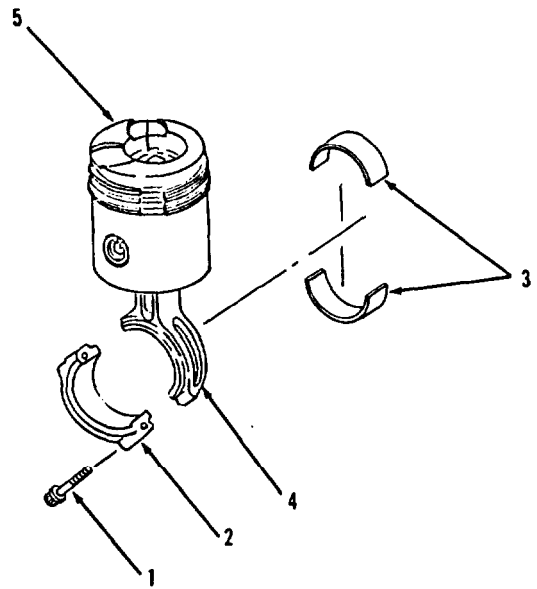
## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

## 13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 11 of 12)

ASSEMBLY**CAUTION**

Avoid striking cylinder sleeve with connecting rod when installing pistons. Failure to follow this procedure will result in damage to the cylinder sleeve.

39. Using piston ring compressor, insert through the top of the cylinder head to compress ring as you install piston (5). The numbers on the rod must face away from the camshaft. The valve depression on the top of piston (5) must face toward the camshaft.

INSTALLATION

40. Coat two bearing halves (3) with moly lube. Install bearing half (3) on connecting rod (4) in lower crankcase.
41. Using a wood punch, tap down connecting rod (4) and piston (5) onto crankshaft. Make sure connecting rod (4) does not nick, scratch or damage crankshaft.
42. Position bearing half (3) and cap (2) on connecting rod (4).

## NOTE

If bolts (1) are being replaced, it will be necessary to repeat step 43, three times. New bolts need to be loosened and re-torqued three times. This only applies to new bolts.

43. Using a 5/8" socket and torque wrench, install two bolts (1). Tighten to 60 lb-ft, then 130 lb-ft. Turn crankshaft and check tightening.

Go to sheet 12

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-8. Pistons, Connecting Rods and Connecting Rod Bearings. (Sheet 12 of 12)

INSTALLATION (cont)

44. Using a 5/8" socket and socket wrench handle, remove two bolts (1), cap (2) and bearing half (3) in lower crankcase.
45. Place suitable length of 0.010 inch virgin lead wire across bearing in cap.
46. Using a 5/8" socket and torque wrench, install bearing half (3), cap (2) and two bolts (1). Tighten two bolts (1) to 115 lb-ft.
47. Remove lead wire and measure with a micrometer to determine running clearance.
48. Using a feeler gage, measure connecting rod (4) end clearance.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



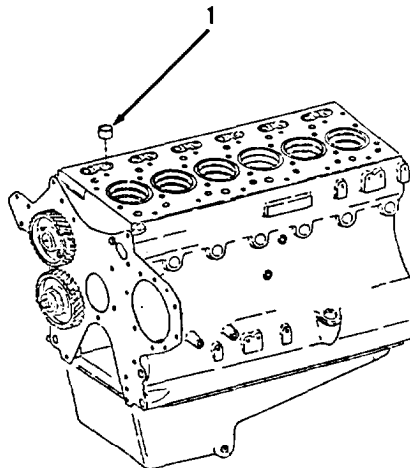


13-9. Camshaft and Timing Gears. (Sheet 2 of 8)

REMOVAL

NOTE

- Before removal of camshaft, check lobe lift with dial indicator. Intake total lobe lift is 0.2905 inch. Exhaust total lobe lift is 0.2907 inch. Replace camshaft and tappets if total wear of 0.020 inch is indicated.
- Before removal of camshaft, check camshaft end play. End play must be 0.005 to 0.013 inches. Replace thrust plate if greater end play is indicated.
- Before removal of camshaft, check backlash of timing gears using dial indicator. Backlash of cam and idler gear must not exceed 0.016 inch. Backlash of idler and crankshaft gear must not exceed 0.016 inch. Backlash of idler and injection pump gear must not exceed 0.016 inch. Replace any pair of gears with excessive backlash.



1. Mark location of 12 tappets (1) in crankcase and remove.

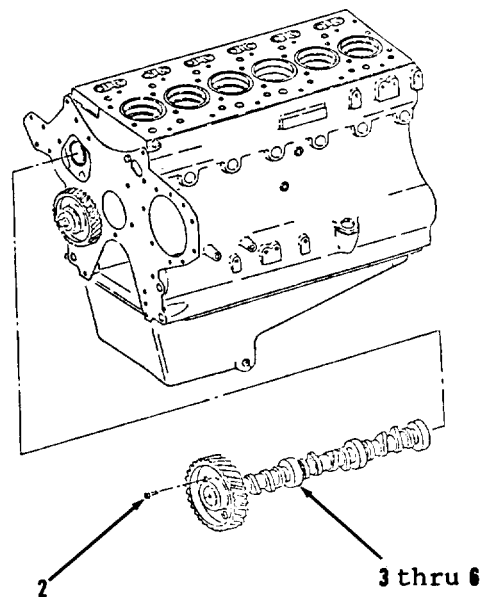
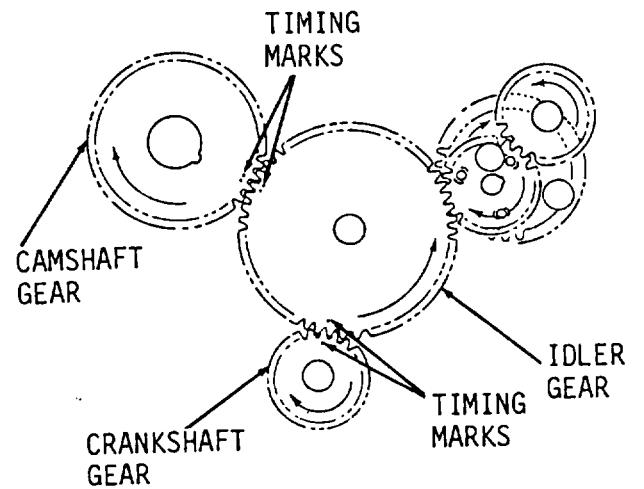
GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-9. Camshaft and Timing Gears. (Sheet 3 of 8)

REMOVAL

NOTE

- Crank engine until timing marks on camshaft gear, idler gear and crankshaft gear are aligned, as shown before removing camshaft.
  - Camshaft must be supported along its length during removal to prevent cam lobes from damaging bearings.
2. Using a 1/2" socket and socket wrench handle, remove two bolts (2) in front of engine,
  3. Remove items 3 thru 6 as an assembly.



Go to sheet 4

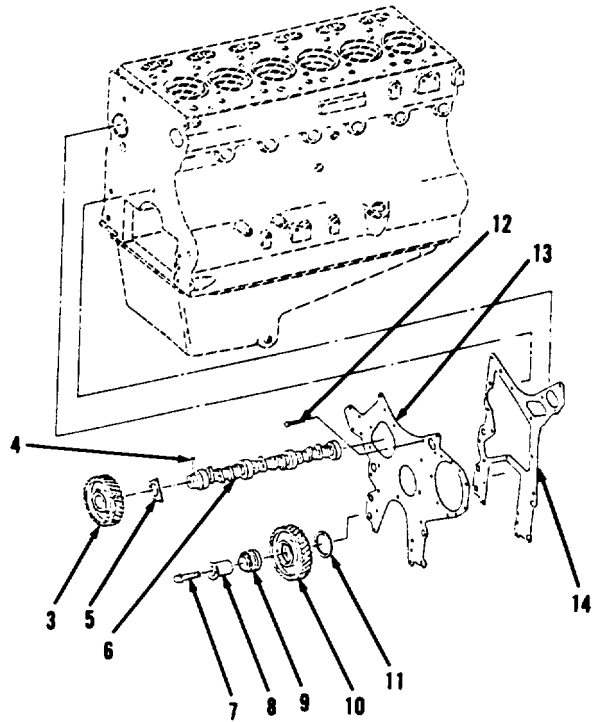
**REMOVAL (cont)**

- Using an arbor press, remove gear (3), key (4) and plate (5) from camshaft (6). Press gear (3) off camshaft (6).

NOTE

Bearing consists of two bearings, two cups and two spacers to be replaced as an assembly.

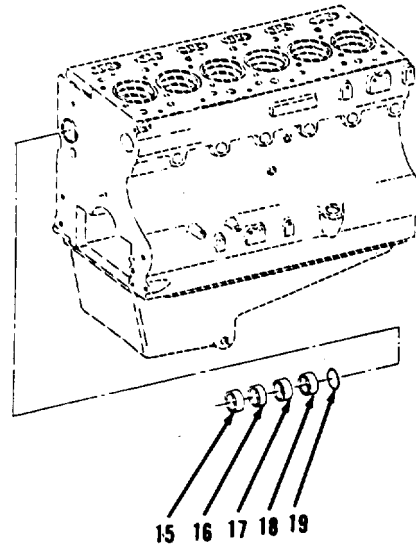
- Using a 5/8" socket and socket wrench handle, remove bolt (7), shaft (8), bearing (9), gear (10) and spacer (11).
- Using a 1/2" socket and socket wrench handle, remove four bolts (12), plate (13) and gasket (14). Discard gasket (14). Remove all gasket material from mounting surfaces.



NOTE

Inspect camshaft bearings for wear. Inside diameter of bearings must be 2.2845 to 2.2880 inches. Replace if worn.

- Using puller, remove and discard bearings (15 thru 18) and preformed packing (19) from rear of engine.



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-9. Camshaft and Timing Gears. (Sheet 5 of 8)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

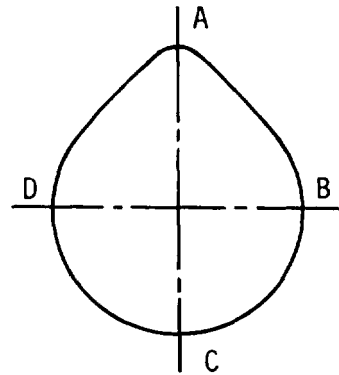
8. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 6

13-9. Camshaft and Timing Gears. (Sheet 6 of 8)

CLEANING/INSPECTION (cont)

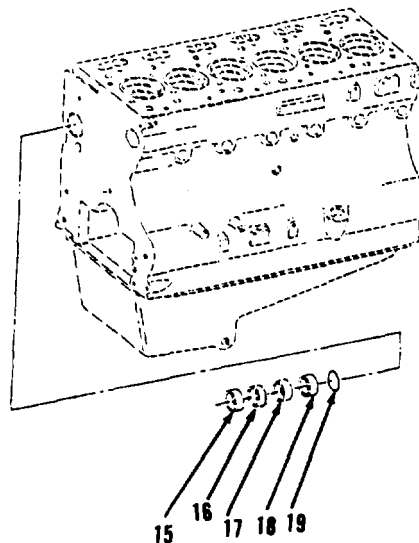
9. Measure lobes in camshaft (6) across points A-C and B-D, as shown. Replace if excessively worn.
10. Measure bearing journals in camshaft (6). Replace if excessively worn.
11. Inspect gears (3 and 10) in camshaft (6) for worn or damaged teeth.
12. Inspect bore of gear (3). Replace if enlarged.
13. Inspect all other parts. Refer to paragraph 2-9.



INSTALLATION

NOTE

- Oil holes in bearings must line up with oil holes in crankcase.
  - To ease oil hole alignment, mark back-up nut in line with oil hole in bearing before installation.
14. Using puller, expanding collet and back-up nut, install new preformed packing (19) and new bearings (18 thru 15) in rear of engine.



Go to sheet 7

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-9. Camshaft and Timing Gears. (Sheet 7 of 8)

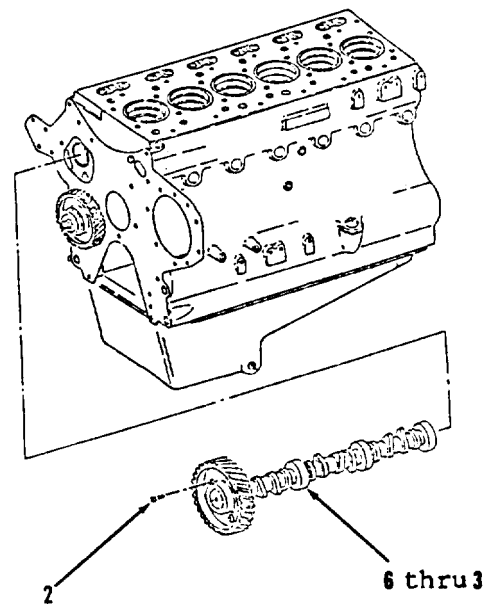
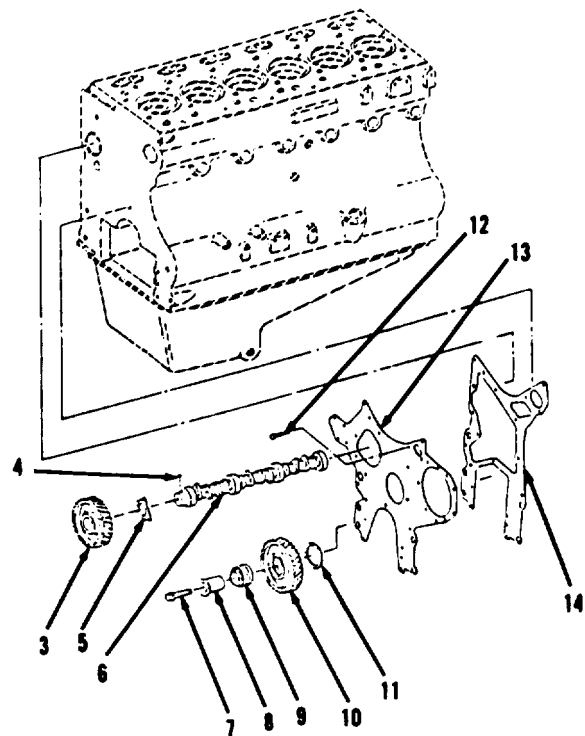
INSTALLATION

15. Using a 1/2" socket and socket wrench handle, install new gasket (14), plate (13) and four bolts (12).
16. Using a 5/8" socket and socket wrench handle, install spacer (11), gear (10), bearing (9), shaft (8) and bolt (7).

**WARNING**

Use asbestos gloves when handling gear during installation to prevent severe burn injury. Temperature of gear is approximately 400 degrees F.

17. Using an arbor press, install plate (5), key (4) and gear (3) in camshaft (6).
18. Using a rubber mallet, install camshaft (6) and items 6 thru 3 as an assembly in front of engine.
19. Using a 1/2" socket and torque wrench, install two bolts (2). Tighten bolts (2) to 20 lb-ft.



Go to sheet 8

TM 10-3930-643-34

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

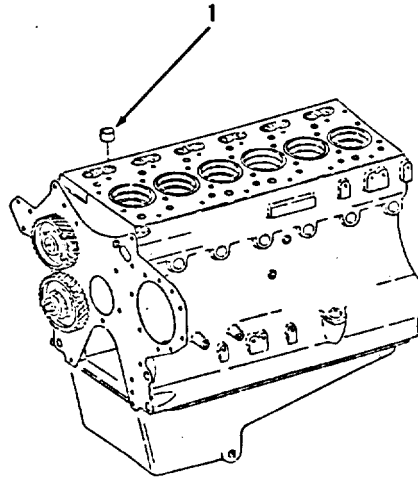
13-9. Camshaft and Timing Gears. (Sheet 8 of 8)

INSTALLATION (cont)

20. Install 12 tappets (1) in top of engine.
21. Check timing of fuel pump, refer to paragraph 4-15.

NOTE

Return H10A Forklift to original equipment condition.



END OF TASK





13-10. Oil Pump Inlet Tube. (Sheet 2 of 3)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

3. Clean all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
- 40 Inspect all parts. Refer to paragraph 2-9.

Go to sheet 3

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

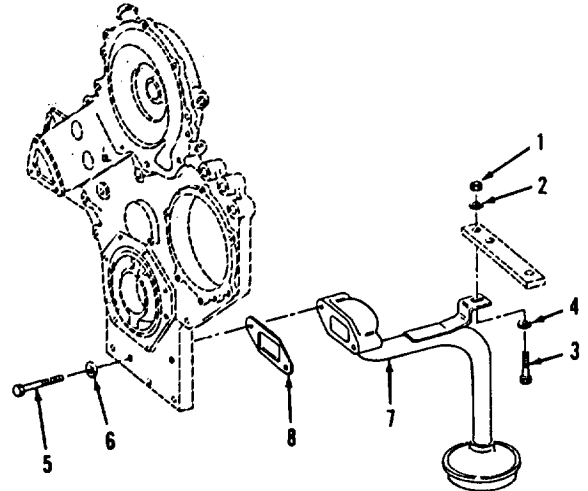
## 13-10. Oil Pump Inlet Tube. (Sheet 3 of 3)

INSTALLATION

5. Using 1/2" socket and socket wrench handle, install new gasket (8), tube assembly (7), two washers (6) and bolts (5).
6. Using a 9/16" socket, socket wrench handle and a 9/16" box and open end wrench, install washer (4), bolt (3), lock washer (2) and nut (1).

## NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-11. Engine Oil Pump. (Sheet 1 of 5)

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

---

INITIAL SETUP

Tools

Tool Kit. General Mechanic's  
Automotive  
NSN 5180-00-177-7033

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Grease (App. C, Item 11)  
Plastigage (App. C, Item 22)  
Preformed packing (2)  
Seal  
Lock screw (6)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

References

Paragraph 4-5

Condition Description

Vibration damper removed.

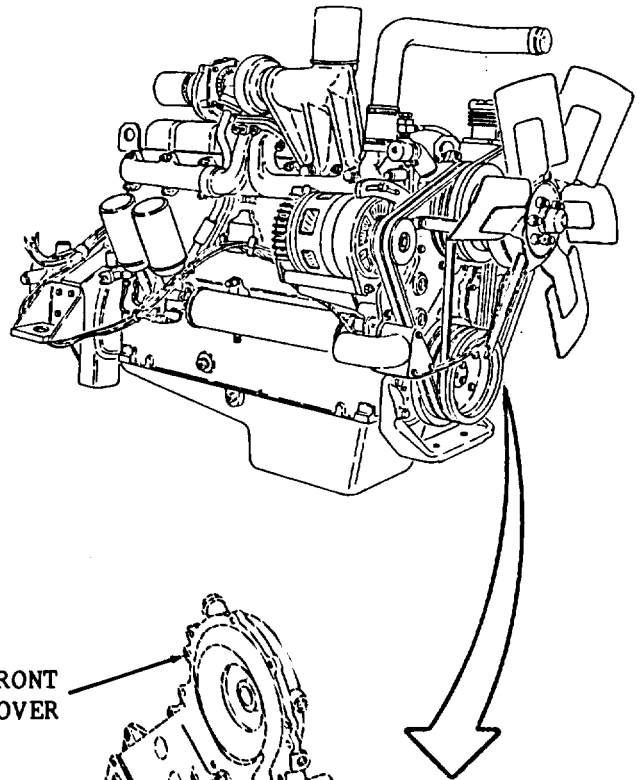
---

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-11. Engine Oil Pump. (Sheet 2 of 5)

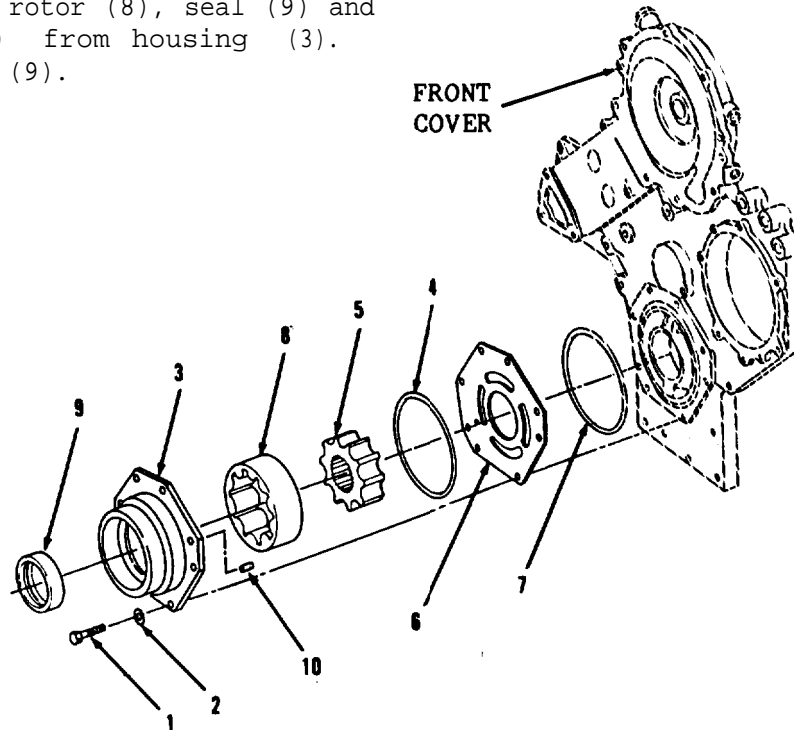
REMOVAL

1. Using a 1/2" socket and socket wrench handle, remove six lock screws (1), washers (2), housing (3) and preformed packing (4) from front cover. Retain six lock screws (1) and preformed packing (4) to be used for measurement of end clearance.



DISASSEMBLY

2. Remove inner rotor (5), plate (6) and preformed packing (7). Discard preformed packing (7).
3. Remove outer rotor (8), seal (9) and two pins (10) from housing (3). Discard seal (9).



Go to sheet 3

13-11. Engine Oil Pump. (Sheet 3 of 5)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

4. Clean all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

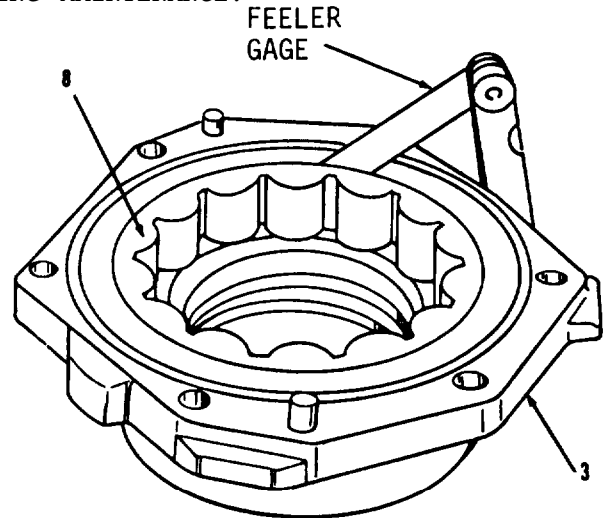
Go to sheet 4

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-11. Engine oil Pump. (Sheet 1 of 5)

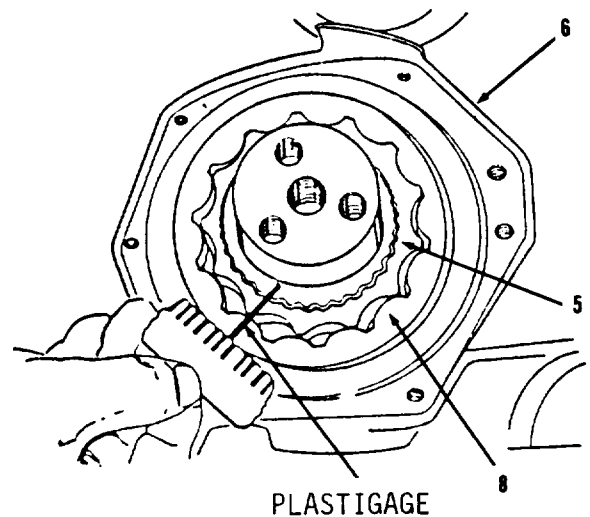
CLEANING/INSPECTION

5. Inspect housing (3), inner rotor (5), outer rotor (8) and plate (6) for nicks, burrs, scoring or unusual wear.
6. Install outer rotor (8) in housing (3).
7. Check clearance between outer rotor (8) and housing (3) with feeler gage. Clearance must be 0.0055 to 0.0095 inches.



ASSEMBLY

8. Install new preformed packing (7), plate (6), inner rotor (5) and outer rotor (8) on front cover. Place plastigage strip across rotors (5 and 8).
9. Using a 1/2" socket and socket wrench handle, install preformed packing (4), housing (3), six washers (2) and lock screws (1) on rear cover.
10. Using a 1/2" socket and socket wrench handle, remove and discard six lock screws (1), washers (2), housing (3) and preformed packing (4). Discard preformed packing (4).
11. Measure plastigage. Clearance between rotors (5 and 8) and housing (3) must be 0.0015 to 0.0043 inches.



Go to sheet 5

13-11. Engine Oil Pump. (Sheet 5 of 5)

ASSEMBLY (cont)

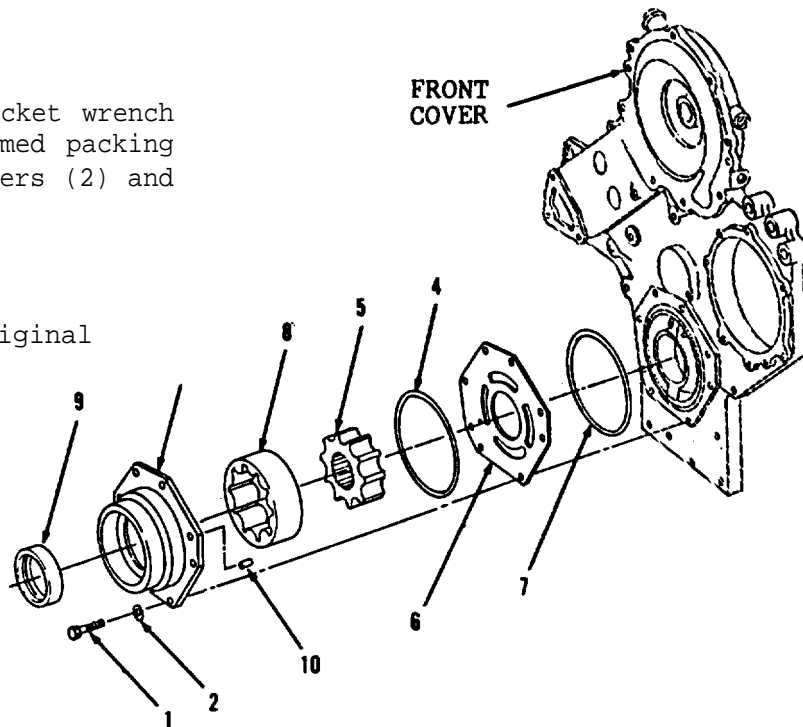
12. Install two pins (10), new seal (9) and outer rotor (8) in housing (3). Pack grooves of outer rotor (8) with grease.
13. Install new preformed packing (7), plate (6) and inner rotor (5).

INSTALLATION

14. Using a 1/2" socket and socket wrench handle, install new preformed packing (4), housing (3), six washers (2) and new lock screws (1).

NOTE

Return M10A Forklift to original equipment condition.



END OF TASK





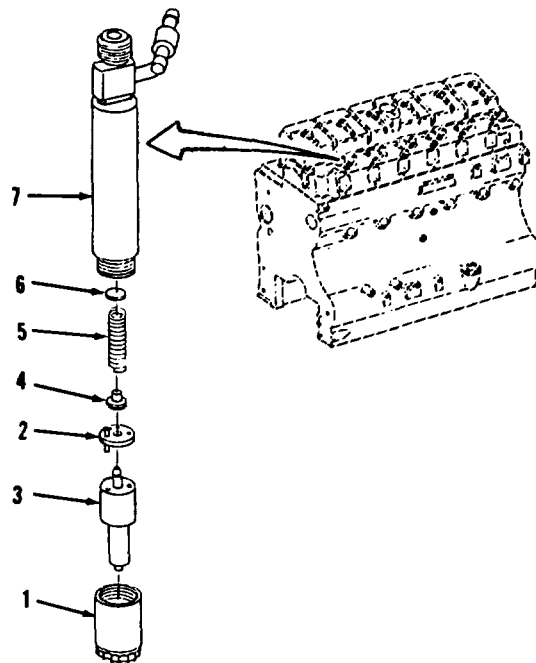
13-12. Fuel Injectors. (Sheet 2 of 4)

DISASSEMBLY

NOTE

There are six fuel injector nozzles. The following is a disassembly procedure for one fuel injector nozzle. The disassembly procedure for the remaining five is identical.

1. Using a 15 mm box wrench and vice, separate nut (1) and housing (7).
2. Remove spacer (2) and nozzle (3) from nut (1).
3. Remove seat (4), spring (5) and spacer (6) from housing (7).



GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-12. Fuel Injectors. (Sheet 3 of 4)

**CLEANING/INSPECTION**

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

4. Clean all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

CLEANING/INSPECTION (cont)

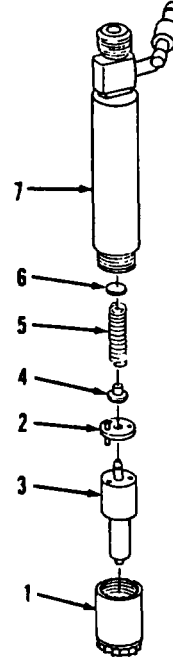
**CAUTION**

Be extremely careful when handling nozzle. Tip is damaged easily.

5. Inspect nozzle (3) for damage and blocked passages.
6. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

7. Install spacer (6), spring (5) and seat (4) in housing (7).
8. Install nozzle (3) and spacer (2) in nut (1).
9. Position nut (1) on housing (7). Be certain opening and two pins on spacer (2) align with nozzle (3). Using a torque wrench, tighten nut (1) to 33 lb-ft.



TESTING

10. Test items 1 thru 7 as an assembly, refer to paragraph 4-12.

NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-13. Fuel Solenoid. (Sheet 1 of 5)

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

INITIAL SETUP

Tools

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, Less Power  
 NSN 4910-00-754-0714

Shop Equipment, Fuel & Electrical System, Engine: Field Maintenance, Basic, MAP only  
 NSN 4910-00-919-0083

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

Materials/Parts

Cleaning solvent P-D-680  
 (App. C, Item 5)  
 Clean cloth (App. C, Item 24)  
 Gasket (2)  
 Lockwire

Torques

Screws (5) to 28 in-lb.  
 Solenoid body (10) to 125 in-lb.

EQUIPMENT CONDITION

References

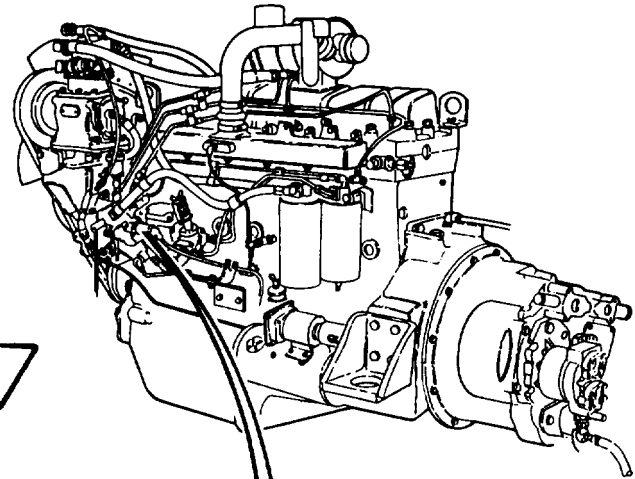
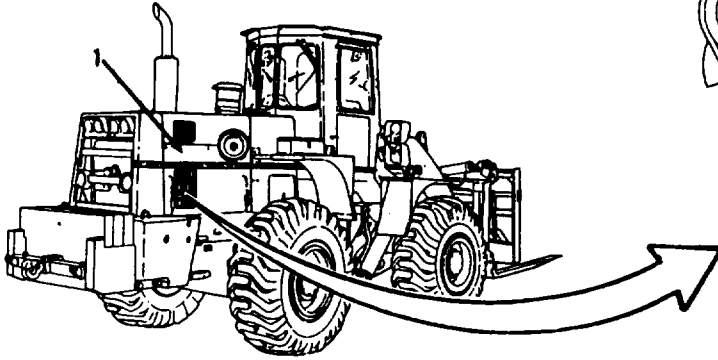
TM 10-3930-643-20

Condition Description

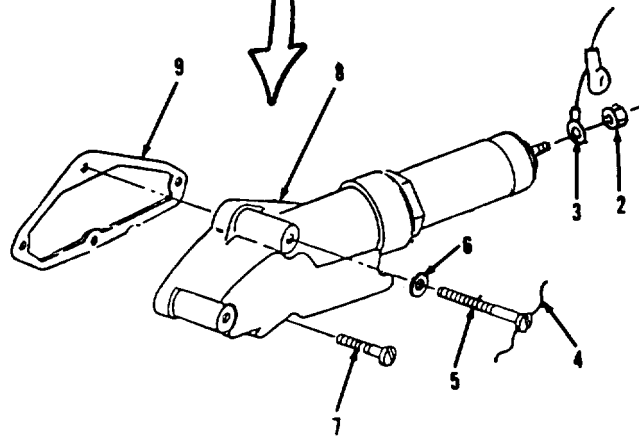
Battery negative disconnect

13-13. Fuel Solenoid. (Sheet 2 of 5)

REMOVAL

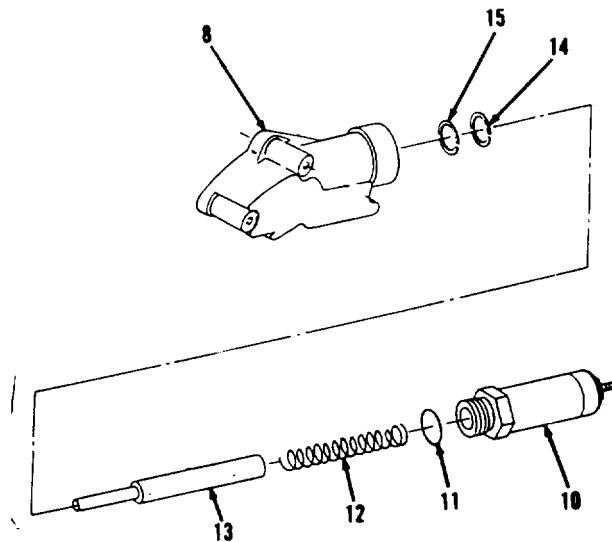


1. Remove engine side access cover (1) from right side of engine compartment, refer to TM 10-3930-643-20.
2. Using a 7/16" open end wrench, remove nut (2) and wire assembly (3) at terminal from right side of engine.
3. Using side cutters, cut, remove and discard lockwire (4).
4. Using a flat tip screwdriver, remove two screws (5), lock washers (6), screws (7), cover (8) and gasket (9). Discard gasket. Remove all gasket material from mounting surfaces.



DISASSEMBLY

5. Using a 3/4" open end wrench, remove solenoid body (10), gasket (11), spring (12), plunger (13), washer (14) and ring (15) from cover (8). Discard gasket (11). Remove all gasket material from mounting surfaces.



Go to sheet 3

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-13. Fuel Solenoid. (Sheet 3 of 5)

**CLEANING/INSPECTION**

6. Wipe solenoid body (10) with clean cloth.

**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

7. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 4

13-13. Fuel Solenoid. (Sheet 4 of 5)

CLEANING/INSPECTION (cont)

8. Inspect two screws (5), lock washers (6), screws (7), cover (8), spring (12), plunger (13), washer (14) and ring (15). Replace if cracked, bent, distorted, broken or damaged or if threads are damaged.
9. Apply 24 volts DC between terminal connection and outside diameter of solenoid body (10), Resistance should be 17.6 to 19.2 ohms (measured at 76 degrees F).
10. Assemble solenoid body (10), new gasket (11), plunger (13), washer (14), ring (15) and cover (8). Do not include spring (12).
11. Apply 18 volts DC between terminal connection and cover (8). Observe plunger (13) action. Plunger (13) should be drawn freely into solenoid body (10) with no evidence of binding or sticking.
12. Apply 18 volts DC between terminal connection and cover (8) while holding plunger (13) with fingers. Compare with force required to operate pump linkage. Force exerted by plunger (13) should be sufficient to operate pump linkage.
13. Disassemble all parts. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5



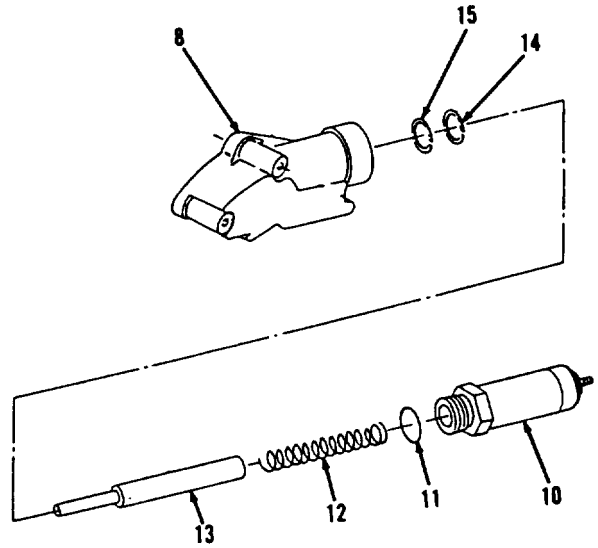
GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-13. Fuel Solenoid. (Sheet 5 of 5)

ASSEMBLY

14. Using a 3/4" open end wrench, install ring (15), washer (14), plunger (13), spring (12), new gaskets (12 and 11) and solenoid body (10) into cover (8). Tighten solenoid body (10) to 125 in-lb.

15. Using a flat tip screwdriver, install new gasket (9), cover (8), two screws (7), lock washers (6) and screws (5) in right side of engine. Tighten two screws (5) to 28 in-lb.

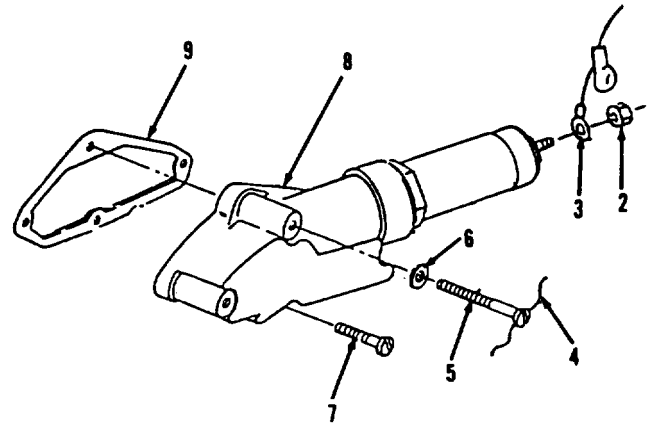


INSTALLATION

16. Using long round nose pliers, install new lockwire (4).

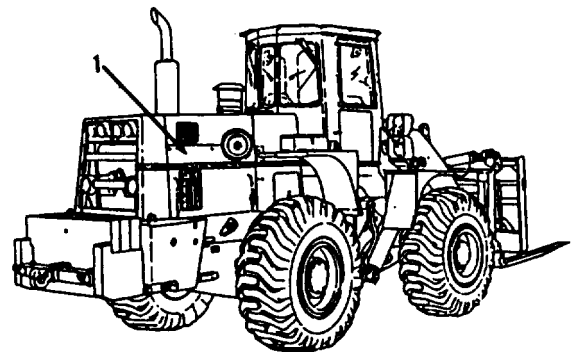
17. Using a 7/16" open end wrench, install wire assembly (3) at terminal and nut (2).

18. Install engine side access cover (1) on right side of engine compartments refer to TM 10-3930-643-20.



NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-14. Turbocharger. (Sheet 1 of 10)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Anti-seize compound  
(App. C, Item 1)  
Locknut  
Seal ring  
Retaining ring (4)  
Piston ring (2)

Torques

Bolts (5) to 100 to 130 in-lb.  
Locknut (9) to 18 to 20 lb-ft.

---

EQUIPMENT CONDITION

References

Paragraph 4-15

Condition Description

Turbocharger removed.

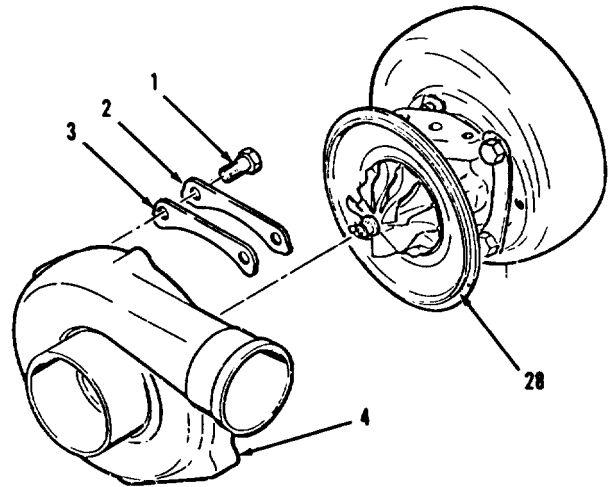
---

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-14. Turbocharger. (Sheet 2 of 10)

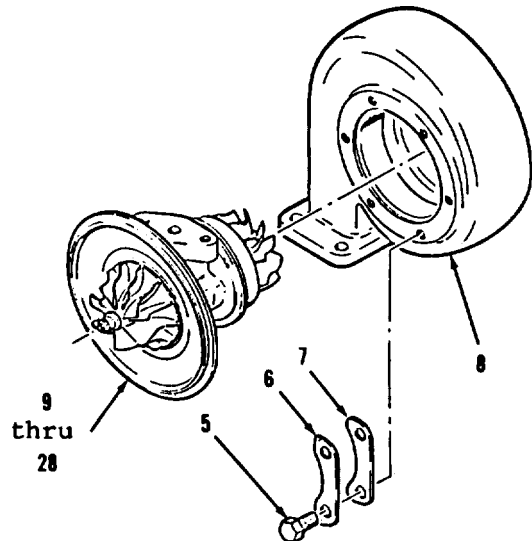
DISASSEMBLY

1. Using a 1/2" socket and socket wrench handle, remove six bolts (1), three lockplates (2) and clamp plate (3) from compressor housing (4).
2. Remove six bolts (5), three lockplates (6) and clamps (7) in turbine housing (8).
3. Lift items 9 through 28 as an assembly carefully from turbine housing (8).



Do not place center housing on either impeller or turbine wheel or damage to wheel will result.

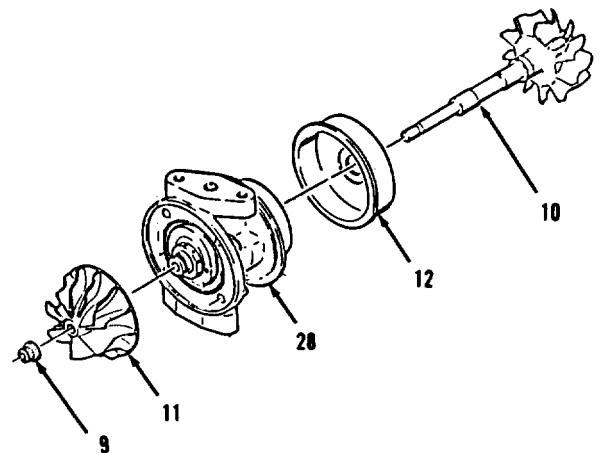
4. Using a 9/16" socket and socket wrench handle, remove and discard locknut (9) from center housing (28). Be careful not to apply side thrust when loosening locknut (9) to avoid bending shaft of wheel assembly (10).



NOTE

Impeller on shaft of wheel assembly is slip-fit not press-fit; however due to carbon build-up, a press may be required. If necessary, grind a radius on the end of a 1/4 inch bolt to fit end of shaft of wheel assembly and press out.

5. Remove wheel assembly (10).
6. Using a press, remove impeller (11) and shroud (12).

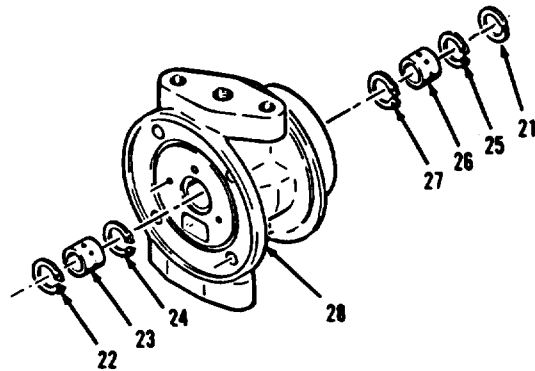
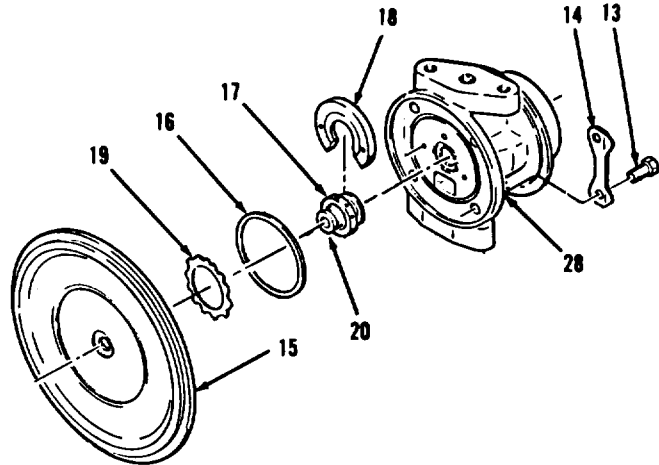


Go to sheet 3

13-14. Turbocharger. (Sheet 3 of 10)

DISASSEMBLY (cont)

7. Using a 1/2" socket and socket wrench handle, loosen four bolts (13). Turn center housing (28) over and remove.
8. Remove two lockplates (14) and backplate (15).
9. Remove seal ring (16), thrust collar (17) and thrust bearing (18). Discard seal ring (16).
10. Using a small flat tip screwdriver, remove spring (19) from backplate (15).
11. Remove and discard piston ring (20) from thrust collar (17).
12. Remove and discard piston ring (21) from center housing (28).
13. Remove retaining ring (22), bearing (23) and retaining ring (24). Discard retaining rings (22 and 24).
14. Using external snap ring pliers, remove retaining ring (25), bearing (26) and retaining rings (27). Discard retaining rings (25 and 27).
15. Cover intake and exhaust ports on turbocharger assembly.



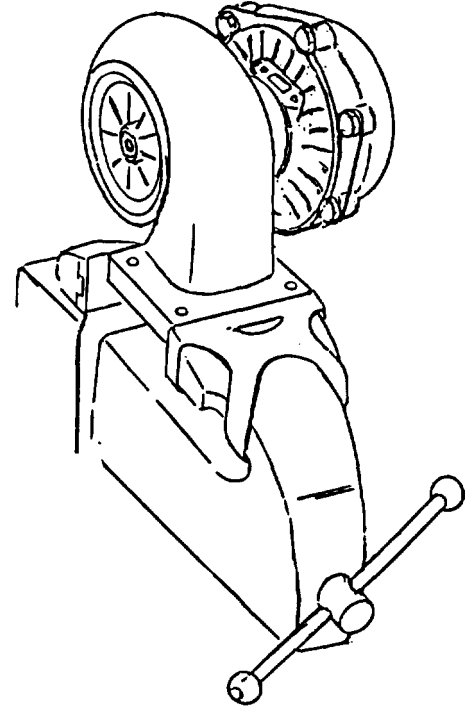
## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-14 1 Turbocharger. (Sheet 4 of 10)

CLEANING/INSPECTION**WARNING**  
**TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

16. Clean exterior of turbocharger thoroughly with cleaning solvent P-D-680. Refer to paragraph 2-8.
17. Place turbocharger on bench with shaft horizontal and spin wheels by hand. Wheels must spin freely. If wheel drags, disassemble and clean turbocharger.
18. Place turbocharger in vise and position dial indicator with foot on turbine end of shaft.



Go to sheet 5

13-89

13-14. Turbocharger. (Sheet 5 of 10)

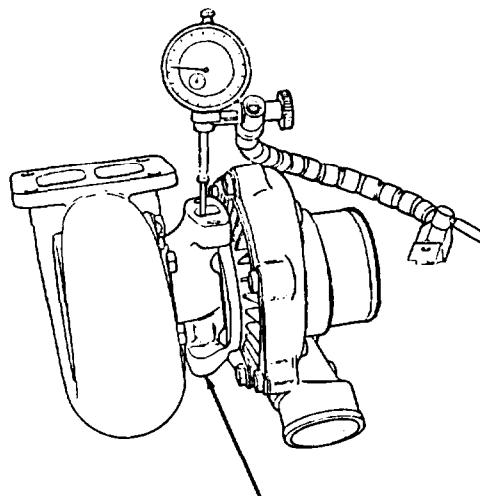
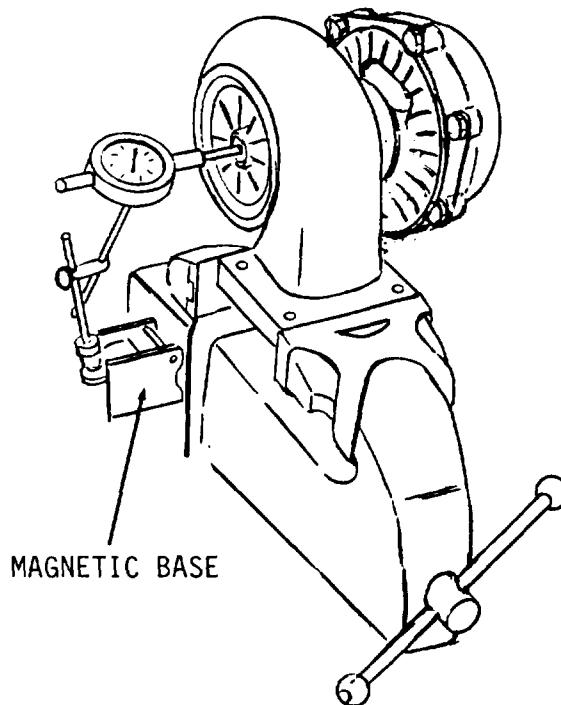
CLEANING/INSPECTION (cont)

19. Move shaft back and forth by hand. Total indicator reading must be 0.001 to 0.004 inch. If reading is outside of this range, disassemble and repair turbocharger.
20. Position dial indicator with foot in contact with shaft through oil drain port in center housing (28).
21. Hold both ends of shaft and move shaft up and down, parallel to dial indicator shaft. Total indicator reading must be 0.003 to 0.006 inch. If reading is outside of this range, disassemble and repair turbocharger.
22. Punch mark assembled position of compressor housing (4) to backplate (15), backplate (15) to center housing (28) and center housing (28) to turbine housing (8) to aid in assembly.

NOTE

Place turbocharger assembly on work surface with compressor housing on bottom.

23. Lift turbine housing (8), center housing (28) and items 5 thru 28 as an assembly carefully from compressor housing (4).
24. Position dial indicator with foot in contact with shaft through oil drain port in turbocharger assembly.
25. Inspect shaft radial movement. Total indicator reading must be 0.003 to 0.006 inches. If reading is outside of this range, disassemble and repair turbocharger.



CENTER HOUSING

## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-14. Turbocharger. (Sheet 6 of 10)

CLEANING/INSPECTION

26. Inspect all parts for signs of rubbing or other defects. Inspection before cleaning is performed to identify defects which might not be evident after cleaning.

**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

27. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

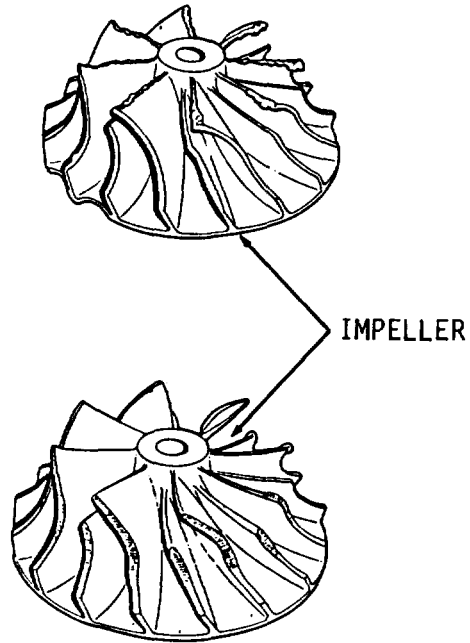
Go to sheet 7

13-91

13-14. Turbocharger. (Sheet 7 of 10)

CLEANING/INSPECTION (cont)

28. Inspect wheel assembly (10) and impeller (11) for damaged or distorted vanes for contact with housings. Spacing between vanes and contour must be uniform. Check cracked or bent blades. If any of above conditions are evident, replace. Do not attempt to straighten blades.
29. Inspect turbine housing (8) for cracks or excessive scoring in outlet contour.
30. Inspect compressor housing (4) for damage.
31. Inspect bearing surfaces in wheel assembly (10) for excessive scratches and wear. If shaft is only slightly scratched, it may be reused. Do not grind or polish shaft as balance will be affected.
32. Inspect bearings (23 and 26) for scratches or worn surfaces. Replace if tin plate is worn off. Inspect bearing bores in center housing (28) for worn or scored surfaces. Replace if bores show signs of excessive scoring or wear.
33. Inspect flange halves which mate to compressor housing (4) and turbine housing (8). Replace if flange halves are damaged.
34. Inspect all parts. Refer to paragraph 2-9.



Go to sheet 8

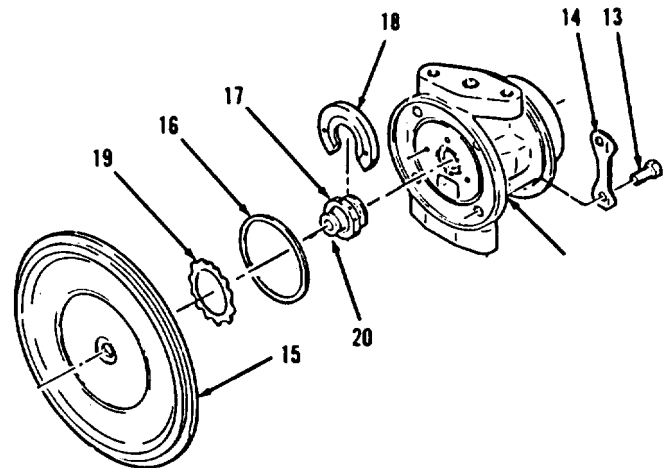
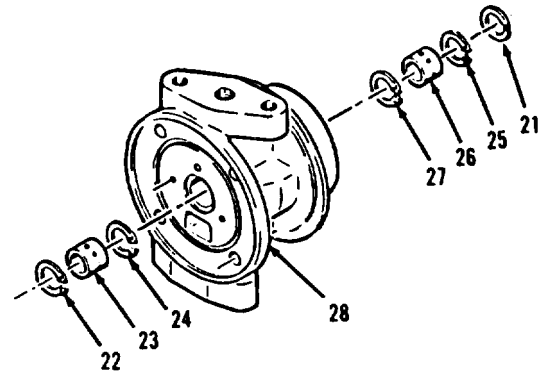


## GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-14. Turbocharger. (Sheet 8 of 10)

ASSEMBLY

35. Lubricate bearing (26) with engine oil. Using external snap ring pliers, install new retaining ring (27), bearing (26) and new retaining ring (25) in center housing (28).
36. Lubricate bearing (23) with engine oil. Using external snap ring pliers, install new retaining ring (24), bearing (23) and new retaining ring (22).
37. Using a flat brass punch, install new piston ring (21).
38. Position shroud (12) over turbine end of center housing (28).
39. Install wheel assembly (10) through shroud (12) and center housing (28).
40. Using a flat brass punch, install new piston ring (20) into thrust collar (17).
41. Install thrust bearing (18).
42. Install thrust collar (17) over shaft of wheel assembly (10) in center housing (28) with thrust bearing (18) first.



Go to sheet 9

13-14. Turbocharger. (Sheet 9 of 10)

ASSEMBLY (cont)

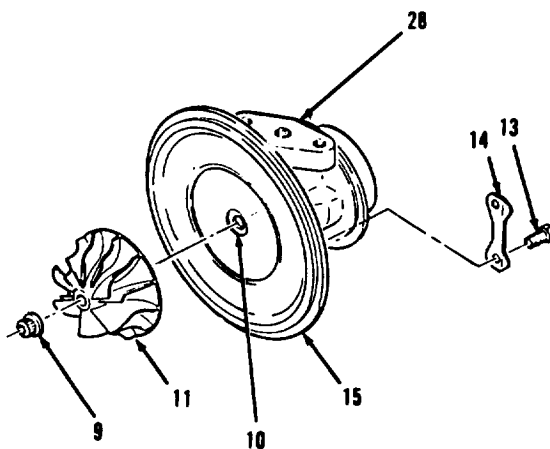
NOTE

Align punch marks on backplate and center housing. Use care not to damage seal ring. To ease installation, engage open side of seal ring in backplate bore first.

43. Install new seal ring (16) on compressor side of center housing (28).
44. Using a flat brass punch, install spring (19) in backplate (15).
45. Install backplate (15) over shaft of wheel assembly (10) and thrust collar (17) in center housing (28).
46. Install lockplates (14) and four bolts (13) in center housing (28).
47. Bend tabs on lockplate (14) to secure four bolts (13).
48. Install impeller (11),
49. Lubricate threads of wheel assembly (10) shaft and contact face of locknut (9) with clean engine oil.
50. Install new locknut (9), finger tight.

NOTE

Place center housing in soft-jawed vise. Clamp on hex-end of turbine wheel.



51. Using a 9/16" socket and torque wrench, tighten locknut (9) to 18 to 20 lb-ft. Tighten an additional 1/4 turn after reaching specification.

Go to sheet 10

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

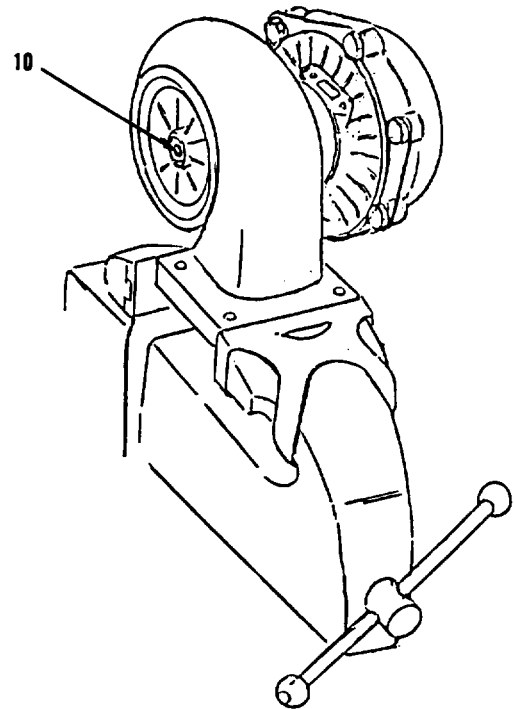
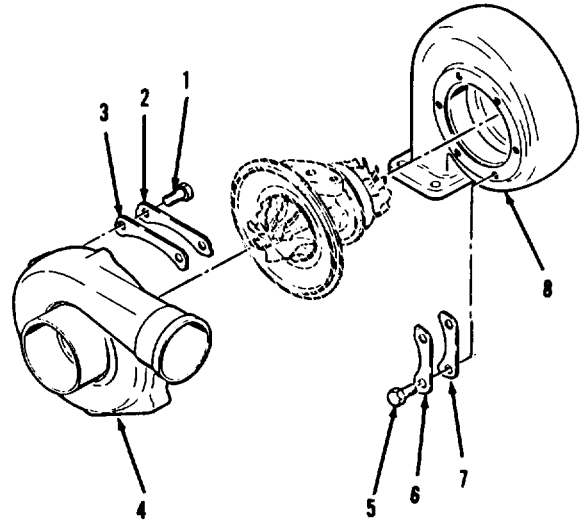
13-14. Turbocharger. (Sheet 10 of 10)

ASSEMBLY

NOTE

Aline punch marks on turbine housing and center housing and well as on compressor housing and center housing during installation.

52. Install turbine housing (8).
53. Coat bolt threads with anti-seize compound. Using a 1/2" socket and torque wrench, install three clamps (7), lockplates (6) and six bolts (5). Tighten bolts (5) to 100 to 130 in-lb.
54. Bend tabs on lockplate (6) to secure bolts (5).
55. Install compressor housing (4).
56. Using a 1/2" socket and socket wrench handle, install three clamp plates (3), lockplates (2) and six bolts (1).
57. Push wheel assembly (10) shaft as far as possible from turbine end.
58. Rotate wheel assembly (10) shaft and check for binding. Wheel assembly (10) shaft must rotate freely without interference. Push as far as possible from compressor end.
59. Rotate wheel assembly (10) shaft and check for binding.



NOTE

- . If turbocharger is not to be installed immediately, lubricate internally and install protective covers on all openings.
- . Return M10A Forklift to original equipment condition.

END OF TASK

TM 10-3930-643-34

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE. (cont)

13-15. Fuel Tank. (Sheet 1 of 1)

For repair of the Fuel Tank, refer to the following publications:

TB 43-0212, dated 1 April 1977.

TM 9-237, dated October 1976, Welding Theory and Application.

GENERAL SUPPORT ENGINE, FUEL, EXHAUST AND COOLING MAINTENANCE.

13-16. Radiator Assembly. (Sheet 1 of 1)

For repair of the Radiator, refer to the following publications:

TM 9-237, dated October, 1976, Welding Theory and Application.

TM 750-254, dated March, 1972, Cooling System:

Tactical Vehicles with Change 1, dated 31 October 1972, Change 2, dated 1973.



CHAPTER 14

GENERAL SUPPORT ELECTRICAL SYSTEM  
MAINTENANCE

CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized general support level maintenance procedures on the M10A Forklift electrical system.

INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Alternator	14-1	14-2
Solenoid	14-2	14-3

**TM 10-3930-643-34**

GENERAL SUPPORT ELECTRICAL MAINTENANCE.

14-1. Alternator. (Sheet 1 of 1)

For repair of the Alternator refer to TM 9-2920-225-34.



GENERAL SUPPORT ELECTRICAL SYSTEM MAINTENANCE.

14-2. Solenoid. (Sheet 1 of 4)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                              c. Assembly

---

INITIAL SETUP

Tools

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

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

TM 10-3930-643-20

Condition Description

Solenoid removed.

---

Go to sheet 2

## TM 10-3930-643-34

GENERAL SUPPORT ELECTRICAL SYSTEM MAINTENANCE. (cont)

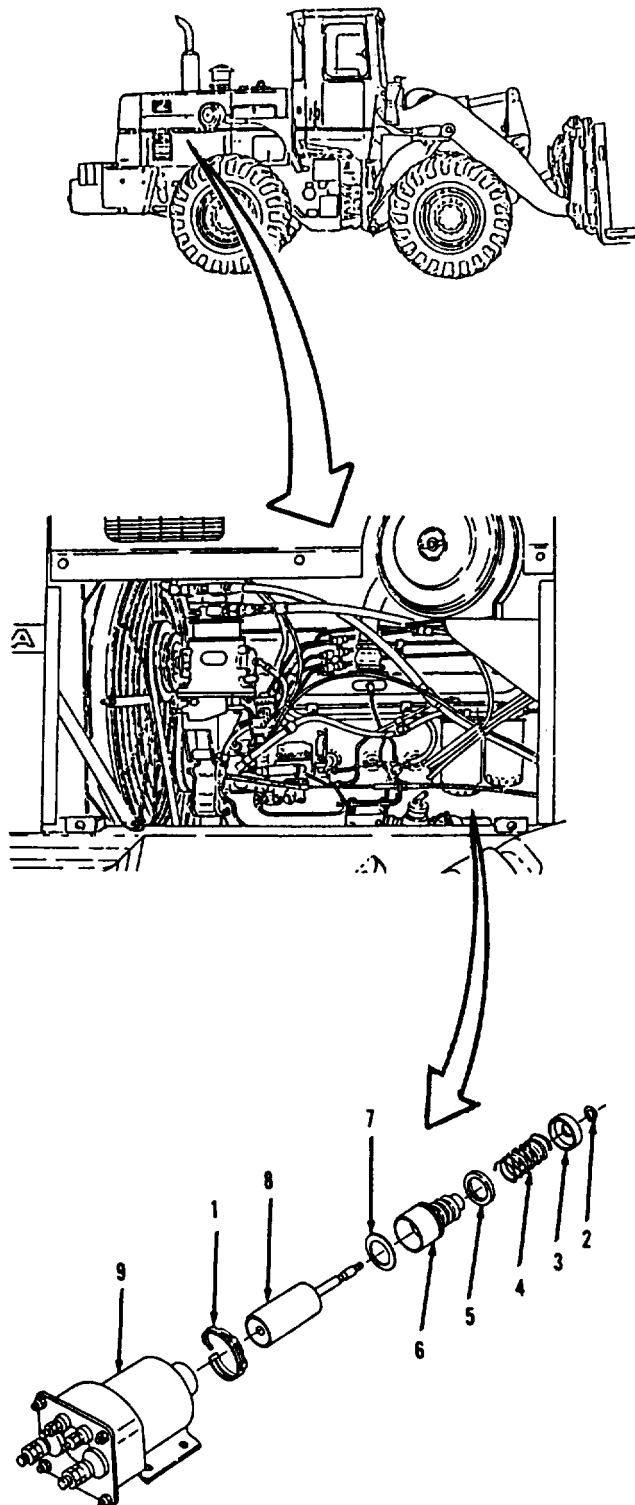
14-2. Solenoid. (Sheet 2 of 4)

### DISASSEMBLY

1. Using a flat tip screwdriver, remove clamp (1) from solenoid (9).
2. Using retaining ring pliers, remove retaining ring (2), washer (3), spring (4) and washer (5).
3. Remove bellows (6), washer (7) and plunger (8).

### CLEANING/INSPECTION

4. Clean bellows (6) with cloth moistened with mild detergent and water solution.
5. Wipe solenoid (9) with clean cloth.



Go to sheet 3

## GENERAL SUPPORT ELECTRICAL SYSTEM MAINTENANCE.

14-2. Solenoid. (Sheet 3 of 4)

CLEANING/INSPECTION

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

6. Wipe all other parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
7. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

## TM 10-3930-643-34

GENERAL SUPPORT ELECTRICAL SYSTEM MAINTENANCE. (cont)

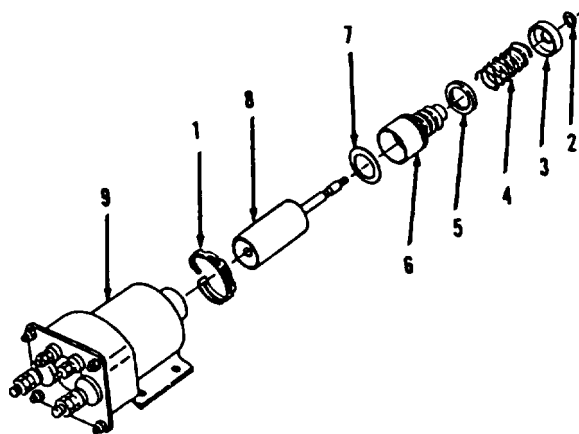
14-2. Solenoid. (Sheet 4 of 4)

### ASSEMBLY

8. Install plunger (8), washer (7) and bellows (6) in solenoid (9).
9. Using snap ring pliers, install washer (5), spring (4), washer (3) and retaining ring (2).
10. Using a flat tip screwdriver, install clamp (1).

#### NOTE

Return M10A Forklift to original equipment condition.



END OF TASK

CHAPTER 15

GENERAL SUPPORT TRANSMISSION  
MAINTENANCE

CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized general support level maintenance procedures on the M10A Forklift.

INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Torque Converter	15-1	15-2
Torque Converter Charging Pump	15-2	15-17
Transmission Assembly	15-3	15-23
First Gear Assembly	15-4	15-49
Second and Third Gear Assembly	15-5	15-56
Forward and Reverse Steering Gear Assembly	15-6	15-73
Transmission Control Valve	15-7	15-86
Transmission Scheduling Valve	15-8	15-95



GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 2 of 15)

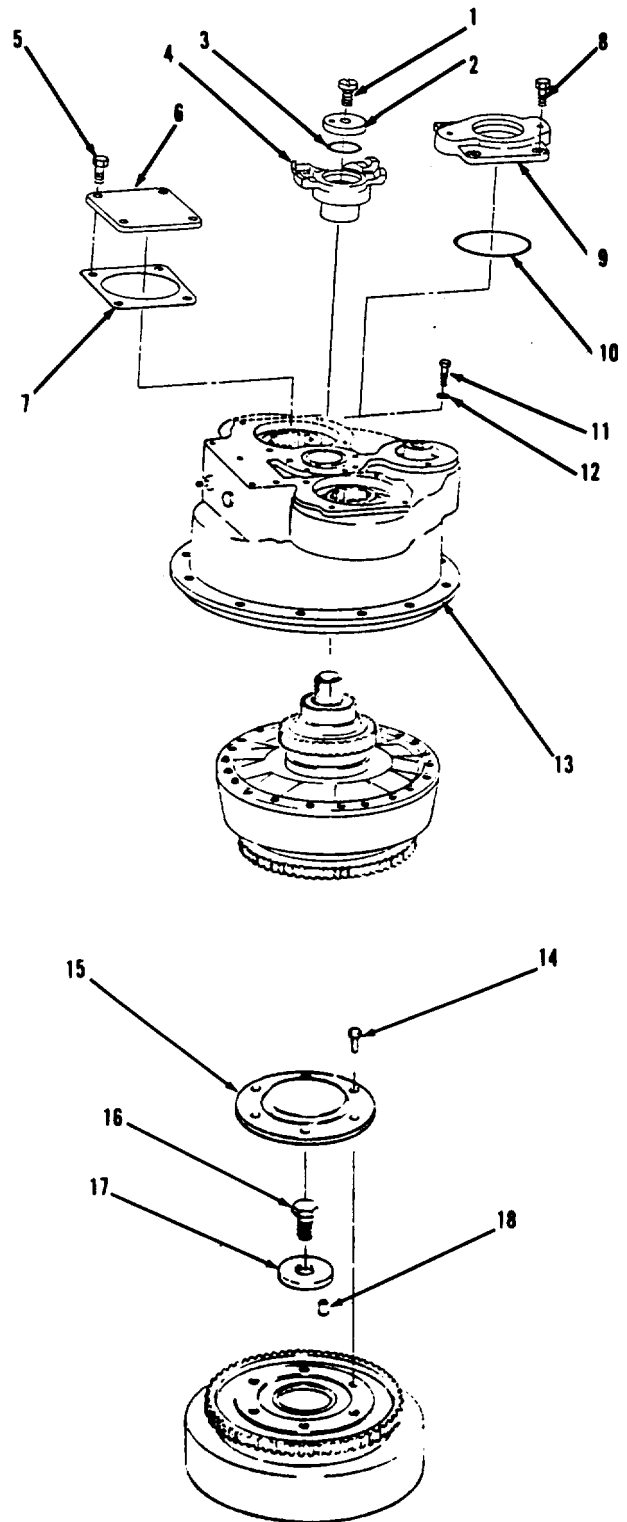
DISASSEMBLY

1. Using a 3/4" socket and socket wrench handle, remove bolt (1), washer (2), preformed packing (3) and yoke (4) from torque converter assembly, output side. Discard preformed packing.
2. Remove four bolts (5), access cover (6) and gasket (7). Discard gasket (7).
3. Remove four bolts (8), access cover (9) and preformed packing (10). Discard preformed packing.
4. Using a 9/16" socket and socket wrench handle, remove six bolts (11) and washers (12) from torque converter assembly, output side.

**WARNING**

Weight of housing is approximately 80 pounds. Use adequate hoist and sling for lifting. Failure to follow this procedure may cause damage to equipment or INJURY. If you are injured, seek medical aid immediately.

5. Using hoist and sling, remove housing (13) from torque converter assembly, output side.
6. Turn torque converter assembly over to input side. Using a 9/16" socket and socket wrench handle, remove six bolts (14) and retainer (15).
7. Using a 3/4" socket and socket wrench handle, remove bolt (16), washer (17) with spring pin (18). Pry up spring pin (18) with washer (17) as an assembly. Do not drill out spring pin (18) from washer (17).



Go to sheet 3

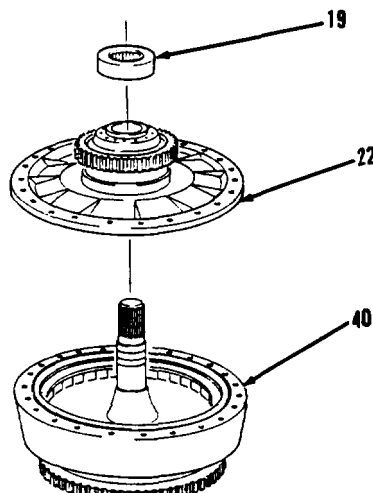
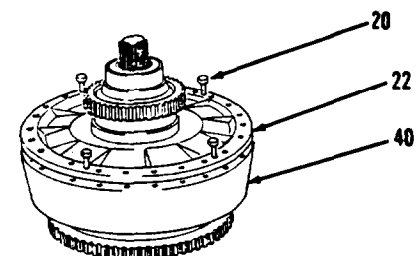
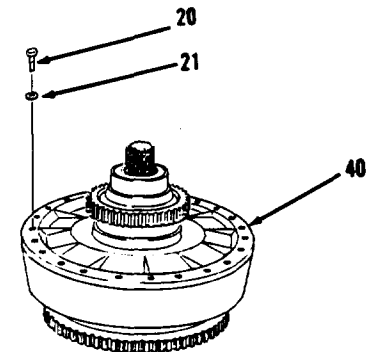
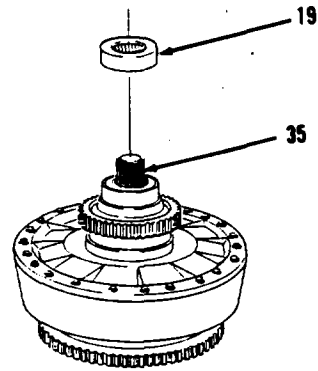
# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cent)

15-1. Torque Converter. (Sheet 3 of 15)

## DISASSEMBLY (Cent)

8. Pry up evenly on both sides of bearing (19) removing both outer and inner races of bearing (19) from shaft (35).
9. Using a 1/2" socket and socket wrench handle, remove 24 bolts (20) and washers (21) from housing (40).
10. Install four bolts (20), removed in step 9, into threaded holes in impeller (22).
11. Turn down four bolts (20) to separate impeller (22) from housing (40). Four bolts (20) must be turned down evenly to avoid distortion or fracture of impeller (22).
12. Separate impeller (22) from housing (40).



Go to sheet 4



GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 4 of 15)

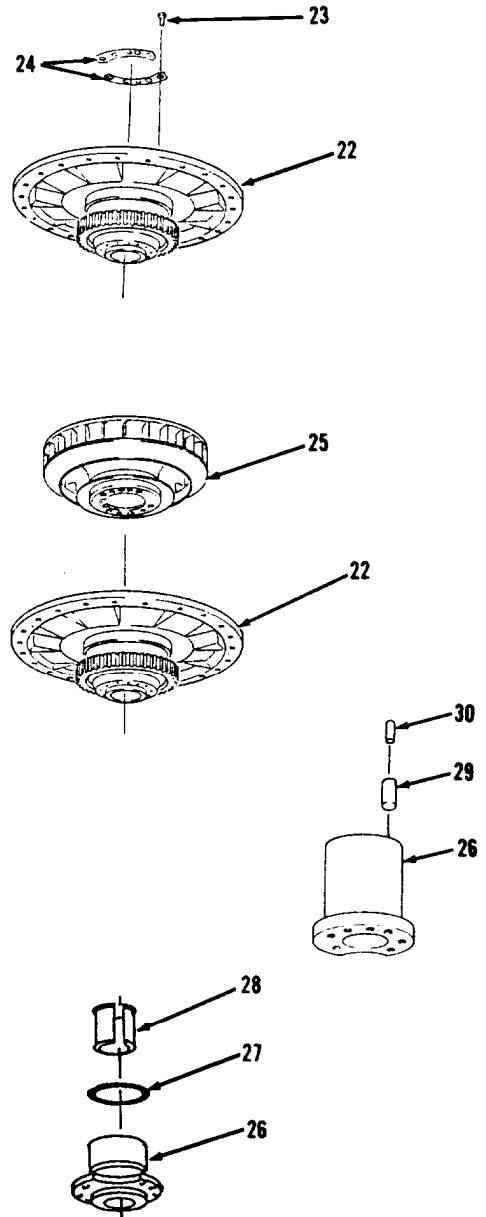
DISASSEMBLY

13. Turn impeller (22) over. Using a 5/16"-12 point socket and socket wrench handle, remove six bolts (23) and two clamps (24) from impeller (22).
14. Remove guide wheel (25) from impeller (22). Two wooden wedges may be used on each side of guide wheel (25) to pry it off evenly.
15. Separate carrier (26) from impeller (22).
16. Remove piston ring (27) from carrier (26).
17. Using slip joint pliers, squeeze split sleeve (28) and remove from carrier (26).

NOTE

It is not necessary to remove spring pins 29 and 30 unless the carrier (26) is being replaced.

18. Remove four spring pins (29 and 30) from carrier (26) if necessary.



Go to sheet 5

# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 5 of 15)

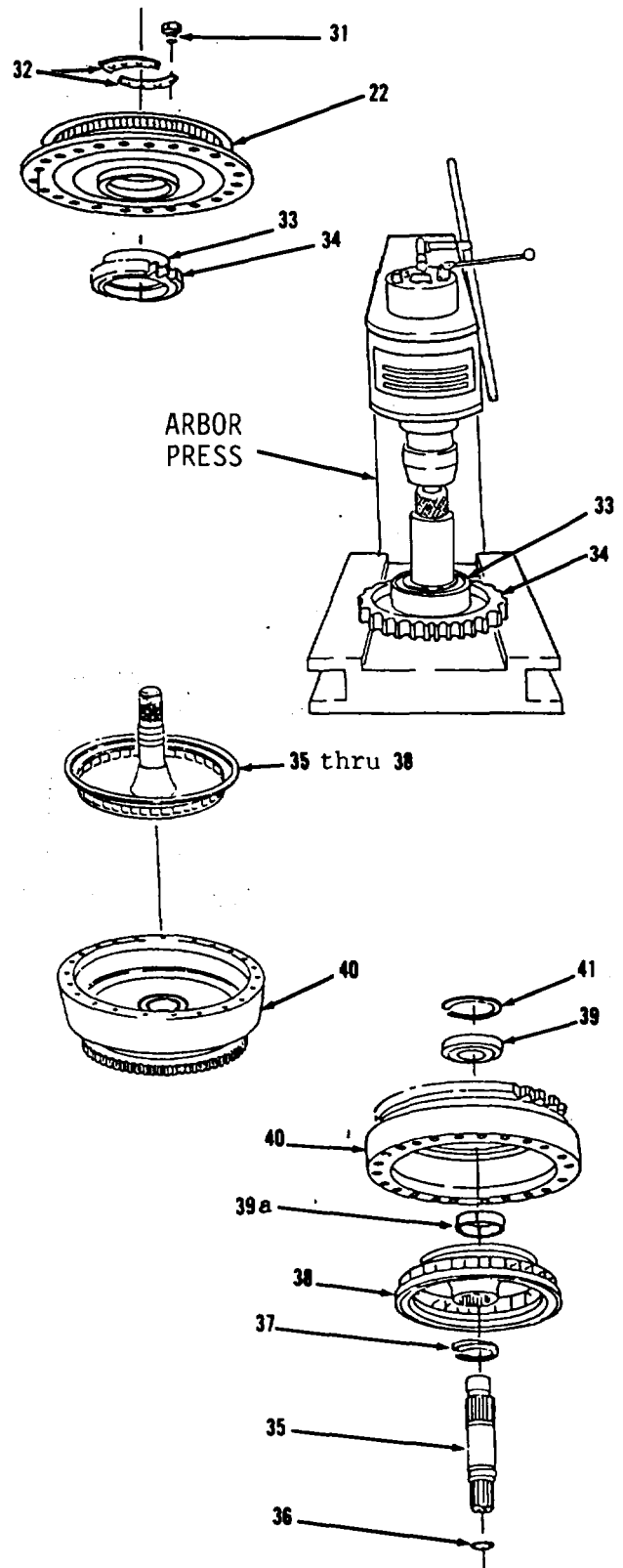
## DISASSEMBLY

19. Using a 1/2" socket and socket wrench handle, remove eight bolts (31) and two clamps (32) from impeller (22), and separate gear (33) and bushing (34) as an assembly.

### NOTE

Separate bushing (34) from gear (33) only if inspection shows replacement is necessary.

20. Using an arbor press, remove bushing (34) from gear (33), if necessary.
21. Using a hammer and brass drift, drive out items 35 thru 38 as an assembly from housing (40).
22. Remove and discard seal (36) from shaft (35).
23. Using snap ring pliers, remove retaining ring (37) from shaft (35).
24. Using hammer and brass drift, drive out shaft (35) from turbine (38) in direction of arrow shown, separating inner bearing race (39a) from turbine (38).
25. Tap outer bearing assembly (39) from housing (40) in one direction only because of retaining ring (41) in bearing assembly (39).
26. Using snap ring pliers, remove retaining ring (41) from bearing (39).



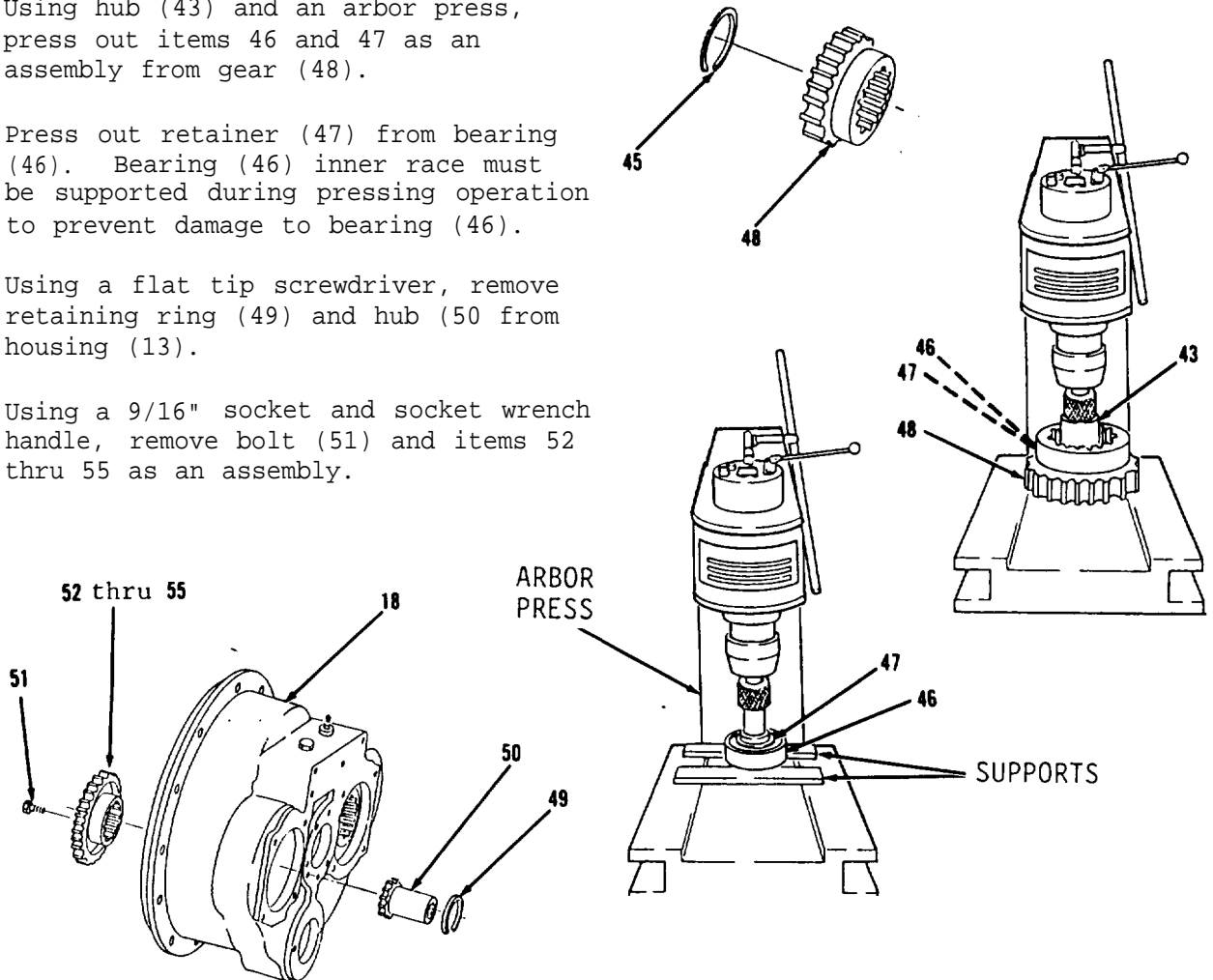
Go to sheet 6

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 6 of 15)

DISASSEMBLY

27. Using a flat tip screwdriver, remove retaining ring (42) and hub (43) from housing (13).
28. Using a 9/16" socket and socket wrench handle, remove bolt (44) and items 45 thru 48 as an assembly.
29. Using a flat tip screwdriver, remove ring (45) from gear (48).
30. Using hub (43) and an arbor press, press out items 46 and 47 as an assembly from gear (48).
31. Press out retainer (47) from bearing (46). Bearing (46) inner race must be supported during pressing operation to prevent damage to bearing (46).
32. Using a flat tip screwdriver, remove retaining ring (49) and hub (50) from housing (13).
33. Using a 9/16" socket and socket wrench handle, remove bolt (51) and items 52 thru 55 as an assembly.



Go to sheet 7

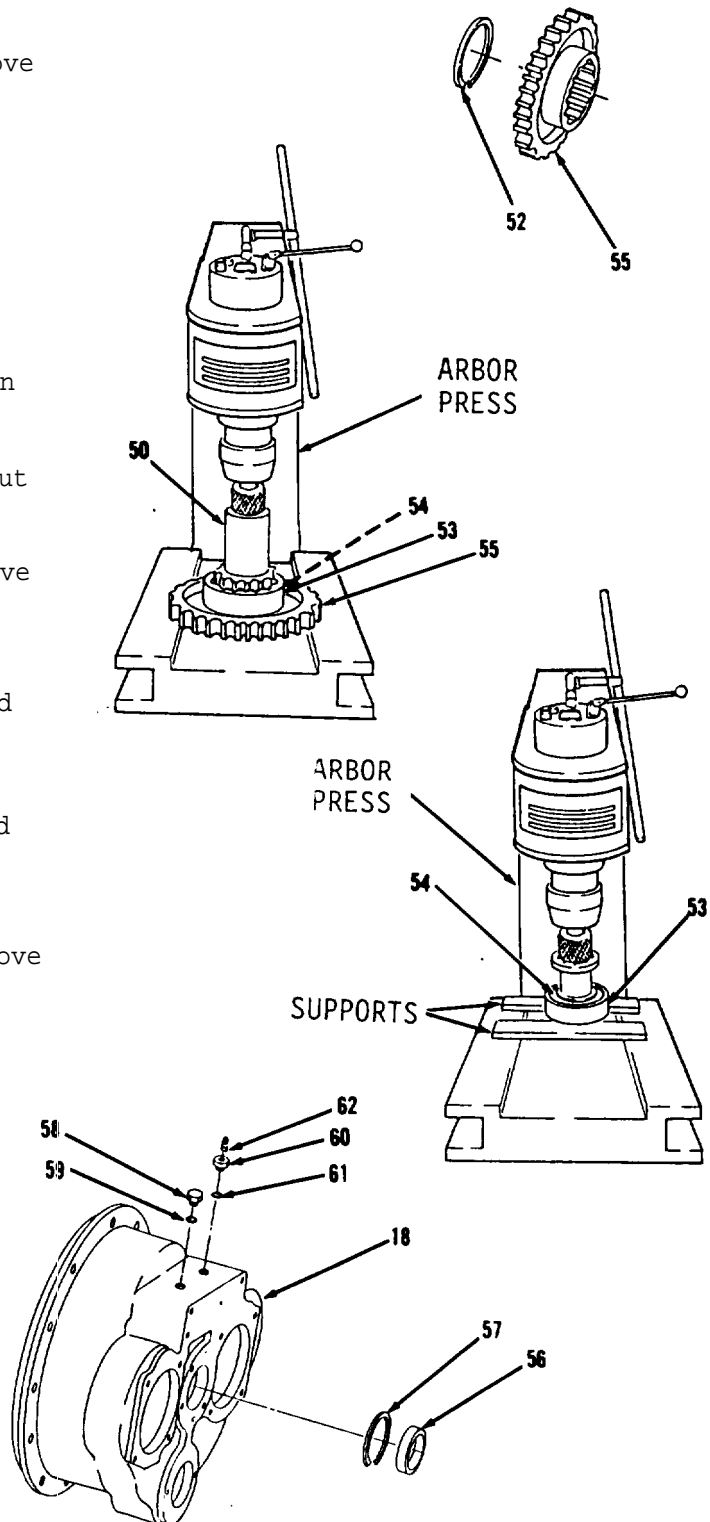
# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 7 of 15)

## DISASSEMBLY (cont)

34. Using a flat tip screwdriver, remove ring (52) from gear (55).
35. Using an arbor press and hub (50), press out items 53 and 54 as an assembly from gear (55).
36. Using an arbor press, press out retainer (54) from bearing (53). Bearing (53) inner race must be supported during pressing operation to prevent damage to bearing (53).
37. Using a chisel and hammer, drive out seal (56). Discard seal (56).
38. Using a flat tip screwdriver, remove ring (57) from housing (13).
39. Using a 1-1/2" socket and socket wrench handle, remove plug (58) and preformed packing (59). Discard preformed packing (59).
40. Remove connector (60) and preformed packing (61). Discard preformed packing (61).
41. Using a 9/16" open end wrench, remove plug (62) from connector (6).



Go to sheet 8

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 8 of 15)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

42. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 9

## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 9 of 15)

### CLEANING/INSPECTION (cont)

43. Inspect housings (13 and 40) for cracks, Check bearing bores and mounting faces for wear, grooves or scratches. Remove minor burrs and scratches with crocus cloth.
44. Inspect impeller (22), guide wheel (25) and turbine (38) for cracks or other damage.
45. Inspect yoke (4), guide wheel (27), gear (33), hub (43), gear (48), hub (50) and gear (55) for worn, twisted, chipped or burred teeth. Remove burrs with soft stone.

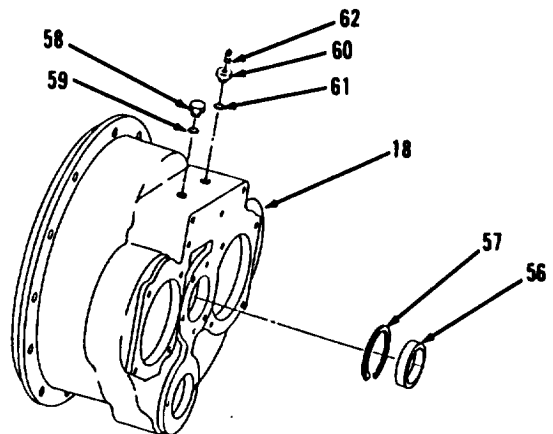
#### NOTE

All parts must be free of metal shavings and foreign material.

46. Inspect all other parts. Refer to paragraph 2-9.

### ASSEMBLY

47. Using a 9/16" open end wrench, install plug (62) to connector (60).
48. Using a 1-1/2" socket and socket wrench handle, install new preformed packing (61) and connector (60) to housing (13).
49. Install new preformed packing (59) and plug (58).
50. Using snap ring pliers, install ring (57).
51. Apply Permatex No. 2 to O.D. of new seal (56).



Go to sheet 10

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 10 of 15)

ASSEMBLY

NOTE

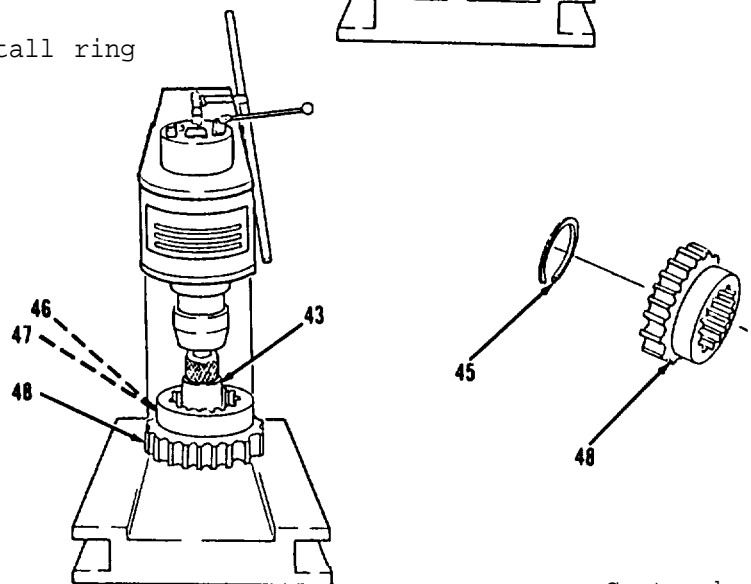
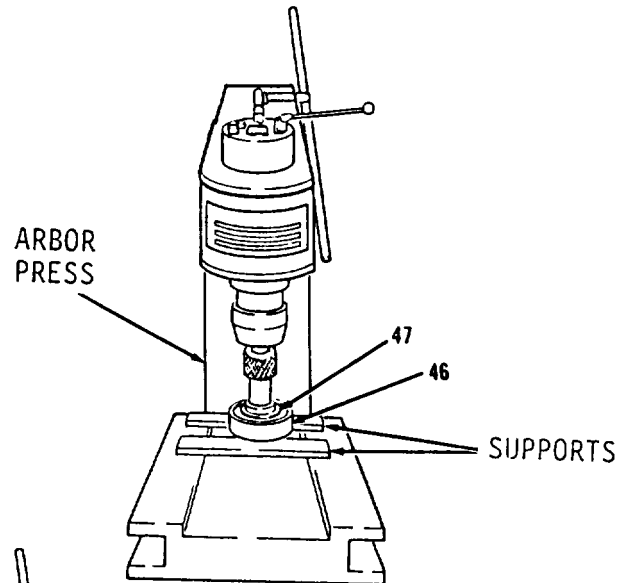
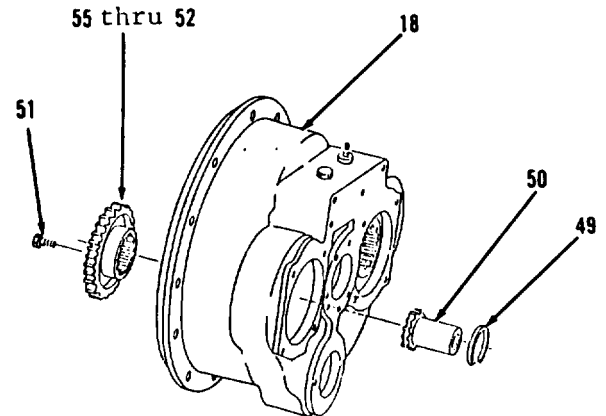
Seal is a double lip seal. Large lip with spring tensioner must face housing interior.

52. Using an arbor press, press new seal (56) into housing (13). Use an output shaft oil seal installation tool, refer to App. D, for fabrication of an output shaft oil seal installation tool.
53. Lubricate I.D. of new seal (56) with grease.

**CAUTION**

Bearing inner race must be supported during pressing operation.

54. Using an arbor press, press retainer (54) into bearing (53).
55. Press items 53 and 54 as an assembly into gear (55). Be sure pressure from arbor press is exerted on bearing (53) outer race.
56. Using snap ring pliers, install ring (52) onto gear (55).



Go to sheet 11

# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 11 of 15)

## ASSEMBLY (cont)

57. Using a 9/16" socket and torque wrench, install items 52 thru 55 as an assembly and bolt (51) to housing (18). Tighten bolt (51) to 37 lb-ft.

58. Install hub (50) and retaining ring (49).

**CAUTION**

Bearing inner race must be supported during pressing operation.

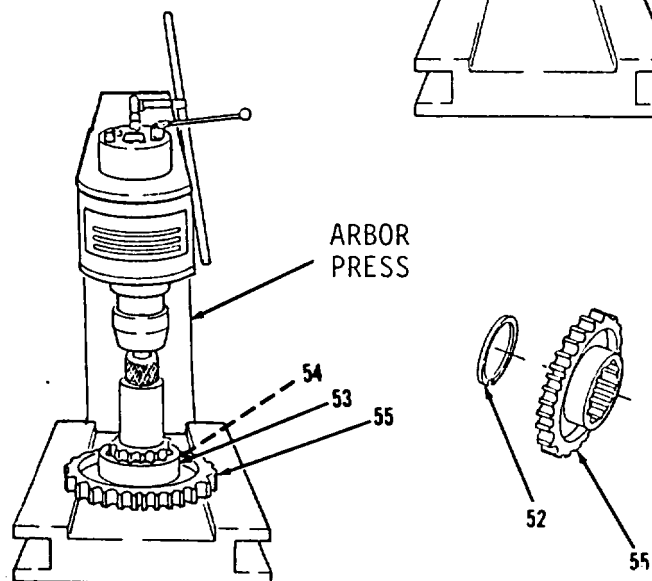
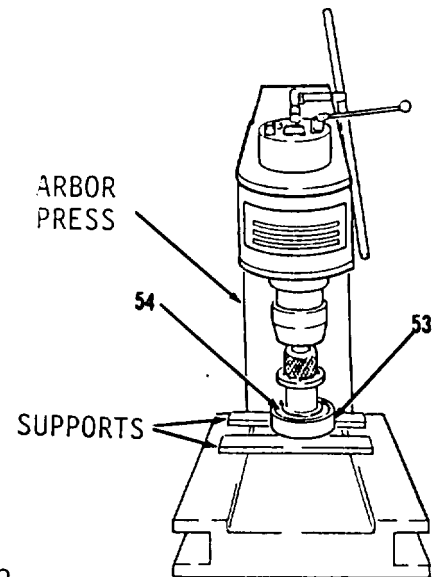
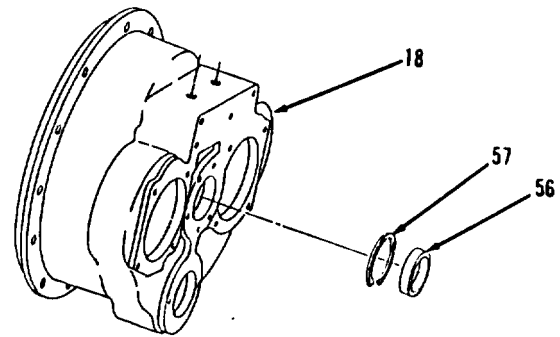
59. Using an arbor press, press retainer (47) into bearing (46).

**CAUTION**

Be sure pressure from arbor press is exerted on bearing outer race.

60. Using an arbor press, press items 47 and 46 as an assembly into gear (48).

61. Using snap ring pliers, install ring (45).



Go to sheet 12

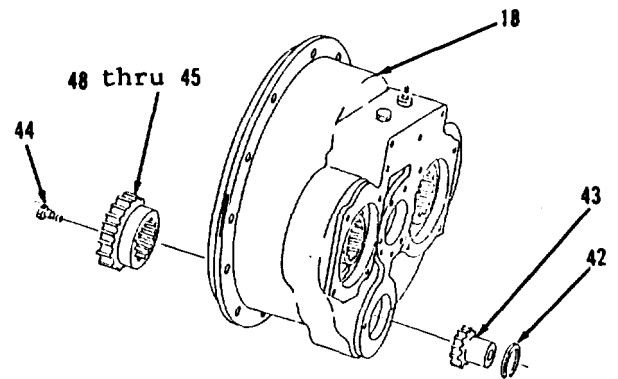


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 12 of 15)

ASSEMBLY

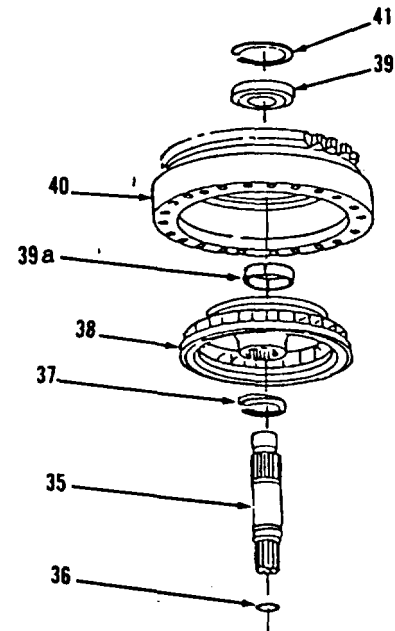
- 62. Using a 9/16" socket and torque wrench, install items 48 thru 45 as an assembly and bolt (44) into housing (13). Tighten bolt (44) to 37 lb-ft.
- 63. Using a flat tip screwdriver, install hub (43) and retaining ring (42).
- 64. Using snap ring pliers, install retaining ring (37) and new seal (36) to shaft (35).
- 65. Using hammer and brass drift, drive shaft (35) into turbine (38) in direction of arrow shown.



NOTE

Be sure inner bearing race (39a) is fully seated on shoulder of shaft (35).

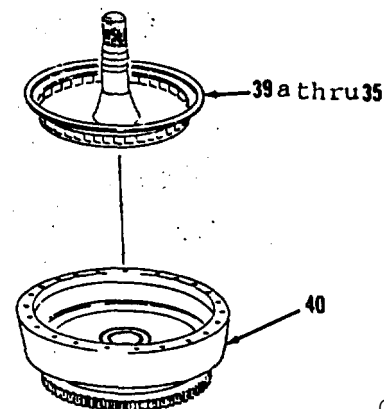
- 66. Using a bearing installation tool install inner bearing race (39a) on shaft (35).
- 67. Using snap ring pliers, Install retaining ring (41) onto outer race of bearing assembly (39).



NOTE

Be sure that retaining ring (41) is fully seated on shoulder of housing (40).

- 68. Using a bearing installation tool install outer bearing assembly (39) and retaining ring (41) as an assembly into housing (40).
- 69. Install items 39a thru 35 as an assembly into housing assembly (40).



Go to sheet 13

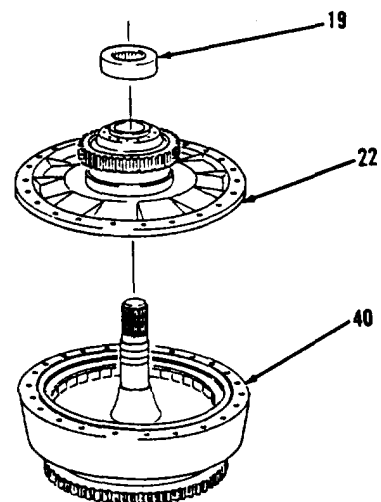
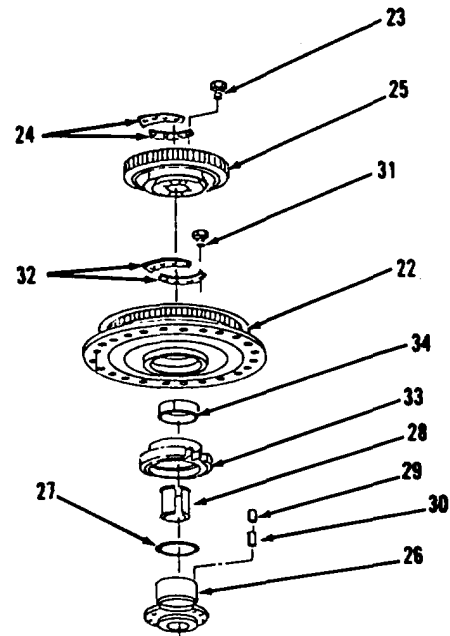
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 13 of 15)

### ASSEMBLY (cont)

70. If removed, using a plastic hammer, install four spring pins (30 and 29) into carrier (26).
71. Using slip joint pliers, squeeze split sleeve (28) and install into carrier (26).
72. Install piston ring (27) onto carrier (26).
73. If removed, using an arbor press, install bushing (34) to gear (33).
74. Install gear (33) to impeller (22).
75. Using a 1/2" socket and torque wrench, install two clamps (32) and eight bolts (31). Tighten eight bolts (31) to 21 lb-ft.
76. Install impeller (22) and guide wheel (25) to carrier (26). Mounting bolts and spring pin bores must be aligned.
- 77\* Using a 5/16" socket and torque wrench, install two clamps (24) and six bolts (23). Tighten six bolts (23) to 26 lb-ft.
78. Install impeller (22) on housing (40) making sure the bolt holes are in alignment.
79. Using an arbor press, press evenly on both inner and outer races of bearing (19) and install on torque converter, output side.



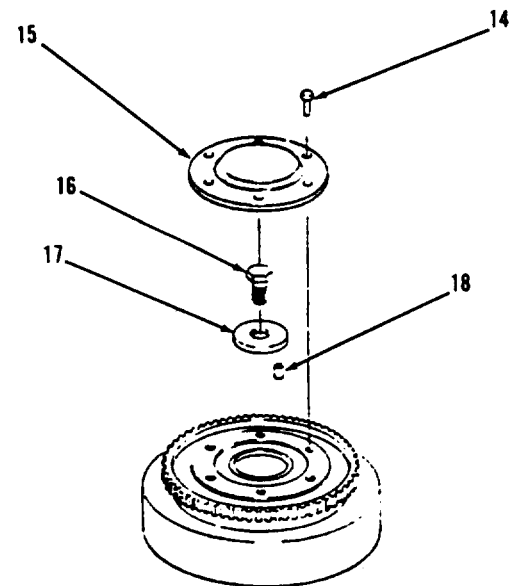
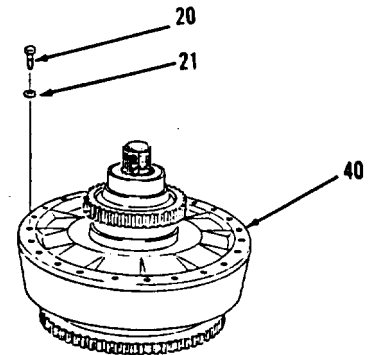
Go to sheet 14

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-1. Torque Converter. (Sheet 14 of 15)

ASSEMBLY

80. Using a 1/2" socket and socket wrench handle , install 24 new washers (21) and bolts (20). Tighten 24 bolts (20) to 21 lb-ft.
81. Turn torque converter assembly over with the input side up.
82. If removed, install new spring pin (18) into washer (17).
83. Using a 3/4" socket and socket wrench handle , install washer (17) with spring pin (18) and bolt (16) to torque converter assembly, input side.
84. Apply liquid gasket to retainer (15).
85. Using a 9/16" socket and socket wrench handle, retainer (15) and six bolts (14). Tighten six bolts (14) to 37 lb-ft .



Go to sheet 15

## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-1. Torque Converter. (Sheet 15 of 15)

### ASSEMBLY (cont)

86. Turn torque converter assembly over with the output side up.

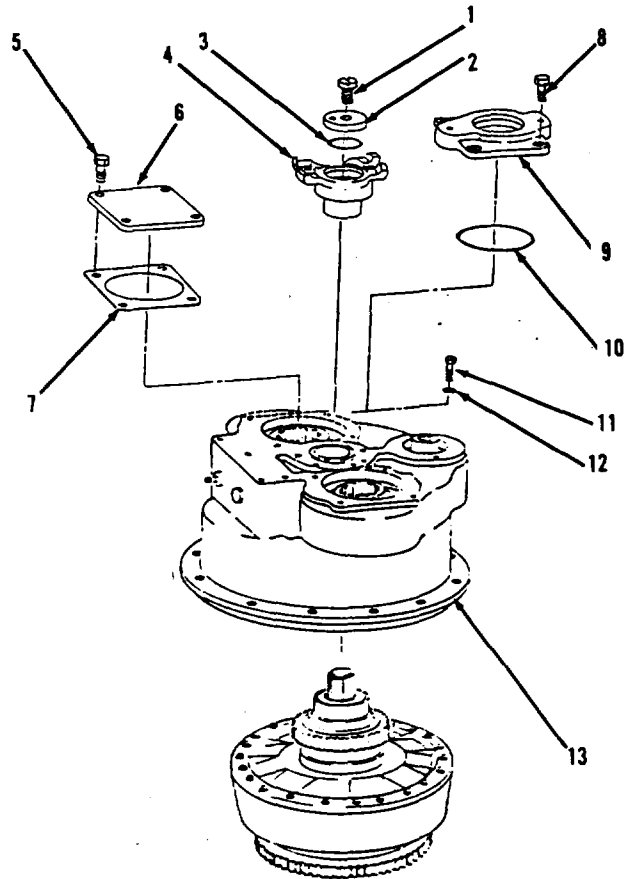
#### **CAUTION**

Use care when installing housing (13) to avoid damage to output yoke seal in housing by shaft,

86. Using hoist and sling, position housing (13) on torque converter assembly.
87. Using a 9/16" socket and torque wrench, install six washers (12) and bolts (11). Tighten six bolts (11) to 38 lb-ft.
88. Using a 3/4" socket and torque wrench, install new preformed packing (10), access cover (9) and four bolts (8). Tighten four bolts (8) to 37 lb-ft.
89. Install new gasket (7), access cover (6) and four bolts (5).
90. Install yoke (4), new preformed packing (3), washer (2) and bolt (1). Tighten bolt (1) to 77 to 85 lb-ft.

#### NOTE

Return M10A Forklift to original equipment condition.



END OF TASK



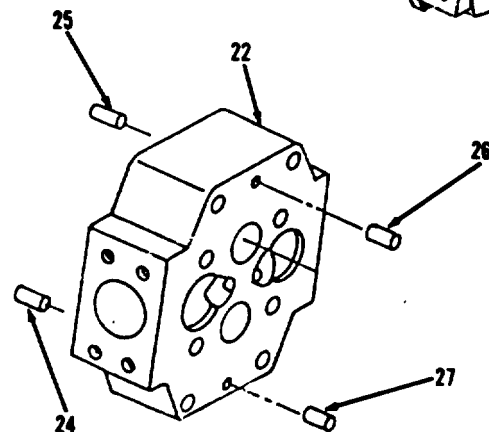
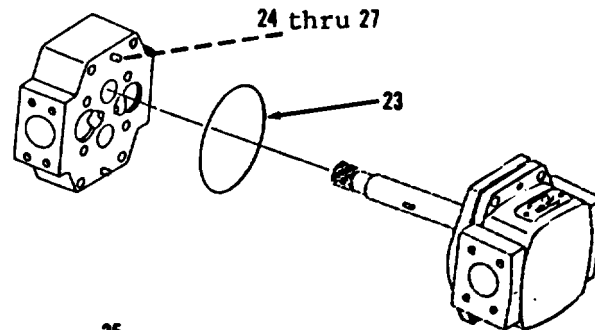
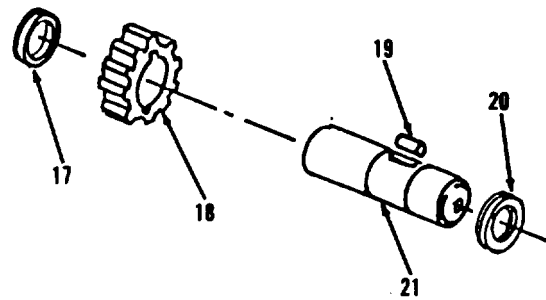
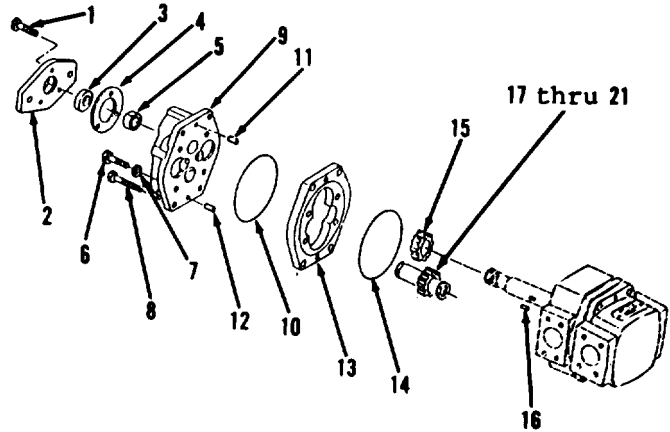
# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-2. Torque Converter Charging Pump. (Sheet 2 of 6)

## DISASSEMBLY

1. Using a 9/16" socket and socket wrench handle, remove three bolts (1), flange (2), seal (3), gasket (4) and ring (5) from drive side of charging pump. Discard seal (3) and gasket (4).
2. Remove four screws (6), seals (7), bolts (8), plate (9) and preformed packing (10). Discard four seals (7) and preformed packing (10).
3. Using slip joint pliers, remove pins (11 and 12) from plate (9).
4. Using a rubber mallet, remove case (13) and preformed packing (14) from drive side of charging pump. Discard preformed packing (14).
5. Remove gear (15), pin (16) and items 17 thru 21 as an assembly.
6. Using snap ring pliers, remove retaining ring (17), gear (18), pin (19) and retaining ring (20) from shaft (21).
7. Using a rubber mallet, remove spacer (22) with preformed packing (23) and items 24 thru 27 as an assembly. Discard preformed packing (23).
8. Using slip joint pliers, remove pins (24, 25, 26 and 27) from spacer (22).



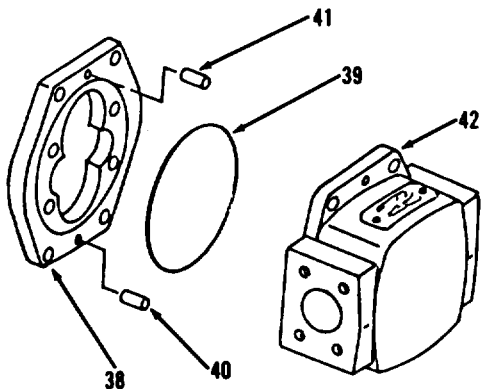
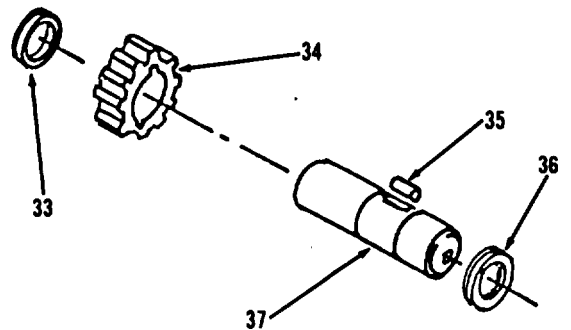
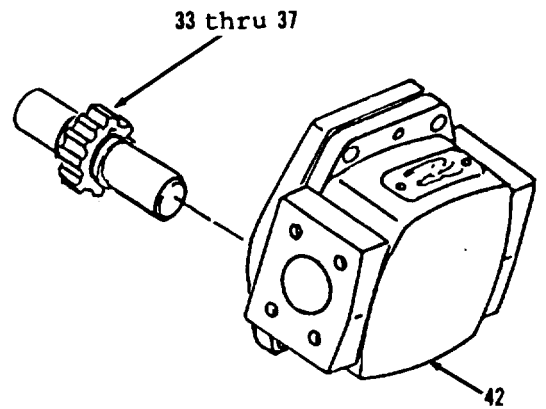
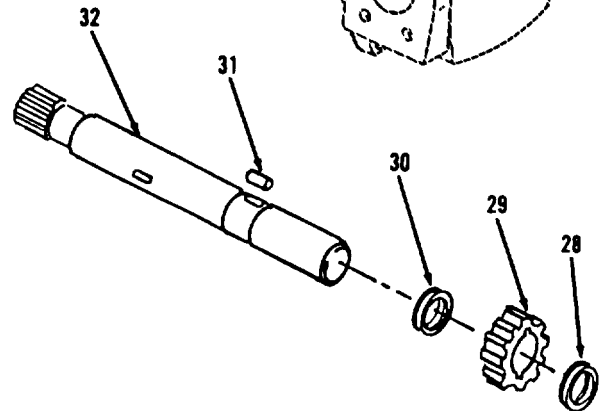
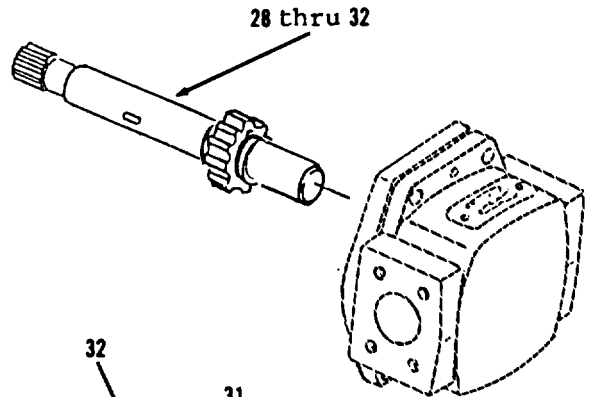
Go to sheet 3

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-2. Torque Converter Charging Pump. (Sheet 3 of 6)

DISASSEMBLY

- 9\* Remove items 28 thru 32 as an assembly.
10. Using snap ring pliers, remove retaining ring (28), gear (29), retaining ring (30) and pin (31) from shaft (32).
11. Remove items 33 thru 37 as an assembly from plate (42).
12. Remove retaining ring (33), gear (34), pin (35) and retaining ring (36) from shaft (37).
13. Using a rubber mallet, remove case (38) and preformed packing (39) from plate (42). Discard preformed packing (39).
14. Using slip joint pliers, remove pins (40 and 41) from case (38)".



Go to sheet 4

## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-2. Torque Converter Charging Pump. (Sheet 4 of 6)

CLEANING/INSPECTION.

### **WARNING**

#### ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

#### ● Compressed AIR HAZARD

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

15. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
16. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 5



GENERAL SUPPORT TRANSMISSION MAINTENANCE.

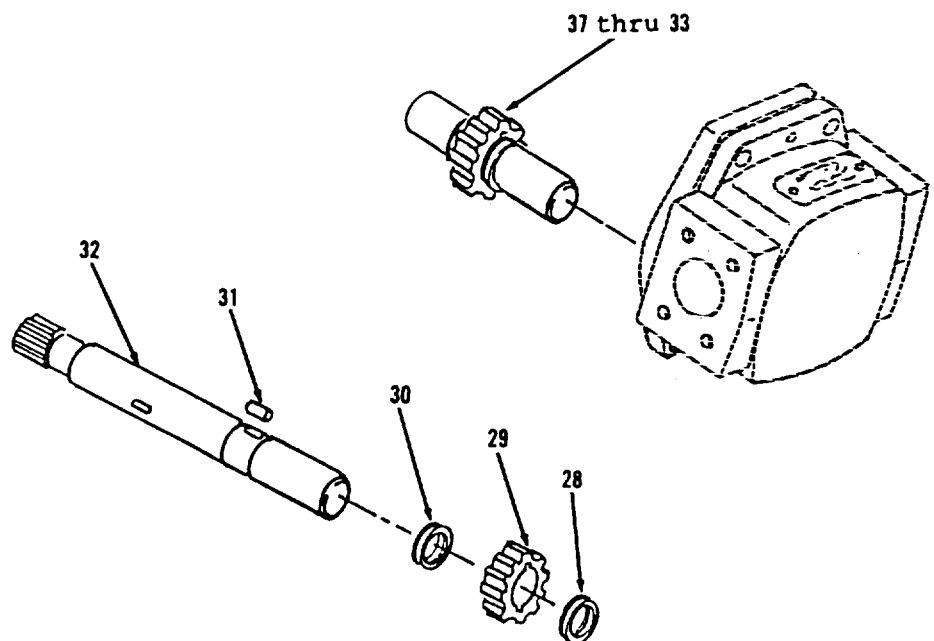
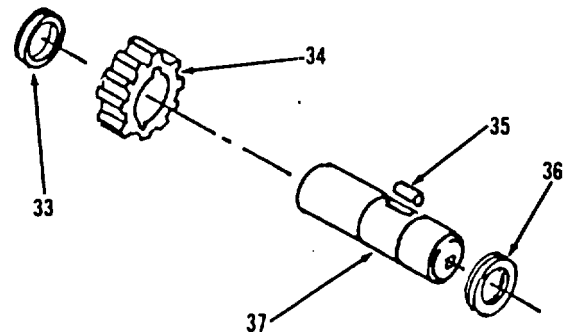
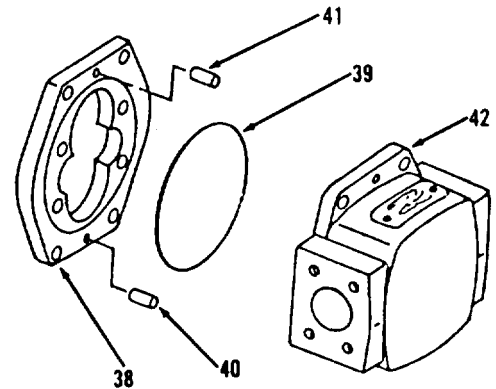
15-2. Torque Converter Charging Pump. (Sheet 5 of 6)

ASSEMBLY

NOTE

Lubricate all parts with lubricating oil before assembly.

17. Using a plastic hammer, install pins (41 and 40) in case (38).
18. Install new preformed packing (39) and case (38) in plate (42).
19. Using snap ring pliers, install retaining ring (36), pin (35), gear (34) and retaining ring (33) in shaft (37)0
20. Install items 37 thru 33 as an assembly.
21. Using a plastic hammer, install pin (31), retaining ring (30), gear (29) and retaining ring (28) on shaft (32).



Go to sheet 6

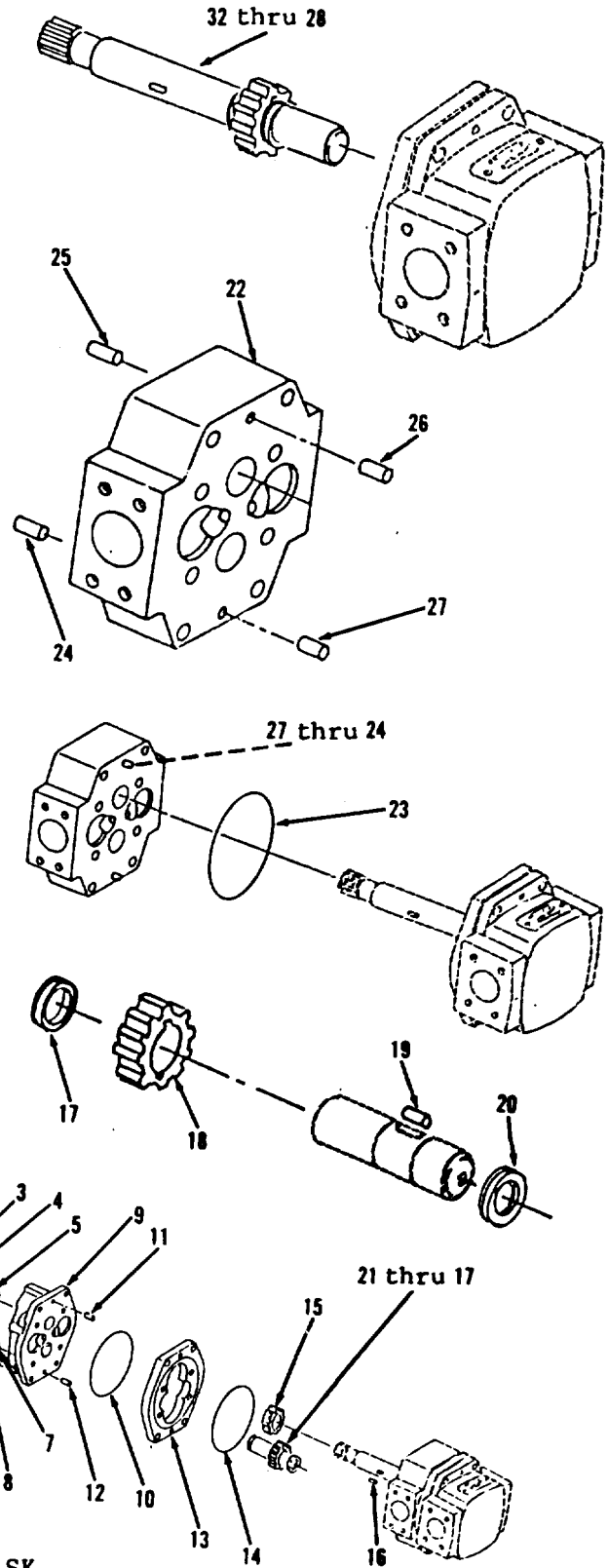
# TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-2. Torque Converter Charging Pump. (Sheet 6 of 6)

## ASSEMBLY (cont)

22. Install items 32 thru 28 as an assembly.
23. Using a plastic hammer, install pins (27, 26, 25 and 24).
24. Install new preformed packing (23) and spacer (22) with items 27 thru 24 as an assembly.
25. Using snap ring pliers, install retaining ring (20), pin (19), gear (18) and retaining ring (17).
26. Using a rubber mallet, install items 21 thru 17 as an assembly, pin (16) and gear (15) on drive side of charging pump.
27. Install new preformed packing (14) and case (13).
28. Using a plastic hammer, install pins (11 and 12).
29. Using an 9/16" socket and socket wrench handle, install new preformed packing (10), plate (9), four bolts (8), new seals (7) and screws (6) on drive side of charging pump.
30. Install ring (5), new gasket (4), new seal (3), flange (2) and three bolts (1).



### NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



**TM 10-3930-643-34**

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cent)

15-3. Transmission Assembly. (Sheet 2 of 26)

---

EQUIPMENT CONDITION

References

Condition Description

TM 10-3930-643-20

Sample valve removed.  
Breather removed.

Paragraph 6-6

Transmission removed.

Paragraph 6-8

Scheduling and control valve removed.

---

Go to sheet 3

**15-24**

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

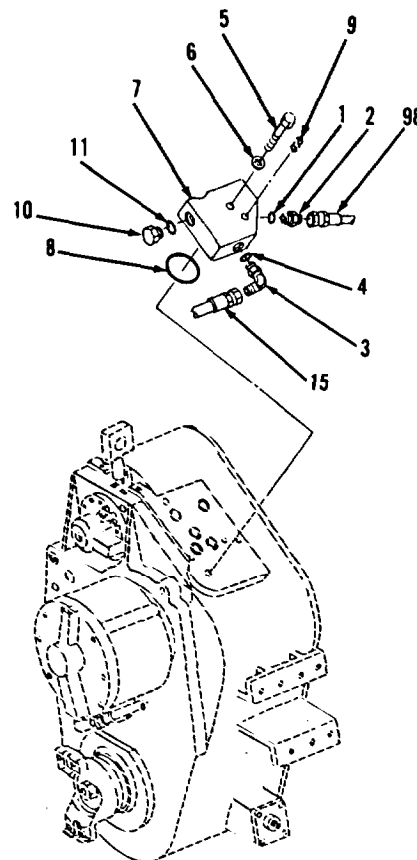
15-3. Transmission Assembly. (Sheet 3 of 26)

DISASSEMBLY

NOTE

Tag all hose and tube assemblies before disconnecting to aid in installation.

1. Using a 1-1/4" open end wrench, disconnect hose assembly (98) at top of transmission housing.
2. Remove adapter (1) and preformed packing (2). Discard preformed packing (2).
3. Disconnect hose assembly (15).
4. Remove elbow (3) and preformed packing (4). Discard preformed packing (4).
5. Using a 9/16" socket and socket wrench handle, remove bolt (5), washer (6), manifold (7) and preformed packing (8). Discard preformed packing (8).
6. Using a 3/16" socket head screw key, remove plug (9).
7. Using a 1-1/4" socket and socket wrench handle, remove plug (10) and preformed packing (11). Discard preformed packing (11).



Go to sheet 4

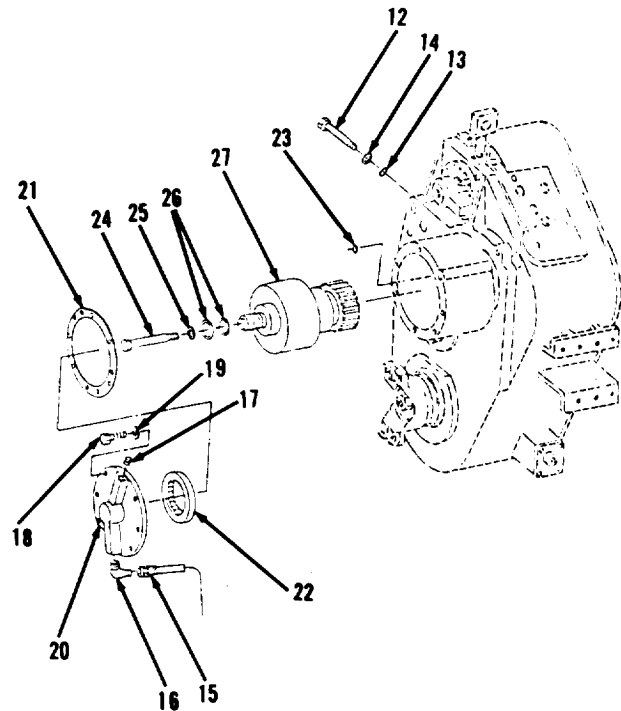
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 4 of 26)

### DISASSEMBLY (cont)

8. Using a 3/8" socket head screw key, remove screw (12) preformed packing (13) and washer (14) from side of transmission housing. Discard preformed packing (13).
9. Using an 11/16" open end wrench, remove hose assembly (15) at front of transmission housing.
10. Using a 1-1/8" and 9/16" open end wrench, remove elbow (16), plug (17), nine bolts (18) and lockwashers (19).
11. Using a 9/16" open end wrench, install two 3/8 in-16 NC forcing screws and tighten until cover (20) is loose.
12. Remove two 3/8-16NC forcing screws.
13. Using a rubber mallet, remove cover (20) and gasket (21). Discard gasket (21)
14. Remove bearing (22) from cover (20).
15. Using a scribe, remove and discard two preformed packings (23).
16. Using a flat tip screwdriver, bend washer (25) back from clutch pack shaft (27).
17. Using a 1-1/8" socket and socket wrench handle, remove bolt (24), washer (25) and two seal rings (26).
18. Remove clutch pack (27). For disassembly of first gear, refer to paragraph 15-4.



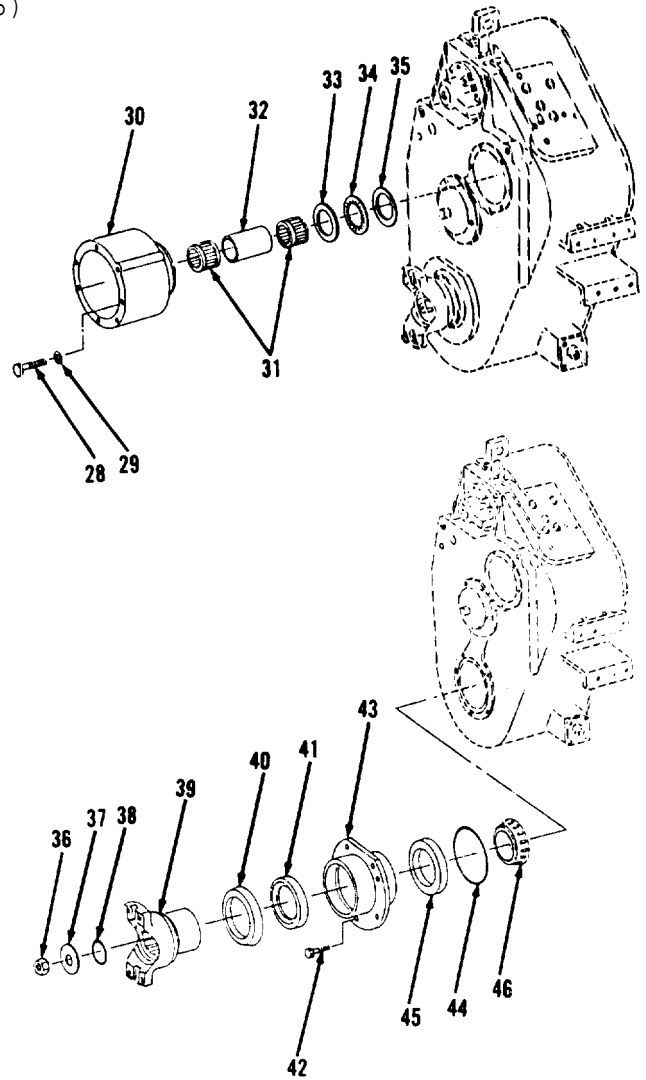
Go to sheet 5

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 5 of 26)

DISASSEMBLY

19. Using a 9/16" socket and socket wrench handle, remove six bolts (28), lock washers (29) and housing (30).
20. Remove two bearings (31), spacer (32), washer (33), thrust bearing (34) and thrust washer (35) from upper countershaft.
21. Using a 1-7/16" socket and socket wrench handle, remove nut (36), washer (37) and preformed packing (38). Discard preformed packing (38).
22. Remove yoke (39), deflector (40) and seal (41). Discard seal (41).
23. Using a 3/4" socket and socket wrench handle, remove six bolts (42) and retainer (43).
24. Using a scribe, remove preformed packing (44) and bearings (45 and 46). Discard preformed packing (44).



Go to sheet 6

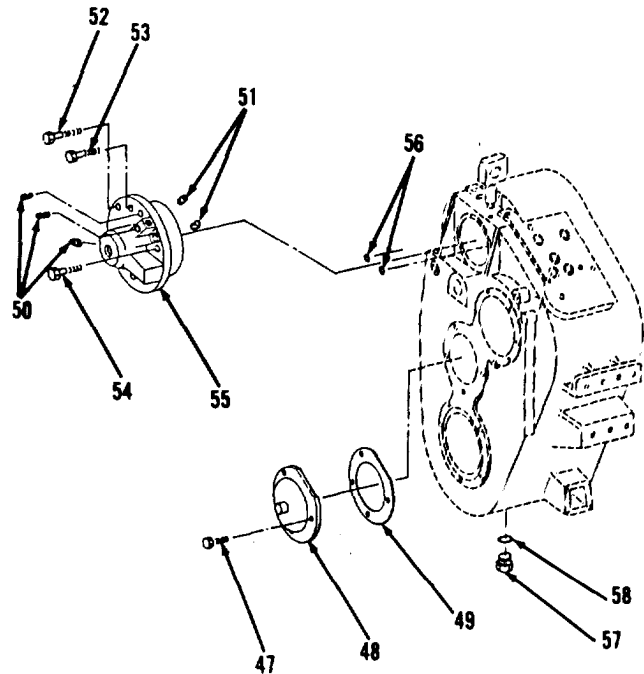
# TM 10-3930-643-34

## GENERAL SUPPORT TRANSMISSION MAINTENANCE, (cont)

### 15-3. Transmission Assembly. (Sheet 6 of 26)

#### DISASSEMBLY (cont)

25. Using a 9/16" socket ,**socket** wrench handle and a 5/16" socket head screw key, remove five bolts (47), adapter plate (48) and gasket (49). Discard gasket (49). Remove all gasket material from mounting surfaces.
26. Using a 3/8" open end wrench, remove three plugs (50) and two plugs (51).
27. Using a 9/16" socket and socket wrench handle, remove six bolts (52), bolt (53) and bolt (54).
28. Using a rubber mallet, remove cap (55) and two preformed packings (56). Discard preformed packings (56).
29. Using 1-1/8" open end wrench, remove plug (57) and preformed packing (58). Discard preformed packing (58).



#### **WARNING**

Weight of transmission assembly is approximately 730 lbs. Use adequate hoist and sling. Failure to follow this procedure could result in **SERIOUS INJURY**. If injured, seek medical attention immediately.

30. Attach hoist and sling to lifting eye.
31. Using a hoist and sling, turn housing over so that cover end is up.
32. Remove hoist and sling.

Go to sheet 7

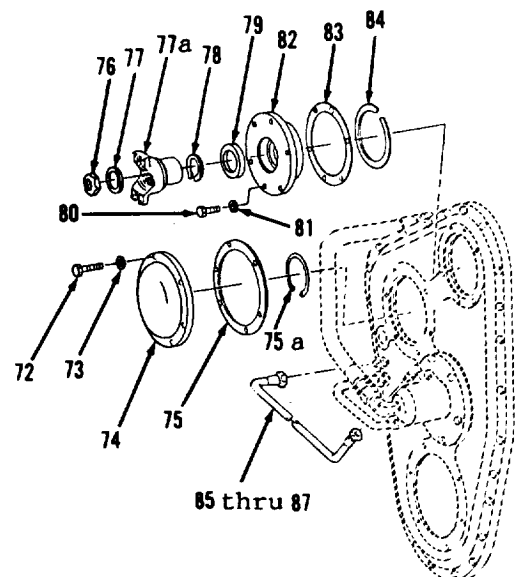
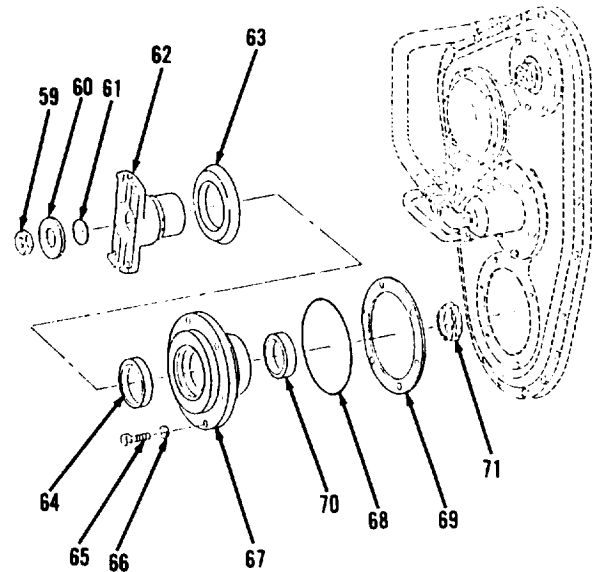


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 7 of 26)

DISASSEMBLY

33. Using a 1-7/16" socket and socket wrench handle, remove nut (59), washer (60) and preformed packing (61) from rear of transmission housing. Discard preformed packing (61).
34. Using a rubber mallet, remove yoke (62), deflector (63) and seal ring (64).
35. Using a 9/16" socket and socket wrench handle, remove six bolts (65), lock washers (66), retainer (67), preformed packing (68) and shim (69). Discard preformed packing (68).
36. Remove bearing (70) and bearing (71).
37. Using a 9/16" socket and socket wrench handle, remove six bolts (72), lock washers (73), cover (74) and gasket (75). Discard gasket (75). Remove all gasket material from mounting surfaces.
38. Using a 1-7/16" socket and socket wrench handle, remove nut (76), washer (77), yoke (77a), retaining ring (78) and seal (79). Discard seal (79).
39. Using a 9/16" socket and socket wrench handle, remove six bolts (80), lock washers (81), retainer (82), gasket (83) and retaining ring (84). Discard gasket (83). Remove all gasket material from mounting surfaces.
40. Using a 3/4" and 11/16" open end wrench, remove items 85 thru 87 as an assembly.



Go to sheet 8

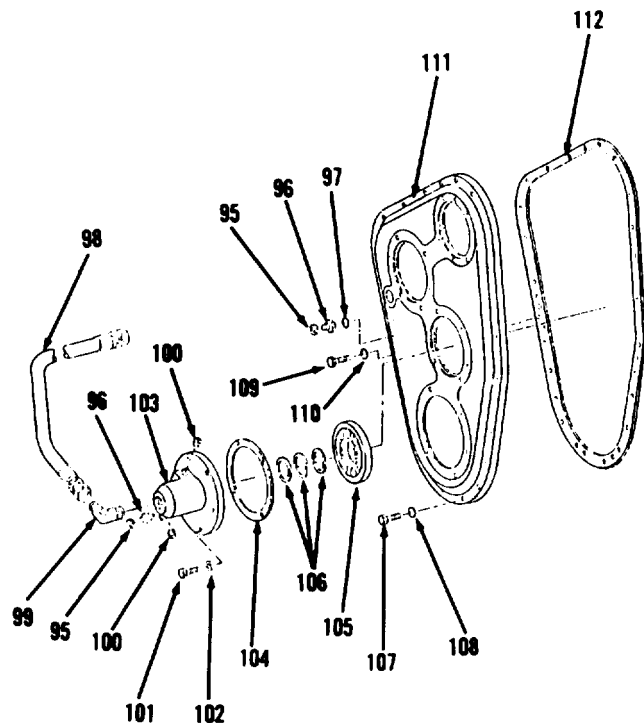
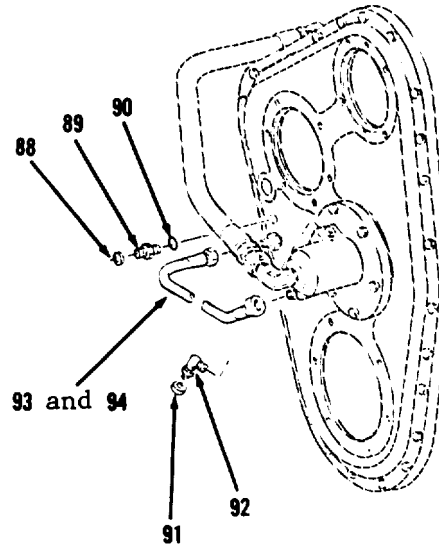
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 8 of 26)

### DISASSEMBLY (cont)

41. Using a 3/4" open end wrench, remove gasket (88), nut (89) and preformed packing (90). Discard preformed packings (88 and 90).
42. Remove seal (91) and elbow (92). Discard seal (91).
43. Remove items 93 and 94 as an assembly.
44. Remove gasket (95), nut (96) and preformed packing (97). Discard preformed packing (97).
45. Using a 1-1/4" open end wrench, remove hose assembly (98).
46. Remove elbow (99).
47. Using a 3/16" socket head screw key, remove two plugs.
48. Using a 9/16" socket and socket wrench handle, remove six bolts (101), lock washers (102), retainer (103) and gasket (104). Discard gasket (104).
49. Remove bearing (105) and three seal rings (106) from cover (111).
50. Remove 19 bolts (107) and lock washers (108).
51. Using a 3/8" socket and socket wrench handle, remove two bolts (109, lock washers (110), cover (111) and gasket (112). Discard gasket (112).



Go to sheet 9

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 9 of 26)

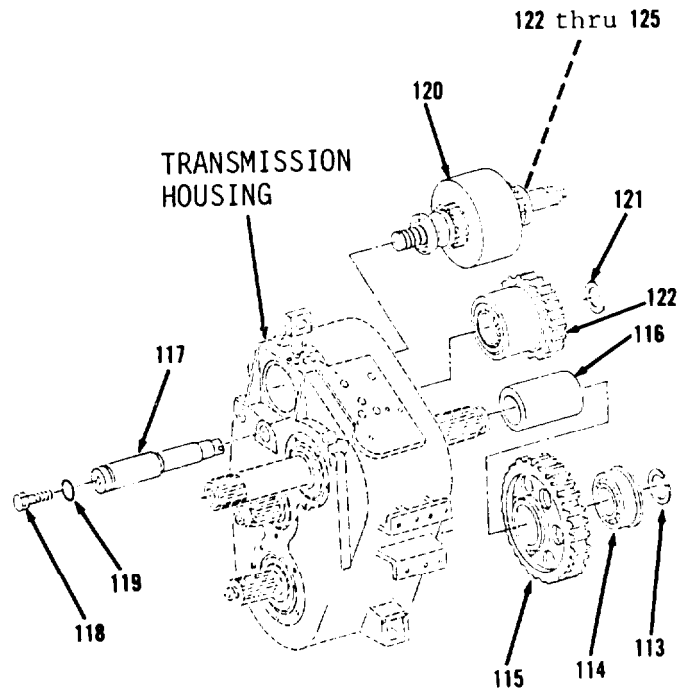
DISASSEMBLY

52. Using long round nose pliers, remove snap ring (113) from internal transmission housing.
53. Using a bearing puller, remove bearing (114).
54. Using a bearing puller, remove gear (115) and spacer (116).

**CAUTION**

Use care when performing the next procedure. Do not let idler shaft fall to ground. Failure to use care could result in damage to idler shaft.

55. Using a drift punch, drive items 117 thru 119 out through rear of transmission housing.
56. Remove washer (121) and gear (122).
57. Using a 3/4" socket and socket wrench handle, remove bolt (118) and preformed packing (119). Discard preformed packing (119).
58. Remove clutch pack (120). For disassembly of forward and reverse clutch, refer to paragraph 15-6.



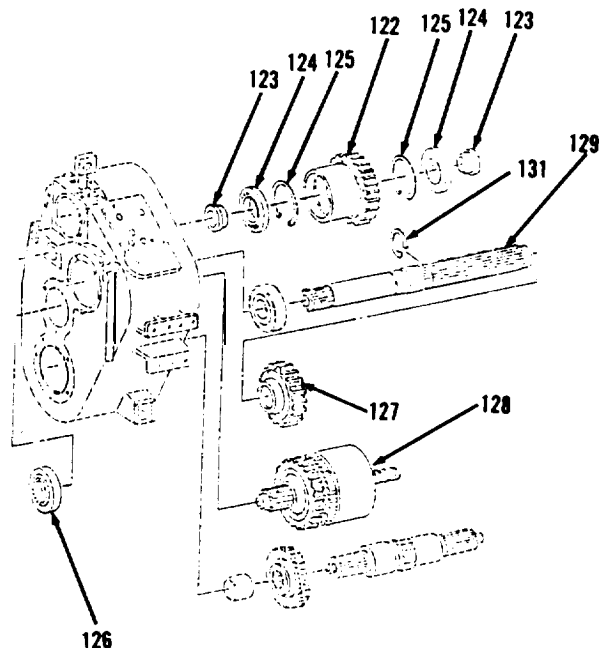
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 10 of 26)

### DISASSEMBLY (cont)

59. Using a scribe, remove two sleeves (123), bearings (124) and retaining rings (125) from gear (122) using a soft metal drift punch for bearing on tooth side of gear and a shop press for opposite bearing.
60. Place a jack under clutch pack (128).
61. Raise jack until one leg of transmission stand is about 1-1/2 inches off the floor.
62. Insert drift punch through hole in first speed driven gear and against bearing (126) race.
63. Using a hammer, tap drift punch to drive out and remove bearing (126).
64. Lower jack until transmission stand is flat on floor.
65. Remove jack.
66. Tilt clutch pack (128) toward bottom of transmission.
67. Remove gear (127).



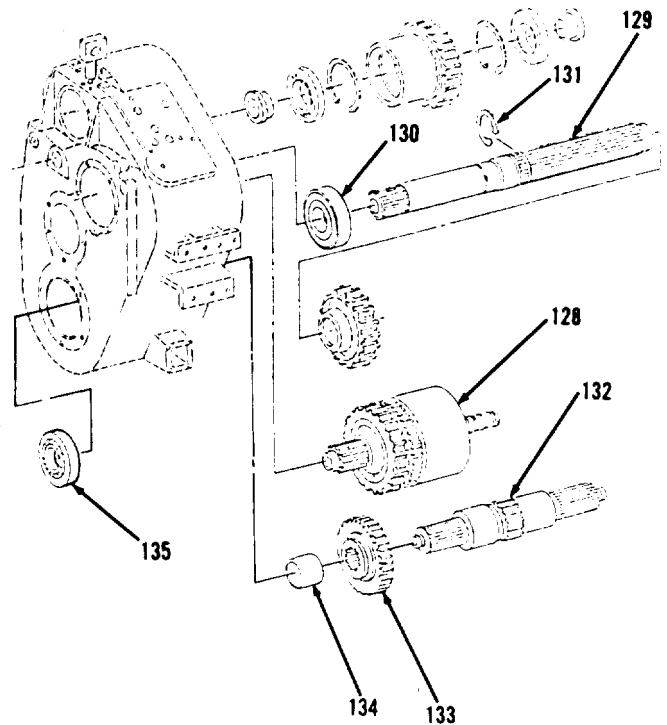
Go to sheet 11

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 11 of 26)

DISASSEMBLY

68. Remove clutch pack (128). For disassembly of second and third gear clutch, refer to paragraph 15-5.
69. Place a jack under shaft (129).
70. Raise jack until one leg of transmission stand is off floor.
71. Using a wooden q allet, tap transmission case to free bearing (130).
72. Remove items 129 thru 131 as an assembly.
73. Using snap ring pliers, separate shaft (129), bearing (130) and retaining ring (131).
74. Repeat steps 69 thru 71 for removal of shaft (132).
75. Remove items 132 thru 135 as an assembly.
76. Remove shaft (132), gear (133), spacer (134) and bearing (135).



Go to sheet 12

## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

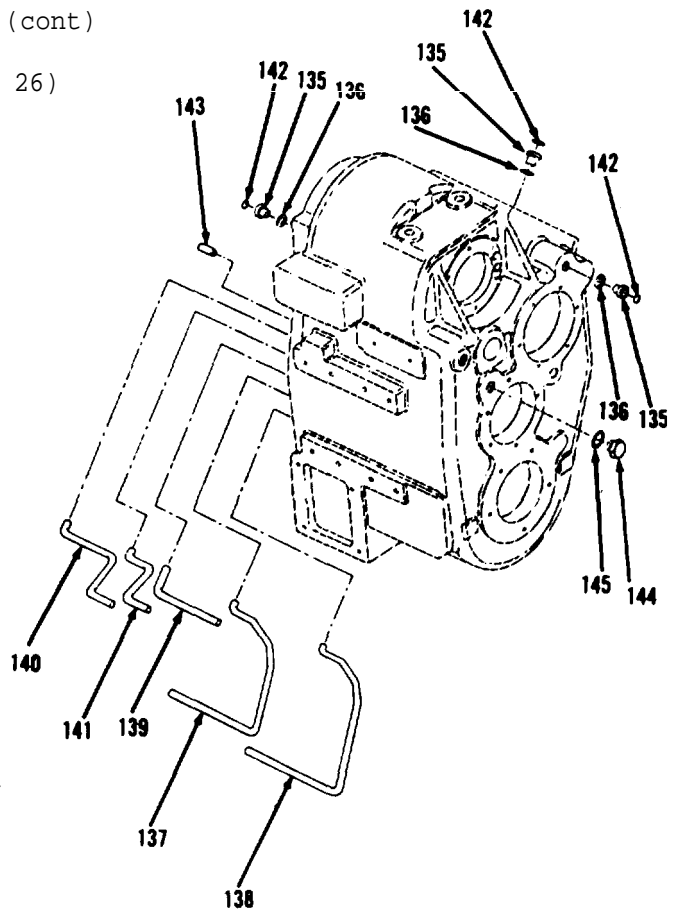
15-3. Transmission Assembly. (Sheet 12 of 26)

DISASSEMBLY (cont)

### NOTE

Do not remove items 135 thru 145 unless inspection shows replacement is necessary.

77. Using a scribe, remove ten bushings (135) and washers (136) from transmission housing.
78. Remove tubes (137 thru 141), ten preformed packings (142), washers (136) and bushings (135). Discard ten preformed packings (142).
79. Remove pin (143).
80. Using a 3/4" open end wrench, remove plug (144) and gasket (145). Discard gasket (145).



Go to sheet 13

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 13 of 26)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

NOTE

All parts should be oiled after cleaning to keep them clean until assembly.

81. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
82. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 14

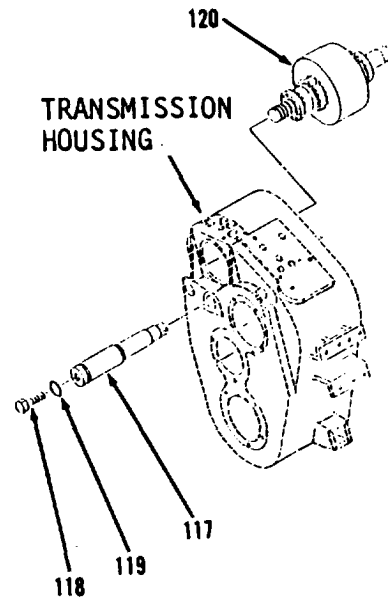
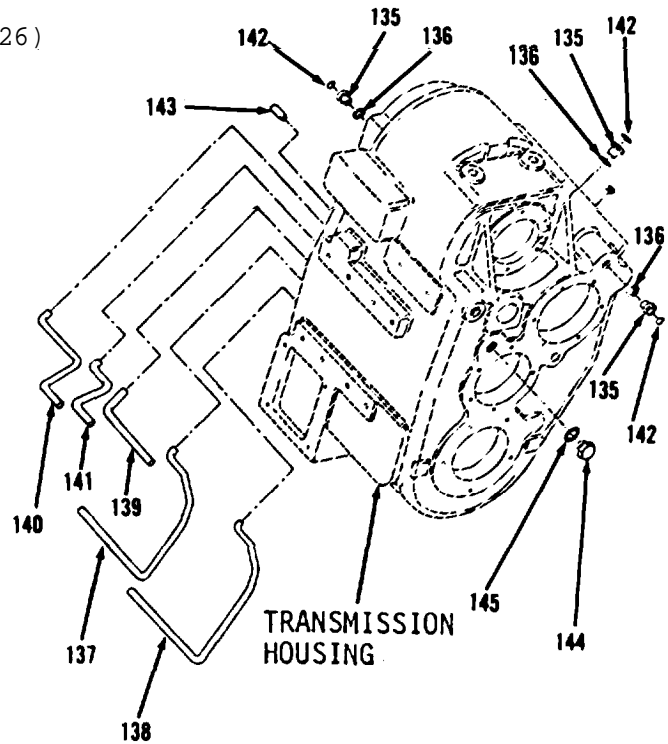
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 14 of 26)

### ASSEMBLY

83. Install new gasket (145) and plug (144) in transmission housing.
84. Using a plastic hammer, install pin (143).
85. Using a 3/4" open end wrench, install tubes (141 thru 137).
86. Coat with lubricating oil and install ten new preformed packings (142), washers (136) and bushings (135).
87. Using a center punch to prevent pressure from pushing tube out, expand tube ends (141 thru 137).
88. Install clutch pack (120).
89. Using a 3/4" socket and socket wrench handle, install new preformed packing (119) and bolt (118) on idler shaft (117).
90. Install items 117 thru 114 as an assembly with flat end of idler shaft (117) facing clutch pack (120).



Go to sheet 15

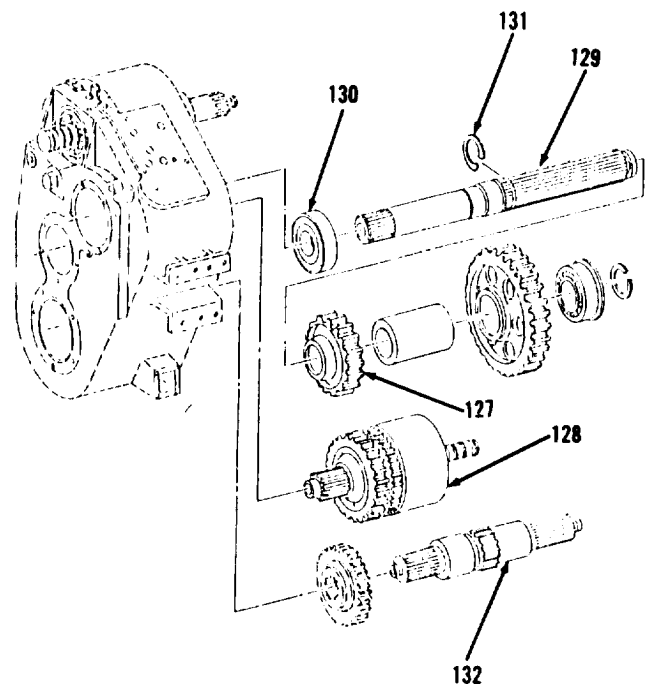
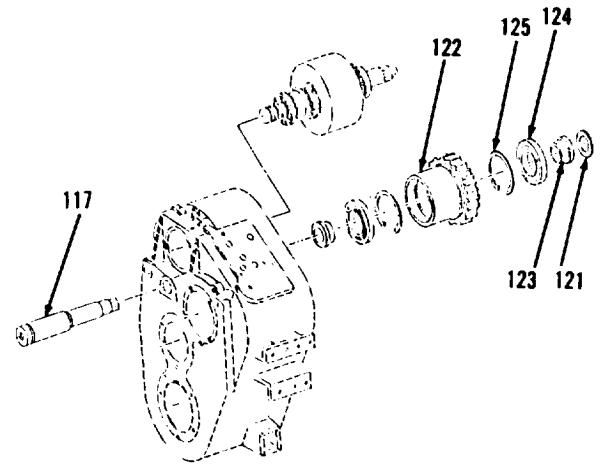


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 15 of 26)

ASSEMBLY

91. Using snap ring pliers, install two retaining rings (125) in grooves in gear (122).
92. Using a wooden dowel, press two bearings (124) into gear (122) until they bottom against two retaining rings (125).
93. Install two sleeves (123) in two bearings (124).
94. Position washer (121) on tooth side of gear (122)\*
95. Position items 125 thru 121 with gear teeth up on idler shaft (117).
96. Using a hammer and wooden dowel, drive idler shaft (117) down until flush with face of web.
97. Using a wooden dowel, drive idler shaft (117) back into original position.
98. Using an arbor press, press bearing (130) on shaft (129) until it bottoms against shoulder on shaft (132).
99. Using snap ring pliers, install retaining ring (131) on shaft (129).
100. Using a rubber mallet, drive shaft (129) down until bearing is flush with bearing bore.
101. Install gear (127) on shaft (129), counterbore in gear hub will index with retaining ring on shaft (132).
102. Install clutch pack (128).



Go to sheet 16

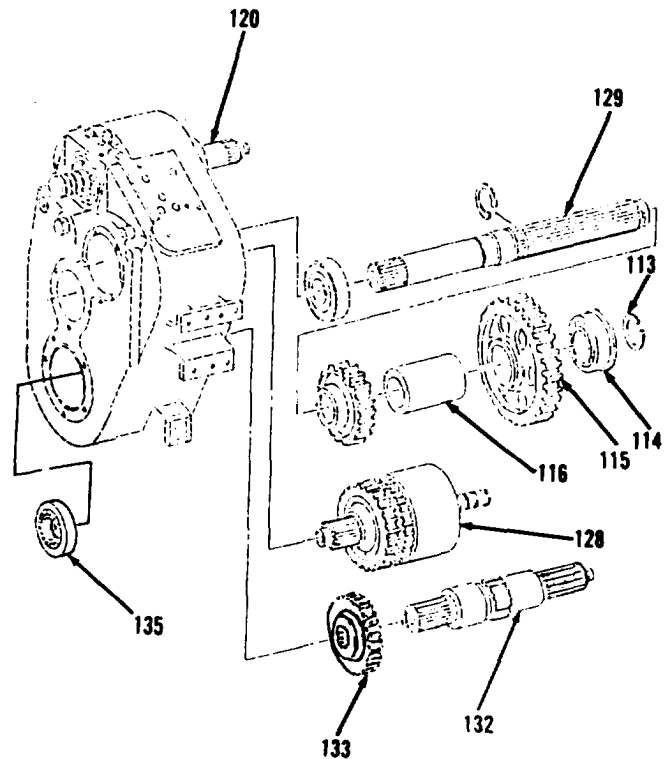
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 16 of 26)

### ASSEMBLY (cont)

- 1030 Install gear (133) by sliding it between case wall and clutch pack (120) to position it, long side of hub up, on it's bore in transmission housing.
104. Engage splines of shaft (132) into gear (133) and seat clutch pack (128) in gear (133).
105. Using a wooden dowel, install spacer (116).
106. Using a bearing installation tool, install gear (115) with the long hub side of gear toward spacer (116).
107. Block bottom end of shaft (129) with wood blocks.
108. Position bearing (114) with retaining ring groove up.
- 109 1 Using a bearing installation tool, drive bearing onto shaft (129).
110. Using snap ring pliers, install snap ring (113).
111. Heat bearing (135) to 250 degrees F in oil or oven.
112. Using insulated gloves and bearing installation tool, seat bearing (135) on shaft (132).



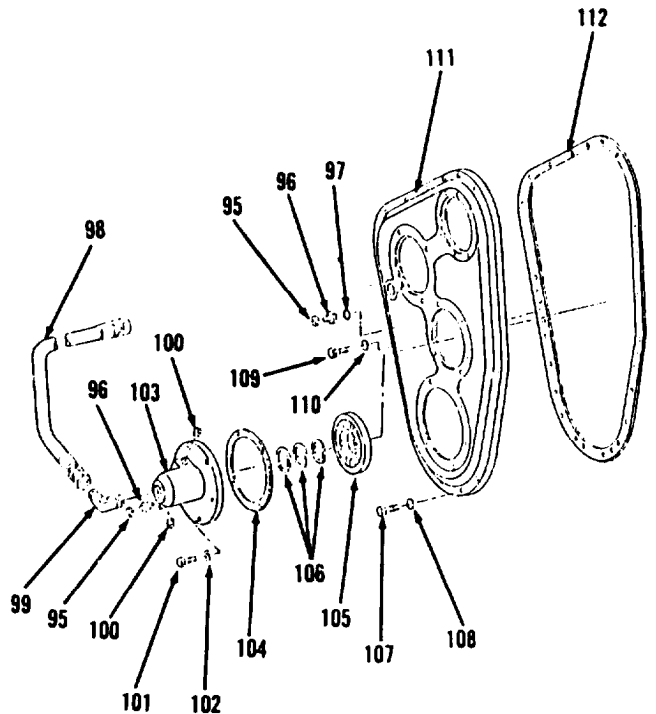
Go to sheet 17

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 17 of 26)

ASSEMBLY

113. Position new gasket (112) and cover (111) and using a plastic hammer tap into place.
114. Using a 3/8" socket and socket wrench handle, install two lock washers (110) and bolts (109).
115. Install 19 lock washers (108) and bolts (107).
116. Install bearing (105) into cover (111) bore. Allow bearing to protrude 1/8 inch above cover (111) Bearing will seat properly when retainer (103) is installed.
117. Install three seal rings (106) on shaft of clutch pack (128). Be sure that rings do not bind and that groove is deeper than seal thickness at all points.
118. Position new gasket (104) and retainer (103).
119. Install six lock washers (102) and bolts (101).
120. Using a 3/16" socket head screw key, install two plugs (100).
121. Using a 1-1/4" open end wrench, install elbow (99).
122. Connect hose assembly (98).
123. Using a 3/4" open end wrench, install new preformed packing (97), two nuts (96) and new gasket (95).



Go to sheet 18

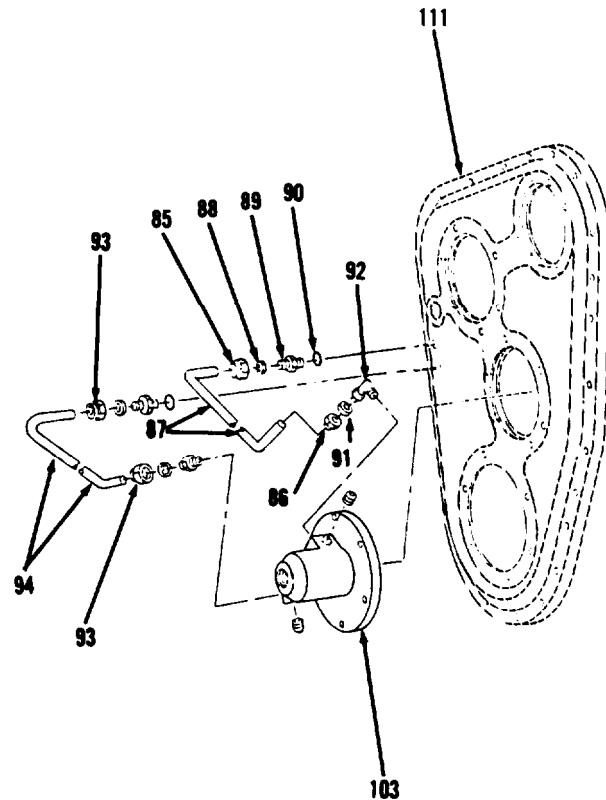
## TM 10-3930-643-34

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 18 of 26)

### ASSEMBLY (cont)

124. Using a 3/4" open end wrench, install two adapters (93) on tube (94).
125. If new tube (94) is used, expand tube ends with a large center punch to prevent pressure from pushing tube out.
126. Install items 94 and 93 as an assembly on cover (111).
127. Install elbow (92) and seal (91) in retainer (103).
128. Install new preformed packing (90), nut (89) and new gasket (88) in cover (111).
129. Install nut (86) and adapter (85) on tube (87).
130. If new tube (87) is being used, expand ends with a large center punch to prevent pressure from pushing tube out.



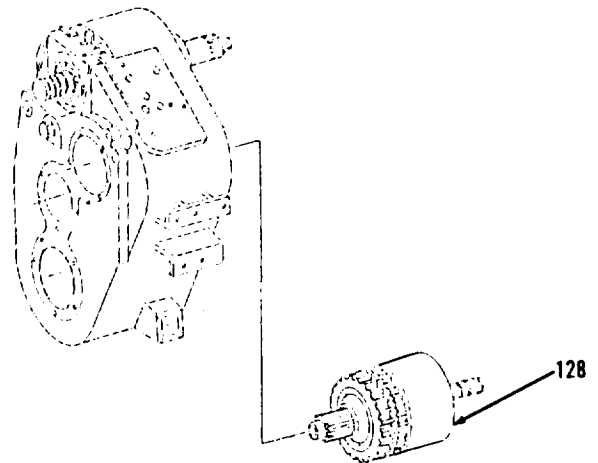
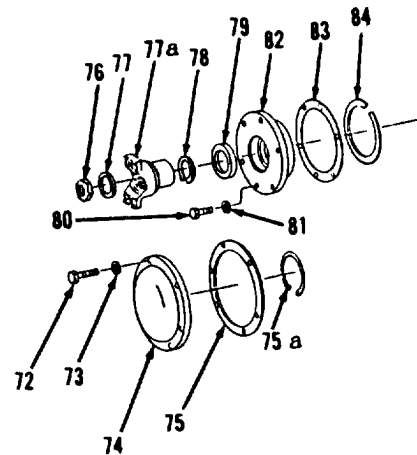
Go to sheet 19

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 19 of 26)

ASSEMBLY

131. Install retaining ring (75a). new gasket (75) and cover (74).
132. Using a 9/16" socket and socket wrench handle, install six lock washers (73) and bolts (72).
133. Press new seal (79) into retainer (82).
134. Using retaining ring pliers, install retaining ring (84).
135. Position new gasket (83) and retainer (82).
136. Install six lock washers (81) and bolts (80).
137. Using a 1-7/16" socket and socket wrench handle, install retaining ring (78), yoke (77a), washer (77) and nut (76) on clutch pack (128).



Go to sheet 20

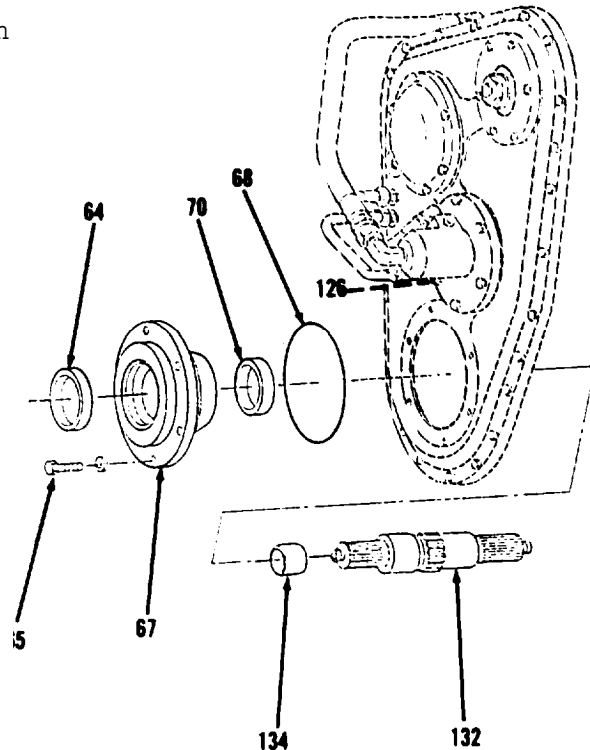
TM **10-3930-643-34**

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 20 of 26)

ASSEMBLY (cont)

138. Install new preformed packing (68) on retainer (67).
139. Press new seal rings (64) and bearing (70) into retainer (67).
140. Using a 9/16" socket and socket wrench handle , install retainer (67) and six bolts (65). Place at 180 degrees.
141. Attach hoist and sling to lifting eye.
142. Using a hoist and sling, turn housing over so that cover end is down.
143. Remove hoist and sling.
144. Heat bearing (126) to 250 degrees F in oil or oven.
145. Using insulated gloves and rubber mallet , install bearing (126) in transmission housing. Allow bearing (126) to protrude 18 inches above housing surface.
146. Heat bearing (46) to 250 degrees F in oil or oven.
147. Using a plastic hammer, install spacer (134) and bearing (46) on shaft (132). Using a bearing installation tool, seat bearing (46) on shoulder of shaft (132).



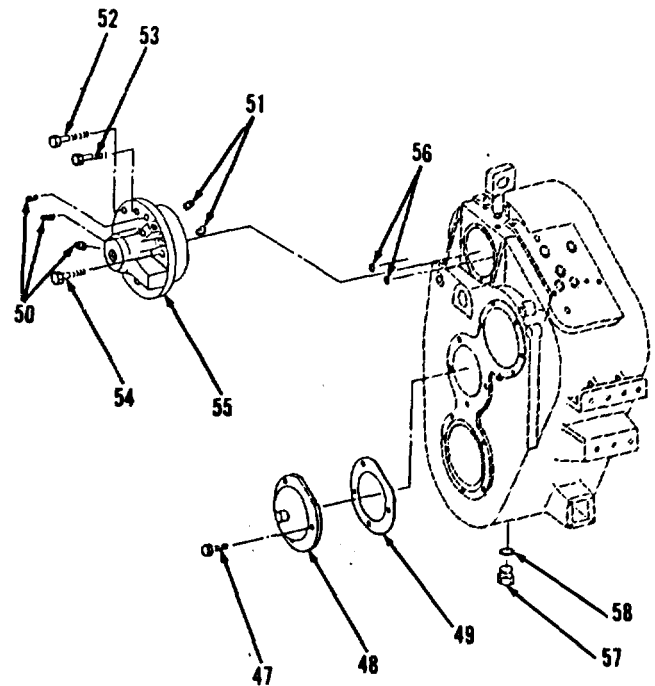
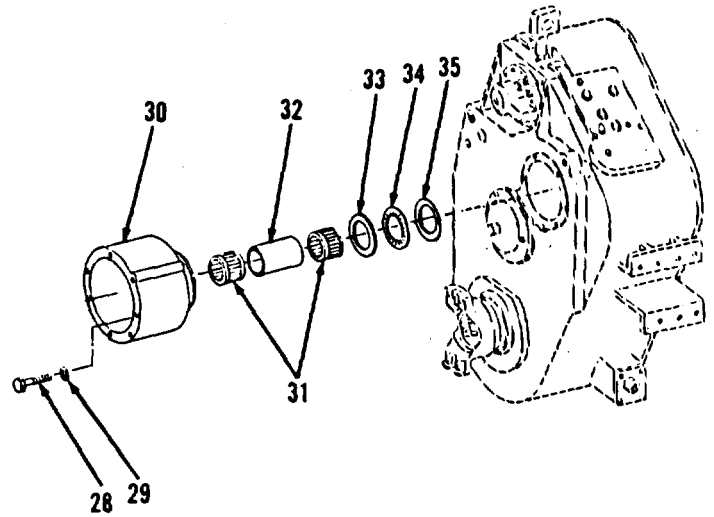
Go to sheet 21

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 21 of 26)

ASSEMBLY

- 148. Using a 5/16" socket head screw key, install new gasket (49) and adapter (48).
- 149. Apply Loctite 277 to five bolts (47) and using a 9/16" socket and torque wrench. install five bolts (47). Tighten five bolts (47) to 24 lb-ft.
- 150. Install two new preformed packings (56).
- 151. Apply Permatex sealant No. 2 to cap (55) mounting surface, refer to Chapter 2.
- 152. Using a 9/16" open end wrench, install two plugs (51) and three plugs (50) in cap (55).
- 153. Position cap (55) on transmission housing.
- 154.** Apply Loctite 277 to bolts (54 and 53) and six bolts (52) and using a 9/16" socket and torque wrench, install bolts (54 and 53) and six bolts (52). Tighten bolts (54 and 53) and six bolts (52) to 24 lb-ft.

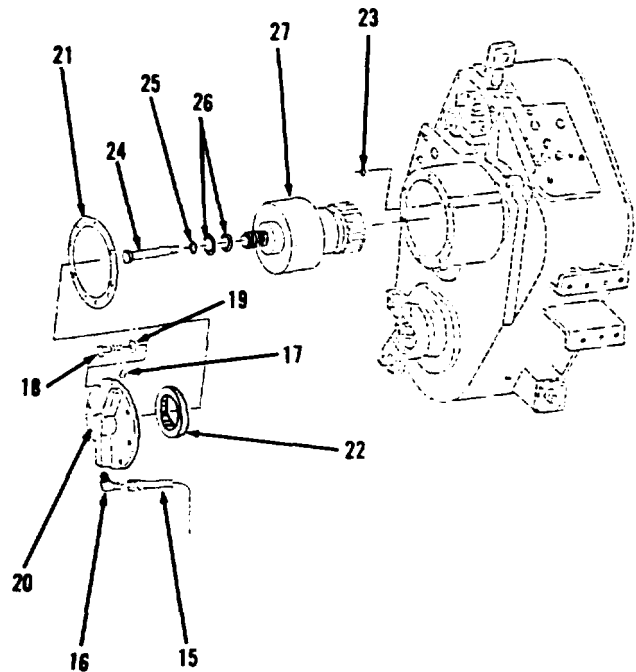


Go to sheet 23

15-3. Transmission Assembly. (Sheet 22 of 26)

ASSEMBLY (cont)

155. Install thrust washer (35), thrust bearing (34), washer (33), spacer (32) and two bearings (31).
156. Install two new preformed packings (23).
157. Apply Permatex sealant No. 2 to housing (30) mounting surface.
158. Position housing (30), being careful not to dislodge two new preformed packings (23).
159. Using a 9/16" socket and socket wrench handle, install six lock washers (29) and bolts (28).
160. Install clutch pack (27) and two seal rings (26).
161. Using a 1-1/8" socket and torque wrench, install washer (25) and bolt (24). Tighten bolt (24) to 100-150 lb-ft.
162. Bend washer (25) back on shaft (27).
163. Using a wooden block, press bearing (22) into cover (20).
164. Position new gasket (21) and cover (20).
165. Using a 1-1/8 and 9/16" open end wrench, install nine lock washers (19) and bolts (18).
166. Install plug (17) in cover (20).
167. Install elbow (16) in cover (20).
168. Using an 11/16" open end wrench, connect hose assembly (15).



Go to sheet 22

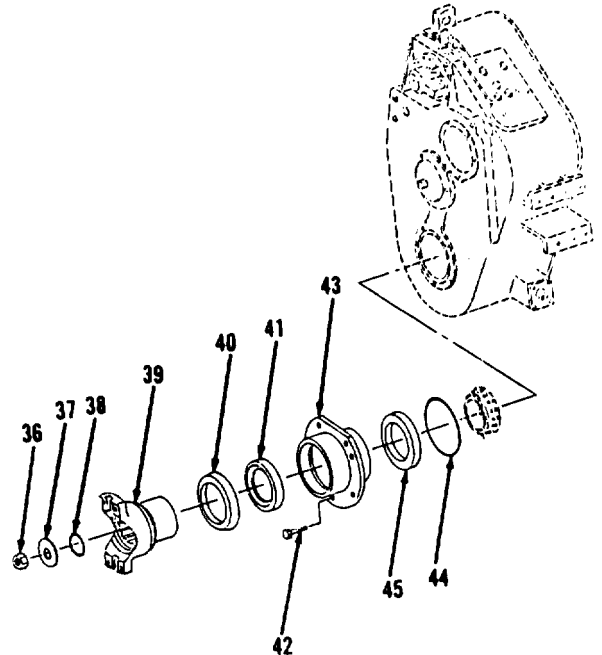


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 23 of 26)

ASSEMBLY

169. Using an arbor press, press bearing (45) and new seal (41) into retainer (43).
170. Install new preformed packing (44) in retainer (43).
171. Apply plastic gasket to retainer (43) mounting surface and position retainer (43) on transmission housing.
172. Using a 3/4" socket and socket wrench handle, install six bolts (42).
173. Install deflector (40) and yoke (39) while rotating shaft to prevent seal damage.
174. Using a 1-7/16" socket and torque wrench, install new preformed packing (38), washer (37) and nut (36). Tighten nut (36) to 60 lb-ft.
175. Attach hoist and sling to lifting eye.
176. Using a hoist and sling, turn transmission housing over.
177. Remove hoist and sling.
178. Remove lifting eye.



Go to sheet 24

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-3. Transmission Assembly. (Sheet 24 of 26)

ASSEMBLY (cont)

179. Using a 9/16" socket and torque wrench, install six bolts (65). Tighten six bolts (65) to 25-30 in-lb.

180. Rotate shaft (132) several times.

181. Tighten six bolts (65) to 50 in-lb.

182. Rotate shaft (132) several times.

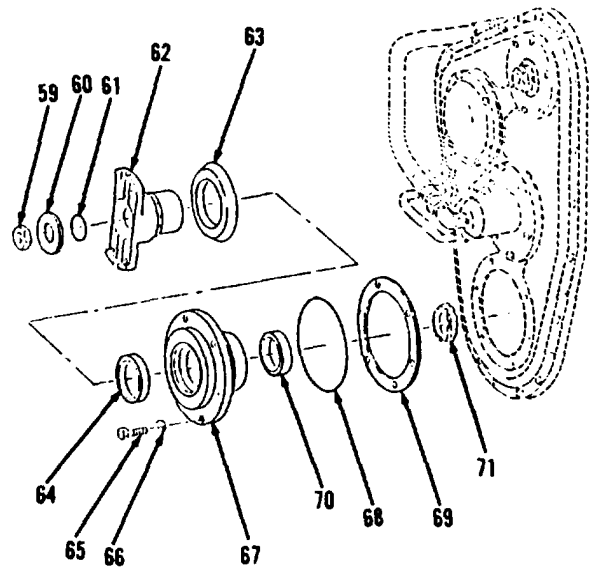
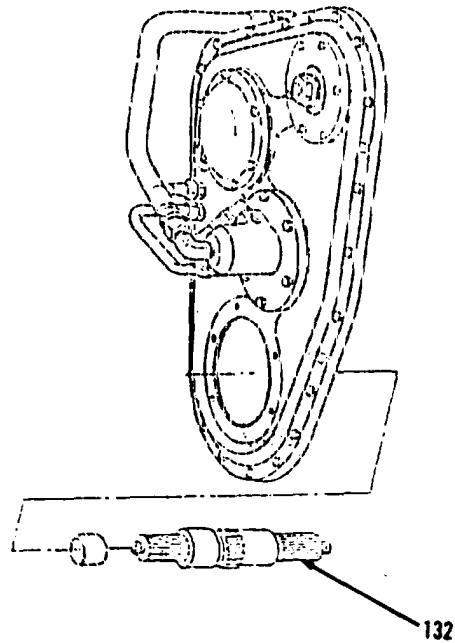
183. Using a feeler gage measure gap between using and retainer (67) at each screw. If readings are different, take the two numbers and divide by two. Add .020 inch.

184. Make shim (69) or shims equal to that thickness.

185. Using a 9/16 socket and socket wrench handle, remove six bolts (65).

186. Position shim (69) and retainer (67).

187. Install six lock washers (66) and bolts (65).



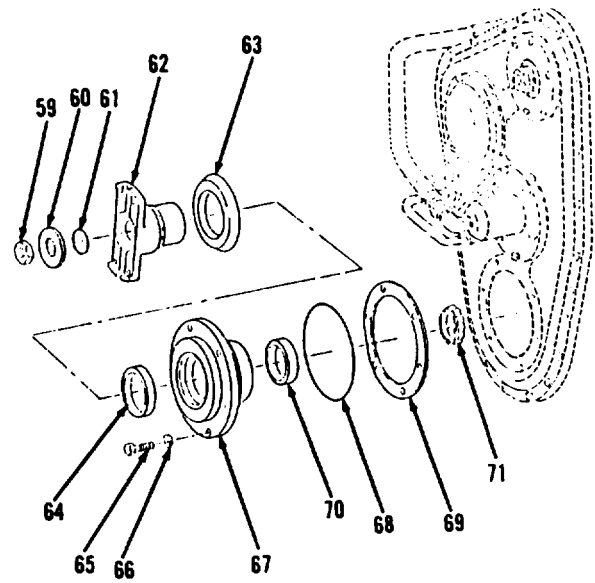
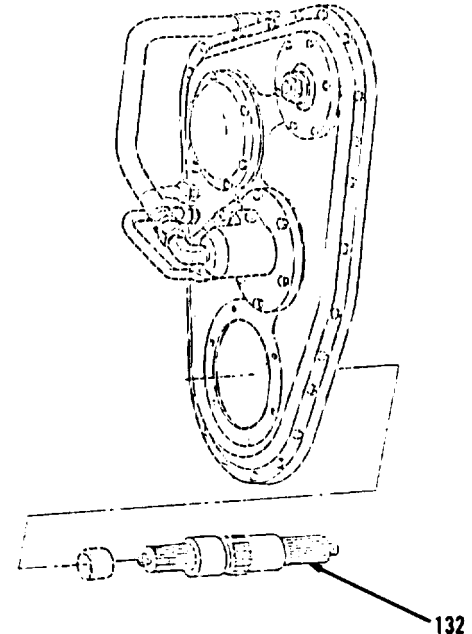
Go to sheet 25

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-3. Transmission Assembly. (Sheet 25 of 26)

ASSEMBLY

188. Install a dial indicator to measure shaft (132) end play.
189. Place a jack under opposite end of shaft (132). Use a block, do not contact the shaft (132).
190. Using a pry bar to exert pressure on end of shaft (132), note reading on dial indicator. Correct shim pack if not within specifications. Allowable end play is 0.005-0.009 inches.
191. Using a rubber mallet, install deflector (63) and yoke (62) on shaft (132). Rotate shaft (132) to prevent seal damage.
192. Install new preformed packing (61), washer (60), and nut (59). Using a 1-7/16" socket and torque wrench, tighten nut (59) to 50 lb-ft.



Go to sheet 26

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

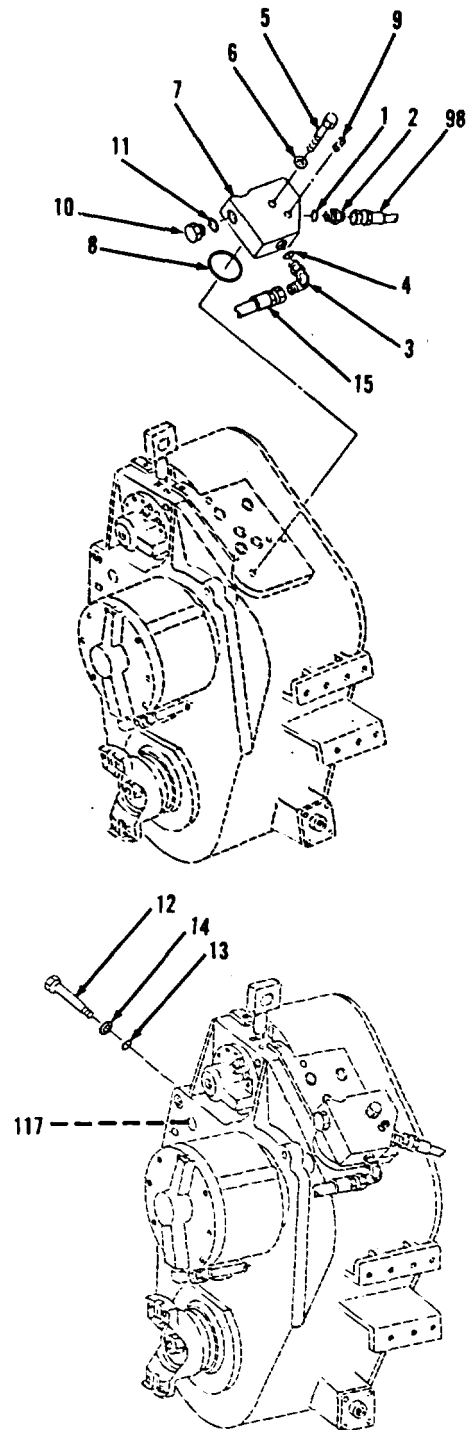
15-3. Transmission Assembly. (Sheet 26 of 26)

ASSEMBLY (cont)

- 193. Install new preformed packing (8) in manifold (7).
- 194. Position manifold (7) on housing.
- 195. Using a 9/16" socket and socket wrench handle, install washer (6) and bolt (5).
- 196. Using a 3/16" open end wrench, install plug (9).
- 197. Using a 1-1/4 socket and socket wrench handle, install new preformed packing (11) and elbow (10).
- 198. Install new preformed packing (4) and elbow (3).
- 199. Connect hose assembly (15).
- 200. Install new preformed packing (2) and adapter (1).
- 201. Connect hose assembly (98).
- 202. Using a 3/8" socket head screw key and torque wrench, install washer (14), preformed packing (13) and screw (12) on idler shaft (117). Tighten screw (12) to 50 lb-ft.

NOTE

Return M10A Forklift to original equipment condition.



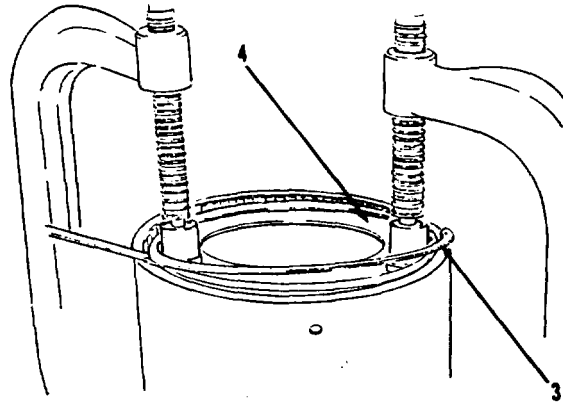
END OF TASK



15-4. First Gear Assembly. (Sheet 2 of 7)

DISASSEMBLY (cont)

3. Using two "C" clamps, depress plate (4).
4. Using retaining ring pliers, remove and discard retaining ring (3).
5. Remove "C" clamps from plate (4).
6. Remove plate (4).



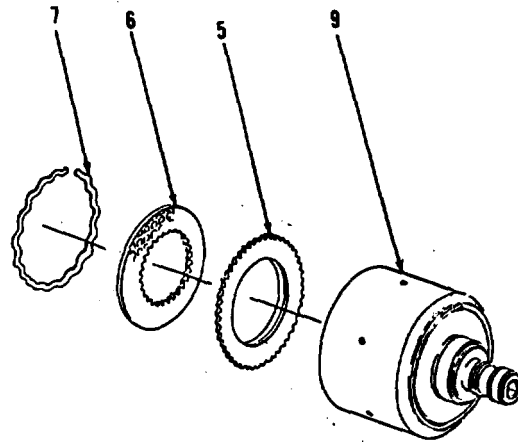
**WARNING**

Wave springs are thin and have sharp edges. Use care when handling them to avoid cutting hands and fingers.

**CAUTION**

Use care when removing and handling clutch plates to avoid nicking and scratching friction surfaces.

7. Remove 15 plates (5), 14 plates (6) and 28 wave springs (7) from housing (9). Discard 28 wave springs (7).



Go to sheet 3

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-4. First Gear Assembly. (Sheet 3 of 7)

DISASSEMBLY

**WARNING**

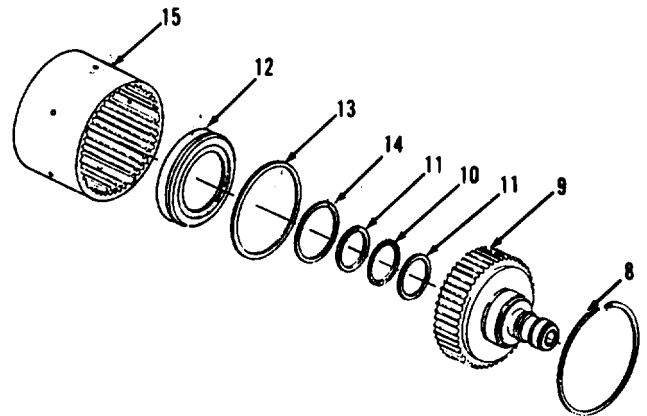
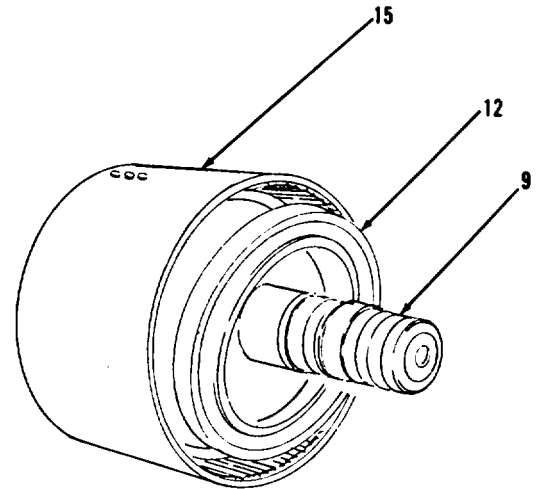
● COMPRESSED AIR HAZARD

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

**CAUTION**

Do not blast piston out of housing. Use air pressure with restraint. Failure to follow this procedure could result in damage to piston or housing.

8. Apply air pressure at bore on housing (9).
9. Remove piston (12).
10. Remove and discard preformed packing (13) and seal ring (14).
11. Remove thrust bearing (10) and two races (11).
12. Using a flat tip screwdriver, remove and discard retaining ring (8).
13. Using a rubber mallet, remove housing (9) from housing (15).



Go to sheet 4

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

14. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.



## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

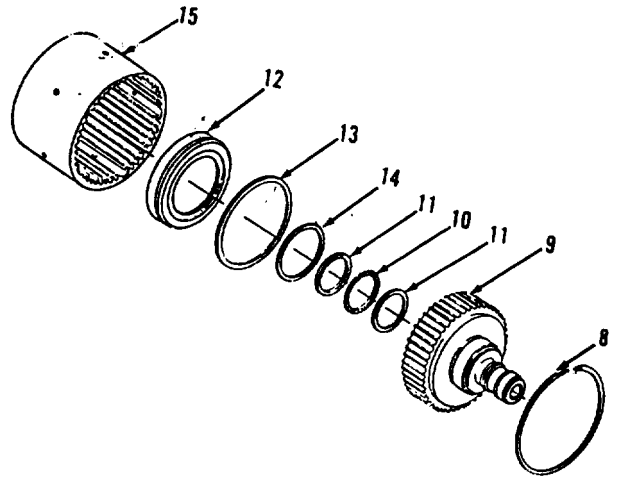
## 15-4. First Gear Assembly. (Sheet 5 of 7)

CLEANING/INSPECTION

15. Inspect teeth on gear (2), housings (9 and 15) and plates (4 thru 6) for wear, chips, cracks or missing teeth. Replace, if necessary.
16. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

17. Install new retaining ring (8) in housing (15). Be sure that open space between retaining ring (8) ends does not align with oil holes.
18. Install housing (9) in housing (15).
19. Install two races (11) and thrust bearing (10).
20. Install new preformed packing (13) and new seal ring (14) on piston (12).
21. Install piston (12) in housing (15).
22. Place housing (15) in an arbor press.



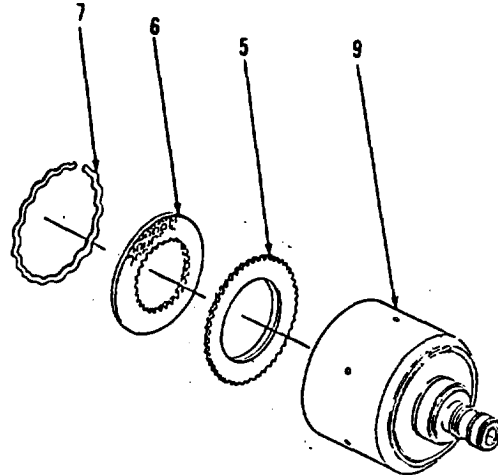
Go to sheet 6

15-4. First Gear Assembly. (Sheet 6 of 7)

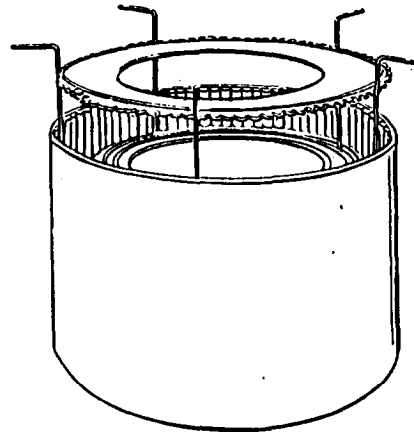
ASSEMBLY (cont)



Before installing friction plates (5 and 6), friction plates must be soaked in transmission oil for one hour. Failure to follow this procedure will result in damage to the transmission.



23. Install 15 plates (5), 14 plates (6) and 28 new springs (7) in housing (9) in the following order: One plate (5), two springs (7) and one plate (6). Be sure that open ends of springs (7) have bend facing up. Each pair of springs (7) must have open ends aligned with each other.

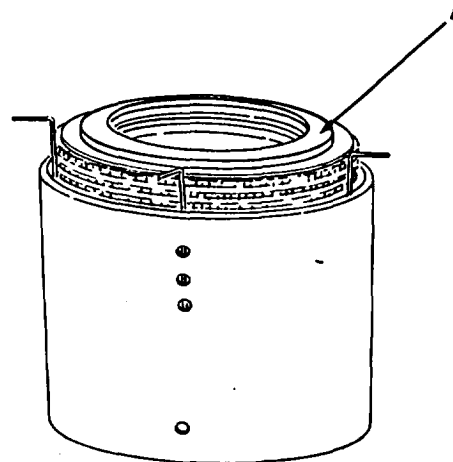


24. Continue stacking until stack is 1 inch from top of housing.

25. Insert guide pins in each oil hole slot, refer to illustration.

26. Continue stacking plates (6 and 5) and springs (7) using guide pins to align teeth of plates. When properly aligned, plate will drop freely into place.

27. Install plate (4).



28. Using an adapter, gradually press springs (7) and plates (6 and 5). Do not press plates (6 and 5) all at once. This procedure will allow springs (7) to seat properly.

29. Repeat several times, each time pressing plates a little further into housing.

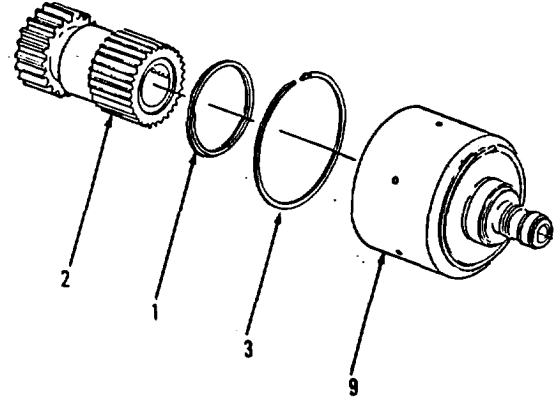
Go to sheet 7

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

## 15-4. First Gear Assembly. (Sheet 7 of 7)

ASSEMBLY

30. Press plates far enough to expose retaining ring (3) groove.
31. Lock arbor press and remove guide pins with removal tools.
32. Install new retaining ring (3) in housing (9). Be sure that open space between retaining ring (3) ends does not align with oil holes.
33. Install gear (2).
34. Using a flat tip screwdriver, install new retaining ring (1).



## NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 1 of 17)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c. Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item s)  
Clean cloth (App. C, Item 24)  
Lubricating oil (App. C, Item 19)  
Wave spring (40)  
Preformed packing (2)  
Retaining ring (6)  
Seal ring (2)  
Wood block

Torques

Except for special torques shown,  
all fasteners are tightened to a  
standard torque. Refer to  
Appendix E.

---

EQUIPMENT CONDITION

References

Paragraph 15-3

Condition Description

Transmission disassembled.

---

Go to sheet 2

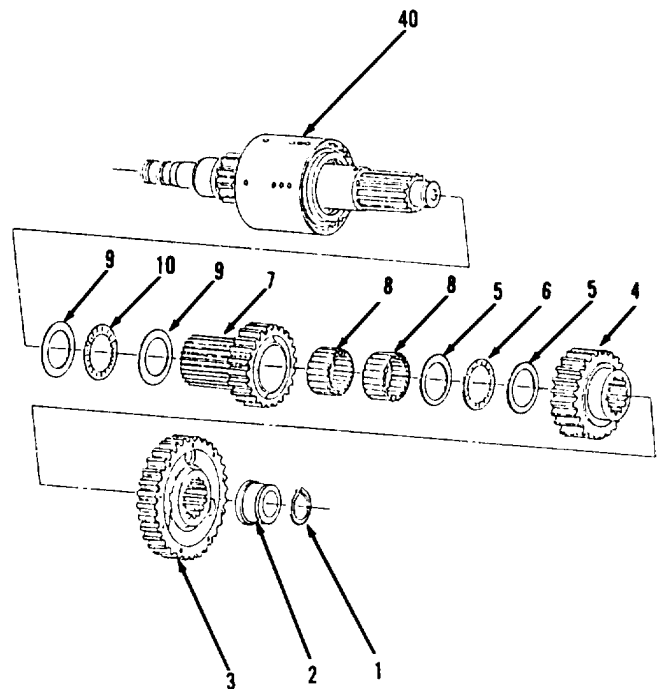
GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 2 of 17)

DISASSEMBLY

Using snap ring pliers, remove and discard retaining ring (1) from second gear side. Second gear side has three oil holes in housing (40). Third gear side has only one oil hole in housing.

2. Using a gear puller, remove race (2) and gear (3).
3. Remove gear (4).
4. Remove two races (5) and thrust bearing (6). Note thickness of races for assembly references.
5. Remove gear (7).
6. Remove two bearings (8) from gear (7).
7. Remove two races (9) and thrust bearing (10). Note that inner races are thinner than outer races.



Go to sheet 3

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 3 of 17)

DISASSEMBLY (cont)

- Using two C clamps, depress plate (12) into third gear side of housing (40).

**WARNING**

Use care when removing retaining ring. Take care not to let fingers inside housing in case "C" clamps fail and plate tension is released.

- Using a machinist's scribe, remove and discard retaining ring (11).
- Remove C clamps from plate (12).
- Remove plate (12).

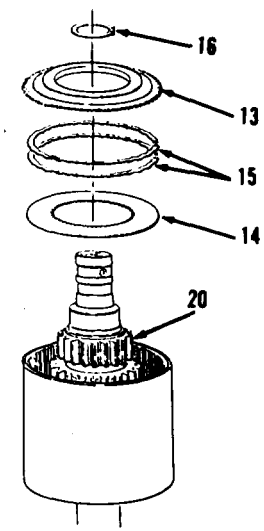
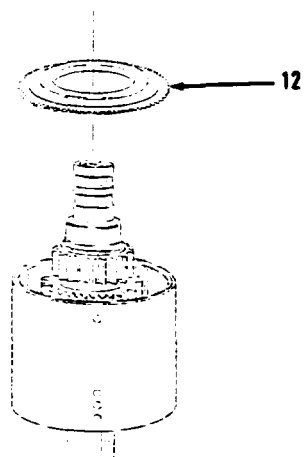
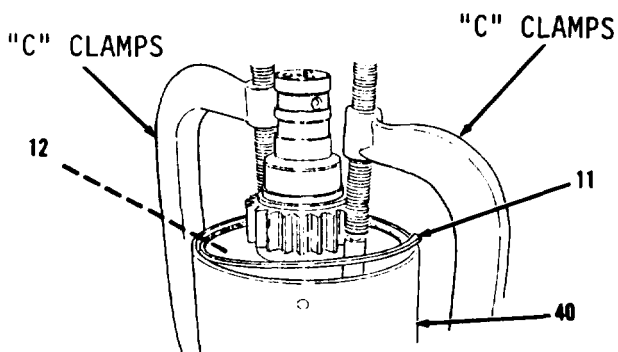
**WARNING**

Wave springs are thin and have sharp edges. Use care when handling them to avoid cutting hands and fingers.

**CAUTION**

Use care when removing and handling clutch plates. Avoid nicking or scratching friction surfaces.

- Using snap ring pliers, remove and discard retaining ring (16).
- Remove plates (13), plates (14) and springs (15) to allow a gear puller to be installed on gear (20). Discard springs (15).



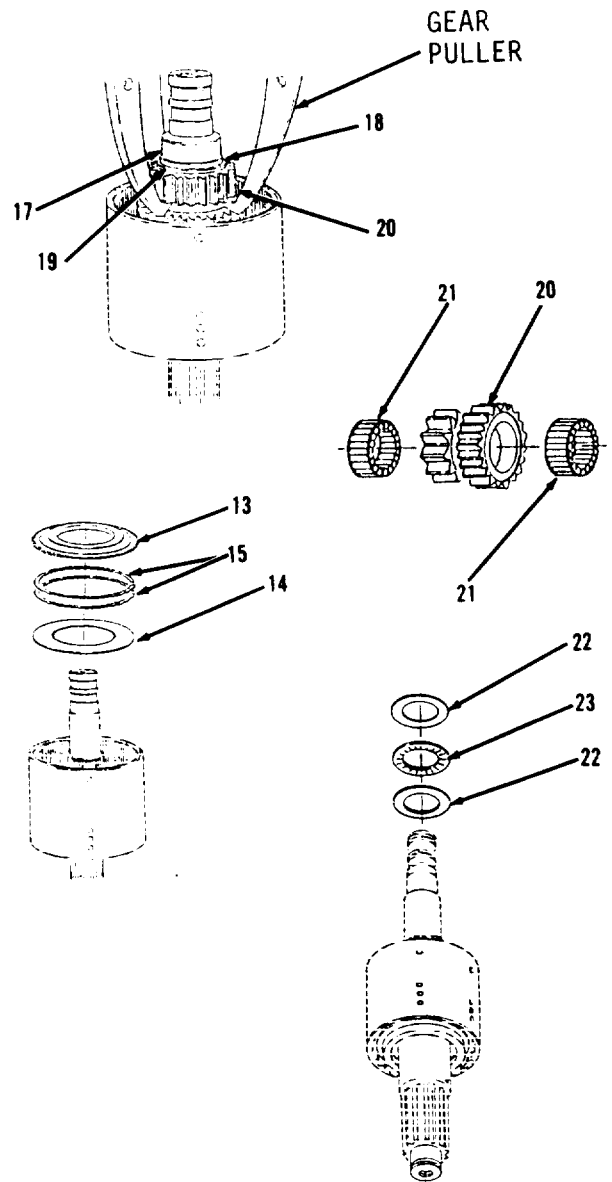
Go to sheet 4

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 4 of 17)

DISASSEMBLY

14. Using a gear puller, remove race (17), two races (18), thrust bearing (19) and gear (20).
15. Remove two bearings (21) from gear (20).
16. Remove remaining plates (13), plates (14) and springs (15). Discard springs (15).
17. Remove two races (22) and thrust bearing (23). Note that inner races are thinner than outer races.



Go to sheet 5

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 5 of 17)

DISASSEMBLY (cont)

18. Using two C clamps, depress plate (25) in second gear side.

**WARNING**

Use care when removing retaining ring. Take care not to let fingers inside housing in case C clamps fail and plate tension is released.

19. Using a machinist's scribe, remove and discard retaining ring (24).
20. Remove "C" clamps from plate (25).

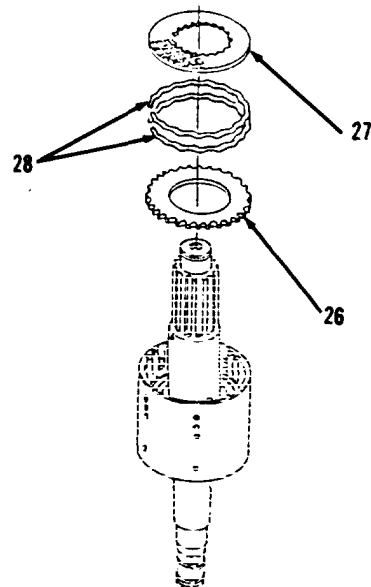
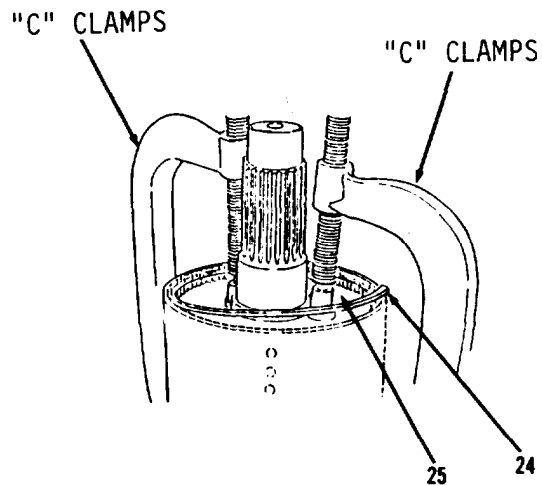
**WARNING**

Wave springs are thin and have sharp edges. Use care when handling them to avoid cutting hands and fingers. If cut, seek medical attention.

**CAUTION**

Use care when removing and handling clutch plates. Avoid nicking or scratching friction surfaces.

21. Using long round nose pliers, remove 15 plates (26), 14 plates (27) and 28 wave springs (28). Discard 28 springs (28).





GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 6 of 17)

DISASSEMBLY

**WARNING**

COMPRESSED AIR HAZARD

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

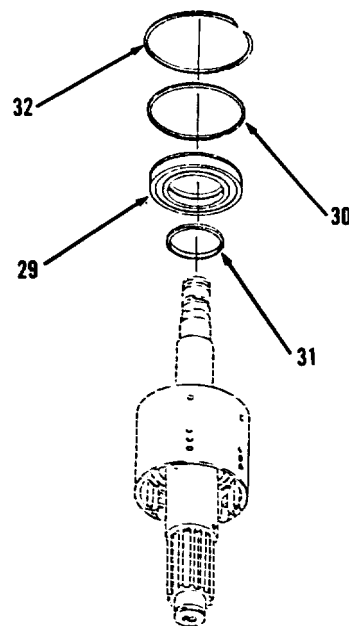
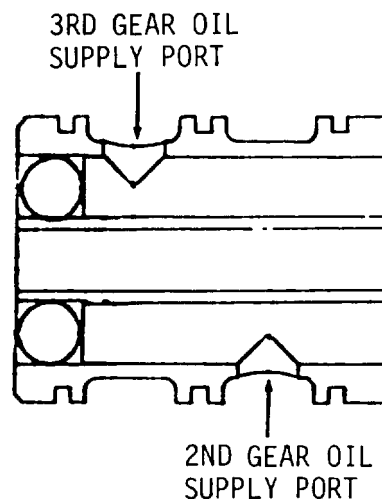
**CAUTION**

Do not blast piston out of cylinder. Use air pressure with restraint. Failure to follow this procedure could result in damage to piston or cylinder.

NOTE

Third gear port is closest to the rear of the shaft.

22. Apply air pressure to shaft bore at third gear side.
23. Remove piston (29).
24. Using a machinist's scribe, remove and discard preformed packing (30) and seal ring (31).
25. Using a machinist's scribe, remove and discard retaining ring (32).



Go to sheet 7

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

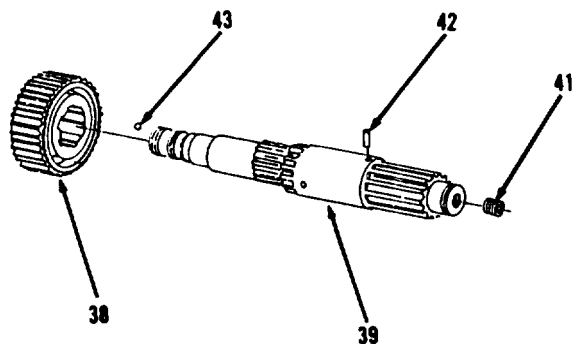
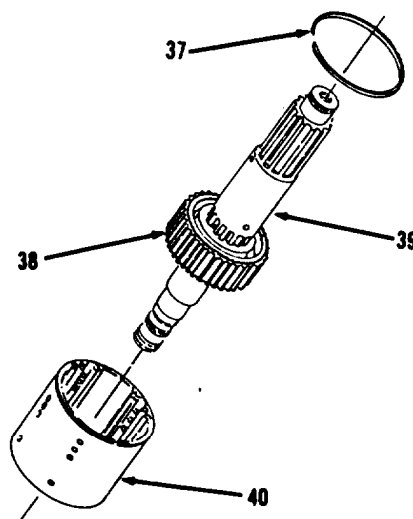
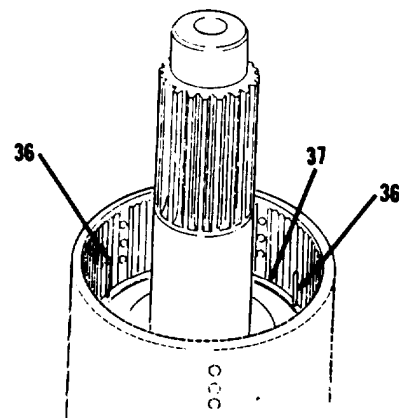
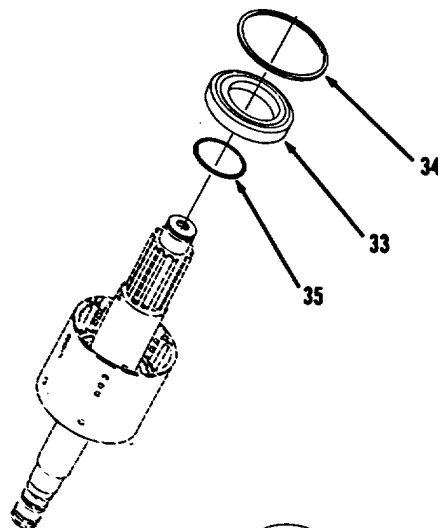
15-5. Second and Third Gear Assembly. (Sheet 7 of 17)

DISASSEMBLY (cont)

NOTE

Second gear port is closest to the front of-the shaft.

26. Apply air pressure to shaft bore at second gear port.
27. Remove piston (33).
28. Using a machinist's scribe, remove and discard preformed packing (34) and seal ring (35).
29. Using a punch and hammer, drive three pins (36) down past retaining ring (37).
30. Using a machinist's scribe, remove and discard retaining ring (37).
31. Remove cylinder (38) and shaft (39) as an assembly from housing (40).
32. Using an arbor press, press shaft (39) from cylinder (38).
33. Using a 3/16" socket head screw key, remove setscrew (41) from shaft (39).
34. Using slip joint pliers, remove two pins (42) from shaft (39),
35. Remove two balls (43).



Go to sheet 8

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 8 of 17)

CLEANING/INSPECTION**WARNING**

## ● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

36. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
37. Inspect shaft (39) splines for wear or damage. Replace, if necessary.
38. Inspect gears (3, 4, 7 and 20), cylinder (38) and plates (12 thru 14 and 25 thru 27) for wear, cracks or missing teeth. Replace, if necessary.

Go to sheet 9

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

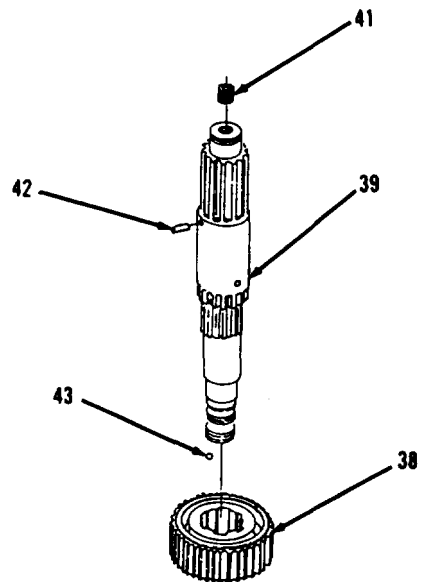
15-5. Second and Third Gear Assembly. (Sheet 9 of 17)

CLEANING/INSPECTION (cont)

- 39. Inspect clutch plates for wear, burning or warping. Replace, if necessary.
- 40. Inspect pistons (29 and 33) and relief orifices to make certain they are open.
- 41. Inspect all bearings and races for pits or spalled areas. Replace, if necessary.
- 42. Inspect all other parts.

ASSEMBLY

- 43. Install two balls (43).
- 44. Using a plastic hammer, install two pins (42) on shaft (39).
- 45. Using a 3/16" socket head screw key, install setscrew (41) on shaft (39).
- 46. Heat cylinder (38) to 275 degrees F.
- 47. With chamfer bore of cylinder (38), facing splined end of shaft (39), align oil holes of shaft (39) with oil holes in cylinder (38).
- 48. Using insulated gloves, lower hot cylinder (38) onto shaft (39). Hot cylinder (38) will position itself correctly on shaft (39).



Go to sheet 10

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

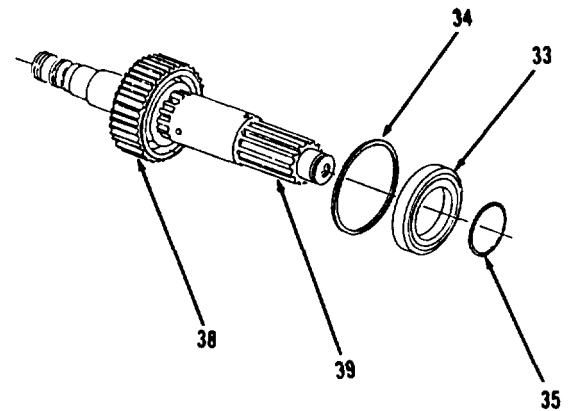
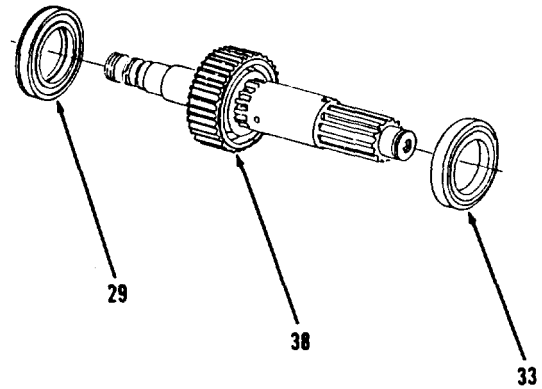
15-5. Second and Third Gear Assembly. (Sheet 10 of 17)

ASSEMBLY

NOTE

Wait until shaft and cylinder assembly is cool before continuing.

49. Install pistons (33 and 29) in cylinder (38).
50. Rotate pistons (33 and 29) to check clearance.
51. Remove pistons (33 and 29).
52. Install new preformed packing (34) and new seal ring (35) in piston (33) on second gear side of shaft (39).
53. Coat piston (33) with clean lubricating oil.
54. Insert piston (33) with new preformed packing (34) and new seal ring (35) end entering cylinder (38) first.
55. Using a plastic hammer, tap piston (33) into place.
56. Turn over shaft (39) so that third gear side is facing up.



Go to sheet 11

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 11 of 17)

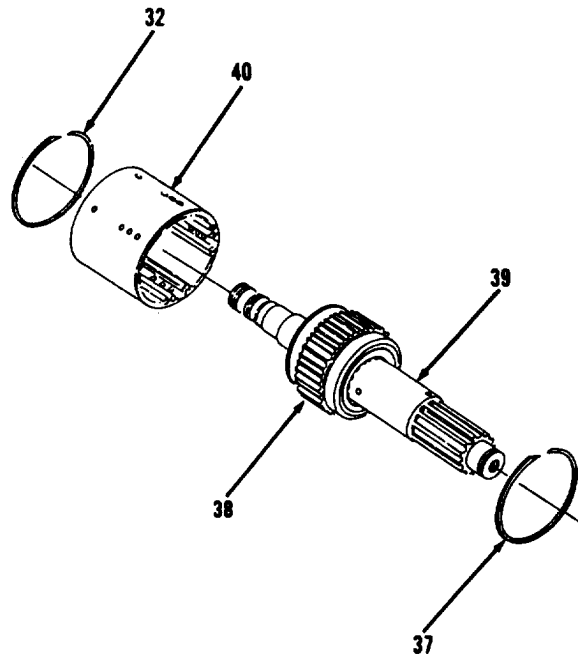
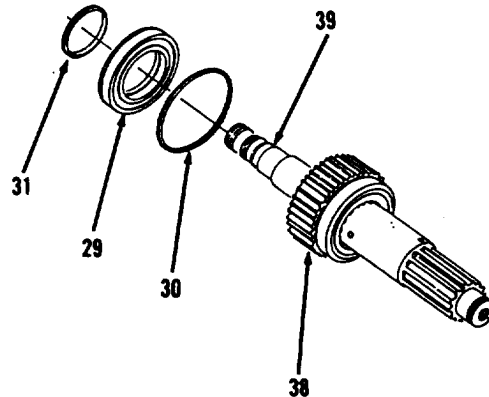
ASSEMBLY (cont)

57. Install new preformed packing (30) and new seal ring (31) in piston (29).
58. Coat piston (29) with clean lubricating oil.
59. Insert piston (29) with new preformed packing (30) end entering cylinder first.
60. Using plastic hammer, tap piston (29) into place into housing.

NOTE

The clutch housing has three oil holes in the second gear side and one hole in the third gear side.

61. Install new retaining ring (37) in second gear side of housing (40). Be sure that open space between new retaining ring (37) end does not align with oil holes.
62. Using a rubber mallet, install shaft (39) and cylinder (38) as an assembly in housing (40) with splined end of shaft facing toward second gear side of housing (40).
63. Install new retaining ring (32) in housing (40) of third gear side. Be sure that open space between new retaining ring (32) end does not align with oil holes.



Go to sheet 12

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 12 of 17)

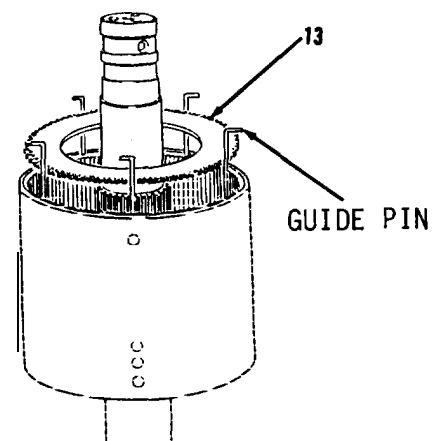
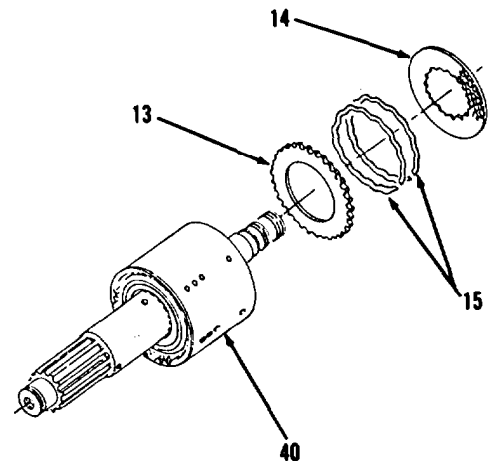
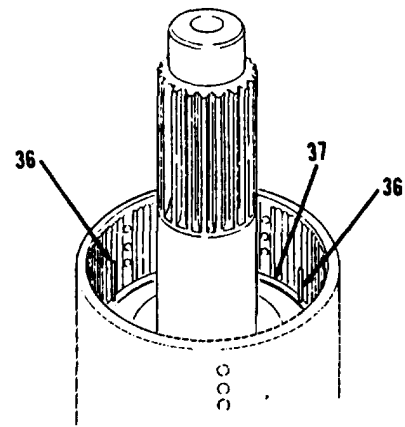
ASSEMBLY

- 64. Using a plastic hammer, install three pins (36) on second gear side, driving pin down until head of pin just clears upper surface of retaining ring (37).
- 65. Place housing (40) in an arbor press third gear side up.

**CAUTION**

Before installing friction plates (13 and 14), friction plates must be soaked in transmission oil for one hour. Failure to follow this procedure will result in damage to the transmission.

- 66. Install 12 new wave springs (15) and six plates (14) and seven plates (13) in the following order: One plate (13), two wave springs (15) and one plate (14). Be sure that open ends of new wave springs (15) have bend facing up. Each pair of new wave springs (15) must have open ends aligned with each other.
- 67. Continue stacking in order until stack is 1 inch from top of housing (40).
- 68. Insert guide pins at each oil hole slot, refer to illustration.
- 69. Continue stacking plates and springs, using guide pins to properly align teeth until all have been installed. Final plate to be installed must be seventh plate (13). When properly aligned, plate will drop freely into place.



Go to sheet 13

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 13 of 17)

ASSEMBLY (cont)

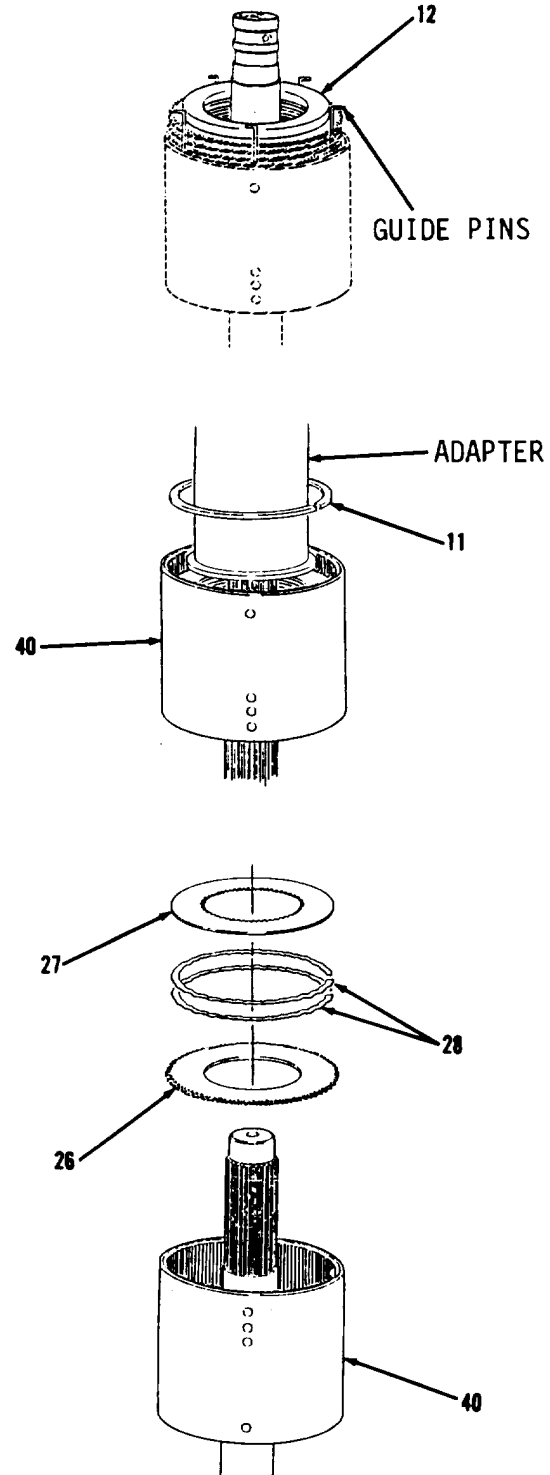
- 70. Install plate (12). Do not remove guide pins.
- 71. Using an adapter, gradually press plates and springs into housing (40). Do not press all at once. Press and release gradually in 1/4 inch increments to allow springs to seat.
- 72. When retaining ring groove of housing is exposed, lock arbor press.
- 73. Using slip joint pliers, remove guide pins.
- 74. Install new retaining ring (11). Be sure that open space between new retaining ring (11) end does not align with oil holes.
- 75. Turn housing (40) over and place in an arbor press with second gear side up.

**CAUTION**

Before installing friction plates (26 and 27), friction plates must be soaked in transmission oil for one hour. Failure to follow this procedure will result in damage to the transmission.

- 76. Install 28 new wave springs (28) and 14 plates (27) and 15 plates (26) in the following order: One plate (26), two wave springs (28) and one plate (27). Be sure that open ends of new wave springs (28) have bend facing up. Each pair of new wave springs (28) must have opens ends aligned with each other.
- 77. Continue stacking in order until stack is 1 inch from top of housing (40).

Go to sheet 14



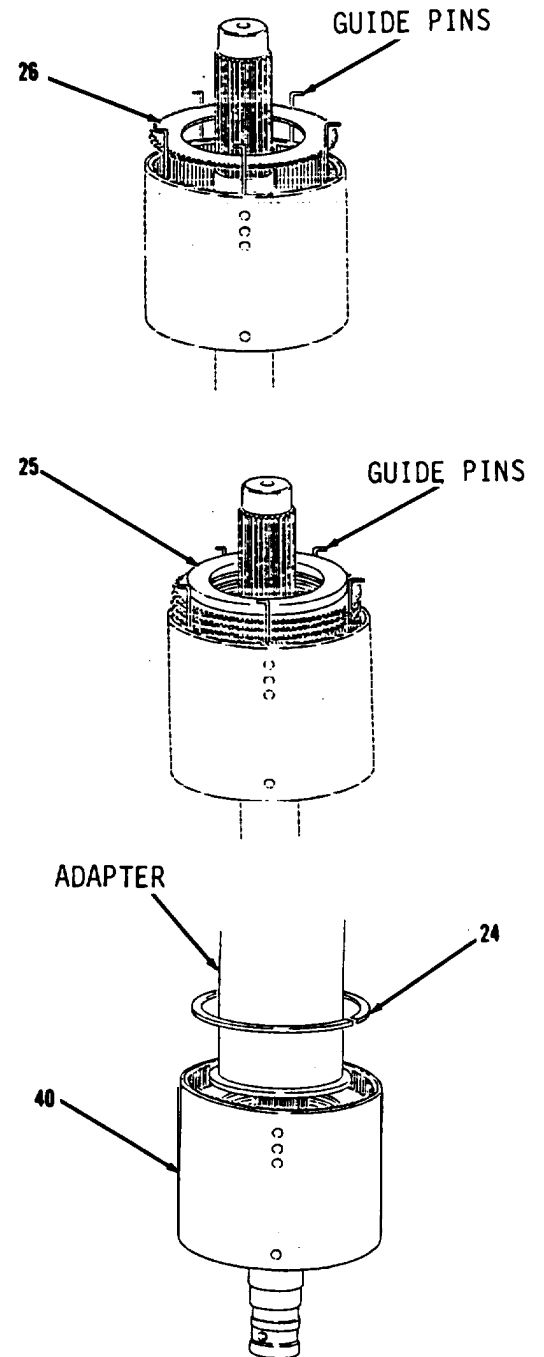


## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 14 of 17)

ASSEMBLY

78. Insert guide pins at each oil hole slot.
79. Continue stacking plates (27 and 26) and springs (28) using guide Pins to properly align teeth until all have been installed. When properly aligned, plate (29) will drop freely.
80. Install plate (25). Do not remove guide pins.
81. Using an adapter, gradually press plates and springs into housing (40). Do not press all at once. Press and release gradually in 1/4 inch increments to allow springs to seat properly.
82. When retaining ring groove of housing (40) is exposed, lock arbor press.
83. Using slip joint pliers, remove guide pins.
84. Install new retaining ring (24). Be sure that open space between new retaining ring (24) end does not align with oil holes.



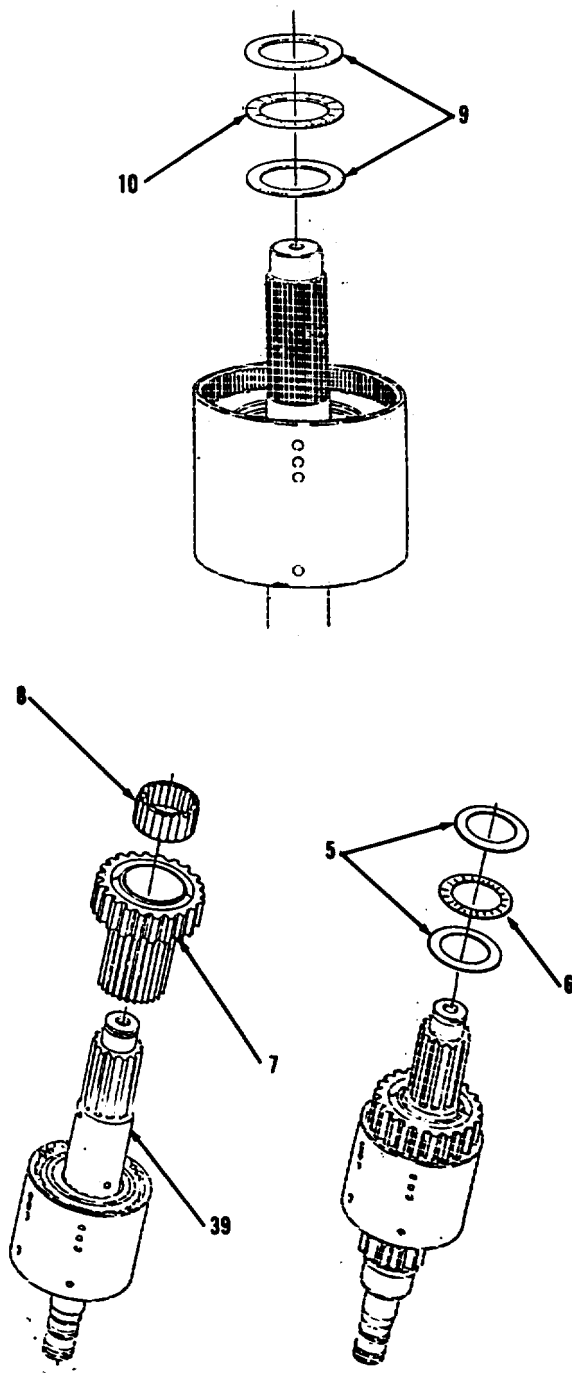
Go to sheet 15

ASSEMBLY (cont)

**CAUTION**

Inner races of second gear are thinner than those used on outer face of gear. Do not mix or interchange races. Failure to follow this procedure could result in damage to transmission.

- 85. Install thrust bearing (10) and two races (9).
- 86. Position gear (7) on shaft (39).
- 87. Install bearing (8) in bore of gear (7).
- 88. Rotate gear (7) back and forth to engage teeth of gear with teeth of clutch plates. If gear does not bottom out fully, remove it and visually align clutch plate keeping gear from bottoming out. Repeat installation procedure.
- 89. Install thrust bearing (6) and two races (5).



GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-5. Second and Third Gear Assembly. (Sheet 16 of 17)

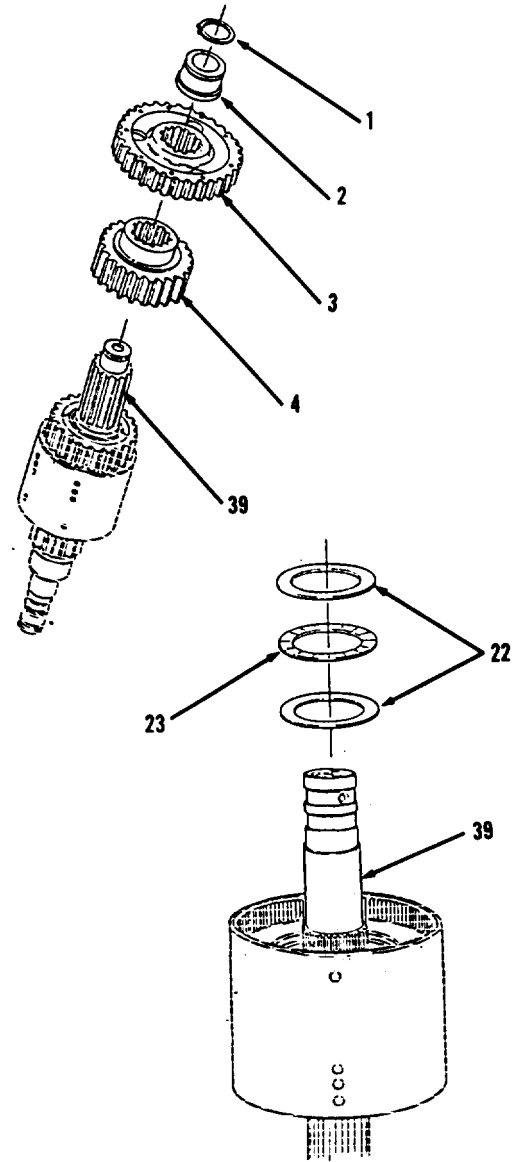
ASSEMBLY

90. Install gear (4).
91. Install gear (3).
92. Heat races (2) to 250 degrees F.
93. Using insulated gloves and plastic hammer, drive races (2) onto shaft (39).
94. Using retaining ring pliers, install new retainer ring (1).

NOTE

Inner and outer races are the same thickness in third gear.

95. Install thrust bearing (23) and race (22) onto shaft (39).



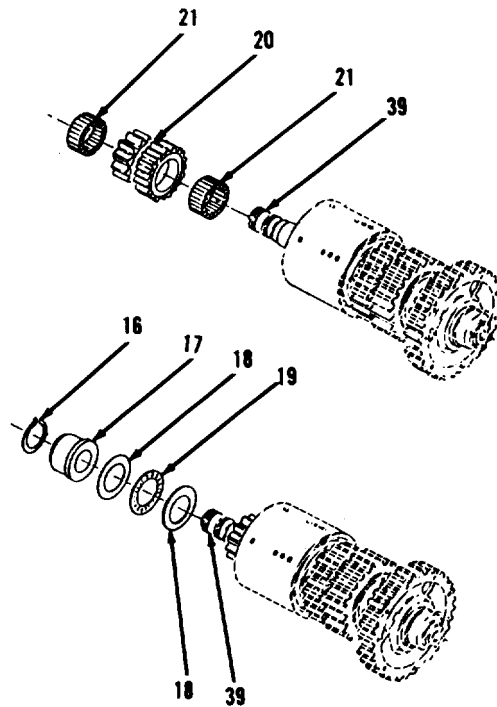
Go to sheet 17

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-5. Second and Third Gear Assembly. (Sheet 17 of 17)

ASSEMBLY (cont)

96. Position gear (20) on shaft (39).
97. Install two bearings (21) in bore of gear (20).
98. Rotate gear (20) back and forth to engage teeth of gear with teeth of clutch plate. If gear does not bottom out fully, remove it and visually align clutch plate keeping gear from bottoming out. Repeat installation procedure.
99. Install one race (19), thrust bearing (18) and remaining race (17) onto shaft (39).
100. Heat race (17) to 250 degrees F, refer to Chapter 2.
101. Using insulated gloves and plastic hammer, drive race (17) onto shaft (39).
102. Using snap ring pliers, install new retaining ring (16).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

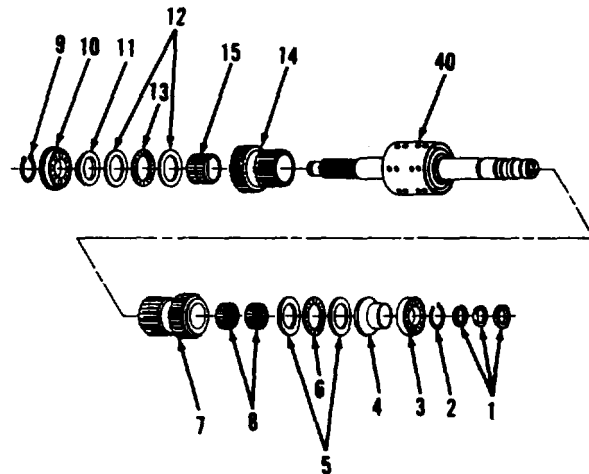


GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-6. Forward and Reverse Steering Gear Assembly. (Sheet 2 of 13)

DISASSEMBLY

1. Using a flat tip screwdriver, remove and discard three seal rings (1) from shaft (40) at forward gear side.
2. Using snap ring pliers, remove and discard retaining ring (2).
3. Remove bearing (3) and spacer (4).
4. Remove two washers (5) and thrust washer (6).
5. Using a gear puller, remove gear (7) from shaft (40).
6. Remove two bearings (8).
7. Using snap ring pliers, remove and discard retaining ring (9) from reverse gear side.
8. Remove bearing (10) and spacer (11).
9. Remove two washers (12) and thrust bearing (13).
10. Remove gear (14) from shaft (40).
11. Remove two bearings (15) from gear (14).



Go to sheet 3

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

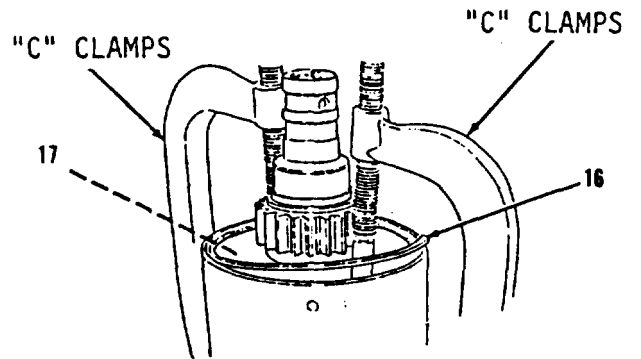
15-6. Forward and Reverse Steering Gear Assembly. (Sheet 3 of 13)

DISASSEMBLY

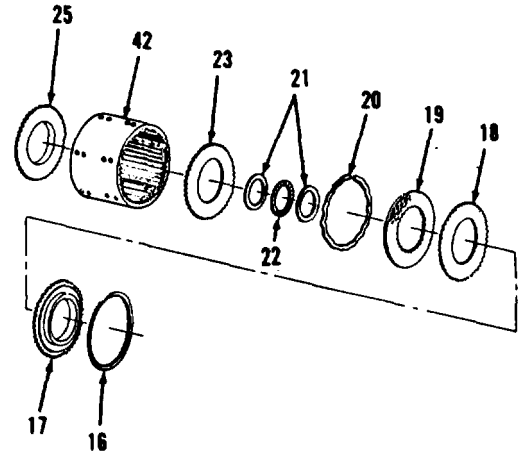
12. Depress plate (17) using two "C" clamps at forward side gear.

**CAUTION**

Be extremely careful when removing ring.



13. Remove and discard retaining ring (16).
14. Remove two C clamps from plate (17).
15. Remove plate (17) from housing (42).
16. Remove nine plates (18 and 19) and 18 wave springs (20). Discard 18 wave springs (20).
17. Remove two washers (21) and thrust bearing (22).
18. Remove plate (23).
19. Depress plate (25) using two "C" clamps at reverse gear side.



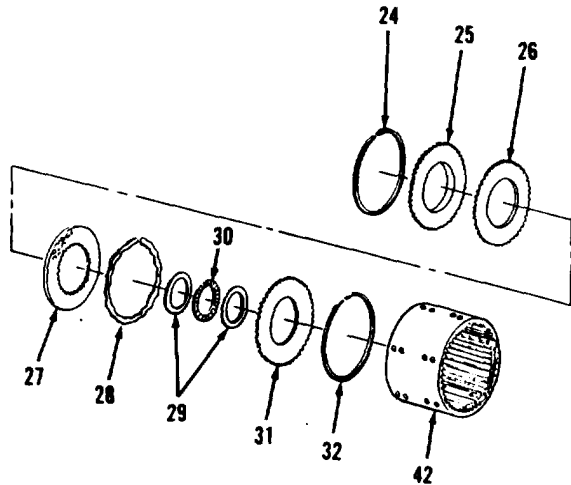
Go to sheet 4

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-6. Forward and Reverse Steering Gear Assembly. (Sheet 4 of 13)

DISASSEMBLY (cont)

20. Remove and discard retaining ring (24).
21. Remove two C clamps from plate (25).
22. Remove plate (25).
23. Remove nine plates (26 and 27) and 18 wave springs (28). Discard 18 wave springs (28).
24. Remove two washers (29) and thrust washer (30).
25. Remove plate (31).
26. Remove retainer ring (32).



**WARNING**

COMPRESSED AIR HAZARD

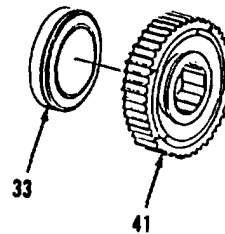
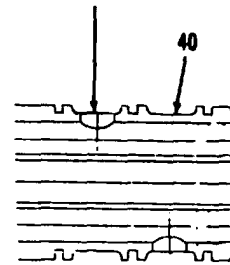
Compressed air will not exceed 30 psi. Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

**CAUTION**

Do not blast piston out of housing. Use air pressure with restraint. Failure to follow this procedure could result in damage to piston or housing.

27. Apply air pressure to reverse oil supply port at end of shaft (40).
28. Remove piston (33) from cylinder (41).

REVERSE OIL SUPPLY PORT



Go to sheet 5

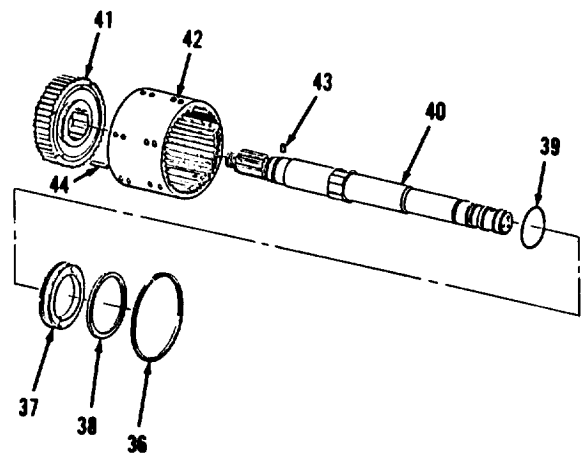
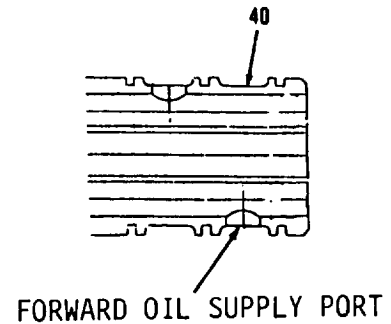
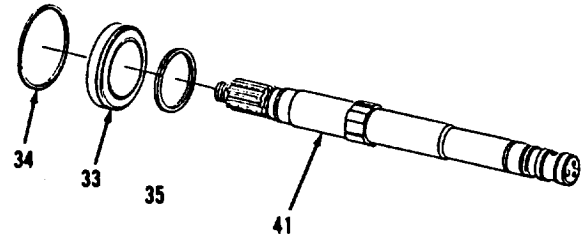


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-6. Forward and Reverse Steering Gear Assembly. (Sheet 5 of 13)

DISASSEMBLY

29. Remove and discard preformed packing (34) from piston (33) and seal ring (35) from shaft (41).
30. Apply air pressure to forward oil supply port at end of shaft (40). Do not blast piston from cylinder.
31. Remove piston (37).
32. Remove and discard preformed packing (38) and seal ring (39).
33. Using a punch and hammer, drive three pins (44) down past retaining ring (36).
34. Remove and discard retaining ring (36).
35. Remove items 40 and 41 as an assembly from housing (42).
36. Using an arbor press, press shaft (40) from cylinder (41).
37. Separate shaft (40) and cylinder (41).
38. Using a punch, remove pin (43) from shaft (40).
39. Using slip joint pliers, remove three pins (44) from cylinder (41).



CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

40. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 7

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

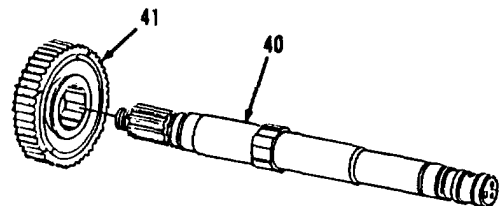
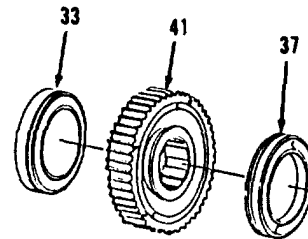
15-6. Forward and Reverse Steering Gear Assembly. (Sheet 7 of 13)

CLEANING/INSPECTION

41. Inspect shaft (40) splines for wear and damage. Replace, if necessary.
42. Inspect all plates, gears, housings and cylinders for chips, cracks, wear or missing teeth. Replace, if necessary.
43. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

44. Install pistons (33 and 37) in cylinder (41).
45. Rotate pistons to check clearance.
46. Remove pistons (33 and 37).
47. Heat cylinder (41) to 275 degrees F.
48. With chamfered bore of cylinder facing splined end of shaft, align oil holes of shaft (40) with oil holes in cylinder (41).
49. Using insulated gloves, lower hot cylinder (41) onto shaft (40). Hot cylinder (41) will position itself correctly on shaft.



Go to sheet 8

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

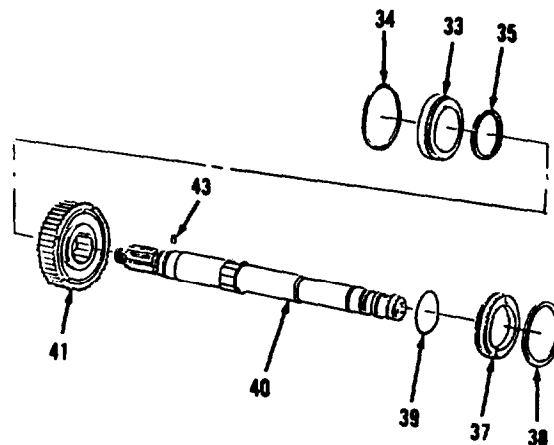
15-6. Forward and Reverse Steering Gear Assembly. (Sheet 8 of 13)

ASSEMBLY (cont)

NOTE

Wait until shaft and cylinder assembly is cool before continuing.

50. Using a plastic hammer, install pin (43) in shaft (40). Must be flush in shaft (40).
51. Install new preformed packing (38) and new seal ring (39) on piston (37).
52. Coat piston (37) with clean lubricating oil.
53. Insert piston (37) in cylinder (41) with new preformed packing (38) entering cylinder first.
54. Using a plastic hammer, tap piston (37) into place.
55. Turn shaft (40) over.
56. Install new preformed packing (34) and new seal ring (35) on piston (33).
57. Coat piston (33) with clean lubricating oil.



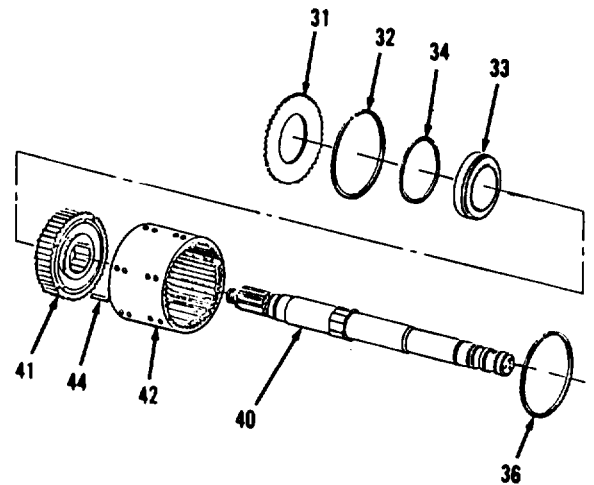
Go to sheet 9

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-6. (Forward and Reverse) Steering Gear Assembly. (Sheet 9 of 13)

ASSEMBLY

58. Insert piston (33) with new preformed packing (34) end entering cylinder first.
59. Using a plastic hammer, tap piston (33) into place.
60. Install new retaining ring (36) in housing (42). Be sure that open space between new retaining ring (36) end does not align with oil holes.
61. Install shaft (40) and cylinder (41) into housing (42).
62. Install new retaining ring (32) into housing (42). Be sure that open space between new retaining ring (32) does not align with oil holes.
63. Using a plastic hammer, install three pins (44), driving three Pins (44) down until heads of three pins (44) just clear upper surface of retaining ring (36).
64. Position housing (42) in arbor press at reverse gear side.
65. Install plate (31).



Go to sheet 10

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

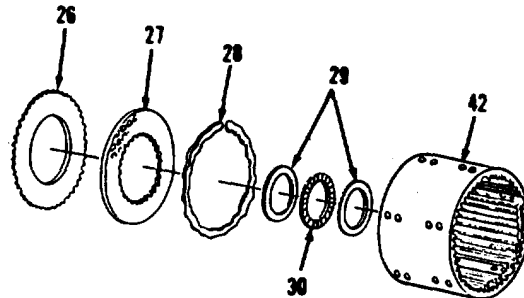
15-6. Forward and Reverse Steering Gear Assembly. (Sheet 10 of 13)

ASSEMBLY (cont)

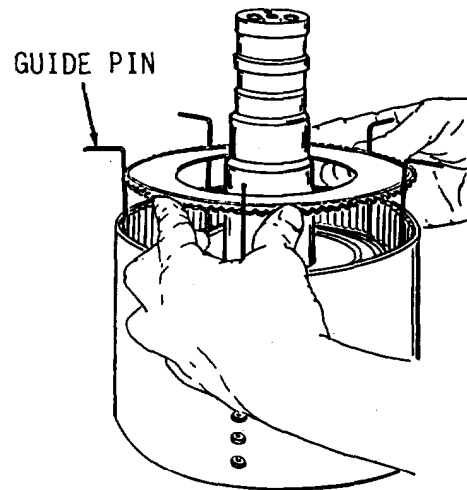
66. Install two washers (29) and thrust washer (30).



Before installing friction plates (26 and 27), friction plates must be soaked in transmission oil for one hour. Failure to follow this procedure will result in damage to the transmission.



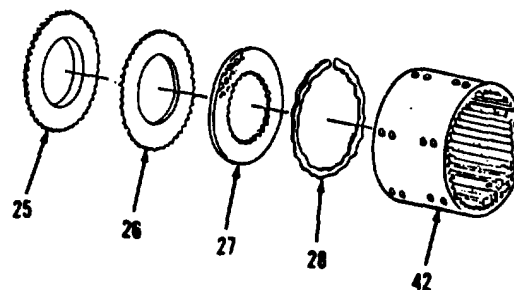
67. Install 18 new wave springs (28) and nine plates (27 and 26) in the following order: One plate (27), two wave springs (28) and one plate (26). Be sure that open ends of new wave springs (28) have bend facing up. Each pair of new wave springs (28) must have opens ends alined with each other.



68. Continuing stacking in order until stack is 1 inch from top of housing (42).

69. Insert guide pins at each oil hole slot, refer to illustration.

70. Continue stacking plates and springs using guide pins to properly aline teeth, until all have been installed. When properly alined, plates will drop freely into place.



71. Install plate (25). Do not remove guide pins.

72. Using an adapter, gradually press plates (27 and 26) and 18 new springs (28) into housing (42). Do not press all at once. Press and release gradually in 1/4 inch increments to allow springs to seat properly.

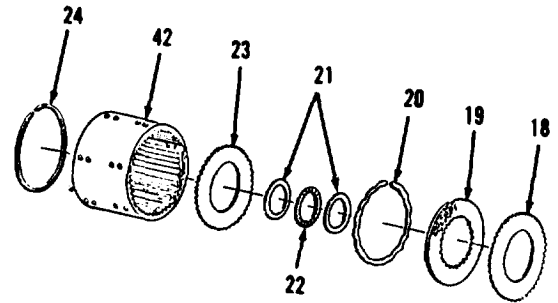
Go to sheet 11

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

## 15-6. Forward and Reverse Steering Gear Assembly. (Sheet 11 of 13)

ASSEMBLY

73. When retaining ring groove in housing is exposed, lock arbor press.
74. Using slip joint pliers, remove guide pins.
75. Install new retaining ring (24). Be sure that open space between new retaining ring (24) end does not align with oil holes.
76. Turn housing (42) over and position in arbor press at forward gear side.
77. Install plate (23).
78. Install two washers (21) and thrust washer (22).



**CAUTION**

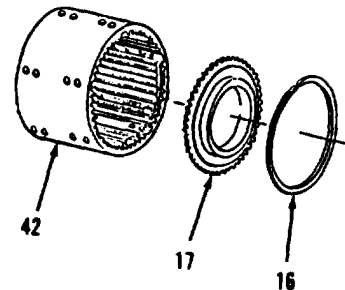
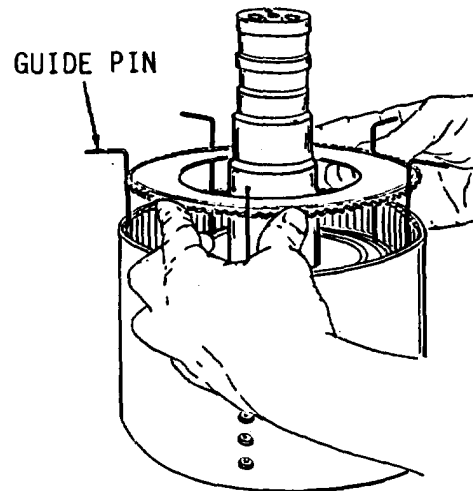
Before installing friction plates (19 and 18), friction plates must be soaked in transmission oil for one hour. Failure to follow this procedure will result in damage to the transmission.

79. Install 18 new wave springs (20) and nine plates (19 and 18) in the following order: One plate (19), two wave springs (20) and one plate (18). Be sure that open ends of new wave springs (20) have bend facing up. Each pair of new wave springs (20) must have open ends aligned with each other.
80. Continue stacking in order until stack is 1 inch from top of housing (42).

Go to sheet 12

ASSEMBLY (cont)

81. Insert guide pins at each oil slot hole.
82. Continue stacking plates and springs, using guide pins to properly align teeth until all have been installed. When properly aligned, plate will drop freely into place.
83. Install plate (17). Do not remove guide pins.
84. Using an adapter, gradually press plates and springs into housing (42). Do not press all at once. Press and release gradually in 1/4 inch increments to allow springs to seat properly.
85. When retaining ring groove in housing is exposed, lock arbor press.
86. Using slip joint pliers, remove guide pins.
87. Install new retaining ring (16). Be sure that open space between new retaining ring (16) ends does not align with oil holes.



Go to sheet 13

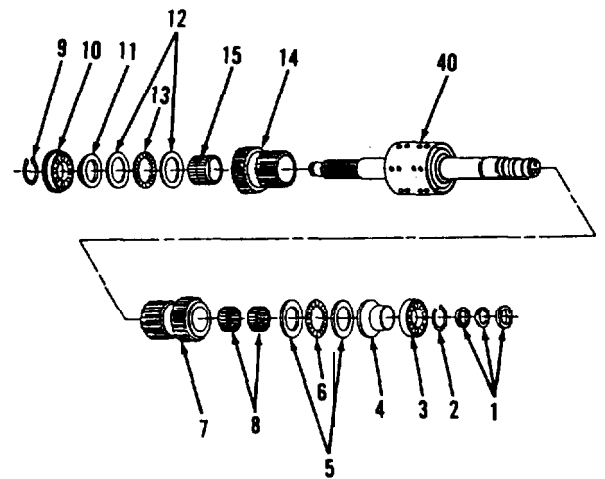


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-6. Forward and Reverse Steering Gear Assembly. (Sheet 13 of 13)

ASSEMBLY

88. Install gear (7) on shaft (40). Turn gear back and forth to aline teeth.
89. Install two bearings (8) in gear (7).
90. Install two washers (5) and thrust washer (6).
91. Install spacer (4) and bearing (3).
92. Using snap ring pliers, install new retaining ring (2).
93. Install three new seal rings (1).
94. Install gear (14) on shaft (40) at reverse gear side. Turn gear back and forth to aline teeth.
95. Install two bearings (15) in gear (14).
96. Install two washers (12) and thrust washer (13).
97. Install spacer (11) and bearing (10).
98. Using snap ring pliers, install new retaining ring (9).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

## 15-7. Transmission Control Valve. (Sheet 2 of 9)

DISASSEMBLY

## NOTE

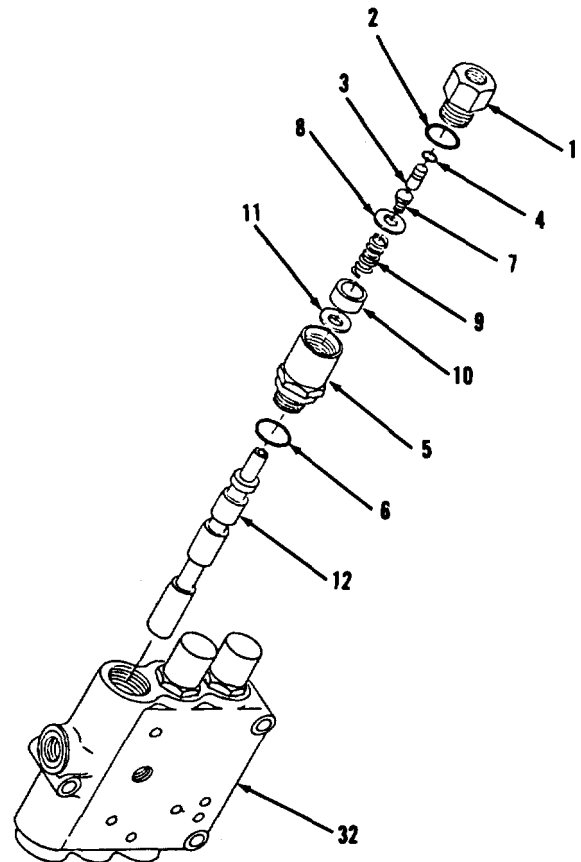
Prepare a clean work area for disassembly. Maintain clean conditions at all times while working on valve.

1. Using an 1-7/16" open end wrench, remove plug (1) and preformed packing (2). Discard preformed packing (2).
2. Using a wooden dowel, remove pin (3). Note location of pin (3) for reference during assembly.
3. Remove and discard preformed packing (4).
4. Push items 7 thru 12 as an assembly out of housing (32) through plug assembly (5).
5. Using an 1-7/16" open end wrench, remove plug assembly (5) and preformed packing (6). Discard preformed packing (6).

**WARNING**

Bolt is under pressure from spring. Use care when removing bolt. Point bolt away from personnel and unscrew slowly. Failure to follow this procedure could result in INJURY. If injured, seek medical attention immediately.

6. Using a 1/2" socket and socket wrench handle, remove bolt (7), washer (8), spring (9), spacer (10) and washer (11) from plunger (12).



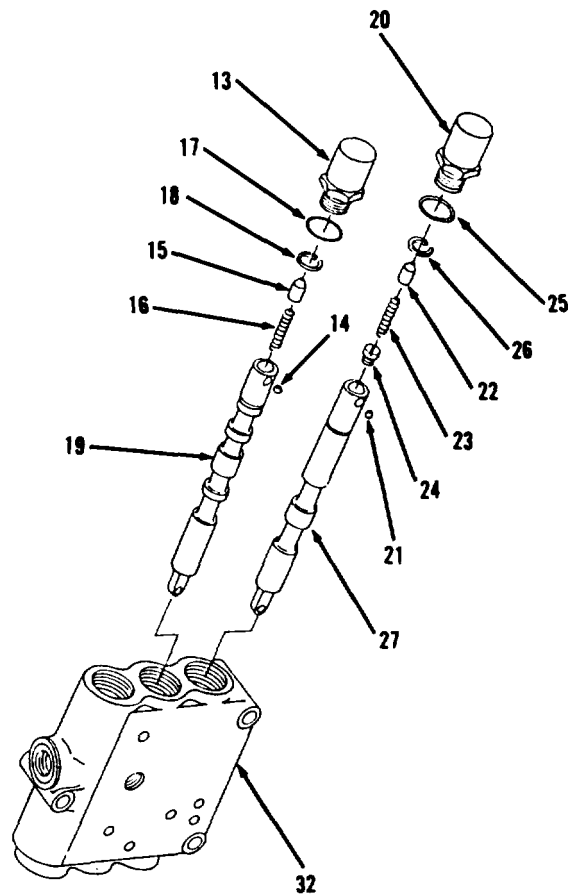
Go to sheet 3

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-7. Transmission Control Valve. (Sheet 3 of 9)

DISASSEMBLY (cont)

7. Using a 1-7/16" open end wrench, unscrew plug (13) from housing (32). Do not remove plug (13).
8. Push items 13 thru 19 as an assembly out of housing (32). Plug (13) and plunger (19) must remain attached.
9. Wrap clean cloth entirely around plunger (19) and carefully separate plug (13), four balls (14), cam (15) and spring (16) from plunger (19). Balls (14), cam (15) and spring (16) will drop into cloth.
10. Remove and discard preformed packing (17).
11. Using snap ring pliers, remove retaining ring (18) from plunger (19).
12. Using an 1-7/16" open end wrench, unscrew plug (20) from housing (32).
13. Push items 20 thru 27 as an assembly out of housing (32). Plug (20) and plunger (27) must remain attached.
14. Wrap clean cloth entirely around plunger (27) and carefully separate plug (20), four balls (21), cam (22) and spring (23) from plunger (27). Balls (21), cam (22) and spring (23) will drop into cloth.
15. Using flat tip screwdriver, remove plug (24).
16. Remove and discard preformed packing (25) from plug (20).
17. Using snap ring pliers, remove retaining ring (26) from plunger (27).



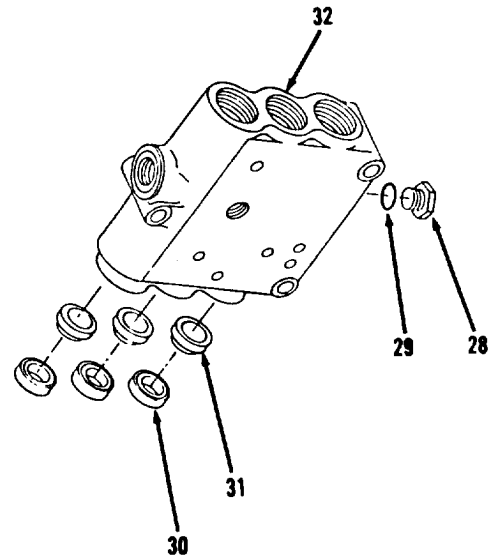
Go to sheet 4

## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

## 15-7. Transmission Control Valve. (Sheet 4 of 9)

DISASSEMBLY

18. Using an 7/8" socket and socket wrench handle, remove plug (28) and preformed packing (29) from housing (32). Discard preformed packing (29).
19. Using long round nose pliers, remove and discard three seals (30) and wipers (31).



Go to sheet 5

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-7. Transmission Control Valve. (Sheet 5 of 9)

CLEANING/INSPECTION

**WARNING**

● TOXIC/FLAMMABLE

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● COMPRESSED AIR HAZARD

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

20. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 6

GENERAL SUPPORT TRANSMISSION MAINTENANCE.

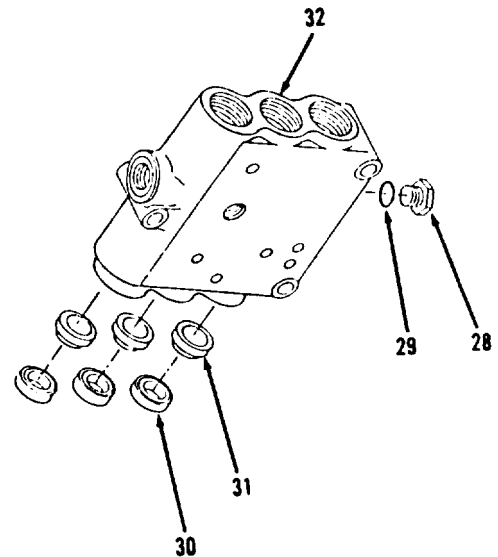
15-7. Transmission Control Valve. (Sheet 6 of 9)

CLEANING/INSPECTION

21. Inspect plungers (12, 19 and 27) for scoring, damage or excessive wear. If any of these conditions are indicated, replace entire control valve assembly.
22. Inspect housing (32) valve bores for scoring, damage or excessive wear. If any of these conditions are indicated, replace entire control valve assembly.
23. Inspect all other parts. Refer to paragraph 2-9.

ASSEMBLY

24. Apply light coating of grease to three new wipers (31) and new seals (30) and install in housing (32) in seal groove. Recessed face of new seal (30) faces inside of housing (32).
25. Using an 7/8" socket and socket wrench handle, install new preformed packing (29) and plug (28).



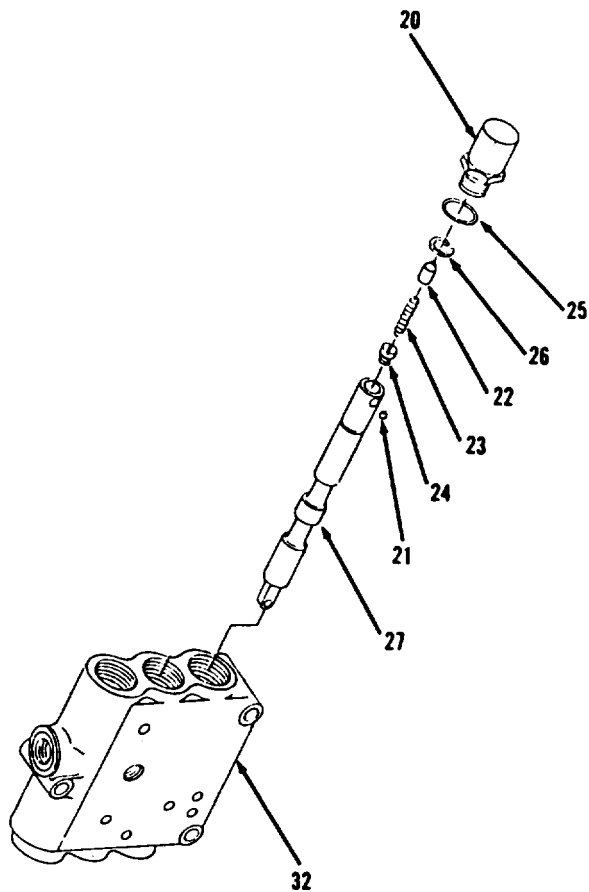
Go to sheet 7

ASSEMBLY (cont)

- 26. Using snap ring pliers, install retaining ring (26).
- 27. Install new preformed packing (25) in plug (20).

NOTE

- Install correct plug on each plunger. Range plunger with holes bored in lands uses longer plug.
  - Secure eye end of plunger in soft jawed vise with plunger in vertical position.
- 28. Using a flat tip screwdriver, install plug (24) in plunger (27).
  - 29. Install spring (23) and cam (22).
  - 30. Hold four balls (21) in position in plunger (27) with one hand.
  - 31. Position plug (20) on end of plunger (27).
  - 32. Push down over balls (21) with quick downward movement.
  - 33. Lubricate items 27 thru 20 as an assembly in housing (32) with clean transmission oil and install into valve bore.
  - 34. Using an 1-7/16" open end wrench, tighten plug (20).



Go to sheet 8



GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-7. Transmission Control Valve. (Sheet 8 of 9)

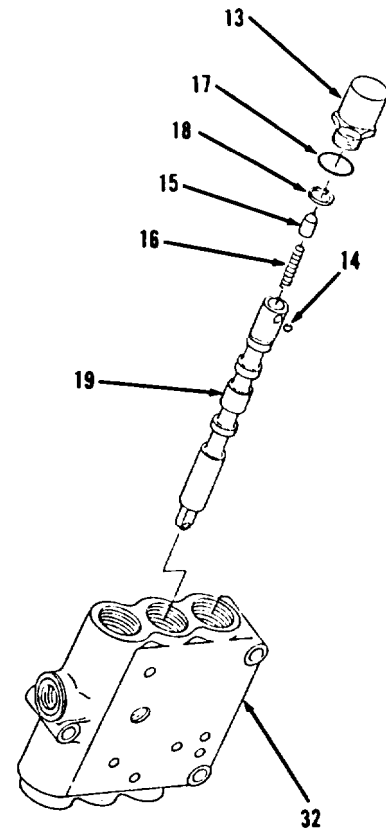
ASSEMBLY

35. Using snap ring pliers, install retaining ring (18) to plunger (19).
36. Install new preformed packing (17) in plug (13).

NOTE

Secure eye end of plunger in soft jawed vise with plunger in vertical position.

37. Install spring (16) and cam (15) in plunger (19).
38. Hold four balls (14) in position in plunger (19) with one hand.
39. position plug (13) on end of plunger (19).
40. Push down over balls (14) with quick downward movement.
41. Lubricate items 19 thru 13 as an assembly in housing (32) with clean transmission oil and install into valve bore.
42. Using a 1-7/16" open end wrench, tighten plug (13).



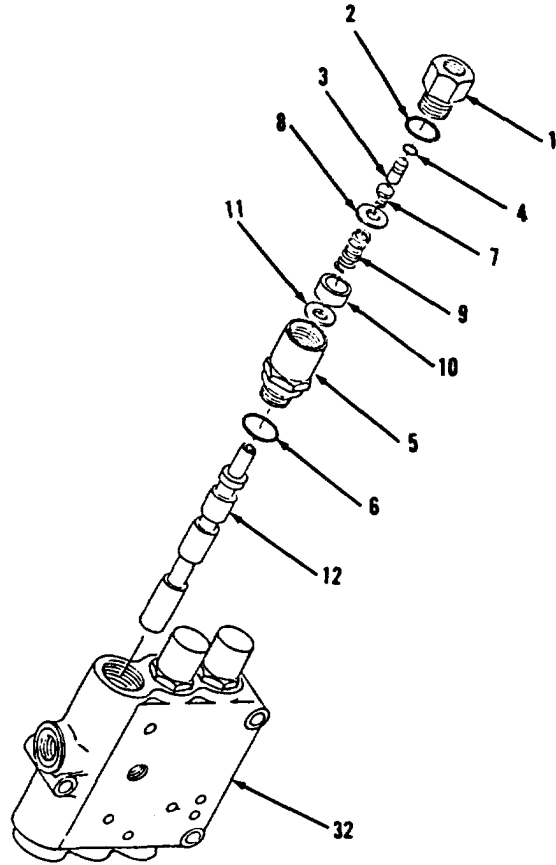
Go to sheet 9

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

15-7. Transmission Control Valve. (Sheet 9 of 9)

ASSEMBLY (cont)

- 43. Install washer (11), spacer (10), spring (9) and washer (8) in plunger (12).
- 44. Using a 1/2" socket and socket wrench handle, install bolt (7). Hold plunger (12) in groove with locking pliers and tighten bolt (7). Do not hold plunger (12) on polished land surfaces.
- 45. Using a 1-7/16" open end wrench, install new preformed packing (6) and plug assembly (5) in housing (32).
- 46. Lubricate items 12 thru 7 as an assembly with transmission oil and install.
- 47. Install new preformed packing (4) in pin (3).
- 48. Install pin (3) in plug (1). Preformed packing (4) must be away from housing (32) end of plug.
- 49. Using an 1-7/16" open end wrench, install new preformed packing (2) and plug (1) in housing (32).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK

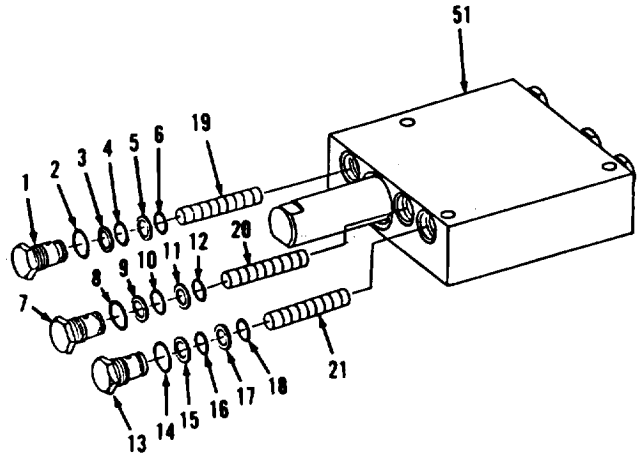


DISASSEMBLY

NOTE

Prepare a clean work area for disassembly. Maintain clean conditions at all times while working on valve. Note proper sequence during disassembly. Identify and segregate all components. Do not mix parts.

1. Using a drive socket and socket wrench handle, remove check valve (1), preformed packing (2), retainer (3), preformed packing (4), retainer (5) and preformed packing (6) from body (51). Discard preformed packings (2,4 and 6).
2. Remove check valve (7), preformed packing (8), retainer (9), preformed packing (10), retainer (11) and preformed packing (12). Discard preformed packings (8,10 and 12).
3. Remove check valve (13), preformed packing (14), retainer (15), preformed packing (16), retainer (17) and preformed packing (18). Discard preformed packings (14, 16 and 18).
4. Using a wooden dowel, remove spools (19 thru 21).

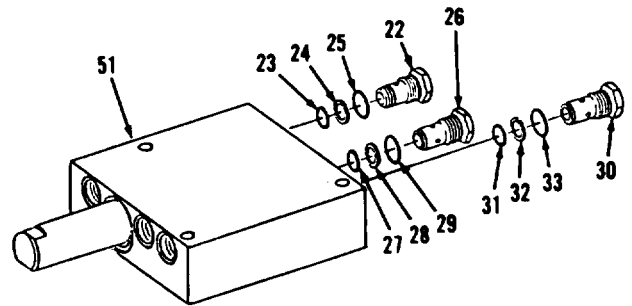


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-8. Transmission Scheduling Valve. (Sheet 3 of 7)

DISASSEMBLY

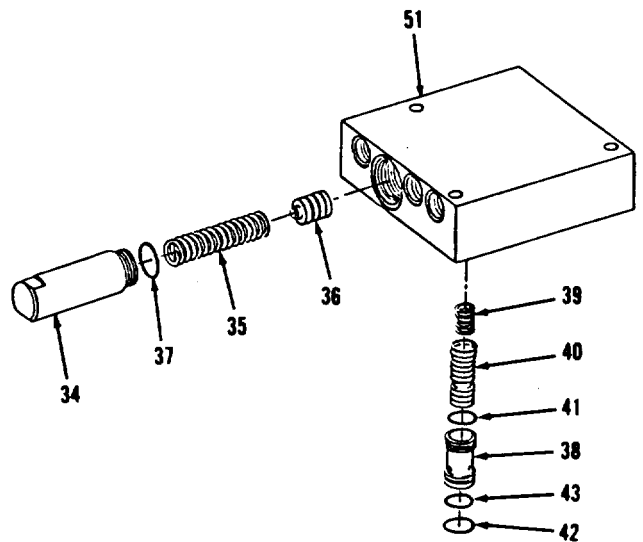
5. Using a 1"- socket and socket wrench handle, remove check valve (22), preformed packing (23), retainer (24) and preformed packing (25). Discard preformed packings (23 and 25).
6. Remove check valve (26), retainer (27), preformed packing (28) and ring (29). Discard preformed packing (28).
7. Remove check valve (30), retainer (31), preformed packing (32) and ring (33). Discard preformed packing (32).
8. Using a 1-1/2" open end wrench, remove retainer (34), spring (35), piston (36) and preformed packing (37). Discard preformed packing (37).



NOTE

Sleeve should not be removed unless it is known to be damaged or not operating properly.

9. Using a wire hook, remove sleeve (38). Wire must be bent into U shape and ends bent outward to form hooks. Hooks can be engaged in cross drilled oil holes in sleeve (38).
10. Remove spring (39), spool (40) and preformed packings (41 thru 43). Discard preformed packings (41 thru 43).



Go to sheet 4

GENERAL SUPPORT TRANSMISSION MAINTENANCE. (cont)

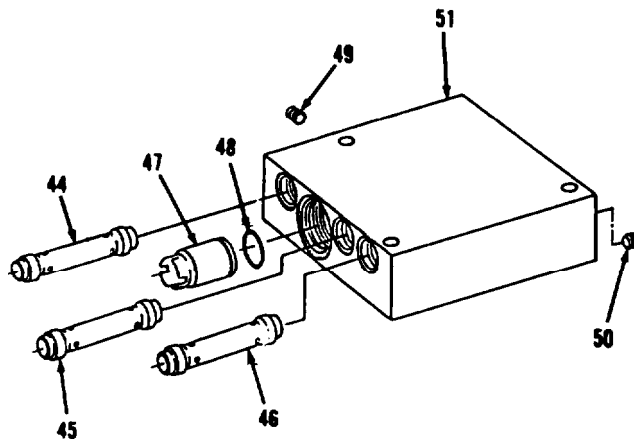
15-8. Transmission Scheduling Valve. (Sheet 4 of 7)

DISASSEMBLY (cont)

NOTE

Inspect sleeves before removal.  
Replace only if scored or  
damaged.

11. Using a wooden dowel, press sleeves (44 thru 46) out with rod. Rod must have diameter smaller than bore in body (51) but larger than inner bore of sleeves (44 thru 46).
12. Remove sleeve (47) and preformed packing (48). Discard preformed packing (48).
13. Using a 3/16" socket head screw key, remove plugs (49 and 50).



## GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-8. Transmission Scheduling Valve. (Sheet 5 of 7)

CLEANING/INSPECTION**WARNING****TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

## ● COMPRESSED AIR HAZARD

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

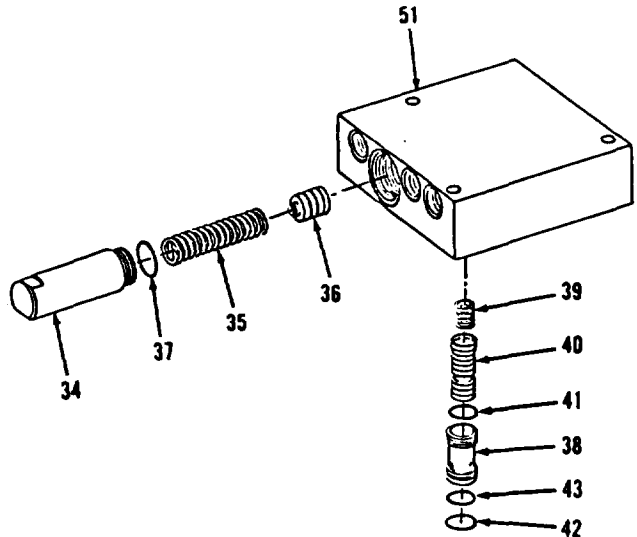
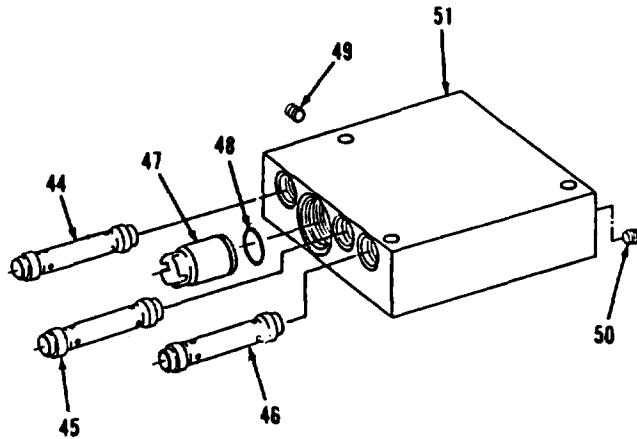
14. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
15. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 6

15-8. Transmission Scheduling Valve. (Sheet 6 of 7)

ASSEMBLY

16. Using a 3/16" socket head screw key, install plugs (50 and 49) to body (51).
17. Install new preformed packing (48) and sleeve (47).
18. Install sleeves (46 thru 44), only if inspection proved necessary to remove.
19. Install new preformed packings (43 thru 41), spool (40) and spring (39).
20. Install sleeve (38).
21. Using a 1-1/2" socket and torque wrench, install new preformed packing (37), piston (36), spring (35) and retainer (34). Tighten retainer (34) to 50 to 60 lb-ft.
22. Using a 1" socket and torque wrench, install ring (33), new preformed packing (32), retainer (31) and check valve (30). Tighten check valve (30) to 30 to 35 lb-ft.



Go to sheet 7

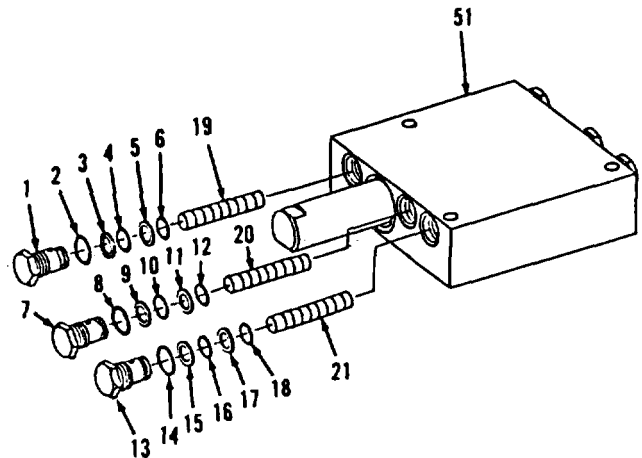
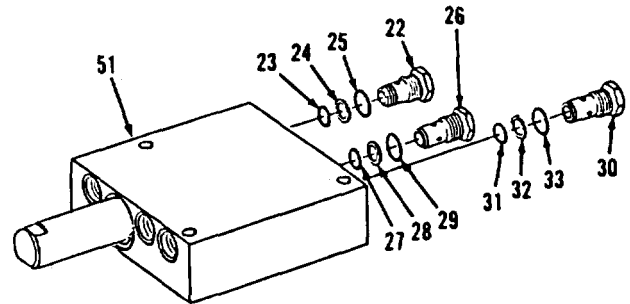


GENERAL SUPPORT TRANSMISSION MAINTENANCE.

15-8. Transmission Scheduling Valve. (Sheet 7 of 7)

ASSEMBLY

23. Using a 1" socket and torque wrench, install ring (29), new preformed packing (28), retainer (27) and check valve (26). Tighten check valve (26) to 30 to 35 lb-ft.
24. Install new preformed packing (25), retainer (24), new preformed packing (23) and check valve (22). Tighten check valve (22) to 30 to 35 lb-ft.
25. Install spools (21 thru 19).
26. Install new preformed packing (18), retainer (17), new preformed packing (16), retainer (15), new preformed packing (14) and check valve (13). Tighten check valve (13) to 30 to 35 lb-ft.
27. Install new preformed packing (12), retainer (11), new preformed packing (10), retainer (9), new preformed packing (8) and check valve (7). Tighten check valve (7) to 30 to 35 lb-ft.
28. Install new preformed packing (6), retainer (5), new preformed packing (4), retainer (3), new preformed packing (2) and check valve (1). Tighten check valve (1) to 30 to 35 lb-ft.



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



## CHAPTER 16

GENERAL SUPPORT PROPELLER AND  
PROPELLER SHAFTS MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized general support level maintenance procedures on the M10A Forklift.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Front Differential Carrier Assembly	16-1	16-2
Front and Rear Planetary	16-2	16-15
Rear Differential Carrier Assembly	16-3	16-19

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cent)

16-1. Front Differential Carrier Assembly. (Sheet 1 of 13)

- This task covers:
- |                |                        |
|----------------|------------------------|
| a. Disassembly | b. Cleaning/Inspection |
| c. Assembly    | d. Adjustment          |

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Fine emery cloth (App. C, Item 4 )  
Permatex No. 2 (App. C, Item 26)  
Gear oil (App. C, Item 18)  
Soft iron wire  
Cotter pin (3)  
Lockwire (2)  
Gasket  
Seal (2)

Torques

Bolts (4) to 160 to 190 lb-ft.  
Bolts (10, 12 and 29) to 105 to  
135 lb-ft.  
Nuts (34 and 56) to 300 to 400 lb-ft.  
Bolts (38, 40, 60 and 62) to 50 to  
65 lb-ft.

---

EQUIPMENT CONDITION

References

Paragraph 7-4

Condition Description

Front differential carrier assembly  
removed.

---

Go to sheet 2

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

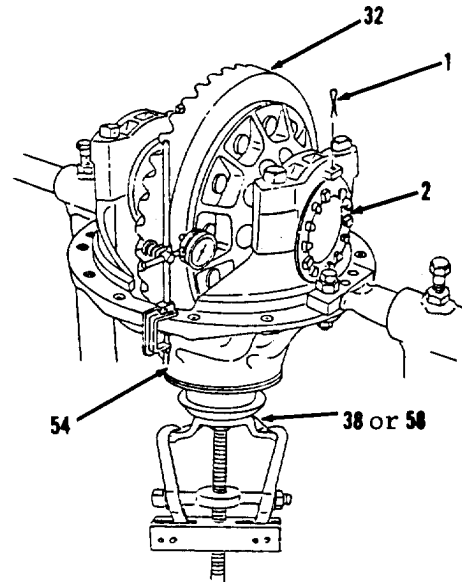
16-1. Front Differential Carrier Assembly. (Sheet 2 of 13)

DISASSEMBLY

NOTE

Prior to disassembly of differential carrier assembly, backlash of gears must be measured and recorded. Steps 1 thru 3 are necessary only if gears are to be reused.

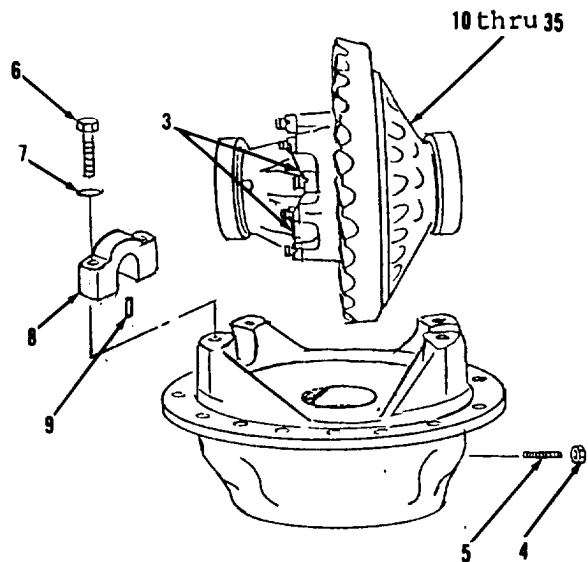
1. Position dial scale indicator on differential carrier assembly as shown.
2. Using a padded vise, secure yoke (38 or 58) and rotate gear (32) back and forth.
3. Record backlash as indicated on dial scale indicator.



NOTE

Except where noted, The following disassembly procedure for the differential assembly is identical for both vehicles S/N 2001 to 2903 and S/N 2000 and below and 2904 and above.

4. Using long round nose pliers, remove two cotter pins (1) and adjustment rings (2) from carrier (54). Discard two cotter pins.



NOTE

The following is a difference between M10A Forklift models.

5. Using diagonal cutters, cut and discard two lock wires (3) on vehicles S/N 2000 and below and 2904 and above.
6. Using a 15/16" socket and socket wrench handle, remove nut (4) and screw (5) from carrier (54) on vehicles S/N 2001 to 2903 only.

Go to sheet 3

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-1. Front Differential Carrier Assembly. (Sheet 3 of 13)

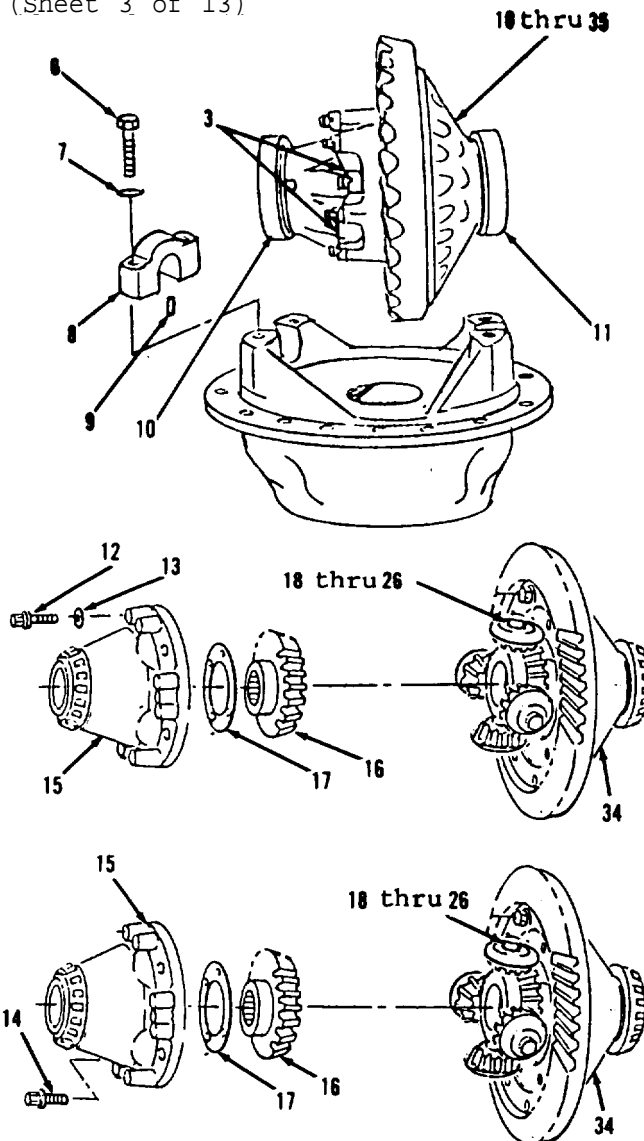
DISASSEMBLY (cont)

7. Using a 15/16" socket and socket wrench handle, remove four bolts (6), washers (7), two bearing caps (8), and pins (9). Mark location of bearing caps (8).
8. Using hoist and sling, remove items 10 thru 35 as an assembly and place on suitable work bench.
9. Mark location of cups (10 and 11) on differential assembly and remove.
10. Using a hammer, punch mark cases (15 and 32).

NOTE

The following is a difference between M10A Forklift models.

11. Using a 1/2" socket and socket wrench handle, remove 16 bolts (12) and washers (13) or 12 bolts (14). 16 bolts (12) and washers (13) on vehicles S/N 2000 and below and 2904 and above or 12 bolts (14) on vehicles S/N 2001 to 2903.
12. Remove case (15), gear (16) and washer (17).
13. Remove items 18 thru 26 as an assembly.



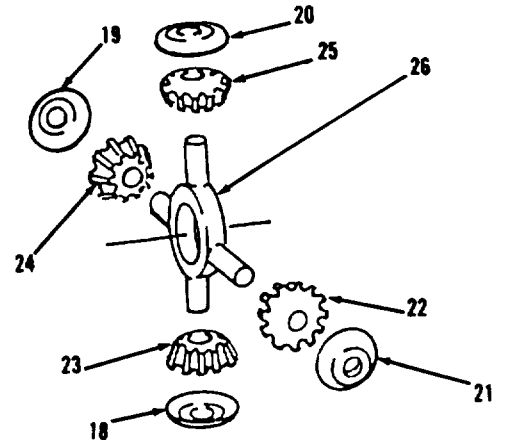
Go to sheet 4

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-1. Front Differential Carrier Assembly. (Sheet 4 of 13)

DISASSEMBLY

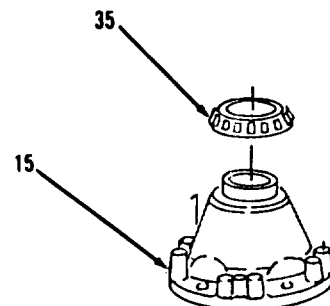
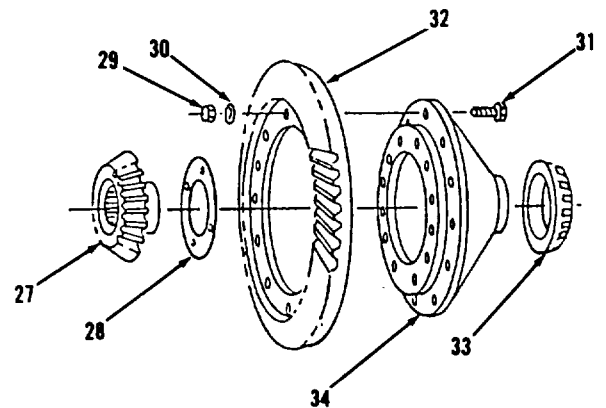
14. Remove washers (18, 19, 20 and 21) from spider (26).
15. Remove gears (22, 23, 24 and 25).
16. Remove gear (27) and washer (28) from case (34).
17. Using a 3/4 open end wrench and 3/8" socket head screw key, remove 12 nuts (29), washers (30), bolts (31) and gear (32).
18. Use puller and heat, if required to remove bearing (33) from case (34).



NOTE

Be certain force is exerted on the inner race, not the bearing cage.

19. Use puller and heat, if required to remove bearing (35) from case (15).



Go to sheet 5

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-1. Front Differential Carrier Assembly. (Sheet 5 of 13)

DISASSEMBLY (cont)

NOTE

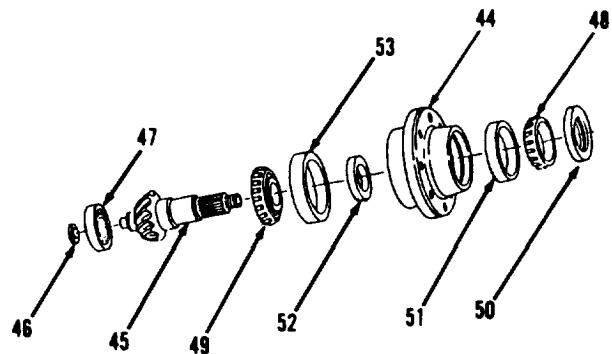
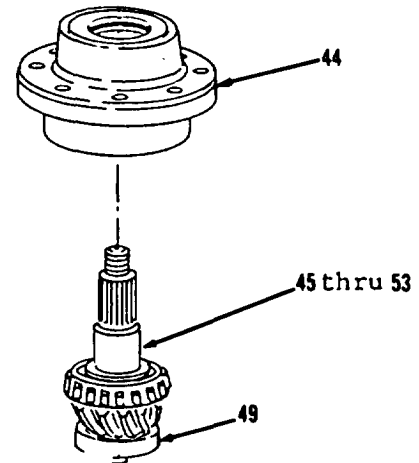
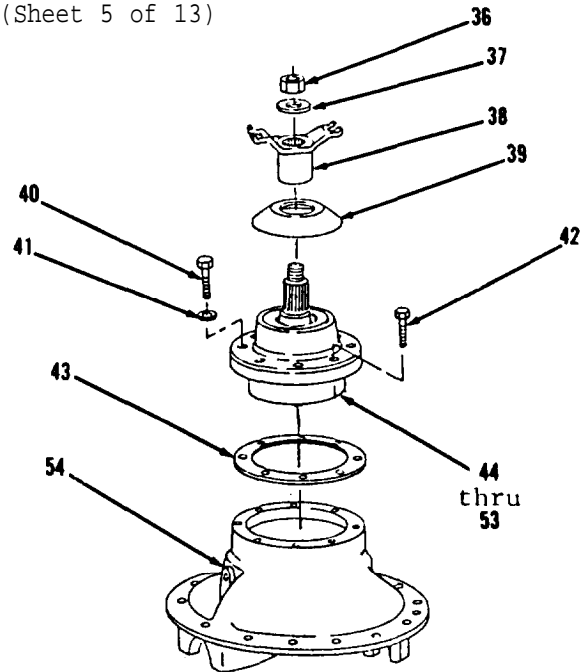
The following steps (20 thru 28) is the disassembly procedure of the differential carrier assembly for vehicles S/N 2000 and below and 2904 and above. The disassembly procedure of the differential carrier assembly for vehicles S/N 2001 to 2903, proceed to steps (29 thru 38).

20. Using 1-1/2 socket and socket wrench handle. remove nut (36) , and washer (37) from carrier (54).
21. Using suitable puller, remove yoke (38) from deflector (39).
22. Using a flat tip screwdriver, remove deflector (39).
23. Using a 5/8 socket and socket wrench handle , remove eight bolts (40), washers (41), two bolts (42), shim (43) and items 44 thru 53 as an assembly.
24. Using an arbor press, remove items 45 thru 49 as an assembly from cage (44).

NOTE

Identify and mark location of all cups and cones on gear or in bearing cage. Relationship between cups and cones must be maintained during reassembly.

25. Remove ring (46) from gear (45).
26. Remove bearing (47) and cone (49) from gear (45).
27. Using a flat tip screwdriver, remove and discard seal (50) and cone (48) from cage (44).
28. Using a brass punch and hammer, remove cup (51), shim (52) and cup (53).





GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

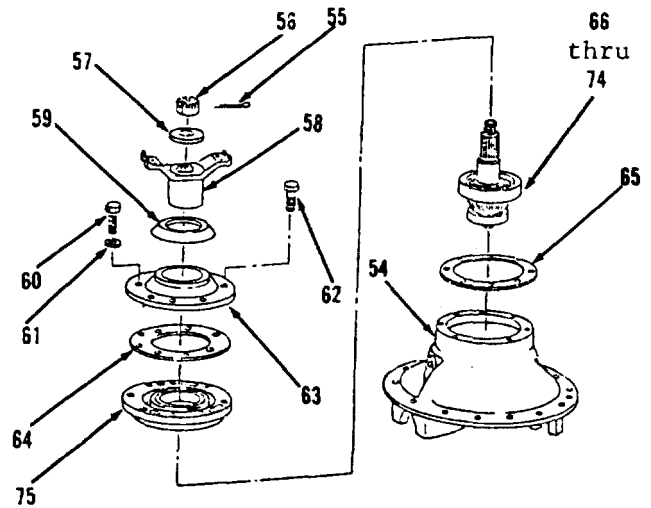
16-1. Front Differential Carrier Assembly. (Sheet 6 of 13)

DISASSEMBLY

NOTE

The following steps (29 thru 38) are for vehicles S/N 2001 to 2903.

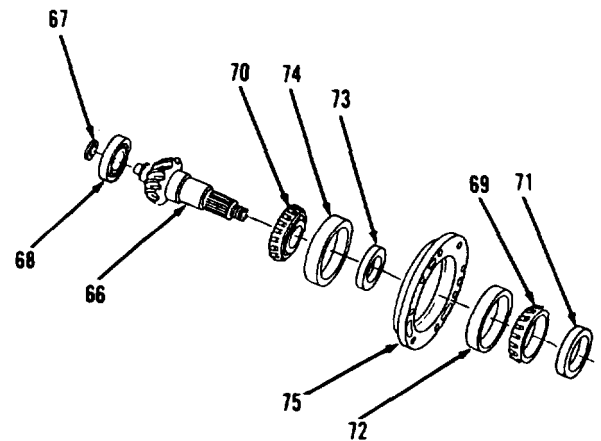
29. Using a long round nose pliers, 1-1/2 socket and socket wrench handle, remove cotter pin (55), nut (56) and washer (57). Discard cotter pin (55).
30. Using a suitable puller, remove yoke (58) .
31. Using a flat tip screwdriver, remove deflector (59).
32. Using a 9/16" socket and socket wrench handle , remove six bolts (60), washer (61), two bolts (62), cover (63) and gasket (64). Discard gasket (64).
33. Using a rubber mallet, remove items 66 thru 75 as an assembly and shim (65) from carrier (54).
34. Using an arbor press, press items 66 thru 74 as an assembly from cage (75).



NOTE

Identify and mark location of all cups and cones on gear or in bearing cage. Relationship between cups and cones must be maintained during reassembly,

35. Using snap ring pliers, remove ring (67) from gear (662).
36. Using a arbor press. remove bearing (68) and cones (69 and 70).
37. Remove and discard seal (71) from cage (75).
38. Using a brass punch and hammer, remove cup (72) and spacer (73) and cup (74) from cage (75).



Go to sheet 7

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-1. Front Differential Carrier Assembly. (Sheet 7 of 13)

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

39. Wipe all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
40. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 8

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-1. Front Differential Carrier Assembly. (Sheet 8 of 13)

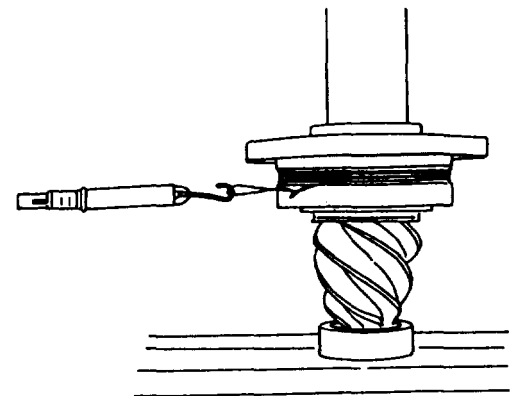
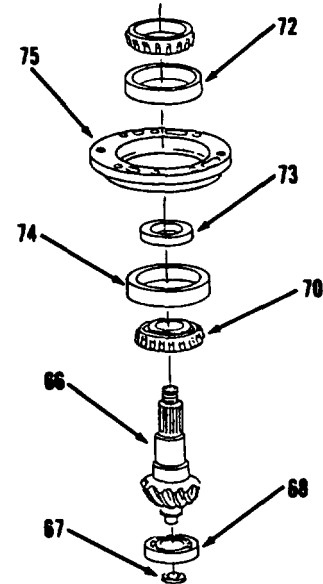
ASSEMBLY

NOTE

The following steps (41 thru 55) is the assembly procedure for differential carrier assembly for vehicles S/N 2001 to 2903. The assembly procedure for differential carrier assembly for vehicles S/N 2000 and below and 2904 and above, proceed to steps (56 thru 68).

When replacing parts, gears must be replaced as a matched set.  
Side gear thrust washers must be replaced as a matched set.

41. Install cup (74), spacer (73) and cup (72) to cage (75).'
42. Install cone (70) and bearing (68) to gear (66).
43. Install ring (67).
44. Using arbor press, install gear (66) in cage (75).
45. Install cone (69).
46. Rotate cage (75) to verify normal bearing contact.
47. Apply load of 6 tons with press as shown.
48. Using soft iron wire and scale indicator, measure bearing preload torque as shown. Bearing preload torque should be 5 to 15 in-lb. Be sure to measure rotating torque and not starting torque. Install thinner spacer (73) to increase or thicker spacer (73) to decrease preload as required.

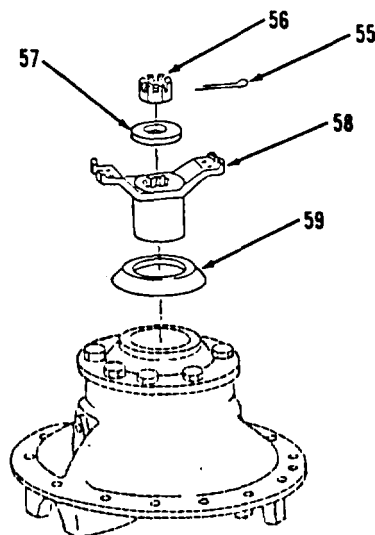
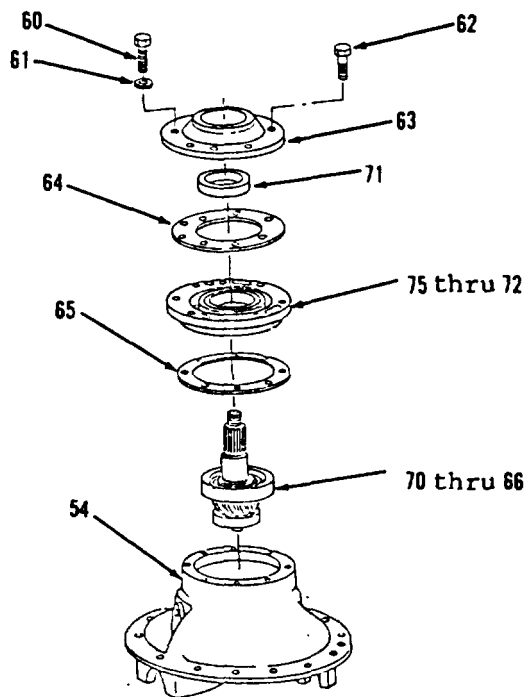


Go to sheet 9

16-1. Front Differential Carrier Assembly. (Sheet 9 of 13)

ASSEMBLY (Cont)

49. Lubricate O.D. of new seal (71) with Permatex No. 2.
50. Install new seal (71) in cover (63).
51. Install shim (65) and items 75 thru 72 and 70 thru 66 as an assembly to carrier (54).
52. Using a 9/16" socket and torque wrench, install new gasket (64), cover (63), two bolts (62), six washers (61) and bolts (60). Tighten bolts (60 and 62) to 50 to 65 lb-ft torque.
53. Install deflector (59).
54. Using rubber mallet, install yoke (58).
55. Using a 1-1/2" socket and torque wrench, install washer (57), nut (56) and new cotter pin (55). Tighten nut (56) to 300 to 400 lb-ft torque.



Go to sheet 10

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

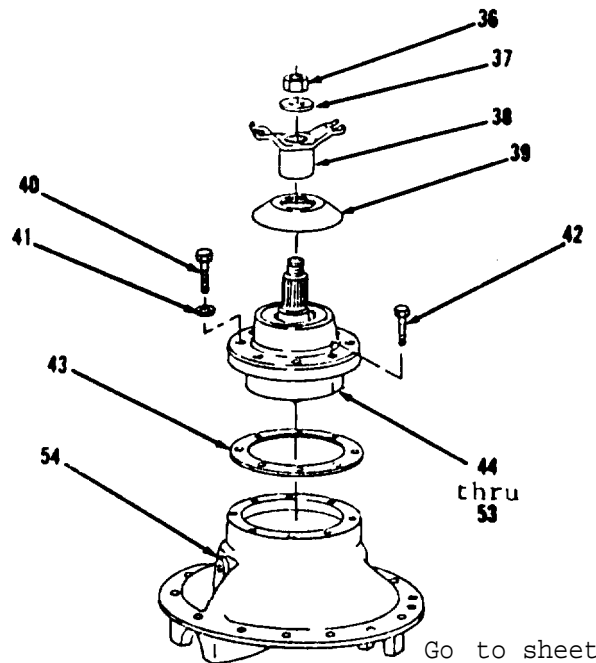
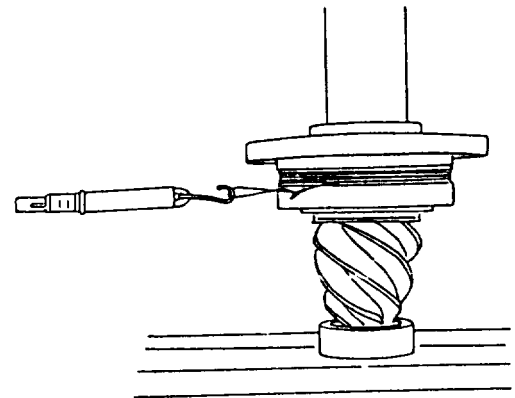
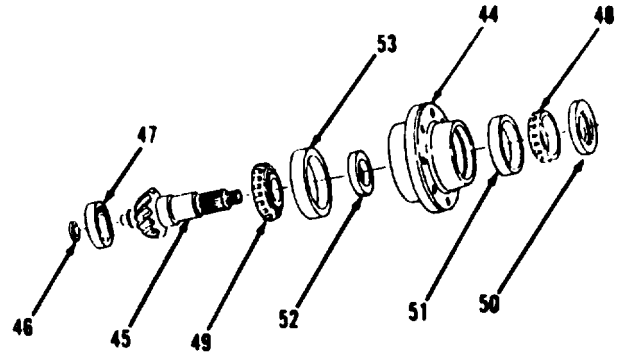
16-1. Front Differential Carrier Assembly. (Sheet 10 of 13)

ASSEMBLY

NOTE

The following steps (56 thru 68) are for vehicles S/N 2000 and below and 2904 and above

56. Install cup (53), shim (52) and cup (51) to cage (44).
57. Install cone (49) and bearing (47) to gear (45).
58. Install ring (46).
59. Using arbor press, install gear (45) in cage (44).
60. Install cone (48).
61. Apply load of 6 tons with press as shown.
62. Using soft iron wire and scale indicator, measure bearing preload torque as shown. Bearing preload torque should be 5 to 15 in-lb. Be sure to measure rotating torque and not starting torque. Install thinner shim (52) to increase or thicker shim (52) to decrease preload as required.
63. Lubricate O.D. of new seal (50) with Permatex No. 2.
64. Install new seal (48).
65. Install shim (43) and items 53 thru 44 as an assembly to carrier (54).
66. Using a 5/8" socket and socket wrench handle, install two bolts (42), eight washers (41) and bolts (40). Tighten bolts (42 and 40) to 50 to 65 lb-ft.
67. Install deflector (39).
68. Using a 1-1/2" socket and torque wrench, install yoke (38), washer (37) and nut (36). Tighten nut (36) to 300 to 400 lb-ft torque.



Go to sheet 11

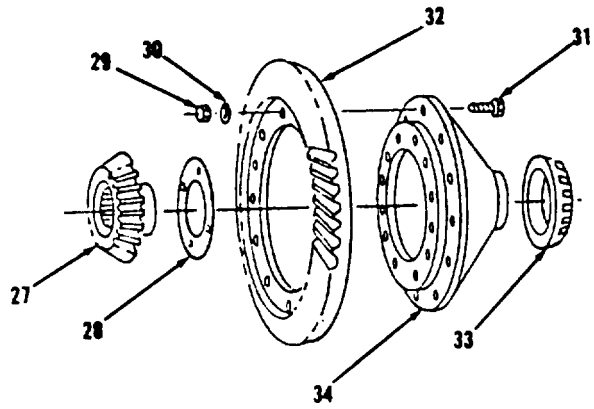
GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-1. Front Differential Carrier Assembly. (Sheet 11 of 13)

ASSEMBLY (Cont)

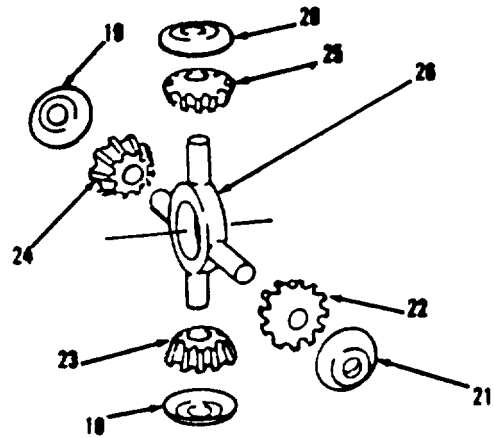
NOTE

Except where noted, The following assembly procedure for the differential assembly is identical for both vehicles S/N 2001 to 2903 and S/N 2000 and below and 2904 and above.



69. Using a 3/4 open end wrench, 3/8" socket head screw key and torque wrench, install gear (32), 12 bolts (31), washers (30) and nuts (29) to case (32). Tighten 12 bolts (31) to 105 to 135 lb-ft torque.

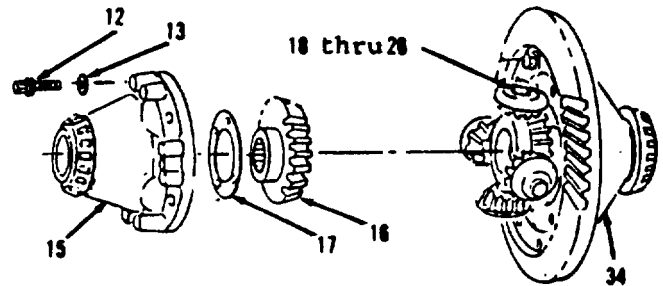
70. Lubricate washer (28) and gear (27) with gear oil and install.



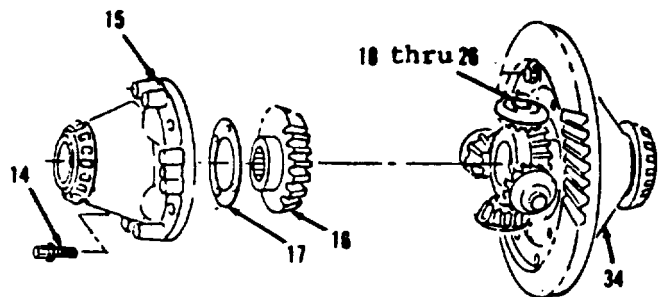
71. Lubricate gears (25, 24, 23 and 22) with gear oil and install on spider (26).

72. Lubricate washers (21, 20, 19 and 18) with gear oil and install.

73. Install items 26 thru 18 as an assembly to case (34).



74. Lubricate washer (17) and gear (16) with gear oil and install.



Go to sheet 12

## GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

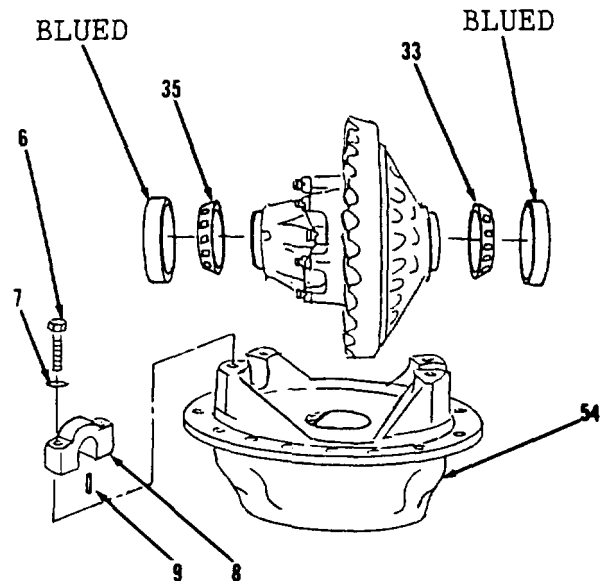
## 16-1. Front Differential Carrier Assembly. (Sheet 12 of 13)

ASSEMBLY (Cont)

## NOTE

The following is a difference between M10A Forklift models.

75. Be sure to align identification marks on cases (15 and 34). Using a 1/2" socket and socket wrench handle, install case (15) with four equally spaced bolts (14) on vehicles S/N 2001 to 2903 or case (15), 16 washers (13) and bolts (12) on vehicles S/N 2000 and below and 2904 and above.
76. Check assembly for free rotation of differential gears.
77. Install remaining bolts (14) and washers (13) or bolts (12). Tighten bolts (13 or 12) to 105 to 135 lb-ft.
78. Install bearings (33 and 35) on differential carrier and lubricate with gear oil.
79. Using a 15/16" socket and torque wrench, install blue cups, two pins (9), bearing caps (8), four washers (7) and bolts (6) to carrier (54). Tighten bolts (6) to 160 to 190 lb-ft. Identification marks on bearing caps and carrier must be aligned during installation.
80. Check fit of cups in bearing cap bores. Cups must be a hand push fit. If cups are too tight, bores must be reworked with emery cloth until push fit is obtained. A blued cup should be used as a gage to check fit.
81. Remove four bolts (6), washers (7), two bearing caps (8), pins (9) and blued cups.



Go to sheet 13

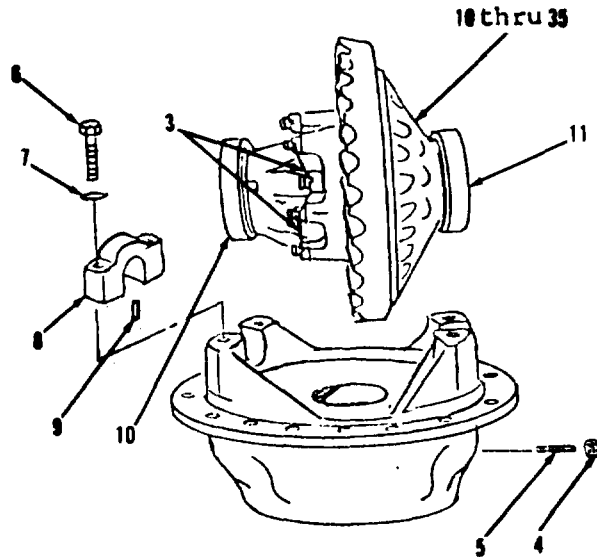
16-13

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-1. Front Differential Carrier Assembly. (Sheet 13 of 13)

ASSEMBLY (cont)

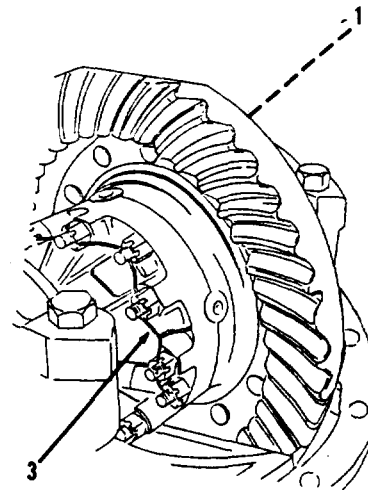
82. Install cups (11 and 10) on differential assembly.
83. Using hoist and sling, position items 10 thru 35 as an assembly to carrier (51).
84. Install two adjustment rings (2). Hand turn against cups (11 and 10).
85. Install two pins (9), bearing caps (8), four washers (7) and bolts (6). Tighten bolts (6) to 160 to 190 lb-ft torque. Identification marks on bearing caps and carrier must be aligned during installation. If bearing caps do not seat properly, check adjustment rings (2) for cross threading.
86. Using a 15/16" socket and socket wrench handle, install screw (5) and nut (4).



NOTE

The following is a difference between M10A Forklift models.

87. Using long round nose pliers, install cotter pin (1) and on vehicles S/N 2000 and below and 2904 and above, install two new lockwires (3).



ADJUSTMENT

88. Refer to paragraph 16-3 for differential assembly adjustment procedures.

NOTE

Return M10A Forklift to original equipment condition.

Go to sheet 14

END OF TASK





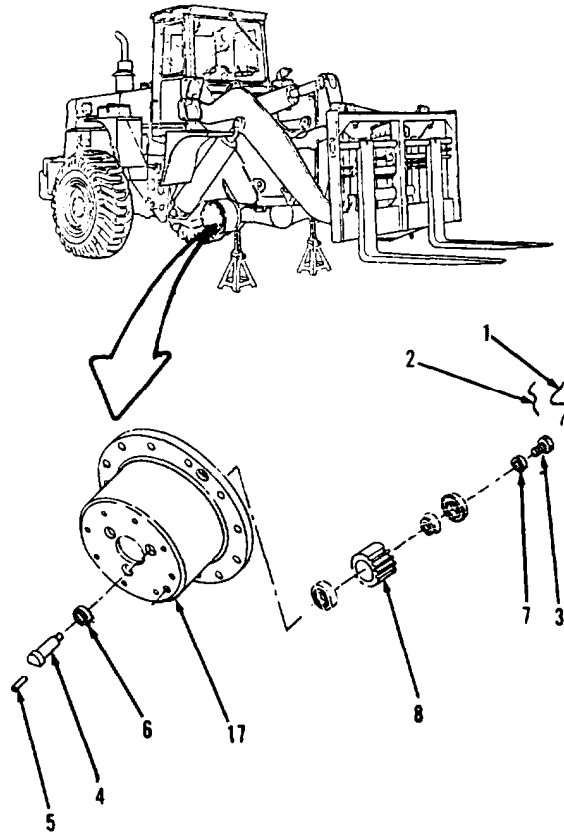
16-2. Front and Rear Planetary. (Sheet 2 of 4)

DISASSEMBLY

NOTE

The following is a difference between M10A Forklift models,

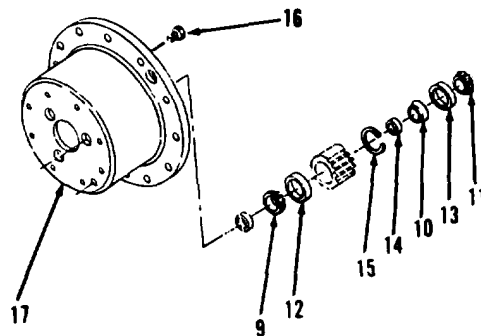
1. Using side cutting pliers, cut and discard lockwire (1) from planetary carrier (17).
2. Cut and discard lockwire (2) on vehicles S/N 2001 and above only.
3. Using a 1-1/2" socket and socket wrench handle, remove three lock bolts (3).
4. Using a brass punch and hammer, drive three pins (4), dowels (5) and spacers (6) out, through the planetary carrier (17).
5. Remove three spacers (7) items 8 thru 15 as an assembly. Move two gears assemblies to O.D. of case to remove third gear assembly through center hole.



NOTE

The following steps are for the disassembly of one gear assembly. Disassembly of the remaining two gear assemblies is identical.

6. Remove cone (9), spacer (10) and cone (11).
7. Using a brass punch and hammer, remove cups (12 and 13), spacer (14) and retaining ring (15).
8. Using a 9/16" socket and socket wrench handle, remove two bolts (16) from planetary carrier (17).



Go to sheet 3

## GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-2. Front and Rear Planetary. (sheet 3 of 4)

CLEANING/INSPECTION**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

9. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
10. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 4

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

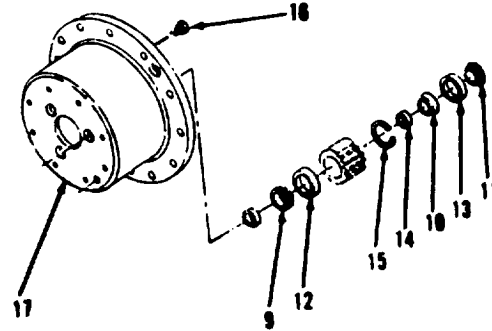
16-2. Front and Rear Planetary. (Sheet 4 of 4)

ASSEMBLY

11. Using a 1-1/2" socket and torque wrench, install two bolts (16) to planetary carrier (17). Tighten bolts (16) to 24 to 26 lb-ft torque.

NOTE

The following steps are for the assembly of one gear assembly. Assembly of the remaining two gear assemblies is identical.



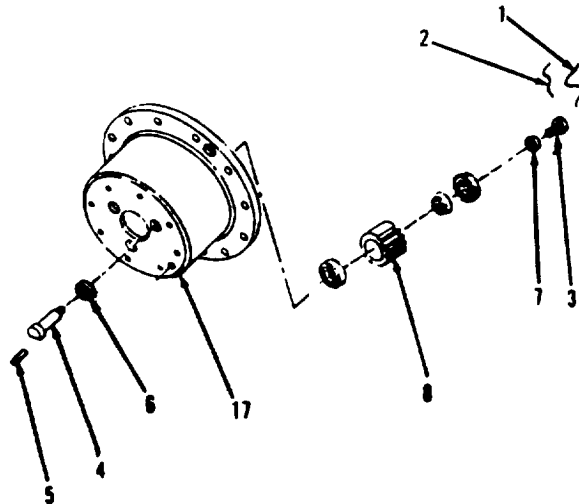
12. Using snap ring pliers, install retaining ring (15), spacer (14) and cups (13 and 12) to gears (6). cup (13 and 12) must be chilled until cups can drop into gears (6) without a press.

13. Install cone (11), spacer (10) and cone (9).

14. Install items 15 thru 8 as an assembly and three spacers (7) in planetary carrier.

15. Install three spacers (6) on pins (4) making sure tapered side of spacer (7) is flush with tapered portion of pin (4)

15. Using a hammer, install three pins (4) with spacers (6) and dowels (5) into planetary carrier. Flat of pins (4) must be toward outside of planetary carrier.



16. Install three lock bolts (3). Tighten bolts (3) to 110 to 120 lb-ft torque.

17. Using long round nose pliers, install new lockwire (2) on vehicles S/N 2001 and above only.

18. Install new lockwire (1).

19. Peen the planetary housing at dowel hole to secure dowel (5) in housing.

END OF TASK



16-3. Rear Differential Carrier Assembly. (Sheet 2 of 12)

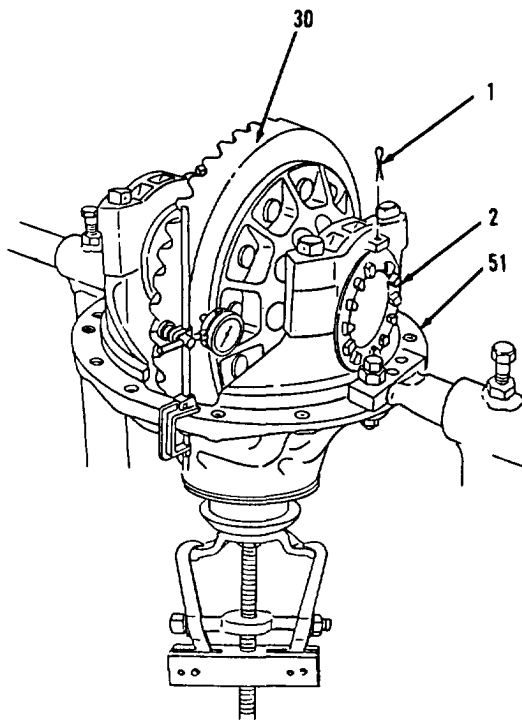
DISASSEMBLY

NOTE

Prior to disassembly of differential assembly, backlash of gears must be measured and recorded. Steps 1 thru 3 are necessary only if gears are to be reused.

Except where noted, The following disassembly procedure for the differential assembly is identical for both vehicles S/N 2001 to 2903 and S/N 2000 and below and 2904 and above.

1. Position dial scale indicator as shown.
2. Secure flange yoke and rotate gear (30) back and forth.
3. Record backlash as indicated on dial scale indicator.
4. Using a 1-1/2" socket and socket wrench handle, remove flange yoke.
5. Using side cutting pliers, remove two cotter pins (1) and adjustment rings (2) from carrier (51). Discard cotter pins (1).



Go to sheet 3

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

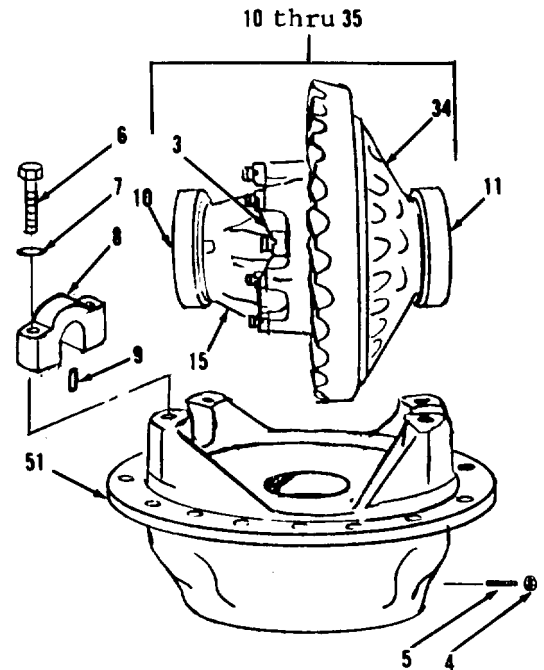
16-3. Rear Differential Carrier Assembly. (Sheet 3 of 12)

DISASSEMBLY (Cont)

NOTE

The following is a difference between M10A Forklift models.

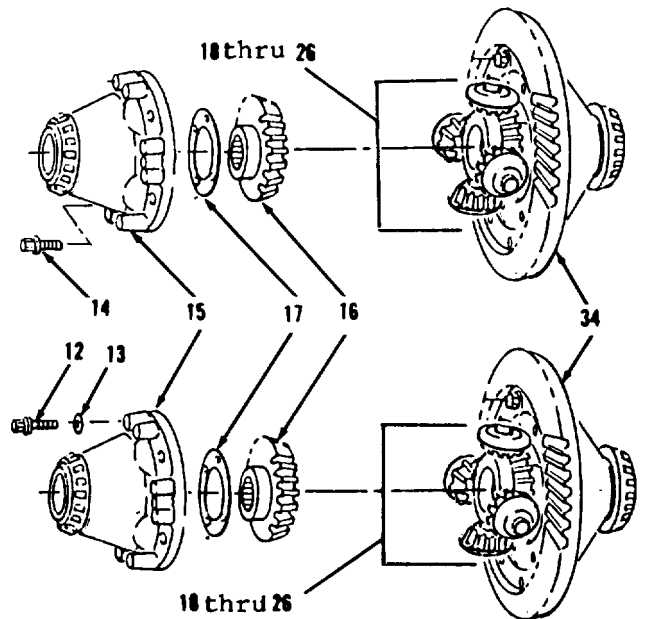
6. Using diagonal cutters, cut and discard two lock wires (3) on vehicles S/N 2000 and below and 2904 and above.
7. Using a 15/16" socket and socket wrench handle, remove nut (4) and screw (5) from carrier (51) on vehicles S/N 2001 to 2903 only.
8. Using a hammer, punch mark bearing caps (8) and carrier (51).
9. Using a 15/16" socket and socket wrench handle, remove four bolts (6), washers (7), two bearing caps (8), and pins (9).
10. Using hoist and sling, remove items 10 thru 35 as an assembly and place on suitable work bench.
11. Mark location of cups (10 and 11) on differential assembly and remove.
12. Using a hammer, punch mark cases (15 and 32).



NOTE

The following is a difference between M10A Forklift models.

13. Using a 1/2" socket and socket wrench handle, remove 16 bolts (12) and washers (13) or 12 bolts (14). 16 bolts (12) and washers (13) on vehicles S/N 2000 and below and 2904 and above or 12 bolts (14) on vehicles S/N 2001 to 2903.
14. Remove case (15), gear (16) and washer (17) .



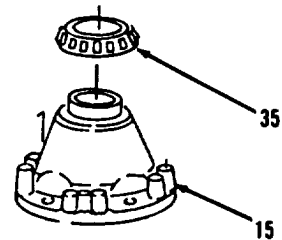
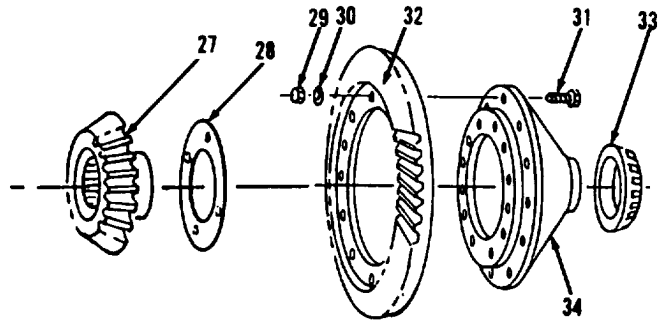
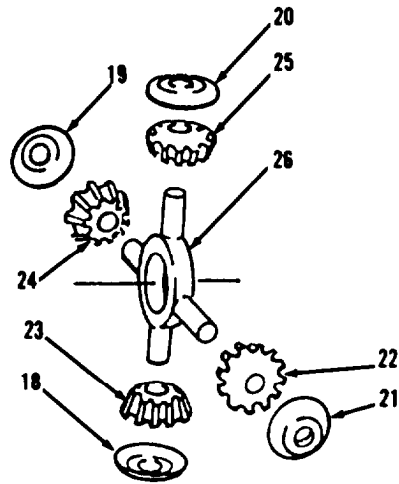
Go to sheet 4

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-3. Rear Differential Carrier Assembly. (Sheet 4 of 12)

DISASSEMBLY

15. Remove items 18 thru 26 as an assembly.
16. Remove washers (18, 19, 20 and 21) from spider (26).
17. Remove gears (22, 23, 24 and 25).
18. Remove gear (27) and washer (28) from case (34).
19. Using a 3/4 open end wrench and 3/8" socket head screw key, remove 12 nuts (29), washers (30), bolts (31) and gear (32).
20. Use puller and heat, if required to remove bearing (33) from case (34).
21. Use puller and heat, if required to remove bearing (35) from case (15).



Go to sheet 5



GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-3. Rear Differential Carrier Assembly. (Sheet 5 of 12)

DISASSEMBLY

22. Using a 5/8" socket and socket wrench handle, remove two bolts (36), cover (37) and gasket (38). Discard gasket (38) .

NOTE

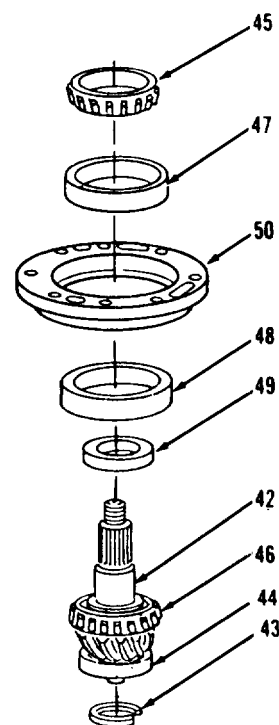
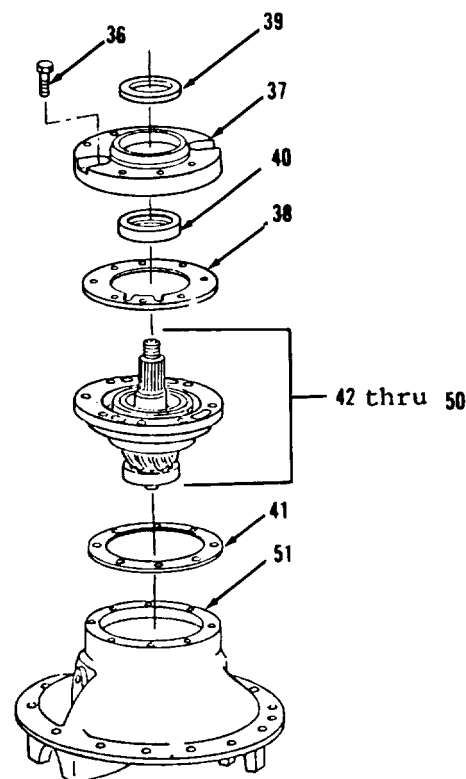
The following is a difference between M10A Forklift models.

23. Remove and discard seals (39 and 40) from cover (37). Seal (40) for vehicles S/N 2001 to 2903 only.
24. Using a rubber mallet, remove items 42 thru 50 as an assembly and shim (41) from carrier (51).
25. Using an arbor press, press items 42 thru 46 as an assembly from cage (50).

NOTE

Identify and mark location of all cups and cones on gear or in bearing cage. Relationship between cups and cones must be maintained during reassembly.

26. Using snap ring pliers, remove ring (43) from gear (42).
27. Using a arbor press. remove bearing (44) and cones (45 and 46).
28. Using a brass punch and hammer, remove cups (47 and 48) and spacer (49) from cage (50).



Go to sheet 5

CLEANING/INSPECTION

**WARNING**

● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

29. Clean all parts with clean cloth moistened with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
30. Inspect all parts. Refer to paragraph 2-9.

Go to sheet 7

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

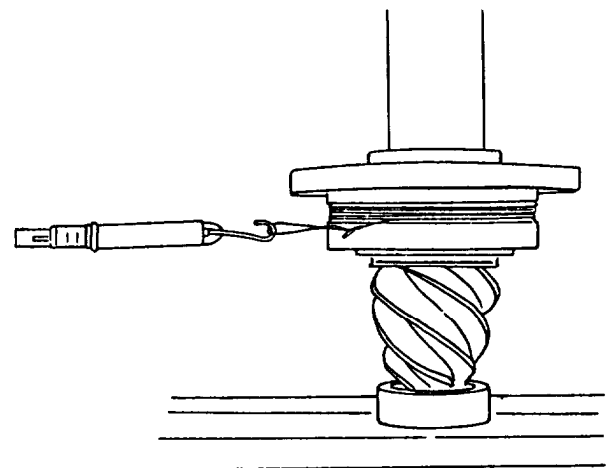
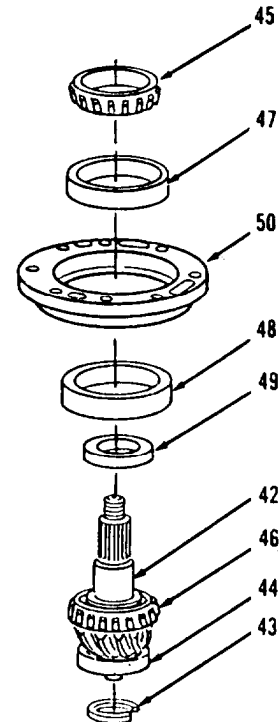
16-3. Rear Differential Carrier Assembly. (Sheet 7 of 12)

ASSEMBLY

NOTE

When replacing parts, gears must be replaced as a matching set. Washers must be replaced as a matched set.

31. Using an arbor press, install spacer (49) and cups (48 and 47) to cage (50).
32. Install cone (46) and bearing (44) to gear (42).
33. Using retaining ring pliers, install ring (43).
34. Using an arbor press, install gear (42) to cage (50).
35. Install cone (45).
36. Rotate cage to verify normal bearing contact.
37. Apply load of 6 tons with press as shown.
38. Using soft iron wire and scale indicator, measure bearing preload torque as shown. Bearing preload torque should be 5 to 15 in-lb. Be sure to measure rotating torque and not starting torque. Install thinner spacer (49) to increase or thicker spacer to decrease preload, as required.



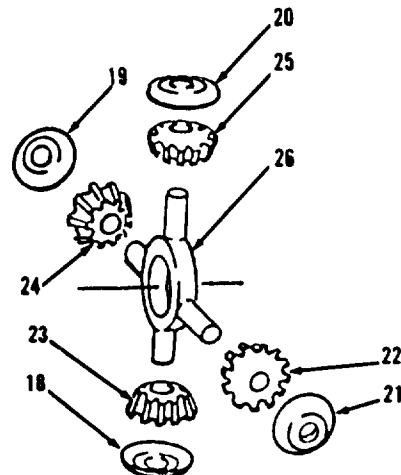
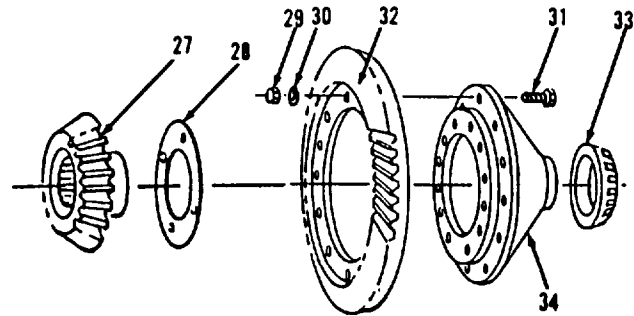
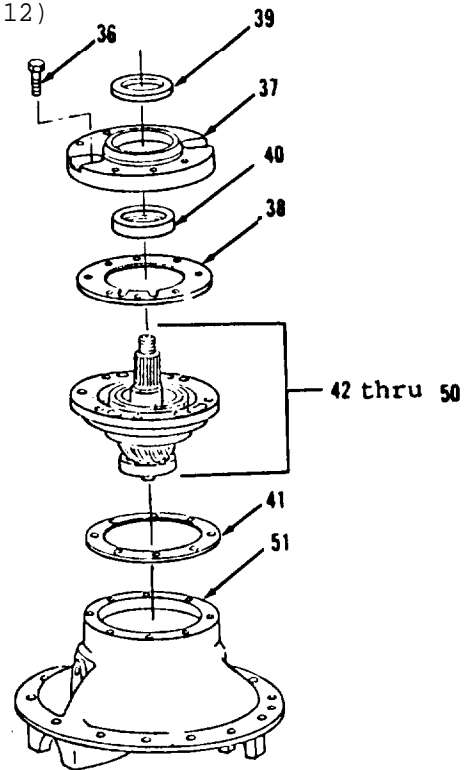
Go to sheet 8

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-3. Rear Differential Carrier Assembly. (Sheet 8 of 12)

ASSEMBLY

39. Lubricate outside diameter of new seals (40 and 39) with Permatex No. 2. Seal (40) for vehicles S/N 2001 to 2903, install to cover (37).
40. Install shim (41) and items 42 thru 50 as an assembly to carrier (51).
41. Using a 5/8" socket and torque wrench, install new gasket (38), cover (37) and two bolts (36). Tighten bolts (36) to 50 to 65 lb-ft torque.
42. Using a 3/4 open end wrench, 3/8" socket head screw key and torque wrench, install gear (30), 12 bolts (29), washers (28) and nuts (27) to case (32). Tighten 12 bolts (29) to 105 to 135 lb-ft torque.
43. Lubricate washer (28) and gear (27) with gear oil and install.
44. Lubricate gears (25, 24, 23 and 22) with gear oil and install on spider (26).
45. Lubricate washers (21, 20, 19 and 18) with gear oil and install.
46. Install items 26 thru 18 as an assembly to case (34).
47. Lubricate washer (17) and gear (16) with gear oil and install.



Go to sheet 9

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

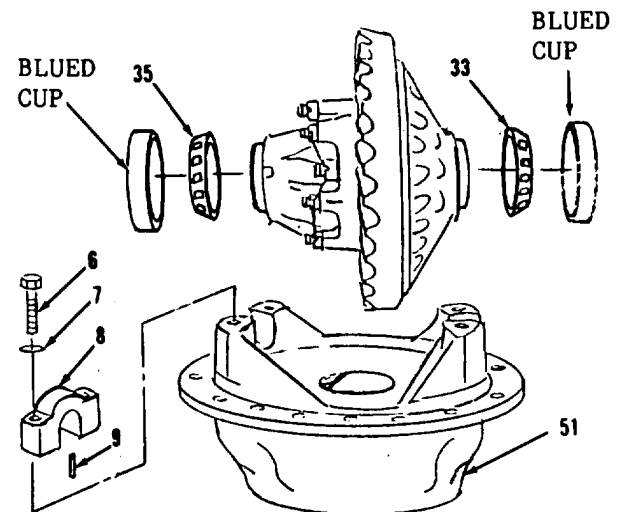
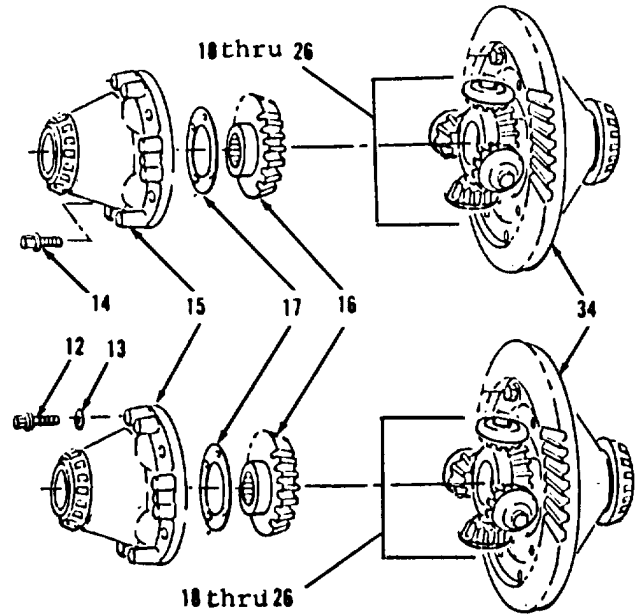
16-3. Rear Differential Carrier Assembly. (Sheet 9 of 12)

ASSEMBLY (Cont)

NOTE

The following is a difference between M10A Forklift models.

48. Be sure to align identification marks on cases (15 and 34). Using a 1/2" socket and socket wrench handle, install case (15) with four equally spaced bolts (14) on vehicles S/N 2001 to 2903 or case (15), 16 washers (13) and bolts (12) on vehicles S/N 2000 and below and 2904 and above.
49. Check assembly for free rotation of differential gears.
50. Install remaining bolts (14) and washers (13) or bolts (12). Tighten bolts (13 or 12) to 105 to 135 lb-ft.
51. Install bearings (33 and 35) on differential carrier and lubricate with gear oil.
52. Using a 15/16" socket and torque wrench, install blue cups, two pins (9), bearing caps (8), four washers (7) and bolts (6) to carrier (51). Tighten bolts (6) to 160 to 190 lb-ft. Identification marks on bearing caps and carrier must be aligned during installation.
53. Check fit of cups in bearing cap bores. Cups must be a hand push fit. If cups are too tight, bores must be reworked with emery cloth until push fit is obtained. A blued cup should be used as a gage to check fit,
54. Remove four bolts (6), washers (7), two bearing caps (8), pins (9) and blued cups.



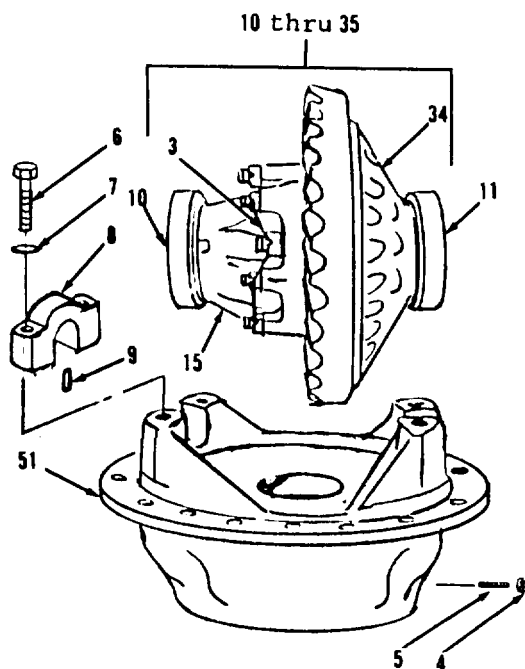
Go to sheet 10

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-3. Rear Differential Carrier Assembly. (Sheet 10 of 12)

ASSEMBLY

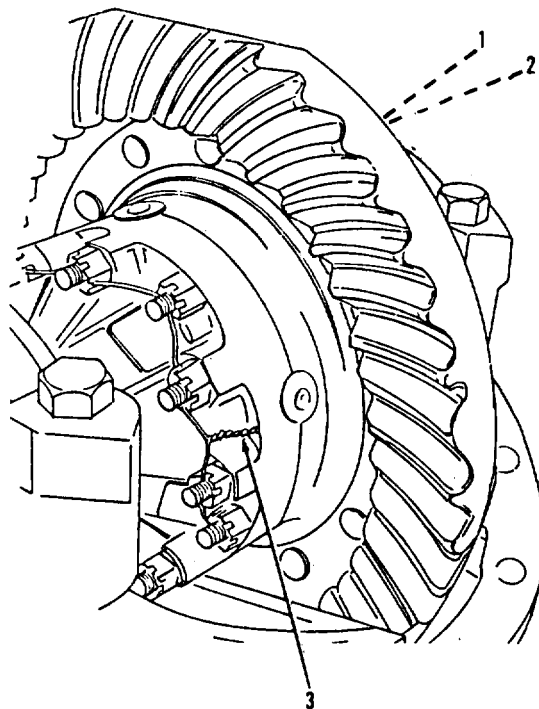
55. Install cups (11 and 10) on differential assembly.
56. Using hoist and sling, position items 10 thru 35 as an assembly to carrier (51).
57. Install two adjustment rings (2). Hand turn against cups (11 and 10).
58. Install two pins (9), bearing caps (8), four washers (7) and bolts (6). Tighten bolts (6) to 160 to 190 lb-ft torque. Identification marks on bearing caps and carrier must be aligned during installation. If bearing caps do not seat properly, check adjustment rings (2) for cross threading.
59. Using a 15/16" socket and socket wrench handle, install screw (5) and nut (4).



NOTE

The following is a difference between M10A Forklift models.

60. Using long round nose pliers, install cotter pin (1) and on vehicles S/N 2000 and below and 2904 and above, install two new lockwires (3).



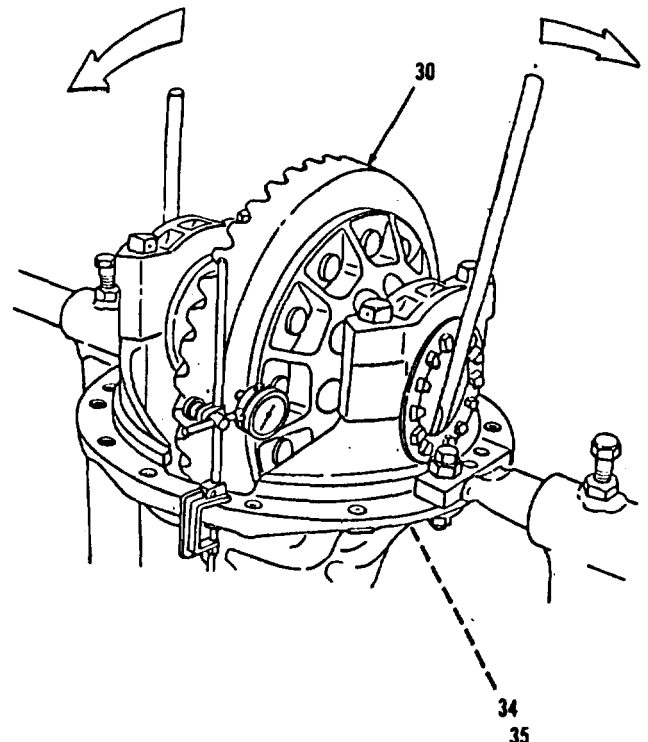
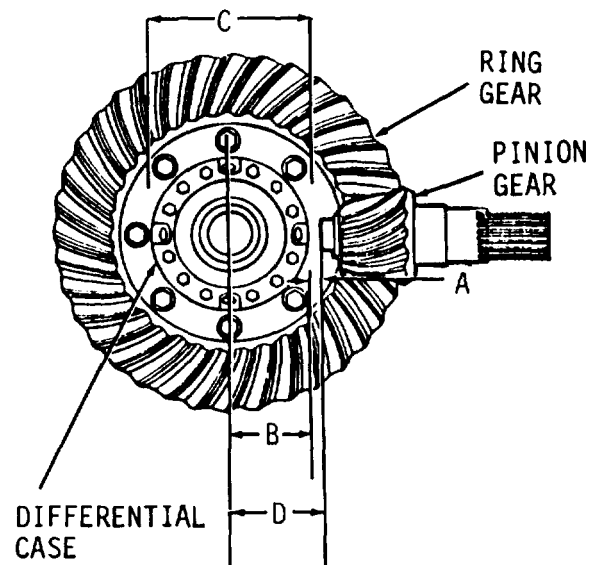
Go to sheet 11

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE. (cont)

16-3. Rear Differential Carrier Assembly. (Sheet 11 of 12)

ADJUSTMENT

61. Adjust cone center: Measure diameter of differential case, Dimension C.
62. Record one half of C, Dimension B.
63. Record Dimension D etched on end pinion gear (42).
64. Subtract Dimension B from Dimension D to find Dimension A. ( $D - B = A$ ).
65. Measure distance between end on pinion gear (42) and differential case with feeler gage.
66. Add or remove shims (41) between case (50) and carrier (51) as required to obtain Dimension A.
67. Adjust backlash: Rotate gears until match marked teeth of ring and pinion gear are meshing.
68. Install dial scale indicator as shown.
69. Loosen adjustment ring on side opposite gear teeth just enough to show end play on indicator.
70. Tighten same adjustment ring enough to obtain 0.00 end play.
71. From 0.00 end play setting, tighten both adjustment rings one notch each to preload bearings.



Go to sheet 12

GENERAL SUPPORT PROPELLER AND PROPELLER SHAFTS MAINTENANCE.

16-3. Rear Differential Carrier Assembly. (Sheet 12 of 12)

ADJUSTMENT

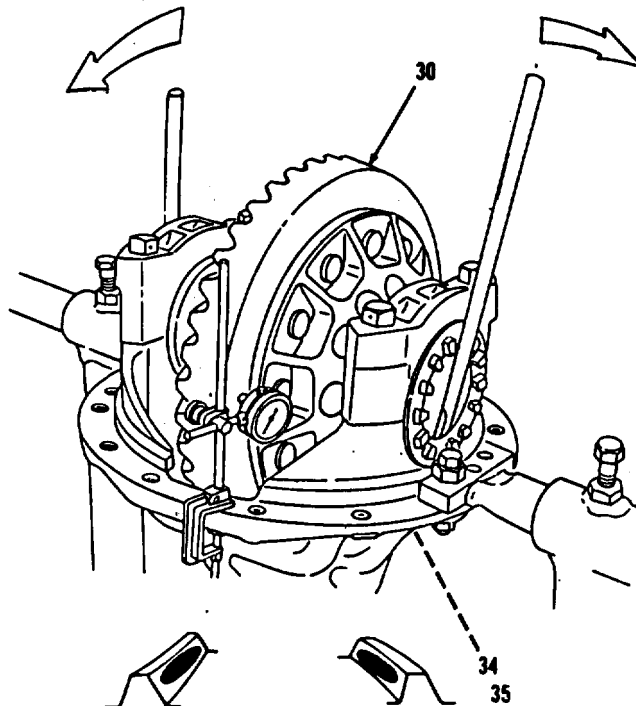
NOTE

If gears were not replaced, use backlash dimension recorded in Step 1. If gears were replaced, use backlash dimension etched on gear.

- 72. Adjust differential assembly to obtain correct backlash dimension by backing off one adjustment ring and advancing the opposite adjustment ring by an equal amount.
- 73. Measure clearance between gear (30) and screw (35). Screw (35) on vehicles S/N 2001 and above only. Clearance should be 0.010 to 0.015 inches.
- 74. Tighten nut (34) to 140 to 170 lb-ft.
- 75. Check gear tooth contact: Coat pinion gear teeth with gear mark.
- 76. Rotate pinion gear.
- 77. Check contact pattern on gear teeth. if too much toe or heel bearing, adjust cone center, refer to Step 61.
- 78. If bearing too too high or low, adjust backlash, refer to Step 67.
- 79. If cross bearing, reject differential assembly.

NOTE

Return M10A Forklift to original equipment condition.



PINION RING  
CORRECT ADJUSTMENT



PINION RING  
TOO MUCH TOE BEARING



PINION RING  
TOO MUCH HEEL BEARING



PINION RING  
BEARING TOO LOW



PINION RING  
BEARING TOO HIGH



PINION RING  
CROSS BEARING

END OF TASK



CHAPTER 17  
GENERAL SUPPORT BRAKE MAINTENANCE

## CHAPTER OVERVIEW

The purpose of this chapter is to help the technician efficiently repair malfunctioning equipment and to perform authorized general support level maintenance procedures on the M10A Forklift brakes.

## INDEX

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
Power Cluster (S/N 2000 and below)	17-1	17-2
Pressure Converter (S/N 2001 and above)	17-2	17-9

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 1 of 7)

This task covers:       a. Disassembly                               b. Cleaning/Inspection  
                          c, Assembly

---

INITIAL SETUP

Tools

Tool Kit, General Mechanic's  
Automotive  
NSN 5180-00-177-7033  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance, Basic,  
Less Power  
NSN 4910-00-754-0705  
Shop Equipment, Automotive  
Maintenance and Repair:  
Field Maintenance  
NSN 4910-00-919-0076

Materials/Parts

Cleaning solvent P-D-680  
(App. C, Item 5)  
Clean cloth (App. C, Item 24)  
Hydraulic fluid (App. C, Item 19)  
Retainer  
cup  
Sealing band  
Gasket

Torques

Locknut (7) to 20 lb-ft.

---

EQUIPMENT CONDITION

References

Paragraph 8-5

Condition Description

Power cluster removed.

---

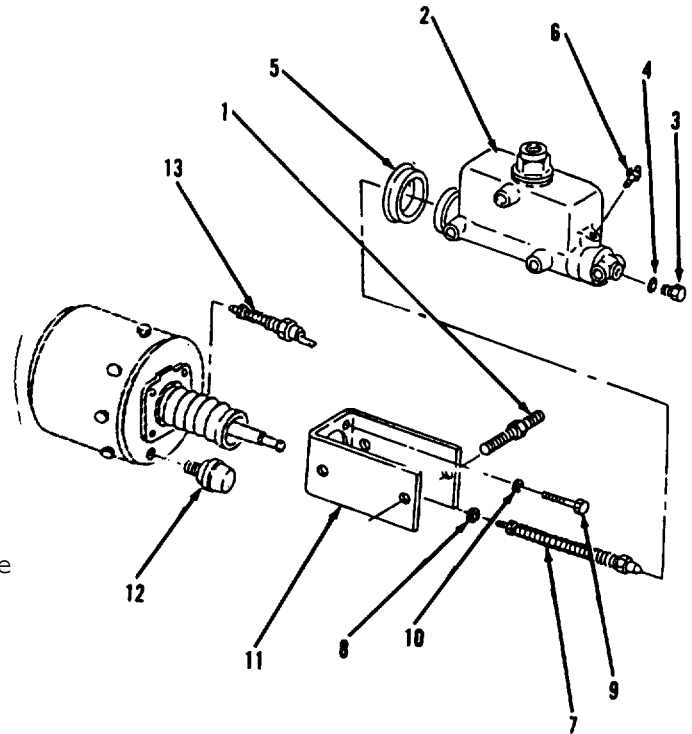
Go to sheet 2

GENERAL SUPPORT BRAKE MAINTENANCE.

17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 2 of 7)

DISASSEMBLY

1. Using a 3/4" open end wrench, remove four studs (1).
2. Separate master cylinder (2) and support (11).
3. Using a 1/2" open end wrench, remove fitting (3) and gasket (4). Discard gasket (4).
4. Using a small flat tip screwdriver, remove and discard sealing band (5).
5. Using a 3/8" open end wrench, remove , bleeder valve (6).
6. Using a 9/16" socket and socket wrench handle, remove stroke indicator (7), lock washer (8), three bolts (9), lock washers (10) and support (11).
7. Using a 5/8" open end wrench, remove breather (12).
8. Using a 9/16" open end wrench, remove switch (13).



Go to sheet 3

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

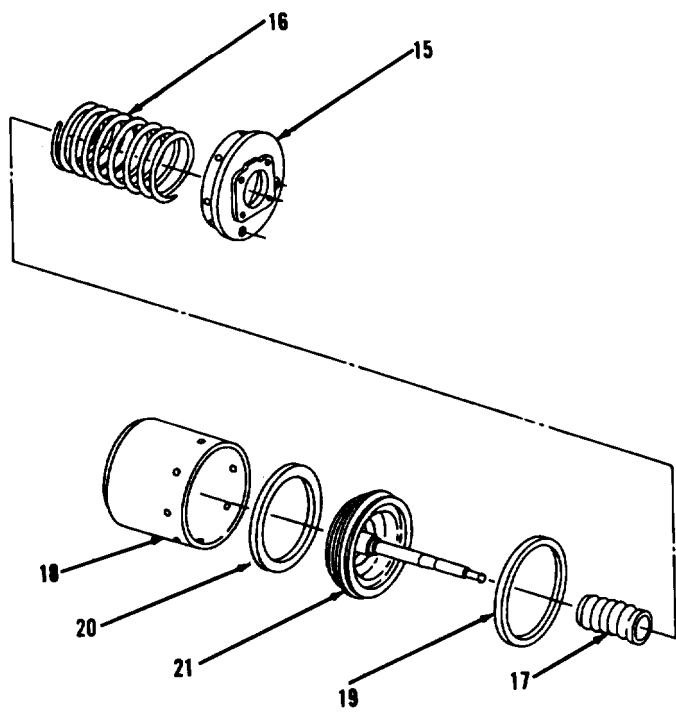
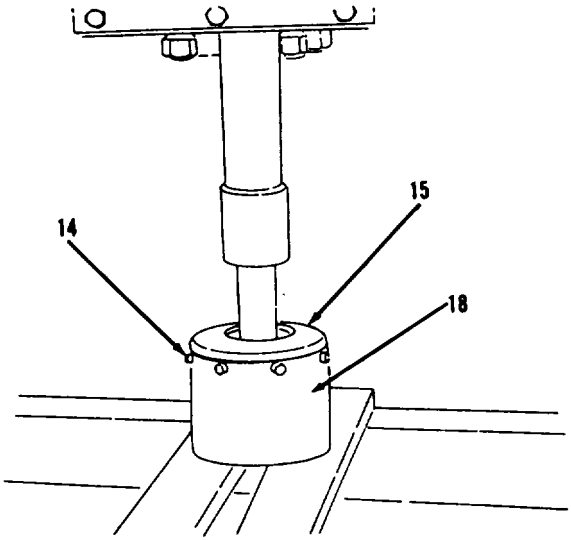
17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 3 of 7)

DISASSEMBLY (cont)

**WARNING**

Spring is under pressure. Remove screws carefully to keep spring from becoming a projectile.

9. Secure head (15) and shell (18) in press.
10. Using a 9/16" socket and socket wrench handle, remove eight screws (14).
11. Release head (15) and remove from press.
12. Remove spring (16) and boot (17).
13. Remove piston assembly (21) from shell (18).
14. Remove and discard retainer (19) and cup (20) from piston assembly (21).



Go to sheet 4

## GENERAL SUPPORT BRAKE MAINTENANCE.

17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 4 of 7)

CLEANING/INSPECTION

15. Clean boot (17) with detergent and water. Wipe dry with clean cloth.

**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

16. Clean exterior of master cylinder (2) with cleaning solvent P-D-680. Wipe dry with clean cloth.
17. Clean all other parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.

Go to sheet 5

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 5 of 7)

CLEANING/INSPECTION (cont)

- 18. Inspect master cylinder (2) for cracks, blocked bores, leakage or damaged threads.

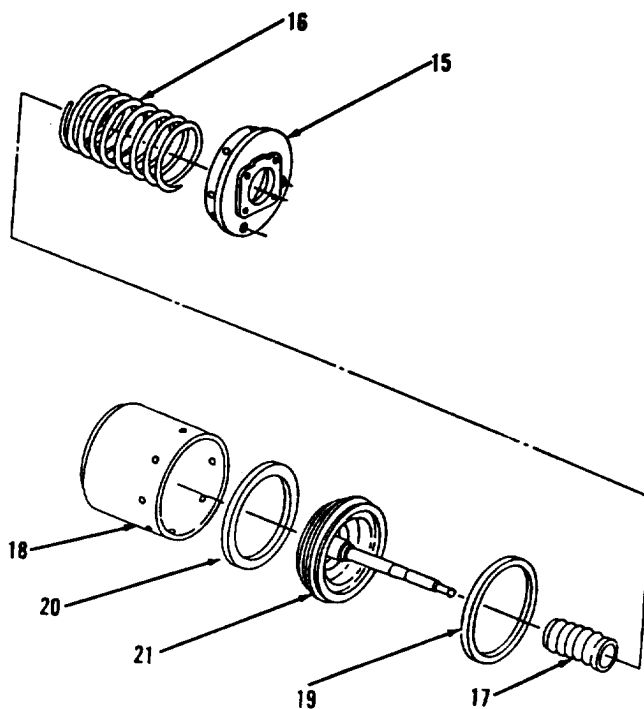
NOTE

Replace master cylinder if hydraulic fluid was present in boot at disassembly.

- 19. Inspect all parts. Refer to paragraph 2-9.

ASSEMBLY

- 20. Soak new retainer (19) in clean hydraulic fluid.
- 21. Install new cup (20) and new retainer (19) on piston assembly (21).
- 22. Coat inside of shell (18) with clean hydraulic fluid and install piston assembly (21) in shell (18).
- 23. Install boot (17) in head (15).
- 24. Install spring (16) on shaft of piston assembly (21).

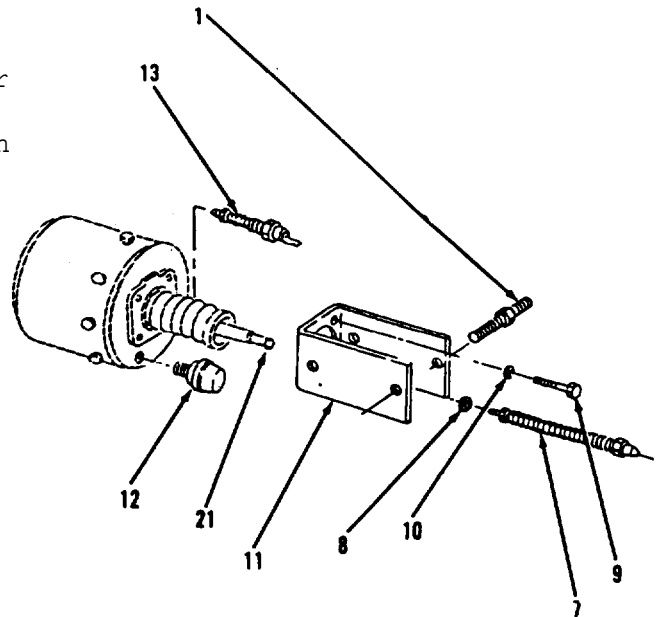
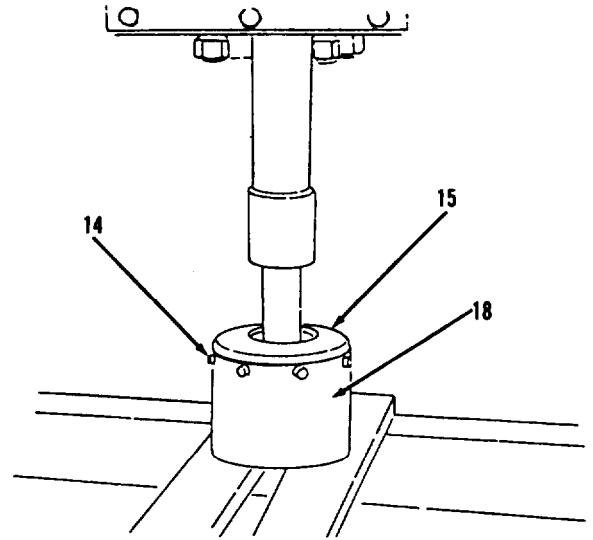


GENERAL SUPPORT BRAKE MAINTENANCE.

17-1. Power Cluster (S/N 2000 and below and 2904 and above). (Sheet 6 of 7)

ASSEMBLY

25. Position head (15) on shell (18).
26. Secure head (15) and shell (18) in press.
27. Using a 9/16" socket and socket wrench handle, install eight screws (14).
28. Using a 9/16" open end wrench, install switch (13) and breather (12).
29. Using a 9/16" socket and socket wrench handle, install support (11), three lock washers (10) and bolts (9).
30. Install lock washer (8) and stroke indicator (7) until contact with piston assembly (21) is made. Piston assembly (21) must be in a relaxed position.
31. Measure length of stroke indicator (7) rod extending past nut when piston assembly (21) is relaxed in shell (18).



Go to sheet 7

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

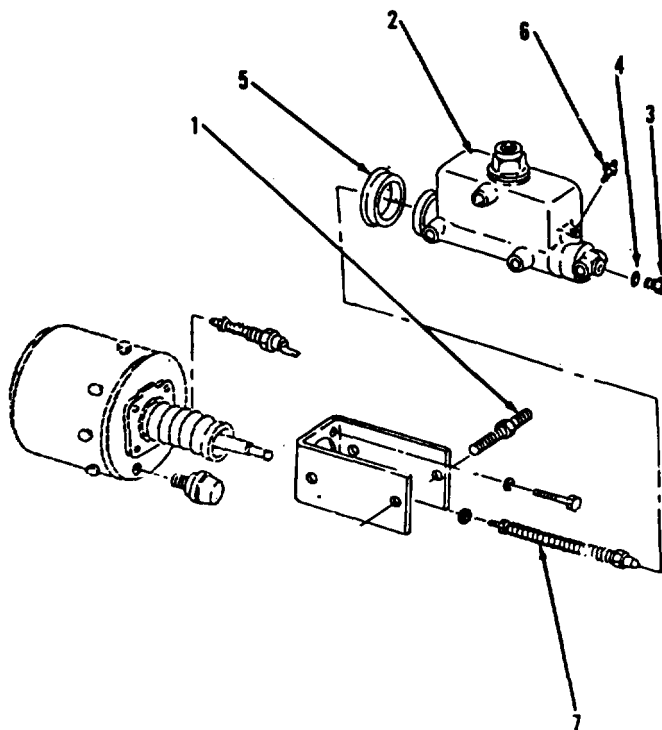
17-1. Power Cluster (SIN 2000 and below and 2904 and above). (Sheet 7 of 7)

ASSEMBLY (cont)

NOTE

Activate piston assembly until stroke indicator extends past the nut to the length of the above measurement plus 2.31 inch.

- 32. Adjust screw of stroke indicator (7) until contact with piston is made. Tighten locknut of stroke indicator (7) to 20 lb-ft.
- 33. Using a 3/8" open end wrench, install bleeder valve (6) in master cylinder (2).
- 34. Install new sealing band (5).
- 35. Using a 1/2" open end wrench, install new gasket (4) and fitting (3).
- 36. Install master cylinder (2) to support (11).
- 37. Using a 3/4" open end wrench, install four studs (1).



NOTE

Return M10A Forklift to original equipment condition.

END OF TASK



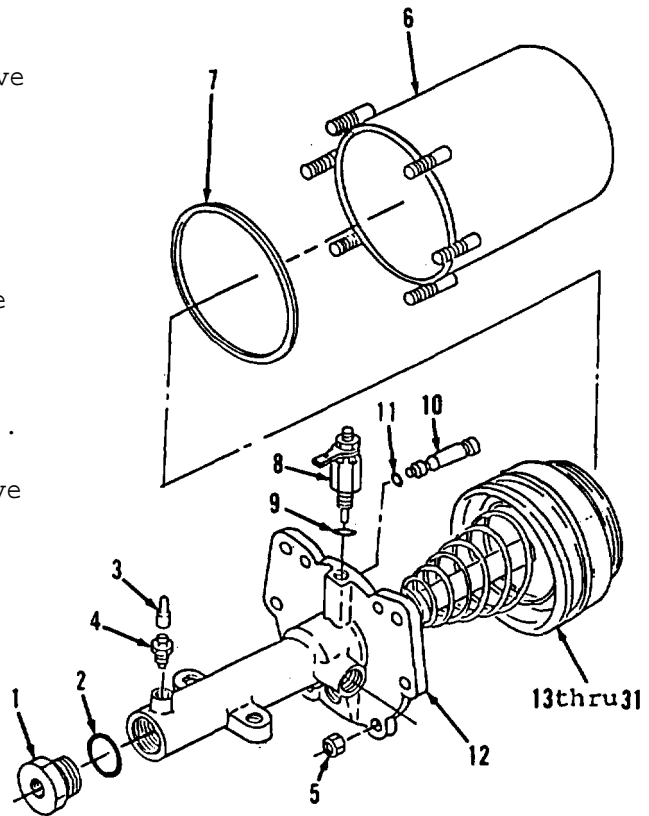


GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 2 of 7)

DISASSEMBLY

1. Using a 1-1/2" open end wrench, remove cap (1) and ring (2) from body (12). Discard ring (2).
2. Using a 3/8" open end wrench, remove cap (3) and bleeder valve (4).
3. Using a 9/16" open end wrench, remove six nuts (5).
4. Remove shell (6) and gasket (7) from items 12 thru 31. Discard gasket (7).
5. Using a 11/16" open end wrench, remove switch (8) and preformed packing (9). Discard preformed packing (9).
6. Remove indicator rod (10) and preformed packing (11). Discard preformed packing (11).
7. Position items 12 thru 31 as an assembly in soft-jaw vice, securing body (12).
8. Using a 1 1/8" open end wrench on bushing (16), remove items 13 thru 31 from body (12).

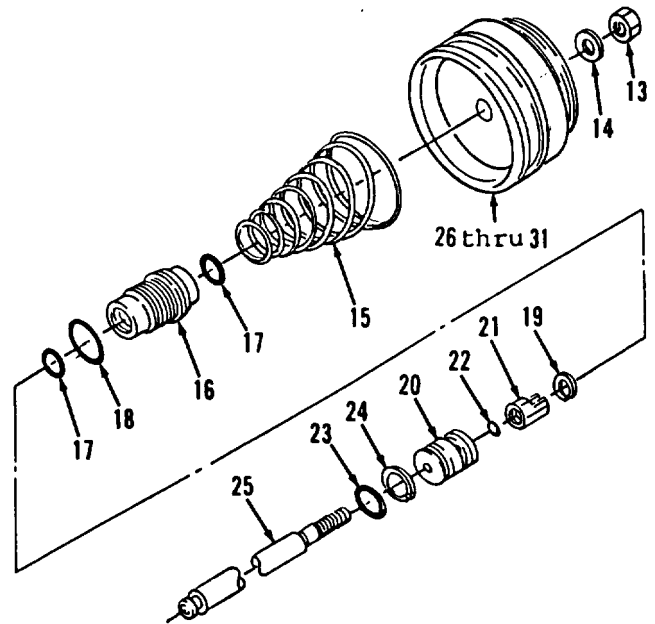


GENERAL SUPPORT BRAKE MAINTENANCE.

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 3 of 7)

DISASSEMBLY

9. Using an 11/16" open end wrench, remove nut (13), washer (14) and items 26 thru 31 as an assembly from rod (25).
10. Remove spring (15).
11. Remove items 16 thru 19 as an assembly from rod (25).
13. Remove and discard preformed packing (17) and two seals (18) from bushing (16).
14. Using snap ring pliers, remove ring (19) in piston assembly (20) on end of rod (25). Discard ring (19).
16. Remove valve (21) from rod (25).
17. Remove regulating valve (22) from valve (21).
16. Remove piston assembly (20) from rod (25).
17. Remove seal (23) and retainer (24) from piston (20).



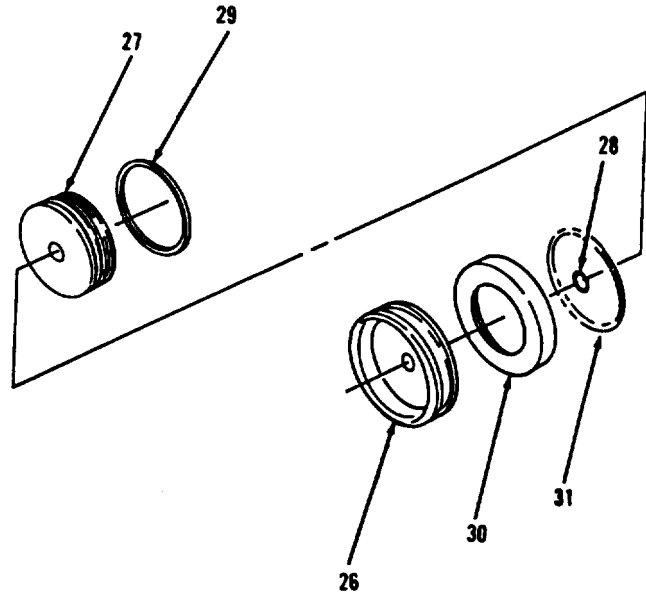
Go to sheet 4

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 4 of 7)

DISASSEMBLY

18. Separate items 26 and 28 as an assembly from items 27 and 29 thru 31 as an assembly.
19. Remove and discard preformed packing (28) from plate (26).
20. Remove felt (29), cup (30) and spring (31) from piston (27). Discard felt (29) and cup (30).



Go to sheet 5

## GENERAL SUPPORT BRAKE MAINTENANCE.

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 5 of 7)

CLEANING/INSPECTION**WARNING**● **TOXIC/FLAMMABLE**

Dry cleaning solvent P-D-680, used for cleaning parts, is toxic and flammable. Use only in well ventilated areas. Wear protective goggles and gloves. Do not smoke or allow open flames or sparks in areas where cleaning solvent is used or stored. Avoid contact with eyes, skin or clothing. If contact with eyes is made, flush with cold water and seek medical attention immediately. If contact with skin or clothing is made, flush with cold water. If you become dizzy while using cleaning solvent, get fresh air immediately.

● **COMPRESSED AIR HAZARD**

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

21. Clean all parts with cleaning solvent P-D-680. Dry thoroughly with compressed air. Refer to paragraph 2-8.
22. Inspect all parts. Refer to paragraph 2-9.

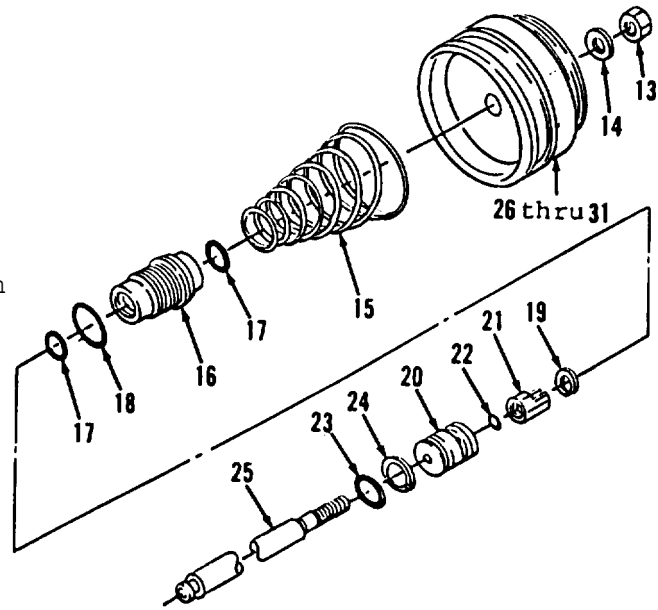
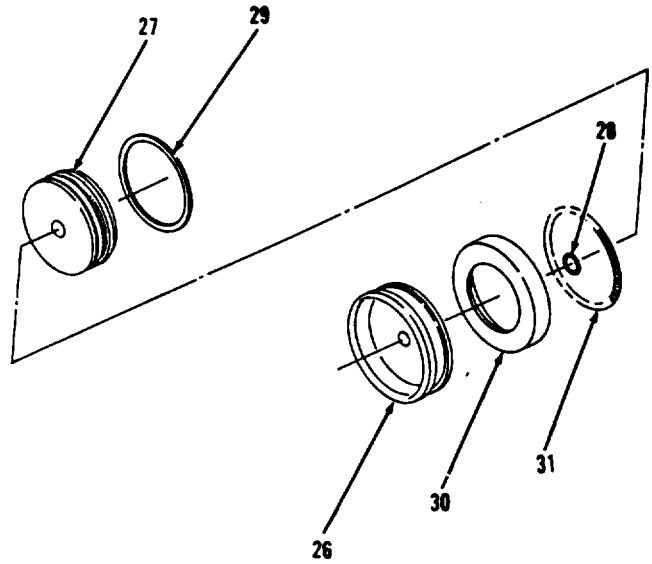
Go to sheet 6

GENERAL SUPPORT BRAKE MAINTENANCE. (cont)

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 6 of 7)

ASSEMBLY

23. Install spring (31) in groove of piston (27).
24. Install new cup (30) over spring (31) and new felt (29) on piston.
25. Install new preformed packing (28) in center hole of plate (26).
27. Install items 31 thru 27 as an assembly and items 28 and 26 as an assembly together.
28. Install retainer (24) and seal (23) on piston (20).
29. Lubricate rod (25) with clean brake fluid and install piston assembly (20).
30. Lubricate regulating valve (22) and install in valve (21)
31. Install valve (21) on rod (25).
32. Using snap ring pliers, install new ring (19) in piston assembly (20).
33. Lubricate and install two new seals (18) and new preformed packing (17) on bushing (16).
34. Install items 19 thru 16 as an assembly on rod (25).
35. Install spring (15).
36. Install items 31 thru 26 as an assembly, washer (14) and nut (13) on rod (25). Tighten nut 13 to 30 lb-ft.



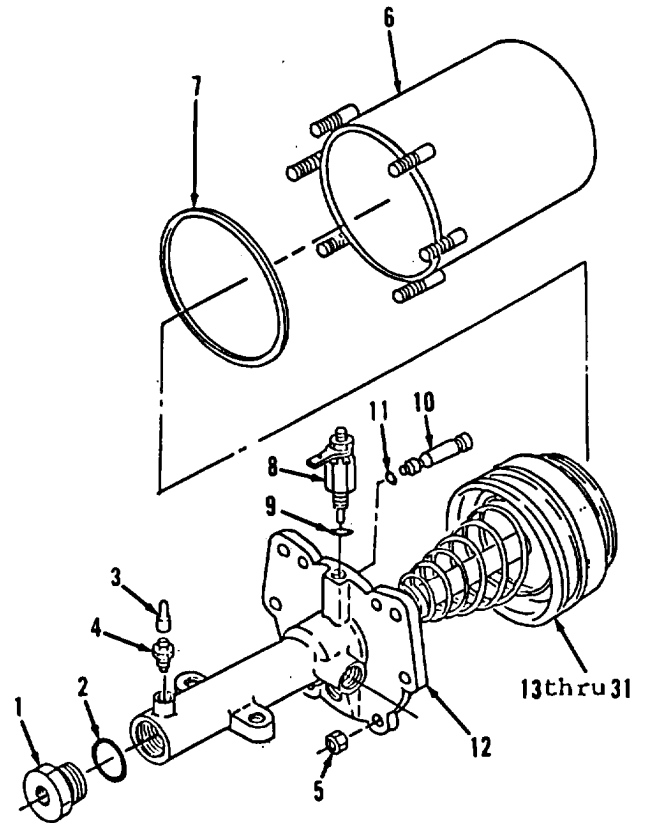
Go to sheet 7

## GENERAL SUPPORT BRAKE MAINTENANCE.

17-2. Pressure Converter (S/N 2001 to 2903). (Sheet 7 of 7)

ASSEMBLY

37. Position body (12) in a soft-jaw vice.
38. Using a 1 1/8" open end wrench on bushing (16), install items 31 thru 13 on body (12).
39. Remove items 31 thru 12 from vice.
40. Lubricate and install new preformed packing (11) and indicator rod (10) to body (12).
41. Using a 11/16" open end wrench, install new preformed packing (9) and switch (8). Tighten switch (8) to 6 lb-ft. Switch must engage with groove in indicator rod (10).
42. Install new gasket (7), shell (6) and six nuts (5) on items 31 thru 13 as an assembly. Tighten nuts (5) 9 lb-ft.
43. Using 3/8" socket and socket wrench handle, install bleeder valve (4) and new cap (3) in body (12). Tighten bleeder valve (4) to 15 lb-ft.
44. Using a 1-1/2" open end wrench, install new ring (2) and cap (1) in body (12). Tighten cap (1) to 70 lb-ft.



## NOTE

Return M10A Forklift to original equipment condition.

Go to sheet 8

17-15





APPENDIX A

REFERENCES

A-1. PUBLICATION INDEXES AND GENERAL REFERENCES.

Indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this publication.

a. MILITARY PUBLICATION INDEXES.

Consolidated Index of Publications and Blank Forms . . . . .DA PAM 310-1

b. GENERAL REFERENCES.

Dictionary of United States Army Terms . . . . .AR 310-25  
 Authorized Abbreviations and Brevity Codes . . . . .AR 310-50  
 Military Training Management . . . . .TC 21-5-7  
 Military Symbols . . . . .FM 21-30

A-2. OTHER PUBLICATIONS.

The following publications contain information pertinent to the major item materiel and associated equipment.

a. VEHICLE.

Truck, Forklift, DED Pneumatic Tire, 10,000 LB.  
 Capacity Rough Terrain, Articulated Frame Steer  
 (Dresser Industries Model M10A, MHE 23) . . . . .LO 10-3930-643-12-1

b. CAMOUFLAGE.

Camouflage . . . . .FM 5-20

c. DECONTAMINATION .

Chemical, Biological, and Radiological  
 Decontamination . . . . .TM 3-220  
 Chemical, Biological, Radiological, and Nuclear Defense . . . . .TM 21-40

d. GENERAL.

Accident Reporting and Records . . . . .AR 385-40  
 Basic Cold Weather . . . . .FM 31-70  
 Cooling Systems: Tactical Vehicles . . . . .TM 750-254  
 Manual for Wheeled Vehicle Driver . . . . .FM 21-305  
 Driver Selection and Training (Wheeled Vehicles ) . . . . .FM 55-30  
 Mountain Operations . . . . .FM 90-6  
 Northern Operations . . . . .FM 31-71  
 Operation and Maintenance of Ordnance Materiel in  
 Cold Weather (0°F. to -65°F.) . . . . .FM 9-207  
 Principles of Automotive Vehicles . . . . .TM 9-8000  
 Prevention of Motor Vehicle Accidents . . . . .AR 385-55  
 Procedures for Destruction of Tank Automotive Equipment  
 to Prevent Enemy Use.... .TM-750-244-6

REFERENCES (cont)

A-2. OTHER PUBLICATIONS. (cont)

- e. FIRST AID.  
First Aid for Soldiers. . . . .FM 21-11
  
- f. MAINTENANCE AND REPAIR.  
Organizational, Direct Support and General Support  
Care Maintenance and Repair:  
Pneumatic Tires and Inner Tubes . . . . .TM 9-2610-200-20  
Description, Use, Bonding Techniques and  
Properties of Adhesives . . . . .TB ORD 1032  
Inspection, Care, and Maintenance of Antifriction  
Bearings . . . . .TM 9-214  
Materials Used for Cleaning, Preserving, Abrading,  
and Cementing Ordnance Materiel and Related  
Materials Including Chemicals . . . . .TM 9-247  
Metal Body Repair and Related Operations . . . . .FM 43-2  
Operation and Organizational Maintenance Manual for  
Lead-Acid Storage Batteries . . . . .TM 9-6140-200-14  
Organizational, Policies, and Responsibilities for  
Army Materiel Maintenance Concepts and Policies . . . . .AR 750-1  
Use of Antifreeze Solutions and Cleaning Compounds  
in Engine Cooling System . . . . .TB 750-651  
Welding Theory and Application. . . . .TM 9-237  
Color, Marking, and Camouflage Painting of Military  
Vehicles Construction Equipment, and Materials  
Handling Equipment . . . . .TB 43-0209
  
- g. SHIPMENT AND LIMITED STORAGE.  
Color Marking, and Preparation of Equipment for  
Shipment of Army Materiel. . . . .AR 746-1  
Preservation and Packing of Military  
Supplies and Equipment . . . . .TM 38-230-1 & 2  
Preservation of USAMECOM Mechanical Equipment  
for Shipment and Storage . . . . .TB 740-97-2  
Preservation, Packaging, Packing and Marking  
Materials, Supplies, and Equipment Used by  
the Army . . . . .SB 38-100  
Shipment and Limited Storage . . . . .MIL-V-62038  
Storage and Serviceability Standard: Tracked  
Vehicles, Wheeled Vehicles and Component Parts . . . . .SB 40-98-1  
Storage and Supply Activities: Covered and Open  
Storage . . . . .SB 740-1  
The Army Maintenance Management Systems (TAMMS) . . . . .TM 38-750

APPENDIX B

MAINTENANCE ALLOCATION CHART

NOT APPLICABLE TO THIS MANUAL



## APPENDIX C

## EXPENDABLE SUPPLIES AND MATERIALS

## Section I. INTRODUCTION.

C-1. SCOPE . This appendix lists expendable supplies and materials you will need to maintain the M10A Forklift. These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items) .

## C-2. EXPLANATION OF COLUMNS.

a. Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use anti-seize graphite, App. C, Item 14").

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item:

- C - Operator/Crew
- O - Organizational Maintenance
- F - Direct Support Maintenance
- H - General Support Maintenance

c. Column 3 - National Stock Number. This is the National Stock Number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical 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 LIST.

ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
1	0	8030-00-243-3285	ANTI-SEIZE COMPOUND MIL-T-5544B	TU
2	0	9150-01-072-8379	BRAKE FLUID, MIL-B-46176 (81349)	CN
3	0	5350-00-221-0872	CLOTH, ABRASIVE CROCUS .50 SHEETS P-C-458 (81348)	PC
4	0	5350-00-584-4654	CLOTH, ABRASIVE EMERY	PC
5	0	6850-00-281-3061	DRY CLEANING SOLVENT 4 OZ. CAN P-D-680 (81348)	CN
6	0	8010-00-297-2105	ENAMEL, SEMIGLOSS, OLIVE DRAB TT-E-485 (81348)	GL
7	0	9150-00-868-0134	LUBRIPLATE 105-1LB	CN
8	0	9150-00-935-1017	CREASE, AUTOMOTIVE, ART. 14 OZ. CAN MIL-C-10924D (81349)	GL
9	0	9150-00-190-0904	CREASE, AUTOMOTIVE, ART. 1 LB. CAN MIL-G-1092 (81349)	CN
10	0	9150-00-985-7248	GREASE, GEAR, MJLTI-PURPOSE, 35 LB. CAN MIL-L-2105B	LB
11	0	9150-00-985-7316	CREASE, GENERAL PURPOSE 1-3/4 LB. CAN MIL-G-23549 (81349)	LB
12	0	9150-01-095-5512	GREASE, #2 LITHIUM, MULTI-PURPOSE MIL-C-109240	CN
13	0	9150-00-935-9808	HYDRAULIC OIL, GRADE 3, MIL-H-Y6001C	
14	0	8030-01-137-6964	LIQUID GASKET, TYPE 1 MIL-A-46016A	
15	0	8030-01-159-4374	LOCTITE 262, GRADE N MIL-S-46163	CN
16	0	8030-00-111-2762	LOCTITE 277, GRADE I MIL-S-46163	CN
17	0	8030-01-054-0740	LOCTITE 592 MIL-S-22473D	CN
18	0	9150-00-231-6689	LUBRICANT, GEAR MIL-10924D	TU
19	0	9150-00-189-6727	LUBRICATING OIL, 1 QT. CAN HIL-L-2104C (81349)	QT

## Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST.

ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
19 (Cont)		9150-00-186-6668	LUBRICATING OIL ENG, 5 GAL. DRUM MIL-L-2104C	5 CAL.
		9150-00-191-2772	OE/HDO 10	55 GAL
		9150-00-186-6681	OE/HDO 30	QT
		9150-00-188-9858	OE/HDO 30	5 GL
		9150-00-188-9859	OE/HDO 30	55 GL
		9150-00-402-4478	MIL -L-46167 (subzero)	QT
		9150-00-402-2372	OE	5 GAL
		9150-00-491-7197	OE	55 GAL
		9150-01-152-4117	15 W40	QT CN
		9150-01-178-4725	15 W40	QT
		9150-01-152-4118	15W40	PLASTIC 5 GAL
		9150-01-152-4119	15 W40	<b>DR.</b> 5 GAL.
20	0	9150-00-402-4478	LUBRICATING OIL ENG, SUBZERO 1 QT. CAN MIL-L-461467	QT
21	0	9150-00-657-4959	LUBRICATING OIL, GEAR MULTI-PURPOSE	GL
22		5210-00-640-6177	PLASTIGAGE	
23		8010-00-652-3626	PRUSSIAN BLUE	
24	0	7920-00-205-3570	CLEAN RAG, WIPING DDD-R-30 (81348) A-A-531 (58536)	
25	0	8030-00-159-8176	SEALING COMPOUND, 303 TUBE MIL-S-45180 (81349)	TU
26	0	8030-00-052-2599	SEALANT, PERMATEX, NO. 2, TYPE 2 MIL-S-45180C	
27	0	6850-01-080-2387	SEALANT, SILICONE MIL-A-46146A	BE
28	0	9905-00-034-3097	TAGS, PAPER	TU

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST.

ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
29	0	7510-01-026-4661	TAPE, INSULATING THERMOMELT, RAYON PLT-118-1	RO
30		8010-00-180-6343	VARNISH, ANTI-CORROSIVE MIL-V-173	
31		8030-00-009-5023	SEALANT, TEFLON THREAD	
32		9150-00-141-6770	CREASE, HMS B27-008	
33		7930-00-249-8036	DETERGENT	
34	0	9150-01-102-9455	BRAKE FLUID BFS (MIL-B-46176)	1 GAL
		9150-01-123-3152	BFS	5 GAL
35	0	9150-01-035-5390	LUBRICATING OIL, GEAR	QT
		9150-01-035-5391	GO 75W (MIL-L-2105)	5 GAL
		9150-01-035-5392		QT
		9150-01-035-5393	GO 80W-90	5 GAL
		9150-01-035-5394		55 GAL
		9150-01-048-4591		QT
		9150-01-035-5395	GO 85W-140	5 GAL
		9150-01-035-5396		55 GAL
36	0	9150-00-065-0029	GAA (MIL-G-10924)	2.25 OZ
		9150-00-935-1017	(Extreme Temperature)	14.0 OZ
		9150-00-190-0904	-65° F. to 300° F	1.75 LB.
		9150-00-190-0905		6.5 LB.
		9150-00-190-0907		35.0 LB.
		9150-00-530-7369		120.0 LB.
		9150-00-935-1017	GAA (MIL-G-10924)	CART - 14 OZ
		9150-00-190-0904	(MULTIPURPOSE AUTO MPG)	CAN 1.75 LB.
		9150-00-190-0905	-12° C to 52° C	CAN 6.5 LB.
		9150-00-190-0907		CAN 35 LB.
		9150-00-530-7369		DR 120 LB.



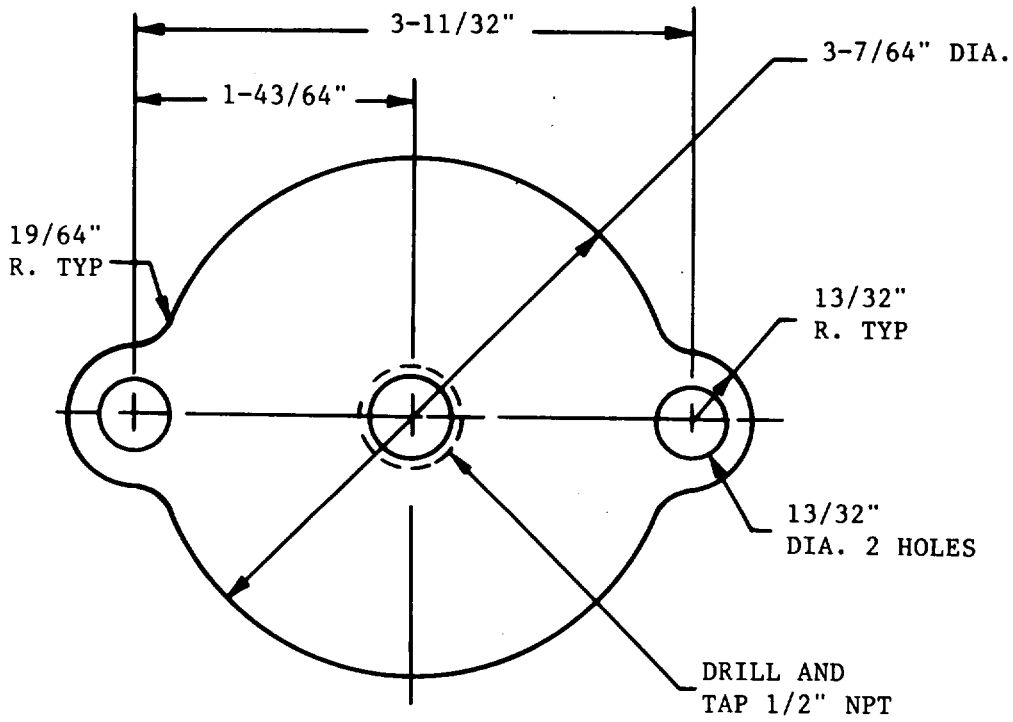
## APPENDIX D

## ILLUSTRATED LIST OF MANUFACTURED ITEMS

D-1. INTRODUCTION. This appendix includes complete instructions for making items authorized to be manufactured or fabricated at direct and general support maintenance. An index is provided for cross-referencing the item to be manufactured to the figure which covers fabrication criteria. All bulk materials needed for manufacture of an item are listed with the illustration.

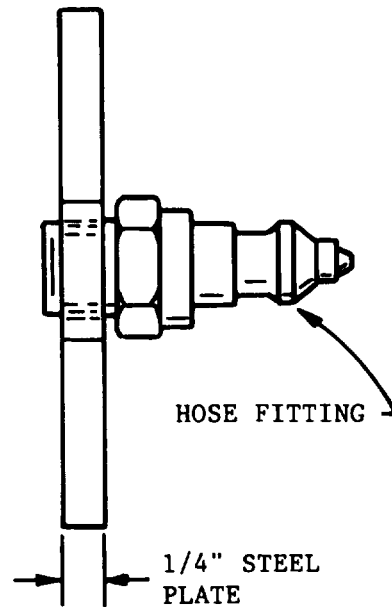
## D-2. MANUFACTURED ITEMS INDEX.

<u>ITEM</u>	<u>FIGURE</u>
Thermostat Housing Pressure Plate	D-1
Thermostat Housing Gasket	D-2
Bottom Pressure Plate	D-3
Bottom Gasket	D-4
Oil Cooler Pressure Plates	D-5
Cylinder Sleeve Holding Adapter	D-6
Output Shaft Oil Seal Installation Tool	D-7
Lifting Eye	D-8
Transmission Stand	D-9
Clutch Plate Alinement Pin and Extractor Tool	D-10
Bearing Removal Tool	D-11
Sandwich Test Block	D-12

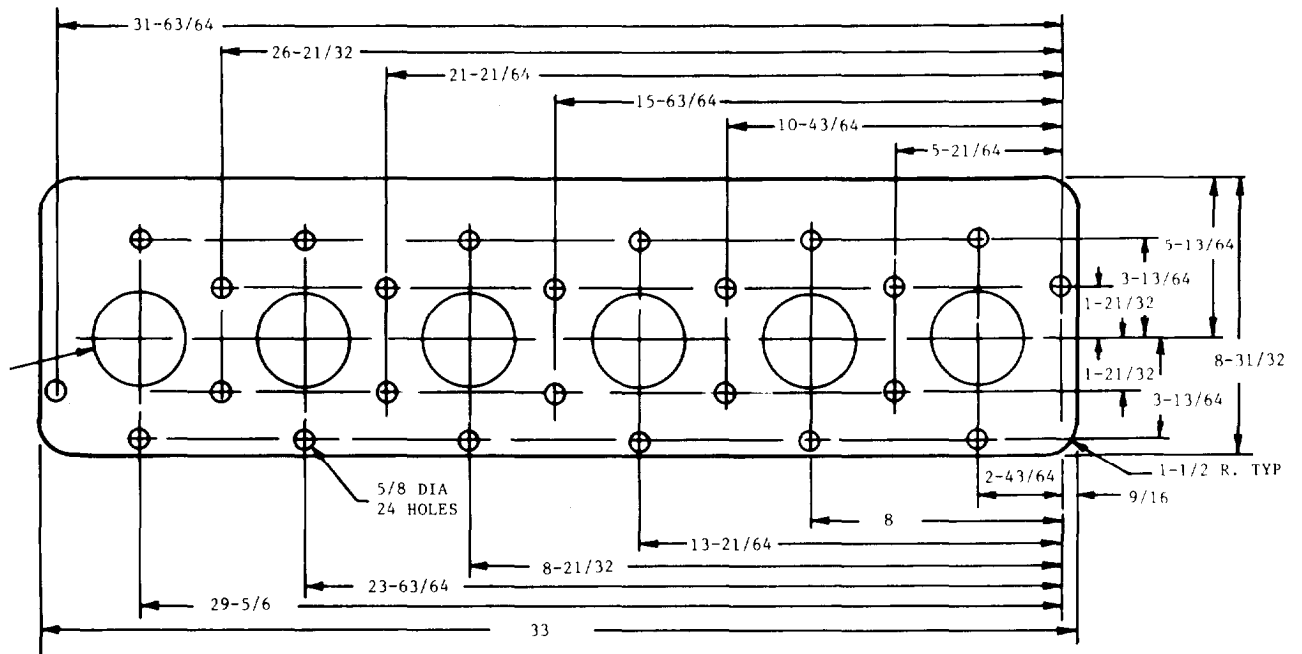


NOTE: Fabricate Part D-1 from  
1/4 inch steel plate

Fabricate Part D-2 from  
1/8 inch rubber



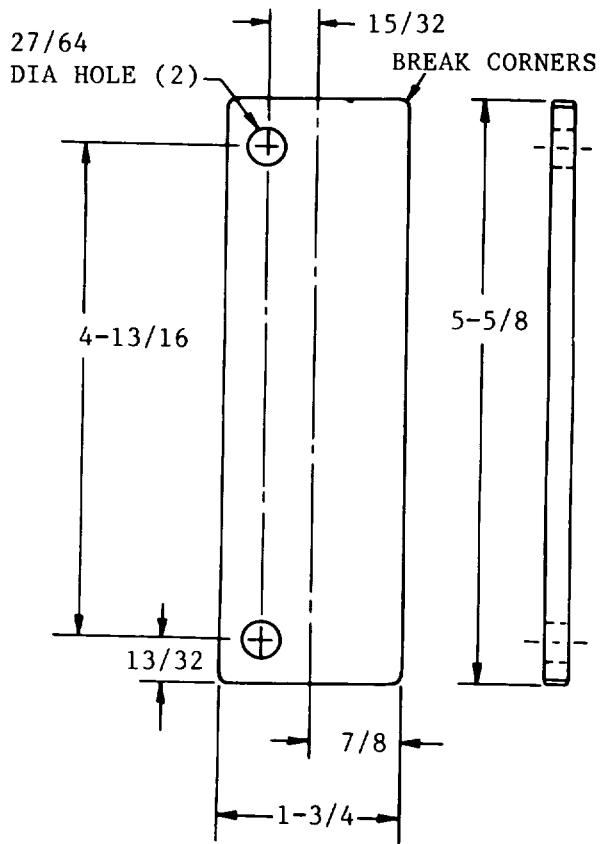
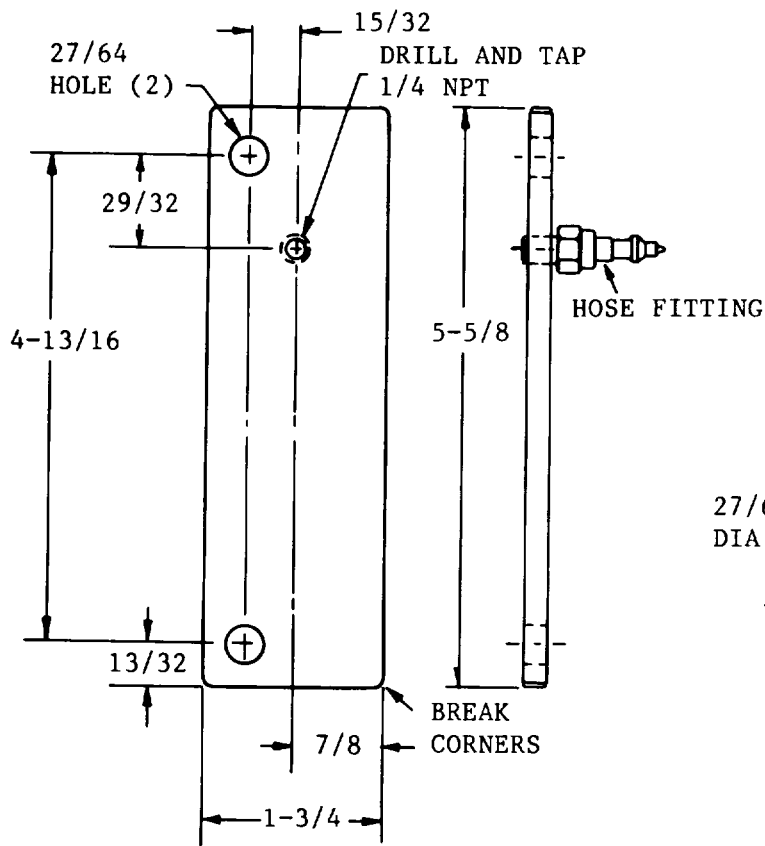
Part D-1. Thermostat Housing Pressure Plate  
Part D-2. Thermostat Housing Gasket



**NOTE:** Fabricate Part D-3 from  
1/2 inch plywood

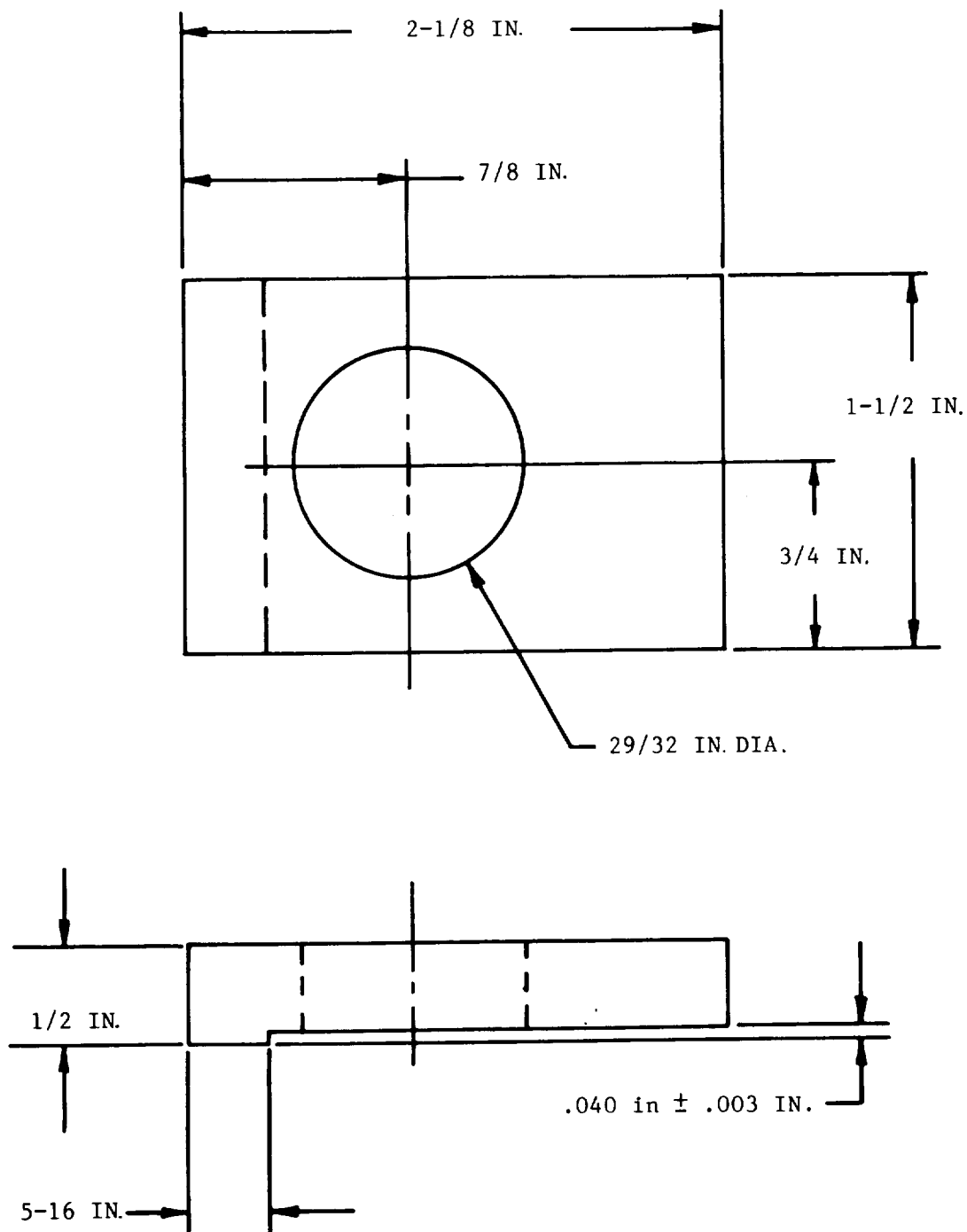
Fabricate Part D-4 from  
1/8 inch rubber

Part D-3. Bottom Pressure Plate  
Part D-4. Bottom Gasket

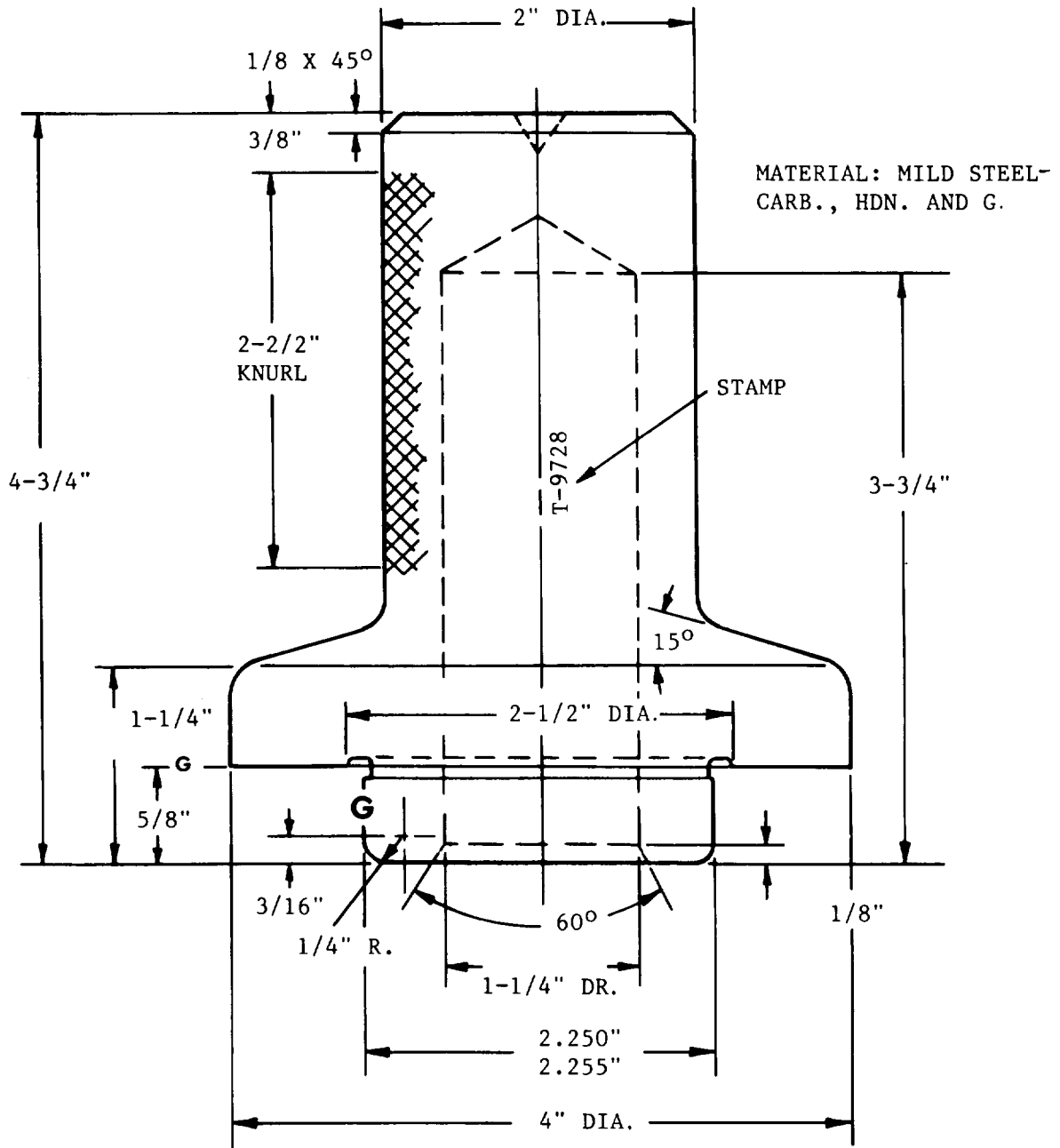


**Material:** 1/4 inch steel plate  
Hose fitting

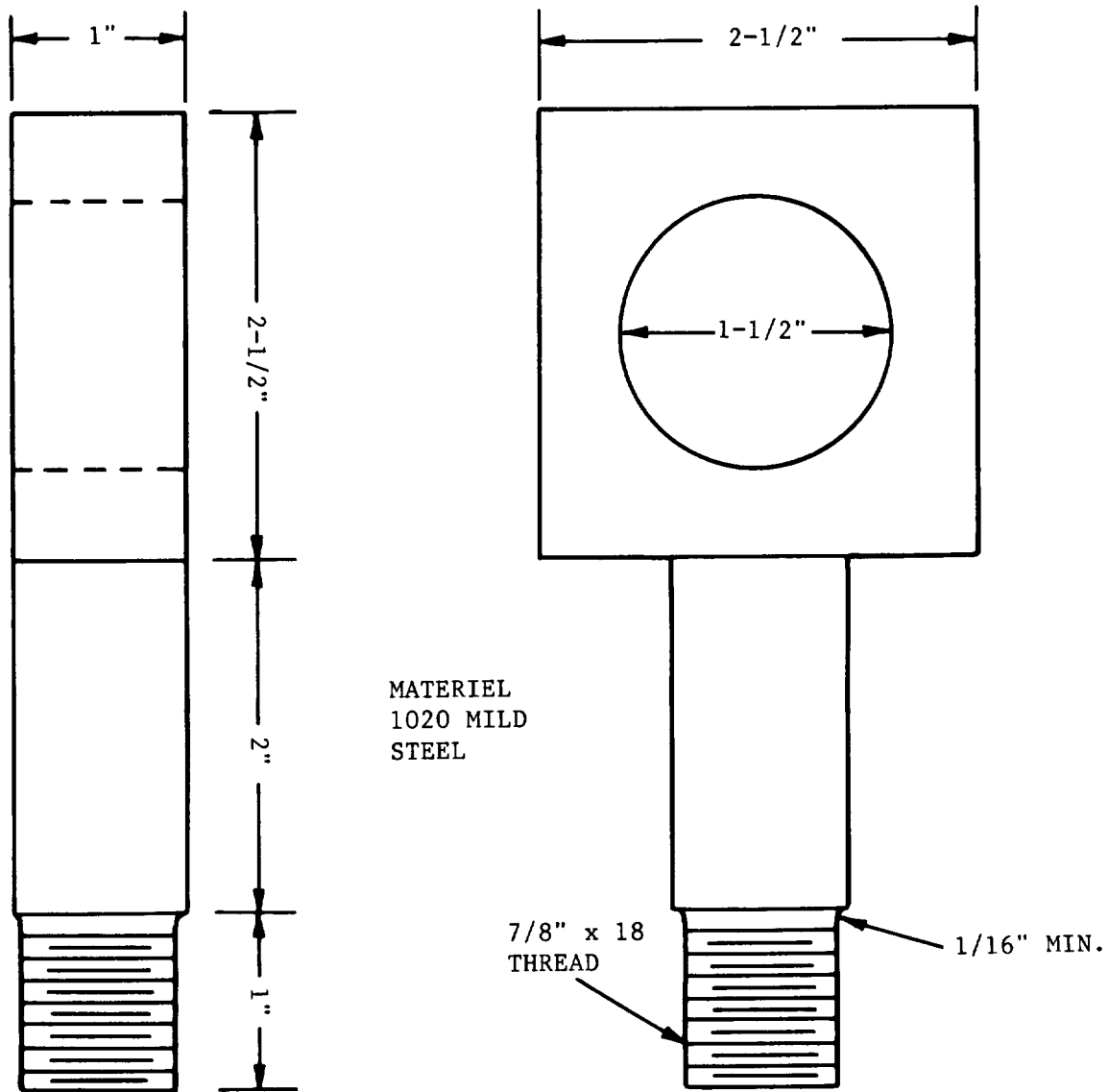
Part D-5. Oil Cooler Pressure Plates



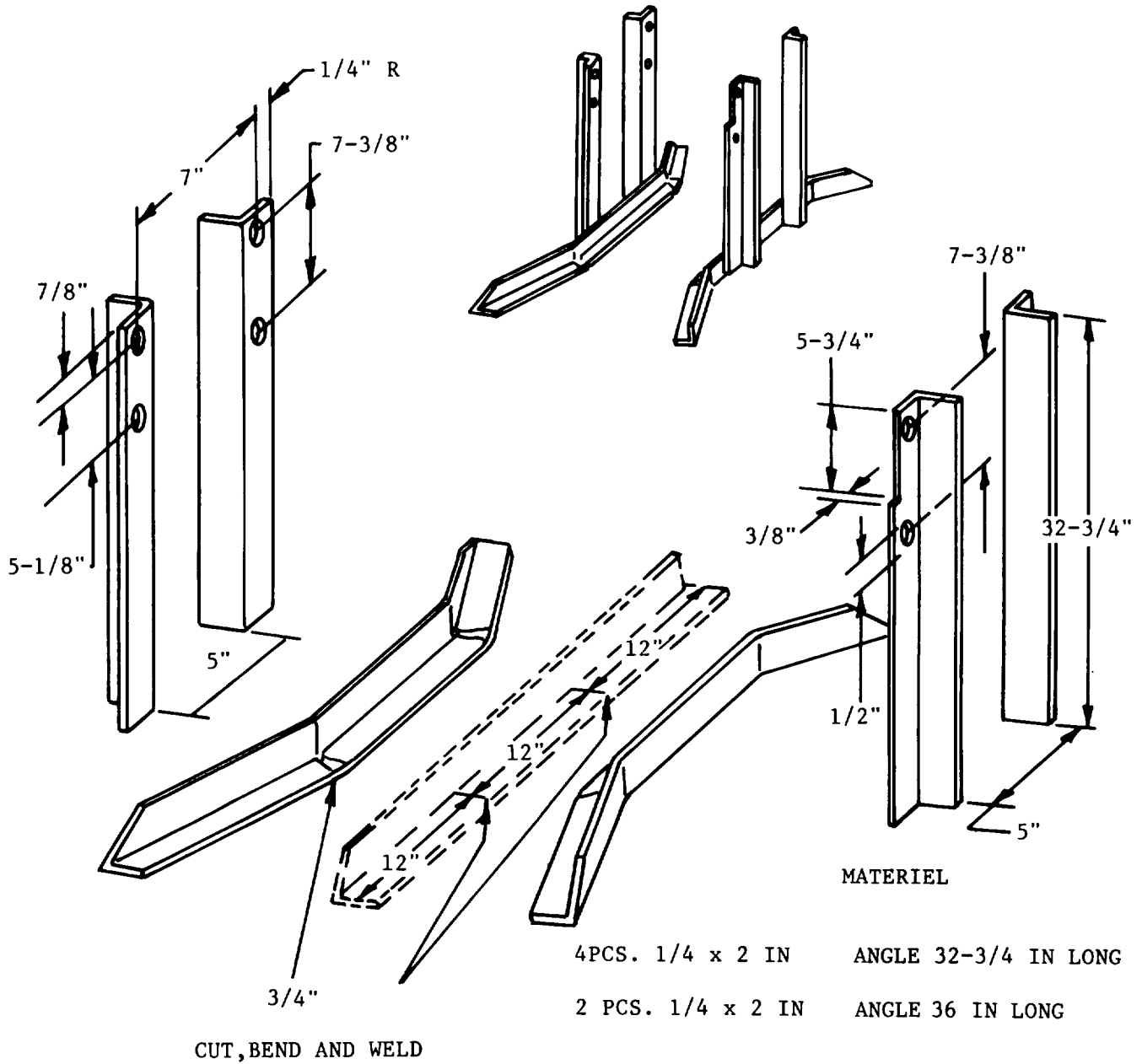
Part D-6. Cylinder Sleeve Holding Adapter



D-7. Output Shaft Oil Seal Installation Tool.

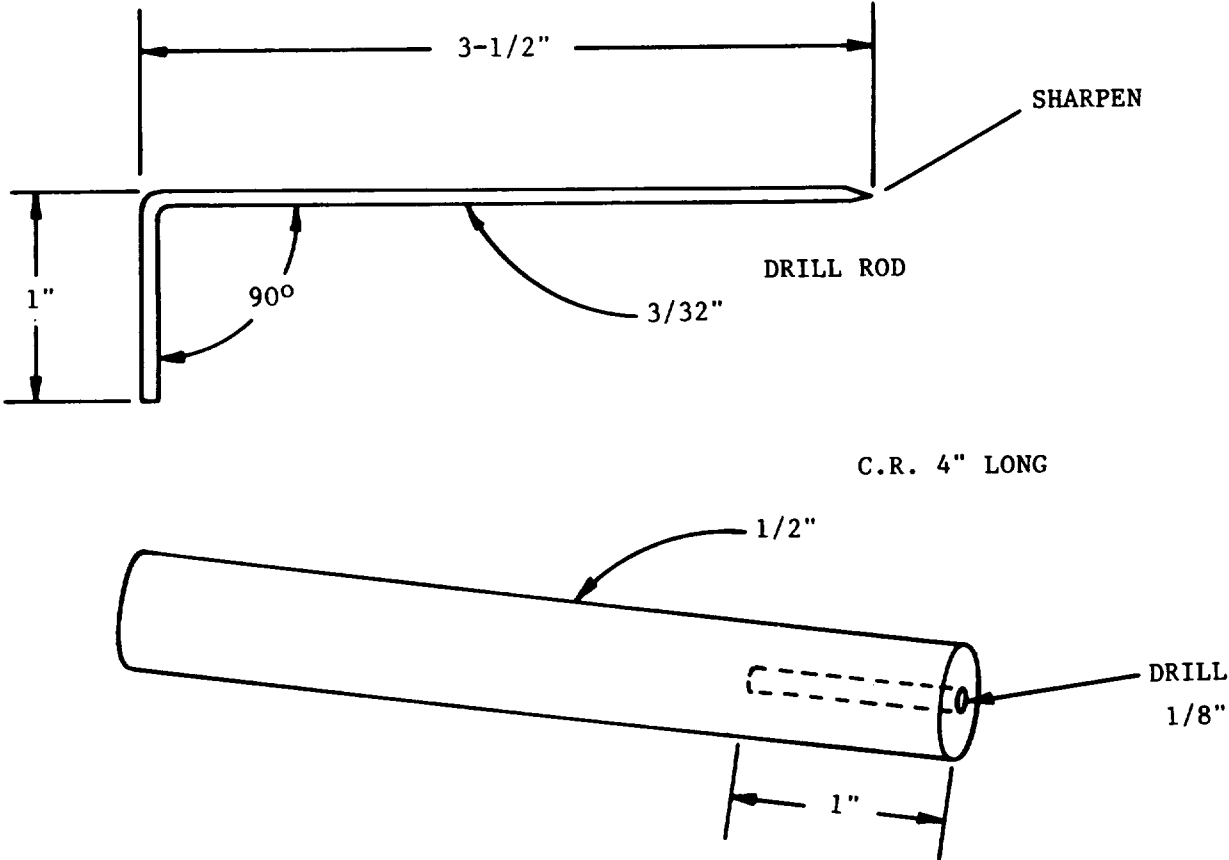


D-8. Lifting Eye



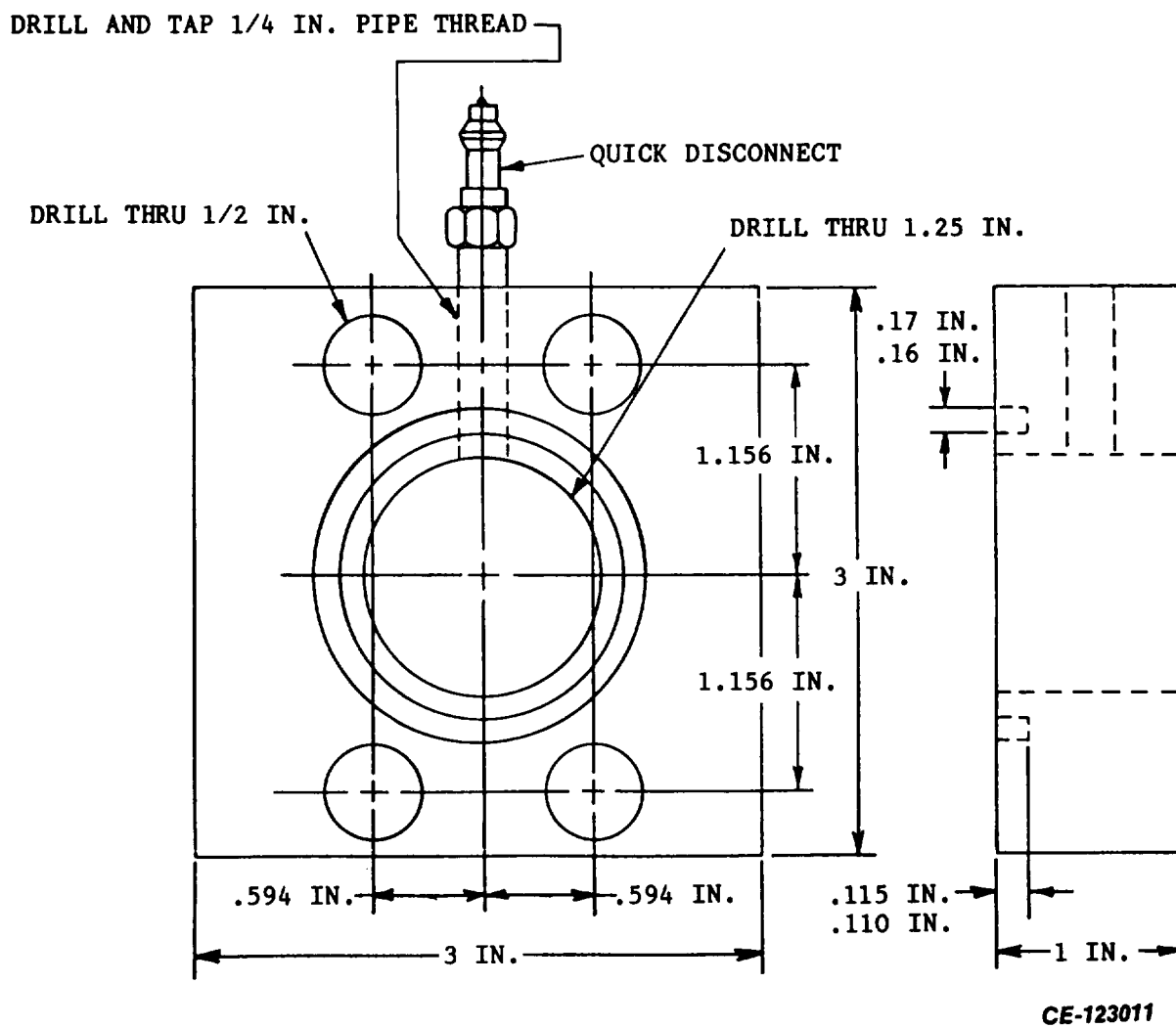
D-9. Transmission Stand





D-10. Clutch Plate Alinement Pin and Extractor Tool





D-12. Sandwich Test Block



APPENDIX E

TORQUE LIMITS

E-1. General Information. This appendix provides general torque limits for fasteners. Special torque values are indicated in the maintenance procedures for applicable components. The general torque values given in this appendix shall be used when specific torque values are not indicated in the maintenance procedures. When applying torque in tightening direction, check torque when the fastener just begins to turn. Conformance is best determined by checking immediately after assembly.

E-2. Torque Limits.

a. Table E-1. Torque Limits for Standard Fasteners. This table provides tightening torque for general purpose applications using Grade 8, coarse thread bolts and nuts, through hardened flat washers (Rockwell "C" 38-45), all phosphate coated, and assembled without supplemental lubrication. The torques shown also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

NOMINAL THREAD DIAMETER	STANDARD TORQUE PLUS OR MINUS 10%	
	FOOT POUNDS	NEWTON METERS
1/4	7	10
5/16	14	19
3/8	24	32
7/16	38	51
1/2	60	80
9/16	80	110
5/8	115	155
3/4	200	270
7/8	320	440
1	480	650
1-1/8	590	800
1-1/4	830	1100
1-3/8	1100	1500
1-1/2	1400	1900
1-3/4	2300	3100
2	3400	4600

APPENDIX E. (cont)

b. Table E-2. Torque Limits for Hose Clamps. This table provides tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating level boots, hydraulic system, etc.).

CLAMP TYPE & SIZE	TORQUE PLUS OR MINUS 0.6 N.m(5 in-lb)			
	RADIATOR, AIR CLEANER, BOOTS, ETC.		HYDRAULIC SYSTEM	
	INCH POUNDS	NEWTON METER	INCH POUNDS	NEWTON METERS
"T" Bolt (Any Diameter)	55-60	6-7	40-50	5-6
Worm Drive--25-50 mm(1-2 in.) Open Diameter & Under	25	3	25	3
Worm Drive--50-102 mm (2-4 in.) Open Diameter	100	11	---	----

c. Table E-3. Torque Limits for Split Flange Connections. This table provides tightening torques for split flange connections used in hydraulic systems. Split flanges and fitting shoulders should fit squarely. Install all bolts finger tight and then torque evenly. Do not overtorque bolts or damage to flanges and/or bolts may occur and leakage may result.

FLANGE SIZE (*)		BOLT SIZE	BOLT TORQUE IN FOOT POUNDS		BOLT TORQUE IN NEWTON METERS		MAX. WORKING PRESSURE	
mm	in.		MIN.	MAX.	MIN.	MAX.	kPa	psi
13	1/2	5/16	15	18	20	24	34474	5000
19	3/4	3/8	22	27	30	37	34474	5000
25	1	3/8	27	35	37	48	34474	5000
32	1-1/4	7/16	35	45	48	61	27579	4000
38	1-1/2	1/2	46	58	62	79	20684	3000
51	2	1/2	55	65	75	88	20684	3000
64	2-1/2	1/2	79	91	107	123	17237	2500
76	3	5/8	138	150	187	203	13790	2000
89	3-1/2	5/8	117	133	159	180	3447	500

(\*)Inside diameter of hydraulic tube or hose fitting.

APPENDIX E (cont)

d. Table E-4. Torque Limits for Tube Nuts. This table provides tightening torques for tube nuts when tubes are flared to use 37 degree fittings. Torque limits given are for plain, cadmium, or zinc plated fittings for wet or dry installations.

FITTING NO.	THREAD SIZE	TORQUE IN FOOT POUNDS		TORQUE IN NEWTON METERS	
		MIN.	MAX.	MIN.	MAX.
4	7/16-20	9	12	12	16
5	1/2 -20	12	15	16	20
6	9/16-18	21	24	29	33
8	3/4 -16	35	40	47	54
10	7/8 -14	53	58	72	79
12	1-1/16-12	77	82	104	111
14	1-3/16-12	90	100	122	136
16	1-5/16-12	110	120	149	163
20	1-5/8 -12	140	150	190	204
24	1-7/8 -12	162	175	217	237
32	2-1/2 -12	225	240	305	325

e. Table E-5. Torque Limits for Hydraulic Fittings. This table provides tightening torques for preformed packing, boss connectors and plugs, 37 degree seat swivel nuts (fittings and hose), and locknuts on adjustable fittings.

FITTING NO.	THREAD SIZE	TORQUE IN FOOT POUNDS		TORQUE IN NEWTON METERS	
		MIN.	MAX.	MIN.	MAX.
4	7/16-20	6	10	8	14
5	1/2 -20	10	15	14	20
6	9/16-18	15	20	20	27
8	3/4 -16	25	30	34	41
10	7/8 -14	35	40	48	54
12	1-1/16-12	60	70	81	95
14	1-3/16-12	70	80	95	109
16	1-5/16-12	80	90	109	122
20	1-5/8 -12	95	115	129	156
24	1-7/8 -12	120	140	163	190
32	2-1/2 -12	250	300	339	407





## GLOSSARY

Terms listed in this manual are adequately defined in the Army, Navy, Air Force, DOS or standard dictionary. The following is a list of abbreviations used in this manual.

A	After
AAL	Additional Authorization List
B	Before
BII	Basic Issue Items
B.O.	Blackout
CCE	Commercial Construction Equipment
COEI	Components of End Item
D	During
DA	Department of Army
D.C.	District of Columbia
DED	Diesel Engine Driven
EIR	Equipment Improvement Recommendations
F	Full
°F	Degrees Fahrenheit
FSCM	Federal Supply Code for Manufacturer
Gal	Gallons
H	High
ICOEI	Integral Components of End Item
In.	Inch
Kg	Kilogram
L	Low
LB	Pounds
LH	Left Hand
M	Medium
MHE	Material Handling Equipment
Mph	Miles per hour
N	Neutral
No.	Number
NSN	National Stock Number
PMCS	Preventive Maintenance Checks and Services
PSI	Pounds per square inch
Qty	Quantity
R	Reverse
RH	Right Hand
Rec'd	Received
SER.	Service
S/N	Serial Number
TAMMS	The Army Maintenance Management System
U/M	Unit of measure



## INDEX

<u>Subject</u>	<u>Page</u>	<u>Subject</u>	<u>Page</u>
		A	B
Adhesives, Application of	2-7	Base, Oil Filter	4-64
Air Compressor	8-62	Bearing Procedures (General Maintenance)	2-26
Alphabetical Index	INDEX 1	Bolster	10-2
Alternator	14-2	Boom Assembly	12-75
Appendix A (References)	A-1	Boom Assembly Valve	12-50
Appendix B (MAC Chart)	B-1	Brake System:	
Appendix C (Expendable Supplies and Materials List)	C-1	Air Compressor	8-62
Appendix D (Illustrated List of Manufactured Items)	D-1	Check Valves-Treadle (S/N 2001 and above)	8-40
Application of Adhesives	2-7	Governor Assembly	8-75
Assembly:		Parking Brake Air Cylinder	8-6
Boom	12-75	Parking Brake Assembly	8-80
Boom Valve	12-50	Power Cluster (S/N 2000 and below)	8-17, 17-2
Carriage, Lifting Forks and Cylinder Head with Valves	12-86	Power Cluster Reservoir (S/N 2000 and below)	8-21
Engine	4-15	Pressure Converter (S/N 2001 and above)	8-26, 17-9
First Gear	15-52	Pressure Converter Reservoir (S/N 2001 and above)	8-31
Fork Valve	12-33	Service Brake Assembly	8-11
Forward and Reverse Steering Gear	15-74	Treadle Two Way Valves (S/N 2000 and below)	8-37
Cylinder Head, with valves	13-8	Treadle Check Valves (S/N 2001 and above)	8-40
Inlet Valve	12-27	Troubleshooting, Parking Brake	8-5
Lifting Forks and Carriage	12-86	Troubleshooting Service Brake	8-2
Parking Brake	8-80	Treadle Valve (S/N 2000 and below)	8-47
Radiator	4-110	Treadle Valve (S/N 2001 and above)	8-54
Rocker Arm and Valve Cover	4-51		
Second and Third Gear	15-59		
Service Brake	8-11		
Steering Gear	9-6		
Tilt Valve	12-42		
Transmission	15-22		
Water Pump	4-112		
Axle:			
Front (S/N 2000 and below)	7-11		
Front (S/N 2001 and above)	7-5		
Rear (S/N 2000 and below)	7-38		
Rear Drive (S/N 2001 and above)	7-32		
Troubleshooting	7-2		

## INDEX(cont.)

<u>Subject</u>	<u>Page</u>	<u>Subject</u>	<u>Page</u>
	C		D
Camshaft and Timing Gears	13-61	Damper, Vibration	4-47
Carriage Assembly, Lifting Forks and	12-86	Destruction to Prevent Enemy Use	1-3
Cautions and Warnings	<b>a</b>	Differences Between Models	1-5
Check Valve, Control Valve and Check Valve-Treadle (S/N 2001 and above)	9-36 8-40	Differential: Front Differential Carrier Assembly	7-18, 16-2
Cleaning (General Maintenance)	2-6	Rear Differential Carrier Assembly	7-46, 16-19
Condition of the Vehicle (General Maintenance)	2-5	Disassembly and Assembly Procedures	2-5
Connecting Rods and Connecting Rod Bearings, Pistons	13-49		E
Control Valve, Transmission	6-54, 15-87	Electrical Repair (General Maintenance)	2-10
Control Valve and Check Valve	9-36	Engine:	
Counterweights	10-19	Assembly	4-15
Crankcase, Cylinder Sleeves	13-14	Camshaft and Timing Gears	13-61
Crankshaft,	13-25	Crankcase Cylinder Sleeves	13-14
Crankshaft Main Bearings	13-34	Crankshaft	13-25
Cylinder:		Crankshaft Main Bearings	13-34
Fork Position (S/N 2000 and below)	12-132	Cylinder Head Assembly with Valves	4-29
Fork Position (S/N 2001 and above)	12-142	Front Cover	13-2
Head Assembly with Valves	4-29, 13-8	Intake and Exhaust Manifolds	4-11
Lift	12-101	Mounts	4-25
Oscillation (S/N 2000 and below)	12-152	Oil Cooler	4-68
Oscillation (S/N 2001 and above)	12-160	Oil Filter Base	4-8
Parking Brake Air	8-6	Oil Pan	4-60
Sideshift (S/N 2000 and below)	12-111	Oil Pressure Regulator Valve	4-73
Sideshift (S/N 2001 and above)	12-121	Oil Pump	13-72
Steering	9-31	Pistons, Connecting Rods and Connecting Rod Bearings	13-49
Tilt	12-65	Rear Oil Seal	13-38
		Rocker Arm Assembly and Valve Cover	4-51
		Engine, Fuel, Exhaust and Cooling Troubleshooting	4-2
		Exhaust Manifolds, Intake and Expendable Supplies and Materials List (Appendix C)	4-76 C-1

INDEX

<u>Subject</u>	<u>Page</u>	<u>Subject</u>	<u>Page</u>
F		G (cont)	
Fan and Clutch	4-117	General Repair Practices (General Maintenance)	2-6
First Gear Assembly	15-52	Governor Assembly	8-75
Flywheel and Housing	13-44	Ground Driven Steering Pump (S/N 2000 and below)	9-14
Fork Control Valve	12-56	Ground Driven Steering Pump (S/N 2001 and above)	9-24
Fork Control Wiring Harness	5-49		
Fork Position Cylinders (S/N 2000 and below)	12-132	H	
Fork Position Cylinders (S/N 2001 and above)	12-142	Heater (S/N 2001 and above)	11-2
Fork Valve Assembly	12-33	Hinge Pin, Frame Assembly	10-6
Forms and Records, Maintenance	1-3	Hoses, Lines and Fittings: Transmission and Torque Converter	6-26
Forward and Reverse Steering Gear Assembly	15-74	Housing, Flywheel and Hydraulic System:	13-44
Frame Assembly and Hinge Pin	10-6	Fork Position Cylinders (S/N 2000 and below)	12-132
Front and Rear Planetary	7-24	Fork Position Cylinders (S/N 2001 and above)	12-142
	16-15	Lift Cylinder	12-101
Front Cover	13-2	Oscillation Cylinder (S/N 2000 and below)	12-153
Front Differential Carrier Assembly	7-18, 16-2	Oscillation Cylinder (S/N 2001 and above)	12-160
Front Axle Assembly (S/N 2000 and below)	7-11	Pump	12-9
Front Axle Assembly (S/N 2001 and above)	7-5	Reservoir and Filter	12-170
Front Lights Wiring Harness	5-53	Sideshift Cylinder (S/N 2000 and below)	12-111
Fuel System:		Sideshift Cylinder (S/N 2001 and above)	12-121
Injectors	4-83, 13-77	Tilt Cylinder	12-65
Injector Lines	4-88	Troubleshooting	12-2
Injection Pump, Cover Plate, Adapter and Drive Gears	4-93		
Solenoid	13-81		
Tank	4-107, 13-96		
G			
Gear:			
Drive	4-93		
First	15-52		
Forward and Reverse Steering	15-74		
Second and Third	15-59		
Steering	9-6		
Timing	13-61		
General Maintenance Procedures	2-1		

INDEX(cont.)

<u>Subject</u>	<u>Page</u>	<u>Subject</u>	<u>Page</u>
<b>I</b>		<b>O</b>	
Illustrated List of Manufactured Items (Appendix D)	D-1	Oil Cooler	4-68
Index, Alphabetical	INDEX 1	Oil Cooler, Transmission	6-58
Index, Troubleshooting	3-1	Oil Filter Base	4-64
Inlet Valve Assembly	12-27	Oil Pan	4-60
Inspection Criteria (General Maintenance)	2-6	Oil Pressure Regulator Valve	4-73
Instrument Panel Wiring Harness	5-17	Oil Pump, Engine	13-72
Intake and Exhaust Manifolds	4-76	Oil Pump Inlet Tube	13-69
Intermediate Wiring Harness (S/N 2000 and Below)	5-41	Oil Seal, Rear	13-38
Intermediate Wiring Harness (S/N 2001 and Above)	5-45	Oscillation Cylinder (S/N 2000 and below)	12-152
Introduction	1-3	Oscillation Cylinder (S/N 2001 and above)	12-160
<b>L</b>		<b>P</b>	
Lift Cylinder	12-101	Parking Brake: Air Cylinder	7-44, 8-6
Lifting Forks and Carriage Assembly	12-86	Assembly	8-80
Lines, Fuel Injector	4-88	Troubleshooting	8-5
Loader Control Valve	12-13	Personnel Precautions	2-2
Lubrication (General Maintenance)	2-7	Pistons, Connecting Rods and Connecting Rod Bearings	13-49
<b>M</b>		Planetary Front and Rear	7-24
Maintenance, General	2-1	Power Cluster (S/N 2000 and below)	8-17, 17-2
Maintenance Forms and Records	1-3	Power Cluster Reservoir (S/N 2000 and below)	8-21
Manifolds, Intake and Exhaust	4-76	Pressure Converter (S/N 2001 and above)	8-26, 17-9
Main Wiring Harness	5-26	Pressure Converter Reservoir (S/N 2001 and Above)	8-31
Models, Differences Between	1-5	Pump:	
Mounts, Engine	4-25	Fuel Injection	4-93
<b>N</b>		Ground Driven Steering (S/N 2000 and below)	9-14
Nomenclature Cross Reference	1-4	Ground Driven Steering (S/N 2001 and above)	9-24
		Hydraulic	12-9
		Oil, Engine	13-72
		Torque Converter Charging	6-20, 15-15
		Water	4-112

## INDEX

<u>Subject</u>	<u>Page</u>	<u>Subject</u>	<u>Page</u>
Q		S (cent)	
Quality Assurance/Quality Control	1-3	Steering Cylinder	9-31
R		Steering System:	
Radiator Assembly	4-110, 13-97	Gear Assembly	9-6
Rear Differential Carrier Assembly	7-46, 16-19	Ground Driven Pump (S/N 2000 and below)	9-14
Rear Axle Assembly (S/N 2000 and below)	7-38	Ground Driven Pump (S/N 2001 and above)	9-24
Rear Drive Axle Assembly (S/N 2001 and above)	7-32	Cylinder	9-31
Rear Oil Seal	13-38	Control Valve and Check Valve	9-36
Rear Planetary, Front and	7-24, 16-15	Circuit Relief Valve	9-51
References (Appendix A)	A-1	Troubleshooting	9-2
Remedies for Injuries (General Maintenance)	2-2	T	
Replacement of Parts (General Maintenance)	2-6	Table of Contents	i
Reporting Equipment Improvement Recommendations (EIR)	1-4	Tank, Fuel	4-107, 13-96
Reservoir:		Tilt Cylinder	12-65
Hydraulic, and Filter	12-170	Tilt Valve Assembly	12-42
Power Cluster (S/N 2000 and below)	8-21	Timing Gears, Camshaft and	13-61
Pressure Converter (S/N 2001 and above)	8-31	Tool Kits (General Maintenance)	2-4
Rocker Arm Assembly and Valve Cover	4-51	Torque Converter:	
Roll Over Protection Structure (S/N 2000 and below)	10-23	Assembly	6-11, 15-2
S		Charging Pump	6-20,
Scheduling Valve, Transmission	6-54	Hoses, Lines and Fittings	6-26
Second and Third Gear Assembly	15-59	Troubleshooting	6-2
Service Brake Assembly	8-11	Transmission:	
Service Brakes Troubleshooting	8-2	Assembly	6-36, 15-22
Sideshift Cylinder (S/N 2000 and below)	12-111	Control Valve	6-54, 15-87
Sideshift Cylinder (S/N 2001 and above)	12-121	Control Valve and Scheduling Valves	6-54
Solenoid	14-3	First Gear Assembly	15-52
Starter Motor	5-2	Forward and Reverse Steering Gear Assembly	15-74
		Hoses, Lines and Fittings	6-26
		Oil Cooler	6-58
		Scheduling Valve	15-95
		Second and Third Gear Assembly	15-59
		Troubleshooting	6-6
		Treadle Valve (S/N 2000 and below)	8-47

INDEX(cont.)

<u>Subject</u>	<u>Page</u>		
T (cont)		W	
Treadle Valve (S/N 2001 and above)	8-54	Warnings	a
Troubleshooting Index		Warranty Information	1-4
Troubleshooting:		Water Pump Assembly	4-112
Axle, Front and Rear	7-2	Wiring Harness:	
Engine, Fuel, Exhaust and Cooling	4-2	Fork Control	5-49
Hydraulic	12-2	Front Lights	5-53
Index	3-2	Instrument Panel	5-17
Parking Brake	8-5	Intermediate (S/N 2000 and below)	5-45
Service Brake	8-2	Intermediate (S/N 2001 and above)	5-41
Steering	9-2	Main	5-26
Torque Converter	6-2		
Transmission	6-6		
Turbocharger	3-81		
Turbocharger and Piping	4-101		
Two-way Valves, Treadle (S/N 2000 and below)	8-37		
V			
Valve Assembly:			
Boom Assembly Valve	12-50		
Check Valves-Treadle (S/N 2001 and Above)	8-40		
Fork Control Valve	12-56		
Fork Valve	12-33		
Inlet Valve	12-27		
Loader Control Valve	12-13		
Oil Pressure Regulator Valve	4-61		
Steering Control Valve and Check Valve	9-36		
Steering Circuit Relief Valve	9-51		
Tilt Valve	12-42		
Transmission Control Valve	15-87		
Transmission Scheduling Valve	15-95		
Treadle Two-way Valves (S/N 2000 and below)	8-37		
Treadle Valve (S/N 2000 and below)	8-47		
Treadle Valve (S/N 2001 and above)	8-54		
Valve Cover, Rocker Arm Assembly and	4-51		
Vehicle Precautions (General Maintenance)	2-3		
Vibration Damper	4-47		



By Order of the Secretary of the Army:

CARL E. VUONO  
General, United States Army  
Chief of Staff

Official:

WILLIAM J. MEEHAN II  
Brigadier General, United States Army  
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25F (Block No. 2241) Direct Support/General Support maintenance requirements for Fork Lift, 10,000 LB Capacity, Rough Terrain, Pneumatic Tire, Diesel (Model-MHE-236).



RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

Your mailing address

DATE SENT

Date you fill out this form

PUBLICATION NUMBER

TM X-XXXX-XXX-XX

PUBLICATION DATE

Date of TM

PUBLICATION TITLE

Title of TM

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
3		2	
109		51	
2-B			2-1
12	1-6a		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Item 10. Change illustration. Reason: Tube end shown assembled on wrong side of lever cam.

Item 3. The NSN and P/N are not listed on the AMDF nor the MCRL. Request correct NSN and P/N be furnished.

Preventive Maintenance Checks and Services. Item 7 under "Items to be inspected" should be changed to read as follows: Firing linkage and firing mechanism pawl.

Since there are both 20- and 30- round magazines for this rifle, data on both should be listed.

SAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

SAMPLE

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

SGT Smith  
101st Trans Co  
APO NY 09101

OFFICIAL BUSINESS

TEAR ALONG PERFORATED LINE

Commander  
US Army Tank-Automotive Command  
ATTN: AMSTA-MB  
Warren, Michigan 48397-5000

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL!

**SOMETHING WRONG WITH THIS PUBLICATION?**

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

TM 10-3930-643-34

PUBLICATION DATE

30 January 1990

PUBLICATION TITLE

Direct Support and General Support Maintenance Manual

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO

PARA-GRAPH

FIGURE NO

TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

---

---

TEAR ALONG PERFORATED LINE

Commander  
US Army Tank-Automotive Command  
ATTN: AMSTA-MB  
Warren, Michigan 48397-5000



FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

TEAR ALONG PERFORATED LINE

Commander  
US Army Tank-Automotive Command  
ATTN: AMSTA-MB  
Warren, Michigan 48397-5000



RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



**SOMETHING WRONG WITH THIS PUBLICATION?**

THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

TM 10-3930-643-34

PUBLICATION DATE

30 January 1990

PUBLICATION TITLE

Direct Support and General Support  
Maintenance Manual

BE EXACT. PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
---------	------------	-----------	----------

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

TEAR ALONG PERFORATED LINE

Commander  
US Army Tank-Automotive Command  
ATTN: AMSTA-MB  
Warren, Michigan 48397-5000

## THE METRIC SYSTEM AND EQUIVALENTS

### LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches  
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches  
 1 Kilometer = 1000 Meters = 0.621 Miles

### 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

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1000 Grams = 2.2 Lb  
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches  
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

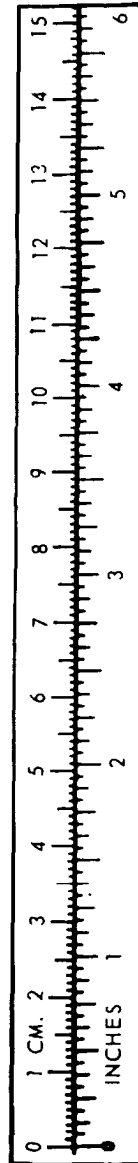
### TEMPERATURE

$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$   
 212<sup>o</sup> Fahrenheit is equivalent to 100<sup>o</sup> Celsius  
 90<sup>o</sup> Fahrenheit is equivalent to 32.2<sup>o</sup> Celsius  
 32<sup>o</sup> Fahrenheit is equivalent to 0<sup>o</sup> Celsius  
 $9/5 \text{ C}^{\circ} + 32 = \text{F}^{\circ}$

### APPROXIMATE CONVERSION FACTORS

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
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

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
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



TA089991

