

TECHNICAL MANUAL

**DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE**

**TRUCK TRACTOR, LINE HAUL,
50,000 GVWR, 6 X 4, M915 (NSN 2320-01-028-4395)**
**TRUCK TRACTOR, LIGHT EQUIPMENT TRANSPORTER
(LET), 56,000 GVWR, 6 X 6, W/WINCH
M916 (NSN 2320-01-028-4396)**
**TRUCK TRACTOR, MEDIUM EQUIPMENT TRANSPORTER
(MET), 75,000 GVWR, 8 X 6, W/WINCH
M920 (NSN 2320-01-028-4397)**
**TRUCK CHASSIS, 75,000 GVWR, 8 X 6,
FOR 20-TON DUMP TRUCK,
M917 (NSN 3805-01-028-4389)**
**TRUCK CHASSIS, 56,000 GVWR, 6 X 6,
FOR BITUMINOUS DISTRIBUTOR TRUCK,
M918 (NSN 3895-01-028-4390)**
**TRUCK CHASSIS, 75,000 GVWR, 8 X 6,
FOR CONCRETE-MOBILE[®] MIXER TRUCK,
M919 (NSN 3895-01-028-4391)**

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pages from Change 1.

CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC 8 April 1987

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
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(NSN 3805-01-028489)
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(NSN 3895-01-028=)
TRUCK CHASSIS, 75,000 GVWR, 8 X 6, FOR
CONCRETE-MOBILE @MIXER TRUCK, M919
(NSN 3895-01-0284~1)

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3-1 /3-2 (Blank)	3-1 thru 3-10
749 and 7-50	749 and 7-50
7-63 and 7-64	7-63 and 7-64
7-85 thru 7-88	7-85 thru 7-88
7-143 thru 7-146	7-143 thru 7-146
7-153 and 7-154	7-153 and 7-154
7-161 and 7-162	7-161 and 7-162
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Index-3 and index-4	Index-3 and Index 4
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General, United States Army
Chief of Staff

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Brigadier General, United States Army
The Adjutant General

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To be distributed in accordance with DA Form 12-38, Direct Support and General Support Maintenance requirements for Truck, Tractor, 6 x 4, M915, 6 x 6, M916, 8 x 6, M920, Truck, Chassis, 8 x 6, M917, 6 X 6, M918 and 8 X 6, M919.

CHANGE }
No 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
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Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form **12-38**, Direct and General Support Maintenance requirements for Truck, Tractor, Line Haul : 6X4,M915; Truck, Tractor, Light Equipment Transporter: 6X6, M916;Truck, Tractor, Medium Equipment Transporter: 8X6, M920.

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WARNING

Minor concentrations of acetic acid vapor may be produced during application of silicone gasket material. Adequate ventilation should be provided when silicone is applied in confined areas. Further, eye contact may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

When using alkali cleaners, avoid skin contact or inhalation. Skin rashes and toxic effects may result.

When using solvent-type cleaners, avoid skin contact, inhalation, or conditions that may cause fire hazards.

Particles blown by compressed air are hazardous. Make certain air stream is directed away from you and other personnel in the area.

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.).

During normal operation, the turbocharger and outlet pipe can become very hot. Be careful not to touch these components with your bare hands. These components may be hot enough to cause severe burns.

Some tests require the ratio selector lever to be moved from the neutral position. Before any of the transmission operation tests are made disconnect the truck drive shaft from the yoke of the transmission, refer to TM 9-2320-273-20.

Diaphragm is spring loaded. Cage chamber while removing nut or injury might result.

Do not attempt disassembly or knuckle repair with the vehicle supported by jacks only. Severe injury can result from an inadequately supported vehicle.

The spring brake air chamber employs a spring with high forces and extreme care should be used to service this air chamber only as outlined in the procedure. Deviating from the procedure may result in injury as a result of the high spring force. **DO NOT ATTEMPT DISASSEMBLY UNTIL YOU HAVE READ AND UNDERSTAND THE FOLLOWING INSTRUCTIONS.** DO NOT uncage the compression spring with the spring brake chamber removed from the assembly as the spring free length is greater than the release stud length. If service of the spring brake housing, compression spring, or pressure plate is required, replace with a spring brake assembly.

Exercise care to avoid skin rashes, fire hazards, and inhalation of vapors when using SD-2 solvent-type cleaners.

Do not use a cutting torch to remove the equalizer beam center bushings or end bushings. All equalizer beams are heat treated for strength and long service life. The use of heat could adversely effect the strength of the equalizer beams.

The weight of the vehicle must be supported by overhead hoisting equipment, floor jacks, or support stands at all times. Do not attempt to support the weight of the vehicle on a hydraulic jack.

TECHNICAL MANUAL
No. 9-2320-273-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
 WASHINGTON, DC, 19 December 1980

DIRECT SUPPORT AND GENERAL SUPPORT
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(NSN 3895-01-028-4391)

REPORTING ERRORS AND
RECOMMENDING IMPROVEMENTS

You can help improve this publication. 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 publication direct to: US Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope.

a. This technical manual contains instructions for Direct Support and General Support maintenance of the M915, M916, and M920 truck tractor and chassis of M917, M918, and M919 vehicles.

b. Appendix A contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to the M915 series vehicles.

c. Appendix B contains a list of all supplies and materials needed to perform the maintenance specified in this manual.

1-2. Maintenance Forms and Records. Equipment maintenance forms and procedures for their use are contained in TM 38-750, the Army Maintenance Management System (TAMMS).

1-3. Reporting Equipment Improvement Recommendations (EIR). EIR's will be prepared using DA Form 2407, Maintenance Request. Instructions for preparing E I R's are provided in TM 38-750, The Army Maintenance Management System. E I R's should be mailed directly to: Commander, U.S. Army, Tank-Automotive Command, ATTN: DRSTA-MBA, Warren, Michigan 48090. A reply will be furnished directly to you.

1-4. Destruction of Army Materiel to Prevent Enemy Use. Procedures outlined in TM 750-244-6 (Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use) are applicable to this equipment.

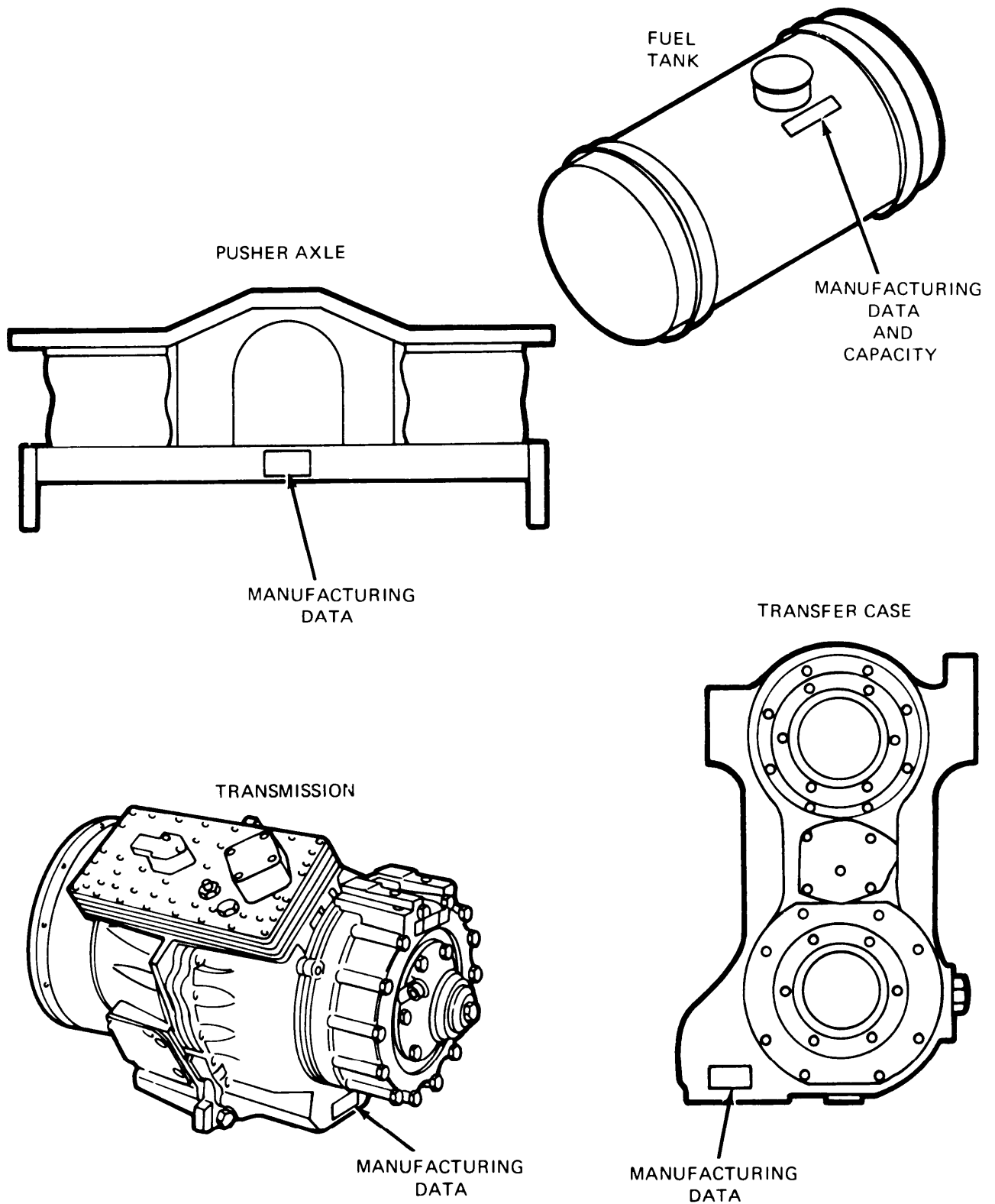
Section II. DESCRIPTION AND DATA

1-5. Description. This manual contains descriptions of the components serviced at Direct Support and General Support maintenance. Vehicle description can be found in TM 9-2320-273-20, chapters 1 and 2.

1-6. Tabulated Data. Vehicle tabulated data, including major components can be found in TM 9-2320-273-20, Approximate coolant, fuel, lubricant, and hydraulic capacities are as follows:

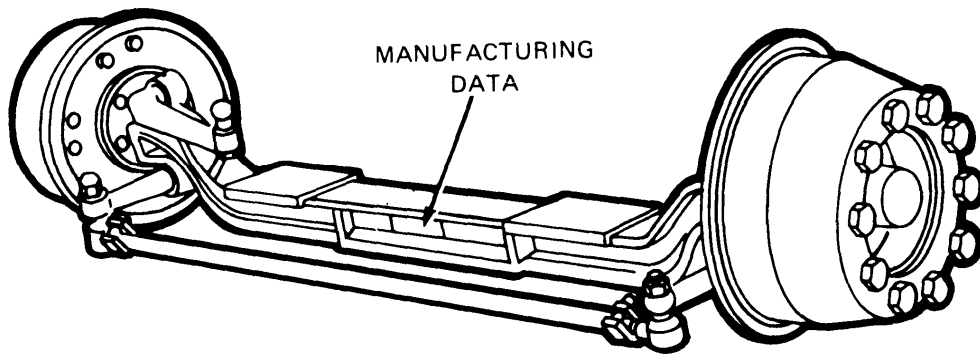
	<u>REFILL</u>	<u>DRY</u>
a. Engine Cooling System	65 qts /62 l)	69 qts (65 l)
b. Engine Lubricating System (Including Engine and Bypass Filter)	46 qts (44 l)	46 qts (44 l)
c. Fuel Tank	110 gals (416 l) (useable)	118gals. (447 l)
d. Transmission (with clutch housing drained)	22 qts (21 l)	22 qts (21 l)
e. Front Axle (M916 thru M920)	35 pts (17 l)	35 pts (17 l)
f. Forward Rear Axle (M916 thru M920)	34 pts (16 l)	34 pts (16 l)
g. Rear Rear Axle (M916 thru M920)	28 pts (13 l)	28 pts (13 l)
h. Forward Rear Axle (M915)	40 pts (19 l)	40 pts (19 l)
i. Rear Rear Axle (M915)	36 pts (17l)	36 pts (17l)
j. Power Steering	2 qts (2 l)	2 qts (2 l)
k. Winch Hydraulic Reservoir (M916 and M920)	42 gals (159 l)	42 gals (159 l)
l. Winch Drum (M916 and M920)	2 qts (2 l)	2 qts (2 l)

1-7. Data and Instruction Plates. Data and instruction plates with operator-type information are described and illustrated in TM 9-2320-273-10. Additional data and instruction plates are shown in figure 1-1.

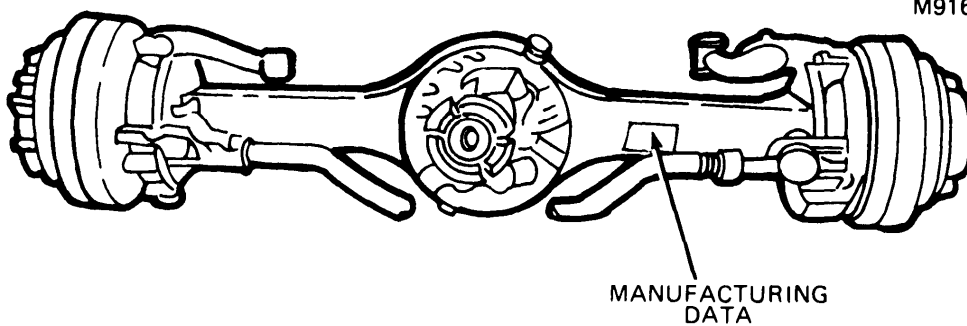


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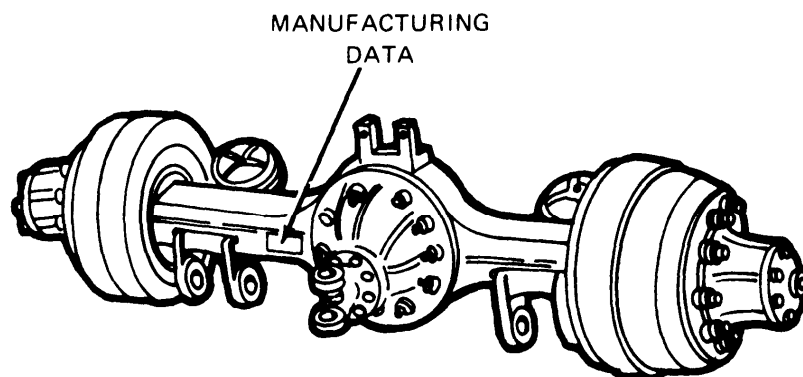
Figure 1-1. Data and instruction Plates (Sheet 1 of 2).



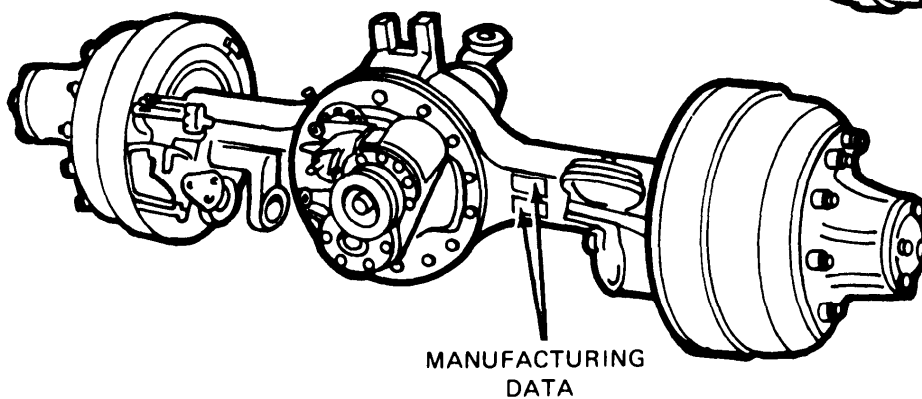
M915 – FRONT



M916 THRU M920 – FRONT



REAR REAR AXLE



FORWARD REAR AXLE

TA 073953

Figure 1-7. Data and instruction Plates (Sheet 2 of 2).

CHAPTER 2

MAINTENANCE INSTRUCTIONS

Section 1. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. Special Tools and Equipment. Special tools and equipment specified for use in this manual are listed in TM 9-2320-273-34P, Direct Support and General Support Repair Parts and Special Tools List.

2-2. Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools list covering Direct Support and General Support Maintenance, TM 9-2320-273-34P.

2-3. Fabricated Tools and Equipment. (See Table 2-1.)

Table 2-1. Fabricated Tools and Equipment

	DESCRIPTION	USE	MATERIALS AND DETAIL DRAWING
1.	Adjustment Gage	Starter Adjustment	Fig. 5-39
2.	Timing Gage	Starter Timing	Fig. 5-39
3.	Test Set	Transmission Testing	Fig. 7-54
4.	Bushing Removal/ Installation Tool	Replace Steering Knuckle Bushings	Fig. 9-7

Section II. TROUBLESHOOTING

2-4. Introduction. This section provides procedures to troubleshoot vehicle systems, assemblies, and components for which repairs are authorized at Direct Support and General Support maintenance level. These procedures supplement the following troubleshooting procedures for the M915 series vehicles.

- a. Operator/crew level (TM 9-2320-273-10)
- b. Organizational level (TM 9-2320-273-20)
- c. Engine Direct Support and General Support level (TM 9-2815-222-34 & P)

To assist in isolating a problem, see one of the following procedures in this section:

PROCEDURE	TABLE
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Table 2-2. Alternator Troubleshooting Procedures.

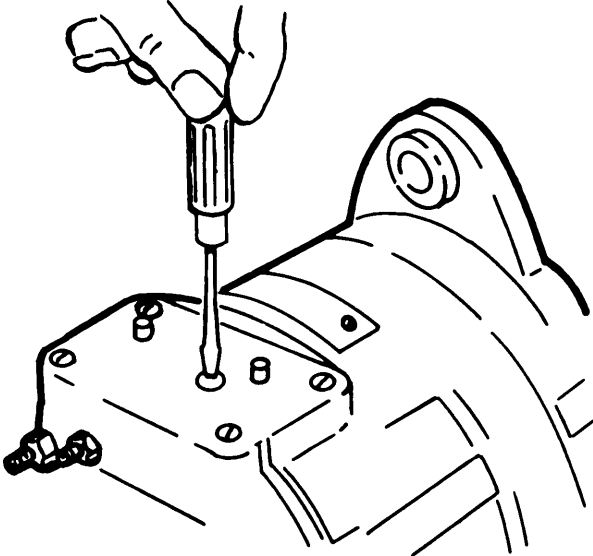
MALF	STEP	INSTRUCTION	INDICATION	YES	NO	REMARKS
		NOTE The procedures in this table may be accomplished on the vehicle or on a test stand. Before performing troubleshooting procedures on the vehicle, check to see that the drive belts are not slipping and the associated wiring is not defective. These are common problems that will invalidate the alternator tests.				
		ALTERNATOR DOES NOT CHARGE.				
		NOTE Determine if problem is the alternator or regulator.				
	1.	Connect voltmeter across battery with engine stopped.				Record voltmeter indication.
	2.	Start engine.	1000 rpm	Go to step 3.		
	3.	Remove plastic cap from regulator and turn adjusting screw back and forth as shown below.	13.6V to 14.2V			If indication is high and cannot be lowered by adjustment screw, regulator is bad. Replace regulator. If the output voltage is low and cannot be raised, either the alternator, regulator, or diode trio may be at fault. Go to step 4.
						

Table 2-2. Alternator Troubleshooting Procedures (Continued).

MALF	STEP	INSTRUCTION	INDICATION	YES	NO	REMARKS
	5.	Remove regulator (para 5-3b (3)) and visually inspect.	Printed circuit track has burned open. (This will generally be the track from the positive regulator terminal to one of the brush terminals.)	Replace regulator.	Go to step 6.	
	6.	Check brush spring caps and their contacts.	Dirt and/or corrosion.	Clean and recheck alternator. If alternator still does not operate properly, repair it (para 5-5).	Repair alternator (para 5-5).	

Table 2-3. Transmission. and Shift Controls Troubleshooting Procedures

MALFUNCTION	
TEST OR INSPECTION	CORRECTIVE ACTION
<p style="text-align: center;">NOTE</p> <p style="text-align: center;">All transmission test and disassembly procedures are provided in chapter 7. See figures 7-51 and 7-55 for location of test ports specified in this table. For parts replacement, refer to applicable portion of ratio selector disassembly and assembly procedures (para 7-3 and 7-5); or case disassembly and assembly procedures (para 7-17 and 7-19).</p>	
1. ENGINE DOES NOT TURN DRIVE SHAFT IN ANY SPEED, FORWARD OR REVERSE.	
Step 1. Check to see if transmission charging valve on ratio selector is pushed in (open).	Push valve in.
Step 2. Check to see if air pressure is going to transmission.	Troubleshoot vehicle compressed air system.
Step 3. Check umbilical cord and connections for air leaks.	Replace or repair leaks at connection.
Step 4. Check oil pressure (para 7-10).	<ul style="list-style-type: none"> a. Check oil level and condition. b. Check oil pump and screen, c. Replace oil pump (para 7-17).
Step 5. Check output clutch pressure (para 7-8a).	<ul style="list-style-type: none"> a. If output clutch has pressure, remove and repair or replace output clutch assembly (para 7-17). b. If output clutch has no pressure, go to step 6.
Step 6. Check for air pressure to ratio selector.	<ul style="list-style-type: none"> a. Loosen umbilical cord connection at transmission end. b. If air pressure is present, repair or replace ratio selector (para 7-2). c. If no air pressure is present, replace transmission control (para 7-17). d. Replace umbilical cord gasket at transmission end and tighten umbilical cord.

Table 2-3. Transmission and Shift Controls Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 7. Check input clutch (fig. 7-1).	Remove, inspect, and repair or replace input clutch (para 7-17).
	Step 8. Check gear group (fig. 7-1).	Repair as required (para 7-1 7).
2. ENGINE TURNS DRIVE SHAFT IN ALL FORWARD SPEEDS, BUT WILL NOT TURN DRIVE SHAFT IN ANY REVERSE SPEED.	Step 1. Check air pressure at REVERSE gage hole on transmission (2, fig. 7-47).	a. If no pressure is present, repair or replace ratio selector, control line and gasket (para 7-2). b. If pressure is present, go to step 2.
	Step 2. Check gear group.	a. Inspect reverse shift fork and gearing. Repair as required (para 7-17). b. If gearing is not damaged, go to step 3.
	Step 3. Replace transmission control (para 7-17).	
3. TRANSMISSION RATIO CHANGE TOO SLOW AND IS NOT SMOOTH WHEN GEARS SHIFT.	Step 1. Check pressure regulator output clutch pressure (para 7-8a).	a. Correct any pressures that are not within tolerances. b. If pressures are correct, go to step 2.
	Step 2. Check quick fill valve pressure (para 7-9).	a. Correct pressure if it is not within tolerances. b. If pressure is correct, go to step 3.
	Step 3. Check input clutch and brakes for pressure pulses during shift.	Replace transmission control (para 7-17).
	Step 4. Remove, inspect, and repair or replace rear clutch assembly (para 7-17).	

Table 2-3. Transmission and Shift Controls Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 5. Remove, inspect, and repair or replace front clutch (para 7-17).	
	Step 6. Remove, inspect, and repair or replace ratio selector (para 7-2).	
4. ENGINE RPM INCREASES BUT TRUCK SPEED DOES NOT.	Step 1. Check pressure regulator output clutch pressure (para 7-8a).	a. Correct any pressures that are not within tolerances. b. If pressures are correct, go to step 2.
	Step 2. Remove, inspect, and repair or replace rear clutch assembly (para 7-17).	
	Step 3. Remove, inspect and repair or replace input clutch assembly.	
	Step 4. Replace transmission control (para 7-17).	
5. TRANSMISSION OIL LEVEL DECREASES.	Step 1. Check transmission case breather (4, fig. 7-47).	a. If clogged, clean or replace. b. If open, go to step 2.
	Step 2. Check for leaks at output shaft seal (para 7-11).	Replace.
	Step 3. Check for leaks at transmission subassemblies mating surfaces.	Disassemble and assemble transmission to correct any leaks (para 7-17).
	Step 4. Check engine crankshaft rear seal.	Replace. (Refer to TM 9-281 5-222-34& P.).
6. TRANSMISSION OIL LEVEL INCREASES.	Engine crankshaft rear seal leaking. (Refer to TM 9-281 5-222-34& P.)	

Table 24. Transfer Assembly Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. TRANSFER WILL NOT SHIFT INTO GEAR.	Step 1. Check for broken diaphragm in declutch air chamber.	Replace diaphragm (para 8-3 C).
	Step 2. Check for broken or bent shift rod (see fig. 8-11).	Replace faulty component (para 8-3 through 8-6).
	Step 3. Check for damaged or worn internal case components.	Replace faulty components (para 8-3 through 8-6).
2. TRANSFER WILL NOT STAY IN GEAR.	Check for damaged or worn internal case components.	Replace faulty components (para 8-3 through 8-6).
3. EXCESSIVE NOISE DURING OPERATION.	Check for damaged or worn internal case components.	Replace faulty components (para 8-3 through 8-6).
4. LUBRICANT LEAKING.	Step 1. Check for defective seals or gaskets.	Replace seals or gaskets (para 8-3 through 8-6).
	Step 2. Check for cracked case.	Replace defective case (para 8-3 through 8-6).

Table 2-5. M916/M920 Front Axle Troubleshooting Procedures.

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

1. EXCESSIVE NOISE,
- Step 1. Check for damaged or worn pinion bearings,

Replace faulty bearings (para 10-3 through 10-8).
- Step 2. Check for damaged or worn differential side carrier bearing.

Replace defective bearings (para 10-3 through 10-8).
- Step 3. Check for defective spider gears.

Replace defective gears (para 10-3 through 10-8).
- Step 4. Check for damaged or worn ring and pinion gears.

Replace defective gears (para 10-3 through 10-8).
2. LUBRICANT LEAKING.
- Step 1. Check for defective seals or gaskets,

Replace seals or gaskets (para 10-3 through 10-8).
- Step 2. Check for cracked housing.

Replace defective housing (para 10-3 through 10-8).

Table 2-6. M915 Rear Axle Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. EXCESSIVE PLAY (BACKLASH).	Step 1. Check differential bearing adjustment.	<ul style="list-style-type: none"> a. Remove differential carrier. (Refer to para 11-4 for forward rear axle or para 11-14 for rear rear axle.) b. Adjust bearing (para 11-9e or 11-17i, as applicable).
	Step 2. Check for damaged or worn differential.	Replace differential (para 11-5 through 11-10, or 11-15 through 11-18, as applicable),
2. EXCESSIVE NOISE.	Step 1. Check for damaged or worn pinion bearings.	<ul style="list-style-type: none"> a. Remove differential carrier. (Refer to para 11-4 for forward rear axle or para 11-14 for rear rear axle.) b. Replace defective bearings (para 11-5 through 11-10, or para 11-15 through 11-18, as applicable).
	Step 2. Check for damaged or worn side carrier bearings.	Replace defective bearings (para 11-5 through 11-9., or para 11-15 through 11-18, as applicable).
	Step 3. Check for damaged or worn spider gears.	Replace defective gears (para 11-5 through 11-9, or para 11-15 through 11-18, as applicable).
	Step 4. Check for damaged or worn ring and pinion gears.	Replace defective gear set (para 11-5 through 11-9, or para 11-15 through 11-18, as applicable).

Table 2-6. M915 Rear Axle Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. LUBRICANT LEAKING.		
Step 1. Check for defective seals or gaskets.		
a. Remove differential carrier, if necessary to replace defective seal or gasket. (Refer to para 11-4 for forward rear axle or para 11-14 for rear rear axle.)		
b. Replace defective seals or gaskets (para 11-5 through 11-10, or para 11-15 through 11-18, as applicable).		
Step 2. Check for cracked housing.		
a. Remove differential carrier. (Refer to para 11-4 for forward rear axle or para 11-14 for rear rear axle.)		
b. Replace housing (para 11-5 through 11-10, or para 11-15 through 11-18, as applicable).		

Table 2-7. M916/M920 Rear Axle Troubleshooting Procedures.

MALFUNCTION	
TEST OR INSPECTION	CORRECTIVE ACTION
1. EXCESSIVE PLAY (BACKLASH).	<p>Step 1. Check differential bearing adjustment.</p> <ul style="list-style-type: none"> a. Remove differential carrier. (Refer to para 12-4 for forward rear axle or para 12-13 for rear rear axle). b. Adjust bearing (para 11-9e). <p>Step 2. Check for damaged or worn differential.</p> <p>Replace differential (para 12-5 through 12-9, or 12-14 through 12-17, as applicable)</p>
2. EXCESSIVE NOISE.	<p>Step 1. Check for damaged or worn pinion bearings.</p> <ul style="list-style-type: none"> a. Remove differential carrier. (Refer to para 12-4 for forward rear axle or para 12-13 for rear rear axle.) b. Replace defective bearings (para 12-5 through 12-9, or para 12-14 through 12-17, as applicable.) <p>Step 2. Check for damaged or worn side carrier bearings.</p> <p>Replace defective bearings (para 12-5 through 12-9, or para 12-14 through 12-17, as applicable).</p> <p>Step 3. Check for damaged or worn spider gears.</p> <p>Replace defective gears (para 12-5 through 12-9, or para 12-14 through 12-17 as applicable).</p> <p>Step 4. Check for damaged or worn ring and pinion gears.</p> <p>Replace defective gear set (para 12-5 through 12-9 or Para 12-14 through 12-17, as applicable).</p>
3. LUBRICANT LEAKING.	<p>Step 1. Check for defective seals or gaskets.</p> <ul style="list-style-type: none"> a. Remove differential carrier, if necessary to replace defective seal or gasket. (Refer to para 12-4 for forward rear axle or para 12-13 for rear rear axle). b. Replace defective seals or gaskets (para 12-5 through 12-9, or para 12-14 through 12-17, as applicable).

Table 2-7. M916/M1920 Rear Axle Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	Step 2. Check for cracked housing,	<ul style="list-style-type: none"> a. Remove differential carrier. (Refer to para 12-4 for forward rear axle or para 12-13 for rear rear axle.) b. Replace housing (para 12-5 through 12-9, or para 12-14 through 12-17, as applicable).

Table 2-8. Brake Troubleshooting Procedures.

MALFUNCTION	
TEST OR INSPECTION	CORRECTIVE ACTION
AIR COMPRESSOR	
1. COMPRESSOR FAILS TO MAINTAIN ADEQUATE PRESSURE.	
Step 1. Check compressor unloader valve action (para 14-2).	Repair the compressor cylinder head group (para 14-3 through 14-8).
Step 2. Check vehicle air system (TM 9-2320-273-20).	Replace faulty component(s) (TM 9-2320-273-20).
2. COMPRESSOR IS NOISY.	
Step 1. Check for excessive carbon in compressor cylinder head or discharge line.	Repair cylinder head or discharge line (para 14-3 through 14-8).
Step 2. Check for worn or burned out bearings.	Replace bearings (para 14-3 through 14-8).
Step 3. Check for worn spline or coupling.	Replace spline or coupling (para 14-3 through 14-8).
3. COMPRESSOR IS PUMPING OIL.	
Step 1. Check for broken ring(s).	Replace rings (para 14-3 through 14-8).
Step 2. Check for worn or damaged cylinder bore.	Repair (para 14-3 through 14-8).
Step 3. Check for bent connecting rod.	Replace (para 14-3 through 14-8).

Table 2-8. Brake Troubleshooting procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
4. COMPRESSOR DOES NOT UNLOAD.		
Step 1. Check air governor for proper operation (TM 9-2320-273-20). Adjust or replace (TM 9-2320-273-20).		
Step 2. Check for defective unloader or cap guide seal (para 14-2). Repair or replace (para 14-3 through 14-8).		
Step 3. Check for unloading cavity plugged with carbon. Repair or replace (para 14-3 through 14-8).		
Step 4. Check for binding unloading cap. Repair or replace (para 14-3 through 14-8).		
Step 5. Check unloader spring for failure. Replace (para 14-3 through 14-8).		
Step 6. Check unloader cap for proper seat on intake valve seat. Repair or replace (para 14-3 through 14-8).		
5. COMPRESSOR HEAD IS LEAKING WATER.		
Step 1. Check capscrews for proper torque. Torque properly (para 14-3 through 14-8).		
Step 2. Check for cracked or porous head or head cover. Replace (para 14-3 through 14-8).		
Step 3. Check fittings for proper installation. Install properly.		

Table 2-9. Steering System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. ABNORMAL NOISE.	Step 1. If a clicking noise is heard when initiating a steering maneuver, or when changing directions of turn, some linkage component is probably loose and shifting under load.	Tighten or replace loose or defective components.
	Step 2. Check for excessive air in the fluid (fluid is foamy) and/or low fluid level.	Fill the pump reservoir to the proper level (LO 9-2320-273-12).
2. NO RECOVERY.	Step 1. Disconnect the lower steering column from the steering gear and check both upper and lower columns for binding.	Repair or replace defective column or universal joint. (Refer to TM 9-2320 -273-20.)
	Step 2. Check for sufficient pump pressure per paragraph 16-4.	Repair the power steering pump (para 16-5 through 16-11).
3. EXTERNAL OIL LEAKS FROM STEERING GEAR.	NOTE	
	External leakage is not acceptable from the steering gear.	
	Step 1. Check for leak at the rubber relief plug (on frame side of the steering gear).	Replace the steering gear (para 16-2 and 16-3).
	Step 2. Check for leak at shaft seals.	Replace steering gear (para 16-2 and 16-3).

Table 2-9. Steering System Troubleshooting Procedures (Continued).

MALFUNCTION	
TEST OR INSPECTION	
CORRECTIVE ACTION	
4. OVERSTEER OR DARTING.	
Step 1. Disconnect the lower steering column from the steering gear and check both upper and lower columns for binding.	Repair or replace defective column or universal joint. (Refer to TM 9-2320 -273-20.)
Step 2. Disconnect the steering gear pitman arm and check front end components for binding.	Repair or replace defective component. (Refer to TM 9-2320 -273-20.)
Step 3. Power steering gear flow control valve sleeve binding.	Replace steering gear (para 16-2 and 16-3).
5. HIGH STEERING EFFORT IN ONE DIRECTION.	
Step 1. (N/A M915) Check for crossed lines to the auxiliary power cylinder.	Install correctly (TM 9-2320-273-20).
Step 2. Check for insufficient pump pressure per paragraph 16-4	Repair power steering pump (para 16-5 through 16-11).
Step 3. Defective Teflon seals in the steering gear control valve.	Replace steering gear (para 16-2 and 16-3).
6. HIGH STEERING EFFORT IN BOTH DIRECTIONS.	
Step 1. Check for overloaded vehicle.	Reduce load.
Step 2. Check fluid level in reservoir.	Fill to proper level (LO 9-2320273-12).
Step 3. Check for clogged filter in the power steering pump reservoir.	Replace the filter. (Refer to TM 9-2320 -273-20.)

Table 2-9. Steering System Troubleshooting Procedures (Continued).

MALFUNCTION	
TEST OR INSPECTION	
CORRECTIVE ACTION	
Step 4.	Check for low tire pressure
	Add air to tires (TM 9-2320-273-10).
Step 5.	Check supply and return lines for kinks and damage that would cause a restriction.
	Replace lines as required (TM 9-2320-273-20).
Step 6.	Check the steering gear for defective internal seals and binding control valve sleeve.
	Replace steering gear (para 16-2 and 16-3).

Table 2-10. Winch Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
WINCH WILL NOT ROTATE EITHER DIRECTION IN HIGH OR LOW SPEED.		
	Step 1. Check to see that PTO is engaged.	<ul style="list-style-type: none"> a. Make sure that PTO shift lever is in fully engaged position; then place your hand on hydraulic pump to find out if it is being driven. (Observe pump noise or vibration.) b. If PTO is not operating, refer to table 2-11. If PTO is operating, go to step 2.
	Step 2. Check oil level in tank.	<ul style="list-style-type: none"> a. If oil level is low, add oil. (Refer to LO 9-2320 -273-12.) b. If problem remains, go to step 3.
	Step 3. Check hydraulic system.	<ul style="list-style-type: none"> a. Perform test of hydraulic system (para 20-13) and repair, as necessary. b. If problem remains, go to step 4.
	Step 4. Check for dirty inlet strainer.	<ul style="list-style-type: none"> a. Remove and clean strainer. (Refer to TM 9-2320 -273-20.) b. If problem remains, go to step 5.
	Step 5. Mechanical failure in winch.	Disassemble (para 20-3) and make necessary repairs (para 20-4 through 20-10, as applicable). Reassemble (para 20-11).
2. WINCH WILL NOT UNSPOOL CABLE.		
	Step 1. Check to see if pilot orifice in winch brake valve is plugged.	<ul style="list-style-type: none"> a. Clean orifice (para 20-14). b. If problem remains, go to step 2.
	Step 2. Check to see if control valve is shifting.	Make sure that handle is tight on valve spool.

Table 2-10. Winch Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. WINCH MOTOR IS EXCESSIVELY NOISY.	Step 1. Check for internal damage to hydraulic motor.	Repair motor (para 20-5).
4. WINCH WILL NOT LIFT RATED LOAD.	Step 1. Check hydraulic system to determine if problem is mechanical or hydraulic.	<ul style="list-style-type: none"> a. Perform hydraulic system test (para 20-13i) and inspect relief valve (by removing) for foreign matter that may be holding relief valve open. b. If hydraulic system is the cause of the problem, repair or replace defective components. c. If hydraulic system is OK, go to step 2.
5. WINCH WILL NOT HOLD SUSPENDED LOAD.	Step 1. Check fail safe brake disk for oil.	<ul style="list-style-type: none"> a. Remove brake (para 20-3) and disassemble (para 20-8). If oil exists, clean and replace motor front seal. b. Inspect fail safe brake disk. If defective or worn excessively, replace disk.

Table 2-10. Winch Troubleshooting procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
6. WINCH LINE SPEED NOTICEABLY SLOWER OR SLUGGISH.	Step 1. Check level in oil tank.	<ul style="list-style-type: none"> a. Add oil, if necessary. (Refer to LO 9-2320-273 -12.) b. If problem remains, go to step 2.
	Step 2. Check cleanliness of inlet strainer.	<ul style="list-style-type: none"> a. Remove and clean. (Refer to TM 9-2320 -273-20.) b. If problem remains, go to step 3.
	Step 3. Check for external leaks in hydraulic lines.	<ul style="list-style-type: none"> a. Carefully inspect all external lines; replace if defective. Tighten fittings on hoses where leaks are suspected. b. If problem remains, go to step 4.
	Step 4. Check relief valve – may open and bypass fluid too soon.	<ul style="list-style-type: none"> a. Perform hydraulic system test (para 20-13i) b. Remove relief valve and inspect. If weak spring is suspected, replace valve; otherwise, clean and reinstall. c. If problem remains, go to step 5.
	Step 5. Check hydraulic pump output pressure (may be too low).	<ul style="list-style-type: none"> a. Test hydraulic system (para 20-13 i). b. If pump output pressure is too low, repair pump (para 20-4).
7. HYDRAULIC PUMP IS NOISY.	Step 1. Check level in tank.	<ul style="list-style-type: none"> a. Add oil, if necessary (LO 9-2320-273-12) and inspect for external leaks. b. If problem remains, go to step 2.

Table 2-10. Winch Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	<p>Step 2. Check cleanliness of inlet strainer.</p> <ul style="list-style-type: none"> a. Remove and clean. (Refer to TM 9-2320-273 -20.) b. If problem remains, go to step 3. <p>Step 3. Check pump inlet lines for blockage.</p> <ul style="list-style-type: none"> a. Remove lines, clean, and inspect. b. If problem remains, go to step 4. <p>Step 4. Check for defective or worn pump.</p> <p>Repair pump (para 20-4).</p>	
8. WINCH DRUM LEAKS LUBRICATING OIL.	<p>Step 1. Check winch drum seal and gaskets.</p> <ul style="list-style-type: none"> a. Disassemble drum (para 20-3). Remove and replace seal and all gaskets. b. Inspect bronze bushing (1, fig. 20-22). 	
9. WINCH DRUM LEAKS HYDRAULIC OIL.	<p>Check for defective hydraulic motor front seal.</p> <ul style="list-style-type: none"> a. Completely drain winch lube from drum. b. Remove hydraulic motor and fail safe brake (para 20-3). c. Replace front shaft seal in hydraulic motor. d. Disassemble and clean the internal brake parts with a solvent to remove all oil. Allow to dry and reassemble. e. Reassemble winch and fill drum with lubricant (Refer to LO 9-2320-273 -12.) 	
10. WINCH WILL NOT OPERATE IN HIGH SPEED.	<p>Step 1. Check to make sure that the high speed valve is shifting (possible loose handle).</p> <ul style="list-style-type: none"> a. Inspect handle for tightness and tighten, if necessary. b. Move handle through both detented positions to determine that valve is shifting. 	

Table 2-10. Winch Troubleshooting procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
		<p>c. If problem remains, go to step 2.</p> <p>Step 2. Check hydraulic system.</p> <p>a. Perform hydraulic system test (para 20- 13i). to determine if rear section of pump is providing proper output. Repair pump (para 20-4), if defective.</p> <p>b. Remove relief valve and inspect for foreign matter that may be holding valve open.</p> <p>c. Clean and reinstall relief valve. Replace if defective.</p>

Table 2-11. Power Takeoff Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. PTO NOISY.	Step 1. Check gear backlash of adapter and PTO.	<ul style="list-style-type: none"> a. See paras 21-12 thru 21-15 and determine that proper number of gaskets have been installed. b. If gaskets are not correct, make necessary replacement. If gaskets are correct, go to step 2.
	Step 2. Check for worn and pitted gears.	<ul style="list-style-type: none"> a. Remove PTO (para 21-2 and 21-3); then disassemble (para 21-4 thru 21-6). b. If gears are defective, replace. If gears are in good condition, go to step 3.
	Step 3. Check for worn or defective bearings.	Inspect bearings. Replace if defective.
	2. PTO JUMPS OUT OF GEAR.	Step 1. Check to determine that shift linkage is not rigged too short.
		<ul style="list-style-type: none"> a. Adjust linkage (para 21-8). b. If problem is not corrected, go to step 2.
		Step 2. Check for broken shifter ball spring.
		<ul style="list-style-type: none"> a. Remove shift linkage and cover (para 21-2 and 21-3) and inspect spring. b. If spring is broken, replace. If spring is in good condition, go to step 3.
		Step 3. Check for worn poppet pin.
		Replace worn pin. If pin is in good condition, go to step 4.
		Step 4. Inspect for worn gear teeth.
		<ul style="list-style-type: none"> a. Remove PTO (para 21-2 and 21-3); then disassemble (Para 21-4 thru 21-6). b. Replace defective gears.

Table 2-11. Power Takeoff Troubleshooting Procedures (Continued).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. PTO LEAKS OIL.	Step 1. Inspect for cracked housing.	Replace defective housing. If housing is in good condition, go to step 2.
	Step 2. Inspect for worn or damaged output shaft oil seal or gaskets.	
	a. Remove hydraulic pump (para 21-2), bearing cap, and oil seal. Replace with new seal.	
	b. Remove shift linkage, shifter cover, and gaskets. Replace with new gaskets.	

Section III. GENERAL MAINTENANCE

2-5. General. This section provides general instructions for cleaning, inspection, and repair of vehicle component parts. Publications are listed in appendix A that provide additional information on general shop practice techniques, sheet metal work, welding, etc.

2-6. Cleaning. The procedures for cleaning will be the same for most parts and components which comprise the vehicle components. To avoid repetition of instructions, the general procedures for cleaning are detailed in a through e, below. Any cleaning procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to the item.

a. General Instructions. The importance of cleaning must be thoroughly understood by maintenance personnel. Great care and conscientious effort are required in all cleaning operations. The presence of dirt or foreign substances is a constant threat to satisfactory vehicle operation and maintenance. The following should apply to all cleaning operations.

- (1) Clean all parts before inspection, after repair, and before assembly.
- (2) Hands should be kept free of any accumulation of grease which can collect dust and grit.
- (3) After cleaning, all parts should be covered or wrapped in plastic or suitable paper to protect them from dust and dirt.

b. Castings.

- (1) Clean inner and outer surfaces of castings and all areas subject to oil and grease with dry-cleaning solvent (item 12, App B).
- (2) Remove sludge and gum deposits from castings using a stiff brush.

WARNING

Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and other personnel in the area.

- (3) Use clean, dry, compressed air to blow out and dry all tapped holes in castings.

c. Oil Passages. Particular attention must be given to all oil passages in castings and machined parts. All oil passages must be clean and free of obstructions.

- (1) Clean passages with wire or a suitable probe to break up any sludge or gum deposits.
- (2) Wash passages by flushing with drycleaning solvent.
- (3) Dry passages by blowing them out with compressed air.

CAUTION

Do not allow drycleaning solvents to come in contact with seals or flexible hoses. These cleaners cause leather, rubber, and synthetic materials to dry out, rot, and lose pliability.

d. Oil Seals and Flexible Hoses. Clean seals and flexible hoses with soap and water.

e. Ball Bearings.

(1) Bearings require special cleaning. After removing surface oil and gum deposits, place bearings in hot oil (140°F) to loosen congealed oil and grease. Wipe bearings dry; do not use compressed air. After cleaning, coat bearings with a light film of oil, and wrap in paper until parts are inspected and assembled.

(2) Refer to TM 9-214 for information on care and maintenance of bearings.

2-7. Inspection. Procedures for inspection will be the same for most parts and components which comprise the vehicle components. To avoid repetition of instructions, the general procedures for inspection are detailed in *a* through *f*, below. Any inspection procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to that item.

a. Castings.

(1) **Inspect all ferrous and nonferrous castings for cracks using a magnifying glass and strong light. Particularly check the areas adjacent to studs, pipe plugs, threaded inserts, and in sharp corners and fillets.**

(2) **Inspect machined surfaces of castings for nicks, burrs, and raised metal. Mark damaged areas for repair.**

(3) **Check all mating flanges on housings and supports for warpage with a straightedge, or on a surface plate. Inspect mating flanges for discoloration which may indicate persistent oil leakage.**

(4) **Inspect all pipe plug and capscrew-tapped openings for damaged or stripped threads.**

(5) Check all castings for conformance to applicable repair standards.

b. Ball and Roller Bearings. Refer to TM 9-214 for inspection of bearings. Check all bearings for conformance to applicable repair standards.

c. Studs. Inspect all studs for stripped or damaged threads, bent or loose conditions, and evidence of stretching.

d. Gears.

(1) **Inspect all gears for cracks, using a magnifying glass and a strong light.**

(2) **Inspect all gear teeth for wear, sharp fins, burrs, and galled or pitted surfaces.**

e. Bushing and Bushing-Type Bearings.

(1) Check all bushing and bushing-type bearings for secure fit in their respective casting or mating part and for evidence of heating which may be indicated by discoloration of bushing or bearing surface.

(2) Inspect bushings and bushing-type bearings for wear, burrs, nicks and out-of-round condition.

(3) Check for dirt in lubrication holes or grooves of bushings or bushing-type bearings. Holes and grooves must be clean and free from damage to insure proper lubrication.

f. Oil Seals. Metal encased oil seals should not be replaced unless inspection indicates damage.

(1) Inspect feather edge of oil seal for damage.

(2) Check seal for loss of pliability and resiliency.

2-8. Repair. Procedures for repair will be the same for most parts and components which comprise the vehicle components. To avoid repetition of instructions, general procedures for repair are detailed in *a* through *f*, below. Any repair procedures which are peculiar to a specific part or component are covered in the section or paragraph relating to that item. After repair, clean all parts thoroughly to prevent metal chips or abrasives used in repair operations from entering working parts of the vehicle components.

a. Castings.

(1) Replace all cracked castings,

(2) Repair minor damage to machined surfaces with a fine file, emery cloth, or crocus cloth dipped in drycleaning solvent. Replace all castings on which machined surfaces are burred or nicked to the point of impairing subsequent assembly or operation.

(3) Repair minor warpage of mounting flanges and gasket surfaces by working the surface across a sheet of emery cloth held tightly on a surface plate or a like flat surface. Finish similarly with crocus cloth. Replace castings having flanges which are warped to the point of impairing assembly or operation.

(4) Repair damaged pipe or capscrew threads in tapped holes with a used tap.

NOTE

Pipe plug threads in castings must be in good condition to prevent oil or water leakage.

b. Ball and Roller Bearings. Replace all galled, pitted or damaged ball bearings. (Refer to TM 9-214)

c. Studs. Replace all bent or loose studs and studs showing evidence of stretching. Repair minor thread damage with a thread chaser. Replace all studs having stripped or damaged threads. Remove and replace studs as outlined in (1) and (2), below.

(1) *Removal.* Using a stud extractor, back the studs out slowly to avoid heating and possible seizure. When the studs are broken off too short to use a stud extractor, drill the stud and extract it with an easy out.

(2) *Replacement* Placement. Only standard studs are supplied for replacement. If threaded openings are damaged and retapping will not clean up threads, drill and tap opening in casting and install a threaded insert.

NOTE

All replacement studs have a special coating and must have a small amount of mica-base antiseize compound (MI L-A-13881) applied on the threads before the stud is installed in the casting.

d. Gears.

(1) Replace all cracked gears.

(2) Replace gears having worn, pitted or galled teeth. Remove sharp fins and burrs from gear teeth with crocus cloth dipped in drycleaning solvent.

e. *Bushings and Bushing Type Bearings.* When bushings and bushing-type bearings are damaged or worn beyond specified limits, generally the associated parts with which they are used must also be replaced.

f. *Oil Seals.* Oil seals must be replaced when the thin feather edge is damaged or when the seal material has become hard or brittle.

(1) *Removal.* press or pry a damaged oil seal from the casting or adapter, being careful not to damage the bore in the casting or adapter.

(2) *Repair.* When a casting oil seal bore or adapter is burred to a point where an oil-tight seal is impossible, replace the casting or adapter. Remove slight nicks, burrs, and scratches from the casting bore or adapter with crocus cloth dipped in drycleaning solvent.

(3) *Installation.* Install a new oil seal in the bore of the casting or adapter using a proper oil seal installation tool.

2-9. Assembly Instructions. Extreme care must be exercised in all component assembly operations to insure satisfactory component performance. Precautionary rules for assembly are outlined below. Step-by-step procedures for assembly of various components are covered in the paragraph relating to the specific component.

a. Precautionary Rules.

(7) Cleanliness is essential in all component assembly operations. Dirt and dust, even in minute quantities, are abrasive. Parts must be cleaned, as specified, and kept clean. Wrap or cover parts and components when assembly procedures are not immediately completed.

(2) Coat all bearings and contact surfaces with operating oil (rear axle oil for axle parts; transmission oil for transmission parts, etc.) to insure lubrication of parts during initial operation after repair.

(3) Replace all gaskets and preformed packings during assembly.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-10. Introduction. This section provides you with procedures for replacing major component parts of the vehicle. Organizational level replacement procedures, described in TM 9-2320-273-20, are not repeated. Following is a list of the replacement procedures given in this section.

- a. Transmission
- b. Engine
- c. Transfer Case
- d. Front Axle
- e. Rear Tandem Axle
- f. Pusher Axle

2-11. Transmission.

a. Removal.

(1) Disconnect transmission heater control wires. (Refer to TM 9-2320-273-20). Remove exhaust pipe section. (Refer to TM 9-2320-273 -20.)

(2) Drain transmission oil. (Refer to LO 9-2320-273-12.)

(3) Disconnect applicable components from the PTO as follows:

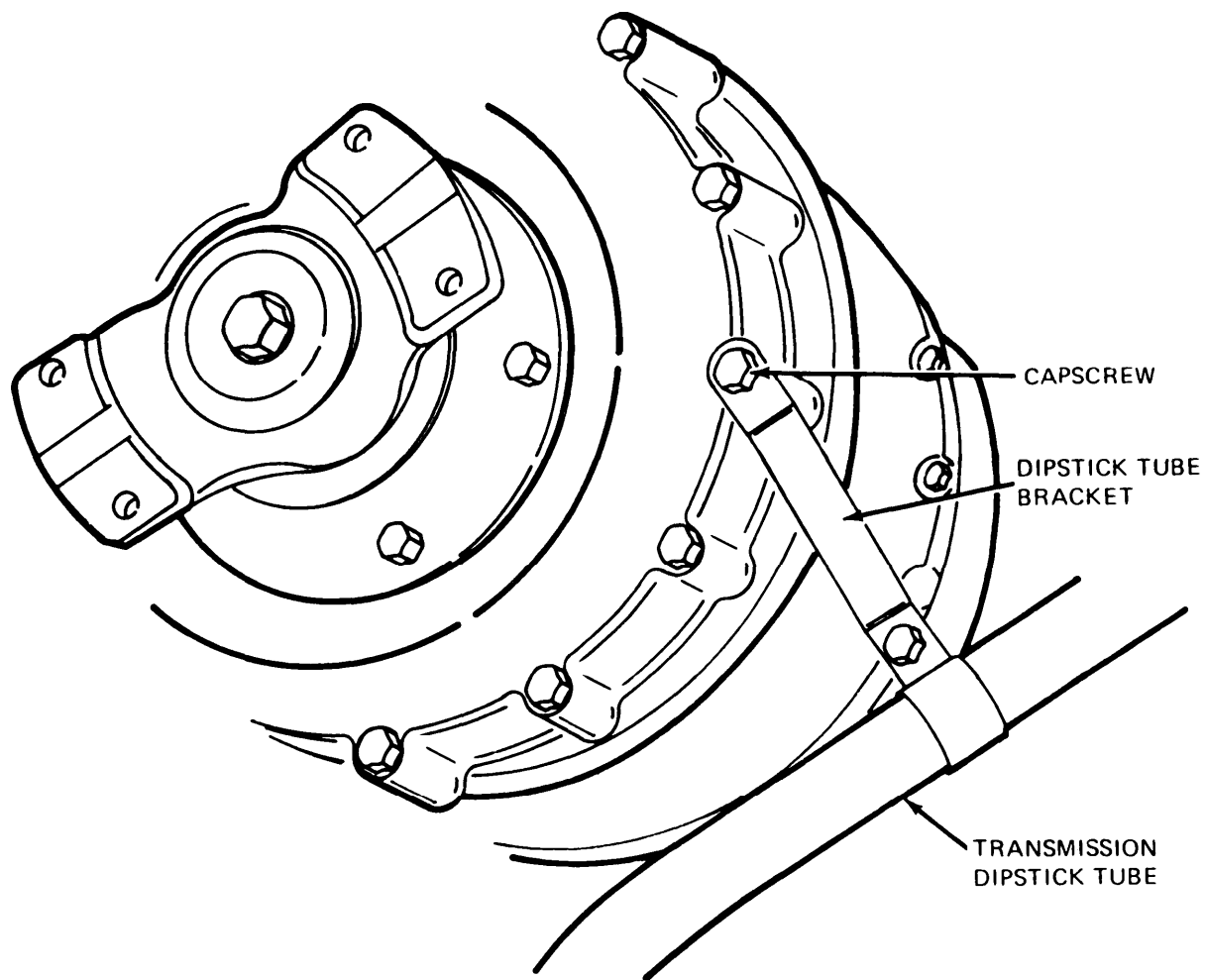
(a) Models M916, M917, M920. Remove hydraulic pump from PTO and tie it out of the way. (Refer to TM 9-2320-273 -20.) It is not necessary to disconnect the hydraulic lines.

(b) Model M918. Remove prop shaft from PTO to hydraulic pump. (Refer to TM 5-3895-371-24& P.)

(c) Model M919. Remove prop shaft from PTO to lower PTO belts shaft. (Refer to TM 5-3895-372-20.)

(4) Disconnect transmission oil cooler tubes at transmission. (Refer to TM 9-2320-273-20).

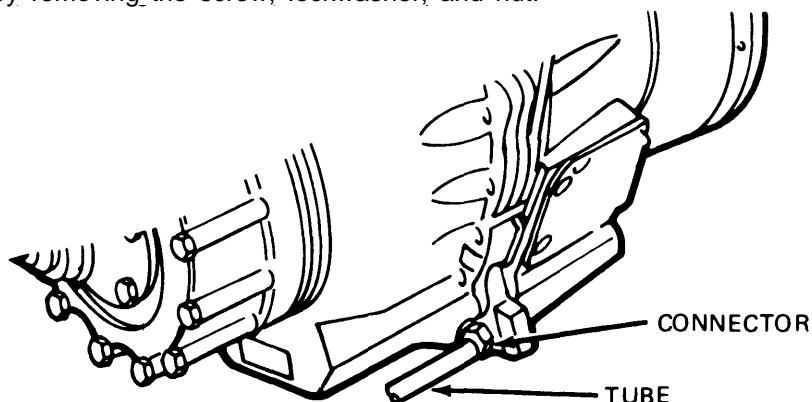
(5) Remove dipstick tube bracket capscrew (fig. 2-1).



TA 073954

Figure 2-1. Remove Transmission Dipstick Tube Bracket.

(6) Disconnect 2 in. connector (fig. 2-2) on transmission and remove the dipstick tube with attached bracket. If necessary, the dipstick tube bracket may be removed from the dipstick tube by removing the screw, lockwasher, and nut.



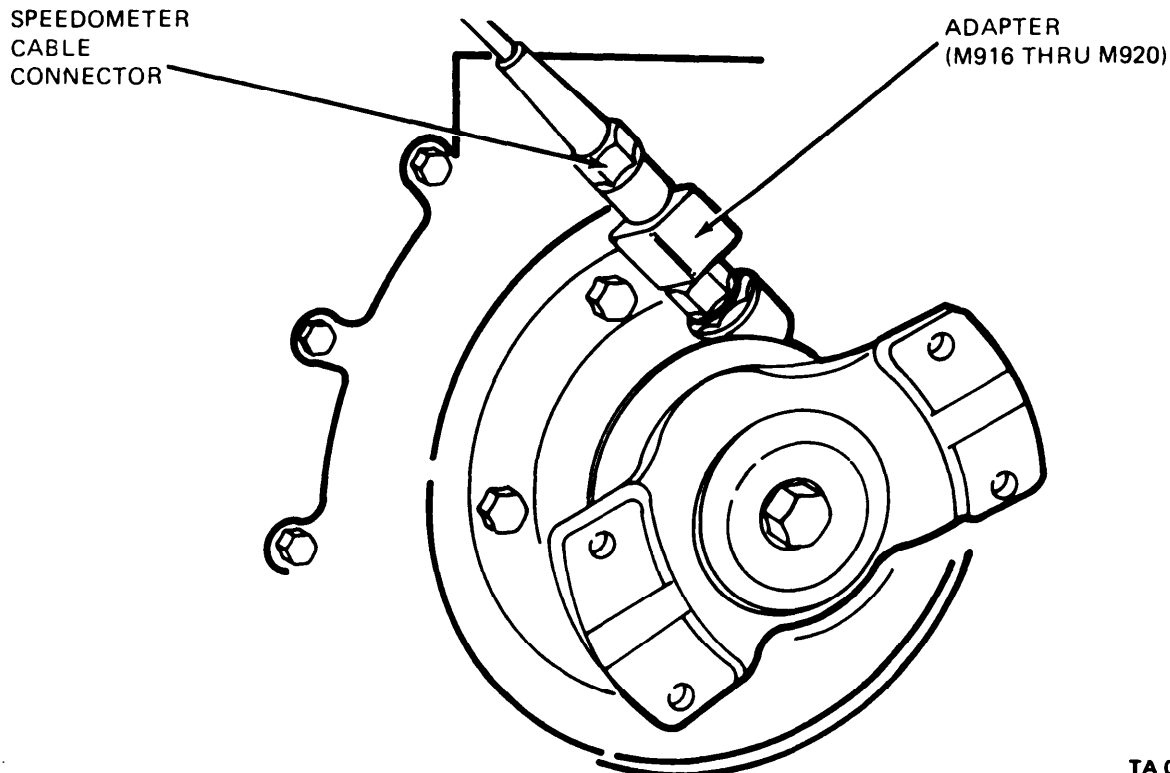
TA 073955

Figure 2-2. Remove Transmission Dipstick Tube.

(7) Remove main propeller shaft from transmission and lay over on driver's side. (Refer to TM 9-2320-273 -20.)

(8) M916 thru M920 - Disconnect front propeller shaft yoke from power transfer case by removing four capscrews, nuts, and washers. Move the shaft to the left side of vehicle where it will not interfere with transmission removal.

(9) Disconnect speedometer cable connector (fig. 2-3) from transmission.



TA 073956

Figure 2-3. Remove Speedometer Cable.

(10) Disconnect electrical lead at oil temperature switch (green wire) (figure 2-4).

(11) M916 thru M920 - Disconnect electrical wire (white with a black tracer) at PTO micro switch. (Refer to TM 9-2320-273-20.)

(12) M916 thru M920 - Disconnect cable at PTO lever. (Refer to TM 9-2320-273-20).

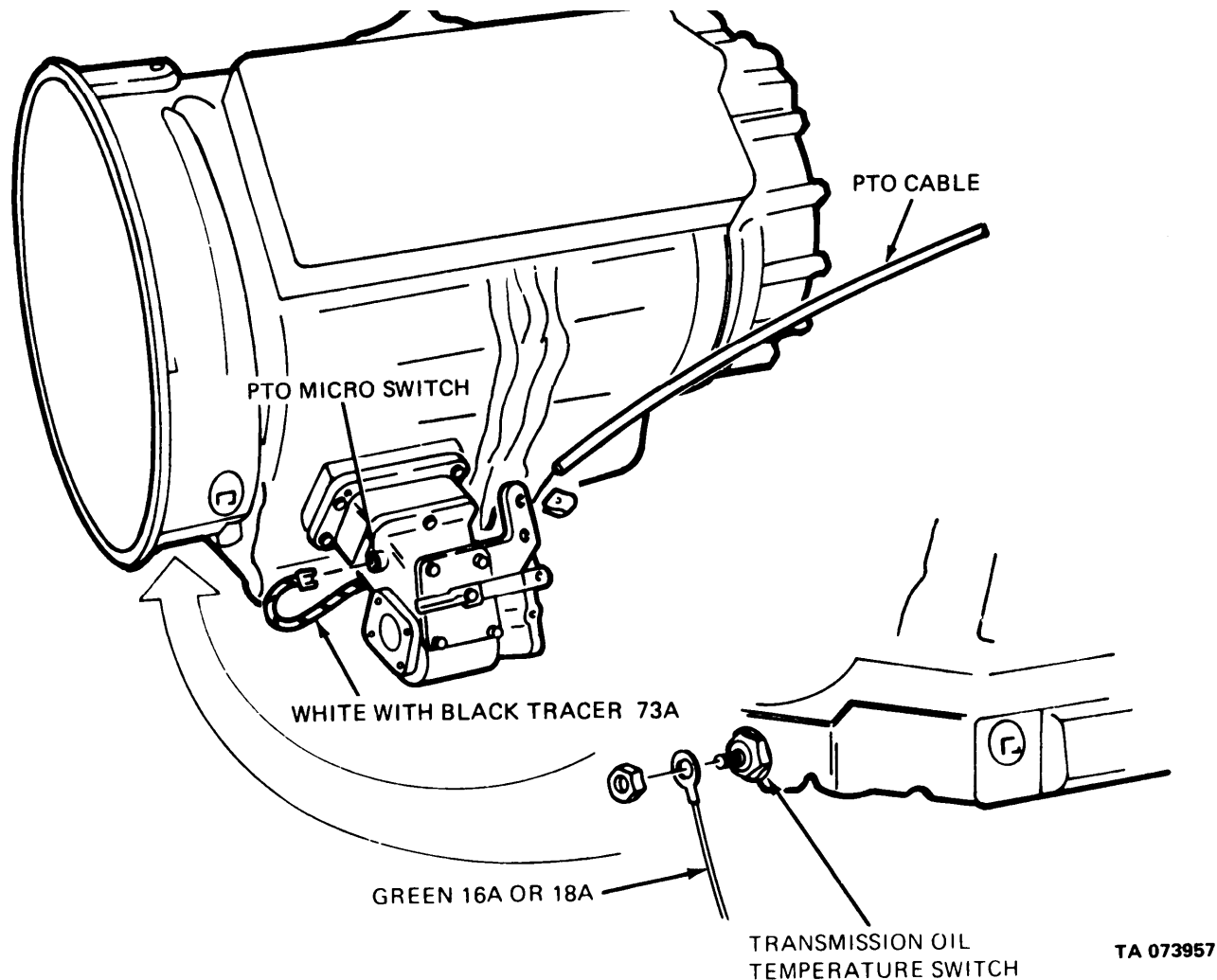


Figure 2-4. Disconnect Oil Temperature and PTO Micro Switch Leads.

- (13) Release air pressure from system by opening petcock (fig. 2-5) on air reservoir above battery box.

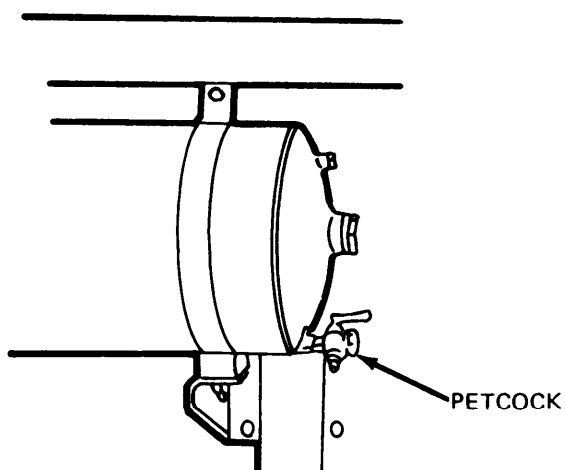
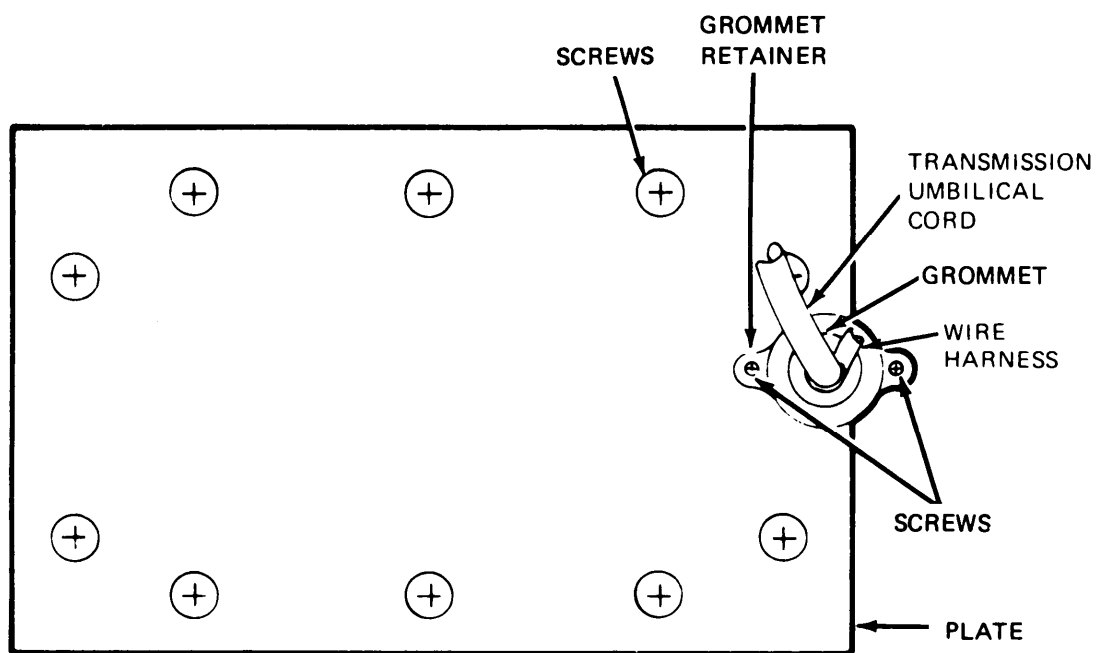


Figure 2-5. Release System Air Pressure.

- (14) If not already removed, remove grommet retainer (fig. 2-6) and grommet by removing screws; then remove floor plate by removing ten screws.

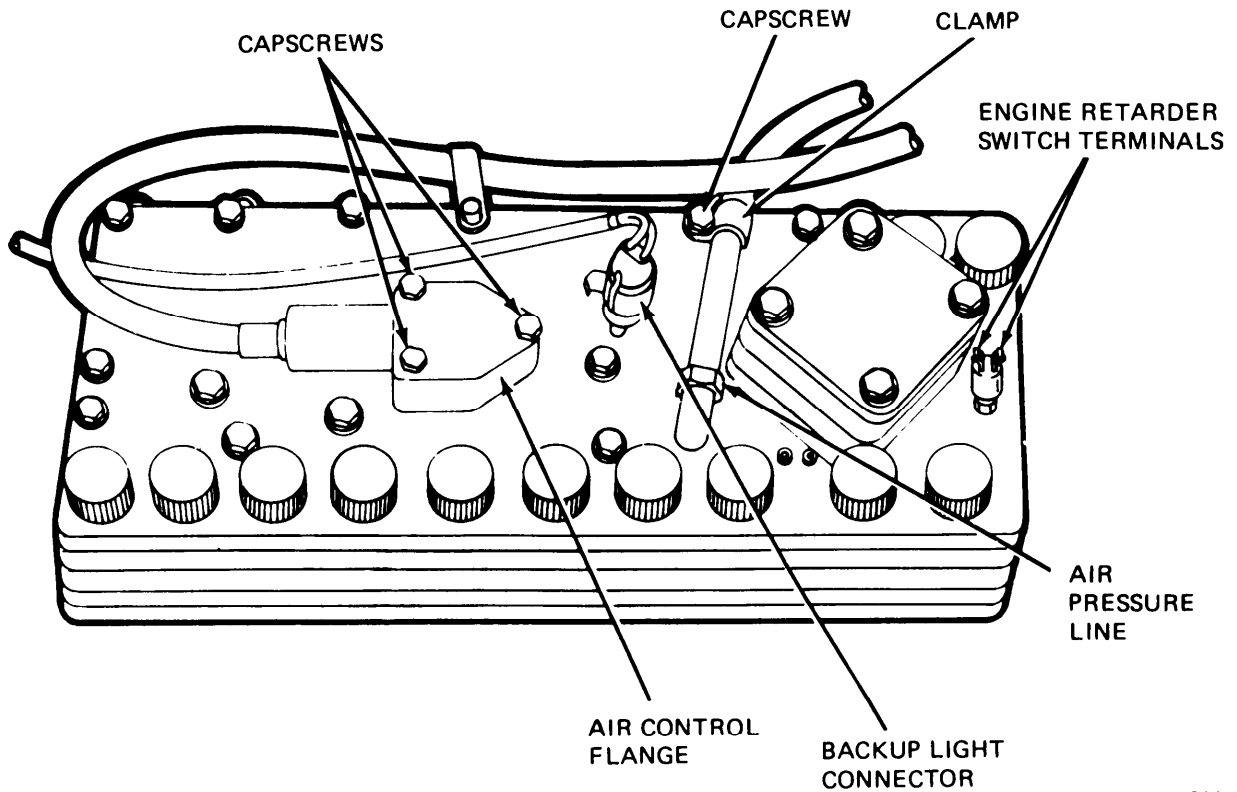


TA 073959

Figure 2-6. Remove Floor Plate and Umbilical Cord Grommet.

(15) Disconnect air pressure line clamp (fig. 2-7) by removing attaching capscREW and washer; then reinstall the capscREW and washer to prevent dirt from getting into the transmission.

(16) Disconnect engine retarder switch wires from terminal, tape for identification. Remove engine retarder switch, if necessary.



TA 073960

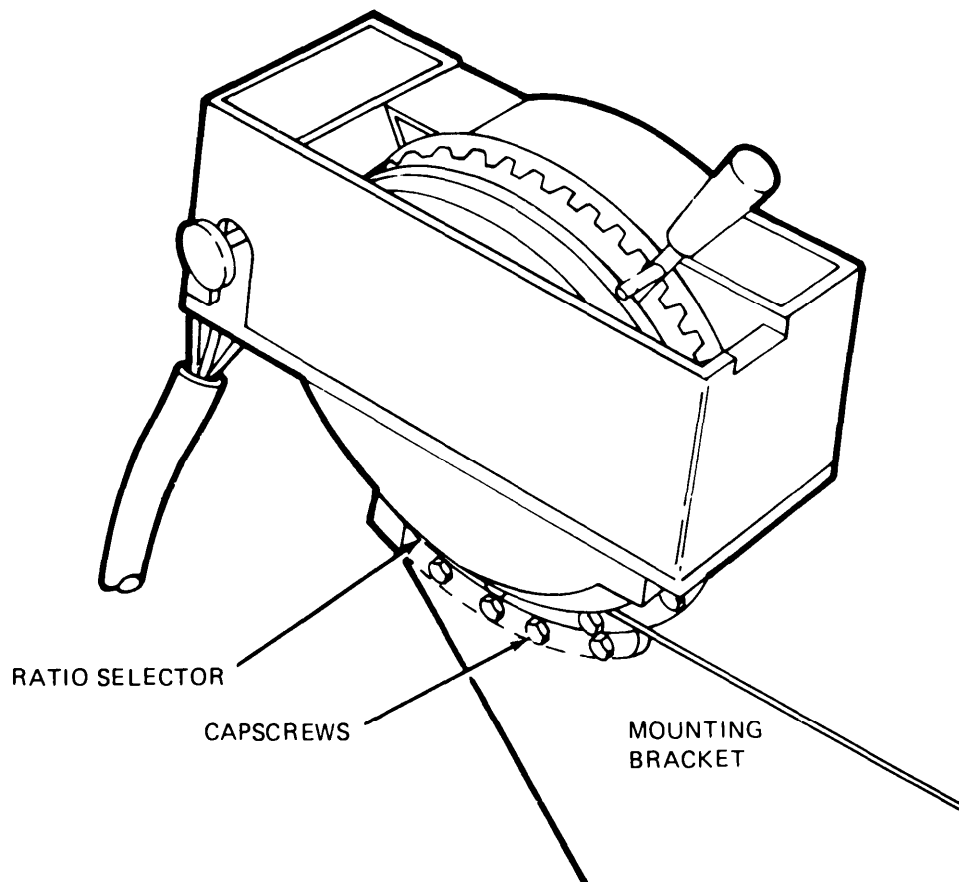
Figure 2-7. Disconnect Lines from Transmission Control.

(17) Disconnect umbilical cord air control flange (fig. 2-7) by removing attaching capscrews. Cover flange opening in transmission with tape or other suitable means. Wrap air control flange in a plastic bag to keep it clean.

(18) Disconnect air pressure line from transmission.

(19) Disconnect backup light connector from transmission.

(20) If necessary for access to remove the transmission mounting capscrews, dismount radio selector (fig. 2-8) by removing four capscrews.

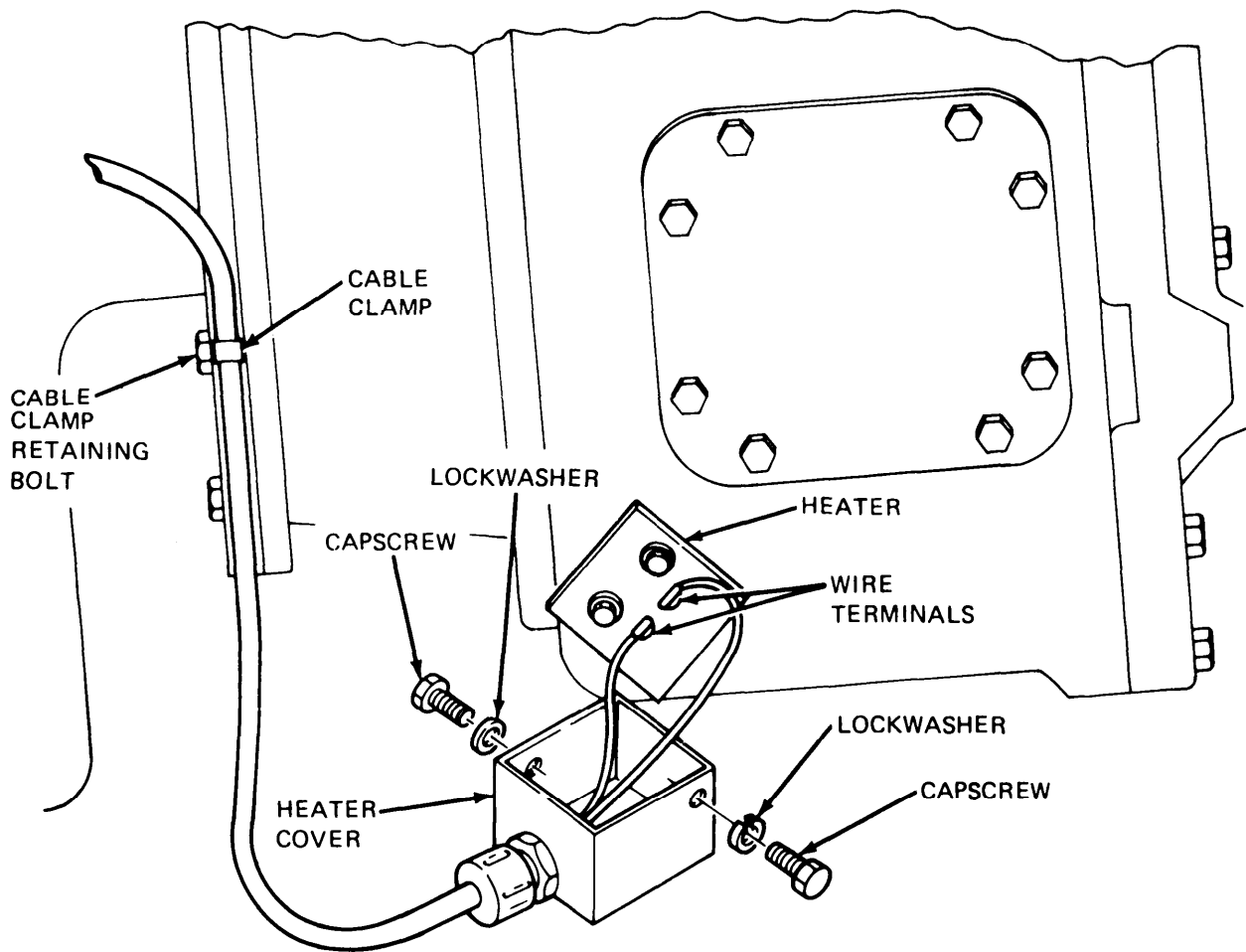


TA 073961

Figure 2-8. Remove Ratio Selector Assembly.

(21) If the vehicle is equipped with an optional transmission oil heater, proceed as follows: .

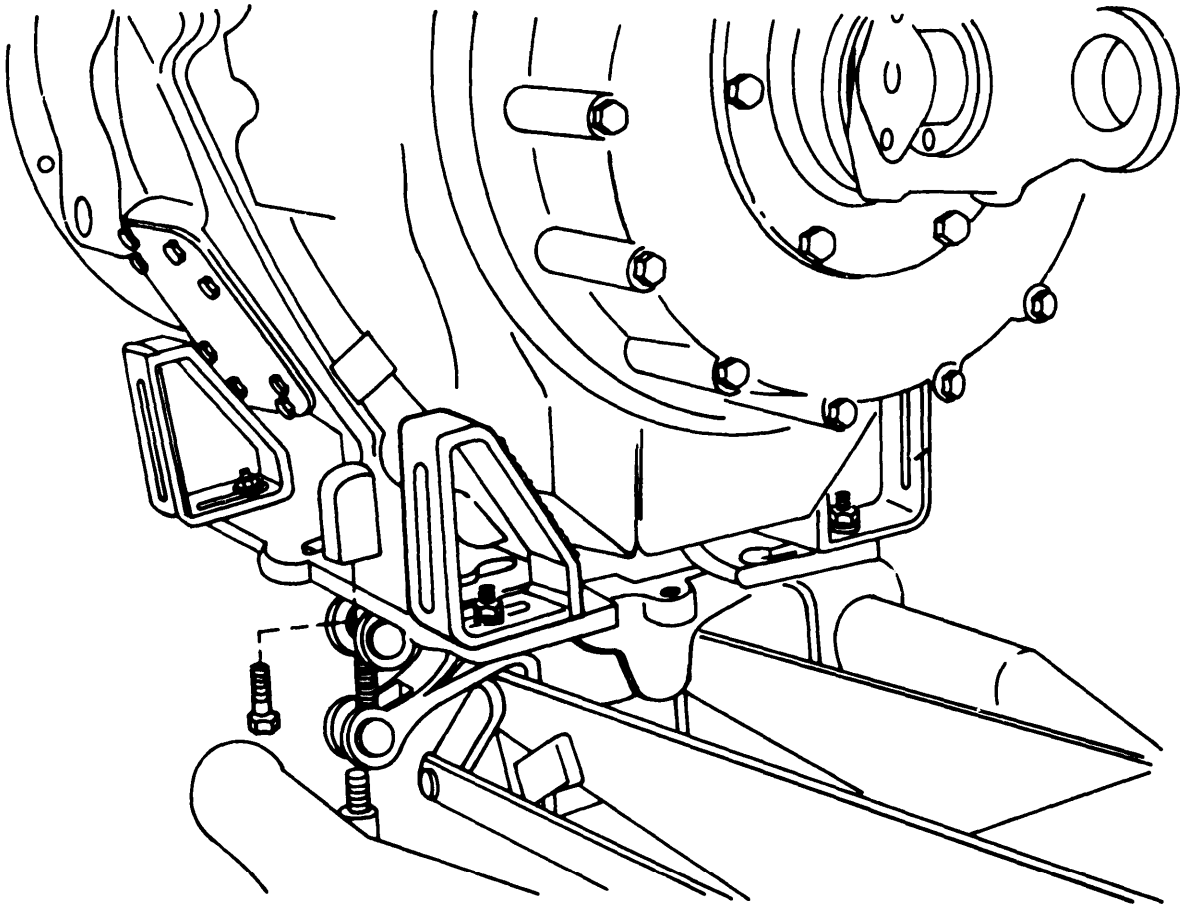
- a. Remove two capscrews (fig. 2-9) and lockwashers from the heater cover. Lift heater cover from heater.
- b. Disconnect wire terminals from heater and tag wires for installation purposes.
- c. Remove the cable clamp retaining bolt and swing cable and heater cover clear for ease of transmission removal.



TA 073962

Figure 2-9. Disconnect Transmission Oil Heater Wires.

(22) Position a suitable transmission jack under the transmission and secure it to the transmission. Figure 2-10 shows a typical arrangement.



TA 073963

Figure 2-10. Transmission on a Typical Floor Jack.

(23) Remove all capscrews (fig. 2-11) and washers that fasten transmission to engine.

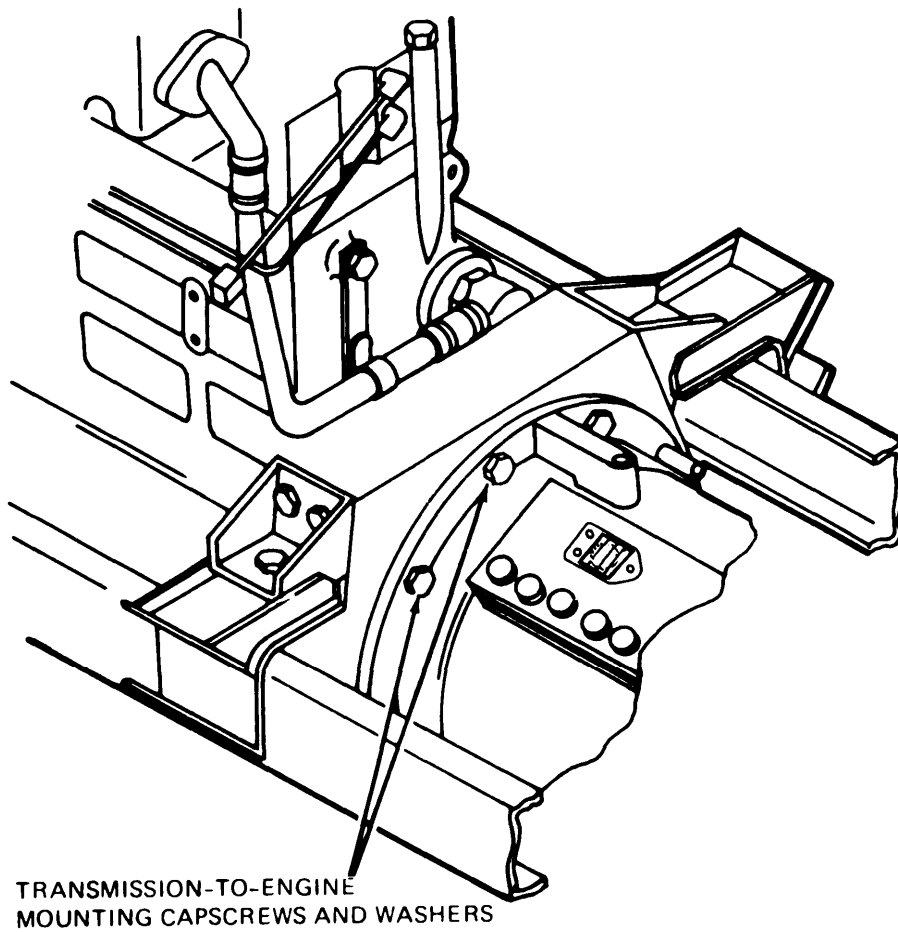


Figure 2-11. Remove Transmission-To-Engine Mounting Capscrews.

(24) Remove two flange nuts (fig. 2-12) that fasten rear of transmission to transmission rear support spring assembly and remove the spring assembly.

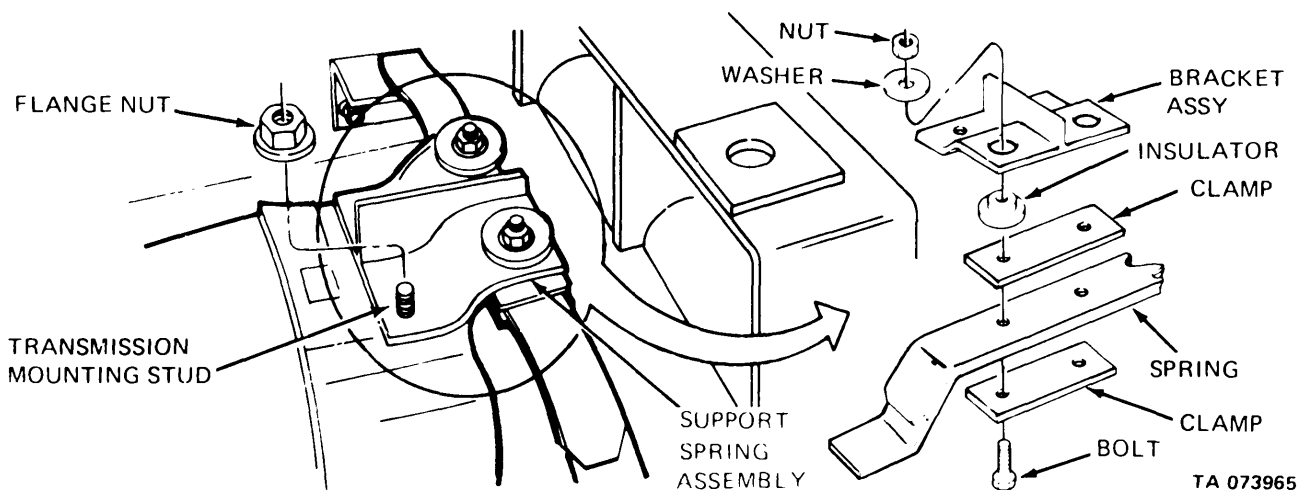


Figure 2-12. Remove Transmission Rear Support Spring Assembly.

- (25) Slowly pull transmission jack back to completely clear engine; then lower jack.
- (26) Hoist or jack-up right rear side of vehicle far enough to allow removal of transmission under right side frame rail (between battery box and forward rear axle); then remove transmission from under truck.
- (27) Cover opening on transmission and engine.
- (28) If necessary, remove PTO and adapter on models M916 thru M920. (Refer to para 21-2 and 21-3).

NOTE

If the replacement transmission is not equipped with a control heater and (if applicable) a transmission oil heater, refer to TM 9-2320-273-20 and para 23-1 respectively, for removal and installation procedures.

(1) *Inspect* support spring assembly (fig. 2-12) for worn or deteriorated insulators. Inspect spring for damage or cracks. If necessary, components of the support spring assembly may be replaced by disassembling two nuts, washers, and bolts. When reassembling, tighten nuts until the top of the insulator deforms to give .25 inch (6.4 mm) gap between the washers and bracket assembly.

(2) If removed, install PTO and adapter on models M916 thru M920 (refer to para 21-12 thru 21-15). Secure the transmission to a suitable transmission jack.

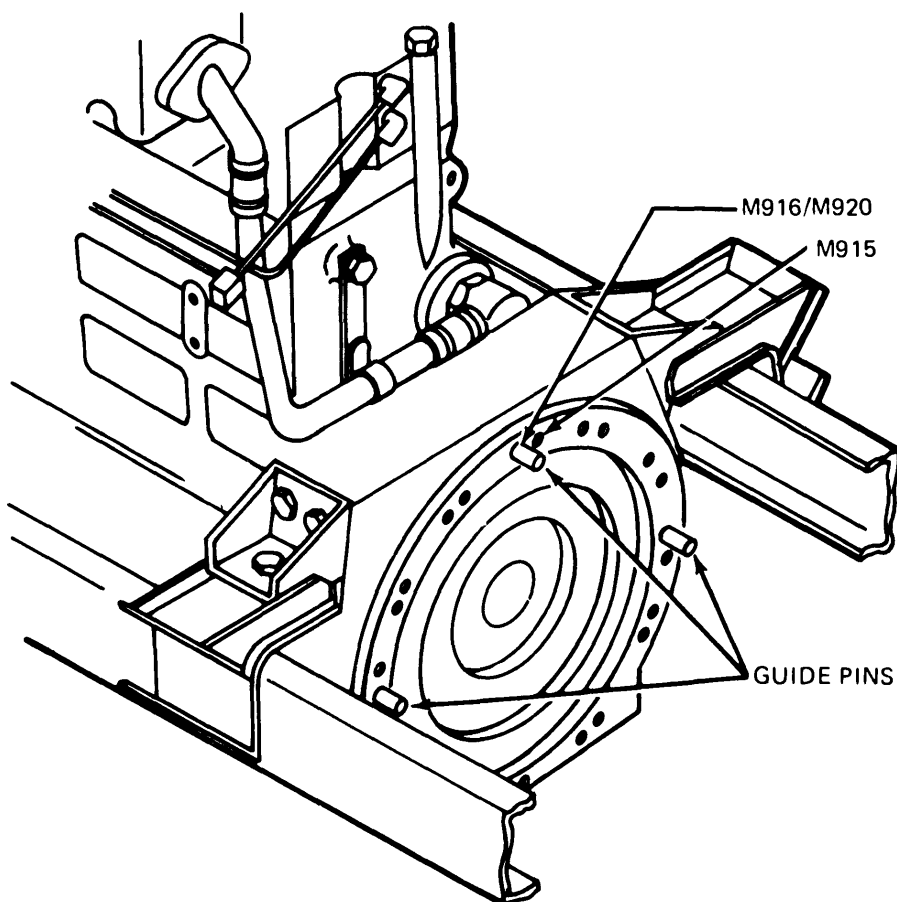
CAUTION

Make sure that transmission and engine mounting flanges are clean. Observe that there are two sets of mounting holes in the engine bellhousing. For M915 installation, the transmission is centered, as shown in figure 2-15. For M916 thru M920; the transmission is installed 80 off center (one bolt hole) in a counter-clockwise direction, as indicated on illustration.

(3) Fabricate and install three guide pins in engine bell housing as shown in fig. 2-13 to aid in mating the transmission to the engine.

NOTE

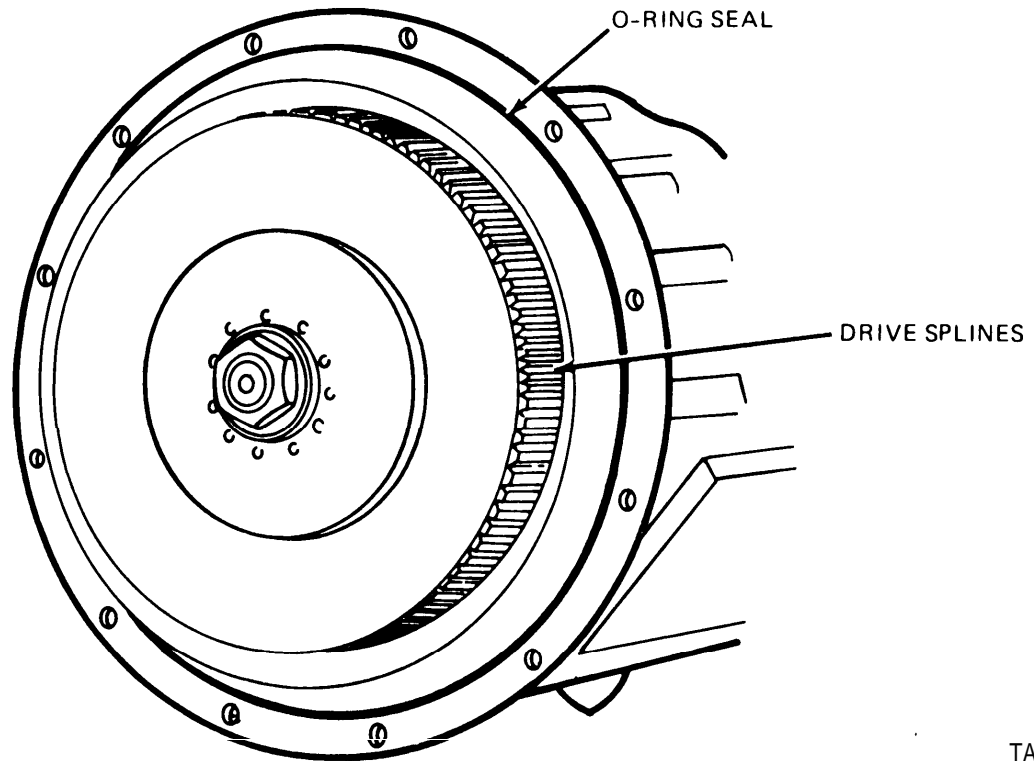
Before installing transmission check torque on drive ring bolts.



TA 073966

Figure 2-13. Install Guide Pins in Engine Bell Housing.

(4) Apply a light coat of engine oil or silicone grease around the perimeter of transmission front O-ring seal (fig. 2-14).



TA 073967

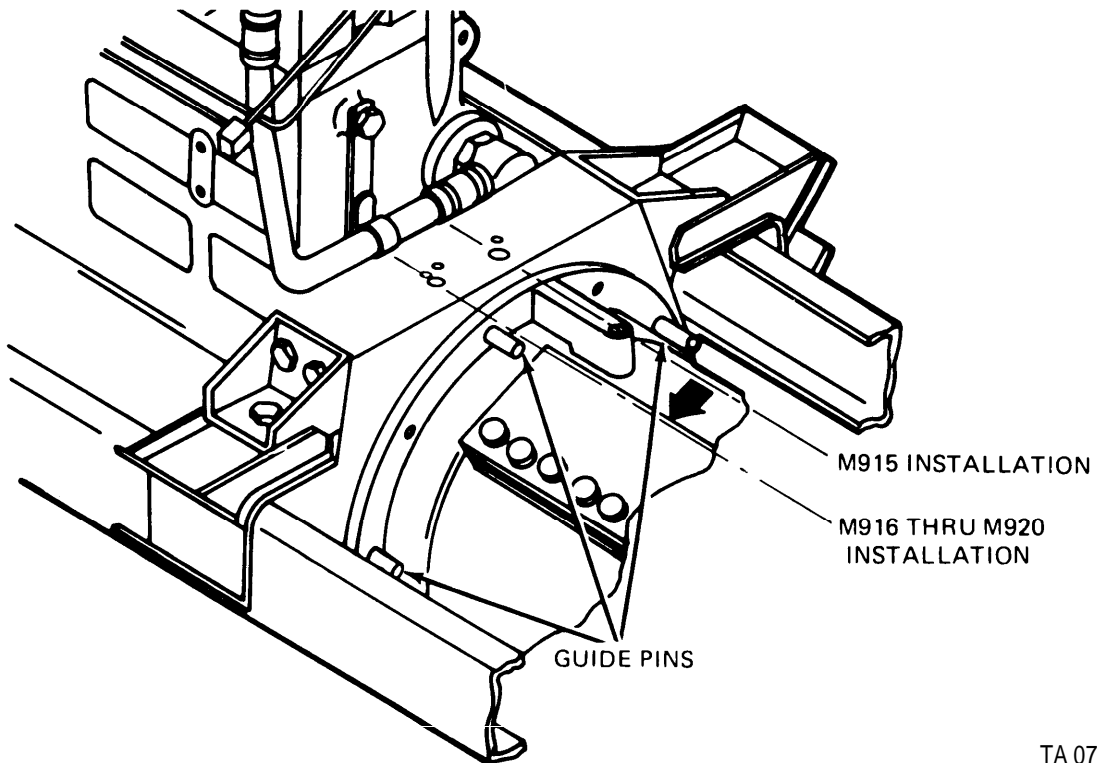
Figure 2-14. Lubricate Front O-Ring Seal.

- (5) Hoist or jack-up right-front side of vehicle high enough to a low installation of transmission under right side of vehicle (between battery box and front rear axle),
- (6) position transmission under vehicle; then remove hoist or jack from vehicle.
- (7) Level and line-up transmission on jack with guide pins in engine.

NOTE

Three men may be required to mate the transmission to the engine. One man directing the movement of the transmission and observing the O-ring seal; and two men positioning the jack,

- (8) slowly move transmission jack in to mate transmission mounting holes on to guide pins (fig. 2-15).



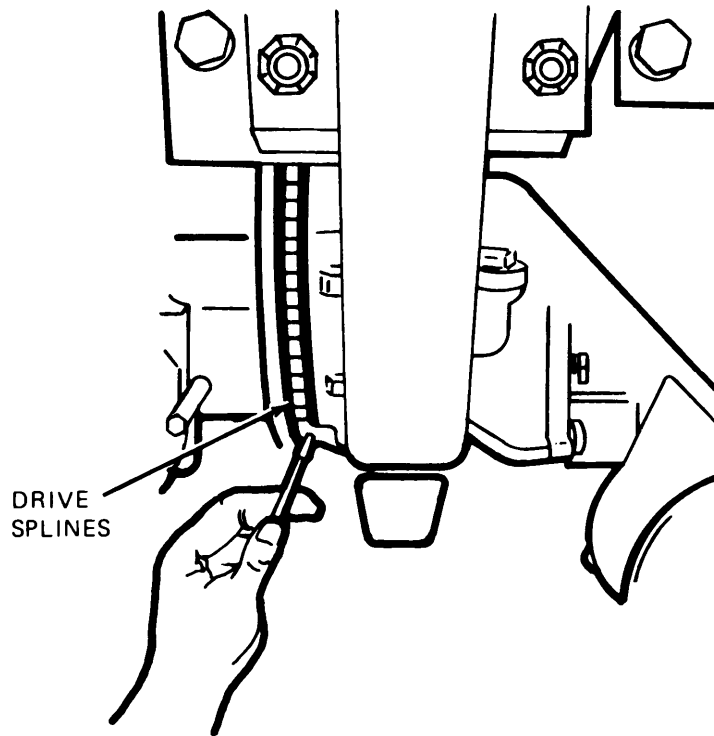
TA 073968

Figure 2-15. Mate Transmission Mounting Holes to Guide Pins.

WARNING

In step (8), don't use your fingers or hand to turn transmission drive assembly.

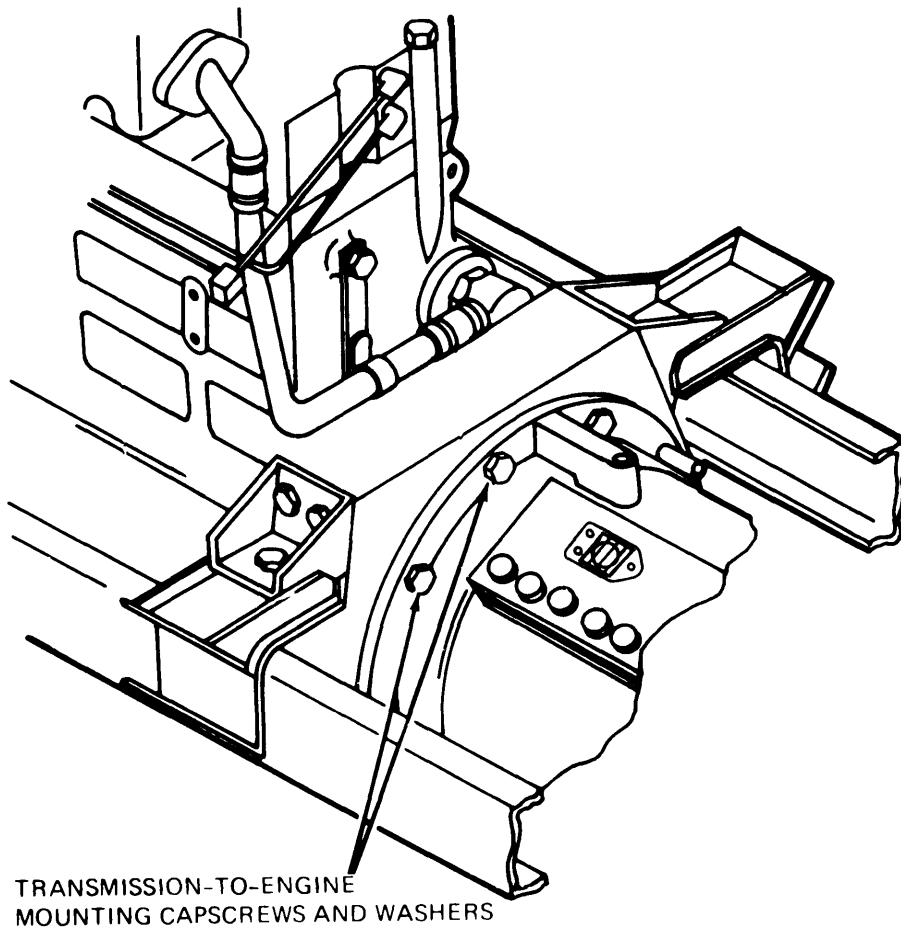
(9) Continue moving transmission in to mate transmission drive splines with engine flywheel drive ring. Several attempts may be necessary to align splines. Each time, back transmission out approximately one inch - move transmission drive splines a fraction of an inch (fig. 2-16) – then try again.



TA 073969

Figure 2-16. A line Drive Ring on Engine Flywheel and Transmission Drive Splines.

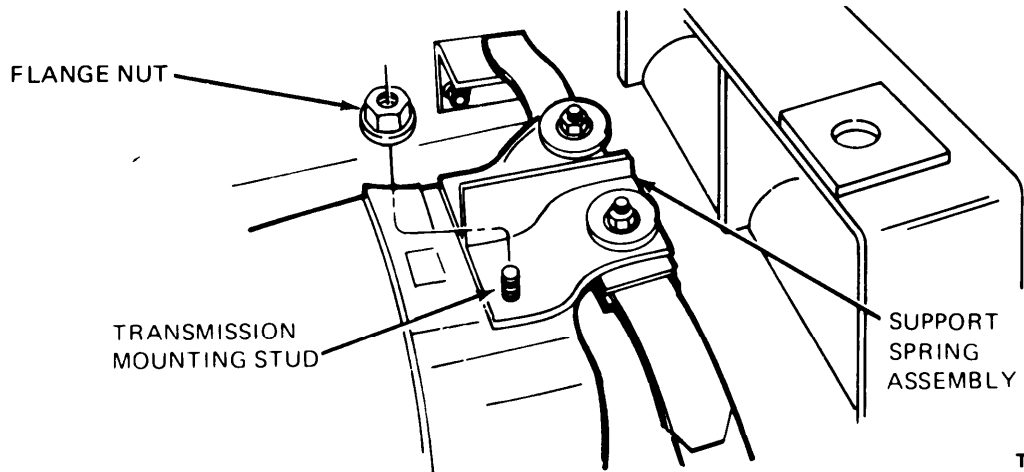
(10) Install transmission-to-engine mounting capscrews and washers (fig. 2-17) finger tight except where the guide pins are installed and the two holes for the exhaust tube support bracket.



TA 073964

Figure 2-17. Install Transmission-To-Engine Mounting Capscrews.

- (11) Install transmission rear support spring assembly (fig. 2-18).
 - (12) Remove guide pins and install three capscrews and washers.
 - (13) Remove transmission jack.
 - (14) Tighten all engine-to-transmission capscrews to 55 ± 5 lb-ft (75 ± 7 N-m) torque.
- Tighten nuts that fasten transmission to the support spring assembly to 75 ± 10 lb-ft (102 ± 14 N-m) torque.



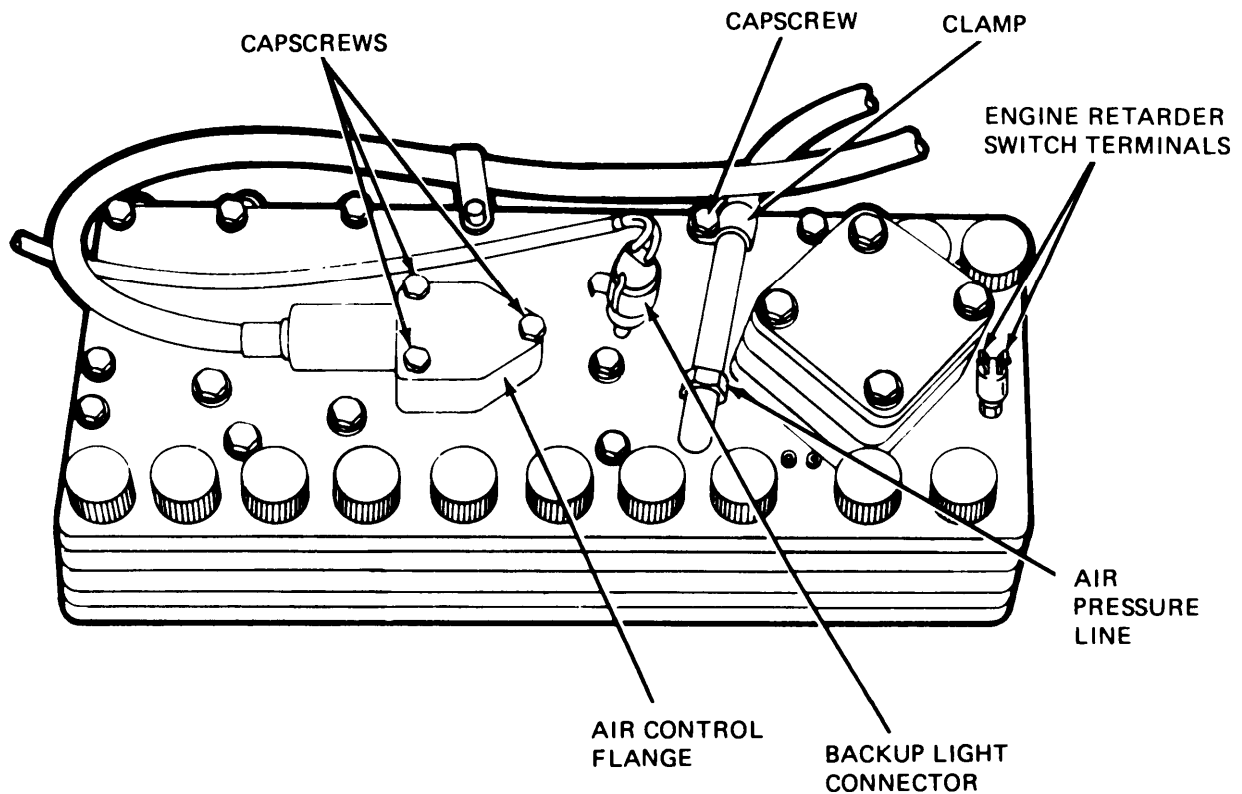
TA 073965

Figure 2-18. Install Transmission Rear Support Spring Assembly.

(15) Install main propeller shaft. (Refer to TM 9-2320-273-20.)

(16) M916 thru M920 - Connect front propeller shaft to power transfer case and secure with four capscrews. Tighten to 98-108 lb-ft (133-146 N·m) torque.

(17) Connect backup light connector (fig. 2-19) to transmission.



TA 073960

Figure 2-19. Connect Lines to Transmission Control.

(18) Connect air pressure line to transmission.

CAUTION

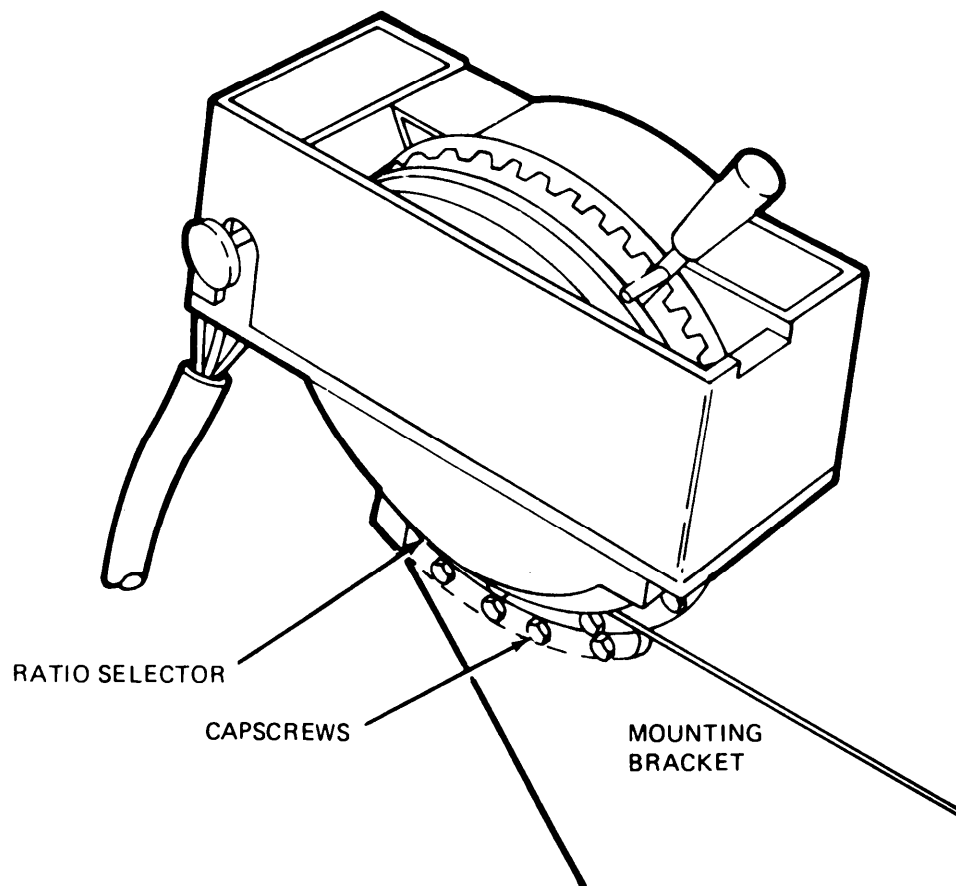
In step (18), make sure that holes in gasket for control flange are aligned with guide pins.

(19) Remove tape and connect umbilical cord air control flange, plate and gasket to transmission. Tighten capscrews to 108 lb-in (12 N-m).

(20) Install engine retarder switch, if removed. Connect wires to terminals.

(21) Connect clamp to air pressure line. Secure to transmission case with capscrew and washer. Tighten to 36 ± 2 lb-ft (46 ± 3 N-m) torque.

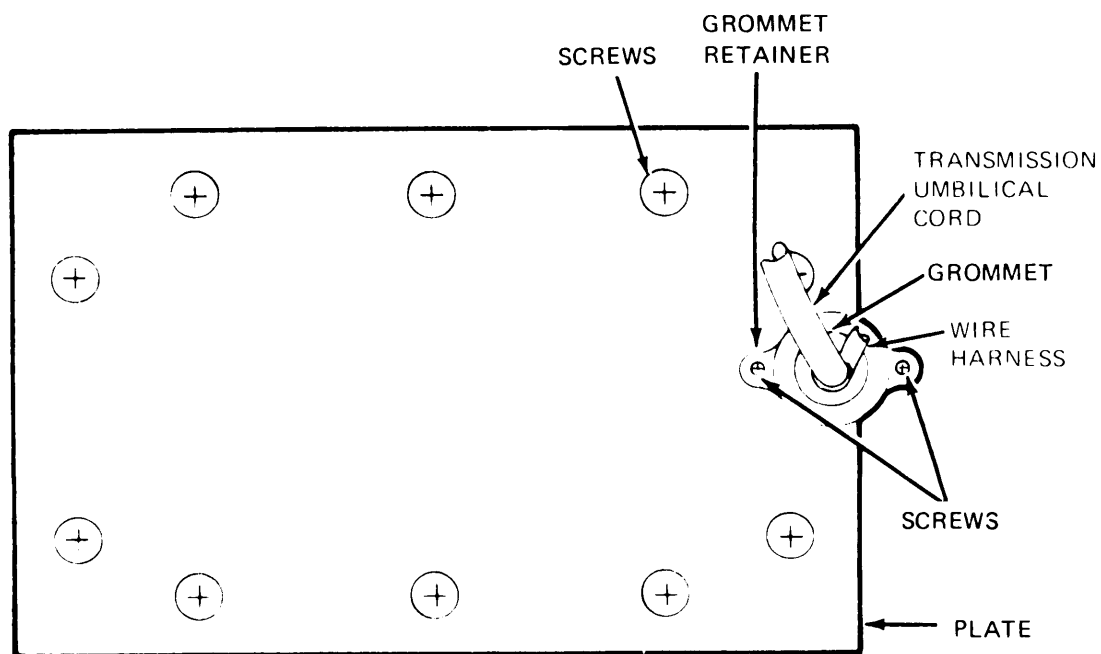
(22) If removed, install ratio selector (fig. 2-20). Secure with capscrews and washers. Tighten capscrews to 36 ± 2 lb-ft (46 ± 3 N-m) torque.



TA 073961

Figure 2-20. Install Ratio Selector Assembly.

(23) Connect transmission control heater wires. (Refer to TM 9-2320-273-20). Install floor plate (fig. 2-21) and secure with screws; then install grommet, grommet retainer and secure with screws.



TA 073959

Figure 2-21. Install Floor Plate and Umbilical Cord Grommet.

- (24) Connect electrical lead to oil temperature switch (green wire) (fig. 2-22).
- (25) M916 thru M920 – Connect electrical wire at PTO micro switch (white wire with a black tracer). (Refer to TM 9-2320-273-20).
- (26) M916 thru M920 – Connect cable at PTO lever. (Refer to TM 9-2320-273-20).

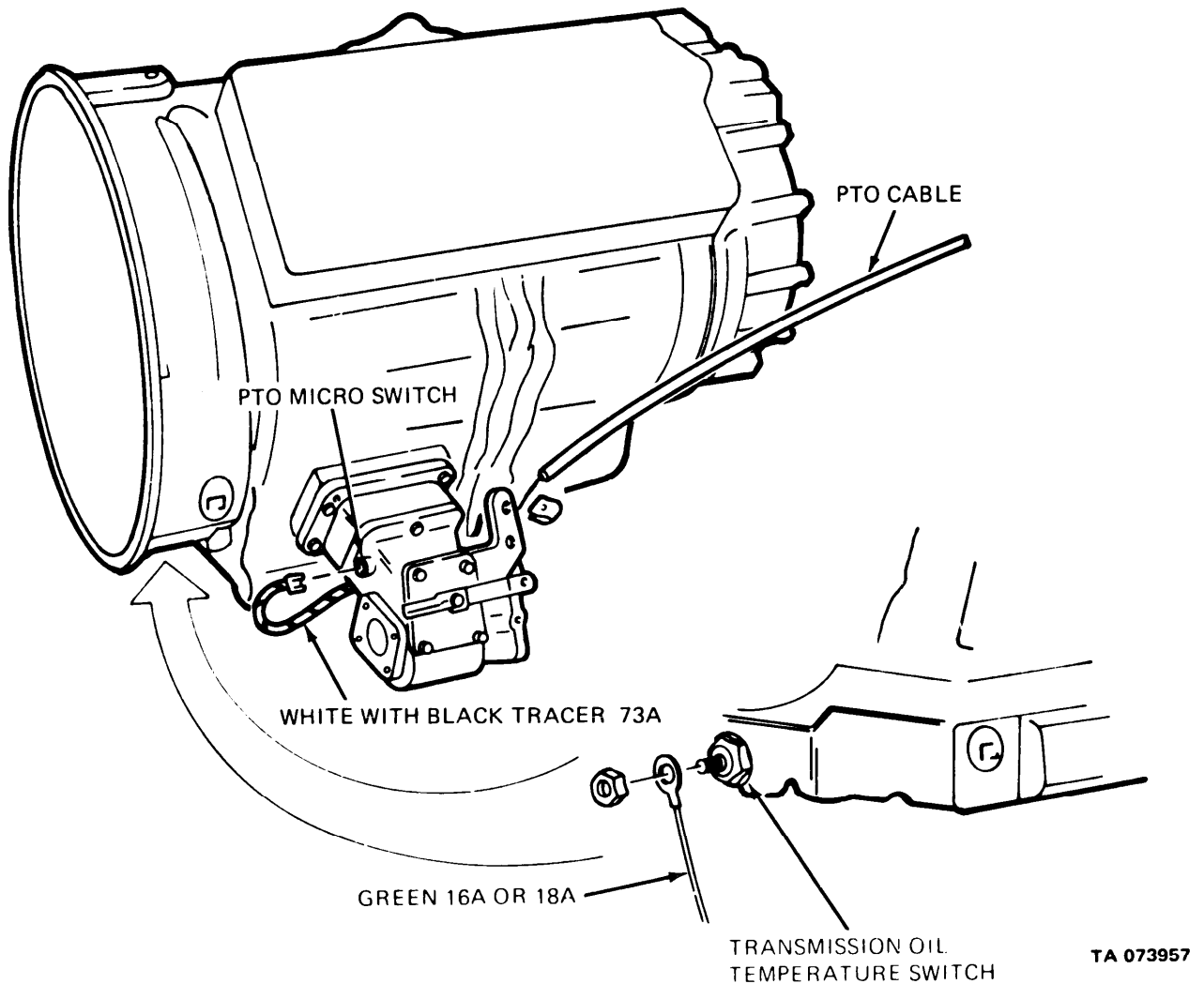
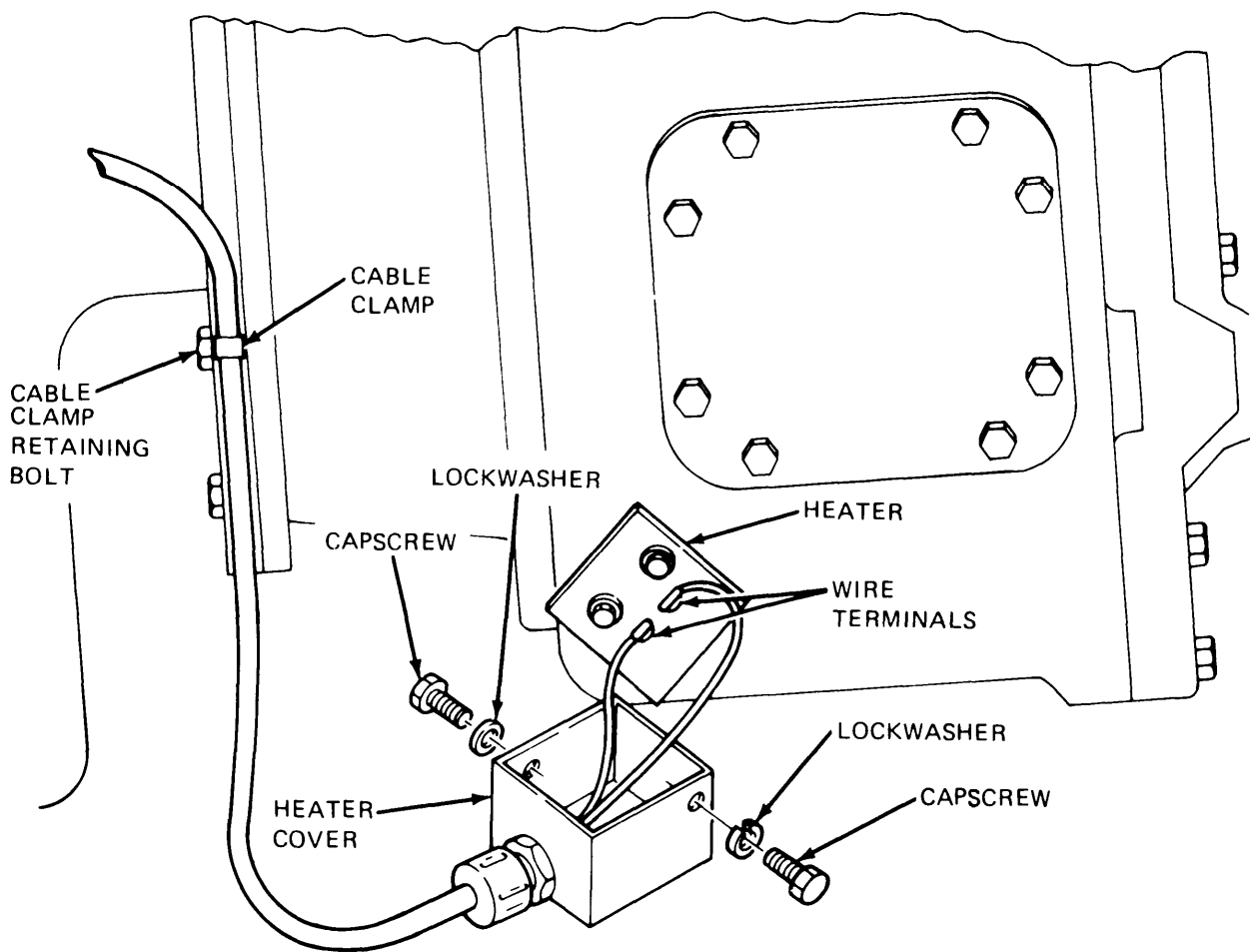


Figure 2-22. Connect Oil Temperature and PTO Micro Switch Lead.

(27) If the vehicle is equipped with an optional transmission oil heater, proceed as follows:

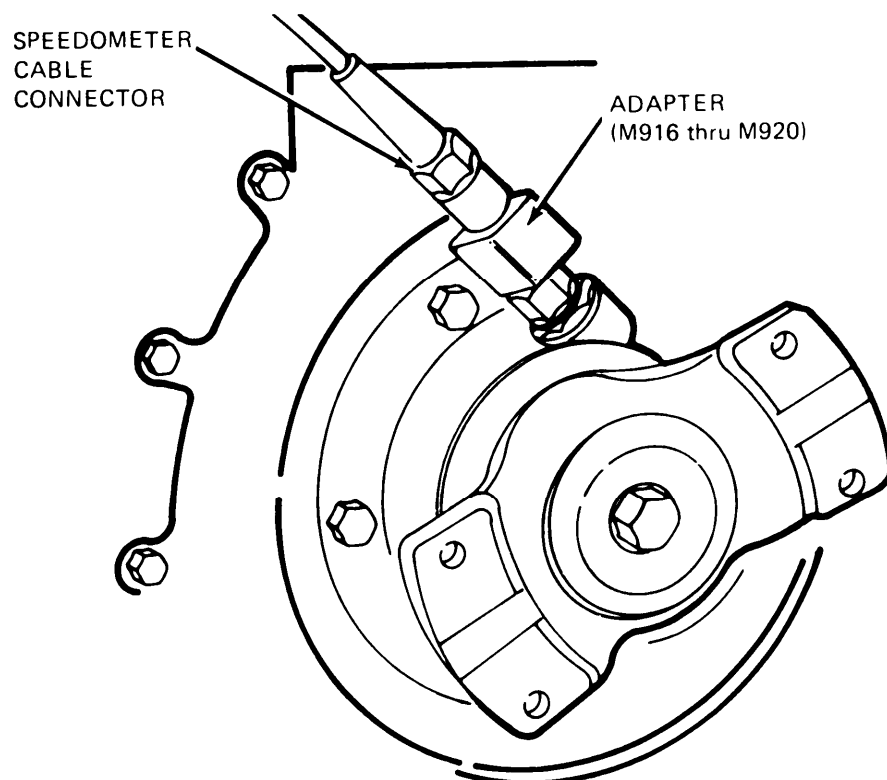
- (a) Swing the heater cable and cover into place (fig. 2-23).
- (b) Connect wires to respective heater terminals,
- (c) place the heater cover over the heater and secure with two capscrews and lockwashers.
- (d) Install the bolt retaining the cable clamp to the transmission.



TA 073962

Figure 2-23. Connect Transmission Oil Heater Wires.

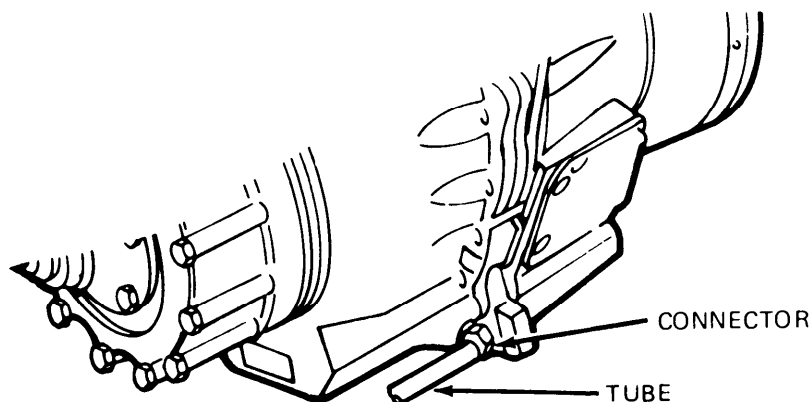
(28) Connect speedometer cable to transmission (fig. 2-24). Tighten to 50 lb-in (6 N-m) torque.



TA 073956

Figure 2-24. Connect Speedometer Cable.

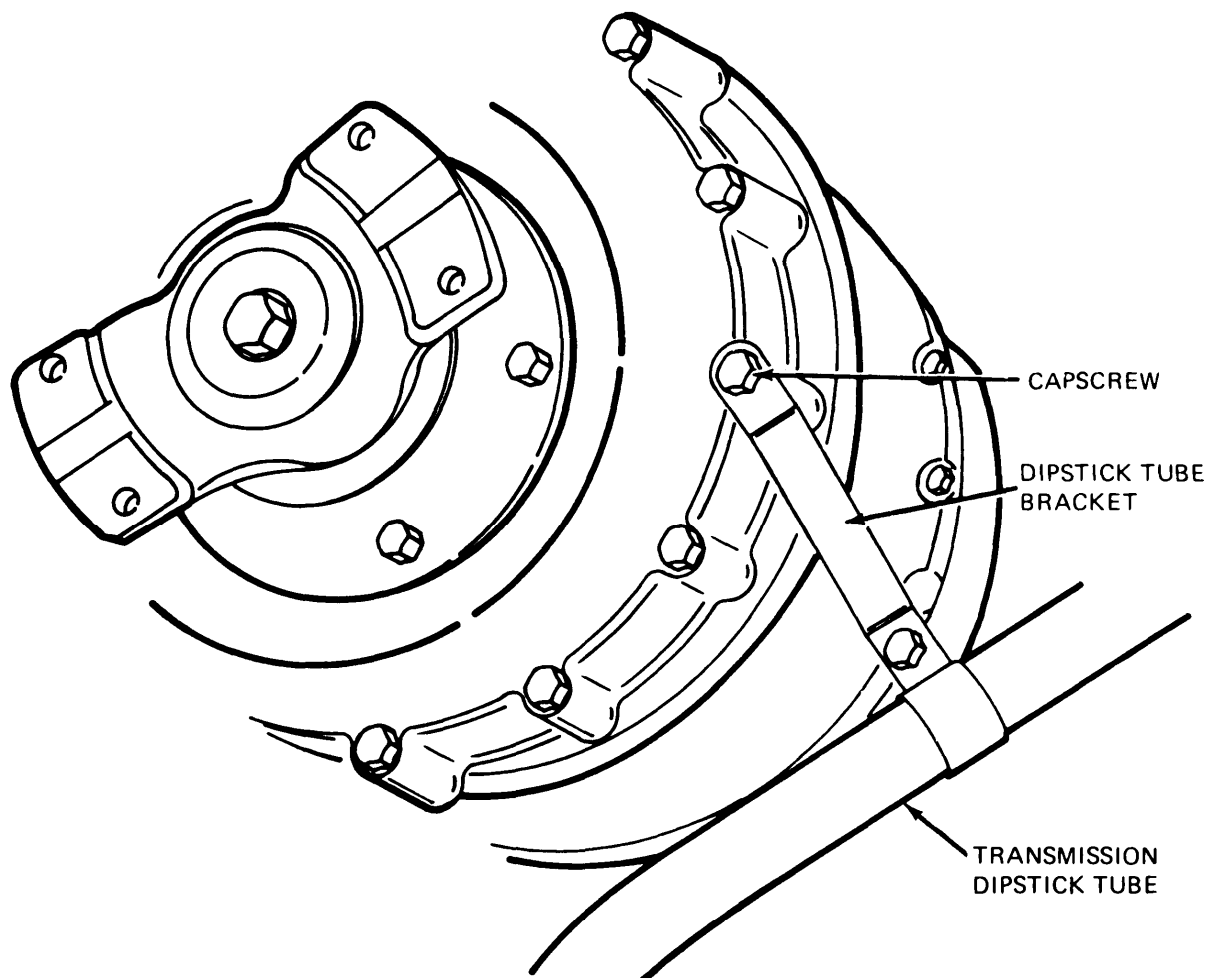
(29) Connect dipstick tube assembly to transmission (fig. 2-25). Secure with 2 in, connector. If removed, mount the dipstick tube bracket (fig. 2-26) to the dipstick tube with one screw, lockwasher and nut.



TA 073955

Figure 2-25. Connect Dipstick Tube to Transmission.

(30) Install capscrew that fastens bracket to transmission. Tighten to 36 lb-ft (47 N·m) torque.



TA 073954

Figure 2-26. Install Transmission Dipstick Tube Bracket.

(31) Connect transmission oil cooler lines to transmission. (Refer to TM 9-2320-273-20).

(32) Install exhaust tubing. (Refer to TM9-2320-273-20).

(33) install exhaust support mounting bolt.

(34) Mount applicable components to the PTO as follows:

(a) Models M916, M917, M920. Swing hydraulic pump into place and secure to PTO (Refer to TM 9-2320-273-20).

(b) Model M918. Install prop shaft from PTO to hydraulic pump (Refer to TM 5-3895-371-24&P).

(c) Model M919. Install prop shaft from PTO to lower PTO belt shaft (Refer to TM 5-3895-372-20).

(35) Fill transmission with fluid (Refer to LO 9-2320-273-12). Do not overfill. Check dipstick with engine OFF.

(36) Start up engine and check for:

- (a) Fluid leaks.
- (b) Exhaust leaks.
- (c) Unusual noises.

(37) Road test vehicle to determine that transmission functions properly.

(38) Recheck transmission fluid level with engine OFF.

2-12. Engine.

a. Removal.

(1) Disconnect battery cables. (Refer to TM 9-2320-273-20).

(2) Complete transmission removal procedure (para 2-11) with the following exceptions:

(a) It is not necessary to remove the main propeller shaft. Disconnect it from one end only.

(b) After the transmission is lowered from engine and frame, cover transmission opening and allow transmission to remain in this position; it is not necessary to raise vehicle or move transmission.

(3) Drain coolant (refer to TM 9-2320-273-20).

(4) Drain engine oil (refer to TM 9-2320-273-20).

(5) Remove hood (refer to TM 9-2320-273-20).

(6) Remove air cleaner assembly, inlet and outlet tubes (refer to TM 9-2320-273-20).

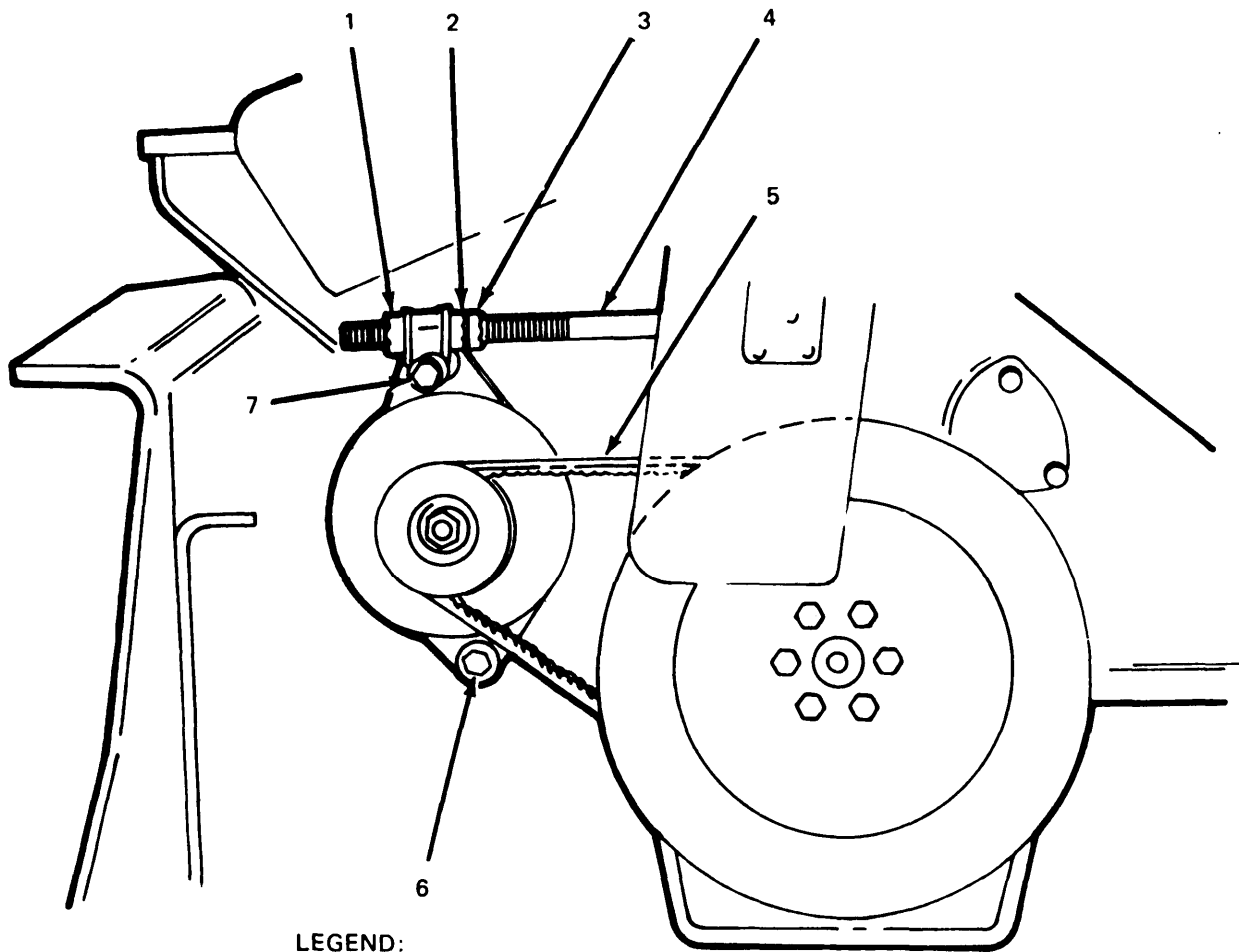
(7) M915 Only – Remove bumper and towing eyes (refer to TM 9-2320-273-20).

(8) M916 thru M920 – Remove brush guard (refer to TM 9-2320-273-20).

(9) Remove radiator and radiator support rods (refer to TM 9-2320-273-20).

(70) Disconnect exhaust tube from turbocharger (refer to TM 9-2320-273-20).

(11) Loosen (turn in) nut (3, fig- 2-27) and nut (2) on alternator adjusting rod (4). Remove capscrew (7) and washer; then disengage rod (4) from alternator. Swing alternator in toward engine as far as it will go.



LEGEND:

- | | |
|------------------|-------------|
| 1. NUT | 5. BELT |
| 2. NUT | 6. CAPSCREW |
| 3. NUT | 7. CAPSCREW |
| 4. ADJUSTING ROD | |

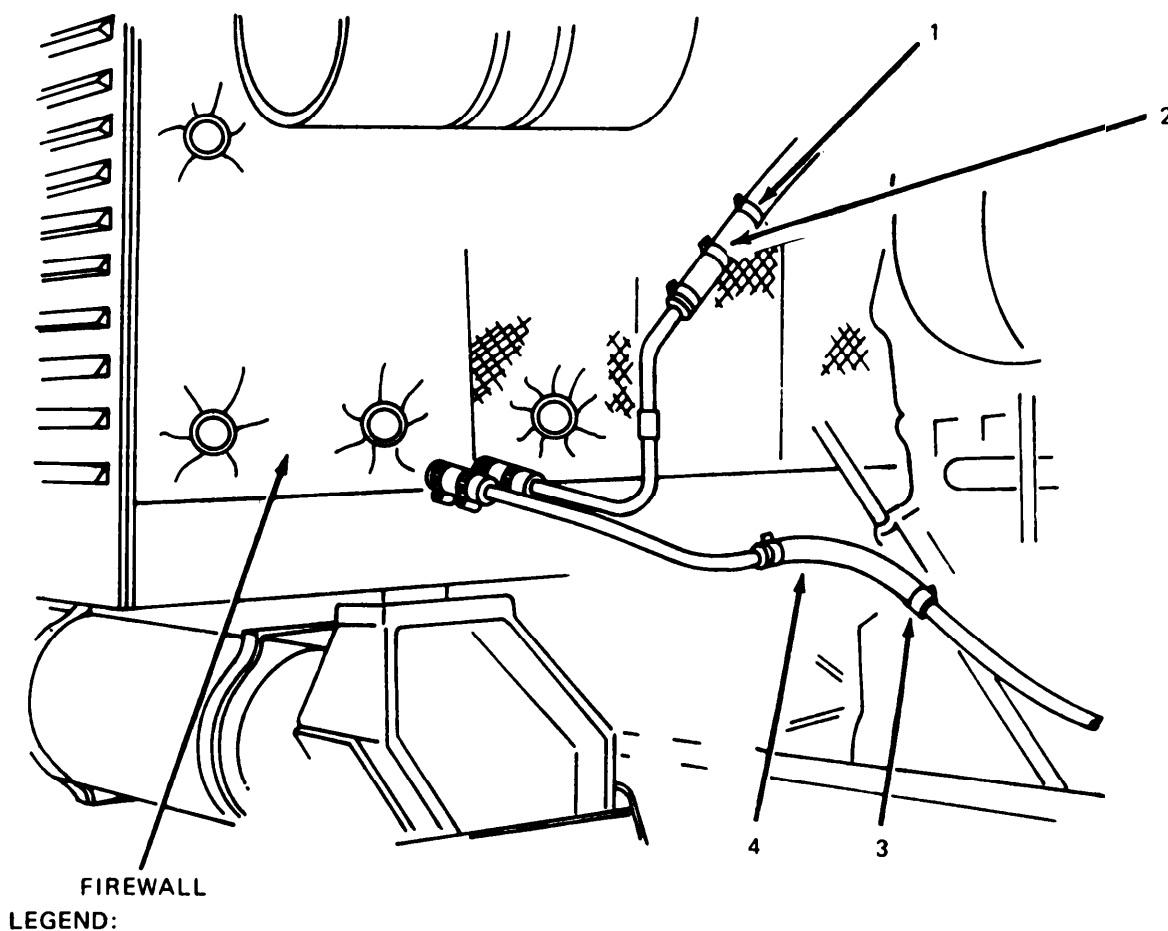
TA 073970

Figure 2-27. Disconnect Alternator Adjusting Rod.

(12) Disconnect wire from horn. (Refer to TM 9-2320-273-20.)

(13) Loosen clamps (1, fig. 2-28) and (3); then disconnect heater hoses (2) and (4).

(14) Remove left front fender. (Refer to TM9-2320-273-20.)



- 1. CLAMP (3)
- 2. HOSE
- 3. CLAMP
- 4. HOSE

TA 073971

Figure 2-28 Disconnect Heater Hoses.

(15) Disconnect lines at power steering pump. (Refer to TM 9-2320-273-20.)

- (16) Disconnect bypass oil filter lines (fig. 2-29) at the bypass oil filter.
- (17) Disconnect tachometer cable from fuel pump. (Refer to TM 9-2320-273-20.)
- (18) Disconnect accelerator rod from fuel pump by removing nut and washer. (Refer to TM 9-2320-273-20.)
- (19) Disconnect fuel supply line from filter. (Refer to TM 9-2320-273-20.)

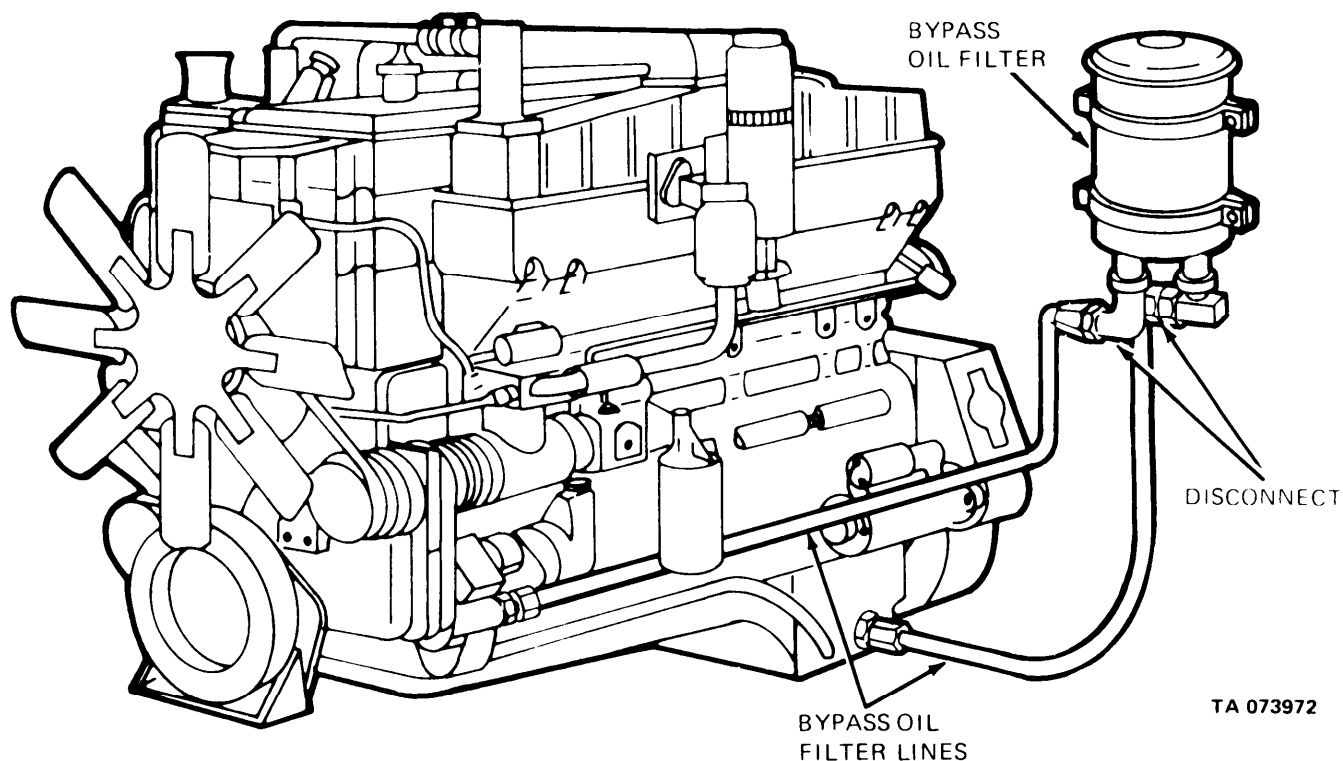
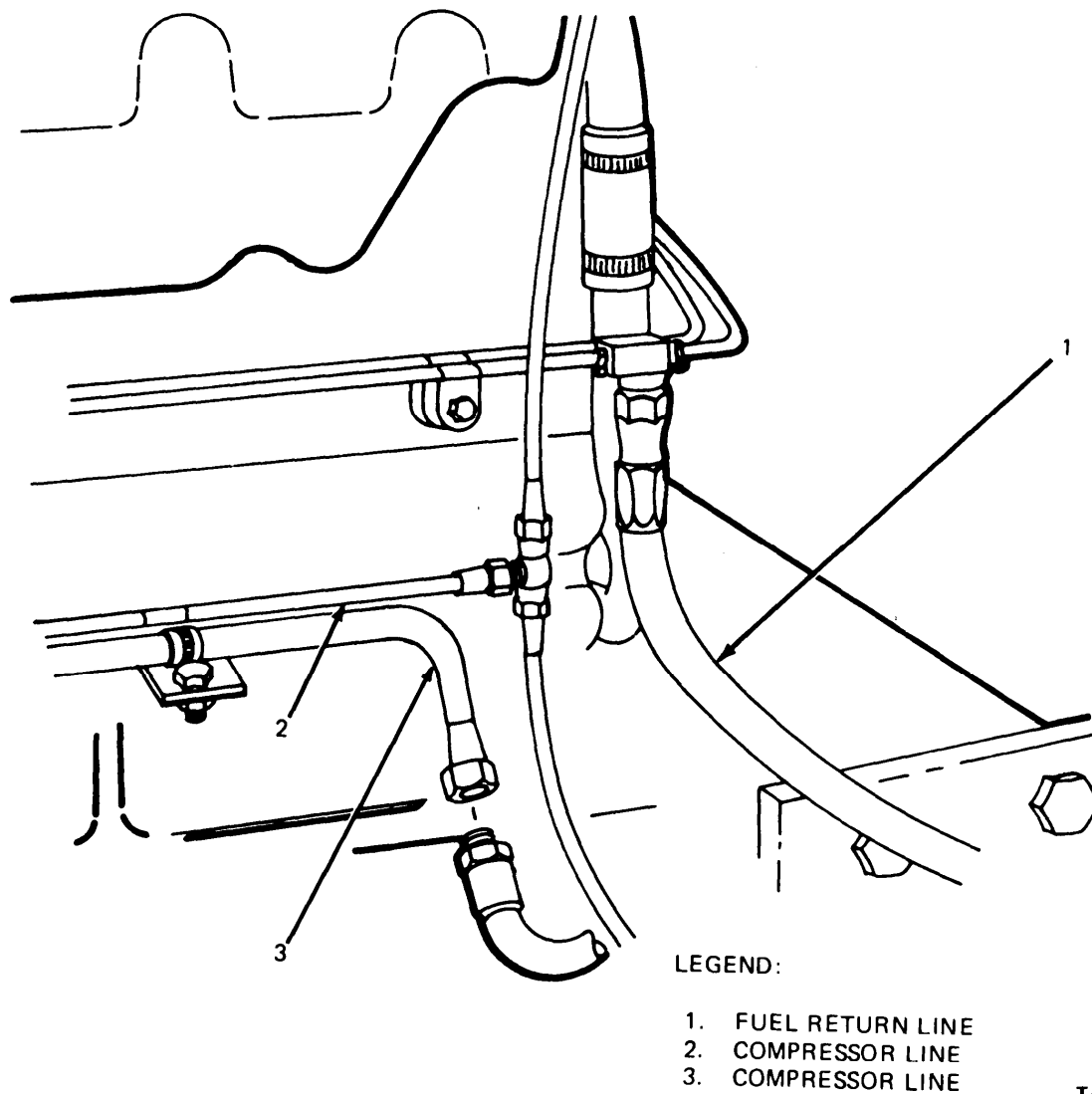


Figure 2-29. Disconnect Bypass Oil Filter Lines.

- (20) If the vehicle is equipped with an optional engine oil heater, remove the cover and disconnect the wire terminals. (Refer to TM 9-2320-273-20).
- (21) if the vehicle is equipped with an optional engine coolant heater, disconnect coolant heater hoses from the front and rear ports of the heater. (Refer to TM 9-2320-273-20).

(22) Disconnect fuel return line (1, fig. 2-30) at tee connector.

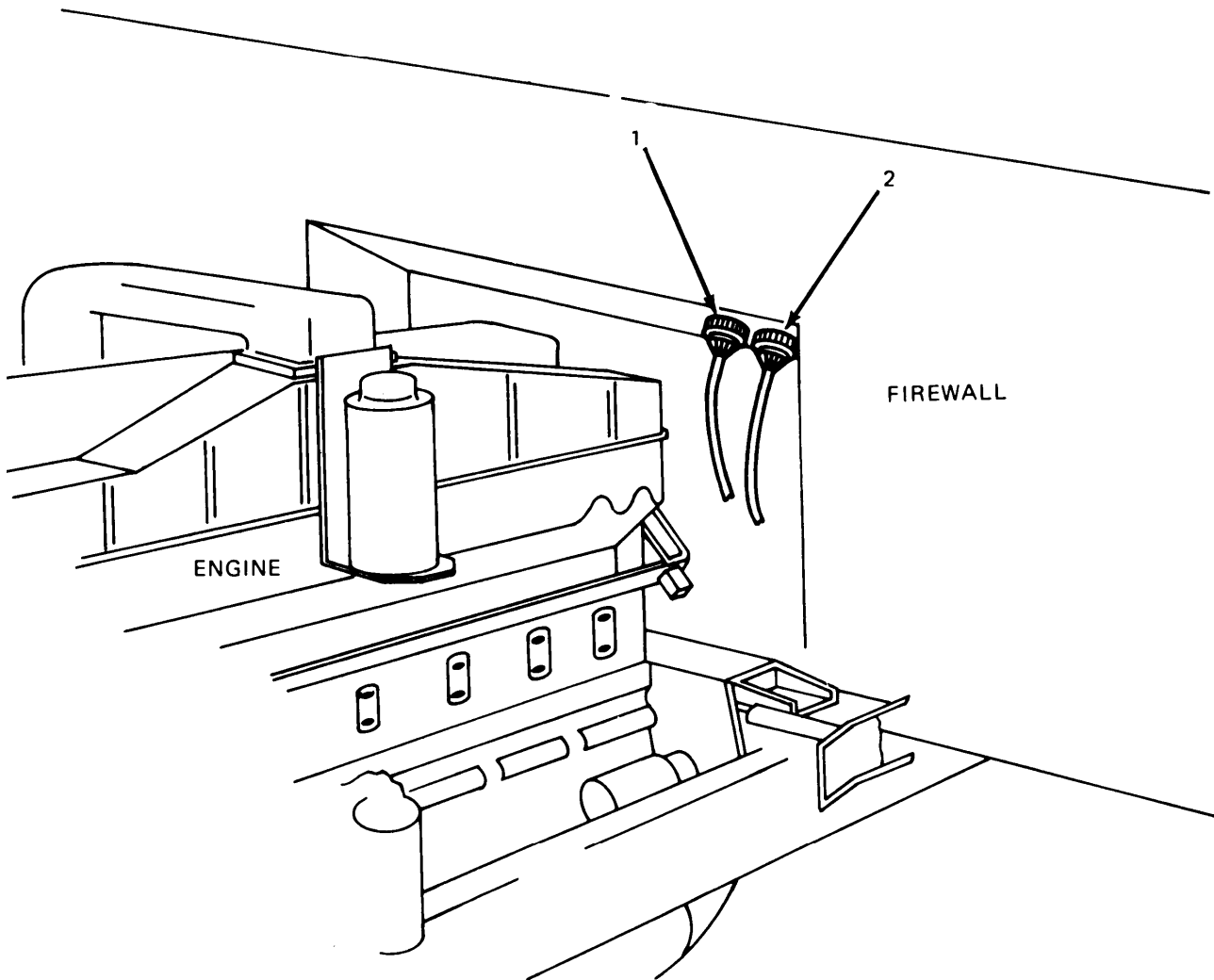
(23) Disconnect compressor lines (2) and (3).



TA 073973

Figure 2-30. Disconnect Fuel and Compressor Lines at Firewall.

(24) Disconnect electrical plug (1, fig. 2-31) and (2) at firewall. Tag plugs to aid in reassembly.



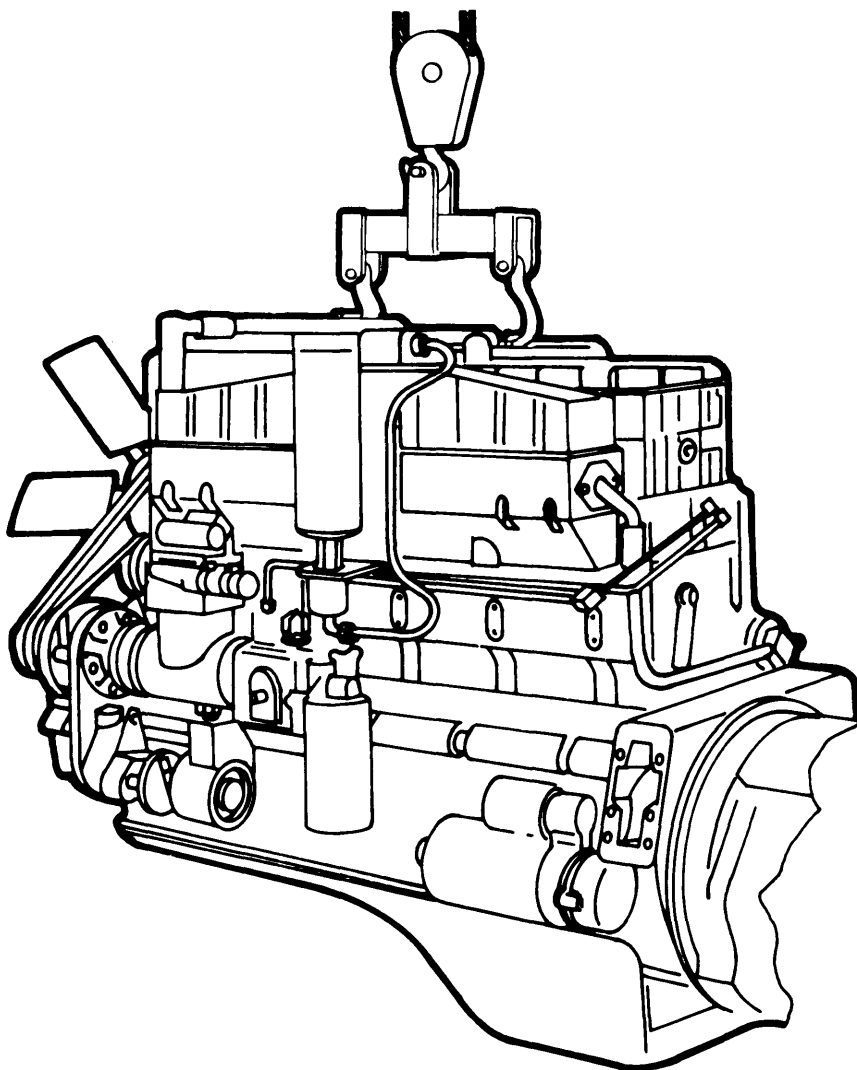
LEGEND:

- 1. PLUG
- 2. PLUG

TA 073974

Figure 2-31. Disconnect Electrical Plugs at Firewall.

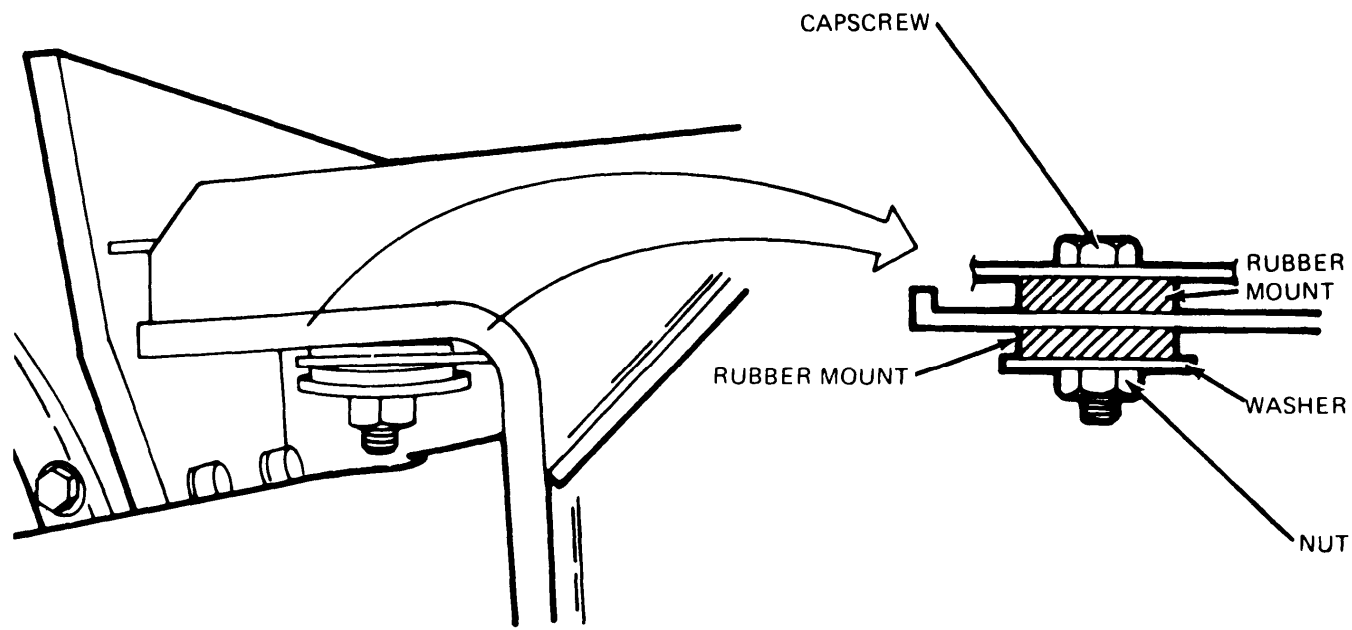
- (25) Disconnect 24-volt cables and ground strap at starter. (Refer to TM 9-2320-273-20.)
- (26) Disconnect block-to-frame ground strap. (Refer to TM 9-2320-273-20.)
- (27) Using a hoist, attach sling to support engine (fig. 2-32).



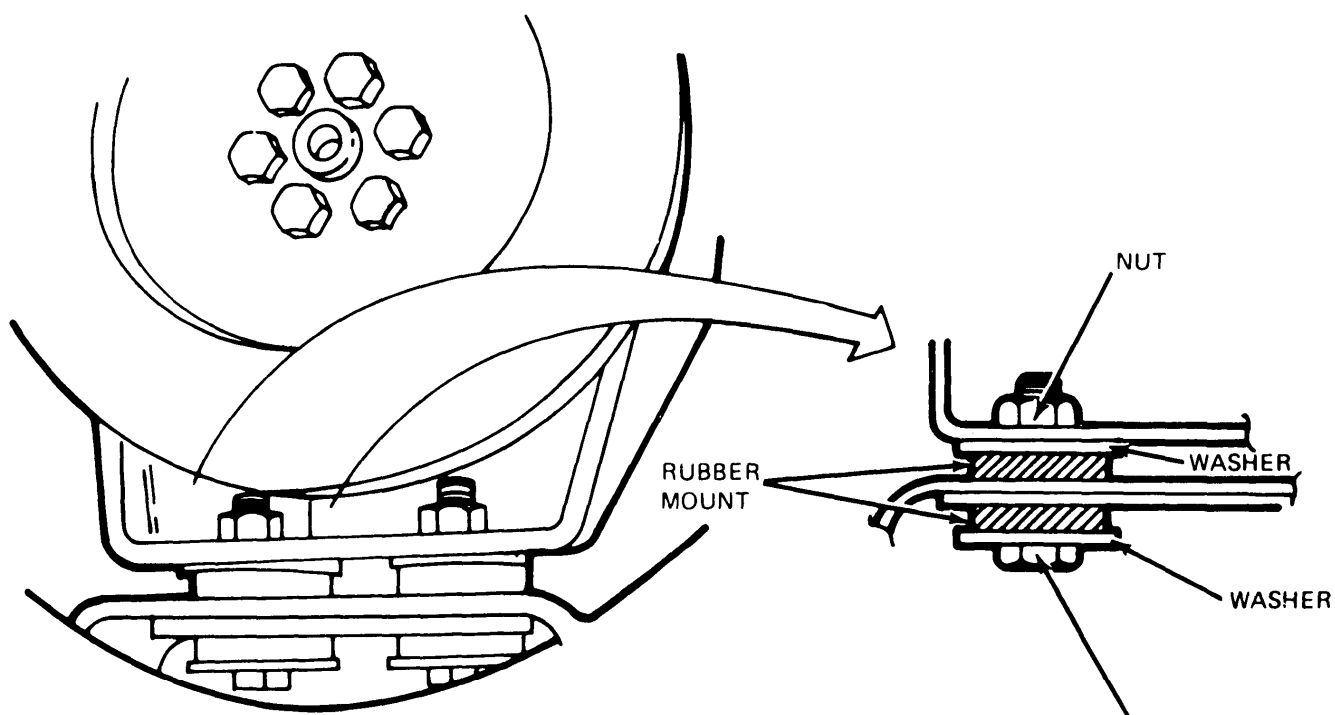
TA 073975

Figure 2-32. Support Engine with Sling and Hoist.

- (28) Remove engine mounting capscrews (fig. 2-33); two at front of engine and one on each side at rear.



REAR SIDE MOUNTS



FRONT MOUNTS

TA 073976

Figure 2-33. Remove Engine Mounting Capscrews

CAUTION

When the engine is being removed, observe the following:

- a. Engine binds or is hard to move (an indication something may still be connected to engine that must be removed).
- b. Wiring, lines, cables, and rods are not in the path of removal. Tie or secure as necessary.
- c. Pay particular attention to the alternator on all models and power steering pump on M915 – clearance to vehicle frame is close.

(29) With two men guiding the engine out (one on each side), slowly lift engine and move clear of vehicle.

b. Installation.

(1) Inspect engine compartment and make sure that all wiring, tubing, and other components present no obstruction to engine installation.

(2) Using a hoist, attach sling to support the engine as shown in figure 2-32.

CAUTION

Pay particular attention to the alternator and power steering pump during engine installation –clearance to vehicle frame is close.

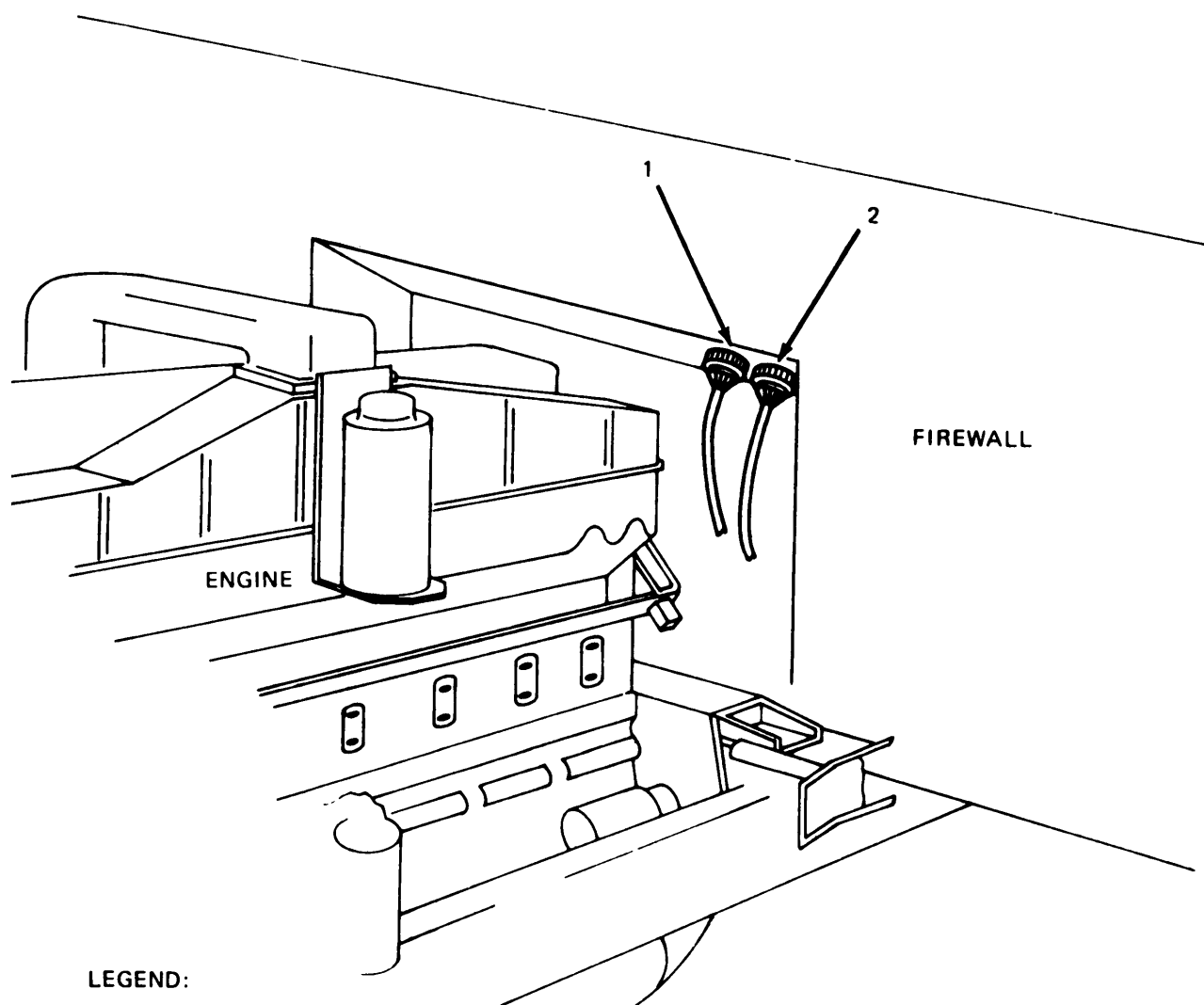
(3) With two men guiding the engine in (one on each side), slowly move engine into engine compartment and lower onto frame mounts.

(4) Install engine mounting capscrews (fig. 2-33); two at front of engine and one on each side at rear. Tighten to 125-165 lb-ft (170-223 N-m) torque.

(5) Connect two 24-volt battery cables; positive (red) cable to the starter solenoid and the negative (black) to the starter motor. (Refer to TM 9-2320-273-20.)

(6) Connect block-to-frame grounding strap and secure with capscrew. (Refer to TM 9-2320-273-20.)

(7) Connect the electrical plugs (1, fig. 2-34) and (2) to receptacles at firewall. If plugs were not identified during removal, observe that plug (2) has 19 wires; plug (1) has 16 wires.



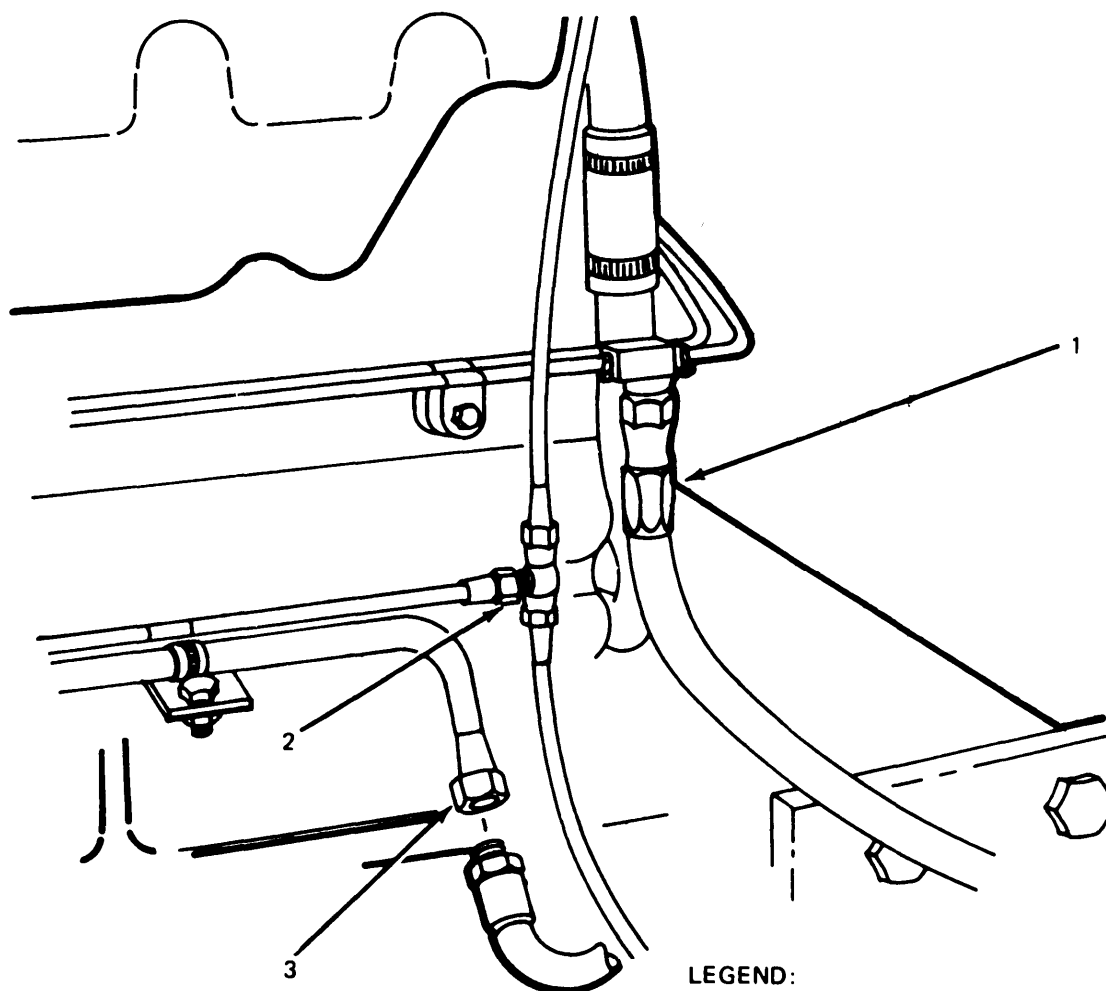
LEGEND:

- 1. PLUG
- 2. PLUG

TA 073974

Figure 2-34. Connect Electrical Plugs at Firewall.

(8) Connect air compressor lines (2, fig. 2-35) and (3).

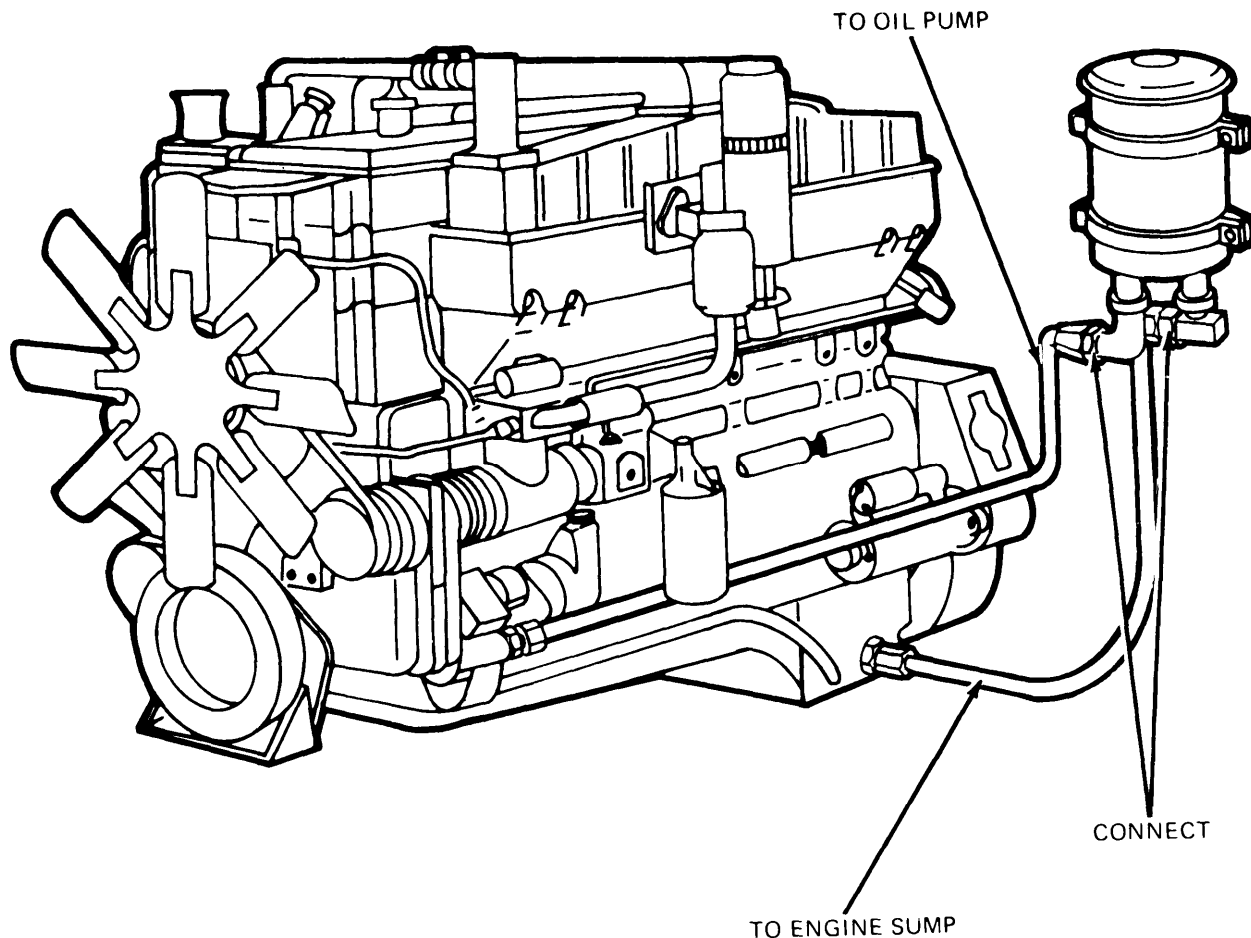


TA 073973

Figure 2-35 Connect Fuel and Compressor Lines at Firewall.

(9) Connect fuel return line (1) to tee connection.

- (10) Connect fuel line to fuel filter. (Refer to TM 9-2320-273-20.)
- (11) Connect tachometer cable to fuel pump. (Refer to TM 9-2320-273-20.)
- (12) Connect accelerator rod to fuel pump. (Refer to TM 9-2320-273-20.)
- (13) Connect bypass oil filter lines (fig. 2-36) to bypass oil filter.



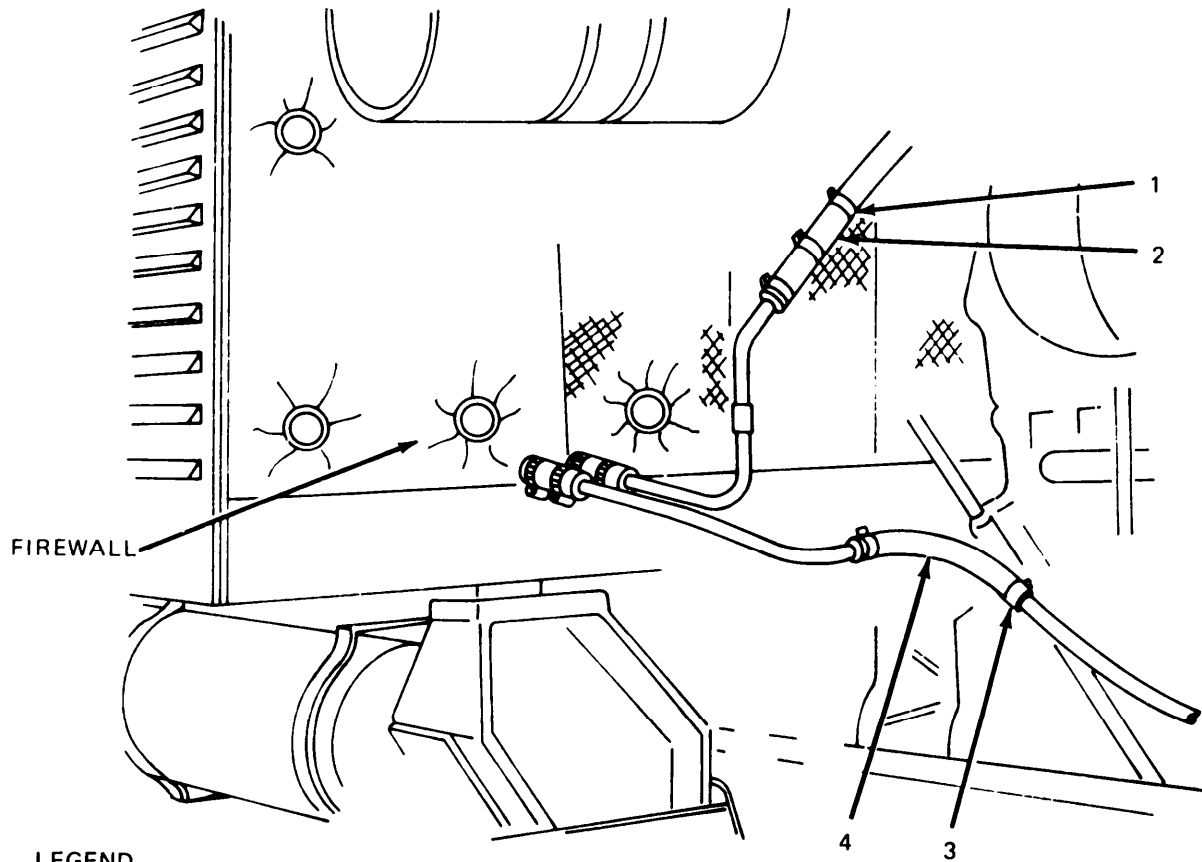
TA 073972

Figure 2-36. Connect Bypass Oil Filter Lines.

(14) If the vehicle is equipped with an optional engine oil heater, connect the wire terminals and install the cover. (Refer to TM 9-2320-273-20).

(15) If the vehicle is equipped with an optional engine coolant heater, connect coolant hoses to front and rear ports of the heater. (Refer to TM 9-2320-273-20).

- (16) Connect hydraulic lines at power steering reservoir. (Refer to TM 9-2320-273-20.)
- (17) Install left front fender. (Refer to TM 9-2320-273-20.)
- (18) Connect heater hoses (2, fig. 2-37) and (4) at rear of engine (right side). Secure with four clamps (1) and (3).
- (19) Connect electrical wire to horn. (Refer to TM 9-2320-273-20.)



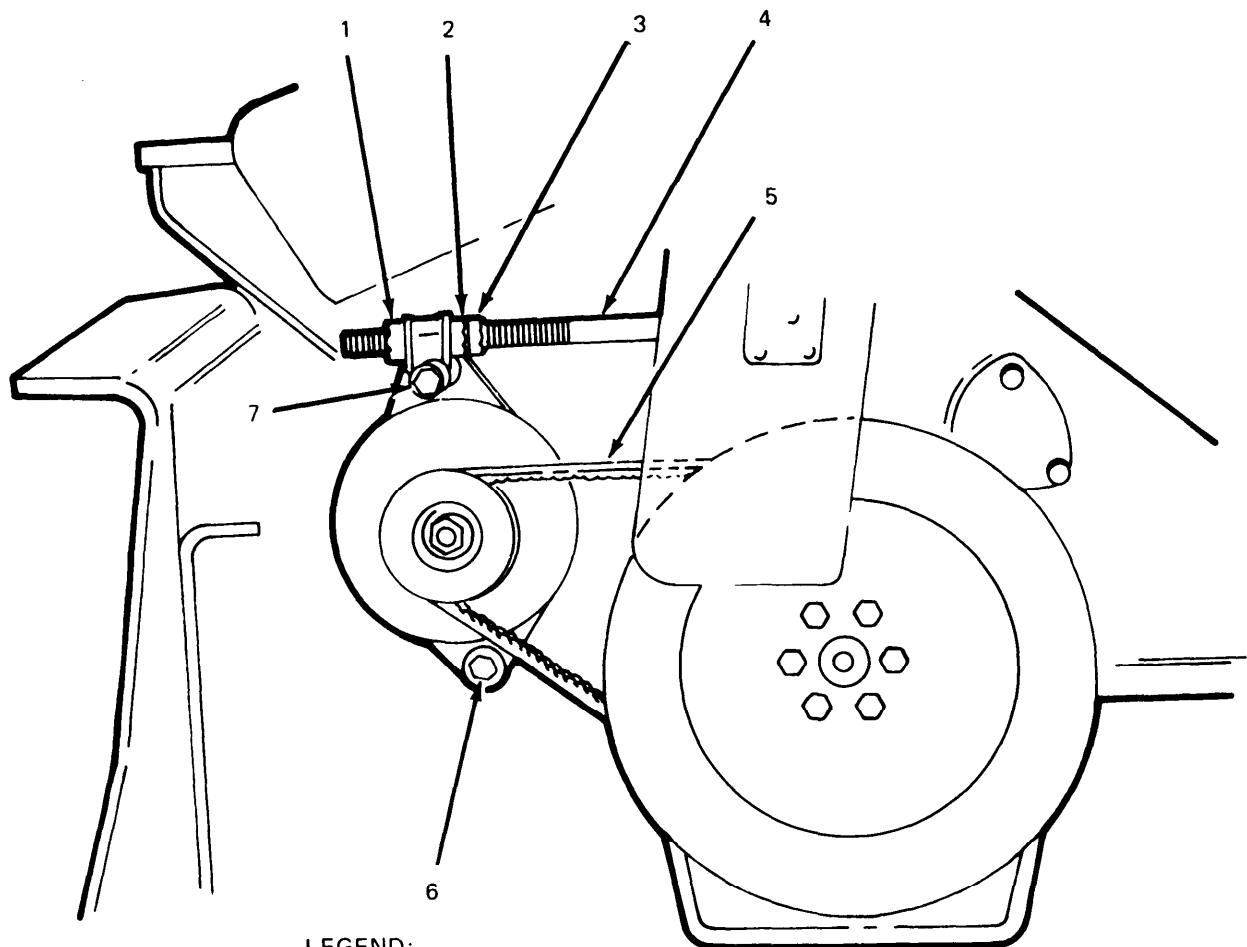
LEGEND

1. CLAMP (3)
2. HOSE
3. CLAMP
4. HOSE

Figure 2-37. Connect Heater Hoses.

TA 073971

(20) Connect adjusting rod (4, fig, 2-38) to alternator and secure with capscrew (7) and washer. Tighten capscrew (7) to 30 lb-ft (41 N-m). Adjust tension of belt (5) as follows.



LEGEND:

- | | |
|------------------|-------------|
| 1. NUT | 5. BELT |
| 2. NUT | 6. CAPSCREW |
| 3. NUT | 7. CAPSCREW |
| 4. ADJUSTING ROD | |

TA 073970

Figure 2-38. Connect Alternator Adjusting Rod.

(a) Loosen capscrew (6).

(b) Loosen nut (1).

(c) Move alternator out along adjusting rod (4) to obtain 110 lbs (50 kg) tension on a new belt or 80 lbs (36 kg) on a used belt. Use gage to measure tension. (A used belt is one that has been in operation for more than 1000 miles.)

(d) Tighten in order nuts (2) and (1).

(e) Tighten two capscrews (6) and (7) to 30 lb-ft (41 N-m) torque.

(f) Re-check tension of belt (5); then tighten nut (3).

- (27) Connect exhaust tube to turbocharger. (Refer to TM 9-2320 -273-20.)
- (22) Install radiator and radiator support rods (refer to TM 9-2320-273-20).
- (23) M916 thru M920 – Install brush guard (refer to TM 9-2320-273-20).
- (24) M915 only -- Install bumper and towing eyes (refer to TM 9-2320-273-20).
- (25) Install air cleaner assembly, inlet and outlet tubes (refer to TM 9-2320-273-20).
- (26) Replenish engine coolant and oil supply (refer to TM 9-2320-273-20).
- (27) Install hood (refer to TM 9-2320-273-20).
- (28) Install transmission as outlined in paragraph 2-11 b.
- (29) Road test vehicle to determine that engine and all engine systems work properly.
- (30) Check transmission and engine oil levels and engine coolant level. Add as required (Refer to LO 9-2320-273-12).

2-13. Transfer Case (M916 thru M920).

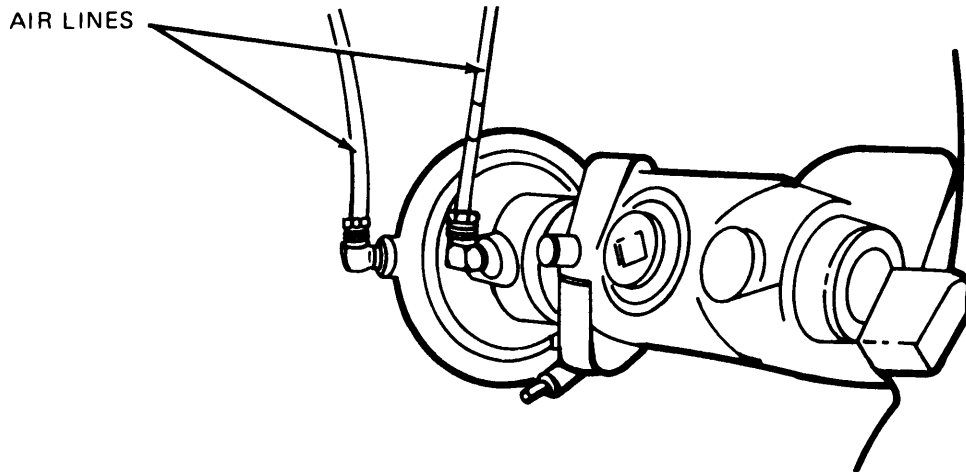
a. Preparation.

- (1) place system park brake on.
- (2) Set inter-axle differential control to unlock.

b. Removal Procedure.

- (1) Drain oil from case (Refer to TM 9-2320-273-20.)
- (2) Disconnect three propeller shafts from transfer case. (Refer to TM 9-2320-273-20.)

- (3) Tag and disconnect two air lines from lockup air chamber (fig. 2-39).



TA 073977

Figure 2-39. Disconnect/Connect Air Lines from Lockup Air Chamber.

NOTE

In steps (4) and (5), three men should be available. Two men supporting the transfer case and one removing the capscrews; then operating the jack.

- (4) Support the transfer case with a suitable jack.

(5) Remove four capscrews (5) and washers (4) that secure the transfer case to each frame rail (fig. 2-40); then lower and remove the transfer case.

(6) Remove four capscrews (1), insulators (2) washers (10) and nuts (11), then remove support (3) and bracket (9).

(7) Remove four capscrews (6) and nuts (13).

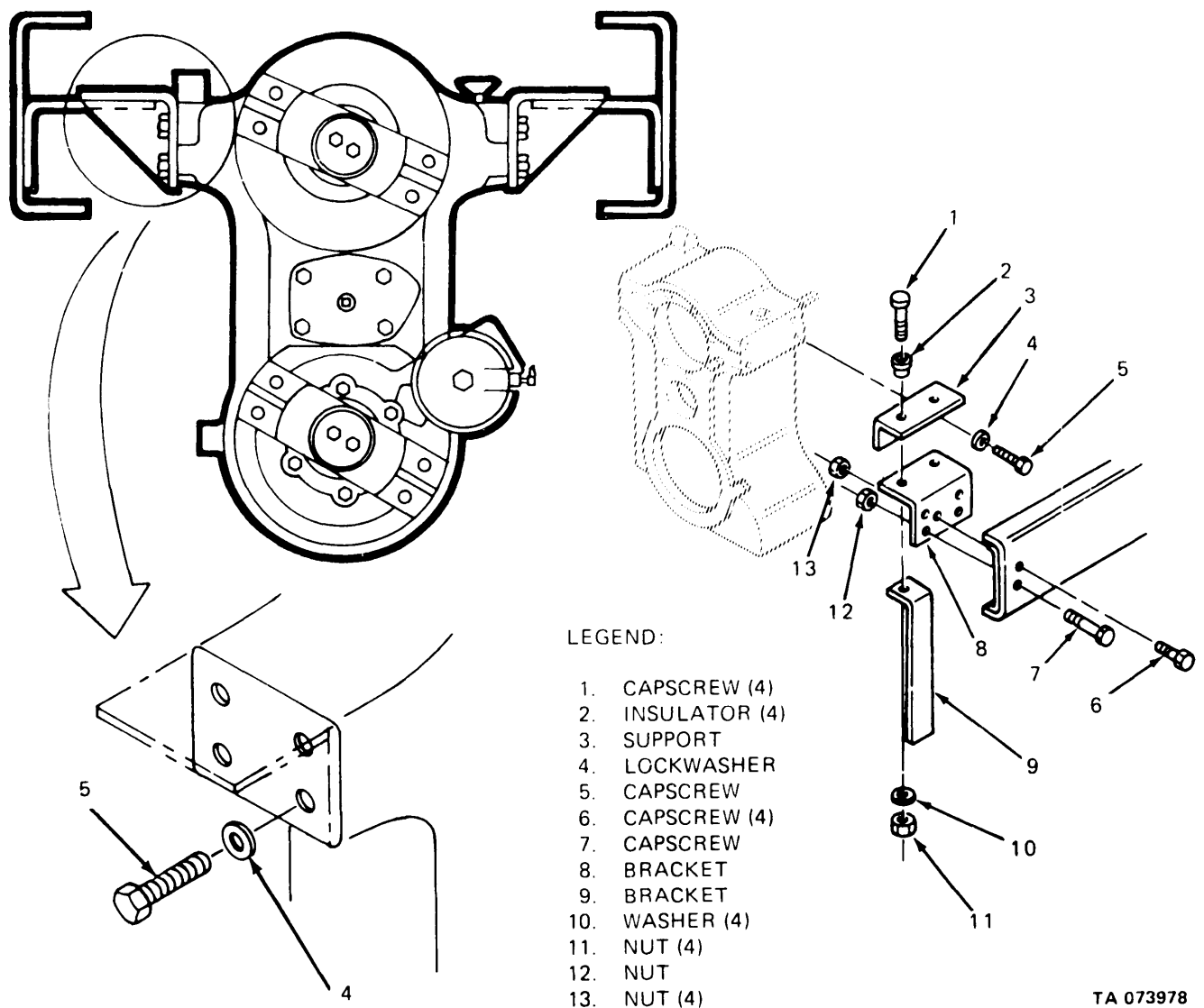
(8) Remove capscrew (7), nut (12), and bracket (8).

c. *Installation Procedure.*

(1) Install bracket (8) with capscrew (7) and nut (12).

(2) Install four capscrews (6) and nuts (13).

(3) Install four capscrews (1) thru insulators (2), support (3), brackets (8) and (9). Secure with four washers (10) and nut (11).



TA 073978

Figure 2-40. Remove/Install Transfer Case Fastening Capscrews.

NOTE

In steps (4) and (5), three men should be available. Two men supporting the transfer case and one operating the jack; then installing the capscrews. Top two capscrews on each side must go in first.

(4) Support transfer case on suitable jack and position under vehicle.

(5) Install four capscrews (5) and lockwashers (4) that secure the transfer case to each frame rail (fig. 2-40). Tighten capscrews to 170 lb-ft (231 N·m) torque.

(6) Apply liquid teflon (Item 14, App B) to threads of two air line connectors (fig. 2-39); then connect two air lines to lockup air chamber.

(7) Connect three propeller shafts to the transfer case. (Refer to TM 9-2320-273-20.)

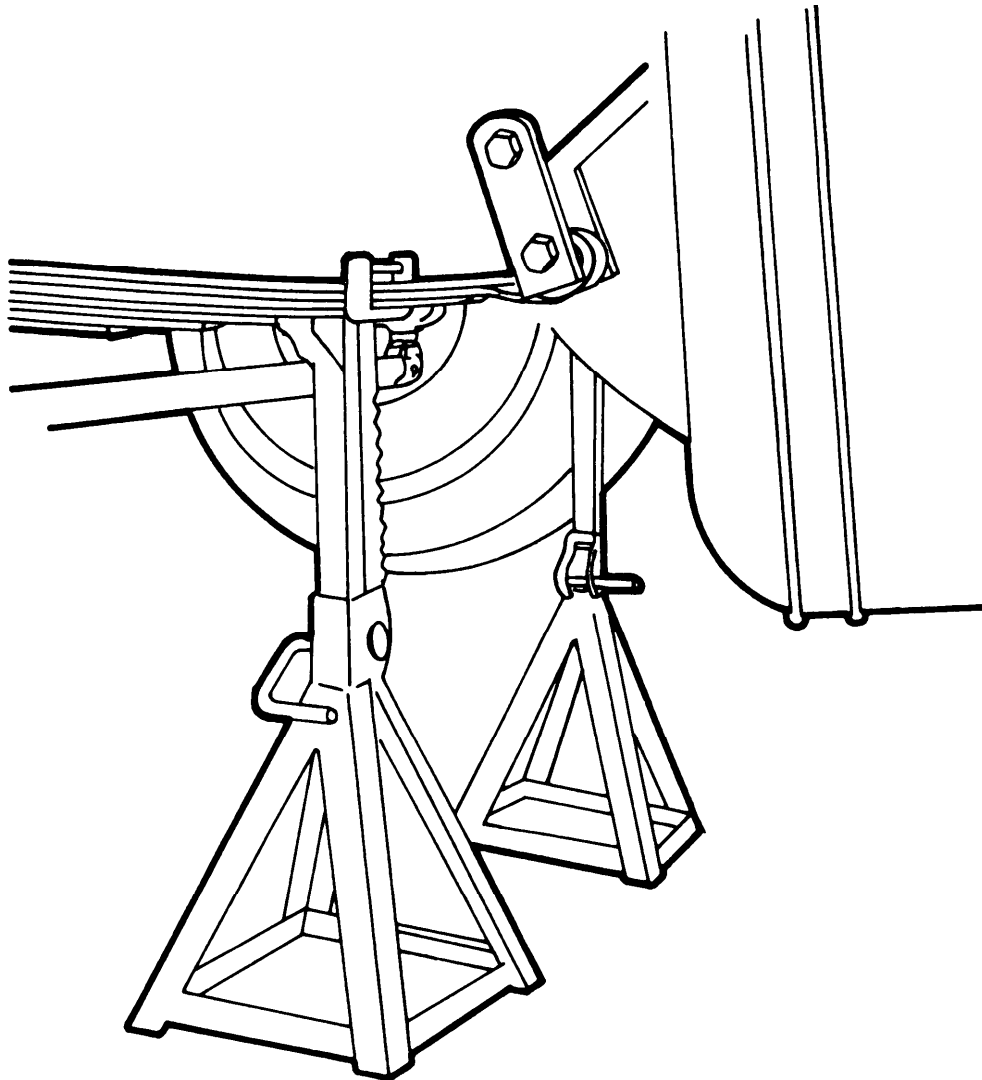
(8) Replenish transfer case oil supply. (Refer to LO 9-2320-273-12.)

2-14. Front Axle (M915).

a. Preparation.

(1) Jack up or hoist vehicle and remove both front wheels in accordance with TM 9-2320-273-10.

(2) Place two stands, each rated for five ton capacity, in position to support vehicle (fig. 2-41).



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Figure 2-41. Support Vehicle on Stands.

(3) Slowly lower jack or hoist so that stands support vehicle.

b. Removal Procedure.

- (1) Remove both shock absorbers. (Refer to TM 9-2320-273-20.)
- (2) Remove brake drum, hub, and wheel bearings as described in procedure for Front Wheel Bearings and Seal Maintenance, TM 9-2320-273-20. Repeat procedure for other side of axle.
- (3) Disconnect drag link from pitman arm by removing cotter pin and 1-5/16 in. nut (fig. 2-42). Pry arm off of pitman arm with a clamp-type press or use a tie rod end fork.

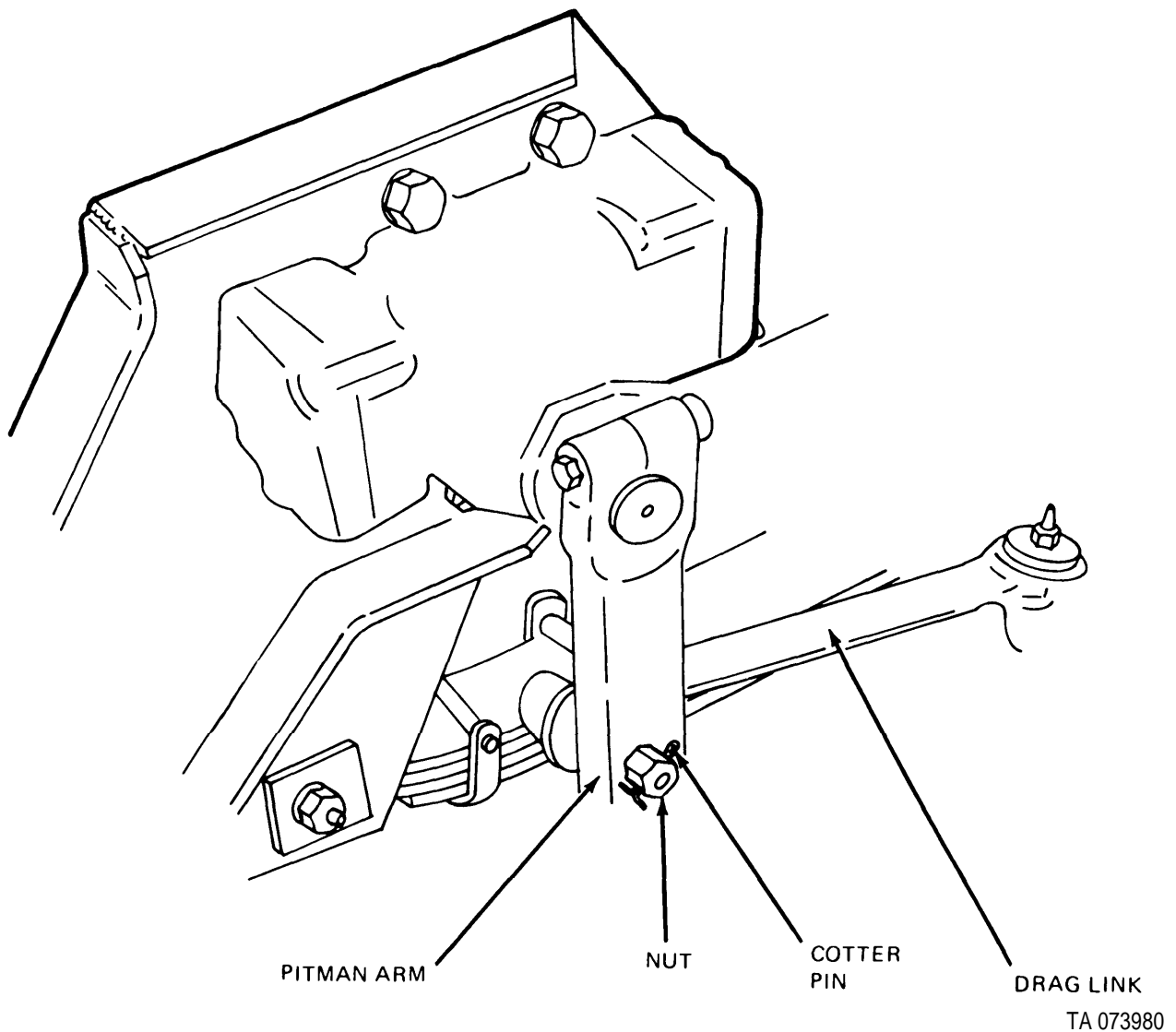


Figure 2-42. Disconnect/Connect Drag Link.

- (4) Disconnect brake air lines (fig. 2-43) in three places at both sides of axle.

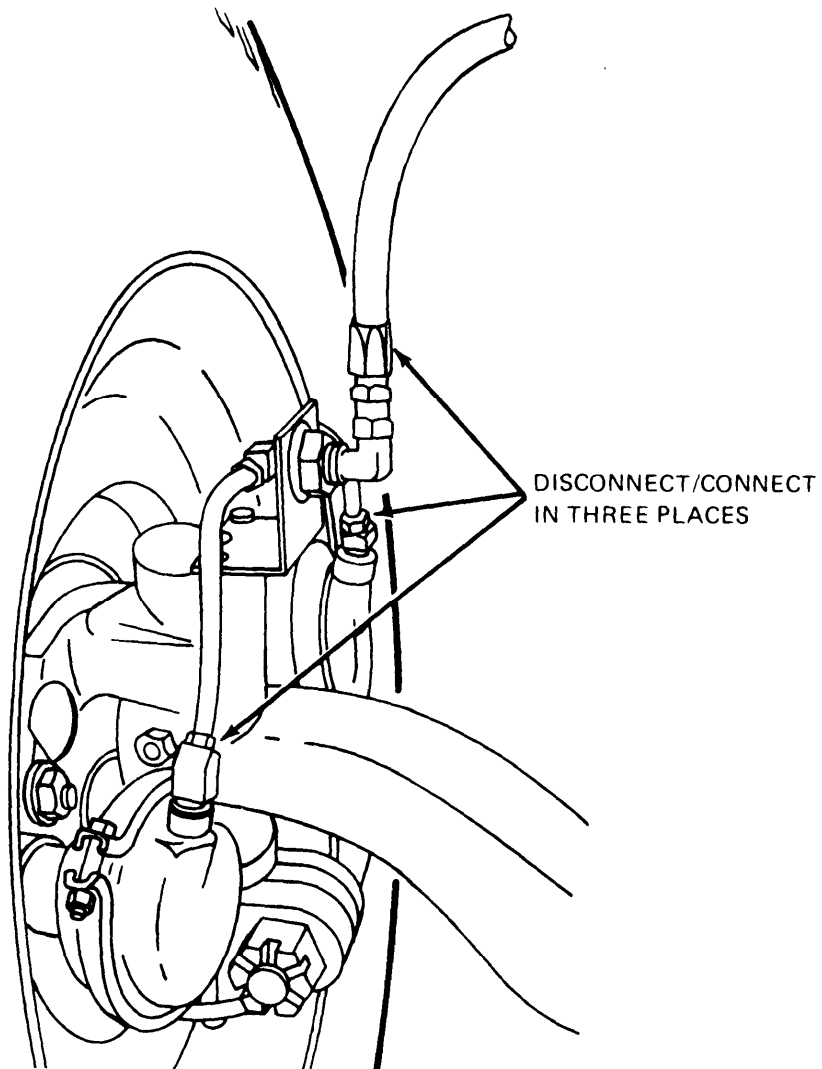


Figure 2-43. Disconnect/Connect Brake Air Lines.

TA 073981

- (5) Place a jack rated for ten ton capacity in center of front axle (fig. 2-44).

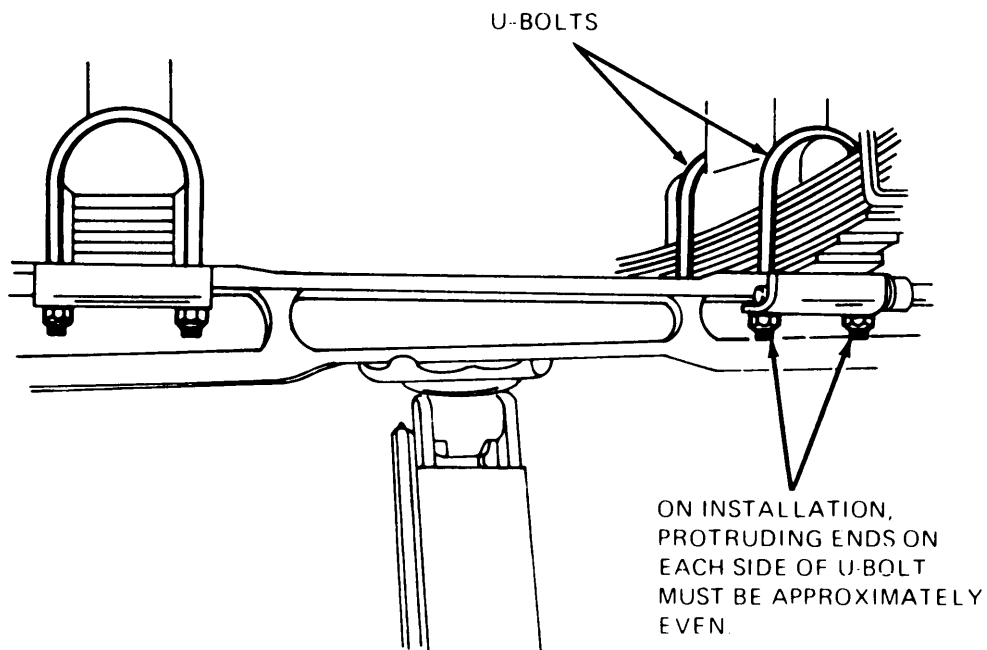


Figure 2-44. Remove/Install Spring U-Bolts.

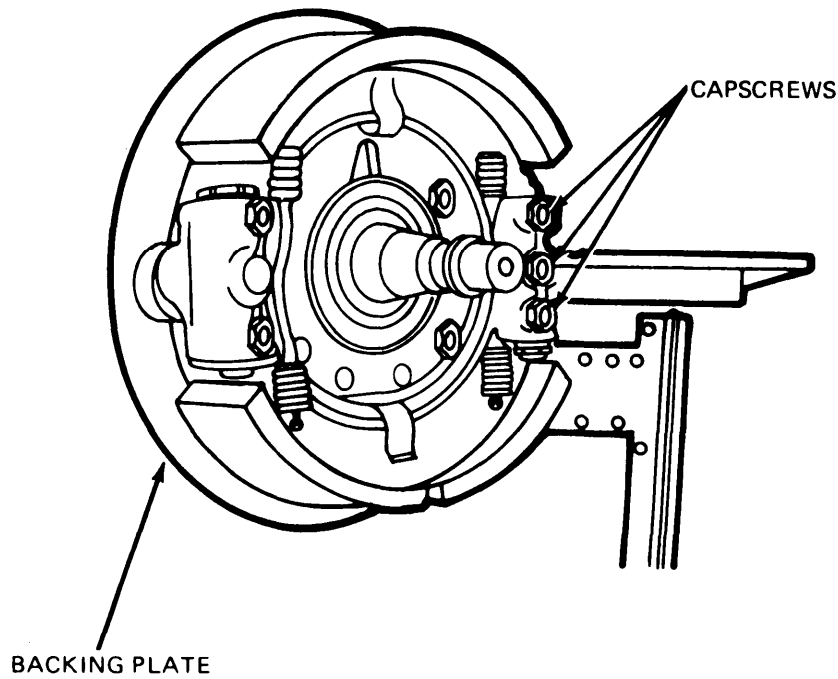
- (6) Remove shock mounting bracket and two U-bolts from each spring by removing attaching nuts and washers.

NOTE

Three men may be required to remove the assembled axle from under the vehicle.

- (7) With one man guiding each end of the axle, lower jack and pull axle out from under vehicle.
- (8) Using a sling and hoist, place axle on suitable bench.

(9) Remove seven capscrews, nuts, and washers that fasten the brake backing plate and remove the backing plate with attached brake assemblies (fig. 2-45).



TA 073983

Figure 2-45, Remove/Install Backing Plate.

c. Installation procedure.

(1) Make sure that vehicle is supported as shown in figure 2-41.

(2) Mount backing plate with attached brake assemblies onto the front axle, as shown in figure 2-45. Push seven capscrews through backing plate and secure assembly with washers and nuts. Tighten to 170 lb-ft (231 N-m) torque.

NOTE

Three men may be required to position and install assembled axle on vehicle.

(3) Using a sling and hoist, place axle on a jack and roll jack into position under vehicle.

(4) With one man guiding each end of axle, raise the axle until it is against each leaf spring. Make sure that spring center bolt enters the guide hole.

NOTE

When installing nuts on each U-bolt, tighten each nut a few turns at a time so that approximately the same number of threads protrude beyond the nut on each side of the bolt (fig. 2-44).

(5) Install shock mounting bracket, washers and nuts on each U-bolt. Tighten to 125-165 lb-ft (170-224 N-m) torque.

(6) Connect brake air lines in three places at each side of axle (fig. 2-43).

(7) Connect drag link to pitman arm (fig. 2-42) and secure with nut tightened to 110-125 lb-ft (149-170 N-m) torque. Install cotter pin.

(8) Install brake drum, hub, and wheel bearings as described in procedure for Front Wheel Bearings and Seal Maintenance, TM 9-2320-273-20. Repeat procedure for opposite side of axle.

(9) Install both shock absorbers, (Refer to TM 9-2320-273-20.)

(10) Install both front wheels. (Refer to TM 9-2320-273-10.)

(11) Road test vehicle and check for vibration, steering or brake problems.

2-15. Front Axle (M916 thru M920). The procedure for replacing the front axle on the models M916 thru M920 are identical to the procedures for the model M915 except as noted below.

a. Preparation. (same as para 2-14a).

b. *Removal Procedure.* Omit step (1) in para 2-14b and perform the following additional tasks at beginning of procedure.

(1) Drain oil from axle differential. (Refer to LO 9-2320-273-12).

(2) Disconnect propeller shaft from axle differential. (Refer to TM 9-2320- 273-20.)

(3) Disconnect auxiliary power steering cylinder from steering linkage by removing cotter pin, nut, and washer. (Refer to TM 9-2320-273-20.)

c. Installation Procedure. Omit step (11) in para 2-14c and perform the following additional tasks prior to road testing vehicle.

(1) Connect auxiliary power steering cylinder (TM 9-2320-273-20) and secure with washer and nut. Tighten nut to 110-125 lb-ft (150-170 N-m) torque and install cotter pin.

(2) Connect propeller shaft to axle differential (Refer to TM 9-2320-273-20).

(3) Replenish axle differential oil supply. (Refer to LO 9-2320-273-12.)

2-16. Rear Tandem Axle and Equalizer Beams.

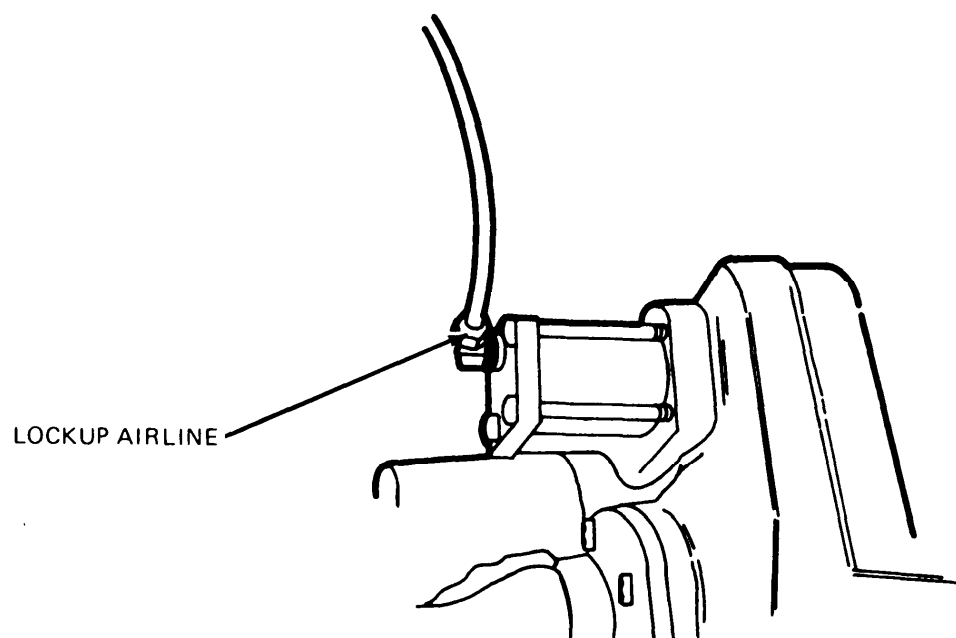
a. Removal.

(1) Disconnect air line at forward rear axle differential lockup air chamber (fig. 2-46).

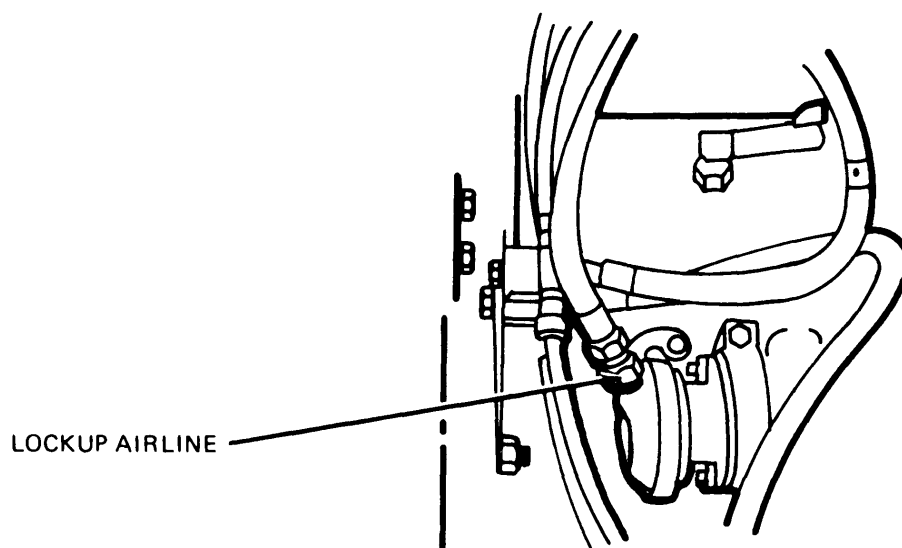
(2) Disconnect air lines as follows:

(a) M915. Disconnect air lines from forward rear axle at the quick-release valve and tee connection (fig. 2-47). Tag for location.

(b) M916 *thru* M920. Disconnect air lines from forward rear axle at the quick-release valve and tee connection. Tag for location.



M915



M916 THRU M920

Figure 2-46. Disconnect/Connect Differential Lockup Chamber Air Line.

TA 073984

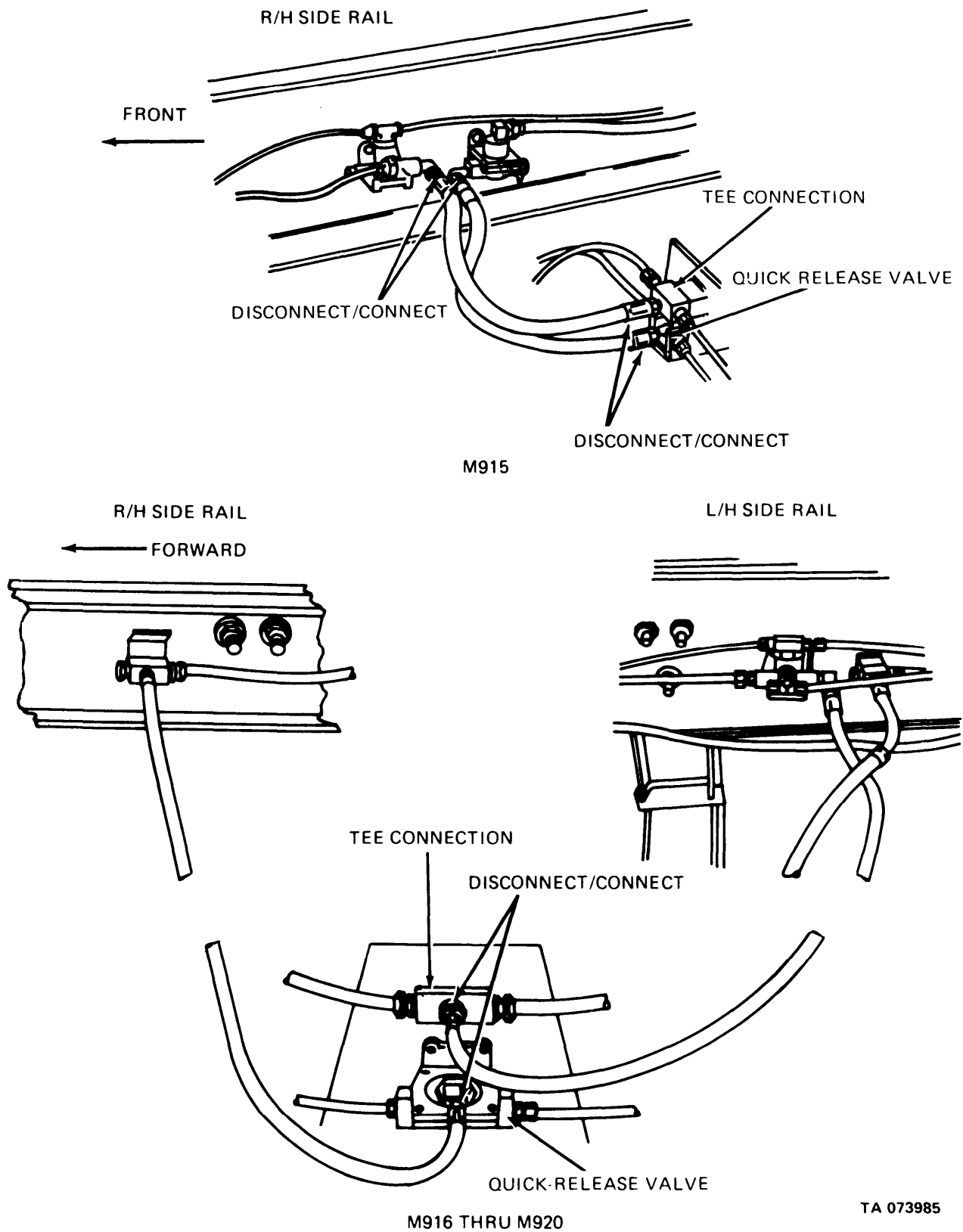


Figure 2-47. Disconnect/Connect Forward Rear Axle Brake Air Line.

(3) Disconnect spring brakes. (Refer to TM 9-2320-273-20.)

(4) Disconnect air lines from rear rear axle at the tee connection and quick-release valve (fig. 2-48). Tag for location.

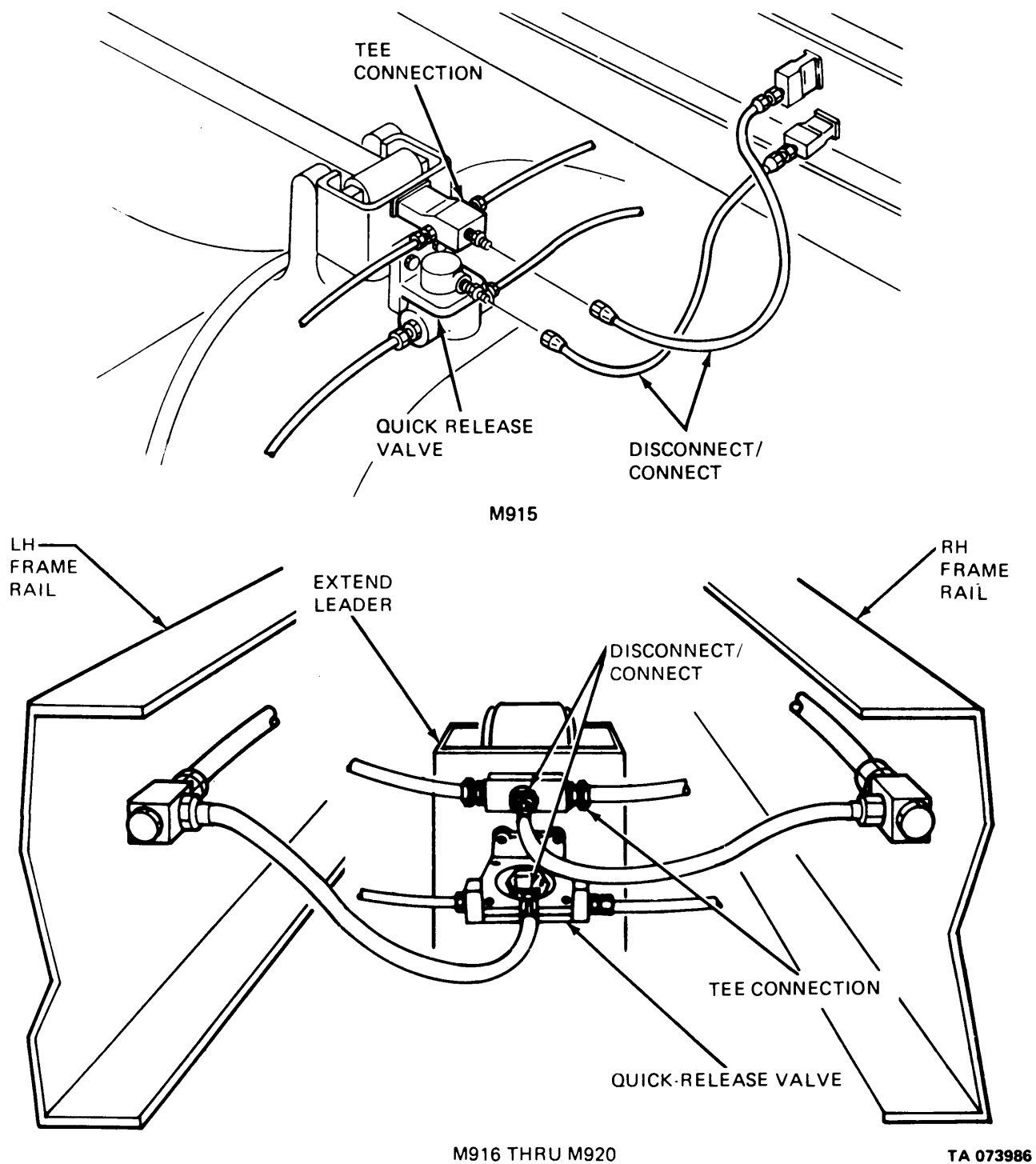
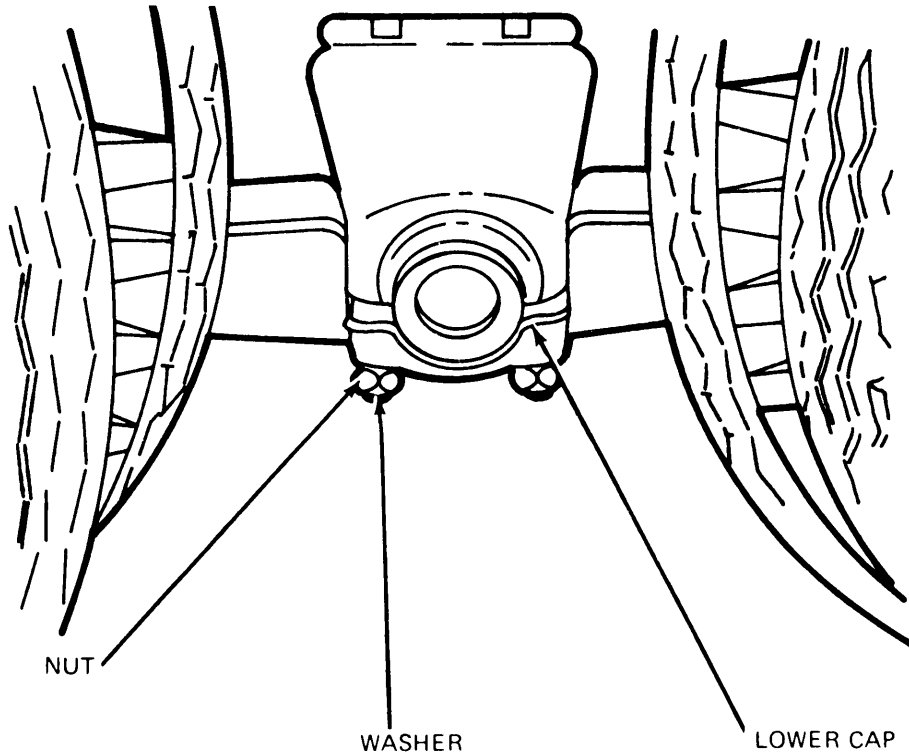


Figure 2-48 Disconnect/Connect Rear Axle Brake Air Lines.

- (5) Disconnect propeller shaft at forward rear axle. (Refer to TM 9-2320-273-20.)
- (6) Disconnect forward and rear torque rods from their respective axles. (Refer to TM 9-2320-273-20.)
- (7) Remove four nuts and washers that fasten spring to beam (fig. 2-49). Pull off two lower caps.



TA 073987

Figure 2-49. Remove/Install Spring U-Bolts and Lower Caps.

- (8) Repeat step (7) for opposite side of axle.
- (9) Block front wheels,
- (10) Raise rear of vehicle high enough to remove rear tandem axle assembly; then roll out the assembly.
- (11) To remove one axle:
 - (a) Disconnect interaxle propeller shafts from the axle being replaced. (Refer to TM 9-2320-273-20.)
 - (b) Remove wheels. (Refer to TM 9-2320-273-10.)
 - (c) If necessary, remove hub, drum, and wheel bearings as described in procedure for Rear Wheel Bearings and Seal Maintenance (TM 9-2320-273-20).
 - (d) Disconnect brake air lines and fittings, as necessary and mark for reassembly.
 - (e) Remove equalizer beam and mountings on both sides and separate axles, see step 12.

NOTE

In some cases, it may be necessary to remove the air brake chambers for assembly. (Refer to TM 9-2320-273-20).

(12) Disconnect equalizer beams from the axle bracket beam hanger, if required.

(a) Remove adapter nut and washer from adapter bolt (fig. 2-50).

(b) Wedge out the outside adapter by driving a chisel in the relief provided, first on one side, then the other.

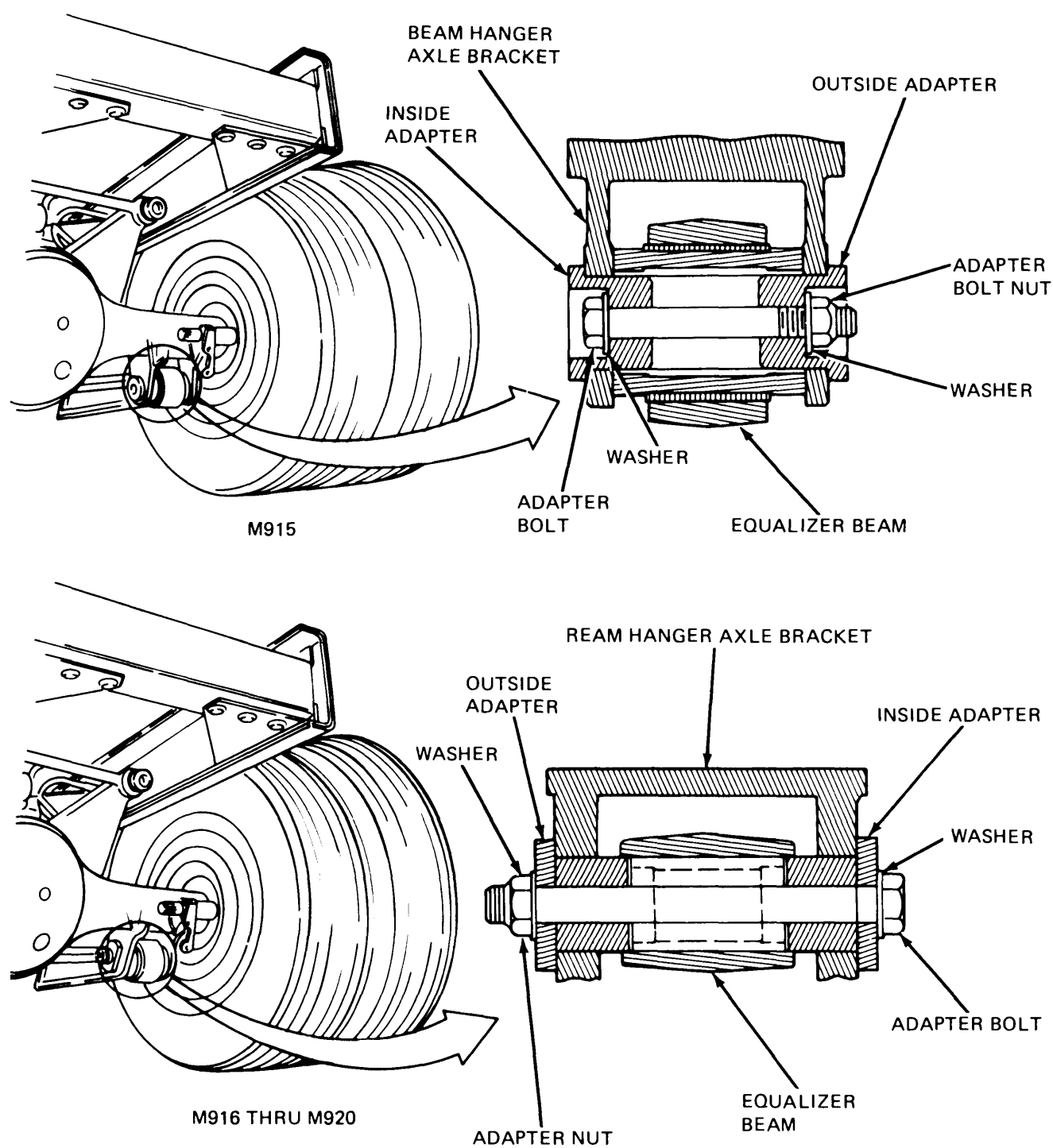
NOTE

(M916 thru M920). On the short side of the axle housing the bolt cannot be removed because of the interference with the differential case. In this situation, the inside adapter must be wedged out first, then the bolt must be pulled down and away from the differential case for removal.

(c) After removing the outside adapter, the inside adapter and bolt can be driven out with an impact hammer or heavy bar and hammer. If this procedure fails, a chisel and hammer may be used.

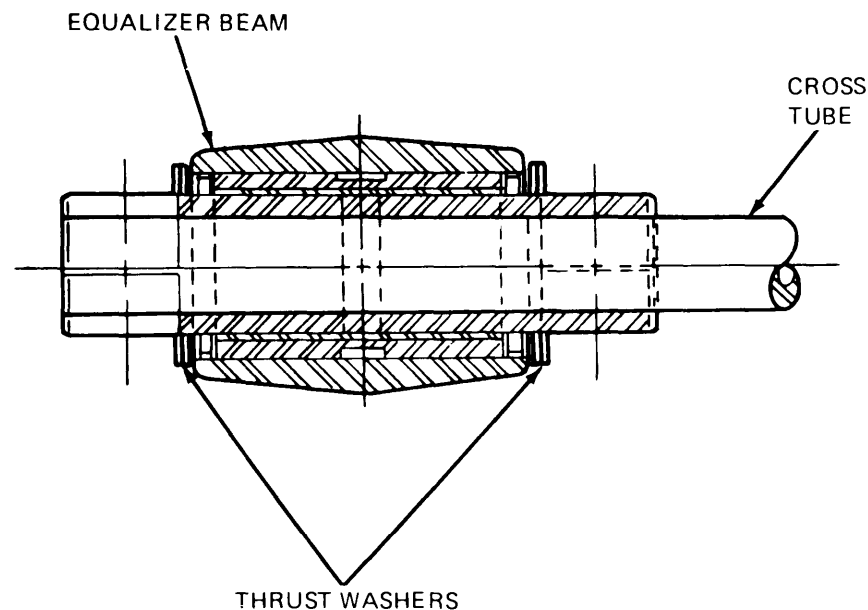
NOTE

M916 thru M920 model vehicles utilize four thrust washers per equalizer beam (fig. 2-51). There are two thrust washers used on both sides of the equalizer beam to separate the beam from the saddle assembly. Note location when separating equalizer beams from cross tube.



TA 073988

Figure 2-50. Remove/Install Equalizer Beam End Connections.



TA 073989

Figure 2-51. Remove/Install Cross Tube.

(d) When both ends of the equalizer beams have been separated from axles, separate the beams from cross tube by pulling apart by hand.

(e) Inspect rubber bushings for damage or deterioration. Petroleum products usually will not harm the equalizer beam center bushings as they are not in an exposed location. The outer edges of the beam end bushings are exposed and will deteriorate from continued oil saturation. If the vehicle has been in service for a long period of time, it is advisable to replace all bushings (refer to para 18-14 and 18-15).

b. Installation.

(1) Join the forward rear axle to rear rear axle as follows:

(a) M915. Install cross tube into equalizer beams and place in position under axles.

(b) (/M976 thru M920). Install four thrust washers on cross tube (fig. 2-51). Install cross tube into equalizer beams. Slide two thrust washers to the inside of each beam. Install two thrust washers on the outside of each beam over the cross tube and lay cross tube and equalizer beams under axle.

(c) Raise and place the same end of each beam into axle brackets of one axle.

(d) Aline the beam end rubber bushings to the axle brackets and apply rustproofing compound to axle bracket holes and to the inner sleeve of end bushing.

(e) Install adapters (apply rustproofing compound) bolt, washers and nut to each beam end to hold beam in bracket. Do not tighten at this time.

(f) Repeat steps b, c, and d for opposite end of beams to other axle.

(2) Install the components to the forward rear and to the rear rear axle as follows:

- (a) Install the air brake chambers, if removed. (Refer to TM 9-2320-273-20.)
- (b) Connect brake air lines and fittings, if removed.
- (c) Install hub, drum and bearings, if removed. (Refer to TM 9-2320-273-20.)
- (d) install wheels. (Refer to TM 9-2320-273-10.)
- (e) Install inter axle propeller shaft. (Refer to TM 9-2320-273-20.)

NOTE

The nuts on the saddle cap studs are self-locking and should be replaced once removed.

(3) With the beams attached to the axles, roll them under the center of saddle, making sure center bushing of each beam is lined up with center of saddle leg. Lower frame, centering saddles on beam center bushings. Install, but do not tighten, saddle caps, washers and nuts (fig. 2-49).

(4) Install torque rod to axle and frame brackets (TM 9-2320-273-20).

(5) Torque saddle cap nuts to 225-275 lb-ft (305-373 N-m) making sure that equalizer beams are level with frame.

CAUTION

Do not exceed specified torque when tightening nut and bolt assembly.

(6) Be sure that flat section on adapter flange is in the vertical position and tighten beam end adapter bolt nuts as follows:

- (a) M915 – 210-240 lb-ft (285-325 N-m).
- (b) M916/M920 – 445-495 lb-ft (603-671 N-m).

(7) Connect propeller shaft to forward rear axle (TM 9-2320-273-20).

(8) Connect air lines to the tee connection and quick release valve at the rear rear axle as tagged at removal (fig. 248).

(9) Reset spring brake at all four brake air chambers (TM 9-2320-273-20).

(10) Connect air lines to the tee connection and the quick release valve at the forward rear axle as tagged at removal (fig. 2-47).

(11) Connect air line to forward rear axle differential lockup air chamber (fig. 2-46).

(12) Check fluid level in each axle differential and replenish if necessary (LO 9-2320-273-12).

(11) Road test vehicle and check for vibration or brake problems.

2-17. Pusher Axle (M917, M919, M920).

a. Removal.

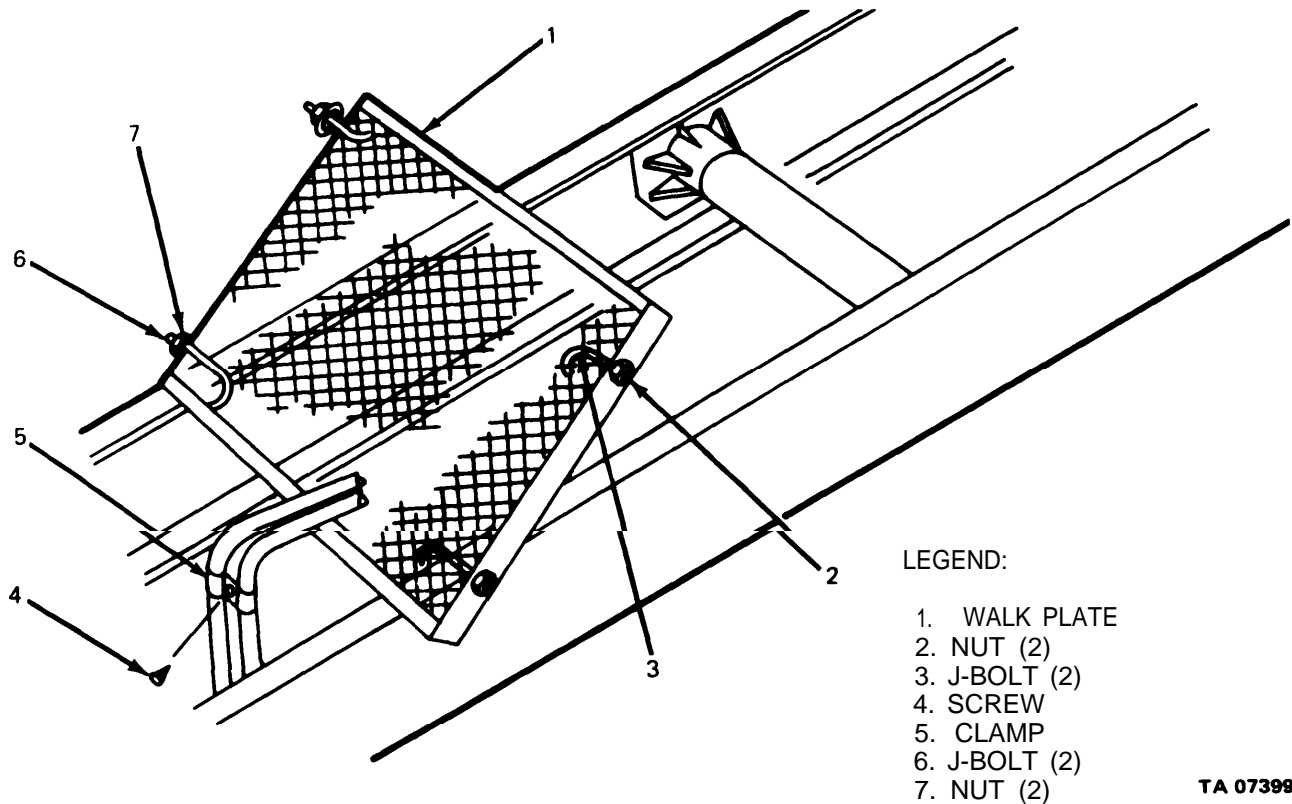
(1) With pusher axle UP/DOWN selector in DOWN position, turn pusher axle CONTROL PRESSURE knob counterclockwise to exhaust system air pressure. Drain air tank (TM 9-2320-273-20).

(2) M920 – Raise walk plate (1, fig. 2-52) as follows:

(a) Loosen nut (2) on two rear J-bolts (3) and disconnect each J-bolt from vehicle frame.

(b) Loosen nut (7) on two forward J-bolts (6) and disconnect each J-bolt from vehicle frame.

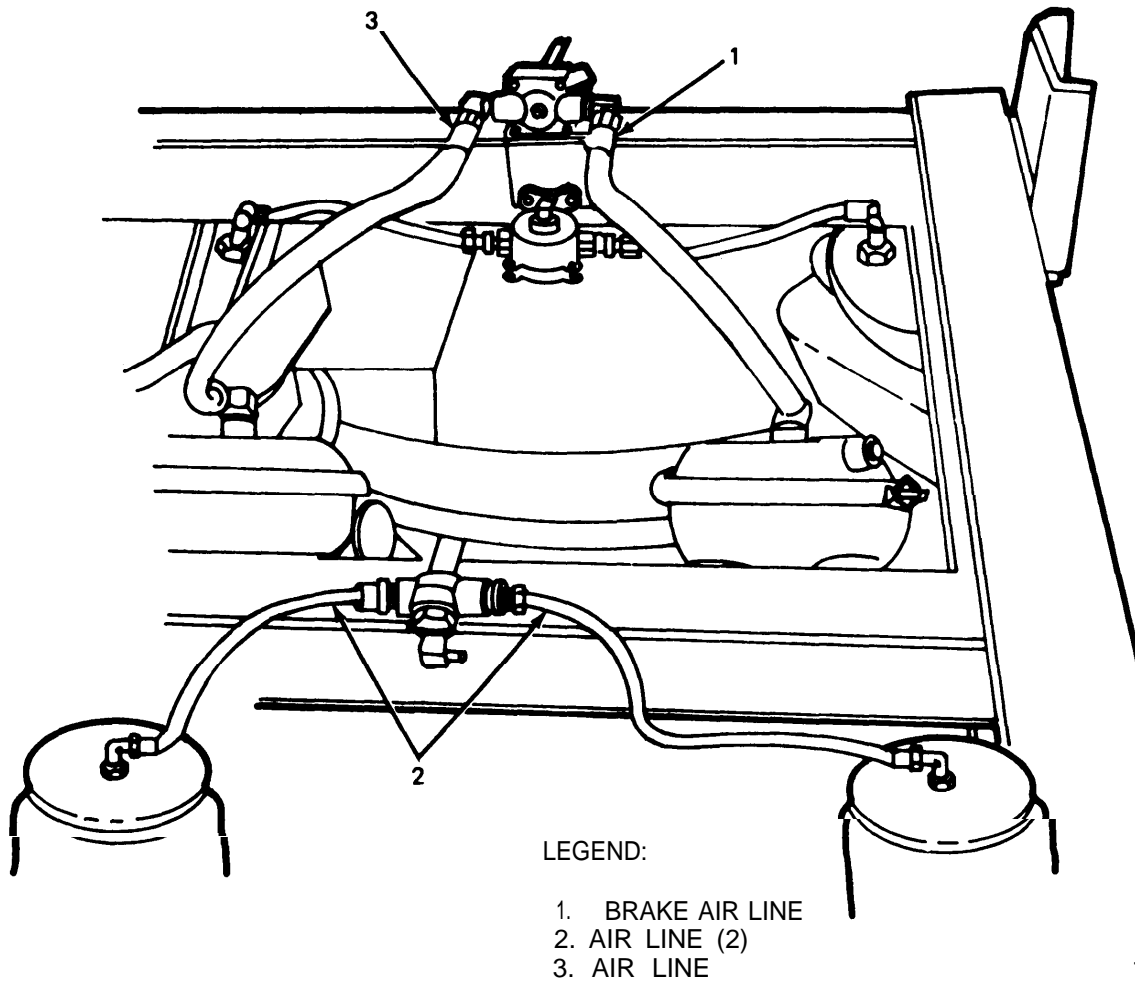
(c) Remove screw (4), air line clamp (5) and lift off walk plate. (1).



TA 073990

Figure 2-52 Raise/Lower Walk Plate.

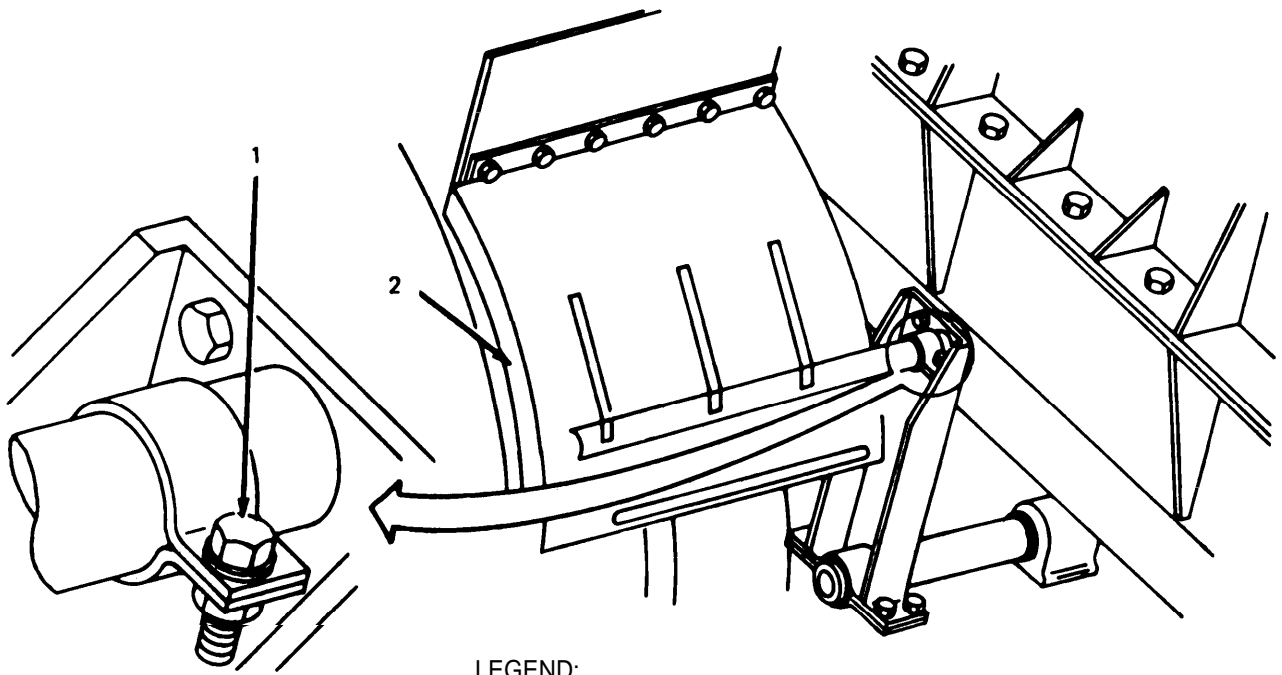
- (3) Disconnect two air lines (2, fig. 2-53).
- (4) Disconnect brake air line (1).
- (5) Disconnect air line (3).



TA 073991

Figure 2-53. Disconnect/Connect Air Lines.

(6) M920 – Loosen capscrew and nut (1, fig. 2-54); then slide off quarter fender (2).



LEGEND:

- 1. CAPSCREW & NUT
- 2. QUARTER FENDER

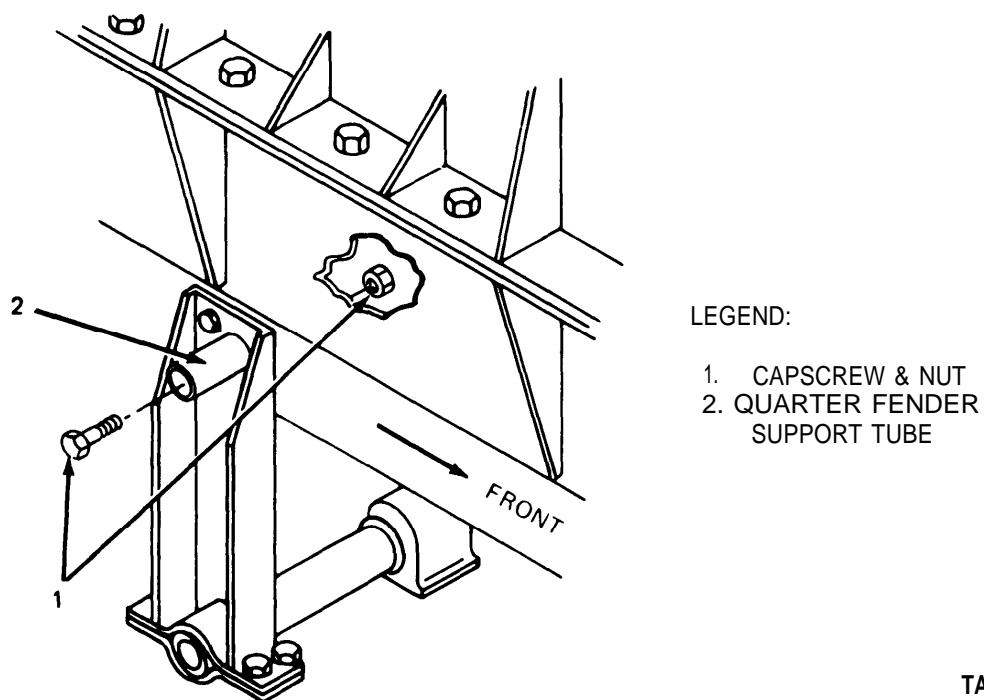
TA 073992

Figure 2-54. Remove/Install M920 Quarter Fenders.

(7) M920 -- Remove capscrew and nut (1, fig. 2-55) that fastens quarter fender (2) support tube to pusher axle.

(8) M920 -- Repeat steps (6) and (7) for fender and support tube on opposite side of vehicle,

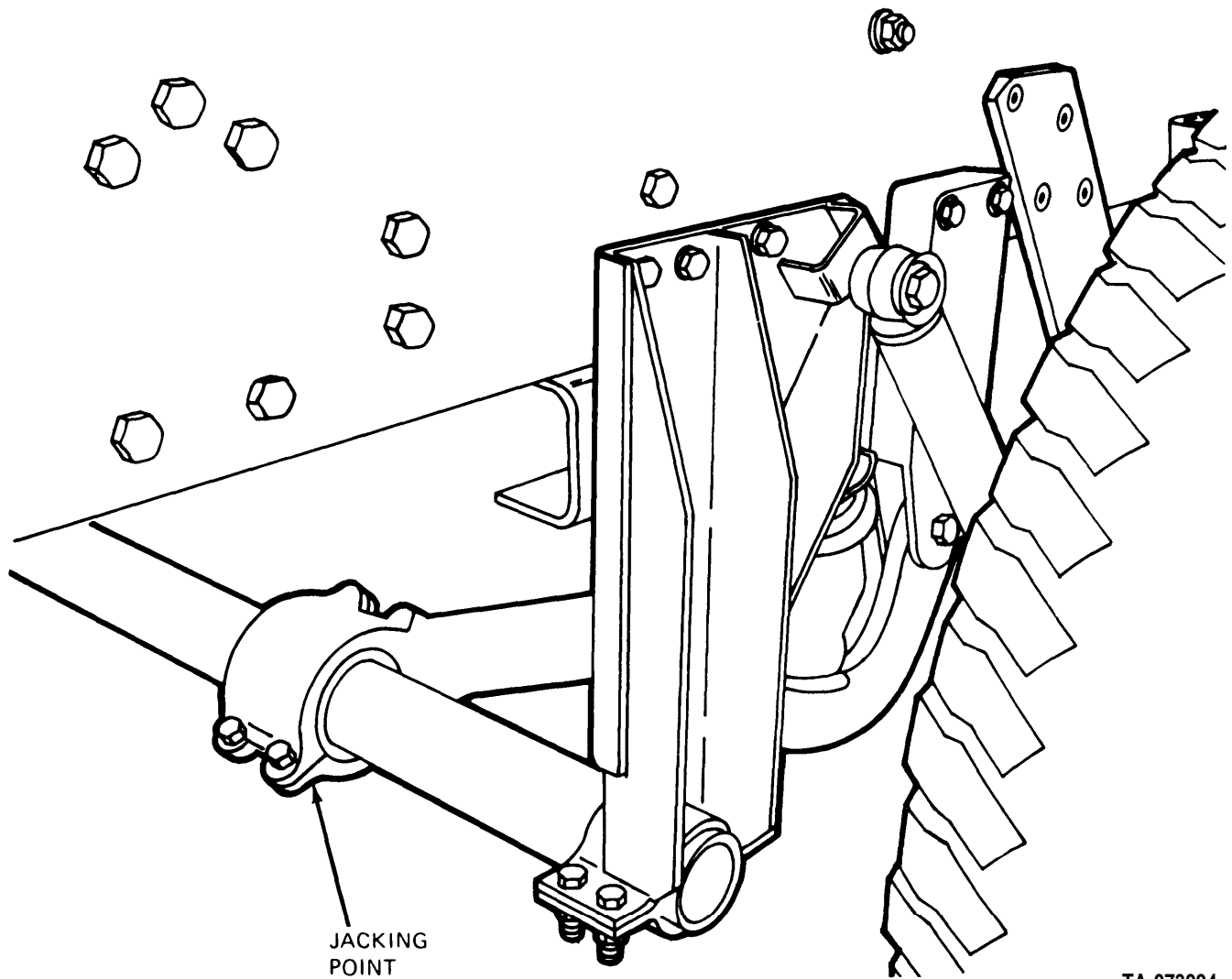
(9) Remove intermediate propeller shaft (refer to TM 9-2320-273-20). Spider should remain attached to intermediate shaft.



TA 073993

Figure 2-55. Remove/Install M920 Quarter Fender Support Tubes.

(10) Place hydraulic jack in position to support pusher axle assembly at jacking point (fig. 2-56).



TA 073994

Figure 2-56. Support Pusher Axle with Hydraulic Jack.

(11) Remove two nuts that fasten the forward air reservoir support hanger to vehicle frame (fig. 2-57); then push the hanger in so that hanger bolts do not protrude through frame.

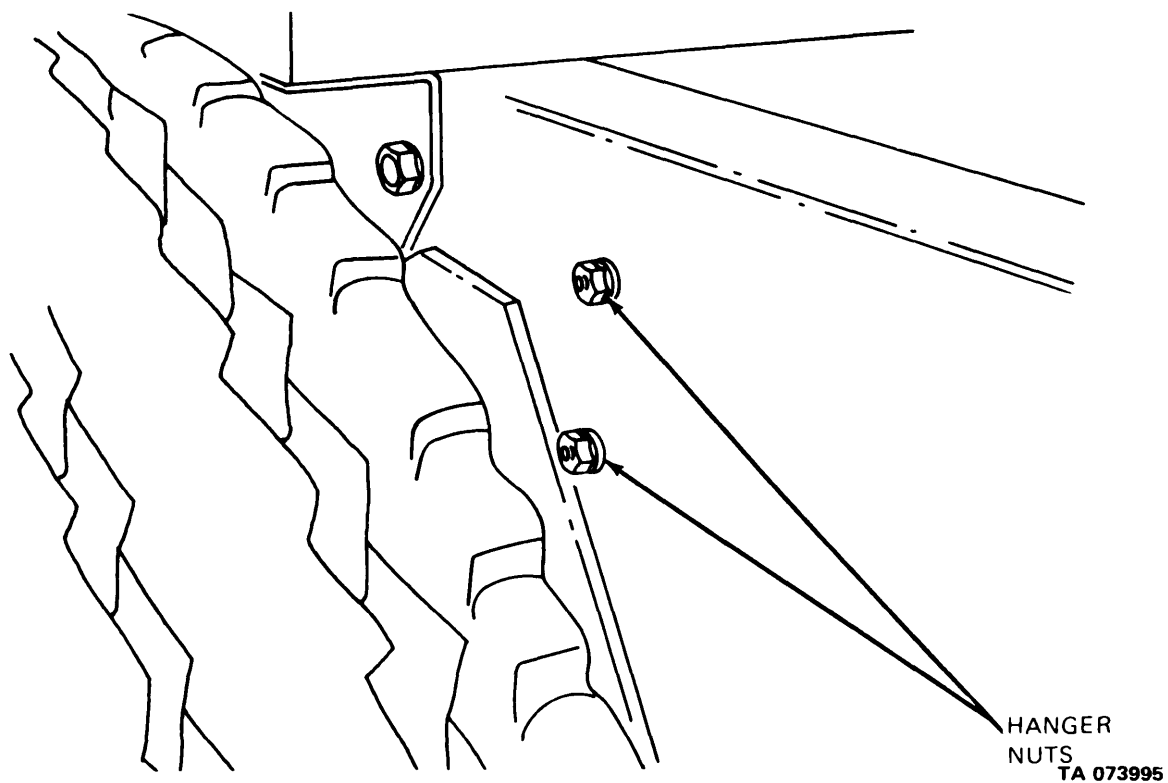
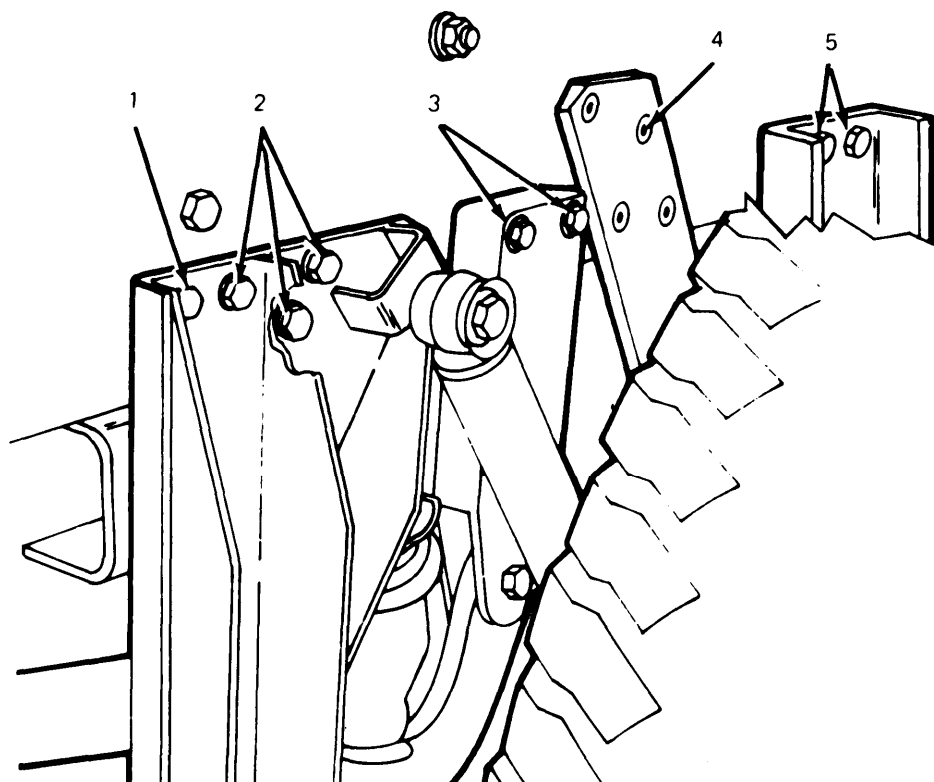


Figure 2-57. Remove/Install Air Reservoir Hanger Nuts.

- (12) Remove four allen-head capscrews (4, fig. 2-58) and locknuts.
- (13) Remove eight capscrews (1), (2), (3), and (5). (Item (1) previously removed on model M920.)
- (14) Repeat steps 11, 12 and 13 on the other side of vehicle.
- (15) Using a vertical crane or a suitable hoist, raise rear of vehicle high enough to allow pusher axle assembly to be removed from side of vehicle.



LEGEND:

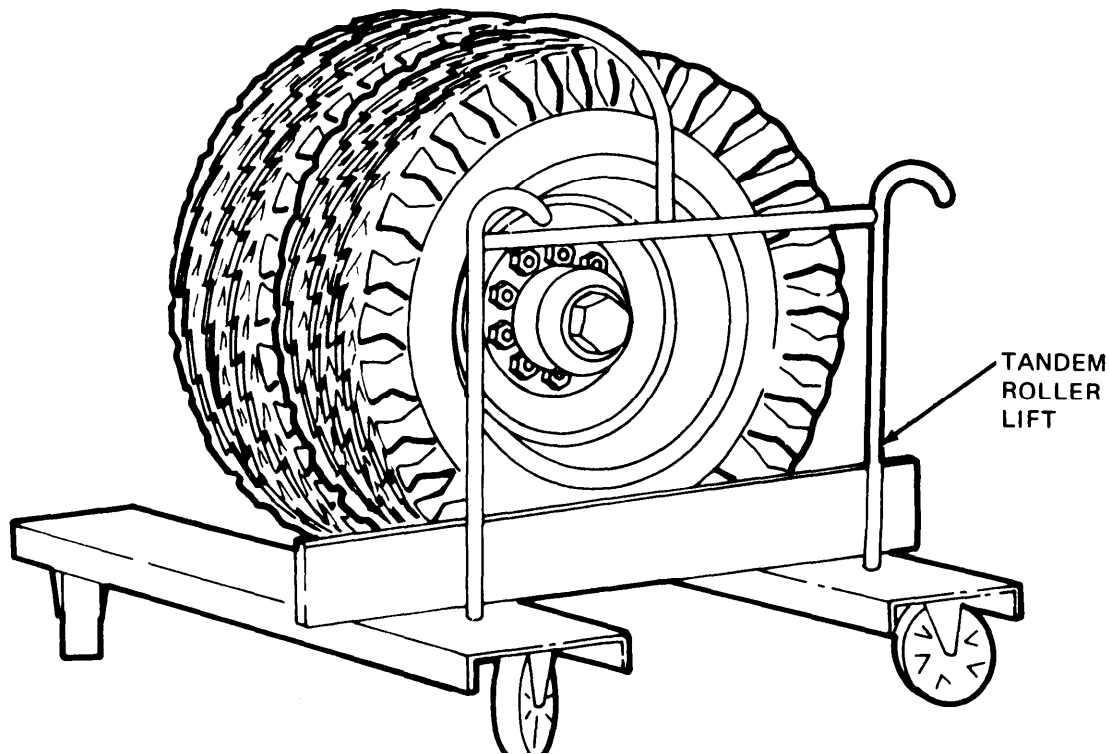
1. CAPSCREW (1)
2. CAPSCREW (3)
3. CAPSCREW (2)
4. ALLEN-HEAD CAPSCREW (4)
5. CAPSCREW (2)

TA 073906

Figure 2-58 Remove/install Pusher Axle Attaching Parts.

(16) Place tandem roller lifts (fig. 2-59) on both right and left sides.

(17) Roll pusher axle assembly towards rear; then out from under vehicle.



TA 073997

Figure 2-59. Place Wheels on Tandem Roller Lifts.

b. Installation.

(1) Place tandem roller lifts (fig. 2-59) on both left and right sides.

(2) Using a vertical crane or suitable hoist, raise rear of vehicle high enough to allow pusher axle assembly to be rolled under side of vehicle.

(3) Place hydraulic jack in position to support pusher axle assembly (fig. 2-56).

NOTE

In step 4, install only seven capscrews on model M920. Leave the front mounting hole for capscrew (1, fig. 2-58) blank at this time.

(4) Line up mounting holes in pusher axle and vehicle frame; then install eight capscrews (1), (2), (3), and (5).

(5) Install four allen-head capscrews (4).

(6) push the forward air reservoir support hanger bolts (fig. 2-57) through the vehicle frame; then secure the hanger with two nuts.

(7) M920 – Install quarter fender support tube (fig. 2-55) and Secure to vehicle frame with capscrew and nut.

(8) M920 – Mount quarter fender on support tube (fig. 2-54) and secure with capscrew, washer, and nut.

(9) Repeat steps (4), (5) and (6) for attaching parts on other side of vehicle for all models; and steps (7) and (8) on model M920.

(10) Tighten attaching parts in steps (4) through (9) to the following torque.

(a) Eight alien-head capscrews: 150 lb-ft (203 N-m).

(b) Sixteen hex-head capscrews (including the one for the quarter fender support tube): 75 lb-ft (102 N-m).

(c) Two capscrews on quarter fender clamps: 83 lb-ft (113 N-m).

(d) Two nuts on air reservoir support hanger: 31 lb-ft (42 N-m).

(11) Remove jack.

(12) Install intermediate propeller shaft. (Refer to TM 9-2320-273-20.)

(13) Connect air line (1, fig. 2-53).

(14) Connect air lines (2).

(15) Connect air lines (3).

(16) M920 – Install walk plate (1, fig. 2-52) and secure with four J-bolts (3) and (6). Make sure that nuts (2 and 7) are tight.

(17) Install clamp (5) on each hose and secure clamps to walk plate with capscrew (4), washer, and nut.

(18) Lubricate pusher axle assembly. (Refer to LO 9-2320-273-12.)

(19) Start up and operate engine to build up system air pressure. (Refer to TM 9-2320-273 -10.)

(20) Check operation of pusher axle by raising and lowering the assembly several times. Check for leaks with system under maximum air pressure (160-190 psi).

CHAPTER 3

REPAIR OF FUEL SYSTEM

3-1. General. This chapter provides repair information for the fuel tank. All other fuel system repairs at Direct Support and General Support Maintenance levels are covered in the Engine Technical Manual, TM 9-2815-222-34.

3-2. Fuel Tank Repair. Repairs are limited to sheet metal straightening and welding. For repairs of this type, refer to the following:

- a. Metal Body Repair and Related Operation – FM 43-2
- b. Welding Theory and Application – TM 9-237

3-3. Fuel Tank Construction. To assist in repairs, observe the following material composition:

- a. Mounting Bracket – Steel, SAE1010-1020 HR P&O #10 Ga (0.1345-inch thick)
- b. Tank and Baffles – Aluminum, 5052H32 or H34 (0.125-inch thick)
- c. Steps – Aluminum, 5052H32 or H34 (0.104-inch thick)

34. Cleaning.

- a. Wire brush all welded areas and remove any existing weld splatter.
- b. Vacuum interior.

3-5. Testing. After all structural repairs, test tank at 10 psi air pressure with tank submerged in water. Check for leaks.

Top Fuel Tank Step Removal.

3-6. Preparation.

WARNING

For the safety of personnel performing this task, TM 9-237 and TB 43-0212 will be strictly adhered to.

Before any work begins on the fuel tank, approval must be obtained first from local safety and fire departments. Work will not begin until declared SAFE BY SAFETY PERSONNEL.

To prevent an y reoccurrence of harmful vapors from reappearing in the fuel tank, replacement of the step will be started and completed immediately following vapor test reading, using an explosive meter.

Under no circumstances will any fuel tank repair be carried over from the previous day, without performing another vapor test reading to be conducted by safety personnel. Repurge fuel tank if vapors are present.

- a. Remove drain plug (1, fig. 3-1) from bottom of fuel tank and drain fuel into suitable containers.
- b. Remove fuel lines (3 and 5, fig. 3-1) and plug open ends.
- c. Remove air vent screw, fuel sending unit, and elbows from fuel tank (2 and 4, fig. 3-1).
- d. Clean and purge fuel tank.

3-7. Removal.

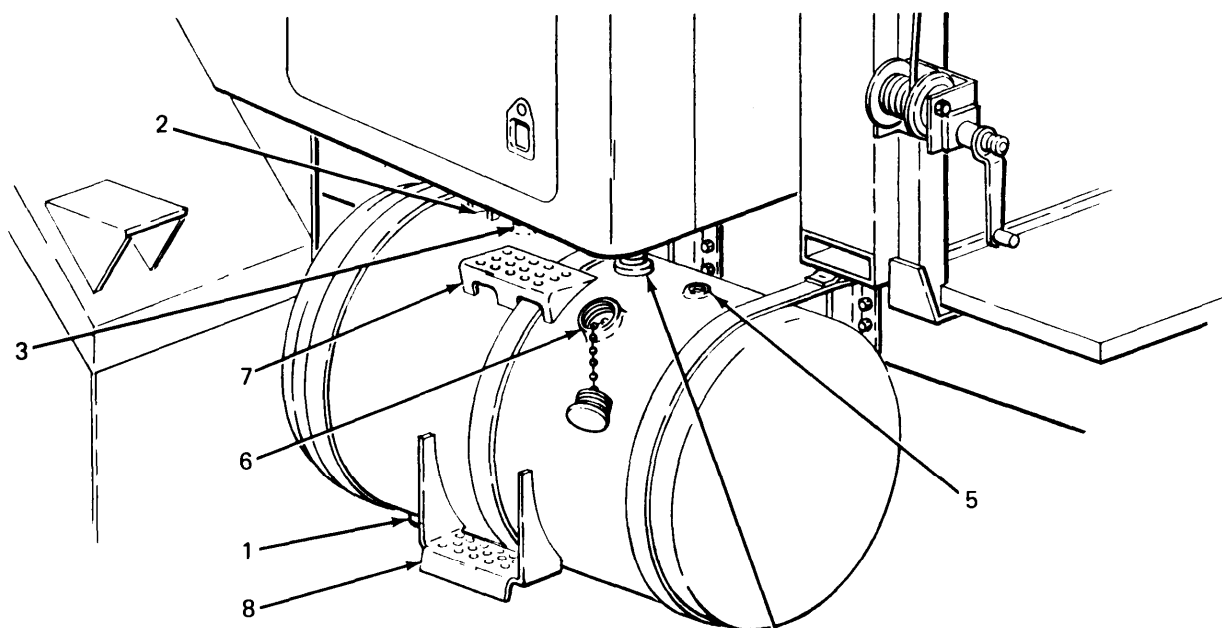
- a. Remove top step using an electric reciprocating saw or hacksaw, cut connecting tabs on sides one and two (fig. 3-2) as close as possible to fuel tank surface. Using a hacksaw, cut sides three and four, and remaining tabs on sides one and two (fig. 3-2).

C A U T I O N

Fuel tank wall thickness is approximately .125 in. (3.17 mm). Extreme care should be taken when grinding or sanding.

WARNING

Wear proper personal protective equipment when grinding or sanding (safety goggles/shield).

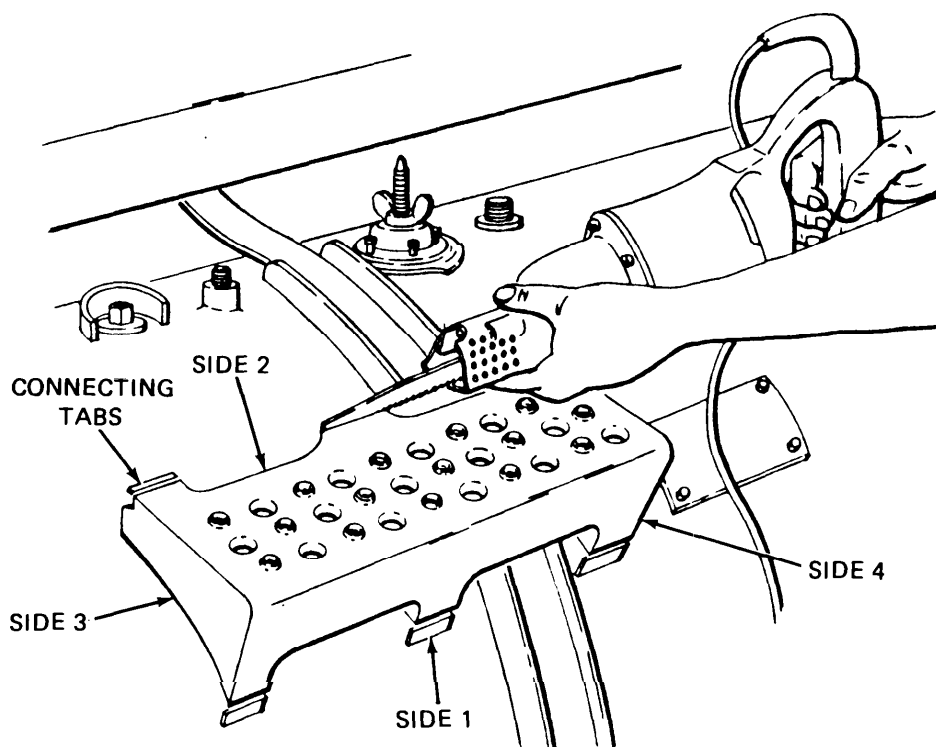


LEGEND:

- | | |
|-----------------------|-----------------------|
| 1. DRAIN PLUG | 5. FUEL LINE (RETURN) |
| 2. AIR VENT SCREW | 6. FUEL FILL NECK |
| 3. FUEL LINE (PICKUP) | 7. TOP STEP |
| 4. FUEL SENDING UNIT | 8. BOTTOM STEP |

TA 239522 ■

Figure 3-1. Fuel Tank Step.



TA 239523 ■

Figure 3-2. Fuel Tank Step.

b. Remove any existing rough metal or weld spots on fuel tank surface, using a sander with a coarse grit aluminum oxide disk.

c. Smooth all sanded surfaces with fine grit aluminum oxide disk.

NOTE

Be sure surface to be welded is free from oil, grease, moisture and any heavy oxide coatings.

d. Oil or grease can be removed by wiping affected area with drycleaning solvent.

e. Heavy oxides can be removed with wire brush or emery cloth.

3-8. Installation.

WARNING

Eye protection must be worn by all personnel while welding is being performed.

NOTE

Use MIG weld with 5356 welding wire for all welding on the fuel tank step.

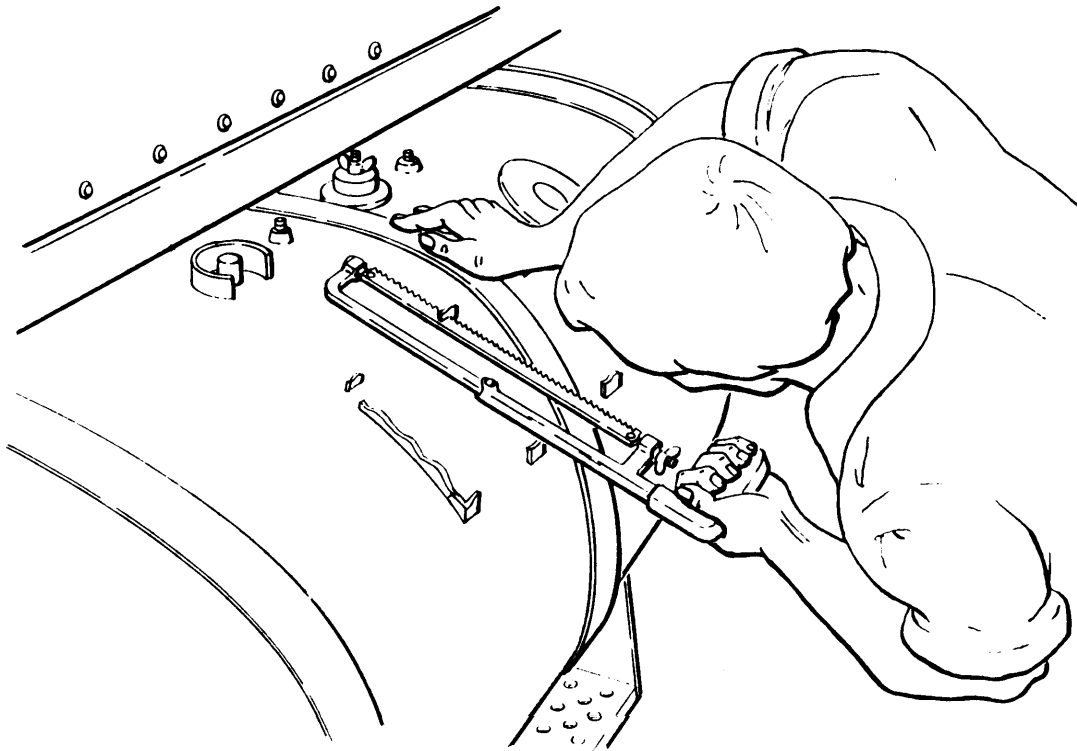
Inspect the new top step seams for gaps. If the gaps are excessive, attach a suitable clamp on outside ends of step, draw both ends into front of step and tack weld together.

a. Mark location of new top step using scribe or marking pencil.

b. Using an assistant place new top step in marked position on fuel tank. Weld front of step to surface, with approximately 1/2 in. (12.7 mm) fillet weld seam. Finish welding back of step and both ends to the fuel tank (fig. 3-3).

c. Wire brush all welded areas. Remove any carbon or weld splatter.

d. Inspect welded areas on step and fuel tank for good contour, continuity, cracks or any other welding defects.



TA 239524

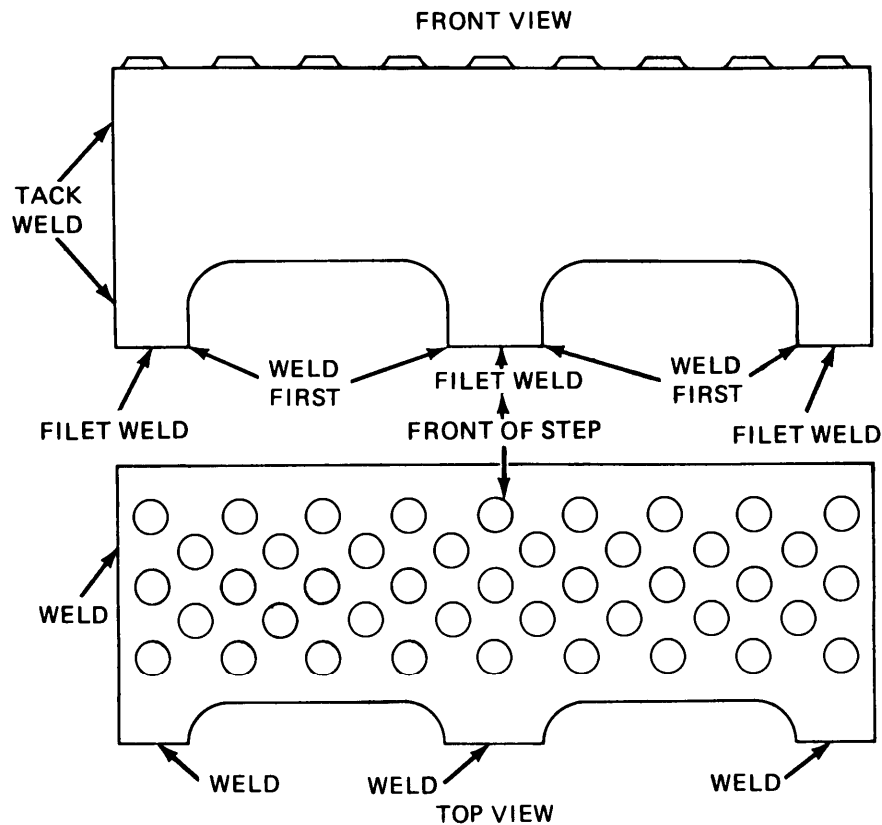
Figure 3-3. Fuel Tank Step.

e. Air dry fuel tank to remove any remaining moisture. Using shop air supply place air hose through filler neck and air exhaust for about five minutes.

f. Install fuel sending unit, drain plug, inlet fuel line, return fuel line and air vent screw (4, 1,3, 5 and 2, fig. 3-4).

g. Refuel tank and install filler cap. Relocate vehicle to a painting facility.

h. Wash welded area with enamel thinner and treat with a metal conditioner (phosphoric acid). Rinse off with clean water and air dry.



TA 239525 ■

Figure 3-4. Fuel Tank Step.

- i. Apply a coat of zinc chromate primer.
- j. Paint all exposed metal surface with an aerosol can, spray gun or brush. Match color of existing exterior painted surface.

Bottom Fuel Tank Step Removal.

3-9. Preparation.

WARNING

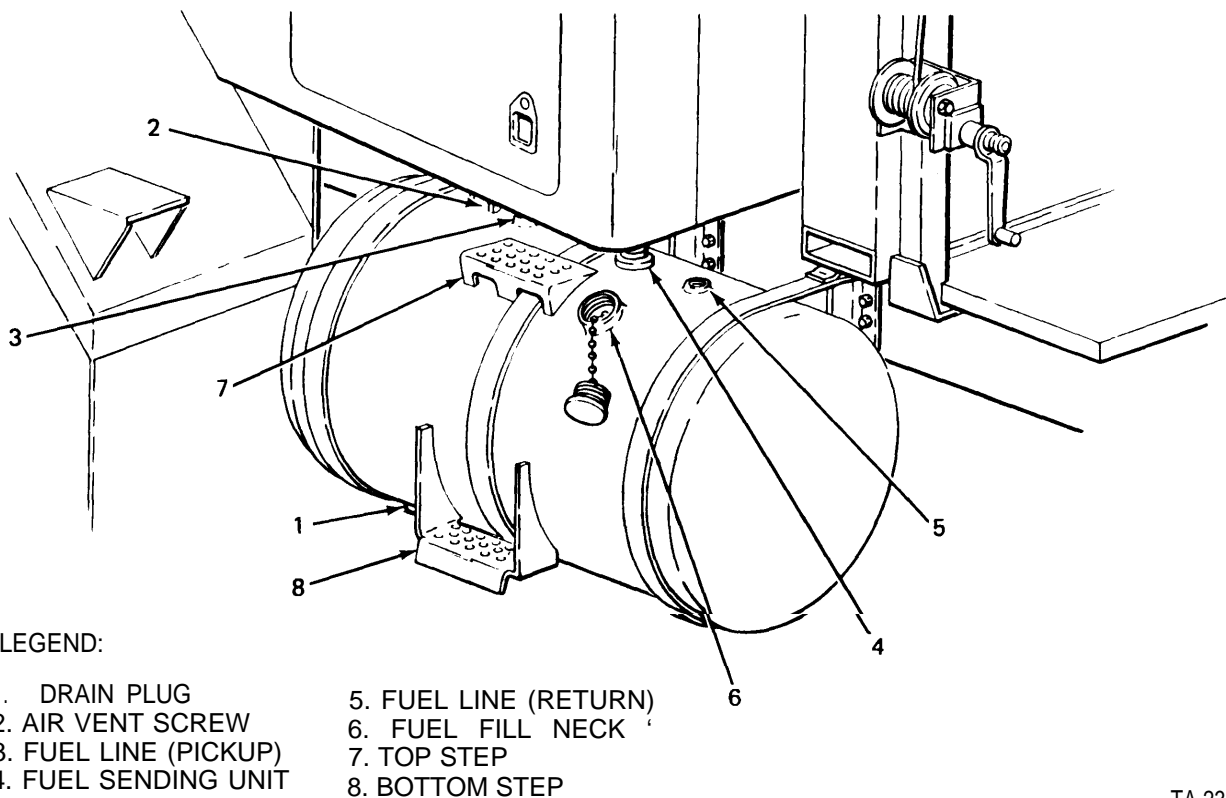
For the safety of personnel performing this task, TM 9-237 and TB 43-0212 will be strictly adhered to.

Before any work begins on the fuel tank, approval must be obtained first from local safety and fire departments. Work will not begin until declared SAFE BY SAFETY PERSONNEL.

To prevent any reoccurrence of harmful vapors from reappearing in the fuel tank, replacement of the step will be started and completed immediately following vapor test reading, using an explosive meter.

Under no circumstances will any fuel tank repair be carried over from the previous day, without performing another vapor test reading to be conducted by safety personnel. Repurge fuel tank if vapors are present.

- a. Remove drain plug (1, fig. 3-5) from bottom of fuel tank and drain fuel into suitable containers.
- b. Remove fuel lines (3 and 5, fig. 3-5) and plug open ends.
- c. Remove air vent screw, fuel sending unit, and elbows from fuel tank (2 and 4, fig. 3-5).
- d. Clean and purge fuel tank.



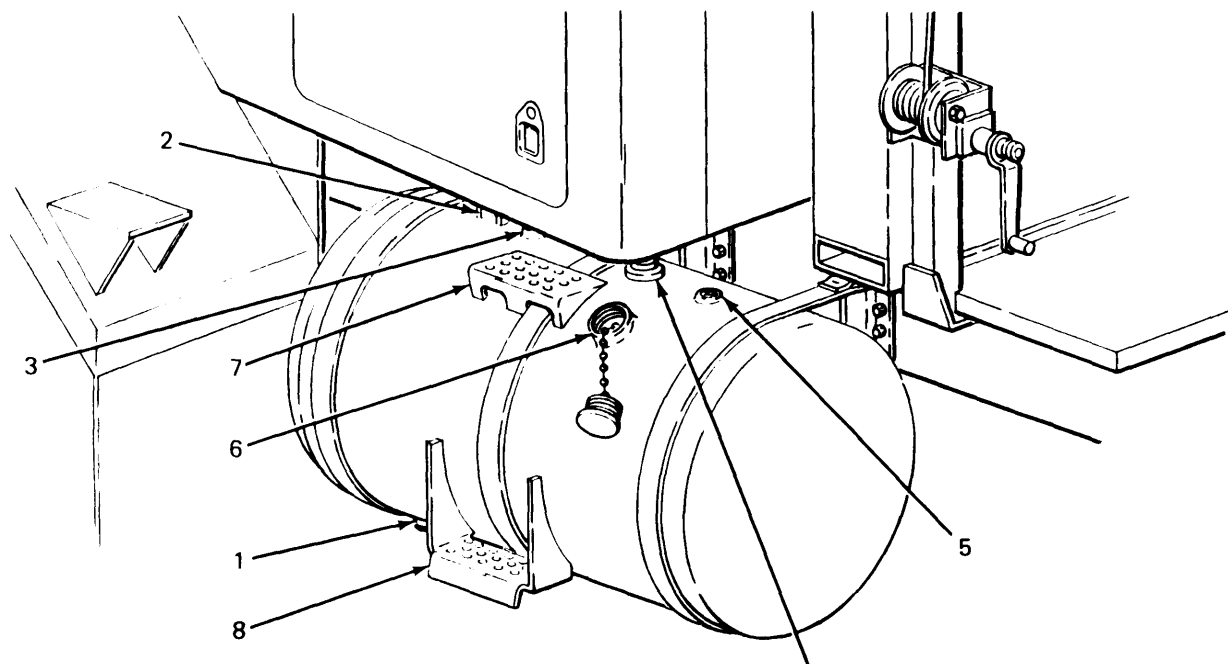
TA 239526 ■

Figure 3-5. Fuel Tank Step.

3-10. Removal.

a. Loosen fuel tank straps. Rotate fuel tank upward until top step restricts any further movement (fig. 3-6).

b. Remove bottom step using an electric reciprocating saw or hacksaw. Cut along both sides of the step as close as possible to the surface of the fuel tank (fig. 3-6).



- | | |
|-----------------------|-----------------------|
| 1. DRAIN PLUG | 5. FUEL LINE (RETURN) |
| 2. AIR VENT SCREW | 6. FUEL FILL NECK |
| 3. FUEL LINE (PICKUP) | 7. TOP STEP |
| 4. FUEL SENDING UNIT | 8. BOTTOM STEP |

TA 239527 ■

Figure 3-6. Fuel Tank Step.

CAUTION

Fuel tank wall thickness is approximately .125 in. (3.17 mm). Extreme care should be taken when grinding or sanding.

WARNING

Wear proper personal protective equipment when grinding or sanding (safety goggles/shield),

c. Remove any existing rough metal or weld spots on fuel tank surface, using a sander with a coarse grit aluminum oxide disk.

d. Smooth all sanded surfaces with fine grit aluminum oxide disk.

NOTE

Be sure surface to be welded is free from oil, grease, moisture and any heavy oxide coatings.

- e. Oil or grease can be removed by wiping affected area with drycleaning solvent.
- f. Heavy oxides can be removed with wire brush or emery cloth.

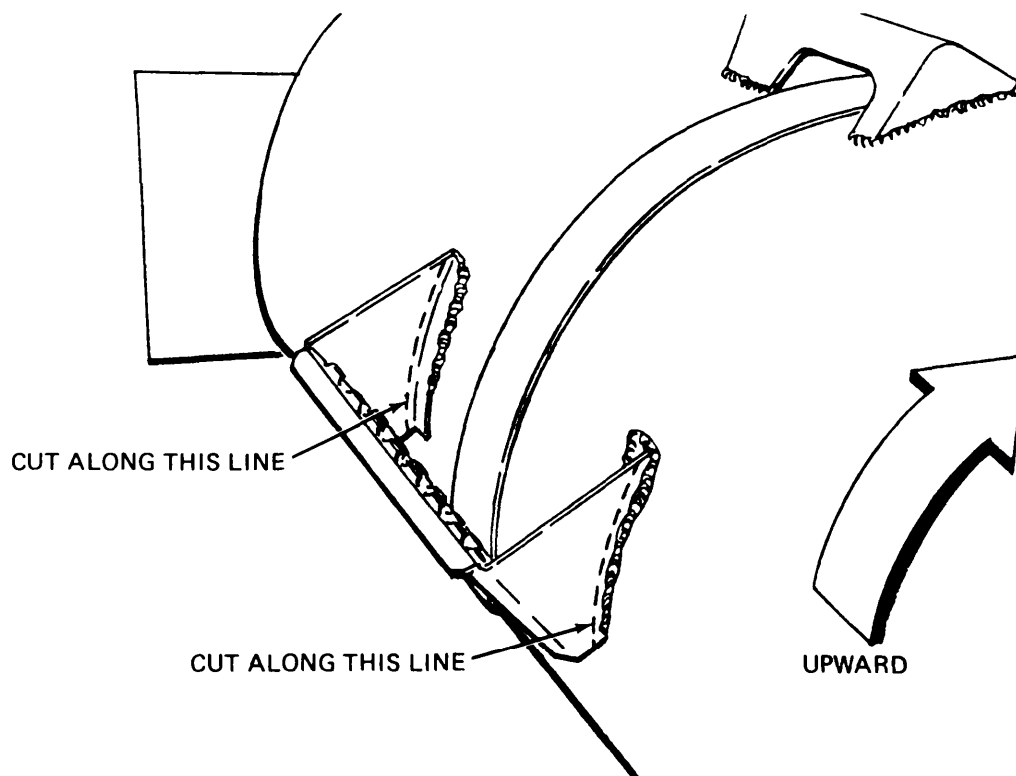
3-11. Installation.**WARNING**

Eye protection must be worn by all personnel while welding is being performed.

NOTE

Use MIG weld with 5356 welding wire for all welding on the fuel tank step.

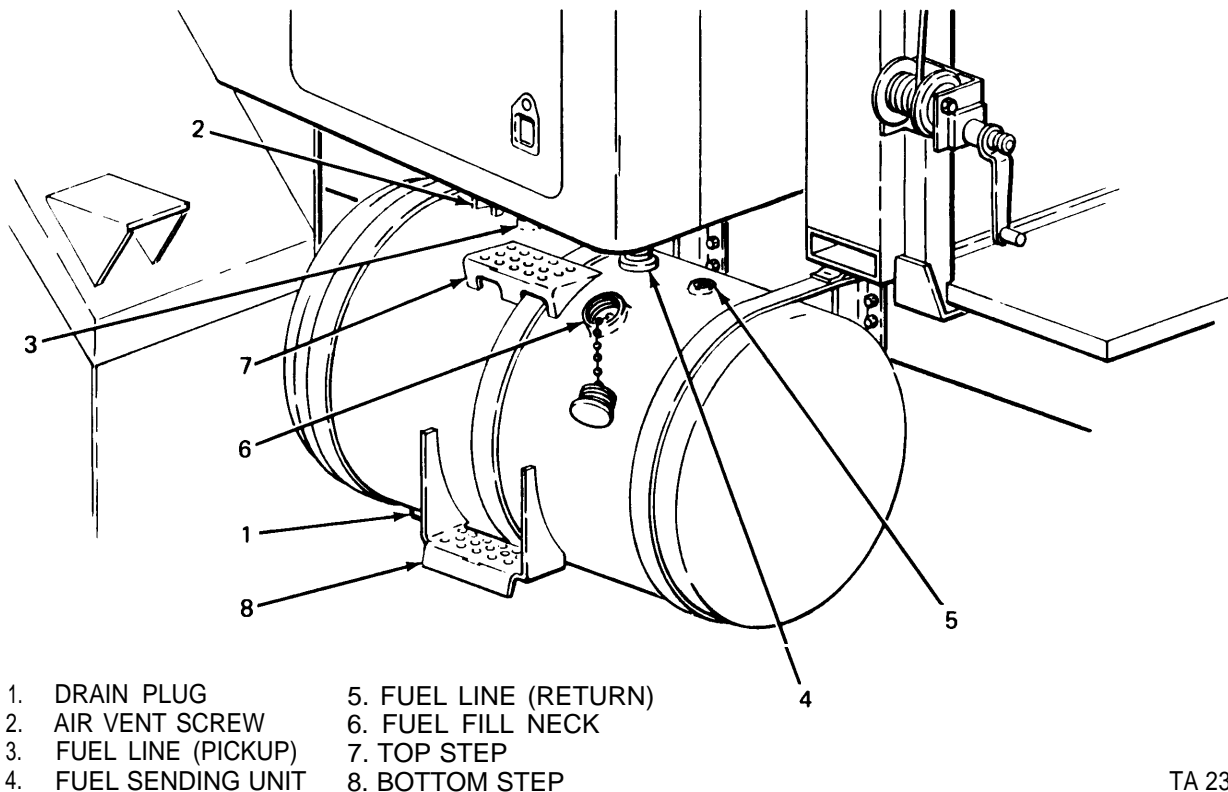
- a. Mark location of new bottom step using scribe or marking pencil.
- b. Using an assistant, butt the new step to the marked position on the fuel tank. Tack weld front flange ends of step to the surface of fuel tank (fig. 3-7).



TA 239528 ■

Figure 3-7. Fuel Tank Step.

- c. Wire brush all welded areas. Remove any carbon or weld splatter.
- d. Inspect welded areas on step and fuel tank for good contour, continuity, cracks or any other welding defects.
- e. Rotate fuel tank back to its proper position, and retighten fuel tank straps.
- f. Air dry fuel tank to remove any remaining moisture. Using shop air supply place air hose through filler neck and air exhaust for about five minutes.
- g. Install fuel sending unit, drain plug, inlet fuel line, return fuel line and air vent screw (4, 1,3, 5 and 2, fig. 3-8).



TA 239529 ■

Figure 3-8.

- h. Refuel tank and install filler cap. Relocate vehicle to a painting facility.
- i. Wash welded area with enamel thinner and treat with a metal conditioner (phosphoric acid). Rinse off with clean water and air dry.
- i. Apply a coat of zinc chromate primer.
- k. Paint all exposed metal surface with an aerosol can, spray gun or brush. Match color of existing exterior painted surface.

CHAPTER 4

REPAIR OF COOLING SYSTEM

SECTION 1. RADIATOR ASSEMBLY

4-1. General. This chapter provides references for repair of the radiator (Fig. 4-1) and fan clutch (Fig. 4-2). All other cooling system repairs at Direct Support and General Support Maintenance levels are covered in the Engine Technical Manual TM 9-2815-222-34&P.

4.2 Radiator Repairs. Perform all repairs in accordance with TM 750-254 (Cooling Systems: Tactical Vehicles).

NOTE

Four pieces of gasket (2, fig. 4-1) are made from gasket (6) cut to length.

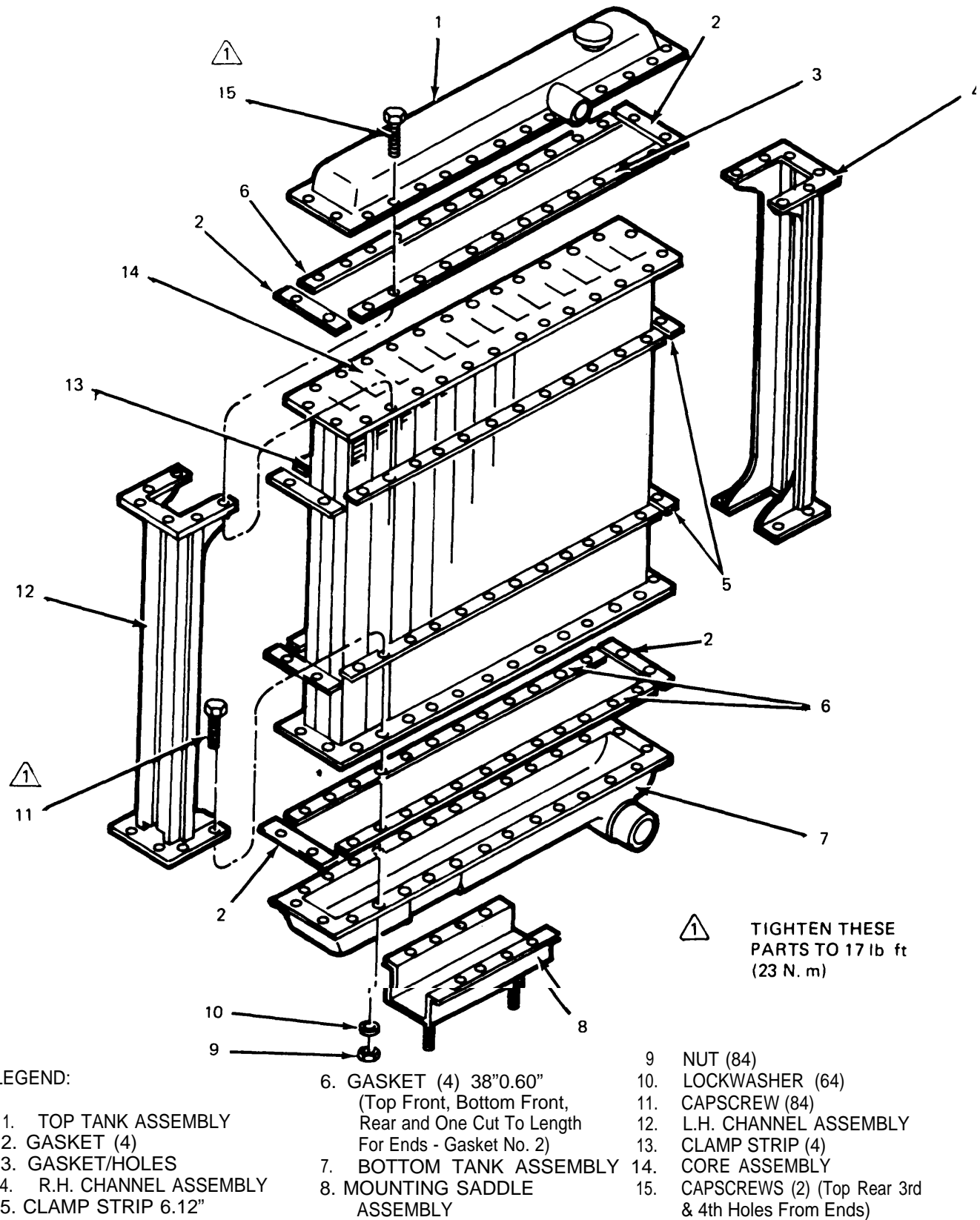


Figure 4-1. Disassemble the Radiator.

TA 073998

Section II. FAN CLUTCH ASSEMBLY

4-3. Description. The fan clutch assembly has been specifically designed to improve the performance of the engine. The fan clutch assembly is built to give greater horsepower transfer while reducing fuel consumption, engine noise and overall weight. Air pressure from the actuator engages the fan when coolant temperature rises above 190° F (88° C). When the coolant temperature decreases, the actuator disengages the fan clutch which will prevent the fan from drawing horsepower from the engine.

4-4. Removal. Remove the upper fan shroud, fan and fan clutch assembly from the vehicle. (Refer to TM 9-2320-273-20).

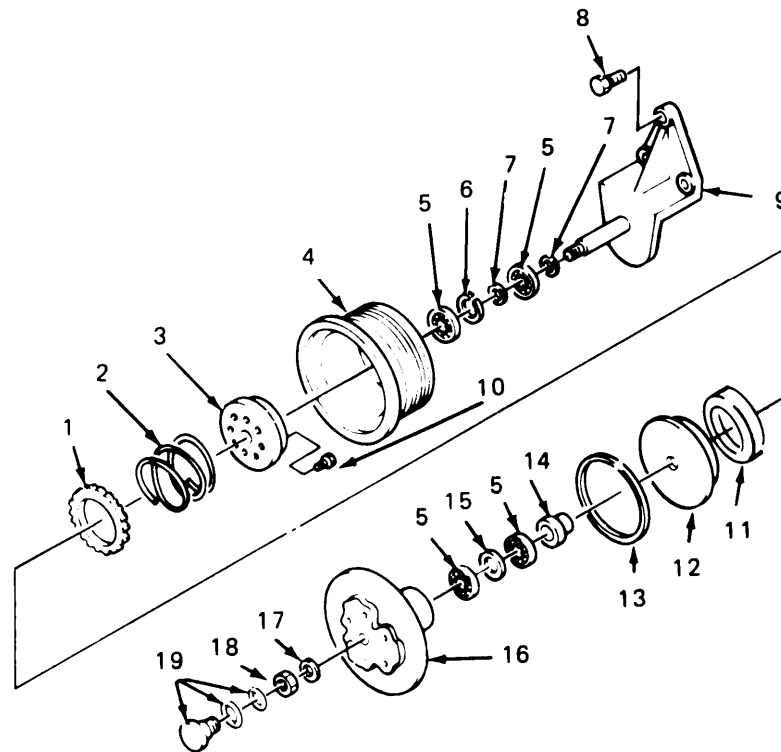
4-5. Disassembly. Clamp the fan clutch in a vise by bracket (10, fig. 4-2). Make sure the housing (16) is facing in an upward position and proceed as follows:

- a. Remove plug assembly (19).
- b. Remove locknut (18) and spacer (17).
- c. The housing (16) and pulley (4) can now be slipped off of the shaft of the bracket assembly (9).
- d. Remove spacer (7) from the shaft of the bracket assembly (9).
- e. Separate the housing (16) from the pulley (4) by hand.
- f. Remove two of the eight screws (10).
- g. Install two No. 10-32 X 2" screws three turns into holes vacated by the two screws just removed. Remove the remaining six screws (10).
- h. Remove the two No. 10-32 X 2" screws and remove the thrust cap (3), spring (2), clutch facing (1) and spacer (14).
- i. Remove piston (12) by tapping the housing (16) with piston facing down on a wood bench or board.
- j. Remove the two O-rings (11) and (13) from the piston (12).
- k. Remove two bearings (5) and spacer (15) from housing (16) with a suitable press.
- l. Remove two bearings (5), spacer (7) and retaining ring (6) from pulley (4) with a suitable press.

4-6. Inspection. Replace all worn or defective parts such as O-rings (11) and (13), clutch facing (1) and four bearings (5). If it is found that the bearings (5) are in suitable condition for reuse, they should be repacked with Dubois-MPG-2 or equal.

LEGEND:

1. CLUTCH FACING
2. SPRING
3. THRUST CAP
4. PULLEY
5. BEARING (4)
6. RETAINING RING
7. SPACER (2)
8. HEX BOLT
9. BRACKET ASSEMBLY
10. SCREW (8)
11. O-RING
12. PISTON
13. O-RING
14. SPACE R
15. SPACER
16. HOUSING
17. SPACE R
18. LOCKNUT
19. PLUG ASSEMBLY



TA 075399

Figure 4-2 Fan Clutch Assembly – Exploded View.

4-7. Assembly.

NOTE

Use Loctite 02 on bearing outside diameter during reassembly.

- a. Install two bearings (5), spacer (7) and retaining ring (6) in pulley (4) with a suitable press.
- b. Install two bearings (5), and spacer (15), in housing (16) with a suitable press.
- c. Install two O-rings (11) and (13) on piston (12).

- d. Lubricate two O-rings (11) and (13) on piston (12) with lubriplate (item 16, App B). Tap O-ring and piston assembly into housing (16) being careful to line up dowel pin holes.
- e. Install clutch facing (1) on housing (16).
- f. Install spring (2) and spacer (14) on housing (16).
- g. Insert two No. 10-32 X 2" screws through two opposite holes in thrust cap (3) and thread three turns into housing (16).
- h. Apply Loctite 01 on threads and install six screws (10) and tighten evenly.
- i. Remove two No. 10-32 X 2" screws. Apply Loctite to the remaining two screws (1 O) and install and tighten securely.
- j. Assemble housing (16) to the pulley (4) being careful to line up drive pins with clutch facing (1).
- k. Install spacer (7) on shaft of bracket assembly (9).
- l. Slide the housing (16) and pulley (4) on shaft of bracket assembly (9).
- m. Install spacer (17) and install a new locknut (18). Tighten to 60 lb-ft (81 .36 N-m).
- n. Install plug assembly (19).
- o. Remove fan clutch assembly from vise.

4-8. Installation. Install fan clutch assembly, fan, and upper fan shroud in vehicle. (Refer to TM 9-2320-273-20).

CHAPTER 5

REPAIR OF ELECTRICAL SYSTEM

Section 1. ALTERNATOR AND TRANSFORMER-RECTIFIER

5-1. Description.

a. *Alternator.* The alternator is a self-load limiting device featuring a fully adjustable, built-in, solid-state voltage regulator. The rated output of the alternator is 85 amperes at 14 volts dc and has a maximum speed of 8000 rpm. Six silicon diodes mounted in heatsinks convert alternating current into direct current. A capacitor connected between the heatsinks assists in suppressing transient voltage spikes which could possibly injure the diodes. The brushes and voltage regulator are located in a waterproof housing and may be removed for replacement or inspection without dismantling the entire alternator. The regulator is also equipped with transient voltage protection and will withstand instantaneous opening of the charging circuit under full load conditions.

b. *Transformer-Rectifier.* The transformer-rectifier consists of a 3-phase transformer to obtain electrical isolation from the alternator, and a 3-phase, full wave rectifier to provide dc output. It is energized from the ac terminals of the alternator to which it is connected by 3 leads. The transformer-rectifier replaces the conventional series parallel switch and is used to provide a source of power for charging the cranking batteries on 12-volt vehicles equipped with 24-volt cranking motors. The system vehicle 12-volt batteries are charged by the alternator in the conventional manner, with the cranking batteries being charged by the transformer-rectifier unit.

c. *Resistor Assembly.* The resistor assembly is a protective device which limits the current flow from the transformer-rectifier. In the event cranking batteries become fully discharged or shorted out, the current flow from the transformer-rectifier could become so high that it would cause a failure to the transformer-rectifier. The resistor assembly limits the current flow to about 25 amperes under all battery conditions.

5-2. On-Vehicle Testing.

a. *Scope.* On-vehicle testing is limited to an attempt to adjust the regulator. On-vehicle troubleshooting is provided in chapter 2 of this manual.

b. Adjustment:

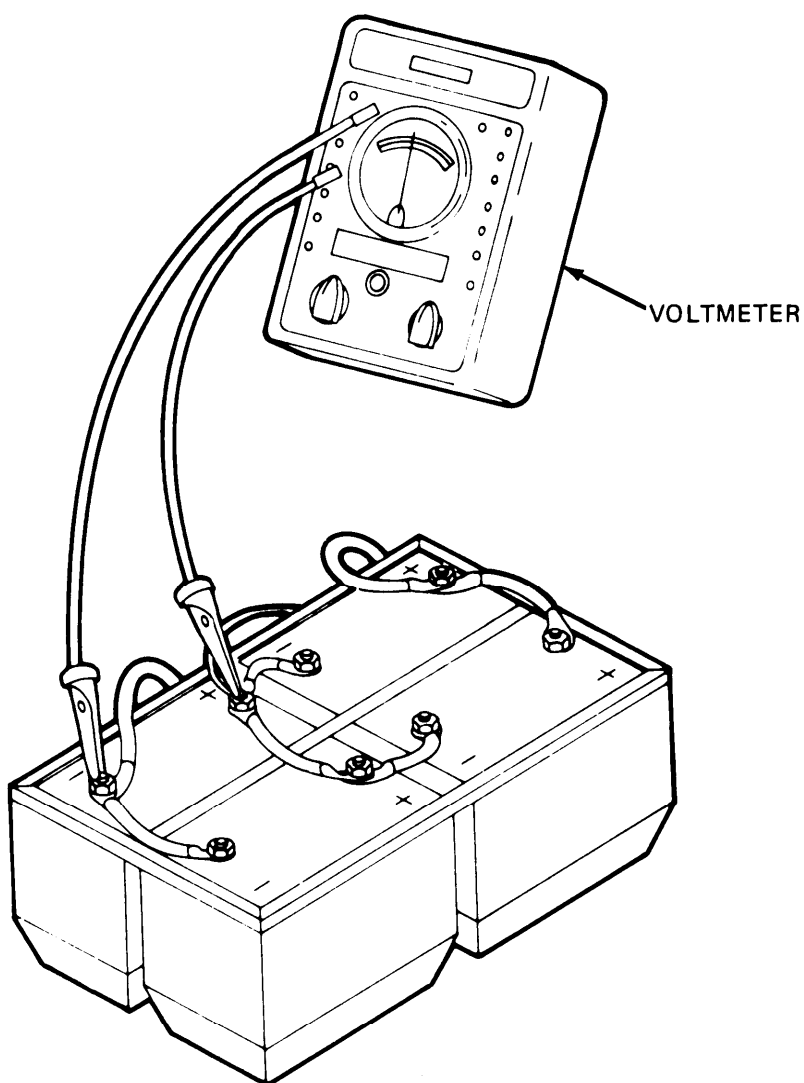
NOTE

Prior to adjusting the voltage regulator, associated wiring, connections, and drive belt, tension must be checked and repaired if needed. The batteries must also be fully charged.

(1) Start the engine and run at fast idle (1,200 rpm) with the transmission in neutral. (Refer to TM 9-2320-273-10.)

(2) Turn off all vehicle electrical loads.

(3) Connect a voltmeter across the batteries as shown in figure 5-1.



TA 073999

Figure 5-1. Connect Voltmeter.

(4) Remove the adjusting screw access plug from the regulator (fig. 5-2).

CAUTION

Do not attempt to force the voltage adjusting screw past its normal stop as damage will result.

(5) Using a small screwdriver, carefully turn the adjusting screw clockwise to raise the voltage, or counterclockwise to lower the voltage. The correct voltage is 13.6 to 14.2 volts dc.

(6) Replace the access screw plug in the regulator.

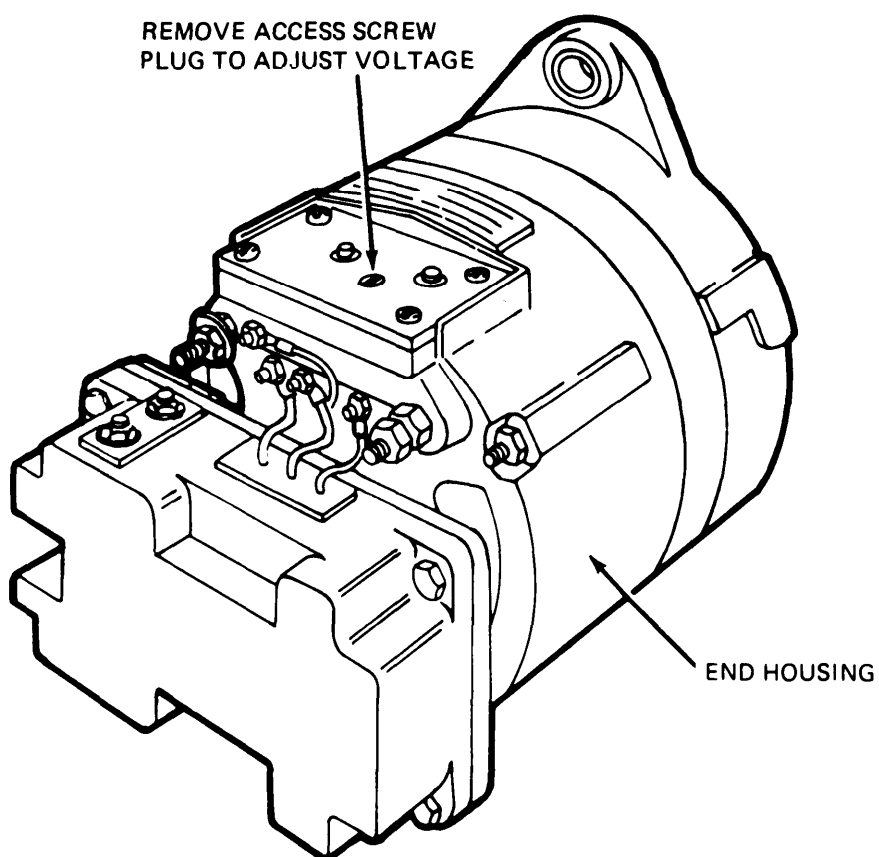


Figure 5-2. Remove Adjusting Screw Access Plug.

TA 074000

5-3. Disassembly.

a. Remove the transformer-rectifier from the alternator as follows:

(1) Disconnect the three wires from the diode trio (fig. 5-3).

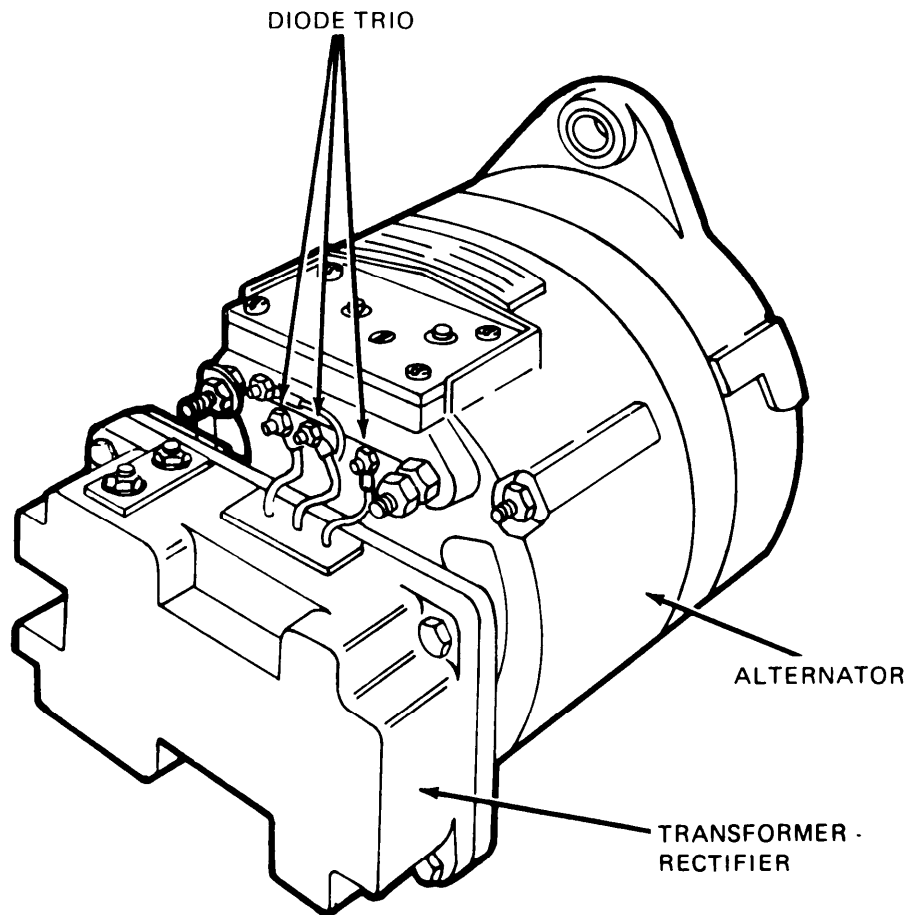
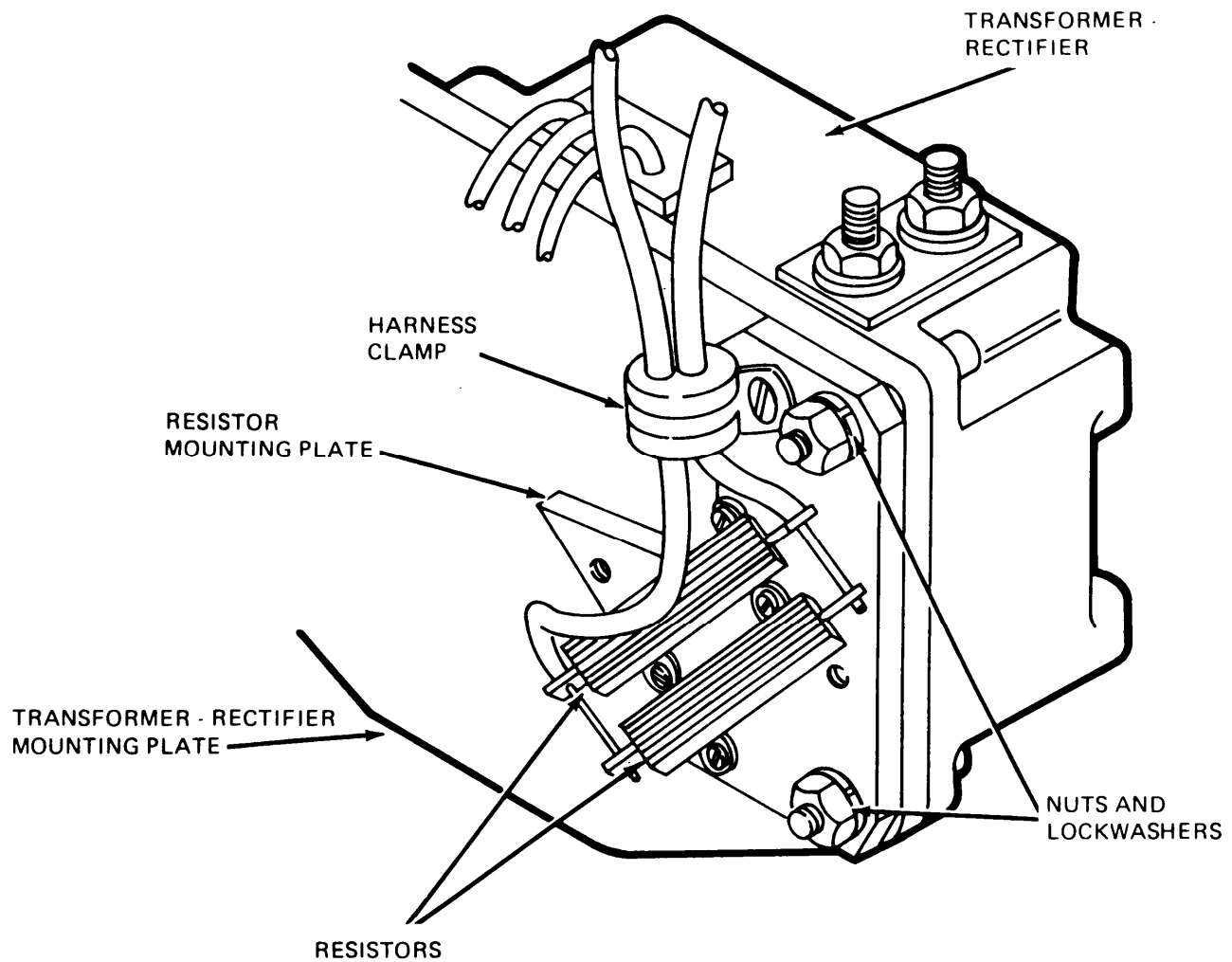


Figure 5-3. Remove Transformer-Rectifier Leads.

TA 074001

(2) Remove the two nuts and lockwashers retaining resistor assembly to the transformer-rectifier mounting plate (left side viewed from transformer-rectifier end) (fig. 5-4).



TA 074002

Figure 5-4. View of Resistor Mounting.

NOTE

In step (3), note the location of the mounting screws to aid in assembly.

(3) Remove four mounting sockethead screws and lockwashers, and remove the transformer-rectifier and resistor (fig. 5-5).

(4) Disconnect resistor lead from the positive terminal on the alternator.

(5) Remove mounting plate by removing three sockethead screws and two spacers.

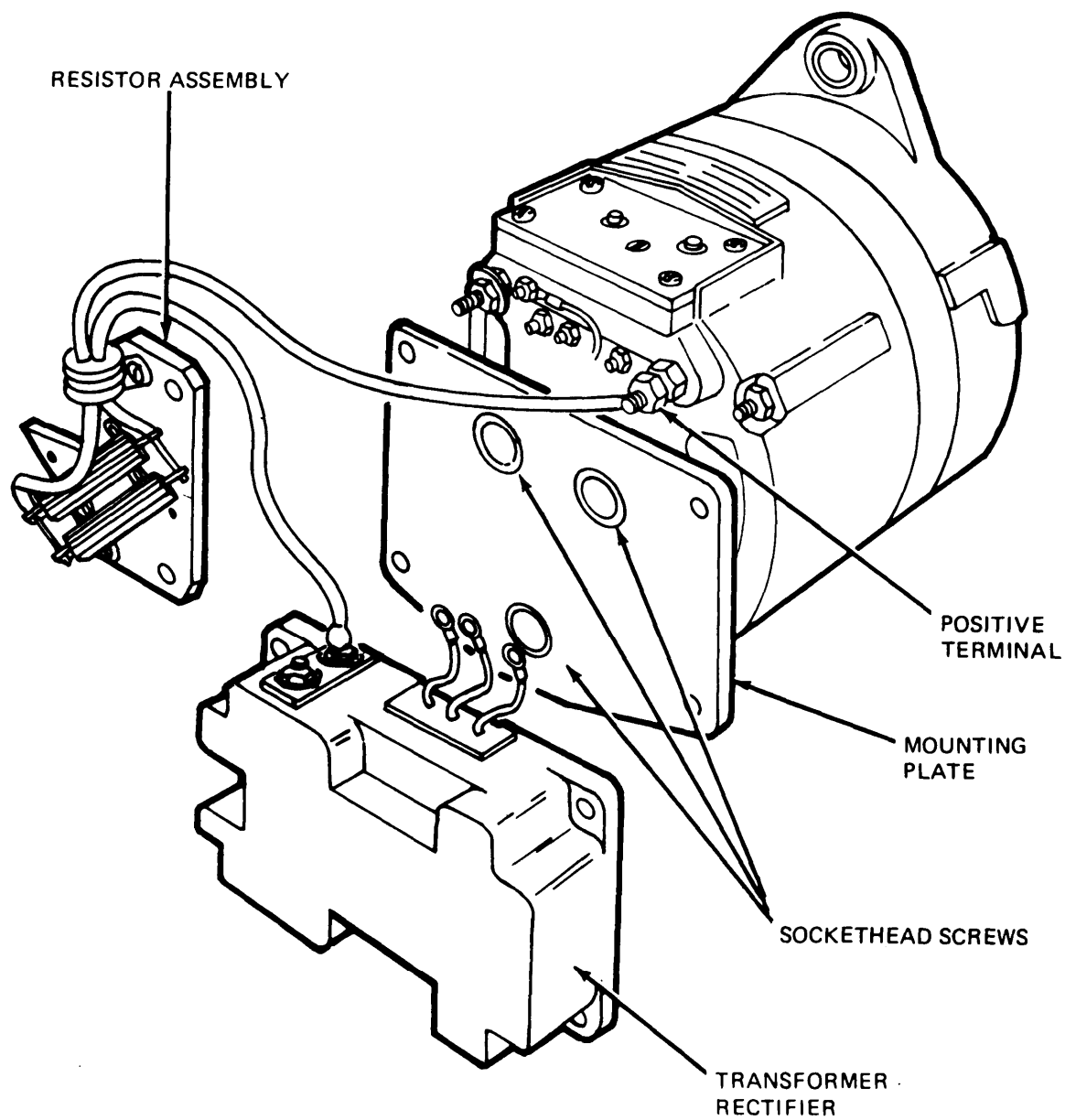
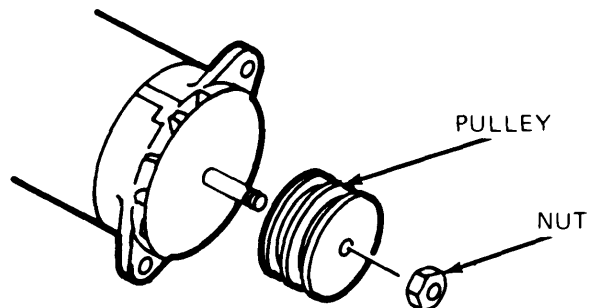


Figure 5-5. Remove Transformer-Rectifier, Resistor, and Mounting Plate.

TA 074003

b. Disassemble the alternator as follows.

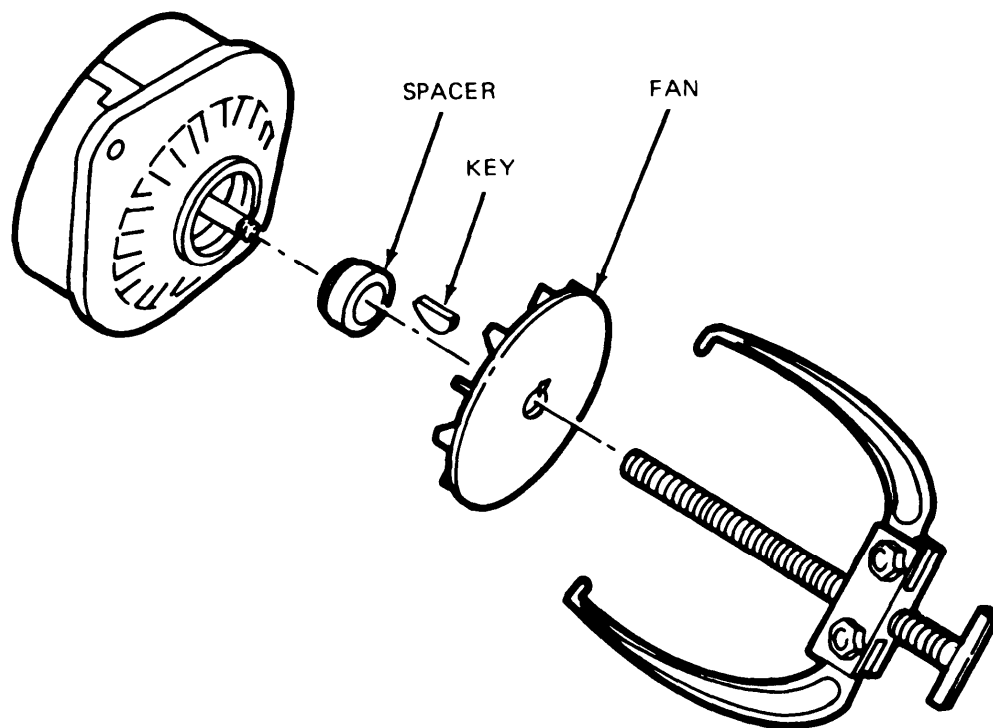
- (1) Remove the pulley nut and pulley (fig. 5-6).



TA 074004

Figure 5-6. Pulley Removal.

- (2) Using a proper size puller, remove the fan; then remove the key and fan spacer (fig. 5-7).



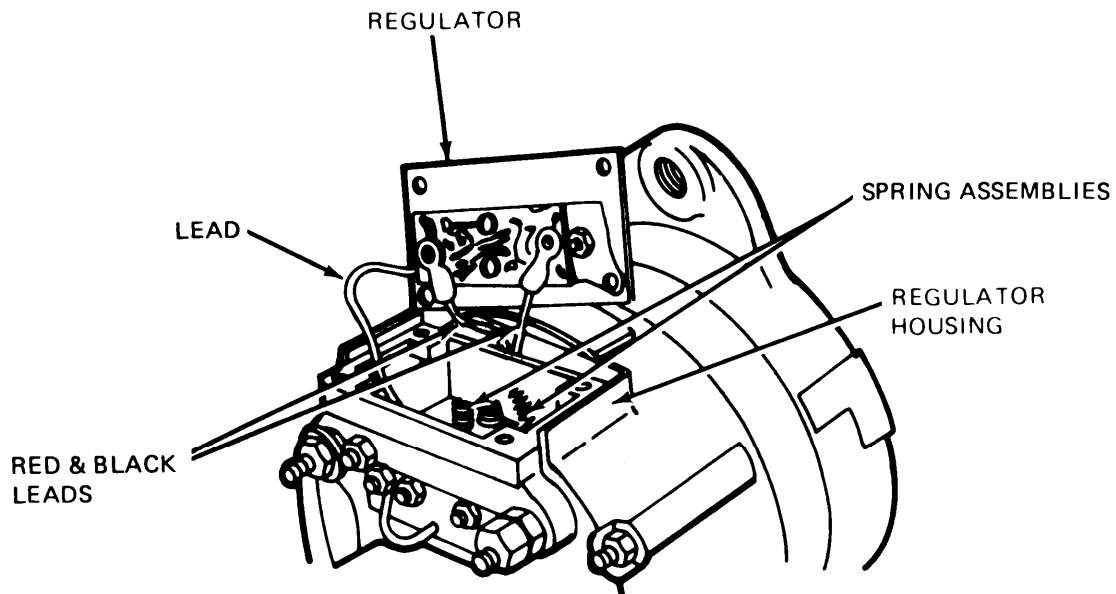
TA 074005

Figure 5-7. Fan Removal.

(3) Remove four screws and carefully lift regulator and gasket free of housing (fig. 5-8). Disconnect the red and black leads from the regulator, noting their positions to facilitate reassembly.

(4) Remove lead from diode trio to terminal on regulator housing. Loosen the inner nut to allow the blue regulator lead to be withdrawn from under the terminal screw. Remove the regulator.

(5) Lift two brush and spring assemblies out of housing.

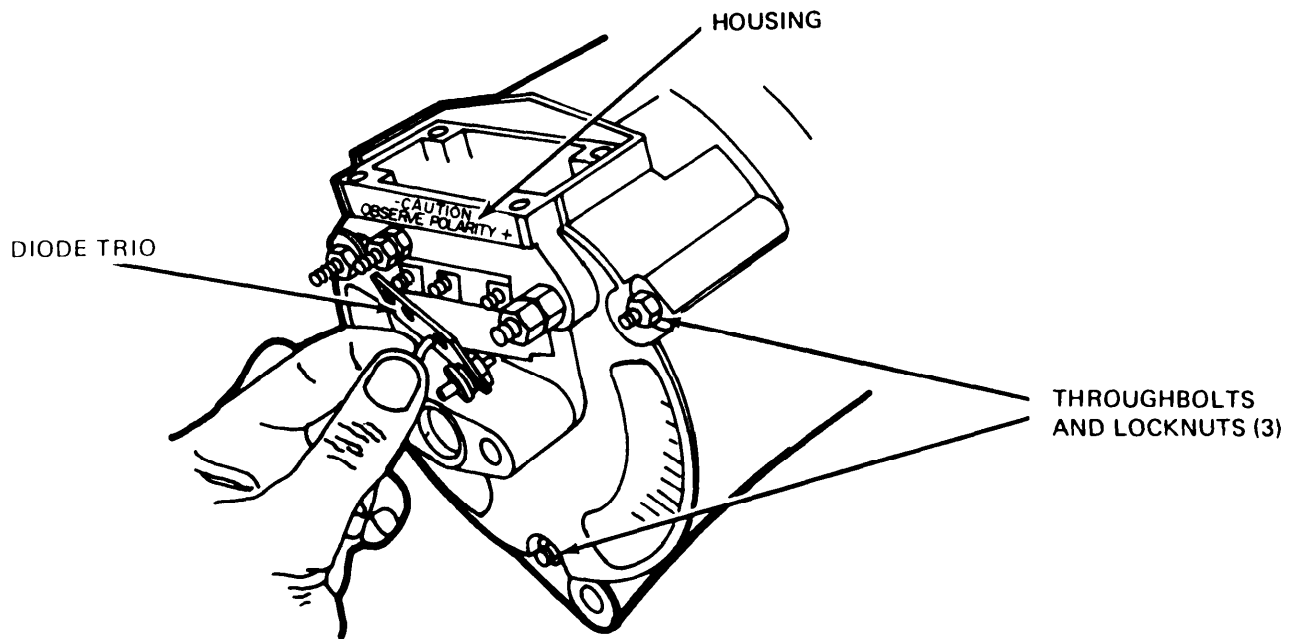


TA 074006

Figure 5-8. Regulator and Brush and Spring Removal.

(6) Remove three nuts and lift diode trio off ac terminal studs (fig. 5-9).

(7) Remove three self-locking nuts and throughbolts.



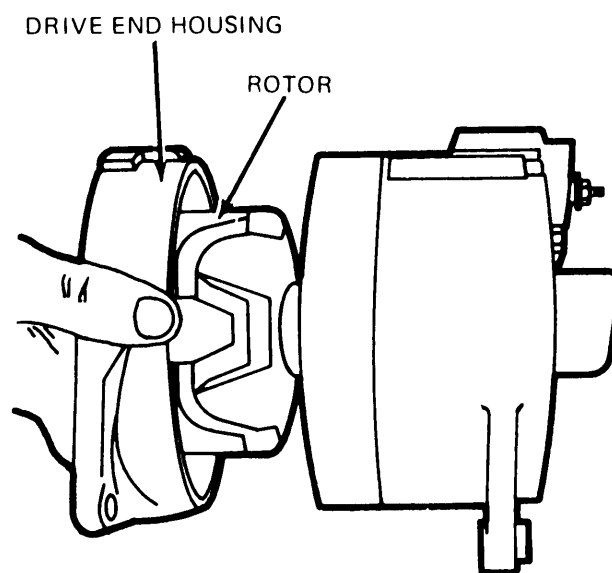
TA 074007

Figure 5-9. Diode Trio and Throughbolt Removal.

CAUTION

Be sure that the drive end housing separates from the stator and that the stator remains attached to the slipring housing to avoid damage to the stator leads.

(8) Remove the rotor and drive housing from the stator and slipring housing assembly (fig. 5-10). If the drive end housing binds on the stator, loosen by tapping gently on the mounting ear with a rubber mallet.

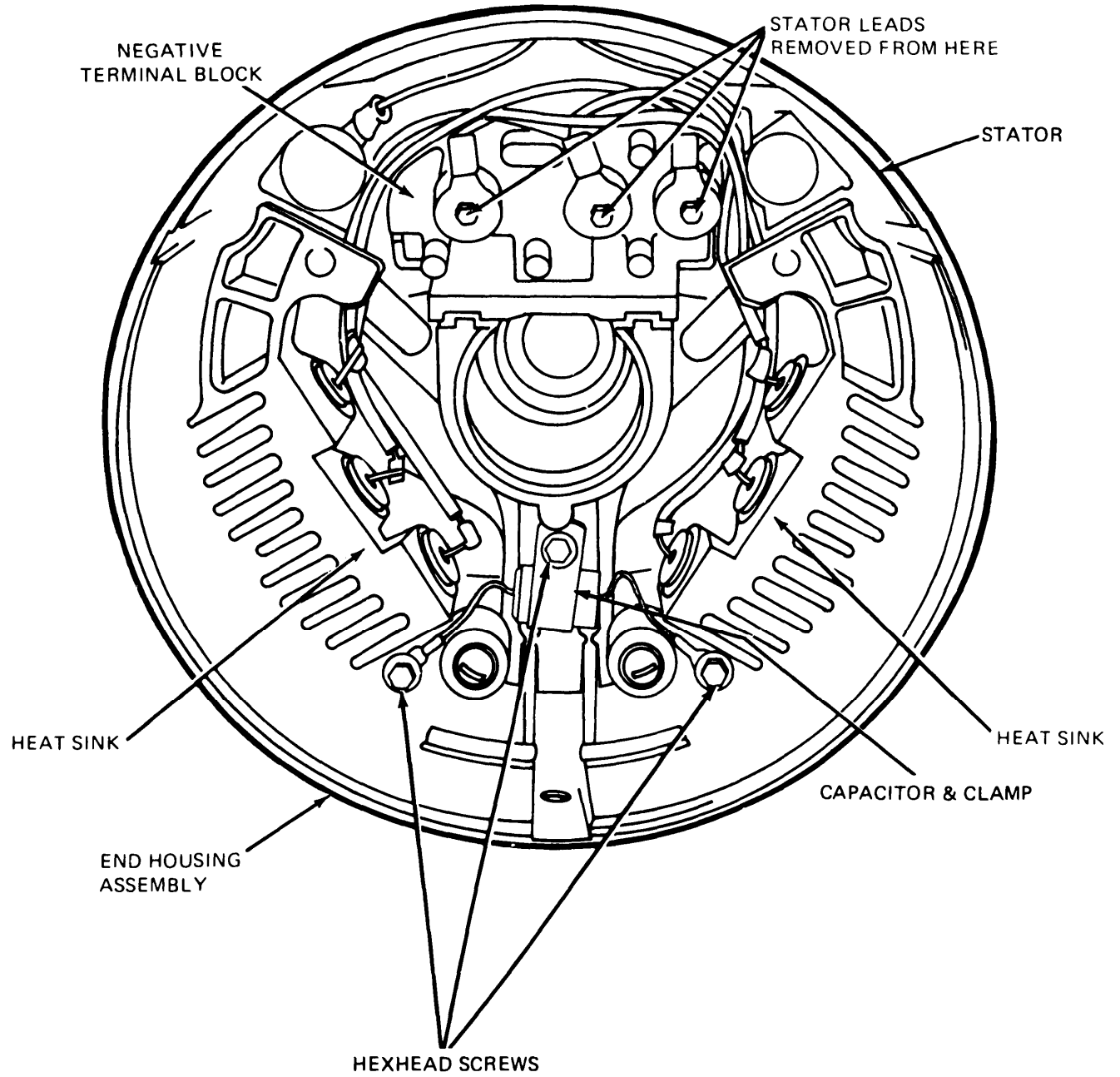


TA 074008

Figure 5-10. Rotor and Drive End Housing Removal.

(9) Remove three nuts that secure the stator leads to the negative terminals (fig. 5-11) and remove the stator from the housing.

(10) Remove three hexhead screws and remove capacitor and clamp connected between the heatsinks.



TA 074009

Figure 5-11. Removal of Stator Leads and Capacitor.

NOTE

In step 11 note the location of the gasket that seals the brush compartment.

(11) Remove the nuts from the positive and negative output terminal studs (fig. 5-12) and remove the regulator housing. Remove the terminal stud insulator bushings.

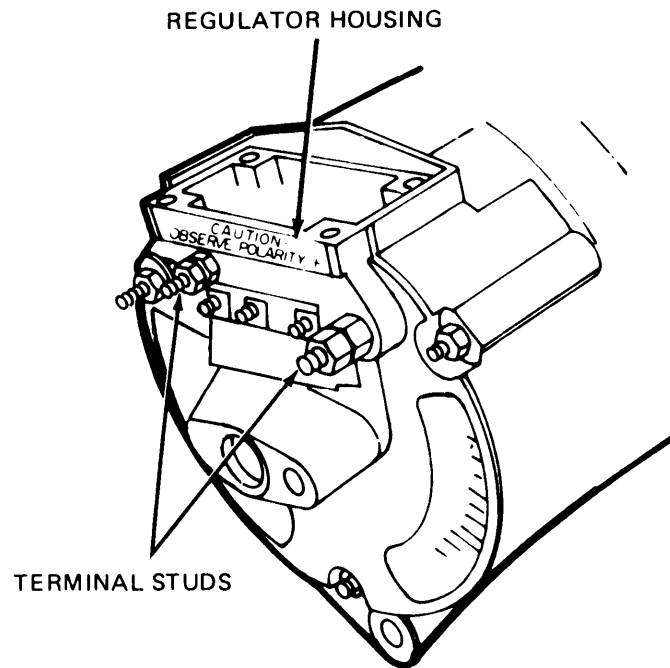
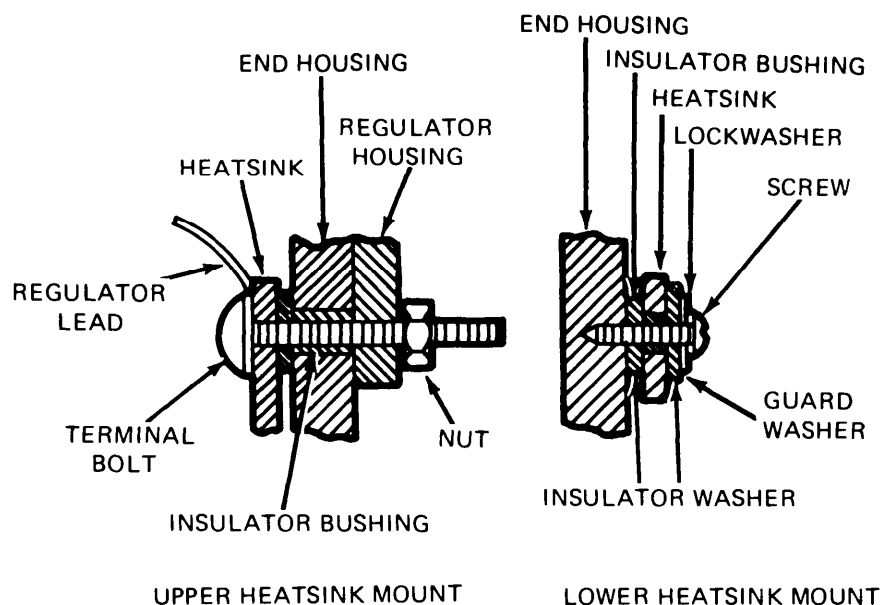


Figure 5-12. Regulator Housing Removal.

TA 074010

(12) Remove the positive and negative terminal bolts (fig. 5-13) noting location of the red and black leads; then remove the two screws, lockwashers, guardwashers, and insulating washers which retain the lower end of the heatsinks. Remove the heatsinks.

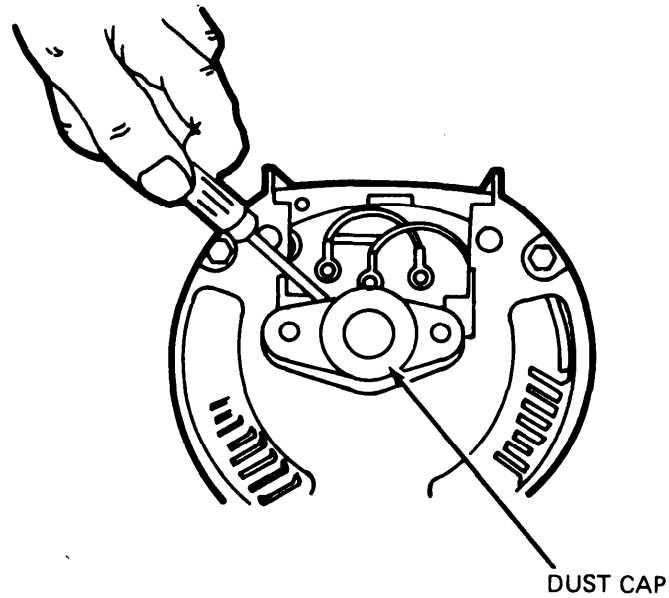


TA 074011

Figure 5-13. Heatsink Removal.

(13) pry flanged dust cap out of the end housing (fig. 5-14).

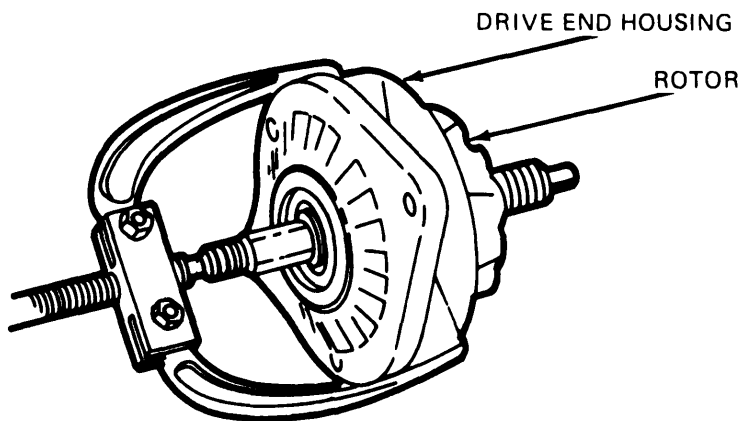
(14) Inspect slipring end bearing. If defective, press bearing from the inside of the housing outward using the following tools: No. CG40-11 and No. CG40-4.



TA 074012

Figure 5-14. Dust Cap Removal.

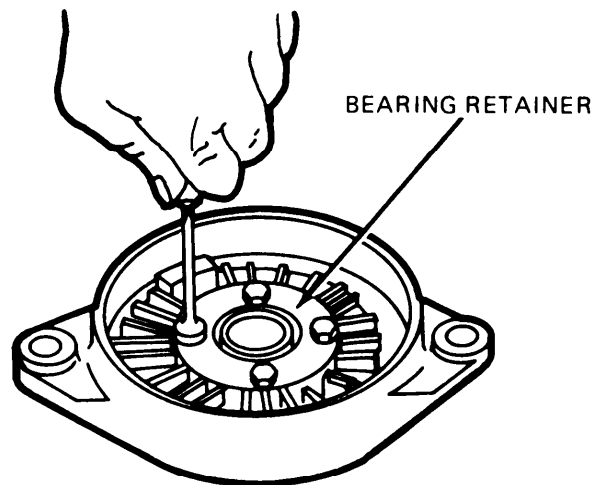
(15) Remove the drive end housing and bearing assembly from the rotor shaft using a puller (fig. 5-15).



TA 074013

Figure 5-15. Drive End Housing Removal.

(16) Remove four screws and the bearing retainer (fig. 5-16). Press the bearing out of the drive end housing.



TA 074014

Figure 5-16. Drive End Housing Bearing Removal.

5-4. Tests and Inspections.

NOTE

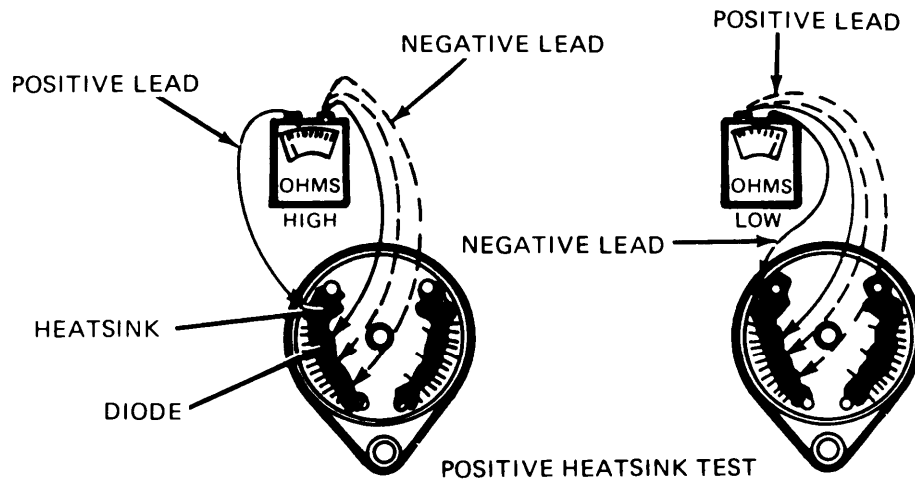
Before performing the following tests, visually inspect all parts for wear, cracks, breakage, or other mechanical defects. Discard and replace any damaged part.

a. Positive Heatsink (Rectifier) Test.

NOTE

The positive heatsink is the one to which the positive output terminal is connected. The square hole in the terminal end of the positive heatsink is larger than the terminal hole in the negative heatsink. This test may be performed without removing the heatsink from the end housing by performing steps (1) thru (4) prior to testing the diodes. If the heatsink has been removed, proceed to step (5).

- (1) Remove the stator.
- (2) Disconnect the red and black leads to the regulator and make sure they are not touching each other.
- (3) Remove the diode trio from the ac terminal studs.
- (4) Disconnect the capacitor across the lower end of the heatsinks.
- (5) Connect the positive lead of an ohmmeter or a test light to the positive heatsink and touch the negative test lead to each of the three diode terminals, one at a time (fig. 5-17). A high resistance should be indicated, or if a test light is used, it should not light. If any of the three diodes show a low resistance, or the test lamp lights, the diode is shorted and the entire heatsink must be replaced.



TA 074015

Figure 5-17. Positive Heatsink Test.

(6) Connect the negative test lead to the positive heatsink and touch the positive lead to each of the three diode terminals, one at a time (fig. 5-17). A low resistance should be indicated. (If a test light is used, it should light.) If a high resistance is obtained, or if test light fails to light, an open diode is indicated and the entire heatsink assembly must be replaced.

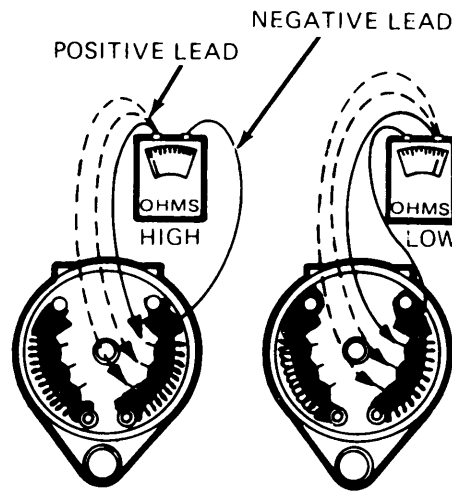
b. Negative Heatsink (Rectifier) Test.

NOTE

The negative heatsink is the one to which the negative output terminal is connected. The square hole in the terminal end of the negative heatsink is smaller than the terminal hole in the positive heatsink. If this test is performed without removing the heatsink from the end housing, verify that steps (1) thru (4) in a, above have been performed.

(1) Connect the negative test lead to the negative heatsink and touch the positive test lead to each of the three diode terminals, one at a time (fig. 5-18). If a low resistance reading is obtained, or if test lamp lights, the diode is shorted and the entire heatsink must be replaced.

(2) Connect the positive test lead to the negative heatsink and touch the positive lead to each of the three diode terminals, one at a time (fig. 5-18). A low resistance reading should be obtained, and if a test light is used, the lamp should light. If high resistance is indicated or the lamp does not light, it is open and the entire heatsink assembly must be replaced.

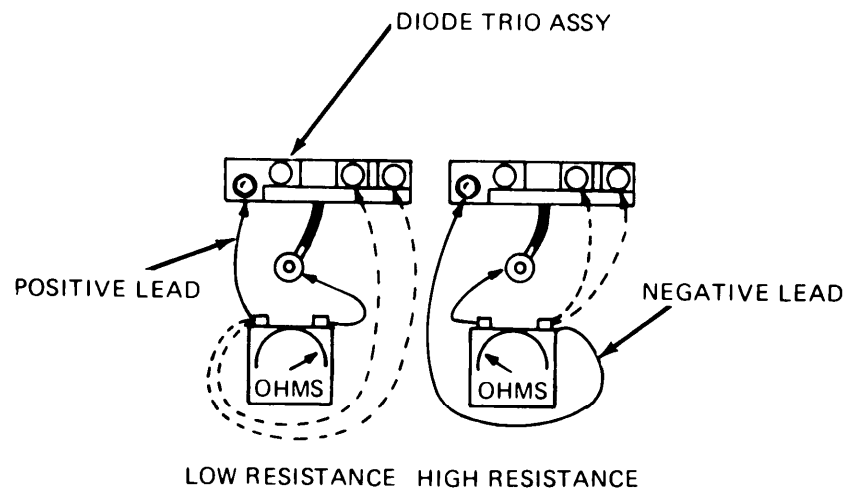


TA 074016

Figure 5-18. Negative Heatsink Test.

c. *Diode Trio Test.* Check the diode trio as follows.

(1) Connect the negative lead of the tester to the output lead of the diode trio and touch the positive test lead to each of the three copper terminal pads, one at a time, (fig. 5-19). A low resistance should be indicated, and if a test lamp is used, it should light. If a high resistance reading is obtained, or if test lamp fails to light, diode trio assembly must be discarded and replaced.

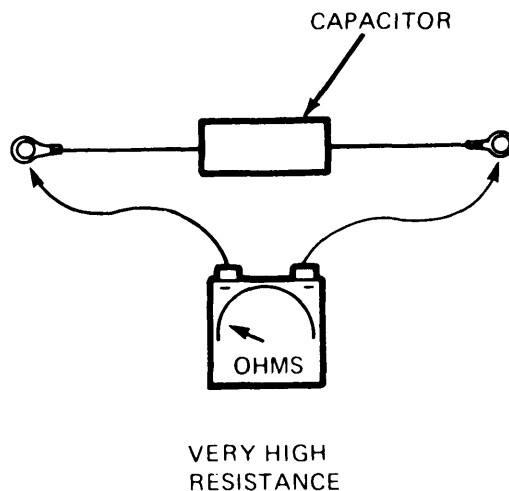


TA 074017

Figure 5-19. Diode Trio Test.

(2) Connect the positive lead of the tester to the output lead of the diode trio, and touch the negative test lead to each of the three copper terminal pads, one at a time, as shown above. A high resistance should be indicated, and if a test lamp is being used, it should not light diode trio which does not pass these tests.

d. *Capacitor Test.* The capacitor connected across the heatsink is checked for shorts using an ohmmeter connected across the terminals (fig. 5-20). A low resistance reading indicates a shorted or leaking capacitor which must be discarded and replaced.



TA 074018

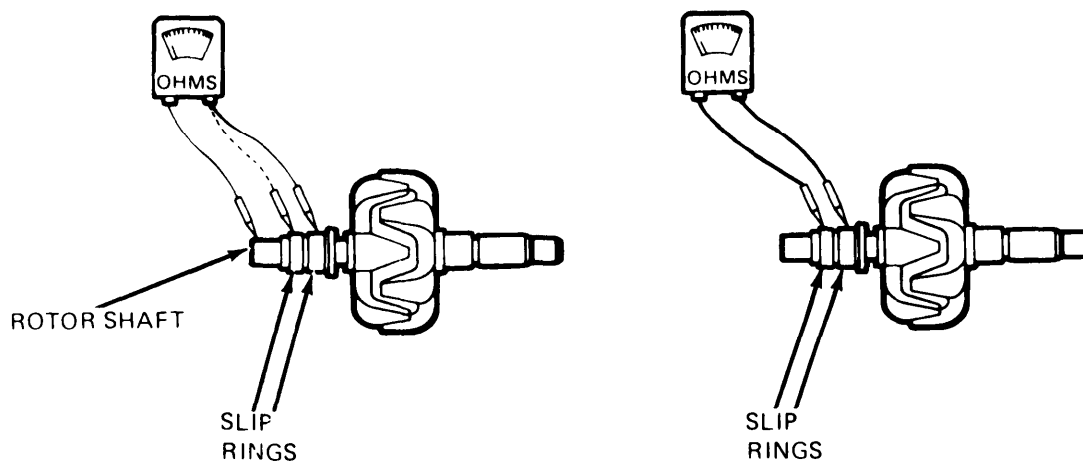
Figure 5-20. Capacitor Test.

e. *Voltage Regulator Test.* The regulator contains devices connected in a way that parallel circuits exist, making it impossible to electrically test each individual component as several will be in the circuit at the same time.

For this reason, point-to-point resistance checks may be inconclusive or misleading. Refer to On-Vehicle Testing, paragraph 5-2.

f. *Rotor Test.* The rotor is tested for grounds and proper coil resistance as follows:

(1) Connect an ohmmeter between the rotor shaft and both sliprings, one at a time (fig. 5-21). If a reading other than infinity is obtained, the rotor coil is grounded and the rotor must be removed and replaced.



TA 074019

Figure 5-27. Rotor Coil Test.

(2) Check rotor coil resistance by connecting an ohmmeter across the two sliprings, as shown above. The resistance should be between 2.3 and 2.7 ohms.

(3) Before condemning a rotor for an open coil, check the solder joints at the slipring leads, as a poor connection at either of these leads will cause the same test result as an open coil. If the proper resistance is not obtained after resoldering these connections, replace the rotor.

g. Stator Test. Replace any stator that appears overheated (discolored) or that has charred insulation, regardless of how they test. Perform continuity and ground tests as follows:

NOTE

Do not test the stator while it is connected to the heatsinks. Remove the stator from the alternator before testing.

(1) Check for continuity by connecting a 115-vac test light to each of the lead combinations in figure 5-22. If the lamp fails to light in any combination, replace the stator.

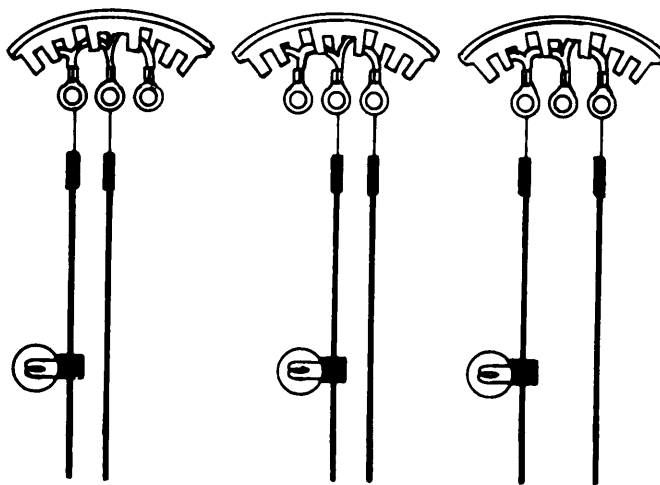


Figure 5-22. Stator Continuity Test.

TA 074020

(2) Check for a ground by connecting the 115-vac test light as shown in figure 5-23. If the lamp lights, replace the stator.

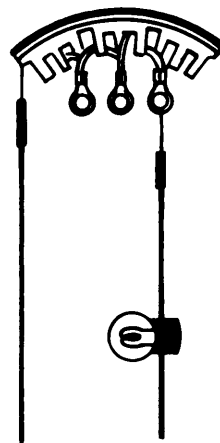
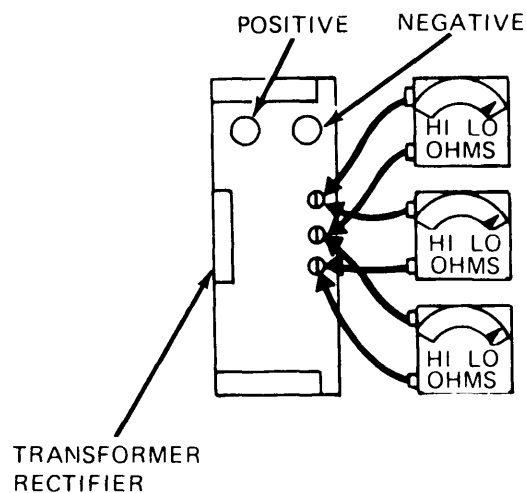


Figure 5-23. Stator Ground Test.

TA 074021

h. Transformer-Rectifier Test. The transformer-rectifier is checked as follows:

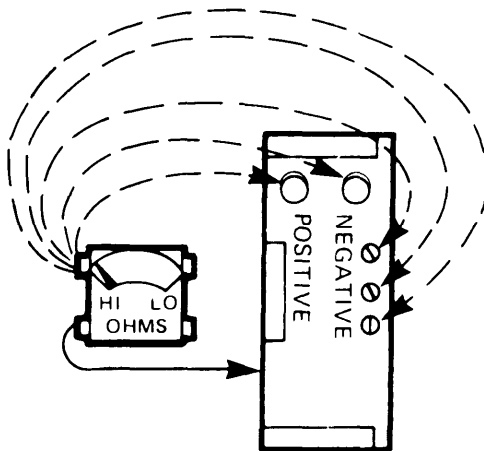
(1) Use an ohmmeter (fig. 5-24) to check for continuity of the transformer windings. If an infinity reading is indicated between any two ac terminals, that winding is open and the unit must be replaced.



TA 074022

Figure 5-24. Transformer-Rectifier Open Test.

(2) Use an ohmmeter (fig. 5-25) to check for grounds between the five terminals and the housing. Any reading other than infinity indicates an internal ground and the unit must be replaced.



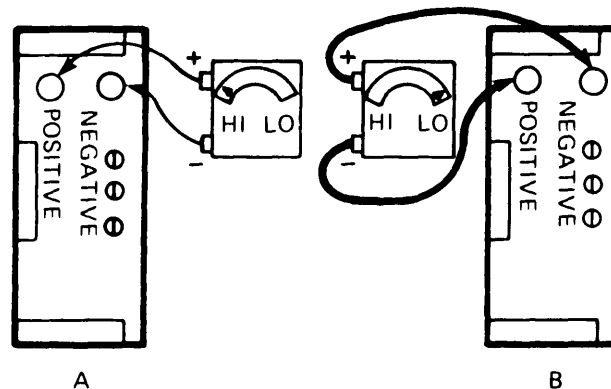
TA 074023

Figure 5-25. Transformer-Rectifier Ground Test.

(3) Connect the ohmmeter positive test lead to the positive terminal of the transformer rectifier, and the negative lead to the negative terminal, as shown in figure 5-26. An infinity reading should be obtained.

(4) Reverse the test leads. A low resistance reading should be indicated.

(5) Failure to obtain a reading in either direction indicates open rectifiers, and a reading in both directions indicates shorted rectifiers. In either case, the unit must be replaced.



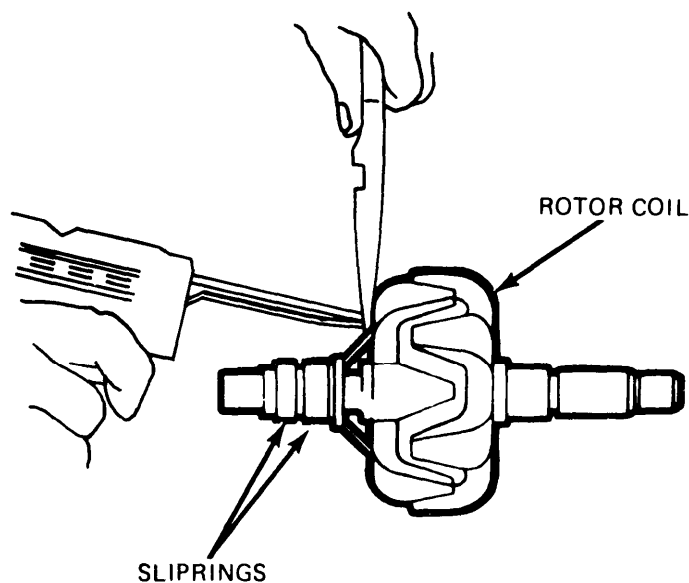
TA 074024

Figure 5-26. Transformer-Rectifier Short Test.

5-5. Repair or Replacement.

a. *Slipring Replacement.* The slipring is replaced as follows:

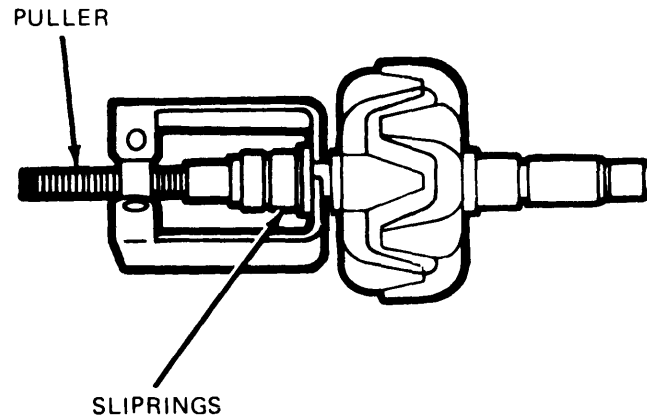
(1) Unsolder the slipring leads (fig. 5-27) and lift them clear of the eyelets that retain them to the rotor coil leads. Do not lose or damage the eyelets.



TA 074025

Figure 5-27. Unsoldering the Slipring Leads.

(2) Remove the slipring assembly from the rotor shaft, using a suitable puller (fig. 5-28).

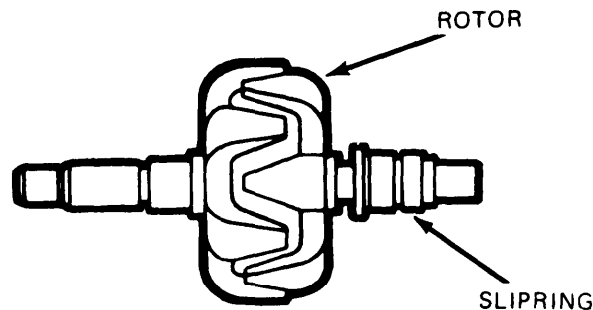


TA 074026

Figure 5-28. Slipring Removal.

(3) Clean the rotor shaft and apply a small amount of Loctite (Item 19, App B) (or equivalent) to the shaft on the section normally occupied by the slipring assembly.

(4) position the new slipring assembly on the shaft so that the two electrical leads are alined with the two rotor coil eyelets. Carefully press the slipring assembly onto the shaft until it is 3/8 in. from the rotor (fig.5-29).



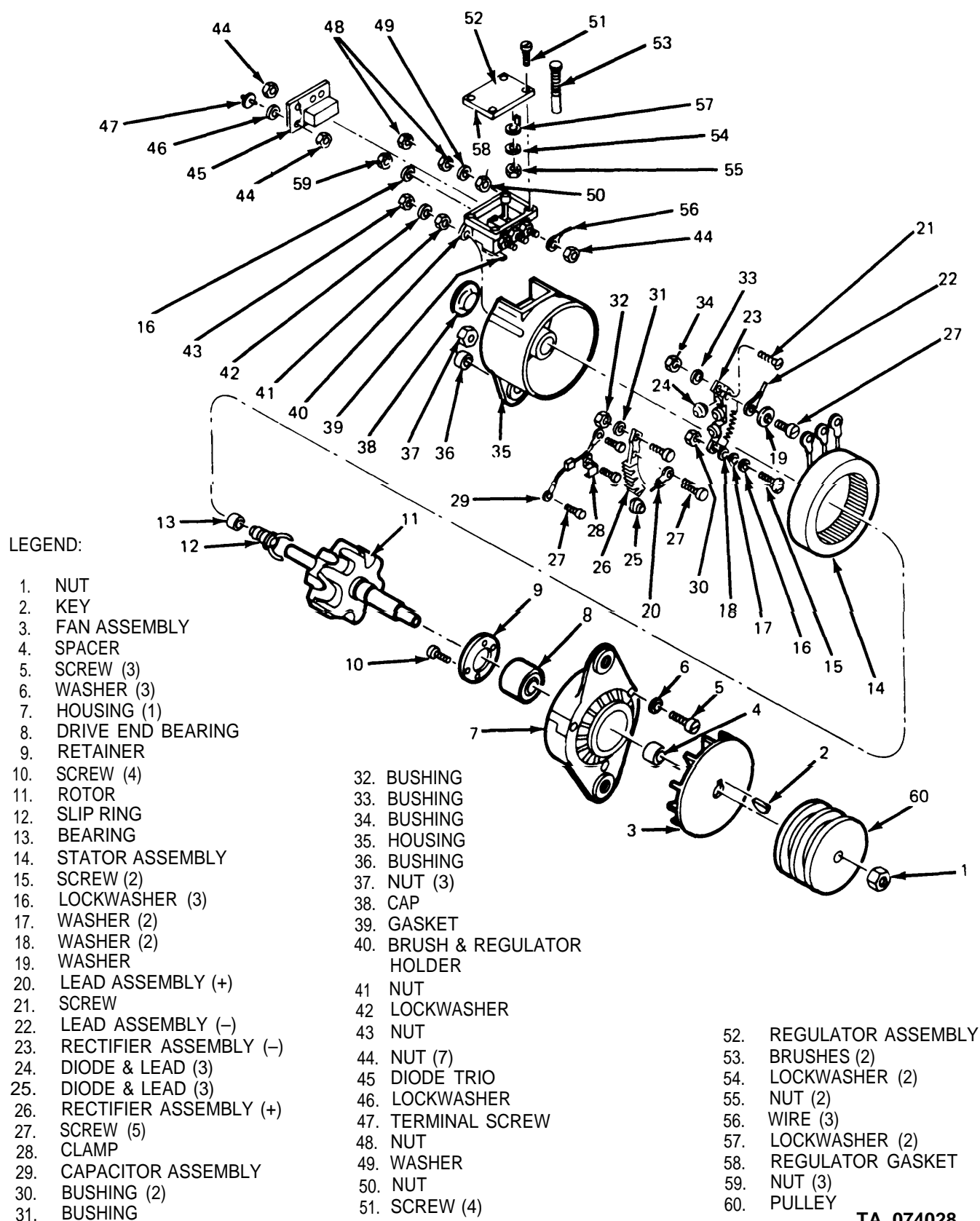
TA 074027

Figure 5-29. Slipring Installation.

5-6. Assembly. (See figure 5-30.)

a. *Assemble the Alternator.* Assemble the alternator as follows:

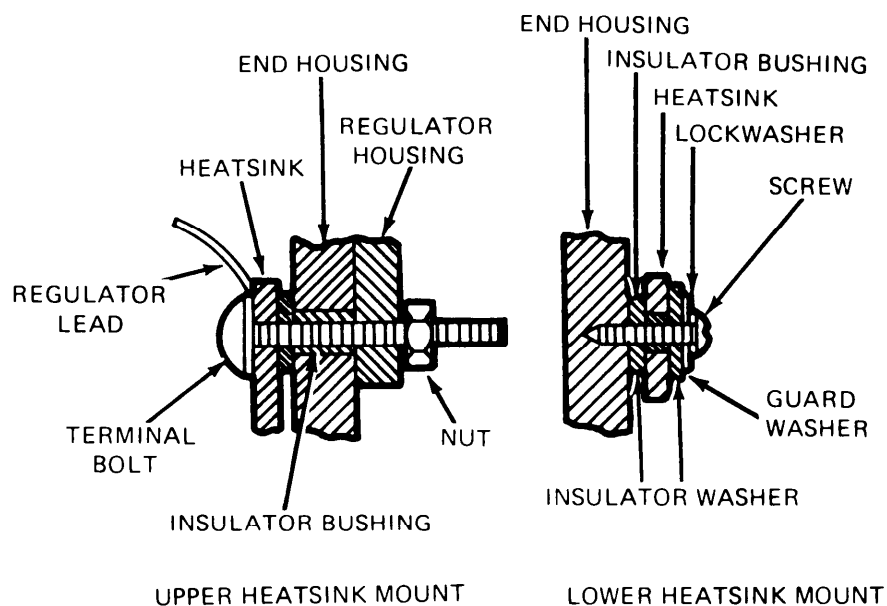
(1) If the slipring end bearing was removed, press a new bearing into the housing from the outside of the housing. The bearing must be installed with the seal facing in toward the sliprings and the manufacturer's part number facing toward the outside of the housing. The bearing should seat against the lip on the inside end of the bearing bore. After installation, apply a small amount of grease to the rollers.



TA 074028

Figure 5-30. Alternator – Exploded View.

(2) Install the heatsinks in the end housing. Be sure that the upper and lower insulating washers are in their proper locations (fig. 5-31). Install, but do not tighten, the lower heatsink retaining screws, lockwashers, guardwashers, and insulating washers.



TA 074011

Figure 5-31. Correct Heatsink Mounting Assembly.

(3) Install terminal bolts and regulator lead wires on the heatsinks. The red wire goes on the positive heatsink (large square hole) and the black wire goes on the negative heatsink. Be sure that mating surfaces of the heatsinks, terminals, and bolts are clean and free of paint to ensure a good electrical connection.

(4) Install two insulating bushings on each terminal stud and install the regulator housing. Route the red and black leads through the cutaway section of the end housing. Install and tighten the nuts on the terminal bolts.

(5) Tighten the lower heatsink screws and check all leads for proper routing, being sure that no lead is pinched under a heatsink.

(6) Install and connect the capacitor.

(7) Install the stator on the end housing; then connect the stator leads with the terminal nuts. Temporarily install the three throughbolts to align the stator and end housing,

CAUTION

When installing the end bearing in the following step, press only on the outer race to avoid transmitting force through the bearing balls and damaging the bearing.

(8) Press the bearing into the drive end housing. Install the bearing retainer and four screws.

CAUTION

In the following step, use a sleeve around the shaft to press on the inner race to avoid damaging the bearing.

- (9) press the drive end housing and bearing onto the rotor shaft.
- (10) Remove the three throughbolts from the stator and end housing. Install the rotor and drive end housing into the stator and slipring end housing, being sure to line up the mounting ears.
- (11) Reinstall the three throughbolts and self-locking nuts. Torque to 50-60 lb-in (6-7 N-m). Place a small amount of grease in the end housing and install the metal dust cap by tapping it into place.
- (12) Install the diode trio and three nuts.
- (13) Insert the outer brush and spring assembly into the housing and compress the brush spring, using a small screwdriver. While holding the spring compressed, insert a pin through the hole in the rear of the housing so that the spring is held in a compressed position. (A suitable pin can be made from a paper clip.) Install and compress the remaining brush and spring assembly in the same manner, and by pushing the pin farther into the housing as shown in figure 5-32.

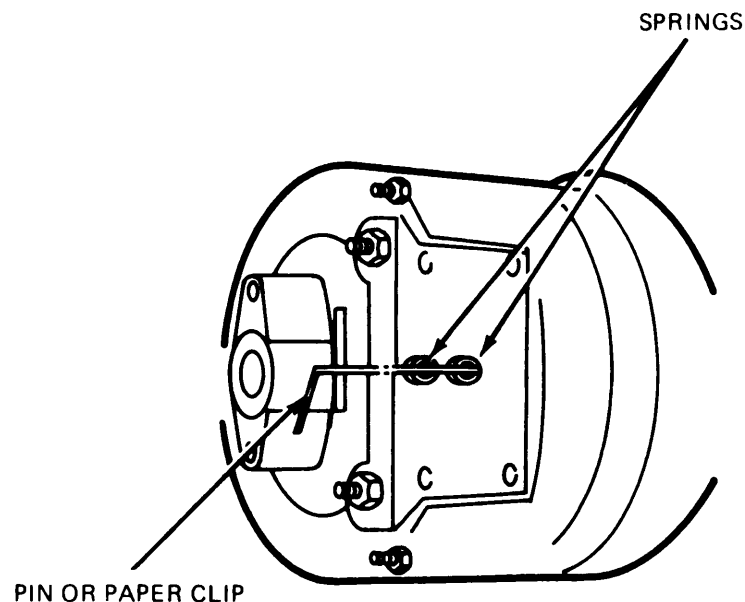
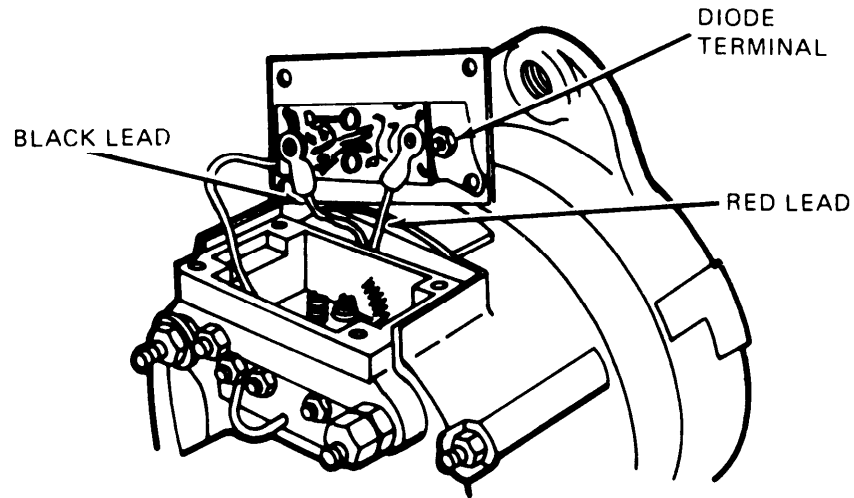


Figure 5-32. Brush and Spring Installation.

TA 074029

- (14) Attach the red and black leads to regulator (fig. 5-33). Attach the blue regulator lead to the diode terminal by sliding the spade terminal under the head of the screw. Tighten the nut on the terminal screw.



TA 074030

Figure 5-33. Regulator Electrical Connections.

(15) Position the regulator, being careful that the red and black leads are routed through their slots in the regulator housing without binding. Loosely install the four mounting screws, withdraw the brushes retaining pin, and tighten the mounting screws.

(16) Install the diode trio lead and nut.



Do not force or pound pulley on shaft.

(17) Install the spacer, key, fan, pulley, and nut. Torque the nut to 70-80 lb-ft (95-108 N-m).

NOTE

Due to the design of the alternator, a small amount of shaft end play will be present in new or rebuilt units. End play between 0.004 and 0.012 in. (0.10-0.30 mm) is normal.

b. *Assemble the Transformer-Rectifier.* Assemble the transformer-rectifier onto the alternator as follows.

(1) Position the mounting plate on the alternator and install the two spacers and three socket-head screws (fig. 5-34). Apply Loctite (Item 19, App B) to screws and tighten.

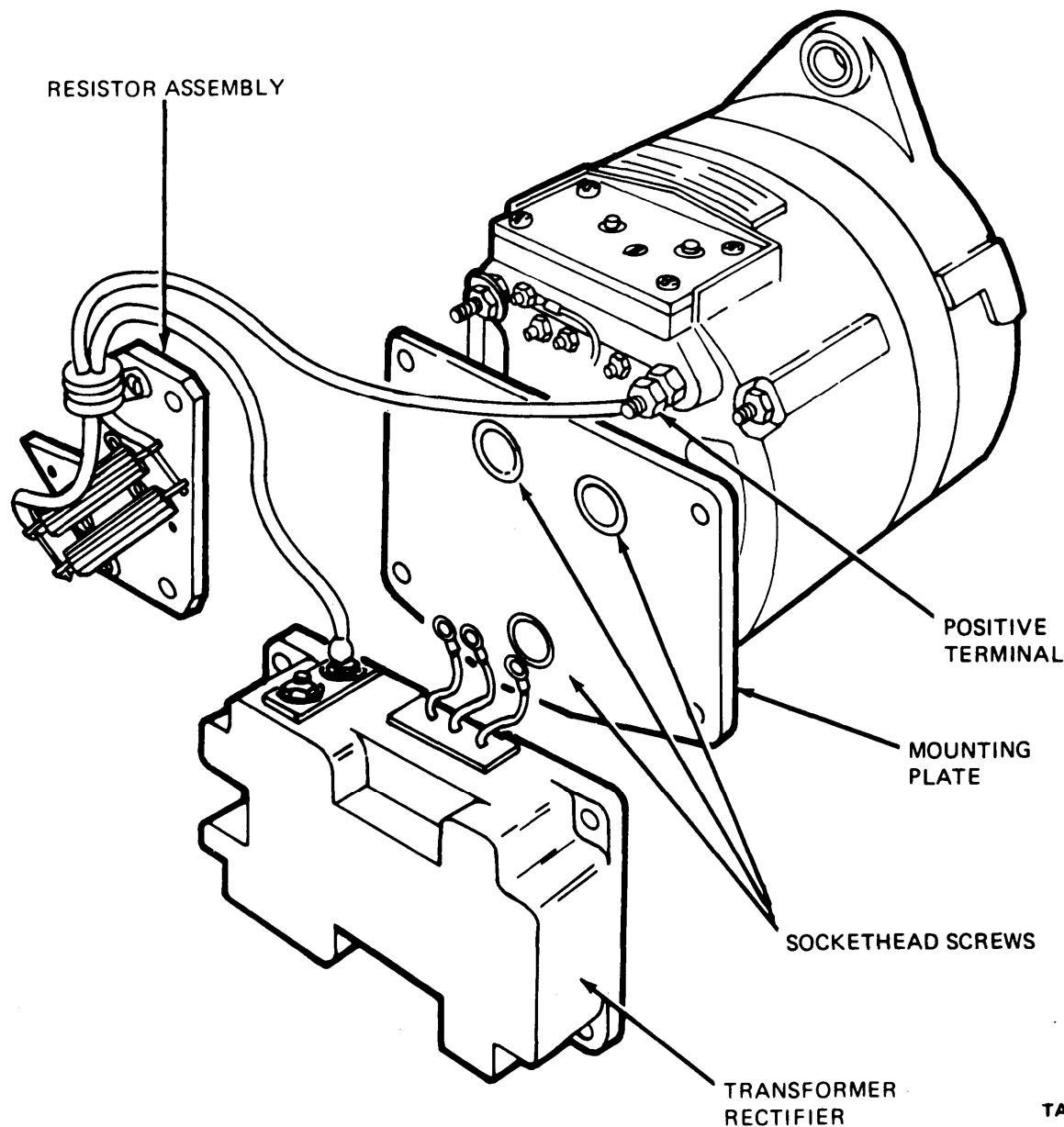


Figure 5-34. Install Transformer-Rectifier, Resistor Assembly and Mounting Plate.

(2) Install resistor assembly positive (to alternator) and negative (to transformer-rectifier) leads.

(3) Install the transformer-rectifier on mounting plate, using the four sockethead screws and lockwashers.

- (4) Install resistor assembly (fig. 5-35) to rectifier mounting plate. Secure with two nuts and lockwashers.

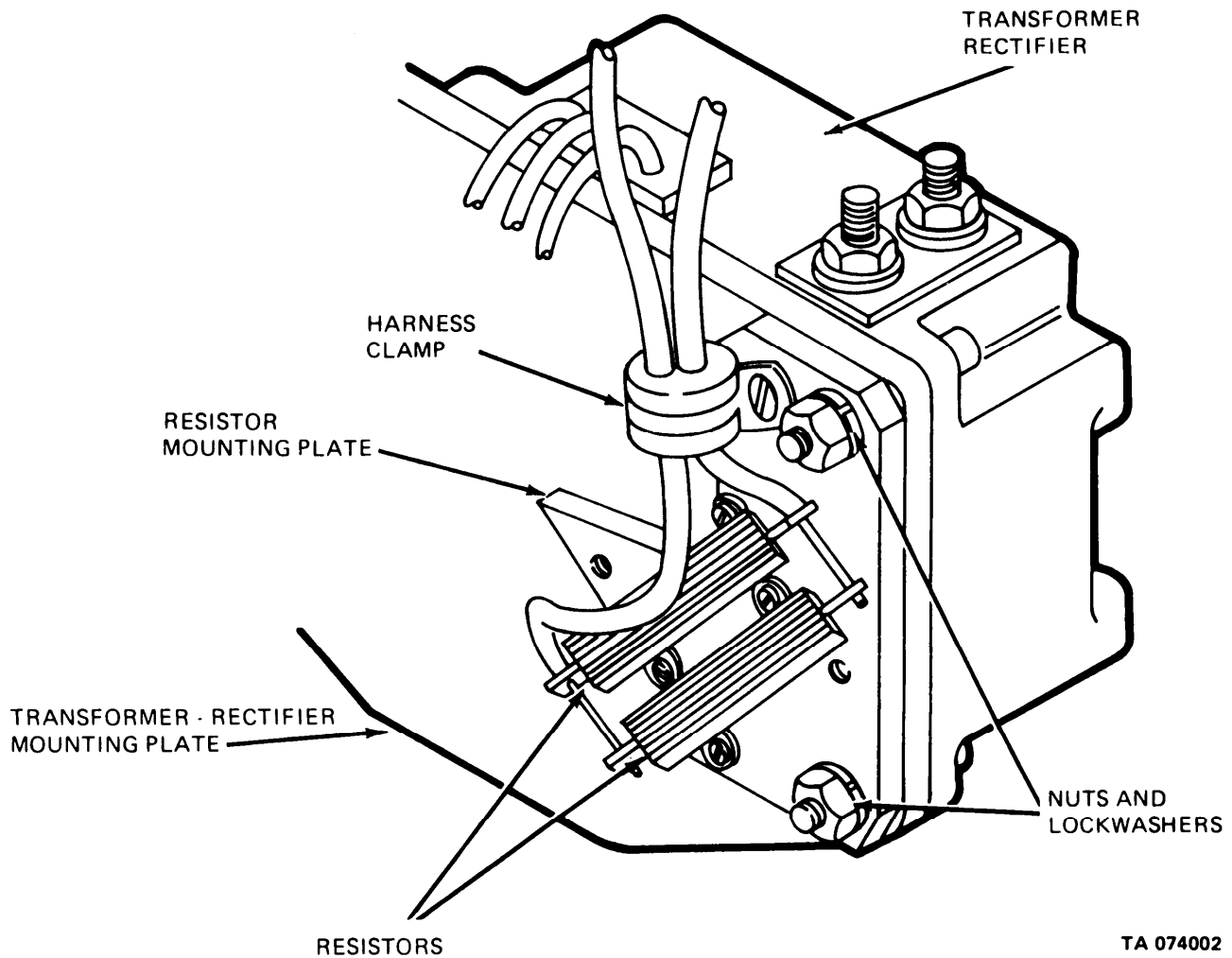


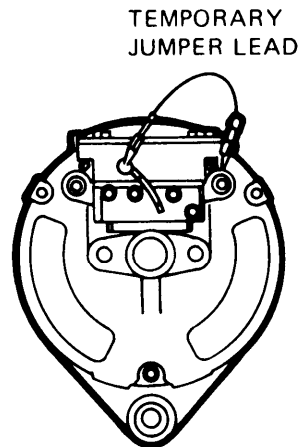
Figure 5-35. View of Resistor Assembly Mounting.

- (5) Install the three ac leads from the transformer-rectifier to the alternator terminals.

5-7. Bench Testing.

a. Test Setup. Because of the internal regulator used on this alternator, the test stand hookup consists only of connecting the positive and negative output leads.

b. Preparation. Before beginning the test, and after making the above connections, momentarily flash the field by connecting a jumper between the diode trio terminal and the alternator positive output terminal (fig. 5-36). This will restore the residual magnetism which may have been weakened by handling or repair procedures.



TA 074031

Figure 5-36. Restoring Residual Magnetism.

c. Testing the Alternator (72- Volt dc Output). Test the alternator as follows:

- (1) Set the test stand speed so that the alternator is running at 580-620 rpm.
- (2) Adjust the regulator output to 14 volts dc.
- (3) Vary the load on the alternator between 1 ampere and 85 amperes and check that the output matches the load.

d. Testing the Alternator with Transformer-Rectifier (24- Volt dc Output). Check the 24-volt charging output as follows:

- (1) Set the test stand speed so that the alternator is running at 580-620 rpm.
- (2) Adjust the regulator output to 28 volts dc.
- (3) Vary the load between 1 ampere and 15 amperes and check that the output matches the load.

Section II. STARTING MOTOR

5-8. Description (fig. 5-37). The starting motor is a 24-volt, water-resistant motor with an electric shift engagement, overrunning clutch drive. A water-resistant solenoid switch is mounted on the motor field ring. The solenoid switch actuates the clutch drive through a hinged yoke and linkage assembly.

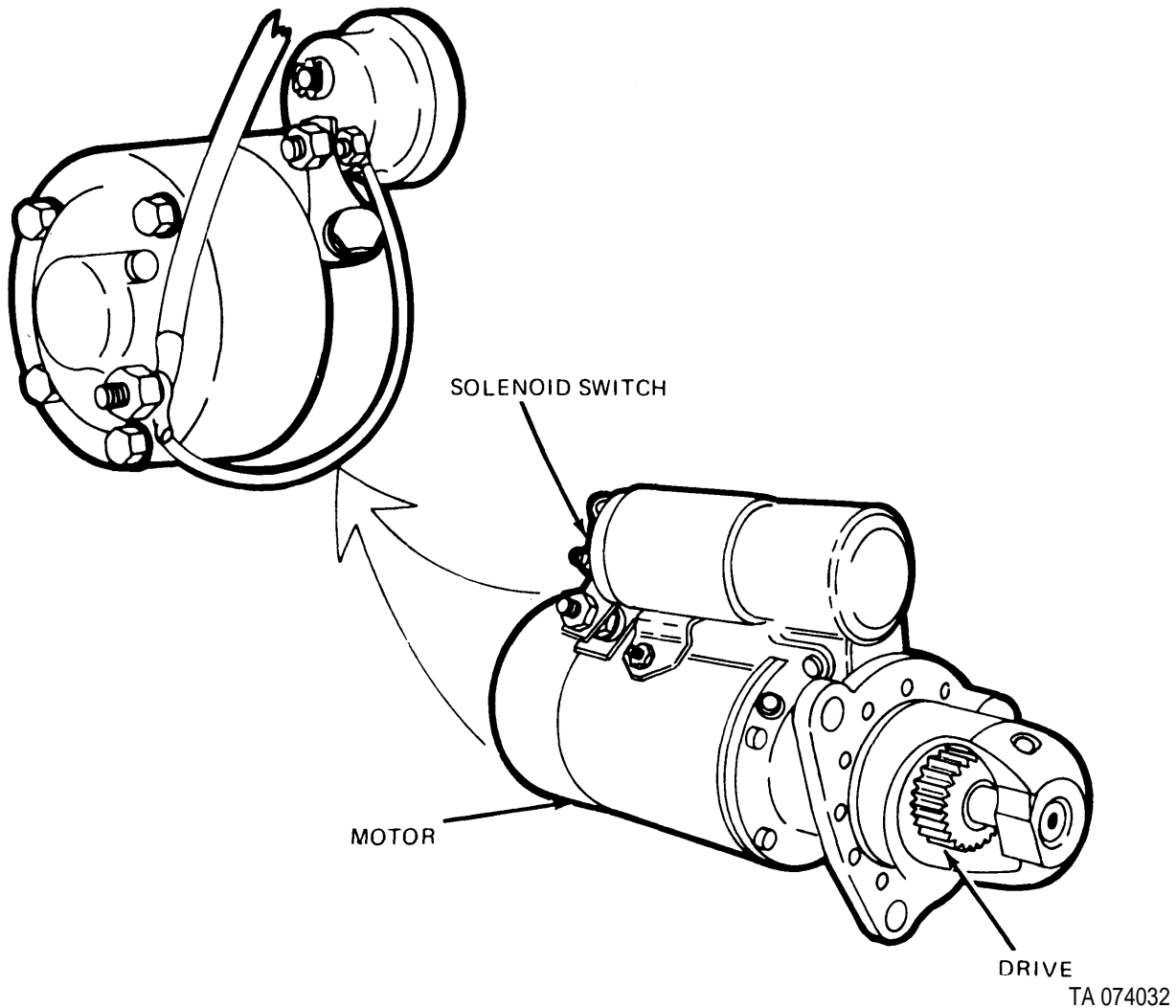
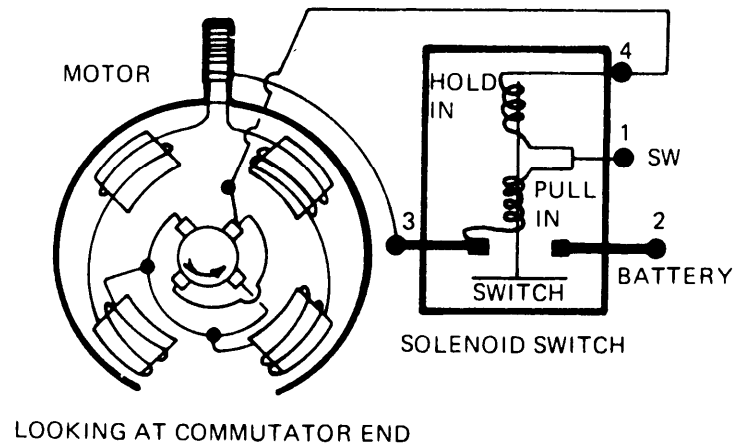


Figure 5-37. Starting Motor.

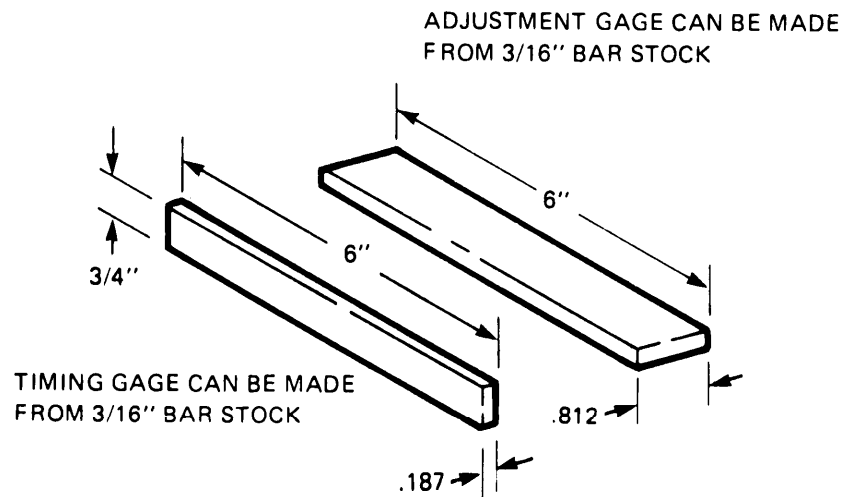
When the START button is pressed, two circuits in the solenoid switch are energized: the pull-in coil and the hold-in coil (fig. 5-38). The solenoid switch moves the drive assembly into mesh with the engine fly-wheel ring gear and, in the proper sequence, closes the cranking contacts in the switch. When the cranking contacts close, the pull-in coil is then in parallel with the contacts and no current flows in this circuit. The hold-in coil holds the cranking switch closed and also holds the pinion in the cranking position. When the engine starts, the overrunning clutch in the drive allows the pinion to run free until the START button is released. At this time the solenoid switch is deenergized and the drive returns to an at-rest position by the return spring in the solenoid switch.



TA 074033

Figure 5-38. Motor and Switch Electrical Circuit.

5-9. Special Tools. Special tools required for adjusting the solenoid switch installation and for the timing test are shown in figure 5-39.



TA 074034

Figure 5-39. Starting Motor Special Tools.

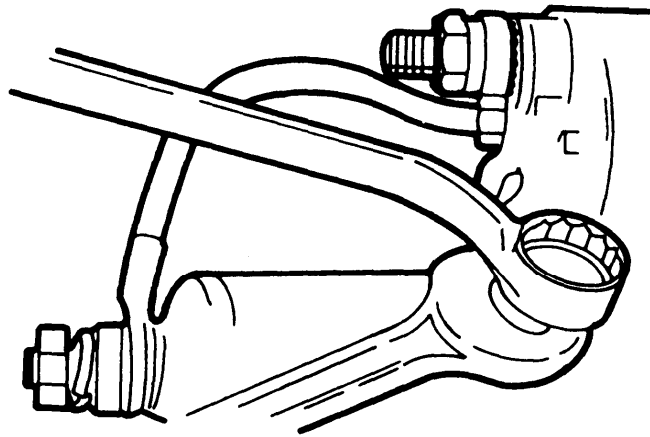
5-10. Disassembly.

a. *Solenoid Switch Removal.* Remove the solenoid switch as follows:



To remove the jumper strap retaining nut at the No. 3 switch stud and at the field ring, it is necessary to heat the stud to approximately 300°F (149°C). Failure to do this may result in breakage of the plastic end base that retains the stud.

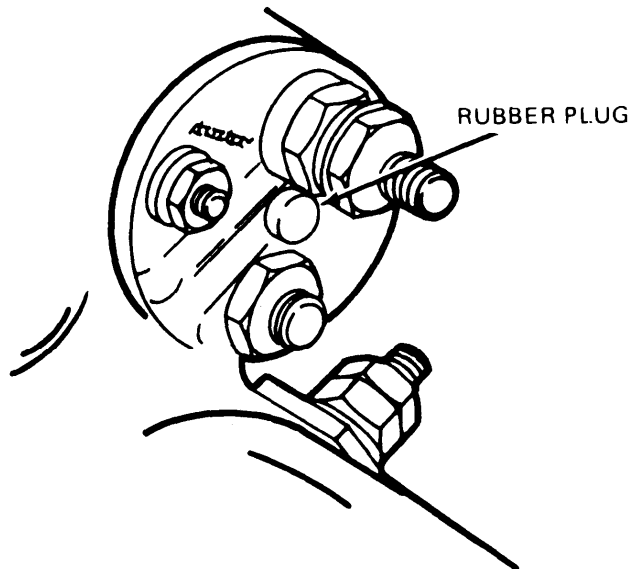
- (1) Disconnect the jumper leads from the Nos. 3 and 4 terminals of the solenoid switch.
- (2) Loosen the field terminal stud nut a few turns, using two wrenches (fig. 5-40).



TA 074035

Figure 5-40. Field Terminal Stud Loosening Method.

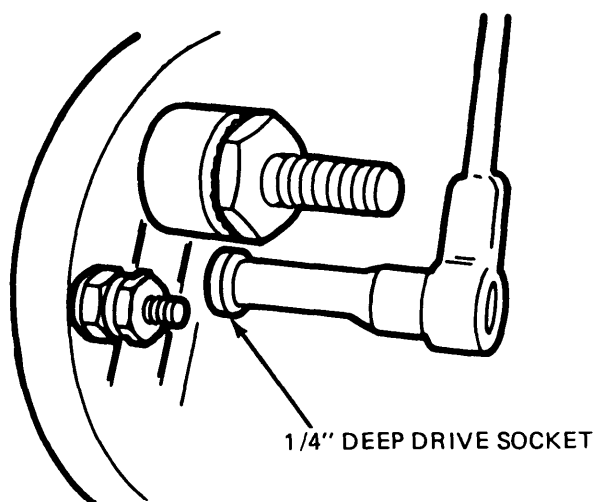
- (3) Remove the rubber plug from the contact housing for access to the timing shaft (fig. 5-41).



TA 074036

Figure 5-41. Timing Shaft Nut Access.

- (4) Insert a 1/4 in. deep drive socket into the switch opening and engage the nut on the end of the timing shaft. Unscrew (counterclockwise) the nut to release the plunger from the arm and shaft (fig. 5-42).



TA 074037

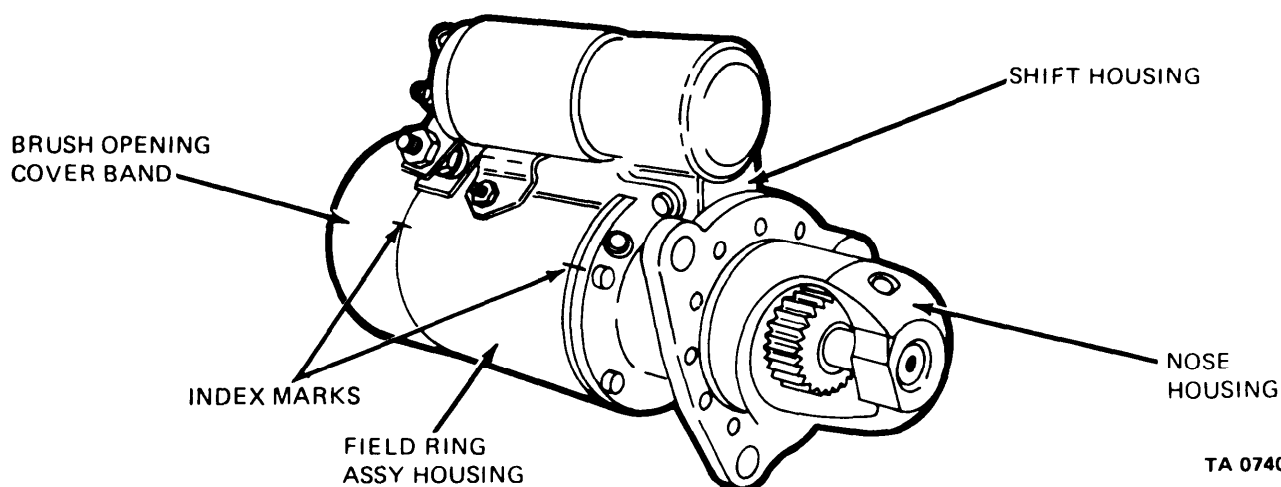
Figure 5-42. Timing Shaft Nut Removal.

(5) Remove the two screws from the switch mounting base and remove the switch.

b. Solenoid Switch Maintenance. The solenoid switch cannot be disassembled. If defective, replace.

c. Motor Disassembly.

(1) Before disassembling the motor, index all housings (in relation to the field ring and each other) by punch marks or other means (fig. 5-43).

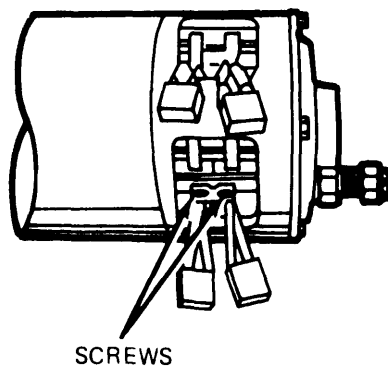


TA 074038

Figure 5-43. Motor Housings Orientation.

(2) Remove the brush opening cover band and gasket.

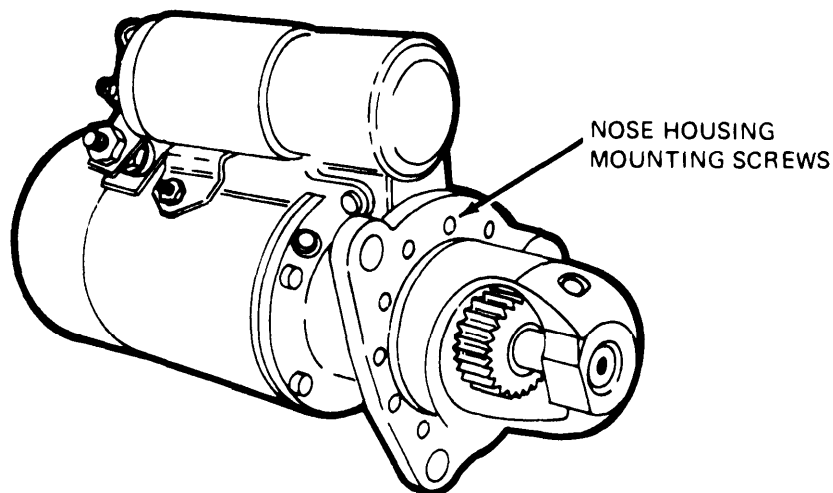
(3) Remove the eight brushes (fig. 5-44). Do not lift the brushes by their pigtails while the brush spring is exerting pressure on the brush.



TA 074039

Figure 5-44. Brushes Removal.

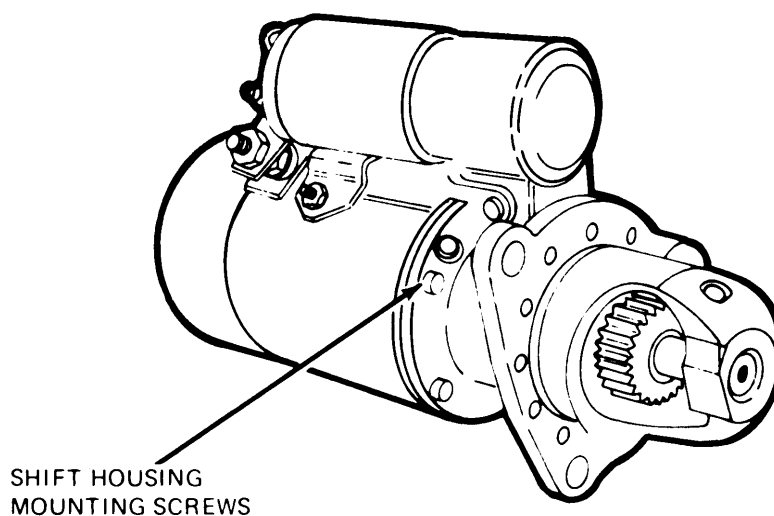
(4) Remove six screws from the nose housing and slide the housing from the armature shaft (fig. 5-45).



TA 074040

Figure 5-45. Nose housing Removal.

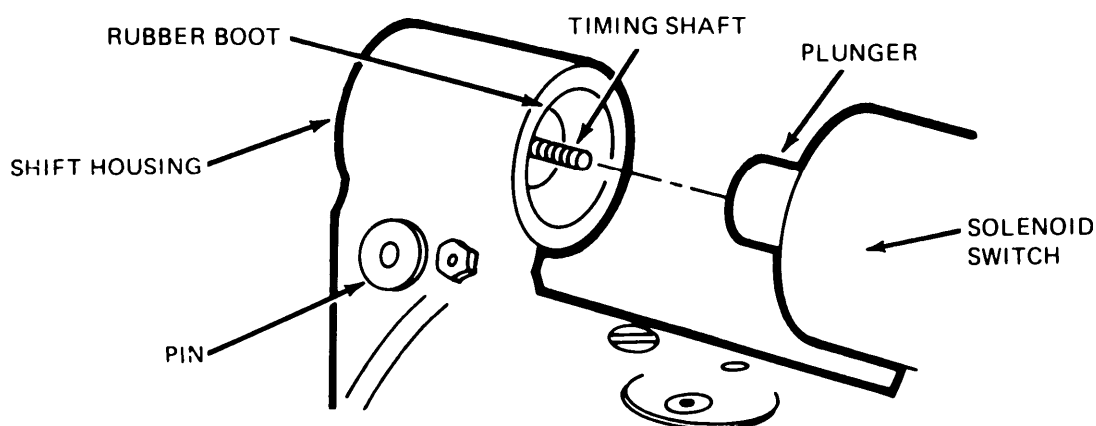
(5) Remove the five screws from the shift housing (fig. 5-46) and slide the complete assembly (arm assembly, shaft assembly, drive assembly, and housing) from the armature shaft.



TA 074041

Figure 5-46. Shift Housing Removal.

(6) Remove the sockethead screw and flatwashers from the shift housing (fig. 5-47); then remove pin. It may be necessary to use a screwdriver to pry pin up.

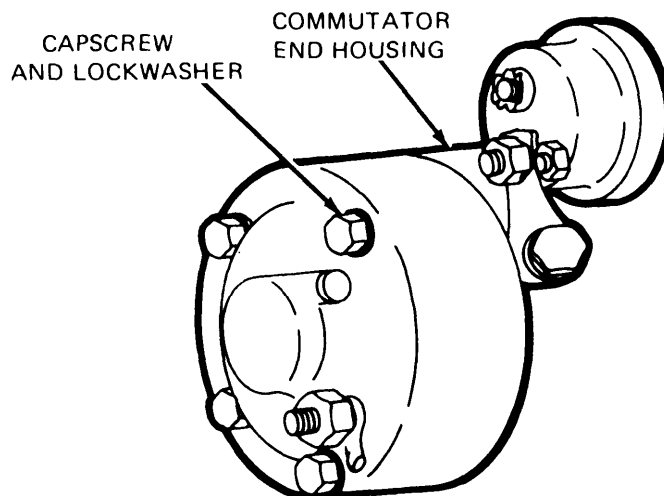


TA 074042

Figure 5-47. Shift Fork Stopscrew Removal.

(7) Remove rubber boot; then remove assembled shift fork and timing shaft from housing.

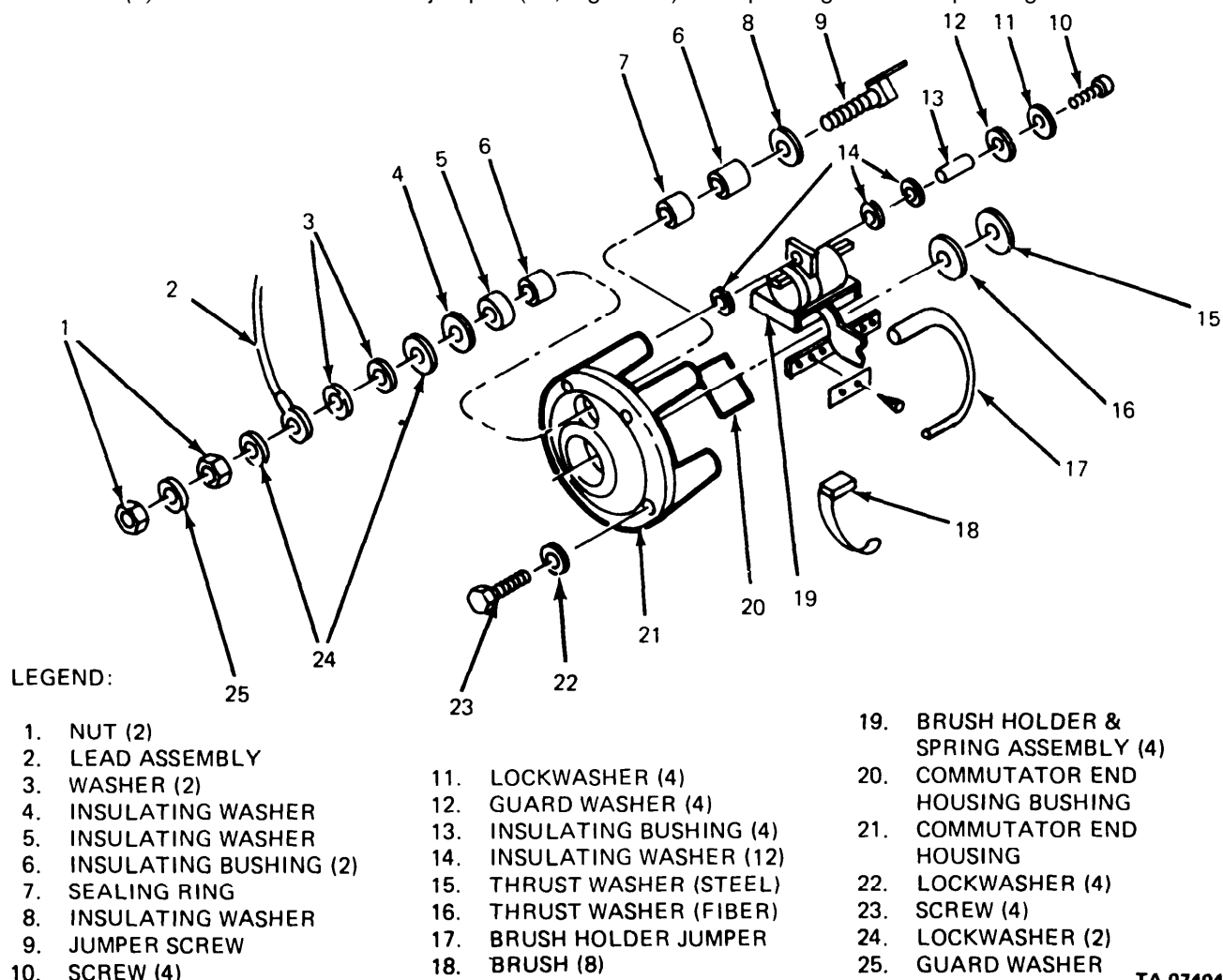
(8) Remove the four hexhead screws (23, fig. 5-49) and lockwashers (22) from the commutator end housing (2) and remove the assembly (end housing and brush rigging assembly) and two thrust washers (15) and (16) from the field ring (fig. 5-48).



TA 074043

Figure 5-48. Remove Commutator End Housing.

(9) Remove brush holder jumper (17, fig. 5-49) and packing. Discard packing.



TA 074044

Figure 5-49. Commutator End Housing Disassembly.

(10) Remove screw (10), lockwasher (11) and guard washer (12), insulating bushing (13), three insulating washers (14). Remove four brush holder and spring assemblies (19).

(11) Remove jumper screw (9), two nuts (1), three insulating washers (4), (5) and (8), guard washer (25), two lockwashers (24), lead assembly (2), two washers (3), two insulating bushings (6) and sealing ring (7) from commutator end housing (21).

NOTE

Do not remove the commutator end housing bushing (20) unless inspection reveals a need for replacement,

(12) Remove the commutator end housing bushing (20) by pulling it out from the inside of the housing (21) with a slide hammer.

5-11. Cleaning.

WARNING

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).

a. Clean the solenoid switch, armature, field coils and drive assembly with SD-2 cleaning solvent (Item 12, App B). Dry the parts using clean, dry, compressed air.

CAUTION

Do not immerse the drive assembly in cleaning solvent. The drive is permanently lubricated and contains a special lubricant.

b. Clean all other metal parts thoroughly with cleaning solvent and a wire brush, if necessary.

c. Clean the six insulating washers (4), (5), (8) and (14), three insulating bushings (6) and (13), and brushes (18) if they are to be reused.

5-12. Inspection and Test.

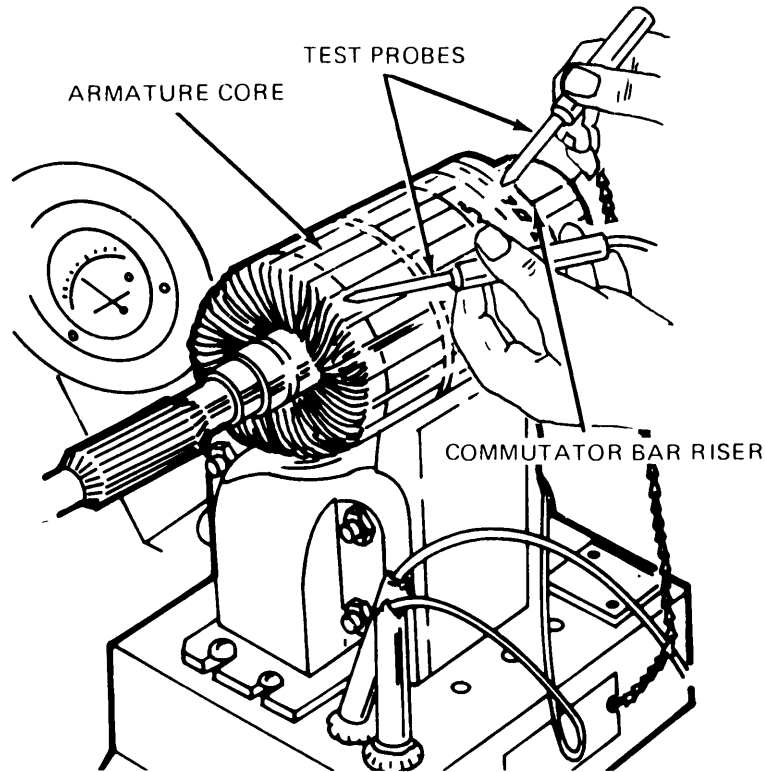
a. *Housings.* Inspect the drive housing, commutator end housing, field ring, and solenoid shell and brackets for cracks, breaks, damaged threads, or other defects.

b. *Armature.*

(1) *On the armature,* inspect the commutator contact surface. A satisfactory condition is indicated by an even, highly burnished dark copper color. If the contact surface is rough, pitted, scored, burned or coated with hard carbon or oil, the commutator must be resurfaced, provided it is determined to be in good mechanical and electrical condition as a result of the following steps.

(2) Set up a dial indicator gage and measure the run-out of the commutator. The total run-out must not exceed 0.003 inch.

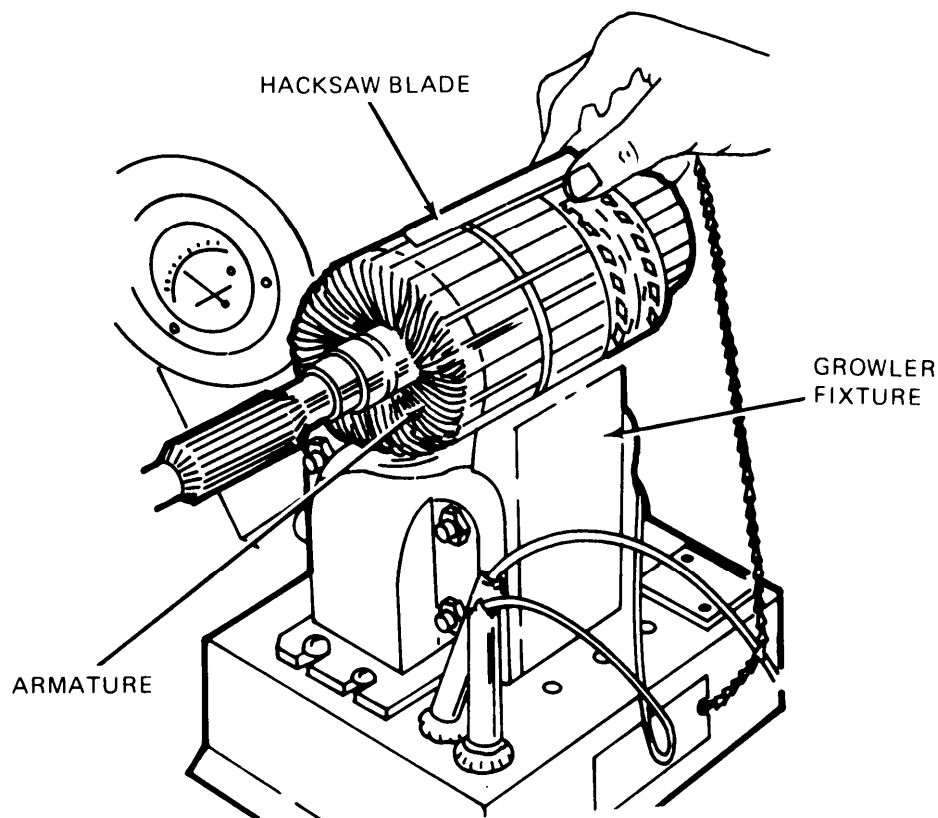
(3) Check the armature for grounds with a 115-volt ac test light by touching one probe to a commutator bar riser and the other to the armature core (fig. 5-50). Test all commutator bars in this manner. If the test light glows, the armature is grounded and must be replaced.



TA 002232

Figure 5-50. Testing Armature for Grounds.

(4) Check the armature for short circuits by turning the armature slowly in a growler while holding a thin steel strip (such as a hacksaw blade) about 1/32-1/16-in. away from the armature core (fig. 551). A short circuit will pull the steel strip against the armature core and cause the strip to vibrate. Replace the armature if a short circuit is found.



TA 002233

Figure 5-51. Testing Armature for Short Circuits.

c. Field Coils.

(1) Check the field coils for ground, using a 115 vac lamp. Make sure the coils are dry if they have been cleaned. Using the growler test lamp, touch one test probe on the field ring and the other on the field terminal. The lamp should not light. If it does, the coils are grounded and require replacement.

d. Shaft and Lever.

(1) Inspect the plunger and shaft assembly for excessive wear or burrs in the seal area. Replace the shaft if defective.

(2) Check the shift lever square cams for damage or excessive wear, Replace if defective.

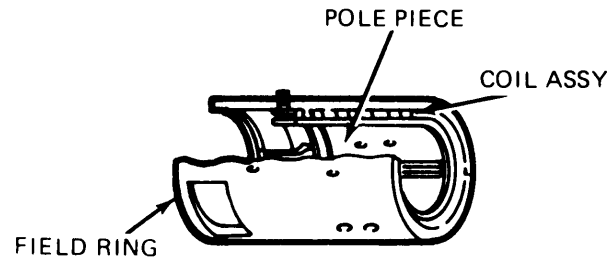
5-13. Assembly.

a. Field Coils Replacement (fig. 5-52).

(1) Heat replacement field coils in an oven to approximately 300°F (149°C).

NOTE

Heating the field coils makes them become pliable and they conform to the field ring more readily.



TA 074045

Figure 5-52. Field Coils Replacement.

(2) Place them in the field ring and install the pole pieces. Draw down the pole piece screws evenly prior to final tightening.

(3) Apply varnish to the coils, being careful not to get any on the inside surface of the pole pieces.

b. Commutator End Housing Bushing Replacement (fig. 5-49).

(1) Press bushing (20) into the end housing from the inside until it is flush with the housing core.

(2) Ream the bushing to a diameter of 0.875 in., ± 0.001 in.

c. Motor Assembly.

(1) Install jumper screw (9), thru insulating washer (8), insulating bushing (6), sealing ring (7), and commutator end housing (21). Then install insulating bushing (6), insulating washers (4) and (5), two lockwashers (24), washers (3), lead wire (2) and nut (1).

(2) Install four brush holder and spring assemblies (19). In each, install three insulating washers (14), insulating bushing (13), lockwasher (11), guard washer (12) and screw (10).

(3) Install brush holder jumper (17) with new packing.

(4) Install armature thru thrust washers (15) and (16) and insert into end housing bushing (20).

(5) Install armature thru field ring and install commutator end housing (21) with new packing ring. Aline index marks and secure with four screws (23) and lockwashers (22).

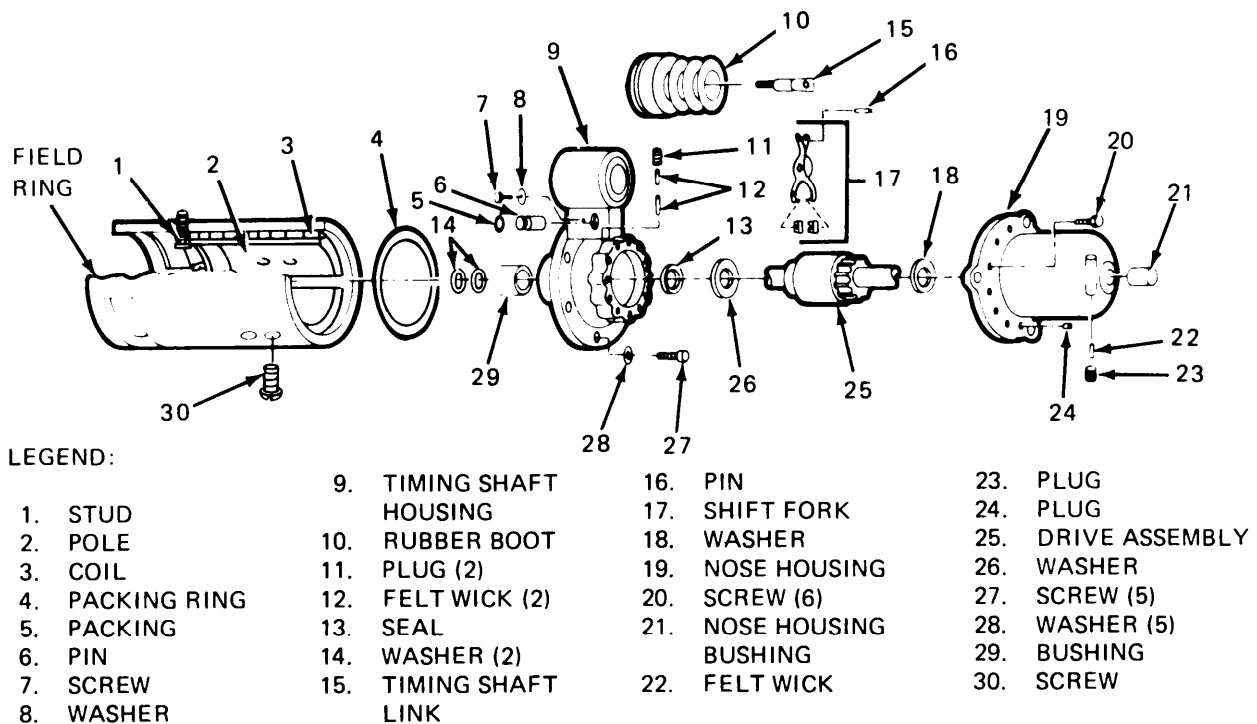
(6) Install eight brushes (18).

(7) Install rubber boot (10, fig. 5-53) into timing shaft housing (9).

(8) Install timing shaft link (15), shift fork (17), and pin (16), into timing shaft housing (9).

(9) Install pin (6) and secure with washer (8), packing (5), and screw (7).

(10) Install two washers (14) on armature shaft and install timing shaft housing (9) with new packing ring (4). Aline index marks and assemble to field ring. Secure with five screws (27) and washers (28).



TA 074042

Figure 5-53. Solenoid Switch Installation.

(11) Install washer (26), drive assembly (25), and washer (18) onto armature shaft.

(12) Inspect nose housing bushing (21) and replace as needed.

(13) Install nose housing (19) and secure with six screws (20).

(14) Install plug (24), felt wick (22) and plug (23).

(15) Install two felt wicks (12) and plugs (11).

(16) Install brush opening cover band (fig. 5-43).

(17) Add 3-5 drops of SAE 30-weight oil to each of the three wicks. (See LO 9-2320-273-12.)

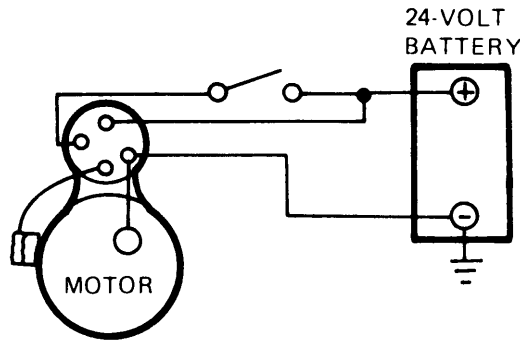
d. Solenoid Switch Installation (fig. 5-53).

(1) Make sure that the shaft is aligned with the threaded hole in the plunger, as shown.

(2) Insert a 1/4-in. deep socket through the access hole in the terminal end of the solenoid switch housing and turn the shaft clockwise 15 complete revolutions while pushing the switch forward into the shift housing.

(3) Aline the mounting holes on the switch bracket with the ones in the field ring and install the two mounting screws.

(4) Connect a 24-volt battery source and switch to switch terminal Nos. 1 and 4 (fig. 5-54).



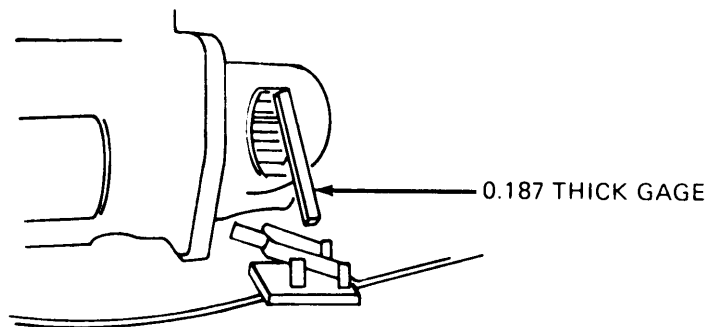
TA 074046

Figure 5-54. Solenoid Switch Test Setup.

NOTE

Do not adjust the switch while it is energized for longer than 30 seconds.

(5) With the switch energized, check the spacing between the face of the pinion and the thrust washer, using a 0.187-in. thick gage (fig. 5-55). The final adjustment is made by turning the socket clockwise or counterclockwise until the 0.187-in. gage just fits between the pinion and the thrust washer.



TA 074047

Figure 5-55. Switch Adjustment Check.

5-14. Switch Timing Test.

- a. Use the same battery and switch setup as in fig. 5-54.
- b. Connect an ohmmeter, as a light in series with a battery, across switch terminal Nos. 2 and 3 (large studs).
- c. Insert a 0.812-in. gage between the pinion face and the thrust washer.
- d. Energize the switch and check for continuity. If continuity is present when the gage is inserted, replace the switch plunger and shaft assembly or the entire solenoid switch.
- e. Replace the rubber plug in the end of the switch terminal housing.

CHAPTER 6

REPAIR OF ENGINE COMPONENTS

Section 1. INTRODUCTION

6-1. Scope. This chapter describes on-vehicle engine maintenance at direct support/general support levels. The following engine maintenance procedures are provided.

- a. Turbocharger replacement.
- b. Accessory drive pulley replacement.
- c. Vibration damper and pulley replacement.
- d. Engine retarder throttle switch linkage adjustment.

Section II. MAINTENANCE PROCEDURES

6-2. Turbocharger

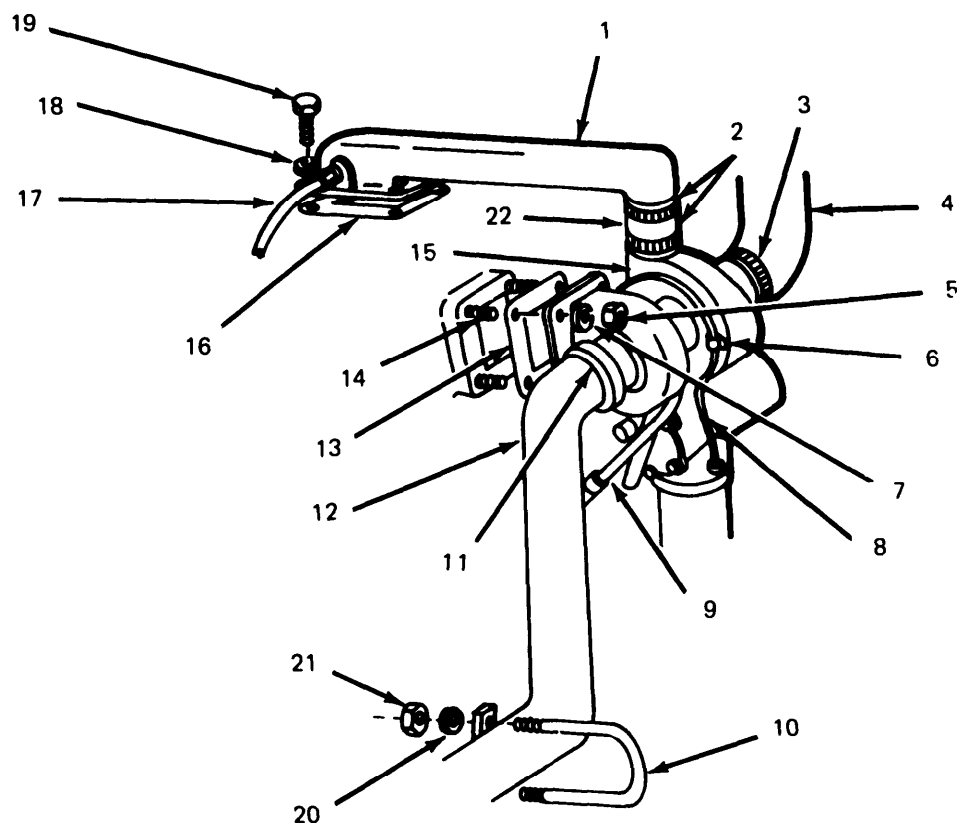


Dirt in the air passages can severely damage the turbocharger and engine. Be sure your work area is clean. Clean parts before installation. Cover openings to keep out dust while you are working.

a. *Removal.*

- (1) Loosen clamps (2, 3, and 11, fig. 6-1). Remove and discard clamp (11).
- (2) Disconnect ether atomizer line (17) from crossover tube (1).
- (3) Remove crossover tube (1) and boot (22) by removing four capscrews (19) and washers (18).
- (4) Remove and discard gasket (16).
- (5) Disconnect air inlet line (4) and outlet tube (12) from turbocharger (15).

Remove two clips (6) that secure oil supply line (9) to turbocharger by removing attaching capscrews.



LEGEND:

- | | | |
|-------------------|--------------------|-------------------------|
| 1. CROSSOVER TUBE | 8. DRAIN LINE | 16. GASKET |
| 2. CLAMP (2) | 9. OIL SUPPLY LINE | 17. ETHER ATOMIZER LINE |
| 3. CLAMP | 10. CLAMP | 18. WASHER (4) |
| 4. AIR INLET LINE | 11. CLAMP | 19. CAPSCREW (4) |
| 5. NUTS (4) | 12. OUTLET TUBE | 20. WASHER (2) |
| 6. CLIP (2) | 13. GASKET | 21. NUT (2) |
| 7. WASHERS (4) | 14. STUDS (4) | 22. BOOT |
| | 15. TURBOCHARGER | |

TA 074048

Figure 6-1. Remove/Install Turbocharger.

(7) Place a rag under turbocharger fittings for lines (8) and (9) to catch oil leakage.

CAUTION

In step (8), put a plug in the end of each oil line as soon as you disconnect it. This keeps oil from spilling out and keeps dirt out of oil system.

(8) Disconnect lines (8) and (9) from turbocharger (15); then plug both lines.

(9) Loosen, but do not remove, two nuts (21) to loosen clamp (10).

(10) Support turbocharger (15) and remove four nuts (5) and washers (7). Remove the turbocharger from four studs (14).

(11) Remove and discard gasket (13).

b. Installation.

(1) Install new gasket (13).

(2) Mount turbocharger (15) on studs (14) and secure with four washers (7) and nuts (5). Tighten nuts to 57 lb-ft (7-9 N-m) torque.

(3) Tighten two nuts (21) to secure clamp (10).

(4) Remove plug from line (8); then connect line to turbocharger. Tighten to 50 lb-ft (68 N-m) torque.

(5) Remove plug from line (9); then connect line to turbocharger. Tighten to 20 lb-ft (27 N-m) torque.

(6) Attach two clips (6) that secure oil supply line (9) to turbocharger. Fasten each clip with a capscrew. Tighten to 5-7 lb-ft (7-9 N-m) torque.

(7) Connect air inlet line (4) and outlet tube (12) to turbocharger. Tighten clamps (3) and (11) to 30-35 lb-in (3-4 N-m) torque.

(8) Install new gasket (16).

(9) Mount crossover tube (1) with attached boot (22) on turbocharger and gasket (16). Secure with four washers (18) and capscrews (19).

(10) Tighten clamps (2) to 30-35 lb-in (3-4 N-m).

(11) Connect ether atomizer line (17) to turbocharger.

c. Leak Check.

(1) Start up engine. (Refer to TM 9-2320-273-10.)

WARNING

During normal operation, the turbocharger and outlet pipe can become very hot. Be careful not to touch these components with your bare hands. These components may be hot enough to cause severe burns.

(2) Check for oil and air leaks.

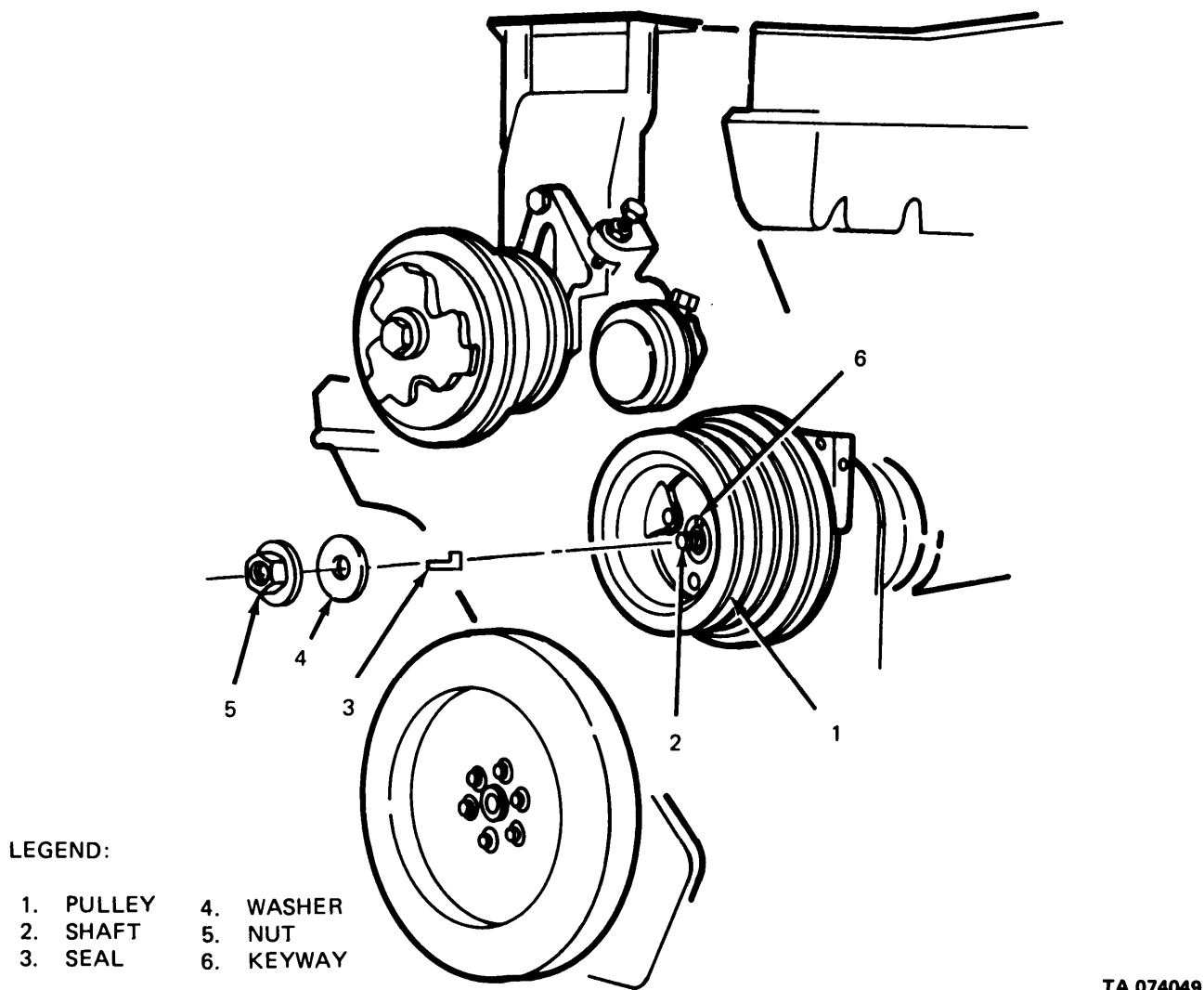
6-3. Accessory Drive Pulley.

a. Removal.

(1) Remove fan. (Refer to TM 9-2320-273-20.)

(2) Remove idler belt. (Refer to TM 9-2320-273-20.)

(3) Remove nut (5, fig. 6-2) and washer (4).



TA 074049

Figure 6-2. Remove /install Accessory Drive Pulley.

(4) Using a suitable puller remove pulley (1) and seal (3) from shaft (2). Discard seal (3).

b. Installation.

(1) Mount pulley (1) and seal (3) on shaft (2) with flat side of seal facing you and inner side pushed into keyway (6).

(2) Place short 2X4 board, or other suitable device, across pulley and tap with a mallet until the pulley is fully seated.

(3) Install washer (4) and nut (5). Tighten to 95 lb-ft (129 N-m) torque. Seal (3) will crush against shaft.

(4) Install idler belt. (Refer to TM 9-2320-273-20.)

- (5) Install fan. (Refer to TM 9-2320-273-20.)

6-4. Vibration Damper and Pulley Maintenance

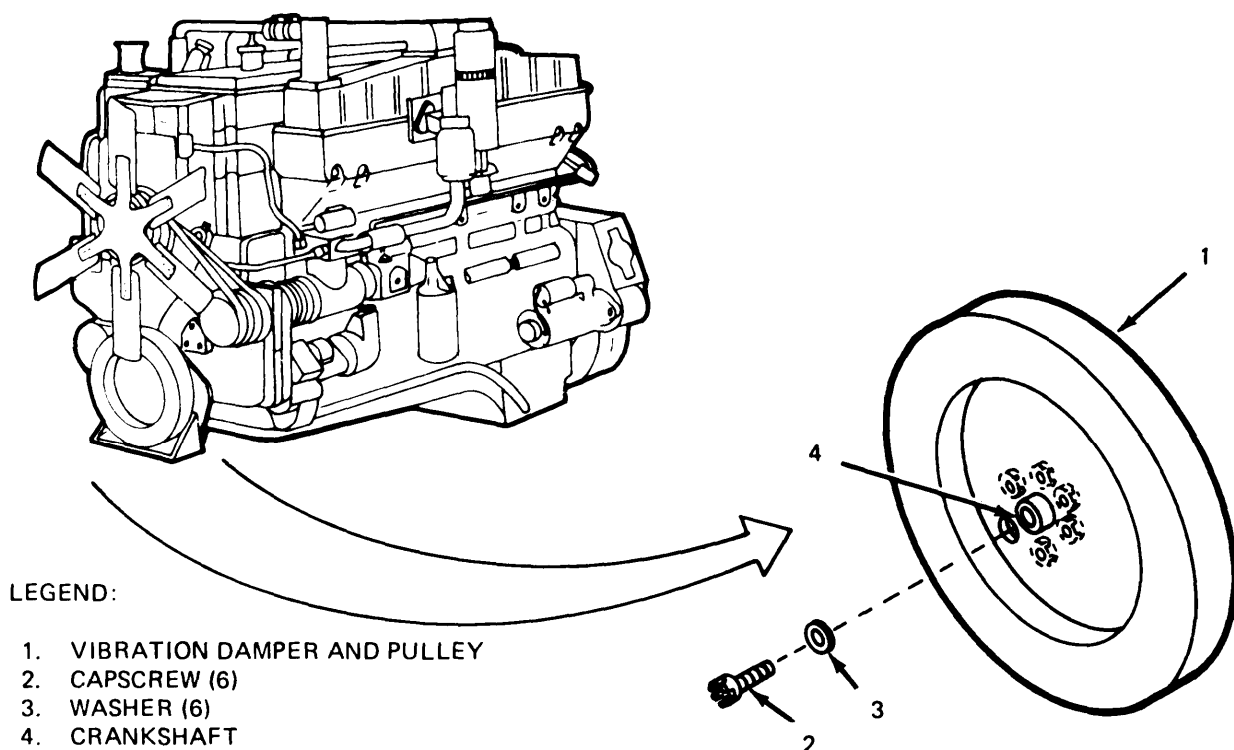
a. Removal.

- (1) Remove fan. (Refer to TM 9-2320-273-20.)
- (2) Remove alternator belts. (Refer to TM 9-2320-273-20.)

CAUTION

Do not resort to prying or pounding when removing the damper. Denting the outer shell may render the damper ineffective and may also result in damage to the crankshaft or other engine components.

- (3) Support vibration damper and pulley (1, fig. 6-3) and remove six capscrews (2) and washers (3). Remove vibration damper and pulley.



TA 074050

Figure 6-3. Remove/Install Vibration Damper and Pulley.

CAUTION

Do not use any lubricant on pulley or crankshaft mating surfaces. Wipe with clean, dry cloth.

b. Installation.

(1) Mount vibration damper and pulley (1) on crankshaft (4) and align holes for capscrews (2). Tap pulley with a rawhide mallet until it is fully seated.

(2) Coat shanks of capscrews (2) with clean lubricating oil; then install six washers (3) and capscrews (2). Tighten to 85 lb-ft (115 N.m) torque.

(3) Install fan. (Refer to TM 9-2320-273-20.)

(4) Install alternator belts. (Refer to TM 9-2320-273-20.)

6-5. Engine Retarder Throttle Switch Adjustment. Repair of the engine retarder, including adjustment of the slave piston is provided in TM 9-2815-222-34&P. Checkout (inspection) of the system is covered in TM 9-2320-273-20. This paragraph describes adjustment of the circuit throttle switch linkage. The adjustment is necessary if it is possible to activate the engine retarder when either the hand throttle or the accelerator pedal are engaged.

a. Adjustment.

(1) Make sure that hand throttle and the accelerator pedal are not engaged.

(2) Loosen locknut (1, fig. 6-4) and turn out adjustment screw (2) until it closes switch (3). An audible click can be heard when the switch closes.

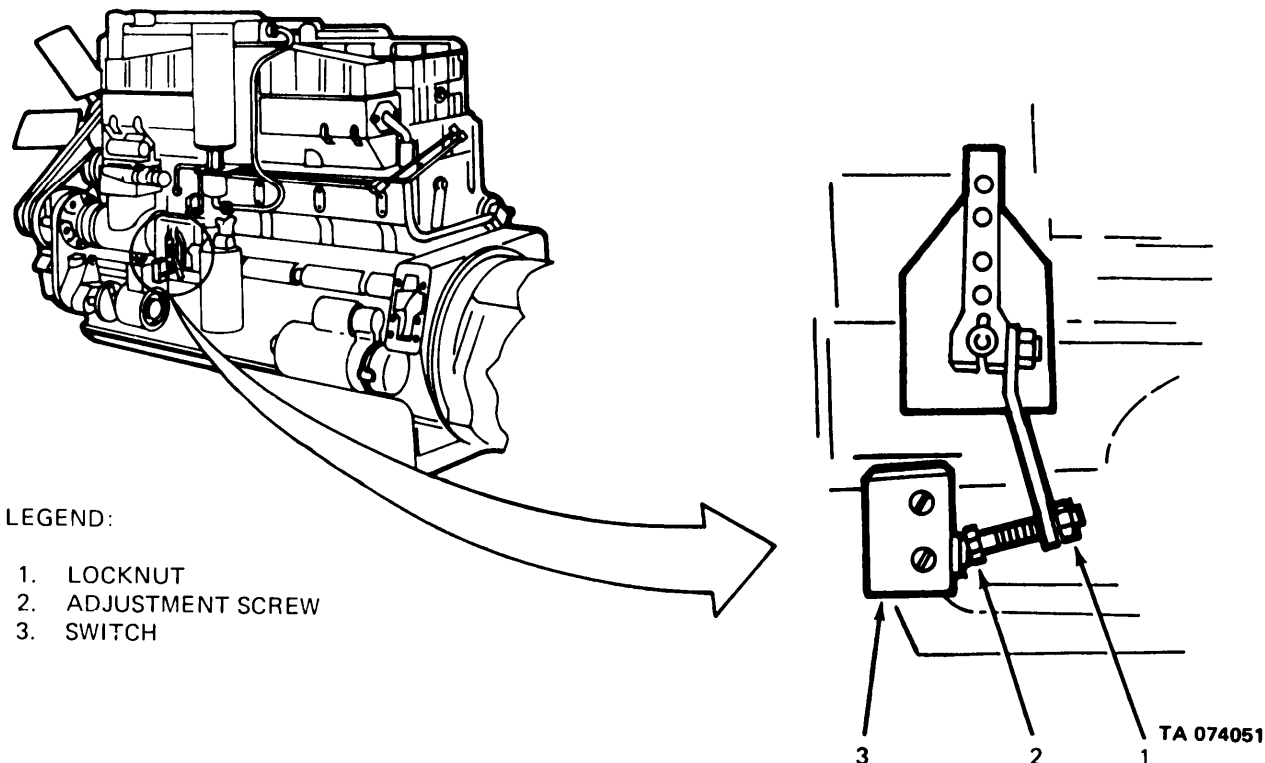


Figure 6-4. Adjust Engine Retarder Throttle Switch Linkage.

(3) Tighten locknut (1).

b. Checkout.

(1) Start and operate engine. (Refer to TM 9-2320-273-10.)

(2) Operate engine retarder to determine that it functions when neither the hand throttle or the accelerator pedal are depressed.

(3) With either the accelerator pedal or the hand throttle engaged, try to place engine retarder in operation. System must not be operable.

CHAPTER 7

REPAIR OF TRANSMISSION

Section 1. INTRODUCTION

7-1. Description and Subassemblies.

a. General. The transmission is a 16-speed forward mechanical drive transmission with two reverse speeds. When starting the vehicle from a stop, the transmission input clutch automatically engages as the engine rpm increases. The operator initiates the gear ratio selection by moving the lever of the ratio selector in the cab. The shift in the transmission is controlled by air pressure acting on air cylinders in the transmission control unit and thereby shifting forks that move the appropriate gear couplings. (Details of the air control system for the transmission and ratio selector are provided in TM 9-2320-273-20.) The shift is made by the following method:

- (1) The gear section of the transmission is temporarily disconnected from the engine and the rear wheels of the truck.
- (2) The rotation of the gear section is stopped.
- (3) The gear couplings are moved for a new gear ratio.
- (4) The gear section is given rotation again.
- (5) The gear section of the transmission is connected to the engine and the rear wheels of the truck again. The shift is now complete,

b. Subassemblies. The major functional components of the transmission are shown in figure 7-1.

(1) *Input Clutch Group.* The input clutch group connects the engine flywheel to the transmission input shaft. The clutch group has several plates and disks that are cooled by oil. The input clutch is engaged by oil pressure. This oil pressure is made by centrifugal force (the force of rotation) on the oil in the clutch. The force of engagement increases as the engine rpm increases up to approximately 1000 rpm. The input clutch is released by air pressure during a ratio change. When the clutch is engaged, power is sent from the engine to the input shaft of the transmission.

(2) *Input Brake Group.* The input brake group is connected to the input shaft of the transmission. The input brake works in combination with the output brake to stop the rotation of the gear group. The input brake has a plate and two disks that are cooled by oil. Air pressure is used to engage the brake. Spring force is used to release the brake. When the brake is engaged, the rotation of the gear group is stopped.

(3) *Gear Group.* The gear group is made up of two sections, with three countershafts in each section. A center gear set is engaged with the three countershafts. The torque is divided and sent through the three countershafts. Reverse idlers are on the front of the rear countershafts. All gears are constantly engaged. Shift collars, moved by forks, cause the connection between the center shaft (with splines on the outside) and the center gears (with splines on the inside). The result is the selection of the desired gear ratio or transmission speed.

(4) *Output Brake Group.* The output brake group is connected to the output shaft of the transmission. The output brake works in combination with the input brake and stops the rotation of the

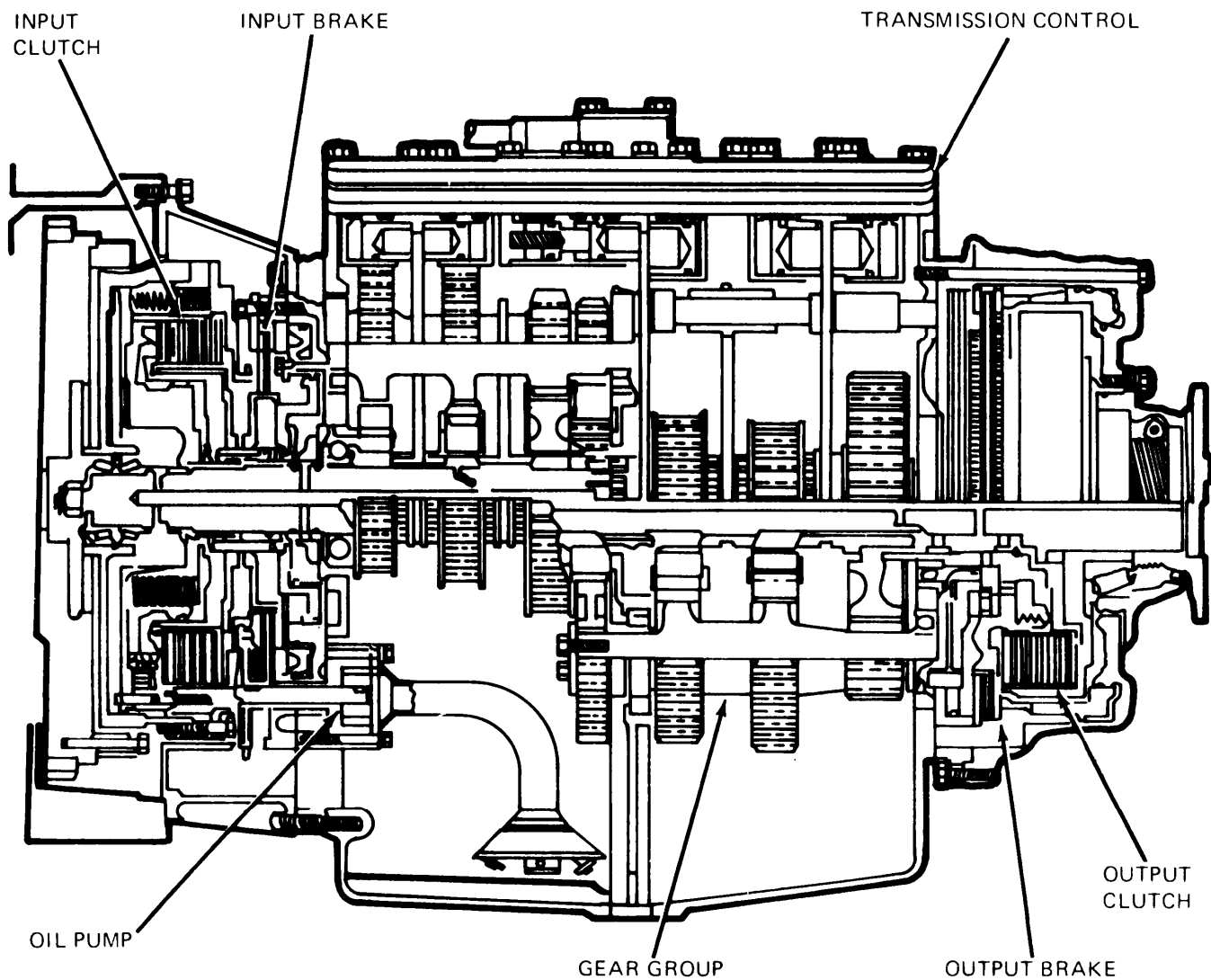


Figure 7-1. Transmission Components.

TA 074052

rear gear group, The output brake has a plate and two disks that are cooled by oil. Air pressure is used to engage the brake. Spring force is used to release the brake. When the brake is engaged, the rotation of the rear gear group is stopped.

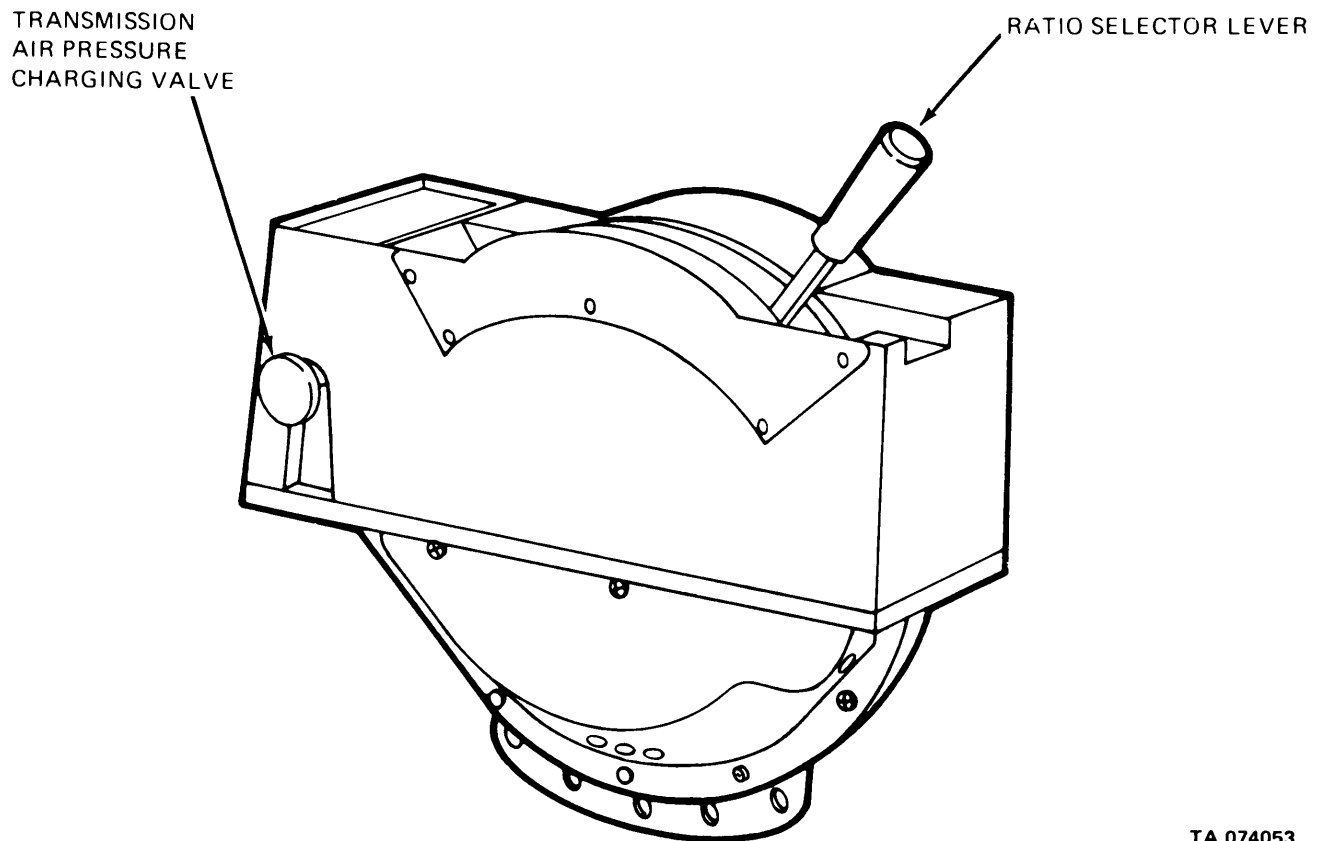
(5) *Output Clutch Group.* The output clutch group connects the gear group to the output shaft of the transmission. The clutch group has several plates and disks that are cooled by oil. The output clutch is engaged by air pressure. Spring force is used to release the clutch. When the clutch is engaged, power is sent from the gear group to the output shaft and to the drive line of the truck,

(6) *Transmission Control Group.* The transmission control group has air cylinders that move the shift forks. These air cylinders are activated in the correct sequence for the desired transmission ratio by air pressure signals sent from the ratio selector.

(7) *Oil Pump.* The oil pump is driven through a connection to the flywheel of the engine. The oil pump:

- (a) Provides oil to fill the input clutch (centrifugal force works on this oil to engage the clutch).
- (b) Provides oil for the lubrication of the clutches and brakes and to keep them cool.
- (c) Provides oil for the lubrication of the gear group and to keep it cool.

(8) *Ratio Selector.* The ratio selector (fig. 7-2) is in the truck cab and is connected to the transmission with an umbilical cord containing 13 air lines. The operator moves the lever of the ratio selector to make the selection of the desired gear ratio or transmission speed. The ratio selector then sends air pressure signals through the correct air line to the transmission control. The ratio selector contains the transmission air pressure charging valve.



TA 074053

Figure 7-2. Ratio Selector.

Section II. RATIO SELECTOR

7-2. Removal.

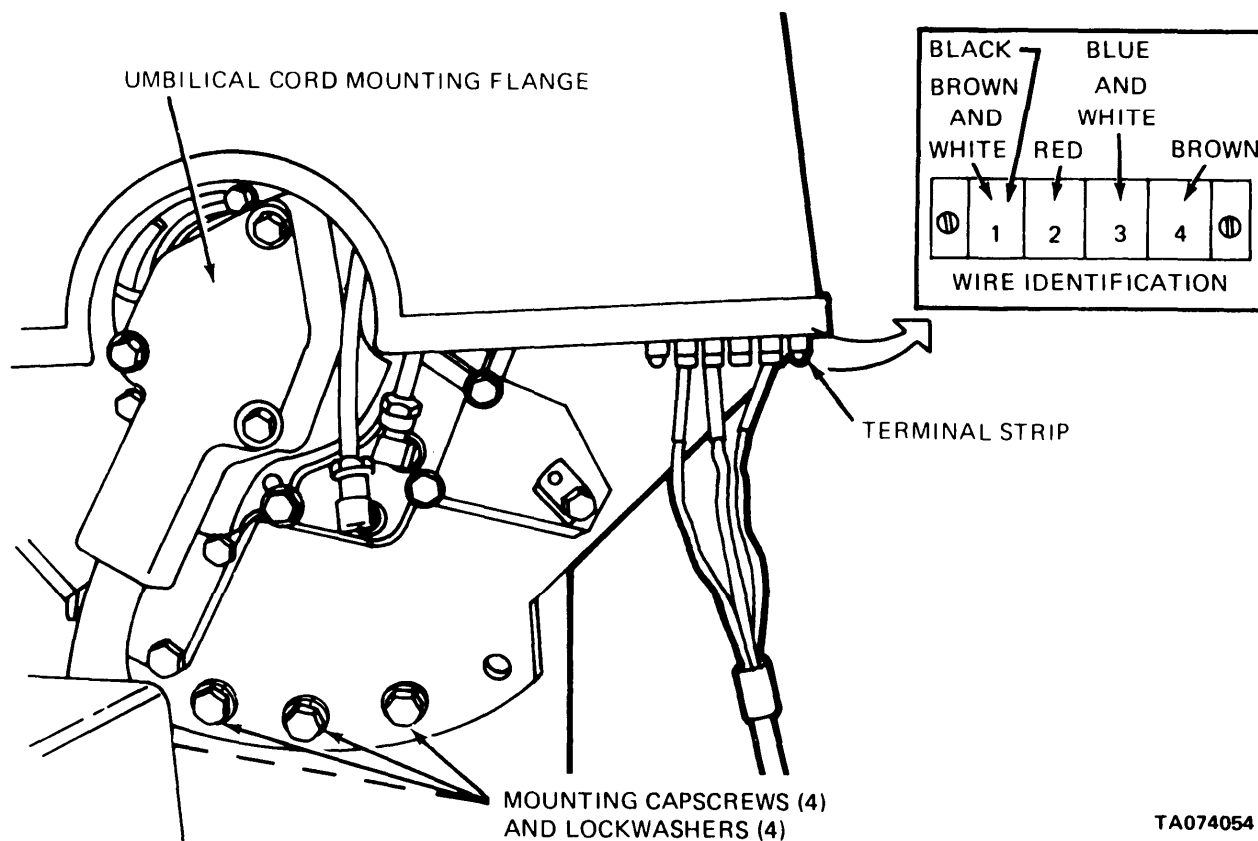
a. Remove four capscrews and washers that fasten ratio selector to mounting bracket and shift tower brace. Lift off the ratio selector. The mounting bracket can be replaced by removing four capscrews and lockwashers.



After completing step *b*, tape flange opening in ratio selector to protect it from foreign matter. In addition, wrap mounting flange in a plastic bag to keep it clean.

b. Turn ratio selector on its side and remove three capscrews that fasten umbilical cord mounting flange. Disconnect the mounting flange and remove gasket.

c. Tag and disconnect wires from terminal strip (fig. 7-3).

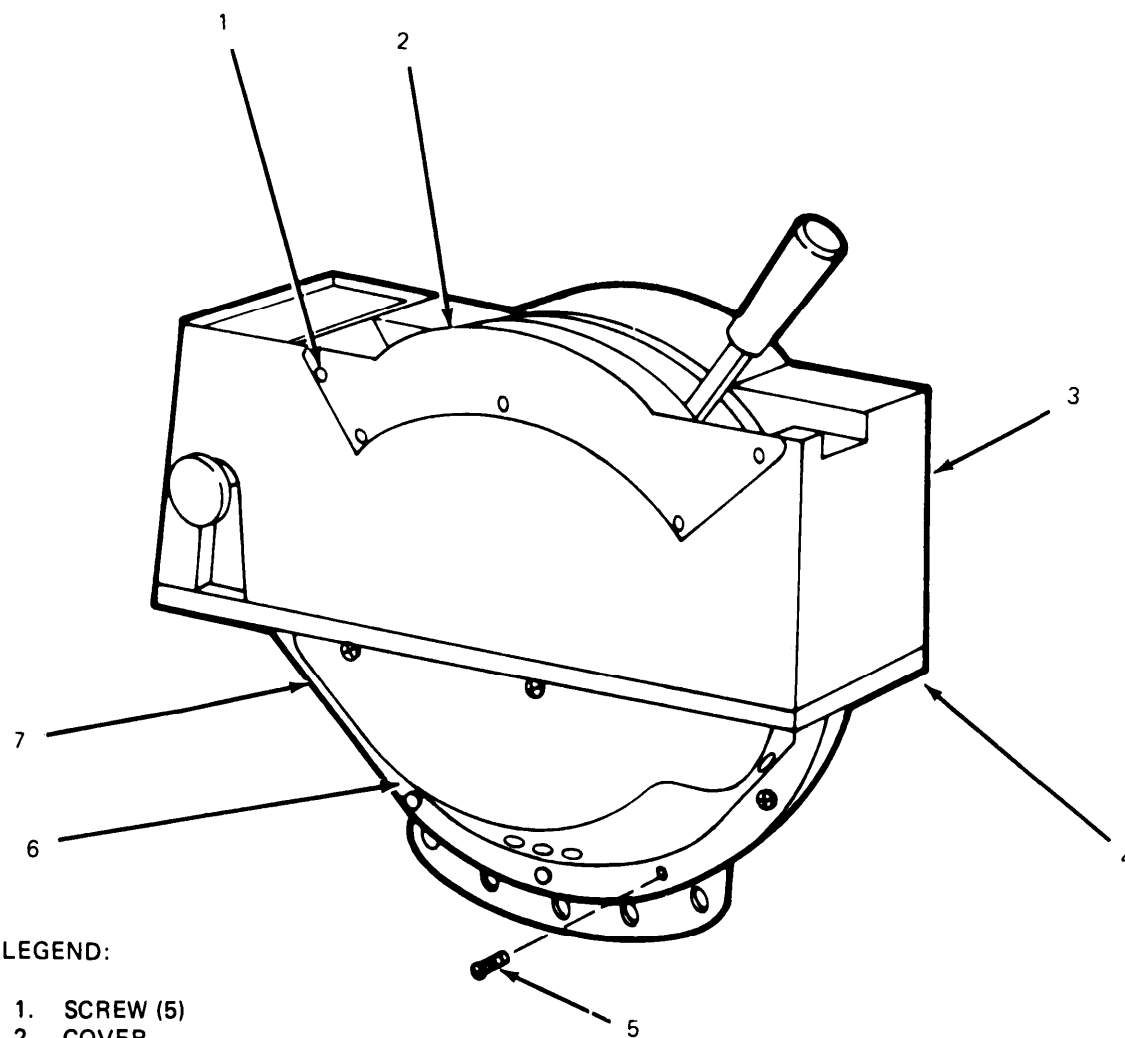


TA074054

Figure 7-3. Remove/Install Ratio Selector.

7-3. Disassembly.

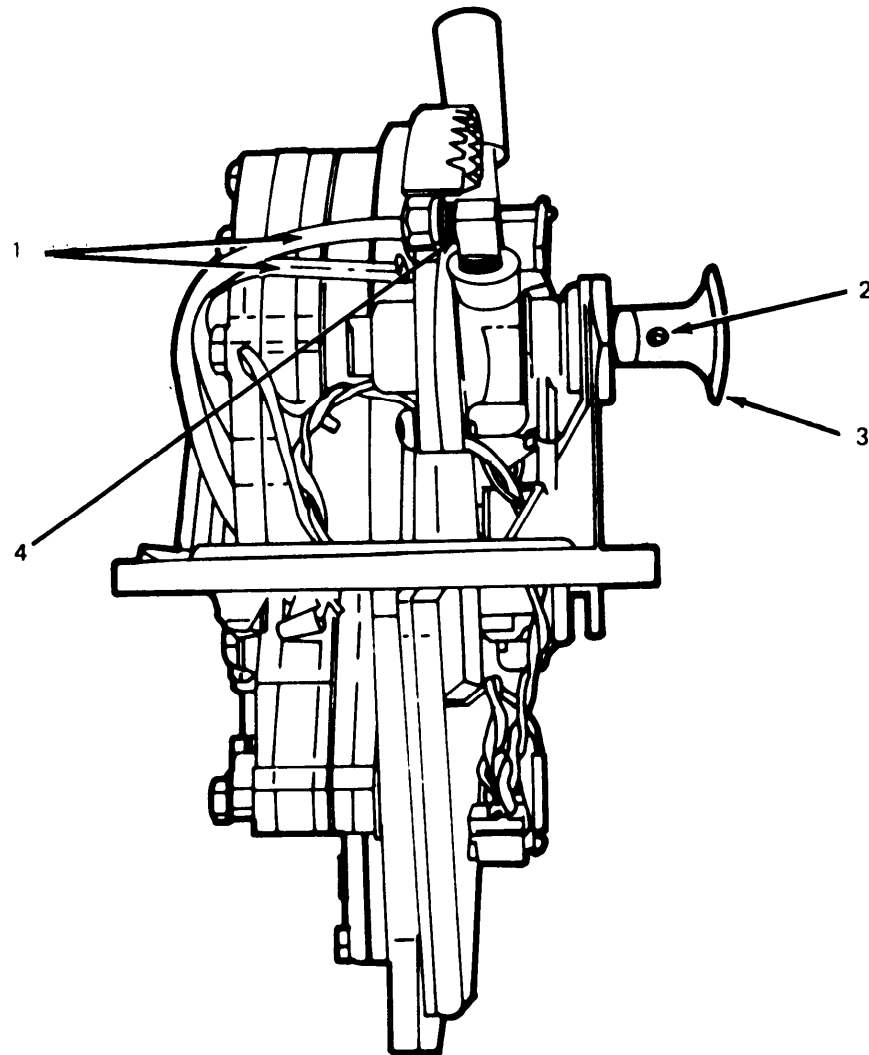
- a. If lamps are to be replaced, remove five screws (1, fig. 7-4) from the cover (2) and remove the cover and dial.
- b. Disconnect the white wire from the terminal strip (located on the bottom right front),
- c. Remove four screws (4) that mount housing (3) to the bracket. Remove the housing.
- d. Remove nine screws (5) that hold shield (6) to the cover (7). Remove the shield. Remove two screws from terminal strip and remove terminal strip, designation plate and grommet.



TA 074055

Figure 7-4. Remove Housing and Cover.

- e. Disconnect, tag, and remove two air lines (1, fig. 7-5) and tube elbows (4) from the valve and plate.
- f. Remove pin (2) that holds knob (3) to the valve, using a hammer and a punch. Remove the knob.



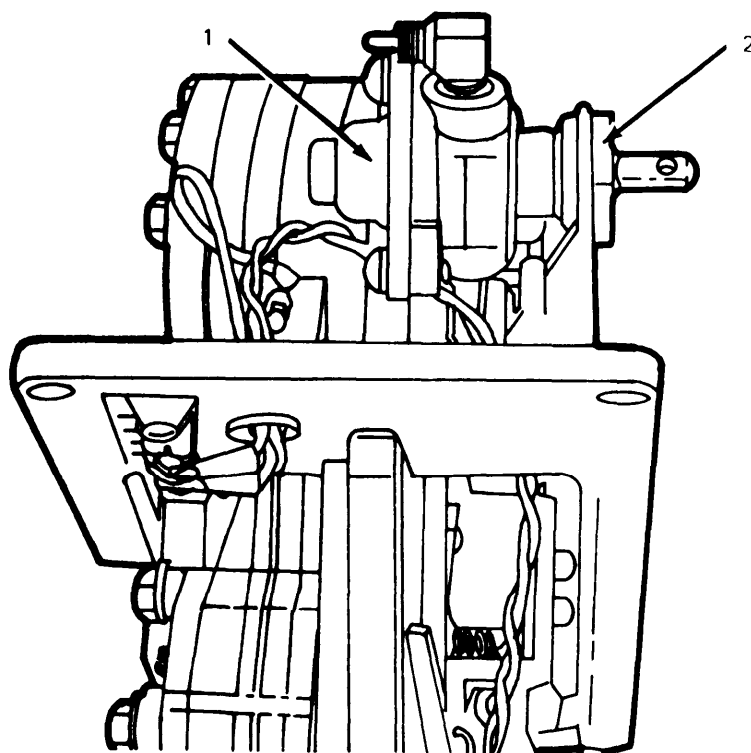
LEGEND:

- 1. AIR LINE (2)
- 2. PIN
- 3. KNOB
- 4. TUBE ELBOW (2)

TA 074056

Figure 7-5. Remove Air Valve Knob.

g. Remove nut (2, fig. 7-6) and valve (1).



LEGEND:

- 1. VALVE
- 2. NUT

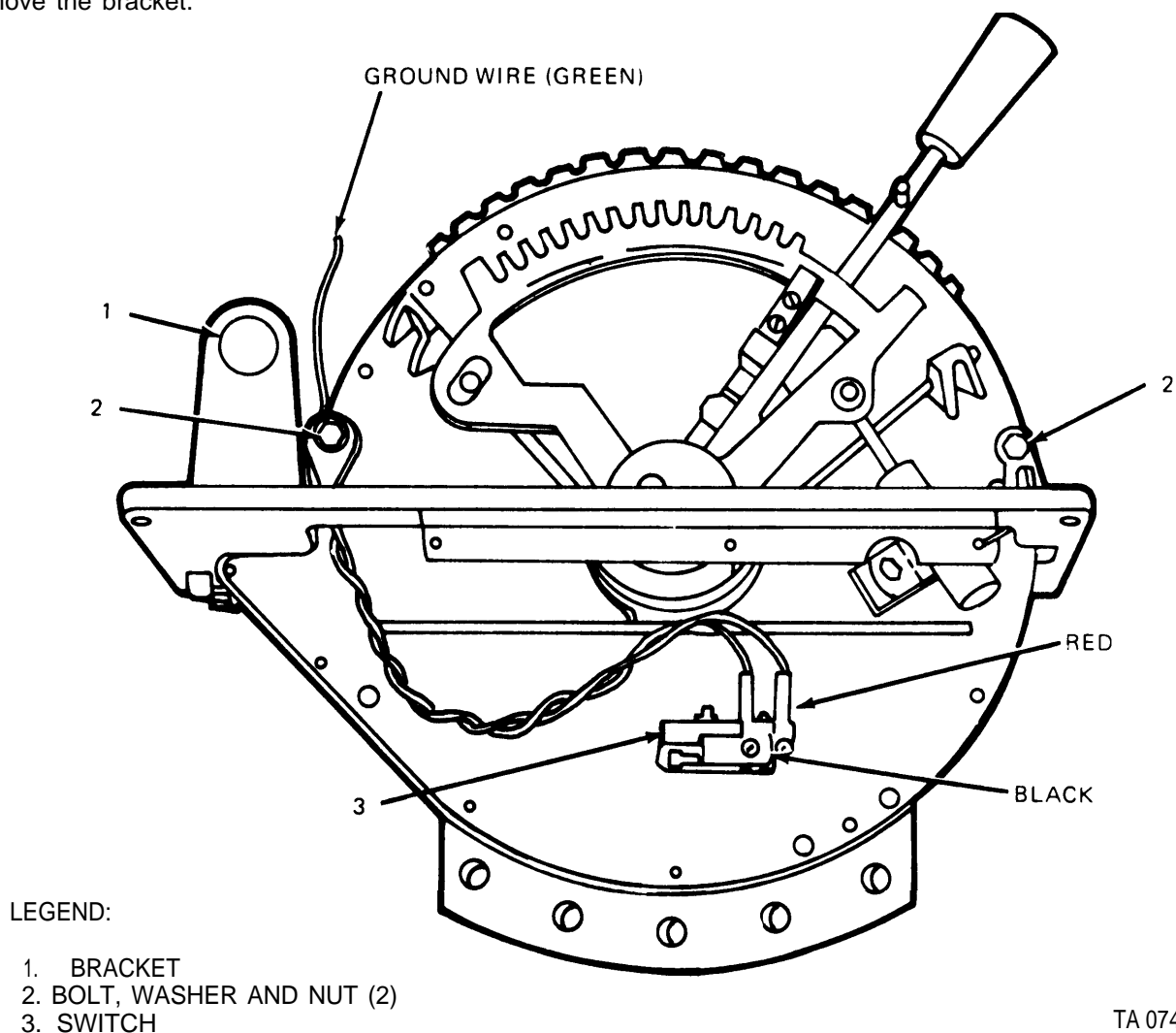
TA 074057

Figure 7-6. Remove Air Charging Valve.

h. Tag the electrical wires to aid in reassembly; then disconnect wires from the switch (3, fig. 7-7).

i. Remove two bolts, washers and nuts (2) that hold the bracket (1) to the selector.

Remove the bracket.



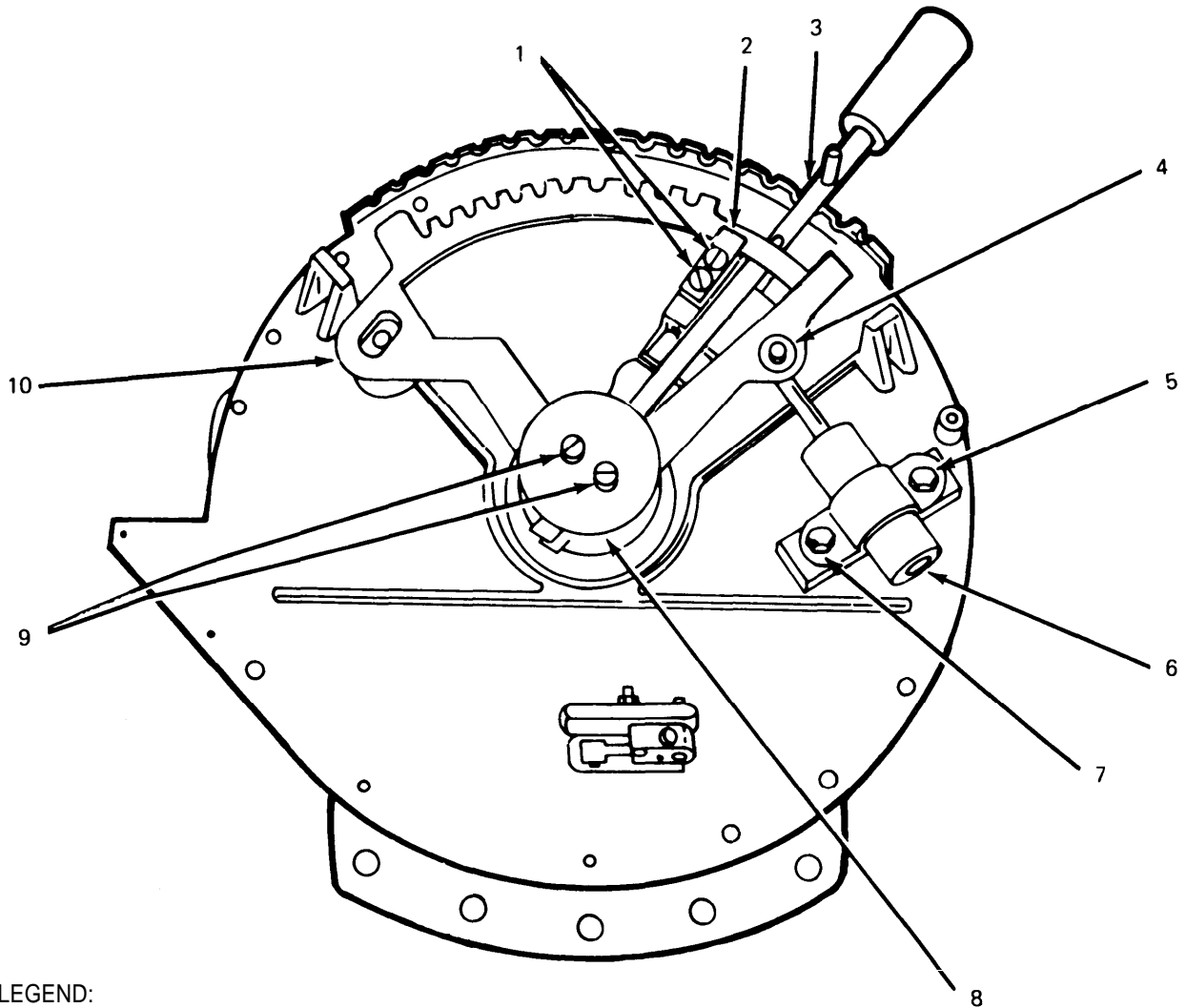
TA 074068

Figure 7-7. Disconnect Wires and Remove Bracket.

j. Remove snapping (4, fig. 7-8). Remove clamp (7) by removing two screws (5); then remove spring housing assembly (6).

k. Remove two screws (1) and guide (2) from the base.

l. Remove two screws and starwashers (9), retainer (8) and lift off plate (10). Remove the shims located under the retainer (8).



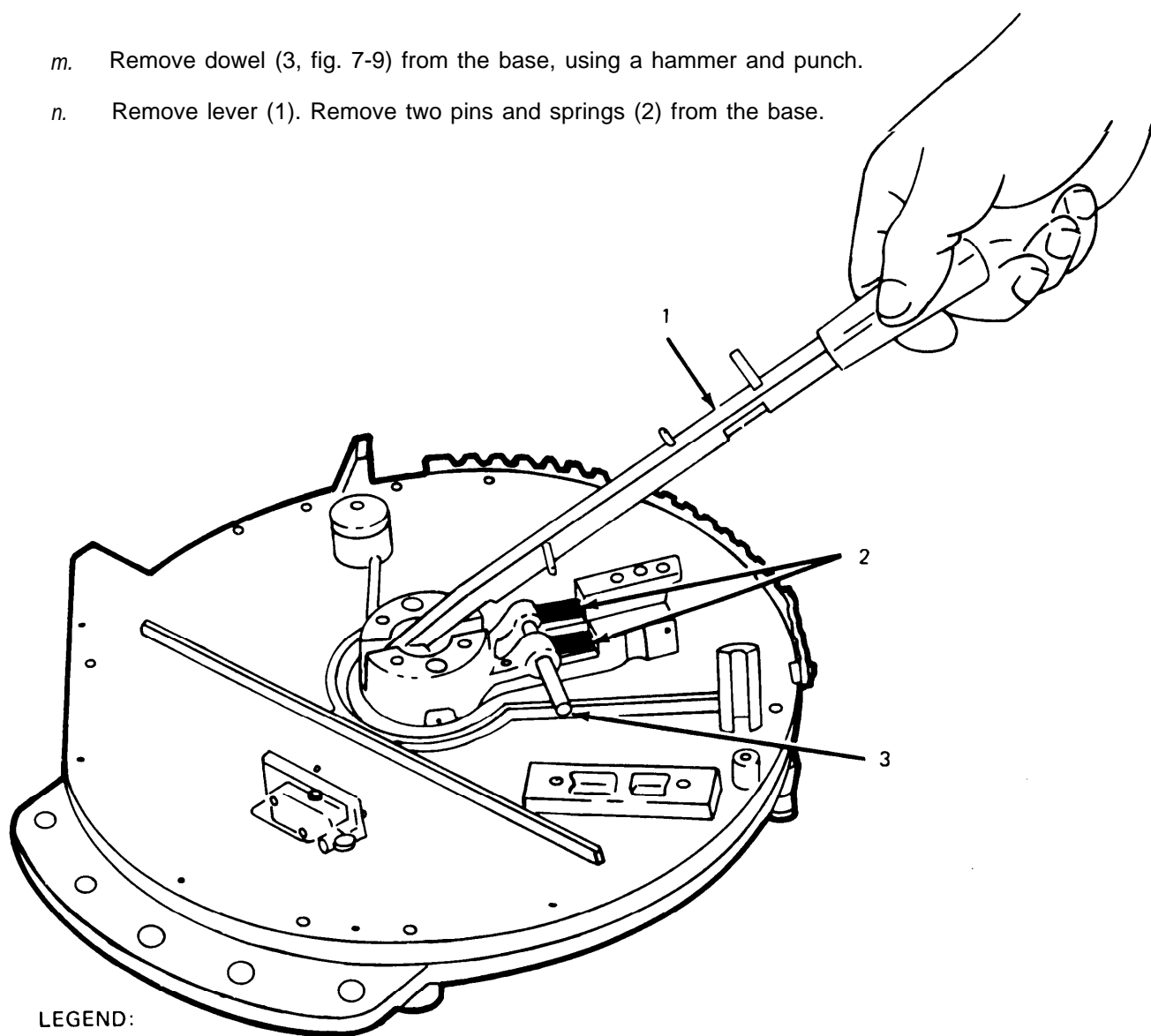
LEGEND:

- | | |
|--------------|-----------------------------|
| 1. SCREW (2) | 6. SPRING HOUSING ASSEMBLY |
| 2. GUIDE | 7. CLAMP |
| 3. LEVER | 8. RETAINER |
| 4. SNAP RING | 9. SCREW AND STARWASHER (2) |
| 5. SCREW (2) | 10. PLATE |

TA 074059

Figure 7-8. Remove Spring Housing, Guide, and Retainer.

- m. Remove dowel (3, fig. 7-9) from the base, using a hammer and punch.
- n. Remove lever (1). Remove two pins and springs (2) from the base.



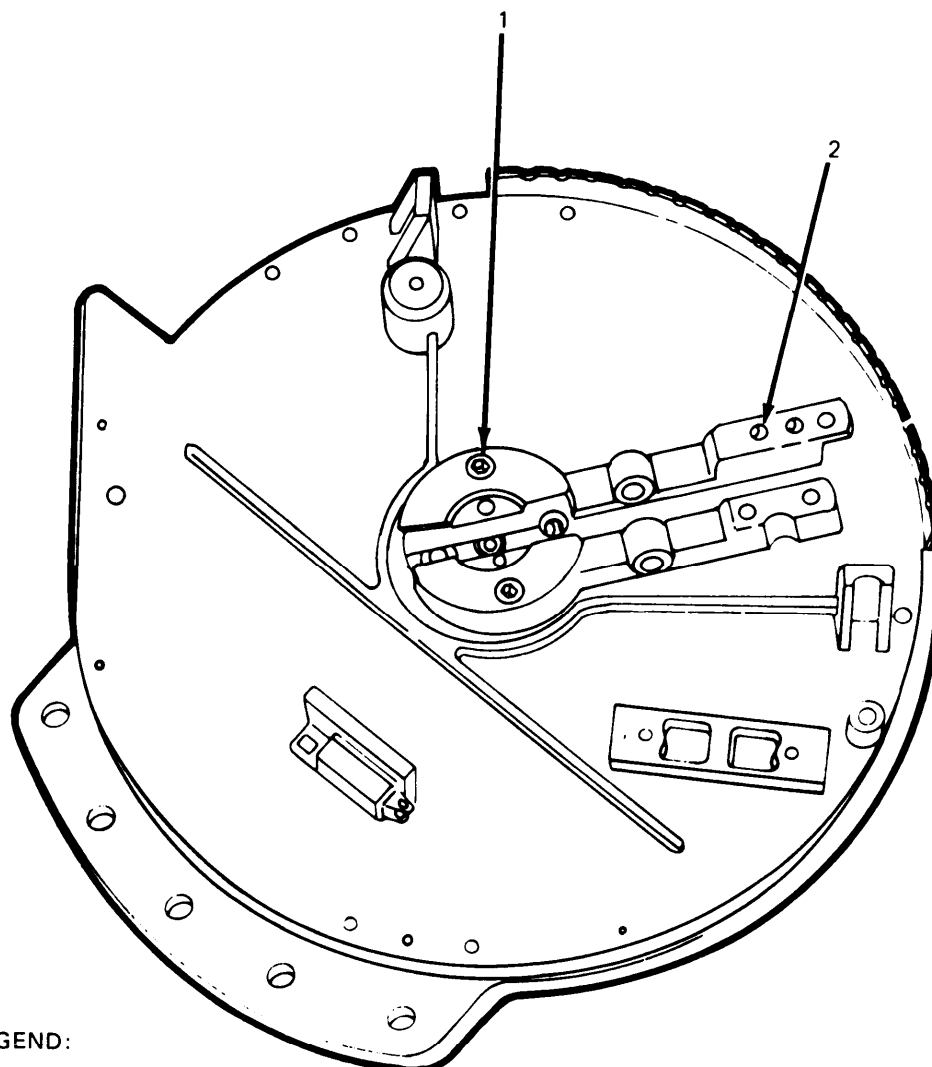
LEGEND:

- 1. LEVER
- 2. PIN AND SPRING (2)
- 3. DOWEL

TA 074060

Figure 7-9. Remove the Lever and Springs.

- o. Remove two allen screws (1, fig. 7-10) and base (2).

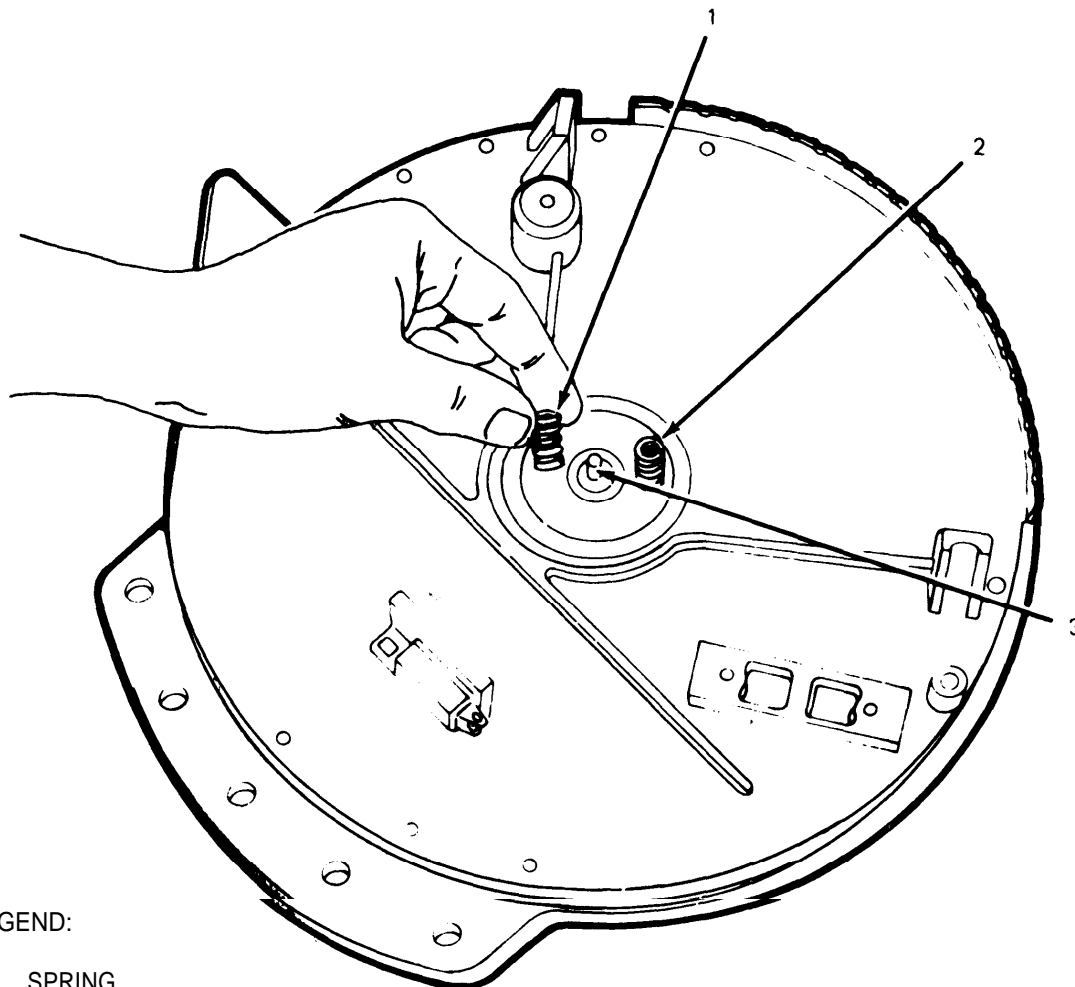


LEGEND:

1. ALLEN SCREW (2)
2. BASE

Figure 7-10. Remove the Base.

- p. Remove springs (1 and 2, fig. 7-11) and plunger, stem and spring (3).



LEGEND:

- 1. SPRING
- 2. SPRING
- 3. PLUNGER, STEM, AND SPRING

TA 074062

Figure 7-11. Remove the Plunger, Stem and Springs.

- q. Remove seven bolts (1, fig. 7-12) and spacers (3) around the outside of plate (4).
- r. Separate plate (4) from cover (2).

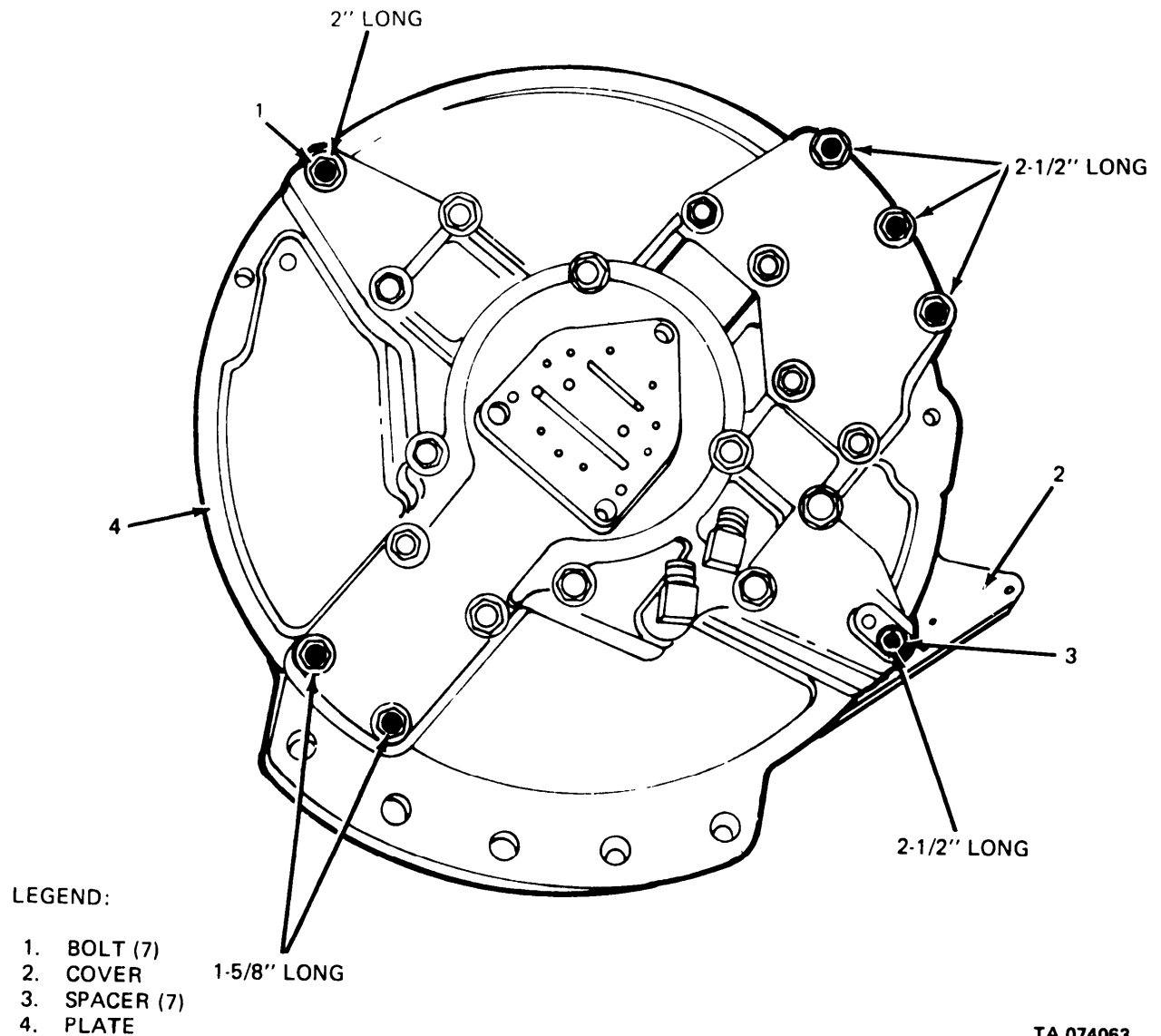
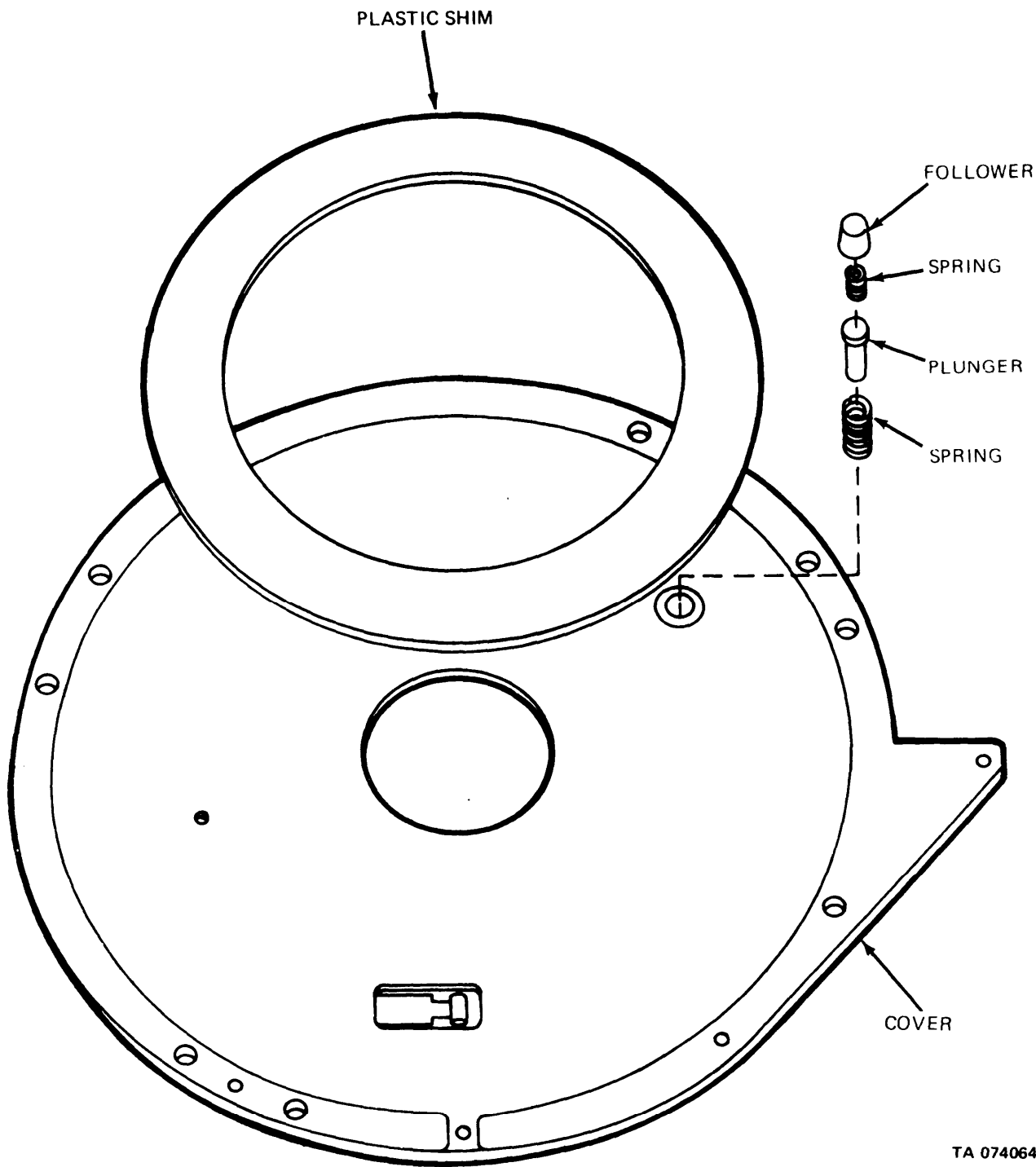


Figure 7-12. Disassemble the Plate and Cover.

- s. Remove plastic shims (fig. 7-13) from the cover.
- t. Remove the follower, two springs, and plunger from cover,



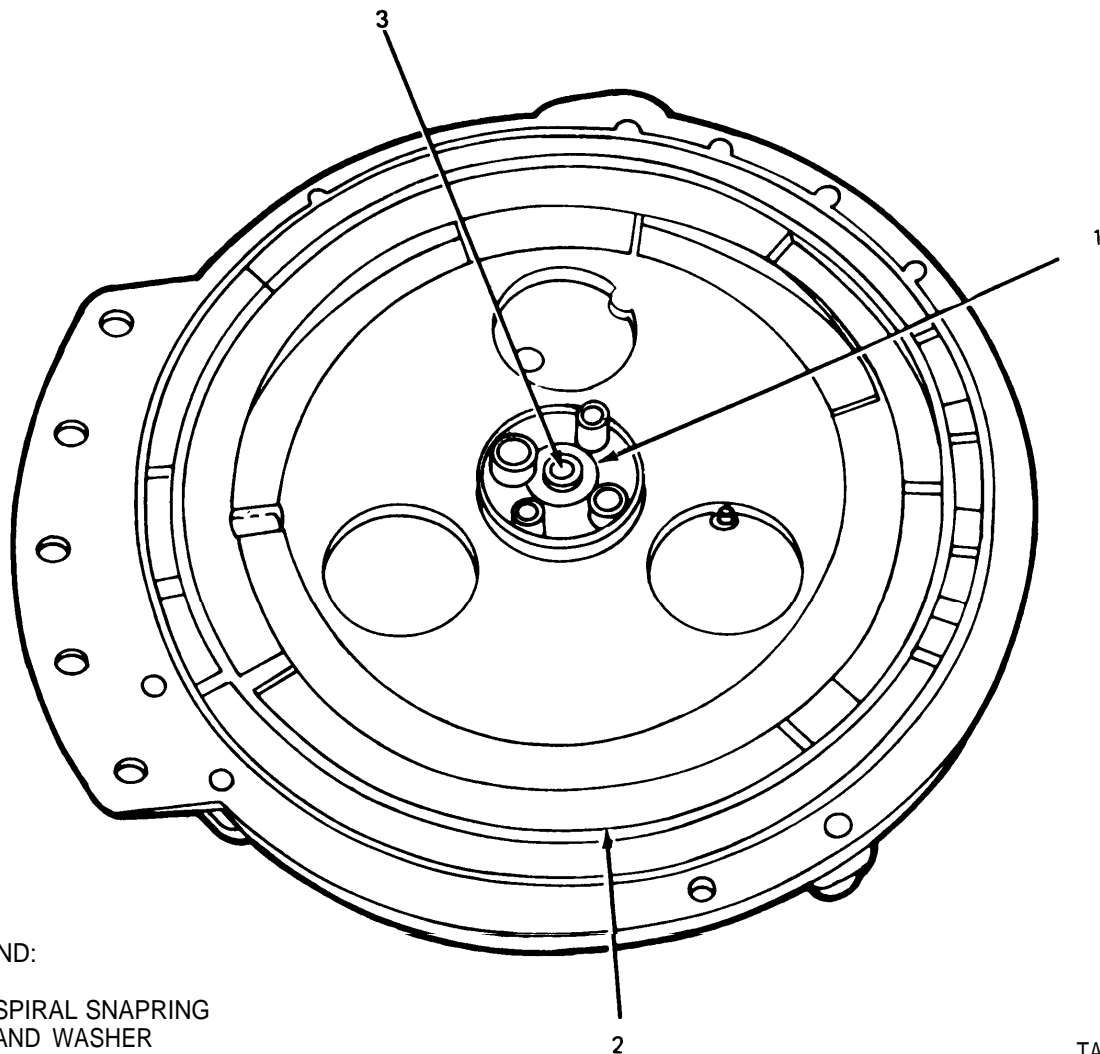
TA 074064

Figure 7-13. Remove Follower, Springs and Plunger.

CAUTION

Use care when the plate is removed in the next step. There is a ball and plunger under spring pressure located under the plate. Do not lose the ball.

u. Remove spiral snapping and washer (1, fig. 7-14). Remove plate (2).

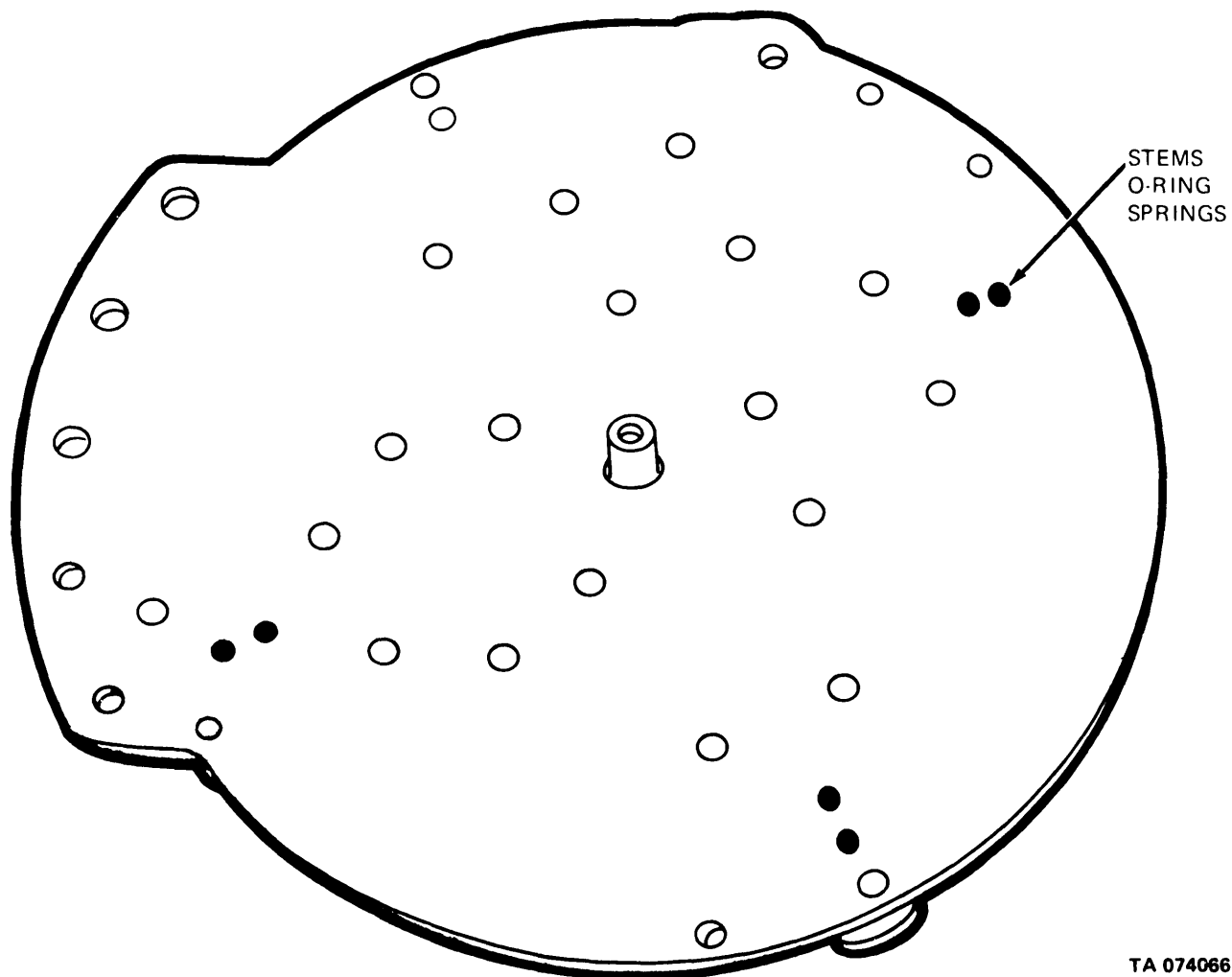
**LEGEND:**

- 1. SPIRAL SNAPPING
AND WASHER
- 2. PLATE
- 3. BALL, SPRING AND
PLUNGER

TA 074055

Figure 7-14. Remove Cam Plate.

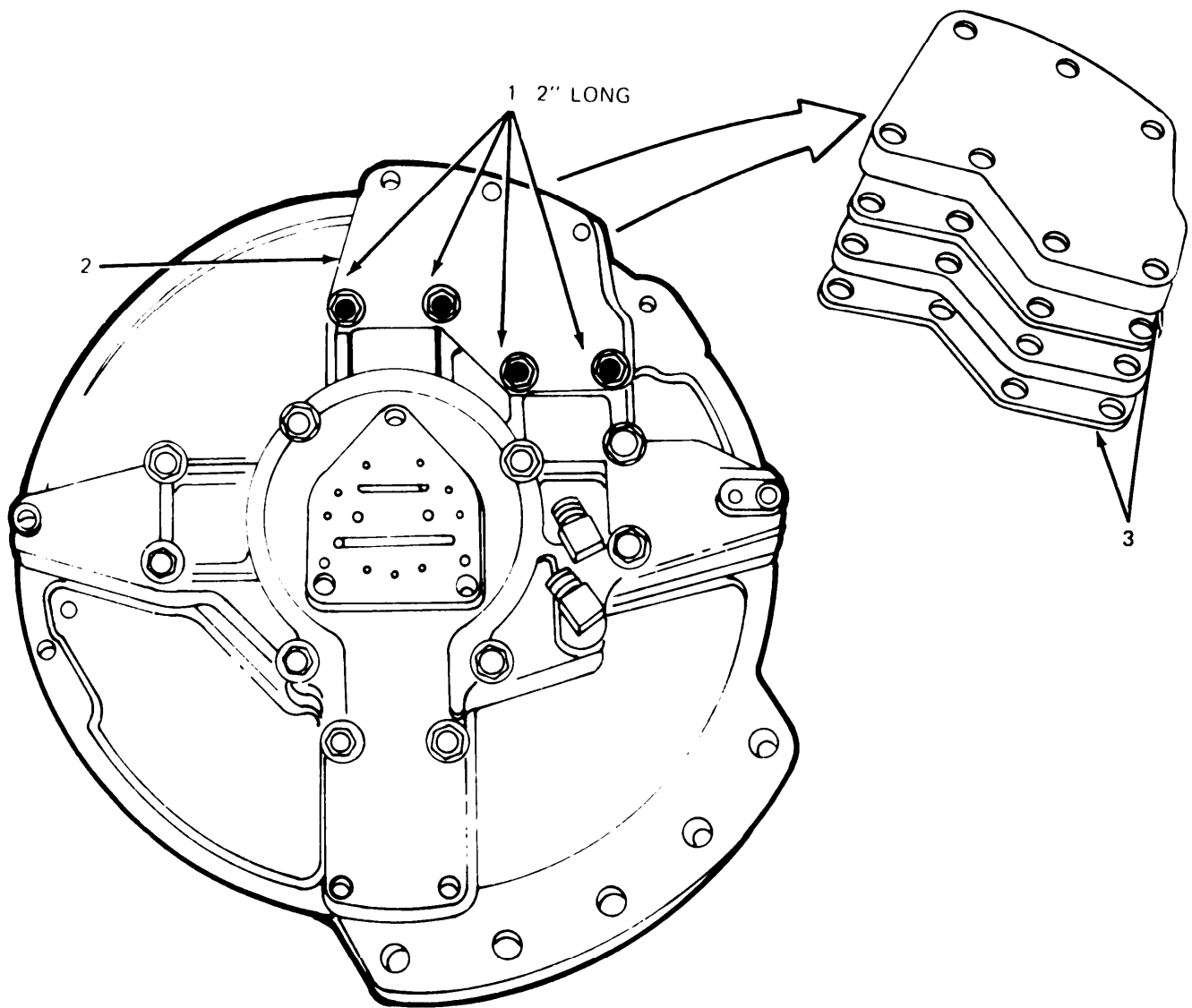
- v. Remove the ball, plunger, and spring (3, fig. 7-14).
- w. Remove six stems (fig. 7-15) and springs from the plate. Remove the O-ring seals from the stems.



TA 074066

Figure 7-15. Remove Stems, O-Rings, and Springs.

x. Remove four bolts (1, fig. 7-16) and cover (2).



- 1. BOLT (4)
- 2. COVER
- 3. GASKET &
PLATE ASSEMBLY

TA 074067

Figure 7-16. Remove the Cover.

y. Remove gasket and plate assembly (3) (fig. 7-16) and three hollow dowels (fig. 7-17).

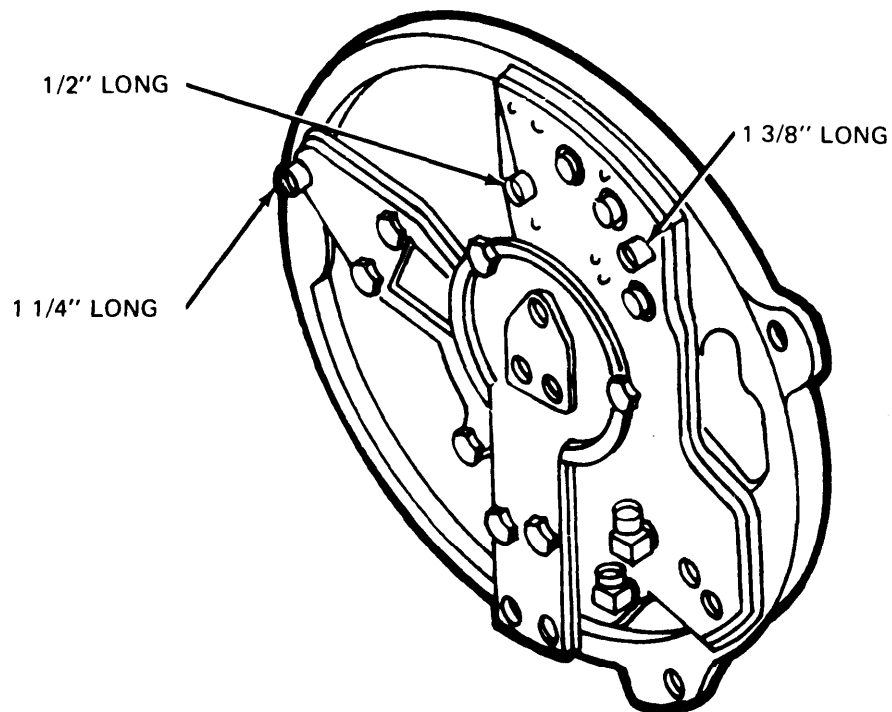


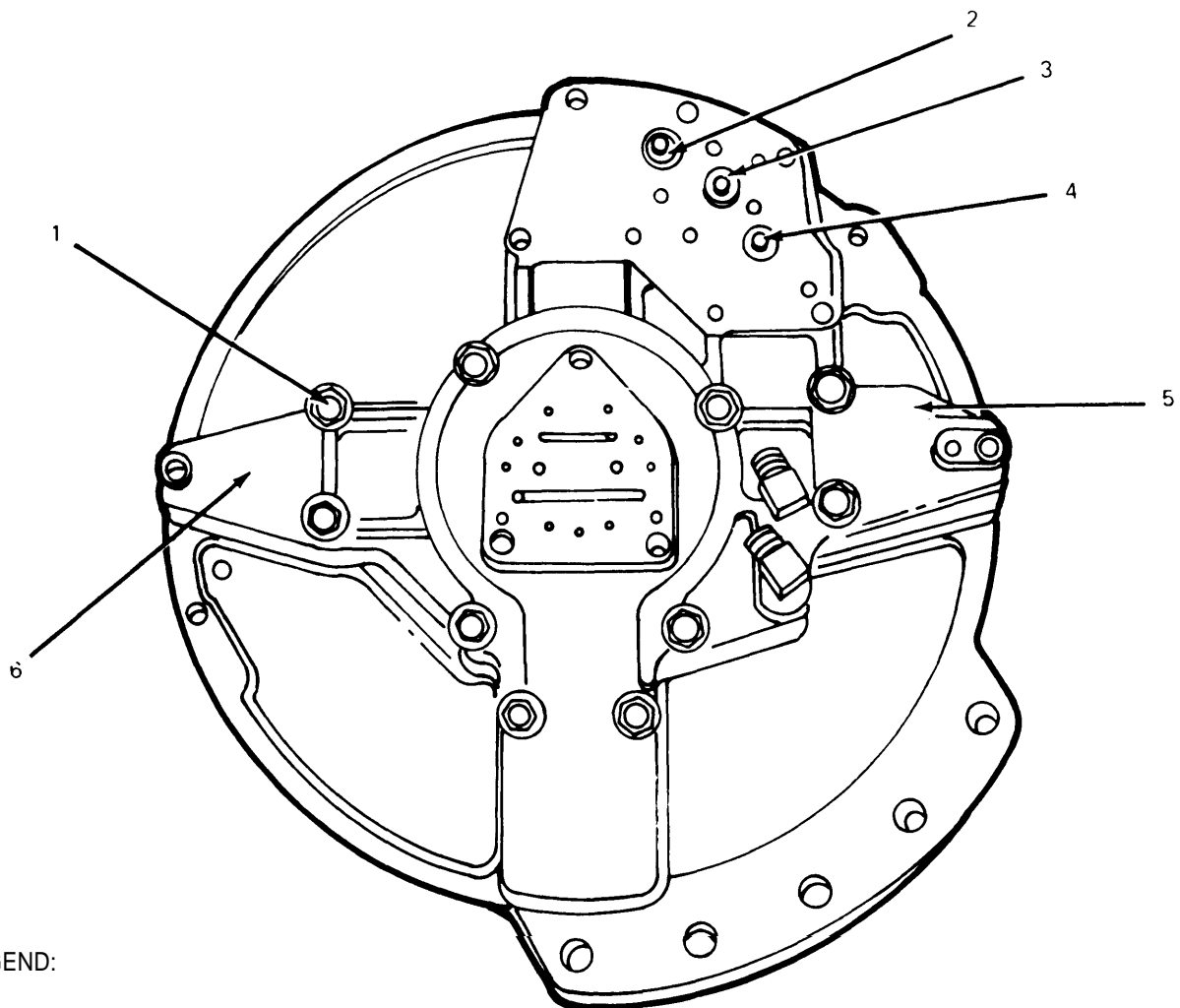
Figure 7-17. Remove Three Hollow Dowels.

TA 074068

z. Remove ten bolts (1, fig. 7-18) and lift off plate assembly (6) and cover (5). Remove the gasket from the plate.

NOTE

Piston and valve assemblies (2), (3), and (4) can be cleaned or replaced. Cut the stem to remove the valve from the piston. Remove the O-ring seals from the piston. (There is a spring under piston (3)).



LEGEND:

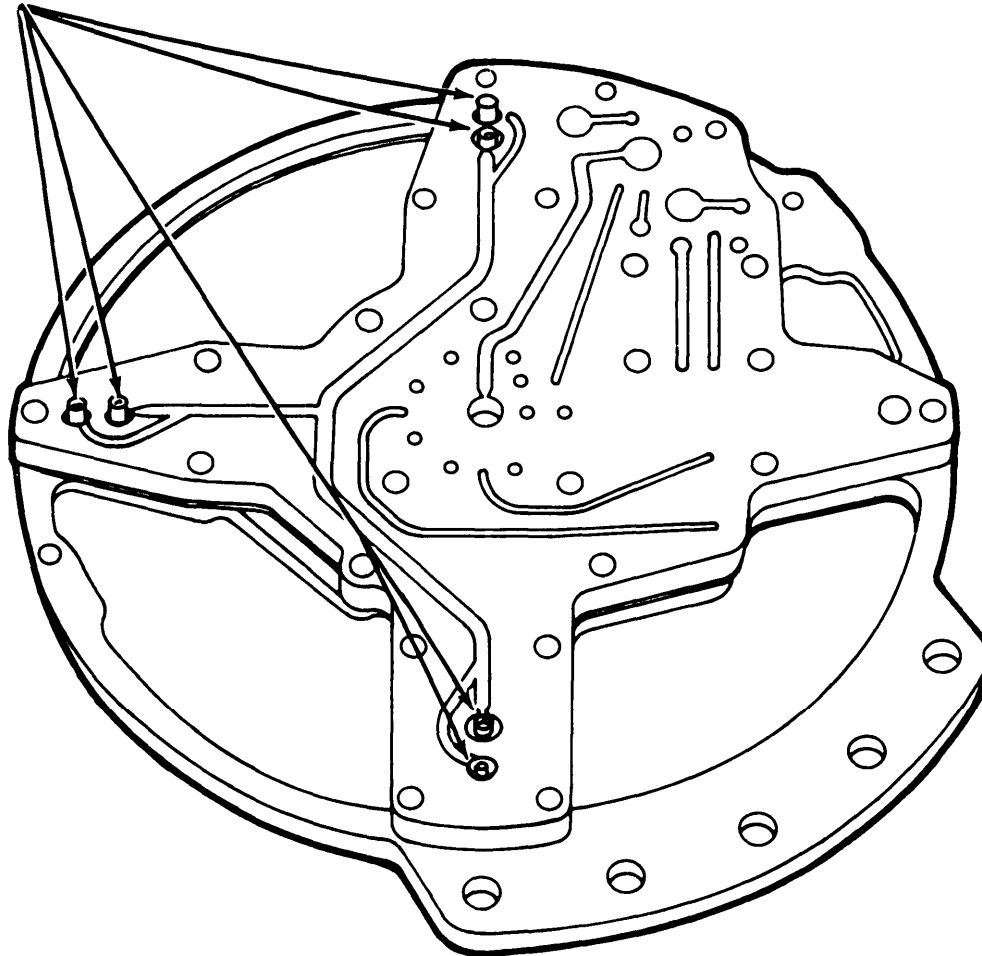
- 1. BOLT (10)
- 2. PISTON & VALVE ASSEMBLY
- 3. PISTON, VALVE AND
SPRING ASSEMBLY
- 4. PISTON & VALVE ASSEMBLY
- 5. COVER
- 6. PLATE ASSEMBLY

TA 074069

Figure 7-18. Remove Plate Assembly.

aa. Remove six springs (fig. 7-19) and valves from the housing.

SPRINGS
AND
VALVES



TA 074070

Figure 7-19. Remove Plate Springs.

bb. Remove check valves and ball valve (fig. 7-20) from the housing.

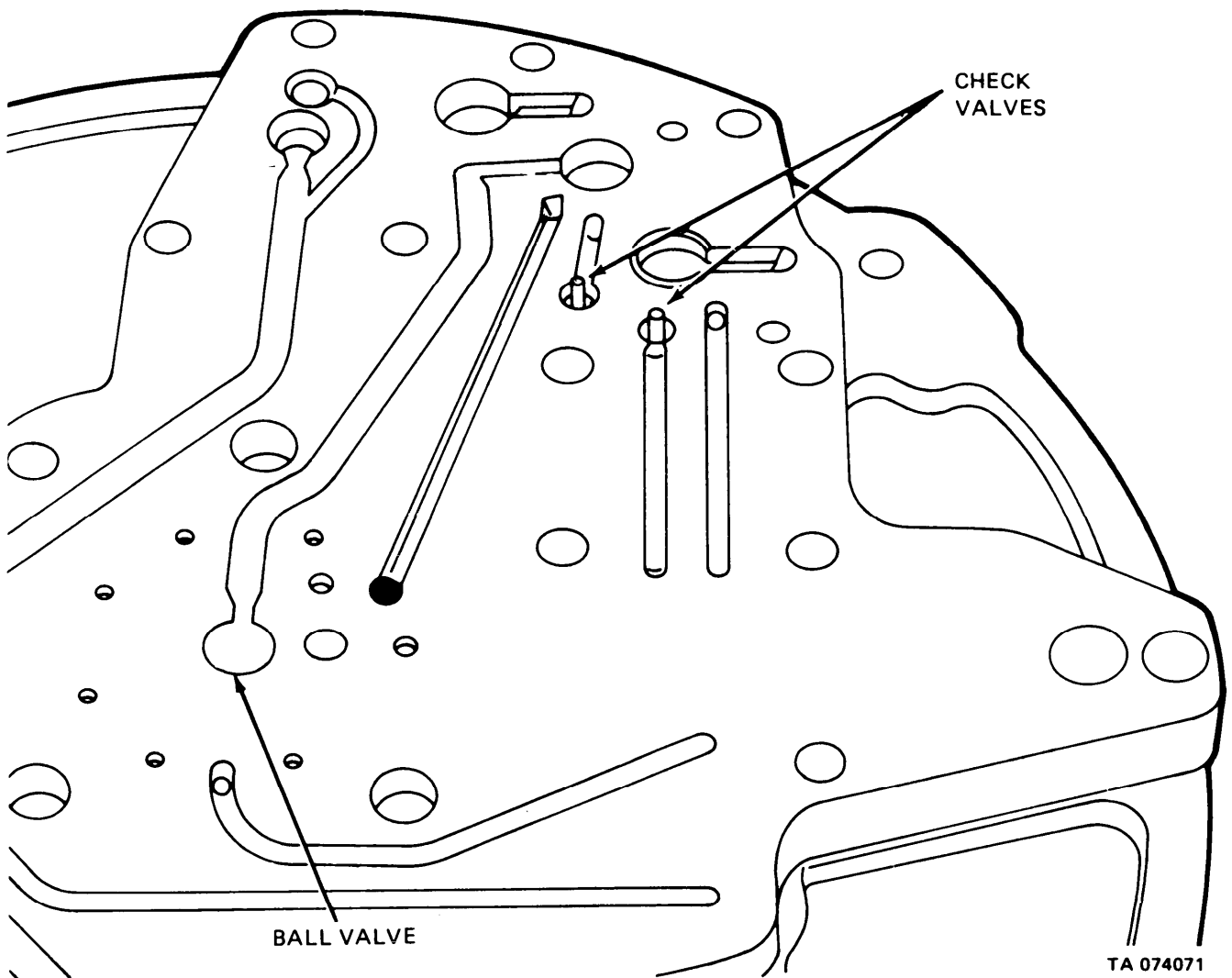


Figure 7-20. Remove Housing Stem Valves.

cc. Remove housing (2, fig. 7-21) from plate (1). Remove the gasket (3).

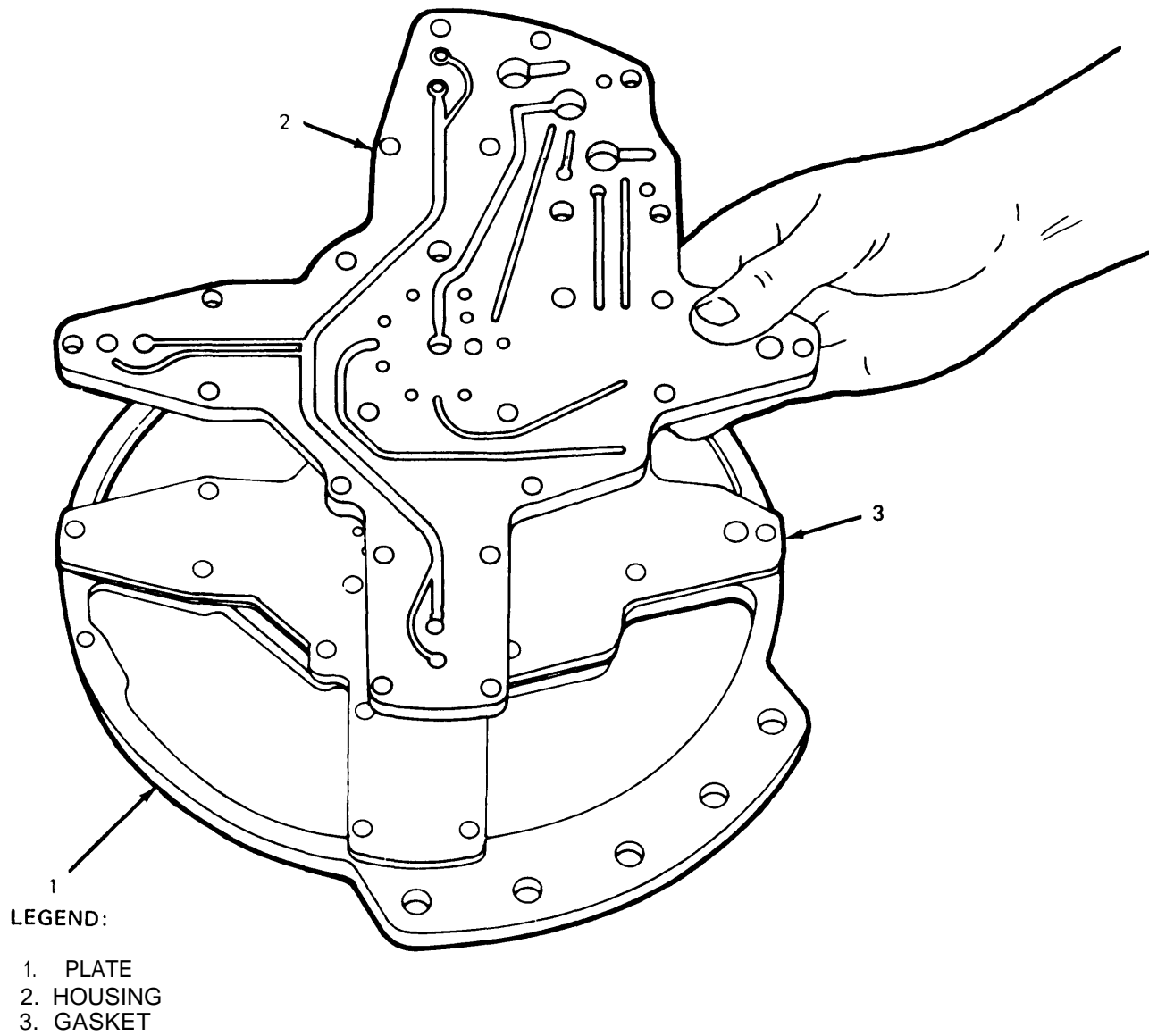


Figure 7-21. Remove the Housing.

dd. Remove spring and center stem (fig. 7-22) from the plate. Remove the O-ring seal from the stem.

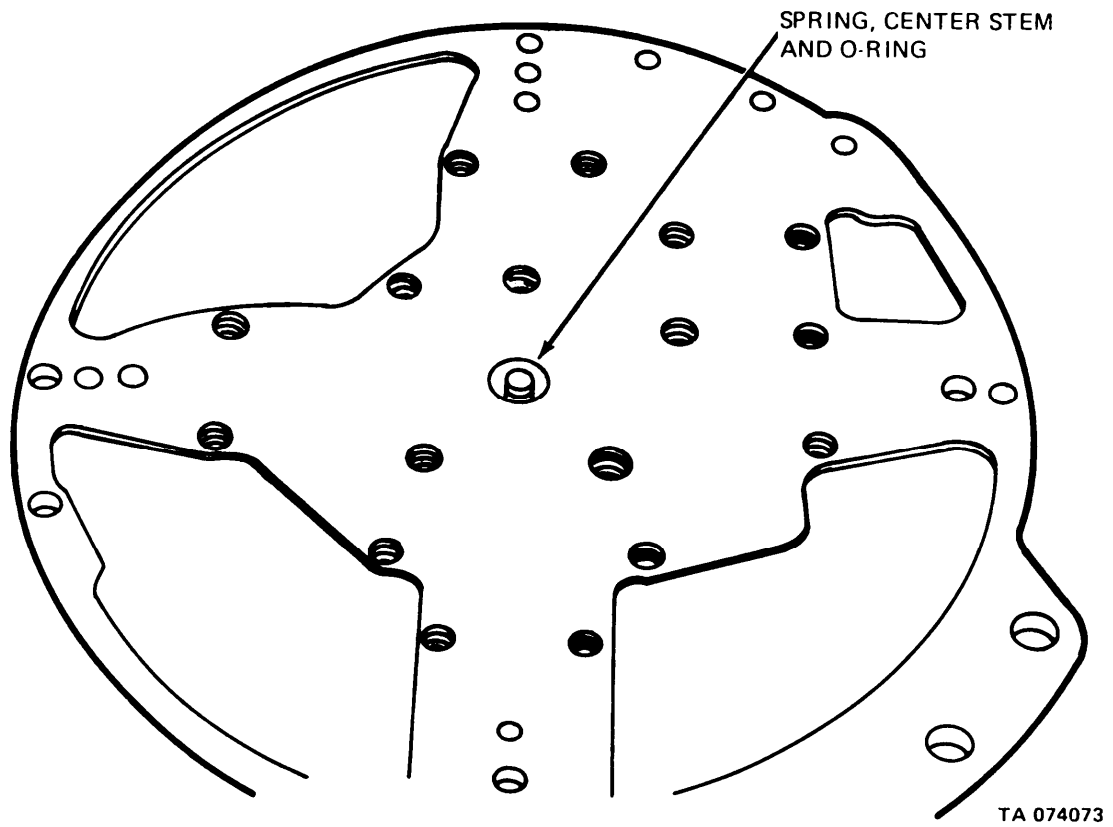
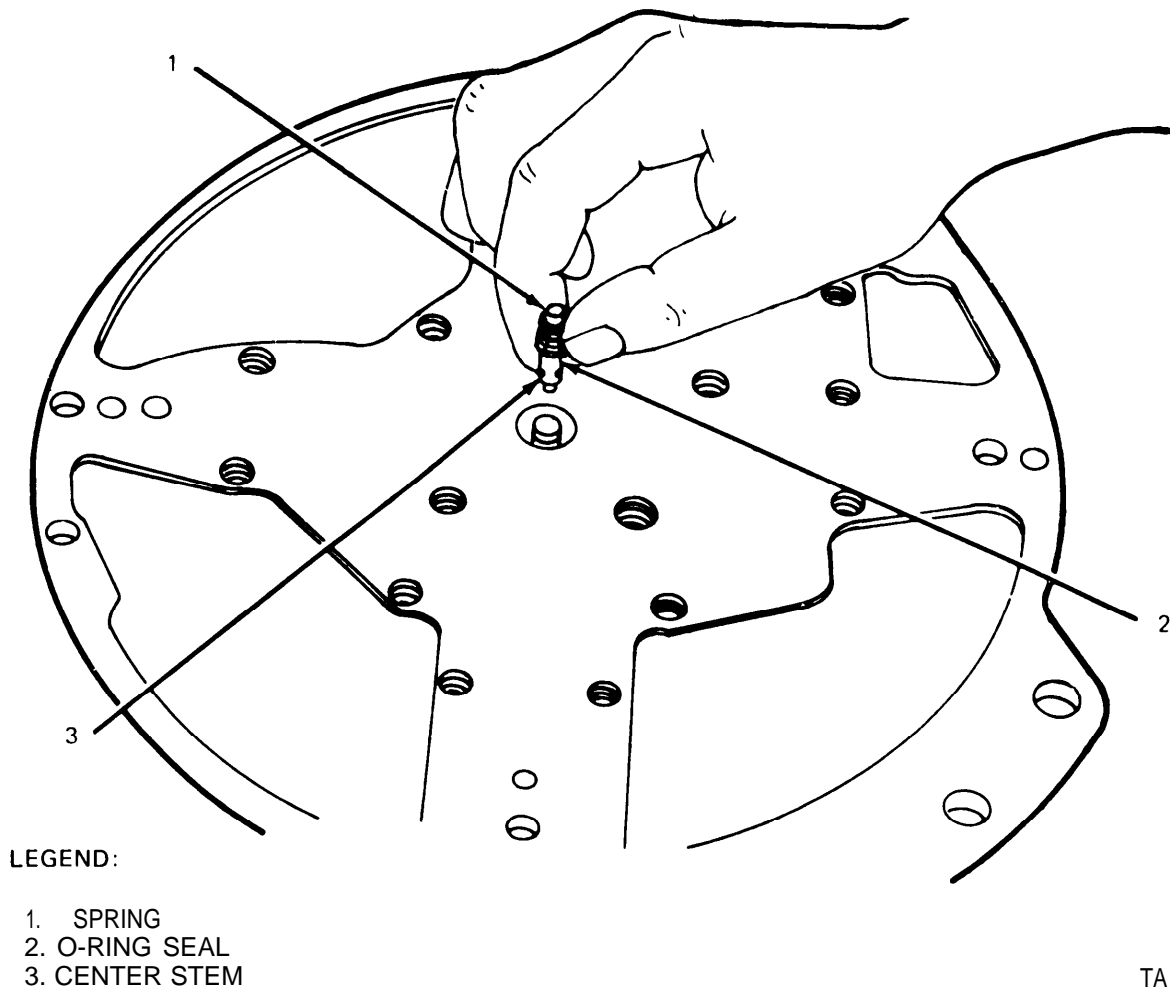


Figure 7-22. Remove Center Stem and Spring.

7-4 Cleaning. Use SD-2 dry cleaning solvent (item 12, appendix B).

7-5 Assembly.

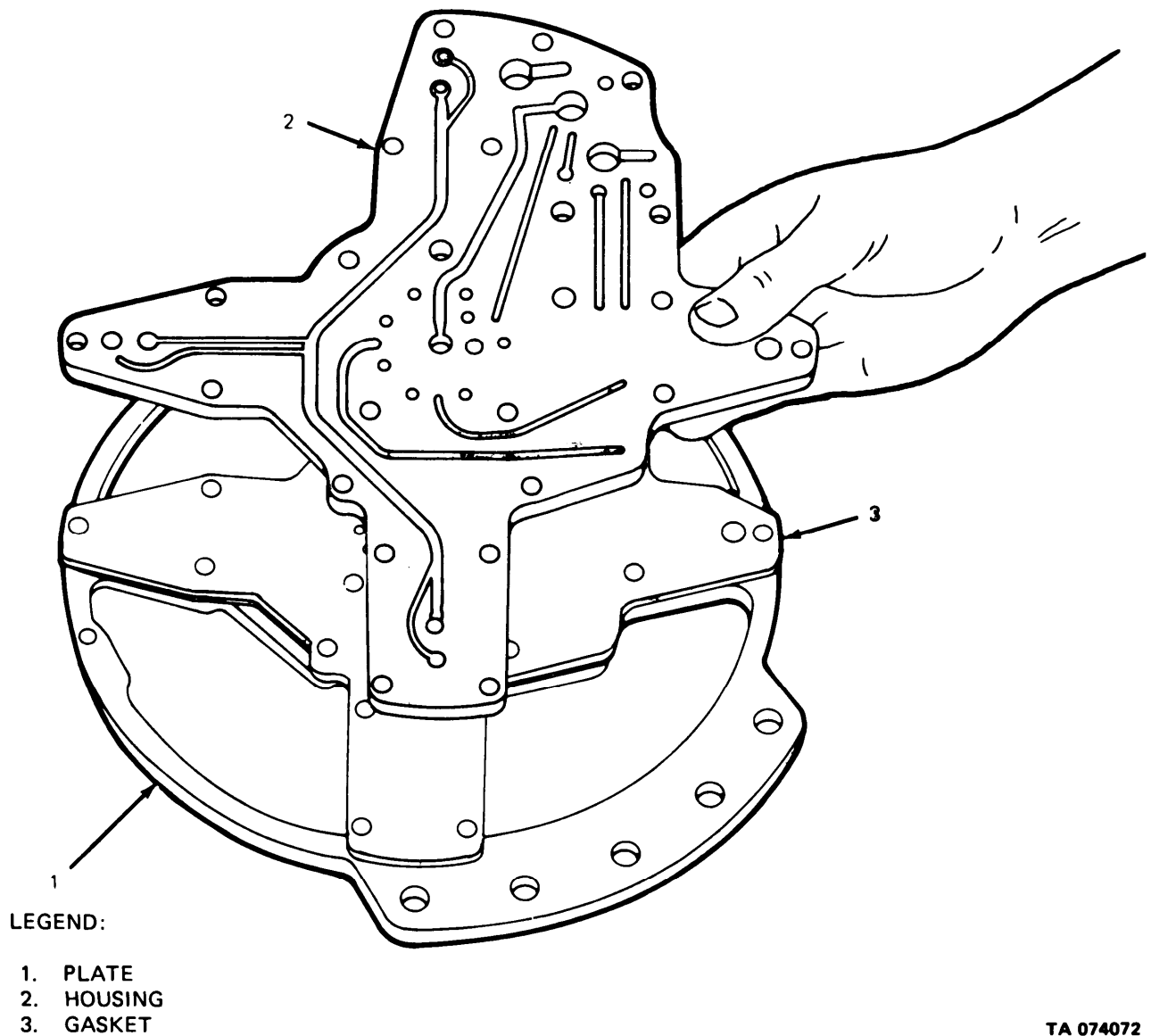
- a. Lubricate O-ring seal and bore with silicone grease.
- b. Install O-ring seal (2, fig. 7-23) on center stem (3). Press center stem (3) and spring (1) in position in the plate.



TA 074074

Figure 7-23. Install Center Stem and Spring.

- c. Install gasket (3, fig. 7-24) on plate (1). Place housing (2) in position on the plate.



TA 074072

Figure 7-24. Install Housing.

- d. Install check valves and ball valve (fig. 7-25) in the housing.

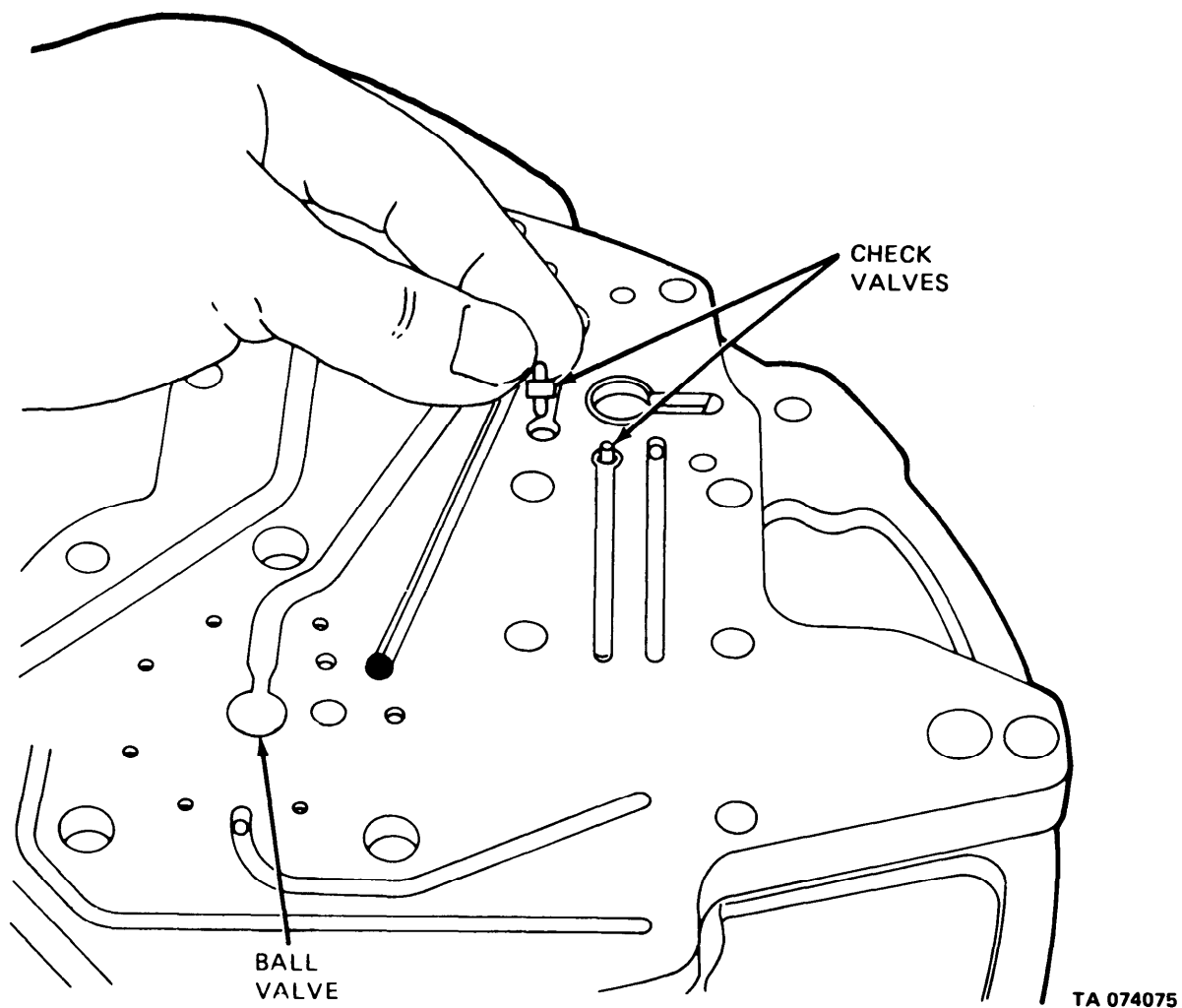
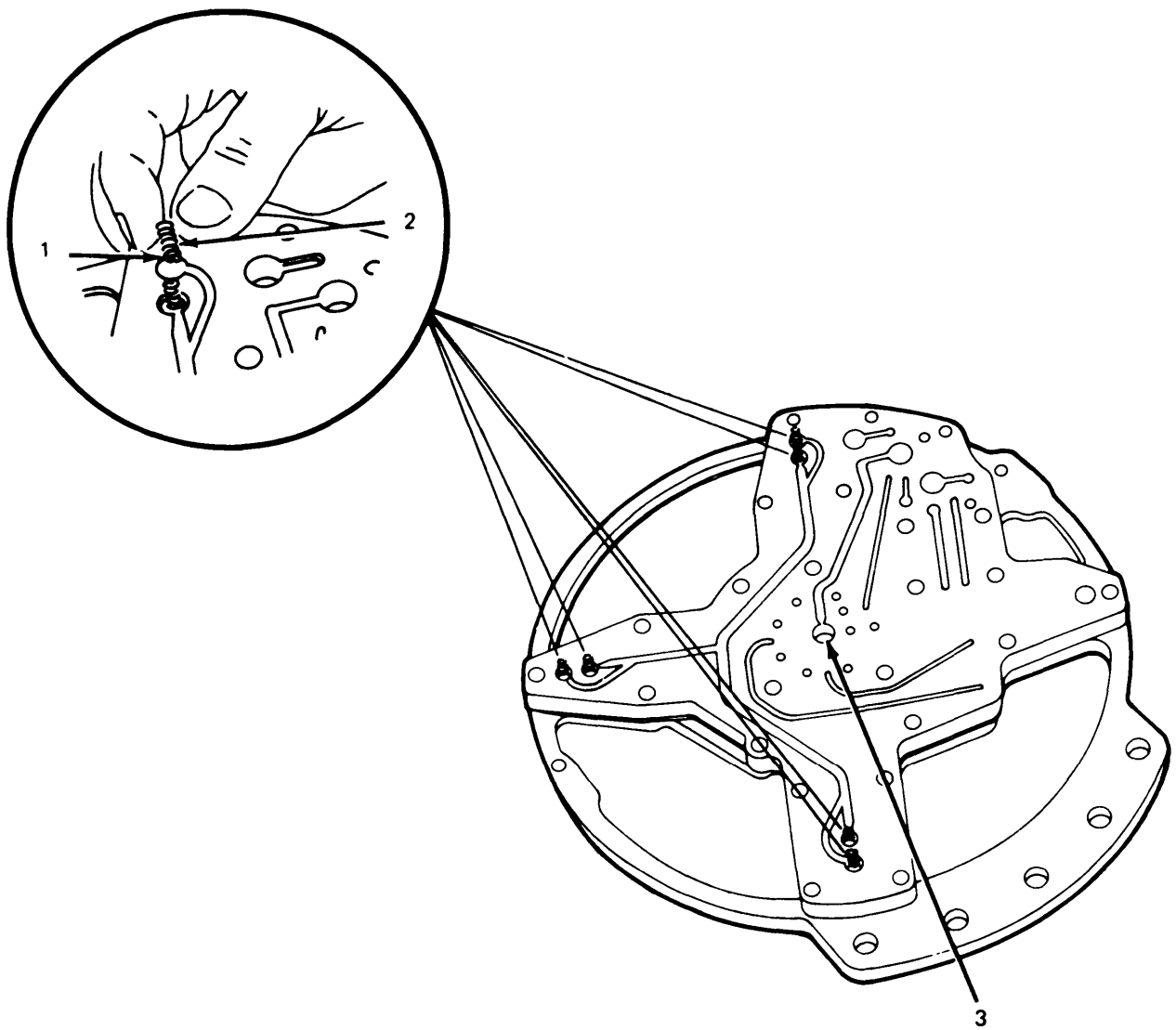


Figure 7-25. Install Check Valves and Ball Valve.

- e. Install six valves (1, fig. 7-26) six springs (2), and ball (3) in the housing.



LEGEND:

1. VALVES (6)
2. SPRING (6)
3. BALL

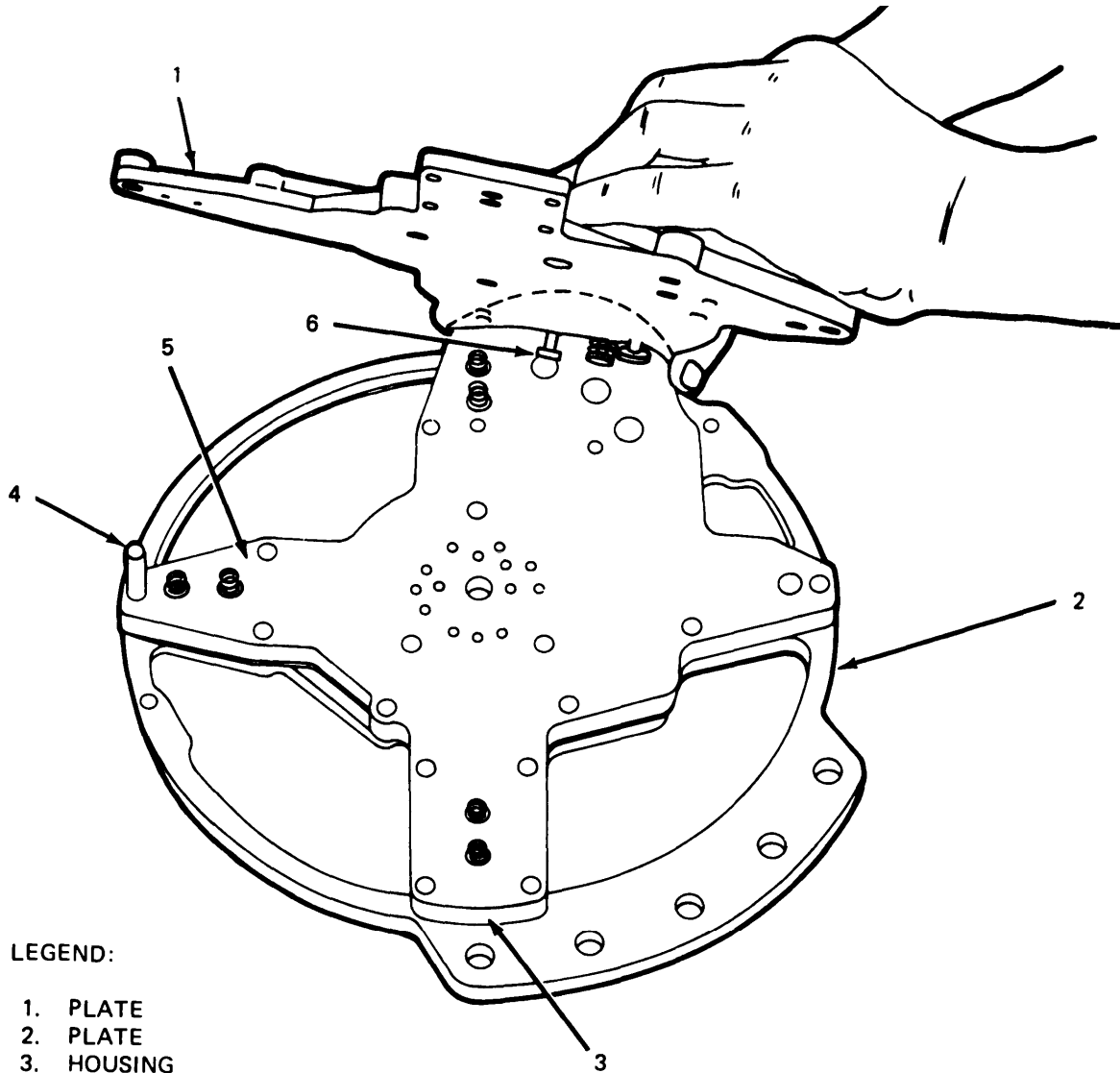
TA 074076

Figure 7-26. Install Springs, Valves, and Ball

f. Install gasket (5, fig. 7-27) on housing (3). Place plate (1) in position on the housing (3). install 1 1/4" long dowel (4) in plate (2).

NOTE

If piston and valve assemblies (6) were removed, lubricate and reinstall exercising care not to damage aluminum face. Check installation to be sure piston does not bind in plate (1).



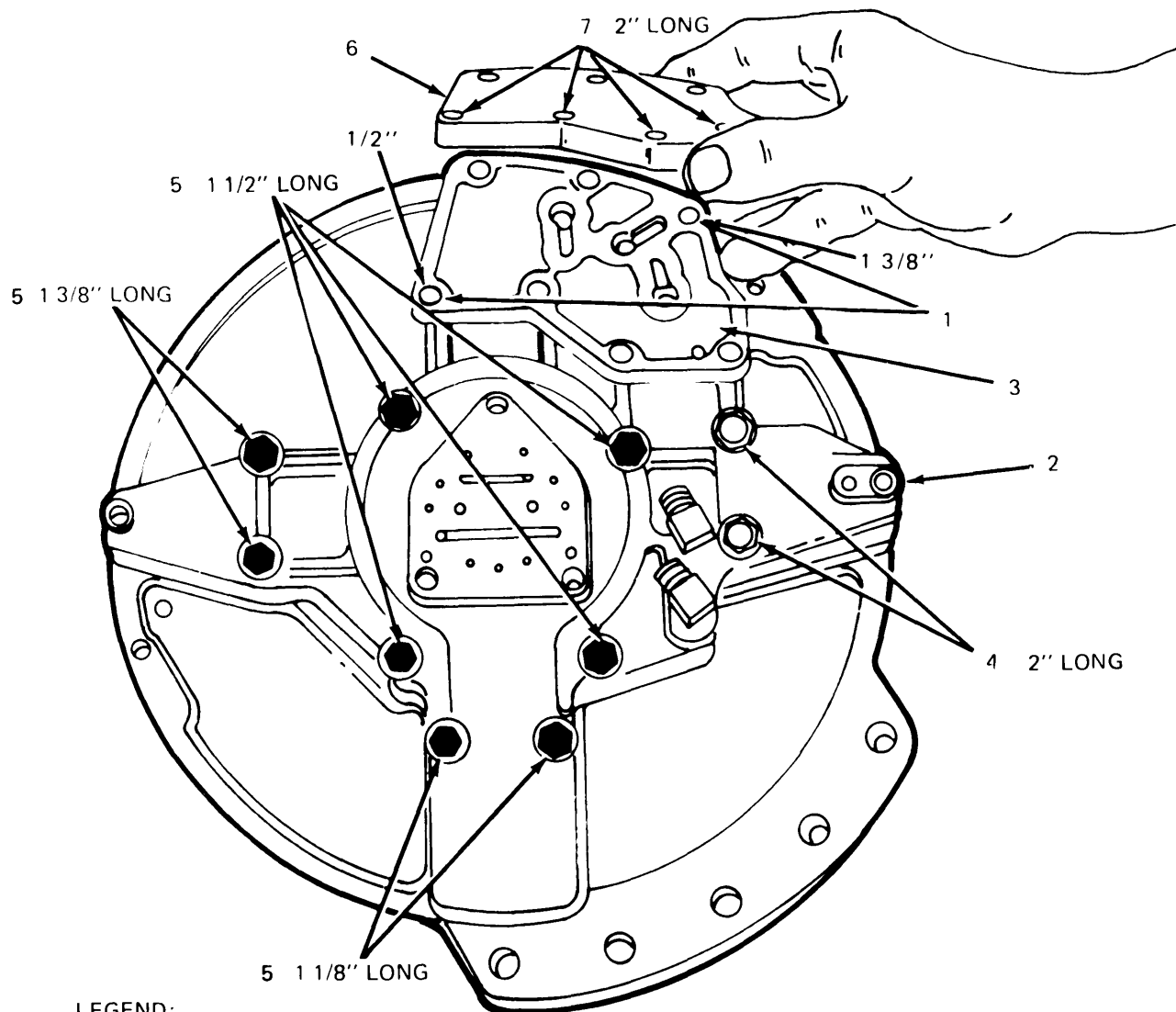
LEGEND:

1. PLATE
2. PLATE
3. HOUSING
4. DOWEL
5. GASKET
6. PISTON AND VALVE ASSEMBLY (3)

TA 074077

Figure 7-27 Install Plate on Housing.

g. Install eight bolts, with washers (5, fig. 7-28) that fasten the housing to the plate and torque to 9 lb-ft (12 N•m)



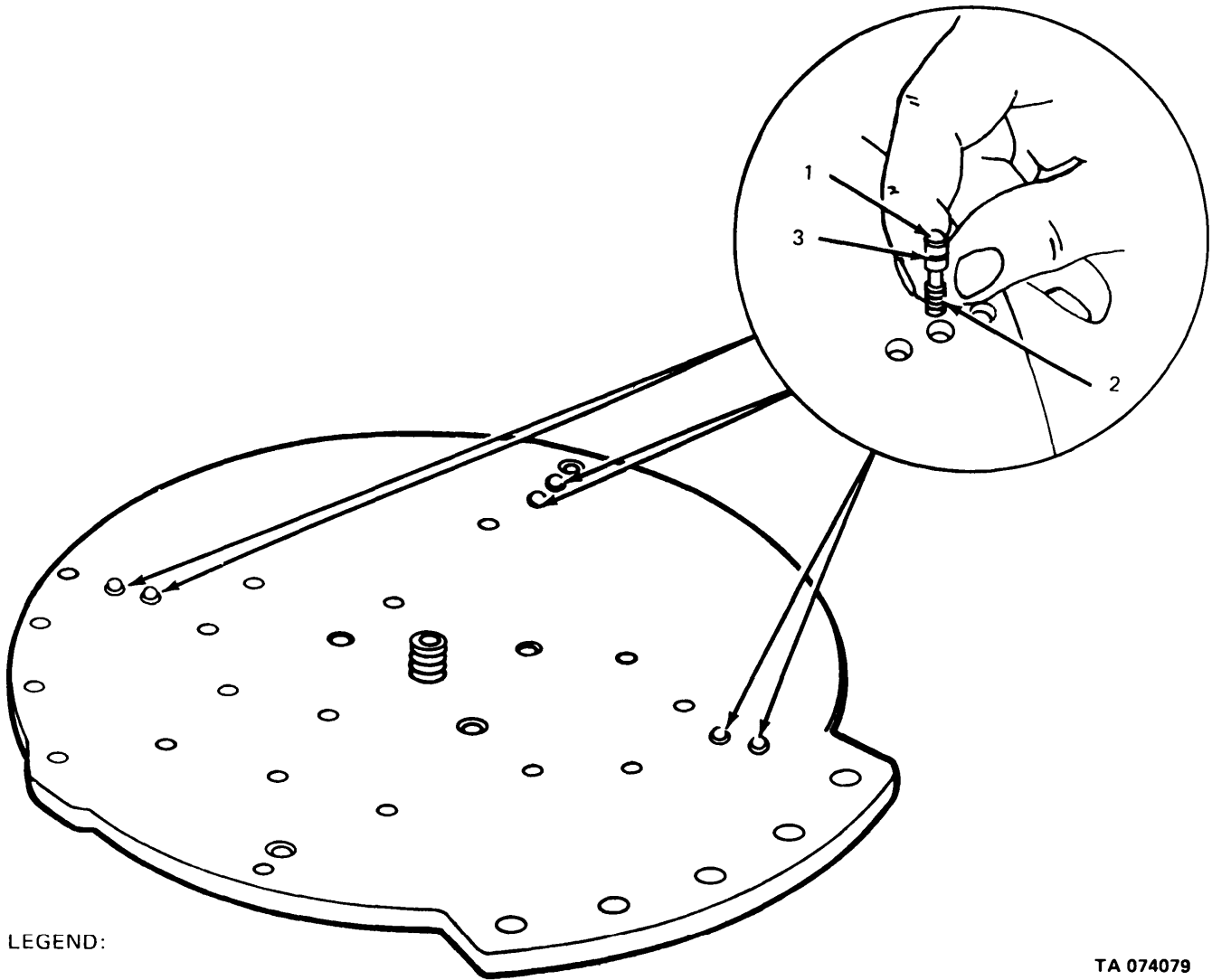
LEGEND:

1. DOWEL (2)
2. HOUSING
3. PLATE
4. BOLT (2)
5. BOLT & WASHER (8)
6. GASKET & PLATE
ASSEMBLY & COVER
7. BOLT (4)

TA 074078

Figure 7-28. Install Covers.

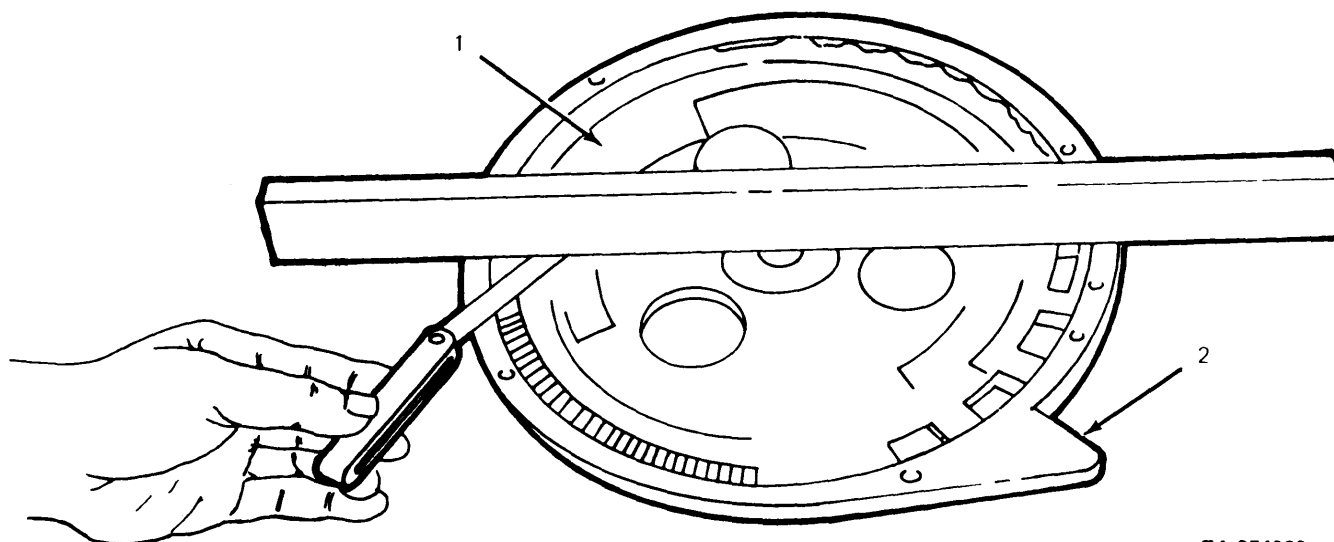
- h. Install housing (2, fig. 7-28). Tighten two bolts (4) to 9 lb ft (12 N•m).
- i. Install hollow dowel (1) and gasket for plate assembly (3) and install plate assembly.
- j. Install gasket and plate assembly cover (6) and secure to housing with four bolts (7).
- k. Lubricate and install O-ring seals (3, fig. 7-29) on stems (1). Install six springs (2) and six stems (1) in the plate assembly.



TA 074079

Figure 7-29. Install Stems.

/. Place cam plate (1, fig. 7-30) in position in cover assembly (2). Use a piece of bar stock with a straightedge to check the dimension between the surface of the cover assembly and the top surface of the plate with a thickness gage. Check the dimension in four places the same distance apart. Use the dimension to determine the amount of shims needed to keep a clearance of 0.001-0.021 in. (0.03-0.28 mm) between the cover assembly and the plate.



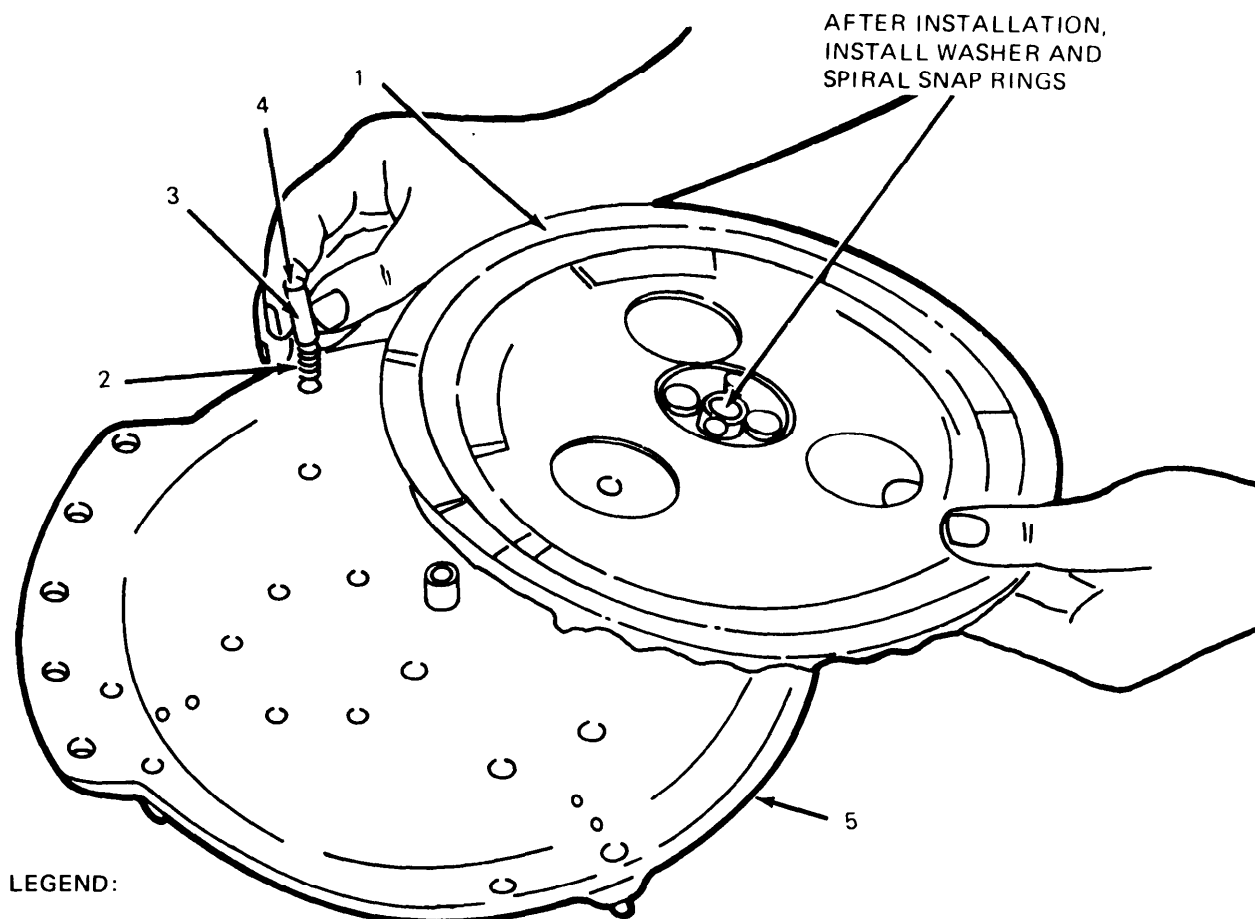
TA 074080

LEGEND:

- 1. CAM PLATE
- 2. COVER ASSEMBLY

Figure 7-30. Check Cover Assembly and Plate Clearance.

m. Lift cam plate (1, fig. 7-31) off of cover (5). Install spring (3, fig. 7-32), plunger (2), spring (4), and follower (1) in the cover. Then install spring (2, fig. 7-31), plunger (3), and ball (4), in cover (5).



LEGEND:

1. CAM PLATE
2. SPRING
3. PLUNGER
4. BALL
5. COVER

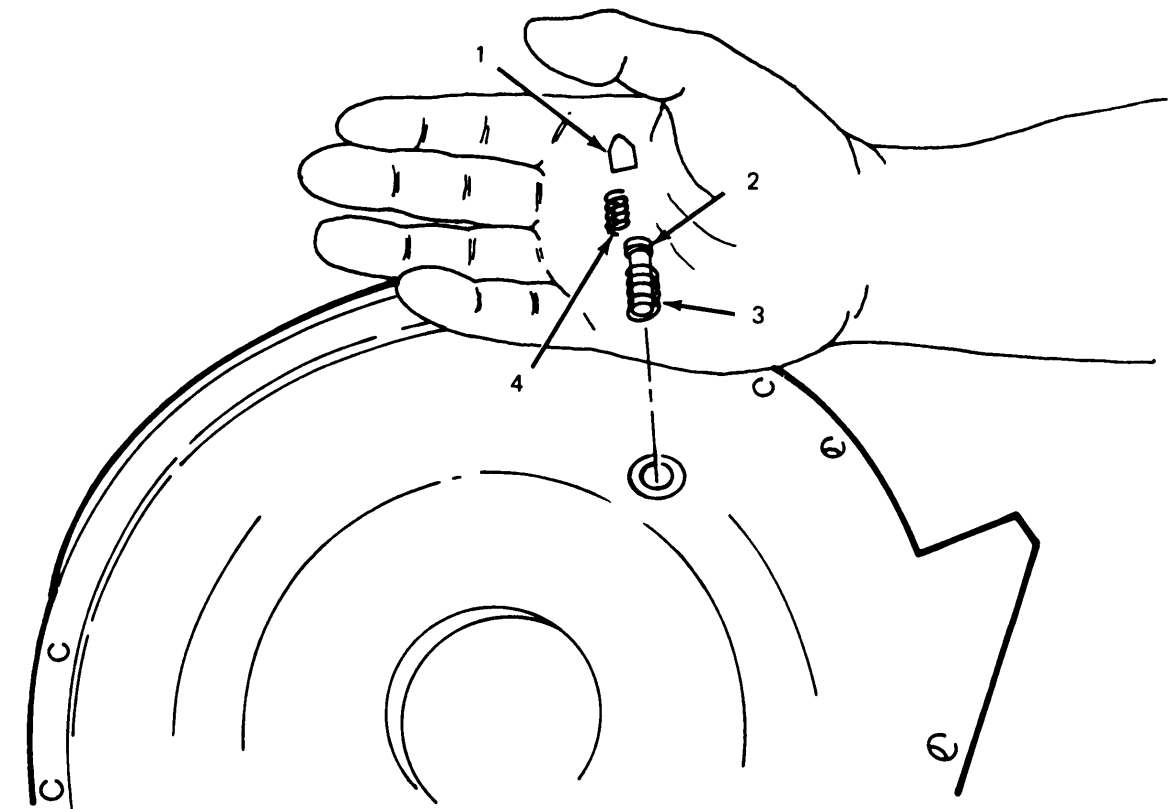
TA 074081

Figure 7-31. Install Cam Plate.

CAUTION

Use care when the plate is installed in the next step. The ball and plunger are under spring pressure.

n. Place cam plate (1) on the cover (5). Install the washer and spiral snapping that hold it.



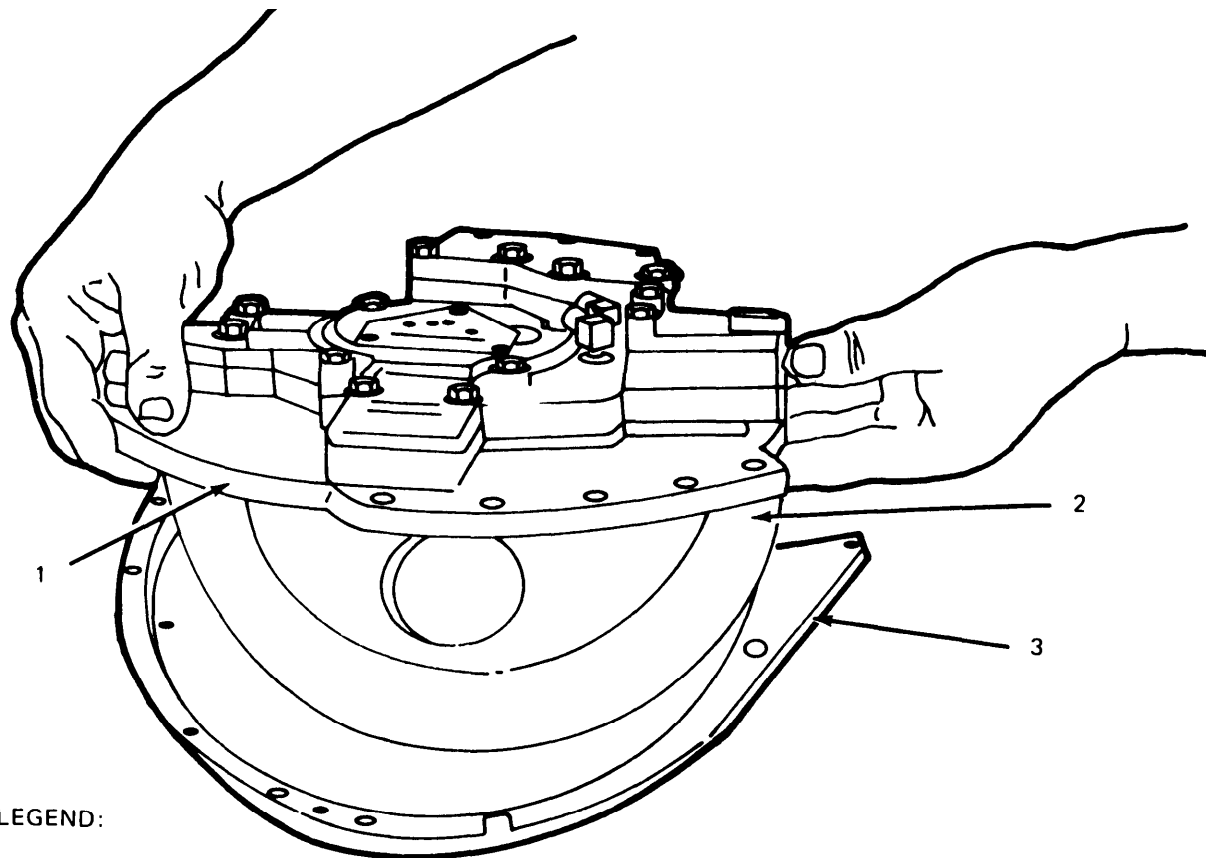
LEGEND:

1. FOLLOWER
2. PLUNGER
3. SPRING
4. SPRING

TA 074082

Figure 7-32. Install Springs, Plunger, and Follower.

o. Install correct amount of shims (2, fig. 7-33) between the cover (3) and plate assembly (1) as found in para 7-3, steps.

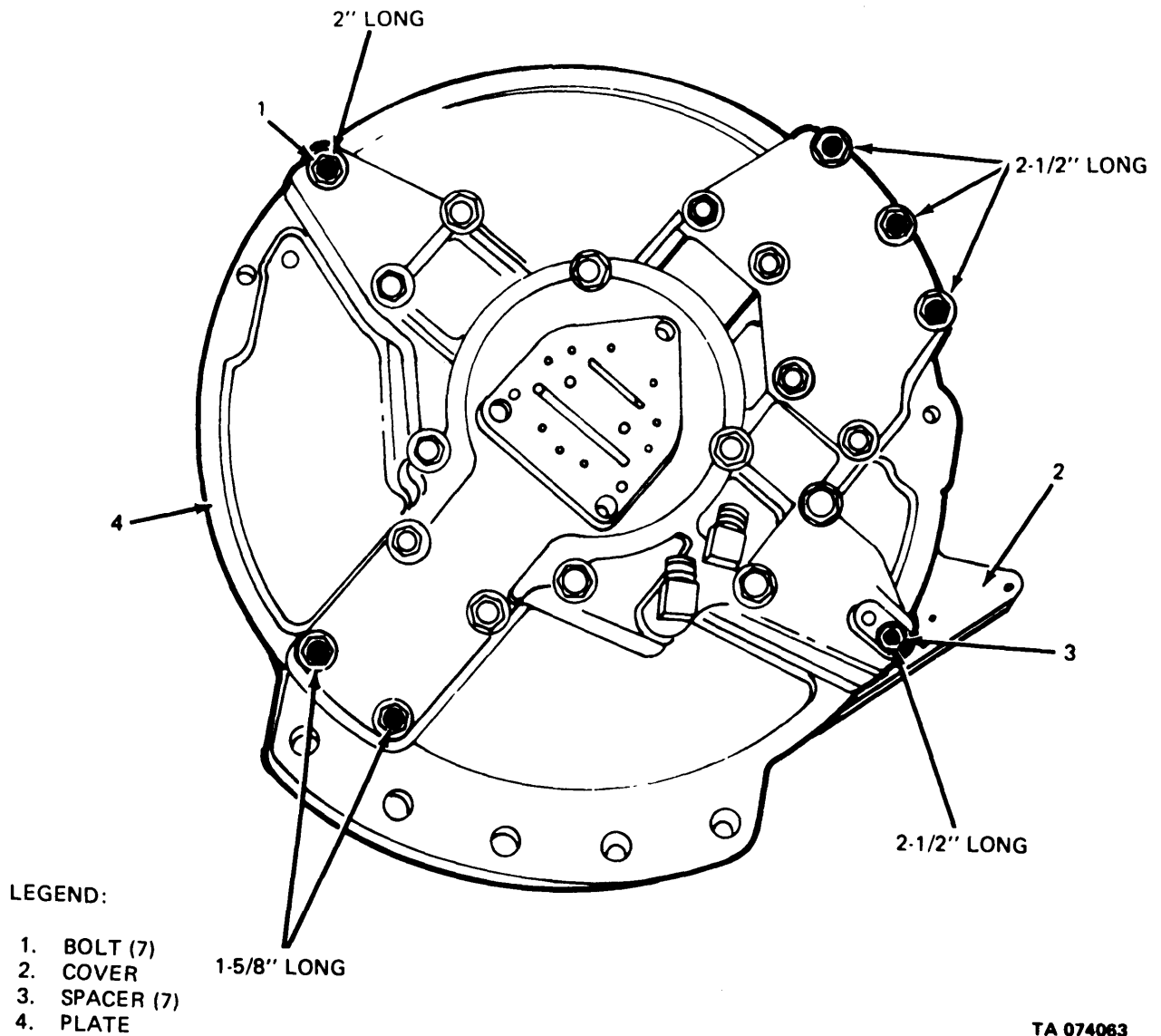


LEGEND:

- 1. PLATE ASSEMBLY
- 2. SHIM
- 3. COVER

Figure 7-33. Install Shims and Plate Assembly.

p.. Place plate assembly (4, fig. 7-34) in position on cover (2). Install seven bolts (1) through spacers (3) around perimeter of plate (4) to fasten it to cover (2). Torque all 21 bolts to 9 lb-ft (12 N•m).



TA 074063

Figure 7-34. Secure Plate Assembly to Cover.

g. Install springs (1 and 2, fig. 7-35) and plunger, stem and spring (3) in the plate. Be sure to place the larger of the two springs in the larger hole.

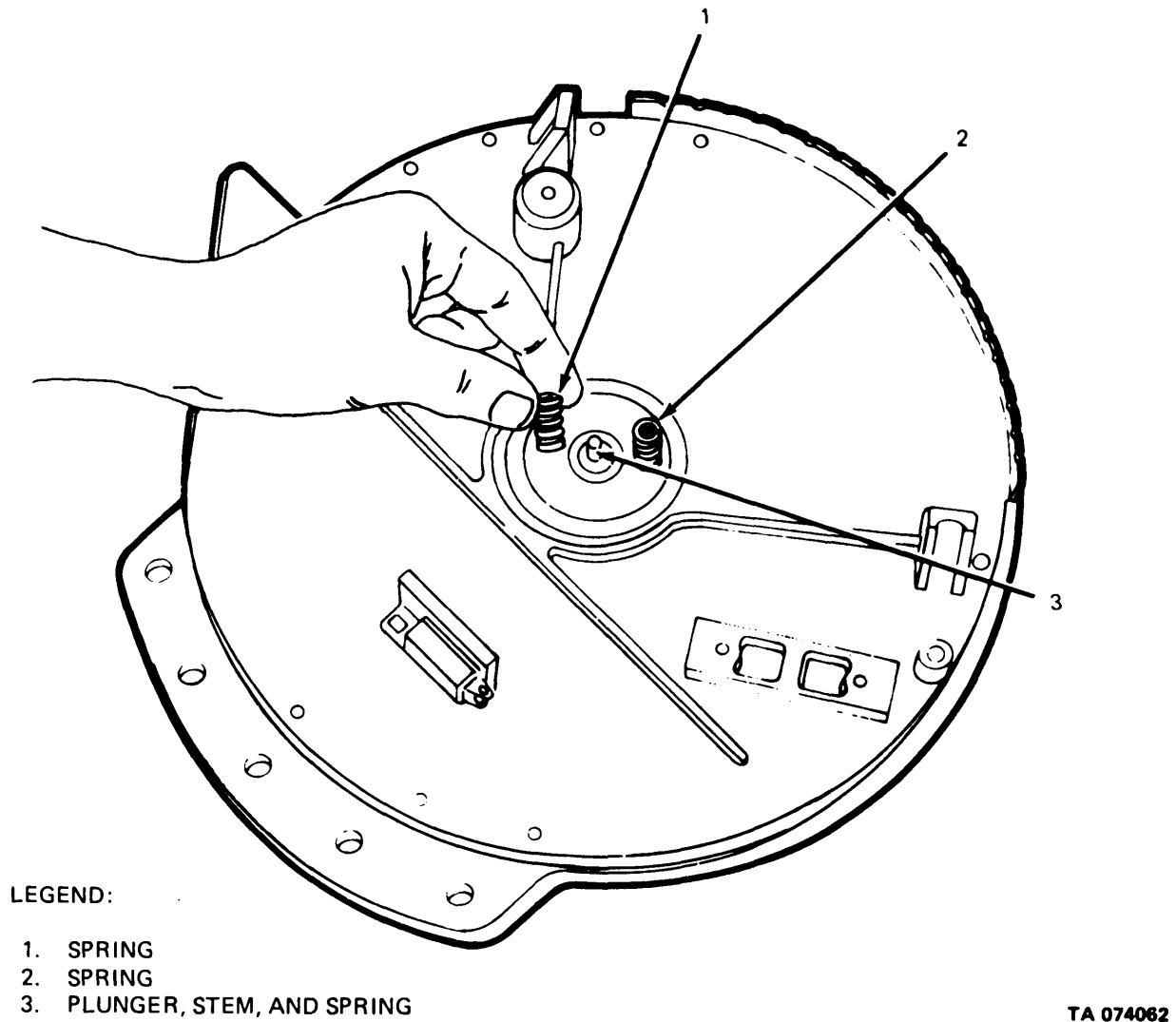
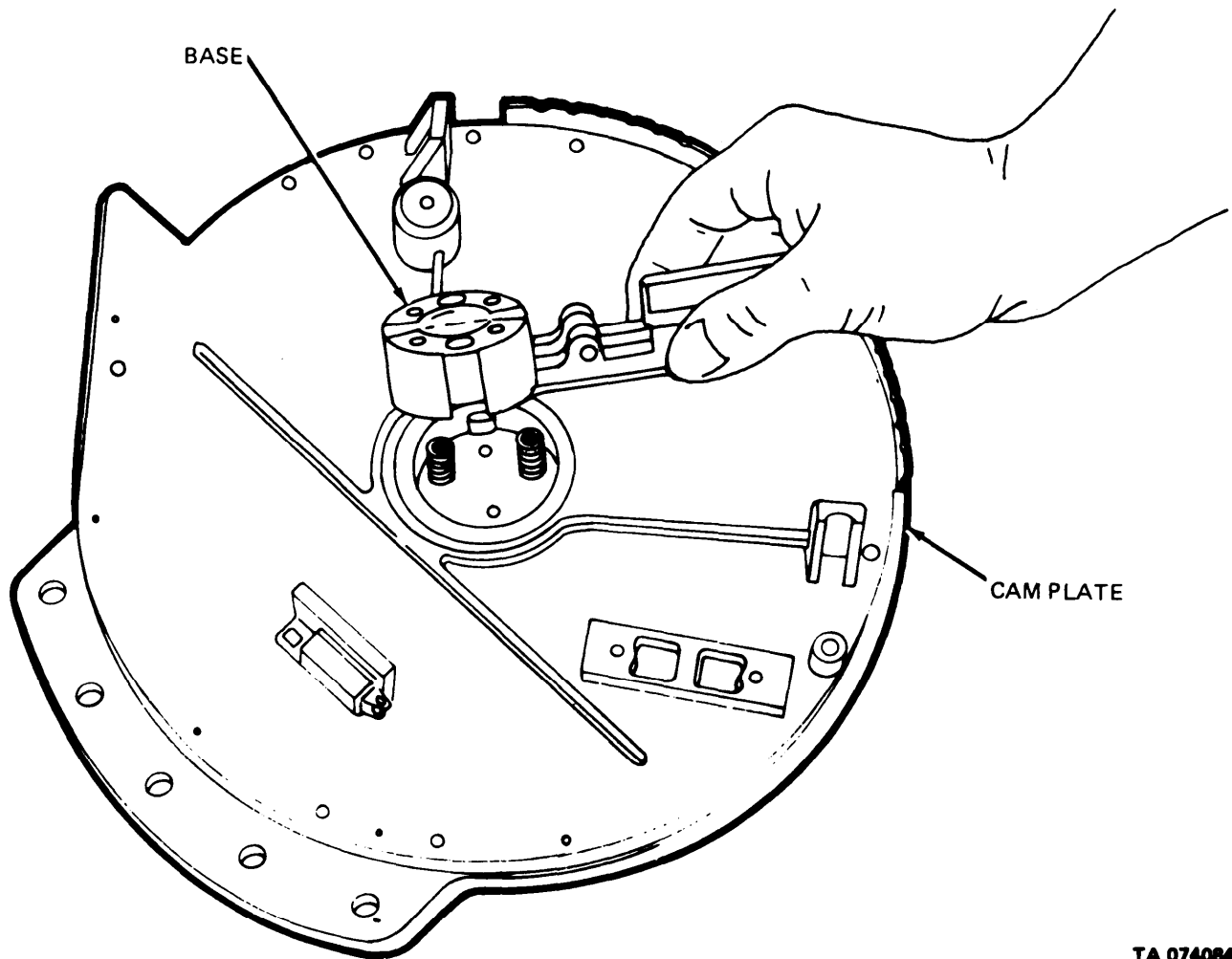


Figure 7-35 Install Springs, Stem and Plunger.

r. Place base (fig. 7-36) in position on the cam plate as shown. Turn center to line up with base.

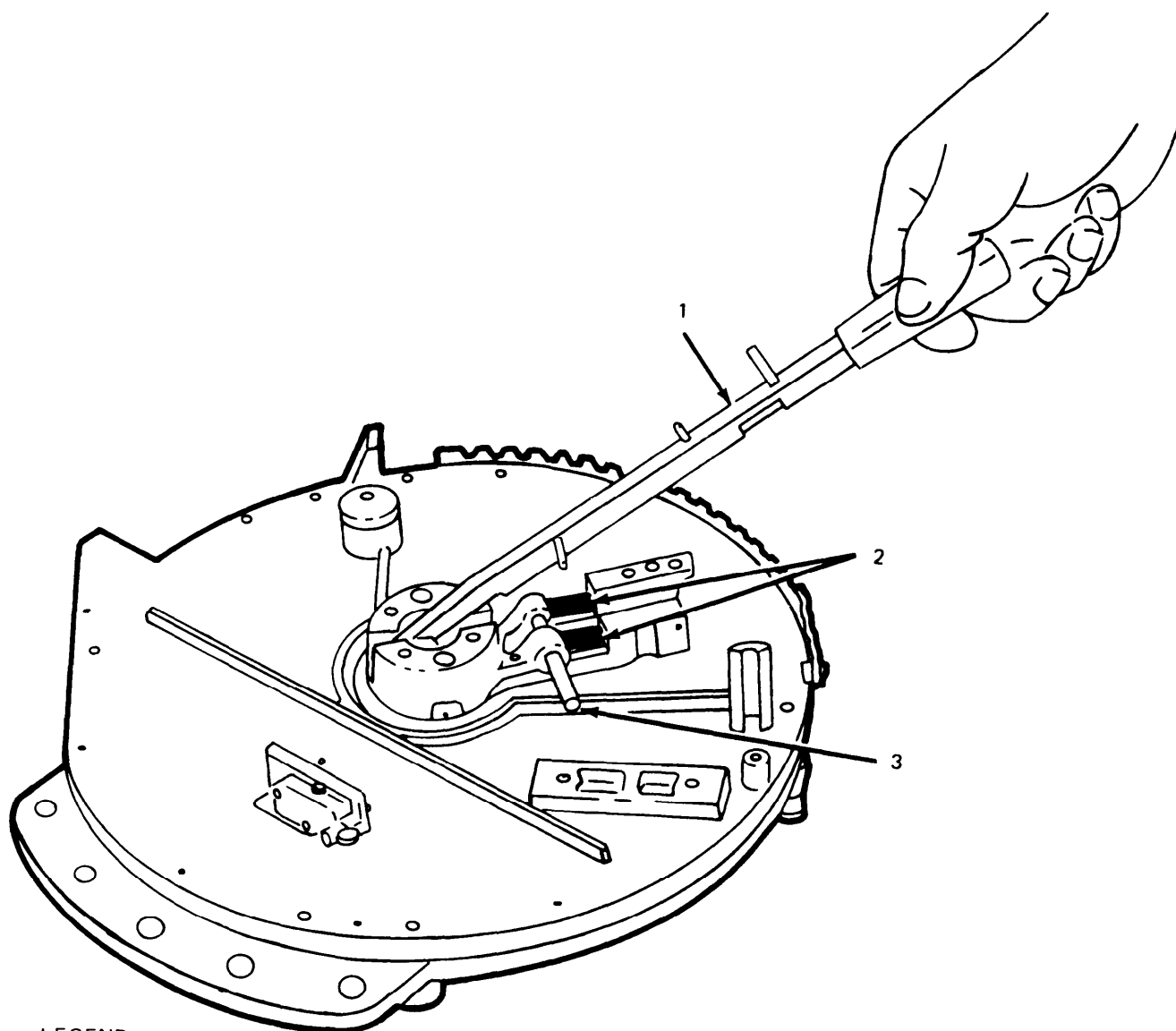


TA 074084

Figure 7-36. Install Base.

s. Install springs and pins (2, fig. 7-37) in the base.

t Place lever (1) in position on the base. Install the dowel (3) in the base.



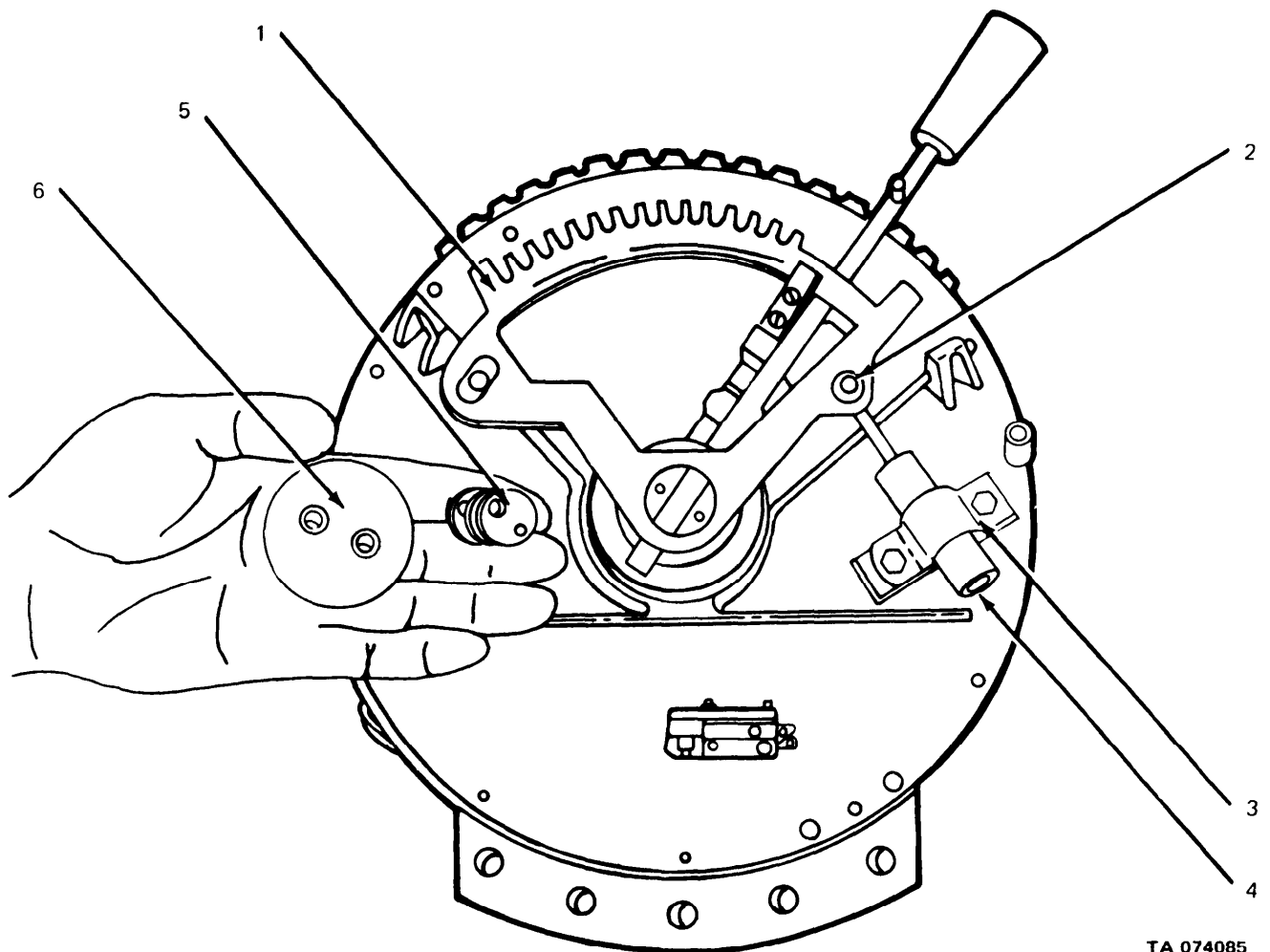
LEGEND:

- 1. LEVER
- 2. SPRING AND PIN
- 3. DOWEL

TA 074060

Figure 7-37 Install Shift Lever and Springs.

u. Place plate (1, fig. 7-38) in position on the base.



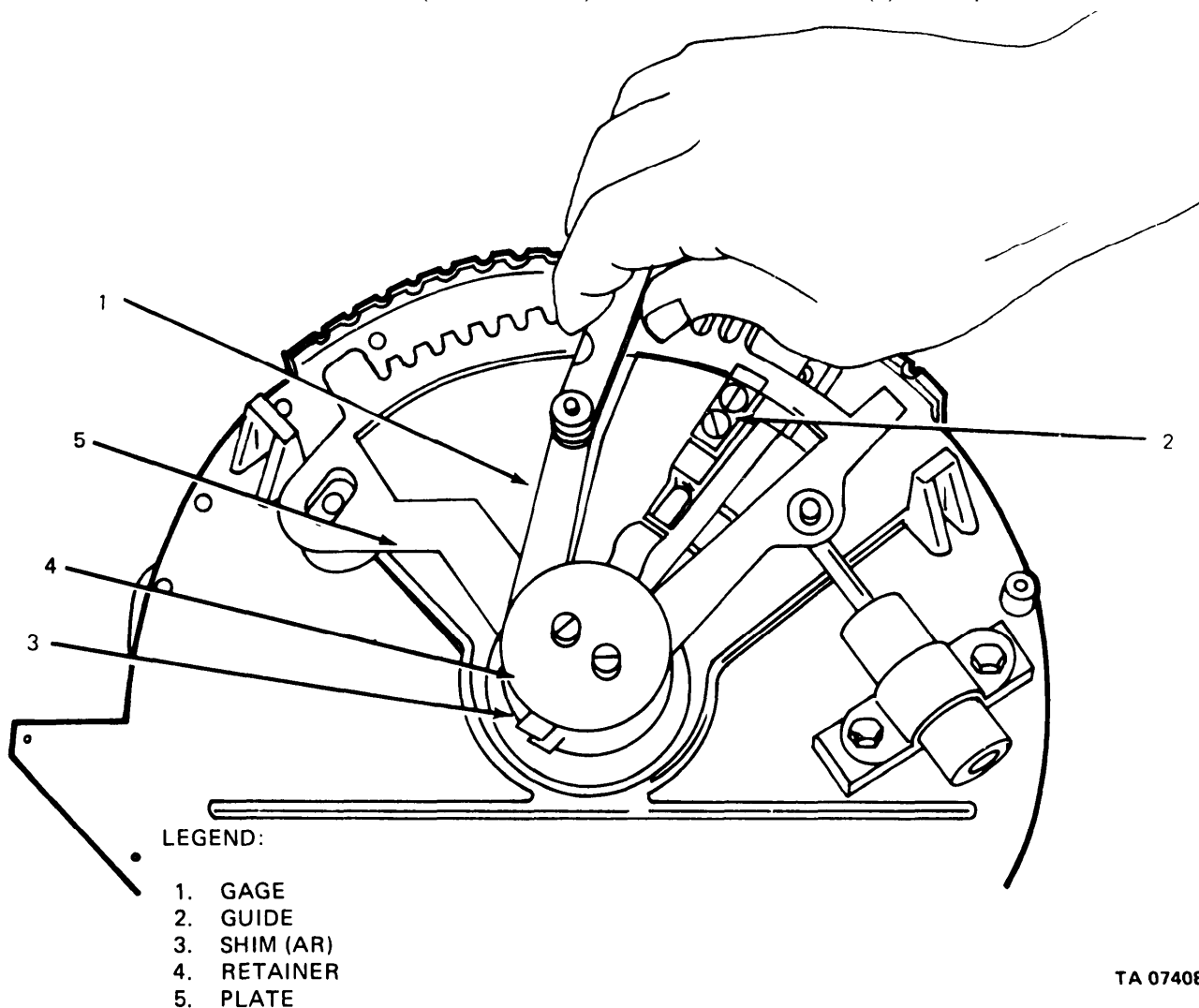
TA 074085

LEGEND:

1. PLATE
2. SNAP RING
3. CLAMP
4. SPRING HOUSING ASSEMBLY
5. SHIM (AR)
6. RETAINER

Figure 7-38. Install Shift Mechanism.

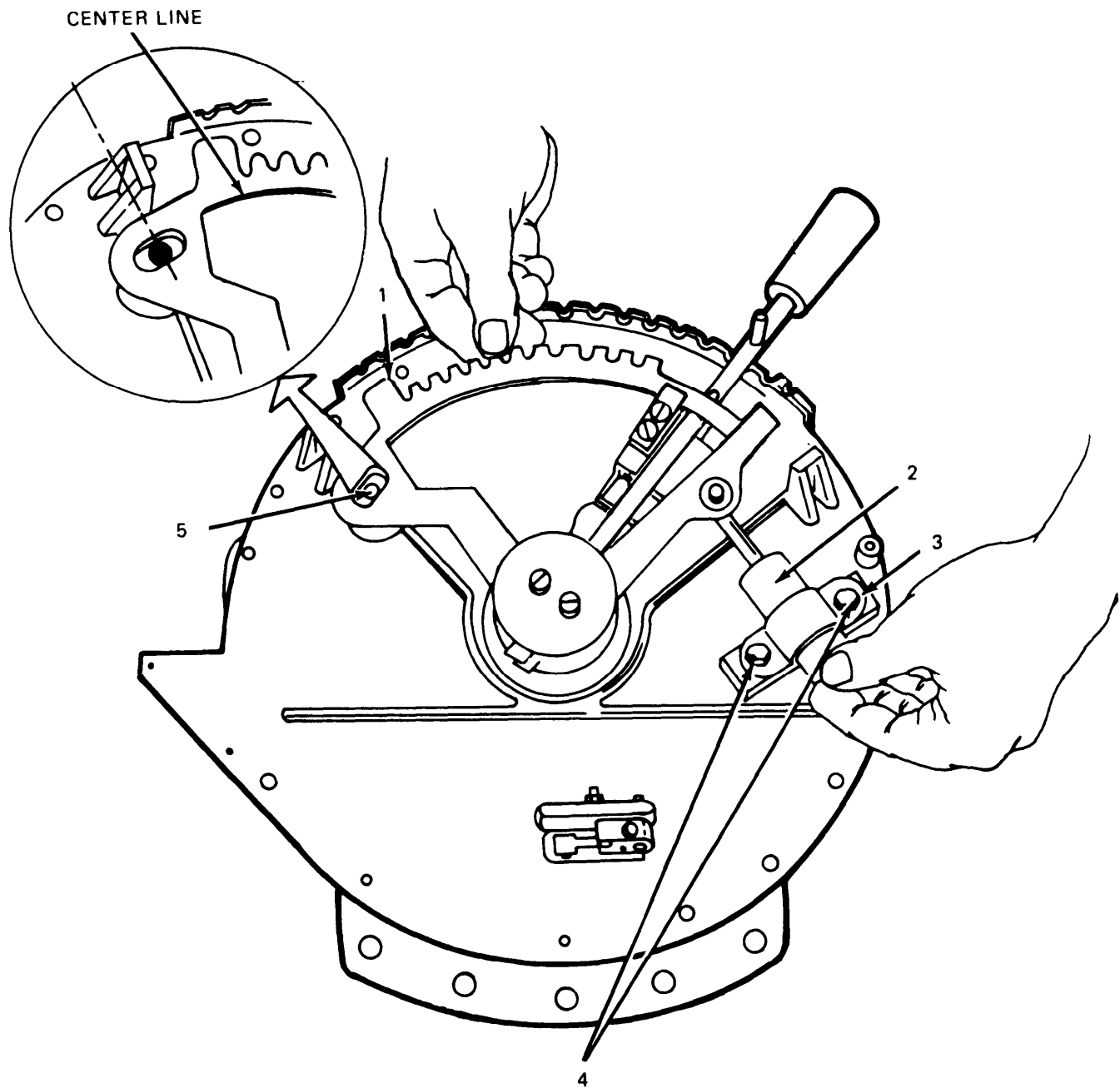
- v. Place spring housing assembly (4) in position on the plate with sleeve bushing. Install snapping (2).
- w. Place clamp (3) in position on the cover. Install two bolts that hold it but do not tighten at this time.
- x. Place shims (5) and retainer (6) in position on the base. Install the two screws that hold them.
- y. Check the clearance between the retainer (4, fig. 7-39) and plate (4) with a thickness gage (1). The clearance must be 0.002-0.005 in (0.05-0.13 mm). Add or remove shims (3) as required.



TA 074086

Figure 7-39. Check Clearance and Install Shift Guide.

- z. Place guide (2) in position and install the two screws that hold it.
- aa. While spring housing assembly (2, fig. 740) is kept free of tension (bolts (4) are loose), place the centerline of the slot in plate (1) in alignment with the, plunger (5).



LEGEND:

1. PLATE
2. SPRING HOUSING ASSEMBLY
3. CLAMP
4. BOLT (2)
5. PLUNGER

TA 074087

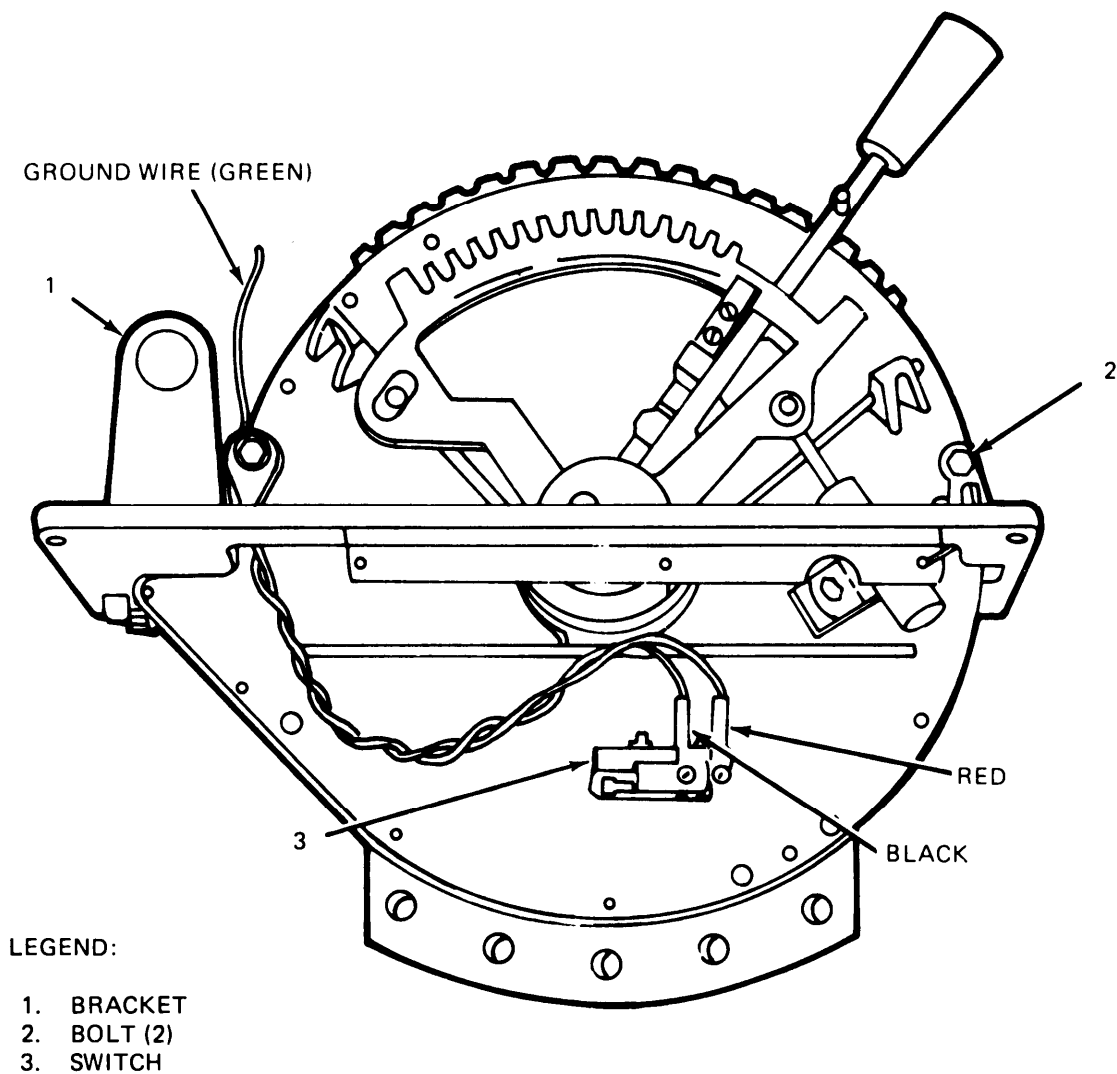
Figure 7-40. Adjust and Lubricate Shift Mechanism.

bb. Tighten bolts (4) that secure clamp (3).

Lubricate the shaft of spring housing assembly (2) and plunger (5) with a light coat of dry lubricant (item 1, App. B).

dd. Place bracket (1, fig. 7-41) in position on the selector. With green ground wire in place, install two bolts (2) and nuts that fasten bracket to selector.

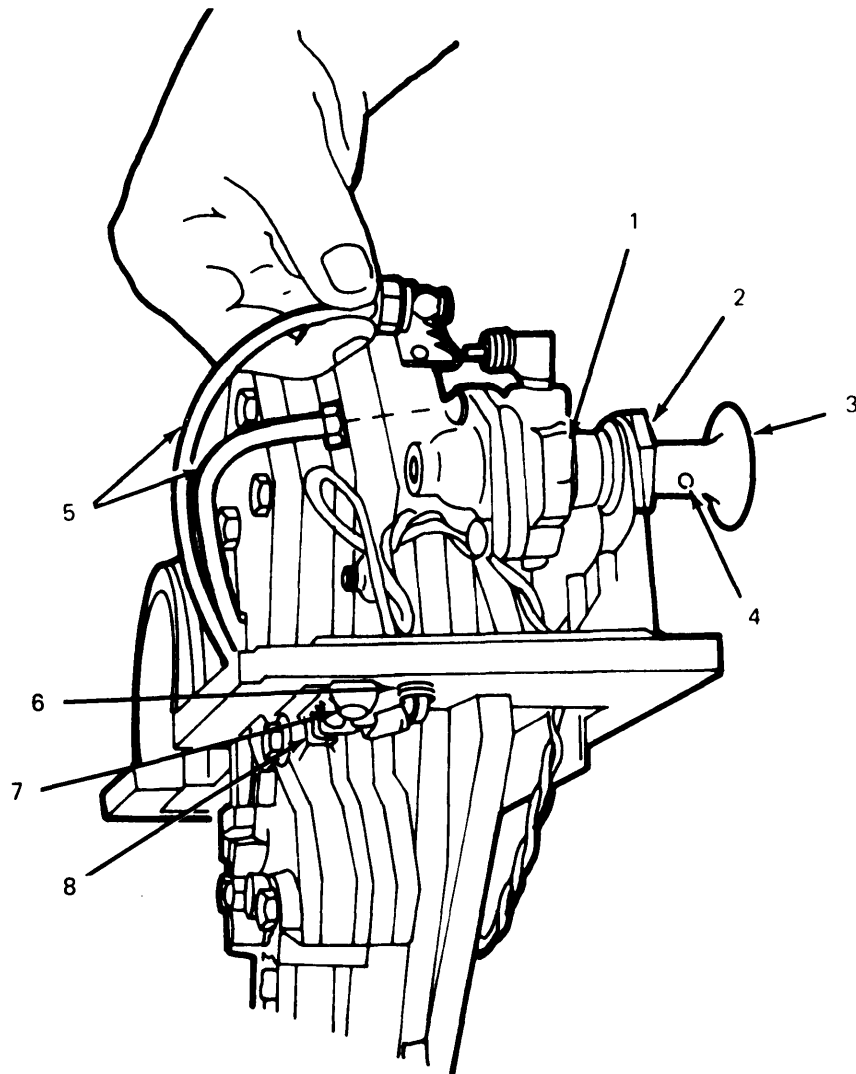
ee. Connect the red and black wires to switch (3).



TA 074058

Figure 7-41. Install Wires and Bracket.

ff. Place valve (1, fig. 7-42) in position on the bracket. Install nut (2) that holds it. Install grommet (6) and terminal strip (8) and secure with two screws (7).



LEGEND:

- | | |
|-----------------|-------------------|
| 1. VALVE | 6. GROMMET |
| 2. NUT | 7. SCREW (2) |
| 3. KNOB | 8. TERMINAL STRIP |
| 4. PIN | |
| 5. AIR LINE (2) | |

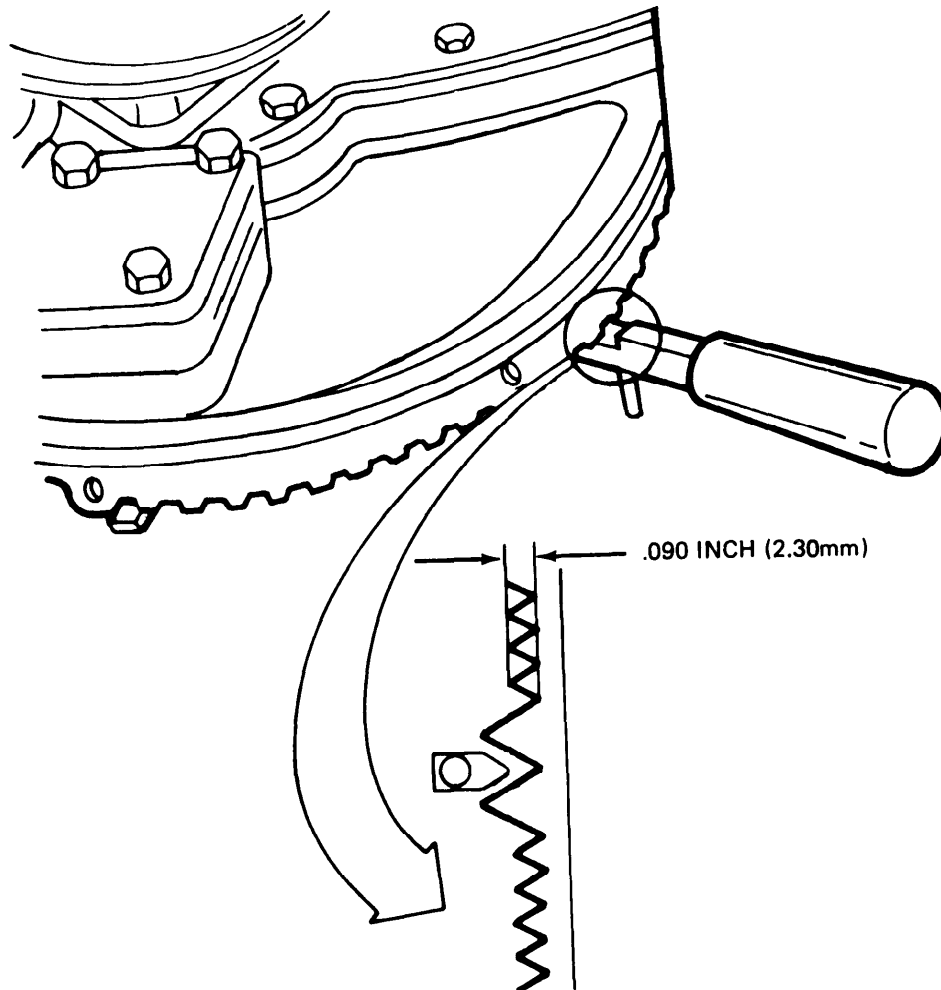
TA 074088

Figure 7-42. Install Air Charging Valve.

gg. Place knob (3) in position on the valve. Install pin (4) to hold it.

hh. Install two tube elbows and air lines (5) on the selector and valve. The air lines are installed correctly if they are not crossed.

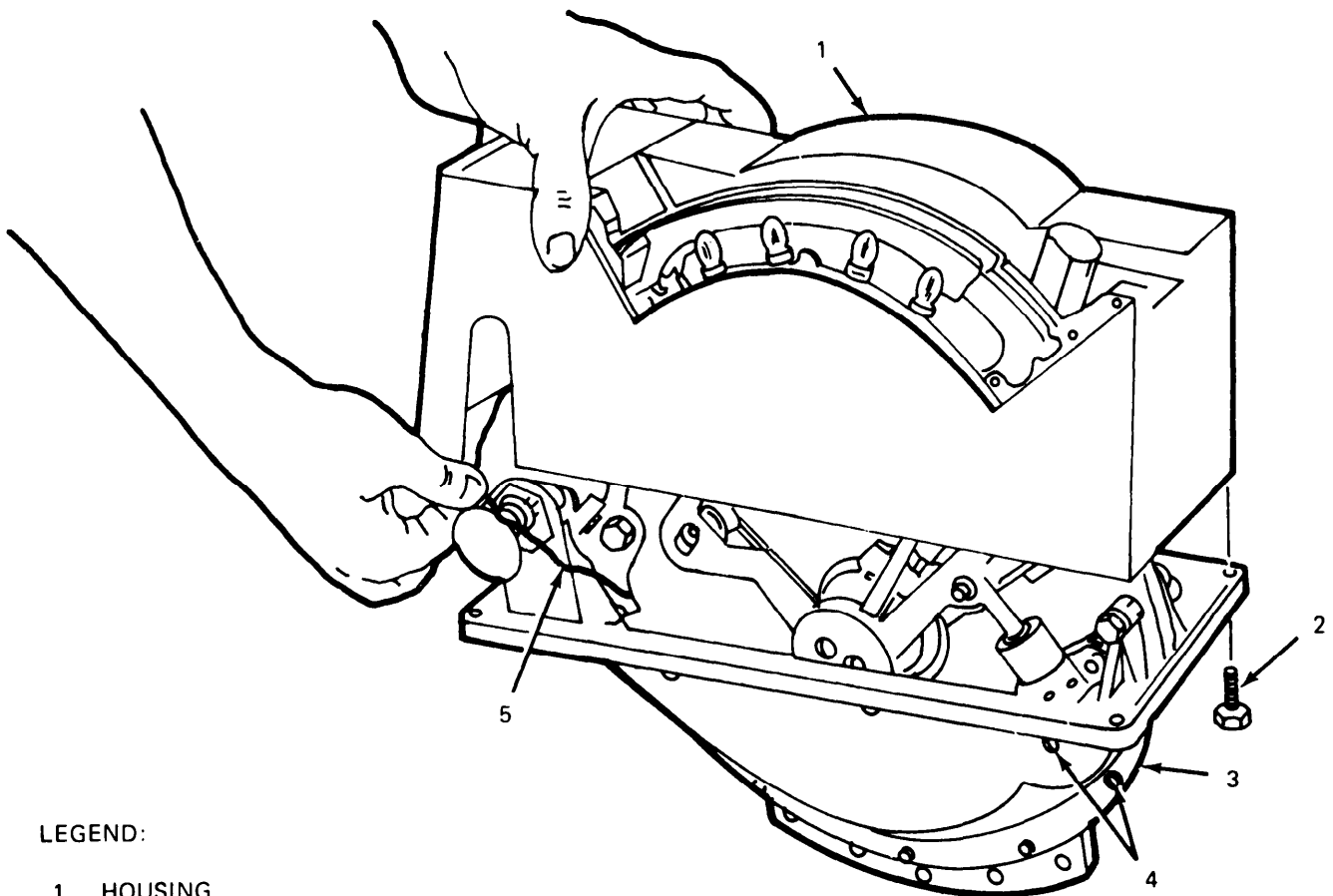
ii. Adjust the plunger, installed in step q, so that the shift starts at 0.090 in. (2.30 mm) movement as the lever is moved into the gate (fig. 7-43).



TA 074089

Figure 743. Adjust Shift Plunger.

jj. Install shield (3, fig. 7-44) and secure to selector with nine screws (4)



LEGEND:

- 1. HOUSING
- 2. SCREW (4)
- 3. SHIELD
- 4. SCREW (9)
- 5. WIRE

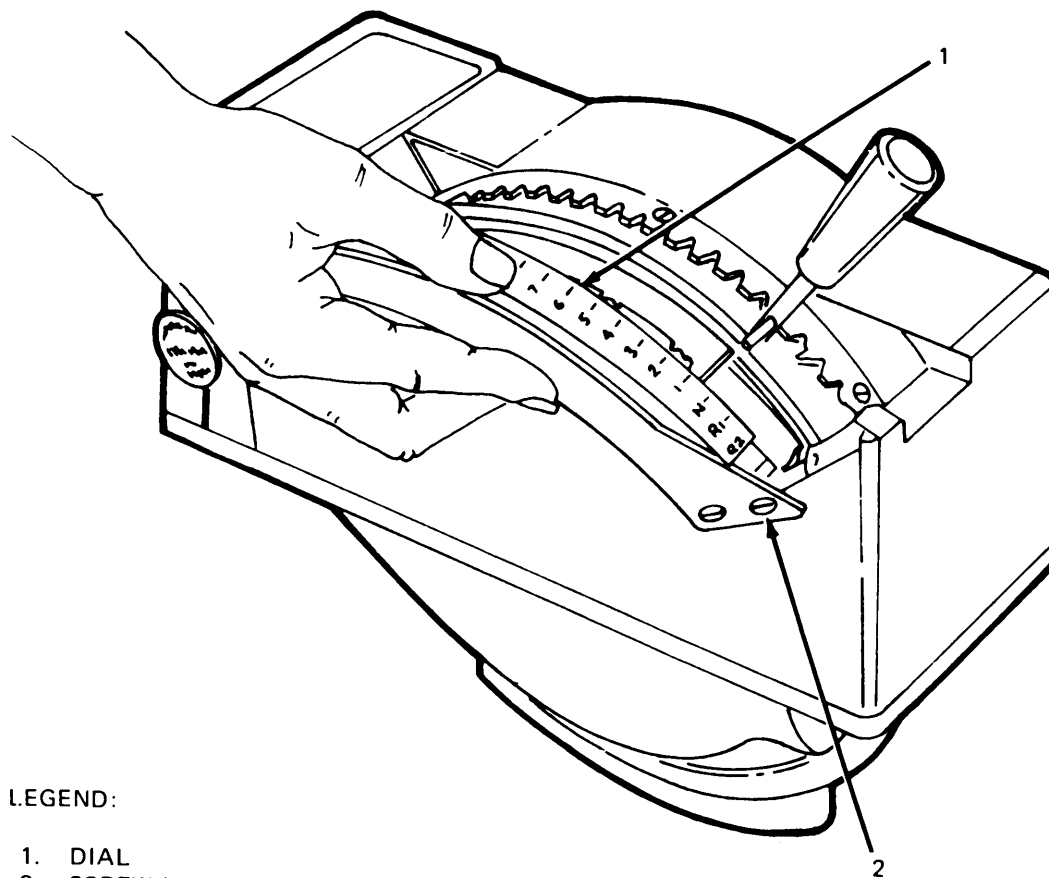
TA 074090

Figure 7-44. Install Shield and Housing.

kk. Insert wire (5) through the hole in the bracket and connect it to the terminal strip (see fig. 7-3 for wiring connections).

//. Install housing (1) and secure to bracket with four screws (2).

mm. Install dial (1, fig. 7-45) and secure to housing with five screws (2).



LEGEND:

- 1. DIAL
- 2. SCREW (5)

TA 074091

Figure 7-45. Install Dial and Cover.

7-6. Installation.

a. Mount ratio selector (fig.7-3) on its mounting bracket, align shift tower brace, and secure with four capscrews and washers. Tighten to $36 \pm \text{lb-ft}$ ($49 \pm 3 \text{ N}\cdot\text{m}$) torque.

CAUTION

In step *b*, make sure that holes in gasket line up with holes in ratio selector.

b. Connect umbilical cord gasket and mounting flange to ratio selector and secure with three cap screws. Tighten to $36 \pm 2 \text{ lb-ft}$ ($49 \pm 3 \text{ N}\cdot\text{m}$) torque.

c. Connect three wires to terminal strip, as shown in illustration.

Section III. TRANSMISSION CASE

7-7. On Vehicle Maintenance. The following components can be maintained with the transmission installed on the vehicle.

- a. Pressure Regulator
- b. Quick-Fill Valve
- c. Oil Pump (pressure test only)
- d. Rear Bearing Support Housing, Bearing, and Seals
- e. Rear Clutch

7-8. Pressure Regulator. The pressure regulator (fig. 7-46) changes the air pressure supplied by the vehicle air system to the correct air pressure needed to engage the output clutch of the transmission.

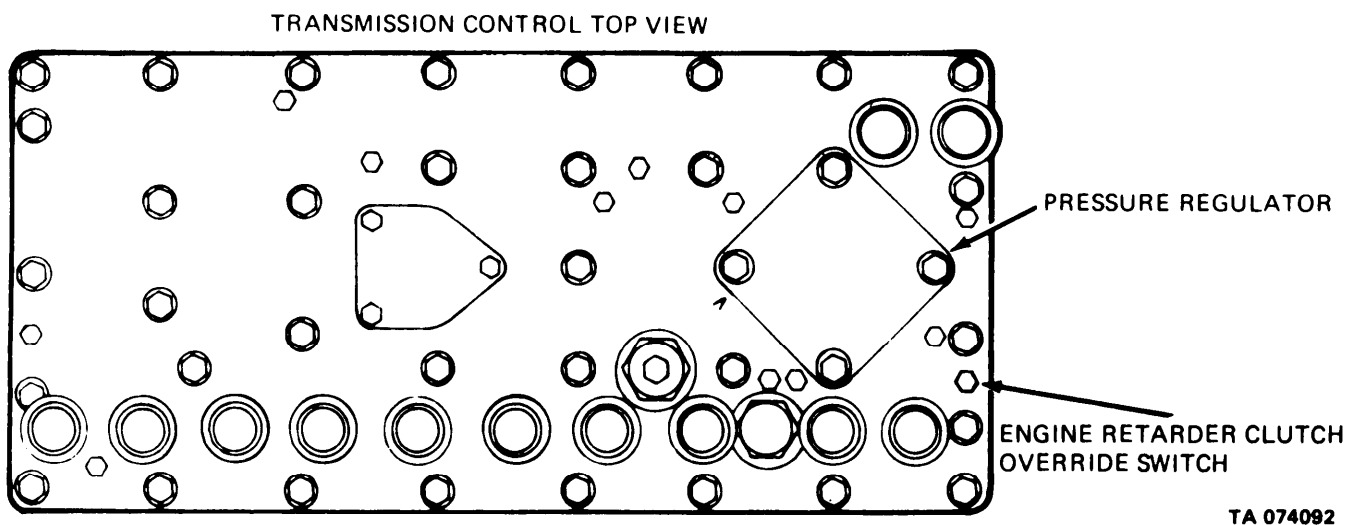


Figure 7-46. Pressure Regulator

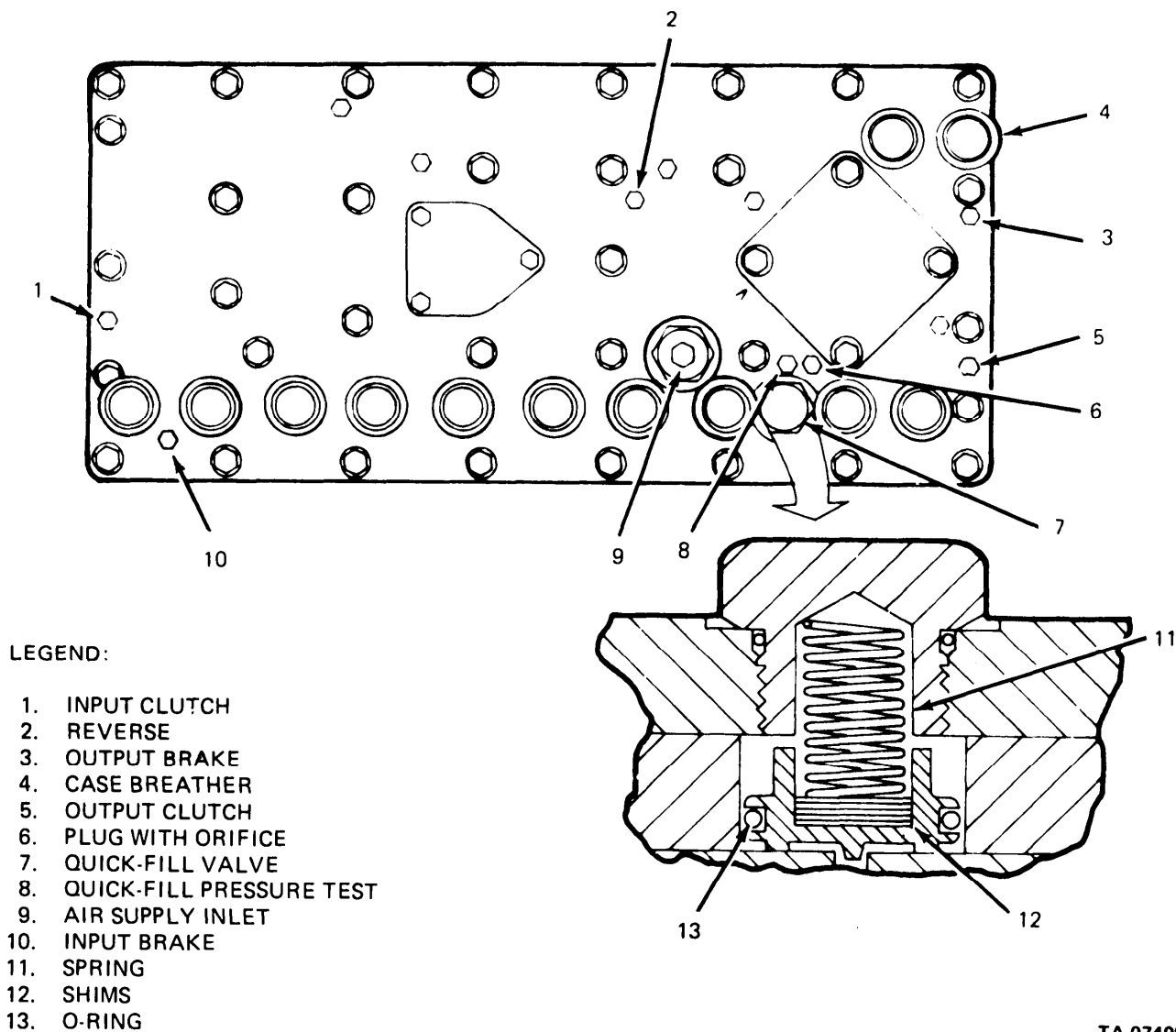
WARNING

Some tests require the ratio selector lever to be moved from the neutral position.

Before any of the transmission operation tests are made disconnect the truck drive shaft from the yoke of the transmission, refer to TM 9-2320-273-20.

a. *Output Clutch Engagement Test and Adjustment.* The four pressure ranges for output clutch engagement are tested as follows:

- (1) Place the transmission charging valve on the ratio selector to the OFF position (knob out),
- (2) Remove engine retarder clutch override switch from test port for output clutch (5, fig. 7-47).



TA 074093

Figure 7-47. Transmission Control Test Points.

(3) Install an air hose with an air pressure gage 0-100 psi (0-690 kPa) and connect in the 1/8-in. NPT hole for test of output clutch (5).

(4) Start and run the engine. When the vehicle air system pressure is normal (120 psi -830 kPa) push in the knob of the air valve on the ratio selector.

(5) Put the system park brake ON to prevent vehicle from rolling.

(6) With the vehicle air system at normal operating pressure, move the selector lever to the 16th speed position. Record the air pressure reading from the test gage. Move the selector lever to the 12th speed position and record the test gage reading. Move the selector lever to the 8th speed position and record the test gage reading. Move the selector lever to the 4th speed position and record the test gage reading. Stop engine and pull out on the knob on the ratio selector.

(7) Compare readings with correct settings shown in table 7-1. If any of the pressure readings are not correct, the pressure regulator must be adjusted.

Table 7-1. Air Pressure to Engage Output Clutch.

SPEEDS	PSI	kPa
13th through 16th	22+5 or -2	150+35 or -14
9th through 12th	40+5 or -2	280+ 35 or -14
5th through 8th	77+5 or -2	530+ 35 or -14
1st through 4th	90+5 or -2	620+ 35 or -14

b. Pressure Regulator Shims. Figure 7-48 shows the location of shims that will require changing if any of the test readings were not correct. Shims come in only two thicknesses, .010 in. (0.25 mm) or .030 in. (0.76 mm). The .010 in (0.25 mm) shim changes pressure setting 1 psi (7 kPa). The .030 in (0.76 mm) shim changes pressure setting 3 psi (20 kPa). Shim locations that control the pressure settings, shown in table 7-1, are as follows:

- (1) Location (6) controls the pressure settings for the 9th thru 12th ratio position.
- (2) Location (9) controls the pressure settings for the 13th thru 16th ratio position.

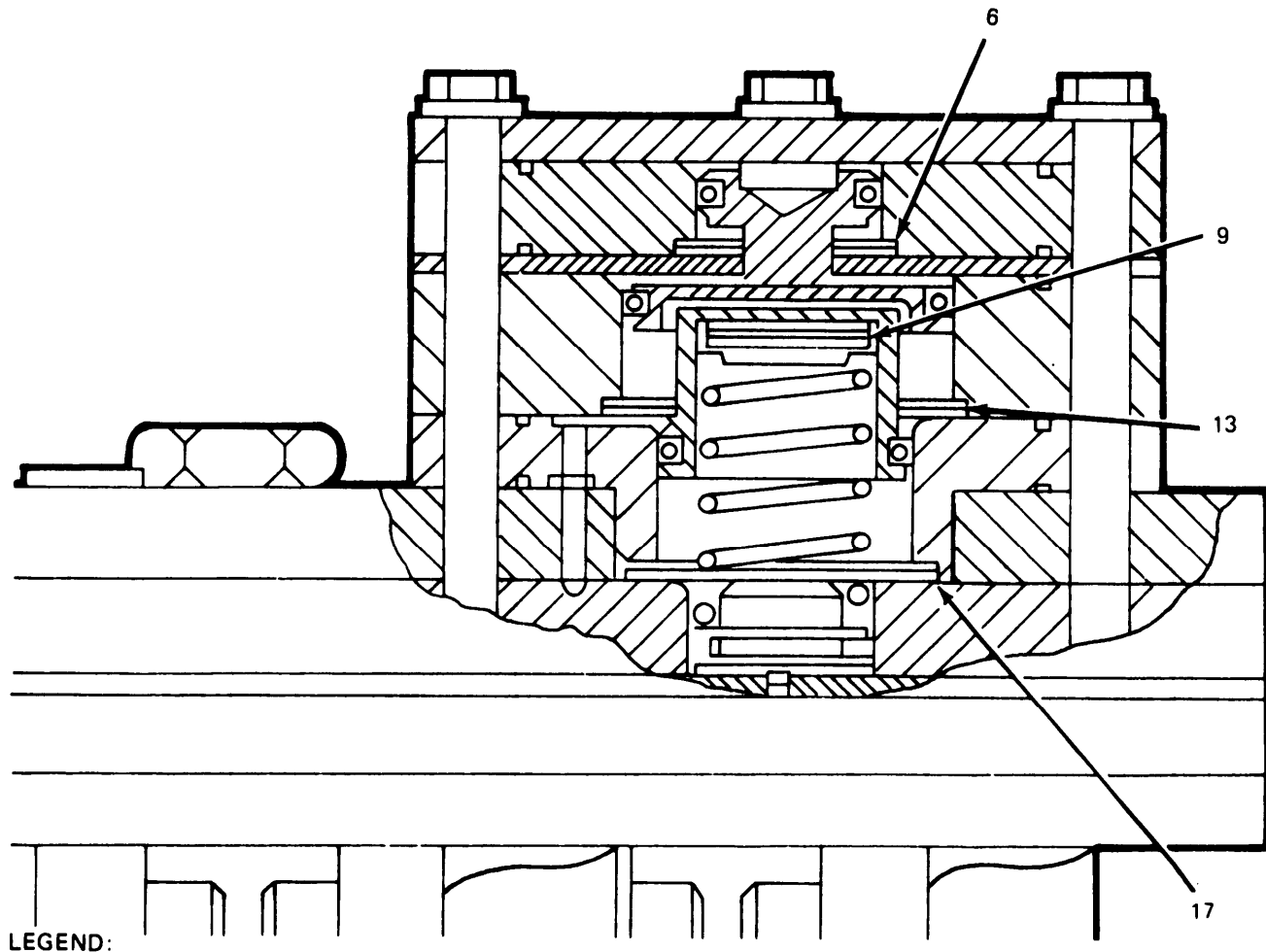
NOTE

These shims also control a uniform increase or decrease in pressure at the four test points.

- (3) Location (13) controls the pressure setting for the 5th thru 8th ratio position.
- (4) Location (17) controls the pressure setting for the 1st thru 4th ratio position.

c. Pressure Regulator Adjustment. Find the thickness of shims required and their location before any removal and disassembly of the pressure regulator is made. Determine shim changes as follows:

(1) If the test pressure readings are either all too high or too low shims (9, fig. 7-48) must be changed. To increase pressure add shims, to decrease pressure remove shims.



LEGEND:

- 6. SHIM
- 9. SHIM
- 13. SHIM
- 17. SHIM

TA 074094

Figure 7-48, Adjust Pressure Regulator Shims,

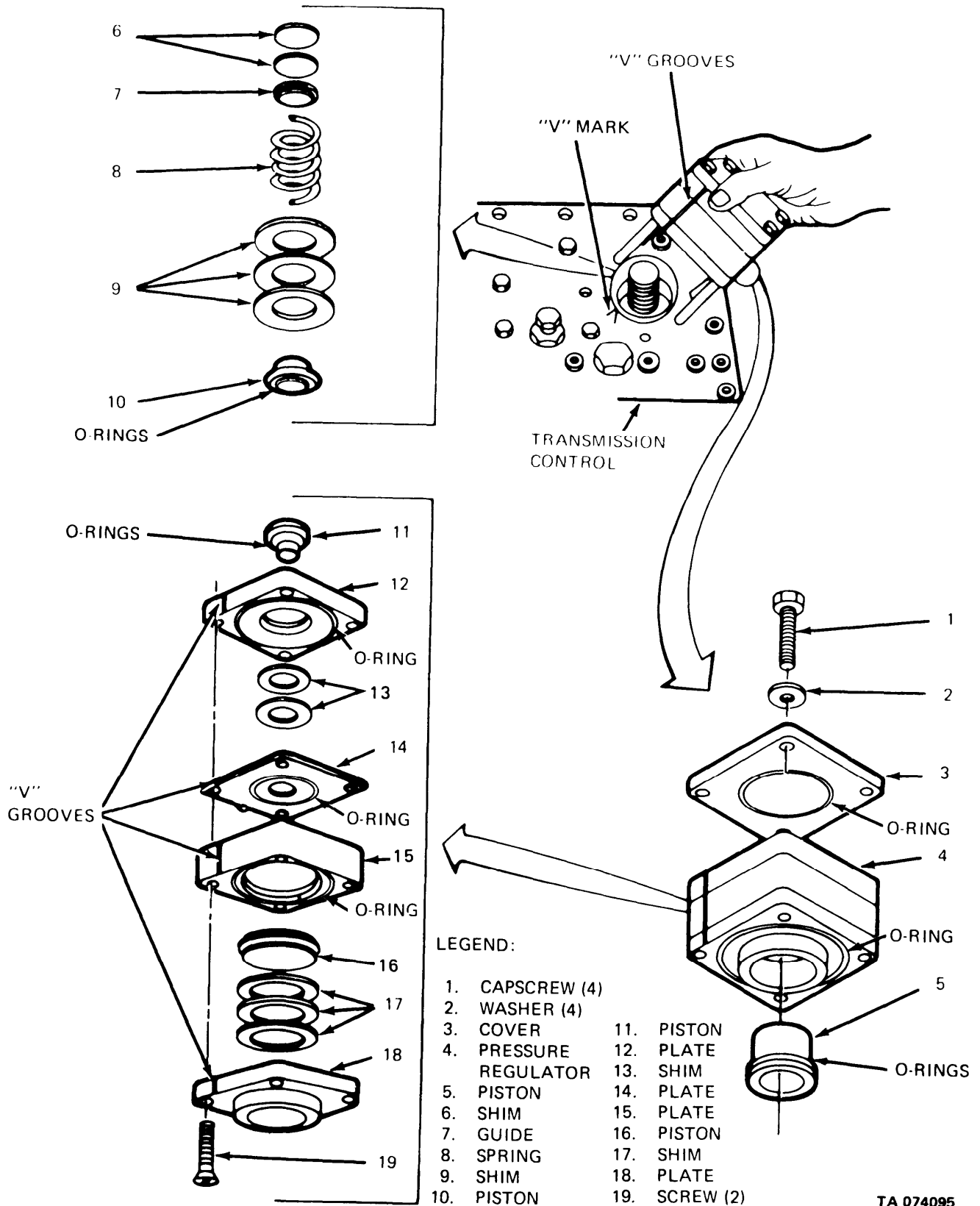
(2) If the low pressure setting is not correct (10th speed, 20-27 psi (140-190 kPa) shims (9) must be changed, however, in this case shims (6), (13), and (17) must also be changed. If a shim (9) is added to increase pressure the same thickness shim (6), (13) and (17) must be removed. If a shim (9) is removed to decrease pressure the same thickness shims (6), (13), and (17) must be added.

(3) If the 12th speed test pressure is not correct (38-45 psi (260-310 kPa) it is only necessary to change shims (6). Remove shims to decrease pressure or add shims to increase pressure.

(4) If the 8th speed test pressure is not correct (75-82 psi (520-750 kPa) it is only necessary to change shims (13). Remove shims to increase pressure or add shims to decrease pressure.

(5) If the 4th speed test pressure is not correct (88-95 psi (610-660 kPa) it is only necessary to change shims (17). Remove shims to increase pressure or add shims to decrease pressure.

(6) After correct shim requirement has been determined, remove and disassemble the pressure regulator (fig. 7-49) only to the point that is required to make the necessary shim change.



TA 074095

Figure 7-49. Remove Pressure Regulator.

d. Removal and Disassembly.

NOTE

The number of shims, shown in figures 7-48 and 7-49 (6), (9), (13), and (17) will vary from transmission-to-transmission. The quantity shown in the figures are for illustration purposes only,

(1) Maintain hand pressure down on the pressure regulator and remove the four mounting capscrews (1, fig. 7-49) and washers (2).



When removing the pressure regulator in step (2), shims (6) and (9), guide (7), spring (8), and piston (10) will remain in the control group cavity as shown in illustration. Take care that these parts do not fall out and become lost.

(2) Lift off assembled pressure regulator (4),

NOTE

At this point changes can be made to shims (6) and (9).

(3) If further disassembly is required remove two screws (19) from pressure regulator (4) and separate the assembly to gain access to shims (13) and (17).

e. Assembly and Installation.

NOTE

Be sure the "V" grooves in plates (12, fig. 7-49), (14), (15), and (18) are aligned during assembly.

(1) Assemble pressure regulator (4) if disassembled, with thickness of shims as determined in paragraphs 7-8a and 7-8b, with new O-ring seals. Assemble to center plate (15) the following parts: plate (14), shims (13). upper plate (12), piston (16), shims (17), and lower plate (18). Secure with two screws (19).

(2) Install O-ring seals on pistons (5) and (11) and install pistons in pressure regulator (4).

(3) *Install* O-ring seal on piston (10).

(4) *Install shims* (9), piston (10), spring (8), guide (7), and shims (6) in transmission control cavity.

(5) Install assembled pressure regulator (4) on transmission control, making sure the notches on the valve are aligned with the "V" marked stamped on the transmission control as shown in illustration.

(6) Install cover (3) with a new O-ring and fasten with four washers (2) and capscrews (1).

f. Test Results of Adjustment.

(1) Start and operate the engine. (Refer to TM 9-2320-273-10).

(2) When the vehicle air system pressure is normal, push in the handle of the air valve in the ratio selector and test the adjustments made to the pressure regulator by repeating paragraph 7-8a.

(3) When the pressure regulator adjustments are correct pull the knob of the transmission air charging valve in the ratio selector to OFF, Remove the test hose and gage; then install clutch disengagement sensor in test port for output clutch (5, fig. 7-47).

7-9. Quick-Fill Valve. The quick-fill valve for output clutch engagement is in operation only when the air pressure to the output clutch is less than 5-7 psi (35-50 kPa), The quick-fill valve can be tested and an adjustment made on the quick-fill valve when the air pressure is not 5-7 psi (35-50 kPa).

a. Test.

(1) Pull the knob of the transmission air charging valve in the ratio selector to the OFF position.

(2) put system park brake ON to prevent vehicle from rolling.

(3) Remove plug (6, fig. 7-50) and clutch disengagement sensor in test port for output clutch (5). Remove orifice in port where plug (6) was removed and install a standard plug (1/16-in. NPT) where the orifice was removed.

(4) Install an air hose with a low pressure test gage 10-15 psi (70-106 kPa) range in port for output clutch (5) (1/8-in, NPT).

(5) Start and run the engine. (Refer to TM 9-2320-273-10). When the vehicle air system pressure is at normal operating pressure, push the knob of the transmission air charging valve on the ratio selector to the ON position,

(6) Move the ratio selector lever to the 16th speed position. Record pressure on test gage. If the pressure is not 5-7 psi (35-50 kPa) the quick-fill valve must be adjusted.

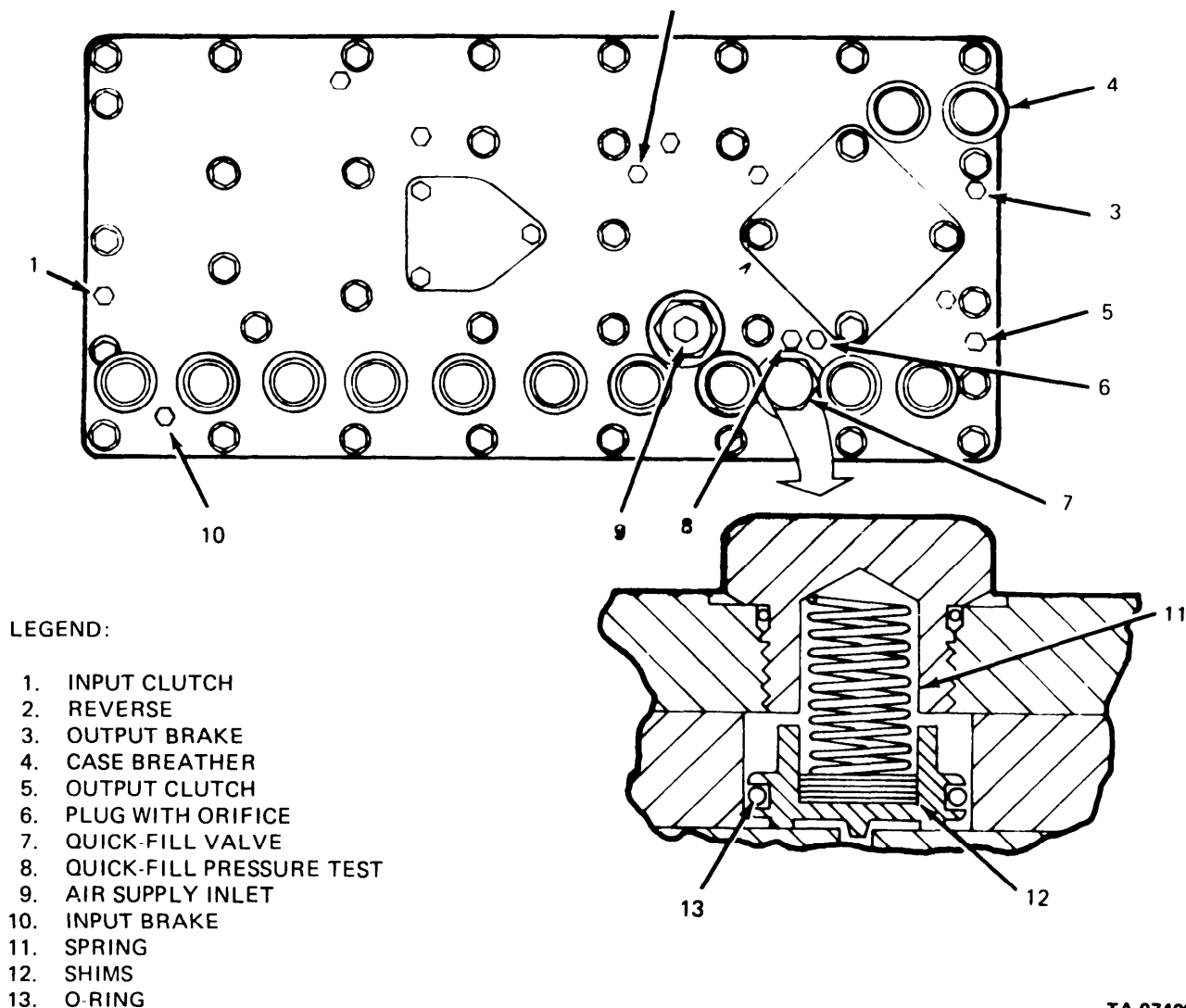
b. Adjustment. Adjustment is accomplished by adding or removing shims (12, fig. 7-50). The effects of a shim change are shown in table 7-2.

Table 7-2. Pressure Change With Removal Or Addition Of One Shim

Shim	Thickness		Change	
Item No.	in.	mm	psi	kPa
12, Figure 7-50	.030	0.76	.25	1.8

(1) Pull the knob on the transmission air charging valve in the ratio selector to the OFF position.

(2) Remove plug in quick-fill valve (7, fig. 7-50).



TA 074093

Figure 7-50. Transmission Control Test points.

(3) Remove spring (11). Add shims (12) to increase or remove shims (12) to decrease pressure; then reinstall plug in quick-fill valve (7).

(4) Push the knob on the transmission air charging valve in the ratio selector to the ON position.

(5) Put the lever for the ratio selector in the 16th speed position to test the quick-fill valve pressure after the adjustment has been made.

(6) When the quick-fill valve pressure is correct, pull the knob on the transmission air charging valve in the ratio selector to the OFF position.

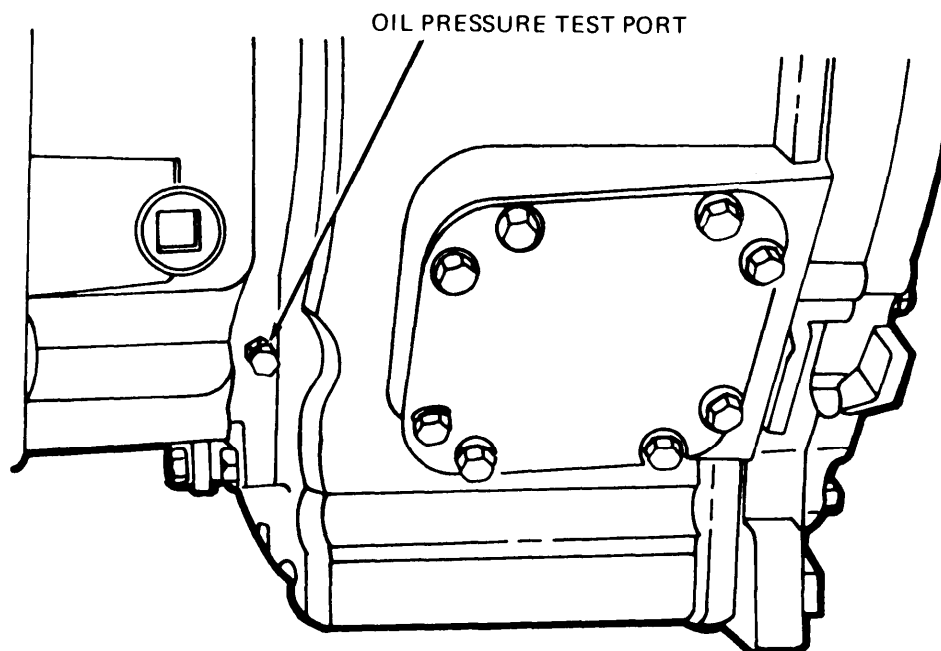
(7) Remove plug (6), then remove the 1/16 NPT plug installed in the orifice. Reinstall orifice and plug (6).

(8) Remove the hose and test gage and install clutch disengagement sensor in test port for output clutch (5).

7-10. Oil Pump. On-vehicle maintenance of the oil pump is limited to pressure testing. The pressure of a new oil pump should be a minimum of 5 psi (35 kPa) at low idle (600 rpm) and 40 psi (280 kPa) at 2000 rpm engine speed. To test proceed as follows :

a. Preparation.

- (1) put system park brake ON to prevent the vehicle from rolling.
- (2) Remove plug in oil pressure test port from left side of transmission case (fig. 7-51).



TA 074096

Figure 7-51. Test Oil Pump Pressure.

- (3) Install 1/8-in. NPT fitting with a pressure gage.

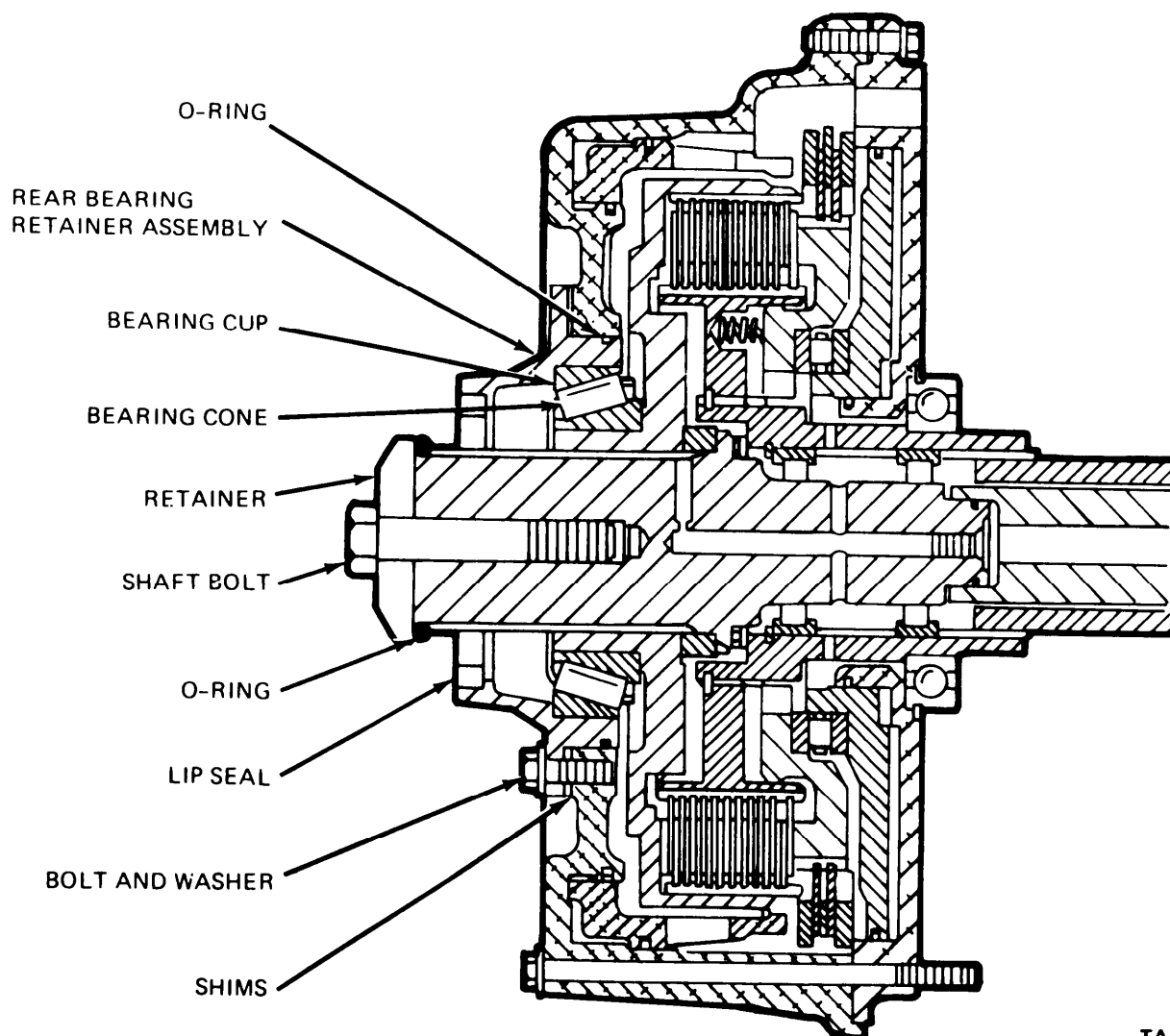
b. Test.

- (1) With system air pressure at normal operating pressure, push in the knob on the transmission air charging valve on ratio selector.
- (2) Place transmission gear selector lever in neutral.
- (3) Start up and operate engine. (Refer to TM 9-2320-273-1 O).
- (4) Run engine for approximately 10 minutes. This will warm up the transmission oil to approximately 100°F (38°C).
- (5) Check oil pressure at 600 rpm – should be a minimum of 5 psi (35 kPa).
- (6) Check oil pressure at 2000 rpm – should be approximately 40 psi (280 kPa).

NOTE

If pressure indications are not as specified, drain transmission oil, clean screen, and replace with new oil of correct viscosity, (refer to LO 9-2320-273-12). Repeat test. If oil pump must be replaced, transmission case must be disassembled as described in paragraph 7-17.

7-11. Rear Bearing Support Housing, Bearing, and Seals. Oil leakage from the rear bearing support housing may be caused by defective seals in the housing (fig. 7-52). To replace, proceed as follows:



TA 074097

Figure 7-52. Rear Bearing Support Housing.

a. *Removal.*

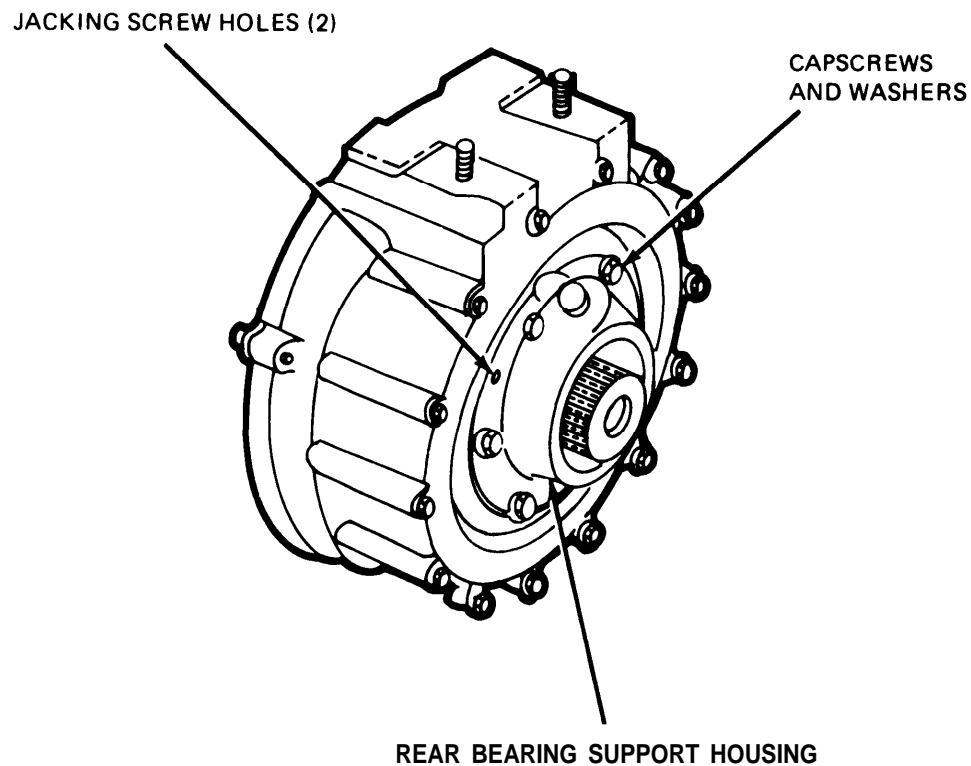
(1) Disconnect propeller shaft at transmission yoke; then remove the yoke. (Refer to TM 9-2320-273 -20.)

(2) Disconnect speedometer cable, refer to TM 9-2320-273-20.



Steps 3 and 4 must be accomplished as described; otherwise transmission disassembly will be necessary.

(3) *Remove any two capscrews and washers (180° apart) that fasten rear bearing support housing to transmission case (fig. 7-53).*



TA 074098

Figure 7-53. Remove Rear Bearing Support Housing.

(4) Thread a 6-in. long rod (3/8-16 NC bar stock) into each of the removed capscrew holes. Use minimum torque. Leave both rods installed for support housing installation.

(5) Remove four remaining capscrews in support housing.

(6) Insert two capscrews into the two jacking screw holes and force off the support housing with attached O-ring and lip seals. Leave shims in place (unless damaged) for installation.

(7) Remove O-ring seal.

(8) Remove lip seal.

(9) Remove bearing cup and bearing cone if damaged or worn.

b. Installation.

(1) Cool bearing cup and press into support housing, if removed.

(2) Install lip seal into support housing.

(3) Install bearing cone.

(4) Install O-ring seal.

(5) Install assembled support housing onto the transmission.

(6) Install four capscrews and washers that fasten the support housing to the transmission case and tighten to 55 ± 5 lb-ft (75 ± 7 N•m) torque.

(7) Remove rod and install two capscrews and washers. Tighten 55 ± 5 lb-ft ($75 \pm$ N•m) torque.

(8) Install speedometer cable, refer to TM 9-2320-273-20.

(9) Lubricate seal with silicone grease, refer to item 22, appendix B, and install yoke and connect propeller shaft. (Refer to TM 9-2320-273-20.)

7-12. Transmission Case Removal. To remove transmission, follow procedures in para 2-1 la.

7-13. Off-Vehicle Repairs. After the transmission has been removed from the vehicle, the following maintenance may be performed without disassembling the case.

a. Front O-ring seal replacement (no detailed procedure is required for this task).

b. Seal leakage tests for clutches and brakes, para 7-14.

c. PTO and adapter backlash check, para 21-12 thru 21-15.

7-14. Seal Leakage Tests for Clutches and Brakes. These tests must be performed with the transmission control removed. (Refer to para 7-17c, steps 1, 2, and 3.)

a. *Preparation.* The air passage holes in the transmission case to the clutches and brakes do not have screw threads. It is necessary to make pressure test blocks and gaskets that can be installed on the transmission case to make the test.

(1) The following items are needed for the tests:

(a) External air supply with approximately 100 psi (690 kpa).

(b) Pressure gage for approximately 125 psi (860 kPa), a 1/4-in. pipe tee, a 1/4-in. pipe – connection, a 1/4-in. pipe shutoff valve (fig. 7-54).

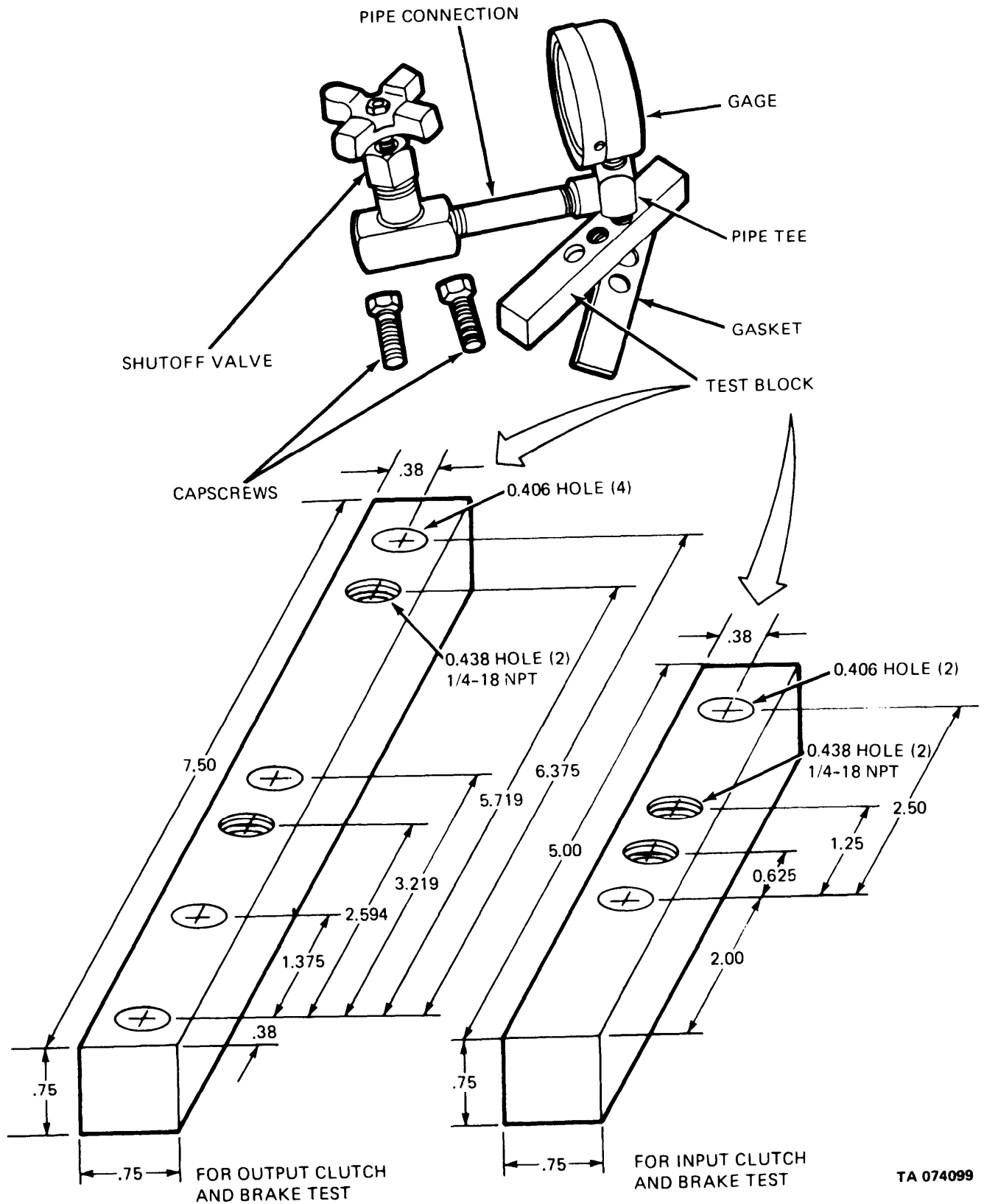


Figure 7-54. Prepare Test Set and Fabricate Test Blocks.

(c) Timer (stopwatch).

(2} Using 3/8-16 bolts, 1-1/4 in. (31.75 mm) long, install test setup over air hole for the input clutch (figs. 7-55 and 7-56).

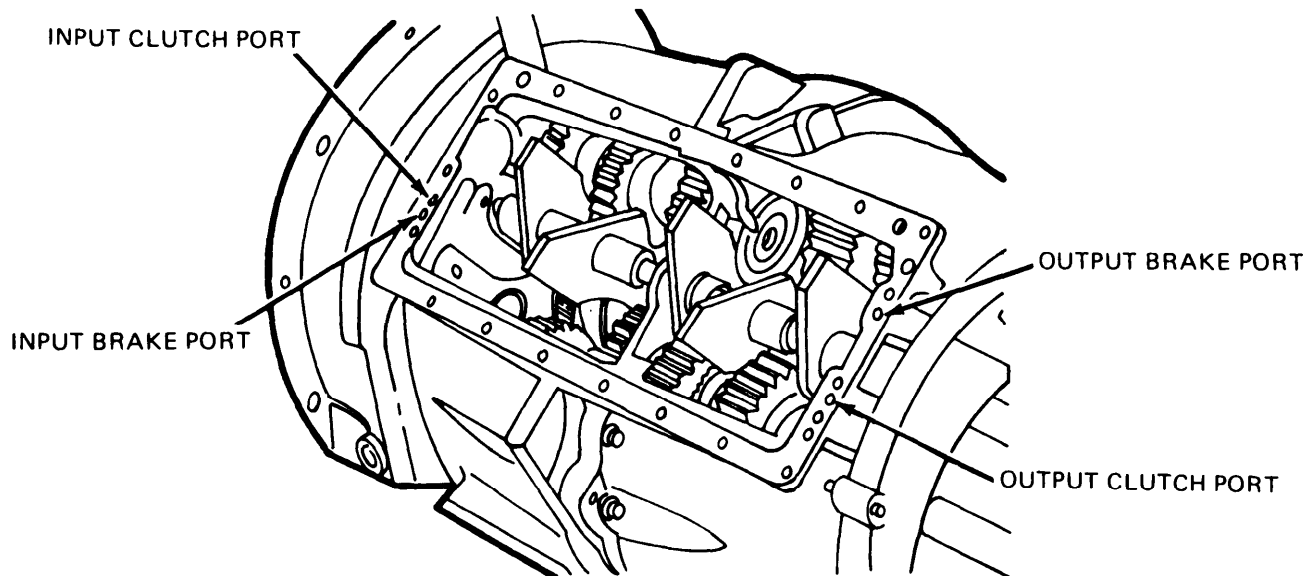


Figure 7-55. Leakage Test Air Ports.

TA 074100

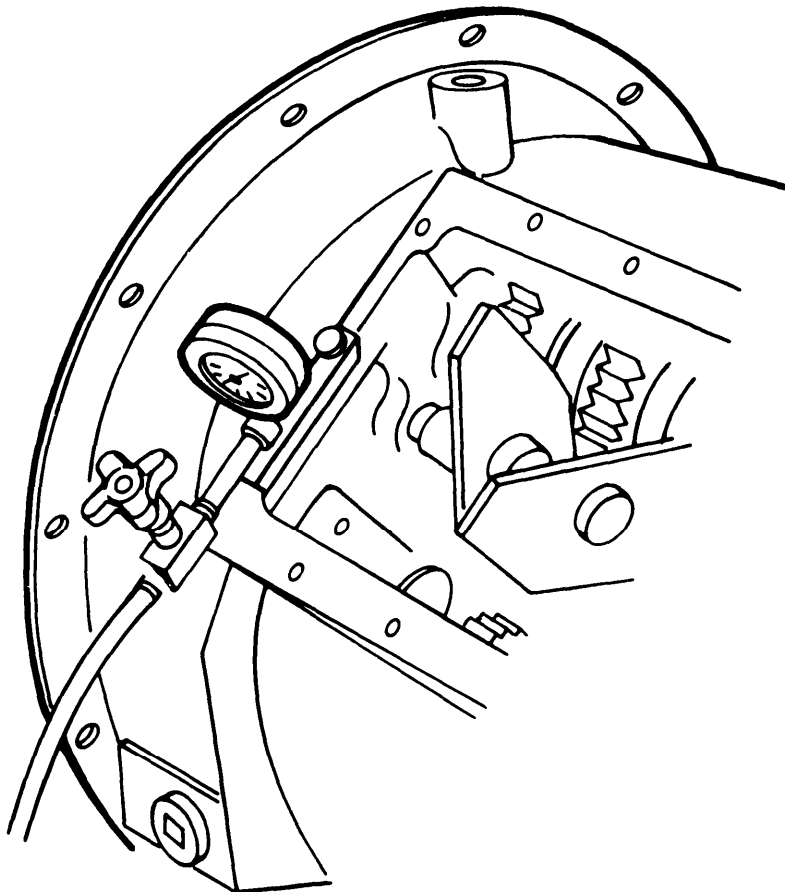


Figure 7-56. Test Input Clutch Seals.

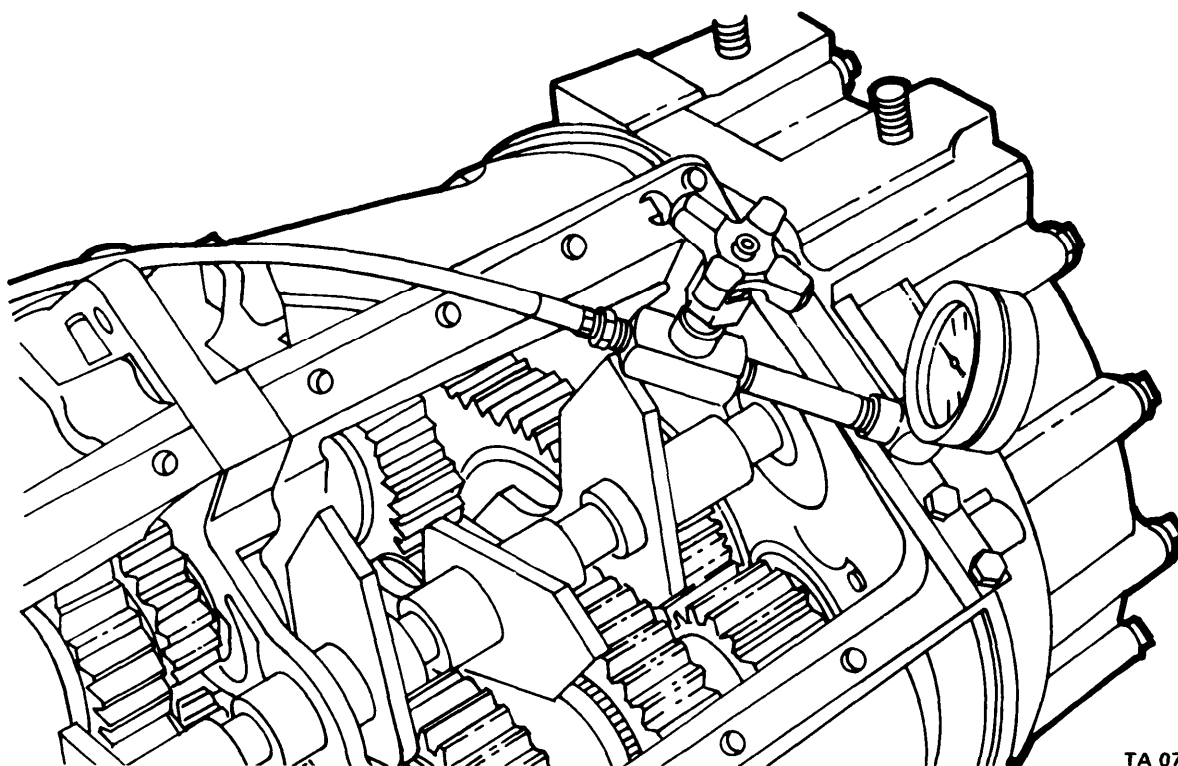
TA 074101

b. Input Clutch and Brake Seal Test.

- (1) Put air pressure through test line until indication on test gage is 90-100 psi (620-690 kPa).
- (2) After 10 seconds, close shutoff valve and start the timer.
- (3) If the pressure decrease is not more than 5 psi (35 kPa) in 11 seconds, the input clutch seals are good. Repeat test three times. If satisfactory, remove air pressure fitting from input clutch port and continue with test.
- (4) Install test setup over air hole for input brake (fig. 7-55).
- (5) Put air pressure through test line until the indication on the test gage is 90-100 psi (620-690 kPa).
- (6) After 10 seconds, close shutoff valve and start the timer, If the pressure decrease is not more than 5 psi (35 kPa) in 3 seconds, the input brake seals are good. Repeat test three times. If satisfactory, remove test setup and continue with test.

c. Output Clutch and Brake Seal Test.

- (7) Install test setup (with long test block) over air hole for the output clutch (fig. 7-55 and 7-57).



TA 074102

Figure 7-57. Test Output Clutch Seals.

- (2) Put air pressure through test line until the indication on test gage is 90-100 psi (620-690 kPa).
- (3) After 10 seconds, close shutoff valve and start the timer.

(4) If the pressure decrease is not more than 5 psi (35 kPa) in 15 seconds the output clutch seals are good. Repeat test three times. If satisfactory, remove test setup and continue with test.

(5) Install test setup over air hole for output brake (fig. 7-55).

(6) Put air pressure through test line until the indication on the test gage is 90-100 psi (620-690 kPa).

(7) After 10 seconds, close shutoff valve and start the timer.

(8) If the pressure decrease is not more than 5 psi (35 kPa) in 5 seconds, the output brake seals are good. Repeat test three times.

7-15. Power Takeoff and Adapter. When the power takeoff is installed on the transmission (M916 through M920), the gear on the adapter assembly must have tooth clearance. (Refer to para 21-12 thru 21-15).

7-16. Flywheel. The procedures for checking the flywheel are given in TM 9-2815-222-34 & P.

7-17. Disassembly.

a. Tool and Equipment Required. The following tools and equipment are required for disassembly of the transmission case, gears, and clutches.

(1) *Tools.*

(a) 5P8693 Lifting Bracket

(b) FT901 Bracket (2)

(2) *Equipment.*

(a) Hoist (1200 lb minimum capacity)

(b) Nylon rope (1/2-in. diameter)

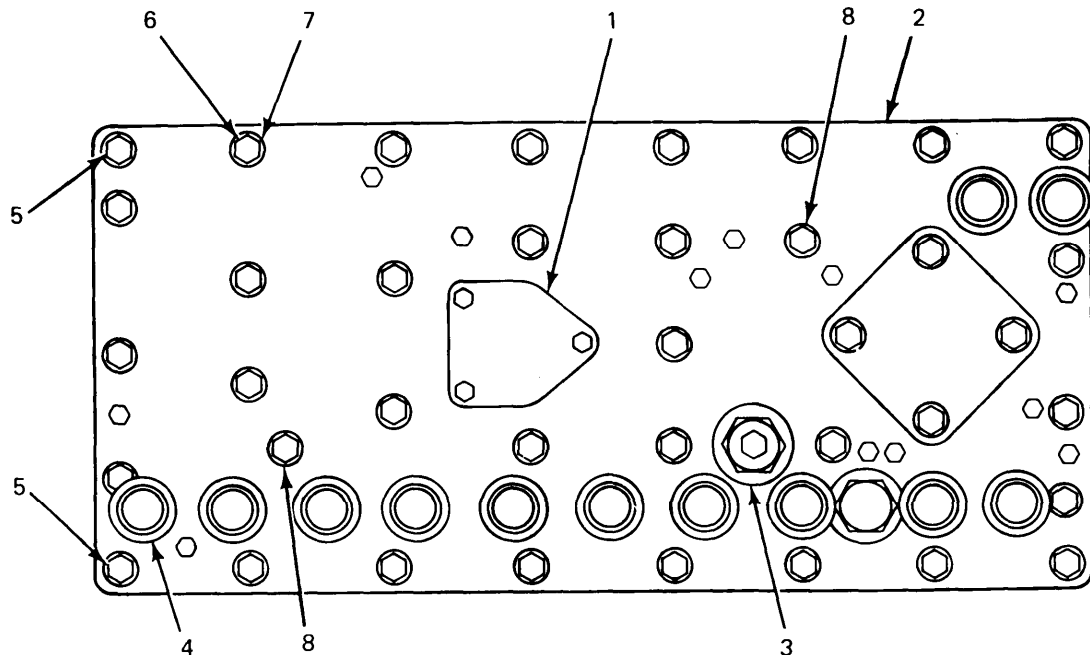
(c) plate, control air ports

(d) plug, air port

b. Preparation.

(1) Drain the oil from the transmission.

(2) Install a plate (1, fig. 7-58) over the ports for umbilical cord mounting flange and a plug (3) in the air source port,



LEGEND:

- | | |
|-------------------------|----------------|
| 1. PLATE | 5. BOLT (2) |
| 2. TRANSMISSION CONTROL | 6. BOLT (20) |
| 3. PLUG | 7. WASHER (20) |
| 4. BREATHER (12) | 8. BOLT (2) |

TA 239530 ■

Figure 7-58, Remove Transmission Control.

(3) Thoroughly clean the outside of the transmission.

c. Remove and Disassemble Transmission Control.

(1) If required, remove twelve breathers (4) (Refer to TM 9-2320-273-20).

(2) Remove twenty bolts (6) and washers (7) from around the outside of the transmission control. (It is not necessary to remove bolts (5).)

(3) Remove two bolts (8) install two eye bolts. Using a suitable lifting device remove transmission control (2) and the gasket.

(4) Remove and disassemble pressure regulator. (Refer to para 7.8d,) Note location, number and thickness of shims,

d. *Remove and Disassemble Rear Clutch and Brake.*

(1) Remove center bolt (7, fig. 7-59), retainer (5) and seal. Using a suitable puller, remove yoke (6) from shaft.

(2) Install two brackets (FT-901)(1). Fasten a suitable hoist to the brackets (1) and take up slack.

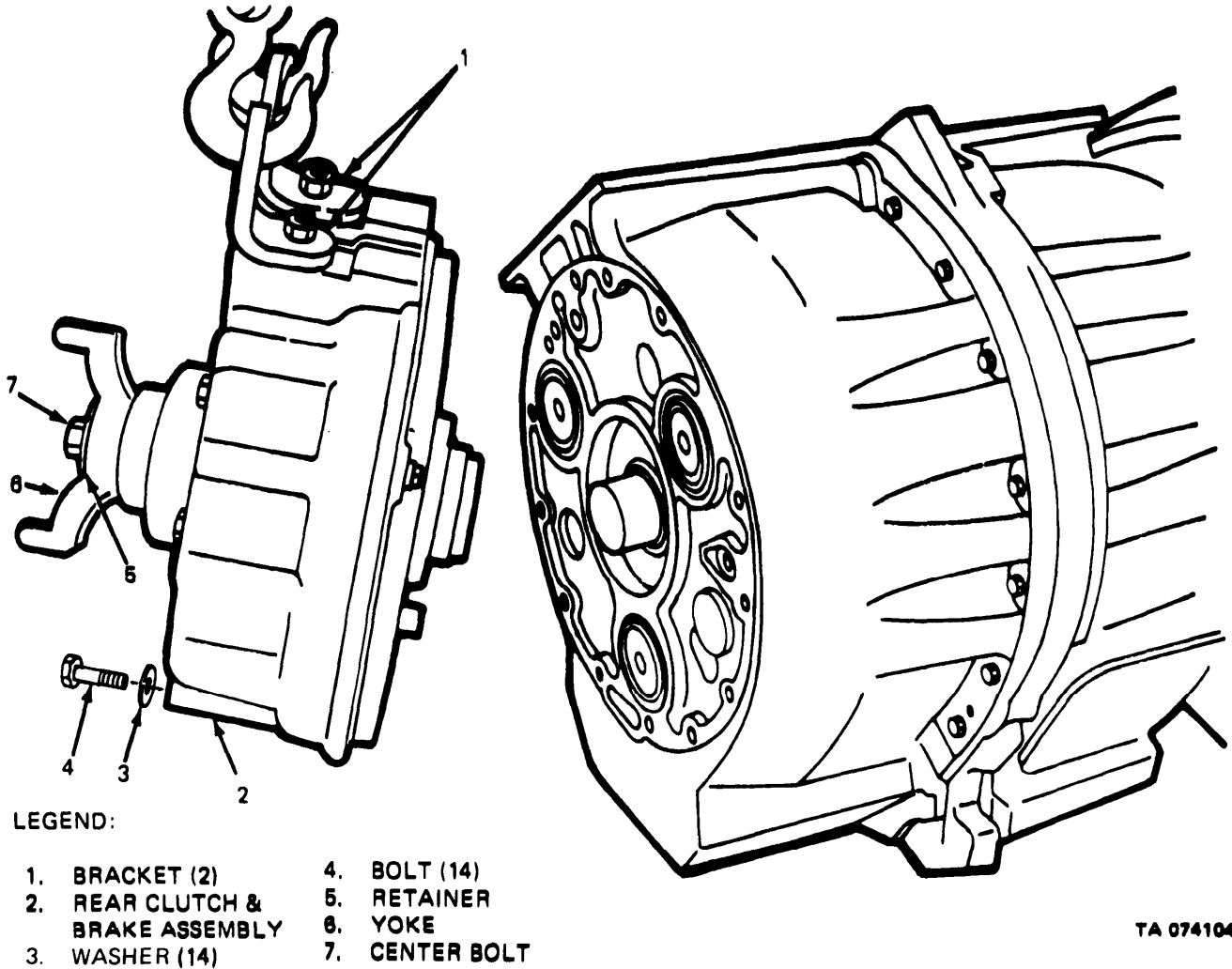


Figure 7-59. Remove Rear Clutch and Brake.

NOTE

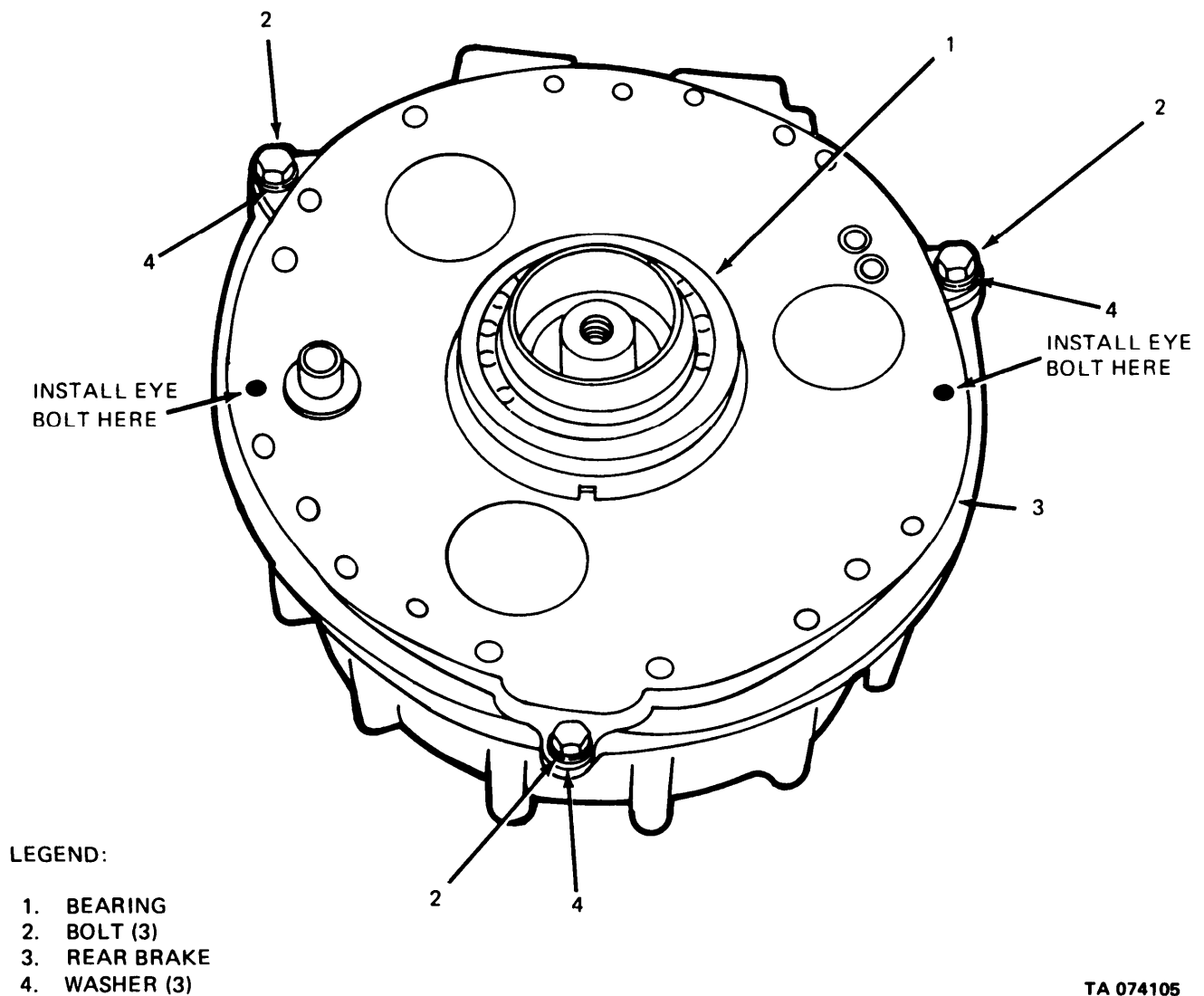
The rear clutch and brake assembly weighs approximately 212 lbs (95 kg).

(3) Remove fourteen washers (3) and bolts (4) and remove the rear clutch and brake assembly (2).

NOTE

In step (3), loosen bolts evenly; that is, a few turns at a time on each bolt until all are out. Scribe brake plate and rear clutch housing to aid in reassembly.

(4) Lay assembly on a bench; then remove three bolts (2, fig. 7-60) and washers (4) that hold the rear brake on the rear clutch.



TA 074105

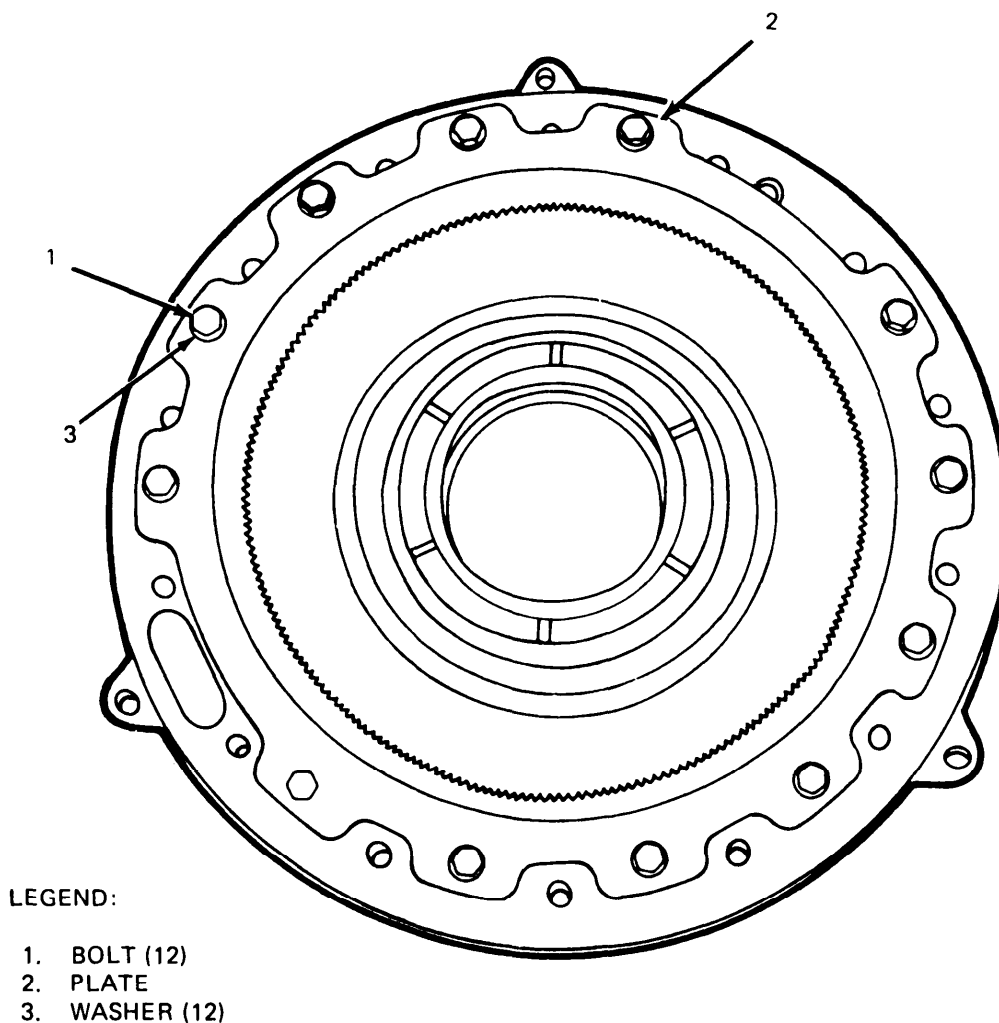
Figure 7-60. Separate Rear Brake and Clutch.

(5) Install two 3/8-16 forged eyebolts in the brake plate. Use a hoist to remove the rear brake (3) approximately three inches; then remove bearing (1). It may be necessary to tap end of shaft with a mallet to loosen bearing. Place brake plate on wood blocks (see fig. 7-62).

NOTE

In step (6), loosen bolts evenly – a few turns at a time on each – until all are out. Scribe plate to aid in reassembly.

(6) Remove 12 bolts (1, fig. 7-61), washers (3), and plate (2) from the brake assembly.



TA 074106

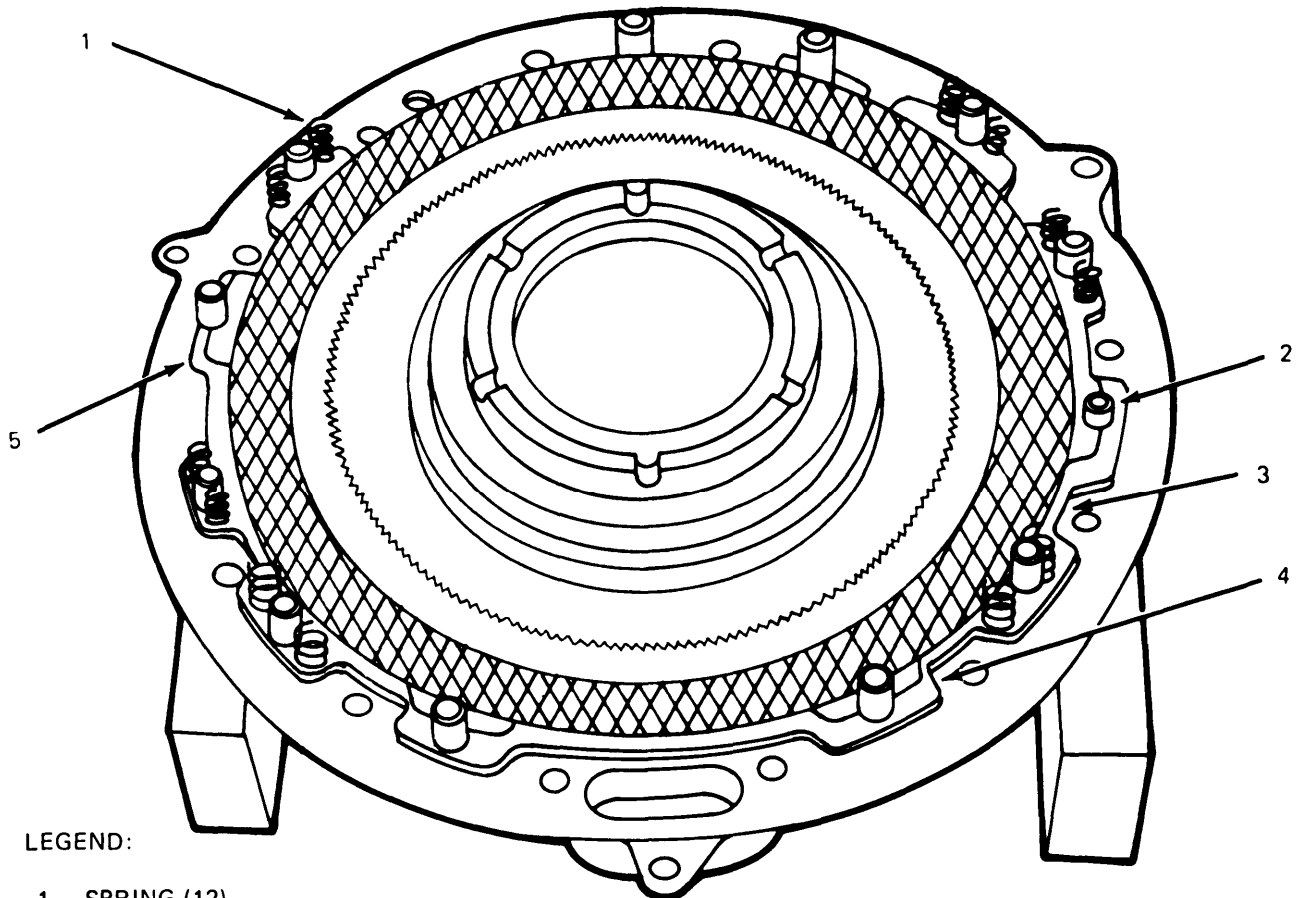
Figure 7-61. Remove Rear Brake Plate.

(7) Remove 12 springs (1, fig. 7-62) and 12 spacers (2).

NOTE

In step (8), make note of the location of the identification TOP on each plate. This will aid during installation. TOP must be to top of transmission when installed.

(8) Remove two disks (3), plate (4), and plate (5).



LEGEND:

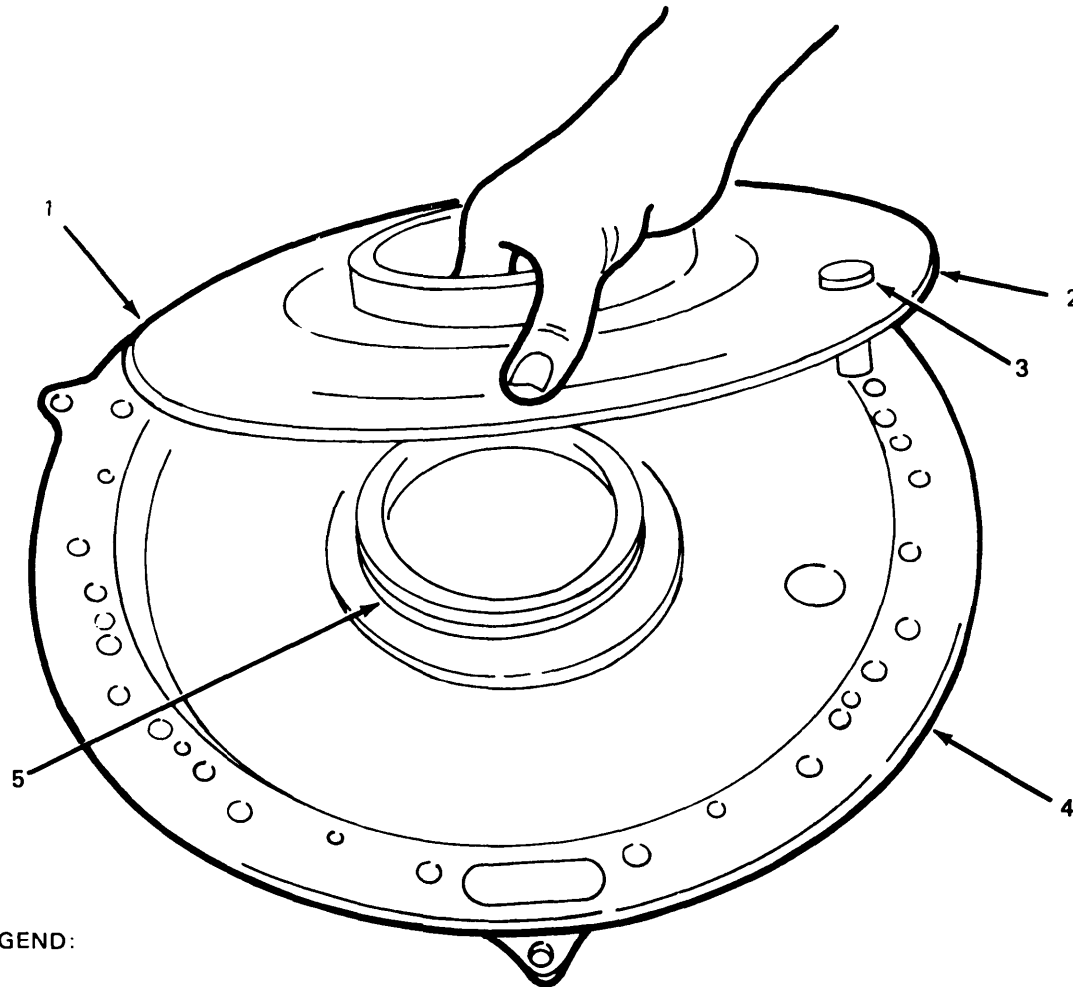
- 1. SPRING (12)
- 2. SPACER (12)
- 3. DISK (2)
- 4. PLATE
- 5. PLATE

TA 074107

Figure 7-62. Remove Rear Brake Disks.

(9) Remove piston (1, fig. 7-63) from the plate (4). It may be necessary to tap the back side of piston dowel with a mallet to free piston (1).

(10) If necessary, the piston dowel and sleeve (3) may be removed from the piston (1) using a suitable press.



LEGEND:

- 1. PISTON
- 2. RING AND SEAL
- 3. PISTON DOWEL AND SLEEVE
- 4. PLATE
- 5. RING AND SEAL

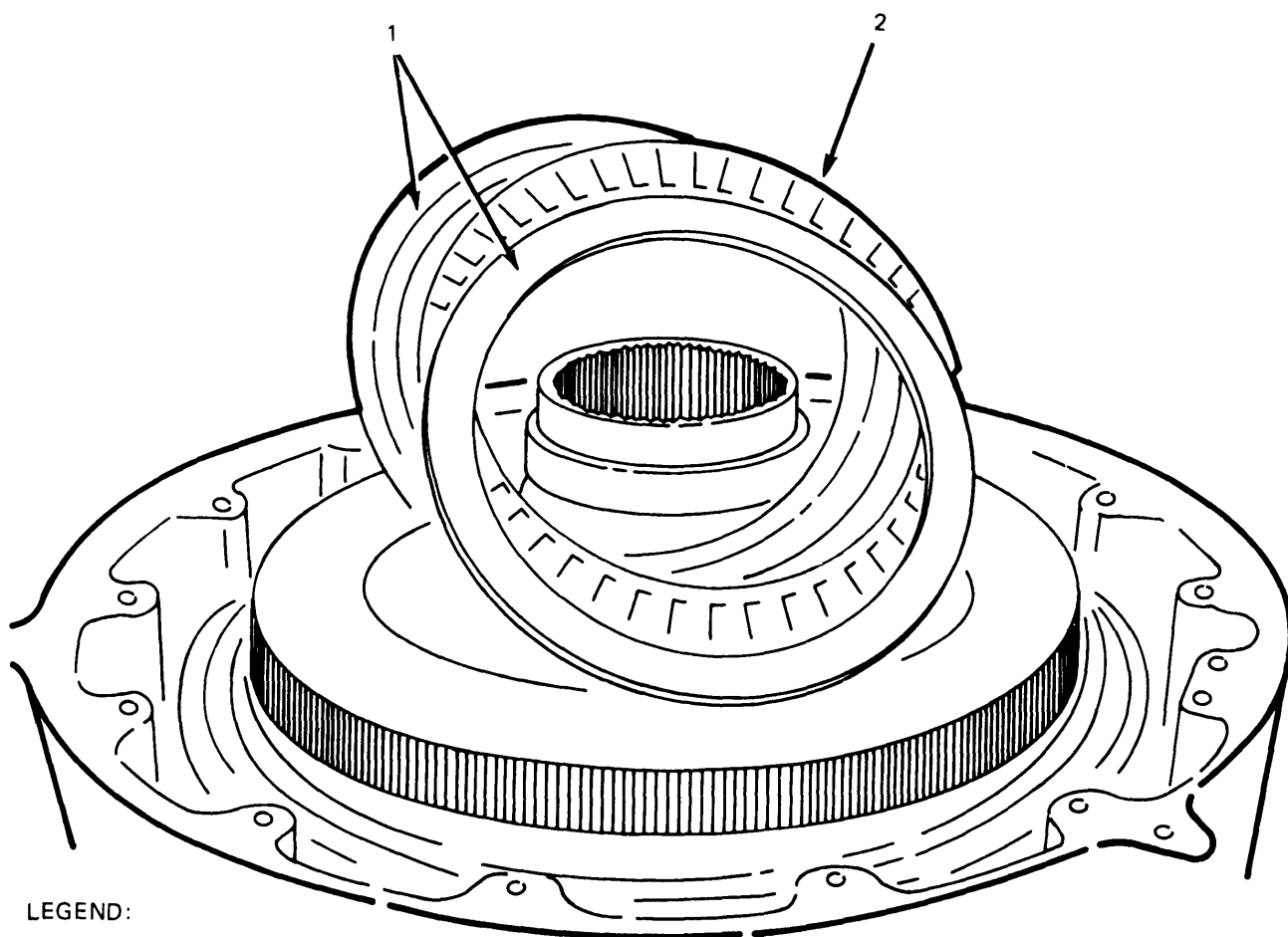
TA 074108

Figure 7-63. Disassemble Piston.

(11) Remove ring and seal (2) from the piston.

(12) Remove ring and seal (5) from the plate.

(13) Remove two bearing races (1, fig. 7-64) and bearing (2) from the hub.



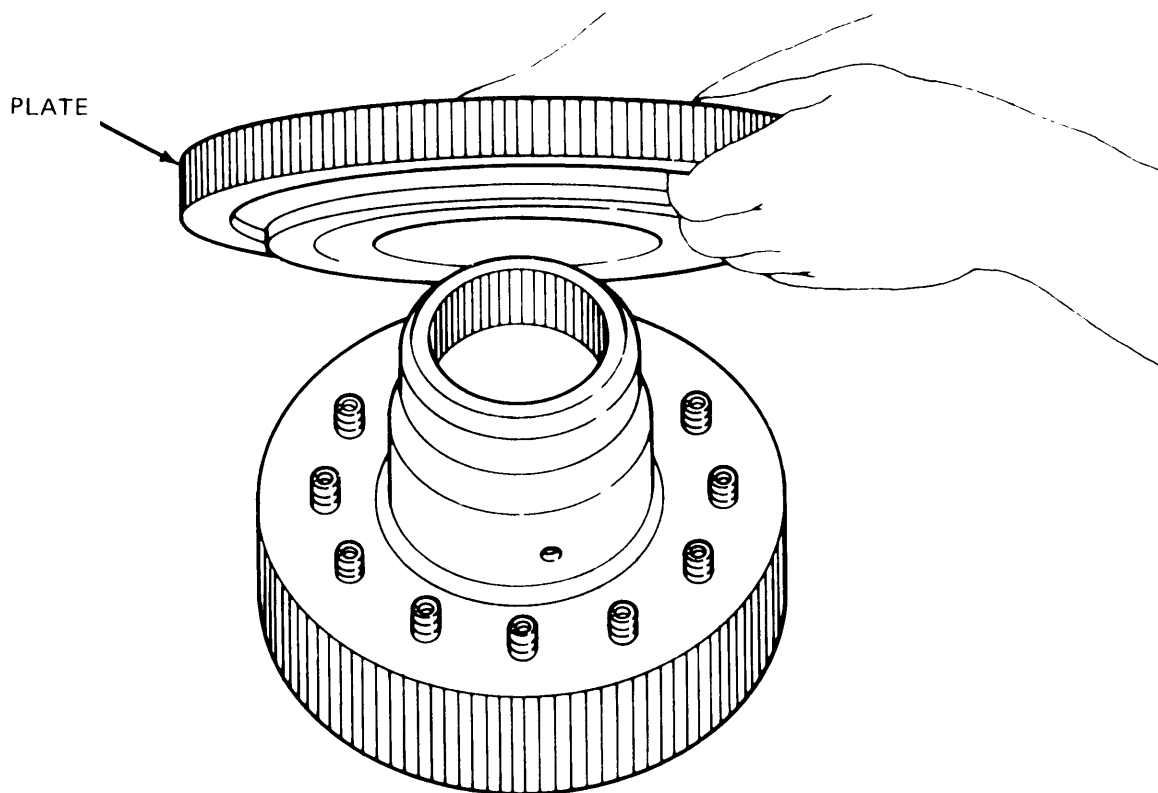
LEGEND:

- 1. BEARING RACE (2)
- 2. BEARING

TA 074109

Figure 7-64. Remove Races and Bearing.

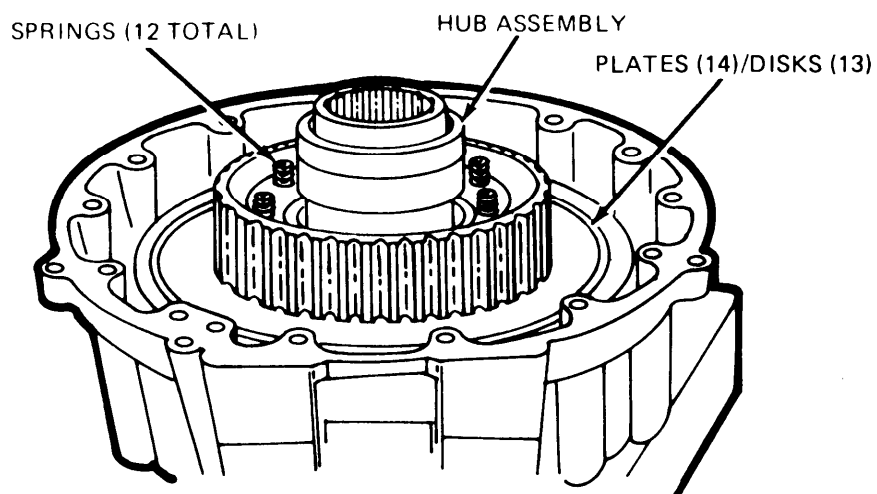
(14) Remove plate (fig. 7-65).



TA 074110

Figure 7-65. Remove Plate.

(15) Remove 12 springs (fig. 7-66) and hub assembly.

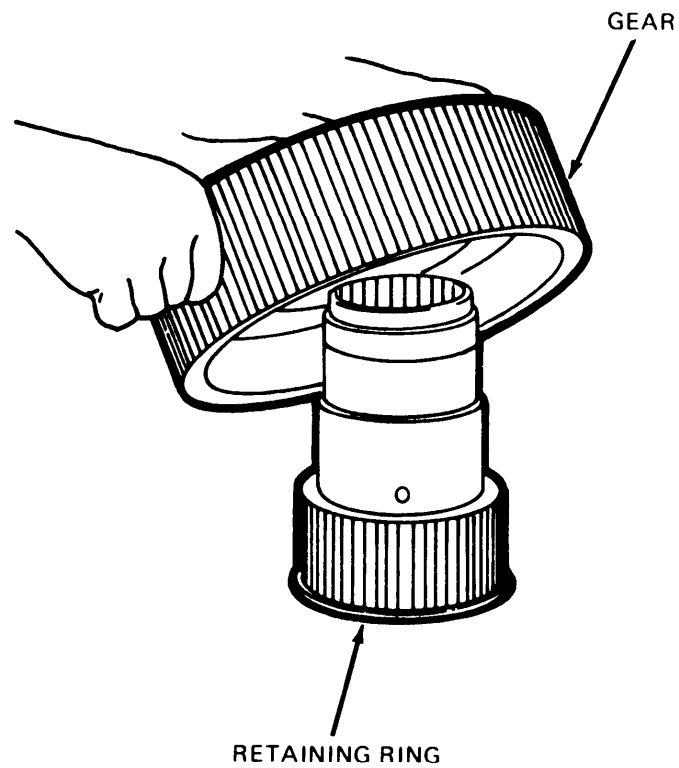


TA 074111

Figure 7-66. Remove Springs and Hub Assembly.

(16) Remove 14 plates and 13 disks.

(17) Remove gear from hub (fig. 7-67).

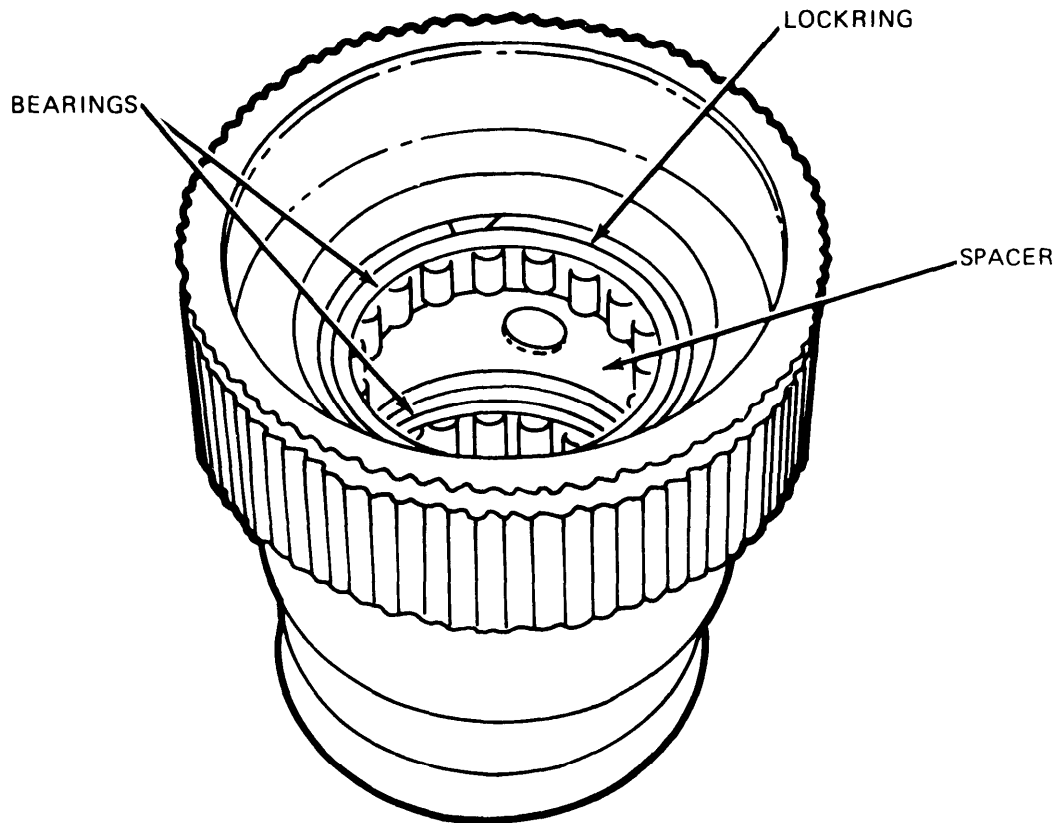


TA 074112

Figure 7-67. Remove Gear and Retaining Ring and Hub.

(18) Remove retaining ring.

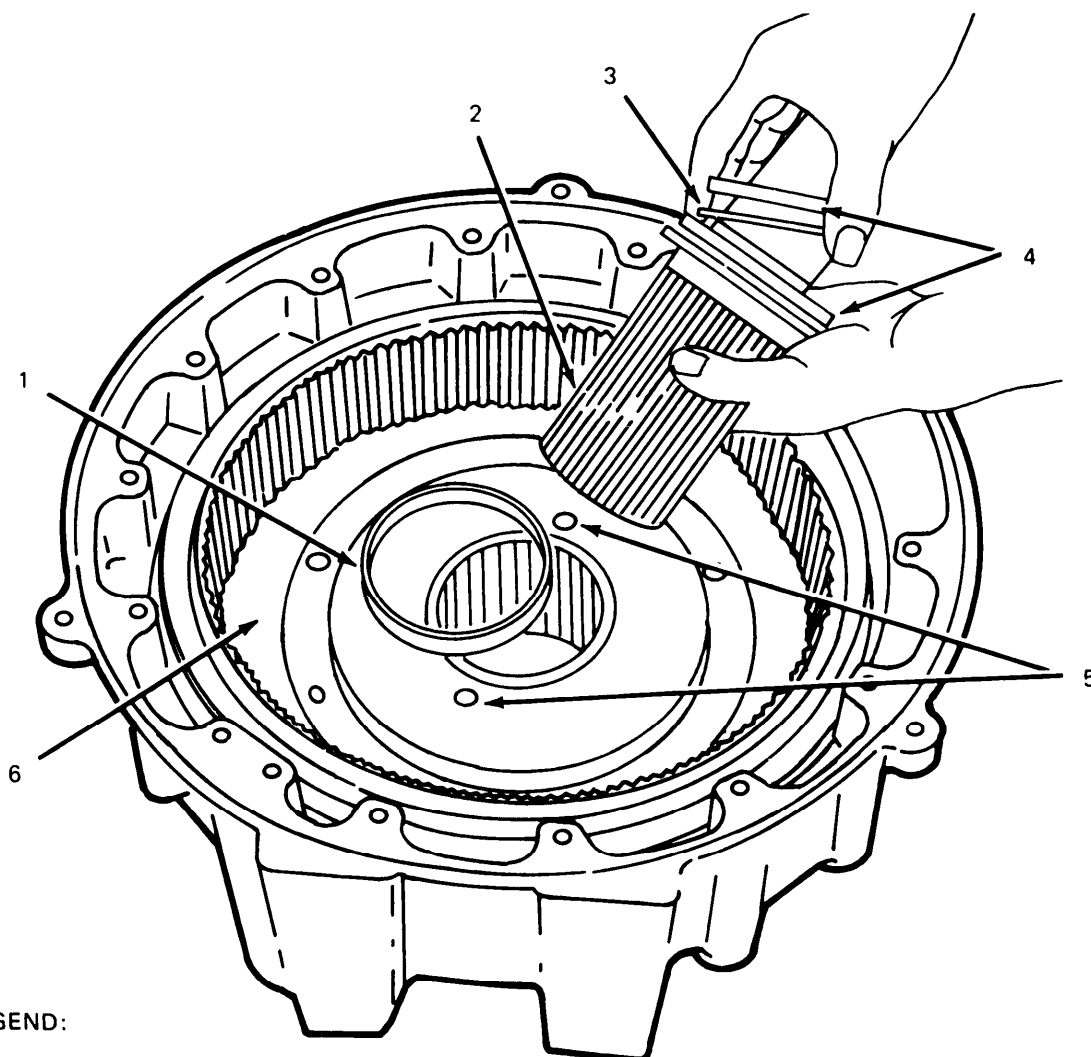
(19) Turn the hub over. Remove lockring (fig. 7-68), two bearings, and spacer.



TA 074113

Figure 7-68. Remove Bearings, Lockring, and Spacer from Hub.

(20)_Remove two bearing races (4, fig. 7-69) and bearing (3) from shaft (2).



LEGEND:

1. SEAL RING
2. SHAFT
3. BEARING
4. BEARING RACE (2)
5. HOLE (2)
6. HUB ASSEMBLY

TA 074114

Figure 7-69. Remove Shaft, Bearing Races, and Bearing.

(21) Remove shaft (2) and seal ring (1).

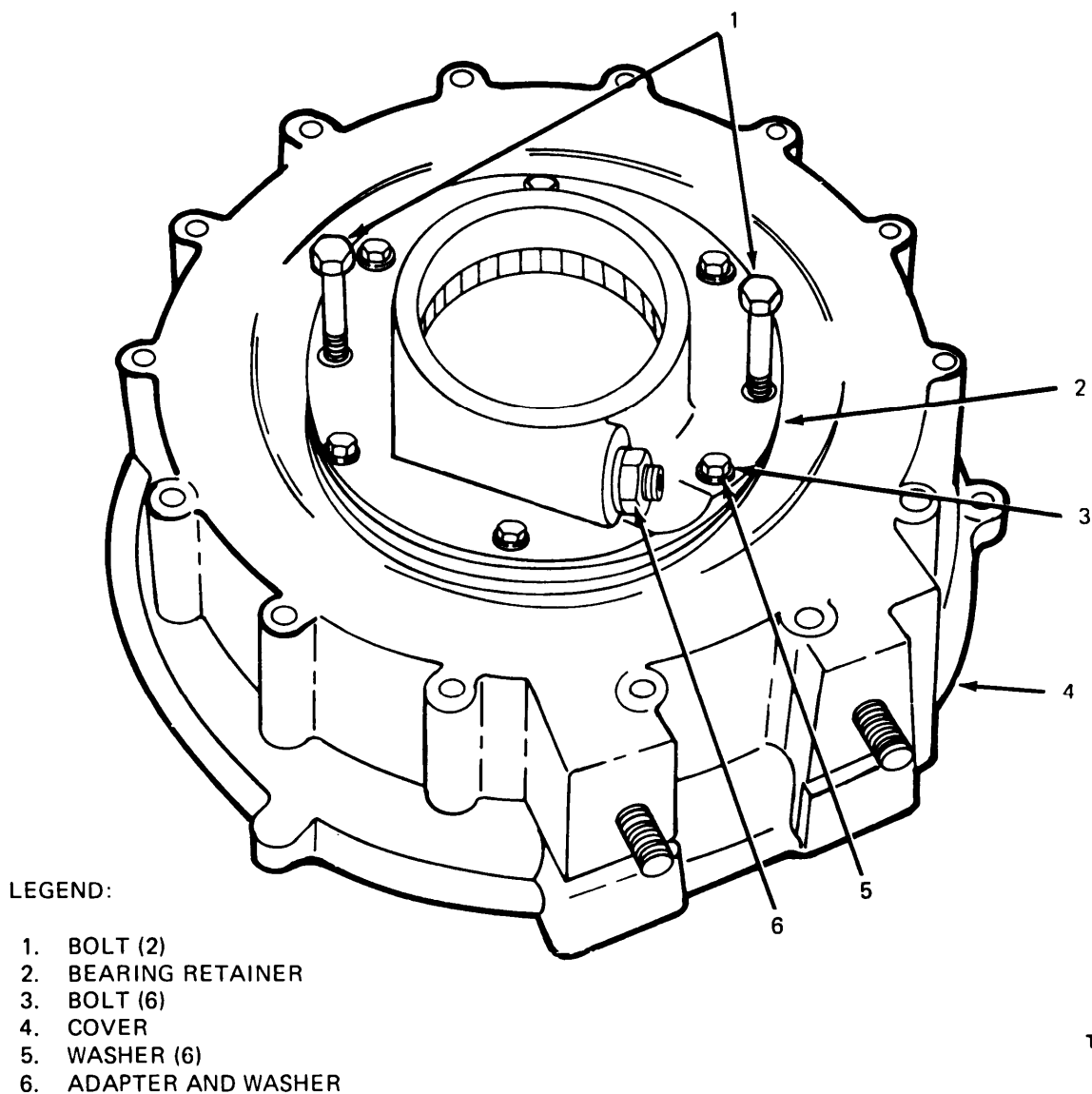
(22) Turn assembly over and remove hub assembly (6) from the case; then remove the bearing cone from the hub using a punch through holes (5).

NOTE

In step (23), scribe bearing retainer and cover to aid in assembly.

(23) Turn cover over and remove six bolts (3, fig. 7-70) that hold the rear bearing retainer (2) to cover (4). Install two 3/8 in. - 16 bolts (1) in the bearing retainer (2) and force the unit off of cover (4).

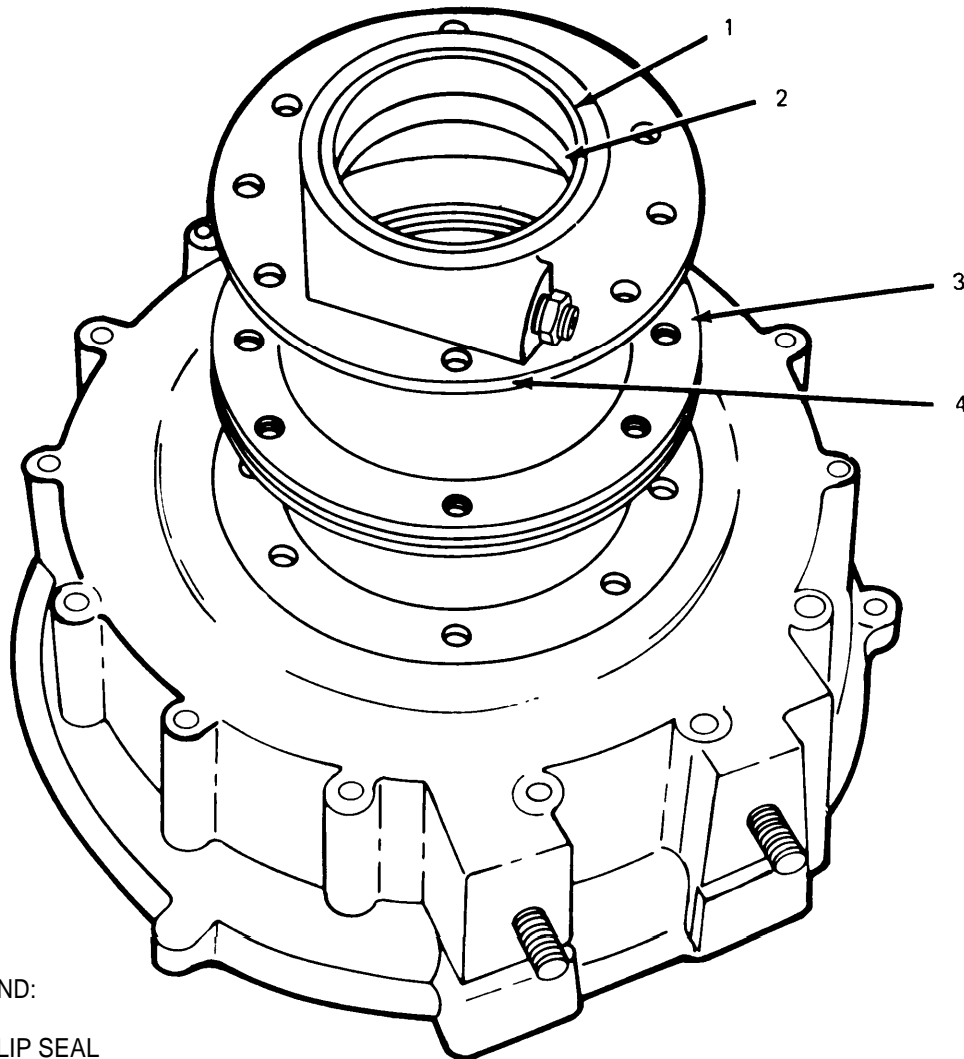
(24) If necessary, remove adapter and washer (6) from bearing retainer (2).



TA 074115

Figure 7-70. Remove Rear Bearing Retainer.

(25) Remove shims (3, fig. 7-71); then turn bearing retainer (4) over and remove the O-ring seal. Retain shims (3) for reassembly.



LEGEND:

- 1. LIP SEAL
- 2. BEARING CUP
- 3. SHIM (AR)
- 4. BEARING RETAINER

TA 074116

Figure 7-71. Disassemble Rear Bearing Retainer.

(26) Remove lip seal (1).

(27) Remove bearing cup (2) using a puller.

(28) Turn cover (2, fig. 7-72) over and use a pry bar and a wooden block to remove the piston (1) from cover (2).

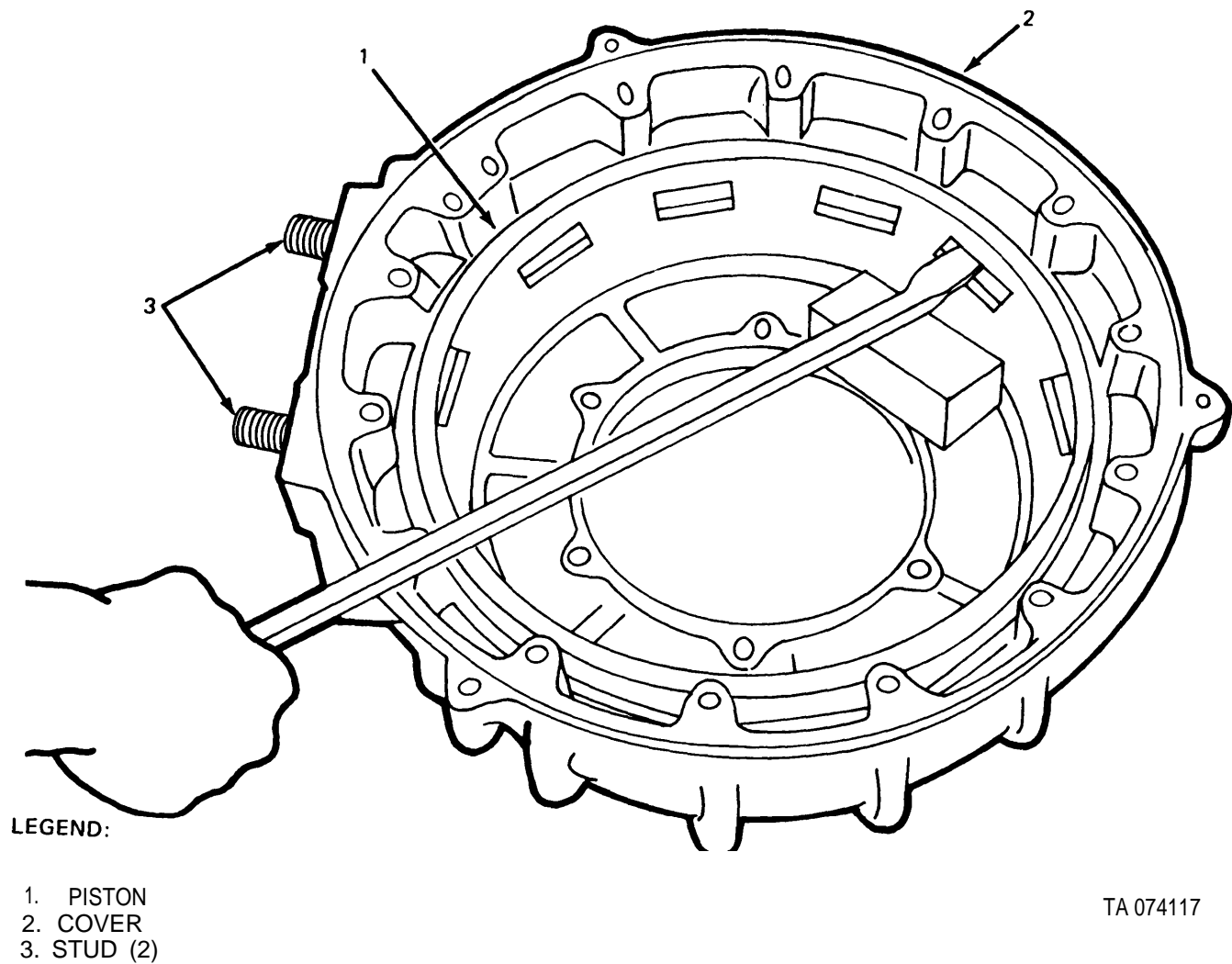


Figure 7-72. Remove Piston and Seals.

(29) Remove the rings and seals from the outside diameter of the piston and the inside diameter of the cover.

(30) If necessary, studs (3) can be removed by unscrewing from the cover (2).

e. *Remove and Disassemble Front Clutch.*

(1) Move the shifting forks in a position that prevents the gears from turning; then remove nut (fig. 7-73) with a 2-3/16 in. socket. Remove the shaft seal retainer, seal and bearing.

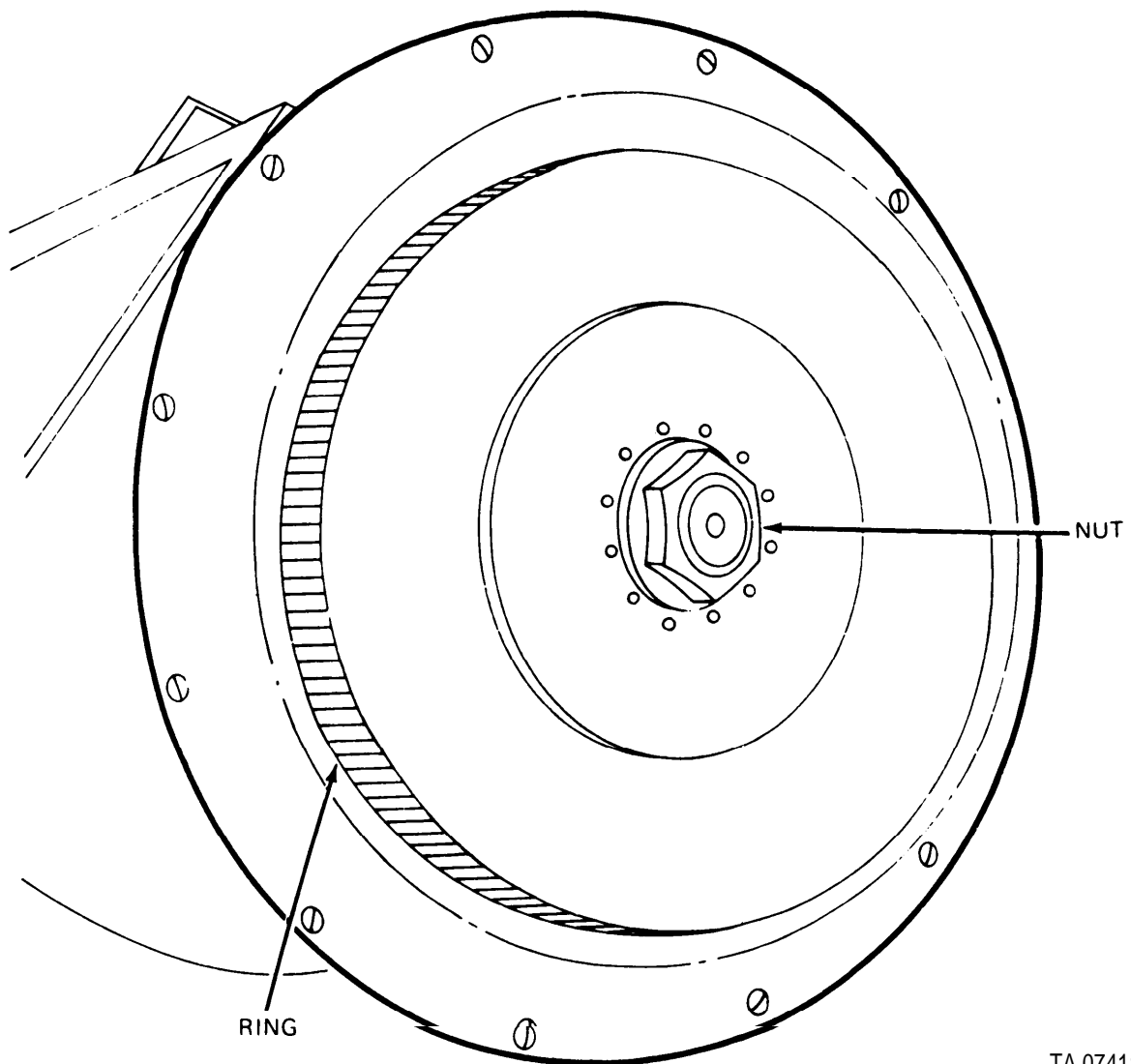
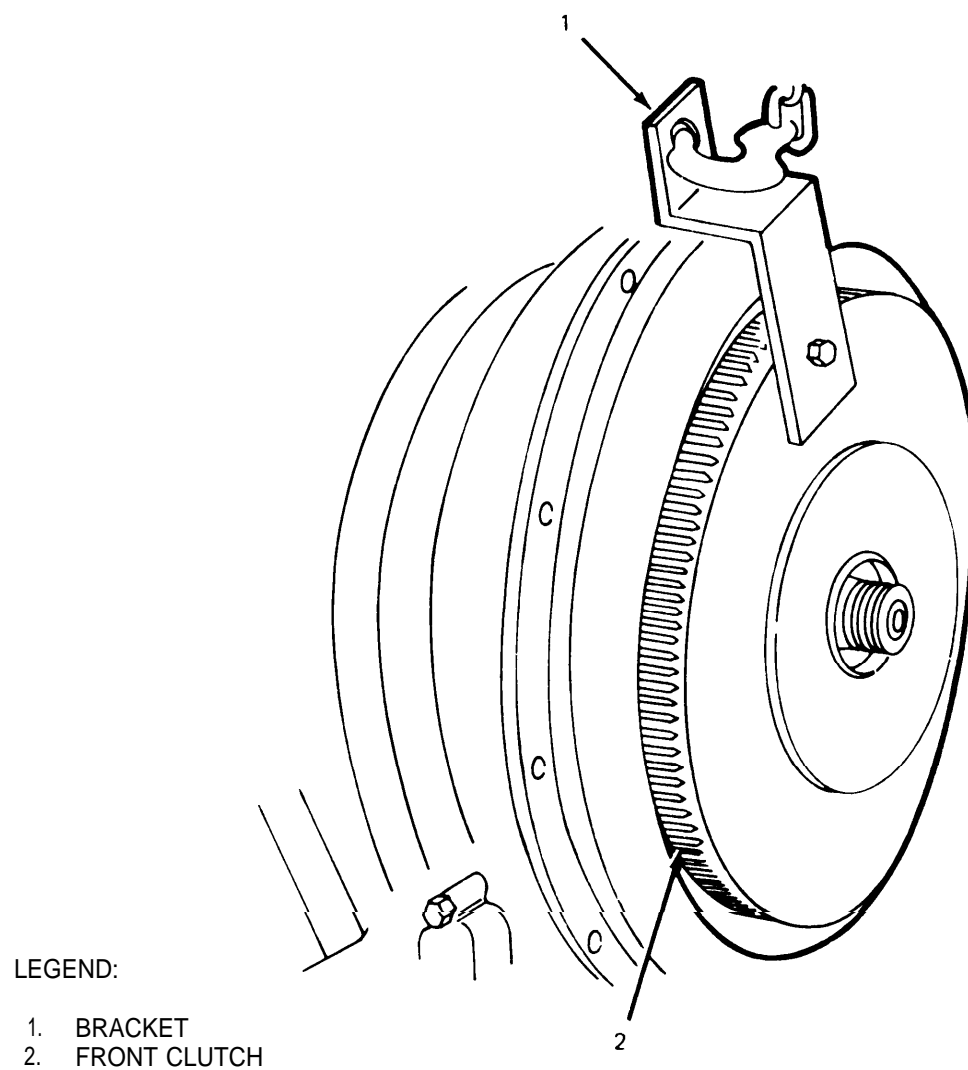


Figure 7-73. Remove Front Clutch Nut.

(2) Install bracket (5P8693) (1, fig. 7-74) on front clutch (2).



TA 074119

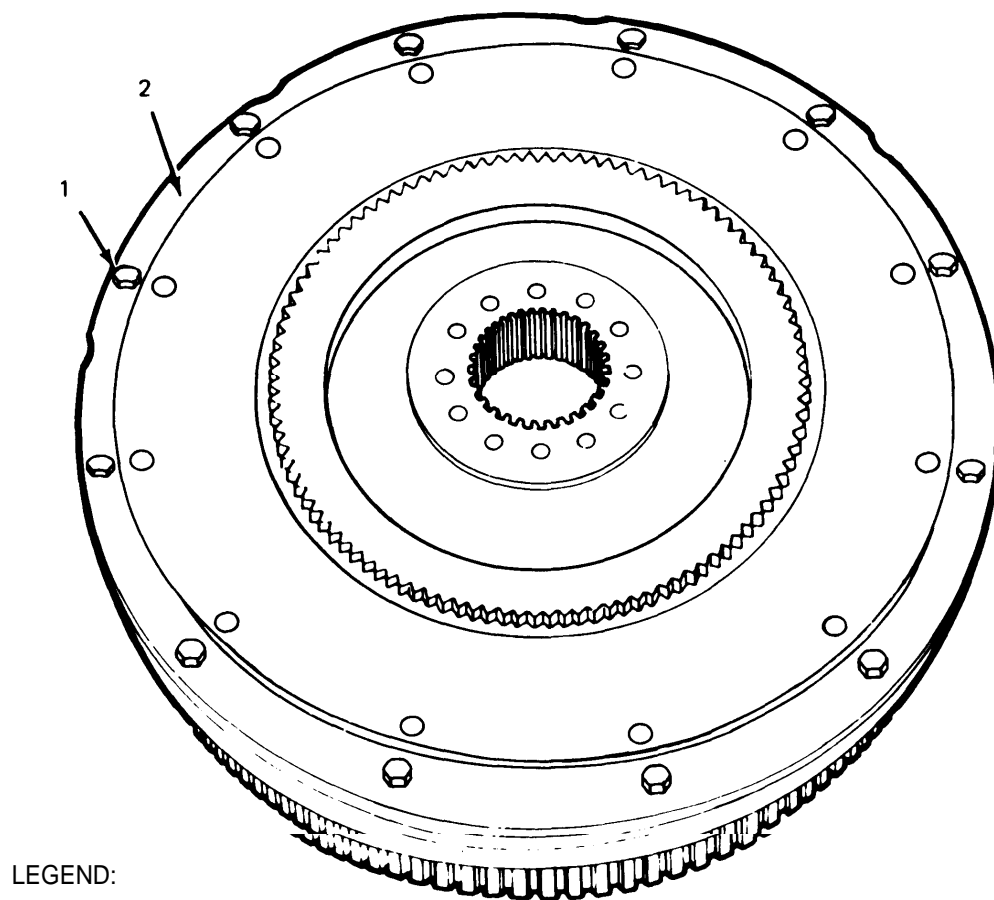
Figure 7-74. Remove Front Clutch.

NOTE

The front clutch assembly weighs approximately 160 lbs (72 kg).

(3) Fasten a hoist to the adapter and remove the front clutch.

(4) Remove 12 bolts (1, fig. 7-75) and washers evenly – a few turns at a time on each – until all are removed; then lift plate (2) off of clutch.

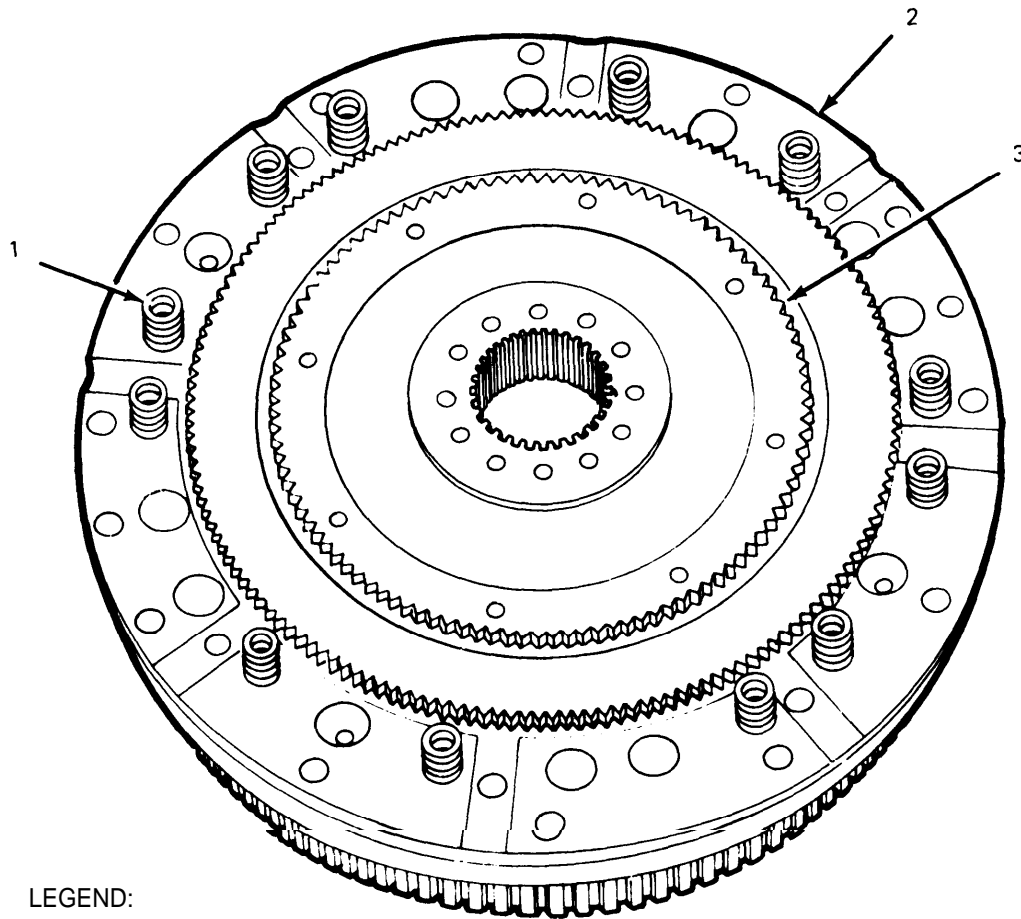
**LEGEND:**

- 1. BOLT (12)
- 2. PLATE

TA 074120

Figure 7-75. Remove Plate.

(5) Remove 12 springs (1, fig. 7-76) from the hub.



LEGEND:

- 1. SPRING (12)
- 2. HUB
- 3. INNER HUB

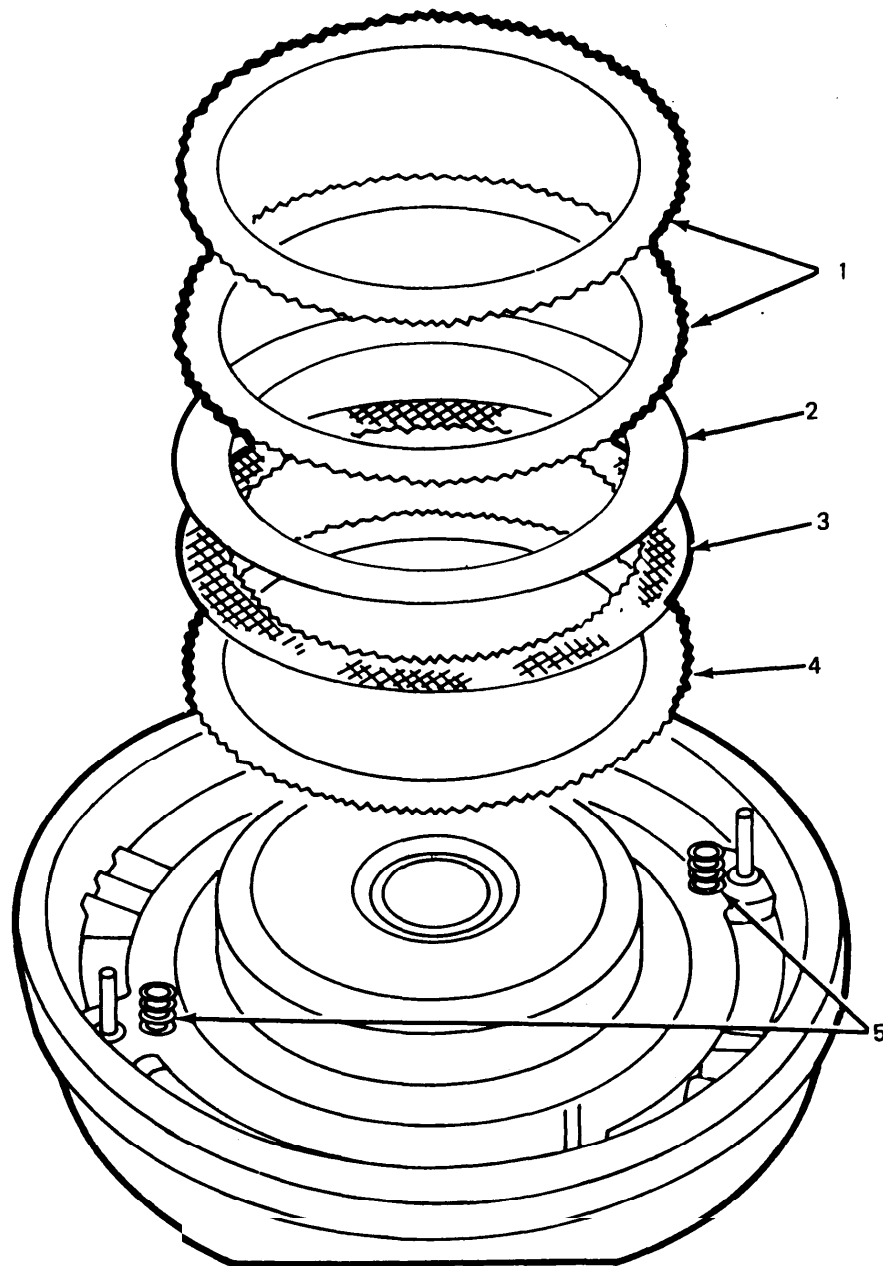
TA 074121

Figure 7-76. Remove Front Clutch Hubs.

(6) Tap outer perimeter of hub (2) with a mallet; then lift off hub.

(7) Remove inner hub (3). Remove two bearing races and bearing from under the hub.

(8) Remove two spacer plates (1, fig. 7-77), plate (2), ten disks (3) and plates (4). Remove two springs (5).



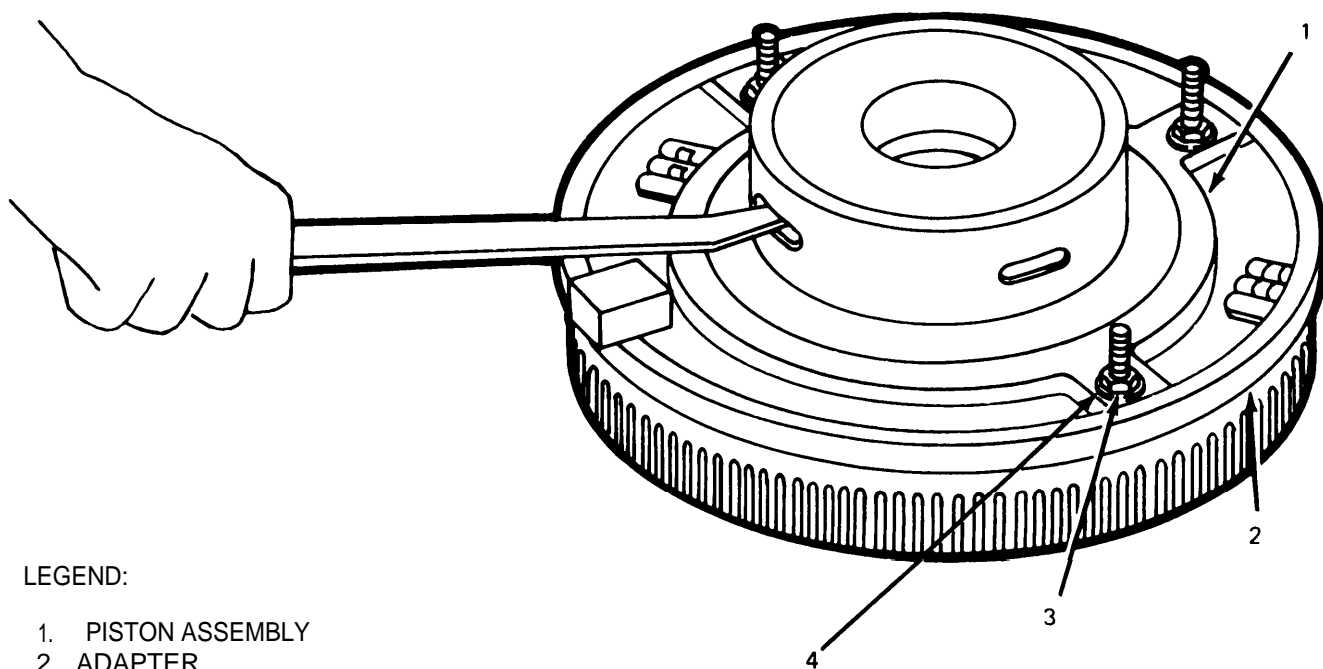
LEGEND:

1. SPACER PLATE (2)
2. PLATE
3. DISK (10)
4. PLATE (10)
5. SPRING (2)

TA 074122

Figure 7-77. Remove Front Clutch Plates and Disks.

(9) Use a pry bar and a wooden block to remove piston assembly (1, fig. 7-78) from the adapter (2).

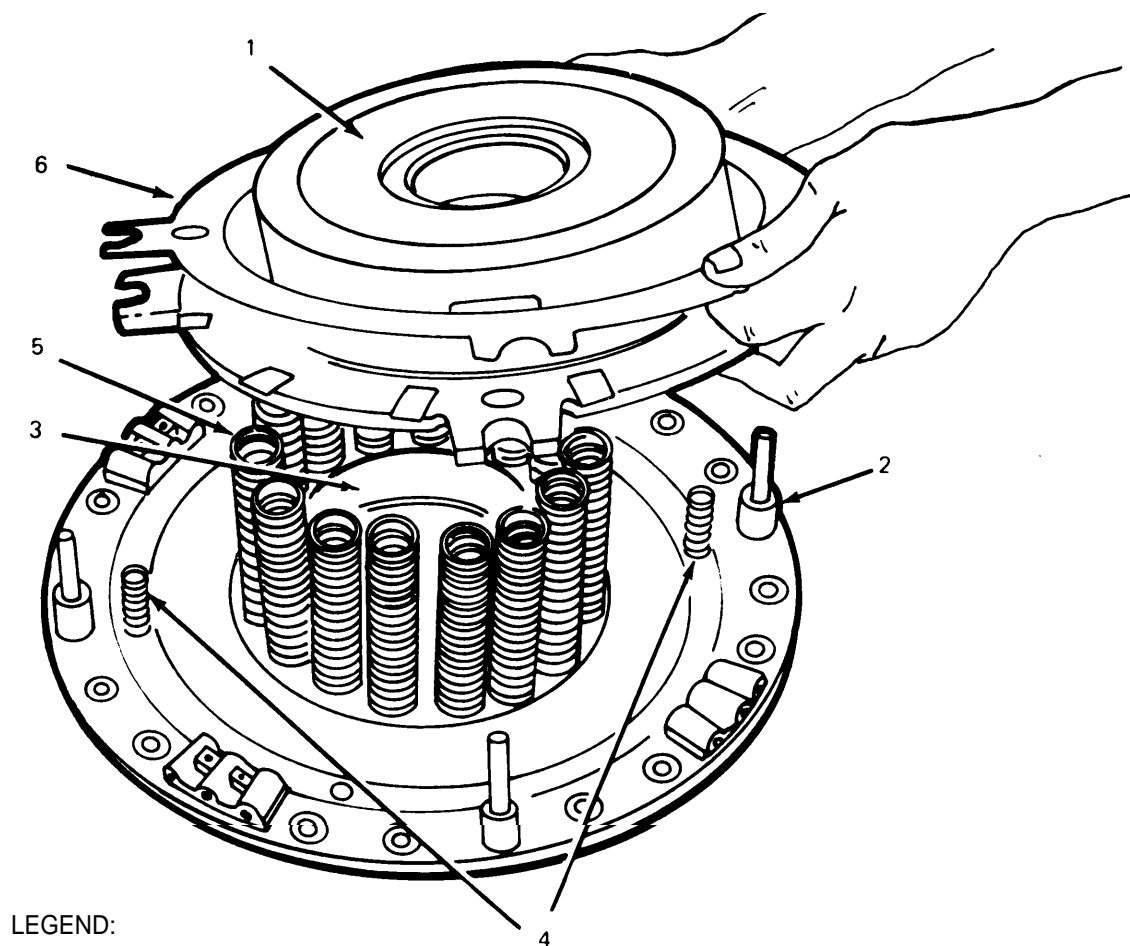


TA 074123

Figure 7-78. Remove Front Clutch Piston.

(10) Loosen four nuts (3) and washers (4) evenly – a few turns at a time on each – until all nuts and washers are removed.

(11) Remove plates (1, fig. 7-79) and (6) from piston assembly.



LEGEND:

- 1. PLATE
- 2. SLEEVE (4)
- 3. DEFLECTOR
- 4. SPRING, SMALL (2)
- 5. SPRING, LARGE (16)
- 6. PLATE

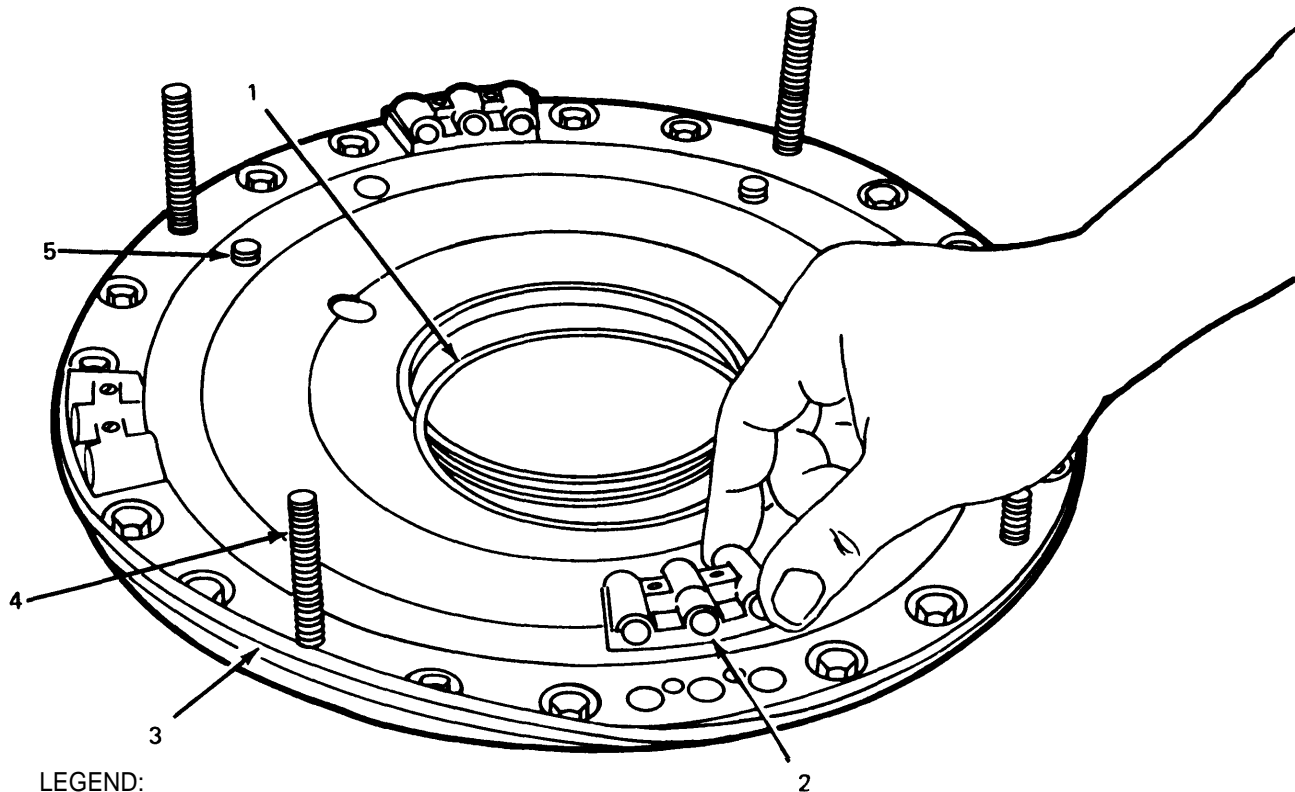
TA 074124

Figure 7-79. Remove Springs and Deflector.

(12) Remove 16 large springs (5), two small springs (4), deflector (3) and four sleeves (2).

(13) Remove O-ring (1, fig. 7-80) from the piston assembly.

(14) Remove O-ring and seal (3, fig. 7-80).



LEGEND:

- 1. O-RING
- 2. VALVE (4)
- 3. O-RING & SEAL
- 4. BOLT (4)
- 5. PIN (4)

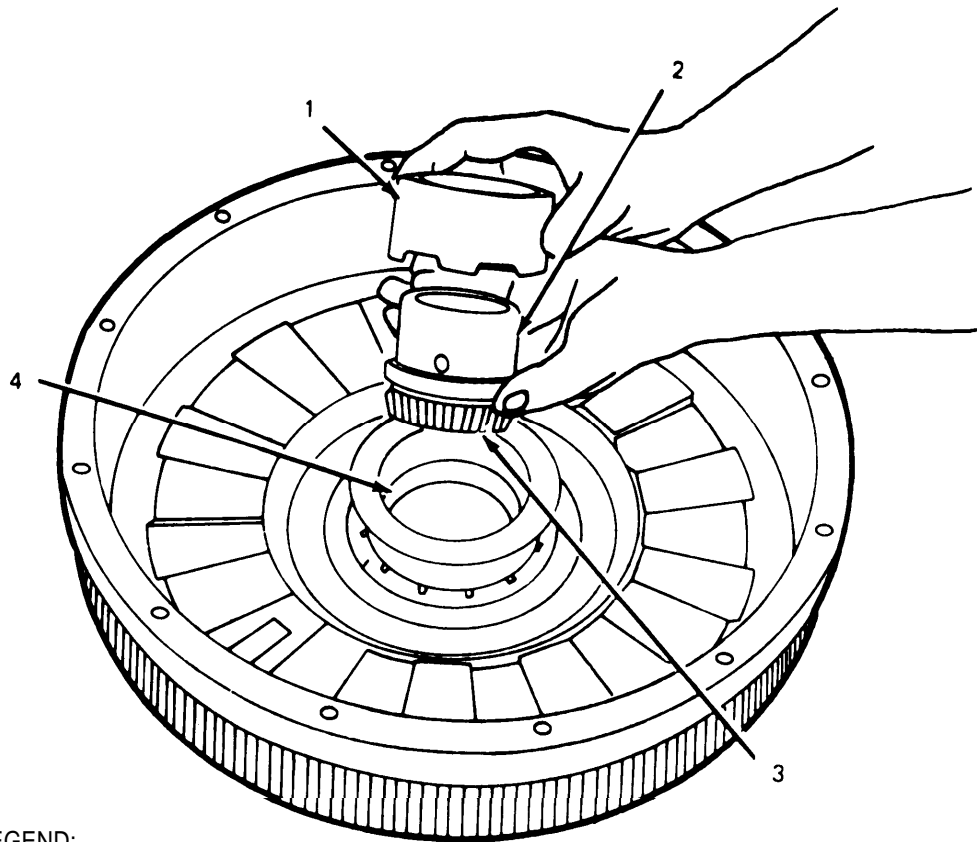
TA 074125

Figure 7-80. Remove Seals and Valves.

(15) Remove four valves (2). (Held by capscrews from back side of piston).

(16) If necessary, four bolts (4) and pins (5) may be removed from the piston assembly by using a suitable press.

(17) Remove sleeves (1, fig. 7-81) and (2), and bearing (3) from the adapter,



LEGEND:

- 1. SLEEVE
- 2. SLEEVE
- 3. BEARING
- 4. BEARING CUP (2)

TA 074120

Figure 7-81. Remove Bearings and Caps.

(18) Use a bearing cup puller to remove the two bearing cups (4).

(19) If necessary, remove snap ring and spacer located between bearing cups (4).

f. *Remove and Disassemble Front Housing and Brake.*

(1) Install a 3/4-10 NC eyebolt (1, fig. 7-82) in the housing. Fasten a hoist to the eyebolt.

(2) Remove four bolts and washers (9) and remove cover and gasket (8) from the housing.

(3) Remove plug (2), plug (5), and orifice plug (4).

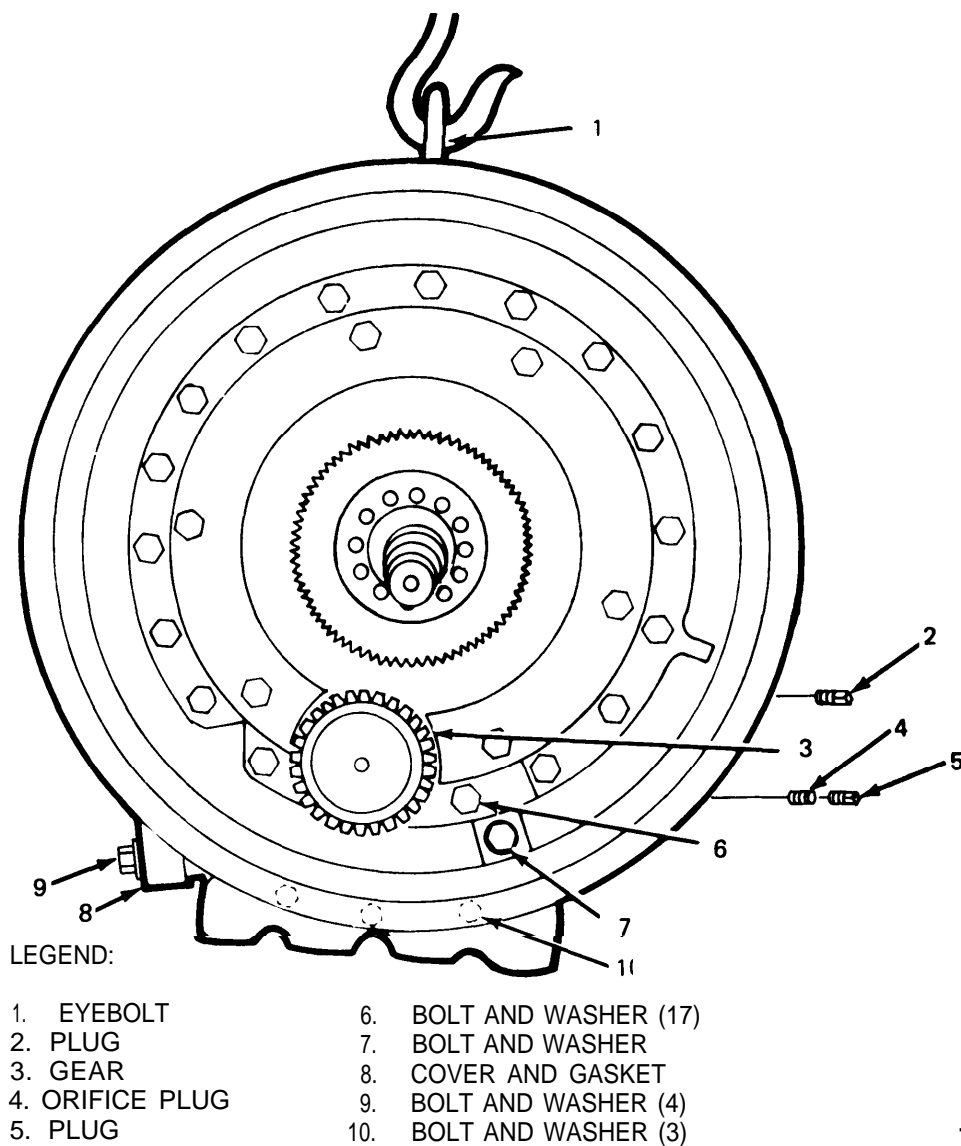


Figure 7-82. Remove Front Housing.

TA 239531 ■

(4) Using suitable gear puller remove gear (3).

(5) Remove seventeen bolts (6) and washers that hold the housing to the main case.

(6) Remove bolt (7) and washer.

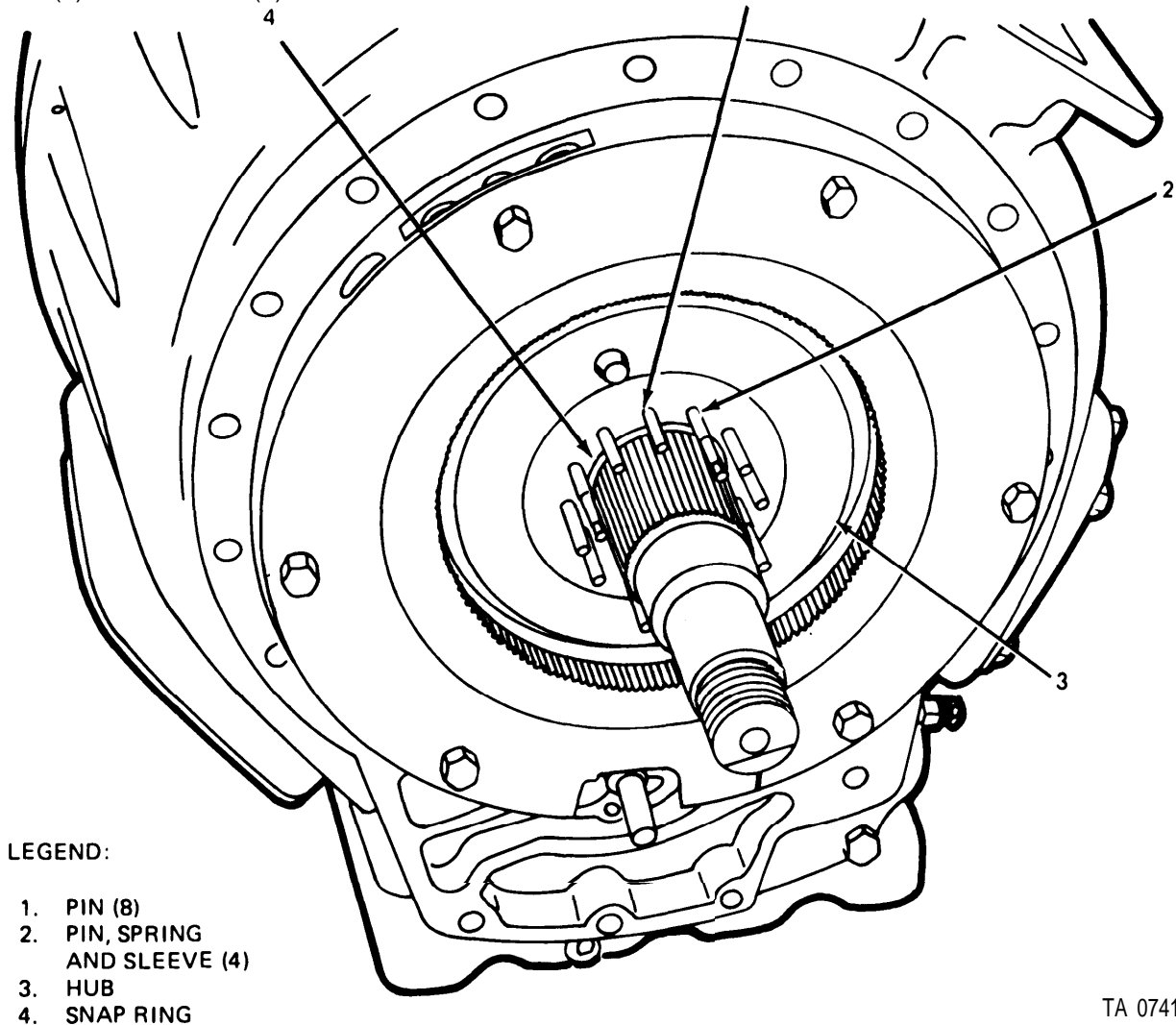
(6.1) Remove three hidden bolts (10) and washers from outside of housing at the bottom.

WARNING

The housing weighs approximately 50 lbs (23 kg). Assistance must be used to prevent personal injury.

(7) Remove the housing.

(8) Remove eight pins (1, fig. 7-83) from the hub (3). Remove four pins, springs, and sleeves (2) from the hub (3).

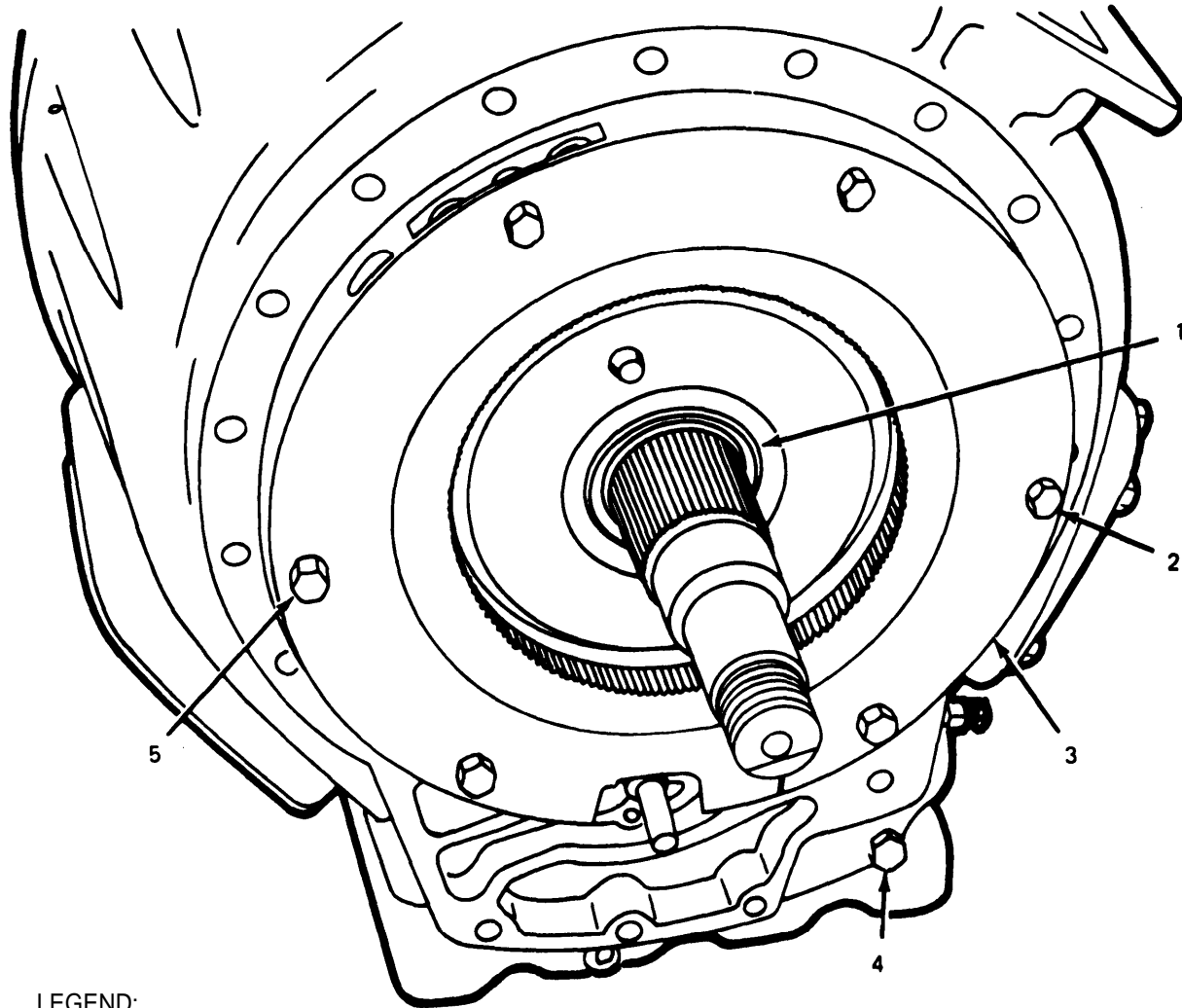


TA 074128

Figure 7-83. Remove Input Shaft.

(9) Remove snapping (4) from the shaft and remove hub (3). Remove the bearing and two races from the shaft.

(10) Remove snapping (1, fig. 7-84) from the shaft.



LEGEND:

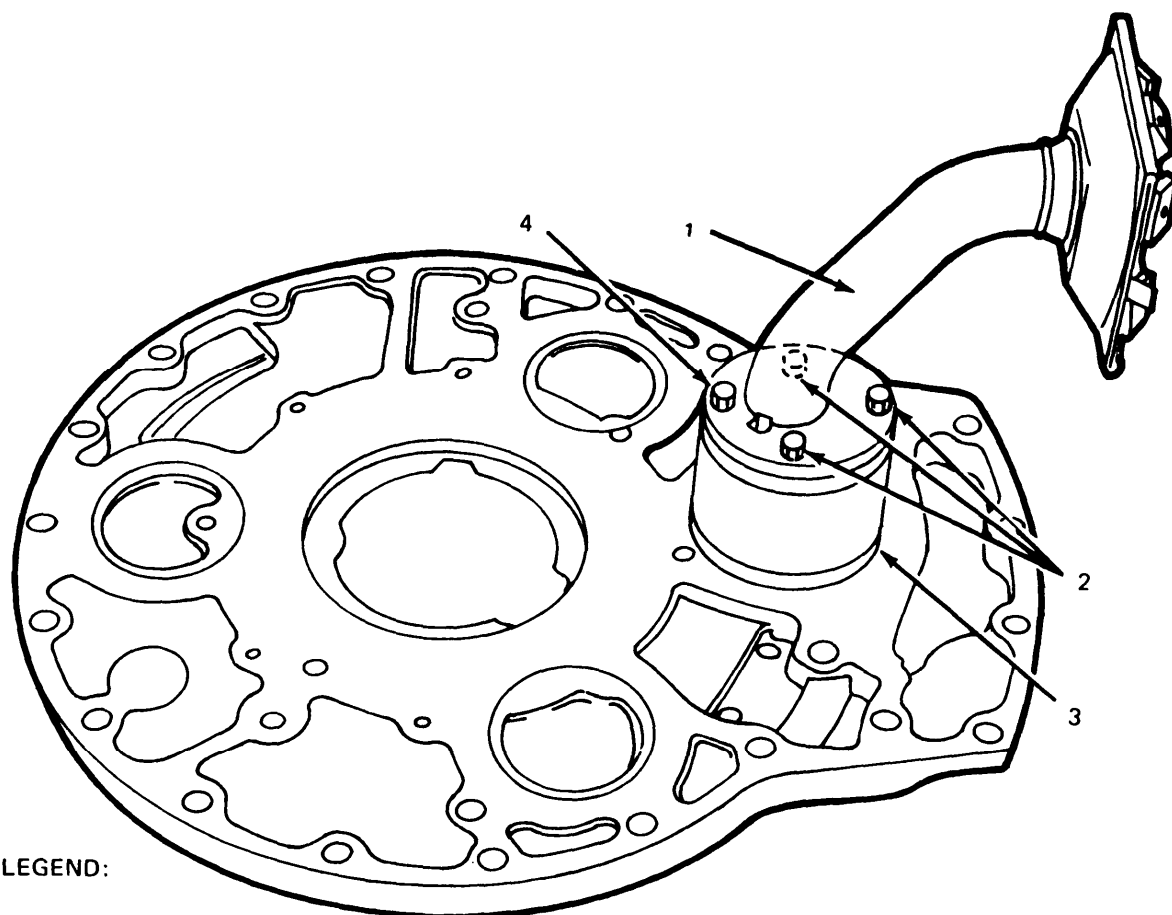
- 1. SNAP RING
- 2. BOLT
- 3. BRAKE ASSEMBLY
- 4. BOLT
- 5. BOLT

TA 074129

Figure 7-84. Remove Front Brake.

(11) Remove three bolts (2), (4), and (5) from the front brake. Remove the front brake assembly (3).

(12) Remove three lower bolts (2, fig. 7-85) and remove the oil pump (3) from the front brake assembly.



LEGEND:

- 1. TUBE
- 2. BOLT (3)
- 3. OIL PUMP
- 4. BOLT

TA 074130

Figure 7-85. Remove Oil Pump.

(13) Remove bolt (4) and separate tube (1) from oil pump.

(14) Remove manifold (6, fig. 7-86), tube assembly (7), and rotor assembly (4) and (5) from housing (3).

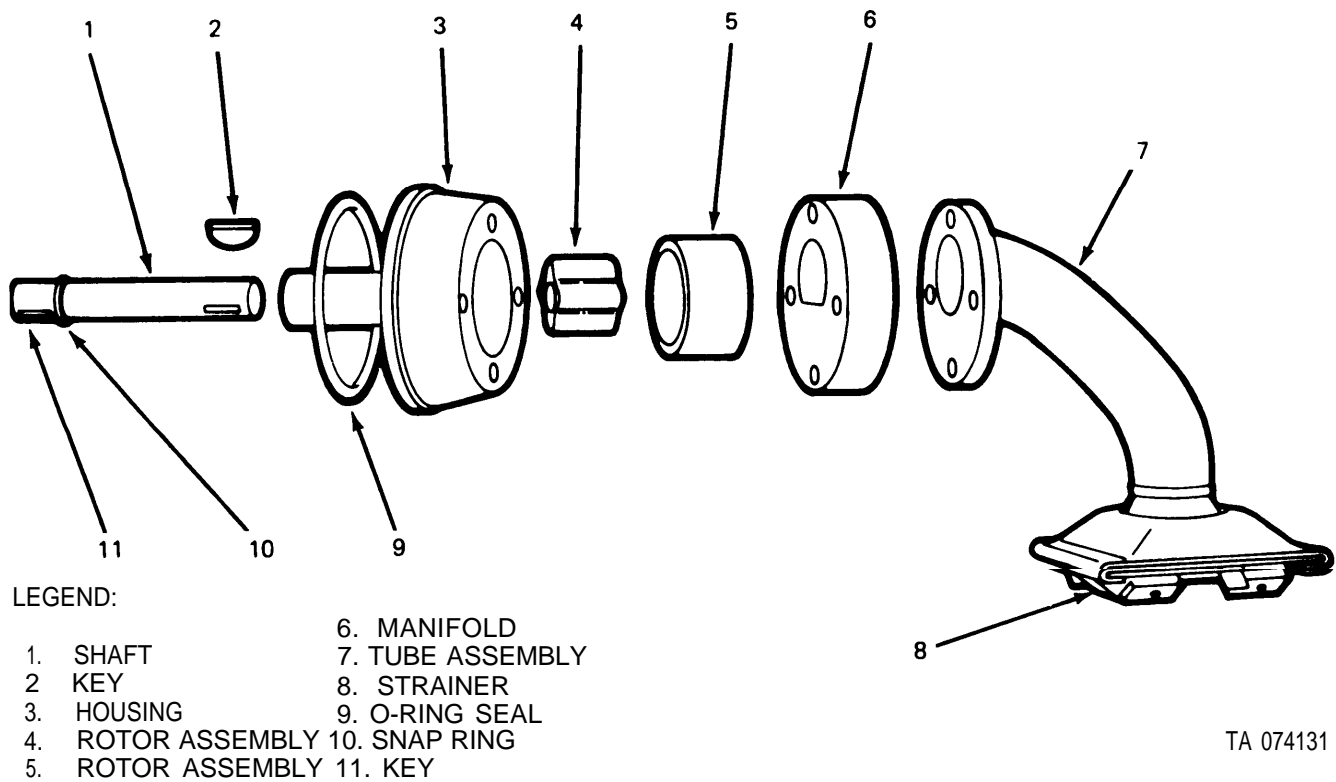
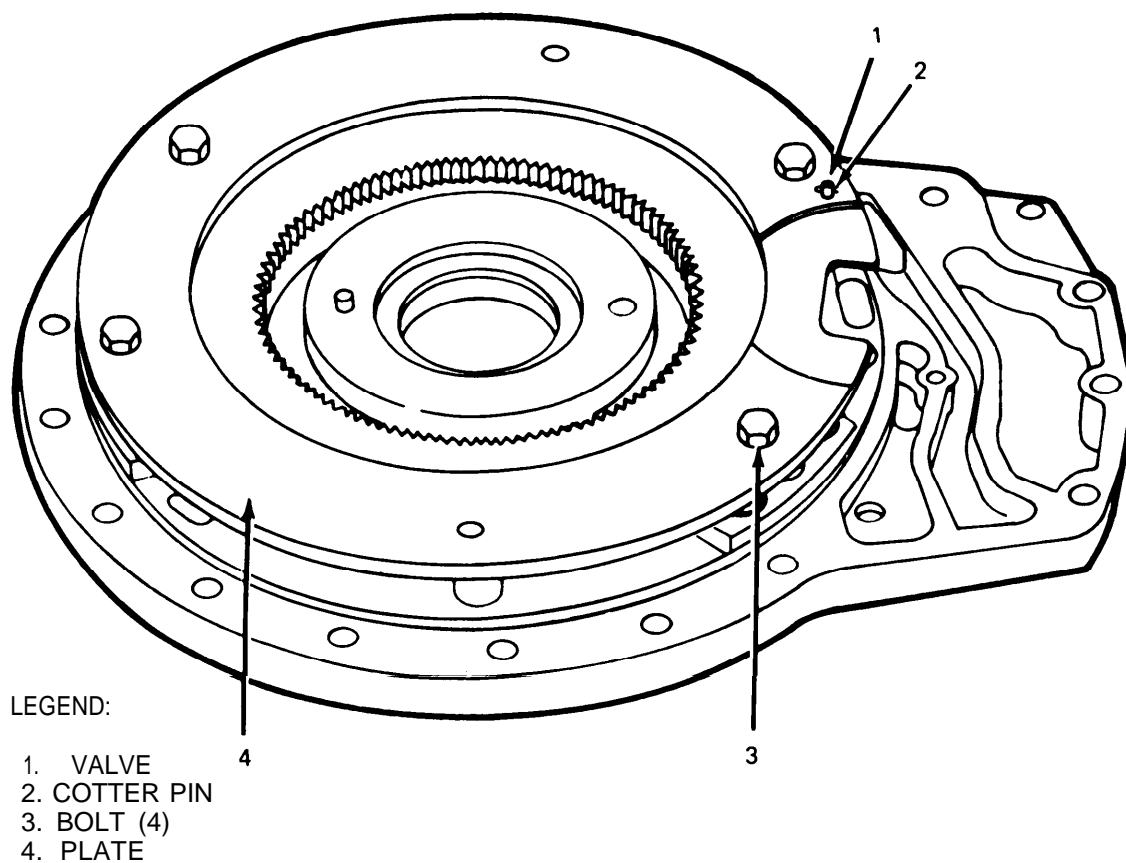


Figure 7-86. Disassemble Oil Pump.

- (15) Remove snapping (10) and key (11) from shaft (1).
- (16) Remove the shaft (1) from the housing (3).
- (13) Remove snapping (8) and key (9) from shaft (1).
- (18) Remove O-ring seal (9) from housing (3).
- (19) If necessary, remove strainer (8) from tube assembly (7).
- (20) Turn front brake over and remove cotter pin (2, fig. 7-87) from valve (1).



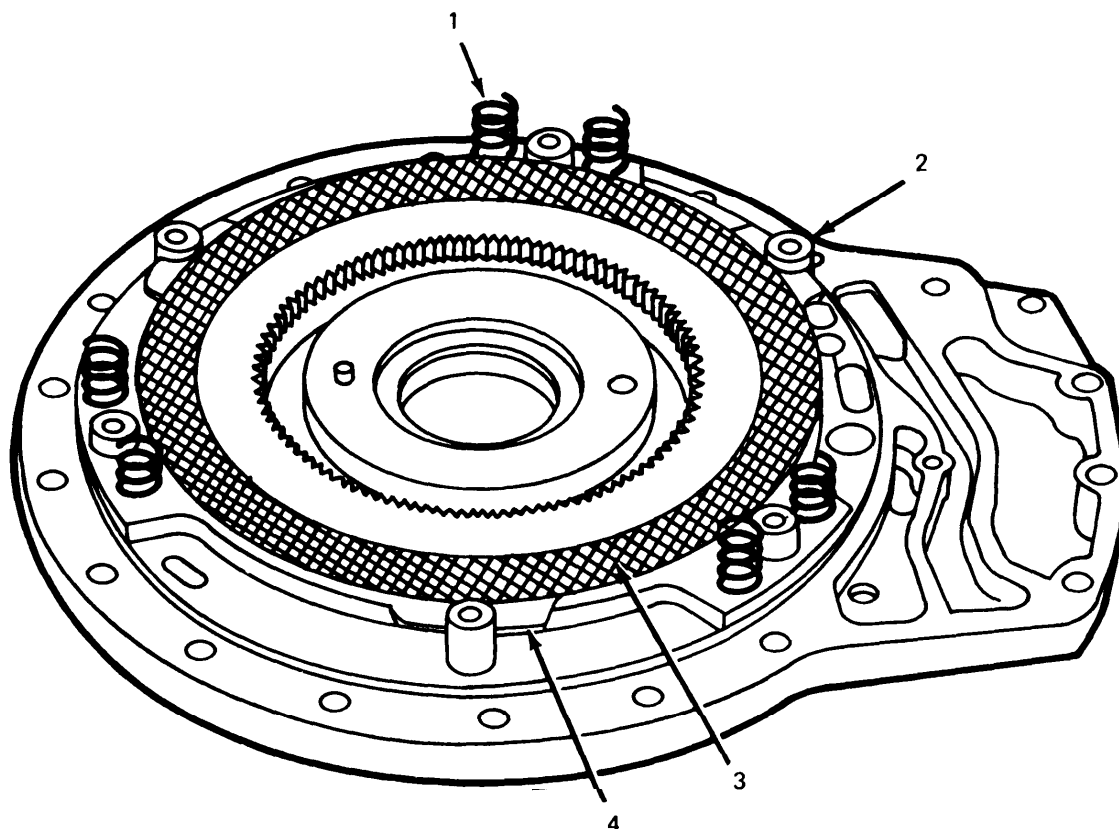
TA 074132

Figure 7-87. Remove Plate and Valves.

(21) Remove four bolts (3) evenly – a few turns at a time on each bolt-until all are removed; then remove plate (4).

(22) Remove valve (1), and the spring located under the valve.

(23) Remove six springs (1, fig. 7-88); then remove the three small inner springs.



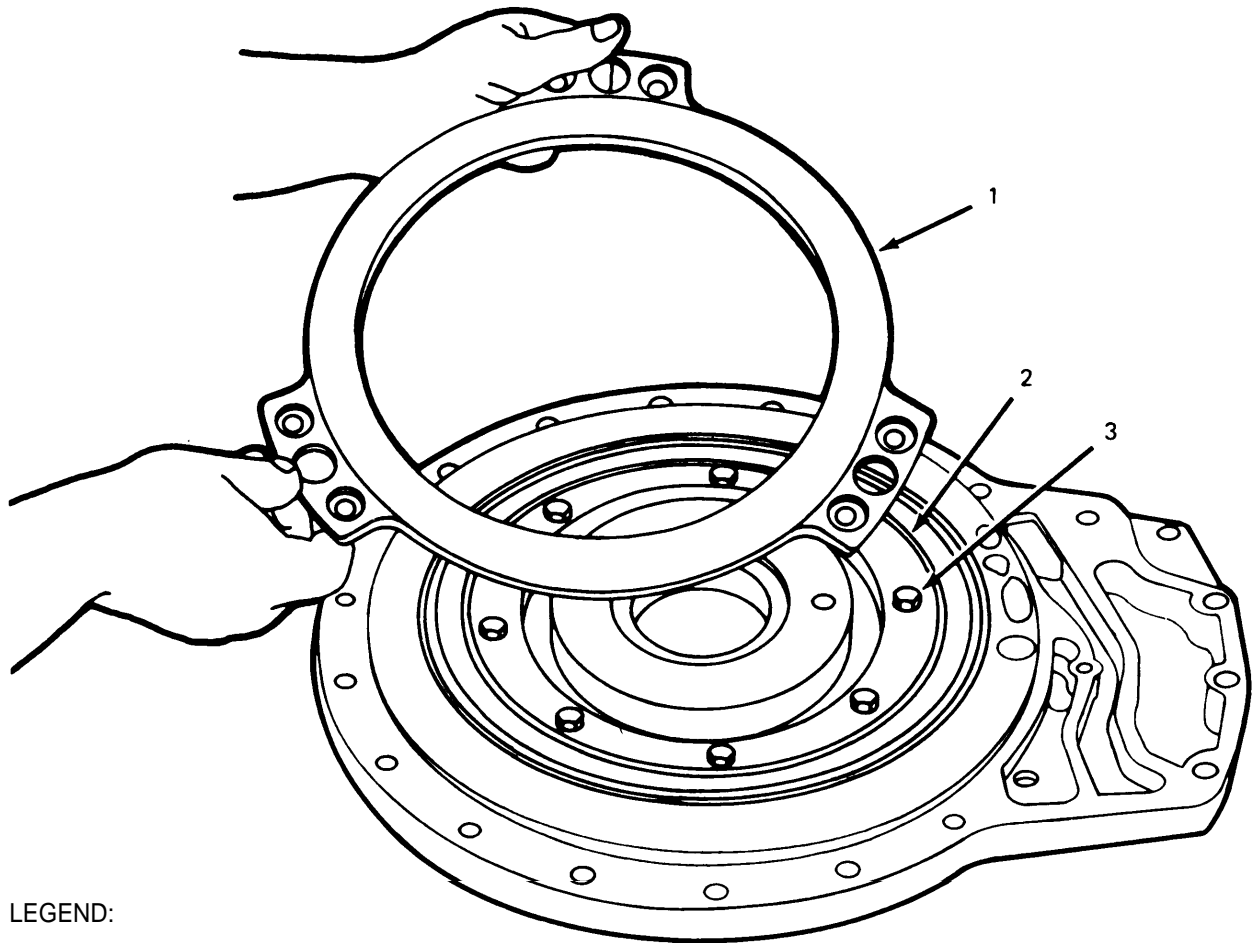
LEGEND:

- 1. SPRING (6)
- 2. SPACER (6)
- 3. DISK (2)
- 4. PLATE

TA 074133

Figure 7-88. Remove Springs and Disks.

- (24) Remove six Spacers (2).
- (25) Remove two disks (3) and plate (4).
- (26) Remove plate (1, fig. 7-89) from the plate assembly.



LEGEND:

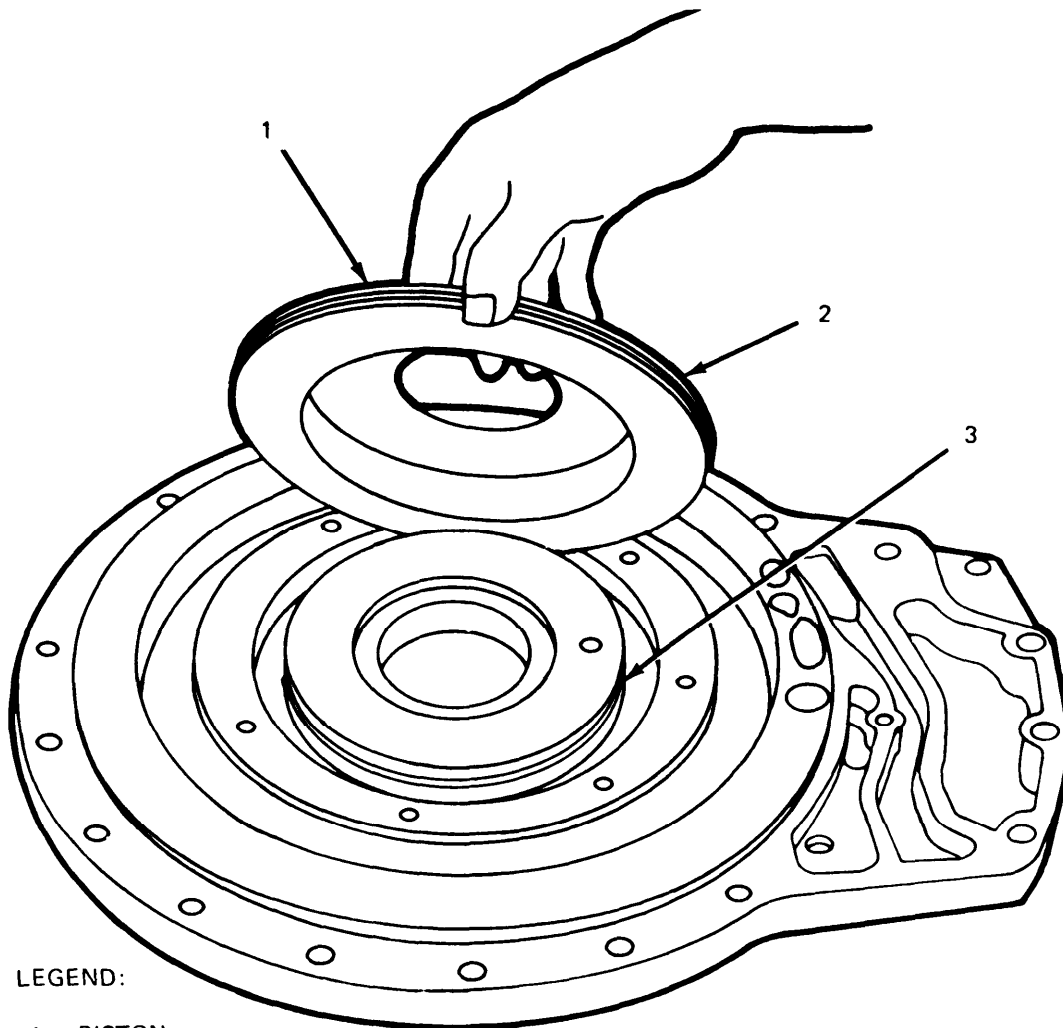
1. PLATE
2. RETAINER RING
3. BOLT (8)

TA 074134

Figure 7-89. Remove Plate.

(27) Remove eight bolts (3) and remove retainer ring (2).

(28) Remove piston (1, fig. 7-90) from the plate assembly. It may be necessary to tap piston from the back side of plate with a punch and mallet to set it free.



LEGEND:

- 1. PISTON
- 2. O-RING & SEAL
- 3. O-RING & SEAL

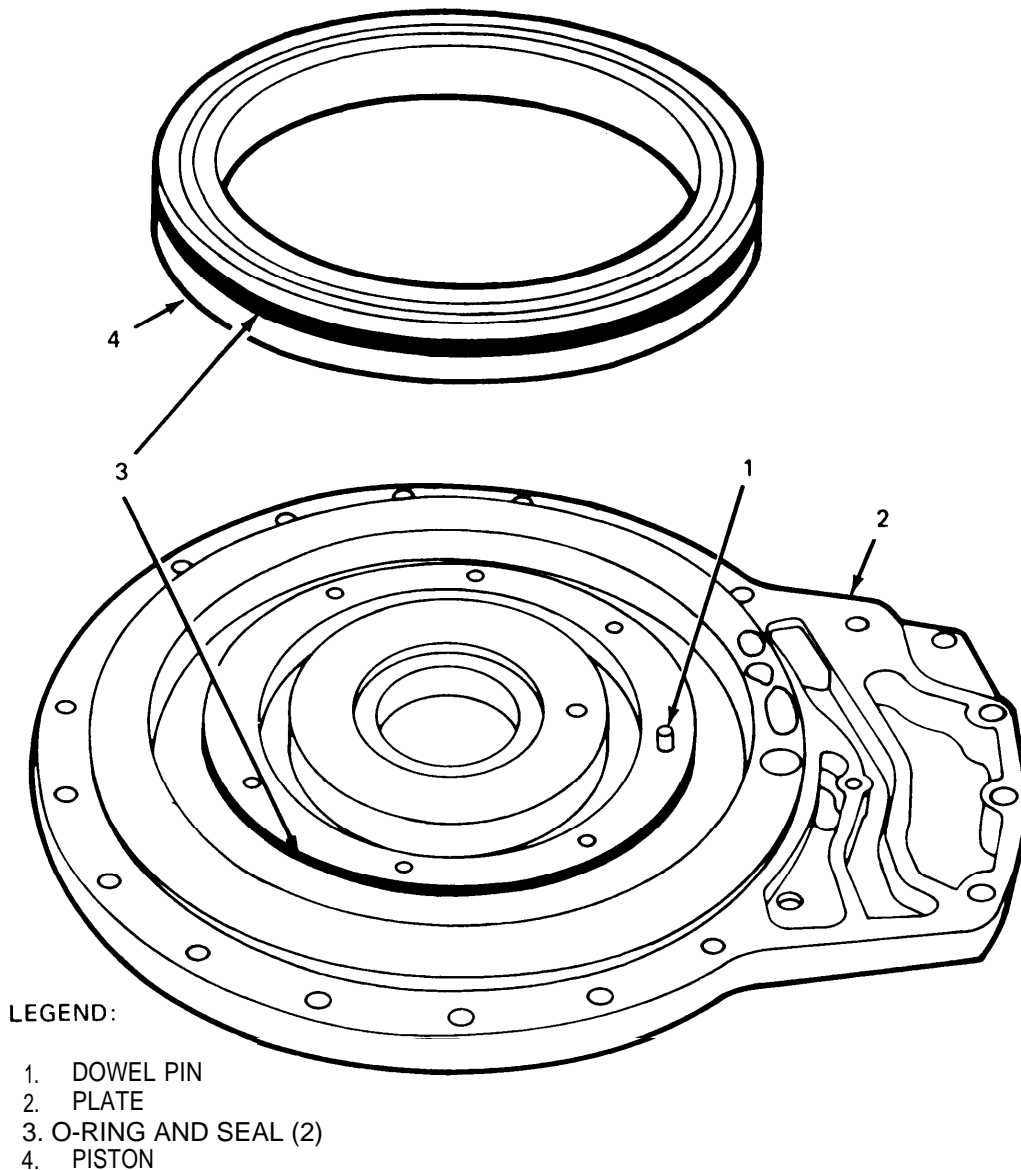
TA 074135

Figure 7-90. Remove and Disassemble Piston.

(29) Remove O-ring and seal (2) from the piston. Remove the O-ring and seal (3) from the plate assembly.

(30) Remove piston (4, fig. 7-91) from plate (2). It may be necessary to tap piston (4) from the backside of plate (2) with a punch and mallet to set it free.

(31) Remove O-rings and seal (3).



TA 074136

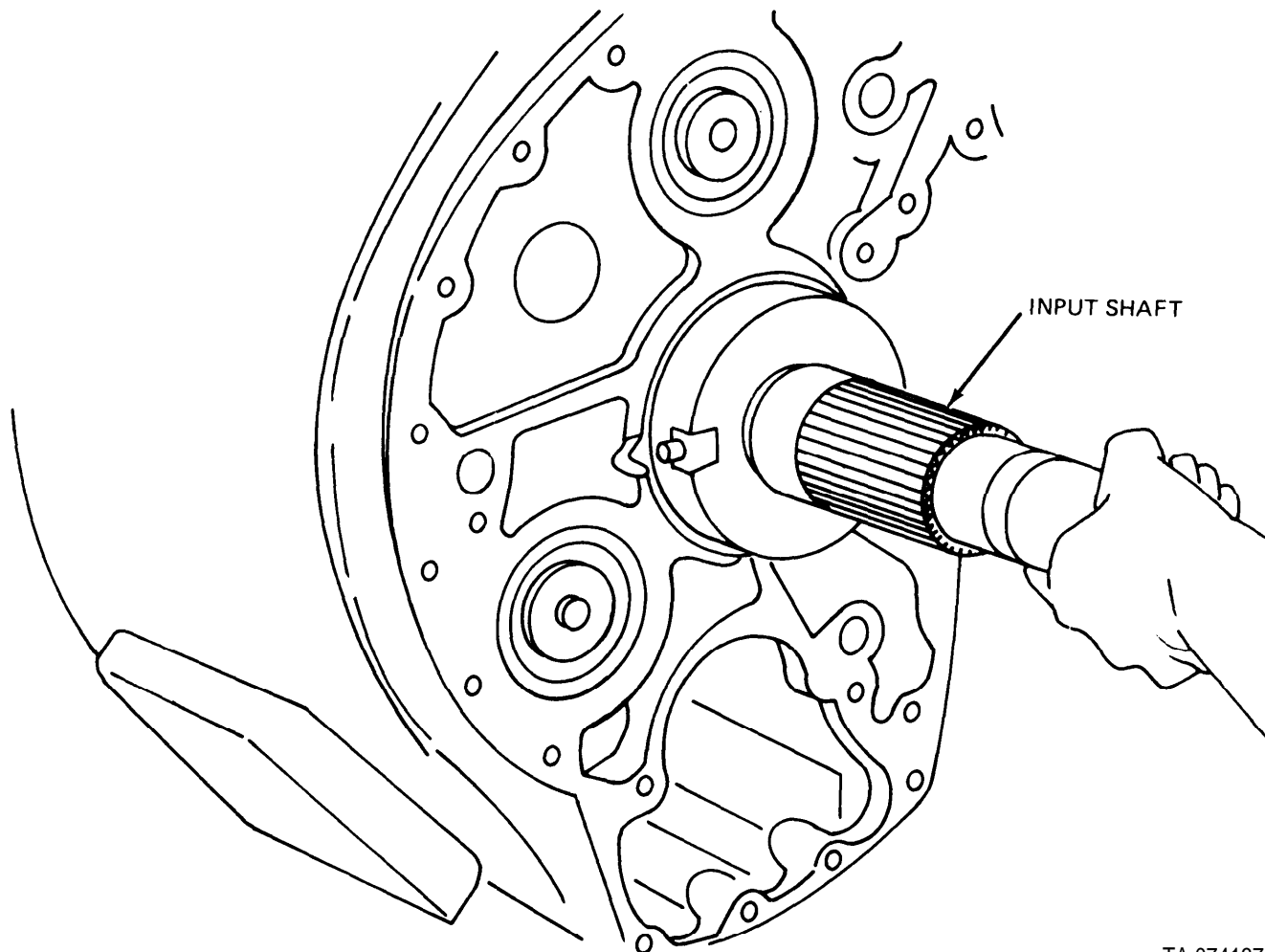
Figure 7-91. Remove Outer Piston.

(32) If necessary, dowel pin (1) may be extracted from plate (2). If the dowel pin (1) is sheared off flush with plate (2), replace plate (2).

(33) Remove two O-rings from the backside of plate (2).

g. Remove and Disassemble input Shaft.

(1) Remove input shaft from front case (fig. 7-92).

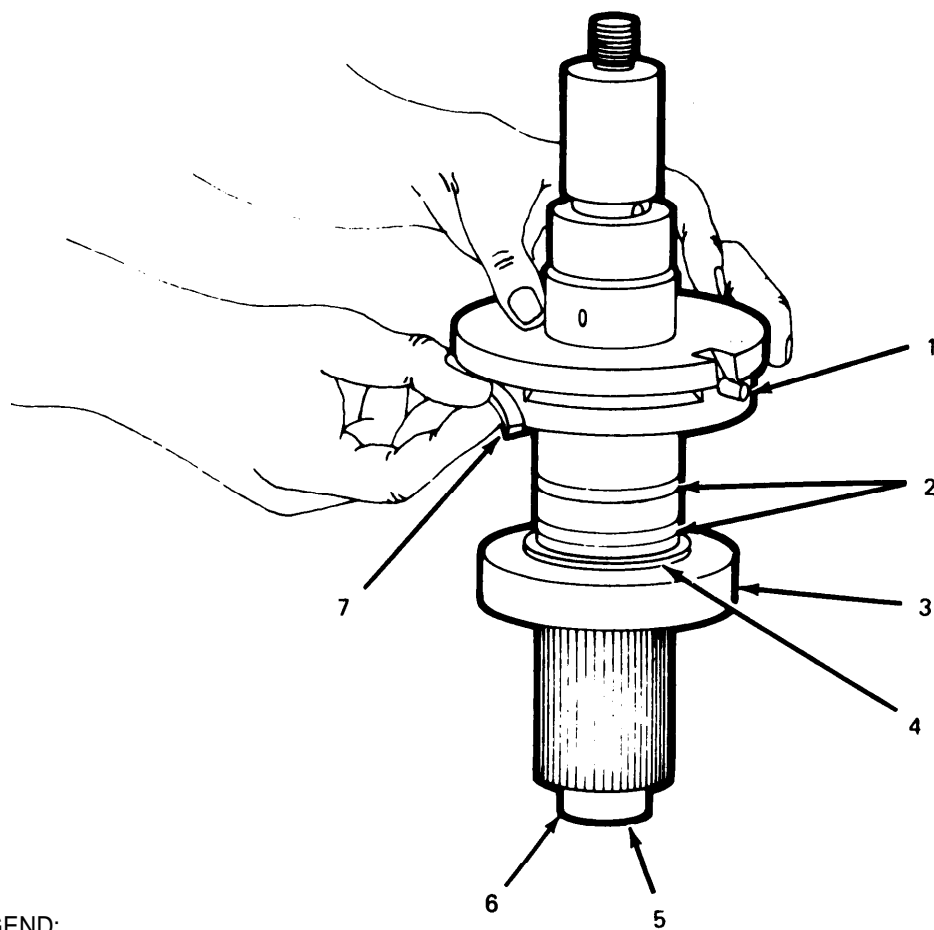


TA 074137

Figure 7-92. Remove Input Shaft.

(2) Remove three keepers (7, fig. 7-93) from the retainer.

(3) Pull out roll pin (1); then lift off bearing retainer. It may be necessary to tap retainer with a mallet to set it free.



LEGEND:

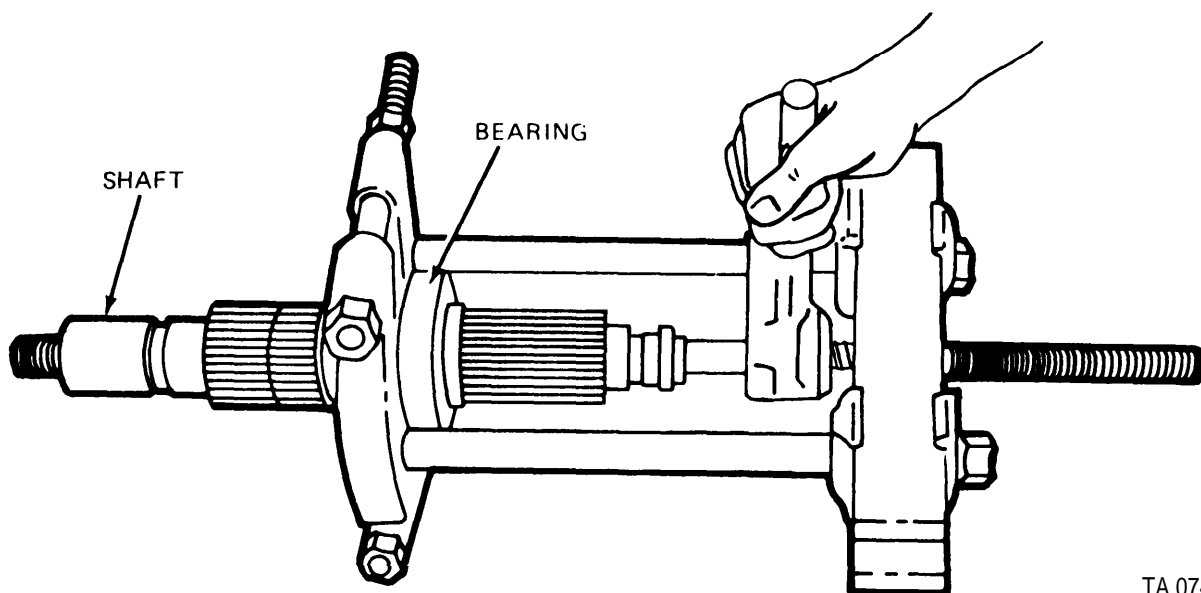
- 1. ROLL PIN
- 2. RING (2)
- 3. BEARING

- 4. SNAP RING
- 5. SEAL RING
- 6. PLUG
- 7. KEEPER (3)

TA 074138

Figure 7-93. Disassemble Input Shaft.

- (4) Remove rings (2) from the shaft.
- (5) Remove snapping (4) and the snapping on the other side of the bearing.
- (6) Remove seal ring (5).
- (7) Remove plug (6) from the shaft.
- (8) Remove bearing (fig. 7-94) from the shaft with a puller.

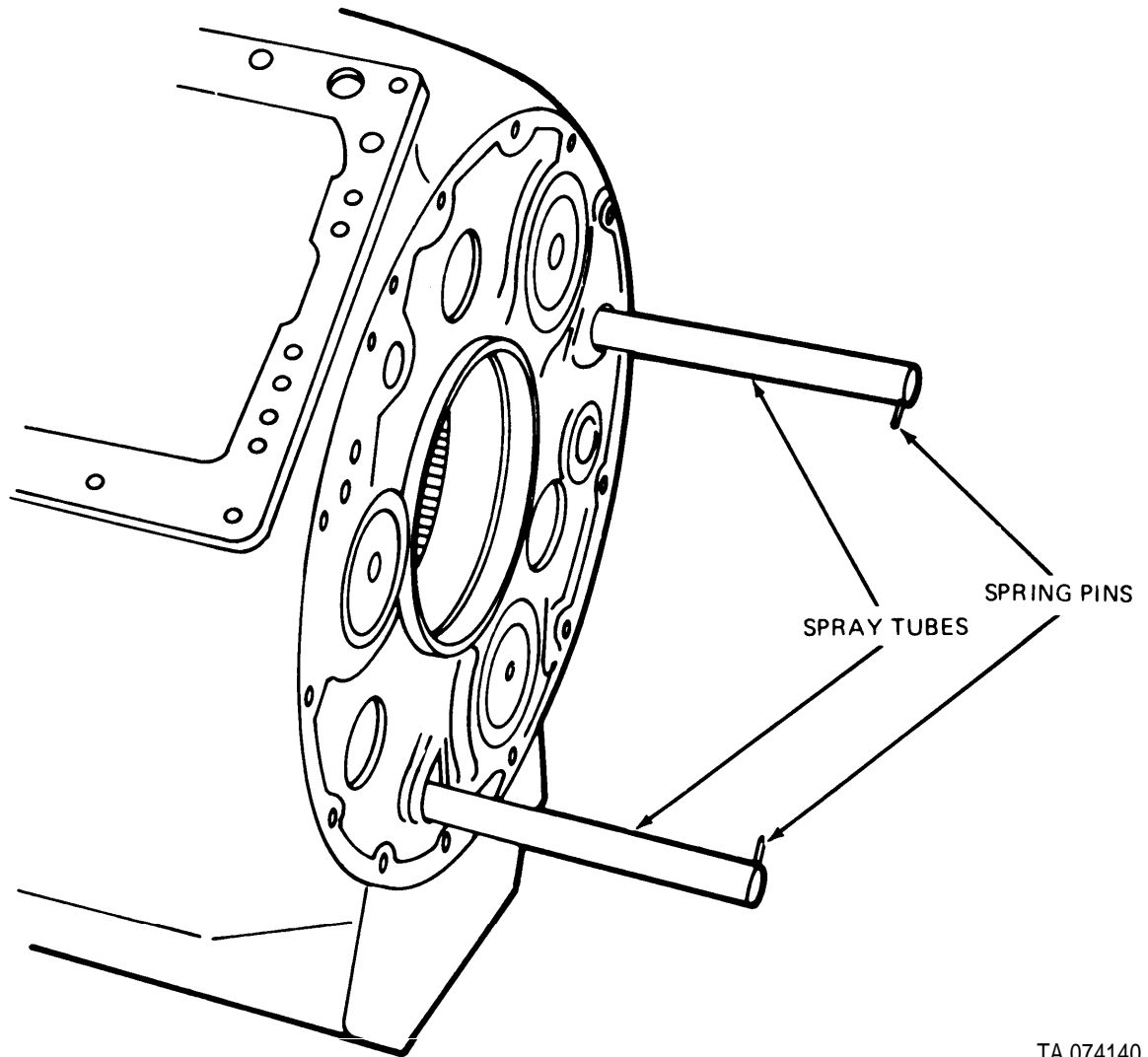


TA 074139

Figure 7-94. Remove Bearing.

h. Main Case Disassembly.

- (1) Remove two spray tubes (fig. 7-95) from the rear of the transmission.
- (2) Remove two spring pins from the spray tubes. Remove one orifice and valve from the spray tubes. Note location for reassembly.



TA 074140

Figure 7-95. Remove Spray Tubes.

- (3) Identify the shifting forks for location and orientation in the transmission to assist in reassembly (fig. 7-96).

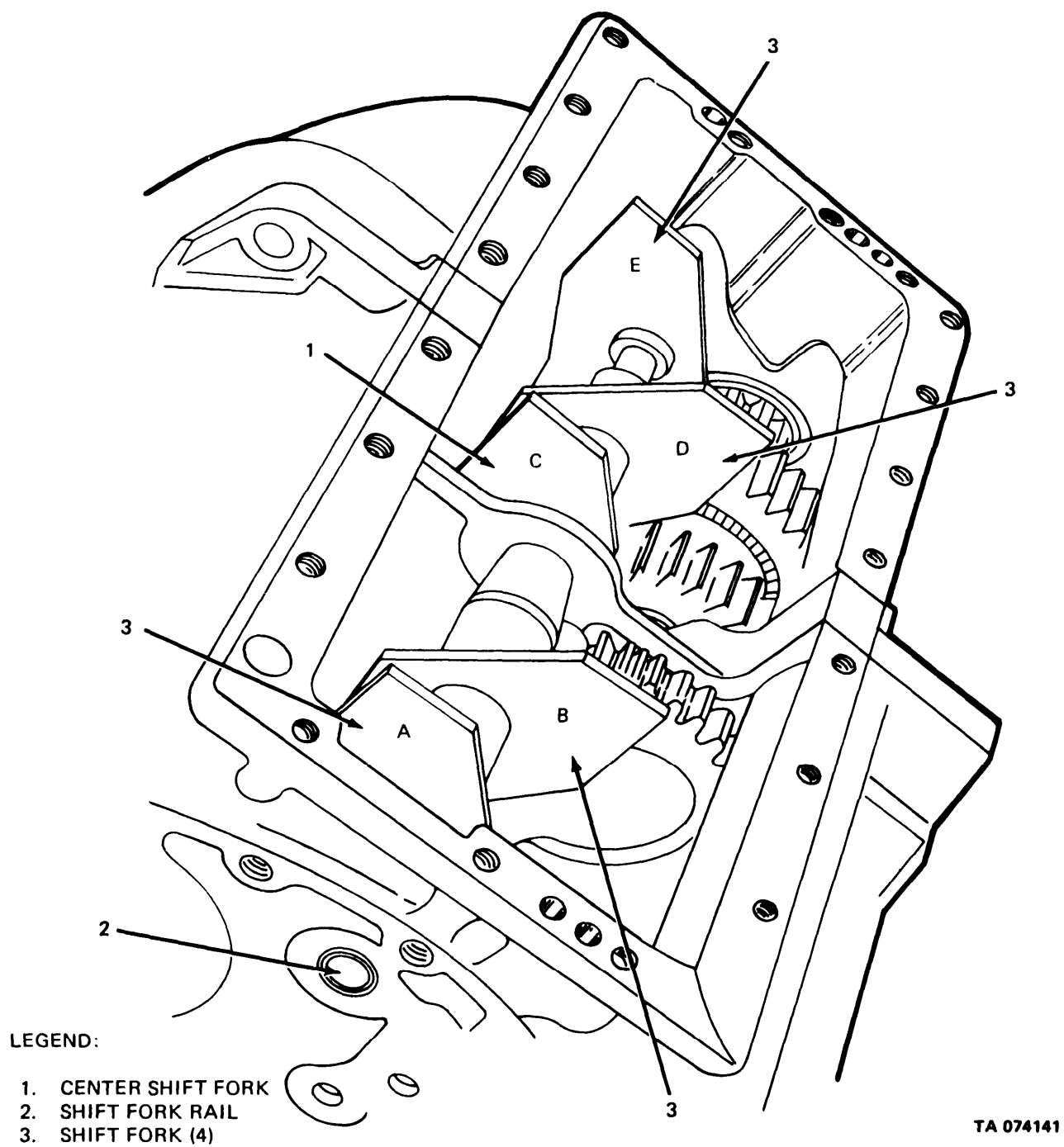


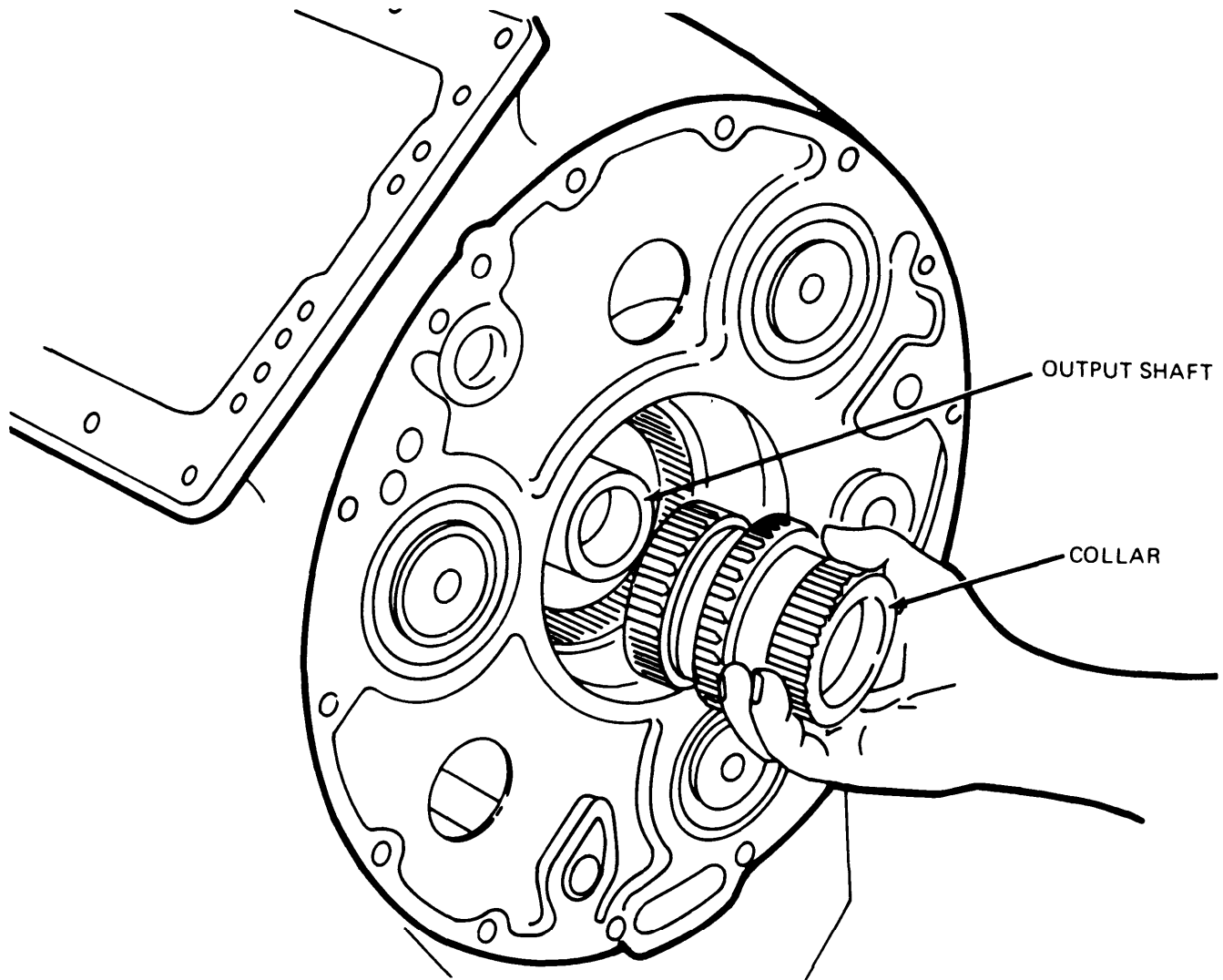
Figure 7-96. Identify and Remove Shift Forks.

NOTE

The center shift fork (1), will not come out until the case has been separated.

(4) Pull shift fork rail (2) from the rear of the transmission and remove four shift forks (3).

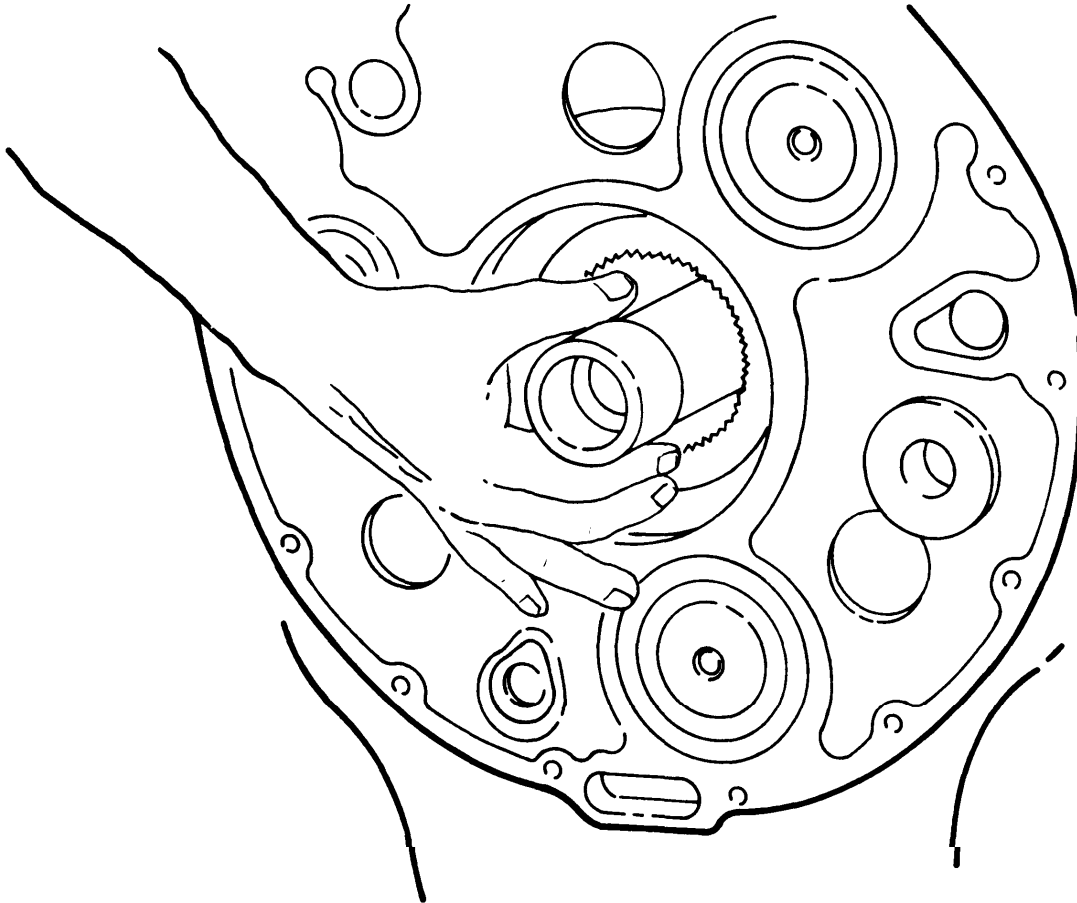
(5) Remove output collar (fig. 7-97).



TA 074142

Figure 7-97. Remove Output Collar.

(6) Remove center shaft (fig. 7-98) from the rear of the transmission.



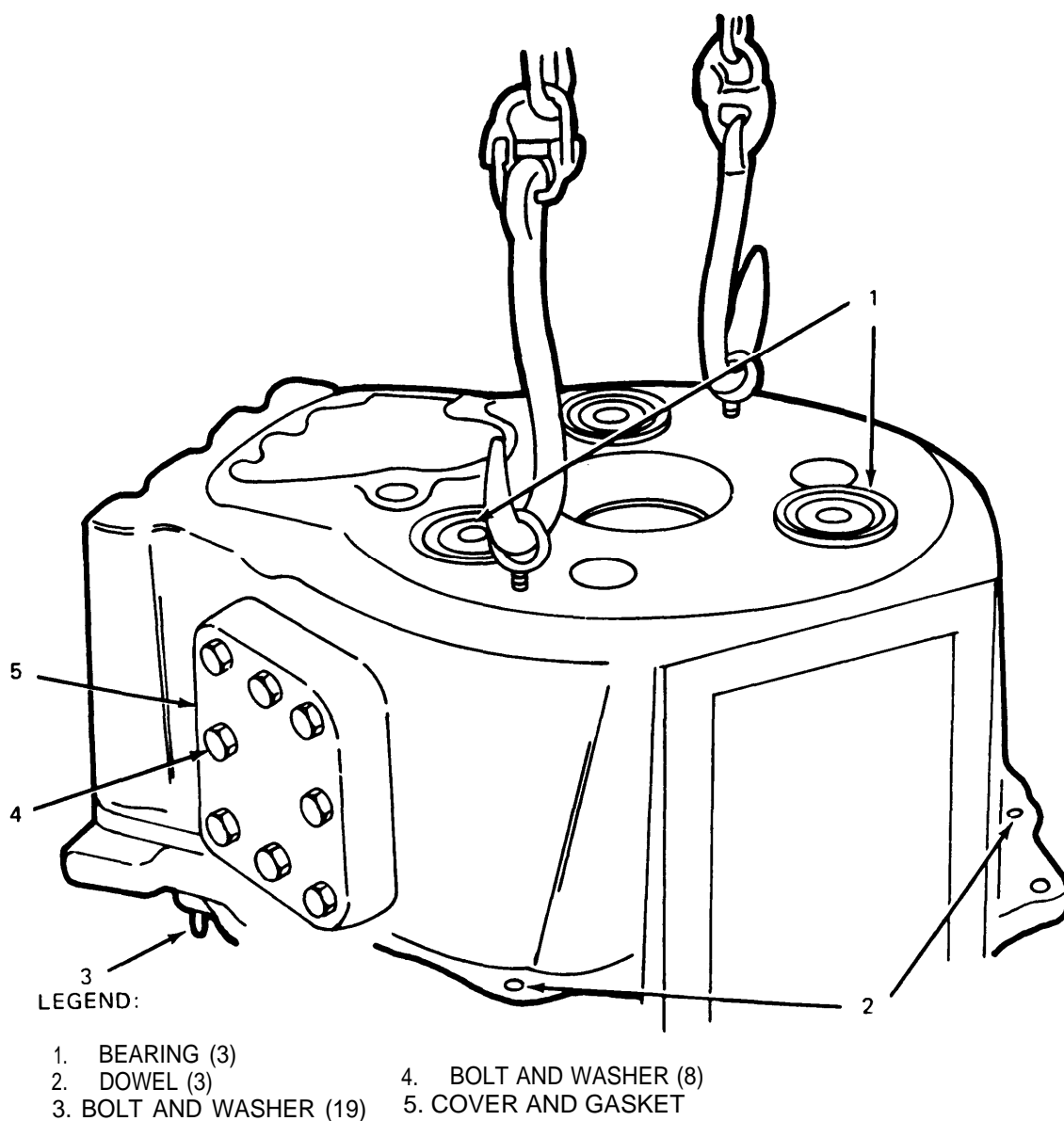
TA 074143

Figure 7-98. Remove Center Shaft.

(7) Turn the transmission up on the rear case.

(8) Install two 3/8 in. 16 forged eyebolts in the front case, (fig. 7-99), and fasten a hoist to the eyebolts.

(9) If necessary, cover and gasket (5) may be removed by removing eight bolts and washers (4). Tap with a mallet to loosen.



TA 074144

Figure 7-99. Install Lifting Eyebolts in Front Case.

(10) Remove 19 bolts (3) and lockwashers that hold the front and rear cases together. There are 15 long bolts and 4 short ones. Note location to aid in reassembly.

(11) Drive three dowels (2) down past upper case flange.

NOTE

The front case weighs approximately 90 lbs (41 kg).

(12) Use a hoist to lift case evenly. It may be necessary to tap perimeter of case with a mallet to separate case halves.

(13) Tap out three bearings (1) using a mallet or soft drift.

NOTE

The countershaft assembled weighs approximately 125 lbs.

(14) Put a strap or rope around the three countershafts (fig. 7-100). Fasten a hoist to the strap or rope. Remove three countershafts (1) and the three gears as a unit.

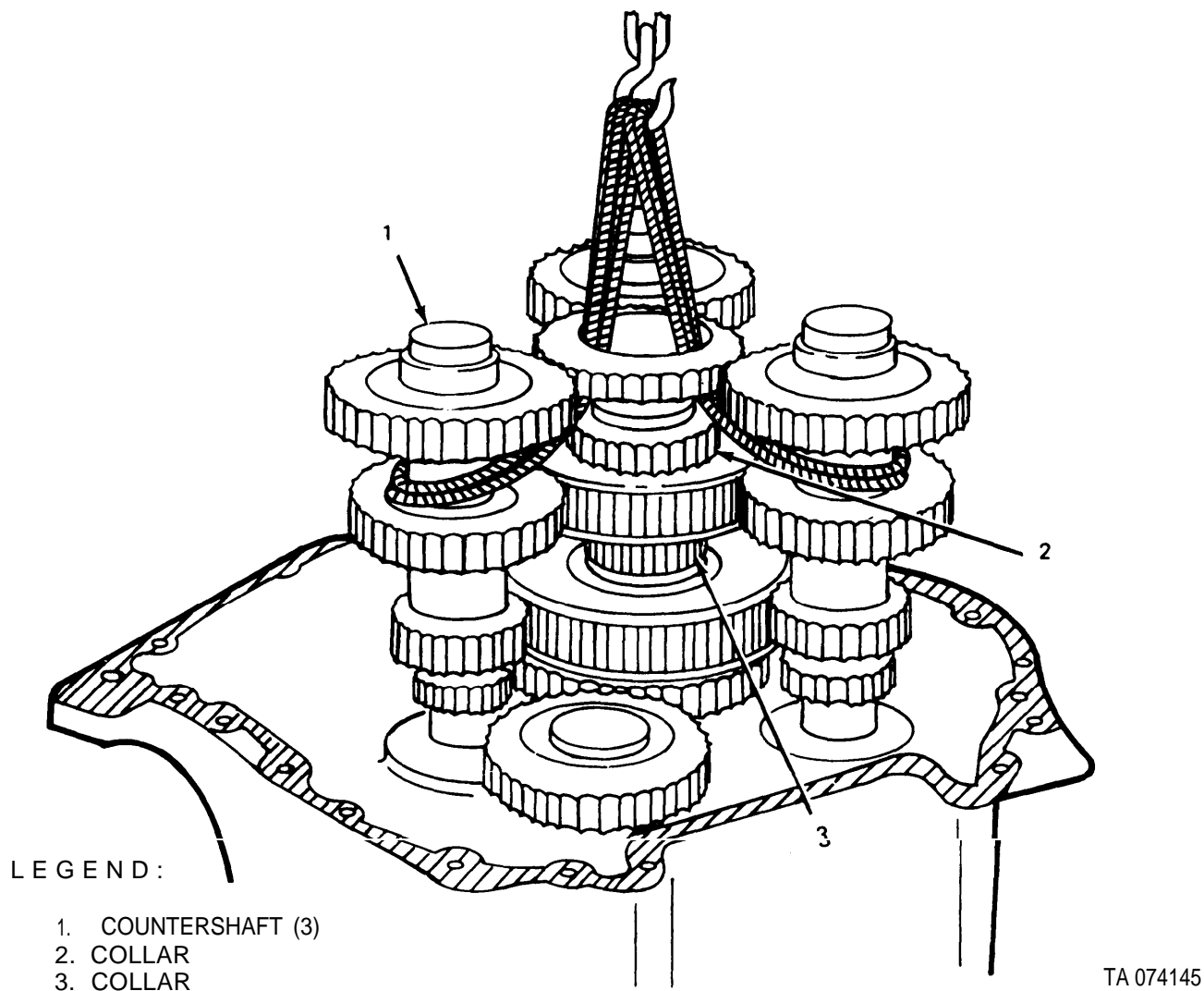
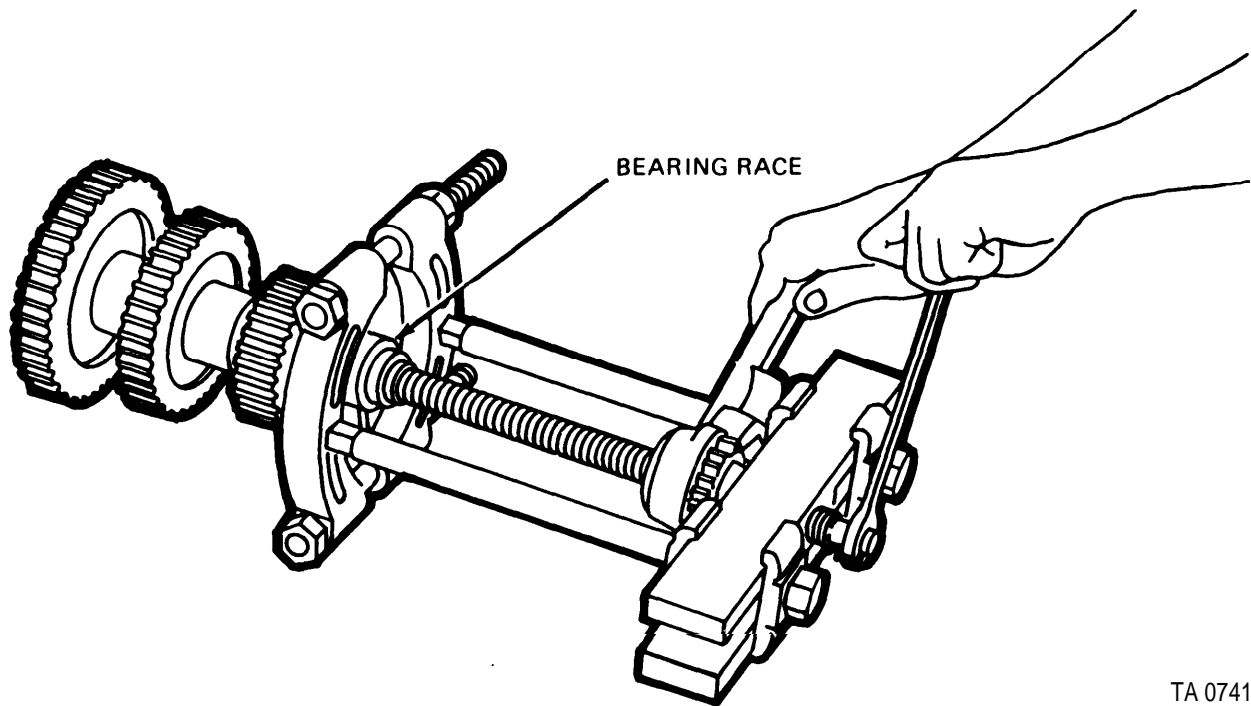


Figure 1-100. Remove Front Gear Cluster.

(15) Put the countershafts and gears on a work bench or on the floor. Separate the countershafts from the gears. Remove collars (2) and (3) from the bottom two gears.

(16) Remove bearing race (fig. 7-101) from each end of the three countershafts with puller or a press.



TA 074146

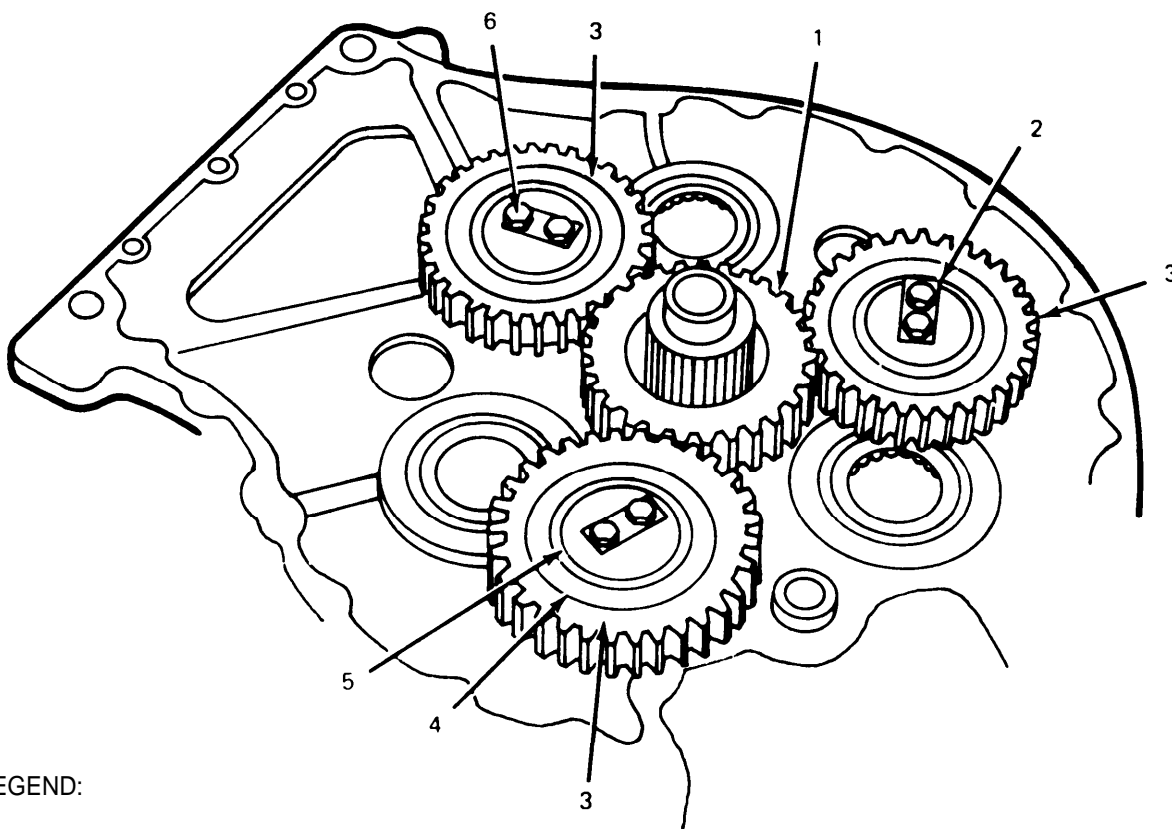
Figure 7-101. Remove Countershaft Bearing Races.

NOTE

Place a wedge between gears (1, 3 fig. 7-102) to aid in removal of bolts (6).

(17) Bend lockplate tabs (2) away from the bolts (6) on each shaft; then remove bolts (6), washers (5) and thrust washers (4).

(18) Remove gear (1) from center plate.



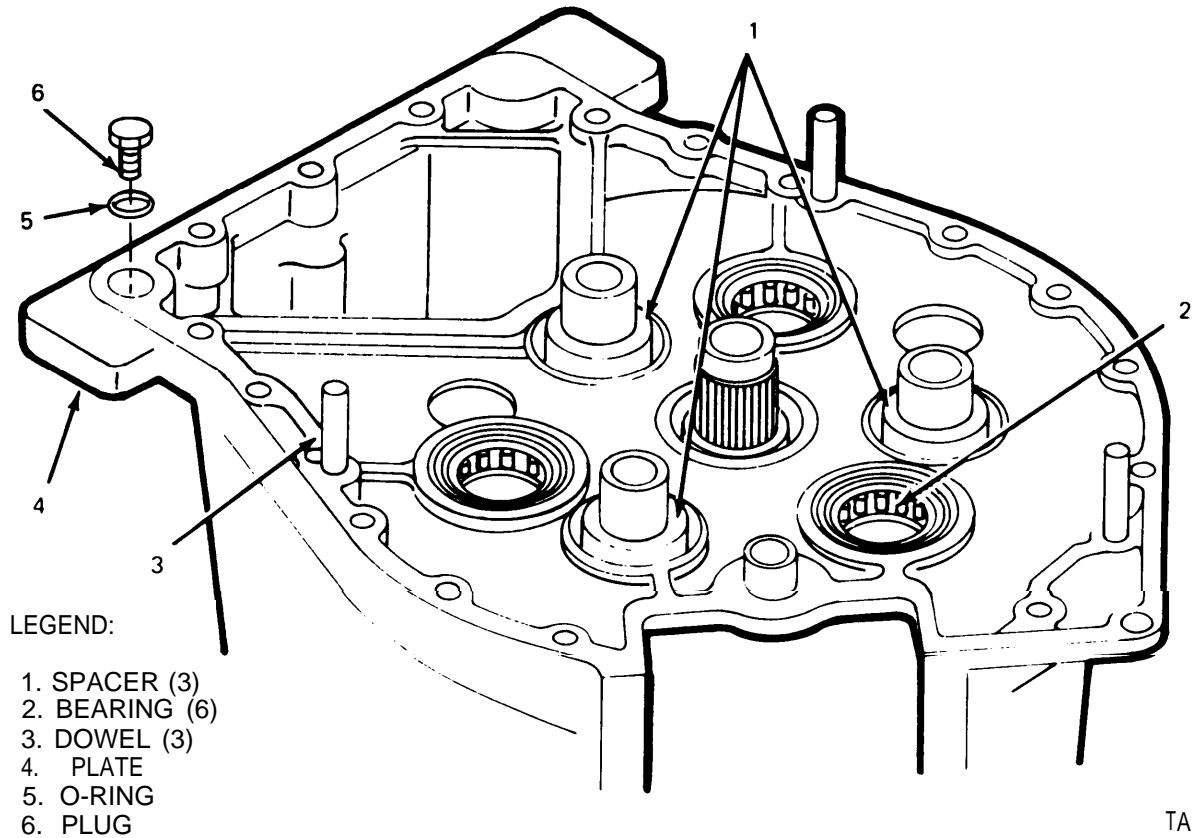
LEGEND:

- 1. GEAR
- 2. TAB (3)
- 3. GEAR (3)
- 4. THRUST WASHER (6)
- 5. WASHER (3)
- 6. BOLT (6)

TA 074147

Figure 7-102. Remove Center Plate Gears.

- (19) Remove three gears (3), rollers and thrust washers that are located under each gear.
- (20) Remove spacers (1, fig. 7-103) from the three countershafts.
- (21) If necessary, O-ring (5) and plug (6) may be removed.
- (22) Drive three dowels (3) down below surface of plate (4); then remove plate (4) from the rear case by tapping up with a soft mallet.

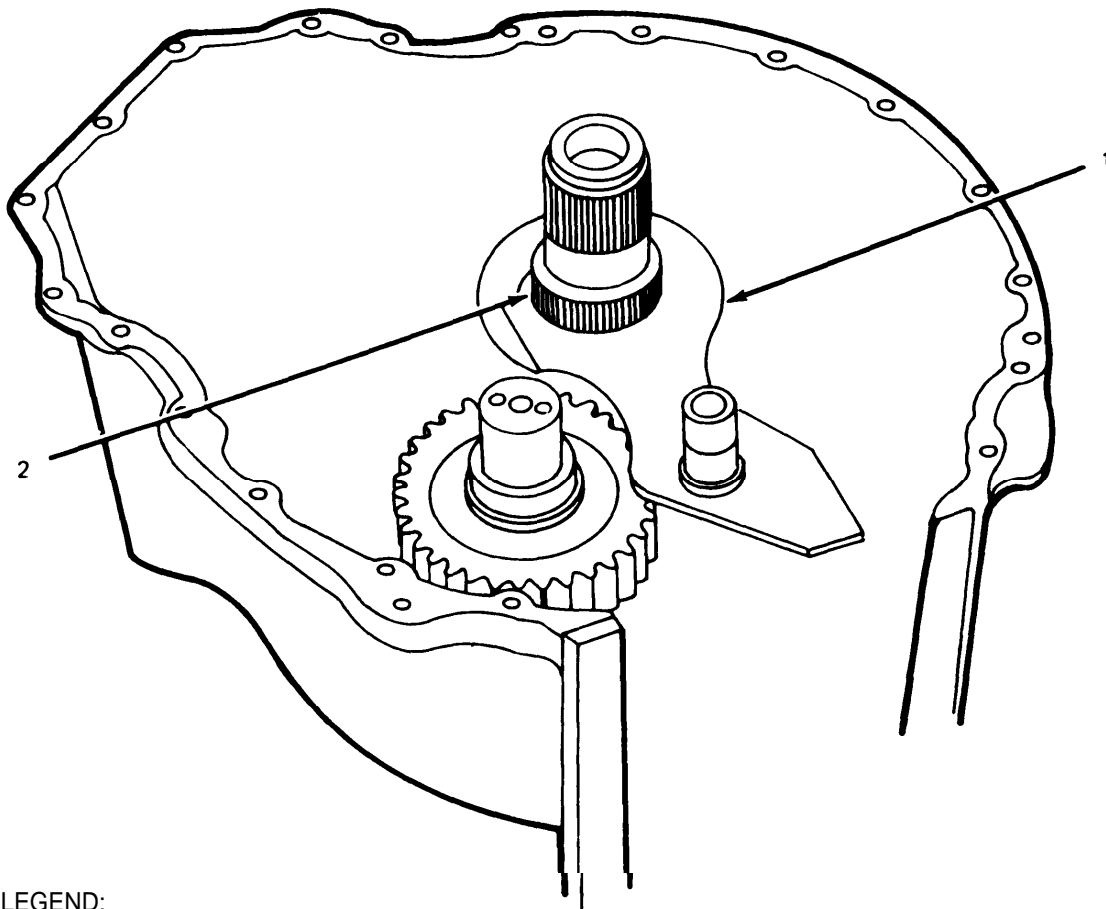


TA 074148

Figure 7-103. Remove Center Plate.

(23) Remove six bearings (2) from center plate using Driver Group IP520.

(24) Remove reverse gear shifting fork (1, fig. 7-104). Remove collar (2) from the shaft.



LEGEND:

- 1. SHIFTING FORK
- 2. COLLAR

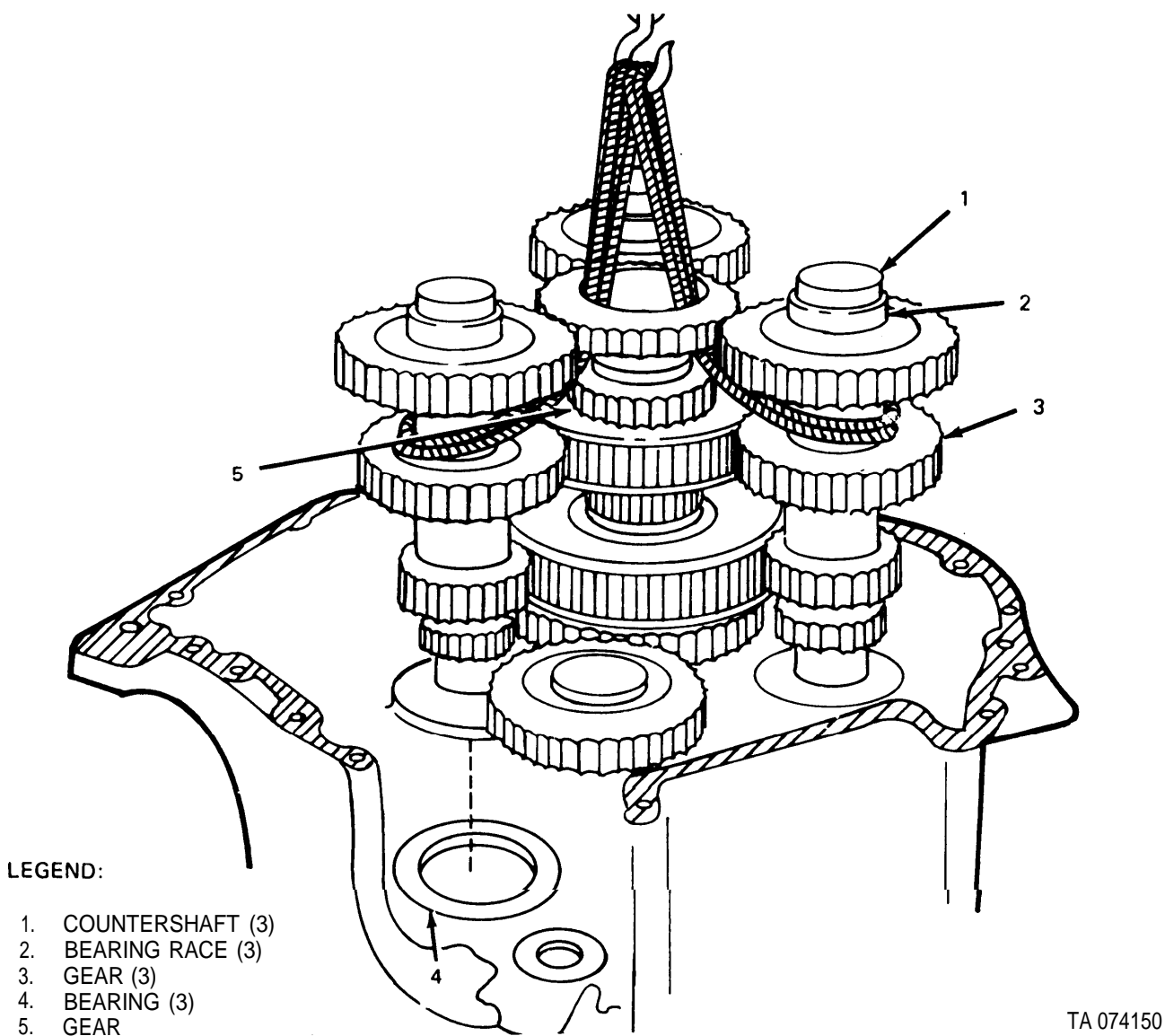
TA 074149

Figure 7-104. Remove Reverse Shift Fork.

NOTE

The countershaft assembly weighs approximately 125 lbs.

(25) Put a strap or rope around three countershafts (fig. 7-105). Fasten a hoist to the strap or rope. Remove three countershafts (1) and the gears as a unit.



TA 074150

Figure 7-105. Remove Rear Gear Cluster.

(26) put the countershafts and gears on a work bench or on the floor. Separate the countershafts from the gears. Remove the collar from gear (5) in the center.

(27) Remove bearing race (2) from each end of the three countershafts, using tools 8H663, 8B7560, 8H684, and 8B7548.

(28) Remove gear (3) and shaft. Remove the collar from the shaft.

(29) Remove three bearings (4) from the rear case using driver group IP520.

7-18. Cleaning. All parts must be thoroughly clean before reassembly. Dry cleaning solvent (item 12, Appendix B) can be used for all areas except for case mating surfaces. On all case mating surfaces, use a rubber cement thinner (item 20, Appendix B) to clean residue of the old liquid gasket material. It is important that these surfaces be thoroughly clean; otherwise, leaks may result when the transmission is assembled.

7-19. Assembly.

a. Tools and Equipment Required.

(1) *Tools.*

- (a) 5P8693 Lifting Bracket
- (b) FT901 Bracket (2)
- (c) 2P8260 Installer

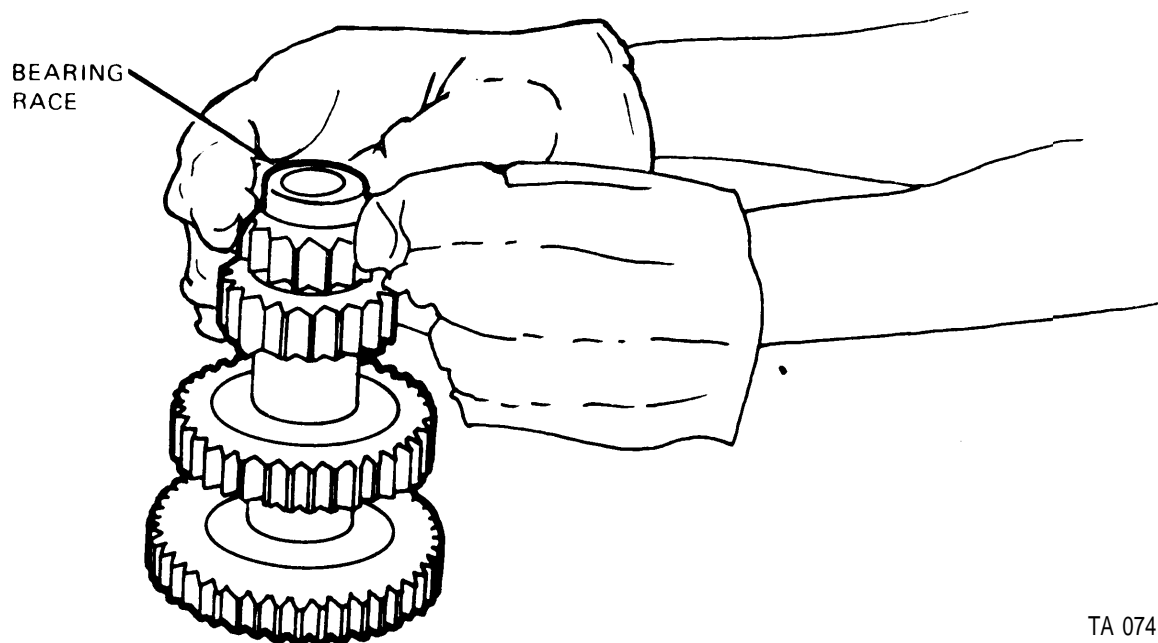
(2) *Equipment.*

- (a) Hoist (1200-lb minimum capacity)
- (b) Nylon rope (1/2-in .diameter)

b. Assemble Main Case.

(1) Install three bearings (4, fig. 7-105) in the rear case.

(2) Heat three bearing races in oil to a maximum temperature of 275°F (135°C); then install the bearing races (fig. 7-106) on the ends of the three countershafts.



TA 074151

Figure 7-106. Install Bearing Races.

(3) Count and mark the teeth on the three floating gears as follows:

GEAR	TOTAL TEETH	MARK
Bottom	48	Every 16th
Middle	27	Every 9th
Top	30	Every 10th

(4) Place shift collar in the center floating gear. Assemble the three countershafts with three floating gears in the center as shown in figure 7-107. Make sure the timing marks (blind splines) on the countershafts mesh with the marks on the floating gears.

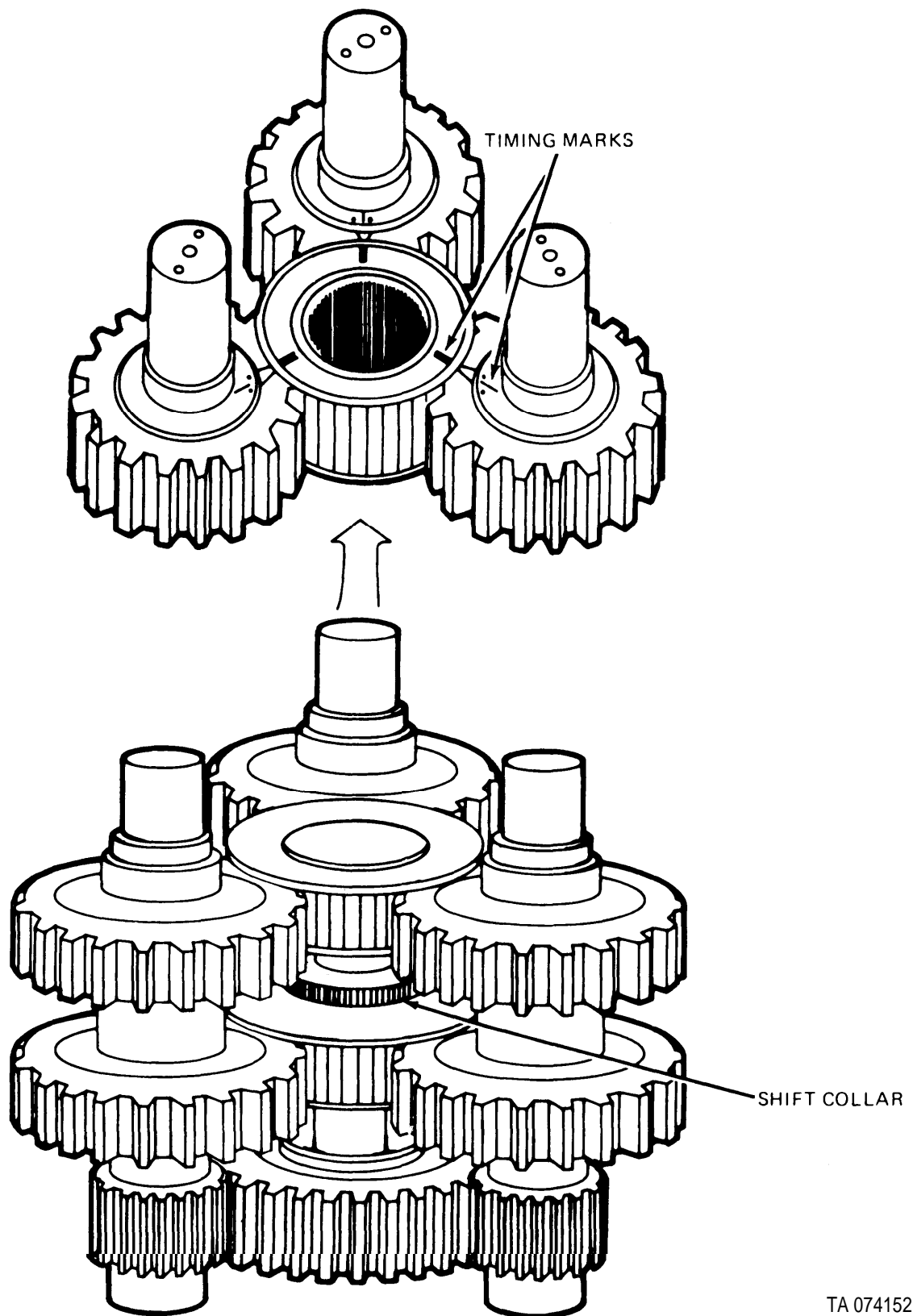


Figure 7-107. Assemble Countershafts and Floating Gears.

TA 074152

(5) put a rope around and through the gear cluster (fig. 7-108). Attach a hoist to the rope.

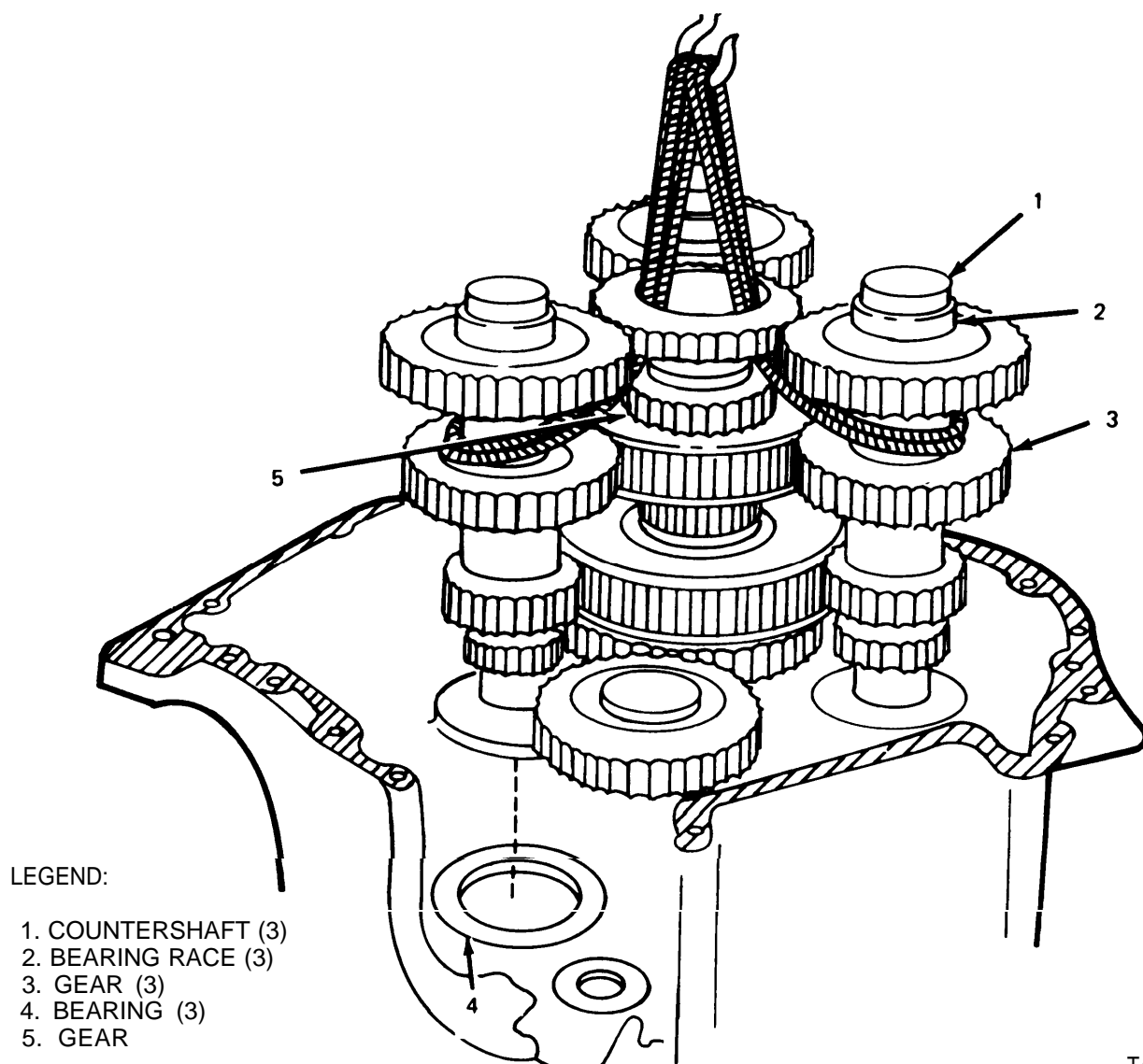


Figure 7-108. Install Rear Gear Group.

TA 074150

(6) Gently lift the gear cluster, checking that all teeth are properly meshed.

NOTE

If the countershafts do not aline with the bearings in the rear case, either the marking (step 3) or the assembly of the gears (steps 4, 5, 6, and 7) were not done correctly. Assembly will not fit into housing if gears are not properly timed.

(7) Install the gear cluster in the rear case as shown in figure 7-109. Any countershaft can go in either of the three holes. Be sure that ledge on bottom floating gear is located in machine surface of each countershaft.

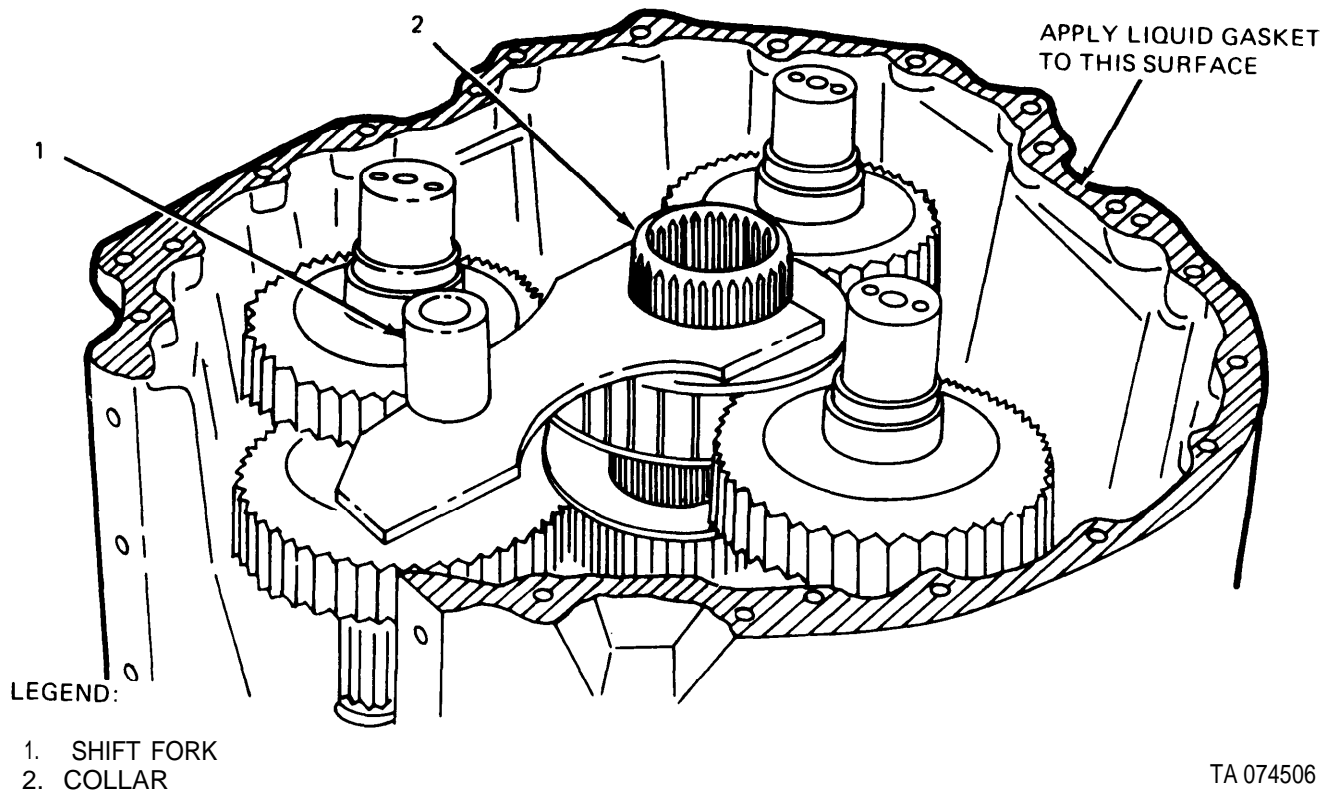


Figure 7-109. Install Reverse Shift Fork.

TA 074506

- (8) Install collar (2) and reverse shift fork (1). Make sure that teeth of collar (2) are up.
- (9) Apply liquid gasket (item 21, Appendix B) to clean surface of rear case as shown.
- (10) If removed, install O-ring and plug in center plate.
- (11) Apply liquid gasket to the clean rear case mating surface of the center plate.
- (12) Drive three dowels (fig. 7-110) up 1/8 inch so that they can guide installation of center plate.

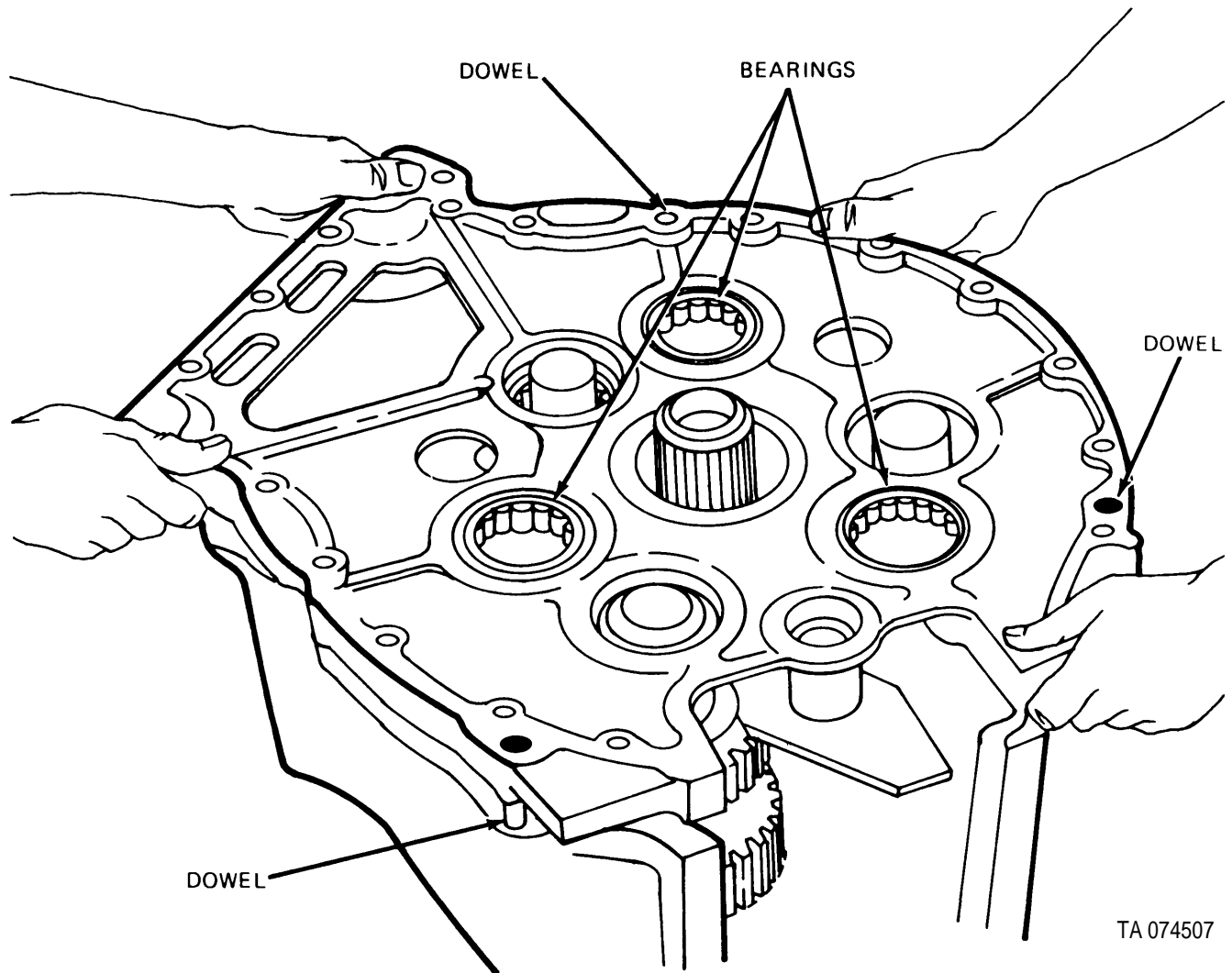
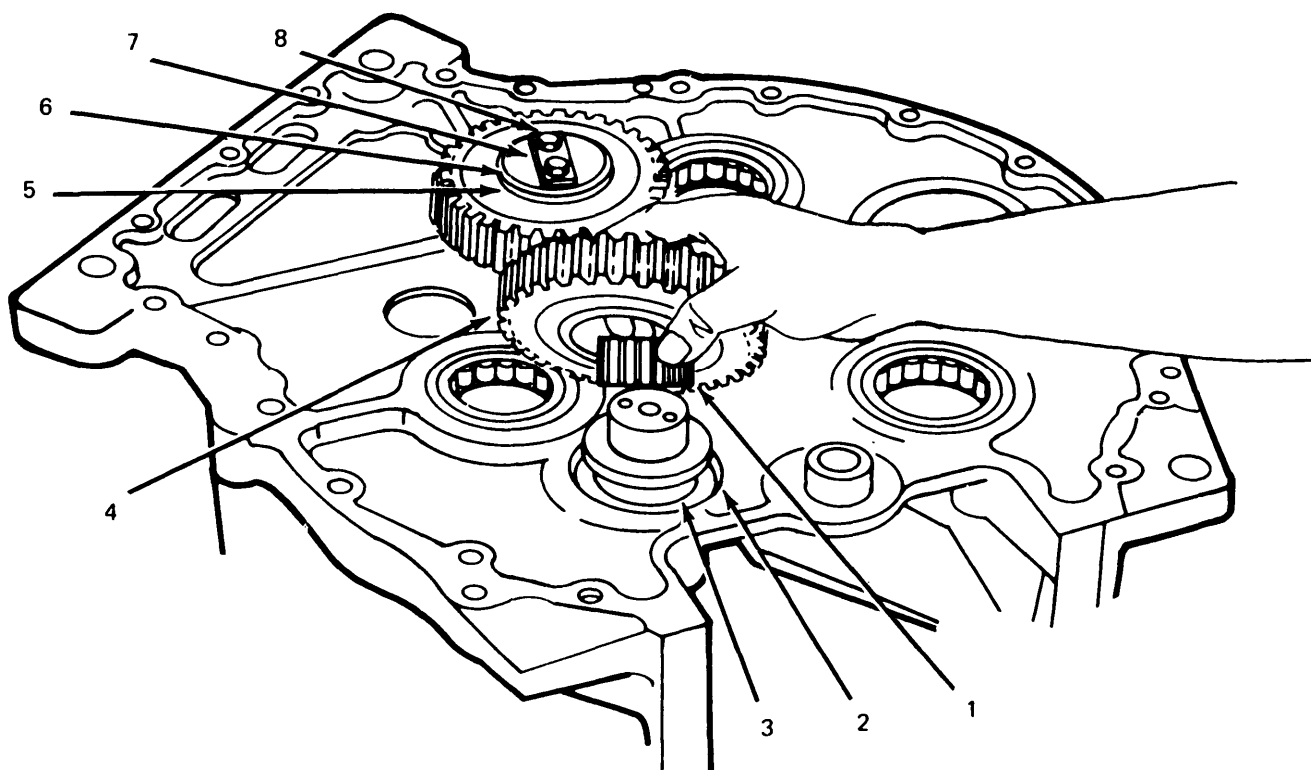


Figure 7-110. Install Center Plate.

- (13) Install three bearings in center plate; one for each rear countershaft.
- (14) Install the center plate on the rear case. Tap down with a wooden mallet to properly seat.
- (15) Install remaining three bearings in the center plate (one on each front countershaft).
- (16) Install spacers (3, fig. 7-111) on the three countershafts (small o.d. down).



LEGEND:

- | | |
|----------------------|----------------------|
| 1. BEARING (3) | 5. THRUST WASHER (3) |
| 2. THRUST WASHER (3) | 6. WASHER (3) |
| 3. SPACER (3) | 7. LOCKPLATE (3) |
| 4. GEAR (3) | 8. BOLT (6) |

TA 074153

Figure 7-111. Install Bearings, Spacers, and Thrust Washers.

- (17) Install the thrust washers (2) on the spacers.
- (18) Install the roller bearings (1) on the countershafts and install the gears (4) and center gear.
- (19) Install the thrust washers (5) and washers (6) on the gear (4).

NOTE

Place a wedge between center gear and gear (4) to aid in torquing countershaft bolts.

(20) Install new lockplates (7) and bolts (8) on the countershafts. Torque to 32 ± 5 lb-ft (43 ± 6 N-m). Bend the lockplate tabs against the bolt heads.

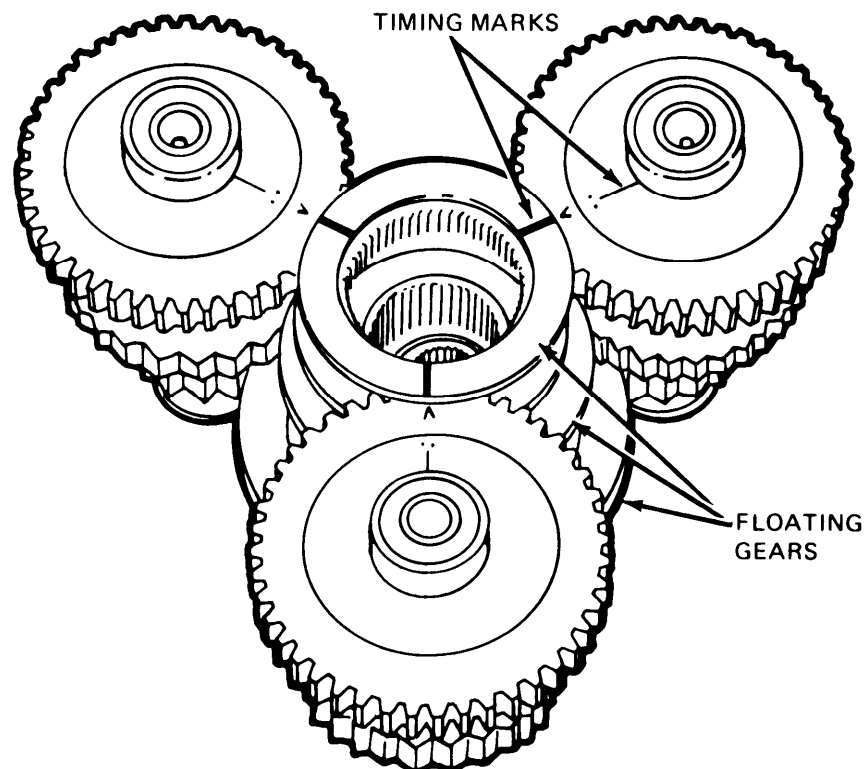
(21) Heat the bearing races for front countershafts in oil to a maximum temperature of 275°F (135°C). Install a race on each end of the three countershafts, as in figure 7-106.

(22) Count and mark the teeth on the three floating gears as follows:

GEAR	TOTAL TEETH	MARK
Bottom	45	Every 15th
Middle	36	Every 12th
Top	30	Every 10th

(23) Install two shift collars in the bottom two floating gears.

(24) Assemble the three countershafts and the three floating gears, making sure the timing marks (blind splines) on the countershafts mesh with the marks on the floating gears (fig. 7-112).



TA 074154

Figure 7-112. Assemble Front Gear Group.

(25) Install center gear (fig. 7-113).

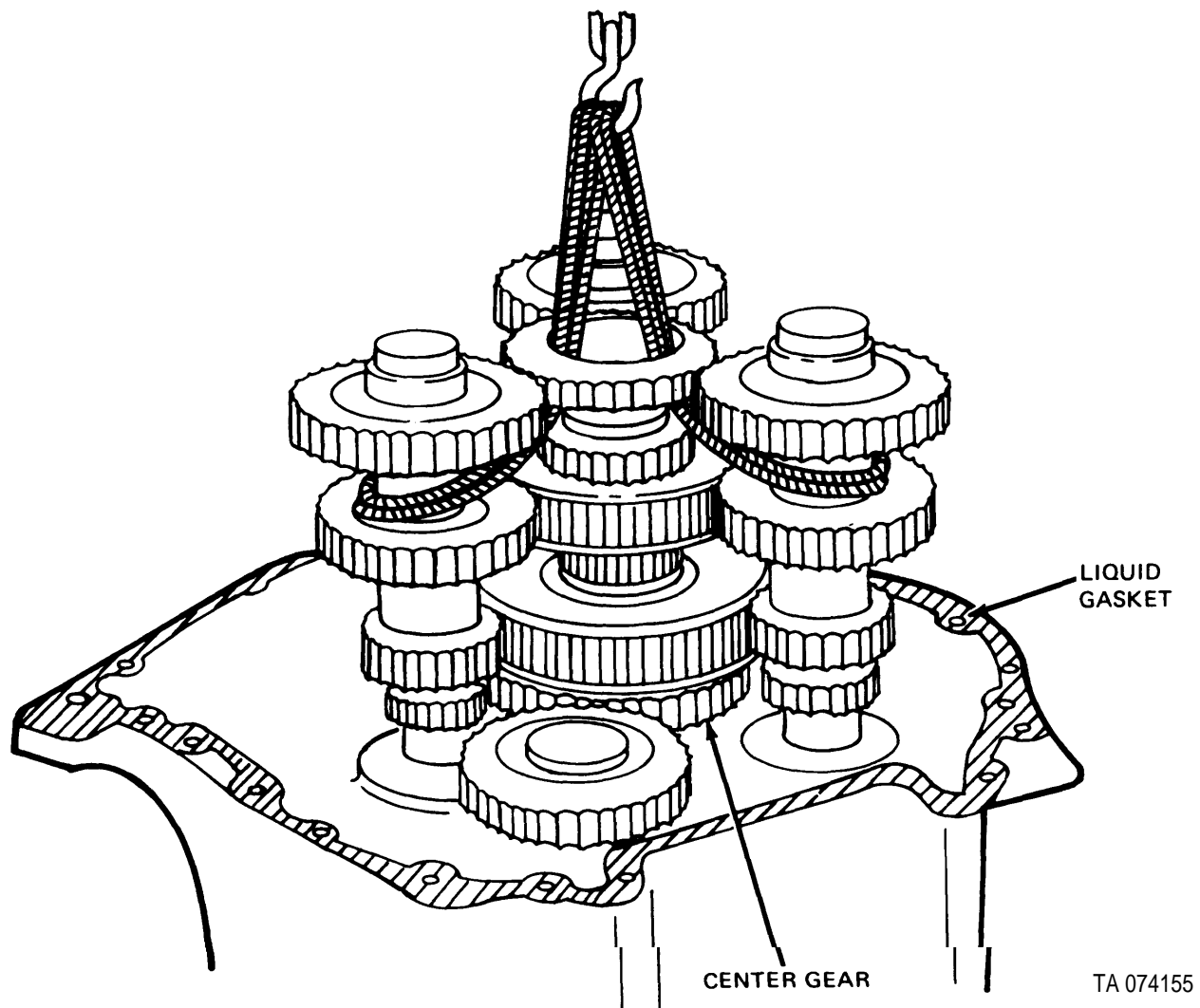


Figure 7-113. Install Front Gear Group.

(26) Put a rope around and through the gear cluster, as shown, and attach a hoist to the rope.

NOTE

In step (27), if the countershafts do not align with the bearing in the center plate, start over at step (22).

(27) Gently lift the gear cluster, checking that all teeth are properly meshed and install the gear cluster in the case center plate.

(28) Install three bearings in front case (fig. 7-114).

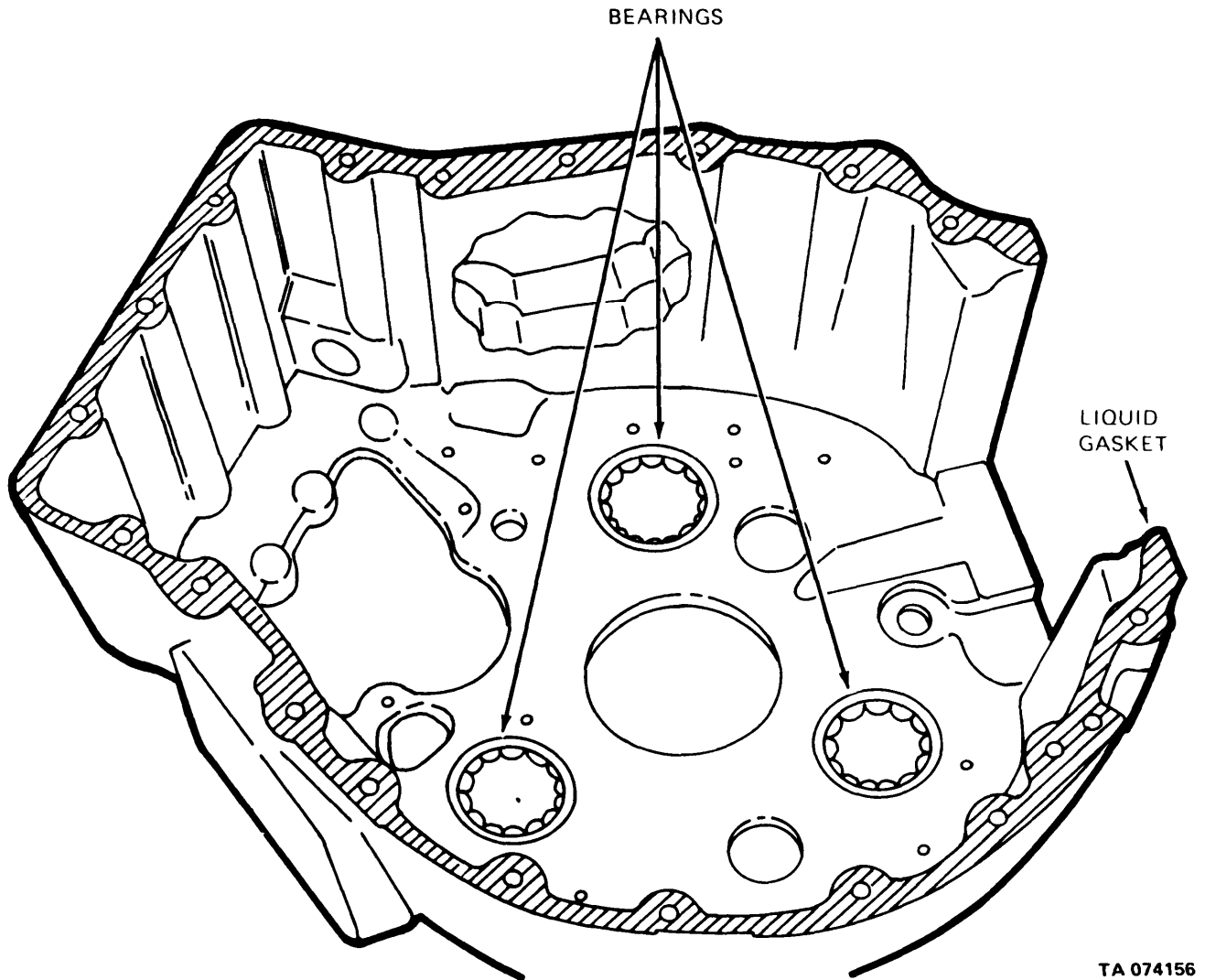


Figure 7-114. Install Bearings in Front Case.

(29) Apply liquid gasket (item 21, Appendix B) to the mating surfaces of the center plate (fig. 7-113) and front cover (fig. 7-114),

(30) Drive three dowel pins in rear case up 1/8 inch to aid in assembly of front case (fig. 7-115).

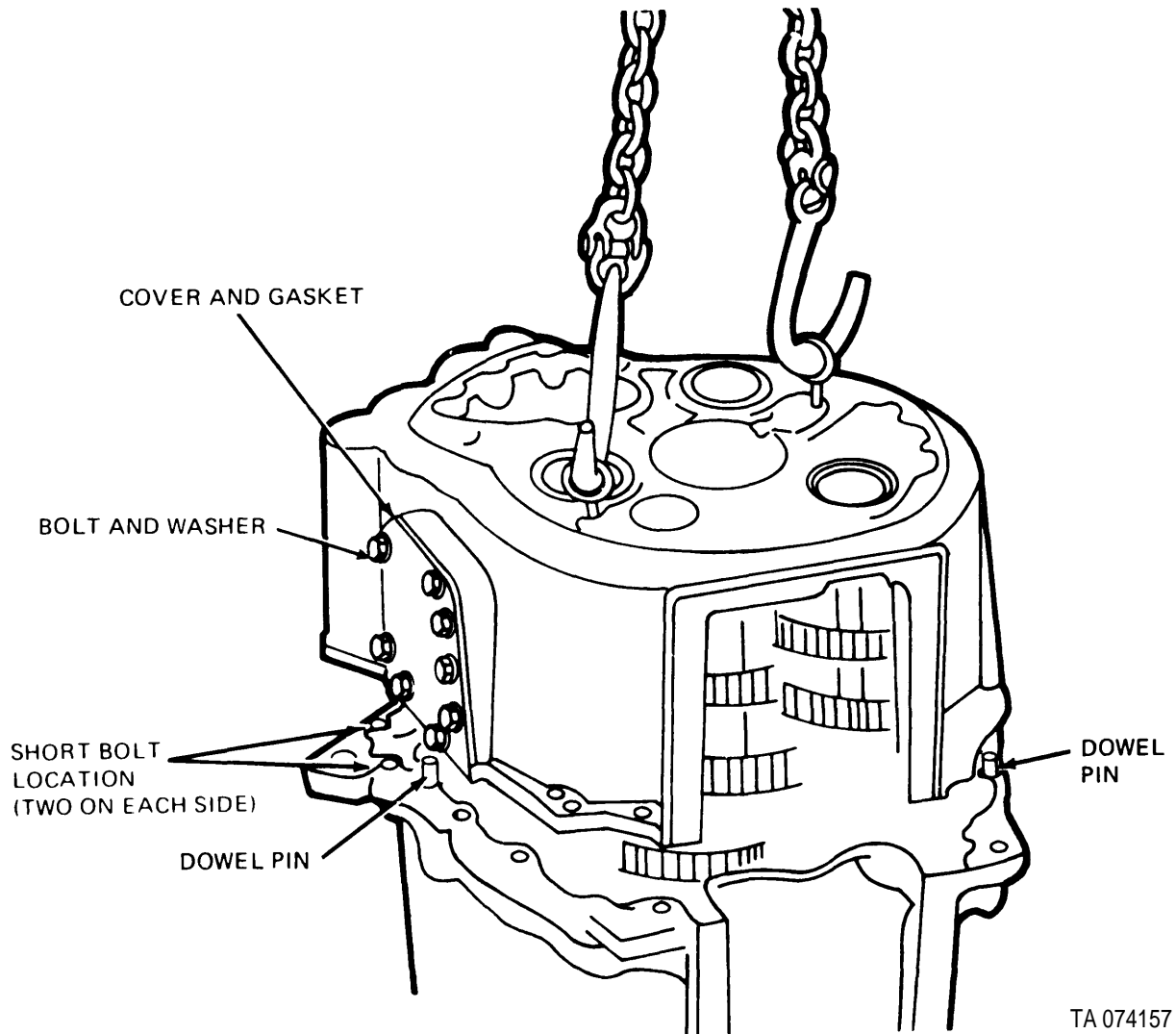


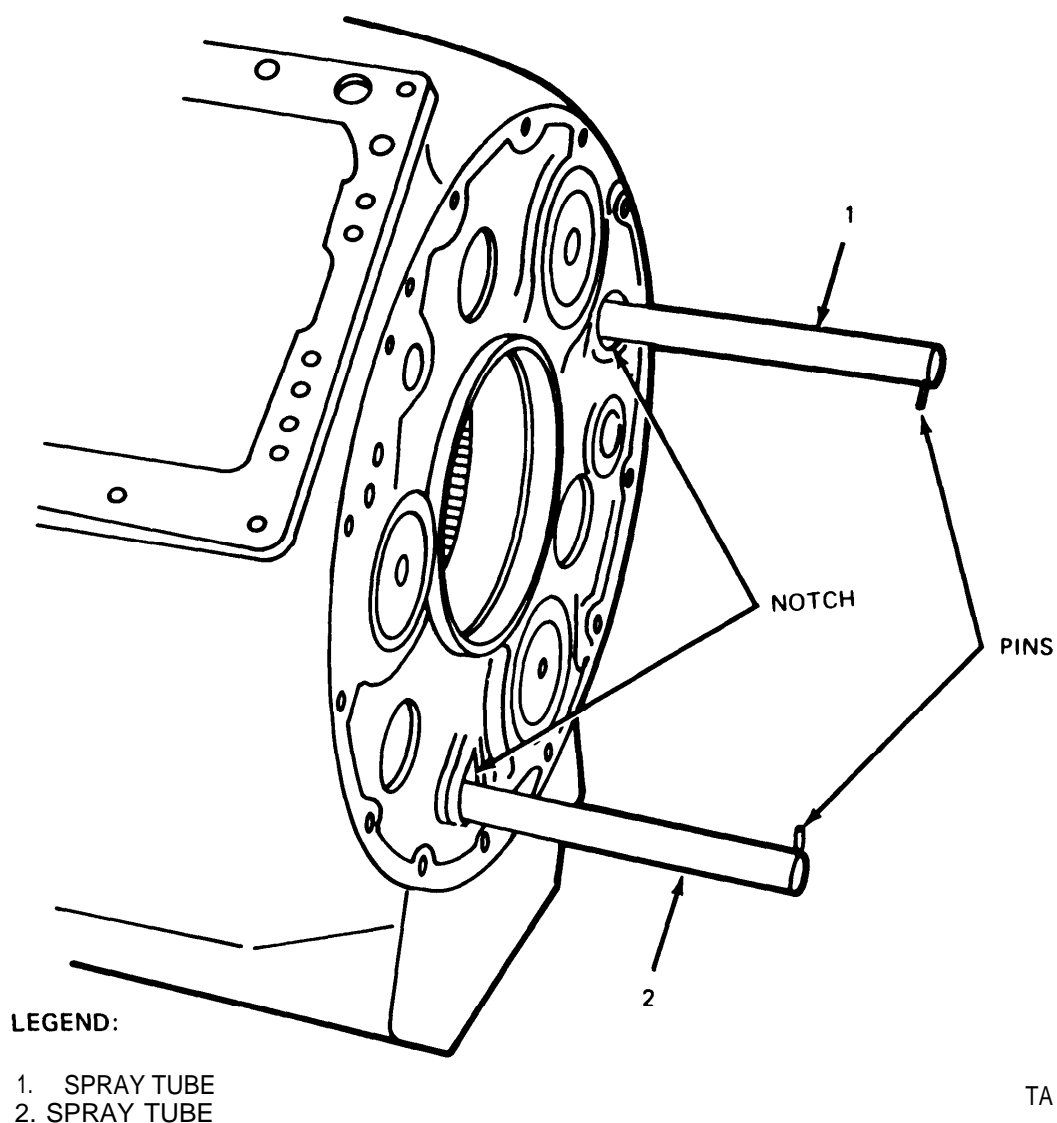
Figure 7-115. Install Front Case.

(31) Install two 3/8"-16 NC forged eyebolts in the front case and fasten a hoist to the eyebolts. Put front case in position on plate.

(32) Install 19 bolts that hold the rear case and the front case together. There are 15 long bolts and four short ones. Torque to 36 ± 2 lb-ft (46 ± 3 N- m).

(33) If the cover and gasket were removed, install using eight bolts and washers.

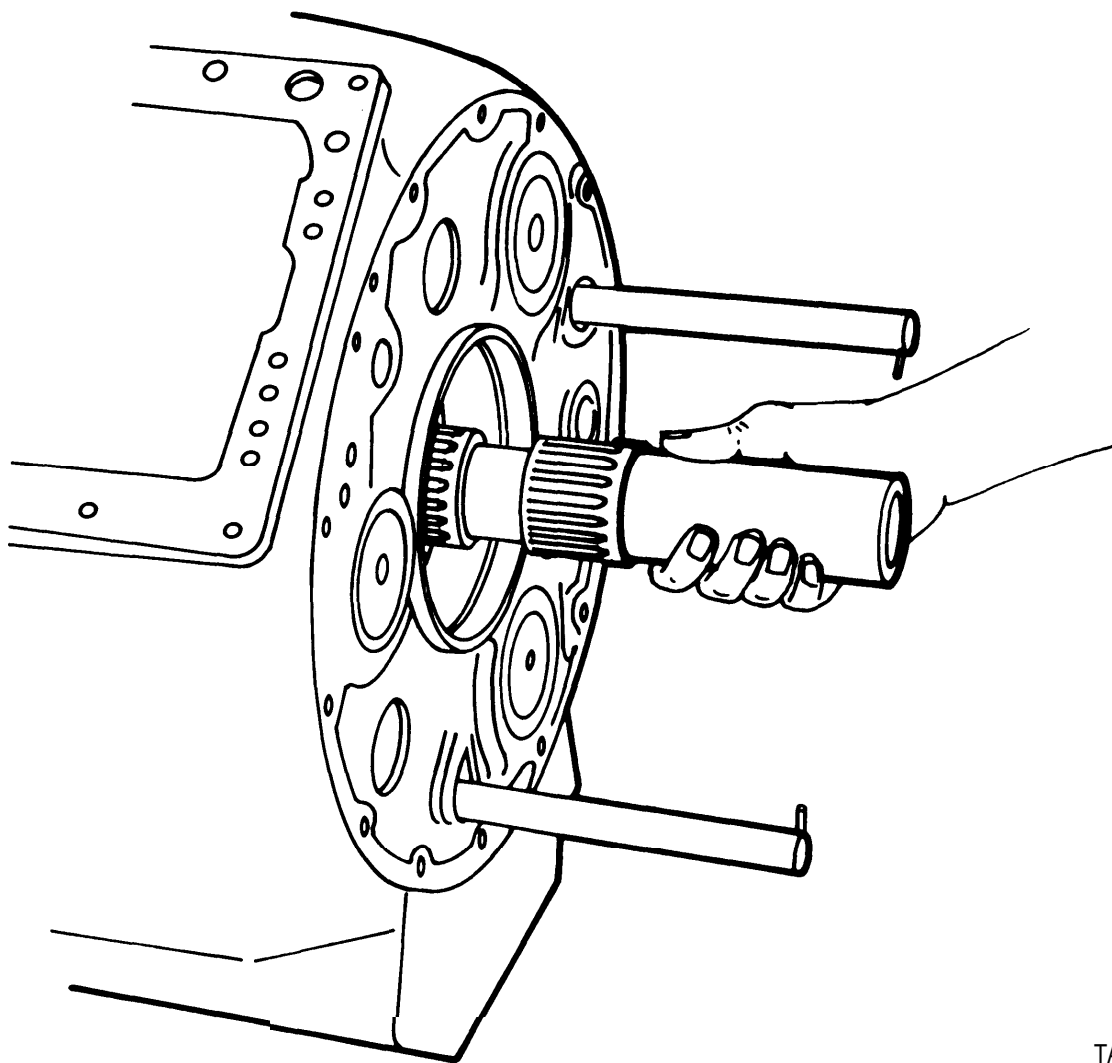
(34) Put the transmission in a horizontal position (fig. 7-116) and install oil spray tubes (1) and (2). Spray tube (2) has a relief valve in the end. Spray tube (1) has an orifice in the end. Make sure the pins on the tubes are in alignment with the notch in the rear case.



TA 074158

Figure 7-116. Install Spray Tubes.

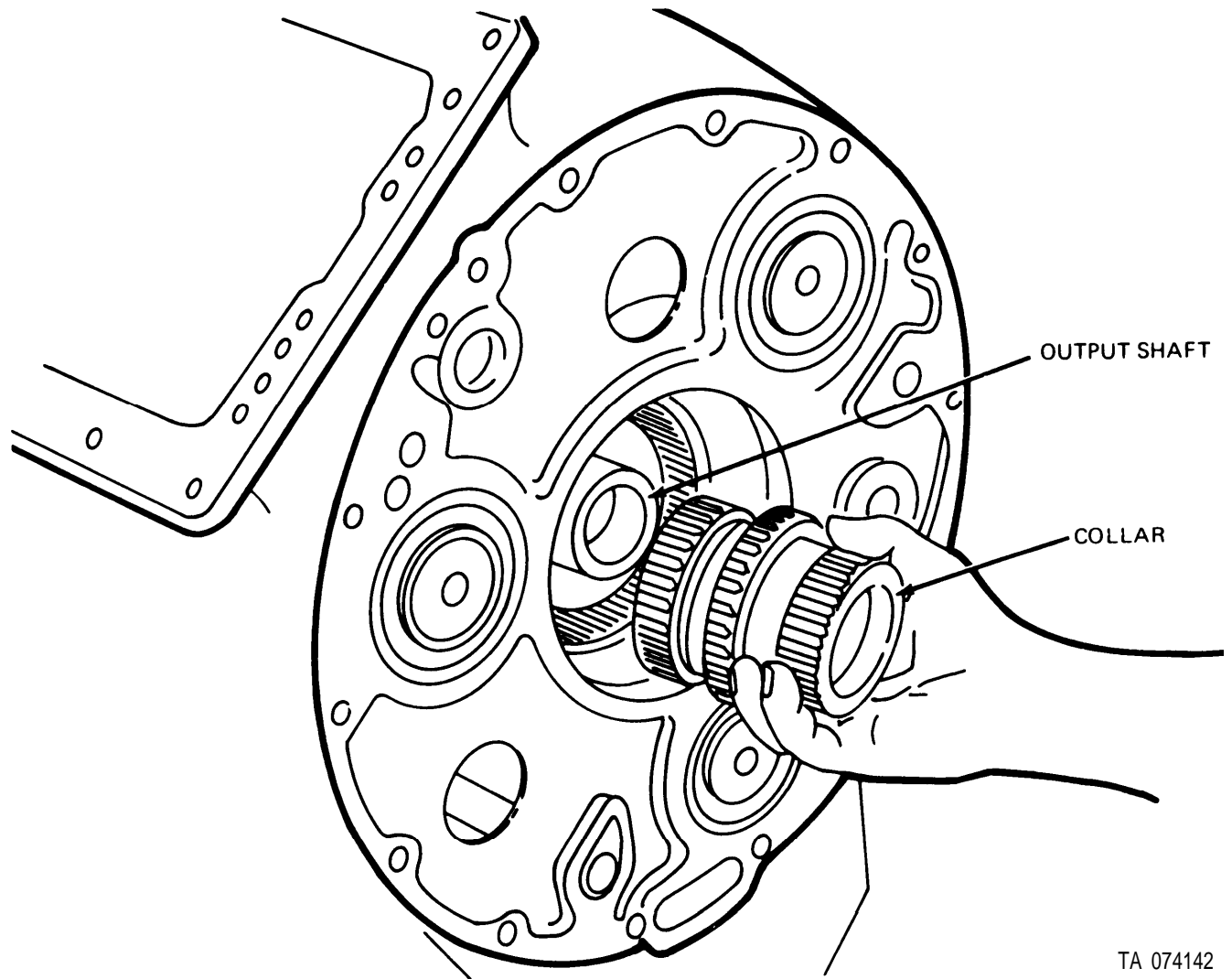
(35) Install the shaft from the rear of the transmission (fig. 7-117).



TA 074159

Figure 7-117. Install Output Shaft.

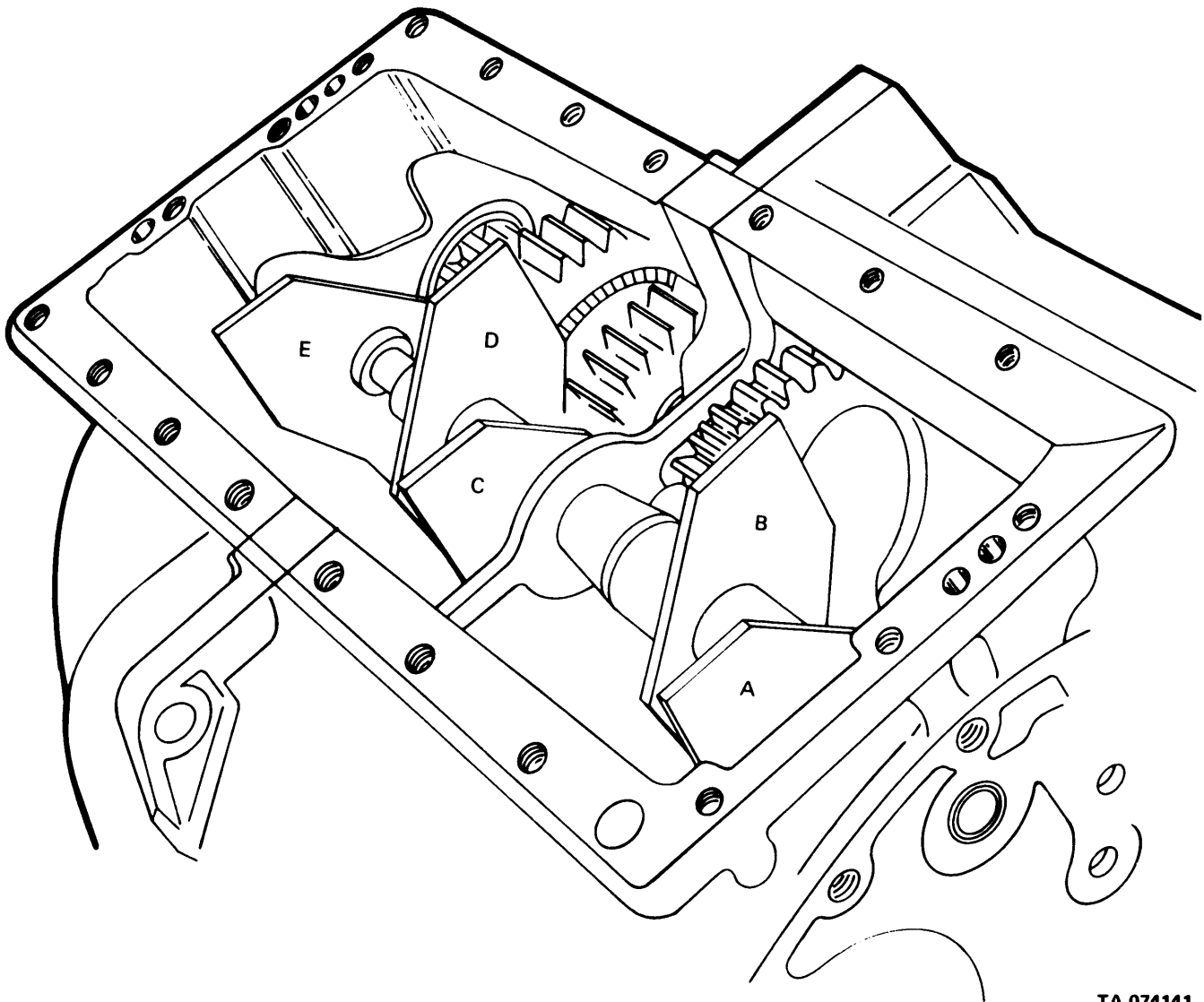
(36) Install collar (fig. 7-118) on the output shaft.



TA 074142

Figure 7-118. Install Collar on Output Shaft.

(37) Install rail and four shifting forks in correct position on their collars (fig. 7-119).

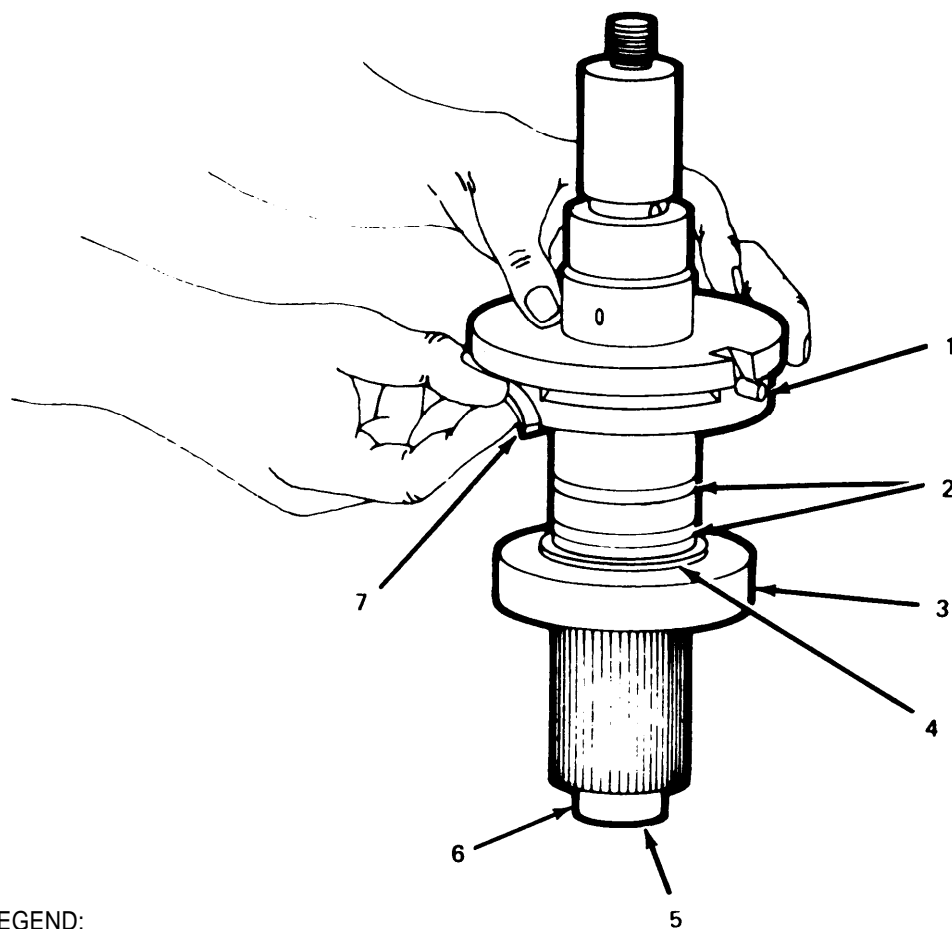


TA 074141

Figure 7-119. Install Shifting Forks.

c. Assemble and Install Input Shaft.

- (1) Install snapring (4, fig. 7-120) on the shaft.



LEGEND:

- 1. ROLL PIN
- 2. SEAL RING (2)
- 3. BEARING

- 4. SNAP RING
- 5. SEAL RING
- 6. PLUG
- 7. KEEPER (3)

TA 074138

Figure 7-120. Assemble Input Shaft.

(2) Heat bearing (3) in oil to a maximum temperature of 275°F (135°C). Install bearing on the shaft. Make sure the groove in the bearing is toward the end of the shaft which has threads on it. Install the snapping on the shaft on the other side of the bearing.

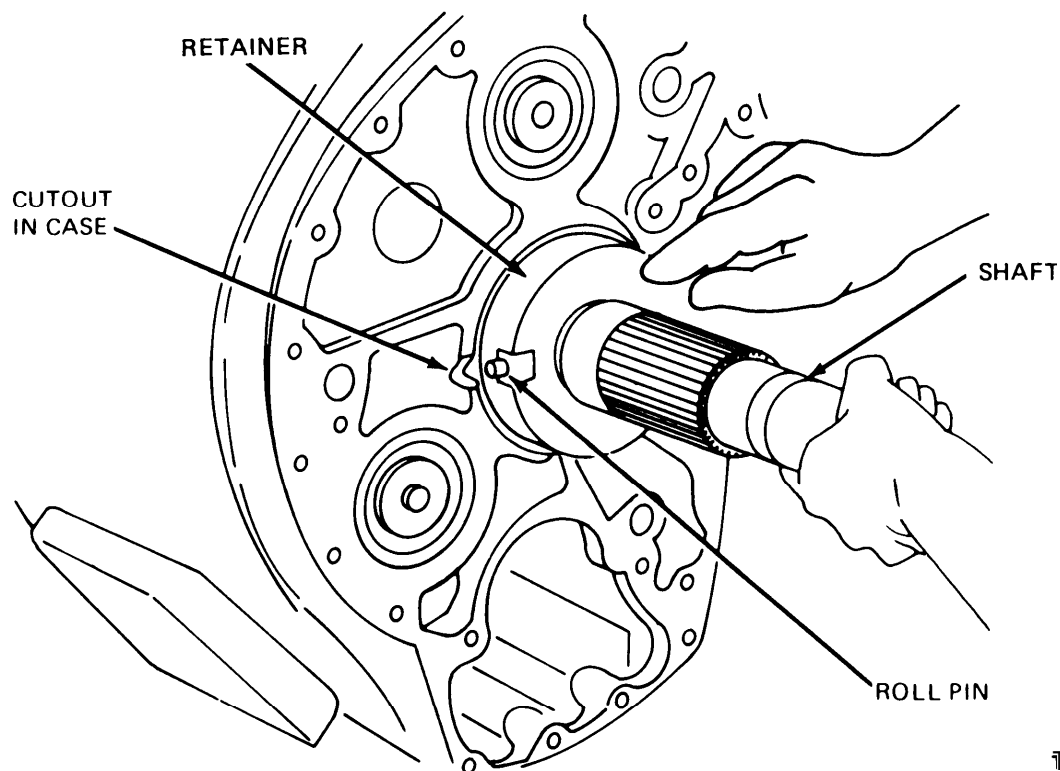
(3) Install two new seal rings (2) on the shaft. Apply a light coat of silicone grease (item 22, Appendix B) on each ring and groove.

(4) Put roll pin (1) in position on the bearing retainer and install retainer. Install three keepers (7). Apply a light coat of silicone grease to hold keepers in place.

(5) Install plug (6).

(6) Install new seal ring (5).

(7) Install the shaft (fig. 7-121) in the front case of the transmission. Make sure roll pin in retainer lines up with cutout in case.

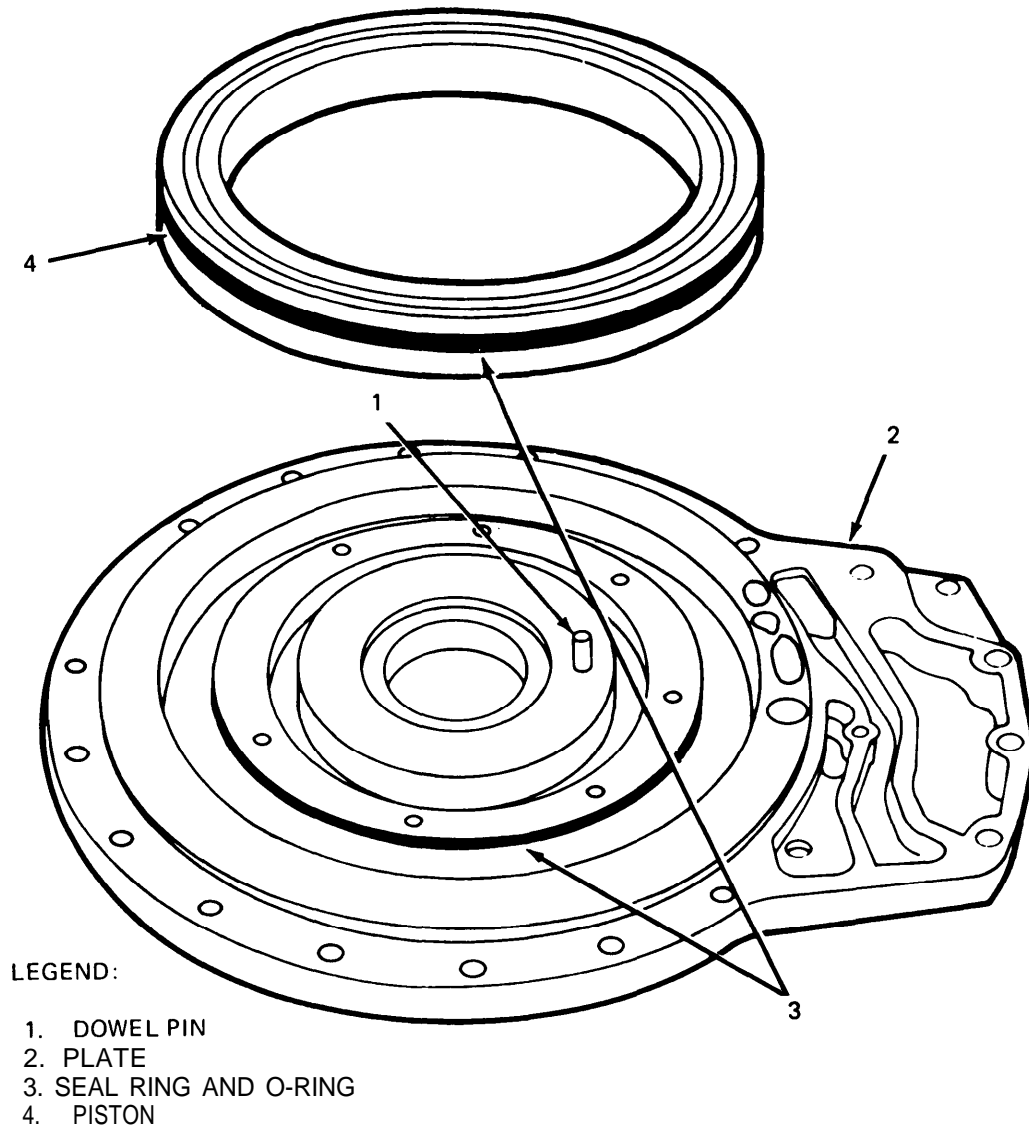


TA 074160

Figure 7-121. Install Shaft in Front Gear.

d. Assemble and Install Front Housing and Brake.

(1) Apply a small amount of silicone grease (item 22, Appendix B) on the O-ring seal bore and seal rings (3, fig. 7-122). Install an O-ring and a seal ring in outer edge of piston (4) and an O-ring and seal ring in plate (2).



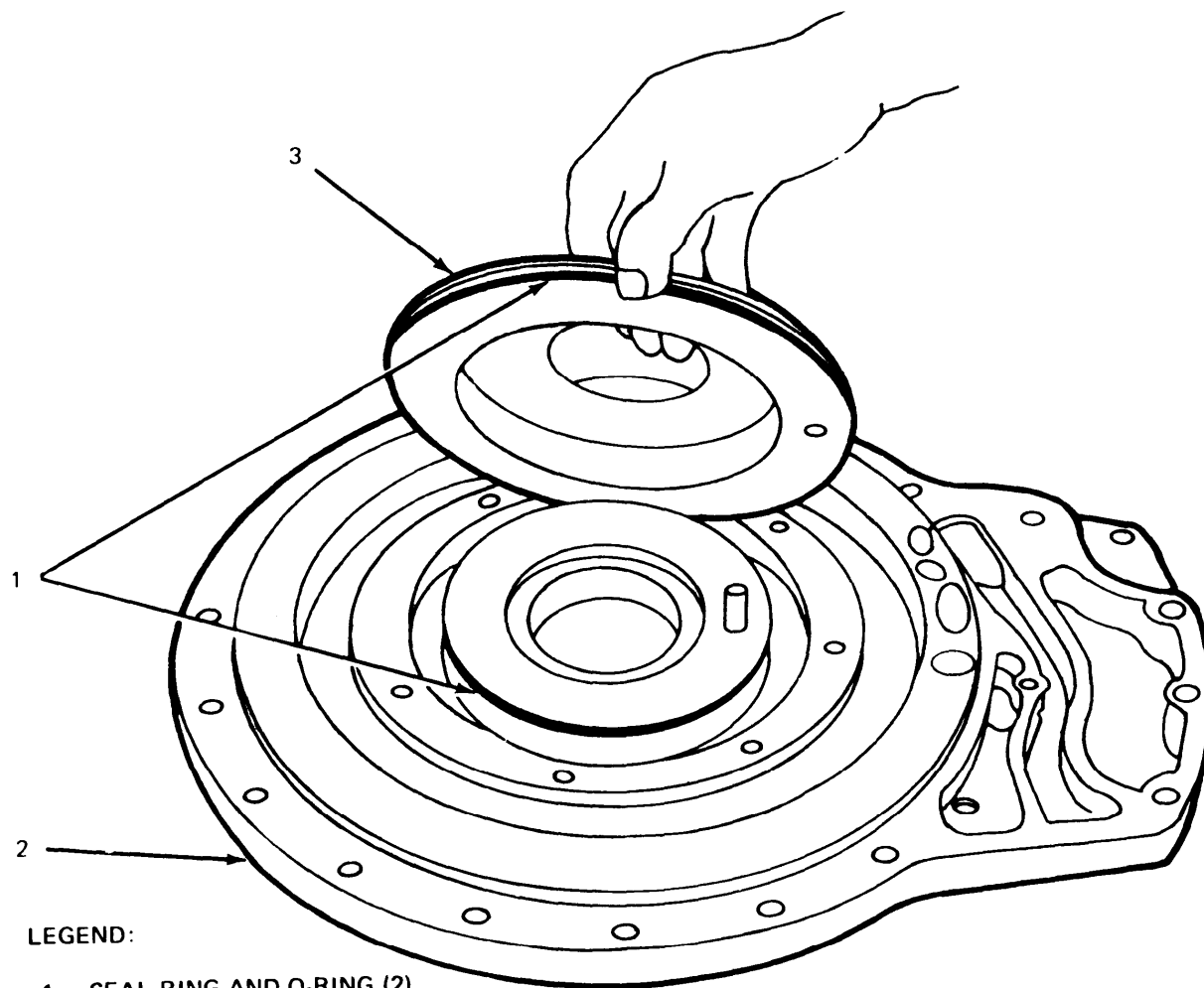
TA 074136

Figure 7-122. Install Outer Piston.

(2) If removed, install dowel pin (1) in plate (2) using a suitable press.

(3) Install the outer piston (4) in the plate (2).

(4) Apply a small amount of silicone grease (item 22, Appendix B) on O-ring bores and seal rings (1, fig. 7-123). Install the O-ring and the seal rings in inner piston (3) and plate (2).



LEGEND:

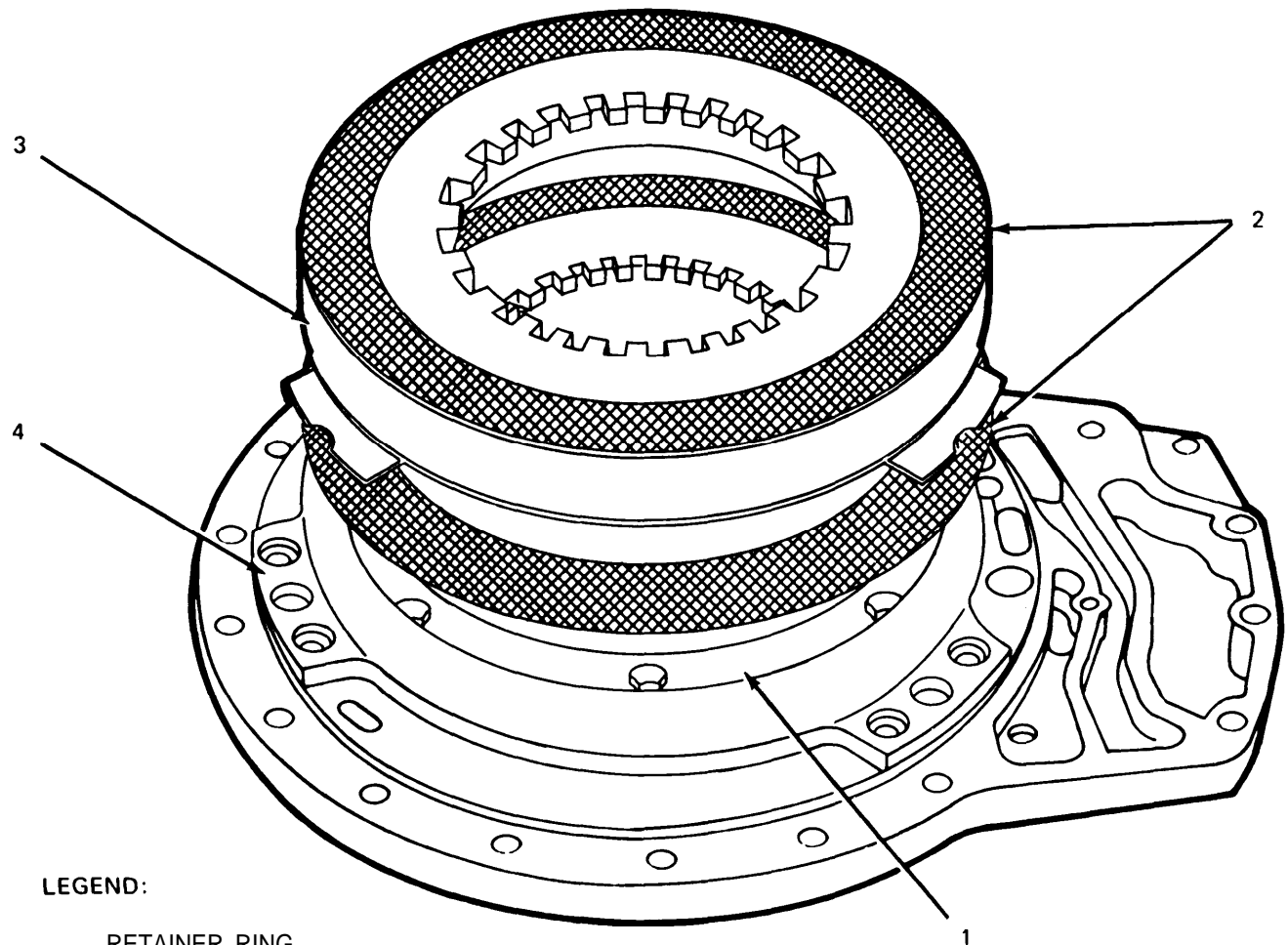
1. SEAL RING AND O-RING (2)
2. PLATE
3. INNER PISTON

TA 074161

Figure 7-123. Install Inner Piston.

(5) Install inner piston (3) in the plate (2). Make sure the hole in the piston is in alignment with the dowel in the plate.

(6) Place retainer ring (1, fig. 7-124) in position on the plate and install the bolts that hold it. Torque the bolts to 22 ± 2 lb-ft (28 ± 3 N-m).



LEGEND:

- RETAINER RING
1. DISK (2)
3. PLATE
4. PLATE

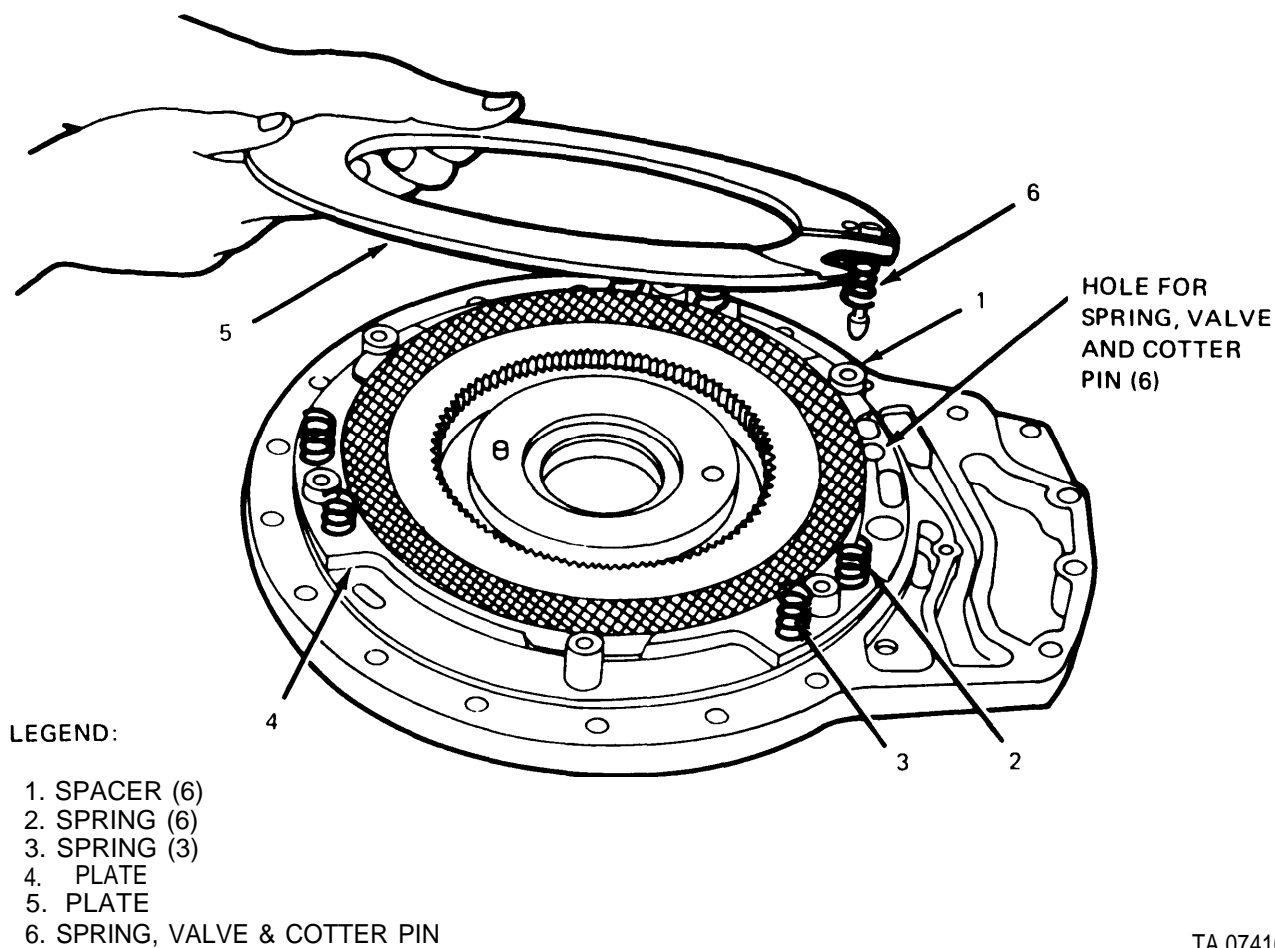
TA 074162

Figure 7-124. Install Retainer and Plate.

(7) Place plate (4) in position on the plate.

(8) Apply OE/HDO 30 oil (item 5, Appendix B) on the two disks (2) and position the disks and plate (3) on the plate.

(9) place six springs (2, fig. 7-125) and three small springs (3) in plate (4). Springs (3) area double set; that is, smaller spring located inside the larger spring.



TA 074163

Figure 7-125. Install Springs, Spacers, and Plate.

- (10) Install six spacers (1).
- (11) Place the valve and spring (6) in position on plate (5) and install the cotter pin that holds it.

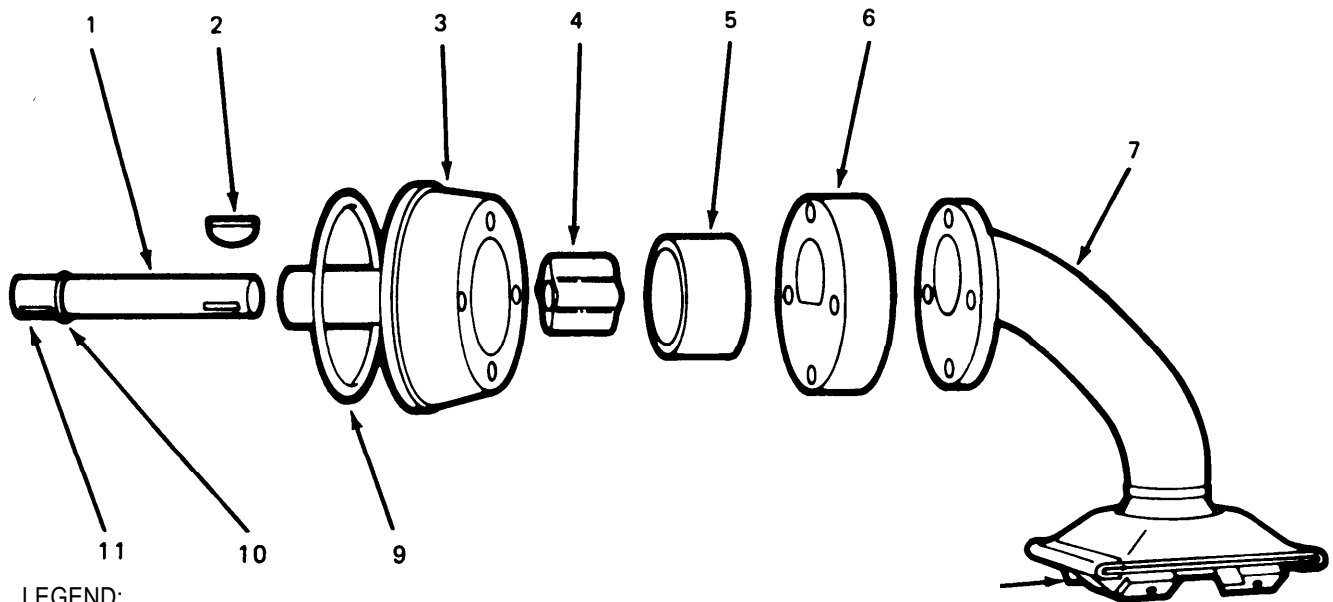
NOTE

Check that the springs stay in place (in the vertical position) when the plate is installed in the next step.

- (12) Place plate (5) in position on the springs and spacers. Make sure that hole in base lines up with valve and spring (6). Install the four bolts that hold the plate – a few turns at a time on each – until all bolts are turned down; then tighten to 36 ± 2 lb-ft (46 ± 3 N-m) torque,

- (13) Put key (2, fig. 7-126) on shaft; then slide shaft (1) through housing (3).

- (14) If the strainer (8) was removed from the tube assembly (7), install.



LEGEND:

- | | |
|-------------------|------------------|
| 1. SHAFT | 6. MANIFOLD |
| 2. KEY | 7. TUBE ASSEMBLY |
| 3. HOUSING | 8. STRAINER |
| 4. ROTOR ASSEMBLY | 9. O-RING SEAL |
| 5. ROTOR ASSEMBLY | 10. SNAP RING |
| 11. KEY | |

TA 074131

Figure 7-126. Assemble Oil Pump.

(15) Install snapping (10) on shaft.

(16) position rotor assembly (4 and (5) in the housing (3).

(17) position manifold (6) on the housing. Alining the openings (slots) in the manifold with the through holes in the pump housing.

(18) Position the tube assembly on the manifold (6). Make sure that hole in manifold (6) lines up with hole in tube assembly. Install one bolt that holds assembly together. (The top bolt hole as shown in illustration.) (DO NOT TIGHTEN.)

(19) Install O-ring seal (9) on the oil pump.

(20) Position the oil pump on plate (1, fig. 7-127) and secure with three bolts (2). Tighten all four bolts in pump 22 ± 2 lb-ft (28 ± 3 N-m) torque.

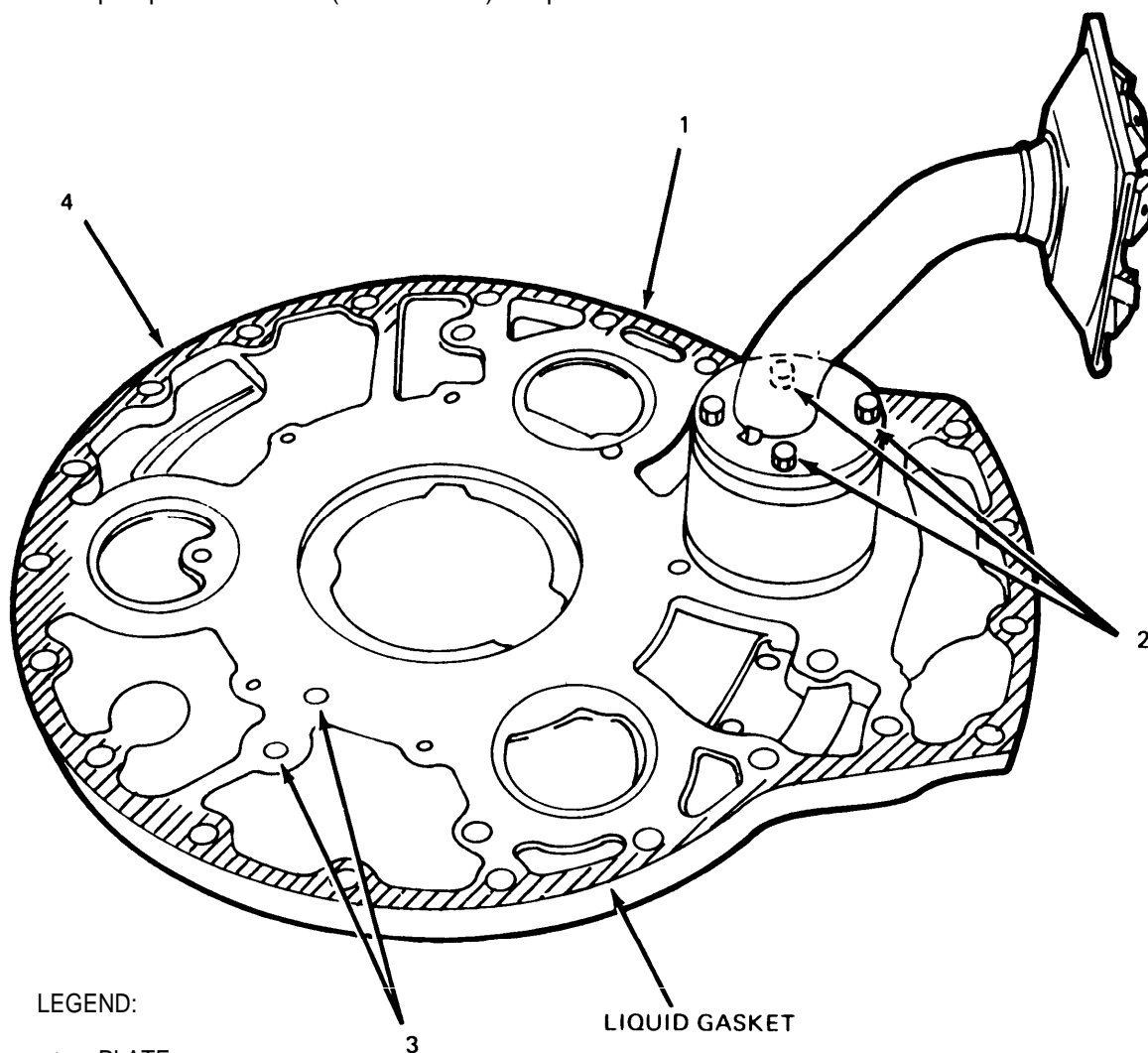


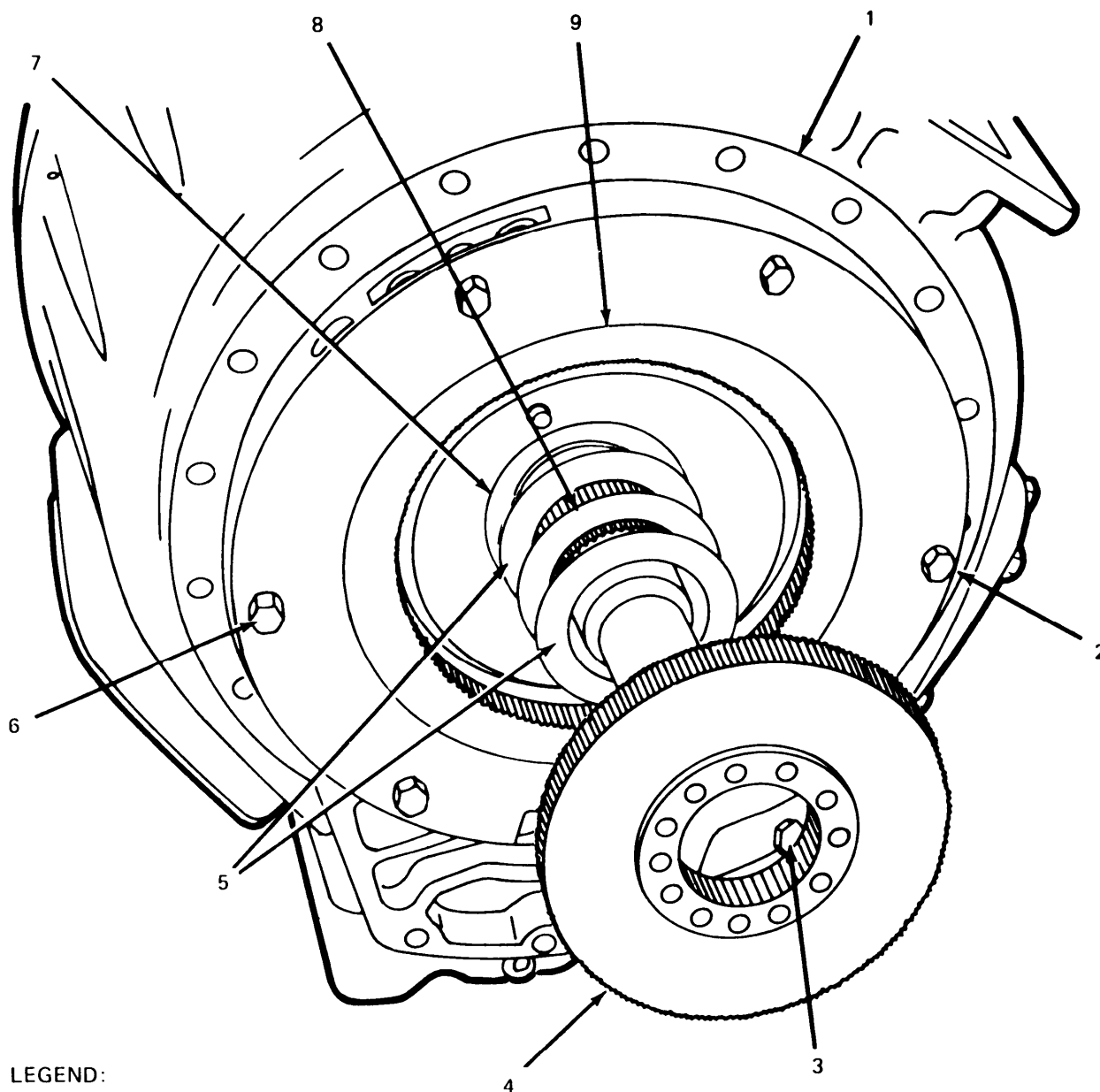
Figure 7-127. Install Oil Pump.

TA 074164

(21) Install two O-rings (3).

(22) Apply liquid gasket (item 21, Appendix B) around perimeter of plate (as shown) and mating surface of front case.

(23) position front brake assembly (1, fig. 7-1 28) on the front case. Install bolts (2), (6), and (3) (Bolts (2) and (6) are the same size; bolt (3) is shorter.) Tighten bolts (2) and (6) to 36 ± 2 lb-ft (46 ± 3 N-m) torque; bolt (3) to 55 ± 5 lb-ft (75 ± 7 N-m) torque.



LEGEND:

- 1. BRAKE ASSEMBLY
- 2. BOLT (2)
- 3. BOLT
- 4. HUB
- 5. BEARING RACE (2)

- 6. BOLT (2)
- 7. SNAPRING
- 8. BEARING
- 9. DISK

TA 074165

Figure 7-128. Install Front Brake and Hub.

- (24) Install snapping (7) on the shaft.
- (25) Position bearings races (5) and bearing (8) on hub (4).

NOTE

It may be necessary to line up the teeth of plates and disks (9) so that hub (4) will seat fully and snap ring can go on.

(26) Position hub (4) on the shaft lining up the blind spline on inside of gear with blind spine on the shaft. (Make sure that hub is installed as shown in illustration, not backwards.)

(27) Install snapping that secures hub (4) to shaft.

(28) Apply liquid gasket to the mating surfaces of the front brake and the front housing.

(29) Install a 3/4-10 NC eyebolt in the housing (fig. 7-129). Fasten a hoist to the eyebolt and position the housing on the front brake. Install the 21 bolts (three different lengths - see fig. 7-129) that hold it and torque to 55 ± 5 lb-ft (75 ± 7 N-m).

(30) If removed, install upper plug, orifice plug, and lower plug.

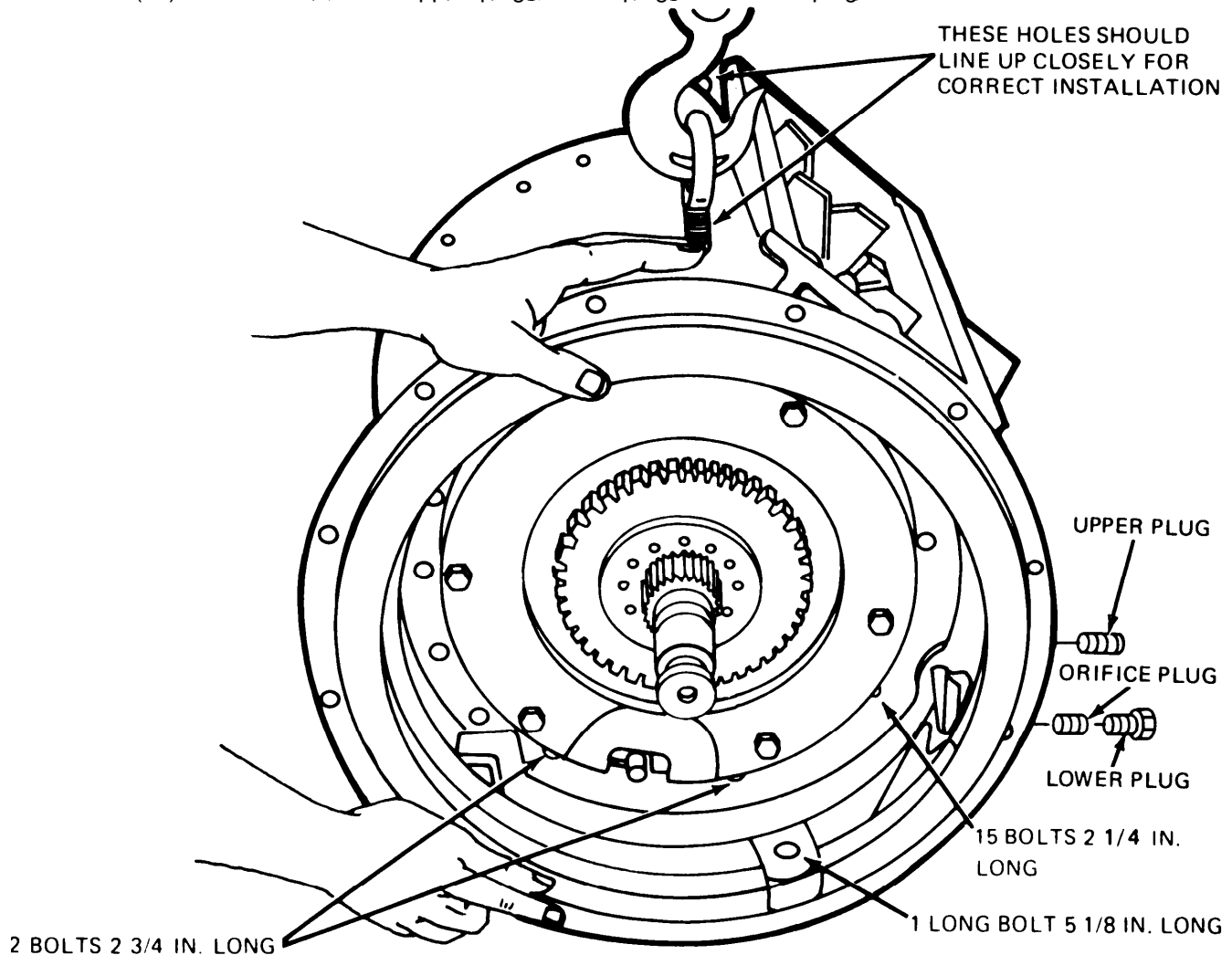
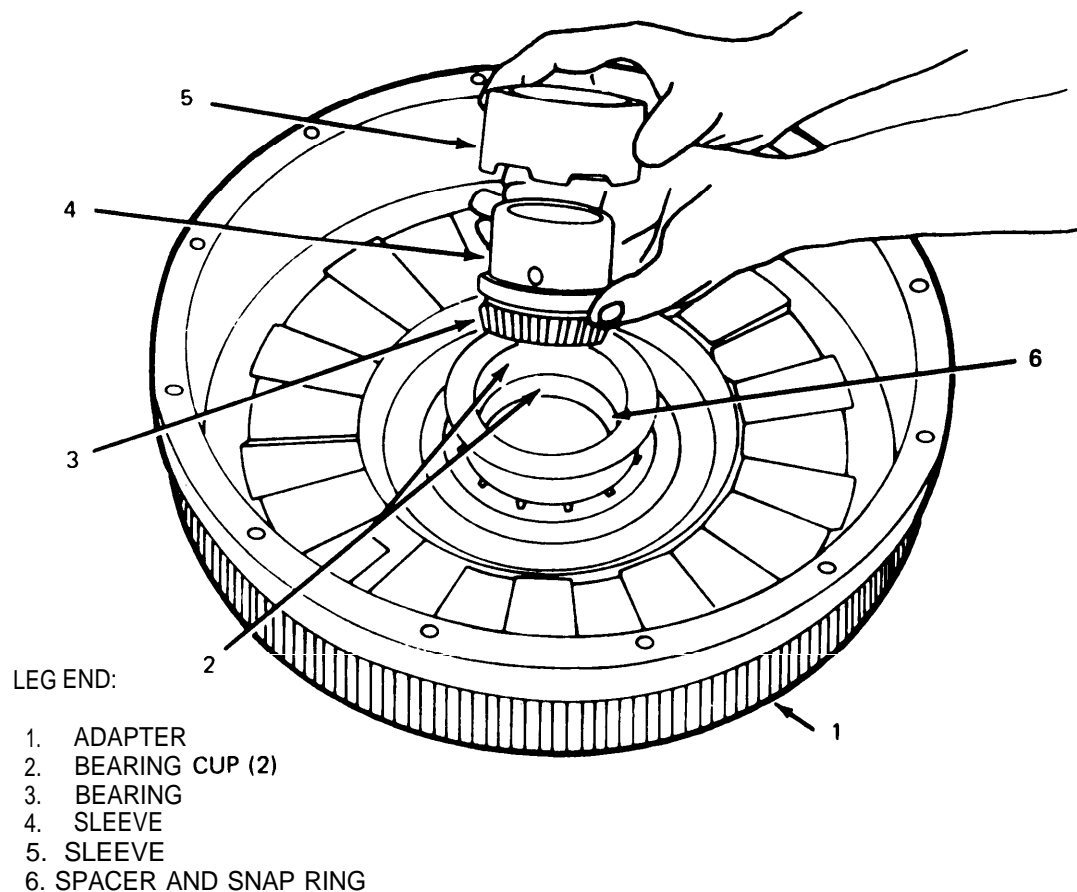


Figure 7-129. Install Front Housing.

TA 074166

e. *Assemble and Install Front Clutch.*

(1) Install the spacer and snapping (6 fig. 7-130) in adapter (1). Spacer and snapping (6) will be located between bearing cups (2).



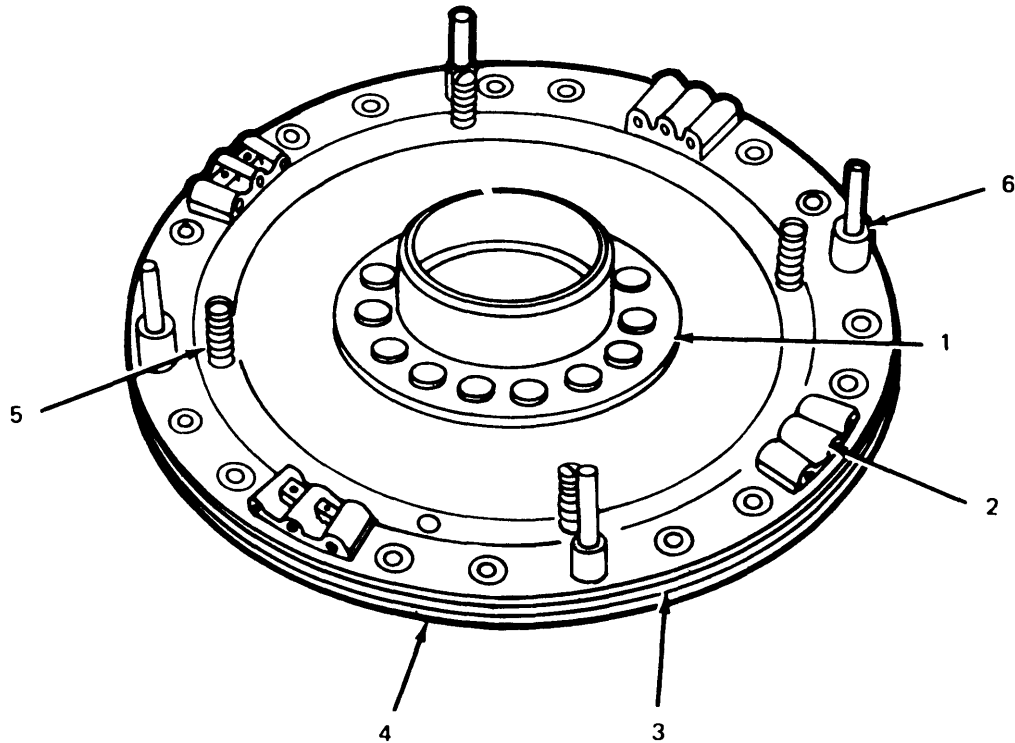
TA 074167

Figure 7-130. Install Input Shaft Bearings.

(2) Lower the temperature of two bearing cups (2) by packing in dry ice or placing in freezer. Install the bearing cups in adapter (1), as shown.

(3) Install bearing (3), and sleeves (4) and (5) in the adapter.

(4) Apply a small amount of silicone grease on O-ring and seal ring (3, fig. 7-131). Install O-ring and seal ring on piston (4).



LEGEND:

1. DEFLECTOR AND SEAL RING
2. VALVE ASSEMBLY
3. SEAL RING
4. PISTON
5. SPRING (4)
6. SPACER (4)

TA 074168

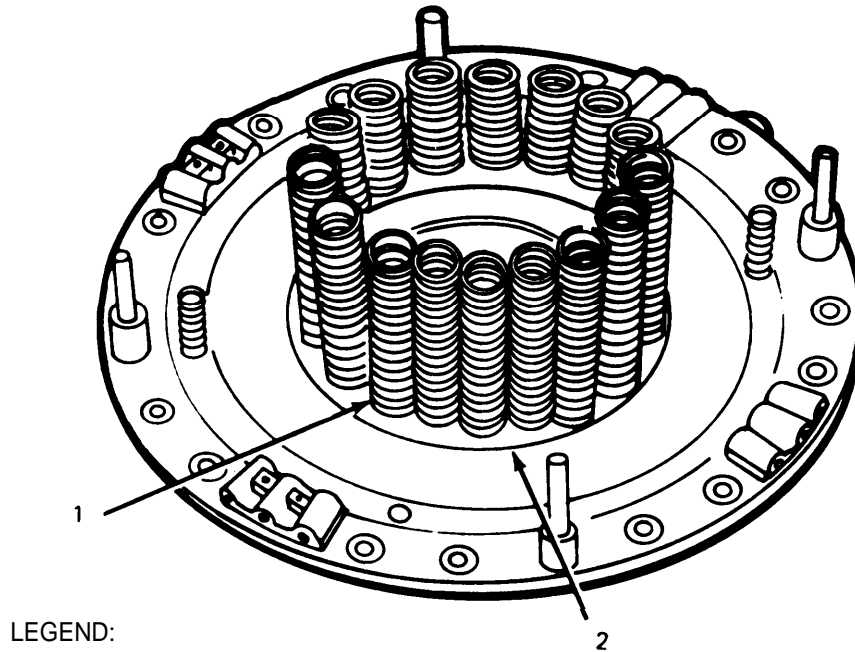
Figure 7-131. Assemble Piston.

(5) Position valve assemblies (2) on the piston with tapered portion of valve facing toward center. Install the capscrews that hold the valve assemblies to the piston. Torque to 10 ± 2 lb-ft (14 ± 3 N-m).

(6) Position deflector (1) on piston (4).

(7) Position four springs (5) and four spacers (6) on the piston.

(8) Position sixteen springs (1, fig. 7-132) on deflector (2).



LEGEND:

- 1. SPRING (16)
- 2. DEFLECTOR AND SEAL RING

TA 074169

Figure 7-132. Assemble Piston and Springs.

(9) Position plates (1, fig. 7-133) and (2) on the piston. Holes in plate (1) must be positioned over four springs (3). Evenly install the nuts and washers that hold plate (2) to the piston. Torque to 36 ± 2 lb-ft (46 ± 3 N-m). Make sure that four spacers (4) fit into cutout of plates (1) and (2).

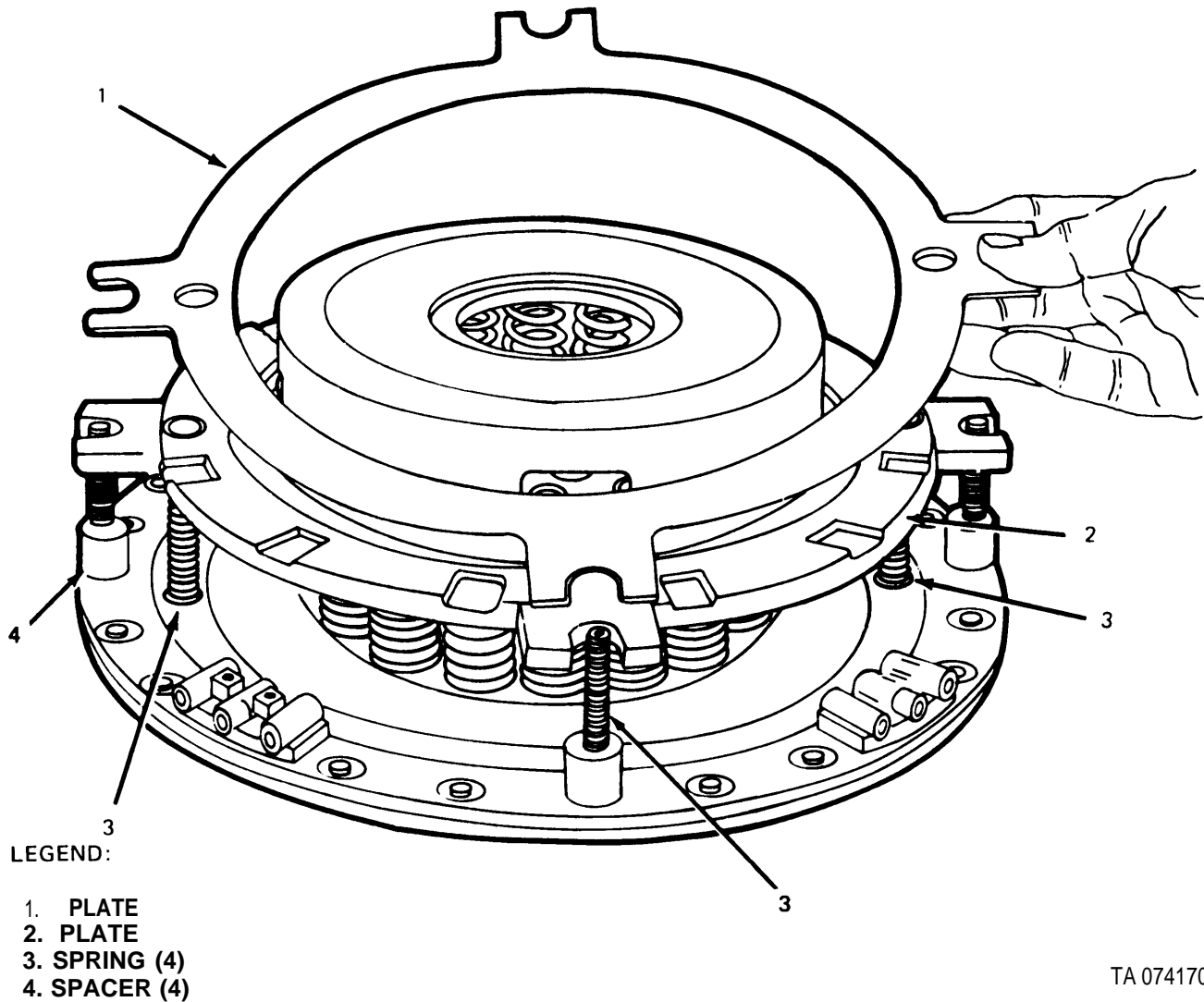


Figure 7-133. Install Clutch Plate.

TA 074170

(10) Position the piston assembly (fig. 7-134) in the adapter. Lineup four holes in adapter with four studs in piston (any piston position as long as the holes and studs line up.) Apply silicone grease to bore.

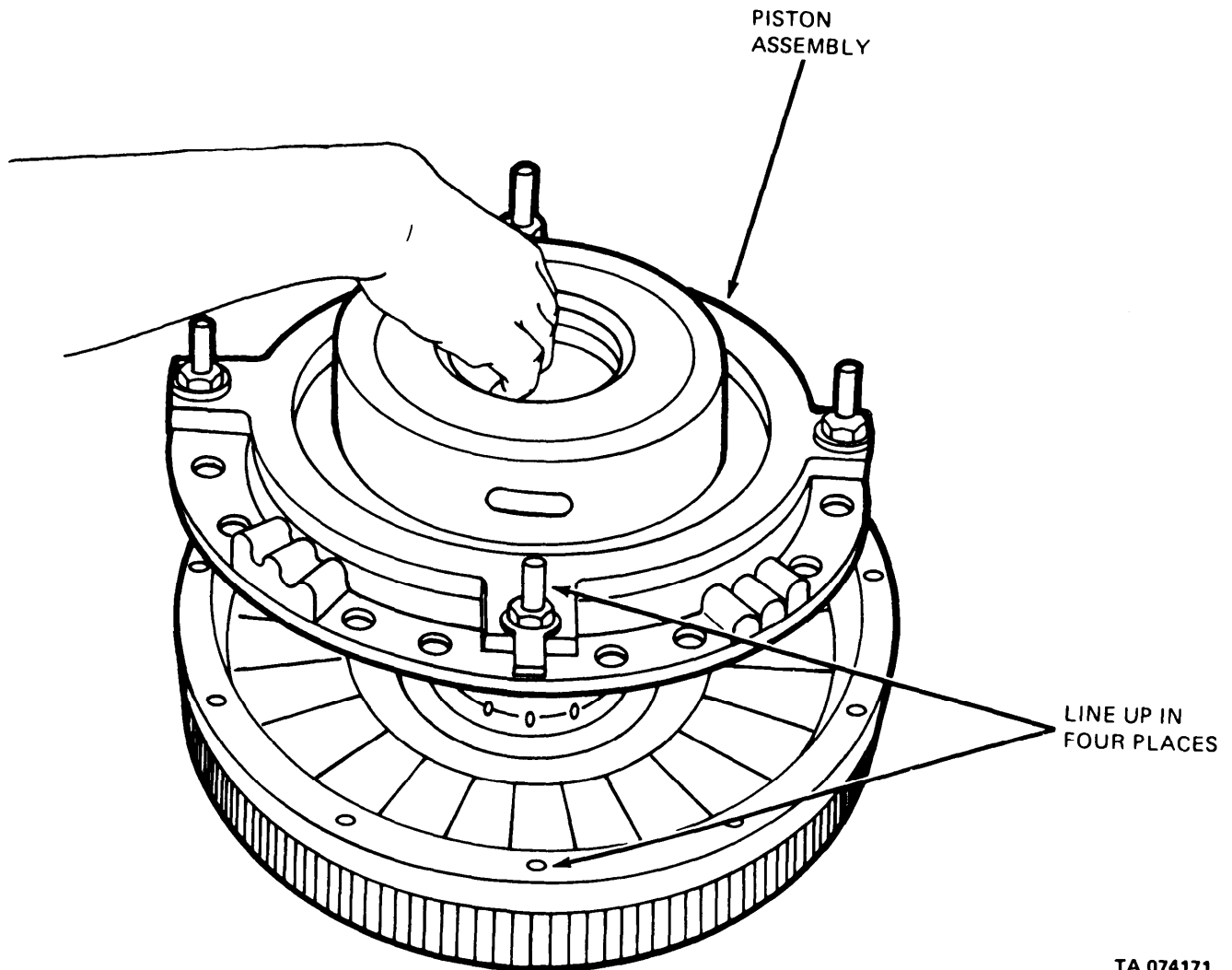
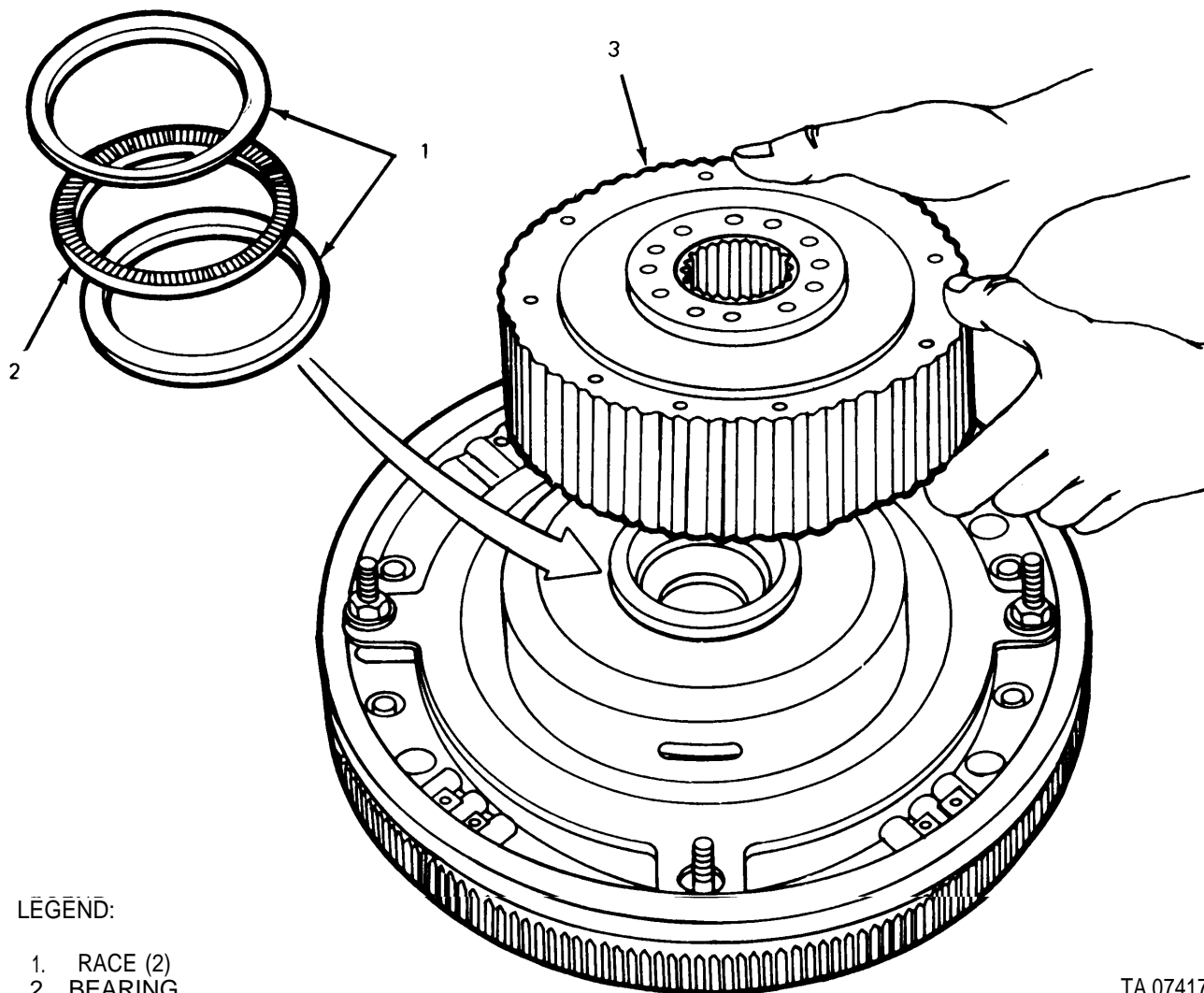


Figure 7-134. Assemble Piston and Adapter.

(11) Install bearing (2, fig. 7-135) and two races (1) in the plate.



LEGEND:

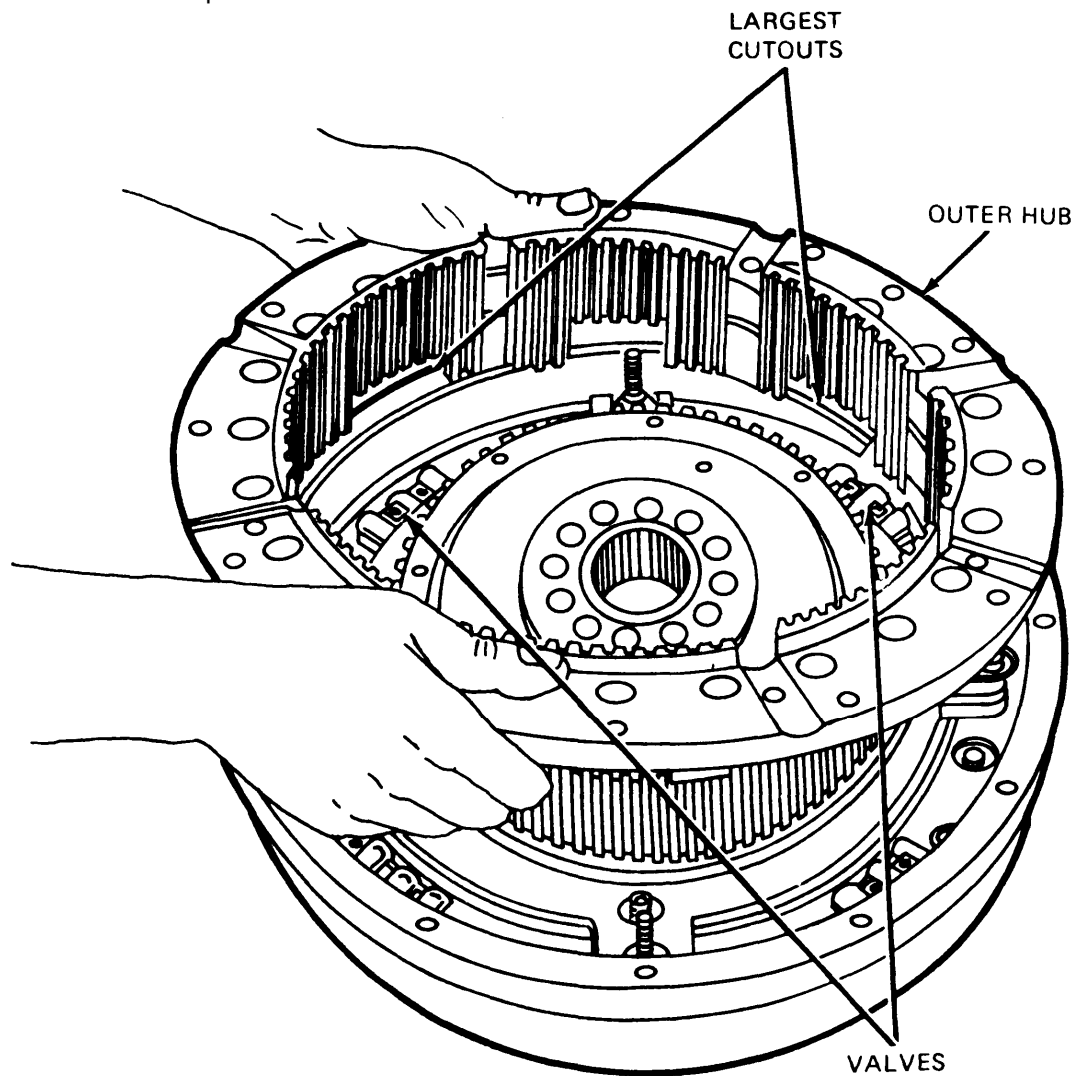
- 1. RACE (2)
- 2. BEARING
- 3. INNER HUB

TA 074172

Figure 7-135. Install Bearing and Inner Hub.

(12) Position inner hub (3) on the piston assembly.

(13) position outer hub (fig. 7-136) on the adapter. Be sure the largest cutout in hub splines are positioned over valves on piston.



TA 074173

Figure 7-136. Install Outer Hub.

(14) Apply OE/HDO 30 oil to disks (fig. 7-137); then install 10 thick plates (teeth on outside diameter) and 10 disks (teeth on inside diameter). Start with a thick plate and end with a disk; then install one plate and two spacer plates on top as required.

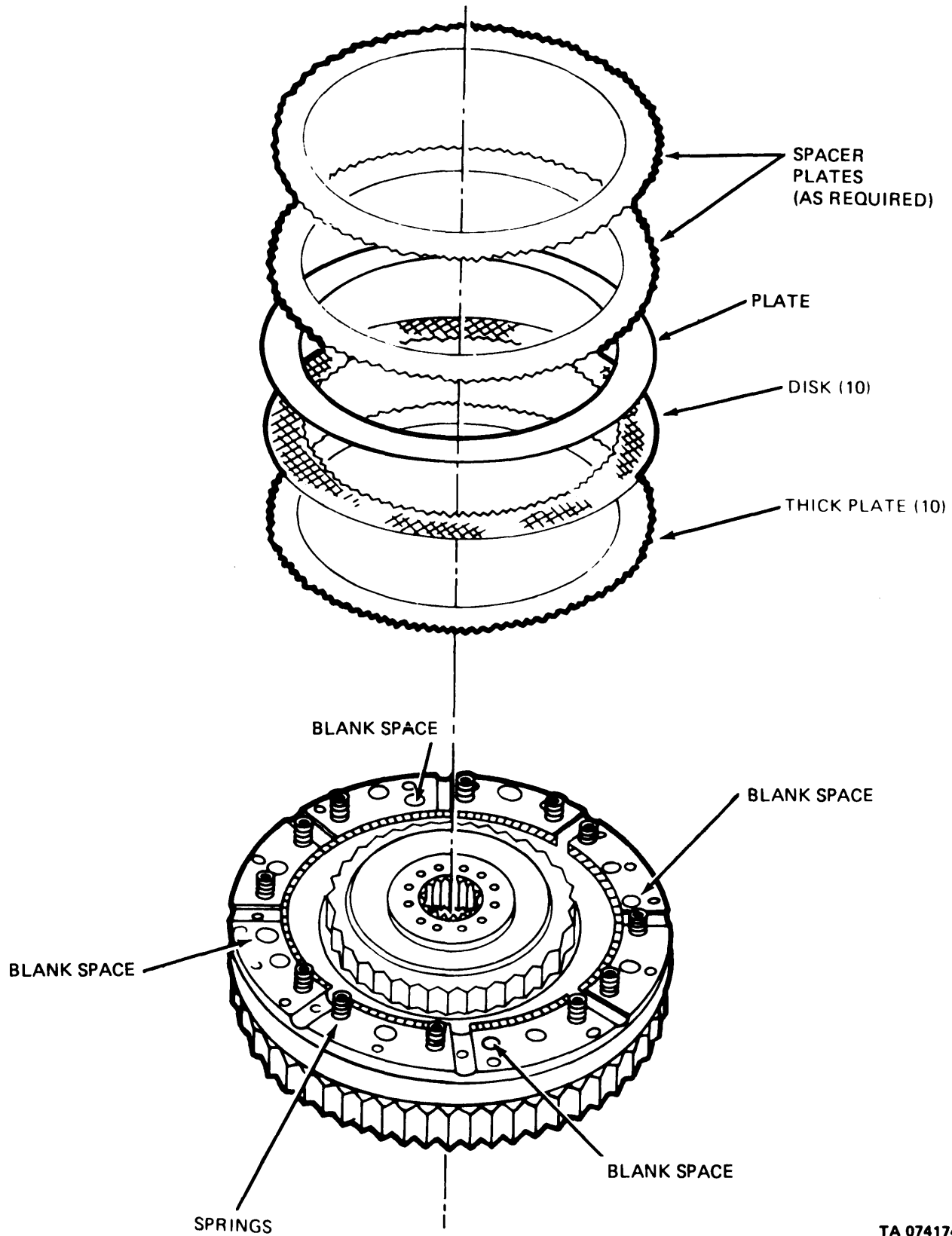


Figure 7-137. Install Disks, Plates, and Springs.

TA 074174

NOTE

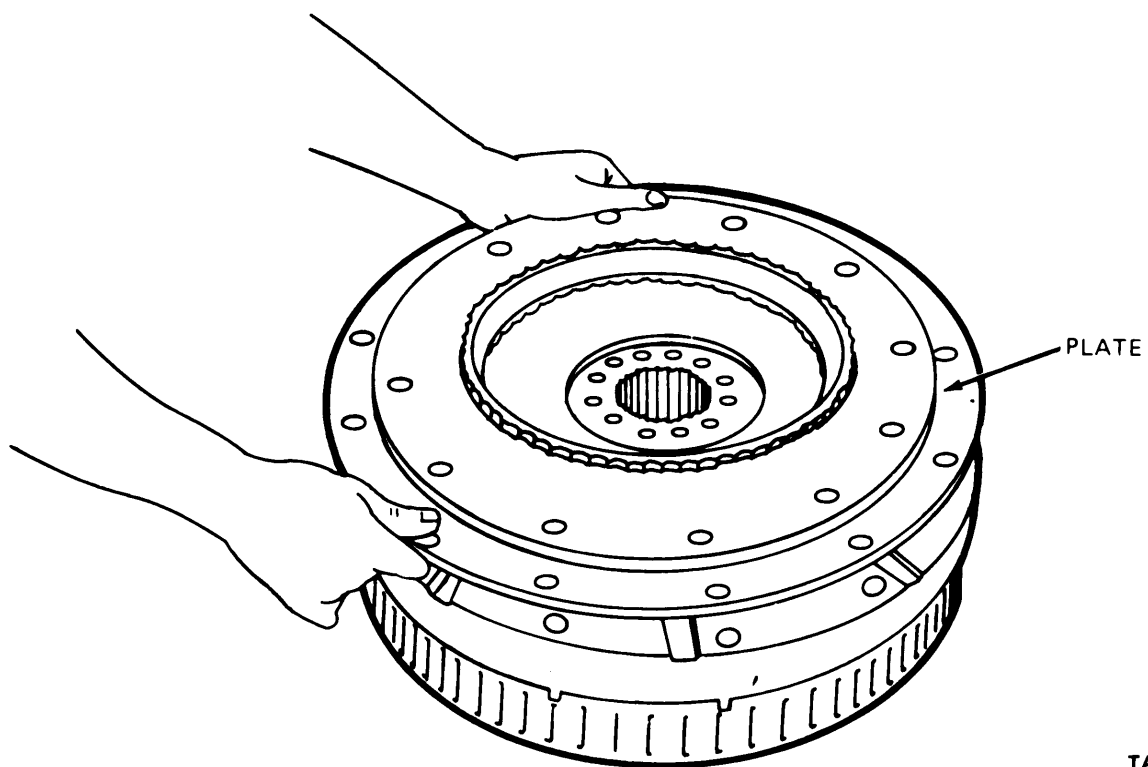
With the centrifugal piston in its forward position, use spacer plates on top of the last disk to obtain a new unit clearance of 0.130 ± 0.015 in. (3.30 ± 0.38 mm) between the hub surface and the spacer plate surface. Used unit clearance maximum is .175 in. (4.44 mm).

(15) position the 12 springs in the hub. Leave four empty spacers 90° apart, as shown.

NOTE

Make sure springs are in alignment with plate.

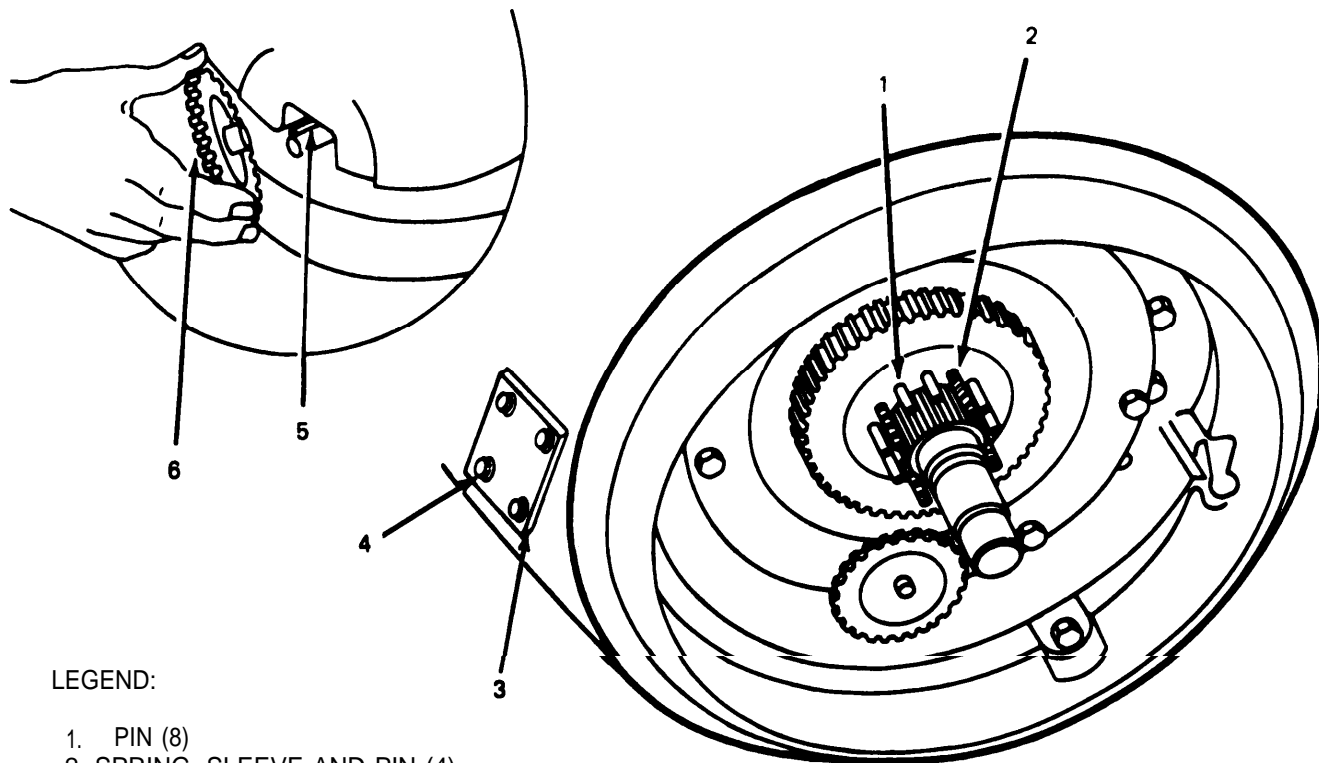
(16) position plate (fig. 7-138). Evenly install the bolts that hold it a few turns at a time on each until all bolts are turned down. Tighten to 36 ± 2 lb-ft (46 ± 2 N-m) torque.



TA 074175

Figure 7-138. Install Clutch Plate.

(17) Install eight pins (1, fig. 7-139) and four pins, sleeves, and springs (2) in the hub equally spaced.



LEGEND:

1. PIN (8)
2. SPRING, SLEEVE AND PIN (4)
3. COVER AND GASKET
4. BOLT AND WASHER (4)
5. KEY
6. GEAR

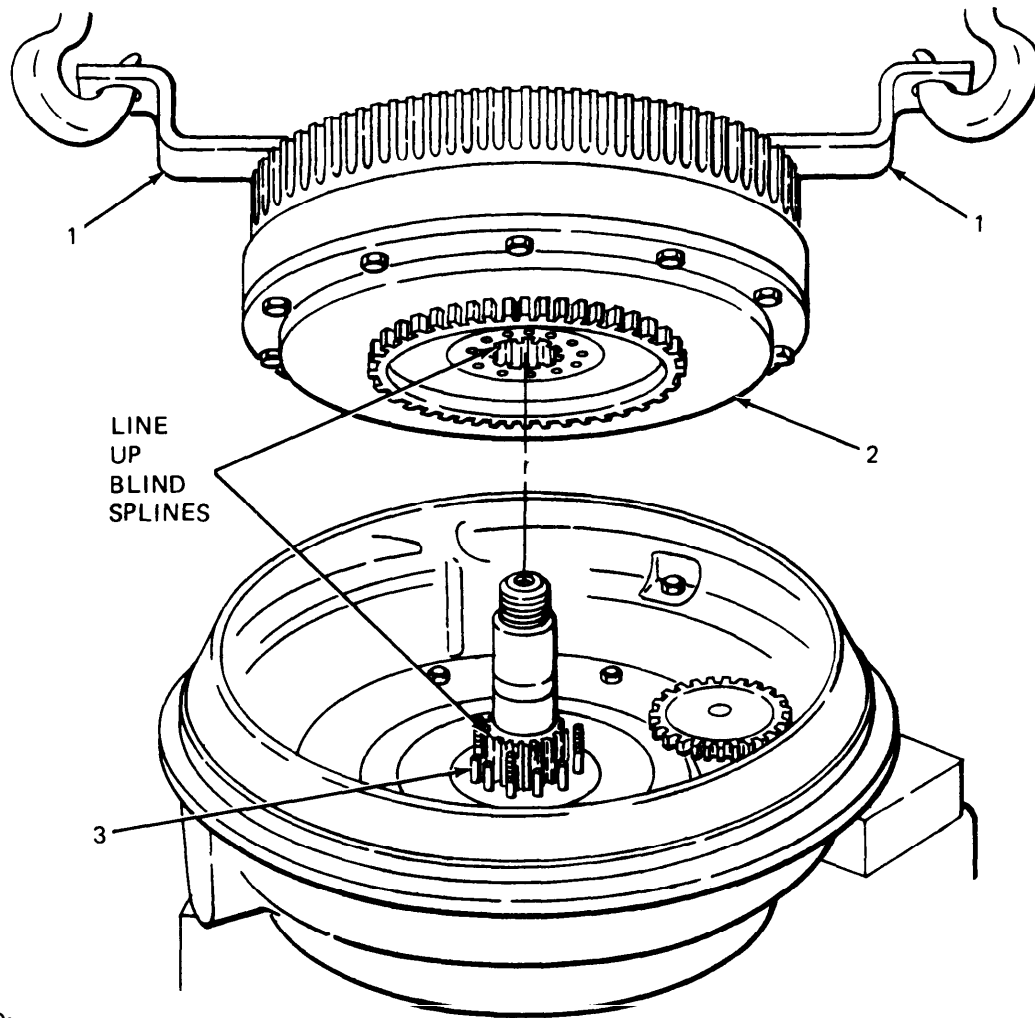
TA 074176

Figure 7-139. Install Pins and Oil Pump Gear.

(18) Install key (5) in the oil pump shaft; then install gear (6) on the shaft.

(19) Using a new gasket (3), install cover and secure with four bolts and washers (4).

(20) Install two suitable adapters (1, fig. 7-140) on the front clutch. push on pins (3) to fully retract clutch air piston. Line up blind spline on shaft with blind spline on clutch; then install the front clutch assembly (2).



LEGEND:

- 1. HOIST ADAPTER
- 2. CLUTCH ASSEMBLY
- 3. PIN (12)

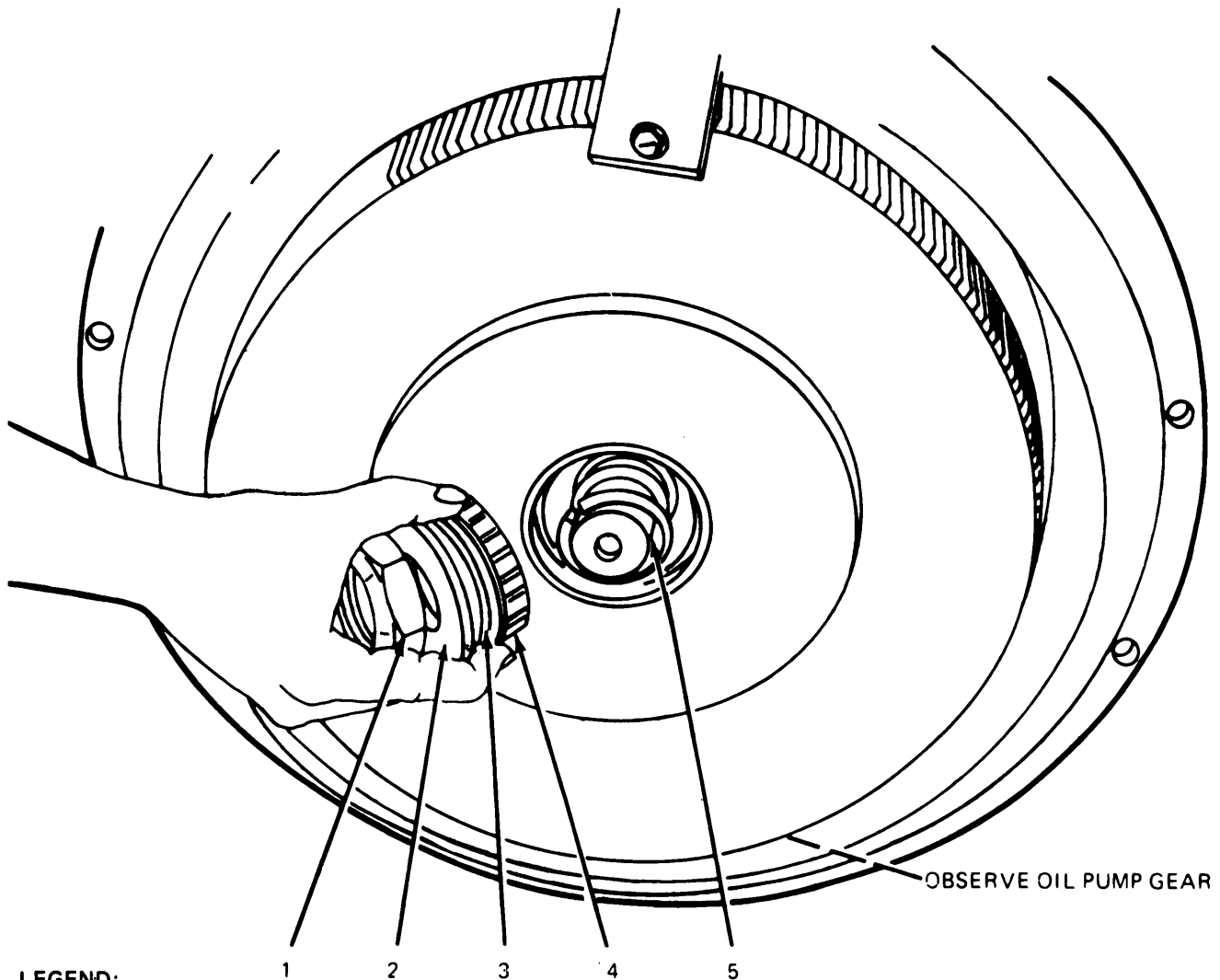
TA 239532■

Figure 7-140, Install Front Clutch,

CAUTION

The oil pump drive gear and front clutch must be engaged before the nut (1, fig. 7-141) is tightened in the next step. Look through opening in bottom of case and observe that oil pump gear turns when front clutch is turned. Failure to observe this precaution will result in damage to the oil pump assembly.

(21) Install spacer (5) bearing (4), seal (3), retainer (2) and nut (1) on the shaft. Move the shifting forks so that the clutch will not turn; then torque nut (1) to 275 ± 25 lb-ft (370 ± 35 N-m).



LEGEND:

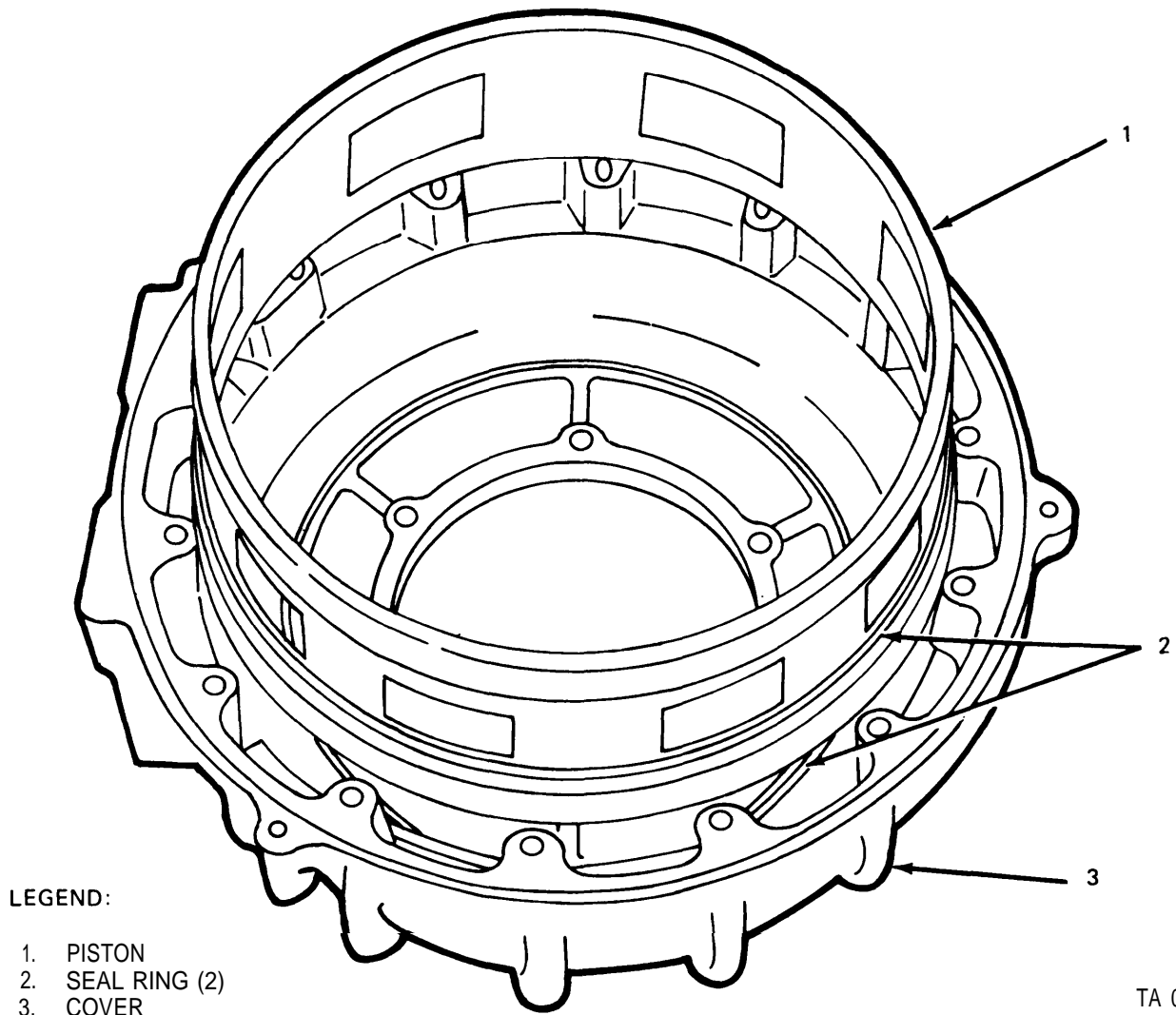
- 1. NUT
- 2. RETAINER
- 3. SEAL
- 4. BEARING
- 5. SPACER

TA 074178

Figure 7-141. Install Bearing.

f. *Assemble and Install Rear Clutch and Brake.*

(1) Apply a small amount of silicone grease on the O-ring seals and seal rings and bore. Install the O-ring seals and seal rings (2, fig. 7-142) on outer edge of piston (1) and inside of cover counterbore (3).



TA 074179

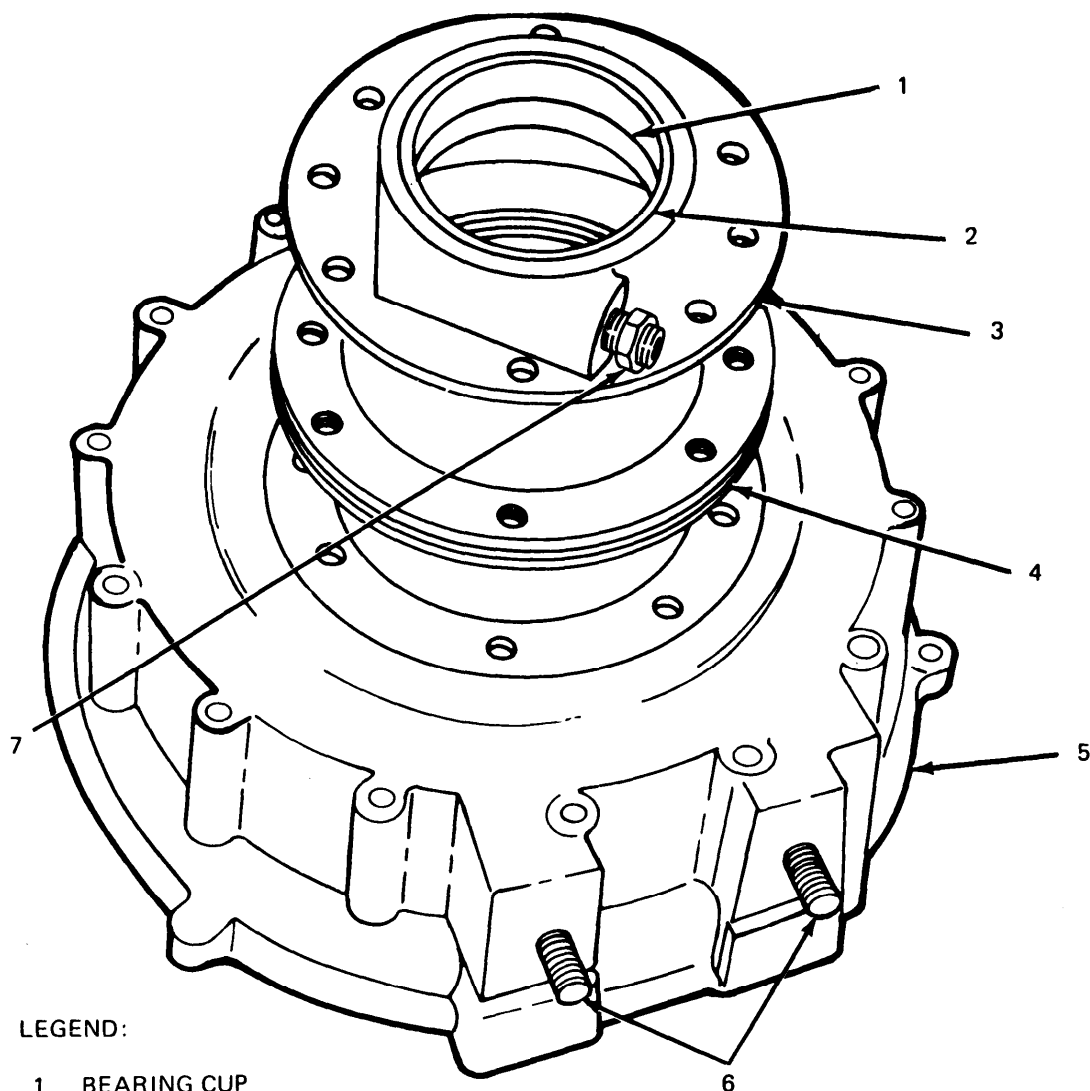
Figure 7-142. Assemble Piston and Cover.

(2) Install piston (1) in the cover (3).

(3) Lower the temperature of bearing cup (1, fig. 7-143) by packing in dry ice or placing in a freezer; then install in the rear bearing retainer (3). Install lip seal (2) in the retainer. Install the O-ring seal on inside flange of retainer. Lubricate O-ring, lip seal, and bores with silicone grease.

(4) If removed, install two studs (6) in the housing (5).

(5) If removed, install adapter and washer (7) in retainer (3).



LEGEND:

1. BEARING CUP
2. LIP SEAL
3. RETAINER
4. SHIM
5. HOUSING
6. STUD (2)
7. ADAPTER AND WASHER

TA 074180

Figure 7-143. Install Bearing Cup and Retainer.

(6) Install the original amount of shims (4) on retainer (3). Make sure that two holes in shim pack line up with two threaded holes in retainer.

CAUTION

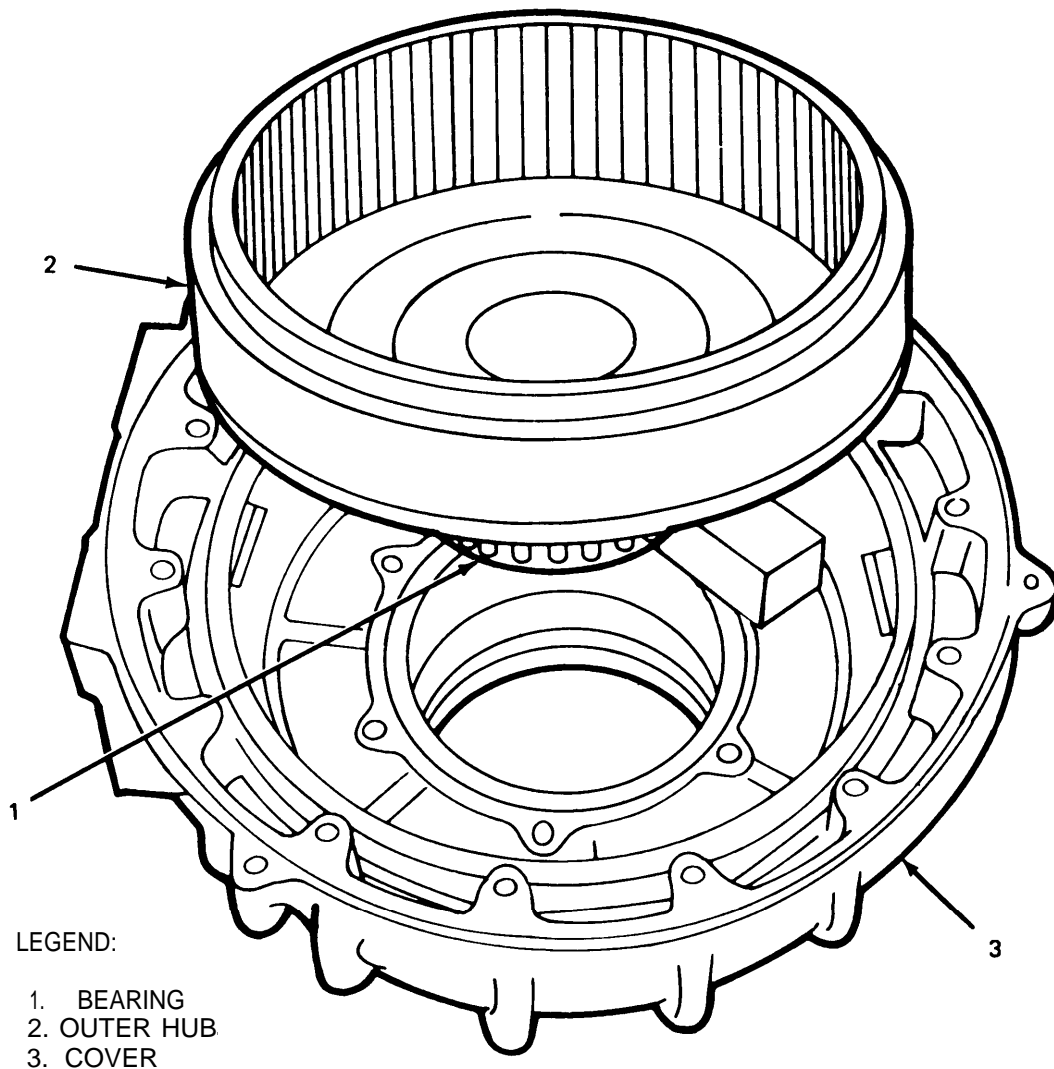
Tighten bolts alternately in order to avoid damage to the O-ring.

NOTE

In step (7), line up scribe marks made during disassembly.

(7) Apply light coat of thread sealant to bolts that fasten retainer (3) to housing (5); then mount retainer on housing and tighten six bolts and washers to 55 + 5 lb-ft (75 + 7 N-m) torque.

(8) Heat bearing (1, fig. 7-144) in oil to a maximum temperature of 275°F (135°C). Press bearing on the hub.

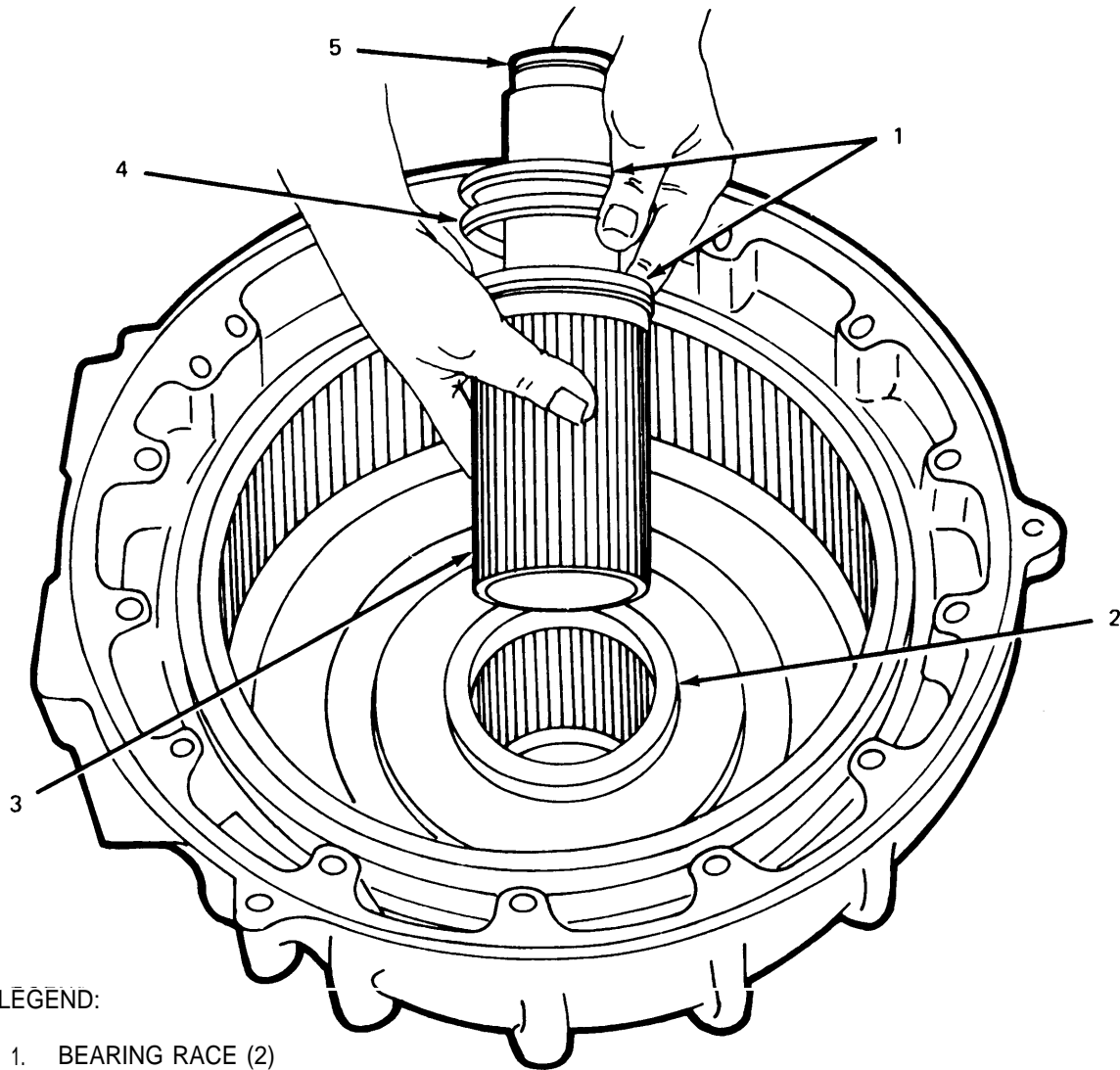


TA 074181

Figure 7-144. Install Bearing and Outer Hub.

(9) Position outer hub (2) in cover (3).

(10) Position ring (2, fig. 7-145) on the hub.



LEGEND:

- 1. BEARING RACE (2)
- 2. RING
- 3. SHAFT
- 4. BEARING
- 5. SEAL RING

TA 074182

Figure 7-145. Install Shaft Assembly.

(11) Install shaft (3) in the hub, turn assembly over and install O-ring, retainer and center bolt to the shaft.

(12) Install bearing races (1) and bearing (4) on the shaft. Replace seal ring (5) and lubricate with silicone grease.

(13) Install spacer (5, fig. 7-146) on center hub (4).

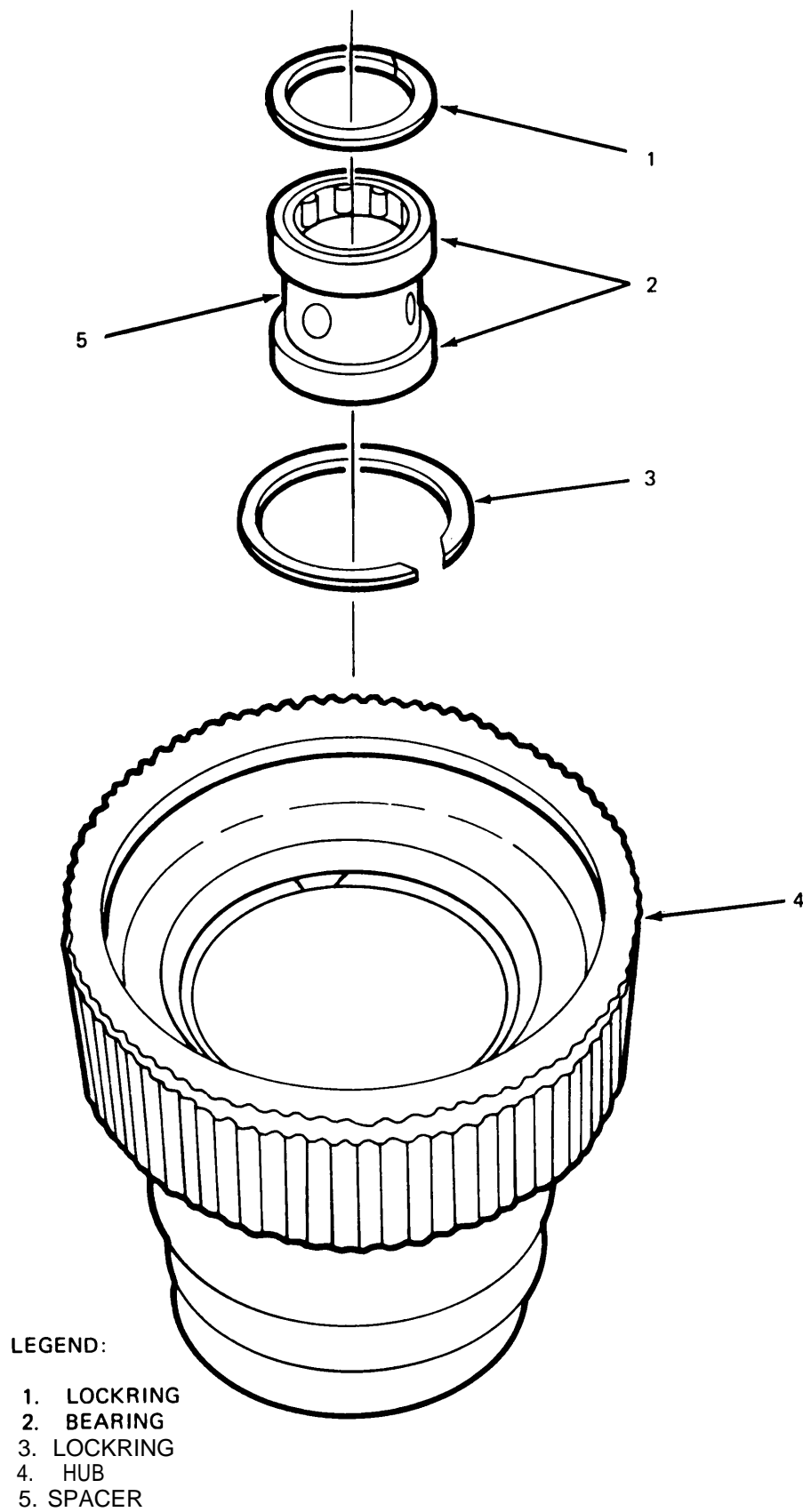
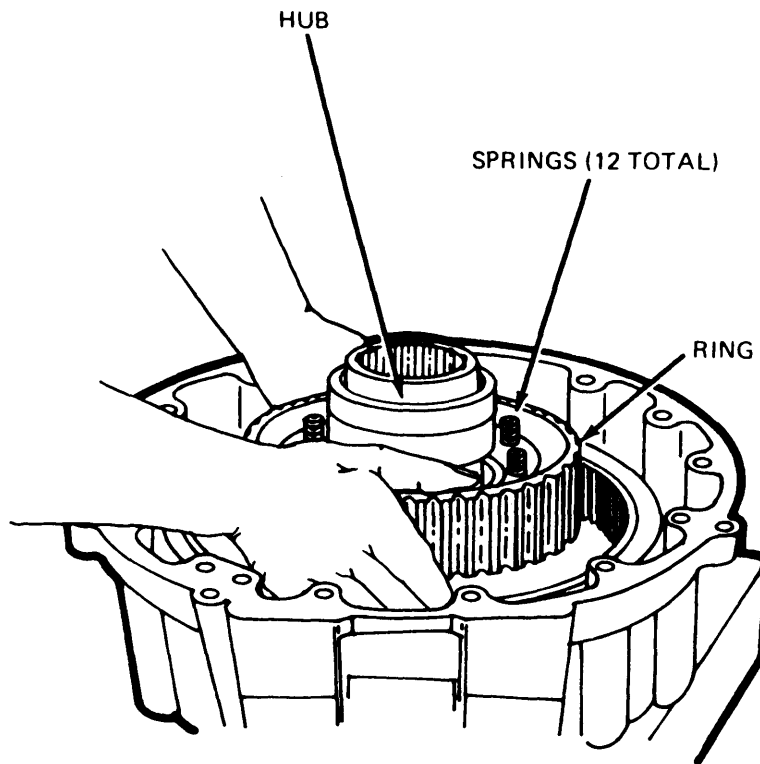


Figure 7-146. Install Inner Hub.

TA 074183

(14) Install bearing (2) in hub (4); then install spacer (5) and other bearing (2) in the hub. Secure with spiral lockring (1). Install assembled hub on shaft (fig.7-147).

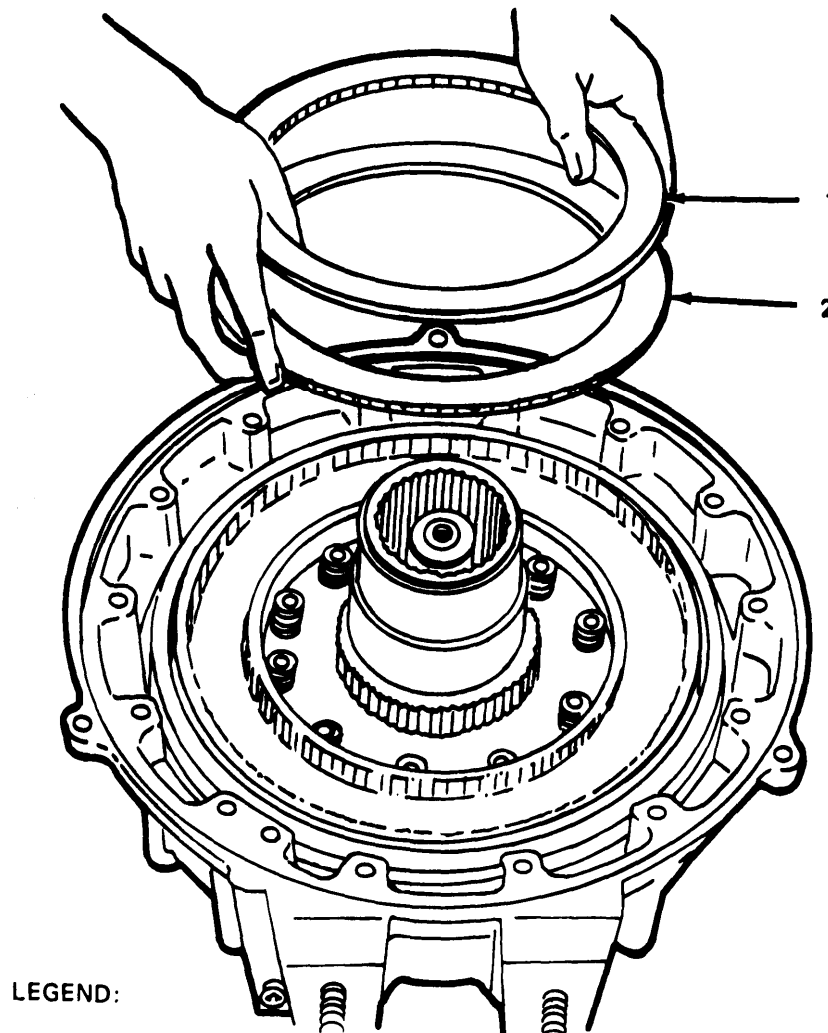
(15) Install 12 springs in the ring and position the ring on the hub.



TA 074184

Figure 7-147. Install Center Hub.

(16) Install 13 disks (2, fig. 7-148) and 14 plates (1) alternately, starting with a disk and ending with a plate on top. Lubricate plates with transmission oil.



LEGEND:

- 1. PLATE (14)
- 2. DISK (13)

TA239544 ■

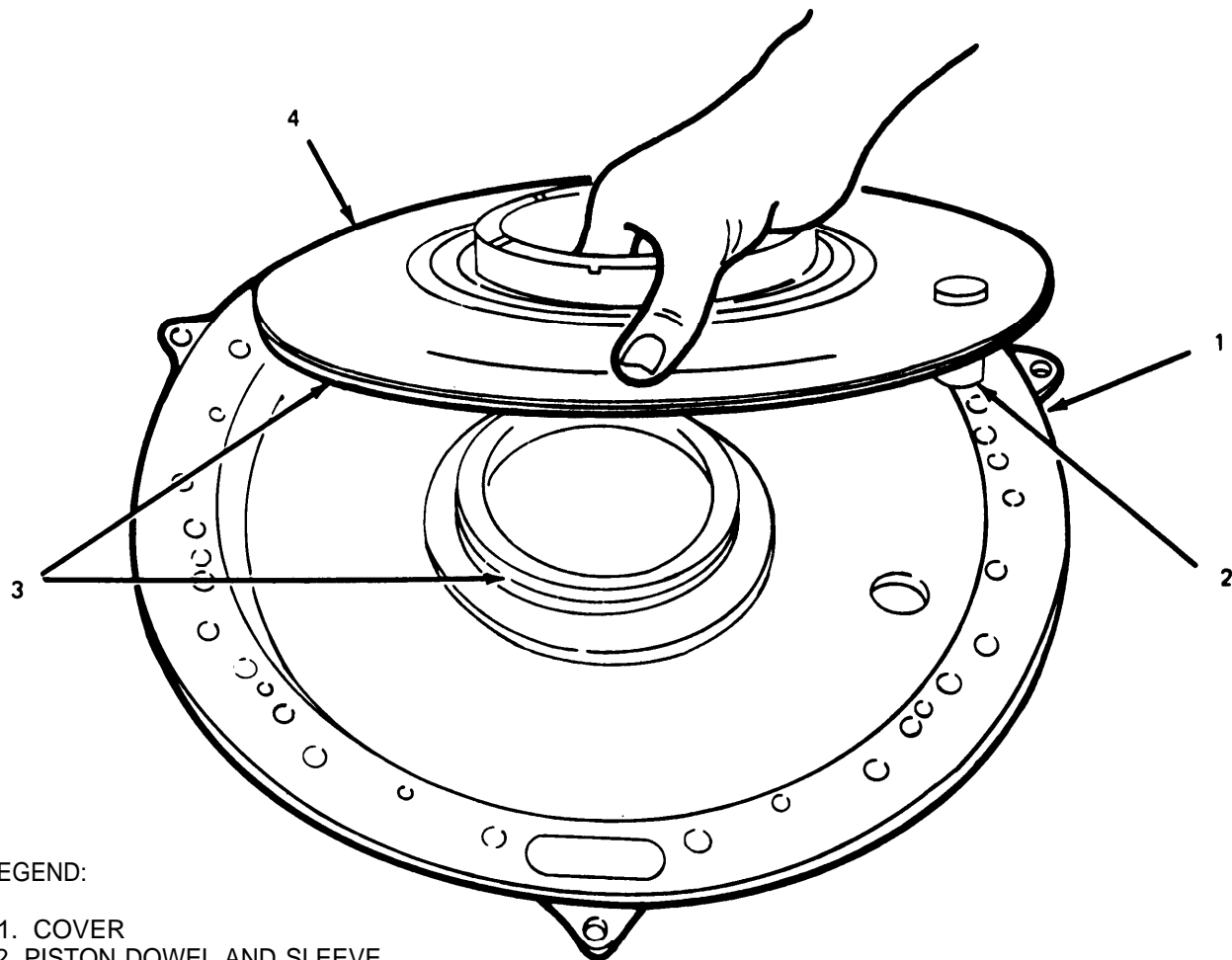
Figure 7-148. Install Plates and Disks.

NOTE

With plates and disks in place measure distance between top clutch plate to face of cover. Clearance of a new unit must be 1.0 in. to 1.06 in. (25.4 mm to 26.9 mm), and no more than 1.10 in. (27.9 mm) if used.

(17) If piston dowel and sleeve (2, fig. 7-149) was removed, press into piston.

(18) Apply a small amount of silicone grease on the O-ring bores and seal rings (3). Install the O-ring and seal ring on the piston (4) and in cover (1). Make sure the dowel (2) is in alignment with the hole in the cover (1).



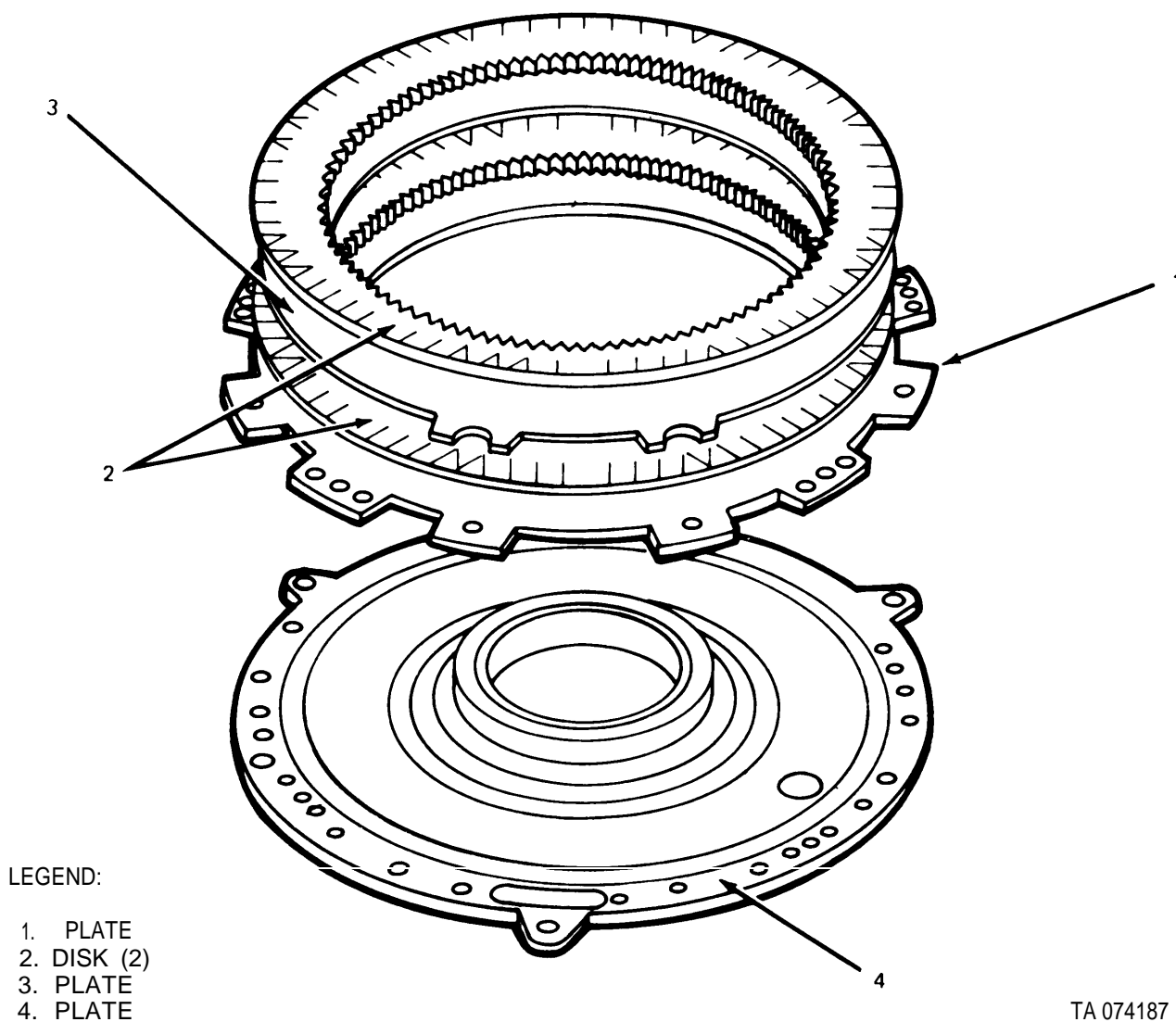
LEGEND:

- 1. COVER
- 2. PISTON DOWEL AND SLEEVE
- 3. SEAL RING (2)
- 4. PISTON

TA 074186

Figure 7-149. Install Piston.

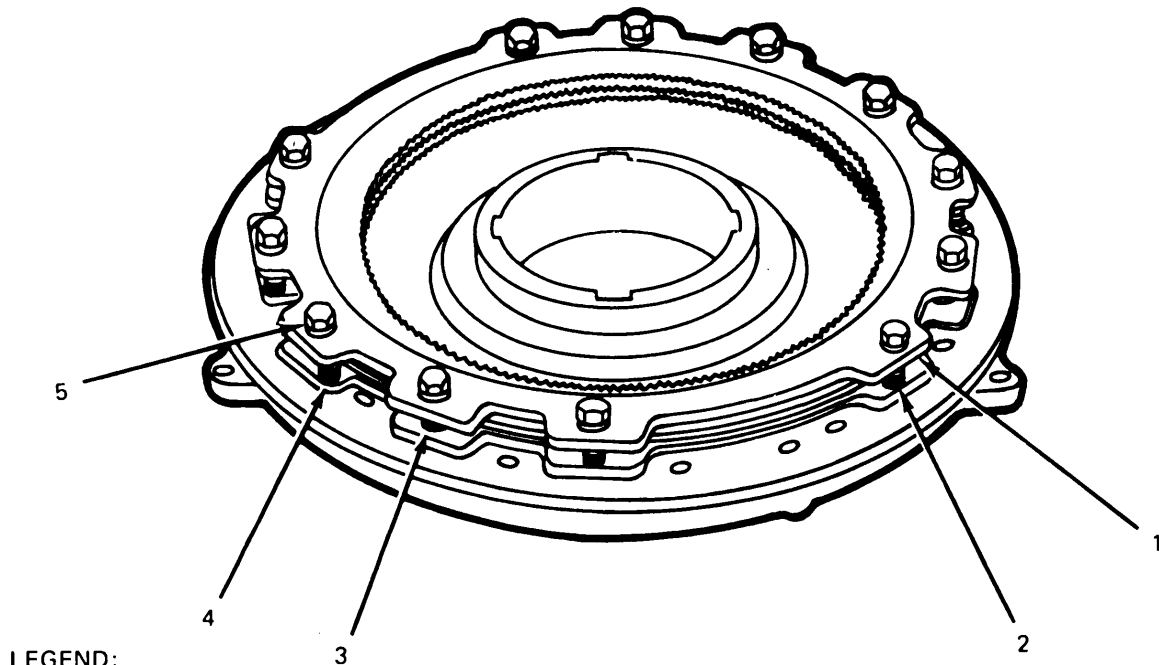
- (19) Apply a coat of anti-seize compound to dowel (2).
- (10) Install the piston in cover (1). Make sure the dowel (2) is in alignment with the hole in the cover.
- (21) position plate (1, fig. 7-150), disks (2), and plate (3) on plate (4), note marking TOP on plates (1) and (3). Lubricate plates and disks with transmission oil.



TA 074187

Figure 7-150. Install Pressure Plates and Disks.

(22) position 12 spacers (3, fig. 7-151) and 12 springs (2) on plate (1).



LEGEND:

- | | |
|----------------|-------------------------|
| 1. PLATE | 4. PLATE |
| 2. SPRING (12) | 5. BOLT AND WASHER (12) |
| 3. SPACER (12) | |

TA 074188

Figure 7-151. Assemble Brake Plates and Springs.

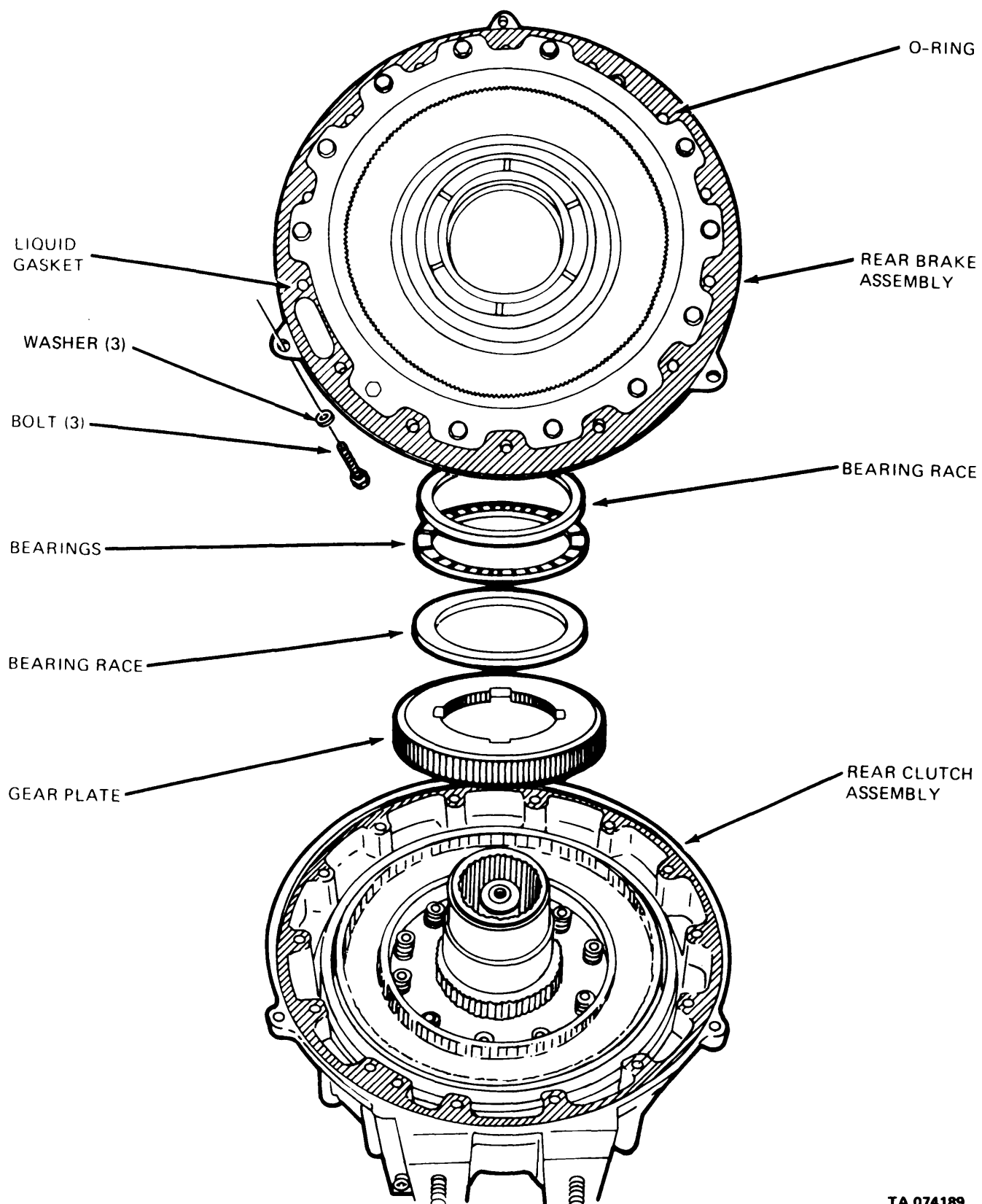
(23) Position plate (1) on plate (4). Loosely install 12 bolts and washers (5) that hold the plate.

(24) Make sure the spacers are properly aligned with the holes; then turn bolts down evenly - a few turns at a time on each - until all are turned down. Torque the bolts to 36 ± 2 lb-ft (46 ± 3 N-m).

(25) Stand rear clutch in upright position; then install a hoist adapter (5P8693) on the rear brake assembly.

(26) Apply liquid gasket (item 21, App. B) to the mating surfaces of the rear clutch and rear brake assemblies.

(27) Apply a light coat of silicone grease to O-ring and install O-ring in the rear brake assembly (fig. 7-152).



TA 074189

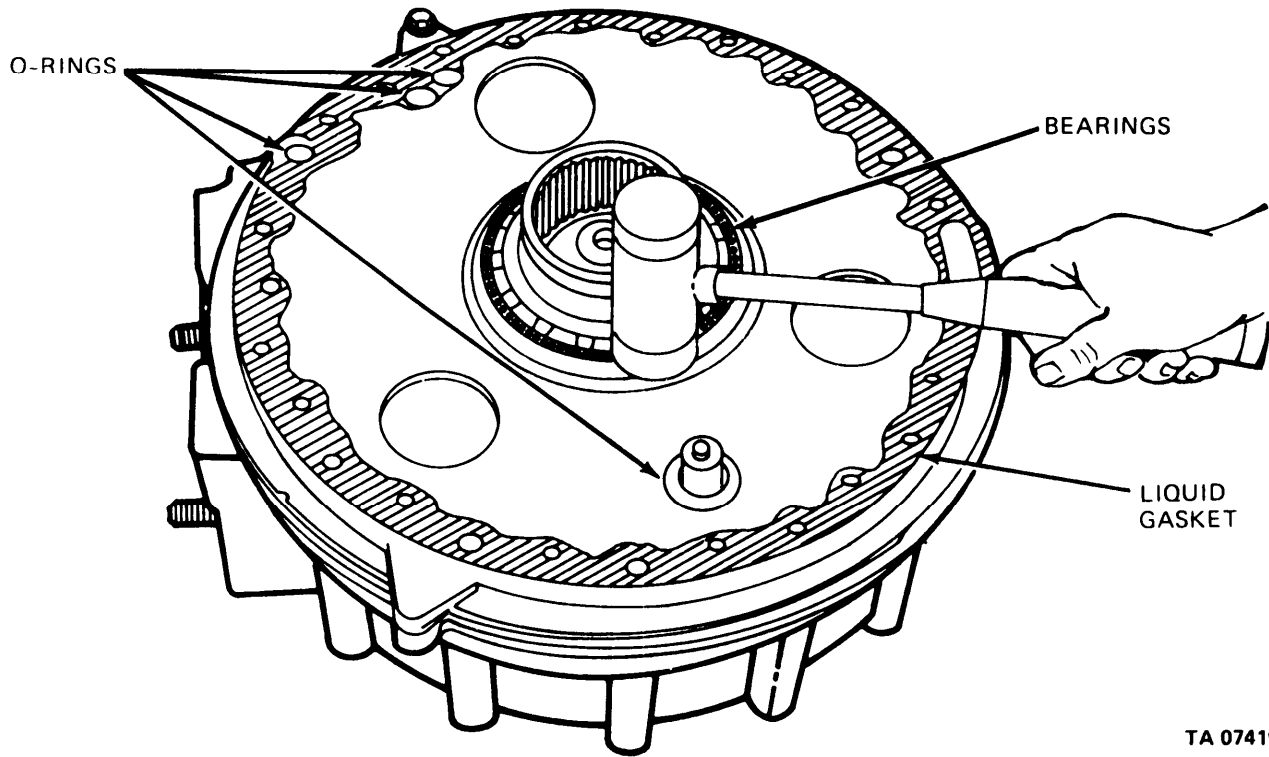
Figure 7-152. Assemble Rear Clutch and Brake.

(28) Install bearing and races.

(29) Install gear plate on clutch hub.

(30) Position the brake assembly on the clutch assembly. Engage splines on both brake disks with gear plate. Turn shaft to make sure it turns freely; then install three bolts and washers and torque to $18 + 2$ lb-ft ($24 + 3$ N-m).

(31) Install bearing (fig. 7-153) on the plate with a soft hammer.



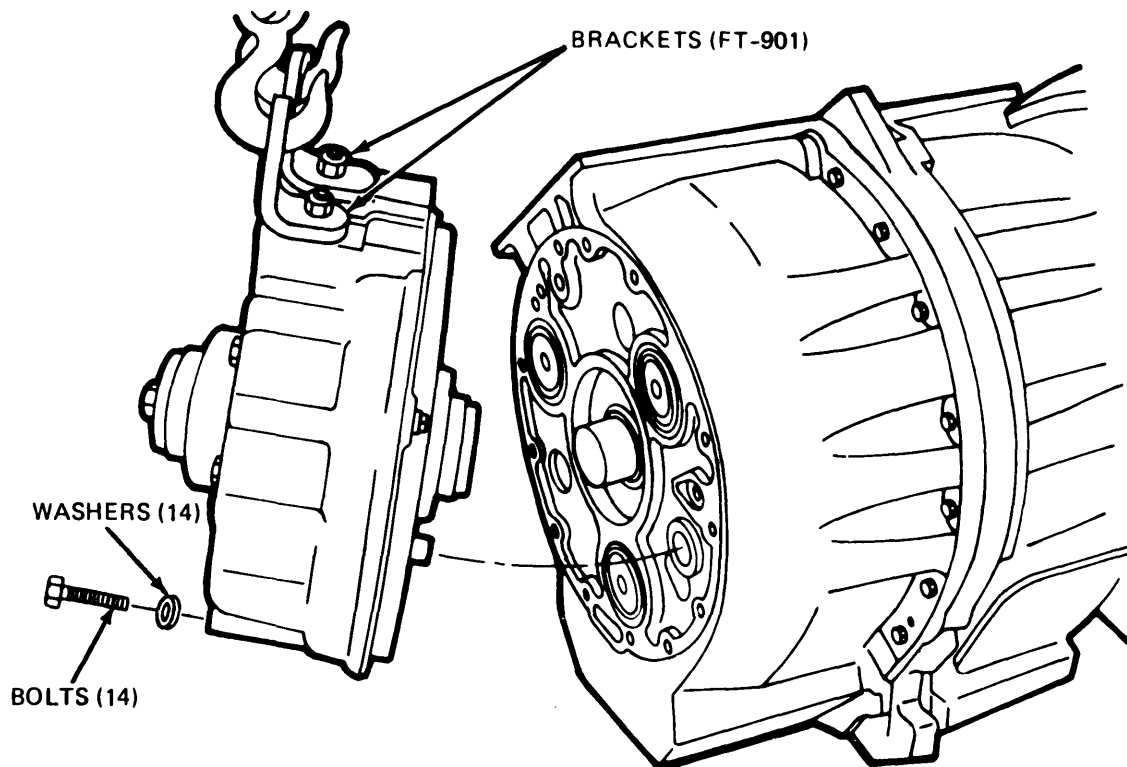
TA 074190

Figure 7-153. Install Rear Clutch Hub Bearing.

(32) Apply liquid gasket (item 21, App. B) on the mating surfaces of the rear case and the rear clutch group (fig. 7-153 and 7-154).

(33) Coat four O-rings with silicone grease and install.

(34) Install the rear clutch and brake on the rear case (fig. 7-154). Apply thread sealant and install 14 bolts and washers that hold the assemblies together and torque to 36 + 2 lb-ft (46 + 3 N-m).



TA 074191

Figure 7-154. Install Rear Clutch and Brake.

(35) Install dial indicator (fig. 7-155) and installer tool (2P8260).

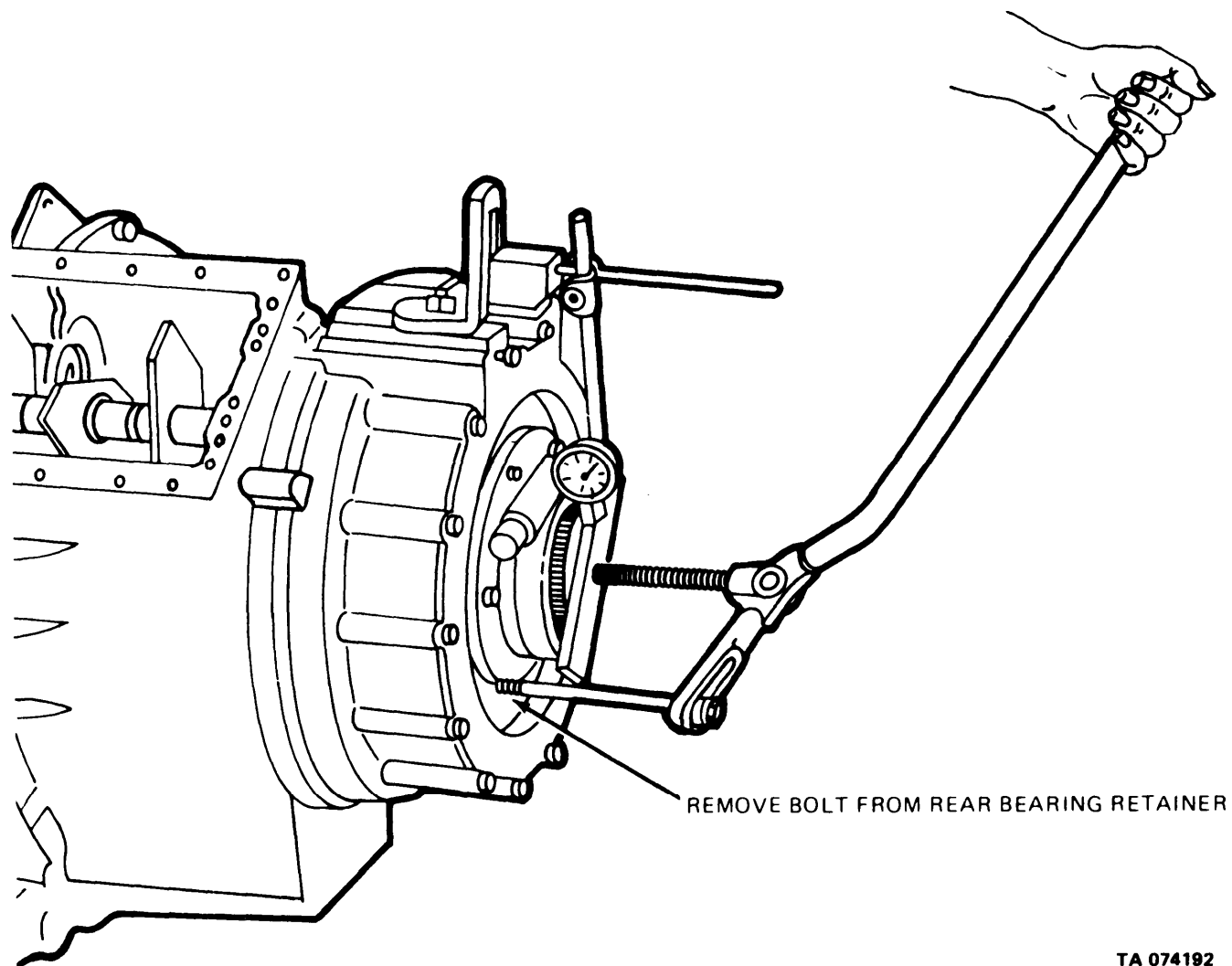
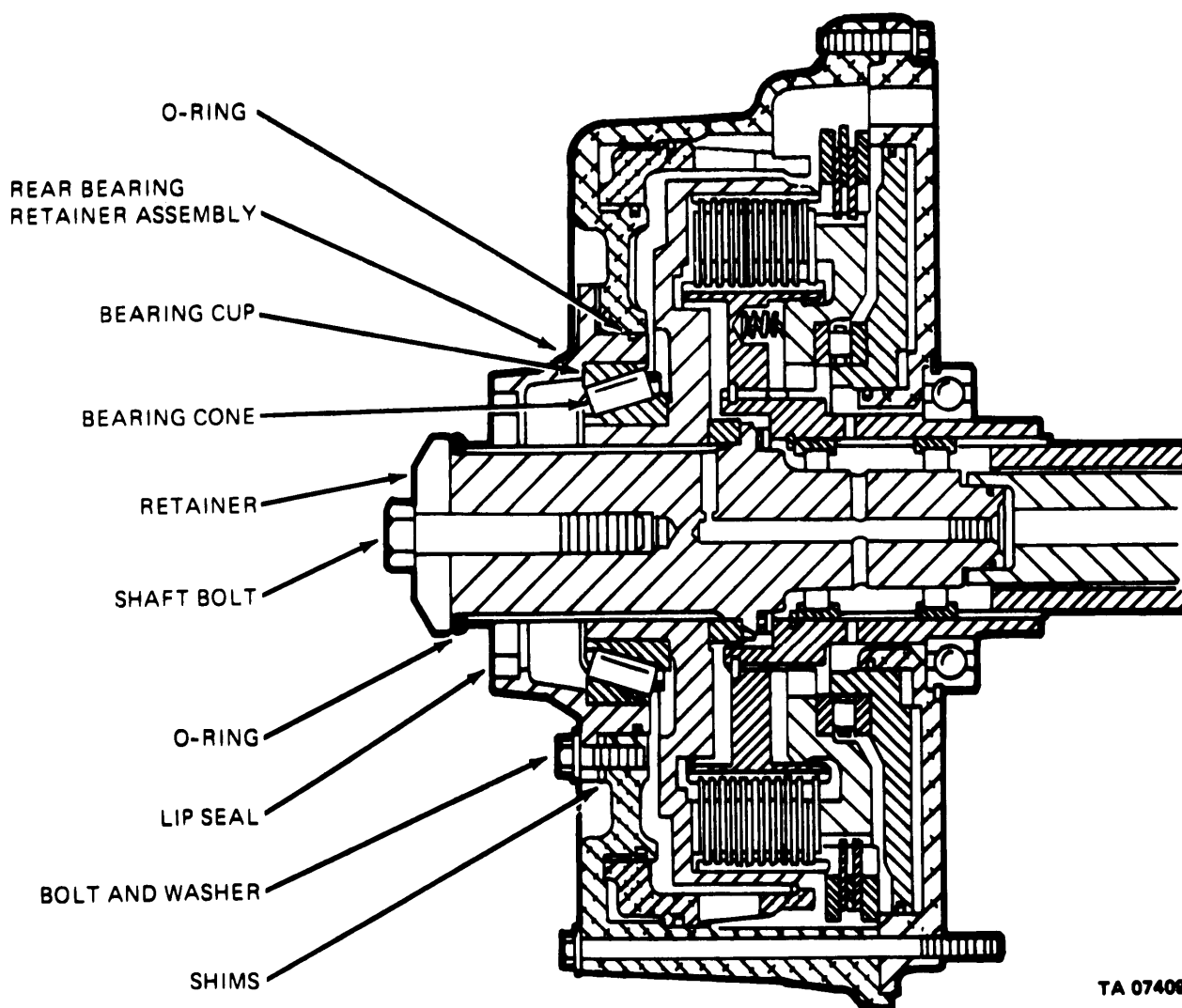


Figure 7-155. Check Output Shaft End Clearance.

(36) Check the end clearance of the output shaft by moving the shaft in and out with installer tool (2P8260). The end clearance must be between 0.005 and 0.010 in. (0.13 and 0.25 mm).

CAUTION

If rear bearing retainer assembly (fig. 7-1 56) is removed the rear clutch plates will drop out of position. When shims are to be removed or added to the retainer assembly, remove two of the bolts from the retainer assembly (180° apart). Install two 7/16 in. -14 NC threaded rods four inches long in their place. Turn the threaded rods by hand until they make contact with the clutch hub assembly in position while the retainer assembly is removed for shim adjustment.



TA 074097

Figure 7-156. Rear Bearing Support Housing.

(37) If end clearance is not correct remove rear bearing retainer assembly and add shims to increase clearance or remove shims to decrease clearance. Reinstall retainer assembly.

(38) Remove dial indicator and installer and install the O-ring, retainer, yoke, and center bolt on the output shaft.

g. Assemble and Install Transmission Control.

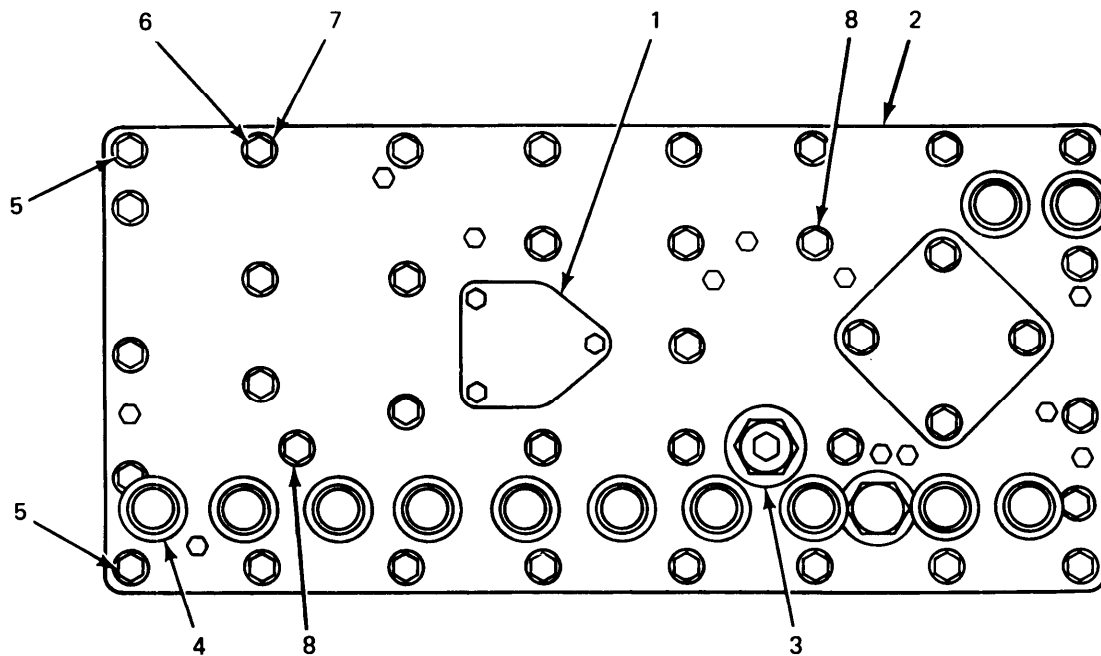
(1) Assemble and install Pressure regulator as described in para 7-8e.

(2) perform seal leakage tests for clutches and brakes as described in para 7-14.

(3) put the transmission control (2, fig. 7-157) in position on transmission case.

(4) Install 20 bolts (6) and two short bolts (5). Torque to 36 ± 2 lb-ft (49 ± 3 N-m).

(5) If required, install twelve breathers (4) (Refer to TM 9-2320-273-20).



LEGEND:

- | | |
|-------------------------|----------------|
| 1. PLATE | 5. BOLT (2) |
| 2. TRANSMISSION CONTROL | 6. BOLT (20) |
| 3. PLUG | 7. WASHER (20) |
| 4. BREATHER (12) | 8. BOLT (2) |

TA 239533■

Figure 7-157. Install Transmission Control.

7-20. Installation. Install transmission as described in Chapter 2, para 2-11 b.

CHAPTER 8

REPAIR OF TRANSFER ASSEMBLY

8-1. Description. The transfer case is used on M916, M917, M918, M919, and M920 vehicles. The assembly has a one-piece cast housing and weighs approximately 540 lbs (254 kg). The case contains 3%-inch constant mesh helical gears providing an input-output gear ratio of 1:1 and a remotely operated air-controlled front axle declutch.

8-2. Removal. (Refer to para 2-13a and 2-13 b.)

8-3. Disassembly.

a. Remove the Propeller Shaft Yokes.

(1) Cut the lockwire (fig. 8-1) between the capscrews on the top input shaft yoke.

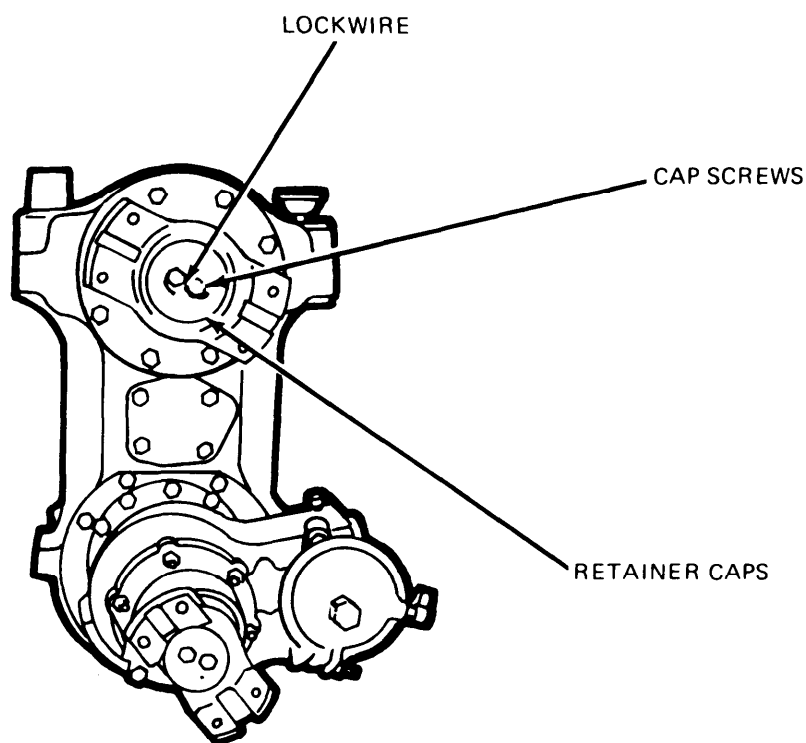
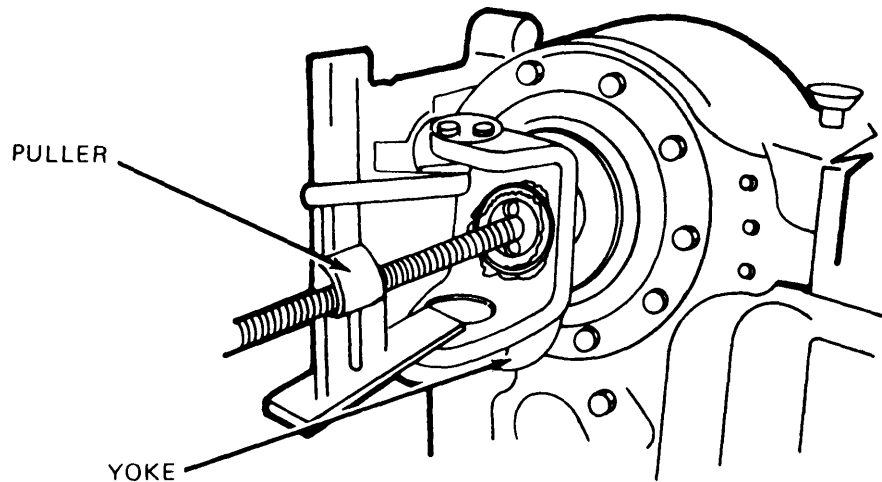


Figure 8-1. Remove Top Input Shaft Yoke Retainer Cap.

TA 074194

- (2) Remove the two capscrews (2, fig. 8-3) and end yoke plate (3).
- (3) Pull the yoke from the end of the shaft with a suitable puller (fig 8-2).



TA 074195

Figure 8-2. Yoke Removal.

NOTE

The procedure is the same for all three yokes. (Lower front output yoke retainer capscrews are not lockwired.)

- (4) Remove the two lower output yokes (Front-17, fig. 8-11; Rear-13, fig. 8-21) by removing two capscrews (Front-56, fig. 8-11; Rear-14, fig. 8-21) and yoke plate (Front-55, fig. 8-11 ; Rear-16, fig. 8-21).

b. Remove and Disassemble Top Front Input Shaft (fig. 8-3).

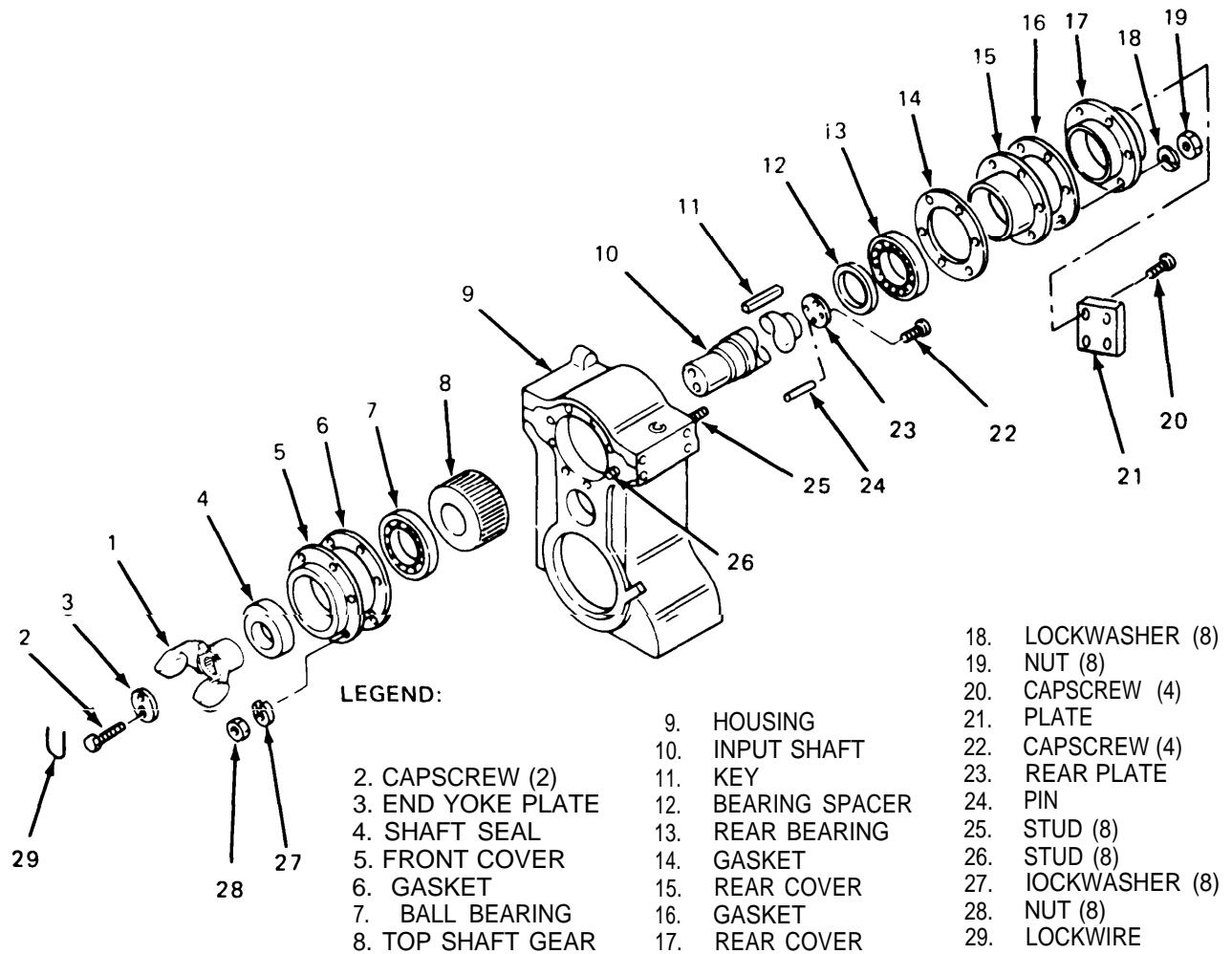
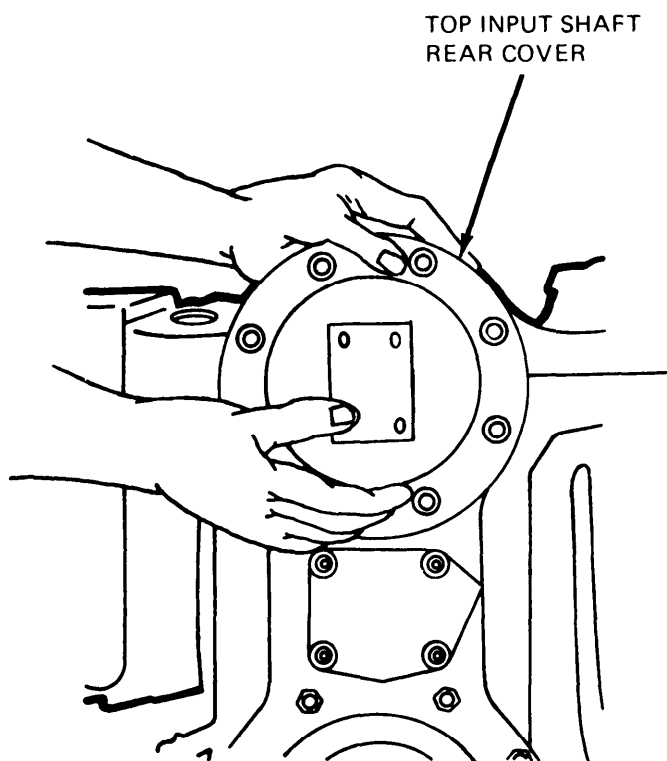


Figure 8-3. Front Top Input Shaft – Exploded View.

- (1) From the rear side of the case, remove the eight nuts (19, fig. 8-3), lockwasher (18), four capscrews (20) and plate (21).
- (2) Remove the cover and gasket (fig. 8-4).



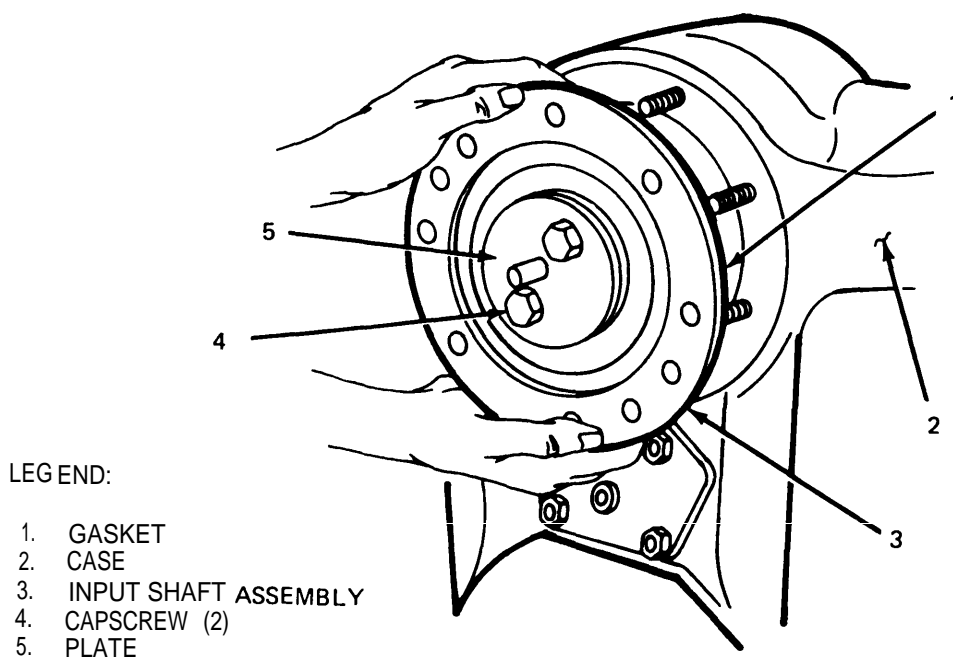
TA 074197

Figure 8-4. Top Input Shaft Rear Cover Removal.

CAUTION

Do not use a metal hammer in step (3),
Use a rubber or fiber mallet so that the
end of the shaft will not be damaged.

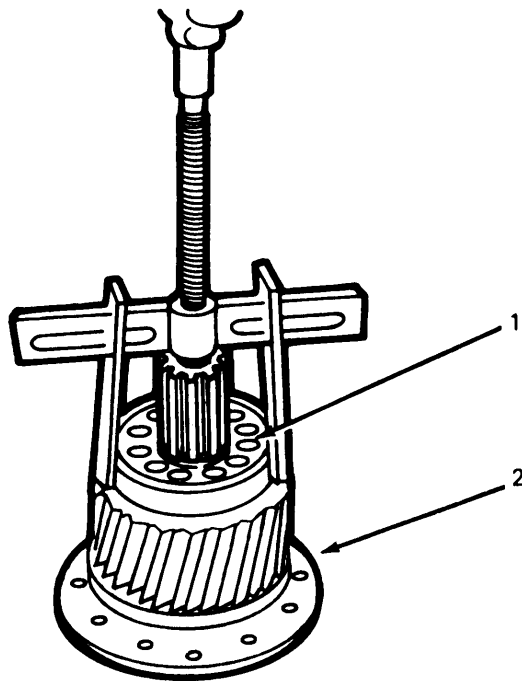
(3) Remove the top input shaft assembly (3, fig. 8-5) and gasket (1) from the rear side of the case by tapping the shaft from the front side with a mallet, then remove two capscrews (4) and plate (5). Do not remove guide pin unless bent or damaged.



TA 074198

Figure 8-5. Top Input Shaft Assembly Removal

(4) Using suitable bearing puller pull the bail bearing (1, fig. 8-6) assembly from the splined end of the top input shaft assembly (2).



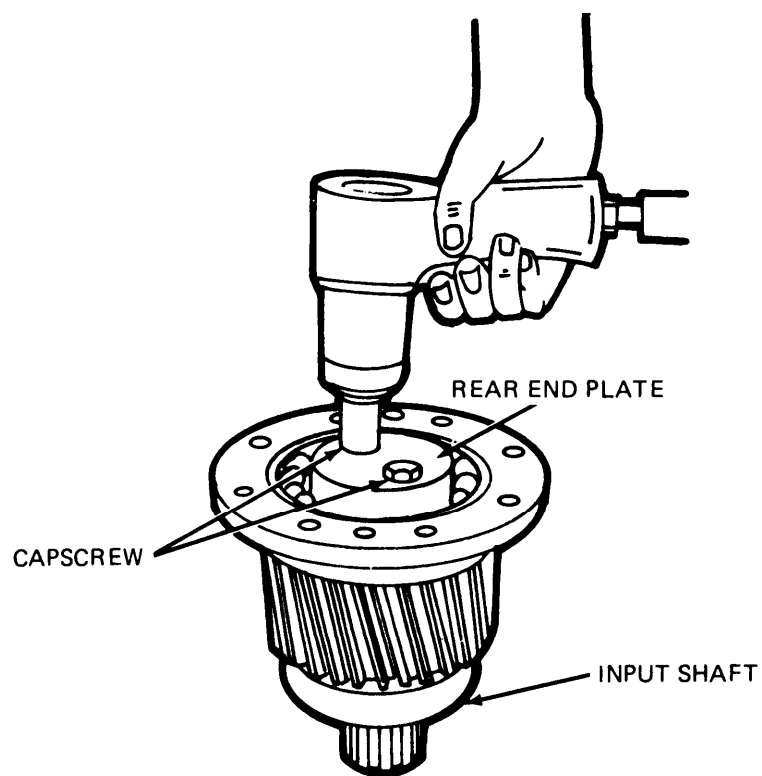
LEGEND:

- 1. BEARING
- 2. INPUT SHAFT ASSEMBLY

TA 074199

Figure 8-6. Forward Bearing Removal.

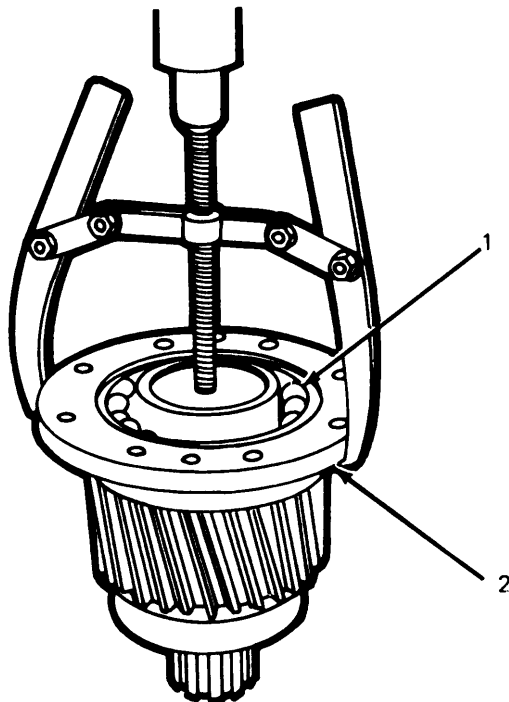
(5) Turn the input shaft assembly over. Cut the capscrew lockwire and remove the two capscrews, end plate (fig. 8-7), tang and cover plugs.



TA 074200

Figure 8-7. Rear End Plate Removal.

(6) Using suitable bearing puller pull the cover (2, fig. 8-8) and ball bearing (1) from the shaft. Remove the bearing spacer.



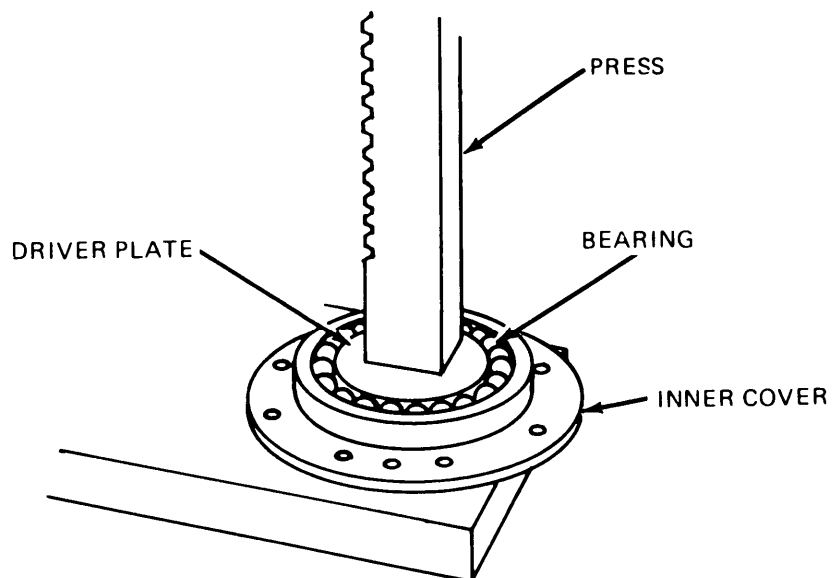
LEGEND:

- 1. BEARING
- 2. COVER

TA 074201

Figure 8-8. Rear Cover and Bearing Removal.

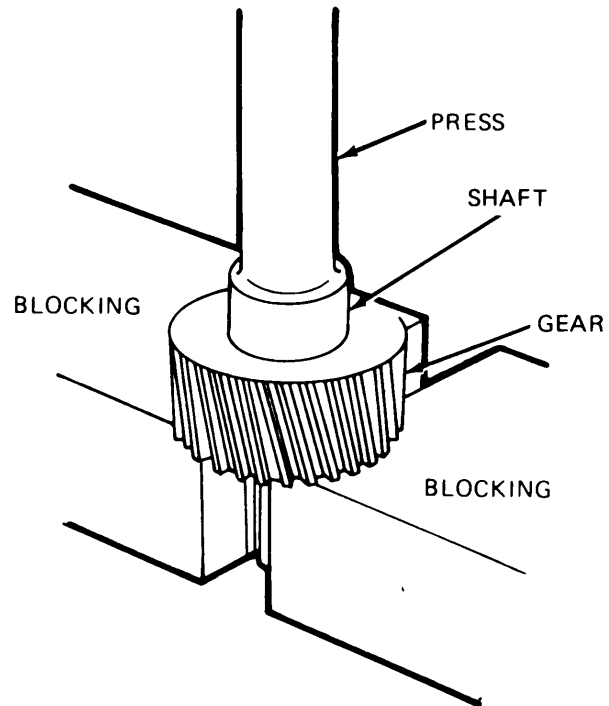
(7) Press the bearing (fig. 8-9) from the cover with seal.



TA 074202

Figure 8-9. Rear Bearing Removal.

(8) Press the shaft (fig. 8-10) from the gear and remove the locking key.



TA 074203

Figure 8-10. Gear Removal.

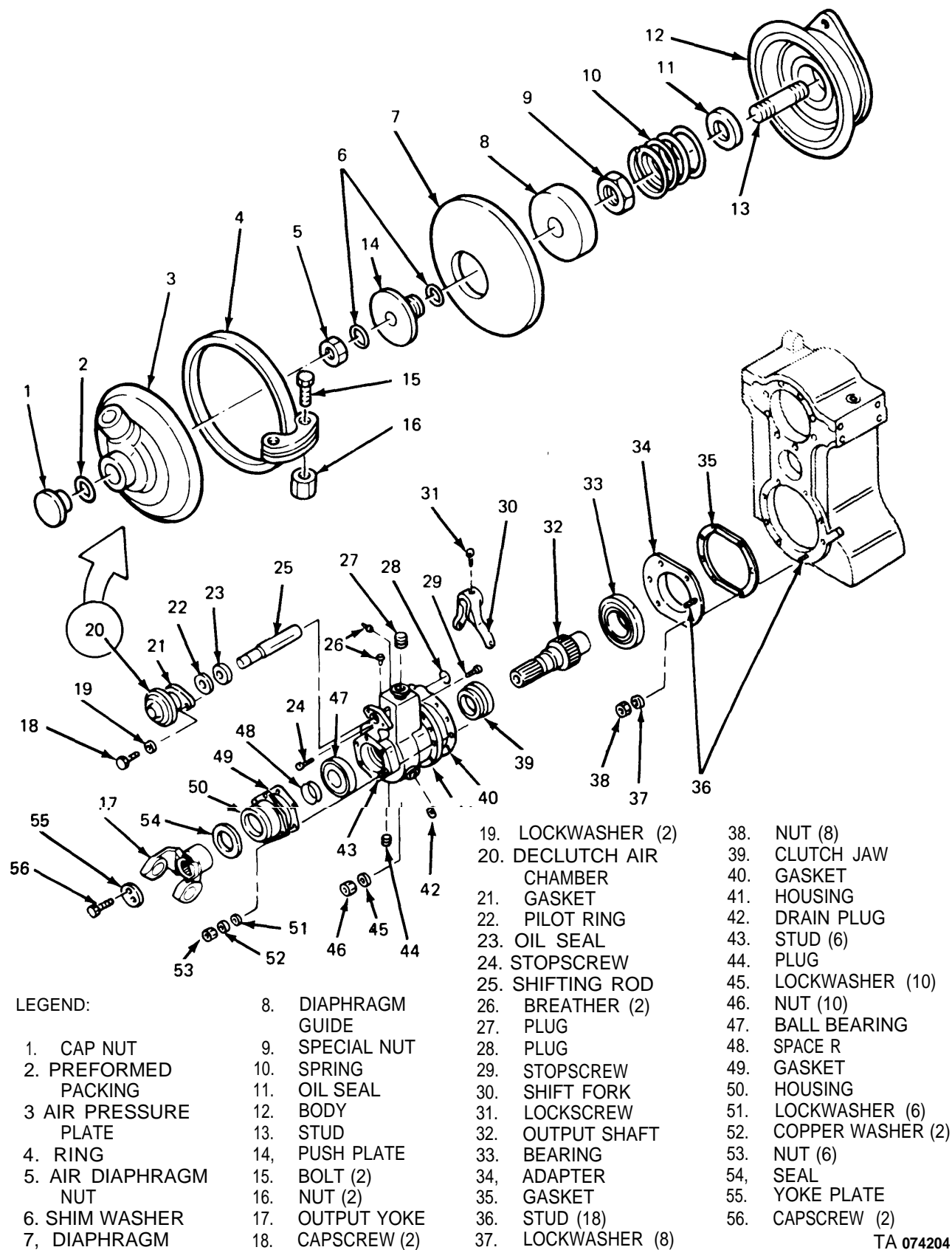


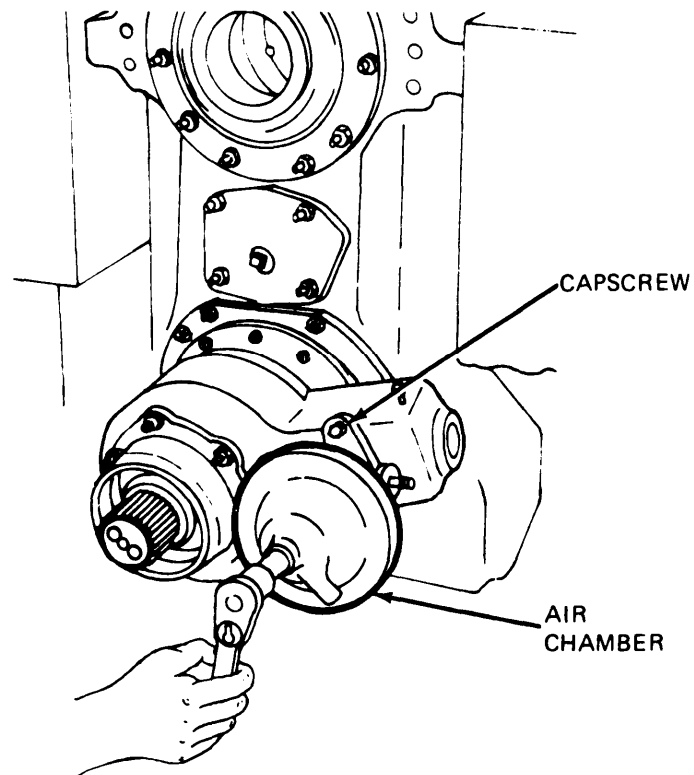
Figure 8-11. Lower Front Output Shaft and Declutch – Exploded View.

c. *Removal of Lower Front Output Shaft and Declutch Assembly (Fig. 8-11).*

WARNING

Diaphragm is spring loaded. Cage chamber while removing nut or injury might result.

(1) Remove the access plug and packing from the air chamber cover and remove nut from end of declutch shift shaft as shown in figure 8-12.

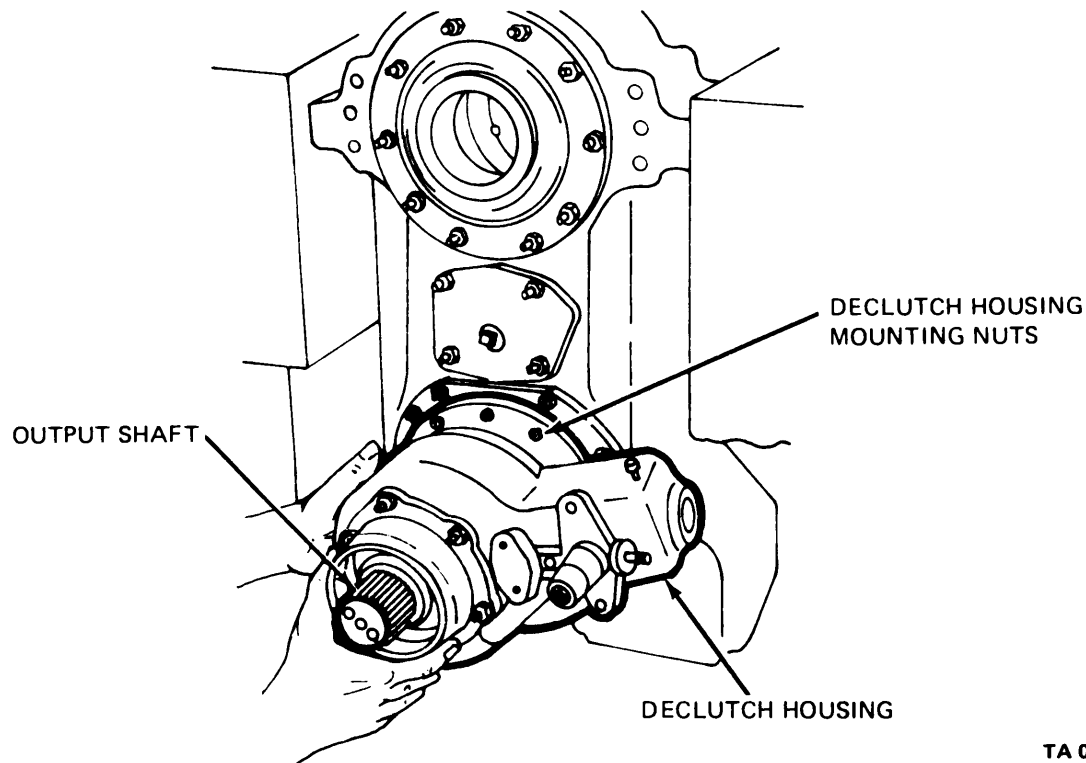


TA 074205

Figure 8-12. Declutch Shift Shaft Nut Removal.

(2) Remove two capscrews and lockwasher (18 and 19, fig. 8-11) from the base of the declutch air chamber. Remove the declutch air chamber (20) and pilot ring (22).

(3) Remove the ten nuts and lockwasher holding the declutch housing (fig. 8-13) to the transfer case. Remove the lower front output shaft assembly and declutch assembly along with the gasket from the transfer case.



TA 074206

Figure 8-13. Declutch Housing and Lower Front Output Shaft Removal.

(4) Remove the access plug from the declutch housing. Unfasten and remove the lockscrew holding the shift fork to the shift rod (fig. 8-14).

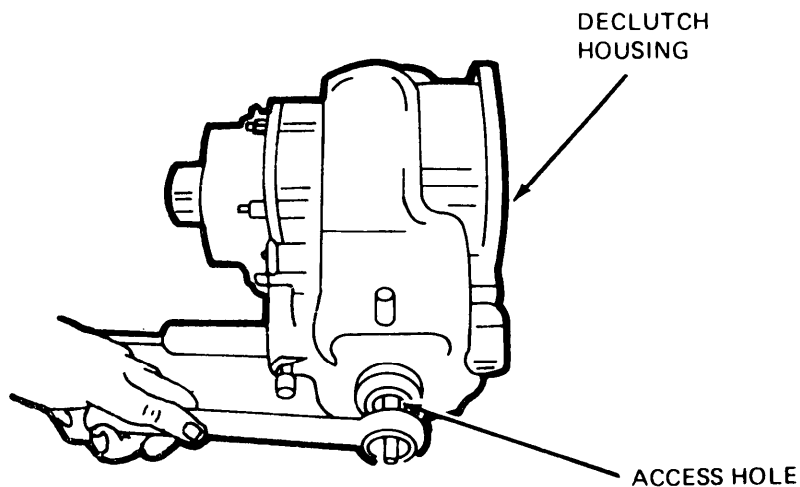
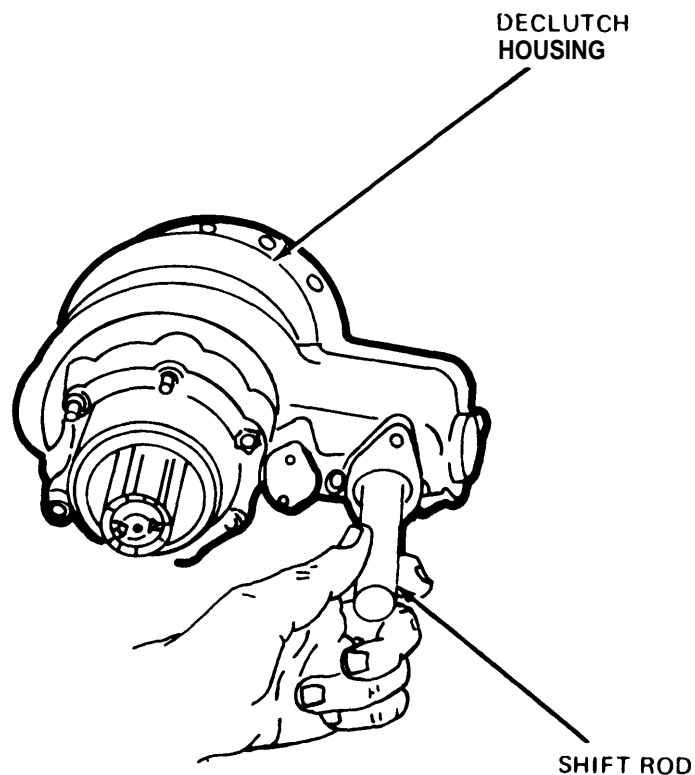


Figure 8-14. Shift Fork Lockscrew Removal.

TA 074207

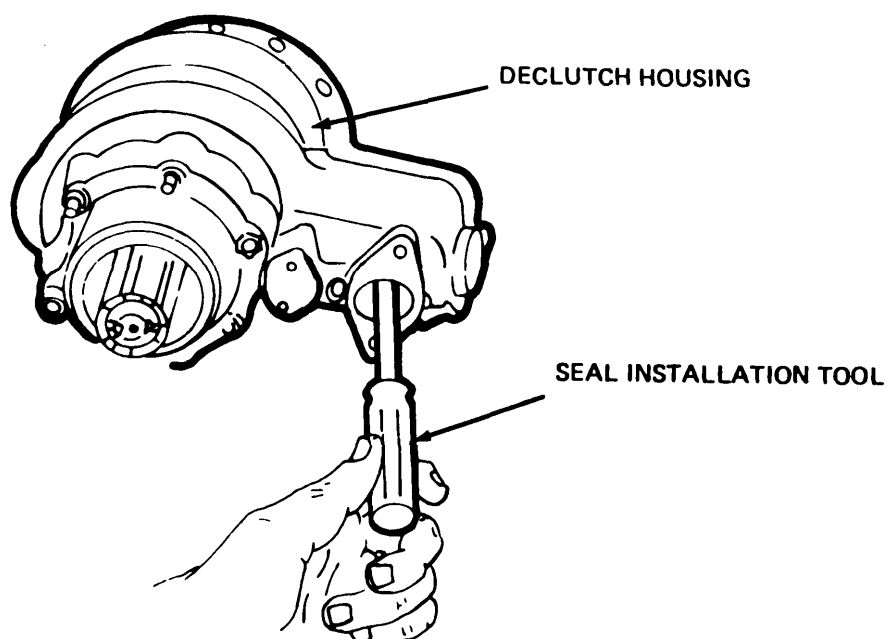
(5) Remove gasket and seal. Then extract the shift rod from the shift fork and housing (fig. 8-15).



TA 074208

Figure 8-15. Shift Rod Removal.

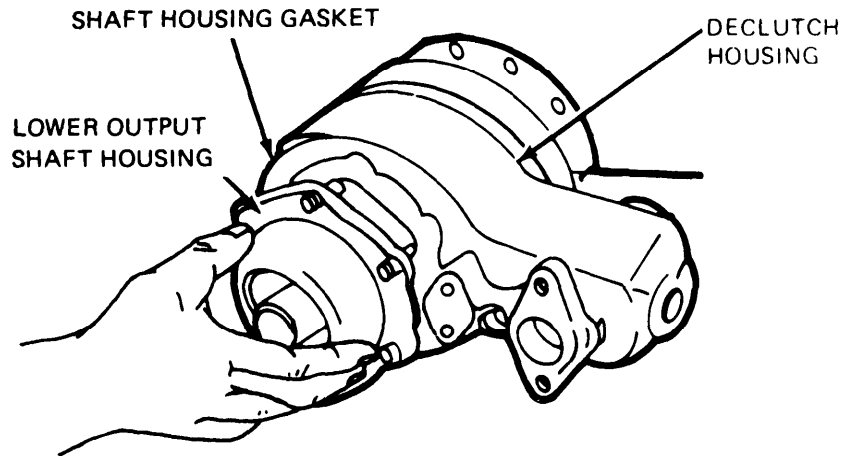
(6) Replace oil seal using a suitable installation tool. When replacing seal (fig. 8-16), apply retaining sealant to outside diameter of seal and grease to inside diameter of seal.



TA 074209

Figure 8-16 Oil Seal Replacement.

(7) Remove six nuts, lockwasher and flat washers from the lower output shaft housing. Remove the shaft housing (fig. 8-1 7) from the declutch housing. Remove shaft housing gasket.

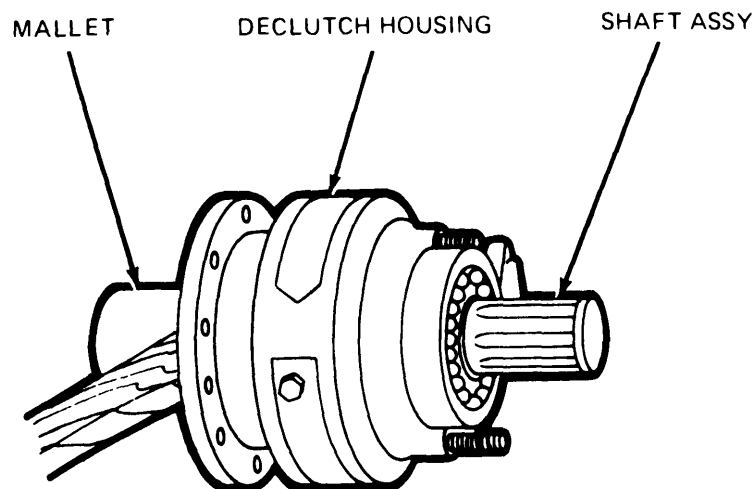


TA 074210

Figure 8-17. Lower Front Output Shaft Housing Removal.

(8) Remove yoke spacer (48, fig. 8-11) from shaft. Remove oil seal (54) in housing (50). Remove breathers (26).

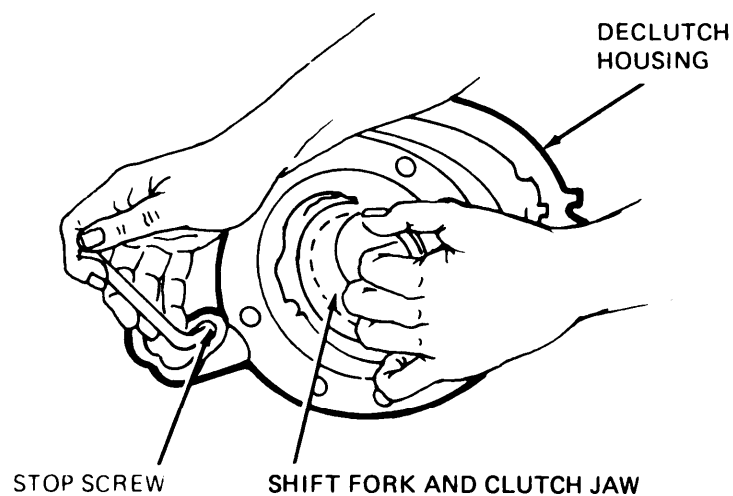
(9) Drive the shaft assembly from the declutch housing with a rubber or rawhide mallet (fig. 8-1 8) and remove shaft.



TA 074211

Figure 8-18. Lower Front Output Shaft Removal.

(70) Remove the rear shift fork stopscrew (fig. 8-19). Remove the shift fork and clutch jaw from the declutch housing.



TA 074212

Figure 8-19. Shift Fork and Collar Removal.

(71) Press the output shaft from the bearing (fig. 8-20),

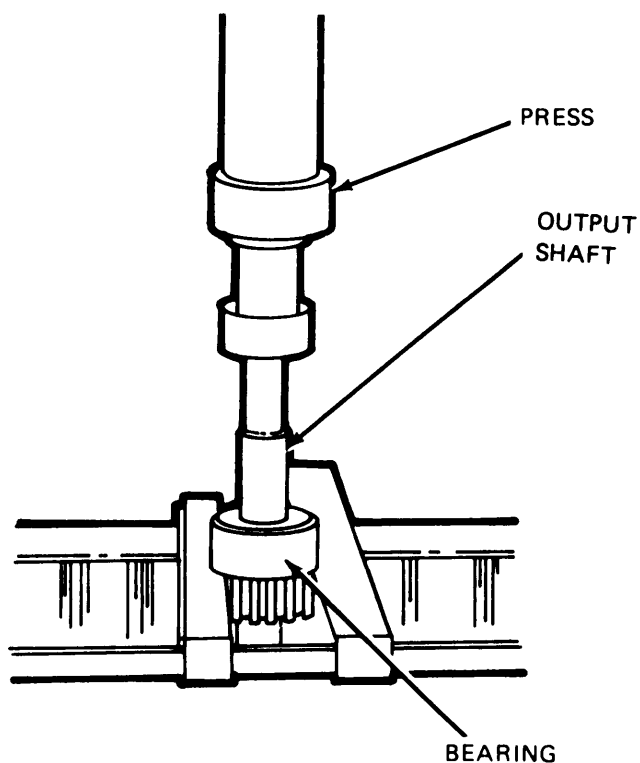
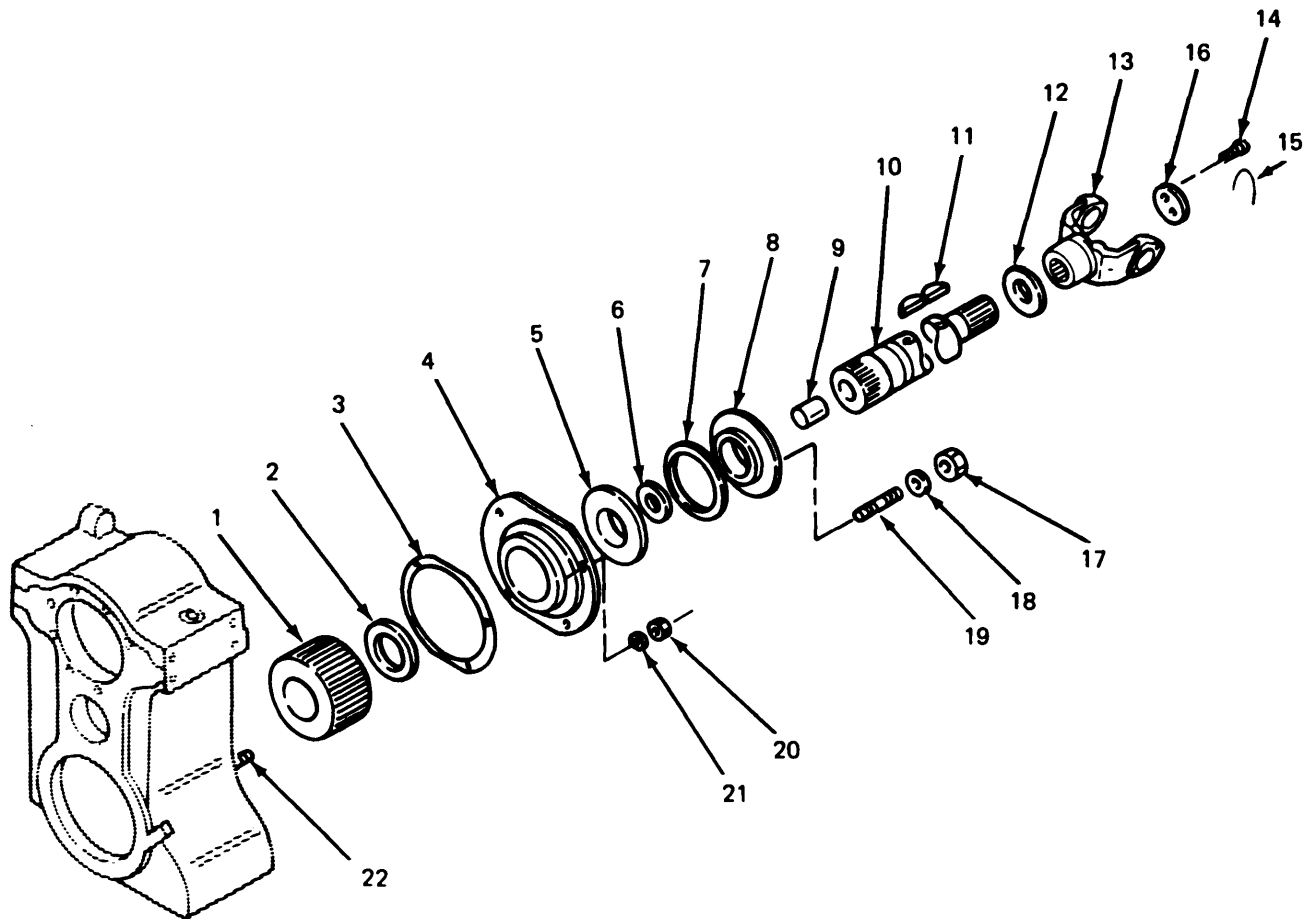


Figure 8-20 Shaft and Bearing Disassembly.

TA 074213



LEGEND:

- 1. SHAFT GEAR
- 2. SPACER
- 3. GASKET
- 4. REAR SHAFT COVER
- 5. BALL BEARING

- 6. SPACER
- 7. GASKET
- 8. CAP
- 9. BUSHING
- 10. OUTPUT SHAFT
- 11. KEY
- 12. OIL SEAL
- 13. YOKE

- 14. CAPSCREW (2)
- 15. LOCK WIRE
- 16. YOKE PLATE
- 17. NUT (6)
- 18. LOCKWASHER (6)
- 19. STUD (6)
- 20. NUT (8)
- 21. LOCKWASHER (8)
- 22. STUD (8)

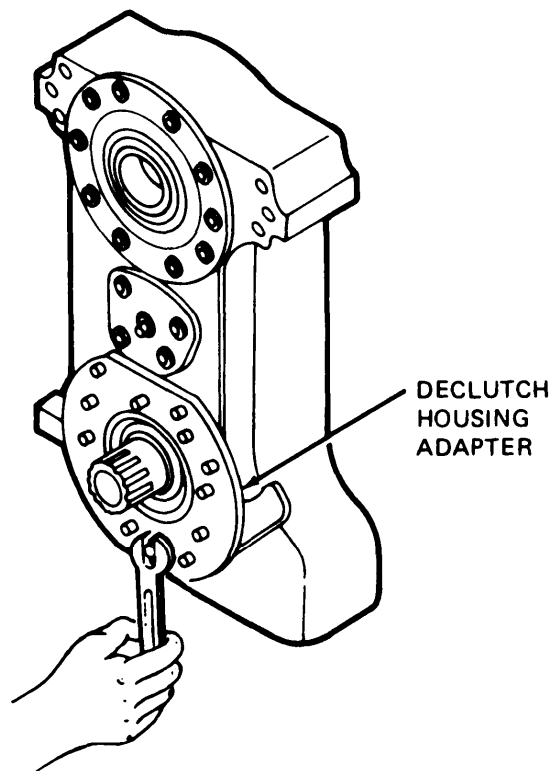
TA 074214

Figure 8-21. Lower Rear Output Shaft Assembly – Exploded View.

d. Remove and Disassemble the Lower Rear Shaft Assembly (Fig. 8-21).

(f) On the front side of the case, remove the eight nuts (38, fig. 8-11) and washers (37) retaining the declutch housing adapter (34).

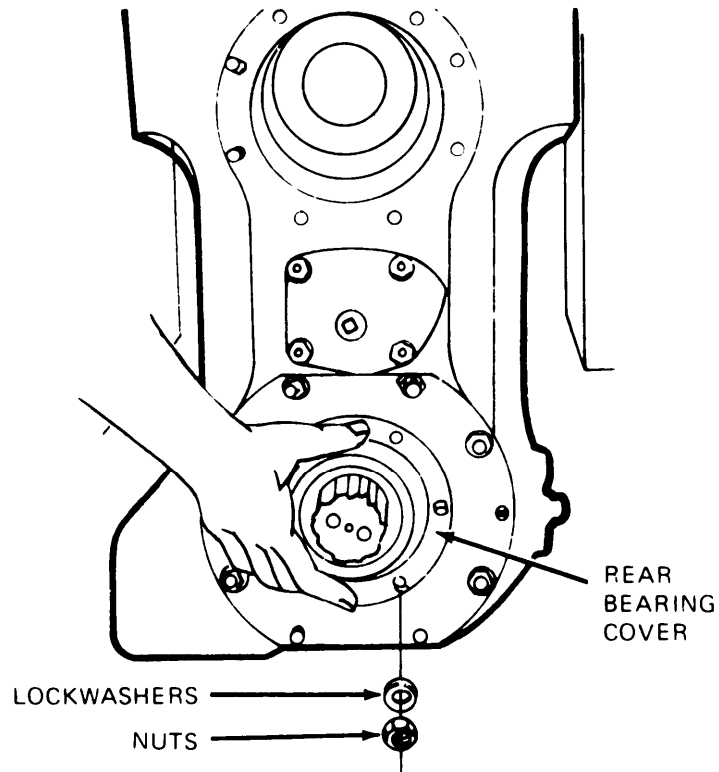
(2) Using the jack holes provided, remove the adapter and gasket from the case (fig. 8-22).



TA 074215

Figure 8-22. Declutch Housing Adapter Removal.

(3) On the rear side of the case, remove six nuts and lockwasher, and the bearing cover and gasket (fig. 8-23).

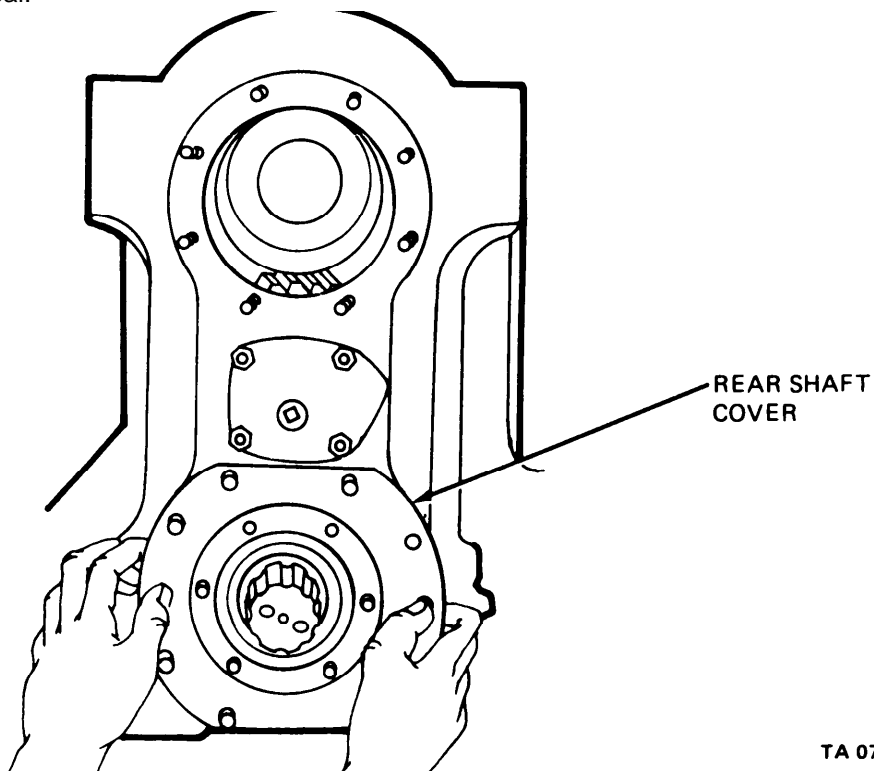


TA 074216

Figure 8-23. Lower Rear Bearing Cover Removal.

(4) Remove eight nuts (20, fig. 8-21) and lockwasher (21) from the lower rear shaft cover
(4). Remove the rear shaft cover (fig. 8-24).

(5) Drive the lower rear output shaft assembly from the front side of the case out of the rear side of the case with a rubber or rawhide mallet and remove six nuts (17, fig. 8-21) and lockwasher (18) from studs (19) and remove seal.



TA 074217

Figure 8-24. Lower Rear Shaft Cover Removal.

(6) Using a suitable bearing puller, pull the outer bearing from the rear output shaft (fig. 8-25).

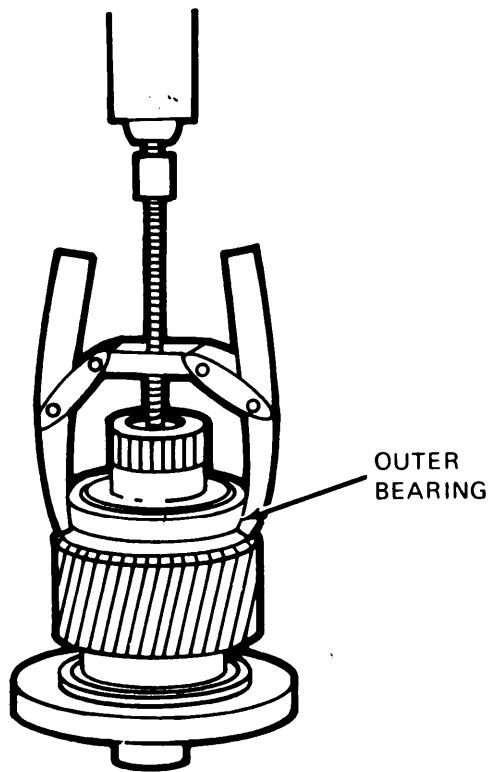
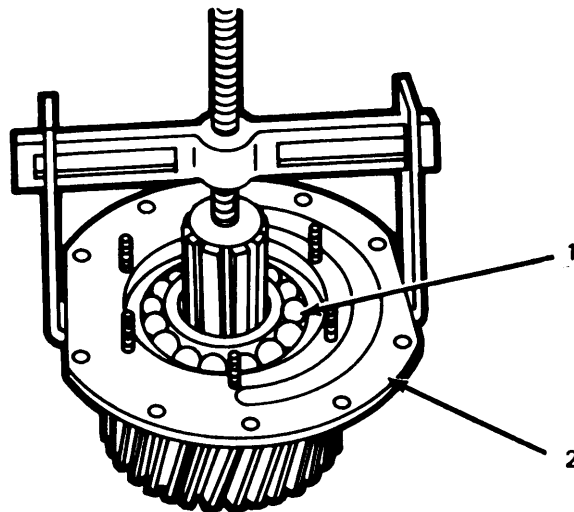


Figure 8-25 Lower Rear Output Shaft Outer Bearing Removal.

(7) Pull the bearing (1, fig. 8-26) and inner cover (2) from the shaft. Remove the bearing spacer, gear and bushing.



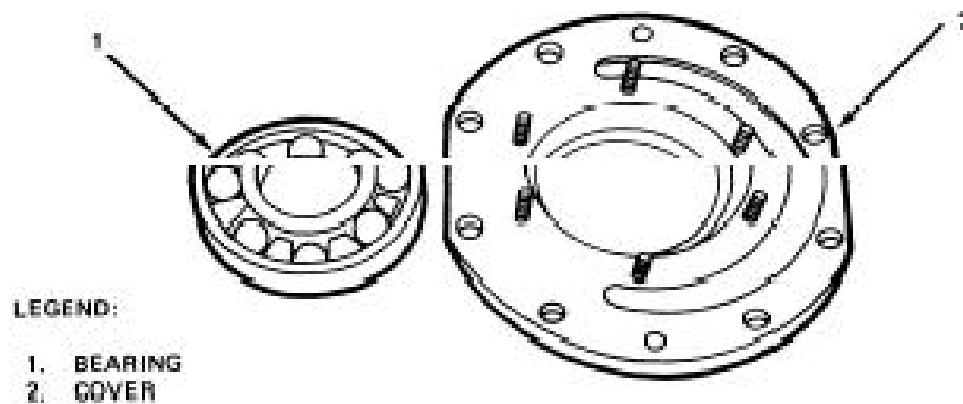
LEGEND:

- 1. BEARINGS
- 2. INNER COVER

TA 074219

Figure 8-26. Lower Rear output shaft Inner Cover Removal.

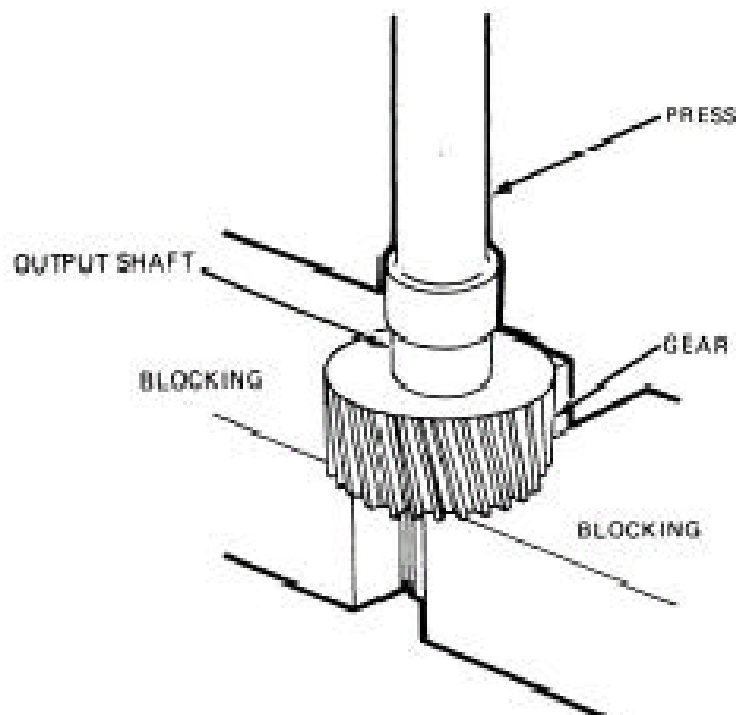
(8) Remove the ball bearing (1, fig. 8-27) from the cover (2).



TA 074220

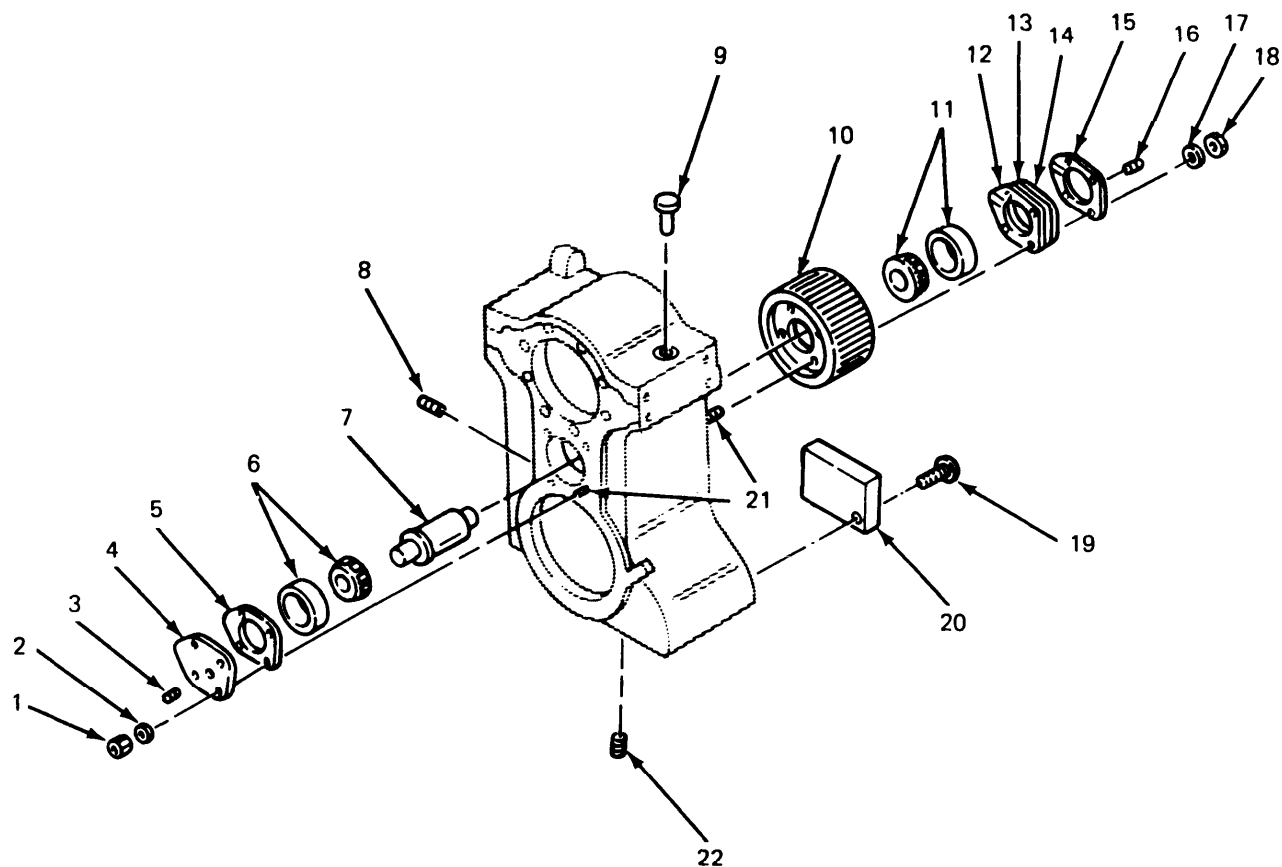
Figure 8-27. Inner Bearing Removal.

(9) Press the output shaft from the gear (fig. 8-28). Remove the key from the shaft.



TA 074221

Figure 8-28. Lower Rear Output Shaft Gear Removal.



LEGEND:

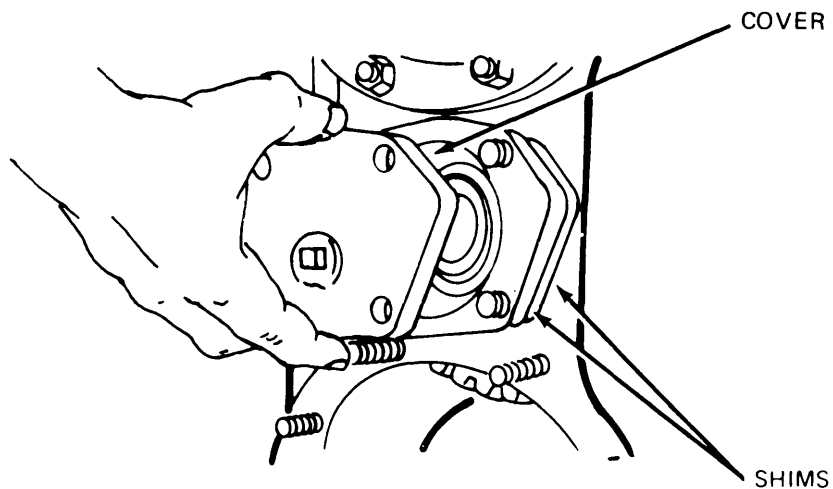
- | | | |
|-------------------|-------------------|--------------------|
| 1. NUT (4) | 7. SHAFT | 15. SHAFT COVER |
| 2. LOCKWASHER (4) | 8. FILLER PLUG | 16. COVER PLUG |
| 3. COVER PLUG | 9. BREATHER | 17. LOCKWASHER (4) |
| 4. SHAFT COVER | 10. GEAR | 18. NUT (4) |
| 5. COVER GASKET | 11. ROLLER | 19. SCREW(2) |
| 6. ROLLER | 12. .030 IN. SHIM | 20. SERIAL NUMBER |
| BEARING | 13. .050 IN. SHIM | PLATE |
| | 14. .020 IN. SHIM | 21. STUD (8) |
| | | 22. DRAIN PLUG |

TA 074222

Figure 8-29. Intermediate Shaft -Exploded View.

e. Remove and Disassemble the Intermediate Shaft (Fig. 8-29).

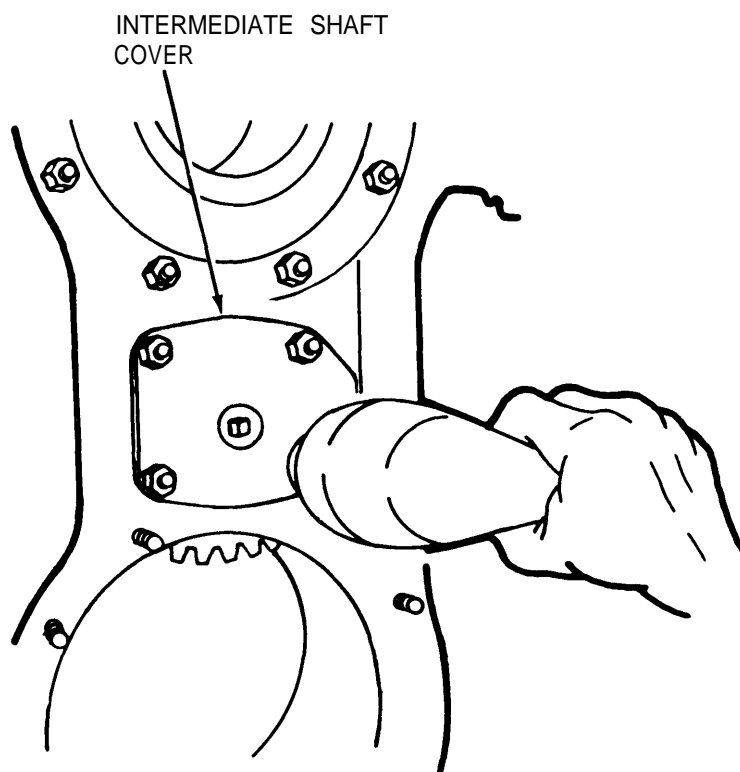
(7) Remove the rear intermediate shaft cover with plug and shims held by four nuts and lockwasher (fig. 8-30).



TA 074223

Figure 8-30 Rear Intermediate Shaft Cover Removal.

(2) Remove the front intermediate shaft cover and gasket held by four nuts and lockwasher (fig. 8-31).



TA 074224

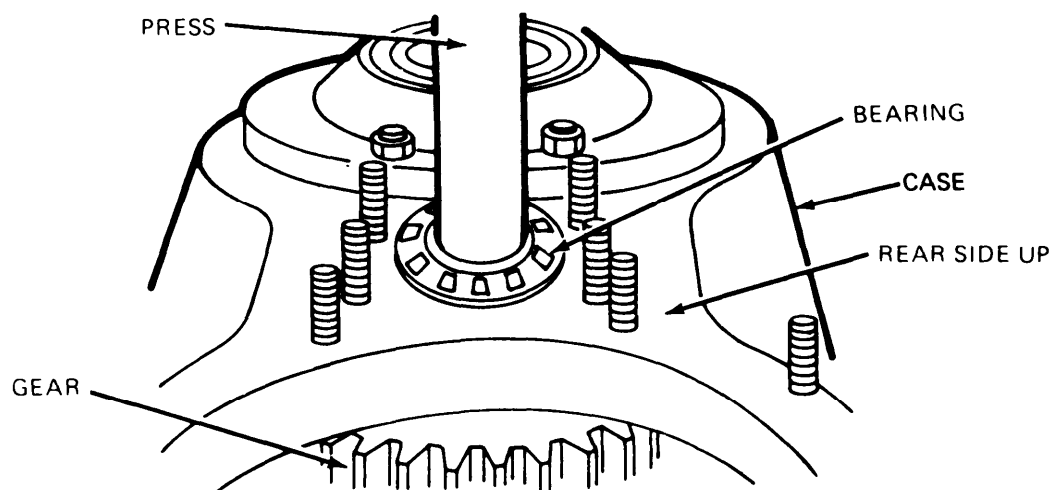
Figure 8-31. Front Intermediate Shaft Cover Removal.

- (3) place the case in a press with the rear side of the case facing up.

CAUTION

The front side of the case must be properly supported in the area of the intermediate shaft to prevent overstressing the case.

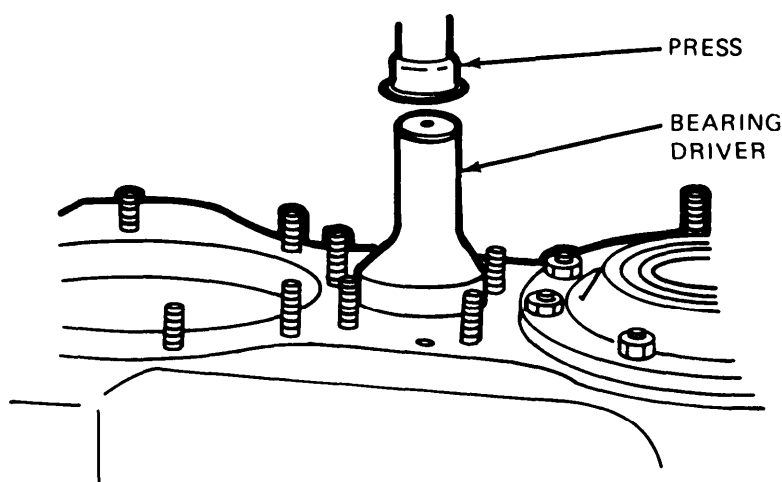
- (4) Press the intermediate shaft from the gear and bearing assembly (fig. 8-32). Remove the gear and rear bearing cone from the case.



TA 0742225

Figure 8-32. Intermediate Shaft Removal.

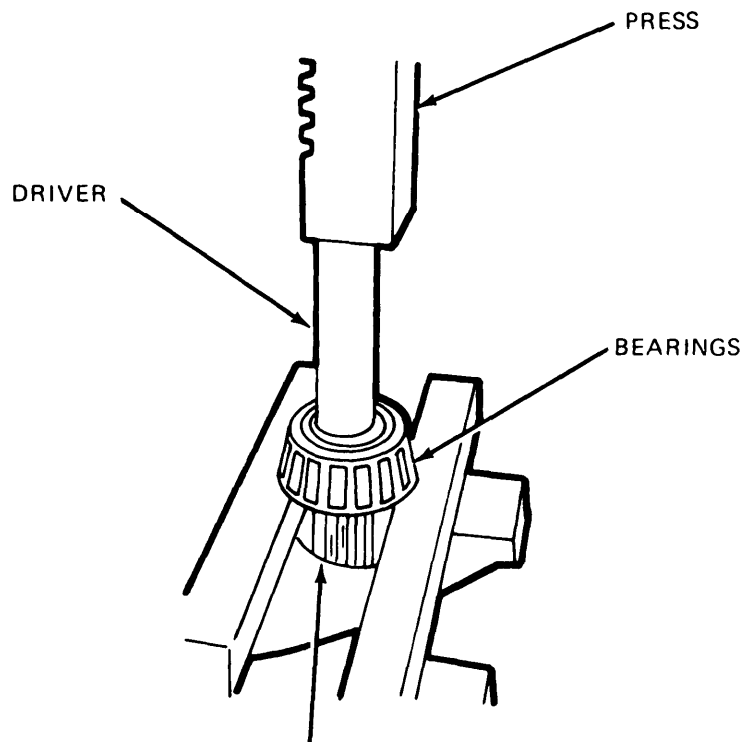
- (5) Press the bearing cup from the rear of the case (fig. 8-33).



TA 07422

Figure 8-33. Rear Bearing Cup Removal.

- (6) Press the shaft from the front bearing cone (fig. 8-34).



TA 074227

Figure 8-34. Front Bearing Cone Disassembly.

8-4. Cleaning. Wash all parts thoroughly in dry cleaning solvent (item 12, APP B).

8-5. Inspection. All parts should be inspected carefully for wear, damage, or other indications of short service life. Replace any parts which are in questionable condition.

8-6. Assembly.

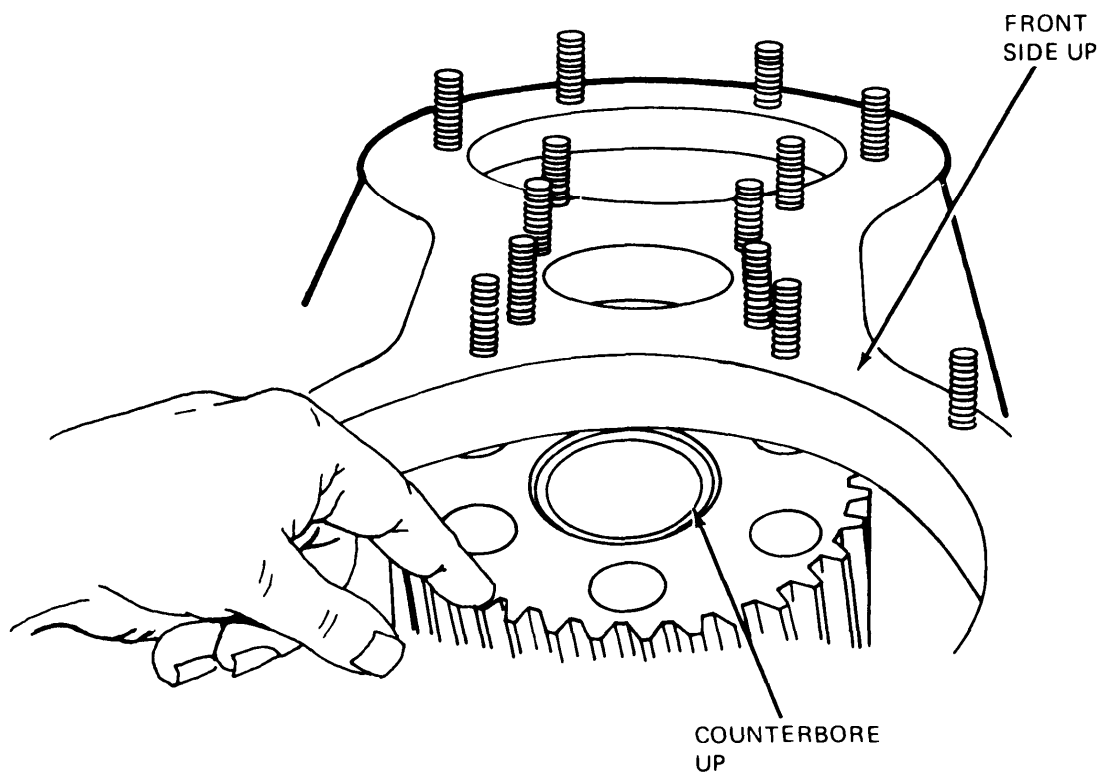
a. Assemble the Intermediate Shaft.

NOTE

It is recommended that the intermediate gear be preheated by soaking in 150°F (66°C) oil and the intermediate shaft surface be prelubricated with molybdenum disulfide base lubricant before assembly.

- (7) Place the case in a press with the front side of the case facing up.

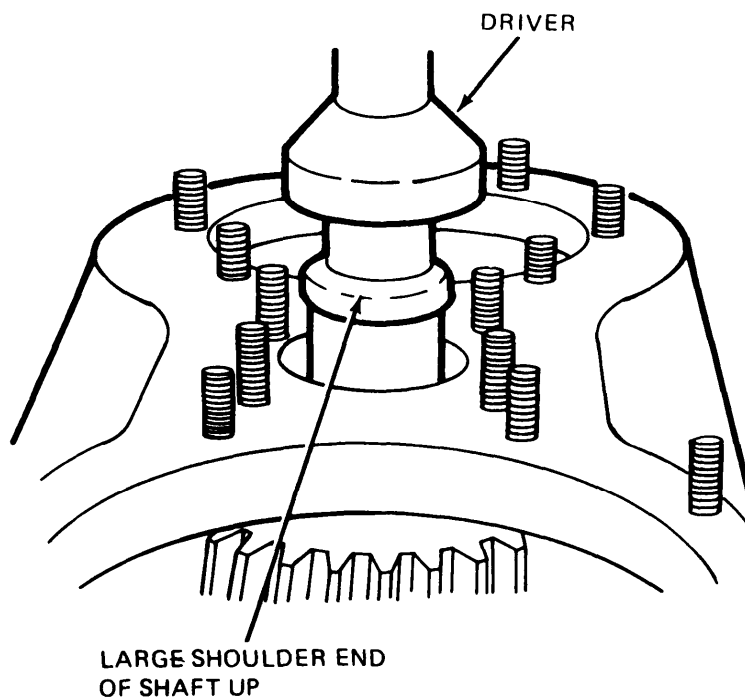
(2) Place the intermediate gear inside the case with the counterbore for the shaft facing up (fig. 8-35). Aline the gear with the intermediate shaft openings in the case.



TA 074228

Figure 8-35 intermediate Gear installation.

(3) with the shoulder end of the intermediate shaft up, insert the shaft into the case and the inside diameter of the gear (fig. 8-36). Press the shaft in until the shaft shoulder is seated firmly against the gear counterbore.



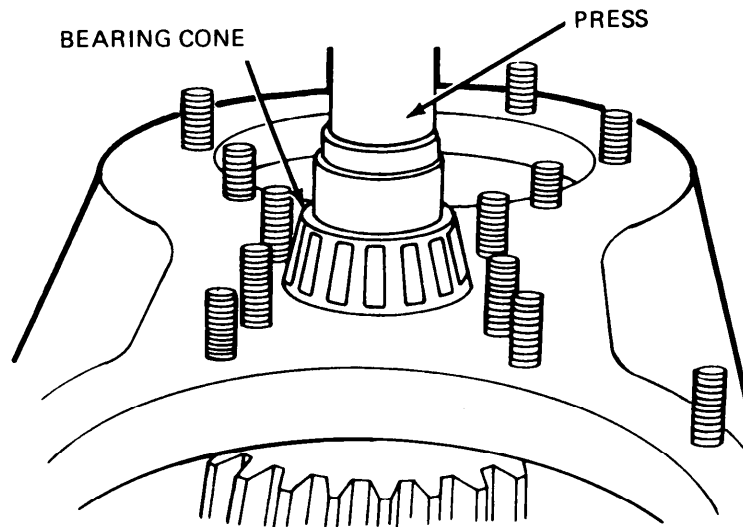
TA 074229

Figure 8-36. Intermediate Shaft Installation.

NOTE

During assembly, make sure the gear and bearings are properly seated to assure correct bearing adjustment after shaft is enclosed inside of case.

- (4) Set the bearing cone over the end of the intermediate shaft. Press until it is firmly seated against the shaft shoulder (fig. 8-37).



TA 074230

Figure 8-37 Front Intermediate Bearing Installation.

- (5) Set the bearing cup over the bearing cone and press until the bearing cup is firmly seated against the bearing rollers (fig. 8-38).

- (6) Turn the case over.

- (7) Install the rear bearing cone and cup the same way the front were installed.

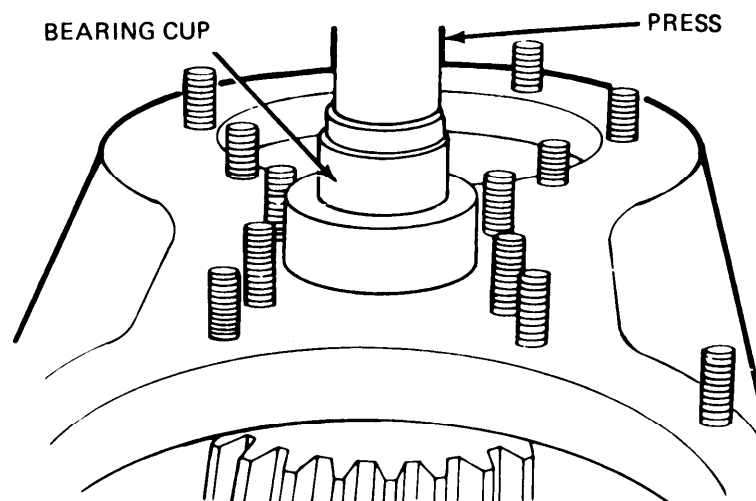


Figure 8-38 Bearing Cup Installation.

TA 074231

(8) On the front side of the case, apply silastic gasket material (item 29, App B) to the mating surface for intermediate cover gasket. Install the gasket. Apply silastic gasket material to the outer surface of the gasket and install the intermediate cover (fig. 8-39).

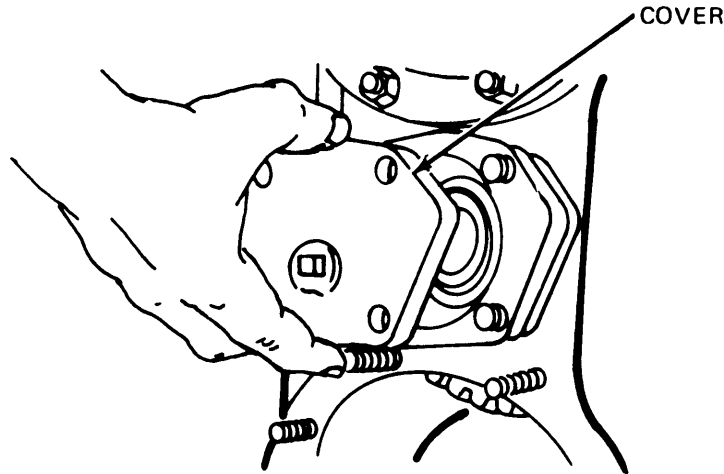


Figure 8-39. Intermediate Shaft Front Cover Installation.

TA 074232

(9) Install four lockwasher and nuts loosely. Oil the stud threads and torque the nuts to 40lb-ft (54 N•m).

(70) On the rear side of the case, install a 0.065 in. (1.65 mm) shim pack and the rear intermediate shaft cover (fig. 8-40).

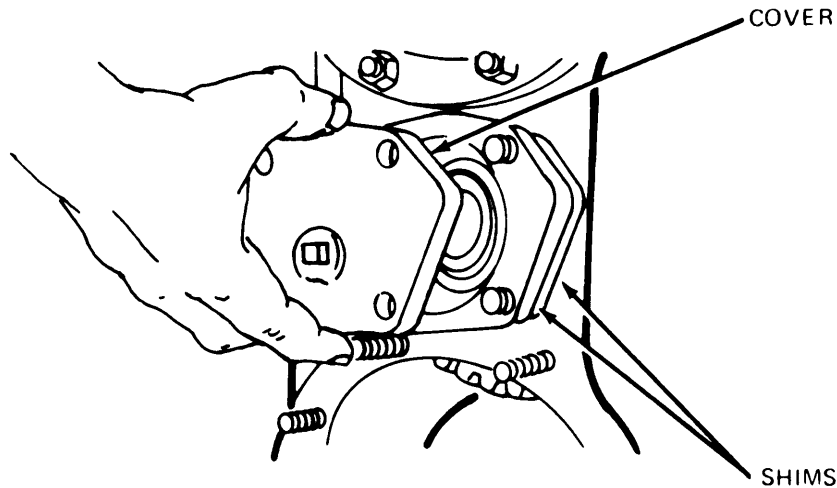


Figure 8-40 Intermediate Shaft Rear Cover Installation.

TA 074223

(77) Install four lockwasher and nuts loosely. Oil the stud threads and torque the nuts to 40lb-ft (54 N•m).

(12) Check and adjust the intermediate shaft end play as follows:

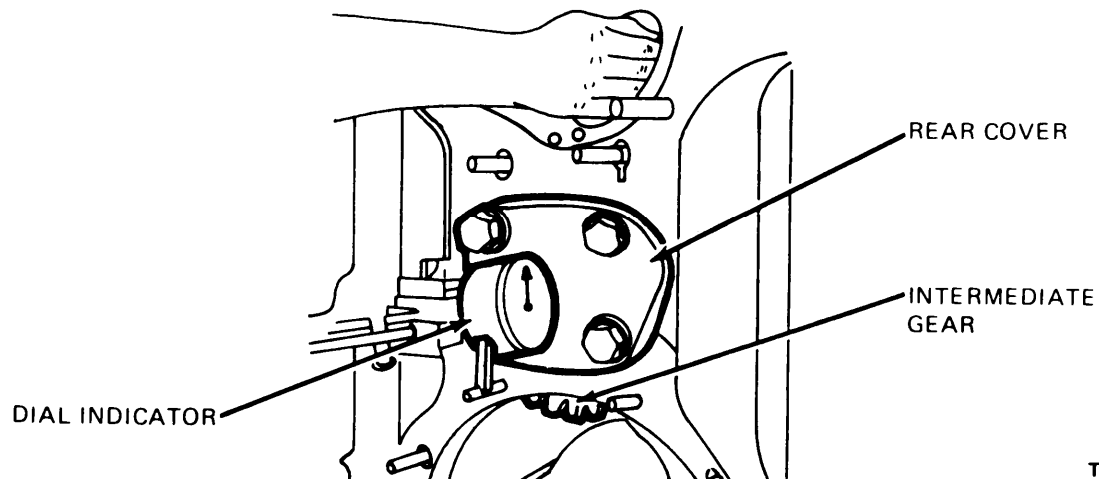
(a) Tap the intermediate gear at the top and bottom from the front and rear of the case to seat the bearings.

(b) Rotate the gear and shaft to seat the bearing rollers.

(c) Remove the pipe plug from the center of the rear shaft cover.

(d) place a dial indicator on a milled surface with the dial indicator rod protruding through the pipe plug opening and against the end of the shaft.

(e) Check the amount of end play by pulling and pushing against the intermediate gear (fig. 8-41) while reading the dial indicator.



TA 074425

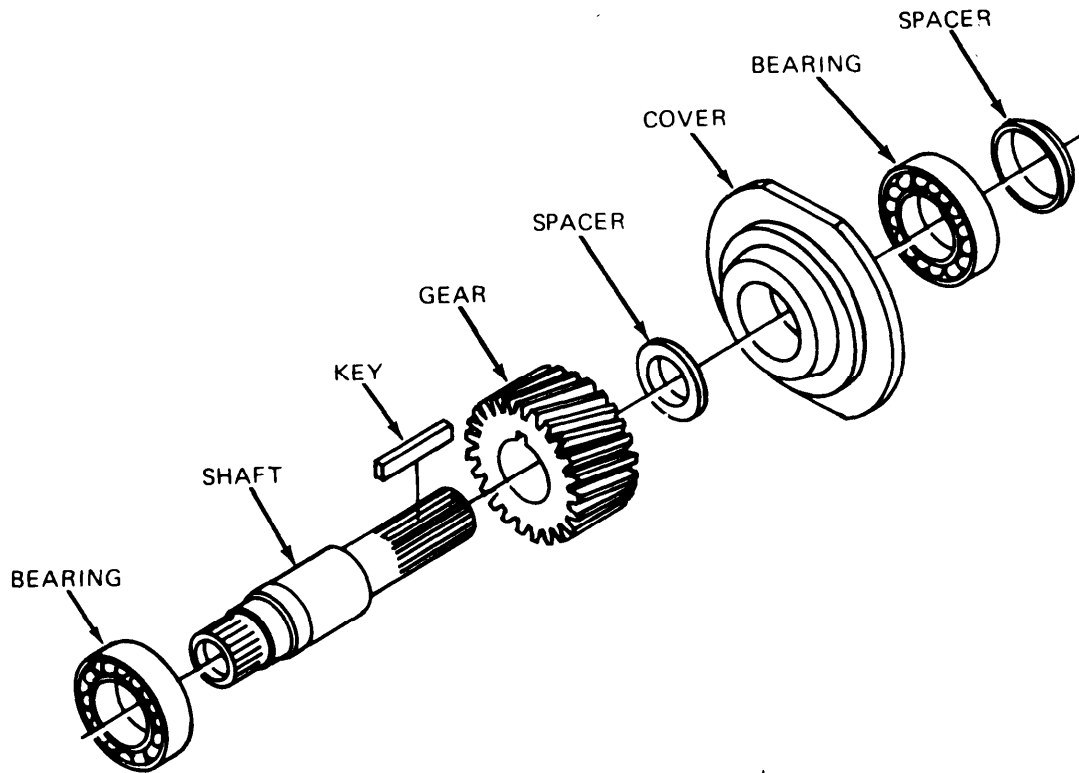
Figure 8-41. Checking the Intermediate Shaft End Play.

(f) Adjust the shim pack thickness on the rear cover as required to bring the end play reading within a range of 0.003-0.005 in. (0.076-0.127 mm).

b. Assemble the Lower Rear Output Shaft (fig. 8-42).

NOTE

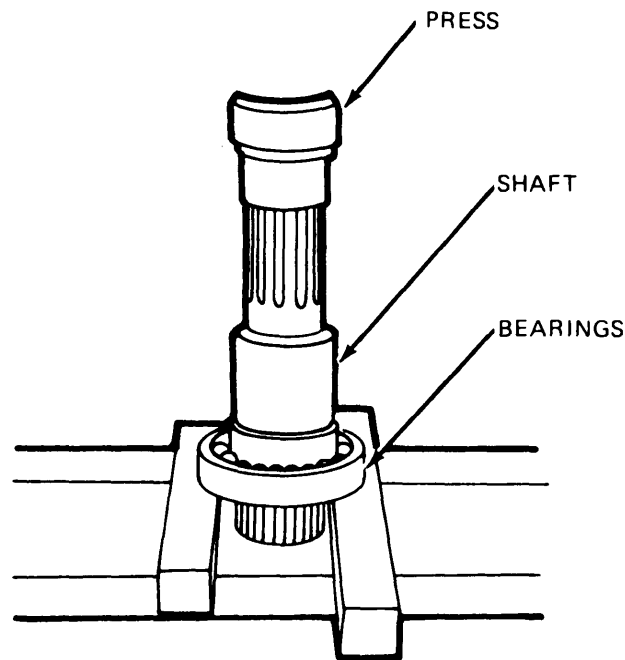
The proper assembly order for the lower rear output shaft is shown in figure 8-42. During assembly, be sure the gear and bearings are properly seated.



TA 074426

Figure 8-42. Lower Rear Output Shaft Assembly.

(f) With the yoke end of the shaft up set the shaft over the roller bearing and press until the bearing is firmly seated against the shaft shoulder (fig, 8-43).



TA 074427

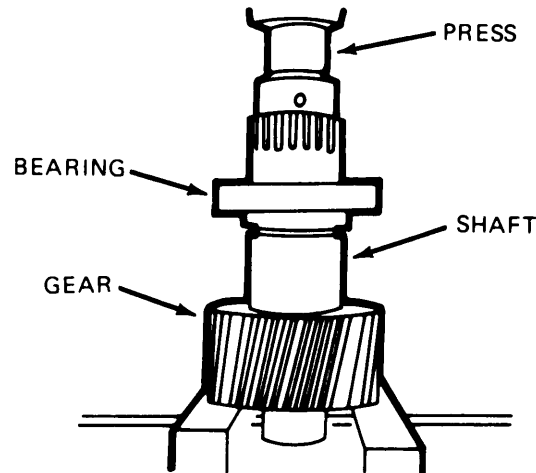
Figure 8-43. Lower Rear output Shaft Front Bearing Installation.

NOTE

It is recommended that the gear be preheated by soaking in 150°F (66°C) oil and the shaft surface be prelubricated with molybdenum disulfide base lubricant to facilitate assembly.

(2) With the yoke end of the shaft down, insert the lock key into the shaft with the rounded end of the key in the shaft shoulder.

(3) press the shaft and key onto the gear until the shaft shoulder is firmly seated against the gear face (fig. 8-44).

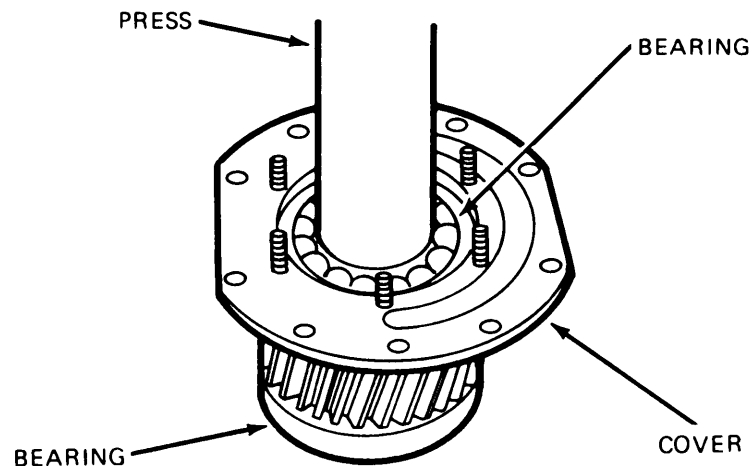


TA 074428

Figure 8-44. Lower Rear Output Shaft Gear Installation.

(4) with the yoke end of the shaft up, install the spacer over the shaft.

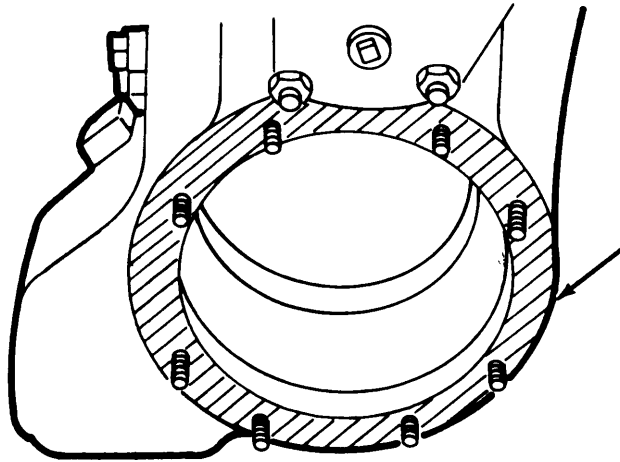
(5) press the cover and bearing onto the shaft until it is firmly seated (fig. 8-45).



TA 074429

Figure 8-45 Lower Rear Output Shaft Rear Bearing Installation.

(6) On the rear side of the case, apply silastic gasket material (Item 29, App B) to the mating surface of the lower rear output shaft cover gasket (fig. S-46). Install the gasket and apply silastic gasket material to the gasket.

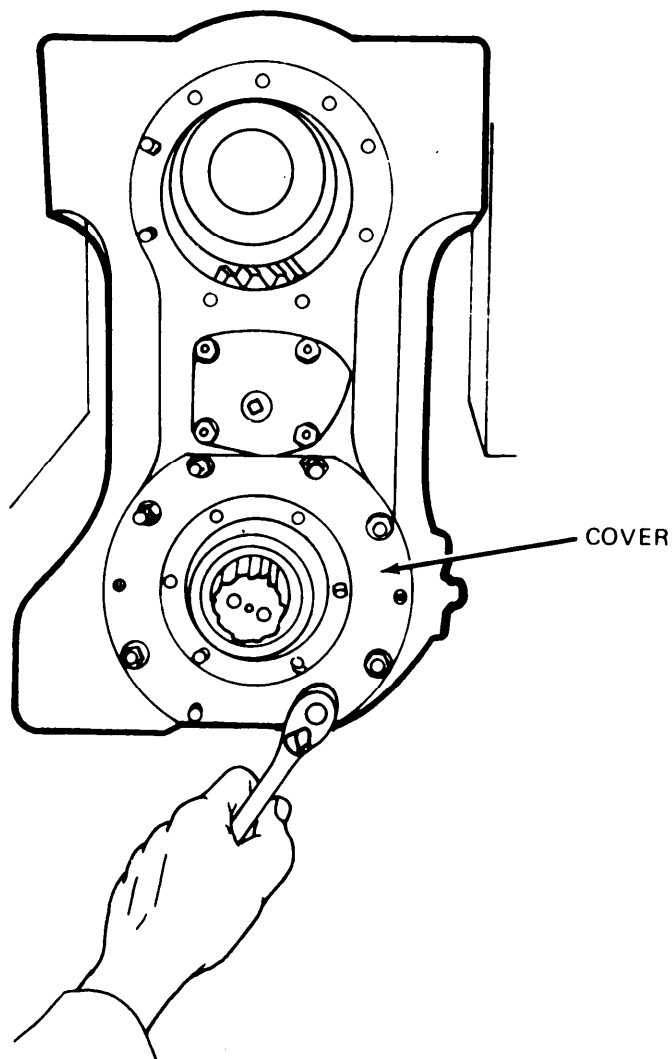


TA 074430

Figure 8-46 Lower Rear Output Shaft Cover Gasket Surface.

(7) From rear side of the case install the lower rear output shaft. The lower shaft gear must mesh with the intermediate gear and the bearing must be in alignment with the lower front output shaft cover.

(8) install eight lockwasher and nuts. Oil the stud threads and torque the nuts to 40lb-ft (54 Nžm) (fig. 8-47). -

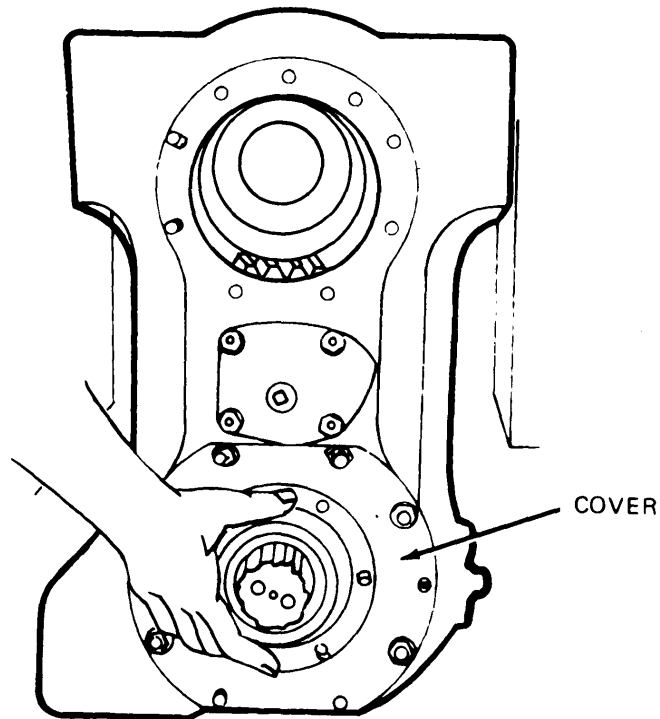


TA 074431

Figure 8-47 Lower Rear output Shaft Assembly Installation.

(9) Apply silastic gasket material (Item 29, App B) to the mating surface for the lower rear output shaft cover gasket. Install the gasket. Apply silastic gasket material to the gasket.

(10) Install the bearing cover (fig. 8-48). Oil the studs and install six lockwasher and nuts. Torque the nuts to 25 lb-ft (34 N·m).

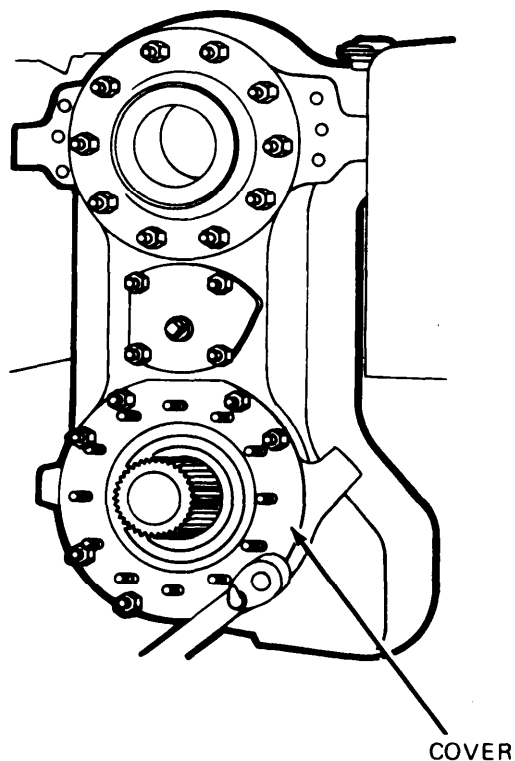


TA 074216

Figure 8-48 Lower Rear Bearing Cover Installation.

(11) on the front side of the case, apply silastic gasket material (Item 29, App B) to the lower case gasket mating surface. Install the gasket and apply silastic gasket to the outside of the gasket.

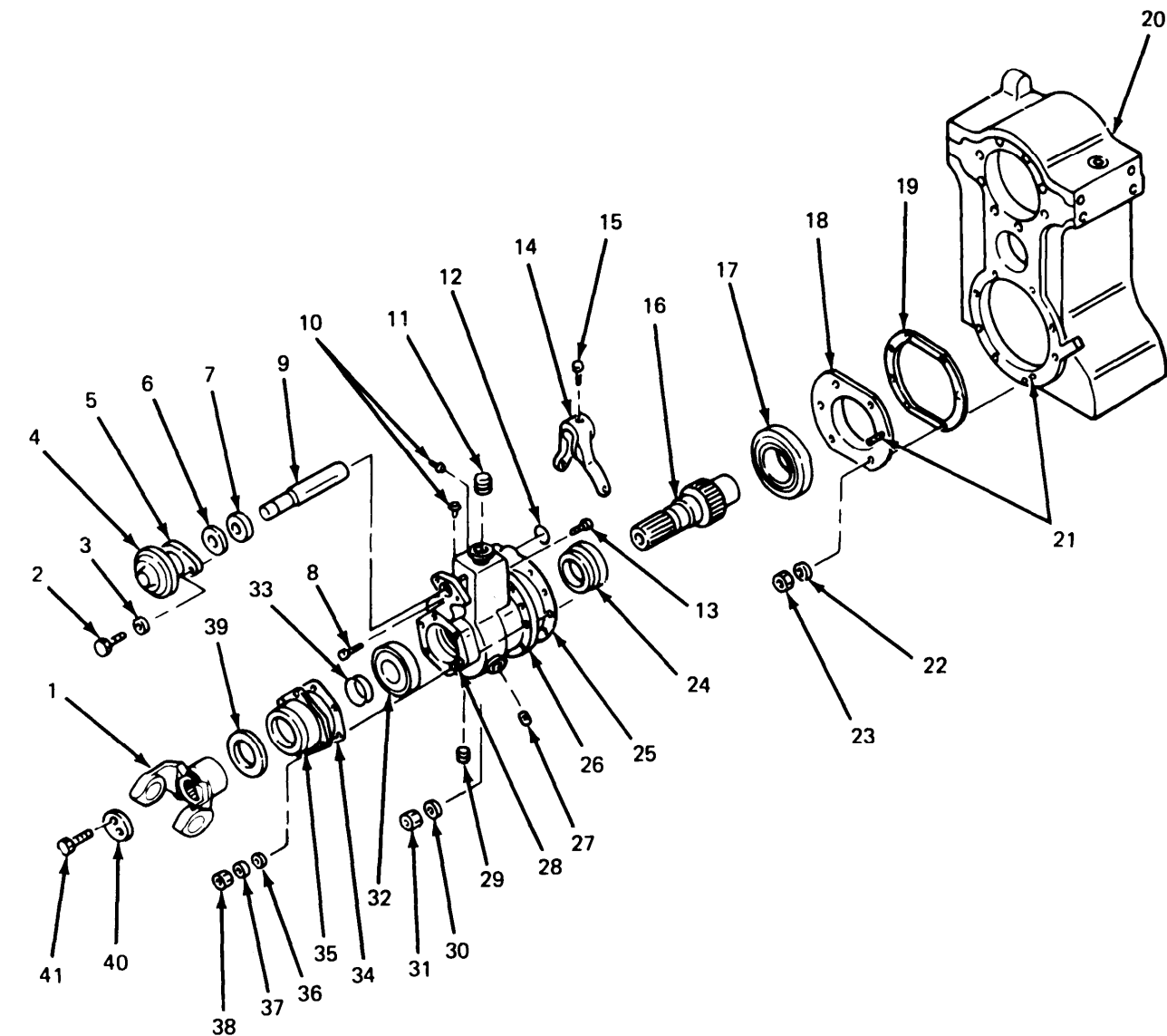
(12) Install the lower front bearing retainer cover. Oil the studs and install eight lockwasher and nuts. Torque the nuts to 40 lb-ft (54 N·m) (fig. 8-49).



TA 074432

Figure 8-49. Lower Front Bearing Retainer Cover Installation.

c. Assemble the lower front output shaft and declutch assembly (fig. 8-50).

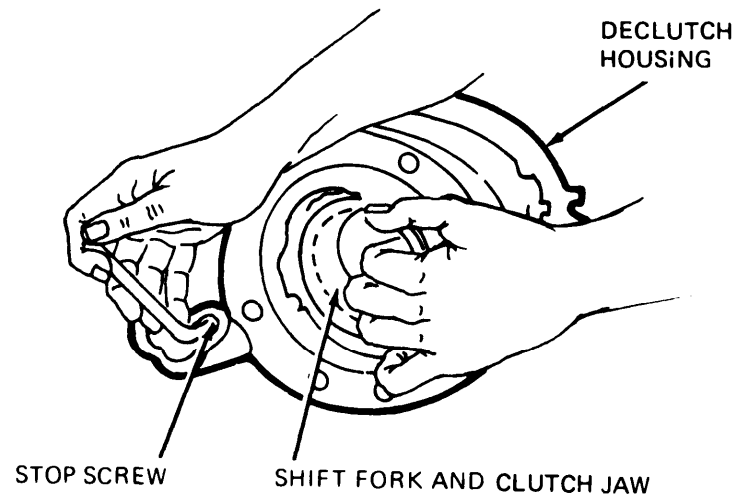


- | | | | |
|-------------------------|--------------------|---------------------|-----------------------|
| 1. YOKE, OUTPUT | 12. PLUG | 23. NUT (8) | 34. GASKET |
| 2. CAPSCREW (2) | 13. STOPSCREW | 24. CLUTCH JAW | 35. HOUSING |
| 3. LOCKWASHER (2) | 14. SHIFT FORK | 25. GASKET | 36. LOCKWASHER (6) |
| 4. DECLUTCH AIR CHAMBER | 15. LOCKSCREW | 26. HOUSING | 37. COPPER WASHER (2) |
| 5. GASKET | 16. OUTPUT SHAFT | 27. DRAIN PLUG | 38. NUT (6) |
| 6. PILOT RING | 17. BEARING | 28. STUD (6) | 39. SEAL |
| 7. OIL SEAL | 18. ADAPTER | 29. PLUG | 40. PLATE |
| 8. STOPSCREW | 19. GASKET | 30. LOCKWASHER (10) | 41. CAPSCREW(2) |
| 9. SHIFTING ROD | 20. CASE | 31. NUT (10) | |
| 10. BREATHER | 21. STUD(18) | 32. BALL BEARING | |
| 11. PLUG | 22. LOCKWASHER (8) | 33. SPACER | |

TA 074434

Figure 8-50. Lower Front Output Shaft and Declutch Assembly -Exploded View.

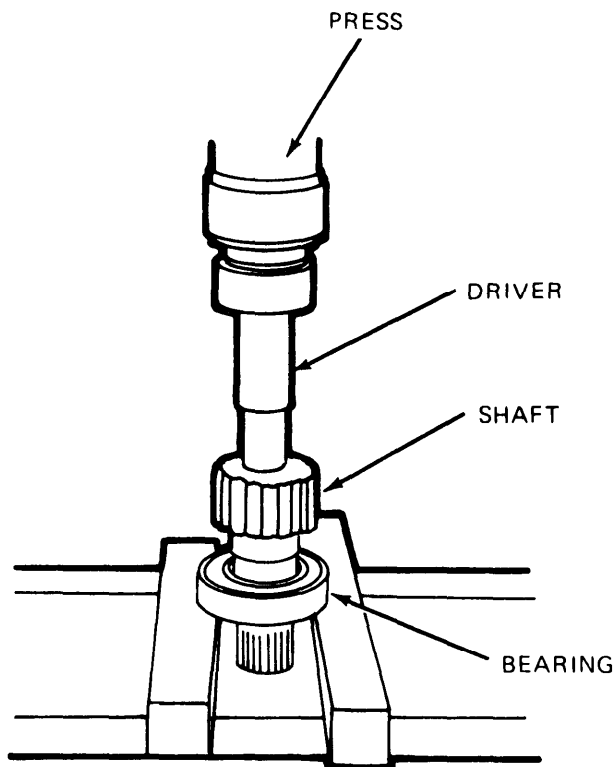
(7) Insert the shift fork and clutch jaw into the declutch housing. Tighten the shift fork stopscrew on the rear of the declutch housing (fig. 8-51).



TA 074212

Figure 8-51. Shift Fork and Clutch Jaw Installation.

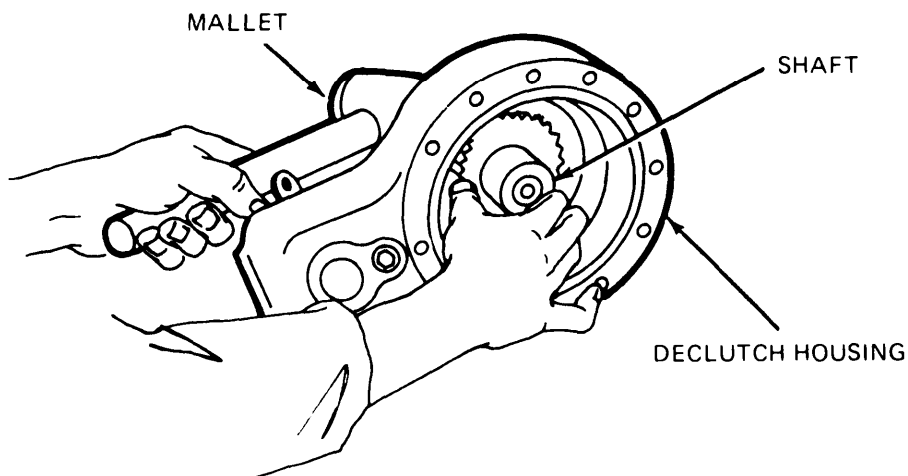
(2) With the splined end of the lower front output shaft down, set the shaft into the ball bearing and press until the bearing is firmly seated against the shaft bearing shoulder (fig. 8-52).



TA 074433

Figure 8-52 Lower Front Output Shaft Bearing Installation.

(3) Insert the smooth end of the lower front output shaft into the declutch housing through the clutch jaw. Then drive the shaft into the housing with a rubber mallet until the bearing seats firmly against the declutch housing shoulder (fig. 8-53).



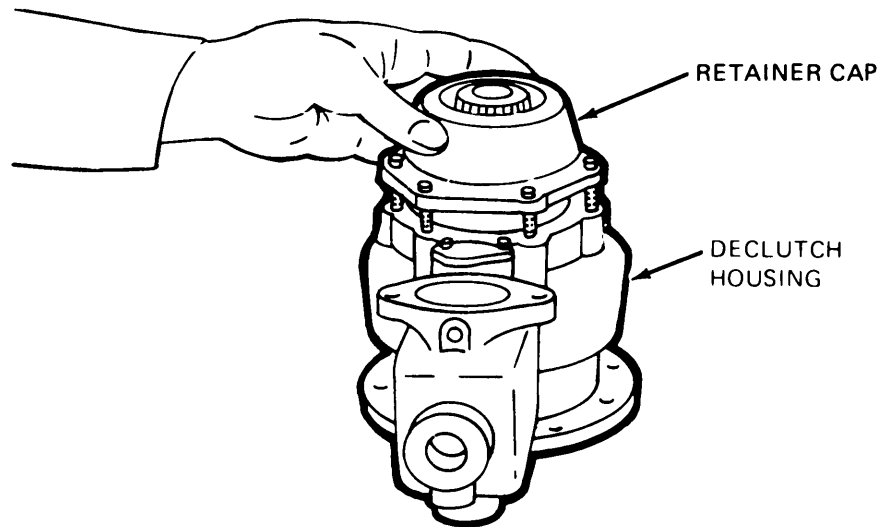
TA 074233

Figure 8-53. Lower Front Output Shaft Installation.

(4) Replace the output shaft housing oil seal in bearing. Apply silicone grease (item 22, App B) to the outside diameter of the seal and lubriplate (item 16, App B) to the inside diameter of the seal.

(5) Apply silastic gasket material (Item 29, App B) to the mating surface for the bearing retainer cap gasket. Install the gasket and apply silastic gasket material to the outside of the gasket.

(6) Install the bearing retainer cap over the studs (fig. 8-54). Oil the studs and install the six lockwasher and nuts. Torque the nuts to 25 lb-ft (34 N·m). Install yoke spacer over splined end of shaft.

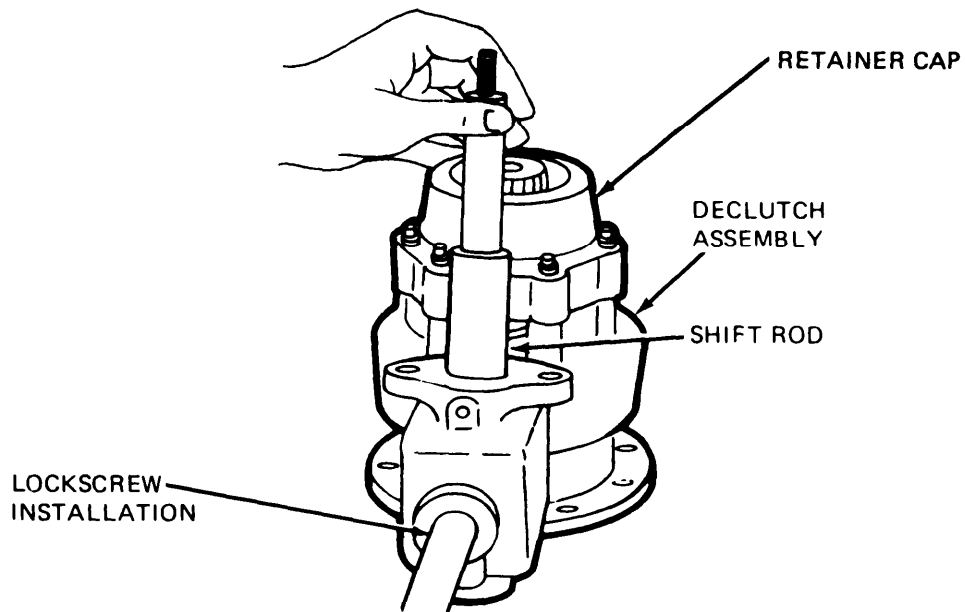


TA 074234

Figure 8-54. Lower Front Output Shaft Bearing Retainer Cap Installation.

(7) Replace the shift rod oil seal by prying it out with a screwdriver. Apply silicone grease to the outside diameter of the seal and lubricate to the inside diameter of the seal.

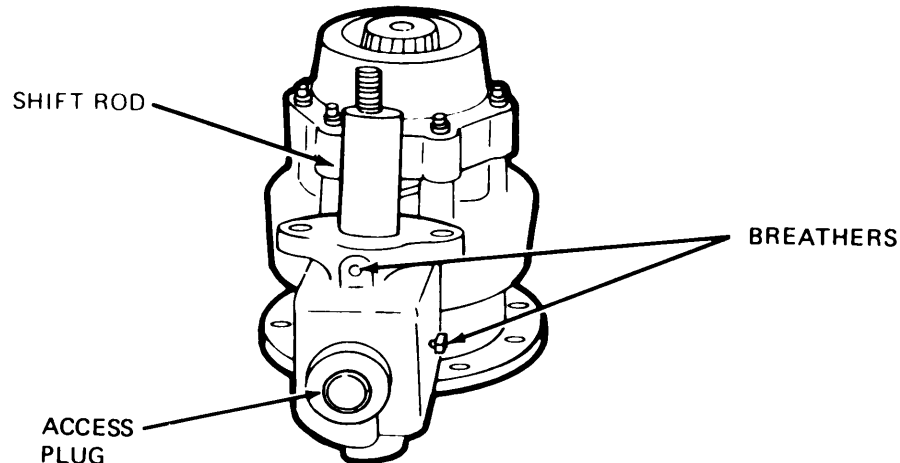
/& Insert the shift rod through the declutch housing into the shift fork. Fasten the shift rod to the shift fork with the lock screw (fig. 8-55).



TA 074235

Figure 8-55 Shift Rod Installation.

- (9) Install the access plug for the shift fork lockscrew. Install two breathers (fig. 8-56).



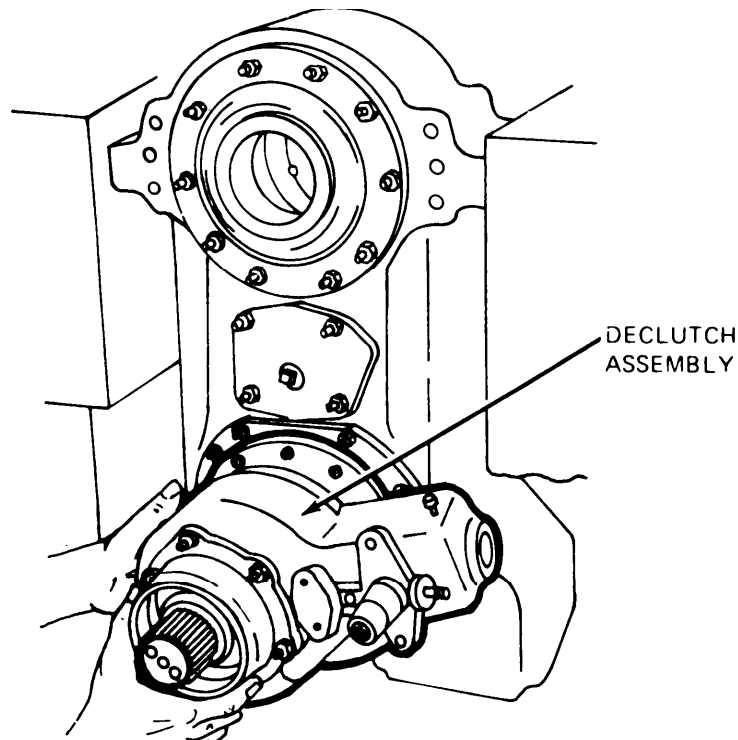
TA 074236

Figure 8-56 Completed Declutch and Front Output Shaft Assembly.

- (10) On the front side of the case, apply lubriplate (item 16, App B) to the pilot bushing cavity in the end of the lower rear output shaft.

- (11) Apply silastic gasket material (item 29, App B) to the mating surface for the declutch housing gasket. Install the gasket over the mounting studs and apply silastic gasket material to the outside of the gasket.

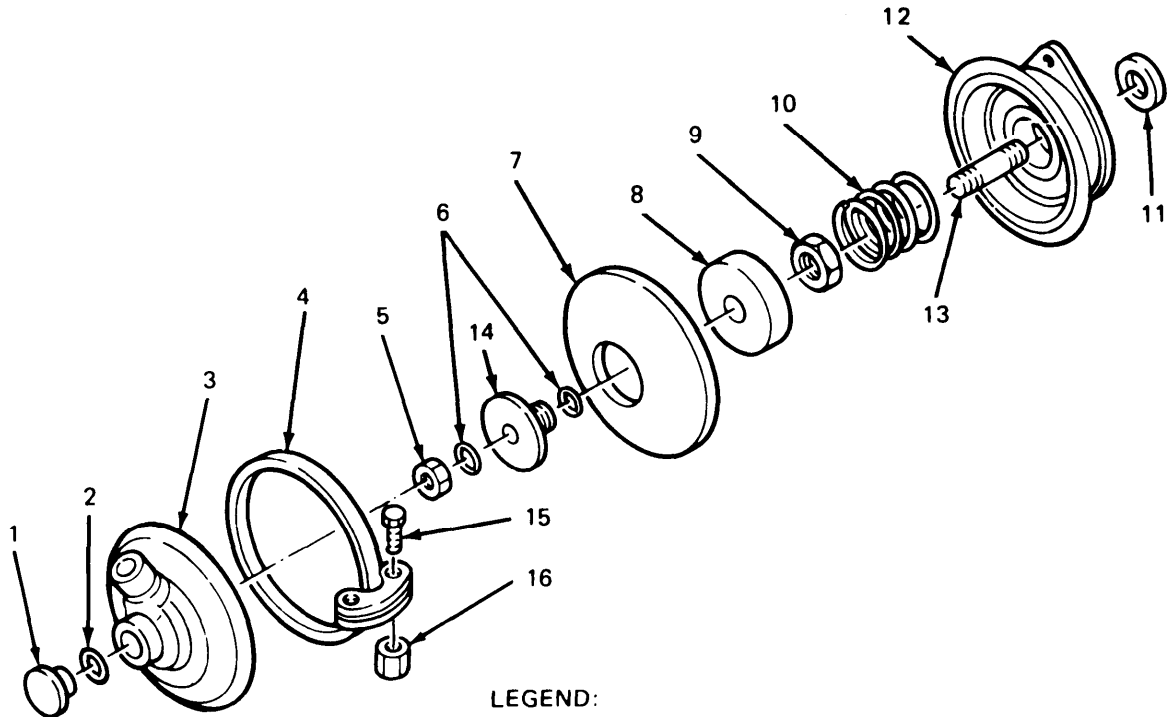
- (12) Install the front output shaft and declutch housing assembly (fig. 8.57). ten lockwasher and nuts. Torque the nuts to 40 lb-ft (54 NŽ.m). .



TA 074237

Figure 8-57 Front Output Shaft and Declutch Housing Installation.

(73) Clamp the declutch air chamber in a vise by the chamber body (12, fig. 8-58). Disassemble the air chamber assembly as follows:



LEGEND:

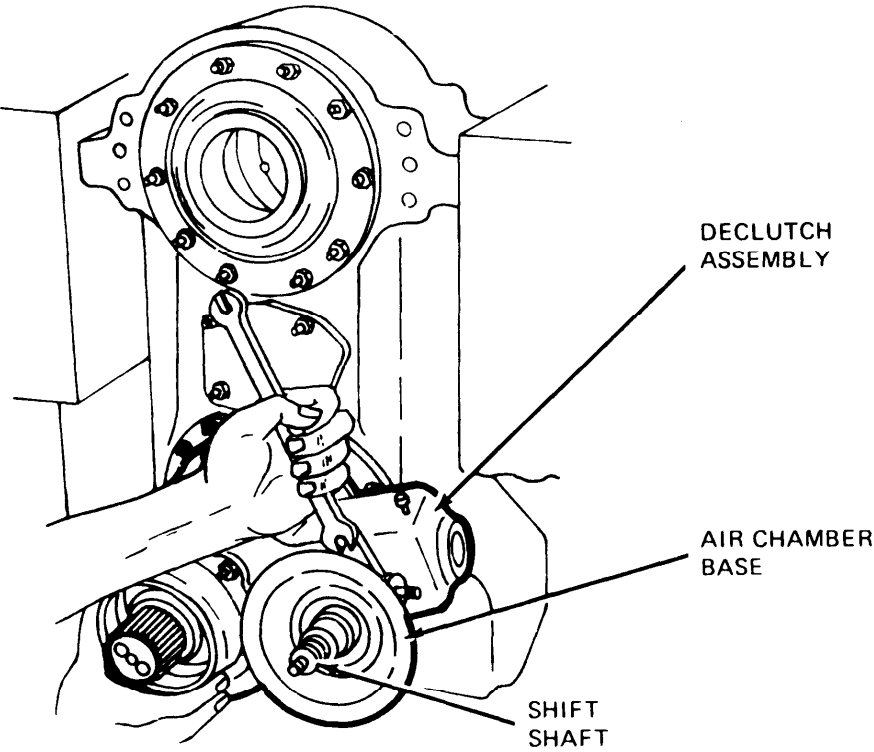
- | | |
|------------------|----------------|
| 1. CAP NUT | 8. DIAPHRAGM |
| 2. PREFORMED | GUIDE |
| PACKING | 9. SPECIAL NUT |
| 3. AIR PRESSURE | 10. SPRING |
| PLATE | 11. OIL SEAL |
| 4. RING | 12. BODY |
| 5. AIR DIAPHRAGM | 13. STUD |
| NUT | 14. PUSH PLATE |
| 6. SHIM WASHER | 15. BOLT (2) |
| 7. DIAPHRAGM | 16. NUT (2) |

TA 074238

Figure 8-58 Declutch Air Chamber – Exploded View.

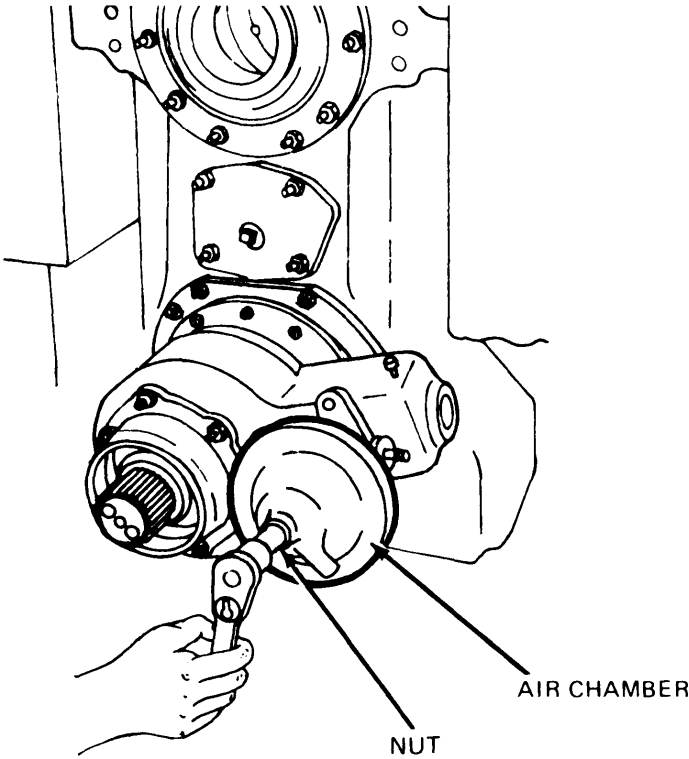
- (a) Remove two bolts (15) and nuts (16).
- (b) Remove ring (4).
- (c) Remove air pressure plate (3).
- (d) Remove nut (9), diaphragm guide (8) and push plate (14) from the diaphragm (7).
- (e) Remove body (12) from the vise and press the oil seal (11) out with a suitable press.

- (14) Assemble the air chamber to the declutch assembly as follows:
- (a) Install the pilot ring (6, fig. 8-50) in the housing (26).
 - (b) Press seal (11, fig. 8-58) in body (12).
 - (c) position the gasket (5, fig. 8-50) with two lubricated screws (2) and lockwasher (3). Torque the capscrews to 25 lb-ft (34 N•m). See figure 8-59 for assembled view.
 - (d) Assemble diaphragm (7, fig. 8-58), push plate (14), diaphragm guide (8) and nut (9).
 - (e) Install one washer (6) over stud (13).
 - (f) Place spring (10) over stud (13).
 - (g) While compressing the spring with the diaphragm assembly, install washer (6) and nut (5) on stud (13) and tighten to the end of the stud.
 - (h) Install the air pressure plate (3) into the ring (4) and position ring over body (12),
 - (i) Install two bolts (15) and nuts (16) and tighten securely.
 - (j) Check the condition of the preformed packing (2). Replace if necessary.
 - (k) Install preformed packing (2) over cap nut (1) and install in air pressure plate (3). Tighten securely. See figure 8-60 for assembled view.



TA 074239

Figure 8-59. Air Chamber Base Installation.

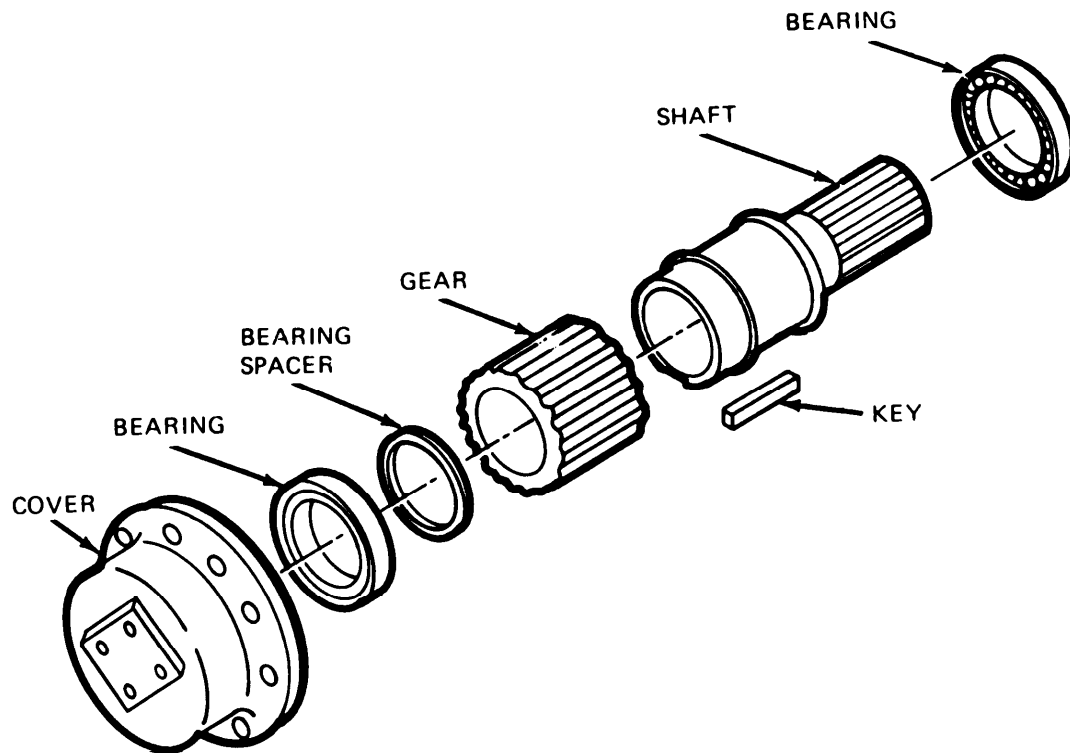


TA 074240

Figure 8-60. Complete Air Chamber Assembly.

d. Assemble and Install the Top Front (Input) shaft.

(f) Assemble the input shaft in the order shown in figure 8-61 and as described in the following steps:



TA 074241

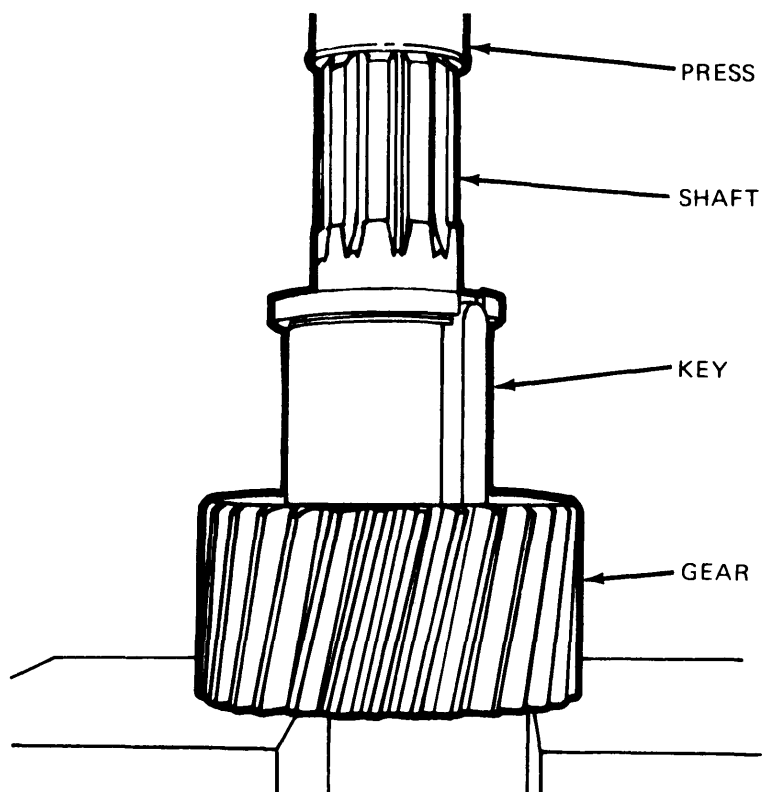
Figure 8-61. Input Shaft Assembly – Exploded View.

(a) Insert the lock key into the shaft keyway with the rounded end of the key in the shaft shoulder.

NOTE

It is recommended that the gear be pre-heated by soaking in 150°F (66°C) oil to facilitate assembly.

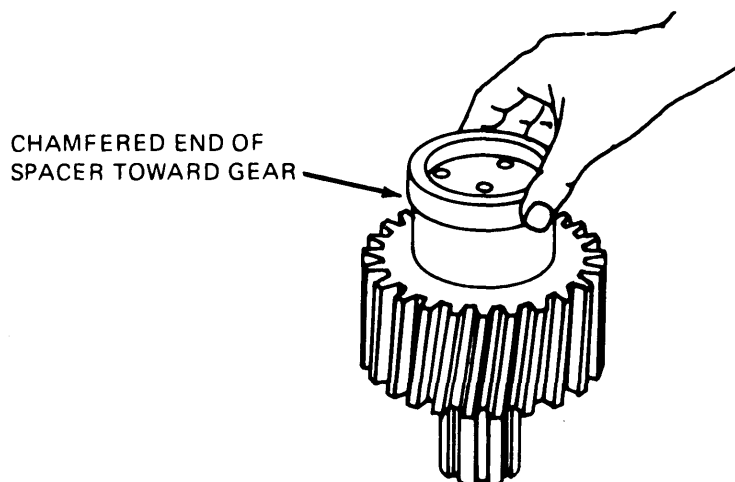
(b) press the shaft, with lock key, into the gear until the shaft shoulder is firmly seated against the gear face (fig. 8-62).



TA 074242

Figure 8-62 Input Shaft Gear Installation.

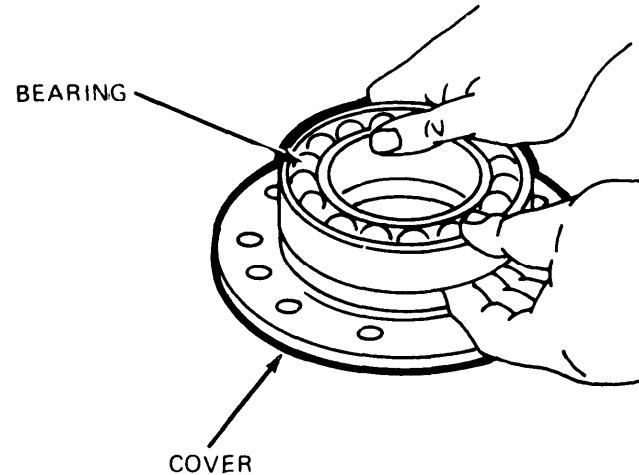
(c) place the splined end of the shaft down. Set the bearing spacer over the shaft with the chamfered end of the spacer toward the gear (fig. 8-63).



TA 074243

Figure 8-63. Input Shaft Spacer Installation.

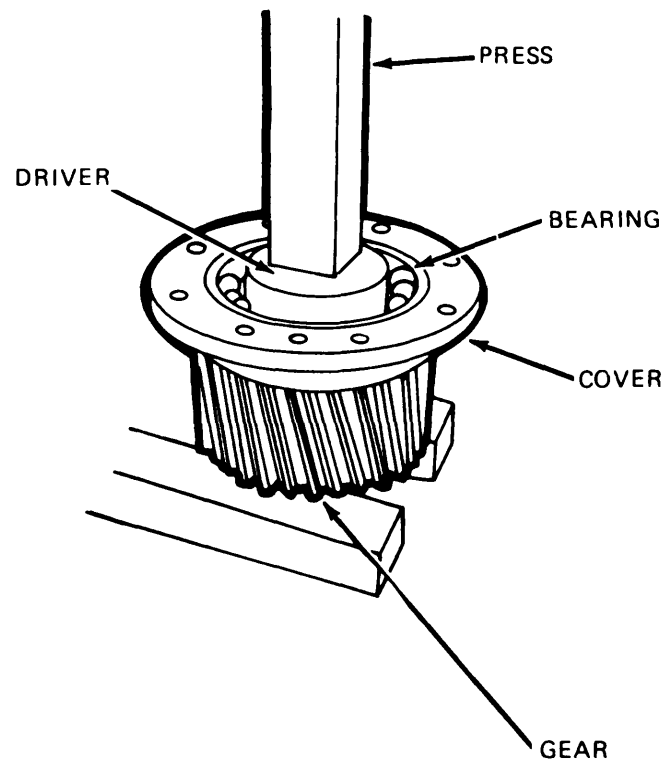
(d) Insert the ball bearing into the cover (fig. 8-64). Press in as necessary.



TA 074244

Figure 8-64. Input Shaft Rear Bearing Installation.

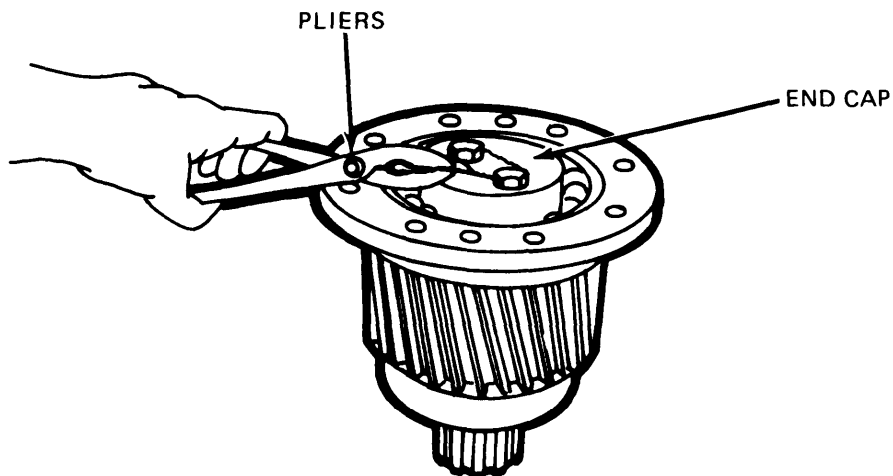
(e) With splined end down press the ball bearing and cover on the shaft until the bearing is firmly seated against the bearing spacer (fig. 8-65).



TA 074245

Figure 8-65 Input Shaft Cover Installation.

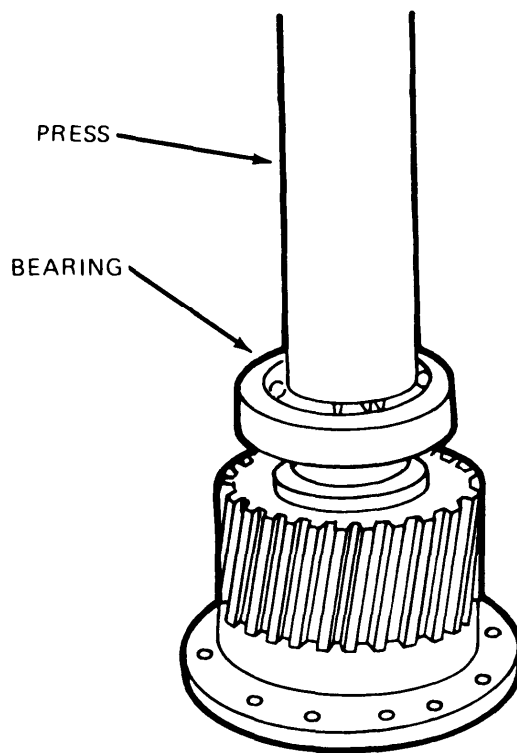
(f) install the end cap and two capscrews (fig. 8-66). Dip the capscrew threads in oil and torque to 25 lb-ft (34 N·m). Secure the capscrew heads with lockwire.



TA 074246

Figure 8-66. Input Shaft End Cap Installation.

(g) place the Splined end of the shaft UP. set the front bearing on the end of the shaft and press until firmly seated against the shaft shoulder (fig. 8-67).



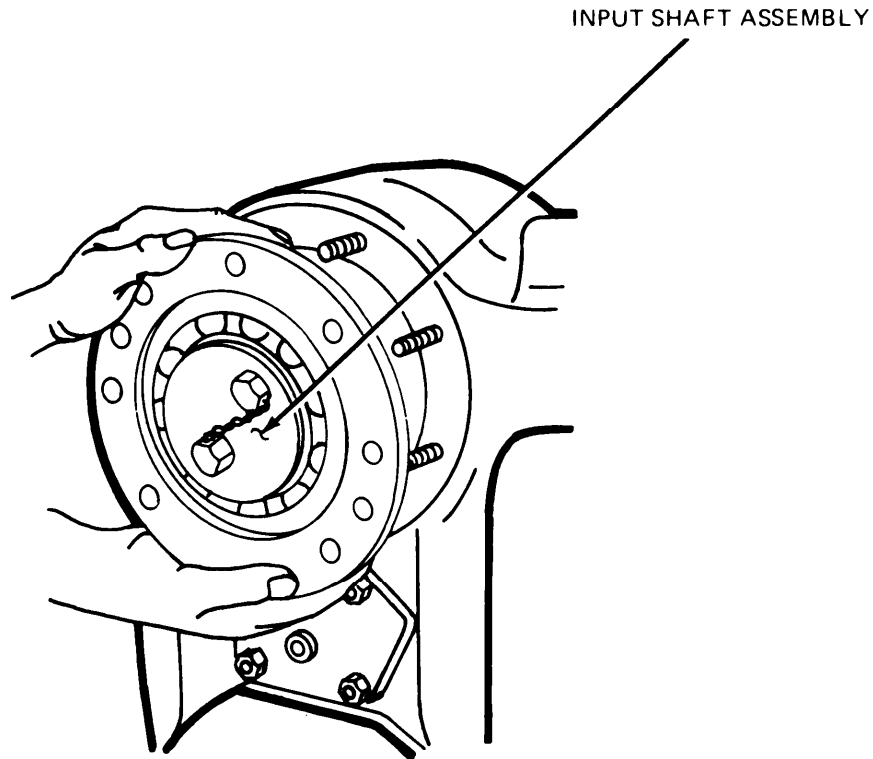
TA 074247

Figure 8-67. Top Input Shaft Front Bearing Installation.

(2) Install the top front shaft into the transfer case as follows:

(a) On the rear side of the case, apply silastic gasket material to the mating surface for the top front input shaft assembly gasket. Install the gasket and apply silastic gasket material (item 29, App B) to the outside of the gasket.

(b) Install the top front input shaft assembly over the studs into the case (fig. 8-68). The top shaft gear must mesh with the intermediate shaft gear and the bearing must be in alignment with the front cover.

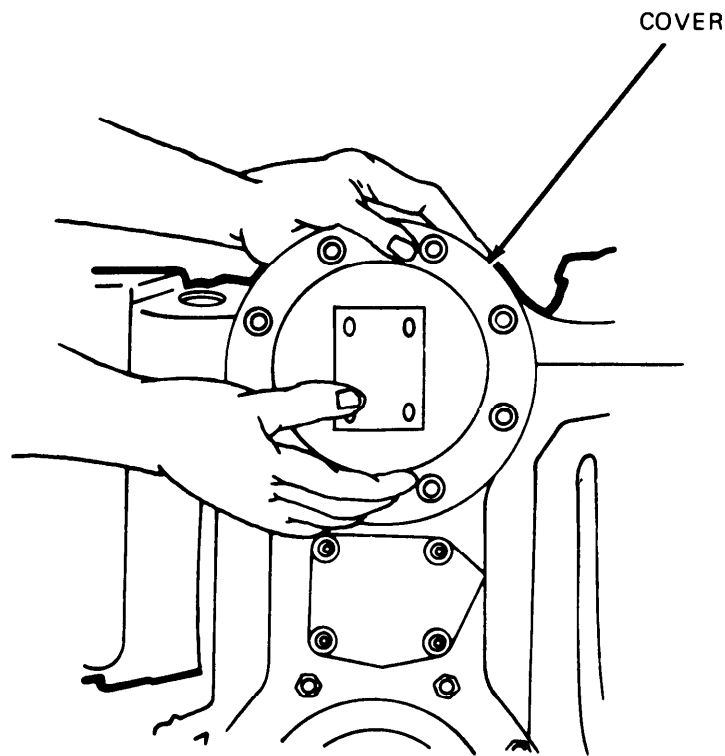


TA 074248

Figure 8-68. Install the Top Front Input Shaft Assembly.

(c) Apply silastic gasket material to the inner cover surface. Install the gasket and apply silastic gasket material to the outside of the gasket.

(d) Install the outer cover (fig. 8-69). Oil the stud threads and install eight lockwasher and nuts. Torque the nuts to 25 lbft (34 NŹm). Install small end plate with four capscrews.



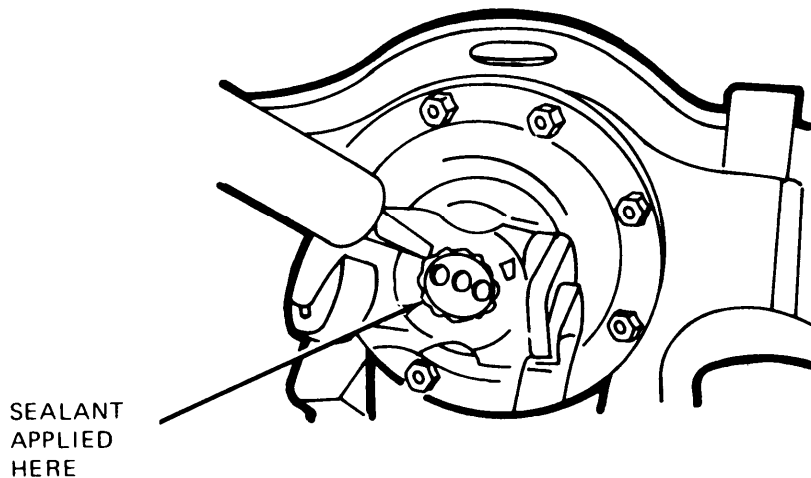
TA 074197

Figure 8-69). Top Front Input shaft Rear Cover Installation.

e. Install the Propeller Shaft Yokes.

(1) Install yokes over the splines of the top front input shaft, lower front output shaft, and lower rear output shaft.

(2) Apply silicone sealant (item 24, App B) to the end of each shaft (fig. 8-70).



TA 074249

Figure 8-70. Apply Silicone Sealant to the Shaft End.

(s) Install the yoke plate ends with two lubricated capscrews.

(4) Torque the capscrews to 60 lb-ft (81 N·m) and secure with lockwire.

8-7. Installation (Refer to para 2-13c.)

CHAPTER 9

REPAIR OF M915 FRONT AXLE

9-1. Description. The non-driving front axle used on the M915 incorporates sealed knuckle pins and permanently lubricated tie-rod end assemblies. The axle center section is an I-beam type with integral spring pads (fig. 9-1).

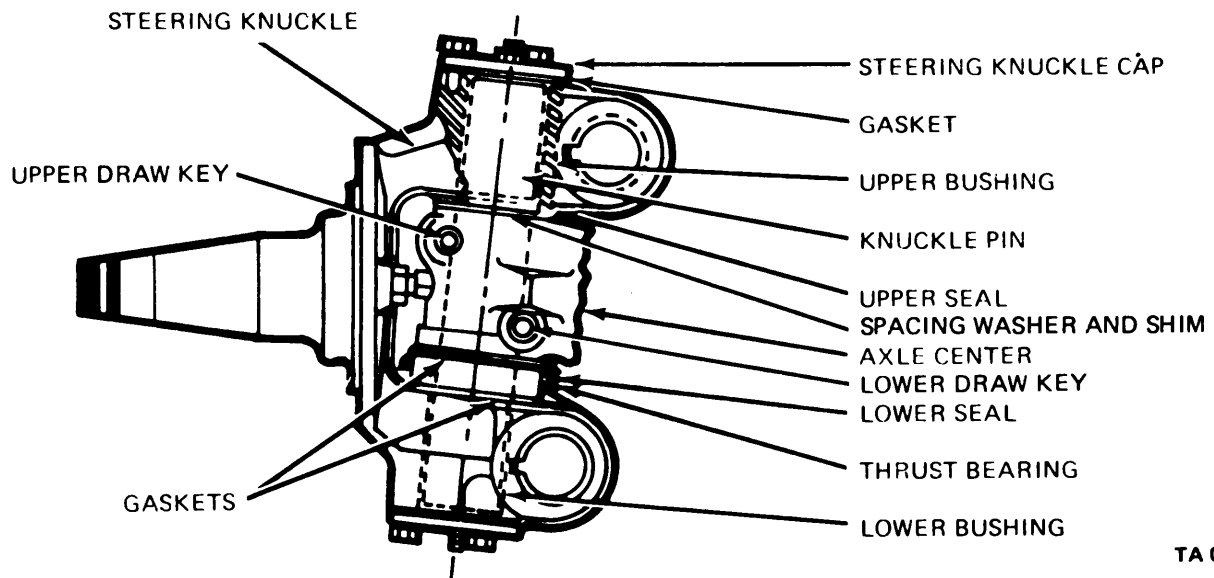


Figure 9-1. Non-Driving Front Axle Steering Knuckle.

a. *Sealed Knuckle Pin.* The sealed knuckle pins are of the straight design, employing two flats for correct positioning inside the axle center, and are held in place by tapered draw keys. The lubricant is protected from road contamination by grease seals and gaskets that enclose the upper and lower pin bushings.

b. *Steering Knuckle and Bushing Assembly.* The steering knuckles are bushed in the upper and lower knuckle pin bosses with steel backed bronze bushings. Top and bottom steering knuckle caps are equipped with grease fittings for periodic lubrication.

c. *Tie-Rod Ends.* The permanently lubricated tie-rod ends employ lube seals to prevent road contamination from the tie-rod ball cavity.

9-2. On-Equipment Testing. Any indication of looseness in the total steering linkage arrangement under normal steering loads is sufficient cause to immediately check all pivot points for wear, regardless of accumulated mileage.

a. Steering linkage pivot points should be checked each time the axle assembly is lubricated. If any indication of lateral movement is found, tie rod ends should be removed for inspection. Looseness at the steering linkage pivot points can be visually detected during movement of the vehicle steering wheel in dry park position.

b. Inspection of knuckle end play without removing the hub and drum from the axle can be accomplished by raising axle wheel end off floor, attaching the dial indicator to the axle center and positioning the indicator plunger on the upper knuckle pin cap with its line of action parallel to the knuckle pin center line. Perform steps (3) thru (5) (para 9-8d). On axles that have been installed under a vehicle, the end play may increase to a maximum of 0.065 inch at which time it will be necessary to re-shim end play back to 0.005-0.025 inch using the above procedures.

9-3. Removal. Procedures for removal of the front axle assembly from the vehicle are given in paragraph 2-14.

9-4. Disassembly.

a. *Removing the Wheel and Hub.* Use the following procedure to remove the wheel and hub from the steering knuckle.

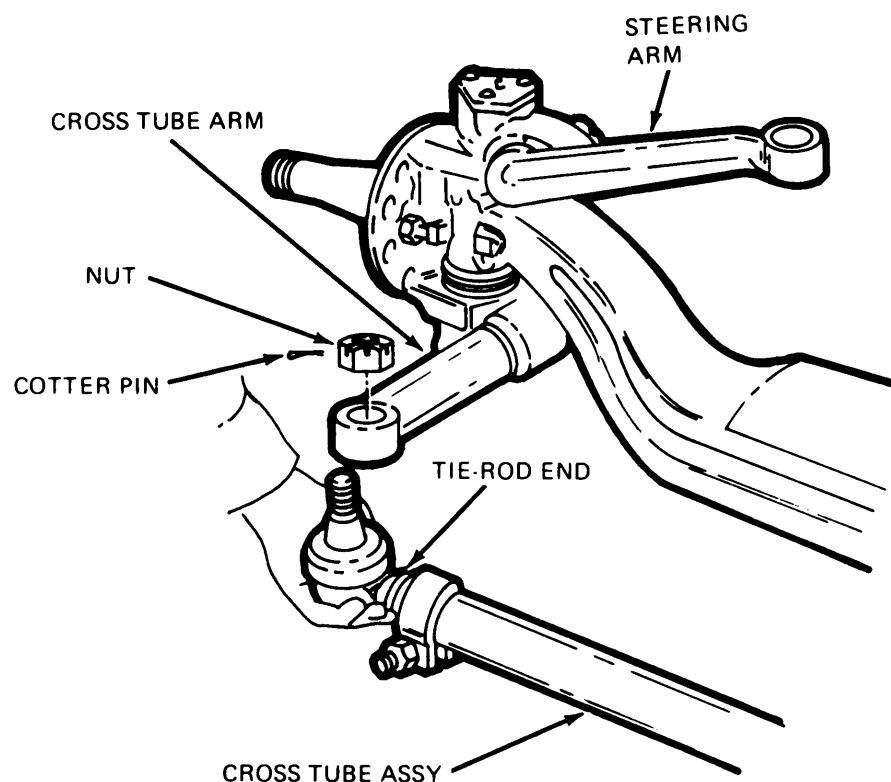
WARNING

Do not attempt disassembly or knuckle repair with the vehicle supported by jacks only. Severe injury can result from an inadequately supported vehicle.

- (1) Raise the front end of the vehicle so that the tires clear the floor. Block it up securely at this position and then remove the jacks.
- (2) Remove the hubcap and gasket.
- (3) Bend the locking washer to release the outer locknut and the inner wheel bearing adjusting nut.
- (4) Remove the outer locknut, locking washer, and inner adjusting nut from the steering knuckle spindle.
- (5) Remove the outer wheel bearing cone.
- (6) Remove the wheel and hub assembly.

b. Removing the Steering Knuckle. Use the following procedure to remove the steering knuckle assembly from the axle center.

- (1) Remove the brake air chambers. (Refer to TM 9-2320-273-20.)
- (2) Remove the brake assembly from the steering knuckle if brake service is required. (Refer to TM 9-2320-273 -20.)
- (3) Remove the cotter pin and tie rod end nut and disassemble the cross tube assembly from the cross tube arm (fig. 9-2).



TA 074251

Figure 9-2. Cross Tube Disassembly.

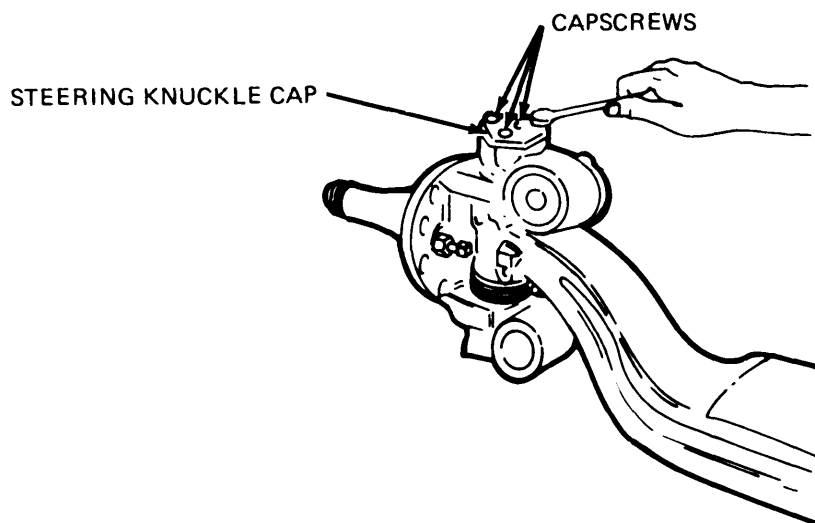
NOTE

It is not necessary to remove either the cross tube arm or the steering arm from the knuckle (steps (4) and (5)) unless service is required.

(4) Remove the cotter pin and nut from the cross tube arm and disassemble the cross tube arm and key from the knuckle.

(5) Remove the cotter pin and nut from the steering arm and disassemble the steering arm and key from the knuckle.

(6) Remove three capscrews and lockwashers from the top and bottom knuckle cap. Remove the caps and gaskets (fig. 9-3). Remove the lubrication fitting in the cap if damaged.



TA 074252

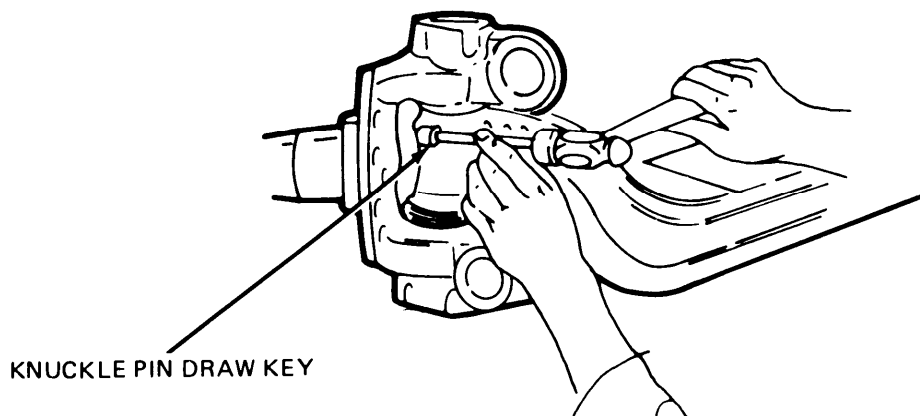
Figure 9-3. Steering Knuckle Caps Removal.

- (7) Remove the draw key nuts.

CAUTION

Do not strike the draw keys or the knuckle pin directly with a steel hammer in steps (8) and (9).

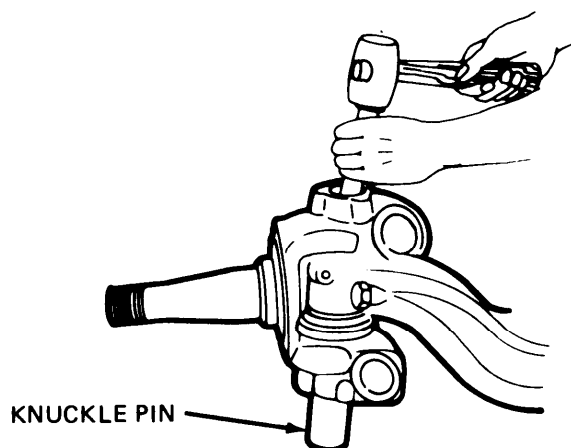
- (8) Tap out the knuckle pin draw keys from the small end using a suitable drift (fig. 9-4).



TA 074253

Figure 9-4. Knuckle Pin Draw Key Removal.

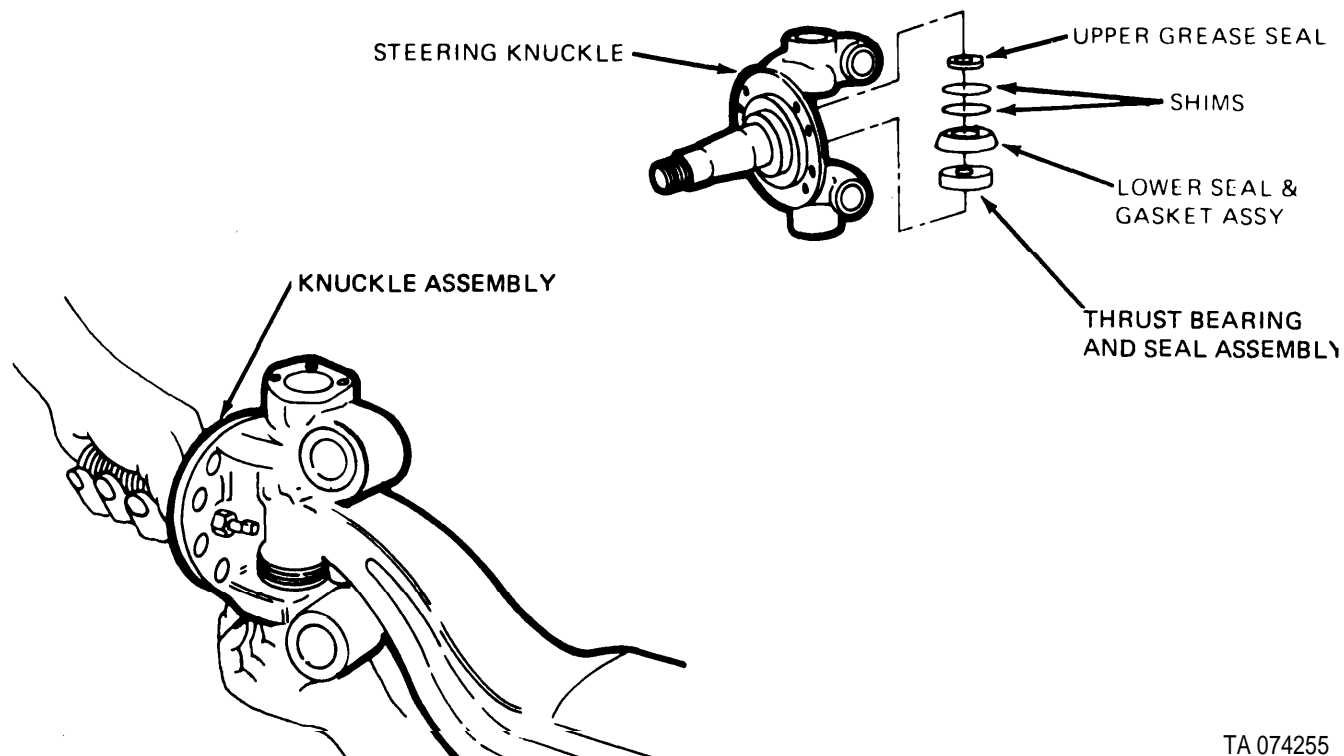
- (g) Tap the knuckle pin out of the axle center and knuckle using a bronze drift (fig. 9-5).



TA 074254

Figure 9-5. Knuckle Pin Removal.

(10) Lift the knuckle assembly, thrust bearing and seal assembly, lower seal and gasket assembly, and shims from the axle center (fig. 9-6). Retain shims, thrust bearing and seal assembly, and lower seal and gasket assembly.



TA 074255

Figure 9-6. Steering Knuckle Removal.

c. *Removing the Upper Grease Seal.* Use the following procedure if it is required to remove the upper grease seal (fig. 9-6) from the knuckle.

NOTE

Do not remove the upper grease seal from the steering knuckle unless replacement is necessary, since the seal is usually ruined upon removal. If not previously removed, the brake assembly and the steering arm must now be removed prior to positioning the knuckle in the vise.

(f) position the upper knuckle boss (top end down) in a vise with soft metal jaws and lock securely.

(2) With the top end of the knuckle held firmly in this position, insert a screwdriver or similar tool between the knuckle counterbore and the seal case. Pry the seal out of the knuckle.

(3) Remove the knuckle from the vise for cleaning and inspection.

9-5. Cleaning.

a. Parts having ground and polished surfaces such as the knuckle pins, knuckle pin sleeves, bearings, and spindles, should be cleaned in dry cleaning solvent (item 12, App B).

NOTE

Do not use gasoline or a hot solution tank. Do not use water and alkaline solutions such as sodium hydroxide, orthosilicates, or phosphates.

b. Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lint-free, absorbent paper towels or rags. Do not dry bearings by spinning with compressed air.

9-6. Inspection. Perform a careful and thorough visual inspection of all components, prior to reassembly, as follows.

a. *Steering Knuckle and Knuckle Pin.*

(f) Inspect the steering knuckle thrust bearing, wheel bearing cones and cups. Replace if rollers or cups are worn, pitted, or damaged in any way. If wheel bearing cups are to be replaced, remove from hubs with a suitable puller. Avoid the use of drift and hammers as they may easily mutilate cup bores.

(2) Inspect the steering knuckles and replace if indications of weakness or excessive wear is found.

(3) Check knuckle pin for excessive wear. Compare with correct specification.

(4) Check upper knuckle pin grease seal for rips, tears and excessive wear. Do not remove upper grease seal from steering knuckle counterbore unless replacement is necessary. If seal must be replaced, follow removal procedures (9-4c).

(5) Remove lower knuckle pin seal from thrust bearing case and inspect seal for wear, rips and tears.

(6) Check thrust bearing and lower seal gaskets for wear. Some axles may employ an integral gasket in the lower seal or thrust bearing.

(7) Check knuckle pin bushings for flaking and galling. Compare with correct specification. Do not remove bushings from steering knuckle unless replacement is necessary.

b. *Tie-rod End.*

(1) Check seals visually for any indications of damage. Also check to make sure seal is securely seated on socket. Tie-rod ends should be replaced if seals are damaged or loose.

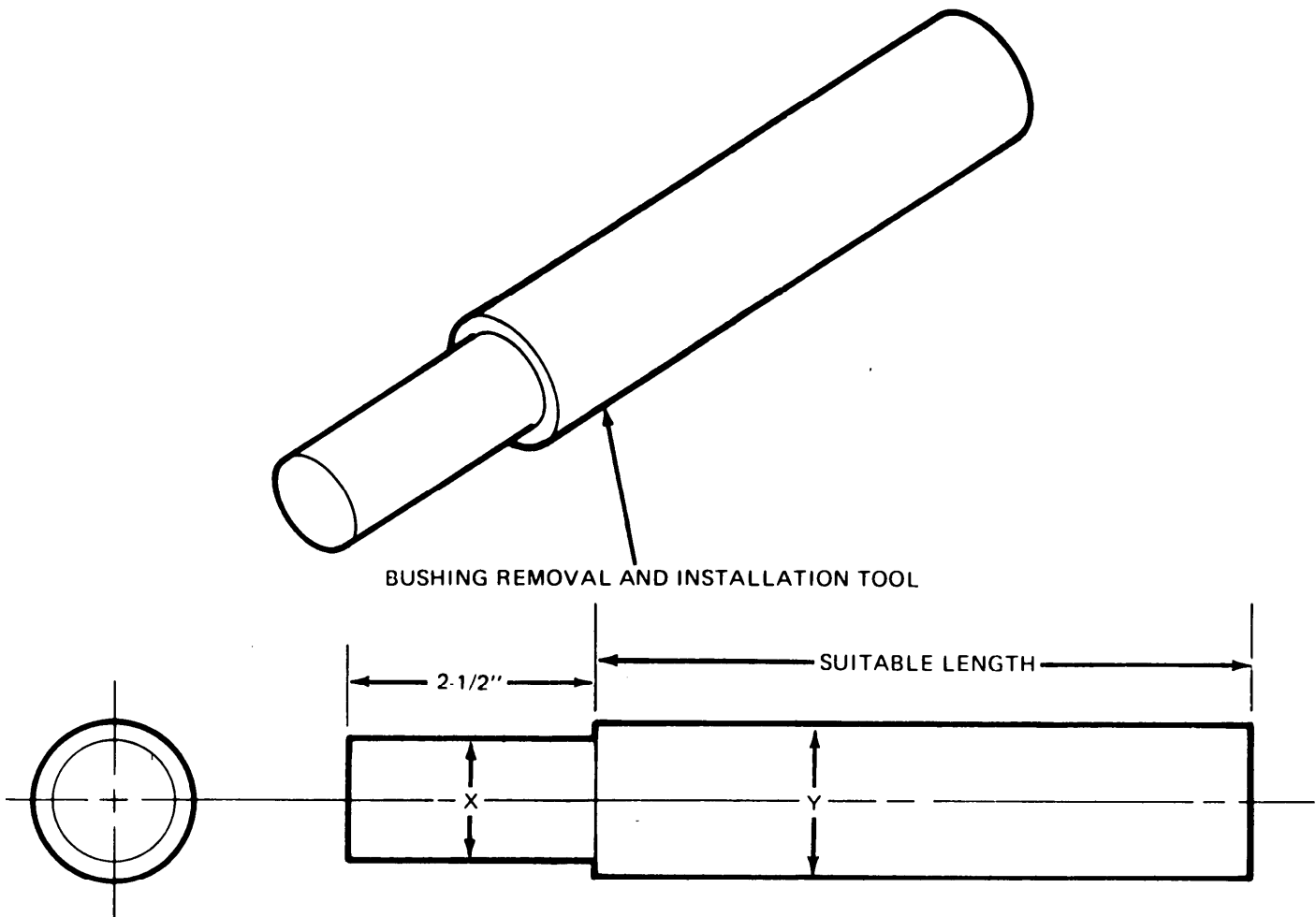
CAUTION

Do not attempt to salvage damaged ends by repacking and replacing the boot seal on non-greasable ends.

(2) Check the turning torque value between the tie-rod end assembly stud and the ball cavity. If torque value is less than five lb-in, the tie-rod end assembly should be replaced. This is not to say the end assembly will fail at this point, but it can no longer provide the type of steering control designed into it once lateral movement develops between the stud and ball cavity.

9-7. Repair or Replacement.

- a. *Bent Parts.* Replace any part bent in service.
- b. *Steering Knuckle Bushings.* Replacement of steering knuckle bushings can be accomplished using a press in conjunction with a suitable bushing installation tool (fig. 9-7).



Dimension "X" is 0.010" less than the bushing bore (1.777-1.779).
Dimension "Y" is 0.010" less than the steering knuckle bore (1.909 1.911).

TA 074256

Figure 9-7. Bushing Removal and Installation Tool.

(7) Press worn bushings out of the knuckle using the small end of the bushing removal tool in the bushing.

(2) Place a replacement bushing on the small diameter end of the tool and press it into the steering knuckle in three steps as follows. This allows the bushing to align itself with the bore.

(a) Press the bushing into the knuckle about 1/8 inch and then relieve pressure.

(b) Press the bushing in another 1/2 inch and relieve the pressure.

(c) Press the bushing in until it is flush with the surface of the upper seal counterbore, for the top, or with the inside surface of the lower knuckle boss for the bottom.

(d) Line ream upper and lower bushings to 1.787-1.789 in.

c. Corrosion Prevention. Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. Spindles, knuckle pins or sleeves that are to be stored for any length of time should be treated with rust preventative, wrapped in oiled paper and boxed to keep dry and clean.

9-8. Assembly

NOTE

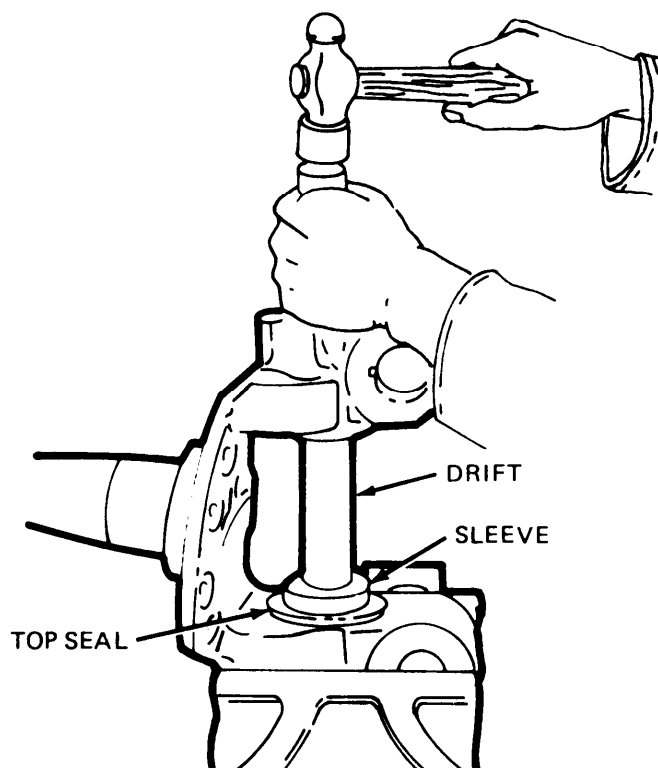
Incorrect installation of the grease seals could result in premature lubricant contamination and a need for more frequent lubrication and service intervals. For maximum operating service from the front axle assembly, install the seals by the following procedures.

a. Upper Grease Seal Installation.

(1) Place the steering knuckle, bottom side up, in a vise equipped with soft metal jaws and lock securely.

(2) With the top end of the knuckle held firmly in this position, place the new grease seal over the knuckle counterbore with the rubber lip facing up.

(3) Using a suitable sleeve and a brass drift, tap the grease seal into the knuckle counterbore until it bottoms (fig. 98).



TA 074257

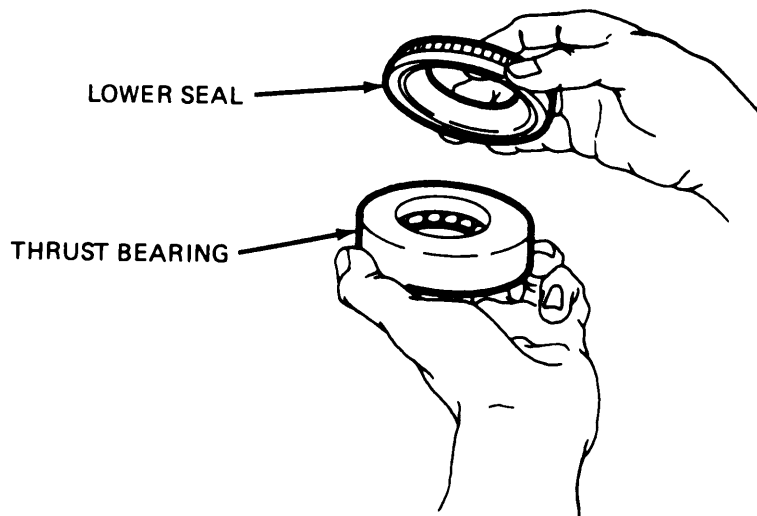
Figure 9-8. Top Seal Installation.

b. Thrust Bearing and Lower Seal Installation.

NOTE

Before installing the thrust bearing and lower seal assembly on the steering knuckle, make certain the lower seal is positioned correctly over the thrust bearing retainer lip.

(1) Hold the thrust bearing with the thrust bearing seal face down. Snap the lower seal and gasket assembly over the thrust bearing chamfered side (fig. 9-9).

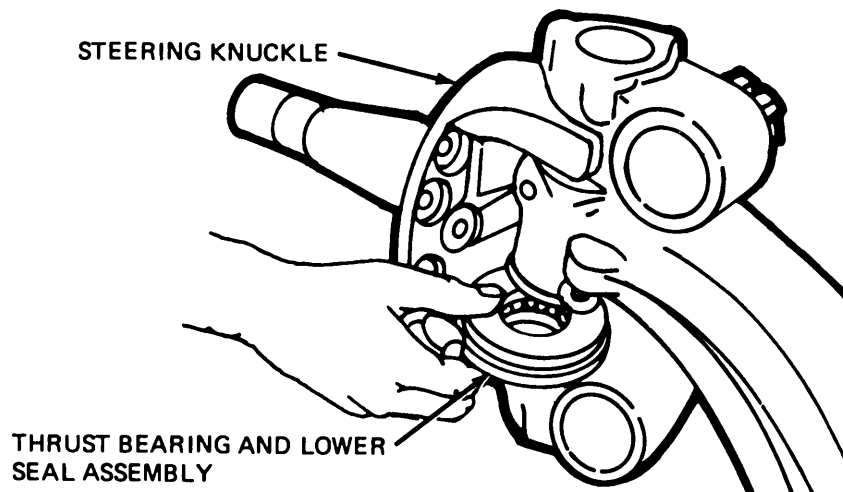


TA 074258

Figure 9-9. Lower Seal and Thrust Bearing Assembly.

(2) With the knuckle pin hole in the axle center clean and dry, position and support the steering knuckle on the axle.

(3) With the seal positioned over the thrust bearing, slide the thrust bearing and lower seal assembly between the lower face of the axle center and the lower knuckle boss (fig. 9-10).



TA 074259

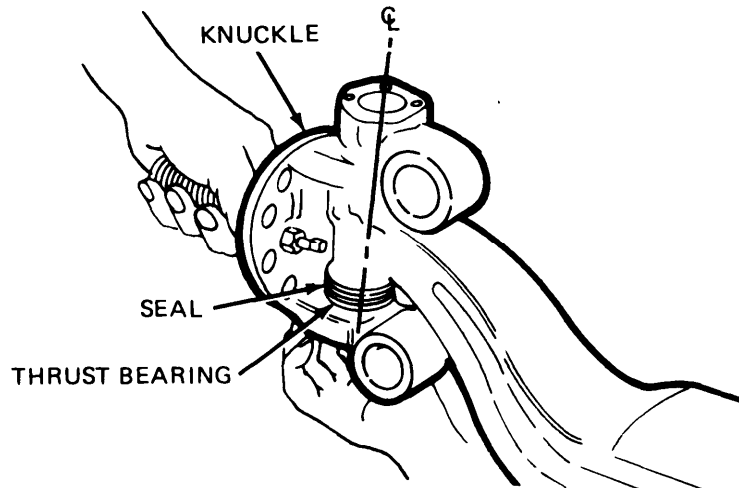
Figure 9-10. Steering Knuckle Installation.

NOTE

The bottom side of the thrust bearing must be seated on the face of the lower knuckle yoke. The lower seal must be positioned beneath the bottom face of the axle center.

c. *Knuckle Pin Installation.*

(1) Aline the pin holes of the knuckle, axle center, lower seal, thrust bearing and seal (fig. 9-11).



TA 074260

Figure 9-11. Knuckle Alignment.

(2) Place a jack under the lower side of the steering knuckle yoke and raise the knuckle so that all clearance is taken up between the lower yoke, thrust bearing and seal, and the lower face of axle center end.

CAUTION

Do not strike the knuckle pin or draw keys directly with a steel hammer.
Use suitable brass drifts.

(3) Align the knuckle pin flats to mate with the draw key holes, and tap the knuckle pin through the knuckle yoke: axle center and the thrust bearing from the top or bottom side.

NOTE

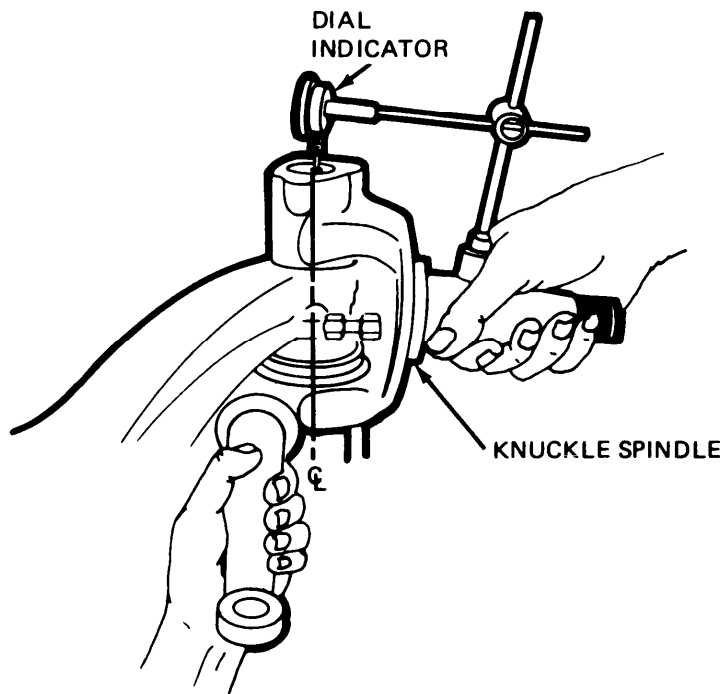
The draw keys are installed one from each side of the axle center. Do not install both keys from the same side. Before setting the draw keys, center the knuckle pin to equalize the gap between the upper and lower gap mounting surfaces.

(4) Install the draw keys so that the flat on the key mates with the corresponding flat on the knuckle pin.

(5) Install the draw key nuts and torque between 30-45 lb-ft (41-61 N·m).

d. *Knuckle Clearance (End Play) Check.* Measure the clearance between the top face of the upper axle surface and the lower face of the knuckle pin boss as follows,

(1) Set up a dial indicator graduated in thousandths with the mechanical clamp or magnetic base affixed to the knuckle spindle such that the knuckle can be turned freely (fig. 9-12).



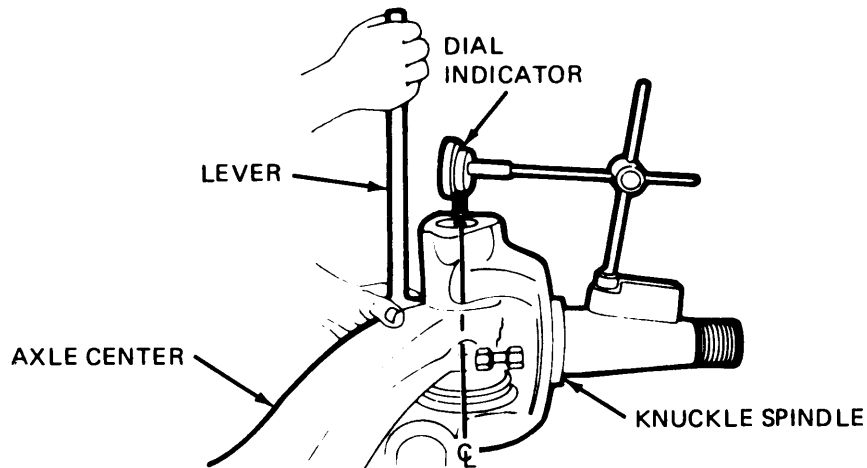
TA 074261

Figure 9-12. Dial Indicator Setup.

(2) Place the dial indicator plunger on the exposed end of the knuckle pin such that its line of action is approximately parallel to the knuckle pin center line.

(3) Zero the dial indicator.

(4) Using a suitable lever or block and lever, lift the knuckle and take the dial reading (fig. 9-13).



TA 074262

Figure 9-13. Knuckle Clearance Check.

NOTE

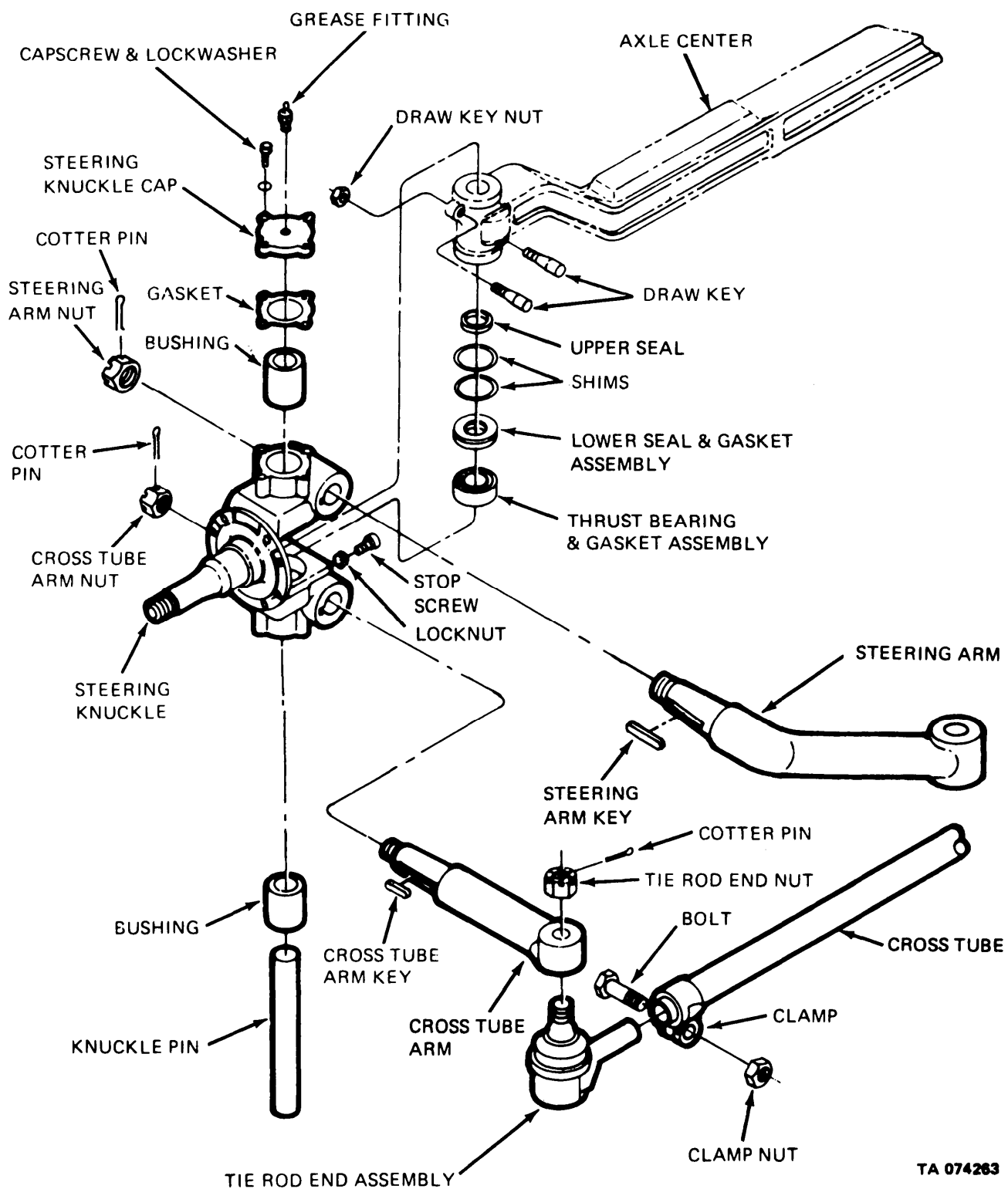
Dial indicator readings taken from three steering knuckle positions are necessary to accurately measure the end play with the dial indicator. The positions are: full right turn, full left turn and the straight ahead position.

(5) Turn the knuckle to each of the three positions and repeat steps one through five for each knuckle position.

e. End Play Adjustment.

(1) Add shims between the upper knuckle boss and the axle center end as required to obtain an end play of 0.005-0.025 in. (0.127-0.635 mm) through the full range of turn.

f. Completing the Assembly (fig. 9-14).



TA 074263

Figure 9-14. Axle Assembly – Exploded View.

(1) Install gaskets and steering knuckle caps at the top and bottom of the steering knuckle bosses. Install three capscrews with lockwasher and torque 20-30 lb-ft (27-40 N·m).

(2) Install steering arm and ball assembly in the upper steering knuckle boss and torque nut between 560 and 785 lb-ft (759 and 1064 N·m). Use the torque wrench to line up the cotter pin hole. Do not back off. Install the cotter pin.

(3) Install the cross tube arm in the lower steering knuckle boss and torque the nut between 560 and 785 lb-ft (759 and 1064 N·m) using the torque wrench to line up the cotter pin hole. Install the cotter pin.

(4) Install the cross tube assembly in the cross tube arm. Torque the tie-rod end nut between 165 and 230 lb-ft (224 and 312 N·m) as above. Install the cotter pin.

(5) If disassembled, the following torque values apply to the steering linkage.

(a) Tie-rod clamp bolt: 45-55 lb-ft (61-75 N·m)

(b) Steering arm ball nut: 165-230 lb-ft (224-312 N·m)

(6) Install the wheel and hub (and brake if applicable) in reverse order of disassembly (para 9-4a and 9-4 b).

(7) Lubricate in accordance with LO 9-2320-273-12.

(8) Wheel bearing adjustment procedure is contained in TM 9-2320-273-20.

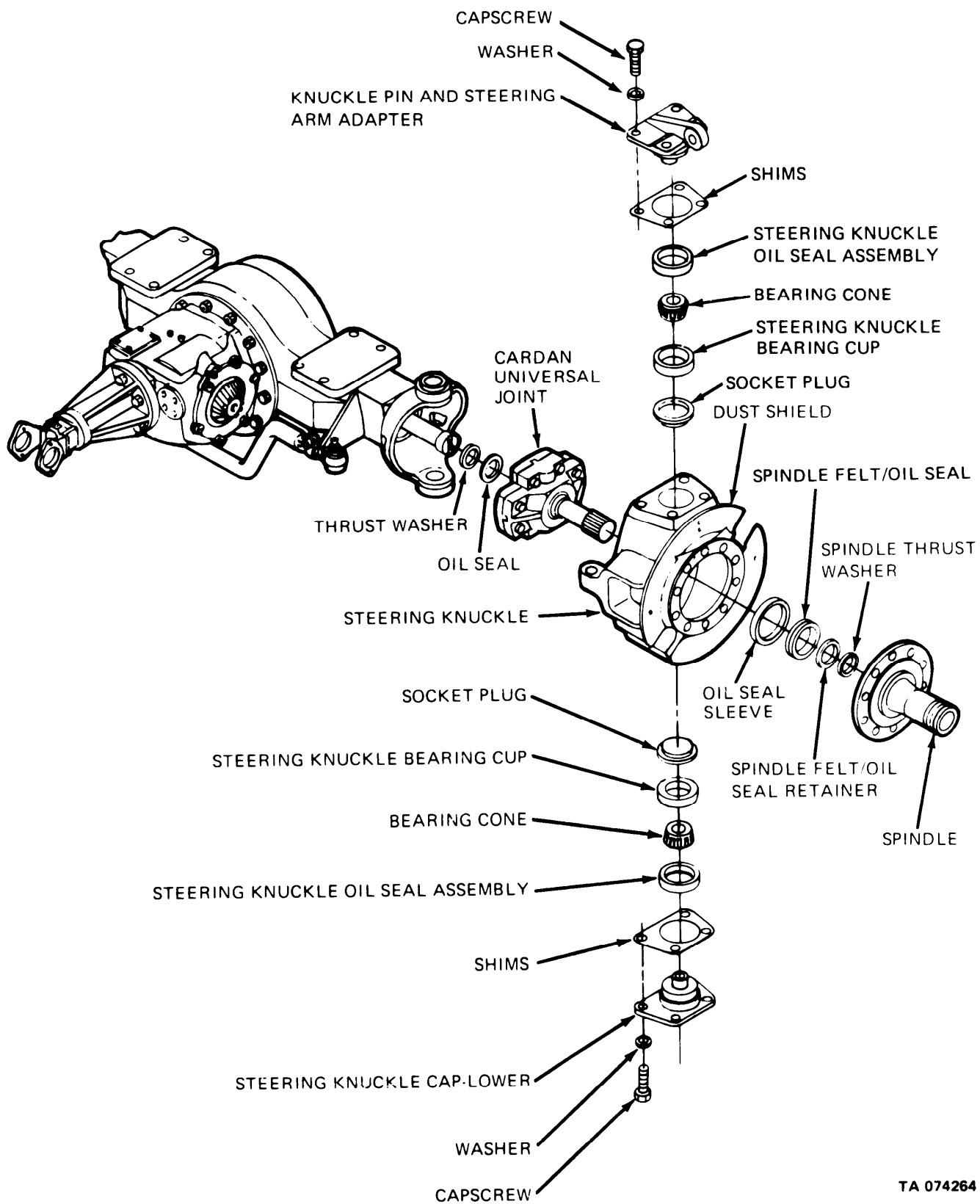
CHAPTER 10

REPAIR OF M916/M920 FRONT AXLE

10-1. Description

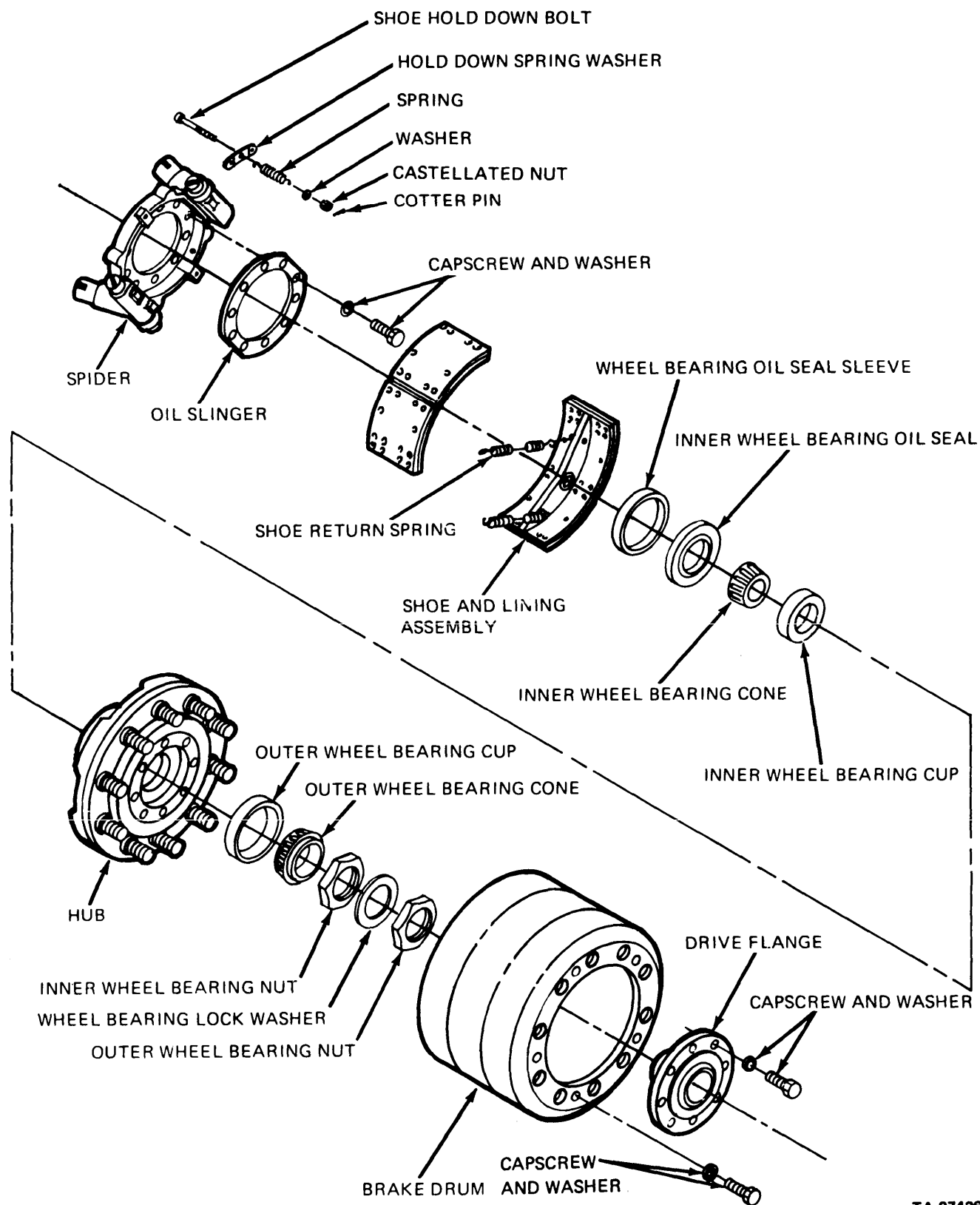
a. The axle has steering ends bolted to the outer ends of the axle housing. A cardan joint in the axle shaft located within the axle ball and socket permits the shaft to rotate and drive the wheel while allowing it to steer the vehicle (fig. 10-1 and 10-2).

b. The drive unit for the front axle is a single reduction unit that employs a heavy-duty spiral bevel or hypoid pinion and gear. The differential and gear assembly is mounted on tapered roller bearings. The straddle mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust and a third bearing behind the pinion teeth to carry the radial load.



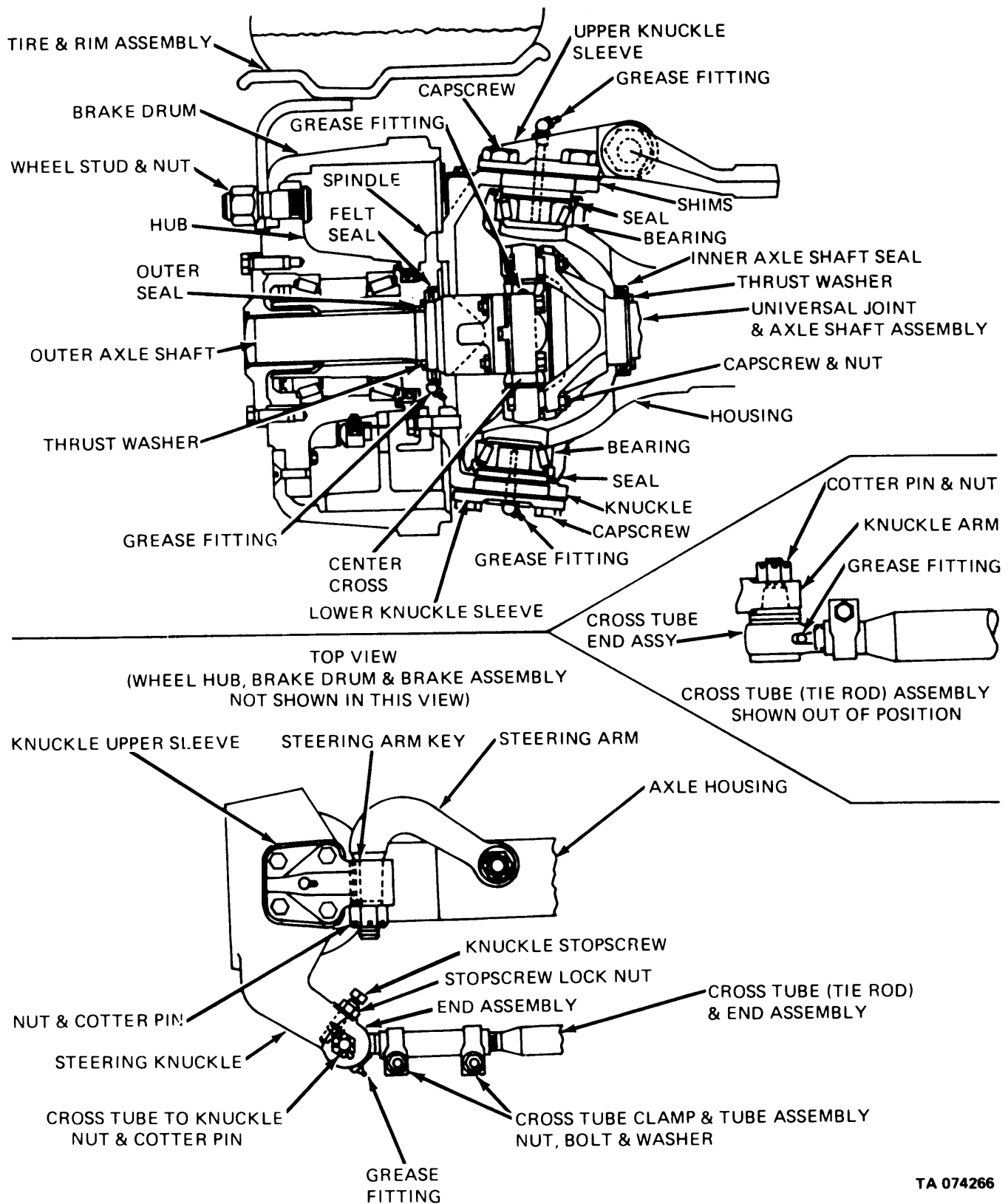
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Figure 101. Wheel End Assembly – Exploded View. (Sheet 1 of 2)



TA 074265

Figure 10-1. Wheel End Assembly – Exploded View. (Sheet 2 of 2).



TA 074266

Figure 10-2. Wheel End Assembly – Sectional View.

10-2. Wheel End Disassembly.*a. Prepare for Disassembly.*

- (1) Block rear wheels of vehicle to prevent it from rolling.

CAUTION

Do not attempt to disassemble wheel ends with vehicle supported by jacks only.

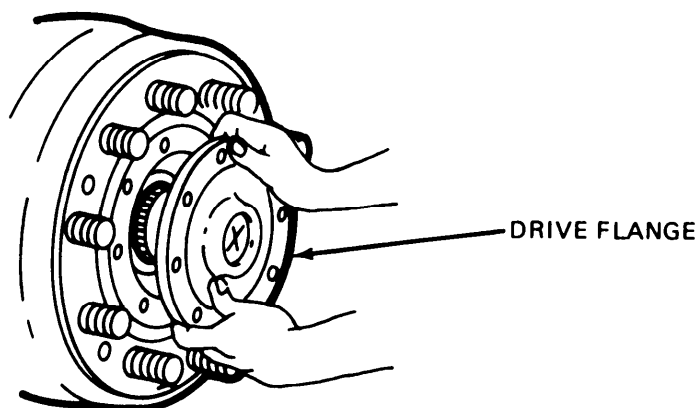
- (2) Jack up front of vehicle so that both tires clear the floor. Block up axle securely under spring seats and hold the vehicle in this position, and remove jacks.

- (3) Remove oil drain plug from bottom of axle housing and drain all lubricant from axle.

*b. Remove Hub, Drum, and Wheel from Axle.***CAUTION**

Do not strike center of flange with a tool and do not pry between flanges with tool. Damage to mating surfaces may occur.

- (1) Remove the drive flange from wheel hub by removing eight capscrews and washers (fig. 10-3). It may be necessary to tap off the flange with a rubber or rawhide mallet because of silastic gasket material.

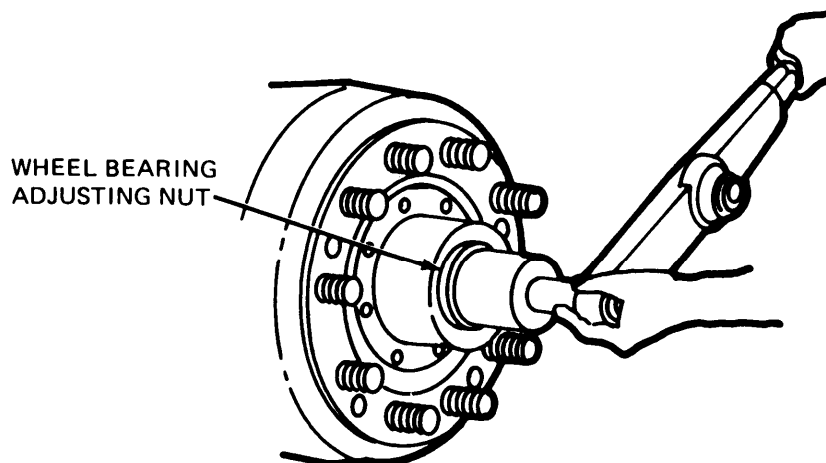


TA 074267

Figure 10-3. Remove Drive Flange.

(2) If necessary, remove expansion plug from drive flange by tapping out from the inside of the drive flange.

(3) Remove 4-7/8 in. bearing jam nut, adjusting lock nut, and wheel bearing adjusting nut from the wheel spindle (fig. 10-4).



TA 074268

Figure 10-4. Remove Wheel Bearing Adjusting Nut.

NOTE

In step (4), the inner and outer bearing cups will remain seated inside the hub cavity. Also, if the inner bearing cone was able to slide off the spindle, the hub and spindle oil seal will remain inside the hub.

(4) Remove the hub, drum, and wheel from the axle by pulling straight off the wheel spindle, using the tire to grip onto and pull. It may be necessary to use a mallet, hitting the inside of the wheel to remove the hub from spindle.

CAUTION

Be careful; the outer bearing cone is loose and will drop off spindle when the hub is removed.

(5) Disassemble the wheel (rim and tire) from the hub to facilitate hub bearing and seal removal, if required. Otherwise, set aside for reassembly.

c. Disassemble Bearing Cups and Seals from Hub.

NOTE

Before removing the bearing cups and seals, it may be desirable to first disassemble the brake drum from the hub. This facilitates handling and working with the hub. Refer to brake drum removal procedures in TM 9-2320-273-20. Otherwise, continue with the following procedures if bearing cup removal is required.

(1) If the hub seal and inner bearing cone are still seated in the hub, remove by using a long screwdriver or other pointed tool to pry loose. Replace the seal at reassembly.

(2) If necessary, remove inner and outer bearing cups from the hub, using a press and sleeve or suitable bearing puller.

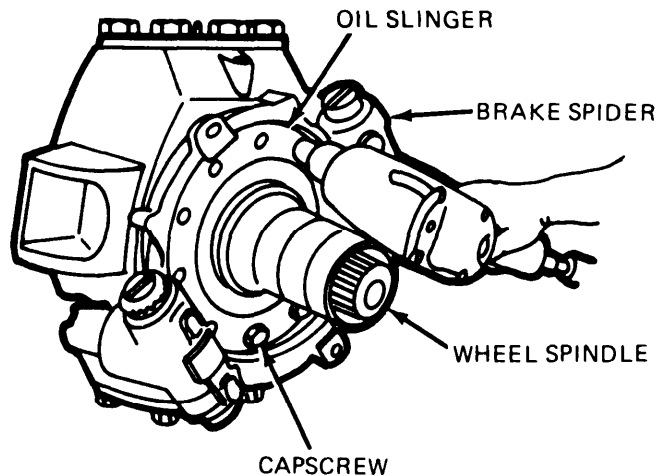
CAUTION

In step *d*, if a press is not available, a brass hammer or drift may be used to drive out the studs. Do not strike wheel studs with a steel hammer or attempt to twist to remove – damage will result.

d. Remove Drum and Wheel Studs. If necessary, remove wheel studs from hub by placing hub in a hydraulic press, drum side up, and press out.

e. Disassemble Spindle, Brake Assembly and Oil Slinger from Knuckle.

(1) Disassemble the hub oil slinger, brake assembly, and wheel spindle from the steering knuckle by removing the eight attaching capscrews and lockwasher (fig. 10-5). It may be necessary to pry spring aside (but do not remove) and position wrench socket on heads of some capscrews.



TA 074269

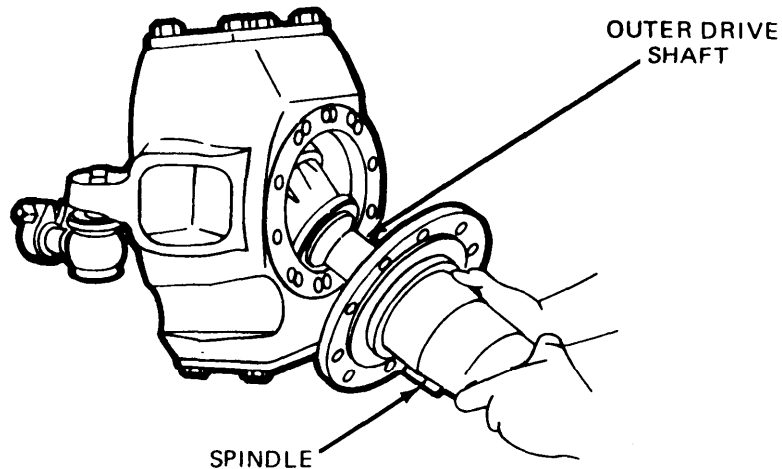
Figure 10-5. Disassemble Hub Oil Slinger, Brake Assembly, and Wheel Spindle.

(2) Remove the oil slinger and brake assembly. If brake maintenance is required, refer to TM 9-2320-273-20. If dust shields are to be removed or replaced, remove two capscrews and washers on each shield and remove.

NOTE

In step (3), the spindle, inner sleeve, felt seal and retainer assembly, the outer drive shaft oil seal wiper, and the outer shaft thrust washer will remain seated inside the spindle. Remove only if required; use a suitable pointed tool for removal.

(3) Pull the spindle straight out from the knuckle and outer drive shaft (fig. 10-6). Remove and replace grease fitting if damaged.



TA 074270

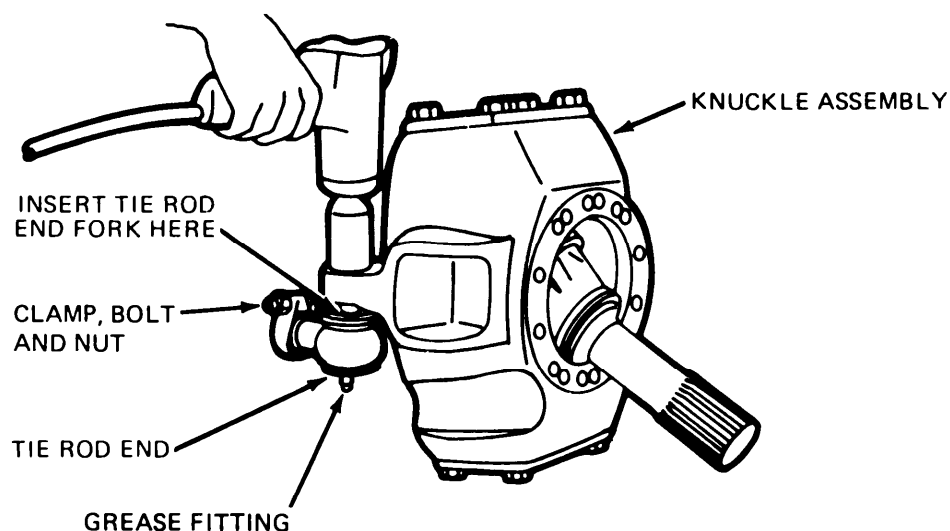
Figure 10-6. Remove Spindle.

f. *Disassemble Steering Knuckle from Housing.*

NOTE

The steering arm and cross tube (tie rod) assemblies may be serviced individually without removing the complete steering knuckle assembly. If it is required to disassemble both the knuckle and steering arm from the axle, the steering arm may be disassembled from the knuckle upper sleeve on the bench. Use the following procedures,

(1) Remove cotter pin and lock nut, then disconnect tie rod end from the steering arm ball stud (fig. 107). It may be necessary to strike side of knuckle housing with rawhide mallet to loosen. If tie rod end assembly is to be replaced, remove clamp, bolt, nut, and lubrication fitting. Unscrew end from tie rod.



TA 074271

Figure 10-7. Disconnect Tie-Rod End.

(2) Remove wheel stop adjusting bolt by unscrewing lock nut.

NOTE

It is not necessary to disassemble both cross tube ends unless both knuckle assemblies are being serviced at the same time,

(3) Remove knuckle upper sleeve (fig. 10-8) from the knuckle by first removing four sleeve to knuckle capscrews and lockwasher. Lift off the upper sleeve from the knuckle bore. The knuckle upper bearing cone will remain seated on the sleeve and comes off at the same time. Remove the bearing cone from the sleeve if required, using a suitable puller. Replace upper and lower grease fittings if damaged.

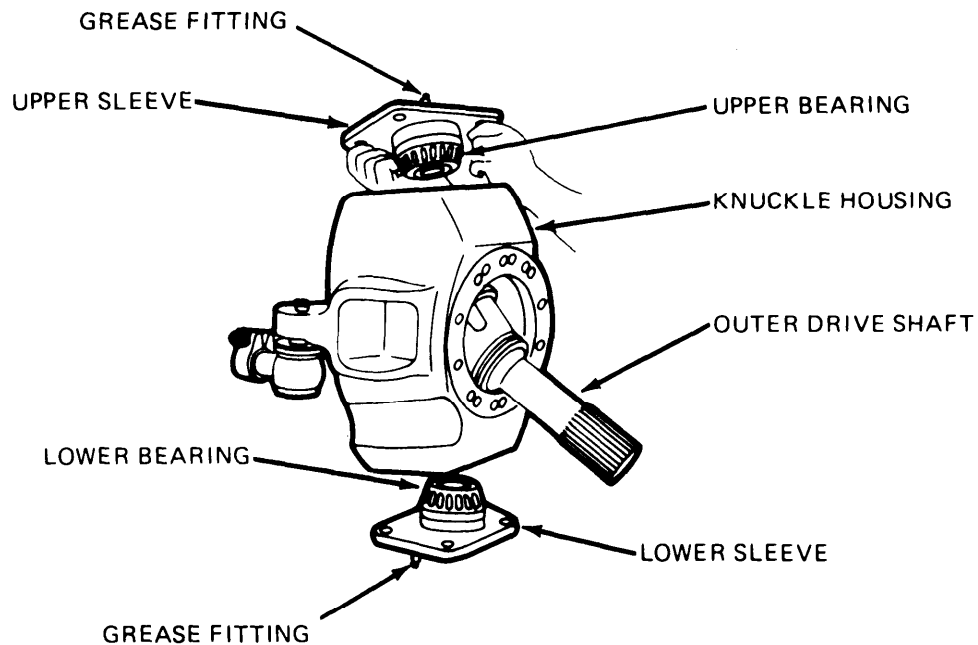
**TA 074272**

Figure 10-8. Remove Upper and Lower Sleeves.

(4) Remove steering arm by removing cotter pin and nut, then drive out of upper sleeve with mallet and remove key.

(5) Remove shims between the sleeve attaching flange and knuckle. Record thickness and inspect. If they are reusable, retain for reassembly.

(6) Disassemble knuckle lower sleeve, bearing cone, and shims as in steps (3), (4) and (5) for the upper sleeve. After removing both the upper and lower sleeves, pull off the knuckle housing, leaving the universal joint in place.

(7) Using a screwdriver or other suitable pointed tool, remove both the upper and lower knuckle oil seals from their bores in the axle housing.

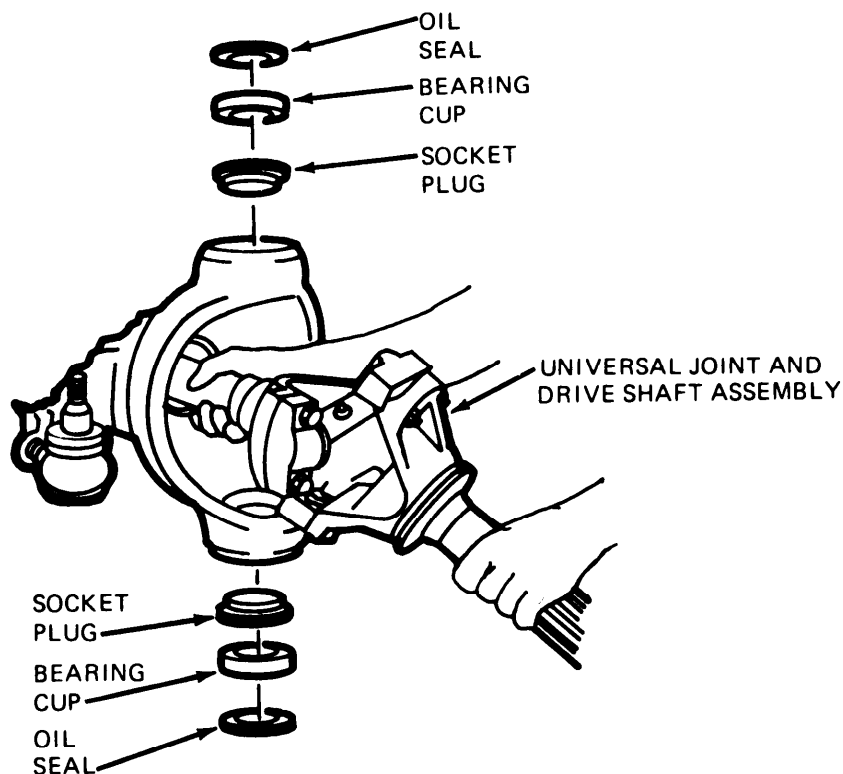
(8) Remove both the upper and lower knuckle bearing cups and socket plugs from their bores in the axle housing. Remove from the inside of the axle housing using a suitable sleeve having a diameter approximately the same as the plug bore, Tap out both the plug and bearing cup at the same time.

g. Remove and Disassemble Universal Joints.

NOTE

The steering knuckle must be removed prior to removing universal joint. The joint cannot be removed through the outer knuckle opening. The oil seal will remain seated on the outer drive shaft. Remove and replace with new seal at reassembly.

(1) Remove the universal joint and drive shaft assembly from the axle by pulling the complete assembly straight out from the carrier and housing (fig. 10-9). If no further maintenance is required, set it aside for reassembly.



TA 074273

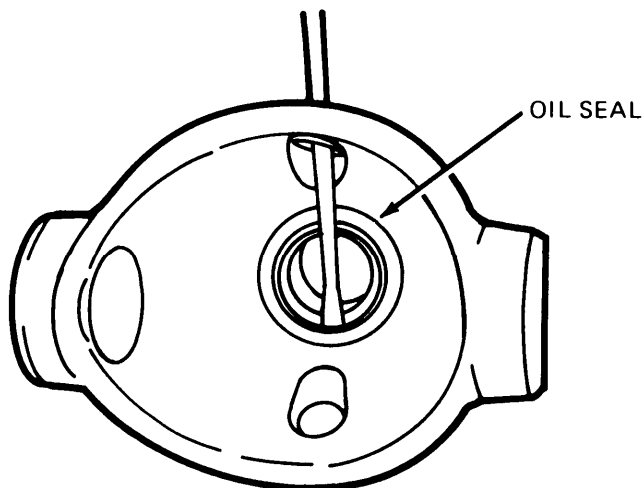
Figure 10-9. Remove Universal Joint and Drive Shaft Assembly.

NOTE

It is not recommended that the cross and cap assembly be disassembled.

(2) If disassembly is necessary, disassemble the universal joint by removing yoke to cross and cap assembly capscrews, nuts and washers. Do not replace individual defective parts – replace with complete pre-assembled unit.

(3) Remove the inner drive shaft oil seal, thrust washer and bushing from the axle housing, if required (fig. 10-10). To remove the bushing, it may be necessary to use a suitable puller.



TA 074274

Figure 10-10. Remove the Inner Drive Shaft Oil Seal, Thrust Washer, and Bushing.

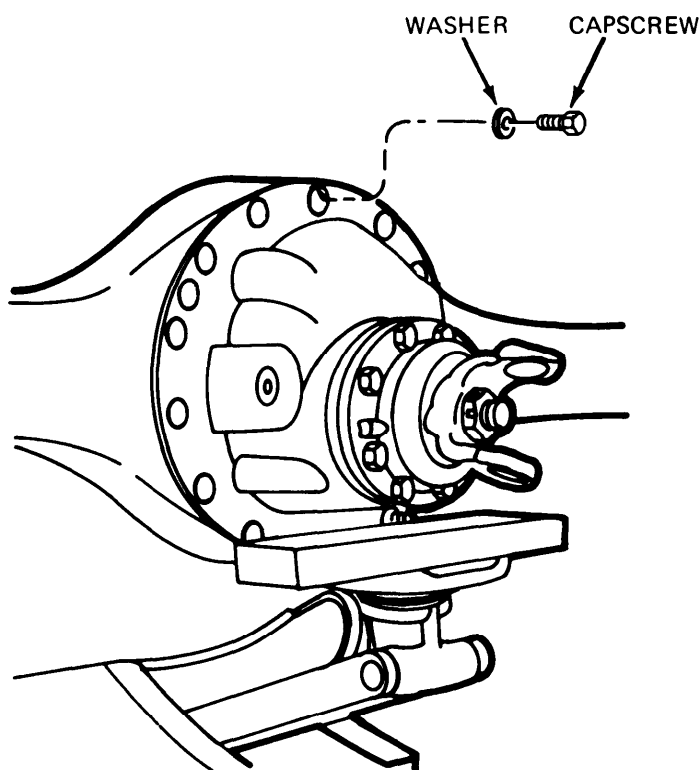
10-3. Differential Carrier Removal and Disassembly.

a. Removal.

NOTE

To remove the differential carrier, both wheel ends must be removed. (Refer to para 9-4.)

- (1) Disconnect universal at pinion shaft.
- (2) Remove all but the top two carrier to housing capscrews and washers. Loosen two top capscrews and leave in place to prevent carrier from falling.
- (3) Break carrier loose from axle housing with rawhide mallet.
- (4) Remove the two top capscrews and washers and work the carrier free. A small pinch bar may be used to straighten the carrier in the housing bore, however, the end must be rounded to prevent indenting the carrier flange. If carrier is being removed while the axle is installed on vehicle, a roller jack may be used to facilitate removal of carrier, as shown in figure 10-11. Otherwise a sling and hoist arrangement may be used.

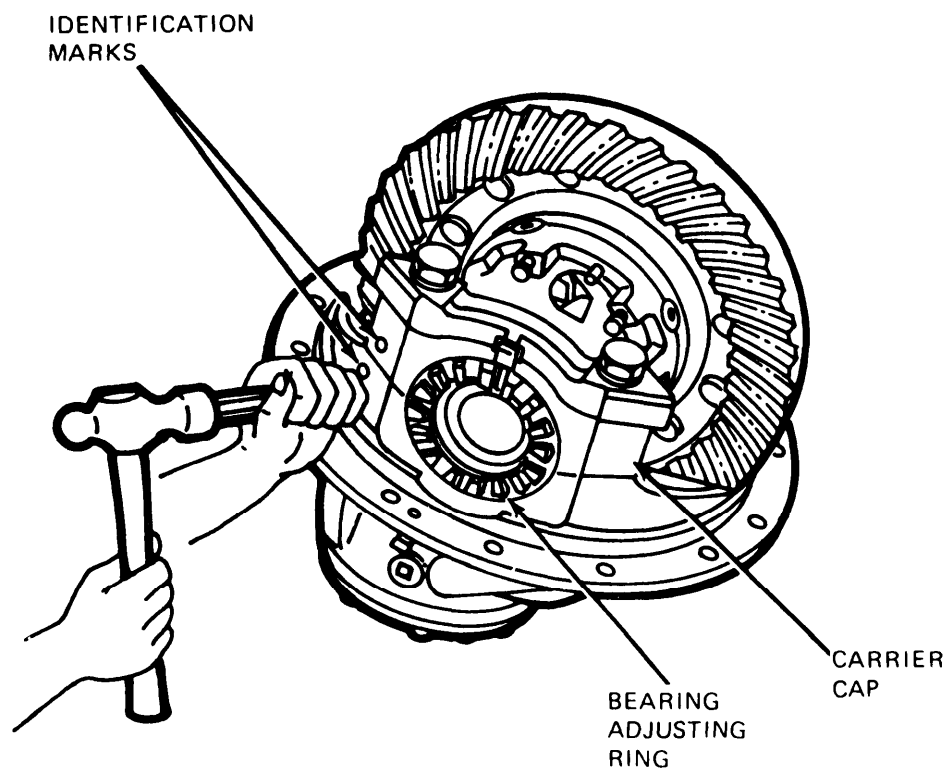


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Figure 10-11. Remove the Differential Carrier.

b. *Remove and Disassemble Differential Case and Gear Assembly.*

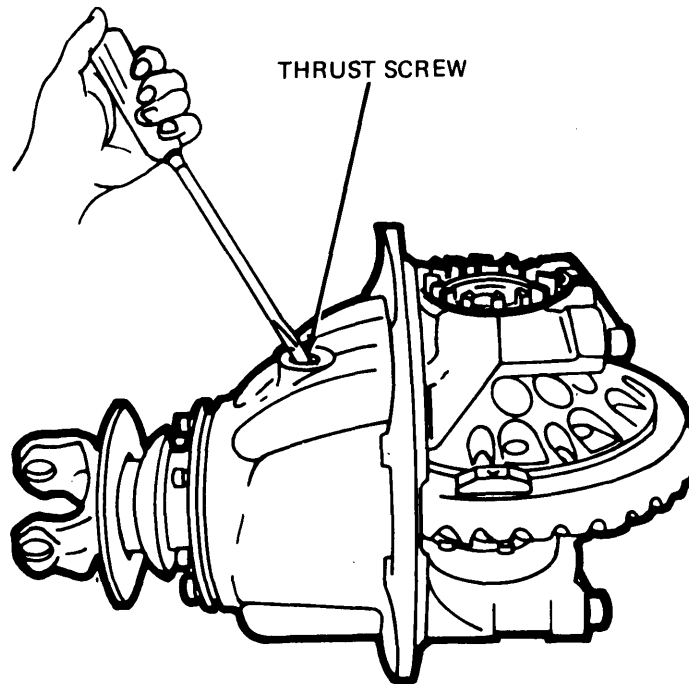
(1) Center-punch one differential carrier leg and bearing cap to identify in reassembly (fig. 10-12).



TA 074276

Figure 10-12. Mark the Carrier Leg and Bearing Cap for Reassembly.

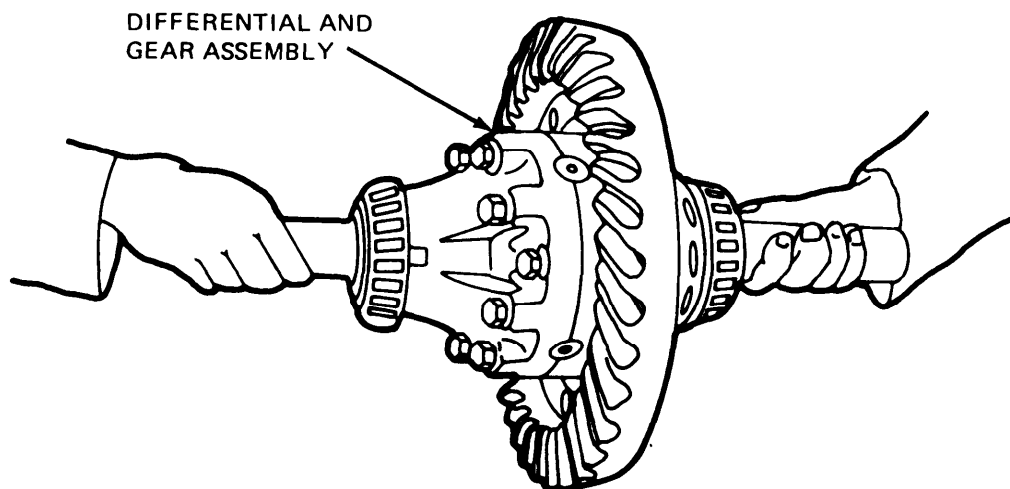
- (2) Remove the leg capscrews, washers, and cotter key.
- (3) Remove the bearing adjusting ring and the carrier cap with dowel.
- (4) Repeat steps (2) and (3) for removal of carrier cap on the opposite side.
- (5) Loosen locknut and back out-thrust screw (fig. 10-13).



TA 074277

Figure 10-13. Loosen Differential Thrust Screw.

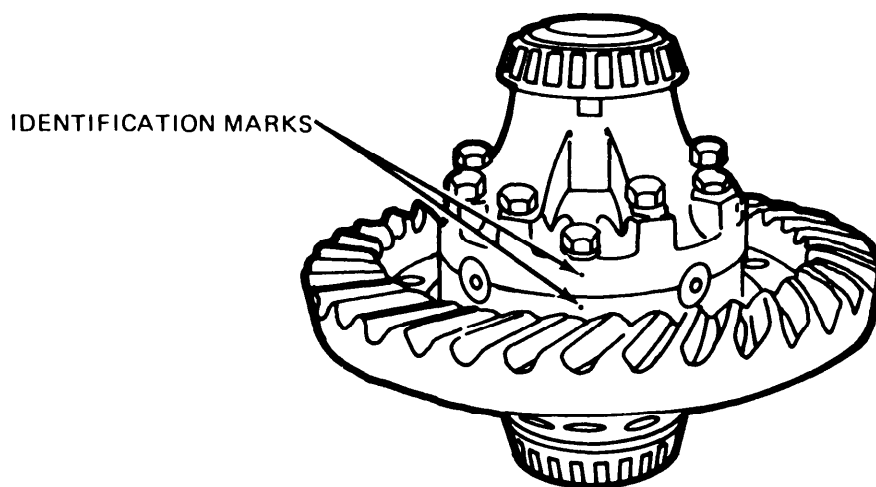
(6) Lift out the differential and gear assembly (fig. 10-14).



TA 074278

Figure 10-14. Lift Differential and Gear Out of Stand.

(7) If original identification marks are not clear, mark the differential case halves with a punch or chisel for correct alignment on reassembly (fig. 10-15).



TA 074279

Figure 10-15. Check Identification Marks on Case Halves.

(8) Remove twelve capscrews, and washers; then separate case halves (fig. 10-16 and 10-17). It may be necessary to tap sides with a mallet.

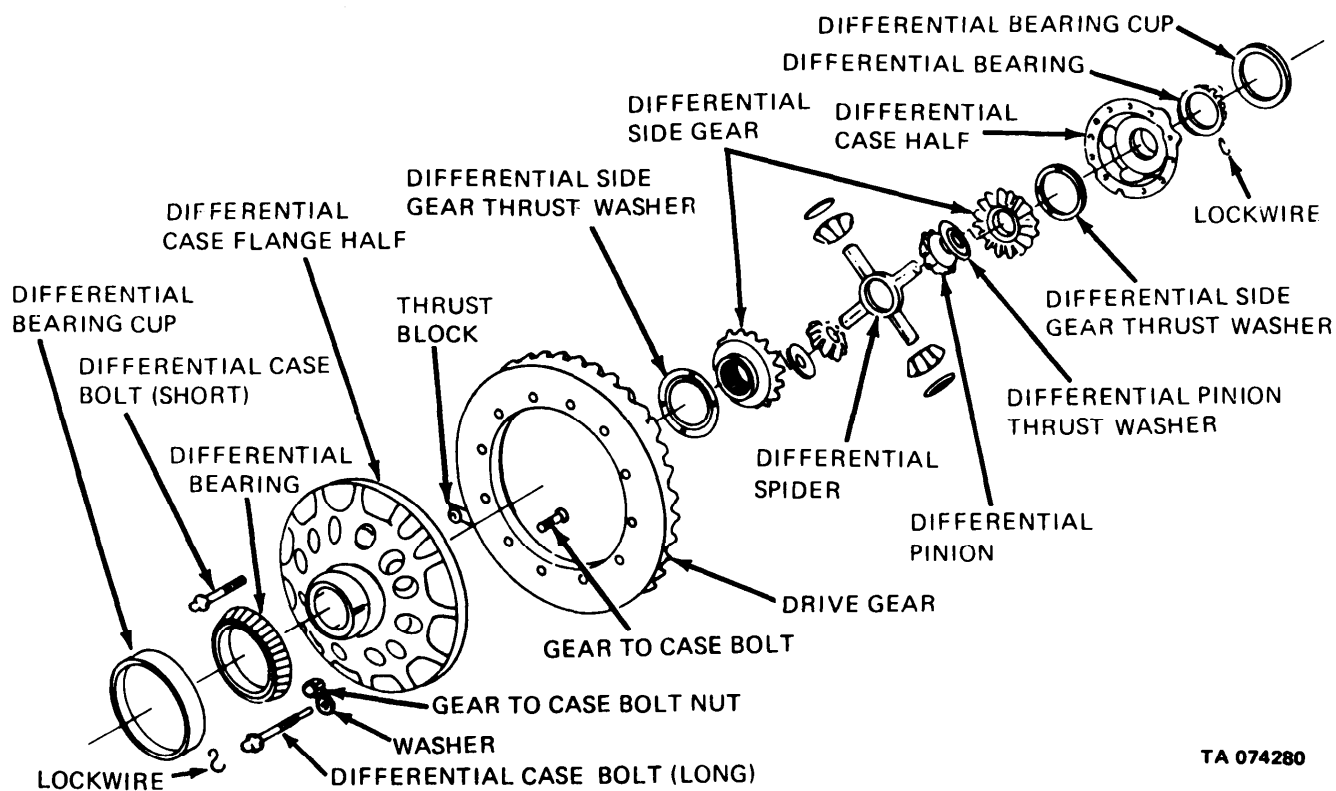


Figure 10-16. Differential Case and Ring Gear — Exploded View.

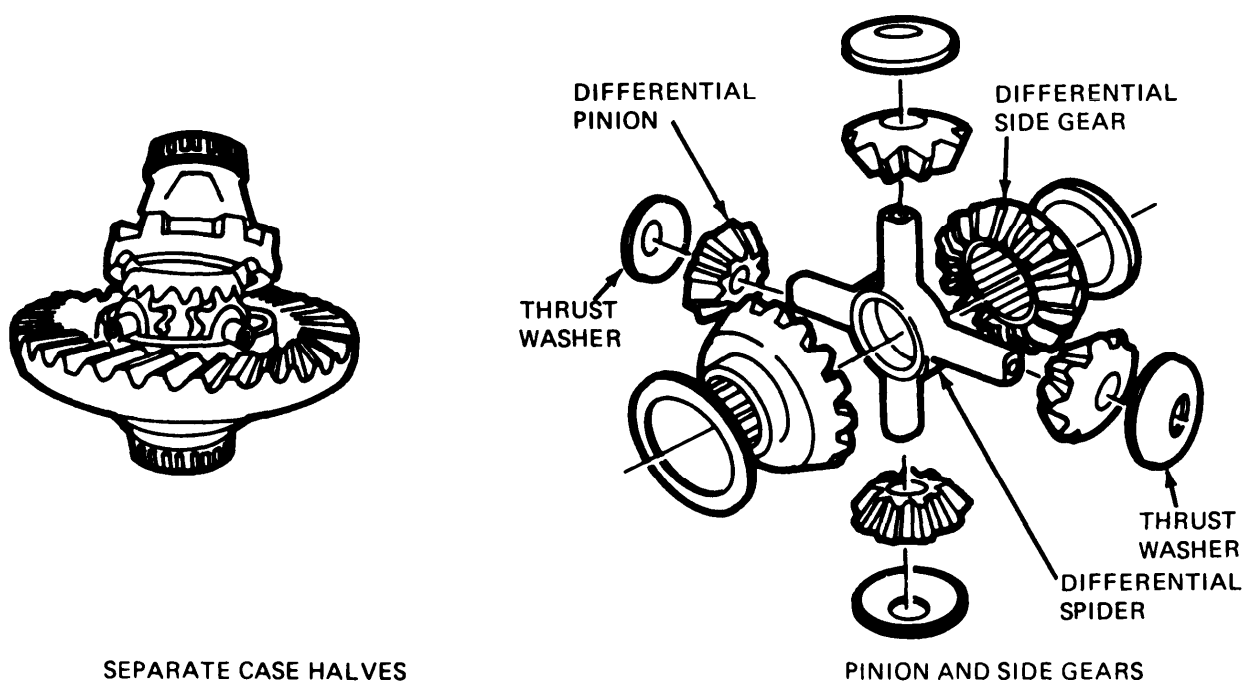


Figure 10-17. Separate Case Halves and Disassemble Pinion and Side Gears.

(9) Remove spider, spider pinions, side gears, and thrust washers (fig.10-17).

(10) If ring gear is to be replaced for any reason, remove capscrews, nuts, and washers, then separate gear from case.

(11) If necessary to replace differential bearings, remove with a suitable puller.

c. *Remove Pinion and Cage Assembly.*

(1) Hold the yoke with suitable tool and remove pinion shaft nut and washer.

(2) Remove yoke with a suitable puller.

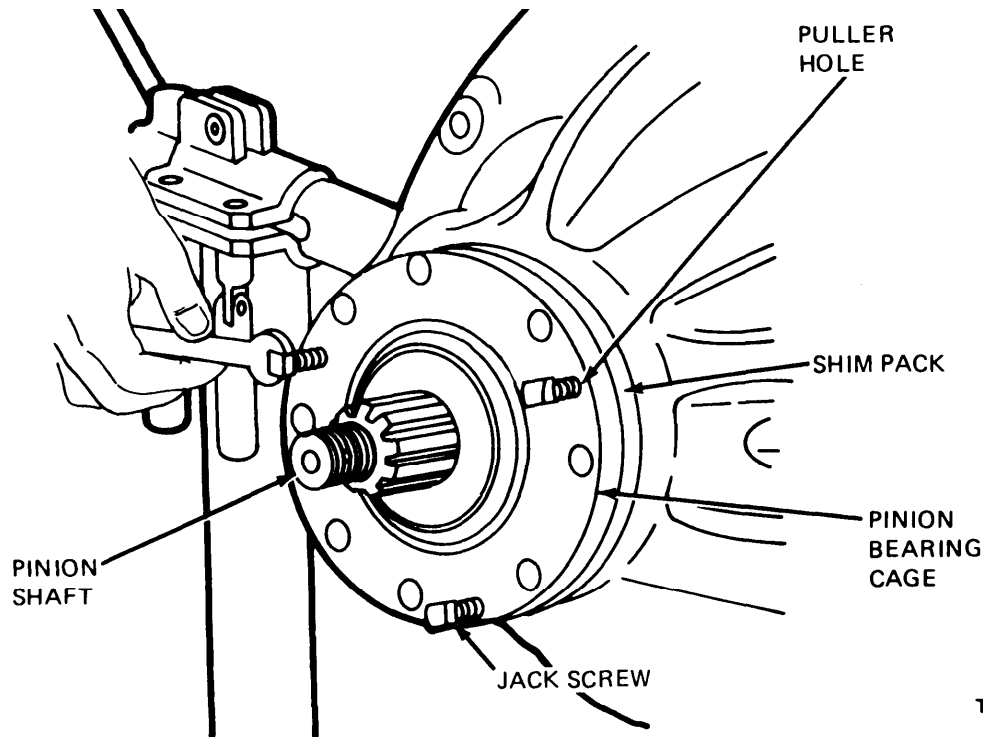
(3) Remove the pinion cage capscrews and washers.

(4) Remove the bearing cover and oil seal assembly.

CAUTION

The use of a pinch bar will damage the shims.
Driving pinion from inner end with a drift will
damage the bearing lock ring groove.

(5) Remove the bearing cage. Original may have jacking screw holes as shown in figure 10-18.



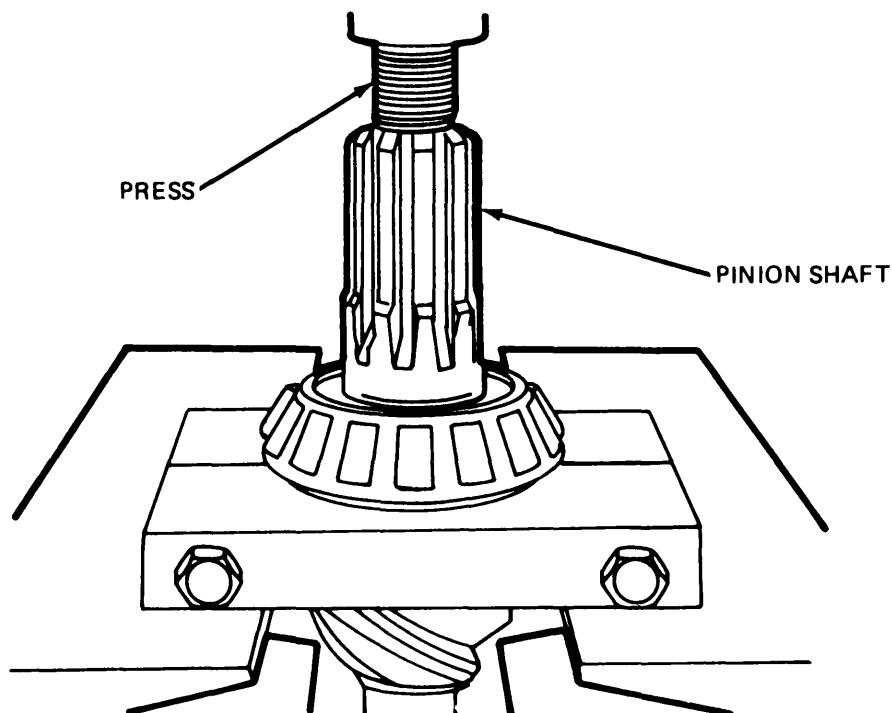
TA 074282

Figure 10-18. Remove Bearing Cage.

(6) Wire shim pack together to facilitate adjustment on reassembling.

d. *Disassemble Pinion and Cage Assembly.*

- (1) Tap shaft out of cage with soft mallet or press shaft from cage.
- (2) Remove outer bearing from cage.
- (3) Remove spacer or spacer combination from pinion shaft.
- (4) If necessary to replace rear thrust bearing or radial bearing, remove with suitable puller (fig. 10-19).



TA 074283

Figure 1019. Press Bearing Cage from Pinion Shaft.

- (5) Remove oil seal assembly from bearing cover.

10-4. Cleaning.

- a. *Ground or Polished Surface Parts.*

W A R N I N G

Exercise care to avoid skin rashes, fire hazards, and inhalation of vapors when using solvent-type cleaners.

C A U T I O N

Do not use gasoline. Do not clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates, or phosphates.

Do not steam clean assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

(1) parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in SD-2 dry cleaning solvent (item 12, App A).

(2) clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful not to damage mating surfaces.

- b. *Rough Parts.*

W A R N I N G

Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

Rough parts, such as differential carrier castings, cast brackets, and some brake parts may be cleaned in hot solution tanks with mild alkali solutions (item 25, App B) providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali. If this solution is not available, drycleaning solvent may be used.

c. Complete Assemblies. Completely assembled axles may be steam cleaned on the outside only to facilitate initial removal and disassembly, provided all openings are closed. Breathers and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

d. Drying. Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

e. Corrosion Prevention. Parts that have been cleaned, dried, inspected, and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good rust preventive and wrapped in special paper or other material designed to prevent corrosion.

10-5. Inspection.

a. Tapered Roller Bearings. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

If any of the following bearing conditions exists, the bearings must be replaced:

1. Large ends of rollers worn flush to recess, or radii at large ends of rollers worn sharp.
2. Visible step wear, particularly at the small end of the roller track.
3. Deep indentations, cracks or breaks in bearing cup and/or cone surfaces.
4. Bright rubbing marks on the dark phosphate surfaces of the bearing cage.
5. Etching or pitting on functioning surfaces.
6. Spalling or flaking on bearing cup and/or cone surfaces.

b. Drive Pinion and Ring Gears. Inspect the ring gear for wear or damage. Gears which are worn, ridged, pitted, or scored should be replaced. When necessary to replace either the pinion or ring gear of a set, the entire gear set must be replaced.

c. Differential Nest Gears. Inspect the differential assembly for the following.

(1) Check for pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions, and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

(2) Inspect for wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

d. Helical Gears. Inspect helical gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. Further, new helical gears used in sets must be permanently marked with matching or timing symbols to aid in correctly positioning the teeth of both gears at reassembly.

e. Axle Shafts. Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

10-6. Repair or Replacement.

a. General.

(1) Replace all worn or damaged parts. Hexnuts with rounded corners, all lockwasher, oil seals and gaskets or silicone gasket material should be replaced at the time of overhaul.

(2) Remove nicks, marks, and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. Studs must be tight prior to reassembling the parts.

(3) When assembling component parts, use a press where possible.

b. Silastic Application.

(1) *Removal* of all gaskets including silicone is accomplished by peeling or scraping the used gasket off the carrier-to-housing surfaces.

(2) Application of silastic (item 29, App B) is as follows:

(a) Remove dirt, grease or moisture from the surface of the carrier and housing.

(b) Dry the surface.

(c) Apply thin bead, approximately 1/8-in. diameter completely around one mating surface and all fastener holes to assure complete sealing and prevent leakage.

W A R N I N G

Minor concentrations of acetic acid vapor may be produced during application. Adequate ventilation should be provided when silicone is applied in confined areas.

Further, eye contact may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

(d) Assemble the components immediately to permit silastic to spread evenly.

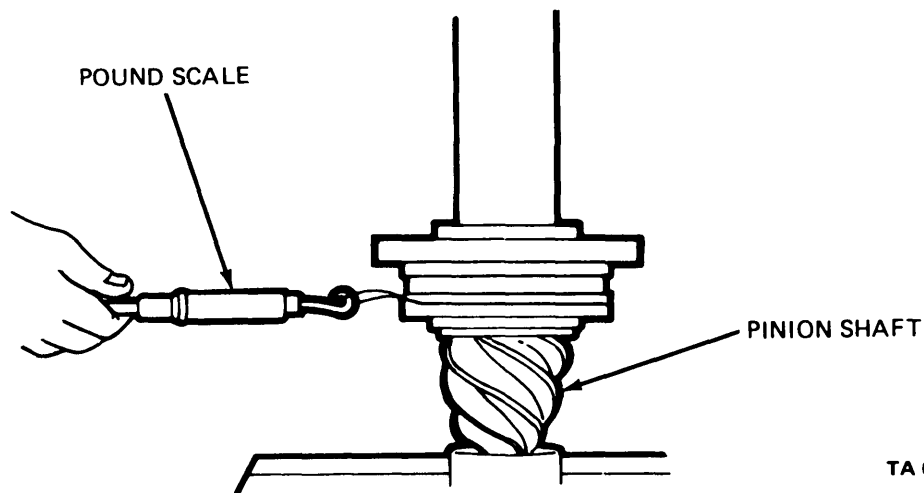
10-7. Differential Carrier Assembly.

CAUTION

Pinion gear and ring gear area matched set and have common identification numbers etched on each. Before assembly, check numbers.

a. Reassemble the Pinion and Cage Assembly.

- (1) If new CUPS are to be installed, press firmly against pinion bearing cage shoulders.
- (2) Lubricate bearings and CUPS with gear lube (item 30, App B).
- (3) press rear thrust and radial bearings firmly against the pinion shoulders with a suitable sleeve that will bear only on bearing inner race.
- (4) Install radial bearing lock ring and squeeze ring into pinion shaft groove with pliers.
- (5) Insert pinion and bearing assembly in pinion cage and position spacer or spacer combination over pinion shaft.
- (6) press front bearing firmly against spacer.
- (7) Rotate cage several revolutions to assure normal bearing contact.
- (8) While in press under pressure, check bearing preload. Wrap soft wire around cage and pull on horizontal line with pound scale (fig. 10-20). If a press is not available, the pinion nut may be tightened to the correct torque and preload checked.



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Figure 10-20. Check the Bearing Rotating Torque.

(9) Check for the following pressure and torque for pinion bearing preload:

- a. Pressure to obtain correct preload: 11 tons
- b. Nut torque to obtain correct preload: 1000-1300 lb-ft (1356-1763 N·m)²

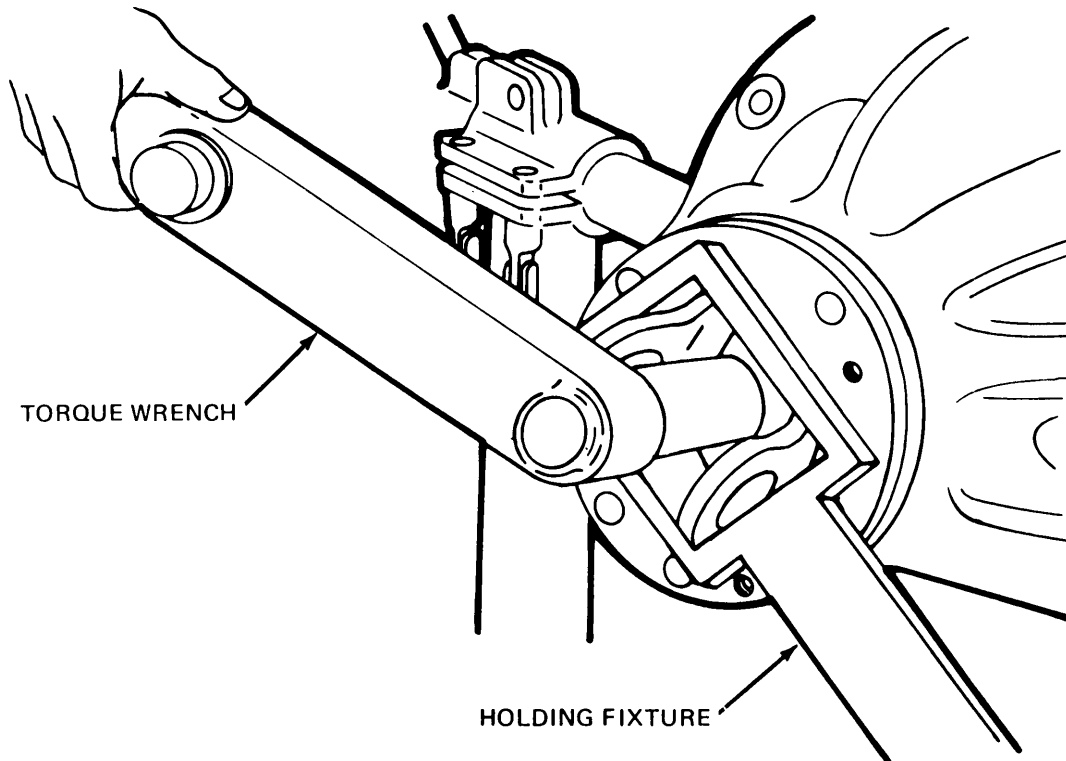
(10) If rotating torque is not within 5-25 lb-in. for new bearings or 5-15 lb-in. for reused bearings, use thinner spacer to increase or thicker spacer to decrease preload.

Example: Assuming pinion cage diameter to be 6 in., the radius would be 3 in. and with 5 lbs pull would equal 15 lb-in. preload torque.

b. Install Pinion and Cage.

(1) press flange or yoke against forward bearing and install washer and pinion shaft nut.

(2) Install pinion and cage assembly and secure with capscrews and washers. Hold flange and tighten pinion shaft nut to the correct torque. The flange must be held with a suitable tool or fixture to tighten nut (fig. 10-21).



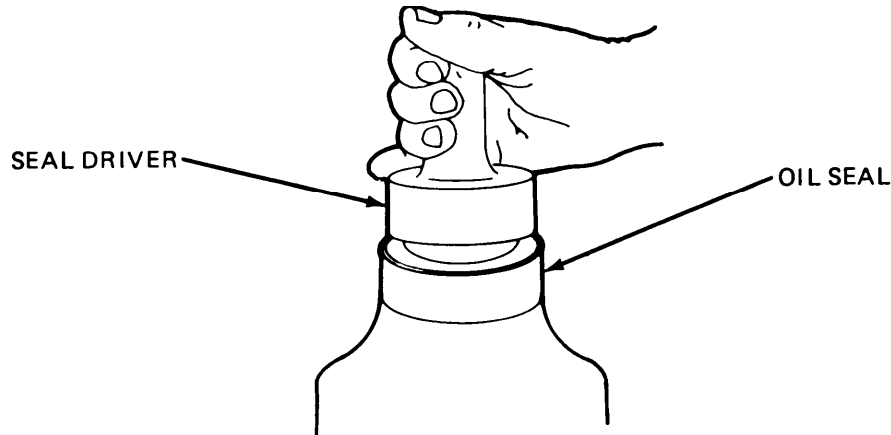
TA 074285

Figure 10-21. Tighten Pinion Shaft Nut.

(3) Recheck pinion bearing preload torque. If rotating torque is not within 5-25 lb-in. for new bearings or 5-15 lb-in. for reused bearings, repeat the foregoing procedure.

(4) Hold yoke and remove pinion shaft nut and yoke.

(5) Lubricate pinion shaft oil seal and cover outer edge of seal body with silicone sealant (item 24, App B) Compound. Press seal against cover shoulder with seal driver (fig. 10-22).



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Figure 10-22. Install Oil Seal.

(6) Install a new gasket and bearing cover.

(7) Install yoke as described in TM 9-2320-273-20,

c. Assemble the Differential and Gear.

CAUTION

The gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and case, thus resulting in gear run-out. Proper installation should, therefore, incorporate preheating the gear to assure correct interference fit and to eliminate metal pickup.

(1) Heat the ring gear in oil to approximately 160°F-180°F for about ten minutes before assembly.

(2) Install fourteen bolts, washers, and nuts. Torque to 180-230 lb-ft (244-312 N·m).

(3) Pre-lubricate the differential case inner walls and all component parts with the recommended axle lubricant.

(4) Position the thrust washer and side gear in the gear case half.

(5) Place the spider with pinions and thrust washers in position.

(6) Install the second side gear and thrust washer.

(7) Position the other case half over the assembly, aligning match marks of both halves. Draw the assembly together with three equally spaced capscrews.

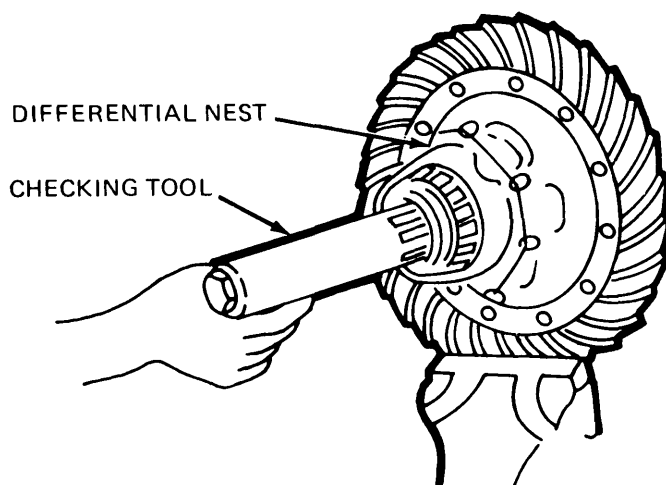
(8) Install the remaining capscrews and torque to 85-115 lb-ft(115-156 N·m).

(9) If new bearings are to be used, press squarely and firmly on the differential case halves with a suitable sleeve.

d. Rolling Resistance of Differential Nest.

(1) Place the differential and ring gear assembly in a vise with soft metal jaws.

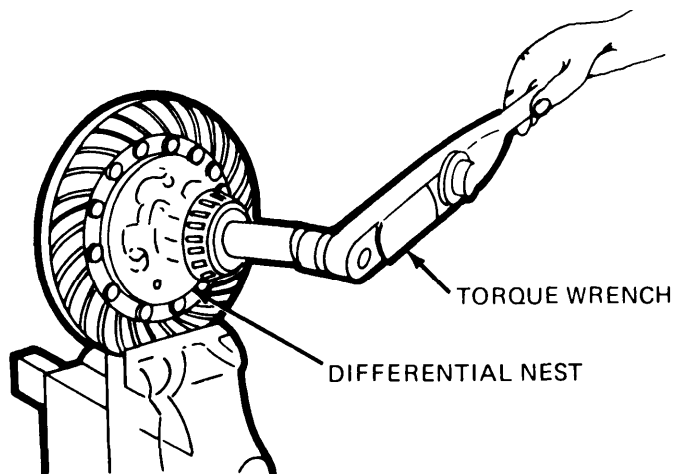
(2) Insert a checking tool (made from a splined axle shaft end) into the differential nest (fig. 10-23). Allow the splines of the tool to engage with the spline of one side gear only.



TA 074287

Figure 10-23. Install Checking Tool.

(3) Using a suitable socket and torque wrench, rotate the differential nest while observing the scale on the torque wrench (fig. 10-24). Correct rolling resistance of the differential assembly is 50 lb-ft (68 N·m) torque maximum applied to one side gear.



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Figure 10-24. Check Rolling Resistance.

e. Install Differential and Gear Assembly.

- (1) Pre-lubricate the differential bearings and cups with gear lube (item 30, App B).
- (2) Place the cups over the bearings and position the assembly in the carrier housing.
- (3) Insert the bearing adjusting nuts and turn hand-tight against bearing cups.

C A U T I O N

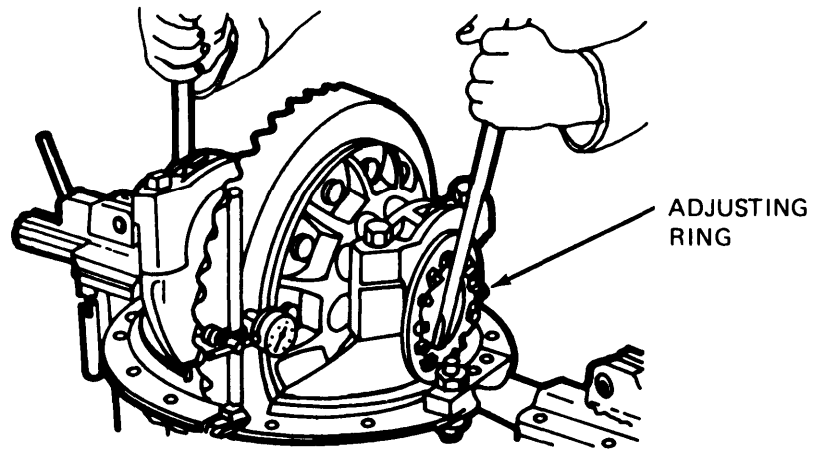
If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting nuts. Forcing the caps into position will result in irreparable damage to the carrier housing or bearing caps.

- (4) Install the bearing caps in the correct location as marked and tap lightly into position.
- (5) Install the carrier leg capscrews and washers and torque to 290-350 lb-ft (393-475 N·m).

f. Adjust the Differential Bearing Preload.

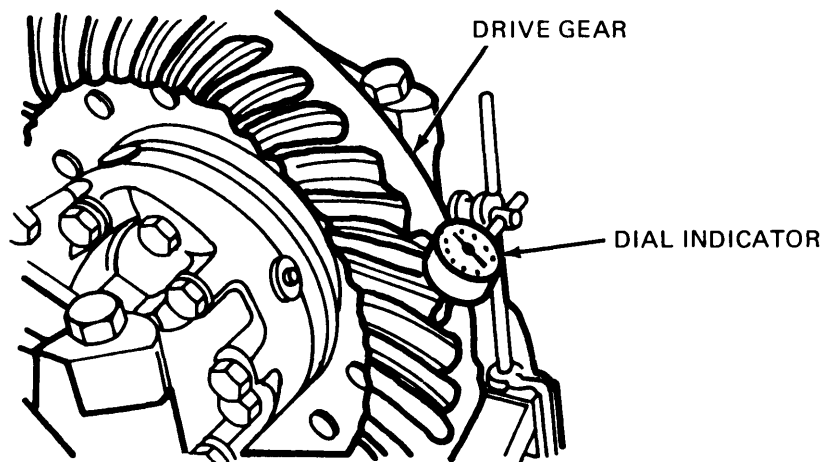
- (1) Using a dial indicator at the backface of the gear (fig. 10-25), loosen the bearing adjusting nut on *the side opposite gear on/y* sufficient to notice end play on the indicator.
- (2) Tighten the same adjusting nut only sufficient to obtain 0.000 end play.
- (3) Check the gear for run-out. If run-out exceeds 0.008 in. (0.203 mm), remove the differential and check for cause.
- (4) Starting with 0.000 end play, tighten each adjusting nut one notch. This will properly preload the differential bearings.

g. Check Gear Backlash. If the drive gear was not replaced, the established backlash recorded before disassembly should be used. For new gears the new backlash should be initially set at 0.010 in. (0.254 mm). Adjust backlash (fig. 10-26) by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.



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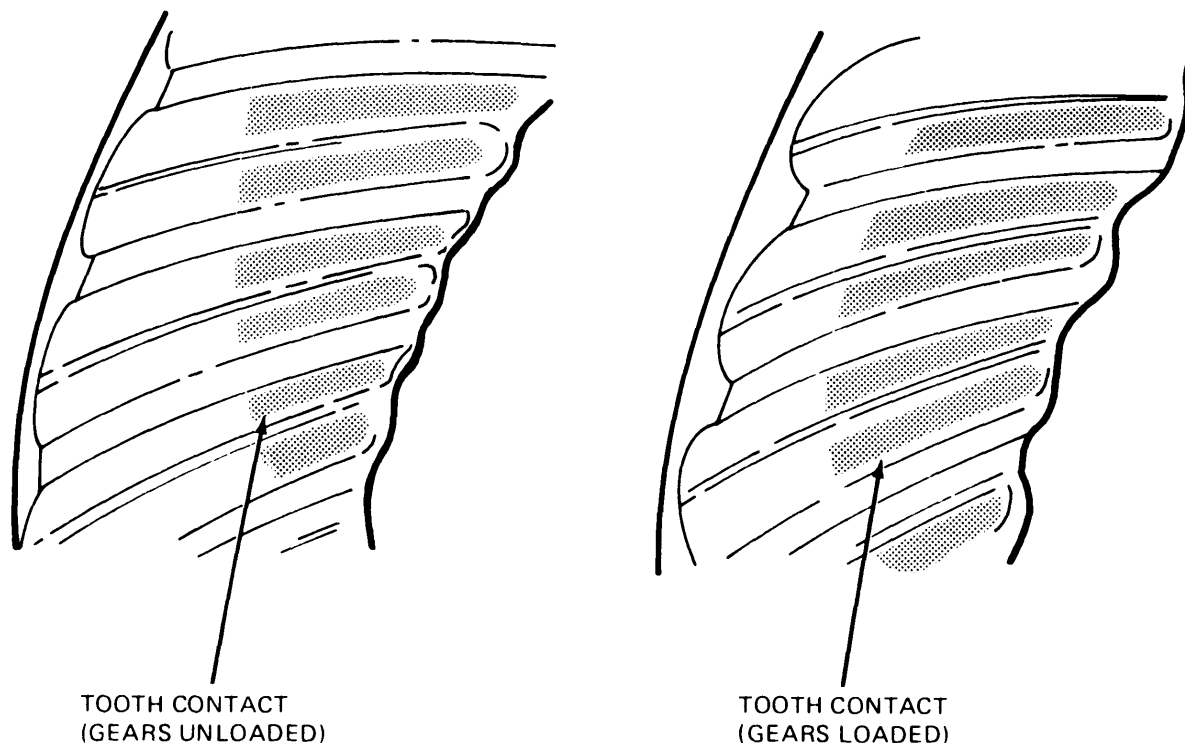
Figure 10-25. Adjust Differential Bearing Pre-Load.



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Figure 10-26. Check Gear Backlash.

h. Check Tooth Contact (fig. 10-27).



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Figure 10-27. Satisfactory Hypoid Tooth Contact.

(1) Apply a red lead compound (item 26, App B) lightly to the gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape, and location of the contacts.

(2) Sharper hand roll impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes,

(3) After obtaining a satisfactory tooth contact, the backlash can be altered within the limits of 0.005-0.015 in. (0.127-0.381 mm).

(4) A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

(5) After correct tooth contact has been established, install adjusting nut cotter pins.

(6) With adjustments properly made (pinion at correct depth and backlash set at 0.010 in. (0.254 mm) the contacts in figure 10-27 will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

(7) The hand-rolled pattern shown (gears unloaded), will result in a pattern centered in the length of the tooth when the gears are under load, as shown (fig. 10-27) (gears unloaded). The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

(8) The pattern on the coast side of teeth will appear the same width as the drive side; however, the overall length will be centered between the toe and heel of gear tooth. After the correct contacts, as shown, have been established with a backlash of 0.010 in. (0.254 mm), open the backlash to measure between 0.005-0.015 in. (0.127-0.381 mm), if required.

(9) Set used gear to have the tooth contacts to match wear patterns. Hand-rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns. Incorrect patterns are shown in figure 10-28. A low contact indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the hypoid gear may be necessary to maintain correct backlash.

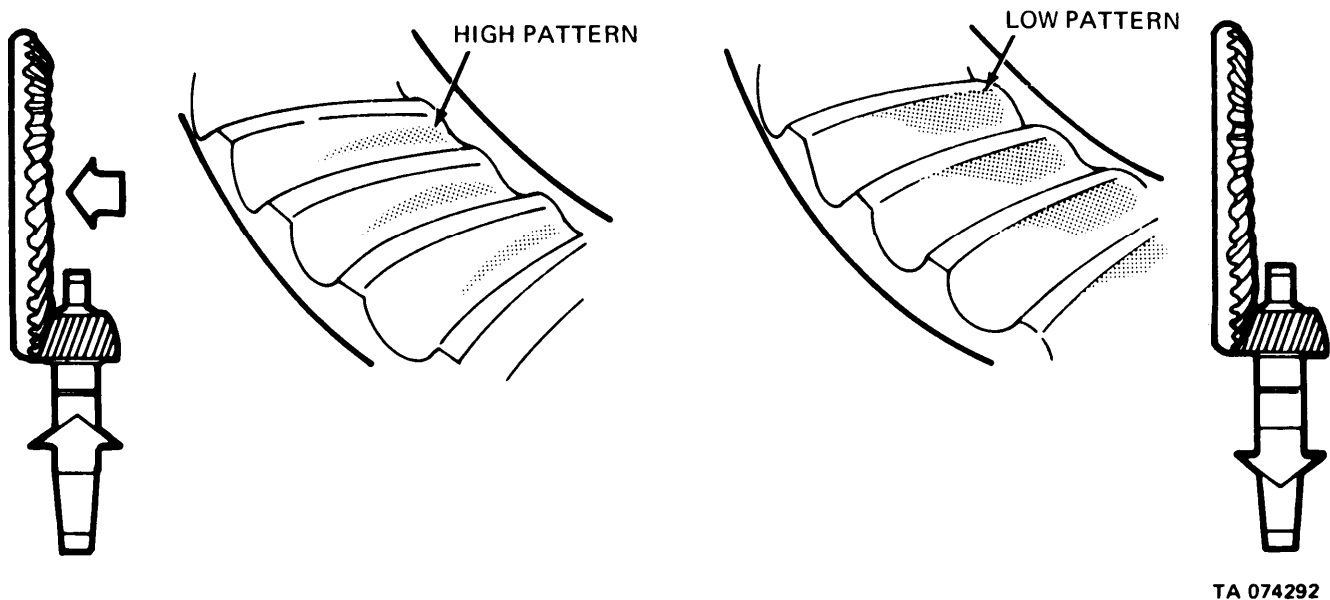


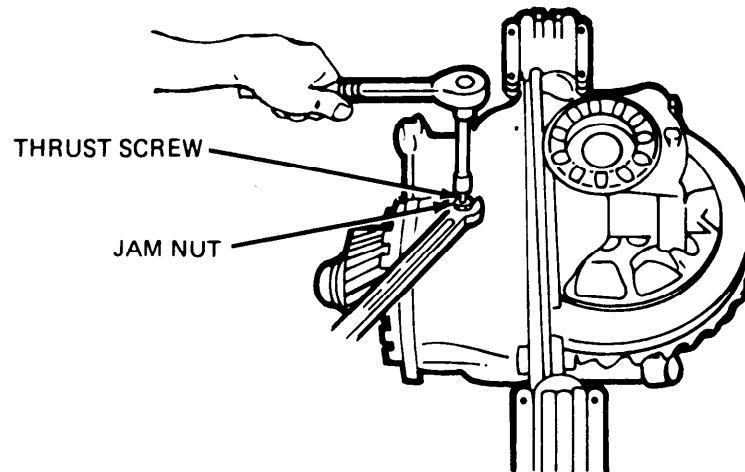
Figure 10-28. Incorrect Tooth Contact.

i. Adjust the Drive Gear Thrust Screw.

- (1) Back out thrust screw (fig. 10-29) and jam nut.
- (2) Coat thrust end of screw with grease and reinstall screw and jam nut into carrier.
- (3) Tighten screw until it is firm against back face of hypoid drive gear.

(4) To secure the correct adjustment of 0.010-0.015 in. clearance, loosen thrust screw 1/4 turn and lock securely with nut. Torque nut 40-55 lb-ft (54-75 N·m).

(5) Recheck clearance between end of thrust screw and backface of gear for 0.010-0.015 in. (0.254-0.381 mm) clearance.



TA 074293

Figure 10-29. Adjust Drive Gear Thrust Screw.

10-8. Differential Carrier Installation.

a. Clean and Inspect the Housing.

WARNING

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.).

(1) Remove any accumulation of dirt, grit or gum from the housing bowl and sleeves. Clean the housing thoroughly with dry cleaning solvent (item 12, App B) and blow dry with compressed air.

(2) Inspect the housing for cracks, nicks and burrs at machined surfaces. Remove nicks and burrs with a stone or file. Make all necessary repairs or parts replacement before installing the drive unit in housing. Be sure the housing is thoroughly cleaned after repairing.

b. Install the Differential Carrier.

(1) Apply silicone sealant material (item 24, App B) over the drive unit opening in the housing.

CAUTION

Driving carrier into the housing with a steel hammer will damage the carrier flange and cause severe oil leakage.

(2) Roll the carrier into position on a roller jack. Start the carrier into the housing with four flat washers and capscrews equally spaced. Tighten alternately to draw the carrier squarely into the axle housing.

(3) After the drive unit has been drawn up tightly to the housing, install the balance of washers and capscrews. Torque capscrews to 180-230 lb-ft (244-312 N·m).

(4) Connect the universal at the pinion shaft.

10-9. Wheel End Assembly.

a. Reassemble Universal Joints.

(1) If the cross and cap assembly was found in need of repair, replace all original parts with a complete new pre-assembled unit.

(2) Before reassembling universal yokes to the cross and cap assembly, clean all capscrews and locknuts.

(3) Assemble the universal joint securing with the four capscrews. Tighten capscrews to 00-110 lb-ft (135-170 N·m) torque. Install four jam nuts and tighten to 20-30 lb-ft (27-41 N·m) torque.

CAUTION

In step (4), do not use excessive pressure to install seal or tap seal after it has bottomed. This will crush the seal retainer and seal damage will result.

(4) If the outer drive shaft oil seal was removed, replace with new seal. Coat inner diameter of seal retainer with Permatex (item 23, App B) or equal and assemble onto shaft.

b. Install Universal Joint and Steering Knuckle in Housing.

CAUTION

In step (1), do not use excessive pressure to install seal or tap seal after it has bottomed. This will crush the seal retainer and seal damage will result.

(1) If the inner drive shaft bushing thrust washer, and oil seal were removed from the housing, reinstall these parts at this time before assembling knuckle components. Coat seal retainer outer diameter with Permatex (item 23, App B) or equal before installing.

CAUTION

In step (2), failure to use appropriate gasket material will cause leakage.

(2) If the knuckle socket plugs were removed from the axle housing, reassemble by first applying a coat of silicone sealant (item 24, App B) around one mating surface only, of either the plug or the inside shoulder of the plug bore.

NOTE

In step (3), after applying pressure to plug, wipe top of plug and bearing bore clean of any excess silicone sealant.

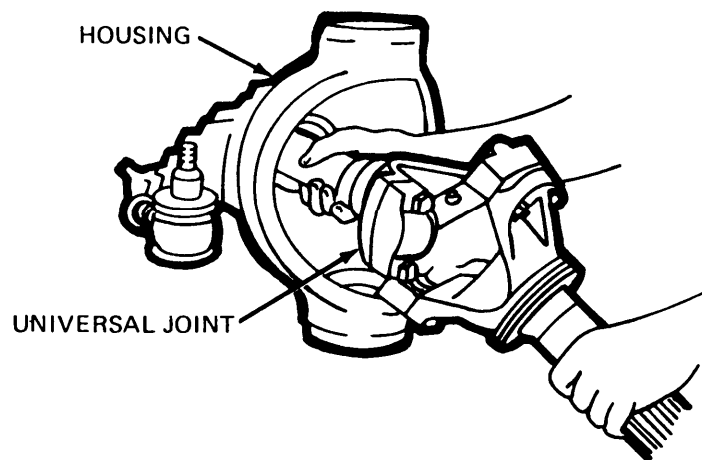
(3) place the socket plug inside its bore in the axle housing; do not allow silicone sealant material to set up. Position plug so the concave side is facing outward and apply hand pressure to the plug.

(4) Continue reassembly by installing the knuckle oil seals into the axle housing, bearing cones onto the upper and lower sleeves and the steering arm and ball stud on the knuckle upper sleeve.

NOTE

In step (5), it may be necessary to index splines of inner shaft with splines of the differential side gear for proper installation.

(5) Carefully install universal joint into housing, aline with differential side gear splines (fig. 10-30). Inspect housing seal and thrust washer to be sure they are installed properly.



TA 074294

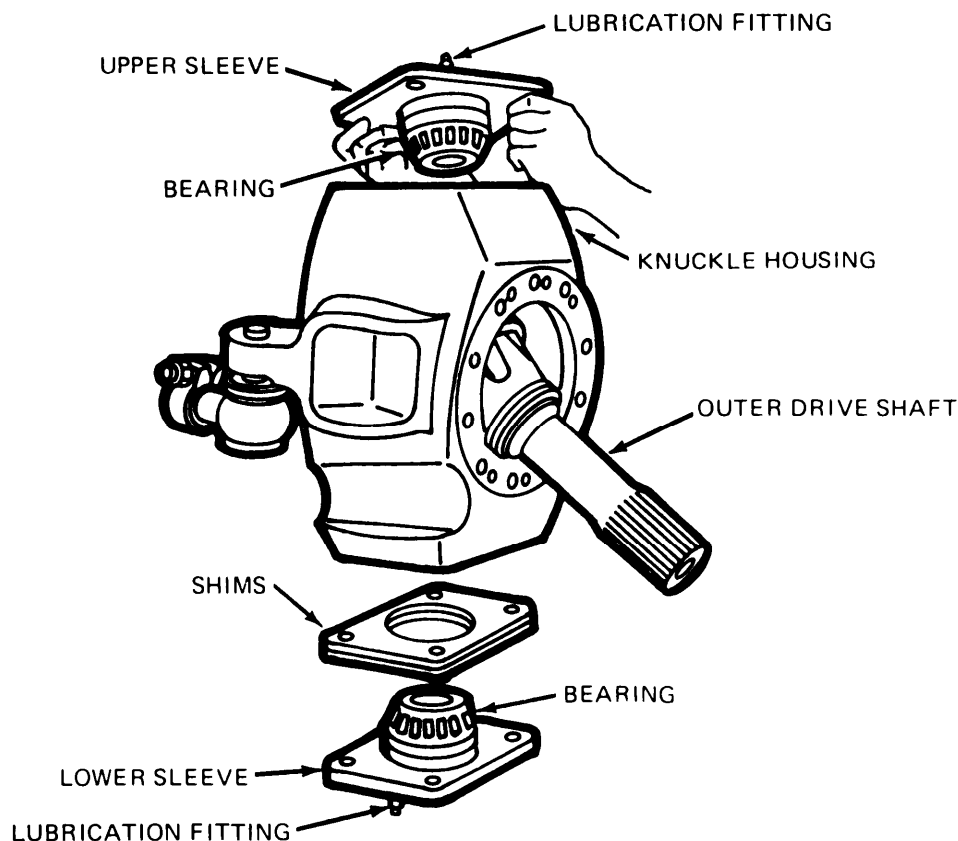
Figure 10-30. Install Universal Joint into Housing.

(6) Position the knuckle over the end of the axle housing, aligning the knuckle bores with the housing bores.

(7) Assemble the lower knuckle sleeve (fig. 10-31) and shims first. Press sleeve with shims through bottom bores of knuckle and housing until the sleeve bottoms. Install four capscrews and torque to 310-400 lb-ft (420-542 N·m).

NOTE

If original knuckles, sleeves, and bearings are reinstalled in housing, the same amount of shim thickness removed should be reinstalled.



TA 074272

Figure 10-31. Install Knuckle Sleeves.

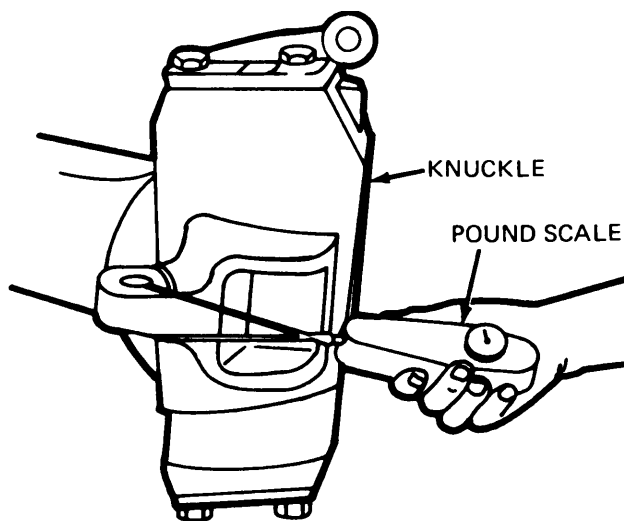
(8) Assemble upper sleeve to knuckle housing. Add shims as required between the upper sleeve and knuckle to obtain 11-15 lb-ft (15-20 N·m) preload on knuckle bearings. Use maximum of three shims and follow the procedure in paragraph c, below. If steering arm was removed, install key into arm and install into sleeve, securing with nut and cotter pin.

c. Adjust Knuckle Bearing Preload.

NOTE

To achieve an accurate bearing preload reading, do not assemble the vehicle steering arm ball stud or the cross tube (tie-rod) assembly to knuckle at this time. Use rotating torque, not starting torque.

(1) Wrap soft wire or cord around the tie-rod ball stud boss and attach a common pound scale to the wire or cord. While holding the outer shaft of the universal joint away from the spindle-to-knuckle pilot diameter, rotate the knuckle with the pound scale (fig. 10-32). Note the pounds pull indicated on the scale.



TA 074295

Figure 10-32. Measure Knuckle Rotating Torque.

(2) To achieve correct knuckle bearing preload of 11-15 lb-ft (15-20 N·m) rotating torque, the pounds pull indicated on the scale should fall between 15 and 21 lbs.

- a. If the pounds pulled on scale in step (1) is within the 15 lbs minimum and 21 lbs maximum (7-10 kg) shimming between the knuckle and sleeve and bearing preload is correct.
- b. To increase bearing preload, increase pounds pulled on scale by removing shims.
- c. To decrease bearing preload, decrease pounds pulled on scale by adding shims.

(3) If it is necessary to readjust the thickness of shims for correct knuckle bearing preload, disassemble the upper knuckle sleeve; then repeat step (8) in paragraph 10-9 *b* and steps (1) and (2) of the paragraph above.

d. Reassemble Spindle, Brake Assembly, and Oil Slinger.

(1) If felt seal and retainer assembly, oil seal wiper, and thrust washer have been removed from inside spindle, install these parts.

(2) Install two assembly studs to act as dowels into knuckle 180° apart. Tighten studs finger tight.

(3) Install spindle into knuckle pilot by slipping over assembly studs. Spindle should be installed so that wheel bearing adjusting nut keyway slot is pointed up (approximately 1 o'clock on left side of vehicle; 11 o'clock on right side).

(4) Install a suitable band around brake shoes during reassembly to the brake. Remove brake shoe return springs.

(5) Install brake assembly and oil slinger over assembly studs. Secure all parts with capscrews and washers. Assembly studs may be removed after two capscrews are installed. Torque capscrews to 180-230 lb-ft (244-312 N·m).

(6) Reinstall both brake shoe return springs using return spring pliers.

e. Reassemble Wheel Bearing and Studs into Hub.

CAUTION

Before pressing the wheel studs into position, also make sure stud serrations in corresponding holes in drum and serrations of studs align correctly. If this procedure is not followed a larger stud hole will develop, resulting in loose wheel studs.

(1) If wheel studs were removed during disassembly, place hub in a press with the inner (long) end pointing upward. Align wheel studs in hub holes and press into position. If a press is not available, a brass hammer or drift may be used to seat wheel studs. Do not strike studs with a steel hammer.

(2) If wheel bearings were removed from the hub, reassemble inner and outer bearing cups into hub using a press and suitable sleeve.

(3) Before assembling hub onto the spindle, repack bearing cones and hub cavity with grease even with the inside diameter of the bearing caps.

CAUTION

Do not use excessive pressure to install seal or tap seal after it has bottomed. This will crush the seal retainer and seal damage will result.

(4) Place the inner bearing cone in position inside the hub against its cup, and install new hub and spindle oil seal. Coat outer diameter of seal retainer with Permatex or equal and tap into position until seal bottoms in bore.

(5) Reassembly of outer bearing cone into hub is accomplished when hub is assembled onto wheel spindle.

f. Adjust the Wheel Bearing.

(1) Assemble hub assembly onto spindle, being careful not to damage oil seal in hub. Press hub until inner bearing is seated flush on the spindle.

(2) place outer bearing cone in position on the spindle and against its cup in the hub. Adjust bearings using the following procedures:

(a) Assemble and tighten bearing adjusting nut onto spindle and against outer bearing. Tighten nut to 50 lb-ft (68 N·m) torque while hub is rotated in both directions to seat bearings.

(b) Back off adjusting nut 1/6-1 1/4 turn.

(c) Assemble nut lock (retainer) and jam nut onto spindle and against adjusting nut. Torque jam nut 250-400 lb-ft (340-540 N·m).

g. Reassemble Drum and Drive Flange.

(1) Install drum over hub pilot. Install drum to hub by installing five flathead capscrews. Tighten capscrews to 15-30 lb-ft (20-40 N·m) torque.

(2) Coat inside hub mating surface of drive flange with silicone sealant.

(3) Apply wheel bearing grease to internal splines of drive flange and external splines of outer universal joint shaft.

(4) Assemble the drive flange onto hub and secure with washers and capscrews. Torque capscrews to 180-230 lb-ft (244-312 N·m).

h. Reassemble the Cross Tube onto Knuckle.

(1) Insert cross tube end assembly shaft through bottom of bore in knuckle arm.

(2) Secure cross tube to knuckle by assembling slotted nut to ball stud through knuckle flange. Torque nut to 165-230 lb-ft (224-312 N·m), Then advance nut to next available cotter pin slot. Final torque should be no more than 300 lb-ft (407 N·m) maximum. Insert cotter pin.

(3) Complete reassembly procedures by assembling wheel (rim and tire) to hub.

i. Adjust the Wheel Toe-in. (Refer to TM 9-2320-273-20 for procedure.)

CHAPTER 11

REPAIR OF M915 REAR TANDEM AXLE

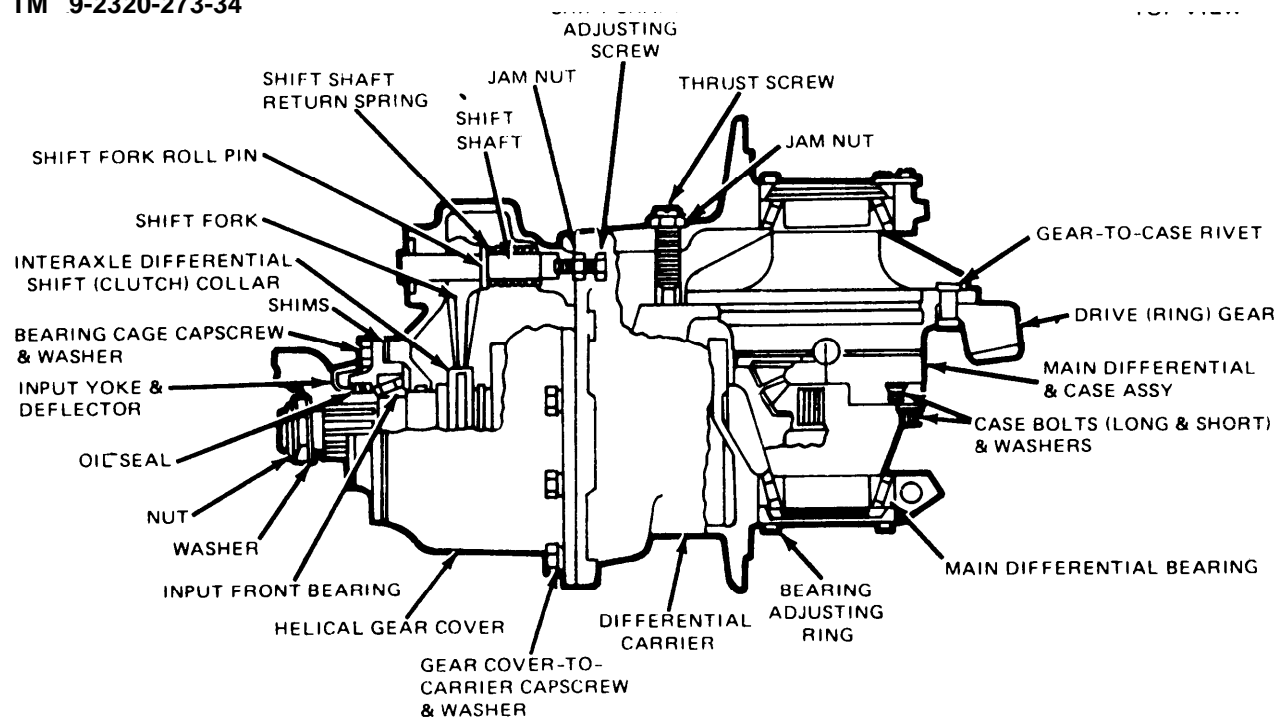
Section 1. FORWARD REAR AXLE

11-1. Description. The forward rear drive unit of the tandem axles is a front-mounted, single-reduction, through-drive type employing a two-gear transfer train. The unit incorporates hypoid reduction gears and bevel type gears in the main differential assembly and interaxle differential assembly, which is located behind the helical drive gear on the input shaft (fig. 11-1 and 11-2). Except for a straight roller bearing on the drive pinion, tapered bearings are employed throughout the unit. Lubrication of this drive unit is accomplished by both the gravity feed (splash) and forced systems. To lubricate the interaxle differential assembly, a pump is employed to force oil through passageways and grooves in the helical gear cover and input shaft. The pump is driven by an integral gear on the input shaft which meshes with the pump drive gear. The gravity feed/oil splash system is used to lubricate all other areas of the drive unit.

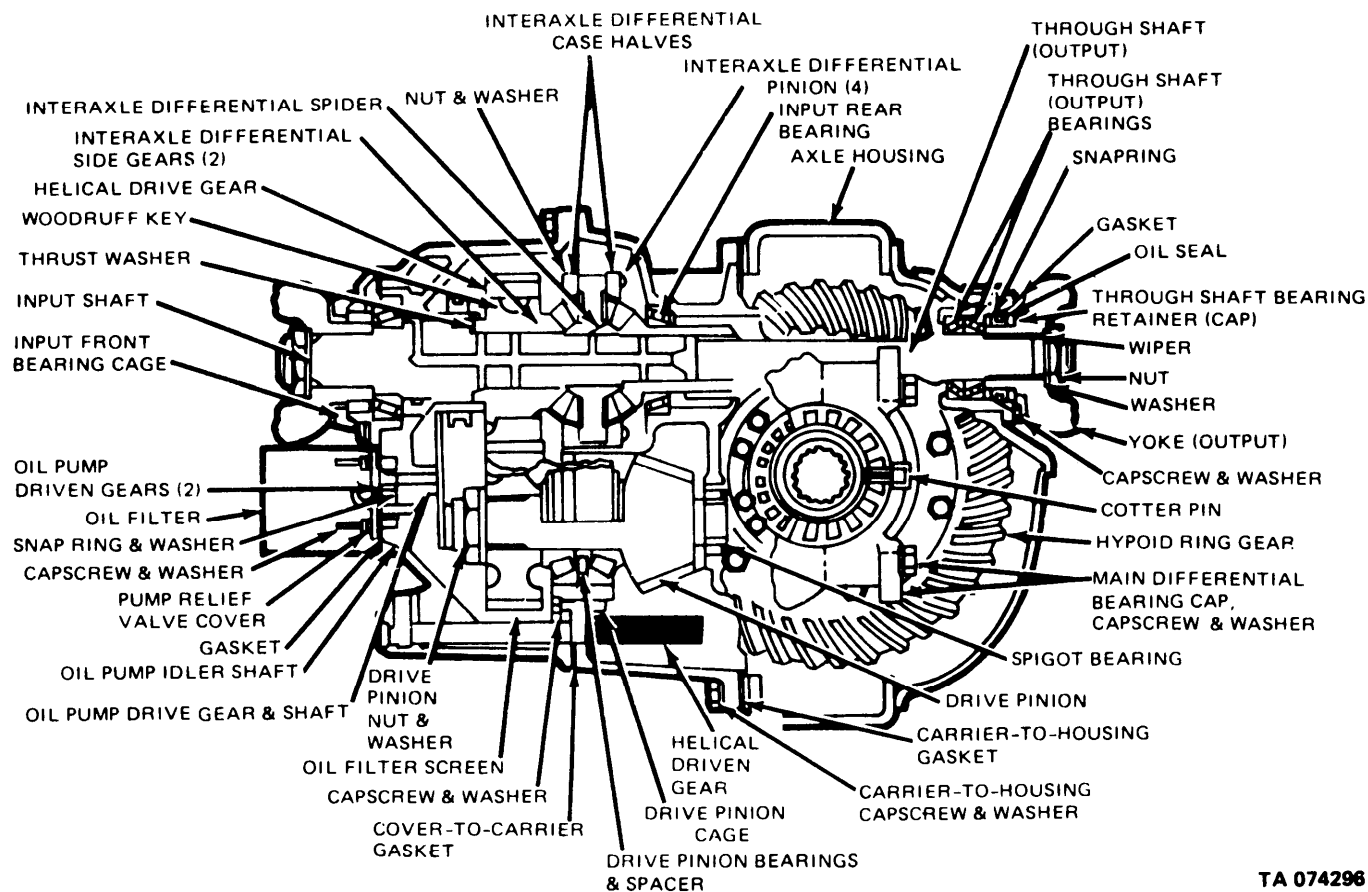
11-2. Positive Locking Differential. The axle incorporates a no-spin positive locking main differential that performs two functions: acts as standard differential to compensate for differences in wheel travel when vehicle is turning or traveling over uneven ground; and prevents wheel spin when one wheel loses traction.

a. When a vehicle is being driven in a straightforward direction, the spider and driven members of the main differential are fully engaged and allow equal torque to be distributed to both rear wheels. Gear teeth on the spider and driven members are so positioned that neither wheel can turn more slowly than the ring-gear speed. If one wheel should lose traction momentarily by rolling onto ice or snow, or over a soft shoulder of the road, the opposite wheel, which still has traction, continues to pull the vehicle until the traction is regained by both wheels,

b. In normal operation when the right wheel passes over an obstruction, or if the vehicle makes a left turn, the right wheel must travel faster and farther than the left wheel. When this situation occurs, the differential automatically allows for the difference in wheel travel. The left driven member remains completely engaged with the spider and continues to drive the vehicle. The right driven member automatically disengages from the spider, allowing the outer wheel to free-wheel around the corner. When the vehicle returns to the smooth surfaced straightaway, the spider automatically re-engages the left driven member and both wheels again drive the vehicle,

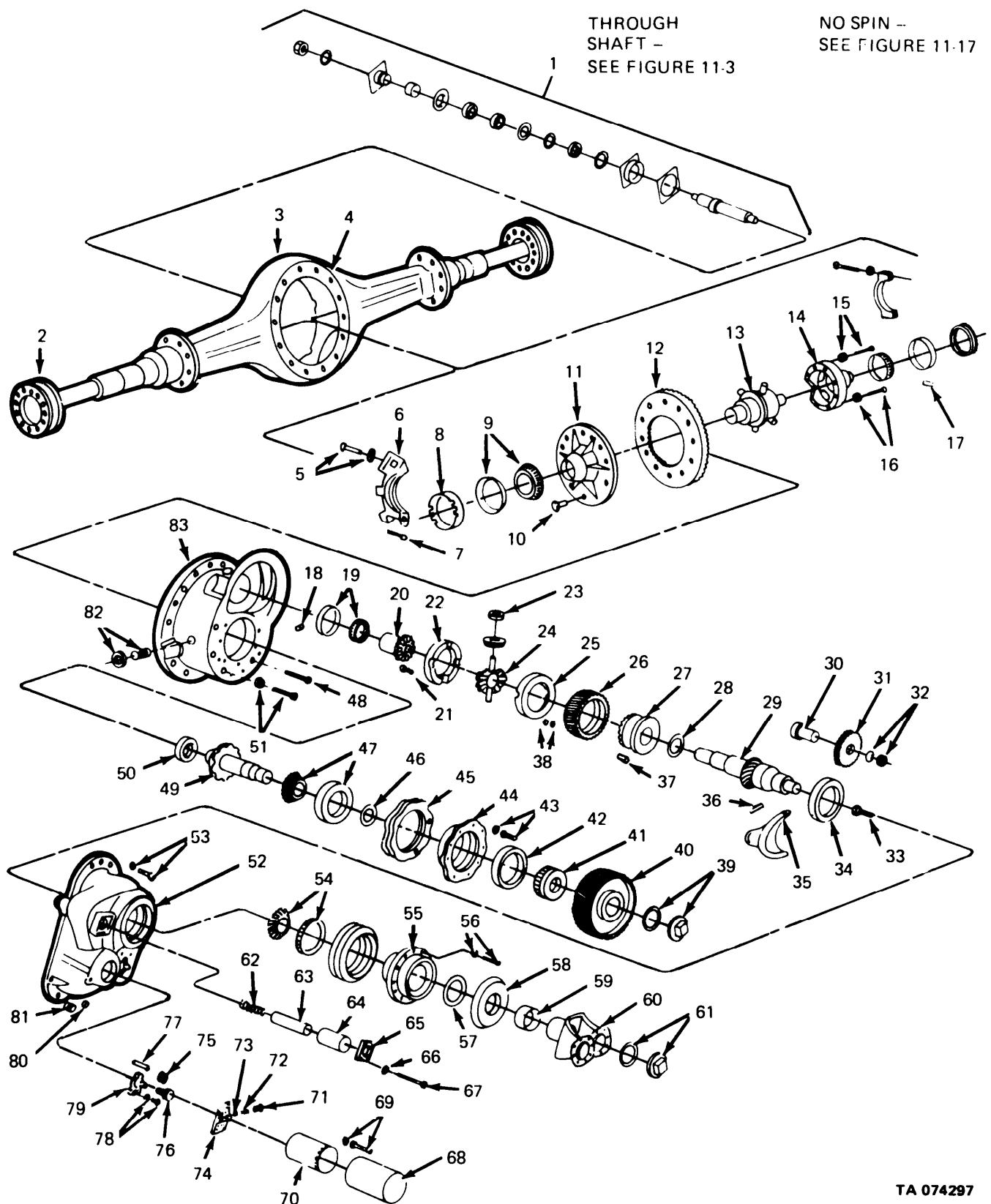


SIDE VIEW



TA 074296

Figure 11-1. Forward Rear Axle Differential Carrier Cross Section.



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Figure 11-2. Forward Rear Axle Differential Carrier - Exploded View. (Sheet 1 of 2)

LEGEND:

- | | |
|---|---|
| 1. THROUGH SHAFT | 43. CAPSCREW & WASHER |
| 2. AXLE SHAFT | 44. PINION BEARING CAGE |
| 3. AXLE HOUSING | 45. SHIMS |
| 4. GASKET | 46. SPACER |
| 5. BEARING CAP CAPSCREW & WASHER | 47. PINION BEARING CUP & CONE |
| 6. DIFFERENTIAL BEARING CAP | 48. OIL FILTER SCREEN |
| 7. COTTER PIN | 49. DRIVE PINION |
| 8. ADJUSTING RING | 50. SPIGOT BEARING |
| 9. DIFFERENTIAL BEARING CUP & CONE | 51. CAPSCREW & WASHER |
| 10. DIFFERENTIAL CASE-TO-DRIVE GEAR RIVET | 52. HELICAL GEAR COVER |
| 11. DIFFERENTIAL CASE (FLANGE HALF) | 53. GEAR COVER-TO-CARRIER CAPSCREW & WASHER |
| 12. DRIVE GEAR DIFFERENTIAL | 54. INPUT FRONT BEARING - CUP & CONE |
| 13. NO SPIN | 55. BEARING CAGE |
| 14. DIFFERENTIAL CASE (PLAIN HALF) | 56. CAPSCREW & WASHER |
| 15. DIFFERENTIAL CASE BOLT (LONG) & WASHER | 57. OIL SEAL |
| 16. DIFFERENTIAL CASE BOLT (SHORT) & WASHER | 58. SLINGER |
| 17. DOWEL | 59. WIPER |
| 18. OIL PLUG | 60. YOKE |
| 19. INPUT REAR BEARING - CUP & CONE | 61. WASHER & NUT |
| 20. DIFFERENTIAL SIDE SCREW | 62. SHIFT SHAFT RETURN SPRING |
| 21. CAPSCREW & WASHER | 63. SHIFT SHAFT |
| 22. DIFFERENTIAL CASE HALF | 64. SHIFT UNIT AIR CHAMBER |
| 23. DIFFERENTIAL PINION THRUST WASHER | 65. SHIFT UNIT COVER |
| 24. DIFFERENTIAL SPIDER | 66. BOLT RETAINER |
| 25. DIFFERENTIAL CASE HALF | 67. BOLT |
| 26. HELICAL DRIVE GEAR | 68. OIL FILTER COVER |
| 27. DIFFERENTIAL SIDE GEAR | 69. CAP SCREW & WASHER |
| 28. THRUST WASHER | 70. OIL FILTER |
| 29. INPUT SHAFT | 71. PLUG |
| 30. OIL PUMP DRIVE | 72. SPRING |
| 31. OIL PUMP DRIVE GEAR | 73. BALL |
| 32. SNAP RING & WASHER | 74. OIL PUMP RELIEF VALVE |
| 33. SHIFT SHAFT ADJUSTING SCREW & JAM NUT | 75. PUMP GEAR (DRIVEN) |
| 34. DIFFERENTIAL SHIFT (CLUTCH) COLLAR | 76. PUMP GEAR (DRIVEN) |
| 35. SHIFT FORK | 77. IDLER SHAFT |
| 36. PEN | 78. CAPSCREW & WASHER |
| 37. WOODRUFF KEY | 79. OIL FILTER ADAPTER |
| 38. WASHER & NUT | 80. PLUG |
| 39. PINION NUT & WASHER | 81. OIL PLUG |
| 40. HELICAL DRIVE GEAR | 82. THRUST SCREW & JAM NUT |
| 41. PINION BEARING CUP | 83. DIFFERENTIAL CARRIER |
| 42. PINION BEARING CONE | |

TA 074298

Figure 11-2. Forward Rear Axle Differential Carrier – Exploded View. (Sheet 2 of 2)

11-3. Through Shaft (Output Shaft) Removal and Disassembly.

a. Removal.

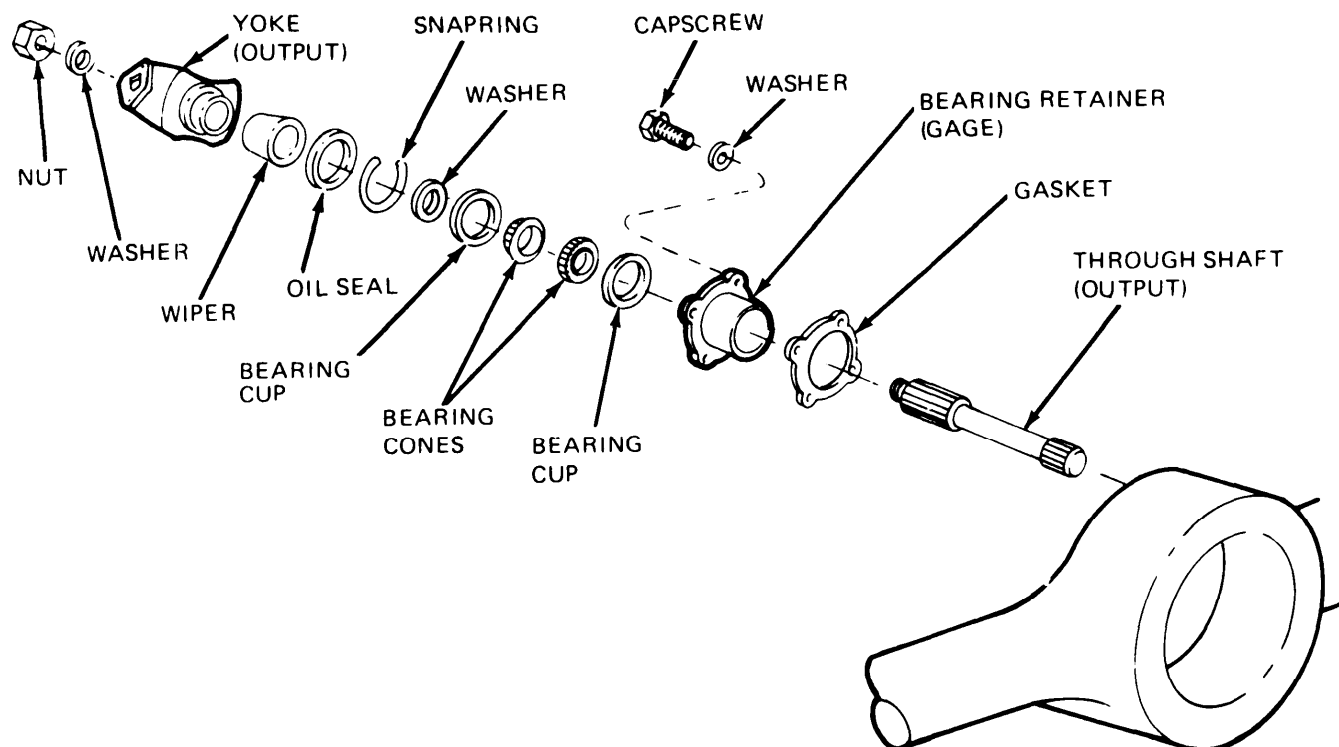
(1) If the unit is in the vehicle, disconnect rear propeller shaft.

(2) Remove the output shaft nut (fig. 11-3) yoke and washer. It may be necessary to use a yoke puller to remove the yoke from the shaft.

(3) Remove output shaft bearing retainer (cage), capscrews and washers and pull the cage, shaft, and bearing assembly from the axle housing. To free the cage from the housing, it may be necessary to tap the shaft and cage with a soft mallet. Care must be taken not to damage seal. Also, remove the bearing cage to housing gasket.

*b. Disassembly.***CAUTION**

The spacer diameter must be less than the outer diameter of the through-shaft to avoid damaging the oil seal and bearings in the next step.



TA 074299

Figure 11-3. Remove and Disassemble the Through-Shaft.

(1) press the output shaft (fig. 11-3) from the bearing cage by placing the shaft and cage in a press, cage to the top. Use a spacer against the through shaft threaded end and press the shaft from the bearings and cage.

NOTE

The oil seal, snap ring spacer and bearings will remain in the bearing cage. If disassembly is required, continue with step *b*; otherwise set aside for assembly.

(2) Remove the oil seal from the cage, using a suitable tool such as a screwdriver to pry seal out. Be careful not to damage the inner diameter of the cage. Discard seal after removal.

(3) Disassemble the snap ring bearing spacer from its groove in the cage inner diameter using snap ring pliers.

(4) Remove both inner and outer bearings (cups and cones) from the cage and spacer washer.

11-4. Differential Carrier Removal.

a. Preparation.

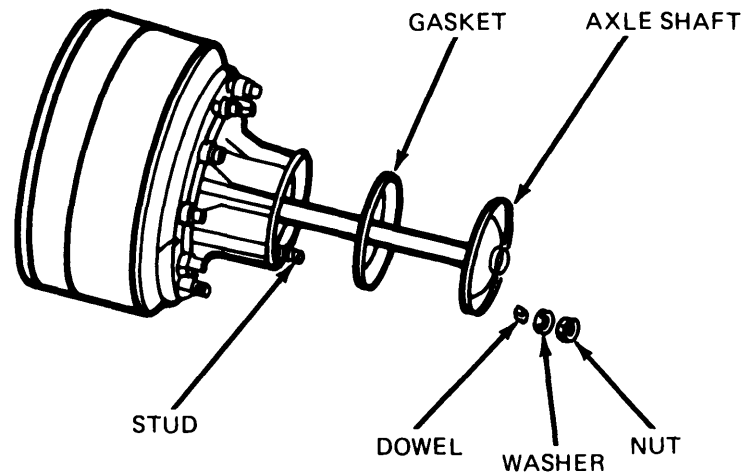
(1) Remove plug from bottom of axle housing and drain lubricant. Do not remove filter plug.

b. Removal.

C A U T I O N

In step (1), do not hit the circular driving lugs on the shaft head. This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels. This will damage the hub, shaft and oil seal.

(1) Remove the axle shaft stud nuts (fig. 11-4), washers, and tapered dowels. To loosen the dowels, hold a 1 1/2-in. diameter brass drift against the center of the axle shaft head, inside the circular driving lugs. Strike the drift a sharp blow with a 5-6 lb hammer or sledge. A 1 1/2-in. diameter brass hammer is an excellent and safe drift.



TA 074300

Figure 11-4. Remove Axle Shaft.

- (2) Remove the right and left axle shafts.
- (3) if unit is in vehicle, disconnect the forward propeller shaft.
- (4) If unit is in vehicle, disconnect air lines at the interaxle differential shift unit.
- (5) To remove carrier from housing, first loosen the two top capscrews and leave attached to the housing. This will prevent the carrier from falling.
- (6) Remove all other capscrews and washers.
- (7) Break the carrier loose from the housing with a rawhide mallet.
- (8) To remove the carrier from the housing, place a roller jack under the carrier. Remove top capscrews and washers and work carrier free. A small pinch bar may be used to straighten carrier in housing bore. However, the end must be rounded to prevent indenting the carrier flange. Discard carrier-to-housing gasket.

11-5. Differential Carrier Disassembly.

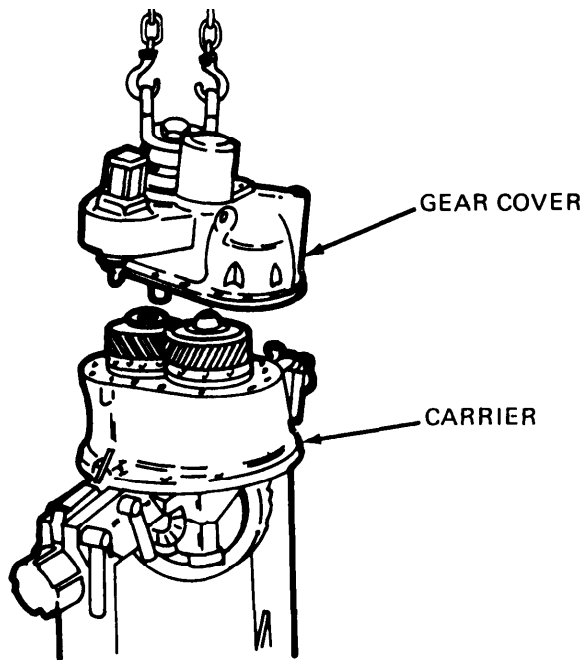
a. Remove Helical Gear Cover Assembly.

- (1) Place the complete drive unit in a suitable repair stand. Lift the unit by the input (front) yoke using a chain fall.
- (2) Place the drive unit (attached to repair stand) in an upright position (input yoke pointing upward).
- (3) Using a suitable wrench or socket, loosen the input yoke nut. However, do not remove. Leave the nut and yoke on the input shaft at this time to facilitate gear cover removal.
- (4) Remove helical gear cover to carrier capscrews and washers.

CAUTION

Do not use pry bars, chisels or wedges to loosen the cover. This will damage the cover and carrier flange mating surfaces.

(5) Separate the gear cover from the carrier by attaching a chain fall to the input yoke (fig. 11-5). It may be necessary to use a rawhide mallet to break the cover from the carrier.



TA 074301

Figure 11-5. Remove Helical Gear Cover Assembly.

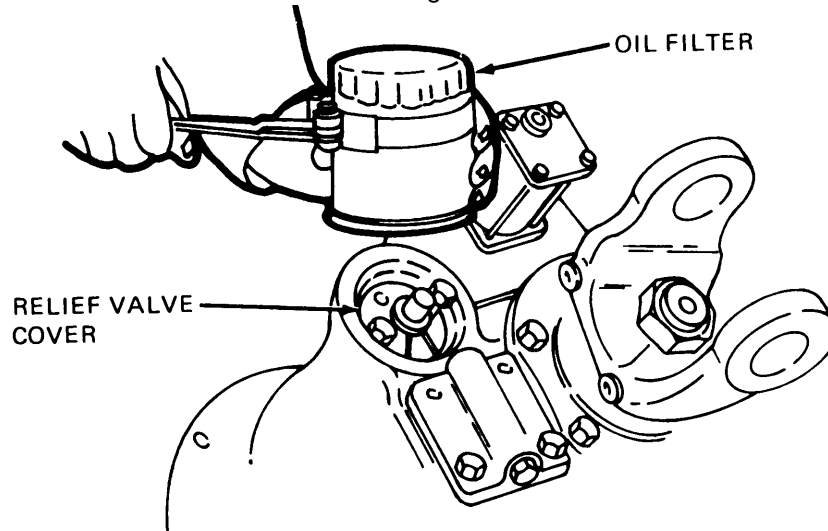
(6) After separating the parts, remove the cover-to-carrier gasket or gasket material and discard.

b. Remove Oil Filter and Pump.

NOTE

There may be approximately one pint of lubricant remaining within the filter. Be careful not to spill it when removing the filter.

(1) Remove two oil pump relief valve cover capscrews securing the filter cover (fig. 11-6). Remove the oil filter cover and filter from the helical gear cover. Use a suitable filter strap wrench.

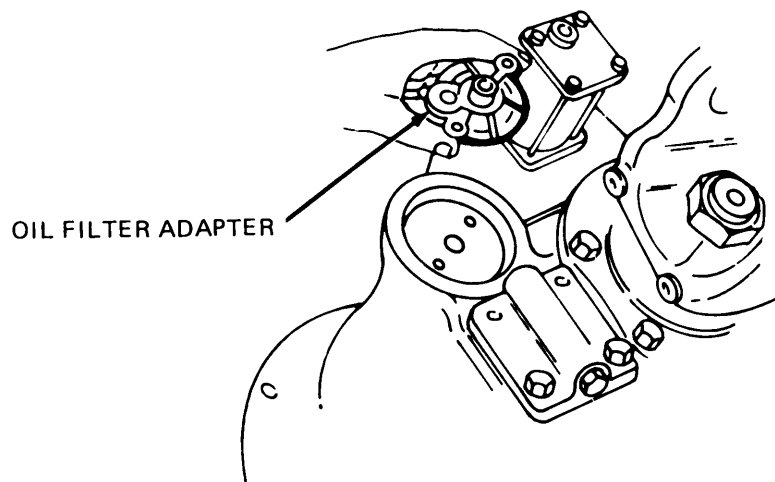


TA 074302

Figure 11-6. Remove Oil Filter.

(2) Disassemble the oil filter adapter from the gear cover by removing capscrews and washers (fig. 1 1-7).

(3) Check the adapter casting and threads on the filter mounting tube. If threads are stripped or casting is cracked, discard and replace during reassembly.

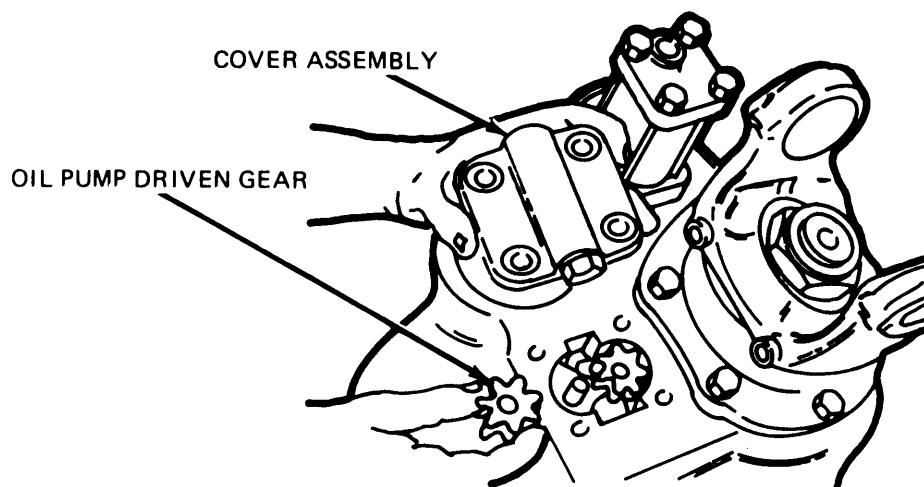


TA 074303

Figure 11-7. Remove Oil Filter Adapter.

(4) Disassemble the oil pump relief valve cover assembly from the gear cover. Remove the remaining two capscrews and washers and lift the cover from the pump.

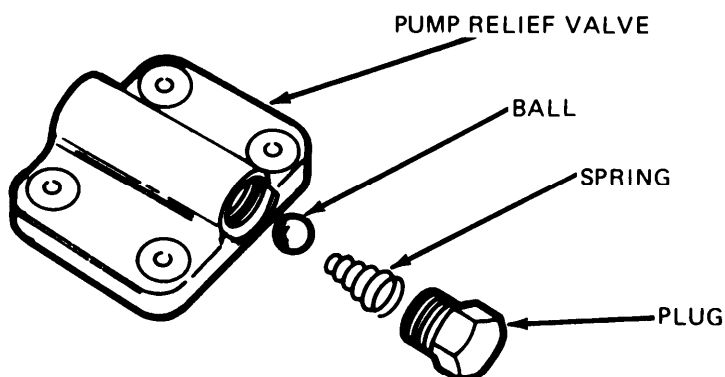
- (5) Remove the pump oil driven gears from their shaft within the oil pump cavity (fig.11-8).



TA 074304

Figure 11-8. Remove Oil Pump Relief Valve Cover Assembly and Oil Pump Gears.

- (6) Disassemble the oil pump relief valve cover assembly by unthreading the hollow capscrew (plug) and removing the spring and ball from the cover cavity (fig. 11-9).



TA 074305

Figure 11-9. Disassemble Oil Pump Relief Valve.

- c. Remove Input Shaft, Forward Bearing, and Shift Collar.

NOTE

To remove the interaxle differential shift collar, it is necessary to disassemble the input shaft from the helical gear cover. Use the following procedure.

- (1) Remove the input yoke nut from the input shaft.

CAUTION

If the input oil seal is not to be serviced, care must be taken when pulling the yoke so as not to damage the seal in the bearing. Do not use a hammer to loosen yoke. This will damage the yoke and splines and cause excessive yoke runout and misalignment.

- (2) Remove the input yoke from the shaft using a yoke puller (fig. 11-10).

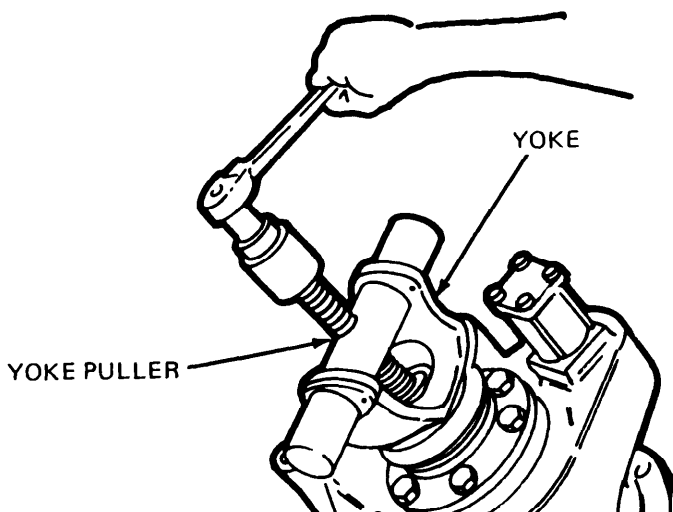


Figure 11-10. Remove Input Yoke.

TA 074306

NOTE

In step (3), as the input shaft is pressed through the helical gear cover and the interaxle differential shift collar inside the cover, the collar will drop from the shift fork and shaft. Also, the input bearing will remain loose in the cover. If seal and/or bearing removal is necessary, continue with step (4).

- (3) *Using* a press, remove the input shaft from the helical gear cover. Press out shaft from the front (input) end.

- (4) Disassemble the input bearing cage from the helical gear cover by removing cage-to-cover capscrews and lockwashers. Remove bearing cage, bearing, and shim pack. The bearing cup will remain in the cage.

- (5) Remove the oil seal from the bearing cage using a press and suitable sleeve. If press is not available, use a drift and hammer and tap out seal.

NOTE

Keep the shim pack from under the bearing cage wired together for reassembly.

(6) Remove the bearing cup from the cage by using a press or suitable puller.

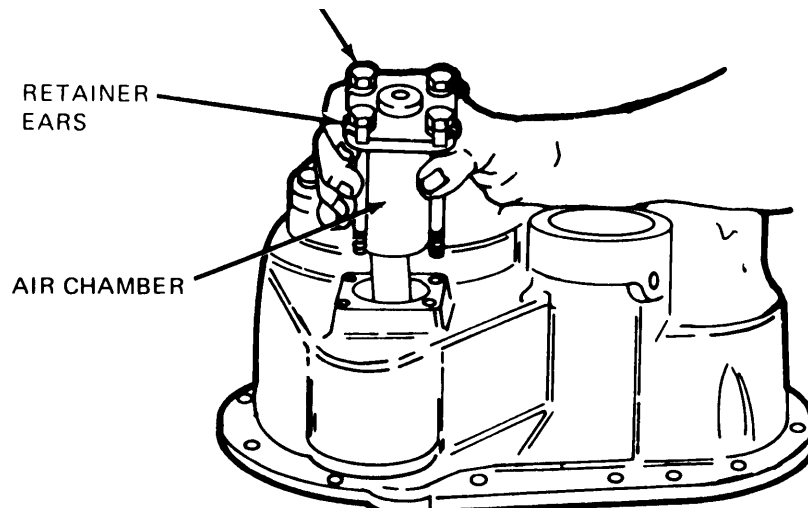
d. *Remove Shift Unit and Oil Pump Drive Gear.*

NOTE

To remove the oil pump drive gear and shaft assembly, it is necessary to first remove the shift unit components.

(1) Using a screwdriver or other sharp-bladed tool: bend back the shift unit air chamber bolt retainer ears. There is one retainer per bolt with one ear bent against the bolt head and two ears bent against the top chamber plate,

(2) Unthread the four air chamber bolts and pull the unit from its seat on the helical gear cover (fig. 11-11).



TA 074307

Figure 11-11. Remove Shift Unit Air Chamber.

NOTE

The components within the air chamber are not serviceable as individual parts. If the air chamber is defective, the complete unit must be replaced.

(3) Working from the inside of the helical gear cover, remove the shift fork to shift shaft roll pin. Use a small diameter drift or punch and hammer to tap the pin out.

(4) Remove the shift shaft, spring and fork from inside the helical gear cover by first pulling the shift shaft through the air chamber opening in the gear cover. The fork and spring will drop out after shaft removal.

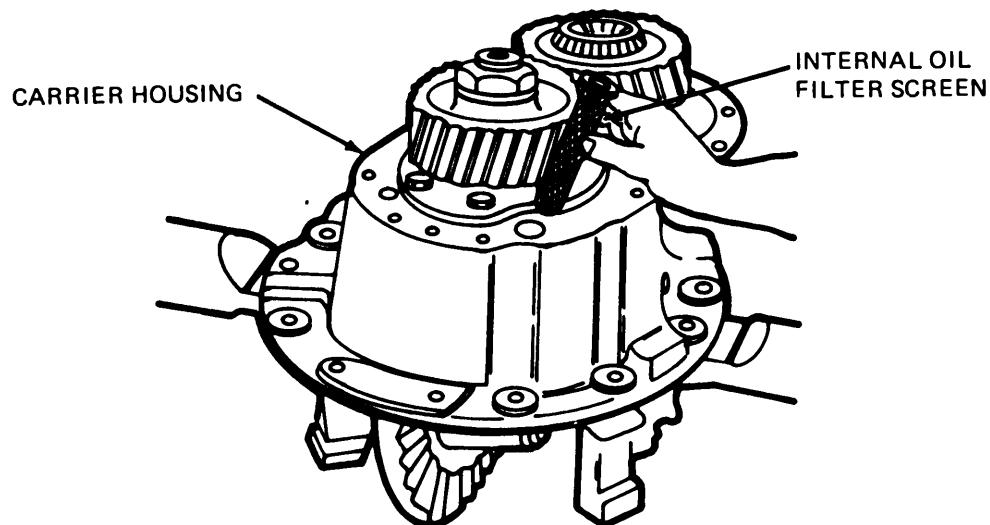
- (5) If desired, remove the shift shaft adjusting screw and jam nut from the helical gear cover.
- (6) Remove the oil pump drive gear (fig. 11-1 2) and shaft from housing by removing lock ring and washer, then pull out gear and shaft from the helical gear cover.

TA 074308

Figure 11-12. Remove Oil Pump Drive Gear.

e. Disassemble the Interaxle Differential.

- (1) Remove the internal oil filter screen from the carrier housing (fig. 11-13). If the screen is damaged in any way, discard it. Otherwise, set it aside for cleaning.



TA 074309

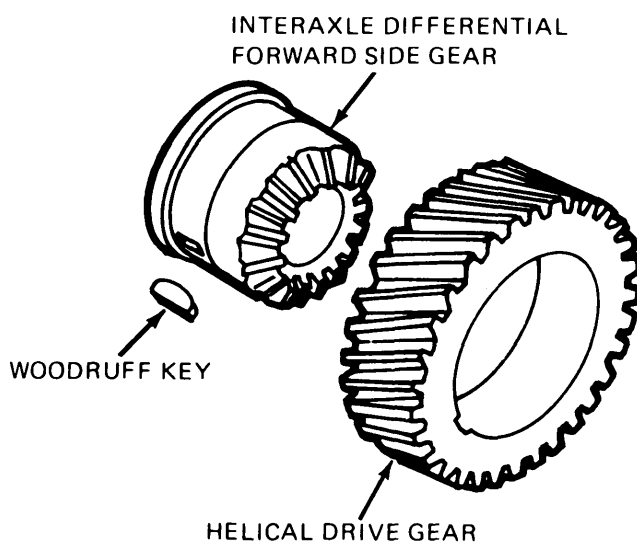
Figure 11-13. Remove Internal Filter Screen.

(2) Lift off the interaxle differential forward side gear, helical drive gear assembly and thrust washer from the interaxle differential nest located to the top of the carrier.

CAUTION

Do not press the side gear out by the gear teeth; damage to the teeth surfaces will occur.

(3) Separate the interaxle forward side gear from the helical drive gear (fig. 11-14). Place the assembly in a press and use a sleeve with an outer diameter that will fit the front hub portion of the side gear.



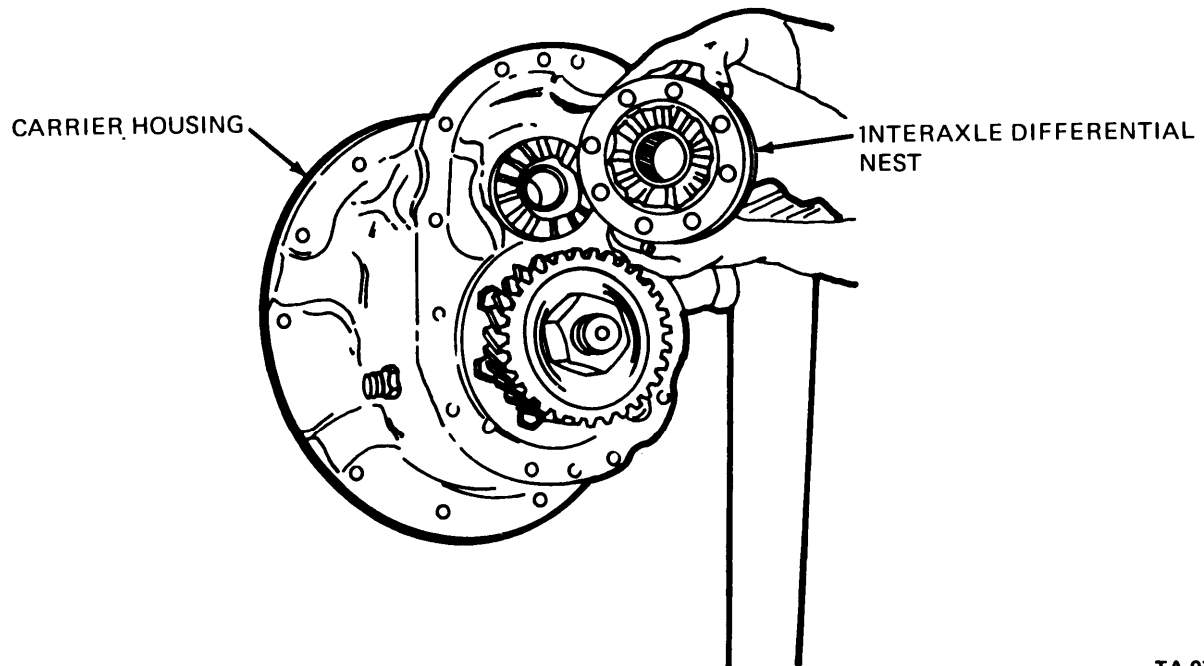
TA 074310

Figure 11-14. Separate Side Gear and Helical Gear.

(4) Lift out the interaxle differential nest and case assembly from the carrier housing (fig. 11-15).

NOTE

The rear side gear and rear input bearing will remain loose in the carrier housing. (Refer to step (7).)



TA 074311

Figure 11-15. Remove and Disassemble Interaxle Differential Case Assembly.

(5) Before disassembling the interaxle differential case halves and gear nest, match mark the case halves with a punch for correct alignment at reassembly.

NOTE

In step (6), there are washers under both the capscrew heads and nuts.

(6) Disassemble the case halves by removing eight rivets. Remove the spider (cross), four pinions, and thrust washers.

(7) Lift out the rear side gear and bearing cone from the carrier housing. The bearing cup will remain in the carrier. If replacement is necessary, remove the cup using a suitable bearing puller.

(8) To remove the bearing cone from the rear side gear, place the gear in a press. Use a suitable sleeve and press the gear from the bearing. If a press is not available, use a suitable bearing puller.

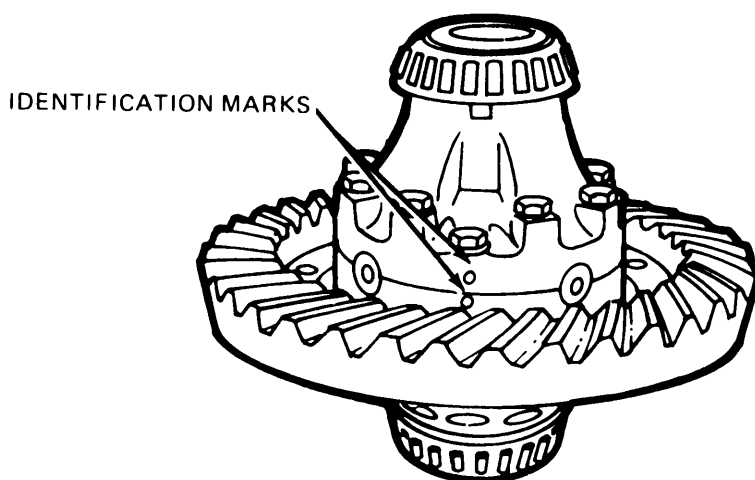
f. Remove Main Differential and Gear Assembly.

(1) With the carrier still in an upright position, loosen the jam nut and back off the drive gear thrust screw.

- (2) Rotate the carrier 180° and bring the drive gear to an upright position.
- (3) Check and record the backlash. This information will be needed in reassembly unless a new gear set is used.
- (4) Center punch one differential carrier leg and bearing cap to identify for reassembly.
- (5) Remove the carrier cap capscrews, washers, and cotter keys from both sides of the carrier.
- (6) Remove the bearing adjusting rings and the carrier caps.
- (7) Lift out the differential and gear assembly.

g. Disassemble Differential Case and Gear.

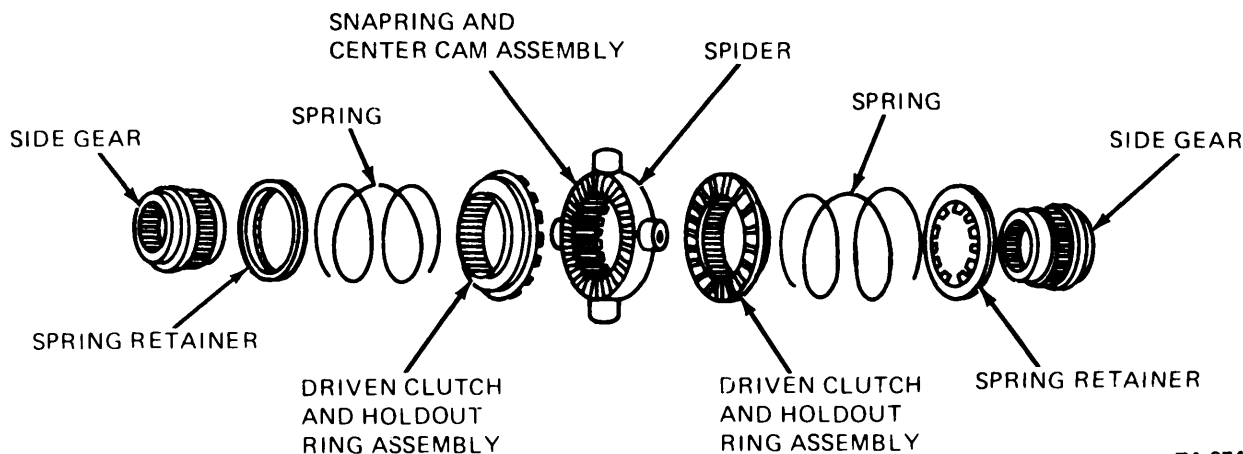
- (1) If original identification marks are not clear, mark the differential case halves with a punch or chisel for correct alignment on reassembly (fig. 11-16).



TA 074279

Figure 11-16. Differential Case and Gear.

- (2) Remove the lockwire (if used) and capscrews and separate the case halves.
- (3) Remove the components of no-spin assembly (fig. 11-17).



TA 074312

Figure 11-17. Remove Components of No-Spin Assembly.

- (4) If gear is to be replaced for any reason, remove rivets and separate the gear from the case, as follows:
 - (a) Carefully center-punch rivets in center of the head.
 - (b) Use a drill 1/32-inch smaller than body of rivet to drill through rivet head from gear side.
 - (c) Punch out the rivets.
- (s) If necessary to replace differential bearings, remove with a suitable puller.

h. Remove Pinion and Cage Assembly.

(7) Loosen the pinion cage capscrews until the heads contact the back (under) face of the helical driven gear. Continue loosening the capscrews approximately three turns each, alternating to the other capscrews. This will avoid cocking the cage in the carrier while the capscrews act as puller screws.

(2) Continue loosening the capscrews until the cage and capscrews are free. Remove the shims from under the cage and wire together for reassembly.

CAUTION

It may be necessary to tap out the pinion and cage assembly by using a brass bar and hammer on the pinion end. Care should be exercised not to damage the spigot bearing. In either case, the spigot bearing will remain on the pinion.

- (3) Remove pinion nut and washer.
- (4) press pinion shaft through cage, bearings and helical driven gear.
- (5) Remove outer bearing from cage and bearing spacer from pinion shaft.
- (6) If necessary, remove the pinion inner bearing and the spigot bearing with a suitable puller.
- (7) If necessary to replace pinion bearing cups, remove with a suitable puller (if cups are in good condition, do not disturb).

11-6. Cleaning.

- a. Ground or Polished Surface Parts.

WARNING

Exercise care to avoid skin rashes, fire hazards, and inhalation of vapors when using solvent-type cleaners.

CAUTION

Do not use gasoline. Do not clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates, or phosphates. Do not steam clean assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

(1) parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in dry cleaning solvent (item 12, App B).

(2) Clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful, not to damage mating surfaces.

b. Rough Parts.

WARNING

Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

Rough parts, such as differential carrier castings, cast brackets, and some brake parts may be cleaned in hot solution tanks with mild alkali solutions (item 25 App B) providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali. If this solution is not available, dry cleaning solvent may be used.

c. Complete Assemblies. Completely assembled axles may be steam cleaned on the outside only, to facilitate initial removal and disassembly, provided all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

d. Drying. Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

e. Corrosion Prevention. Parts that have been cleaned, dried, inspected, and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good *rust preventive* and wrapped in special paper or other material designed to prevent corrosion.

11-7. Inspection.

a. Tapered Roller Bearings. The forward rear carrier employs tapered roller bearings in five areas: at the input and output shafts, the drive pinion, the interaxle differential, and main differential. The rear rear carrier employs tapered roller bearings at the drive pinion and main differential. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts. If any of the following bearing conditions exists, the bearings must be replaced:

- (1) Large ends of rollers worn flush to recess, or radii at large ends of rollers worn sharp,
- (2) Visible step wear, particularly at the small end of the roller track.
- (3) Deep indentations, cracks or breaks in bearing cup and/or cone surfaces.
- (4) Bright rubbing marks on the dark phosphate surfaces of the bearing cage.
- (5) Etching or pitting on functioning surfaces.
- (6) Spalling or flaking on bearing cup and/or cone surfaces.

b. Drive Pinion and Ring Gears. Inspect the ring gear for wear or damage. Gears which are worn, ridged, pitted, or scored should be replaced. When necessary to replace either the pinion or ring gear of a set, the entire gear set must be replaced.

c. Differential Nest Gears. Inspect the differential assembly for the following.

(1) Check for pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions, and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

(2) inspect for wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

d. Helical Gears. Inspect helical gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. Helical gears of two-gear transfer trains or drop boxes with one-to-one ratios, such as employed in the forward/rear carrier, must be replaced in sets. Further, new helical gears used in sets must be permanently marked with matching or timing symbols to aid in correctly positioning the teeth of both gears at reassembly.

e. Ax/e Shafts. Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

11-8. Repair or Replacement.

a. General.

(1) Replace all worn or damaged parts. Hexnuts with rounded corners, all lockwashers, oil seals and gaskets or silicone gasket material should be replaced at the time of overhaul.

(12) Remove nicks, mars, and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. Studs must be tight prior to reassembling the parts.

(3) When assembling component parts, use a press where possible.

b. Silastic Application (item 29, App B).

(1) Removal of all gaskets including silicone is accomplished by peeling or scraping the used gasket off the carrier-to-housing surfaces.

(2) Application of silastic is as follows:

(a) Remove dirt, grease or moisture from the surface of the carrier and housing.

(b) Dry the surface.

(c) Apply thin bead, approximately 1/8-inch diameter completely around one mating surface and all fastener holes to assure complete sealing and prevent leakage.

WARNING

Minor concentrations of acetic acid vapor may be produced during application. Adequate ventilation should be provided when silicone is applied in confined areas. Further, eye contact may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

(d)) Assemble the components immediate/y to permit silastic to spread evenly.

c. Wear Sleeve Replacement.

(1) Place the yoke on its side in a vise,

CAUTION

Do not completely split or penetrate the wear sleeve and damage the yoke.

(2) Using a cold chisel, notch the wear sleeve slightly to expand the sleeve and permit its removal from the yoke (fig. 11-18).

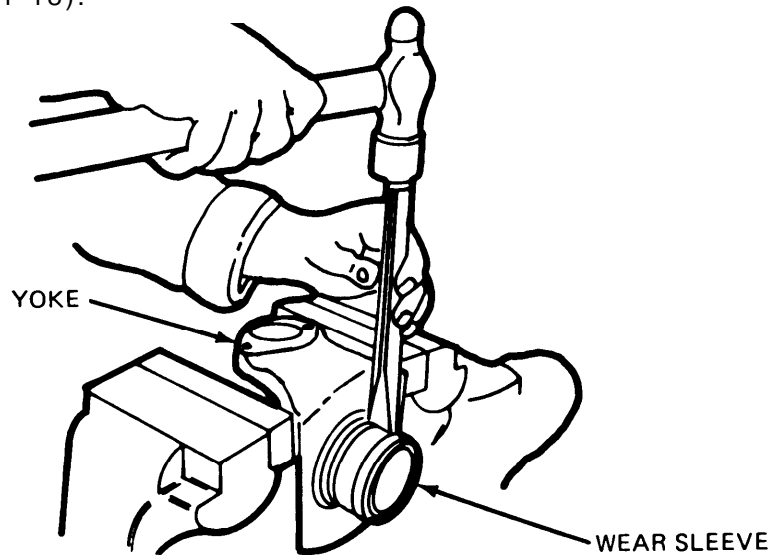
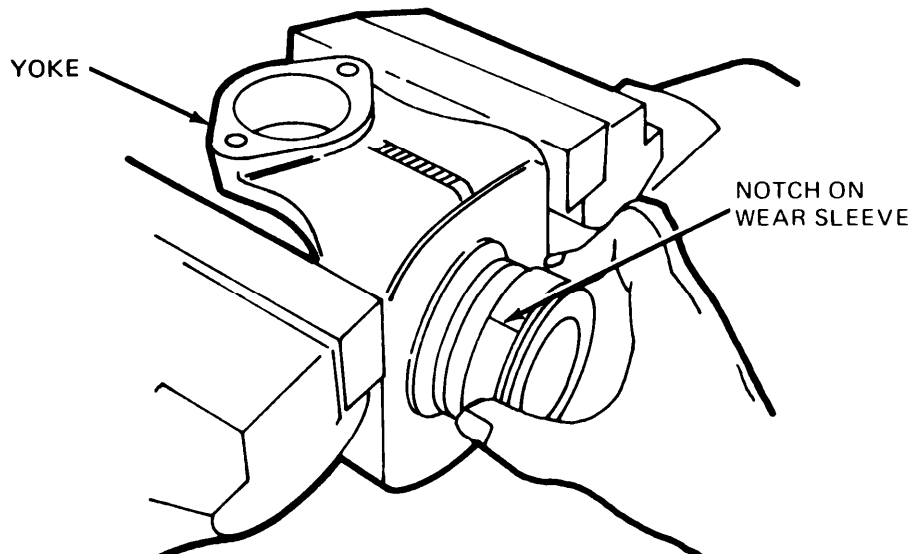


Figure 11-18. Loosen Wear Sleeve.

- (3) Remove the sleeve (fig. 11 -19).



TA 074314

Figure 11-19. Remove Wear Sleeve.

- (4) If unsuccessful, notch the sleeve in the same location again.

CAUTION

Do not split the sleeve.

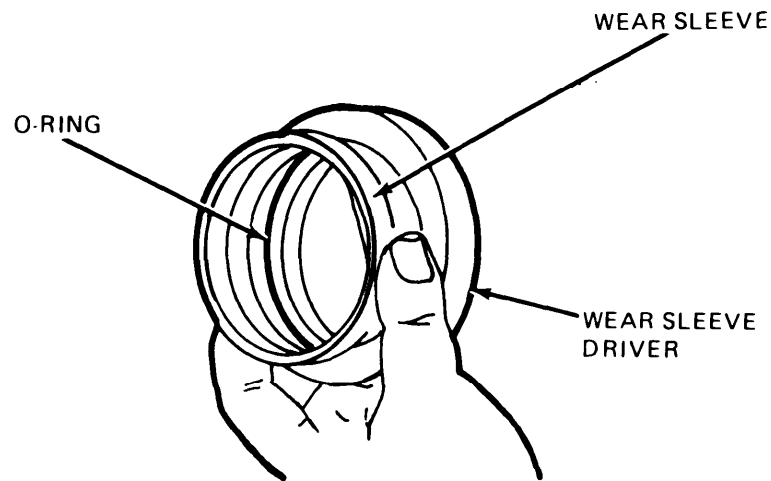
- (5) Remove the sleeve.

- (6) If unsuccessful, rotate the yoke 180°, notch slightly again, and remove sleeve.

NOTE

Replacement of the wear sleeve requires a wear sleeve driver.

(7) Grease the o-ring inside the tool with bearing grease (item 1, App B) to facilitate sliding new wear sleeve into the tool (fig. 11-20).



TA 074315

Figure 11-20. Mount the Wear Sleeve in the Driver.

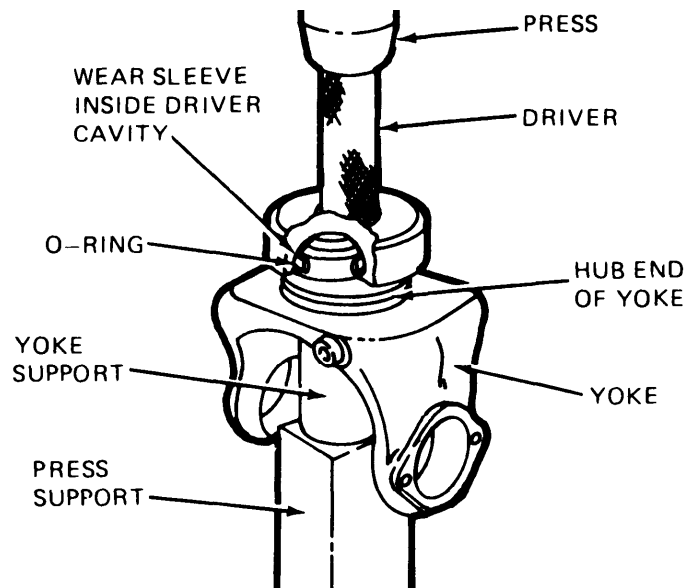
(8) Position the driver and wear sleeve into the tool cavity, tapered end first.

(9) Place the driver and wear sleeve squarely against the hub end of the yoke.

CAUTION

Do not install the wear sleeve by striking the driver, as this practice may cause excessive expansion of the wear sleeve and will permit the sleeve to rotate on the yoke.

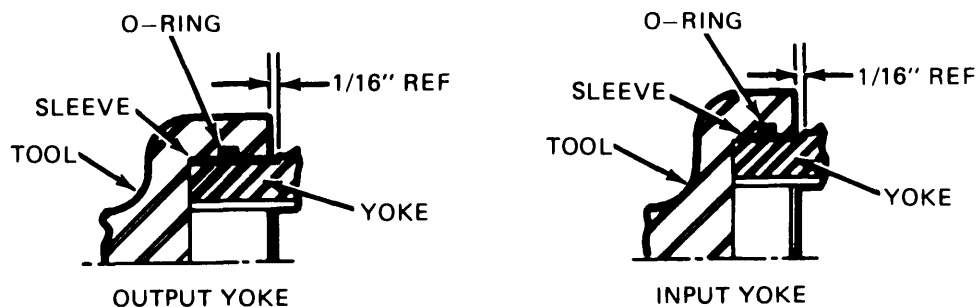
(10) Employing a small mechanical press, place the driver, wear sleeve and yoke into the press (fig. 11-21).



TA 074316

Figure 11-21. Install the Wear Sleeve.

(11) Activate the press, forcing the driver to push the wear sleeve onto the yoke until it bottoms (fig. 11-22).



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Figure 11-22. Sleeve Positioning.

(12) When removing the driver, pull the driver straight off. Do not work the driver in a circular or alternately back-and-forth motion, as this may damage the wear sleeve surface.

(13) Examine the wear sleeve after installation for nicks or burrs that may cut or wear the seal. These may be removed by careful filing.

11-9. Differential Carrier Assembly.

CAUTION

Pinion gear and ring gear are a matched set and have a common number etched on each. Before assembly, check numbers.

a. Assemble Pinion and Cage Assembly.

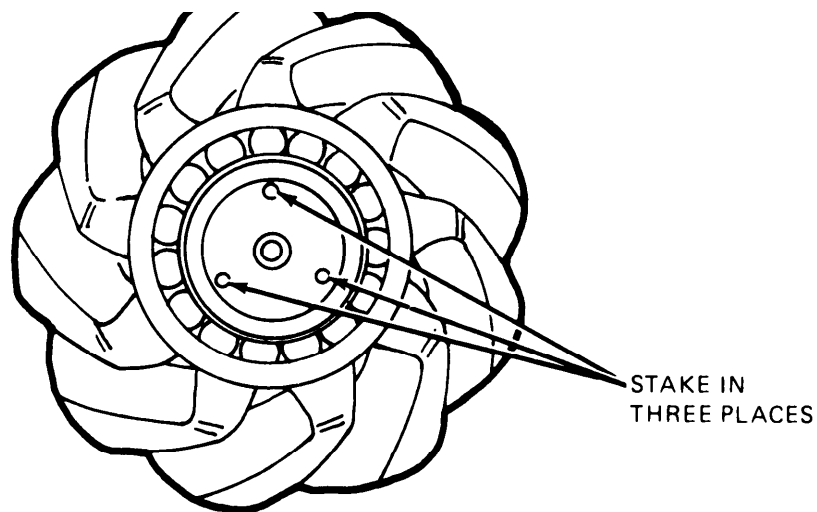
NOTE

Before assembling, coat all parts of bearings with recommended axle lubricant (item 30, App B).

(1) Press rear bearing firmly against the pinion shoulder with a suitable sleeve against the bearing inner race.

(2) press the spigot bearing into position on the pinion end.

(3) To retain the spigot bearing on the pinion end, it is necessary to stake the pinion at three points (fig. 11-23). Use the proper staking tool to fit over the end of the pinion and spigot bearing to correctly achieve this.



TA 074318

Figure 11-23, Stake Pinion.

CAUTION

Do not strike the spigot bearing or attempt to stake bearing onto pinion using a punch and hammer – damage will result. Staking points are not to be spotted at the root angle grooves of the pinion (if present) or in the original staking points if using the original bearing.

(4) Position the drive pinion with spigot bearing pointing upward in a press and place the staking tool over the pinion end and bearing. Apply a 3-3% ton pressure to the staking tool.

(5) If new CUPS are to be installed, press the cups into cage using suitable sleeve. Make sure the cups are firmly against the cage shoulders.

(6) Insert the pinion and bearing assembly in the pinion cage and position the spacer over the pinion shaft.

(7) Press the forward bearing firmly against the spacer.

(8) Rotate the cage several revolutions to assure normal bearing contact.

(9) While in the press under pressure, check the bearing preload torque. Wrap a soft wire around the cage pilot and pull on a horizontal line with a pound scale. (If the press is not equipped with a pressure gage, the pinion nut may be tightened to the correct torque and the preload checked in a vise).

NOTE

For new pinion bearings, the rotating torque must be within 5-25 lb-in. For reused pinion bearings, the rotating torque must be within 5-15 lb-in.

(10) If the rotating torque is not within these values, use a thinner spacer to increase, or a thicker spacer to decrease the preload torque. The correct pressure and nut torque for checking pinion bearing preload are as follows:

Pinion Shaft Thread Size	Required Nut Torque to Obtain Correct Preload	Required Pressure To Obtain Correct Preload
1-3/4x 12	900-1200 lb-ft (1220-1627 N•m)	11-14 tons (10-12.7 metric tons)

(11) Insert pinion cage to carrier capscrews and washers in their respective holes in the pinion cage.

NOTE

If the helical driven gear must be replaced with a new gear, replace both the drive and driven gears as a set.

(12) Press the drive pinion helical gear against the forward bearing and install washer and pinion shaft nut.

(13) Using a suitable holder on gear, tighten the pinion shaft nut to the required torque.

(14) Recheck pinion bearing preload torque. If rotating torque is not within specified values, repeat the foregoing procedure.

(15) If the original gears are reused, install the original shim pack. If gears have been replaced, alter the original shim pack as follows: Note the variation from the nominal assembly dimension on both the old and new pinion. (The nominal dimension is stamped and the variation is etched on the nose of the pinion.) Increase or reduce the shim pack in accordance with the change in the variation from the old to the new pinion. After changing the sign of the old variation – plus-to-minus or minus-to-plus – add to the new variation (sign unchanged).

(16) Position the pinion and cage assembly in the carrier pinion cage bore and tap into place with a soft mallet. Make certain that capscrews are alined with respective holes in carrier, and that cage is not cocked in its bore.

(17) Start turning in pinion cage capscrews approximately y three turns each and alternating to other capscrews. This will avoid cocking the cage in the carrier while the capscrews push the cage into position. When the cage is seated in the carrier loosen the capscrews and then retighten to torque of 80-105 lb-ft (108-142 N•m).

b. Assemble the Differential Case and Gear.

CAUTION

The ring gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and the case, thus resulting in gear run-out. Proper installation should, therefore, incorporate preheating the gear to assure correct interference fit and to eliminate metal pick up.

(1) Heat the ring gear in oil to approximately 1600°F-1800°F (71.1°C-82.2°C) for about ten minutes before assembly.

(2) If ring gear has been separated from case, fasten with twelve bolts, washers, and nuts. Torque to 180-230 lb-ft (244-312 N•m).

(3) Assemble and install no-spin assembly as follows.

(a) Lightly lubricate all parts with recommended gear case lubricant (item 30, App B).

(b) Lay ring gear and large half of case on bench with the bearing end of case hub down and the inner case facing upward. *Be sure no thrust washers are inside the case.*

(c) Place the ground hub of a side gear into the bore of the case, being sure the side gear will rotate freely in the case. Some two-speed axles use different length side gears and the correct side gear must be used.

(d) Assemble a spring retainer over the side gear splines, with the side gear flange firmly seated into the cupped section of the retainer (fig. 11-24). Make sure this part is installed correctly. Incorrect assembly of the spring retainer can limit the spring movement and prevent proper no-spin assembly operation.

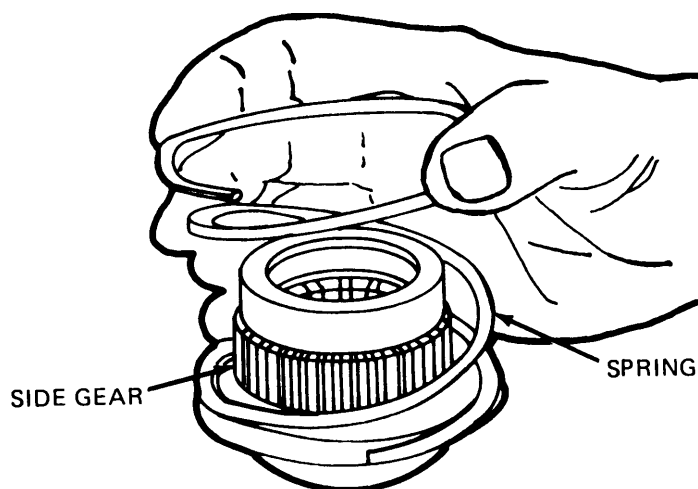


Figure 11-24. Install Spring on Side Gear.

(e) Place a spring over the side gear inner hub and splines and against the spring retainer seat. Some models have tapered, conically-shaped springs and the end with the smaller diameter should fit against the spring retainer.

(f) Assemble the clutch (or the clutch and holdout ring assembly if silent-type) over the spring with the clutch teeth up. Check to see if spring is functioning freely by compressing clutch over the side gear splines.

(g) Check to see that spring is not binding and coils do not overlap and there is good contact between the end coil and the spring retainer when the clutch and side gear splines are fully indexed (fig. 11-25).

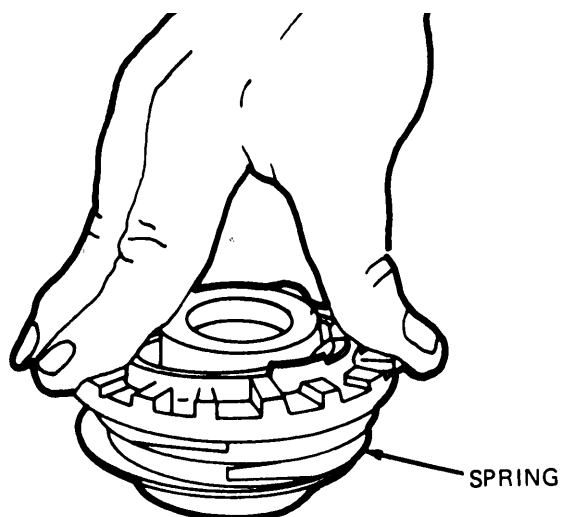
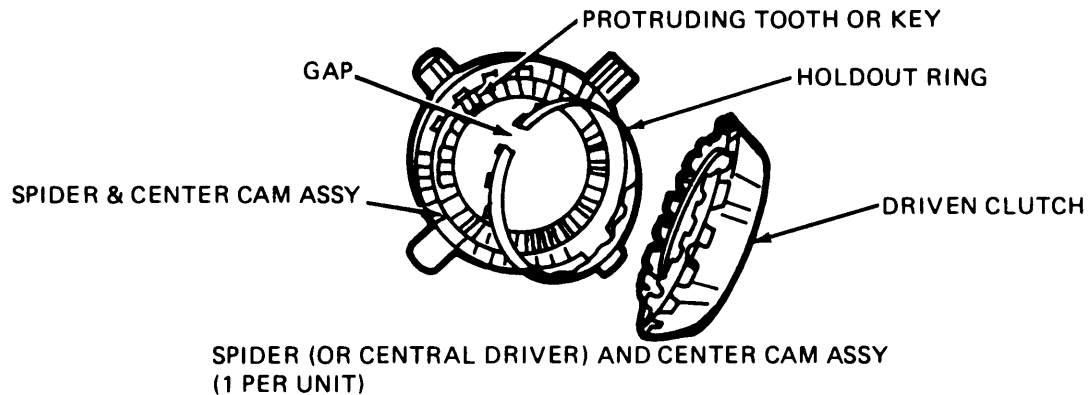


Figure 11-25. Check Installation of Spring.

TA 074320

(h) Place spider-center cam assembly on the driven clutch, indexing the teeth. Make sure slot in the holdout-ring and spider-key are properly mated, as shown in figure 11-26.



TA 074321

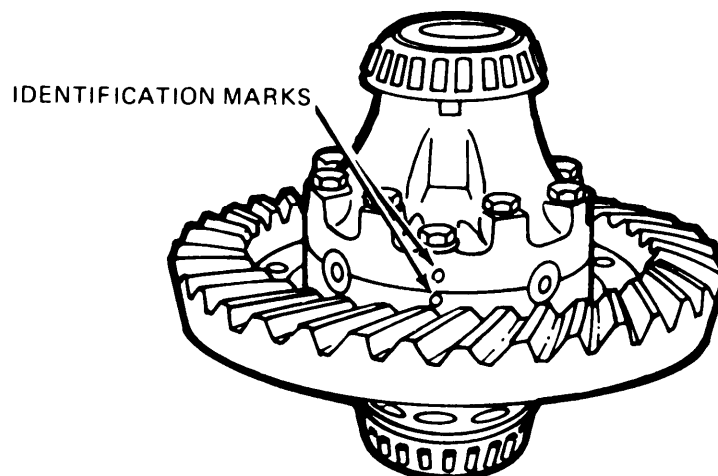
Figure 11-26. A line Gaps in Holdout Rings with Spider Keys.

(i) Place the other clutch holdout-ring assembly on the spider again, indexing the teeth, and being sure again that the spider-key and holdout-ring slot are properly aligned. Assemble the spring over the clutch with larger diameter of spring against the clutch.

(j) Place the other spring retainer over the other side gear splines (cup section up with the retainer firmly seated against the side gear flange), and assemble the spring retainer and side gear over the spring.

(k) Mount the mating half of the case over the side gear and compress unit. Be sure the side gear splines are completely indexed with the clutch splines. (See figure 11-17 for illustration of complete assembly.)

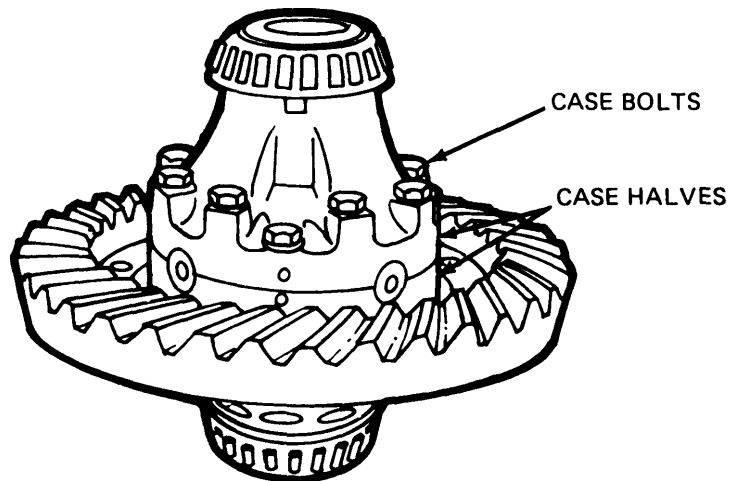
(l) Hold the case halves together firmly, aligning the punch marks (fig. 11-27) to be sure the two case halves are properly mated. Start threading some of the case bolts but do not release hand pressure until two or more bolts are drawn up enough to overcome the spring pressure.



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Figure 11-27. Mount the Mating Case Halves.

Tighten case bolts to a torque of 85-115 lb-ft (115-156 N•m) (fig. 11-28). Check to be certain of a snug fit between the two case halves at all points and between the holes in case and the spider trunnions.



TA 074322

Figure 11-28. Assemble the Case and Ring Gear Assembly.

(4) If roller bearings and bearing cones have been removed, press cone onto each end of assembly using a suitable sleeve.

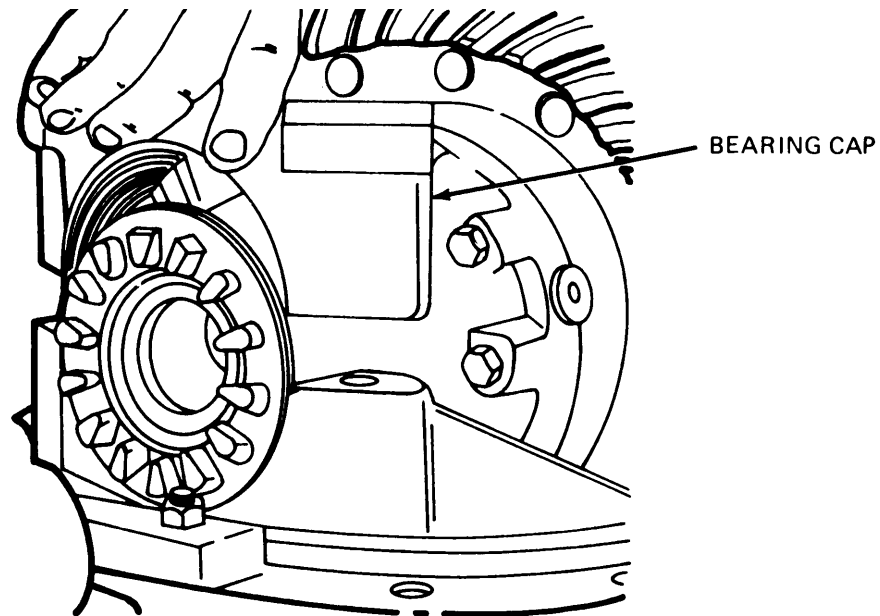
c. Install Differential and Gear Assembly.

- (1) *Pre-lubricate* differential bearings and cups with the recommended axle lubricant.
- (2) Place cups over bearings and position assembly in carrier housing.
- (3) Insert the bearing adjusting nuts and turn handtight against bearing cups.

CAUTION

In step (4), if the bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting nuts. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

(4) Install the bearing caps (fig. 11-29) in the correct location as marked and tap lightly into position.



TA 074323

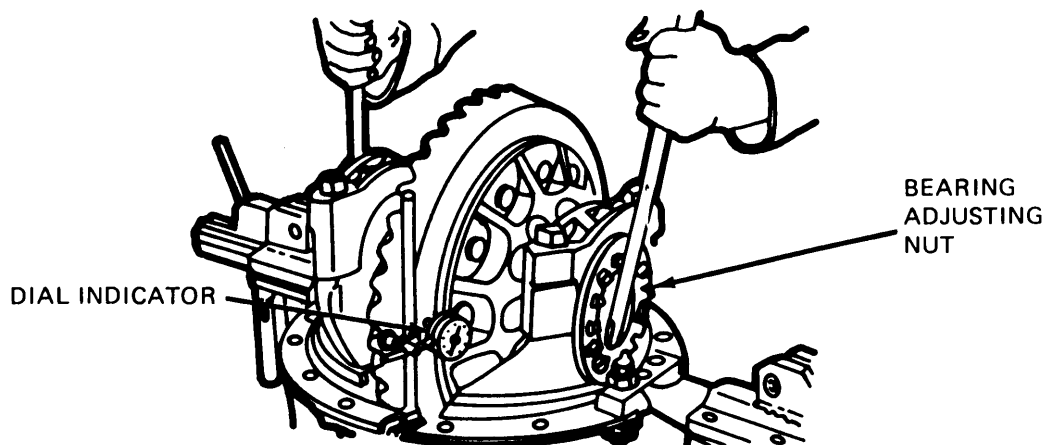
Figure 11-29. Install Differential and Gear Assembly.

(5) Install the carrier leg capscrews and washers and torque to 290-350 lb-ft (393-475 N•m),

(6) Install the adjusting nut. (Cotter keys will be installed after final adjustments are made.)

d. Adjust the Differential Bearing Preload.

(1) Using a dial indicator at the backface of the gear (fig. 11-30), loosen the bearing adjusting nut on *the side opposite gear on/y* sufficient to notice end play on the indicator.



TA 074289

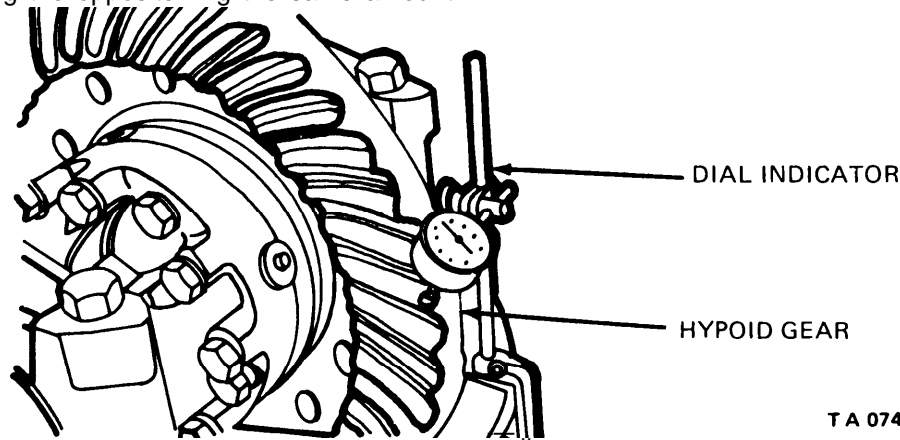
Figure 11-30. Adjust Differential Bearing Pre-Load.

(2) Tighten the same adjusting ring only sufficient to obtain 0.000 end play.

(3) Check the gear for run-out. If run-out exceeds 0.008 in. (0.203 mm), remove the differential and check for cause.

(4) Starting with 0.000 end play, tighten each adjusting ring one notch. This will properly preload the differential bearings.

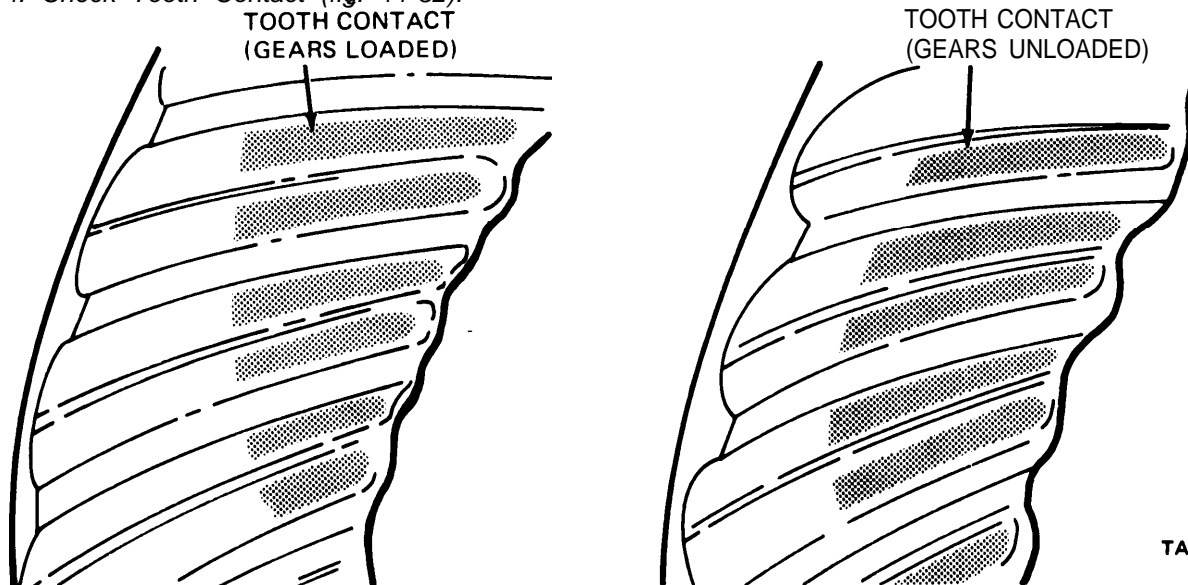
e. *Check Hypoid Gear Backlash.* If the drive gear is not going to be replaced, the established backlash recorded before disassembly should be used. For new gears the new backlash should be initially set at 0.010 in. (0.254 mm). Adjust backlash (fig. 11-31) by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.



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Figure 11-31. Check Gear Backlash.

f. *Check Tooth Contact (fig. 11-32).*



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Figure 11-32. Satisfactory Hypoid Contact.

(1) Apply a red lead compound (item 26, App B) lightly to the gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape, and location of the contacts.

(2) Sharper hand roll impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

(3) After obtaining a satisfactory tooth contact, the backlash can be altered within the limits of 0.005-0.015 in. (0.127-0.381 mm) for M915 forward rear axle and both rear axles on models M916 through M920. Use 0.008-0.020 in. (0.203-0.508 mm) for M915 rear rear axle gears to obtain a better contact position relative to the length of the tooth.

(4) A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

(5) After correct tooth contact has been established, install adjusting nut cotter pins and capscrews.

(6) With adjustments properly made (pinion at correct depth and backlash set at 0.010 in. (0.254 mm) the contacts in figure 11-32 will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

(7) After final adjustments, install cotter keys in adjusting nuts (fig. 11-30).

(8) The hand-rolled pattern shown (gears unloaded), will result in a pattern centered in the length of the tooth when the gears are under load, as shown (gears loaded). The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

(9) The pattern on the coast side of teeth will appear the same width as the drive side shown above; however, the overall length will be centered between the toe and heel of gear tooth. *After the correct contacts, as shown, have been established with a backlash of 0.010 in. (0.254 mm), open the backlash to measure between 0.005-0.015 in. (0.127-0.381 mm), if required.*

(10) Set used gear to have the tooth contacts to match wear patterns. Hand-rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns.

(11) Incorrect patterns are shown in figure 11-33. A low contact indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the gear may be necessary to maintain correct backlash.

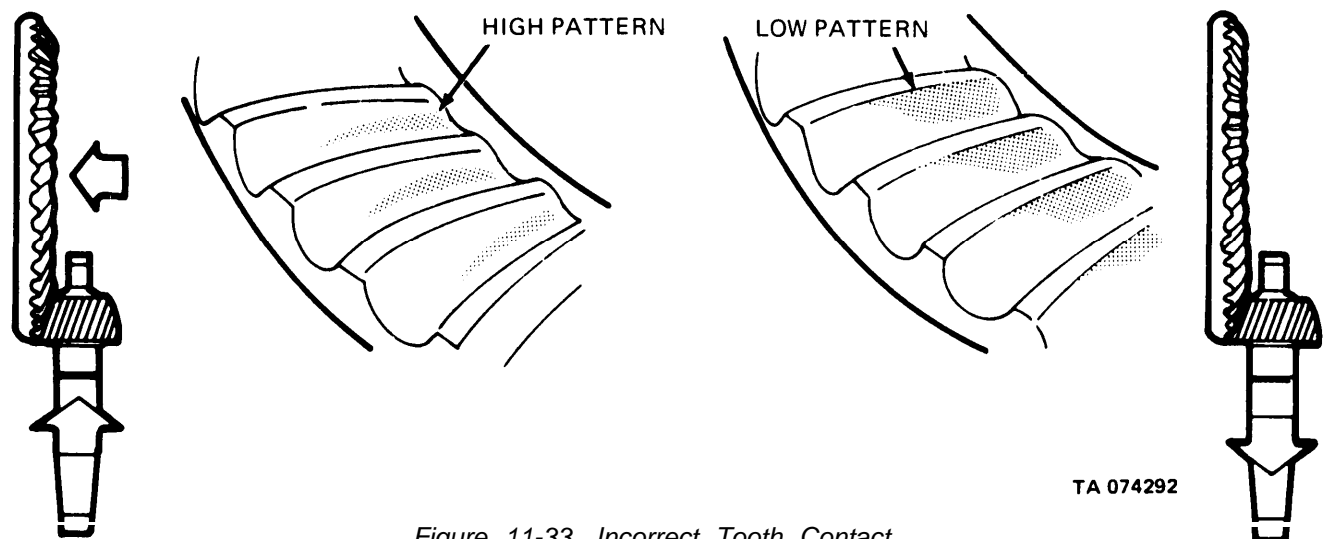
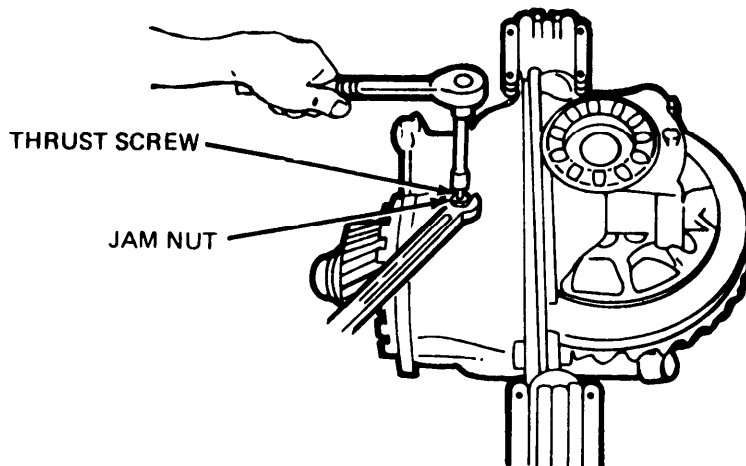


Figure 11-33. Incorrect Tooth Contact.

g. Adjust Drive Gear Thrust Screw.

- (1) Back out thrust screw (fig. 11-34) and jam nut.



TA 074293

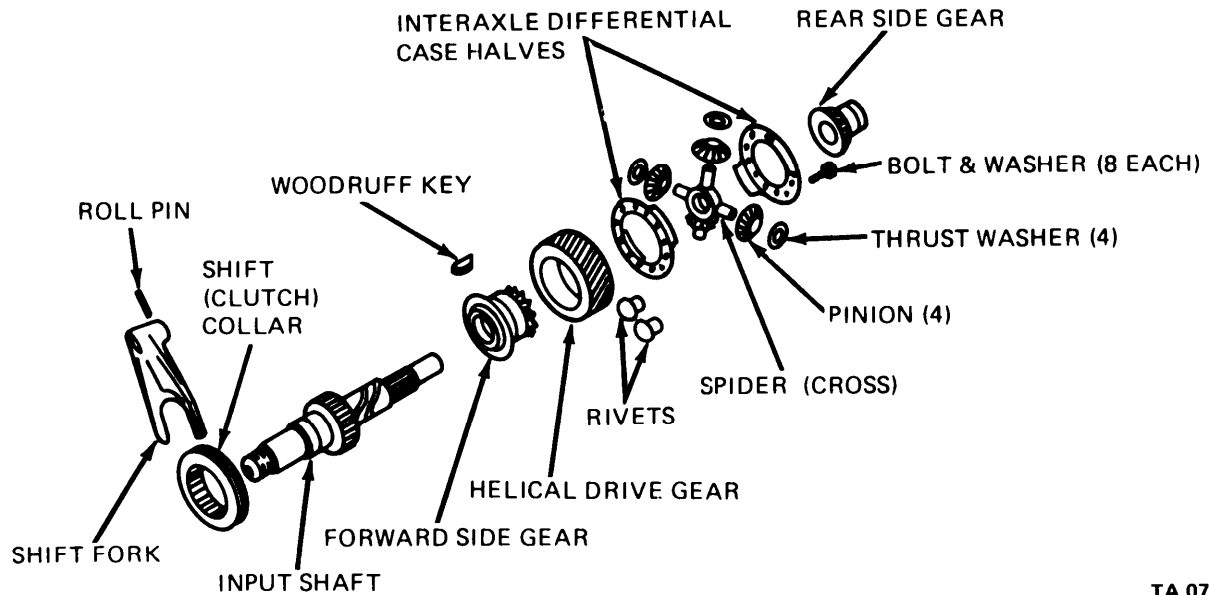
Figure 11-34. Adjust Drive Gear Thrust Screw.

- (2) Coat thrust end of screw with grease and reinstall screw and jam nut into carrier.
- (3) Tighten screw until it is firm against back face of hypoid drive gear.
- (4) To secure the correct adjustment of 0.010-0.015 in. clearance, loosen thrust screw 1/4 turn and lock securely with nut. Torque nut 40-55 lb-ft (54-75 N•m).
- (5) Recheck clearance between end of thrust screw and backface of gear for 0.010-0.015 in. (0.254-0.381 mm) clearance.

h. Assemble Interaxle Differential.

- (1) Place the differential carrier (attached to repair stand) in an upright position (pinion nut pointing upward).

(2) Pre-lubricate all interaxle differential parts, such as inside walls of interaxle differential case halves, spider, pinions, and bearings, etc., with the recommended axle lubricant (item 30, App B) (fig. 11-35).

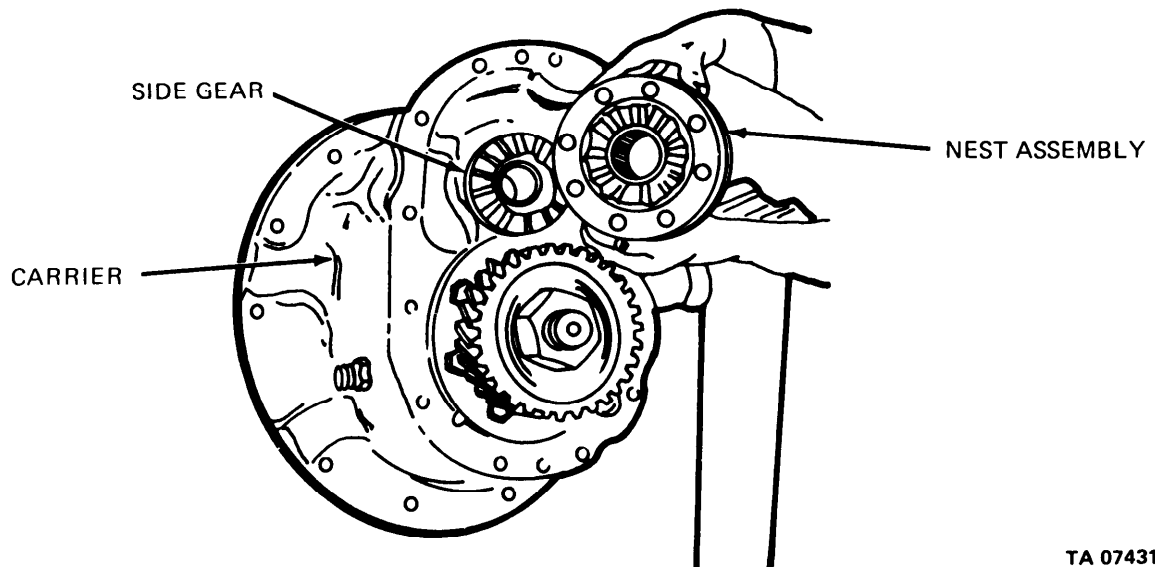


TA 074324

Figure 11-35. Interaxle Differential Assembly.

(3) If new rear input bearing is to be used, press bearing cup squarely into differential carrier and bearing cone squarely onto rear interaxle differential side gear hub.

(4) Position the interaxle differential case and nest assembly (rivet heads up) into the carrier and over the rear side gear (fig. 11-36).



TA 074311

Figure 11-36. Install the Differential Case and Nest.

(5) To assemble the forward side gear and helical drive gear, first position the woodruff key in place on the side gear hub (fig. 11-37).

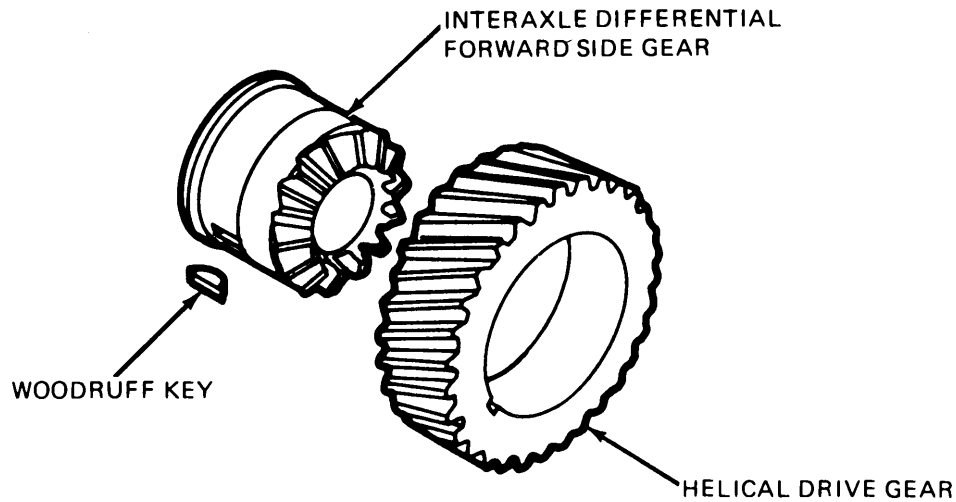


Figure 11-37. Assemble the Forward Side Gear and Helical Drive Gear.

NOTE

If the helical drive gear must be replaced with a new gear, replace both the drive and driven gears as a set.

(6) Place helical drive gear in a press with the flat side down and position the side gear (gear side down) with woodruff key over the helical gear. Make sure the woodruff key aligns with the keyway in the I.D. of the helical gear.

(7) press the side gear into the helical gear until it bottoms.

(8) position the forward side gear and helical drive gear assembly over the interaxle differential case and nest assembly already in position, Ensure that alinement marks are in proper position as shown (fig. 11-38).

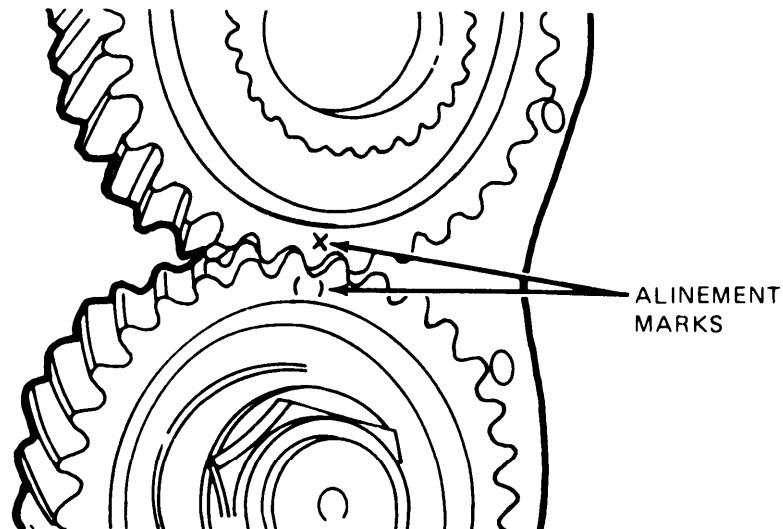


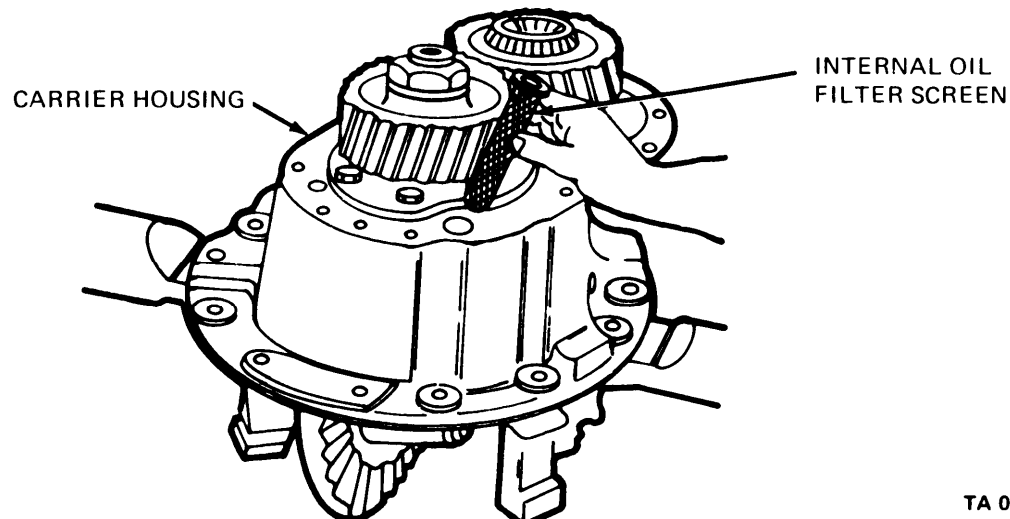
Figure 11-38. Install the Helical Gear Assembly.

TA 074325

(9) When placing the side gear and helical drive gear assembly in position on the carrier, be sure to align mating marks of both the helical drive and driven gears as shown; if new gears are installed, mark one tooth of each gear, as shown.

(10) Check for free rotation of the gears.

(11) Clean and install the internal oil filter screen in its seat in the carrier (fig. 11-39).



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Figure 11-39. Install Internal Filter Screen.

(12) Set the differential carrier assembly aside at this time and continue with assembling the helical gear cover.

i. Install Oil Pump Drive.

(1) Insert the shaft of the oil pump drive gear through bore inside the helical gear cover after dipping shaft in oil to assure lubrication before running.

(2) Hold the gear in place from the inside of the gear cover and install the washer and lock ring (fig. 11-40).

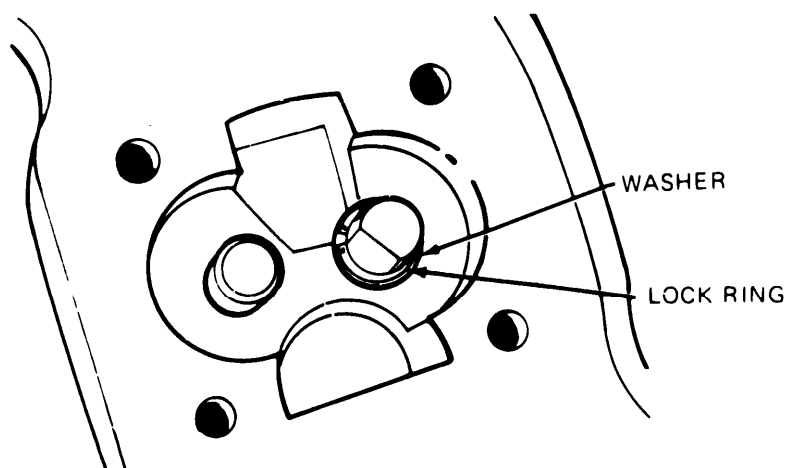


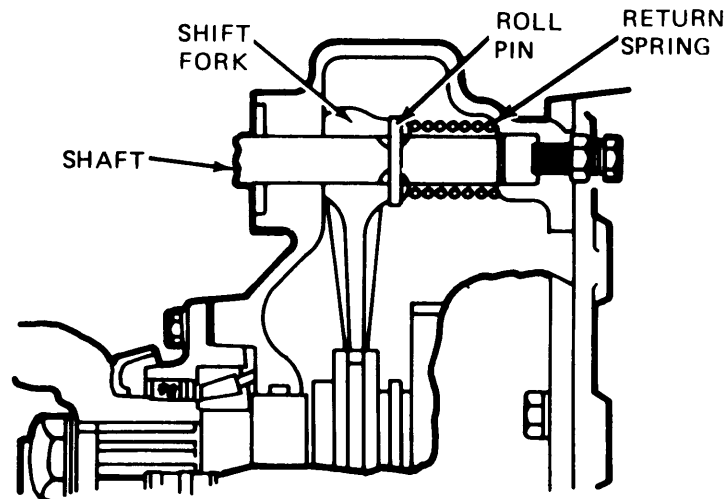
Figure 11-40. Install the Oil Pump Drive.

j. *Assemble the Shift Unit, Fork, and Shaft.*

NOTE

Before installing the shift shaft into the helical gear cover and shift fork, inspect and remove any rough spots or burrs by polishing the shaft with fine emery cloth.

(1) Install the shift shaft partially through its bore in the shift unit opening of the helical gear cover (fig. 11-41). Install the short end of shaft first, (Measure from the roll pin hole to shaft ends to determine short end.) Use a rawhide mallet to tap the shaft through.



TA 074326

Figure 11-41. Assemble Shift Unit, Shaft, and Fork.

(2) Position the shift fork to the inside front of the helical gear cover, aligning its shaft bore with the bore in the cover. The long boss of the fork with the drilled roll pin hole must be facing toward the back.

(3) Holding the shift fork in position, continue to tap the shift shaft through the gear cover and fork. Tap shaft in enough to support the fork.

(4) Install the shift fork return spring between the fork and rear shaft bore in the gear cover. Make sure inner diameter of spring coils are aligned with the shaft bores of the fork and gear cover.

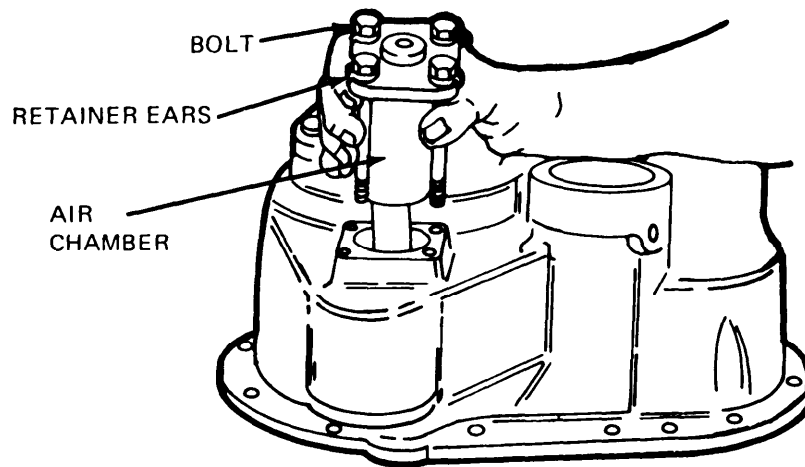
(5) Continue to tap the shift shaft into position with the rawhide mallet.

NOTE

As the shaft is installed, make sure the roll pin holes of the fork and shaft are aligned. Rotate the shaft if necessary to align holes.

(6) Assemble the roll pin through the holes in the fork boss and shaft. Use a small drift and hammer

(7) Assemble the shift unit air chamber over the shift shaft and onto the helical gear cover (fig. 11-42). Install capscrew retainers and capscrews. Torque to 75-100 lb-in. (8.5-11.3 N•m).



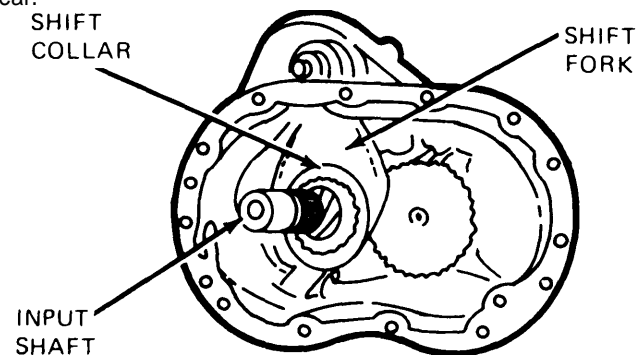
TA 074307

Figure 11-42. Install Shift Unit Air Chamber.

(8) After tightening the capscrews, bend one ear of each retainer up against the capscrew head, Bend the other two down against the top plate of the chamber.

k. Assemble Input Shaft and Bearings.

(7) Install the input shaft and the interaxle differential shift collar into the helical gear cover (fig. 11-43). While holding the shift collar in position engaging it with the shift fork, insert the input shaft through the collar. Index the shaft and/or collar to engage splines. At the same time the shaft splines must engage the oil pump drive gear.



TA 074327

Figure 11-43. Install Input Shaft and Shift Collar.

(2) Press the forward bearing cone onto the input shaft while securing the shaft in position in the helical gear cover.

(3) Press the forward input bearing cup squarely into the bearing cage

CAUTION

Do not exert pressure on the seal retainer after it bottoms. Damage to the seal will result.

(4) If the front oil seal was removed, install a new seal into the front of the bearing cage. Coat the sealing lip with *Lubriplate* (item 16, App B) and outer diameter of retainer with a non-hardening sealing material, such as *Permatex* (item 23, App B). Use a press or arbor and suitable sleeve and press seal into position until it bottoms in the bearing cage.

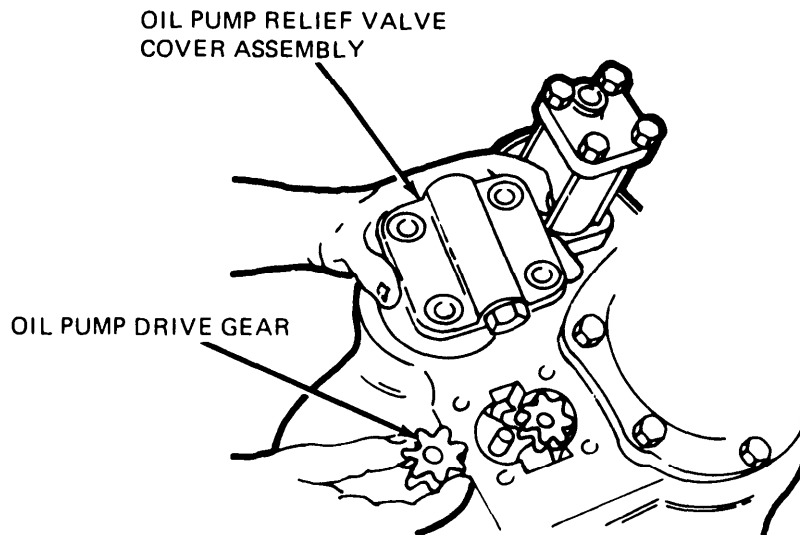
(5) When the original bearing is reused, assemble the original shim pack and bearing cage with the bearing cup onto the helical gear cover. Secure the cage with capscrews and washers. Torque to 35-50 lb-ft (47-68 N•m).

(6) If a new bearing is used, assemble the bearing cage with a new cup over the helical gear cover. Do not install a shim pack. Assemble and tighten the capscrews and washers to finger-tight while rotating the shaft to seat bearings.

1. Assemble the Oil Pump, Filter, and Cover.

(1) Assemble the oil pump relief valve cover by inserting ball, spring (small diameter against ball), and hollow capscrew. Torque capscrew to 40-55 lb-ft (54-75 N•m).

(2) Install oil pump gears on their shafts in the housing (fig. 11-44).



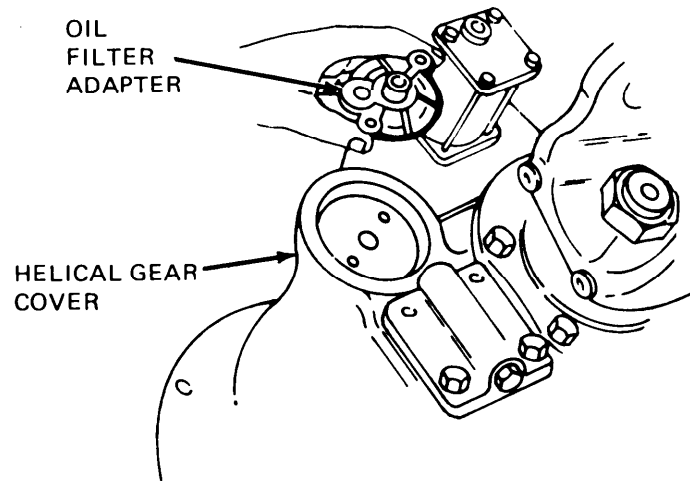
TA 074304

Figure 11-44. Install Pump Drive Gear and Cover Assembly.

(3) Pack the pump cavity completely with *Lubriplate* before installing the pump relief valve cover.

(4) Assemble the oil pump relief valve cover over gears and secure to the helical gear cover with two washers and short capscrews. (Install the two capscrews in the holes farthest from oil filter opening.) Torque to 20-30 lb-ft (27-41 N•m).

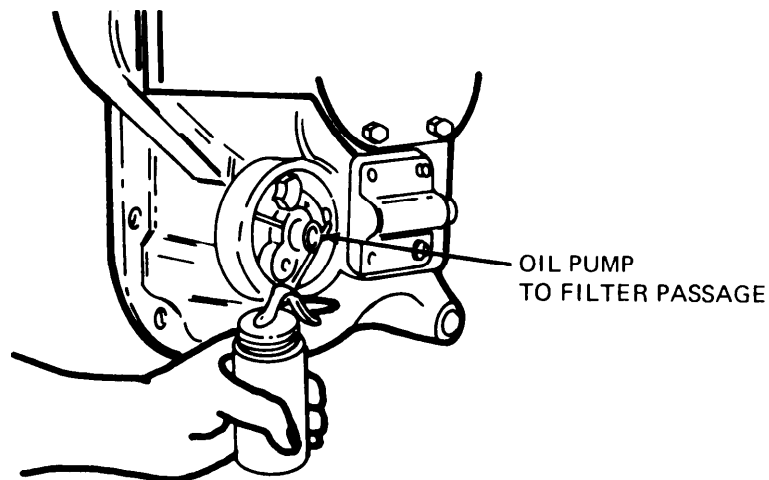
(5) Position the oil filter adapter in its bore in the helical gear cover (fig. 11-45). Install washers and capscrews, and torque to 20-30 lb-ft (27-41 N•m).



TA 074303

Figure 11-45. Install the Oil Filter Adapter.

(6) Pour or squirt two ounces of specified drive unit lubricant (item 30, App B) into the oil pump to filter passage (fig. 11-46).



TA 074328

Figure 11-46. Lubricate the Filter Passage.

CAUTION

If the filter is tightened more than one turn after contacting gasket, damage to the filter may result.

(7) Coat the face of the gasket on the new oil filter with the gear lube (item 30, App B). Install the oil filter over the adapter and tighten one full turn after the gasket contacts the base, using a filter strap wrench. Do not overtighten.

(8) Assemble filter cover over filter on helical gear cover. Secure with two long oil pump relief valve cover capscrews and washers. Torque to 20-30 lb-ft (27-41 N•m).

m. Assemble and Install Input Shaft Yoke

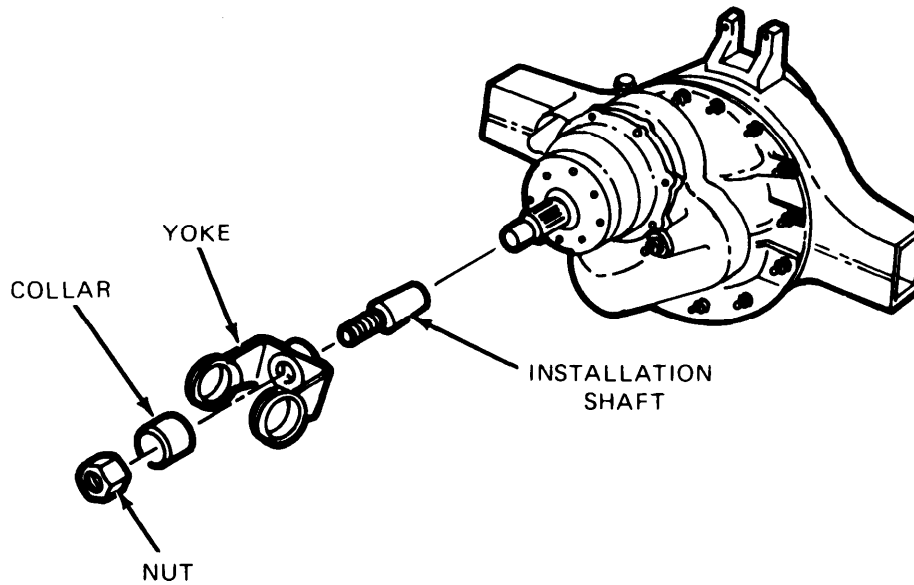
CAUTION

Do not drive yoke onto shaft by pounding or tapping.

(1) Coat yoke seal elements with gear lube. Also ensure that there are no burrs or nicks on the yoke wiper surface or on any surfaces that will pass through the seal during installation.

(2) Install slinger on input shaft (see fig. 11-2),

(3) Thread the yoke installation shaft into pinion input, output or through-shaft until installation shaft bottoms (fig. 11-47).



TA 074329

Figure 11-47. Install Yoke with Installation Tool.

(4) Slide the yoke over the installation shaft, alining yoke and shaft splines of drive unit.

(5) Place installation collar over the installation shaft, against yoke.

(6) Thread nut onto installation shaft, against the collar. Continue threading the nut against collar until yoke seats against bearing. A torque value of 200 lb-ft (270 N•m) on nut may be required to properly install and seat yoke.

CAUTION

Do not use a prevailing torque nut to install the yoke, as damage to the threads will result. Use only the nut furnished with tool.

(7) Remove all parts of the installation tool from the drive unit.

(8) Install washer and nut. Tighten nut to 450-600 lb-ft (610-813 N•m).

n. Assemble the Helical Gear Cover onto Carrier.

(1) Before assembling the cover to carrier, coat the forward interaxle differential side gear thrust washer and backface of integral shift collar gear (on input shaft) with grease.

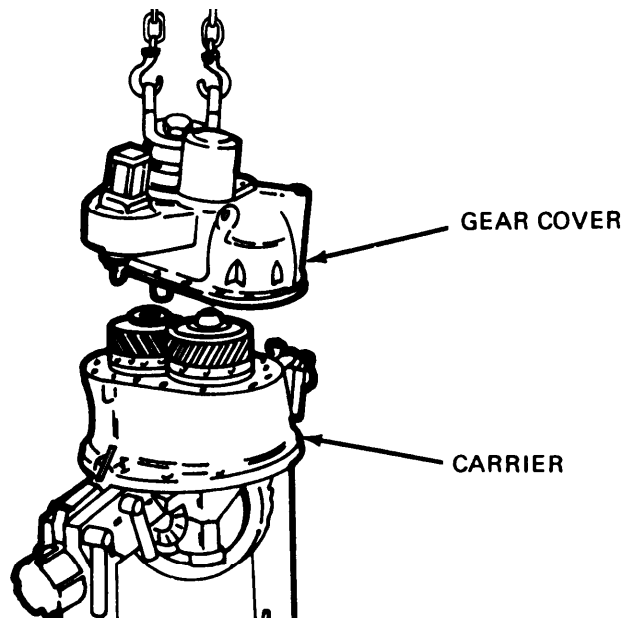
(2) Place the thrust washer onto the back face of shift collar gear. The grease will allow the washer to stick to the gear.

CAUTION

Do not assemble the thrust washer onto the forward side gear in carrier. Damage to the washer will occur if the slightest misalignment is present.

(3) Apply silicone gasket material to the mating surfaces of the two cases.

(4) Using a hoist attached to the input yoke (fig. 11-48), position the gear cover above the carrier.



TA 074301

Figure 11-48. Install Cover on Carrier.

(5) As the helical gear cover is lowered onto the carrier, make certain the input shaft aligns with the bore through the interaxle differential; continue to lower the cover onto the carrier. As the input shaft enters the interaxle differential, it may be necessary to index the shaft through the splines of the spider (cross).

(6) With the gear cover in position on the carrier, assemble the gear cover-to-carrier capscrews and washers and torque capscrews to 85-115 lb-ft (1 15-156 N•m).

o. Adjust Input Bearing End Play.

NOTE

If original input shaft forward bearing is installed with shim pack (para 11-9k (5), tighten yoke nut enough to eliminate any play between the yoke and bearing; then proceed to step (5).

(1) With the forward input bearing in place and the bearing cage assembled finger-tight on the helical gear cover with no shim pack, measure the gap between the bearing cover and helical gear cover using a feeler gage.

(2) Add approximately 0.005 inch (0.127 mm) to measurement figure of gap. Add this amount of shims under the bearing cover,

NOTE

Use a minimum of three shims under bearing cover with the thinnest shims on outer sides.

(3) Remove the input yoke if assembled and bearing cover and install the initial amount of shims. Reassemble the cover, washers and capscrews. Torque capscrews to 35-50 lb-ft (47-68 N•m).

(4) Assemble the input yoke and nut over the input shaft. Tighten the yoke nut enough to eliminate any play between the yoke and the bearing.

(5) Check the bearing end play using a dial indicator mounted against the nose of the input shaft (fig. 11-49). Use a dial indicator with a magnetic base or c clamp arrangement mounted on the helical gear cover.

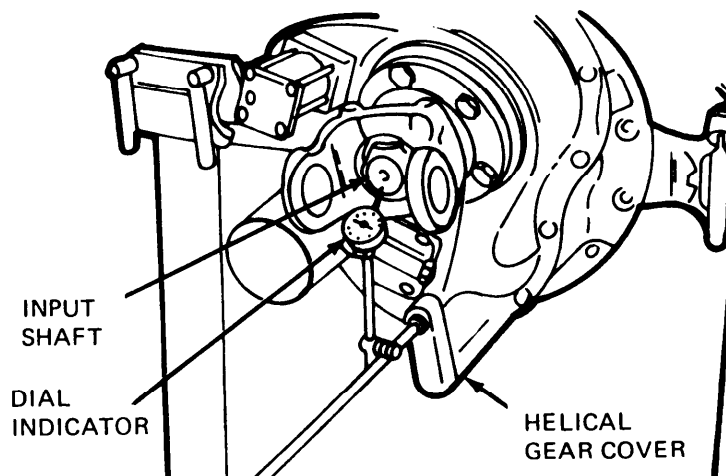


Figure 11-49. Check Input Bearing End Play.

TA 074330

(6) Holding the input yoke, push in the input bearing while turning the yoke side to side to seat the bearing. Set the indicator to zero.

(7) Next, pull the yoke outward, again turning it side to side and take note of reading on the dial indicator.

(8) Final end play must be between 0.003-0.007 inch (0.076-0.178 mm). If not, adjust by either adding or removing shims from under the bearing cover and repeat above procedures.

NOTE

Add shims to increase end play;
remove shims to decrease end play.

(9) After correct end play has been established, torque the input yoke nut to 450-600 lb-ft (610-813 N•m).

p. Adjust Shift Shaft.

(7) If the shift shaft adjusting screw and jam nut have not been assembled, install both parts into the helical gear cover in back of the shift shaft. Turn in the adjusting screw approximately two turns at this time.

(2) Using a shop air supply, apply air pressure to the air chamber. This will move the shift shaft, fork and collar back, locking the interaxle differential.

(3) Make sure the collar travels over the splines and engages with the rear side gear. If necessary, index the shift collar by turning the input shaft.

(4) With the shift shaft moved back its full travel, turn in the adjusting screw until it just touches the end of the shift shaft.

(5) From this point continue turning in screw 1-1 1/4 turns more and lock adjusting screw with jam nut; torque jam nut to 40-55 lb-ft (54-75 N•m). This will allow correct clearance between the fork and groove of the collar, thus eliminating wear.

(6) After shift shaft adjustment has been made, remove the air line from the air chamber.

11-10. Differential Carrier Installation.

a. Clean and Inspect the Housing.

(1) Remove any accumulation of dirt, grit, or gum from the housing bowl and sleeves. Clean the housing thoroughly with SD-2 dry cleaning solvent (item 12, App B) and blow dry with compressed air.

(2) Inspect the housing for cracks, nicks, and burrs on machined surfaces. Remove nicks and burrs with a stone or file. Make all necessary repairs or parts replacements before installing the drive unit in the housing. Be sure the housing is thoroughly cleaned after repairing.

b. Install the Differential Carrier.

(1) Apply silicone sealant (item 24, App B) over the drive unit opening in the housing.

CAUTION

Driving carrier into housing with a steel hammer will damage carrier flange and cause severe oil leakage.

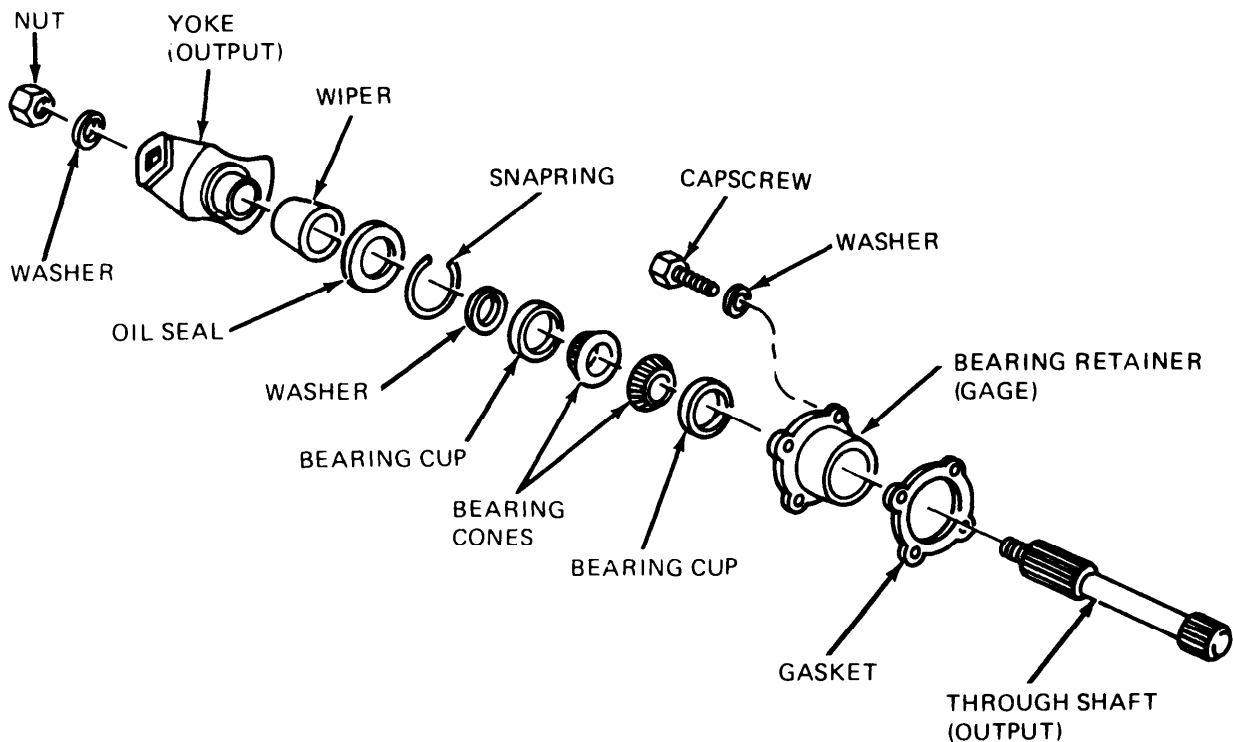
(2) Roll the carrier into position on a roller jack. Start the carrier into the housing with four flat washers and capscrews equally spaced. Tighten alternately to draw the carrier squarely into the axle housing.

(3) After the drive unit has been drawn up tightly to the housing, install the balance of washers and capscrews. Torque capscrews to 180-230 lb-ft (244-312 N•m).

(4) Install right and left axles with new gaskets (fig. 11-4). Secure with tapered dowels, washers, and nuts. Torque nuts to 175 lb-ft (237 N•m).

11-11. Output Shaft Assembly.

a. Coat bearings with recommended axle lubricant (item 30, App B) and press both inner and outer bearing cones (back-to-back) onto end of output shaft until inner bearing cone bottoms on the shaft shoulder (fig. 11-50). Use a press and suitable sleeve.



TA 74299

Figure 11-50. Assemble Output Shaft and Yoke.

CAUTION

Use soft metal shields over vise jaws to avoid damaging the cage.

b. Secure the output shaft bearing cage in a vise and place the inner bearing cup in position in the bearing cage and insert the output shaft with bearing cones through the cage.

c. Position the outer bearing cup into the cage and over the bearing cone on the through shaft. Secure bearings and shaft in the cage with a snap ring bearing spacer. This snap ring also controls the bearing end play.

NOTE

Do not assemble the oil seal or yoke and spacer at this time.

11-12. Output Shaft Installation.

a. *Adjust Bearing End Play.*

NOTE

The output bearing end play is controlled by the thickness of the snap ring bearing spacer. The snap ring is available in thicknesses ranging from 0.155-0.182 inch in increments of 0.003 inch. Select and install one snap ring to obtain a 0.0001-0.0030 inch (0.0025-0.0762 mm) bearing end play. Use the following procedures.

(1) With the bearing cage and through-shaft assembly secured in a vise, attach a dial indicator to the cage flange. Adjust the indicator so its pointer contacts the end of the through shaft and set the dial to zero.

(2) While observing the dial, pull the through-shaft to rack in the output bearings while turning the shaft side-to-side to seat the bearings.

(3) Next, push the through-shaft while turning it side-to-side and take note of the dial indicator reading.

(4) Final end play should be between 0.0001-0.0030 inch. If the bearing end play does not fall within this range, replace the snap ring bearing spacer.

NOTE

A thinner snap ring will increase end play, and a thicker snap ring will decrease end play.

(5) After establishing correct bearing end play, assemble the yoke spacer and yoke onto the through-shaft against the outer bearing. Secure the yoke with nut and torque to 450-600 lb-ft (610-813 N•m).

NOTE

Use a yoke holder while tightening the yoke nut.

(6) Using the dial indicator, make a second check of the bearing end play with the yoke and spacer installed. Use the same procedures as with the first check, steps (1) thru (3).

(7) Remove the yoke and spacer from the through-shaft using a yoke holder while loosening the nut.

(8) Coat the output seal lips with Lubriplate (item 16, App B) and outer diameter of retainer with a non-hardening sealing material, such as Permatex (item 23, App B).



Do not exert pressure on the seal retainer after it bottoms. Damage to seal will result,

(9) Assemble the oil seal into the cage by placing the through-shaft and cage assembly in a press. Use a suitable sleeve having a diameter that will fit inside the cage inner diameter and press in the seal until it bottoms in cage. If a press is not available, use the sleeve and a mallet to seat the seal in the cage.

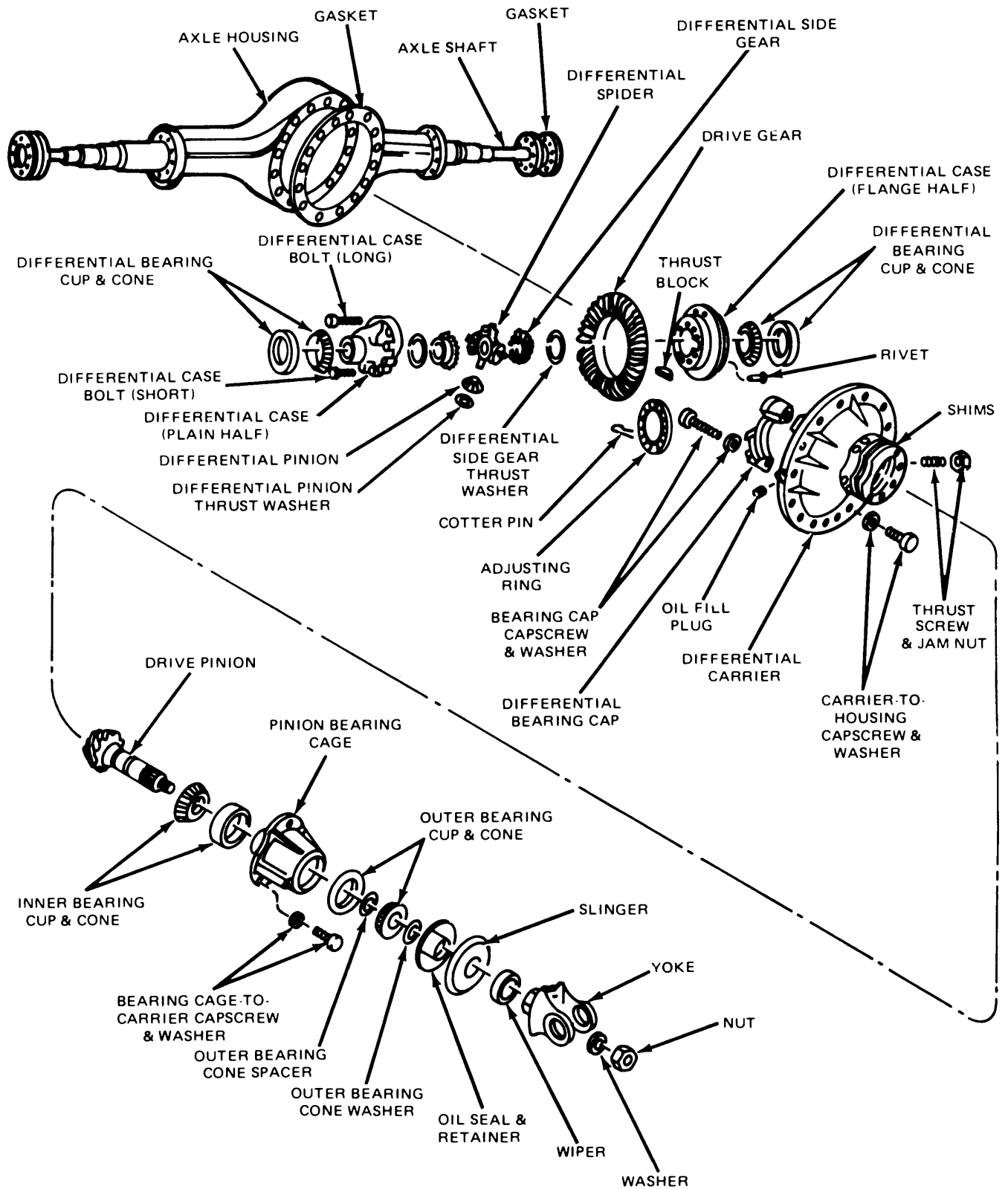
b, Install Output Shaft and Yoke.

(1) Install the output shaft and cage assembly into the axle housing. It may be necessary to rotate the shaft to index splines of shaft and side gear. Secure the bearing cage to housing with capscrews. Torque capscrews to 35-50 lb-ft (47-68 N•m).

(2) Install the output yoke as described in paragraph 11-9 m.

Section II. REAR REAR AXLE

11-13. Description. A single-reduction, final drive unit is employed as the rear rear drive unit of the tandem axle (see fig. 11 -51). This type of drive unit employs a heavy-duty amboid pinion and gear set. The differential and gear assembly is mounted between tapered roller bearings, and the pinion is mounted with two tapered roller bearings in front of the pinion head to take the forward and reverse thrusts and radial loads.



TA 074331

Figure 11-51. Rear Rear Axle- Exploded View

11-14. Differential Carrier Removal.

- a. Remove the plug from bottom of the axle housing and drain the lubricant.

CAUTION

Do not hit the circular driving lugs on the shaft head. This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels. This will damage the hub, shaft, and oil seal.

- b. Remove the axle shaft stud nuts, washers and tapered dowels (fig. 11-4). To loosen the tapered dowels, hold a 1%-inch diameter brass drift against the center of the axle shaft head, inside the circular driving lugs. Strike the drift a short blow with a 5-8 lb hammer or sledge. A 1%-inch diameter brass drift is excellent and safe.

- c. Remove the axle shaft from the drive unit and housing. (Refer to para 11-4 b.)

- d. To remove the carrier from the housing, first loosen the two top capscrews and leave them attached to the housing. This will prevent the carrier from falling.

- e. Remove all other capscrews, nuts, and washers. Break the carrier loose from the housing with a rawhide mallet.

- f. Place a roller jack under the carrier. Remove the top capscrews and washers and work the carrier free. A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange. Discard the carrier-to-housing gasket if used. Remove studs only if replacement is needed.

- g. Place the carrier assembly in a suitable holding fixture.

11-15. Differential Carrier Disassembly (fig. 11-51).

- a. *Remove Differential and Gear Assembly.*

- (1) With the carrier still in an upright position, loosen jam nut and back off the drive gear thrust screw.

- (2) Rotate the carrier 180° and bring the drive gear to an upright position.

- (3) Check and record the backlash. This information will be needed in reassembly unless a new gear set is used,

- (4) Center-punch one differential carrier leg and bearing cap to identify at reassembly.

- (5) Remove the carrier cap capscrews, washers, and cotter keys from both sides of the carrier.

- (6) Remove the bearing adjusting rings and the carrier caps.

- (7) Remove the thrust block from the inside of the carrier housing.

b. Disassemble Differential Case and Gear Assembly.

- (1) If original identification (matching) marks are not clear, mark the differential case halves with a punch for correct alignment at reassembly.
- (2) Remove the capscrews and washers and separate the case halves.
- (3) Remove the spider, pinions, side gear, and thrust washers.
- (4) If the gear is to be replaced for any reason, remove the rivets and separate gear from the case.
 - (a) Carefully center-punch rivets in the center of the head on the gear side of the assembly.
 - (b) Use a drill 1/32-inch smaller than the body of the rivet to drill through the head.
 - (c) Press out the rivets.
- (5) If necessary to replace the differential bearings, remove with a suitable puller.

c. Remove Pinion and Cage Assembly.

- (7) Hold the yoke with a suitable tool and remove the pinion shaft nut and washer.



Driving the yoke will cause run-out.

- (2) Remove the yoke with a suitable puller.



The use of a pinch bar will damage the shims.

- (3) Remove the pinion cage capscrews and washers, then remove the bearing cage from the carrier.
- (4) Wire the shim pack together to facilitate adjustment at reassembly.

d. Disassemble Pinion and Cage Assembly.

- (1) Tap the shaft out of the cage with a soft mallet or press the shaft from the cage.
- (2) Remove the oil seal and retainer from the cage.
- (3) Remove the outer bearing from the cage.
- (4) Remove the spacer or spacer combination from the pinion shaft.
- (5) If necessary to replace the rear (inner) bearing, remove (with suitable puller) from the pinion shaft.

11-16. Cleaning, Inspection, and Repair. (Refer to para 11-6, 11-7, and 11-8.)

11-17. Differential Carrier Assembly.

a. Assemble Pinion and Cage.



Take care not to damage the bearing rib in the cage.

(1) Coat the bearings with gear lube (item 30, App B) and if new cups are to be installed, press firmly against the pinion bearing cage shoulders.

(2) press the rear (inner) bearing firmly against the pinion shoulder with a suitable sleeve that will bear only on the bearing inner race.

(3) Insert the pinion and bearing assembly in the pinion cage and position the spacer or spacer combination over the pinion shaft.

(4) press the front (outer) bearing firmly against the spacer.

(5) Rotate the cage several revolutions to assure normal bearing contact.

(6) While in the press, under pressure, check the bearing preload torque. Wrap a soft wire around the cage and pull on a horizontal line with a pound scale.

(7) If a press is not available, the pinion nut may be tightened to the correct torque and the preload checked. The correct pressures and torque for checking the pinion bearing preload are as follows:

PINION SHAFT THREAD SIZE	REQUIRED NUT TORQUE TO OBTAIN CORRECT PRELOAD	REQUIRED PRESSURE TO OBTAIN CORRECT PRELOAD
1 1/4 inch x 12	700-900 lb-ft (949-1220 N•m)	11 tons (10 metric tons)

NOTE

Use rotating torque, not starting torque.

(8) if rotating torque is not within 20-45 lb-in (2.3-5.1 N•m) for new bearings, or 10-22 lb-in (1.1-3.4 N•m) for reused bearings, use a thinner spacer to increase or a thicker spacer to decrease the preload.

(9) Press the yoke against the forward bearing and install the pinion shaft nut.

(10) Place the pinion and cage assembly in the carrier and secure with capscrews and washers. Hold the flange and torque the pinion shaft nut to 700-900 lb-ft (949-1220 N•m). The yoke must be held with a suitable tool or fixture to tighten the nut.

(11) Recheck the pinion bearing preload torque. If rotating torque is not within 15-25 lb-in (1.7-3.8 N•m), repeat the foregoing procedure.

(12) Hold the yoke and remove the pinion shaft nut; also remove the yoke.

(13) Lubricate the oil seal and coat the outer edge of the seal retainer with a non-hardening sealing compound (item 23, App B). Press the seal and retainer against the shoulder of the pinion cage with a seal driver.

(14) Press the yoke and washer against the forward bearing and install the pinion shaft nut. Torque to 700-900 lb-ft (949-1220 N•m).

b. Install the Pinion and Cage Assembly.

(1) Original Gear Set.

(a) If the original pinion and drive gear are to be reassembled into the carrier, use the same shim pack, if reusable, between the pinion bearing cage and the carrier. Otherwise, use a new shim pack of the same thickness.

NOTE

Use a minimum of three shims per pack.

(b) Install the correct shim pack. Locate thin shims on both sides for maximum sealing ability.

(c) Place the pinion and cage assembly (with shims) into the carrier and tap into position with a soft mallet.

(d) Install capscrews. Torque to 85-115 lb-ft (1 15-156 N•m).

NOTE

After the differential and gear assembly is installed into the carrier, make a gear tooth contact check.

(2) New Gear Set.

NOTE

If the pinion or drive gear require replacement, both must be replaced in matched sets.

(a) Before installing a new pinion and gear set, check and compare the matching number of both the pinion and drive gear; they must be the same. An example of this number would be M29 or any combination of a letter and number marked on the nose of the pinion and on the front face of the drive gears.

NOTE

All amboid pinions have a nominal mounting distance and a plus or minus variation indicated as PC (pinion cone) marked in the same area. An example of these numbers would be 7.875 PC + 5. The PC number indicates the variation in thousandths from the nominal mounting distance for that specific gear set.

(b) To determine the proper shim pack thickness to be used with a new pinion and gear set, use one of the following procedures (c or d) as applicable.

c. Adjust the Pinion Cage Shim Pack Thickness without Pinion Setting Gage.

(1) Measure the thickness of the original shim pack used with the gear set being replaced; use a micrometer or vernier gage. Make a note of this measurement.

(2) Note the PC or variation number on the original pinion being replaced. If this number is a plus (+) value, subtract it from the original shim pack measurement taken in step (1). If the variation number is a minus (-) value, add it to the measurement from step (1). Make a note of this value.

NOTE

The value calculated in step (2) will establish a "standard shim pack thickness" without a variation. This value will be used in calculating the shim pack thickness used with a new pinion and gear set.

(3) Note the PC or variation number on the new pinion. Add or subtract this number as indicated by the variation sign (+ add or - subtract) from the calculated standard shim pack thickness determined in step (2).

(4) The resulting answer indicates the thickness (in thousandths) of the new shim pack to be used. *Use a minimum of three shims per pack.*

(5) Assemble the new pinion and cage assembly with the correct shim pack into the carrier.

NOTE

After assembling the pinion and cage assembly with new shim pack and differential and gear assembly into carrier, make a gear tooth contact check.

d. Adjust the Pinion Cage Shim Pack Thickness with Pinion Setting Gage.

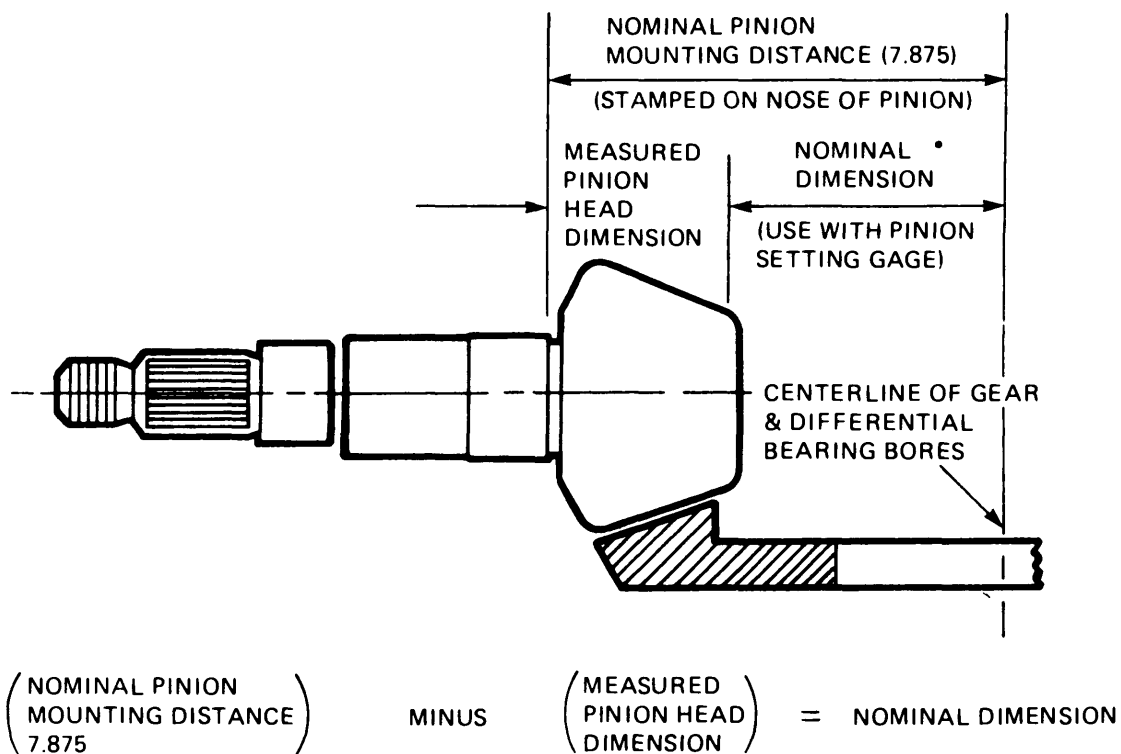
(1) Because the pinion setting gage measures the distance or depth of the pinion in the carrier from the centerline of the main differential bearing bores to the nose of the pinion, it is necessary to calculate and establish the correct nominal or gage dimensions to work with.

CAUTION

Do not directly use the dimension (i.e., 7.875) stamped on the nose of the pinion for calculations when using the pinion setting gage.

(2) The dimension (i.e., 7.875) stamped on the pinion indicates the distance from the center of the differential bearing bores to the pinion bearing shoulder. This dimension must be modified to a workable value as follows.

(3) Make a note of the nominal pinion mounting distance dimension stamped on the pinion nose (fig. 11-52).



TA 074332

Figure 11-52. Establish Nominal Dimension.

(4) Measure the length of the pinion head. Measure this distance from the nose to the bearing shoulder using a 3-4 in. micrometer or vernier.

(5) Mark the spot on the pinion nose from which the head length measurement was taken. Later, when using the pinion setting gage, measure to the same spot.

(6) Subtract the measured pinion head length from the nominal pinion mounting distance noted in step (3). The remainder is the nominal or gaging distance used for calculations when using the pinion setting gage. See figure 11-52 for the formula.

(7) Continue with procedures using the calculated nominal (gaging) distance and the plus or minus PC variation.

e. Assemble the Differential and Gear.



The gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and case, thus resulting in gear run-out. Proper installation should, therefore, incorporate preheating the gear to assure correct interference fit and to eliminate metal pickup.

(1) Heat the ring gear in oil to approximately 160°F–180°F (71.1°C–82.2°C) for about ten minutes before assembly.

(2) Install twelve bolts, washers, and nuts. Torque to 180-230 lb-ft (244-312 N•m).

(3) Pre-lubricate the differential case inner walls and all component parts with the recommended axle lubricant.

(4) position the thrust washer and side gear in the gear case half.

(5) Place the spider with pinions and thrust washers in position.

(6) Install the second side gear and thrust washer.

(7) Position the other case half over the assembly, aligning match marks of both halves. Draw the assembly together with three equally spaced capscrews.

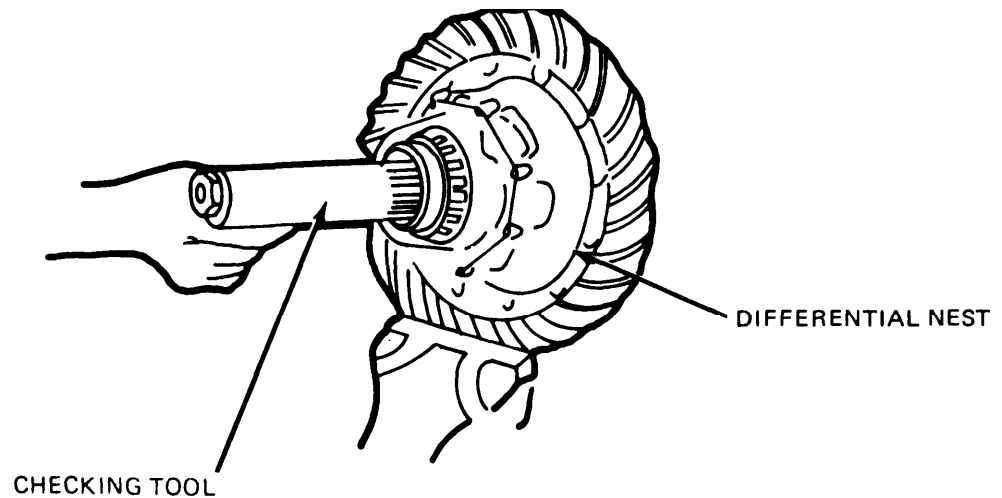
(8) Install the remaining capscrews and torque to 85-115 lb-ft (115-156 N•m).

(9) If new bearings are to be used, press squarely and firmly on the differential case halves with a suitable sleeve.

f. Rolling Resistance of Differential Nest.

(1) Place the differential and ring gear assembly in a vise with soft metal jaws.

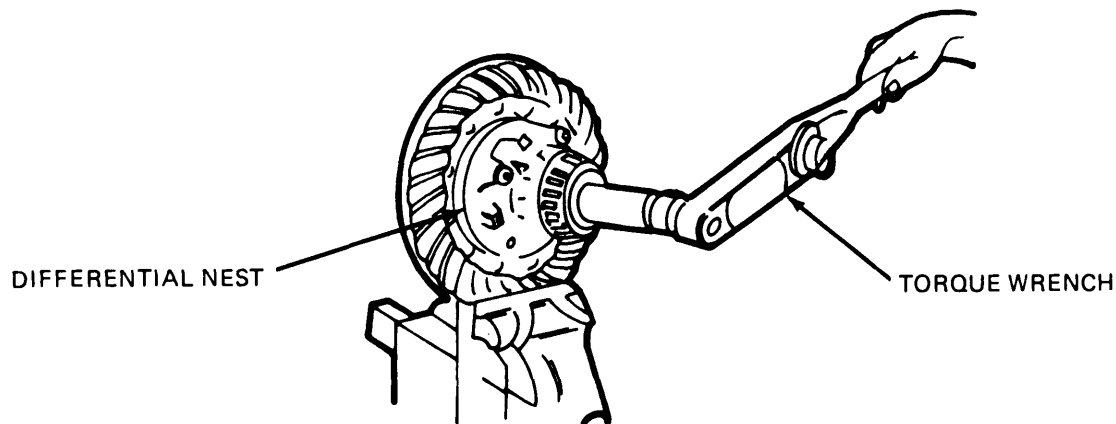
(2) Insert a checking tool (made from a splined axle shaft end) into the differential nest (fig. 11-53). Allow the splines of the tool to engage with the spline of one *side gear only*.



TA 074287

Figure 11-53. install the Checking Tool.

(3) Using a suitable socket and torque wrench, rotate the differential nest while observing the scale on the torque wrench (fig. 11-54). Correct rolling resistance of the differential assembly is 50 lb-ft (68 N·m) torque maximum applied to one side gear;



TA 074288

Figure 11-54 Check Rolling Resistance.

g. Install the Differential and Gear Assembly.

- (1) Pre-lubricate the differential bearings and cups with gear lube (item 30, APP B).
- (2) place the cups over the bearings and position the assembly in the carrier housing,
- (3) Insert the bearing adjusting nuts and turn hand-tight against bearing cups.

C A U T I O N

If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting nuts. Forcing the caps into position will result in irreparable damage to the carrier housing or bearing caps.

(4) Install the bearing caps in the correct location as marked and tap lightly into position.

(5) Install the carrier leg capscrews and washers and torque to 290-350 lb-ft (393-475 N·m). Install adjusting nut, dowel, and cotter keys after final adjustments are made.

h. Adjust the Differential Bearing Preload.

(1) Using a dial indicator at the backface of the gear, loosen the bearing adjusting nut on *the side opposite gear on/y* sufficient to notice end play on the indicator.

(2) Tighten the same adjusting nut only sufficient to obtain 0.000 end play.

(3) Check the gear for run-out. If run-out exceeds 0.008 in. (0.203 mm), remove the differential and check for cause.

(4) Starting with 0.000 end play, tighten each adjusting nut one notch. This will properly preload the differential bearing.

i. Check the Amboid Gear Backlash.

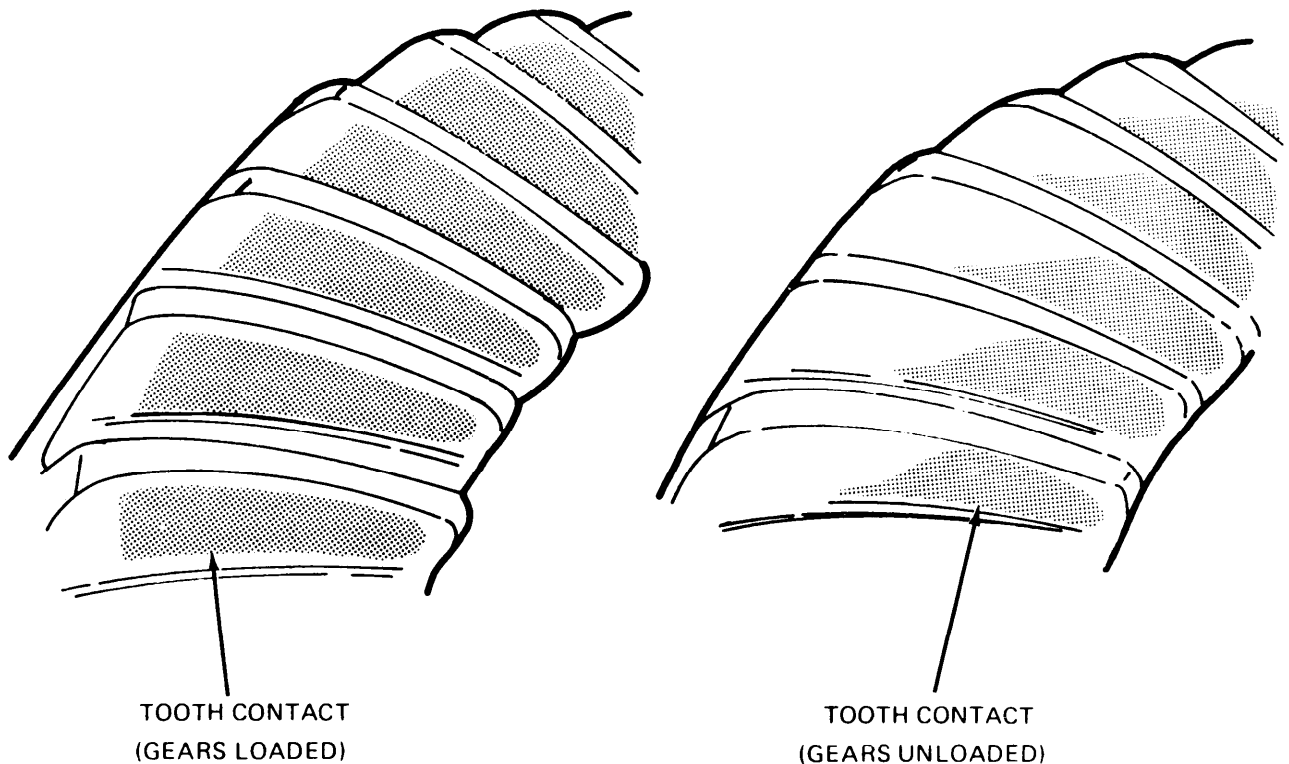
(1) If the drive gear is being replaced, the established backlash recorded before disassembly will be used. For new gears, the new backlash should be initially set at 0.015 in. (0.381 mm).

/2) Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount. Use a dial indicator mounted on the carrier-to-housing flange with the indicator pointer against one ring gear tooth.

j. Check the Tooth Contact.

(1) Refer to paragraph 11-9f for checking procedure.

(2) With adjustments properly made (pinion at correct depth and backlash set at 0.015 in. (0.38 mm), the contact in figure 11-55 will be procured. The area of contact is at the toe and is centered between the top and bottom of the tooth.



TA 074333

Figure 11-55. Satisfactory Amboid Tooth Contact.

(3) The hand-rolled pattern shown (gears unloaded) will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

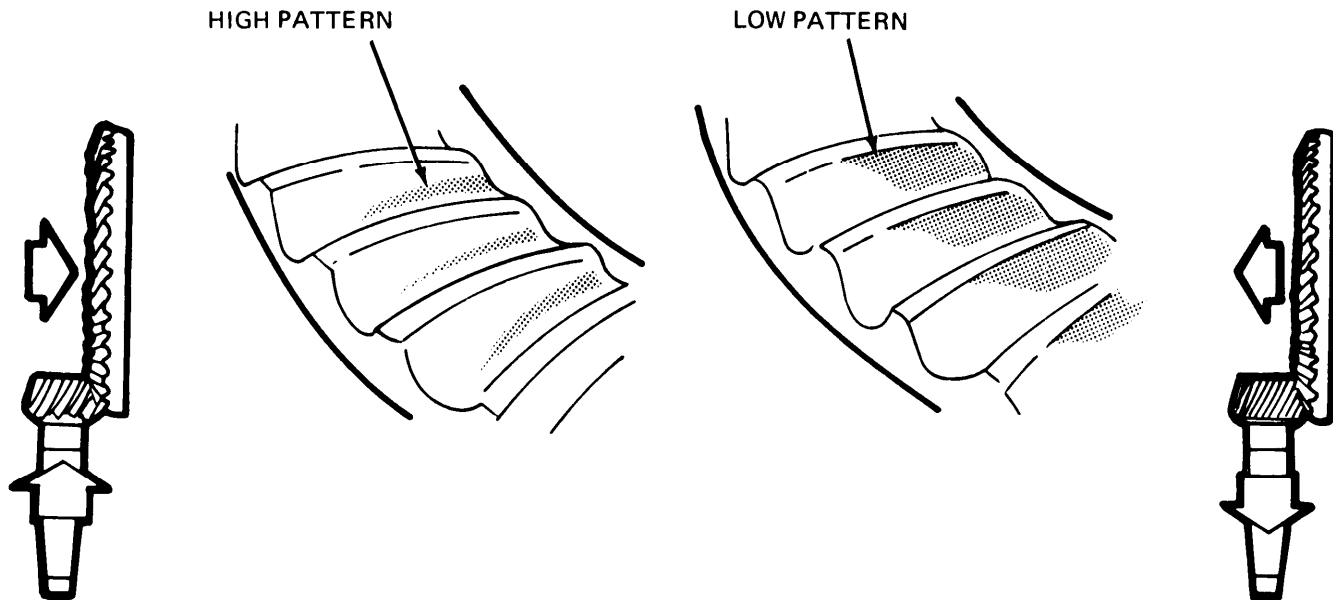
(4) If facilities are available for applying approximately 200 lb-ft (271 N·m) of torque or more to the pinion shaft, the following final check of tooth contacts is suggested.

NOTE

The pattern on the coast side of teeth will appear the same width as the drive side.

(5) After the correct contacts (shown above) have been established with a backlash of 0.015 in. (0.381 mm) open backlash to measure between 0.008-0.020 in. (0.203-0.508 mm) if required.

(6) Set used amoid gear to have the tooth contacts match wear patterns. Hand-rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns. Incorrect patterns are shown in figure 11-56.



TA 074334

Figure 11-56. Incorrect Contact Patterns.

k. Install the Thrust Block.

- (1) Remove the carrier from the stand and position with the backface of amboid gear upward.
- (2) Remove the adjusting screw and locknut.
- (3) Place the thrust block on the rear face of the amboid gear and rotate the gear until the hole in the thrust block is aligned with the adjusting screw hole.
- (4) Install the adjusting screw and locknut and tighten adjusting screw sufficiently to locate the thrust block firmly against the backface of amboid gear.
- (5) To secure the correct adjustment of 0.010-0.015 inch (0.254-0.381 mm) clearance, loosen adjusting screw $\frac{1}{4}$ turn and lock securely with nut. Torque nut to 150-190 lb-ft (203-258 N·m).
- (6) Recheck to assure clearance of 0.010-0.015 inch during full rotation of amboid gear.

11-18. Differential Carrier Installation.

a. Clean and Inspect the Housing.

(1) Remove any accumulation of dirt, grit or gum from the housing bowl and sleeves. Clean the housing thoroughly with dry cleaning solvent (item 12, App B) and blow dry with compressed air.

(2) Inspect the housing for cracks, nicks and burrs at machined surfaces. Remove nicks and burrs with a stone or file. Make all necessary repairs or parts replacements before installing the drive unit in housing. Be sure the housing is thoroughly cleaned after repairing.

b. Install the Differential Carrier.

(1) Apply silicone sealant (item 24, App B) over the drive unit opening in the housing.

CAUTION

Driving carrier into the housing with a steel hammer will damage the carrier flange and cause severe oil leakage.

(2) Roll the carrier into position on a roller jack. Start the carrier into the housing with four flat washers and capscrews equally spaced. Tighten alternately to draw the carrier squarely into the axle housing.

(3) After the drive unit has been drawn up tightly to the housing, install the balance of washers and capscrews. Torque capscrews to 180-230 lb-ft (244-312 N·m).

(4) Connect the universal at the pinion shaft.

(5) Install the axle shafts (Refer to TM 9-2320-273-20.)

CHAPTER 12

REPAIR OF M916/M920 REAR TANDEM AXLE

Section 1. FORWARD REAR AXLE

12-1. Description. The forward rear drive unit of the tandem axles is a front-mounted, single-reduction, through-drive type employing a two-gear transfer train. The unit incorporates hypoid reduction gears and bevel type gears in the main differential assembly and interaxle differential assembly, which is located behind the helical drive gear on the input shaft (figs. 12-1 and 12-2). Lubrication is accomplished by oil pump feed, splash, and spray. The unit has a no-spin positive locking differential identical to the one in the M915. (See para 11-2 for description.)

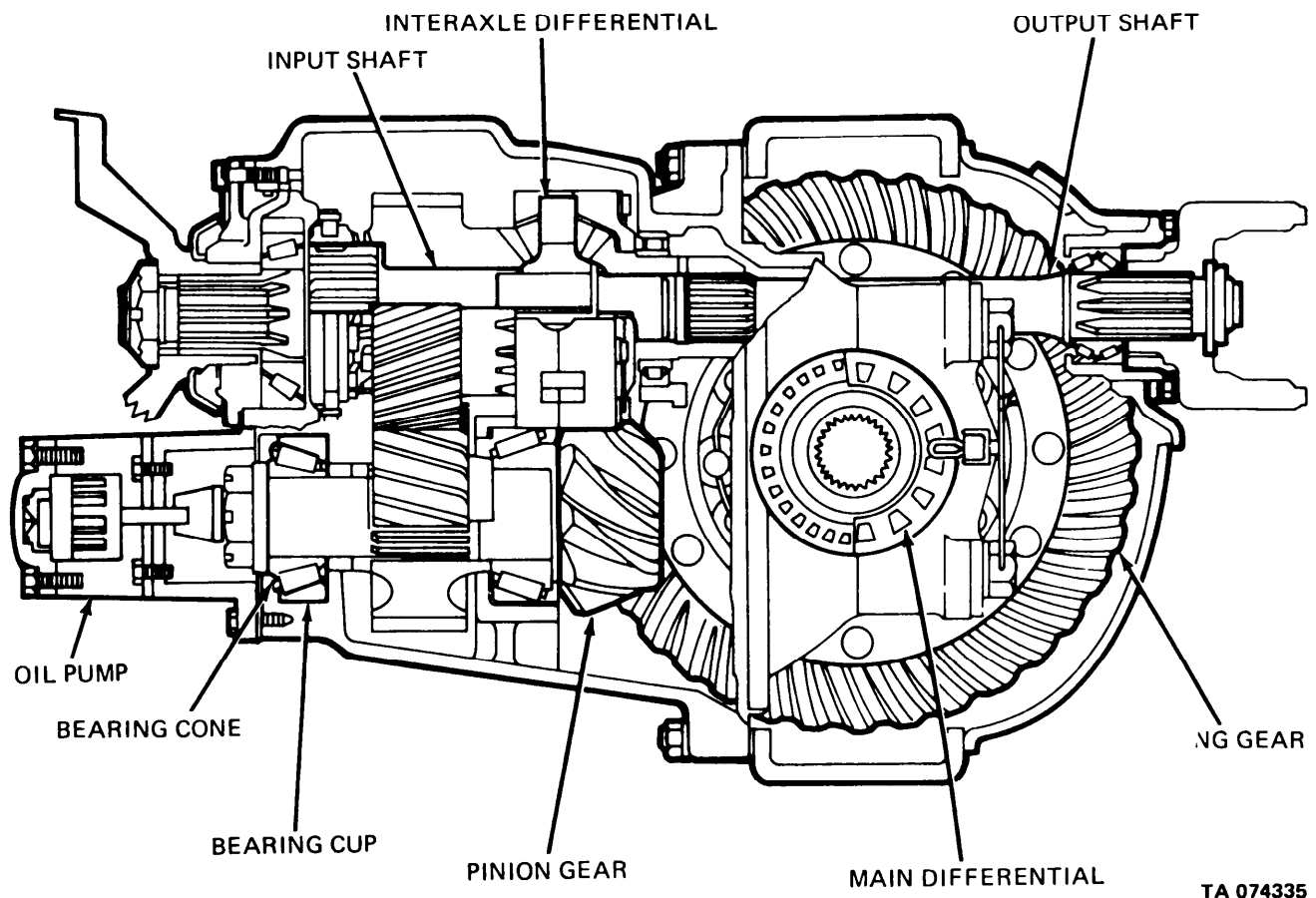
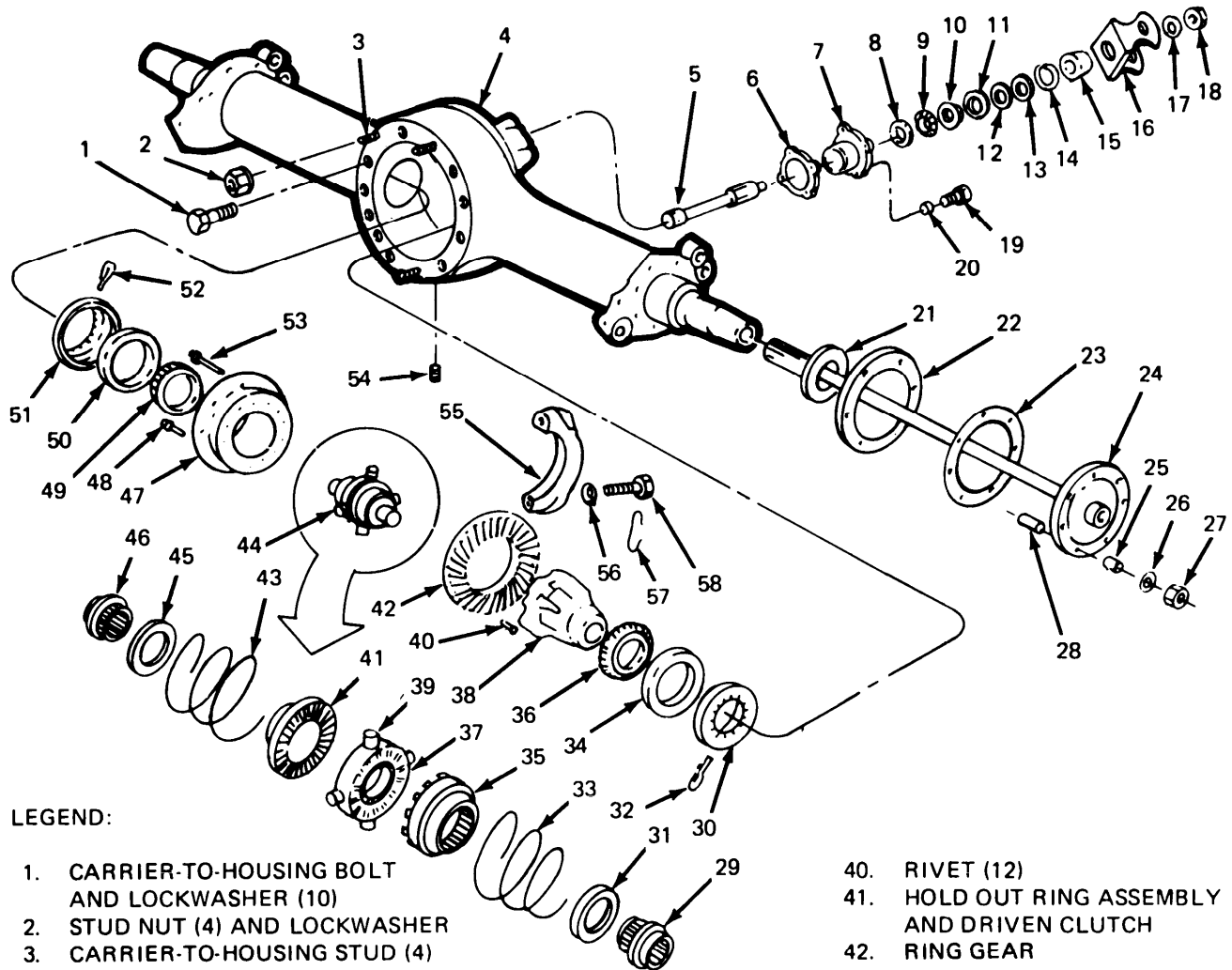


Figure 12-1. Forward Rear Axle Differential Carrier Cross Section (M916 thru M920).



LEGEND:

- | | | |
|--|--|--|
| 1. CARRIER-TO-HOUSING BOLT AND LOCKWASHER (10) | 24. AXLE SHAFT (2) | 40. RIVET (12) |
| 2. STUD NUT (4) AND LOCKWASHER | 25. DOWEL (16) | 41. HOLD OUT RING ASSEMBLY AND DRIVEN CLUTCH |
| 3. CARRIER-TO-HOUSING STUD (4) | 26. WASHER (16) | 42. RING GEAR |
| 4. AXLE HOUSING | 27. NUT (16) | 43. SPRING |
| 5. THROUGH SHAFT (OUTPUT) | 28. STUD (16) | 44. NO SPIN ASSEMBLY |
| 6. GASKET | 29. SIDE GEAR | 45. SPRING RETAINER |
| 7. BEARING RETAINER (CAGE) | 30. BEARING ADJUSTING RING | 46. SIDE GEAR |
| 8. BEARING CUP | 31. SPRING RETAINER | 47. DIFFERENTIAL CASE (FLANGED HALF) |
| 9. BEARING CONE | 32. COTTER PIN | 48. DIFFERENTIAL CASE BOLT (SHORT) (4) |
| 10. BEARING CONE | 33. SPRING | 49. DIFFERENTIAL BEARING |
| 11. BEARING CUP | 34. BEARING CUP | 50. BEARING CUP |
| 12. SHIM | 35. DRIVEN CLUTCH & HOLD OUT RING ASSEMBLY | 51. BEARING ADJUSTING RING |
| 13. SHIM | 36. DIFFERENTIAL BEARING | 52. COTTER PIN |
| 14. OIL SEAL | 37. SNAP RING & CENTER CAM ASSEMBLY | 53. CASE BOLT (LONG) (8) |
| 15. WIPER | 38. DIFFERENTIAL CASE (PLAIN HALF) | 54. PLUG |
| 16. YOKE (OUTPUT) | 39. SPIDER | 55. BEARING CAP (2) |
| 17. WASHER | | 56. WASHER (4) |
| 18. NUT | | 57. LOCKWIRE |
| 19. CAPSCREW (4) | | 58. DIFFERENTIAL BEARING CAPSCREW (4) |
| 20. WASHER (4) | | |
| 21. OIL SEAL (2) | | |
| 22. GASKET (2) | | |
| 23. GASKET (2) | | |

TA 074336

Figure 12-2. Forward Rear Axle Differential Carrier – Exploded View (M916 thru M920). (Sheet 1 of 3)

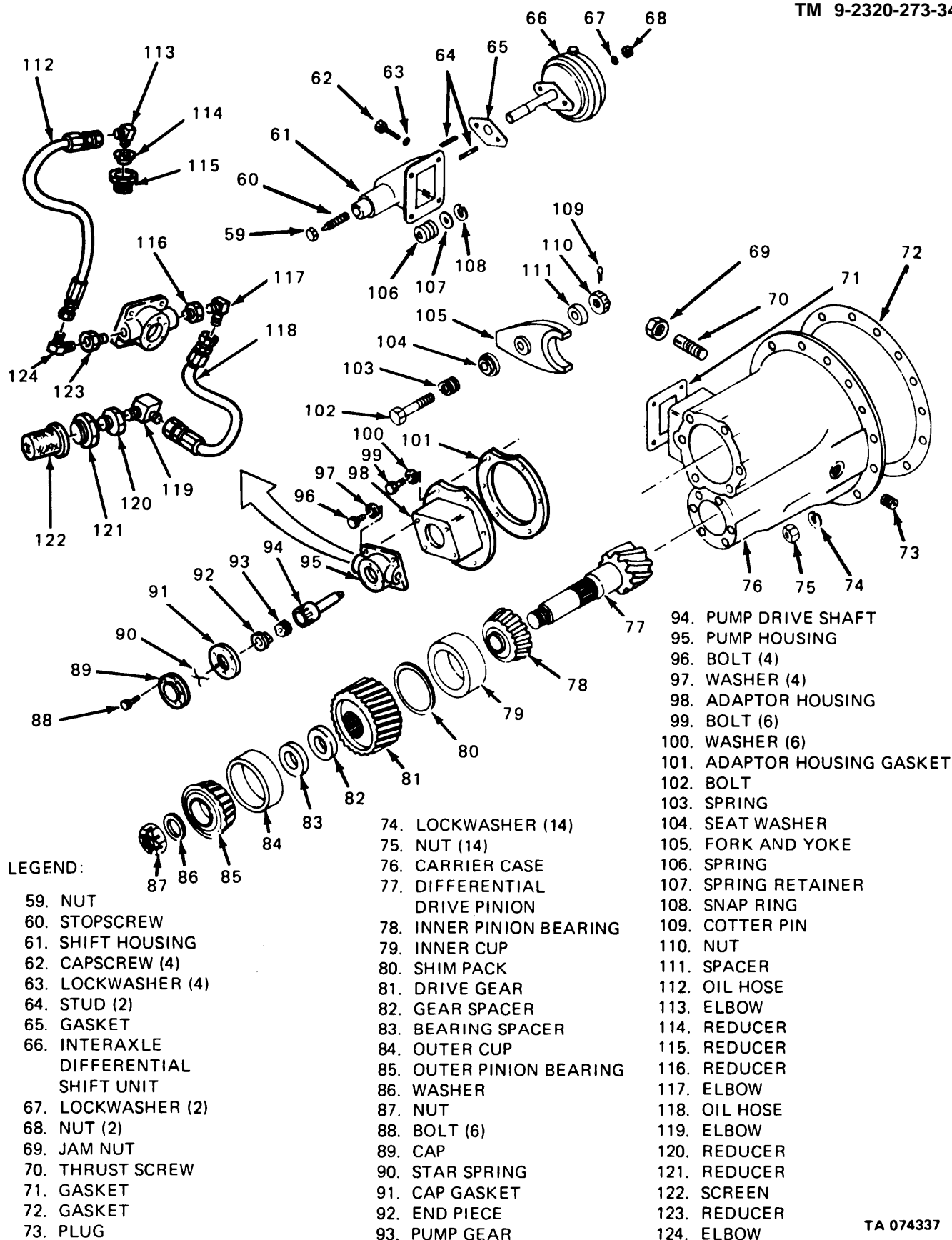


Figure 12-2. Forward Rear Axle Differential Carrier –
 Exploded View (M916 thru M920). (Sheet 2 of 3)

TA 074337

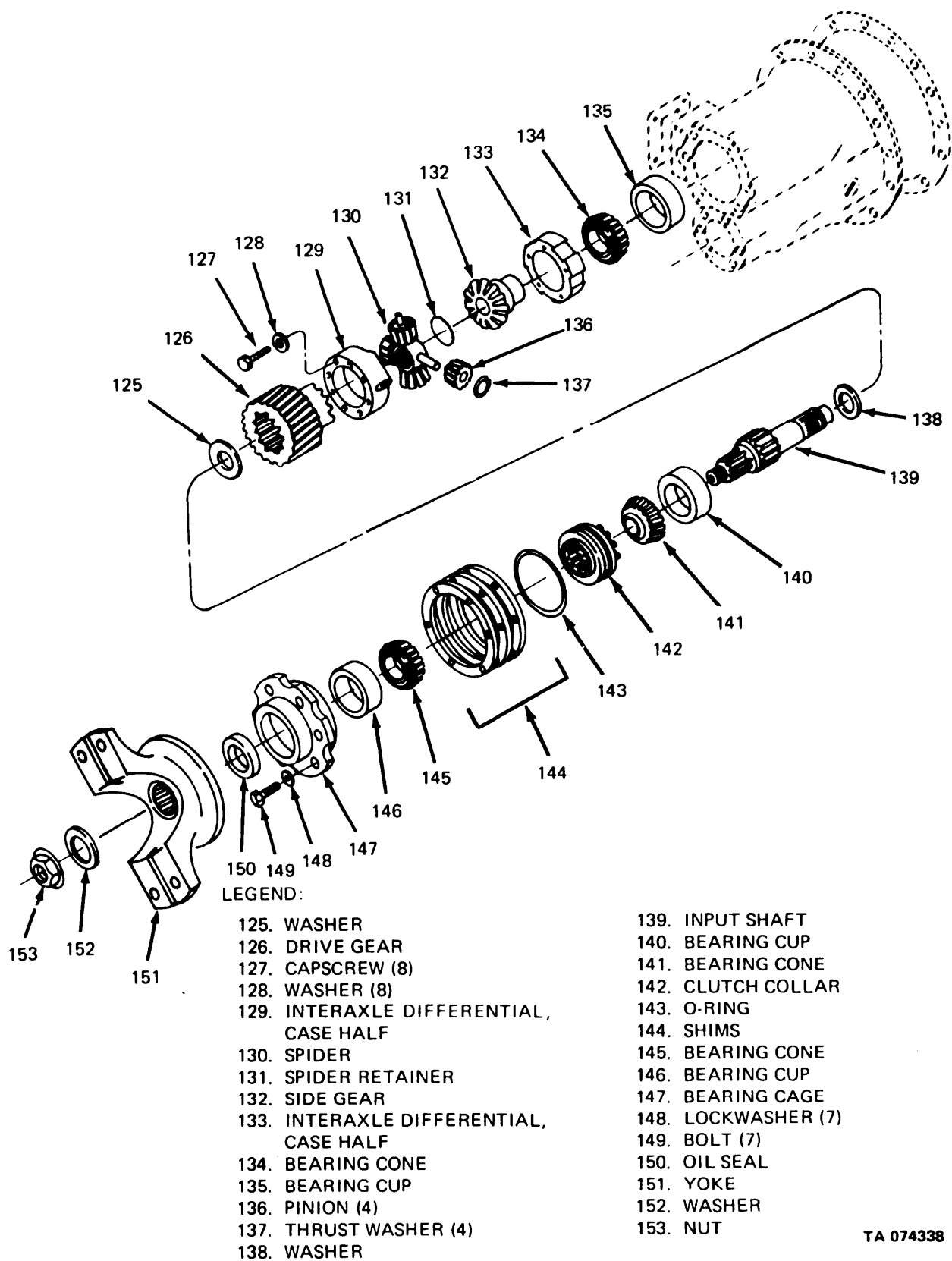


Figure 12-2. Forward Rear Axle Differential Carrier –
 Exploded View (M916 thru 44920). (Sheet 3 of 3).

TA 074338

12-2. Output Shaft Removal. (Refer to para 11-3.)

12-3. Output Shaft Disassembly. (Refer to para 11-3.)

12-4. Differential Carrier Removal (Fig. 12-2).

a. Remove plug (54) from bottom of the axle housing (4) and drain lubricant. (Refer to TM 9-2320-273-20.)

C A U T I O N

Do not hit the circular driving lugs on the shaft head. This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels. This will damage the hub, shaft and oil seal.

b. Remove the eight nuts (27), eight washers (26), and eight tapered dowels (25) from the eight studs (28) on each axle shaft (24). To loosen the dowels, hold a 1½ - in. diameter brass drift against the center of the axle shaft head, inside the circular driving lugs. Strike the drift a sharp blow with a 5-6 lb hammer. A 1½- in. diameter brass drift is excellent and safe for this purpose.

c. Remove the right and left axle shafts (24) from the axle housing (4).

d. If the unit is on the vehicle, disconnect the forward propeller shaft.

e. If the unit is on the vehicle, disconnect air line at the interaxle differential shift unit (66).

f. Remove eight carrier-to-housing bolts (1), four stud nuts (2) and their washers. Loosen two top stud nuts but leave them on their studs (3) to prevent carrier case (76) from falling.

g. Break carrier case (76) loose from axle housing (4) with a rawhide mallet.

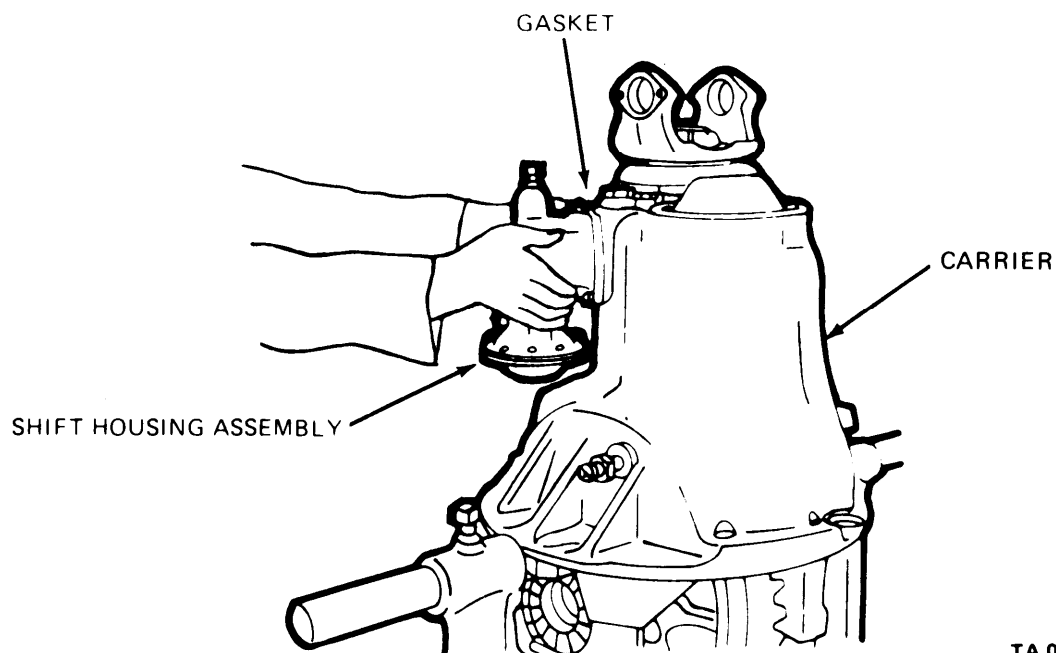
h. Place roller jack under carrier; then remove the top two nuts and lockwashers (2) and work carrier case (76) free. A small pinch bar may be used to straighten carrier in housing bore. However, the end must be rounded to prevent indenting the carrier flange.

12-5. Differential Carrier Disassembly.

a. Remove and Disassemble Shift Unit Housing Assembly.

(1) Place carrier case (76) in a suitable fixture (fig. 12-3); then remove four capscrews (62) four lock washers (63) from the shift housing (61) (see fig. 12-2).

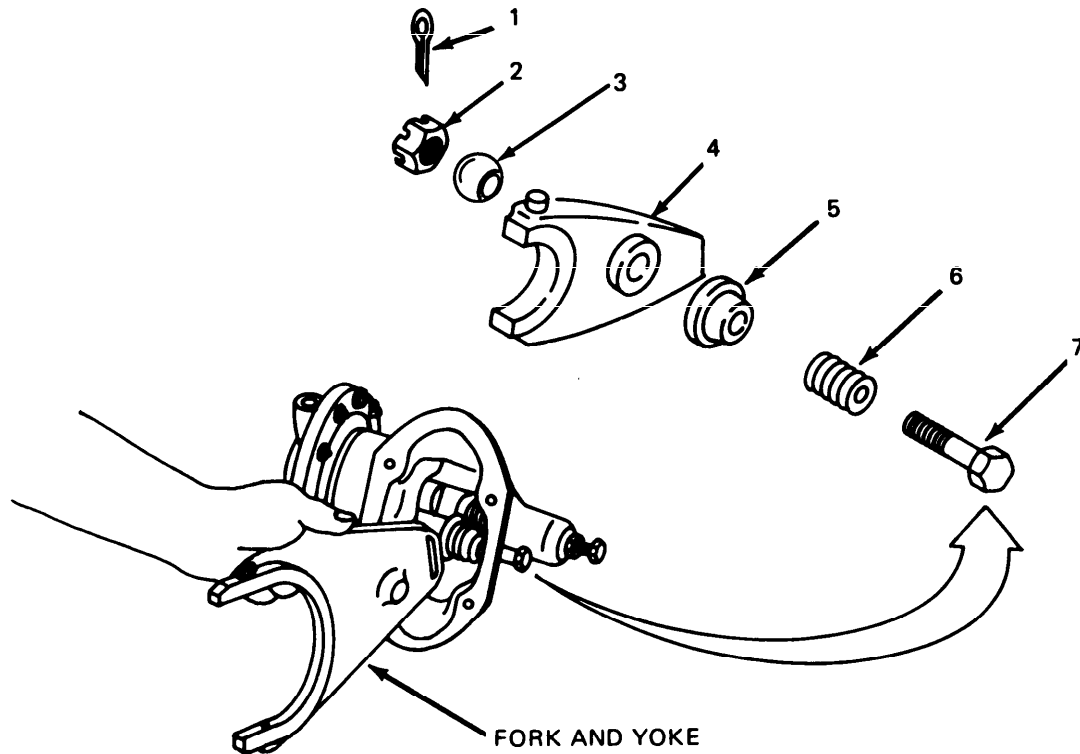
(2) Remove the shift housing assembly and gasket (61) and (71) (fig. 12-2). This is shown also in figure 12-3.



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Figure 72-3. Remove Shift Housing Assembly.

(3) Remove fork and yoke (4) (fig. 12-4) by removing cotter Pin (1), nut (2), bolt (7), spring (6), seat washer (5) and spacer (3).

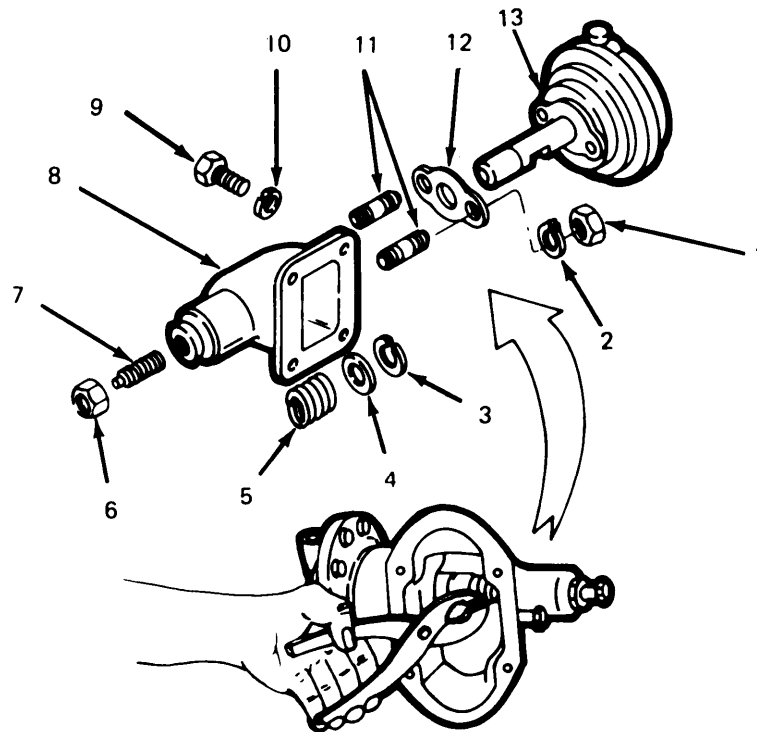
**LEGEND:**

1. COTTER PIN
2. NUT
3. SPACER
4. FORK AND YOKE
5. SEAT WASHER
6. SPRING
7. BOLT

TA 074340

Figure 12-4. Remove Fork and Yoke Assembly.

(4) Remove nut (1, fig. 12-5) and lock washer (2). Using snap ring pliers, expand snap ring (3) to clear shaft groove and slide out shift unit (13) and gasket (12).



LEGEND:

- | | | |
|--------------------|------------------|---------------------|
| 1. NUT | 5. SPRING | 10. LOCK WASHER (4) |
| 2. LOCK WASHER | 6. NUT | 11. STUD (2) |
| 3. SNAPRING | 7. STOP SCREW | 12. GASKET |
| 4. SPRING RETAINER | 8. SHIFT HOUSING | 13. SHIFT UNIT |
| | 9. CAPSCREW (4) | |

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Figure 12-5. Remove Shift Unit and Disassemble Chamber.

(5) Remove spring retainer (4) and spring (5) from the shift housing (8).

(6) Remove nut (6) and stop screw (7) and push rod from shift housing (8).

(7) Remove studs (11) with stud remover only if damaged or need replacing.

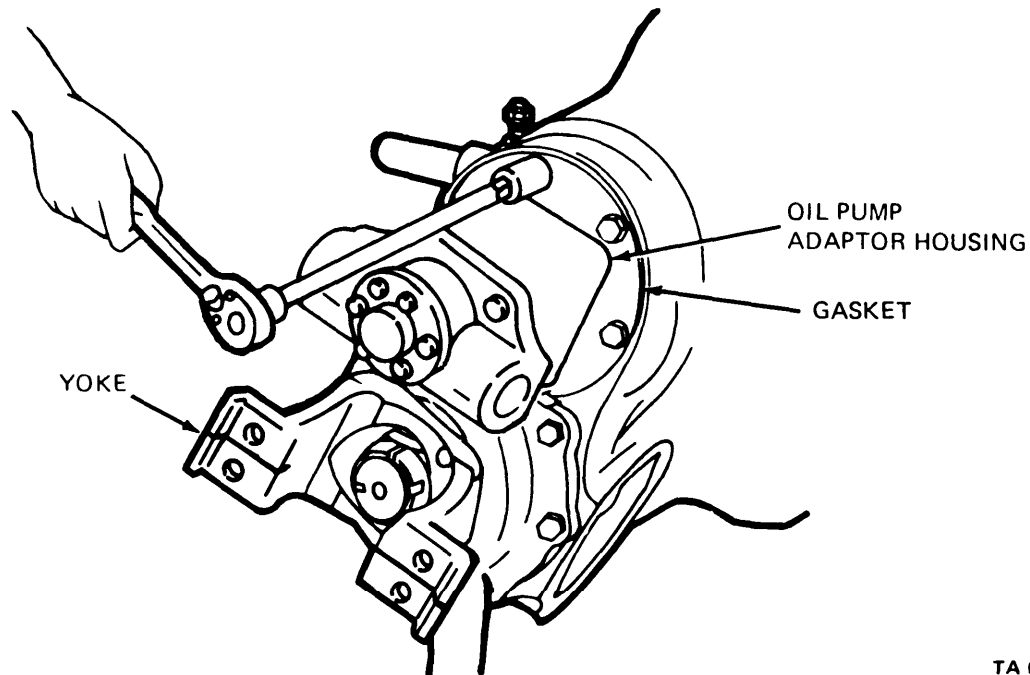
b. Remove Interaxle Differential and Cage Assembly.

NOTE

Before disassembly is started, record gear backlash. Gear must be reset to this figure at reassembly.

(1) Remove six bolts and six lock washers (fig. 12-6) holding the oil pump adaptor housing to the carrier case. Remove oil pump adaptor housing and gasket.

(2) Refer to figure 12-2. Remove two oil hoses(112 and 118), elbows (113, 117, 119 and 124), reducers (114, 115, 116, 120, 121 and 123) and the screen (122). Tag parts for easy reassembly.



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Figure 12-6. Remove Pinion Bearing Cover.

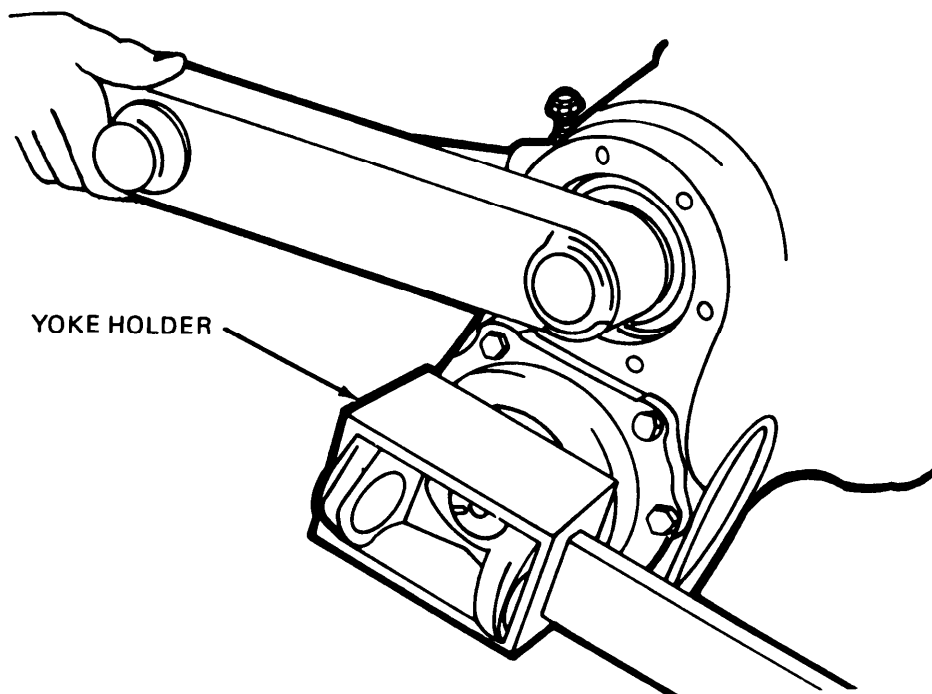
(3) Scratch or paint a line from the adaptor housing (98) to the pump housing (95) and from the pump housing to the cap (89) for easy alinement during reassembly.

(4) Remove four bolts (96) and four washers (97) attaching the pump housing (95) to the adaptor housing (98). Tap the pump housing with small mallet to free it from the adaptor housing.

(5) Remove six bolts (88) attaching cap (89) to the pump housing (95). Remove the cap and the cap gasket (91). Note position of small hole in gasket relative to lubrication slot in cap. Also note position of star spring (90) in cap and position of end piece (92). Do not rotate end piece until you have noted its original position.

(6) Remove end piece (92), pump gear (93) and pump driver shaft (94).

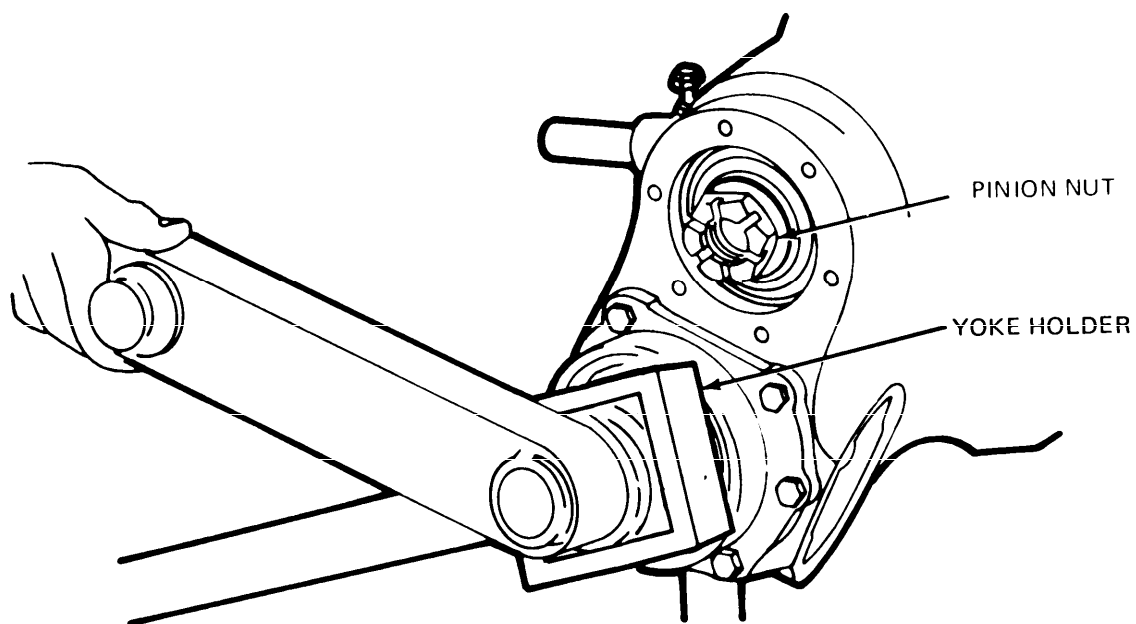
(7) Remove pinion nut cotter key, if used, and loosen pinion nut (fig. 12-7). (Do not remove pinion nut (87, fig. 12-2.)



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Figure 12-7. Loosen Pinion Nut.

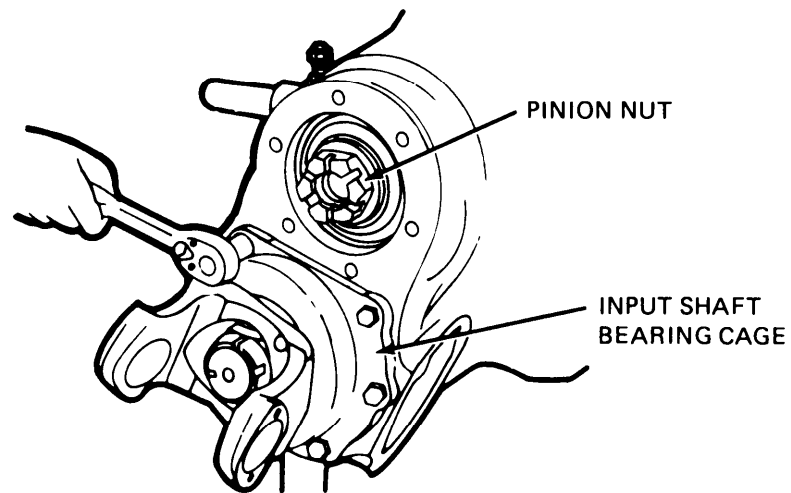
(8) Remove input shaft cotter key, if used, and loosen yoke nut (fig. 12-8). (Do not remove nut at this time.)



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Figure 12-8. Loosen Input Shaft Yoke Nut.

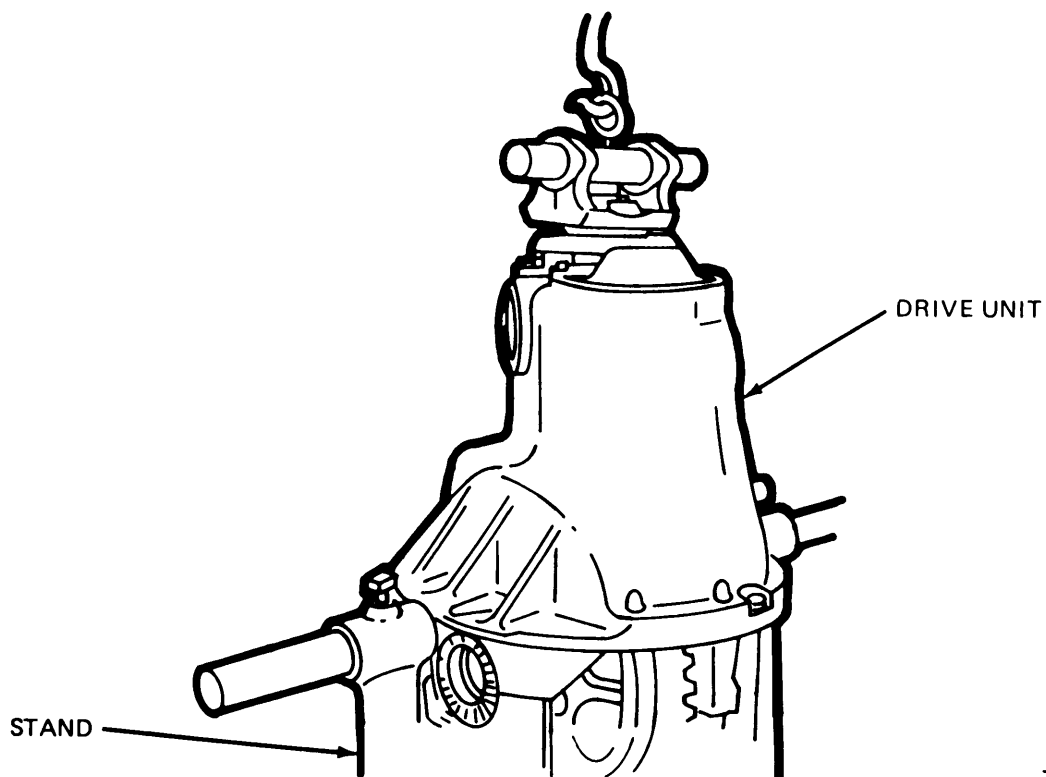
(9) Remove the six capscrews and lockwashers on the input shaft bearing cage (fig. 12-9).



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Figure 12-9. Remove Input Shaft Bearing Cage Capscrews.

(10) Turn the drive unit assembly to a vertical position in the carrier stand and remove the interaxle differential assembly with a chain fall (fig. 12-10).



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Figure 12-10. Remove Interaxle Differential.

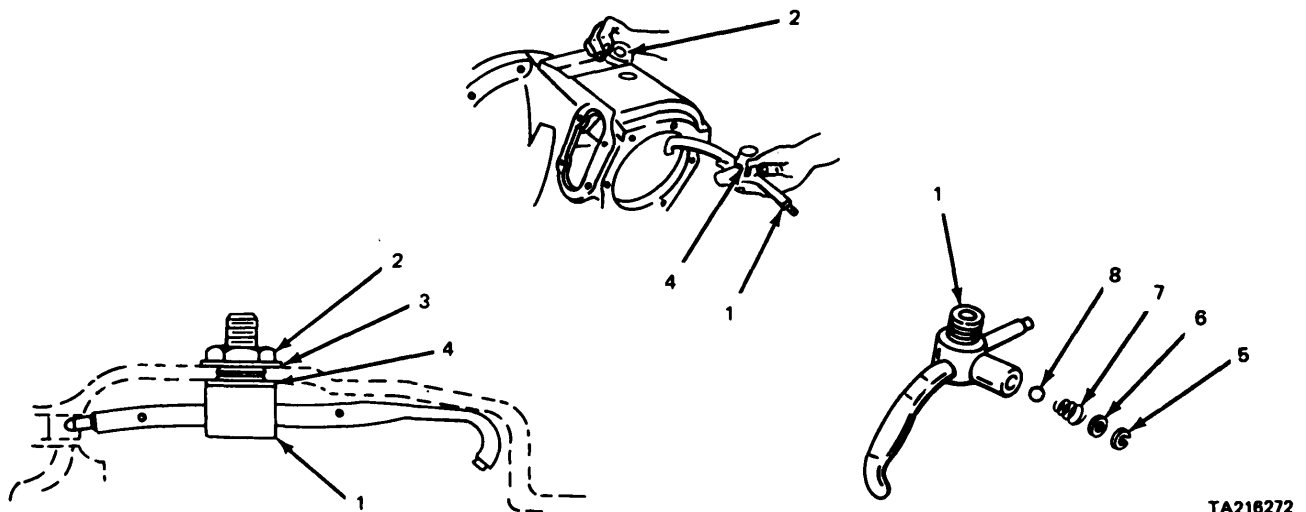
(11) Lightly tap the housing with rawhide hammer to free assembly. It maybe necessary to rotate the input shaft to aline one flat at rear of interaxle differential case with the transfer gear.

b.1 Remove and Disassemble oil valve and Tube assembly. (Refer to Fig. 12-10.1).

(1) Remove the oil valve and tube assembly (1) from carrier by unthreading the large retainer nut (2) from the oil valve and tube assembly (1). As the nut is loosened and removed, hold the oil valve and tube assembly (1) in position inside the carrier to prevent the assembly from dropping. Along with the retainer nut (2) remove the thread seal washer (3).

(2) Pull the oil valve and tube assembly (1) with Teflon washer (4) down and out from it's seat inside the carrier.

(3) Disassemble the oil valve and tube assembly (1) (pressure relief valve) only if required. Remove the snap ring (5) from valve body opening and remove washer (6), spring (7), and ball (8).



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Figure 12-10.7. Remove Oil Valve and Tube Assembly

c. Remove and Disassemble Differential Case and Gear Assembly.

(1) Center-punch one differential carrier leg and bearing cap to identify in reassembly (fig. 12-11).

(2) Remove the leg capscrews with washers and cotter pin.

(3) Remove the bearing adjusting ring and the carrier cap.

(4) Repeat steps (2) and (3) for removal of carrier capon the opposite side.

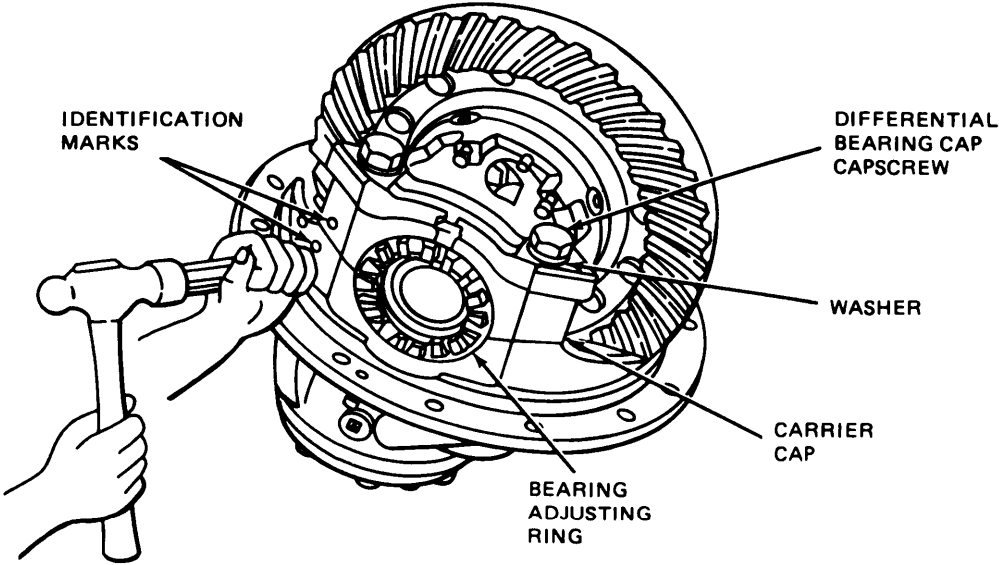
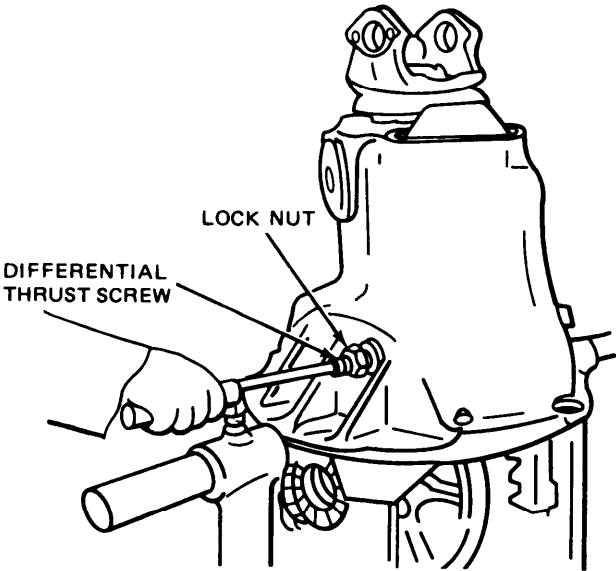


Figure 12-11. Mark Carrier Leg and Bearing Cap for Reassembly.

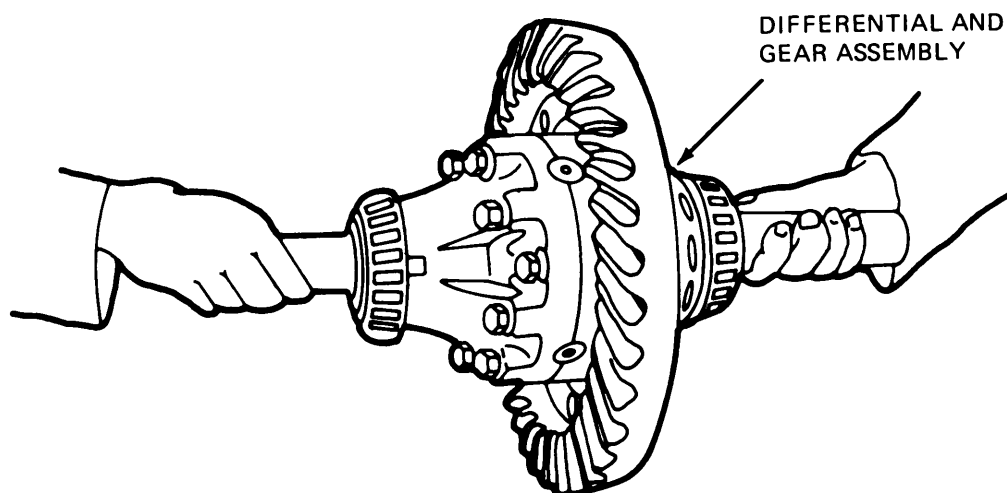
(5) Loosen lock nut and back out thrust screw (fig. 12-12).



TA216274 ■

Figure 12-12. Loosen Differential Thrust Screw.

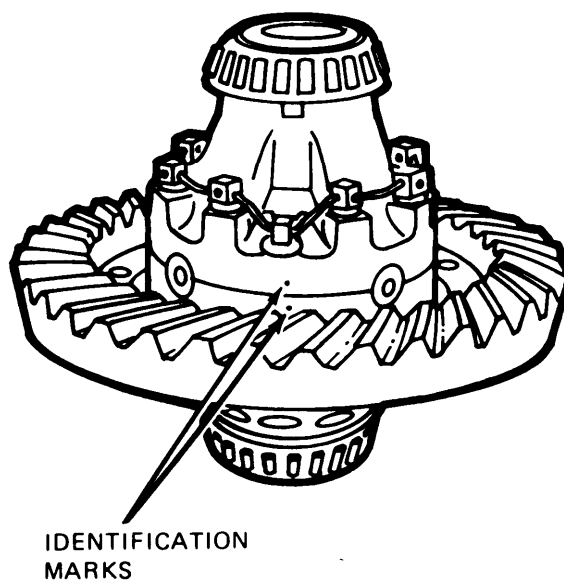
(6) Lift out the differential and gear assembly (fig. 12-13).



TA 074278

Figure 12-13. Lift Differential and Gear Out of Stand

(7) If original identification marks are not clear, mark the differential case halves with a punch or chisel for correct alignment on reassembly (fig. 12-14).

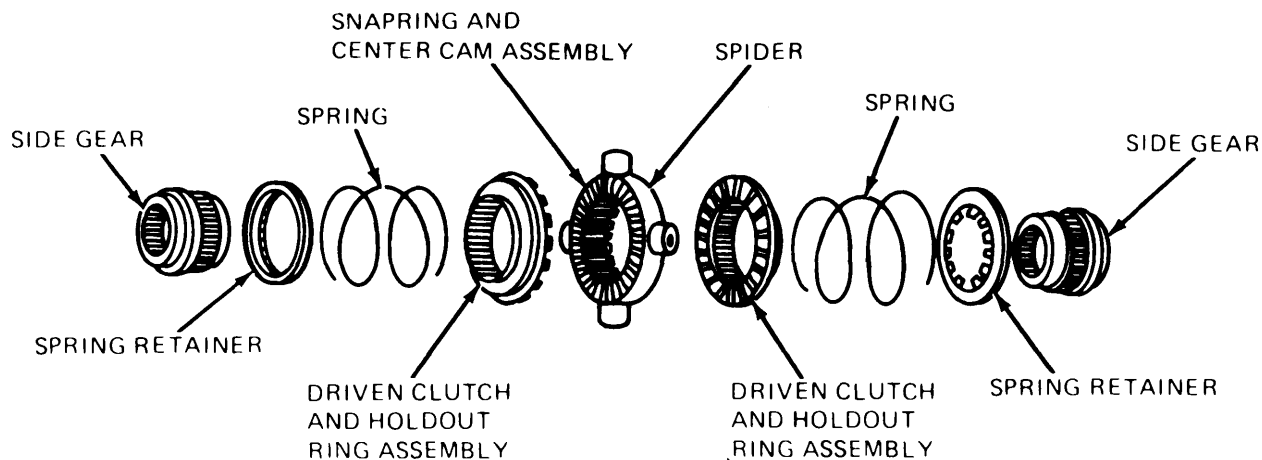


TA 074348

Figure 12-14. Check Identification Marks on Case Halves.

(8) Remove twelve bolts (48 and 53, fig. 12-2); then separate case halves. It may be necessary to tap sides with a mallet.

(9) Remove the components of no-spin assembly (fig. 12-15) by removing spider then remove driven clutch and holdout ring assembly, spring, spring retainer and side gear from each side.



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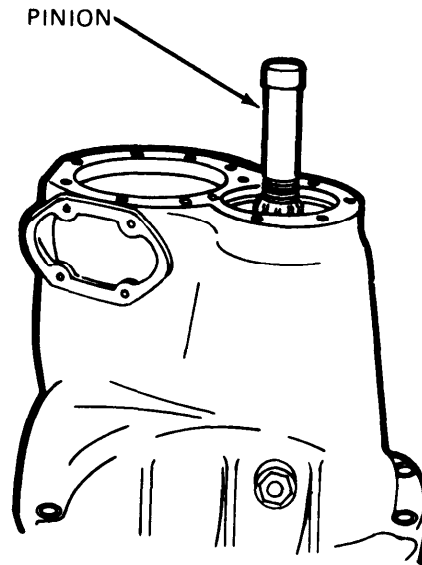
Figure 12-15. Remove Components of No-Spin Assembly.

(10) If ring gear is to be replaced for any reason, remove twelve bolts, nuts and washers and separate gear from case.

(11) If necessary to replace differential bearings, remove with a suitable puller.

d. Remove the Pinion.

(1) Position the drive unit in a press supported by press plates under the carrier-to-housing mounting flange (fig. 12-16).



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Figure 12-16. Remove Pinion.

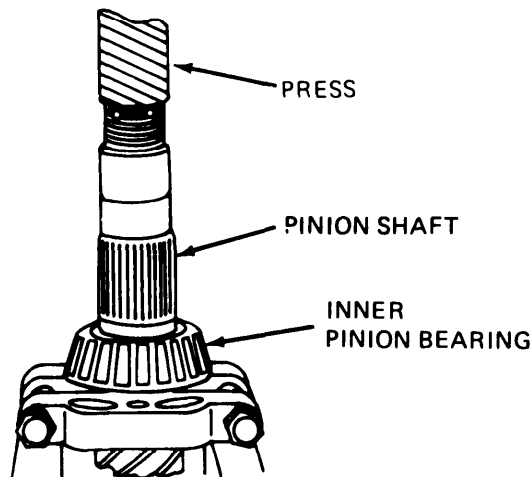
- (2) Remove the pinion nut (87) (previously loosened) and washer (86) (see fig. 12-2).
- (3) Press the drive pinion (77) through the outer pinion bearing (85) and drive gear (81) and remove drive pinion (77).
- (4) Lift out the outer pinion bearing (85) and spacers (82 and 83). Remove the drive gear (81).
- (5) Remove the outer cup (84) with a suitable puller.
- (6) Remove the inner cup (79) with a suitable puller and remove shim pack (80).

NOTE

The shim pack controls the depth of pinion in relation to the hypoid gear and it may be increased or decreased to change the tooth contact at time of reassembly.

- (7) Wire the shim pack together to facilitate reassembly.

(8) Remove the inner pinion bearing (78) by using a suitable puller that bears against bearing inner race; or press off with a fixture that supports inner race (fig. 12-17).



TA 074350

Figure 12-17. Remove Inner Pinion Bearing.

e. *Disassemble Interaxle Differential Assembly (See figure 12-2).*

(1) Remove side gear (132) and bearing cone (134) from carrier.

(2) If bearings require replacement, remove bearing cup (135) from carrier, using a suitable puller. Remove the bearing cone from side gear using a press and bearing puller.

(3) Remove the spider retainer (131) from input shaft (139) and slide interaxle differential nest from shaft.

NOTE

Before splitting interaxle differential case halves, make certain identification marks are clear for correct reassembly. If markings are not clear, use a punch or chisel and re-mark.

(4) Disassemble interaxle case halves (129, 133) by removing eight capscrews (127) and washers (128). This will free the spider (130), four pinions (136), and thrust washer (137).

(5) Slide off drive gear (126), washers (125 and 138), and clutch collar (142), from input shaft (139).

(6) Remove yoke (151), or flange nut (153), and washer (152), from input shaft (139). Using a suitable puller, remove yoke or flange. This will free the bearing cage (147); lift cage off from input shaft (139).

(7) If bearings require replacement, remove the bearing cones (145 and/or 141), from input shaft (139), and the bearing cup (146 and/or 140), from bearing cage (147), and remove oil seal (150).

(8) Remove O-ring (143) and shims (144).

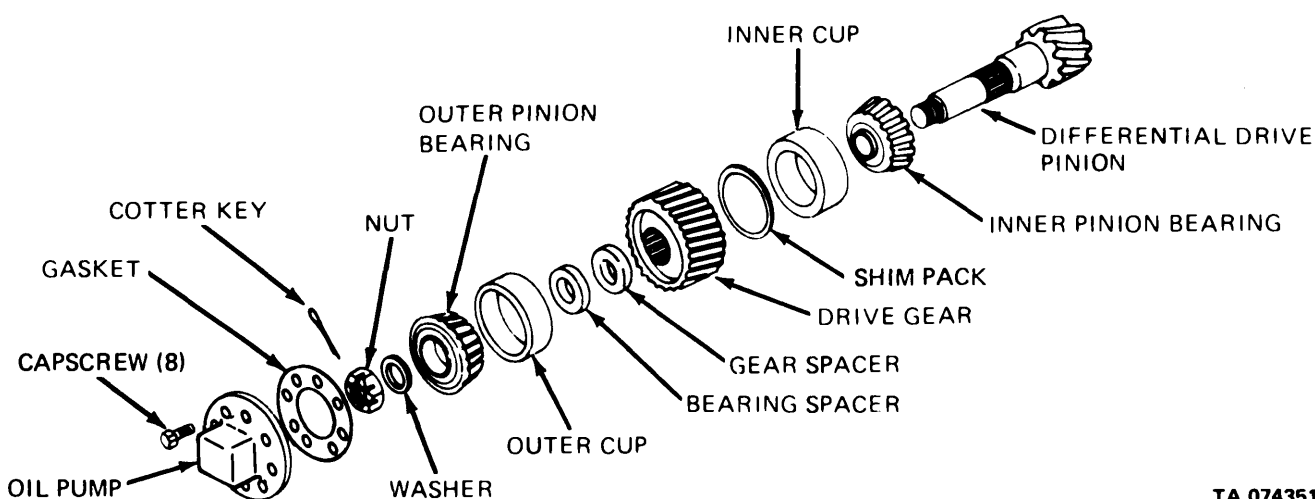
12-6. Cleaning, Inspection, and Repair. (Refer to paras 11-6, 11-7, and 11-8.)

12-7. Differential Carrier Assembly.

CAUTION

Pinion gear and ring gear are a matched set and have a common number etched on each. Before assembly, check numbers.

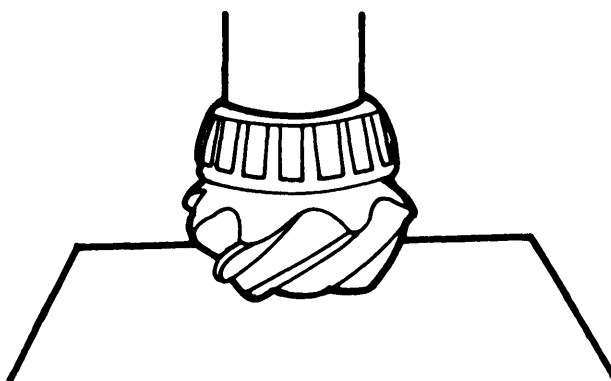
a. Assemble Pinion (fig. 12-18).



TA 074351

Figure 12-18. Assemble Pinion

(1) press the inner pinion bearing squarely and firmly against the pinion head. Use a suitable sleeve that will bear against cone (fig. 12-19).



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Figure 12-19. Install Pinion Bearing Cone.

(2) Install shim pack (80) into carrier case (76). (See figure 12-2.)

(3) Install the inner cup (79) against the shim pack (80).

(4) Install drive gear (81).

(5) Install the outer cup (84) to bottom in cup bore.

(6) Lubricate bearing and cups with light machine oil or lubriplate (item 16, App B).

(7) Place the carrier and cap under a press, carrier legs down. Hold drive gear (81) in position and thread drive pinion (77) up through inner cup (79) and gear (81). Support pinion and carrier under pinion head. Install "fixed" (thick) cone spacers (82 and 83).

(8) Start outer pinion bearing (85) on drive pinion (77). Press bearing on with a suitable sleeve that will bear against the cone race. Press bearing in place with two tons of pressure to seat rollers.

(9) Assemble the pinion nut washer (86) and nut (87) with 100 lb-ft (136 N·m) torque. Hold pinion by placing a hardwood block between pinion teeth and carrier wall.

b. *Assemble Differential Case and Ring Gear (see figure 12-2).*

CAUTION

The ring gear should not be pressed or driven onto the case, as this would cause excessive metal particles to lodge between the gear and the case, thus resulting in gear runout. Proper installation should, therefore, incorporate preheating the gear to assure correct interference fit and to eliminate metal pickup.

(1) Heat the ring gear (42, fig. 12-2) in oil to approximately 160°F – 180°F for about ten minutes before assembly.

(2) If the ring gear has been separated from the case, fasten gear (42) to case (47) with high-shear strength bolts, lockwashers, and nuts. Torque to 180-230 lb-ft (244-312 N·m).

(3) Assemble and install no-spin assembly as described in paragraph 11-9b.

(4) If the differential bearings (36 and 49) have been removed, press one onto each end of assembly using a suitable sleeve.

c. *Install Differential Case and Ring Gear. (Refer to para 11-9c.)*

d. *Adjust Differential Bearing Preload. (Refer to para 11-9d.)*

e. *Check Gear Backlash. (Refer to para 11-9e.)* Since this axle is equipped with no-spin assembly, the clearance should be set as closely as possible to the minimum specified dimension, after satisfactory tooth contact is obtained (step f, following).

- f. Check Pinion-to-Ring Gear Tooth Contact.* (Refer to para 11-9f.)
- g. Adjust Drive Gear Thrust Screw.* (Refer to para 11-9g.)
- g.1 Assemble and Install Oil Valve and Tube Assembly.* (Refer to Fig. 12-10.1).

NOTE

If the oil valve and tube assembly was not disassembled, start with step (2) for installation into carrier.

(1) Install the pressure relief valve ball (8), spring (7), small diameter first, washer (6), in the oil valve and tube assembly, and secure with snap ring (5).

(2) Position Teflon washer (4) over threaded body portion of oil valve and tube assembly (1).

(3) Working from inside the carrier housing, insert the valve locating pin of the oil valve and tube assembly (1) into threaded capscrew hole at front of carrier and the threaded portion of valve body through hole in top of carrier.

(4) Hold the oil valve and tube assembly (1) in this position and install the thread seal washer (3) and large retainer nut (2). Torque retainer nut (2) to 50 lb-ft (68 N·m).

h. Assemble Interaxle Differential Assembly (Refer to Fig. 12-2).

(1) Press the input shaft rear bearing cup (135) into bore in the carrier. Use a press and sleeve of the correct diameter to press in the cup.

(2) Press the input shaft bearing cone (145) onto the new input shaft (139). Use a sleeve to press on cone by the inner race only. Coat the bearing rollers with the recommended axle lubricant (item 30, App B).

(3) Install the clutch collar (142) onto the input shaft splines with the clutch teeth facing the rear of shaft.

(4) Prelubricate both sides of the helical drive gear washers (125 and 138) and the gear journal of the input shaft (139) with gear lube. Place the thrust washer (125) into its pilot bore in the helical drive gear and install the drive gear (126) and washer onto the input shaft.

(5) Assemble the interaxle differential spider (130), pinions (136), and thrust washers (137) between the case halves (129 and 133). Thoroughly prelubricate both sides of the thrust washers and spider legs as the parts are being assembled.

(6) Secure tie assembly together with eight hardened washers (128) and capscrews (127). Torque capscrews to 60-75 lb-ft (81-102 N·m).

(7) Prelubricate the forward side gear teeth (integral with helical drive gear) and install the interaxle differential nest assembly into the input shaft (139) with the capscrew heads facing toward the rear of the shaft.

(8) Retain the interaxle differential nest assembly on the input shaft (139) by installing the new spider retainer (131) into the groove shaft.

(9) Press the input shaft rear bearing cone (134) onto rear side gear (132). Use a sleeve to press on cone by the inner race only.

(10) Prelubricate the bearing rollers and side gear teeth. position the carrier upright and place the rear side gear (132) with bearing cone (134) into carrier against bearing cup (135) previously installed.

CAUTION

In step (11), observe that one helical gear is marked with an "X" at one tooth, while the other helical gear is marked with a corresponding symbol at one tooth. These marks must be aligned at installation for correct gear contact.

(11) Using a chain fall, carefully lower the new input shaft assembly into the carrier.

(12) Install the new O-ring (143) in groove in the input bearing cage pilot outside diameter. Applying axle lubricant to O-ring will facilitate installation. Install new oil seal (150) into bearing cage (147).

(13) Place the input bearing cage (147) and cup (146) into position over the shaft against the input bearing cone (145). Continue by adjusting input shaft endplay as described in paragraph *i*.

i. Adjust Input Shaft Endplay.

(1) Install the bearing cage-to-carrier capscrews and tighten to fingertight only. As capscrews are tightened, rotate the input shaft several revolutions to seat bearings. Keep the hypoid ring gear from rotating by blocking gear with wood wedge.

NOTE

In step (2), use a minimum of three shims in the pack with the thinnest shims positioned at both sides to allow pack to compress for sealing.

(2) Using a feeler gage, measure the gap between the bearing cage and machined carrier face. Add 0.003 in. to the gap measurement (0.003 in. + gap measurement) and select a new shim pack to correspond to this value.

(3) Remove the cage capscrews and lift the input assembly slightly, using a chain fall.

NOTE

The shims in step (4) may be split. With split shims it is not necessary to completely remove the cage or input shaft assembly from carrier to install shim pack.

(4) Slide the shim pack into position under the bearing cage and lower the input shaft assembly and cage back into carrier.

(5) Secure the cage-to-carrier with two capscrews and lockwashers positioned in opposite holes. Tighten capscrews to 40-55 lb-ft (54-75 N·m) torque. As capscrews are tightened, rotate the input shaft several revolutions to seat bearings.

NOTE

In step (6) the use of a magnetic base will facilitate mounting the indicator.

(6) Mount a dial indicator onto the front face of carrier with the pointer (plunger) seated against the end of the input shaft. Turn the input shaft in both directions while pushing inward. Set the dial indicator to zero.

(7) While observing the dial indicator, pull the input shaft outward and take note of the reading. Final endplay must be 0.003-0.007 in. If endplay is not within correct range, adjust shim pack by adding or removing shims as required.

(8) Adding shims will increase endplay, while removing shims will decrease endplay. If shim pack requires further adjustment, repeat steps (3) thru (6).

(9) After correct endplay has been established, assemble the remaining capscrew and lock-washers. Torque capscrews to 40-55 lb-ft (54-74 N-m).

j. *Install Oil Pump (Refer to fig. 2-2).*

NOTE

Be sure to align parts using the painted or scratched lines made during disassembly (see 12-5 b).

(1) Thoroughly clean the surfaces of the carrier case (76) and of the adaptor (98). Dry both surfaces, install new adaptor housing gasket (101), and install adaptor housing (98) to carrier case (76) with six bolts (99) and six washers (100).

(2) Clean surfaces of adaptor housing (98) and of the pump housing (95). Dry both surfaces thoroughly and apply a 1/8-inch diameter bead of silicone sealant (item 24, App B) to the pump housing surface. Apply the sealant material to one surface only and around all fastener holes. (Refer to para 11-8b).

(3) Immediately, line up scratch lines and fasten the pump housing (95) to the adaptor housing (98) with four bolts (96) and four washers (97). If a new pump housing is being installed, position it against the adaptor housing so that the port stamped is to your right (to the truck's left when all assembled).

(4) Insert pump driver shaft (94) into pump housing (95), and rotate it until its flattened end slips into the notched end of the differential drive pinion (77).

(5) Install pump gear (93) onto end piece (92) and insert the assembly into the pump housing (95), meshing the teeth of the pump gear with the teeth of the pump driver shaft (94), and rotating the end piece (92) to the proper position. The proper position is with the shaft of the pump gear (the shaft pressed into the end piece) at the 7 o'clock position as you face the pump on an assembled axle.

(6) Clean surfaces of pump housing (95) and of cap (89). Install new cap gasket (91) aligning small inner hole with lubrication groove in cap.

(7) put star spring (90) into cap, legs down.

(8) Carefully put cap (89) against pump housing (95), lining up scratches made during disassembly. If new cap is being installed, make sure lubrication groove is aligned with small hole in cap gasket (90) which is aligned with lubrication hole on delivery side of pump housing (95). Fasten cap to pump housing with six bolts (88).

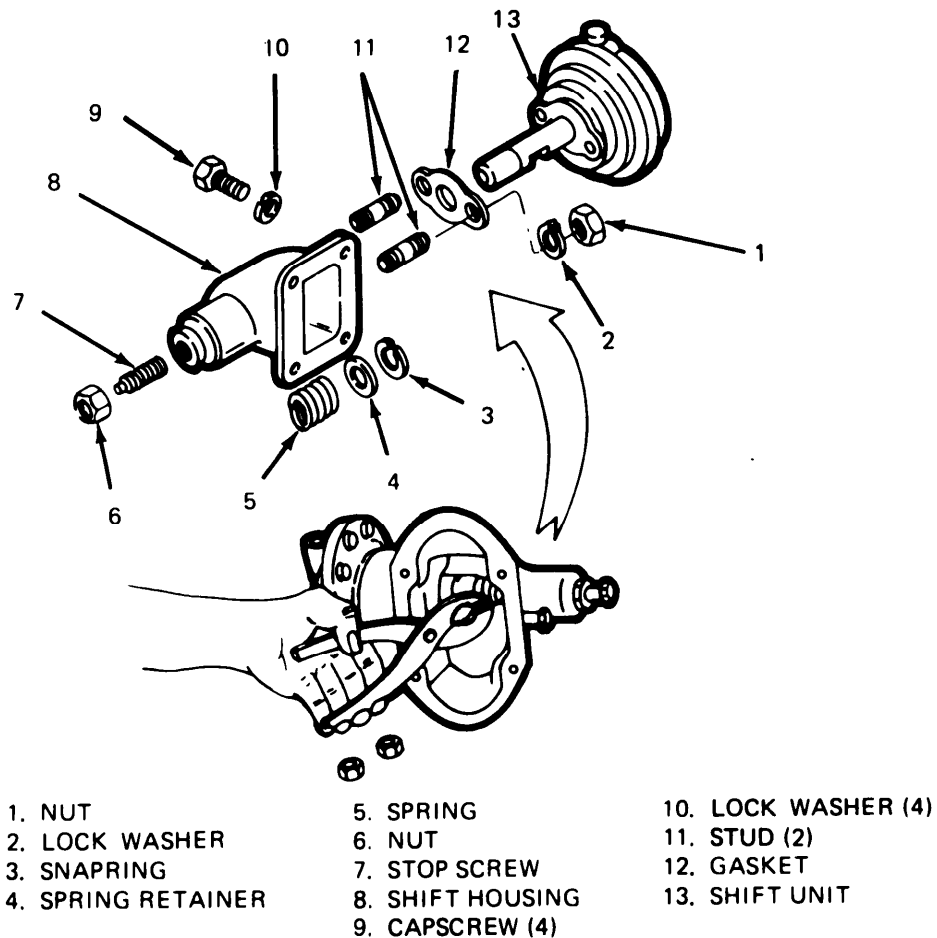
(9) Install reducers (116 and 123) to ports of pump housing (95).

(10) Install elbows (117 and 124) to reducers (116 and 123).

(11) Install screen (122), reducers (121 and 120), elbow (119), and oil hose (118) to port at bottom of carrier case (76).

(12) Install reducers (115 and 114), elbow (113) and oil hose (112) to port on top of carrier case (76).

(13) install oil hoses (112 and 118) to elbows (117 and 124).



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Figure 12-20. Install Shift Unit and Assemble Chamber.

k. Assemble and Install Shift Unit Housing and Diaphragm Assembly.

(1) Install the shift unit (13, fig. 12-20) with new gasket (12) on shift housing (8) and install spring (5) and spring retainer (4). Secure shaft of shift unit (13) with snap ring (3).

(2) Proceed with inserting the shaft until shift unit (13) mates with housing studs (11) and gasket (12). Install lock washers (2) and nuts (1); then tighten nuts to 40-55 lb-ft (54-74 N·m). Install the stop screw (7) and nut (6).

(3) Install fork and yoke assembly (fig. 12-21) into housing. Install bolt (5), spring (4), seat washer (3), spacer (2), and nut (6). Tighten nut 20-30 lb-ft (27-41 N·m) torque. Install cotter pin (1).

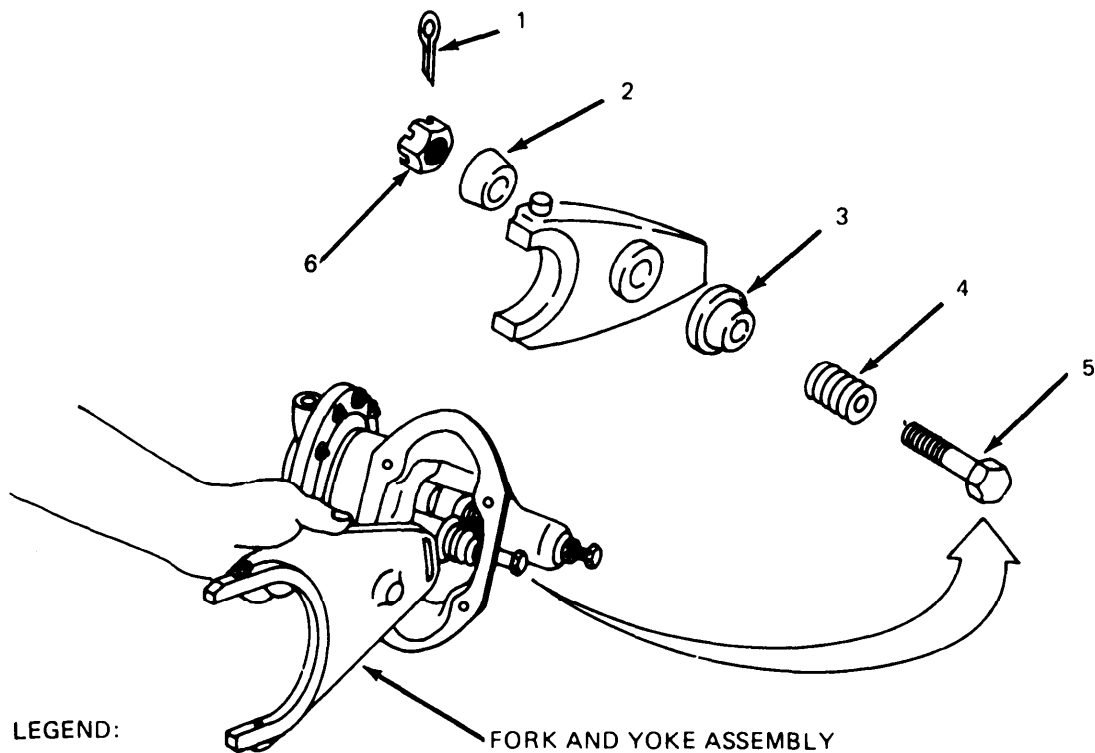


Figure 12-21. Install Fork and Yoke Assembly.

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(4) Position the shift and housing assembly into the carrier assembly against a new gasket or silicone sealant (Refer to para 11-8b.)

I. Adjust Shift Shaft.

(1) Back off adjusting screw locknut so screw is free to turn.

(2) Shift assembly to engaged position with power chamber. Be sure shift collar is fully engaged with rear gear.

(3) Turn in screw until it is finger-tight against the push rod.

(4) Turn in screw 1/2 revolution more to center the fork in groove.

(5) Tighten locknut to 40-55 lb-ft (54-74 N·m) torque.

12-8. Input Shaft Yoke Installation. (Refer to para 11-9m).

12-9. Differential Carrier Installation,

a. Clean and Inspect Drive Unit Housing. (Refer to para 11-10a.)

b. Install Differential Carrier. (Refer to para 11-10h.)

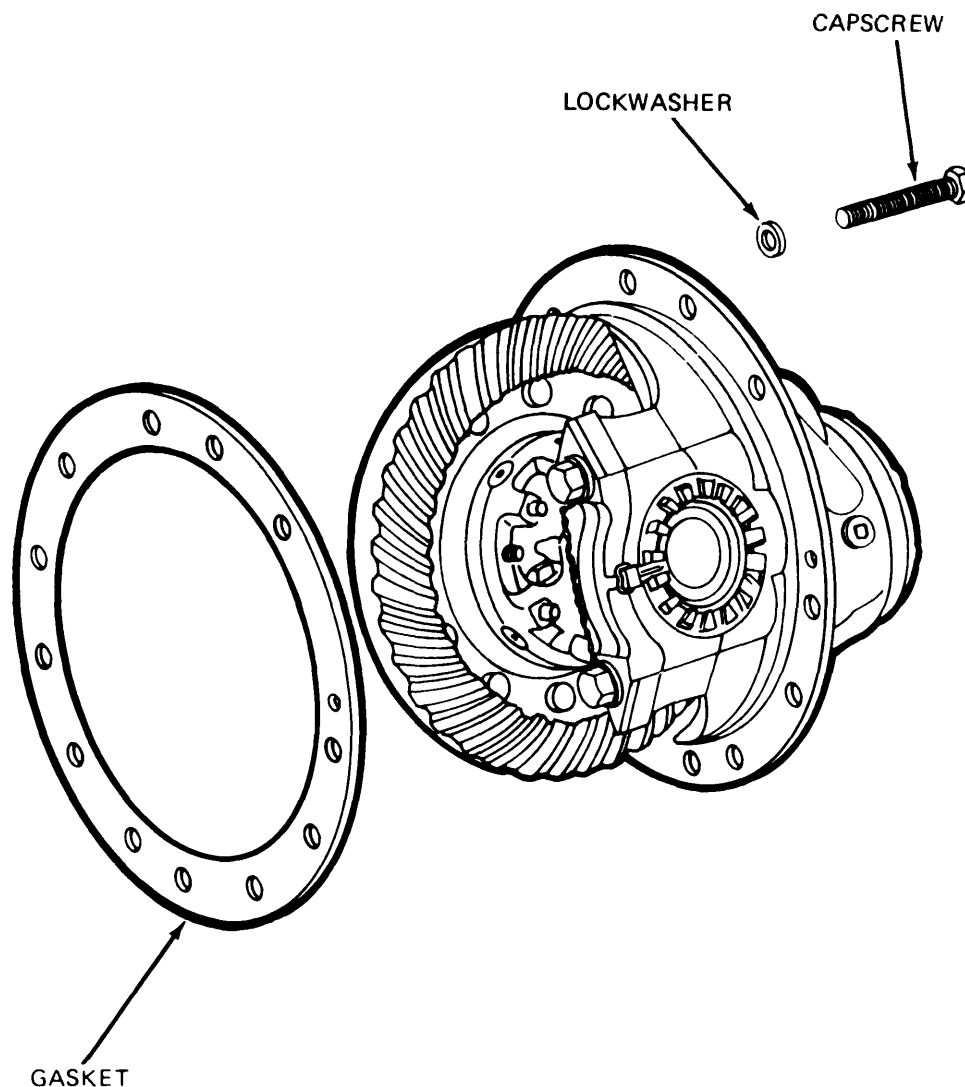
12-10. Output Shaft Assembly. (Refer to para 11-11.)

12-11. Output Shaft Installation. (Refer to para 11-12.)

Section II. Rear Rear Axle

12-12. Description. The rear rear axle is a single-reduction, final drive which employs a heavy-duty spiral bevel or hypoid pinion and ring gear. The differential and gear assembly is mounted on tapered roller bearings. The straddle-mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust and a third bearing behind the pinion teeth to carry the radial load. The unit has a no-spin positive locking differential, identical to the one in the model M915. (See para. 11-2 for description.)

12-13. Differential Carrier Removal. (See fig. 12-22).



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Figure 12-22. Remove Differential Carrier from Axle Housing.

- a. Remove the plug from bottom of axle housing and drain the lubricant.

CAUTION

Do not hit the circular driving lugs on the shaft head. This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels. This will damage the hub, shaft and oil seal.

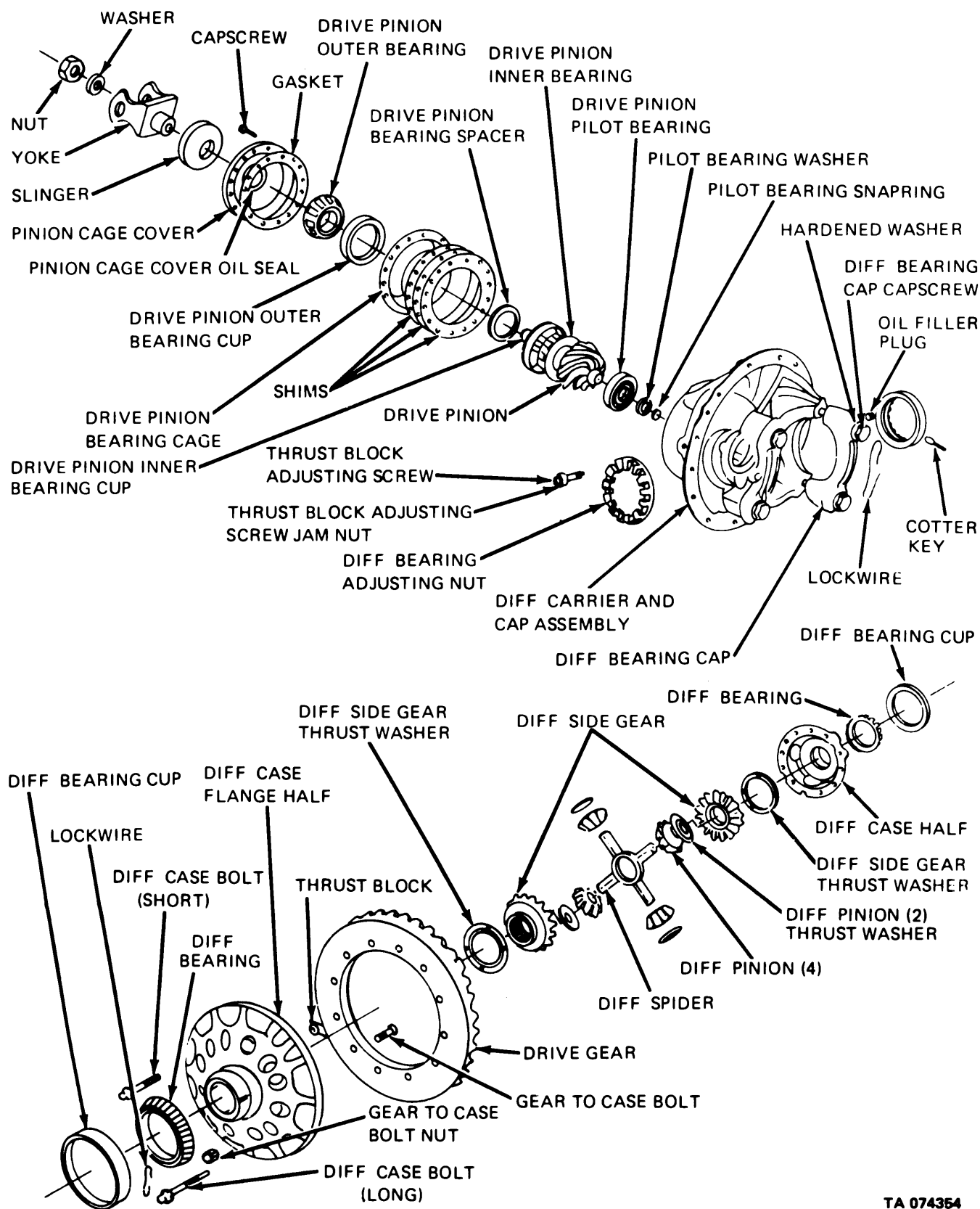
- b. Remove the eight axle shaft stud nuts (27, fig. 12-2), washers, and tapered dowels (25). To loosen the dowels, hold a 1'-in. diameter brass drift against the center of the axle shaft head, inside the circular driving lugs. Strike the drift a sharp blow with a 5-6 lb hammer. A 1'-in. diameter brass drift is excellent and safe.
- c. Remove the right and left axle shafts from the drive unit and housing.
- d. If the unit is on the vehicle, disconnect the rear propeller shaft.
- e. Remove twelve of the fourteen carrier-to-housing capscrews and washers leaving the two top capscrews and washers in place to prevent the carrier from falling.
- f. Break the carrier loose from housing with a rawhide mallet.
- g. Place roller jack under carrier; then remove the two top capscrews and lockwashers and work the carrier free. A small pinch bar may be used to straighten carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange.

12-14. Differential Carrier Disassembly. (See fig. 12-23.)

- a. *Remove and Disassemble the Differential Case and Gear Assembly.* (Refer to para 12-5c.)
- b. *Remove the Pinion and Cage Assembly.*
 - (1) Hold the yoke with suitable tool and remove pinion shaft nut and washer.
 - (2) Remove yoke with a suitable puller.
 - (3) Remove the pinion cage stud nuts or capscrews.
 - (4) Remove the bearing cage and oil seal assembly.

CAUTION

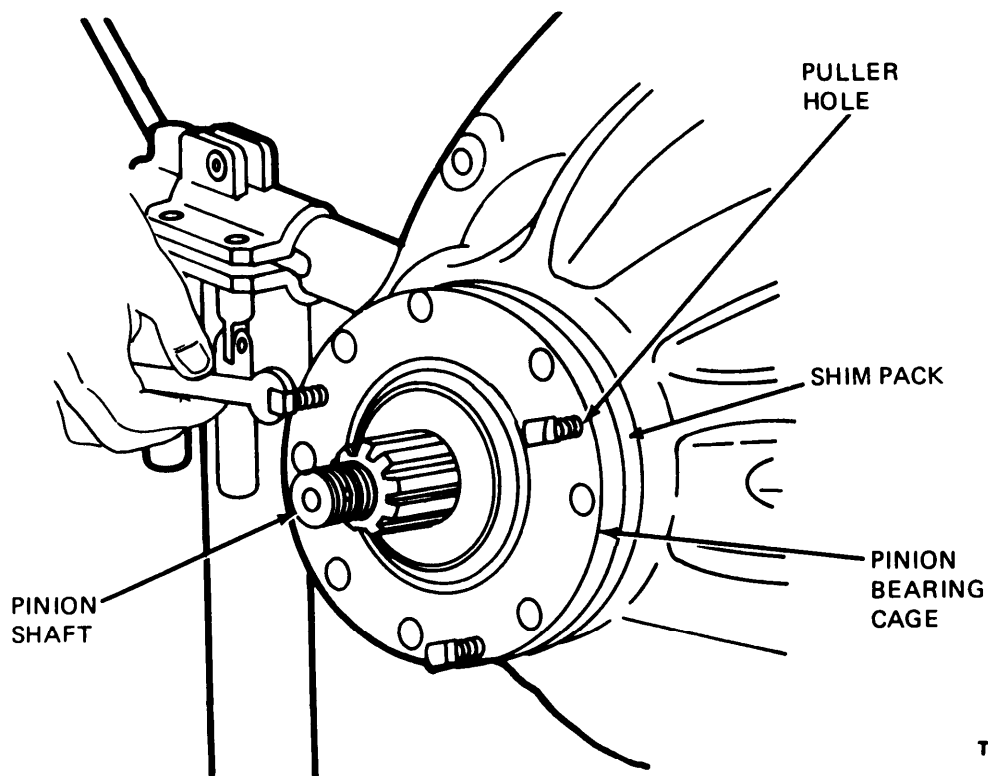
The use of a pinch bar will damage the shims. Driving pinion from inner end with a drift will damage the bearing lock ring groove.



TA 074354

Figure 12-23. M916 thru M920 Rear Rear Axle — Exploded View.

(5) Remove the bearing cage. Original may have puller holes as shown in figure 12-24.



TA 074282

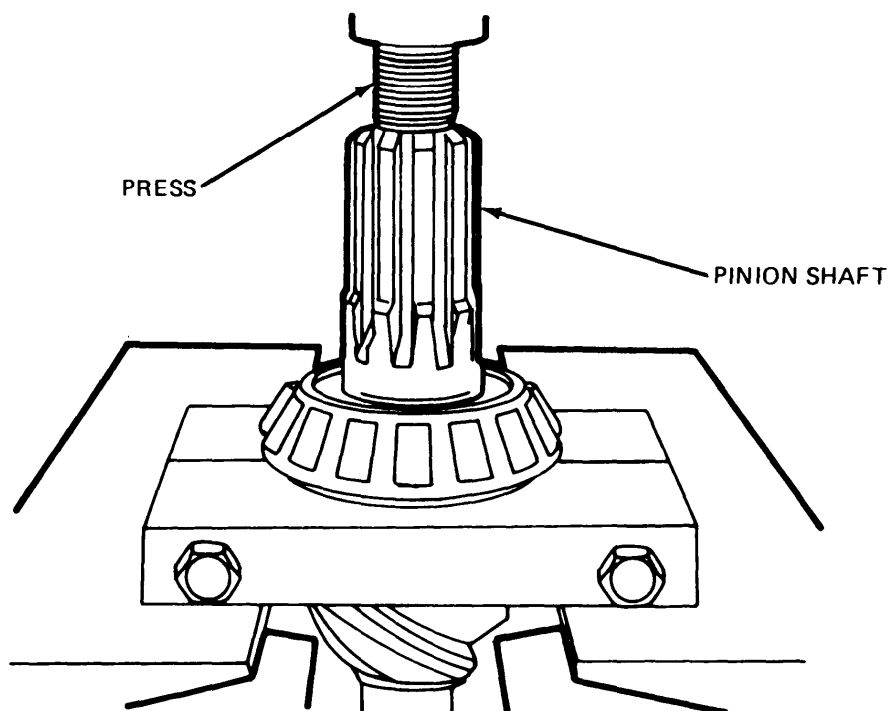
Figure 12-24. Remove Bearing Cage.

(6) Wire shim pack together to facilitate adjustment on reassembling.

c. Disassemble the Pinion and Cage Assembly.

- (1) Tap shaft out of cage with soft mallet or press shaft from cage.
- (2) Remove outer bearing from cage.
- (3) Remove spacer or spacer combination from pinion shaft.

(4) If necessary to replace rear thrust bearing or radial bearing, remove with suitable puller (fig. 12-25).



TA 074283

Figure 12-25 Press Bearing Cage from Pinion Shaft.

(5) Remove oil seal assembly from bearing cover.

12-15. Cleaning, Inspection, and Repair. (Refer to para 11-6, 11-7, and 11-8.)

12-16. Differential Carrier Assembly.

CAUTION

The pinion gear and ring gear are a matched set and have common identification numbers etched on each. Before assembly, check numbers.

a. Reassemble the Pinion and Cage Assembly.

(1) If new cups are to be installed, press firmly against pinion bearing cage shoulders.

(2) Lubricate bearings and cups with gear lube (item 30, App B).

(3) press rear thrust and radial bearings firmly against the pinion shoulders with a suitable sleeve that will bear only on bearing inner race.

(4) Install radial bearing lockring and squeeze ring into pinion shaft groove with pliers.

(5) Insert pinion and bearing assembly in pinion cage and position spacer or spacer combination over pinion shaft.

(6) Press front bearing firmly against spacer.

(7) Rotate cage several revolutions to assure normal bearing contact.

(8) While in press under pressure, check bearing preload. Wrap soft wire around cage and pull on horizontal line with pound scale (fig. 12-26). If a press is not available, the pinion nut may be tightened to the correct torque, as noted in step (9), and preload checked.

(9) Check for the following pressure and torque for pinion bearing preload:

(a) Pressure to obtain correct preload: 11 tons

(b) Nut torque to obtain correct preload: 1000-1300 lb-ft (1356-1763 N·m).

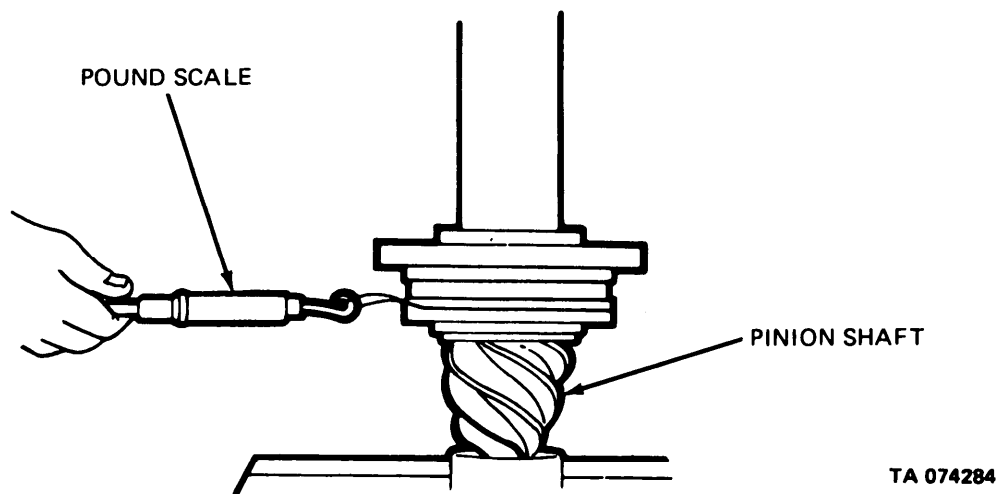


Figure 12-26. Check Bearing Rotating Torque.

(10) If rotating torque is not within 5-25 lb-in. (0.6-3 N·m) for new bearings or 5-15 lb-in. (0.6-1 N·m) for reused bearings, use thinner spacer to increase or thicker spacer to decrease preload.

Example: Assuming pinion cage diameter to be 6 inches, the radius would be 3 inches and with 5 lbs pull would equal 15 lb-in. preload torque.

(11) press flange or yoke against forward bearing and install washer and pinion shaft nut.

(12) Place pinion and cage assembly over carrier studs; hold flange and tighten pinion shaft nut to 300 to 400 lb-ft (407 to 542 N·m). The flange must be held with a suitable tool or fixture to tighten nut (fig. 12-27).

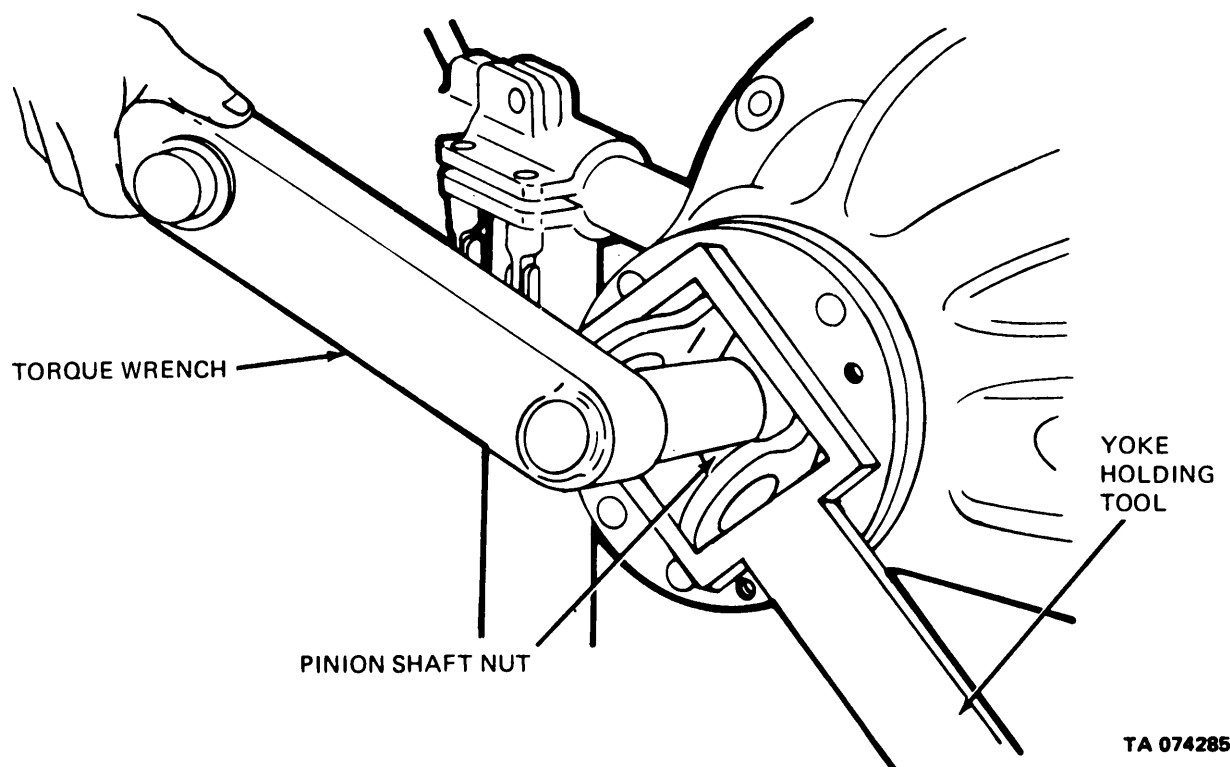
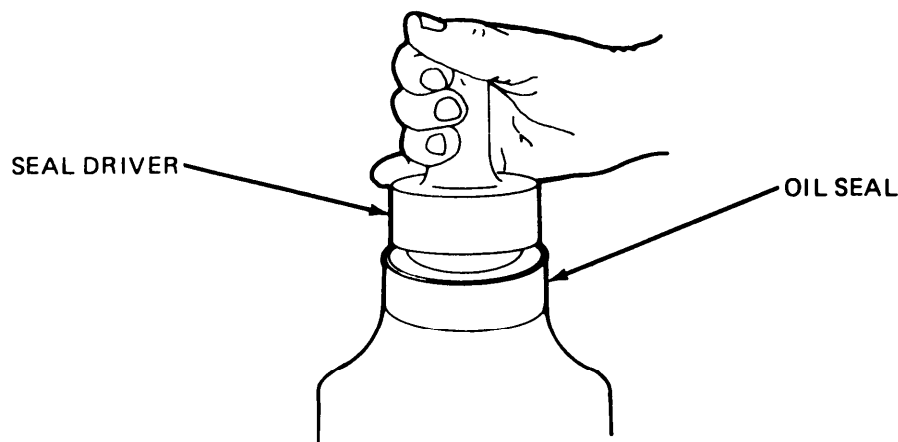


Figure 12-27. Tighten Pinion Shaft Nut.

(13) Recheck pinion bearing preload torque. If rotating torque is not within 5-25 lb-in. (0.6-3 N·m) for new bearings or 5-15 lb-in. (0.6-1 N·m) for reused bearings, repeat the foregoing procedure.

(14) Hold yoke and remove pinion shaft nut and yoke.

(15) Lubricate pinion shaft oil seal and cover outer edge of seal body with silicone sealant (item 24, App B). Press seal against cover shoulder with seal driver (fig. 12-28).



TA 074286

Figure 12-28. Install Pinion Shaft Oil Seal

(16) Install a new gasket and bearing cover.

(17) Install yoke as described in paragraph 11-9m.

b. Install Pinion and Cage Assembly.

(1) Install the correct shim pack. Locate thin shims on both sides for maximum sealing ability.

(2) Position pinion and cage assembly over studs and tap into position with soft mallet.

(3) Install lockwashers and stud nuts or capscrews. Tighten to the correct torque.

c. Assemble Differential Case and Ring Gear. (Refer to para 12-7 b.)

d. Install Differential Case and Ring Gear. (Refer to para 11-9c.)

e. Adjust Differential Bearing Preload. (Refer to para 11-9d.)

f. Check Pinion-to-Ring Gear Tooth Contact. (Refer to para 11-9f.)

g. Adjust Drive Gear Thrust Screw. (Refer to para 11-9g.)

12-17. Differential Carrier Installation.

a. Clean and Inspect Drive Unit Housing. (Refer to para 11-10a.)

b. Install Differential Carrier. (Refer to para 11-10h.)

CHAPTER 13

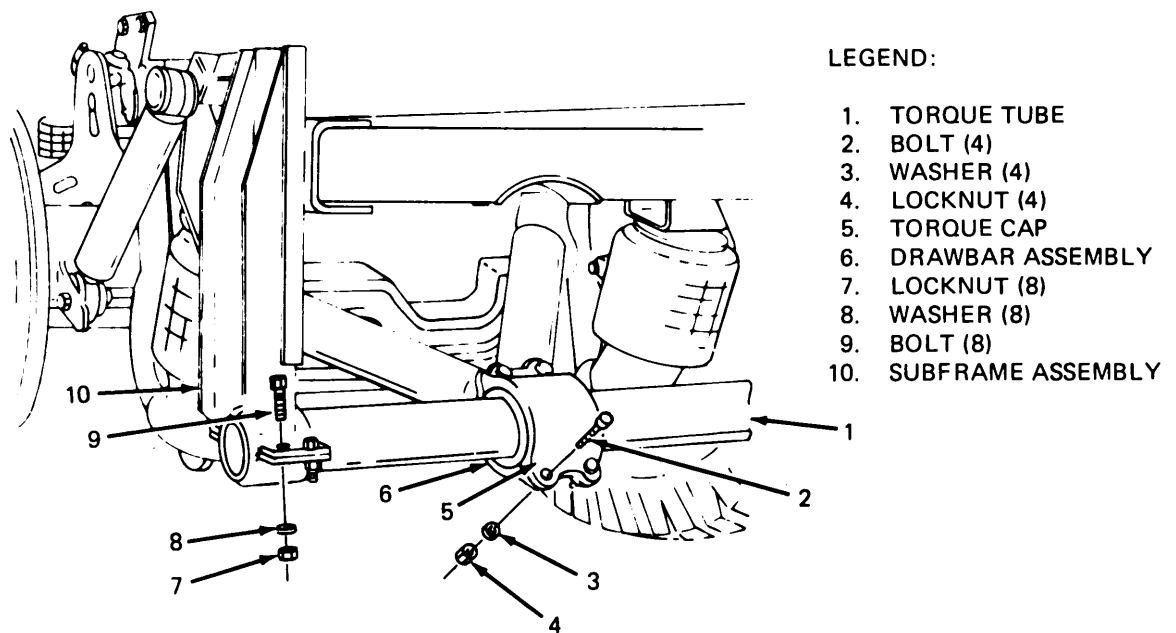
REPAIR OF PUSHER AXLE

13-1. Description. The pusher axle, which is used on models M917, M919 and M920, is described in TM 9-2320-273-20. Maintenance at Direct Support/General Support activities is limited to replacement of the entire assembly (para 2-17) and repair of the torque tube. On vehicle replacement and maintenance of the following components are covered in TM 9-2320-273-20:

- a. Spring lobes
- b. Lift lobes
- c. Shock absorbers
- d. Wheel bearings and seals
- e. Brakes

13-2. Repair of Torque Tube.

Remove four bolts (2, fig. 13-1), washers (3) and locknuts (4) from torque cap (5) while supporting axle and drawbar assembly with a hydraulic floor jack. Remove torque cap (5).



TA 074355

Figure 13-1. Remove/Install Torque Tube.

b. Remove eight bolts (9), washers (8), and locknuts (7) from torque bushings. Lower jack enough to clear subframe assembly (10) and remove torque tube (1).

c. Inspect tube for signs of damage or cracks. Check four welds holding torque bushings to tube. If welds are damaged, refer to TM 9-237.

d. Install torque tube (1) and secure to subframe assembly (10) with eight bolts (9), washers (8) and locknuts (7). Raise jack as necessary to mate subframe and torque bushings. Torque bolts to 200 lb-ft (271 N·m).

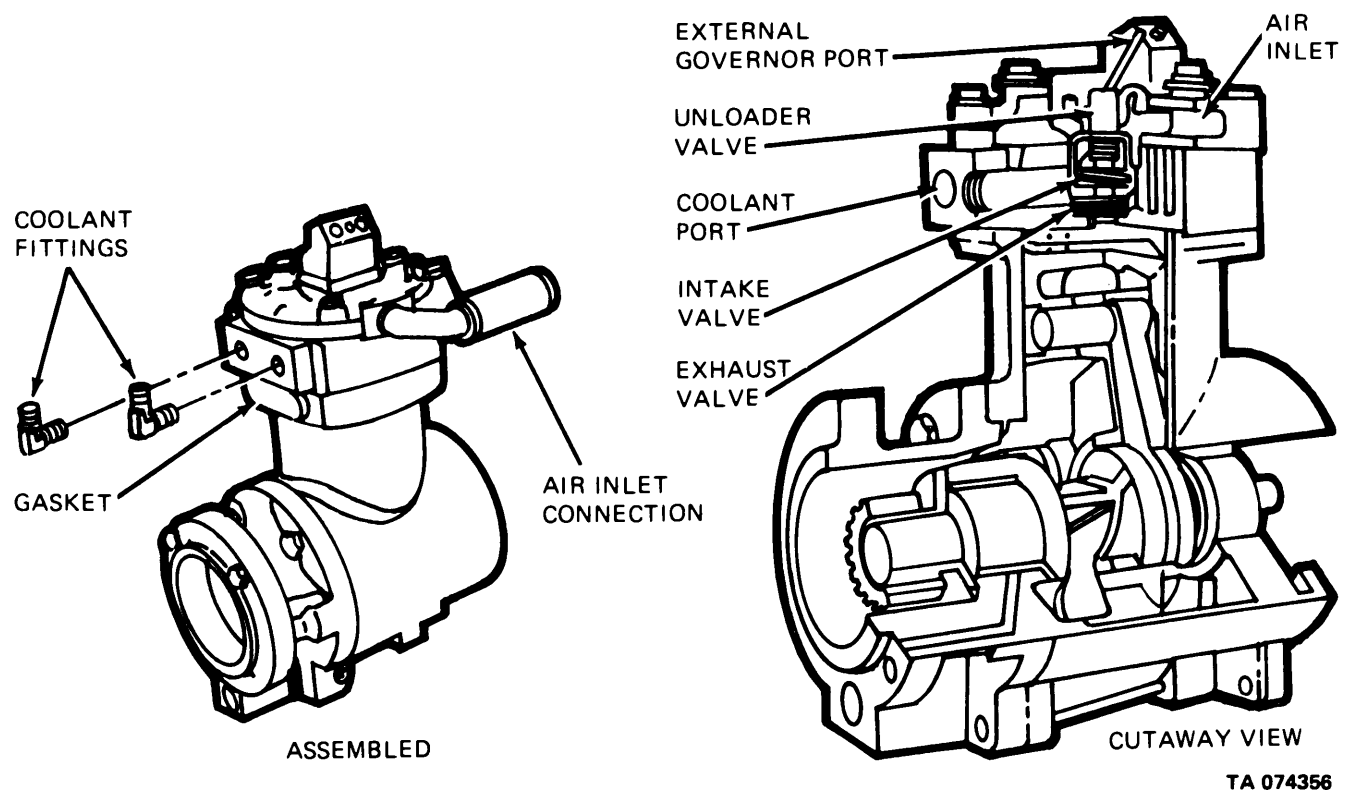
e. Install torque cap (5) and secure to axle and drawbar assembly (6) with four bolts (2), washers (3) and locknuts (4). Torque bolts to 200 lb-ft (271 N·m).

CHAPTER 14

REPAIR OF AIR COMPRESSOR AND BRAKES

Section 1. AIR COMPRESSOR

14-1. Description. The air compressor (fig. 14-1) is a continuously operating, single-cylinder, 13.2 cu ft per minute (CFM) unit. Compression is controlled by an external air governor which acts on an unloader valve in the compressor cylinder head to start or stop the compression of air. The unit is lubricated by engine oil and cooled by engine coolant.



TA 074356

Figure 14-1. Air Compressor.

14-2. On-Engine Testing.*a. Leakage Check.*

(1) Check for water leakage at cylinder head, cylinder head gasket and bolts, water connections, and pipe plugs.

(2) Check for oil leakage at the mounting flanges.

b. Unloader Valve.

(1) Apply 100 psi (690 kPa) shop air pressure to unloader port and operating the engine at rated speed, the compressor should unload (not pump air).

(2) Reduce the air pressure to the unloader valve to zero. The air compressor should operate (pump air). The operation of the unloader valve must be free from chatter and must respond rapidly to pressure changes in the line.

14-3. Removal (Engine in Chassis).

a. Preparation.

(1) Disconnect battery cables (refer to TM 9-2320-273-20).

(2) Release air system pressure by opening petcock on air tank above the battery box.

(3) Raise hood and secure in the UP position.

(4) Drain engine coolant (refer to TM 9-2320-273-20).

(5) Remove left front fender (refer to TM 9-2320-273-20).

b. Removal.

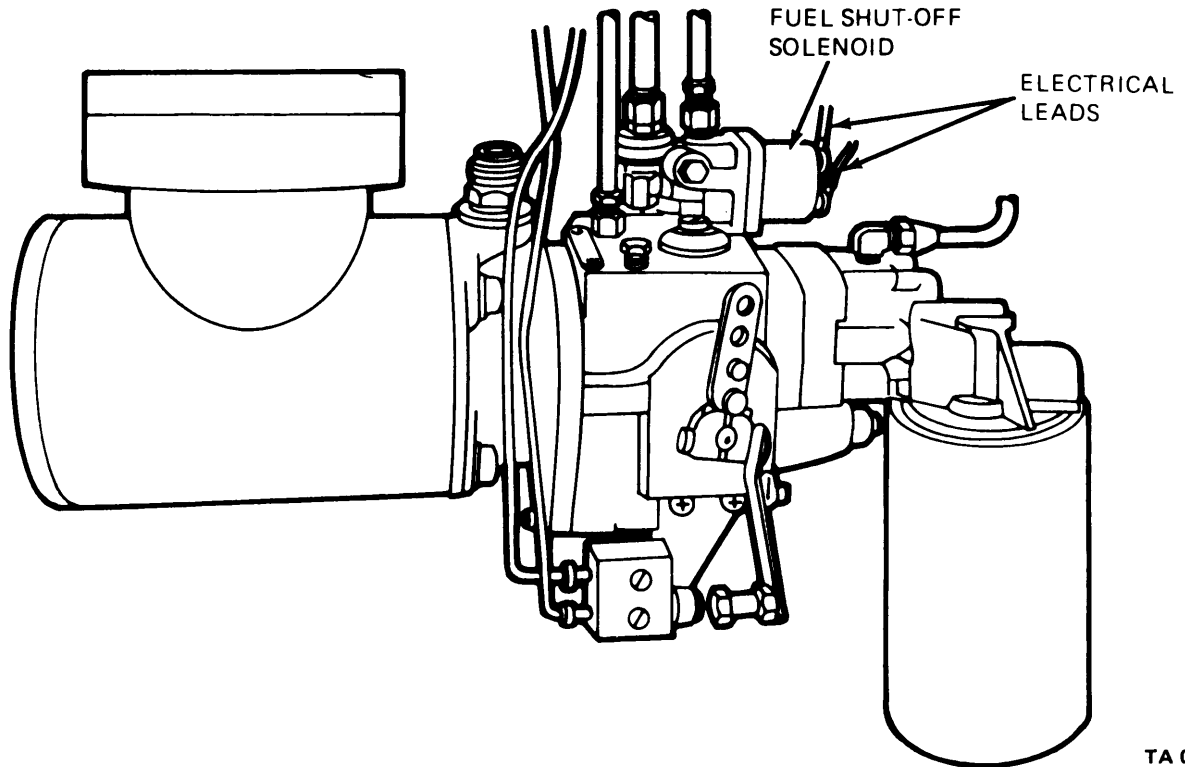
(1) Remove accelerator return spring (refer to TM 9.2320.273.20).

(2) Disconnect accelerator rod at fuel pump lever (refer to TM 9-2320-273-20).

(3) Disconnect fuel inlet line at the fuel filter (refer to TM 9-2320-273-20).

(4) Disconnect tachometer cable (refer to TM 9-2320-273-20).

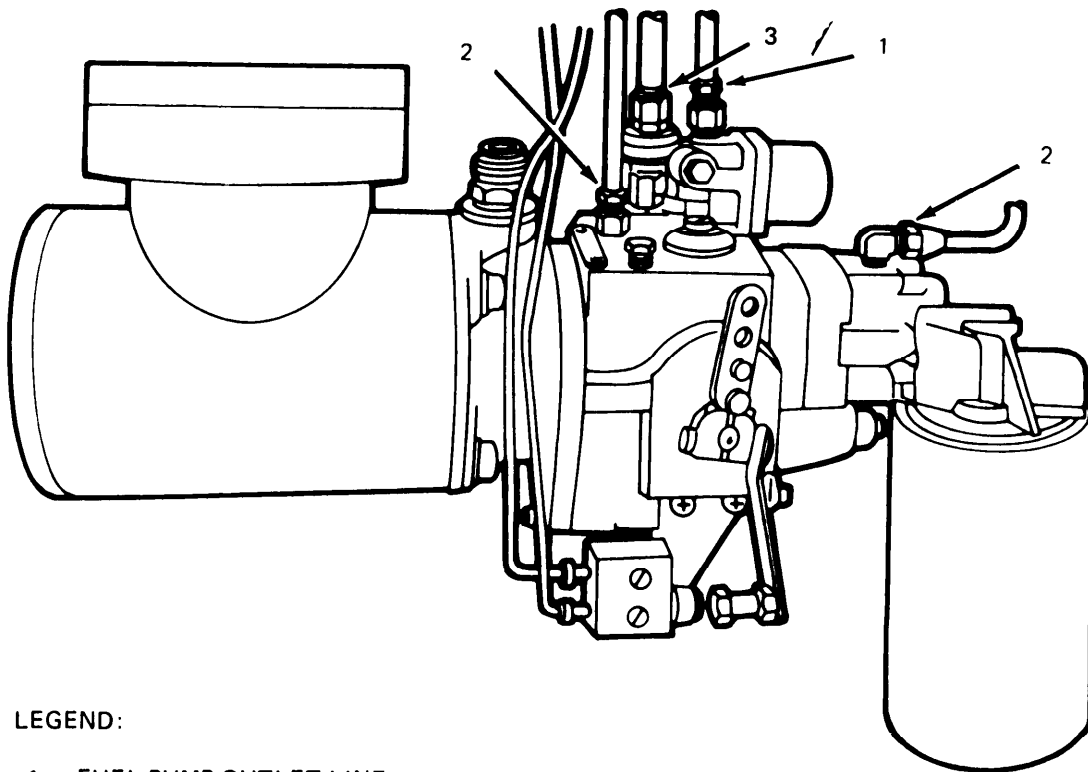
(5) Disconnect fuel shut off solenoid electrical leads (fig. 14-2). (Tag to aid during installation.)



TA 074357

Figure 14-2. Disconnect Fuel Shut Off Solenoid.

(6) Disconnect fuel pump outlet line (1, fig. 14-3) at the fuel shut off solenoid.



LEGEND:

- 1. FUEL PUMP OUTLET LINE
- 2. FUEL RETURN LINE (2)
- 3. AIR PRESSURE LINE

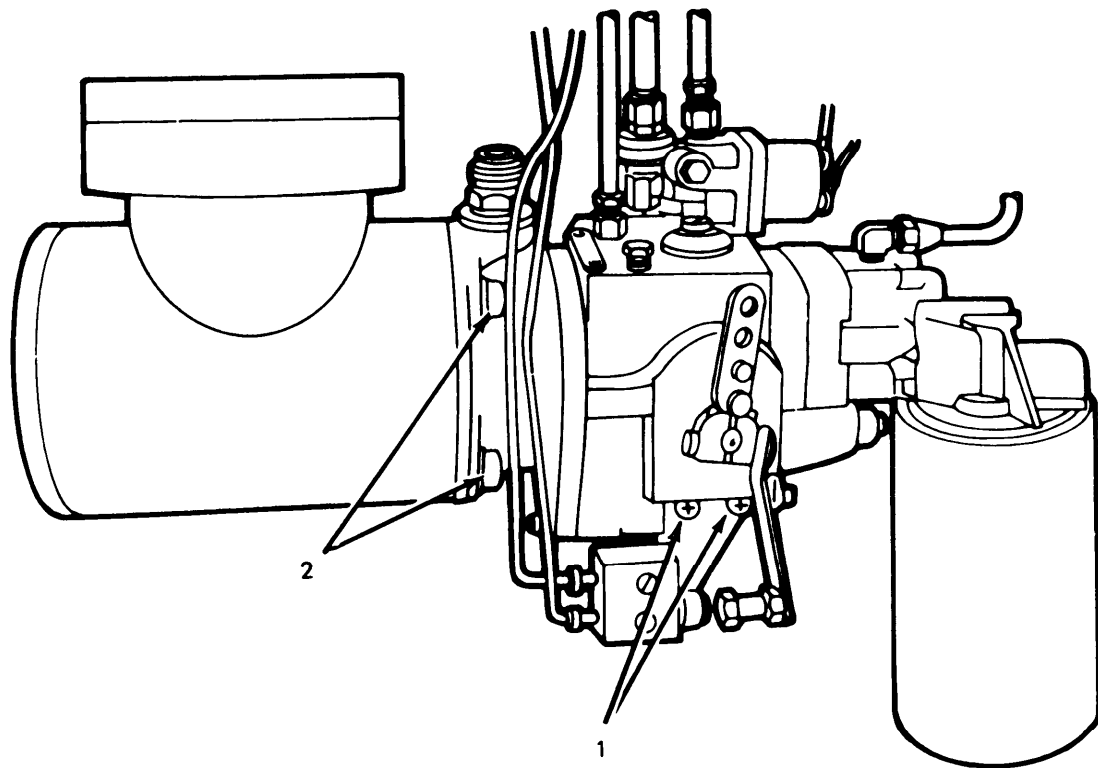
TA 074358

Figure 14-3. Disconnect Fuel Pump Fuel and Intake Manifold Air Lines.

(7) Disconnect two fuel return lines (2).

(8) Disconnect intake manifold air pressure line (3).

(9) Remove two engine retarder micro switch mounting screws (1, fig. 14-4) and tie switch and bracket out of the way.



LEGEND:

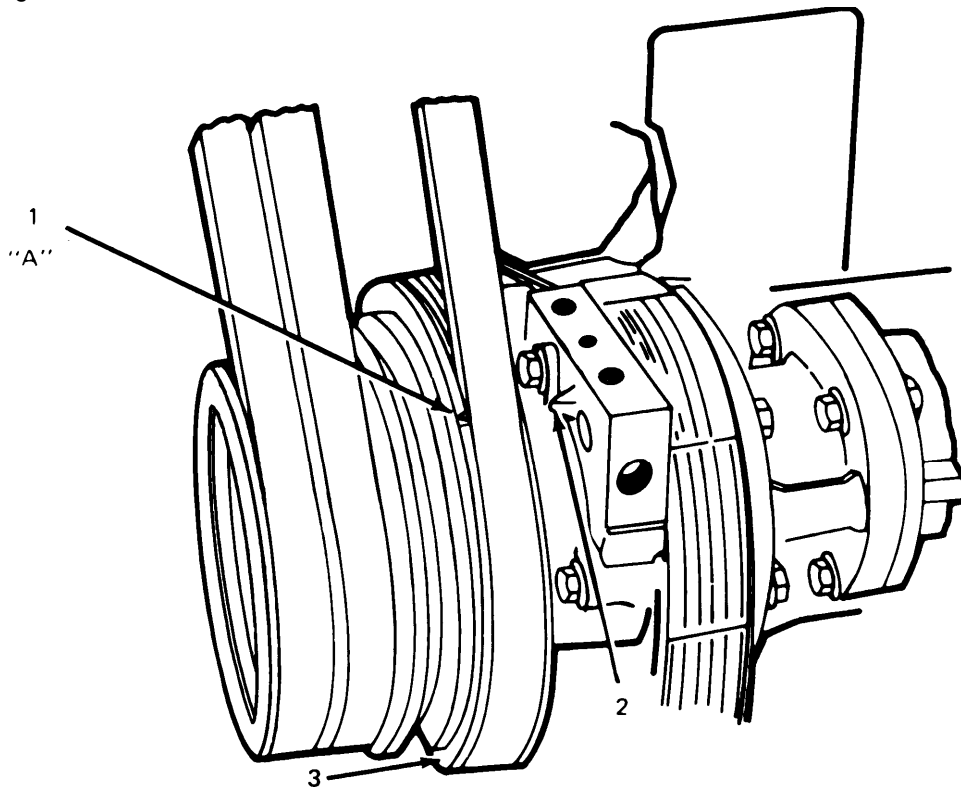
- 1. SCREW (2)
- 2. CAPSCREW (4)

TA 074359

Figure 14-4. Remove Engine Retarder Micro Switch and Fuel Pump Mounting Capscrews.

(10) Remove four fuel pump mounting cap screws (2) and remove fuel pump.

(11) Aline "A" timing mark (1, fig. 14-5) on accessory drive pulley (3) with pointer (2) on accessory drive gear cover.



LEGEND:

1. TIMING MARK
2. POINTER
3. ACCESSORY DRIVE PULLEY

TA 074360

Figure 14-5. A line "A" Timing Mark.

C A U T I O N

If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting nuts. Forcing the caps into position will result in irreparable damage to the carrier housing or bearing caps.

(4) Install the bearing caps in the correct location as marked and tap lightly into position.

(5) Install the carrier leg capscrews and washers and torque to 290-350 lb-ft (393-475 N·m). Install adjusting nut, dowel, and cotter keys after final adjustments are made.

h. Adjust the Differential Bearing Preload.

(1) Using a dial indicator at the backface of the gear, loosen the bearing adjusting nut on *the side opposite gear on/y* sufficient to notice end play on the indicator.

(2) Tighten the same adjusting nut only sufficient to obtain 0.000 end play.

(3) Check the gear for run-out. If run-out exceeds 0.008 in. (0.203 mm), remove the differential and check for cause.

(4) Starting with 0.000 end play, tighten each adjusting nut one notch. This will properly preload the differential bearing.

i. Check the Amboid Gear Backlash.

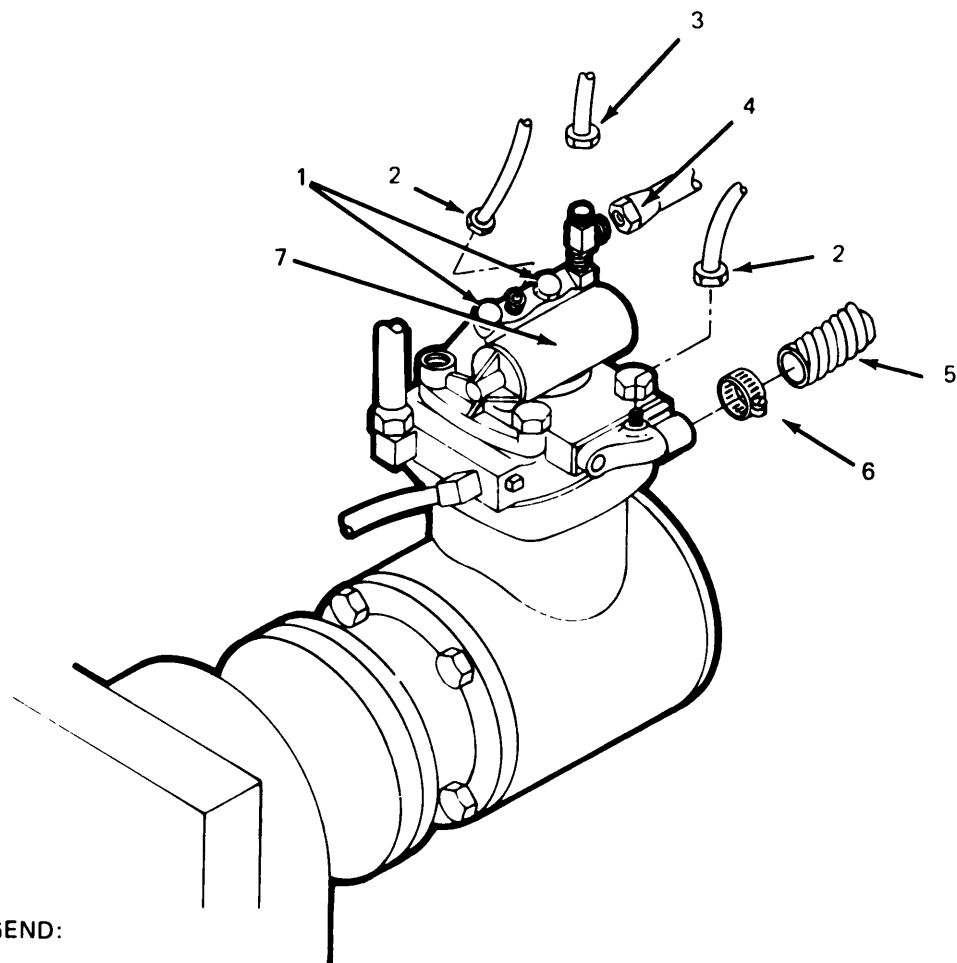
(1) If the drive gear is being replaced, the established backlash recorded before disassembly will be used. For new gears, the new backlash should be initially set at 0.015 in. (0.381 mm).

/2) Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount. Use a dial indicator mounted on the carrier-to-housing flange with the indicator pointer against one ring gear tooth.

j. Check the Tooth Contact.

(1) Refer to paragraph 11-9f for checking procedure.

(12) Disconnect air compressor inlet tube (5, fig. 14-6) by removing screw clamp (6).



LEGEND:

1. AIR GOVERNOR
MOUNTING SCREW (2)
2. EVAPORATOR LINE (2)
3. AIR SUPPLY LINE
4. AIR PRESSURE SENSING
LINE
5. INLET TUBE
6. SCREW CLAMP
7. AIR GOVERNOR

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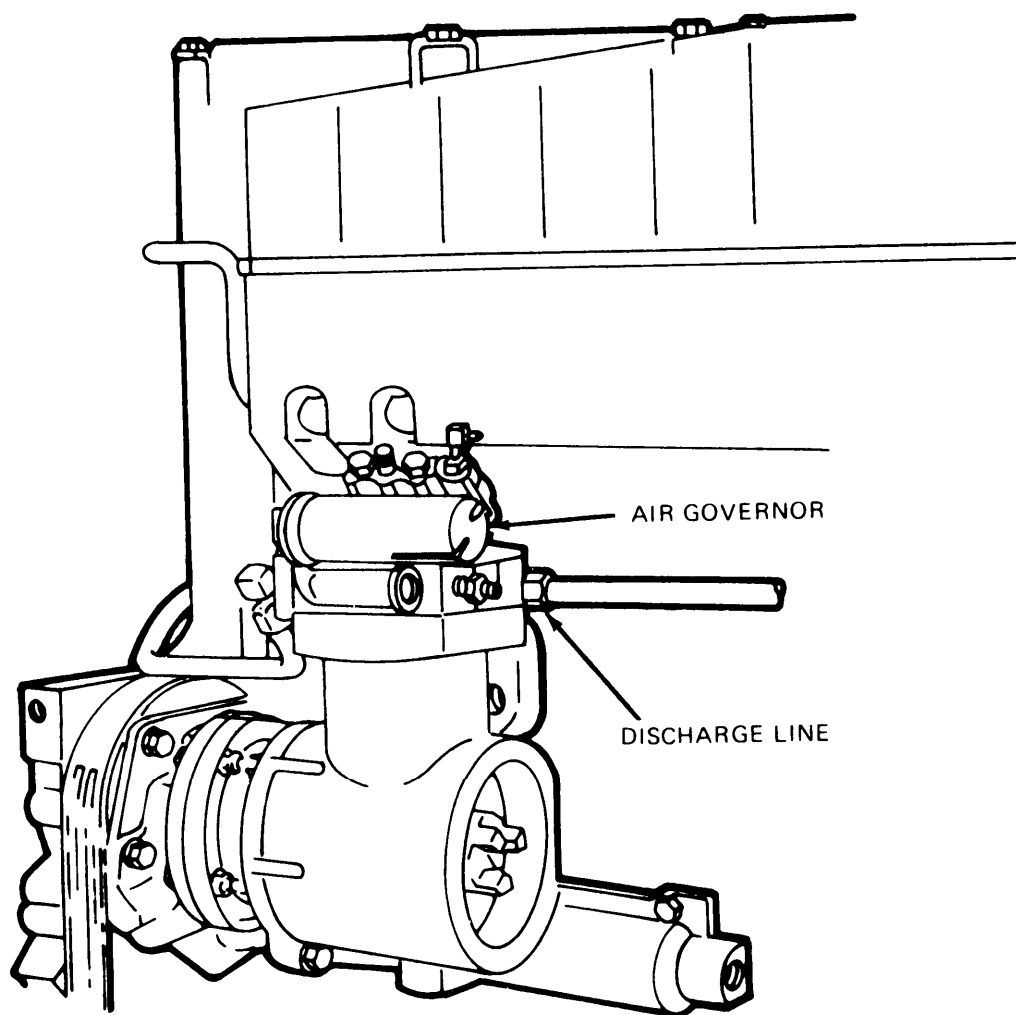
Figure 14-6. Disconnect Air Compressor Hookups.

(13) Disconnect two alcohol evaporator lines (2) at the air governor (7).

(14) Disconnect fan clutch air supply line (3).

(15) Disconnect air governor air pressure sensing line (4).

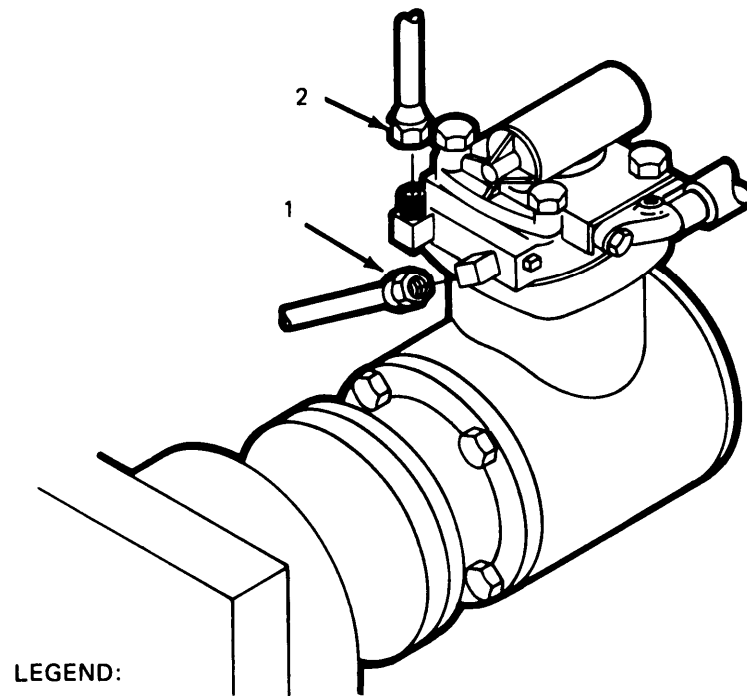
(16) Disconnect air compressor discharge line (fig. 14-7).



TA 074362

Figure 14-7. Disconnect Discharge Line.

(17) Disconnect engine coolant inlet line (1, fig. 14-8) and engine coolant outlet line (2).



LEGEND:

- 1. ENGINE COOLANT INLET LINE
- 2. ENGINE COOLANT OUTLET LINE

TA 074363

Figure 14-8. Disconnect Coolant Inlet and Outlet Lines.

NOTE

In step (18), the lower inside mounting capscrew must be removed using special tool 3375159.

(18) Remove air compressor-to-adapter mounting hardware (fig. 14-9). Two bolts and nuts (1) are used in the upper location and two capscrews (2) are used in the lower location.

(19) Remove two air governor mounting screws (3) and set air governor aside.

(20) Remove air compressor and coupling.

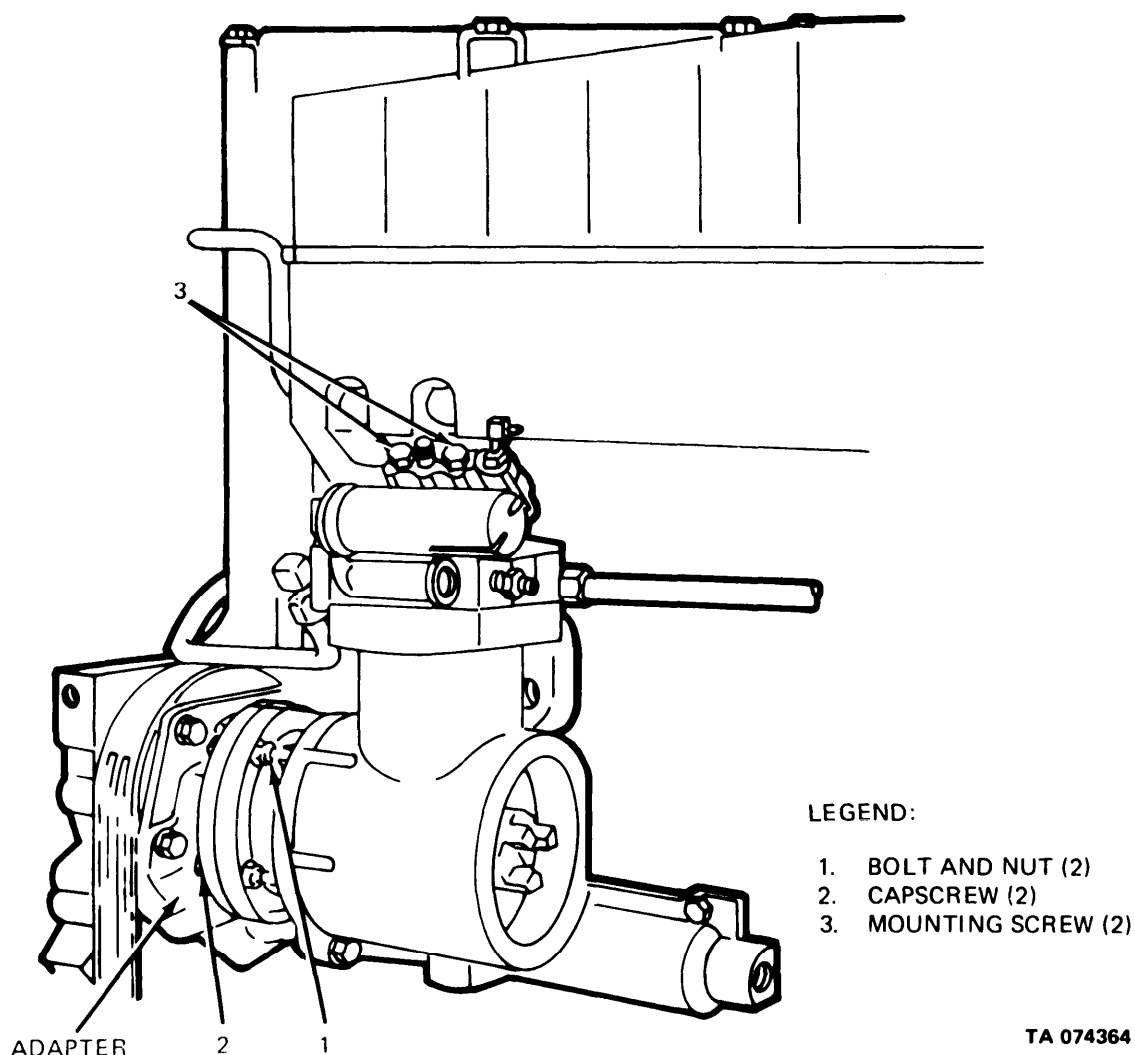


Figure 14-9. Remove Air compressor-To-Adapter Mounting Hardware.

14-4. Disassembly.

a. Cylinder Head Group.

NOTE

The cylinder head group consists of the cylinder head, cover, and valve assembly.

(1) Mount the compressor crankcase in a suitable vise.

(2) Remove the air outlet and water fittings.

(3) Remove the capscrews and washers securing the air inlet connection to the compressor; then remove the connection and discard the gasket.

(4) Remove the two capscrews (1, fig. 14-10), lockwashers (2), and flatwashers (3) securing the unloader valve body (4). Work the assembled unloader valve body gently from the cylinder head.

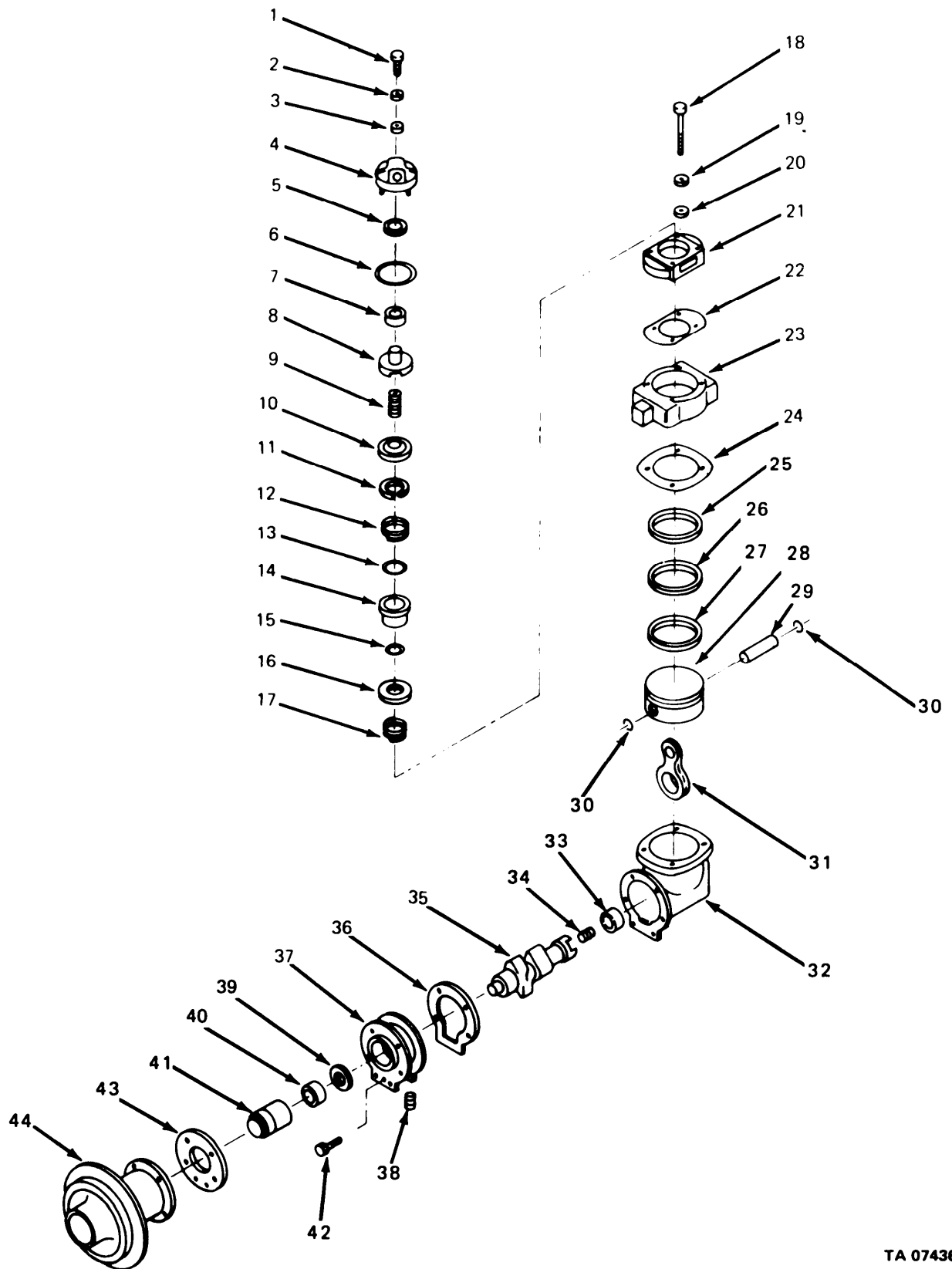


Figure 14-10. Disassemble Air Compressor. (Sheet 7 of 2)

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LEGEND:

1. CAPSCREW (2)	16. EXHAUST VALVE	31. CONNECTING ROD
2. LOCKWASHER (2)	17. SPRING	32. CRANKCASE
3. WASHER (2)	18. CAPSCREW (4)	33. BUSHING
4. UNLOADER VALVE BODY	19. LOCKWASHER (4)	34. PIPE PLUG
5. WEAR PLATE	20. WASHER (4)	35. COMPRESSOR CRANKSHAFT
6. O-RING	21. COVER	36. GASKET
7. SEAL	22. GASKET	37. SUPPORT
8. UNLOADER CAP	23. COMPRESSOR HEAD	38. PIPE PLUG
9. SPRING	24. GASKET	39. THRUST WASHER
10. INLET VALVE SEAT	25. COMPRESSION RING	40. COUPLING HALF
11. INLET VALVE	26. COMPRESSION RING	41. COUPLING
12. SPRING	27. OIL CONTROL RING	42. CAPSCREW (4)
13. O-RING	28. PISTON	43. GASKET
14. EXHAUST VALVE SEAT	29. PISTON PIN	44. HOUSING
15. O-RING	30. SNAP RING (2)	

TA 074366

Figure 14-10. Disassemble Air Compressor. (Sheet 2 of 2)

- (5) Remove the O-ring (6) from the unloader body and discard.
- (6) Lift the unloader cap spring (9) from the inlet valve seat (10).
- (7) Remove the unloader cap (8) from the unloader valve body (4).
- (8) Remove the unloader seal (7) from inside the unloader body.
- (9) Remove the wear plate (5) from the unloader body.
- (10) Insert a large screwdriver into the slots of the inlet valve seat (10) and rotate the seat from the cylinder head.
- (11) Remove the inlet valve (11) and spring (12) from the cylinder head. Throw away spring (12).
- (12) Remove the four cylinder head capscrews (18), lockwashers (19), and washers (20); then remove cover (21), gasket (22), compressor head (23), and gasket (24). Discard the gasket (24).
- (13) press the exhaust valve (16) from the underside of the head with thumb pressure.
- (14) Remove the O-rings (13) and (15) from the exhaust valve seat (14).
- (15) Remove exhaust valve (16) and spring (17) from the exhaust valve seat (14). Throw away spring (17).

b. Crankcase Group.

NOTE

The crankcase group consists of the crankcase, support, crankshaft, connecting rod, and piston assembly.

- (7) Using a coupling puller, pull the coupling half (40) from the crankshaft and remove thrust washer (39).
- (2) Remove four capscrews (42) securing the support (37) to the crankcase (32). Remove support (37) and gasket (36). Discard the gasket.
- (3) Remove crankshaft (35) from crankcase (32) and connecting rod (31).
- (4) Clean any carbon from the worn ridge at the top bore of the crankcase (32) and then push the piston (28) and connecting rod (31) out the top of the crankcase.
- (5) Remove compression rings (25) and (26) and oil control ring (27). Discard the rings.
- (6) Remove the two snap rings (30).
- (7) Place the piston (28) in hot water to expand the piston pin bore.



CAUTION

Do not drive the pin from the piston, as this will distort the piston.

- (8) Push the piston pin (29) from the piston (28) and remove connecting rod (31).

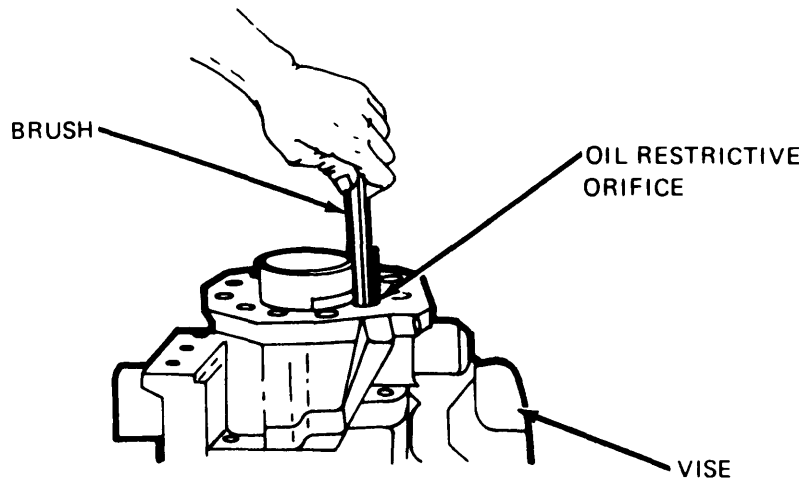
14-5. Cleaning.



Do not use a screwdriver to remove carbon and scale as this may damage the sealing surfaces.

a. Immerse parts in SD-2 drycleaning solvent (item 12, App B). Remove all carbon from valve cavities as well as rust and scale from water cavities. Use compressed air to blow dirt from all cavities.

b. Clean oil passages in crankshaft and support with clean, dry compressed air. Using a stiff brush, clean out the oil restrictive orifice (fig. 14-11).



TA 074367

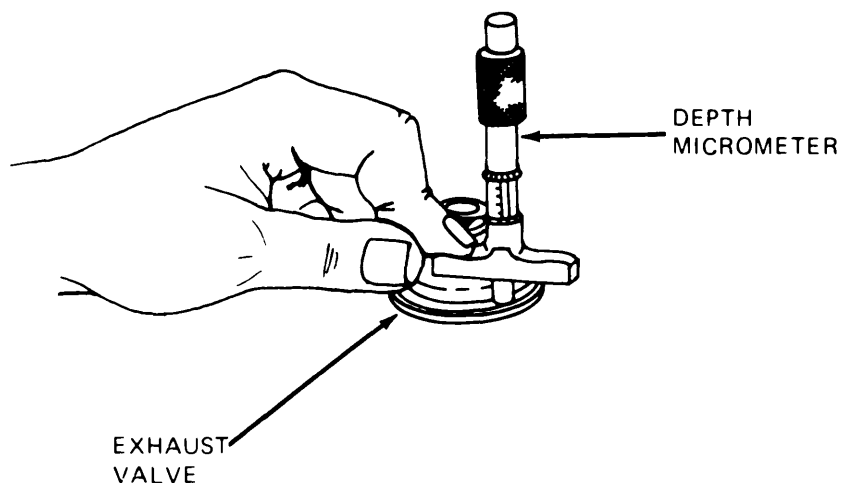
Figure 14-11. Clean Out Oil Restrictive Orifice.

14-6. Inspection and Repair.

a. Cylinder Head Group.

- (1) Check for visible cracks, breaks or mutilation in the compressor head (23, fig. 14-10).

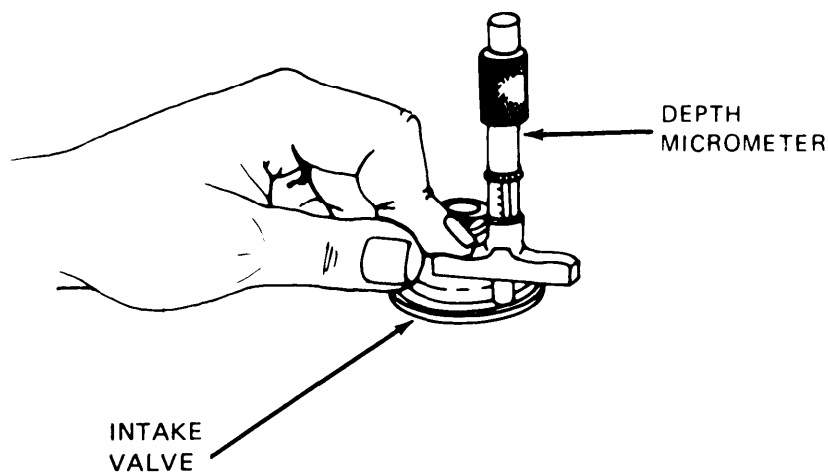
(2) Check the exhaust valve seat height (fig. 14-12). If the height is less than 0.485 in. (12.32 mm), discard the seat.



TA 074368

Figure 14-12. Check Exhaust Valve Seat Height.

(3) Check the intake valve seat height (fig. 14-13). If the height is less than 0.270 in. (6.87 mm), discard the seat.



TA 074369

Figure 14-13. Check Intake Valve Seat Height.

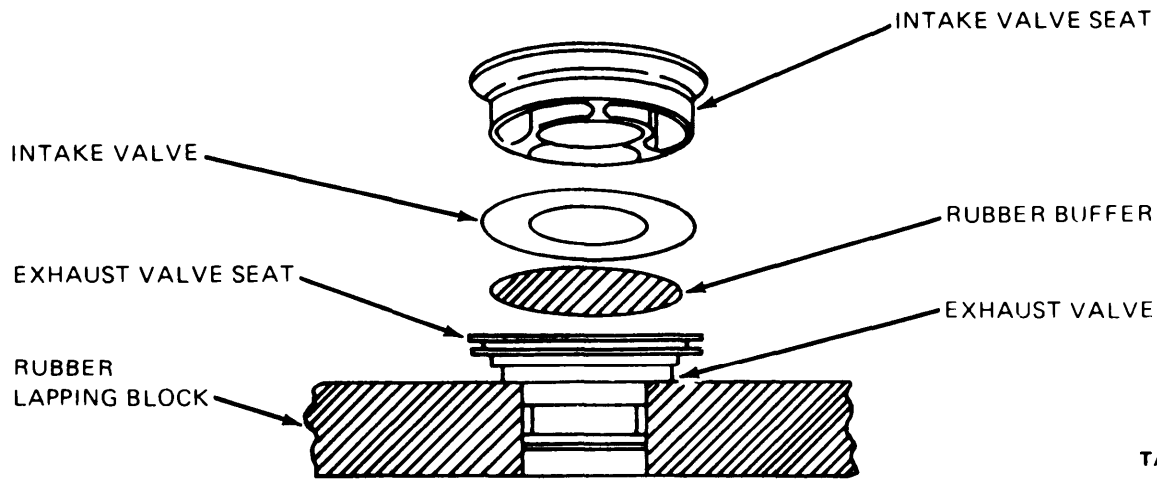
(4) Apply bluing to the exhaust and intake valve seating surfaces to check the seats. If the seating surfaces are not 100 percent true, they may be lapped. If lapping will reduce the valve seat height beyond wear limits, discard the valve assembly.

(5) If lapping is necessary to acquire a good valve seat:

(a) Apply bluing to the surface of the exhaust valve to be lapped, and allow to dry.

(b) Apply lapping compound (items 27 and 28, App B) (a half-and-half mixture of 38900A and A-600) to the exhaust valve and place the valve on the seat.

(c) Insert the valve seat in lapping block (fig. 14-14).



TA 074370

Figure 14-14. Lapping Valve and Valve Seats.

(d) Using a standard hand valve lapper and rubber suction cup, lap the valve until a good seat is acquired. Add additional lapping compound as necessary.

(e) The valve must be flat within 0.001 in. (0.025 mm) total indicator reading.

(f) Clean parts thoroughly to remove all lapping compound.

(6) Lapping Intake Valve.

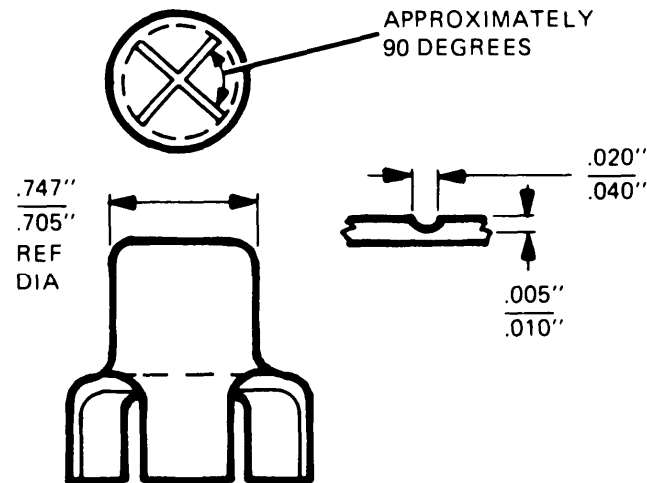
(a) Install a rubber buffer in top of the exhaust valve seat.

(b) Apply bluing to the intake valve. Allow to dry.

(c) Apply lapping compound to the intake valve. Place the intake valve seat on the intake valve and lap until a good seat is acquired. Valve must be flat within 0.001 in. (0.025 mm) of total indicator reading.

(d) Remove all lapping compound before assembly.

(7) Check the upper part of the unloader cap where the packing seal seats for scoring or excessive wear. If the top of the unloader cap sticks to the bottom of the unloader body, file a cross on top of the unloader cap (fig. 14-15).



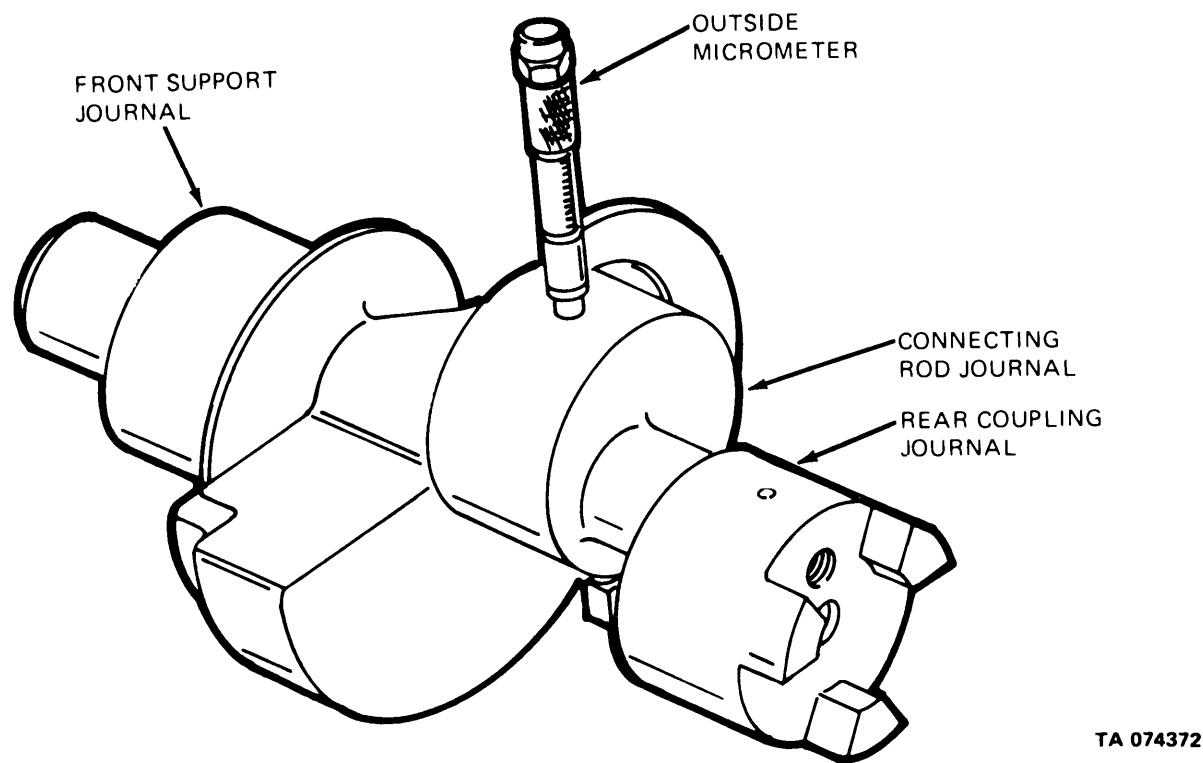
TA 074371

Figure 14-75. File Cross on Top of Unloader Body.

- (8) Check the seating area of the unloader cap for distortion, pitting, or wear.
- (9) Check the compressor head for water leakage:
 - (a) Assemble the cylinder head and cylinder head cover to the crankcase using new gaskets.
 - (b) Install capscrews and tighten alternately to a final torque of 15-19 lb-ft (20-26 N-m).
 - (c) Plug the water outlet port and apply water under 20-30 psi (138-207 kPa) pressure through the water inlet port.
 - (d) Check for leaks. Discard parts as necessary. Release pressure from the inlet. Remove the plug from the water outlet port and replace the water outlet fitting.
 - (e) Remove cylinder head from crankcase.

b. Crankcase Group.

(1) Check the crankshaft for scratches, scoring, and wear. Replace if worn beyond replacement limits in figure 14-16.



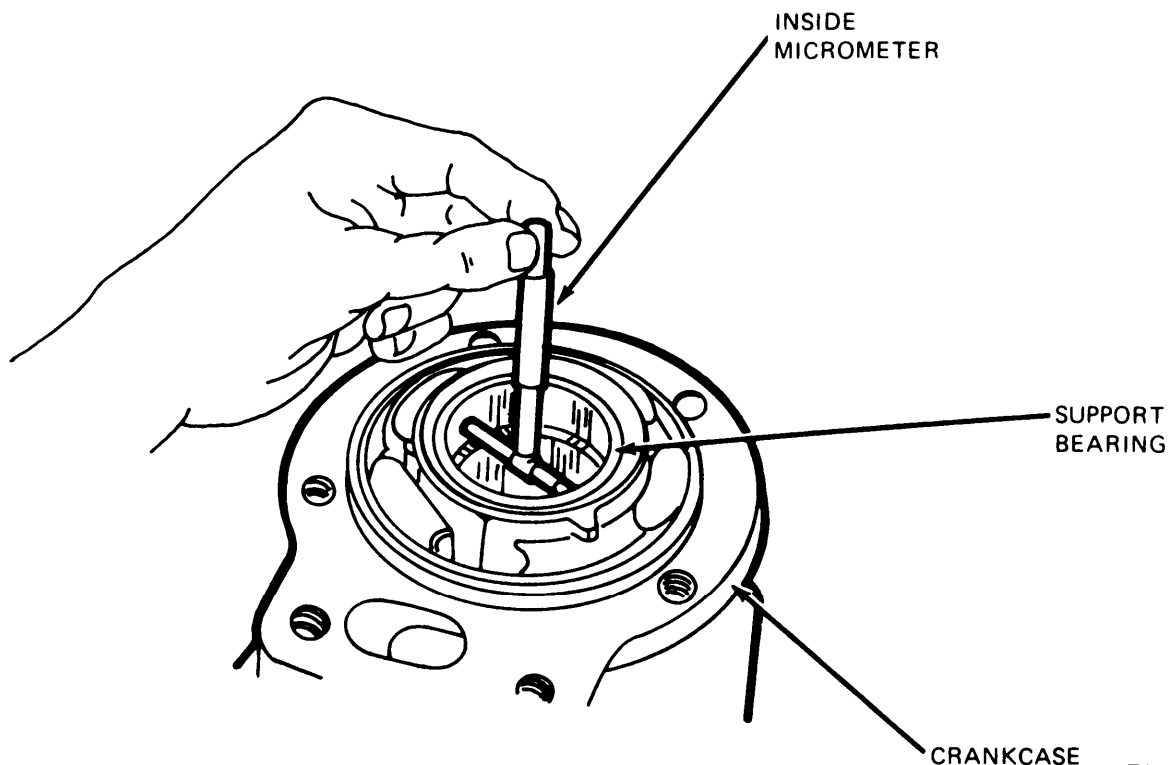
TA 074372

CRANKSHAFT DIMENSIONS

Front Support Journal			Connecting Rod Journal			Rear Coupling Journal		
Min In. (mm)	Max In. (mm)	Worn Limit	Min In. (mm)	Max In. (mm)	Worn Limit	Min In. (mm)	Max In. (mm)	Worn Limit
1.872 (47.55)	1.873 (47.57)	1.871 (47.52)	1.9345 (49.136)	1.9355 (49.162)	1.9330 (49.098)	1.872 (47.55)	1.873 (47.57)	1.871 (47.52)

Figure 14-16. Check Crankshaft For Wear.

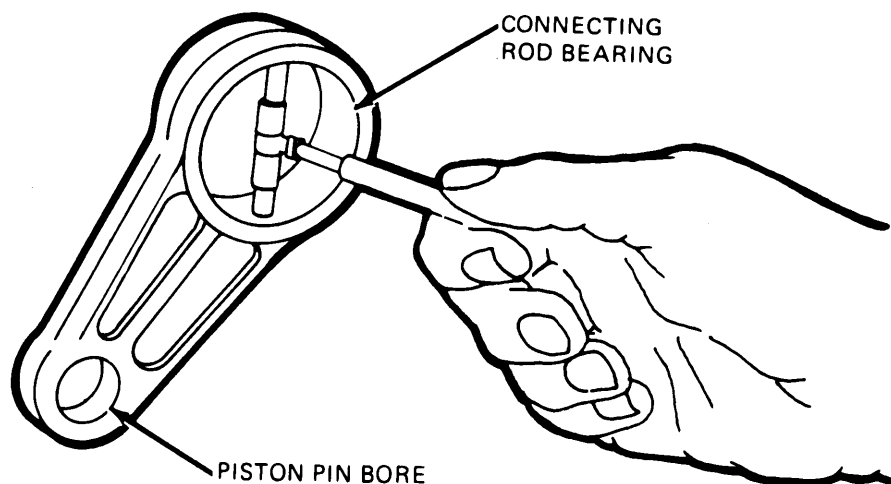
(2) Check the crankshaft support bearing for scoring and wear (fig. 14-17). If I D exceeds 1.877 in. (47.68 mm), replace the support and bearing as an assembly.



TA 074373

Figure 14-17. Check Support Bearing for Wear.

(3) Check the connecting rod bearings for scoring or wear (fig. 14-18). If I D exceeds 1.9395 in. (49.263 mm) at the crankshaft end or 0.689 in. (17.50 mm) at the piston pin end, the connecting rod must be scrapped.

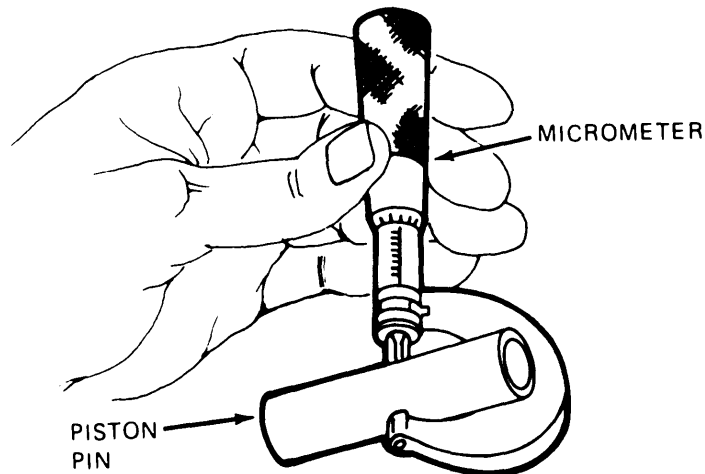


TA 074374

Figure 74-18. Check Connecting Rod Bearing.

(4) Check the connecting rod for bend and twist. Bend must not exceed 0.002 in. (0.05mm) or twist 0.004 in. (0.10 mm).

(5) Check the piston pin outside diameter with micrometer (fig. 14-19). New Pin outside diameter is 0.6875-0.6876 in. (17.46-17.465 mm); if worn smaller than 0.6872 in. (17.45 mm), the pin should be replaced.



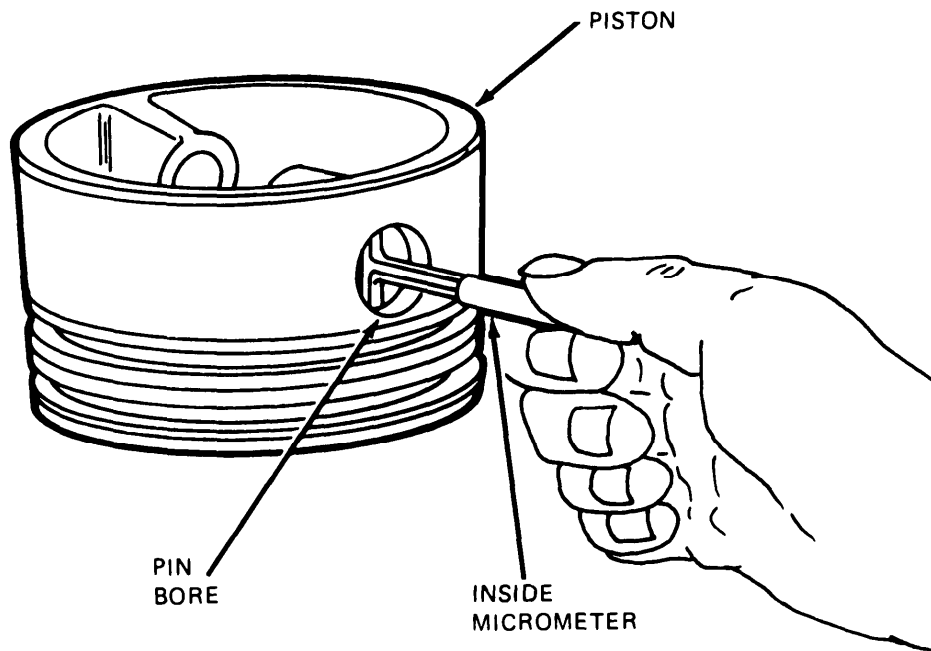
TA 074375

Figure 14-19. Check Piston Pin for Wear.

(6) Inspect the piston for scoring, cracks, wear, or other damage.

(7) Measure the piston wear at the bottom of the skirt and at a right angle to the piston pin bore. If the skirt diameter is less than 3.6165 in. (91.860 mm) at 70°F, discard the piston. New skirt diameter is 3.619-3.620 in. (91.92-91.95 mm).

(8) Measure the piston pin bore at 70°F, with inside micrometer (fig. 14-20). Piston pin bore on a new piston is 0.6875-0.6880 in. (17.463-17.465 mm); if worn larger than 0.6885 in. (17.488 mm), replace piston.



TA 074376

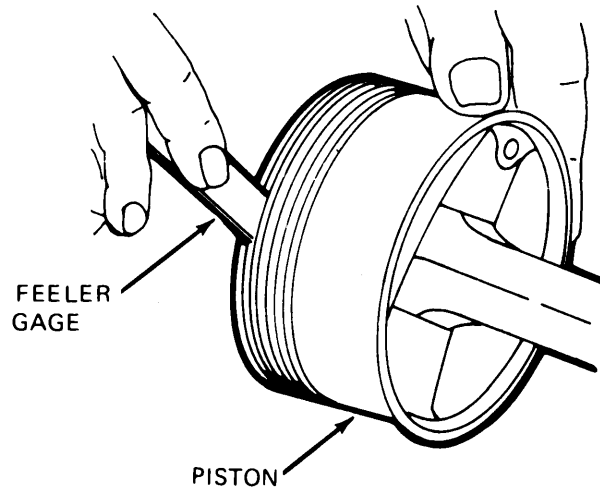
Figure 14-20. Check Piston Pin Bore.

(9) Checking the ring groove wear:

(a) Install anew ring in groove of piston.

(b) Insert a 0.004 in. (0.10 mm) feeler gage between the ring and the piston groove

(fig. 14-21).



TA 074377

Figure 14-21. Check Piston Ring Groove for Wear.

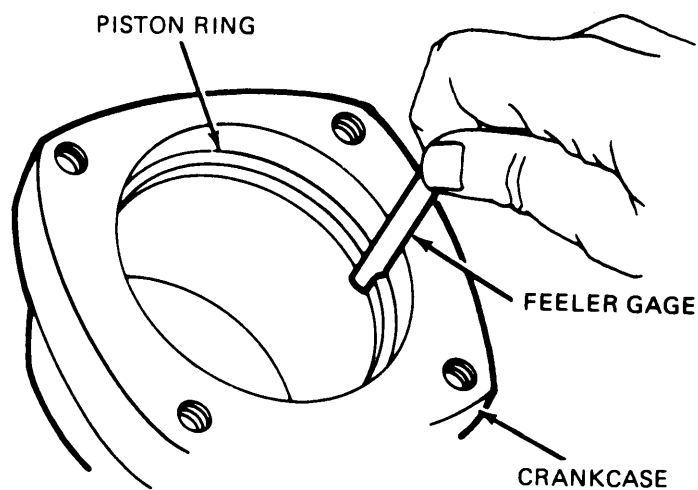
(c) Compress the ring in the piston groove. If the ring is below the piston land surface with feeler gage in place, wear is excessive and the piston must be scrapped.

(10) Check the piston ring gap:

(a) Insert the rings (one at a time) in the cylinder, seating squarely with a piston head in an unworn portion of the cylinder bore.

(b) Measure with feeler gage; gap should be 0.010-0.020 in. (0.2540-0.5080 mm)

(fig. 14-22).



TA 074378

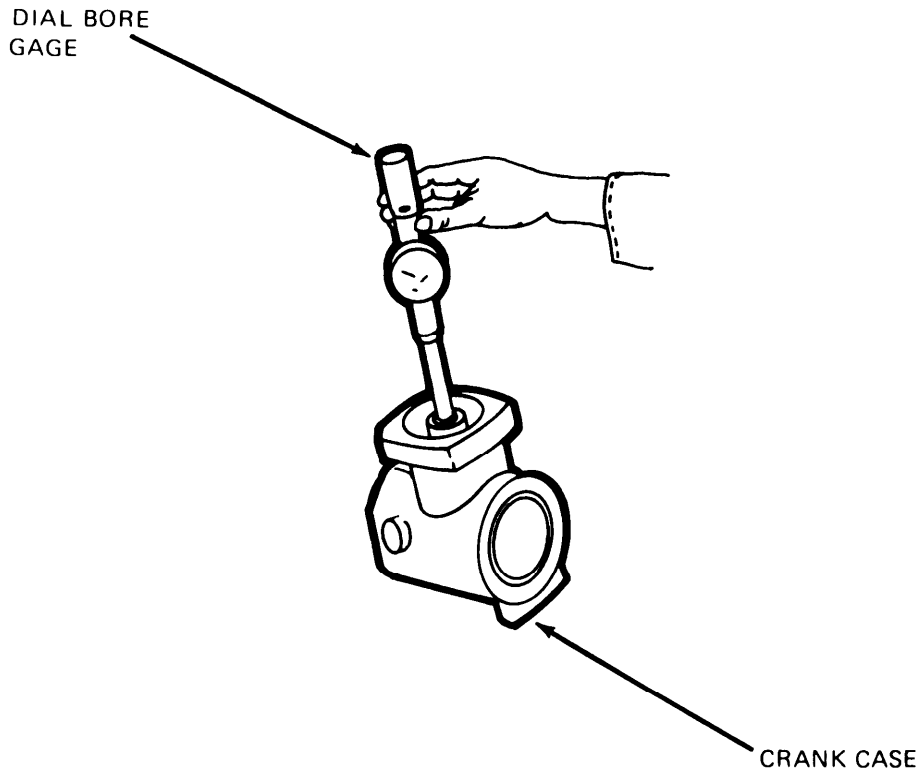
Figure 14-22. Check Piston Ring Gap.

(11) Visually inspect the cylinder bore for scoring. Hone as needed.

(12) Check the crankcase cylinder bore for out-of-roundness and wear with a dial bore gage (fig. 14-23). Bore and hone the cylinder bore to accommodate 0.010, 0.020 or 0.030 in. (0.25, 0.50 or 0.76 mm) oversize pistons and rings with 150 grit stone if:

(a) Out-of-roundness exceeds 0.0015 in. (0.038 mm).

(b) Bore is worn beyond 3.6285 in. (92.164 mm).

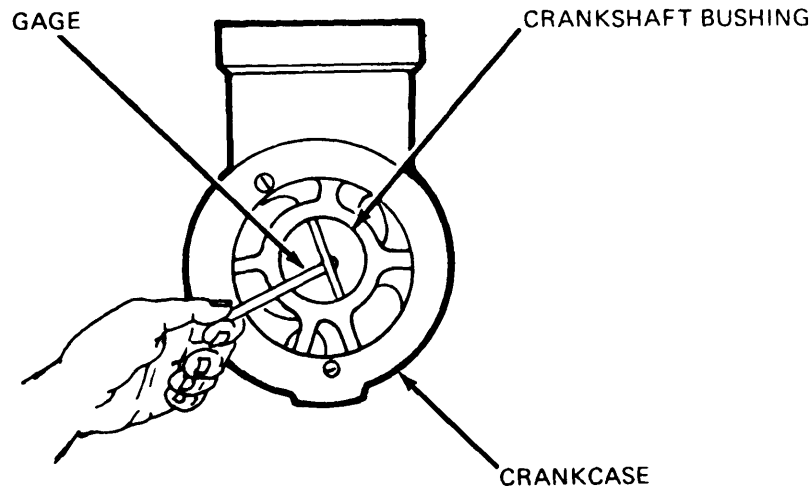


TA 074379

Figure 74-23. Check Cylinder Bore.

(13) A new crankcase cylinder bore is 3.625-3.626 in. (92.08-92.01 mm).

(14) Check the crankcase bushing in the crankcase. If worn larger than 1.8780 in. (4.7701 cm), bushing must be replaced (fig. 14-24).



TA 074380

Figure 14-24. Check Crankshaft Bushing Bore in Crankcase.

(15) Replace the crankshaft bushing in the crankcase.



Support the crankcase while removing or installing the bushing.

(a) Press out the old crankshaft bushing with ST-1105.

(b) Lubricate the bushing bore in the crankcase and press in a new bushing with ST-1105 until flush with the bore surface.

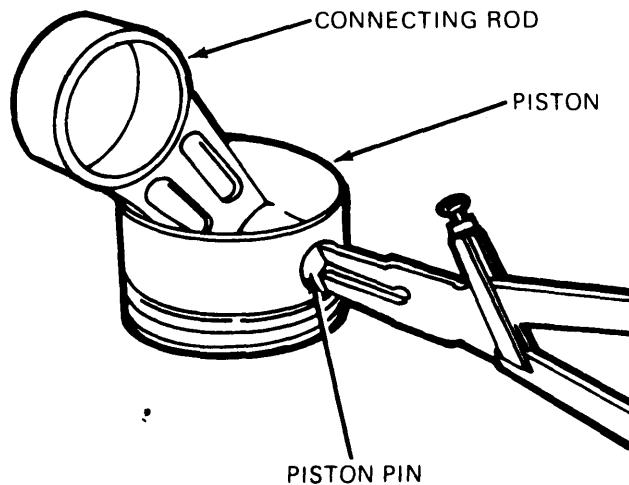
14-7. Assembly.

a. Crankcase Group.



Do not drive the piston pin into the piston pin bore. Driving the piston pin into the piston will distort the piston.

- (1) Heat the piston in hot water to expand the piston pin bore. Lubricate the piston pin; then install pin (fig. 14-25) through the piston and connecting rod.
- (2) Secure the piston pin with the snap rings (one at each end of piston pin).



TA 074381

Figure 14-25. Secure Piston Pin with Snap Rings.

CAUTION

Keep the word TOP on the compression rings up (toward crown of piston), Do not scratch the piston when installing the rings. Do not clamp the rod in a vise unless the rod is protected by soft wood.

- (3) Install the piston rings on the piston. Stagger the gap in the piston rings. (An exploded view of the piston and rings is shown in fig. 14-10.)
- (4) Lubricate the piston rings and crankcase bore.
- (5) Install the piston and rod assembly in the crankcase using a standard ring compressor.
- (6) Lubricate the crankshaft journals and work it through the connecting rod and crankcase bearings.
- (7) Install the thrust washer (39, fig. 14-10) (with the groove side against the support) support (37) and a new gasket (36). Secure with four capscrews (42). Torque capscrews to 30 lb-ft (41 N·m).

NOTE

In step (8), the drive coupling is pressed on the crankshaft up to the shoulder.

- (8) press coupling half (40) and coupling (41) over the crankshaft with a sleeve or pipe.

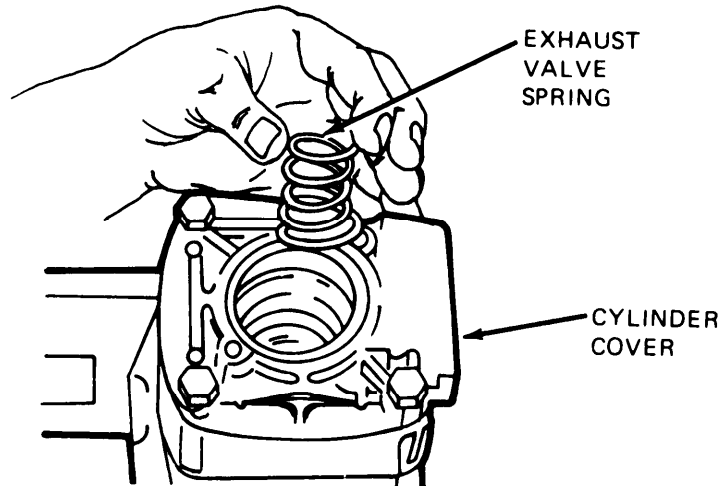
b. *Cylinder Head Group.*

(1) Install gasket (24, fig. 14-10), compressor head (23), gasket (22), and cover (21). Secure with washer (20), lockwasher (19), and capscrews (18). Tighten alternately to 15-19 lb-ft (20-26 N·m) torque.

(2) Coat exhaust valve (16) with engine oil.

(3) Place the exhaust valve on the exhaust valve seat (14) and install new O-rings (13) and (15) on the exhaust valve seat. Lubricate both O-rings,

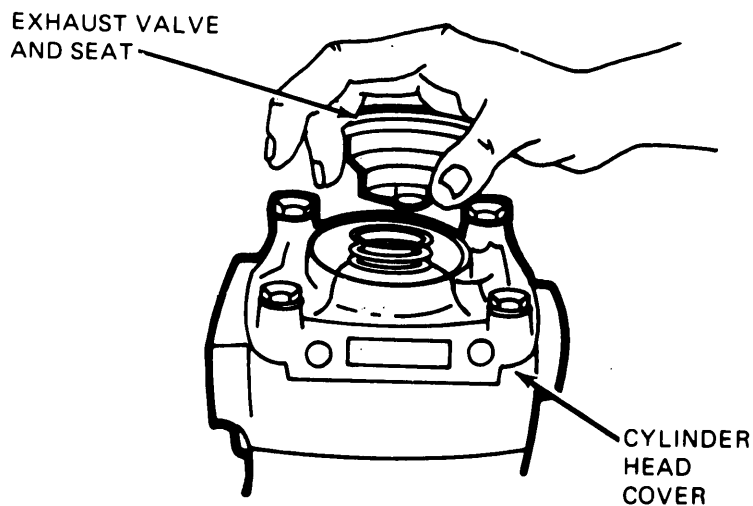
(4) install exhaust valve spring (17) in head, as shown in figure 14-26.



TA 074382

Figure 14-26. Install Exhaust Valve Spring.

(5) Install exhaust valve unit in the head. Apply pressure with thumbs to seat the exhaust valve (fig. 14-27).



TA 074383

Figure 14-27. Install Exhaust Valve and Seat.



In step 6, lapped surface of the valve must be up.

(6) Install intake valve spring (fig. 14-28) with the turned-in end against the top of the exhaust valve seat.

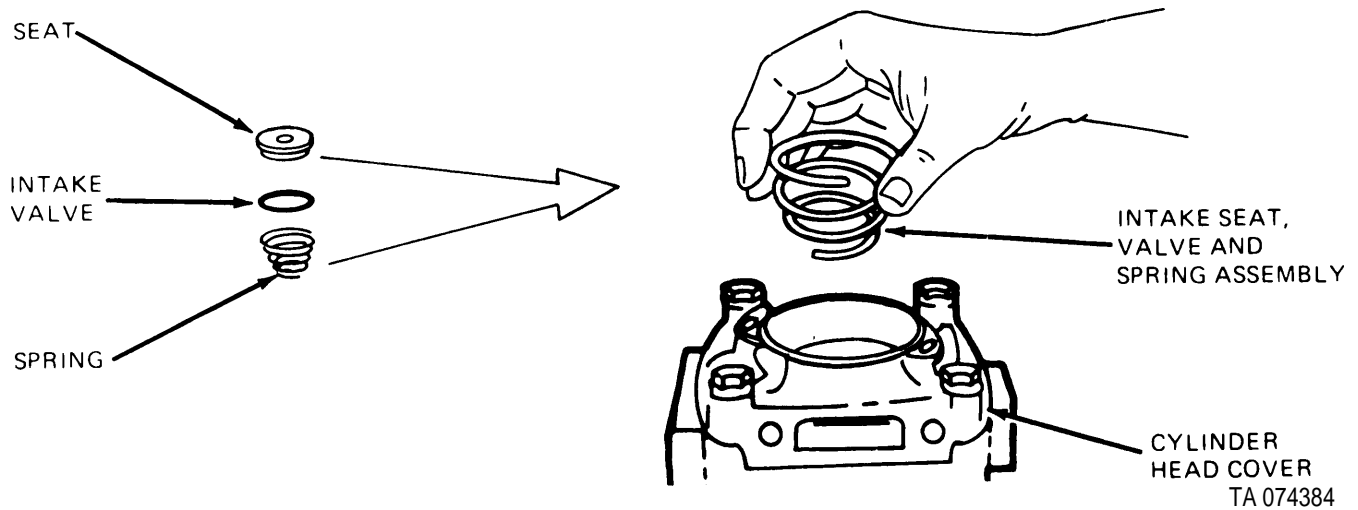


Figure 14-28. Install Intake Valve, Seat, and Spring.

(7) Insert intake valve on top of spring.

(8) Insert intake valve seat on top of the intake valve.

(9) Install the unloader valve spring (fig. 14-29) in the intake valve seat.

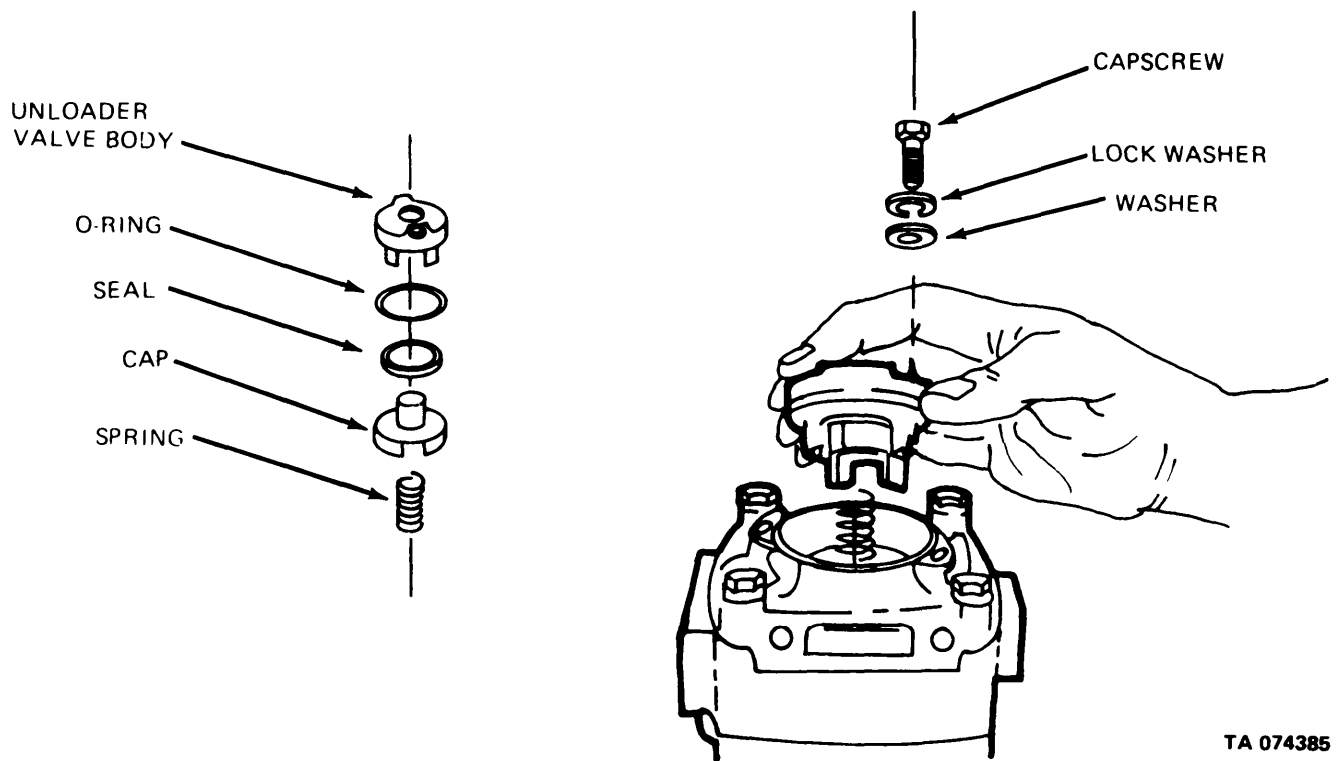


Figure 14-29. install Unloader Cap and Body.

(10) Apply clean lubricating oil to the new yellow unloader body O-ring and install on the body.

(11) Lubricate the outside diameter of the unloader cap and seal and slide the unloader cap with seal into bore of the unloader body.

(12) Apply clean lubricating oil to the body and O-ring and install the cap over the spring in the compressor cylinder head. Be certain the three legs of the cap protrude into the three of openings of the intake valve seat.

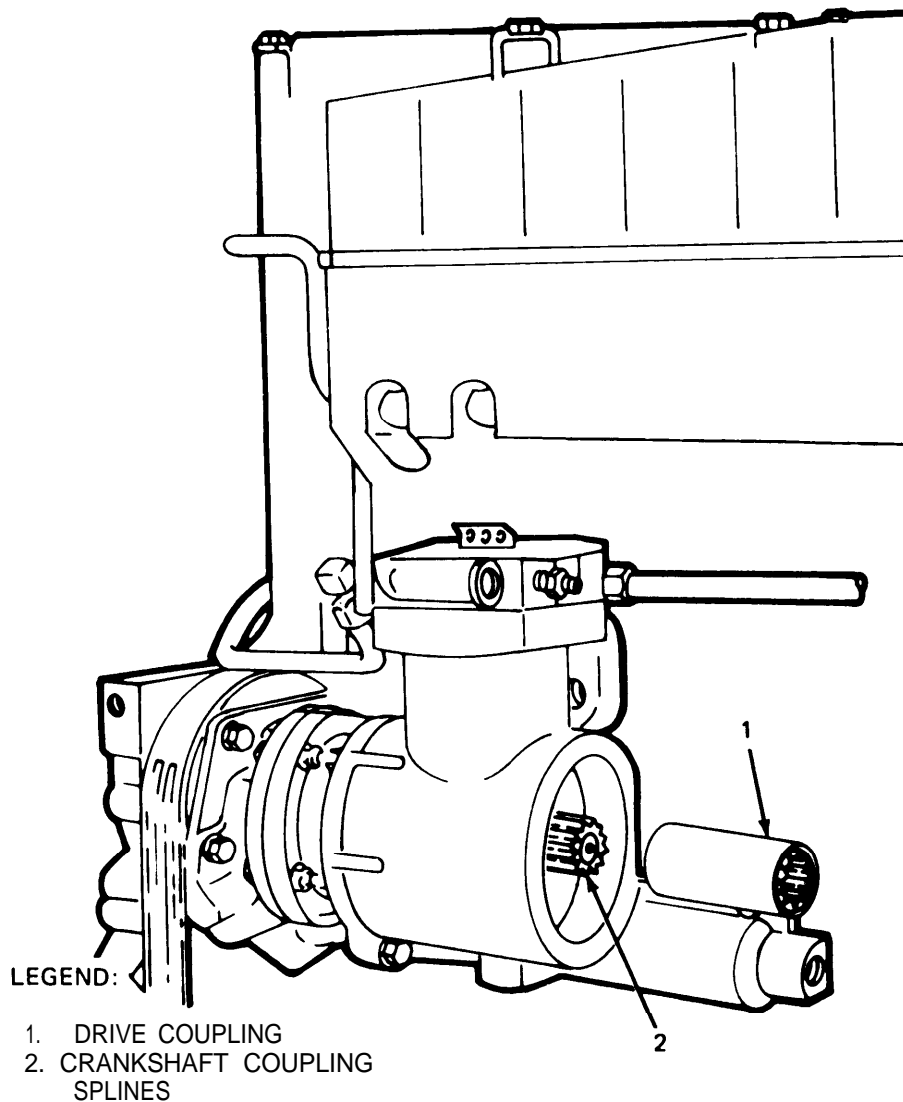
(13) Install washers, lockwashers, and capscrews. Torque alternately to a final torque of 8-11 lb-ft (11-15 N-m).

(14) Install the air and water fittings, as shown in figure 14-1.

14-8. Installation (Engine in Chassis).

a. Preparation.

(1) Install drive coupling (1, fig. 14-30) to crankshaft coupling splines (2).



TA 074386

Figure 14-30. Install Drive Coupling.

CAUTION

The air compressor must be timed to the engine when installed. Before proceeding be sure that the "A" timing mark is aligned as performed during removal. (Refer to para 14-3b (11).

(2) Utilizing drive coupling turn the crankshaft so that the allen head plug at the rear of the crankshaft is positioned between two o'clock and three o'clock as viewed from the rear of the air compressor (fig. 14-31).

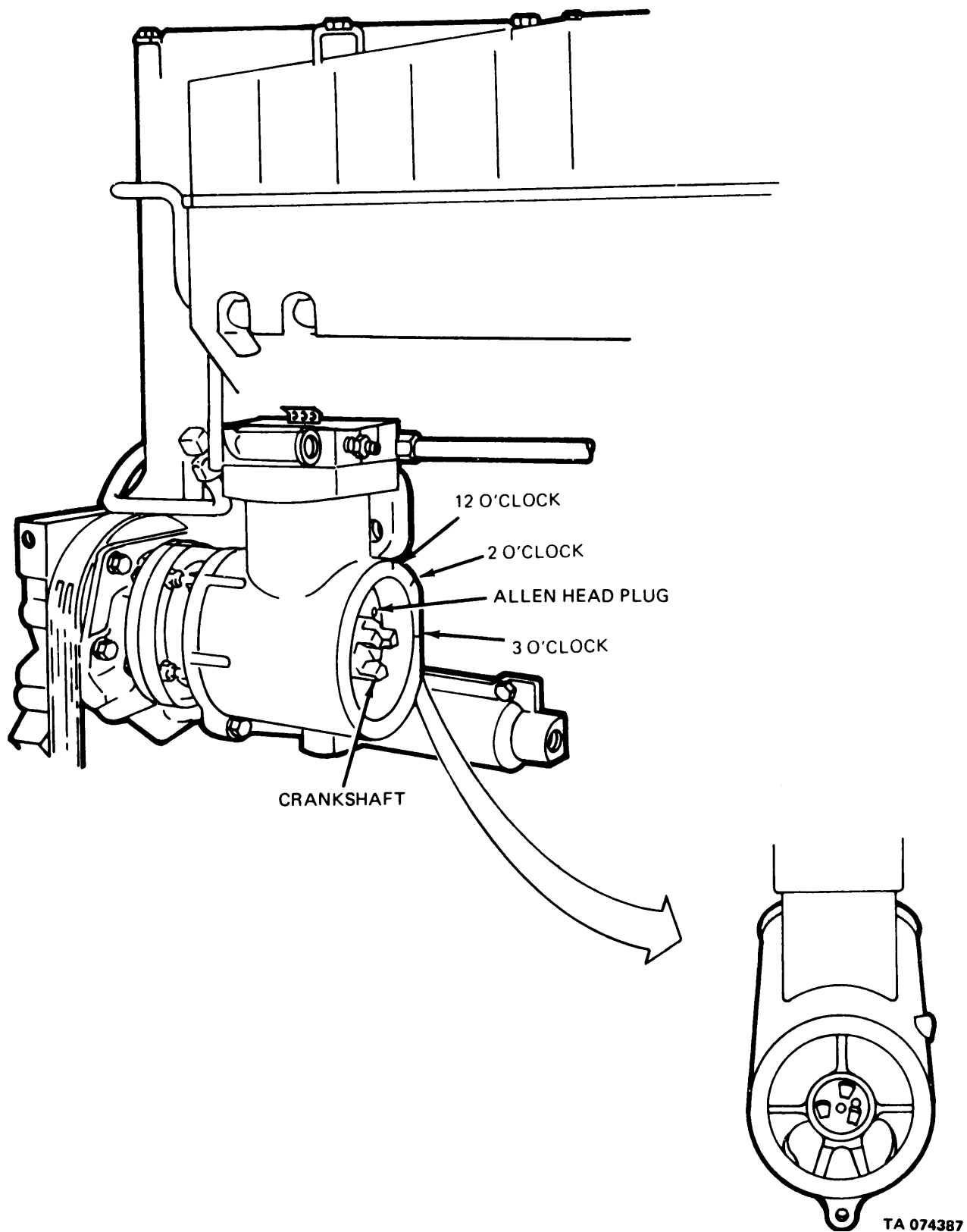


Figure 14-31. Air Compressor Timing.

b. Installation.

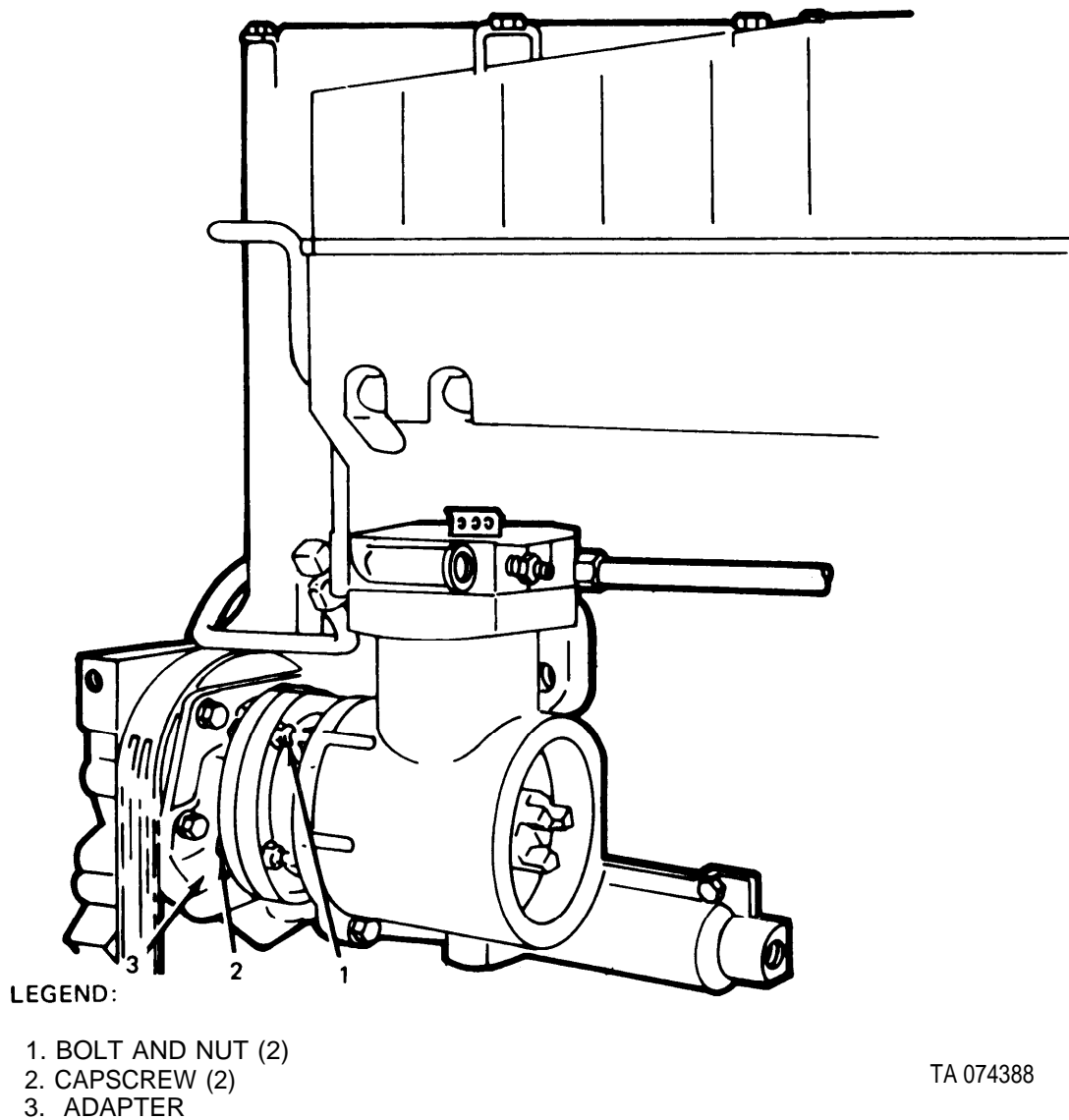
(1) Install new gasket on air compressor.

(2) Install air compressor on the adapter (3, fig. 14-32) making sure that the timing position remains correct.

NOTE

In step (3), the lower inside mounting capscrew must be installed and tightened using special tool 3375159.

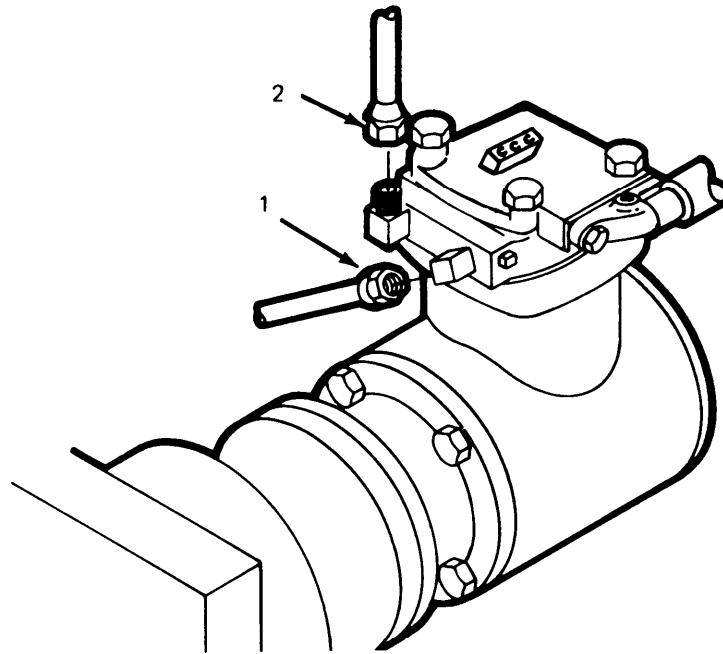
(3) Install air compressor-to-adapter mounting hardware. Two bolts and nuts (1) are used in the upper location and two capscrews (2) are used in the lower location. Tighten the lower inside capscrew and torque the other three to 49 lb-ft (66 N-m).



TA 074388

Figure 14-32. Install Air Compressor Mounting Hardware.

- (4) Connect engine coolant inlet line (1, fig. 14-33) and engine coolant outlet line (2).



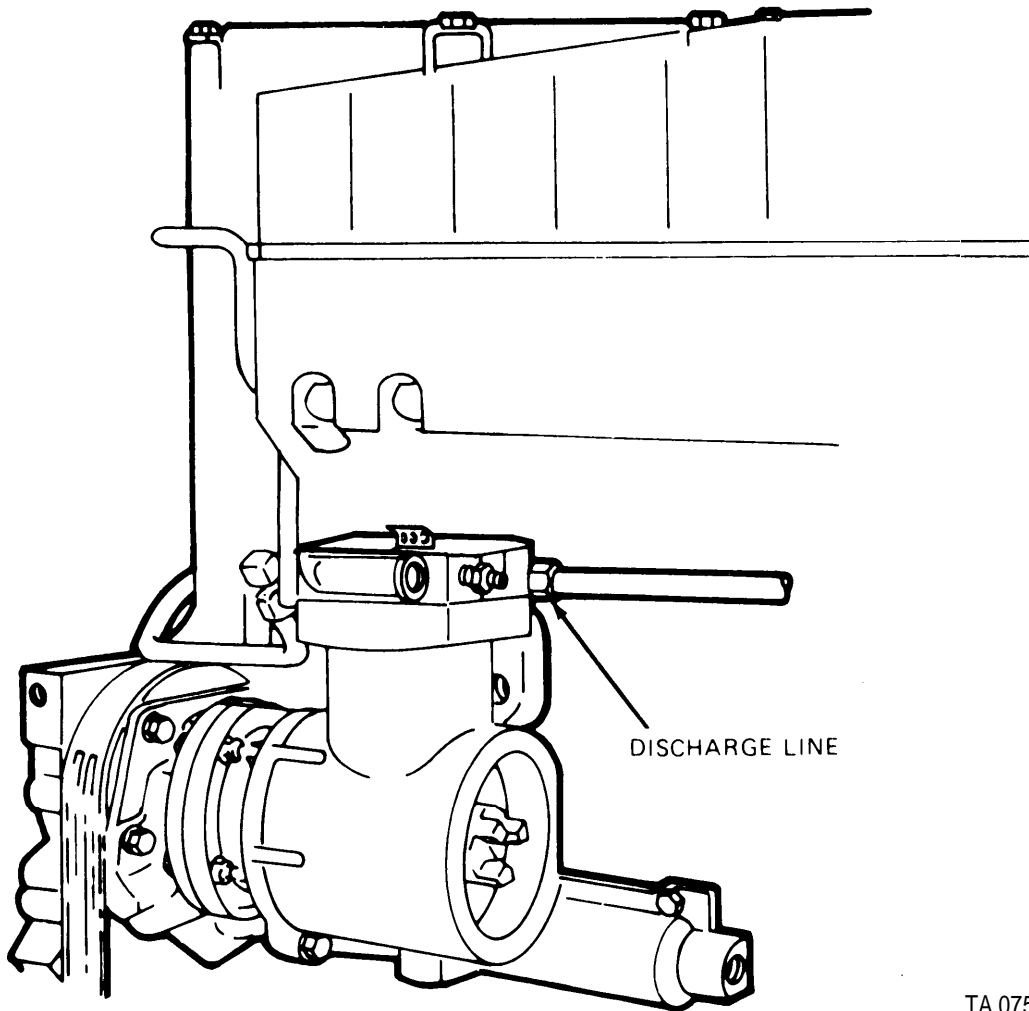
LEGEND:

1. ENGINE COOLANT INLET LINE
2. ENGINE COOLANT OUTLET LINE

TA 074363

Figure 14-33. Connect Coolant Inlet and Outlet Lines.

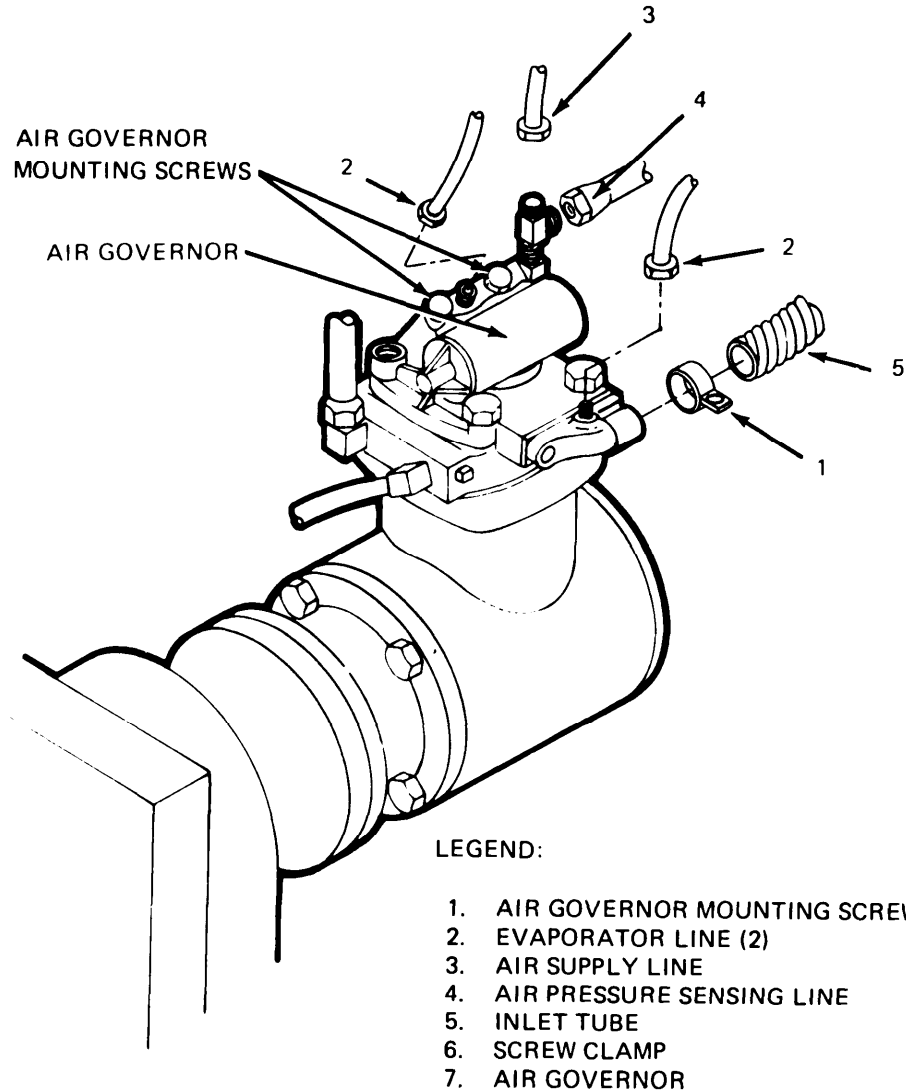
- (5) Connect air compressor discharge line (fig. 14-34).



TA 075400

Figure 14-34. Connect Discharge Line.

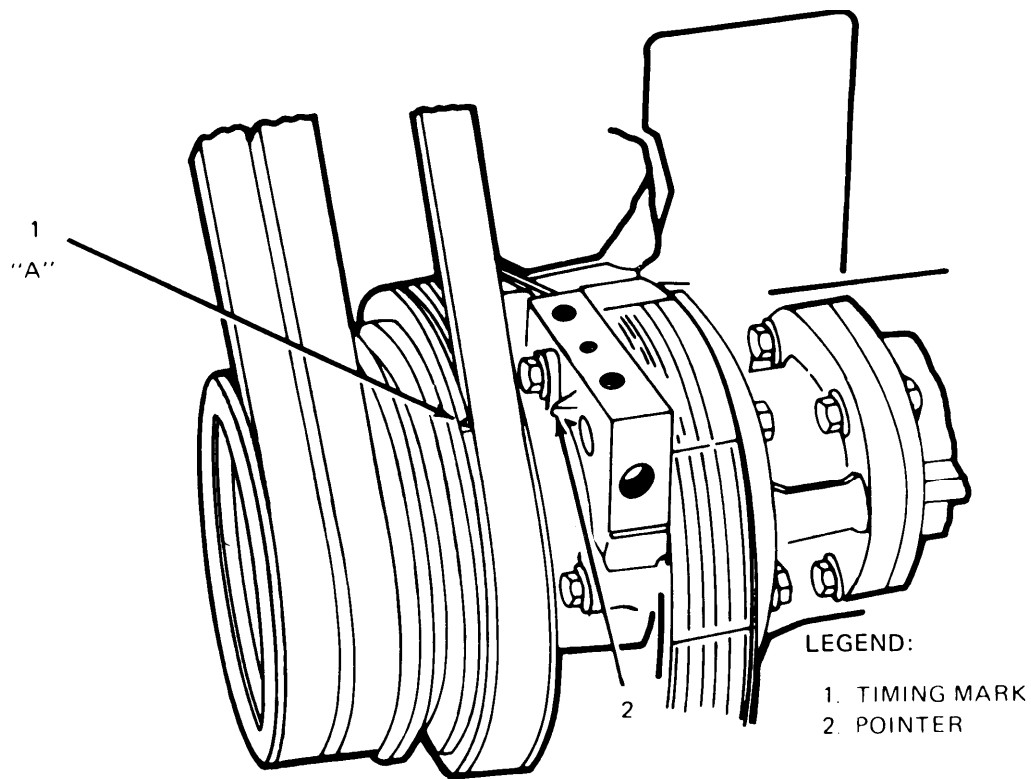
- (6) Install the air governor (7, fig. 14-35) with two air governor mounting screws (1).
- (7) Connect air governor air pressure sensing line (4, fig. 14-35).



TA 074361

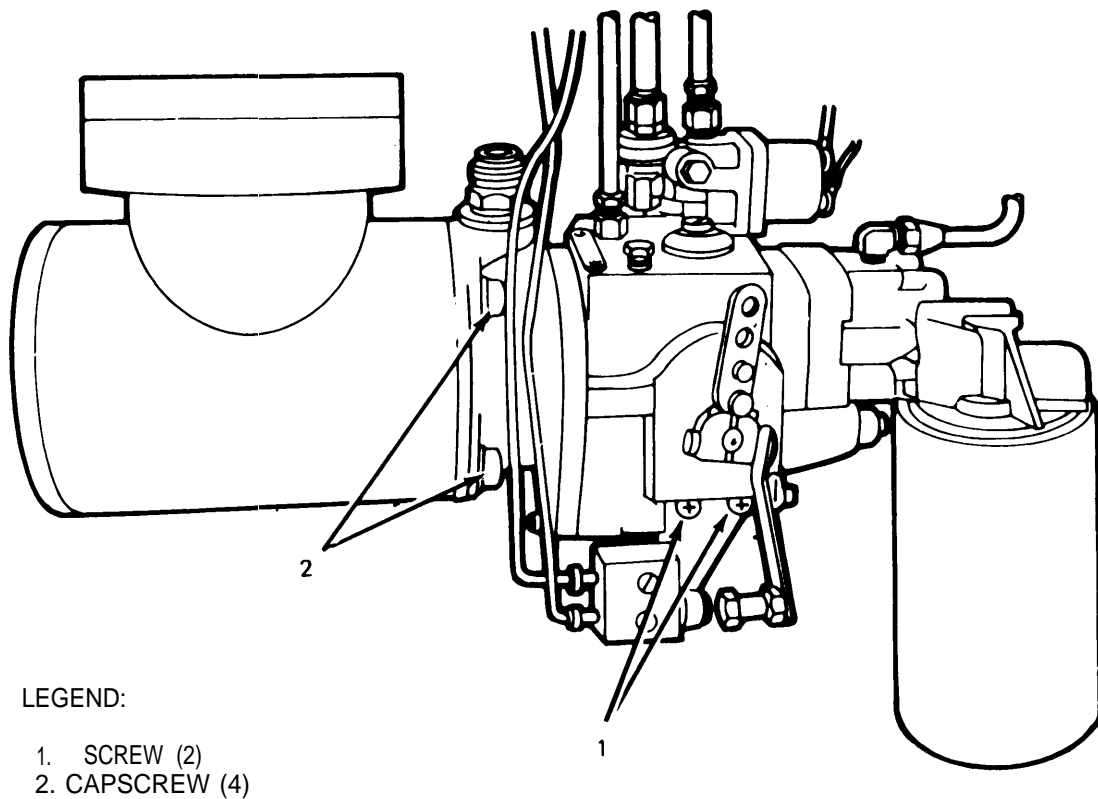
Figure 14-35. Connect Air Compressor Hookups.

- (8) Connect fan clutch air supply line (3).
- (9) Connect two alcohol evaporator lines (2).
- (10) Connect air compressor inlet tube (5) to governor and secure with screw clamp (6).
- (11) Check to see that timing mark (1, fig. 14-36) and pointer (2) are aligned. Realine if necessary.
- (12) Install new gasket on fuel pump, install fuel pump and torque the four mounting cap-screws (2, fig. 14-37) to 49 lb-ft (66 N-m).
- (13) Install engine retarder micro switch and gasket. Use two screws (1).



TA 074360

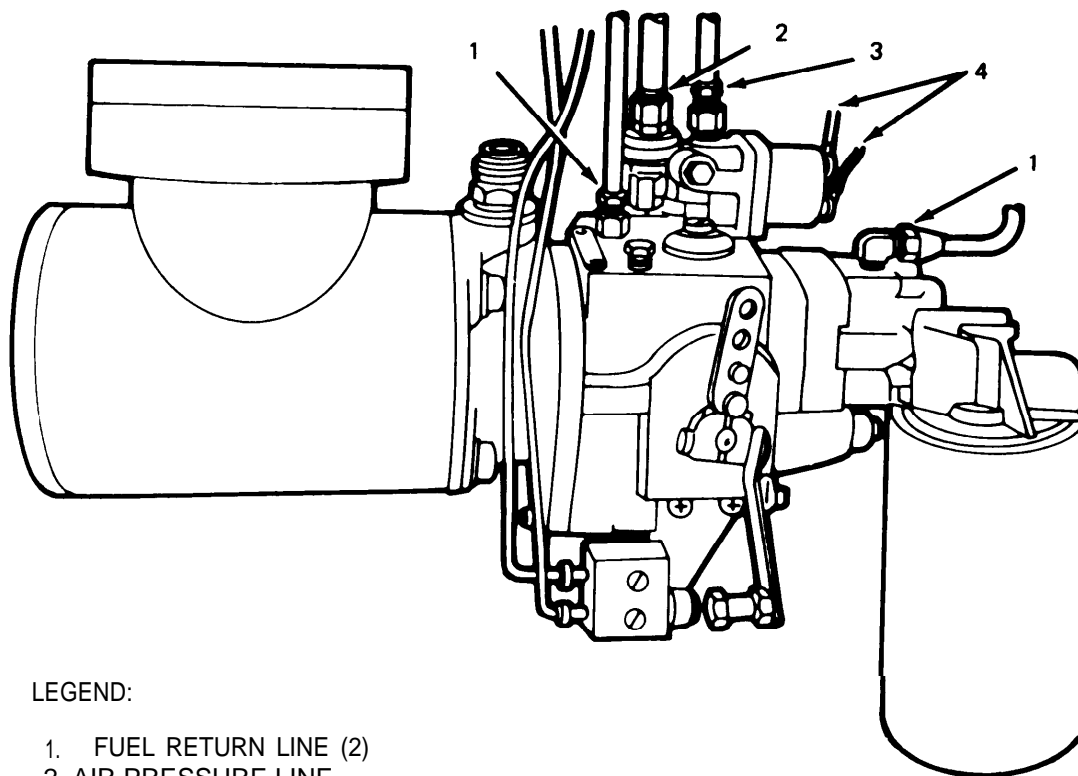
Figure 14-36. Check Timing Marks.



TA 074359

Figure 14-37. Install Engine Retarder Micro Switch and Fuel Pump Mounting Capscrews.

(14) Connect intake manifold air pressure line (2, fig. 14-38).



LEGEND:

- 1. FUEL RETURN LINE (2)
- 2. AIR PRESSURE LINE
- 3. FUEL PUMP OUTLET LINE
- 4. SOLENOID ELECTRICAL LEAD (2)

TA 075666

Figure 14-38. Connect Fuel Pump Lines and Solenoid Leads.

- (15) Connect two fuel return lines (1).
- (16) Connect fuel pump outlet line (3) to the fuel shut off solenoid.
- (17) Connect fuel shut off solenoid electrical leads (4). Power wire (blue) to the long terminal.
- (18) Connect tachometer cable (refer to TM 9-2320-273-20).
- (19) Connect fuel inlet line (refer to TM 9-2320-273-20).
- (20) Connect accelerator rod to fuel pump lever (refer to TM 9-2320-273-20).
- (21) Install accelerator return spring (refer to TM 9-2320-273-20).
- (22) Install left front fender (refer to TM 9-2320-273-20).
- (23) Replenish engine coolant (refer to TM 9-2320-273-20).
- (24) Connect battery cables and close air tank petcock (refer to TM 9-2320-273-20).
- (25) Start and run engine and check air compressor operation (refer to TM 9-2320-273-10).
- (26) Lower and latch hood (refer to TM 9-2320-273-10).

Section II. AIR GOVERNOR

14-9. Description. The air governor operates in conjunction with the air compressor unloading mechanism and controls air pressure to a maximum (cut-out) and minimum (cut-in) pressures. Only the maximum (cut-out) pressure is adjustable. The minimum (cut-in) pressure is designed into the valve and is about 25 psi (172 kPa) below maximum pressure.

14-10. Disassembly and Assembly.

a. *Disassembly.* Remove all line connections to the air governor (refer to para 14-3 b, (13), (14), and (15)). Remove two screws mounting air governor to compressor (fig. 14-6) and Proceed as follows:

- (1) Remove cover (fig. 14-39).

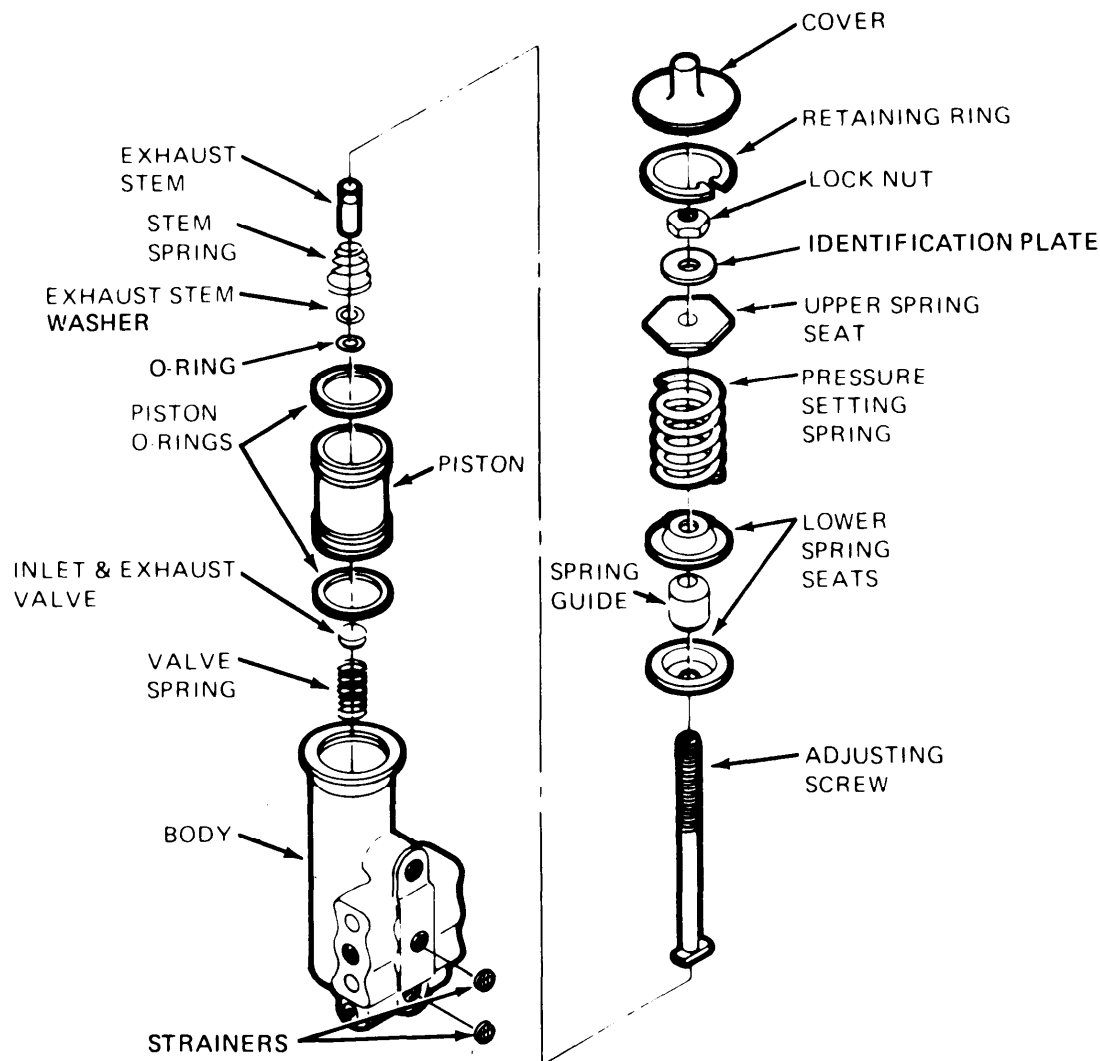


Figure 14-39. Air Governor – Exploded View.

TA 074389

- (2) Using a pair of retainer ring pliers, remove the retaining ring.
- (3) Remove the locknut, identification plate and then the hex-shaped upper spring seat from the adjusting screw.
- (4) Remove the pressure setting spring, one lower spring seat, spring guide and the other lower spring seat from the adjusting screw.
- (5) Remove the exhaust stem and stem spring from the piston.
- (6) Invert the body and tap it on a wood surface and remove the piston.
- (7) Remove the inlet and exhaust valve and valve spring.
- (8) Remove the two outer piston O-rings.
- (9) With a hooked wire, remove the exhaust stem O-ring and the exhaust stem washer from the stem bore of the piston.
- (10) Remove and clean strainers.

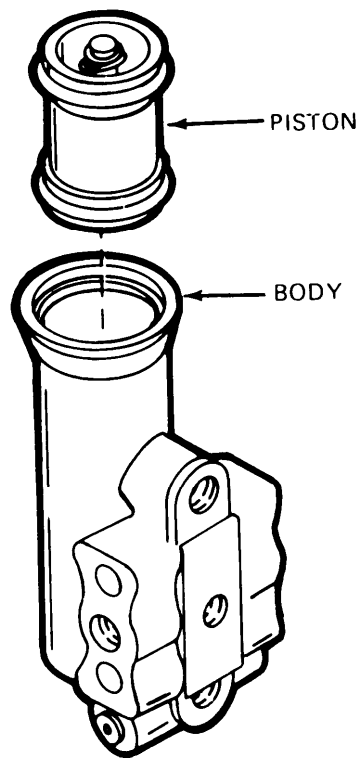
b. Inspection. Clean all metal parts in mineral spirits. Wipe rubber parts dry and inspect for wear or damage. Inspect body for cracks or other damage. Be particularly careful that all air passages in the body, strainers, exhaust stem, and piston are not obstructed. Repairs to governor parts are not recommended. Replace all parts which are worn or damaged.

c. Assembly.

NOTE

Prior to assembly all parts must be lubricated with Bendix lubricant, Part Number 240176, or equivalent.

- (1) Install the exhaust stem O-ring in its groove in the stem bore of the piston and the exhaust stem washer.
- (2) Install the two outer O-rings on the piston.
- (3) Install the inlet and exhaust valve in the bottom of the piston.
- (4) Install the valve spring with its narrow coil end against the valve. Press the spring down until the large coil end snaps into the groove inside the piston.
- (5) Position the exhaust stem spring over the exhaust stem with the narrow coil end toward the stem head. Carefully press the stem into the stem bore of the piston.
- (6) Install the assembled piston in the body (fig. 14-40). Push the piston in until it bottoms.

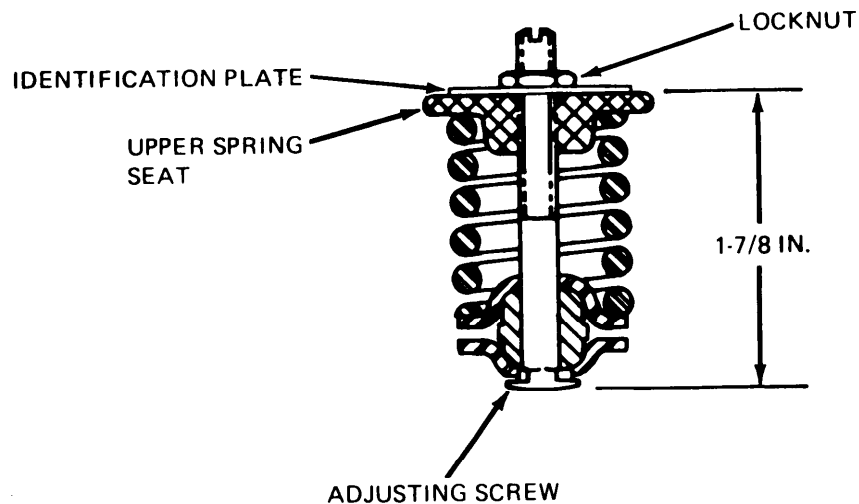


TA 074390

Figure 14-40. Install Assembled Piston.

(7) Assemble the spring assembly on the adjusting screw (fig. 14-41) in the following order:

- (a) One lower spring seat (cone toward adjusting screw head).
- (b) Spring guide.
- (c) One lower spring seat (cone away from adjusting screw head).
- (d) Pressure setting spring.
- (e) Upper spring seat.



TA 074391

Figure 14-41. Adjusting Screw Measurement.

(8) Tighten the hex-shaped upper spring seat to obtain a measurement of 1-7/8 in. (4.8 cm) from the top of the upper spring seat to the bottom of the adjusting screw head. Install locknut.

NOTE

Before installing the spring assembly, be sure that the exhaust stem and its spring are in place.

- (9) Install spring assembly in body.
- (10) Install the retaining ring and install the cover.
- (11) Install air governor using two screws (fig. 14-6).
- (12) Install all air governor line connections (para 14-86 (7), (8) and (9)).
- (13) Check adjustment as described in paragraph 14-11.

14-11. Adjustment.

Preparation. Perform leakage check and unloader valve adjustment, as described in paragraph 14-2. If adjustment is necessary, proceed to paragraph *b*, below.

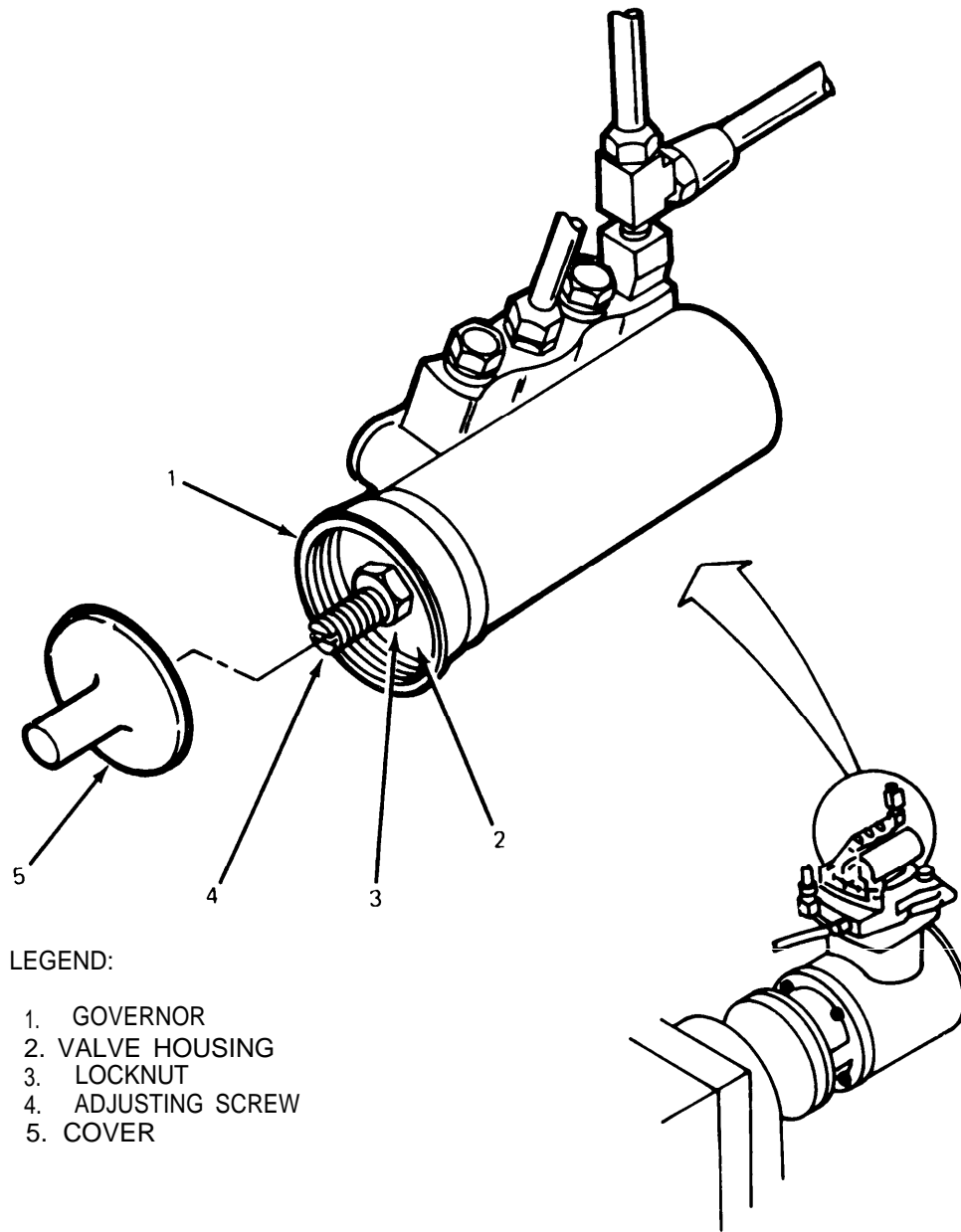
b. Adjustment Procedures.

- (1) Remove the cover (5, fig. 14-42).
- (2) Loosen locknut (3).



In step (3), do not force valve housing (2) to move it. Damage can result.

- (3) Gently turn valve housing (2) in until it bottoms; then back out three-quarter turn and hold this position while performing step (4).
- (4) Turn adjusting screw (4) in (clockwise) until screw just touches the spring located inside governor (1).
- (5) Start up and operate engine. (Refer to TM 9-2320-273-10).
- (6) When air pressure reaches 125 psi (862 kPa), observe the following:
 - (a) If the governor cuts out before reaching 125 psi, stop the engine and turn the adjusting screw (4) in (clockwise) one turn. Then, repeat step (5).
 - (b) If it still doesn't reach 125 psi, turn the adjusting screw in another turn; then shut down engine.
- (7) With the air pressure holding at 125 psi (862 kPa), slowly turn adjusting screw out (counter-clockwise) until the governor cuts out. (The governor will make a dull popping sound when it cuts out.)
- (8) Start up and operate engine. (Refer to TM 9-2320-273-10.)



TA 074392

Figure 14-42. Adjust Air Compressor Governor.

(9) Slowly bleed off air pressure by opening a drain petcock on one of the air reservoirs. Observe the following:

(a) The cut-in pressure should be between 102 and 108 psi (763-745 kPa). If the cut-in pressure is below 102 psi, hold the adjusting screw (4) so it won't turn, and rotate the exhaust valve housing (2) out (counterclockwise) one-sixth of a turn,

(b) If the cut-in pressure is above 108 psi (745 kPa), hold the adjusting screw (4), and turn the exhaust valve housing (2) in (clockwise) one-sixth of a turn.

NOTE

One-sixth of a turn will change the pressure setting by approximately 5 psi (35 kPa).

(c) Repeat steps (a) and (b) until the pressure setting is between 102 and 108 psi (703-745 kPa).

(10) Close the air reservoir drain petcock (opened in step (9) and build up air pressure in system; then repeat step (9) until pressure setting is between 102 and 108 psi (703-745 kPa). Close drain petcock.

(17) Repeat steps (5), (6), and (7) to reset the cut-out pressure.

(72) Tighten locknut (3).

(13) Install cover (5).

(14) Shut down engine (refer to TM 9-2320-273-10).

Section III. BRAKE SHOES

14-12. Brake Shoes.

a. Brake shoes on the M915 series vehicles have two linings each, fastened onto the brake shoes with rivets. Figure 14-43 shows the different types of brakes used along with their major components.

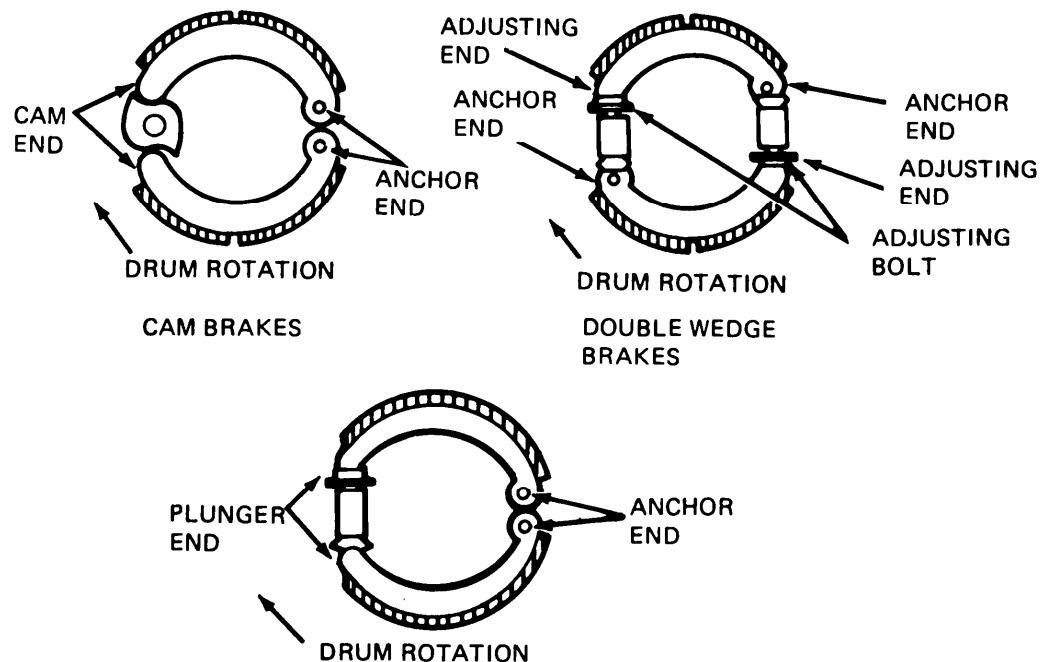


Figure 14-43 Brake Shoe Components.

TA 074393

- b. Inside every hub are two brake shoes and four brake linings. One of the linings on each shoe may be different from the other.

CAUTION

Make sure you use the specified linings for the brake shoes you are servicing. Ensure that the lining is installed in the correct position on the proper shoe. Stopping effectiveness is directly affected by the lining position.

Whenever you reline brake shoes, reline all the shoes on an axle. Failure to do so will cause uneven braking and pulling to one side.

NOTE

In this manual, the phrase shoe and lining assembly means one brake shoe, two linings, and the rivets holding the linings to the shoe.

A brake lining kit, in this manual, is a set of brake linings and rivets sufficient to repair all the brake shoes on one axle, that is, eight linings and more than enough rivets to attach the linings to the shoes.

Clamp shoe in a vise and drill out the old rivets, then remove the linings. Use a drill bit no larger in diameter than the rivet. Clean the shoe before clamping new lining in position. Use only the rivets that come in the brake lining kit.

CAUTION

Make certain the lining is firmly clamped to the shoe, locating the C-clamp as close to the rivet holes as possible.

- d. Clamp the lining to the brake shoe with C-clamps so the rivet holes in both pieces are in alignment.
- e. Drive the new rivets squarely into the holes with a 7/16 inch flat head drift.
- f. Form the rivets with the correct tubular rivet set following the sequence shown in figure 14-44 (work from heel to toe).

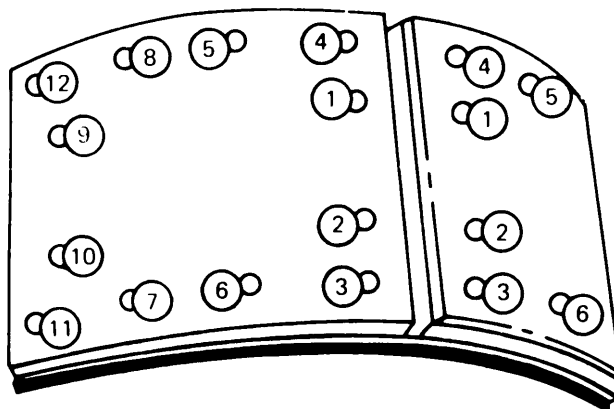


Figure 14-44. Rivet Forming Sequence.

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Section III.1. BRAKE DRUM

14-12.1. Brake Drum.

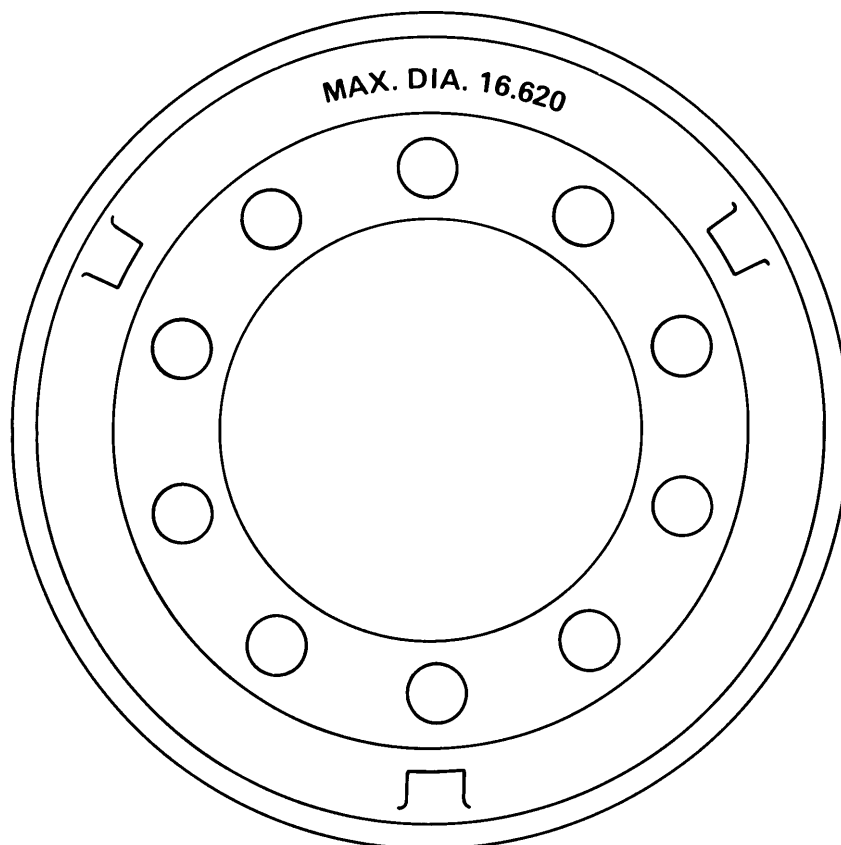
NOTE

This information given is to stress the importance of rebores limits and maximum wear limits of brake drums.

a. A brake drum may be turned by following standard DIO procedures. The 15 inch diameter brake drum has a maximum diameter of 15.120 inches and the 16.5 inch diameter brake drum has a maximum diameter of 16.620 inches. The dimension found stamped on the brake drum is the maximum safe diameter permitted, this includes turning, grinding or wear.

CAUTION

When a brake drum reaches or exceeds maximum diameter, whether it be from refacing or normal wear, it is considered unsafe and must be immediately replaced.



TA 239534■

Figure 14-44.1. Brake Drum.

Section IV. SPRING BRAKE AIR CHAMBER

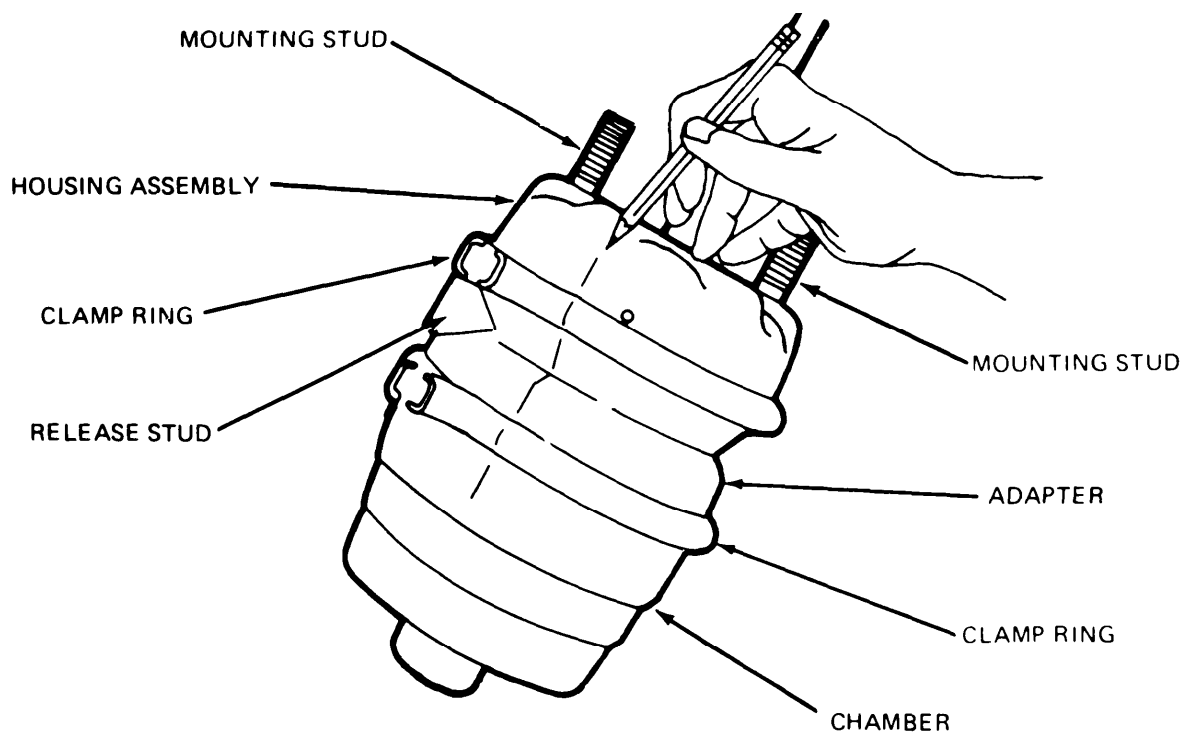
14-13. Removal. Refer to TM 9-2320-273-20.

14-14. Disassembly.

a. Preparation.

(1) Clean the exterior of the entire spring brake air chamber.

(2) Before proceeding with disassembly, mark the chamber, clamp rings, adapter, and housing assembly in such a manner, that upon reassembly the same position of the parts can be determined (fig. 14-45).



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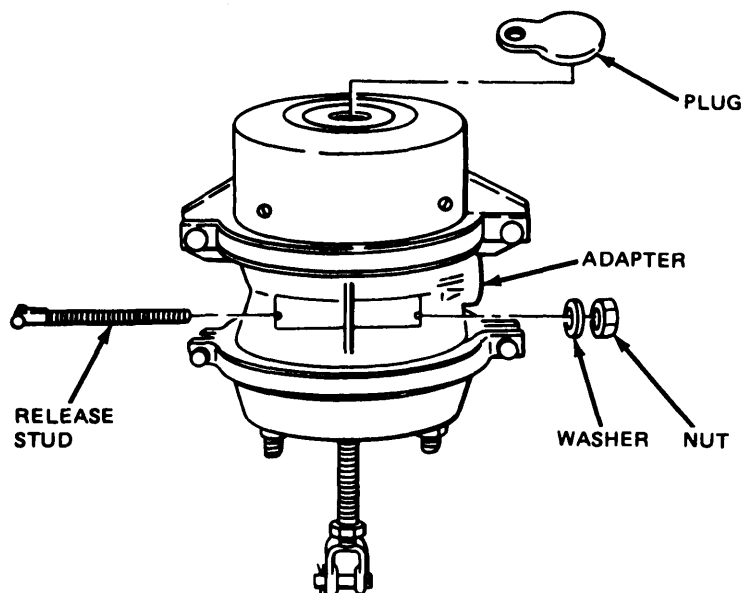
Figure 14-45 Mark the Spring Brake Air Chamber to Facilitate Reassembly.

b. Disassembly. (See figure 14-46.)

WARNING

The spring brake air chamber employs a spring with high forces. Extreme care should be used to service this air chamber only as outlined in the following procedure. Deviating from this procedure may result in injury as a result of the high spring force. DO NOT ATTEMPT DISASSEMBLY UNTIL YOU HAVE READ AND UNDERSTAND THE FOLLOWING INSTRUCTIONS. DO NOT uncage the compression spring with the spring brake chamber removed from the assembly. The spring free length is greater than the release stud length. If smite of the spring brake housing, compression spring, or pressure plate is required, replace with a spring brake assembly.

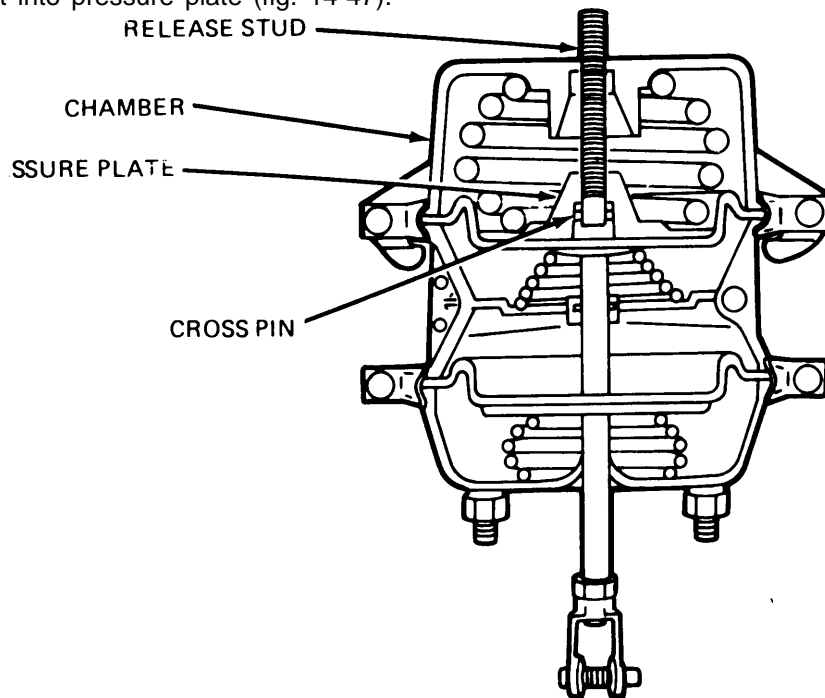
- (1) Remove the plug (fig. 14-46).
- (2) Remove the nut, washer, and release stud.



TA216277

Figure 14-46. Release Stud Removal/installation.

(3) Insert release stud through opening (where plug was removed) in the chamber and insert into pressure plate (fig. 14-47).

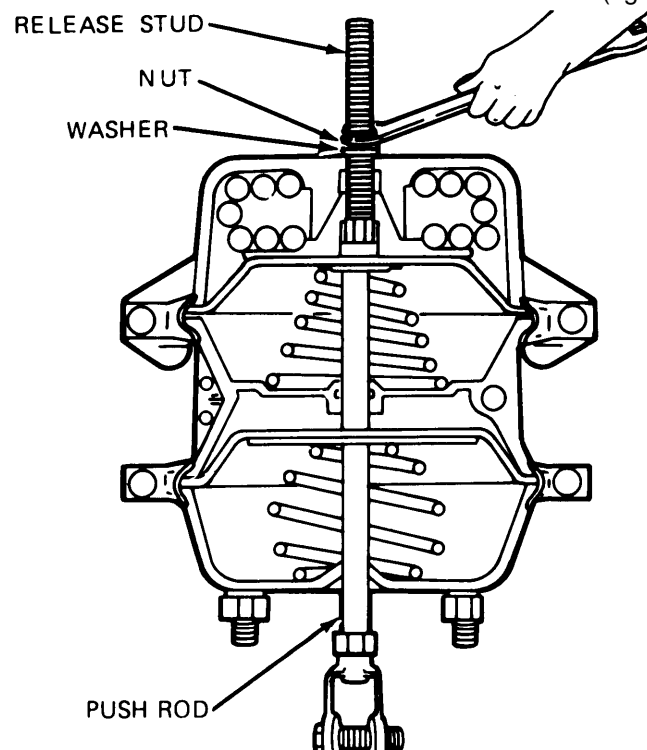


TA 074397

Figure 14-47. Inserting Release Stud.

(4) Turn release stud 1/4 turn clockwise in pressure plate to secure cross pin into cross pin area of pressure plate and lock into manual release position.

(5) Assemble release stud washer and nut onto release stud (fig. 14-48).

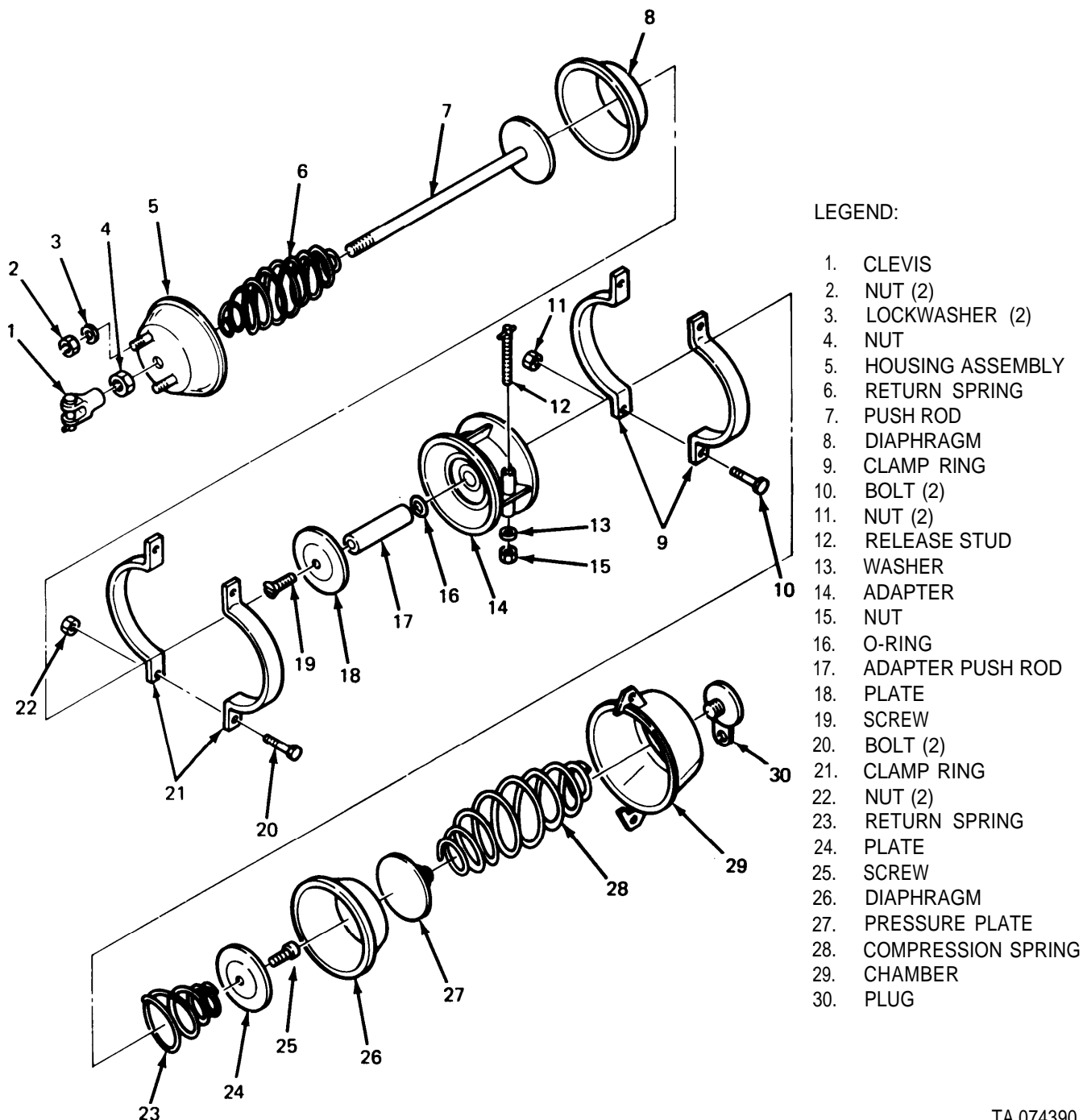


TA 074398

Figure 14-48. Compressing the Compression Spring.

(6) Turn release stud nut with wrench until compression spring is fully caged. While doing so, check visually to make certain the push rod is retracting while tightening the release stud nut. Do not torque beyond 50 lb-ft (67.8 N-m). The spring brake has now been mechanically released.

(7) Remove two bolts (10, fig. 14-49) and nuts (11). Remove clamp ring (9).



TA 074390

Figure 14-49. Spring Brake Air Chamber – Exploded View.

- (8) Slide chamber (29) off of adapter (14).
- (9) Remove diaphragm (26).
- (10) Loosen nut (4) from clevis (1).
- (11) Remove clevis (1) from push rod (7).
- (12) Remove nut (4) from push rod (7).

NOTE

There will be a slight spring force when the housing assembly (5) is removed.

(13) Remove two bolts (20) and nuts (22). Remove clamp (21). Lift housing assembly (5) off of push rod (7).

- (14) Disassemble return spring (6), push rod (7), and diaphragm (8).

NOTE

There will be a slight spring force when removing screw (25) and plate (24).

- (15) Remove screw (25), plate (24) and return spring (23).

(16) Remove O-ring (16) from adapter push rod (17) and slide adapter (14) off of adapter push rod (17).

- (17) Remove screw (19) and plate (18) from adapter push rod (17).

c. Cleaning and Inspection. Wash all metal parts in dry cleaning solvent (item 12, App B). Inspect all the parts for excessive wear or damage. Replace all parts not found in good condition. It is recommended that all rubber parts be replaced.

d. Assembly.

(1) *insert screw (19, fig. 14-49) through plate (18) and install into adapter push rod (17).* Tighten securely.

- (2) Insert adapter push rod (17) through adapter (14).
- (3) Install O-ring (16).
- (4) Install return spring (23) over adapter push rod (17).

(5) While compressing return spring (23) with plate (24), install screw (25) into adapter push rod (17) and tighten securely.

(6) Install return spring (6) over push rod (7) and slide housing assembly (5) over push rod (7).

/7) Assemble housing and push rod assembly, diaphragm (8) and adapter (14).

(8) Install clamp ring (21) around housing assembly (5) and adapter (14) being careful not to misalign the diaphragm (8).

(9) Install two bolts (20) and nuts (22). Tighten securely.

(10) Install nut (4) on push rod (7).

(11) Install clevis (1) on push rod (7). Do not tighten nut (4) and clevis (1) at this time.

Figure 14-50. Deleted

- (12) Place diaphragm (26, fig. 14-49) in chamber (29).
- (13) Slide chamber (29) onto adapter (14).
- (14) Position the clamp ring (9) into place being careful not to misalign diaphragm (26).
- (15) Install two bolts (10) and nuts (11) to retain clamp ring (9). Tighten securely.
- (16) Remove nut and washer (fig. 14-48).
- (17) Unlock by turning counterclockwise and remove release stud from pressure plate.
- (18) Install release stud into flange provided in adapter and secure with washer and nut (fig. 14-46).
- (19) Install plug.

14-16. Installation. Refer to TM 9-2320-273-20.

14-17. Operating and Leakage Test.

NOTE

Vehicle wheels should be blocked or
vehicle held by some means other than
the vehicle brakes.

- a. Build air pressure in system to 100 psi (690 kPa) minimum; then shut down engine.
- b. Place PARK BRAKE valve in park position; air brake chambers should apply immediately.
- c. Place PARK BRAKE valve in release position; air brake chambers should release immediately.
- d. With the PARK BRAKE valve in the release position, apply a soap solution around the clamp ring, and at both the drain slots and exhaust breather on the body. Disconnect the hose at the service port and apply a soap solution to check for piston O-ring leakage. A slight bubble leakage is permitted. Reconnect hose.
- e. With PARK BRAKE valve in release position, make a full foot valve application and note that air brake chambers apply and release properly. Check push rod travel; it should be at a minimum without brakes dragging. Check for leakage around the service clamping ring and the exhaust breather of the piggyback section. A slight bubble leakage is permitted.

Section V. TRAILER HANDBRAKE VALVE MAINTENANCE

14-18. Description. The trailer hand brake is normally used to operate the trailer brake independently of the tractor brakes. The trailer hand brake valve provides the operator with an easily operated and finely graduated means of applying and releasing the brakes. It is mounted on the right side of the steering column where the handle can be conveniently reached by the operator. The valve should never be used to hold the brakes applied when the vehicle is parked unattended.

14-19. Removal and Disassembly.

a. *Removal.* (Refer to TM 9-2320-273-20).

b. *Disassembly.*

(1) Remove two connectors (32, fig. 14-51).

(2) Remove two screws (1) and lockwashers (2); then lift off designation plate (3).

(3) Pull valve assembly (4) out of body (33). Remove and discard preformed packing (11).

(4) Remove two screws (12) and separate cover (25) from body (33).

(5) Remove spring (16) and gasket (26).

(6) push piston (15) out of body (33); then remove preformed packing (14) from piston (15). Discard the preformed packing.

(7) Remove spring (13).

(8) Drive out spiral pin (20); then pull out lever (18) and remove preformed packing (19) from the lever. Knob (17) may be removed from lever (18) if desired, by pulling and twisting.

(9) Remove cam follower (27) and cam (28).

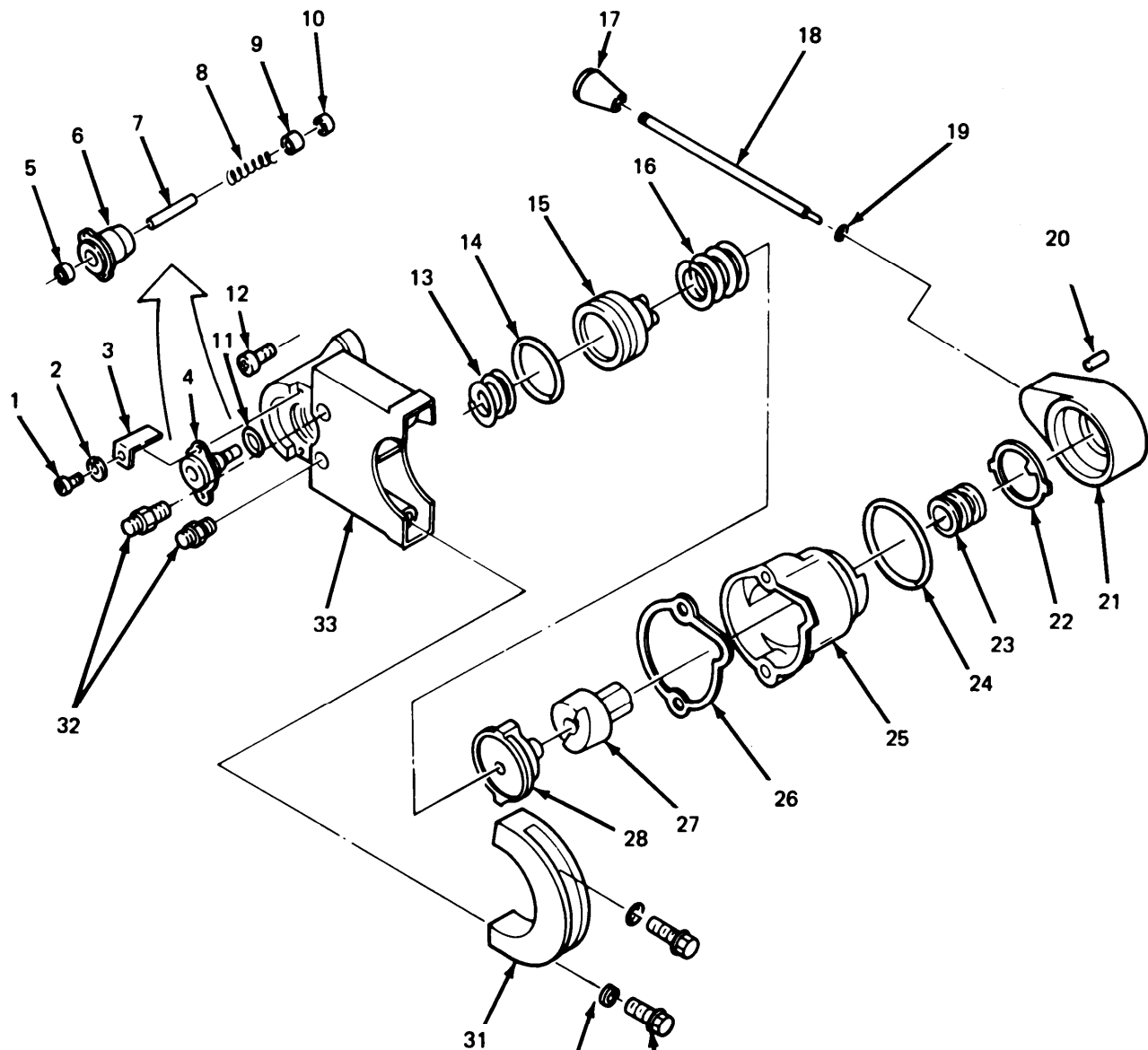
(10) Remove and discard preformed packing (24).

(11) Remove adjusting ring lockwasher (22) and adjusting ring (23) from cover (25).

(12) If valve assembly (4) is suspected to be faulty, it can be disassembled for repair by the following procedure:

(a) Remove exhaust valve (10).

(b) Disassemble inlet valve (5), valve seat (6), valve stem (7), spring (8) and valve guide (9).



LEGEND:

1. SCREW (2)
2. LOCKWASHER (2)
3. DESIGNATION PLATE
4. VALVE ASSEMBLY
5. INLET VALVE
6. VALVE SEAT
7. VALVE STEM
8. SPRING
9. VALVE GUIDE
10. EXHAUST VALVE
11. PREFORMED PACKING

12. SCREW
13. SPRING
14. PREFORMED PACKING
15. PISTON
16. SPRING
17. KNOB
18. LEVER
19. PREFORMED PACKING
20. SPIRAL PIN
21. HEAD
22. ADJUSTING RING LOCKWASHER

23. ADJUSTING RING
24. PREFORMED PACKING
25. COVER
26. GASKET
27. CAM FOLLOWER
28. CAM
29. LOCKWASHER (2)
30. BOLT (2) CLAMP
32. CONNECTOR (2)
33. BODY

Figure 14-51. Disassemble/Assemble Trailer Hand Brake Valve.

TA 074401

14-20. Cleaning and Inspection of Parts.

a. Cleaning. Clean all metal parts in dry cleaning solvent (item 12, App B). Do not immerse rubber parts in solvent, but wipe them clean and dry.

b. Inspection. Inspect valve seats for nicks or burrs and remove any deposits. Check all springs for distortion, cracks, and corrosion. All rubber parts should be inspected for wear or deterioration. Replace all parts not considered serviceable during their inspection.

14-21. Assembly and Installation.

a. Assembly.

(1) Install a new preformed packing (24, fig. 14-51) on cover (25).

(2) Coat the cam (28) and cam follower (27) with lubriplate (item 16, App B); then assemble cam and cam follower and install into cover (25). The tabs on the cam follower (27) must be lined up with openings in cover (25) before the cam and cam follower can be fully seated.

(3) Install adjusting ring (23) until flush with the top of the cover (25).

(4) Install spring (16).

(5) Install spring (13) in body (33).

(6) Install a new preformed packing (14) on piston (15).

(7) Press piston (15) into body (33).

(8) position gasket (26) on cover (25) and assemble to body (33). Secure with two screws (12) and torque to 75-95 lb-in. (8.5-10.7 N-m).

(9) If valve assembly (4) was disassembled, proceed as follows:

(a) Press inlet valve (5) on valve stem (7).

(b) Place valve stem (7) with inlet valve (5) installed in valve seat (6). Insert a small object such as a capscrew to hold the inlet valve up against its seat.

(c) position spring (8) and valve guide (9) over valve stem (7).

(d) Depress valve guide (9) and spring (8), then press exhaust valve (10) on stem.

(10) Place preformed packing (11) over valve assembly (4) and install valve assembly into body (33). Secure with two screws (1) and lockwashers (2) and designation plate (3). Torque to 60-80 lb-in. (6.8-9.0 N-m).

(11) Install preformed packing (19) on lever (18). Install knob (17) if removed by pushing onto lever (18) and twisting (no threads are used).

(12) Install head (21) on cover (25).

(13) Install lever (18) in head (21) and secure with spiral pin (20),

(14) Install two connectors (32).

b. Installation. (Refer to TM 9-2320-273-20).

14-22. Adjustment. The trailer hand brake valve should deliver full reservoir pressure. The following procedure may be used for testing and adjustment of the trailer hand brake valve.

- a. Remove the air line from the delivery port of the trailer hand brake valve.
- b. Install a suitable pressure gage that will read up to 200 psi (1379 Kpa).
- c. Start up and operate engine until maximum air reservoir pressure is obtained. (Refer to TM 9-2320-273-10).
- d. Operate trailer hand brake valve.
- e. Test gage should read between 90-120 psi (620.6-827.4 Kpa).
- f. If the delivered pressure is below final delivery pressure, it can be adjusted by removing the head (21, fig. 14-51) and adjusting ring lockwasher (22) and rotating the adjusting ring (23) clockwise, with a small screwdriver inserted in one of the inner notches of the adjusting ring to raise the delivery pressure. Likewise, the delivery pressure can be lowered by rotating the adjusting ring counterclockwise.
- g. After adjustments have been made, install the adjusting ring lockwasher (22) and head (21).
- h. Return trailer hand brake valve to exhaust air pressure on test gage.
- i. Remove test gage and install air delivery line.
- j. Shut down engine. (Refer to TM 9-2320-273-10).

CHAPTER 15
REPAIR OF WHEELS AND TIRES

15-1. Description. Wheel and tire description and data is given in TM9-2320-273-20.

15-2. Replacement. Procedures for wheel and tire replacement are given in TM9-2320-273-10 and TM9-2320-273-20.

15-3. Cleaning, Inspection, and Repair. Repair procedures for wheels and tires are given in TM 9-2610-200-20. Included in these manuals are procedures for cleaning, inspection, and replacement standards.

CHAPTER 16

REPAIR OF STEERING SYSTEM COMPONENTS

Section 1. STEERING GEAR

16-1. Description. The steering gear is an integral steering unit incorporating a hydraulic control valve, a hydraulic power cylinder, and a manual steering mechanism. The unit is identical on M915 thru M920 vehicles.

NOTE

For on the vehicle replacement of the steering gear input and output seal refer to section V of this chapter.

16-2. Removal.

a. Preparation.

- (1) Remove left front fender refer (TM 9-2320-273-20).
- (2) Drain the steering gear system by disconnecting hydraulic fluid lines (4 and 5, fig. 16-1) at the gear case.
- (3) Thoroughly clean the area around the hydraulic fittings.

b. Procedure.

- (1) Remove bolt (7), lockwasher (3), and nut (2) from the lower steering column universal (6) at the gear case.
- (2) Remove the pitman arm clamp retaining nut (8) and bolt (12).
- (3) Put alinement marks on the end of the sector shaft (13) and the pitman arm (11) to facilitate reassembly. Using a pitman arm puller, remove the pitman arm (11) from the steering gear sector shaft (13).

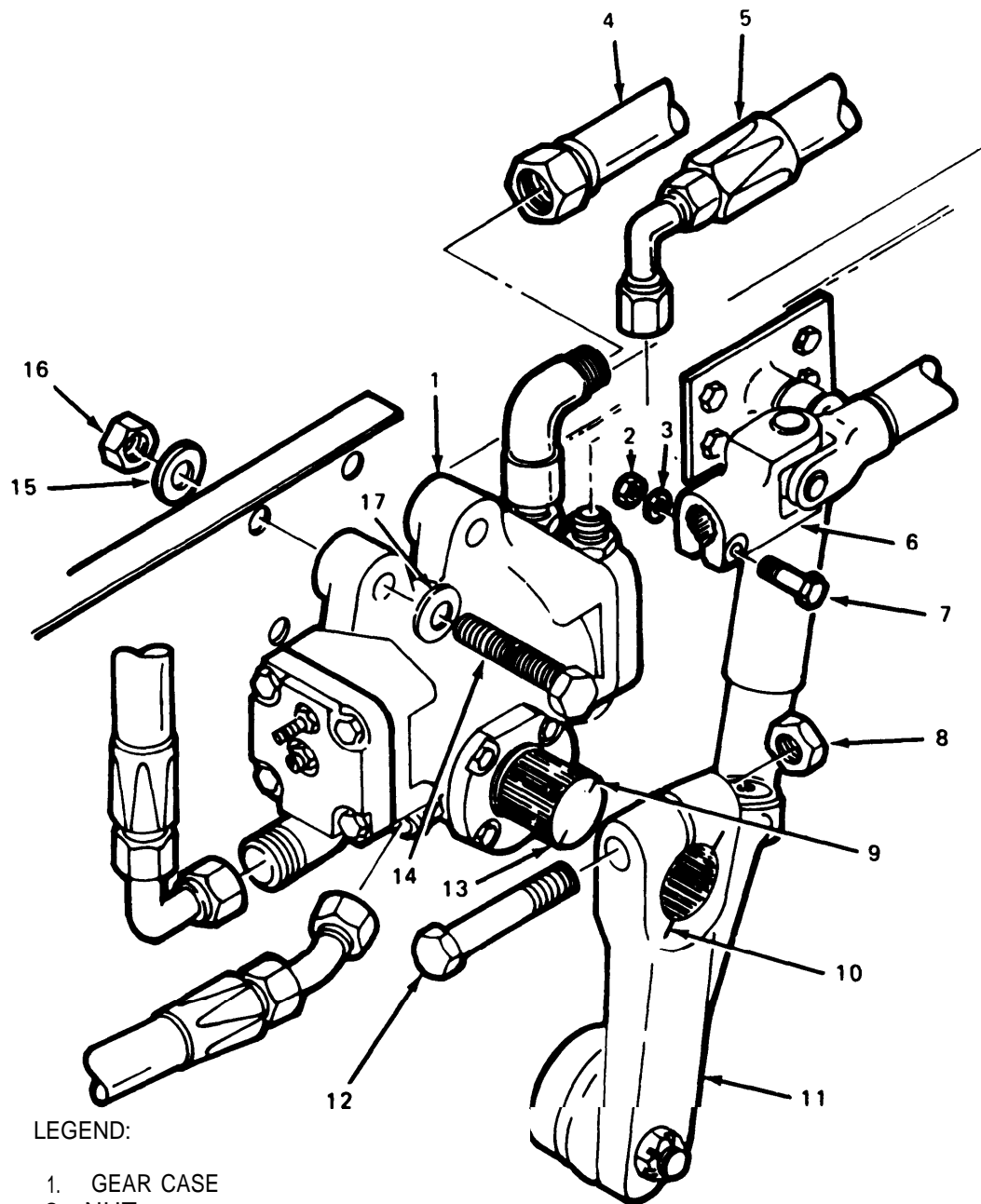
NOTE

The steering gear weighs 105 lbs (48 kg).

- (4) Remove the four mounting nuts (16), washers (15), (17) and bolts (14), then remove the gear case (1). Drain remaining oil from the gear case.

NOTE

Service of the steering gear assembly at the Direct Support/General Support level is limited to replacement of the entire unit only.



LEGEND:

- | | |
|-------------------|------------------|
| 1. GEAR CASE | 10. PITMAN ARM |
| 2. NUT | ALINEMENT MARK |
| 3. LOCKWASHER | 11. PITMAN ARM |
| 4. FLUID LINE | 12. BOLT |
| 5. FLUID LINE | 13. SECTOR SHAFT |
| 6. LOWER STEERING | 14. BOLT (4) |
| COLUMN UNIVERSAL | 15. WASHER (4) |
| 7. BOLT | 16. NUT (4) |
| 8. NUT | 17. WASHER (4) |
| 9. SECTOR SHAFT | |
| ALINEMENT MARK | |

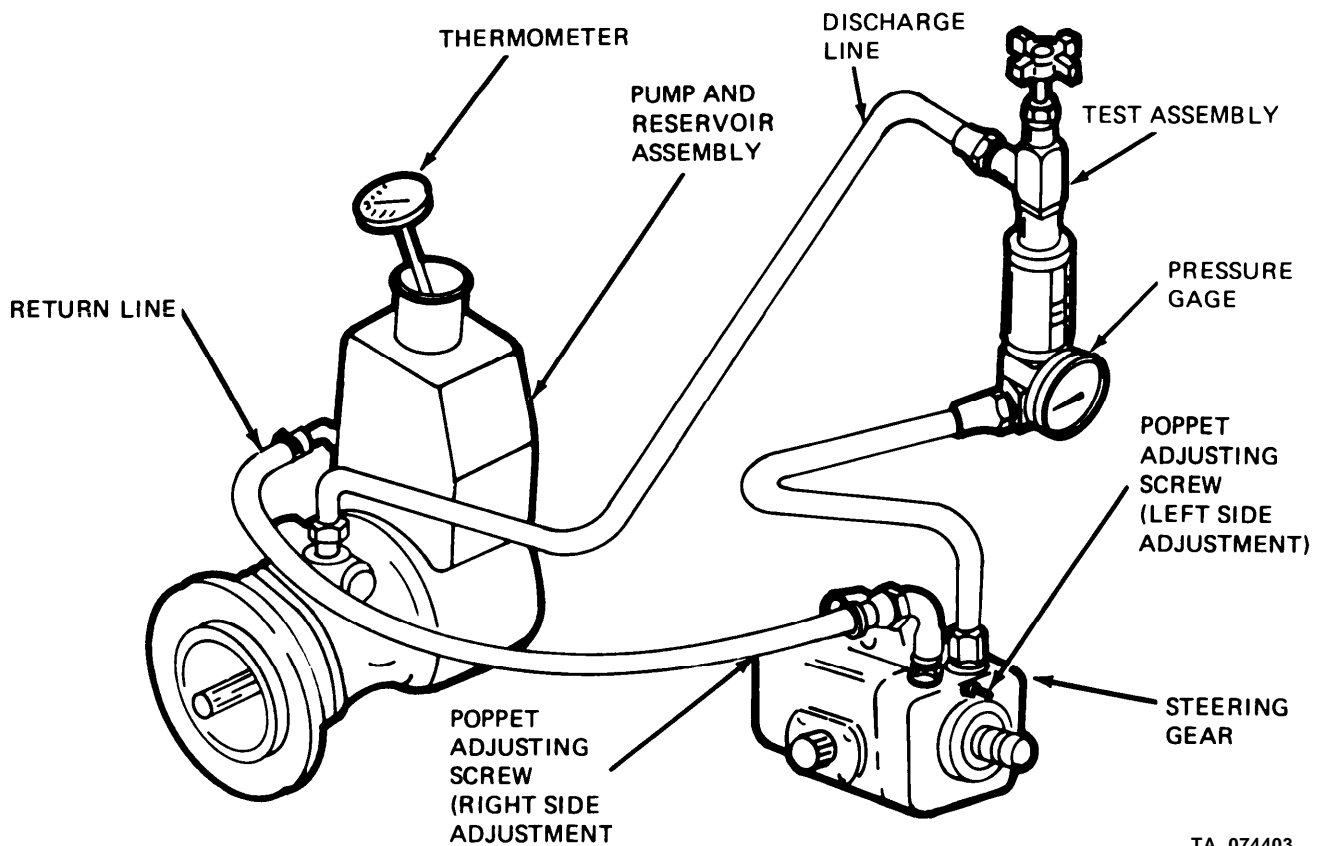
TA 07002

Figure 16-1. Steering Gear Removal.

16-3. Installation.

- a. Slide lower steering column universal (6, fig. 16-1) over the worn gear shaft on the steering gear and align steering gear mounting holes.
 - b. Install the four mounting bolts (14), washers (17), (15) and nuts (16). Torque nuts to 260-280 lb-ft (353-380 N.m).
 - c. Install bolt (7), lockwasher (3), and nut (2) in lower steering column universal (6) Torque to 35 lb-ft (47 N.m).
 - d. Drive a wedge in the slot on the pitman arm to open up slightly, making sure that the sector shaft alignment mark (9) and pitman arm alignment mark (10) are properly positioned. Tap pitman arm (11) onto the sector shaft (13) using a soft headed hammer.
- Install the pitman arm clamp retaining nut (8) and bolt (12). Torque to 380-420 lb-ft (515-569 N.m).
- f. Fill and bleed the hydraulic system. (Refer to TM 9-2320-273 -20.)
 - g. Install the left front fender. (Refer to TM 9-2320-273 -20.)

16-4. Adjustment. The purpose of this procedure is to set the poppet adjusting screws (fig. 16-2) so that the poppet contacts the screw just before full lock position is attained. Then at full lock (when steering against axle stops) the poppet should be fully tripped and pressure shown by a gage in discharge line should be between 400 and 900 psi at 4.5 gallons per minute. Adjust as follows:



TA 074403

Figure 16-2. Poppet Adjustment

- a. Remove the discharge line and install the test assembly as shown in figure 16-2.



When setting the poppets, do not hold steering in the full lock position for more than 15 seconds. If full lock position is held for more than 15 seconds, excessive heat will build up in system and extensive damage may occur.

- b. Steer the vehicle to the left into the full lock position. Note the pressure on the gage. If the pressure reading is less than the system relief pressure, back left side poppet adjusting screw out until the system is operating at relief pressure while steering is in full lock position. Screw left side adjusting screw in until pressure on gage reads less than 900 psi (6.205 Kpa) while steering is in full lock position. Lock adjusting screw in this position by tightening locknut. Torque to 12-18 lb-ft (16-24 N.m). Repeat procedure for right hand direction of turn, using right side poppet adjusting screw.

NOTE

The 900 psi figure used above is valid only for automatic transmission fluid at 130°F (57°C) and a flow rate of 4.5 gpm.

- c. Remove the test gage assembly and install the discharge line.

NOTE

During the above procedure, observe for any tendency of the gear to self steer or motorize. If self steering does occur, check steering column, slip joint(s) and universal joint(s) for binding or excessive friction.

Section II. HYDRAULIC STEERING PUMP AND RESERVOIR ASSEMBLY

16-5. Description. The power steering pump is a roll vane pumping element type, rated at 1.65 in.³ (27 mm³) per revolution. The pump has an internal flow control and relief valve system operating at 2000 psi (13,790 kPa) with flow rates up to 5 gal (9 litres) per minute (50 psi) at 3000 rpm shaft speed (fig. 16-3).

16-6. Removal. Refer to TM 9-2320-273-20.

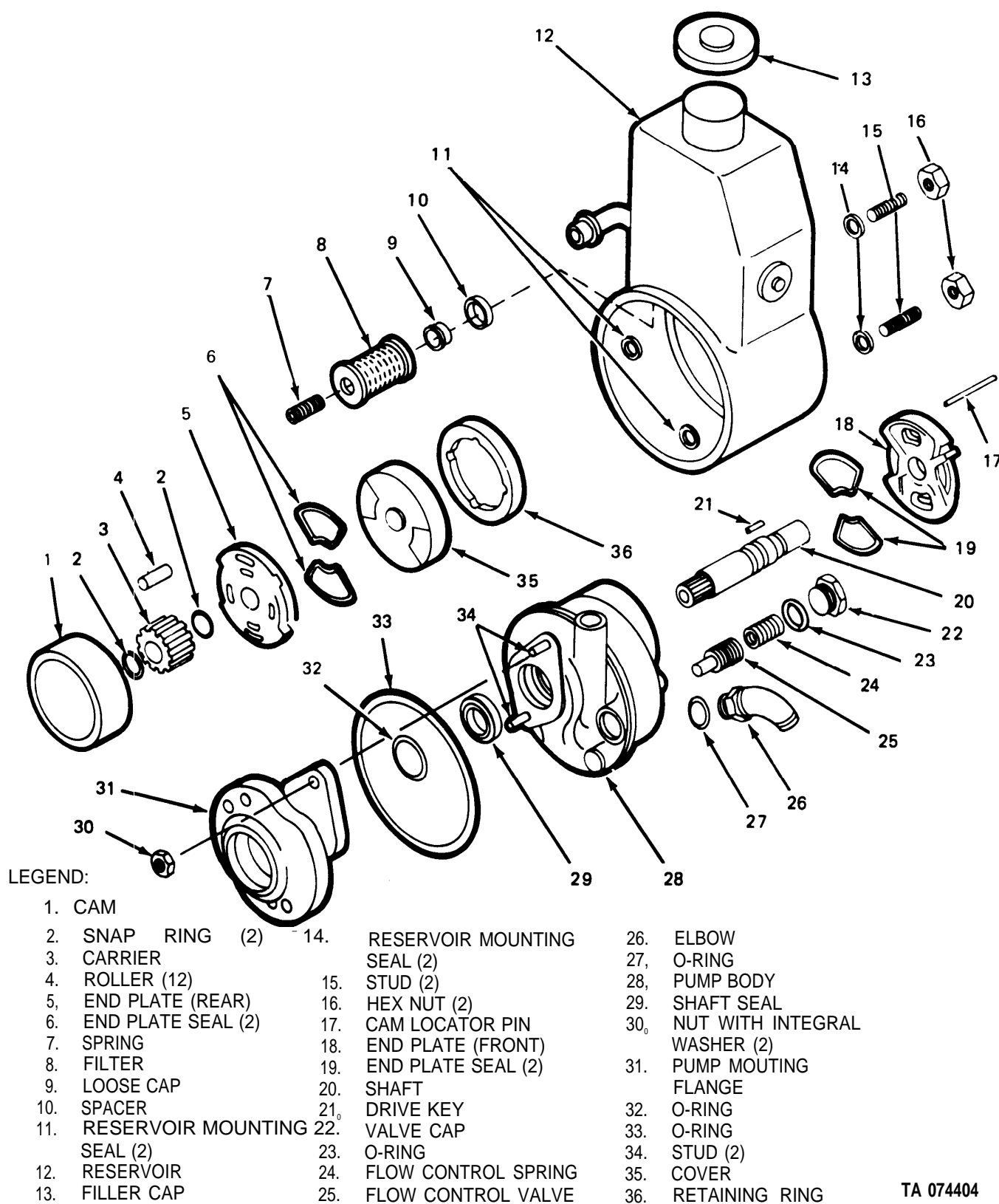


Figure 16-3. Hydraulic Steering Pump and Reservoir Assembly.

16-7. Disassembly.

- a. Remove all dirt and oil from the external surfaces of the pump assembly.
- b. Remove filler cap (13, fig. 16-3) from the reservoir (12) and drain the balance of the oil from the reservoir.

CAUTION

Do not clamp on the pump or reservoir as they are easily damaged by a vise.

- c. Clamp the pump mounting flange (31) into a vise.
- d. Remove the two nuts (16) and reservoir mounting seals (14) from studs (15) on the backside of the reservoir (12).

CAUTION

Do not pry on the edge of the reservoir with any tool.

Once the reservoir has been loosened, it must be removed and a new O-ring (33) installed.

- e. Note the position of the reservoir on the case pump for later reassembly.
- f. Carefully remove the reservoir from the pump body (28) by gently tapping the side of the reservoir with a rubber mallet.
- g. Remove reservoir mounting seals (11).
- h. Loosen, but do not remove, the retaining ring (36) using a spanner wrench.
- i. Remove the elbow (26) and O-ring (27) from the pump body (28).
- j. Remove the flow control valve cap (22), spring (24), and valve (25).
- k. Remove O-ring (23) from valve cap (22).
- l. Remove the pump from the vise for further disassembly on a repair bench.

- m.* Remove the two mounting flange nuts with integral washers (30) and remove the pump mounting flange (31). Remove O-ring (32).
- n.* Remove the retaining ring (36), Note which side is marked up.
- o.* Remove the cover (35) by lightly tapping the front end of the pump shaft (20).
- p.* Remove the rear end plate (5).

NOTE

The end plates (5) and (18) are not identical and should be marked for later reassembly.

- q.* Remove the pump shaft (20), carrier (3), and the 12 loose rollers (4).

WARNING

Sharp corners on the cam ring can cut your fingers.

NOTE

The up side of the cam must be marked for reassembly.

- r.* Remove the cam (1) using a clean rag to hold it with.
- s.* Remove the cam locator pin (17) and the front end plate (18). If the dump body has two holes for the locator pin, note which one is used, for later reassembly.
- t.* Remove end plate seals (6) and (19). Discard seals.
- u.* Remove the large O-ring (33) from the pump body.
- v.* Remove the shaft seal (29).
- w.* Refer to para 16-9j for maintenance of spring (7), filter (8), loose cup (9), and spacer (10).

16-8. Cleaning. Clean all metal parts in SD-2 solvent and air dry.

16-9. Inspection and Repair. Inspect each component for excessive wear as follows:

a. Body and Bushing Assembly. Inspect the shaft bushing for excessive burning, scoring, or oversize condition. If any of these conditions exist, replace the body and bushing as an assembly. If the ball plug near the valve cap threads has blown out, the ball must be driven back into the drilled angle hole to a depth of 1/4 in. below the cast surface.

b. Cover and Bushing Assembly. Inspect the shaft bushing for excessive burning, scoring, or oversize condition. If any of these conditions exist, replace the cover and bushing as an assembly.

c. Cam. Inspect the internal surface of the cam ring for wear or scoring. Polish marks in some areas are normal but any wear severe enough to raise a noticeable burr on the inside diameter corner of the cam face indicates that the cam should be replaced.

d. Carrier. Inspect the carrier on the ends and tooth drive surfaces for excessive wear or scoring. If the ends are worn or scored, or the wear pattern on the roller drive surfaces is greater than 3/32 in. in width, the carrier must be replaced. If a new carrier is needed and the shaft is serviceable, replace the carrier as follows:

(1) Remove the two snap rings (2) from the end of the shaft (20). Be careful not to scratch the shaft.

(2) Note the carrier (3) tooth orientation and then remove it from the shaft.

(3) Install a new carrier (3) in the same orientation over the drive key (21),

(4) Install the two snap rings (2) in the shaft grooves.

e. Shaft. Inspect the pump shaft for excessive wear, burning, or scoring in the area of the two bushings. If any of these conditions exist, replace the shaft. If a new shaft is needed and the carrier is okay, replace the shaft as described in *d* above except both snaprings must be removed from the old shaft and assembled on the new shaft.

f. Rollers. Inspect each of the 12 rollers for burning, scoring, or wear on the outside diameter surface. Replace any defective rollers.

g. End Plates. Inspect both end plates for wear, cracks, or scoring on the surface opposite the sealing rings. Any defect indicates replacement is required.

h. Control Valve. It is difficult to visually determine if the valve is defective. If the complaint was one of low pressure and the pumping elements show no signs of wear, the control valve may be at fault. Check that the valve has a good fit and moves smoothly in the valve bore.

i. Seals and Gaskets. Replace all seals and gaskets whenever the pump is disassembled.

j. Reservoir Filter. The filter (fig. 16-4) should be replaced whenever the reservoir is disassembled. Replace as follows:

(1) Insert a screwdriver behind the filter spring and pry the spring out.

(2) Remove the filter.

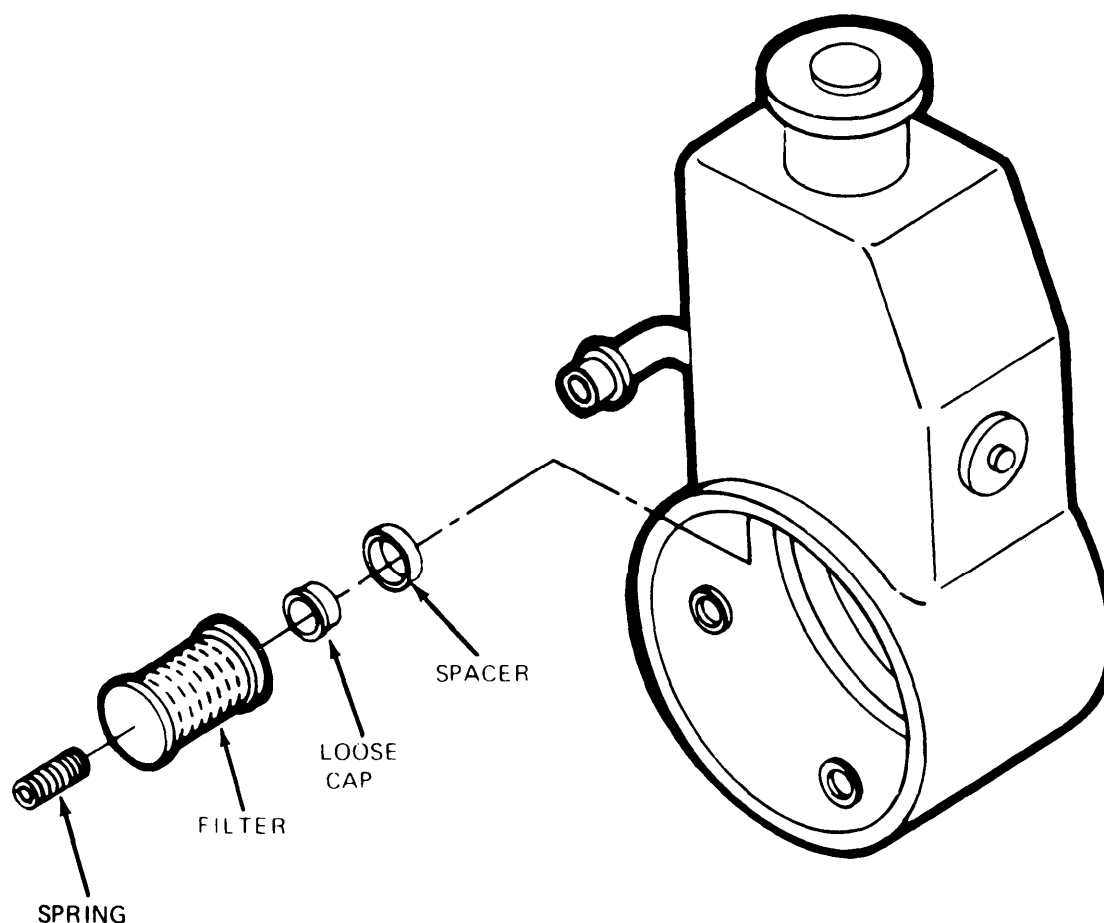
(3) Remove the loose cap and spacer on the return tube inside the reservoir.

(4) Clean the reservoir thoroughly.

(5) Slide the spacer and cap over the end of the return tube.

(6) Position the open end of the filter over the cap.

(7) Insert the spring into the cupped, closed end of the filter and push it into position in the neck of the reservoir.



TA 074405

Figure 16-4. Replace Filter.

16-10. Assembly.

- a. Verify that all parts are clean.
- b. Assemble a new shaft seal (29, fig. 16-3) into the pump body spring side in. Press the seal until it bottoms out.
- c. Install two end plate seals (19) onto the front end plate (18) using a small amount of grease (item 1, App B) to hold them in place.
- d. Install the front end plate (18) in the pump body (28) by inserting the cam locator pin (17) through the slot in the plate and into the dowel hole inside the pump body. (If there are two holes, be sure to use the one noted during disassembly.)
- e. Carefully install the cam (1) into the pump body (28) positioning it over the locator pin. Be sure to assemble the cam with the marked side the same way noted during disassembly. (On models equipped with two cam pins, install the second pin in the cam.)

- f.* Lubricate the face of the end plate, the shaft bushing, and the inside surface of the cam with a small amount of oil (item 7, App B) to be used in the steering system (LO 9-2320-273-12).
- g.* Lubricate the shaft seal with a generous amount of grease (GAA) (item 1, App B).
- h.* Assemble the shaft and carrier into the pump body.
- i.* Insert the 12 rollers (4) into the carrier and lubricate the carrier and shaft with a small amount of the steering system oil (item 7, App B).
- j.* Assemble two new end plate seals (6) onto the rear end plate (5) using a small amount of grease to hold them in place.
- k.* Install the rear end plate (5) into the pump body (28) with the seal side out.
- l.* Install the cover (35) over the shaft (20) and onto the locator pin for proper installation. (When properly assembled, the open slots of the pump body (28) end plates (5) and (8) and cover (35) should be in line.).
- m.* Thread the retaining ring (36) into the pump body (28) finger tight. Be sure proper side is out as noted during disassembly.

Lubricate the flow control valve bore with a small amount of oil. Insert the flow control valve (25) into the bore with the long small diameter end in first. Install O-ring (23) on valve cap (22).
- n.* Insert the flow control spring (24) and install the valve cap (22) finger tight.
- o.* Place a new O-ring (27) on the elbow (26) and thread the fitting into the pump body (28) finger tight. Place O-ring (32) on pump mounting flange (3).
- p.* Install pump mounting flange using two nuts with integral washers (30). Torque to 35 lb-ft (47 N.m).
- q.* Clamp mounting flange in vise.
- r.* Torque the flow control valve cap (22) to 40-55 lb-ft (54-75 N.m).
- s.* Torque the retaining ring (36) to 90-120 lb-ft (122-163 N.m).
- t.* Torque the elbow (26) to 30-45 lb-ft (41-61 N.m) while holding it in the same position as when disassembled.
- u.* Check the pump shaft to verify that it rotates freely and smoothly.
- v.* Install a new O-ring (33) into the groove on the pump body with the yellow side facing out.
- w.* Apply a small amount of clean grease to the O-ring to facilitate assembly of the reservoir.
- x.* Assemble two new reservoir mounting seals (11) on the studs (15).
- y.* Carefully locate the reservoir (12) on the pump body (28). Some tapping with a rubber mallet may be necessary to position the reservoir properly.

Install two new reservoir mounting seals (14) and two nuts (16). Torque nuts to 20-30 lb-ft (27-41N.m).

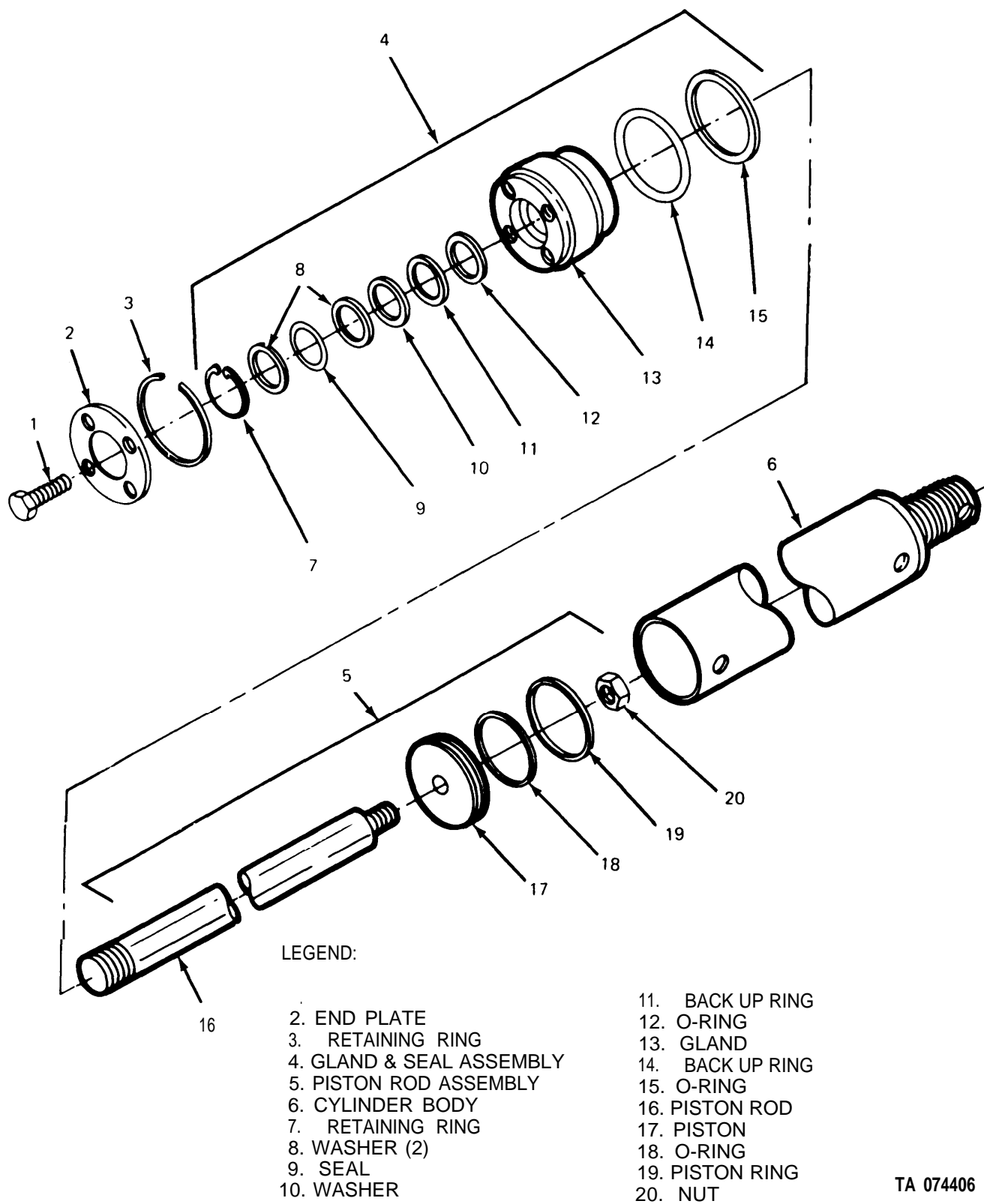
16-11. Installation. (Refer to TM 9-2320-273-20.)

Section III. POWER STEERING ASSIST CYLINDER

16-12. Removal. (Refer to TM 9-2320-273 -20.)

16-13. Disassembly.

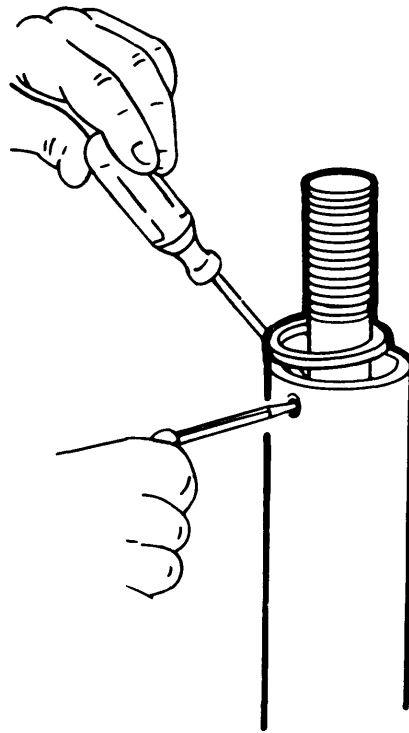
- a. Stroke piston rod full travel holding parts down to remove oil from the cylinder.
- b. Plug ports (1/4 in. npt plug) and thoroughly clean the outside of the cylinder paying particular attention to the piston rod end.
- c. Carefully clamp the cylinder in a vise with piston rod end up.
- d. Remove the four end retaining capscrews (1, fig. 16-5).
- e. Remove end plate (2).



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Figure 16-5. Disassemble/Assemble Auxiliary Power Steering Cylinder.

f. With a punch entered through hole in the cylinder body, push in retaining ring (3) and pry it out with a screwdriver as shown in figure 16-6.



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Figure 16-6. Remove Retaining Ring.

g. Inspect threaded end and wrench slot of piston rod assembly (5, fig. 16-5) for burrs, nicks, and corrosion. Remove these if present.

h. Wrap one layer of cellophane tape over piston rod threads and wrench slot. This will allow the gland and seal assembly to be easily removed from piston rod.

i. Pull on piston rod assembly (5) only far enough to pull gland and seal assembly (4) out of cylinder body (6).

j. Holding gland and seal assembly (4) push piston rod assembly (5) back into cylinder body (6).

k. Remove gland and seal assembly (4) by sliding it off the taped end of piston rod assembly (5).

l. Remove piston rod assembly (5) from cylinder body (6).

m. Disassemble gland and seal assembly (4) in the following order. Remove retaining ring (7), washer (8), seal (9), washer (8), washer (10) (copper), backup ring (11), O-ring (12), O-ring (15), and backup ring (14).

n. Remove piston ring (19) and O-ring (18) from piston (17).

o. Remove nut (20) from piston rod (16) and remove piston (17).

p. Clean all parts in dry cleaning solvent (item 12, App B).

1614. Assembly.

- a. Install O-ring (18, fig. 16-5) and piston ring (19) on piston (17).
- b. Install piston assembly on piston rod (16) with nut (20). Torque to 60-64 lb-ft (81-87 N.m).
- c. Lubricate the inside of the cylinder body (6) and piston ring (19) with steering system fluid.
- d. Install assembled piston rod assembly (5) into cylinder body (6) and bottom piston.
- e. Assemble gland and seal assembly (4) in the following order. Install:
 - Gland (13)
 - Backup ring (14)
 - O-ring (15)
 - O-ring (12)
 - Backup ring (11)
 - Washer (10) (copper)
 - Washer (8)
 - Seal (9)
 - Washer (8)
 - Retaining ring (7)
- f. If cellophane, applied during disassembly was damaged during cleaning, remove and install one layer of new cellophane tape on piston rod threads and wrench slot.
- g. Dip gland and seal assembly (4) in steering system fluid to lubricate complete assembly.

CAUTION

In the next step, be sure that the port
in the gland and seal assembly is aligned
with the hole in the cylinder body.

- h. Slide gland and seal assembly (4) over piston rod assembly (5) end and into cylinder body (6) so that the top of the assembly is slightly below the groove in the cylinder body for retaining ring (3).
- i. Install retaining ring (3).
- j. Install end plate (2) and four capscrews (1). Torque to 100-120 lb-in. (11-14 N.m).
- k. Remove cellophane tape from piston rod threads and wrench slot.

16-15. Installation. Refer to TM 9-2320-273-20.

Section IV. UPPER STEERING COLUMN

16-16. Removal.

- a. Remove steering wheel and horn button. (Refer to TM 9-2320-273-20.)
- b. M915, M916, M917 and M920. Remove the trailer hand brake valve. (Refer to TM 9-2320-273-20.)
- c. Remove turn signal control. (Refer to TM 9-2320-273-20.)
- d. Unfasten two screws (4, figure 16-7) and washers (3) from horn brush cover (5). Remove cover.
Unfasten two screws (7) and washers (8) which retain horn brush (6) to upper steering column housing (10) and remove horn brush (6) and terminal (9).
- t. Disconnect the upper steering shaft (2) from the U-joint connection to the lower steering shaft. (Refer to TM9-2320:273-20).
- g. Remove six screws (20) and washers (21) from steering column clamp (22) and rubber insulator (23), then remove the upper steering column from the vehicle cab.

16-17. Disassembly.

- a. Install nut (1, figure 16-7) onto upper steering shaft (2).
- b. Insert nut (1) and upper steering shaft (2) into a large socket to protect the horn wire.
- c. Place socket with nut (1) and upper steering shaft (2) on the floor.
- d. With a suitable tool, push down on retaining ring cage (19) and remove retaining ring (18), retaining ring cage (19), spring (17), flat washer (16), and sleeve spacer (15) from upper steering shaft (2).
- e. Drive out ball bearing (14) from upper steering column housing (10).
- f. Place other end of upper steering shaft (2) on the floor and drive out ball bearing (13) with upper steering shaft (2).
- g. Bend out tang of sleeve spacer (11).
- h. Remove sleeve spacer (11), nut (1), sleeve spacer (12) and ball bearing (13) from upper steering shaft (2).

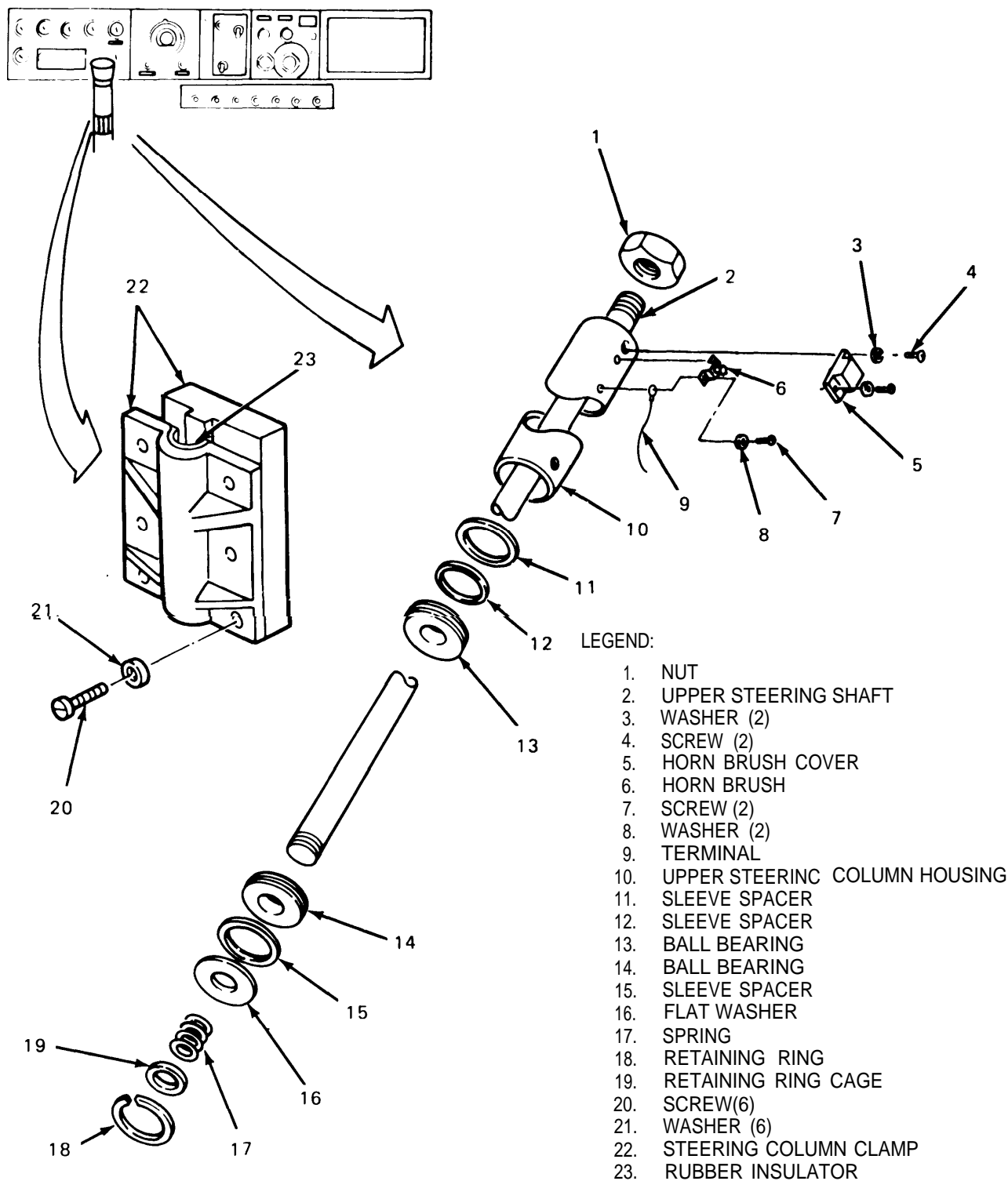


Figure 16-7. Upper Steering Column.

16-18. Assembly.

- a. Slide ball bearing (13, figure 16-7) and sleeve spacers (11) and (12) onto upper steering shaft (2).
- b. Install nut (1) onto upper steering shaft (2).
- c. Bend in tang on sleeve spacer (11) to index the hole in upper steering shaft (2).
- d. Insert upper steering shaft (2) into upper steering column housing (10).
- e. Drive ball bearing (14) into upper steering column housing (10).
- f. Insert nut (1) and upper steering shaft (2) into a large socket to protect the horn wire.
- g. Place socket with nut (1) and upper steering shaft (2) on the floor.
- h. Install the sleeve spacer (15), flat washer (16), spring (17), retaining ring cage (19) and retaining ring (18) to the upper steering shaft (2).
- i. Remove nut (1) from upper steering shaft (2).

16-19. Installation.

Position upper steering column in steering column clamp (22, fig. 16-7) and rubber insulator (23), and fasten with six screws and washers (21).

- b. Connect the upper steering shaft (2) to the lower steering column U-joint. (Refer to TM 9-2320-273-20).

Fasten horn brush (6) and terminal (9) to upper steering column housing (10) with two screw (7) and washers (8).

- d. Install horn brush cover (5) with two screws (4) and washers (3).
- e. Install turn signal control. (Refer to TM 9-2320-273 -20.)
- t M915, M916, M917 and M920. Install the trailer hand brake valve. (Refer to TM 9-2320-273-20.)
- g. Install steering wheel and horn button. (Refer to TM 9-2320-273 -20.)

Section V. ON-VEHICLE STEERING GEAR REPAIRS

16-20. Description. Since removal of the steering gear from the vehicle is difficult and time consuming, it's often easier to perform the necessary repairs and adjustments on the vehicle. After cleaning, if the steering gear is visibly leaking fluid or there is a high rate of internal leakage, a seal has probably failed.

16-21. Output Shaft Seal Replacement (Figure 16-8).

a. Preparation.

- (1) Raise vehicle's front end and secure with jack stands positioned under front axle.
- (2) Remove left front wheel for accessibility to steering gear.

b. Procedures.

- (1) Remove the pitman arm clamp retaining nut (9) and bolt (8).
- (2) Put alinement marks on the end of the sector shaft (11) and the pitman arm (10) to facilitate reassembly. Using a pitman arm puller, remove the pitman arm (10) from the steering gear sector shaft (11) to gain access to the output shaft seal area.
- (3) Remove the dust seal (7) and clean the output shaft. Clean the exposed shaft with emery paper.
- (4) Place a container under the steering gear, to capture hydraulic fluid lost, when trunnion cover and shaft seal package are removed.
- (5) Remove the four trunnion cover's cap screws (6) holding the trunnion cover (5) on the steering gear. Remove trunnion cover (5) and the shaft seal package (2, 3, & 4).
- (6) place the trunnion cover (5) on a bench in order to install a new seal package. Begin with the teflon back-up washer (4), followed by the two-piece output shaft seal (3).

NOTE

The words "oil side" must face inward toward the gear.

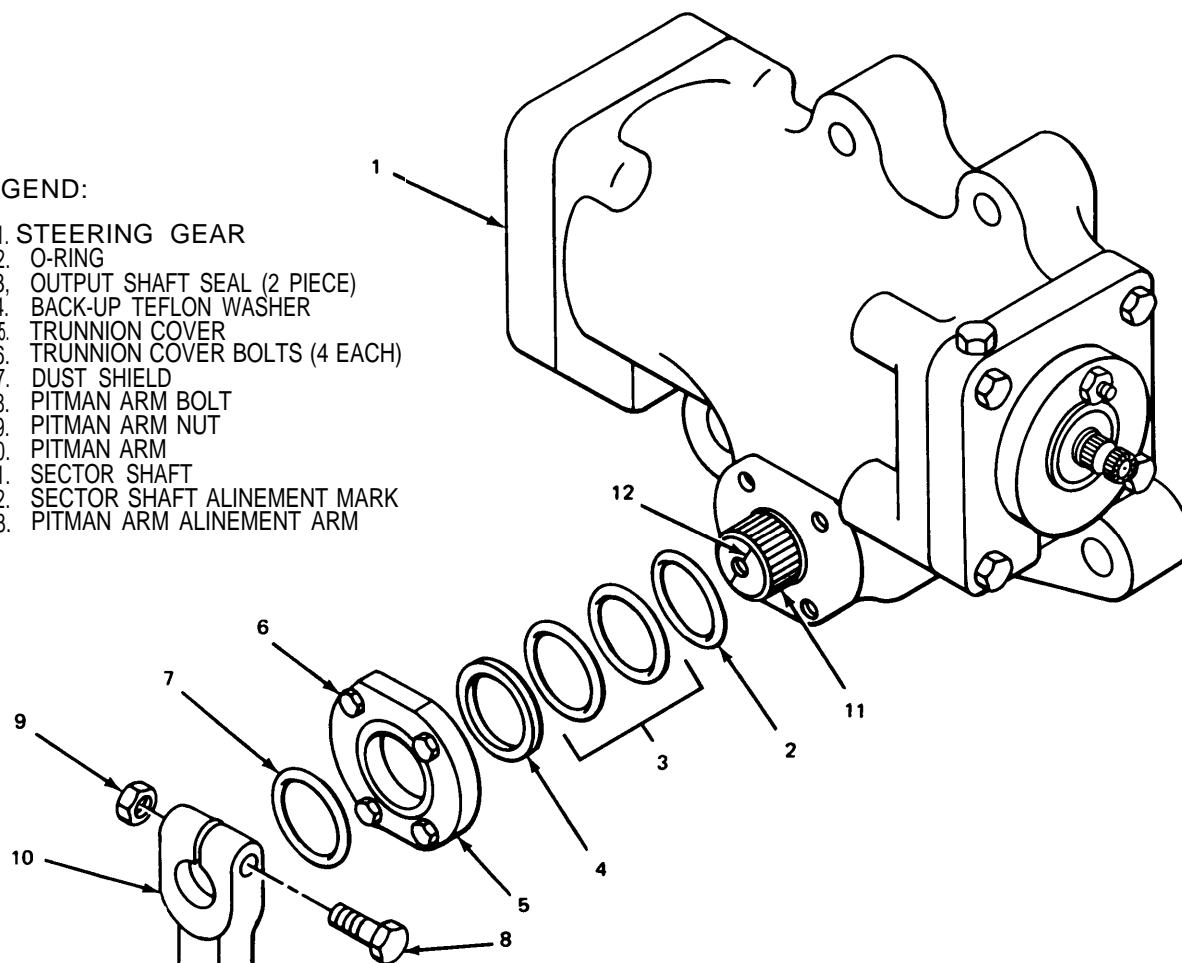
- (7) Grease the new O-ring seal (2) and install it in the cover groove.
- (8) To avoid damaging the new seals, tape over the serrations on the output shaft. Replace the trunnion cover (5) and install a new dust seal (7). Install the trunnion covers cap screws (6) and torque them 15-22 lb-ft. (20-30 N-m). Remove the tape over the serrations on the output shaft.
- (9) Drive a wedge in the slot on the pitman arm to open up slightly, making sure the sector shaft alinement mark (12) and the pitman arm alinement mark (13) are properly positioned. Tap pitman arm (10) onto the sector shaft (11) using a soft headed hammer. Install the pitman arm clamp retaining nut (9) and bolt (8). Torque to 380-420 lb-ft. (515-569 N-m).

(10) Top up the fluid in the reservoir and bleed the hydraulic system. (Refer to TM9-2320-273-20).

(11) Install the left front wheel. Raise the vehicle and remove the jack stands positioned under the front axle, then lower the vehicle.

LEGEND:

1. STEERING GEAR
2. O-RING
3. OUTPUT SHAFT SEAL (2 PIECE)
4. BACK-UP TEFLON WASHER
5. TRUNNION COVER
6. TRUNNION COVER BOLTS (4 EACH)
7. DUST SHIELD
8. PITMAN ARM BOLT
9. PITMAN ARM NUT
10. PITMAN ARM
11. SECTOR SHAFT
12. SECTOR SHAFT ALINEMENT MARK
13. PITMAN ARM ALINEMENT ARM



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Figure 16-8. Output Shaft Seal Replacement.

16-22. Input Shaft Seal Replacement (Figure 16-9).

a. Preparation.

(1) Refer to Output Shaft Seal Replacement preparation, paragraph 16-21.

b. Procedure.

(1) Remove bolt (4), lockwasher (3), and nut (2) from the lower steering column universal (1) at the gear case, and remove lower steering column. Clean area around the shaft.

(2) place container under the steering gear, to capture hydraulic fluid lost when lines and seals are removed. Remove and plug the hydraulic supply and return lines. Plug supply port (10).

(3) Remove the dust seal (7) and retaining ring (9) from the input shaft and clean the shaft with emery cloth.

(4) Hold a shop rag over the input shaft (12) and apply shop air pressure to the valve housing return port (11).



Wear proper eye protection equipment and comply with OSHA maximum air pressure requirements.

The seal assembly (6), the back-up washer (8) and some fluid will pop out of the steering gear (5). Disconnect the shop air from the housing return port (11) as soon as the seal assembly is out.

(5) Apply clean grease to the new input shaft seal assembly (6) and to the input shaft (12), install input shaft seal assembly (6), flatside outward using the seal driver.

(6) Install the back-up washer (8). Using the seal driver again, press against the back-up washer (8) until the tool flange seats.

(7) Install the retaining ring (9), pack the area around the shaft (12) with clean grease and install the dust seal (7), using the seal driver.

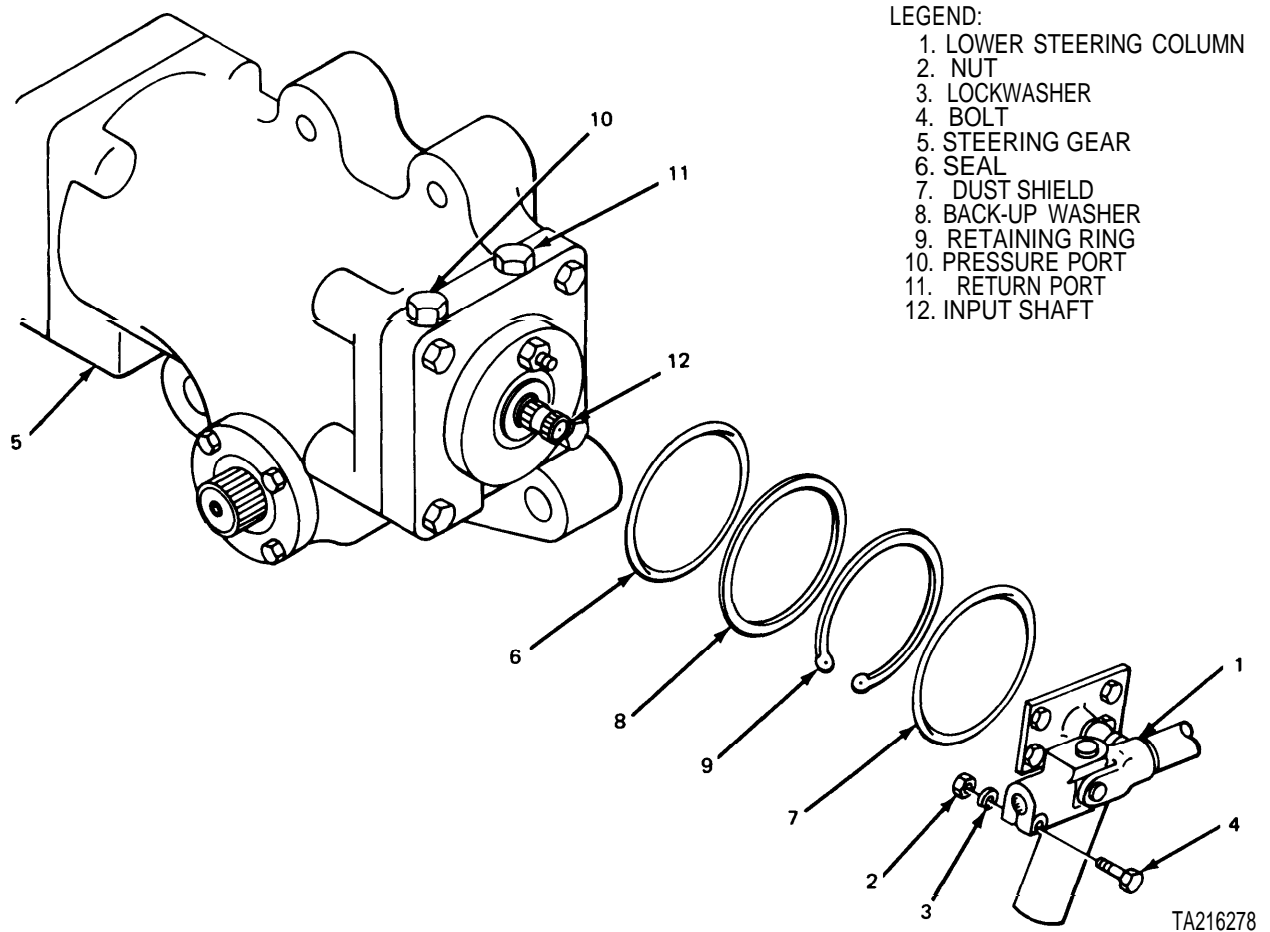


Figure 16-9. Input Shaft Replacement.

(8) Remove all plugs from the fitting ports (10&11) and reconnect all fittings and hydraulic hoses.

(9) Install lower steering column (1) to input shaft (12). Install bolt (4), lockwasher (3), and nut (2) in lower steering column (1). Torque to 35 lb-ft. (47 N-m).

(10) Top up the fluid in the reservoir and bleed the hydraulic system. (Refer to TM 9-2320-273-20).

(11) Install left front wheel. Raise the vehicle and remove the jack stands positioned under the front axle, then lower the vehicle.

CHAPTER 17

REPAIR OF FIFTH WHEEL

Section I. M915

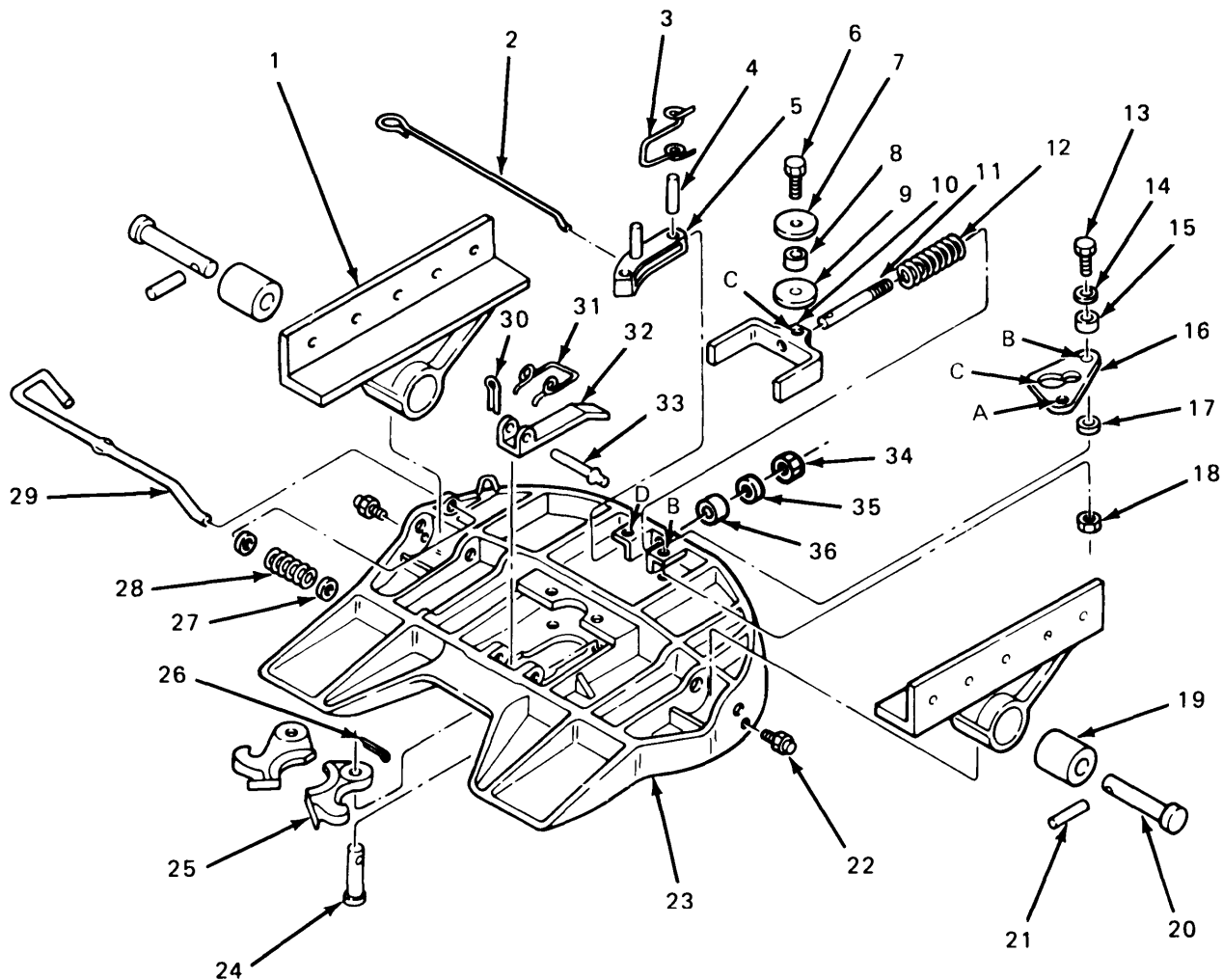
17-1. Removal. (Refer to TM 9-2320-273 -20.)

17-2. Disassembly (fig. 17-1).

- a. Using a hammer and knockout punch, drive out spiral pins (21, fig. 17-1).
 - b. Using hammer, tap out bracket pins (20) and lift off brackets (1) from plate (23).
 - c. Using rawhide hammer and wood dowel, tap out rubber bushings (19).
 - d. Remove capscrew (6), washers (7) and (9), and roller (8) from hole (C) in camplate (16).
 - e. Remove locknut (18), capscrew (13), washers (14) and (17), and roller (15) from hole (B) in camplate (16).
 - f. Remove camplate (16) from release handle (29).
 - g. Remove release handle (29) with spring (28) and washers (27) attached and then remove washers (27) and spring (28) by sliding over covered end of handle (29).
 - h. Using punch and hammer remove roll pin (4).
 - i. Remove secondary lock (5) and spring (3).
 - j. Remove secondary lock handle (2).
 - k. Remove yoke shank (11), spring (12), rubber block (36), washer (35), and locknut (34) by pulling on shank and tapping on back of yoke (10) with hammer.
 - l. Remove yoke (10).
 - m. Remove cotter pins (30), pin (33), spring (31), and lockguard (32).
- Remove cotter pins (26) and, using a hammer and suitable drift, drive out lockpins (24) from bottom side of assembly.
- o. Remove lock jaws (25),

17-3. Repair or Replacement.

- a. Check to see that grease fittings (22) will take grease. Replace if necessary.
- b. Replace any component that is cracked or deformed.



LEGEND:

- | | | |
|-----------------------------|------------------------|--------------------|
| 1. BRACKET (2) | 13. CAPSCREW | 26. COTTER PIN (2) |
| 2. SECONDARY LOCK
HANDLE | 14. WASHER | 27. WASHER (2) |
| 3. SPRING | 15. ROLLER | 28. SPRING |
| 4. ROLL PIN | 16. CAMPLATE | 29. RELEASE HANDLE |
| 5. SECONDARY LOCK | 17. WASHER | 30. COTTER PIN (2) |
| 6. CAPSCREW | 18. LOCKNUT | 31. SPRING |
| 7. WASHER | 19. RUBBER BUSHING (2) | 32. LOCK GUARD |
| 8. ROLLER | 20. BRACKET PIN (2) | 33. PIN |
| 9. WASHER | 21. SPIRAL PIN (2) | 34. LOCKNUT |
| 10. YOKE | 22. GREASE FITTING (2) | 35. WASHER |
| 11. YOKE SHANK | 23. PLATE | 36. RUBBER BLOCK |
| 12. SPRING | 24. LOCKPIN (2) | |
| | 25. LOCKJAW (2) | |

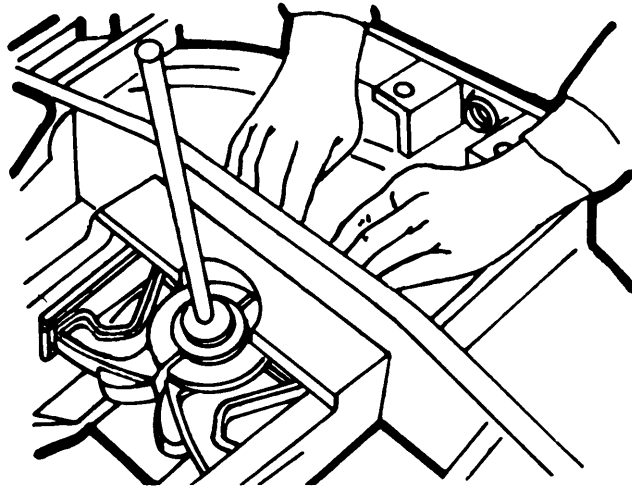
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Figure 17-1. M915 Fifth Wheel – Exploded View.

- c. Replace all cotter pins, springs, nuts, bolts, and washers during rebuild of the fifth wheel.
- d. Lubricate all moving parts to be installed. (Refer to LO 9-2320-273-12.)

17-4. Assembly (fig 17-1).

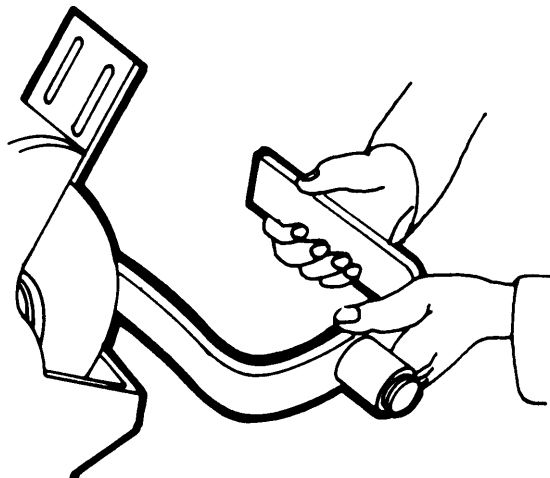
- a. Assemble lock jaws (25) into plate (23).
- b. Install lockpins (24) and cotter pins (26).
- c. Install yoke (10) and check for proper fit using a new kingpin. (fig. 17-2)



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Figure 17-2. Check the Yoke Fit.

- d. If yoke does not go completely in, grind off the outside of the yoke (fig. 17-3).



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Figure 17-3. Grind the Yoke to Fit.

- e. Remove kingpin.
- f. Install spring (12, fig. 17-1) and yoke shank (11).
- g. Install rubber block (36), washer (35), and locknut (34).
- h. Install washers (27), spring (28), on release handle (29).
- i. Install release handle assembly in plate (23).
- j. Install camplate (16) onto release handle (29). (Release handle (29) inserts in hole (A) of camplate (16).)
- k. Position camplate (16) on plate (23) so that camplate hole (B) is lined up with hole (B) on the plate.
- l. Put one washer (17) between the plate (23) and the camplate (16) in line with hole (B).
- m. Install roller (15) in hole (B) of the camplate (16).
- n. Install the other washer (14) on capscrew (13) and insert the capscrew into hole (B).
- o. Install the locknut (18) and torque capscrew to 85 lb-f-t (115 N.m).
- p. Check that the camplate (16) moves freely on the roller (15).
- q. Position the camplate (16) so that hole (C) is over hole (C) in the yoke (10).
- r. Install one washer (9) between the camplate (16) and yoke (10). Install roller (8) into hole (C) of the camplate (16).
- s. Install the other washer (7) and capscrew (6) through the roller (8) into the yoke (10). Verify the recess in the yoke shank (11) is aligned with hole (C) and then torque capscrew (6) to 120 lb-ft (163 N.m).
- t. Check that camplate (16) still moves freely.
- u. Install secondary lock handle (2) through plate (23) and into secondary lock (5).
- v. Straddle secondary lock (5) with spring (3) and position under lug in line with hole (D). Insert roll pin (4), making sure it does not protrude above the face of the plate (23).
- w. Install a new kingpin in the lock jaws (25) to close. Adjust nut (34) as required to provide a snug fit on the kingpin. Verify the yoke ends come at least to the end of the lock jaws.
- x. Install lock guard (32), spring (31), pin (33), and cotter pins (30).
- y. Install rubber bushings (19) by lubricating with soap solution (item 15, App B) and tapping into brackets (3) with rawhide hammer.
- z. Set brackets (1) in plate (23) and install bracket pins (20) and spiral pins (21).

Section II. M916 AND M920 FIFTH WHEEL

17-5. Removal. (Refer to TM 9-2320-273-20.)

17-6. Disassembly (fig. 17-4).

- a. Remove two cotter pins (2).
- b. Remove two castellated nuts (26).
- c. Tap out two bolts (8).
- d. Remove fifth wheel plate (7) from brackets.
- e. Place locks in closed position.
- f. Remove bolt (3), two washers (6), and nut (24).

NOTE

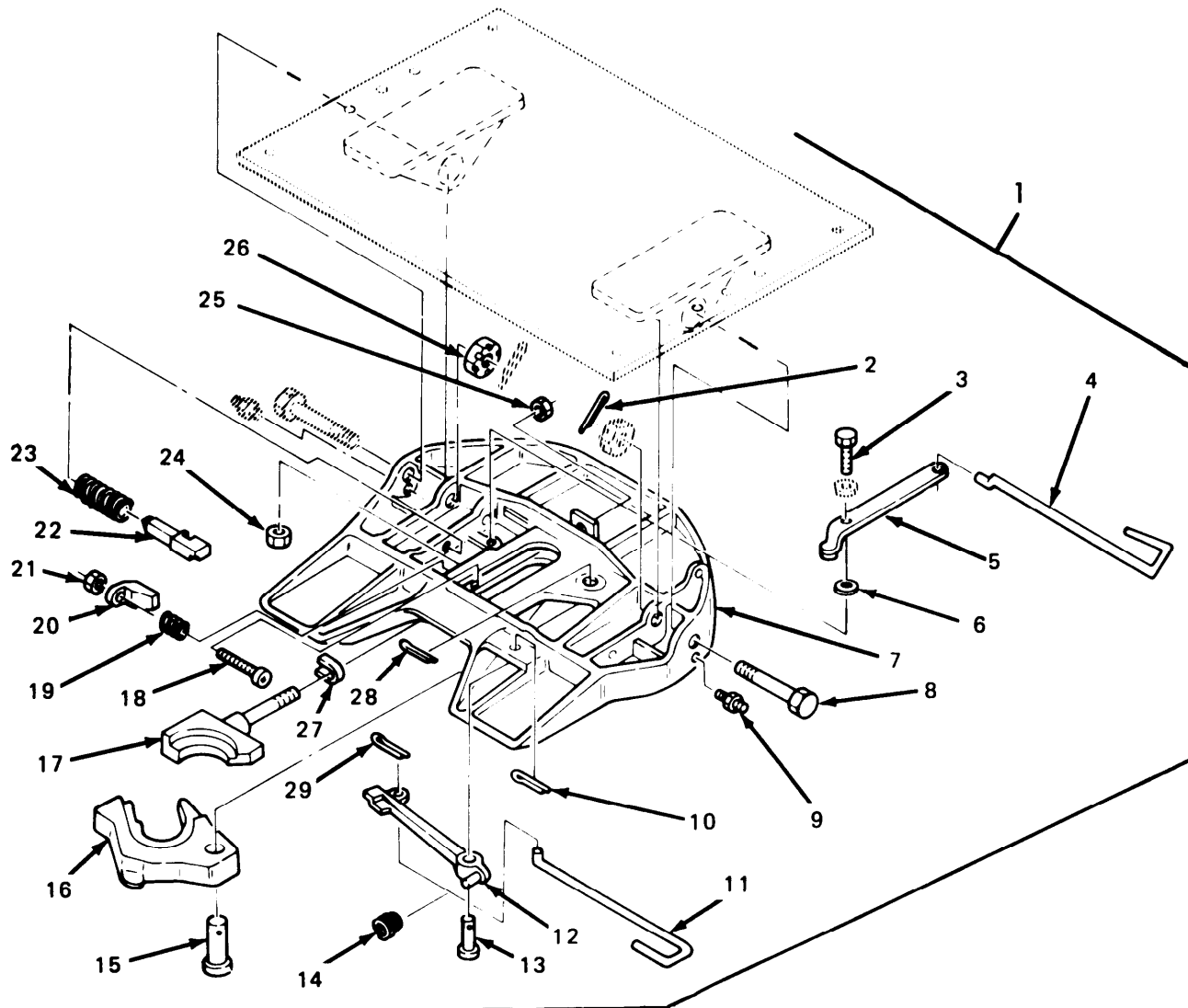
It is necessary to bend the forward release handle (4) in order to remove it from release lever (5) in step g.

- g. Remove release lever (5), and forward release handle (4).
- h. Remove cotter pin (10), lockpin (13), secondary lock arm (12), spring (14), cotter pin (29), and rear release handle (11).
- i. Remove cotter pin (28), hinged lockpin (15), hinged lock (16).
- j. Remove plunger (22), and spring (23).
- k. Remove jam nut (25), stationary lock (17), and U-spring (27).
- l. Remove capscrew (18), locknut (21), adjusting wedge (20), and spring (19).
- m. Check to see that grease fittings (9) take grease. Replace if necessary.

17-7. Inspection. Inspect all parts for cracks or deformity.

17-8. Repair or Replacement.

- a. Replace any component that is cracked or deformed.
- b. Replace all cotter pins, springs, nuts, bolts and washers during rebuild of the fifth wheel.
- c. Lubricate all moving parts to be installed. (Refer to LO 9-2320-273-12.)



LEGEND:

- | | |
|-----------------------------|-------------------------|
| 1. FIFTH WHEEL | 14. SPRING |
| 2. COTTER PIN (2) | 15. HINGED LOCK PIN |
| 3. BOLT | 16. HINGED LOCK |
| 4. RELEASE HANDLE (FORWARD) | 17. STATIONARY LOCK |
| 5. RELEASE LEVER | 18. CAPSCREW |
| 6. WASHER (2) | 19. SPRING |
| 7. FIFTH WHEEL PLATE | 20. ADJUSTING WEDGE |
| 8. BOLT (2) | 21. LOCK NUT |
| 9. GREASE FITTING (2) | 22. PLUNGER |
| 10. COTTER PIN | 23. SPRING |
| 11. RELEASE HANDLE (REAR) | 24. LOCK NUT |
| 12. SECONDARY LOCK ARM | 25. JAM NUT |
| 13. LOCK PIN | 26. CASTELLATED NUT (2) |
| | 27. U-SPRING |
| | 28. COTTER PIN |
| | 29. COTTER PIN |

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Figure 17-4. M916 and M920 Fifth Wheel – Exploded View

17-9. Assembly (fig.17-4).

a. Install adjusting wedge (20), spring (19), capscrew (18), and lock nut (21). Tighten until one thread shows out of lock nut at this time. Final adjustment will be made later.

b. Install spring (23) and-plunger (22).

NOTE

Plunger (22) must be held while release lever (5) is installed.

c. Install forward release handle (4) in fifth wheel plate (7) and release lever (5) on forward release handle (4).

d. Install one washer (6) between release lever (5) and fifth wheel plate (7).

e. Install release lever (5) into the slot in plunger (22).

f. Install the other washer (6) on bolt (3) and install through the pivot point of release lever (5) into the fifth wheel plate (7).



Do not over tighten the bolt and locknut in the next step as the release lever must move freely after tightening.

g. Install the lock nut (24) on bolt (3) and tighten. Check for free movement of release lever.

NOTE

Release lever (4) should be straightened out at this time.

h. Install U-spring (27).

i. Install stationary lock (17) and jam nut (25). Tighten.

j. Install hinged lock (16), hinged lock pin (15), and cotter pin (28).

k. Install release handle (11) into fifth wheel plate (7). Install secondary lock arm (12) and cotter pin (29) on release handle (11).

l. Install lock pin (13) and cotter pin (10).

m. Lock fifth wheel and install spring (14).

n. Check fifth wheel for proper locking operation using a new kingpin.

(1) Install kingpin and lock fifth wheel.

WARNING

Over adjustment can cause a potential partial lock.

(2) Tighten or loosen lock nut (21) as required for proper locking on the kingpin.

(3) Check locking and unlocking motion three times.

o. Install fifth wheel plate (7) into brackets.

p. Install two bolts (8), two castellated nuts (26) and tighten.

q. Install new cotter pins (2).

r. Install new cotter pins (2).

17.10. Reinstall. (Refer to TM 9-2320-273-20).

Section III. M916 AND M920 COMPENSATOR MOUNTING PLATE

17-11. Removal (Refer to para 17-6 a through d).

17-12. Disassembly (Figure 17-5).

- a. Pull two shoes (3) off tie rod (13) and compensator sub-assembly (12).
- b. Pull two hard rubber cushions (6) and any plainwashers (5) off tie rod (13).
- c. Pull tie rod (13) out of compensator frame sub-assembly (12).
- d. Remove six hex-head bolts (9 and 11) and lockwashers (8) from each end of subassembly (12).

NOTE

Count the shims and where they came from for reassembly.

- e. Remove two bearing adjusting plates (2) and shims (1) from each end of sub-assembly (12).

17-13. Inspection. Inspect for cracked welds, deformed, worn or cracked parts.

17-14. Repair or Replacement.

- a. Weld cracked welds in accordance with TM9-237.
- b. Replace components that are deformed, cracked, or severely worn.
- c. The shoe sub-assembly must be replaced if the rubber bushing (4) is unserviceable.
- d. Replace grease fittings (7 and 10) if necessary.

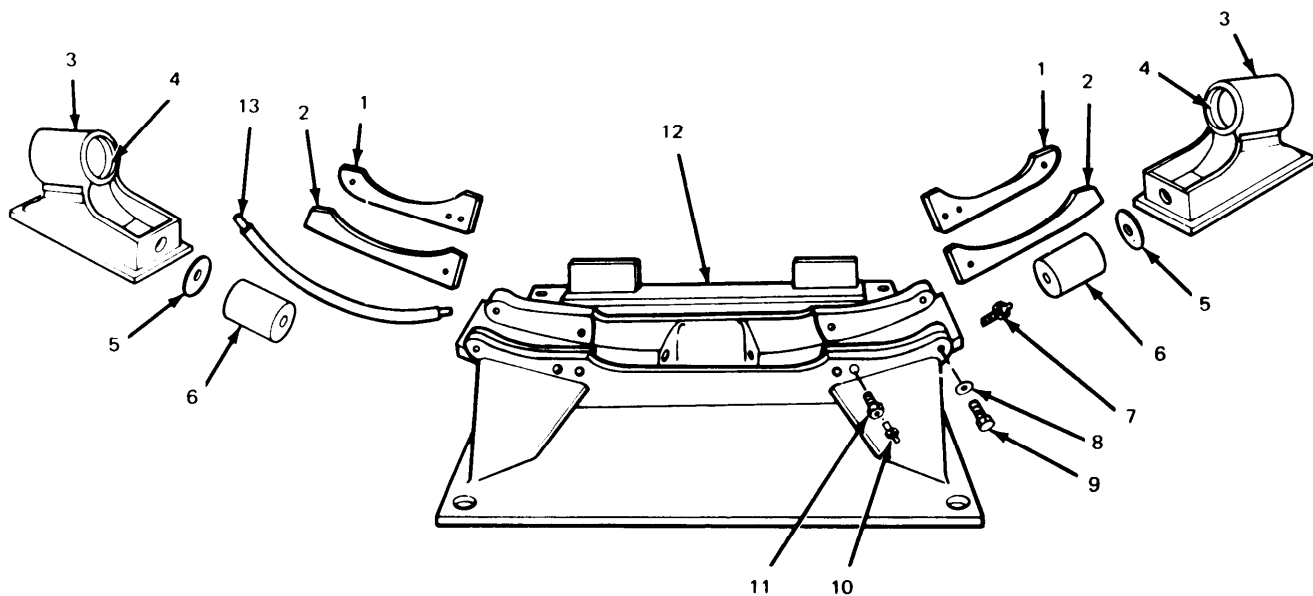
17-15. Assembly (Figure 17-5).

- a. Place the bearing adjusting plates (2) and all shims (1) removed.
- b. Install lockwashers (8) on hex-head bolts (9 and 11).

NOTE

Make sure that the hex-head bolts (11) with grease fittings (10) are placed in the holes that are drilled through the bearing adjusting plates.

- c. Install six hex-head bolts (9 and 11) on each end of sub-assembly (12).
- d. Position tie rod (13) in compensator frame sub-assembly (12).



LEGEND

- | | |
|--------------------------------|--------------------------------|
| 1. ADJUSTING SHIM (V) | 8. LOCKWASHER (12) |
| 2. BEARING ADJUSTING PLATE (4) | 9. HEX-HEAD SCREW (8) |
| 3. SHOE SUB-ASSEMBLY (2) | 10. GREASE FITTING (4) |
| 4. RUBBER BUSHING (2) | 11. HEX-HEAD SCREW-DRILLED (4) |
| 5. PLAINWASHER (V) | 12. COMPENSATOR SUB-ASSEMBLY |
| 6. RUBBER CUSHION (2) | 13. TIE ROD |
| 7. GREASE FITTING (2) | |

TA216426

Figure 17-5. M916 and M920 Compensator Mounting Plate.

- e. Install two hard rubber cushions (6) and any needed plainwashers (5) on tie rod (13).

NOTE

Plainwashers (5) are added or removed to adjust the shoes (3) for differences in fifth wheel top plates.

- f. install two shoes on compensator frame sub-assembly (12) and tie rod (13).

17-16. Reinstall (Refer to para 17-9 p through q).

CHAPTER 18

REPAIR OF SUSPENSION

Section I. FRONT SPRINGS

18-1. Description. The front axle springs are leaf-type, fixed-rate springs attached to fixed pivot pins on the front and shackles on the rear.

18-2. Removal.

WARNING

The weight of the vehicle must be supported by overhead hoisting equipment, floor jacks, or support stands at all times. Do not attempt to support the weight of the vehicle on a hydraulic jack.

NOTE

Each spring assembly weighs approximately 115 lbs (52 kg).

a. Depending on vehicle model being serviced, refer to para 2-14a and b or para 2-15a and b and remove front axle assembly.

NOTE

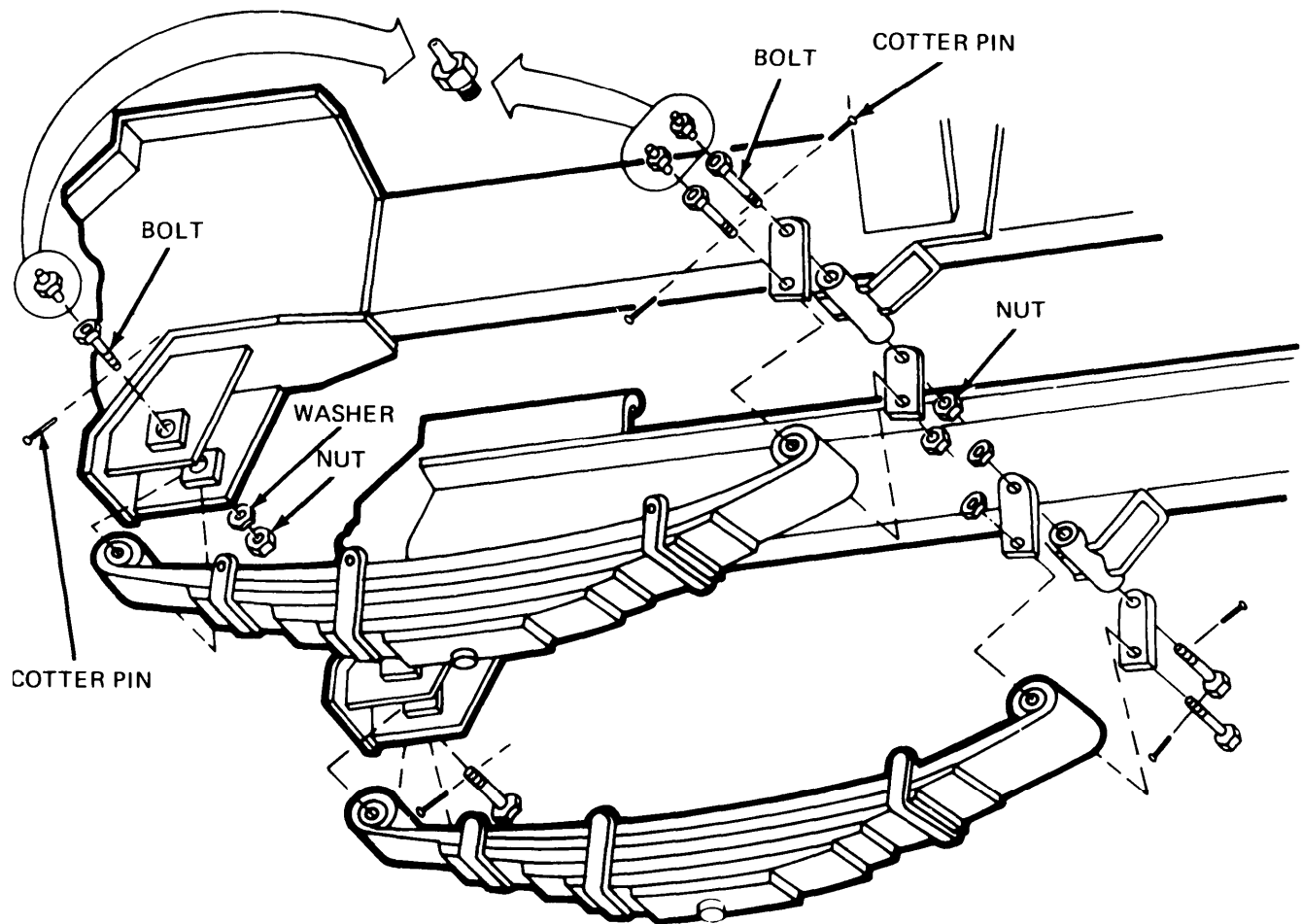
The weight of the vehicle must be supported by other means than at leaf springs. Hoist vehicle and place a hydraulic jack under springs which will aid in lowering springs when removed.

NOTE

In steps *b* and *c*, it is necessary to drive out bolts, front and rear, using a hammer and suitable drift.

b. Remove cotter pin, nut and bolt from rear of spring (fig. 18-1).

c. Remove cotter pin, nut, washer, and bolt from the front of the spring. Lower the spring from the vehicle with a hydraulic jack.

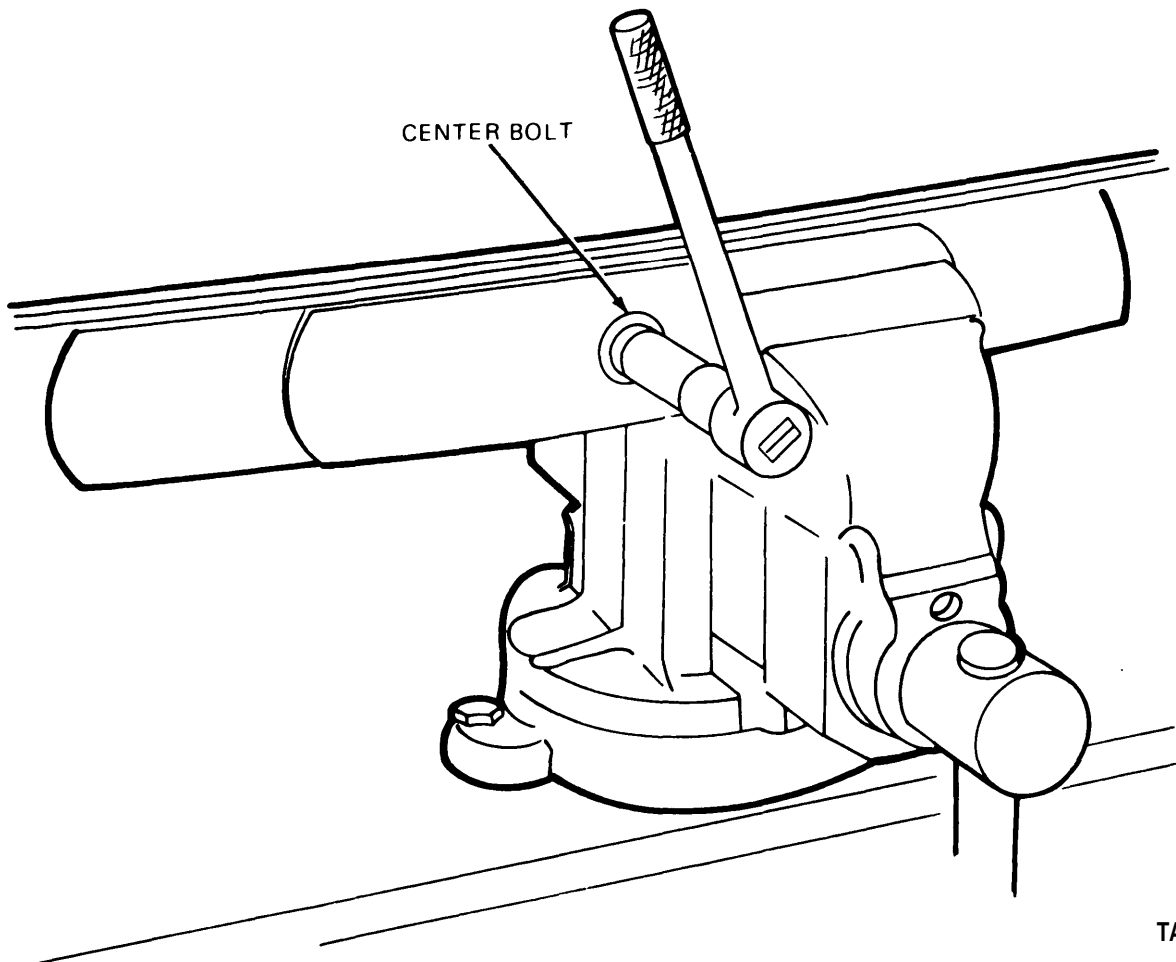


TA 074412

Figure 18-1. Front Springs Installation.

18-3. Disassembly.

- a. Clamp the spring assembly in a vise (fig. 18-2). Remove the spring alignment clamps and remove the center bolt.



TA 074413

Figure 18-2. Disassemble the Spring Assembly.

- b. Insert a long drift in the center hole and release the vise slowly.
- c. Remove the assembly from the vise and check for any broken leaves.
- d. Replace any broken leaf.

18-4. Assembly.

- a. Place the spring leaves in a vise.
- b. Insert a long drift in the center hole and slowly tighten the vise.
- c. Remove the drift and install the center bolt and nut. Torque to 75-85 lb-ft (100-115 N.m).

- d.* Install the alinement clamps in their original positions. Torque the nuts 45-55 lb-ft (61-74 N.m).
- e.* Remove the spring assembly from the vise.

18-5. Installation.

- a.* Position spring on a hydraulic jack and raise into place. Position the front spring eye with the bolt hole in the front bracket and install the bolt, washer, and nut (fig. 18-1). Do not tighten at this time.
- b.* Aline the rear spring eye with the shackle bolt hole and install the bolt and nut. Torque bolt to 300-400 lb-ft (407-452 N.m). Install cotter pin.
- c.* Torque bolt on the front spring eye to 300-400 lb-ft (407-452 N.m). Install cotter pin.
- d.* Depending on vehicle model being serviced, refer to para 2-14c or 2-15c and install front axle assembly.

Section II. REAR SPRINGS

18-6. Description. The rear axles are suspended by leaf-type, two-stage springs.

18-7. Removal.

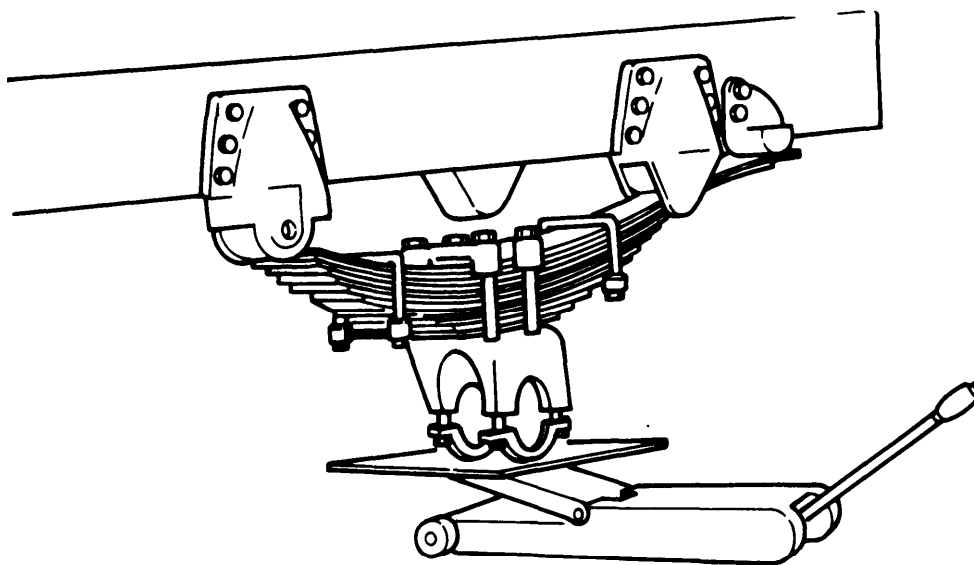
WARNING

The weight of the vehicle must be supported by overhead hoisting equipment, floor jacks, or support stands at all times. Do not attempt to support the weight of the vehicle on a hydraulic jack.

NOTE

Each spring assembly weighs approximately 100 lbs.

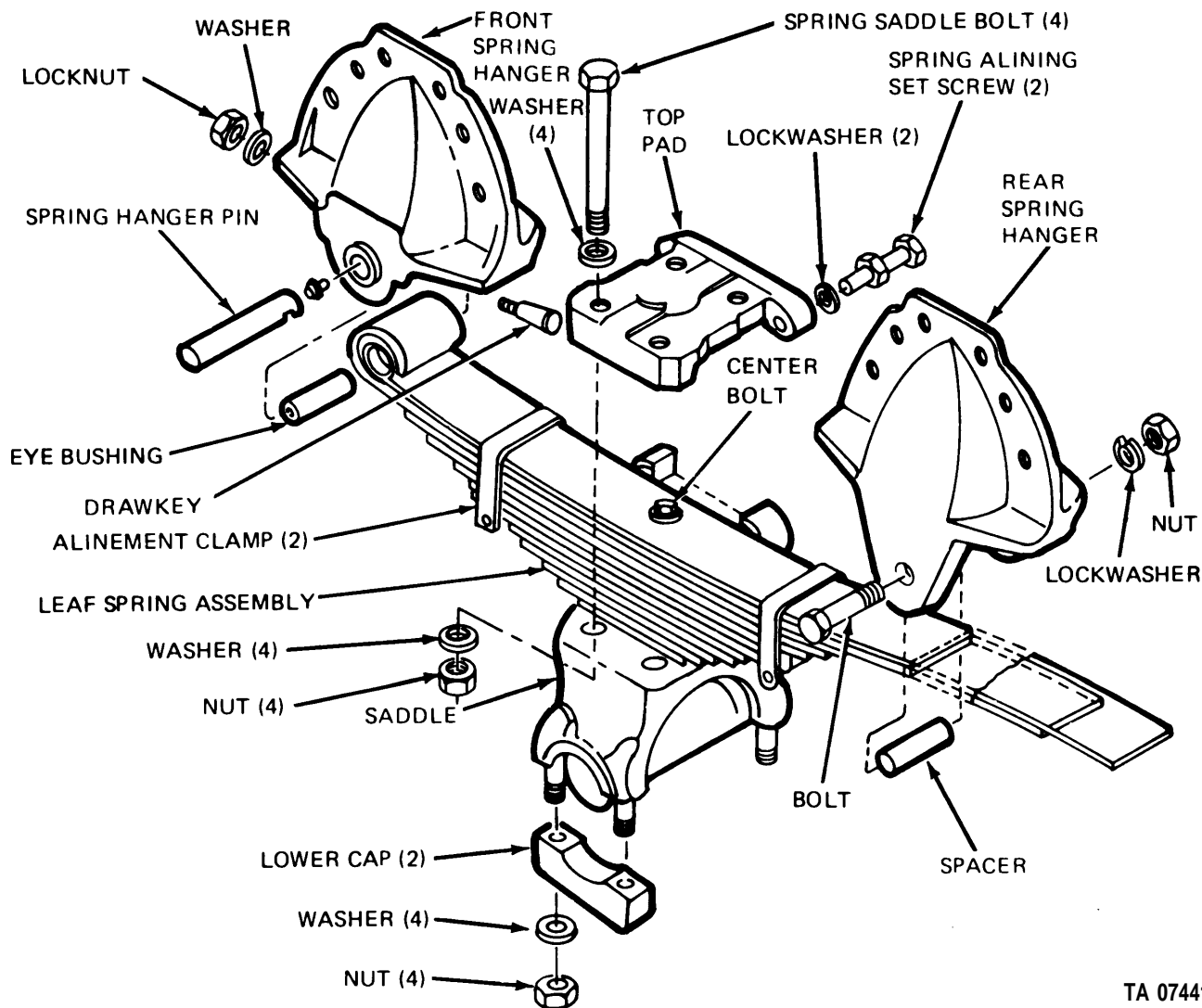
- a. Remove the rear tandem axle (refer to para 2-16a).
- b. Support the rear of the vehicle by the frame with an overhead hoist or other suitable means.
- c. Replace the lower saddle caps and nuts (fig. 18-3) to protect the stud threads and support the spring and saddle assembly with a floor jack.



TA 074414

Figure 18-3. Supporting the Spring & Saddle Assembly.

- d. Loosen the locknut on the drawkey (fig. 18-4) sufficiently to protect the drawkey threads, then strike nut with brass hammer to loosen drawkey.
- e. Remove the nut and washer and remove the drawkey.
- f. Drive the spring hanger pin out with a suitable drift and hammer.
- g. Remove the rear spring hanger nut, lockwasher, bolt, and spacer.
- h. Lower the spring and saddle assembly from the frame.



TA 074415

Figure 18-4. Rear Spring and Saddle Assembly.

18-8. Disassembly.

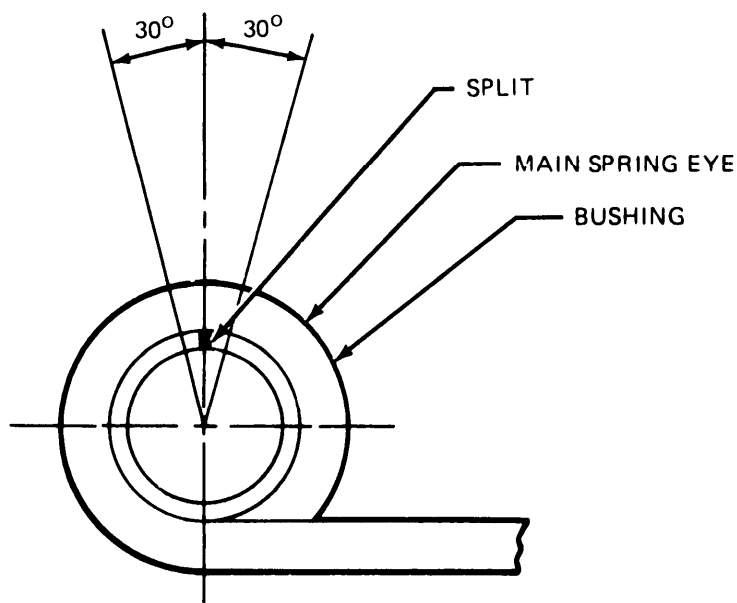
- a. Loosen the two spring alining setscrews (fig. 18-4).
- b. Remove the four spring saddle bolts, nuts, and eight washers.
- c. Remove the top pad.
- d. Remove the leaf spring assembly from the saddle.
- e. Remove the spring center bolt and two alinement clamps.
- f. Press the eye bushing from the top spring leaf.

18-9. Inspection.

- a. *Spring Hanger, Front.* Inspect the forward spring hanger outside pin hole for wear or elongation of the hole. Wear at this point may result in breakage of the pin, due to offset loading. This wear condition could be the result of improper installation of the draw key. Replace the hanger if this condition is found.
- b. *Spring Hanger, Rear.* Inspect for excessive wear of the cam due to high mileage. The outside legs of the rear hanger should also be inspected for wear from the spring. This could be caused by excessive wear of spring eye bushings and pins.
- c. *Spring Hanger Pins.* Visually inspect to determine wear. Install new pins and spring eye bushings at major overhaul.
- d. *Spring Assembly.* Check for cracked or broken leaves. If cracked or broken leaves are found, replace spring assembly.

18-10. Assembly.

- a. Press bushing with split to the top of the spring eye (unloaded side) $\pm 30^\circ$ as shown in figure 18-5.
- b. *Install the spring center bolt and two spring alignment clamps (fig. 18-4). Torque the center bolt to 65-75 lb-ft (88-102 N.m).*
- c. Seat the spring assembly in the saddle with the head of the spring center bolt positioned in the hole provided in the saddle.
- d. Position the top pad on the spring, making sure the pad is properly seated into the saddle chair back.
- e. install the four spring saddle bolts, nuts, and eight washers. Do not tighten.
- f. Install the two setscrews. Torque to 100-150 lb-ft (136-203 N.m); then tighten jam nuts until the lockwashers are flat.
- g. Torque the spring saddle bolts to 275-300 lb-ft (373-407 N.m) per tightening sequence (fig. 18-6).

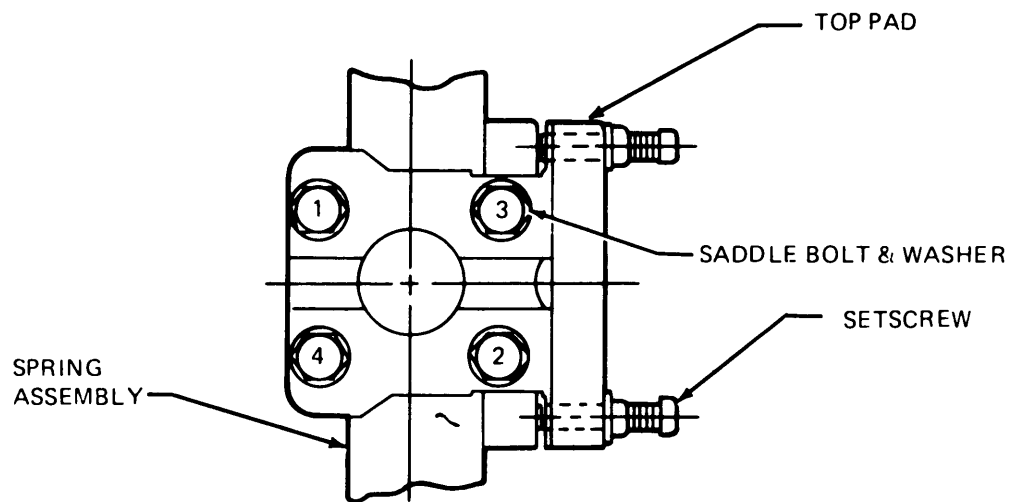


TA 074416

Figure 18-5 Install Spring Eye Bushing.

18-11. Installation.

- a. Use a floor jack to position the spring and saddle assembly in the front and rear spring hanger frame brackets (fig. 18-3).
- b. Aline the front spring eye with the front hanger (fig. 8-4) spring hanger pin bore. Oil the inside of the eye bushing and spring hanger pin.
- c. Install the spring hanger pin, being careful to aline the drawkey slot in the spring hanger pin with the drawkey hole in the hanger.
- d. Install the drawkey, washer, and nut. Torque to 75-100 lb-ft (102-136 N.m).
- e. Install the spacer, bolt, lockwasher and nut in the rear spring hanger. Torque to 70-80 lb-ft (95-108 N.m).
- f. Lubricate per LO 9-2320-273-12.
- g. Replace rear tandem axle assembly (para 2-16 b).



TA 074417

Figure 18-6. Spring Saddle Bolt Tighting Sequence.

Section III. EQUALIZING BEAMS

18-12. Description. The equalizing beams distribute the load equally between the axles. The beam design reduces bumps and regardless of road or load conditions, they offer better tire wear, stability and freedom from maintenance.

18-13. Removal.

- a. Remove rear tandem axle and equalizer beam (para 2-16a).

18-14. Disassembly.

WARNING

Do not use a cutting torch to remove the equalizer beam center bushings or end bushings. All equalizer beams are heat treated for strength and long service life. The use of heat could adversely effect the strength of the equalizer beams.

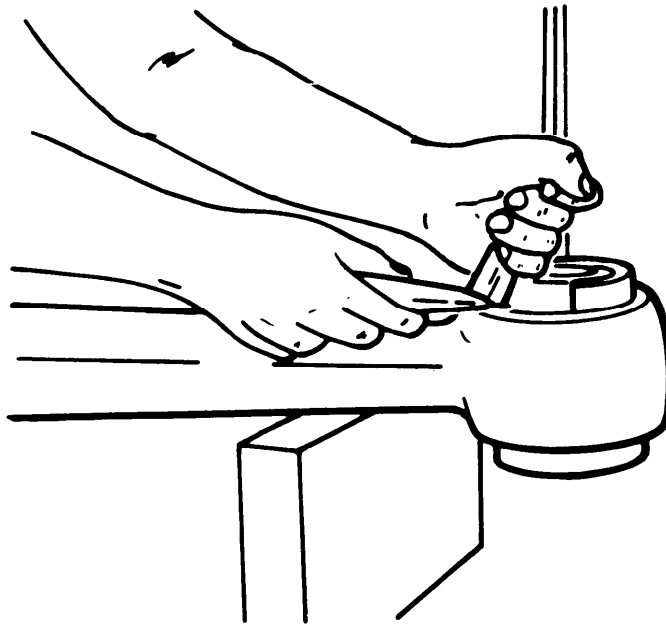
NOTE

Shop made adapters can be made easily from standard tubing for removing and installing rubber bushings. Refer to Table 18-1 for adapter that will meet removal and installation requirements. Press pressures required to remove the bushings will generally be between 35 to 50 tons (31.75 to 45.36 metric tons).

Table 18-1. Bushing Removal and Installation Adapters

IDENT. No.	ADAPTER SIZE	APPLICATION
1.	4.14"O D X 5" Long	Equalizer Beam End Bushing Remover
2.	4.12" I D X 5" Long	Equalizer Beam End Bushing Installer
3.	4.625" OD X 8" Long	Equalizer Beam Center Bushing Remover and Installer

- a. Place equalizer beam on work bench and cut rubber off one side of beam end bushing flush with equalizer beam (fig. 18-7).



TA 074418

Figure 18-7. Cutting Off Rubber Bushing.

- b. Position the equalizer beam in a press. Using a suitable adapter as described in Table 18-1, Identification No. 1, press the end bushing out of the equalizer beam.
- c. (M915) Using adapter identification No. 3, press the center bushing from the equalizer beam.

d. (M916 thru M920). Pry out the inner and outer oil seal (fig. 18-8). Using adapter identification No. 3 (Table 18-1), press the center bushing from the equalizer beam.

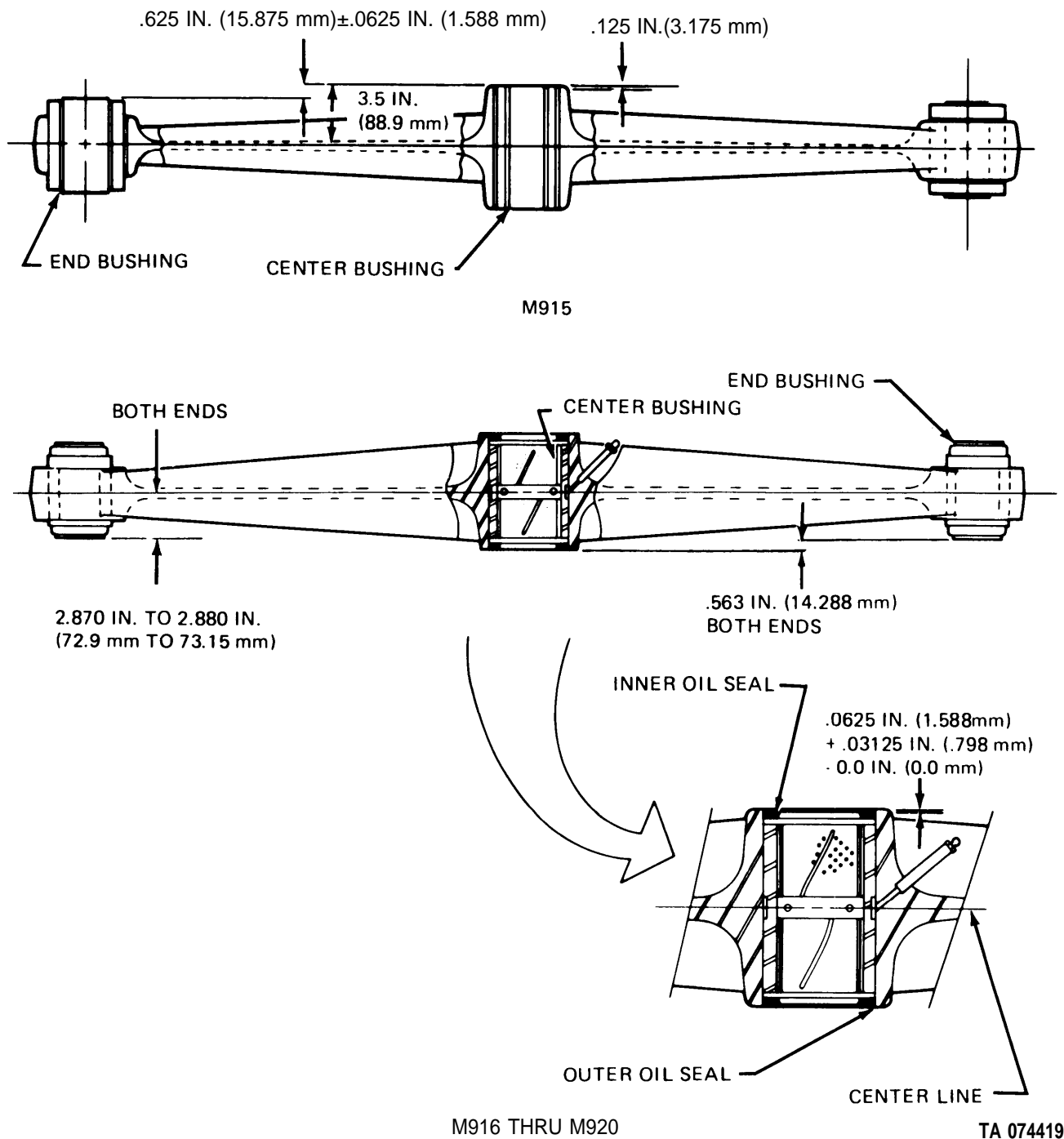
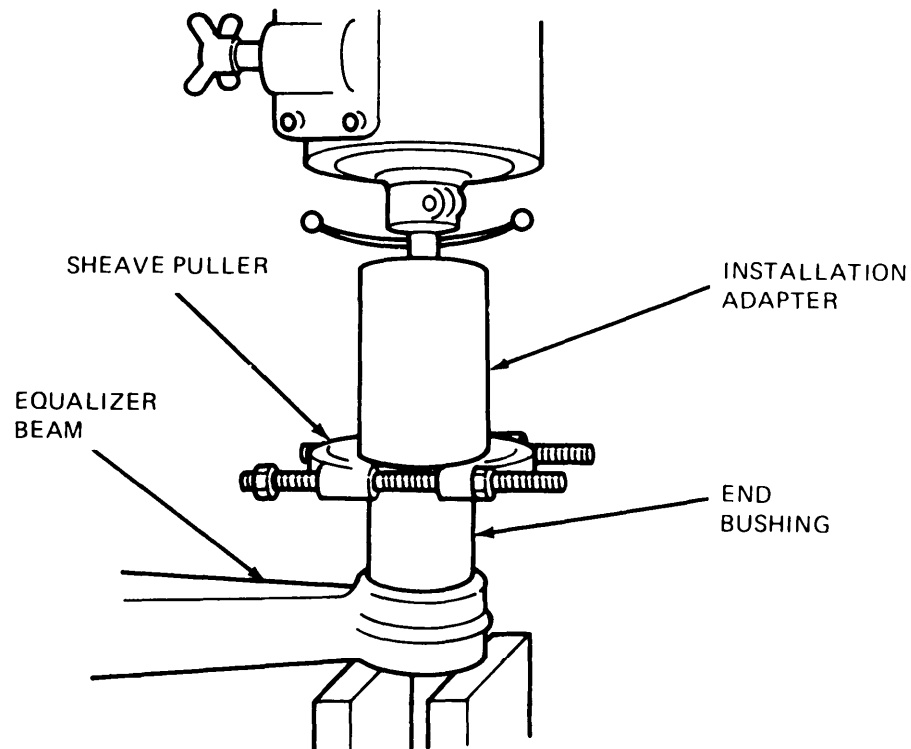


Figure 18-8 Pry Out Inner and Outer Oil Seal.

18-15. Assembly.

- a. Position the equalizer beam in a press.
- b. To install a new end bushing, use a sheave puller to compress the extruded rubber of the bushing until puller jaws seat past the lip of the outer metal sleeve portion of the bushing (fig. 18-9).



TA 074420

Figure 18-9. Pressing In the End Bushing.

- c. Apply a thin coat of lubricant to the outer diameter of the end bushing.
- d. Use adapter identification No. 2 (Table 18-1) to fit over rubber and press against jaws of the puller to install bushing into end beam (fig. 18-9). The bushing should be installed to meet the specifications in figure 18-8. Once installed, remove puller.
- e. Apply a thin coat of lubricant to the outer diameter of the center bushing.
- f. M915). Using adapter identification No. 3 (Table 18-1), install center bushing to meet specifications in figure 18-8.
- g. (M916 *thru* (M920). Using adapter identification No. 3 (Table 18-1), install center bushing assembly into equalizer beam. The lube grooves must be in alignment with the vertical center line on the equalizer beam and when installed, the bushing must be equal distance from sides of equalizer beam (fig. 18-8).
- h. (M4916 *thru* (M920). Install oil seals by gently tapping on outer edge.

18-16. Installation. Install equalizer beam and rear tandem axle (refer to para 2- 16 b).

CHAPTER 19

REPAIR OF CAB AND BODY

Section 1. CAB

19-1. Removal

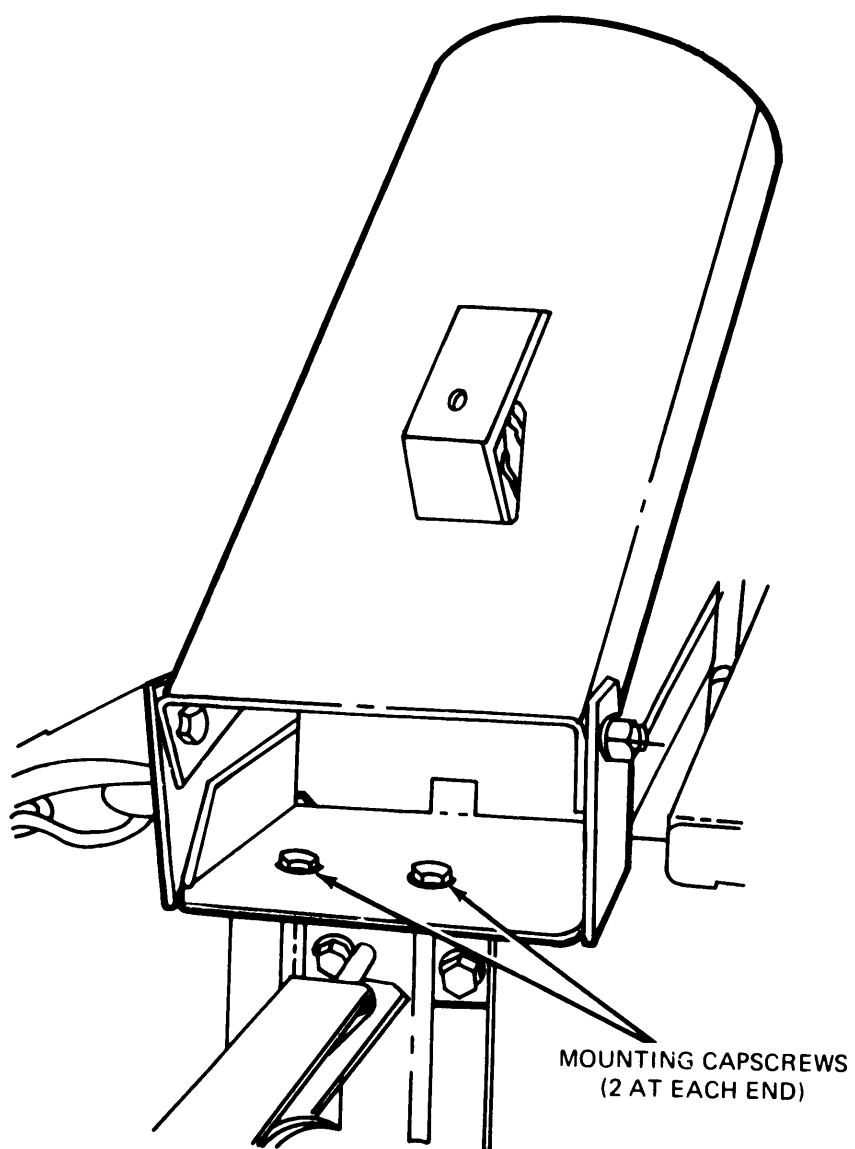
- a. Using TM 9-2320-273-20 for instructions, perform the following tasks:

- (1) Disconnect battery cables.
- (2) Remove hood.
- (3) Remove radiator support rods.
- (4) Remove both front fenders.
- (5) Remove air cleaner inlet tube.
- (6) Drain radiator.
- (7) Remove heater.
- (8) Disconnect speedometer cable from tachograph.
- (9) Disconnect tachometer cable from tachograph.
- (10) Remove lower steering column.

NOTE

When cab is being removed indoors, ceiling clearance may be a problem. If this problem exists, perform steps *b*, *c*, and *d* as indicated; otherwise, proceed to step *e*.

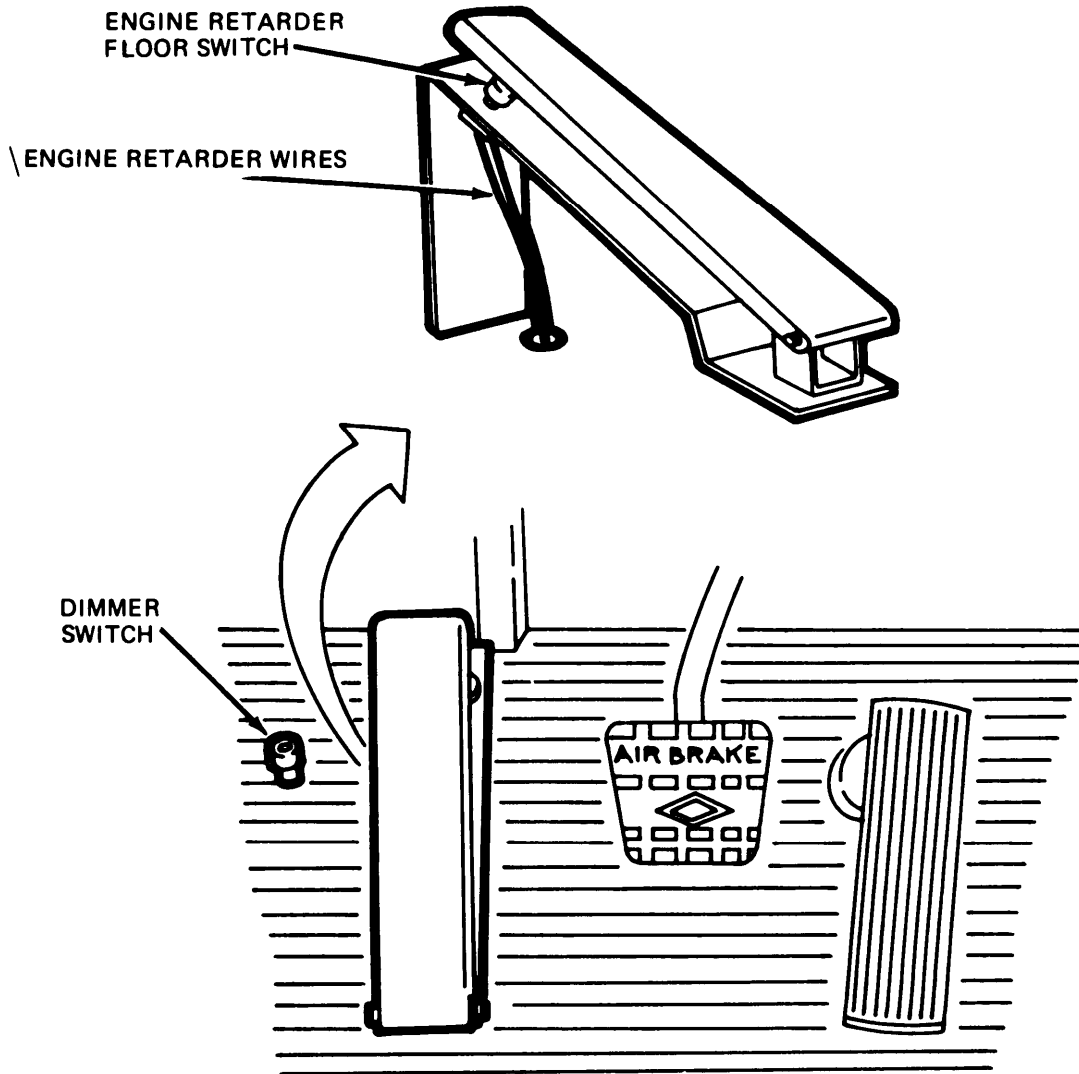
- b.* Remove tailpipe and muffler (refer to TM 9-2320-273-20).
- c.* Remove spare tire - M915 only (refer to TM 9-2320-273-10).
- d.* On model M915 - remove the spare tire support assembly (fig. 19-1) by removing four capscrews, four nuts, and eight washers.



TA 074421

Figure 19-1. Remove/install Spare Tire Support Assembly (M915 Only).

- e. Dismount headlight dimmer switch (fig. 19-2) from inside cab by removing two attached screws.

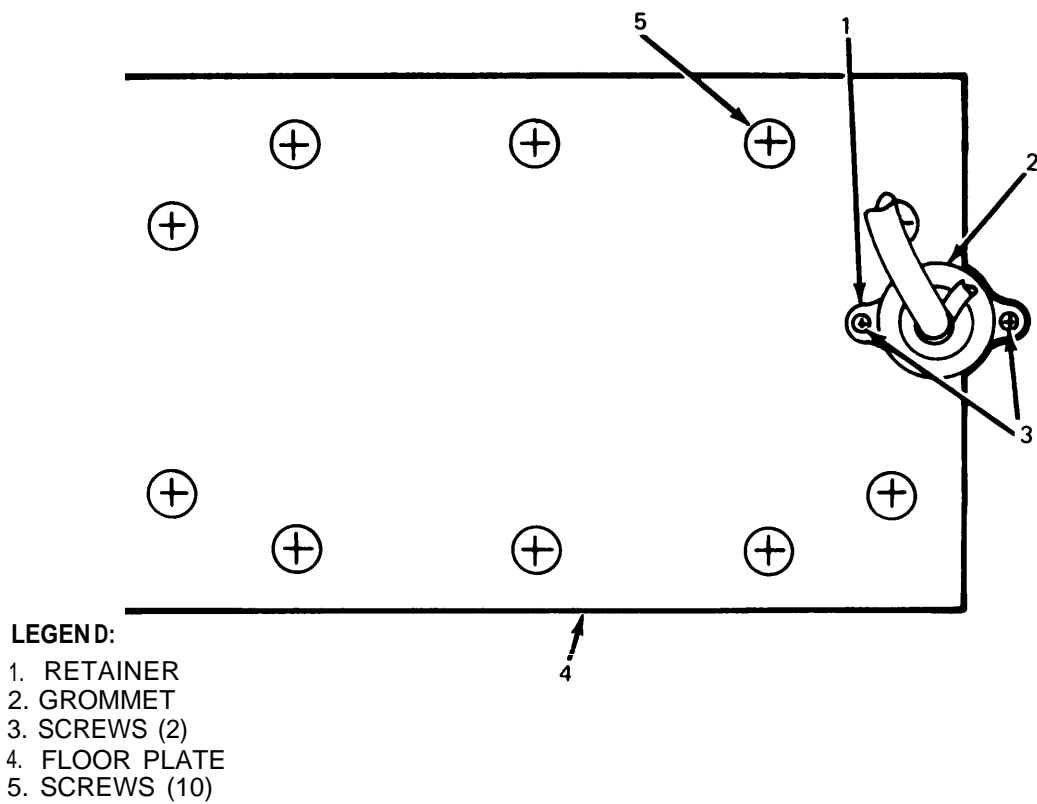


TA 074422

Figure 19-2. Dismount/Install Dimmer Switch and Engine Retarder Floor Switch.

- f. Disconnect Engine Retarder floor switch (fig. 19-2) by removing two wires. Tag wires to aid in reassembly.

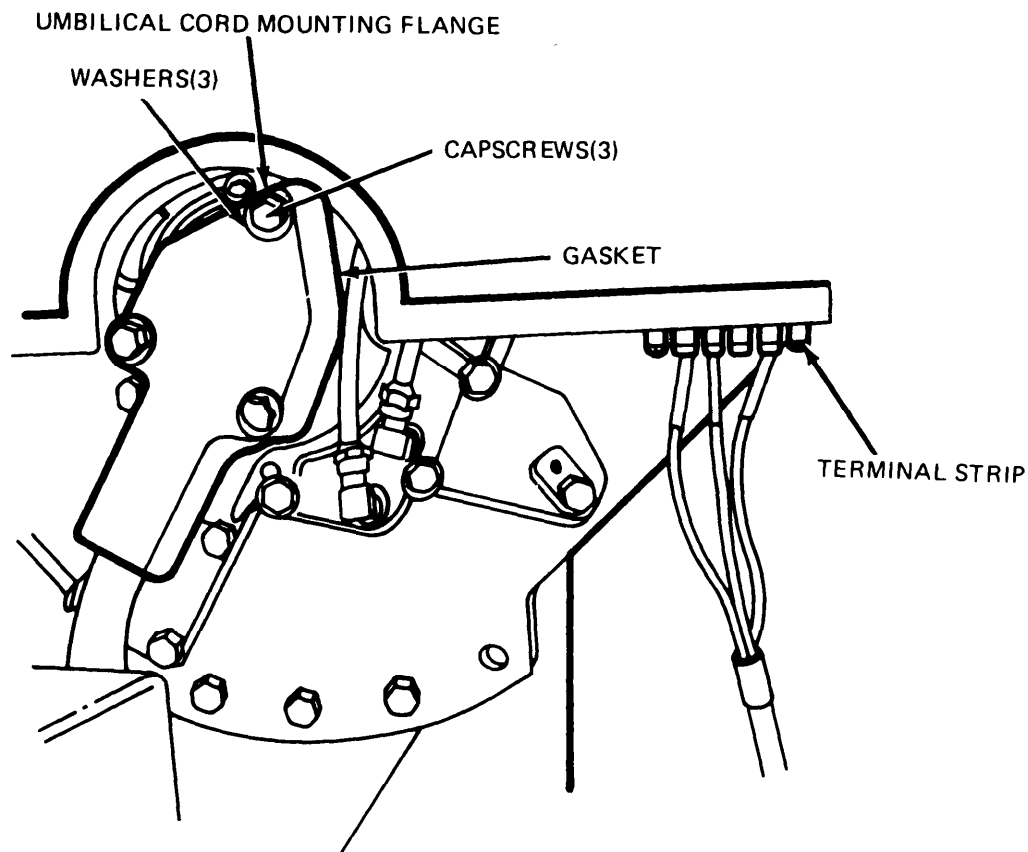
g. Remove floor plate (4, fig. 19-3) by removing ten screws (5), two screws (3), grommet (2), and retainer (1).



TA 074423

Figure 19-3. Remove/Install Floor Plate.

- h. Disconnect umbilical cord and gasket (fig. 19-4) from ratio selector by removing three capscrews and washers.

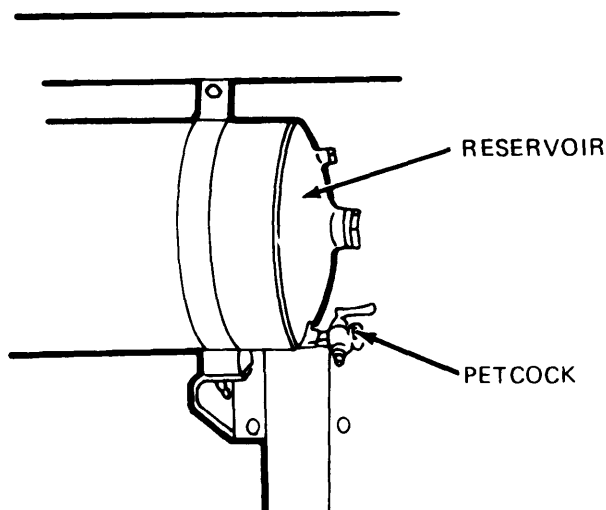


TA 074424

Figure 19-4. Disconnect/Connect Umbilical Cord Mounting Flange and Wires from Ratio Selector.

- i. Tag and disconnect three wires from ratio selector terminal strips.

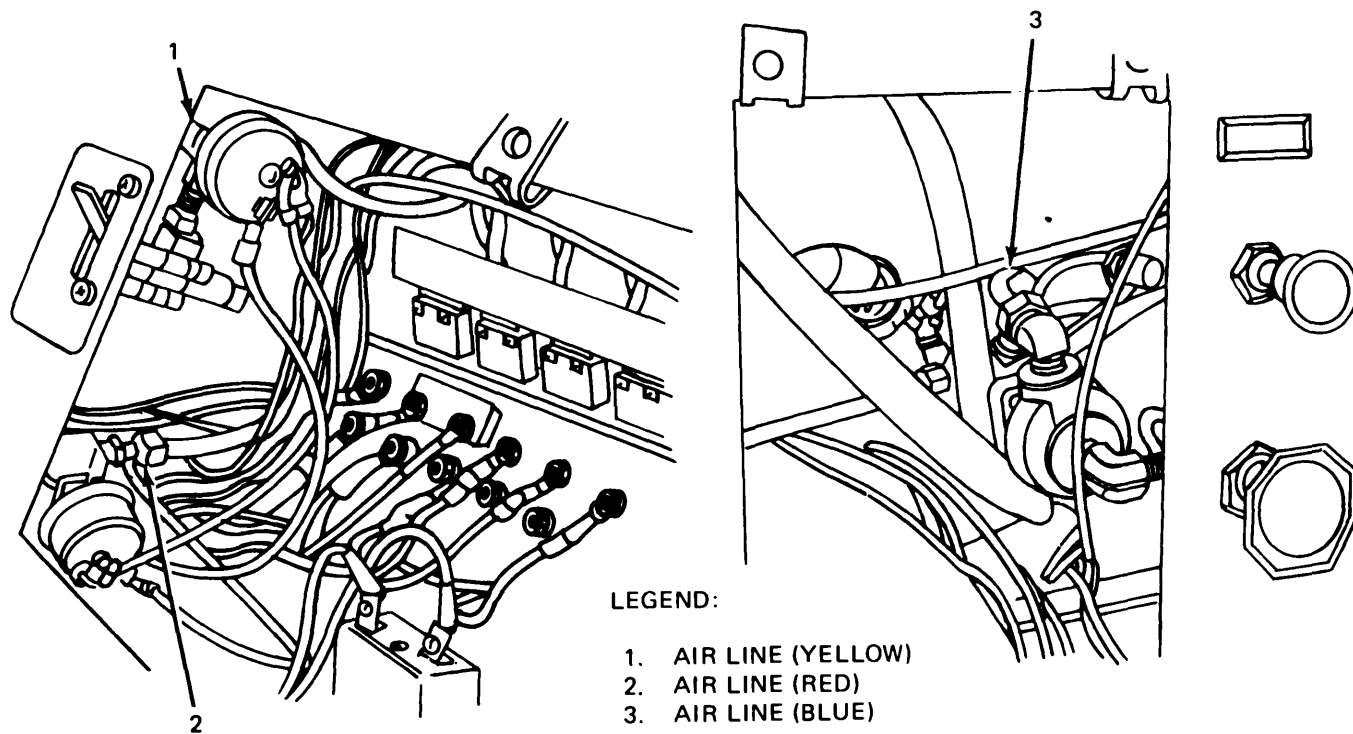
- j. Bleed off air pressure in compressed air system by opening petcock on reservoir (fig. 19-5) located above battery box.



TA 074435

Figure 19-5. Bleed Off Air Pressure in Compressed Air System.

- k. Lower the circuit breakers access panel; then disconnect yellow air line (1, fig. 19-6) from top of INTERAXLE DIFFERENTIAL control and red air line (2) from PARKING BRAKE valve.

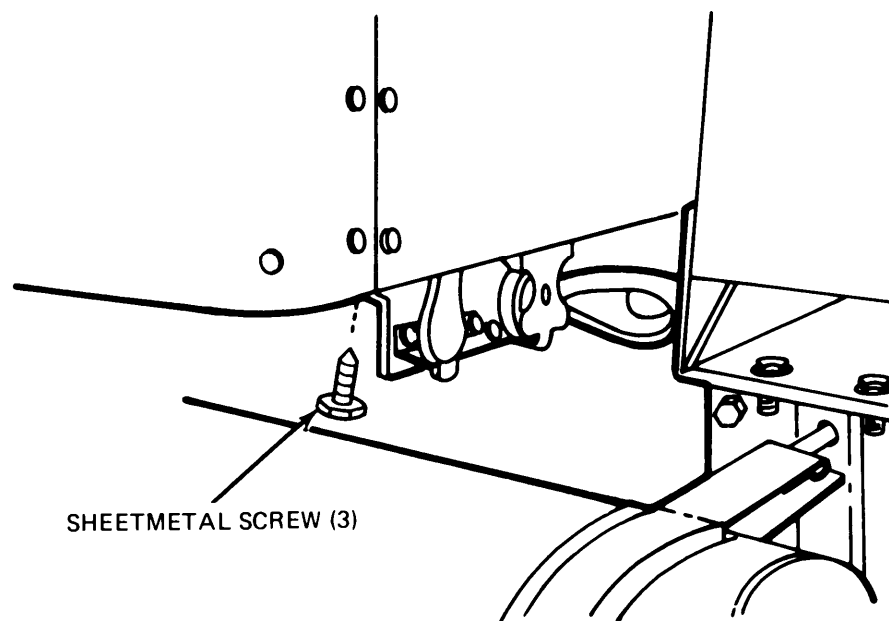


TA 074436

Figure 19-6. Disconnect/Connect Instrument Panel Air Lines.

l. Lower the panel adjacent to WIPER control; then disconnect blue air line (3) from TRAILER EMERGENCY valve.

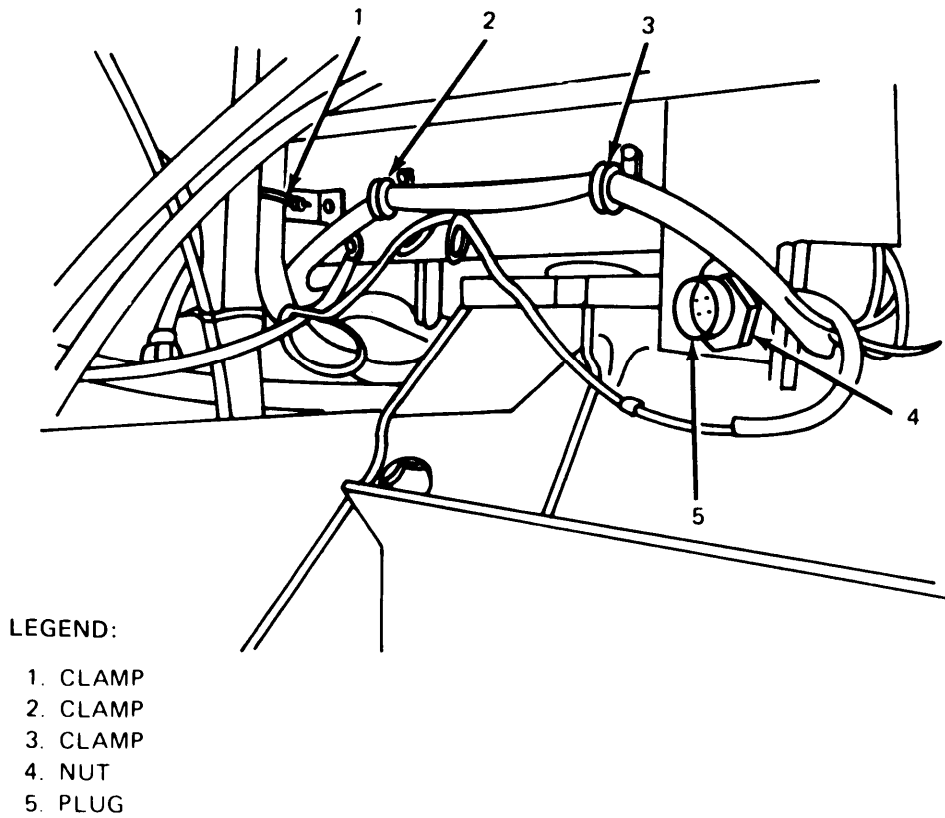
m. Dismount receptacle bracket (fig. 19-7) from the left rear corner of cab by removing three sheetmetal screws.



TA 074437

Figure 19-7. Dismount/Install Receptacle Bracket from Rear of Cab.

n. Remove three clamps (1, 2, and 3, fig. 19-8) along lower left side of firewall by removing attaching screws.

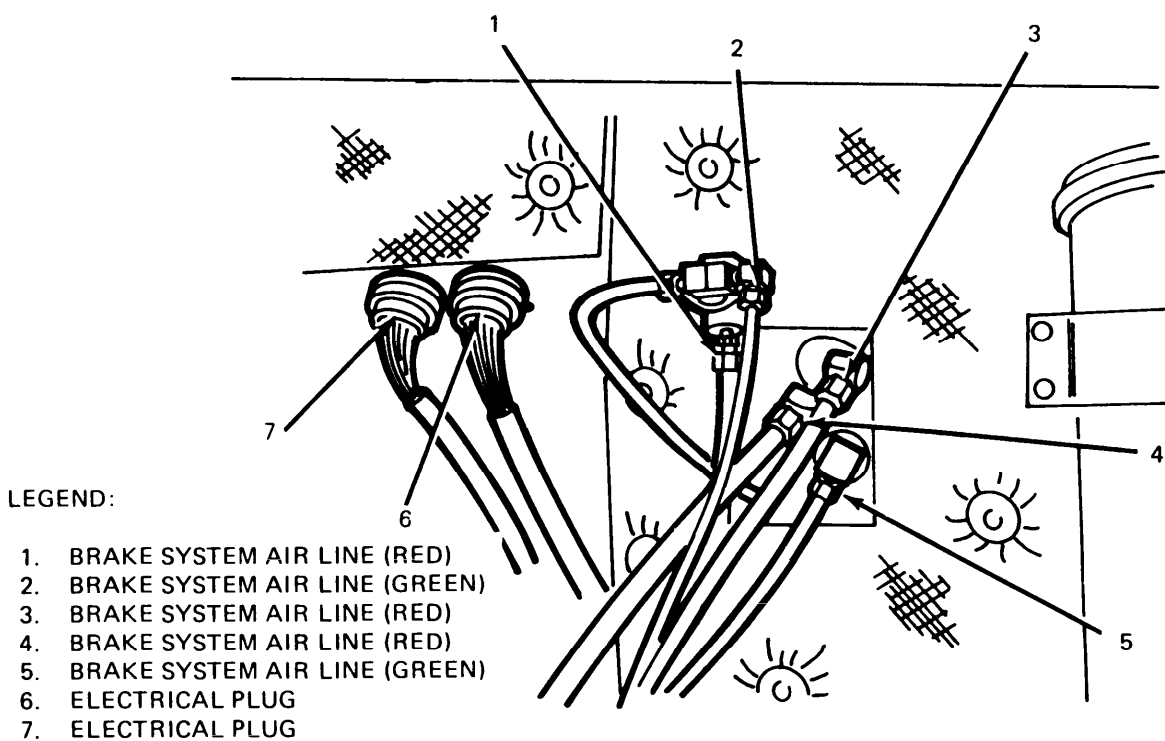


TA 074438

Figure 19-8. Disconnect/Connect Electrical Plug and Cable Clamps from Front of Cab.

o. Remove nut (4) and disconnect electrical plug (5) from its mounting bracket.

P. Disconnect five brake system air lines (1 thru 5, fig. 19-9) from left side of firewall. Tag lines to aid in reassembly.

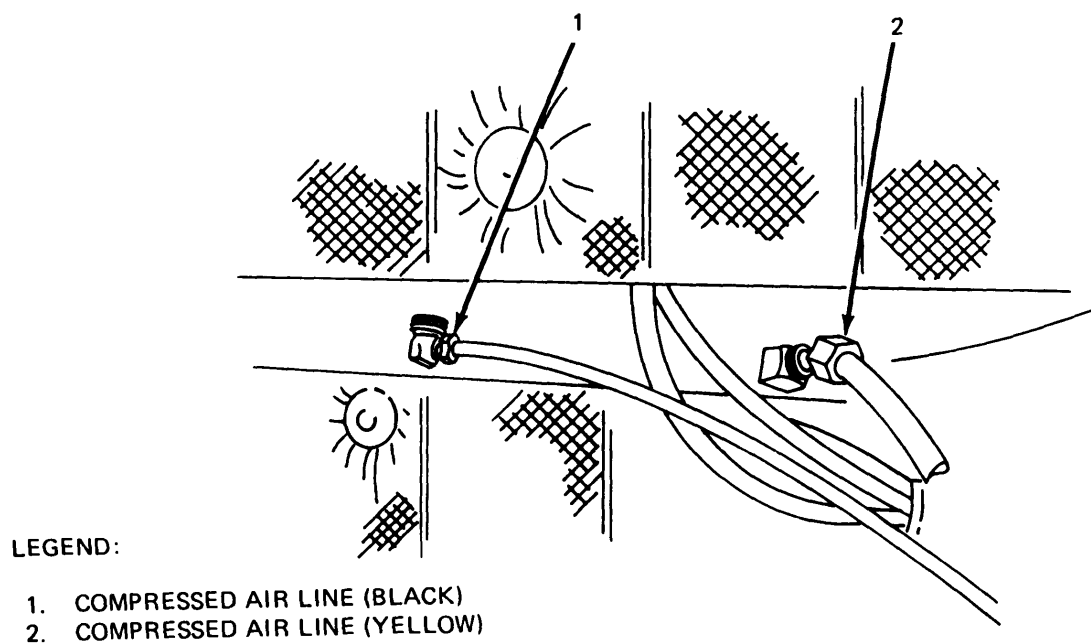


TA 074439

Figure 19-9. Disconnect/Connect Brake System Air Lines and Electrical Plugs from Firewall.

9. Disconnect electrical plugs (6) and (7). Tag each to aid in reassembly.

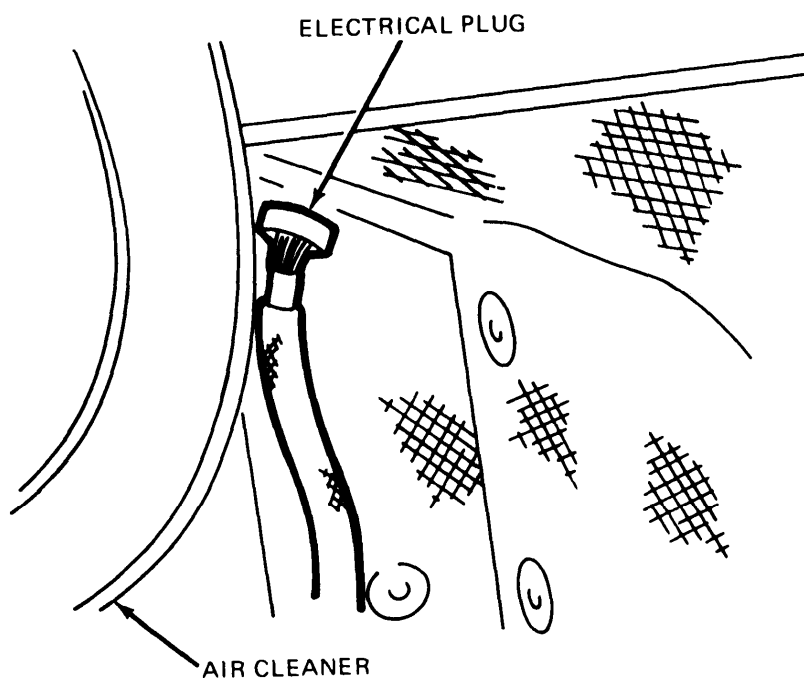
- r. Disconnect compressed air lines (1 and 2, fig. 19-10).



TA 074440

Figure 19-10. Disconnect/Connect Compressed Air Lines from Firewall.

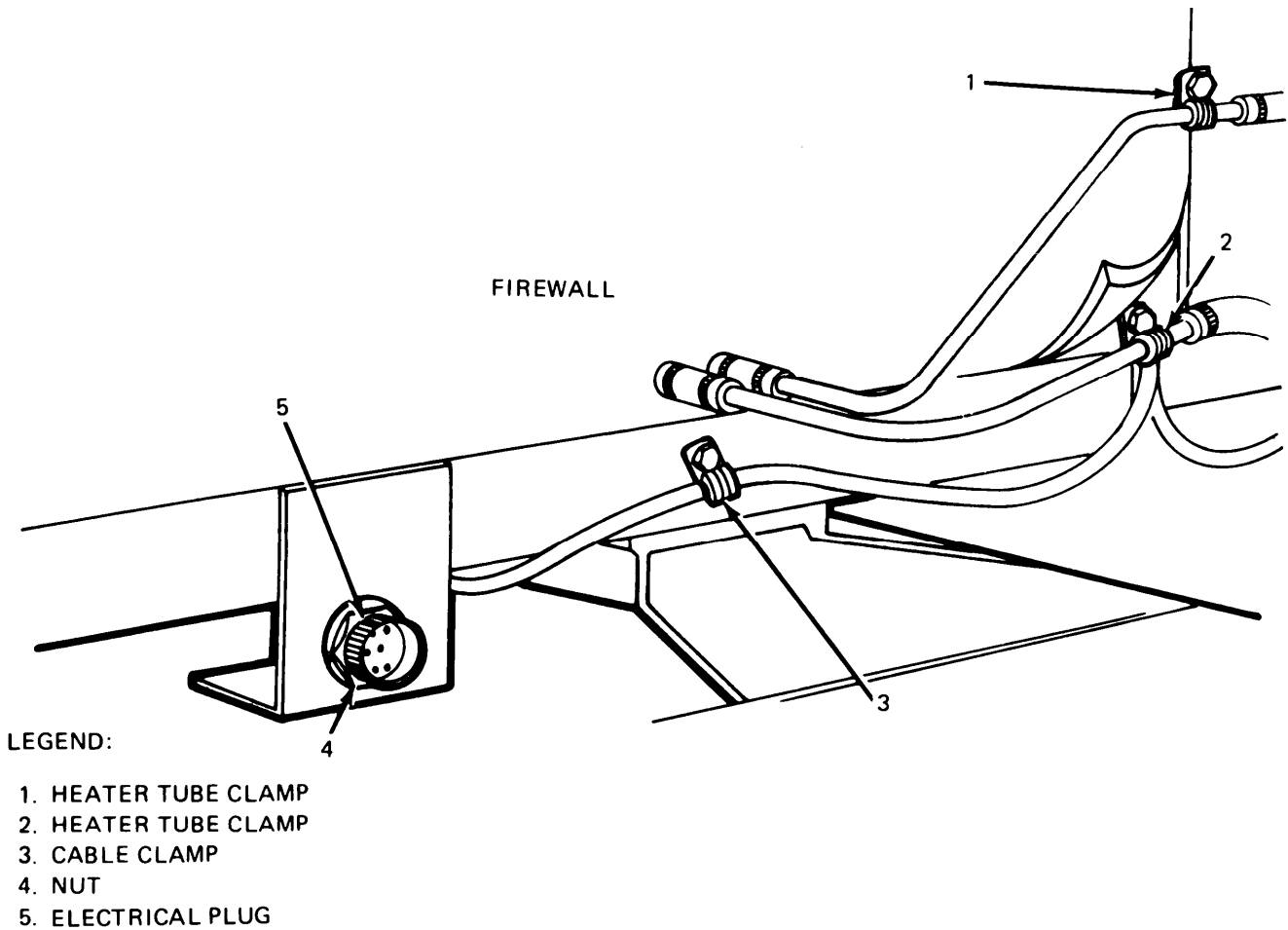
- s. Disconnect electrical plug (fig. 19-11) from right side of firewall (behind air cleaner).



TA 074441

Figure 19-11. Disconnect/Connect Electrical Plug from Firewall.

t. Disconnect, from right side of firewall, heater tube clamps (1 and 2, fig. 19-12) and electrical cable clamp (3) by removing attaching screws.



TA 074442

Figure 19-12. Disconnect/Connect Heater Tube Clamps, Cable Clamp, and Electrical Plug.

u. Remove nut (4) and disconnect electrical plug (5) from bracket.

- v. Support cab with hoist and sling arrangement as shown in figure 19-13.

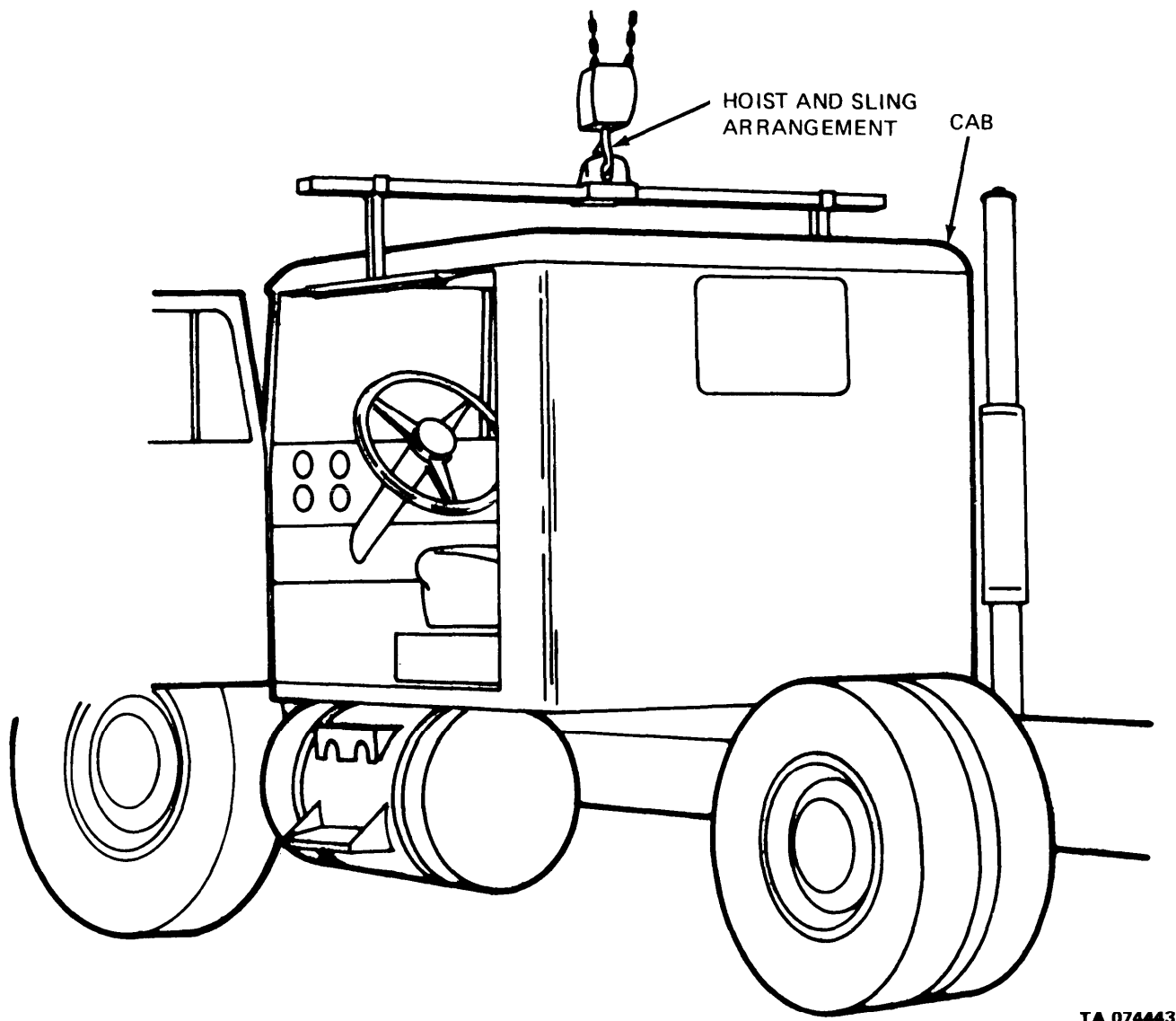
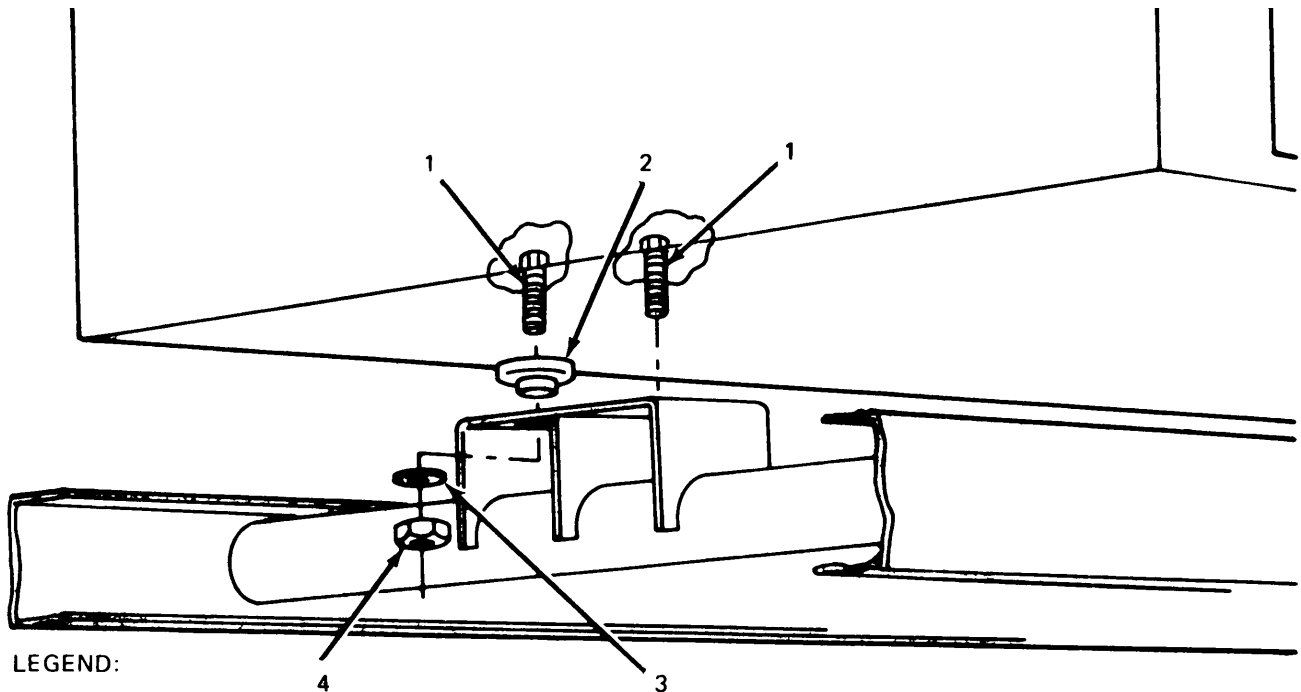


Figure 19-13. Support Cab with Hoist and Sling Arrangement.

w. Remove four capscrews (1, fig. 19-14), mounts (2), washers (3), and nuts (4). There is one of each at each front cab corner and two of each at the center rear of the cab. (Rear mount location shown.)



LEGEND:

- 1. CAPSCREW (4)
- 2. MOUNTS (4)
- 3. WASHER (4)
- 4. NUT (4)

TA 074444

Figure 19-14. Remove/Install Cab Mounts.

CAUTION

In step w, lift cab slowly and check for parts which may still be connected to cab and vehicle structure.

x. Slowly raise cab up and off of cab mount, then lower to ground carefully.

19-2. Dismantling and Reassembly. If the cab is being replaced, the existing cab can be dismantled and the new cab built-up, as necessary, by using the old cab as a guide. See also maintenance procedures in TM 9-2320-273-20 for instructions on replacing specific parts.

19-3. Installation.

- a. Inspect all four cab mounts on vehicle frame. Check for cracks or other damage. Replace, if necessary.
- b. Install four mounting capscrews (1) from inside cab (fig. 19-14).

c. Using a hoist and sling arrangement, as shown in figure 19-13, lower the cab on the four mounts (2, fig. 19-14); then secure with capscrews (1), washers (3) and nuts (4).

d. Install heater tube clamps (1 and 2, fig. 19-12) on heater tubes and secure to firewall with sheetmetal capscrews.

e. install clamp (3) on electrical cable and secure to firewall with sheetmetal screw.

f. Install electrical plug (5) and secure to bracket with nut (4).

g. Connect electrical plug (fig. 19-11) to receptacle on right side of firewall.

h. Connect compressed air lines (1 and 2, fig. 19-10) to firewall connectors.

i. Connect electrical plugs (6 and 7, fig. 19-9) to firewall connectors.

j. Connect brake system air lines (1 thru 5, fig. 19-9) to firewall connectors.

k. Install clamps (1, 2, and 3, fig. 19-8) and secure to lower left side of firewall with sheetmetal screws.

l. Install plug (5) and secure to bracket with nut (4).

m. Install receptacle bracket (fig. 19-7) and secure to left rear corner of cab with three sheetmetal screws.

n. Lower the circuit breaker panel; then connect yellow air line (1, fig. 19-6) to top of INTERAXLE DIFFERENTIAL control and red air line (2) to PARK BRAKE valve.

o. Lower the panel adjacent to WIPER control; then connect blue air line (3) to TRAILER EMERGENCY valve.

p. Connect three wires to ratio selector terminal board (fig. 19-4).

CAUTION

In step 9, make sure that holes in gasket line up with holes in ratio selector.

q. Connect umbilical cord gasket and mounting flange (fig. 19-4) to ratio selector and secure with three capscrews and washers. Tighten to 36 ± 2 lb-ft (49 ± 3 N•m) torque.

r. Install floor plate (4, fig. 19-3) with ten screws (5). *Install grommet (2) and retainer (1) with two screws (3).*

s. Connect engine retarder floor switch by installing two wires as tagged (fig. 19-2).

t. Install headlight dimmer switch (fig. 19-2) and secure to floor with two screws.

. On model M915, install spare tire support assembly (fig. 19-1) and secure to vehicle frame with four capscrews, eight washers, and four nuts. Tighten nuts to 50 lb-ft (68 N•m) torque.

v. Install spare tire (M915 only – refer to TM 9-2320-273-10).

w. Using TM 9-2320-273-20 for instructions, perform the following tasks.

(1) If removed, install tailpipe and muffler.

(2) Install lower steering column.

- (3) *Connect tachometer cable to tachograph.*
- (4) Connect speedometer cable to tachograph.
- (5) Install heater.
- (6) Install air cleaner inlet tube.
- (7) Install both front fenders.
- (8) Install radiator support rods.
- (9) Install hood.
- (10) Connect battery cables.
- (11) Fill radiator with coolant. (Refer to TM 9-2320-273-20.)
- x. Startup and operate engine. (Refer to TM 9-2320-273-1 O.) Check operation of the following.
 - (1) Compressed air and brake systems.
 - (2) All lighting systems.
 - (3) Electrical Horn.
 - (4) Steering Gear.
 - (5) All other components that were installed in replacement cab.
- y. Road test vehicle and check for cab vibration.

Section II, HOOD

19-4. Disassembly.

- a. Remove each of four hood hook brackets (fig. 19-15) by removing two screws, washers, and nuts from each.
- b. Remove each of two hood handles by removing four screws, washers, and nuts from each.
- c. Remove either side panel by removing 14 capscrews, washers, and nuts.
- d. Remove either top panel from the center panel by removing 14 capscrews, washers, and nuts; then remove capscrow and nut holding hood brace.
- e. Remove either locating pin by removing four screws, washers, and nuts.

19-5. Reassembly.

- a. Mount each locating pin on center panel and secure with four screws, washers, and nuts.
- b. Mount top panels on center panel and secure each panel with 14 capscrews, washers, and nuts.
- c. Install both hood braces and secure each with capscrow and nut.
- d. Mount side panels on top panels and secure each with 14 capscrews, washers, and nuts.
- e. Mount each hood handle on side panel and secure with four screws, washers, and nuts.
- f. Mount two hook brackets on each side panel and secure with two screws, washers and nuts.

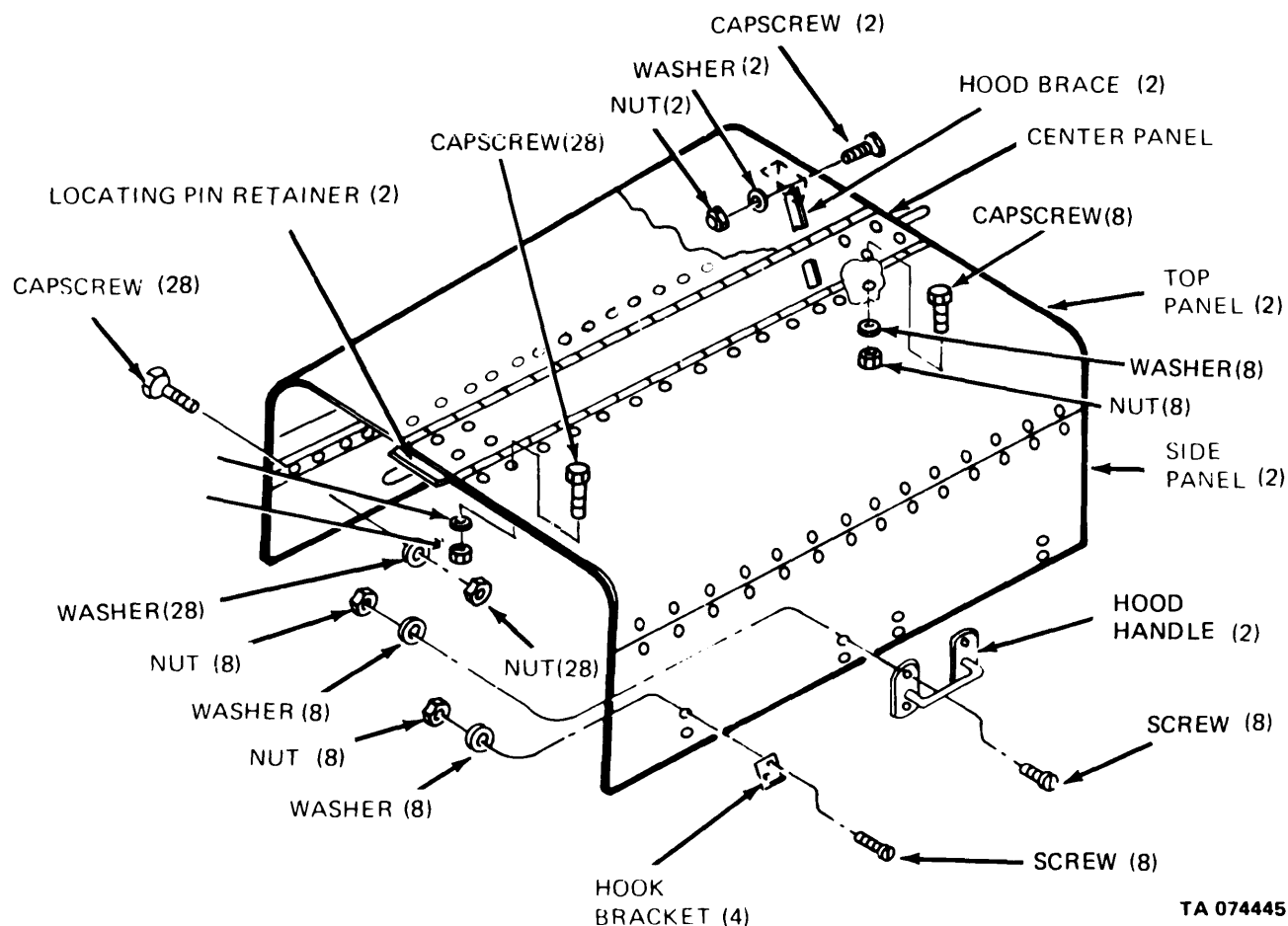


Figure 19-15. Disassemble/Assemble Hood.

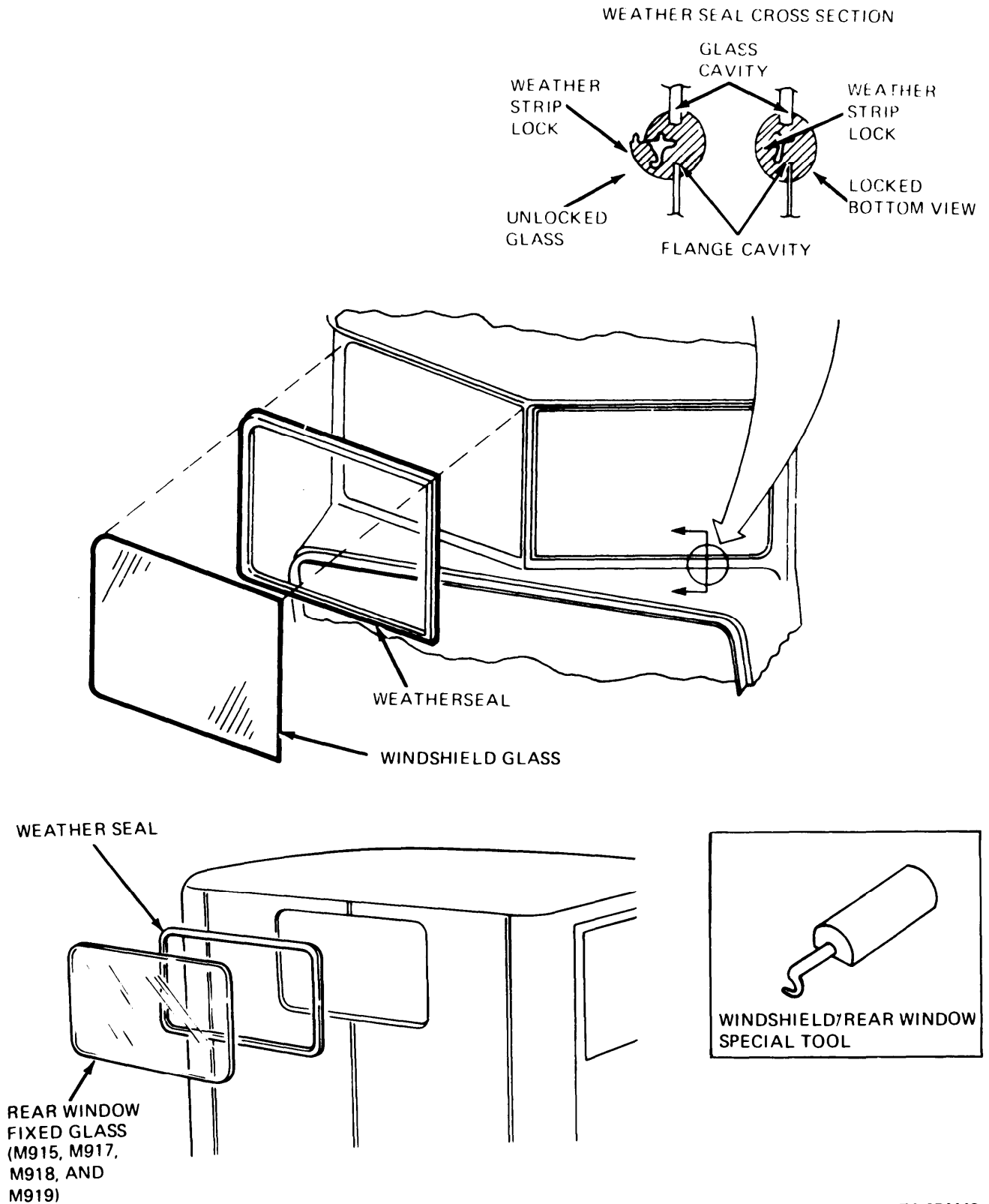
Section III. WINDSHIELD AND/OR REAR WINDOW

19-6. Removal.

- Remove windshield wiper arm. (Refer to TM 9-2320-273-20.)
- Using special tool (see insert view in fig. 19-16), break weather strip lock loose.
- Working from inside cab, push out glass.
- Inspect weather seal; replace if defective.

19-7. Installation.

- Coat the inner and outer grooves of the weather seal with a soap and water solution.
- If removed, install the weather seal to opening.
- Aline the glass with the seal.
- Install the glass into the seal using a glass installation tool.



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Figure 19-16. Replace Windshield and/or Rear Window.

19-8. Repair of Sliding Rear Window Assembly (M916 and M920.

a. Stationary Glass Removal.

- (1) Remove top and bottom outer frame filler plugs (1, fig. 19-1 7).
- (2) Remove two screws (11) from stationary end rail assembly (14) and pull glass (16) and glazing strip (15) out of outer frame (12).
- (3) Check glazing strip (15) and vinyl seal (13) for signs of cracks or damage, and replace if necessary.

b. Sliding Glass Removal.

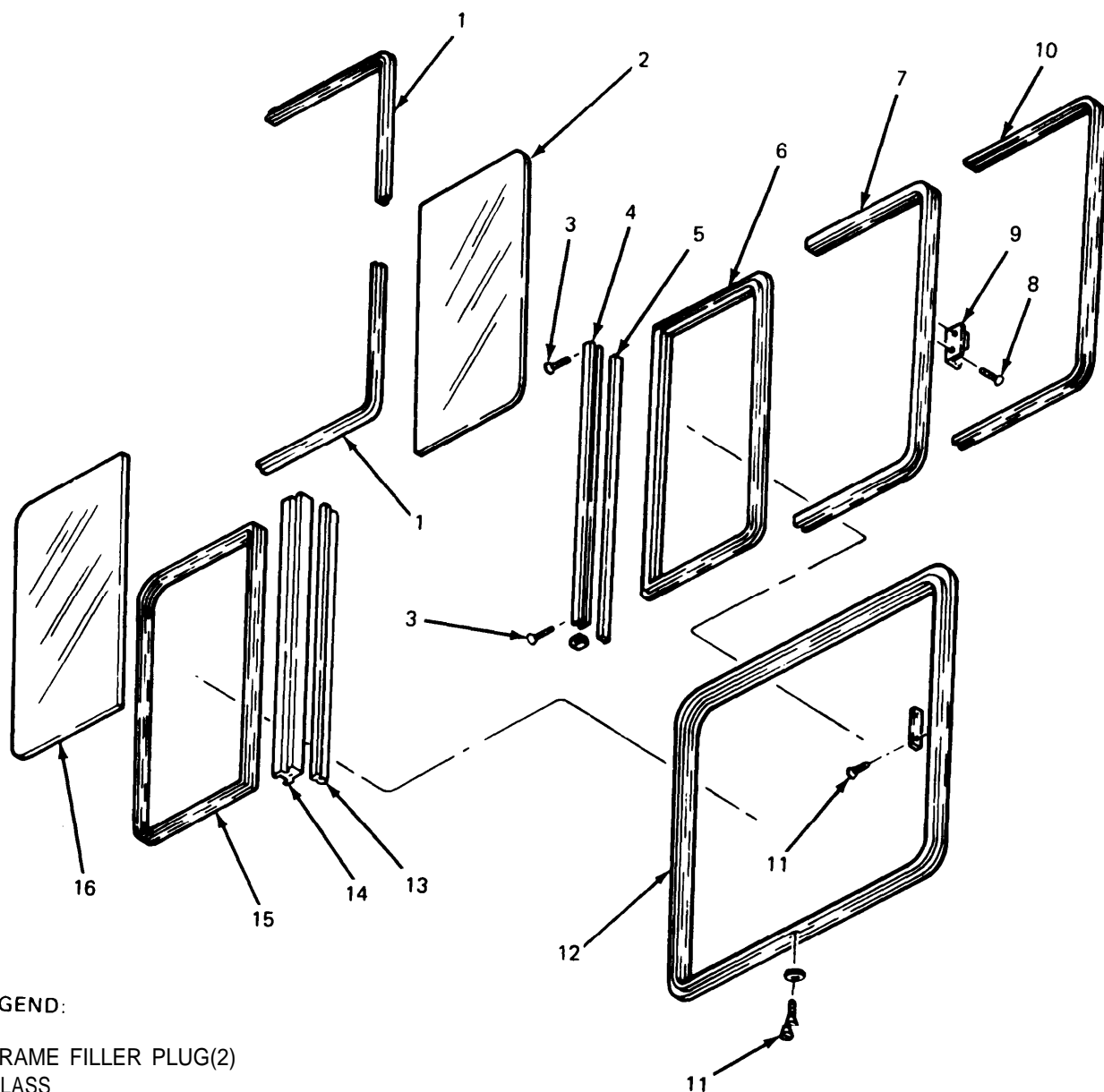
- (1) Slide glass assembly to latched position.
- (2) Remove two screws (3) from slide frame end rail (4) and remove end rail.
- (3) Pull glass (2) and glazing strip (6) out of slide frame (7).
- (4) Check glazing strip (6) and weather strip (5) for signs of cracks or damage and replace if necessary.
- (5) Replace latch assembly (9) by removing two screws (8).
- (6) Check run channel (10) for damage or deterioration and replace if necessary.

c. Stationary Glass Installation.

- (1) Slide glass (16) with glazing strip (15) attached into outer frame (12).
- (2) position stationary end rail assembly (14) in place making sure that glazing strip (15) seats properly, and secure with two screws (11).
- (3) Install top and bottom outer frame filler plugs (1) starting at stationary end rail assembly (14).

d. Sliding Glass Installation.

- (1) Slide glass (2) with glazing strip (6) attached into slide frame (7).
- (2) Position slide frame end rail (4) in place, making sure that a glazing strip (6) seats properly, and secure with two screws (3).



LEGEND:

1. FRAME FILLER PLUG(2)
2. GLASS
3. SCREW (2)
4. SLIDE FRAME END RAIL
5. WEATHER STRIP
6. GLAZING STRIP
7. SLIDE FRAME
8. SCREW (2)
9. LATCH ASSEMBLY
10. RUN CHANNEL
11. SCREW (2)
12. OUTER FRAME
13. VINYL SEAL
14. STATIONARY END RAIL
15. GLAZING STRIP
16. GLASS

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Figure 19-17. Sliding Rear Window Assembly (M916 and M920).

Section IV. SEATS

19-9. Driver's Seat Disassembly.

NOTE

For ease of disassembly of the driver's seat, it will be necessary to remove the seat assembly from the vehicle. (Refer to TM 9-2320-273 -20.) If there is ample accessibility to remove a defective component, it will not be necessary to remove the seat assembly from the vehicle.

a. Back Cushion.

(1) Remove four capscrews (18, fig. 19-18) and four lockwashers (17).

(2) Remove pan (9), cover (8), and pad (11) as an assembly.

(3) Separate cover (8), pan (9), and pad (11) by peeling the cover (8) away from the pan (9) and clips (10).

b. Seat Cushion.

(1) Remove four nuts (21), four lockwashers (22), and four washers (23).

(2) Remove cover and pad (14) and pan (12) as an assembly.

(3) Separate the cover and pad (14) from the pan (12) by peeling the cover away from the pan and clips (13).

c. Frame and Related Components.

NOTE

Complete steps *a* and *b* before attempting step *c*.

(1) Remove side panel (20).

(2) Remove lubrication fitting (19), if necessary,

(3) Remove retainer (16), bearing (15) and position indicator (68).

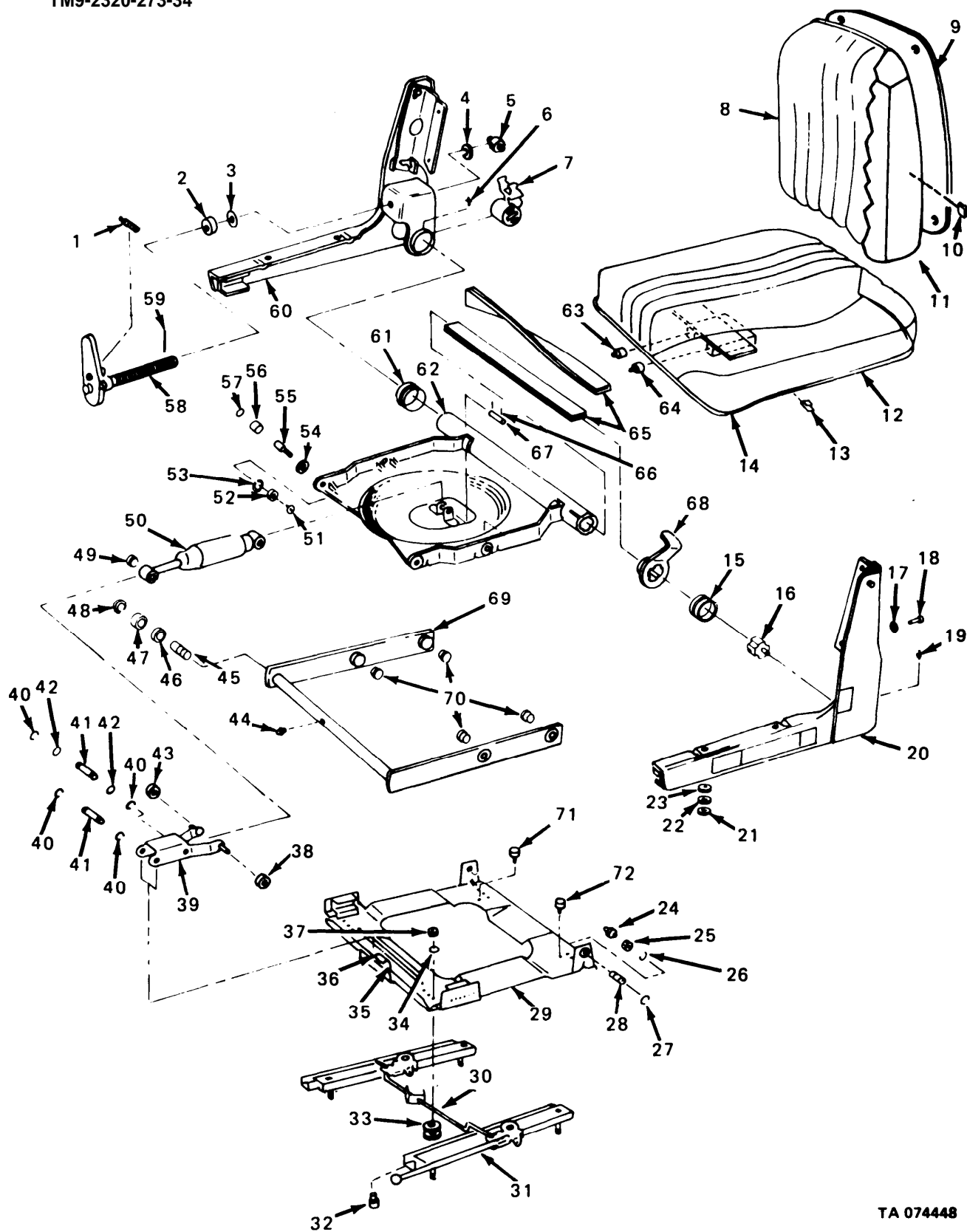
(4) Remove drive pin (59).

(5) Remove adjusting screw (58) by rotating counterclockwise. If necessary spring (1) may be removed from adjusting screw (58).

(6) Remove bearing (2), washer (3), washer (4), and adjuster pin (5).

(7) *Tap side panel (60) off of tube.* Remove lubrication fitting (6), if necessary.

- (8) Remove yoke (7) and bearing (61).
- (9) Remove torsion bars (65).
- (10) Remove rollers (38) and (43) from shock lever (39).
- (11) Drive out two roll pins (66) and remove shaft (67).
- (12) Remove two snap rings (40), washers (42), and hinge shaft (41) that retains the lower end of the shock absorber (50) and remove the shock absorber. Remove four bearings (49) from shock absorber.
- (13) Remove snap rings (40) and hinge shaft (41) and remove shock lever (39).
- (14) If necessary, two bumpers (63) and (64) may be removed from the underside of pan (12).
- (15) Remove two snap rings (48), roller and bearing assemblies (47), washers (46), and pins (45) from outer lower assembly (69).
- (16) Remove four lubrication fittings (24).
- (17) Remove four nuts (25), lockwashers (26), studs (28), and snap rings (27).
- (18) Separate outer lever (69) from center lever (62).
- (19) If necessary, remove lubrication fitting (44).
- (20) Remove four bearings (70).
- (21) If necessary, remove bumpers (71) and (72).
- (22) Separate center lever (62) from base (29).
- (23) Remove two lubrication fittings (51).
- (24) Remove two nuts (52), lockwashers (53), washers (54), studs (55), roller and bearing (56), and snap rings (57).
- (25) Remove four capscrews (32), eight washers (33), four lockwashers (34), and four nuts (37).
- (26) Separate base (29) from slide rails (31).
- (27) Latch wire (30) may be removed from slide rails (31), if necessary.
- (28) Remove two bearings (35) and (36) from base (29).
- d. *Inspection.* Inspect all bearings and rollers for defects. Inspect shock absorber for wear and signs of leakage. Replace all components found defective.



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Figure 19-18. Driver's Seat — Exploded View. (Sheet 1 of 2)

LEGEND:

- | | |
|-----------------------------|-------------------------------------|
| 1. SPRING | 37. NUT (4) |
| 2. BEARING | 38. ROLLER |
| 3. WASHER | 39. SHOCK LEVER |
| 4. WASHER | 40. SNAP RING (4) |
| 5. ADJUSTER PIN | 41. HINGE SHAFT (2) |
| 6. LUBRICATION FITTING | 42. WASHER (2) |
| 7. YOKE | 43. ROLLER |
| 8. COVER | 44. LUBRICATION FITTING |
| 9. PAN | 45. PIN (2) |
| 10. CLIP | 46. WASHER (2) |
| 11. PAD | 47. ROLLER AND BEARING ASSEMBLY (2) |
| 12. PAN | 48. SNAP RING (2) |
| 13. CLIP (6) | 49. BEARING (4) |
| 14. COVER AND PAD | 50. SHOCK ABSORBER |
| 15. BEARING | 51. LUBRICATION FITTING (2) |
| 16. RETAINER | 52. NUT (2) |
| 17. LOCKWASHER (4) | 53. LOCKWASHER (2) |
| 18. CAPSCREW (4) | 54. WASHER (2) |
| 19. LUBRICATION FITTING | 55. STUD (2) |
| 20. SIDE PANEL | 56. ROLLER AND BEARING (2) |
| 21. NUT (4) | 57. SNAP RING (2) |
| 22. LOCKWASHER (4) | 58. ADJUSTING SCREW |
| 23. WASHER (4) | 59. DRIVE PIN |
| 24. LUBRICATION FITTING (4) | 60. SIDE PANEL, RH |
| 25. NUT (4) | 61. BEARING |
| 26. LOCKWASHER (4) | 62. CENTER LEVER |
| 27. SNAPRING (4) | 63. BUMPER |
| 28. STUD (4) | 64. BUMPER |
| 29. BASE | 65. TORSION BAR (2) |
| 30. LATCH WIRE | 66. ROLL PIN (2) |
| 31. SLIDE RAILS | 67. SHAFT |
| 32. CAPSCREW (4) | 68. POSITION INDICATOR |
| 33. WASHER (8) | 69. OUTER LEVER ASSEMBLY |
| 34. LOCKWASHER (4) | 70. BEARING (4) |
| 35. BEARING | 71. BUMPER |
| 36. BEARING | 72. BUMPER |

Figure 19-18 Driver's Seat – Exploded View (Sheet 2 of 2).

19-10. Driver's Seat Assembly.

a. Frame and Related Components.

- (1) Press two bearings (35) and (36) into base (29).
- (2) If removed, install latch wire (30) between slide rails (31).
- (3) Position base (29) on slide rails (31).
- (4) Install four capscrews (32), eight washers (33), four lockwashers (34), and four nuts (37) to secure base (29) to slide rails (31). Tighten nuts securely.
- (5) install two snap rings (57) on studs (55).
- (6) Install two roller bearings (56) and washers (54) over studs (55).
- (7) Install stud (55) in center lever (62) and secure with two lockwashers (53) and nuts (52).
- (8) Install two lubrication fittings (51).
- (9) If removed, install two bumpers (71) and (72) in base (29).
- (10) Position center lever (62) to base (29).
- (11) Install four bearings (70).
- (12) If removed, install lubrication fitting (44).
- (13) Position outer lever (69) to center lever (62) and secure with four studs (28), snap rings (27), lockwashers (26), and nuts (25).
- (14) Install four lubrication fittings (24).
- (15) Install two pins (45), washers (46), roller and bearing assemblies (47) and snap rings (48) to outer lever assembly (69).
- (16) If removed, install two bumpers (63) and (64) to the underside of pan (12).
- (17) position shock lever (39) into position on base (29) and secure with one hinge shaft (41) and two snap rings (40).
- (18) install four bearings (49) in shock absorber (50).
- (19) position shock absorber (50) in shock lever (39) and secure with one hinge shaft (41), two washers (42) and two snap rings (40).
- (20) Position shock absorber (50) in center lever (62) and secure with shaft (67). Stake shaft (67) with two roll pins (66).

(21) Install two rollers (38) and (43) in shock lever (39).

(22) Install torsion bars (65).

(23) If removed, install lubrication fitting (6).

(24) Install bearing (61) and yoke (7).

(25) Tap side panel (60) on tube.

(26) If removed, install spring (1) to adjusting screw (58).

(27) Install adjusting screw (58), bearing (2), washer (3), washer (4), and adjusting pin (5).
Stake adjusting screw (58) with drive pin (59).

(28) position indicator (68), bearing (15), and retainer (16) into place.

(29) position side panel (20) into place. Install lubrication fitting (19) if removed.

b. Seat Cushion.

(1) Install clips (13) on pan (12).

(2) Install cover and pad (14) over pan (12) securing it with six clips (13).

(3) Set seat cushion assembly into place and secure with four washers (23), lockwashers (22) and nuts (21).

c. Back Cushion.

(1) Install cover (8) over pad (11).

(2) Install six clips (10) on pan (9).

(3) Install cover (8) and pad (11) over pan (9) securing with clips (10).

(4) Set the back cushion assembly into place and secure with four lockwashers (17) and capscrews (18).

19-11. Companion Seat Disassembly.

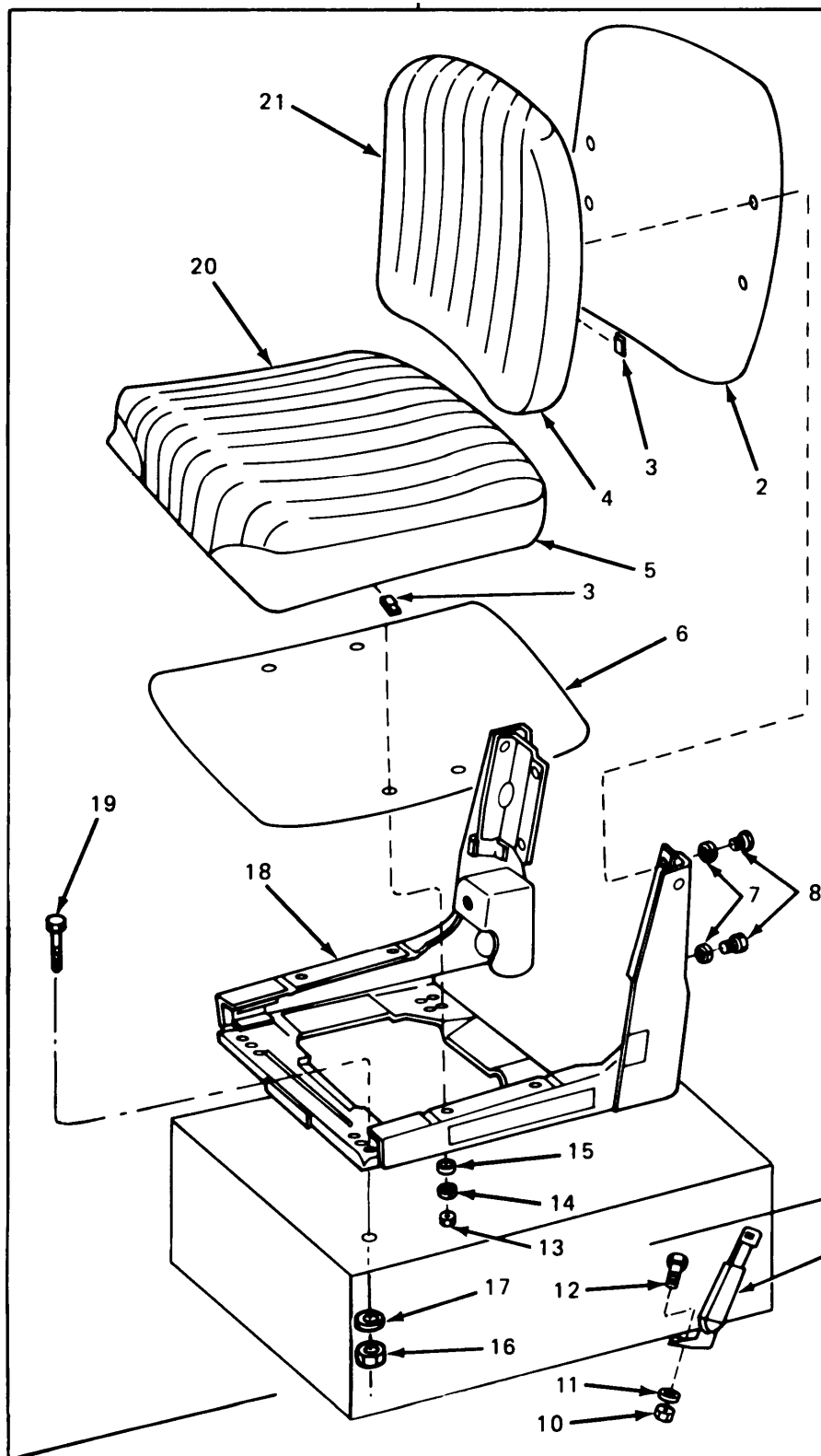
- a. Remove companion seat assembly (1) from seat riser box by removing four nuts (16) and four washers (17) and four bolts (19) inside seat riser box.
- b. Remove back cushion (4) and pan (2) by removing four capscrews (8) and four lockwashers (7) from back of frame (18).
- c. Remove back cover (21) if necessary by removing six fastener clips (3) from pan.(2).
- d. Remove seat cushion (5) and pan (6) by removing four nuts (13) and four lockwashers (14) and four washers (15) from frame (18).
- e. Remove seat cover (20) if necessary by removing six fastener clips (3) from pan (6).

19-12. Seat Belt Disassembly. Remove seat belt assembly (9) by removing two bolts (12), two lockwashers (11), and two nuts (10) from floor bracket.

19-13. Reassembly of Companion Seat.

- a. Install seat cover (20) by attaching six fastener clips (3) to pan (6).
- b. Install seat cushion (5) and pan (6) to frame (18) by attaching four nuts (13) and four lockwashers (14) and four washers (15) to frame (18).
- c. Install back cover (21) by attaching six fastener clips (3) to pan (2).
- d. Install back cushion (4) and pan (2) by attaching four capscrews (8) and four lockwashers (7) to frame (18).
- e. Install companion seat assembly (1) to seat riser box by attaching four bolts (19), four washers (17) and four nuts (10).

19-14. Reassembly of Seat Belt. Install seat belt assembly (9) by attaching two bolts (12), lockwashers (11) and nuts (10) to floor bracket.



LEGEND:

1. COMPANION SEAT ASSEMBLY
2. BACK PAN
3. FASTENER CLIP (12)
4. BACK CUSHION
5. SEAT CUSHION
6. SEAT PAN
7. LOCKWASHER (4)
8. CAPSCREW (4)
9. SEAT BELT ASSEMBLY
10. NUT (2)
11. LOCKWASHER (2)
12. BOLT (2)
13. NUT (4)
14. LOCKWASHER (4)
15. WASHER (4)
16. NUT (4)
17. WASHER (4)
18. FRAME
19. BOLT (4)
20. SEAT COVER
21. BACK COVER

Figure 19-19. Companion Seat-Exploded View.

TA 075221

Section V. DOORS AND WINDOWS

19-15. Disassembly.

a. Using retainer pliers remove clip that secures crank handle (fig. 19-20) to cranking mechanism and pull off the crank handle.

b. Remove ash receptacle on driver's door only, by removing two screws.

Remove three screws and washers that fasten door check strap assembly and twelve screws that fasten hinge.

d. Remove 21 screws that fasten inner door panel to frame and lift off the panel.

e. Remove four screws that fasten upper door latch to door frame.

f. Disconnect latch rod (fig. 19-20, sheet 2) from upper door latch; then remove the upper door latch.

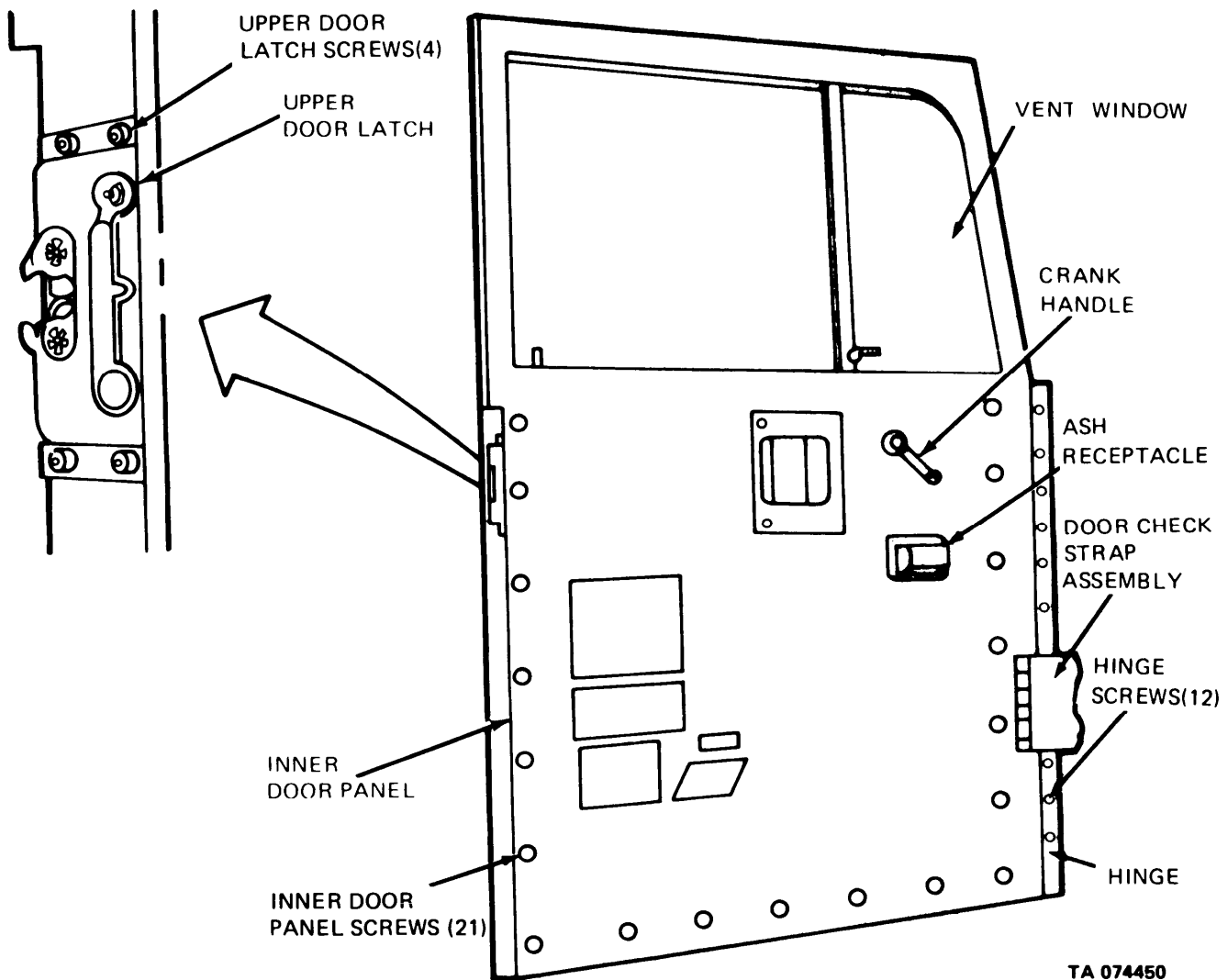
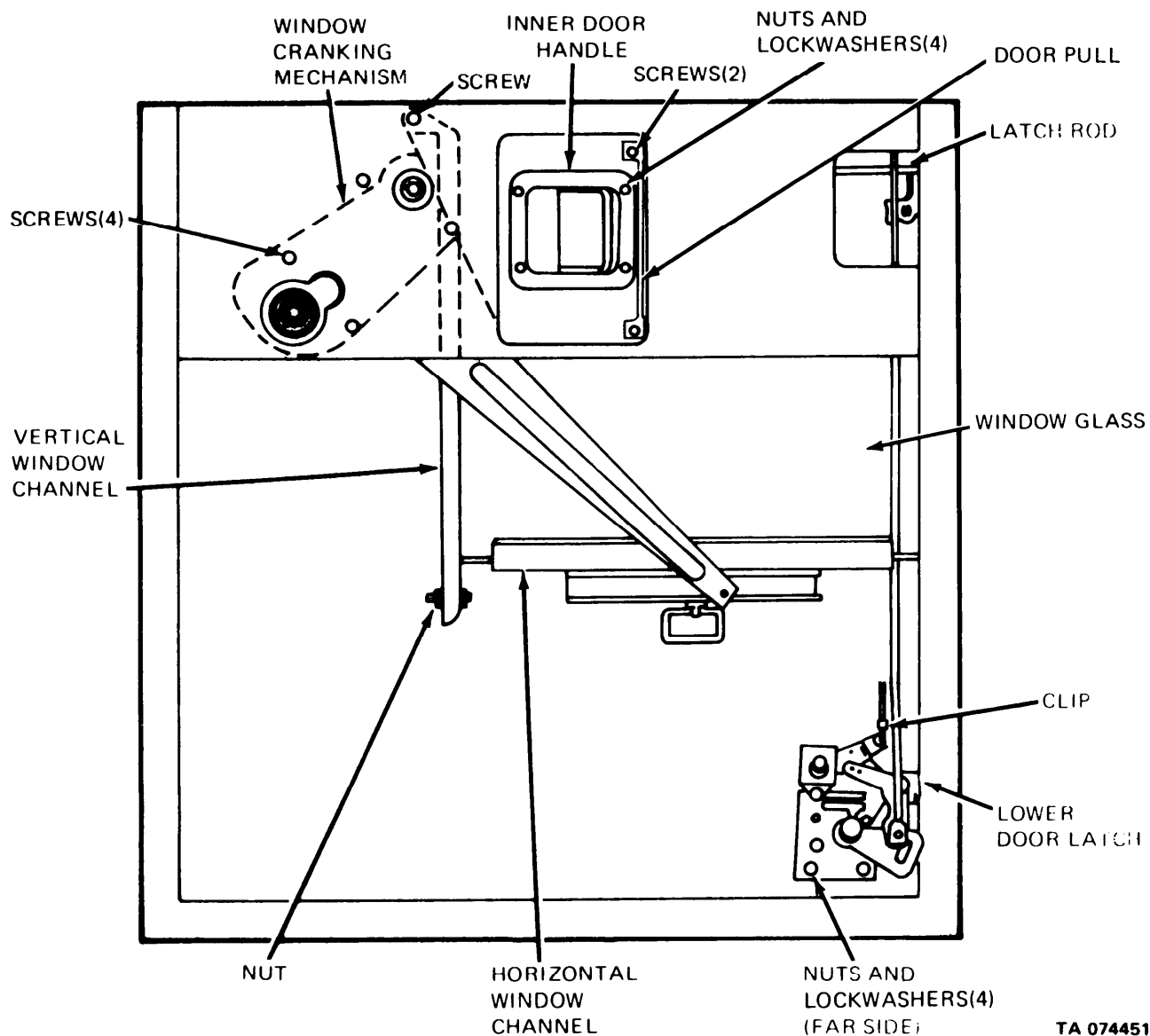


Figure 19-20. Disassemble/Assemble Door (Sheet 1 of 2).



TA 074451

Figure 19-20. Disassemble/Assemble Door (Sheet 2 of 2).

CAUTION

In step e, hold the bottom of glass to prevent it from falling out.

- g. Remove nut at base of vertical window channel and a screw at top of the channel; then pull out the channel.
- h. Slide glass out from bottom of door.
- i. Remove four nuts and lockwashers that fasten inner door handle to door panel and pull out the inner door handle. Remove two screws from inner door pull, if desired.
- j. Remove four screws that fasten window cranking mechanism to door panel and remove the mechanism.
- k. Remove lower door latch by removing clip from rod; then remove four nuts and lockwashers that fasten the latch to the door frame. Pull out the door latch.
- l. Remove vent window (fig. 19-21) by pulling the rubber seal out to gain access to the fastening screws. Remove the fastening screws; then take out the complete vent window and frame.

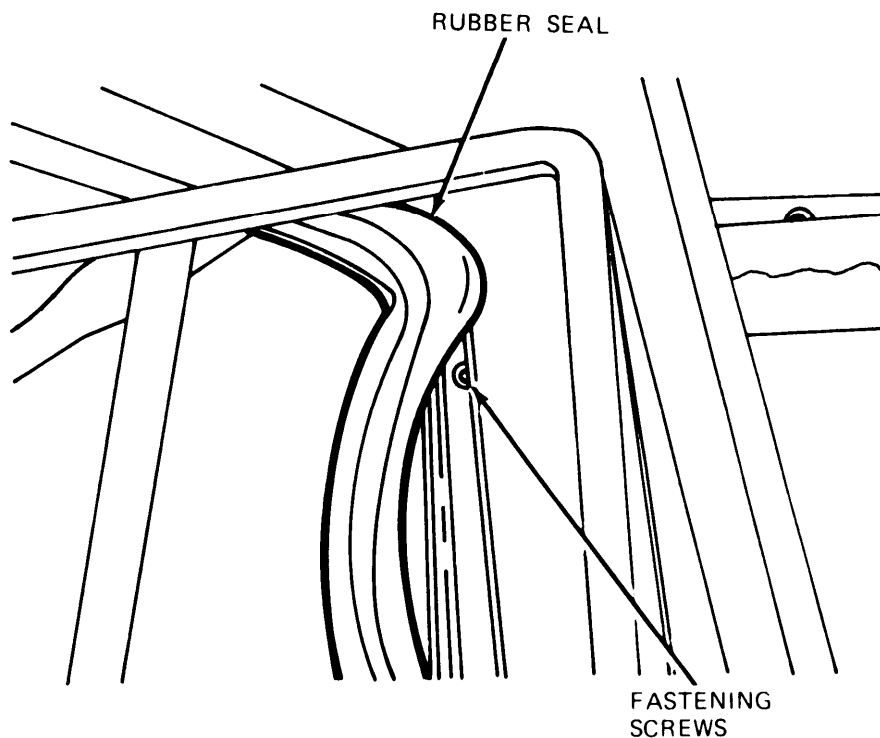


Figure 19-21. Remove/Install Vent Window.

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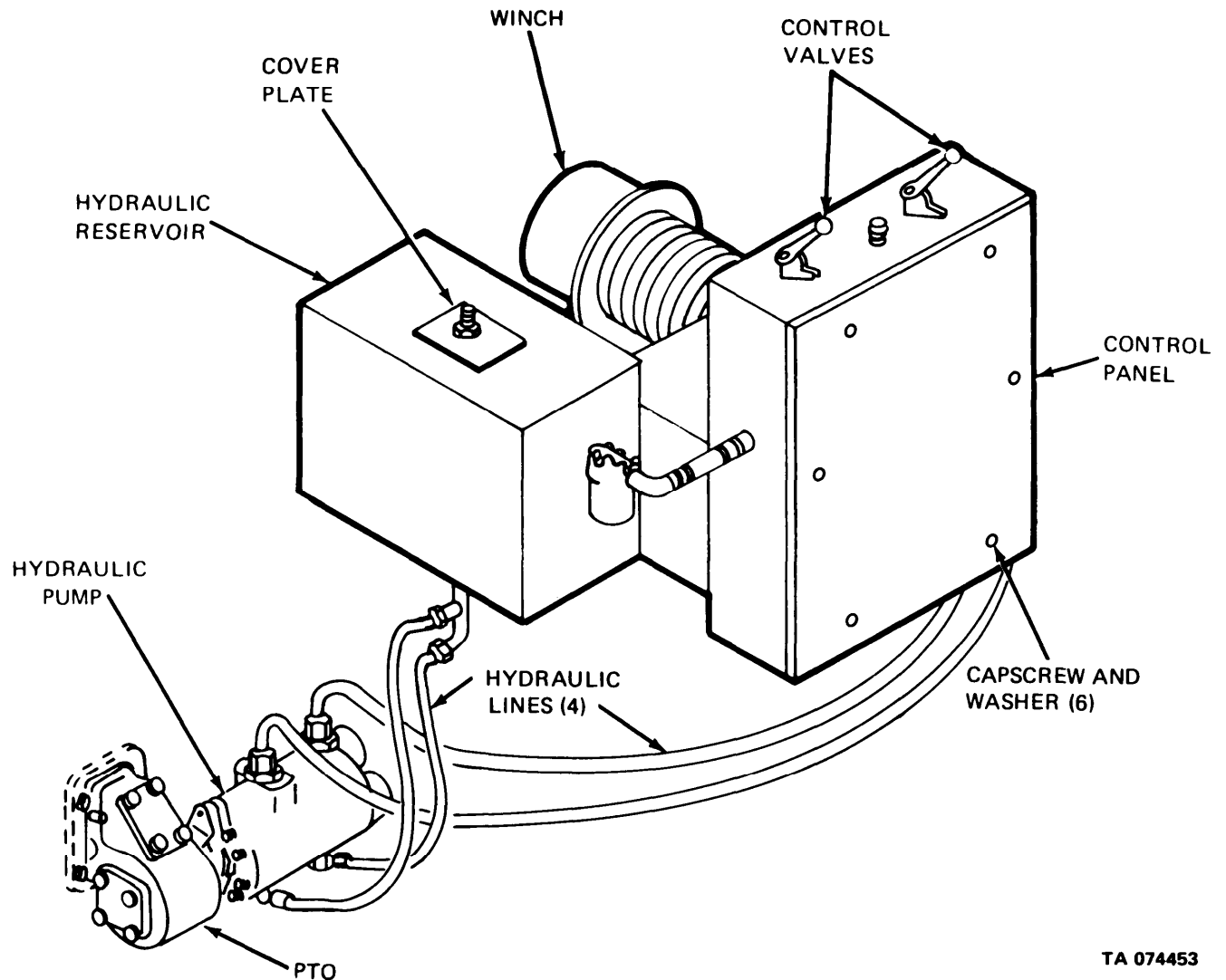
19-16. Assembly.

- a. Inspect vent window rubber seal (fig. 19-21),replace if defective.
- b. Position vent window and frame in door and secure with fastening screws.
- c. Install lower door latch (fig. 79-20, sheet 2) in door and secure with four nuts and lock-washers. Attach upper rod to latch and secure with clip.
- d. Mount windows cranking mechanism in door and secure with four screws.
- e. Install inner door handle in door and secure with four lockwashers and nuts. Install door pull with two screws, if removed.
- f. Slide window glass up into window channel.
- g. Install vertical window channel with nut at base and screw at top.
- h. Install upper door latch and connect latch rod. Secure door latch to door with four screws (fig. 79-20, sheet 1).
- i. Check operation of door latches and window cranking mechanism.
- j. Install inner door panel with twenty-one screws.
- k. Install door check strap assembly with three screws and washers.
- l. Install hinge with twelve screws.
- m. Install ash receptacle with two screws.
- n. Install crank handle with clip using retainer pliers.

CHAPTER 20

REPAIR OF WINCH ASSEMBLY

20-1. Description. The winch assembly, which is used only on models M916 and M920, is described in TM 9-2320-273-20. The hydraulic pump (fig. 20-1) is considered part of the winch assembly on models M916 and M920. Service procedures for the pump are included in this chapter.



TA 074453

Figure 20-1. Winch Assembly.

20-2. Winch Assembly Removal. To remove the winch assembly as a unit (less the hydraulic pump) follow the procedures as outlined.

a. Preparation.

- (1) Remove spare tire (M916 only).
- (2) Remove spare tire hoist (M916 only).
- (3) Drain oil from hydraulic reservoir (approximately 42 gal) as follows:
 - (a) Loosen nut and slide cover plate on top of hydraulic reservoir to one side.
 - (b) Using a suction pump, pump oil from reservoir into a suitable drum.

(4) Disconnect all four lines at hydraulic pump (fig. 20-1) and continue draining the oil (approximately one gallon). After draining, reconnect the lines.

b. Removal.

- (1) Disconnect two hydraulic lines at base of hydraulic reservoir (fig. 20-1).
- (2) Disconnect trailer receptacle bracket (fig. 20-2) by removing three capscrews, washers, and nuts.

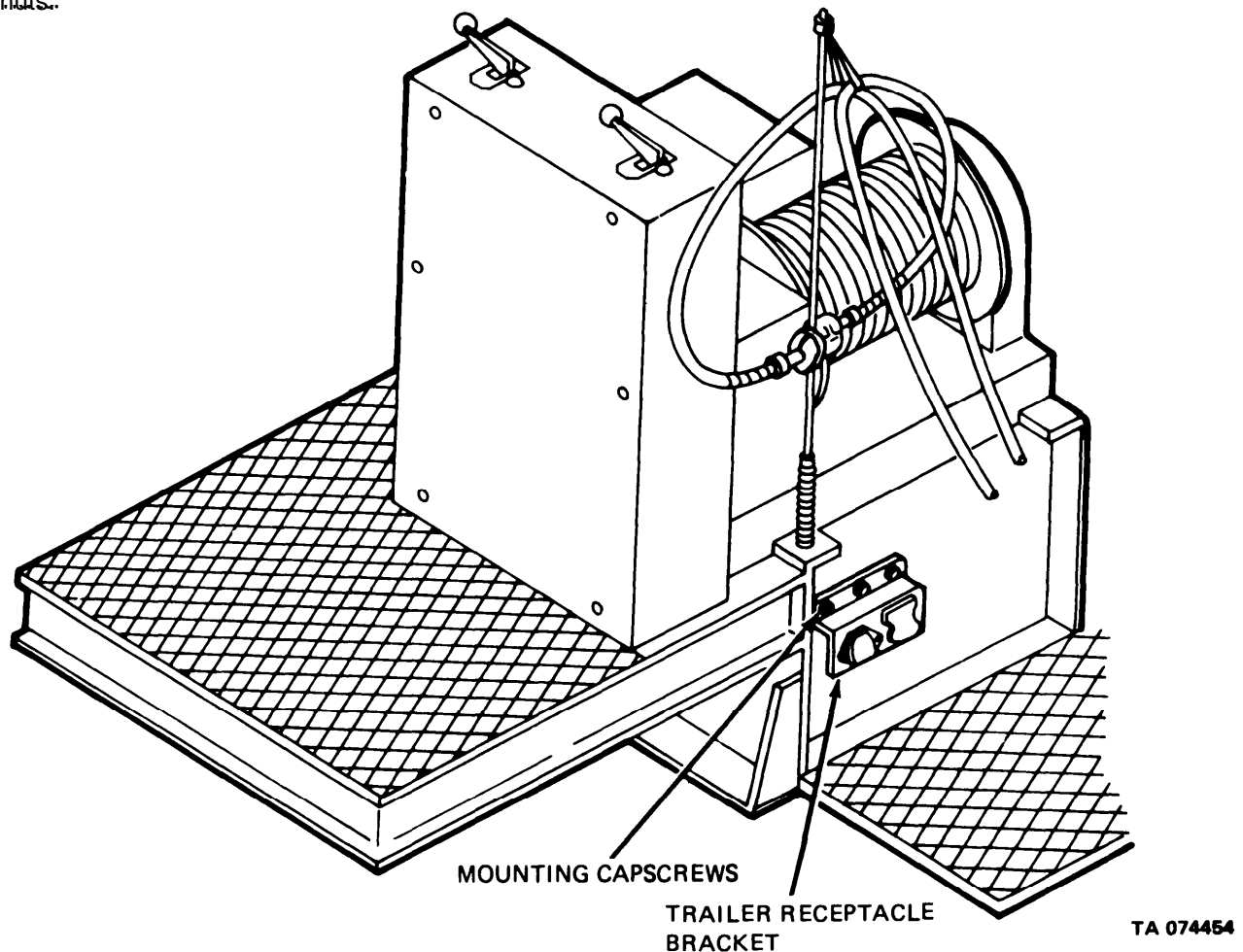


Figure 20-2. Disconnect Trailer Receptacle Mounting Bracket.

(3) Remove air lines (fig. 20-3) from pogo stick straps.

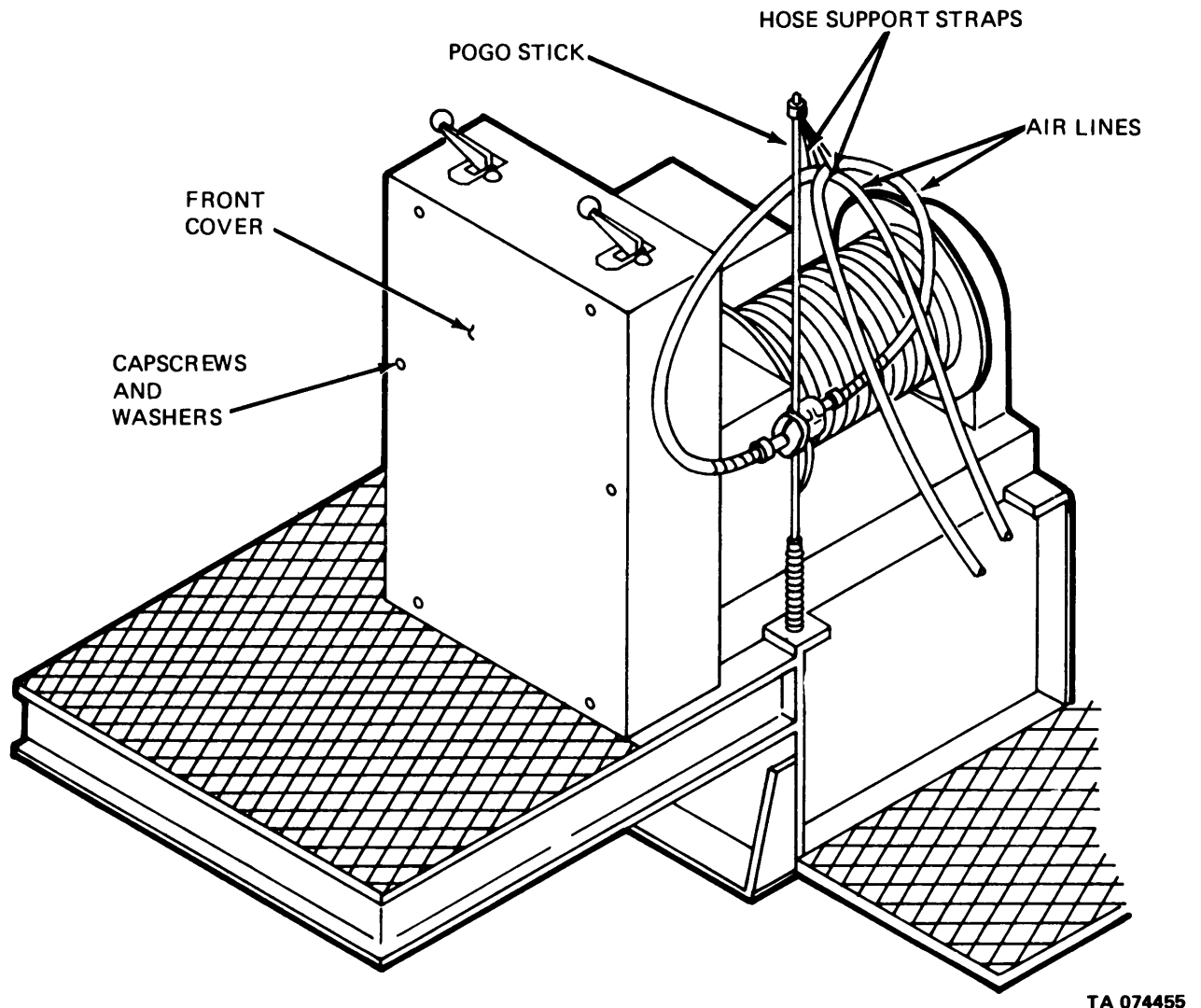


Figure 20-3. Remove/Install Air Lines on Pogo Stick.

(4) Remove front cover from control panel by removing attaching screws and washers; then disconnect two inlet pressure hydraulic lines (1, fig. 20-4) and (2).

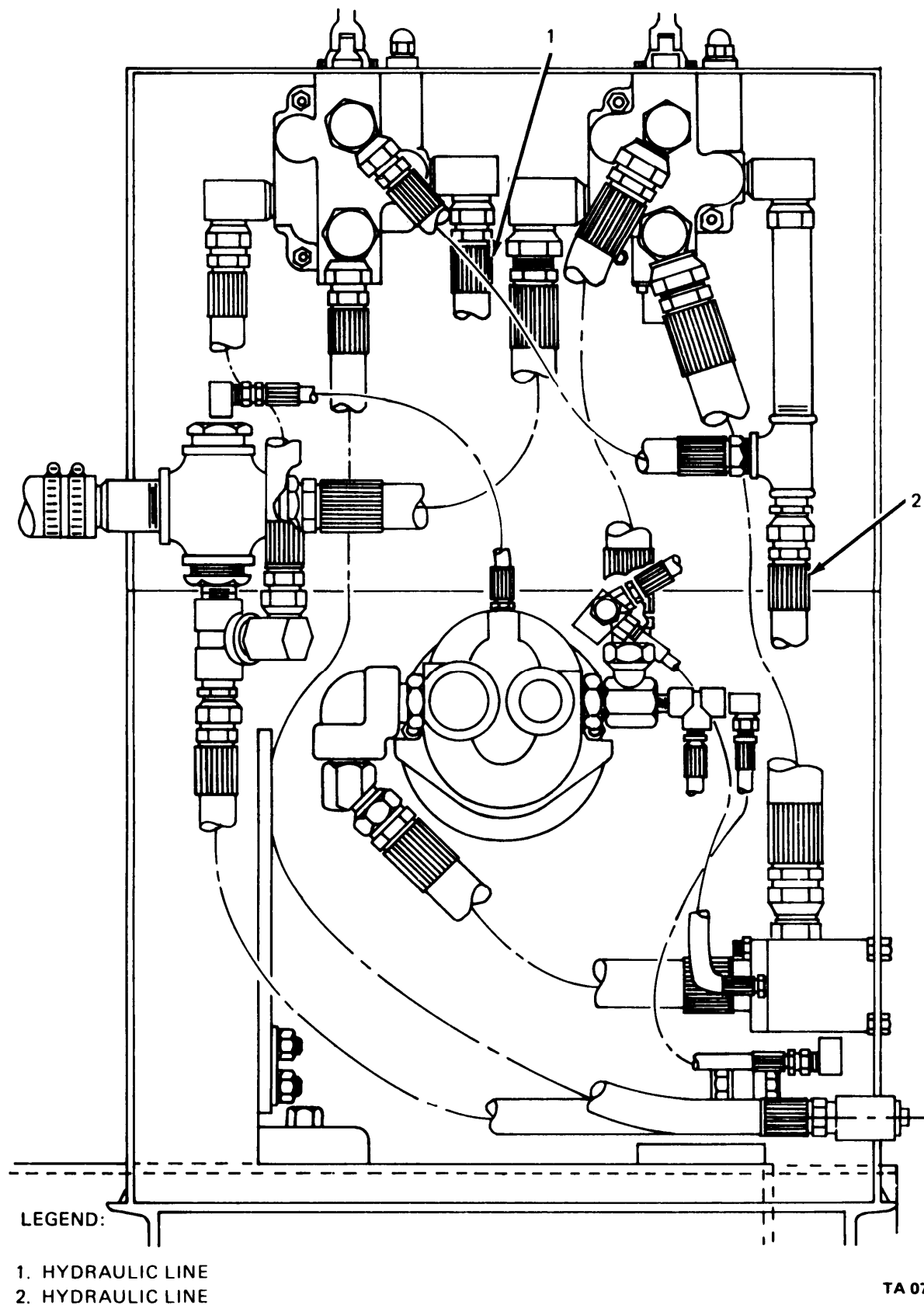
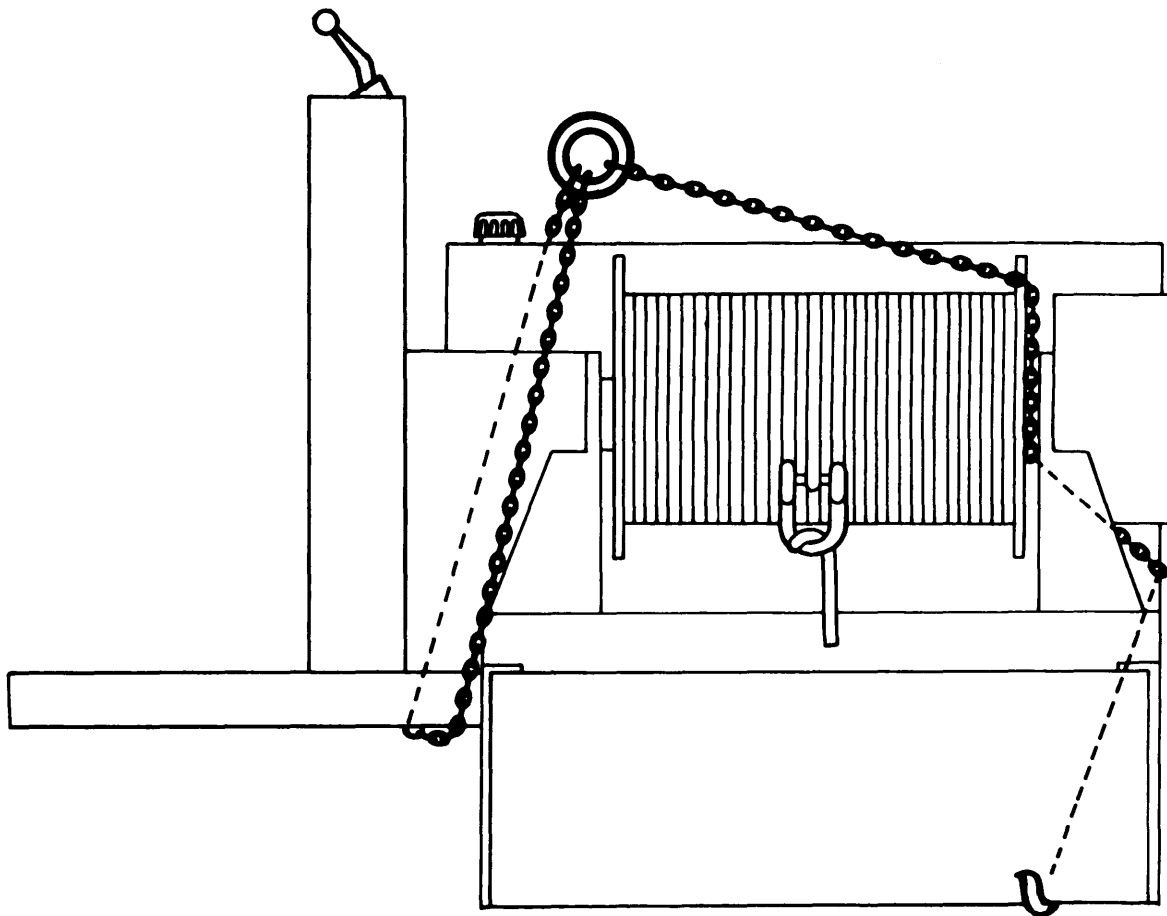


Figure 20-4. Disconnect/Connect Inlet Pressure Lines.

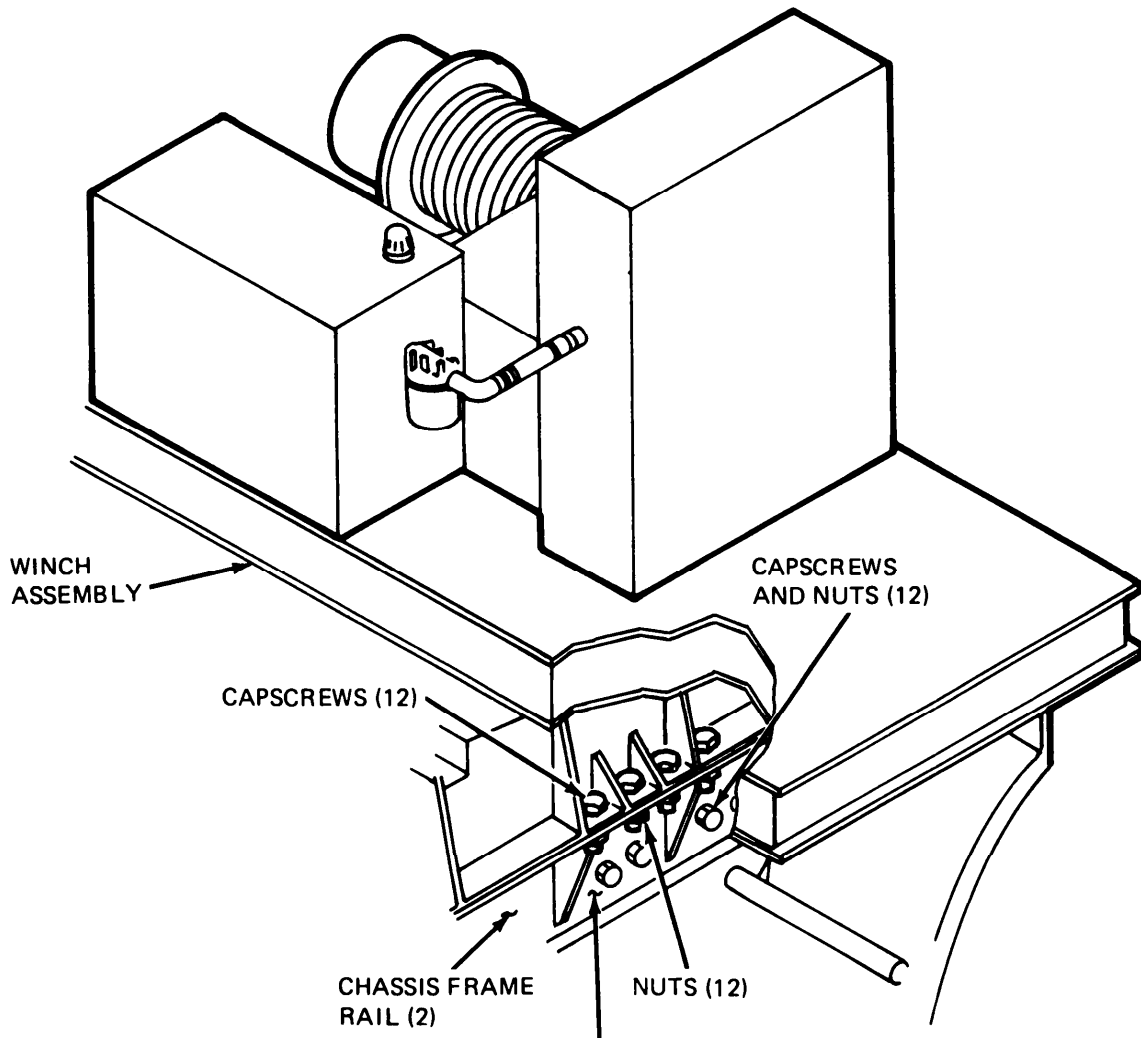
- (5) Attach a sling and hoist (fig. 20-5) to support winch assembly.



TA 074457

Figure 20-5. Attach Sling and Hoist to Winch Assembly.

(6) Remove 12 capscrews and nuts (six on each side of the vehicle) that fasten winch assembly to winch frame support channel (fig. 20-6).



TA 074458

Figure 20-6. Remove/install Winch Assembly Attaching Parts.

WARNING

In step (7), lift slowly and make sure assembly is balanced on the sling.

(7) Carefully lift assembly off of vehicle.

(8) If needed, the two winch frame support channels can be removed from the two chassis frame rails by removing six capscrews and nuts from each side.

20-3. Winch Removal and Disassembly. When only maintenance on the winch (fig. 20-7) is required it is not necessary to remove the winch assembly from the vehicle. Perform preparation requirements (para 20-2a) and proceed with the following steps.

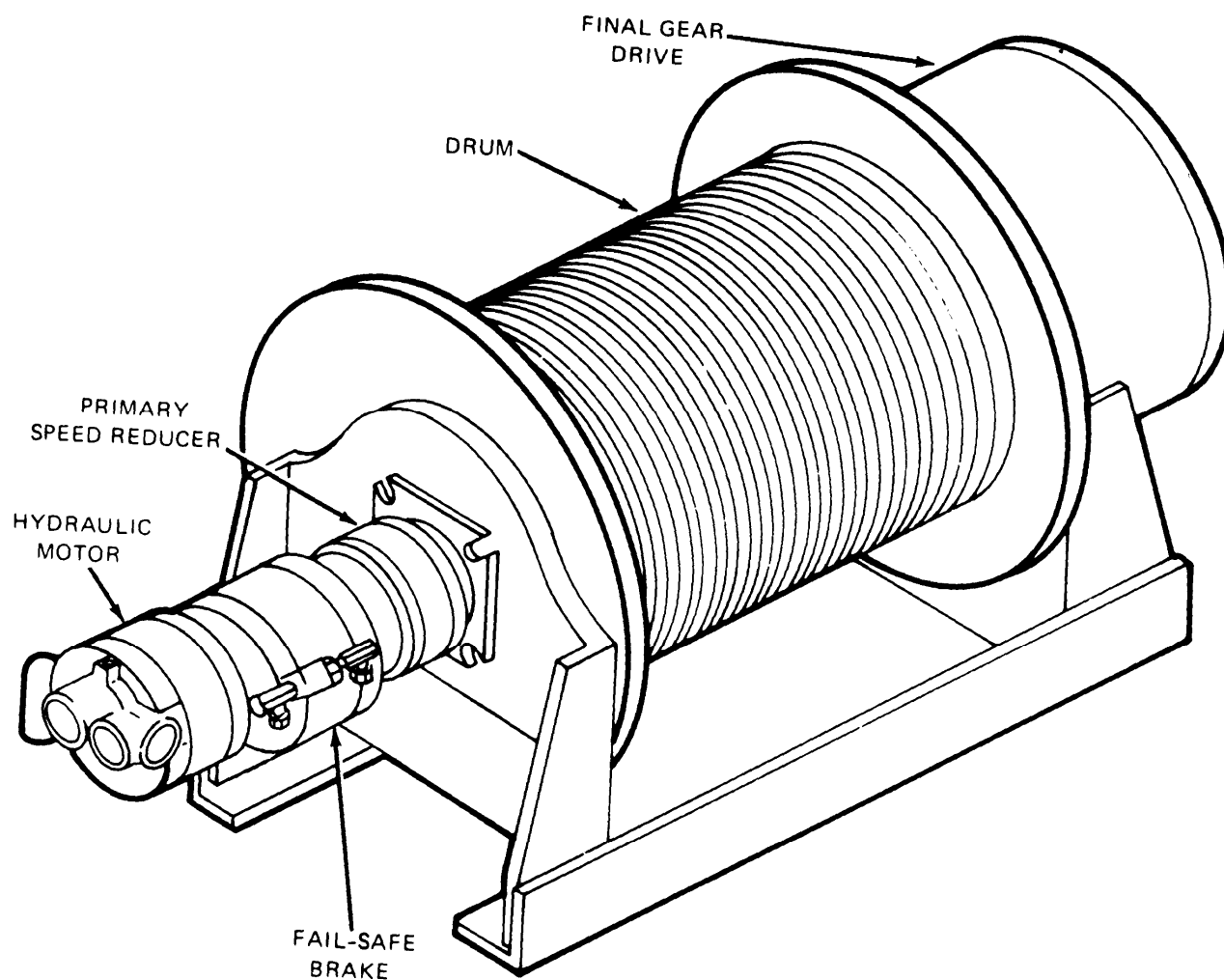


Figure 20-7. Major Components of Winch.

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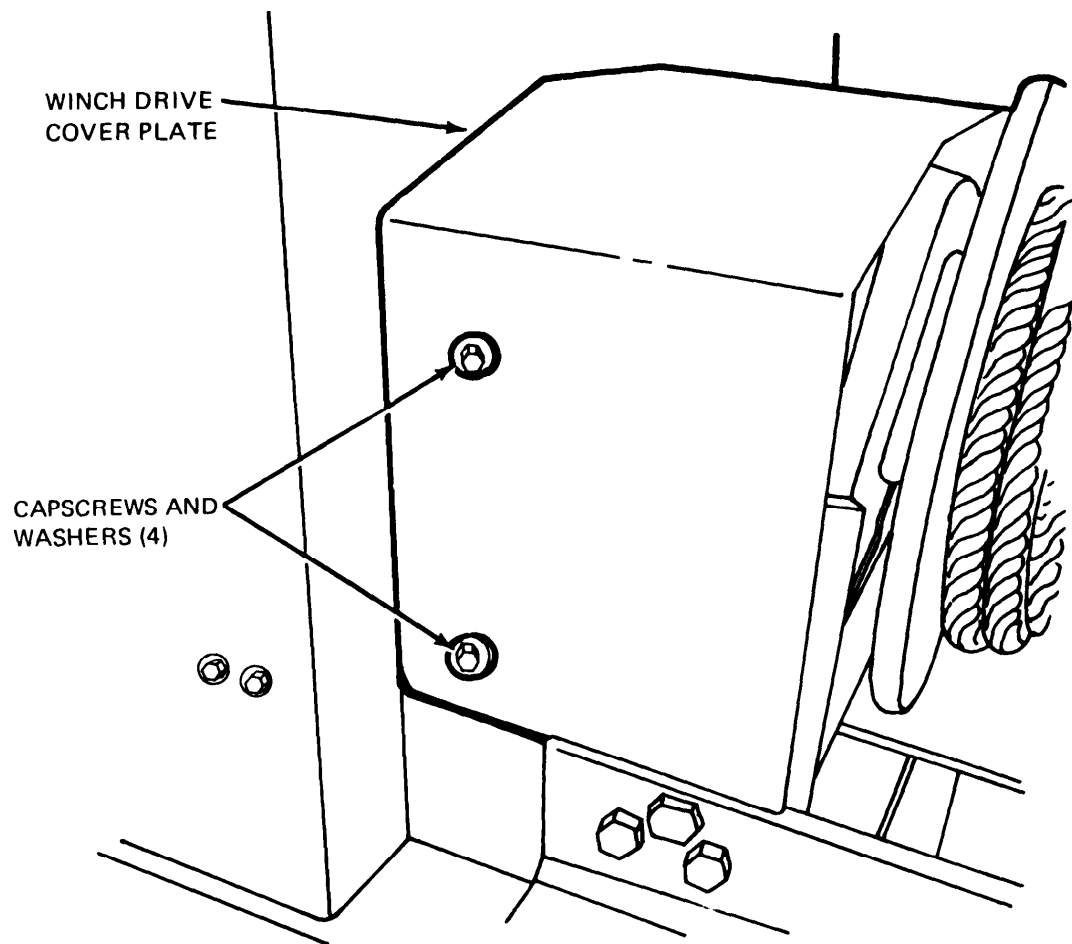
NOTE

If winch is operable, it may be desirable to remove cable before maintenance is performed.

a. *Removal.*

(7) Remove control panel front cover (fig. 20-1) by removing six capscrews and washers.

(2) Remove winch drive cover plate (fig. 20-8) by removing four capscrews and washers.



TA 074460

Figure 20-8. Remove Winch Drive Cover Plate.

(3) Disconnect seven hydraulic lines (1, fig. 20-9) from hydraulic motor (6), and fail safe brake (4). Tag all lines to aid in assembly.

WARNING

In step (4) be sure that the primary speed reducer input sun gear shaft remains in position when brake is removed.

(4) Remove two capscrews (5) and nuts (3) and remove hydraulic motor (6) from fail safe brake (4) and primary speed reducer (2).

(5) Remove two nuts and washers (8) with capscrews (7) and remove fail safe brake (4) from primary speed reducer (2).

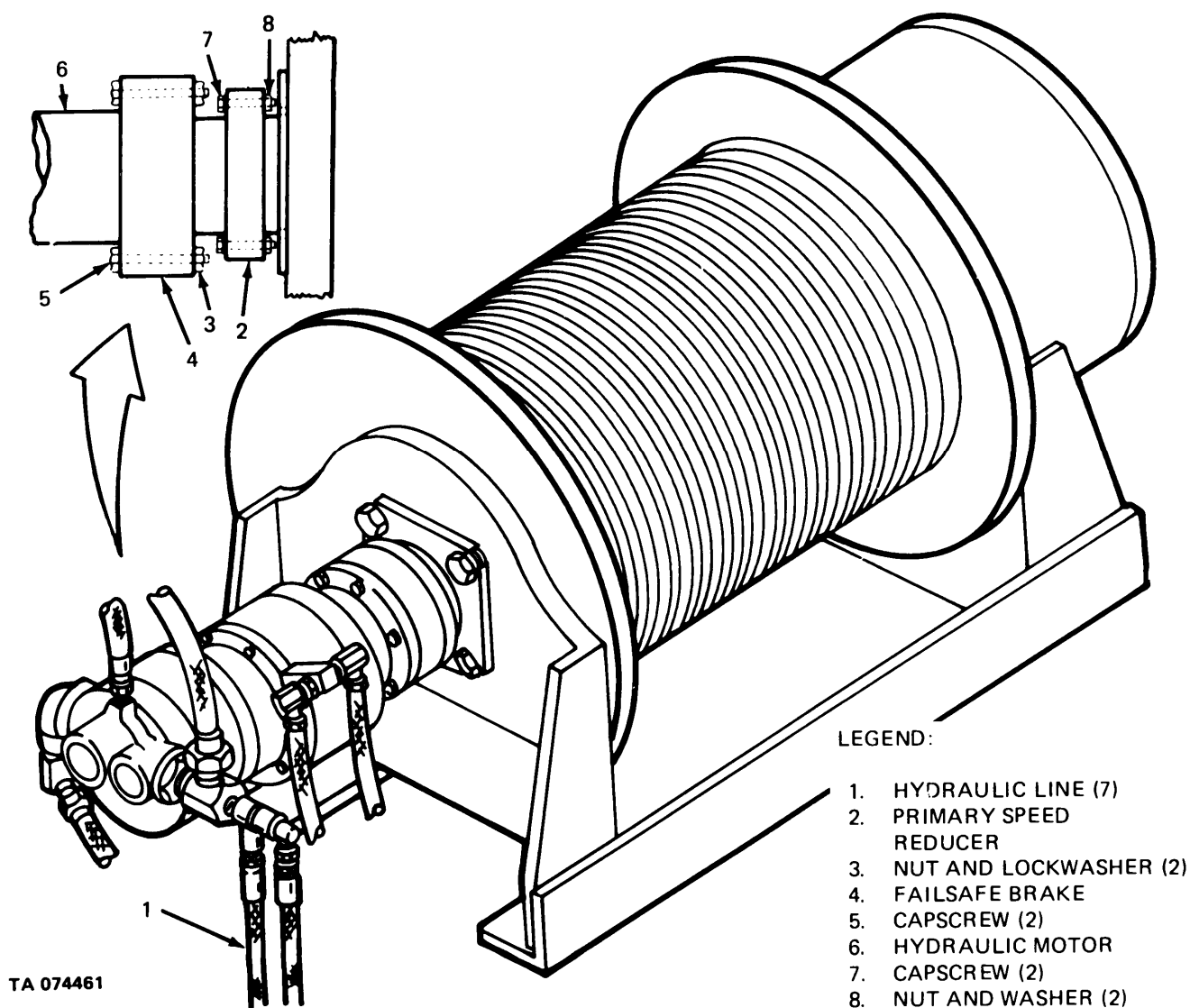
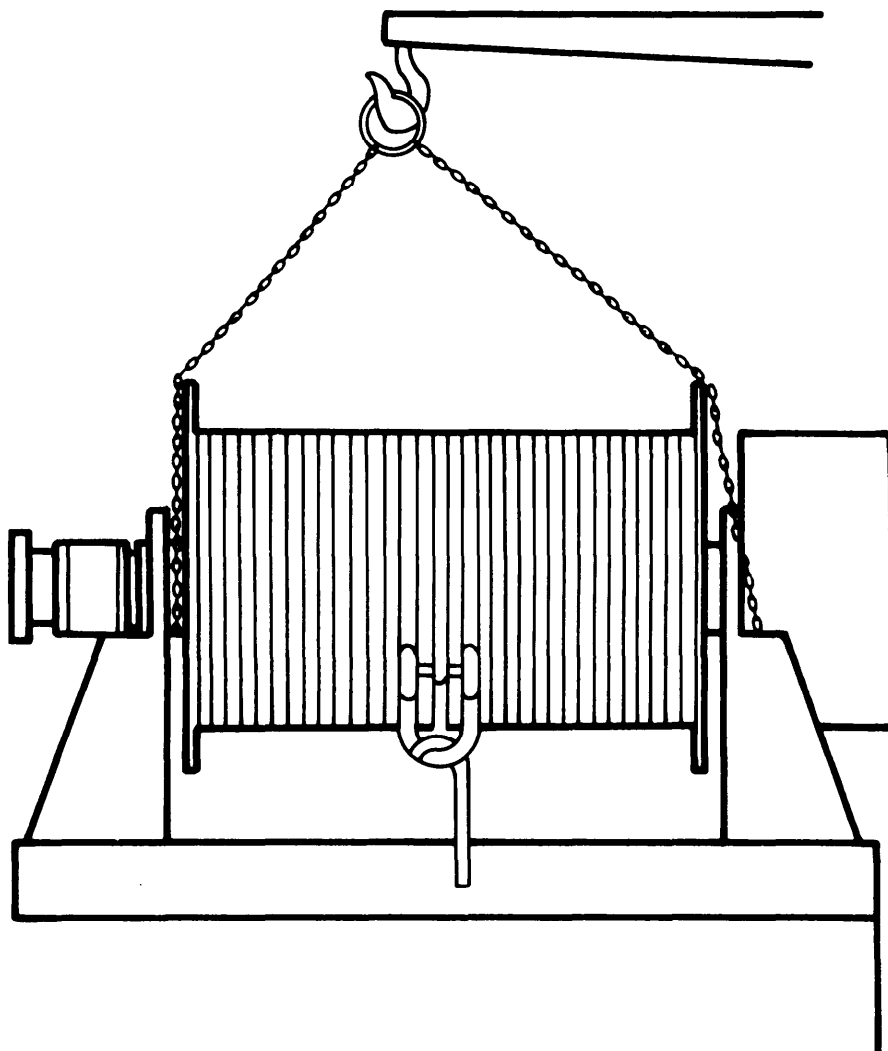


Figure 20-9. Disconnect Hydraulic Lines from Winch Drive.

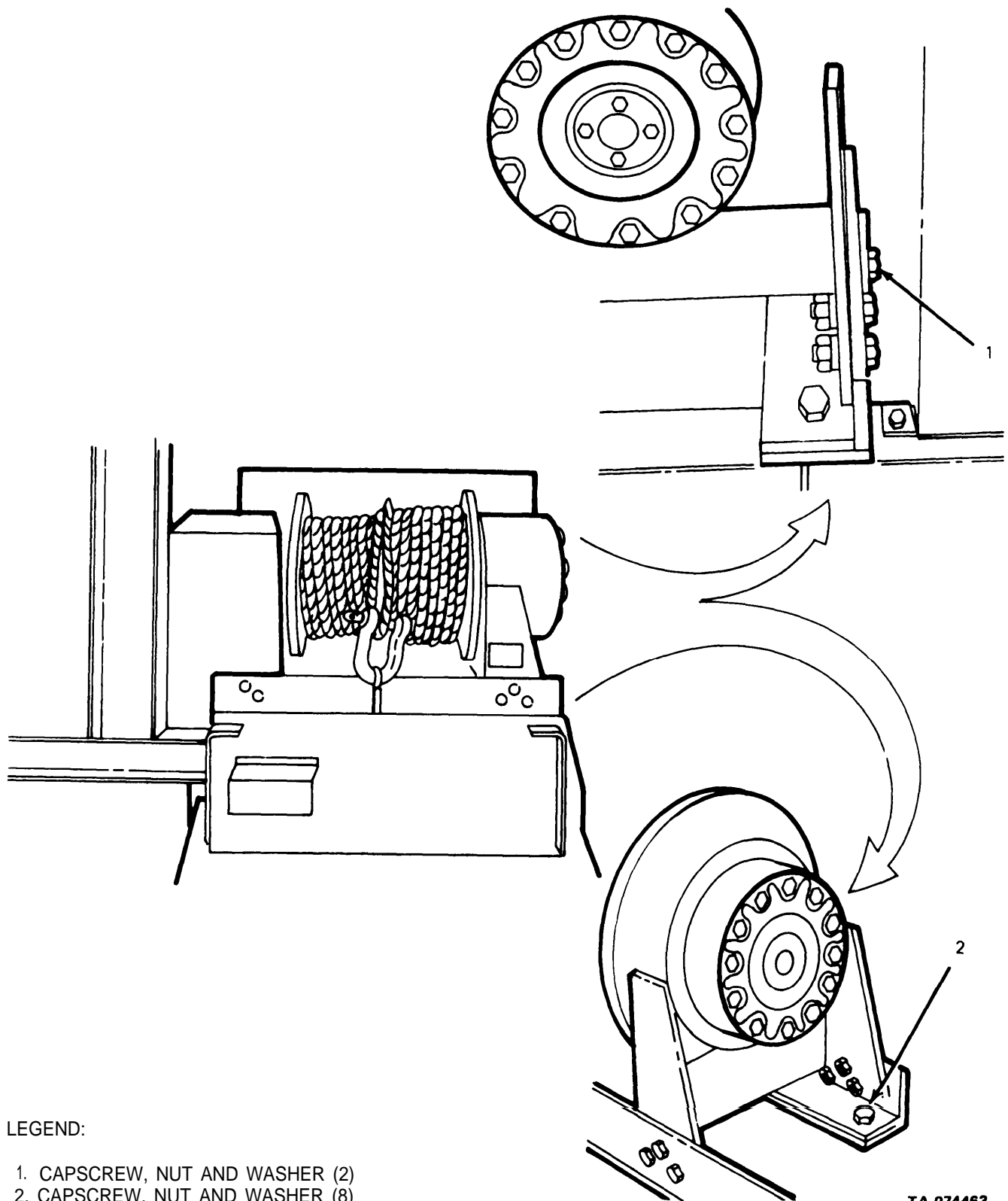
(6) Attach a sling and hoist (fig. 20-10) to support winch.



TA 074462

Figure 20-10. Attach Sling and Hoist to Winch.

(7) Remove eight capscrews (2, fig. 20-11), nuts, and washers that fasten winch to frame. Remove two capscrews (1), nuts, and washers that fasten winch to support angle.



TA 074463

Figure 20-17. Remove/Install Winch Attaching Parts.

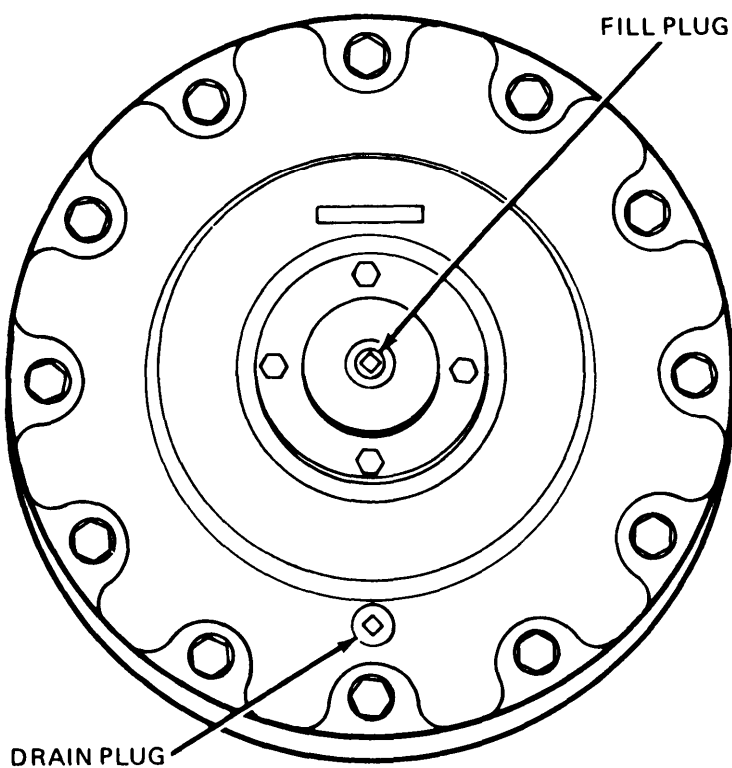
WARNING

In step (8), lift slowly and make sure winch is balanced on sling.

(8) Carefully lift winch off of vehicle.

b. Disassembly.

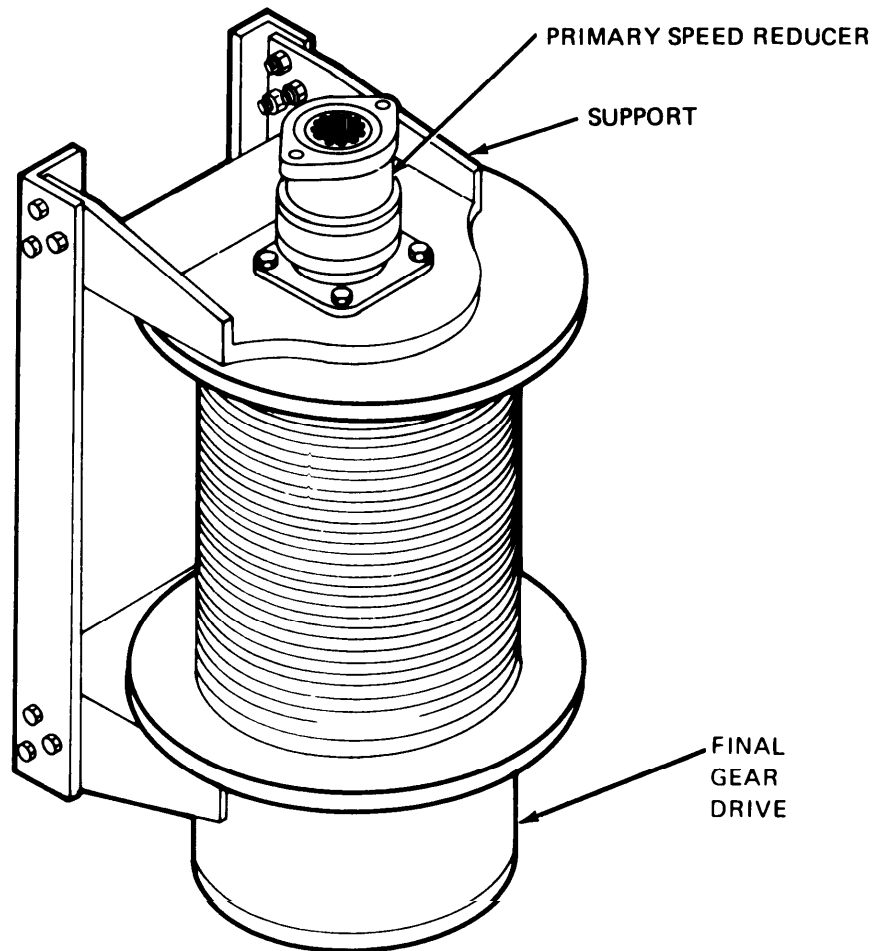
(1) Drain oil from winch by removing drain plug in final drive gear (fig. 20-12).



TA 074464

Figure 20-12. Drain Oil from Winch.

(2) Stand winch on final gear drive end (fig. 20-13).

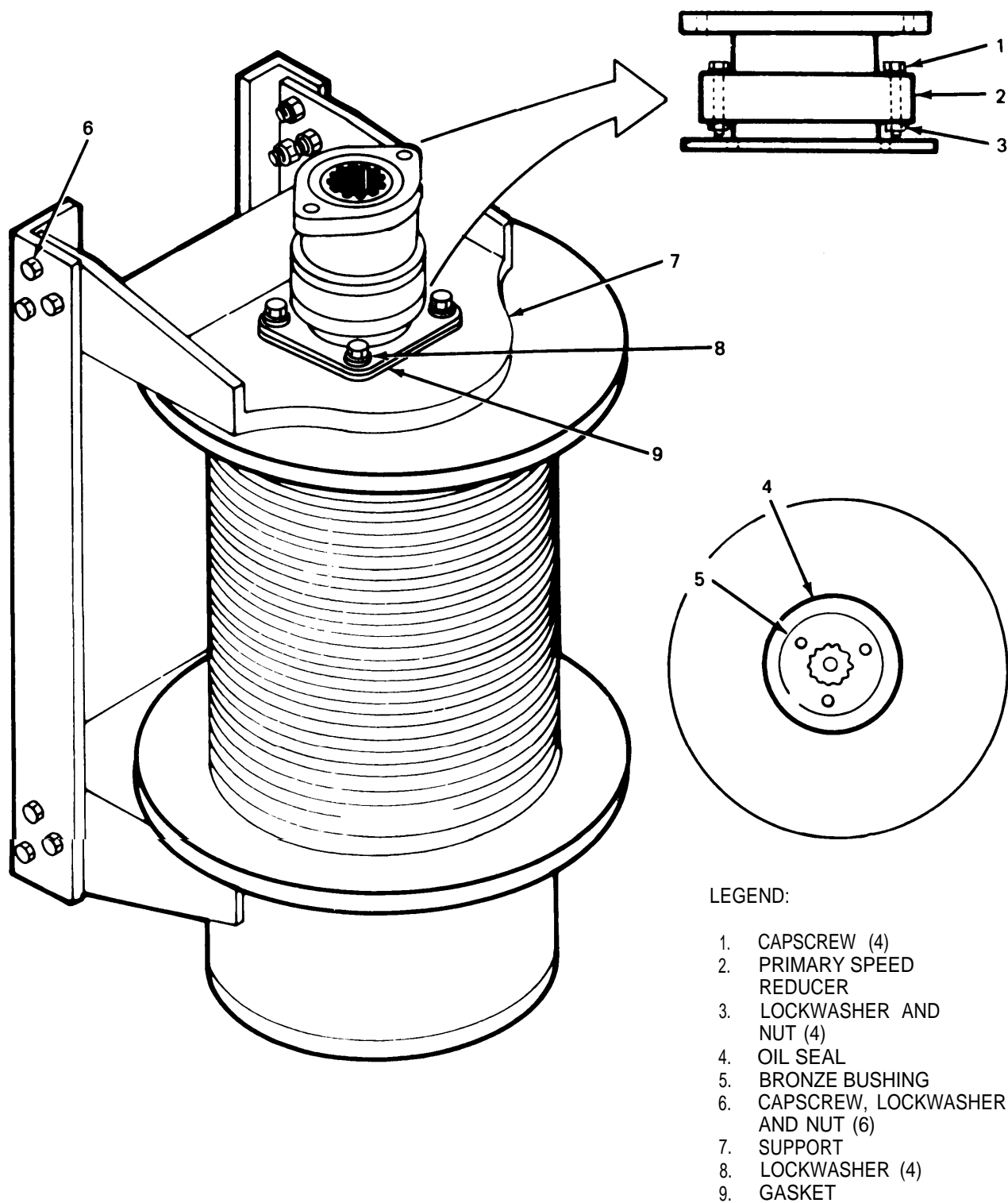


TA 074465

Figure 20-13. Prepare Winch for Disassembly.

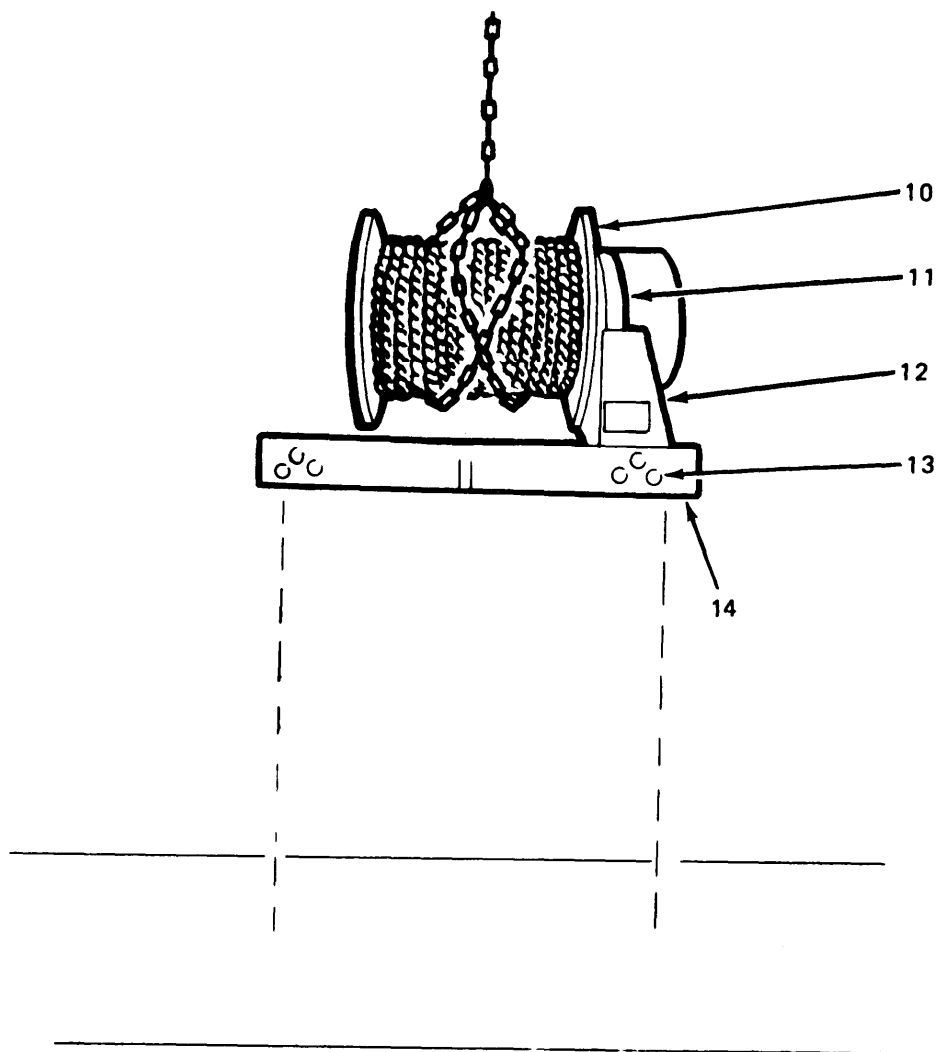
(3) Remove four capscrews (1, f ig. 20-14), lockwashers (8), gasket (9), and nuts (3).

(4) Remove coupling and primary speed reducer input shaft.



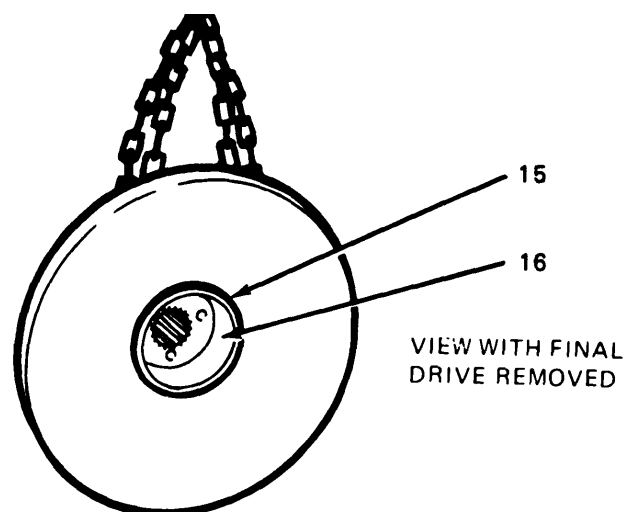
TA 074466

Figure 20-14. Disassemble/Assemble Winch (Sheet 1 of 2).



LEGEND:

- 10. DRUM SUPPORT
- 11. DRIVE HOUSING
- 12. GEAR SUPPORT
- 13. CPASCREW, LOCKWASHER AND NUT (6)
- 14. SIDE RAIL (2)
- 15. BRONZE BUSHING
- 16. OIL SEAL



TA 074467

Figure 20-14. Disassemble/Assemble Winch (Sheet 2 of 2).

(5) Remove six capscrews, lockwashers, and nuts (6, fig. 20-14); then remove support (7) by sliding it off of winch drum.

(6) Using a sling and hoist, support winch drum and set assembly on its side rails, as shown in figure 20-14, sheet 2.

(7) Remove six capscrews, washers, and nuts (13) that fasten final drive gear support (12) to both side rails (14). Remove complete final drive gear assembly by prying evenly in two places between drum support (10) and final drive housing (11).

(8) Remove oil seal (4).

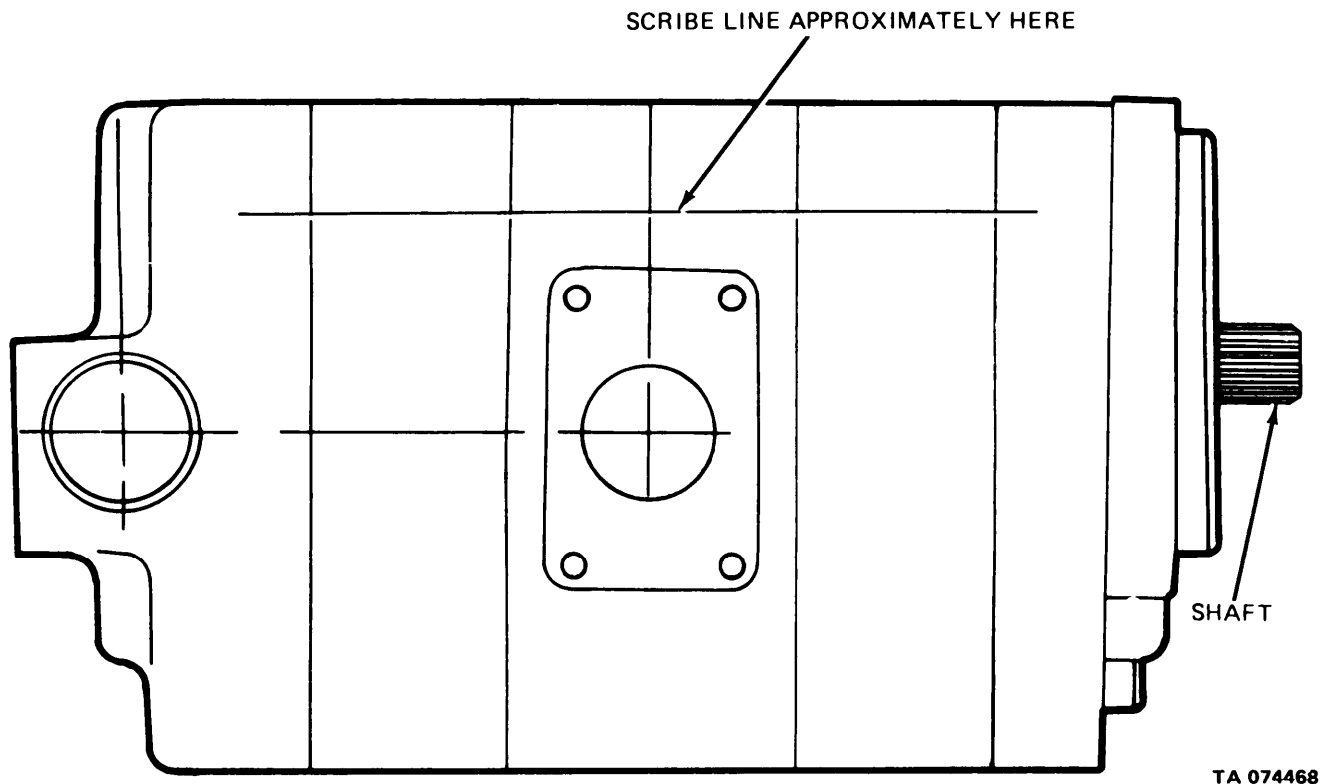
(9) Remove oil seal (16) and bronze bushing (15).

20-4. Repair of Hydraulic Pump.

a. *Disassembly.*

(1) Clean the outside of the pump thoroughly.

(2) Scribe a line on the outside of the pump across the front cover, body and rear cover to ensure proper reassembly. (See figure 20-15).

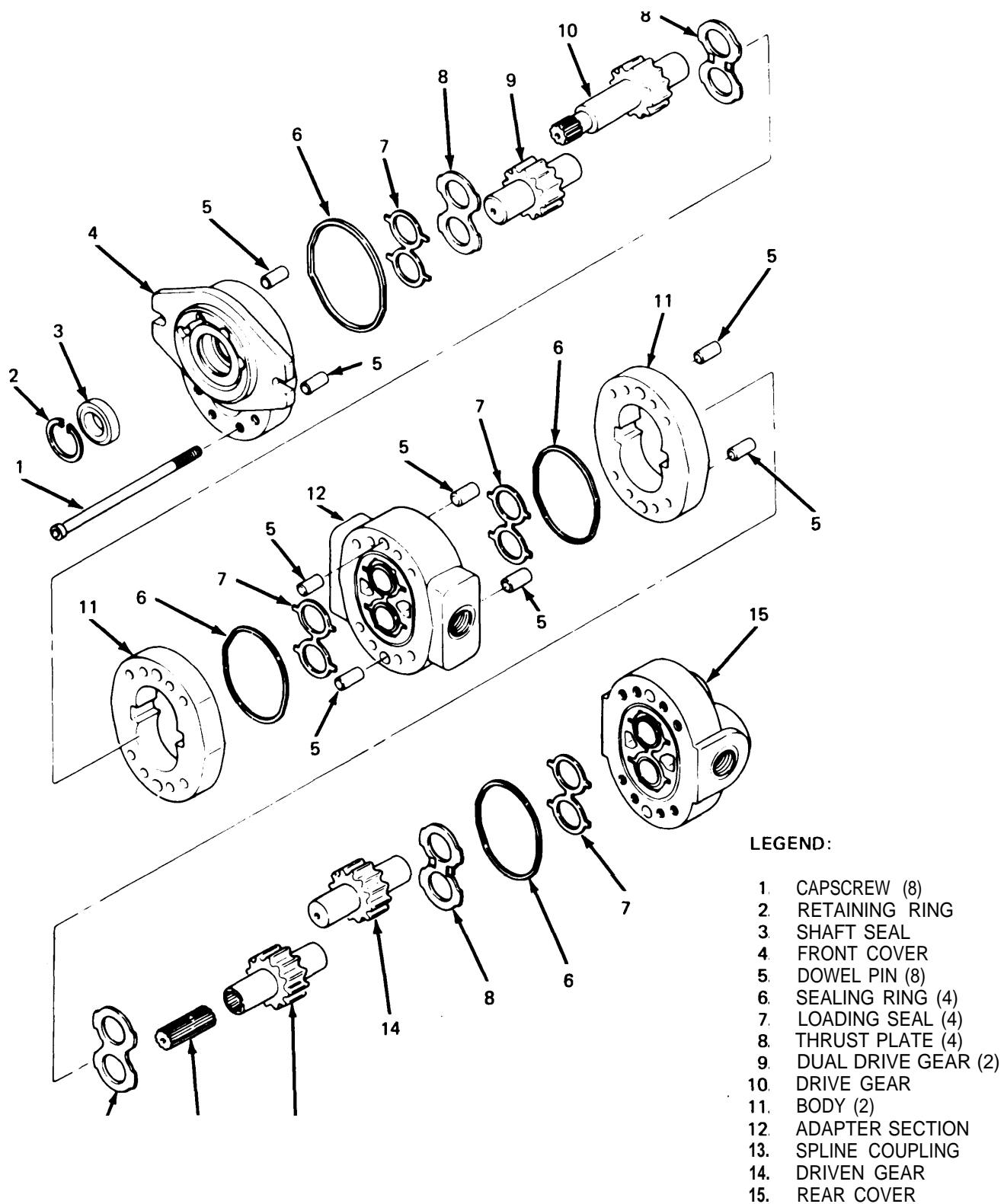


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Figure 20-15. Scribe Reference Mark on Hydraulic Pump.

(3) With the shaft end up, clamp the pump in a vise.

(4) Remove the eight capscrews (1, fig. 20-16) from the front cover using a 5/16 in. alien wrench.



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Figure 20-76. Hydraulic Pump – Exploded View.

(5) Remove the pump from the vise. Holding the pump in both hands, tap the shaft on a wooden block to separate the front cover (4) from the rear cover (15). Bodies (11) and adapter section (12) will remain with either the front cover or rear cover.

(6) Remove adapter section as follows:

(a) If the adapter section remains with the front cover and body, tap the input shaft with a wooden block to separate the adapter section and front body.

(b) if the adapter section remains with the rear cover and body, use a plastic mallet to tap the inlet and outlet port bosses alternately to separate the adapter section and body.

(7) To separate the front body and front cover or the rear body and rear cover, tap the end of the protruding shaft with a wooden block.

(8) Remove the four thrust plates (8) and sealing rings (6).



Be careful not to damage the sides of the groove or face of the front cover.

(9) Using a knife blade, lift the loading seal (7) out of the groove in the front cover (4).

(10) Remove the sealing ring (6) from the rear cover (15) and adapter section (12) following the same procedure as in step (9) above.

(11) Remove the retaining ring (2) from the shaft seal cavity in the front cover. Use internal Truarc type snap ring pliers.

(12) Clamp the front cover in a vise, flat side up and drive the shaft seal (3) out of the seal cavity. Use a screwdriver approximately 3/8 inch at the tip held at a 45 degree angle.

b. Inspection.

(1) Clean and dry all parts.

(2) Inspect the drive gear for damaged splines.

(3) Inspect both the drive and driven gears at bearing points, sides and tooth faces for rough surfaces and signs of excessive wear.

(4) If damage or signs of excessive wear are noted, the gears should be replaced.

(5) Inspect the inside diameter of the bushings in both covers for scoring. If the bushings are grooved or badly pitted, the cover must be replaced. (Bushings are not available as separate items.)

NOTE

As the pump is used, the inside diameter of bushings will change from dull gray to bronze in color. Ignore my variation in color.

(6) Check the inside gear pockets of the body (1) for excessive scoring and wear. If there are grooves which would allow leakage past the ends of the gear teeth, the body must be replaced.

(7) It is not necessary to inspect the seals or thrust plates for wear. These parts must be replaced each time the pump is disassembled.

c. Assembly.

(1) Install the shaft seal (3) in the front cover (4). Using a seal driver (a socket with an outside diameter of approximately 1-5/8 inch works well) press the shaft seal in until the snapping groove is barely exposed. Do not press further than is necessary to install the snapping as the seal will close off part of the bearing drain hole. If this does occur, remove the seal and begin again.

(2) Install the retaining ring (2) in the shaft seal cavity using truarc type snap ring pliers. Be sure the retaining ring is completely seated in the groove.

(3) *Install the* loading seals (7) in the seal groove in the front and rear cover and the adapter section. Hold the seal in place over the groove and tap into the groove with a plastic mallet. Do not use a steel hammer as it will dent the face of the cover and cause damage to the seals.

(4) place sealing rings (6) in the grooves in the front and rear cover and adapter section.

(5) Aline the scribed mark on the rear body with the scribed mark on the rear cover and push down on the body to engage the dowel pins.

NOTE

It may be necessary to tap each dowel alternately with a plastic mallet until the body and rear cover are nearly together.

(6) Lower one of the thrust plates (8) into the body (11) (flat side down) until the thrust plate rests against the rear cover (15).

(7) Insert the gears (14) and (9) into the rear body with the driven gear (14) nearest the scribed mark on the rear body and rear cover.

(8) Slide the second thrust plate over the ends of the gear shafts. The thrust plate must be against the gears and not on the top surface.

(9) Aline the scribed mark on the adapter section and rear body. Push down on the adapter section to engage the dowel pins.

CAUTION

Do not dislodge the seals in the adapter section.

NOTE

it may be necessary to tap each dowel alternately with a plastic mallet until the body and adapter section are together.

(10) Install the spline coupling (13) in the dual drive gear (9).

(11) Align the scribed mark on the front body with the mark on the adapter section and install as described in step (9) above.

(12) Lower a thrust plate into the front body until the thrust plate rests against the adapter section.

(13) Install the drive gear (10) and dual drive gear (9) in the adapter section and front body.

(14) Install the final thrust plate over the end of the shafts. The thrust plate must be against the gears.

(15) Lubricate the splined end of the drive shaft so the shaft seal will slide over the chamfer on the shaft without damage.

(16) Slide the front cover down onto the shafts and tap lightly with a plastic mallet to engage the dowel pins. Be sure the scribed line is continuous across the front cover, body and rear cover.

(17) Install the eight capscrews and tighten evenly to 35-40 lb-ft (47-54 N-m) torque.

(18) Rotate the shaft to be sure that the gears will be free to turn when the pump is mounted.

NOTE

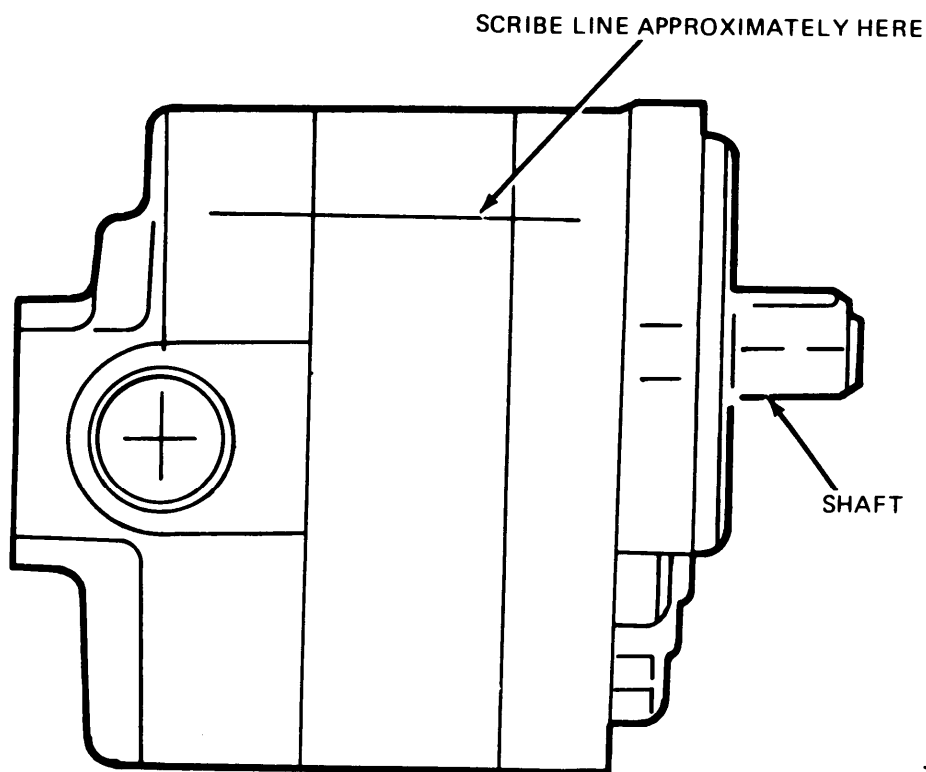
The pump will have a small amount of drag but should turn freely after a short period of use.

20-5. Repair of Hydraulic Motor.

a. Disassembly.

(1) Clean the outside of the motor thoroughly.

(2) Scribe a line on the outside of the motor across the front cover, body, and rear cover to ensure proper reassembly. Refer to figure 20-17.



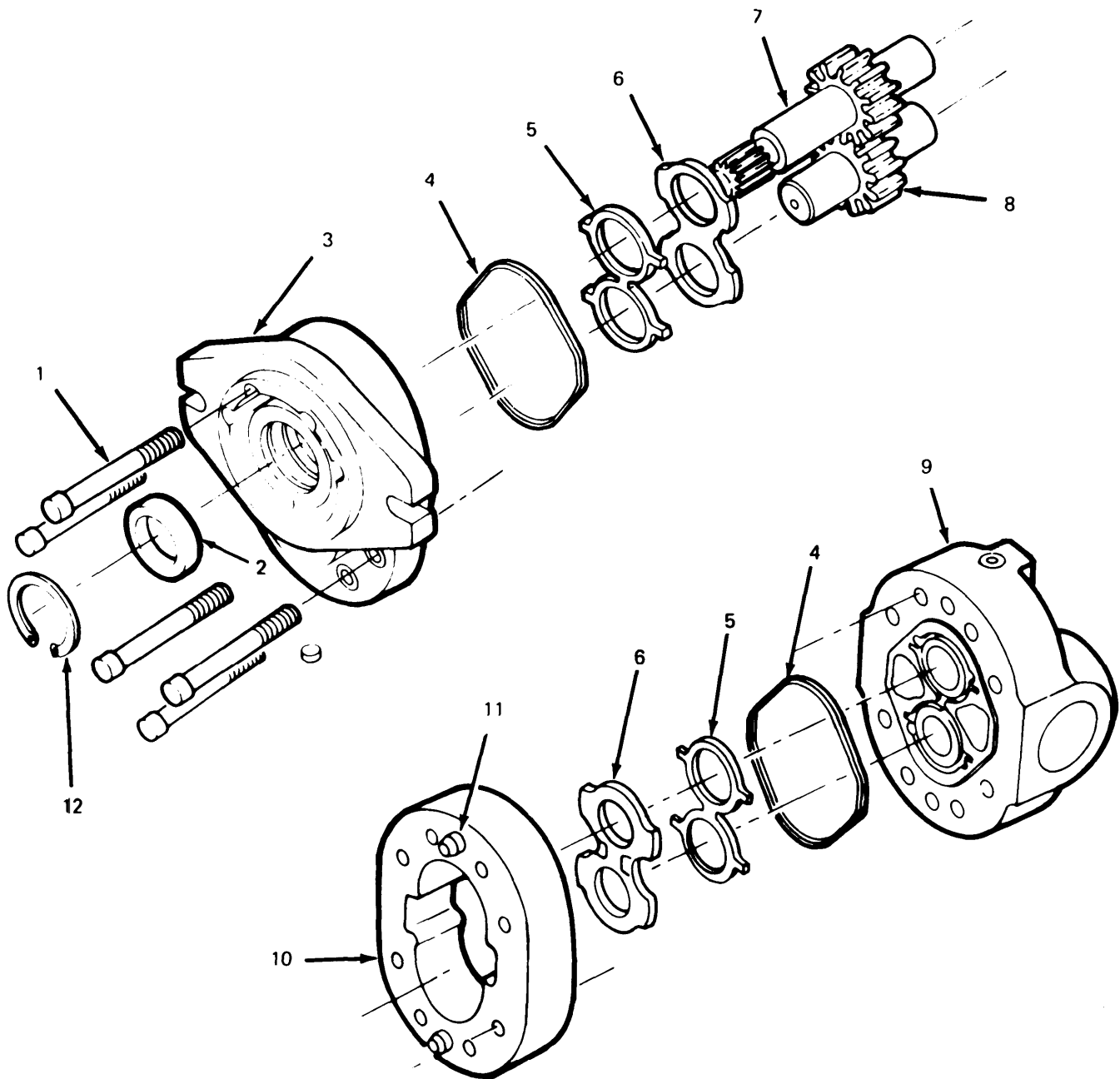
TA 074470

Figure 20-17. Scribe Reference Mark Hydraulic Motor.

- (3) With a shaft end up, clamp the motor in a vise.
- (4) Remove the eight capscrews (1, fig. 20-18) from the front cover (3) allen wrench.
- (5) Remove the motor from the vise. Holding the motor in both hands, tap the shaft on a wooden block to separate the front cover (3) from the rear cover (9). The body (10) will remain with either the front cover or the rear cover.
- (6) To separate the body from the section it remains with, remove the driven gear (8). Place the drive gear (7) in the bearing and tap the protruding end on a wooden block.
- (7) Remove both thrust plates (6) and sealing rings (4).

CAUTION

Be careful not to damage the sides of the groove or face of the front cover.



LEGEND:

- | | |
|---------------------|--------------------|
| 1. CAPSCREW (8) | 7. DRIVE GEAR |
| 2. SHAFT SEAL | 8. DRIVEN GEAR |
| 3. FRONT COVER | 9. REAR COVER |
| 4. SEALING RING (2) | 10. BODY |
| 5. LOADING SEAL (2) | 11. DOWEL PIN (4) |
| 6. THRUST PLATE (2) | 12. RETAINING RING |

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Figure 20-18. Hydraulic Motor – Exploded View.

(8) Using a knife blade, lift the loading seal (5) out of the *groove* in the front cover.

(9) Removing the loading seal from the rear cover following the same procedure as described in step (8) above.

(10) Remove the retaining ring (12) from the shaft seal cavity in the front cover, Use internal Truarc type snap ring pliers.

(11) Clamp the front cover in a vise, flat side up, and drive the shaft seal (2) out of the cavity. Use a screwdriver approximately 3/8 in. wide at the end held at a 45 degree angle.

b. Inspection.

(1) Clean and dry all parts.

(2) Inspect the drive gear for damaged splines.

(3) Inspect both drive and driven gears at bearing points, sides and tooth faces for rough surfaces and signs of excessive wear.

(4) If damage or signs of excessive wear are noted, the gears must be replaced.

(5) Inspect the inside diameter of the bushings in both covers for scoring. If the bushings are scored or badly pitted, the cover must be replaced. (Bushings are not available as separate items.)

NOTE

As the motor is used, the inside diameter of the bushings will change from-dull gray to bronze in color. Ignore any variation in color.

(6) Check the inside gear pockets of the body for signs of excessive wear and scoring. If there are grooves which would allow leakage past the ends of the gear teeth, the body must be replaced.

(7) It is not necessary to inspect the seals or thrust plates for wear or damage, These parts must be replaced each time the motor is disassembled.

c. Assembly.

(1) Install the shaft seal (2) in the front cover. Using a seal driver (a socket with an outside diameter of approximately 1-5/8 in. works well), press the shaft seal in until the snap ring groove is barely exposed. Do not press further than is necessary as the seal will close off part of the bearing drain hole. If this does occur, remove the seal and begin again.

(2) Install the retaining ring (12) in the shaft seal cavity using truarc type snap ring pliers. Be sure the retaining ring is completely seated in the groove.

(3) Install the loading seals (5) in the seal groove in the front and rear covers. Hold the seal in place over the groove and tap it into the groove with a plastic mallet. Do not use a steel hammer as it will dent the face of the cover and cause damage to the seals.

(4) Place the sealing rings (4) in the grooves in the front and rear covers.

(5) Aline the scribed mark on the body with the scribed mark on the rear cover. Push down on the body to engage the dowel pins (11). It may be necessary to tap each dowel alternately with a plastic mallet until the body and the rear cover come almost together.

(6) Lower one of the thrust plates into the body (flat side down) until the thrust plate rests against the rear cover.

(7) Insert the gears into the body with the drive gear nearest the scribed mark on the body and rear cover.

(8) Slide the second thrust plate over the ends of the gear shafts. The thrust plate must be against the gears and not resting on the top surface.

(9) Lubricate the keyed or splined end of the drive shaft so the shaft seal will slide over the chamber on the shaft without damage.

(10) Slide the front plate down onto the shafts and tap lightly with a plastic mallet to engage the dowel pins. Be sure the scribed line is continuous across the front cover, body and rear cover.

(11) Install the eight capscrews and tighten even to 35-40 lb-ft (47-54 N-m) torque.

(12) Rotate the shaft to be sure that the gears will be free to turn when the motor is mounted.

NOTE

The motor will have a slight amount of drag but should turn freely after a short period of use.

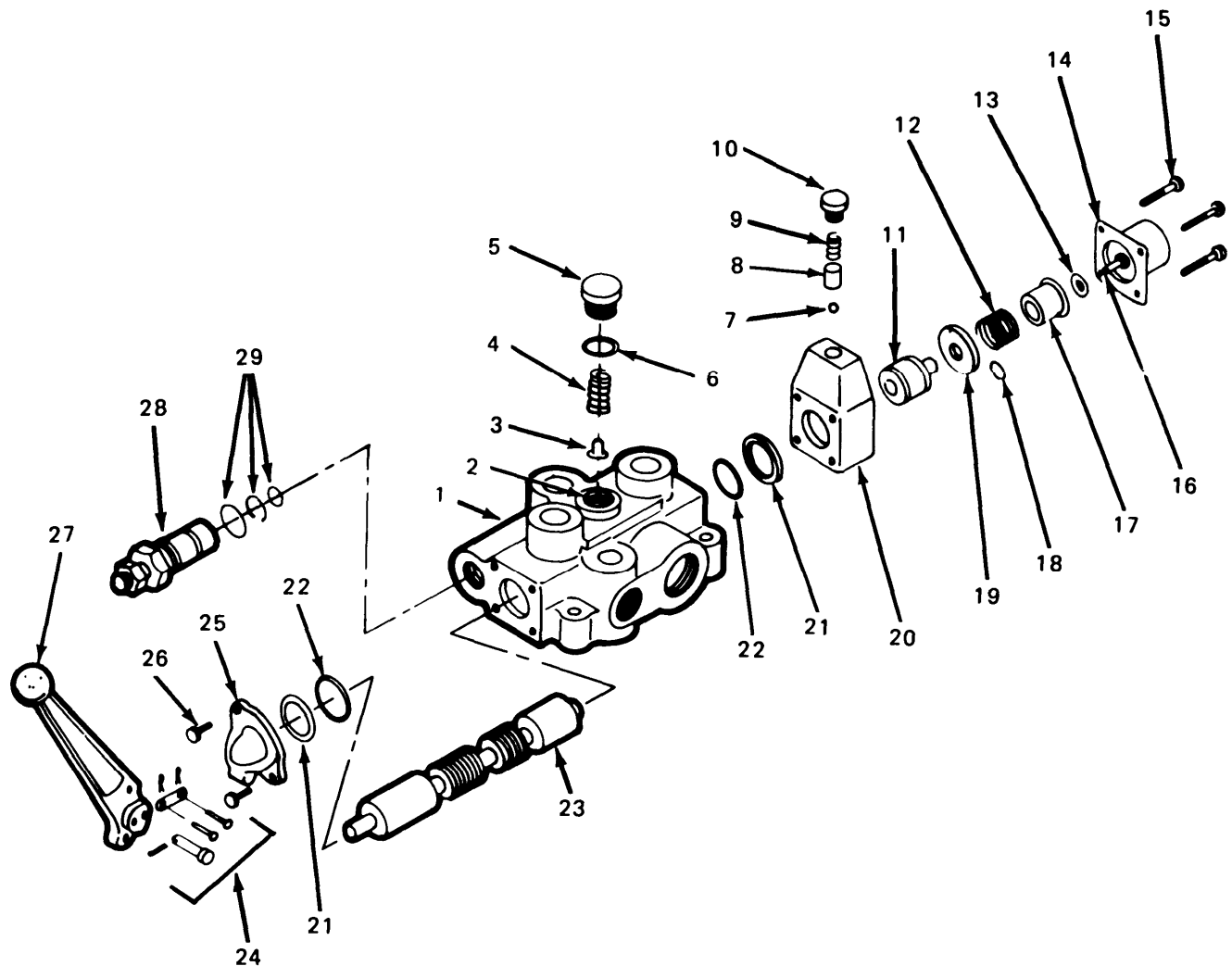
20-6. Repair of Control Valve (Speed Control).

a. Removal. (Refer to TM 9-2320-273-20.)

b. Disassembly.

(1) Clean the outside of the valve thoroughly.

(2) Clamp the valve body (1, fig. 20-19) in a vise.



LEGEND:

- 1. BODY
- 2. SEAL
- 3. CONE
- 4. SPRING
- 5. PLUG ASSEMBLY
- 6. O-RING
- 7. BALL
- 8. SLEEVE
- 9. SPRING
- 10. DETENT PLUG
- 11. DETENT SLEEVE
- 12. CENTER SPRING
- 13. WASHER
- 14. END CAP

- 15. MACHINE SCREW (4)
- 16. MACHINE SCREW
- 17. SPOOL COLLAR
- 18. SPACER WASHER
- 19. STOP WASHER
- 20. HOUSING
- 21. RETAINER (2)
- 22. SPOOL SEAL (2)
- 23. SPOOL
- 24. PIN KIT
- 25. HANDLE BRACKET
- 26. SCREW (2)
- 27. HANDLE
- 28. RELIEF VALVE
- 29. SEAL KIT

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Figure 20-19. Control Valve (Speed Control)— Exploded View.

(3) Remove the handle (27) by disassembling the pin kit (24).

(4) Remove the four machine screws (15) and the end cap (14).

(5) Remove the machine screw (16) from the end of the spool (23). This allows items (13), (17), (12), (19), (23), (20), (22), (21), and (18) to be removed.

(6) Remove the two screws (26) from the body (1). Remove handle bracket (25), retainer (21), and spool seal (22).

(7) Remove plug assembly (5), O-ring (6), spring (4), cone (3) and seal (2).

(8) Remove the relief valve (28) and seal kit (29).

(9) Remove the detent plug (10), spring (9), ball (7), and detent sleeve (8) from the housing (20). Inspect for spring damage and moisture contamination.

(10) Inspect the relief valve (28) for damage and contamination.

(17) Inspect all parts for wear and signs of damage. If the spool (23) or body (1) are worn or pitted, the valve must be replaced.

c. Assembly.

NOTE

Replace all seals.

(1) Install the plug assembly (5), O-ring (6), spring (4), cone (3), relief valve (28) and seal kit (29).

(2) Install the spool (23).

(3) Install the detent subassembly: items (13), (17), (12), (19), (11), (23), (20), (22), (21), and (18). Secure with machine screw (16). Torque to 8 lb-ft (11 N•m).

(4) Install the ball (7), spring (9), and detent plug (10) in the housing (20).

(5) Install handle bracket (25), screws (26) in body (1). Torque to 8 lb-ft (11 N•m).

(6) Install the handle (27) and secure it with the pin kit (24).

(7) Install the end cap (14) and four machine screws (15). Tighten the machine screws to 8 lb-ft (11 N•m) torque.

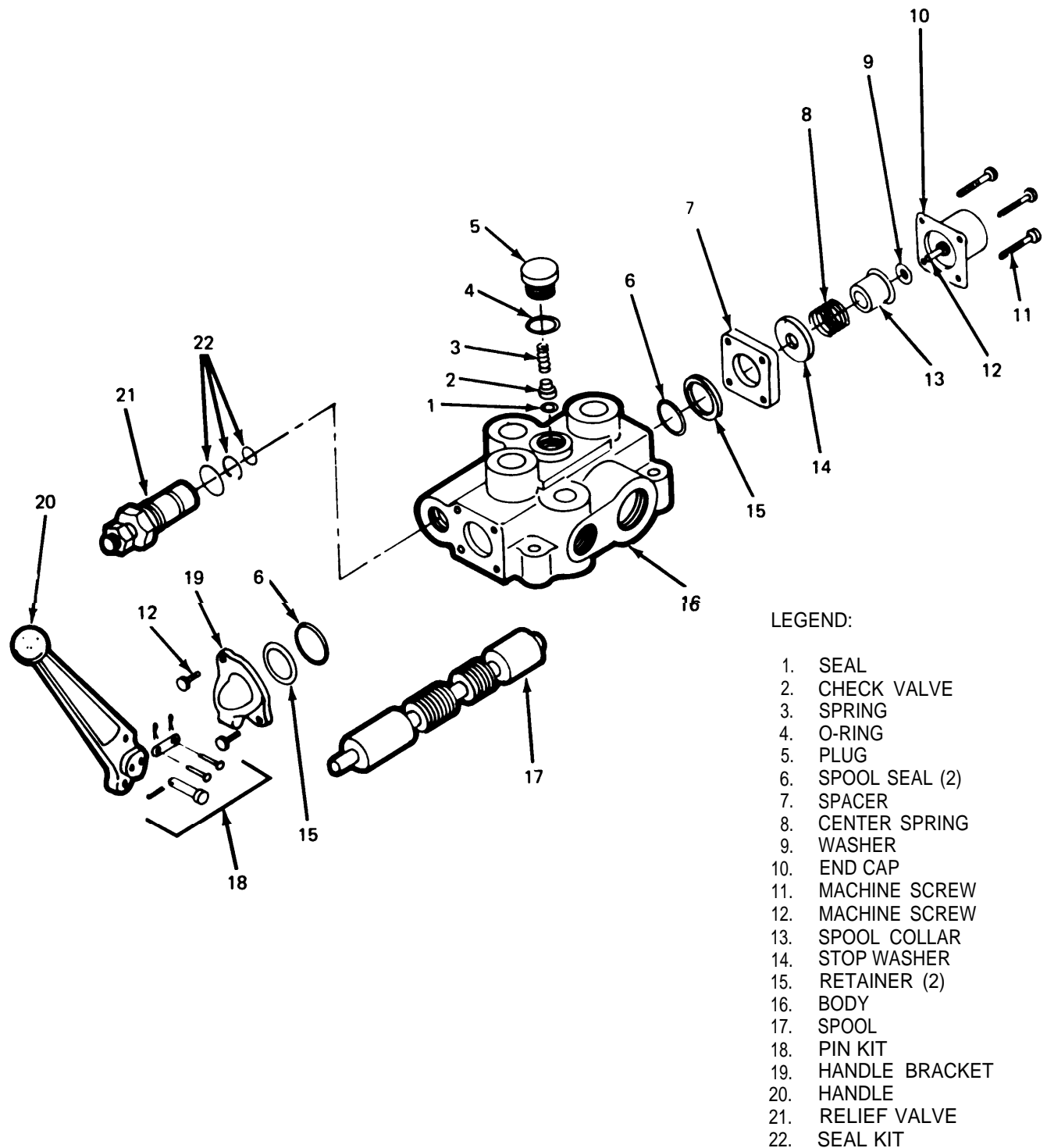
20-7. Repair of Control Valve (Directional Rotation).

a. Removal. (Refer to TM 9-2320-273-20.)

b. Disassembly.

(1) Clean the outside of the valve thoroughly.

(2) Clamp the valve body (16, fig. 20-20) in a vise.



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Figure 20-20. Control Valve (Directional Rotation) - Exploded View.

(3) Remove the four machine screws (11) and end cap (10).

(4) Remove the machine screw (12) from the end of the spool (17). This allows items (6), (15), (7), (14), (8), (13) and (9) to be removed.

(5) Remove the handle (20) by disassembling the pin kit (18).

(6) Remove the two machine screws (12) from the valve body (16). Remove handle bracket (19), retainer (15) and spool seal (6). This allows the spool to be removed.

(7) Remove the spool (17).

(8) Remove the relief valve (21) and seal kit (22).

(9) Inspect the relief valve for damage and contamination.

(10) Remove plug (5), O-ring (4), spring (3), check valve (2), and seal (1).

(11) Inspect all parts for wear and other damage. If the spool (17) or body (16) are worn or pitted, the valve must be replaced.

c. Assembly.

NOTE

Replace all seals.

(1) Install the relief valve (21) and with seal kit (22).

(2) Install seal (1), check valve (2), spring (3), O-ring (4), and plug (5).

(3) Install the spool (17).

(4) Assemble and install items (9), (13), (8), (14), (7), (15), and (6). Install the machine screw (12) in the end of the spool (17). Torque to 8 lb-ft (11 N•m).

(5) Install the handle bracket (19) and machine screws (12) into body (16). Torque to 8 lb-ft (11 N•m).

(6) Install the handle (20) and secure with the pin kit (18).

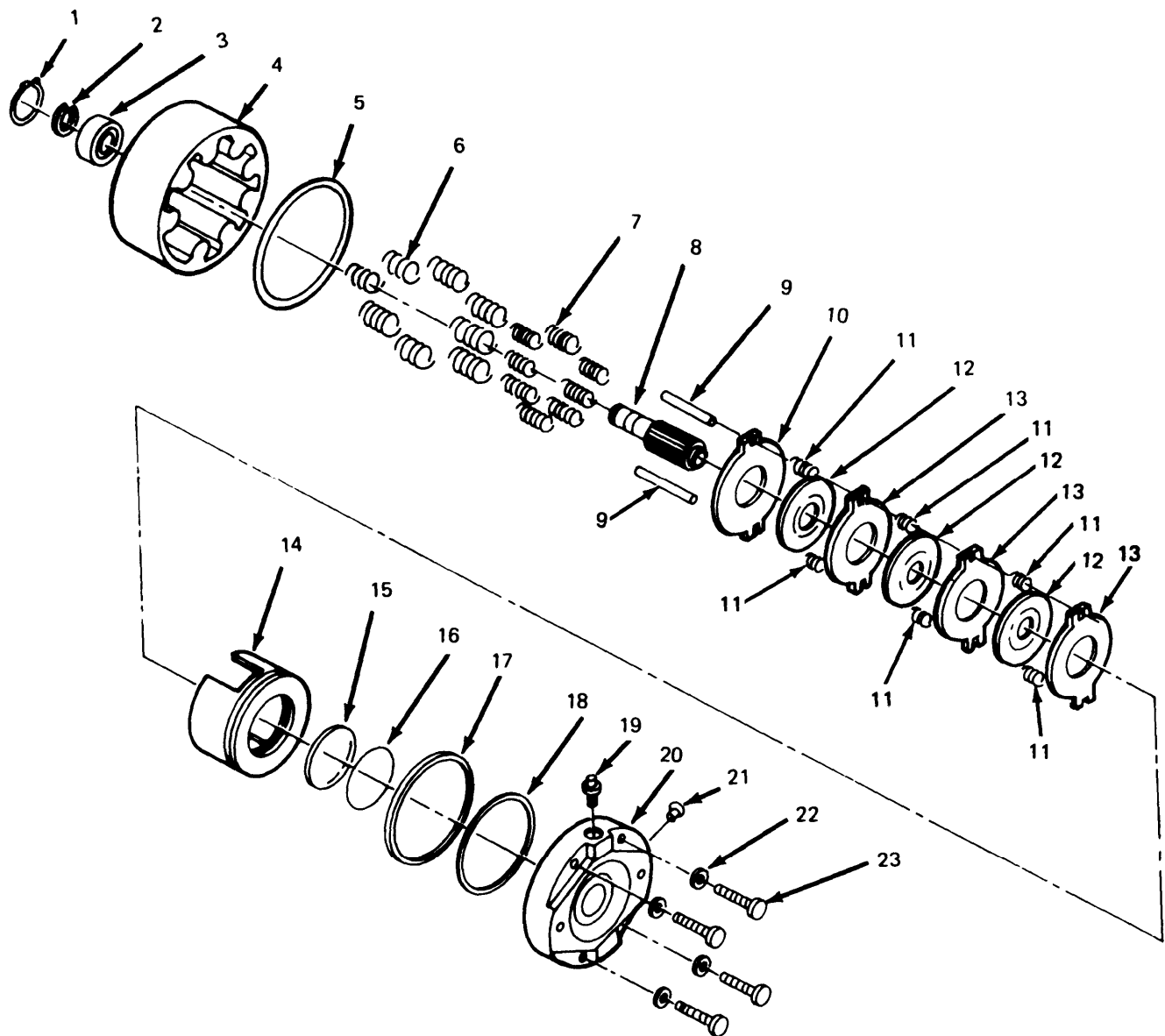
(7) Install the end cap (10) and four machine screws (11). Tighten the machine screws (11) to 8 lb-ft (11 N•m) torque.

d. Installation (Refer to TM 9-2320-273-20).

20-8. Repair of Fail-Safe Brake.

a. Disassembly.

(1) position unit with shaft (8, fig. 20-21) pointing down.



LEGEND:

- | | |
|-----------------------|-------------------------|
| 1. SNAP RING | 13. STATIONARY DISK (3) |
| 2. SNAP RING | 14. PISTON |
| 3. BEARING | 15. BACKUP RING |
| 4. HOUSING | 16. O-RING |
| 5. O-RING | 17. BACKUP RING |
| 6. SPRING (8) | 18. O-RING |
| 7. SPRING (8) | 19. BLEEDER SCREW |
| 8. SHAFT | 20. POWER PLATE |
| 9. PIN (2) | 21. PROTECTIVE PLUG |
| 10. PRIMARY DISK | 22. WASHER (4) |
| 11. SPRING (6) | 23. CAPSCREW (4) |
| 12. ROTATING DISK (3) | |

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Figure 20-21. Fail-Safe Brake – Exploded View.

(2) Alternately remove capscrews (23) and washers (22). Lift off the following:

- (a) Power plate (20)
- (b) O-ring (5)
- (c) Stationary disks (13)
- (d) Springs (11)
- (e) Rotating disks (12)
- (f) Primary disk (10)
- (g) Pins (9)
- (h) Springs (6) and (7)

(3) Remove snaprings (1) and (2).

(4) Remove shaft (8) with attached bearing (3) by lightly tapping the shaft with a plastic mallet.

(5) Separate shaft (8) and bearing (3) by supporting the bearing inner race and applying pressure to the shaft.

(6) Remove piston (14) from power plate (20) by introducing low air pressure – approximately 15 psi – into hydraulic inlet port, Make sure piston is pointing away from you.

NOTE

In step (7), do not remove backup rings (15) and (17) unless replacement is planned.

(7) Remove O-rings (16) and (18) and backup rings (15) and (17) from piston (14).

b. Assembly.

(1) Make sure that all parts are clean and dry. Use drycleaning solvent for cleaning.

(2) Apply a light coat of hydraulic oil on new O-rings (16) and (18) and install in piston (14).

(3) If removed, install new backup rings (15) and (17).

(4) Assemble piston (14) into power plate (20) using a shop press, being careful not to damage the O-rings or Teflon backup rings. Visually aline the center of the cut-outs in the piston with the n (9) holes in the power plate (20).

(5) press bearing (3) on shaft (8) and install into housing (4). Secure with snap rings (1) and (2).

(6) Install O-ring (5) in housing (4).

(7) Install springs (6) and (7).

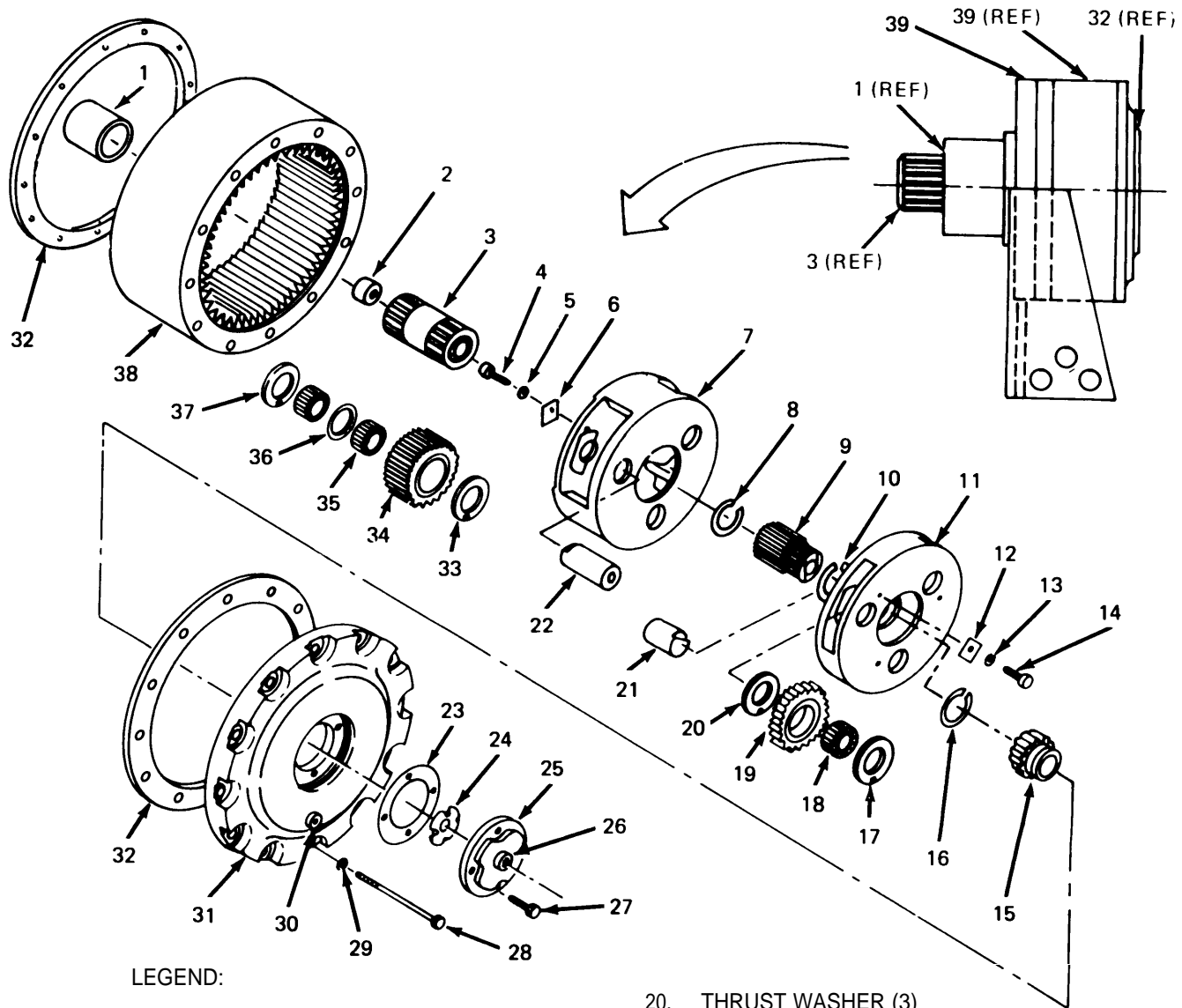
(8) Assemble primary disk (10), rotating disks (12) and stationary disks (13). Lineup assembly with-two pins (9) and install in piston (14).

(9) Install four capscrews (23) and washers (22). Alternately tighten bolts down; then torque to 50-60 lb-ft (68-81 N•m).

20-9. Repair of Final Drive Gear.

a. Disassembly.

(1) Remove capscrews (27, fig. 20-22) and pull off cover (25), thrust washer (24) and gasket (23).



LEGEND:

- | | |
|----------------------------|-------------------------|
| 1. SLEEVE BUSHING (BRONZE) | 20. THRUST WASHER (3) |
| 2. SLEEVE BUSHING | 21. PINION SHAFT (3) |
| 3. OUTPUT SHAFT | 22. PINION SHAFT (3) |
| 4. CAPSCREW (3) | 23. GASKET |
| 5. LOCKWASHER (3) | 24. THRUST WASHER |
| 6. RETAINER (3) | 25. COVER |
| 7. SECONDARY CARRIER | 26. OIL LEVER PLUG |
| 8. RETAINING RING | 27. CAPSCREW (4) |
| 9. SUN GEAR | 28. CAPSCREW (12) |
| 10. RETAINING RING | 29. LOCKWASHER (12) |
| 11. PRIMARY CARRIER | 30. FILL AND DRAIN PLUG |
| 12. RETAINER (3) | 31. COVER |
| 13. LOCKWASHER (3) | 32. GASKET |
| 14. CAPSCREW (3) | 33. THRUST WASHER (3) |
| 15. SUN GEAR | 34. PINION GEAR (3) |
| 16. RETAINING, RING | 35. NEEDLE ROLLER (2) |
| 17. THRUST WASHER (3) | 36. SPACER (3) |
| 18. NEEDLE ROLLER | 37. THRUST WASHER (3) |
| 19. PINION GEAR (3) | 38. RING GEAR |
| | 39. SUPPORT |

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Figure 20-22. Final Drive Gear – Exploded View.

- (2) Remove capscrews (28) and lockwashers (29); then pull off cover (31) and gasket (32).
- (3) Remove sun gear (15).
- (4) Remove primary carrier assembly (11).
- (5) Remove ring gear (38).
- (6) Remove secondary carrier assembly (7) and output shaft (3).
- (7) Disassemble primary carrier assembly (11) as follows:
 - (a) Remove capscrews (14), lockwashers (13) and retainer (12).

NOTE

In step (b), be prepared to catch sun gear (9), needle rollers (18), and thrust washers (20) and (17) when pinion shaft (21) is removed.

- (b) Remove pinion shaft (21) and pinion gear (19), needle rollers (18) and thrust washers (20) and (17).
- (c) Repeat steps (a) and (b) for remaining two pinion gears (19).
- (d) Remove retaining rings (10) and (16) from grooves of sun gear (9), then pull sun gear (9) from splines of primary carrier (11).
- (8) Disassemble secondary carrier (7) as follows:
 - (a) Remove capscrew (4), lockwasher (5) and retainer (6).

NOTE

In step (b), be prepared to catch pinion gear (34), two pinion needle roller bearings (35), spacer (36), and thrust washers (37) and (33) when pinion shaft (22) is removed.

- (b) Remove pinion shaft (22) and pinion gear (34), two pinion needle roller bearings (35), spacer (36) and thrust washers (37) and (33).
- (c) Repeat steps (c) and (b) for remaining two pinion gears (34).
- (d) Remove retaining ring (8) and pull out output shaft (3).
- (9) Using a suitable bearing puller, remove sleeve bushing (1) from support (39) and sleeve bushing (2) from output shaft (3).
- b. *Assembly.*
 - (1) Clean all parts using SD-2 drycleaning solvent (item 12, Appendix B).
 - (2) Inspect all parts for damage or excessive wear; replace as necessary.
 - (3) Apply a light coat of Loctite (item 19, Appendix B) to outer surface of new sleeve bushing (1); then press bushing (1) into support (39).

(4) Assemble secondary carrier (7) as follows:

(a) Apply a light coat of Loctite to outer surface of bushing (2); then press bushing into bore of output shaft (3).

(b) Insert output shaft (3) into splines of secondary carrier (7); then install retaining ring (8) on output shaft (3).

NOTE

In step (d) use Lubriplate (item 16, Appendix B) or a grease with a low melting point to retain needle rollers (35) when they are assembled into pinion gears.

(c) Assemble 16 needle rollers (35) into one end of each pinion gear (34).

(d) Install spacer (36); then assemble 16 needle rollers (35) into the other end of pinion gear (34).

(e) Install each assembled pinion gear (34) into secondary carrier (7) and install thrust washer (37) and (33) between each gear (34) and inside walls of carrier. Make sure that tabs on thrust washers are aligned with recess in the carrier.

(f) Install three pinion shafts (22) into carrier and through each pinion gear (34). Align pinion shafts (22) so that retainers (6) can be installed in shaft slot.

(g) Apply Loctite (item 19, Appendix B) to threads of capscrews (4); then install with lockwashers (5) to secure each retainer (6) to secondary carrier (7). Tighten to 27-32 lb-ft (37 N•m) torque.

(h) Check end play of each gear (34). Should be 0.004 to 0.020 in. If end play is more than 0.020 in., replace thrust washers (33 and 37).

(i) Check each pinion gear (34) to determine that it rotates freely, without binding or restriction.

(5) Assemble primary carrier (11) as follows:

(a) Install retainer ring (10) on shoulder of sun gear (9); then slide the gear into splines of primary carrier (11).

(b) from inside primary carrier (11), install retaining ring (16) in groove of sun gear (9).

NOTE

In step (c), use Lubriplate (item 16, Appendix B) or a grease with a low melting point to retain needle rollers (18) when they are assembled into bore of pinion gear (19).

(c) Assemble needle rollers (18) into each pinion gear (19).

(d) Install each pinion gear (19) into primary carrier (11), and install thrust washers (20) and (17) between the gear and the walls of the carrier. Make sure that tabs on thrust washers (20) and (17) are aligned with recess in the carrier.

(e) install each pinion shaft (21) into carrier and through each pinion gear (19). Aline pinion shafts (21) to permit installation of retainer (12) on slot of shafts.

(f) Apply Loctite (item 19, Appendix B) to threads of capscrews (14); then install capscrews (14) and lockwashers (13) to secure each retainer (12) to carrier. Tighten to 27-32 lb-ft (37-43 N•m) torque.

(g) Check end play of each pinion gear (19), Should be 0.004-0.020 in. If end play is more than 0.020 in., replace thrust washers (17) and (20).

(h) Check each pinion gear (19) to determine that it rotates freely, without binding or restriction.

(6) Insert the external spline shaft of secondary carrier (7) into sleeve bushing (1) from inside of gear reduction support (39).

(7) Install gasket (32) on gear support.

NOTE

In step (8), check to insure that ring gear (38) fits pilot of support (39). If not, reverse ring gear (38) and reinstall.

(8) Install ring gear (38) over pinion gears in secondary carrier (7) and against face of support (39). Aline holes for capscrews in ring gear (38) and support (39).

(9) Install primary carrier (11) into ring gear (38). Rotate pinion gears (19) in primary carrier and sun gear (9) as necessary to engage teeth of ring gear and teeth of gears in secondary carrier (7).

(10) Insert sun gear (15) into primary carrier (11).

(11) Mount gasket (32) and cover (31) on ring gear (38); then install lockwashers (29) and capscrews (28). Tighten 85-95 lb-ft (1 15-129 N•m) torque.

NOTE

In step (12), more than one gasket (23) may be necessary to ensure that thrust washer (24) has sufficient clearance for installation.

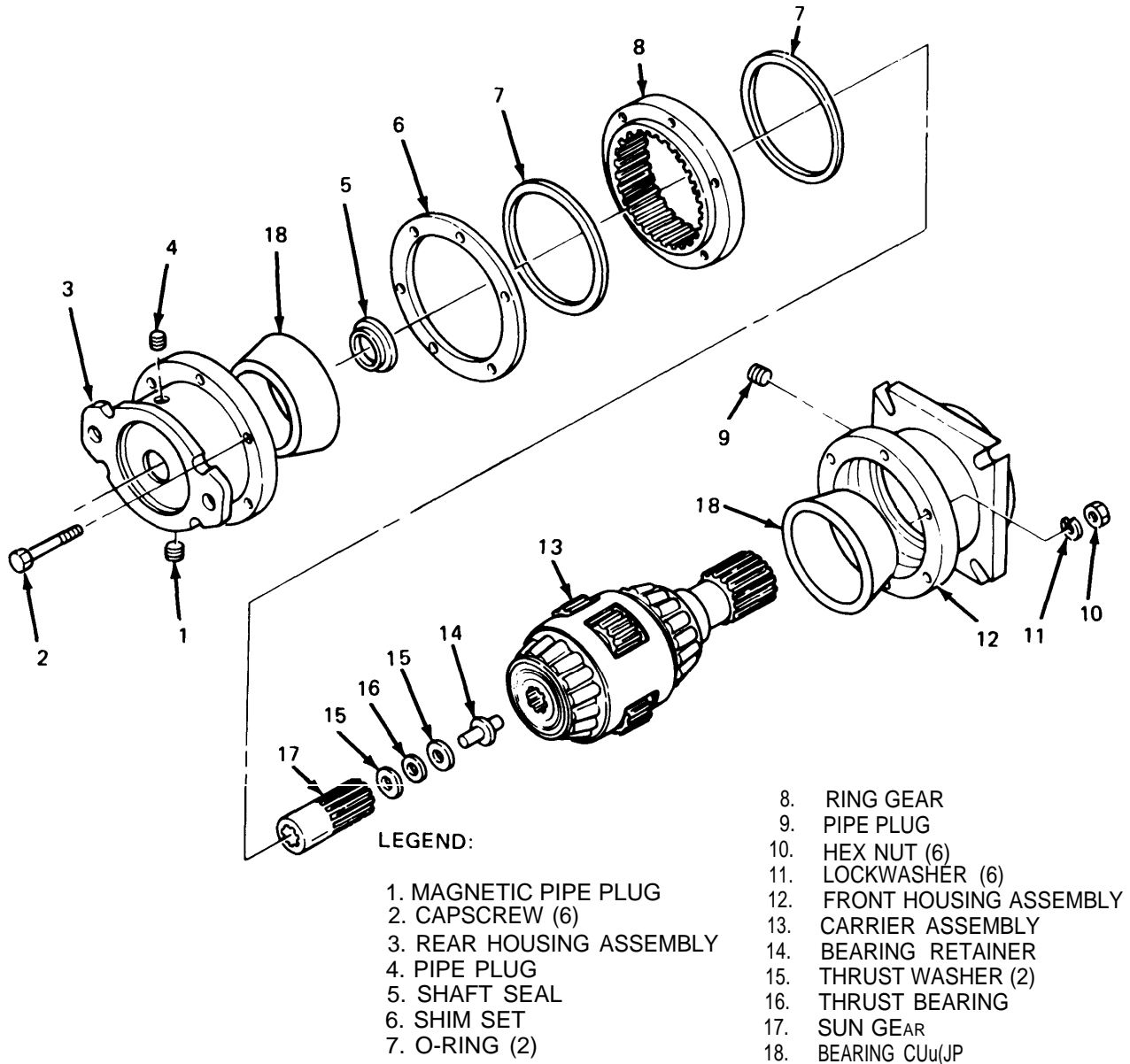
(12) Mount gasket (23), thrust washer (24) and cover (25) on cover (31), then install capscrews (27) and tighten to 20-25 lb-ft (27-34 N•m) torque.

(13) Using a winch input shaft, rotate the assembled final drive gear to determine that it functions properly. If assembly will not rotate, add gasket(s) (23) as necessary to remove thrust load on gears.

20-10. Repair of Primary Speed Reducer.

a. Disassembly.

- (1) Remove magnetic pipe plug (1, fig. 20-23) and drain residual oil.
- (2) Remove six capscrews (2), lockwashers (11) and hex nuts (10) and remove front housing assembly (12).
- (3) Remove ring gear (8) from carrier assembly (13) being careful not to damage shim(s)
- (6).
- (4) Remove carrier assembly (13) from rear housing assembly (3).



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Figure 20-23. Primary Speed Reducer.

(6) Remove shaft seal (5) from rear housing assembly (3) and discard.

(7) Remove bearing cups (18) only if replacement is necessary.

b. Assembly.

(1) Clean all parts using drycleaning solvent SD 2 (item 12, Appendix B).

(2) Inspect all parts for damage or excessive wear; replace as necessary. Check O-rings (7) for nicks or signs of deterioration and replace as needed.

(3) Assemble sun gear (17), two thrust washers (15) and thrust bearing (16) and install on bearing retainer (14) and into carrier assembly (13).

(4) Install new shaft seal (5) in rear housing assembly (3).

(5) Install magnetic pipe plug (1) in rear housing assembly (3).

(6) Install carrier assembly (13) with sun gear (17) in place into the rear housing assembly (3).

(7) Install two capscrews (2) through opposite sides of mounting flange of rear housing assembly (3). Hold capscrews in place and install shim(s) (6), ring gear (8) with two O-rings (7) and front housing assembly (12). Install two lockwashers (11) and hex nuts (10) finger tight.

(8) *Install remaining* four capscrews (2), lockwashers (11) and hex nuts (10). Torque to 17 lb-ft (23 N•m).

20-11. Winch Reassembly.

a. Inspect bronze bushing (5, fig. 20-14). If bushing is scored or otherwise defective, replace. On installation, use Loctite No. 601 (item 19, Appendix B) to secure bushing.

b. Install new oil seal (4). Seal should be flush with end of drum when installation is correct.

c. Coat seal (4), inside of bronze bushing (5), and the drum female spline teeth with an all purpose grease (item 1, Appendix B).

d. Mount assembled final drive housing (11) and gear support (12) on drum support (10), mating the male gear on the final drive with the female spline gear in the drum. It may be necessary to tap the final drive with a rawhide mallet to seat it fully.

e. Using a sling and hoist, support winch drum and set assembly on its side rails, as shown in figure 20-14, sheet 2.

f. Install six capscrews, nuts, and washers (13) that fasten final gear support (12) to both side rails (14). Tighten to 275 lb-ft (373 N•m) torque.

g. Install input shaft in center of drum (small diameter end of shaft towards final drive gear).

h. Stand the winch of final gear drive end, as shown in figure 20-14, sheet 1.

i. Inspect bronze bushing (15). If bushing is scored or otherwise defective, replace. On installation, use Loctite (item 19, Appendix B) to secure bushing.

j. Install new oil seal (16). Seal should be flush with end of drum when installation is correct.

- k. Coat oil seal (16) and bronze bushing (15) with an all purpose grease (item 1, Appendix B).
- l. Install coupling on end of shaft in winch drum.
- m. Mount support (7, fig. 20-1 4) on winch and secure to both side rails with capscrews, lockwashers, and nuts (6). Tighten to 275 lb-ft (373 N•m) torque.
- n. Mount the primary speed reducer (2) with gasket (9) on winch support (7). Secure with four capscrews (1), lockwashers and nuts (3). Tighten to 75 lb-ft (102 N•m) torque.
- o. Fill winch with oil. (Refer to LO 9-2320-273-1 2.)

20-12. Winch Installation.

NOTE

If entire winch assembly was removed for maintenance, omit this procedure and perform procedure outlined in paragraph 20-13.

- a. Attach a sling and hoist (fig. 20-10) to support winch.
- b. Position the winch on vehicle and install two capscrews, nuts, and washers (1, fig. 20-11), that fasten winch to support angle. Install eight capscrews, washers, and nuts (2) that fasten winch to vehicle frame. Tighten 10 capscrews to 270 lb-ft (366 N•m) torque.

CAUTION

In step (c) be sure that primary speed reducer input sun gear is flush with housing when brake is installed.

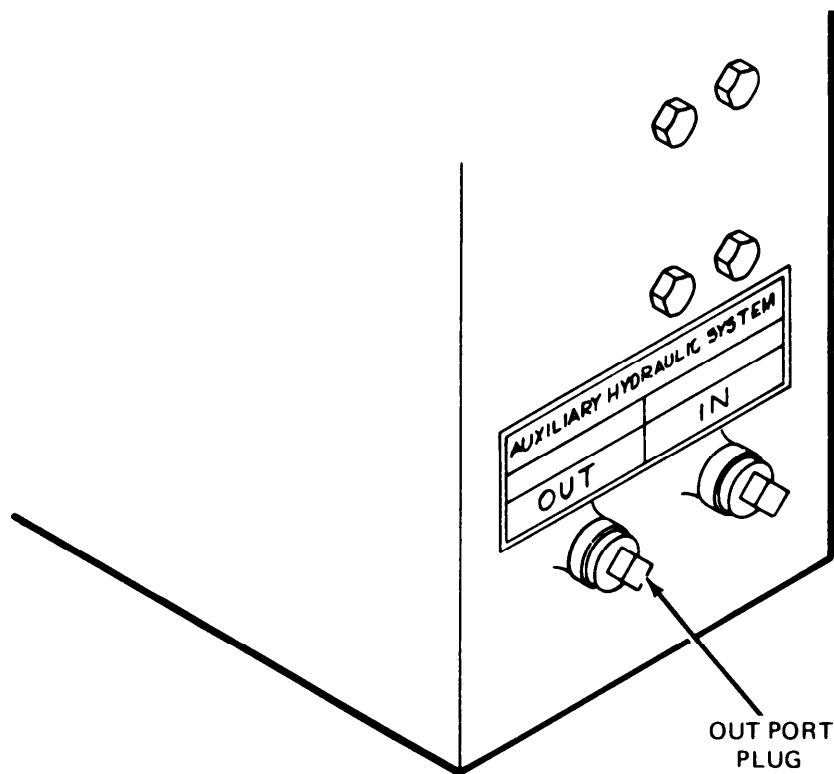
Mount fail-safe brake (4, fig. 20-9) and hydraulic motor (6) on primary speed reducer (2) and secure with capscrews (5), lockwashers and nuts (3).

- d. Connect seven hydraulic lines (1) to hydraulic motor (6), fail-safe brake (4), and primary speed reducer (2).
- e. Install winch drive cover plate (fig. 20-8) and secure with four capscrews and washers.
- f. Install control panel front cover (fig. 20-3) and secure with six capscrews and washers.

20-13. Winch Assembly Installation.

- a. Attach a sling and hoist to support winch assembly, as shown in figure 20-5.
- b. Install winch assembly on vehicle and secure with 12 capscrews and nuts (six on each side of the vehicle). Tighten to 375400 lbft (576-614 N•m) torque. (fig. 20-6).

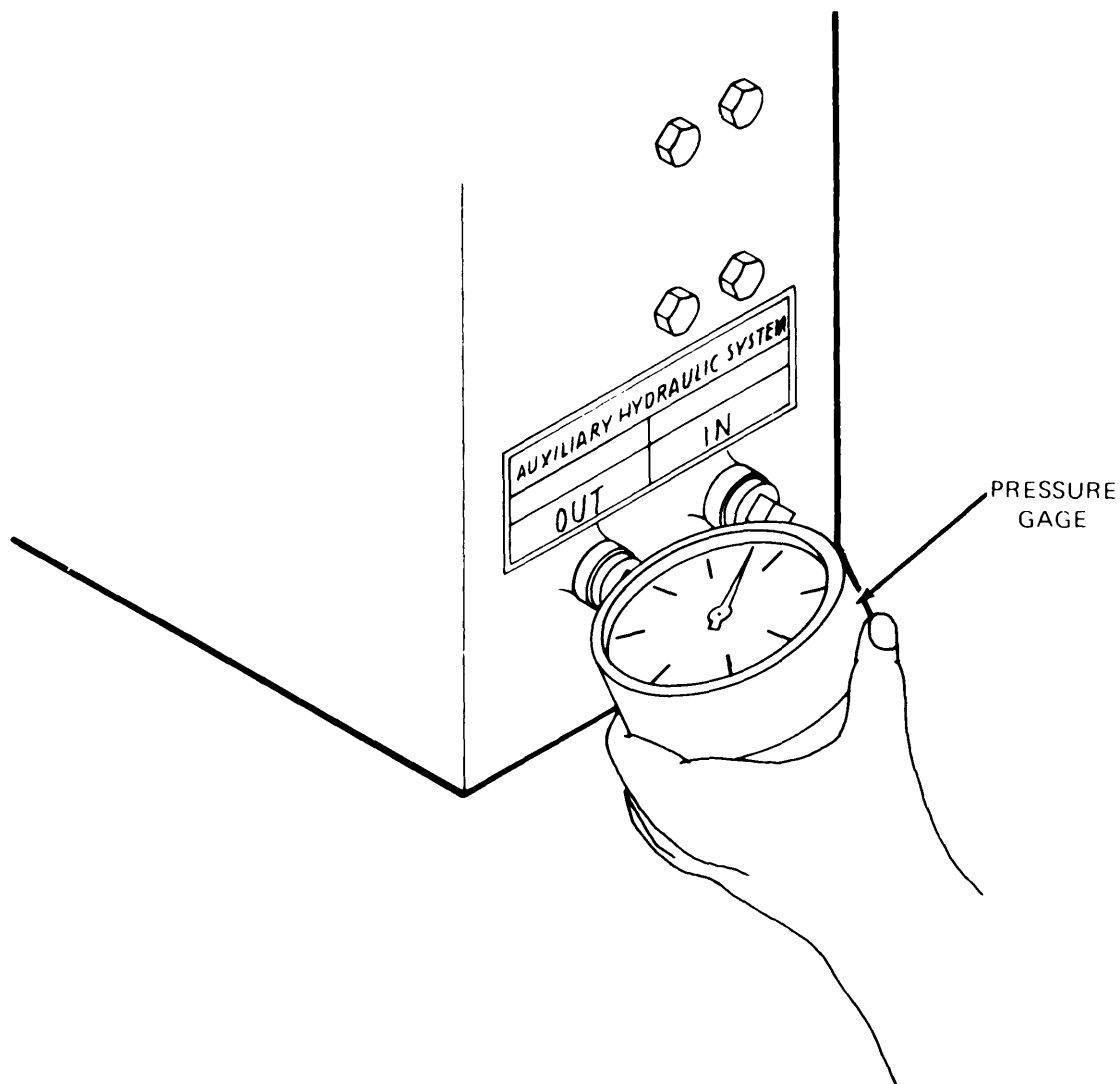
- c. Connect two inlet pressure hydraulic lines (1, fig. 20-4) and (2).
- d. Connect two hydraulic lines to fittings at base of hydraulic reservoir. Either line can be connected to either fitting (fig. 20-1).
- e. Secure air lines (fig. 20-3) to pogo stick straps.
- f. Install trailer receptacle mounting bracket (fig. 20-2) and secure with three capscrews, washers, and nuts.
- g. Fill hydraulic reservoir with oil. (Refer to LO 9-2320-273-12.)
- h. Start up engine and operate winch to determine that it functions properly. (Refer to TM 9-2320-273-10.) Check for leaks.
- i. Check and set relief pressure as follows.
 - (1) Remove pipe plug from OUT port of auxiliary hydraulic system (fig. 20-24).



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Figure 20-24. Remove/Install Out Port Plug.

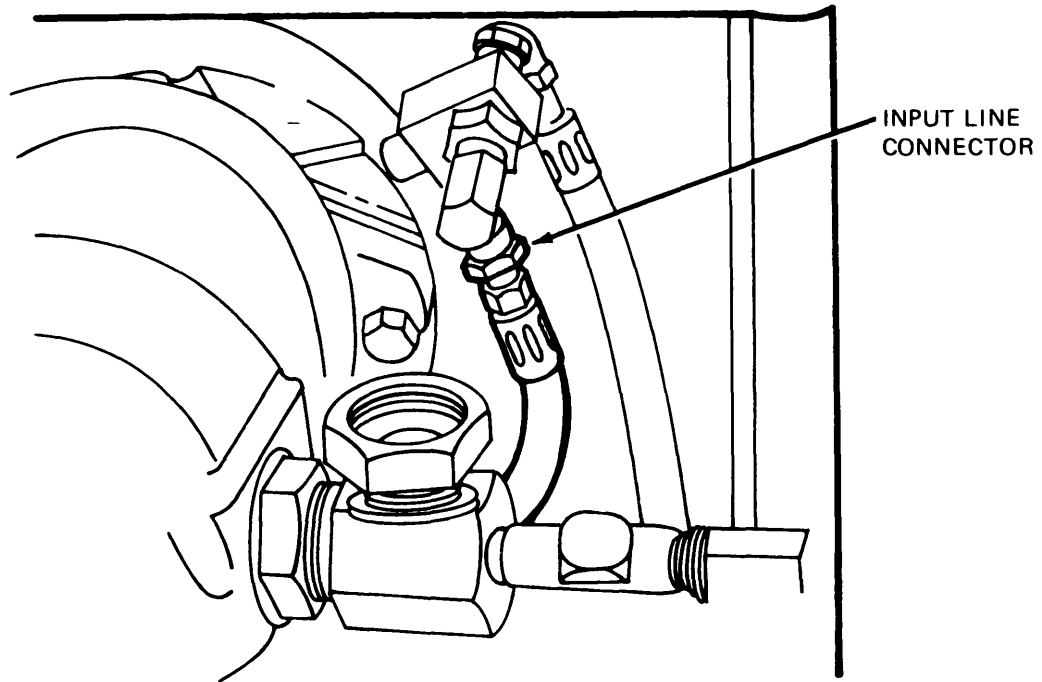
- (2) Install a 3000 psi (20,685 kPa) gage in auxiliary hydraulic system out port (fig. 20-25).



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Figure 20-25. Install Pressure Gage in Out Port.

(3) Disconnect input line at the fail-safe brake (fig. 20-26).



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Figure 20-26. Disconnect/Connect Input Lines to Fail-Safe Brake.

(4) Install a 3000 psi (20,685 kPa) gage and input line hose (fig. 20-27).

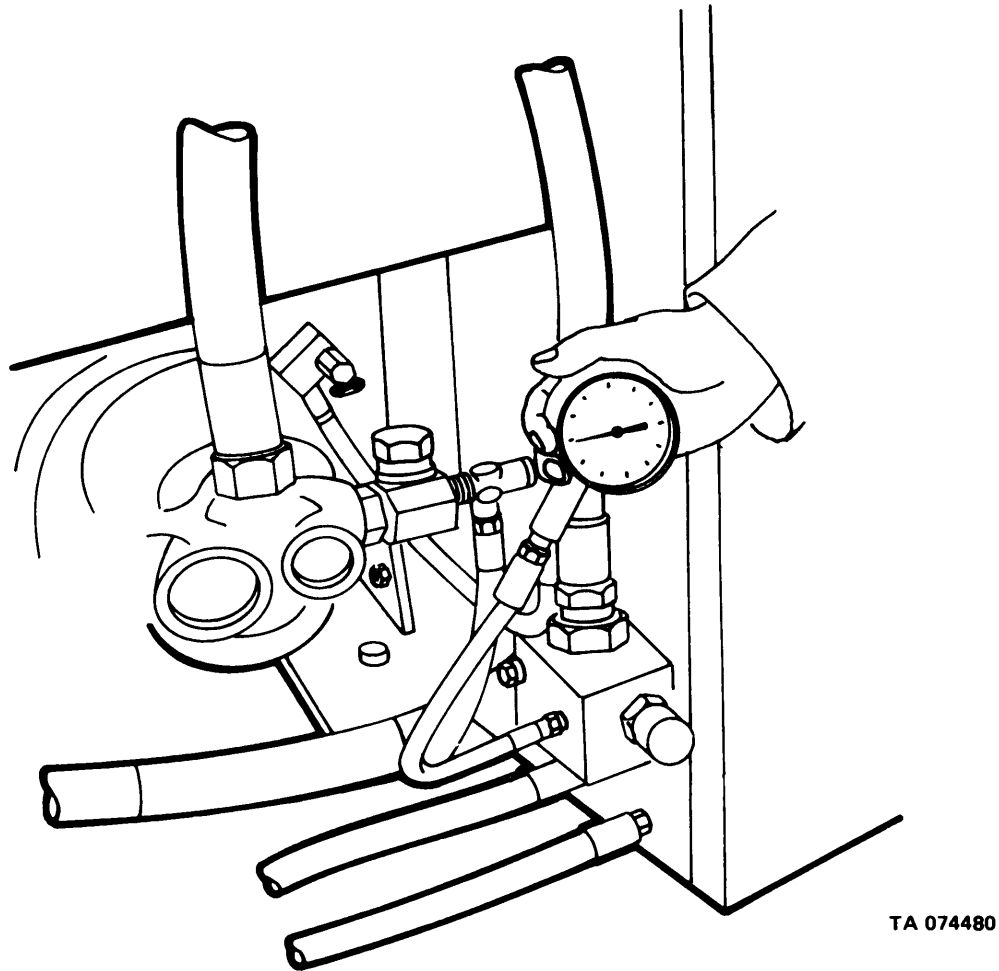


Figure 20-27. Install Pressure Gage in Input Lines to Fail-Safe Brake.

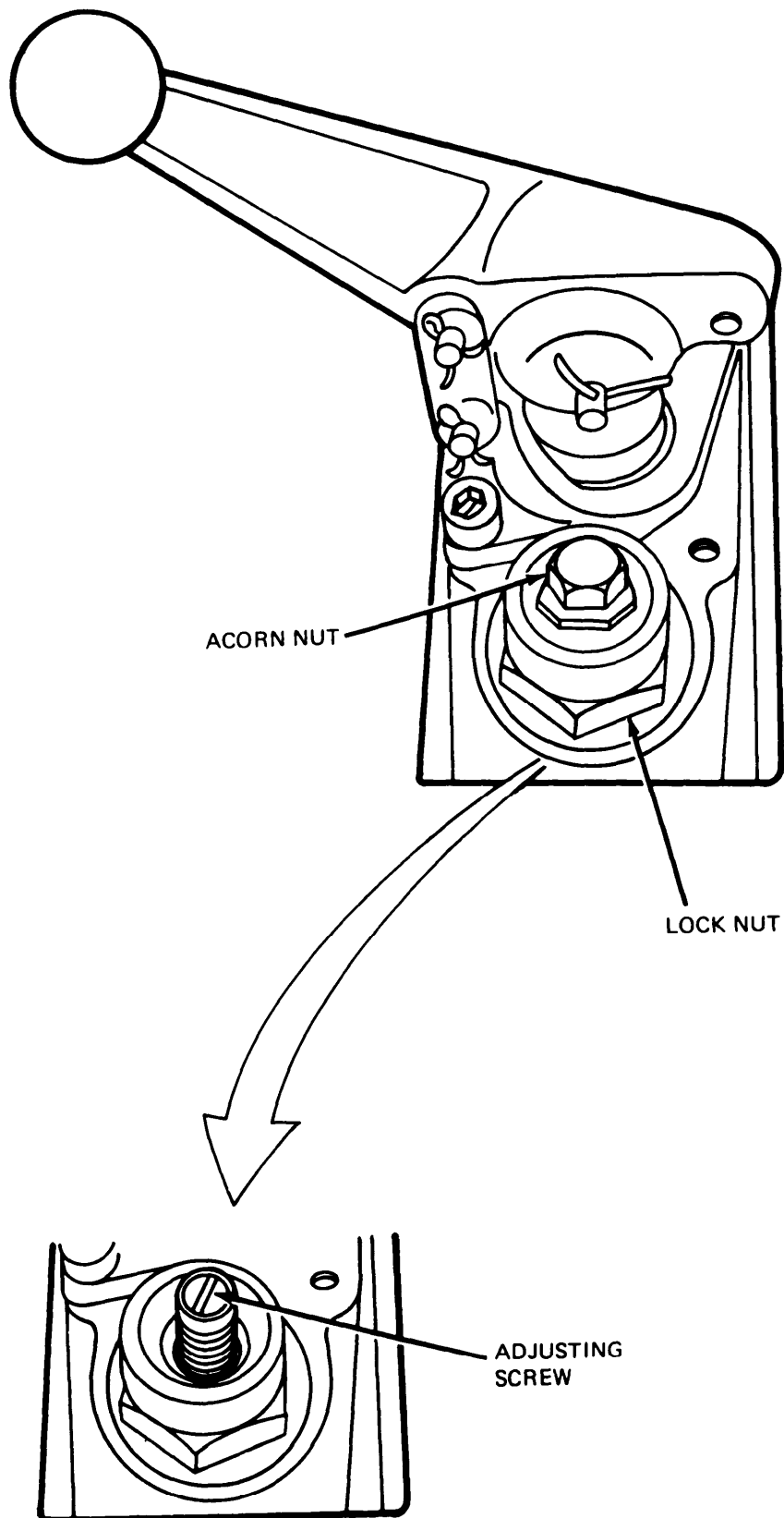
(5) start engine and set cab controls to operate winch. (Refer to TM 9-2320-273-10.)

(6) push down on winch CONTROL NO. 1 and record indication from gage installed in the input line hose (fig. 20-27). Should indicate 2500 psi (23,238 kPa).

(7) pull up on winch CONTROL NO. 2 and record indication from gage installed in auxiliary hydraulic system OUT port (fig. 20-25). Should indicate 2000 psi (13,790 kPa).

(8) If results of either test is not correct, remove the acorn nut (fig. 20-28) from the pressure relief valve that needs adjusting (CONTROL VALVE NO. 1 or NO. 2). Loosen adjusting screw locknut and adjust the pressure as follows. Turn the adjusting screw in (clockwise) to increase pressure. Turn adjusting screw out (counterclockwise) to decrease pressure.

(9) Repeat step (6) or (7), as applicable, and adjust as described in step (8) until results are satisfactory; then reinstall locknut and acorn nut on pressure regulator.



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Figure 20-28. Adjust Pressure Regulator.

(70) Shutdown the engine and winch controls in cab. (Refer to TM 9-2320-273-10).



Before removing gage installed in the auxiliary out port be sure pressure has been relieved (gage at zero) by moving number 2 control lever to the fast position.

(11) Remove both test gages.

(12) Install plug in OUT port (fig. 20-24).

(13) Connect input line to fail safe brake (fig. 20-26).

j. Install front cover on control panel and secure with six screws.

k. Install spare tire hoist (M916 only).

l. Install spare tire (M916 only).

20-14. Orifice Removal.

a. Unscrew and remove six capscrews and washers; remove control panel cover (fig. 20-1).

b. Disconnect hydraulic lines (fig. 20-29). Remove brake valve (5) by unscrewing four nuts (7), lockwashers (6), capscrews (4), spacer (3), two O-rings (9), flange (8) and plate (10). Place brake valve (5) in vise.

c. Remove fitting (1, fig. 20-30) from brake valve.

d. Using a hex key wrench, remove orifice (2) from valve inlet.

e. Cleaning and Inspection.

(1) Using a pin or a piece of wire and cleaning solvent (item 12, Appendix B), clean out small hole in orifice.

(2) Inspect for damage. If unrepairable, replace orifice.

b. *Installation.*

(1) Install orifice (2) in valve body through inlet and tighten securely with a hex key wrench.

(2) Coat threads of fitting (1) with liquid teflon (item 14, Appendix B) and install in valve.

(3) Remove brake valve (5) from vise and place in mounting location on winch assembly. Secure with four capscrews (4), spacer (3), lockwashers (6), nuts (7), two O-rings (9), flange (8) and plate (10).

(4) Connect hydraulic lines and check for leaks.

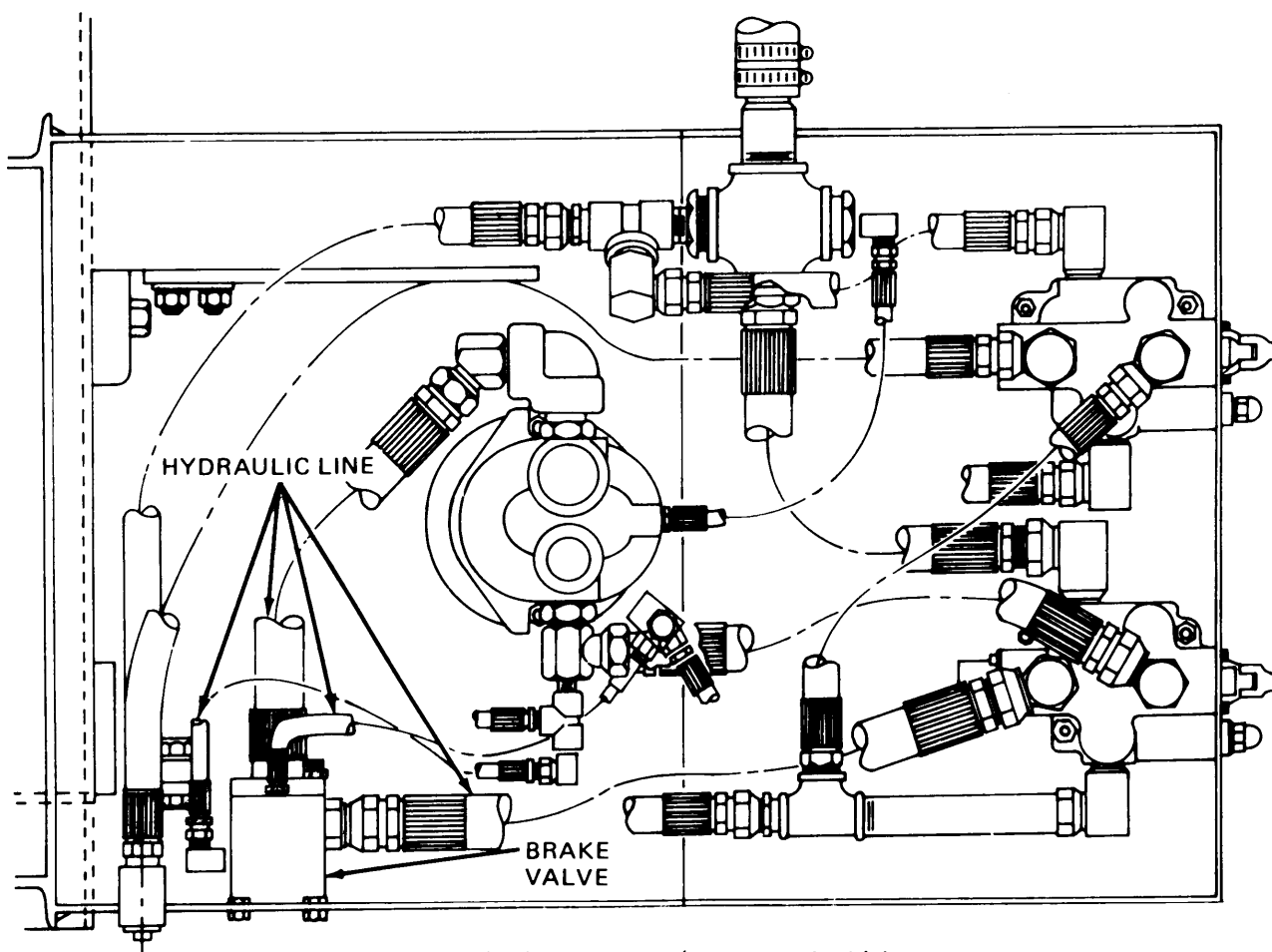
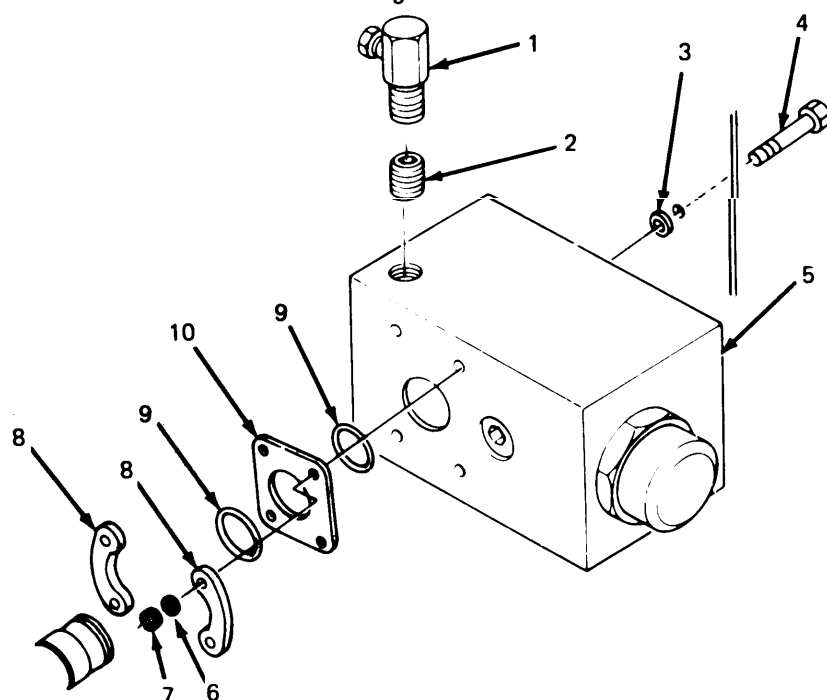


Figure 20-29. Remove/Install Brake Valve.



LEGEND:

1. HYDRAULIC LINE FITTING
2. ORIFICE
3. SPACE R (4)
4. CAPSCREW (4)
5. BRAKE VALVE
6. LOCKWASHER (4)
7. NUT (4)
8. FLANGE (2)
9. O-RING (2)
10. PLATE

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Figure 20-30. Remove/Install Orifice.

CHAPTER 21

REPAIR OF POWER TAKEOFF AND ADAPTER

21-1. Description. The power takeoff and the adapter unit (fig.21-1) are driven by the transmission to supply auxiliary power for the following:

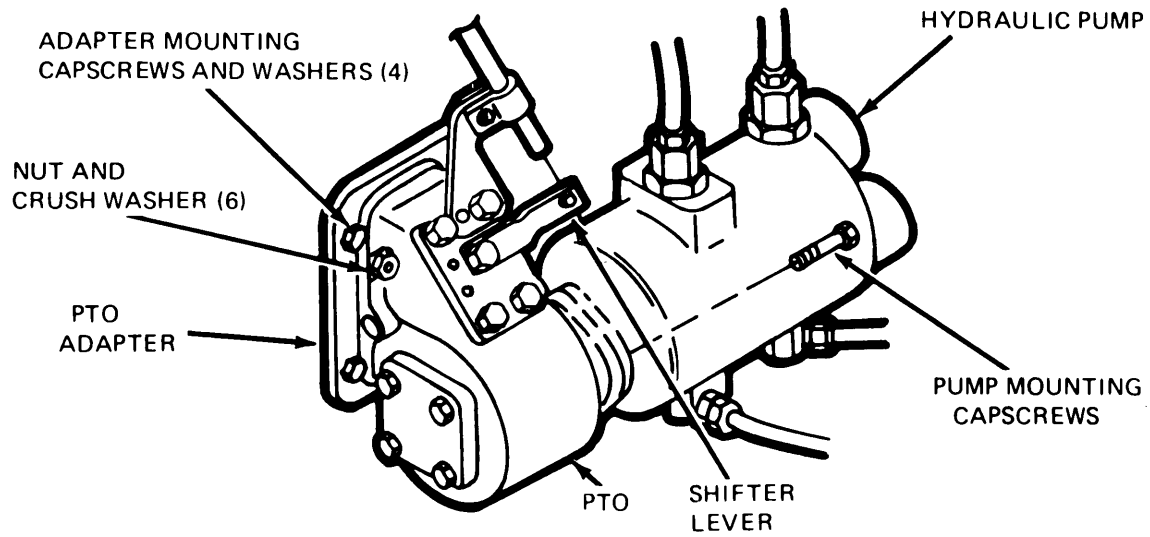
- a. M916 and M920 – Drives a hydraulic pump for winch hydraulic power.
- b. M917 – Drives a hydraulic pump which supplies power for the dump body hoist.
- c. M918 – Powers a drive shaft which supplies the drive for bituminous spreader operating components.
- d. M919 – Powers a drive shaft which supplies the drive for all mixer operating components.
- e. The adapter is a single shaft gear unit that transfers drive from the transmission to the PTO. The shaft is supported by two roller bearings. The adapter is identical on all M916 thru M920 vehicles.
- f. The PTO is a single speed, two gear unit. The unit is engaged or disengaged by mechanical linkage from the cab.
- g. The adapter and the PTO are lubricated internally by transmission oil and require no servicing.

21-2. Removal (M916, M917 and M920).

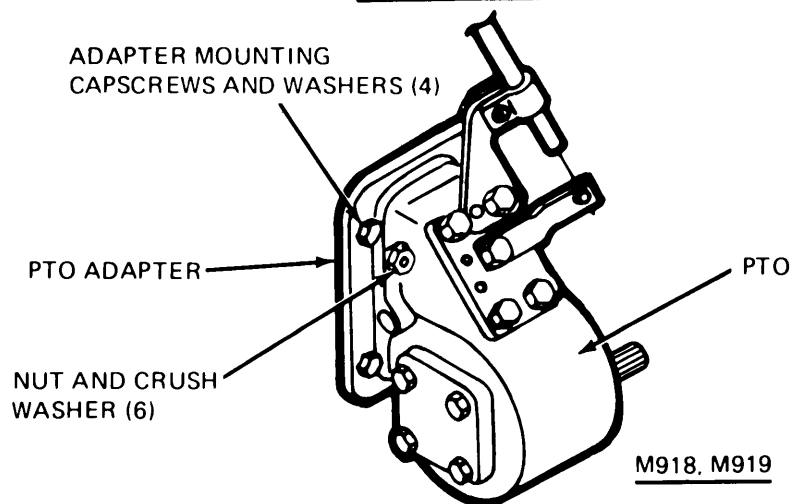
- a. Remove two capscrews (M916 and M920) or four capscrews (M917) that fasten hydraulic pump to the PTO (fig. 21-1) and disconnect the hydraulic pump from the PTO. It is not necessary to remove the hydraulic lines from the pump.
- b. Disconnect PTO control cable from shifter lever. (Refer to TM 9-2320-273 -20.)
- c. Remove PTO switch from PTO. (Refer to TM 9-2320-273-20.)
- d. Remove four capscrews and washers that fasten the PTO adapter to the transmission housing and remove the adapter with the PTO and gasket attached. Measure thickness of the gasket to aid in installation.

21-3. Removal (M918 and M919).

- a. Disconnect driveshaft and yoke. (Refer to TM 5-3895-371-24 & P (M918) or TM 5-3895-372-20 (M919) for detailed procedures.)
- b. Disconnect PTO control cable from shifter lever. (Refer to TM 9-2320-273-20.)
- c. Remove PTO switch from PTO. (Refer to TM 9-2320-273 -20.)
- d. Remove four capscrews and washers that fasten the PTO adapter to the transmission housing and remove the adapter with the PTO and gasket attached (fig. 21-1). Measure thickness of the gasket to aid in installation.



M916, M917 AND M920



M918, M919

Figure 21-1. PTO and Adapter Arrangement.

21-4. Disassembly of PTO (M916, M917, and M920).

a. Remove six nuts and crush washers that fasten the PTO to the adapter (fig. 21-1). Separate the PTO and the adapter. Remove gasket (36, fig. 21-1) from case (31).

b. Remove three capscrews (11) from cover (17). (The fourth capscrew (11) was removed during the PTO cable removal procedure). Remove PTO switch bracket (12).

c. Remove capscrew (13) and lockwasher (14) that fastens the shifter lever (15) to the cover. Mark the lever and the spindle so that they can go back together in the same position. pull off the lever (15), washer (16) and cover (17). Remove O-ring (18). Remove plate subassembly (8).

d. Remove poppet pin (9) and shifter ball spring (10), if required.

e. Remove spacer (19) and two gaskets (7).

f. Back out setscrew (32) flush to surface of case (31).

g. Press out idler shaft (30) and remove idler gear (34), two bearing cones (35) and spacer(s) (33). Measure thickness of spacer(s) to aid in reassembly.

h. Remove four capscrews (1) and carefully pry off cover (2) with attached bearing cup (4). Remove gasket (3) and press out bearing cup, if required.

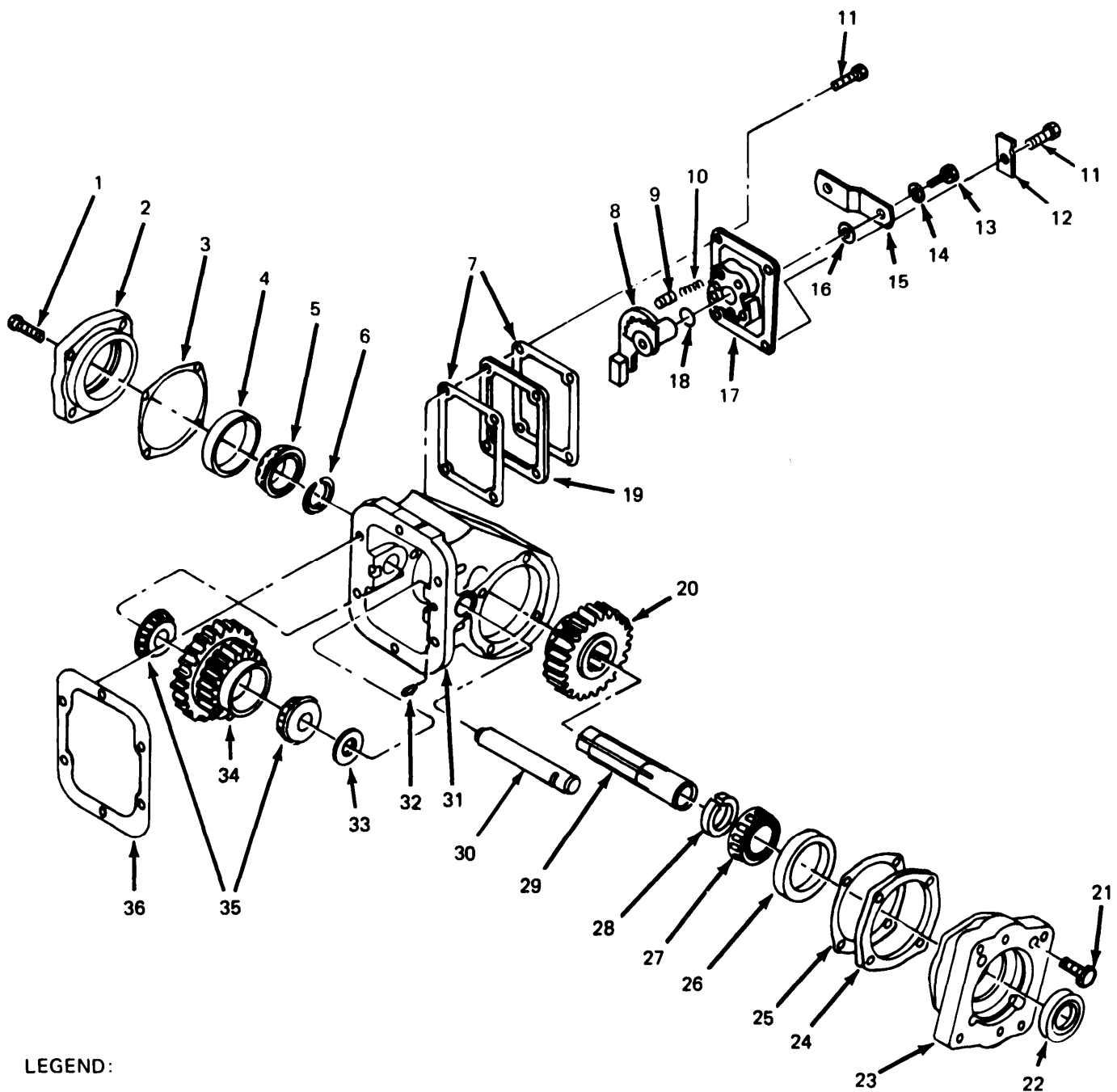
i. Remove four Allen head capscrews (21) and carefully pry off cover (23) with seal (22) and bearing cup (26) attached. Remove spacer (24) and gasket (25). If required, pry out seal and press out bearing cup.

Using a suitable bearing puller, remove bearing cone (5) from end of output shaft (29). (See fig. 21-5).

k. Remove snapring (6) and pull output shaft (29) out from opposite end of case (31).

i. Remove bearing cone (27) with a suitable puller and then remove snapring (28).

m. Pull output sliding gear (20) out of case (31).



LEGEND:

- | | | | |
|-------------------|-------------------------|-------------------------|----------------------|
| 1. CAPSCREW (4) | 10. SHIFTER BALL SPRING | 19. SPACER | 28. SNAPRING |
| 2. COVER | 11. CAPSCREW (4) | 20. OUTPUT SLIDING GEAR | 29. OUTPUT SHAFT |
| 3. GASKET | 12. PTO SWITCH BRACKET | 21. CAPSCREW (4) | 30. IDLER SHAFT |
| 4. BEARING CUP | 13. CAPSCREW | 22. SEAL | 31. CASE |
| 5. BEARING CONE | 14. LOCKWASHER | 23. COVER | 32. SETSCREW |
| 6. SNAPRING | 15. SHIFTER LEVER | 24. SPACER | 33. SPACER |
| 7. GASKET (2) | 16. WASHER | 25. GASKET | 34. IDLER GEAR |
| 8. PLATE ASSEMBLY | 17. COVER | 26. BEARING CUP | 35. BEARING CONE (2) |
| 9. POPPET PIN | 18. O-RING | 27. BEARING CONE | 36. GASKET |

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Figure 27-2. M916, M977 and M920 PTO Exploded View.

21-5. Disassembly of PTO (M918).

a. Remove six nuts and crush washers that fasten the PTO to the adapter (fig. 21-1). Separate the PTO and the adapter. Remove gasket (38, fig. 21-3) from case (30).

b. Remove three capscrews (11) from cover (17). (The fourth capscrew (11) was removed during the PTO cable removal procedure). Remove PTO switch bracket (12).

c. Remove capscrew (13) and lockwasher (14) that fastens the shifter lever (15) to the cover. Mark the lever and the spindle so that they can go back together in the same position. Pull off the lever (15), washer (16) and cover (17). Remove O-ring (18). Remove plate subassembly (8).

d. 1 Remove poppet pin (9) and shifter ball spring (10), if required.

e. Remove two gaskets (7).

f. Back out setscrew (31) flush to surface of case (30).

g. Press out idler shaft (29). Remove two thrustwashers (32) and (39) and input sliding gear (37) with sleeve (36), needle bearings (33) and spacer (34) still inside. Carefully remove spacer and needle bearings (17 per set, 34 total) and keep in sets if possible.

h. Press sleeve (36) out of input sliding gear (37) and remove key (35).

Remove four capscrews (1) and carefully pry off cover (2) with attached bearing cup (4). Remove gasket (3) and press out bearing cup, if required.

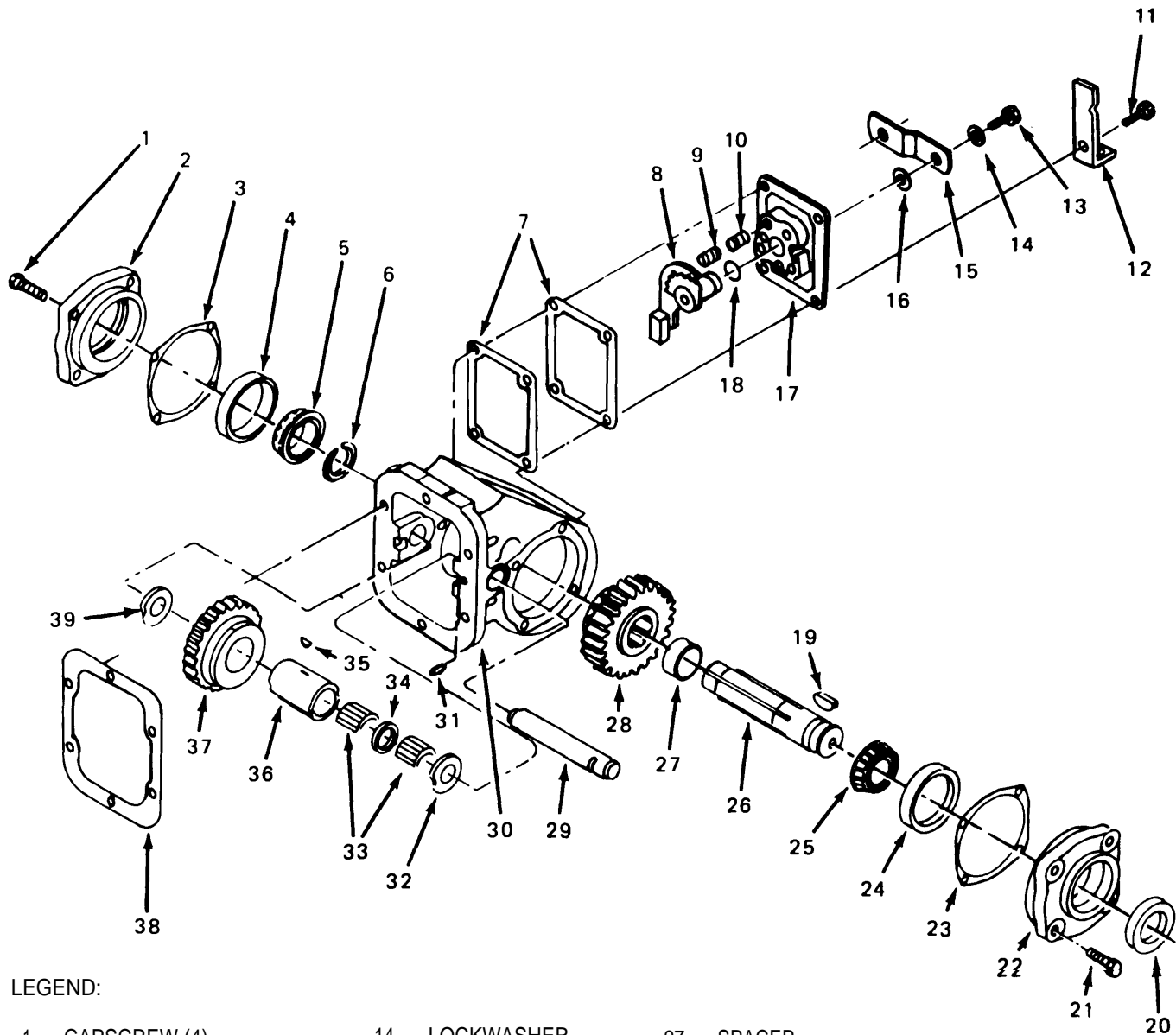
i. Remove key (19) from end of output shaft (26). Remove four capscrews (21) and carefully pry off cover (22) with seal (20) and bearing cup (24) attached. Remove gasket (23). If required, pry out seal and press out bearing cup.

k. Using a suitable bearing puller, remove bearing cone (5) from end of output shaft (26). (See fig. 21-5).

l. Remove snapping (6) and pull output shaft (26) out from opposite end of case (30). Remove spacer (27).

m Remove bearing cone (25) with a suitable puller.

n. Pull output sliding gear (28) out of case (30).



LEGEND:

- | | | |
|-------------------------|-------------------|-------------------------|
| 1. CAPSCREW (4) | 14. LOCKWASHER | 27. SPACER |
| 2. COVER | 15. SHIFTER LEVER | 28. OUTPUT SLIDING GEAR |
| 3. GASKET | 16. WASHER | 29. IDLER SHAFT |
| 4. BEARING CUP | 17. COVER | 30. CASE |
| 5. BEARING CONE | 18. O-RING | 31. SETSCREW |
| 6. SNAP RING | 19. KEY | 32. THRUST WASHER |
| 7. GASKET (2) | 20. SEAL | 33. NEEDLE BEARING (2) |
| 8. PLATE SUBASSEMBLY | 21. CAPSCREW (4) | 34. SPACER |
| 9. POPPET PIN | 22. COVER | 35. KEY |
| 10. SHIFTER BALL SPRING | 23. GASKET | 36. SLEEVE |
| 11. CAPSCREW (4) | 24. BEARING CUP | 37. INPUT SLIDING GEAR |
| 12. PTO SWITCH BRACKET | 25. BEARING CONE | 38. GASKET |
| 13. CAPSCREW | 26. OUTPUT SHAFT | 39. THRUST WASHER |

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Figure 21-3. M918 PTO Exploded View

21-6. Disassembly of PTO (M919).

a. Remove six nuts and crush washers that fasten the PTO to the adapter (fig. 21-1). Separate the PTO and the adapter. Remove gasket (36, fig. 21-4) from case (31).

b. Remove three capscrews (12) from cover (17). (The fourth capscrew (12) was removed during the PTO cable removal procedure). Remove PTO switch bracket (13).

c. Remove capscrew (14) and lockwasher (15) that fastens the shifter lever (16) to the cover. Mark the lever and the spindle so that they can go back together in the same position. Pull off the lever (16), washer (11) and cover (17). Remove O-ring (18). Remove plate subassembly (8).

d. Remove poppet pin (9) and shifter ball spring (10), if required.

e. Remove spacer (19) and two gaskets (7).

f. Back out setscrew (32) flush to surface of case (31).

g. Press out idler shaft (30) and remove idler gear (34), two bearing cones (35) and spacer(s) (33). Measure thickness of spacer(s) to aid in reassembly.

h. Remove four capscrews (1) and carefully pry off cover (2) with attached bearing cup (4). Remove gasket (3). Remove key (20) from end of shaft (27). If required, remove bearing cup (4) from cover (2).

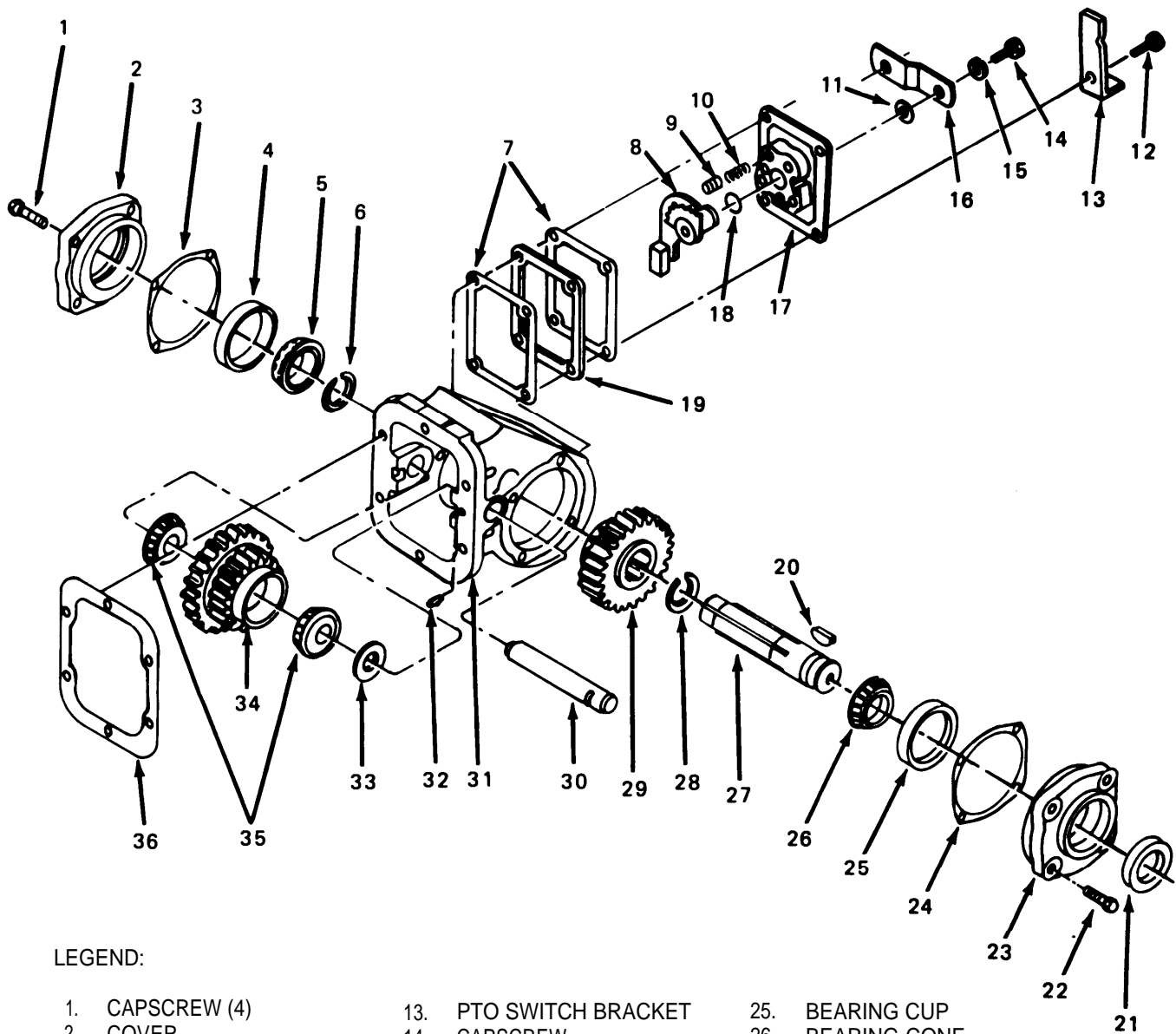
Remove four capscrews (22) and carefully pry off cover (23) with seal (21) and bearing cup (25) attached. Remove gasket (24). If required, pry out seal and press out bearing cup.

i. Using a suitable bearing puller, remove bearing (5) from end of output shaft (27). (See fig. 21-5).

k. Remove snapring (6) and pull output shaft (27) out from opposite end of case (31).

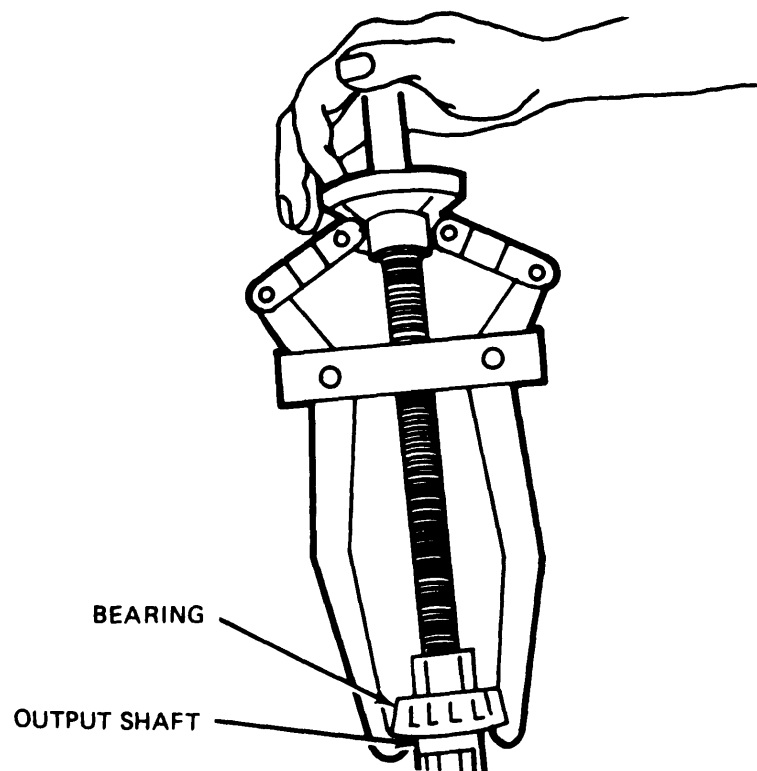
l. Remove bearing (26) with a suitable puller and then remove snapring (28).

m. Pull output sliding gear (29) out of case (31).



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Figure 21-4. M919 PTO Exploded View.

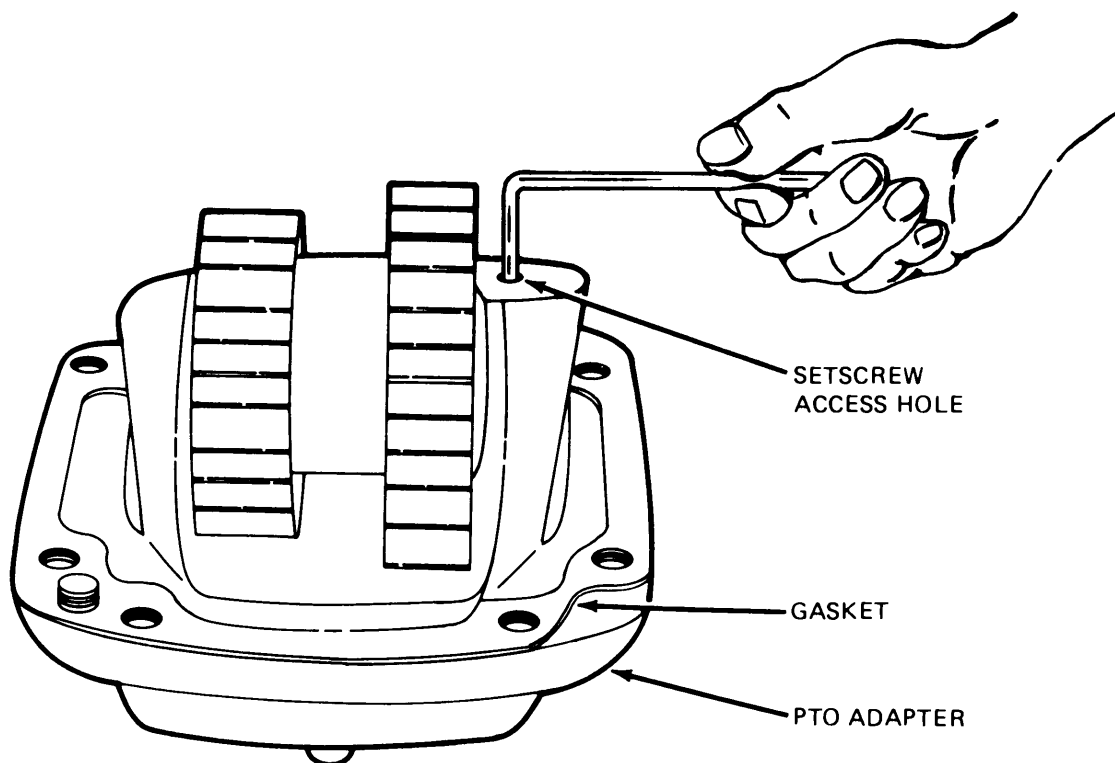


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Figure 21-5. Remove Bearing From Output Shaft.

21-7. Disassembly of PTO Adapter (M916 thru M920).

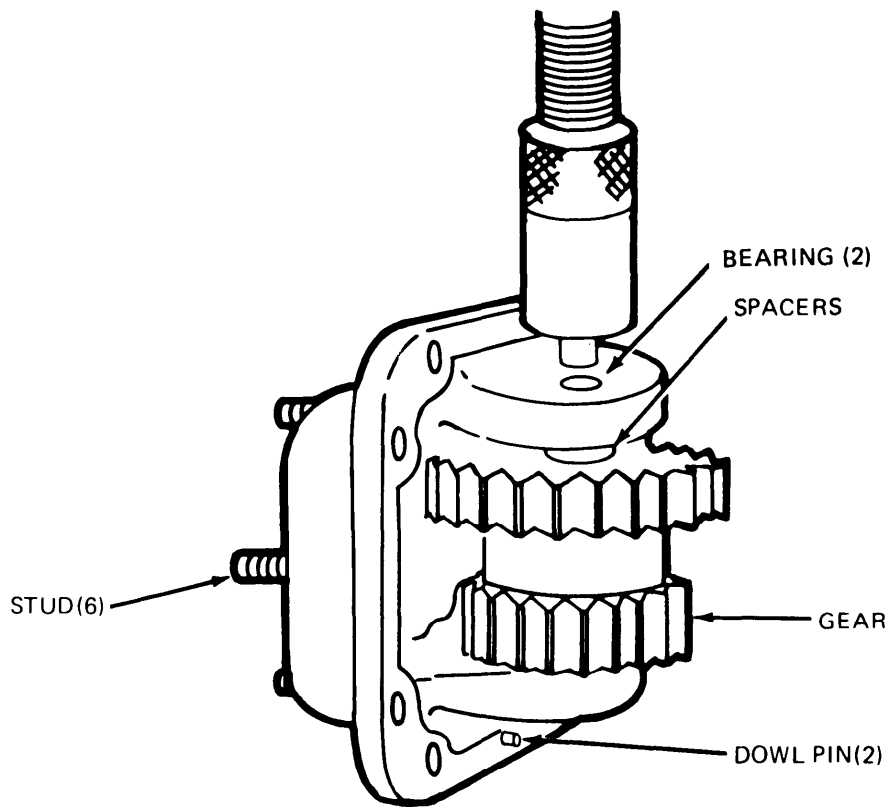
- a. Backout setscrew flush to surface of housing (fig. 21-6).



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Figure 21-6. Loosen Gear Shaft Setscrew.

- b. Press out shaft (fig. 21-7).



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Figure 21-7. Press Shaft Out of PTO Adapter.

- c. Remove gear, two bearings, and spacer(s). Measure thickness of spacer to aid in reassembly.
- d. If necessary, six studs and two dowel pins may be removed.

21-8. Reassembly of PTO Adapter.

- a. Assemble gear, two bearings, and spacer(s) (same thickness as removed) into housing as shown in figures 21-6 and 21-7. Large gear and spacers positioned at same end of housing as the setscrew access hole.
- b. Press shaft into housing with flat on shaft positioned over the setscrew access hole.
- c. Tighten setscrew to secure shaft.

21-9. Reassembly of PTO (M916, M917 and M920).

- a. position output sliding gear (20, fig. 21-2) and output shaft (29) in case (31).
- b. Install snaprings (6) and (28) on each end of the output shaft.
- c. Press bearing cones (5) and (27) onto output shaft.
- d. If removed, install bearing cup (26) and seal (22) into cover (23).
- e. install cover (23), new gasket (25) and spacer (24) to case (31) with four capscrews (21). Tighten capscrews to 17 lb-ft (23 N•m) torque.
- f. If removed, install bearing cup (4) into cover (2).
- g. Install cover (2) and new gasket (3) to case (31) with four capscrews (1). Tighten capscrews to 17 lb-ft (23 N•m) torque.
- h. Position idler gear (34), two bearing cones (35) and spacer (33) in case (31). Use same thickness spacer(s) as removed.
- i. Press idler shaft (30) into case (31) with flat on shaft positioned in line with setscrew hole in case.
- j. Install setscrew (32) to secure idler shaft (30).
- k. If removed, install shifter ball spring (10) and poppet pin (9) into cover (17).
- l. Install new O-ring (18) onto plate subassembly (8). Install plate subassembly (8), washer (16), shifter lever (15), lockwasher (14) and capscrew (13) to cover (17). Aline marks made during disassembly and tighten capscrew to 17 lb-ft (23 N•m)torque.
- m. Position cover (17), two new gaskets (7) and spacer (19) to case (31). Install two capscrews (11) to upper left and lower right holes finger tight. position PTO switch bracket (12) mounting hole to lower left hole and install capscrew (11). Torque three capscrews (11) to 17 lb-ft (23 N•m). The fourth capscrew (11) will be installed in the upper right hole during the PTO cable installation procedure.

21-10. Reassembly of PTO (M918).

- a. position output sliding gear (28, fig. 21-3) and output shaft (26) in case (30).
- b. Install snaprings (6) and spacer (27) on the output shaft on appropriate side of the gear.
- c. Press bearing cones (5) and (25) onto output shaft.
- d. If removed, install bearing cup (24) and seal (20) into cover (22).
- e. Install cover (22) and new gasket (23) to case (30) with four capscrow (21). Tighten capscrows to 17 lb-ft (23 N•m) torque.
- f. If removed, install bearing cup (4) into cover (2).
- g. Install cover (2) and new gasket (3) to case (30) with four capscrows (1). Tighten capscrows to 17 lb-ft (23 N•m) torque.
- h. Press sleeve (36) and key (35) into input sliding gear (37). Position spacer (34) in center of sleeve and coat remaining inner diameter of the sleeve with GAA. Install two sets of needle bearings (33) into sleeve. position gear with sleeve, needle bearings and two thrust washers (32) and (39) inside case (30).
- i. Carefully press idler shaft (29) into case (30) with flat on shaft positioned in line with setscrew hole in case.
- j. Install setscrew (31) to secure idler shaft (29).
- k. If removed, install shifter ball spring (10) and poppet pin (9) into cover (17).
- l. Install new O-ring (18) onto plate subassembly (8). Install plate subassembly (8), washer (16), shifter lever (15), lockwasher (14) and capscrow (13) to cover (17). Aline marks made during disassembly and tighten capscrow to 17 lb-ft (23 N•m) torque.
- m. position cover (17) and two new gaskets (7) to case (30). Install two capscrows (11) to upper left and lower right holes finger tight. Position PTO switch bracket (12) mounting hole to lower left hole and install capscrow (11). Torque three capscrows (11) to 17 lb-ft (23 N•m). The fourth capscrow (11) will be installed in the upper right hole during the PTO cable installation procedure.
- n. Install key (19) into output shaft and secure with tape.

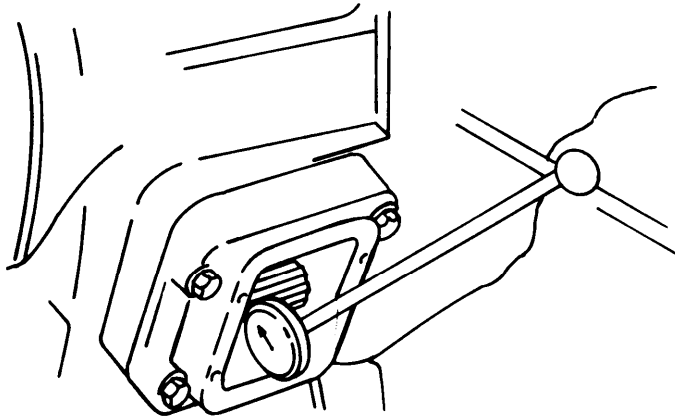
21-11. Reassembly of PTO (M919).

- a. position output sliding gear (29, fig. 21-4) and output shaft (27) in case (31).
- b. Install snapring (6) and (28) on each end of the output shaft.
- c. press bearing cones (5) and (26) onto output shaft.
- d. If removed, install bearing cup (25) and seal (21) into cover (23).
- e. Install cover (23) and new gasket (24) to case (31) with four capscrews (22). Tighten capscrews to 17 lb-ft (23 N•m) torque.
- f. If removed, install bearing cup (4) into cover (2).
- g. Install cover (2) and new gasket (3) to case (31) with four capscrews (1). Tighten capscrews to 17 lb-ft (23 N•m) torque.
- h. Position idler gear (34), two bearing cones (35) and spacer (33) in case (31). Use same thickness spacer(s) as removed.
- i. Press idler shaft (30) into case (31) with flat on shaft positioned in line with setscrew hole in case.
- j. Install setscrew (32) to secure idler shaft (30).
- k. If removed, install shifter ball spring (10) and poppet pin (9) into cover (17).
- l. Install new O-ring (18) onto plate subassembly (8). Install plate subassembly (8), washer (11), shifter lever (16), lockwasher (15) and capscrew (14) to cover (17). Align marks made during disassembly and tighten capscrew to 17 lb-ft (23 N•m) torque.
- m. Position cover (17), two new gaskets (7) and spacer (19) to case (31). Install two capscrews (12) to upper left and lower right holes finger tight. position PTO switch bracket (13) mounting hole to lower left hole and install capscrew (12). Torque three capscrews (12) to 17 lb-ft (23 N•m). The fourth capscrew (12) will be installed in the upper right hole during the PTO cable installation procedure.
- n. Install key (20) into output shaft (27) and secure with tape.

21-12. Installation of PTO Adapter.

- a. Install gasket (fig. 21-6) same thickness as removed.
- b. Mount PTO adapter on transmission and secure with four capscrews. Tighten to 30 lb-ft (41 N•m) torque.

Check gear backlash as follows: Mount dial indicator, as shown in figure 21-8, and measure backlash of small gear in the adapter. Should be 0.006-0.014.



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Figure 21-8. Check Gear Backlash.

NOTE

Backlash may be adjusted by adding or subtracting thickness of gasket (fig. 21-6). Adding gasket thickness increases backlash; subtracting decreases backlash. A thin gasket (0.010) changes backlash approximately 0.006.

21-13. Installation of PTO (M916, M917 and M920).

- a. Install gasket (36, fig. 21-2) on PTO adapter and mount PTO. Secure PTO to adapter with six nuts and six new crush washers. Tighten nuts to 35-40 lb-ft (48-54 N•m) torque.
- b. Using a dial indicator, check backlash of small gear assembly as described in para 21-12. Adjust backlash by changing thickness of gasket (36).
- c. Install PTO cable. (Refer to TM 9-2320-273 -20.)
- d. Install pump, with hydraulic lines inplace, as follows:
 - (1) Align spline.
 - (2) Secure pump to PTO with two capscrews (M916 and M920) or four capscrews (M917). Tighten capscrews to 50 lb-ft (68 N•m) torque.
- e. Install PTO switch. (Refer to TM 9-2320-273 -20.)

21-14. Installation of PTO (M918).

- a. Install gasket (38, fig. 21-3) on PTO adapter and mount PTO. Secure PTO to adapter with six nuts and six new crush washers. Tighten nuts to 35-40 lb-ft (48-54 N•m) torque.
- b. Using a dial indicator, check backlash of gear as described in para 21-12c. Adjust backlash by changing thickness of gasket (38).
- c. Install PTO cable. (Refer to TM 9-2320-273 -20.)
- d. Remove tap securing key (19) and install drive shaft. (Refer to TM 5-3895-371-24 & P).
- e. install PTO switch. (Refer to TM 9-2320 -273-20.)

21-15. Installation of PTO (M919).

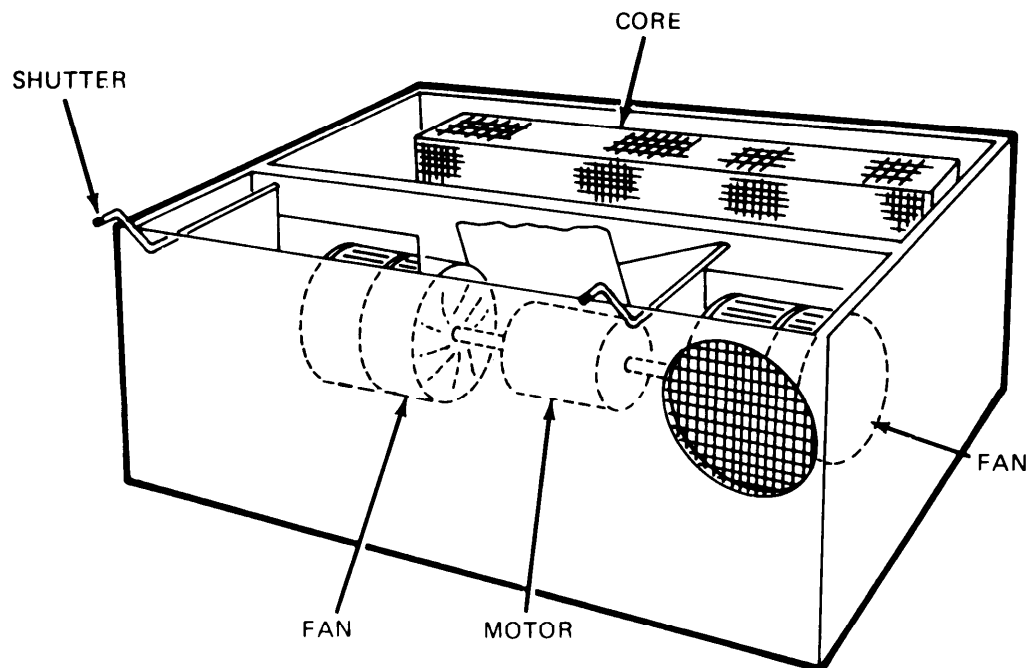
- a. *Install* gasket (36, fig. 21-4) on PTO adapter and mount PTO. Secure PTO to adapter with six nuts and six new crush washers. Tighten nuts to 35-40 lb-ft (48-54 N•m) torque.
- b. Using a dial indicator, check backlash of small gear as described in para 21-12c. Adjust backlash by changing thickness of gasket (36).
- c. Install PTO cable. (Refer to TM 9-2320-273 -20.)
- d. Remove tape securing key (20) and install driveshaft. (Refer to TM 5-3895-372-20).
- e. Install PTO switch. (Refer to TM 9-2320-273-20.)

CHAPTER 22

REPAIR OF HEATER

22-1. Description. All M915 series vehicles use the same cab heater assembly. The assembly is a hot water type unit, which consists of the following major items (fig. 22-1).

- a. *Core.* Receives hot coolant from engine block. It absorbs the heat from the coolant in a manner similar to the engine radiator.
- b. *Fans.* Draw cold outside air through the heater core, where the air picks up the heat, and directs the hot air into the cab.
- c. *Motor.* Drives both fans.
- d. *Shutters.* Allow the driver to direct the hot air to the floor of the cab or to the windshield (for defroster operation).
- e. *Controls.* Allow the driver to place heater assembly in operation and regulate temperature of air from heater. (See TM 9-2320-273-20 for description and illustration.)



TA 074492

Figure 22-1. Heater Assembly.

22-2. Removal. (Refer to TM 9-2320-273 -20.)

22-3. Disassembly.

- a. Remove nine capscrews (fig. 22-2) and lift off cover.

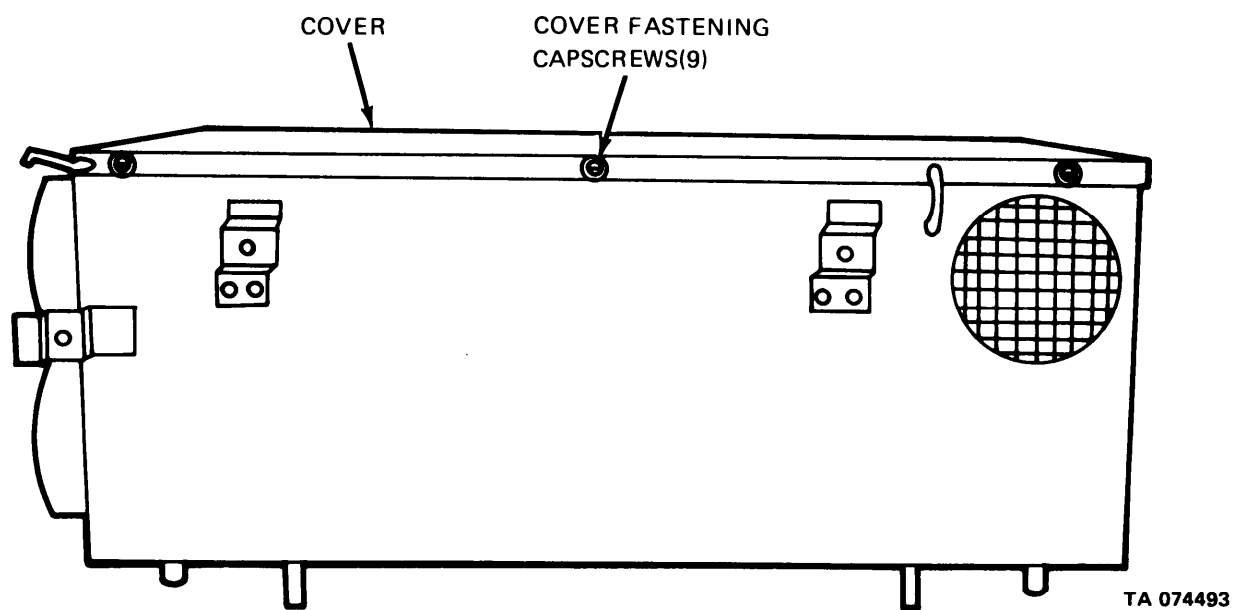


Figure 22-2. Remove/Install Cover.

- b. Open and remove grommet (fig. 22-3).

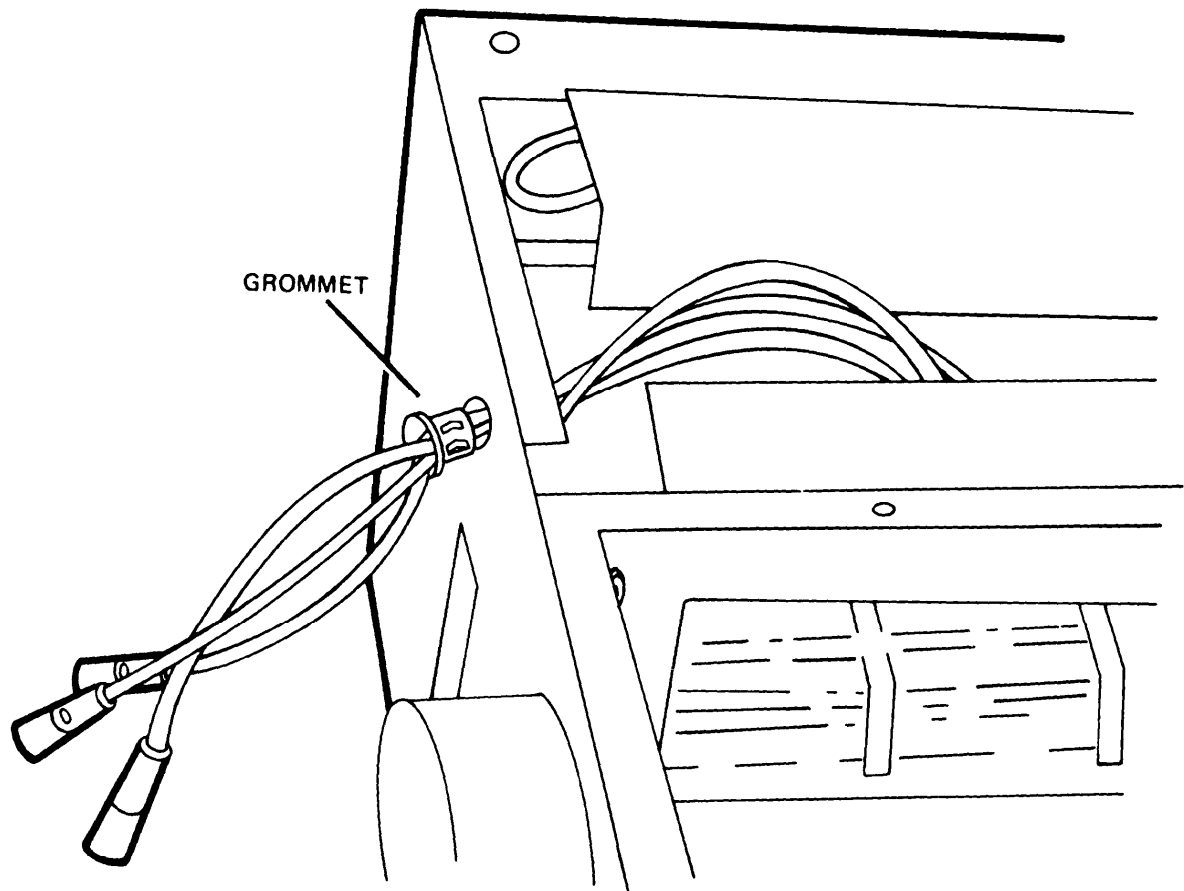
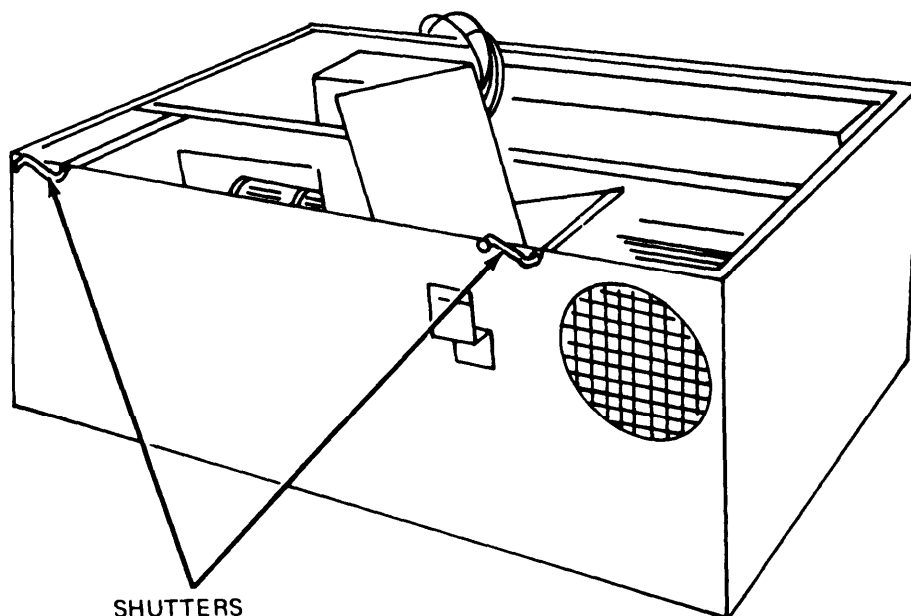


Figure 22-3. Remove/Install Grommet.

- c. Pull wires through hole in housing.
- d. Rotate control shutter located on the end of housing (fig. 22-4); then lift up and out of retaining holes.



TA 074495

Figure 22-4. Remove/Install Shutters.

- e. Rotate other control shutter to full upright position, as shown in the illustration; then slide it out of retaining holes.

CAUTION

In step *f*, hold the motor and fan support plate when removing the attaching cap-screws. When lifting out the support plate, do not rub against the heater core.

- f. Remove four capscrews (two at each end of case) and carefully lift out motor and fan support plate (fig. 22-5).

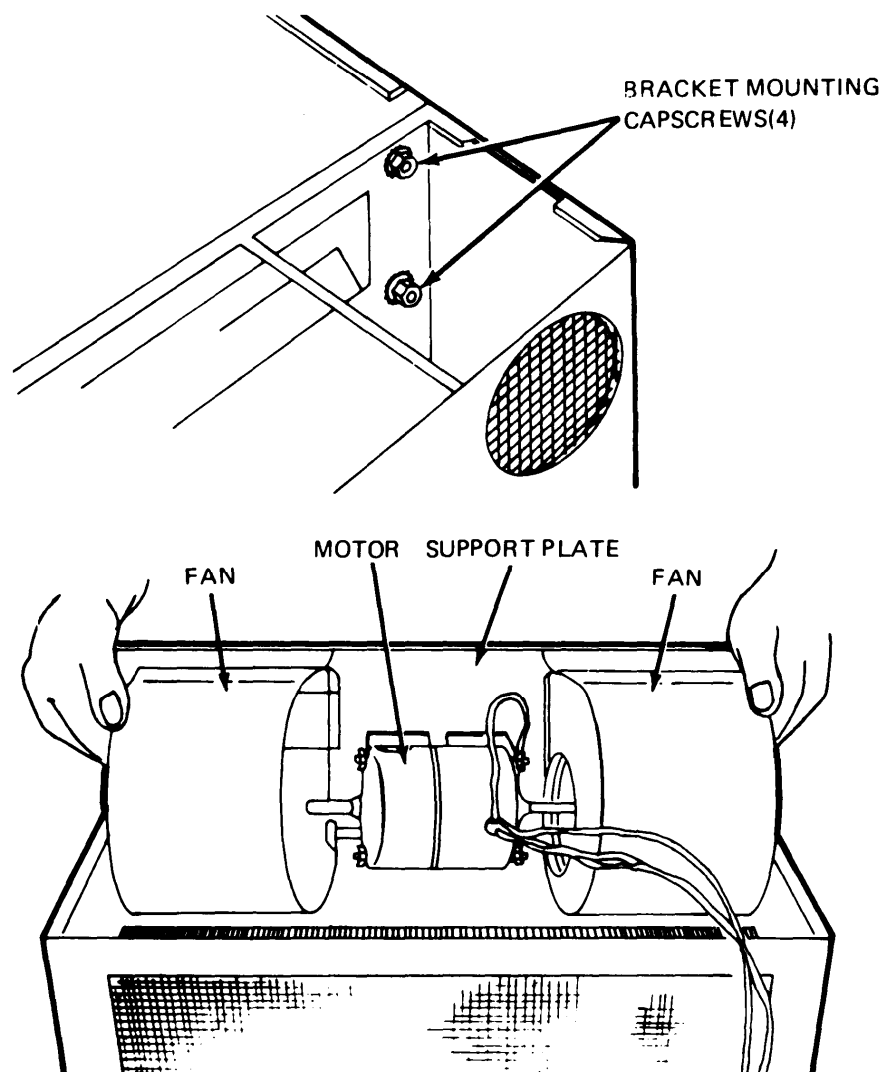


Figure 22-5. Remove/Install Motor and Fan Support Plate.

NOTE

In step g, fan shaft setscrew (fig. 22-6) is accessible from top, through blades of fan.

- g. Using a 1/8-in. allen wrench, back out setscrew at end of fan shaft; then pull off fan.

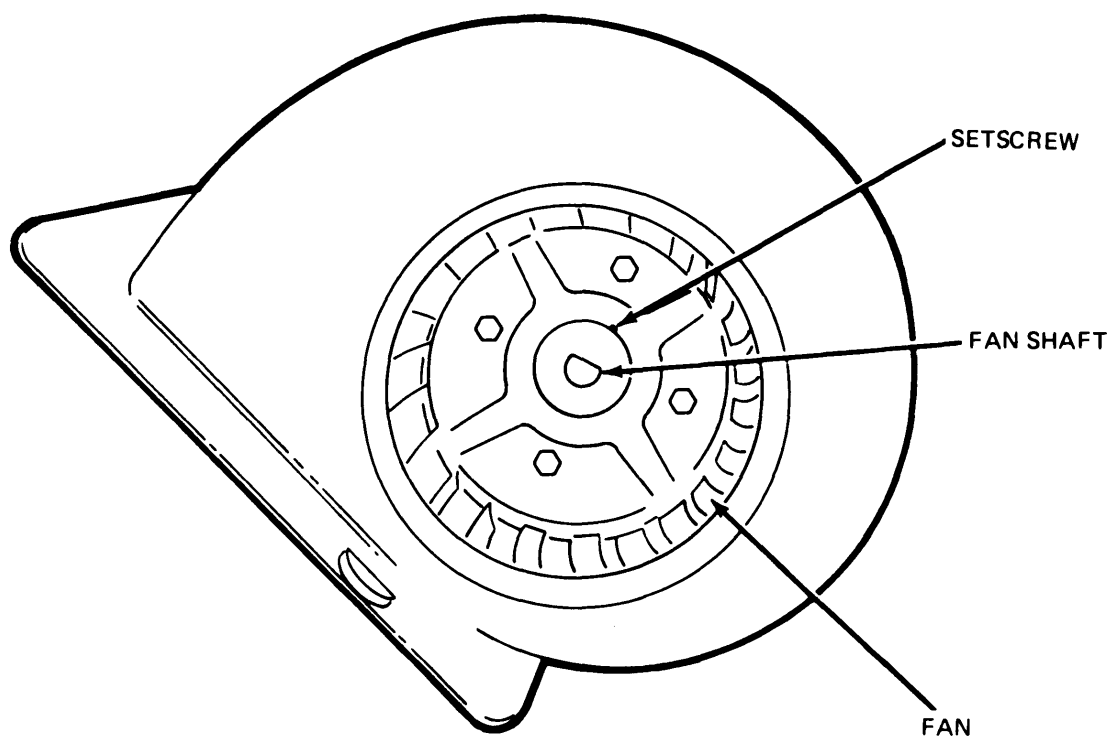
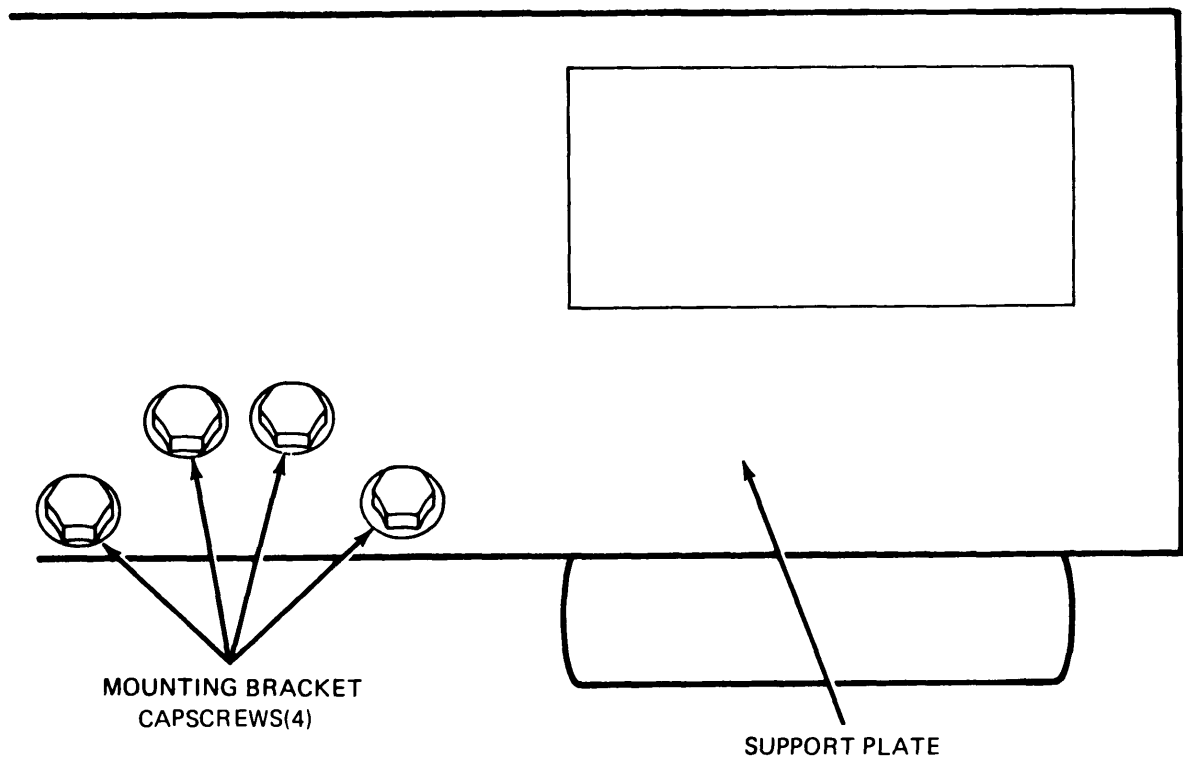


Figure 22-6. Remove/install Fans.

TA 074497

- h. Repeat step g for other fan at opposite end of motor shaft.

- i. Support motor, as shown in fig. 22-7, and remove four capscrews that fasten the two motor mounting brackets to the support plate.



TA 074498

Figure 22-7. Remove/Install Motor Mounting Brackets from Support Plate.

j. Remove four nuts (fig. 22-8) that fasten motor to two mounting brackets; then set brackets aside and pull out motor.

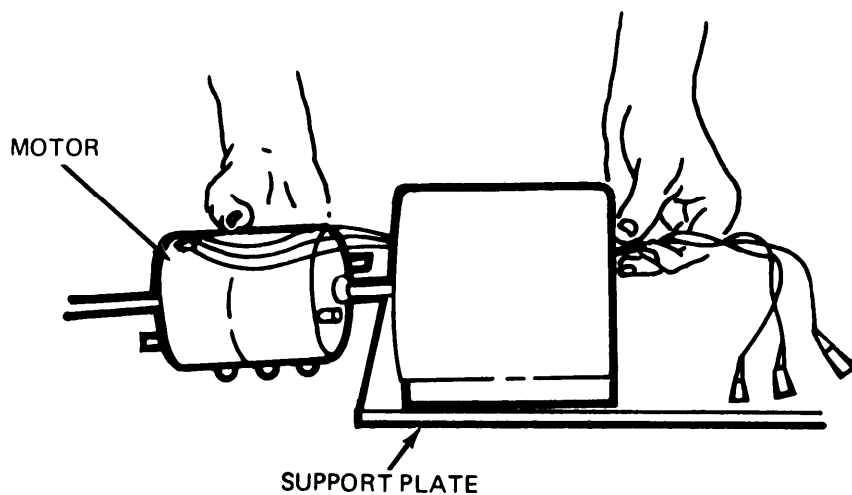
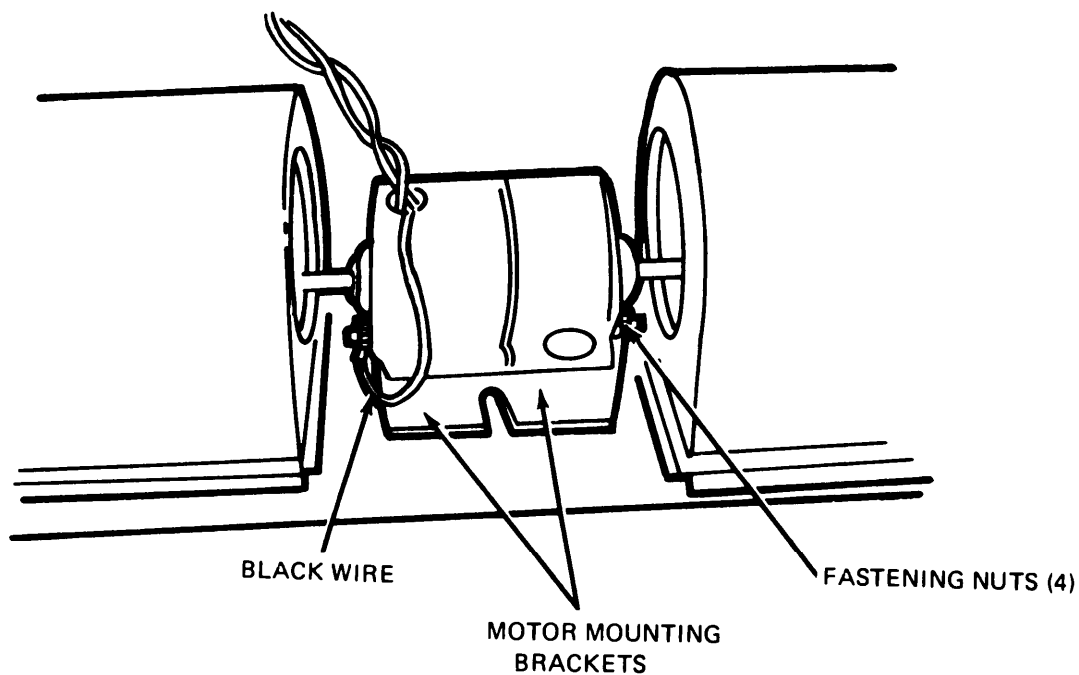
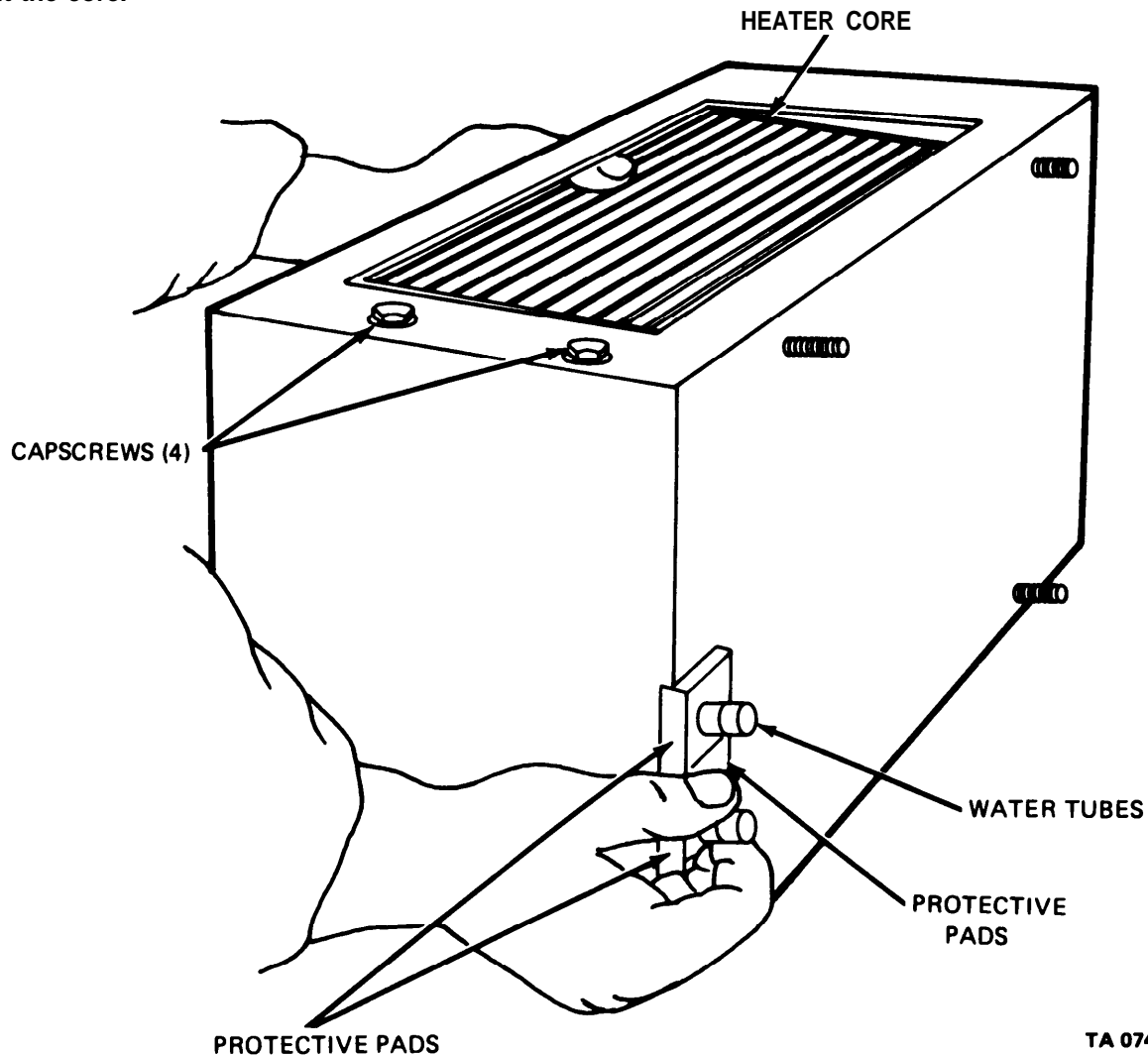


Figure 22-8. Remove/install Motor.

TA 074499

k. Support heater core (fig. 22-9) and remove four capscrews that fasten the core to housing. Pull out the core.



TA 074500

Figure 22-9. Remove/Install Heater Core.

22-4. Reassembly.

Position heater core in housing, carefully passing the water tubes through the protective pads (fig. 22-9). Secure core to housing with four capscrews.

- b. Position motor in center of support plate (fig. 22-8) and set motor on two mounting brackets.
- c. Connect black wire; as shown in figure 22-8, and secure motor to mounting brackets with four nuts.
- d. Position motor mounting brackets on support plate (fig. 22-7) and secure with four capscrews.

NOTE

In step e, fan shaft setscrew (fig. 22-6) is accessible from top, through blades of fan.

- e. Install fan on motor shaft (either end). Shaft should protrude approximately 1/4-inch beyond end of fan. Tighten 1/8-inch allen-head setscrew to secure fan to shaft.
- f. Repeat step e for other fan at opposite end of motor shaft.



In step g, when installing motor and fan support plate, do not rub against the heater core.

- g. Position motor and fan support plate (fig. 22-5) into heater housing and secure with four capscrews.
- h. Place control shutter into opening at end of housing (fig. 22-4). It may be necessary to rotate the shutter to a position where it will fit into its retaining hole.
- i. Install the other control shutter by rotating it to its full upright position (as shown); then slide it into retaining holes.
- j. Pull wires through hole in housing (fig. 22-3) and install grommet.
- k. Mount cover on housing and secure with nine capscrews (fig. 22-2).

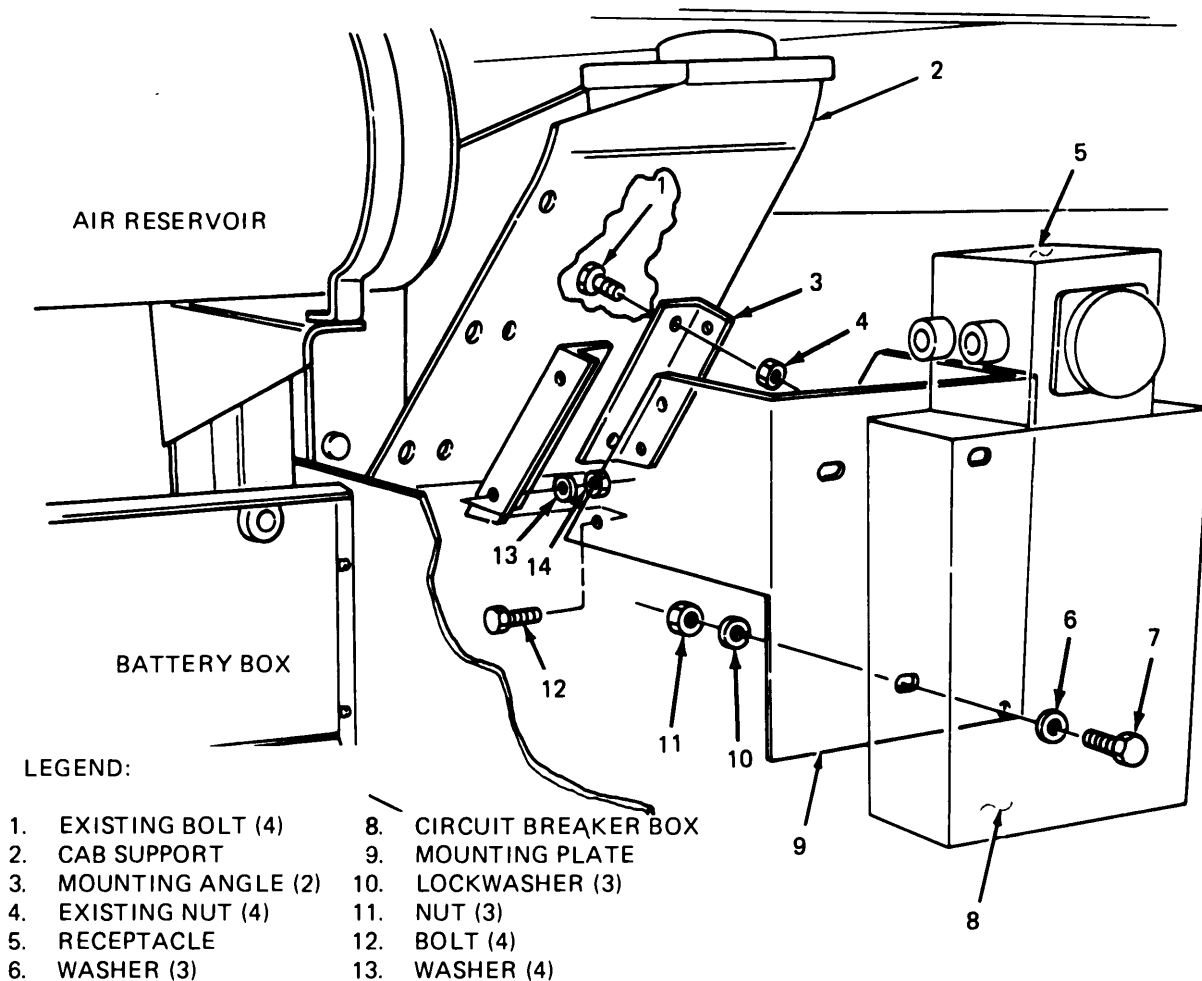
22-5. Installation. (Refer to TM 9-2320-273-20.)

CHAPTER 23

REPAIR OF WINTERIZATION KIT

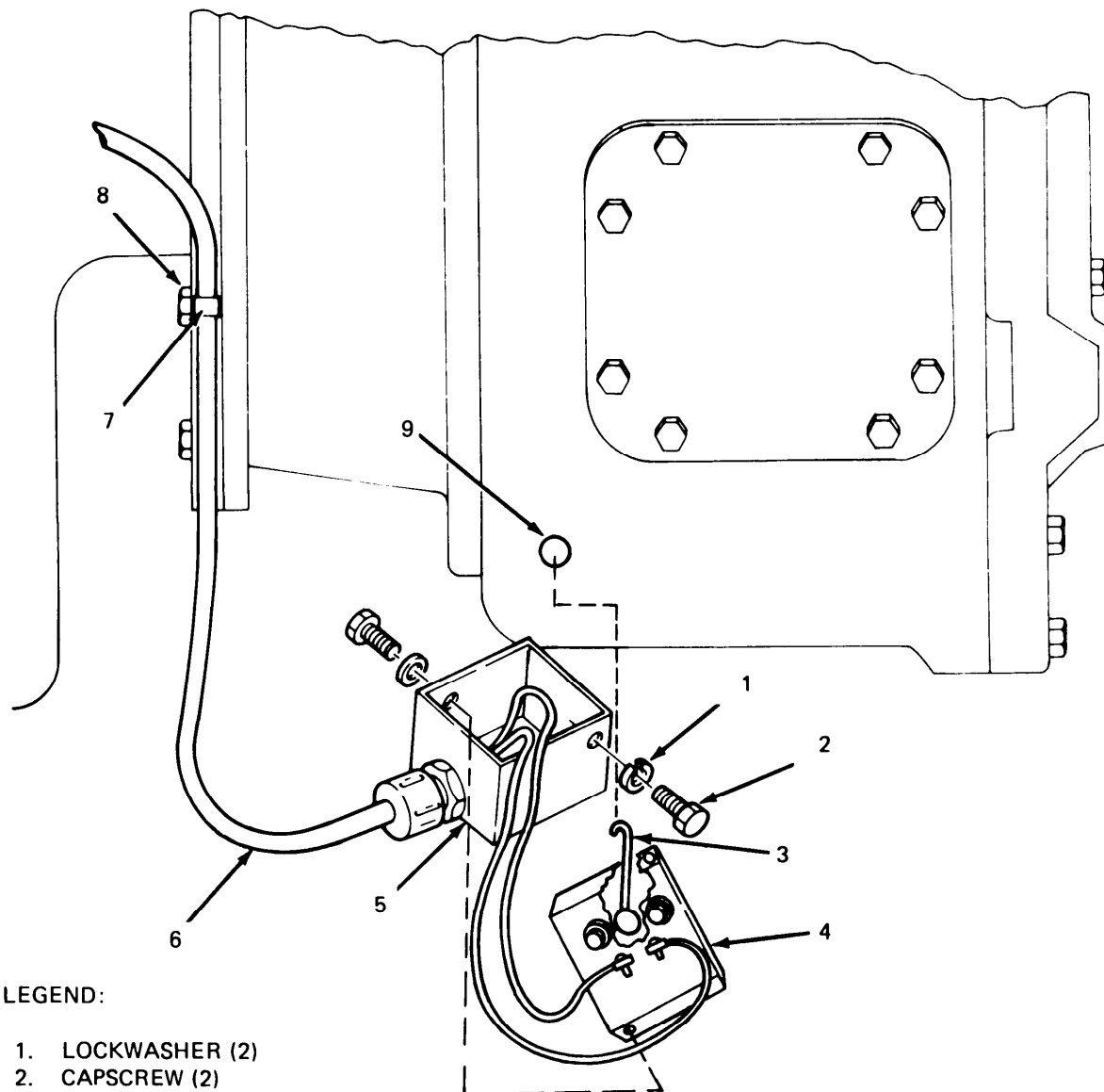
23-1. Description. All M915 series vehicles which are to be used in Arctic Regions may be equipped with an optional Winterization Kit to permit vehicle start-up down to -50°F (-45.6°C). The system is powered thru connection to an outside 110 VAC source and should be put in operation as soon as the vehicle is stopped or parked for any length of time. If the vehicle is allowed to cold "soak" for an extended time before activating the Winterization Kit, considerable time will be required to attain a starting level temperature. Further explanation of components and operation instructions may be found in TM 9-2320-273-10. The system consists of the following major components:

- a. Circuit Breaker Box and Power Receptacle (fig. 23-1).
- b. Transmission Oil Heater (fig. 23-2).
- c. Engine Oil Heater (fig. 23-3).
- d. Engine Coolant Heater (fig. 23-4).
- e. Battery Box Heater (fig. 23-5).



TA 074501

Figure 23-1. Circuit Breaker Box and Power Receptacle Installation.



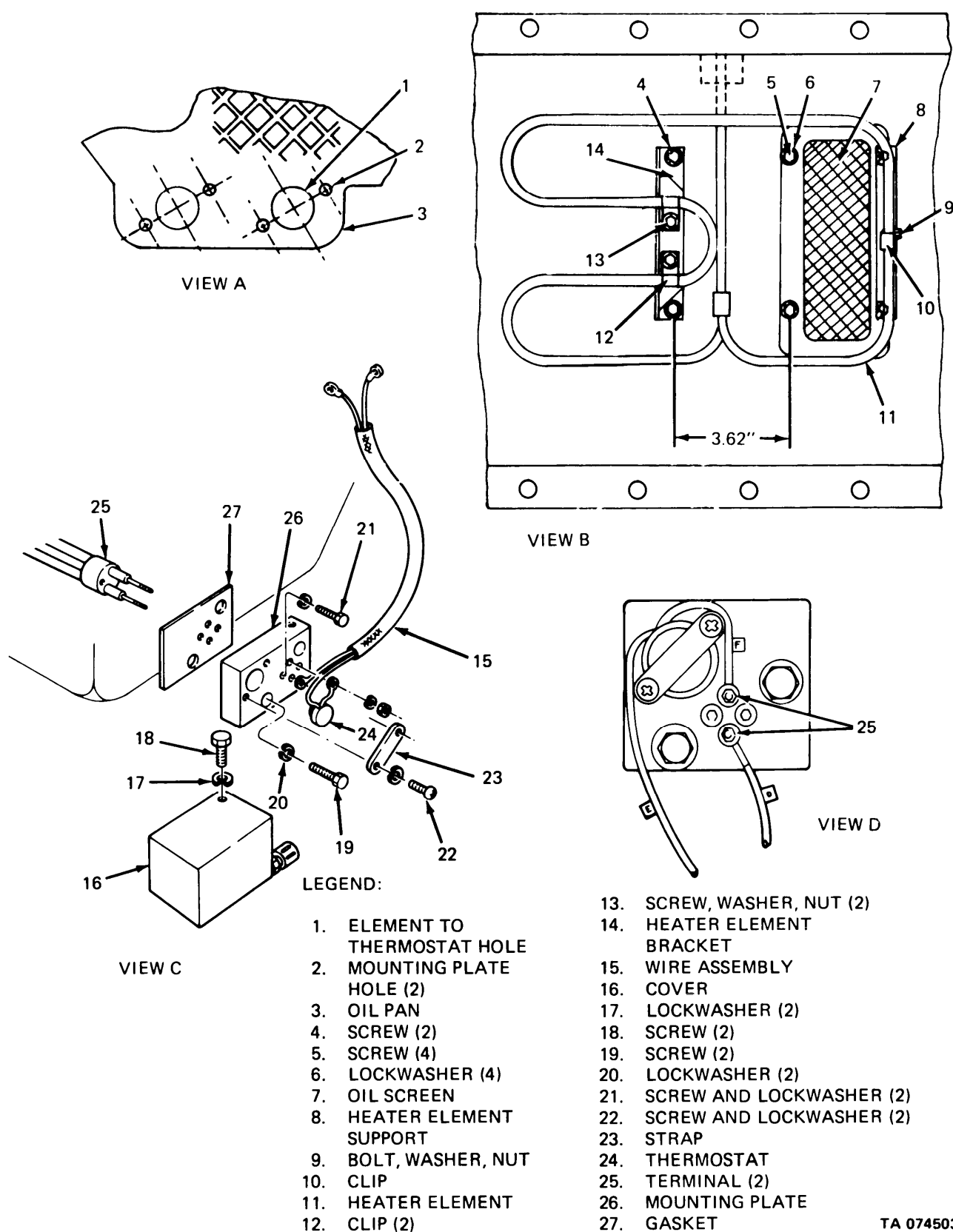
LEGEND:

1. LOCKWASHER (2)
2. CAPSCREW (2)
3. HEATER ELEMENT
4. HEATER ELEMENT MOUNTING PLATE
5. HEATER COVER
6. WIRE ASSEMBLY
7. CLAMP
8. EXISTING BOLT
9. TAPPED HOLE

TA 074502

TA 074502

Figure 23-2. Installation of Transmission Oil Heater.



TA 074503

Figure 23-3. installation of Engine Oil Heater.

LEGEND:

1. ADAPTER
2. HEATER ASSEMBLY
3. SINGLE FRAME BRACKET
4. DOUBLE FRAME BRACKET
5. NUT
6. CLAMP (2)
7. WIRE ASSEMBLY
8. BOLT, LOCKWASHER AND NUT (2)
9. THERMOSTAT
10. ADAPTER
11. DRAINCOCK
12. TEE FITTING
13. ELBOW
14. ELBOW
15. HEATER
16. HOSE ADAPTER
17. MANIFOLD PORT
18. ADAPTER
19. TEE FITTING
20. DRAINCOCK
21. ADAPTER
22. HOSE CLAMP(2)
23. HOSE
24. OUTPUT TUBE
25. PIPE PLUG
26. WATER PIPE
27. HOSE (2)
28. CLAMP(4)
29. ELBOW
30. SHUTOFF VALVE
31. ADAPTER(2)
32. RETURN HOSE
33. HOSE CLAMP(2)
34. HOSE
35. HOSE CLAMP(2)

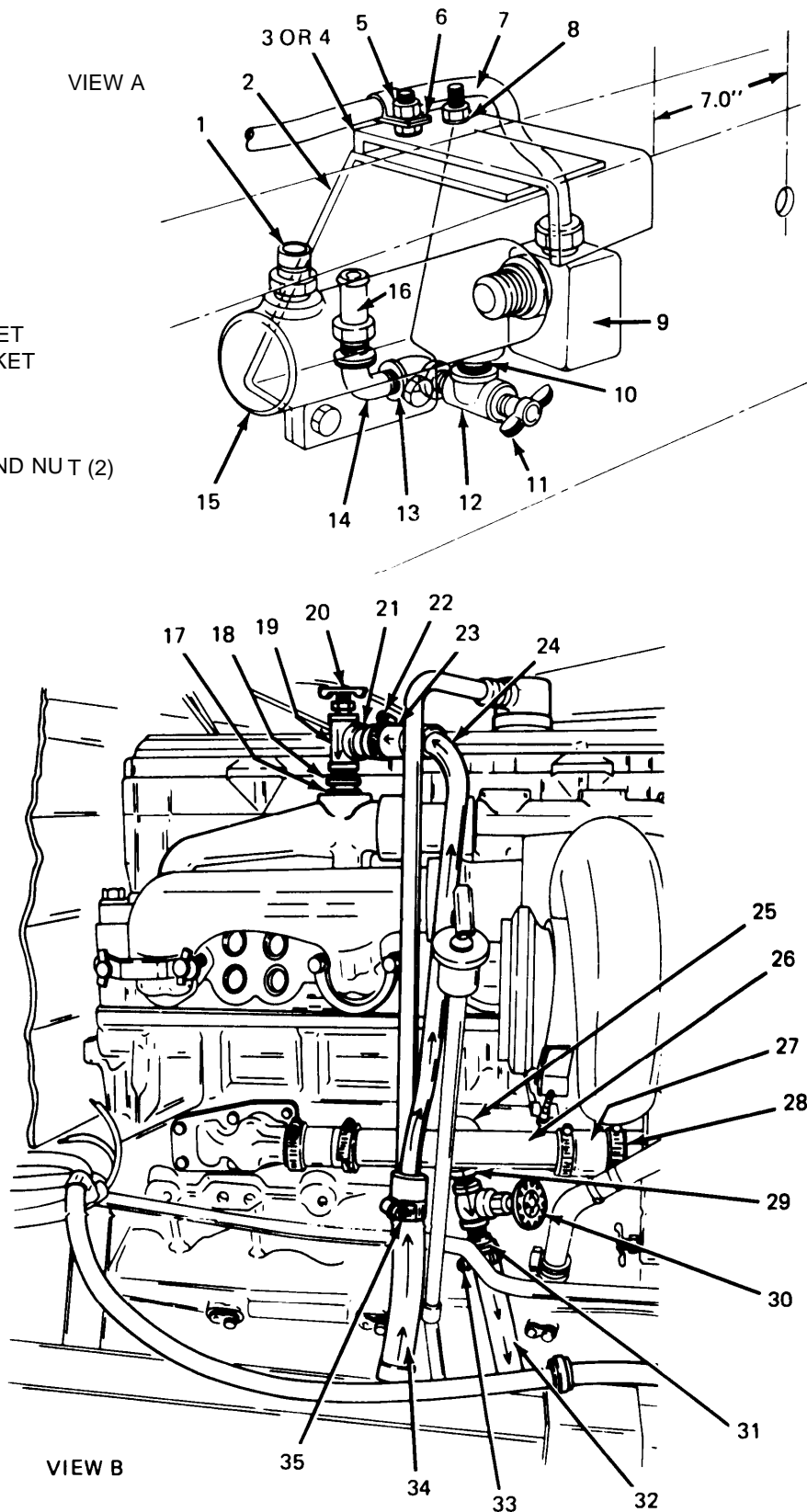


Figure 23-4. installation of Engine Coolant Heater.

TA 074504

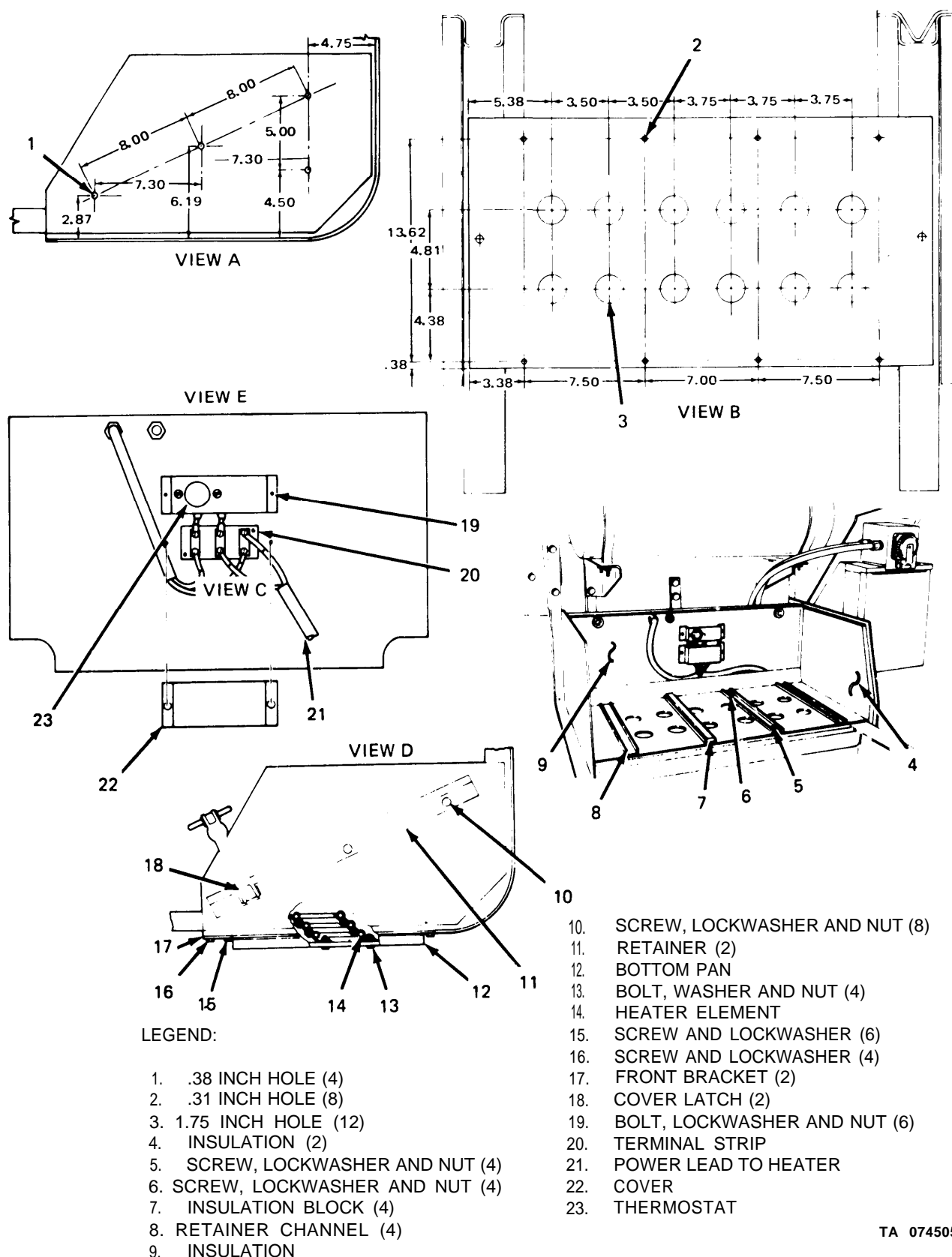


Figure 23-5. Battery Box Heater.

TA 074505

23-2. Removal. Removal and replacement procedures for all major Winterization Kit components, except for the engine oil heating unit, are contained in TM 9-2320-273-20.

23-3. New Installation of Circuit Breaker Box and Power Receptacle.

- a. Remove four existing bolts (1, fig. 23-1) and nuts (4) from the right hand cab support (2).
- b. Install two mounting angles (3) to cab support with four bolts (1) and nuts (4); torque to 90-120 lb-ft (122-162 N-m).
- c. Attach mounting plate (9) to mounting angles (3) with four bolts (12), washers (13), and nuts (14)
- d. install circuit breaker box (8) with receptacle (5) attached to plate (9) with three bolts (7), washers (6), lockwashers (10) and nuts (11).

23-4. New Installation of Transmission Oil Heater.

- a. Drain transmission oil (Refer to TM 9-2320-273-20).
- b. Remove 1-1/4-inch pipe plug from tapped hole (9, fig. 23-2) on forward left hand side of transmission.

Screw heater element (3) with heater element mounting plate (4) attached, into tapped hole (9). c.
- d. Install wire assembly (6) through heater cover (5); attach wires to heater element mounting plate (4) as shown.

Secure heater cover (5) to heater element mounting plate (4) with two capscrews (2) and lockwashers (1).
- f. Remove existing bolt (8) from left hand front face of transmission, route wire assembly (6) as shown to circuit breaker box on right hand side (see fig. 23-1), insert bolt (8) thru clamp (7) but do not tighten as wire assembly from engine oil heater will also be routed through this same clamp.
- g. Refill transmission (Refer to TM 9-2320-273-20).

23-5. New Installation of Engine Oil Heater.

- a. Drain engine oil (Refer to TM 9-2320-273-20).
- b. Remove engine oil pan (Refer to TM 9-281 5-222-34& P).
- c. Drill a 1.265 inch diameter hole (1, fig. 23-3) thru left hand side of oil pan (3) as shown in view A.
- d. Drill and tap two .38-16 inch diameter 29 holes (2) .840-.870 inch deep in left hand outside of oil pan (3) as shown in view A.

Drill two .172 inch diameter holes for screws (4) .360 inch deep in bottom inside of oil pan as show: in view A; these must be in line with four screen mounting bolts (5).
- f. Remove four screws (5) and oil screen (7). See view B.
- g. Position heating element (11) in bottom of oil pan (3) as shown in view B.

h. Place gasket (27) and mounting plate (26) in position as shown in view C and install to outside of oil Pan with two screws (19) and lockwashers (20).

i. Fasten heater element (11) to mounting plate (26) with two screws and lockwashers (21) as shown in view C.

j. Install screen (7) and heater element support (8) to inside bottom of oil pan (3) with four screws (5) and lockwashers (6). See view B.

k. Attach heater element bracket (14) to inside bottom of oil pan with two screws and washers (4). See view B.

l. Attach heater element to bracket (14) with two clips (12), screws, washers, and nuts (13). See view B.

m. Attach heater element to heater element support (8) with one clip (10) and one bolt, washer, and nut (9). See view B.

n. Fasten thermostat (24) to mounting plate (26) with strap (23) using two screws and lockwashers (22). See view C.

o. Install wire assembly (15) to cover (16), attaching wires (D), (E), and (F) to thermostat terminals (25). See views C and D.

p. Mount thermostat cover (16) to mounting plate (26) with two lockwashers (17) and screws (18). See view C.

Route wire assembly (15) thru clamp (7, fig. 23-2), tighten with bolt (8), and run wire assembly t-circuit breaker box on right hand side of vehicle (Refer to fig. 23-1).

r. Install oil pan (3, fig. 23-3). (Refer to TM 9-281 5-222-34& P.)

s. Replenish engine oil. (Refer to TM 9-2320-273-20.)

23-6. Removal of Engine Oil Heater.

Remove thermostat.(Refer to TM 9-2320-273 -20.)

Drain engine oil. (Refer to TM 9-2320-273-20.)

Remove oil pan.(Refer to TM 9-2815-222-34 & P.)

d. Remove bolt, washer, and nut (9, fig. 23-3) from clip (10); remove clip from heater element (11) and support (8). See view B.

e. Remove two screws, washers, and nuts (13) from two clips (12); remove clips from heater element (11) and bracket (14). See view B.

f. Unscrew two screws with washers (4) and remove bracket (14). See view B.

g. Unscrew four screws (5) and lockwashers (6); remove support (8) and screen (7) from oil pan (3). See view B.

h. Unscrew two screws and lockwashers (21) to separate heater element (11) from mounting plate (26); remove heater element from oil pan (3). See view C.

Unscrew two screws (19) with lockwashers (20); remove mounting plate (26) and gasket (27); 'discard gasket. See view C.

23-7. New Installation of Engine Coolant Heater.

- a. Drain engine coolant (Refer to TM 9-2320-273-20).
- b. Remove engine air cleaner and ducts (Refer to TM 9-2320-273-20).

Install heater assembly (2, fig. 23-4) to right hand frame rail, using single frame bracket (3) for M915 or double frame bracket (4) for M916 thru M920. Mount to frame using two bolts, lock-washers, and nuts (8). Position forward edge of bracket exactly 7.0 inches behind the centerline of existing .750 inch diameter frame hole. See view A.

- d. Remove four clamps (28), two hoses (27) and water pipe (26) for access to block mounted pipe plug (25); remove plug (25). See view B.

Using pipe sealant on all threads, screw elbow (29) into block port where pipe plug (25) was removed. To elbow (29), screw in one adapter (31). See view B.

- f. Using pipe sealant on all threads, install adapter (10), tee fitting (12), draincock (11), elbow (13), elbow (14) and hose adapter (16) as shown in view A.

- g. Install return hose (32) to adapters (31) and (16) with two hose clamps (33). See views A and B.

- h. Replace water pipe (28), two hoses (27), and four clamps (26). See view B.

- i. Inspect rear water manifold section at location (17). If a 1/2 inch NPT pipe plug is found, remove plug. If no plug is found, do the following:

- (1) Remove rear manifold section. (Refer to TM 9-2320-273-20.)

- (2) Drill and tap a 1/2 inch NPT.

- (3) Remove all metal shavings and reinstall on engine. Refer to TM 9-2320-273-20.)

- j. Using pipe sealant on all threads, install adapter (18), tee fitting (19), draincock (20), and adapter (21). See view B.

- k. Using pipe sealant, install adapter (1) to top rear port of heater. See view A.

- l. Connect two hoses (23) and (34), with output tube (24) and adapters (21) and (1) using two hose clamps (22) and two hose clamps (35). See views A and B.

m. Secure wire assembly (7) to top of bracket (3) or (4) with clamp (6) and nut (5). A second clamp (6) should be installed to the inside rear of the fender to secure the wire assembly. Attachment to the fender is accomplished by drilling one .312 diameter clamp mounting hole and securing with one .25-20 hex nut. See view A.

- n. Route wire assembly (7) to circuit breaker box and connect. (Refer to figure 23-1.)

- o. Close draincock (11, fig. 23-4) and open valve (30). See views A and B.

- p. Refill engine coolant. (Refer to TM 9-2320-273-20.)

- g. Open draincock (20, fig. 23-4) to allow any trapped air to escape, then close. See view B.

- r. Replace engine air cleaner and ducts. (Refer to TM 9-2320-273-20.)

- s. Start engine (Refer to TM 9-2320-273-10) and check for leaks. Tighten any loose connections, re-check, and shut down engine.

23-8. New Installation of Battery Box 'Heater.

- a. Remove the following (Refer to TM 9-2320-273-20):
 - (7) Battery box cover.
 - (2) Disconnect and remove batteries.
 - (3) Plywood pad; discard.
 - (4) Cover latches and catches.
- b. Drill four .38 inch holes (1, fig. 23-5) in each side panel. See view A.
- c. Drill twelve 1.75 inch holes (3) in base plate. See view B.
- d. Drill eight .31 inch holes (2) in base plate. See view B.
- e. Mount four retainer channels (8) on base plate; attach at back with four screws, lockwashers, and nuts (6). At the front edge, attach with four screws, lockwashers, and nuts (5). Those used in the back are slotted truss head, while those at the front are phillips head screws. See view C.
- f. Activate dry back adhesive insulation (4 and 9) with Milsolv and affix to inside surface of either end panel and rear panel. See view C. Also affix to inside of box cover.
- g. Mount two retainers (11) and two cover latches (18) to end panels with eight screws, lockwashers, and nuts (1 O). See view D.
- h. Mount heater element (14) to inside bottom pan with four bolts, washers, and nuts (13). See view D.
- i. Mount bottom pan (12) to battery box with six screws and lockwashers (15). See view D.
 Mount two front brackets (17) to bottom front of battery box with four screws and lockwashers (16).
- k. Mount four insulation blocks (7) in retainer channels (8); locate with countersunk dimple over the rear screws (6). See view C.
- l. Drill six 10-32 holes in rear cover as shown in view C for installation of the terminal strip (20) and thermostat (23). See view E.
 Attach heater element power lead (21), wire harness to circuit breaker and wire connections from terminal strip (20) to thermostat (23). See view E.
 Install terminal strip (20) and cover (22) plus thermostat (23) to rear box cover with six bolts, lockwashers, and nuts (19). See view E.
- o. Connect wire harness to circuit breaker box; refer to figure 23-1.
- p. Install batteries and reconnect (Refer to TM 9-2320-273-20).
- q. Install battery box cover and remount cover latches for a secure fit with catches.

CHAPTER 24

REPAIR OF FRAME

24-1. Scope. This chapter describes frame maintenance procedures. The following maintenance procedures are provided:

- a. Frame alinement check.
- b. Inspection and repair of frame.

24-2. Frame Alinement Check.

NOTE

Make sure truck is parked in a straight line on a level floor so that rear axles are not on a twist or binding from turning action.

The M915 series vehicles have 3 frame types. The frame shown below is for a 5-ton truck. While this is not the same as your vehicle, the procedures given below may be used to check your truck. When checking frame alinement on any truck, use same bolt, rivet or bracket on each side of truck.

- a. Tape paper to floor under each frame crossmember (1) and rear spring seat cap (2, Fig. 24-1).

NOTE

When marking floor at cross member, use front edge of brush guard brackets (3, fig. 24-1).

- b. Using plumb bob and pencil, carefully mark point on paper below outer sides of frame at each cross-member (1) and the two front screws (4) in rear spring seat caps (2, fig. 24-1).

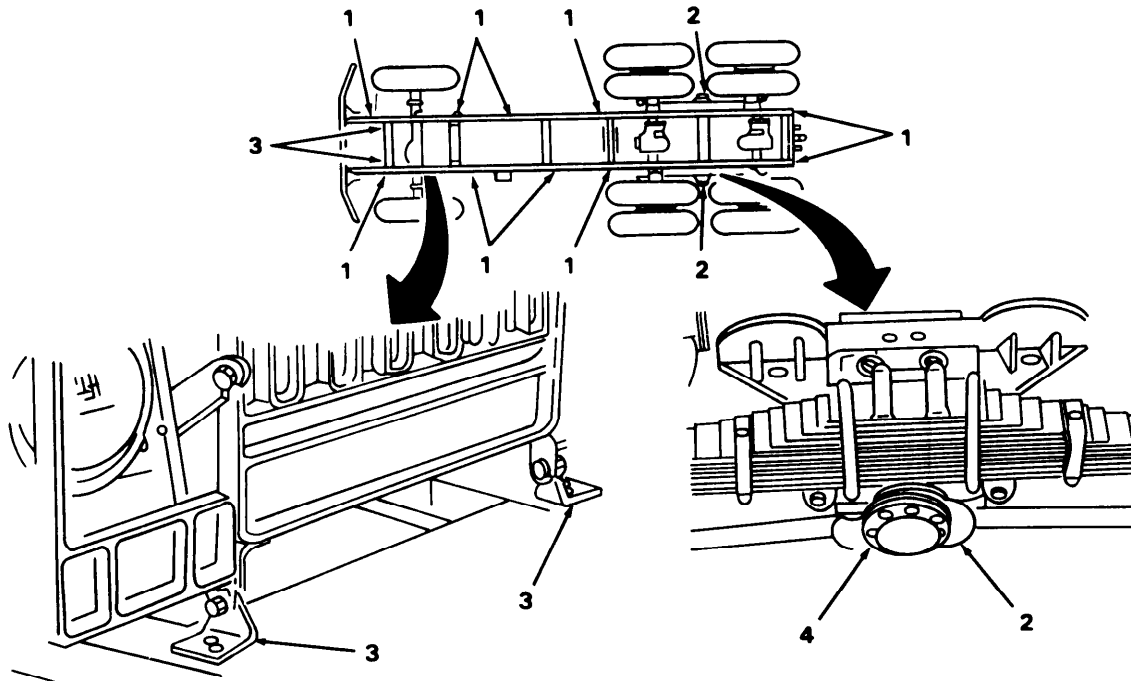
- c. Start engine and drive truck off marked paper. Refer to TM 9-2320-273-10.

- d. Using chalk line, mark a line between points (1 and 2) and (3 and 4) (fig. 24-2).

- e. Using tape measure, measure lines between points (1 and 2) and (3 and 4). If distances are not between 33 7/8 inches and 34 1/8 inches, frame is bent (fig. 24-2).

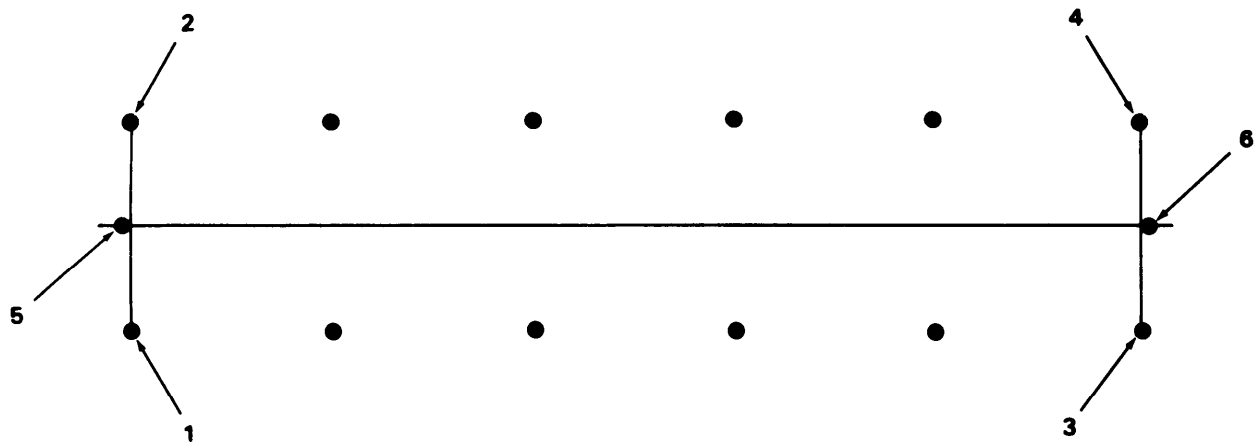
- f. Using tape measure, find the center point of lines (1 and 2) and (3 and 4) and mark points (5 and 6) on floor (fig. 24-2).

- g. Using chalk line, mark a line between points (5 and 6) (fig. 24-2).



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Figure 24-1. Transferring Frame Alinement Points.

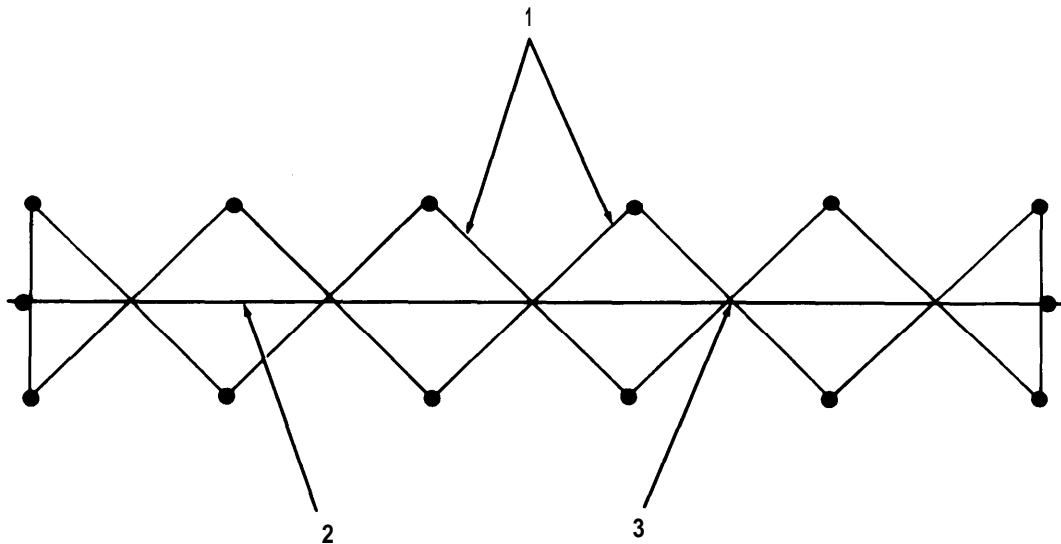


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Figure 24-2. Checking Alinement of Frame at Front End and Rear End.

h. Using chalk line, mark 10 diagonal lines (1) as shown (fig. 24-3).

i. Diagonal lines (1) should cross at center line (1) as shown at point (3). If lines (1) cross more than 1/8 inch from center line, frame is bent (fig. 24-3).



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Figure 24-3. Checking Parallel Alinement of Frame.

24-3. Inspection and Repair of Frame.

a. Check that frame rails are not cracked, bent or misaligned. Check that cross members have no cracks or damage. If they are damaged refer to TB 9-2300-24740.

b. Check that all riveted joints have no cracks or broken rivets. If they are damaged refer to TB 9-2300-247-40.

c. Check that all bolted brackets and supports are not cracked or damaged. Repair if damaged. Refer to TM 9-237 for welding procedures and to TB 9-2300-24740.

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.

Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Doctrinal, Training, and Organizational Publications	DA Pam 310-3
Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9) Supply Bulletins, and Lubrication Orders .,	DA Pam 310-4
Index of Graphic Training Aids and Devices	DA Pam 310-5

b. General References.

Authorized Abbreviations and Brevity Codes	AR 310-50
Techniques of Military Instruction	FM 21-6
Military Symbols	FM 21-30

A-2. Forms.

Refer to TM 38-750, The Army Maintenance Management System (TAMMS), for instructions on the use of maintenance forms pertaining to the material.

A-3. Other Publications.

The following publications contain information pertinent to the major item materiel and associated equipment.

a. Vehicle.

Lubrication Order, Truck Tractor, M915, M916 and M920, and Chassis for M917, M918 and M919	LO 9-2320-273-12
Lubrication Order, Dump Truck Body M917	LO 5-3805-274-12
Lubrication Order, Bituminous Distributor Body M918	L05-3895-371-12
Lubrication Order, Concrete-Mobile®Body M919	LO 5-3895-372-12

Operator's Manual (chassis)	TM9-2320-273-10
Operator's Manual (Dump Truck Body)	TM 5-3805-274-10
Operator's Manual (Bituminous Distributor Body)	TM 5-3895-371-10
Operator's Manual (Concrete-Mobile®Body)	TM 5-3895-372-10
Organizational Maintenance (Chassis).	TM 9-2320-273-20
Organizational Maintenance Repair Parts and Special Tools List (Chassis).	TM 9-2320-273-20P
Direct and General Support Manual Including Repair Parts and Special Tools List (Engine)	TM 9-2815-222-34 & P
Direct and General Support Repair Parts and Special Tools List (Chassis).	TM 9-2320-273-34P

b. *Camouflage.*

Camouflage	FM 5-20
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c. *Decontamination.*

Chemical, Biological, and Radiological (CBR) Decontamination	TM 3-220
Chemical, Biological, Radiological, and Nuclear Defense	FM 21-40

d. *General.*

Basic Cold Weather Manual	FM 31-70
Cooling Systems: Tactical Vehicles	TM 750-254
Manual for Wheeled Vehicle Driver	FM 21-305
Army Motor Transport Units and Operations.	FM 55-30
Northern Operations	FM 31-71
Operation and Maintenance of Ordnance Materiel in Cold Weather (0°to-65°F)	FM9-207
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

e. *Maintenance and Repair.*

Description, Use, Bonding Techniques, and Properties of Adhesives	TB ORD1032
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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
Operator's, Organizational, DS and GS Maintenance Manual for Lead-Acid Storage Batteries	TM 9-6140-200-14
Painting instructions for Field Use	TM 43-0139
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling System	TB 750-651
Welding Theory and Application	TM 9-237

f. Administrative Storage.

Administrative Storage of Equipment	TM 740-90-1
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APPENDIX B

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section 1. INTRODUCTION

B-1. Scope.

This appendix lists expendable supplies and materials you will need to operate and maintain the M915, M916, M920 Truck Tractors and Chassis for M917, M918 and M919.

These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

B-2. Explanation of Columns.

a. *Column 7 – 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 dry cleaning solvent, item 12, App. B”).

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 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.

(1)	(2)	(3)	(4)	(5)
ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
1	c	9150-00-065-0029 9150-00-935-1017 9150-00-190-0904 9150-00-190-0905 9150-00-190-0907	Grease, Automotive and Artillery, GAA (MI L-G-10924C) 2-1 /4 oz tube 14-oz cartridge 1-lb can 5-lb can 35-lb can	 oz oz lb lb lb
2	c	9150-00-234-5197 9150-00-261-7891	Oil, Lubricating, Exposed Gear, CW (VV-L-751C) 5-lb can 35-lb pail	 lb lb
3	0	9150-00-261-7904 9150-00-257-5440 9150-00-257-5443	Oil, Lubricating, Gear Subzero, GOS (MIL-L-10324) 1-qt can 5-gal drum 55-gal drum	 qt gal gal
4	c	9150-00-265-9425 9150-00-265-9428 9150-00-265-9429 9150-00-265-9430	Oil, Lubricating, OE/HDO 10 (MIL-L-2104C) 1-qt can 5-gal drum 55-gal drum, 16 gage 55-gal drum, 18 gage	 qt gal gal gal
5	c	9150-00-265-9433 9150-00-265-9435 9150-00-265-9436 9150-00-265-9437	Oil, Lubricating, OE/HDO 30 (MIL-L-2104C) 1-qt can 5-gal drum 55-gal drum, 16 gage 55-gal drum, 18 gage	 qt gal gal gal
6	c	9150-00-265-9440 9150-00-265-9442 9150-00-265-9441	Oil, Lubricating, OE/HDU50 (MIL-L-2104C) 1-qt can 5-gal drum 55-gal drum, 16 gage	 qt gal gal

(1)	(2)	(3)	(4)	(5)
ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
7		9150-00-935-9807 9150-00-935-9808 9150-00-935-9809 9150-00-935-9810	Fluid, Hydraulic, OHT (MIL-H-6083C) 1-qt can 1-gal can 5-gal pail 55-gal drum	 qt gal gal gal
8			Oil, Lubricating, OEA ICE, Subzero, (MIL-L-46167)	
9		9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	1-qt can 5-gal can 55-gal drum	qt gal gal
10	c		Oil, Fuel, Diesel DF-1 Winter (VV-F-800)	
		9140-00-286-5286 9140-00-286-5287 9140-00-286-5288 9140-00-286-5289	Bulk 5-gal can 55-gal drum, 16 gage 55-gal drum, 18 gage	gal gal gal gal
11	c		Oil, Fuel, Diesel DF-2 Regular (VV-F-800)	
		9140-00-286-5294 9140-00-286-5295 9140-00-286-5296 9140-00-286-5297	Bulk 5-gal can 55-gal drum, 16 gage 55-gal drum, 18 gage	gal gal gal gal
12	c		MISCELLANEOUS Solvent. Dry Cleaning, SD-2 (P-D-680)	
		6850-00-664-5685 6850-00-281-1985	1-qt can 1-gal can	qt gal
13	c	6850-00-243-1992	Antifreeze, Permanent, Glycol, Inhibited (MIL-A-461 53)	1 gal
14	O		Liquid Teflon	
15	O		Soap Solution	

(1)	(2)	(3)	(4)	(5)
ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	DESCRIPTION	U/M
16	0	6810-00-957-3608 6810-00-275-6010	Lubriplate	gal gal
17	0		Methanol, Technical 1-gal can 5-gal can	
18	F	Caterpillar 7M7260	Teflon Tape	
19	F		Loctite	
20	F		Rubber Cement Thinner	
21	F		Liquid Gasket	
22	F		Silicone Grease	
23	F		Permatex	
24	F		Silicone Sealant	
25			Alkali	
26			Red Lead Compound	
27	F		Lapping Compound (38900A)	
28	F		Lapping Compound (A-600)	
29	F		Silastic	
30			Lubricant, Gear, Multi- purpose, GO. (MIL-L-2105C)	

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X Y Z

By Order of the Secretary of the Army:

E. C. MEYER
General United States Army
Chief of Staff

Official:

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PAGE NO	PARA- GRAPH	FIGURE NO	TABLE NO
400		183	
512		191	

IN THIS SPACE TELL WHAT IS WRONG
AND WHAT SHOULD BE DONE ABOUT IT:

Change illustration. Reason: Tube end shown
assembled on wrong side of lever cam.

Figure 191, item 3 has the wrong NSN. Supply
rejects orders for this item. The NSN shown here is
not listed in the AMDF or the MCRL.

Please give us the correct NSN and P/N.

SAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

John Smith, S. SGT.

793/XXXX

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John Smith

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TEAR ALONG PERFORATED LINE

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
 1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
 1 Kilogram = 1000 Grams = 2.2 Lb
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
 1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
 1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

TEMPERATURE

$59^{\circ}\text{F} - 32 = ^{\circ}\text{C}$
 212°F is equivalent to 100°C
 90°F is equivalent to 32.2°C
 32°F is equivalent to 0°C
 $9^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

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

