

POWER STEERING GEAR AND PUMP

CONTENTS

Subject Page	Page No.
DESCRIPTION AND OPERATION:	
Description of Power Steering Gear	3F-64
Description of Power Steering Oil Pump	3F-66
DIAGNOSIS:	
External Leak Diagnosis	3F-68
Trouble Diagnosis	3F-69
MAINTENANCE AND ADJUSTMENTS	
Power Steering Oil Pump Belt Adjustment	3F-76
MAJOR REPAIR:	
Removal and Installation of Pitman Shaft	
Seals, Gear in Car	3F-76
Removal and Installation of Power	
Steering Gear Assembly	3F-77
Disassembly of Power Steering Gear	3F-77
Disassembly, Inspection and Reassembly of	
Individual Units	3F-78
Adjuster Plug	3F-78
Valve and Stub Shaft	3F-80
Pitman Shaft and Side Cover	3F-82
Rack-Piston	3F-82
Steering Gear Hose Connector and Poppet	
Check Valve	3F-83
Pitman Shaft Needle Bearing and Seals	3F-84
Reassembly of Power Steering Gear	3F-85
Adjustments of Power Steering Gear	3F-86
Removal and Installation of Oil Pump Shaft	
Seal With Pump Assembled	3F-90
Removal and Installation of Oil Pump Flow	
Control Valve	3F-90
Removal and Installation of Power Steering	
Oil Pump Assembly	3F-90
Disassembly, Inspection, Reassembly of	
Power Steering Oil Pump	3F-91
SPECIFICATIONS:	
Tightening Specifications	3F-95
Gear Specifications	3F-95
Pump Specifications	3F-95

DESCRIPTION AND OPERATION

DESCRIPTION OF POWER STEERING GEAR

The major internal components of the variable ratio steering gear are the rotary valve assembly steering

worm, rack-piston assembly, and the pitman shaft, Figure 3F-1. The movement of these parts, while turning or parking, is aided by hydraulic pressure supplied by the pump. Manual steering is always available at times when the engine is not running, or

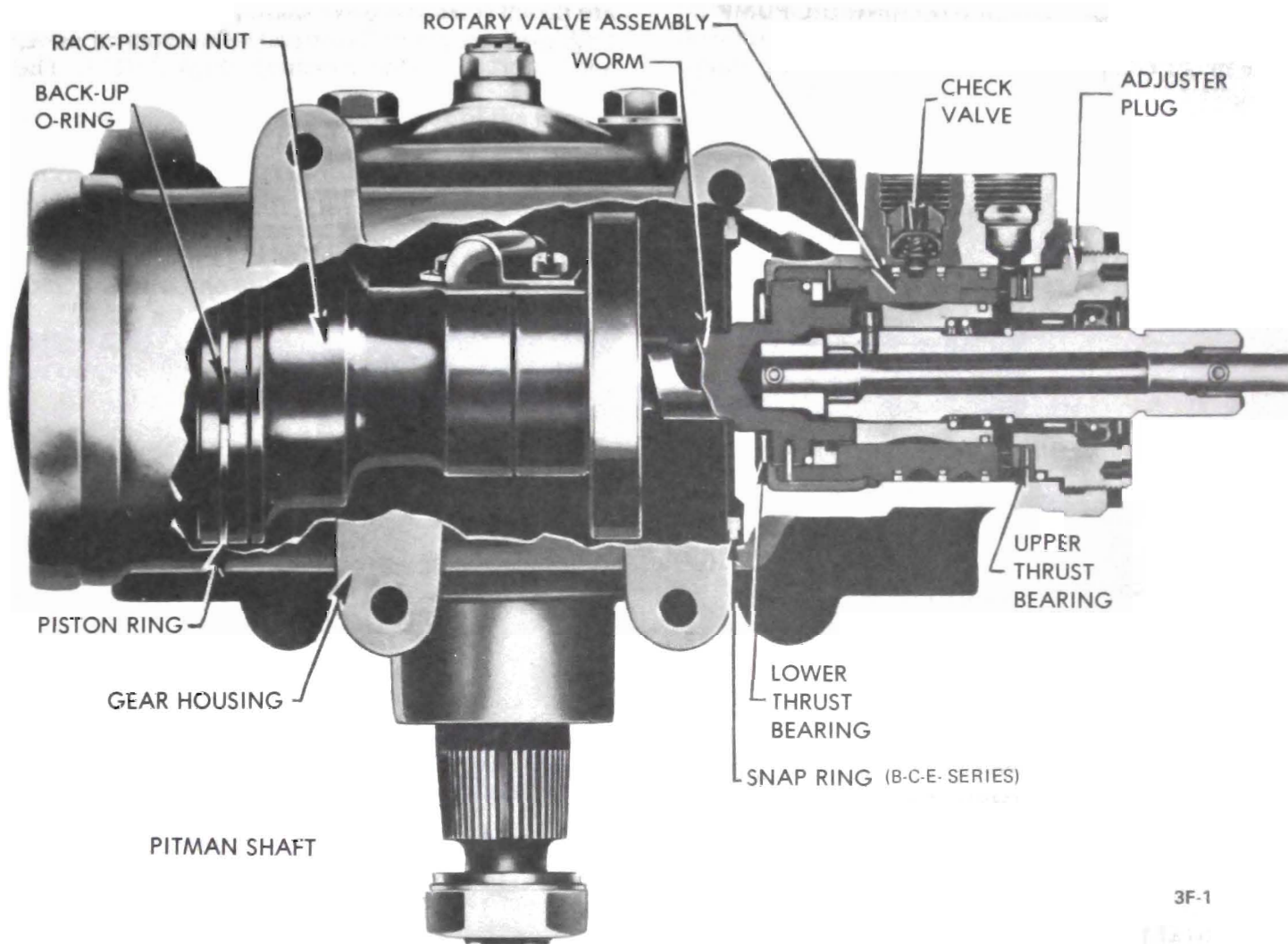


Figure 3F-1 Power Steering Gear Cutaway

in the event of pump or belt failure. Steering effort is increased under such conditions.

The steering stub shaft, rotary valve, worm shaft, and rack-piston assembly are all "in line". The rack-piston in the variable ratio steering gear is modified to accommodate the larger center tooth on the pitman shaft gear. All oil passages are internal within the gear housing, except for the pressure and return hoses between the gear and the pump. Figure 3F-1.

The mechanical element of this steering gear is a low-friction, recirculating ball system, in which steel balls act as a rolling thread between the steering worm and the rack-piston. The one-piece rack-piston assembly is geared to the sector of the pitman shaft.

The hydraulic rotary valve is concentric with the input shaft and is contained in the upper section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar allows the spool to rotate in relation to the valve body, thereby operating the valve. Figure 3F-2.

Under normal driving conditions the steering wheel effort will range from 1 to 1-1/2 pounds, and parking effort will range from 2 to 2-1/2 pounds.

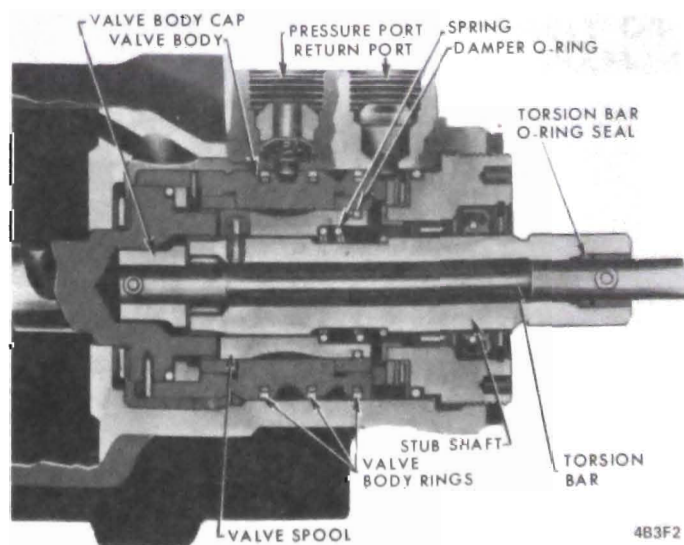


Figure 3F-2 Rotary Valve Assembly

DESCRIPTION OF POWER STEERING OIL PUMP

The major components of the power steering pump

are the oil reservoir, drive shaft, pump housing, cam ring, pressure plate, thrust plate, flow control valve, and rotor and vane assembly, Figure 3F-3. The

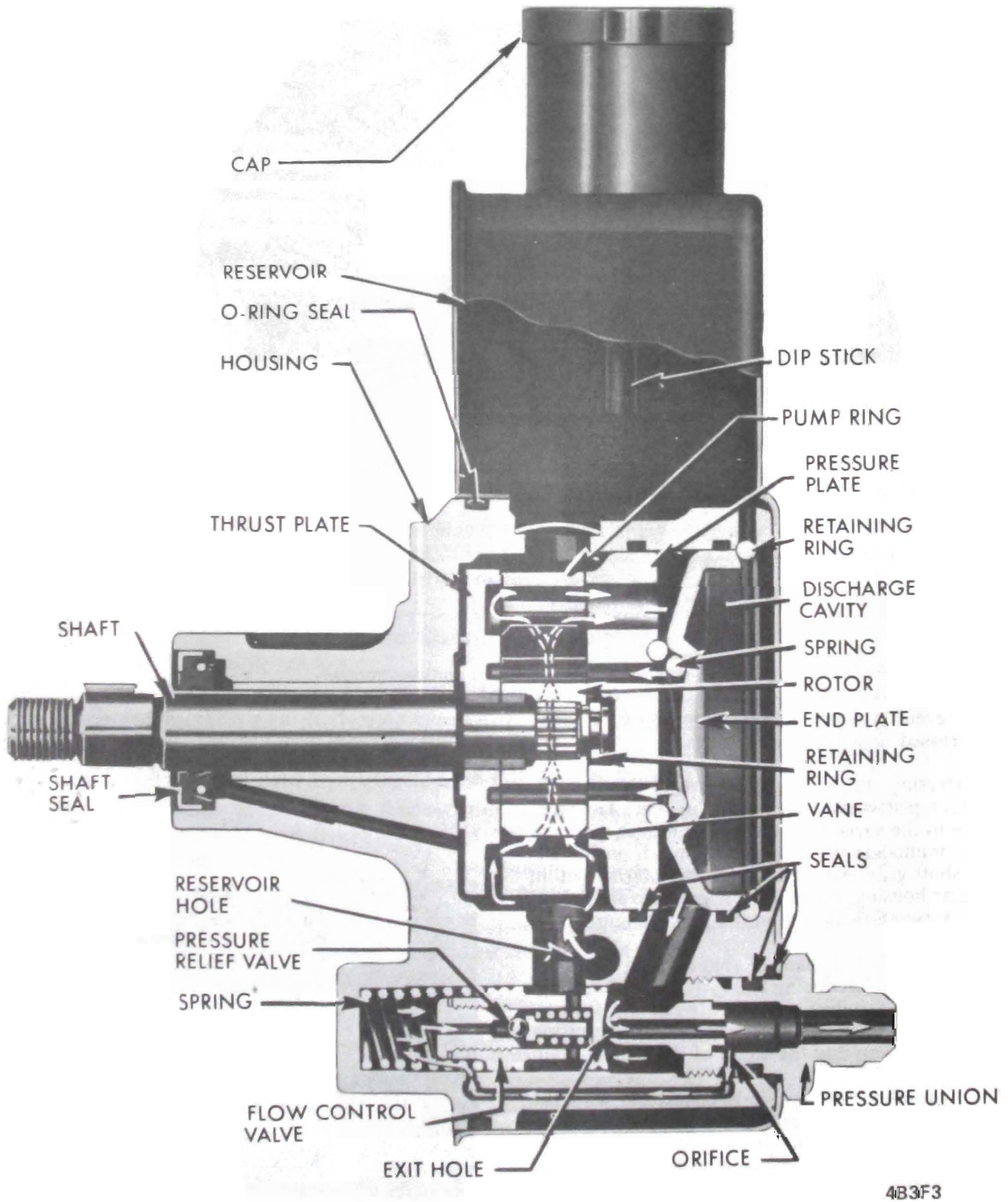


Figure 3F-3 - Oil Pump Cutaway

4B3F3

pump housing and component parts are encased in the oil reservoir. The reservoir filler cap has a dipstick attached to show the oil level in the reservoir.

There are two bore openings at the rear of the pump housing. The larger of these openings contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. Figure 3F-3. The smaller opening contains the pressure line union, flow control valve, and spring. The flow control orifice is part of the pressure line union. Figure 3F-4. A pressure

relief valve inside the flow control valve limits pump pressure. A magnet is installed in the pump housing attached by its magnetic force. The magnet will pick up any metal impurities in the oil. If the pump is disassembled the magnet should be cleaned.

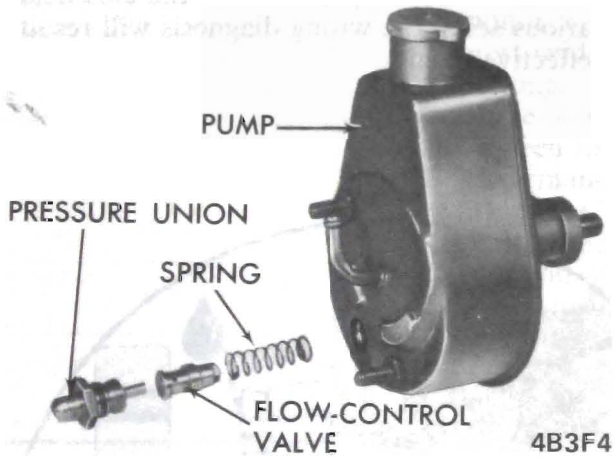


Figure 3F-4 - Flow Control Valve

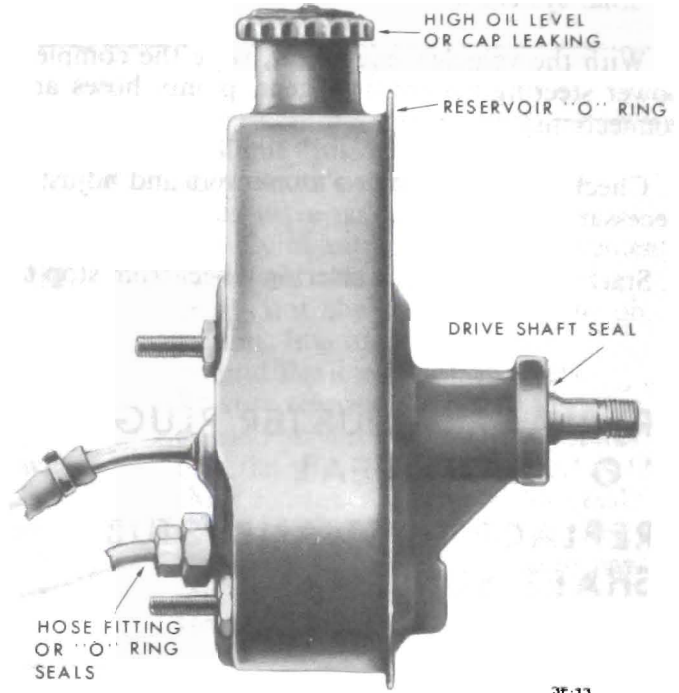


Figure 3F-5 - Oil Pump Leaks

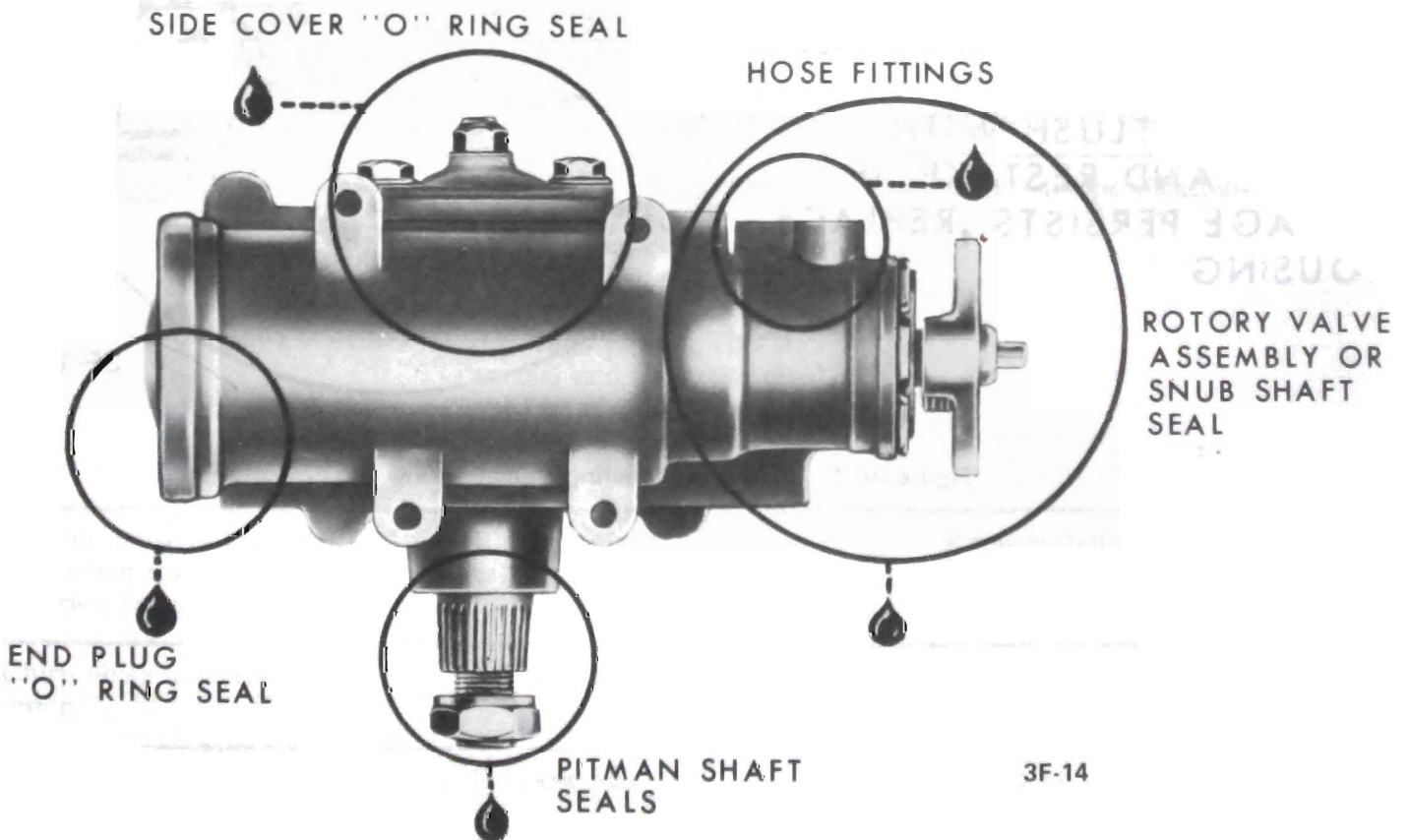


Figure 3F-6 - Steering Gear Leaks

DIAGNOSIS**EXTERNAL LEAK DIAGNOSIS**

The following method can be used to locate most external system leaks:

1. With the vehicle's engine off, wipe the complete power steering system dry (gear, pump, hoses and connections).
2. Check oil level in pump's reservoir and adjust if necessary.
3. Start engine and turn steering wheel from stop to

stop several times. Do not hold in corner for any length of time as this can damage the power steering pump. It is easier if someone else operates the steering wheel while you search for the seepage.

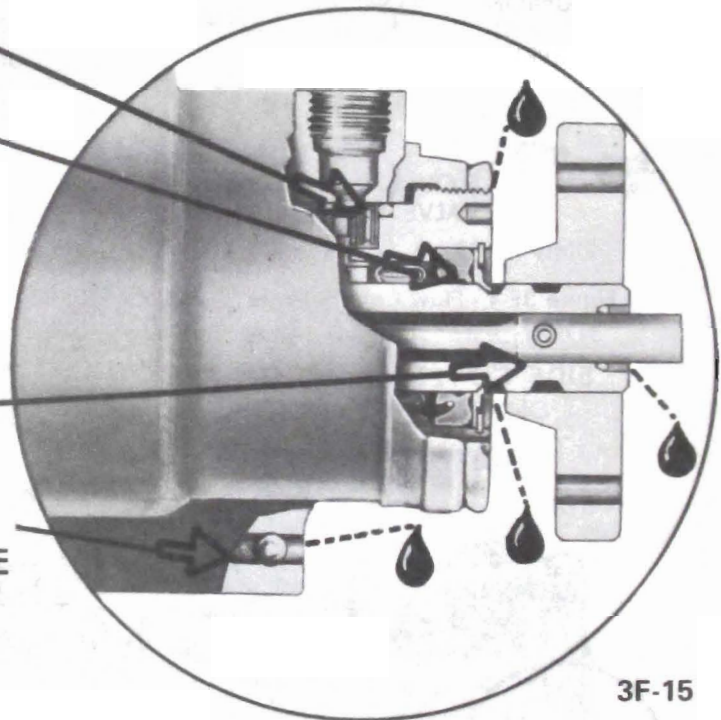
4. Find the exact area of leakage. See Figures 3F-5, 3F-6, and 3F-7.
5. Make the correct repair to stop the leak.

Leaks occurring near the upper end of the gear (where the rotary valve is visible) are not as easily pinpointed and more intense diagnosis may be necessary to make the correct repair. Due to the closeness of the various seals, the wrong diagnosis will result in an ineffective repair.

REPLACE ADJUSTER PLUG
"O" RING SEAL
REPLACE DUST AND STUB
SHAFT SEALS.

REPLACE ROTARY VALVE
ASSEMBLY

SEAT BALL FLUSH WITH
PUNCH AND RESTAKE. IF
SEEPAGE PERSISTS, REPLACE
HOUSING



3F-15

Figure 3F-7 - Upper End Steering Gear Leaks

TROUBLE DIAGNOSIS

This paragraph covers only those causes of trouble which may be due to the hydraulic power mechanism. Causes which are due to the steering linkage and front suspension are the same as described for standard steering gear.

Condition	Possible Cause	Correction
Hissing noise in steering gear.	1. There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	1. Slight "hiss" is normal and in no way affects steering. Do not replace valve unless "hiss" is extremely objectionable. A replacement valve will also exhibit slight noise and is not always a cure for the objection. Investigate clearance around flexible coupling rivets. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane is not distorted as shaft rotates. Any metal-to-metal contacts through flexible coupling will transmit valve "hiss" into passenger compartment through the steering column.
Rattle or Chuckle noise in steering gear.	1. Gear loose on frame.	1. Check gear-to frame mounting screws. Tighten bolts to 70 ft. lbs.
	2. Steering linkage looseness.	2. Check linkage pivot points for wear. Replace if necessary.
	3. Pressure hose touching other parts of car.	3. Adjust hose position. Do not bend tubing by hand.
	4. Loose pitman shaft over center adjustment. NOTE: A slight rattle may occur on turns because of increased clearance off the "high point". This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.	4. Adjust to specifications.
Squawk noise in steering gear when turning or recovering from a turn.	1. Dampener "O" ring on valve spool cut.	1. Replace dampener "O" ring.
Chirp noise in steering pump.	1. Loose belt.	1. Adjust belt tension to specification.
Belt squeal (particularly noticeable at full wheel travel and standstill parking).	1. Loose belt.	1. Adjust belt tension to specification.

Condition	Possible Cause	Correction
Growl noise in steering pump.	1. Excessive back pressure in hoses or steering gear caused by restriction.	1. Locate restriction and correct. Replace part if necessary.
Growl noise in steering pump (particularly noticeable at standstill parking).	1. Scored pressure plates, thrust plate or rotor	1. Replace parts and flush system.
	2. Extreme wear of cam ring.	2. Replace parts.
Groan noise in steering pump.	1. Low oil level.	1. Fill reservoir to proper level.
	2. Air in the oil. Poor pressure hose connection.	2. Tighten connector to specified torque. Bleed system by operating steering from right to left - full turn.
	3. Loose bolt in pump mounting.	3. Tighten to specifications.
Rattle or knock noise in steering pump.	1. Loose pump pulley nut.	1. Tighten nut to specified torque.
Rattle noise in steering pump.	1. Vanes not installed properly.	1. Install properly.
	2. Vanes sticking in rotor slots.	2. Free up by removing burrs, varnish or dirt.
Switch noise in steering pump.	1. Malfunctioning flow valve.	1. Replace part.
Whine noise in steering pump.	1. Pump shaft bearing	1. Replace housing and shaft. Flush system.
Poor return of steering wheel to center.	1. Lack of lubrication in linkage and ball joints.	1. Lube linkage and ball joints.
	2. Lower coupling flange rubbing against steering gear adjuster plug.	2. Loosen pinch bolt and assembly properly.
	3. Steering gear to column misalignment.	3. Align steering column.
	4. Tires not properly inflated.	4. Inflate to specified pressure.
	5. Improper front wheel alignment.	5. Check and adjust as necessary. With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or ball joints are binding.

Condition	Possible Cause	Correction
	6. Steering linkage binding.	6. Replace pivots.
	7. Ball joints binding. (Turn steering wheel and listen for internal rubbing in column - check causes listed and correct as directed).	7. Replace ball joints.
	8. Steering wheel rubbing against directional signal housing.	8. Adjust steering jacket.
	9. Tight or frozen steering shaft bearings.	9. Replace bearings.
	10. Rubber spacer binding.	10. Make certain spacer is properly seated. Lubricate inside diameter with silicone.
	11. Sticky or plugged valve spool.	11. Remove and clean or replace valve.
	12. Steering gear adjustments tight.	12. Check adjustment with gear out of vehicle. Adjust as required.
Car pulls to one side or the other. (Keep in mind road condition and wind. Test car on flat road going in both directions).	1. Front end misaligned.	1. Adjust to specifications.
	2. Tire pull (Radial tires)	2. Check tires for running true under load.
	3. Unbalanced steering gear valve. NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction.	3. Replace valve.
Momentary increase in effort when turning wheel fast to right or left.	1. Low oil level in pump.	1. Add power steering fluid as required.
	2. Pump belt slipping.	2. Tighten or replace belt.
	3. High internal leakage.	3. Check pump pressure (see pump pressure test).
Steering wheel surges or jerks when turning with engine running, especially during parking.	1. Low oil level.	1. Fill as required.

Condition	Possible Cause	Correction
	2. Loose pump belt.	2. Adjust tension to specification.
	3. Steering linkage hitting engine oil pan at full turn.	3. Correct clearance.
	4. Insufficient pump pressure.	4. Check pump pressure. (See pump pressure test). Replace relief valve if malfunctioning.
	5. Sticky flow control valve.	5. Inspect for varnish or damage. Replace if necessary.
Excessive wheel kick-back or loose steering.	1. Air in system.	1. Add oil to pump reservoir and bleed by operating steering. Check hose connectors for proper torque and adjust as required.
	2. Steering gear loose on frame.	2. Tighten attaching screws to specified torque.
	3. Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose.	3. Tighten flange pinch bolts to 30 ft. lbs., if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque.
	4. Steering linkage joints worn enough to be loose.	4. Replace loose pivots.
	5. Front wheel bearings incorrectly adjusted or worn.	5. Adjust bearings or replace with new parts as necessary.
	6. Worn poppet valve (gear).	6. Replace poppet valve.
	7. Loose thrust bearing preload adjustment (gear).	7. Adjust to specification with gear out of vehicle.
	8. Excessive "over-center" lash.	8. Adjust to specification with gear out of vehicle.
Hard steering or lack of assist.	1. Loose pump belt.	1. Adjust belt tension to specification.
	2. Low oil level in reservoir. NOTE: Low oil level will also result in excessive pump noise.	2. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors to 30 ft. lbs.
	3. Steering gear to column misalignment.	3. Align steering column.

Condition	Possible Cause	Correction
	4. Lower coupling flange rubbing against steering gear adjuster plug.	4. Loosen pinch bolt and assemble properly.
	5. Tires not properly inflated.	5. Inflate to recommended pressure.
NOTE: If checks 1-5 do not reveal cause of hard steering, follow the procedure below to deter-	Further possible causes could be:	In order to diagnose conditions such as listed in 6, 7, 8, and 9, a test of the entire power steering system is required.
	6. Sticky flow control valve.	
	7. Insufficient pump pressure output.	
	8. Excessive internal pump leakage.	
	9. Excessive internal gear leakage.	

POWER STEERING SYSTEM

TEST PROCEDURE

1. Disconnect pressure hose at union of pump, use a small container to catch any fluid which might leak.
2. Connect a spare pressure hose to pump union.
3. Using Pressure Gauge J-5176-1, Adapter Fitting J-22326, connect gauge to both hoses.
4. Open hand valve on gauge.
5. Start engine, allow system to reach operating temperatures and check fluid level, adding any fluid if required. When engine is at normal operating temperature, the initial pressure read on the gauge (valve open) should be in the 80-125 PSI range. Should this pressure be in excess of 200 PSI, check the hoses for restrictions and the poppet valve for proper assembly.
6. Close gate valve fully three times. Record the highest pressures times. Record the highest pressures attained each time. (Note: Do not leave valve fully closed for more than five seconds, as the pump could be damaged internally).
 - a. If the pressures recorded are within the listed specifications and the range of read 50 PSI, the pump is functioning within specifications (Ex. Spec. 1350 - 1450 PSI - readings - 1370 - 1375 - 1380).

Condition	Possible Cause	Correction
		<p>b. If the pressures recorded are high but do not repeat within 50 PSI, the flow controlling valve is sticking. Remove the valve, clean it, and remove any burrs using crocus cloth or fine hone. If the system contains some dirt, flush it. If it is exceptionally dirty, both the pump and the gear must be completely disassembled, cleaned, and reassembled before further usage.</p> <p>c. If the pressures recorded are constant but more than 100 PSI below the low listed specification, replace the flow control valve and recheck. If the pressures are still low, replace the rotating group.</p> <p>7. If the pump checks to specifications, leave the valve open and turn, or have turned, the steering wheel into both corners. Record the highest pressures and compare with the maximum pump pressure recorded.</p> <p>If this pressure cannot be built in either (or one) side of the gear, the gear is leaking internally and must be disassembled and repaired.</p> <p>8. Shut off engine, remove testing gauge, spare hose, reconnect pressure hose, check fluid level or make needed repairs.</p>

Condition	Possible Cause	Correction
Foaming milky power steering fluid, low fluid level, and possible low pressure.	1. Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	<p>1. Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing.</p> <p>Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.</p>
Low pressure due to steering pump.	1. Flow control valve stuck or inoperative.	1. Remove burrs or dirt or replace.
	2. Pressure plate not flat	2. Correct.
	3. Extreme wear of cam ring.	3. Replace parts. Flush system.

Condition	Possible Cause	Correction
	4. Scored pressure plate, thrust plate or rotor.	4. Replace parts (if rotor, replace with rotating group kit). Flush system.
	5. Vanes not installed properly.	5. Install properly.
	6. Vanes sticking in rotor slots.	6. Free-up by removing burrs, varnish or dirt.
	7. Cracked or broken thrust or pressure plate.	7. Replace part.
Low pressure due to steering gear.	1. Pressure loss in cylinder due to worn piston ring or scored housing bore.	1. Remove gear from car for disassembly and inspection of ring and housing bore.
	2. Leakage at valve rings, valve body to worm seal.	2. Remove gear from car for disassembly and replace seals.

Condition	Test or Inspection
Air in system	Power steering fluid in the pump will be foamy and an abnormal noise will also result. Bleed the system by operating steering. If the bleeding fails, check for external leaks at the hoses and other connections and adjust as necessary.
Pump belt loose, worn or slipping	Either adjust the pump belt tension, replace the belt or dress the belt with an appropriate lubricant.
Low oil level in pump	Will result in excessive pump noise. Check the level and fill as needed. Check all connections for leakage and adjust as needed.
Incorrect steering gear adjustments	Remove gear and make adjustments as outlined in the Major Repair section.
Gear loose on frame	Visual observation of the gear will substantiate the condition. Attach the gear to the frame properly and torque as specified.
Steering gear to column misaligned	Observe action between the shaft and the gear. If misaligned adjust column to align.
Unbalanced steering gear valve	Steering effort will be very light in direction of leakage and heavy in the opposite direction. Remove the rotary valve.

Condition	Test or Inspection
Sticky slow control valve	Jerky operation or lack of assist. Remove the valve from the pump as outlined in Major Repair section and inspect for damage or varnish. Clean or replace as necessary.
Low pressure due to gear or pump	Usually results in an overhaul condition. Power steering system test procedure.

MAINTENANCE AND ADJUSTMENTS

POWER STEERING OIL PUMP BELT ADJUSTMENT

350 and 455 Engines

1. Loosen the pump bracket adjusting bolts (2) and nut (1). See Figure 3F-51. Also loosen lower A.I.R. bracket bolt.
2. Place a 1/2" drive breaker bar into the square hole in the pump bracket and apply tension.
3. Tighten the pump bracket bolts and nut to 35 lb. ft.
4. Belt tension should be 90 lbs.

L-6 Engine

1. Loosen pivot bolt and pump brace adjusting nuts. Figure 3F-53
2. Do not pry on reservoir or neck. Move pump to tighten belt to 90 lbs.
3. Tighten brace nuts and pivot bolt.

MAJOR REPAIR

REMOVAL AND INSTALLATION OF PITMAN SHAFT SEALS, GEAR IN CAR

Removal

If, upon inspection of the gear, it is found that oil leakage exists at the pitman shaft seals, the seals may often be replaced without removing gear assembly from car as follows:

1. Remove pitman arm nut and disconnect pitman arm from pitman shaft using puller J-5504. See Figure 3F-8. Do not hammer on end of puller.

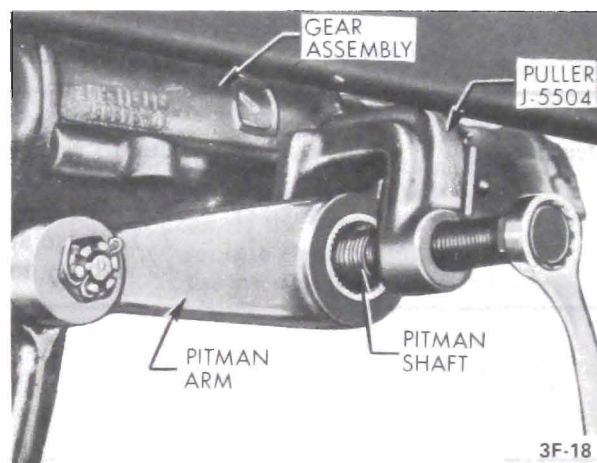


Figure 3F-8 - Removing Pitman Arm From Pitman Shaft

2. Thoroughly clean end of pitman shaft and gear housing, then tape splines on end of pitman shaft to insure that seals will not be cut by splines during assembly. Only one layer of tape should be used; an excessive amount of tape will not allow the seals to pass over it, due the close tolerance between the seals and the pitman shaft.
3. Remove pitman shaft seal retaining ring with snap ring pliers J-4245.
4. Start engine and turn steering wheel fully to the left so that oil pressure in the housing can force out pitman shaft seals. Turn off engine. Use suitable container to catch oil forced out of gear. This method of removing the pitman shaft seals is recommended, as it eliminates the possibility of scoring the housing while attempting to pry seals out.
5. Inspect seals for damage to rubber covering on O.D. IF O.D. appears scored, inspect housing for burrs. Remove any burrs before installing new seals. Also inspect for any other defects.

Installation

1. Lubricate the seals thoroughly with power steer-

ing fluid and install seals with installer J-6219. Install the inner single lip seal first, then a back-up washer. Drive seal in far enough to provide clearance for the other seal, back-up washer and retaining ring. *Make sure that the inner seal does not bottom on the counterbore.* Install the outer double lip seal and the second back-up washer in only far enough to provide clearance for the retaining ring. Install retaining ring.

2. Fill pump reservoir to proper level. Start engine and allow engine to idle for at least three minutes without turning steering wheel. Turn wheel to left and check for leaks. Adjust level if necessary.

3. Remove tape and reconnect pitman arm. Tighten pitman arm retaining nut to 180 lb. ft. on A-B-C-E Series and 140 lb. ft. on X Series.

CAUTION: *This pitman arm to steering gear fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number, or with an equivalent part, if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

REMOVAL AND INSTALLATION OF POWER STEERING GEAR ASSEMBLY.

Removal

1. Place fender cover over left fender.
2. Remove the steering coupling shield Figure 3F-40.
3. Clean the hose connecting area of the gear to prevent dirt from entering the gear.
4. Disconnect the pressure and return line hoses at the steering gear and elevate ends of hoses higher than pump to prevent oil from draining out of pump.
5. Remove pinch bolt securing lower steering column flexible coupling flange to steering gear stub shaft.
6. Remove pitman arm nut, then remove the pitman arm using puller J-5504. See Figure 3F-8.
7. Loosen the three frame to steering gear bolts at outside of frame and remove steering gear. Figure 3F-49 or 3F-50.

Installation

CAUTION: *Fasteners in step 1 are important attaching parts in that they could af-*

fect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

1. Install the gear assembly by reversing the procedure for removal. Torque pitman nut 180 lb. ft. on A-B-C-E Series and 140 lb. ft. on X Series. Figure 3F-49 or 3F-50.

Torque flexible coupling pinch bolt to 30 lb. ft. Power steering hoses should be installed to maintain a minimum clearance of 1" between hoses and 1/2" to surrounding parts. Figures 3F-54, 3F-55, 3F-56, 3F-57.

2. Fill pump reservoir to correct level with Buick Power Steering oil or equivalent.

3. Start engine and maintain oil level in reservoir while allowing engine to idle for at least three minutes before turning steering wheel. Then rotate steering wheel through its entire range slowly a few times with engine running. Re-check oil level and inspect for possible leaks. If air becomes trapped in the oil, the oil pump may be noisy until all air is out of oil. This may take some time since air trapped in oil does not bleed out rapidly.

DISASSEMBLY OF POWER STEERING GEAR

Disassembly

The following procedures are with the gear assembly removed from the vehicle.

If complete assembly is not to be overhauled, remove the unit to be overhauled and proceed to the disassembly and assembly of that unit.

1. Rotate end cover retainer ring so that one end of the ring is over the hole in the side of the housing. Force the end of the ring from its groove and remove ring. Figure 3F-9.

2. Turn the coupling flange counter-clockwise until the rack-piston just forces end cover out of housing. Remove cover and discard "O" ring.

DO NOT turn stub shaft any further than absolutely necessary to remove the end plug, or balls from rack-piston and worm circuit may escape and lay loose inside the rack-piston chamber.

3. Remove the rack-piston end plug as shown in Figure 3F-10.

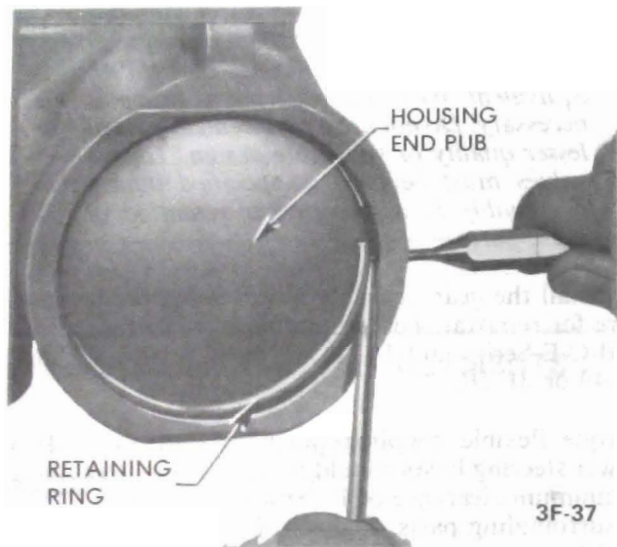


Figure 3F-9 - Removing End Cover Retaining Ring

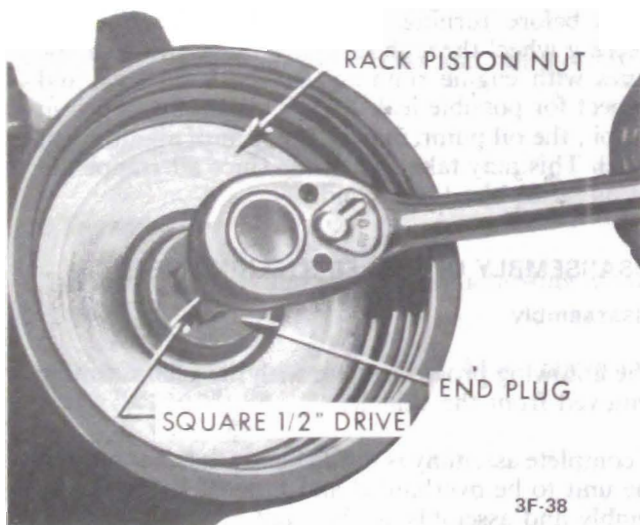


Figure 3F-10 - Removing Rack-Piston End Plug

To aid in loosening end plug, tap end plug with a brass drift of 1" diameter or larger.

4. Remove the pitman shaft and side cover as follows:

a. Loosen the over-center adjusting screw lock-nut and remove the 4 side cover attaching bolts.

b. Rotate the side cover until the rack-piston and pitman shaft teeth are visible, then turn the coupling flange until the pitman shaft teeth are centered in the housing opening. Tap the pitman shaft with a soft hammer and remove the pitman shaft and side cover

from the housing. Remove the side cover gasket. Discard if damaged.

5. Remove the rack-piston as follows:

a. Insert Ball Retainer Tool J-7539 into the rack-piston bore with pilot of tool seated in the end of the worm. Turn stub shaft counter-clockwise while holding tool tightly against worm. The rack-piston will be forced onto the tool. Figure 3F-11. Hold tool and pull rack piston farther onto tool to prevent end circuit balls from falling out.

b. Remove the rack-piston with Ball Retainer Tool J-7539 from gear housing.

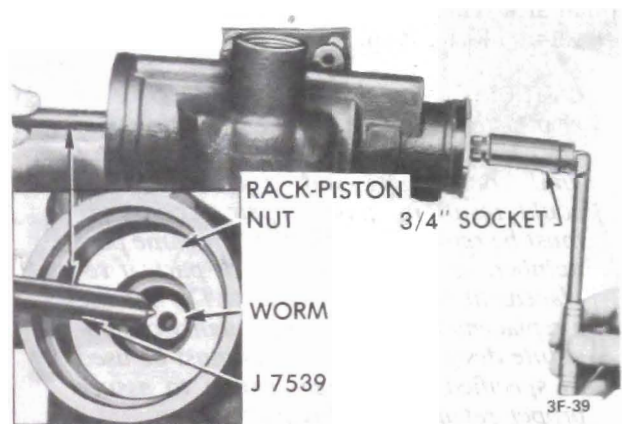


Figure 3F-11 - Removing Rack Piston

6. Remove the adjuster plug as follows:

a. Loosen the adjuster plug locknut and remove.

b. Remove adjuster plug assembly with Spanner Wrench J-7624. Remove and discard the plug "O" ring.

7. Grasp the lower shaft and pull the valve assembly from the housing bore. Separate worm and valve and remove the lower shaft cap "O" ring and discard.

8. If the worm or the lower thrust bearing and race remained in the gear housing, remove them at this time.

DISASSEMBLY, INSPECTION, AND REASSEMBLY OF INDIVIDUAL UNITS

ADJUSTER PLUG

Disassembly

1. If the oil seal ONLY is to be replaced, and not the bearing, install the adjuster plug loosely in the gear housing. Remove the retaining ring with Internal Pliers J-4245. With a screw driver, pry the dust seal

and oil seal from the bore of the adjuster plug being careful not to score the needle bearing bore. Discard the oil seal.

2. If the thrust bearing ONLY is to be removed, pry the thrust bearing retainer at the two raised areas with a small screw driver. Figure 3F-12. Remove the spacer, thrust bearing washer, thrust bearing and washer.

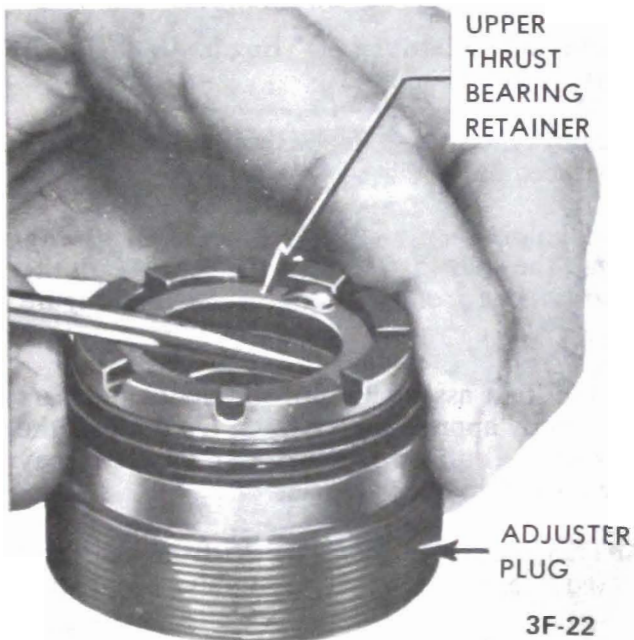


Figure 3F-12 - Removing Retainer

3. If the needle bearing is to be replaced remove the retaining ring using Internal Pliers J-4245. Figure 3F-13. Remove thrust bearings as outlined in step 2

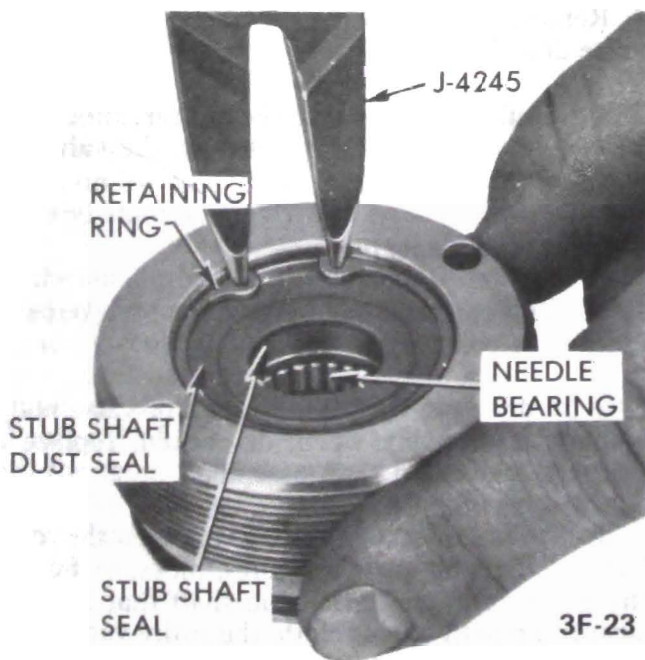


Figure 3F-13 - Removing Retaining Ring

above. Drive needle bearing, dust seal and oil seal from adjuster plug using Tool J-6221.

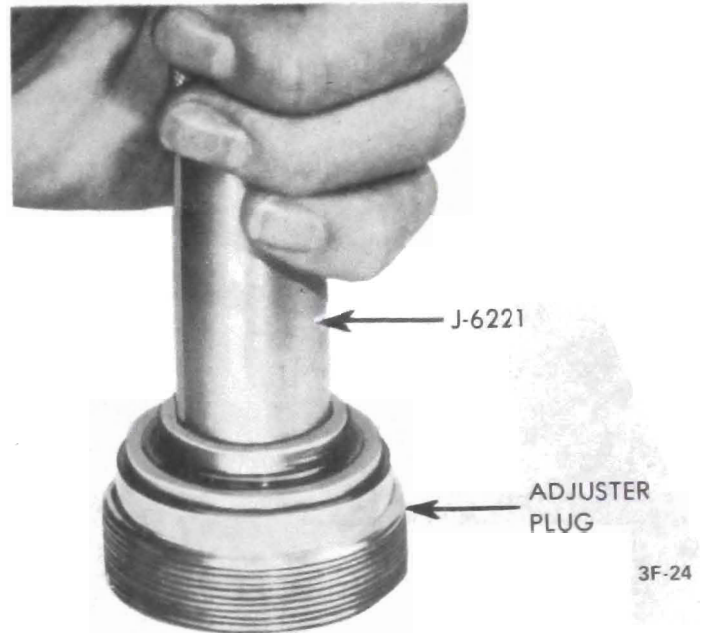


Figure 3F-14 Removing Needle Bearing

4. Wash all parts in clean solvent and dry parts with compressed air.
5. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.
6. Inspect thrust bearing rollers and thrust washers for wear, pitting or scoring. If any of these conditions exist, replace the bearing and washers.

Assembly

1. If the needle bearing was removed, place new needle bearing over Tool J-6221, with the bearing manufacturer's identification against the tool, and drive the bearing into the adjuster plug until the end of bearing is flush with bottom surface of stub shaft seal bore. Place a block of wood under plug to protect it.
2. Lubricate new stub shaft seal with power steering oil and install seal with spring in seal toward adjuster plug using Tool J-5188. See Figure 3F-15.
3. Install seal only far enough in plug to provide clearance for dust seal and retaining ring. Place new dust seal with lip up in plug, then install retaining ring with Internal Pliers, J-4245.
4. Lubricate the thrust bearing assembly with Power Steering Fluid. Place the flanged thrust bearing washer on the adjuster plug hub then install the upper thrust bearing, small bearing washer and spacer (grooves of spacer away from bearing washer).

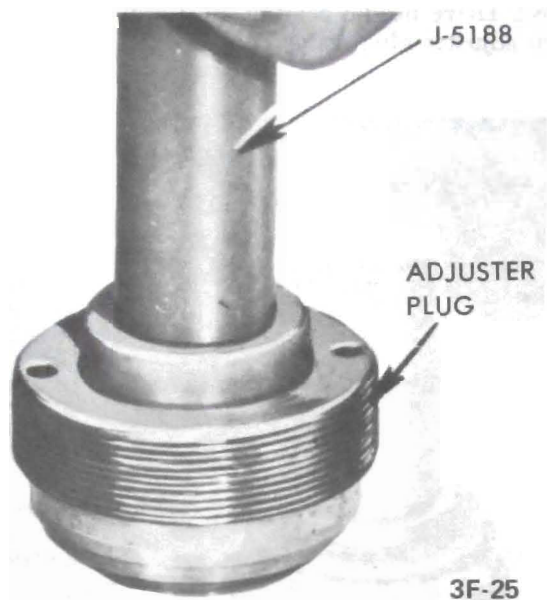


Figure 3F-15 - Installing Seal

5. Install a new bearing retainer on the adjuster plug by carefully tapping on the flat surface of the retainer. Figure 3F-16.

The projections must not extend beyond the spacer when the retainer is seated. The spacer must be free to rotate.

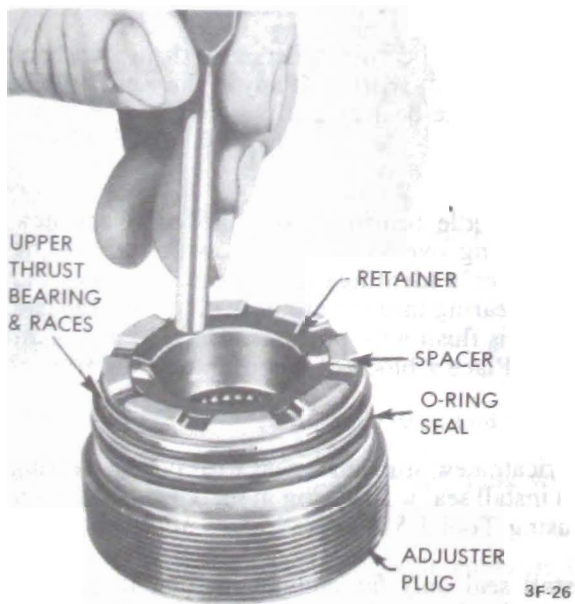


Figure 3F-16 - Installing Retainer

VALVE AND STUB SHAFT

Disassembly

It is very uncommon to have to make any service

repairs to the valve assembly with the possible exception of the valve spool dampener "O" ring seal. DO NOT disassemble the valve unless absolutely necessary since this may result in damage to the assembly. If the valve spool dampener "O" ring seal requires replacement, remove the valve spool only, replace the "O" ring and reinstall the spool immediately. DO NOT disassemble further.

Cleanliness of parts and work area is of the utmost importance during servicing of the valve assembly.

1. Remove and discard the "O" ring in the shaft cap end of the valve assembly.
2. To remove the stub shaft assembly from the valve body, proceed as follows:
 - a. While holding the assembly (stub shaft down), lightly tap the stub shaft against the bench until the shaft cap is free from the valve body. See Figure 3F-17.
 - b. Pull the shaft assembly until the shaft cap clears the valve body approximately 1/4". Do not pull the shaft assembly out too far or the spool valve may become cocked in the valve body.
 - c. Carefully disengage the shaft pin from the valve spool and remove the shaft assembly. See Figure 3F-17.

3. Push the spool valve out of the flush end of the valve body until the dampener "O" ring is exposed, then carefully pull the spool from the valve body, while rotating the valve. See Figure 3F-18. If the spool valve becomes cocked, carefully realign the spool valve, then remove.

4. Remove the dampener "O" ring from the spool valve and discard.

5. If the teflon oil rings are to be replaced, cut the three teflon oil rings and "O" rings from the valve body and discard.

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out all oil holes with compressed air.
2. If the drive pin in the stub shaft or valve body is cracked, excessively worn, or broken, replace the complete valve and shaft assembly.
3. If there is evidence of leakage between the torsion bar and the stub shaft or scores, nicks, or burrs on the ground surface of the stub shaft that cannot be cleaned up with crocus cloth, the entire valve assembly must be replaced.
4. Check the outside diameter of the spool valve and

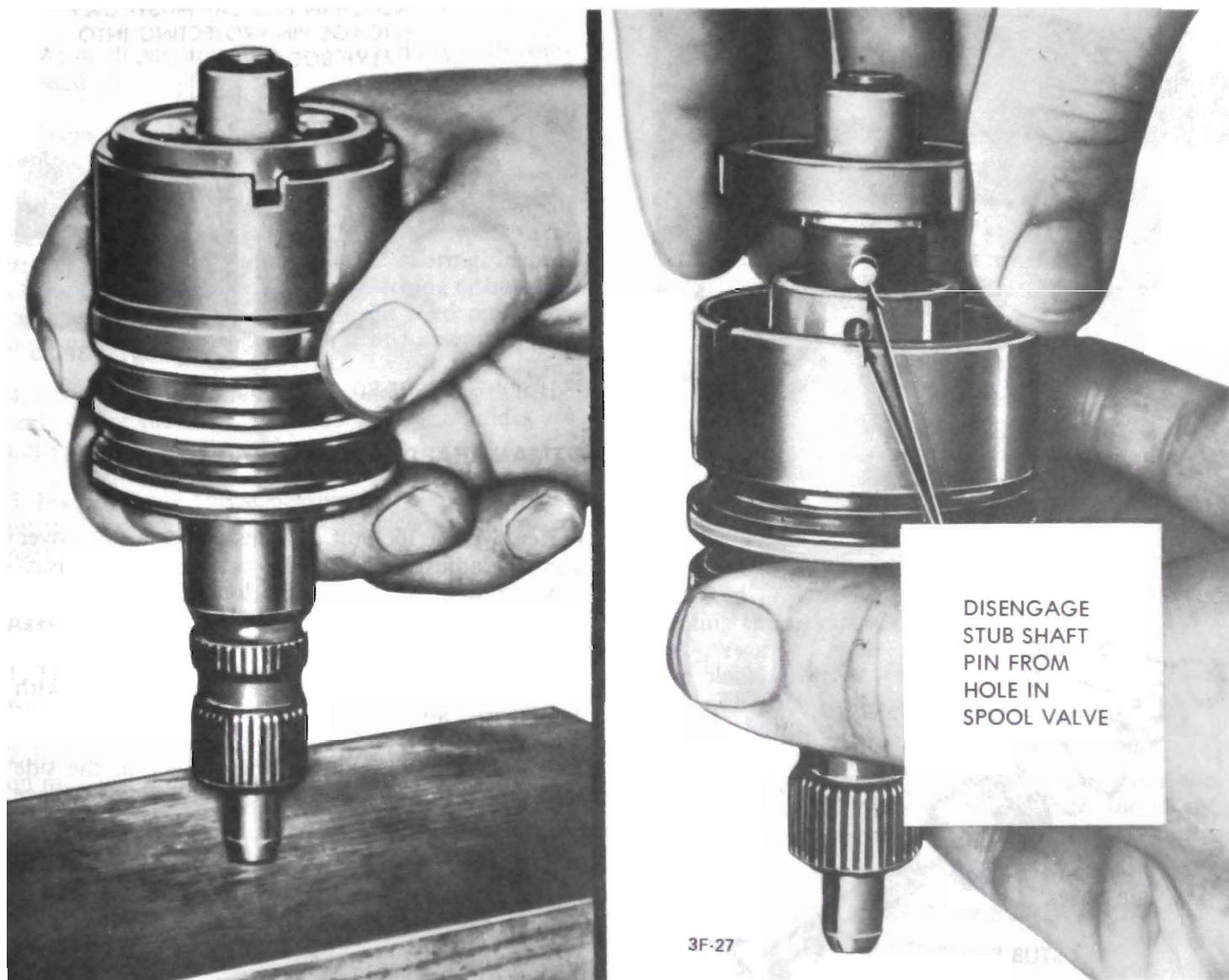


Figure 3F-17 - Removing Stub Shaft Assembly

the inside diameter of the valve body for nicks, burrs, or bad wear spots. If the irregularities cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.

5. If the small notch in the skirt of the valve body is excessively worn, the complete valve assembly will have to be replaced.

6. Lubricate the spool valve with power steering fluid and check the fit of the spool valve in the valve body (with the spool valve dampener "O" ring removed). If the valve does not rotate freely without binding, the complete valve and shaft assembly will have to be replaced.

Assembly

1. If valve body "O" rings and teflon rings were

removed, install new "O" rings in the oil ring grooves and lubricate with power steering fluid.

2. Lubricate the three new teflon oil rings with power steering fluid and install in grooves over "O" rings.

The teflon rings may appear to be distorted, but the heat of the oil during operation of the gear will straighten them out.

3. Lubricate the spool valve dampener "O" ring with Power Steering Fluid and install over the spool valve.

4. Lubricate the spool valve and valve body with Power Steering Fluid and slide the spool valve into the valve body. Rotate the spool valve while pushing it into the valve body being careful not to cut "O" ring. Push the spool valve on through the valve body until the shaft pin hole is visible from the opposite end (spool valve flush with shaft cap end of valve body).

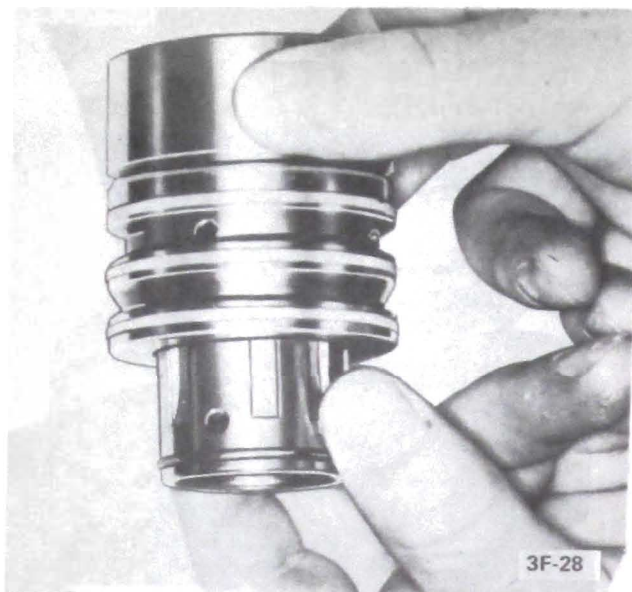


Figure 3F-18 - Removing Spool Valve

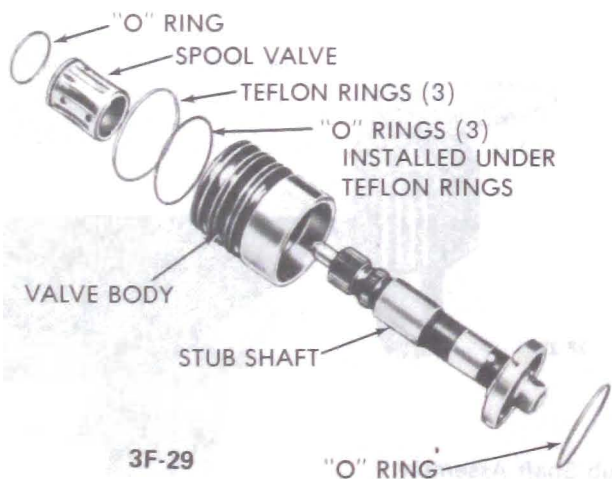


Figure 3F-19 - Exploded View of Valve Body and Shaft

5. Lubricate the shaft assembly with Power Steering Fluid and carefully install it into the spool valve until the shaft pin can be placed into the spool valve.

6. Align the notch in the shaft cap with the pin in the valve body and press the spool valve and shaft assembly into the valve body. Figure 3F-20.

CAUTION: Make sure that the shaft cap notch is mated with the valve body pin before installing valve body into the gear assembly.

7. Lubricate a new "O" ring with Power Steering Fluid and install it in the shaft cap end of the valve body assembly.

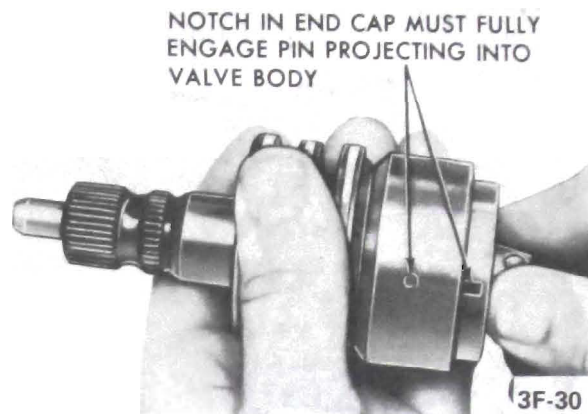


Figure 3F-20 - Installing Stub Shaft

PITMAN SHAFT AND SIDE COVER

Disassembly

1. Remove the locknut and unscrew the side cover from the adjusting screw. Do not attempt to disassemble pitman shaft. Discard locknut.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry parts with compressed air.

2. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.

3. Check the sealing and bearing surfaces of the pitman shaft for roughness, nicks, etc. If minor irregularities in surface cannot be cleaned by use of crocus cloth, replace the pitman shaft.

4. Replace pitman shaft assembly if teeth are damaged or if the bearing surfaces are pitted or scored.

5. Check pitman shaft lash adjusting screw. It must be free to turn with not perceptible end play. If adjusting screw is loose replace the pitman shaft assembly.

Assembly

1. Thread the side cover onto the pitman shaft adjusting screw until it bottoms and then turn in 1/2 turn. Install a new adjusting screw locknut, but do not tighten.

RACK-PISTON

DISASSEMBLY

1. Thread the worm out of the rack-piston, remove ball return guide clamp, guide halves and balls.

2. If necessary to replace the teflon oil seal and "O" ring, remove at this time.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry with compressed air.
2. Inspect gear housing bore. If badly scored or worn, replace housing.
3. Inspect the worm and rack-piston grooves and all the balls for excessive wear or scoring. Inspect rack-piston nut teeth for pitting, wear or scoring. Inspect O.D. of rack-piston nut for wear, scoring or burrs. If either the worm or rack-piston nut need replacing, both must be replaced as a matched assembly.
4. Inspect ball return guides, making sure that the ends where the balls enter and leave the guides are not damaged. Replace if necessary.
5. Inspect lower thrust bearing and races for wear, pitting, scoring or cracking. Replace any damaged parts.

Assembly

1. Thoroughly clean and lubricate the internal parts with power steering oil.
2. Install new piston ring back-up "O" ring in groove on rack-piston nut. Place a new piston ring over the back-up "O" ring. See Figure 3F-21.



Figure 3F-21 - Installing Ring on Rack Piston

3. Install worm into rack-piston nut to bearing shoulder.
4. Align the ball return guide holes in the rack-piston nut with the worm groove. Figure 3F-22.

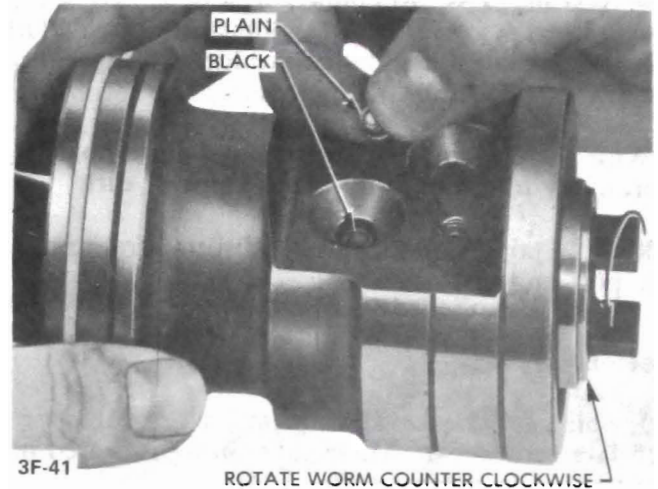


Figure 3F-22 - Loading Balls in Rack-Piston Nut

5. Lubricate the balls with Power Steering Fluid, then feed 17 balls into the rack-piston, while slowly rotating the worm counter-clockwise.

The black balls are .0005" smaller than the silver balls. The black and silver balls must be installed alternately into the rack-piston and return guide.

Alternately install 7 balls into the return guide and retain with grease at each end of guide. Install the return guide clamp and tighten the 2 clamp screws to 6 ft. lbs.

STEERING GEAR HOSE CONNECTOR AND POPPET CHECK VALVE

Disassembly

The following procedure can be performed on car as well as on bench.

1. Disconnect pressure and return line hoses at steering gear and secure hose ends in a raised position to prevent loss of fluid.
2. To prevent metal chips from becoming lodged in valve assembly, pack inside of connector seats of pressure and return port housing with petrolatum.
3. Tap threads in connector seats, using a 5/16-18 tap.

Do not tap threads too deep in pressure hose connector seat as tap will bottom poppet valve against housing and damage it. It is necessary to tap only 2 or 3 threads deep.

4. Thread a 5/16-18 bolt with a nut and flat washer into tapped hole.
5. To pull connector seat, hold bolt from rotating

while turning nut off bolt. This will pull connector from housing. Discard connector seat.

It is also possible to remove connector by using a No. 4 screw extractor. (easy out)

6. Wipe petrolatum from housing and clean housing thoroughly to remove any metal chips or dirt.

7. Remove poppet check valve and spring from pressure port and discard.

Assembly

1. Install new check valve spring in pressure port with large end down. Make sure spring is seated in counterbore in pressure port.

2. Install new check valve over spring with tangs pointing down. Make sure valve is centered on small end of spring.

3. Install new connector seats, using petrolatum to hold connector seat on check valve in pressure port. Drive connector seats in place using Valve Connector Seat Installer, J-6217.

4. Check operation of valve by pushing lightly against valve with a small punch or small rod. Valve should reseat itself against connector seat when pressure is removed from spring.

5. Connect pressure and return line hoses on steering gear. Tighten hose fittings to 30 foot-pounds.

6. Check fluid in pump reservoir and add if necessary.

PITMAN SHAFT NEEDLE BEARING AND SEALS

Disassembly

When prying out seals, be extremely careful not to score the housing bore.

1. If pitman shaft seals **ONLY** are to be replaced, remove the seal retaining ring with Internal Pliers J-4245 and remove outer steel washer. Using screw driver under lip of seal pry out the outer seal. Remove the inner steel washer, then pry out the inner seal. Figure 3F-23. Discard seals.

2. If pitman shaft needle bearing replacement is necessary, remove with Tool J-6657. Since this bearing is shouldered, it must be pressed out the pitman shaft end of the housing. Figure 3F-24.

Assembly

1. If pitman shaft needle bearing was removed be-

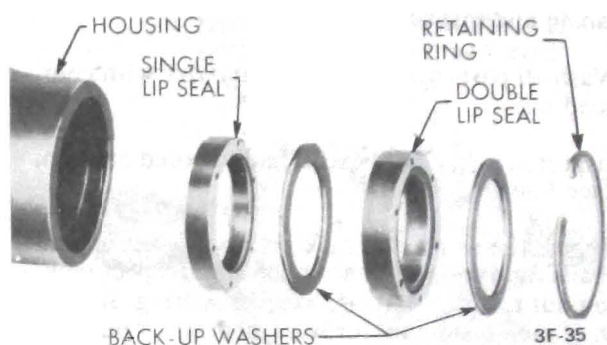


Figure 3F-23 - Pitman Shaft Seals

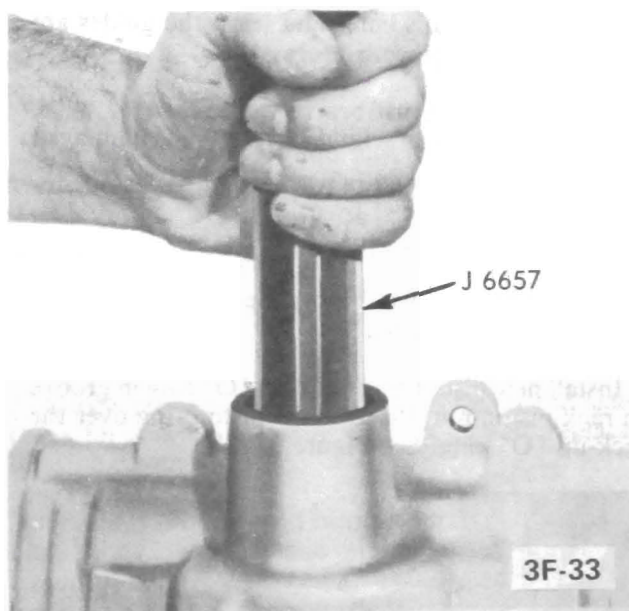


Figure 3F-24 - Removing Pitman Shaft Needle Bearings

cause of damage, install new needle bearing into gear housing bore from seal bore end, pressing against stamped identification on bearing with Tool J-6657. Press in until bearing clears shoulder in gear housing, 1/32" maximum. Rollers in bearing must be free to rotate.

2. Lubricate new pitman shaft seals with power steering oil. Install the inner, single lip seal in bore first, then a back-up washer. See Figure 3F-23. Using Tool J-6219, drive the seal and washer in far enough to provide clearance for the outer seal, back-up washer and retaining ring. See Figure 3F-25. *The inner seal must not bottom on the counterbore.* Install the outer double lip seal and the second back-up washer in bore only far enough to provide clearance for the retaining ring with Tool J-6219. Install retaining ring with No. 3 Truarc pliers Tool J-4245, making certain that ring is seated properly.

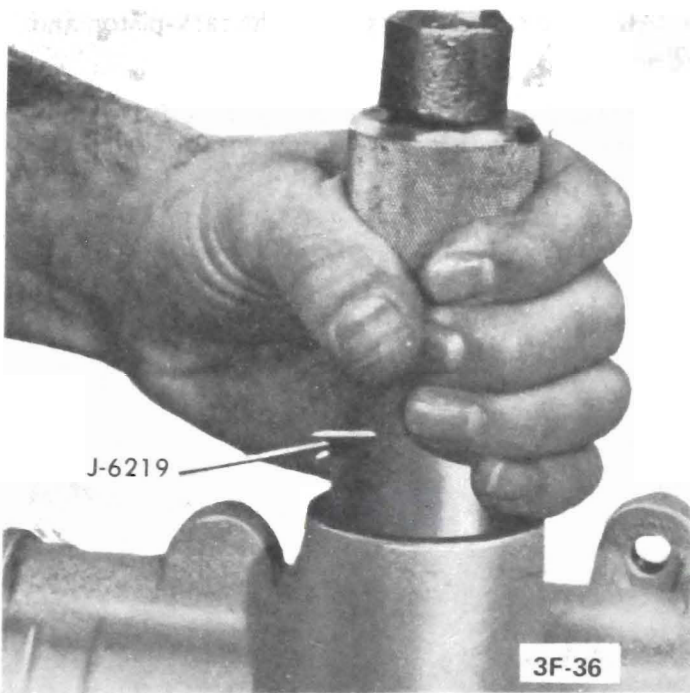


Figure 3F-25 - Installing Seals

REASSEMBLY OF POWER STEERING GEAR

Reassembly

1. Lubricate the worm, lower thrust bearing and the two thrust washers with Power Steering Fluid, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm. Figure 3F-26.

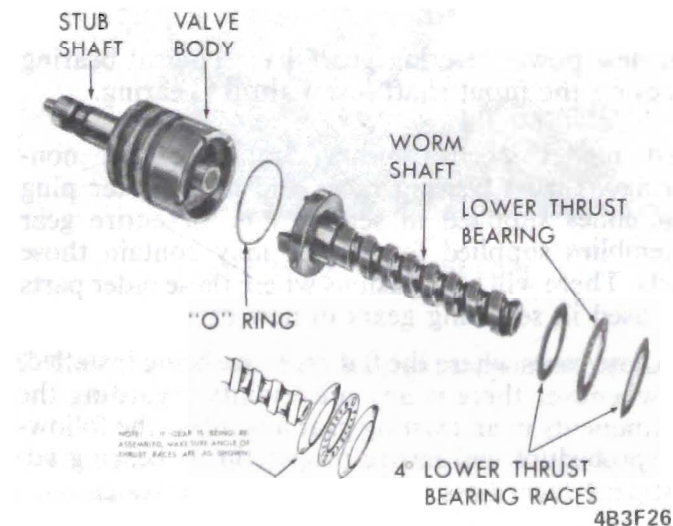


Figure 3F-26 - Installation of Thrust Washers

2. Lubricate the valve body teflon rings and a new lower shaft cap "O" ring with Power Steering Fluid. Install the lower shaft cap "O" ring in the valve body so it is seated against the lower shaft cap. Align the **NARROW NOTCH** in the valve body with pin in

the worm, then install the valve and shaft assembly in the gear housing. Apply pressure to the **VALVE BODY** when installing. If pressure is applied to the lower shaft during installation, the shaft may be forced out of the valve body. Figure 3F-27.

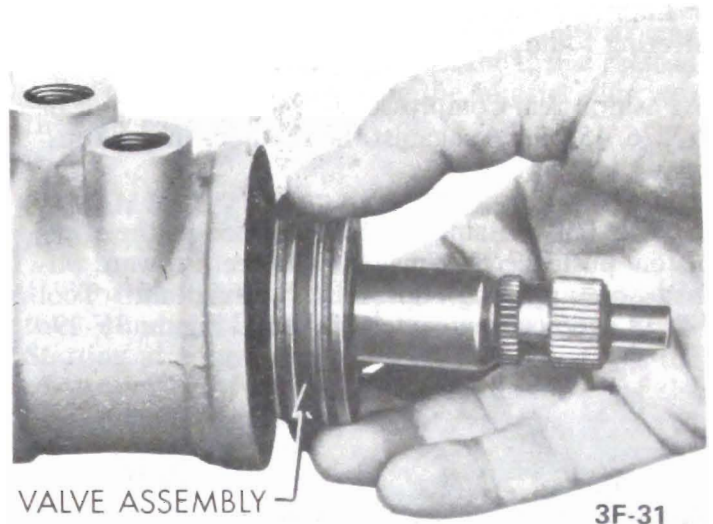


Figure 3F-27 - Installing Valve Assembly

The valve body is properly seated when the oil return hole in the housing is entirely uncovered. Figure 3F-28.

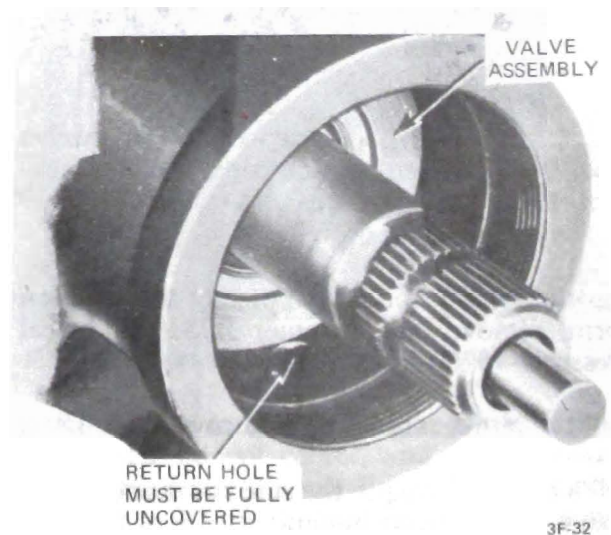


Figure 3F-28 - Valve Assembly Installed

3. Lubricate a new adjuster plug "O" ring with Power Steering Fluid and install in groove on ad-

juster plug. Place Seal Protector J-6222 over stub shaft, then install the adjuster plug assembly in the housing until it seats against the valve body, back off plug 1/8 turn. Remove Seal Protector. Do not adjust the thrust bearing preload at this time.

4. Install the rack-piston as follows:

- a. Lubricate the rack-piston teflon seal with Power Steering Fluid.
- b. Position Seal Compressor J-8947 for 350 engine or J-7576, 455 engine against the shoulder in the housing.
- c. With Ball Retainer J-7539 in place in the rack-piston, push the rack-piston (with teeth toward pitman shaft opening), into the housing until Tool J-7539 contacts the center of worm. Figure 3F-29.

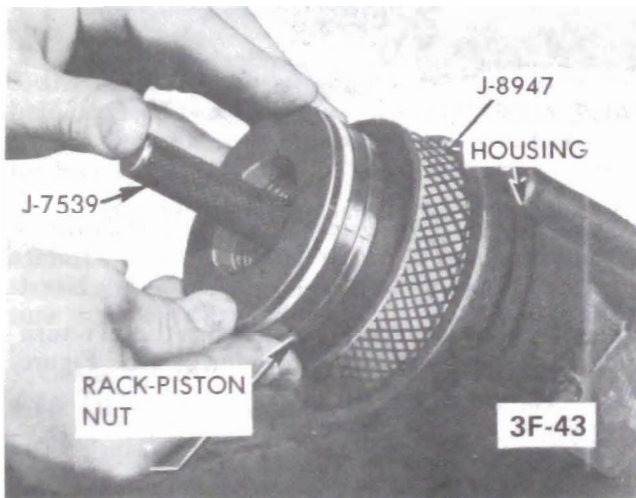


Figure 3F-29 - Installing Rack Piston

- d. Turn the stub shaft clockwise with a 3/4" twelve point socket or box end wrench to thread the rack-piston onto the worm while holding Tool J-7539 against the end of the worm.
 - e. When the rack-piston is completely threaded on the worm, remove Ball Retainer J-7539 and Seal Compressor J-7576 or J-8947.
5. Install the pitman shaft and side cover as follows:
- a. Install a new "O" ring in the side cover and retain with heavy grease. Most integral.
 - b. Turn the stub shaft until the rack-piston teeth are centered in the pitman shaft opening, then install the pitman shaft and side cover so that the center tooth of the pitman shaft engages the center groove of the rack-piston.
 - c. Install new side cover bolts and tighten to 35 ft. lbs.

6. Install the rack-piston plug in the rack-piston and torque to 75 ft. lbs. Figure 3F-30.

7. Install a new housing end cover "O" ring and lubricate it with Power Steering Fluid. Install the end cover and retaining ring.

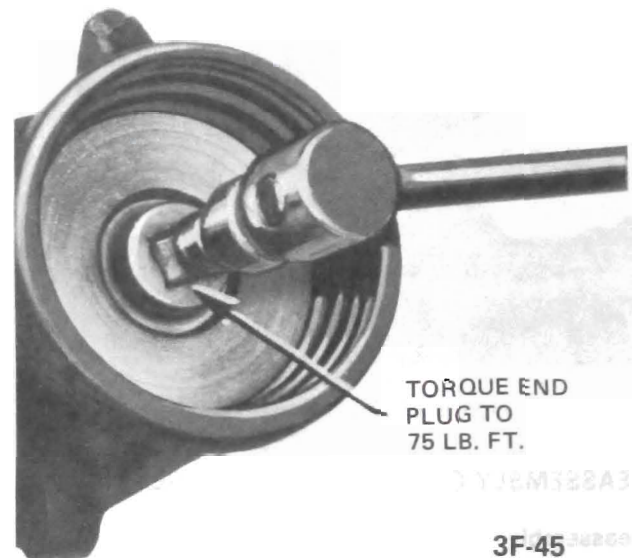


Figure 3F-30 - Installing Rack-Piston Plug

ADJUSTMENTS OF POWER STEERING GEAR

Worm Thrust Bearing

All new power steering gears have conical bearing races on the input shaft lower thrust bearing.

Past model steering gears contained flat, non-springy, thrust bearing races and all adjuster plug assemblies supplied in service kits, or entire gear assemblies supplied for service may contain those parts. There will be occasions where these older parts are used in servicing gears in new cars.

In those cases where the flat races are being installed, or whenever there is any uncertainty regarding the components in an existing gear assembly, the following procedure will insure proper thrust bearing adjustment regardless of the race configuration:

1. Loosen pitman shaft lash adjuster screw lock nut.
2. Loosen the pitman shaft lash adjuster screw 1-1/2 turns and retighten the lock nut. If it bottoms, turn it back 1/2 turn. Figure 3F-31.
3. Loosen the adjuster plug lock by using a drift.
4. Loosen the adjuster plug (1) turn. Figure 3F-32.

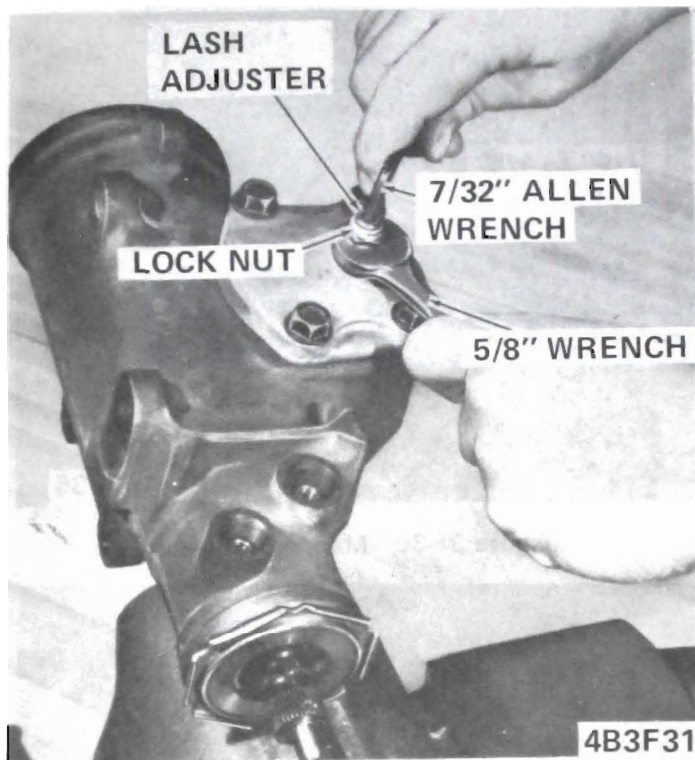


Figure 3F-31 - Pitman Shaft Adjuster

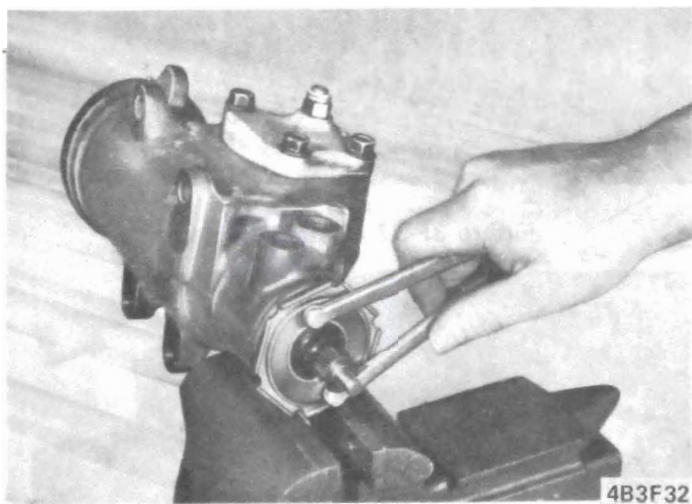


Figure 3F-32 - Adjuster Plug

5. Turn the stub shaft to the right stop and then back 1/2 turn.
6. Using an in-lb. torque wrench on the stub shaft, measure the drag torque.
7. Bottom out the adjuster plug firmly (clockwise, avoid excessive torque). At this stage, there must be no axial lash in the assembly. Then back off the adjuster plug (counterclockwise) to obtain 3-4 in-lb. stub shaft torque in excess of the drag torque. (Example, drag torque reading-3 in. lbs. Total torque reading without adjuster plug tightened 6-7 in. lbs.)
8. Tighten the adjuster plug locknut securely while

holding the adjuster plug in position with spanner J-7624 tool. Preload torque tends to drop off when the lock nut is tightened. Therefore, the torque reading must be re-checked with the lock nut tight and the torque must still be 3-4 in.-lb. in excess of the seal drag.

It is not possible to properly adjust the thrust bearing preload unless the adjuster plug is firmly bottomed out and the torque set while the adjuster plug is being loosened. Never attempt to adjust the thrust preload while tightening or advancing the adjuster plug into the gear assembly.

PITMAN SHAFT "OVER-CENTER" SECTOR ADJUSTMENT

1. Turn the stub shaft from stop to stop, counting the total number of turns. Divide this number by 2. Starting at either stop, turn the stub shaft 1/2 the total number of turns. This is the "center" of the gear. (The flat on the stub shaft is normally up and parallel with the side cover when the gear is "on center" Figure 3F-33, and the block tooth on the pitman shaft is in line with the over-center preload adjuster. Figure 3F-34.



Figure 3F-33 - Stub Shaft Parallel with Side Cover

2. Rotate the torque wrench approximately 45 degrees each side of center, and "read" near or on center (highest reading). Figure 3F-35. Loosen the lock nut and turn the preload adjusting screw CW until the correct "O" center torque, in excess of the reading just taken, is obtained.

Limits for "new" and "used" gears are different, as follows:

(a) "New" gear over-center torque to be 4-8 lbs.-in. additional torque, but total over-center torque must not exceed 18 lb.-in.

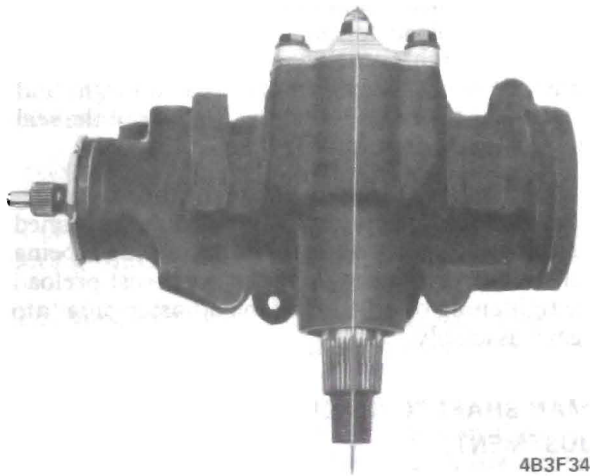


Figure 3F-34 - Block Tooth of Pitman Inline with Preload Adjuster

(b) "Used" gear (400 or more miles). Over-center torque to be 4 to 5 lbs.-in. additional torque, but total over-center must not exceed 14 lbs.-in.

Tighten the lock nut to 35 ft.-lbs. while holding the preload adjuster screw. Recheck the "O" center adjustment.

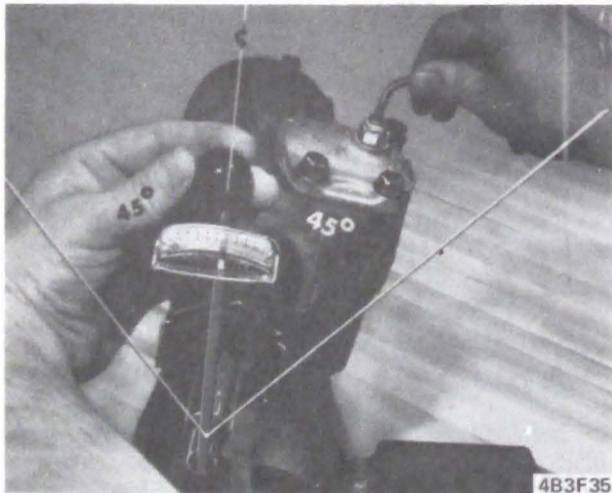


Figure 3F-35 - Over Center Check

If a gear is known to contain the new thrust bearing parts, thrust bearing adjustment in service is greatly simplified.

Recommended procedure:

1. Turn the adjuster plug in (clockwise) until the plug and thrust bearing are firmly bottomed.

CAUTION: *Avoid excessive torque as this can damage the bearing. Figure 3F-32.*

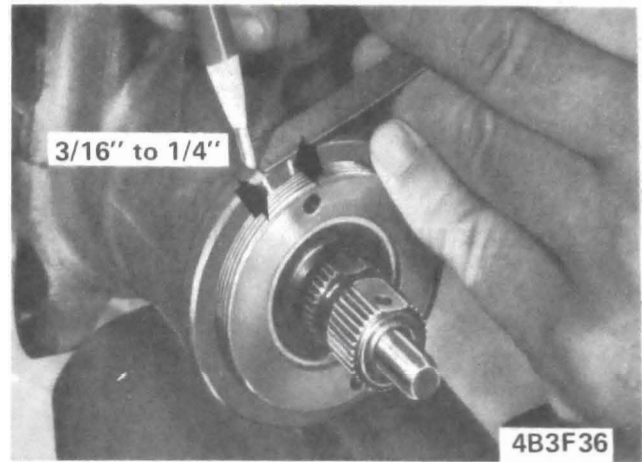


Figure 3F-36 - Marking Housing

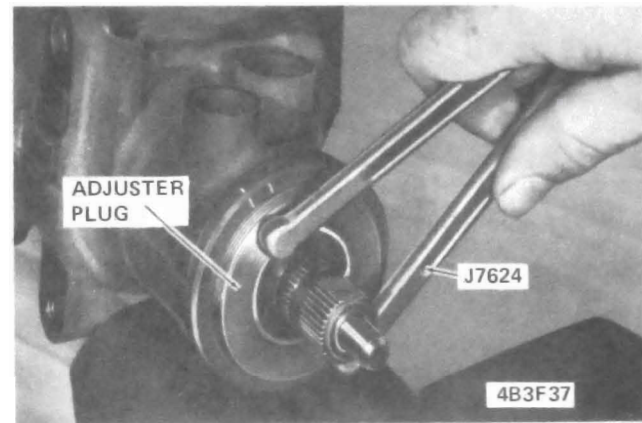


Figure 3F-37 - Rotate Adjuster

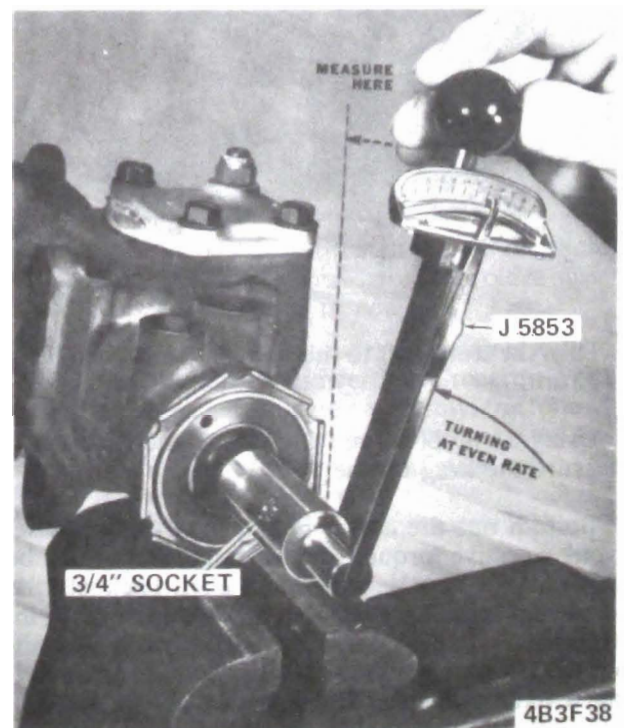


Figure 3F-38 - Rotating Torque Wrench

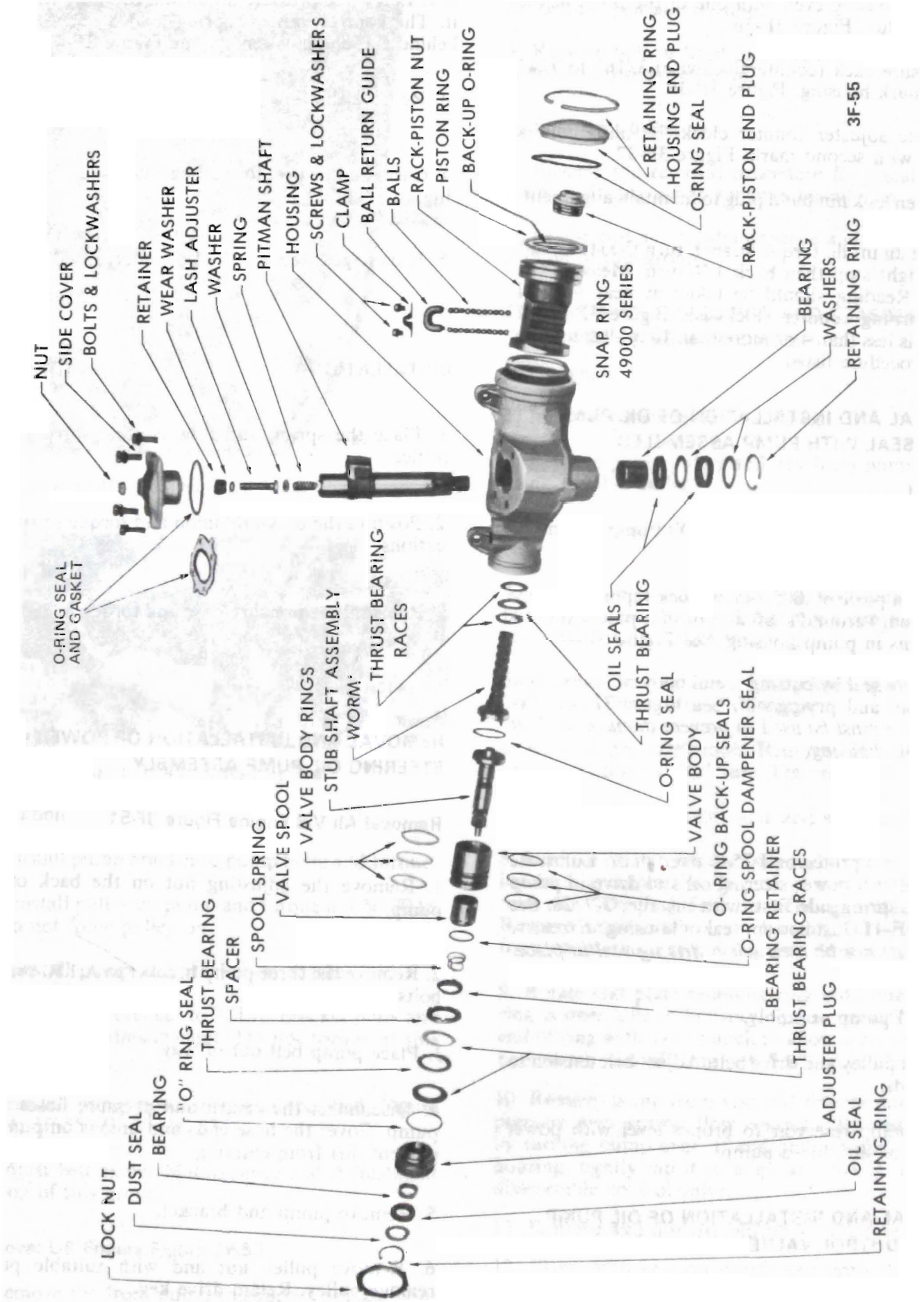


Figure 3F-39 - Exploded View - Power Steering Gear

3F- 90 1974 BUICK SERVICE MANUAL

2. Mark housing even with one of the holes in the adjuster plug. Figure 3F-36.
3. Measure back (counterclockwise) 3/16" to 1/4" and remark housing. Figure 3F-36.
4. Rotate adjuster counter clockwise until hole is aligned with second mark. Figure 3F-37.
5. Tighten lock nut hand plug to maintain alignment.
6. Using an in.-lb. torque wrench turn the stub shaft to the right stop then back 1/4 turn. Measure the torque. Reading should be taken at near vertical while turning counter clockwise. Figure 3F-38. If reading is less than 4 or more than 10 in.-lbs. use the other procedure listed.

REMOVAL AND INSTALLATION OF OIL PUMP SHAFT SEAL WITH PUMP ASSEMBLED**Removal**

1. Remove pump as outlined in Oil Pump Assembly Removal and Installation.
2. Insert a piece of .005" shim stock (approximately 2-1/2" long) around shaft and push it past seal until it bottoms in pump housing. See Figure 3F-40.
3. Remove seal by cutting metal body of seal with a sharp tool and prying out. See Figure 3F-40. *Extreme care must be used to prevent damage to shaft and pump housing.*

Installation

1. Place seal protector J-7586 over shaft. Lubricate new seal with power steering oil and drive in pump housing, spring side first, with installer J-7728. See Figure 3F-41. Just bottom seal in housing. *Excessive force must not be used when driving seal in place.*
2. Install pump assembly.
3. Install pulley and drive belt. Adjust belt tension to 90 pounds.
4. Fill pump reservoir to proper level with power steering oil and bleed pump.

REMOVAL AND INSTALLATION OF OIL PUMP FLOW CONTROL VALVE**Removal**

1. Disconnect the pressure line from the pump.

2. Unscrew the pressure union and carefully remove it. The control valve is spring loaded and located behind the union assembly. See Figure 3F-4.

3. Remove the flow control valve and spring.

4. Clean and inspect for damage, burrs, dirt or scoring.

5. If damaged, replace the flow control valve.

INSTALLATION

1. Place the spring and flow control valve in the orifice.

2. Position the pressure union and torque to specifications.

3. Reinstall the pressure hose and torque to 20-30 lb. ft.

REMOVAL AND INSTALLATION OF POWER STEERING OIL PUMP ASSEMBLY**Removal All V-8 Engine Figure 3F-51**

1. Remove the adjusting nut on the back of the pump.

2. Remove the three pump bracket to A.I.R. bracket bolts.

3. Place pump belt out of way.

4. Disconnect the return and pressure hoses from pump. Cover the hose ends and unions on pump to prevent dirt from entering.

5. Remove pump and bracket.

6. Remove pulley nut and with suitable puller, remove pulley. Retain drive key.

7. Remove the two pump bracket to pump bolts.

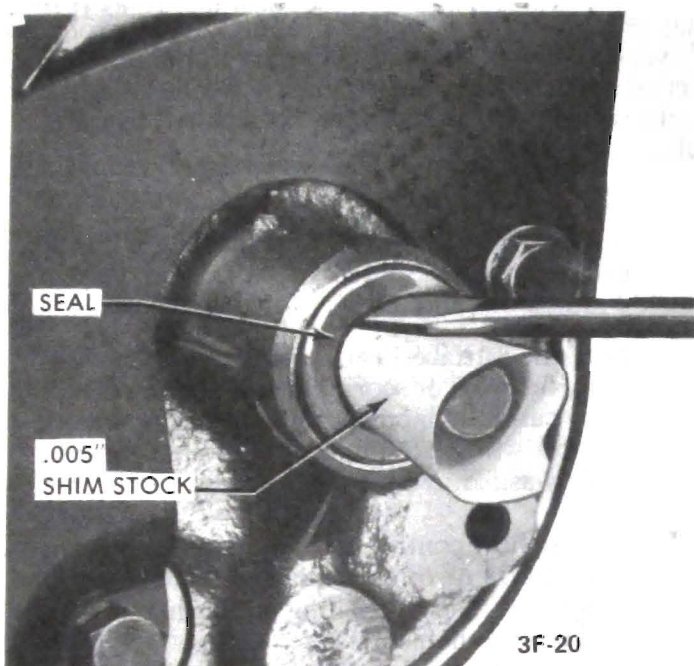


Figure 3F-40 - Removing Oil Pump Shaft Seal

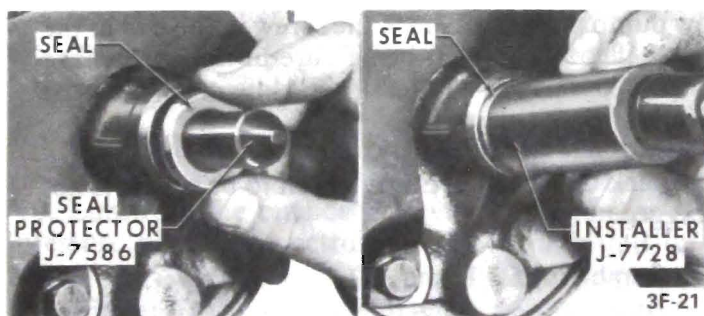


Figure 3F-41 - Installing Seal

Installation

1. Reinstall pump bracket to pump bolts and torque.
2. Reinstall pulley on pump and torque nut 50-70 lb. ft. Do not force pulley on.
3. Reinstall pump and bracket on engine.
4. Install pump bracket to A.I.R. bracket bolts and rear of pump adjusting nut. Do not torque at this time.
5. Reinstall pump hoses torque as specified. Figure 3F-54, 3F-55, 3F-56, 3F-57.
6. Adjust belt as per Maintenance and Adjustment Section of this group.

Removal L-6 Engine Figure 3F-53

1. Remove the front pump to support bracket bolt.
2. Loosen the bolt in front and nut in back securing the pump to the lower support.

3. Remove belt and oil lines.
4. Remove bolt in front and nut on back of lower support and remove pump.

Installation L-6 Engine

1. Reverse the removal procedure for installation. Refer to Figure 3F-56 for hose installation.
2. Adjust belt as per Maintenance and Adjustment Section of this group.

DISASSEMBLY, INSPECTION AND REASSEMBLY OF POWER STEERING OIL PUMP**Disassembly**

1. Remove oil pump front vehicle.
2. Remove pump pulley and key from pump shaft, using suitable puller.
3. Remove reservoir cap and drain out oil in pump reservoir.
4. Install pump in a soft jaw vise with pump shaft pointing down. Do not clamp pump too tightly in vise as this may distort bushing.
5. Remove two reservoir to pump housing studs and "O" rings. Discard the "O" rings.
6. Remove pressure union. Remove "O" ring from union and discard "O" ring. Figure 3F-46.
7. Remove flow control valve and spring.
8. Remove reservoir from housing by rocking housing back and forth while pulling upward. Remove reservoir "O" ring seal on housing and discard. Remove small reservoir to housing "O" ring seal from counterbore in housing and discard.
9. Rotate end plate retaining ring until one end of ring is over hole in housing. Spring inward on one end of ring with 1/8" punch to allow screwdriver to be inserted and lift ring out. See Figure 3F-42.
10. Remove pump from vise and remove end plate, pressure plate spring, flow control valve and spring by turning pump over. If end plate should stick in housing, lightly tap it to align and free it. Do not disassemble control valve.
11. Remove and discard end plate "O" ring seal.
12. Place shaft end on bench and press down on housing until shaft is free. Turn housing over and remove shaft and rotor assembly, being careful not to drop parts. If the two dowel pins did not come out with assembly, remove dowel pins from housing.

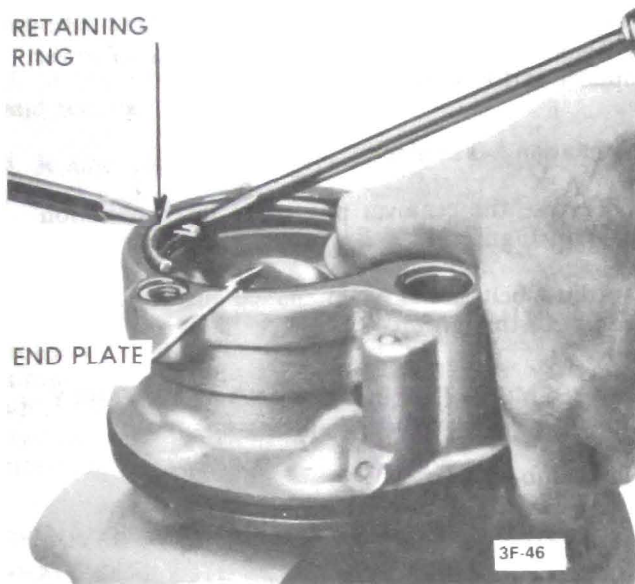


Figure 3F-42 - Removing End Plate Retaining Ring

13. If it is desired to disassemble the shaft and rotor assembly, use a screwdriver as shown in Figure 3F-43.

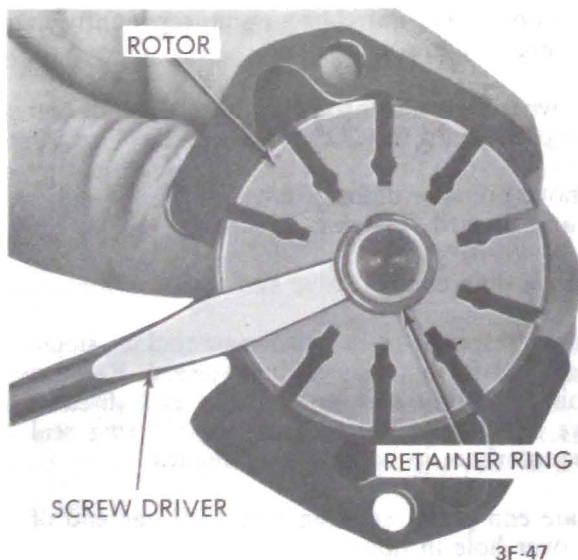


Figure 3F-43 - Removing Rotor Retaining Ring

14. Remove and discard pressure plate "O" ring seal.

15. Remove shaft seal, if defective, by prying out with small screwdriver.

Inspection of Oil Pump Parts

Clean all parts thoroughly with solvent and wipe dry with clean, lint-free cloth before inspecting.

1. Inspect shaft for wear.
2. Check fit of the ten vanes in slots of rotor; vanes must slide freely but fit snugly in slots. Tightness

may be removed by thorough cleaning. Replace rotor if excessive looseness exists between rotor and vanes. Replace vanes if they are irregularly worn or scored. Light scoring on the rotor can be repaired by carefully lapping surface of rotor.

3. Inspect all ground surfaces of the rotor ring for roughness or irregular wear. Replace ring if inside cam surface is badly scored or worn and inspect outside radius of vanes closely for damage.

4. Inspect the surfaces of the pressure plate and thrust plate for wear or scoring. Light scoring can be repaired by carefully lapping until surface is smooth and flat, after which all lapping compound must be thoroughly washed away.

5. Inspect the flow control valve bore in the housing for scoring, burrs or other damage. Hair line scratches are normal. Inspect bushing in housing, if worn or scored, replace housing.

6. Inspect the surfaces of the flow control valve for scores and burrs. Hair line scratches are normal. Replace valve if badly scored or if it is the cause of low pump pressure. Check the screw in the end of the valve, if loose, tighten being careful not to damage machined surfaces. Filter in end of screw must be clean.

7. Check Orifice in pressure union to be sure it is not plugged.

Reassembly of Oil Pump

1. Make sure all parts are absolutely clean. Lubricate seals and moving parts with power steering oil during assembly. Also clean the reservoir magnet.

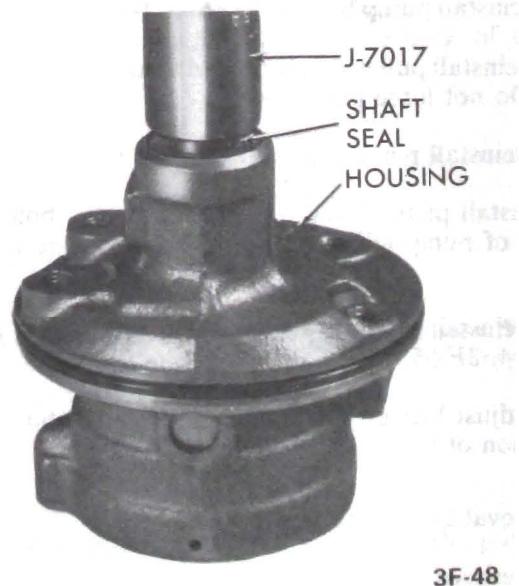


Figure 3F-44 - Installing Shaft Seal

2. If shaft seal was removed, use installer J-7017 to drive new seal into housing with spring side of seal toward housing. See Figure 3F-44. Just bottom seal in housing.

3. Mount housing in vise with shaft end down. Install new pressure plate "O" ring seal in groove in housing bore. This seal is smaller than the end plate "O" ring seal and it has a daub of paint on it for identification.

4. Insert shaft into housing and press down with thumb on splined end to properly seat shaft. Be careful not to damage shaft seal in housing.

5. Install the two dowel pins in housing and install thrust plate on the pins with ported face of plate to rear of housing.

6. Install pump ring with small holes in ring on dowel pins and with arrow on outer edge to rear of housing.

7. Install rotor on pump shaft with spline side of rotor to rear of housing. Rotor must be free on shaft splines.

8. Install ten vanes in rotor slots with radius edge toward outside and flat edge toward center of rotor.

9. Install shaft retaining ring on pump shaft.

10. Lubricate the outside diameter and chamfer of pressure plate with petroleum jelly and install on dowel pins with ported face toward rotor. Dowel pins fit into slots in plate that are nearest outside diameter of plate. Use a soft plastic or wood rod and lightly tap around *outside diameter* of pressure plate to seat it. See Figure 3F-45. Pressure plate will travel about 1/16" to seat. *Never press or hammer on the center of pressure plate as this will cause permanent distortion and result in pump failure.*

11. Install new end plate "O" ring seal in groove in bore of housing. Be sure not to install it in end plate retaining ring groove which is first groove from rear of housing. See Figure 3F-45.

12. Install the pressure plate spring.

13. Lubricate outside diameter and chamfer of end plate with petroleum jelly and insert in housing.

14. Place end plate retaining ring on top of end plate. Use an arbor press to lower end plate into housing

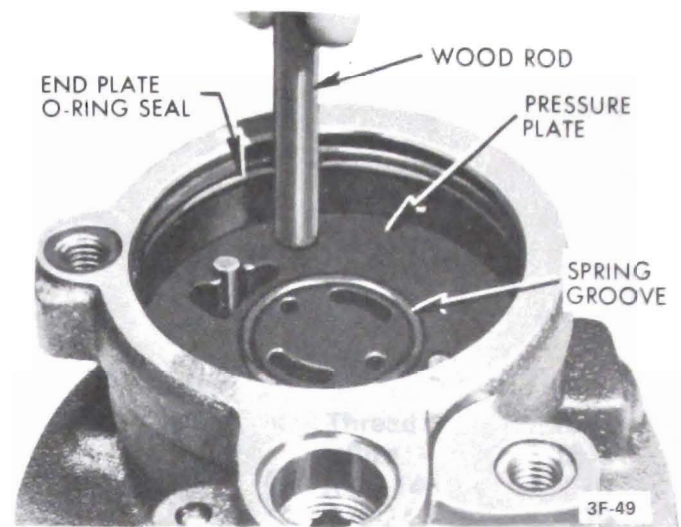


Figure 3F-45 - Seating Pressure Plate in Housing

until ring groove in housing is evenly exposed. Be sure ring is completely seated in housing groove and end plate is aligned properly. Press end plate into housing only far enough to install retaining ring in groove.

15. Install new reservoir "O" ring seal on housing. Place pressure union seal and two stud seals in proper counterbores on rear of housing.

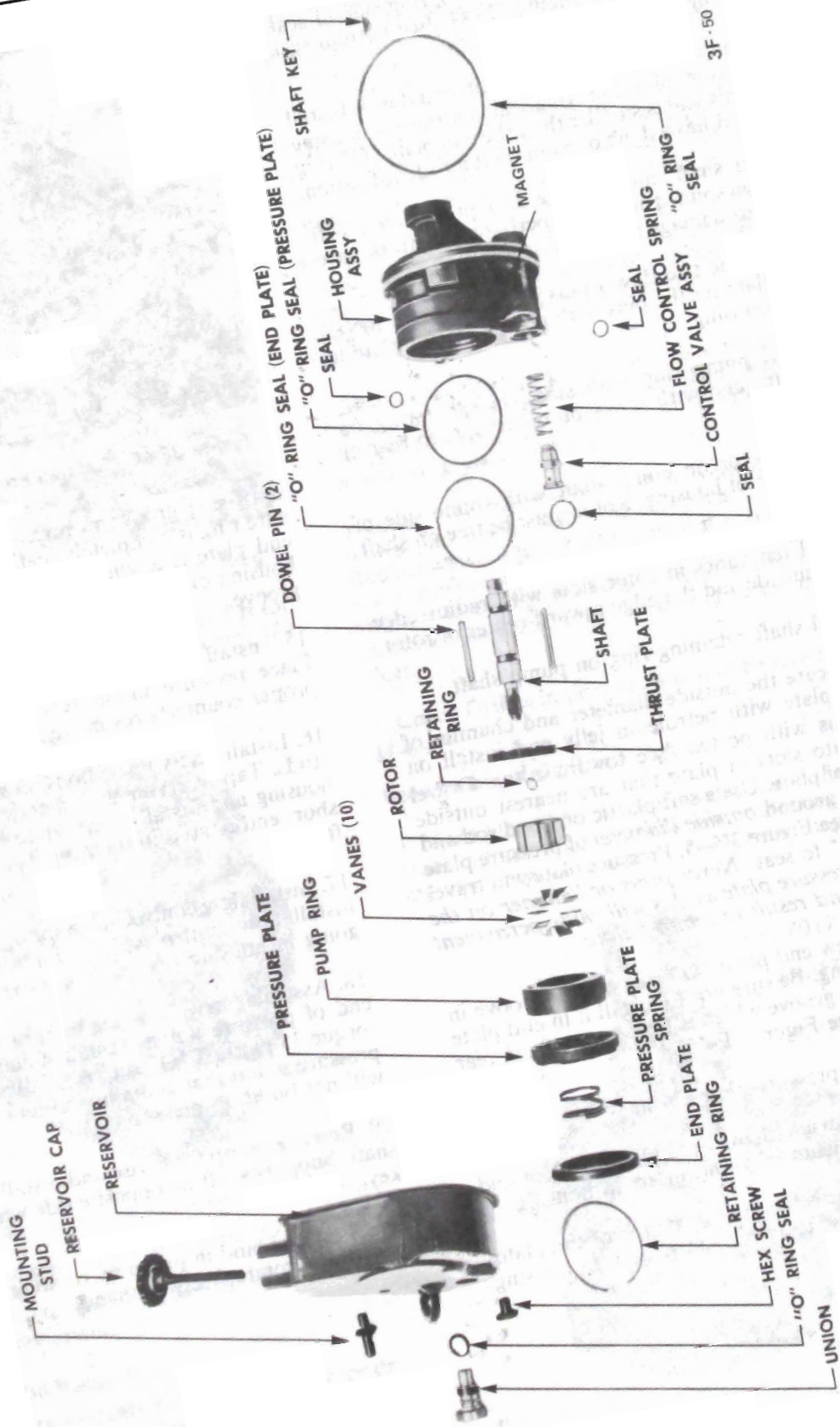
16. Install reservoir on housing and line up holes for studs. Tap reservoir with a soft mallet to seat it on housing and install reservoir to housing studs with short end of stud in housing. Torque studs to 35 lb. ft.

17. Install flow control valve spring in housing. Then install flow control valve with hex head of valve going in housing first. Check movement of valve.

18. Assemble new "O" ring in groove nearest outlet end of pressure union. Install union in pump and torque 35 lb. ft. If "O" ring is installed in groove on pressure union that contains the flow orifice, pump will not build up pressure.

19. Remove pump from vise and install shaft key on shaft. Support shaft on opposite side while installing key.

20. Check for bind in pump by rotating drive shaft. Shaft must rotate freely by hand.



3F-50

Figure 3F-46 - Exploded View - Oil Pump

SPECIFICATIONS

Tightening Specifications

Use a reliable torque wrench to tighten the parts listed to insure proper tightness without training or distorting parts. These specifications are for clean and lightly-lubricated threads only. Dry or dirty threads produce increased friction which prevents accurate measurements of tightness.

Gear Part	Location	Thread Size	Torque Lb. Ft.
Bolt	Gear Housing to Frame	7/16-14	70
Bolt	Lower Coupling Flange to Worm Shaft.....	3/8-24	30
Nut	Steering Column Coupling to Steering Gear Shaft Flange	5/16-24	20
		3/8-24	20
Bolt	Gear Side Cover to Housing.....	3/8-16	35
Nut	Pitman Arm to Pitman Shaft A-B-C-E Series.....	Special	180
	X Series	Special	140
Nut	Adjuster Plug Locking	Special	80
Nut	Pitman Shaft Lash Adjuster Locking	Special	23
Plug	Rack - Piston Nut End.....	Special	75
Screw	Ball Return Guide Retainer	1/4-28	5
Pump			
Fitting	Pump Discharge Part	5/8-18	35
Nut	Pump Pulley Retaining	9/16-18	60
Nut	Pump to Mounting Bracket.....	3/8-16	35
Bolt	Pump Mounting Bracket to Engine.....	3/8-16	35
Fitting	Pressure Hose to Pump	5/8-18	35
Fitting	Pressure Hose to Gear	11/16-18	35
Fitting	Return Hose to Gear	5/8-18	35

Gear Specifications

Gear Type Recirculating Ball, Worm and Nut
 Make..... Saginaw

Gear Ratio Only

X-A Series 16.0:1
 B, C, E Series (A Series Optional) 15.0:1

Ratio Overall (Including Linkage)

X Series 18.9:1
 A Series (Less Station Wagon) 18.05:1
 A Station Wagon 19.20:1
 B Series (350 Engine) 17.90:1
 B, C, E Series..... 16.50:1

Steering System Oil Type Power Steering Oil That Meets GM Specifications

Number of Worm and Rack-Piston Nut Balls

All Series 12 Black; 12 Plain

Pump Capacity (Minimum) Gal./Min. at 465 RPM (Pump) x 665/735 PSI

All..... 1.25

Pump Capacity (Maximum) Gal./Min at 150 RPM (Pump) x 50 PSI

All Engines..... 2.80

Relief Valve Opening Pressure (PSI)

L-6 and 350 Engine..... 1350-1450

455 Engine 1350-1450

Pump Test Pressure, Min. PSI at 525 RPM (Engine)

and 170 F. Oil Temperature 1000 Min.

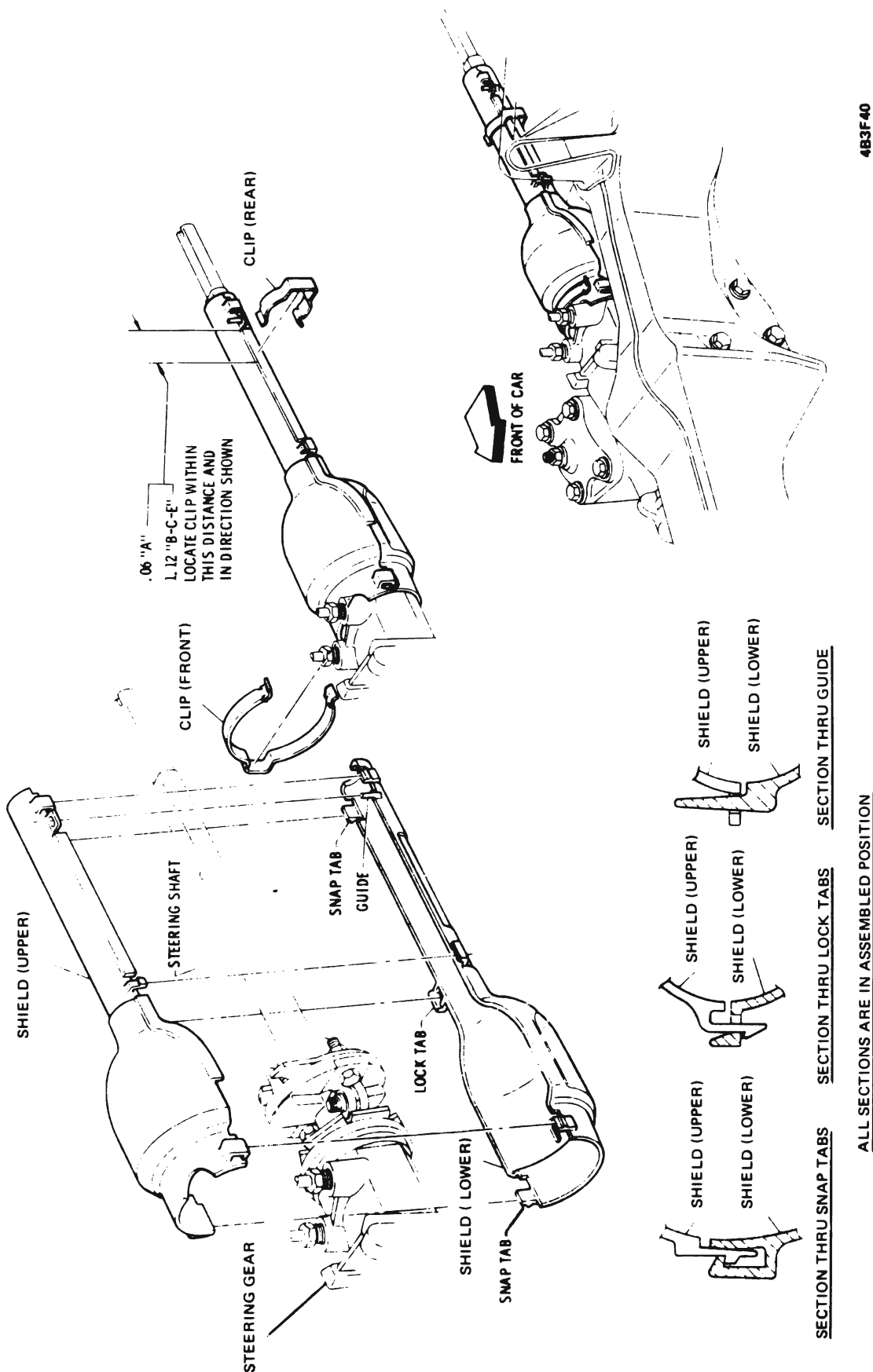
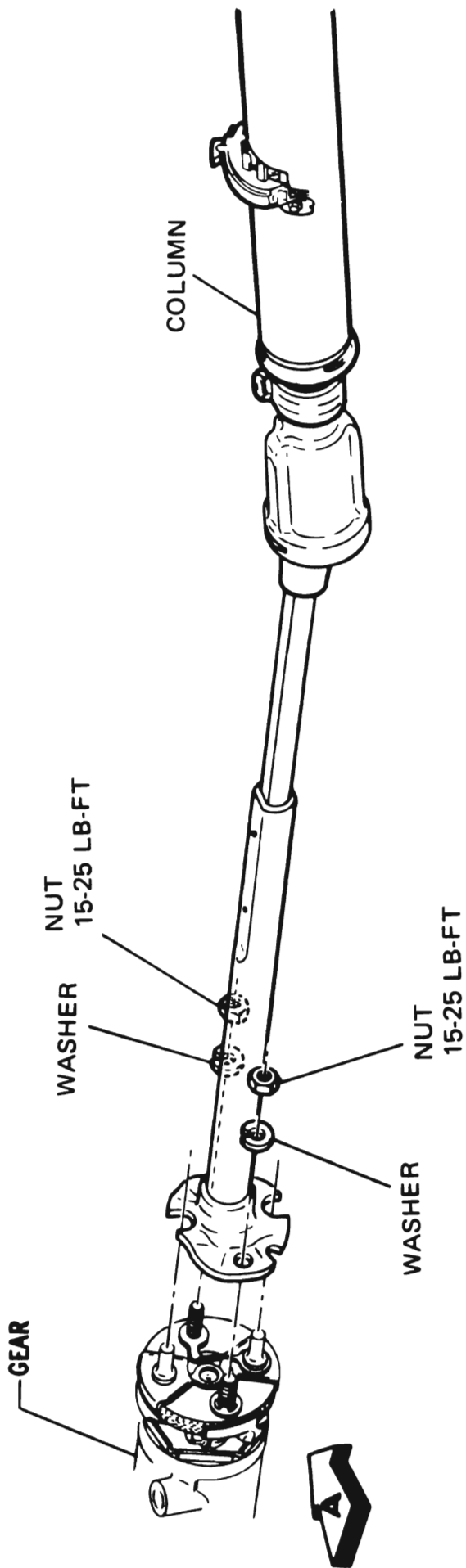


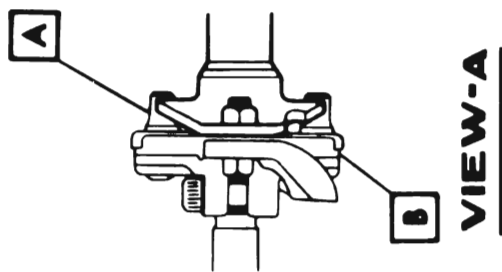
Figure 3F-47 - Steering Coupling Shield A-B-C-E Series

ALL SECTIONS ARE IN ASSEMBLED POSITION

4B3F40

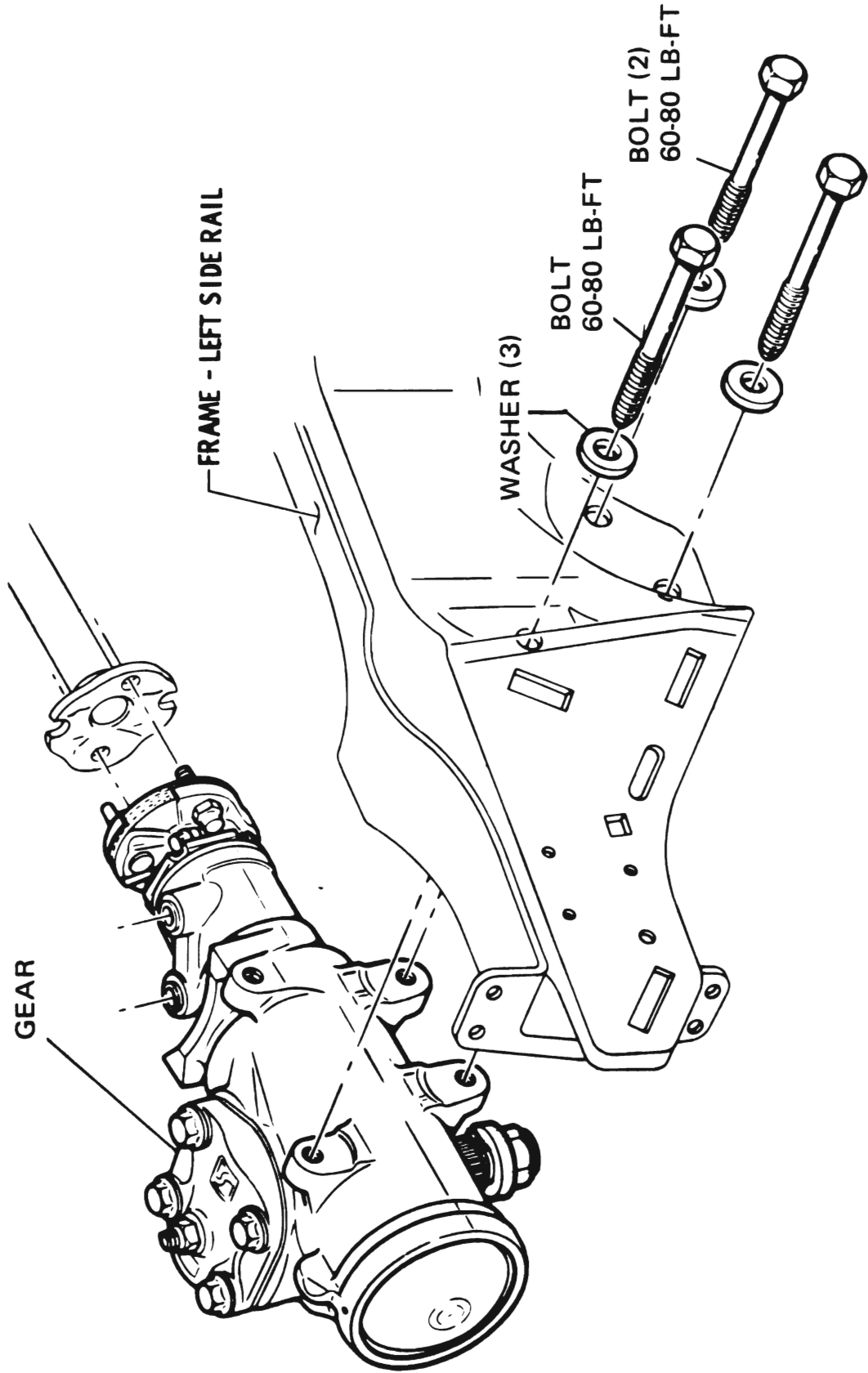


- A** PIN SHOULD BE CENTERED IN FLANGE SLOTS AND ENDS OF PINS EXTEND ABOVE THE FLANGE BY THICKNESS OF FLANGE AFTER ASSEMBLY.
- B** RUBBER DISC OF FLEXIBLE COUPLING MUST BE FLAT WITHIN $+ .060$.



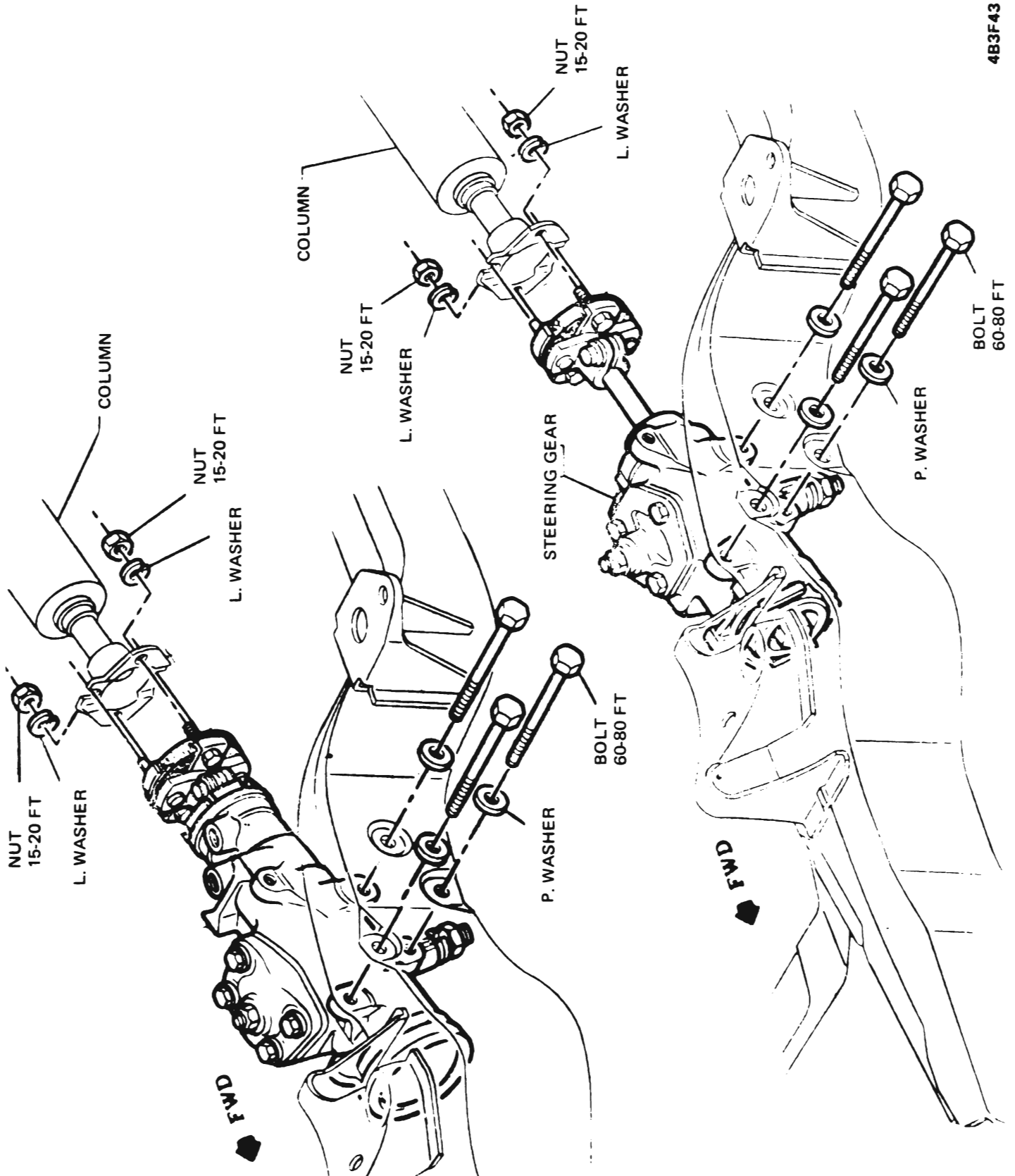
4B3F41

Figure 3F-48 - Steering Gear Coupling A-B-C-E Series



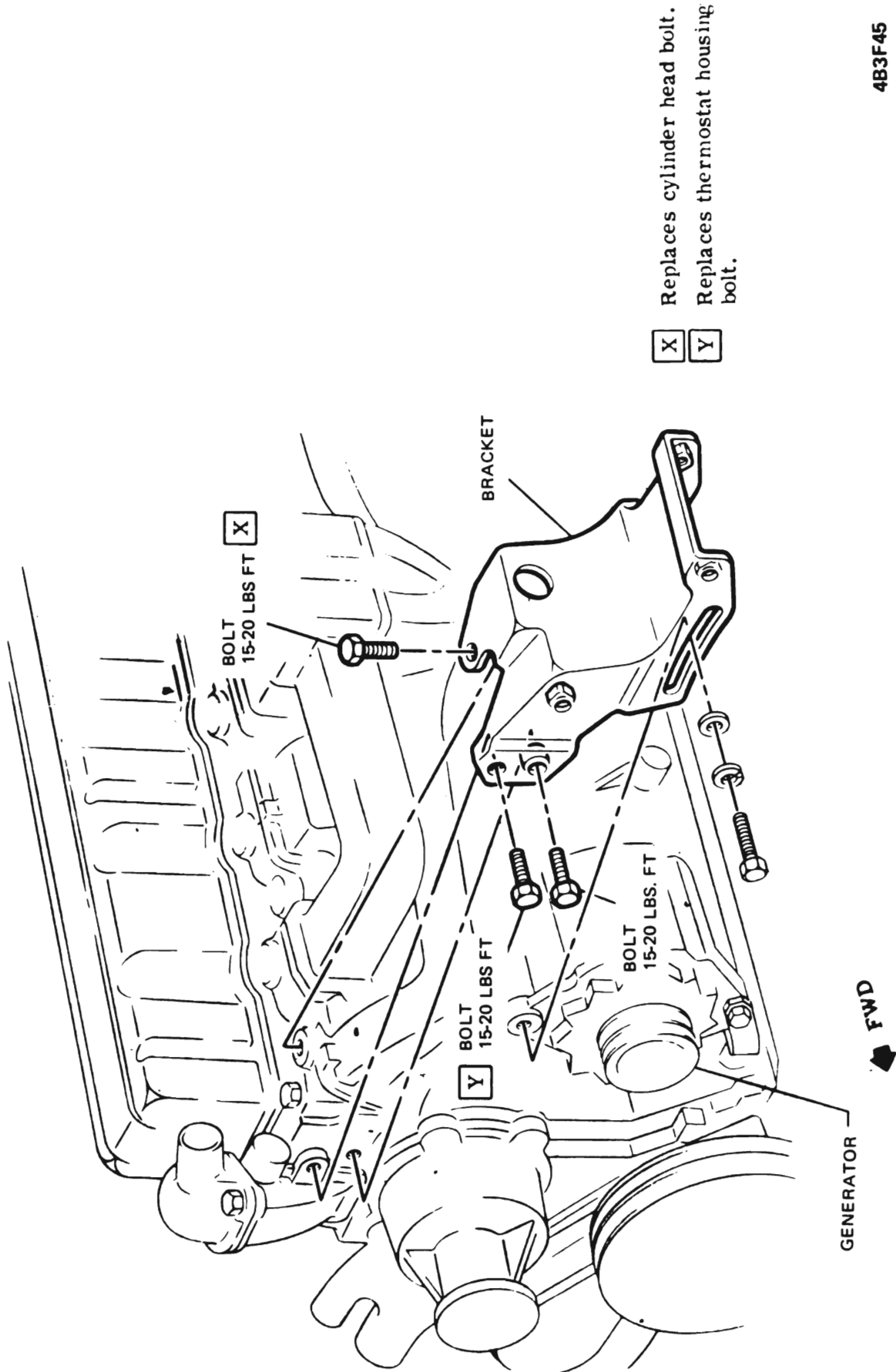
4B3F42

Figure 3F-49 - Steering Gear Mounting A-B-C-E Series



483F43

Figure 3F-50 - Steering Gear Mounting X Series



4B3F45

Figure 3F-52 - X Series L-6 Oil Pump Bracket to Engine

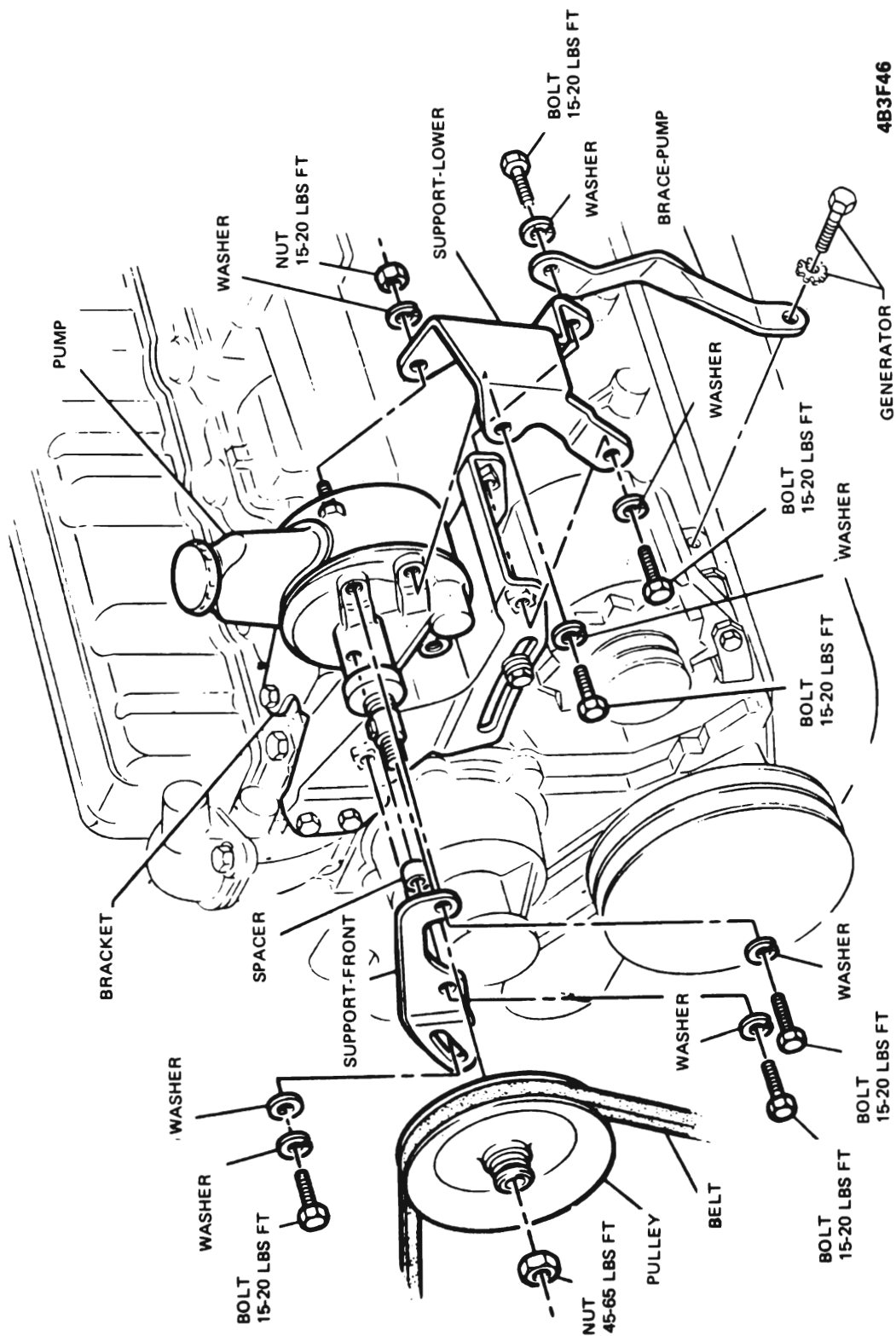
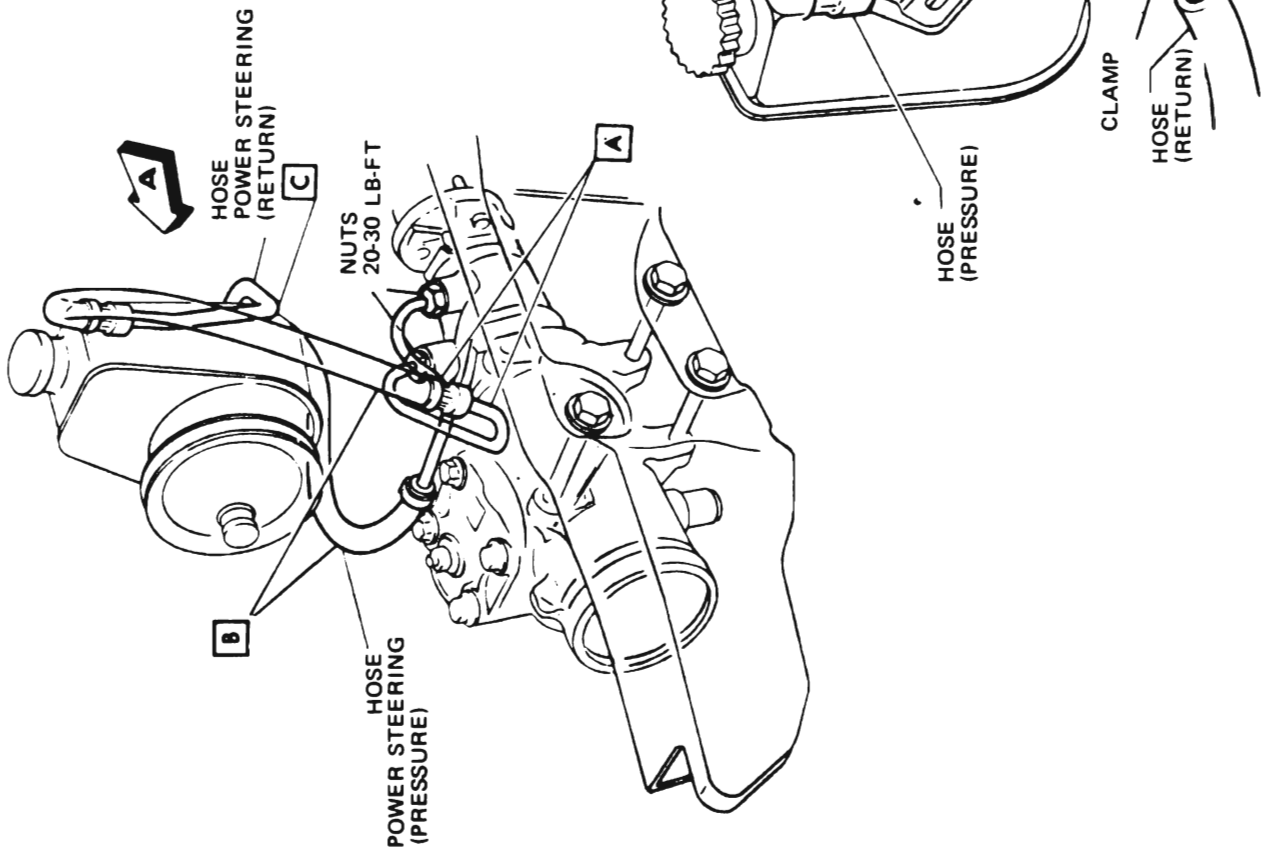


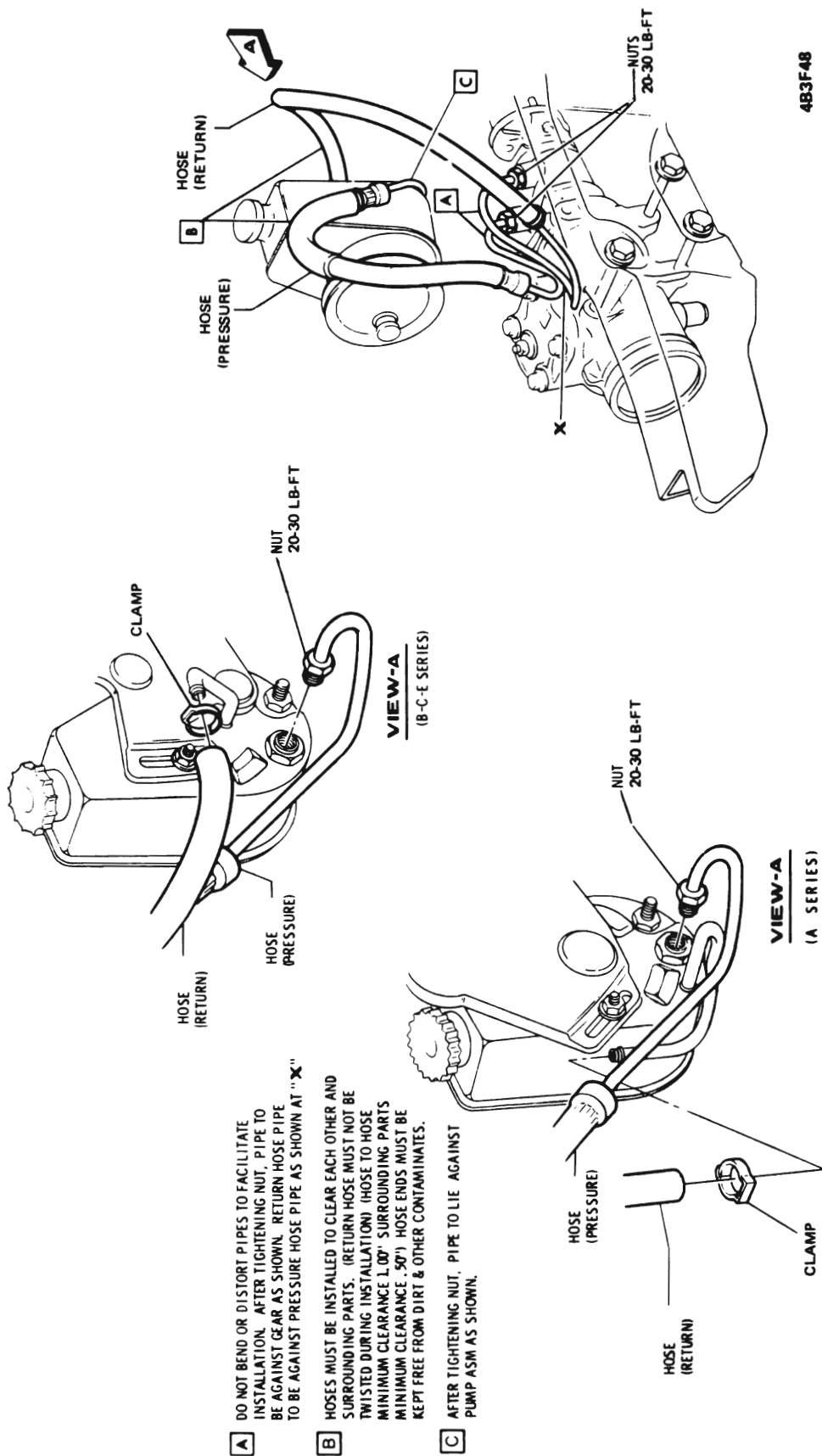
Figure 3F-53 - X Series L-6 Oil Pump Mounting



- A** DO NOT BEND OR DISTORT PIPES TO FACILITATE INSTALLATION. AFTER TIGHTENING NUT, PIPE TO BE AGAINST GEAR AS SHOWN.
- B** HOSES MUST BE INSTALLED TO CLEAR EACH OTHER AND ALL SURROUNDING PARTS. (RETURN HOSE MUST NOT BE TWISTED DURING INSTALLATION). HOSE ENDS MUST BE KEPT FREE FROM DIRT AND OTHER CONTAMINATES.
- C** AFTER TIGHTENING NUT, PIPE TO LIE AGAINST PUMP ASSEMBLY AS SHOWN.

4B3F47

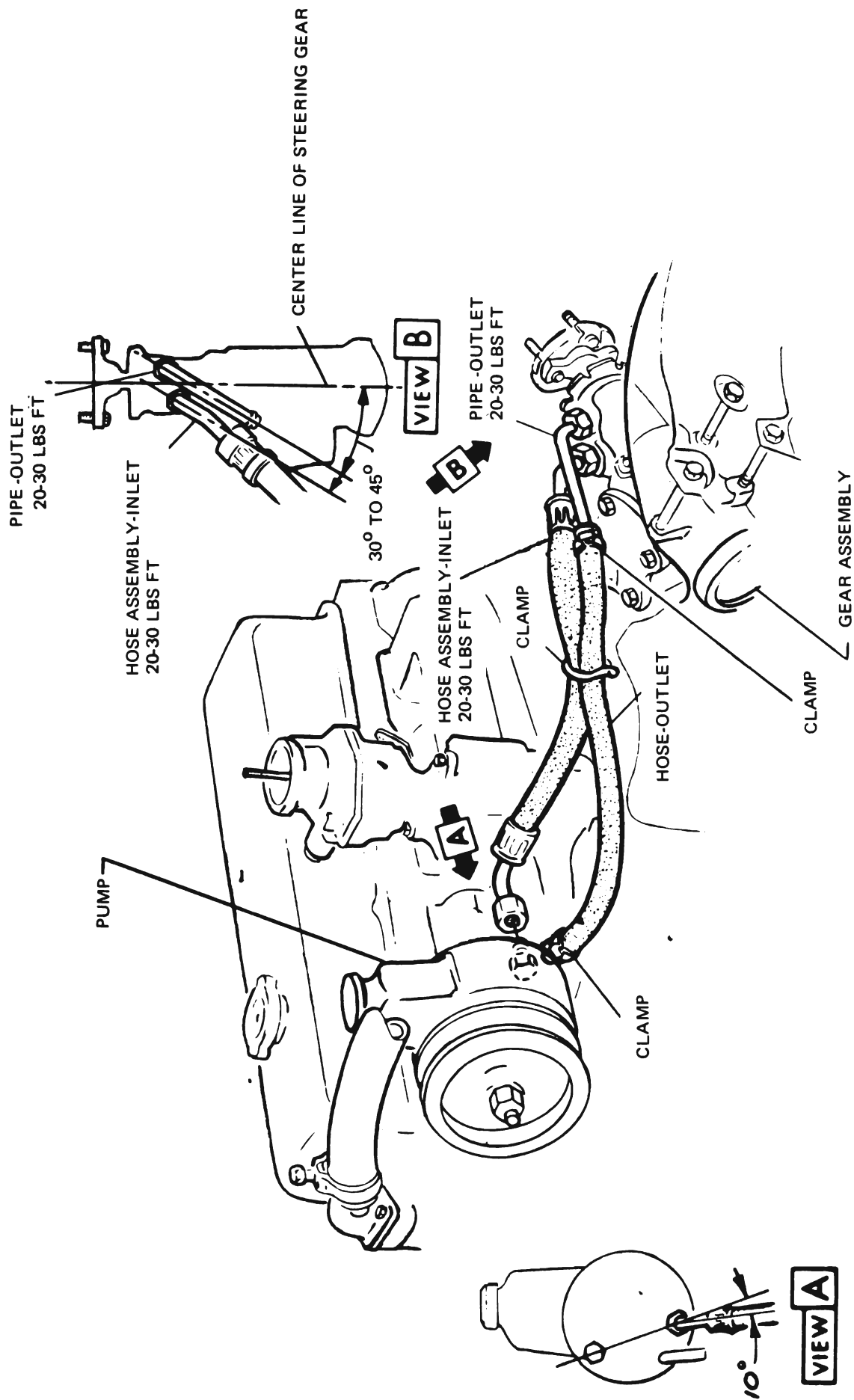
Figure 3F-54 - A-B 350 Oil Pump Hose Routing



483F48

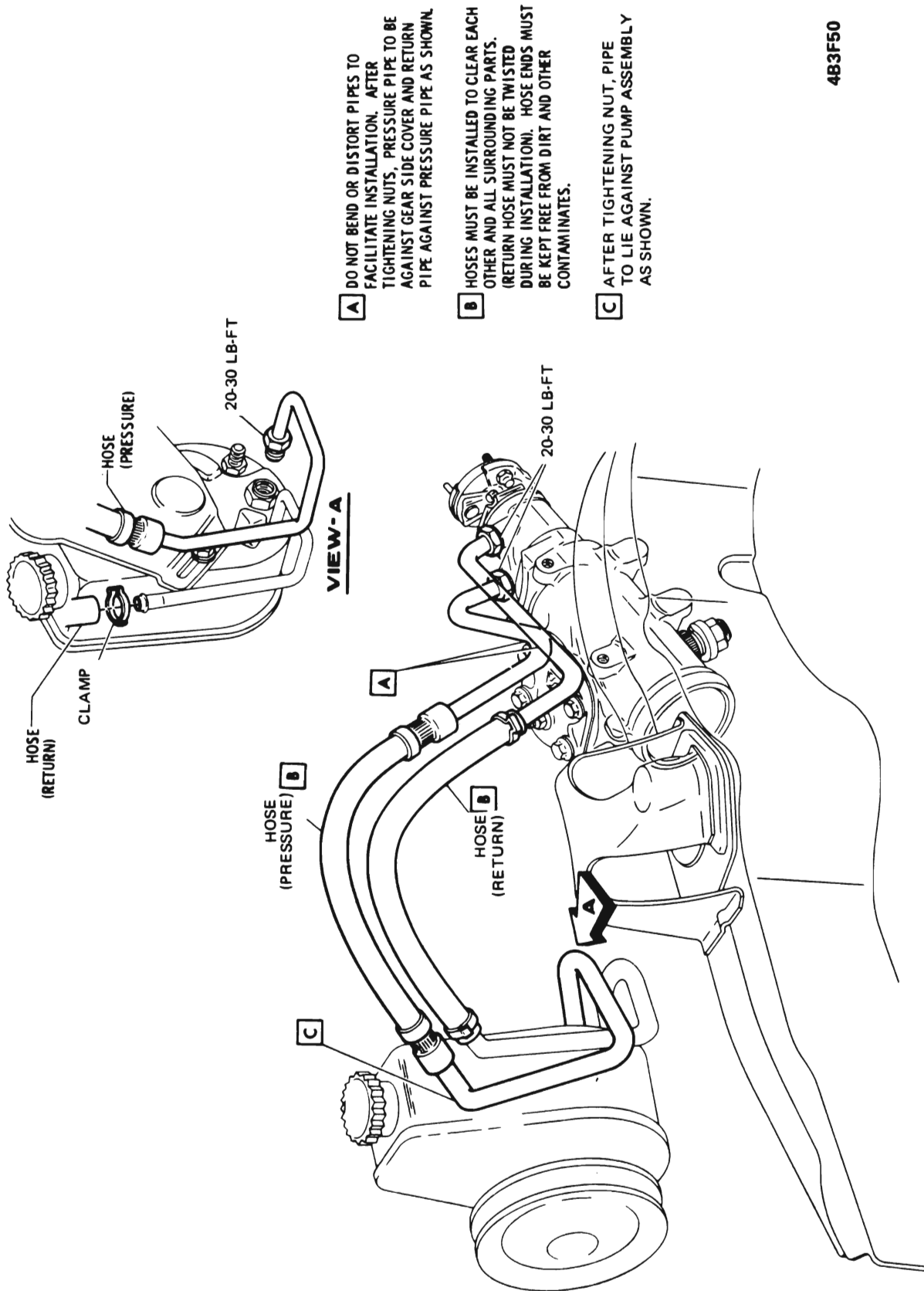
- A** DO NOT BEND OR DISTORT PIPES TO FACILITATE INSTALLATION. AFTER TIGHTENING NUT, PIPE TO BE AGAINST GEAR AS SHOWN. RETURN HOSE PIPE TO BE AGAINST PRESSURE HOSE PIPE AS SHOWN AT "X".
- B** HOSES MUST BE INSTALLED TO CLEAR EACH OTHER AND SURROUNDING PARTS. (RETURN HOSE MUST NOT BE TWISTED DURING INSTALLATION) (HOSE TO HOSE MINIMUM CLEARANCE 1.00" SURROUNDING PARTS MINIMUM CLEARANCE .50") HOSE ENDS MUST BE KEPT FREE FROM DIRT & OTHER CONTAMINATES.
- C** AFTER TIGHTENING NUT, PIPE TO LIE AGAINST PUMP ASM AS SHOWN.

Figure 3F-55 - A-B-C-E 455 Oil Pump Hose Routing



4B3F49

Figure 3F-56 - X Series L-6 Hose Routing



- A** DO NOT BEND OR DISTORT PIPES TO FACILITATE INSTALLATION. AFTER TIGHTENING NUTS, PRESSURE PIPE TO BE AGAINST GEAR SIDE COVER AND RETURN PIPE AGAINST PRESSURE PIPE AS SHOWN.
- B** HOSES MUST BE INSTALLED TO CLEAR EACH OTHER AND ALL SURROUNDING PARTS. (RETURN HOSE MUST NOT BE TWISTED DURING INSTALLATION). HOSE ENDS MUST BE KEPT FREE FROM DIRT AND OTHER CONTAMINATES.
- C** AFTER TIGHTENING NUT, PIPE TO LIE AGAINST PUMP ASSEMBLY AS SHOWN.

483F50

Figure 3F-57 - X Series 350 Hose Routing