

POWER STEERING GEAR AND PUMP

CONTENTS

DESCRIPTION AND OPERATION:	
Description of Power Steering Gear.....	3F- 1
Description of Power Steering Oil Pump.....	3F- 1
DIAGNOSIS:	
External Leak Diagnosis.....	3F- 2
Trouble Diagnosis.....	3F- 5
MAINTENANCE AND ADJUSTMENTS:	
Power Steering Oil Pump Belt Adjustment.....	3F-11
MAJOR REPAIR:	
Removal and Installation of Pitman Shaft Seals, Gear in Car.....	3F-12
Removal and Installation of Power Steering Gear Assembly.....	3F-12
Disassembly of Power Steering Gear.....	3F-13
Disassembly, Inspection and Reassembly of Individual Units	
Adjuster Plug.....	3F-14
Valve and Stub Shaft.....	3F-15
Pitman Shaft and Side Cover.....	3F-17
Rack-Piston.....	3F-17
Steering Gear Hose Connector and Poppet Check Valve.....	3F-18
Pitman Shaft Needle Bearing and Seals.....	3F-18
Reassembly of Power Steering Gear.....	3F-19
Adjustments of Power Steering Gear.....	3F-20
Removal and Installation of Oil Pump Shaft Seal with Pump Assembled.....	3F-24
Removal and Installation of Oil Pump Flow Control Valve.....	3F-24
Removal and Installation of Power Steering Oil Pump Assembly.....	3F-24
Disassembly, Inspection, Reassembly of Power Steering Oil Pump.....	3F-25
SPECIFICATIONS:	
Tightening Specifications.....	3F-28
Gear Specifications.....	3F-28
Pump Specifications.....	3F-28

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 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.

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 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

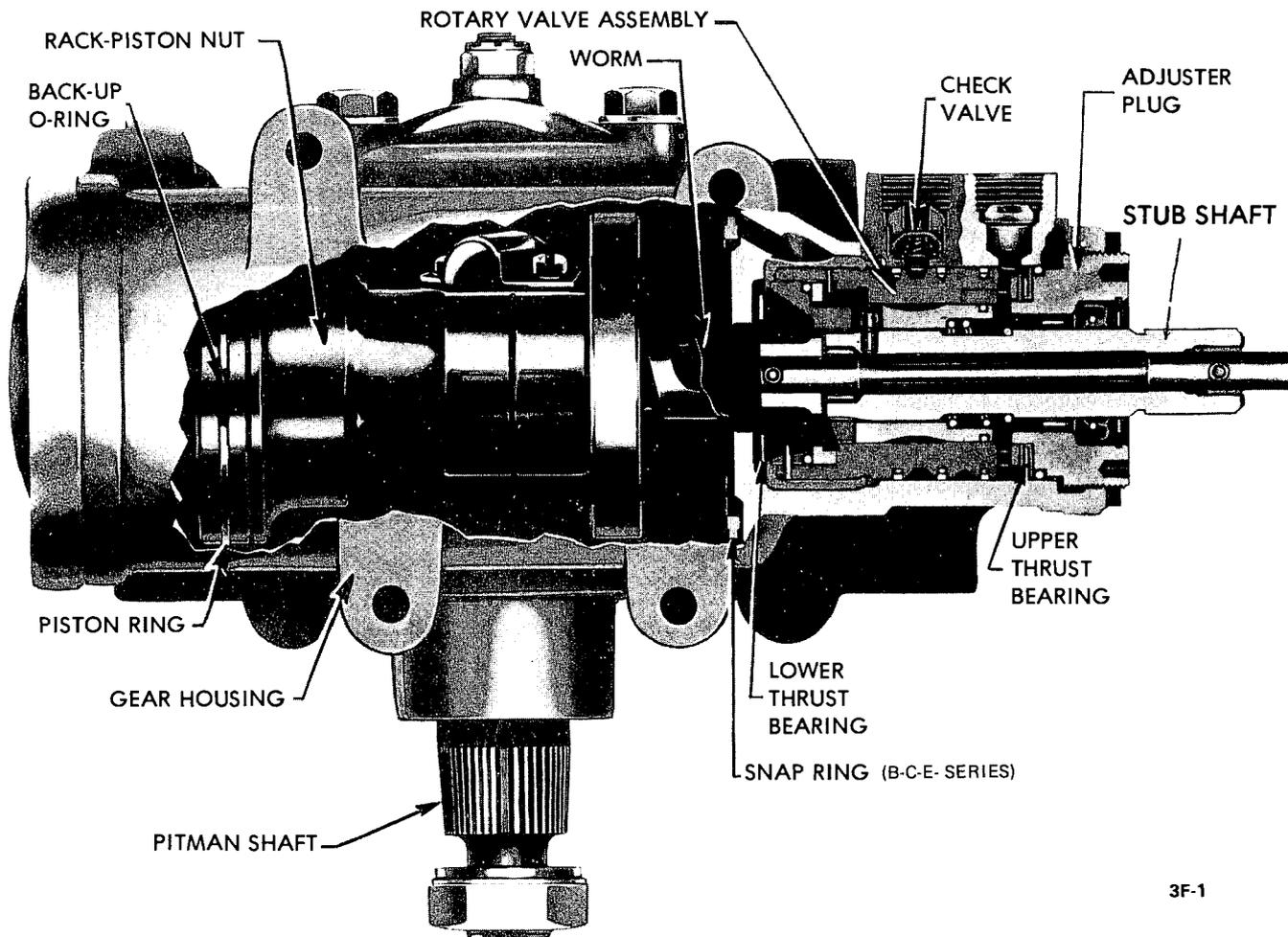


Figure 3F-1 Power Steering Gear Cutaway

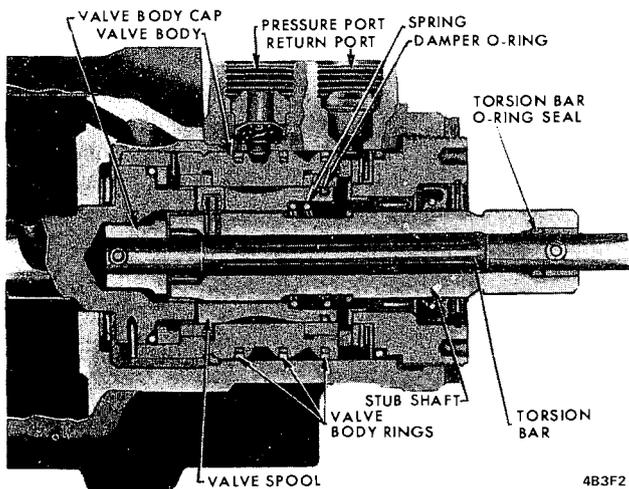


Figure 3F-2 Rotary Valve Assembly

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

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.

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

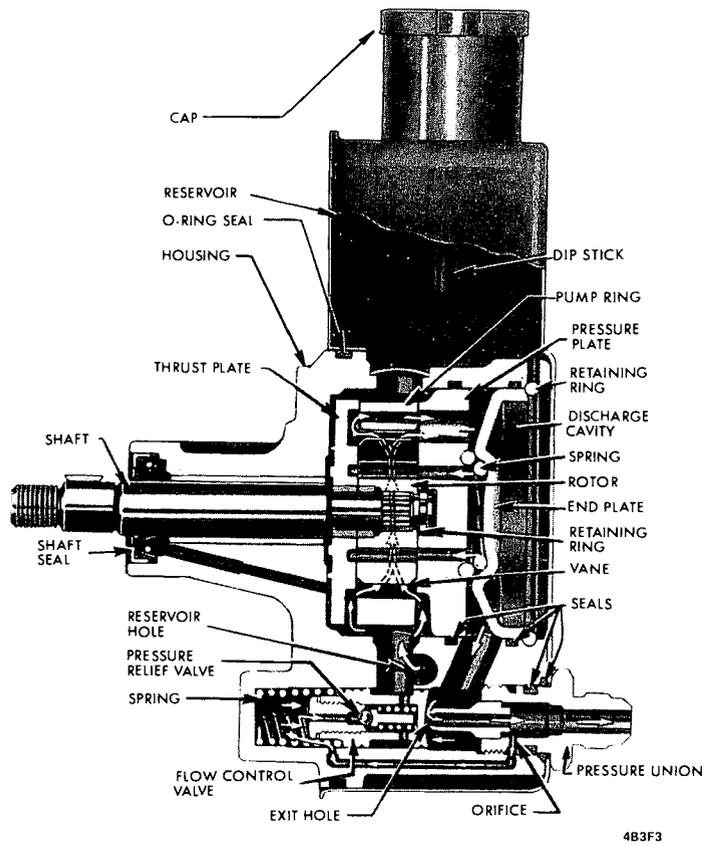


Figure 3F-3 - Oil Pump Cutaway

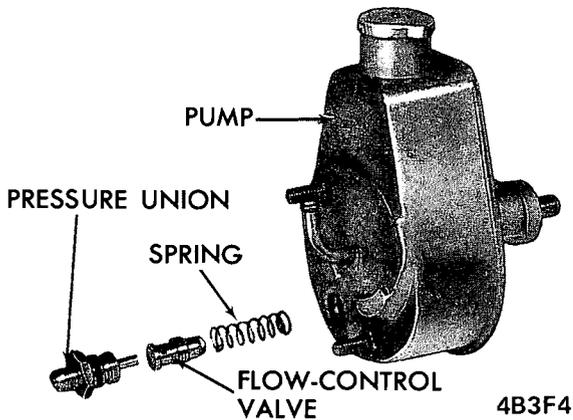


Figure 3F-4 - Flow Control Valve

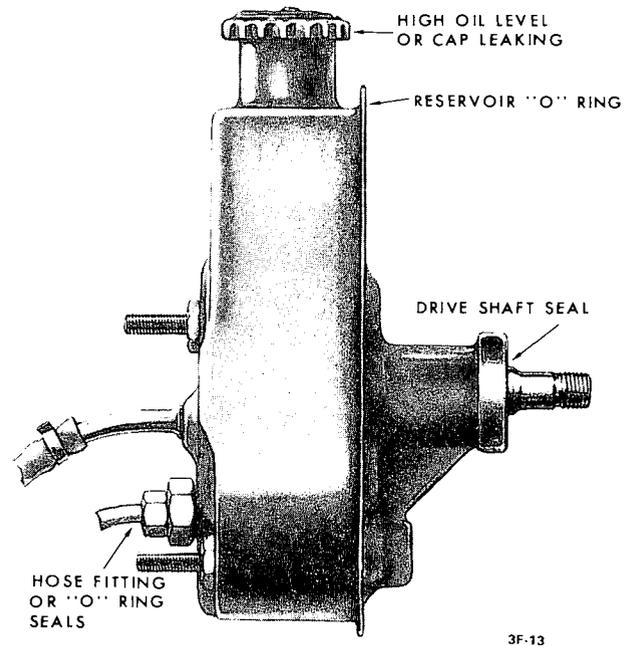


Figure 3F-5 - Oil Pump Leaks

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.

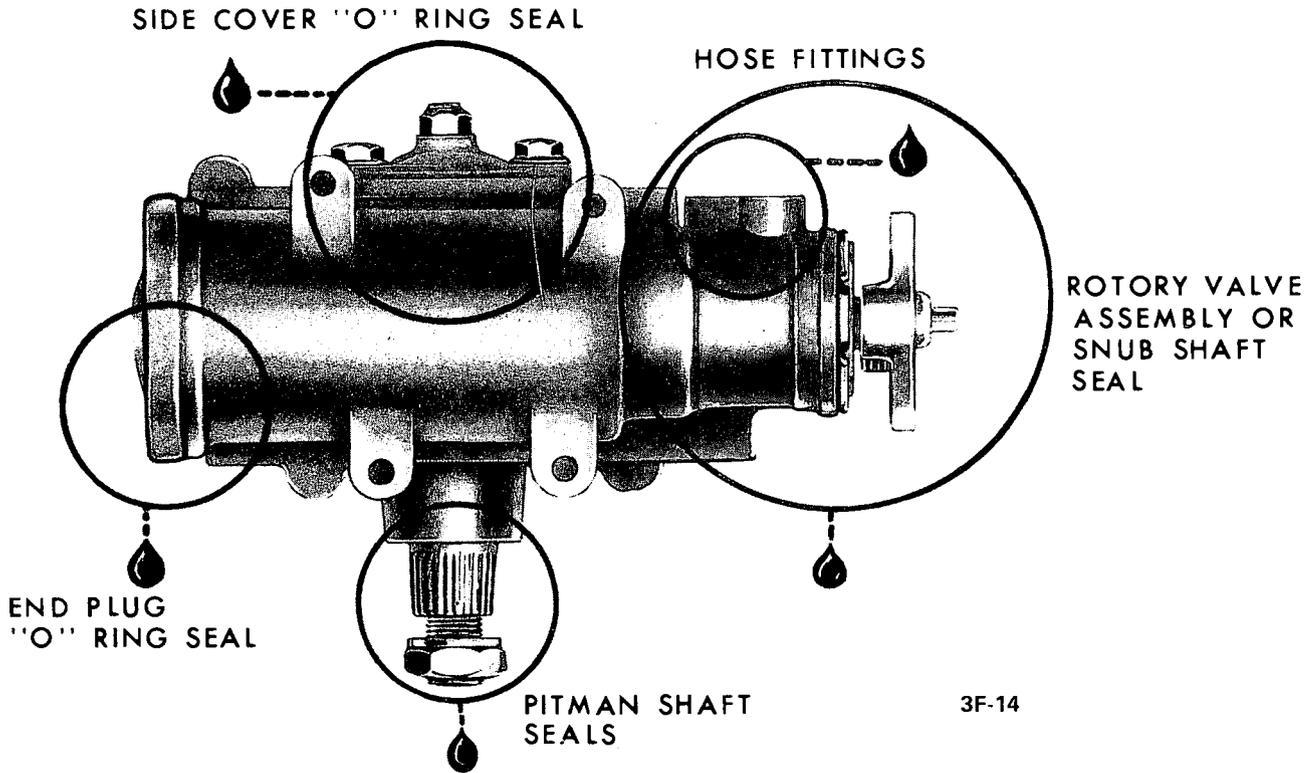


Figure 3F-6 - Steering Gear Leaks

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

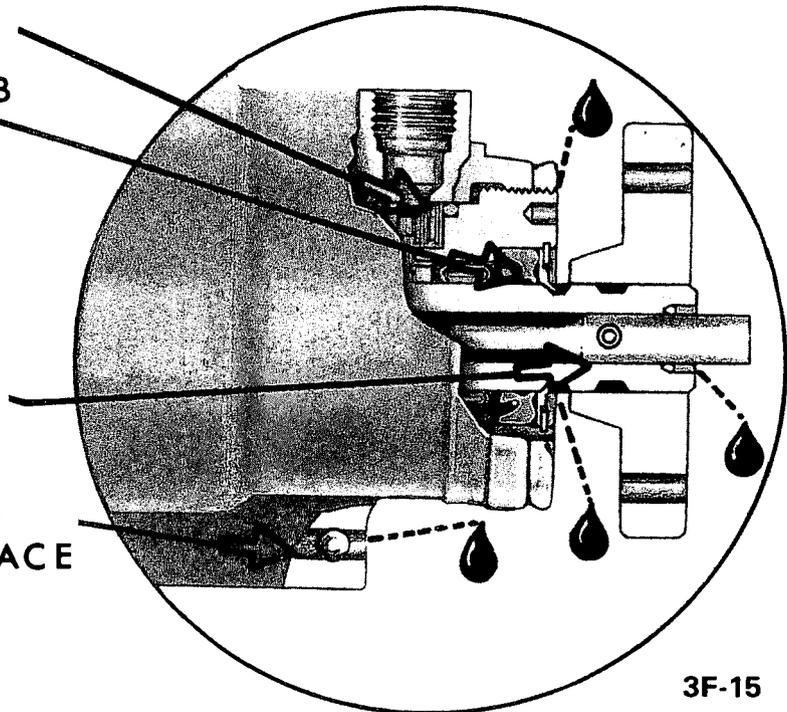


Figure 3F-7 - Upper End Steering Gear Leaks

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.	<p>1. There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking.</p> <p>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.</p>	<p>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.</p>
Rattle or Chuckle noise in steering gear.	1. Gear loose on frame.	1. Check gear-to frame mounting screws. Tighten bolts to specifications.
	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. 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.
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.

Condition	Possible Cause	Correction
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. 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. 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 specifications.
	3. Steering gear to column misalignment.	3. Align steering column.
	4. Lower coupling flange rubbing against steering gear adjuster plug.	4. Loosen pinch bolt and assemble properly.

Condition	Possible Cause	Correction
If checks 1-5 do not reveal cause of hard steering, follow the procedure below to determine fault	5. Tires not properly inflated.	5. Inflate to recommended pressure.
	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 attained each time. 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 readings are within 50 PSI, the pump is functioning within specifications. (Ex. Spec. 1350 - 1450 PSI - readings - 1370 1375 - 1380).

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>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. 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>
	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. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.	
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.
	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.

Condition	Possible Cause	Correction
	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.
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

1. Loosen the pump to bracket adjusting bolts and or nuts. See Figures at the end of this section. Also loosen any bolts that involve the A.I.R. if equipped.

- 2. Refer to the art at the end of this section for the engine and pump combination being worked on for the access point to apply pressure. Tighten the belt.
- 3. Tighten all bolts and or nuts to specifications.
- 4. Belt tension should be as specified in Section 6B.

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.

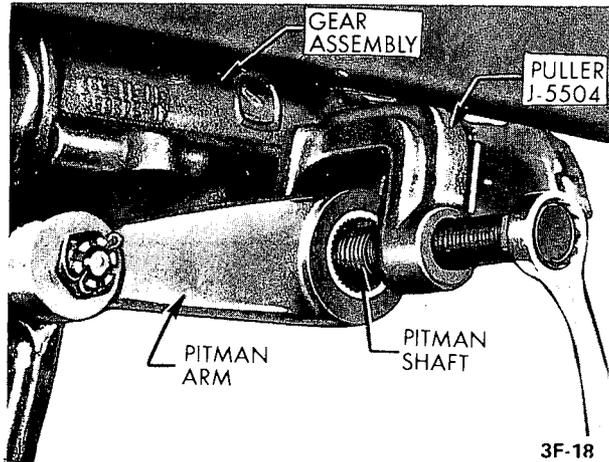


Figure 3F-8 - Removing Pitman Arm From Pitman Shaft

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 steering 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 specifications.

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.
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.

Installation

CAUTION: *Fasteners in step 1 are important attaching parts in that they could affect 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 to specifications.

Torque flexible coupling pinch bolt to specifications. Power steering hoses should be installed to maintain a minimum clearance of 1" between hoses and 1/2" to surrounding parts. Figures are at the end of this section.

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.

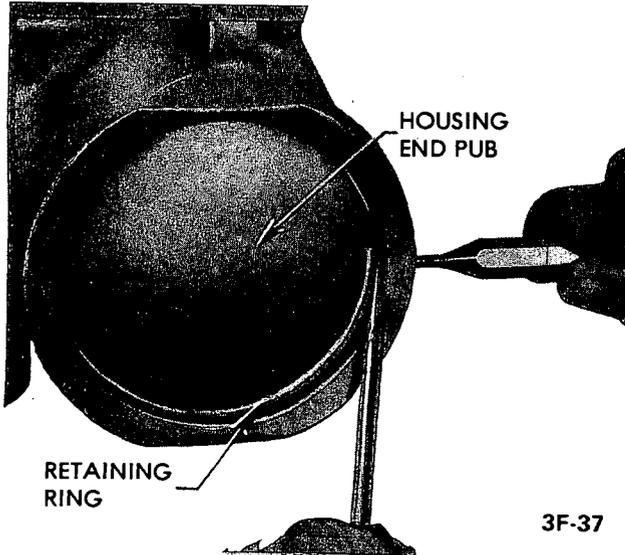


Figure 3F-9 - Removing End Cover Retaining Ring

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

CAUTION: *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.

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

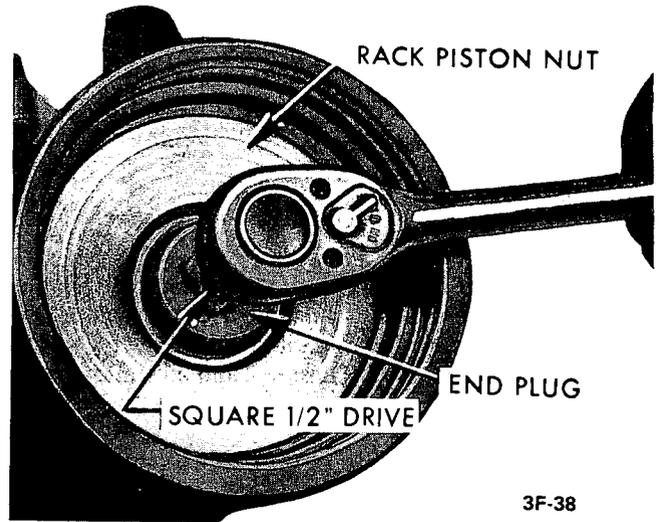


Figure 3F-10 - Removing Rack-Piston End Plug

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-21552 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 from gear housing.

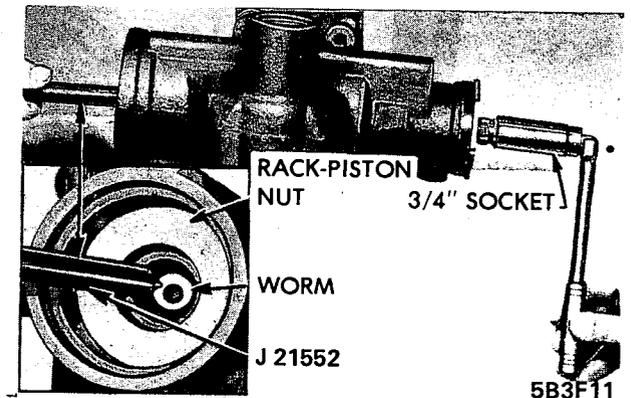


Figure 3F-11 - Removing Rack Piston

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.

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

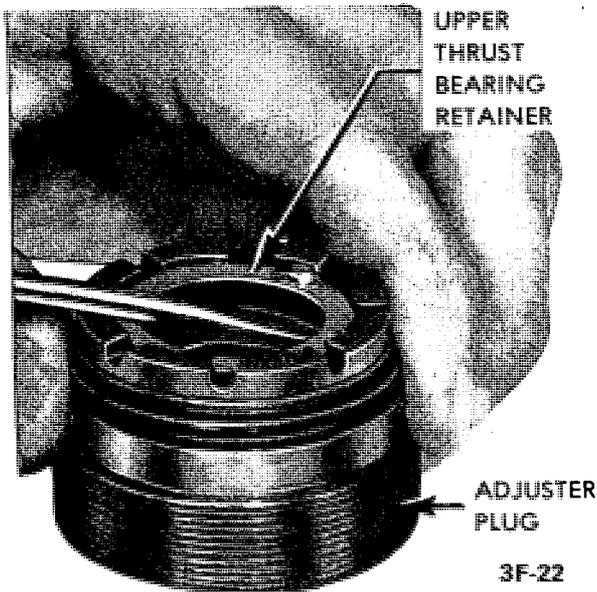


Figure 3F-12 - Removing Retainer

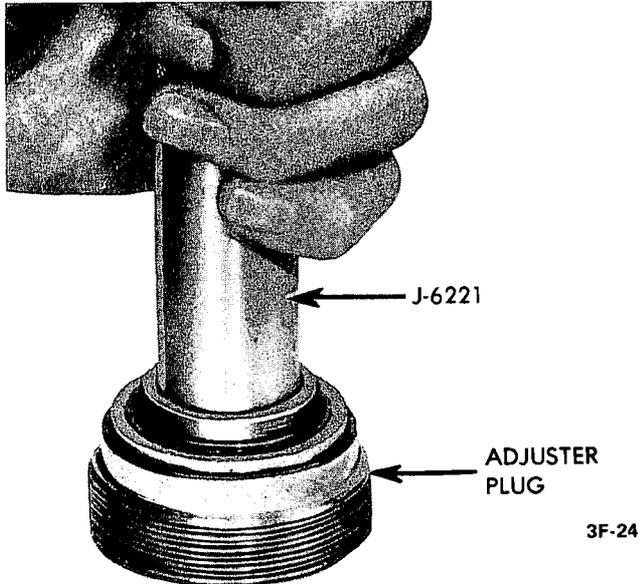


Figure 3F-14 Removing Needle Bearing

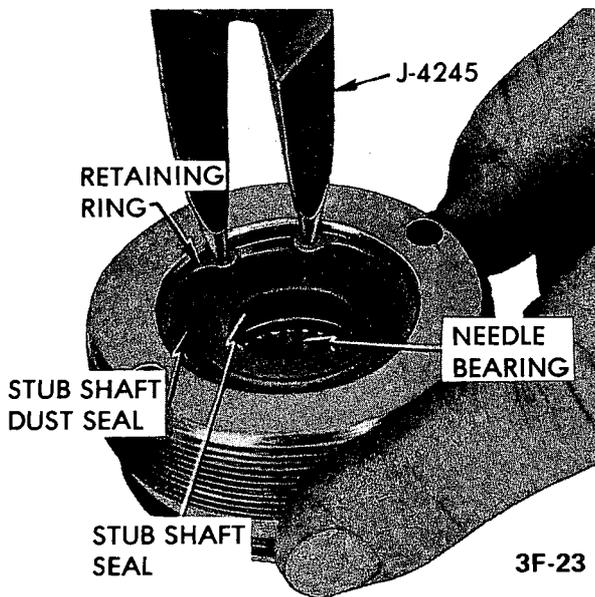


Figure 3F-13 - Removing Retaining Ring

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.

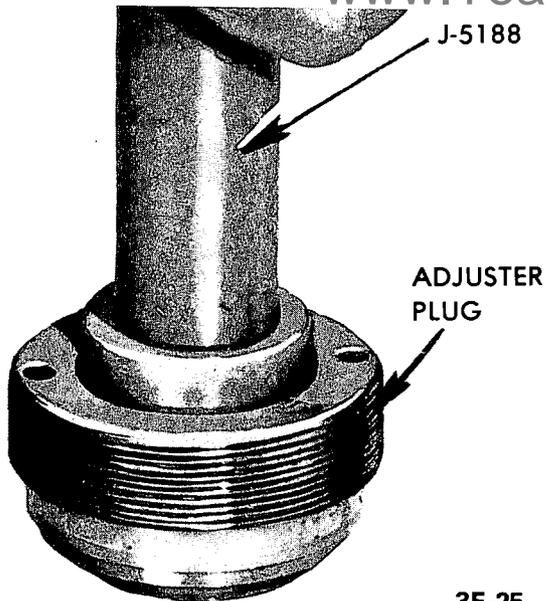
6. Inspect thrust bearing rollers and thrust washers for wear, pitting or scoring. If any of these conditions exist, replace the bearing and washers.

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 in seal toward adjuster plug using Tool J-5188. See Figure 3F-15. 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).



3F-25

Figure 3F-15 - Installing Seal

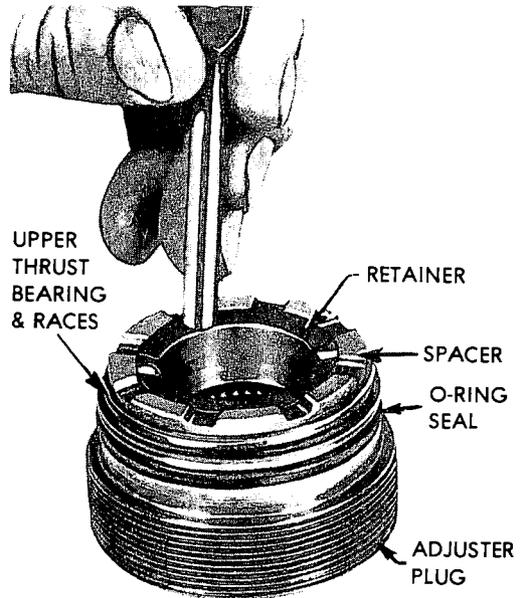
5. Install a new bearing retainer on the adjuster plug by carefully tapping on the flat surface of the retainer. Figure 3F-16.

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

VALVE AND STUB SHAFT

Disassembly

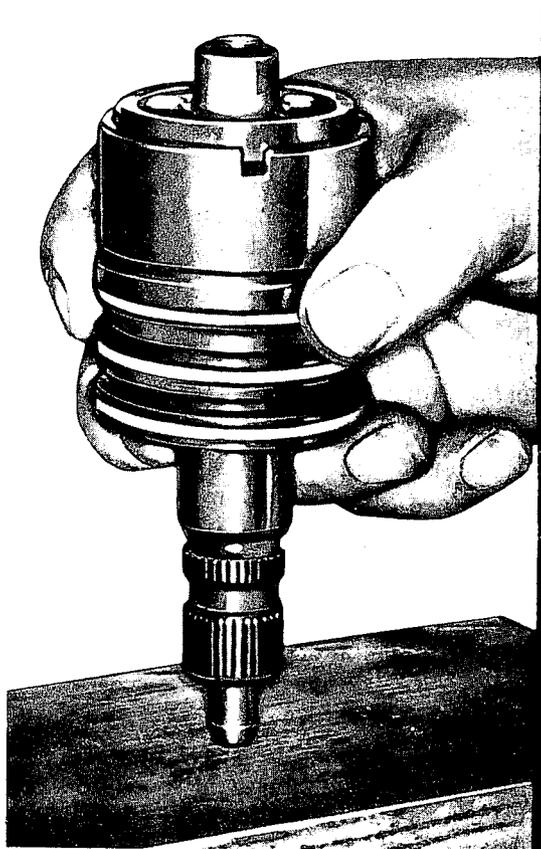
It is very uncommon to have to make any service repairs



3F-26

Figure 3F-16 - Installing Retainer

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.



3F-27

Figure 3F-17 - Removing Stub Shaft Assembly

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.



Figure 3F-18 - Removing Spool Valve

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, 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 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.

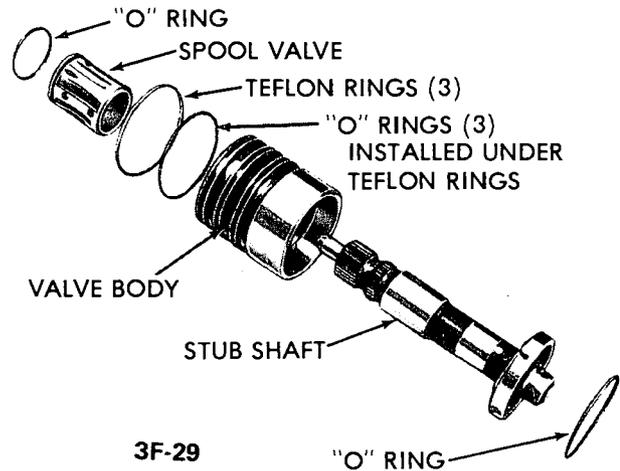


Figure 3F-19 - Exploded View of Valve Body and Shaft

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).
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.

NOTCH IN END CAP MUST FULLY ENGAGE PIN PROJECTING INTO VALVE BODY

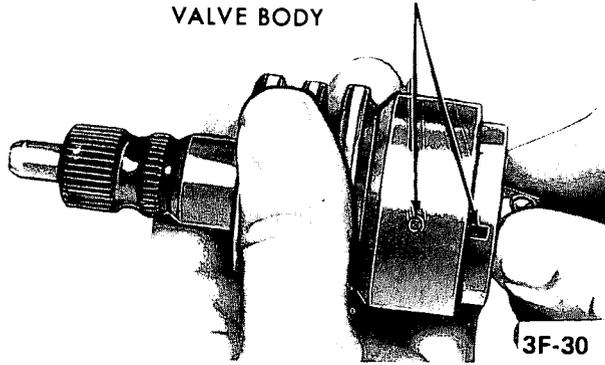


Figure 3F-20 - Installing Stub Shaft

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.

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. Lubricate and install new teflon oil seal and "O" ring in groove on rack-piston nut. Place a new piston ring over the back-up "O" ring. See Figure 3F-21.

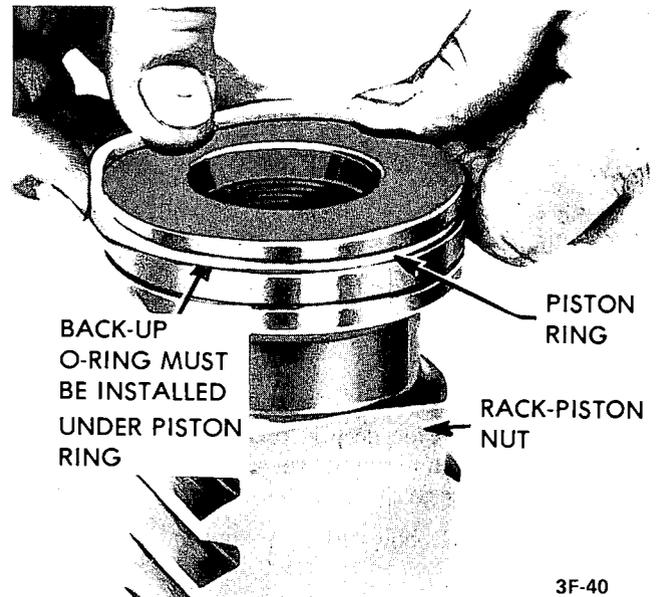


Figure 3F-21 - Installing Ring on Rack Piston

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.
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.

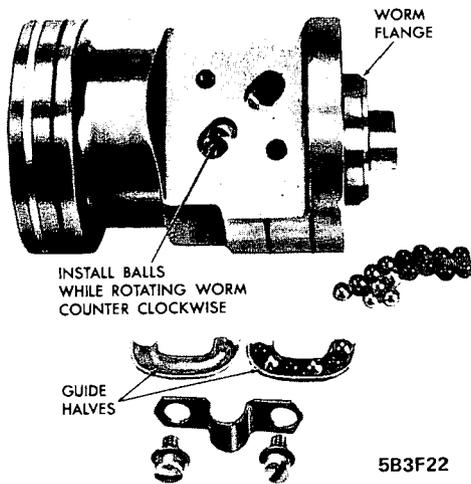


Figure 3F-22 - Loading Balls in Rack-Piston Nut

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 specifications.

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.

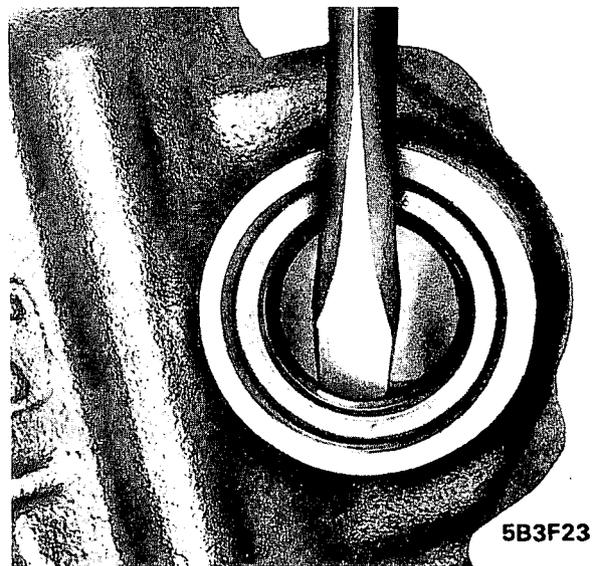


Figure 3F-23 - Prying Out Inner Seal

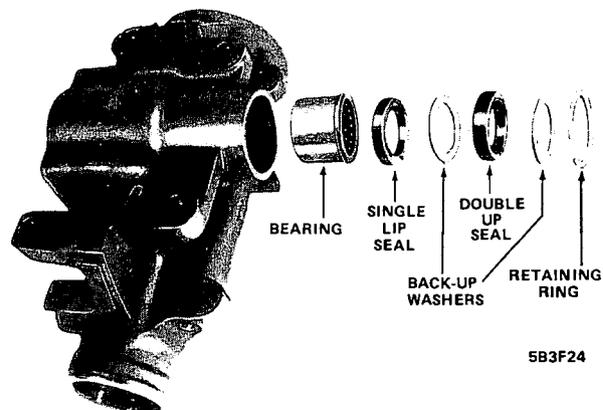


Figure 3F-24 - Pitman Shaft Seals

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-25.

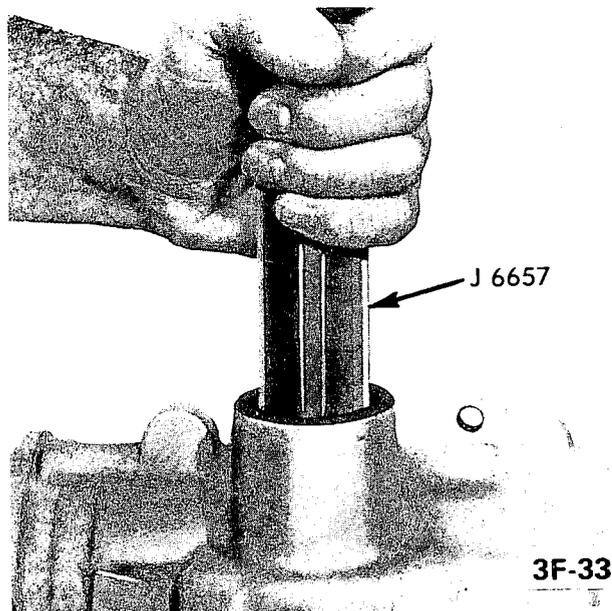


Figure 3F-25 - Removing Pitman Shaft Needle Bearings

Assembly

1. Clean parts and lubricate with power steering oil. If pitman shaft needle bearing was removed because of damage, install new needle bearing into gear housing bore from seal bore end, pressing against stamped identification on bearing with Tool J-22407. 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. *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 Tool J-4245, making certain that ring is seated properly.

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.

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.

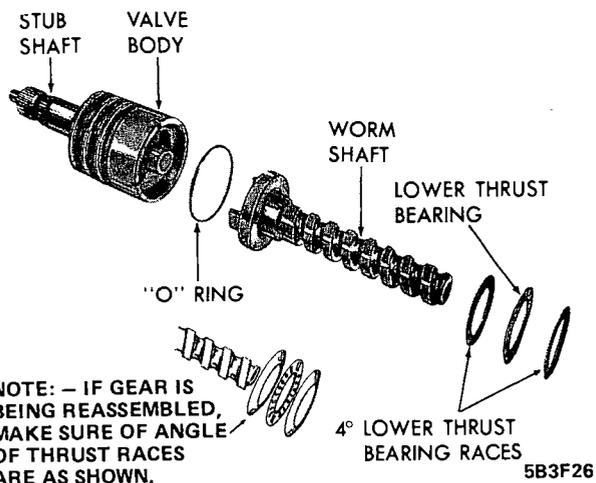


Figure 3F-26 - Installation of Thrust Washers

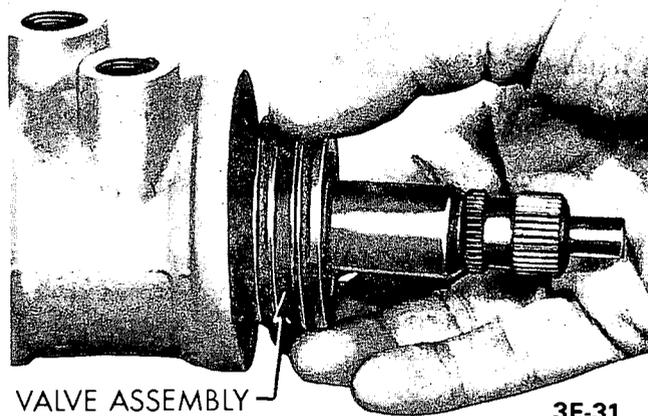


Figure 3F-27 - Installing Valve Assembly

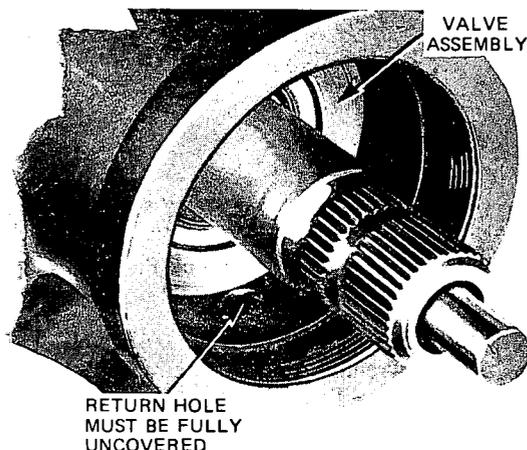


Figure 3F-28 - Valve Assembly Installed

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

3. Lubricate a new adjuster plug "O" ring with Power Steering Fluid and install in groove on adjuster 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. Remove Seal Protector.

4. Adjust thrust bearing preload as follows:

a. Using spanner wrench J-7624 tighten adjuster plug up snug (clockwise). Back adjuster plug off 1/4 turn and measure seal drag, using 3/4 12 point socket and in. lb. torque wrench.

b. Bottom out the adjuster plug again snugly (clockwise, avoid excessive torque). Then back off the adjuster plug (counterclockwise) obtain 3-4 in. lbs. in excess of the seal drag (measured in Step 4a) or a maximum of 10° (.200 inches at rim of adjuster plug), whichever comes first. Tighten the adjuster plug locknut securely while holding adjuster plug in position with Tool J-7624.

Preload torque tends to drop off when the locknut is tightened. Therefore, the torque reading must be rechecked with the locknut tight and the torque must still be 3-4 in. lbs. in excess of the seal drag.

5. Install the rack-piston as follows:

a. Lubricate the rack-piston teflon seal with Power Steering Fluid.

b. Position Seal Compressor J-8947 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.

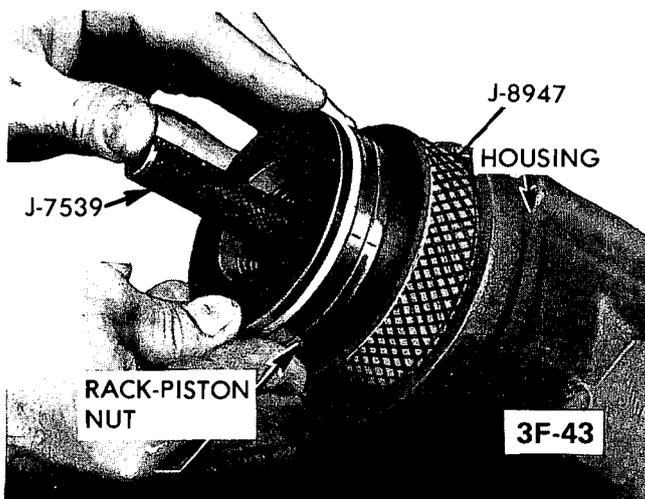


Figure 3F-29 - Installing Rack Piston

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-8947.

6. 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 specifications.

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

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

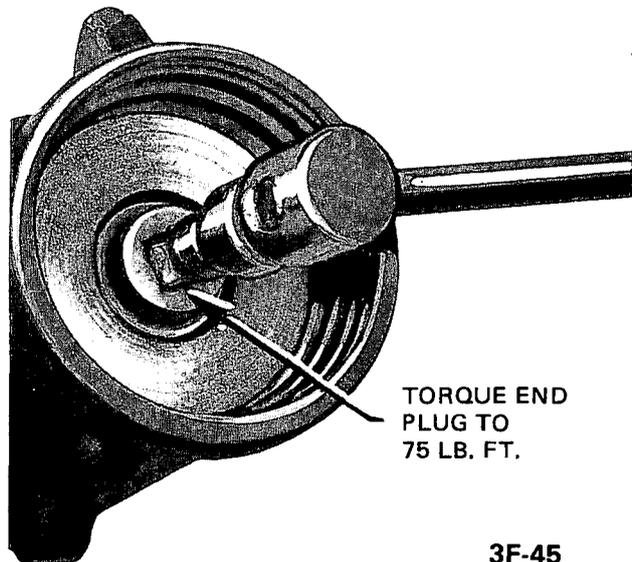


Figure 3F-30 - Installing Rack-Piston Plug

9. Adjust the over-center sector preload as follows:

a. Make sure the pitman shaft over-center adjusting screw is backed all the way out. Then turned back in 1/2 turn.

b. Install an inch-lb. torque wrench with a 3/4", 12-point socket on the stub shaft splines.

c. Rotate the stub shaft from one stop to the other. Count the number of turns and locate the center of travel, then check the combined ball and thrust bearing preload by rotating the torque wrench through the center of travel. Note the highest reading.

d. Tighten the pitman shaft over-center adjusting screw until the torque wrench reads 3-6 in. lbs. higher than the reading, noted in Step c. The total reading should not exceed 14 in. lbs.

e. While holding the adjusting screw, tighten the locknut to 35 ft. lbs. using Adapter J-5860 and recheck the adjustment.

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 preload 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.

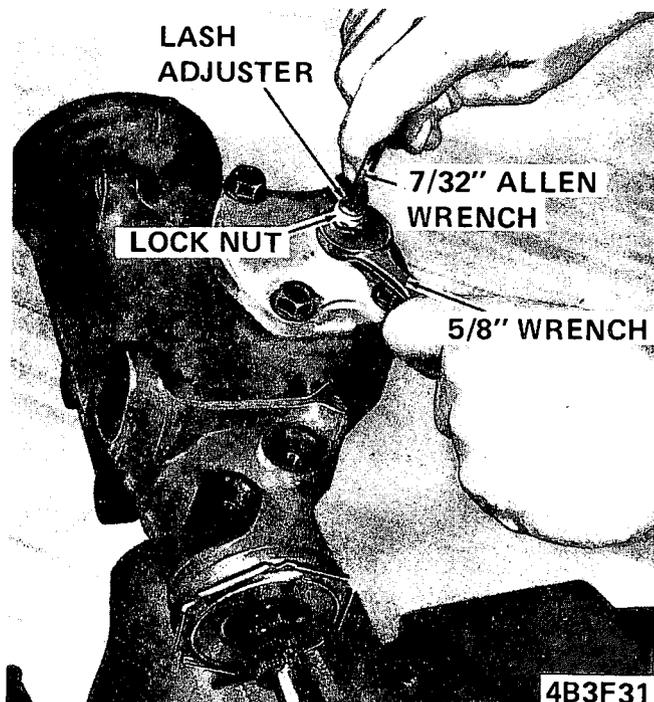


Figure 3F-31 - Pitman Shaft Adjuster

3. Loosen the adjuster plug lock by using a drift.
4. Loosen the adjuster plug (1) turn. Figure 3F-32.
5. Turn the stub shaft to the right stop and then back 1/2 turn.

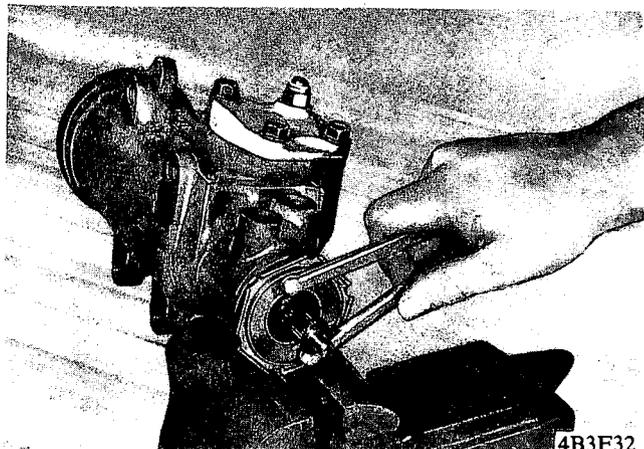


Figure 3F-32 - Adjuster Plug

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 rechecked 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.

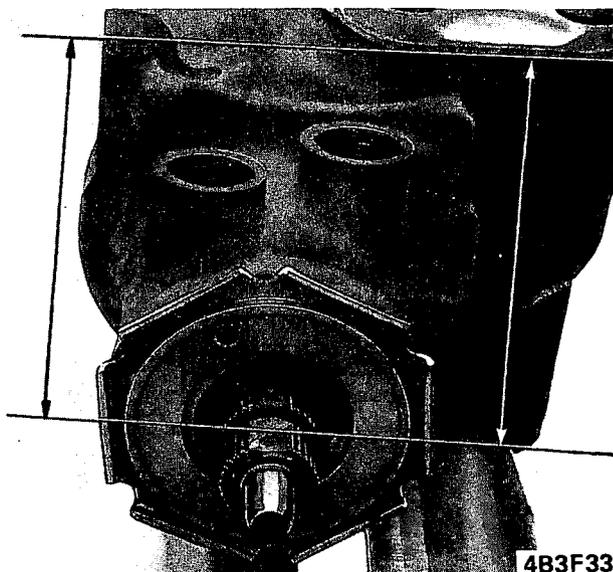
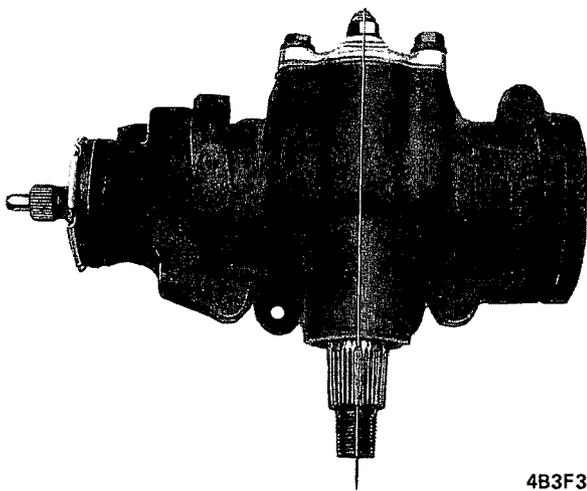


Figure 3F-33 - Stub Shaft Parallel with Side Cover

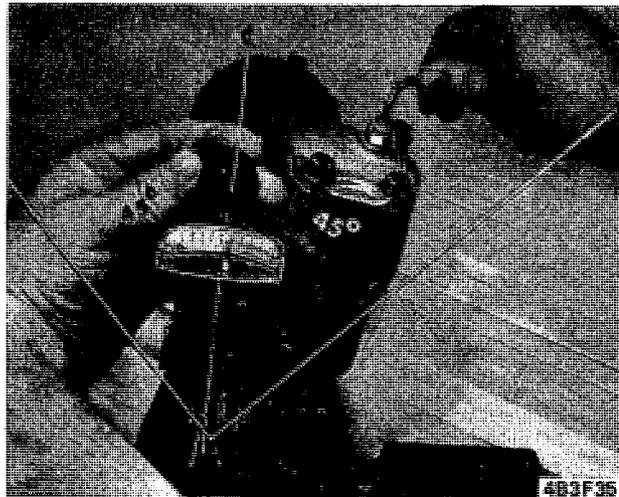
2. Rotate the torque wrench approximately 45 degrees each side of center, and "read" near or on center (highest reading). Figure 3F-35. Loosen the lock nut and turn the preload adjusting screw CW until the correct "O" center torque, in excess of the reading just taken, is obtained.

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



4B3F34

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



4B3F35

Figure 3F-35 - Over Center Check

(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.

(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.

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.

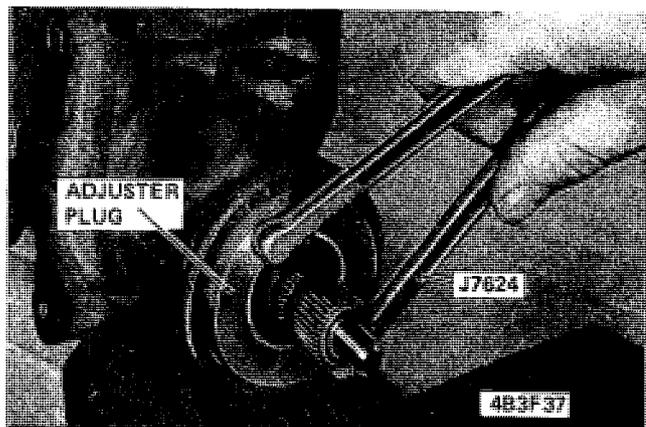
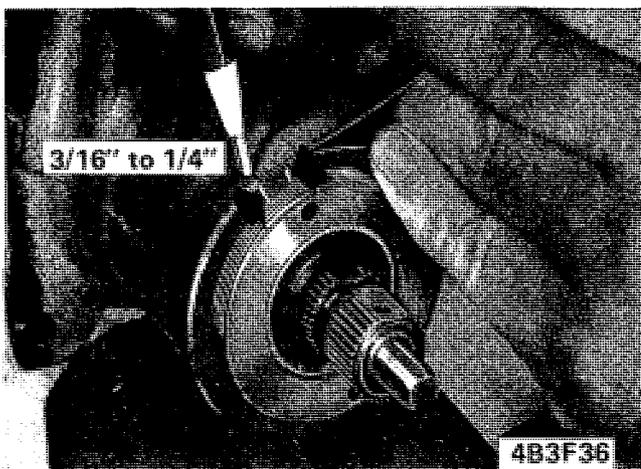
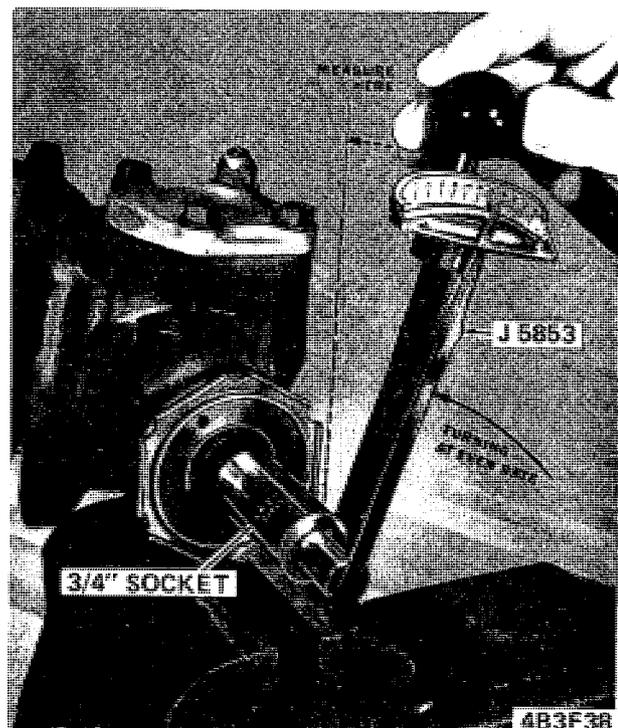


Figure 3F-37 - Rotate Adjuster



4B3F36

Figure 3F-36 - Marking Housing



4B3F38

Figure 3F-38 - Rotating Torque Wrench

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.*

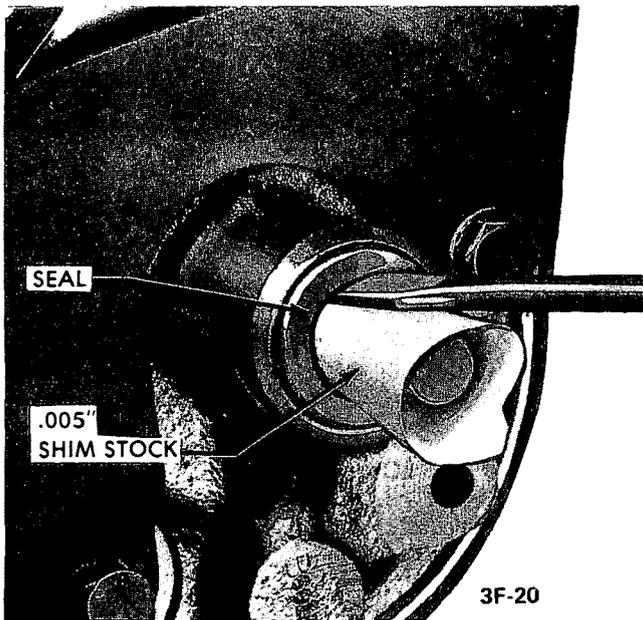


Figure 3F-40 - Removing Oil Pump Shaft Seal

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.*

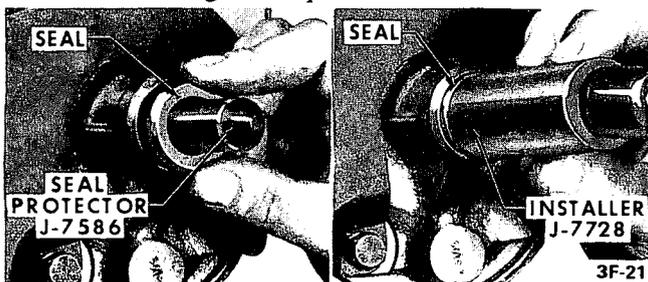


Figure 3F-41 - Installing Seal

2. Install pump assembly.

3. Install pulley and drive belt. Adjust belt tension to specification outlined in Section 6B.
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 specifications.

REMOVAL AND INSTALLATION OF POWER STEERING OIL PUMP ASSEMBLY

Pump Pulley Removal and Installation

The pump pulley is pressed on and can be removed with Tool J-25034 and installed with Tool J-25033.

The Do's and Dont's of the pressed on pulley are:

DO'S

1. Use care to prevent nicks on pump and pulley, shaft and hubs.
2. Be certain pulley hub is fully engaged in tool head.
3. Use care to align tool with shaft thread.
4. Install pulley until tool bottoms against shaft shoulder.
5. Grip pump shaft with padded jaw pliers only.
6. Make sure pulley hub is flush with shaft after removing tool.

DONT'S

1. Don't clamp any parts of pump in vise.
2. Don't put loads on pump reservoir.
3. Don't spin pump shaft with power tools.
4. Don't use steel jawed pliers to prevent shaft from turning.
5. Don't side load the tool when installing pulley.
6. Don't hammer non-seated pulley.

Removal All V-8 Engine Figures

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

2. Remove the pump bracket to A.I.R. bracket bolts if equipped.
3. Remove the pump bracket to engine bracket bolts.
4. Place pump belt out of way.
5. Disconnect the return and pressure hoses from pump. Cover the hose ends and unions on pump to prevent dirt from entering.
6. Remove pump and bracket.
7. Remove pulley with puller J-25034, remove pulley.
8. Remove the two pump bracket to pump bolts.

Installation

1. Reinstall pump bracket to pump bolts and torque.
2. Reinstall pulley on pump with Tool J-25033.
3. Reinstall pump and bracket on engine.
4. Install pump bracket to A.I.R. bracket bolts, if equipped and rear of pump adjusting nut. Do not torque at this time.
5. Reinstall pump hoses torque as specified.
6. Adjust belt as per Maintenance and Adjustment Section of this group.

Removal L-6 Engine Figure

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.
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 using J-25034.
3. Remove reservoir cap and drain out oil in pump reservoir.
4. Clamp front hub of pump in vise so that the extending portion of shaft is directed downward, being careful not to clamp vise too tight as this may distort the bearing.
5. Using proper sized wrenches, remove union and "O" ring assembly and both mounting studs from back of reservoir. Discard all seals and "O" rings. Figure 3F-46.
6. Reservoir may then be removed from housing by rocking it slightly back and forth to unseat the "O" ring. Remove "O" ring and discard.

7. Remove both mounting stud and union seals from counterbored spaces between reservoir and housing. Discard these seals also.

8. Remove the end plate retaining ring by inserting a small punch in the 1/8 inch diameter hole in the housing side opposite the flow control valve hole. Compress the retaining ring with the punch and remove by inserting a screwdriver under the ring and twisting the screwdriver. Figure 3F-42.

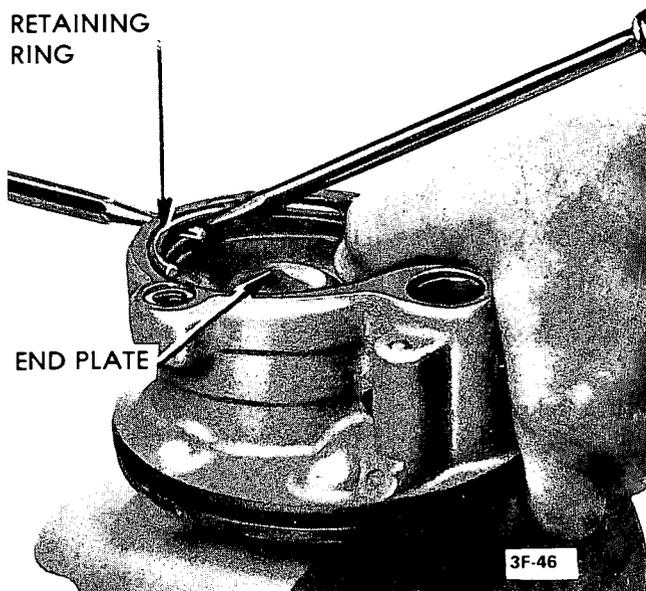


Figure 3F-42 - Removing End Plate Retaining Ring

9. Remove end plate and end plate "O" ring. End plate is spring loaded and will generally sit above the housing level for ease of removal. If sticking should occur, a slight rocking action of the end plate should be used to free it.
10. Remove pump from vise and invert. Flow control valve and valve spring will fall free.
11. With end cover "O" ring and shaft key removed, tap very lightly on end of shaft, only until pressure plate falls free.
12. Remove pressure plate, shaft, pump ring, vanes and rotor.
13. Remove shaft retaining ring and discard. (Some models do not have retaining rings).
14. Remove rotor and thrust plate from shaft and both dowel pins from housing.
15. Pry shaft seal out of housing, being careful not to damage the housing bore; discard the shaft seal.
16. Remove, clean and replace magnet.

ASSEMBLY OF PUMP

Before beginning assembly of pump, clean all metal parts in a nontoxic solvent.

Steps in Assembly of Pump:

1. Install new pump shaft seal using seal protector J-

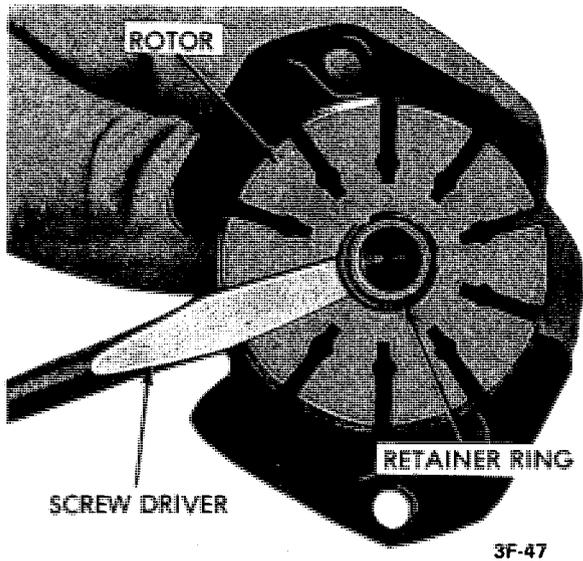


Figure 3F-43 - Removing Rotor Retaining Ring

22616 and seal installer J-7728 or a 1 inch socket with an arbor press or hammer. Do not use any more force than necessary to seat the seal.

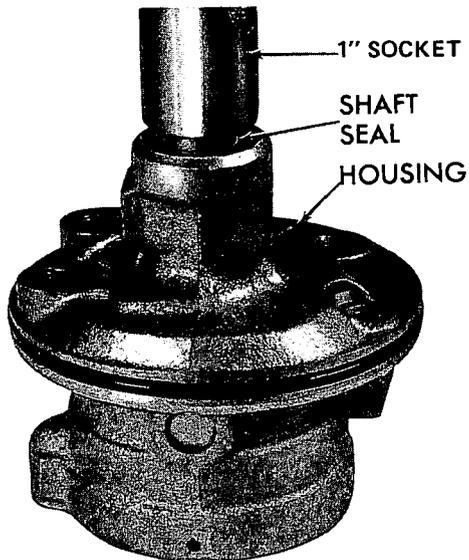


Figure 3F-44 - Installing Seal

2. Lubricate new pressure plate "O" ring with Power Steering Fluid, and install in third groove from rear of housing.

3. Clamp end hub of housing in vise in same position as before and insert both dowel pins. Do not over tighten the vise - damage to the bearing could occur.

4. Insert shaft through the thrust plate and rotor, and install new snap ring on shaft. Open the snap ring just enough to slide over the end of shaft. (Rotor must have counter sunk side toward thrust plate.)

5. Insert shaft in housing, making sure thrust plate slides properly on dowel pins.

6. Install pump ring on dowel pins with the arrow toward rear of housing.

7. Install all ten vanes in rotor slots with rounded edge of vanes outward. Vanes should slide freely.

8. Lubricate pressure plate with Power Steering Fluid so as not to damage pressure plate "O" ring.

9. Install pressure plate on dowel pins with circular depression for spring toward rear of housing. Pressure plate must be pressed about 1/16 inch over the "O" ring to seat.

10. Lubricate new end plate "O" ring with Power Steering Fluid and install in second groove from rear of housing.

11. Install end plate spring in groove provided in pressure plate.

12. Lubricate end plate with Power Steering Fluid so as not to damage "O" ring and press into housing. Figure 45. Depress only far enough to enable retaining ring to seat properly in groove.

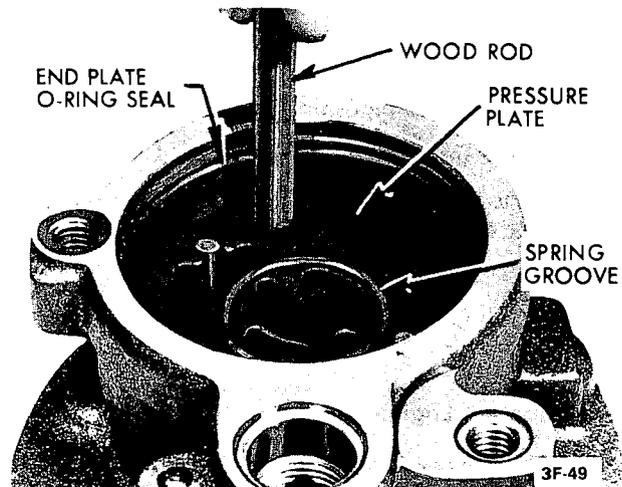


Figure 3F-45 - Seating Pressure Plate

13. Install end plate retaining ring and release arbor press.

14. Place flow control valve spring in hole first and then insert flow control valve with screened end toward front of housing.

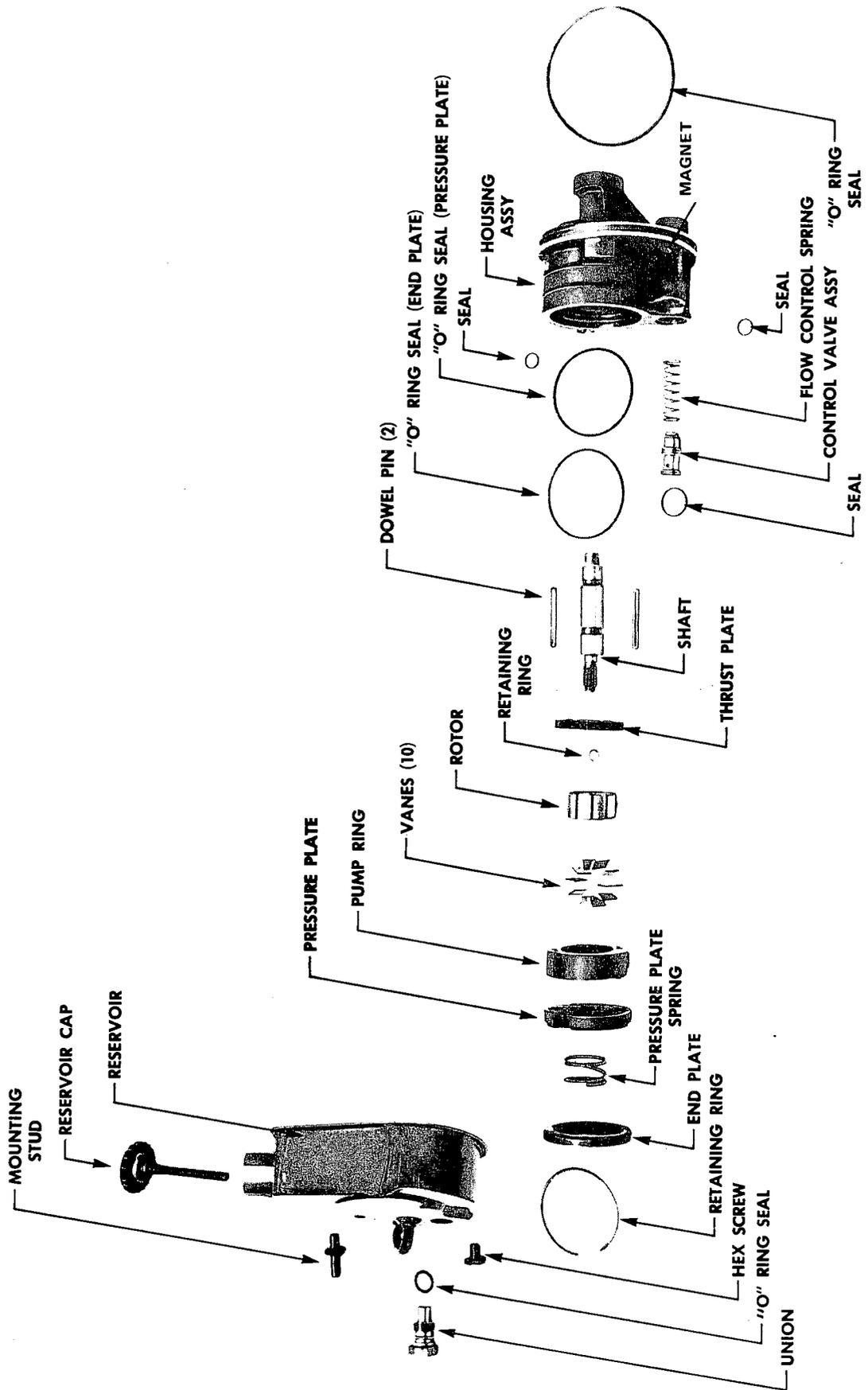
15. Install new stud seals and union seals in counter sunk holes, and lubricate with Power Steering Fluid and install new reservoir "O" ring on housing.

16. Lubricate inside edge of reservoir with Power Steering Fluid and install on housing being careful to align holes at the same time.

17. Insert both stud bolts and tighten with proper sized wrenches (25-40 ft. lb.)

18. Install new "O" ring on union and lubricate with Power Steering Fluid. Make sure "O" ring is in the groove next to the head hex. Insert union in flow control valve hole in back of reservoir and tighten with proper size wrenches. (25-40 ft. lbs.)

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



3F-46

Figure 3F-46 - Exploded View - Oil Pump

SPECIFICATIONS

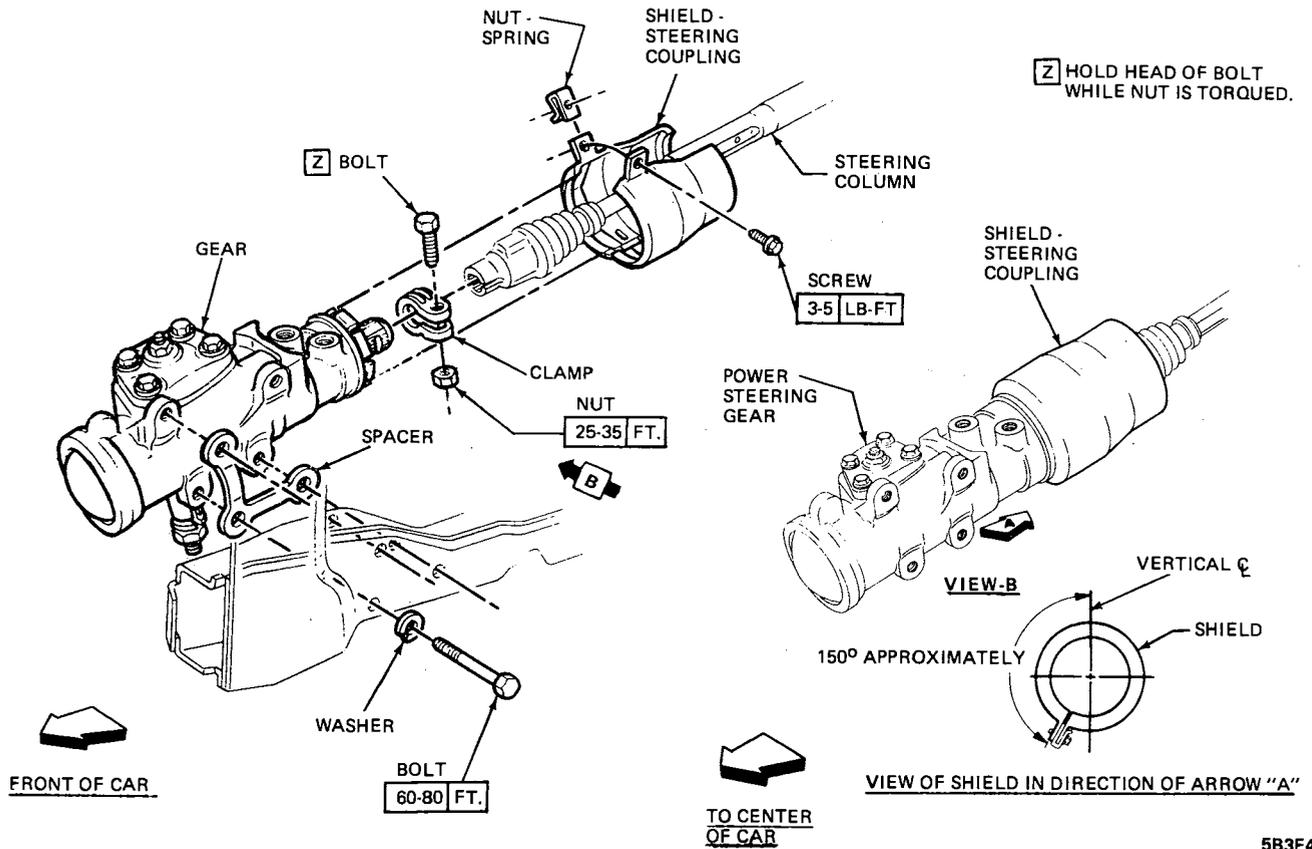
Tightening Specifications

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	45
Nut	Pitman Arm to Pitman Shaft A-B-C-E Series.....	Special	180
	H Series	Special	140
Nut	Adjuster Plug Locking	Special	80
Nut	Pitman Shaft Lash Adjuster Locking	Special	35
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 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

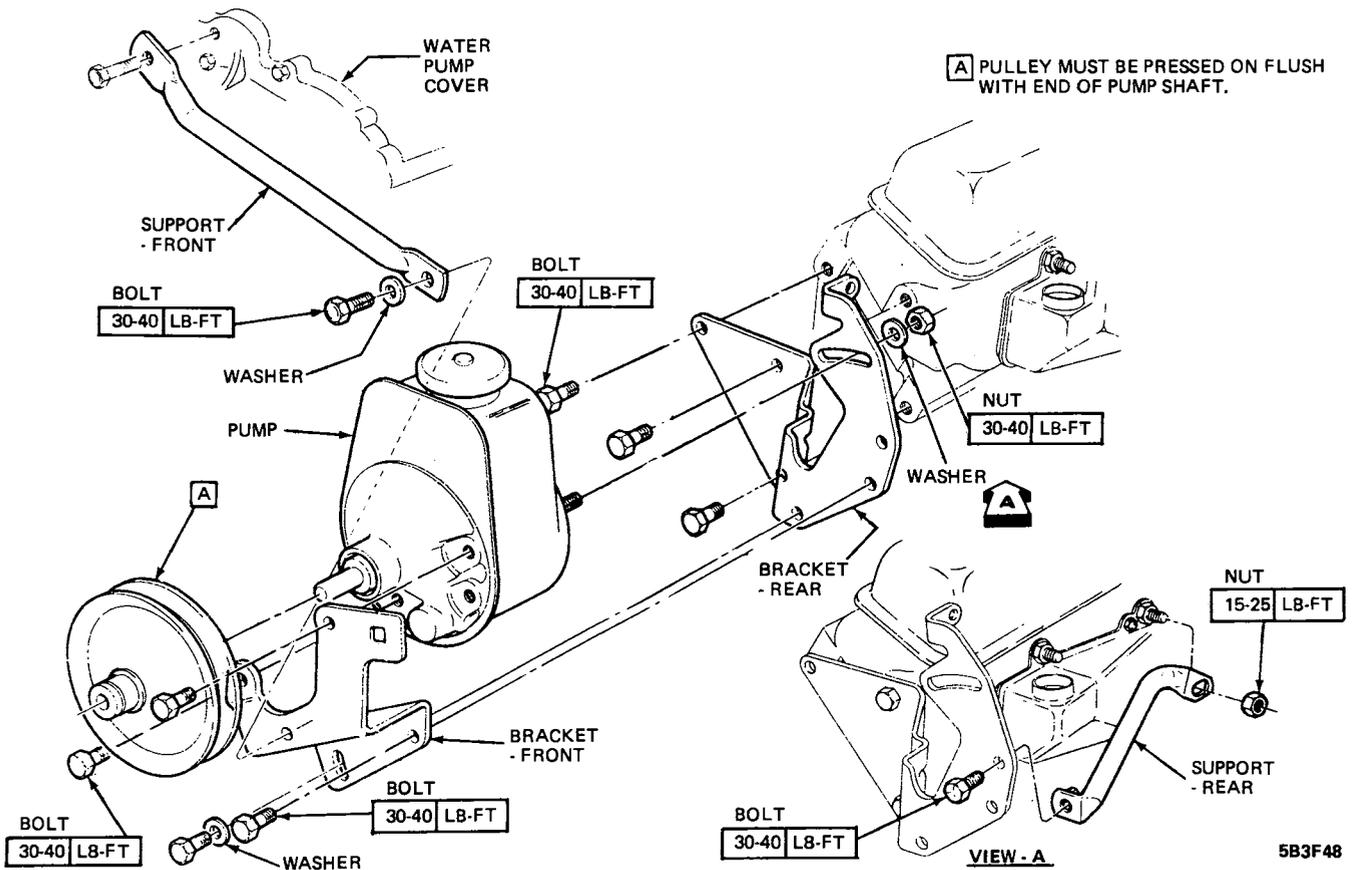
Gear Specifications

Gear Type	Recirculating Ball, Worm and Nut
Make	Saginaw
Gear Ratio Only	
H-X-A Series	16.0:1
B, C, E Series (A Series Optional).....	15.0:1
Ratio Overall (Including Linkage)	
H Series	16.5:1
X Series	18.9:1
A Series (Less Station Wagon).....	18.19:1
A Station Wagon.....	19.76:1
A Optional.....	16.73:1
B Series (350 Engine)	17.6:1
B, C, E Series	16.6:1
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 Specifications	
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.



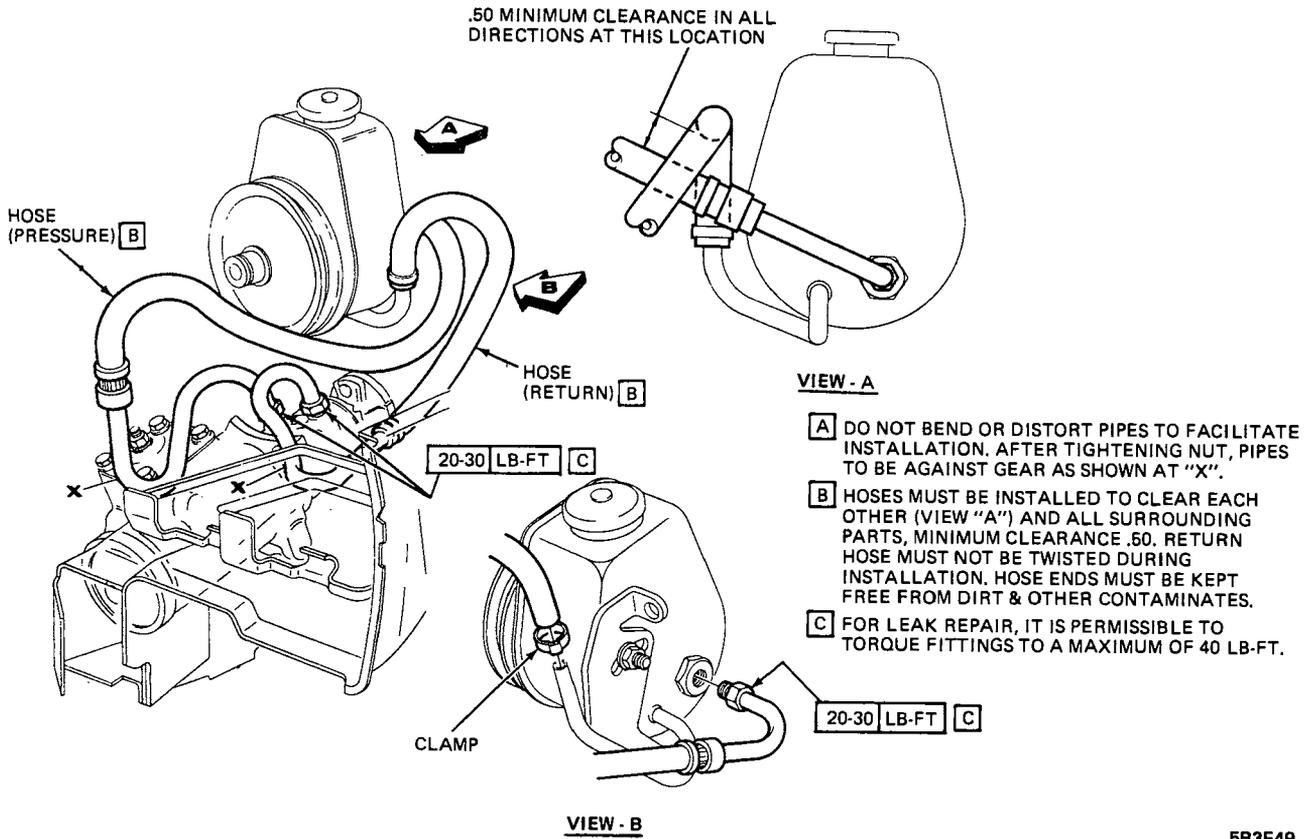
5B3F47

Figure 3F-47 - H Series Steering Gear Mounting and Coupling Shield



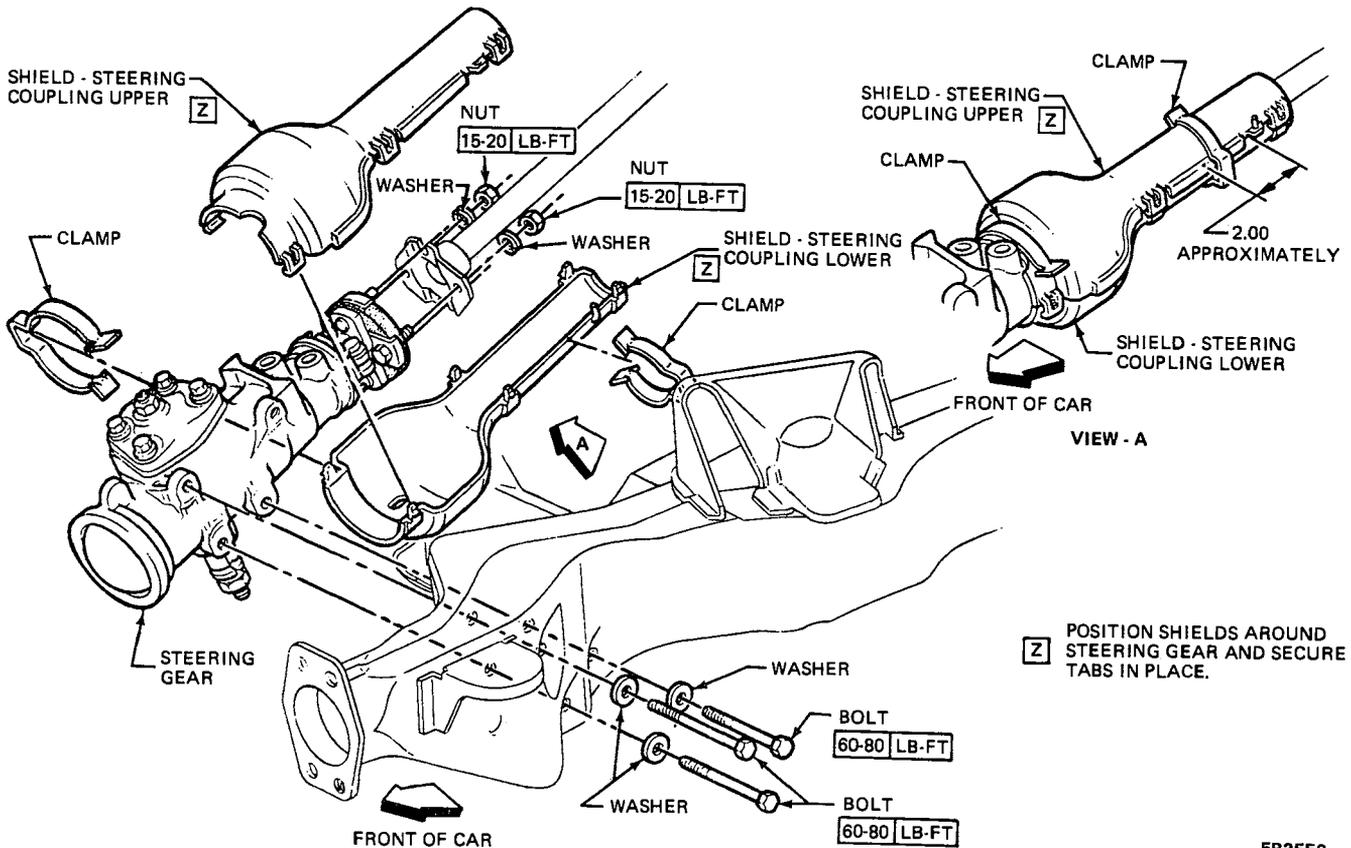
5B3F48

Figure 3F-48 - H Series Power Steering Pump Mounting



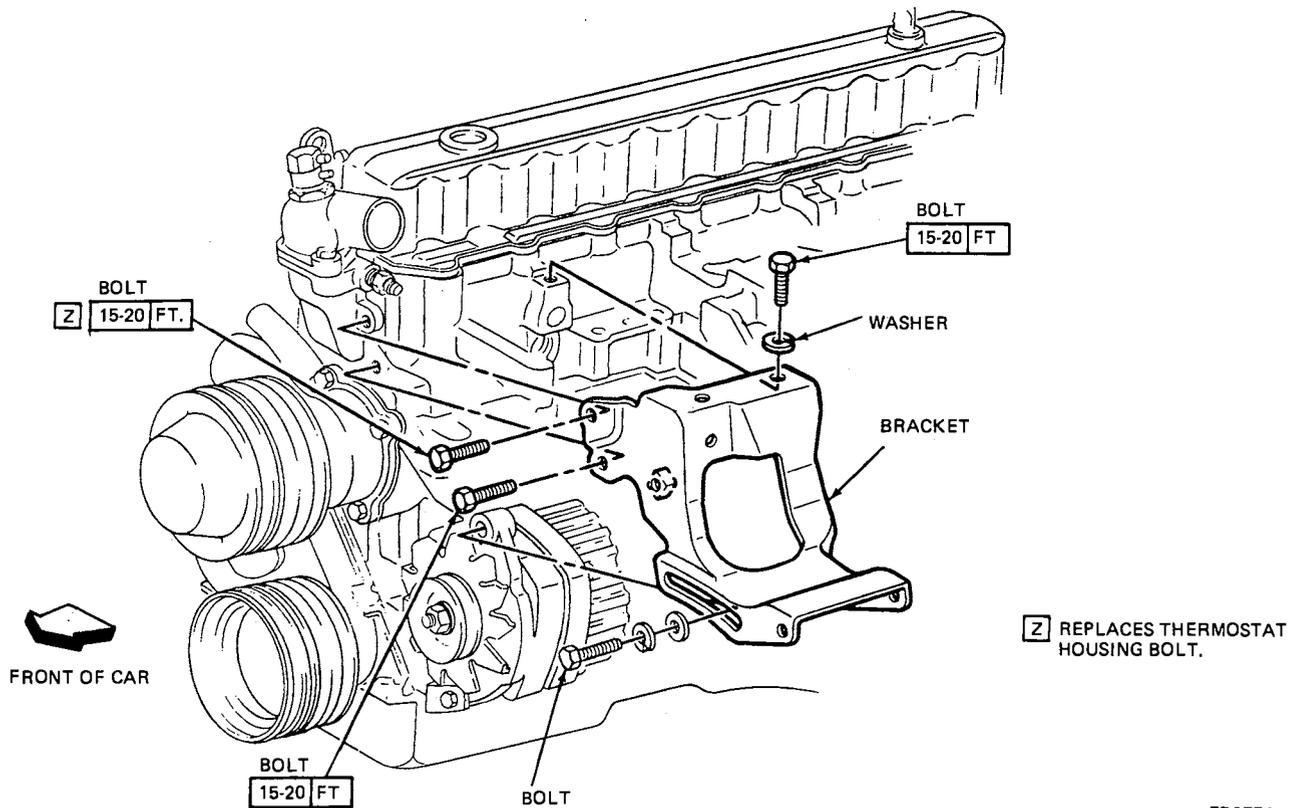
5B3F49

Figure 3F-49 - H Series Power Steering Hose Routing



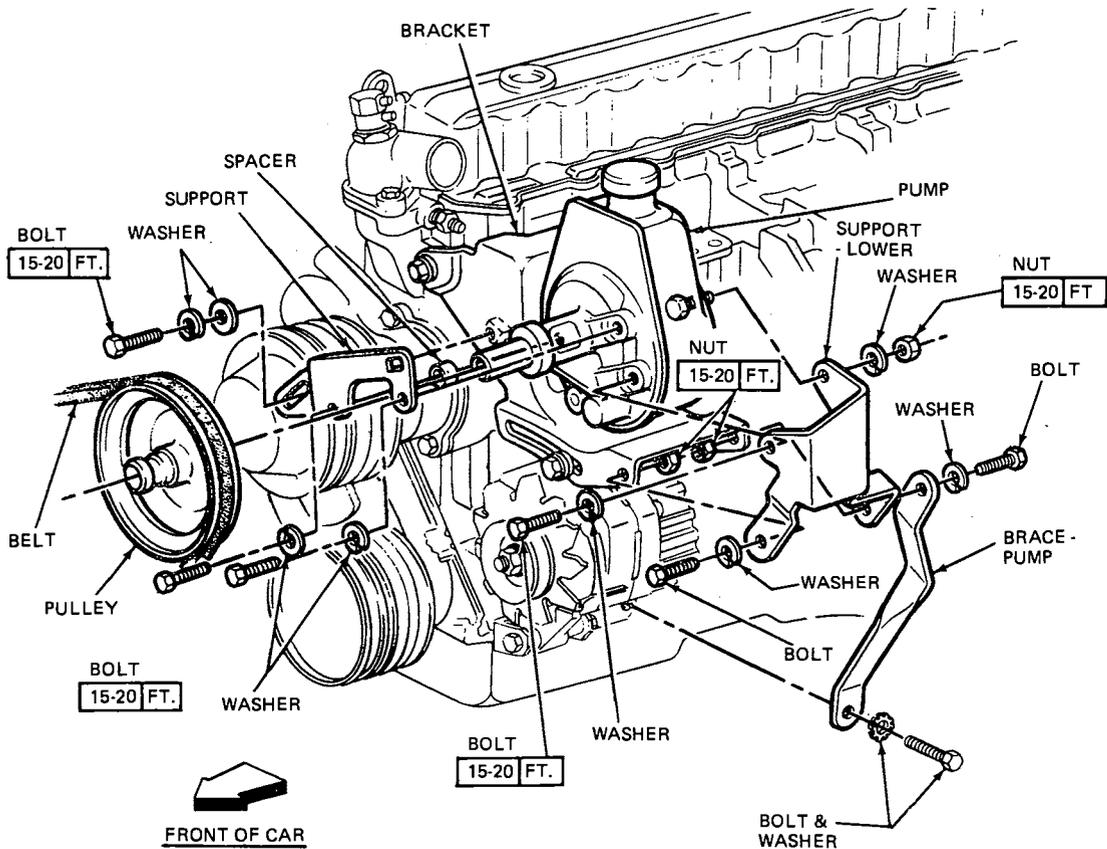
5B3F50

Figure 3F-50 - X Series Steering Gear Mounting and Shield



5B3F51

Figure 3F-51 - X Series Pump Mounting Bracket L-6 Non A.I.R.



5B3F52

Figure 3F-52 - X Series Pump Mounting L-6 Non A.I.R.

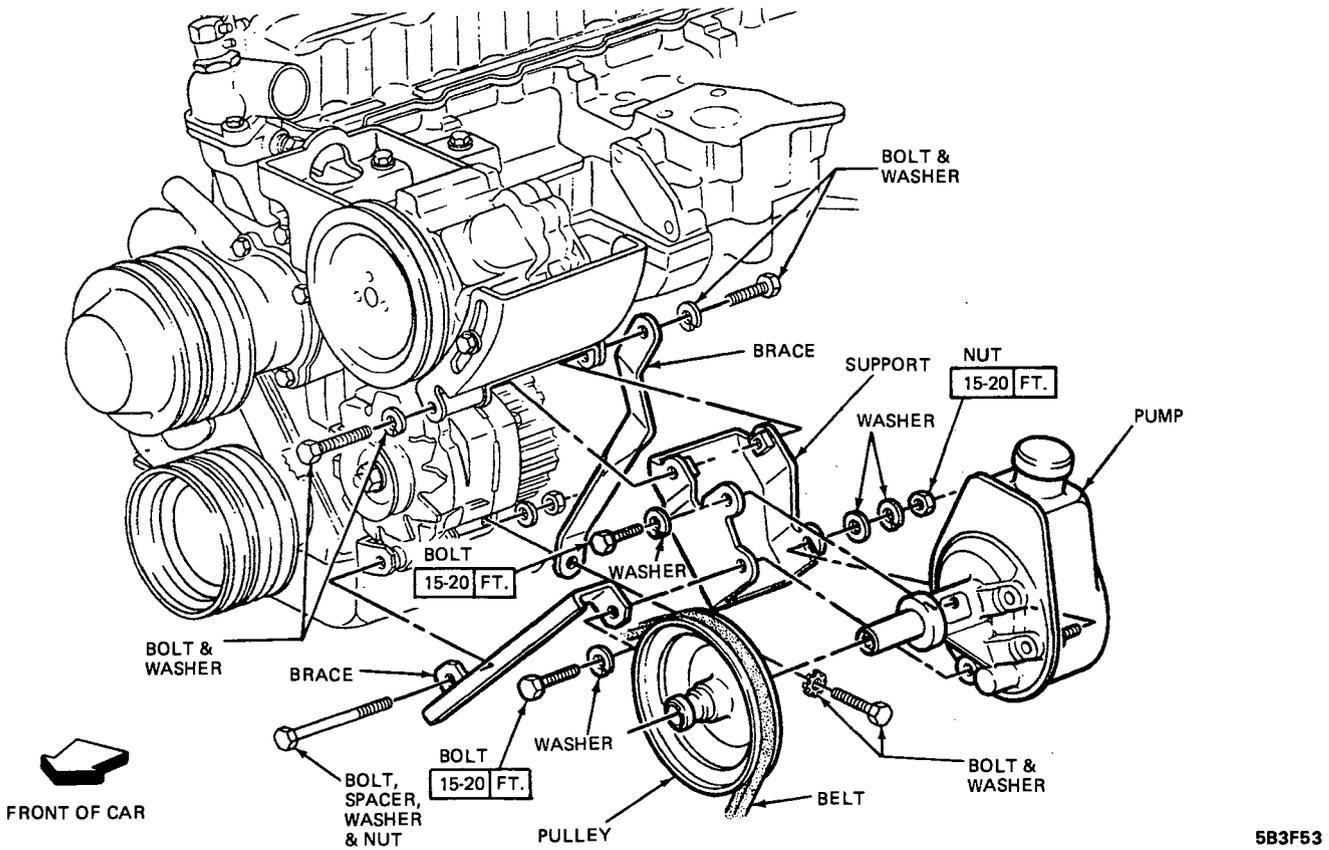


Figure 3F-53 - X Series Pump Mounting L-6 with A.I.R.

5B3F53

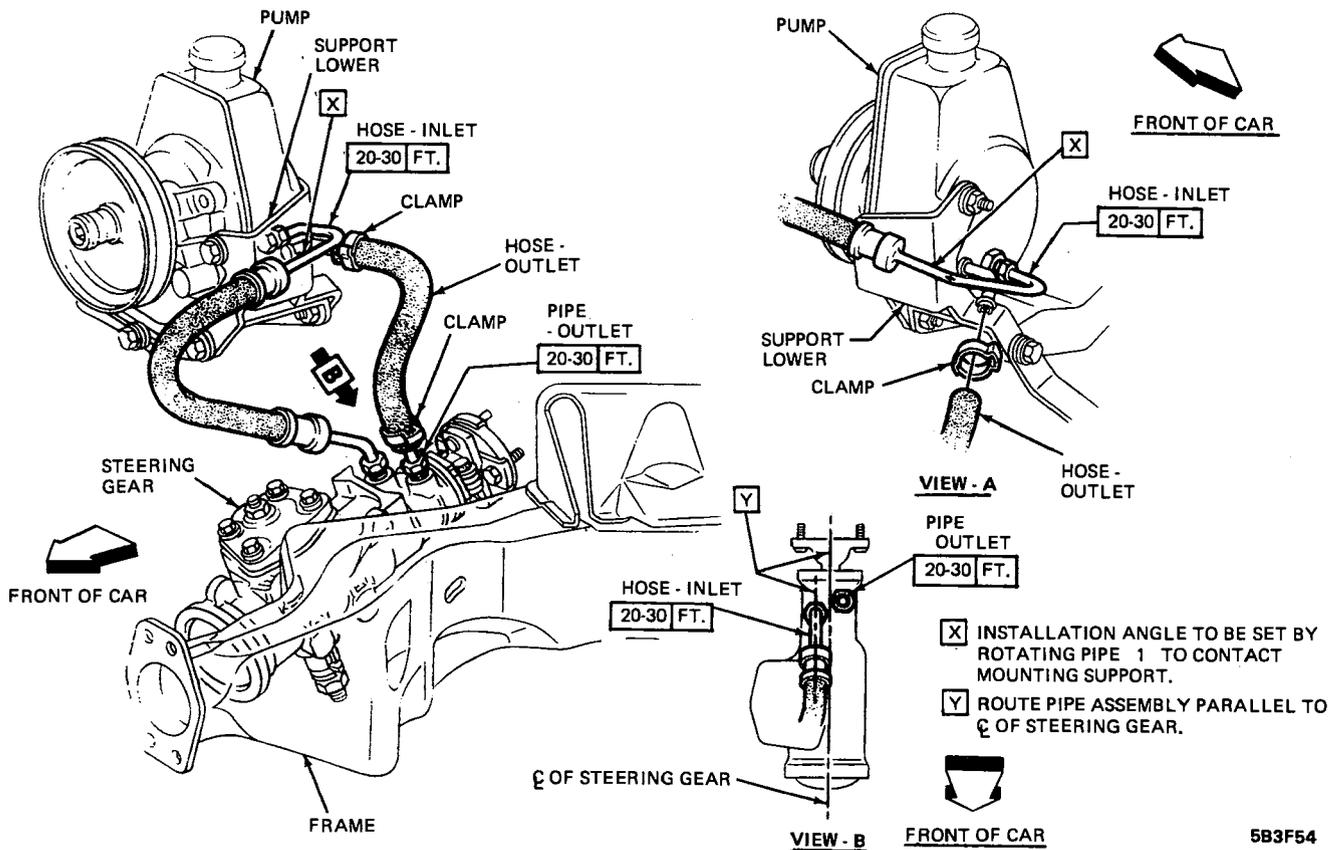


Figure 3F-54 - X Series Hose Routing L-6

5B3F54

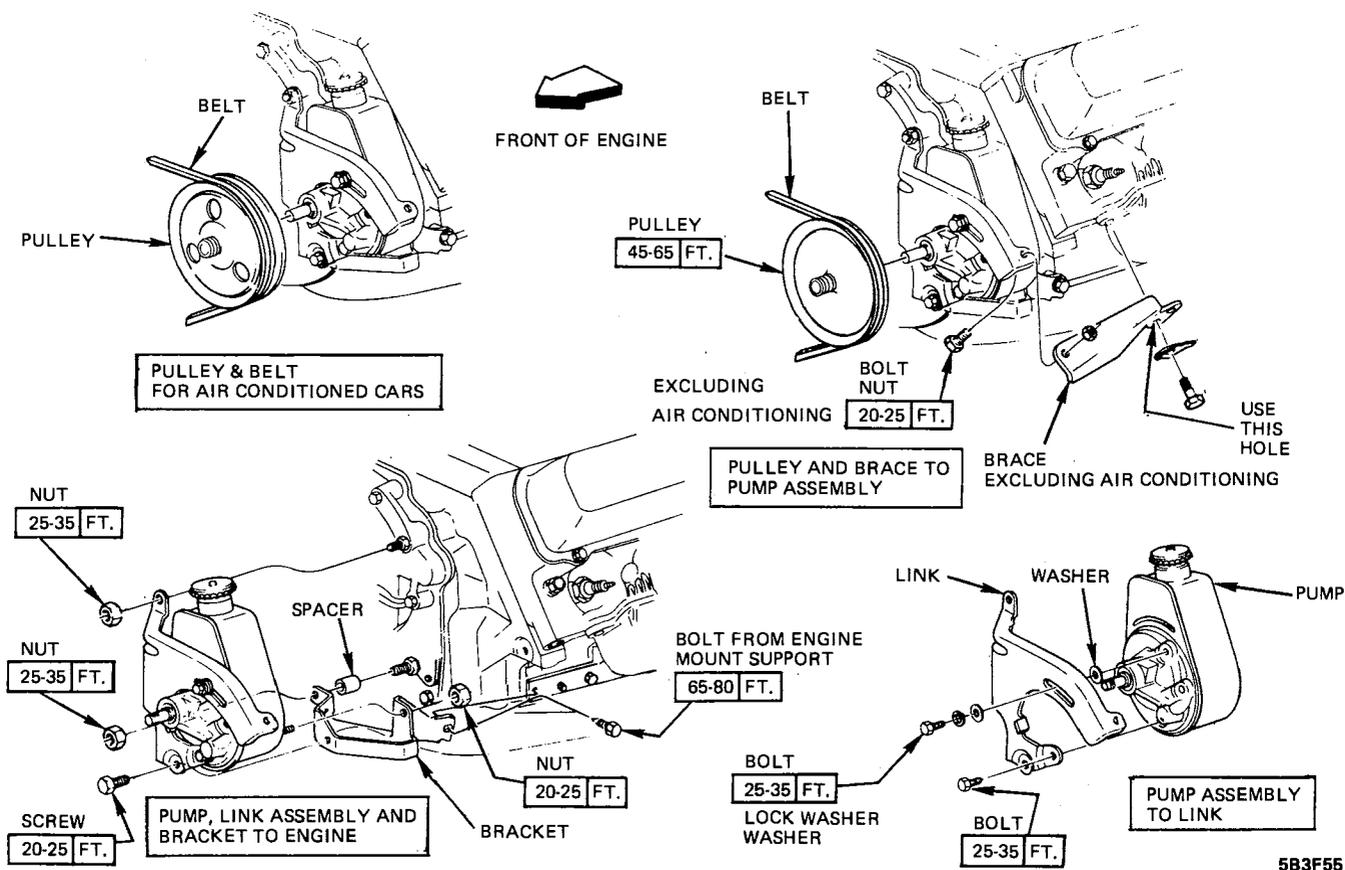


Figure 3F-55 - X Series Power Steering Pump Mounting 260-V8

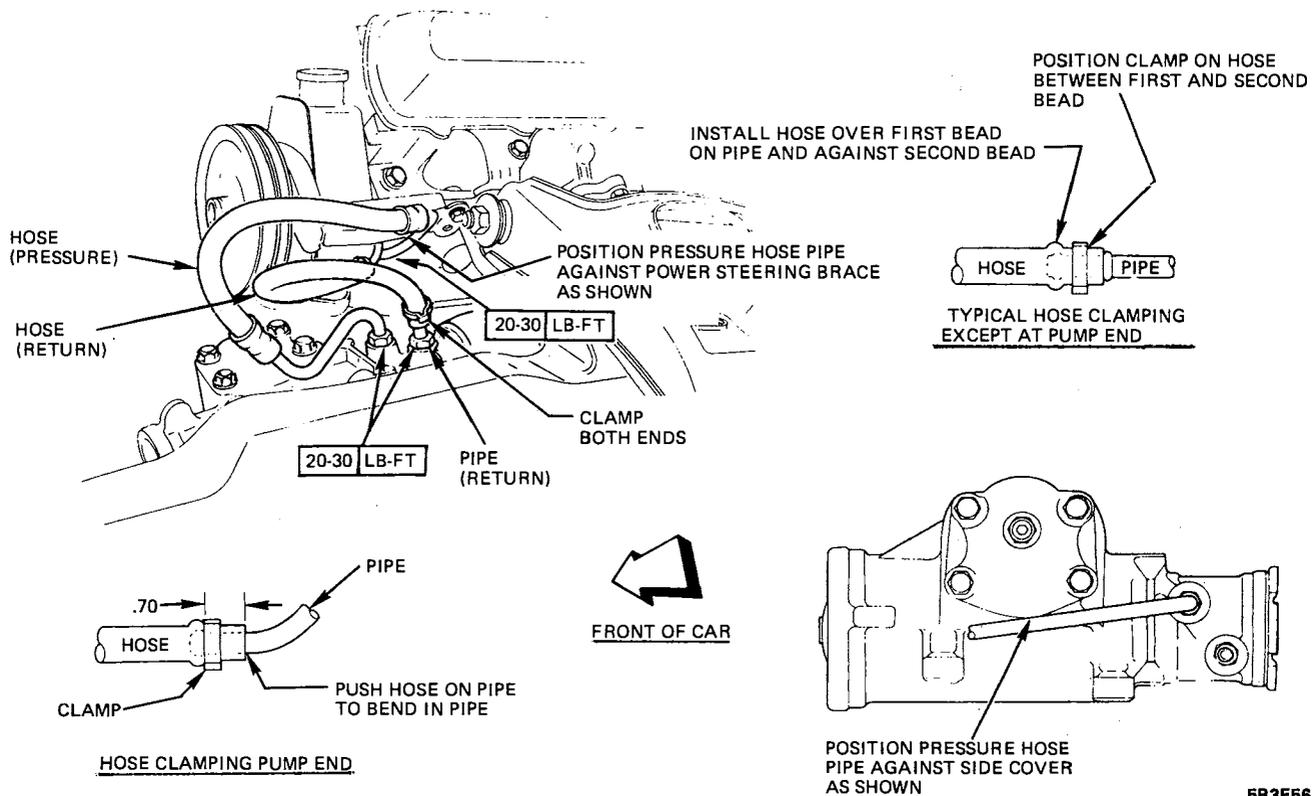
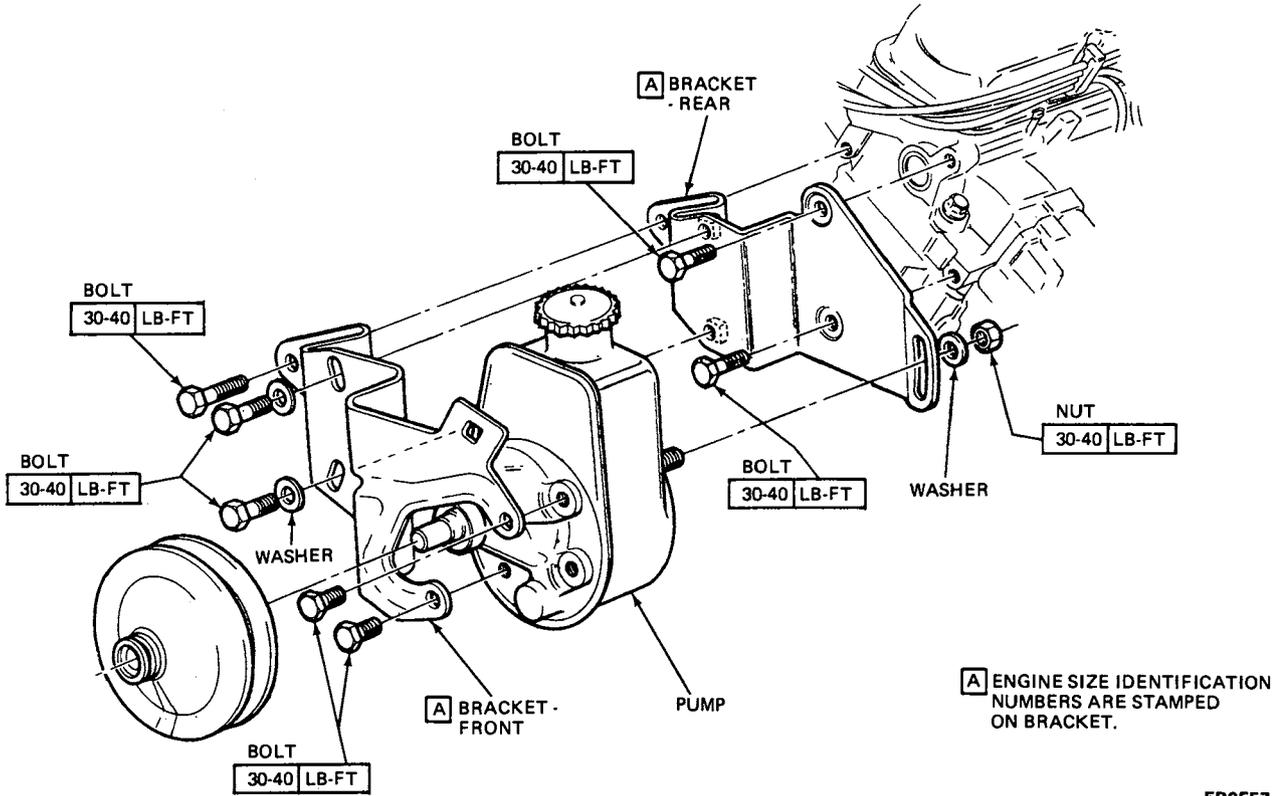
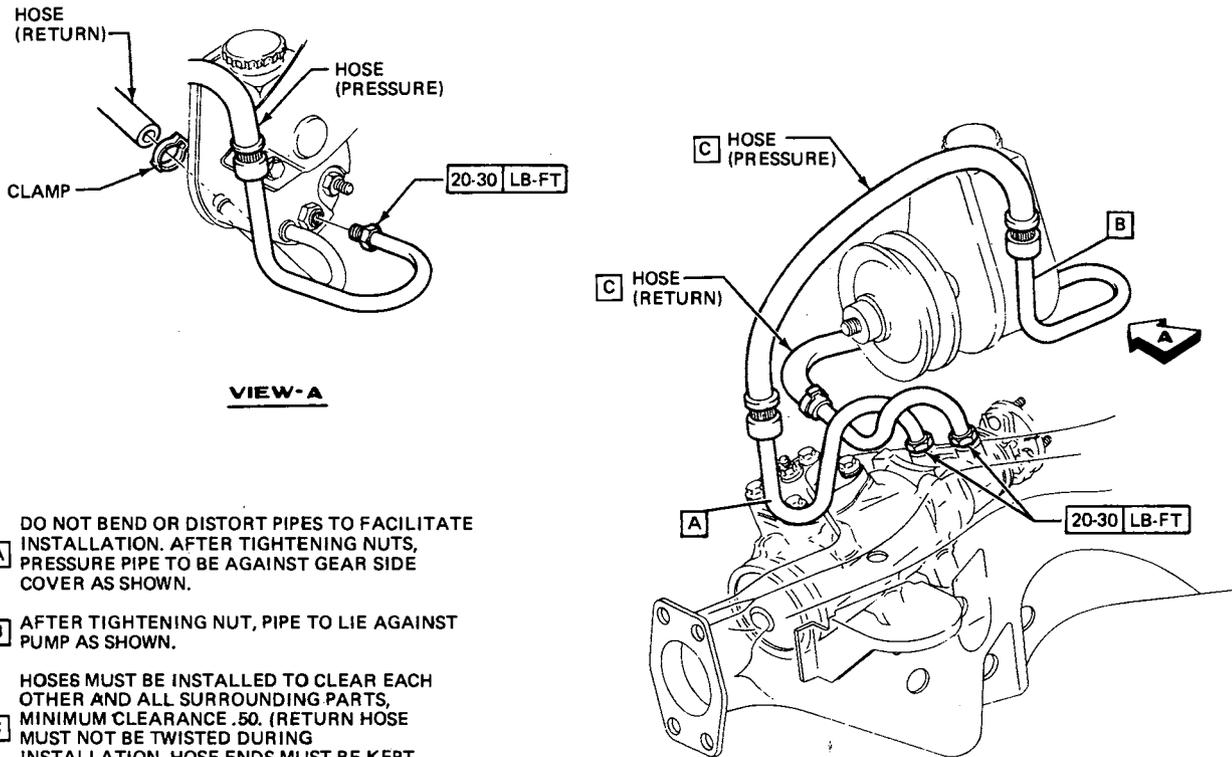


Figure 3F-56 X Series Power Steering Hose Routing 260-V8



5B3F57

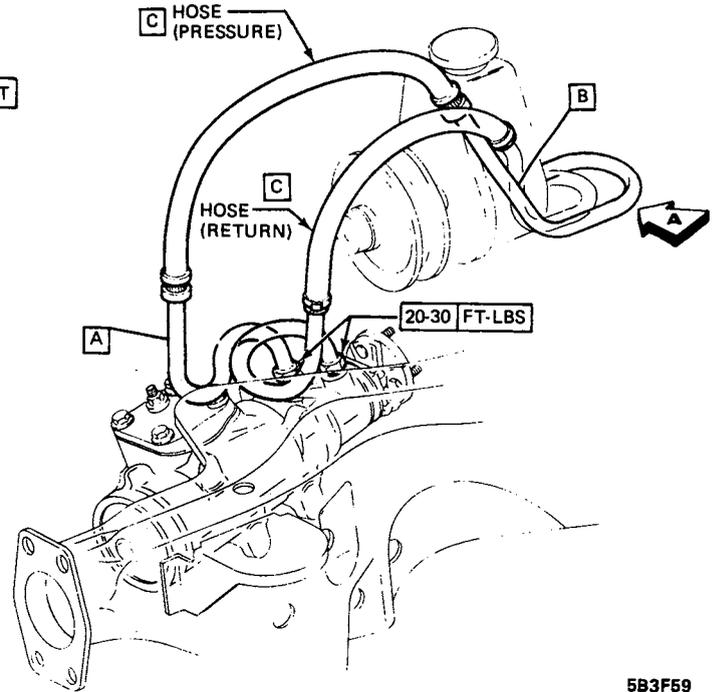
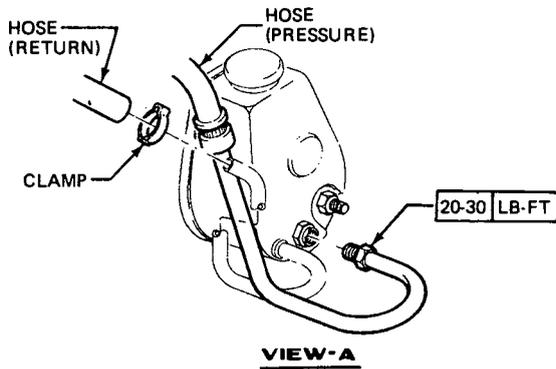
Figure 3F-57 - X Series Power Steering Pump Mounting 350 V-8 and 231 V-6 less A.I.R.



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

5B3F58

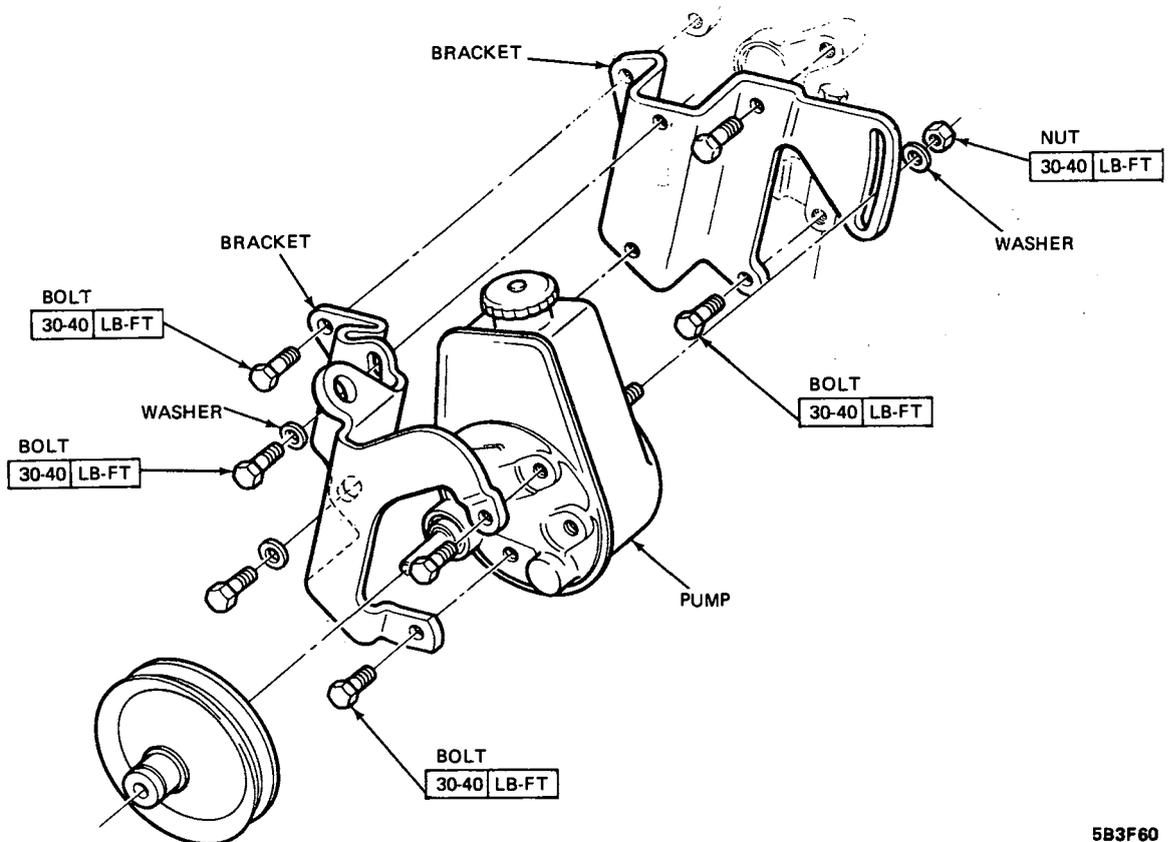
Figure 3F-58 - X Series Power Steering Hose Routing 350 V-8



- 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** AFTER TIGHTENING NUT, PIPE TO LIE AGAINST PUMP AS SHOWN.
- C** HOSES MUST BE INSTALLED TO CLEAR EACH OTHER AND ALL SURROUNDING PARTS, MINIMUM CLEARANCE .50. (RETURN HOSE MUST NOT BE TWISTED DURING INSTALLATION). HOSE ENDS MUST BE KEPT FREE OF DIRT AND OTHER CONTAMINATES.

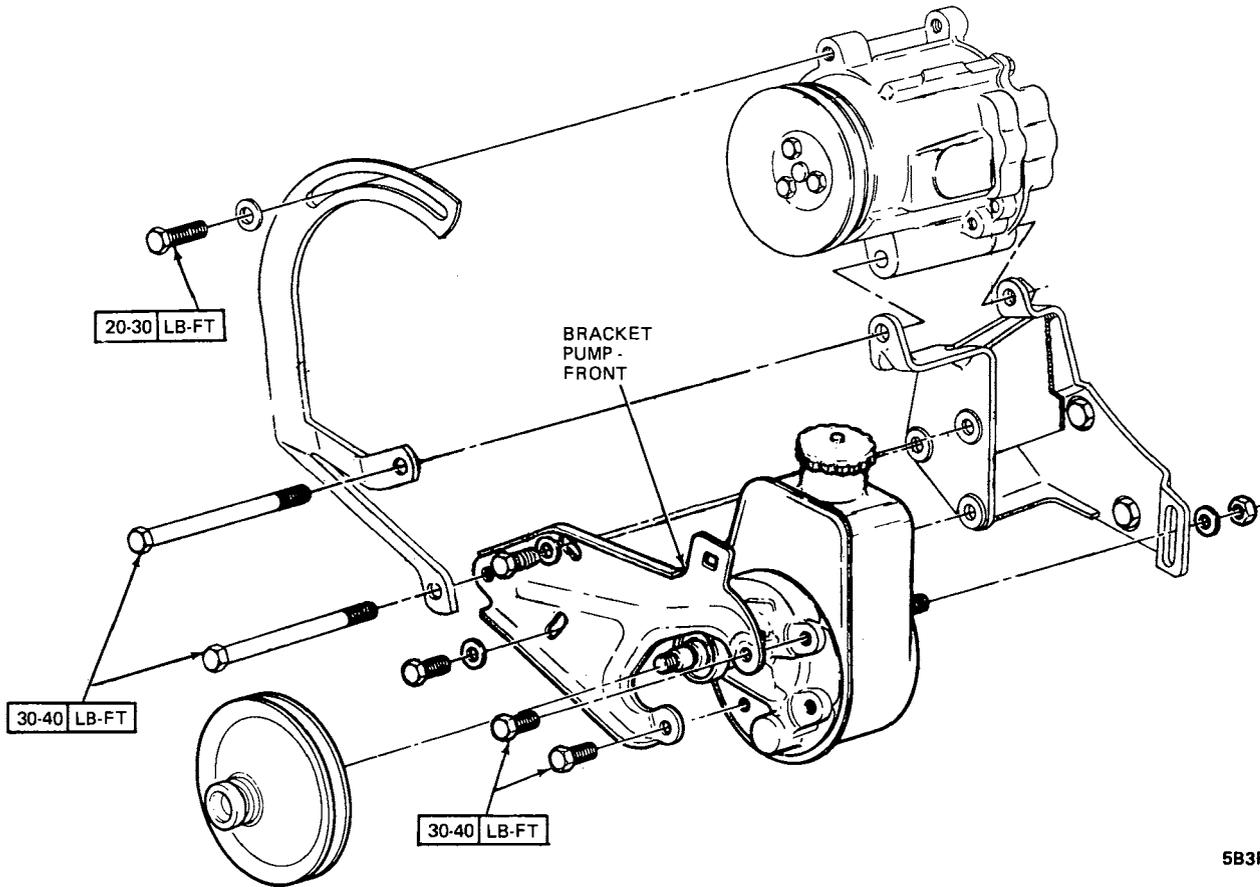
5B3F59

Figure 3F-59 - A and X Series 231 V-6 Power Steering Hose Routing



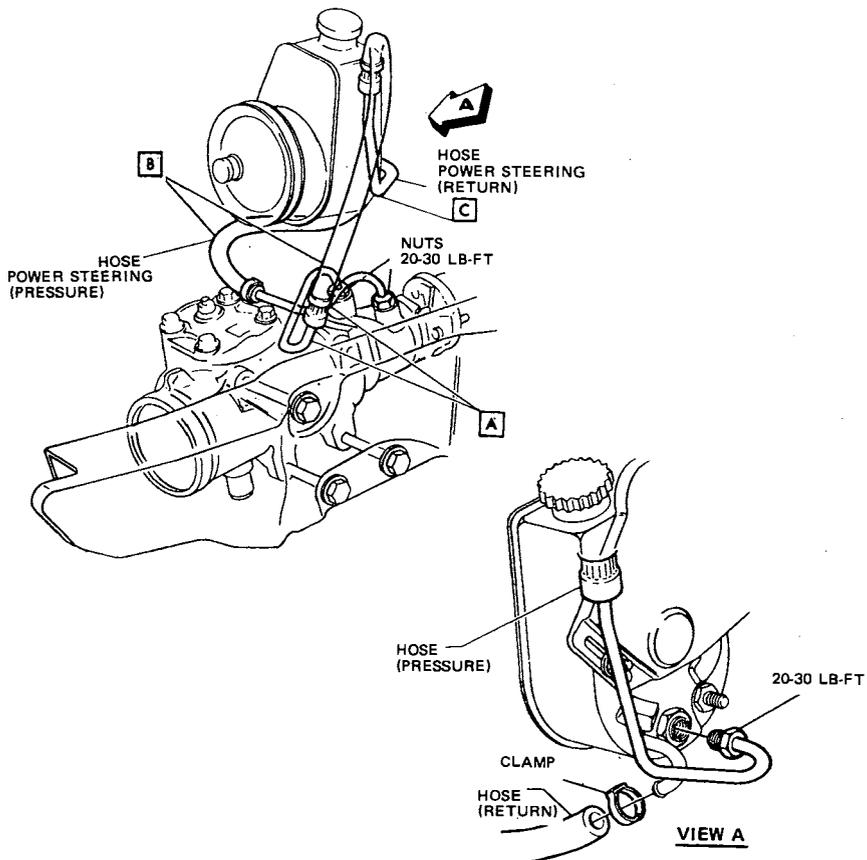
5B3F60

Figure 3F-60 - A-B-C-E Series Pump Mounting 350 and 455 less A.I.R.



5B3F61

Figure 3F-61 - A-B Series Pump Mounting 350 with A.I.R.



- 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.

5B3F62

Figure 3F-62 - A-B Series 350 Hose Routing

- 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.

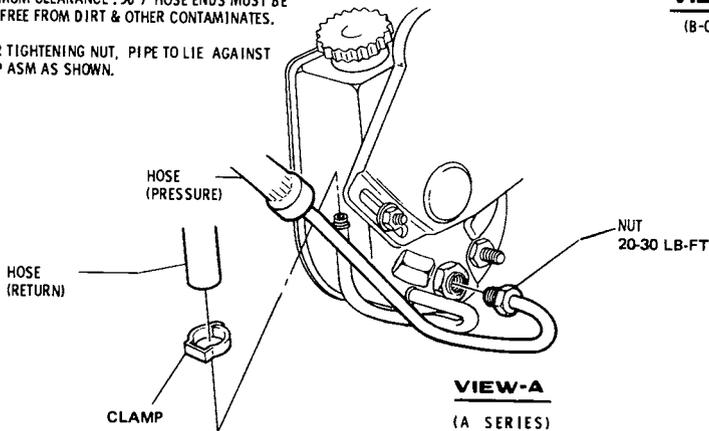
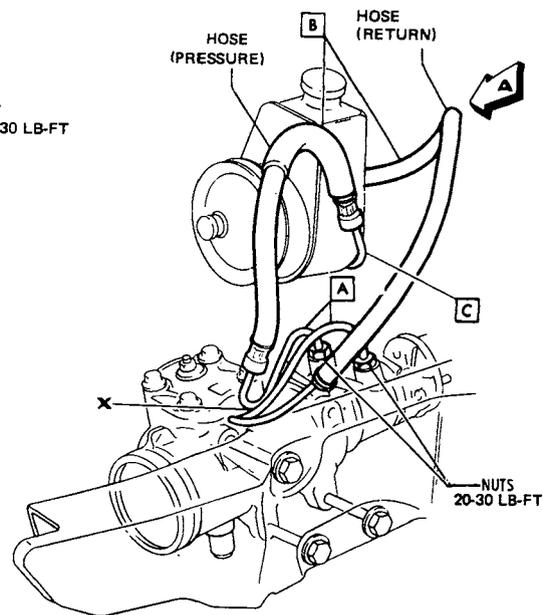
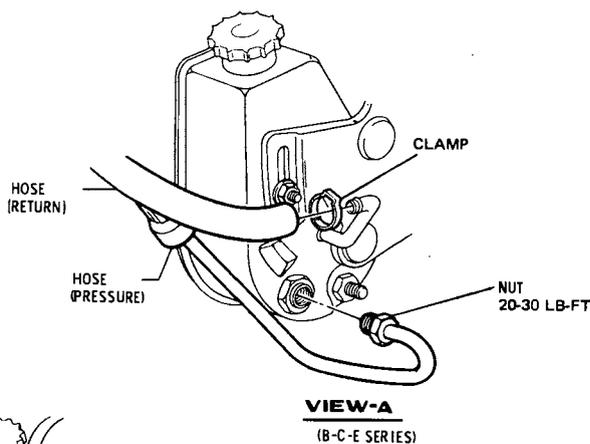
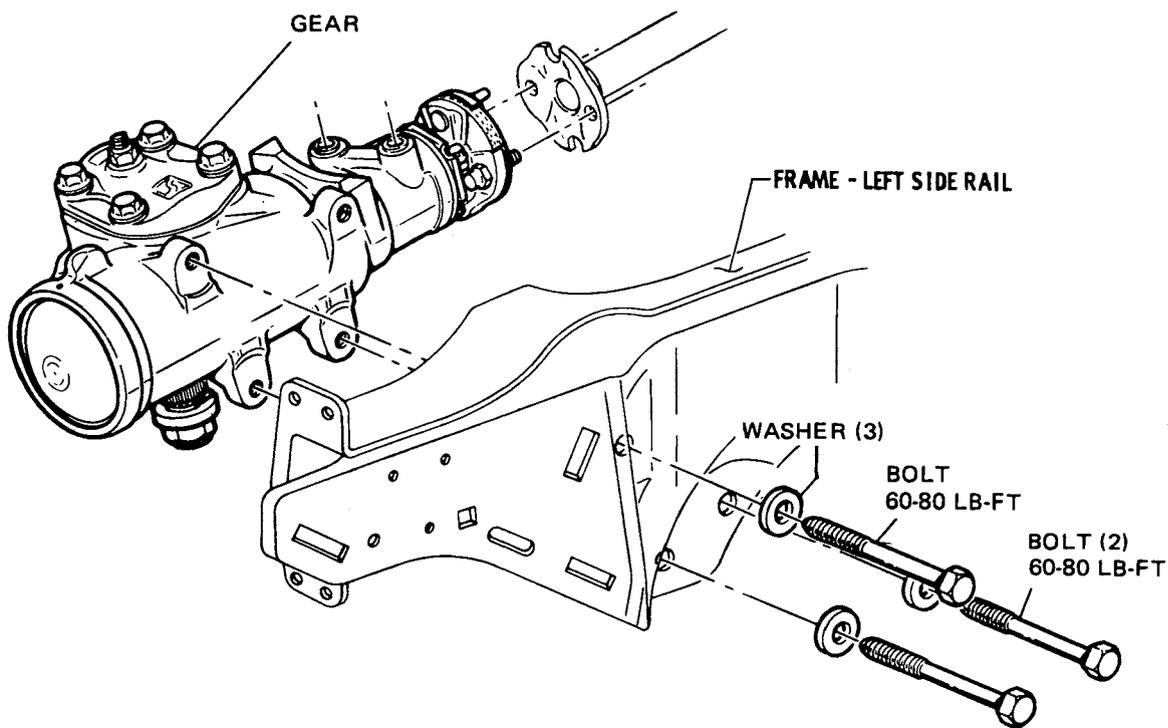
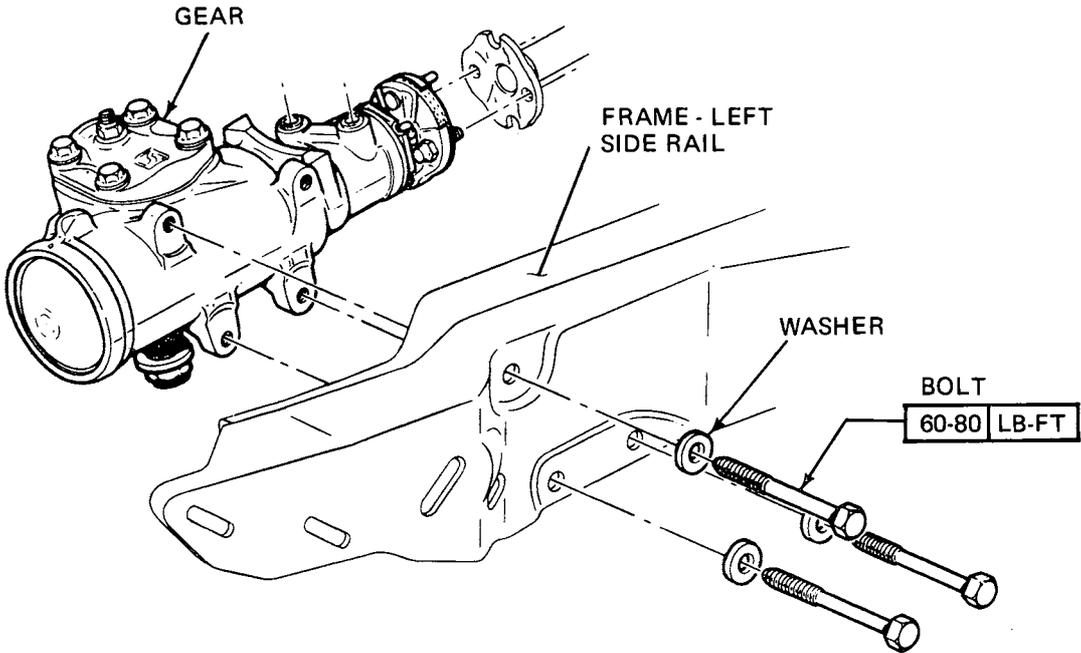


Figure 3F-63 - B-C-E Series Hose Routing 455



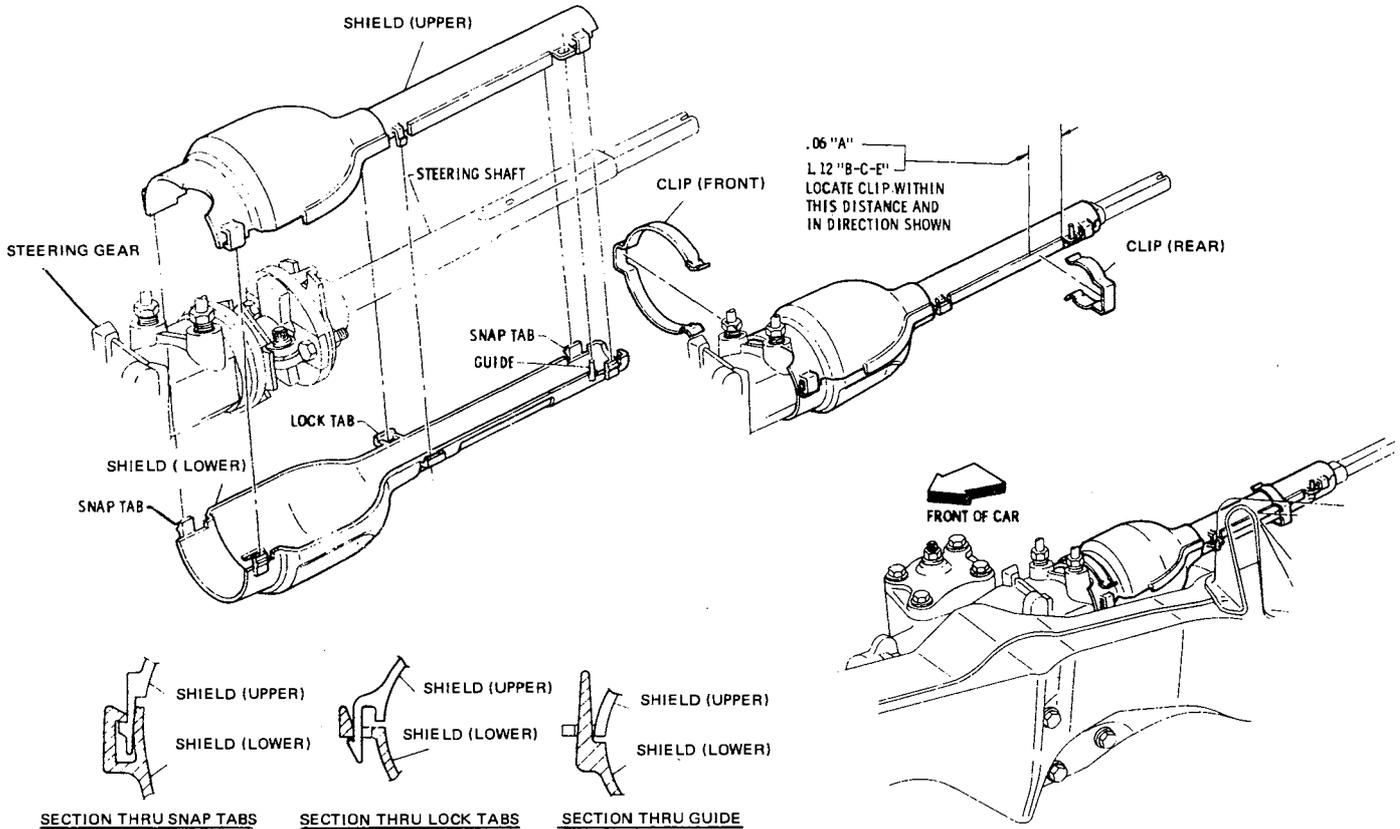
5B3F64

Figure 3F-64 - A Series Power Steering Gear Installation



5B3F65

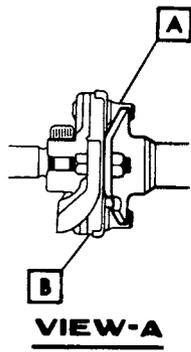
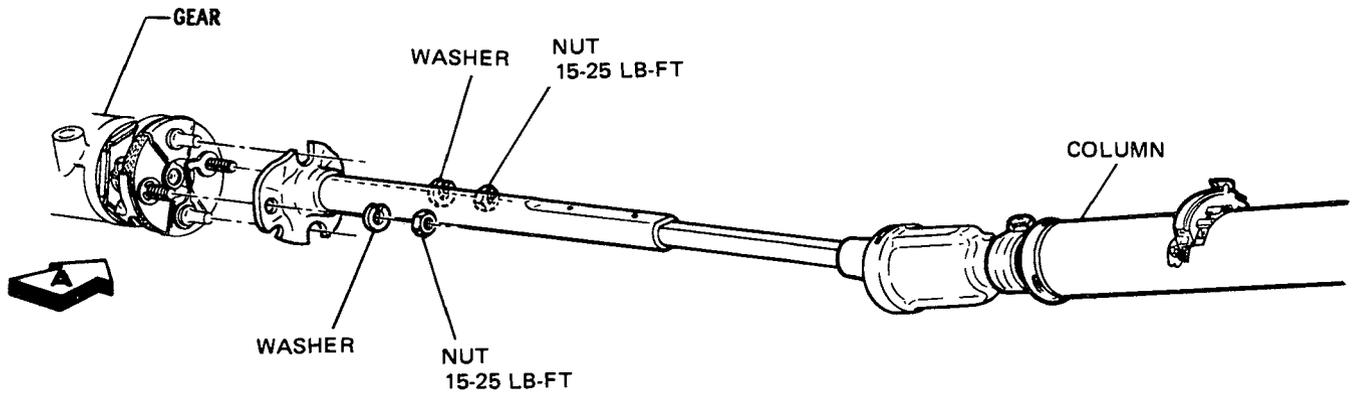
Figure 3F-65 - B-C-E Series Power Steering Gear Installation



ALL SECTIONS ARE IN ASSEMBLED POSITION

5B3F66

Figure 3F-66 - A-B-C-E Series Steering Coupling Shield



- 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 $\pm .060$.

5B3F67

Figure 3F-67 - A-B-C-E Series Steering Gear Coupling