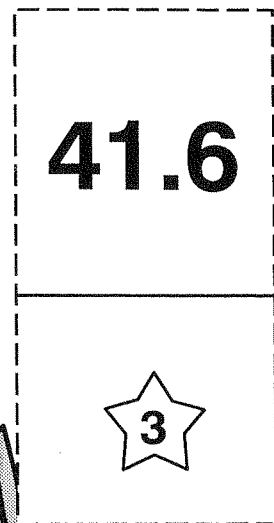
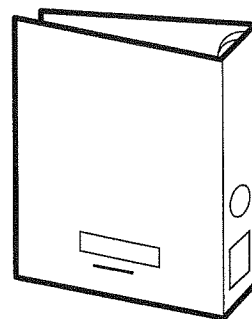
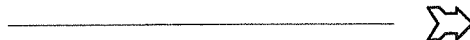
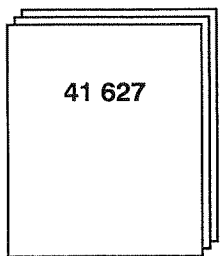


41 627 - AN - 12.1995

STEERING REPAIR SHEPPARD M 83



STEERING REPAIR	VEHICLES
SHEPPARD M 83	S RANGE S 120 S 135 S 150 S 210

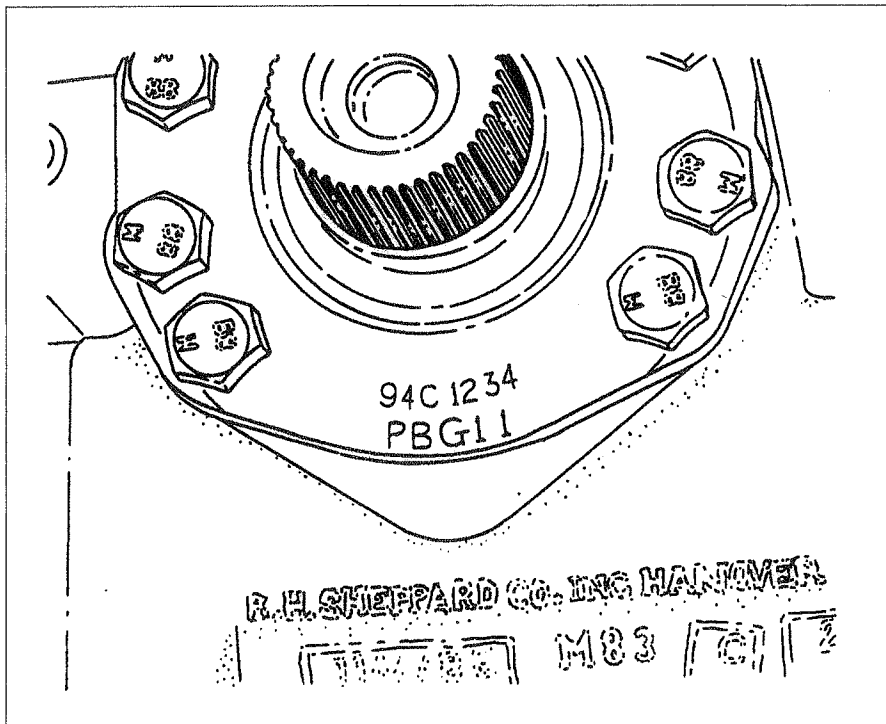
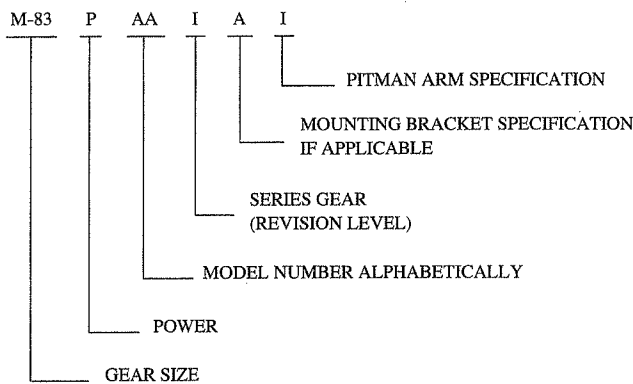


Figure 1

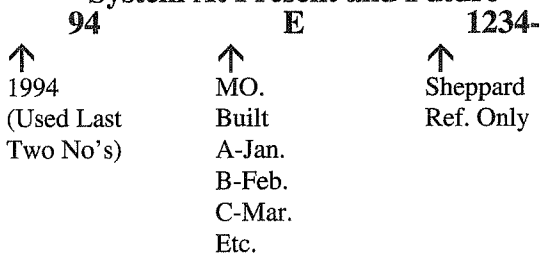
A number is cast into the steering gear housing and identifies the basic family the steering gear belongs to (Figure 1 and Figure 2). Stamped letters and numbers on an exposed machined surface of the housing opposite the mounting side identifies the gear specification; see gear P/N chart below. In the above example the complete identification is Model M-83PADI A I. Cast number M-83 would refer to the M-Series steering gear family.

GEAR P/N CHART



A serial number is also assigned to each steering gear and is interpreted below:

SERIAL NUMBER SYSTEM System At Present and Future



THIS SERIAL NO. IS 94E1234

REPRESENTS:
(94) YEAR BUILT — 1994
(E) MONTH — MAY
(1234) REF. ONLY

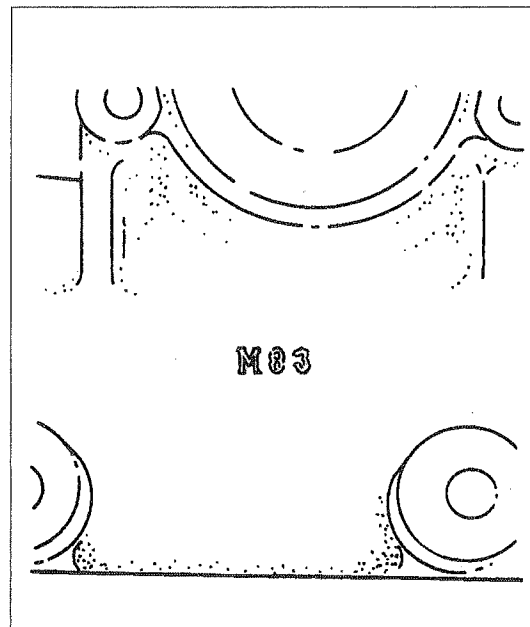


Figure 2

Lubrication – Steering Gears

FLUID RECOMMENDATIONS

The lubricant used in the power steering system lubricates moving parts and removes heat. Too much heat reduces efficiency and increases wear. It is important to use the lubricant specified by the Vehicle Manufacturer and approved by the R. H. Sheppard Co., Inc.

The R. H. Sheppard Co. recommends the use of Dexron II Automatic Transmission Fluid for Sheppard M83 steering gears.

LUBRICATION – BEARING CAP COVER (If Equipped)

A grease fitting is provided to remove contaminants from the salt seal in the bearing cap cover. Add chassis grease with low pressure when the vehicle is serviced.

⚠ CAUTION

Use only a hand or low pressure air grease gun when servicing the bearing cap fitting (Figure 3). Grease at high pressure will push the salt seal out of the cover.

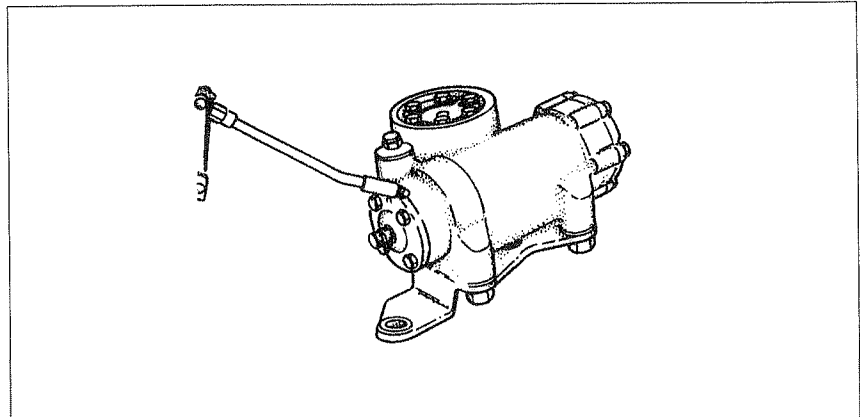


Figure 3

TORQUE SPECIFICATIONS

DESIGNATION	SIZE	GRADE	FT. LBS.	(Nm)
Cylinder Head	M10 x 1.5	10.9	58	(79)
Bearing Cap Cover	M10 x 1.5	10.9	58	(79)
Sector Shaft Cover	M8 x 1.25	10.9	30	(41)
Bracket	M18 x 1.5	10.9	260	(350)
Pitman Arm Retainer	—	—	225	(310)

Bleeding

PROCEDURE

1. Park the vehicle on a solid surface.
2. Raise the cab.
3. Make sure the reservoir is full.
4. Start the engine and allow the engine to run at idle.



WARNING

BEFORE STARTING THE ENGINE REFER TO THE VEHICLE MANUFACTURERS SERVICE MANUAL FOR INSTRUCTIONS AND CAUTIONS.

5. Turn the wheels from lock to lock.
6. If you have changed the steering gear, it is necessary to adjust the relief plungers.
7. Check the fluid level in the reservoir and fill if necessary.
8. Shut the vehicle off.
9. Lower the cab following the vehicle manufacturer's procedure.

Set Relief Plungers

Relief plunger adjustment should be checked during pre-delivery. Anytime tire size or steering gears are changed; relief plunger adjustment will be necessary. A relief plunger is located in each end cap of the steering gear (Figure 4 and Figure 5). One for right turn; one for left turn.

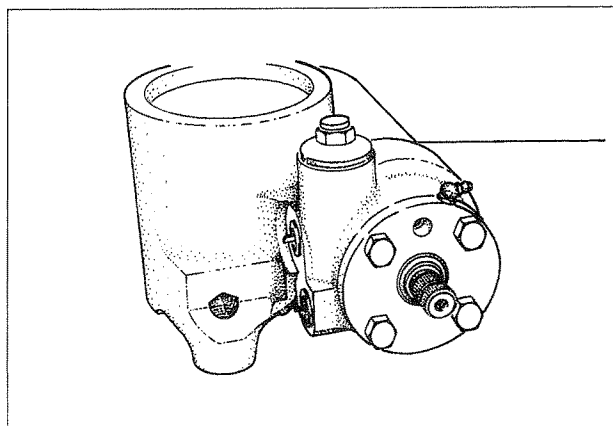


Figure 4

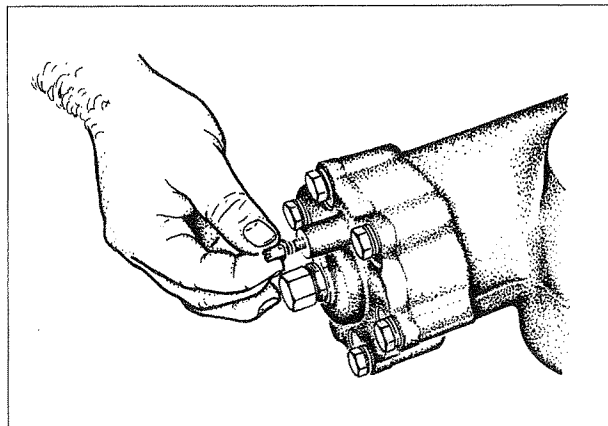


Figure 5

PROCEDURE:

NOTE:

Never attempt to adjust relief plungers until the axle stops are set following Vehicle Manufacturers Specifications.

1. Park the vehicle on a clean, dry, solid surface, preferably concrete. Set the parking brake and block the wheels.
2. Place the transmission in neutral and start the engine.
3. Allow the engine to operate at idle speed.

NOTE:

It is always best to have 2 people when setting plungers. 1 to steer the vehicle and 1 to set and check adjustments.

4. Locate the plungers.
5. Determine which plunger is used to adjust right and left turns based on direction of Pitman Arm travel.
6. Turn the steering wheel to a full left turn and check the clearance using the steel flat stock as a feeler gauge between the axle stop bolt and the axle. If the clearance is not 1/8", plunger adjustment will be necessary.

▲ WARNING

IF THE STOP BOLT HITS THE AXLE UNDER PRESSURE RELEASE THE WHEEL IMMEDIATELY! DAMAGE TO STEERING COMPONENTS MAY RESULT.

7. Return the front tires to the straight ahead position and release the steering wheel. Using the screwdriver, adjust the plunger for left turn. Turning the plunger in will increase the clearance between the stop bolt and the axle, while turning the plunger out will decrease the clearance.

▲ WARNING

NEVER ADJUST THE PLUNGER BEYOND FLUSH WITH THE END CAP. LEAKAGE OR PERSONAL INJURY MAY RESULT.

8. Turn the steering wheel to a full left turn. Check the 1/8" clearance using the steel flat stock as a feeler gauge.

▲ WARNING

THE FLAT STOCK IS USED AS A FEELER GAUGE ONLY. DO NOT SQUEEZE OR PINCH THE FLAT STOCK BETWEEN THE STOP BOLT AND AXLE. DAMAGE TO PARTS MAY RESULT.

9. If further adjustment is required, repeat steps 7 & 8 until the 1/8" clearance is achieved.
10. Repeat steps 6 thru 9 for the right turn.

Common Procedures

This section of the service manual covers repairs that do not require removal of the power steering gear. Before you attempt repairs, read the procedure, make sure you have all the parts, tools and information needed to finish the job. Always refer to the Vehicle Manufacturer's Service Manual and any service bulletins covering the vehicle you are working on.

WARNING

REPAIRS TO HEAVY DUTY POWER STEERING SYSTEMS MUST BE MADE BY HIGHLY TRAINED PROFESSIONAL MECHANICS.

FAILURE TO FOLLOW SAFETY PROCEDURES COULD RESULT IN LOSS OF STEERING, ACCIDENT DAMAGE OR PERSONAL INJURY.

PREVENTIVE MAINTENANCE

PARTS REQUIRED:

Specified steering fluid
Specified filter

DRAIN

1. Park the vehicle on a clean, dry, solid surface. Set the parking brake, block the rear wheels and place the transmission in neutral.
2. Tilt the hood or raise the cab using the procedure in the Vehicle Manufacturer's Service Manual.
3. Raise the front end of the vehicle until the tires have cleared the surface using the hydraulic jack.
4. Place the drain pan under the steering gear to catch the fluid.
5. Remove the pressure and return lines from the steering gear to drain fluid.
6. Wipe off the area around the reservoir cap with a clean towel. Remove the cover bolt from canister type reservoirs. Remove the cover.
7. Remove the filter from the canister and discard.
8. Wipe the inside of the reservoir canister clean with a clean shop towel.
9. With the hoses disconnected, slowly turn the steering wheel from full left to full right three or more times to purge oil from the steering gear. Make sure the drain pan will catch the oil from the steering gear.

REFILL

10. Attach the pressure and return lines to the steering gear and tighten.
11. Install a new filter element in the reservoir. Follow the directions on the filter element and refer to the Vehicle Manufacturer's Service Manual.

CAUTION

Do not allow the reservoir to empty during start up. Pump damage may result.

Pitman Arm Removal

PROCEDURE

1. Park the vehicle on a dry solid surface. Set the parking brake and block the wheels.
2. Remove the steering gear from the vehicle.
3. Bend the tabs out of the retainer (Figure 6).

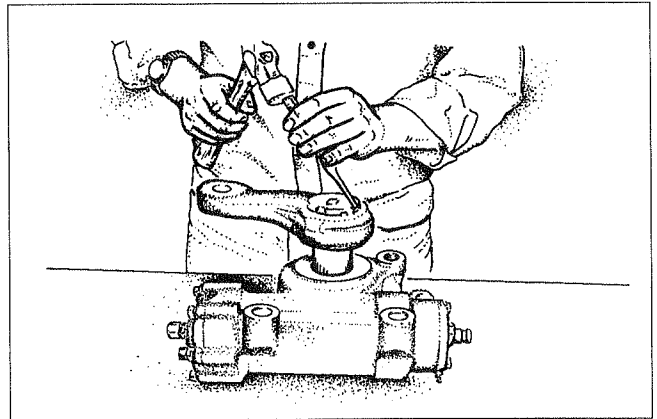


Figure 6

4. Remove the retainer (Figure 7).

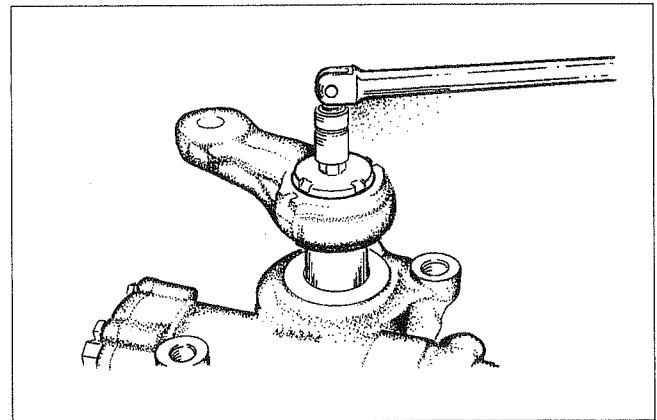


Figure 7

5. Remove the Pitman arm using a three jaw puller (Figure 8).

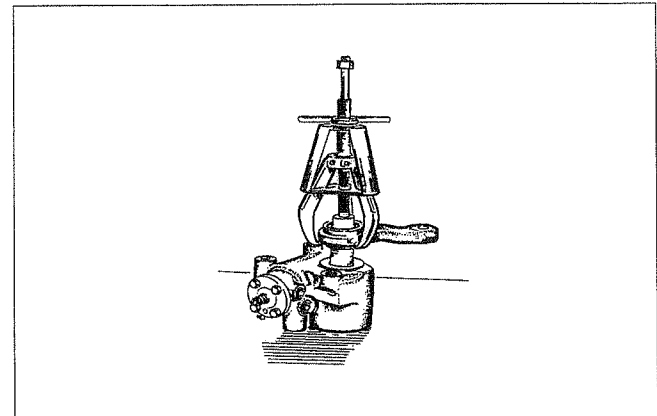


Figure 8

Pitman Arm Installation

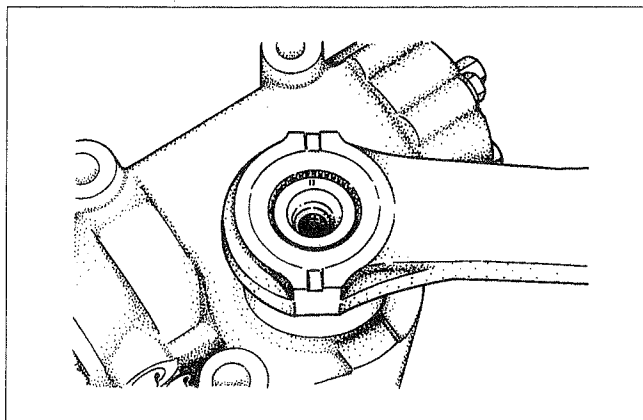


Figure 9

PROCEDURE

1. Install the Pitman arm on the sector shaft. Align the timing mark on the arm with the timing mark on the sector shaft (Figure 9).
2. If necessary, replace the Pitman arm retainer.

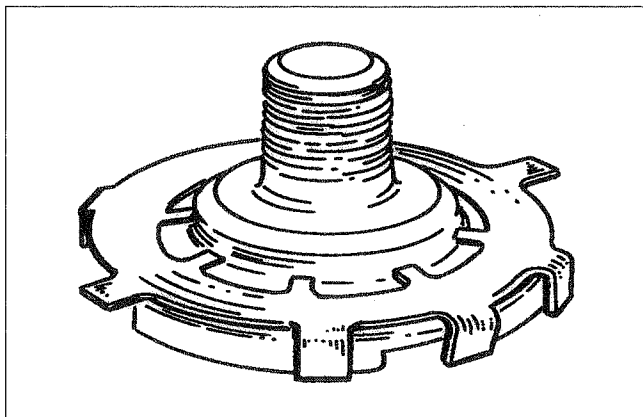


Figure 10

3. Apply never seize compound to the threads of the retainer and both sides of the friction washer (Figure 10).

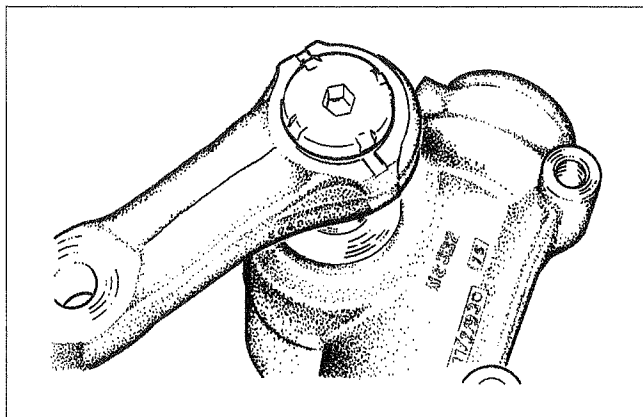


Figure 11

4. Screw the retainer into the sector shaft, aligning the tabs of the retainer with the notches of the Pitman arm (Figure 11).

5. Torque the retainer to 310Nm (225 ft. lbs.) (Figure 12).

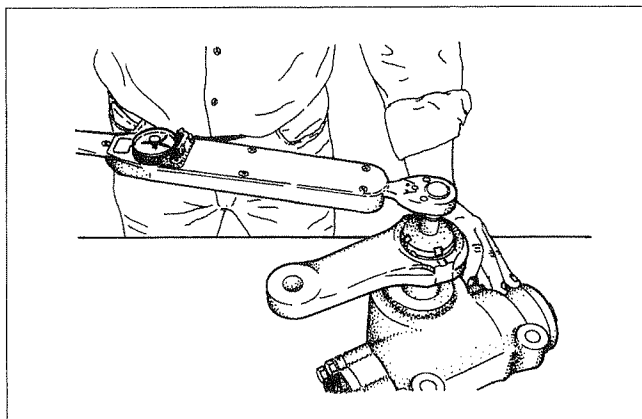


Figure 12

6. After reaching the specified torque, continue tightening the retainer until two restraining tabs align with two notches in the retainer (Figure 13).

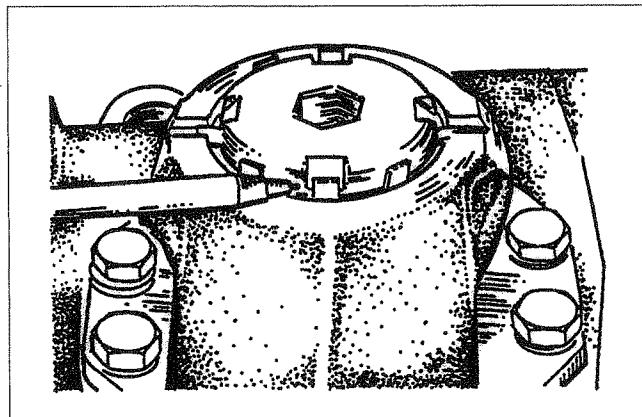


Figure 13

⚠ WARNING

IF THE TABS DO NOT LINE UP, TIGHTEN BEYOND THE SPECIFIED TORQUE VALVE UNTIL TWO TABS ALIGN. NEVER BACK OFF THE RETAINER TO ALIGN THE RESTRAINING TABS!

7. Bend the tabs into the retainer (Figure 14).

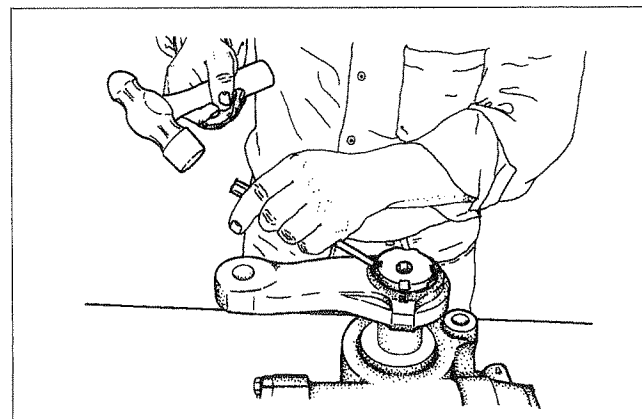


Figure 14

Seal Replacement

PREPARATION FOR REPAIRS

The diagnosis and troubleshooting section of this manual has been prepared to help with proper diagnosis.

IMPORTANT:

The Sheppard integral power steering gear is a precision machined assembly and care must be taken during repair to keep it free of dirt and foreign material. All internal parts must be handled carefully to avoid damages to machined surfaces. Nicks or burrs can cause damage to mating parts and must be removed with a fine hand stone before reassembly. Working on a soft cardboard or plywood surfaced workbench is best. Follow disassembly procedures as required.

CLEANING & INSPECTION

Cleaning

Cleanliness is important. Dirt and foreign material that gets into the steering system during repair operations can cause damage or a possible steering malfunction at a later date. Due to the close tolerances between mating parts it is best to have all parts at the same temperature for reassembly.

Clean the machined parts individually to avoid damage caused by “bumping” together. Use clean solvent to wash parts. Dry the parts with compressed air. Nicks or burrs must be removed with a fine hand stone before assembly. Use clean lubricant to coat parts for assembly.

All hoses, lines and the reservoir should be cleaned before reinstalling a repaired steering gear or after pump replacement. Replace the filter element or cartridge.

Inspection

Make a careful visual inspection of all steering gear parts. Replace worn parts as well as any parts that show signs of stress or fatigue.

DANGER

STEERING GEARS THAT HAVE BEEN DAMAGED IN AN ACCIDENT MUST BE REPLACED. IMPACT LOADS TRANSMITTED THROUGH THE FRONT AXLE AND STEERING LINKAGE INTO THE STEERING GEAR CAN STRESS PARTS TO A POINT JUST SHORT OF FAILURE. FURTHER USE IS UNSAFE AND THE STEERING GEAR ASSEMBLY AND PITMAN ARM MUST BE REPLACED. DISTORTED PITMAN ARMS, TWISTED SECTOR SHAFTS, BROKEN OR CRACKED RACK AND PINION GEAR TEETH ARE SOME SIGNS OF IMPACT DAMAGES. BROKEN OR DAMAGED MOUNTING BRACKETS MUST BE REPLACED.

Input Shaft Seal Replacement

⚠ IMPORTANT

Do not remove the steering gear for this repair (Figure 15).

DISASSEMBLY

1. Park the vehicle on a clean dry solid surface. Apply the parking brake. Place the transmission in neutral.
2. Raise the cab. Remove the pinch bolt from the universal joint and remove the universal joint from the input shaft.
3. Place a drain pan under the steering gear. Draining the system is not necessary but some fluid will be lost.
4. Loosen and remove the 4 bearing cap cover bolts. Remove the bearing cap cover (Figure 16).

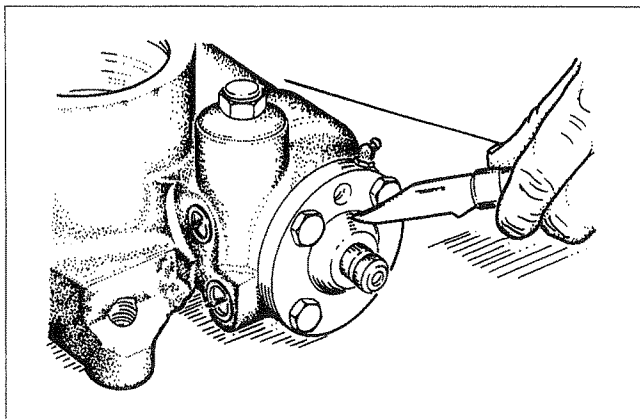


Figure 15

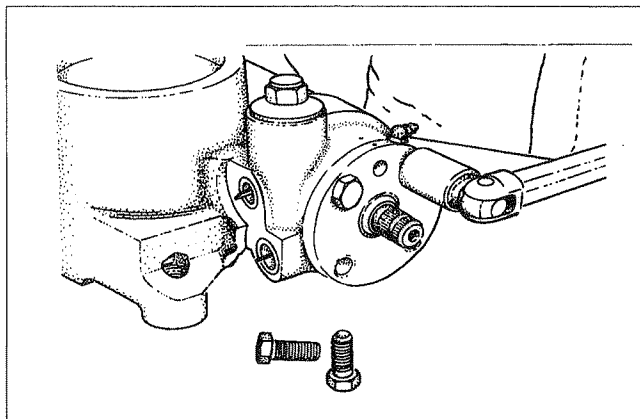


Figure 16

5. With a screw driver lightly pry the salt seal out of the braking cap cover (Figure 17).

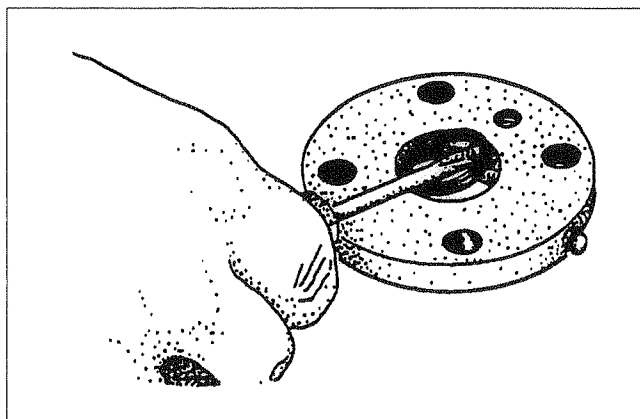


Figure 17

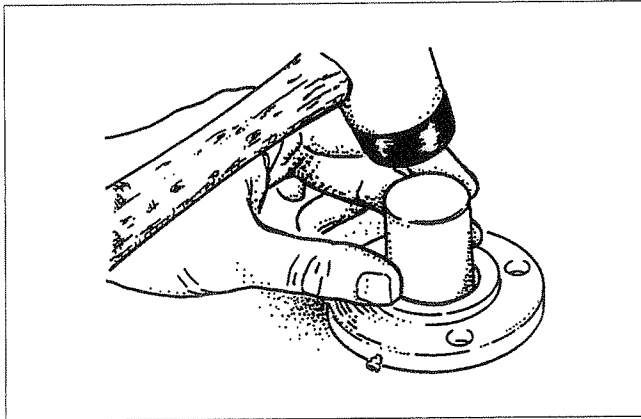


Figure 18

6. Using a suitable size socket and hammer to drive the seal out of the bearing cap cover. Discard the seal (Figure 18).
7. Remove the bearing cap cover O-ring.
8. Clean the bearing cap cover with a suitable solvent and blow it dry using low pressure air.

Reassembly

1. Using the appropriate size seal driver, install the seal (Figure 19).

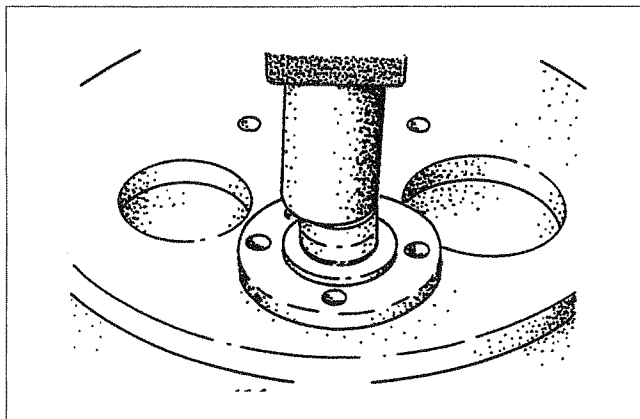


Figure 19

2. Install a new O-ring on the bearing cap cover, coat the seal with grease or oil (Figure 20).

CAUTION

Before installing the bearing cap cover, tape the splines of the input shaft to prevent damage to the seal during installation.

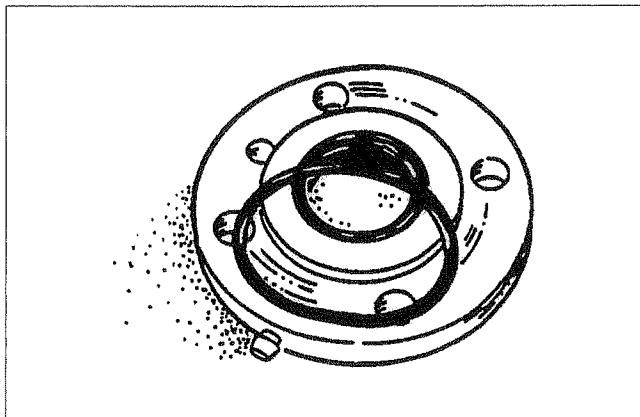


Figure 20

3. Install the bearing cap cover (Figure 21) on the steering gear taking care to align the plunger hole with the plunger in the gear.

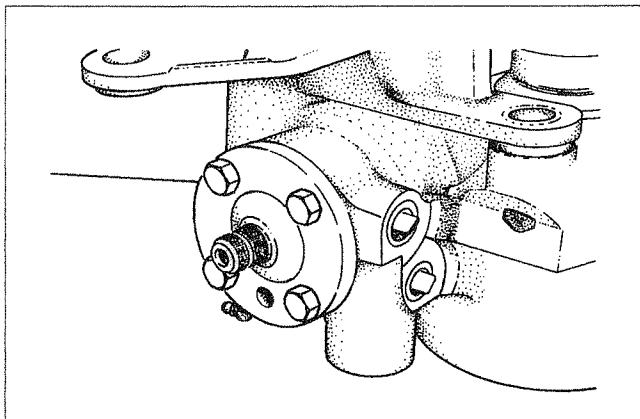


Figure 21

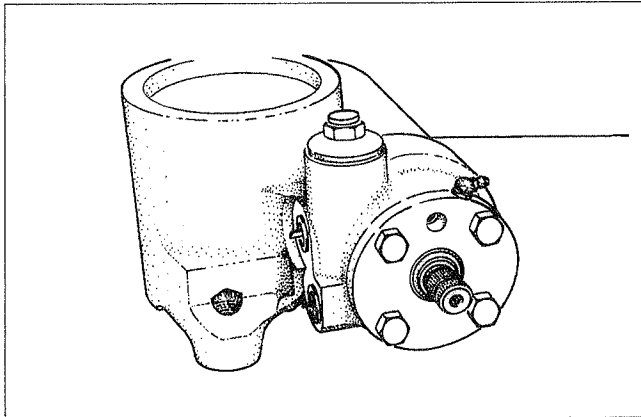


Figure 22

4. Install the salt seal over the input shaft ensuring the lip faces outward. Push the salt seal into the bearing cap cover until it is flush with the face of the cap (Figure 23).

⚠ WARNING

DO NOT EXCHANGE BEARING CAP COVERS BETWEEN STEERING GEARS. MIXING OF COMPONENTS COULD CAUSE STEERING GEAR LOCK UP.

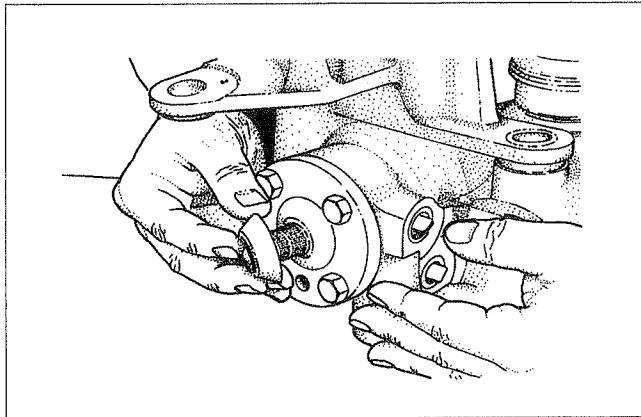


Figure 23

5. Remove the tape from the input shaft splines.
6. Install the dust shield on the input shaft.
7. Slide the lower yoke of the steering shaft onto the input shaft. Align the timing mark of the input shaft with the timing mark of the U-joint.
8. Install the pinch bolt and torque to 50Nm.
9. Grease the input shaft.
10. Check the oil level.
11. Start the vehicle and allow it to idle. Check for leaks.
12. Shut the engine down after checking for leaks. check fluid level.

Lower the cab to the driving position.

Sector Shaft Seal Replacement

1. Using a screwdriver, remove the plungers from the steering gear.
2. Remove the bracket (Figure 24).

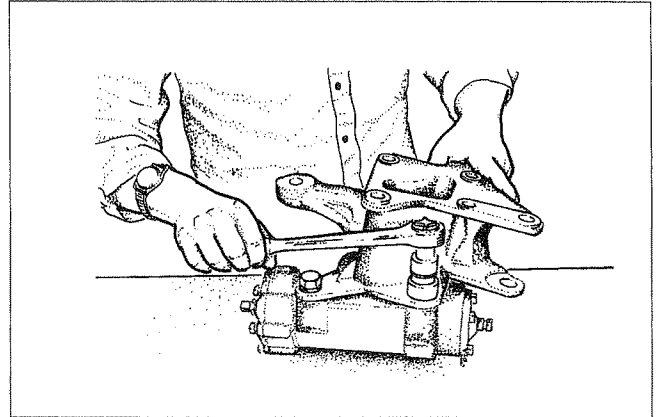


Figure 24

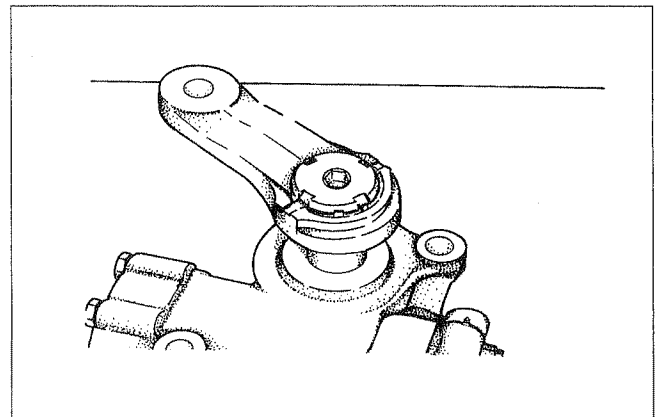


Figure 25

3. Remove the Pitman arm (Figure 26).

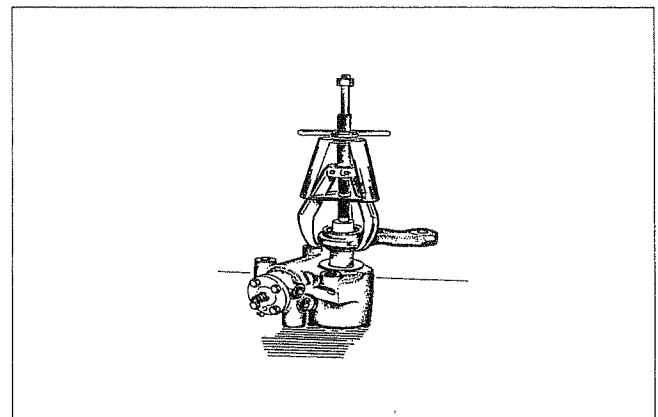


Figure 26

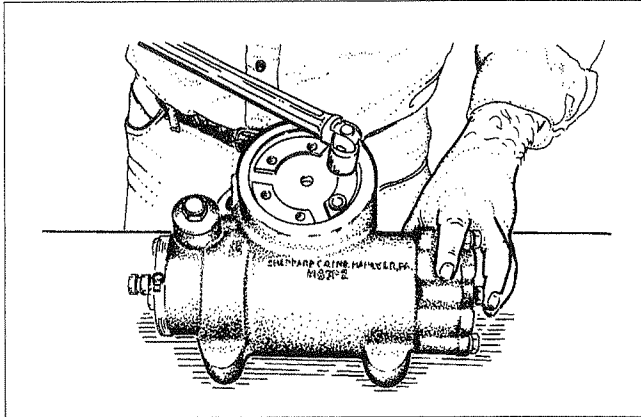


Figure 27

4. Remove the rubber plug from the sector shaft cover. Remove the 6 bolts from the sector shaft cover using a 13mm socket (Figure 27).

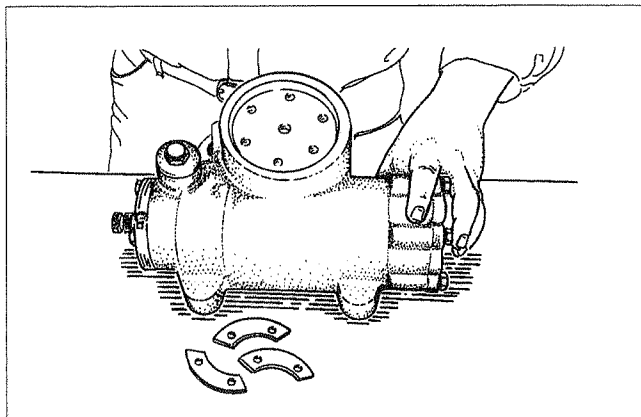


Figure 28

5. Remove the 3 retaining clips from the sector shaft cover as shown (Figure 28).

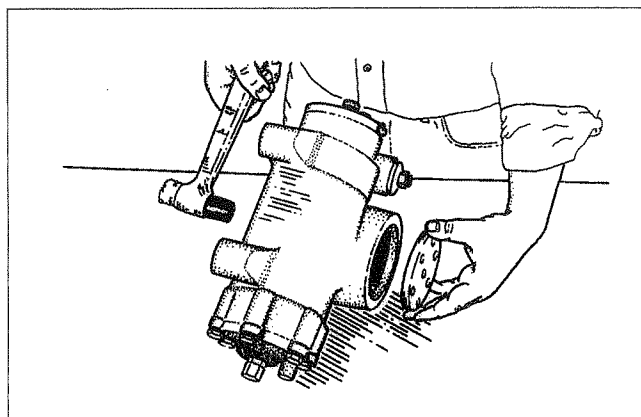


Figure 29

6. Using a soft hammer, tap on the end of the sector shaft to remove the cover and sector shaft (Figure 29).

Sector Shaft Seal Installation

1. Install a new seal in the housing with the blue side of the seal toward the outside of the gear (Figure 30).

NOTE:

A light coat of grease or oil on the seal will make installation easier.

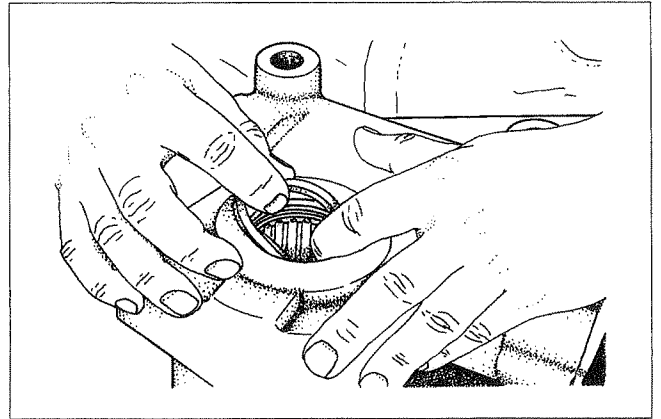


Figure 30

2. Locate the timing mark on the piston and center the piston in the sector shaft bore (Figure 31).

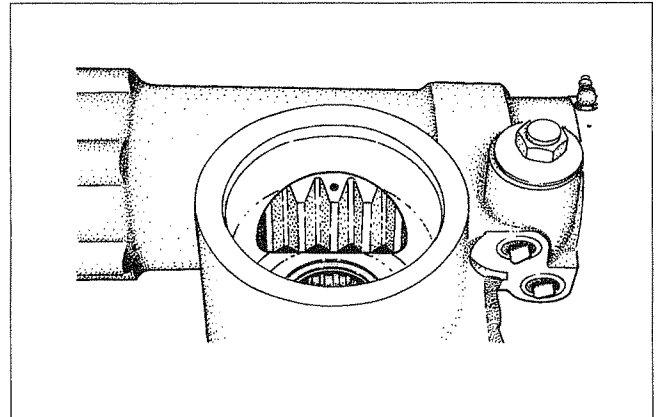


Figure 31

3. Install the sector shaft (Figure 32).

⚠ IMPORTANT

The timing mark on the sector shaft must line up with the timing mark on the piston rack.

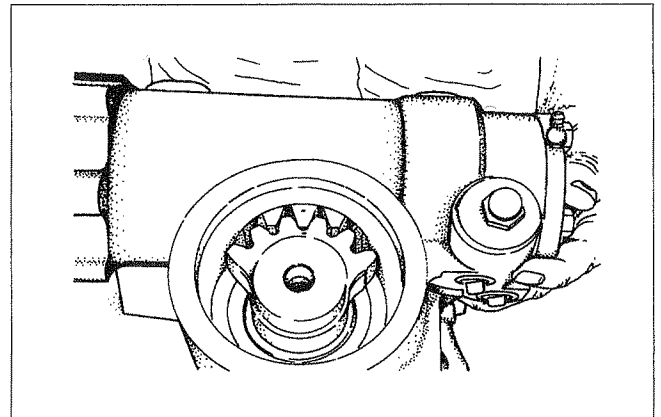


Figure 32

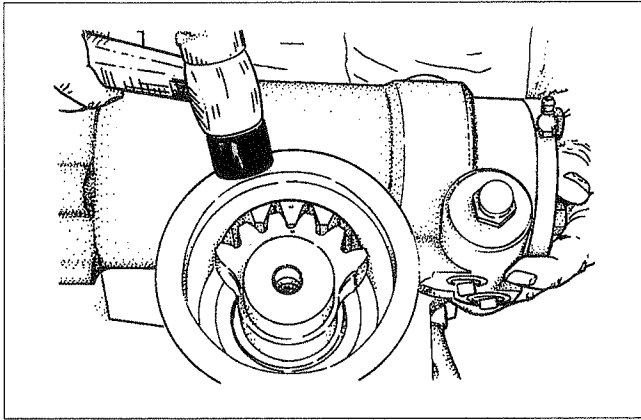


Figure 33

4. It will be necessary to tap the end of the sector shaft with a soft hammer to ensure proper engagement of the rack and pinion (Figure 33).

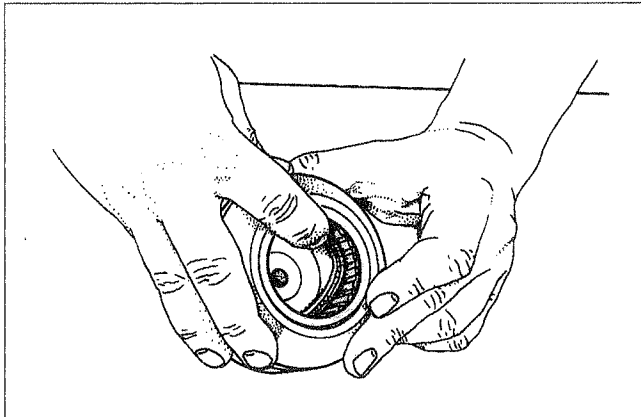


Figure 34

5. Install a new seal in the bore of the sector shaft cover. Insure the blue side of the seal faces outward.

NOTE:

A light coat of grease or oil on the seal will make installation easier.

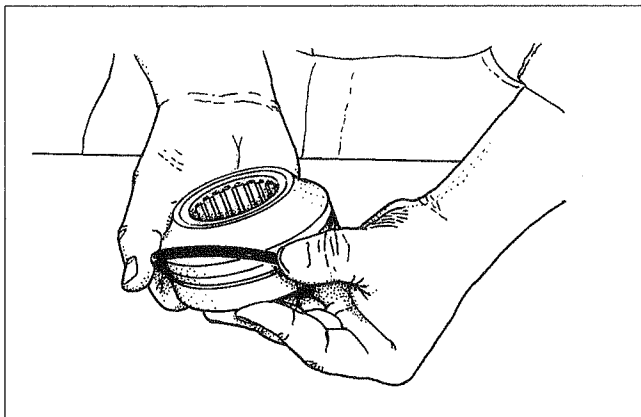


Figure 35

6. Install a new O-ring in the groove of the sector shaft cover (Figure 34 and Figure 35).

NOTE:

A light coat of grease or oil will make installation of the seal easier.

7. Install the sector shaft cover. Install the plug in the cover (Figure 36).

NOTE:

When the cover is properly installed the cover will be slightly below the groove for the cover retaining clips.

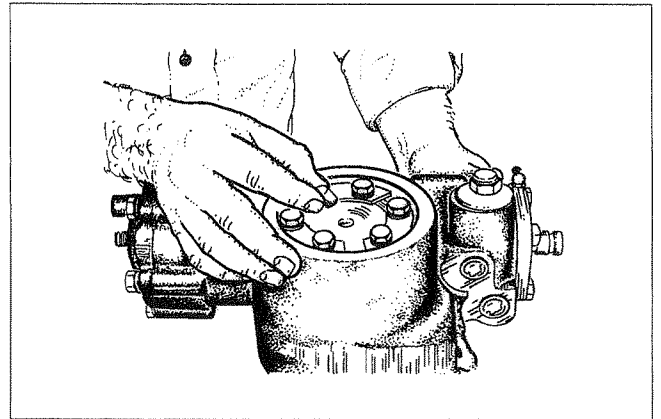


Figure 36

8. Install the three cover retaining clips. Install the six cover retaining bolts and torque to 41Nm (Figure 37).

! IMPORTANT

The sector shaft cover will turn. You must hold the cover in place to ensure proper torque on the bolts. Install the dust shield under the Pitman arm.

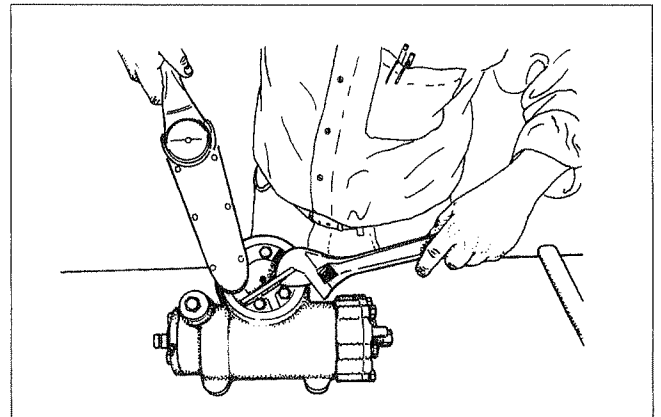


Figure 37

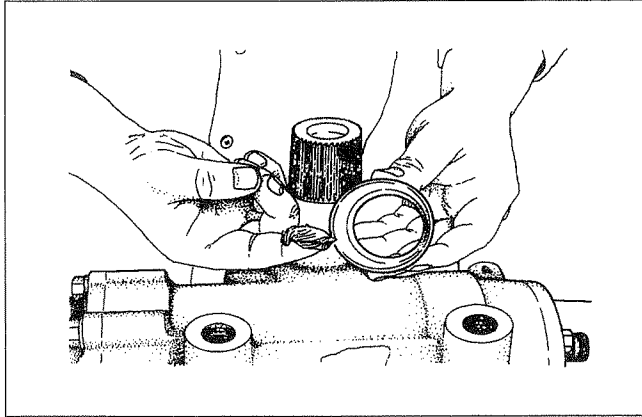


Figure 38

9. Install the relief plungers.

NOTE:

The longer plunger will be installed in the input shaft end of the gear (Figure 38 and Figure 39).

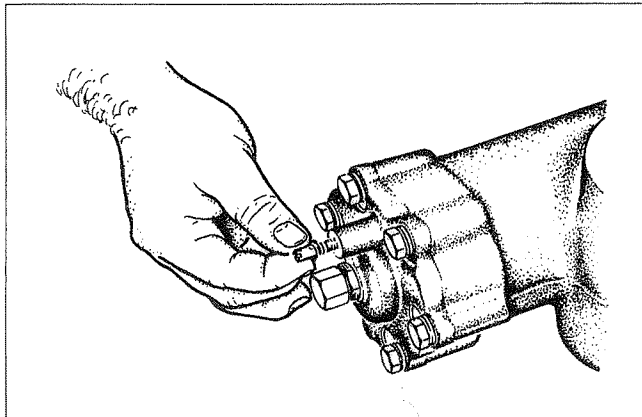


Figure 39

Reassembly

1. Position indexed brg. assy. in the cover and roll pin in its housing (Figure 40).

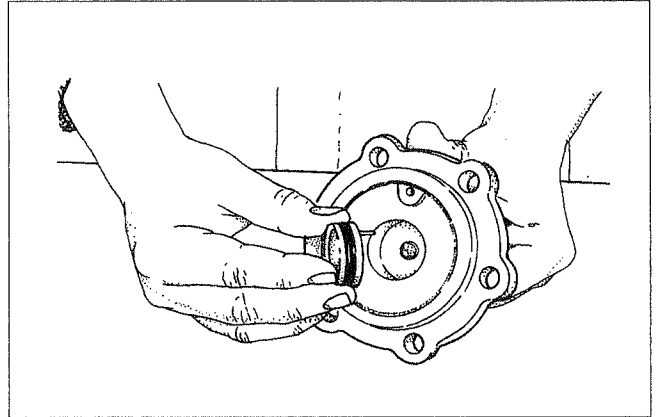


Figure 40

2. Reassemble the inferior (cyl. head) cover and torque to 79Nm (Figure 41).

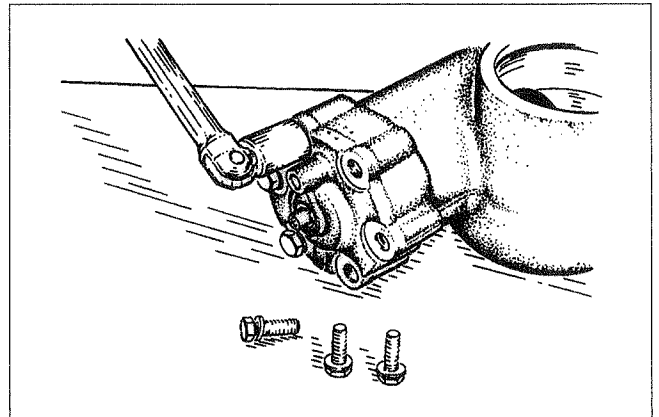


Figure 41

3. Tighten the adj. screw to 11.3Nm with a 6mm allen wrench in order to tighten (fasten) the indexed brg. assy. Unscrew the adj. screw (Figure 42).

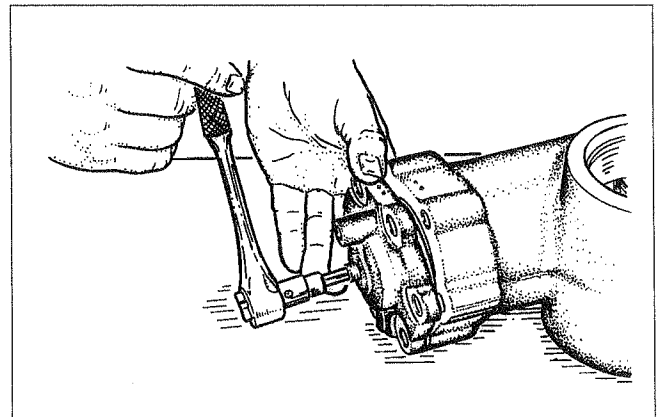


Figure 42

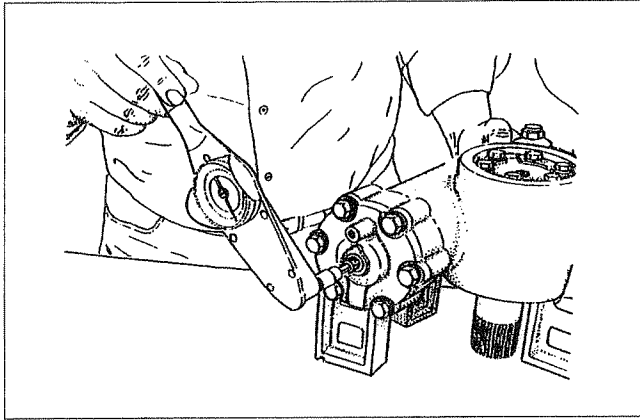


Figure 43

4. Tighten the adj. screw to 3.4Nm (Figure 43).

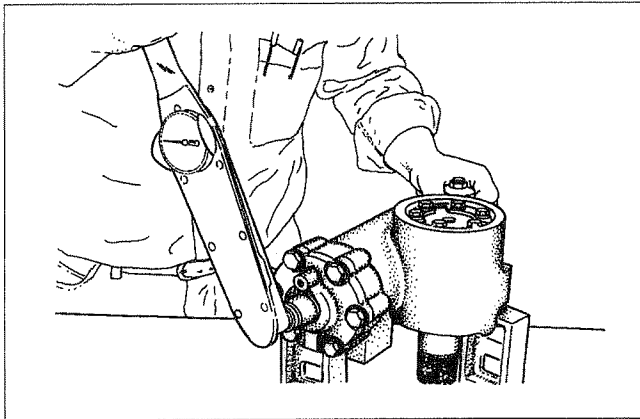


Figure 44

5. Tighten the locknut to 3.4Nm (Figure 44).

Cylinder Head Seal Replacement

1. Remove the cylinder head (Figure 45).
2. If necessary, change the O-ring in indexed brg. assy.

NOTE:

Do not drop the adjusting ring and the roller brg.

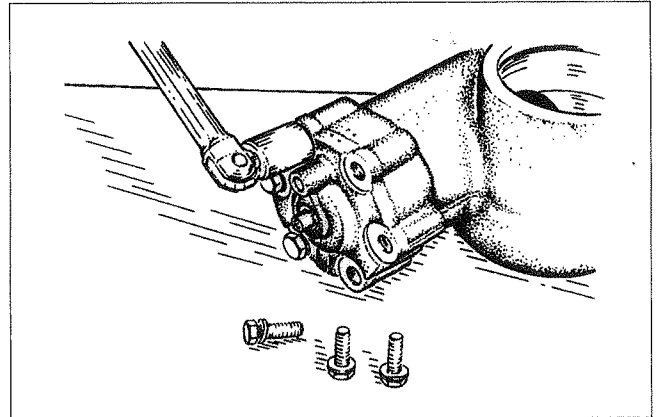


Figure 45

3. For that, unscrew the cover of the adj. screw. Unscrew the locknut of the adj. screw (Figure 46 and Figure 47).

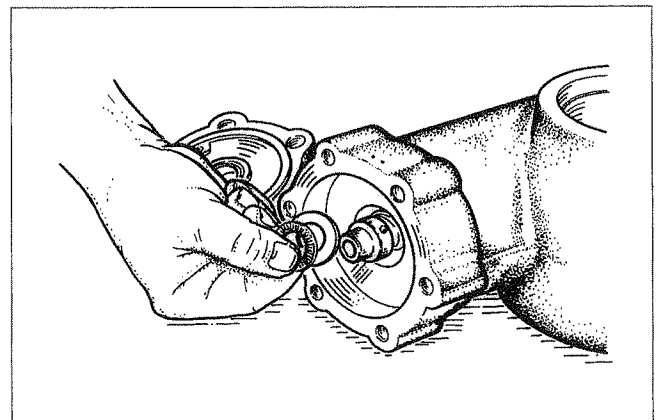


Figure 46

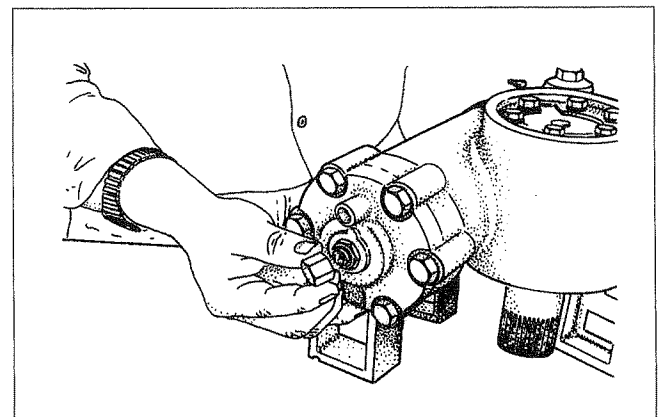


Figure 47

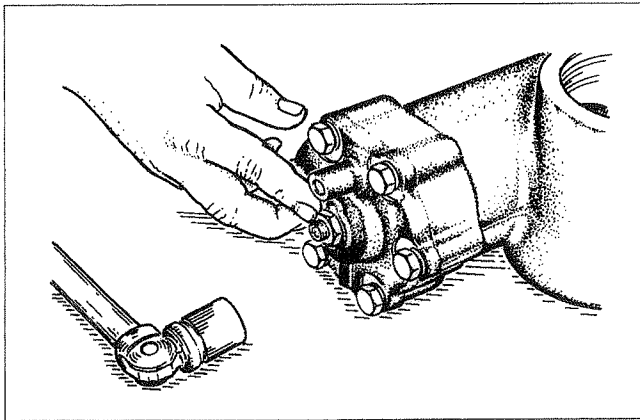


Figure 48

4. Tighten the adj. screw with a 6mm allen wrench to lift off the indexed brg. Change O-ring (Figure 48).

⚠ WARNING

A light coat of grease on the seal will keep it in place during assy.

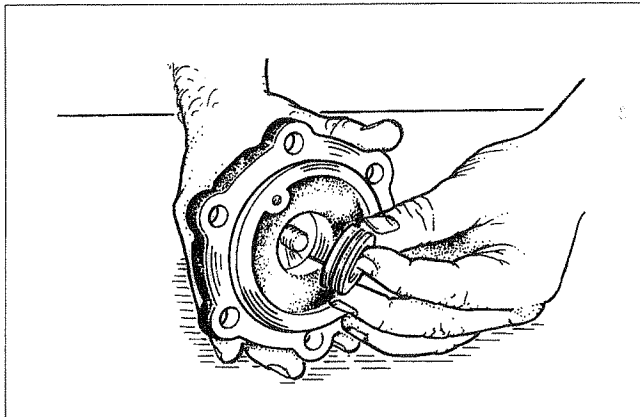


Figure 49

5. Reassemble the cap to gear using the 4 bolts. Tighten the bolts to 79Nm (Figure 49).

DIAGNOSIS AND TROUBLESHOOTING

WARNING DO NOT REMOVE GEAR!

To diagnose strg. problems, it is important for the mechanic to completely understand the strg. system. A large number of factors can affect performance, such as poor tire alignment or existing play in steering tie rods.

GENERAL DIAGNOSIS

Too often, gear removal is without just cause in the absence of a systematic procedure to follow in the case of repair. A glossary of terminology is supplied in this manual for the purpose of helping the mechanic best understand the problem. Start your diagnosis in using the following steps:

I. UNDERSTAND THE DRIVER'S COMPLAINT

- a. Question the driver. Refer him to the index. Communicate with driver.
- b. Drive the truck. If possible, let the usual driver demonstrate the problem. Drive truck a second time and re-create the problem.

II. VISUAL INSPECTION OF VEHICLE

- a. Verify grease and lube points. Absence of grease contributes to premature wearing of strg. tie rods.
- b. Check tires (diff. size, pressure, wear).
- c. Check for poor loading conditions. Equipment and special bodies can influence performance of strg. column.
- d. Check suspension. A poorly aligned rear axle can contribute to poor road feel.

III. INSP. OF MECH. ELEMENTS (COMPONENTS)

- a. Check hinge pins; premature wear, clamping and seizing.
- b. Examine tightness of mtg. bolts. A mal-adjusted gear reduces performance.

IV. INSPECT HYDR. CIRCUIT: FOLLOW PROCEDURE DESCRIBED IN MR41032.

COMMON COMPLAINTS

1. Wander – Wander is described as the vehicle not tracking properly on the road surface. The vehicle tends to drift side to side. Continual correction is required to keep the vehicle on the road.

The driver may describe wander in the following ways:

- * Squirrely
- * Continually correcting
- * Constantly fighting the wheel
- * Can't hold it on the road
- * All over the road

To determine if wander is present drive the vehicle on a straight road with no traffic and carefully release the steering wheel. If the vehicle has a wander condition the vehicle will tend to drift from side to side as described above. The most probable cause of wandering is looseness in mechanical components.

2. Pulls – Pulling is a term used to describe a constant movement of the vehicle in one direction.

The driver may describe pulling in the following ways:

- * Won't track
- * Pushes to one side
- * Wanders
- * Drives one way
- * Heads for the ditch

If a directional pull is present the most probable cause will be misalignment of the rear axle.

3. Binds – Binding is an increase in steering wheel effort that is momentary or intermittent.

The driver may describe binding in the following ways:

- * High spot
- * Hangs up
- * Locks up
- * Catches when turning
- * Seizes

Binding is normally a result of some mechanical problem with steering components. Most often the bind will occur at the same position on the steering wheel while turning.

4. No Return – No return is used to describe the lack of wheel coming back to center after a turn or correction is completed.

The driver may describe no return in the following ways:

- * The wheel won't come back
- * Hangs up in turns
- * Wheel sticks

No return can result from a misaligned front axle or a bind in mechanical components external to the steering gear. Front axle caster angles should be checked in return complaints.

5. Hard steering – Hard steering is experienced when steering wheel effort exceeds 100 inch pounds measured at the steering wheel retaining nut. Hard steering will remain constant through the full turn. Do not confuse hard steering with binding.

The driver may describe hard steering in the following ways:

- * No power assist
- * Steers like a manual gear
- * Won't turn all the way

Hard steering can result from hydraulic and/or mechanical problems. A complete mechanical and hydraulic diagnosis is necessary to determine the cause.

6. Excessive Free Play / Unresponsive Motion – Excessive free play is a condition where there is too much steering wheel movement before the steer tires move. A small amount of free play is considered normal.

The driver may describe free play in the following ways:

- * Too much slop in the wheel
- * Slack in the wheel
- * Too much backlash

Free play is normally a function of looseness in the linkage.

7. Shimmy – Shimmy is a shake or vibration of the front tires that is transmitted through the steering wheel.

The driver may describe shimmy in the following ways:

- * Steering wheel shake
- * Steering wheel chatter
- * Cab shakes

Shimmy is a function of looseness in the steering linkage, looseness in front end components or unbalanced tires. Shimmy can also be caused by air trapped in the system.

8. Noise – Noise in the steering system can come from any number of components. Harmonics or hydraulic noise can be caused by fluid flow. Metallic or grinding noises come from component parts.

The driver may describe noise in the following ways:

- * Growls
- * Pops when steering
- * Swishes
- * Moans

When noise is present you must first determine if it is a mechanical or hydraulic noise. Most mechanical noises are a result of looseness or wear in components. Hydraulic noise will normally be associated with problems in pump flow, such as cavitation or low fluid levels.

GLOSSARY

1. Actuating Valve – Internal valve in the bearing cap of the steering gear. It is actuated by the steering wheel through the yoke connection of the steering column.
2. Back Pressure – The pressure found on the return side of the system.
3. Base Mounted Gear – The steering gear is mounted to the frame rail or bracket utilizing the eight mounting holes opposite the sector shaft cover.
4. Bearing Cap – End cap of the steering gear that houses the actuating shaft and valve.
5. Bearing Cap Cover – Small cover on the end of the bearing cap of the steering gear. The bearing cap cover houses the input shaft oil and salt seal.
6. Bleeder Screw – 1/8" allen screw located in the sector shaft bore of the steering gear.
7. Cavitation – Bubbles that form in the oil which keep the pump from supplying pressure and volume.
8. Contamination – Dirt or other foreign material in a fluid.
9. Cylinder Bore – Long bore of the steering gear where the steering gear piston is housed.
10. Cylinder Head – The end cap of the steering gear bolted on the housing opposite the actuating shaft end of the gear.
11. Displacement – The volume of fluid that can pass through a pump or cylinder in a single revolution or stroke.
12. Feedback – A transfer of energy from the output of a device to it's input.
13. Fluid Flow – The stream or movement of a fluid, or the rate of it's movement.
14. Piston – Is found in the cylinder bore and changes the hydraulic force to mechanical force in the steering gear.
15. Plunger – Slotted pins that are used to limit the travel of the steering gear piston under pressure. Plungers are located in the cylinder head and bearing cap.
16. Pressure Relief Valve – Optional pressure relief valve integral to the steering gear to limit system operating pressure. Identified by a large hex nut on the side of the bearing cap.
17. Pump – A device that converts mechanical force and motion into hydraulic fluid power.
18. Rack Teeth – The area on the piston that engages the sector shaft teeth.
19. Recirculating Ball Thread – The area of the rotary valve on which the 24 steel balls travel.
20. Relief Valve – A pressure control valve used to limit system pressure.
21. Sector Shaft – The shaft the pitman arm is attached to.
22. Sector Shaft Bore – Area of the steering gear that houses the sector shaft.
23. Slave Gear – Right hand gear in a dual system application. Identifiable by a lack of an actuating shaft on either end of the steering gear.
24. Slave Ports – Threaded openings in the cylinder head, bearing cap and sector shaft bore to install the pressure lines to operate the slave gear.
25. Tab – Lock Retainer – Bolt assembly used to provide initial torque when installing the pitman arm. Uses alignment tabs that fit into the pitman arm and restraining tabs to be locked into the head of the retainer.
26. Volume of Flow – The amount of fluid that passes a certain point in a unit of time. The volume of flow is usually expressed in gallons per minute for liquids.

TROUBLESHOOTING GUIDE

This section is designed to give you causes and possible remedies for the most common problems. Four (4) columns which give you the Symptom, Possible Cause, Remedy and Reference are listed. You will see a letter after the Remedy and under the Reference column. Use the chart at the end of this section. Find the reference letter you need, this will show where the repair procedure may be found.

Symptom	Possible Cause	Remedy
Oil leaking at output shaft of steering gear	Damaged sector shaft seal	Replace sector shaft seal
Oil leaking at actuating shaft of steering gear	Worn or damaged oil seal Damaged actuating shaft seal surface	Replace actuating shaft seal Replace bearing cap, actuating shaft assembly
Oil leaking at supply pump drive shaft	Damaged oil seal Oil seal-heat damaged Loose or damaged bushing on pump drive shaft	Replace oil seal Check operating temperature Repair pump per pump service instruction
Lubricant milky or white in appearance	Water entry through reservoir venting system	Clean vent system or replace cap assembly
Oil forced out of reservoir or foaming	Clogged oil filter	Change oil and oil filter Change more often
	Air in system	Bleed air from system Check for air leak on suction side of supply pump
	Relief plungers of steering gear not adjusted properly creating high operating temperatures	Adjust relief plungers (See Common Procedures)
	Air leak in suction side of supply pump	Refer to pump servicing instructions
	Pump cavitating	Check for restriction in pump supply
	Oil overheating	Check for restriction in steering gear return
Engine Oil in power steering reservoir (Gear driven pump)	Faulty seal at pump drive shaft	Repair pump
	Faulty seal at accessory shaft driving supply pump	Repair accessory drive
Lubricating Oil discolored or smells bad	Operating temperatures too high	Check and correct cause of overheating
	Change intervals too long	Change oil more often
	Incorrect lubricant used	Drain, flush and refill with recommended fluid
High Operating Temperatures	Oil flow restriction	Check back pressure
	Oil flow too high	Check maximum oil flow

Symptom	Possible Cause	Remedy
No power steering on cold starting	Hydraulic supply pump vanes not extending (Vane type pump only)	Increase engine speed momentarily to extend vanes and start pump action. Usually does not happen often and does not last long. Not a cause for pump repair or replacement
Excessive pump pressure with steering gear in neutral position	Pinched oil return line High back pressure	Relocate line
	Binding steering column	Repair steering column
Wheel cuts restricted	Relief plungers not adjusted properly	Adjust relief plungers
Erratic steering or mechanical steering only	Insufficient volume of oil	Refer to pump servicing instructions
	Sticking pressure relief valve in steering gear	Repair or replace relief valve as required
Hard Steering	Loose pump drive belts	Tighten or replace belts
	Faulty supply pump	Check pump flow
	Steering out of alignment	Align front end
	High operating temperature	Locate and correct cause of overheating
Wheel turns hard in one or both directions	Dirt or foreign matter trapped in piston relief	Check pressure relief
	Bent or damaged king pins and tie rods	Repair or replace king pins and tie rods Refer to servicing instructions
	Front end load too great	Lighten load
	Low oil level in steering system	Fill oil reservoir as required
	Air in system	Bleed system and check for cause of air
	Caster degree incorrect	Correct to "Specifications"
	Wheel turns hard in one direction	Metal or foreign material in relief ball seat in piston of steering gear
No attempt to return straight ahead from turns / should also be hard steering complaint	No positive caster	Set caster to 3° to 5° positive caster
	Steering column bind	Check and repair U-joints and support bearings
	Steering gear mounting distorted	Shim mounting pads to correct piston to bore interference. Make sure correct bolt length is used on the base mount gears
	Linkage ball sockets seized or binding	Check and repair or replace
	King pins seized or binding	Repair or replace
	Oil flow rate incorrect	Check and correct supply pump

Symptom	Possible Cause	Remedy	
Darting, wandering (oversteering)	Oil flow too high	Supply pump not to specifications	
	Air trapped in steering gear	Bleed system	
	Looseness, worn front end parts	Check and repair as required	
	Front end alignment not correct	Align front end – Caster	
	Overloading	Reduce loads	
	Rear axle not parallel	Check & repair as required	
	Tight tie rod ends & drag link sockets	Check rotational torque & replace if necessary	
Excessive backlash / freeplay	Worn universal joint	Replace universal joint	
	Worn pins and keys in universal joint to actuating shaft and universal joint to steering shaft	Replace pins and keys	
	Pitman arm ball worn “egg-shaped” (if equipped)	Replace pitman arm assembly where riveted ball is used	
	Loose bracket frame to bracket or bracket to gear	Remove bracket, clean frame and bracket. Check radius of frame making sure bracket is not bearing on radius surface. Check bracket for wear from being loose. Replace bracket and tighten to recommended torque rating by size and grade of bolts. If necessary, replace bracket.	
	Rack on piston damaged	Replace steering gear	
	Damaged sector shaft/splines	Replace steering gear	
	Worn or damaged pitman arm splines	Replace pitman arm and/or sector shaft	
	Universal joint yoke loose on actuating shaft	Repair or replace damaged parts	
	Steering input not smooth	Worn universal joint	Check and replace as required
		Lack of lubrication	Lubricate per vehicle manufacturer’s recommendations
Universal joints not phased properly		Re-phase columns*	
Low oil flow		Idle speed too slow Drive belts slipping Supply pump not to specifications	
Pump cavitating		Correct pump supply	
Overheating		Correct cause of overheating	

NOTE: Universal Joints

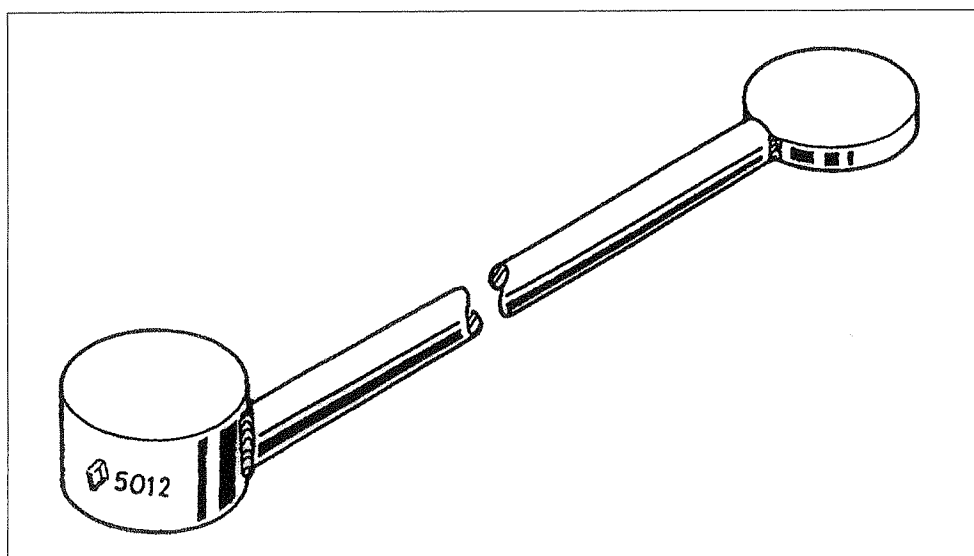
Universal joints are designed to operate best when the angle between the drive and driven shaft is a maximum of 20 to 25 degrees. Angles greater than this may upset steering performance.

IMPORTANT:

Actuating shaft thread wear generally comes from improper lubrication or excessive manual steering. Manual steering results from low pump pressure or flow or an overloaded front axle.

*To check phasing of the universal joints in the steering column, use an inch-pound graduated dial type torque wrench. With a socket on the steering wheel retaining nut, read the difference in the torque while steering from lock-to-lock. Variation of more than 15 in. -lb. means improper phasing. Take the reading with the vehicle stationary and the engine running at idle.

Phasing can usually be corrected by rotating the two piece intermediate shaft one spline at a time until the torque reading remains the same throughout the 360 degree rotation of the steering wheel.



TOOL FOR ADJUSTING HYDRAULIC STOPS.