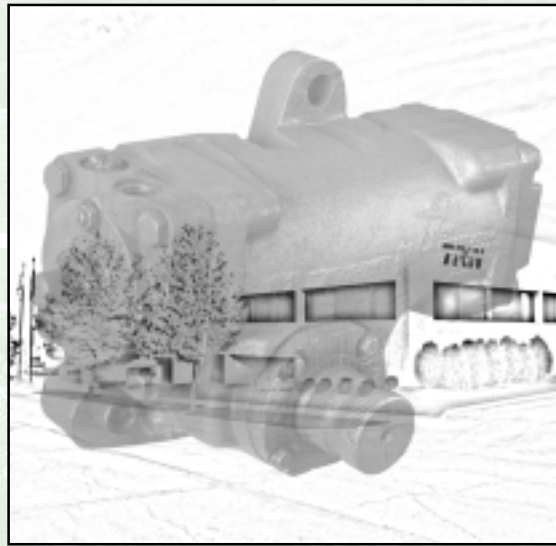


# HFB Steering Gear Service Manual

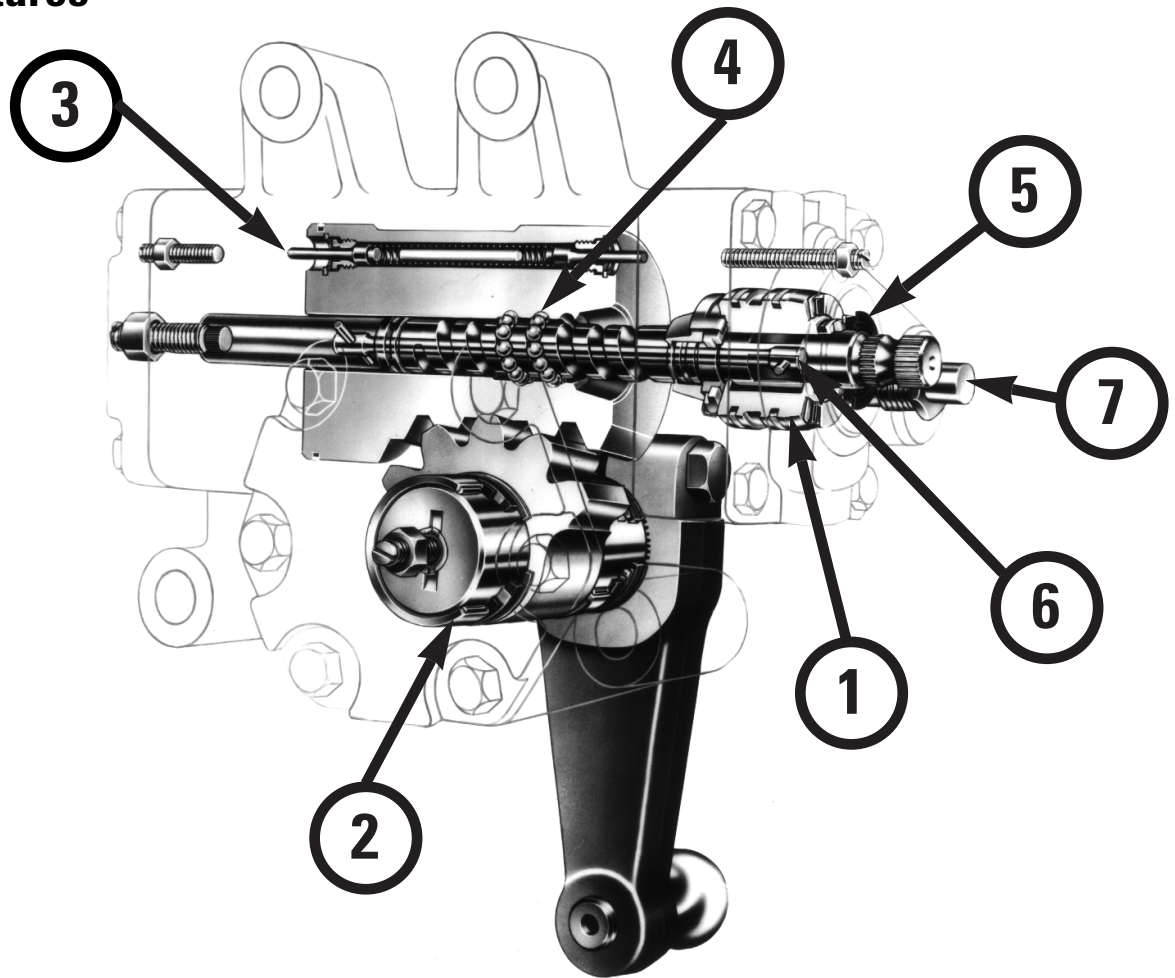
HFB64 SERIES



# HFB64 Integral Hydraulic Power Steering Gear

This steering gear was specifically designed for motor trucks; new design features and our design experience with previous models of integral hydraulic power steering gears have been combined into this new product.

## Design Features



1. **Rotary Valve** - This device provides responsive steering control
2. **\*DU bushing and or Roller Bearings** - Allow the steering gear to operate with high efficiency and reversibility
3. **Unloading Valves** - Furnish power steering pump protection and reduce pressure to unload steering linkage at the ends of steering gear travel (optional)
4. **Recirculating Balls** - Combines high mechanical efficiency with smooth operation
5. **Dirt and Water Seals** - Lip type seals on both input and output shafts
6. **Torsion Bar** - Provides positive valve centering with definitive "feel of the road"
7. **Relief Valves** - Furnish pump protection by limiting maximum pressure (optional)
  - Balanced Area Cylinder - Back pressures cannot affect steering stability
  - High Temperature Seals - These specially developed seals may be operated intermittently at 300° F (148.9° C)
  - Manual Steering Capability - Provides for steering control in the event of hydraulic failure
  - Compactness - Lowest weight to output torque ratio in the industry
  - Auxiliary Porting Available - For auxiliary cylinder control
  - Seal Protectors - Provide protection from harsh environment

\* DU is a registered trademark of Glacier Metal Co. Ltd.

# Definitions

**NOTE:** A NOTE gives key information to make a procedure easier or quicker to follow.

**CAUTION:** A CAUTION refers to those procedures that must be followed to avoid damage to a steering component or the gear.

**WARNING:** A WARNING REFERS TO THOSE PROCEDURES THAT MUST BE FOLLOWED FOR THE SAFETY OF THE DRIVER AND THE PERSON INSPECTING OR REPAIRING THE GEAR.

# Disclaimer

This Service Manual has been prepared by TRW Ross Gear Division for reference and use by mechanics who have been trained to repair and service steering components and systems on heavy commercial vehicles. TRW Ross Gear Division has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding the techniques and tools required for maintaining, repairing and servicing the complete line of TRW Ross Gear HFB64 Integral Power Steering Gears. However, despite the care and effort taken in preparing this general Service Manual, TRW makes no warranties that (a) the Service Manual or any explanations, illustrations, information, techniques or tools described herein are either accurate, complete or correct as applied to a specific HFB64 steering gear, or (b) any repairs or service of a particular HFB64 steering gear will result in a properly functioning steering gear.

If inspection or testing reveals evidence of abnormal wear or damage to the HFB64 steering gear or if you encounter circumstances not covered in the Manual, STOP - CONSULT THE VEHICLE MANUFACTURER'S SERVICE MANUAL AND WARRANTY. DO NOT TRY TO REPAIR OR SERVICE A HFB64 STEERING GEAR WHICH HAS BEEN DAMAGED OR INCLUDES ANY PART THAT SHOWS EXCESSIVE WEAR UNLESS THE DAMAGED AND WORN PARTS ARE REPLACED WITH ORIGINAL TRW REPLACEMENT AND SERVICE PARTS AND THE UNIT IS RESTORED TO TRW'S SPECIFICATIONS FOR THE HFB64 STEERING GEAR.

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular HFB64 steering gear to (a) inspect the steering gear for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the vehicle, or the safe operation of the vehicle, and (c) fully inspect and test the steering gear and the vehicle steering system to insure that the repair or service of the steering gear has been properly performed and that the steering gear and system will function properly.

# Patents

This TRW Ross Gear Division vehicle power steering gear is covered by one or more of the following United States patent numbers: 3,896,702; 3,606,819; 3,741,074; 3,773,081; 3,955,473; 3,935,790; and 3,921,669. Other United States patent applications are pending, and corresponding foreign patents are pending or issued.

# Assembly Preparation

Wash all parts in clean petroleum-based solvent. Blow them dry only.

## WARNING

**WARNING: SINCE THEY ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.**

## WARNING

**WARNING: WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA OR OTHER MAXIMUM AIR PRESSURE REQUIREMENTS.**

Replace all seals, seal rings, and gaskets with new ones each time you disassemble the gear.

Ross Gear does provide individual seals, seal rings, and gaskets, as well as complete and partial seal kits. SEE FIGURE 95. These parts should be available through most OEM parts distributors. (Contact your local dealer for availability.)

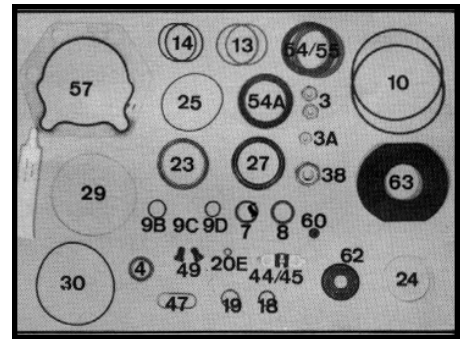


Figure 95

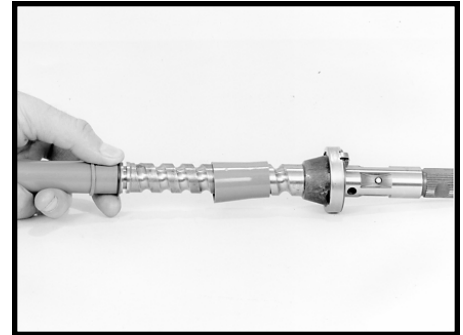


Figure 96

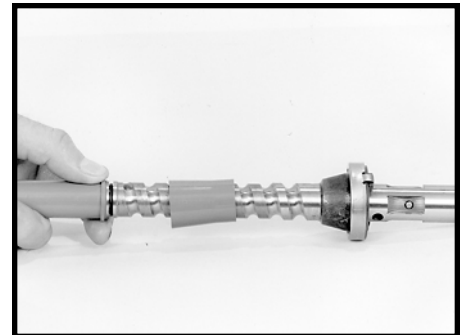


Figure 97

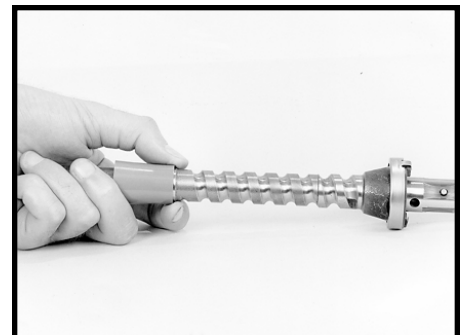


Figure 98

## Assembly

### assemble worm shaft O-ring & seal ring

- Slide compression tool J26649, small diameter end first, onto the worm end of worm shaft/input shaft (17) until it is beyond the seal ring groove. Using seal installation tool J26550-01 assemble the new worm shaft O-ring (18), and then the new seal ring (19). SEE FIGURES 96, 97. Next, compress the seal ring by pulling the compression tool back over the seal ring. Allow the worm shaft/input shaft to set with compression tool in place for at least ten minutes. SEE FIGURE 98.

## CAUTION

**CAUTION: Allow for this 10 minutes to insure that the O-ring and seal ring are properly seated when you install the worm shaft into the rack piston. If you do not allow for this time, the seal may tear or be cut when you place the worm into the rack.**

### install housing bearing and retaining ring

- If you are installing a new housing bearing (21) or using the old housing and bearing assembly, apply a generous amount of clean grease to the bearing race to retain the bearing rolls. Then, place the rolls into the race, being sure you have the correct quantity of rolls for your particular bearing assembly. To install the new bearing assembly (21) into the housing, first install the retaining ring (22) into the groove on the bearing's outside diameter. Then press the bearing into the housing from the trunnion side using bearing mandrel (special tool) J26738 or J37071 against the lettered end of the bearing shell so that the retaining ring is away from the housing bore. SEE FIGURE 99. During this procedure be sure that the housing is square with press base and the bearing is not cocked.



Figure 99



**NOTE**

**NOTE:** If you are installing bearing BR-866-1 or a bearing with no part number, install 44 rolls. If you are installing bearings F83508, install 43 rolls.

**CAUTION**

**CAUTION:** The bearing rolls must be in place to insure proper installation of the bearing. If the rolls are improperly installed, the bearing race may collapse and fail. The flange may break, causing premature failure of the bearing. Again, do not mix the housing bearing rolls with the side cover bearing rolls. Be sure the bearing mandrel used is clean.

**NOTE**

**NOTE:** The bearing assembly (21) may be of caged (retained) roll type therefore not requiring reassembly of the rolls.

**install rack piston seal and O-ring**

3. Install the new rack piston backup O-ring (30) and then the new Teflon rack piston seal ring (29) SEE FIGURES 100, 101. Do not over stretch these rings as you install them. After you install them, coat them with a liberal amount of grease.

**WARNING**

**WARNING: DURING STEP 4, YOU SHOULD WEAR EYE PROTECTION, AS THE SPRING LOADED POPPETS COULD EJECT, AND CAUSE EYE INJURY.**

**install poppet assembly, if removed**

4. If the gear is equipped with poppets and the poppets were removed, then install into the rack piston (31) one poppet seat (33). SEE FIGURE 102. From the other end of the rack piston install one poppet (34), the spring (36), the nylon spacer rod (35), the other poppet (34), and the other poppet seat (33). Torque both poppet seats to 20-25 ft. lbs. (27-34 N m). Install both retaining rings (32). SEE FIGURES 103,104.



Figure 100



Figure 101

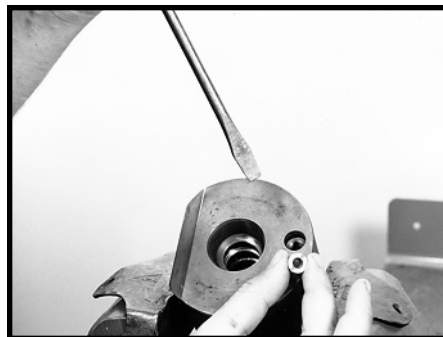


Figure 102



Figure 103



Figure 104

**install worm shaft/input shaft into rack piston**

5. When the 10 minute compression time has elapsed, remove the compression tool from the worm shaft/input shaft assembly (17). Grease the worm shaft seal ring (19) and the sealing surface inside the rack piston (31). Install the worm shaft/input shaft assembly into the rack piston end that will position the worm seal ring in the rack bore and position the worm ball track grooves to accept the set of balls through the rack piston ball guide holes. SEE FIGURE 105.

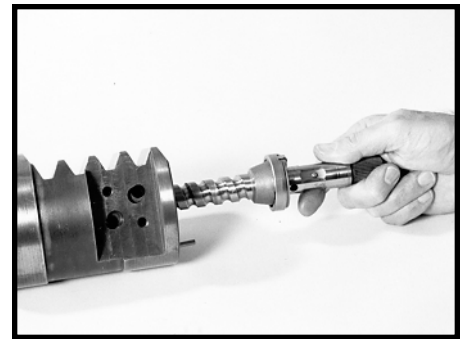


Figure 105

**assemble ball return guide halves**

6. Assemble the ball return guide halves (43) into the rack piston (31) Make sure they are correctly seated. SEE FIGURE 106.

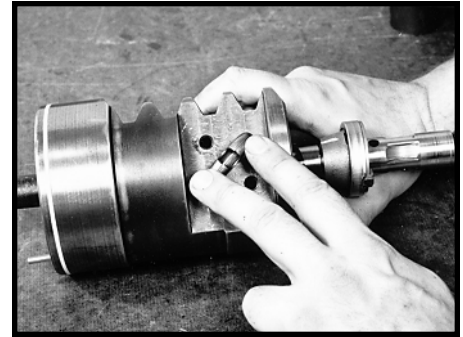


Figure 106

**WARNING**

**WARNING: DO NOT SEAT GUIDES WITH A HAMMER, DAMAGE TO GUIDES CAN RESULT IN SUBSEQUENT LOCKUP OR LOSS OF STEERING.**

**assemble balls**

7. Assemble 27 steel balls (42) into the ball return guide through the hole provided in the top of the guide. As you drop the balls into the guide, rotate the worm shaft (17) to pull the balls down into the ball track grooves. SEE FIGURE 107.

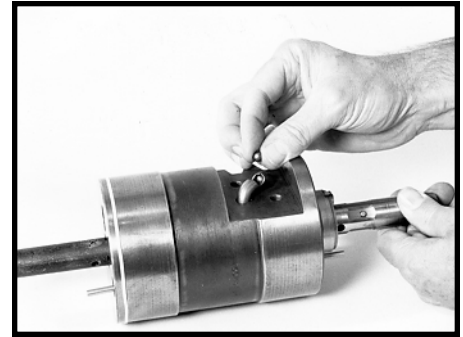


Figure 107

**WARNING**

**WARNING: MAKE SURE THE BALL RETURN GUIDE STAYS DOWN IN PLACE AS YOU DROP THE BALLS THROUGH THE HOLE. FAILURE TO HOLD THE GUIDE DOWN MAY RESULT IN A BALL BEING TRAPPED OUTSIDE THE CLOSED LOOP. A TRAPPED BALL CAN RESULT IN A STEERING LOCKUP, WHICH COULD CAUSE AN ACCIDENT.**

**assemble ball return guide clip, if equipped**

8. If your gear is equipped with the ball return guide clip (44), install it so that both bolt hole faces are in full contact with the rack piston surface. Install two new lock tabs (45) and the two hex head bolts (46). Torque the bolts to 14-22 ft. lbs. (19-30 N m). Finish by bending the locking tabs up against the bolt head flats. 1/2 inch socket required. SEE FIGURE 108.

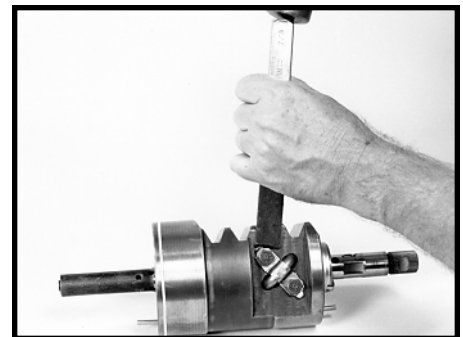


Figure 108

**NOTE**

**NOTE: The current ball return guide clip (44/45) will have integral lock tabs and be included in current service seal kits.**

**assemble ball return guide cap, if equipped**

9. If your gear is equipped with the ball return guide cap (48), instead of the clip, grease the ball return guide cap seal (47) and place it in the seal groove of the cap. Assemble the cap so that the seal makes full contact with the rack piston surface. SEE FIGURE 109. Install two new Allen or Torx head bolts (49) and torque them to 14-22 ft. lbs. (19-30 N m). A 5/32 inch Allen socket or T-30 Torx socket required.

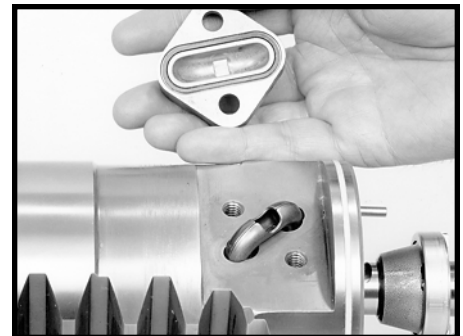


Figure 109

**WARNING**

**WARNING: ROTATE THE WORM SHAFT FROM ONE END OF TRAVEL TO THE OTHER, TO MAKE CERTAIN THAT YOU HAVE INSTALLED THE BALLS PROPERLY. SEE FIGURE 110. IF YOU CANNOT ROTATE THE WORM SHAFT, YOU WILL HAVE TO REMOVE THE BALLS AND REASSEMBLE THEM. IF YOU INSTALL A GEAR ON A TRUCK WITH THE WORM SHAFT UNABLE TO ROTATE, THE GEAR WILL NOT FUNCTION CORRECTLY. DAMAGE MAY RESULT.**

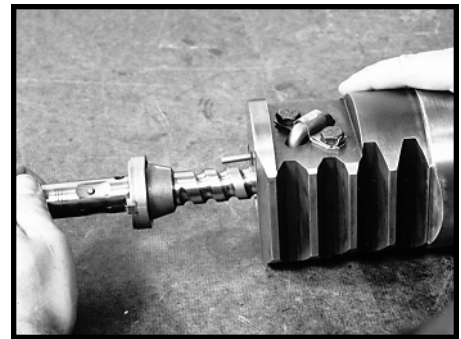


Figure 110

**install rack piston and worm shaft/input shaft assembly into housing**

10. Position the housing (20) securely in a vise as it was for the disassembly procedures. SEE FIGURE 38 page 20. Apply a generous amount of clean grease to the Teflon rack piston seal ring (29) and to the housing cylinder bore. Install the rack piston (31) and worm shaft/input shaft (17) as an assembly into the long end of the gear housing (20), if the housing rack piston bore is open on both ends, so that the Teflon rack piston seal ring goes in last. SEE FIGURE 111.

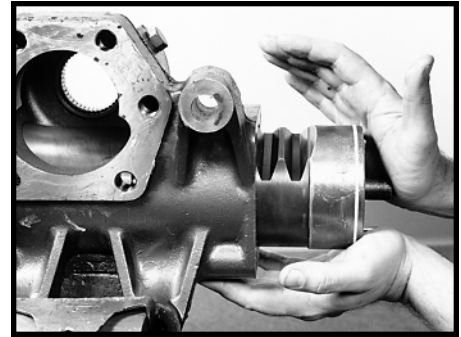


Figure 111

**CAUTION**

**CAUTION: Be certain that the seal goes into the long end of the housing last if the housing bore is open on both ends. Otherwise, a large section of the seal will be cut, and the vehicle will have no power steering assist.**

**CAUTION**

**CAUTION: If the housing rack piston bore is open only on one end and the seal ring end of the rack piston must enter the housing first, the rack piston cannot be removed after it is assembled into the housing without destroying the rack piston seal ring.**

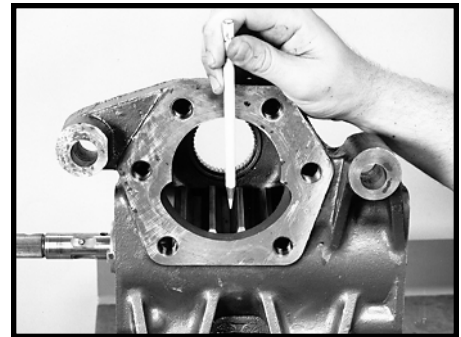


Figure 112

**NOTE**

**NOTE: To ease the later assembly of the sector shaft, rotate the rack piston and worm shaft assembly in the housing so that the rack teeth are exposed in the sector shaft cavity of the housing. SEE FIGURE 112.**

**assemble sealing nuts and adjusting screws**

11. If they were disassembled, assemble the new worm shaft adjusting screw sealing nut (38) onto the non-slotted end of the worm shaft preload adjusting screw (39) so that the seal on sealing nut will face the end cover (37) or closed end of housing. SEE FIGURE 113. Assemble a new sealing nut (3) onto poppet adjusting screws (2) and (40) in the same manner.



Figure 113

**assemble poppet screw assembly into end cover**

- 12. Assemble poppet adjusting screw (40) and nut (3) assembly into end cover (37) or closed end of housing (20) a few turns. Final adjustments will be made later.

**WARNING**

**WARNING: IF SCREWS (2) AND (40) ARE UNEQUAL IN LENGTH, YOU MUST INSTALL THE SHORTER SCREW INTO END COVER OR CLOSED END OF HOUSING. OTHERWISE, THE POPPET ASSEMBLY MAY BREAK AND LOCK UP THE STEERING GEAR, POSSIBLY RESULTING IN AN ACCIDENT.**

**NOTE**

**NOTE: More recent models of the HFB64 have a 5/16 24-2A poppet adjusting screw (2A) in the valve housing (9). This screw has an enlarged end. If your gear is equipped with this screw you must install the sealing nut (3A) onto the end of the screw after you assemble the screw into the valve housing. SEE FIGURE 121.**

**install adjusting screw**

- 13. Install the worm shaft preload adjusting screw (39) and nut (38) into the end cover (37) or closed end of the gear housing (20) a few turns. SEE FIGURE 114. Final adjustments for worm and poppet adjusting screws will be made later.

**install end cover seal ring**

- 14. If your gear is equipped with the removable end cover (37), apply clean grease to the seal ring groove in the end cover. Install the new end cover seal ring (10) into the groove. SEE FIGURE 115.

**NOTE**

**NOTE: When installed, the seal ring will extend slightly above the machined surface of the end cover.**

**CAUTION**

**CAUTION: When performing step 15, make sure that the rack piston teeth are fully visible in the sector shaft cavity of the gear housing (20). This will insure proper location of the poppets and insure also that the poppet adjusting screw will contact the poppet.**

**install end cover**

- 15. If your gear has the removable end cover (37), position it so that the poppet adjusting screw (40) is aligned with the end of the poppet (34). SEE FIGURE 116. Push the end cover in until it contacts the gear housing.



Figure 114

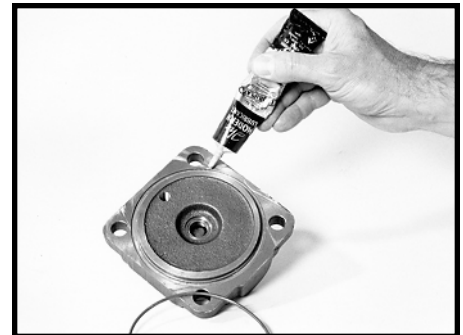


Figure 115

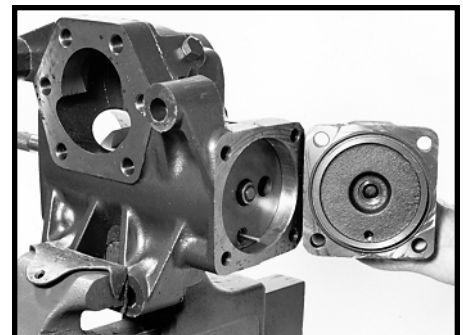


Figure 116

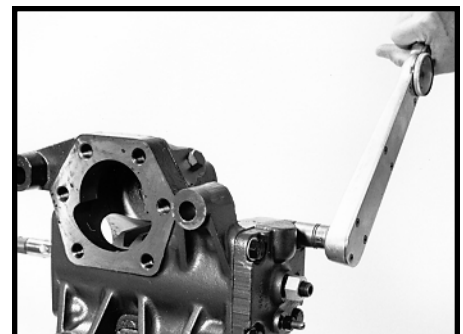


Figure 117



**install end cover bolts**

16. Install the four end cover bolts (41) 1.38 inch (35.1 mm) long and washers (41A), and torque the bolts to 105-115 ft. lbs. (142-156 N m) if dry or 75-85 ft. lbs. (102-115 N m) if lubricated. SEE FIGURE 117. 13/16 inch hex or E-16 Torx socket required.

**install valve sleeve rings and seals**

17. Grease the two new backup O-rings (14) and the two new Teflon seal rings (13). Using seal installation tool J26647, assemble the backup O-rings, and then the seal rings onto the valve sleeve (15). SEE FIGURES 118,119.

**NOTE**

**NOTE: Assemble each O-ring and seal ring from the end closest to its groove.**



Figure 118



Figure 119

**compress rings**

18. Use the compression tool J26648 to compress the Teflon seal rings. Leave this compression tool on for 10 minutes. SEE FIGURE 120.

**CAUTION**

**CAUTION: Allow for this at least ten minutes, to ensure that the seals are properly seated. Otherwise, the valve sleeve will be difficult to assemble into the valve housing, and the seal maybe cut during installation.**



Figure 120

**assemble poppet screw**

19. If removed, assemble the poppet valve adjusting (2) and nut (3) assembly into the valve housing (9) a few turns.

**NOTE**

**NOTE: If your gear is equipped with the 5/16 24 UNF 2A poppet adjusting screw (2A), assemble the screw from the inside of the valve housing. The screw should be run out until just before the enlarged end of the screw bottoms on the counterbore of the valve housing. Then assemble sealing nut (3A) with the seal facing the housing. SEE FIGURES 121, 122.**

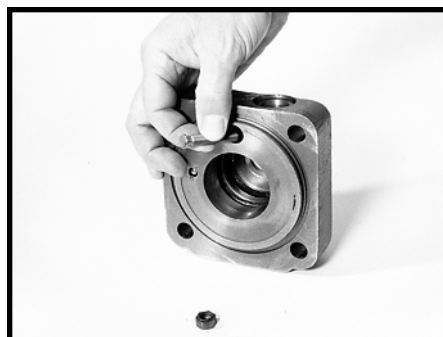


Figure 121

**CAUTION**

**CAUTION: Take special care when you run this screw out. If you apply excessive torque (above 35 in. lbs. or 4.0 N m) to the screw after the enlarged end bottoms in the counterbore, you could break the internal Allen hex or driver slot. You will then have to replace the screw, and if you cannot remove it from the valve housing, you will have to replace the entire valve housing assembly.**

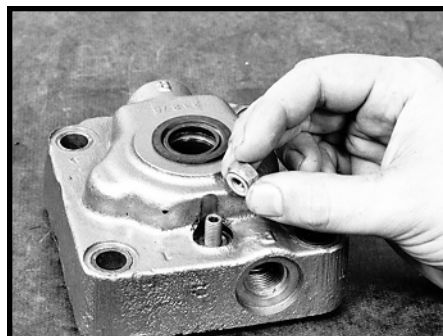


Figure 122

**install valve housing seal ring**

- 20. Apply clean grease to the seal ring groove in valve housing (9) and install a new seal ring (10) into the groove. SEE FIGURE 123. If the unit is equipped with an automatic bleed screw, apply clean grease to a new passage way seal (20E) and install it in the valve housing.

**NOTE**

**NOTE: When installed, the valve housing seal ring should extend slightly above the machined surface of the valve housing.**

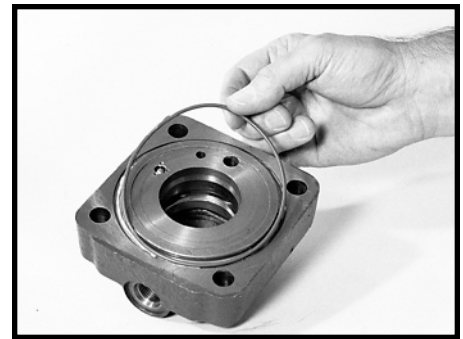


Figure 123

**install first thrust washer**

- 21. Apply a generous amount of clean grease to one thrust washer (11). Place the valve housing, exterior side down, on a flat surface and place the thrust washer into the valve housing (9), making sure to center the washer. SEE FIGURE 124.

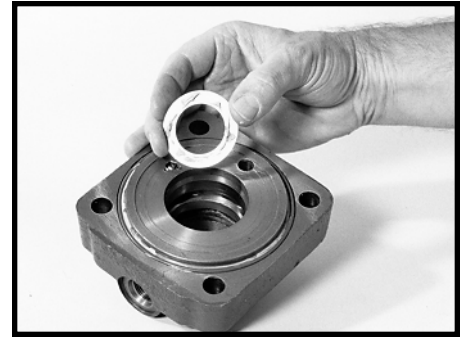


Figure 124

**install thrust bearing**

- 22. Apply a generous amount of clean grease to the thrust bearing (12). Install the bearing into the valve housing (9) and onto the first thrust washer, making sure to center the bearing on the washer. SEE FIGURE 125.

**WARNING**

**WARNING: THE THRUST WASHER AND THRUST BEARING MUST BE FLAT AND CENTERED IN THE COUNTERBORE SURFACE OF THE VALVE HOUSING. OTHERWISE, THE THRUST WASHER COULD BREAK WHEN YOU PLACE THE VALVE HOUSING ONTO THE GEAR HOUSING. A BROKEN THRUST WASHER COULD CAUSE UNCONTROLLABLE STEERING, POSSIBLY RESULTING IN AN ACCIDENT.**

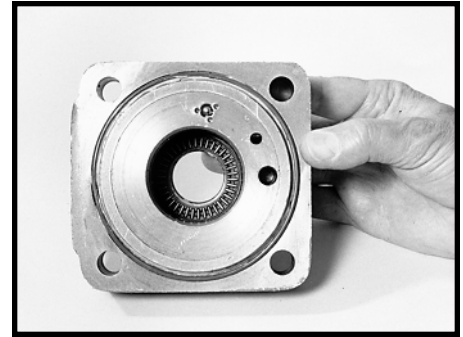


Figure 125



Figure 126

**install second thrust washer**

- 23. When the compression time has elapsed, remove the compression tool from the valve sleeve (15). Apply more grease to the valve sleeve seals (13 and 14), and grease the thrust washer face on the end of the valve sleeve without the drive slots. SEE FIGURE 127. Place the second thrust washer (11) onto this face.



Figure 127

**WARNING**

**WARNING: THIS THRUST WASHER MUST BE SECURELY IN PLACE ON THE VALVE SLEEVE. IF IT IS NOT, IT CAN BREAK AND CAUSE UNCONTROLLABLE STEERING, POSSIBLY RESULTING IN AN ACCIDENT.**



Figure 128

**assemble valve sleeve into valve housing**

24. Locate the timing mark on the valve sleeve (15), a faint, punched mark on the chamfered edge of the sleeve or an indented mark on the front face of the sleeve. Make a corresponding mark on the front face with a felt marker if the edge is marked. SEE FIGURE 128. Assemble the valve sleeve (15), with the second thrust washer attached, into the valve housing (9), thrust-washer end first. When the valve sleeve is properly in place, the valve sleeve face should measure approximately .40 in. (10.2 mm) below the face of the valve housing. SEE FIGURE 129.

**WARNING**

**WARNING: DO NOT FORCE THE VALVE SLEEVE DOWN INTO THE VALVE HOUSING. MAKE SURE THE VALVE SLEEVE SEAL RINGS ARE COMPRESSED. MISASSEMBLY OR INCORRECT MEASUREMENT MAY CAUSE THE THRUST WASHERS OR THRUST BEARING TO BREAK DURING GEAR OPERATION. THIS WILL RESULT IN UNCONTROLLABLE STEERING.**

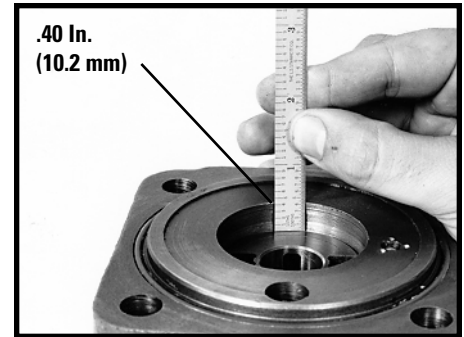


Figure 129

**position rack piston and rotate worm shaft/input shaft assembly**

25. Position the rack piston (31) so that it is flush with the valve housing end of the gear housing. Rotate the worm shaft (17) until it extends out of the rack piston as far as it will go. SEE FIGURE 130.

**WARNING**

**WARNING: THE WORM SHAFT AND VALVE SLEEVE ASSEMBLY IS ASSEMBLED AND SOLD AS A MATCHED SET. USE ONLY MATCHED SETS FOR REPLACEMENT. NEVER MATE AN OLD VALVE SLEEVE WITH A NEW WORM SHAFT, OR AN OLD WORM SHAFT WITH A NEW VALVE SLEEVE. TO DO EITHER MAY RESULT IN DAMAGE TO THE GEAR OR INJURY TO THE DRIVER DURING OPERATION.**

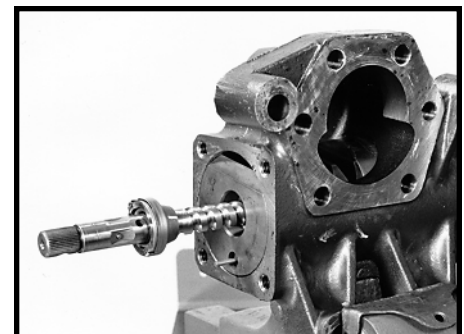


Figure 130

**install valve assembly onto worm shaft/input shaft assembly**

26. Locate the scribed timing marks on the worm shaft/input shaft assembly (17) and valve sleeve (15). SEE FIGURE 131. Next, grasp the valve housing (9) and valve sleeve as an assembly, with your thumbs on the valve housing and your fingers applying pressure on the valve sleeve to keep it in the valve housing. SEE FIGURE 132. Align the previously located timing marks and place the valve housing and valve sleeve as an assembly onto the input shaft end of the worm shaft/input shaft until the drive lugs on assembly (17) are fully engaged in valve sleeve lug slots. SEE FIGURE 133.

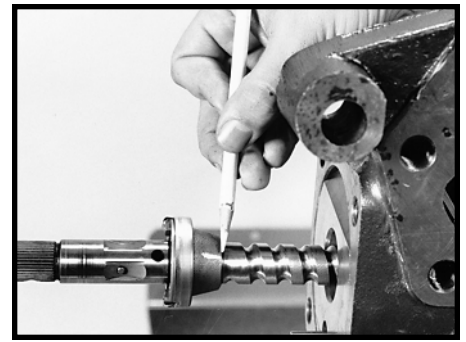


Figure 131

**NOTE**

**NOTE: Valve sleeves are identified and matched to a right or left hand lead of the worm screw. If the screw has a right hand thread (that is, goes into the rack piston when turned clockwise), the valve sleeve will have the letter "R" stamped between the seal lands. For a left hand worm lead (which will come out of the rack piston when turned clockwise), the mating valve sleeve has no identifying letter or has the letter "L" stamped between the seal lands.**



Figure 132

**WARNING**

**WARNING: IF YOU PLACE AN INCORRECT VALVE SLEEVE ON A WORM AND ASSEMBLE THIS INTO THE GEAR, THE GEAR WILL NOT FUNCTION PROPERLY. INSTEAD, THE MECHANISM WILL JERK THE STEERING WHEEL WITH SUCH FORCE, THAT IT COULD INJURE THE DRIVER.**

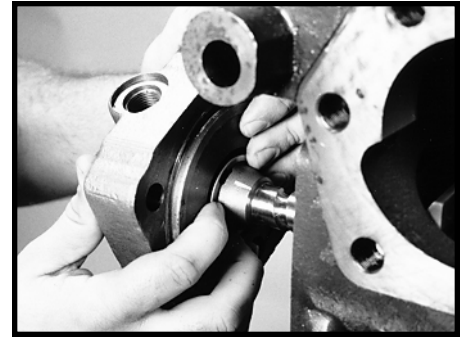


Figure 133

**finish valve housing installation**

27. Maintain pressure on the valve end of the valve housing to insure continued engagement of the drive lugs and thrust bearing package. While maintaining this pressure, rotate the valve housing to align the poppet adjusting screw (if equipped) with the poppet in the rack piston (31). SEE FIGURE 134. The automatic bleed passageway must also be aligned if so equipped. While maintaining pressure, rotate the input shaft to bring the valve housing into contact with the gear housing face.



Figure 134

**NOTE**

**NOTE: If a line was scribed across the valve housing and gear housing before disassembly, as recommended, use the line for correct valve housing positioning.**



### install valve housing bolts

28. Install the four valve housing bolts (1), 2.13 inch (54.0 mm) long, into the valve housing (9) Torque them to 105-115 ft. lbs. (142-156 N m) if dry or 75-85 ft. lbs. (102-115 N m) if lubricated. SEE FIGURE 135.

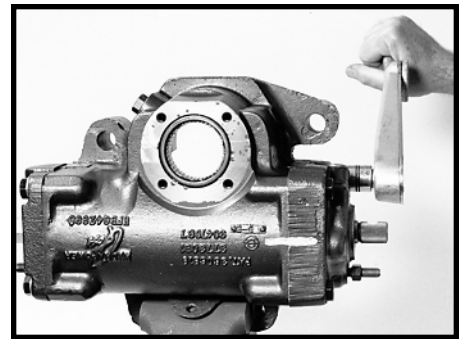


Figure 135

### install relief valve

29. If your gear is equipped with a relief valve (9A), then assemble the new O-ring (9B), the new Teflon seal ring (9C), and the new O-ring (9D) onto the relief valve. SEE FIGURE 136. Install the relief valve into the valve housing (9) and torque it to 25-35 ft. lbs. (34-48 N m). One inch socket required



Figure 136

### assemble adjusting screw and retainer

30. If the adjusting screw (51) has been removed from the sector shaft (50), clamp the sector shaft into a soft-faced vise by gripping the serrated end. Coat the expanded end of the new adjusting screw with a suitable grade of wheel bearing grease and insert into recess in end of sector shaft. Thread a new sector shaft screw retainer (52) into the sector shaft and adjust to permit free rotation of sector shaft adjusting screw by hand without perceptible end play (.000 to .002 in. [.05 mm] loose). Stake the new retainer into the two slots provided using a suitable punch and again check freedom of adjusting screw movement and end play. SEE FIGURE 137.

### WARNING

**WARNING: USE CARE IN SECURELY STAKING THE RETAINER (52) INTO THE SECTOR SHAFT SLOTS. A RETAINER THAT IS BROKEN OR CRACKED DURING THE STAKING PROCEDURE MUST BE REPLACED AS IT COULD RESULT IN THE SECTOR SHAFT NOT BEING RETAINED AND THE LOSS OF MANUAL AND POWER STEERING CONTROL.**

### grease side cover bearing or oil "DU" bushing

31. Apply a generous amount of clean wheel bearing grease (do not substitute another type of grease) to the bearing race inside the side cover (58), and to the rolls if they are caged (retained) rolls. Apply only oil for assembly purposes if the side cover has a "DU" bushing instead of a roller bearing assembly.

### CAUTION

**CAUTION: Use only wheel bearing grease on the roller bearing assembly. This bearing is sealed and will receive no lubrication from the hydraulic fluid in the gear. Without wheel bearing grease, the bearing could wear prematurely. The "DU" bushing material does not require lubrication.**



Figure 137

**assemble side cover bearing rolls**

- 32. If the side cover (58) has loose bearing rolls, assemble the bearing rolls into the side cover bearing race. An unmarked bearing or bearing BR-866-1 requires 44 rolls. Bearing F83508 requires 43 rolls. SEE FIGURE 138.

**CAUTION**

**CAUTION: Apply more wheel bearing grease to these rolls to retain them in the bearing race.**

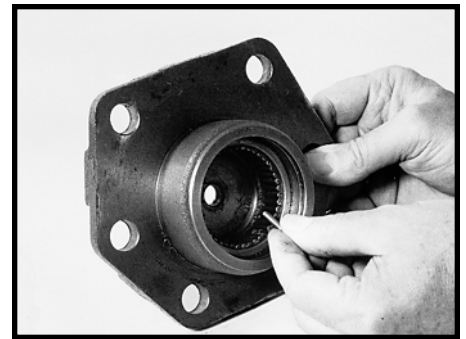


Figure 138

**assemble side cover seal pack**

- 33. If side cover (58) is being reassembled, assemble the steel back up washer (56) into side cover. Assemble a new two piece seal (54/55) that has the integral Teflon washer, into the side cover, such that the words "oil side" are visible after the seal is assembled. SEE FIGURE 139.

**WARNING**

**WARNING: THE WORDS "OIL SIDE" MUST BE VISIBLE ONCE THE SEAL IS IN PLACE. OTHERWISE, THE SEAL WILL NOT FUNCTION, WHICH COULD RESULT IN A LOSS OF POWER STEERING ASSIST.**

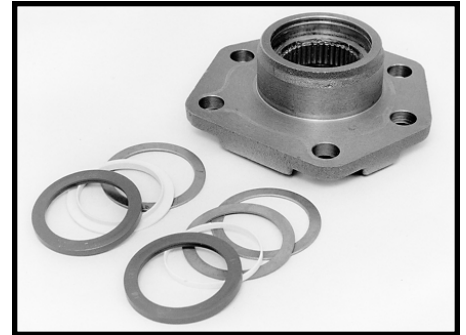


Figure 139

If side cover (58A) that requires only one piece seal (54A) is being assembled, lightly oil and assemble a new seal on bearing and seal installation tool J37071 so that the side with the garter spring is against the shoulder of the tool. Pilot the tool into the side cover bushing and press the seal into the side cover with a force of 100-800 LB. (45.4-362.8 KG) until it is seated against the bottom of the counterbore. SEE FIGURE 140.

**CAUTION**

**CAUTION: Be sure that a separate Teflon washer (55) is not used with a two-piece seal (54/55) that has the Teflon washer integral to it.**



Figure 140

**assemble retaining ring**

- 34. Assemble the side cover retaining ring (53) into the ring groove of the side cover (58) if required. SEE FIGURE 141.



Figure 141

**install sector shaft into side cover**

35. Apply a generous amount of clean grease to the short bearing area of the sector shaft (50) only if the shaft cover has a roller bearing or lightly oil short bearing area if shaft cover has a "DU" bushing. Insert the sector shaft into the side cover (58) or (58A). Screw in the sector shaft adjusting screw (51) counterclockwise into the side cover until the screw reaches solid height. Then, rotate the adjusting screw clockwise one turn, so that the side cover will rotate freely on the sector shaft. SEE FIGURE 142.

**CAUTION**

**CAUTION: Be sure that one or more bearing rolls do not become dislodged during assembly of sector shaft into side cover.**

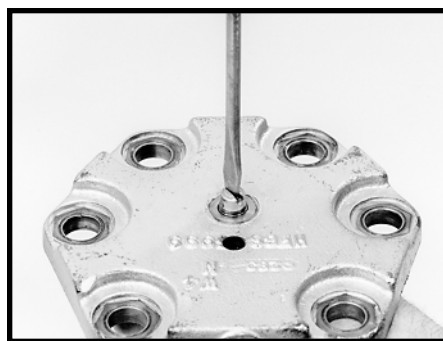


Figure 142

**install jam nut**

36. Install the sector shaft adjusting screw jam nut (59) onto the sector shaft adjusting screw(51) a few threads. Final adjustment will be made later. SEE FIGURE 143.

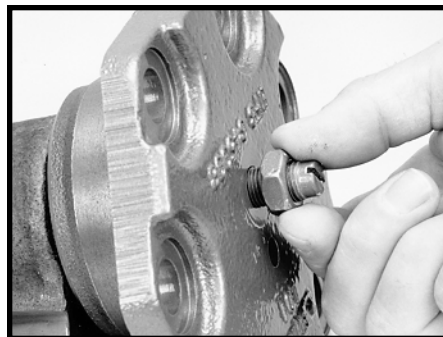


Figure 143

**assemble vent plug**

37. Press the new vent plug (60) into the hole provided in the side cover (58) until the plug is flush. SEE FIGURE 144.

**WARNING**

**WARNING: DO NOT WELD OR OTHERWISE PLUG THIS HOLE IN ANY PERMANENT MANNER. THIS IS A SAFETY VENT WHICH FUNCTIONS ONLY IF THE SIDE COVER SEAL FAILS. IF THE SEAL FAILS AND THE PLUG CANNOT VENT, THE STEERING GEAR MAY LOCKUP OR OTHERWISE MALFUNCTION.**

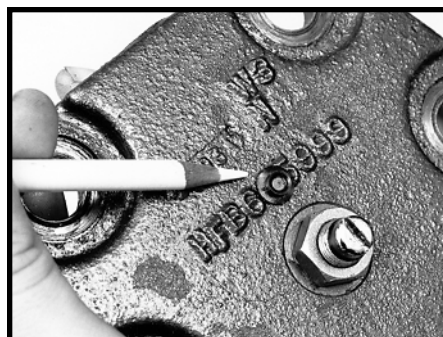


Figure 144

**install side cover gasket**

38. Apply clean grease to the new side cover gasket (57), and assemble it onto the side cover (58). Apply enough grease to hold the gasket in place. SEE FIGURE 145.

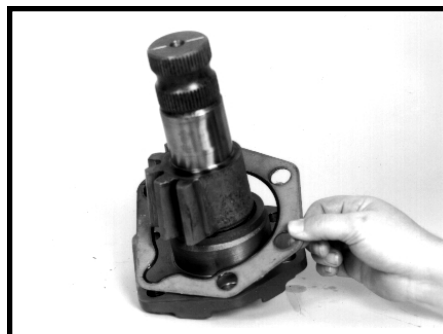


Figure 145

### center rack piston

39. There are four teeth on the rack piston (31). SEE FIGURE 146. Position the rack piston so that the tooth space identified by the pencil, it is the space between the second and third teeth, is in the center of the sector shaft opening. SEE FIGURE 147. This will center the rack piston in the opening.

### WARNING

**WARNING: IF THE RACK PISTON IS NOT CENTERED WHEN SECTOR SHAFT IS INSTALLED, GEAR TRAVEL WILL BE SEVERELY LIMITED IN ONE DIRECTION. THIS COULD RESULT IN AN ACCIDENT.**

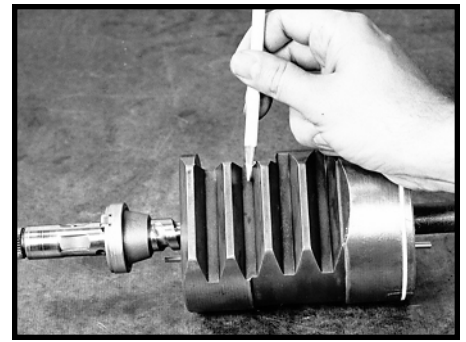


Figure 146

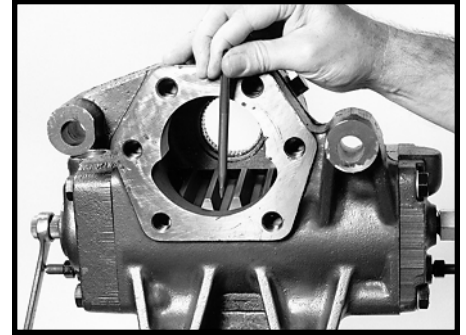


Figure 147

### make initial worm preload adjustment

40. With the rack piston (31) in its center position, torque the worm shaft/input shaft adjusting screw (39) using a 5/16 inch Allen wrench socket into solid height (15 to 20 ft. lbs. [20.3 to 27.1 N m]). Then loosen the adjusting screw 1/4 to 1/2 turn and note torque required to rotate worm shaft/input shaft (17) through 90°; each side of center, using an 11/16 inch or 3/4 inch 12 point socket and an appropriate torque wrench. SEE FIGURE 148. Loosen adjusting screw if noted input shaft torque exceeds 15 in. lbs. (1.7 N m). Return rack piston to center position.

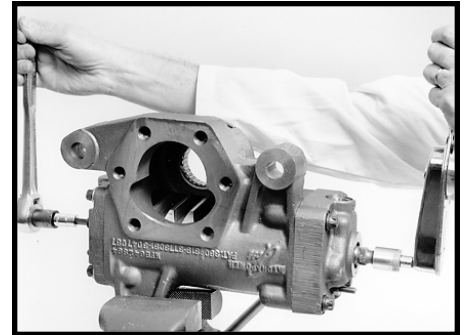


Figure 148

### install sector shaft and side cover into housing

41. Clean off any old tape on the sector shaft (50) serrations. Retape the serrations and bolt groove with one layer of masking tape. Install the sector shaft and side cover (58) into the gear housing (20) as an assembly. Make sure that the center tooth of the sector shaft engages the center space (between the second and third teeth) of the rack piston. SEE FIGURE 149.

### WARNING

**WARNING: AS YOU PLACE THE SECTOR SHAFT THROUGH THE HOUSING BEARING (21), DO NOT KNOCK ANY OF THE BEARING ROLLS OUT OF THE BEARING RACE. DO NOT PINCH THE SIDE COVER GASKET (57). IF YOU DO EITHER, THE BEARING OR SEAL MAY PREMATURELY FAIL, AND THIS COULD RESULT IN A LOSS OF POWER STEERING ASSIST.**

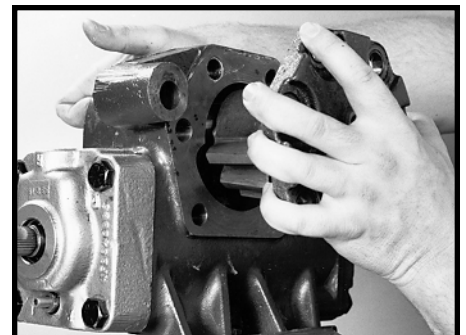


Figure 149

### install side cover bolts

42. Install the six special side cover bolts (61) into the side cover and torque them to 220-240 ft. lbs. (298-325 N m) if dry or 160-180 ft. lbs. (217-244 N m) if lubricated. 15/16 inch socket required.

### install trunnion cover washer

43. Place the trunnion cover (26) exterior face down on a bench and install the **new** Teflon backup washer (24). SEE FIGURE 150.



Figure 150



### install seal

- Next, install the **new** two-piece sector shaft seal (23) so that the words "oil side" are visible after the seal is in place. SEE FIGURE 151.

### WARNING

**WARNING: THE WORDS "OIL SIDE" MUST BE VISIBLE ON THE SEAL AFTER IT IS IN PLACE. IF NOT, THE SEAL WILL NOT FUNCTION, AND A LOSS OF POWER STEERING ASSIST MAY OCCUR.**

### install seal ring

- Grease the **new** trunnion cover seal ring (25) and install it into the trunnion cover (26) seal ring groove.

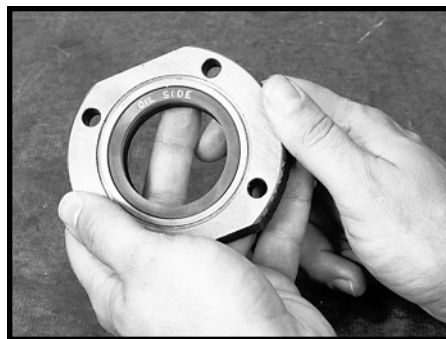


Figure 151



Figure 152

### install trunnion cover and bolts

- Visually inspect the housing bearing (21) to make sure that all of the bearing rolls are properly in place. Then install the trunnion cover (26). SEE FIGURE 152. Install the four trunnion cover bolts (28) and torque them to 15-22 ft. lbs. (20-30 N m) if dry or 11-16 ft. lbs. (15-22 N m) lubricated. SEE FIGURE 153.

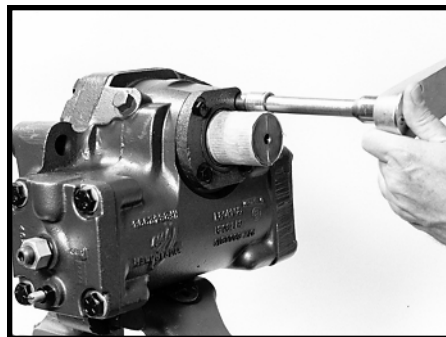


Figure 153

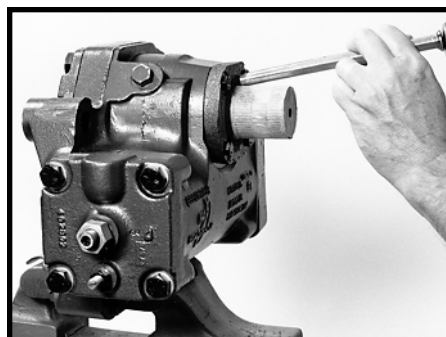


Figure 154

### assemble dirt and water seal and protector boot

- Pack the cavity around the seal area of sector shaft (50) with clean high temperature industrial grease per Ross specification 045231, Mobil Temp 1 or 2 or equivalent. Assemble a **new** dirt and water seal (27) using a suitable blunt end drift. SEE FIGURE 154. Apply a generous amount of the same grease inside of the inner ring of protector boot (63) Assemble protector boot (63) over sector shaft (50) and trunnion cover (26), locating the grease fitting hole toward the input shaft end of gear assembly. Assemble grease fitting (64) into its hole in the protector boot if required. SEE FIGURE 155.



Figure 155

**install input shaft seal pack**

- 48. Apply clean grease to the input shaft seal assembly (7 and 8) and to the input shaft. Install the new two-piece input shaft seal (7 and 8), flat side out, and then the steel backup washer (6), using seal driving tool J26653. Install the retaining ring (5) SEE FIGURES 156, 157.

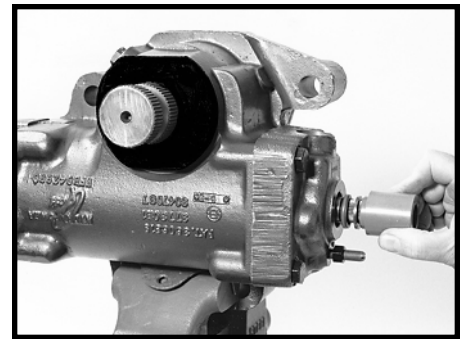


Figure 156

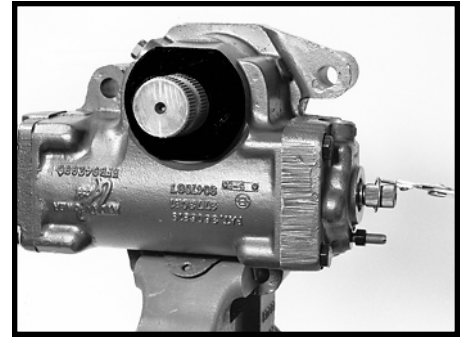


Figure 157

**pack with grease, install dirt and water**

- 49. Pack the area around the input shaft with clean high temperature industrial grease per Ross specification 045231, Mobil Temp 1 or 2 or seal equivalent, and install the new dirt and water seal (4), with part number facing out, using seal driving tool J26654 or suitable blunt-ended drift. SEE FIGURE 158. If the dirt and water seal has a rim, it should be pressed against the valve housing face. If the seal does not have a rim, the seal should be pressed in flush with the valve housing face.

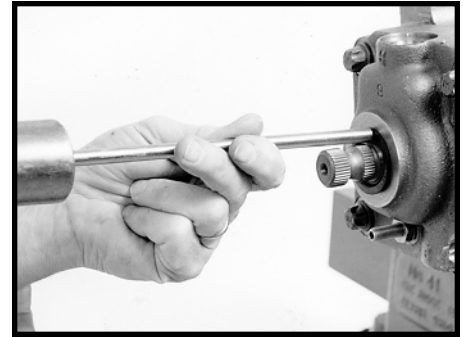


Figure 158

**assemble seal protector**

- 50. Apply more of the special grease to the cupped side of the new seal protector (62) and assemble it, cupped side in onto the worm shaft/input shaft (17) and into the serration relief groove. SEE FIGURE 159.



Figure 159

**install manual bleed screw, if equipped**

- 51. If your gear is equipped with the manual bleed screw (20A), install it into the gear housing (20) and torque it to 27-33 in. lbs. (3.1-3.7 N m). SEE FIGURE 160. 5/16 inch hex socket required.



Figure 160

**CAUTION**

**CAUTION: For next step, make sure gear is very secure in vise.**

**install automatic bleed screw, if equipped**

52. If your gear is equipped with the automatic bleed screw (20B), position the steering gear so that the cylinder bore axis is vertical and the input shaft is pointing down. SEE FIGURE 161. Then, install the spring (20D), the special pin (20C) spherical end first, and the automatic bleed screw (20B) into the housing. SEE FIGURE 162. Torque the screw to 16-20 ft. lbs. (22-27 N m). 1/2 inch hex or E-10 Torx socket required.

**WARNING**

**WARNING: IF THE AUTOMATIC BLEED ASSEMBLY IS IMPROPERLY ASSEMBLED, THERE MAY BE A LOSS OF POWER STEERING IN ONE DIRECTION.**

This completes assembly of the HFB64 steering gear. Before you install the gear into the vehicle, make final adjustments described on page 49. All ports should be plugged until unit is installed in the vehicle.

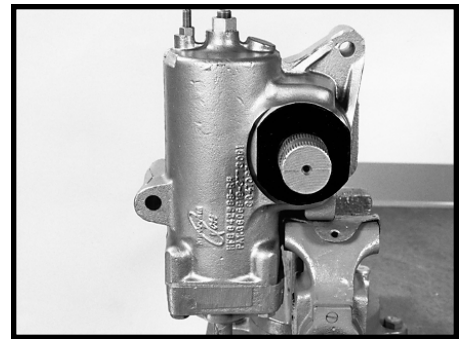


Figure 161

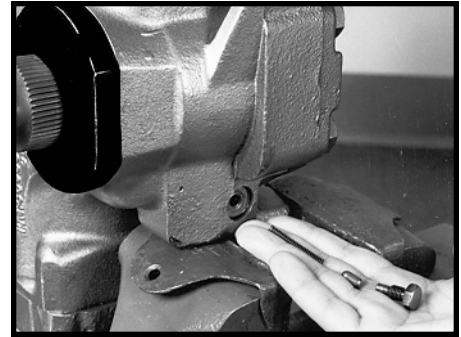


Figure 162

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