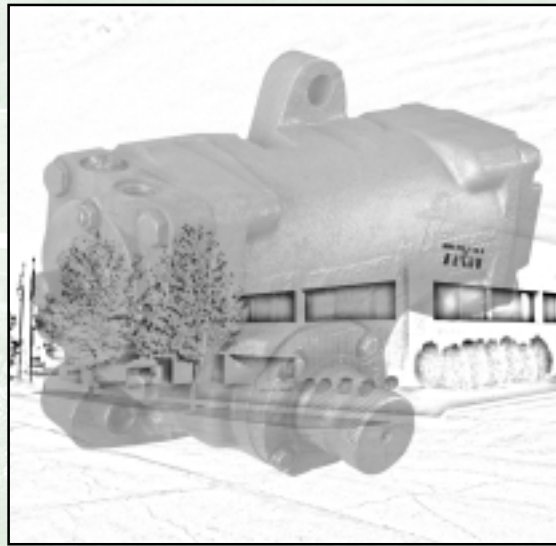


# HFB Steering Gear Service Manual

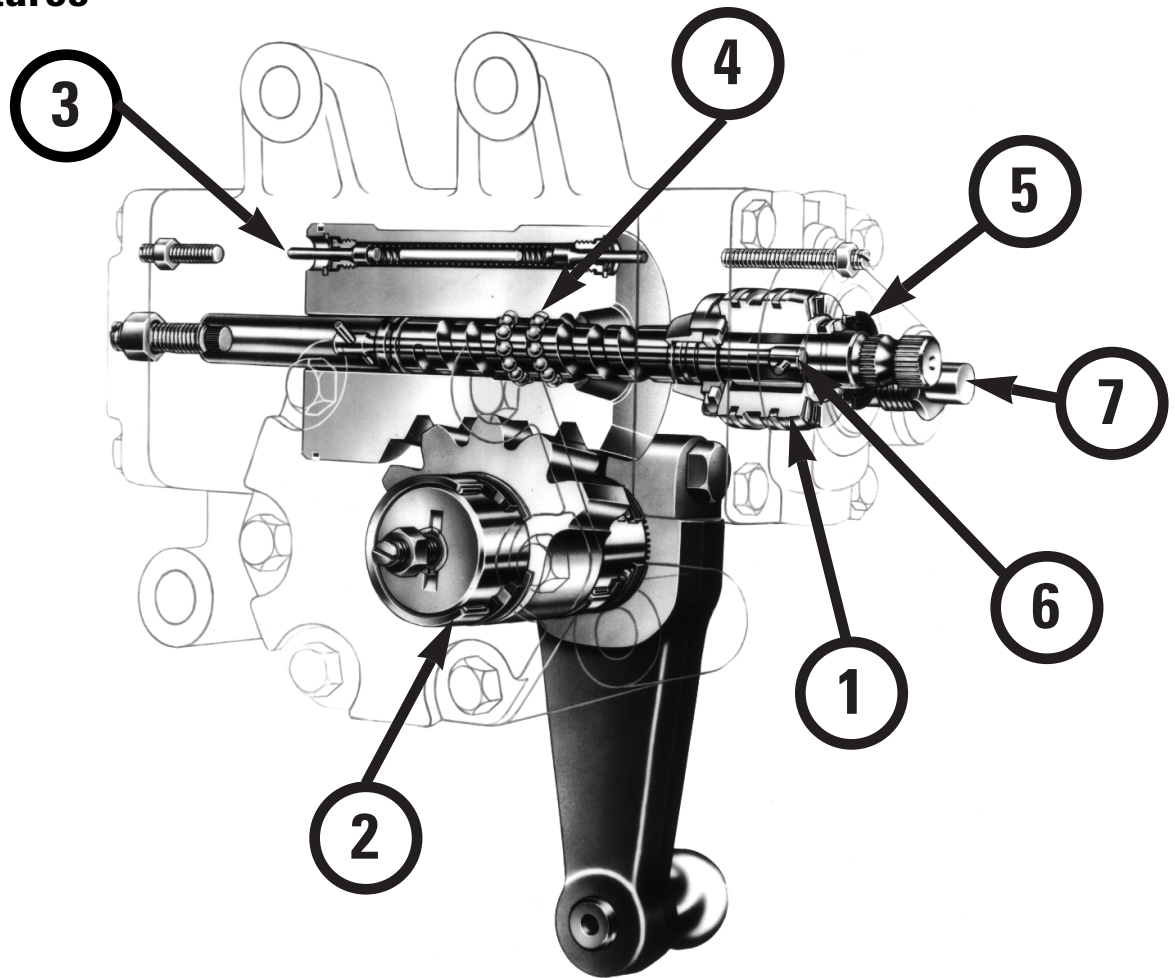
HFB64 SERIES



# 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.

# Disassembly

## Preparation

- ∫ THOROUGHLY CLEAN OFF ALL OUTSIDE DIRT, ESPECIALLY FROM AROUND FITTINGS AND HOSE CONNECTIONS, BEFORE YOU REMOVE THE GEAR.
- ∫ Drain the steering gear assembly.
- ∫ Remove input and output shaft connections per 1.1 and 2.1, Page 11 and 14.
- ∫ Remove the supply and return lines from the gear, and immediately plug all port holes and fluid lines.

**WARNING: THIS STEERING GEAR WEIGHS APPROXIMATELY 80 POUNDS 36 KG DRY. EXERCISE CAUTION WHEN YOU REMOVE, LIFT, OR CARRY IT. DO NOT POUND THE UNIVERSAL JOINT OR INPUT SHAFT COUPLING ON OR OFF THE INPUT SHAFT. INTERNAL DAMAGE TO THE STEERING GEAR CAN RESULT.**

- ∫ Remove the steering gear from the vehicle and take it to a clean surface (a piece of wrapping paper makes an excellent disposable top).
- ∫ Clean and dry the gear before you start to disassemble it.
- ∫ As you disassemble the gear, clean all parts in clean, petroleum-based solvent, and blow them dry only.

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

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

**CAUTION: Never steam clean or high-pressure wash hydraulic steering components. Do not force or abuse closely fitted parts.**

- ∫ Keep each part separate to avoid nicks and burrs.
- ∫ Discard all seals, O-rings, and gaskets removed from the gear. Replace them with new parts only.

## Disassembly

### position gear and sector shaft

1. Position the steering gear firmly in a vise with the gear's worm shaft/input shaft (17) in a horizontal direction. Prepare for fluid drainage and unplug fluid line ports. Rotate worm shaft/input shaft with an 11/16 inch or 3/4 inch 12 point socket or box end wrench, through the gear travel several times to purge hydraulic fluid from the unit. Then position the timing mark located on the end of the sector shaft to a vertical direction. SEE FIGURE 38.

### remove protector boot & dirt and water seal

2. Remove the seal protector boot (63), grease fitting (64) if included and the dirt and water seal (27) from the trunnion cover (26). SEE FIGURE 39. Discard protector boot and seal.

### clean sector shaft and loosen jam nut

3. Remove any paint or corrosion from the nonserrated area of the sector shaft (50) (as in 1.3, Page 11), and loosen the sector shaft adjusting screw jam nut (59).

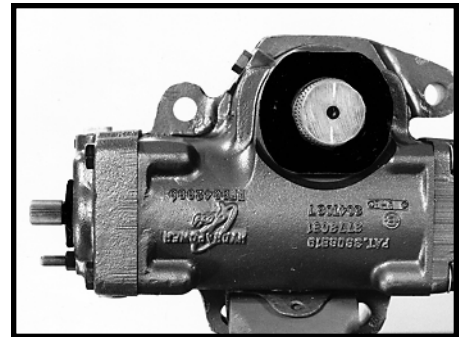


Figure 38

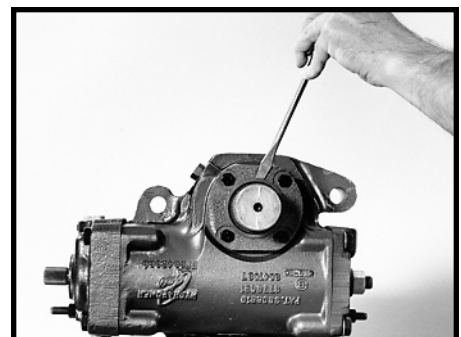


Figure 39

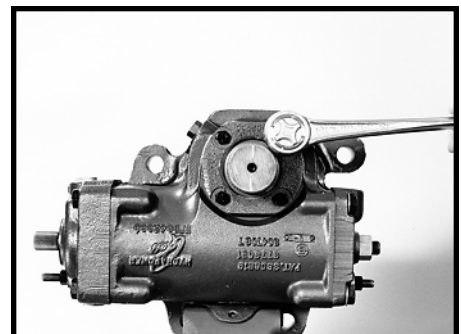


Figure 40

**remove trunnion cover bolts**

4. Remove the four trunnion cover bolts 1281 with a 1/2 inch socket. SEE FIGURE 40.

**remove trunnion cover and seal package**

5. Remove the trunnion cover (26). Remove and discard the seal ring (25), the two piece sector shaft seal (23) and the Teflon back-up washer (24) from the trunnion cover. SEE FIGURE 41.

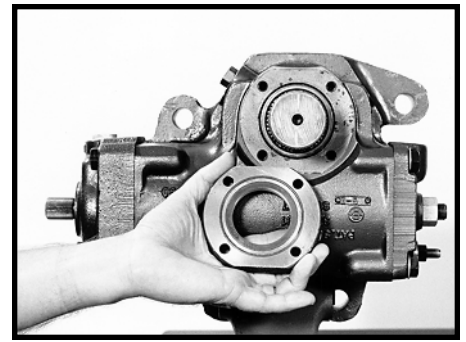


Figure 41

**tape sector shaft**

6. Tape the serrations and bolt groove of the sector shaft (50) with one layer of masking tape to prevent loose bearing rolls from "hanging up" the sector shaft during its removal. SEE FIGURE 42. The tape should not extend on to the sector shaft bearing diameter.



Figure 42

**remove side cover bolts**

7. Prepare for fluid to drain, and remove the six special bolts (61) from the side cover (58) with a 15/16 inch socket. SEE FIGURE 43.

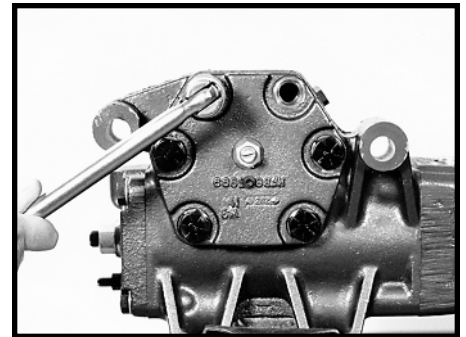


Figure 43

**NOTE**

**NOTE: These bolts are special because they are equipped with either a ring or washer design on the underside of the head. SEE FIGURE 44. If you replace one or more bolts, you must use bolts of either design and of the SAME SPECIAL TYPE AND LENGTH AS THOSE YOU REMOVED. Do not use a substitute. You can get these bolts through your OEM parts distributor.**

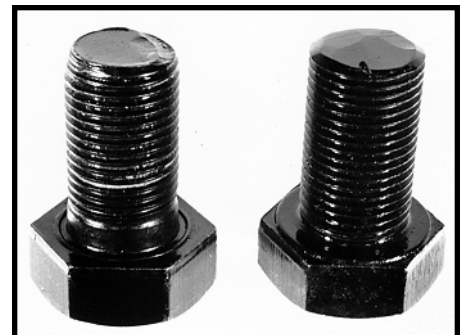


Figure 44

**begin to remove side cover**

8. Begin to remove the side cover (58) and sector shaft (50) as an assembly. SEE FIGURE 45. Stop removal when the bearing rolls in the housing bearing (21) are half exposed. Coat the bearing rolls with grease. As a means of starting the removal of the side cover and sector shaft assembly, you may use a soft hammer or wooden hammer handle.

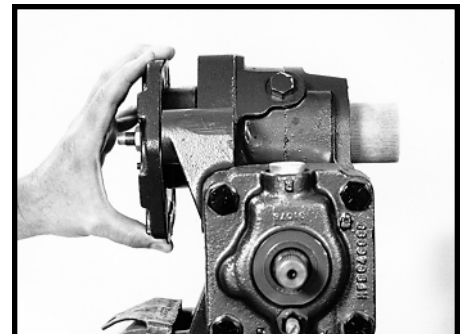


Figure 45

**NOTE**

**NOTE: When the bearing rolls are half exposed and it is evident that the unit has a caged bearing (rolls retained), the following two notes do not apply.**

**NOTE**

**NOTE:** Take care to remove this assembly slowly, or it may come out too quickly for you to retain the bearing rolls in the housing bearing race. Follow the shaft end with the bearing tool (J26738) to retain the rolls, or when the rolls are half exposed, be sure to coat them with grease to retain them in the housing bearing. SEE FIGURE 46.

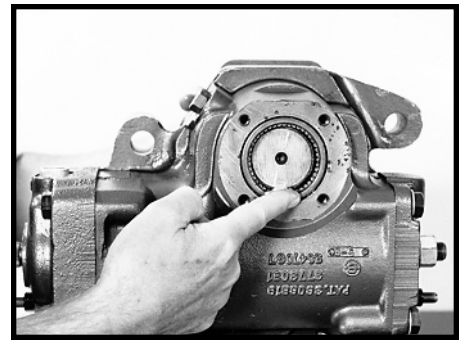


Figure 46

**CAUTION**

**CAUTION:** If one or more of the rolls is lost, you must replace the entire bearing (see disassembly step 41). If the bearing is identified as BR-866-1 or is not identified, there are 44 rolls. If the bearing is identified as F83508, there are 43 rolls. The number on the housing bearing may not be visible while it is in place, so take care to insure that no rolls are lost during disassembly or assembly

**remove side cover and sector shaft**

- 9. Finish removing the side cover (58) and sector shaft (50) as an assembly. Remove side cover gasket (57) and discard.

**remove bearing rolls**

- 10. If the housing bearing has loose rolls, remove the bearing rolls from the bearing (21) race, count them and put them aside as a set for cleaning, inspecting and reassembly

**remove jam nut**

- 11. Remove the sector shaft adjusting screw jam nut (59). SEE FIGURE 47. 3/4 inch socket required.

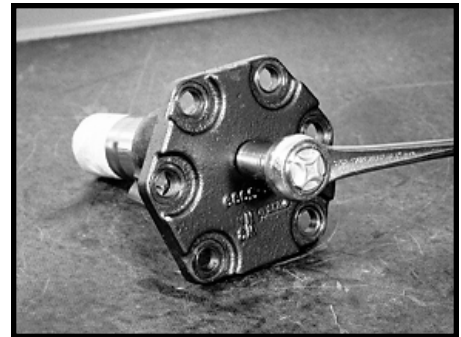


Figure 47

**NOTE**

**NOTE:** A side cover (58A) will have a "DU" bushing and once piece seal (54A). A side cover (58) will have a "DU" bushing or a roller bearing, steel back up washer (56) teflon backup washer (55), two piece seal (54) and retaining ring (53). The side cover roller bearing can have retained (caged) or loose rollers. The teflon backup washer (55) and two piece seal (54) may have been replaced with an integral washer and seal (54/55). See exploded assembly view.

**remove sector shaft from side cover**

- 12. Screw the sector shaft adjusting screw (51) through the side cover (58 or 58A). SEE FIGURE 48. Place the side cover exterior side down and lift the sector shaft out vertically. SEE FIGURE 49.

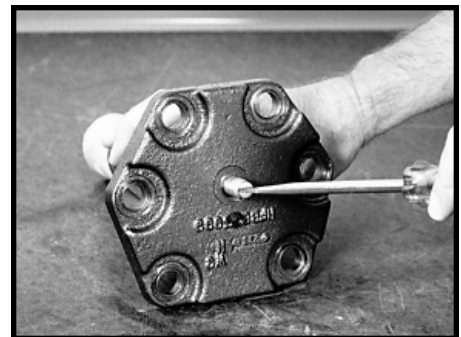


Figure48

**NOTE**

**NOTE:** If the side cover bearing assembly has uncaged (loose) rolls, the vertical position will allow the side cover bearing rolls to fall into the side cover, where you may easily collect and count them. The bearing with no identification or identified as BR-866-1 will have 44 rolls. The bearing identified as F83508 will have 43 rolls.



Figure 49

**CAUTION**

**CAUTION:** The part number of the bearing in the side cover may not be visible on the surface. Take care not to lose any rollers during disassembly and assembly, or you will have to replace the complete side cover assembly.

**WARNING**

**WARNING:** IF THE BEARING IS THE UNCAGED (LOOSE) ROLL TYPE, DO NOT MIX THE ROLLS FROM THE SIDE COVER WITH THE ROLLS FROM THE HOUSING BEARING. THE BEARING RACE AND ROLLS ARE A MATCHED SET. INTERCHANGING THE ROLLS COULD RESULT IN PREMATURE BEARING OR SEAL FAILURE, WHICH COULD CAUSE A LOSS OF POWER STEERING.

**remove side cover seal package**

- 13. If included, remove the side cover retaining ring (53), the two-piece side cover seal (54), the Teflon backup washer (55), and the steel backup washer (56) from the side cover (58) SEE FIGURES 50 & 51. Discard the two-piece seal and the Teflon backup washer.

Or if seal (54A) is to be removed, clamp side cover (58A) in a vise as shown. Screw a 1/2-20 UNF 2A x 3" bolt into the side cover adjusting screw hole so that the bolt end is at a position that will support a rolling head (ladyfoot) type pry bar. With the pry bar supported on the bolt end, pry seal out of the side cover. Discard seal and remove bolt. SEE FIGURE 51A. Remove and discard vent plug (60).

**CAUTION**

**CAUTION:** Exercise special care when removing seal (54A) to prevent damaging the cover seal bore or "DU" bushing.

**remove retainer and adjusting screw**

- 14. Only if replacement of the retainer (52) and or adjusting screw (51) is required (see inspection procedure 8 page 32), place the sector shaft (50) firmly in a soft jawed vise and unstake the retainer using a suitable chisel. Turn the retainer out of the sector shaft pocket and remove the adjusting screw. Discard the retainer. SEE FIGURE 52.

**remove worm shaft adjusting screws and sealing nuts**

- 15. Loosen the worm shaft preload adjusting screw sealing nut (38) with a 1-1/16 inch socket, and loosen the worm shaft preload adjusting screw (39) about two turns with a 5/16 inch Allen socket or screwdriver. SEE FIGURE 53. If your gear is equipped with poppets, loosen the poppet adjusting screw sealing nut (3) and the poppet adjusting screw (40) about two turns. An 11/16 inch hex wrench required.

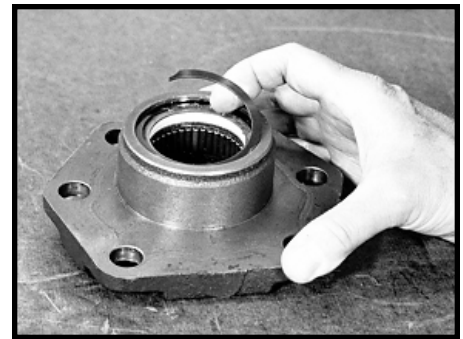


Figure 50

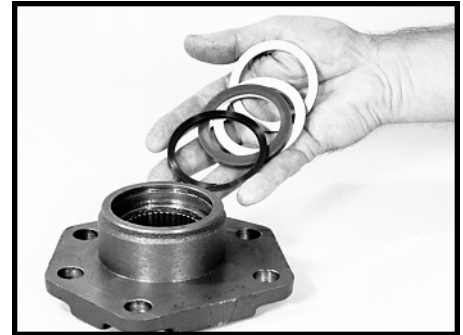


Figure 51

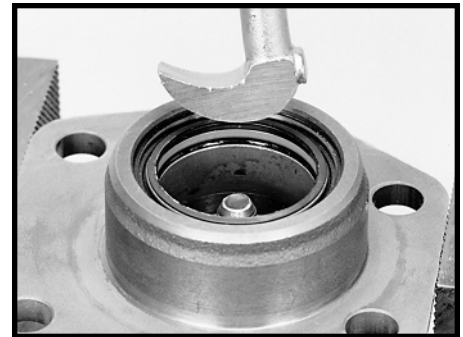


Figure 51A



Figure 52

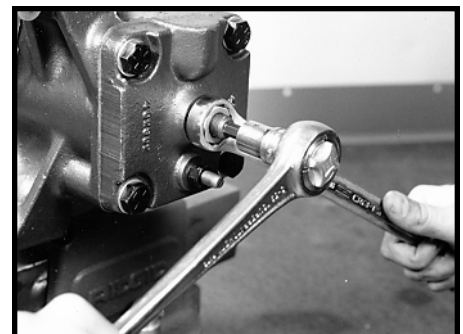


Figure 53

**NOTE**

**NOTE: The worm shaft adjusting screw and sealing nut and poppet adjusting screws and sealing nuts do not have to be removed unless apparent fluid leaks at the adjusting screw or damage indicate the sealing nuts and or screws be replaced.**

**remove end cover bolts and end cover, if equipped**

16. If your gear is equipped with a removable end cover (37), remove the four end cover bolts (41) and washers (41A) with a 13/16 inch hex or E-16 Torx socket. Then prepare for fluid to drain and remove the end cover. SEE FIGURE 54.

**remove end cover seal ring**

17. Remove the end cover seal ring (10) from the groove in the end cover (37). SEE FIGURE 55.

**NOTE**

**NOTE: Gears with the closed end housing do not have an end cover seal ring, end cover bolts or washers.**

**remove relief valve, if equipped**

18. Remove the relief valve (9A), if equipped, from the valve housing (9). SEE FIGURE 56. One inch hex socket required.

**remove relief valve seal pack**

19. Remove and discard the two relief valve O-rings (9B and 9D) and the Teflon seal ring (9C) from the relief valve (19A) SEE FIGURE 57.

**remove seal protector, clean input shaft**

20. Remove and discard seal protector (62) from worm shaft/input shaft (17). Clean any paint or foreign matter from the exposed nonserrated area of the input shaft with a fine grade of emery paper. SEE FIGURE 20 page 14.

**loosen other poppet sealing nut and screw**

21. If your gear is so equipped, loosen the other poppet adjusting screw sealing nut (3 or 3A) and the other poppet adjusting screw (2 or 2A) in the valve housing (9) about two turns.

**NOTE**

**NOTE: It is recommended that a line be scribed across the edge of valve housing (9) and gear housing (20) before disassembly of valve housing for correct positioning at reassembly.**

**remove valve housing bolts and valve housing**

22. Remove the four valve housing bolts (1) with a 13/16 inch hex or E-16 Torx socket. Prepare for some fluid to drain, and remove the valve housing (9). SEE FIGURE 58 & 59.

**NOTE**

**NOTE: The valve sleeve (15) will probably remain in the valve housing.**



Figure 54

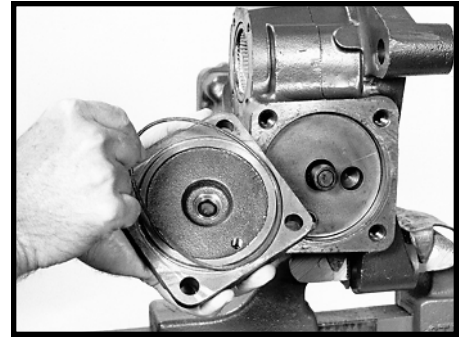


Figure 55

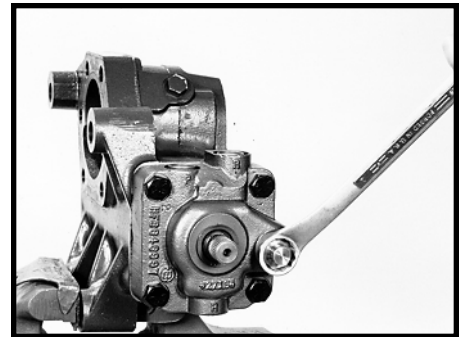


Figure 56

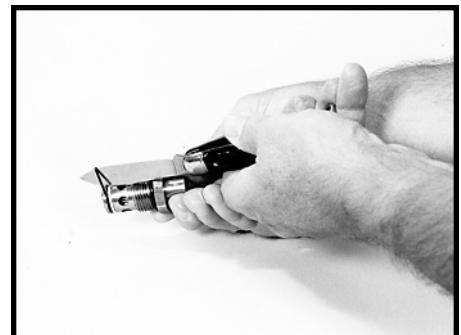


Figure 57



Figure 58



**WARNING**

**WARNING: DO NOT DISASSEMBLE THE WORM SHAFT/INPUT SHAFT ASSEMBLY (17) WHICH INCLUDES THE WORM SHAFT, INPUT SHAFT, TORSION BAR, TORSION BAR PINS, DRIVE RING AND DRIVE RING RETAINER, AND INSERT. DO NOT UNBEND THE DRIVE RING RETAINER TANGS THAT HOLD THE DRIVE RING IN PLACE. SEE FIGURE 60. DOING EITHER WILL ALTER THE VALVE TIMING, WHICH COULD CAUSE THE VEHICLE TO PULL TO ONE SIDE OR THE OTHER.**

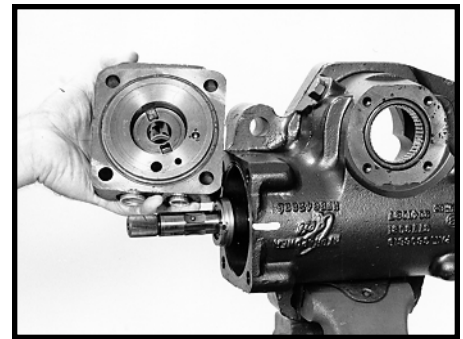


Figure 59

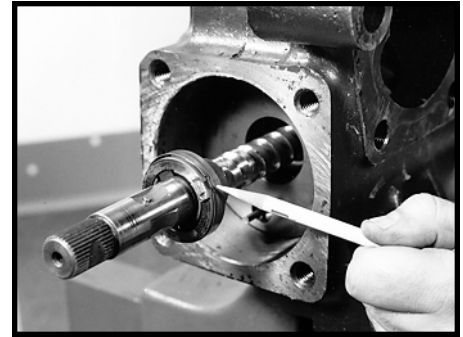


Figure 60

**remove valve sleeve**

- 23. Remove the valve sleeve (15) from the valve housing (9). SEE FIGURE 61.



Figure 61

**remove thrust washers and bearing**

- 24. Remove the first thrust washer (11), the thrust bearing (12), and the second thrust washer (11) from the valve housing (9). SEE FIGURE 62.

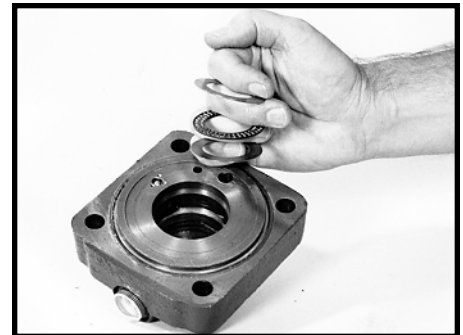


Figure 62

**NOTE**

**NOTE: The first thrust washer may stay on the end of the valve sleeve. If so, remove it from the sleeve.**

**remove seal rings**

- 25. Remove and discard the two Teflon seal rings (13) from the valve sleeve (15). SEE FIGURE 63.

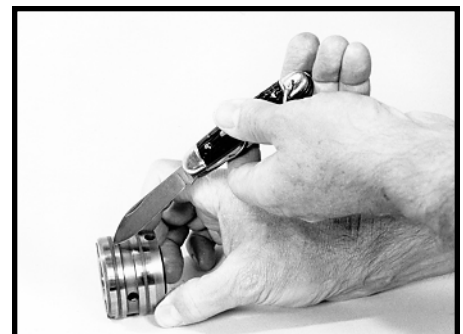


Figure 63

**remove O-rings**

- 26. Remove and discard the two backup O-rings (14) from the grooves in the valve sleeve (15).

**remove seal ring and O-ring**

- 27. Remove and discard seal ring (10) and, if included, the automatic bleed passage way O-ring (20E) from valve housing (9).

**remove dirt and water seal**

- 28. Remove and discard the dirt and water seal (4) SEE FIGURE 64.

**remove retaining ring**

29. Remove the retaining ring (5). SEE FIGURE 65.

**remove valve housing seal package**

30. Remove the steel backup washer (6), the input shaft seal (7), and the input shaft O-ring (8) from the valve housing (9). Discard the seal and O-ring. SEE FIGURE 66.

**remove poppet adjusting screw and nut**

31. Remove poppet adjusting screw (2 or 2A) and nut (3 or 3A) if replacement is required. A 5/16 24-2A UNF adjusting screw (2A) can be removed from the internal face of the valve housing after removing nut (3A) 9/16 or 11/16 inch socket required.

**remove rack piston and worm shaft/ input shaft**

32. Remove the rack piston (31) and worm shaft/input shaft (17) from the gear housing (20) as an assembly. SEE FIGURE 67. Set the rack piston and worm shaft assembly on a clean rag to keep the piston from rolling.

**NOTE**

**NOTE: The worm shaft part of the assembly will be inside the rack piston, with the input shaft part of the worm protruding from the rack. Take care when you remove this assembly from the housing. To prevent the Teflon rack piston seal (29) from getting caught in the sector shaft cavity, remove the assembly from the long end of the housing, if the housing is open on both ends.**

**NOTE**

**NOTE: To prevent the Teflon rack piston seal ring (29) from "hanging up" as it exits the housing sector shaft cavity in housings that are closed at the long end of the rack piston bore, cut and remove the seal ring from the rack piston when it is exposed in the sector shaft cavity of the housing, during the removal of worm shaft/input shaft, rack piston assembly.**

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

33. For rack pistons with the ball return guide clip (44), bend the tangs down on the two locking tabs (45). SEE FIGURE 68. Remove the two hex head bolts (46), tabs and clip. Discard locking tabs. SEE FIGURE 69. 1/2 inch hex socket required.

**NOTE**

**NOTE: The current HFB64 units and seal kits will utilize a ball return guide clip (44/45) with the two lock tabs integral to it.**

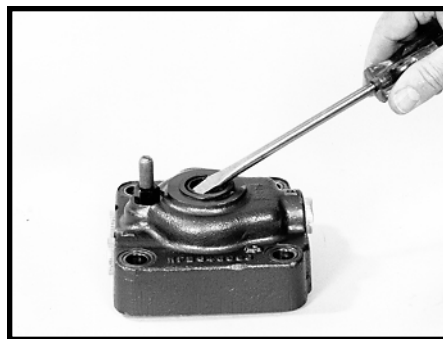


Figure 64

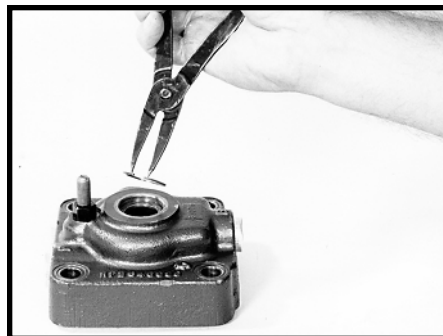


Figure 65

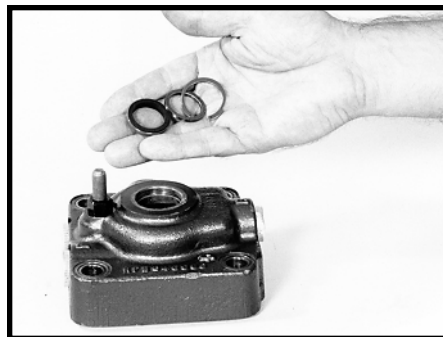


Figure 66

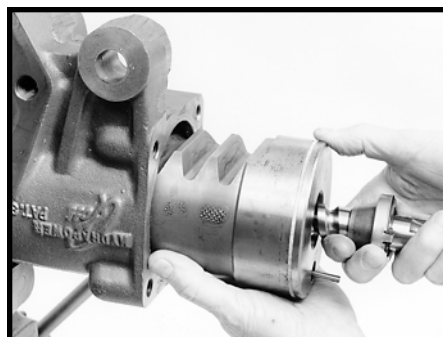


Figure 67



Figure 68

**NOTE**

**NOTE: If the seal kit being used includes a ball return guide clip (44/45) with integral lock tabs, discard the ball return guide clip removed from the unit.**

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

- 34. For a rack piston with the ball return guide cap (48) instead of the clip, remove the two special screws (49) which will require either a 5/32 inch Allen wrench or a T-30 Torx wrench. SEE FIGURE 70. Remove the ball return guide cap and the ball return cap seal (47). SEE FIGURE 71. Discard screws and cap seal.

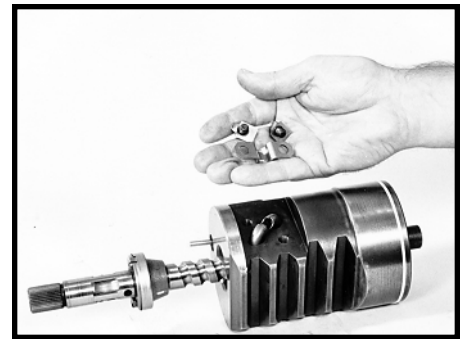


Figure 69

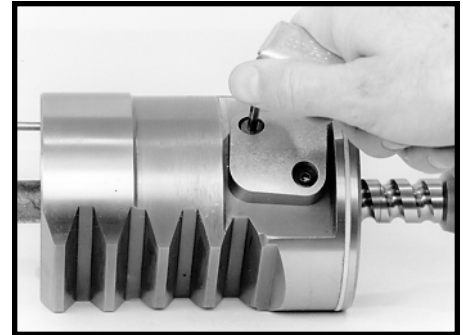


Figure 70

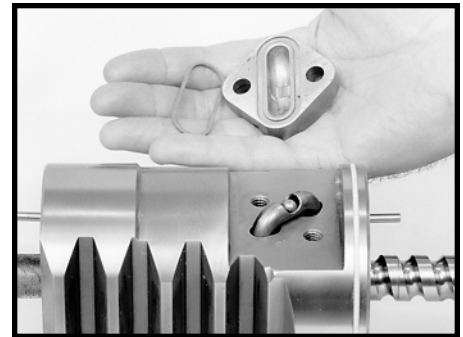


Figure 71

**remove guides and balls**

- 35. Remove the halves of the ball return guide (43) SEE FIGURE 72. Next, remove the 27 steel balls (42) from the rack piston (31) by rotating the worm shaft/input shaft (17) until the balls fall out. SEE FIGURE 73.

**NOTE**

**NOTE: The ball return guide is closely fitted with the rack piston, and you may have to remove the halves by carefully inserting a screwdriver between the rack and the guide. See composite picture of both rack piston assembly types in FIGURE 74.**

**CAUTION**

**CAUTION: The 27 steel balls are a matched set. Take care not to lose any of them. If you lose any of the balls, you must replace them with a complete, new set.**

**WARNING**

**WARNING: INCORRECT MATCHING OF BALLS, WORMSCREW AND RACK PISTON CAN RESULT IN LOSS OF STEERING, WHICH COULD RESULT IN AN ACCIDENT.**

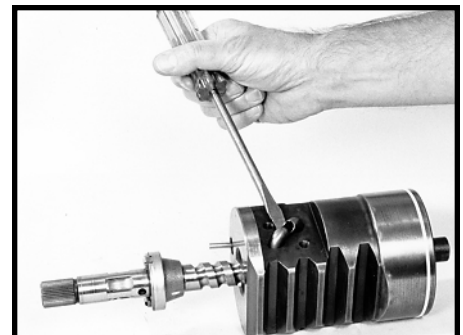


Figure 72

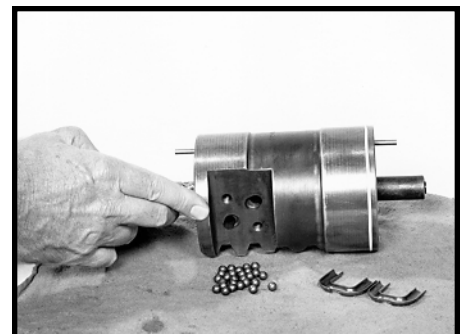


Figure 73

**remove worm shaft/input shaft**

36. Remove the worm shaft/input shaft (17) from the rack piston (31). SEE FIGURE 75.

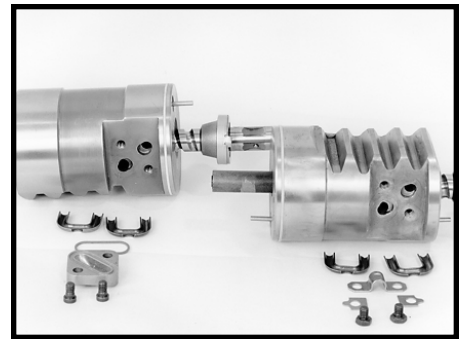


Figure 74

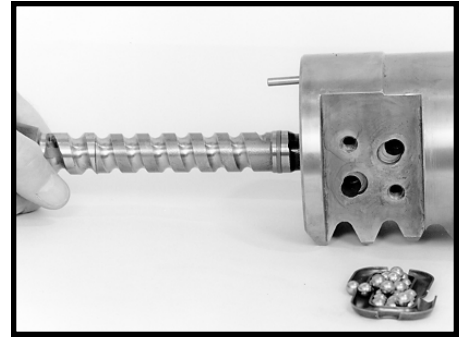


Figure 75

**remove seal ring and O-ring**

37. Remove and discard the Teflon rack piston seal ring (29) and backup O-ring (30). SEE FIGURE 76.

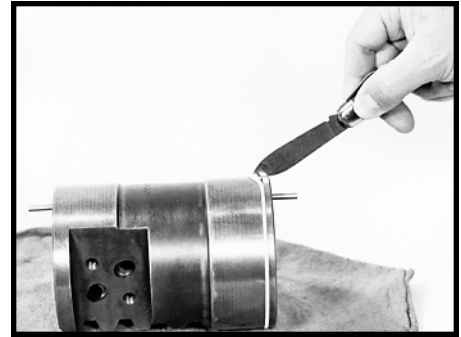


Figure 76

**remove worm shaft seal ring and O-ring**

38. Remove and discard the Teflon worm shaft seal ring (19) and O-ring (18). SEE FIGURE 77.

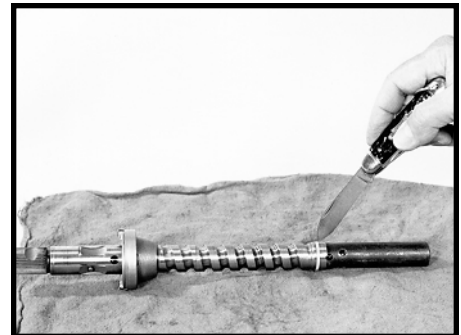


Figure 77

**remove bleed screw**

39. Your gear may be equipped with either a manual bleed screw (20A) or an automatic air bleed assembly (20B-E). If your gear has the manual bleed screw, remove it from the gear housing (20). A 5/16 inch socket required. SEE FIGURE 78. If your gear has the automatic air bleed assembly, it is usually not required that you service it. If it is necessary, however, remove the automatic bleed screw (20B) from the housing with a 1/2 inch socket or E-10 Torx socket. Then, tilt the housing upside down so that the special pin (20C) and spring (20D) will fall out. SEE FIGURE 79.

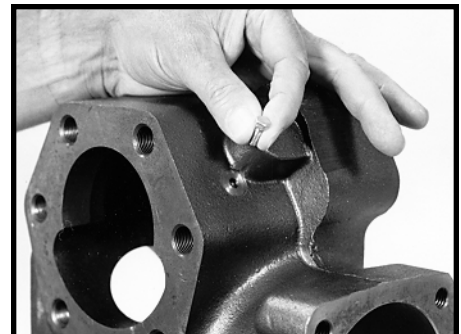


Figure 78

**WARNING**

**WARNING: DURING STEP 40 YOU SHOULD WEAR EYE PROTECTION, AS THE SPRING LOADED POPPETS COULD EJECT, AND CAUSE EYE INJURY.**

**remove poppets, if equipped**

- 40. If your gear is equipped with poppets, they will usually not require servicing. If it is necessary, however, position the rack piston (31) in a softjawed vice. Then, remove two poppet retaining rings (32), two poppet seats (33), two poppets (34), the nylon spacer rod (35), and the poppet spring (36). SEE FIGURES 80, 81, 82.

**remove housing bearing, if necessary**

- 41. The housing bearing assembly (21) or race should only be removed if you determine that only the bearing must be replaced after following inspection procedures 4, 5 and 6 on page 31. Remove the bearing in the following manner: Use bearing mandrel (special tool) J26738 or J37071 to apply pressure from the side cover opening and press the bearing out through the trunnion cover opening. SEE FIGURE 83. Maintain a good, square contact between the housing and press base to avoid damaging the housing bearing bore. Remove retaining ring (22) from bearing. Discard bearing.

**CAUTION**

**CAUTION: If the bearing is cocked while you press it out, it will burnish the bore, causing it to become oversized. You will then have to replace the gear housing.**

This completes disassembly of the HFB64 steering gear.



Figure 79



Figure 80

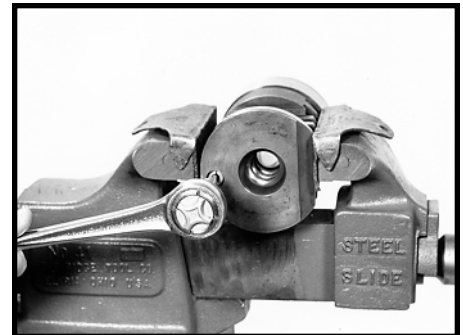


Figure 81

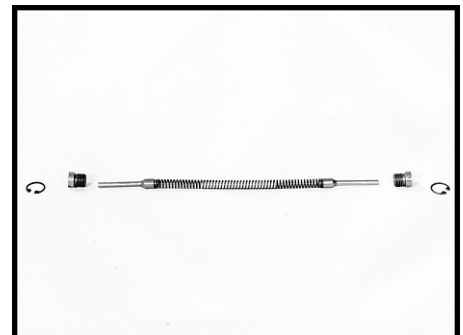


Figure 82

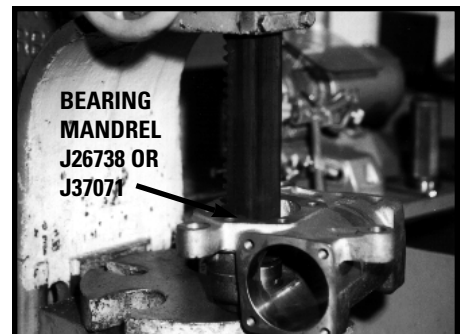


Figure 83

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