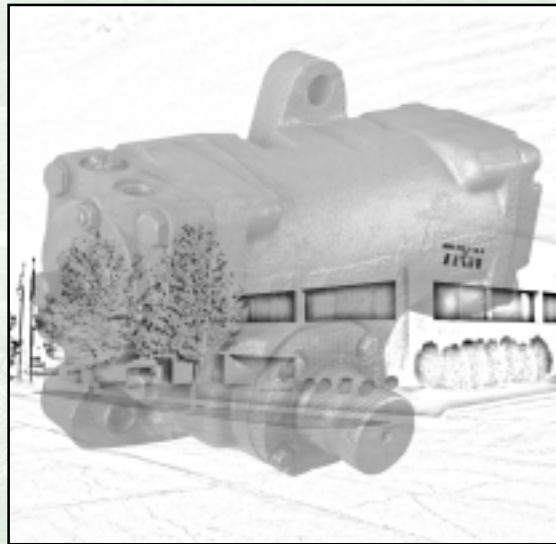


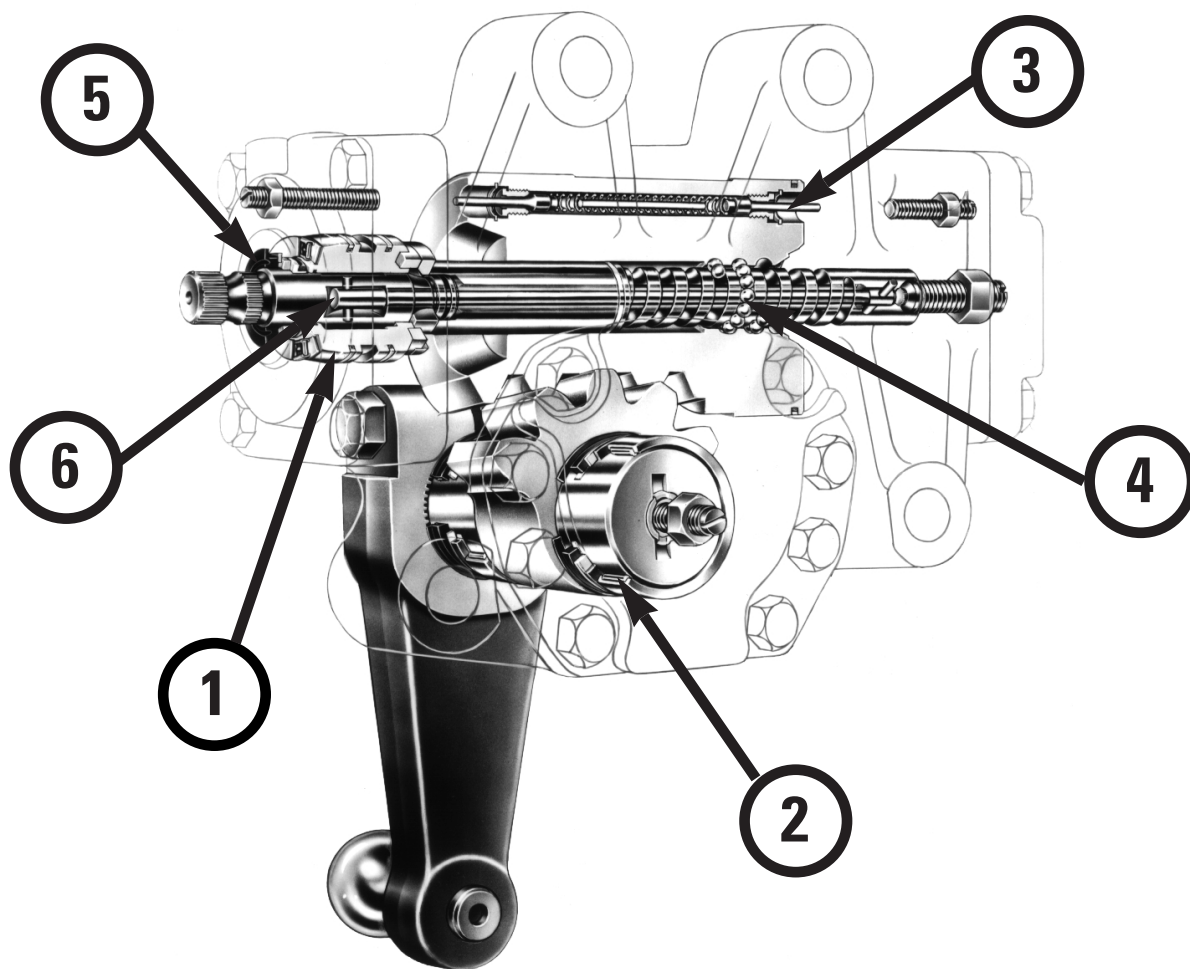
HFB Steering Gear Service Manual

HFB70 SERIES



HFB70 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. **Precision 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
 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"
- **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

Definitions

NOTE: A NOTE gives key information to make procedures easier or clearer.

CAUTION: A CAUTION refers to those procedures which must be followed to avoid damage to the gear.

WARNING: A WARNING REFERS TO THOSE PROCEDURES WHICH 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 HFB70 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 HFB70 steering gear, or (b) any repairs or service of a particular HFB70 steering gear will result in a properly functioning steering gear.

If inspection or testing reveals evidence of abnormal wear or damage to the HFB70 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 AN HFB70 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 HFB70 STEERING GEAR.

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular HFB70 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 HFB70 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.

This TRW Ross Gear Division vehicle power steering gear is covered by one or more of 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 and issued.

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Inspection

- Check to make sure that all sealing surfaces and seal cavities are free from nicks and corrosion. If any part is nicked or corroded where sealing occurs, you must replace the part to insure proper sealing.
- 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.

inspect rack piston teeth

1. Inspect the rack piston (29) teeth for cracks and wear. If you can detect a step by running your fingernail horizontally across the teeth surface, you must replace both the rack piston and sector shaft (48) and use a set of 34 service balls (43). SEE FIGURE 87.

inspect rack piston internal grooves

2. Inspect the rack piston internal ball-track grooves for brinelling (dents) or spalling (flaking). SEE FIGURE 88. If either condition exists, you must replace all of the following parts: the rack piston (29), the worm shaft/input shaft assembly (16), the valve sleeve (14) and the set of 34 balls (43).

inspect worm shaft

3. Inspect the worm shaft/input shaft assembly (16) ball track grooves for brinelling or spalling. SEE FIGURE 89. If either condition exists, you must replace all of the following parts: the worm shaft/input shaft assembly (16), the rack piston (29), the valve sleeve (14), the set of 34 balls. Visually inspect the upper shaft seal area near the input shaft serrations for nicks, and run your fingernail edge across the sealing surface to detect steps. SEE FIGURE 90. Visually inspect the sleeve (14) contact area of the worm shaft/ input shaft for discoloration from excess heat. If either of these conditions exist you must replace the worm shaft/input shaft assembly (16) and valve sleeve (14) as a matched set.

NOTE

NOTE: The input shaft is pinned to the worm shaft by the torsion bar pin, and the assembly is flexible and may appear slightly bent at this joint. This slight bend is normal. SEE FIGURE 91.

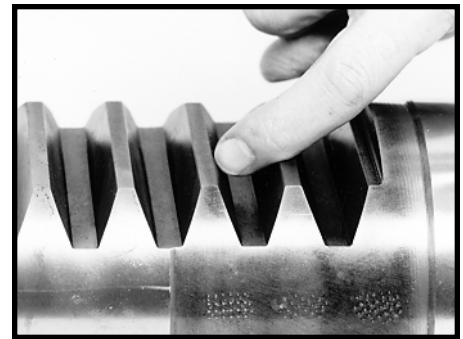


Figure 87



Figure 88

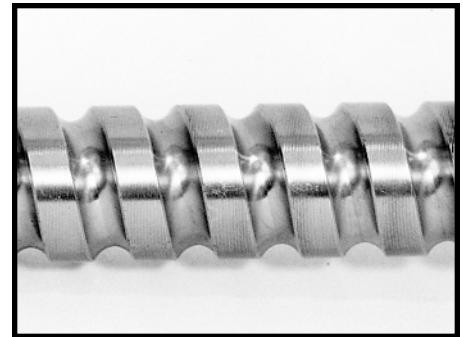


Figure 89

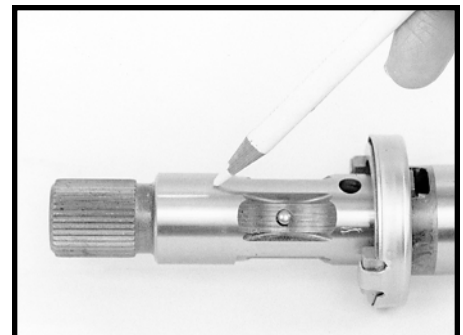


Figure 90



Figure 91

inspect housing cylinder bore

4. Inspect the housing (19) cylinder bore. SEE FIGURE 92. You will probably notice normal scoring marks running lengthwise through the bore. Since this scoring is normal, you should not compare it to the scoring considered detrimental in the cylinder bores of an internal combustion engine. Replace the housing only if you've tested it for internal leakage (as described in the troubleshooting section on page 7) and you've determined that the scoring, and not damaged seals, is responsible for the excessive internal leakage, greater than 1.5 gpm (5.7 liters/min.)

NOTE

NOTE: In running the internal leakage test after reassembly of the unit, make sure that internal leakage exceeding 1.0 gpm (3.8 liters/min.) can only be attributed to the housing and not to the improper assembly of the new seals in the worm shaft, rack piston, and valve assembly, before you decide to replace the housing.

inspect housing faces

5. Inspect the housing (19) faces for nicks that would prevent proper sealing. Replace the gear housing if these nicks are present and cannot be easily removed with a fine-toothed flat file without changing the dimensional characteristics. SEE FIGURE 93.

inspect housing and side cover bearings

6. Inspect the housing bearing and the side cover bearing race and rolls for brinelling or spalling. If either condition exists, replace the damaged housing bearing (20). For the housing bearing, follow disassembly step 41 and assembly step 2, Pages 30 and 34. If the side cover bearing is damaged, replace side cover assembly. SEE FIGURES 94, 95.

WARNING

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

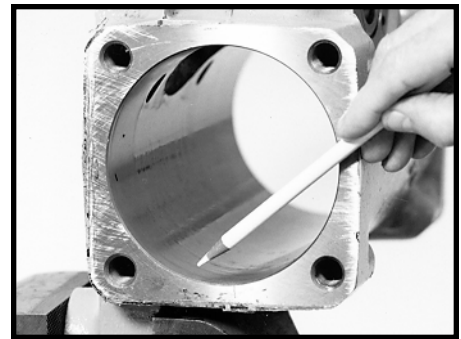


Figure 92

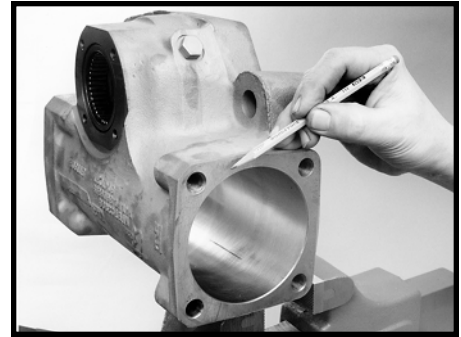


Figure 93

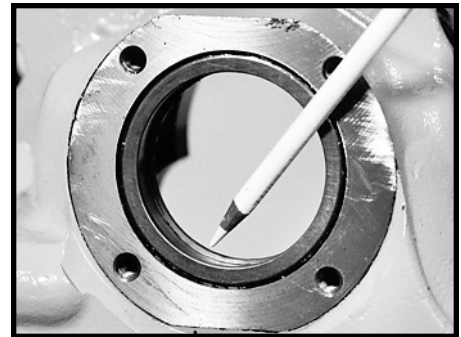


Figure 94



Figure 95

inspect sector shaft assembly

7. Inspect the sector shaft (48) bearing and sealing areas and sector teeth contact surfaces for brinelling or spalling. SEE FIGURE 96. Run your fingernail edge across these areas to detect steps. Inspect also for cracks. Remove any masking tape from the shaft serrations and inspect for twisted or otherwise damaged serrations. If any of these conditions exist, replace the sector shaft.

NOTE

NOTE: A service shaft assembly will have the adjusting screw (49) and retainer (50) assembled into it. The screw (49) and retainer (50) can be serviced separately if required.

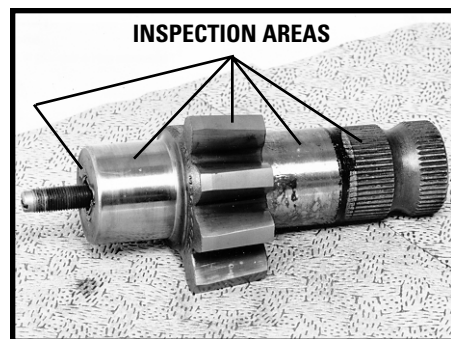


Figure 96

inspect adjusting screw and retainer

8. Inspect the sector shaft assembly for damaged adjusting screw (49) threads. The staked retainer (50) must be locked in place, and have no cracks. The adjusting screw must rotate by hand with no perceptible end play (lash) Replace adjusting screw, if damaged. Replace the retainer, if damaged, or if the adjusting screw requires replacement or adjustment.

inspect thrust washers and bearing

9. Inspect the thrust bearing (11) rollers for any deterioration. Inspect the two thrust washers for brinelling, spalling, or cracks. SEE FIGURE Replace any part with these conditions.

This completes inspection of the HFB70 steering gear.

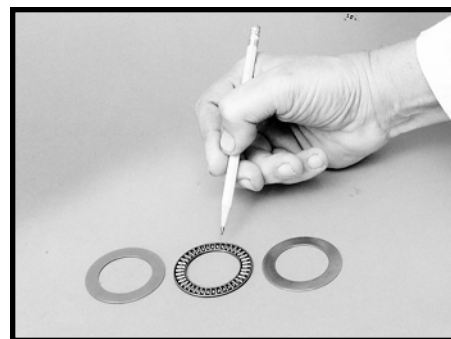


Figure 97

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