TRW Automotive

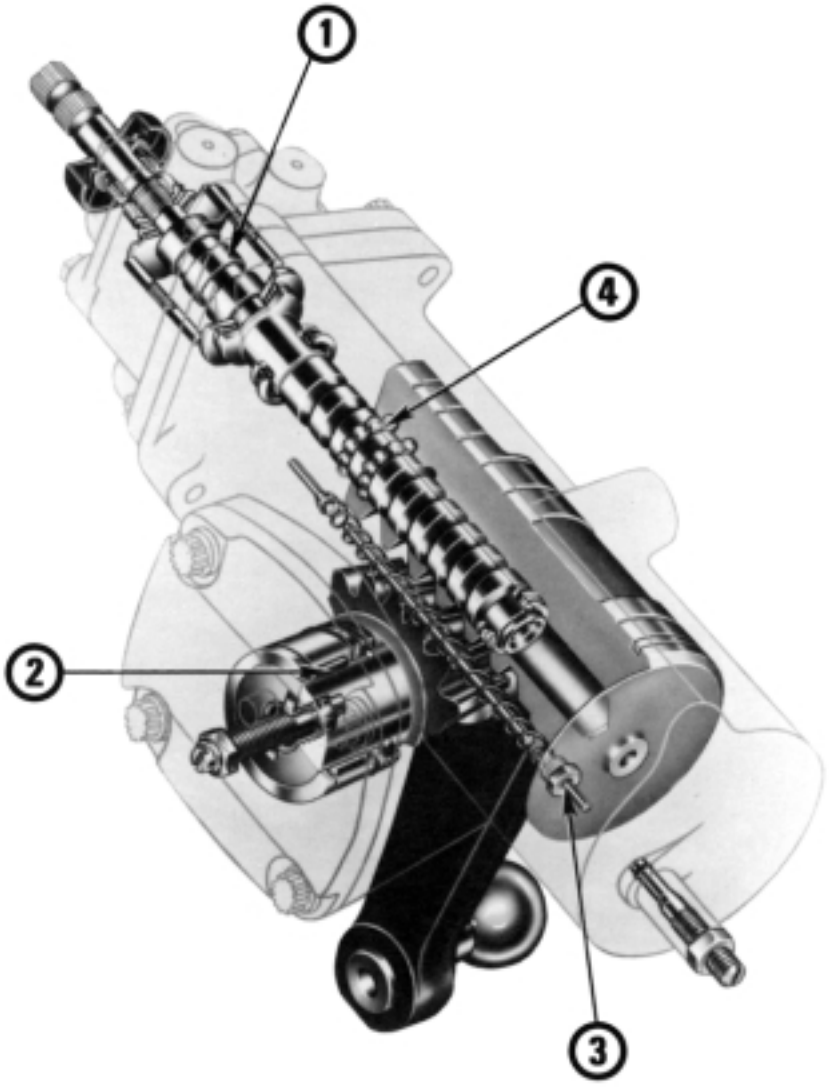
Commercial Steering Systems

HF Steering Gear Service Manual

HF54 SERIES

HF54 Integral Hydraulic Power Steering Gear

This steering gear was specifically designed for motor trucks. Our design experience with previous models of hydraulic power steering gears have been incorporated into this product.



Design Features

1. **Preloaded Linear Spool 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

- High Temperature Seals—These specially developed seals may be operated intermittently at 250°F (121.1°C)
- Manual Steering Capability—Provides for steering control in the event of hydraulic failure
- Auxiliary Porting Available—For auxiliary cylinder control
- Seal Protectors—Provide protection from harsh environment

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.

The product represented herein is protected by United States patent No. 3, 047, 087

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Table of Contents

WARNING: ALL STEERING MECHANISMS ARE LIFE AND LIMB ITEMS. AS SUCH, IT IS IMPERATIVE THAT THE INSTRUCTIONS IN THIS BOOKLET ARE FOLLOWED TO THE LETTER. FAILURE TO OBSERVE THE PROCEDURES SET OUT IN THIS PAMPHLET MAY RESULT IN LOSS OF STEERING.

Introduction

Service Manual for Model HF54

This service manual has one purpose: to guide you in maintaining, troubleshooting and servicing the HF54 Hydrapower™ integral power steering gear.

Material in this manual is organized so you can work on the HF54 and get results without wasting time or being confused. To get these results, you should review the contents of this manual before you begin any work on the HF54.

The section of this manual on General Design and Operation, treats the major parts of the HF54 and explains how they function together. The knowledge you acquire from reviewing this section should assist you in solving your steering problem.

This manual also contains troubleshooting information and checklists. With them, you can diagnose a steering problem without removing the HF54 from the vehicle. If you must service the HF54, the checklists will help you to determine where the problem may be.

The three-column format of the Repairs, Adjustments, Disassembly, Inspection and Assembly sections will make it easier for you to service the HF54. Column 1 gives a brief key for each procedure. Column 2 explains in detail the procedure you should follow. Column 3 illustrates this procedure with photographs. Pay special attention to the notes, cautions and warnings.

A foldout page with the same typical HF54 exploded assembly view on both sides is provided in this manual. The component part names and item numbers assigned on this exploded assembly view correspond with names and item numbers (in parentheses) used in the disassembly, assembly and other procedures set forth in this manual. When this exploded assembly view page is folded out, you can easily identify components and locate their relative position on the exploded assembly view as you follow the disassembly, assembly and other procedures.

As you gain experience in servicing the HF54 you may find that some information in this manual could be clearer and more complete. If so, let us know about it. Don't try to second guess the manual; if you are stuck, contact us. Servicing the HF54 should be a safe and productive procedure.

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 with air 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 rack piston (39) teeth for cracks and wear. If you can detect a step by running your fingernail horizontally across the teeth surface, you must replace the rack piston, sector shaft (51) and set of 22 balls (34). SEE FIGURE 88.

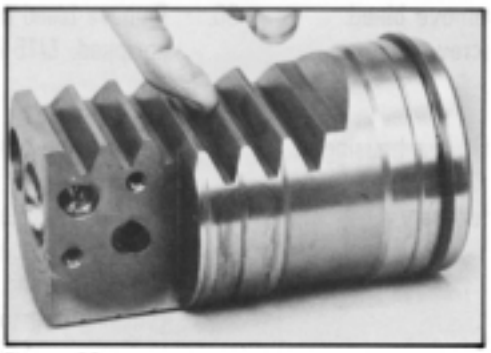

Figure 88

inspect ball track grooves on rack piston and worm shaft

2. Inspect the rack piston internal ball-track grooves for brinelling (dents) or spalling (flaking). SEE FIGURE 89. If either condition exists, you must replace the rack piston (39), worm shaft (23) and use a set of service balls (34).

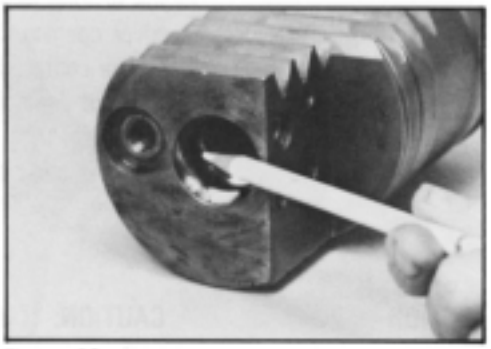

Figure 89

NOTE

NOTE: If a ball (34A) (34B) is lost during service procedures all 22 balls must be replaced with a service ball kit. Damaged balls would require a matched worm shaft, rack piston and ball set replacement.

inspect worm shaft

3. Inspect the worm shaft (23) ball track grooves for brinelling or spalling. SEE FIGURE 90. If either condition exists, you must replace the worm shaft, rack piston (39), and the set of service balls (34). Visually inspect the sealing surface on the worm shaft for nicks, and run your fingernail edge across the sealing surface to detect steps. These conditions would require worm shaft replacement and a service ball kit. If discoloration from excess heat is detected replace worm shaft, valve rack piston, adaptor and upper cover assembly. SEE FIGURE 91.

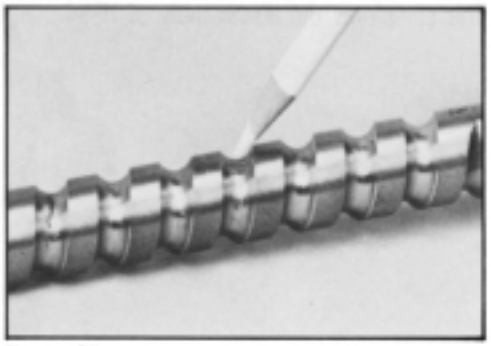

Figure 90

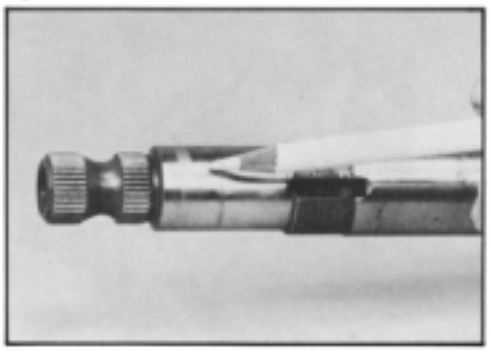

Figure 91

inspect valve assembly

4. Inspect valve spool (15B) and valve body (15A) bore for broken sealing edges. SEE FIGURE 92.

CAUTION

CAUTION: The valve assembly (15) is the control center of the hydraulic system. The major parts, which are the body and spool, are machined to very close tolerance and with precision machined edges. The valve spool and valve body are selectively fitted at the factory and therefore these two parts are not separately replaceable. If either is damaged or excessively worn, the whole valve assembly should be replaced - good performance of power steering is not assured if "mis-matched" valve spool and valve body are used. Care should be exercised in the handling of these parts to prevent damage. Sealing edges of the valve body bore and the valve spool should not be broken. This will result in excessive leakage and reduce hydraulic power. Should valve spool (15B) or other valve components become disassembled, follow the assembly procedures with care.

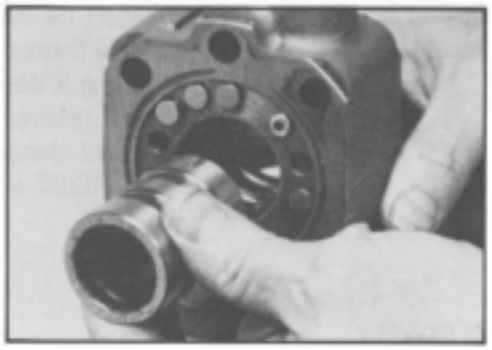

Figure 92

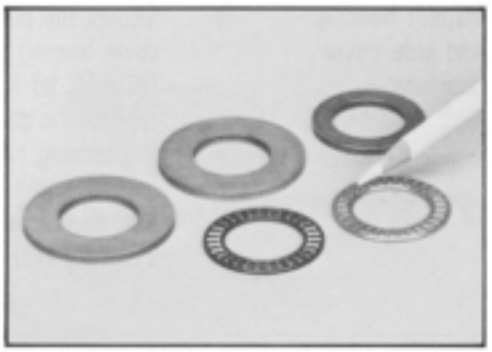

Figure 93

inspect thrust washers and bearing

5. Inspect the thrust bearing (13) rollers for any deterioration. Inspect the thrust washers (12) and (14) for brinelling, spalling, or cracks. SEE FIGURE 93. Replace the part if you detect these conditions.

inspect housing cylinder bore

6. Inspect the housing (55) cylinder bore, SEE FIGURE 94. 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 1.5 GPM (5.7 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 replace the housing.

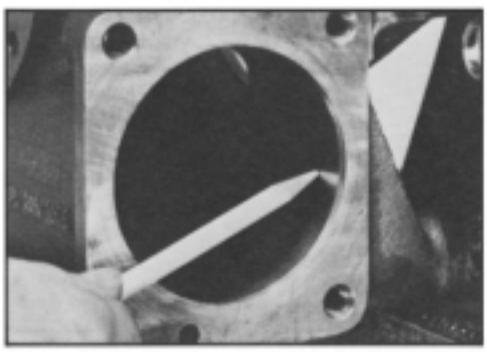

Figure 94

inspect housing faces

7. Inspect the housing (55) 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 95.

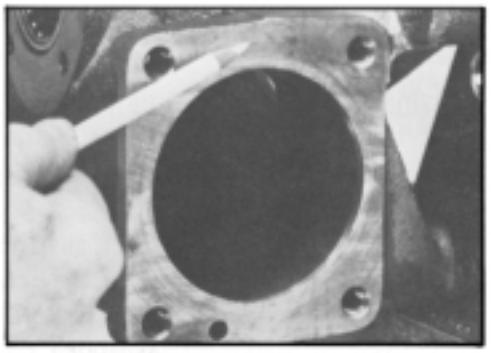

Figure 95

inspect housing and side cover bearings

8. Inspect the housing bearing (57) and the side cover bearing for brinelling or spalling. SEE FIGURES 96 & 97. If either condition exists, replace the damaged housing bearing (57). For the housing bearing, follow disassembly step 37 and assembly step 1, pages 31 and 35. If the side cover bearing is damaged, replace side cover assembly (43).

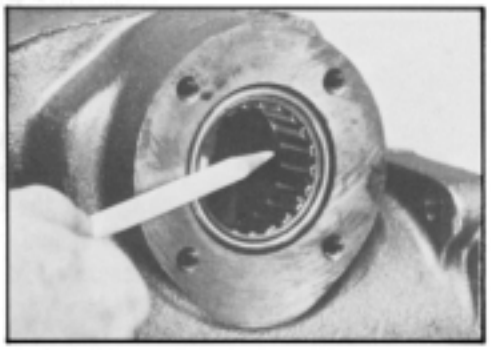

Figure 96

inspect sector shaft assembly

9. Inspect the sector shaft (51) bearing and sealing areas and sector teeth contact surfaces for brinelling or spalling. SEE FIGURE 98. 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.

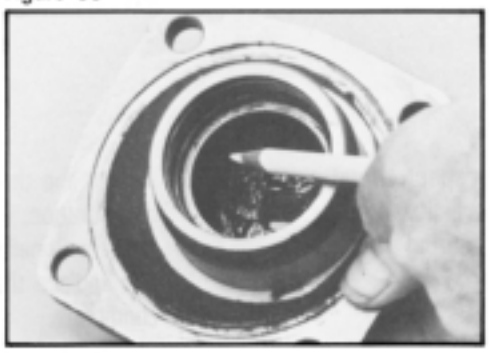

Figure 97

inspect adjusting screw and retainer

10. Inspect the sector shaft assembly for damaged adjusting screw (50) threads. The staked retainer (49) 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.

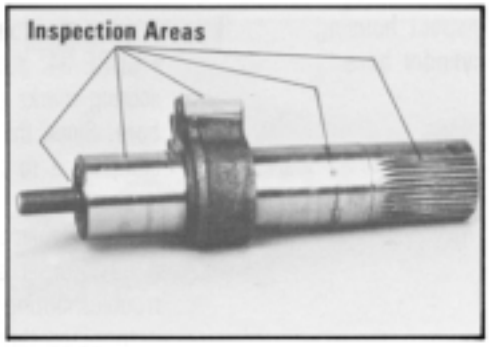

Figure 98

NOTE

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

This completes inspection of HF54 steering gear.

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