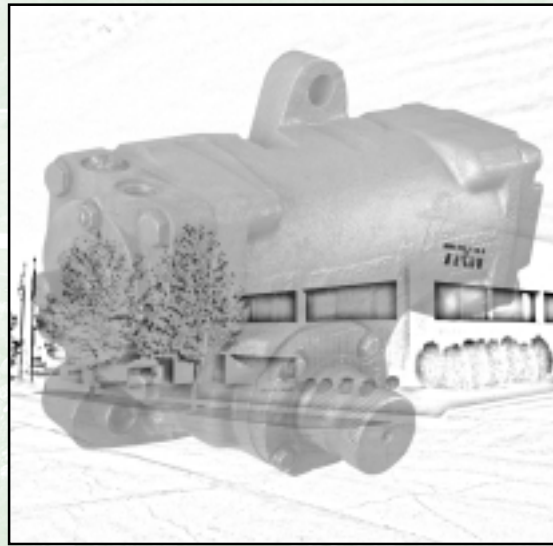


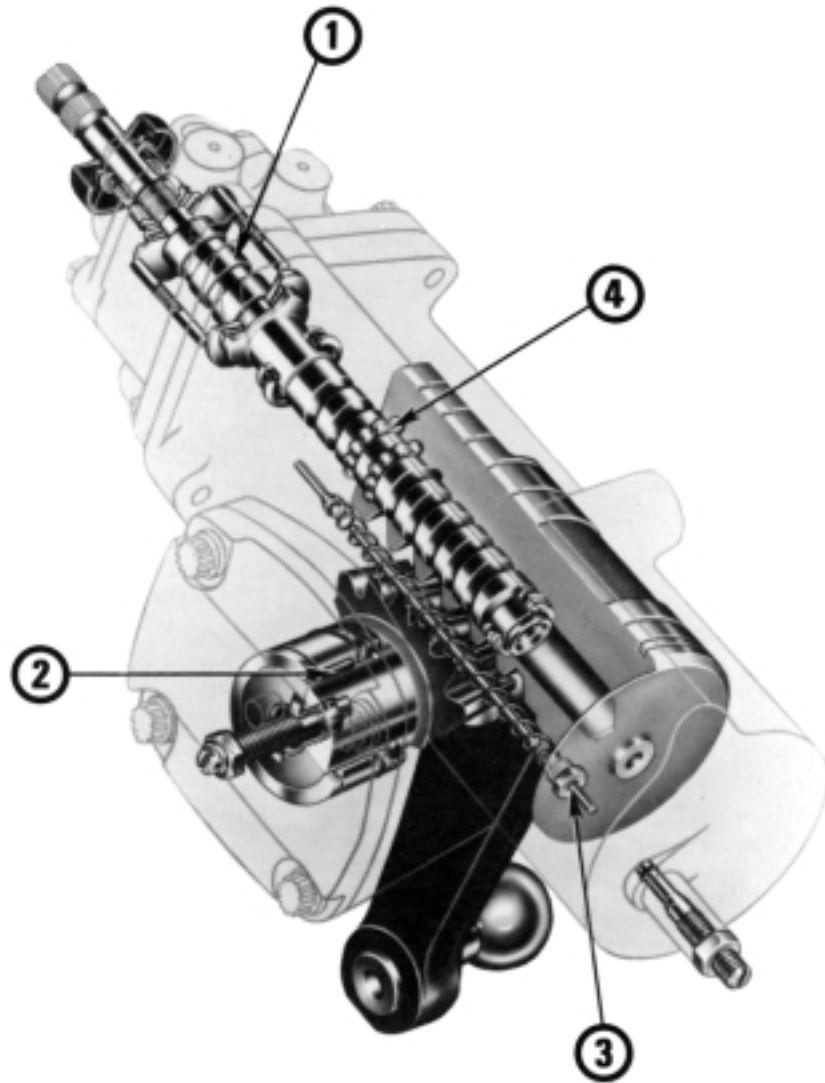
# HF Steering Gear Service Manual

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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**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.

## Final Adjustments

center steering gear

1. To center the steering gear, rotate worm shaft (23) until the timing mark on the end of sector shaft (51) is perpendicular to the worm shaft. SEE FIGURE 165. A 12 point 11/16 or 3/4 inch box end or socket required.

NOTE

**NOTE:** Worm, valve thrust bearing preload adjustment was accomplished in assembly procedure 11, page 37.

tighten adjusting screw

2. Tighten sector shaft adjusting screw (50) to provide 20-25 inch lbs. (2.3-2.8 N m) of torque required to rotate the worm shaft (23) through 90 degrees each side of center. SEE FIGURE 166.

NOTE

**NOTE:** This procedure will properly mesh and seat the rack piston teeth and sector shaft teeth for final adjustments.

loosen adjusting screw and note torque

3. Loosen sector shaft adjusting screw (50) one turn and note maximum torque required to rotate the worm shaft (23) through 90 degrees each side of center.

adjust adjusting screw

4. Adjust sector shaft adjusting screw (50) to increase maximum torque noted in procedure #3 by 2 to 4 inch lbs. (.23 to .45 N m). Torque jam nut (40) using a 3/4 inch socket, to 40-45 ft. lbs. (54-61 N m) and check worm shaft torque again. Readjust if worm shaft torque exceeds 15 inch lbs. (1.7 N m).

This completes the final adjustments of the HF54 gear to be made before it is installed into the vehicle's steering system. Install the gear by following instructions in the vehicle shop manual. Then follow the succeeding sections of this service manual HF54 on "HYDRAULIC FLUID" and "FILLING AND AIR BLEEDING THE SYSTEM" which also includes instructions for adjustment of the adjustable poppet valve.

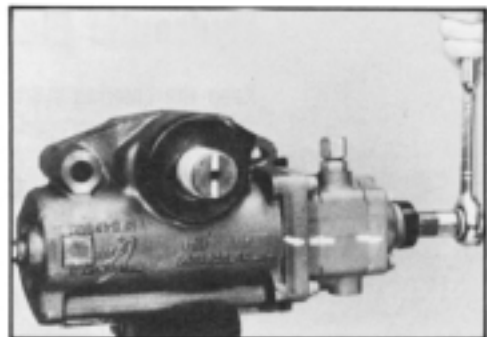


Figure 165

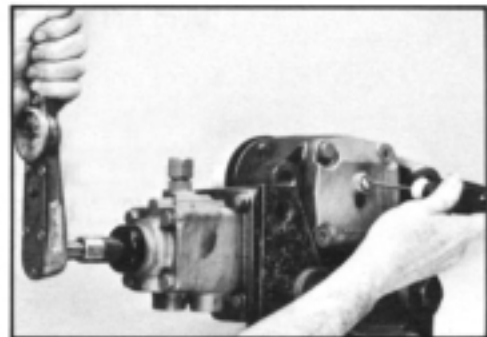


Figure 166

## Hydraulic Fluid

Keep the steering system filled with one of the following fluids:

AUTOMATIC TRANSMISSION FLUID TYPE "E" or "F"	
FORD SPEC. M2C138CJ	
AUTOMATIC TRANSMISSION FLUID DEXRON II	
SHELL ROTELLA T .....	SAE 30
MOBIL .....	SAE 10W30
ASHLAND .....	SAE 10W40
UNION .....	SAE 10W40
TEXACO .....	SAE 10W40
MOBIL .....	SAE 10W40

**WARNING: COMPLETELY FLUSH THE STEERING SYSTEM WITH ONE OF THE RECOMMENDED FLUIDS ABOVE ONLY. DO NOT MIX OIL TYPES. ANY MIXTURE OR ANY UNAPPROVED OIL COULD LEAD TO SEAL DETERIORATION AND LEAKS. A LEAK COULD ULTIMATELY CAUSE THE LOSS OF FLUID, WHICH COULD RESULT IN A LOSS OF POWER STEERING ASSIST.**

## Filling and Air Bleeding the System

**CAUTION:** For steps 1 and 2, do not turn the steering wheel. Otherwise, air may be induced into the system.

1. Fill the reservoir nearly full. Crank the engine for 10 seconds without, if possible, allowing it to start. If the engine does start, shut it down immediately. Check and refill the reservoir. Repeat at least three times, each time checking and refilling the reservoir.

**CAUTION:** Do not allow the fluid to drop significantly or run out of the reservoir. This may induce air into the system.

2. Start the engine and let it idle for 2 minutes. Shut the engine off and check the fluid level in the reservoir.
3. Start the engine again. Steer the vehicle from full left to full right turn several times. Add fluid, as necessary, to the fill line on the dipstick.

**NOTE:** Poppets, equipped on the gear, must be adjusted so that they relieve pressure at full left and right turns to aid in the removing of air from the system. At this time, make sure any poppets are properly adjusted. If they are not, adjust them in accordance with section 4 (page 19) and repeat step 3.

The above procedures should remove all the air from the steering system, unless the gear is mounted in an inverted position and is equipped with the manual bleed screw (55B) (See FIG. 164, Page 48). If this is so, refer to step 4.

4. Remove the air from a gear mounted in an inverted position and equipped with a manual bleed screw (55B) by following steps 1, 2 and 3 above. Then, with the engine idling, steer the gear from full left turn to full right turn several times. Loosen the manual bleed screw about one turn, with the steering gear in neutral (no steering action), allowing air and aerated fluid to "bleed out" around the bleed screw until only clear (non aerated) fluid is bleeding out then close the bleed screw. 5/16 inch socket required. Check and refill reservoir.

Repeat this procedure 3 or 4 times starting with the steering maneuver with bleed screw closed, until only clear (non aerated) fluid is discharged when bleed screw is loosened. Torque the manual bleed screw to 27-33 in. lbs. (3.1-3.7 N m). Check and refill reservoir.

**CAUTION:** Do not turn steering wheel with bleed screw loosened as this could induce air into the system.

## **Warnings for Proper Steering Gear Operation**

**WARNING:** DO NOT WELD, BRAZE OR SOLDER ANY STEERING GEAR OR SYSTEM ARM COMPONENTS.

**WARNING:** MAXIMUM FLOW UNDER ANY CONDITIONS MUST NOT EXCEED VEHICLE MANUFACTURER'S SPECIFICATIONS.

**WARNING:** MAXIMUM OPERATING PRESSURE MUST NOT EXCEED 1500 PSI (103.4 bar).

**WARNING:** ALWAYS CAREFULLY INSPECT ANY STEERING COMPONENT WHICH HAS BEEN (OR IS SUSPECTED TO HAVE BEEN) SUBJECTED TO IMPACT. REPLACE ANY DAMAGED OR QUESTIONABLE COMPONENT.



## Steering System Maintenance Tips

- Prevent internal bottoming of the steering gear. Carefully check axle stops to be sure that they meet the manufacturer's specifications.
- Regularly check the fluid and the fluid level in the power steering reservoir.
- Keep tires inflated to correct pressure.
- Always use a puller, never a hammer or torch, to remove pitman arms.
- Investigate and immediately correct the cause of any play, rattle, or shimmy in any part of the steering linkage or steering mechanism.
- Remove the cause of steering column misalignment.
- Encourage all drivers to report any malfunctions or accidents that could have damaged steering components.
- Do not attempt to weld any broken steering component. Replace the component with original equipment only.
- Do not cold straighten, hot straighten, or bend any steering system component.
- Always clean off around the reservoir filler cap before you remove it. Prevent dirt or other foreign matter from entering the hydraulic systems.
- Investigate and correct any external leaks, no matter how minor.
- Replace filters and pumps in compliance with specification.
- If extended stationary use of vehicle is developing excessive hydraulic fluid temperatures consult vehicle manufacturer for auxiliary cooling method.
- Maintain grease pack applied behind the input and output shaft's protector seal as a general maintenance procedure.

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