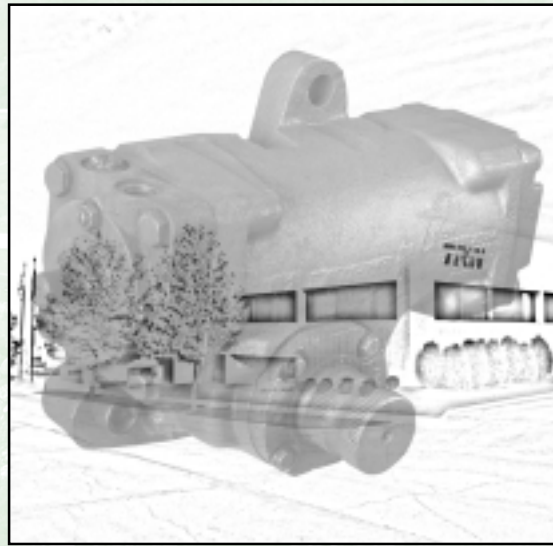


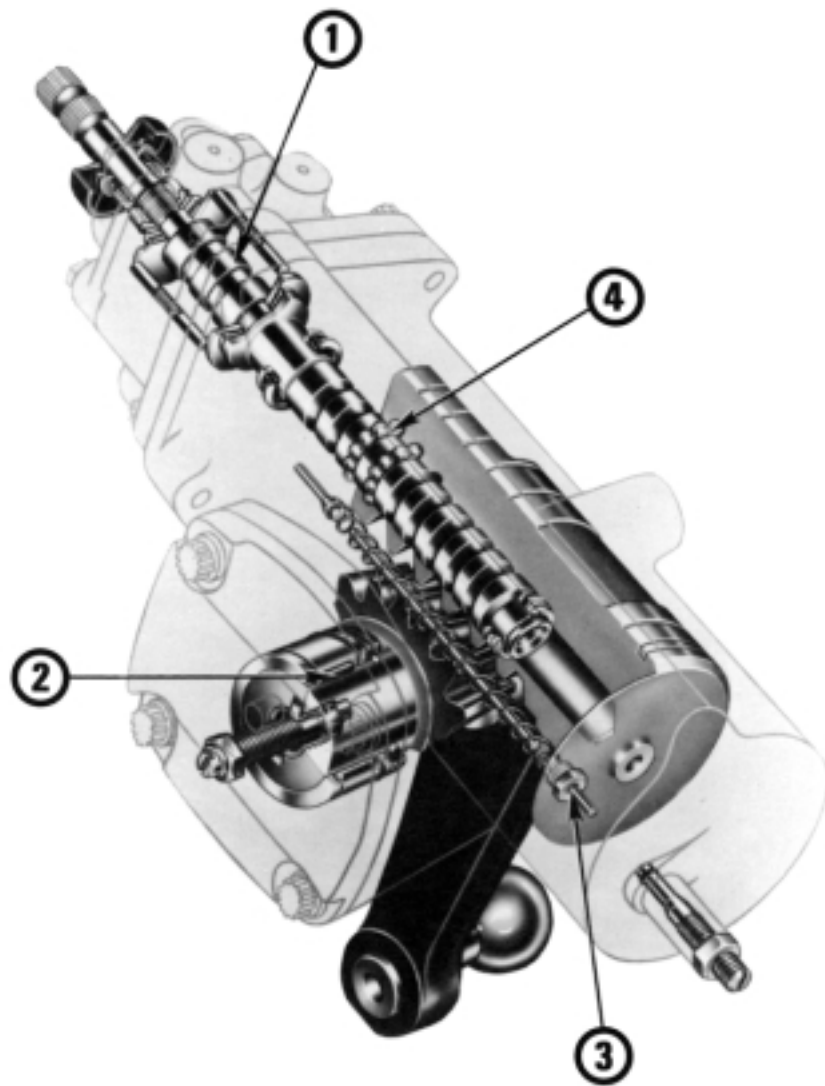
HF Steering Gear Service Manual

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

Table of Contents

	Page
HF54 Design Features and Phantom View	Inside Front Cover
Definitions and Patents	1
Introduction	3
HF54 Hydraulic Fluid Flow Illustration	4
Valve Hydraulic Fluid Flow Illustration	5
HF54: General Design and Operation	6
Troubleshooting Information	7
Troubleshooting Guide	9
Repairs and Adjustments on Vehicle	12
–The Sector Shaft and Trunnion Cover Seal	12
–The Worm Shaft Seal	15
–Worm Shaft, Valve, Thrust Bearing Preload Adjustment	17
–Poppet Valve Adjustment	19
–Cross Shaft or Sector Shaft Adjustment	20
Torque Chart	21
Tools and Materials Required for Servicing	21
HF54 Exploded Assembly View-Typical	21A and 21B
Disassembly	22
Inspection	32
Assembly	35
Final Adjustments	49
Hydraulic Fluid	50
Filling and Air Bleeding the System	50
WARNINGS for Proper Steering Gear Operation	51
Steering System Maintenance Tips	52

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.

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 and seal rings with **new** ones each time you disassemble the gear.
- Ross Gear does provide individual seals, seal rings, as well as complete and partial seal kits. SEE FIGURE 99. These parts should be available through most OEM parts distributors. (Contact your local dealer for availability.)

Assembly

install housing bearing and retaining ring

1. If you are installing a **new** housing bearing (57), first install the retaining ring (56) into the groove in the housing bearing (55) bore if it was removed. Place the housing, side cover face down on a wooden block if necessary to protect the cover face. Carefully press the bearing into the housing from the trunnion cover side until the bearing contacts the retaining ring. SEE FIGURE 100. During this procedure be sure the housing is square with the press base and the bearing is not cocked. Lubricate bearing and set housing aside.

install bearing into upper cover

2. If you are installing a **new** needle bearing (5) into the upper cover (7), a suitable pressing mandrel must be fabricated which will pilot on the inner diameter of the needle bearing and have clearance in the bearing bore. Place the mandrel against the lettered end of bearing and press bearing into upper cover bearing bore from the valve face side until the bearing is positioned 1.13 inch (29 mm) from upper cover valve face. After the bearing assembly is pressed in upper cover the bearing rollers must orbit and rotate freely in bearing shell. Lubricate bearing. SEE FIGURE 101.

clamp valve body or assembled valve body in vise

3. Assemble a hydraulic fitting securely in valve body (15A) hydraulic port. Clamp valve body assembled or disassembled securely in a vise, clamping against the hydraulic fitting or port bosses. Position valve body in the vise so that worm shaft, adaptor and upper cover can be assembled. SEE FIGURE 102.

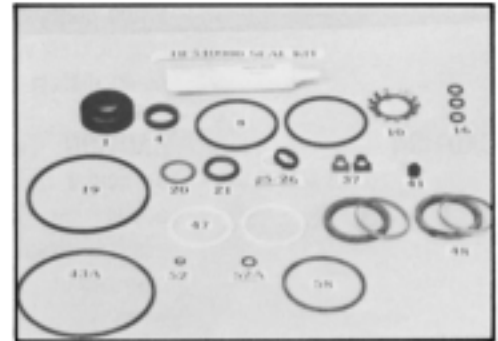


Figure 99

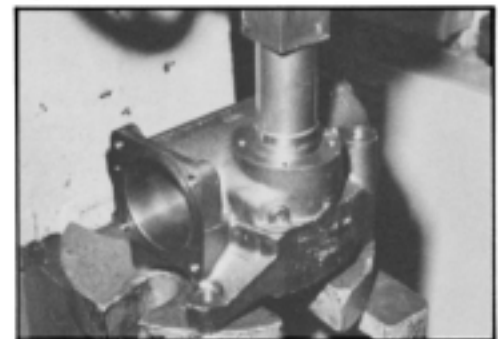


Figure 100

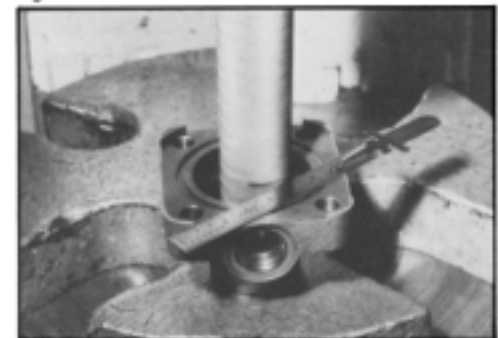


Figure 101

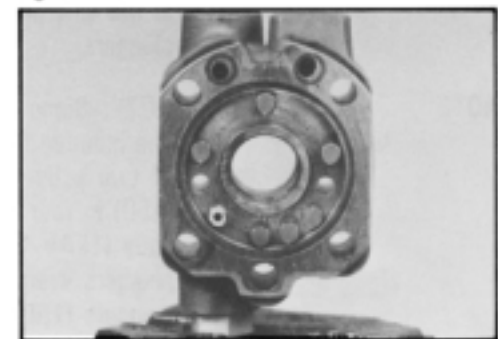


Figure 102

CAUTION

CAUTION: Use only the correct size standard 3/4-16 or 9/16-18 JIC-SAE hydraulic fitting in the valve ports. The use of a wrong fitting such as pipe fitting will damage the valve port and require replacement of the complete valve assembly.

CAUTION

CAUTION: Clamp valve body only as directed and use care not to clamp against machined valve faces or sides of valve body. This could damage sealing surfaces or distort valve bore. When clamping against valve port bosses do not tighten vise with extreme force as this could distort valve ports.

CAUTION

CAUTION: The valve assembly is unique to the particular HF54 steering gear flow rate application. Use only the specified valve assembly replacement to ensure proper operation.

NOTE

NOTE: If valve assembly components are not disassembled go to assembly procedure #7.

**assembly of
valve spool**

4. If valve assembly (15) is disassembled, refer to the enlarged exploded view, on pages 21A & 21B. Assemble valve spool (15B) into valve body (15A). The end of the valve spool with identification grooves in the bore or in the undercut or relief on the outside diameter must be toward the adaptor side or face of valve body after assembly. The adaptor side or face of the valve body has two (blind) cylinder feed holes that do not extend through to the opposite side or face. On some valve bodies the cast identification # boss is pointed on the end toward the adaptor side or face. SEE FIGURE 103.

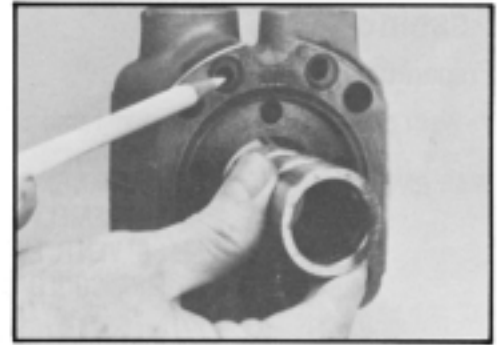


Figure 103

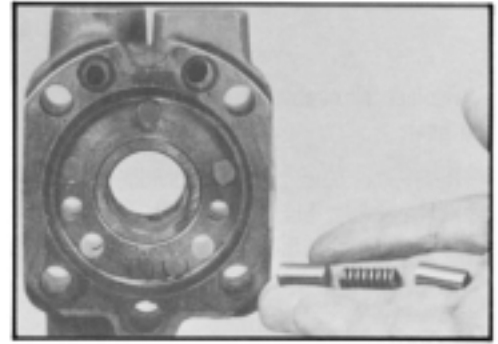


Figure 104

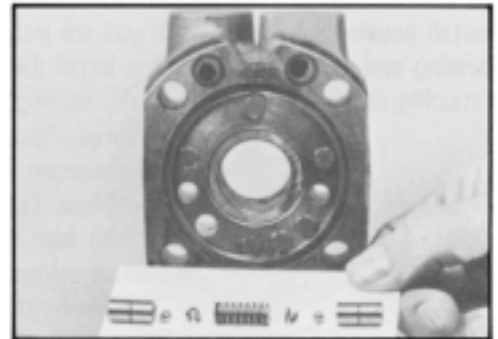


Figure 105

**assemble
plungers and
spring sets**

5. Assemble a plunger (15C) a spring (15D) and another plunger (15C) in that order in six through holes in the valve body (15A) as shown in the enlarged exploded view on fold out pages. SEE FIGURE 104.

NOTE

NOTE: The two oil transfer holes designated in the enlarged view are too small to accept plungers.

NOTE

NOTE: Some valve assemblies (15) may have one inactive (long) plunger instead of the set of two active plungers (15D) and a spring (15D) in four of the plunger holes in the valve body (15A). Assemble these inactive (long) plungers evenly as possible among the active plungers (15D) sets in the circle of plunger holes if their original positioning was not noted during disassembly.

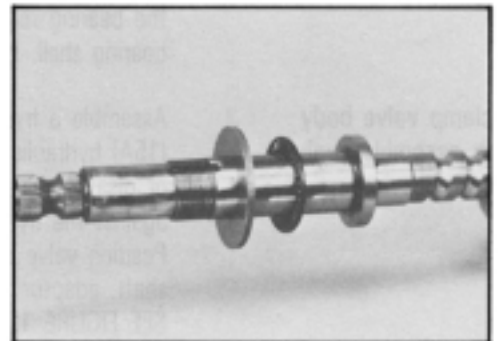


Figure 106

assemble check valve, plungers and spring

6. Assemble a ball (15F) and conical spring (15G), small end first, into the two check valve plungers (15E) if they became disassembled. Assemble one check valve plunger assembly, a spring (15D) and then the other check valve plunger assembly into the remaining valve body plunger hole as shown in the exploded view. The spring end of the check valve plungers must face each other when assembled in valve body. SEE FIGURE 105.



Figure 107

assemble first thrust bearing package on worm shaft

7. Assemble thrust bearing (13) and a thrust washer (14) on the input (serrated) end of worm shaft (23) and against worm shaft shoulder. SEE FIGURE 106.

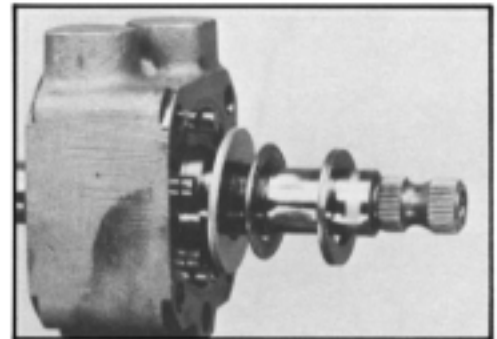


Figure 108

assemble worm subassembly into valve assembly

8. Assemble the input (serrated) end of the worm shaft (23) with bearing package into the adaptor end of the valve spool (15B) bore as described in procedure #4, until shaft and bearing assembly stops against the spool. SEE FIGURE 107.

assemble thrust bearing package

9. Assemble the other thrust washer (14), thrust bearing (13) and thrust washer (12) onto the input (serrated) end of worm shaft (23) and against the valve spool (15B). SEE FIGURE 108.

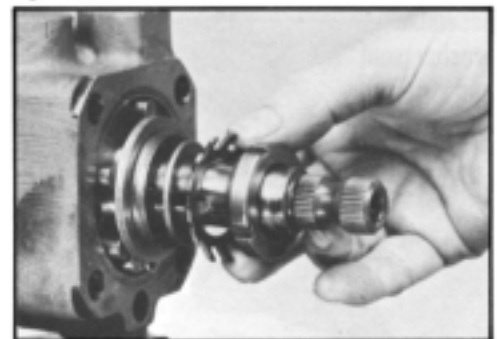


Figure 109

assemble bearing lockwasher and nut

10. Assemble washer (11) then a **new** bearing lock-washer (10) onto worm shaft (23). The internal washer tangs must enter slot in worm shaft and the external tangs of bearing lock-washer must face out. SEE FIGURE 109. Assemble bearing lock nut (9), large chamfer side in, onto threaded diameter of worm shaft until components are at solid height and snug against valve spool (15B).

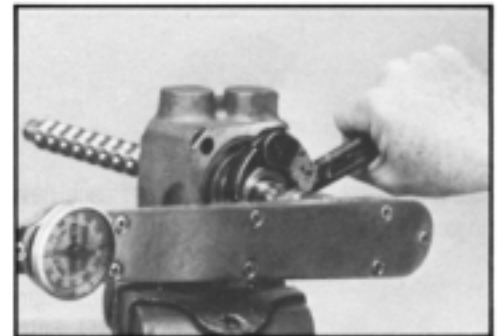


Figure 110

torque bearing lock nut

11. Torque the bearing nut (9) to 30 ft. lbs. (41 N m) to seat the components. Back the nut off and then torque to 15-20 ft. lbs. (20-27 N m). SEE FIGURE 110. Back the nut off approximately 20 degrees and bend one tang of lock-washer (10) into a matching nut slot. SEE FIGURE 111. A hook type spanner wrench, a 3/4 or 11/16 inch 12 point socket and a ft. lb. (N m) torque wrench required.

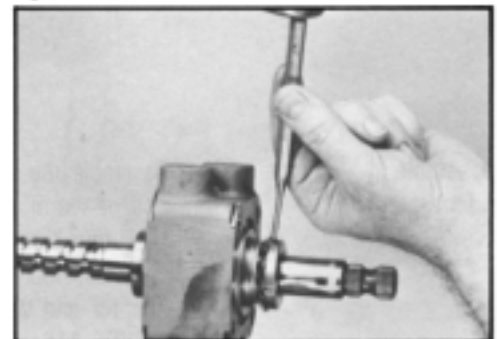


Figure 111

check worm
shaft rotation

12. Check for free rotation of worm shaft (23) in valve assembly (15) and for perceptible end play. SEE FIGURE 112.

NOTE

NOTE: The worm shaft in the above assembly should rotate at 3 to 5 inch lbs. (.34 to .57 N m). No end play should be evident.

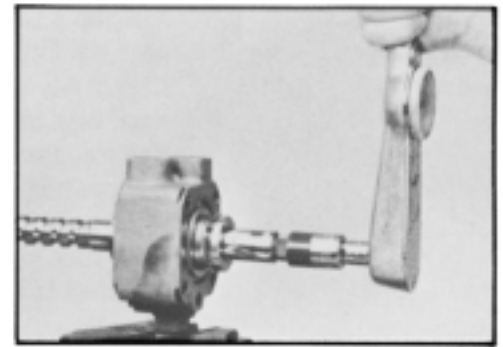


Figure 112

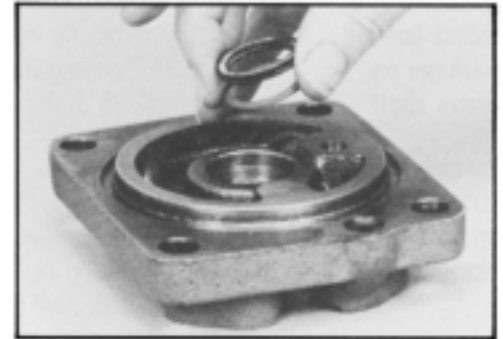


Figure 113

assemble
washer seal
and retainer
into adaptor

13. Assemble back up washer (20) and then **new** seal (21) into adaptor (18) so that seal lip is facing out of seal cavity. SEE FIGURE 113. Assemble retaining ring (22). SEE FIGURE 114.

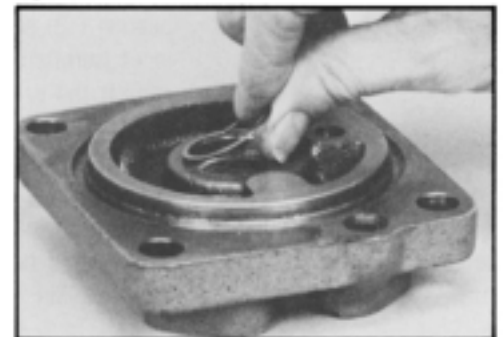


Figure 114

assemble seal
rings

14. Coat each **new** seal ring liberally with clean grease for retention and assemble **new** seal ring (8), three **new** seal rings (16), **new** seal ring (19) in the appropriate recesses provided in adaptor (18). SEE FIGURE 115.

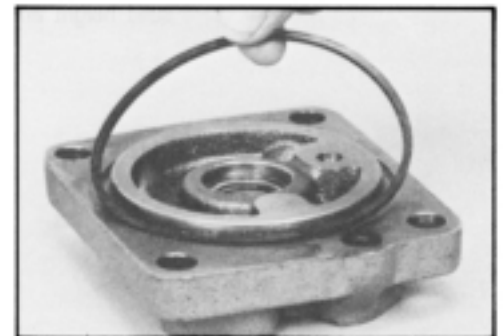


Figure 115

assemble
adaptor on
worm assembly

15. Assemble the adaptor (18) onto the rack piston end of worm shaft (23) assembly with the side with four threaded holes against the face of the valve assembly and the cylinder feed holes in adaptor and valve body (15A) aligned. SEE FIGURE 116.

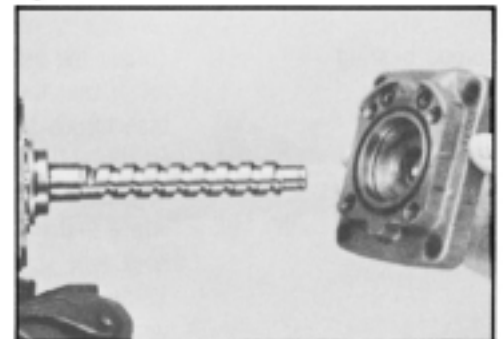


Figure 116

assemble upper cover seal, spacer, retaining ring and seal ring

16. On a clean work surface, assemble **new** seal (4) into upper cover (7) with the seal lip facing the upper cover bearing. Grease and assemble **new** spacer (3). SEE FIGURE 117. Install retaining ring (2) securely into the upper cover retaining ring groove. SEE FIGURE 118. Retaining ring pliers or small screw driver required. Apply clean grease liberally to **new** seal ring (8) and assemble it into the upper cover recess provided.



Figure 117

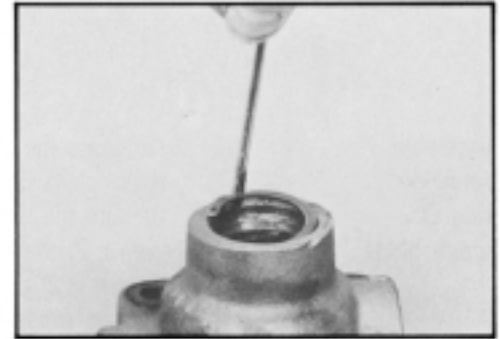


Figure 118

tape worm shaft serrations

17. Tape the worm shaft (23) serrations and lightly coat the remaining portion of the worm shaft with oil. SEE FIGURE 119.

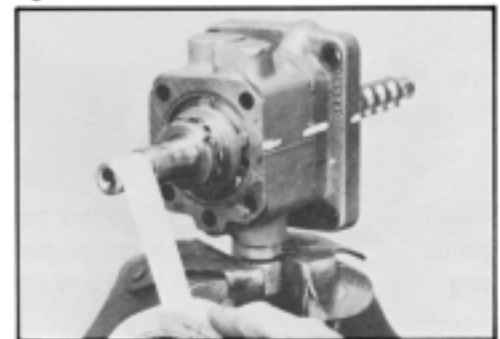


Figure 119

install upper cover

18. Install upper cover (7) assembly carefully over worm shaft (23) serrations, aligning the upper cover, valve body (15A) and adaptor (18) in their original positions. SEE FIGURE 120.

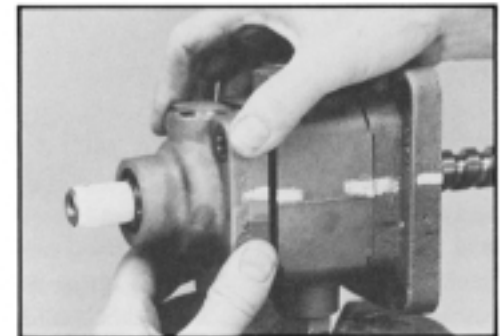


Figure 120

NOTE

NOTE: If a line was scribed across these components before disassembly you can now utilize the line to align these components.

assemble upper cover bolts and washer

19. Assemble four upper cover bolts (6) and washers (6A). Carefully tighten the bolts while checking that the adaptor (18) valve assembly (15) and upper cover (7) faces are properly piloted and positioned with all seal rings in place. Torque bolts to 25-35 ft. lbs. (34-47 N m) if dry, or 21-27 ft. lbs. (28-37 N m) if lubricated. 9/16 inch socket required. SEE FIGURE 121.

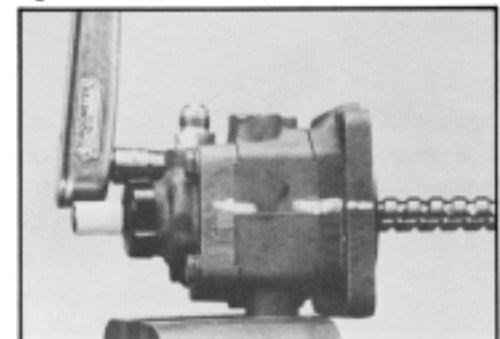


Figure 121

assemble seal components on worm shaft

20. Assemble onto the rack end of worm shaft (23) steel washer (24), **new** seal (25), with sharp corner side toward steel washer, **new** seal cup (26) with counter bore toward seal, bronze back up washer (27) and retaining washer (28) with counter bore out. SEE FIGURE 122.

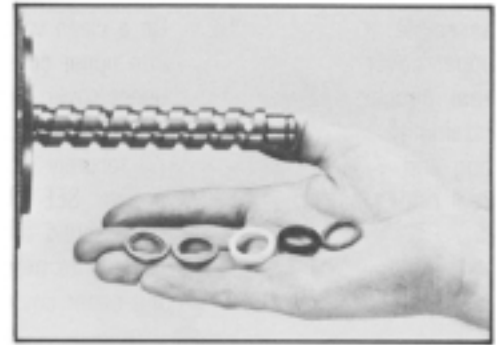


Figure 122

assemble retaining ring on worm shaft

21. Compress the seal components just assembled on worm shaft (23) and assemble retaining ring (29). Be sure the retaining ring is properly seated in its groove in the worm shaft and in the retaining washer (28) counter bore. SEE FIGURE 123. Remove subassembly from vise.

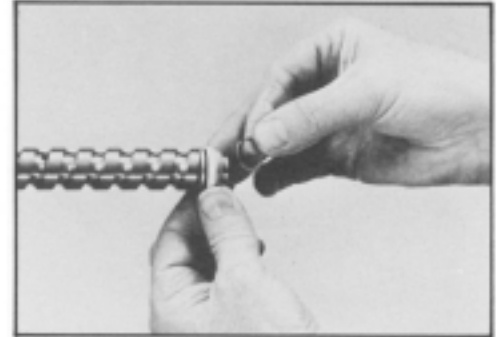


Figure 123

install piston ring

22. Place rack piston (39) in a soft jawed vise in a horizontal position. Carefully expand piston ring (39A) over end of rack piston and install in the ring groove. SEE FIGURE 124.

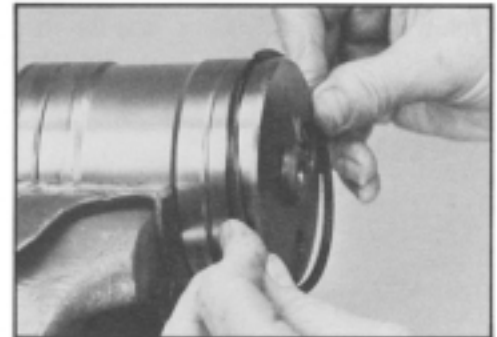


Figure 124

clean and apply locquic to rack piston and poppet seats

23. If poppets were removed, clean the two threaded poppet seat holes in the end of the rack piston (39) with clean/clear solvent and blow dry. Apply Locquic grade "T" primer to the threaded holes and to the two poppet seat (30) threads and allow to dry for ten minutes. SEE FIGURE 125.



Figure 125

apply studlock and assemble poppet seat

24. When the Locquic primer has dried for 10 minutes, apply Stud Lock to poppet seat (30) threads and threaded poppet hole at one end of rack piston (39). Assemble the poppet seat into that end of the rack piston and torque to 20-25 ft. lbs. (27-34 N m). 9/16 inch socket required. SEE FIGURE 126 AND 127.



Figure 126

assemble poppet components

25. Insert a poppet (31), spring (32), rod (33) and another poppet (31) at the opposite end of rack piston poppet hole. Apply Stud Lock to the second poppet seat (30) threads and its' threaded hole in the rack piston. Assemble the second poppet seat (30) and torque to 20-25 ft. lbs. (27-34 N m). SEE FIGURE 128. Allow Stud Lock to dry 20 minutes before adding hydraulic fluid. Remove the rack piston from vise and place on a clean cloth covered work surface with the ball return guide holes up.



Figure 127

assemble worm shaft assembly into rack piston

26. Lubricate the rack piston (39) worm bore and worm shaft seal (25) with clean grease. And assemble worm shaft (23) as assembled into rack piston bore so that the rack piston ball guide holes are aligned over the worm shaft ball track grooves and the worm seal is positioned in the rack piston worm bore. SEE FIGURE 129.



Figure 128

NOTE

NOTE: If the original set of 22 balls are being reassembled, they must be segregated by micrometer measurement into a group of 11 large balls (34A) and a group of 11 smaller spacer balls (34B). The small spacer balls were originally colored black for identification as are the spacer balls in a service ball kit. The set of **original large (working) balls** will measure .0005 inch (.01270 mm) larger than the spacer balls. SEE FIGURE 130.

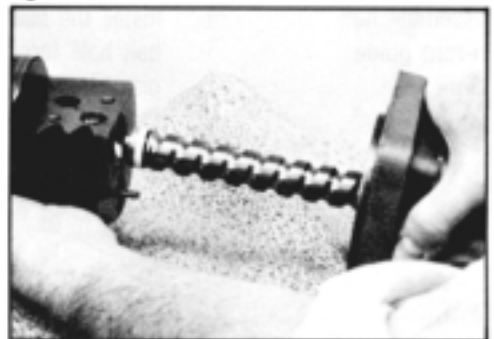


Figure 129

assemble 16 balls into rack piston

27. Insert the eraser end of a pencil into one ball return guide hole in the rack piston (39) as far as it will go. Alternately insert one large ball (34A) then one small (spacer) ball (34B) into the other ball return guide hole while slowly turning the worm shaft (23) to work each ball down the same ball groove path on one side of the worm shaft and up and around toward the other ball return guide hole. When 16 balls are inserted, remove pencil. A ball should be visible at each ball return guide hole. SEE FIGURE 131.

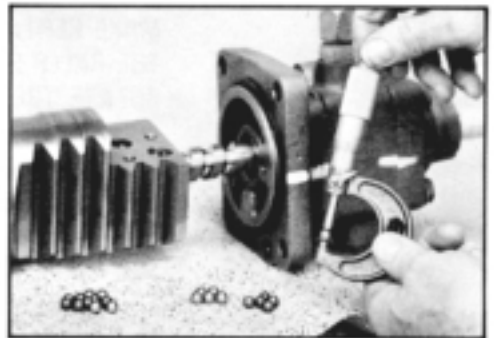


Figure 130

WARNING

WARNING: BE SURE EACH BALL INSERTED STARTS DOWN THE BALL GROOVE ON THE CORRECT SIDE OF THE WORM SHAFT. DO NOT ALLOW THE WORM SHAFT OR RACK PISTON TO ROTATE AFTER THE PENCIL IS REMOVED UNTIL THE BALL RETURN GUIDES ARE RETAINED IN THE RACK PISTON. SUCH ROTATION COULD MOVE A BALL OR BALLS INTO THE DEAD TRACK BEYOND THE BALL RETURN GUIDE LOOP (PASSAGE) RESULTING IN A STEERING LOCKUP WHICH COULD CAUSE AN ACCIDENT.

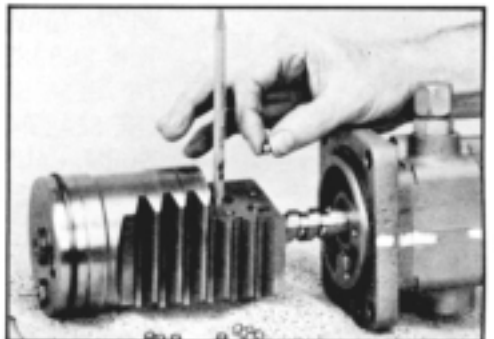


Figure 131

install ball return guide halves and balls

28. Coat a ball return guide half (35) liberally with grease and insert the remaining 6 balls alternately large (34A) and small (34B) (black) into the greased guide half. SEE FIGURE 132. Join the guides halves together and firmly seat this subassembly into the rack piston (39) ball return guide holes.

CAUTION

CAUTION: The grease must hold the balls in the return guides until the guides are seated in the rack piston.

WARNING

WARNING: DO NOT SEAT THE BALL RETURN GUIDES WITH A HAMMER. DAMAGE TO THE GUIDES CAN RESULT IN SUBSEQUENT LOCK-UP OR LOSS OF STEERING.



Figure 132



Figure 133

assemble ball return guide clip

29. Install the ball return guide clip (36) so that the bolt hole faces are in full contact with the rack piston (39) surface. Install the two **new** lock tabs (37) and the two hex head screws (38). SEE FIGURE 133. Torque screws to 8-10 ft. lbs. (11-14 N m). Bend up lock tabs against the screw heads. 7/16 inch socket required. SEE FIGURE 134.

WARNING

WARNING: ROTATE THE WORM SHAFT WHILE HOLDING THE RACK PISTON, FROM END OF TRAVEL TO END OF TRAVEL, TO MAKE CERTAIN THAT YOU HAVE INSTALLED THE BALLS PROPERLY. IF YOU CANNOT ROTATE THE WORM SHAFT, YOU WILL HAVE TO REMOVE THE BALLS AND REASSEMBLE THEM. IF YOU INSTALL THE GEAR ON A VEHICLE WITH THE SHAFT UNABLE TO ROTATE, THE GEAR WILL NOT FUNCTION. SEE FIGURE 135.

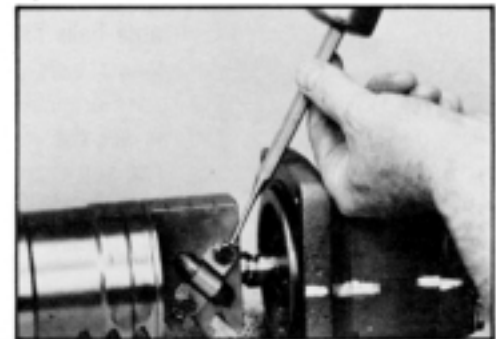


Figure 134

WARNING

WARNING: DO NOT ALLOW RACK PISTON TO ROTATE TO THE EXTREME LOWER END OF WORM TRAVEL BY IT'S OWN WEIGHT WHILE THIS SUBASSEMBLY IS NOT CONTAINED IN THE GEAR HOUSING. THIS COULD DESTROY THE SEAL PACKAGE AT THE LOWER END OF WORM, CAUSING LOSS OF POWER STEERING IN ONE DIRECTION.

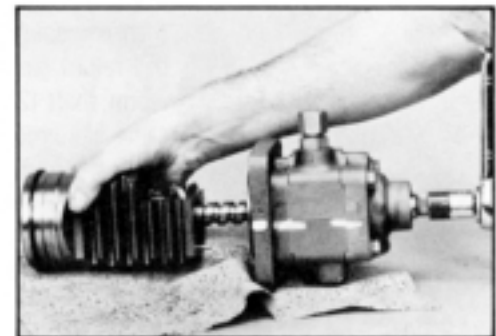


Figure 135

position housing in vise

30. Position housing (55) firmly in vise positioned as it was for the disassembly procedures. SEE FIGURE 136.

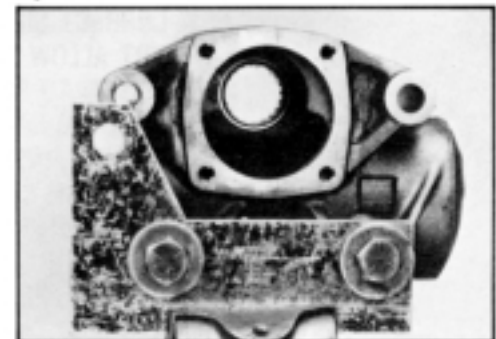


Figure 136

assemble retaining ring

31. If a spacer ring (55A) was removed from the housing (55) assemble and seat the spacer ring in the bottom of the housing rack piston bore. SEE FIGURE 137.



Figure 137

assemble and install poppet assembly

32. If you removed a non adjustable hex head poppet screw (53A) and o-ring (52A) from the housing, assemble a **new** o-ring (52A) on the poppet screw. Install the poppet screw assembly in housing (55) and torque screw to 15-20 ft. lbs. (20-27 N m). SEE FIGURE 138. 1/2 or 9/16 inch hex socket required.

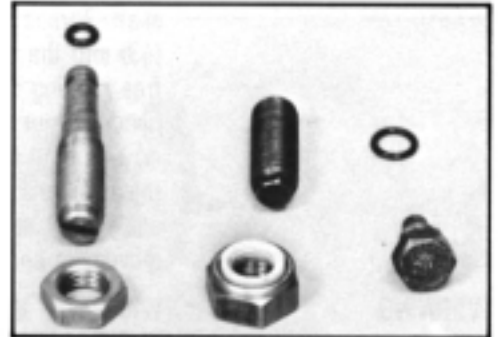


Figure 138

If you removed nut (54), poppet adjusting screw (53) and o-ring (52), assemble a **new** o-ring (52) and the nut on the adjusting screw and turn the screw assembly into the housing (55) until 7/8 inch (22 mm) of screw thread protrudes from the housing.

If you removed sealing nut (54A) and poppet adjusting screw (53B), turn the threaded end of the adjusting screw into the end of a **new** sealing nut (54A) away from its seal so that the seal will face the housing. Turn the screw assembly a few turns into the housing. The final adjustment of either type of adjustable poppet screw must be made after the reassembled gear is installed on the vehicle.

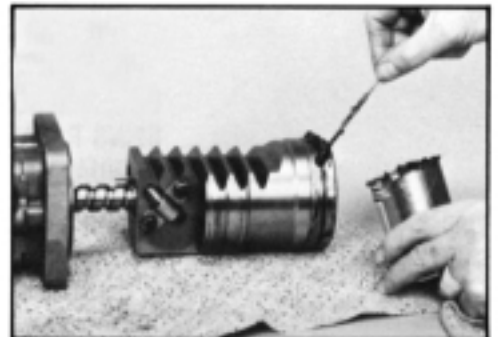


Figure 139

grease piston ring and housing bore

33. Apply a generous amount of clean grease to the piston ring (39A) on assembled rack piston and to the housing (55) rack piston bore. SEE FIGURE 139.

insert the assembled rack piston assembly

34. Insert the assembled rack piston (39) into housing (55) and position rack teeth to be visible through the side cover opening and the poppet (31) in line with poppet screw in the housing. As the rack piston enters the lubricated housing bore compress piston ring (39A) and work the rack piston into assembled position. SEE FIGURE 140.

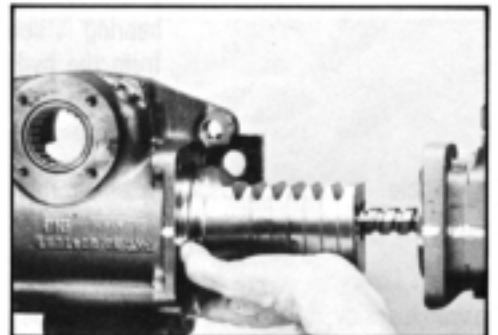


Figure 140

position adaptor against housing

35. Move the adaptor (18) against housing (55) with their bolt holes aligned and their cylinder feed (oil transfer) hole aligned. The poppet recess in the adaptor must align with poppet (31) and seal ring (19) and seal ring (16) must be in place. SEE FIGURE 141.

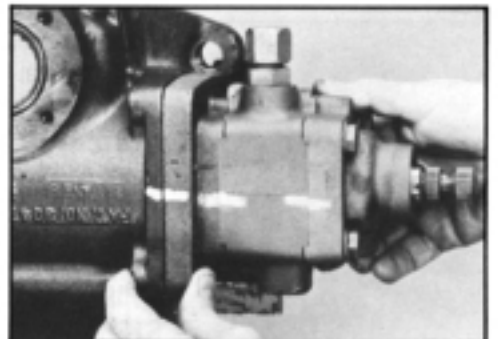


Figure 141

NOTE

NOTE: The lines scribed before disassembly can again be used to insure correct assembly alignment.

assemble
adaptor
bolts and
washers

36. Assemble four bolts (17) through adaptor (18) into housing (55). Torque bolts to 45-55 ft. lbs. (61-75 N m) if dry or 42-52 ft. lbs. (57-71 N m) if lubricated. A 7/16 inch 12-point socket required. SEE FIGURE 142.

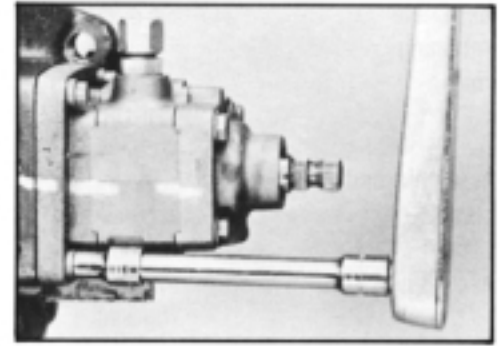


Figure 142

assemble
adjusting
screw and
retainer

37. If the adjusting screw (50) has been removed from the sector shaft (51), 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 (49) into the sector shaft and adjust to permit free rotating 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 143.

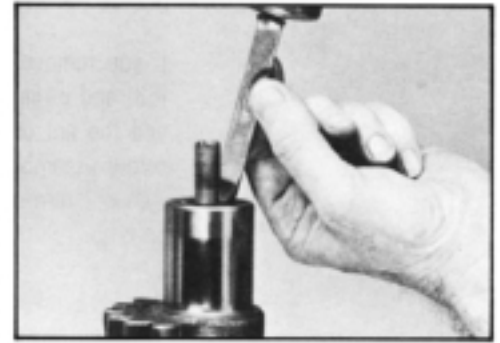


Figure 143

WARNING

WARNING: USE CARE IN SECURELY STAKING THE RETAINER (49) 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

38. Apply a generous amount of clean wheel bearing grease (do not substitute another type of grease) to the bearing in side cover (43). SEE FIGURE 144.

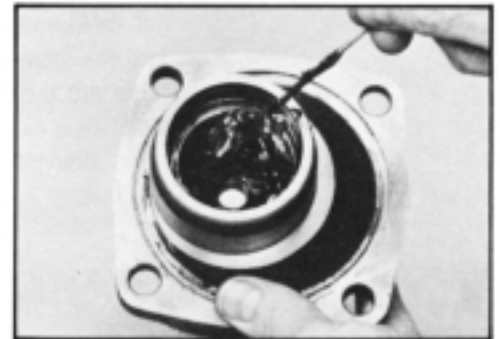


Figure 144

CAUTION

CAUTION: Use only wheel bearing grease. 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.

assemble
retaining
ring

39. Assemble retaining ring (45) into side cover (43) ring groove closest to the bearing, if the retaining ring was removed.



Figure 145

assemble side
cover seal
pack

40. Assemble the steel backup washer (46) into side cover (43). Assemble a **new** Teflon washer (47) then a **new** two piece seal (48) into the side cover, such that the words "Oilside" are visible after the seal is assembled. SEE FIGURE 145. Grease and assemble **new** seal ring (43A) into side cover. SEE FIGURE 146.



Figure 146

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.

assemble retaining ring

41. Assemble retaining ring (62) into its' ring groove in side cover (43). SEE FIGURE 147.

NOTE

NOTE: Retaining ring (62) is not included in all HF54 steering gears.

install sector shaft into side cover

42. Apply a generous amount of clean grease to the short bearing area of the sector shaft (51). Insert the sector shaft carefully into the side cover (43). Screw in the sector shaft adjusting screw (50) counter-clockwise 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 148.

CAUTION

CAUTION: Be sure the two piece seal remains correctly assembled and that the vent plug (41) has been removed during these procedures.



Figure 147

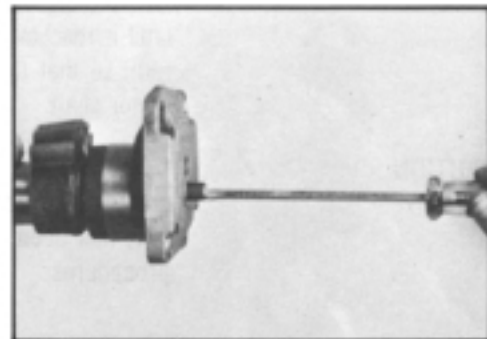


Figure 148

NOTE

NOTE: If the side cover two piece seal (48) cannot be maintained in position when the shaft (51) is assembled into the shaft side cover (43) using procedures #40, #41, and #42, go to alternate procedures #43, #44, and #45.

assemble seal ring and steel and Teflon washers into side cover

43. Grease and assemble seal ring (43A). Assemble the steel backup washer (46) and then the new Teflon washer (47) into the side cover (43) bearing bore. SEE FIGURE 149.



Figure 149

assemble retaining ring and seal

44. Slide retaining ring (62) if required onto the cover end of sector shaft (51). Assemble the new two-piece seal (48) onto the end of the sector shaft about 1 inch (25.4 mm). The words "Oil Side" on the seal must face toward the sector shaft. SEE FIGURE 150.

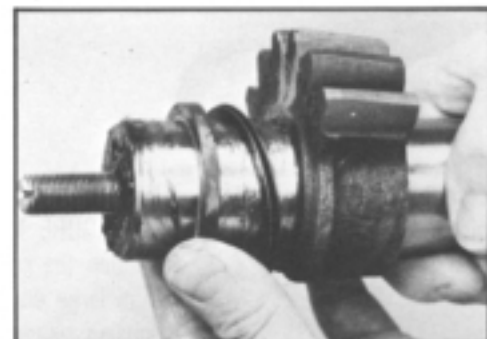


Figure 150

install
sector
shaft into
side cover

45. Be sure the side cover bearing, the sector shaft bearing diameter and seal are well greased, then insert sector shaft (51) assembly into the side cover (43) bearing and turn the adjusting screw (50) into the side cover about 8 turns. Slowly and carefully work the two piece seal (48) down the sector shaft and squarely into the side cover until it is past the retaining ring groove. Then work the retaining ring (62) if included into the retaining ring groove. Use an appropriate blunt end punch or punches. SEE FIGURE 151. Carefully turn the adjusting screw (50) through side cover until it reaches solid height then back screw one turn, so that the side cover rotates freely on sector shaft.

CAUTION

CAUTION: Be sure the two piece seal remains correctly assembled and that the vent plug (41) has been removed during these procedures.

install jam
nut

46. Install the sector shaft adjusting screw jam nut (40) onto the sector shaft adjusting screw (50) a few threads. Final adjustment will be made later. SEE FIGURE 152.

assemble vent
plug

47. Press a **new** vent plug (41) into the hole provided in the side cover (43) until the plug is flush. SEE FIGURE 153.

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 LOCK UP OR OTHERWISE MALFUNCTION.

center rack
piston

48. There are five full teeth on the rack piston (39). SEE FIGURE 154. Rotate the worm shaft (23) to position the center rack piston tooth (third tooth from large end) in line with the center of the housing sector shaft bore. SEE FIGURE 155.



Figure 151

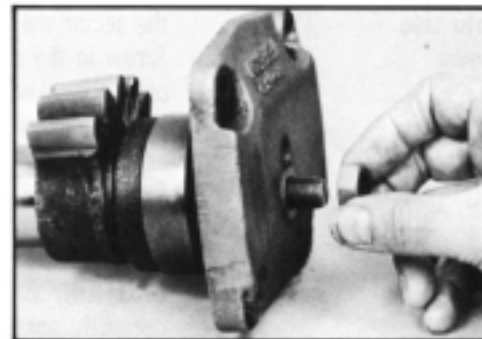


Figure 152

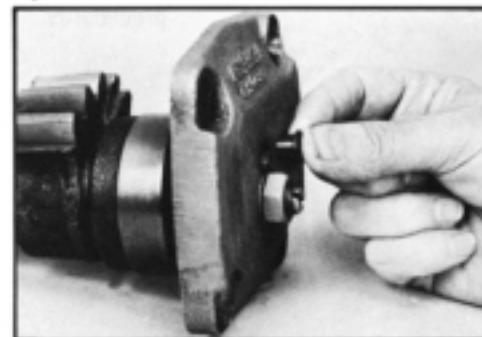


Figure 153

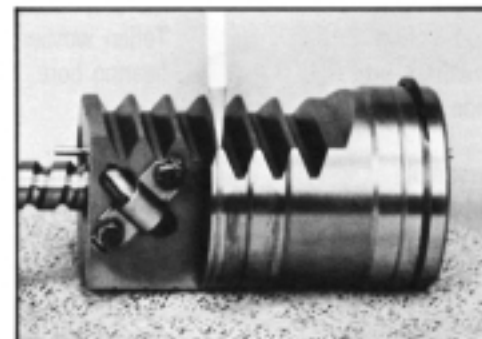


Figure 154

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.

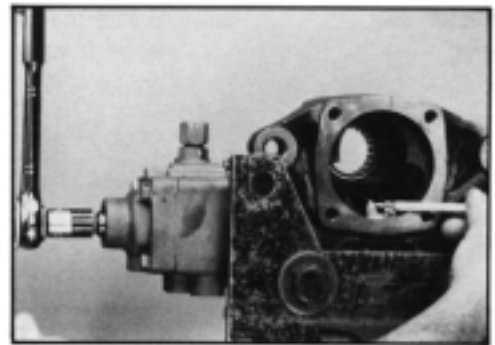


Figure 155

add timing mark to sector shaft

49. If there is not a timing mark on the end of sector shaft (51) add a timing mark with chalk or marking pencil on the end of the sector shaft in line with the center of the center tooth **space**. SEE FIGURE 156.

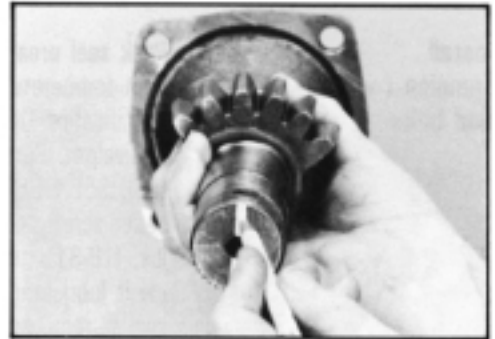


Figure 156

install sector shaft and side cover assembly

50. Remove any old tape from sector shaft (51) serrations and apply one layer of new tape to shaft serrations and bolt groove if necessary to protect seal. Install sector shaft and side cover assembly into housing (55). The sector shaft center tooth space as indicated by the timing mark on the end of sector shaft must engage the rack piston (39) center tooth. SEE FIGURE 157.

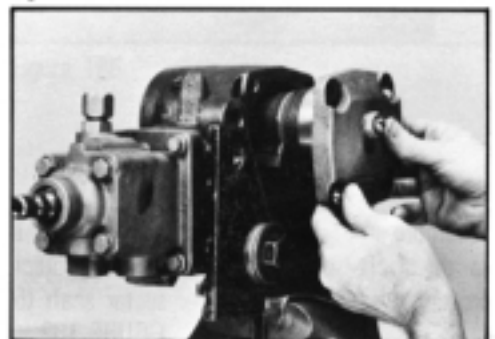


Figure 157

CAUTION

CAUTION: Be sure seal ring (43A) is in place.

install side cover bolts

51. Install the four special side cover bolts (42) and washers (42A) into the side cover and torque them to 45-55 ft. lbs. (61-75 N m) if dry or 33-40 ft. lbs. (45-54 N m) if lubricated. 5/8 inch or T-50 Torx socket required. SEE FIGURE 158.



Figure 158

NOTE

NOTE: One or more of the side cover bolts may be flat head TORX bolts (42B) for clearance purposes.

install trunion cover washer and seal

52. Place the trunion cover (59) exterior face down on a bench and install the **new** Teflon backup washer (47) and then the **new** two piece seal (48). The words "Oil Side" on the seal must be visible after assembly. SEE FIGURE 159.



Figure 159

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

53. Grease the **new** trunnion cover seal ring (58) and install it into the trunnion cover (59) seal ring groove.

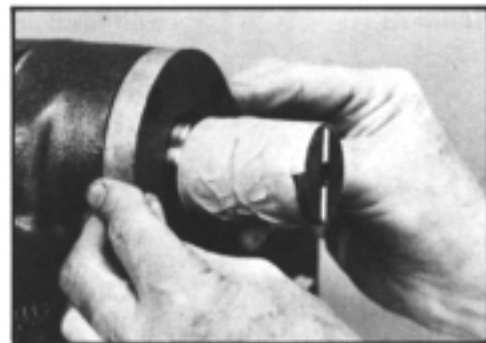


Figure 160

install trunnion cover and bolts

54. Pack seal area of sector shaft (51) with clean high temperature industrial grease per Ross specification 045231, Mobil Temp 1 or 2 or equivalent. Carefully install the trunnion cover (59). SEE FIGURE 160. Install the four trunnion cover screws (60) and torque them to 13-23 ft. lbs. (18-31 N m) if dry or 11-16 ft. lbs. (15-22 N m) if lubricated. A 5/16 inch 12 point thin wall socket required. SEE FIGURE 161.

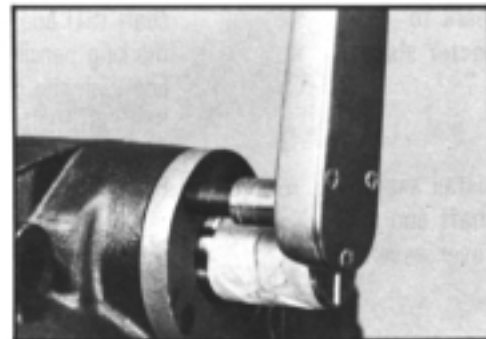


Figure 161

assemble sector shaft protector seal

55. Add more of the special grease to the cupped side of protector seal (61) and assemble over sector shaft (51) and trunnion cover (59). SEE FIGURE 162.

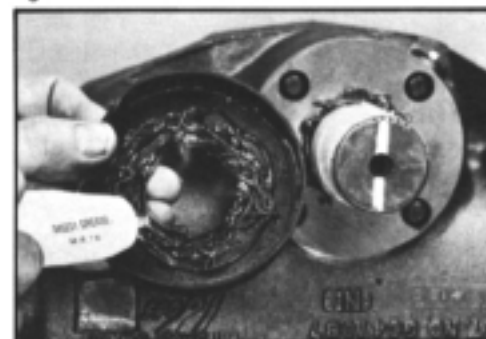


Figure 162

assemble worm shaft protector seal

56. Add the special grease to cupped side of protector seal (1) and assemble seal over worm shaft (23) and upper cover (7). SEE FIGURE 163.

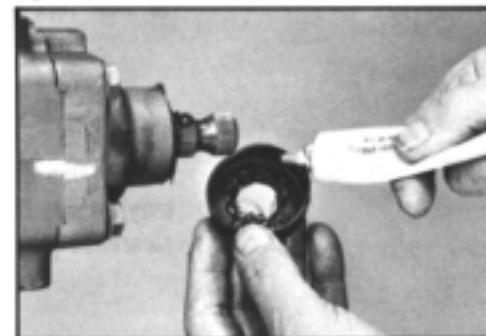


Figure 163

assemble bleed screw

57. If bleed screw (55B) was removed from housing (55) reassemble and torque to 27-33 in. lbs. (3.1-3.7 N m). SEE FIGURE 164.

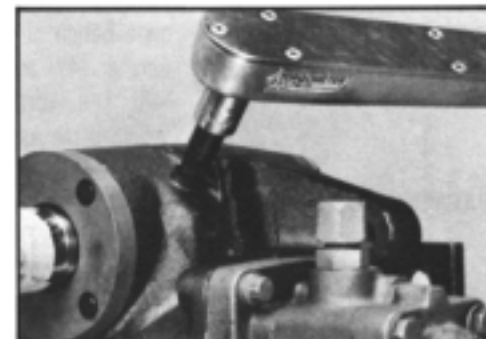


Figure 164

This completes assembly of the HF54 steering gear. Before you install the gear onto the vehicle, make final adjustments described on page 49. All ports should be plugged until unit is installed in vehicle.



TRW Automotive
Commercial Steering Systems
800 Heath Street
Lafayette, IN 47904
Tel 765.423.5377
Fax 765.429.1868
<http://www.trw.com/commercialsteering>