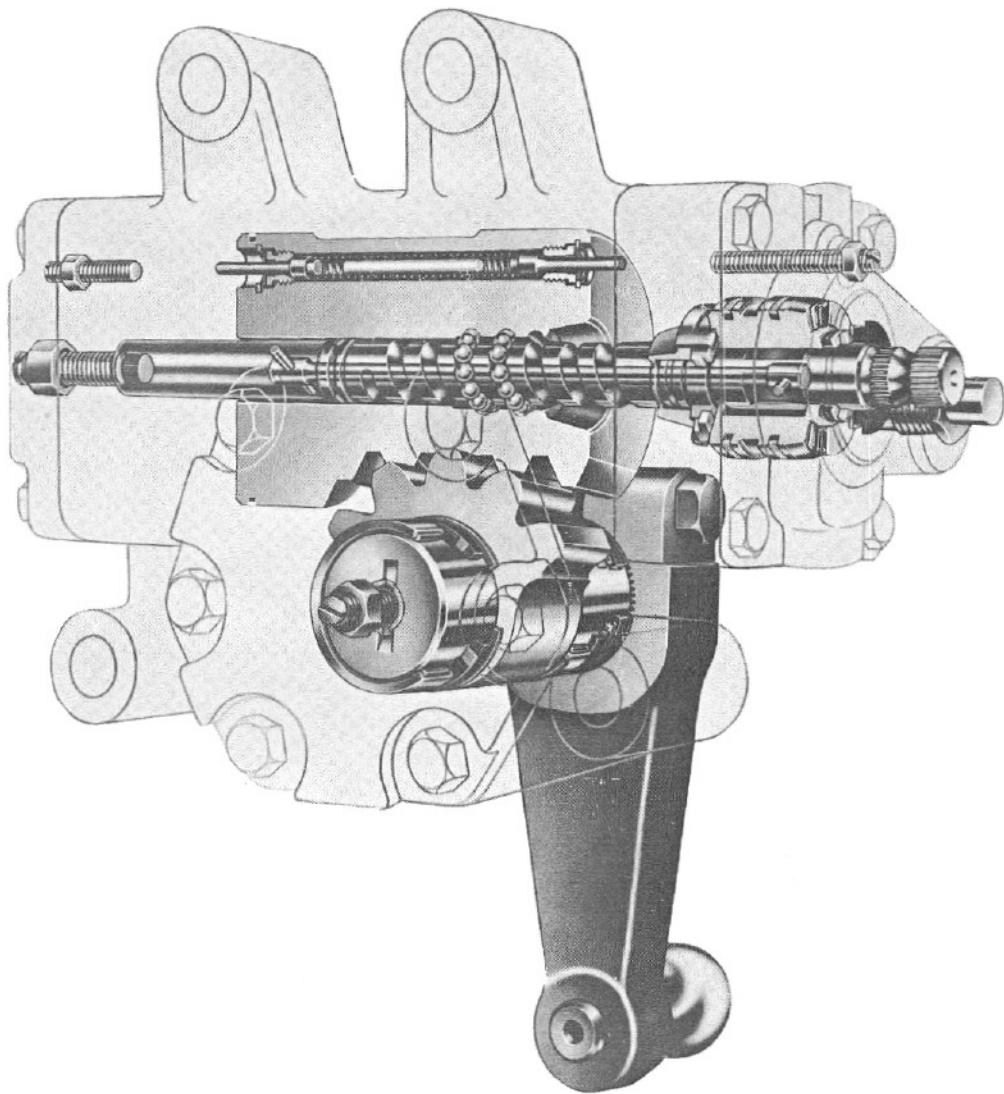


HydrapowerTM Integral Power Steering Gear

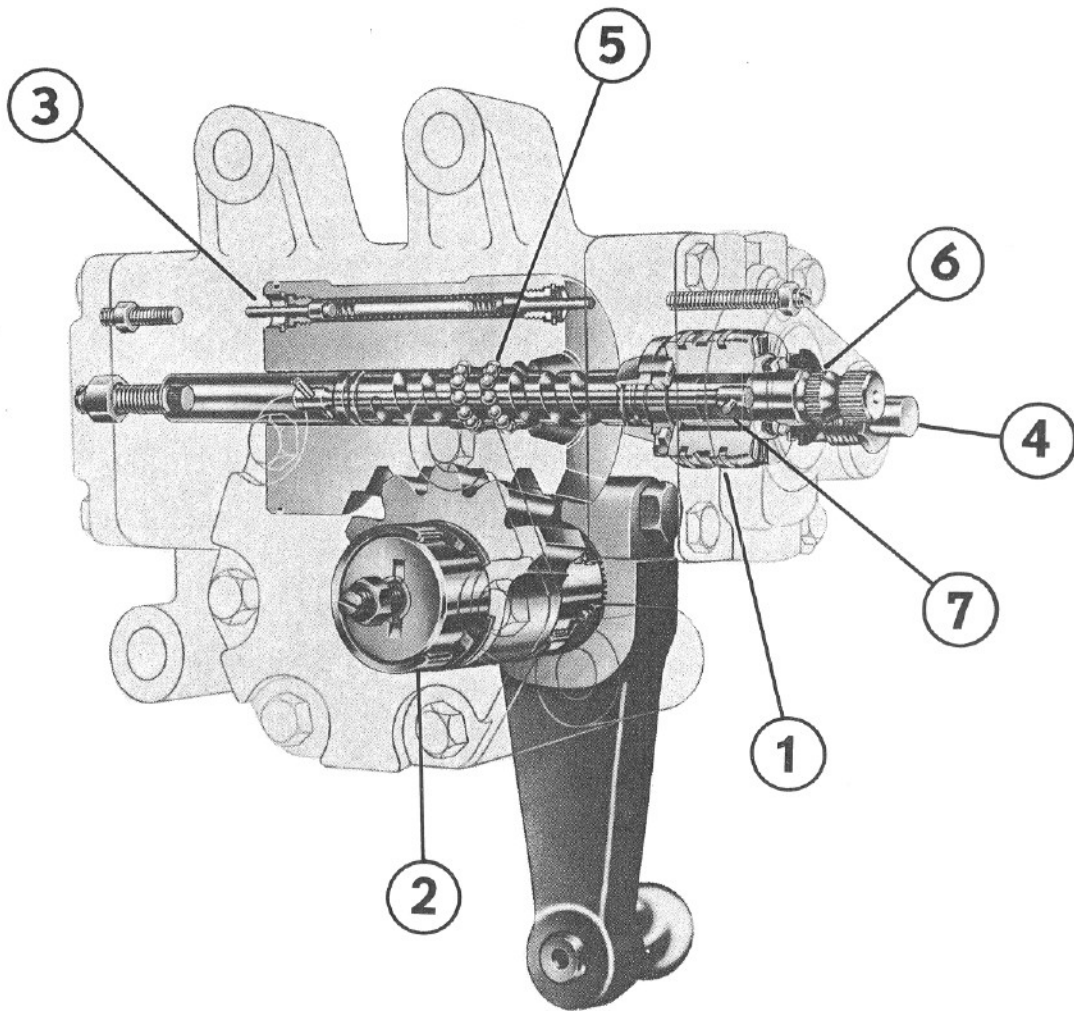
HFB64 Service Manual



TRW
ROSS GEAR DIVISION

HFB64 DESIGN FEATURES

The HFB64 integral hydraulic power steering gear is specifically designed for trucks with a front-end weight of approximately 12,000 pounds. We have designed some new features into this product, pictured and described below, and have added them to features retained from previous models of our HF series of power steering gears.



1. The **rotary control valve** supplies fluid to the gear for responsive steering feel.
2. Two sets of precision **sector shaft roller bearings** provide for high efficiency and reversibility.
3. On some HFB64's, **unloading (poppet) valves** operate at the ends of steering gear travel to protect the power steering pump and to reduce forces on the linkage.
4. Some HFB64's are equipped with a **relief valve** to limit maximum pressure so as to protect the power steering pump.
5. **Recirculating balls** allow for smooth steering and provide a capability for high efficiency manual steering.
6. Lip-type **dirt and water seals** at the input shaft and trunnion cover protect the gear from contamination.
7. A **torsion bar** provides positive valve recentering and good "feel-of-the-road" steering.

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.

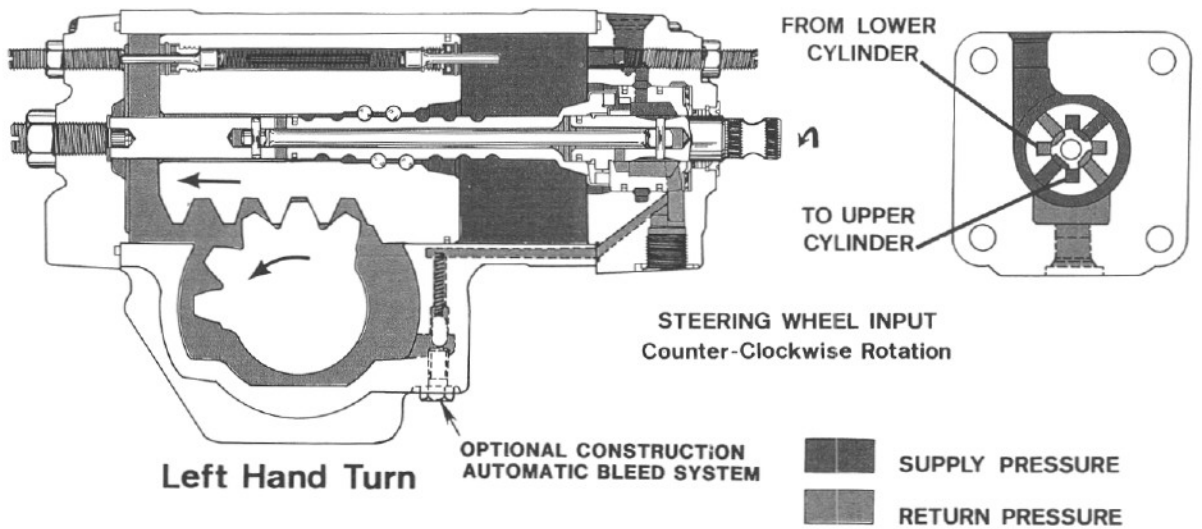
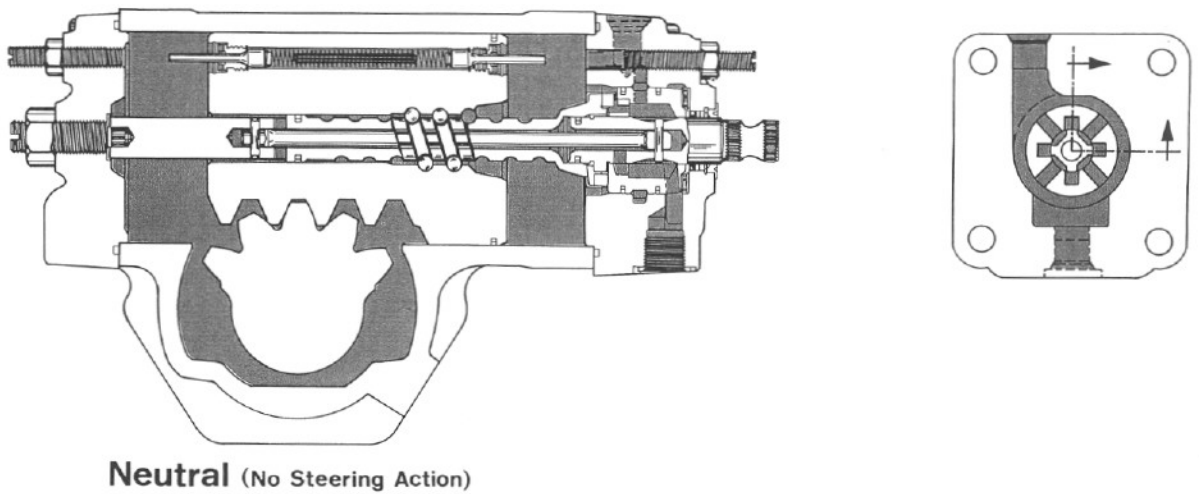
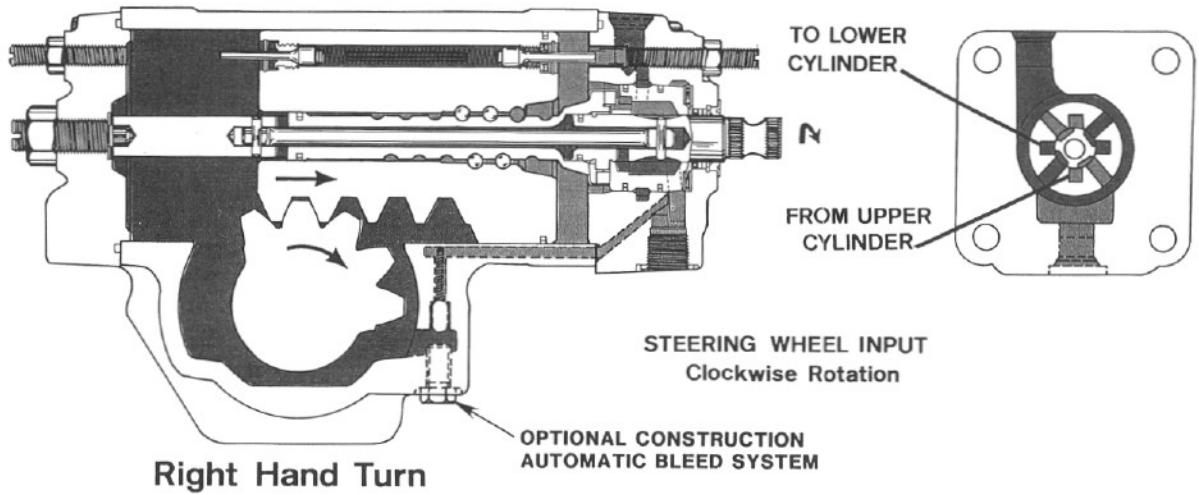
PATENTS

This TRW Ross Gear Division vehicle power steering gear is covered by one or more of the following United States patent numbers: 3,047,087; 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.

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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.

HFB 64 OIL FLOW ILLUSTRATION



HFB64: GENERAL DESIGN AND OPERATION

DESIGN

Integral Power Steering

The HFB64 power steering gear is the latest design in the Ross family of integral hydraulic power steering gears. Integral hydraulic power steering means that the gear box contains a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder, all in a single, compact package.

Rotary Control Valve

The rotary control valve combines simplicity of construction with desirable performance characteristics. The speed at which the driver can turn the steering wheel with power assist is dependent upon the pump flow (measured in gallons per minute—gpm) directed to a cylinder cavity.

The pressure (measured in pounds per square inch—psi) required for the gear to steer the vehicle is created by the power steering pump to overcome resistance at the steered wheels. The control valve senses these requirements and directs fluid to the cylinder cavity at the proper flow rate and pressure.

Pressure Means Work, Flow Means Speed

The higher the pressure a gear can withstand, the more work it can perform. The HFB64 can steer a vehicle with a front-end weight rating of about 12,000 pounds through a turn at low vehicle speed and engine idle. As the driver turns the steering wheel faster or slower, more or less fluid will be required by the gear in one minute. For the HFB64, maximum operating pressure is 2000 psi, maximum flow rate 6 gpm. **NOTE: The recommended minimum flow at 1½ hand wheel turns/second must be no less than 2.9 gpm.**

OPERATION

What Happens During a Steering Maneuver

When the driver turns the steering wheel, he transmits force from the wheel to the steering gear input shaft. A torsion bar, pinned at its one end to the input shaft and at its other end to the worm shaft, turns with the input shaft and exerts a rotational force on the worm shaft. In response to this rotational force, the worm shaft, acting through the recirculating ball mechanism, tries to move the rack piston axially through the gear housing cylinder bore.

The rack piston's axial movement is resisted by its engagement to the sector shaft, which is connected by linkage to the steered wheels. Because of this resistance, the torsion bar is twisted by the input shaft, thereby actuating the control valve. Pressurized fluid, directed by the control valve, assists in moving the rack piston axially through the cylinder bore. The rack piston then turns the sector shaft to steer the vehicle.

Shock Loads to the Gear

If the steered wheels receive a shock load, the shock forces are transmitted through the sector shaft, to the rack piston, and onto the worm shaft. The internal geometry of the steering gear causes the control valve to send high-pressure fluid to the correct cylinder cavity to resist the shock forces. By absorbing the shock forces hydraulically, the steering gear prevents objectionable kickback at the steering wheel.

Unloading (Poppet) Valves

Some HFB64 gears are equipped with two unloading valves, one at each end of the rack piston. One valve or the other, depending on the direction of turn, will trip as the steered wheels approach the axle stops (which must be set according to manufacturer's specifications). The tripped valve reduces pressure in the gear and helps to reduce heat generated by the pump. At the same time, the valves also reduce forces on the steering linkage.

Relief Valve

Some HFB64 gears, whether equipped with or without poppets, are also supplied with a relief valve. The relief valve limits maximum supply pressure to protect the power steering pump, but it does not reduce pressure as the steered wheels approach the axle stops.

Bleed Systems

Some HFB 64 gears which are mounted with the output shaft above the rack piston bore are equipped with either an automatic bleed system or a manual bleed screw.

The procedure for servicing the manual bleed screw is described under "Filling and Air Bleeding" (page 45) in this manual.

If the unit has an automatic bleed system, illustrated as optional on the oil flow diagram, no servicing is required on the vehicle.

TROUBLESHOOTING INFORMATION

Preliminary Checks

When a customer comes to you with a problem related to his truck's steering, you can save a lot of time and work if you first verify the problem. Make sure you're both talking the same language about the same problem. If he says the truck's hard to steer, find out exactly what he means. Is it hard steering into a right or left turn? Only when turning the steering wheel while the truck is sitting still? Is there only intermittent power steering? Or is there no power assist at all?

If at all possible, and if it's safe to do so, test drive the truck. If you're not familiar with the rig, let the customer drive it while you sit beside him. Take hold of the wheel while he drives to get a feel for the problem he's talking about. Since most of his driving will be with his truck hauling a load, arrange for a load if one is required to reproduce the steering problem.

Once you've determined the problem and its symptoms, don't jump right in to tear the steering gear or pump apart. In most cases, in fact, the gear should be the last component you check. There are many other components in the steering system that could be causing the problem (see FIG. 1). These you should check first.

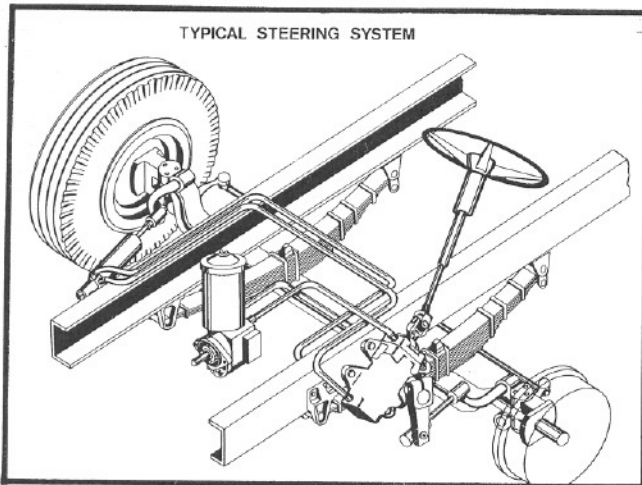


Figure 1

Begin, then, by checking the steered wheels: make sure that the tires are at correct pressure and equal all around, that they are properly sized, and that they are not worn or damaged.

Next, have the front-end alignment checked and look for abnormal looseness or tightness in the steering linkage, ball joints, and king pins.

A service replacement hose or fluid line may be misrouted or may be too small in diameter, or it may be restricted in some other way. Reroute any hose that is kinked or bent sharply. Replace any hoses that are not the same as original equipment.

Continue by checking the power steering fluid reservoir

to make sure that oil is up to the correct level. Also, check the pump drive belt, if one is used, to see if it is slipping. The belt may be tight, but it may also be glazed, and a slipping belt doesn't always squeal. If you adjust the belt, check the specifications.

These are just some of the checks you should make before you turn to the steering gear or pump. The Troubleshooting Guides on pages 7 and 8 explain what to diagnose for a particular steering problem. Match the trouble symptom against the chart and follow the recommended troubleshooting sequence. Doing so will most likely save you time and may prevent unnecessary repairs and costs.

Hydraulic Tests

If the checks described above all prove satisfactory, it is possible that the cause of the steering problem can be traced to a lack of pressure or insufficient flow. In this case, you may have to do more detailed troubleshooting that involves conducting hydraulic tests.

PREPARATION FOR HYDRAULIC TESTS

To conduct the following hydraulic tests, first install a flow meter, pressure gage and load (shut off) valve in the appropriate fluid line, as indicated by the instructions that come with the flow meter. Steering system analyzers are available with the 3 units integral. Place a thermometer in the reservoir (FIG. 2). You must use a flow meter, and it is recommended that you use a thermometer, if you are to troubleshoot the hydraulic system accurately.

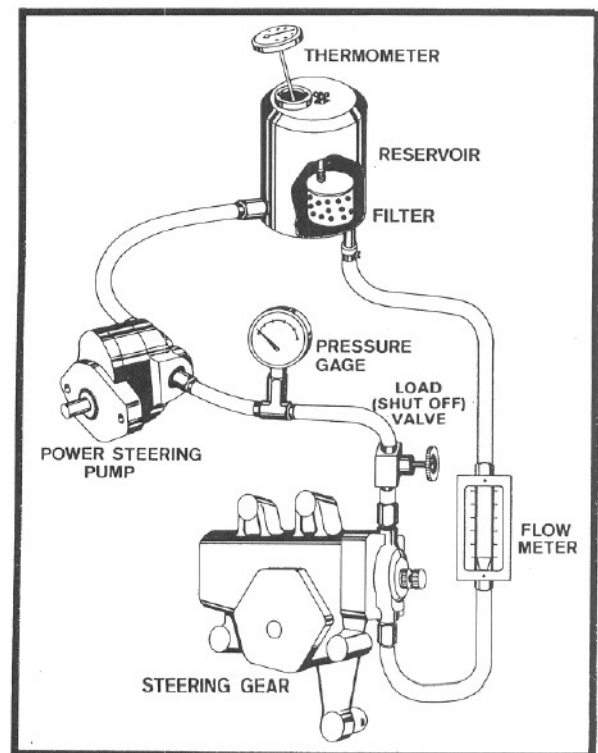


Figure 2

Next, warm the system up. To do this, partially close the load valve until the pressure gage reads 1000 psi. When the fluid temperature, as indicated on the thermometer, reaches between 125°F and 135°F, open the load valve. The system is warmed up, and you can conduct the tests.

CAUTION: Do not close the load valve completely and leave it closed, or you may damage the pump. At no time allow fluid temperature to exceed 180°F. Run all the tests at the prescribed temperature range of 125°F-135°F.

POWER STEERING PUMP PRESSURE TEST

With the engine idling, close the load valve and read the pressure gage. If the pressure reads below the minimum specified by the pump manufacturer, repair or replace the pump.

CAUTION: Do not keep the load valve closed for longer than 5 seconds to avoid damaging the pump. Closing the load valve causes the pump to operate at relief pressure and the fluid temperature to increase rapidly. Allow fluid to cool to between 125°F and 135°F before you resume with the other tests.

POWER STEERING PUMP FLOW TEST

WARNING: MAXIMUM FLOW RATE FOR THE HFB64 STEERING GEAR IS 6 GPM. FLOW RATE SHOULD NOT EXCEED 6 GPM. EXCESSIVE FLOW CAN CAUSE DAMAGE TO INTERNAL PARTS OF THE STEERING GEAR, WHICH COULD RESULT IN A LOSS OF POWER STEERING.

NOTE: If flow specifications and methods of checking flow rate are provided by the vehicle manufacturer, you should follow those instructions rather than the procedure described below.

With the engine idling and the fluid temperature between 125°F and 135°F, check the pump manufacturer's specifications for flow rate. Compare these specifications with the flow rate on the flow meter.

Now, fully close the load valve until the pressure gage registers the pressure at which the pump is relieving. When pump relief is reached, flow rate must be zero gpm. **IMMEDIATELY OPEN THE LOAD VALVE.** The flow rate must instantly return to the original reading. If this rate does not return immediately, the pump is malfunctioning, which can result in intermittent power assist.

Now, set the engine at governed rpm, and fully close the load valve again until pump relief is reached. At pump relief, the flow rate must be zero gpm. **IMMEDIATELY OPEN THE LOAD VALVE.** The flow rate must instantly return to the original reading. If this rate does not return immediately, the pump is malfunctioning, which can result in intermittent power assist.

NOTE: Conduct the pump flow test once at idle rpm and three times at governed rpm.

CAUTION: Do not allow the fluid temperature to exceed 180°F. Run each phase of this test between 125°F and 135°F.

STEERING GEAR INTERNAL LEAKAGE TEST

To test the steering gear for internal leakage, you must first prevent operation of the gear's internal unloading (poppet) valves or relief valve (or both, in some gears). This will allow full pump relief pressure to develop. To prevent operation of the poppets, place a steel spacer block, about 1 inch thick and long enough to keep your fingers clear, between the axle and stop at one wheel (see FIG. 3). To prevent operation of the relief valve, remove the relief valve by following disassembly step 17. Install the relief valve plug, special tool J29059, in its place.



Figure 3

NOTE: Be sure you reinstall the relief valve, with new seals and O-rings, back onto the gear. Follow assembly step 28.

With the fluid temperature between 125°F and 135°F, turn the steering wheel until the axle stops bottom on the spacer block (FIG.3).

CAUTION: When running this test, do not hold the steering wheel in the full turn position for longer than 5 to 10 seconds at a time to avoid damaging the pump.

WARNING: KEEP YOUR FINGERS CLEAR OF THE AXLE STOPS AND SPACER BLOCK DURING THIS TEST. MAKE SURE THAT THE SPACER BLOCK CONTACTS THE AXLE STOP SQUARELY. CONTACT THAT IS NOT SQUARE COULD BREAK THE AXLE STOPS OR DANGEROUSLY THROW OR EJECT THE SPACER BLOCK.

Apply 20 lbs. to the rim of the steering wheel during this test to be sure that the steering gear control valve is fully closed. The pressure gage should now read pump relief pressure, as noted during the pump pressure test. You can now read steering gear internal leakage on the flow meter. Acceptable internal leakage can range from 0 to 1 gpm.

If internal leakage is greater than 1 gpm, repair the gear.

Repeat this test for the opposite direction of turn. (See inside back cover for Internal Leakage Diagram)

—If the power steering pump is belt-driven, a squealing noise may indicate that the belt or belts should be tightened or replaced.

—A clicking noise heard during a turn, or when changing directions, may indicate that some component is loose and shifting under load.

—A change in the normal noise of the pump may indicate that air has been induced into the system or that fluid level is low.

III. POSSIBLE STEERING PROBLEMS AND CAUSES

Road Wander

- Tire pressure incorrect or unequal left to right.
- Components in steering linkage loose or worn (Steering wheel to road wheel).
- Wheel bearings improperly adjusted or worn.
- Front end alignment out of specification.
- Dry fifth wheel or poor finish on fifth wheel or trailer plate.
- Steering gear mounting bolts loose on frame.
- Steering gear improperly adjusted.
- Looseness in rear axle assemblies or trailer bogies.

No Recovery

- Tire pressure low
- Front end components binding
- Front end alignment incorrect
- Tight front axle king pins
- Dry fifth wheel or poor finish on fifth wheel or trailer plate
- Steering column binding
- Pump flow insufficient
- Steering gear improperly adjusted
- Steering gear control valve spool or sleeve tight or improperly adjusted.

Shimmy

- Badly worn or unevenly worn tires
- Improperly mounted tire or wheel
- Wheel bearings improperly adjusted or worn
- Components in steering linkage loose or worn
- Wheels or brake drums out of balance

- Front end alignment incorrect

- Air in the hydraulic system

External Oil Leakage

- Finding the location of a leak may be difficult, since oil may run away from the leak source, the fittings, hoses, pump, or gear to a low point on the gear or chassis.

- A leak from the vent plug at the side cover indicates failure of the sector shaft oil seal inside the side cover.

Oversteering or Darting

- Dry fifth wheel or poor finish on fifth wheel or trailer plate

- Front end components binding or loose

- Steering column binding

- Steering gear improperly adjusted

- Steering gear control valve spool or sleeve tight or improperly adjusted.

- Rear axle mounts (rear steer)

High Steering Effort in One Direction

- Unequal tire pressure

- Vehicle overloaded

- Inadequate hydraulic system pressure

- Excessive internal leakage in one direction of turn only (verify with internal leakage test)

High Steering Effort in Both Directions

- Low tire pressure

- Vehicle overloaded

- Low hydraulic fluid level

- Low pressure or flow from pump

- Components of steering system binding

- Restriction in return line, or line too small in diameter

- Excessive internal leakage (verify with internal leakage test)

- Oversize tires (check manufacturer's specifications)

Lost Motion (Lash) at the Steering Wheel

- Steering wheel loose on the shaft

- Loose connection between the steering gear, intermediate column, and steering column

- Steering gear loose on frame

- Pitman arm loose on output shaft

- Components in steering linkage loose or worn

- Steering gear improperly adjusted

Excessive Heat (150°F Over Ambient)

- Excessive pump flow

- Vehicle overloaded

- Undersized replacement hose or line

- Restricted hose or line that is kinked or severely bent or internally blocked

- Restricted recentering of gear valve caused by column bind or side load on the input shaft

- Poppets not adjusted properly (only for gears equipped with poppets)

1 The Sector Shaft and Trunnion Cover

remove pitman arm

- 1.1 If you detect a leak in the trunnion cover area, on many HFB64 installations you can remove the trunnion cover with the gear on the vehicle to gain access to the sector shaft seal package. First, remove the pitman arm clamp bolts and then the pitman arm (FIGS. 4 and 5).

NOTE

NOTE: Use of a chisel to spread the boss will help you to loosen the pitman arm.

WARNING

WARNING: WHEN USING A CHISEL TO SPREAD THE PITMAN ARM BOSS IN ORDER TO LOOSEN THE PITMAN ARM FOR REMOVAL FROM THE SHAFT, MAINTAIN A FIRM GRIP ON THE CHISEL AT ALL TIMES. FAILURE TO DO THIS MAY RESULT IN THE CHISEL FLYING LOOSE WHICH COULD CAUSE AN INJURY. NEVER LEAVE THE CHISEL WEDGED IN THE PITMAN ARM BOSS. IF YOU CANNOT REMOVE THE PITMAN ARM FROM THE SHAFT WITH A CHISEL AND YOUR HANDS, REMOVE THE CHISEL FROM THE PITMAN ARM AND USE A PULLER ONLY TO REMOVE THE PITMAN ARM.

remove dirt and water seal

- 1.2 Remove the dirt and water seal (27) (FIG. 6).

clean sector shaft

- 1.3 Clean the sector shaft (50) with a fine grade of emery paper (FIG. 7). Be sure to remove any and all paint.

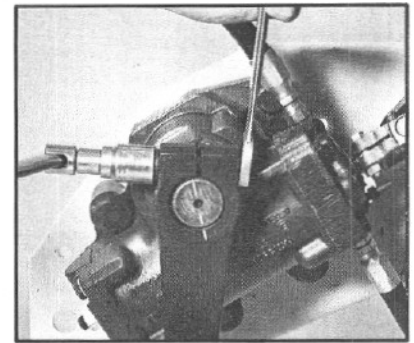


Figure 4

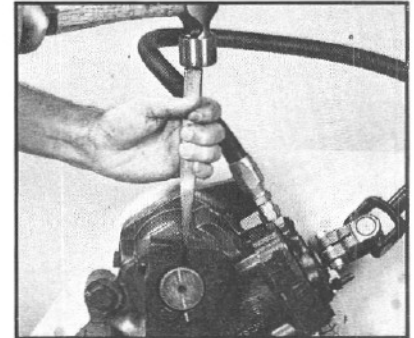


Figure 5

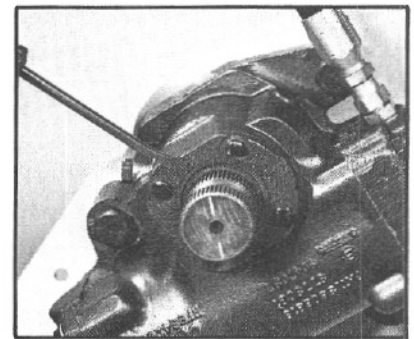


Figure 6

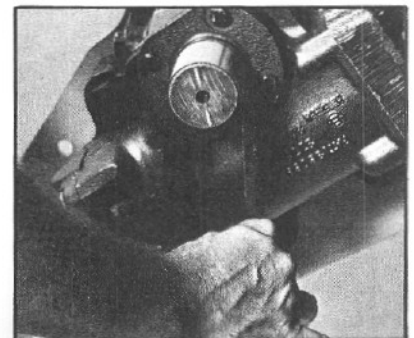


Figure 7

**remove
trunnion cover
and seal
package**

- 1.4 Next, remove the four trunnion cover bolts (28) and then the trunnion cover (26) (FIG. 8). Then, remove and discard the sector shaft seal package, consisting of the Teflon* backup washer (24), the two-piece sector shaft seal (23), and the trunnion cover O-ring (25) (FIG. 9).

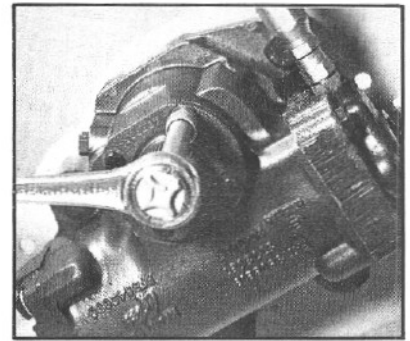


Figure 8

**clean and
inspect trunnion
cover**

- 1.5 Clean the trunnion cover (26) in petroleum-based solvent and inspect its seal cavity and sealing face for nicks or corrosion. Replace the trunnion cover with a new one if these conditions exist.

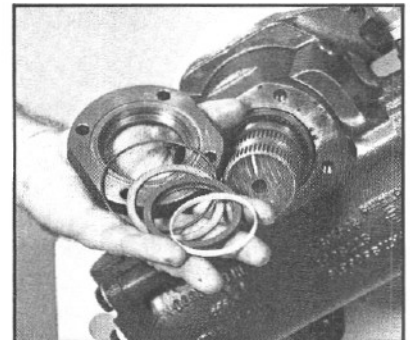


Figure 9

WARNING

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

**install new
washer, seal,
and O-ring**

- 1.6 Place the trunnion cover (26) on a bench to install the new seal package. Start with the new Teflon backup washer (24). Next, install the new two-piece sector shaft seal (23) (FIG. 10) so that the words OIL SIDE are visible after the seal is in place.



Figure 10

WARNING

WARNING: THE WORDS "OIL SIDE" MUST BE VISIBLE AFTER THE SEAL IS IN PLACE (FIG. 10). IF NOT, THE SEAL WILL NOT FUNCTION AND A LOSS OF POWER STEERING ASSIST MAY OCCUR.

Grease the new trunnion cover O-ring (25) and install it into the cover groove.

**tape sector
shaft**

- 1.7 Cover the serrations of the sector shaft (50) with one layer of masking tape to avoid damaging the seals during trunnion cover installation (FIG. 11).

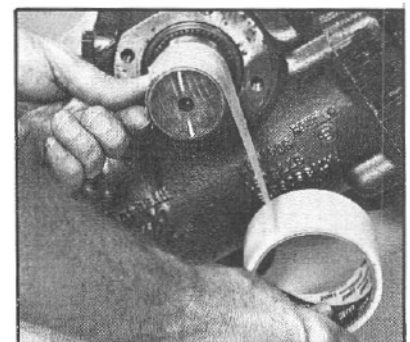


Figure 11

*Teflon is a registered trademark of DuPont Corporation

install trunnion cover

- 1.8 Install the trunnion cover (26) (FIG. 12).

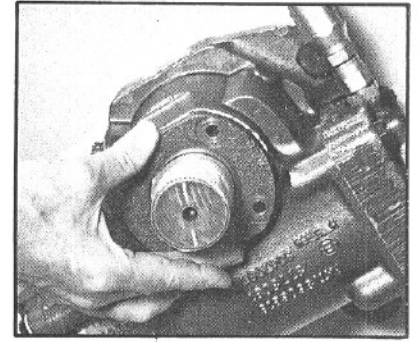


Figure 12

install new dirt and water seal; torque bolts

- 1.9 Install the four trunnion cover bolts (28) and torque them to 15-22 ft. lbs. (FIG. 13). Pack the cavity around the seal area of sector shaft (50) with *Mobil Temp 1 or 2 grease. Install a new dirt and water seal (27) using a suitable blunt-ended drift (FIG. 14). Remove the tape from the sector shaft.

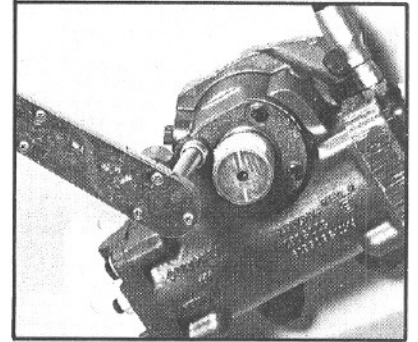


Figure 13

install pitman arm

- 1.10 Reconnect the pitman arm, making sure that the timing mark on the pitman arm aligns with the timing mark on the sector shaft (FIG. 15).

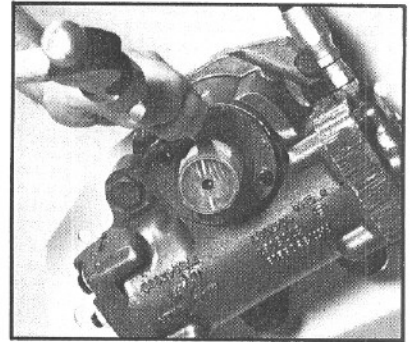


Figure 14

WARNING

WARNING: WHEN USING A CHISEL TO SPREAD THE PITMAN ARM BOSS FOR ASSEMBLY ONTO THE SECTOR SHAFT (50), MAINTAIN A FIRM GRIP ON THE CHISEL AT ALL TIMES. FAILURE TO DO THIS MAY RESULT IN THE CHISEL FLYING LOOSE WHICH COULD CAUSE AN INJURY. NEVER LEAVE THE CHISEL WEDGED IN THE PITMAN ARM BOSS.

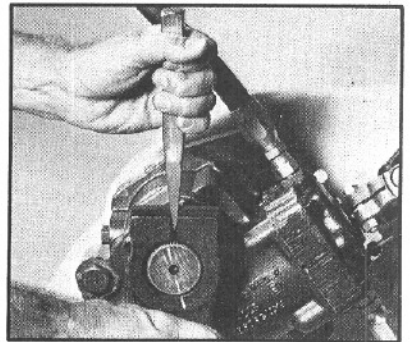


Figure 15

install and torque pitman arm bolt

- 1.11 Insert the pitman arm clamp bolt and nut assembly, using a 3/4-16 grade 8 bolt (FIG. 16). If the bolt is lubricated or plated, torque it to 300-320 ft. lbs. If it is dry and unplated, torque it to 380-420 ft. lbs.

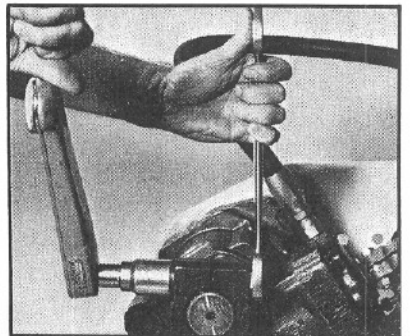


Figure 16

*Mobil Temp is a registered trademark of Mobil Oil Co.

2 The Input Shaft Seal

remove input coupling; clean input shaft

- 2.1 If there is a leak in the input shaft seal, you can usually replace the seal assembly with the gear on the vehicle. Start by removing the input coupling (FIG. 17).

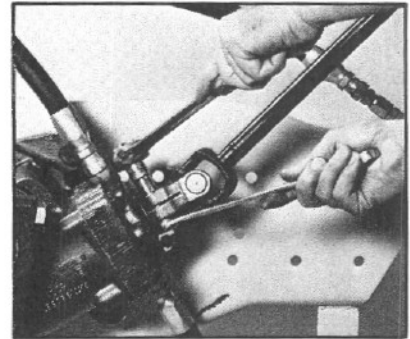


Figure 17

WARNING

WARNING: DO NOT DRIVE OR PRY COUPLING FROM SHAFT. INTERNAL DAMAGE TO THE STEERING GEAR CAN RESULT. IF COUPLING IS TIGHT, INSERT SCREWDRIVER INTO SLOT TO RELEASE.

Clean the area around the input shaft with a fine grade of emery paper (FIG. 18). Be sure to remove any and all paint.

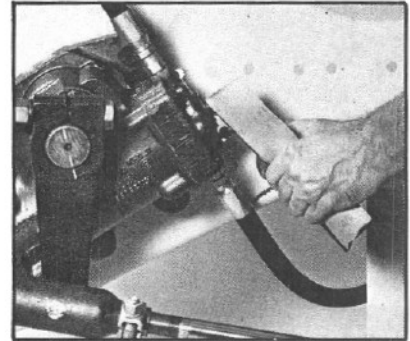


Figure 18

remove and plug the return line

- 2.2 Remove and plug the return line (FIG. 19).

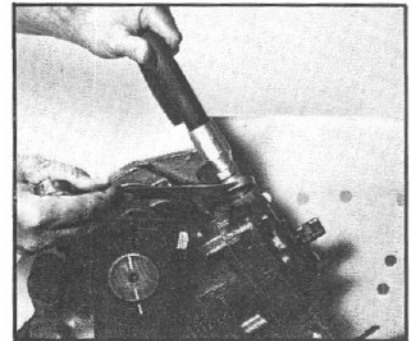


Figure 19

remove seal

- 2.3 Remove and discard the dirt and water seal (4) (FIG. 20).

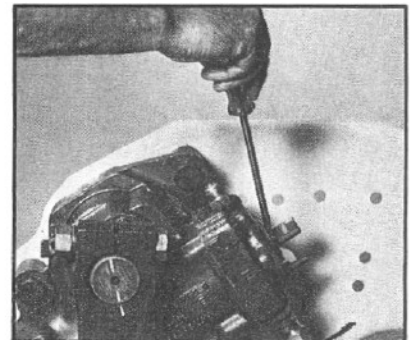


Figure 20

remove retaining ring

- 2.4 Remove the retaining ring (5) from the input shaft (FIG. 21).

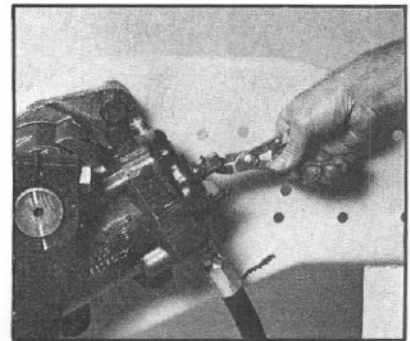


Figure 21

MAXIMUM AIR PRESSURE REQUIREMENTS.

remove seal and washer

- 2.6 The air pressure will force the two-piece input shaft seal (7 and 8) and the steel backup washer (6) to pop out of the gear, and some fluid will leak from the gear (FIG. 23). Discard the two-piece seal. Disconnect the shop air as soon as the seal assembly is out.

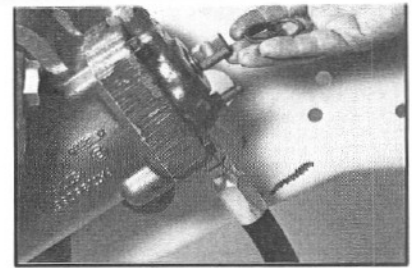


Figure 23

install seal package

- 2.7 Apply clean grease to the new input shaft seal assembly (6, 7, and 8) and to the input shaft. Install the new two-piece seal (7 and 8) flat side up and the steel backup washer (6), using seal driving tool J26653 (FIG. 24). Install the retaining ring (5).

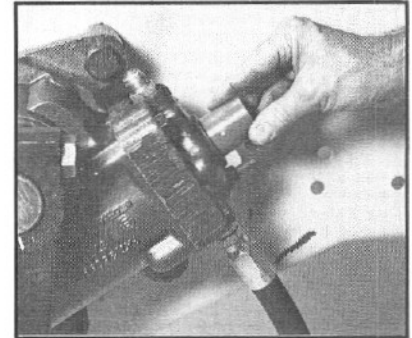


Figure 24

grease input shaft

- 2.8 Pack the area around the input shaft with Mobil Temp 1 or 2 grease (FIG. 25).

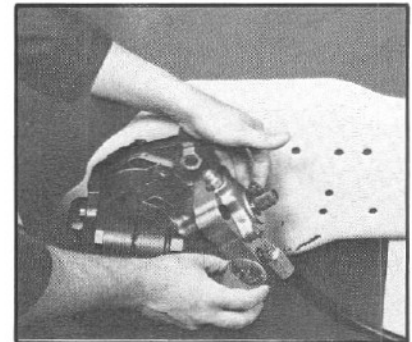


Figure 25

install dirt and water seal

- 2.9 Install the new dirt and water seal (4), using the seal driving tool J26654 or a suitable blunt-ended drift (FIG. 26).

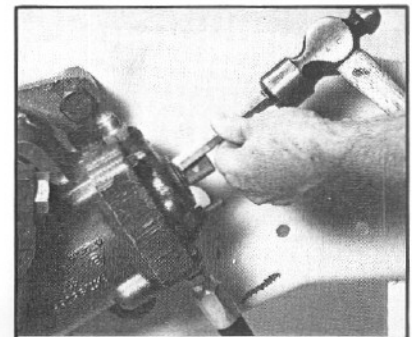


Figure 26

- reconnect line** 2.10 Remove the plug and reconnect the return line.
- reconnect input coupling** 2.11 Reconnect the input coupling. If the input coupling male assembly slides free of the female end during reassembly, realign the timing marks to insure proper phasing of the U-joints. Refer to vehicle manufacturer for recommended torque.

WARNING

WARNING: MISTIMED U-JOINTS CAN RESULT IN A BUMPY SENSATION AT THE STEERING WHEEL AND POSSIBLY AFFECT STEERING CONTROL.

- fill and bleed system** 2.12 Before operating the steering gear, fill the system with the recommended fluid and bleed air from the system by following the Filling and Air Bleeding instructions on page 45.

ADJUSTMENTS

You can make three adjustments to the gear while it is mounted on the vehicle: the worm shaft preload adjustment, the poppet valve adjustment, if your gear is equipped with poppets, and the sector shaft adjustment.

3 Worm Shaft Preload Adjustment

- loosen jam nut and adjusting screw** 3.1 Back off the worm shaft adjusting screw jam nut (38) three turns (FIG. 27). Back off the worm shaft preload adjusting screw (39) one turn (FIG. 28). Inspect the threads between the jam nut and housing end (or end cover, 37, if equipped) for foreign matter. Clean the threads or replace the jam nut if necessary (FIG. 29).

NOTE

NOTE: HFB64 gears are equipped with a housing that has either a closed, non-removeable end or a removeable end cover (37). The worm shaft preload adjustment described here applies in either case, and you should make the adjustment according to the instructions in this manual.

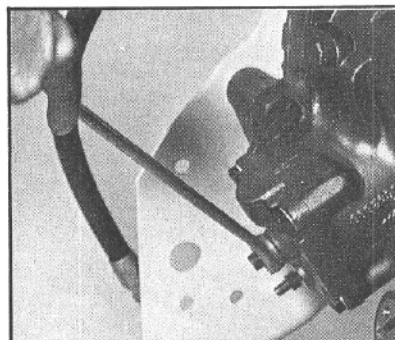


Figure 27

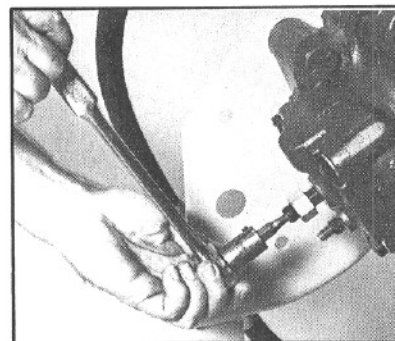


Figure 28

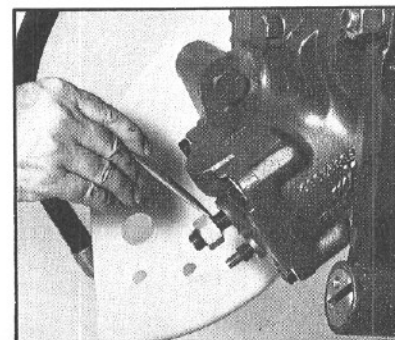


Figure 29

torque adjusting screw 3.2

While someone lightly moves the steering wheel back and forth about one inch total, torque the worm shaft preload adjusting screw (39) to 60-70 in. lbs.

NOTE

NOTE: While torquing the adjusting screw, make sure that the worm shaft adjusting screw jam nut (38) does not tighten (FIG. 30).

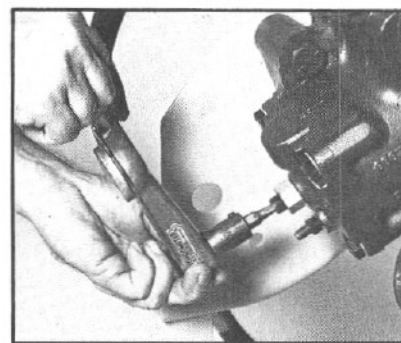


Figure 30

torque jam nut 3.3

Torque the worm shaft adjusting screw jam nut (38) to 70-80 ft. lbs., making sure that the worm shaft preload adjusting screw (39) does not move.

NOTE

NOTE: If the sealing material in the jam nut has separated, remove the adjusting screw and replace the jam nut with a new one onto the nonslotted end of the adjusting screw. Then, adjust the assembly as described here.

4 Poppet Valve Adjustment

NOTE

NOTE: This adjustment is for all HFB64 gears equipped with poppet (unloading) valves, whether they are also equipped with a relief valve or not.

set axle stops 4.1

Before you adjust the poppets, set the axle stops according to the manufacturer's specifications.

install flow meter 4.2

Install a flow meter into the supply line from the pump to the gear. Make sure that the flow meter can be pressurized. Bring the fluid temperature to between 125°F and 135°F, using the method to warm the system up described in the troubleshooting section, page 6.

rotate sector shaft 4.3

With the engine at idle, have someone turn the steering wheel to full lock while you observe the rotation of the sector shaft (50) (FIG. 31). If the sector shaft turns counter-clockwise, adjust the poppet identified by the arrow in FIG. 31. If the sector shaft turns clockwise, adjust the other poppet.

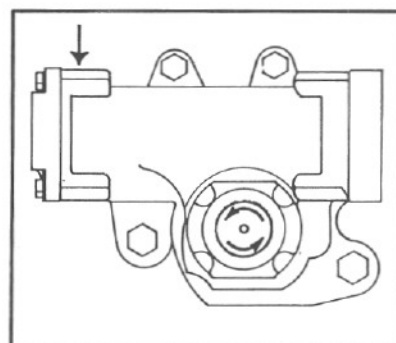


Figure 31

CAUTION

CAUTION: If relief pressure is reached while the steering wheel is at full lock, release the steering wheel from this position. At no time should relief pressure be maintained for longer than 5 seconds as damage to the pump may result.

**loosen jam nut
and adjusting
screw**

- 4.4 Once you have determined which poppet to adjust, loosen the poppet adjusting screw jam nut (3) and the poppet adjusting screw (2 or 40) until the pressure gage reads maximum pump relief pressure (FIG. 32).

CAUTION

CAUTION: Poppet adjusting screws of the latest design come with an internal allen head hex for adjustment. These adjusting screws will be found in the valve housing only. If your gear is equipped with such an adjusting screw, it cannot be removed externally. See Fig. 32-A. If removal is required, see valve housing assembly procedures.

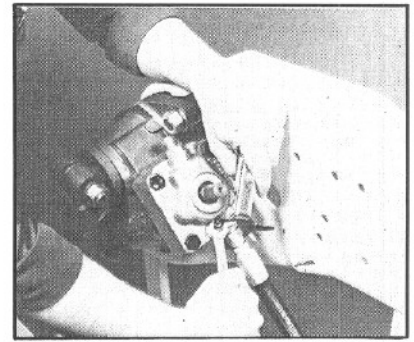


Figure 32

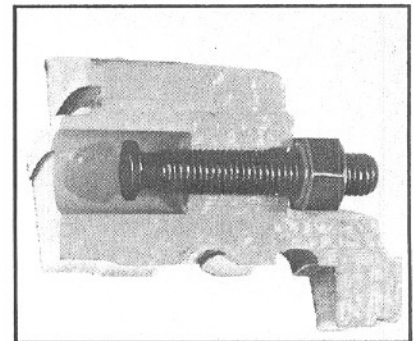


Figure 32-A

**set screw and
tighten jam nut**

- 4.5 Screw in the poppet adjusting screw (2 or 40) until the pressure gage shows a significant drop in pressure (200-400 psi) with the steering gear against the axle stops. Tighten the poppet adjusting screw jam nut (3) to 12-18 ft. lbs., if the nut has 3/8-24 threads. If it has 5/16-24 threads, tighten it to 8-11 ft. lbs.

**adjust other
poppet**

- 4.6 To adjust the other poppet, repeat these instructions for full lock in the other direction (FIG. 33).

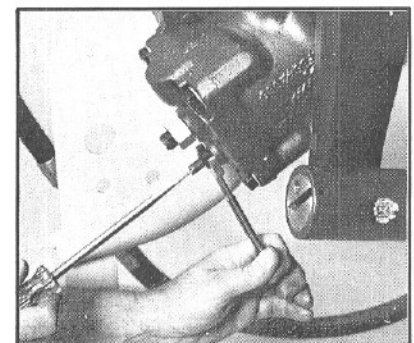


Figure 33

5 Cross-shaft or Sector-shaft Adjustment

locate adjusting nut

- 5.1 If the sector-shaft adjusting screw jam nut (59), located on the side cover, is not accessible, the steering gear must be removed prior to adjustment.

remove the drag link

- 5.2 If the sector shaft adjusting screw (51) is accessible, remove the drag link from the pitman arm.

CAUTION

CAUTION: This adjustment must be performed with the sector shaft on its center of travel.

center the sector shaft

- 5.3 To position the sector shaft on center of travel, rotate handwheel (input shaft) one half the full number of available handwheel turns (input shaft rotations) from either stop. This procedure will locate the timing marks midway between two bolts on the trunion cover (26) (See FIG. 6).

check for lash

- 5.4 With the sector shaft (50) in the center position, grasp the pitman arm and gently try to move this arm back and forth in the direction of travel. Finger-tip force is adequate to detect lash of a loose sector shaft. There must be **no movement** of the input shaft or sector shaft. If no lash is detected, do not adjust.

position adjusting screw

- 5.5 If lash is detected, loosen jam nut and move the adjusting screw clockwise until the sector shaft and rack piston (31) are in contact. (Use no more than 10 ft. lbs. of torque.) Then, turn the adjusting screw counterclockwise one turn.

check for lash

- 5.6 At this point, there should be lash at the pitman arm.

eliminate lash

- 5.7 To adjust, slowly turn the adjusting screw clockwise until no lash is felt at the pitman arm. Hold the adjusting screw in place, and tighten the jam nut to 40-45 ft. lbs.

recheck for lash

- 5.8 Recheck the pitman arm for lash. Turn the steering wheel $\frac{1}{4}$ turn each side of center. No lash should be felt. If lash exists, repeat adjustments 5.3-5.8.

connect drag link

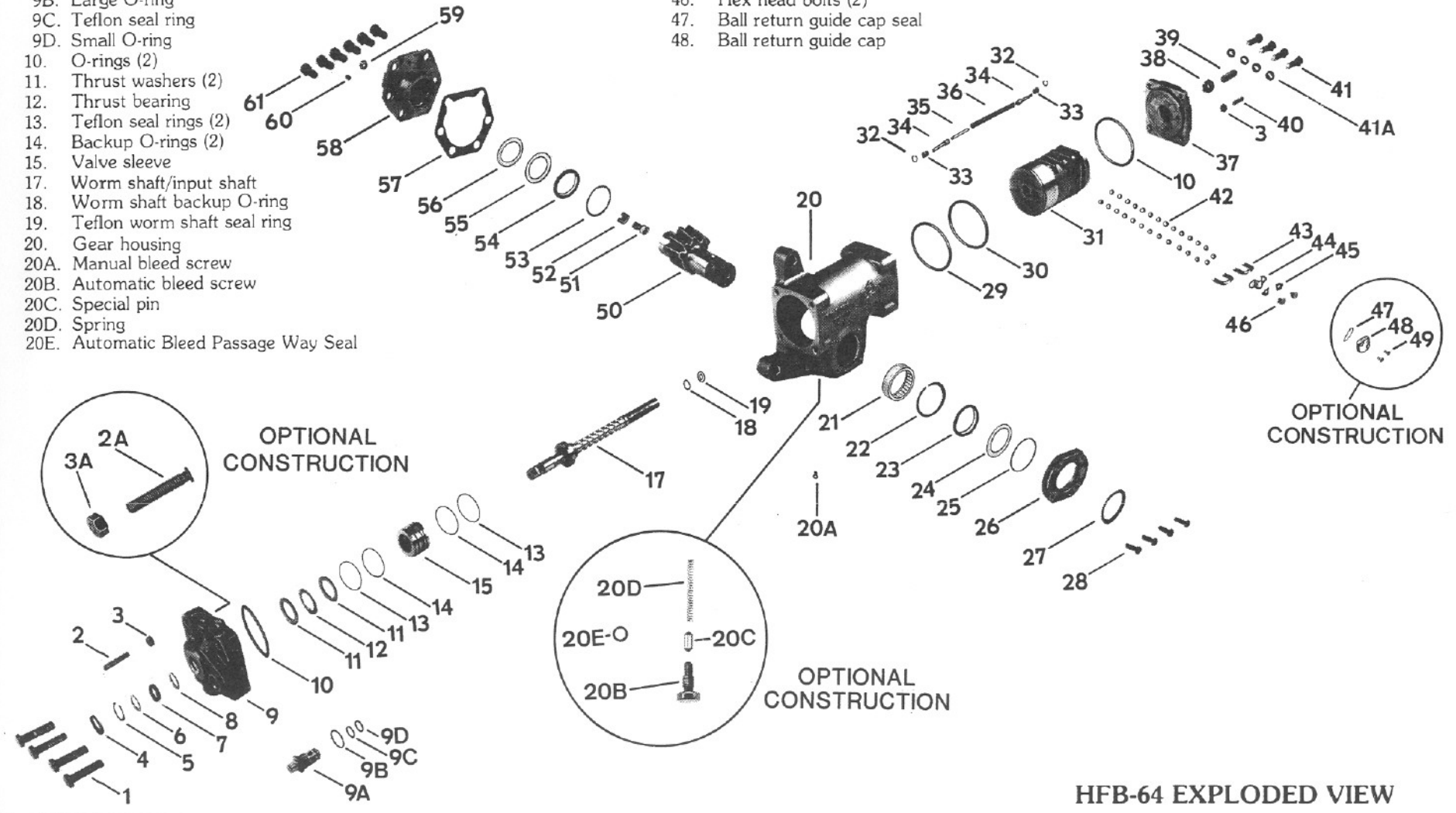
- 5.9 Re-connect drag link to pitman arm.

- 1. Valve housing bolts (4)
- 2. Poppet adjusting screw
- 2A. Allen Head Hex Poppet Adjusting Screw
- 3. Poppet adjusting screw jam nut
- 3A. Sealing Nut
- 4. Dirt and water seal
- 5. Retaining ring
- 6. Steel backup washer
- 7. Input shaft seal
- 8. Input shaft O-ring
- 9. Valve housing
- 9A. Relief valve
- 9B. Large O-ring
- 9C. Teflon seal ring
- 9D. Small O-ring
- 10. O-rings (2)
- 11. Thrust washers (2)
- 12. Thrust bearing
- 13. Teflon seal rings (2)
- 14. Backup O-rings (2)
- 15. Valve sleeve
- 17. Worm shaft/input shaft
- 18. Worm shaft backup O-ring
- 19. Teflon worm shaft seal ring
- 20. Gear housing
- 20A. Manual bleed screw
- 20B. Automatic bleed screw
- 20C. Special pin
- 20D. Spring
- 20E. Automatic Bleed Passage Way Seal

- 21. Housing bearing
- 22. Retaining ring
- 23. Two-piece sector shaft seal
- 24. Teflon backup washer
- 25. Trunnion cover O-ring
- 26. Trunnion cover
- 27. Dirt and water seal
- 28. Trunnion cover bolts (4)
- 29. Teflon rack piston seal
- 30. Rack piston backup O-ring
- 31. Rack piston
- 32. Poppet retaining rings (2)
- 33. Poppet seats (2)

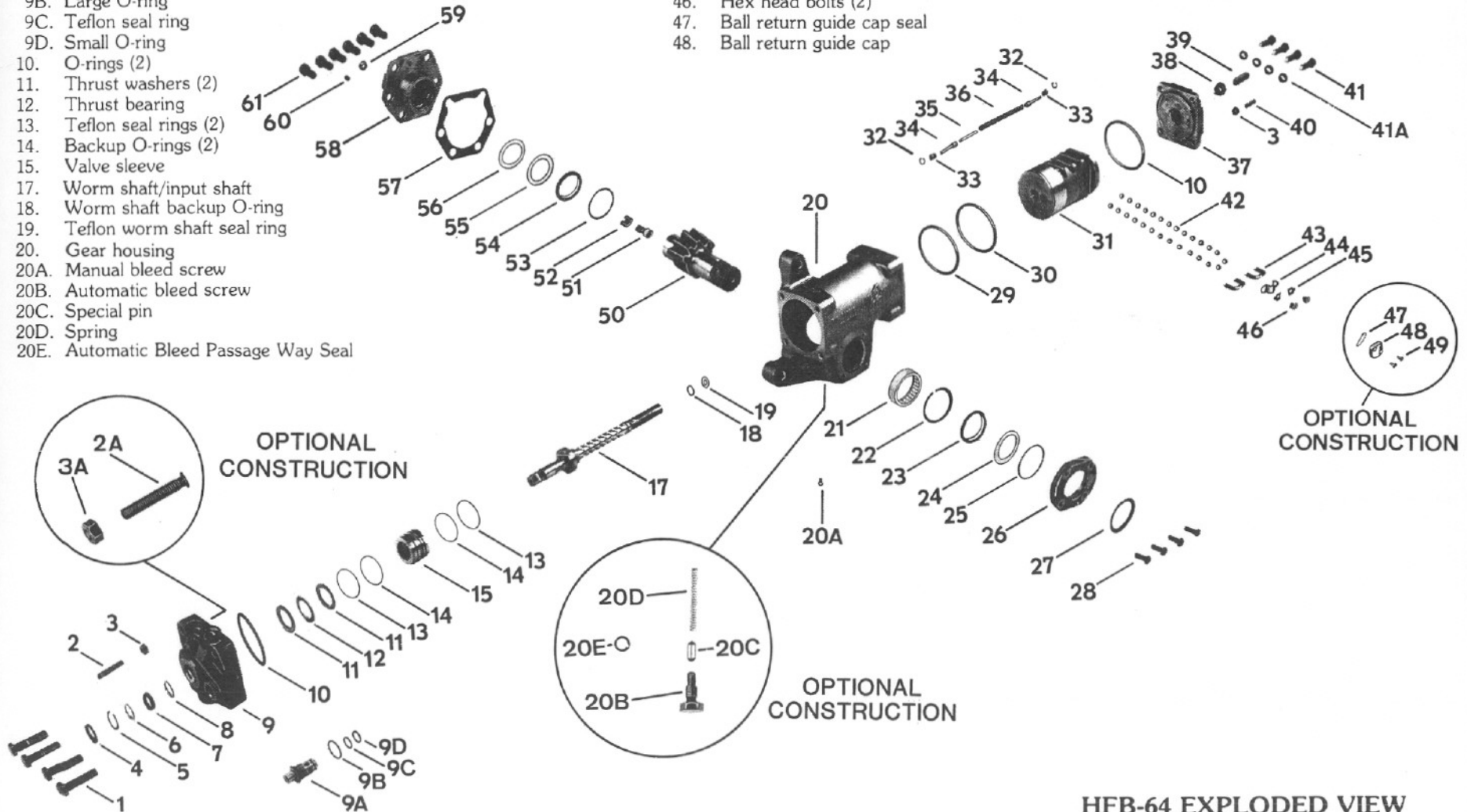
- 34. Poppets (2)
- 35. Nylon spacer rod
- 36. Poppet spring
- 37. End cover
- 38. Worm shaft adjusting screw jam nut
- 39. Worm shaft adjusting screw
- 40. Poppet adjusting screw
- 41. End cover bolts (4)
- 41A. Washers (4)
- 42. Steel balls (27)
- 43. Ball return guides (2)
- 44. Ball return guide clip
- 45. Locking tabs
- 46. Hex head bolts (2)
- 47. Ball return guide cap seal
- 48. Ball return guide cap

- 49. Allen head bolts (2)
- 50. Sector shaft
- 51. Sector shaft adjusting screw
- 52. Retainer
- 53. Side cover retaining ring
- 54. Two-piece side cover seal
- 55. Teflon backup washer
- 56. Steel backup washer
- 57. Side cover gasket
- 58. Side cover
- 59. Sector shaft adjusting screw jam nut
- 60. Rubber plug
- 61. Special bolts (6)



HFB-64 EXPLODED VIEW

- | | | | |
|--|---------------------------------|--|--|
| 1. Valve housing bolts (4) | 21. Housing bearing | 34. Poppets (2) | 49. Allen head bolts (2) |
| 2. Poppet adjusting screw | 22. Retaining ring | 35. Nylon spacer rod | 50. Sector shaft |
| 2A. Allen Head Hex Poppet
Adjusting Screw | 23. Two-piece sector shaft seal | 36. Poppet spring | 51. Sector shaft adjusting screw |
| 3. Poppet adjusting screw jam nut | 24. Teflon backup washer | 37. End cover | 52. Retainer |
| 3A. Sealing Nut | 25. Trunnion cover O-ring | 38. Worm shaft adjusting screw jam nut | 53. Side cover retaining ring |
| 4. Dirt and water seal | 26. Trunnion cover | 39. Worm shaft adjusting screw | 54. Two-piece side cover seal |
| 5. Retaining ring | 27. Dirt and water seal | 40. Poppet adjusting screw | 55. Teflon backup washer |
| 6. Steel backup washer | 28. Trunnion cover bolts (4) | 41. End cover bolts (4) | 56. Steel backup washer |
| 7. Input shaft seal | 29. Teflon rack piston seal | 41A Washers (4) | 57. Side cover gasket |
| 8. Input shaft O-ring | 30. Rack piston backup O-ring | 42. Steel balls (27) | 58. Side cover |
| 9. Valve housing | 31. Rack piston | 43. Ball return guides (2) | 59. Sector shaft adjusting screw jam nut |
| 9A. Relief valve | 32. Poppet retaining rings (2) | 44. Ball return guide clip | 60. Rubber plug |
| 9B. Large O-ring | 33. Poppet seats (2) | 45. Locking tabs | 61. Special bolts (6) |
| 9C. Teflon seal ring | | 46. Hex head bolts (2) | |
| 9D. Small O-ring | | 47. Ball return guide cap seal | |
| 10. O-rings (2) | | 48. Ball return guide cap | |
| 11. Thrust washers (2) | | | |
| 12. Thrust bearing | | | |
| 13. Teflon seal rings (2) | | | |
| 14. Backup O-rings (2) | | | |
| 15. Valve sleeve | | | |
| 17. Worm shaft/input shaft | | | |
| 18. Worm shaft backup O-ring | | | |
| 19. Teflon worm shaft seal ring | | | |
| 20. Gear housing | | | |
| 20A. Manual bleed screw | | | |
| 20B. Automatic bleed screw | | | |
| 20C. Special pin | | | |
| 20D. Spring | | | |
| 20E. Automatic Bleed Passage Way Seal | | | |



HFB-64 EXPLODED VIEW

TORQUE CHART

Part Name	Item Number	Torque
Valve housing bolts (4)	1	105-115 ft. lbs.
Poppet adjusting screw jam nut		
-3/8-24	3	12-18ft. lbs.
-5/16-24	3	8-11 ft. lbs.
Relief Valve	9A	25-35 ft. lbs.
Manual bleed screw	20A	27-33 in. lbs.
Automatic bleed screw	20B	16-20 ft. lbs.
Auxiliary cylinder fitting	—	25-35 ft. lbs.
Trunnion cover bolts (4)	28	15-22 ft. lbs.
Poppet seat	33	20-25 ft. lbs.
Worm shaft adjusting screw jam nut	38	70-80 ft. lbs.
Worm shaft preload adjusting screw	39	60-70 in. lbs.
End cover bolts (4)*	41	105-115 ft. lbs.
Hex head bolts (2)	46	13-17 ft. lbs.
Allen head bolts (2)	49	13-17 ft. lbs.
Sector shaft adjusting screw jam nut	59	40-45 ft. lbs.
Special bolts (4)	61	220-240 ft. lbs.
Pitman arm clamp bolt	lubed or plated	300-320 ft. lbs.
Pitman arm clamp bolt	dry or unplated	380-420 ft. lbs.

*End cover bolts not on gears with closed-end housing

Universal joint bolts — torque to vehicle manufacturer's specifications

TOOLS AND MATERIALS REQUIRED FOR SERVICING

Service manual	Retaining ring pliers
Masking tape	Breaker bar
Grease — **Mobil Temp 1 or 2	Ratchet
Wheel bearing grease	Sockets: 5/16, 1/2, 9/16, 11/16, 3/4
Adjustable wrench	15/16, 1, and 1 1/16
Pocket knife	Allen sockets: 5/32, 5/16
Torque wrench — in. lbs.	12-point sockets: 3/4 and 11/16
Torque wrench — ft. lbs.	Chisel
Soft punch	Pitman arm puller
Rubber mallet	Screw driver
Allen wrench set	Screw driver with blade socket

Special Tools*

Seal Installation Tool	J26650-01	Seal Driving Tool	J26653
Seal Compression Tool	J26649	Seal Driving Tool	J26654
Seal Installation Tool	J26647	Relief Valve Plug	J29059
Seal Compression Tool	J26648	Bearing Mandrel	J26738

*Special Tools Available From:

Kent-Moore Tool Division
29784 Little Mack
Roseville, MI 48066
Phone: 313-774-9500

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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 connections per 1.1 and 2.1, Page 9 and 12.
- 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 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.

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 gear in a vise with the gear's worm shaft/input shaft (17) in a horizontal direction. Rotate the worm shaft to position the timing mark on the sector shaft halfway between two trunnion cover bolts and pointing up. (FIG. 34).

clean sector shaft and loosen jam nut

2. Remove any paint or corrosion from the non-serrated area of the sector shaft (50) (as in 1.3, Page 9), and loosen the sector shaft adjusting screw jam nut (59).

remove dirt and water seal

3. Remove and discard the dirt and water seal (27) from the trunnion cover (26) (FIG. 35).

remove trunnion cover bolts

4. Remove the four trunnion cover bolts (28) with a 1/2 inch socket (FIG. 36).

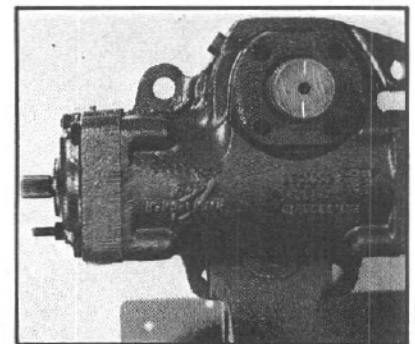


Figure 34

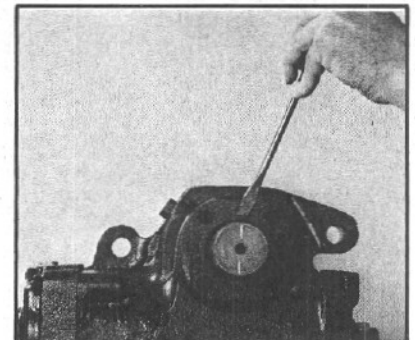


Figure 35

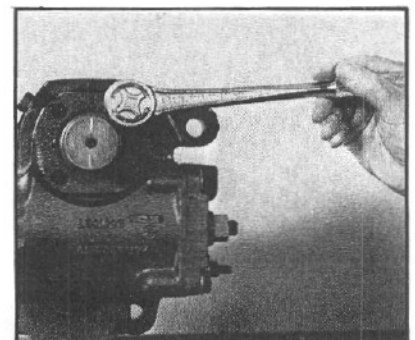


Figure 36

**remove
trunnion cover
and seal
package**

5. Remove the trunnion cover (26) (FIG. 37). Remove and discard the trunnion cover O-ring (25) from the trunnion cover, and the Teflon backup washer (24) and the two-piece sector shaft seal (23).

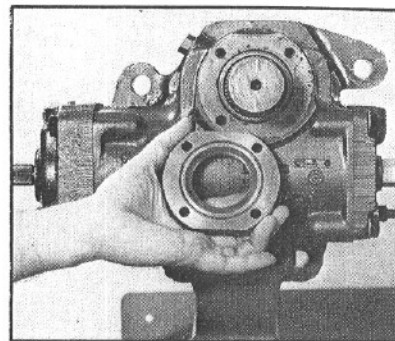


Figure 37

**tape sector
shaft**

6. Tape the serrations and bolt groove of the sector shaft (50) with one layer of masking tape (FIG. 38).

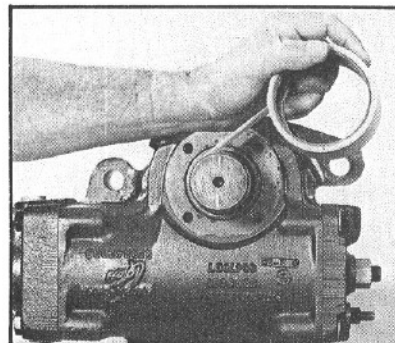


Figure 38

**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 (FIG. 39).

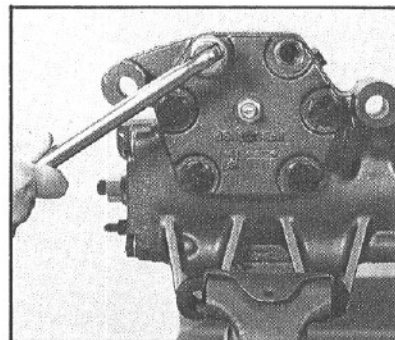


Figure 39

NOTE

NOTE: These bolts are special because they are equipped with either a ring or washer design on the underside of the head (FIG. 40). 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.

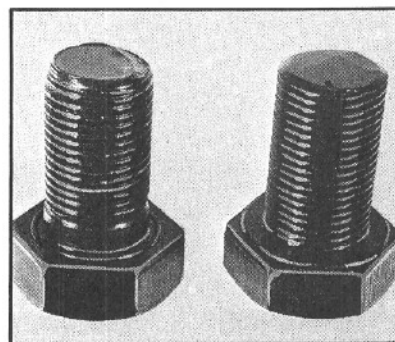


Figure 40

**begin to remove
side cover**

8. Begin to remove the side cover (58) and sector shaft (50) as an assembly (FIG. 41). 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 handle.

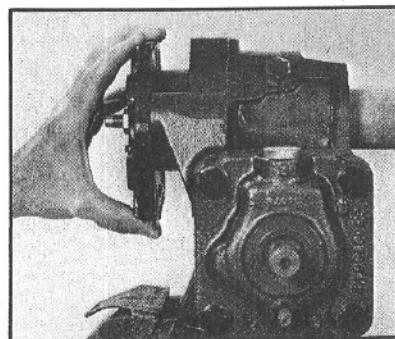


Figure 41

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 (FIG. 42).

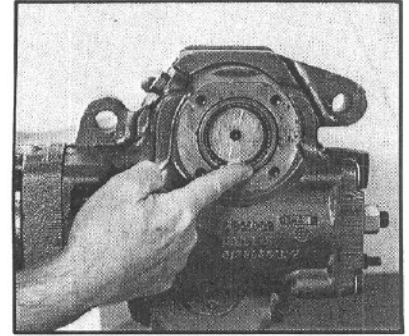


Figure 42

CAUTION

CAUTION: If one or more of the rolls is lost, you must replace the entire bearing (see disassembly step 10). 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 housing bearing, if necessary

- 10. Only if the housing bearing (21) race is damaged, or if one or more of the rolls is lost, should you replace the housing bearing. Remove the bearing in the following manner: Using bearing mandrel (special tool) J26738, apply pressure from the side cover opening and press the bearing out through the trunnion cover opening, away from the cylinder bore (FIG. 43). Maintain a good, square contact between the housing and press base to avoid damaging the housing bearing bore.

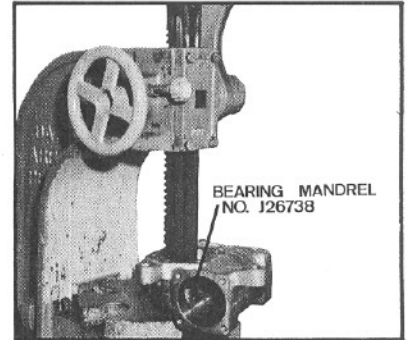


Figure 43

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.

remove jam nut

- 11. Remove the sector shaft adjusting screw jam nut (59) (FIG. 44).

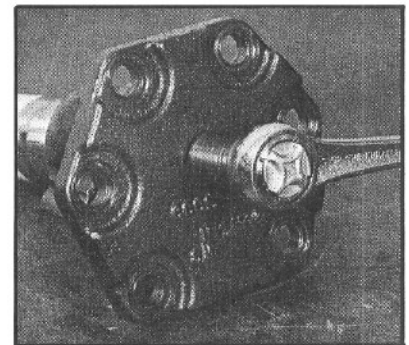


Figure 44

remove sector shaft from side cover

- 12. Screw the sector shaft adjusting screw (51) through the side cover (58) (FIG. 45). Place the side cover exterior side down and lift the sector shaft out vertically.

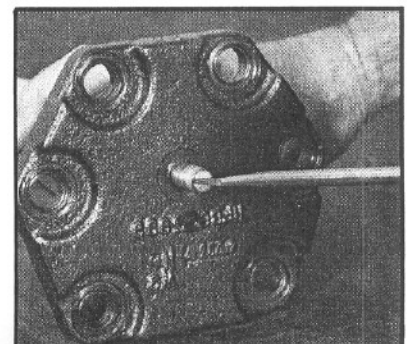


Figure 45

NOTE

NOTE: Doing this will allow the side cover bearing rolls to fall into the side cover, where you may easily collect them. Immediately gather all of the side cover bearing rolls 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.

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: DO NOT MIX THE ROLLS FROM THE SIDE COVER 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.

remove side cover seal package

13. Remove the side cover retaining ring (53) (FIG. 46), the two-piece side cover seal (54), the Teflon backup washer (55), and the steel backup washer (56) from the side cover (58) (FIG. 47). Discard the two-piece seal and the Teflon backup washer. Remove the rubber plug (60) and discard it.

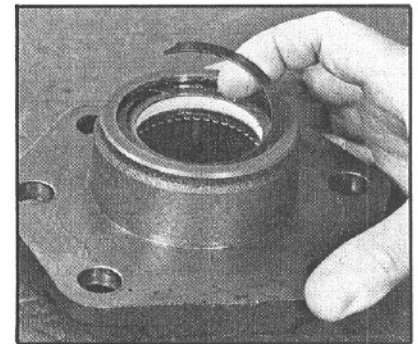


Figure 46

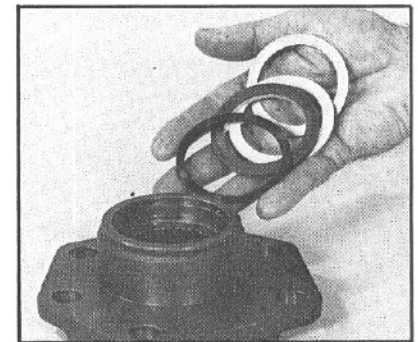


Figure 47

remove adjusting screws and jam nuts

14. Loosen the worm shaft preload adjusting screw jam nut (38) with a 15/16 inch socket, and loosen the worm shaft preload adjusting screw (39) about two turns with a 5/16 inch allen socket or screw driver (FIG. 48). If your gear is equipped with poppets, loosen the poppet adjusting screw jam nut (3) and the poppet adjusting screw (40) about two turns.

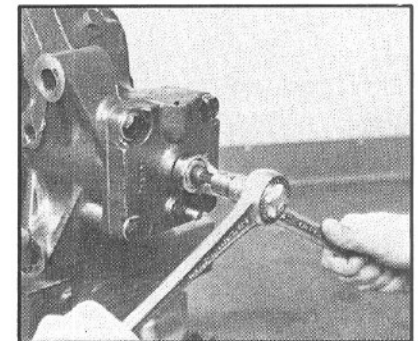


Figure 48

remove end cover bolts and end cover, if equipped

15. 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 socket (FIG. 49). Then prepare for fluid to drain and remove the end cover.

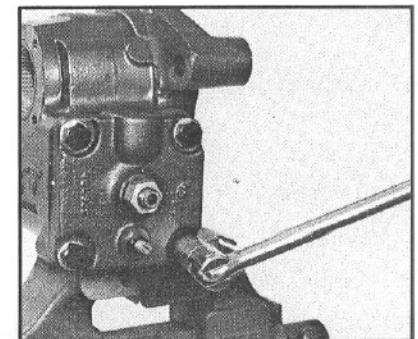


Figure 49

remove end cover O-ring

16. Remove the end cover O-ring (10) from the groove in the removable end cover (37) (FIG. 50).

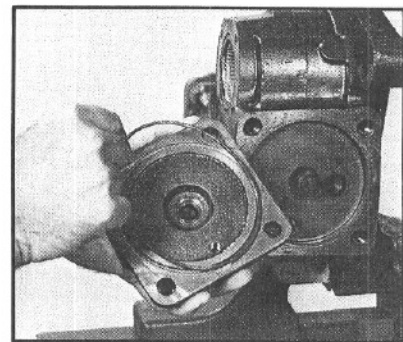


Figure 50

NOTE

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

remove relief valve, if equipped

17. Remove the relief valve (9A), if equipped, from the valve housing (9) (FIG. 51).

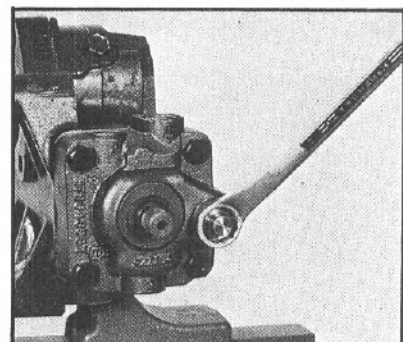


Figure 51

remove relief valve seal pack

18. Remove and discard the two relief valve O-rings (9B and 9D) and the Teflon seal ring (9C) from the relief valve (9A) (FIG. 52).

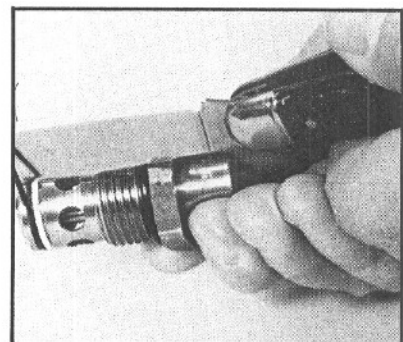


Figure 52

clean input shaft

19. Clean any paint or foreign matter from the nonserrated area of the input shaft with a fine grade of emery paper, as in 2.1, Page 12.

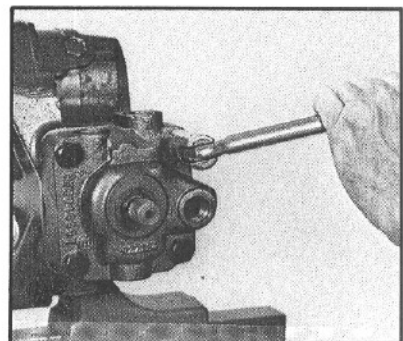


Figure 53

loosen other poppet jam nut and screw

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

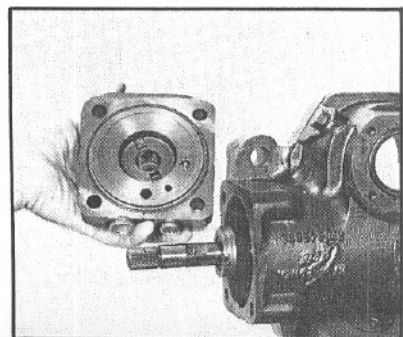


Figure 54

remove valve housing bolts and valve housing

21. Remove the four valve housing bolts (1) with a 13/16 inch socket (FIG. 53). Prepare for some fluid to drain, and remove the valve housing (9) (FIG. 54).

NOTE

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

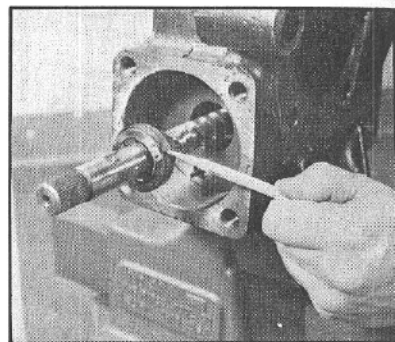


Figure 55

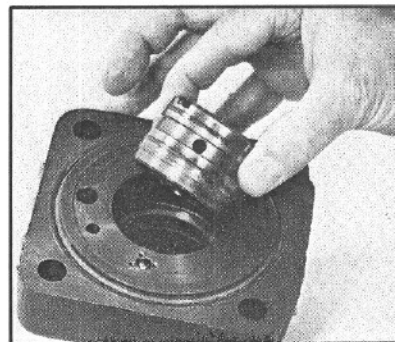


Figure 56

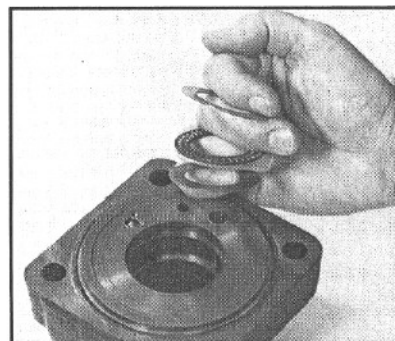


Figure 57

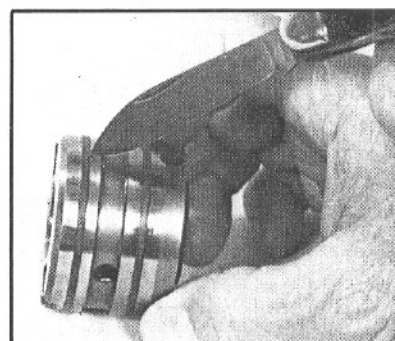


Figure 58

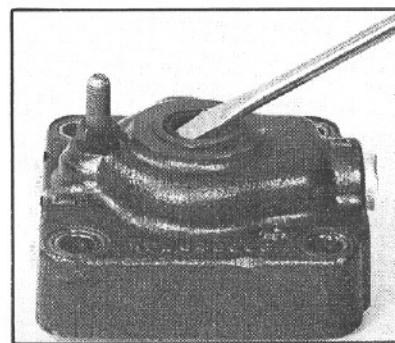


Figure 59

WARNING

WARNING: DO NOT DISASSEMBLE THE WORM SHAFT/INPUT SHAFT (17), WHICH INCLUDES THE WORM SHAFT, INPUT SHAFT, TORSION BAR, TORSION BAR PINS, DRIVE RING AND DRIVE RING RETAINER. DO NOT UNBEND THE DRIVE RING RETAINER TANGS THAT HOLD THE DRIVE RING IN PLACE (FIG. 55). DOING EITHER WILL ALTER THE VALVE TIMING, WHICH COULD CAUSE THE VEHICLE TO PULL TO ONE SIDE OR THE OTHER.

remove valve sleeve

- 22. Remove the valve sleeve (15) from the valve housing (9) (FIG. 56).

remove thrust washers and bearing

- 23. Remove the first thrust washer (11), the thrust bearing (12), and the second thrust washer (11) from the valve housing (9) (FIG. 57).

NOTE

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

remove seal rings

- 24. Remove and discard the two Teflon seal rings (13) from the valve sleeve (15) (FIG. 58).

remove O-rings

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

remove O-ring

- 26. Remove and discard the valve housing O-ring (10) from the valve housing (9).

remove dirt and water seal

- 27. Remove and discard the dirt and water seal (4) (FIG. 59).

remove retaining ring

28. Remove the retaining ring (5) (FIG. 60).

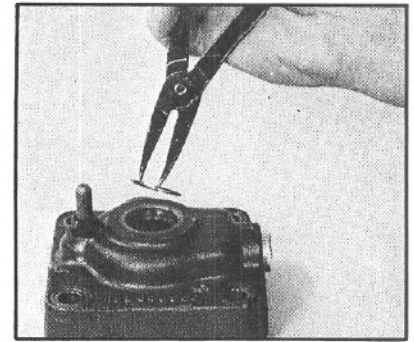


Figure 60

remove valve housing seal package

29. Remove the steel backup washer (6), the input shaft seal (7), and the input shaft O-ring (8) from the valve housing (9) (FIG. 61). Discard the seal and O-ring.

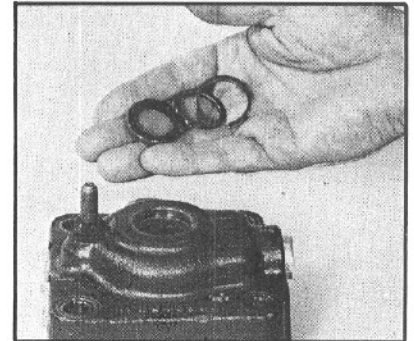


Figure 61

remove rack piston and worm shaft/ input shaft

30. Remove the rack piston (31) and worm shaft/ input shaft (17) from the gear housing (20) as an assembly (FIG. 62).

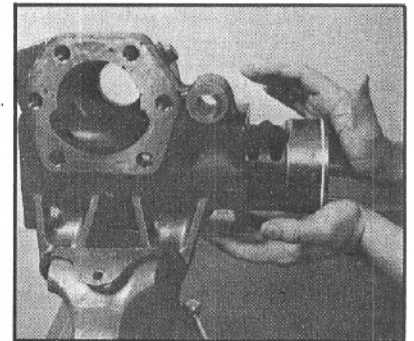


Figure 62

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.

Set the rack piston and worm shaft assembly on a clean rag to keep the piston from rolling.

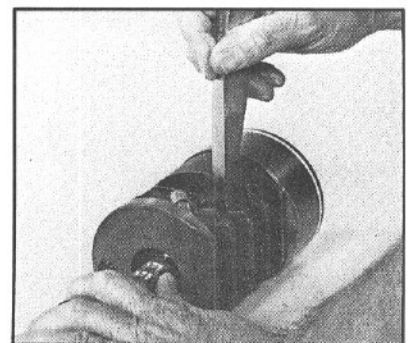


Figure 63

remove ball return guide clip, if equipped

31. For rack pistons with the ball return guide clip (44), bend the tangs down on the two locking tabs (45) (FIG. 63). Remove the two hex head bolts (46). Then, remove the clip (FIG. 64).

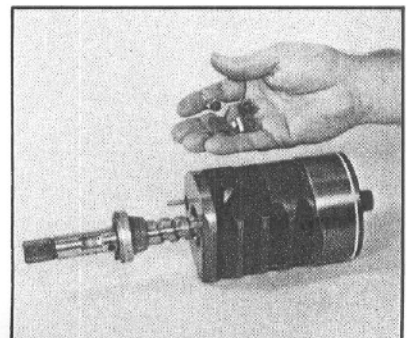


Figure 64

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

32. If the rack is equipped with the ball return guide cap (48), instead of the clip, remove the two allen head bolts (49) (FIG. 65). Remove the ball return guide cap and the ball return cap seal (47) (FIG. 66).

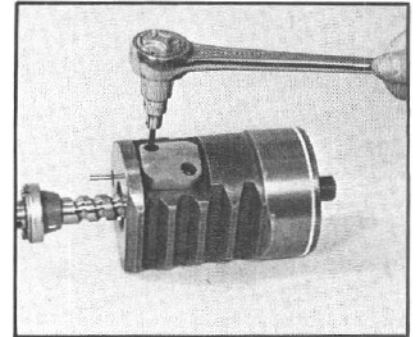


Figure 65

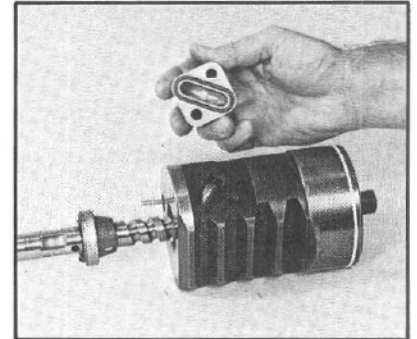


Figure 66

**remove guides
and balls**

33. Remove the halves of the ball return guide (43) (FIG. 67). 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 (FIG. 68).

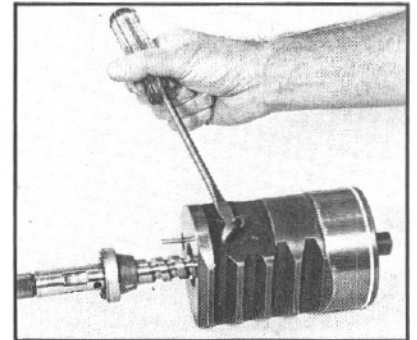


Figure 67

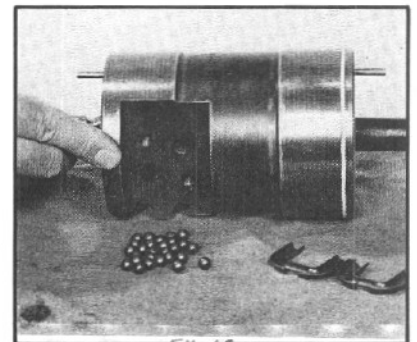


Figure 68

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 screw driver between the rack and the guide. See composite picture of both assembly types in FIG. 69.

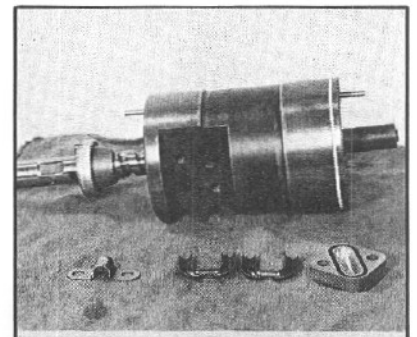


Figure 69

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.

remove worm shaft/input shaft

34. Remove the worm shaft/input shaft (17) from the rack piston (31) (FIG. 70).

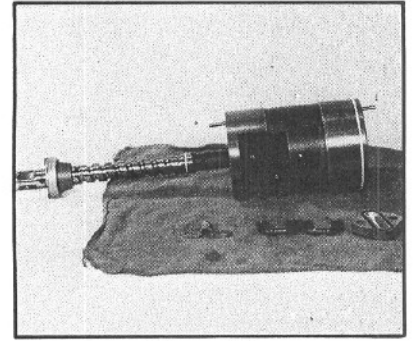


Figure 70

remove seal and O-ring

35. Remove and discard the teflon rack piston seal ring (29) and backup O-ring (30) (FIG. 71).

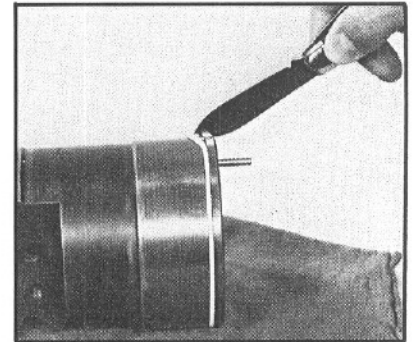


Figure 71

remove worm shaft seal and ring

36. Remove and discard the teflon worm shaft seal ring (19) and O-ring (18) (FIG. 72).

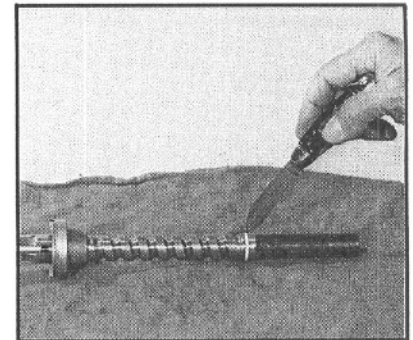


Figure 72

remove bleed screw

37. 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) (FIG. 73). 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) and automatic bleed passageway seal (20E) from the housing. Then, tilt the housing upside down so that the special pin (20C) and spring (20D) will fall out (FIG. 74).

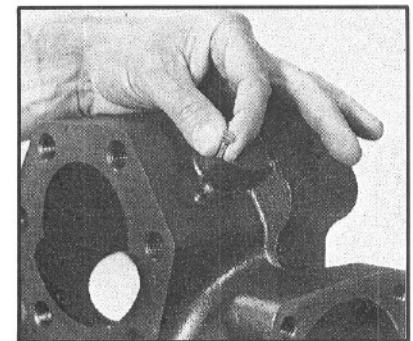


Figure 73

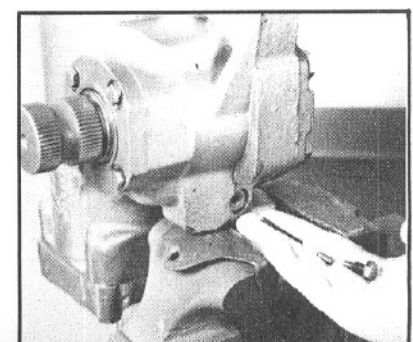


Figure 74

**remove
poppets, if
equipped**

38. 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 soft-jawed vice. Then, remove two poppet retaining rings (32) (FIG. 75), two poppet seats (33) (FIG. 76), two poppets (34), the nylon spacer rod (35), and the poppet spring (36) (FIG. 77).

This completes disassembly of the HFB64 steering gear.

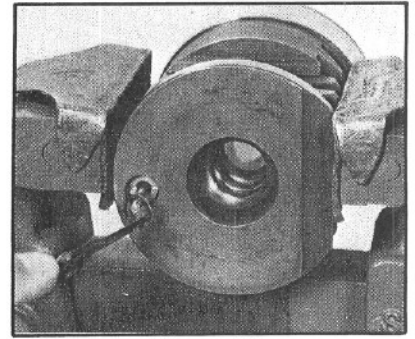


Figure 75

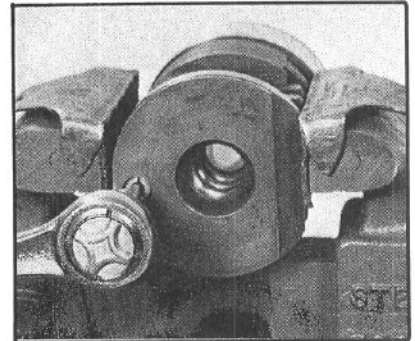


Figure 76

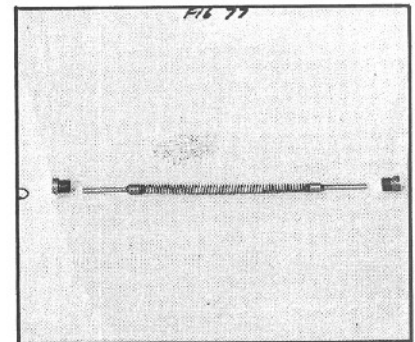


Figure 77

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.

inspect rack piston teeth

1. Inspect the rack piston (31) 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 (50) (FIG. 78).

inspect rack piston internal grooves

2. Inspect the rack piston internal ball-track grooves for brinelling (dents) or spalling (flaking) (FIG. 79). If either condition exists, you must replace all of the following parts: the rack piston, the worm shaft/input shaft (17), the drive ring (16), and the valve sleeve (15).

inspect worm shaft

3. Inspect the worm shaft (17) ball track grooves for brinelling or spalling (FIG. 80). If either condition exists, you must replace all of the following parts: the worm shaft/input shaft (17), the drive ring (16), the rack piston (31), the valve sleeve(15). 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 (FIG. 81).

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 (FIG. 82). This slight bend is normal.

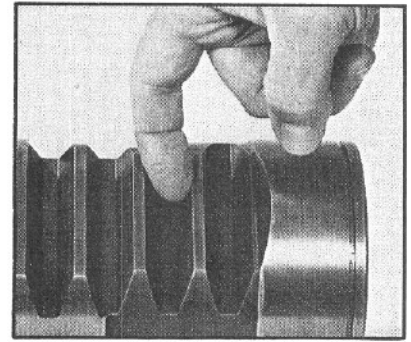


Figure 78

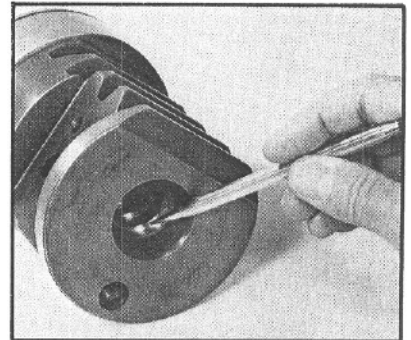


Figure 79

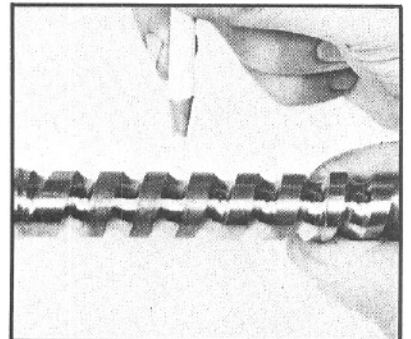


Figure 80

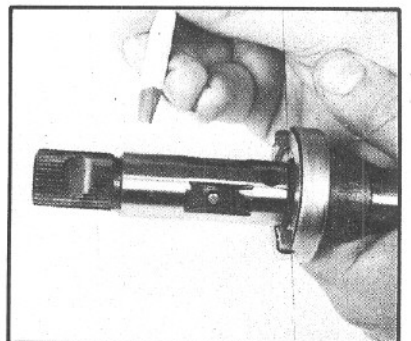


Figure 81

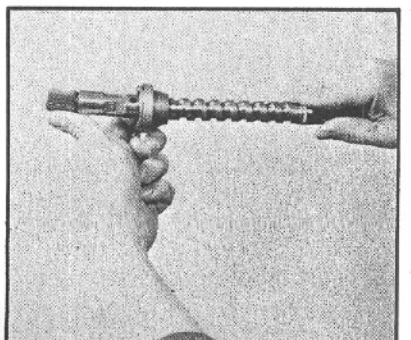


Figure 82

**inspect housing
cylinder bore**

4. Inspect the housing cylinder bore (FIG. 83), where 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 you might find 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 6) and you've determined that the scoring, and not damaged seals, is responsible for the excessive internal leakage (greater than 1 gpm).

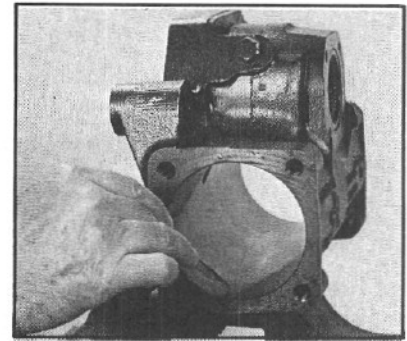


Figure 83

NOTE

NOTE: In running the internal leakage test, make sure that internal leakage exceeding 1 gpm can only be attributed to the housing and not to the new seals in the worm shaft, rack piston, and valve assembly.

**inspect housing
faces**

5. Inspect the housing (20) 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 (FIG. 84).

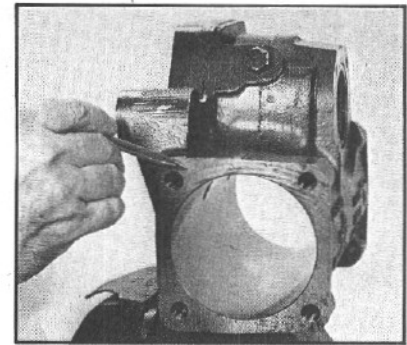


Figure 84

**inspect housing
and side cover
bearings**

6. Inspect the housing bearing (21) (FIG. 85) and the side cover bearing (FIG. 86) for brinelling or spalling. If either condition exists, replace the damaged housing bearing (21). For the housing bearing, follow disassembly step 10, assembly step 2, Pages 19 and 30. If the side cover bearing is damaged, replace side cover assembly (58).

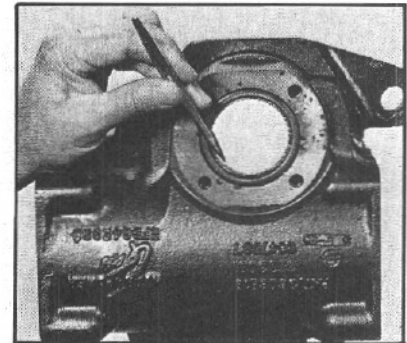


Figure 85

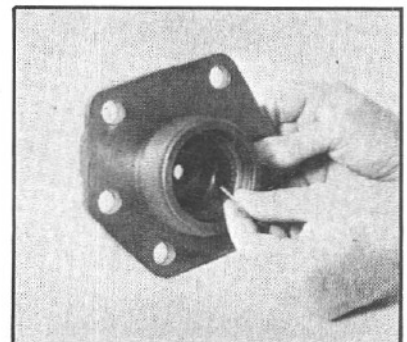


Figure 86

inspect sector shaft

7. Inspect the sector shaft (50) bearing and sealing areas for brinelling or spalling (FIG. 87). Run your fingernail edge across these areas to detect steps. Inspect also for cracks. If any of these conditions exist, replace the sector shaft.

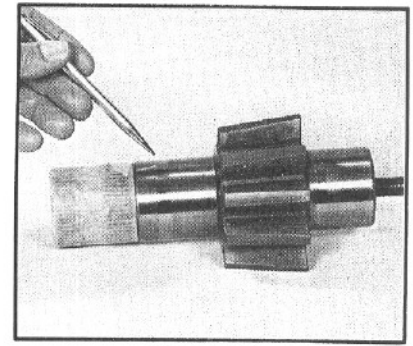


Figure 87

inspect thrust washers and bearing

8. Inspect the thrust bearing rollers (12) for any deterioration. Inspect the two thrust washers (11) for brinelling, spalling, or cracks (FIG. 88). Replace any part if you detect these conditions.

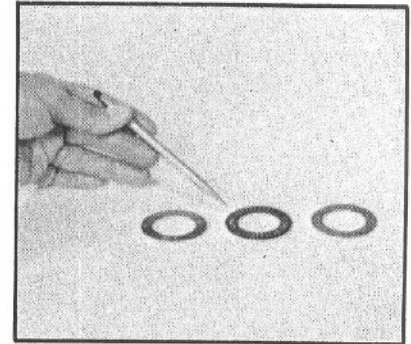


Figure 88

This completes inspection of the HFB64 steering gear.

ASSEMBLY

Preparation

- Wash all parts again 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.

- Replace all seals, seal rings, and gaskets with new ones each time you disassemble the gear.
- Ross Gear does provide individual seals, seal rings, and gaskets, as well as complete seal kits (FIG. 89). These parts should be available to most OEM parts distributors. (Contact your local dealer for availability.)

Assembly

assemble worm shaft seal and ring

1. Using seal installation tool J26650-01, assemble the new worm shaft backup O-ring (18) (FIG. 90), and then the new teflon worm shaft seal ring (19) (FIG. 91). Next, compress the seal ring with compression tool J26649, and set the worm shaft/input shaft (17) aside for 10 minutes (FIG. 92).

CAUTION

CAUTION: Allow for this 10 minutes to insure that the ring and seal are properly seated when you install the worm shaft/input shaft into the rack piston. If you do not allow for this time, the seal may tear or be cut when you place the worm into the rack.

install housing bearing

2. If you are installing a new housing bearing (21), apply a generous amount of clean grease to the bearing race to retain the bearing rolls. Then, place the bearing rolls into the race, being sure that you have counted the rolls correctly and have matched the quantity with the correct number for your particular bearing. Press the bearing into the housing from the trunnion side using bearing mandrel (special tool) J26738 (FIG. 93). Take care during this procedure to make certain that the housing is square with the press base and that the bearing is not cocked.

NOTE

NOTE: If you are installing bearing BR-866-1 or a bearing with no part number, install 44 rolls. If you are installing bearing F83508, install 43 rolls.

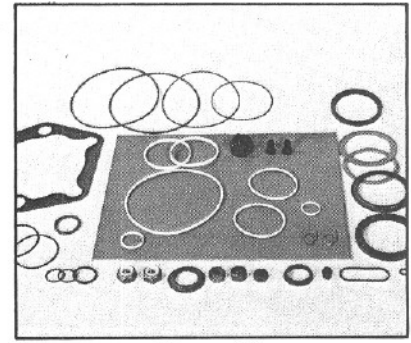


Figure 89

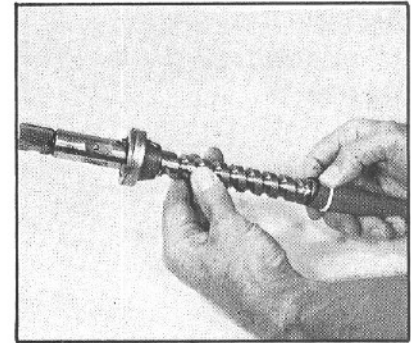


Figure 90

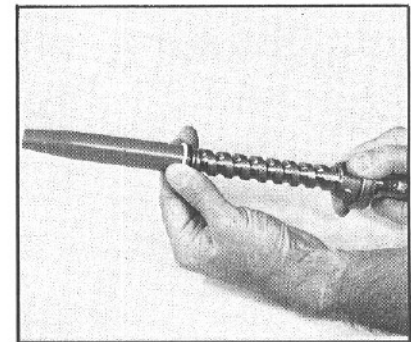


Figure 91

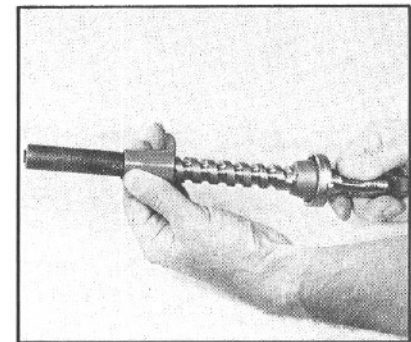


Figure 92

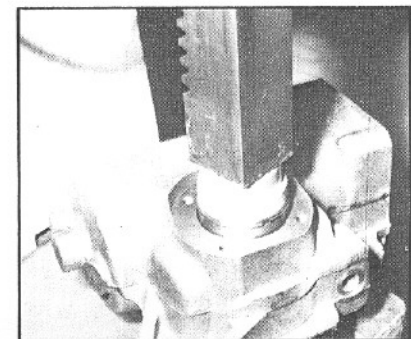


Figure 93

CAUTION

CAUTION: The bearing rolls must be in place to insure proper installation of the bearing. If the rolls are improperly installed, the bearing race may collapse and fail. The flange may break, causing premature failure of the bearing. Again, do not mix the housing bearing rolls with the side cover bearing rolls. Be sure the bearing mandrel used is clean.

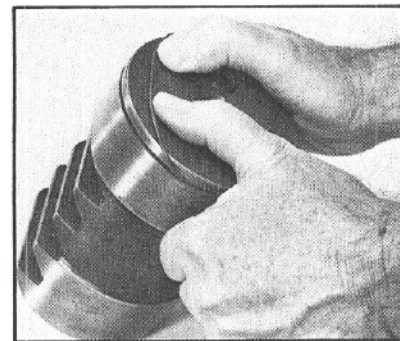


Figure 94

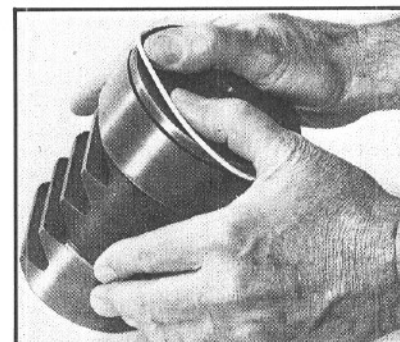


Figure 95

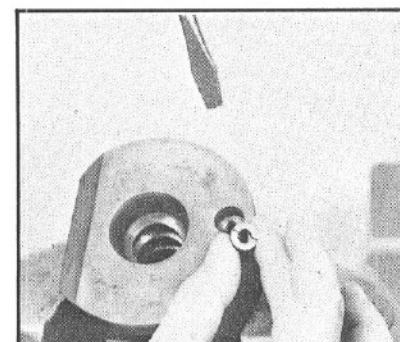


Figure 96

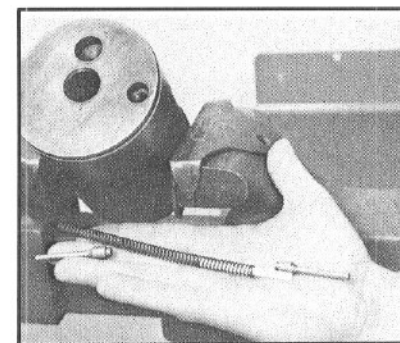


Figure 97

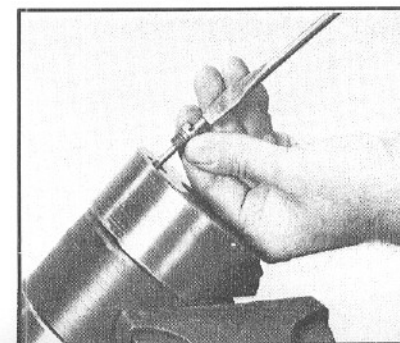


Figure 98

install rack piston seal and O-ring

3. Install the new rack piston backup O-ring (30) (FIG. 94), and then the new Teflon rack piston seal ring (29) (FIG. 95). Do not over stretch these rings as you install them. After you install them, coat them with a liberal amount of grease.

WARNING

WARNING: DURING STEP 4, YOU SHOULD WEAR EYE PROTECTION, AS THE SPRING LOADED POPPETS COULD EJECT, AND CAUSE EYE INJURY.

install poppet assembly, if equipped

4. If your gear is equipped with poppets and you removed them, then install in the following order:
 - a. one poppet seat (33), (FIG. 96),From the other end of the poppet hole in the piston, install:
 - b. one poppet (34),
 - c. the poppet spring (36),
 - d. the nylon spacer rod (35), (FIG. 97),
 - e. the other poppet (34), and
 - f. the other poppet seat (33) (FIG. 98).Torque the poppet seats to 25-30 ft. lbs. Install both retaining rings (32).

install worm shaft/input shaft into rack piston

5. If more than 10 minutes have elapsed since you installed the worm shaft seal and ring, grease the sealing surface inside the rack piston (31) and install the worm shaft/input shaft (17) assembly into the rack (FIG. 99).

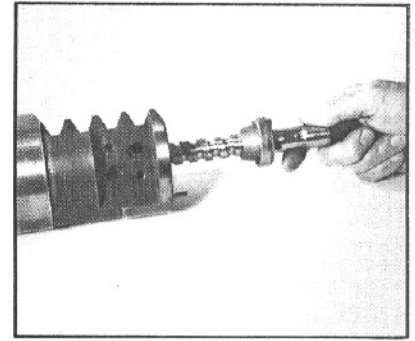


Figure 99

assemble ball return guide halves

6. Assemble the ball return guide halves (43) into the rack piston (31) (FIG. 100). Make sure they are correctly seated.

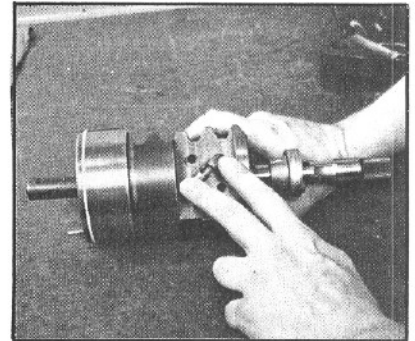


Figure 100

WARNING

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

assemble balls

7. Assemble 27 steel balls (42) into the ball return guide through the hole provided in the top of the guide. As you drop the balls into the guide, rotate the worm shaft (17) to pull the balls down into the grooves (FIG. 101).

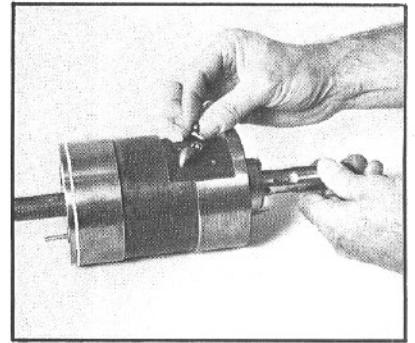


Figure 101

WARNING

WARNING: MAKE SURE THE BALL RETURN GUIDE STAYS DOWN IN PLACE AS YOU DROP THE BALLS THROUGH THE HOLE. FAILURE TO HOLD THE GUIDE DOWN MAY RESULT IN A BALL BEING TRAPPED OUTSIDE THE CLOSED LOOP. A TRAPPED BALL CAN RESULT IN A STEERING LOCKUP, WHICH COULD CAUSE AN ACCIDENT.

assemble ball return guide clip, if equipped

8. If your gear is equipped with the ball return guide clip (44), install it so that both bolt hole faces are in full contact with the rack piston surface. Install the two lock tabs (45) and the two hex head bolts (46). Torque the bolts to 13-17 ft. lbs. Finish by bending the locking tabs up against the bolt head flats (FIG. 102).

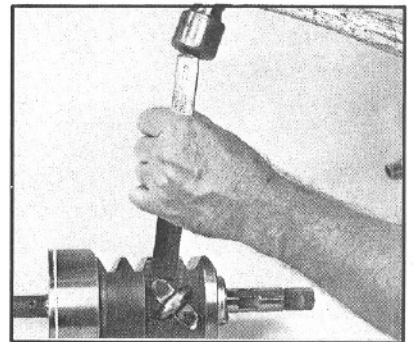


Figure 102

assemble ball return guide cap, if equipped

9. If your gear is equipped with the ball return guide cap (48), instead of the clip, grease the ball return guide cap seal (47) and place it in the seal groove of the cap. Assemble the cap so that the seal makes full contact with the rack piston surface (FIG. 103). Install the two allen head bolts (49) and torque them to 13-17 ft. lbs.

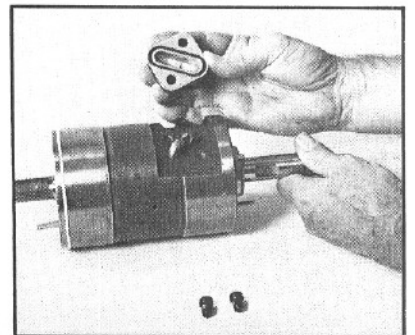


Figure 103

WARNING

WARNING: ROTATE THE WORM SHAFT FROM ONE END OF TRAVEL TO THE OTHER, TO MAKE CERTAIN THAT YOU HAVE INSTALLED THE BALLS PROPERLY (FIG. 104). IF YOU CANNOT ROTATE THE WORM SHAFT, YOU WILL HAVE TO REMOVE THE BALLS AND REASSEMBLE THEM. IF YOU INSTALL A GEAR ON A TRUCK WITH THE WORM SHAFT UNABLE TO ROTATE, THE GEAR WILL NOT FUNCTION CORRECTLY. DAMAGE MAY RESULT.

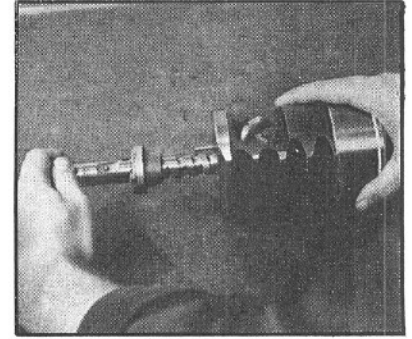


Figure 104

install rack piston and worm shaft/ input shaft assembly into housing

10. Apply a generous amount of clean grease to the teflon rack piston seal ring (29) and to the housing cylinder bore. Install the rack piston (31) and worm shaft/input shaft (17) as an assembly into the *long* end of the gear housing (20), so that the Teflon rack piston seal goes in last (FIG. 105).

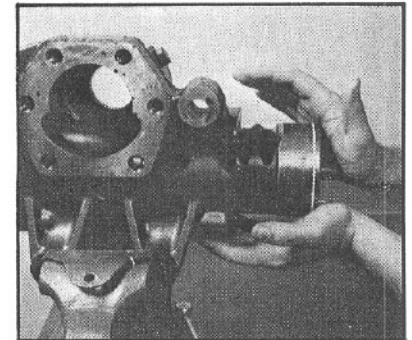


Figure 105

CAUTION

CAUTION: Be certain that the seal goes into the long end of the housing last. Otherwise, a large section of the seal will be cut, and the vehicle will have no power steering assist.

NOTE

NOTE: To ease the later assembly of the sector shaft, rotate the rack piston and worm shaft assembly in the housing so that the rack teeth are exposed in the sector shaft cavity of the housing. (FIG. 106).

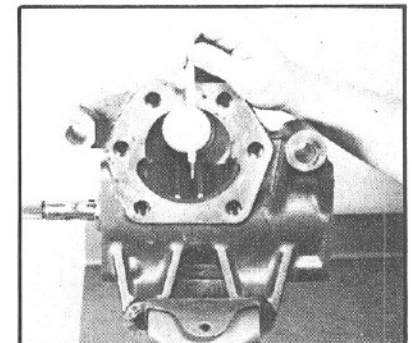


Figure 106

assemble jam nuts and adjusting screws

11. Assemble the worm shaft adjusting screw jam nut (38) onto the nonslotted end of the worm shaft preload adjusting screw (39) so that the seal on the jam nut faces the end cover (37) or closed end of the housing. (FIG. 107). Assemble one poppet valve adjusting screw (40) and jam nut (3), and the other poppet valve adjusting screw (2) and jam nut (3) in the same manner as described for parts 38 and 39. If your gear is not equipped with poppets, assemble only the worm shaft adjusting screw and jam nut.

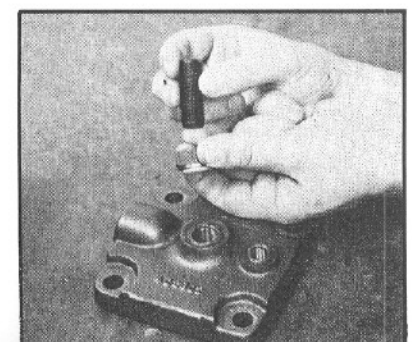


Figure 107

NOTE

NOTE: The poppet valve adjusting screws (2 and 40) may or may not be the same length. If they are not, assemble the shorter adjusting screw (40) into the end cover or closed end of the housing a few turns.

WARNING

WARNING: IF THE SCREWS ARE UNEQUAL IN LENGTH, YOU MUST INSTALL THE SHORTER SCREW INTO THE END COVER OR CLOSED END OF THE HOUSING. OTHERWISE, THE POPPET ASSEMBLY MAY BREAK AND LOCKUP THE STEERING GEAR, POSSIBLY RESULTING IN AN ACCIDENT.

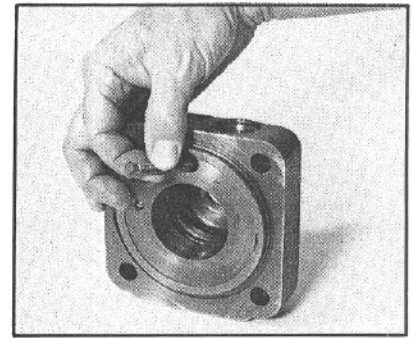


Figure 108

NOTE

NOTE: More recent models of the HFB64 have an internal allen hex poppet adjusting screw in the valve housing (9). This screw has a mushroom-shaped end (FIG. 108). If your gear is equipped with this screw, you must install the sealing jam nut onto the internal allen hex end of the screw after you assemble the screw into the valve housing (FIG. 109). The seal on the jam nut must face toward the housing.

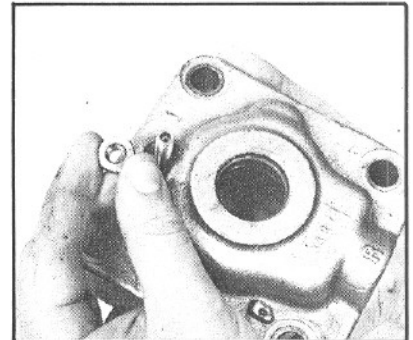


Figure 109

install adjusting screw

12. Install the worm shaft preload adjusting screw (39) into the end cover (37) or closed end of the gear housing (20) a few turns (FIG. 110). Final adjustments for steps 11 and 12 will be made later.

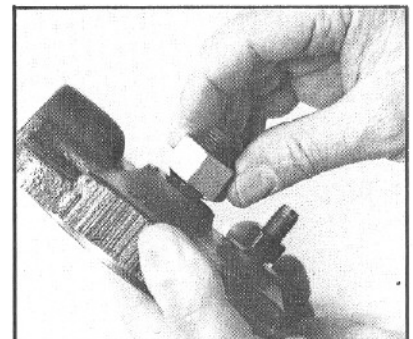


Figure 110

install end cover O-ring

13. If your gear is equipped with the removable end cover (37), apply clean grease to the O-ring groove in the end cover. Install the new end-cover O-ring (10) into the groove (FIG. 111).

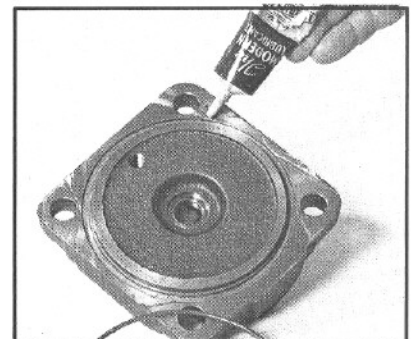


Figure 111

NOTE

NOTE: When installed, the O-ring will extend slightly above the machined surface of the end cover.

CAUTION

CAUTION: When performing step 14, make sure that the rack piston teeth are fully visible in the sector shaft cavity of the gear housing (20). This will insure proper location of the poppets and insure also that the poppet adjusting screw will contact the poppet.

install end cover

14. If your gear has the removable end cover (37), position it so that the poppet adjusting screw (40) is aligned with the end of the poppet (34) (FIG. 112). Push the end cover in until it contacts the gear housing.

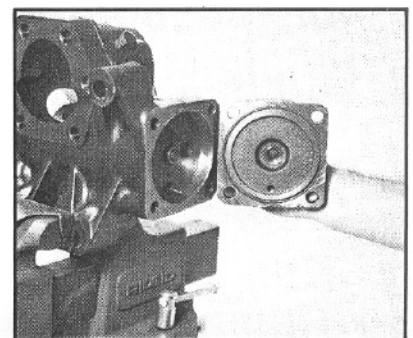


Figure 112

install end cover bolts

15. Install the four end cover bolts (41; 2.625 in. long) and washers (41A), and torque the bolts to 105-115 ft. lbs. (FIG. 113).

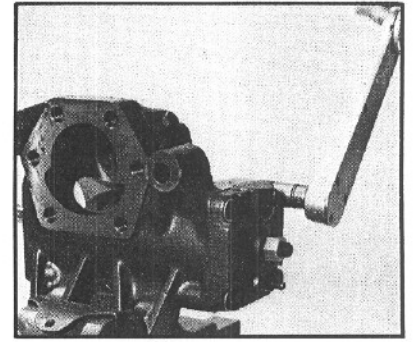


Figure 113

install valve sleeve rings and seals

16. Grease the two new backup O-rings (14) and the two new Teflon seal rings (13). Using seal installation tool J26647, assemble the backup O-rings (FIG. 114), and then the seal rings onto the valve sleeve (15) (FIG. 115).

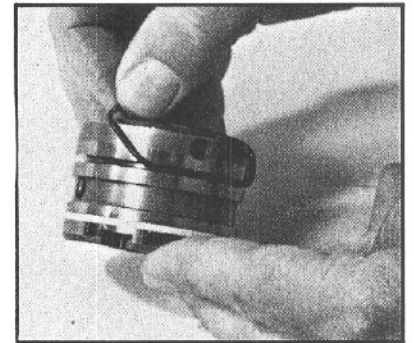


Figure 114

compress rings

17. Use the compression tool J26648 to compress the Teflon seal rings (FIG. 116). Leave this compression tool on for 10 minutes.

CAUTION

CAUTION: Allow for this at least ten minutes, to ensure that the seals are properly seated. Otherwise, the valve sleeve will be difficult to assemble into the valve housing, and the seal may be cut during installation.

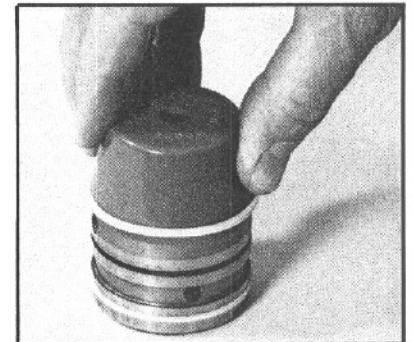


Figure 115

assemble poppet adjusting screw

18. If equipped, assemble the poppet valve adjusting screw (2) into the valve housing (9) a few turns.

NOTE

NOTE: If your gear is equipped with the internal allen hex screw, you must assemble the screw from the inside of the valve housing. The screw should be run out until just before the flange head of the screw bottoms on the counterbore of the valve housing.

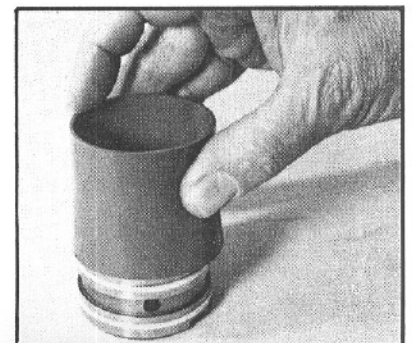


Figure 116

CAUTION

CAUTION: Take special care when you run this screw out. If you apply excessive torque (above 35 in. lbs.) to the screw after the flange head bottoms in the counterbore, you could break the internal allen hex. You will then have to replace the screw, and if you cannot remove it from the valve housing, you will have to replace the entire valve housing assembly.

install valve housing O-ring

19. Apply clean grease to the O-ring groove in the valve housing (9). Install the new valve housing O-ring (10) into the groove (FIG. 117).

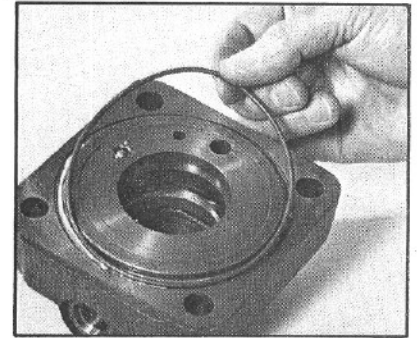


Figure 117

NOTE

NOTE: When installed, the valve housing O-ring should extend slightly above the machined surface of the valve housing.

install first thrust washer

20. Apply a generous amount of clean grease to one thrust washer (11). Place the valve housing exterior side down on a flat surface and place the thrust washer into the valve housing (9), making sure to center the washer (FIG. 118).

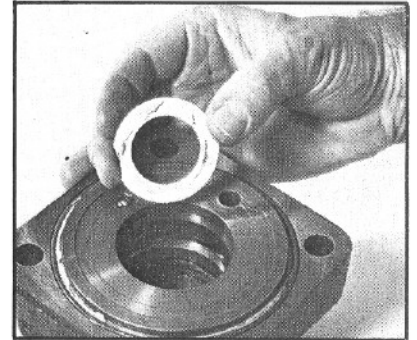


Figure 118

install thrust bearing

21. Apply a generous amount of clean grease to the thrust bearing (12). Install the bearing into the valve housing (9) and onto the first thrust washer, making sure to center the bearing on the washer (FIG. 119).

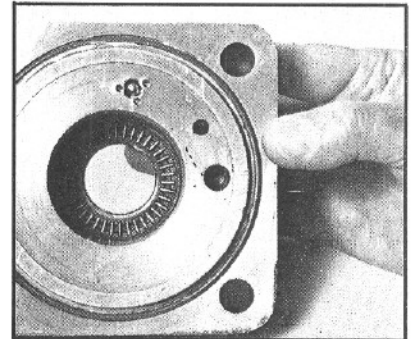


Figure 119

WARNING

WARNING: THE THRUST WASHER AND THRUST BEARING MUST BE FLAT AND CENTERED IN THE COUNTERBORE SURFACE OF THE VALVE HOUSING (FIG. 119). OTHERWISE, THE THRUST WASHER COULD BREAK WHEN YOU PLACE THE VALVE HOUSING ONTO THE GEAR HOUSING. A BROKEN THRUST WASHER COULD CAUSE UNCONTROLLABLE STEERING, POSSIBLY RESULTING IN AN ACCIDENT.

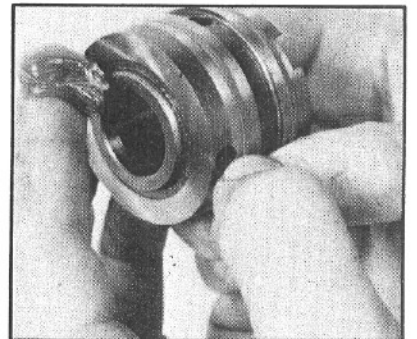


Figure 120

install second thrust washer

22. Remove the compression tool from the valve sleeve (15). Apply more grease to the valve sleeve seals (13 and 14), and grease the thrust washer face on the end of the valve sleeve without the drive slots (FIG. 120). Place the second thrust washer (11) onto this face (FIG. 121).

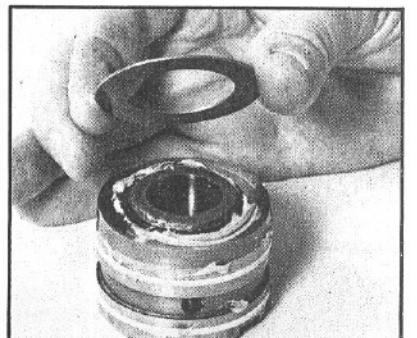


Figure 121

front face of the sleeve (FIG. 122). Make a corresponding mark on the front face with a felt marker (as indicated by white pencil, at right), if the edge is marked.

Assemble the valve sleeve (15), with the second thrust washer attached, into the valve housing thrust-washer end first (9). When the valve sleeve is properly in place, the valve sleeve face should measure approximately .400 in. below the face of the valve housing (FIG. 123).



Figure 122

WARNING: DO NOT FORCE THE VALVE SLEEVE DOWN INTO THE VALVE HOUSING. MAKE SURE THE VALVE SLEEVE SEAL RINGS ARE COMPRESSED. MISASSEMBLY OR INCORRECT MEASUREMENT MAY CAUSE THE THRUST WASHERS OR THRUST BEARING TO BREAK DURING GEAR OPERATION. THIS WILL RESULT IN UNCONTROLLABLE STEERING.

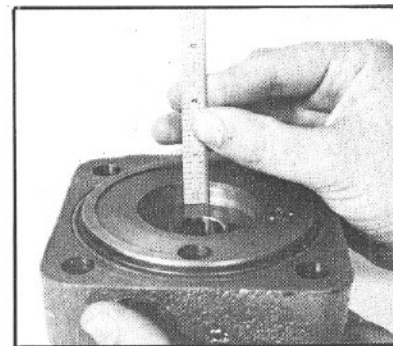


Figure 123

WARNING

position rack piston and rotate worm shaft

24. Position the rack piston so that it is flush with the open end of the gear housing. Rotate the worm shaft (17) until it extends out of the rack piston as far as it will go. (FIG. 124).

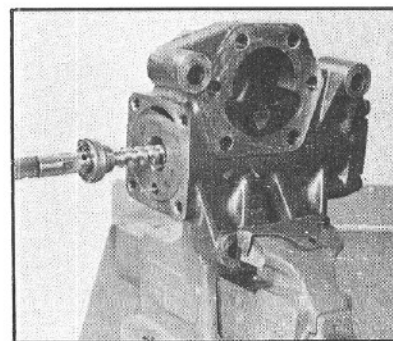


Figure 124

WARNING

WARNING: THE WORM SHAFT AND VALVE SLEEVE ASSEMBLY IS ASSEMBLED AND SOLD AS A MATCHED SET. USE ONLY MATCHED SETS FOR REPLACEMENT. NEVER MATE AN OLD VALVE SLEEVE WITH A NEW WORM SHAFT, OR AN OLD WORM SHAFT WITH A NEW VALVE SLEEVE. TO DO EITHER MAY RESULT IN DAMAGE TO THE GEAR OR INJURY TO THE DRIVER DURING OPERATION.

install valve assembly onto input shaft

25. Locate the scribed timing mark on the worm shaft (FIG. 125).

Next, grasp the valve housing (9) and valve sleeve (15) as an assembly, with your thumbs on the valve housing and your fingers applying pressure on the valve sleeve to keep it in the valve housing (FIG. 126).

Align the previously located timing marks and place the valve housing and valve sleeve as an assembly onto the input shaft end of the worm shaft/input shaft until the drive lugs are fully engaged (FIG. 127).

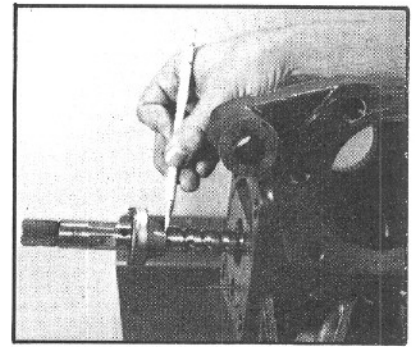


Figure 125

NOTE

NOTE: Valve sleeves are identified and matched to a right or left hand lead of the worm screw. If the screw has a right hand thread (that is, goes into the rack piston when turned clockwise), the valve sleeve will have the letter "R" stamped between the seal lands. For a left hand worm lead (which will come out of the rack piston when turned clockwise) the mating valve sleeve has no identifying letter between the seal lands.

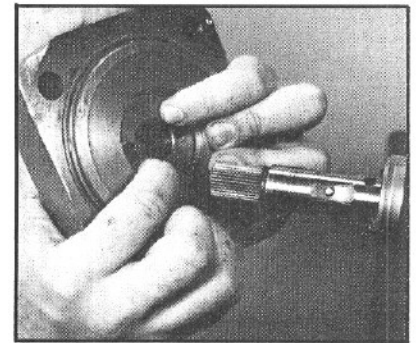


Figure 126

WARNING

WARNING: IF YOU PLACE AN INCORRECT VALVE SLEEVE ON A WORM AND ASSEMBLE THIS INTO THE GEAR, THE GEAR WILL NOT FUNCTION PROPERLY. INSTEAD, THE MECHANISM WILL JERK THE STEERING WHEEL WITH SUCH FORCE, THAT IT COULD INJURE THE DRIVER.

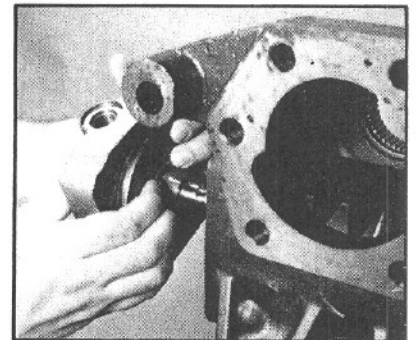


Figure 127

finish valve housing installation

26. Maintain pressure on the valve end of the valve housing to insure continued engagement of the drive lugs and thrust bearing package. While maintaining this pressure, rotate the valve housing to align the poppet adjusting screw (if equipped) with the poppet in the rack piston (FIG. 128).

Continuing pressure, rotate the input shaft to bring the valve housing into contact with the gear housing face.

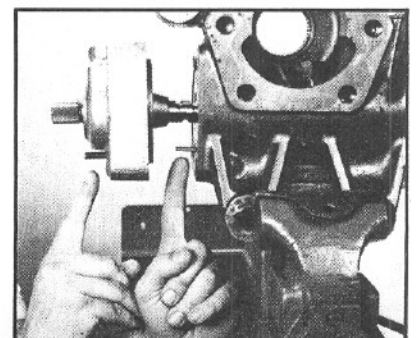


Figure 128

install valve housing bolts

27. Install the four valve housing bolts (1; 2.125 in. long) into the valve housing (9) and torque them to 105-115 ft. lbs. (FIG. 129).

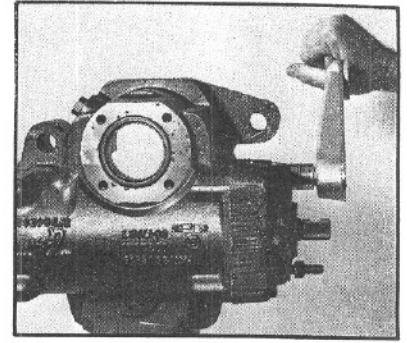


Figure 129

install relief valve

28. If your gear is equipped with a relief valve (9A), then assemble the new O-ring (9B), the new Teflon seal ring (9C), and the new O-ring (9D) onto the relief valve (FIG. 130). Install the relief valve into the valve housing (9) and torque it to 25-35 ft. lbs.

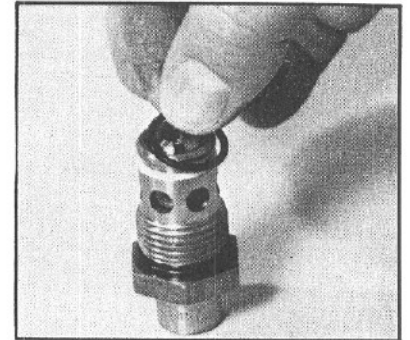


Figure 130

grease side cover bearing

29. Apply a generous amount of clean *wheel bearing grease* (do not substitute another type of grease) to the bearing race inside the side cover (58).

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 side cover bearing rolls

30. Assemble the bearing rolls into the side cover bearing race (FIG. 131). If you install an unmarked bearing or bearing BR-866-1, assemble 44 rolls. If you install bearing F83508, assemble 43 rolls.

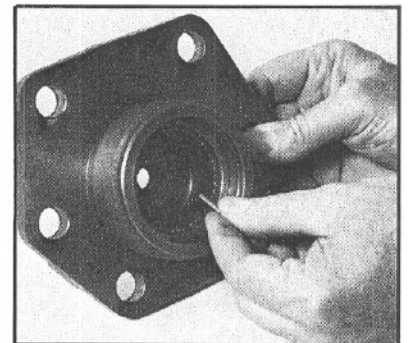


Figure 131

CAUTION

CAUTION: Apply wheel bearing grease to these rolls to retain them in the bearing race.

assemble side cover seal pack

31. Assemble the steel backup washer (56), the new Teflon backup washer (55), and the new two-piece side cover seal (54) into the side cover (58) (FIG. 132). Assemble the two-piece seal so that the words OIL SIDE are visible after it is installed.



Figure 132

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

32. Assemble the side cover retaining ring (53) into the ring groove of the side cover (58) (FIG. 133).

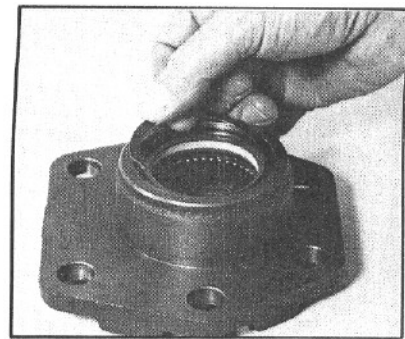


Figure 133

install sector shaft into side cover

33. Apply a generous amount of clean grease to the short bearing area of the sector shaft (50). Insert the sector shaft into the side cover (58). Screw in the sector shaft adjusting screw (51) counter-clockwise in the side cover until the screw reaches solid height (FIG. 134). Then, rotate the adjusting screw clockwise one turn, so that the side cover will rotate freely on the sector shaft.

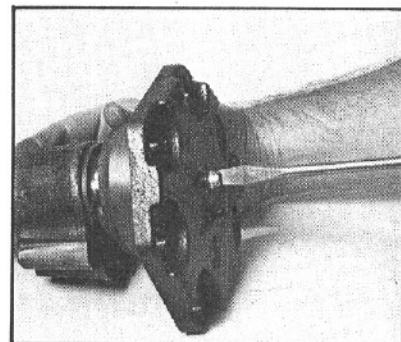


Figure 134

install jam nut

34. Install the sector shaft adjusting screw jam nut (59) onto the sector shaft adjusting screw (51) a few threads (FIG. 135). Final adjustment will be made later.

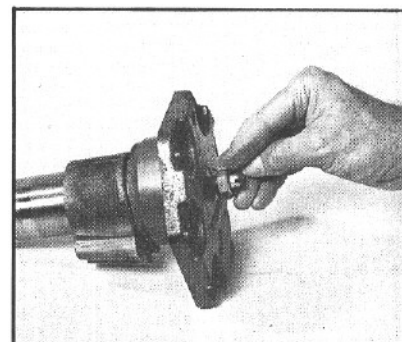


Figure 135

assemble vent plug

35. Press the rubber plug (60) into the hole provided in the side cover (58) until the plug is flush (FIG. 136).

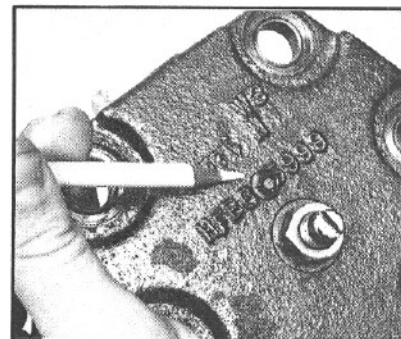


Figure 136

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 LOCKUP OR OTHERWISE MALFUNCTION.

install side cover gasket

36. Apply clean grease to the new side cover gasket (57), and assemble it onto the side cover (58) (FIG. 137). Apply enough grease to hold the gasket in place.

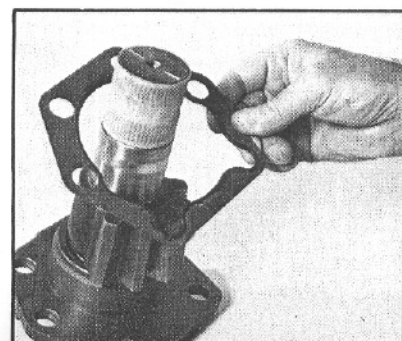


Figure 137

center rack piston

37. There are four teeth on the rack piston (31) (FIG. 138). Position the rack piston so that the tooth space identified by the pencil in FIG. 138 (it is the space between the second and third teeth) is in the center of the sector shaft opening (FIG. 139). This will center the rack piston in the opening.

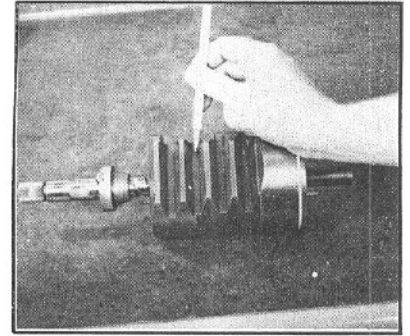


Figure 138

WARNING

WARNING: IF THE RACK PISTON IS NOT CENTERED, GEAR TRAVEL WILL BE SEVERELY LIMITED IN ONE DIRECTION. THIS COULD RESULT IN AN ACCIDENT.

install sector shaft and side cover into housing

38. Clean off any old tape on the sector shaft (50) serrations. Retape the serrations and bolt groove with one layer of masking tape. Install the sector shaft and side cover (58) into the gear housing (20) as an assembly. Make sure that the center tooth of the sector shaft engages the center space (between the second and third teeth) of the rack piston (FIG. 140).

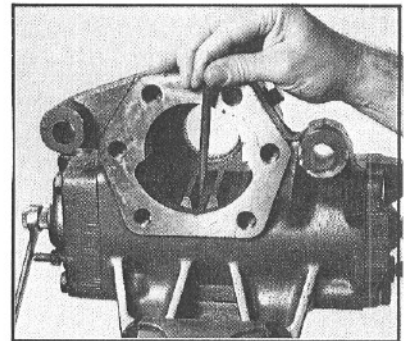


Figure 139

WARNING

WARNING: AS YOU PLACE THE SECTOR SHAFT THROUGH THE HOUSING BEARING (21), DO NOT KNOCK ANY OF THE BEARING ROLLS OUT OF THE BEARING RACE. DO NOT PINCH THE SIDE COVER GASKET (57). IF YOU DO EITHER, THE BEARING OR SEAL MAY PREMATURELY FAIL, AND THIS COULD RESULT IN A LOSS OF POWER STEERING ASSIST.

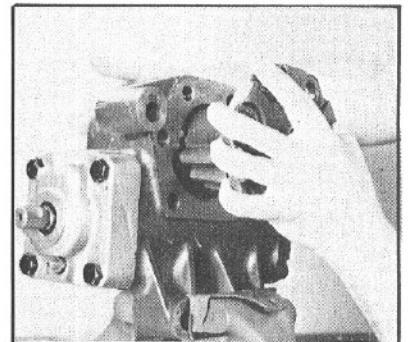


Figure 140

install side cover bolts

39. Install the six special side cover bolts (61) into the side cover and torque them to 220-240 ft. lbs.

install trunnion cover washer

40. Place the trunnion cover (26) exterior face down on a bench and install the new Teflon back-up washer (24). (FIG. 141).

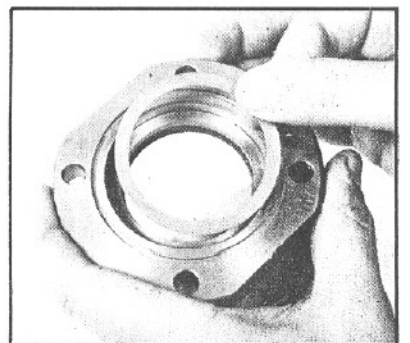


Figure 141

install seal

41. Next, install the new two-piece sector shaft seal (23) so that the words OIL SIDE are visible after the seal is in place.

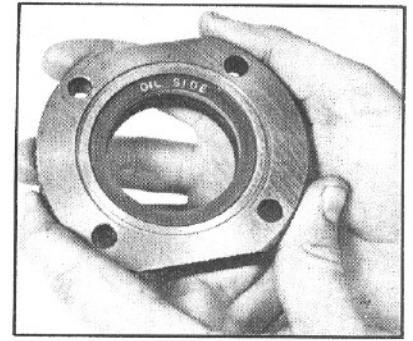


Figure 142

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 (FIG. 142).

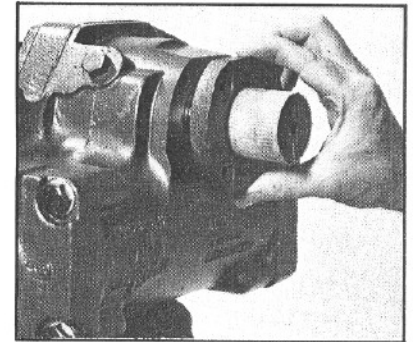


Figure 143

install O-ring

42. Grease the new trunnion cover O-ring (25) and install it into the trunnion cover (26) O-ring groove.

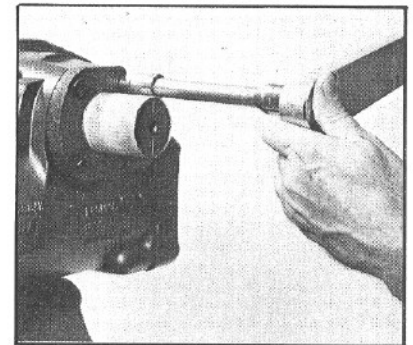


Figure 144

install trunnion cover and bolts

43. Visually inspect the housing bearing (21) to make sure that all the bearing rolls are properly in place. Then, install the trunnion cover (26) (FIG. 143). Install the four trunnion cover bolts (28), and torque them to 15-22 ft. lbs. (FIG. 144). Pack the cavity around the seal area of the sector shaft (50) with Mobil Temp 1 or 2 grease. Install a new dirt and water seal (27) using a suitable blunt-ended drift. (FIG. 145).

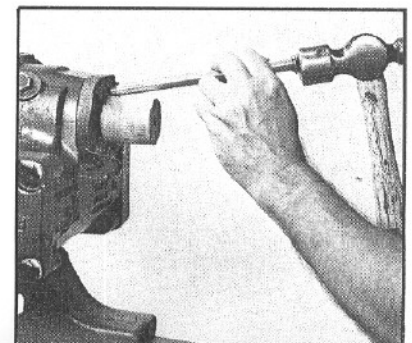


Figure 145

install input shaft seal pack

44. Apply clean grease to the input shaft seal assembly (7 and 8) and to the input shaft. Install the new two-piece input shaft seal (7 and 8), flat side out, and the steel backup washer (6), using seal driving tool J26653 (FIG. 146). Install the retaining ring (5) (FIG. 147).

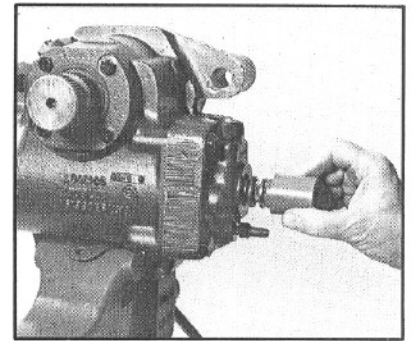


Figure 146

install dirt and water seal

45. Pack the area around the input shaft with Mobil Temp 1 or 2 grease, and install the dirt and water seal (4), using seal driving tool J26654 or suitable blunt-ended drift.

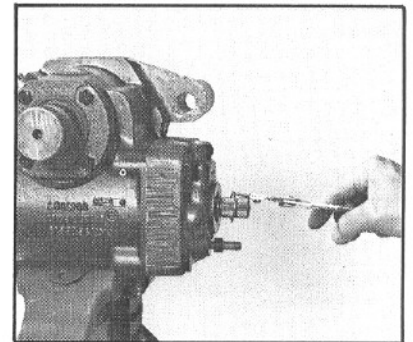


Figure 147

install manual bleed screw, if equipped

46. If your gear is equipped with the manual bleed screw (20A), install it into the gear housing (20) and torque it to 27-33 in. lbs. (FIG 148).

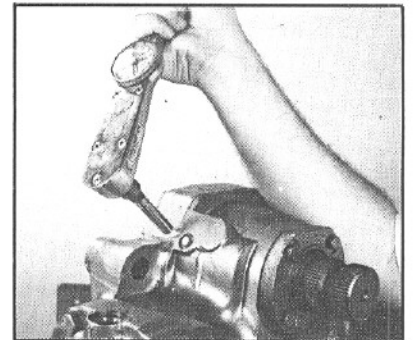


Figure 148

CAUTION

CAUTION: For next step, make sure gear is very secure in vise.

install automatic bleed screw, if equipped

47. If your gear is equipped with the automatic bleed screw (20B), position the steering gear so that the cylinder bore axis is vertical and the input shaft is pointing down (FIG. 149). Then, install the spring (20D), the special pin (20C), and the automatic bleed screw (20B) into the housing (FIG. 150). Torque the screw to 16-20 ft. lbs.

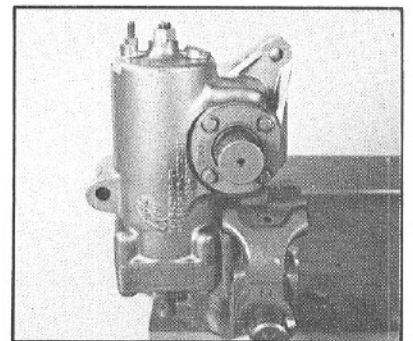


Figure 149

WARNING

WARNING: IF THE AUTOMATIC BLEED ASSEMBLY IS IMPROPERLY ASSEMBLED, THERE MAY BE A LOSS OF POWER STEERING IN ONE DIRECTION.

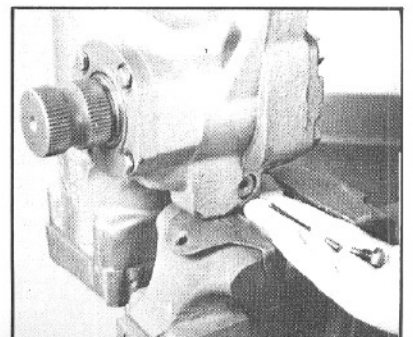


Figure 150

This completes assembly of the HFB64 steering gear. Before you install the gear onto the vehicle, make the final adjustments described below.

FINAL ADJUSTMENTS

adjust worm shaft preload 1. Screw the worm shaft preload adjusting screw (39) finger tight until it contacts the worm shaft (17). Apply 5 to 10 ft. lbs. of torque. Back screw out one turn.

center steering gear 2. To center the steering gear, align the sector shaft timing mark halfway between two trunnion cover bolts. The timing mark should be perpendicular to the center line of the cylinder bore. (See FIG. 6).

adjust screw; rotate input shaft 3. Adjust the sector shaft adjusting screw (51) while you rotate the input shaft 90 degrees each side of center, until the input shaft reaches a torque of 25-30 in. lbs. (FIG. 151).

NOTE

NOTE: Use a 12-point socket and an in. lbs. torque wrench to rotate the input shaft.

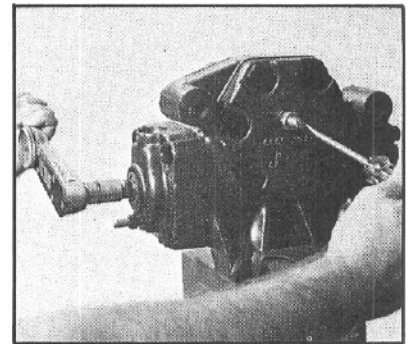


Figure 151

continue sector shaft adjustment 4. Next, back out the sector shaft adjusting screw (51) one turn. Note the torque now required to rotate the input shaft through 90 degrees each side of center. Then move the adjusting screw in to increase noted torque by 2 to 6 in. lbs. The increase should be noted at a point within 45 degrees each side of center.

tighten jam nut; note torque 5. Tighten the sector shaft adjusting screw jam nut (59) to 45-50 ft. lbs. The torque now required to rotate the input shaft should not exceed 20 in. lbs. at any point in the steering gear travel. If it does exceed 20 in. lbs., repeat step 4.

adjust worm shaft adjusting screw 6. Adjust the worm shaft preload adjusting screw (39) to increase the maximum noted input torque by 10 to 15 in. lbs., while you rotate the input shaft 45 degrees each side of center. Make sure that the worm shaft adjusting screw jam nut (38) does not contact the closed end of the housing (or the end cover, 37) while making this adjustment. Torque the jam nut to 70-80 ft. lbs., making sure that the adjusting screw does not move.

check torque 7. The torque now required to rotate the input shaft to traverse the gear through complete travel should not exceed 35 in. lbs. If it does exceed 35 in. lbs., repeat step 6.

This completes final adjustments of the HFB64 gear. Install the gear following instructions of the vehicle shop manual.

HYDRAULIC FLUID

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

AUTOMATIC TRANSMISSION FLUID TYPE "E" & "F"
FORD SPEC. M2C138CJ
AUTOMATIC TRANSMISSION FLUID DEXRON II
SHELL ROTELLA TSAE 30
MOBILSAE 10W30
ASHLANDSAE 10W40
UNIONSAE 10W40
TEXACOSAE 10W40
MOBILSAE 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, if 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 15) 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 (20A) (See FIG. 148, Page 43). If this is so, refer to step 4.

4. For inverted mounted gears equipped with the manual bleed screw (20A), remove air by following steps 1, 2, and 3 above. Then, with the engine idling, loosen the manual bleed screw about one turn. Steer the gear from full lock to full lock two or three times and look for clear fluid or fluid mixed with bubbles at the threaded area of the bleed screw. Repeat this procedure, including the steering maneuver, and add fluid as necessary, until only clear fluid discharges. Tighten the manual bleed screw to 27-33 in. lbs. Refill the reservoir, if necessary, to the fill line on the dipstick.

WARNING: DO NOT LOOSEN OR REMOVE THE AUTOMATIC BLEED SCREW (20B) (SEE FIG. 149) WHEN THE STEERING GEAR IS MOUNTED ON THE VEHICLE. IF IT IS LOOSENED OR REMOVED, THERE MAY BE A LOSS OF POWER STEERING ASSIST IN ONE DIRECTION OF TURN.

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 CONDITION MUST NOT EXCEED 6 GPM.

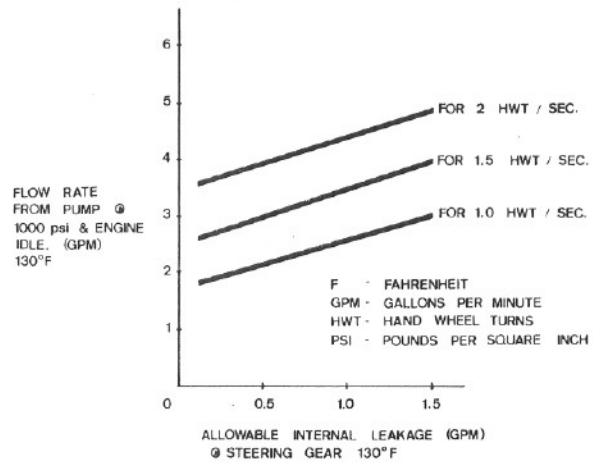
WARNING: MAXIMUM OPERATING PRESSURE MUST NOT EXCEED 2000 PSI.

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 GEAR 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 and other foreign matter from entering the hydraulic system.
- Investigate and correct any external leaks, no matter how minor.
- Replace filters and pumps in compliance with specifications.
- Always replace seals when you work on the steering gear.

PUMP FLOW RATE VS ALLOWABLE INTERNAL LEAKAGE
HFB 64 GEAR
VARIOUS SPEEDS OF STEERING AS NOTED



HFB64 Service Manual

WRITE OR CALL FOR INFORMATION AND ADDED DETAILS
CONCERNING YOUR INSTALLATION AND APPLICATIONS.

PHONE: (317) 423-5377
TELEX: 279413
WRITE: TRW ROSS GEAR DIVISION
800 HEATH STREET
LAFAYETTE, INDIANA 47902

TRW
ROSS GEAR DIVISION

HFB64-105
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