

VOLVO POWER-ASSISTED RECIRCULATING BALL

140 Series
164 Series

NOTE — 140 models may have power steering as optional equipment. Power steering is standard on 164 models.

DESCRIPTION

This power steering unit is a ZF recirculating ball and nut type. Main components of this system are the steering gear, power pump, and fluid reservoir (with filter). In addition to the mechanical gear, the power cylinder and control valves are built into the gear housing.

MAINTENANCE & ADJUSTMENT

ON-CAR SERVICING

Always clean all components, especially hose connections and pump cover, before disconnecting. Only Type "A" or Dexron power steering fluid is to be used with this system.

CHECKING OIL LEVEL

Oil level should be checked every 6000 miles. First check level with engine off. Oil level should be approximately $\frac{1}{4}$ " (5-10 mm) above full mark; if lower, fill to this level. Start engine and recheck oil level: It should fall to full mark. When engine is shut off, oil level may again rise to $\frac{1}{4}$ " (5-10 mm) above full mark.

DRAINING OIL

Raise front of vehicle, remove drain plug, then turn steering wheel to left stop. Remove reservoir cover. Start engine and run approximately 10 seconds (maximum), until oil is emptied. Stop engine and turn wheel from stop to stop to ensure all oil has drained.

FILLING & BLEEDING

NOTE — Oil capacity is approximately 2.5 pints (1.2 liters). Do not reuse drained oil.

1) Fill oil reservoir to top edge. Start engine and gradually fill reservoir (to full mark) as oil level drops. When level has stabilized at full mark, turn steering wheel from lock to lock several times (turn wheel slowly and evenly). Recheck oil level.

2) Open bleeder screw $\frac{1}{2}$ -1 turn and close it when oil begins to flow out. Continue turning wheel until reservoir shows no air bubbles. Stop engine. Oil should rise to $\frac{1}{4}$ " (5-10 mm) above full mark. If it rises further, air is still in system and bleeding should be continued. When bleeding is satisfactorily completed, lower front end. *NOTE* — After bleeding, a small amount of air may remain in system, but this will be dispersed as vehicle is driven.

PRESSURE POINT ADJUSTMENT

NOTE — This adjustment should be made only if there is reason to suspect some fault in system; however, it should not be made as a compensation for damage to system. Accurate adjustment is made during overhaul. See procedure as outlined in this article.

1) Turn wheels fully to right, attach puller, and remove pitman arm from sector shaft. Return steering to center position. Slacken adjusting screw lock nut. Turn screw clockwise until a slight resistance is felt in steering column flexible coupling as steering is turned to right and left of center.

2) Hold adjusting screw and tighten lock nut. Check adjustment by turning steering wheel several times through center position. At center, a slight increase in tension should be observed. Set wheels straight-ahead and reattach pitman arm.

REMOVAL & INSTALLATION

POWER STEERING GEAR

Removal — Raise front of vehicle. Drain oil as previously described. Turn wheels to right stop and remove pitman arm from sector shaft. Clean and disconnect oil lines from gear housing. Slacken pinch bolt at flexible coupling. Unbolt gear assembly from vehicle and remove from engine compartment.

Installation — To install, set gear, front wheels, and steering wheel in center positions and reverse removal procedure. Fill reservoir with oil and bleed system, as previously described.

POWER STEERING PUMP

Removal — Clean and detach all hose connections at pump. Be aware of oil drainage as hoses are disconnected. Unscrew tensioning bolt and all bracket bolts. Remove pump.

Installation — Install pump in reverse order of removal, attaching hoses with new seals, and adjusting belt tension such that a $\frac{3}{8}$ " (5 mm) deflection is obtained in middle of belt. Fill reservoir with oil and bleed system as previously outlined.

OVERHAUL

POWER STEERING GEAR

Disassembly — 1) Clamp steering gear in padded vise, with gear in horizontal position. Remove lock nut from adjusting screw and unscrew bolts from top cover. Remove cover by turning in adjusting screw. Take out loose needles in cover bearing.

2) Remove circlip from top of sector shaft and withdraw adjusting screw. Set steering gear in center position, pull up on sector shaft, and remove loose rollers from upper and lower bearings, using a magnet.

3) Remove seal from control valve end of housing (worm shaft splines). Unbolt and remove valve housing. Remove housing circlip and press out seal. Remove worm assembly, with piston cover and piston. Hold piston and screw out worm. Note that 23 recirculating balls will drop out when this is done. Detach cover from assembly; remove needle bearing and bearing washer. Remove packing, "O" rings, and shims from cover.

4) With a screwdriver, remove upper sealing ring from housing. Turn housing over and remove bottom circlip. Pry out adjacent sealing ring. Remove needle bearing race only if bearing is damaged.

5) Secure worm in padded vise. Remove inner bearing sleeve and bearing. Remove all rings from worm. Clamp piston in padded vise and unscrew lock ring and separate adjoining components. Do not disassemble worm valve head.

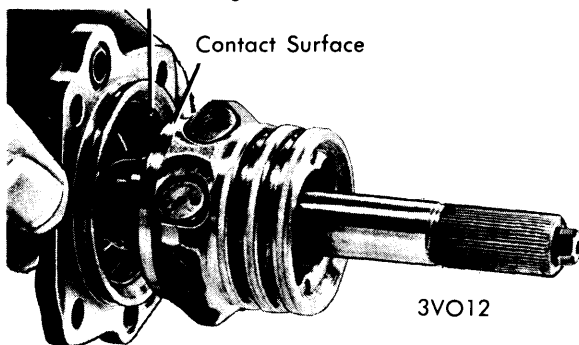
Assembly — 1) Before assembling, all parts should be cleaned and well-oiled. Place worm needle bearing in bearing sleeve and check for excessive play. If necessary, use bearing with thicker needles: these are available in four gradations of .0008" (.002 mm) each.

VOLVO POWER-ASSISTED RECIRCULATING BALL (Cont.)

2) Clamp valve housing in padded vise with large hole upward. Place preassembled worm in housing. Fit needle bearing, washer, and cover to valve housing. Bolt valve housing to gear housing and check turning torque of worm: Wrap a cord around worm shaft, attach a pull-scale, and note reading when worm begins to turn. It should be 3.7-6.5 lbs. (17-30 kg). **NOTE** — Make this check without worm shaft sealing ring in place. Preload is variable by replacing bearing washers with ones of different thicknesses. After correct preload has been obtained, remove valve housing.

3) Place new "O" rings on three grooves of worm. Carefully fit packing rings on top of "O" rings, starting with inner one. Place "O" ring in groove of piston cover and apply packing of .067" (1.7 mm) to "O" ring. Apply marking color to contact surface of worm, insert and rotate worm. Lift out worm and check contact against packing. If full contact is not obtained, replace packing with that of greater thickness.

Packing On "O" Ring



CHECKING PISTON COVER PACKING

4) Remove and clean the worm. Install all "O" rings on valve housing side of cover. Fit same number of shims as removed. Install inner "O" ring and packing in housing. Place bearing washer and bearing in cover. Attach small valve housing sealing ring on suitable installation tool (2863) and insert in housing. Secure with circlip.

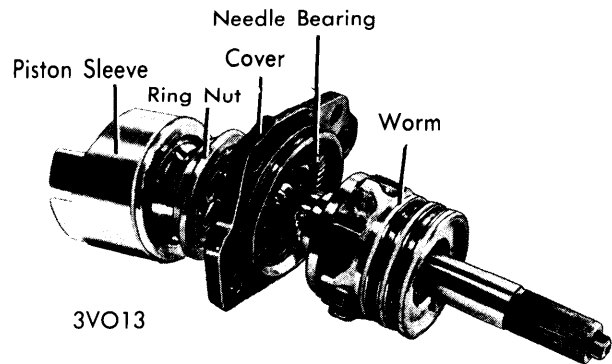
5) The preassembled cover and valve housing are attached to the worm, using the installation tool (2863). Screw cover and valve housing together with four nuts and bolts. Clamp piston in padded vise (horizontally) and check worm torque. Torque should now be 10-15 lbs. (48-75 kg). Release worm and bearing from valve housing.

6) Clamp valve housing in padded vise. Slide piston sleeve onto worm. Insert worm far enough into piston bore so that 16 recirculating balls may be inserted from front piston bore while turning worm. Insert remaining seven balls in ball guide tube and install guide.

7) Now check torque required to turn worm in piston. Correct reading on the pull-scale will be 5-10 lbs. (23-47 kg). If value is out of tolerance, replace all balls; they are available in five different dimensions.

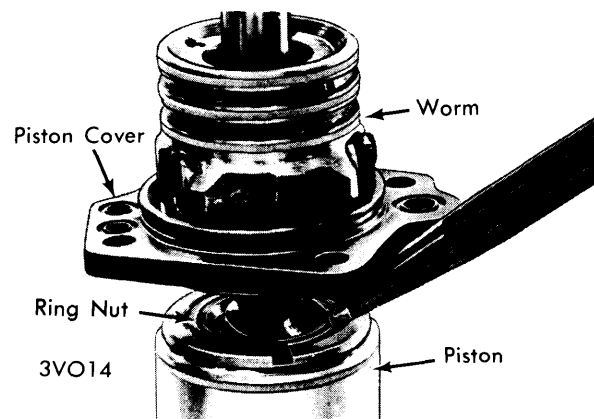
8) Place "O" ring and piston ring in recess on piston sleeve. Attach preassembled cover with bearing washer, bearing, ring nut, and sleeve on the worm (see illustration).

9) Insert worm into piston while making sure all 23 balls are correctly installed. Place packing strip over ball guide. Assemble piston and piston sleeve (note replacement of set pin if it was removed), positioning sleeve recess on tooth side of piston.



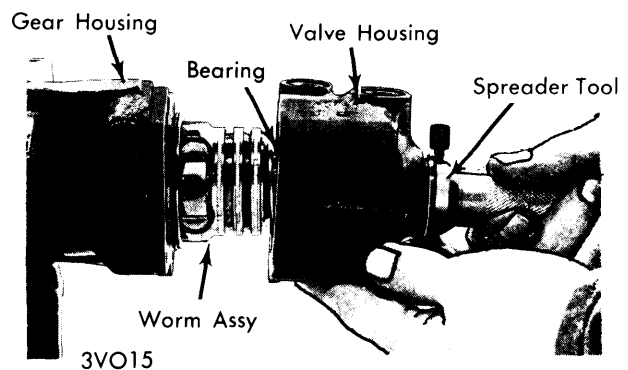
ASSEMBLING WORM COMPONENTS

CAUTION — When assembling, take care not to allow worm to come out of piston too far, or balls may fall into piston bore. Pull out ring nut and lock it by punch-locking with a center-punch (see illustration).

LOCKING RING NUT
(WORM & PISTON ASSEMBLED)

10) Clamp housing in padded vise (housing horizontal) and insert middle needle bearing washer in housing (this is for bearing which rides beneath sector teeth). Fit its adjacent sealing ring with lip upward: Install with suitable drift.

11) Install large oiled "O" ring on piston-side flange of piston cover, then install all other remaining "O" rings in cover. Insert piston and worm assembly into gear housing. Install suitable spreader tool (2863) in valve housing end sealing ring (see illustration), install housing end bearing, spread sealing ring, and install valve housing to gear housing.



ATTACHING VALVE HOUSING

VOLVO POWER-ASSISTED RECIRCULATING BALL (Cont.)

12) Place piston teeth in center position by lining up mark on end of worm shaft with line on housing end cover. If sector shaft middle and lower needle bearing races have not been replaced, grease and install bearing needles into races.

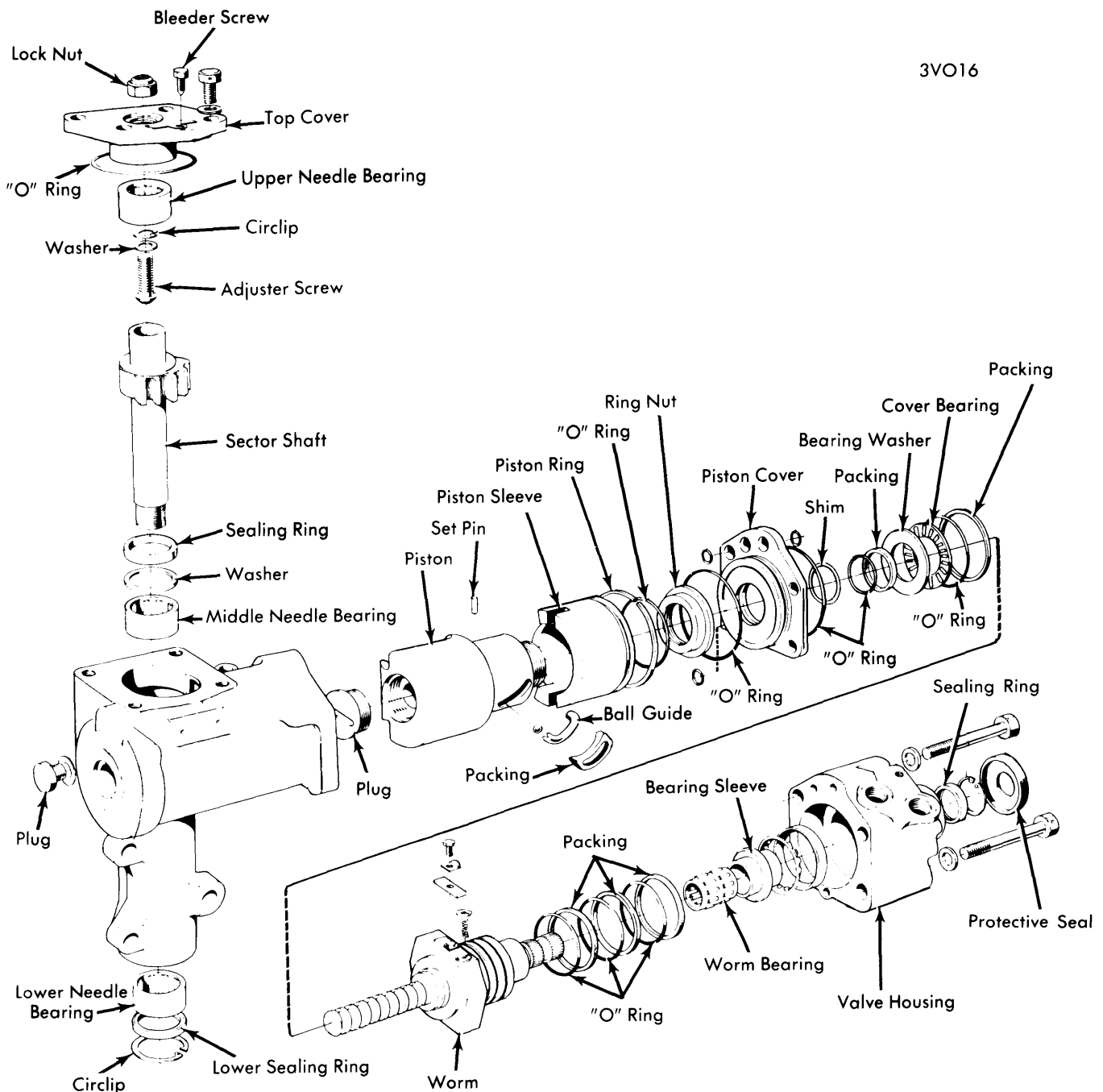
13) Tape splines on sector shaft (to protect seal during installation) and insert shaft in housing, aligning sector teeth at mid position with piston teeth. Turn sector shaft back and forth a few times to ensure proper mesh of the gears.

14) Install adjuster screw, adjuster washer, and circlip in top of sector shaft. Check that adjuster screw free play in shaft does not exceed .002" (.05 mm). An increase in washer thickness will take up excessive play.

15) Install needles in upper sector shaft bearing race. Place "O" ring on top cover. Attach cover by turning out adjuster screw until cover is in position. Temporarily install adjuster screw lock nut. Screw in cover retaining bolts. Install protective seal over worm shaft splines. Attach sealing ring and circlip on bottom end of sector shaft.

16) Rotate sector shaft to one stop, turn back 1/2 turn, attach a pull-scale and check required turning torque. Now return sector shaft to center position and turn in adjuster screw until a noticeable midpoint pressure is obtained. This should give a torque of 10-13 lbs. (4.5-6.2 kg) greater than that measured at the 1/2 turn from end stop, but no greater than 40 lbs. (18.5 kg). Hold adjuster screw in this position and tighten lock nut.

3V016



POWER STEERING GEAR DISASSEMBLED

Power Steering

VOLVO POWER-ASSISTED RECIRCULATING BALL (Cont.)

POWER STEERING PUMP

Disassembly – 1) Remove pulley and mounting brackets. Remove large circlip from rear of pump, remove rear cover, spring, and plate. Shake out intermediate piece and rotor (if intermediate piece does not shake out, allow it to remain in pump until pump is further disassembled).

2) Remove circlip from pulley end of shaft, then carefully press out shaft. Press front plate out of pump housing (if not previously removed, the intermediate piece should not come out). Screw out housing plug; withdraw spring and piston. Press out rear smaller bearing and seal, and extract "O" rings from housing.

Inspection – Check all components for wear, cracking, or chipping. Ensure control valve piston does not jam in hole. Carefully screw control valve piston apart; clean and inspect all components. If damaged, replace complete piston.

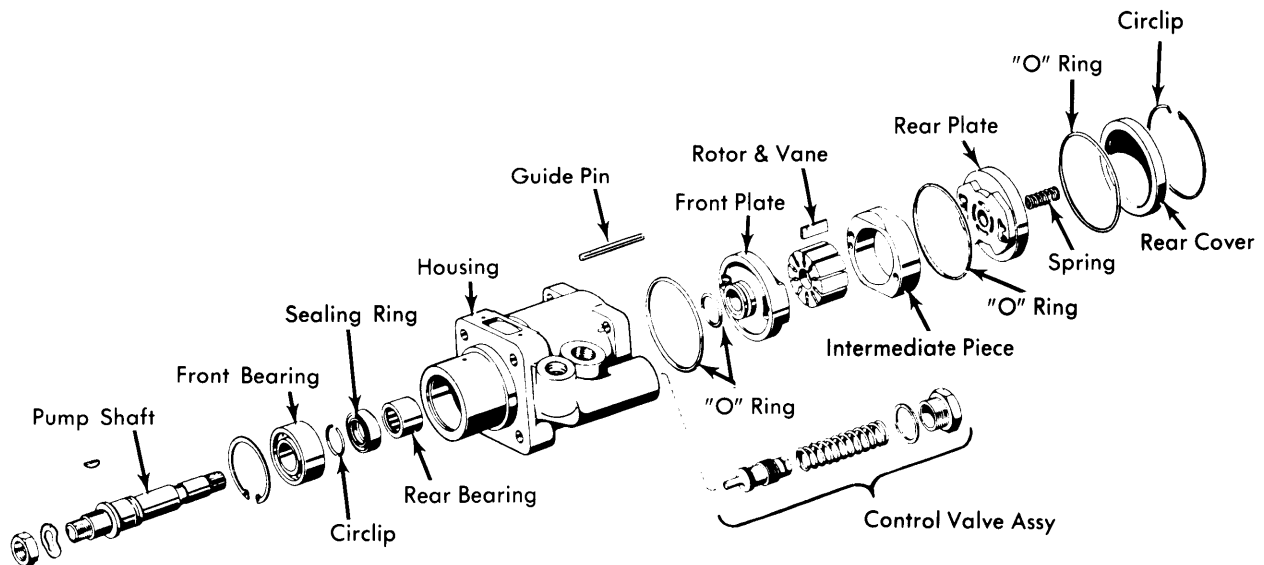
Assembly – 1) Before assembly, ensure all parts are well cleaned and oiled. Replace all seals with new ones. Install rear

bearing in housing. Grease sealing ring lips and install seal. Place "O" ring in housing inner groove. If forward bearing was removed, press shaft into bearing and attach circlip. Insert shaft and secure with forward large circlip.

2) Place "O" ring on front plate groove and install plate. Position intermediate piece such that its small hole is on the pin and both other holes are in line with plate holes. Install large "O" ring in housing.

3) Install rotor with smooth opening facing pulley side of pump. Insert all rotor vanes with rounded edges outward toward intermediate piece. Position rear plate on intermediate piece, with guide pin in small notch and holes showing through both larger notches. Fit large rear "O" ring in housing groove, install spring, and insert rear cover. Press down on cover and install retaining circlip.

4) Reassemble control valve components in pump hole. Install hose nipple, pulley, and mounting brackets.



3VO17

POWER STEERING PUMP DISASSEMBLED