

Power Steering Gears

1965-74 JEEP (SAGINAW) ROTARY VALVE POWER STEERING

J-Models (1965-74)
Cherokee (1974)
Wagoneer (1974)

DESCRIPTION

Gear is variable ratio, recirculating ball type. Steel balls work as a rolling thread between steering gear worm shaft and rack-piston nut. Worm shaft thrust is supported by a thrust bearing and two thrust races at lower end, and by bearing in adjuster plug at upper end. This design provides continual spring loaded pressure on worm shaft to prevent loss of thrust bearing preload for life of the gear. Adjuster plug provides initial preload adjustment, and service adjustment when repairing gear. As worm shaft is turned right, rack-piston moves upward in gear; turning worm shaft left moves rack-piston downward in gear. Rack-piston teeth mesh with sector, which is forged as part of the sector shaft. Turning worm shaft turns sector shaft, which turns wheels through mechanical linkage.

LUBRICATION

Check fluid in pump reservoir every 6,000 miles. Steering gear and fluid must be at normal operating temperature. If necessary, add Dexron automatic transmission fluid to bring to proper level on pump dipstick.

ADJUSTMENT

THRUST BEARING PRELOAD

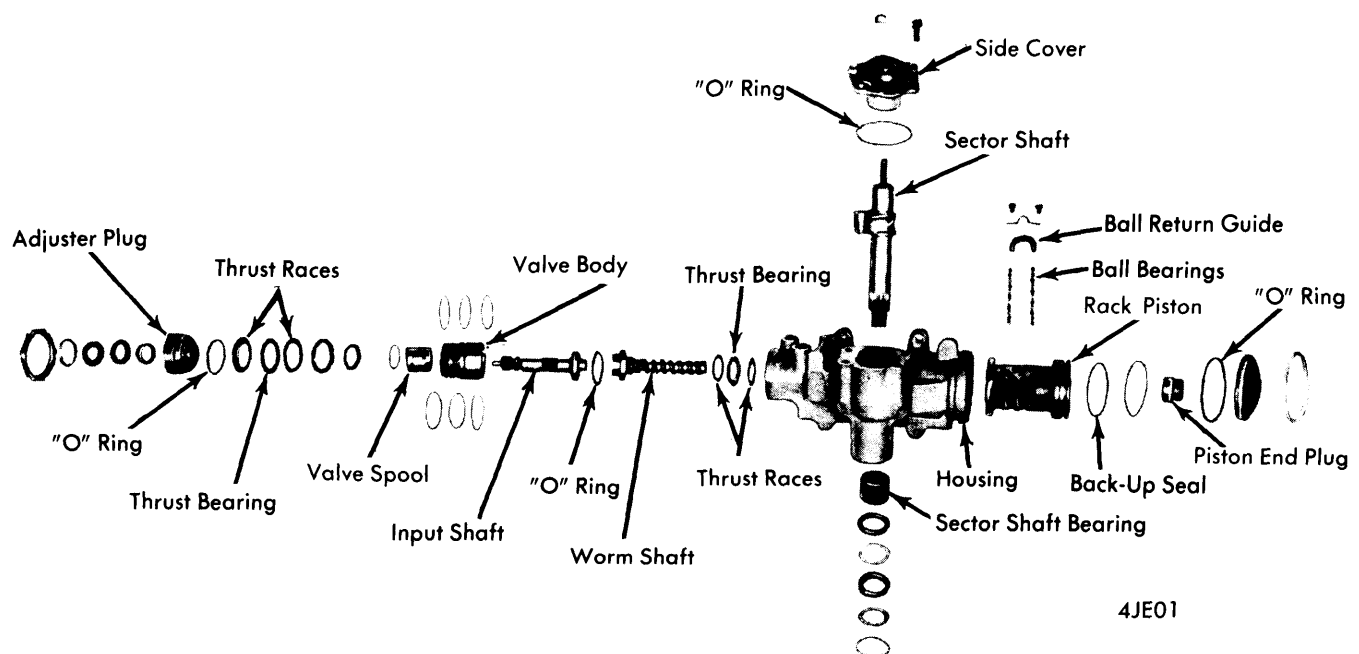
NOTE — Two thrust bearing preload adjustment procedures are given. One is for gears with conical thrust races, and the other is for gears with flat thrust races.

Conical Thrust Races — Rotate input shaft from stop to stop several times to force all fluid from steering gear. Mount gear-box in a soft-jawed vise, then loosen and remove adjuster plug lock nut. Using a spanner wrench, turn adjuster plug clockwise until plug and thrust bearing are firmly bottomed. Place an index mark on housing, opposite hole in adjuster plug. Measure counterclockwise $\frac{3}{16}$ - $\frac{1}{4}$ " , and remark housing. Rotate adjuster plug counterclockwise until hole in plug is in line with second mark. Tighten lock nut while holding adjuster plug in position.

NOTE — This procedure gives proper preload for gears with conical races. Since gear is assembled and it cannot be determined for certain whether races are conical or not, drag torque must be checked as follows:

Turn input shaft to right stop, then turn back $\frac{1}{4}$ turn. Using an INCH lb. torque wrench attached to input shaft, measure rotational torque required to turn input shaft through an arc of 60° . Reading should be taken with beam of torque wrench near vertical while turning counterclockwise at an even rate. If reading is more than 10 INCH lbs., or less than 4 INCH lbs., use adjustment procedure for flat thrust races. If reading is within 4-10 INCH lbs., record reading.

Flat Thrust Races — Rotate input shaft from stop to stop several times to force all fluid from steering gear. Mount gear-box in a soft-jawed vise. Loosen sector shaft adjuster lock nut, then turn adjuster $1\frac{1}{2}$ turns counterclockwise. Retighten lock nut. **NOTE** — If adjuster bottoms when turning it counterclockwise, turn back clockwise $\frac{1}{2}$ turn. Loosen adjuster plug lock nut. Using a spanner wrench, loosen adjuster plug one turn counterclockwise. Turn input shaft to right turn stop, then back $\frac{1}{4}$ turn. Attach an INCH lb. torque wrench to input shaft, and measure rotational torque required to turn input shaft through an arc of 60° . Tighten adjuster plug until it bottoms, then loosen plug until torque reading is 3-4 INCH lbs. greater than previously noted. Tighten adjuster plug lock nut,



STEERING GEAR ASSEMBLY

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and recheck preload torque. **CAUTION** — *It is not possible to properly adjust thrust bearing preload unless adjuster plug is firmly bottomed and torque set while adjuster plug is being loosened. Never attempt to adjust thrust preload while tightening adjuster plug into gear assembly.*

OVERCENTER POSITION

Rotate input shaft from stop to stop, counting number of turns required, then turn back ½ total number of turns from stop to center gear. Attach INCH lb. torque wrench to input shaft and rotate shaft approximately 45° to each side of center. Note highest reading obtained on or near center. Loosen adjuster screw lock nut, and turn preload adjuster to obtain correct overcenter torque reading. Reading should be 4-8 INCH lbs. higher than Thrust Bearing Preload, but should not exceed 18 INCH lbs. total.

TESTING

With fluid at proper level in pump reservoir, belt tension properly adjusted, and power steering fluid at normal operating temperature, install suitable gauge and valve assembly between power steering pump and high pressure hose. With engine idling at 600-800 RPM, and gauge valve open, note pressure reading while turning wheels from steering stop to steering stop. If maximum reading is not between 1000-1200 psi, temporarily close gauge valve and note reading obtained. **CAUTION** — *Do not leave gauge valve closed for more than five seconds. If reading with valve closed is below specified range, pump is faulty. If reading is within specified range, steering gear is faulty.*

REMOVAL & INSTALLATION

STEERING GEAR

Removal & Installation — Remove pitman arm from sector shaft, and disconnect hydraulic lines at steering gear. Remove steering gear-to-steering shaft clamp bolts. Remove gearbox attaching bolts, and remove gearbox assembly from vehicle. To install, reverse removal procedure, and bleed system. See **POWER STEERING PUMPS** in this Section.

OVERHAUL

NOTE — *If complete assembly is not to be overhauled, remove subassembly to be repaired, and proceed to disassembly and reassembly of that unit.*

STEERING GEAR

Disassembly — 1) Rotate housing end plug retainer ring until one end of ring is over hole in housing. Force end of ring from its groove in the housing, and remove ring. Rotate input shaft counterclockwise to force rack-piston end plug out of housing. **CAUTION** — *Do not rotate shaft more than necessary to remove plug or ball bearings will fall out of rack-piston and worm assembly.* Rotate input shaft clockwise ½ turn to draw piston inward. Remove piston end plug from rack-piston.

2) Remove lock nut from sector shaft adjuster, and remove sector shaft cover. Remove and discard cover "O" ring. Turn input shaft until sector shaft teeth are centered in housing. Tap end of sector shaft with a soft-faced hammer to free shaft from housing, and remove sector shaft. Remove adjuster plug lock nut. Using a suitable spanner wrench (J-7624), remove adjuster plug. Insert suitable arbor tool (J-7539-01) into end of rack-piston until tool just contacts worm shaft.

3) Rotate input shaft counterclockwise until worm is free of rack-piston. Remove rack-piston assembly from housing, being sure to keep tool fully inserted in order to prevent ball bearings from falling out. Remove input shaft and control valve assembly from housing. Lift worm, lower thrust bearing, and races from housing.

Reassembly — 1) Lubricate all parts with clean power steering fluid prior to assembly. Install thrust bearing and races on worm. Align valve body drive pin on worm with narrow pin slot in valve body, and install "O" ring between valve body and worm head. Install valve body and worm assembly in housing, making sure fluid return hole in gear housing is fully visible.

2) Position suitable seal protector (J-7586) over input shaft, install new adjuster plug "O" ring, then install adjuster plug. Remove seal protector from housing, and loosely install adjuster plug lock nut. Adjust thrust bearing preload. Insert arbor tool in rack-piston, and install rack-piston assembly into housing. Force rack-piston into housing until arbor tool contacts worm shaft. Turn input shaft clockwise until middle rack groove in rack-piston is aligned with sector shaft roller bearing, then remove arbor tool.

3) Install new sector shaft cover "O" ring, then thread sector shaft cover onto adjuster screw until bottomed. Back off 1½ turns. Install sector shaft so that center gear tooth meshes with center groove in rack-piston, and install cover attaching bolts. Install adjuster lock nut, and install piston end plug in rack-piston. Install housing end plug, and end plug retainer ring. Adjust sector shaft preload.

ADJUSTER PLUG

Disassembly — Remove thrust bearing retainer ring with a screwdriver, being careful not to score needle bearing bore. Discard retainer ring. Remove thrust bearing spacer, thrust bearing, and bearing races. Remove and discard adjuster plug "O" ring, then remove input shaft seal retainer. Remove and discard dust seal, then pry input shaft seal from adjuster plug. Inspect needle bearing in adjuster plug, and remove by pressing out from spacer end.

Inspection — Inspect thrust bearing spacer for cracks, and inspect thrust bearing rollers for pitting, scoring, or cracking. If any of these conditions exist, replace both thrust bearing races and check thrust bearing spacer.

Reassembly — Press needle bearing into adjuster plug with identification end down, until bottomed on input shaft seal bore. Install input shaft seal, with ring in seal facing adjuster plug. Install dust seal, with lip facing upward, into adjuster plug, then install retainer ring. Install adjuster plug "O" ring. Assemble thrust bearing, thrust bearing races, and thrust bearing spacer on adjuster plug. Using brass or wooden dowel, press bearing retainer into needle bearing bore.

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RACK-PISTON & WORM

Disassembly — Remove piston ring and back-up "O" ring from rack-piston nut. Remove ball return guide clamp, ball return guide, arbor tool, and all ball bearings from rack-piston.

Inspection — Clean and dry all parts. Inspect worm and rack-piston grooves for scoring. Inspect ball bearings for damage. *NOTE* — If either worm or rack-piston are damaged, both must be replaced as a matched set. If any ball bearings are damaged, replace entire set. Check ball guides for pinching at ends. Inspect lower thrust bearing races for cracking, scoring, or pitting.

Reassembly — 1) Install "O" ring and piston ring on rack-piston, using care not to twist "O" ring. Install worm into rack-piston, until worm is against piston shoulder. Install 16 ball bearings into rack-piston, while slowly rotating worm counterclockwise. *NOTE* — Install silver and black balls alternately. Install remaining balls into ball return guide, making sure balls in guide alternate in color with last ball installed in rack-piston. Install guide into rack-piston, install guide clamp, and tighten clamp attaching screws.

2) Clamp rack-piston in a soft-jawed vise, with worm shaft up, and install rotary valve assembly on worm such that it engages worm drive pin. Rotate worm until a clearance of 1 1/4" exists between rack-piston and thrust bearing face. Install an INCH lb. torque wrench on input shaft, and note torque required to rotate shaft through an arc of 60° in either direction. Torque with worm rotating should be 1-4 INCH lbs. If rotational torque is not correct, install next larger size ball bearings to increase preload, or next smaller size balls to decrease preload.

3) Remove valve assembly from worm. Remove rack-piston from vise. Insert suitable arbor tool into plug end of rack-piston until it contacts worm shaft. Apply pressure to tool while rotating worm shaft out of rack-piston. Leave tool in place until piston is installed in housing.

ROTARY VALVE

NOTE — Complete valve assembly is hydraulically balanced during manufacture. If replacement of any part other than rings, seals, or valve spool centering spring is necessary, replace complete valve assembly.

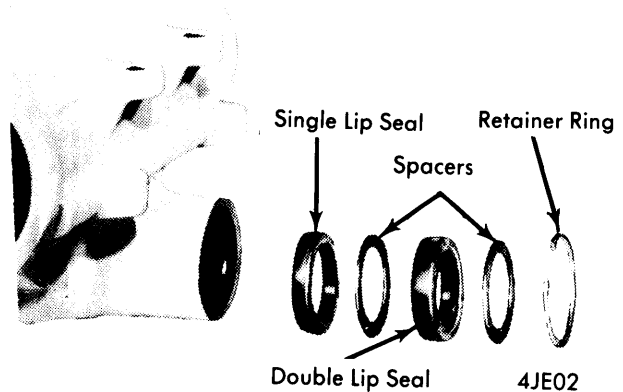
Disassembly — Lightly tap torsion bar end of valve on work bench until torsion bar cap separates from valve body. Remove and discard valve-to-body "O" ring. Push input shaft down through valve body until drive pin hole is visible. Tilt input shaft to disengage drive pin from valve spool, then remove input shaft from valve body. Slide valve spool out of top of valve body.

Reassembly — Lubricate dampener "O" ring with power steering fluid and install on spool. Insert spool into valve body, using a turning motion, until spool is even with valve body bottom, and drive pin hole is directly opposite deep notch in valve body. Install input shaft into valve spool, making sure drive pin holes are aligned. Insert drive pin into hole in valve spool, and pull assembly into valve body, keeping cap slot and body pin aligned. *NOTE* — Cap is correctly seated when top surface of cap is at least 3/32" below deep notch in valve body. Install cap-to-body "O" ring.

STEERING GEAR HOUSING

Disassembly — Remove sector shaft seal retaining ring, and remove lower spacer washer. Remove lower seal, spacer washer, and upper seal from housing. Press sector shaft bearing out of housing from lower end. To remove port seat, tap out seat using a 3/16"-18 tap. Thread a bolt, with nut and flat washer, into seat. Hold bolt from turning while tightening nut to extract seat from housing.

Reassembly — Working from upper end, press new bearing into housing until seated .030" below edge of bore. Lubricate new seal with power steering fluid, then install single lip seal, spacer washer, double lip seal, and second spacer washer. Install sector shaft seal retaining ring. If port seat was removed, position new seat over opening in housing, and drive into place using a brass drift.



HOUSING SEAL ARRANGEMENT

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Pitman Arm Attaching Nut.....	160-210
Adjuster Plug Lock Nut.....	50-110
Sector Shaft Adjuster Lock Nut.....	27-37
Hose Couplings.....	25-35
Rack-Piston End Plug.....	50-100
Side Cover Attaching Bolts.....	30-45