

## 1965-74 GENERAL MOTORS (SAGINAW) ROTARY VALVE POWER STEERING

Chevrolet (1965-74)  
GMC (1965-74)

### DESCRIPTION

Both constant ratio and variable ratio, recirculating ball type gears are used on Chevrolet and GMC vehicles. 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 a bearing in the adjuster plug at the 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

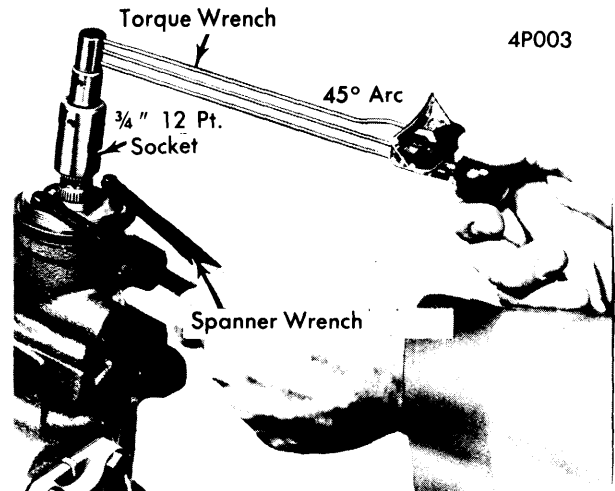
Check fluid level in pump reservoir every 6,000 miles. Gear and fluid must be at normal operating temperature. If necessary, add power steering fluid to bring to proper level on pump dipstick.

### ADJUSTMENT

#### THRUST BEARING PRELOAD

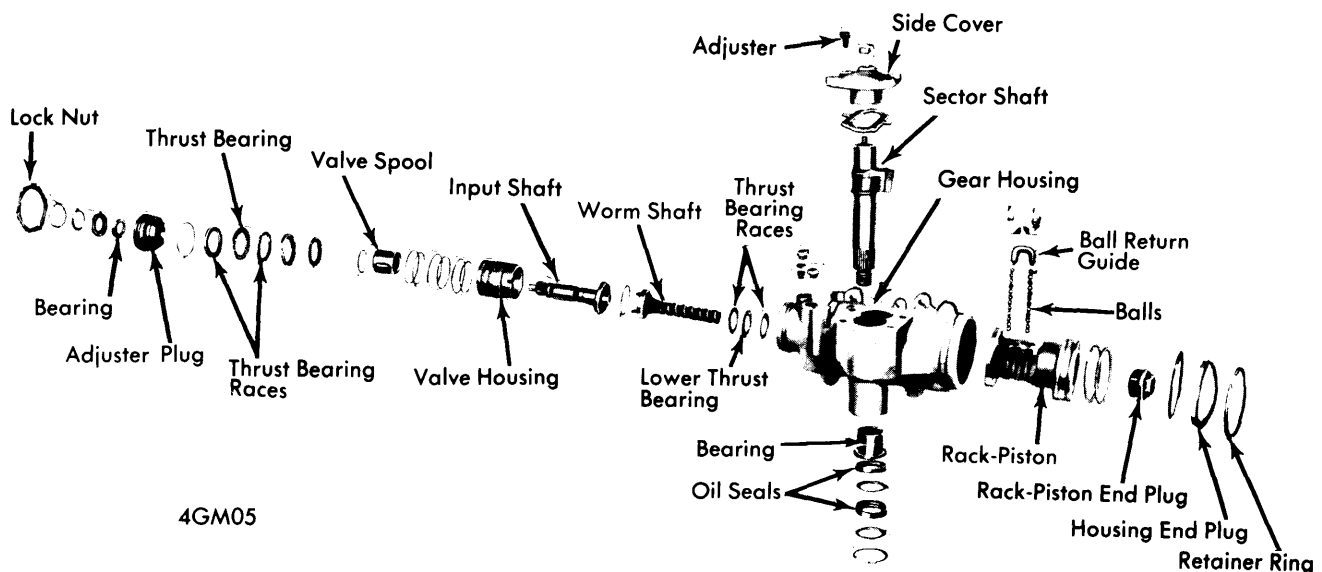
1) Loosen sector shaft adjuster lock nut, then turn adjuster  $1\frac{1}{2}$  turns counterclockwise. **NOTE** — If screw bottoms before  $1\frac{1}{2}$  turns is reached, turn back  $\frac{1}{2}$  turn from bottom. Loosen adjuster plug lock nut, then loosen adjuster plug one turn

counterclockwise. Turn input shaft to right turn stop, then turn shaft back  $\frac{1}{4}$  -  $\frac{1}{2}$  turn. Attach an INCH lb. torque wrench to the input shaft and measure torque required to rotate input shaft through an arc of  $45^\circ$ .



#### ADJUSTING THRUST BEARING PRELOAD

2) Bottom adjuster plug firmly by turning clockwise, then back off until torque reading is 3-4 INCH lbs. higher than reading obtained with adjuster plug loose. Tighten adjuster plug lock nut. **NOTE** — It is not possible to properly adjust thrust bearing preload unless adjuster plug is firmly bottomed, and torque set while loosening plug. Never adjust preload while tightening adjuster plug.



STEERING GEAR ASSEMBLY

# Power Steering

## 1965-74 GENERAL MOTORS (SAGINAW) ROTARY VALVE POWER STEERING (Cont.)

### OVERCENTER POSITION

Rotate input shaft from stop to stop, counting number of turns, then turn shaft back exactly  $\frac{1}{2}$  number of turns counted to center gear. Using an INCH lb. torque wrench attached to input shaft, rotate shaft approximately  $45^\circ$  to each side of center and note torque reading. Loosen lock nut and turn sector adjuster clockwise until rotational torque is 4-5 INCH lbs. (4-8 INCH lbs. if gears in service less than 400 miles) greater than previously noted. Total torque reading should not exceed 14 INCH lbs. (18 INCH lbs. if gears in service less than 400 miles). Tighten adjuster lock nut.

### 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 900-1100 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 range, steering gear is faulty.

### REMOVAL & INSTALLATION

#### STEERING GEAR

**Removal & Installation** — Disconnect power steering hoses at steering gear, and cap all openings. Remove flexible coupling attaching hardware. Remove pitman arm from sector shaft. Remove gearbox-to-frame attaching bolts, then remove gearbox 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 serviced, 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 housing end plug out of housing. **CAUTION** — Do not rotate shaft more than necessary to remove plug, or ball bearings will fall out of worm and rack-piston assembly. Rotate input shaft clockwise  $\frac{1}{2}$  turn to draw rack-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 soft-faced hammer to free shaft from housing, then remove sector shaft. Remove adjuster plug lock nut. Using suitable spanner wrench (J-7624), remove adjuster

plug. Insert suitable arbor tool (J-21552) into end of rack-piston until tool just contracts 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 into housing, making sure fluid return hole in gear housing is fully visible.

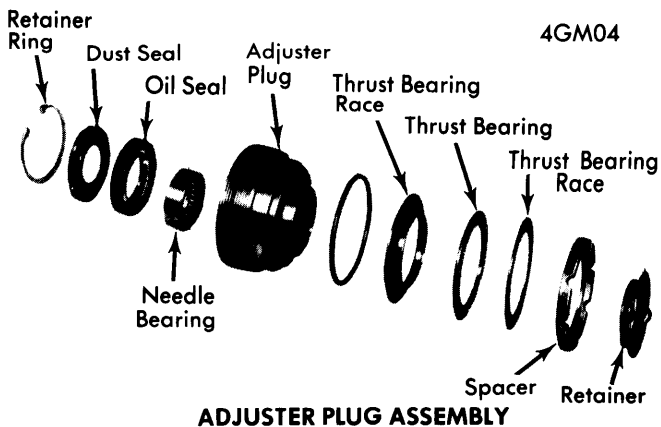
2) Position suitable seal protector (J-6222) over input shaft, install new adjuster plug "O" ring, then install adjuster plug. Remove seal protector from housing, and loosely install adjuster plug lock nut. Adjust thrust bearing preload. Insert arbor tool in rack-piston, and install rack-piston assembly 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  $1\frac{1}{2}$  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 overcenter position.

#### 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 spacer.



## 1965-74 GENERAL MOTORS (SAGINAW) ROTARY VALVE POWER STEERING (Cont.)

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

### 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 rings. Install worm into rack-piston, until worm is against piston shoulder. Install 17 ball bearings into rack-piston, while slowly rotating worm counterclockwise. **NOTE** — *Install light and dark colored 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.

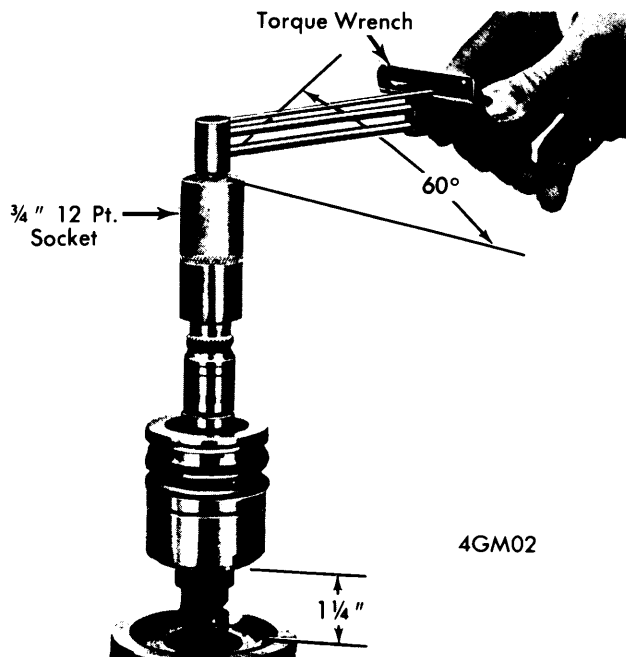
2) Clamp rack-piston in a soft-jawed vise, with worm shaft up, and install rotary valve assembly on worm such that it engages worm drive pin. Rotate worm until a clearance of  $1\frac{1}{4}$ " exists between rack-piston and thrust bearing face. Install an INCH lb. torque wrench on input shaft, and note torque required to rotate shaft through an arc of  $60^\circ$  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.

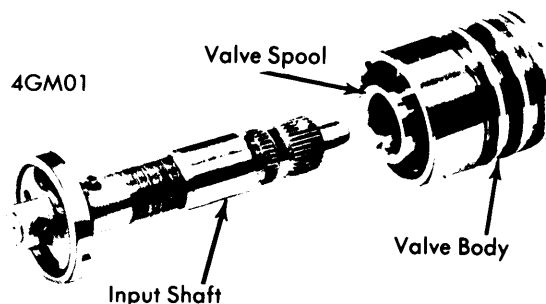
### ROTARY VALVE

**NOTE** — *Complete valve assembly is hydraulically balanced during manufacture. If replacement of any part other than rings or seals 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.



CHECKING BALL BEARINGS



ROTARY VALVE ASSEMBLY

**Reassembly** — Lubricate dampener "O" ring with power steering fluid and install on valve 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  $\frac{3}{32}$ " below deep notch in valve body.* Install cap-to-body "O" ring.

# Power Steering

## 1965-74 GENERAL MOTORS (SAGINAW) ROTARY VALVE POWER STEERING (Cont.)

### 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  $\frac{3}{16}$ -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.

### TIGHTENING SPECIFICATION

Application	Ft. Lbs.
Gearbox Attaching Bolts.....	70-80
Hydraulic Line Connections.....	30
Sector Shaft Adjuster Lock Nut.....	35
Side Cover Attaching Bolts .....	35
Adjuster Plug Lock Nut.....	80
Coupling Flange Nuts.....	20
Rack-Piston End Plug .....	75
Return Guide Clamp Screws .....	5