

1965-74 IHC (SAGINAW) ROTARY VALVE POWER STEERING

International Harvester (1965-74)

NOTE — Some models use other units. See IHC (Ross) Power Steering in this Section.

DESCRIPTION

Gear is single 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 conical 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.

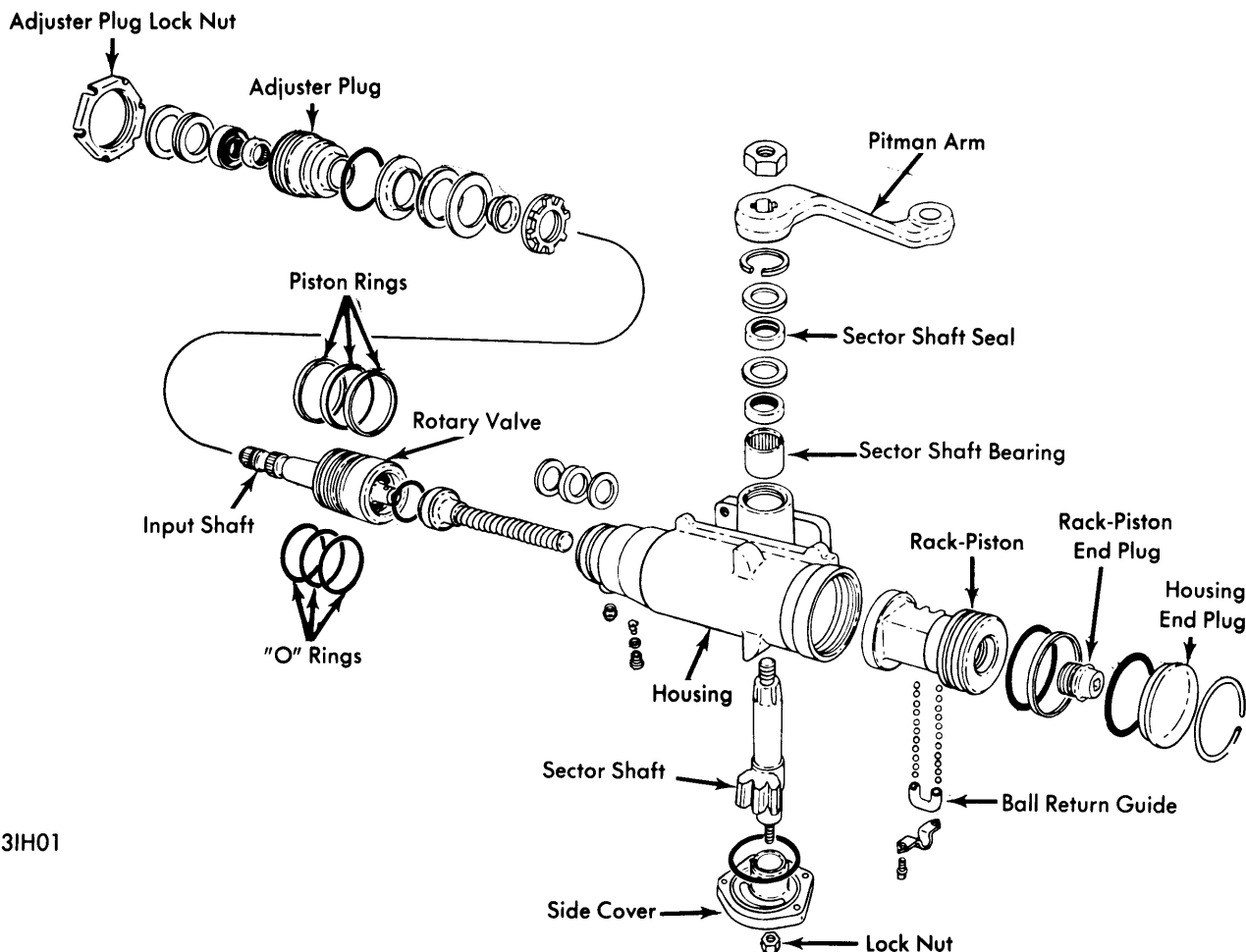
LUBRICATION

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

ADJUSTMENT

THRUST BEARING PRELOAD

With steering gear removed from vehicle, loosen adjuster plug lock nut. While rotating input shaft, tighten adjuster plug until a slight drag is felt. Loosen adjuster plug $\frac{1}{8}$ turn. Using an INCH lb. torque wrench, measure input shaft rotational drag. Tighten adjuster plug until drag is increased by 1-3 INCH lbs. Tighten adjuster plug lock nut, and recheck preload. Total preload must not exceed 8 INCH lbs.



3IH01

STEERING GEAR ASSEMBLY

1965-74 IHC (SAGINAW) ROTARY VALVE POWER STEERING (Cont.)

SECTOR SHAFT PRELOAD

With steering gear removed from vehicle, and in center position, loosen sector shaft adjusting screw. Attach an INCH lb. torque wrench to steering input shaft. Using torque wrench, rotate input shaft through an arc of 20° to either side of center, noting rotational torque reading. Tighten sector shaft adjusting screw until reading is increased 4-8 INCH lbs. Tighten adjusting screw lock nut, and recheck preload.

OVERCENTER POSITION

Disconnect pitman arm from sector shaft, and remove horn button from center of steering wheel. Position steering gear at center position, then rotate steering wheel ½ turn in either direction. Using an INCH lb. torque wrench, measure torque required to rotate steering shaft through an arc of 20° from this position. Center steering gear, then measure torque required to rotate steering shaft through an arc of 20° from center position. Turn sector shaft adjuster in until second reading exceeds the first by 4-8 INCH lbs. Tighten adjuster screw lock nut, and recheck rotational torque.

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 below 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 gauge valve closed is below 1200 psi, pump is faulty. If reading is 1200 psi or more, power steering gear is faulty.

REMOVAL & INSTALLATION

STEERING GEAR

Removal & Installation — Raise and support vehicle under frame, and position drip pan under steering gear assembly. Center steering gear, and tie steering wheel in this position. Disconnect hydraulic hoses at steering gear, and cap ends to prevent fluid loss. Disconnect and remove battery on models using gearbox with vertical sector shaft. Remove pitman arm from sector shaft. Remove flexible coupling clamp bolt, and steering gear attaching bolts. Remove steering gear assembly from vehicle. To install, reverse removal procedure, and bleed system. See **POWER STEERING PUMPS** in this Section.

OVERHAUL

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

STEERING GEAR

Disassembly — 1) Rotate 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 from 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 (SE-2279), remove adjuster plug. Insert suitable arbor tool (SE-2277) 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 (SE-2278) 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 into 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.

ROTARY VALVE

NOTE — Valve assembly is a precision unit with selectively fitted parts which are hydraulically balanced during assembly. Individual parts of valve assembly are not replaceable. Valve is serviced as a complete assembly only.

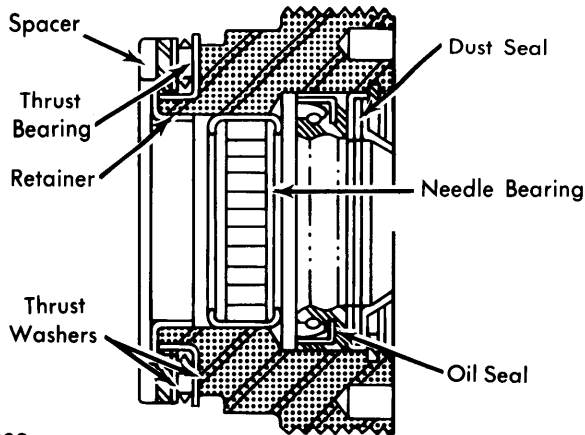
ADJUSTER PLUG

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 water, 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 spring 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 a brass or wooden dowel, press bearing retainer into needle bearing bore.

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ADJUSTER PLUG ASSEMBLY

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.

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.

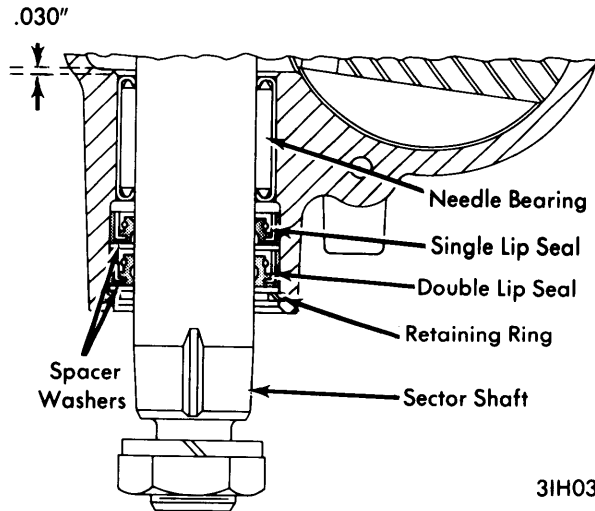
Reassembly — 1) Install "O" ring and piston ring on rack-piston, using care not to twist "O" ring. Install worm into rack-piston, until worm is against piston shoulder. Install 16 balls into rack-piston, while slowly rotating worm counterclockwise. **NOTE** — Install silver and black balls alternately. 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 guide 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 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 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.

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 5/16-18 tap. Thread a bolt, with nut and flat washer into seat. Hold bolt from turning while tightening nut to extract seat from housing.



3IH03

SECTOR SHAFT SEAL ARRANGEMENT

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 SPECIFICATIONS

Application	Ft. Lbs.
Pitman Arm Retaining Nut.....	100-160
Hose Connections.....	20-30
Gearbox Attaching Bolts.....	45-55
Adjuster Plug Lock Nut.....	50-110
Ball Return Guide Clamp Screws.....	8-12
Side Cover Attaching Bolts.....	25-35
Rack-Piston End Plug.....	50-100
Sector Shaft Adjuster Screw Lock Nut.....	27-37
Flexible Coupling Clamp Bolt (Upper).....	15-20
Flexible Coupling Clamp Bolt (Lower).....	30-35
Steering Wheel Retaining Nut.....	25-30