

BMW POWER-ASSISTED WORM & SECTOR

530i
633CSi
733i

DESCRIPTION

STEERING GEAR

Power steering gear consists of a gear housing containing a sector shaft with sector gear, a power piston with gear teeth in side of piston which is in constant mesh with sector shaft teeth, and a worm shaft connecting steering shaft to power piston through a universal joint coupling. Worm shaft is geared to piston through recirculating ball contact; and a steering valve is incorporated into upper end of worm gear assembly.

STEERING PUMP

Power steering pump is a high pressure, belt driven, vane type pump. A fluid reservoir incorporating a filter element supplies hydraulic fluid to pump. Pump maintains hydraulic pressure to power steering gear assembly.

LUBRICATION

CAPACITY

System Capacity – 3.8 pints.

LUBRICANT TYPE

Initial or Subsequent Filling – BMW recommends Shell ATF Dexron B (or equivalent).

Subsequent Filling (Max. ½ pint) – Veedol Automatic Transmission Fluid Type A Suffix A AQ 1407 A, or suitable equivalent.

FILTER REPLACEMENT

Remove brake booster return hose and cap opening in reservoir. Fill reservoir with fluid. Run engine 10 minutes and turn wheel lock to lock several times. Depress brakes quickly 10 times and collect fluid from return hose. Stop engine, drain fluid from reservoir. Remove washer, spring, screen, filter, washer and bottom filter from reservoir. Replace filter cartridge. Install filters and washers in reservoir and connect brake booster hose. Fill tank.

ADJUSTMENT

PUMP BELT

Loosen adjustment bolts and shift pump to tighten belt. Adjustment is correct when it is possible to press in belt 0.2-0.4" (5-10 mm) with the thumb.

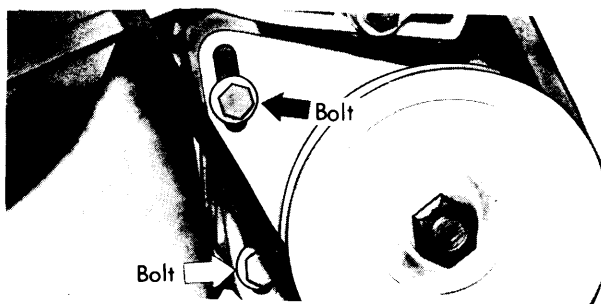


Fig. 1 Power Steering Belt Adjustment Locations

HYDRAULIC SYSTEM BLEEDING

1) Power steering must be bled whenever system is opened, or oil level falls so low that the vane type pump picks up air. Fill reservoir to upper mark with fluid. Turn engine over with starter and continue to add fluid. When oil level no longer falls, start and run engine at idle speed.

2) Turn steering wheel rapidly from lock to lock and back until no further air bubbles rise in reservoir. During this operation, and when completed, fluid level must remain at upper mark.

SECTOR SHAFT

Adjustment (In Vehicle) – 1) Position front wheels straight ahead. Remove cotter pin and castle nut from tie-rod. Press off center tie-rod from steering arm. Remove BMW emblem from steering wheel. Turn wheel counterclockwise 1 turn from center. Install torque wrench on nut, turn wheel clockwise and read frictional torque.

2) Torque should be 2.7-3.5 INCH lbs. (3.1-4 cmkg). To adjust, turn steering wheel counterclockwise from center 1 turn. Loosen locknut on steering gear and turn adjusting screw clockwise until correct torque is reached when passing through center position. Tighten locknut and recheck adjustment. Replace cotter pin and castle nut.

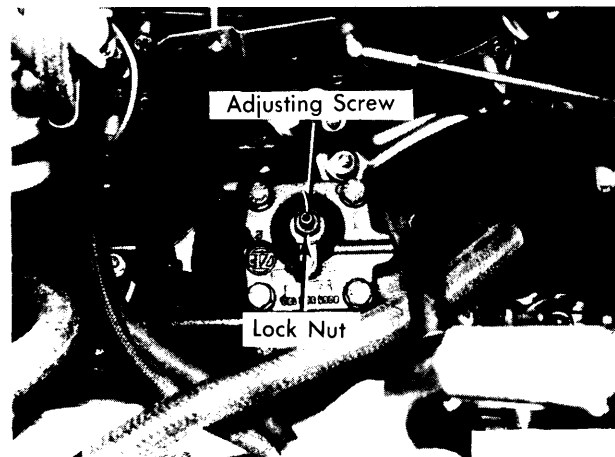


Fig. 2 Sector Shaft Adjusting Screws

TESTING

STEERING PUMP PRESSURE

1) Disconnect pressure line from pump. Install pressure line from pressure gauge 32-4-000 (or equivalent) in its place. Connect pump pressure line to gauge. Disconnect pressure line from control regulator and connect it to pressure gauge.

2) Shut cut-off valve on gauge. Open shut-off valve on pressure line (See Fig. 6), and bleed system with engine running at idle. After bleeding, close valve in pressure line for 10 seconds maximum and read pressure. Pressure should be 1560 ± 156 psi (109.7 ± 11 kg/cm²). If pressure is not within limits, check belt tightness. Replace pump if belt adjustment does not help.

BMW POWER-ASSISTED WORM & SECTOR (Cont.)

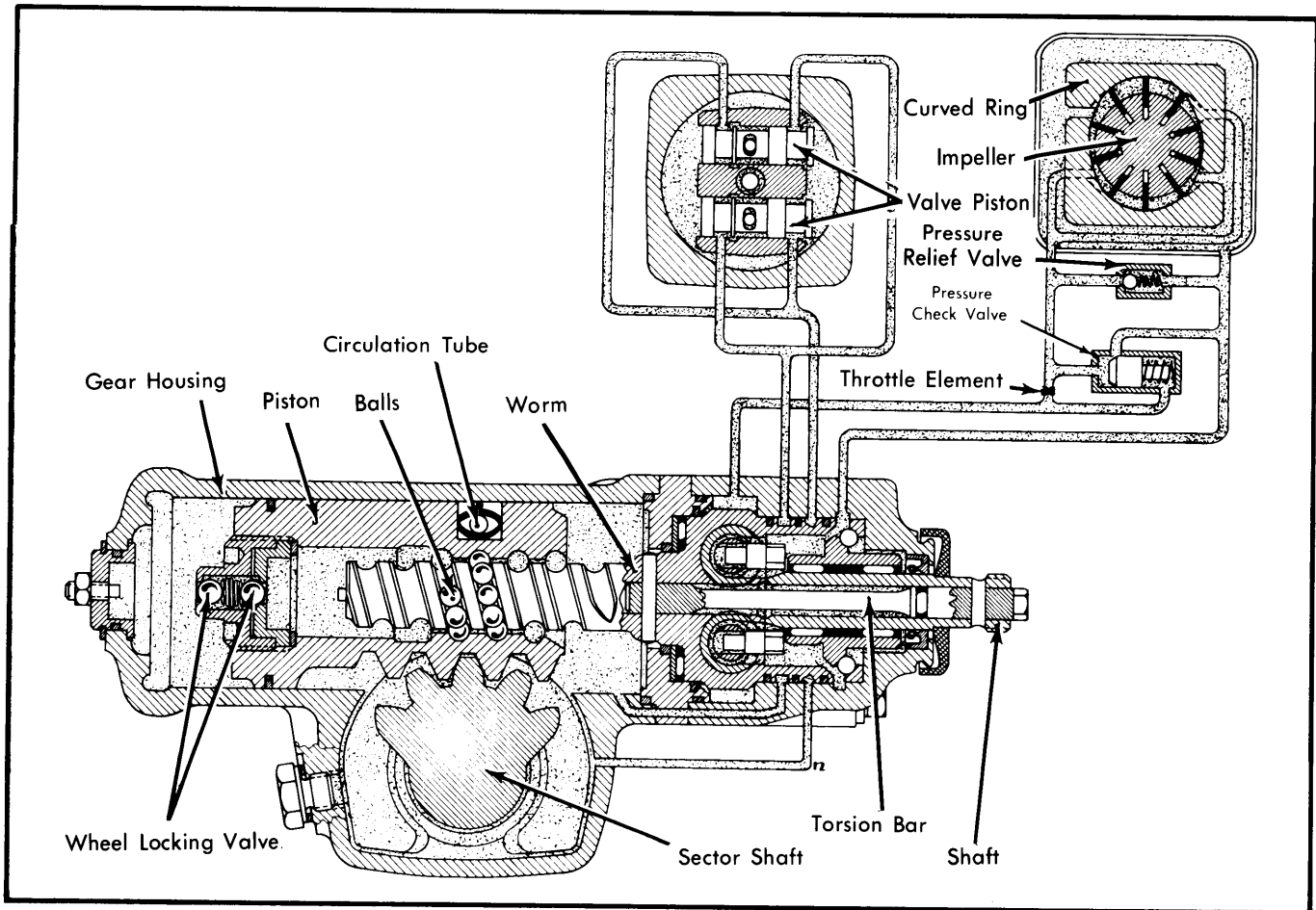


Fig. 3 Cross-Sectional View of Power Steering Gear Assembly

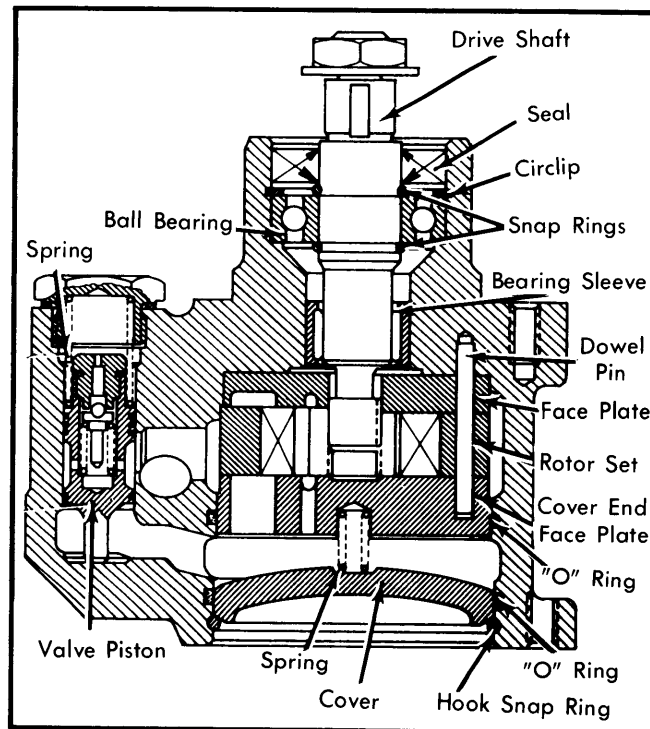


Fig. 4 Cross-Sectional View of Power Steering Pump

BMW POWER-ASSISTED WORM & SECTOR (Cont.)

STEERING GEAR PRESSURE

Raise front of car and support with safety stands. Install pressure tester 32-4-000 (or equivalent), in same position as pump pressure test. Limit steering from reaching full lock position by $\frac{1}{2}$ - $\frac{3}{4}$ turn. With engine running, pull steering wheel against final lock with 22 lbs. (9.9 kg) pressure for 5 seconds. Read pressure. Correct reading should be 1560 psi. Check opposite side pressure. Replace steering gear if pressure not up to specifications.

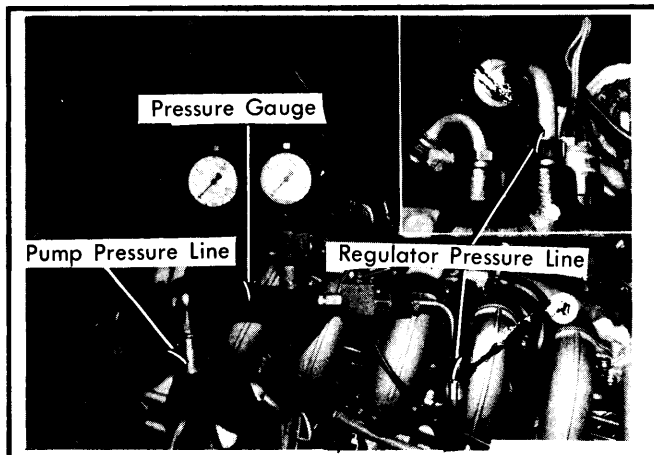


Fig. 5 Power Steering Pump Pressure Gauge Installation

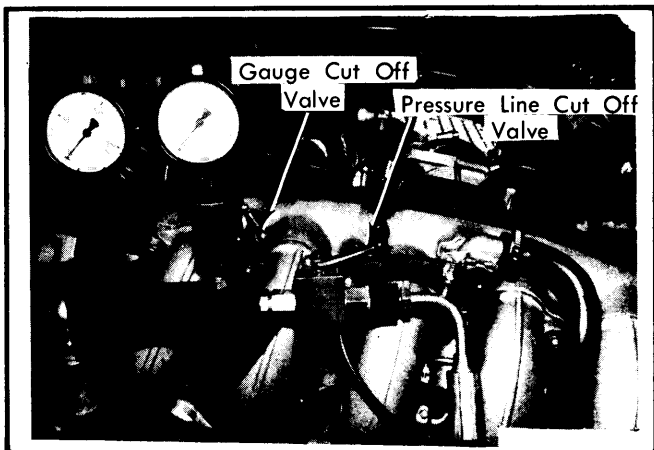


Fig. 6 Power Steering Pump Pressure Check

REMOVAL & INSTALLATION

STEERING GEAR

Removal — 1) Turn steering to full left lock. This moves piston to top of travel. Discharge hydraulic fluid by depressing brake pedal approximately 20 times. Detach pressure and return hoses from steering gear and cap openings.

CAUTION — Do not reuse fluid drained from system.

2) Remove cotter pin and nut from tie rod end. Press off tie rod from steering arm. Remove bolt from locking groove of steering shaft (See Fig. 7). Push up pivot flange with steering column. Detach steering gear from front axle carrier.

Installation — To install, reverse removal procedures, noting the following: Replace hose seals. Position steering wheel straight ahead. Align marks on pivot flange with steering shaft. Make sure bolt is in locking groove of steering shaft. Tighten all connections to proper torque. Bleed system.

STEERING PUMP

Removal — Discharge hydraulic fluid by depressing brake pedal approximately 20 times. Detach hoses from pump. Loosen pump mounting bolts and remove "V" belt. Remove mounting bolts and remove pump.

Installation — To install, reverse removal procedures, noting the following: Install hoses so that they do not rub on engine carrier. Torque to specifications. Bleed system.

OVERHAUL

STEERING GEAR

NOTE — Power steering gear assembly cannot be repaired except in exceptional cases. BMW recommends replacing the entire unit if malfunctions occur in the steering gear.

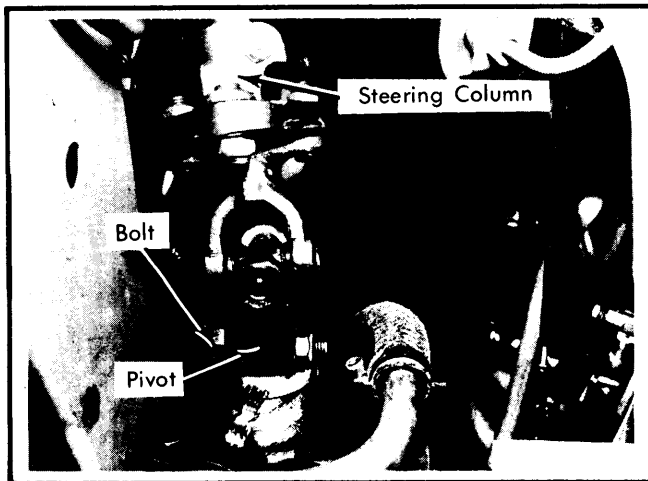


Fig. 7 Removing Steering Shaft Flange

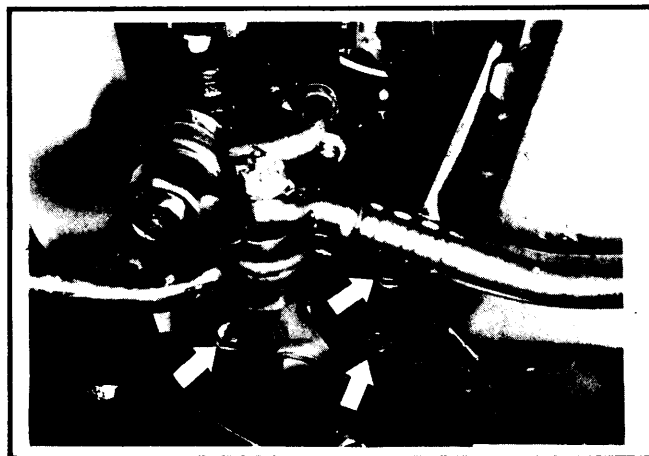


Fig. 8 Steering Gear to Front Axle Removal

BMW POWER-ASSISTED WORM & SECTOR (Cont.)

POWER STEERING PUMP

NOTE — Disassembly procedures are for model 530i only. For model 733i, BMW recommends replacing power steering pump if malfunctions occur. Overhaul procedures for model 633CSi were not available at time of printing. Two versions of the power steering pump are available on 530i models. One has a speed controlled pump and one does not. Differences in disassembly are noted in italics for the version with a speed controlled pump.

1) Press cover in slightly and remove retaining ring. Remove cover, coil spring and "O" ring. Remove end plate and "O" ring, noting location of pin in one of the small holes in end plate.

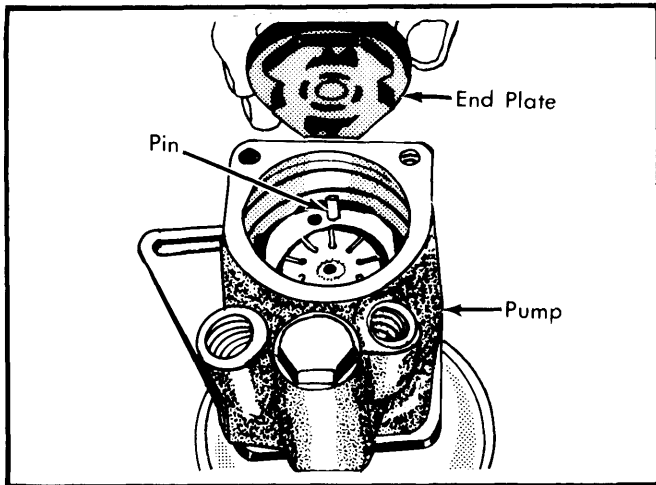


Fig. 9 Pin Location Inside of Pump Housing

2) Tilt housing and remove cam ring and rotor. Note that side of rotor with recessed hole faces drive shaft, the rounded off side of rotor faces cam ring, and the cast-in half arrow indicates direction of rotor rotation.

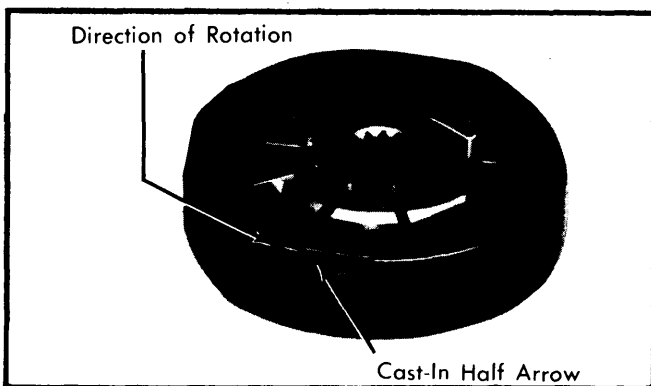


Fig. 10 Mark Showing Direction of Rotation

3) Remove drive end face plate and "O" ring. If it should be necessary to remove input shaft, proceed as follows: Remove pulley, (shaft seal in models with speed controlled pump), and circlip from housing. Force out input shaft from housing. Inspect seal and needle roller bearing and replace if necessary. Replace ball bearing on drive shaft if necessary. (In speed controlled version press out bearing sleeve with mandrel, and when replacing, press in flush.)

NOTE — Installed depth of needle roller bearing is 1.457" + .008" (37 + 0.2 mm)

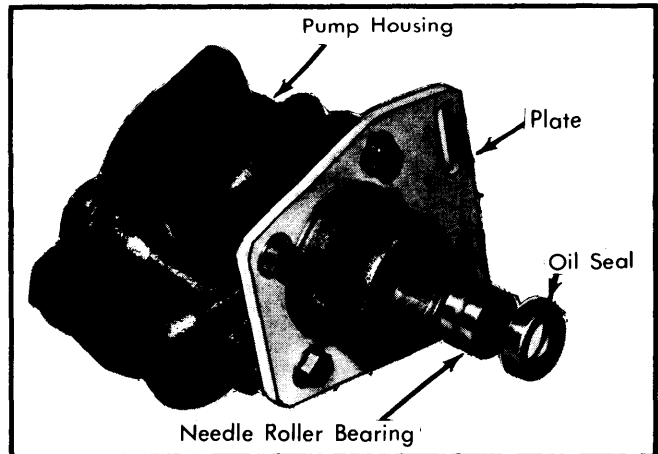


Fig. 11 Location of Needle Roller Bearing in Housing

4) Remove plug from pressure valve bore, then remove coil spring and valve piston. Note that threaded section on valve piston faces coil spring. **CAUTION** — Do not alter length of coil spring or thickness of plug sealing ring.

5) The valve tolerance group (1 or 2) is stamped into housing adjacent to pressure valve bore and valve barrel should be scribed with one or two marks (lines) agreeing with group number stamped into housing. **CAUTION** — If valve must be replaced, install valve of same tolerance group.

6) Clean and inspect all parts. Clean restrictor insert in pump outlet passage. Valve piston may be disassembled for cleaning. **CAUTION** — When disassembling piston, do not clamp across the sliding surfaces. A pressure valve is located inside valve piston (flow limit valve), and thickness of washers determines cut-in range of pressure valve. Maximum pump pressure should not be more than 10% below the value stated on manufacturer's plate attached to pump.

7) Clean power steering reservoir, wipe dry with lint free cloth, and install new filter element.

REASSEMBLY

To reassemble, reverse disassembly procedure.

ADJUSTMENT TORQUE

Application	INCH Lbs. (cmkg)
Worm in Piston	1.7-3.5 (2-4)
Worm Bearing in Valve Housing	1.3-2.2 (1.5-2.5)
Total for Worm Gear	3.5-5.2 (4-6)
Worm in Intermediate Housing	0.9-1.7 (1-2)

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Steering Gear to Front Axle	32-35 (4.4-4.8)
Worm End Cover	25 (3.5)
Sector Shaft End Cover	23 (3.1)
Adjusting Screw Counternut	22 (3.0)
Adjusting Screw Lock Nut for Piston Movement	4 (.5)
Steering Pump Mounting	17 (2.4)
Hose Connections	33-37 (4.5-5.1)