

BMW POWER-ASSISTED RECIRCULATING BALL

528e, 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 inside of piston which is in constant mesh with sector shaft teeth.

A worm shaft connects steering shaft to power piston through a universal joint coupling. The worm shaft is geared to the piston through recirculating ball contact. The 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

528e and 633CSi 1.25 qt. (1.2L).

733i 2.1 qt. (2.0L).

FLUID TYPE

ATF Dexron II.

FILTER REPLACEMENT

528e & 633CSi

Remove reservoir cap. Remove spring and filter cover. Replace filter.

733i

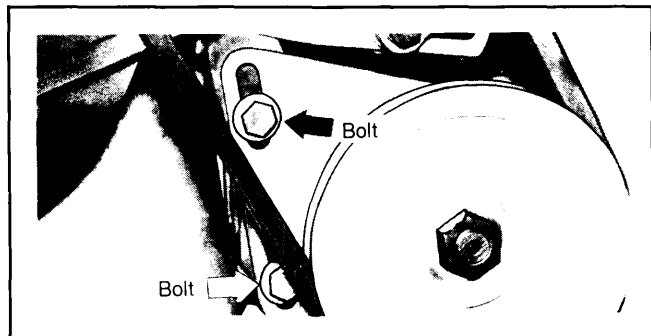
Remove reservoir cap. Remove nut, washer, spring, fine mesh filter screen and filters. Clean fine mesh filter screen and replace filters.

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



Adjustment is made using thumb pressure only.

HYDRAULIC SYSTEM BLEEDING

1) Power steering system 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.

2) Turn engine over with starter and continue to add fluid. When oil level no longer falls, start and run engine at idle speed.

3) Turn steering wheel rapidly from lock to lock and back until no further air bubbles rise in reservoir. Stop engine on 733i and operate brake pedal to discharge hydraulic accumulator.

4) On all models, during and after operation, fluid level must remain at upper mark.

SECTOR SHAFT

Adjustment (In Vehicle)

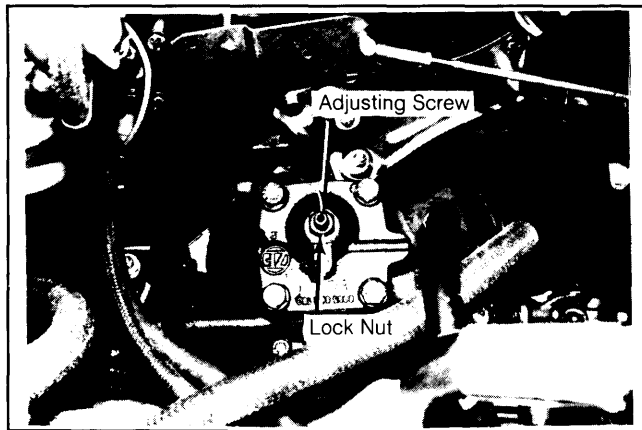
1) Position wheels straight ahead. Remove cotter pin and castle nut from tie-rod. Press off center tie-rod from steering arm. Remove BMW emblem from steering wheel.

2) Turn wheel counterclockwise 1 turn from center. Install torque wrench on nut, turn wheel clockwise and read frictional torque. Torque should be 2.7-3.5 INCH lbs. (.31-.40 N.m).

3) To adjust, turn steering wheel counterclockwise from center 1 turn. Loosen lock nut on steering gear.

4) Turn adjusting screw clockwise until correct torque is reached when passing through center position. Tighten lock nut and recheck adjustment.

Fig. 2: Sector Shaft Adjusting Screws



Turn adjusting screw clockwise to adjust.

TESTING

STEERING PUMP PRESSURE

1) On 733i, discharge accumulator by operating brake pedal 20 times. On all models, disconnect pressure line from pump. Connect pump pressure line to gauge.

2) Disconnect pressure line from control regulator and connect it to pressure gauge. Shut cut-off valve on gauge. Open shut-off valve on pressure line See Fig. 6.

3) Bleed system with engine running at idle. After bleeding, close valve in pressure line for 10 seconds

Power Steering

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

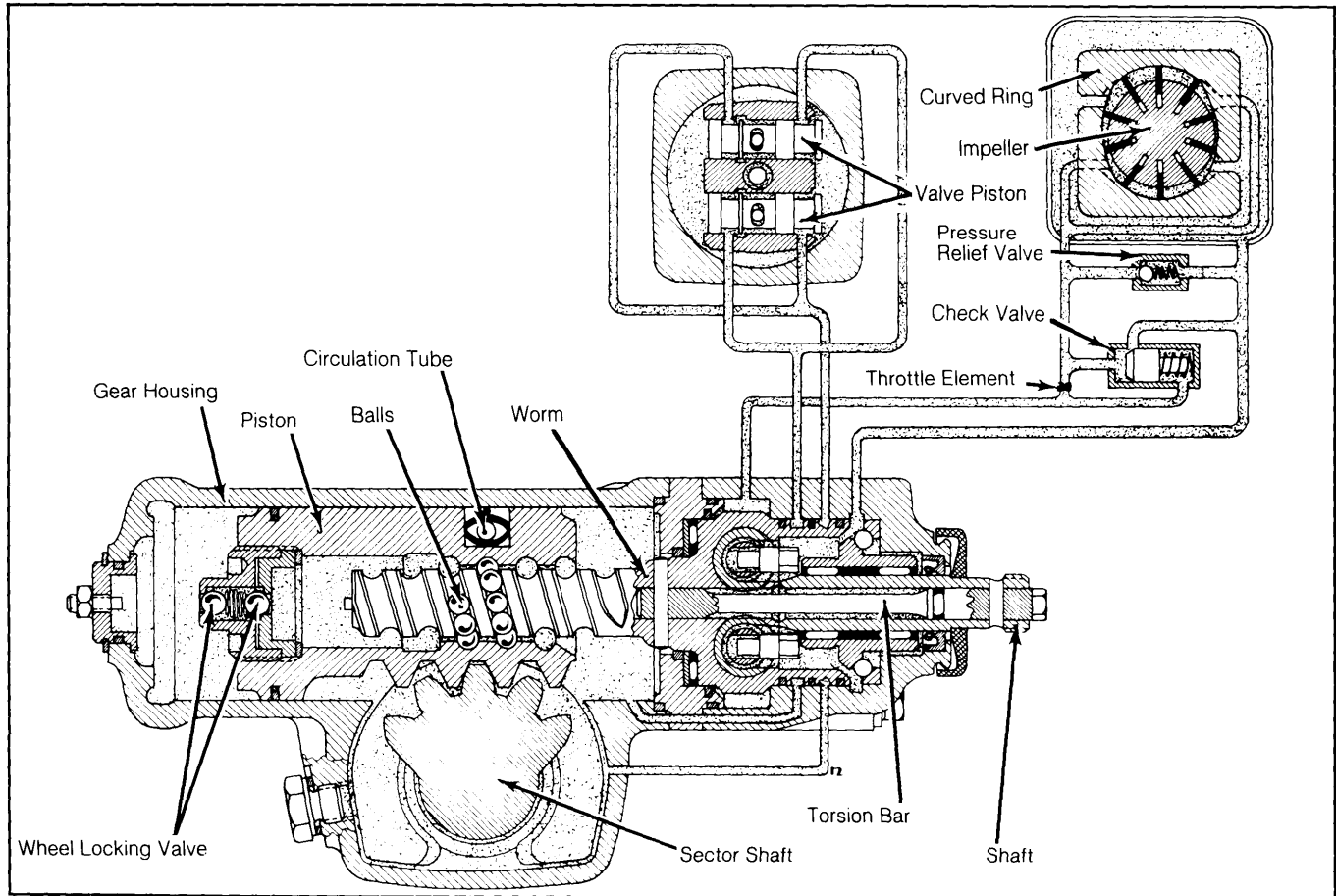
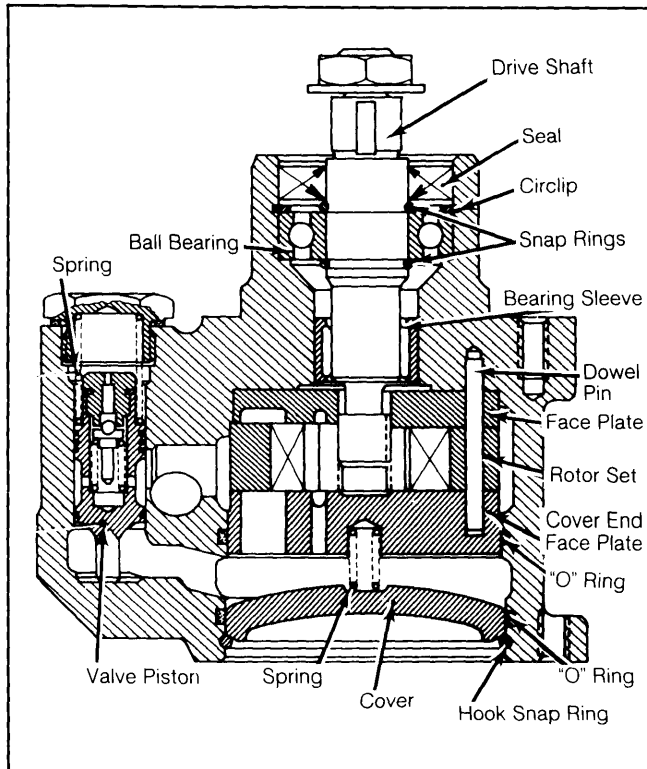


Fig. 4: Cross-Sectional View of Power Steering Pump.



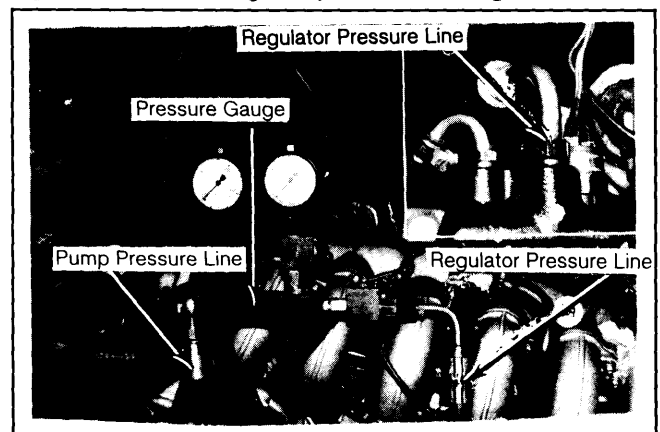
maximum and read pressure. On 528e and 633CSi, pressure should be 1260-1540 psi. (88.7-108.3 kg/cm²).

4) On 733i, pressure should be 1404-1716 psi. (98.5-120.5 kg/cm²). If pressure is not within limits, check belt tightness. Repair or replace pump if belt adjustment does not remedy problem.

STEERING GEAR PRESSURE

NOTE: Perform Steering Pump Pressure test before performing this test.

Fig. 5: Power Steering Pump Pressure Gauge Installation



Bleed system with engine idling.

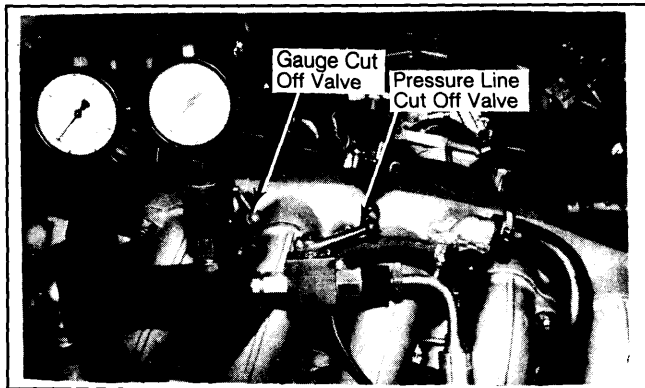
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1) Raise vehicle and support with safety stands. Install pressure tester (32-4-000), in same position as pump pressure test. Limit steering from reaching full lock position by 1/2-3/4 turn.

2) With engine running, pull steering wheel against final lock with 22 lbs. (98 N) pressure for 5 seconds. Read pressure. Pressure reading should be within specifications given in Steering Pump Pressure test.

3) Check pressure with gear at opposite lock. Replace steering gear, if pressure is not within specifications.

Fig. 6: Power Steering Pump Pressure Check



When wheel is turned to lock, hold pressure for no more than 5 seconds.

REMOVAL & INSTALLATION

STEERING GEAR

Removal

1) Turn steering to full left lock. On 733i, discharge hydraulic accumulator by depressing brake pedal 20 times. On all models, 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. Separate 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

1) To install, reverse removal procedures. Replace hose seals. Position steering wheel straight ahead. Align marks on pivot flange with steering shaft.

2) Make sure bolt is in locking groove of steering shaft. Tighten all connections to specifications. Bleed system.

STEERING PUMP

Removal

On 733i, discharge hydraulic accumulator by depressing brake pedal 20 times. On all models, detach hoses from pump. Loosen pump retaining bolts and remove belt. Remove retaining bolts and remove pump.

Installation

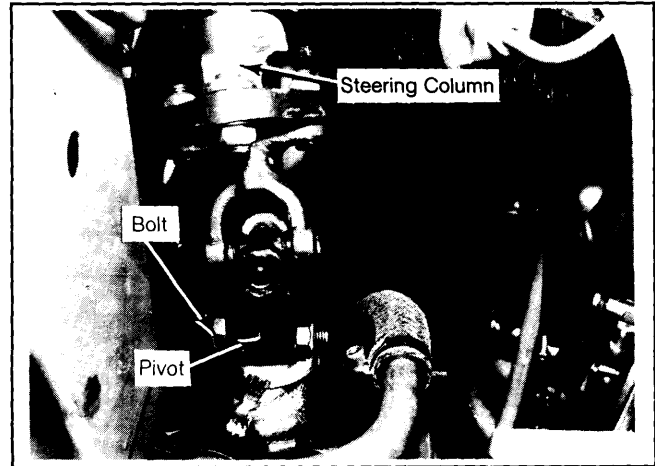
To install, reverse removal procedures. Install hoses so that they do not rub on engine carrier. Torque to specifications. Bleed system.

OVERHAUL

STEERING GEAR

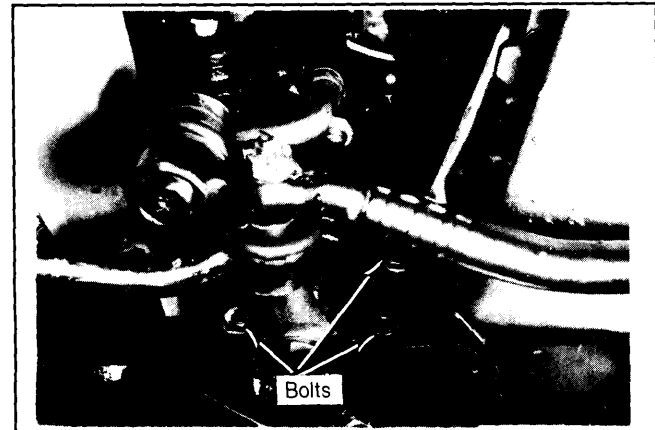
NOTE: BMW recommends replacing the entire unit if malfunctions occur in the steering gear.

Fig. 7: Removing Steering Shaft Flange



Push up flange with steering column and detach.

Fig. 8: Steering Gear-to-Front Axle Removal



Remove bolts retaining steering gear to axle carrier.

POWER STEERING PUMP

NOTE: Overhaul procedures are for 528e and 633CSi only. For 733i, BMW recommends replacing power steering pump if malfunctions occur.

DISASSEMBLY

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.

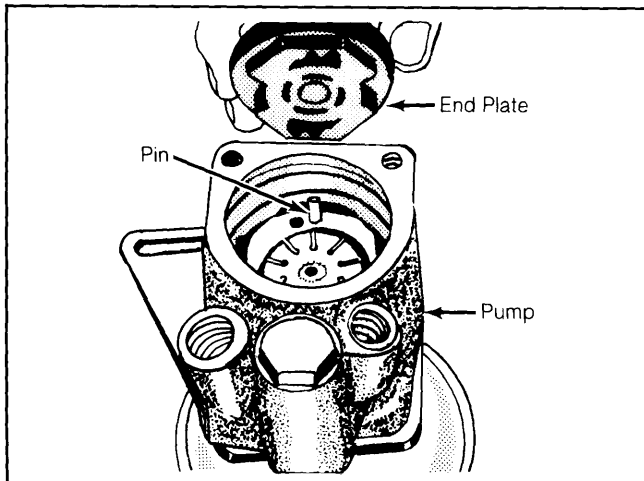
2) Tilt housing and remove cam ring and rotor. Note that side of rotor with recessed hole faces drive shaft, the rounded off side of rotor faces cam ring, and the cast-in half arrow indicates direction of rotor rotation.

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, and snap ring from housing.

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Fig. 9: Pin Location Inside of Pump Housing

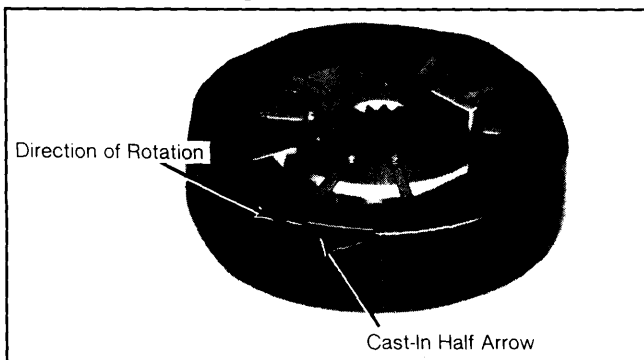


Note which hole pin is located in when disassembling.

4) Remove circlip and press ball bearing off of shaft. Using a mandrel, press bearing sleeve out of housing.

5) Remove plug from pressure valve bore. Remove coil spring and valve piston. Note that threaded section on valve piston faces coil spring.

Fig. 10: Mark Showing Direction of Rotation



The rounded off side of rotor faces cam ring.

CAUTION: Do not alter length of coil spring or thickness of plug sealing ring.

6) 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.

NOTE: If valve must be replaced, install valve of same tolerance group.

CAUTION: When disassembling piston, do not clamp across sliding surfaces.

7) Clean and inspect all parts. Clean restrictor insert in pump outlet passage. Valve piston may be disassembled for cleaning. A pressure valve is located inside valve piston (flow limit valve).

8) Thickness of washers determines cut-in range of pressure valve. Maximum pump pressure should not be more than 10% below value stated on plate attached to pump.

REASSEMBLY

To reassemble, reverse disassembly procedure, replacing all seals and worn components.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Steering Gear to Front Axle	33-35 (45-48)
Worm End Cover	25 (34)
Sector Shaft End Cover	
528e, 633SCi	23 (31)
733i	50 (68)
Adjusting Screw Counternut	22 (30)
Steering Pump Mounting	17 (23)
Hose Connections	33-37 (45-50)