

2000-01 STEERING**Power Recirculating Ball - Catera****DESCRIPTION & OPERATION****STEERING GEAR**

Steering gear assembly contains a recirculating ball system which acts as a rolling thread between worm shaft and rack piston. Steering gear housing contains a control valve that directs hydraulic pressure through rotary valve spool and body, to either side of rack piston. Hydraulic pressure exerted on rack piston lessens mechanical force required to turn pitman shaft and steering linkage.

Vehicles are equipped with Variable Effort Steering (VES) system. VES system provides maximum steering assist at low speeds for ease of turning and parking. At higher speeds, increased steering effort provides driver with firmer steering and directional stability. Power steering control module uses vehicle speed input from Electronic Brake Traction Control Module/Brake Pressure Modulator Valve (EBTCM/BPMV). This input causes an appropriate change in fluid flow control valve actuator. Power steering fluid flow control valve actuator, mounted on steering gear, uses a pintle valve to control fluid flow.

POWER STEERING PUMP

Power steering pump is a constant displacement vane-type pump with a remote fluid reservoir. When fluid pressure exceeds preset limits, an internal flow control pressure relief valve opens, allowing fluid to return to reservoir and inlet side of pump. See [Fig. 1](#).

TROUBLE SHOOTING

NOTE: See appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

SYSTEM TESTS

NOTE: Incorrect fluid level, belt tension, idle speed or damaged pump pulley can affect test results. Correct such conditions before testing power steering system.

1. Connect Power Steering Pressure Tester (J-5176-E) and Adapters (J-5176-11A and J-5176-5A) in pressure line. Open valve fully. Start and run engine until fluid reaches normal operating temperature. Bleed power steering system. See [HYDRAULIC SYSTEM BLEEDING](#). Check fluid level. Add fluid as necessary.
2. With engine at operating temperature, pressure reading should be less than 150 psi (10.5 kg/cm²). If pressure is more than 150 psi (10.5 kg/cm²), inspect system for restrictions. Check for proper installation of check valve in steering gear.

CAUTION: To prevent pump damage, do not hold valve closed for more than 5 seconds.

3. Completely close valve for less than 5 seconds and then open it, recording highest pressure obtained when valve is closed. Repeat procedure 2 more times. Each reading should be at least 1600 psi (112.5 kg/cm²).
4. If readings are within 50 psi (3.5 kg/cm²) of each other, pump is okay. If pressure readings are less than 1600 psi (112.5 kg/cm²), replace pump. If pump meets specification, leave valve open. Turn steering wheel from stop to stop, recording highest pressure at each stop. If pressure at both stops is not equal to pressure recorded in step 3, steering gear is leaking internally. Repair or replace steering gear.

LUBRICATION

CAPACITY

NOTE: Information is not available from manufacturer.

FLUID TYPE

When adding or changing fluid, use Dexron III automatic Transmission Fluid (GM 12346143). Use of improper fluid will cause hose, pump and seal damage, resulting in fluid leaks and/or failure to operate.

FLUID LEVEL CHECK

Fluid level is indicated by marks on reservoir dipstick. When fluid is at operating temperature, about 170°F (77°C), fluid level should be at FULL HOT mark. Fluid level should be at FULL COLD mark when fluid is cold, about 70°F (21°C).

HYDRAULIC SYSTEM BLEEDING

NOTE: If power steering system has been serviced, an accurate fluid reading cannot be obtained unless air is bled from steering system. Air in fluid may cause pump cavitation noise and may cause pump damage over a period of time.

NOTE: When adding fluid or making a complete fluid change, always use proper power steering fluid, failure to use proper fluid will cause hose, and seal damage and fluid leaks. Verify that hoses do not touch any other part of vehicle and that all hose connections are tight.

1. Remove reservoir cap. Inspect fluid, if necessary. Attach Power Steering Bleeder Adapter (J-43485) to Mity Vac (J-35555), or equivalent. Place Power Steering Bleeder Adapter on reservoir filler neck. Apply a vacuum of 20 in Hg. Wait 5 minutes. If vacuum does not hold steady, it may be necessary to replace pump.
2. Reinstall pump reservoir cap. Start engine and allow to idle. Turn engine off. Inspect fluid level. Add fluid, if necessary.
3. Start engine and allow to idle. Partially raise and support vehicle in order to allow front tires and wheel to turn freely. Verify front tires and wheels are in straight-ahead position. DO NOT turn steering wheel to lock. Turn steering wheel 180-360 degrees in both directions 5 times. Repeat steps until fluid is purge of air and fluid is Red in appearance.

ADJUSTMENTS

POWER STEERING PUMP BELT

Power steering pump is driven by a serpentine belt. Belt tension is maintained by automatic tensioner. No maintenance or adjustment is necessary. Check belt operating range, indicated by marks on tensioner. If belt is not within operating range, check for proper installation before replacing belt.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

POWER STEERING PUMP

Removal & Installation

1. Siphon fluid from power steering reservoir. Disconnect negative battery cable. Remove power steering pump pulley. See **PUMP PULLEY** . Disconnect gear inlet hose connection from pump. Disconnect fluid reservoir inlet hose clamp and disconnect hose from pump.
2. Raise and support vehicle. Remove AIR injection crossover pipe support bracket bolts and remove support bracket. Remove pump mounting bolts. Remove pump. To install, reverse removal procedure. Fill and bleed hydraulic system. See **HYDRAULIC SYSTEM BLEEDING** under LUBRICATION.

PUMP PULLEY

Removal & Installation

Disconnect negative battery cable. With drive belt still installed, loosen pump pulley bolts. Remove drive belt. Remove power steering pump pulley bolts and remove pulley from pump. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

FLUID FLOW CONTROL VALVE ACTUATOR

Removal & Installation

Disconnect negative battery cable. Remove steering gear. See **POWER STEERING GEAR** . Remove fluid flow control valve actuator screws. Remove fluid flow control valve actuator from steering gear. To install, reverse removal procedure. Tighten screws to specification. See **TORQUE SPECIFICATIONS** .

POWER STEERING GEAR

Removal

1. Disconnect negative battery cable. Remove windshield wiper assembly. Disconnect 3 body harness electrical connectors. Remove Engine Control Module (ECM) from electrical box on left side of engine compartment. See REMOVAL & INSTALLATION article in ENGINE PERFORMANCE. Drain cooling system. Remove upper radiator hose. Discharge A/C refrigerant from A/C system using approved recovery/recycling equipment. Remove A/C evaporator line extension bolt.
2. Siphon fluid from power steering reservoir. Remove power steering reservoir bracket bolt. Reposition reservoir aside. Siphon fluid from brake system reservoir. Disconnect brake booster vacuum connection from intake plenum. Disconnect brake lines from master cylinder. Disconnect electrical connector from master cylinder reservoir cap.

NOTE: To prevent damage to SIR coil inside steering column, do not allow steering wheel to rotate when steering coupler is disconnected.

3. Remove sound insulator tabs and sound insulator. Remove steering coupler bolts. Mark lower steering coupler-to-steering gear spline alignment for installation reference if reusing original gear. Place steering wheel in straight-ahead position, and lock into place. Remove ignition key. Carefully separate steering column from steering gear.
4. Disconnect brake pedal from brake power booster link rod. Remove instrument panel knee bolster. Remove fuse/relay panel screws and reposition panel aside for access to upper brake vacuum booster nuts. Remove brake vacuum booster nuts from inward side of cowl. Remove brake vacuum booster with master cylinder attached.
5. Disconnect A/C evaporator line extension quick connect. Disconnect power steering hoses from steering gear and reposition aside for access to EBTCM/BPMV. Remove EBTCM/BPMV assembly. Remove heat shield upper mounting bolt.

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6. Raise and support vehicle. Mark pitman arm-to-steering gear spline alignment for installation reference if steering gear is to be reinstalled. Remove pitman arm nut and washer. Using pitman arm puller, separate pitman arm from steering gear. Remove lower heat shield nuts. Remove steering gear lower bolts, nuts and washers.
7. Lower vehicle. Remove heat shield. Disconnect fluid flow control valve actuator electrical connector. Note position of steering gear shim(s) for installation reference. Remove upper steering gear bolt and shim(s). Remove steering gear from vehicle.

Installation

NOTE: Center steering gear before installing steering gear into vehicle.

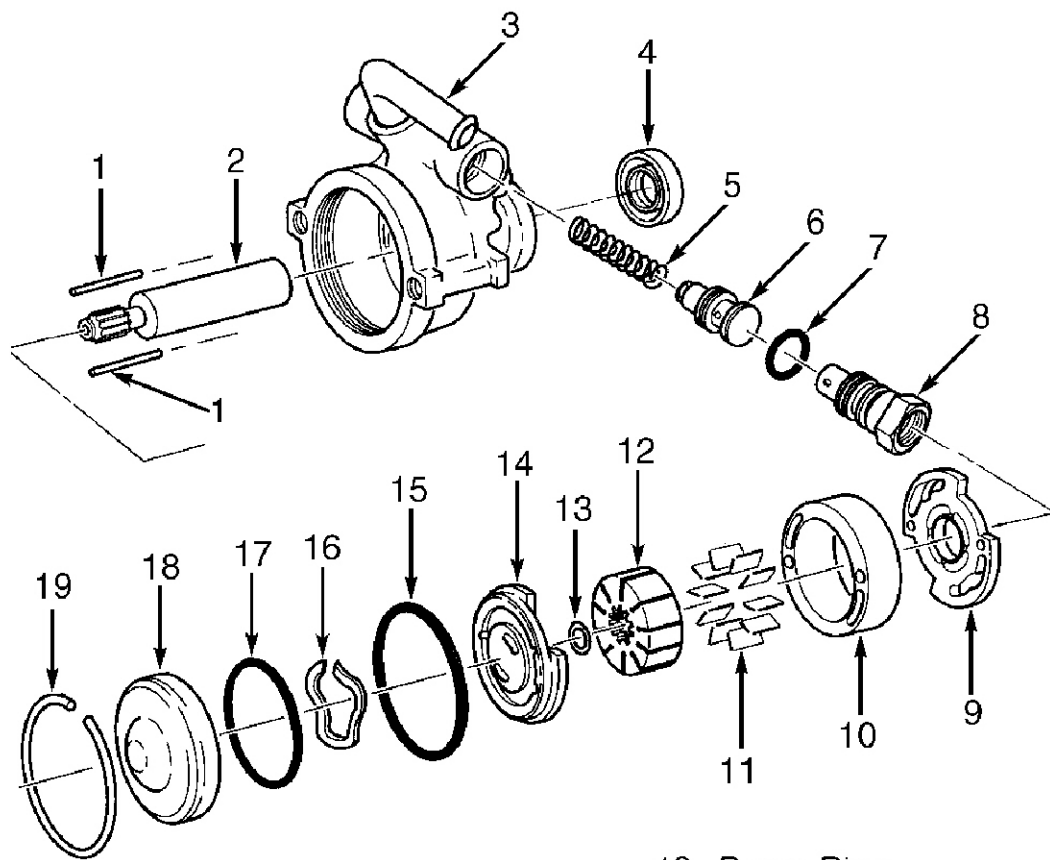
1. Using an 5/16" (8 mm) open-end wrench, rotate steering gear stub shaft from stop to stop counting number of turns. Beginning from either stop, rotate stub shaft half of number of turns counted. Align mark on stub shaft to "V" mark on steering gear case. Steering gear should be centered. Install shim(s) and upper steering gear bolt. Hand tighten bolt.
2. To complete installation, reverse removal procedure. Ensure rubber steering gear shaft protector is in place prior to installation of pitman arm. Lubricate NEW A/C evaporator line extension "O" rings with mineral oil before installation.
3. Fill and bleed power steering system. See **HYDRAULIC SYSTEM BLEEDING** under LUBRICATION. Fill cooling system. Evacuate, recharge and leak test A/C system. Fill and bleed brake system. See **BLEEDING BRAKE SYSTEM** in DISC - CATERA article in BRAKES.

OVERHAUL

NOTE: Power steering gear is not serviceable. Power steering gear must be replaced as a complete assembly. Exploded view of power steering pump is furnished for informational purposes only. See Fig. 1 .

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- 1. Pump Ring Dowel Pin
- 2. Drive Shaft
- 3. Hydraulic Pump Housing Assembly
- 4. Drive Shaft Seal
- 5. Flow Control Spring
- 6. Control Valve Assembly
- 7. "O" Ring Seal
- 8. "O" Ring Union Fitting
- 9. Thrust Plate
- 10. Pump Ring
- 11. Vane
- 12. Pump Rotor
- 13. Shaft Retaining Ring
- 14. Pressure Plate
- 15. "O" Ring Seal
- 16. Pressure Plate Spring
- 17. "O" Ring Seal
- 18. End Cover
- 19. Retaining Ring

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Fig. 1: Exploded View Of Power Steering Pump
 Courtesy of GENERAL MOTORS CORP.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Evaporator Line Extension Bolt	15 (20)
AIR Injection Crossover Pipe Support Bracket Bolt	15 (20)
Brakelines-To-Master Cylinder	12 (16)
Brake Vacuum Booster Nut	15 (20)
Gear Inlet & Outlet Hose Connections	21 (28)
Idler Arm Bolt	44 (60)
Lower Heat Shield Nut	11 (15)
Pitman Arm Nut	118 (160)
Power Steering Pump Mounting Bolt	15 (20)
Power Steering Pump Pulley	15 (20)
Relay Rod Ball Stud	

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To-Idler Arm Nut	44 (60)
To-Pitman Arm Nut	44 (60)
Steering Coupler Bolt	16 (22)
Tie Rod Adjuster Clamp Bolt	11 (15)
Tie Rod Ball Stub Nut (Inner & Outer)	44 (60)
Upper & Lower Steering Gear Bolt	30 (41)
	INCH Lbs. (N.m)
Fluid Flow Control Valve Actuator Screw	27 (3)
Power Steering Fluid Reservoir Clamp Bolt	62 (7)
Upper Heat Shield Bolt	71 (8)

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