

STEERING SYSTEM - POWER RECIRCULATING BALL

1998 Mitsubishi Montero

1997-98 STEERING
Mitsubishi - Power Recirculating Ball

Montero, Montero Sport

DESCRIPTION & OPERATION

STEERING GEAR

The power steering gear displaces fluid to provide hydraulic pressure assist while turning. A one-piece rack piston nut is geared to cross shaft. Backlash is adjusted with an adjusting screw.

STEERING LINKAGE

Linkage consists of an idler arm, relay rod, steering knuckles and adjustable tie rods. Components are connected by ball joints. Linkage assembly is connected to steering gear by pitman arm.

LUBRICATION

FLUID TYPE

Recommended fluid type is Dexron-II ATF.

FLUID LEVEL CHECK

Place vehicle in level position. Start engine and let idle. Turn steering wheel left and right. Replace fluid if it has bubbles or has become white. Fluid level should be between MIN and MAX marks on dipstick. Fill to proper level.

FLUID REPLACEMENT

CAUTION: DO NOT crank engine for more than 15-20 seconds at a time.

1) Remove reservoir cap. Disconnect return hose at reservoir. Drain fluid. Disconnect coil high tension wire. Raise and support vehicle.

2) Turn steering wheel lock-to-lock several times while cranking engine to drain fluid from steering gear. Reconnect hose. Fill power steering system with fluid. Bleed system. See HYDRAULIC SYSTEM BLEEDING.

HYDRAULIC SYSTEM BLEEDING

CAUTION: DO NOT crank engine for more than 15-20 seconds at a time.

Add fluid as needed during procedure to prevent reservoir level from dropping.

1) Ensure reservoir is filled before bleeding. Add fluid (if necessary) during bleeding. Raise and support front of vehicle. Disconnect coil high tension wire.

2) While cranking engine, turn steering wheel lock-to-lock 5 or 6 times. Lower vehicle. Connect coil wire. Start engine and let idle. Turn steering wheel lock-to-lock until no more bubbles appear in oil reservoir.

3) Turn steering wheel lock-to-lock. Fluid level should not change more than .2" (5 mm). If pump is noisy, fluid rises after engine is turned off, or fluid level changes more than specified, repeat bleeding procedure.

ADJUSTMENTS

BELT TENSION ADJUSTMENT SPECIFICATIONS

BELT ADJUSTMENT

Application	(1) Deflection: In. (mm)
Montero	
New Belt	.42-.54 (11-14)
Used Belt	.58-.66 (15-17)
Montero Sport	
2.4L	
New Belt	.16-.24 (4-6)
Used Belt	.24-.28 (6-7)
3.0L	
New Belt	.44-.52 (11-13)
Used Belt	.56-.64 (14-16)

(1) - With 22 lbs. (10 kg) pressure applied midway on longest belt run.

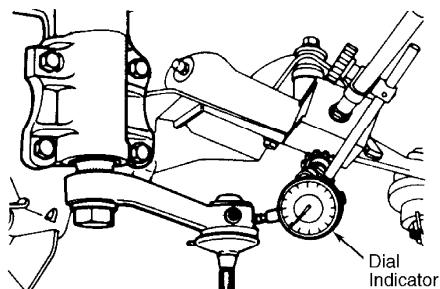
STEERING WHEEL PLAY

Raise and support vehicle. Start engine and let idle. With steering wheel in center position, ensure free play is 1.1" (27 mm) or less. If measured value exceeds specification, check steering gear backlash and linkage ball joint end play. See STEERING GEAR BACKLASH and LINKAGE BALL JOINT END PLAY.

STEERING GEAR BACKLASH

1) Set steering wheel in straight-ahead position. Raise and support vehicle. Disconnect relay rod from pitman arm. Using a dial indicator, measure steering gear backlash at top end of pitman arm.

2) Steering gear backlash should not exceed .02" (.5 mm). If measured value exceeds limit, turn steering gearbox adjusting bolt until steering wheel free play is within specification. See Fig. 1.



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Fig. 1: Measuring Steering Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

TESTING

HYDRAULIC SYSTEM PRESSURE TEST

1) Disconnect pressure hose from power steering pump. Attach Pressure Gauge (MB990662-01) and Adapters (MB990993-01 and MB990994-01). See Fig. 2. Tighten fittings to 22-29 ft. lbs. (30-39 N.m).

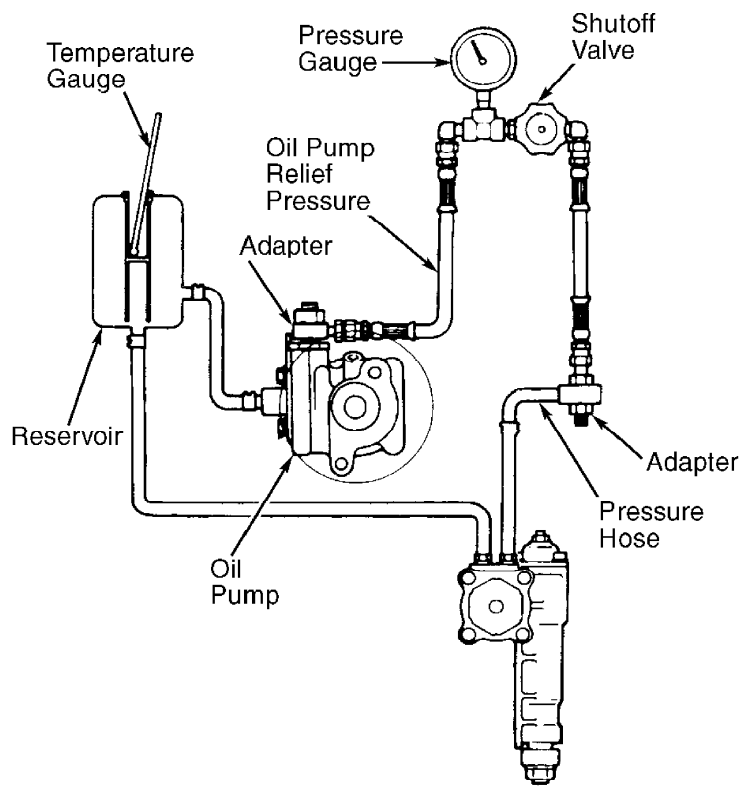
2) Bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Turn wheel several times to bleed air from gauge. Start engine and let idle. Place thermometer in reservoir. Check fluid level. Add fluid as necessary.

3) When fluid temperature reaches 122-140°F (50-60°C), check pressure. See POWER STEERING PUMP PRESSURE SPECIFICATIONS table. Reinstall pressure hose. Do not twist hose or let hose interfere with adjacent parts. Replace power steering pump if pressure is not within specification. Bleed system.

CAUTION: DO NOT keep shutoff valve closed more than 3 seconds at a time. DO NOT keep steering wheel turned to full lock position for more than 10 seconds at a time.

POWER STEERING PUMP PRESSURE SPECIFICATIONS

Application	psi (kg/cm ²)
Valve Closed Or Wheel At Full Lock	1204-1305 (83-90)
Valve Open (Standard)	114-142 (8-10)



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Fig. 2: Connecting Pressure Gauge & Shutoff Valve
Courtesy of Mitsubishi Motor Sales of America.

P/S PRESSURE SWITCH

1) Disconnect pressure hose from power steering pump. Attach Pressure Gauge (MB990662-01) and Adapters (MB990993-01 and MB990994-01). See Fig. 2. Tighten fittings to 22-29 ft. lbs. (30-39 N.m).

2) Bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Turn wheel several times to bleed air from gauge. Start engine and let idle. Place thermometer in reservoir. Check fluid level. Add fluid as necessary.

3) When fluid temperature reaches 122-140°F (50-60°C), disconnect connector from P/S pressure switch. Connect ohmmeter across switch terminals. Slowly close shut-off valve. Check pressure when ohmmeter indicates switch has closed (continuity). Pressure should be 218-290 (15-20 N.m). Slowly open shut-off valve. Check pressure when ohmmeter indicates switch has opened (no continuity). Pressure should be 102-174 (7-12 N.m). Reinstall pressure hose. Do not twist hose or let hose interfere with adjacent parts. Replace P/S pressure switch if pressure is not within specification. Bleed system.

CAUTION: DO NOT keep shutoff valve closed more than 3 seconds at a time. DO NOT keep steering wheel turned to full lock position for more than 10 seconds at a time.

STEERING WHEEL TURNING FORCE

Stationary Test

1) Position vehicle on level surface. Place steering wheel in straight-ahead position. Start engine and let idle. Using a spring scale, measure steering wheel turning force clockwise and counterclockwise.

2) On Montero, turning force should be 8.2 lbs. (3.7 kg) or less. On Montero Sport, turning force should be 8.8 lbs. (3.9 kg) or less. If turning force exceeds specification, check for loose or damaged belt, insufficient fluid, air in power steering fluid, and collapsed or twisted hoses. Repair or replace as necessary.

REMOVAL & INSTALLATION

IDLER ARM

Removal

Loosen relay rod-to-idler arm lock nut. Using Steering Linkage Puller (MB991113 or MB990635), separate idler arm from relay rod and remove relay rod-to-idler arm lock nut. Remove idler arm bolts and nuts. Remove idler arm. On Montero, loosen, but DO NOT remove idler arm-to-bracket nut. Press arm from bracket and remove nut and arm.

Inspection

Check idler arm bushings for damage or wear. Check idler arm ball stud for looseness.

Installation

1) Apply multipurpose grease to inside surface of bushing and idler arm support shaft. Insert bushing in idler arm. Insert idler arm support in idler arm.

2) Install washer (knurled side toward bushing) and NEW lock nut. Tighten lock nut to specification. See TORQUE SPECIFICATIONS. Place idler arm assembly in vise. Using a spring gauge, measure turning resistance.

3) On all models, turning resistance should be 3-18 INCH lbs. (.3-2.0 N.m). On Montero, if turning resistance is not within specification, loosen or tighten lock nut to obtain proper resistance.

4) Install idler arm bolts and nuts. Install relay rod-to-

idler arm. See TORQUE SPECIFICATIONS.

POWER STEERING GEAR

Removal & Installation

1) Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Remove steering shaft-to-steering gear clamp bolt. Disconnect pressure and return hoses from steering gear.

2) Remove cotter pin and castle nut from pitman arm. Using Puller (C-3894-A), separate pitman arm from relay rod.

3) Remove steering gear mounting nuts. Disconnect steering shaft from steering gear. Remove steering gear. To install, reverse removal procedure.

POWER STEERING PUMP & RESERVOIR

Removal

Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Disconnect hoses from reservoir. Remove reservoir. Disconnect hoses from pump. Loosen pump retaining bolts. Remove belt. Remove pump and mounting bracket(s).

Installation

To install, reverse removal procedure. Check power steering pump bracket for slack. Tighten bracket (if necessary). Fill and bleed reservoir. See FLUID REPLACEMENT and HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Start engine and turn steering wheel lock-to-lock to check for fluid leaks.

RELAY ROD

Removal

Remove inner tie rod end cotter pins and lock nuts. Separate tie rod ends from relay rod. Remove cotter pins and castle nuts from idler arm and pitman arm. Using a puller, separate relay rod from idler arm and pitman arm.

Installation

To install relay rod, reverse removal procedure. Ensure dust covers are well greased and lower edge of covers are coated with packing sealer. Tighten relay rod-to-idler arm and relay rod-to-pitman arm castle nuts to specification. See TORQUE SPECIFICATIONS.

TIE ROD ASSEMBLY

Removal

1) Remove skid plate (if necessary). Remove cotter pins and loosen lock nuts from tie rod ball studs at steering knuckle and relay rod end.

2) Using Steering Linkage Puller (MB991113 or MB990635), separate tie rod ends from knuckle and relay rod end and remove lock nuts. Loosen tie rod adjusting sleeve lock nuts, and unscrew tie rod ends.

Inspection

Check tie rod ends for damage and ball studs for looseness. On Montero, measure ball stud starting torque. Torque should be 9-27 INCH lbs. (1.0-3.0 N.m). If ball stud starting torque exceeds specification, replace tie rod.

Installation

1) Install "O" ring on ball socket. Grease inside of tie rod

end dust cover. Coat lower edge of cup with packing sealer. Install tie rod ends into adjusting sleeves.

2) Measure center-to-center distance between tie rod studs for both tie rod assemblies. Adjust center-to-center distance to specification. See TIE ROD INSTALLATION LENGTH table.

3) An equal number of threads should be visible on each side of adjusting sleeve. Install tie rod ends in steering knuckle and relay rod. Install tie rod end castle nuts and NEW cotter pins. Tighten castle nuts to specification. See TORQUE SPECIFICATIONS. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

TIE ROD INSTALLATION LENGTH

Application	In. (mm)
Montero	12.05 (306.0)
Montero Sport	12.0 (305)

OVERHAUL

POWER STEERING GEAR

Disassembly

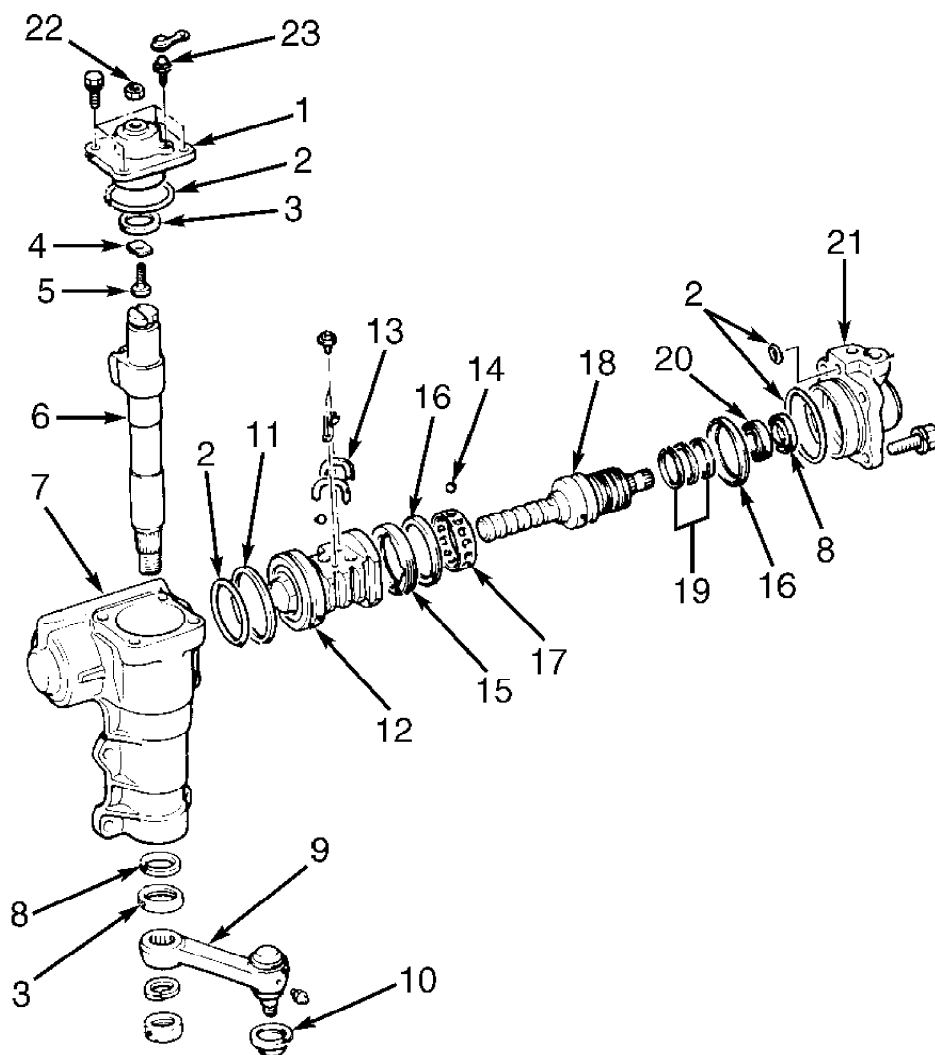
1) Scribe mating marks on pitman arm and cross shaft. Remove pitman arm nut. Using a puller, remove pitman arm. Drain power steering fluid. Remove side cover bolts. See Fig. 3. Loosen adjusting bolt lock nut, and screw in adjusting bolt so side cover raises slightly.

2) With mainshaft and cross shaft placed in straight-ahead position, tap bottom of cross shaft with plastic hammer. Remove cross shaft and side cover as an assembly. Remove side cover from cross shaft by turning adjusting bolt.

3) Remove valve housing and rack piston as an assembly by turning rack piston counterclockwise. See Fig. 3. Carefully remove rack piston from mainshaft without losing balls inside rack piston.

4) Remove cross shaft oil seal from gearbox housing. Put rack piston in soft jawed vise. Using Spanner Wrench (MB991367) and Pin Set (MB991394), remove lock nut. Remove mainshaft while applying pressure to bearing race to prevent balls from falling out. Drive out bearing and oil seal.

NOTE: DO NOT remove cross shaft "U" packing at rear of needle bearing unless fluid leakage is found coming from adjusting bolt threads. If leakage exists, replace "U" packing.



- | | |
|---------------------|-----------------------------|
| 1. Side Cover | 13. Circulator |
| 2. "O" Ring | 14. Ball |
| 3. "U" Packing | 15. Lock Nut |
| 4. Adjusting Plate | 16. Bearing Race |
| 5. Adjusting Bolt | 17. Cage |
| 6. Cross Shaft | 18. Mainshaft |
| 7. Gear Box Housing | 19. Seal Rings |
| 8. Oil Seal | 20. Bearing |
| 9. Pitman Arm | 21. Valve Housing |
| 10. Dust Cover | 22. Adjusting Bolt Lock Nut |
| 11. Seal Ring | 23. Breather Screw |
| 12. Rack Piston | |

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Fig. 3: Exploded View Of Power Recirculating Ball Steering Gear
Courtesy of Mitsubishi Motor Sales of America.

Inspection

Check mainshaft for wear and damage. Check tooth surface of

cross shaft and rack piston for wear and damage. Check contact part of adjusting bolt for uneven wear. Check dust seal, oil seal and "O" rings for wear and damage.

Reassembly

1) Install NEW cross shaft lower "U" packing (if removed). Press lower cross shaft oil seal into gearbox housing. See Fig. 3. Press bearing and oil seal into top cover. Install bearing race and "O" ring.

2) Apply transmission fluid to seal ring contact areas on mainshaft, and install seal rings firmly into valve grooves. Wrap serrated part of mainshaft with vinyl tape. Mount valve body to valve housing. Install cage and align hole in cage with channel in mainshaft. Install bearing race and insert balls.

3) Install mainshaft into valve housing while pressing on bearing race to prevent balls from falling out. Using spanner wrench, install lock nut and tighten until it contacts bearing race.

4) Tighten lock nut while measuring mainshaft endplay using dial indicator. When mainshaft endplay is .001" (.003 mm), use a punch to crimp circumference of lock nut. Ensure mainshaft rotates freely.

5) Apply transmission fluid to "O" ring and piston seal ring, and install into gearbox housing. Install rack piston until it contacts edge of mainshaft. Rotate mainshaft to align ball raceway with insertion hole. Install 19 balls.

NOTE: Insert balls so no clearance exists between balls.

6) Place remaining 7 balls in circulator and install circulator to rack piston. Install circulator holder. Install NEW cross shaft upper "U" packing (if removed). Install upper cross shaft "O" ring. Apply transmission fluid to rack piston seal ring and insert valve housing. Rotate mainshaft until rack piston is centered (neutral position).

7) Install adjusting plate so beveled part is facing upward. Using a feeler gauge, measure clearance between adjusting bolt and cross shaft. If clearance is greater than .002" (.05 mm), replace with appropriate adjusting plate.

8) Apply multipurpose grease to seal surface of "U" packing. Apply transmission fluid to cross shaft teeth and side cover "O" ring. Install cross shaft to side cover, and temporarily tighten adjusting bolt lock nut.

CAUTION: DO NOT rotate side cover during installation, or damage to cross shaft oil seal may result.

9) Apply transmission fluid to rack piston teeth and shaft areas. Apply multipurpose grease to oil seal lip. Install side cover assembly (with cross shaft) to gearbox.

10) Position mainshaft in straight-ahead position. While turning adjusting bolt, measure mainshaft combined starting torque using Preload Socket (MB990228-01) and an INCH-lb. torque wrench. Combined starting torque should be 4-11 INCH lbs. (.5-1.3 N.m). Center reading should be 2 INCH lbs. (.2 N.m) higher than reading at either end.

11) Tighten adjusting bolt lock nut to specification. See TORQUE SPECIFICATIONS. Install pitman arm with mating marks aligned.

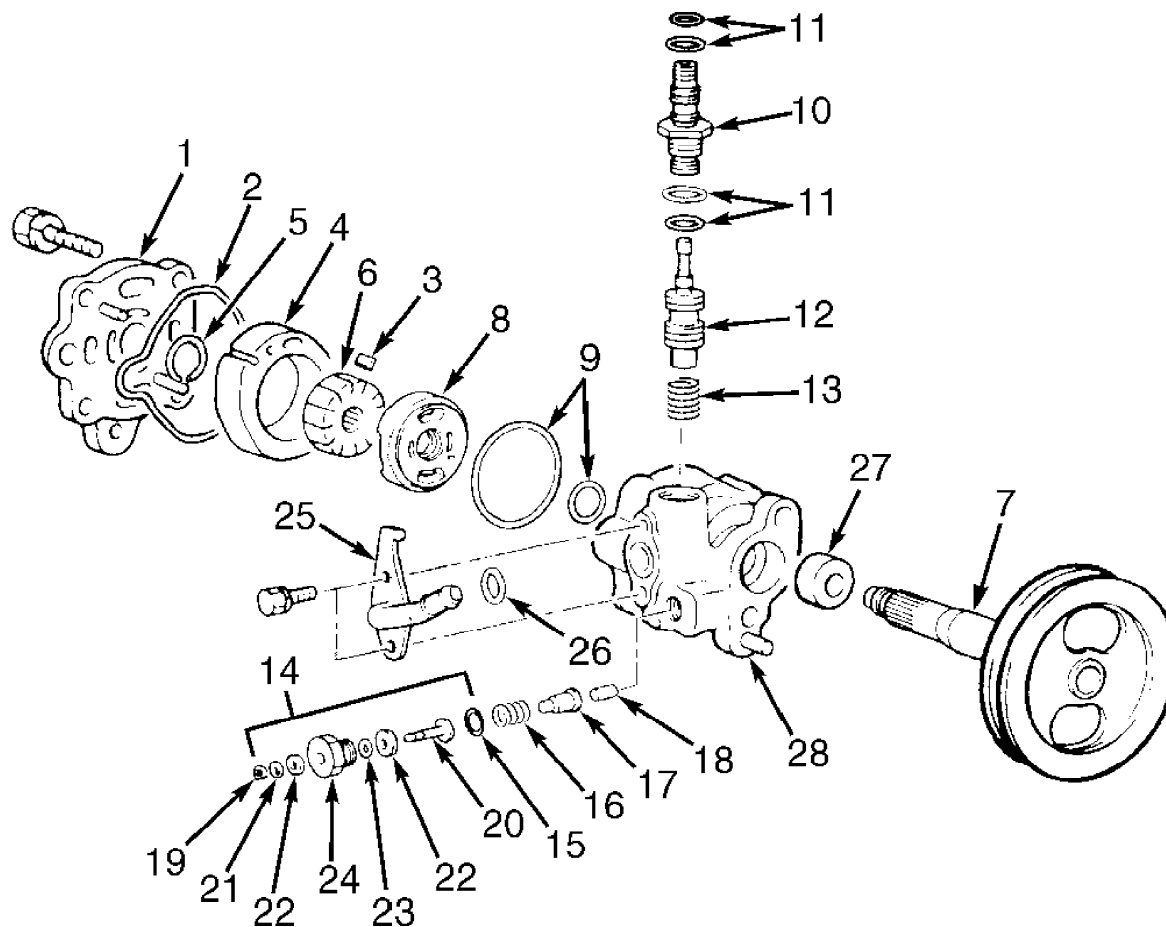
POWER STEERING PUMP

Disassembly

1) Remove suction connector bolts. Mount pump in a soft-jawed vise. Remove pump cover bolts and cover. Using a plastic mallet, tap pulley assembly shaft from pump housing. See Fig. 4.

2) Remove cam ring, vanes, shaft assembly and "O" rings. Remove snap ring from shaft assembly. Remove collar, rotor and side plate from shaft.

3) Pry oil seal out of housing. Remove pressure connector. Remove flow control valve assembly, flow control spring and 2 "O" rings. DO NOT disassemble flow control valve assembly.



- | | | |
|--------------------|-------------------------|-----------------------|
| 1. Pump Cover | 10. Connection | 19. Snap Ring |
| 2. "O" Ring | 11. "O" Ring | 20. Terminal |
| 3. Vanes | 12. Flow Control Valve | 21. Washer |
| 4. Cam Ring | 13. Flow Control Spring | 22. Insulator |
| 5. Snap Ring | 14. Terminal Assembly | 23. "O" Ring |
| 6. Rotor | 15. "O" Ring | 24. Plug |
| 7. Pulley Assembly | 16. Spring | 25. Suction Connector |
| 8. Side Plate | 17. Plunger | 26. "O" Ring |
| 9. "O" Ring | 18. Piston Rod | 27. Oil Seal |
| | | 28. Oil Pump Body |

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Fig. 4: Exploded View Of Power Steering Pump
Courtesy of Mitsubishi Motor Sales of America.

Inspection

1) Inspect pump shaft oil seal lip and bushing end for

damage. Inspect groove of rotor vane and cam surface for stepped wear. Check vane for damage. Install vane into rotor groove. Measure clearance between vane and rotor groove. If clearance exceeds .0024" (.061 mm), replace entire assembly.

2) Check ring and rotor sides for damage. Replace entire assembly if any damage is present. Check sliding surfaces of control valve for obstructions. Replace parts as required. If control valve is replaced, always use valve with same identification mark as one being replaced. Check power steering fluid pressure.

Reassembly

1) Lubricate "O" rings and internal pump components with ATF before reassembly. Install flow control valve spring and control valve in housing.

2) Install and tighten pressure connector. Depress control valve to check for smooth operation. Apply grease to lip of oil seal. Install oil seal into pump body. Install pulley assembly into pump body.

3) Install rotor to pulley assembly with punch mark at pump cover side. Install snap ring. Lift rotor to ensure that snap ring is in countersunk part of shaft. Align cam ring dowel holes and install cam ring with punch mark on pump body side.

4) Apply transmission fluid to vanes, and install vanes onto rotor with rounded edges outward. Install "O" ring, cam case and pump cover. Install and tighten suction connector.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Adjusting Bolt Lock Nut	27 (37)
Idler Arm Bracket-To-Frame Bolt & Nut	
Montero	40-47 (54-64)
Montero Sport	43 (59)
Idler Arm-To-Bracket Lock Nut	101 (44)
Oil Pump Cover Bolts	15 (20)
Pitman Arm-To-Cross Shaft Nut	
Montero	108-123 (146-176)
Montero Sport	108-123 (147-167)
Pressure Hose In-Line Fitting	
Montero	25 (34)
Montero Sport	16 (22)
Relay Rod-To-Idler Arm Nut	33 (44)
Relay Rod-To-Pitman Arm Nut	33 (44)
Side Cover Bolts	
Montero	36 (49)
Montero Sport	41-47 (50-64)
Steering Gear Hose Fittings	11 (15)
Steering Gear-To-Frame Bolts	40-47 (54-64)
Tie Rod Adjusting Sleeve Lock Nuts	69 (93)
Tie Rod End Castle Nuts	33 (44)
Valve Housing Bolts	
Montero	36 (49)
Montero Sport	41-47 (56-64)
Valve Housing Lock Nut	(1)

(1) - Tighten lock nut until it contacts bearing race.